

July 7, 2014

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

Re: **Notice of Exempt Modification – Facility Modification  
539 Plains Road, Haddam, Connecticut**

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless (“Cellco”) currently maintains twelve (12) antennas at the 178-foot level of the existing 181-foot tower at 539 Plains Road in Haddam, 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 adding three (3) model 742 213V01, 2100 MHz antennas, for a total of fifteen (15) antennas, all at the same 178-foot level on the tower. Cellco also intends to install three (3) remote radio heads (“RRHs”) behind its 2100 MHz antennas and one (1) HYBRIFLEX™ antenna cable. Included in Attachment 1 are specifications for Cellco’s replacement antennas, RRHs and HYBRIFLEX™ cable.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Melissa J. Schlag, First Selectman for the Town of Haddam. A copy of this letter is also being sent to 539 Plains Road 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).

13012390-v1

# Robinson+Cole

Melanie A. Bachman

July 7, 2014

Page 2

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's new antennas and RRHs will be installed at a centerline height of 178 feet on the existing 181-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 is 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:

Melissa J. Schlag, Haddam First Selectman  
539 Plains Road LLC  
Sandy M. Carter

# **ATTACHMENT 1**

Kathrein's X-polarized adjustable electrical downtilt antennas offer the wireless carrier the ability to tailor polarization diversity sites for optimum performance. Using variable downtilt, only a few models need be procured to accommodate the needs of widely varying conditions. Remotely controlled downtilt is available as a retrofitable option.

- 0-6° downtilt range.
- UV resistant pultruded fiberglass radome.
- DC Grounded metallic parts for impulse suppression.
- No moving electrical connections.
- Wideband vector dipole technology.
- Optional remote downtilt Control.
- Will accommodate future 3G / UMTS applications.

### General specifications:

Frequency range	1710-2200 MHz
VSWR	< 1.5:1
Impedance	50 ohms
Intermodulation (2x20w)	IM3: <-150 dBc
Polarization	+45° and -45°
Front-to-back ratio (180°±30°)	>30 dB (co-polar) >25 dB (total power)
Maximum input power	300 watts per input (at 50°C)
Electrical downtilt continuously adjustable	0-6 degrees
Connector	2 x 7-16 DIN female
Isolation	>30 dB
Cross polar ratio	
Main direction 0°	25 dB (typical)
Sector ±60°	>10 dB
Tracking, average	0.5 dB
Squint	±2.0°
Weight	19.8 lb (9 kg) 24.3 lb (11 kg) clamps included
Dimensions	76.9 x 6.1 x 2.8 inches (1954 x 155 x 70 mm)
Wind load	at 93 mph (150kph)
Front/Side/Rear	115 lbf / 32 lbf / 115 lbf (510 N) / (140 N) / (510 N)
Mounting category	M (Medium)
Wind survival rating*	120 mph (200 kph)
Shipping dimensions	88 x 6.8 x 3.6 inches (2235 x 172 x 92 mm)
Shipping weight	28.7 lb (13 kg)
Mounting	Fixed mounts for 2 to 4.6 inch (50 to 115 mm) OD masts are included and tilt options are available.

See reverse for order information.

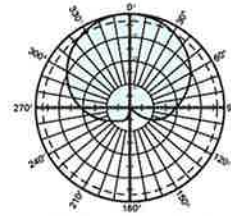
Specifications:	1710-1880 MHz	1850-1990 MHz	1920-2200 MHz
Gain	19 dBi	19.2 dBi	19.5 dBi
+45° and -45° polarization horizontal beamwidth	67° (half-power)	65° (half-power)	63° (half-power)
+45° and -45° polarization vertical beamwidth	4.7° (half-power)	4.5° (half-power)	4.3° (half-power)
Sidelobe suppression for first sidelobe above main beam	0° 2° 4° 6° T 18 18 16 15 dB	0° 2° 4° 6° T 18 18 17 16 dB	0° 2° 4° 6° T 18 18 18 18 dB



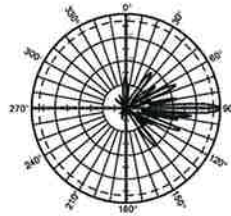
11271-B  
936.3740/b



\* Mechanical design is based on environmental conditions as stipulated in TIA-222-G-2 (December 2009) and/or ETS 300 019-1-4 which include the static mechanical load imposed on an antenna by wind at maximum velocity. See the Engineering Section of the catalog for further details.

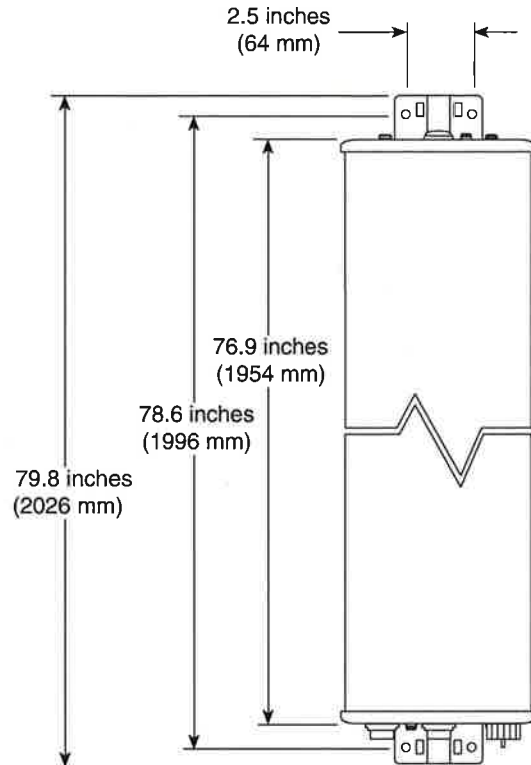
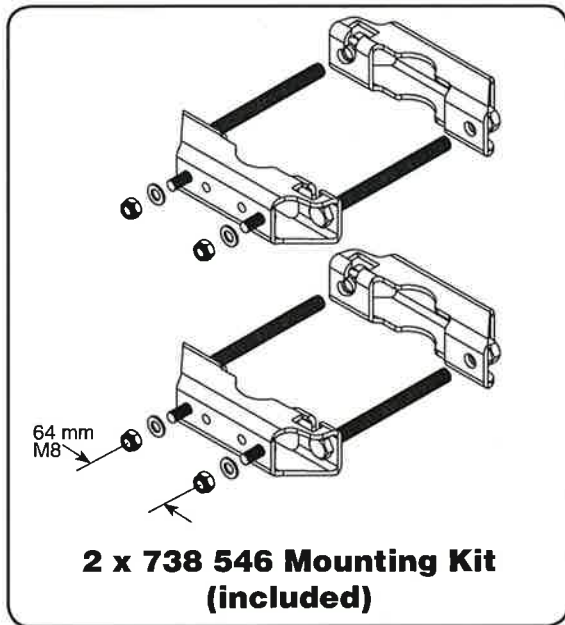


Horizontal pattern  
±45°- polarization



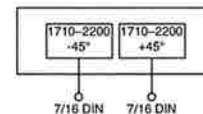
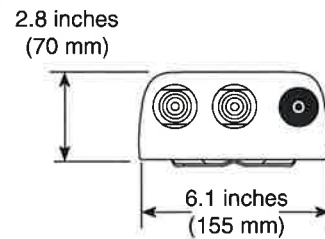
Vertical pattern  
±45°- polarization  
0°-6° electrical downtilt





**Mounting Options:**

Model	Description
2 x 738 546 (included)	Mounting Kit for 2 to 4.6 inch (50 to 115 mm) OD mast. 4.4 lb (2 kg)
850 10013	Tilt Mount Kit 0–11 degrees downtilt angle. 7.4 lb (3.7 kg)
742 263	Three-panel Sector Mounting Kit (120 deg. ea.) for 3.5 inch (89 mm) OD mast.



**Order Information:**

Model	Description
742 213V01	Antenna with 7-16 DIN connectors 0°–6° adjustable electrical downtilt

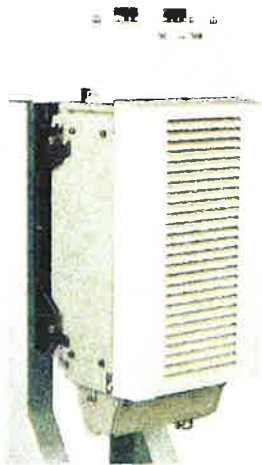
All specifications are subject to change without notice. The latest specifications are available at [www.kathrein-scala.com](http://www.kathrein-scala.com).

Kathrein Inc., Scala Division Post Office Box 4580 Medford, OR 97501 (USA) Phone: (541) 779-6500 Fax: (541) 779-3991  
Email: [communications@kathrein.com](mailto:communications@kathrein.com) Internet: [www.kathrein-scala.com](http://www.kathrein-scala.com)

## Alcatel-Lucent RRH2x40-AWS

### REMOTE RADIO HEAD

The Alcatel-Lucent RRH2x40-AWS is a high-power, small form-factor Remote Radio Head (RRH) operating in the AWS frequency band (1700/2100MHz - 3GPP Band 4). The Alcatel-Lucent RRH2x40-AWS 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-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. The Alcatel-Lucent RRH2x40-AWS has two transmit RF paths, 40 W RF output power per transmit path, and is designed to manage up to four-way receive diversity. The device is ideally suited to support macro coverage, with multiple-input multiple-output (MIMO) 2x2 operation in up to 20 MHz of bandwidth.

The Alcatel-Lucent RRH2x40-AWS is designed to make available all the benefits of a distributed eNodeB, with excellent RF characteristics, with low

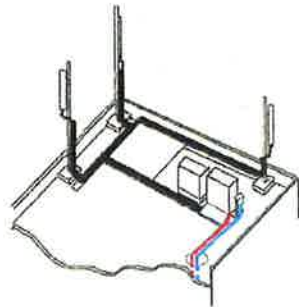
capital expenditures (CAPEX) and low operating expenditures (OPEX). The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment or require costly cranes to be employed, leaving coverage holes. However, many of these sites can host an Alcatel-Lucent RRH2x40-AWS 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-AWS 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-AWS is compact and weighs less than 20 kg (44 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

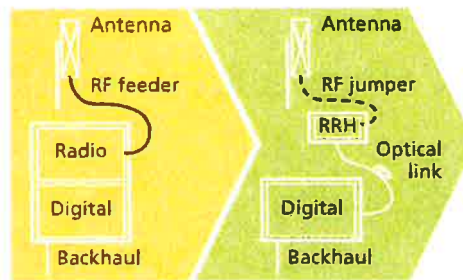
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation 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-AWS provides more RF power while at the same time consuming less electricity.



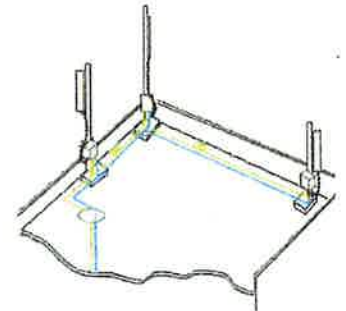
Macro

## 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
- Best-in-class power efficiency, with significantly reduced energy consumption



RRH for space-constrained cell sites



Distributed

## 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

## Technical specifications

### Physical dimensions

- Height: 620 mm (24.4 in.)
- Width: 270 mm (10.63 in.)
- Depth: 170 mm (6.7 in.)
- Weight (without mounting kit): less than 20 kg (44 lb)

### Power

- Power supply: -48VDC

### 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: 1700/2100 MHz (AWS); 3GPP Band 4
- Bandwidth: up to 20 MHz
- RF output power at antenna port: 40 W nominal RF power for each Tx port
- Rx diversity: 2-way or 4-way with optional Rx Diversity module
- Noise figure: below 2.0 dB typical
- Antenna Line Device features
  - TMA and Remote electrical tilt (RET) support via AISG v2.0

### Optical characteristics

#### Type/number of fibers

- Single-mode variant
  - One Single Mode Single Fiber per RRH2x, carrying UL and DL using CWDM
  - Single mode dual fiber (SM/DF)
- Multi-mode variant
  - Two Multi-mode fibers per RRH2x: one carrying UL, the other carrying DL

### Optical fiber length

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

### Digital Ports and Alarms

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

[www.alcatel-lucent.com](http://www.alcatel-lucent.com) Alcatel, Lucent, Alcatel-Lucent and the Alcatel-Lucent logo are trademarks of Alcatel-Lucent. All other trademarks are the property of their respective owners. The information presented is subject to change without notice. Alcatel-Lucent assumes no responsibility for inaccuracies contained herein. Copyright © 2010 Alcatel-Lucent. All rights reserved. CPG2809100912 (09)



**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.

**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



Figure 1: HYBRIFLEX Series

**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
<b>Physical Properties</b>			
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)
<b>Electrical Properties</b>			
DC-Resistance Outer Conductor Armor		(Ω/km (Ω/1000ft))	0.68 (0.255)
DC-Resistance Power Cable, 8.4mm² (8AWG)		(Ω/km (Ω/1000ft))	2.1 (0.307)
<b>Optical Properties</b>			
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, UL1656 RoHS Compliant		
<b>DC Properties with Dimensions</b>			
Size (Power)	(mm (AWG))	8.4 (8)	
Quantity, Wire Count (Power)	16 (8 pairs)		
Size (Alarm)	(mm (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		
<b>Environmental</b>			
Installation Temperature	(°C (°F))	-40 to +65 (-40 to 149)	
Operation Temperature	(°C (°F))	-40 to +65 (-40 to 149)	

\* This data is provisional and subject to change

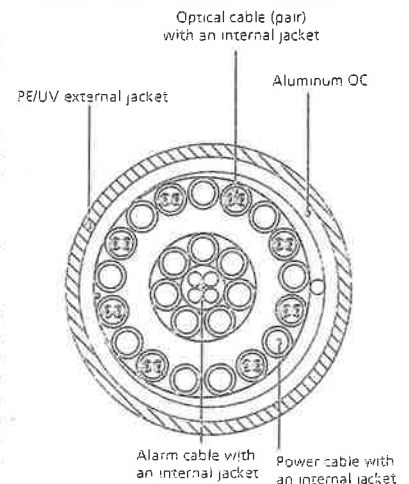


Figure 2: Construction Detail

All information contained in the present datasheet is subject to confirmation at time of ordering



# **ATTACHMENT 2**



# **ATTACHMENT 3**

Date: January 29, 2014



Elaine Neumann  
Crown Castle  
5350 North 48th Street, Suite 300  
Chandler, AZ 85226  
(480) 734-2425

Vertical Structures, Inc.  
309 Spangler Dr, Suite E  
Richmond, KY 40475  
(859) 624-8360  
bgreenwell@verticalstructures.com

**Subject: Structural Analysis Report**

<b>Carrier Designation:</b>	<b>Verizon Wireless Change-Out</b>	
	<b>Carrier Site Number:</b>	N/A
	<b>Carrier Site Name:</b>	Haddam, CT
<b>Crown Castle Designation:</b>	<b>Crown Castle BU Number:</b>	806478
	<b>Crown Castle Site Name:</b>	HRT 080
	<b>Crown Castle JDE Job Number:</b>	257095
	<b>Crown Castle Work Order Number:</b>	703087
	<b>Crown Castle Application Number:</b>	212081 Rev. 1
<b>Engineering Firm Designation:</b>	<b>Vertical Structures, Inc. Project Number:</b>	2014-004-005
<b>Site Data:</b>	<b>539 Plains Road, Haddam, CT, Middlesex County</b> <b>Latitude 41° 26' 35", Longitude -72° 30' 22.4"</b> <b>181.583 Foot - Self Support Tower</b>	

Dear Elaine Neumann,

Vertical Structures, 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 611360.

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

LC7: Existing + Reserved + Proposed Equipment

**Sufficient Capacity**

Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA/EIA-222-F standard and the 2005 Connecticut State Building Code with 2009 amendment 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 Vertical Structures, 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:

Ben Greenwell, P.E.  
Project Engineer



## TABLE OF CONTENTS

### 1) INTRODUCTION

### 2) ANALYSIS CRITERIA

Table 1 - Proposed Antenna and Cable Information

Table 2 - Existing and Reserved Antenna and Cable Information

Table 3 - Design Antenna and Cable Information

### 3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

3.1) Analysis Method

3.2) Assumptions

### 4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Table 6 – Tower Component Stresses vs. Capacity - LC7

4.1) Recommendations

### 5) APPENDIX A

tnxTower Output

### 6) APPENDIX B

Base Level Drawing

### 7) APPENDIX C

Additional Calculations

**1) INTRODUCTION**

This tower is a 181.583 ft Self Support tower designed by Rohn in 1986. The tower was designed for Zone 'A' wind loading under a previous revision of the EIA. The tower was reworked in 2008 to accommodate additional loading.

**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 and 50 mph under service loads. Also, per Crown Castle's direction and in accordance with ASCE-7-05 we have considered a fastest mile wind speed of 38 mph with an escalating 0.75 inch ice thickness.

**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
178.0	178.0	3	alcatel lucent	RRH2X40-AWS BTS	1	1 5/8	
		3	kathrein	742 213 w/ Mount Pipe			
		1	rfs celwave	DB-T1-6Z-8AB-0Z BTS			

**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		
182.0	186.0	1	ems wireless	19" Accelerator	6	1 5/8	1		
		3	ems wireless	RR90-17-02DP w/Mount Pipe					
178.0	178.0	1		Sector Mount [SM 506-3]	12	1 5/8	1		
		3	antel	BXA-171085-12BF-2 w/ Mount Pipe					
		3	antel	BXA-70063-6CF-2 w/ Mount Pipe					
		4	antel	LPA-80080/6CF w/Mount Pipe					
		2	antel	LPA-80080/6CF w/Mount Pipe					
		6	celwave	FD9R6004/2C-3L Diplexer					
165.0	167.0	6	powerwave technologies	7770.00 w/ mount pipe	12	1 1/4	1		
		6	powerwave technologies	LGP21401 TMA					
		6	powerwave technologies	LGP21903 TMA					
	165.0	1		Sector Mount [SM 506-3]				2	7/16
		1	andrew	DBXNH-6565B-R2M w/ Mount Pipe				1	3/8
		6	ericsson	RRUS-11 BTS					
		2	kmw communications	AM-X-CD-16-65-00T-RET w/ Mount Pipe					
		1	raycap	DC6-48-60-18-8F					
157.0	157.0	1		Pipe Mount [PM 601-1]	1	EW52	2		
		1	andrew	PAR6-59					
150.0	152.0	6	decibel	DB980H90E-M w/Mount Pipe	6	1 5/8	1		
	150.0	1		Sector Mount [SM 504-3]					
141.0	141.0	1		Sector Mount [SM 506-3]	9	1 1/4	1		
		9	decibel	DB844H90E-XY w/Mount Pipe					
135.0	135.0	3	kathrein	742 213 w/ Mount Pipe	6	1 5/8	1		
125.0	125.0	1		Pipe Mount [PM 601-1]	1	EW52	2		
		1	andrew	PAR6-59					
119.0	119.0	1		Pipe Mount [PM 601-1]	1	EW52	2		
		1	andrew	HP8-57W					
50.0	50.0	1		18" Side Arm	1	1/2	1		
		1		GPS					

- Notes:  
 1) Existing Equipment  
 2) Reserved Equipment  
 3) Equipment to be Removed

**Table 3 - Design Antenna and Cable Information**

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
180	180	4	Celwave	PD10017		
		4	Rohn	3' Sidearm		
171	171	6	Celwave	PD1132		
		3	Rohn	6' Sidearm		
161	161	2		6' Std. Dish		
100	100	1	Celwave	PD1109		
		1	Rohn	6' Sidearm		

### 3) ANALYSIS PROCEDURE

**Table 4 - Documents Provided**

Document	Remarks	Reference	Source
Online Application	Verizon Wireless Change-Out Revision #1	212081	CCIsites
Tower Drawings	Rohn Drawing No. A861587-1	1067089	CCIsites
Foundation Information	Rohn Drawing No. C821532	300985	CCIsites
Foundation Information	FDH Project No. 06-0884N	300985	CCIsites
Geotechnical Report	FDH Project No. 06-0884G	1240448	CCIsites
Rework Drawings	Vertical Structures Job No. 2008-004-059, Revision C	1274944	CCIsites
Rework Drawings	Vertical Structures Job No. 2008-004-124	1274944	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. Vertical Structures, 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 (lb)	SF*P_allow (lb)	% Capacity	Pass / Fail
T1	181.583 - 161.458	Leg	ROHN 2 STD	3	-23308.40	32298.46	72.2	Pass
		Diagonal	L1 3/4x1 3/4x3/16	12	-4189.51	8084.28	51.8 77.9 (b)	Pass
		Top Girt	L2x2x1/8	4	-399.47	2488.55	16.1	Pass
T2	161.458 - 156.396	Leg	ROHN 2.5 EH	39	-27429.60	65601.59	41.8	Pass
		Diagonal	L1 3/4x1 3/4x3/16	48	-4052.99	6183.40	65.5 73.7 (b)	Pass
		Top Girt	L2x2x1/8	40	-174.82	2457.08	7.1 7.6 (b)	Pass
T3	156.396 - 151.396	Leg	ROHN 2.5 EH	51	-35744.60	65600.12	54.5	Pass
		Diagonal	L1 3/4x1 3/4x3/16	55	-4108.67	5654.15	72.7 76.7 (b)	Pass
T4	151.396 - 146.396	Leg	ROHN 2.5 EH	60	-44695.80	65600.12	68.1	Pass
		Diagonal	L1 3/4x1 3/4x3/16	64	-4755.92	5127.52	92.8	Pass
T5	146.396 - 141.333	Leg	ROHN 2.5 EH	69	-58383.70	65601.59	89.0	Pass
		Diagonal	2L1 3/4x1 3/4x3/16x3/16	73	-4951.03	8137.21	60.8 78.2 (b)	Pass
T6	141.333 - 134.604	Leg	ROHN 3 EH	78	-64832.30	83786.24	77.4	Pass
		Diagonal	2L2x2x3/16x1/2	82	-6379.95	23455.73	27.2 73.9 (b)	Pass
T7	134.604 - 127.937	Leg	ROHN 3 EH	87	-78380.80	83784.51	93.6	Pass
		Diagonal	2L2x2x3/16x1/2	91	-6475.86	22121.00	29.3 76.3 (b)	Pass
T8	127.937 - 121.187	Leg	ROHN 3 EH	96	-97639.10	114754.10	85.1	Pass
		Diagonal	2L2x2x3/16x1/2	105	-7610.16	22848.42	33.3 87.5 (b)	Pass
		Horizontal	L2 1/2x2 1/2x1/4	104	-1693.28	9182.48	18.4 20.2 (b)	Pass
		Redund Horz 1 Bracing	L2x2x1/4	128	-1693.28	19342.10	8.8	Pass
		Redund Diag 1 Bracing	L2x2x1/4	129	-1032.04	16811.13	6.1	Pass
T9	121.187 - 114.437	Leg	ROHN 3.5 EH	138	-103187.00	132156.15	78.1	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x1/2	141	-6980.88	32411.09	21.5 80.9 (b)	Pass
		Secondary Horizontal	L2 1/2x2 1/2x1/4	146	-1789.52	8084.18	22.1	Pass
T10	114.437 - 107.771	Leg	ROHN 3.5 EH	150	-115515.00	132182.14	87.4	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x1/2	152	-6882.74	31426.54	21.9 80.4 (b)	Pass
		Secondary Horizontal	L2 1/2x2 1/2x1/4	158	-2003.39	7172.02	27.9	Pass
T11	107.771 - 101.021	Leg	ROHN 3.5 EH Reinforced w/ 2" B7 S.R. (3' Span)	162	-134435.00	175142.86	76.8	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x1/2	165	-7038.72	30046.89	23.4 82.7 (b)	Pass
T12	101.021 - 80.8333	Leg	ROHN 4 EH Reinforced w/ 2" B7 S.R. (3' Span)	171	-167974.00	213474.61	78.7	Pass

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (lb)	SF*P_allow (lb)	% Capacity	Pass / Fail	
		Diagonal	2L3x3x3/16x1/2	174	-7373.47	37929.45	19.4 87.0 (b)	Pass	
T13	80.8333 - 60.625	Leg	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	192	-	200473.00	237180.68	84.5	Pass
		Diagonal	2L3x3x3/16x1/4	195	-8726.87	27189.20	32.1 74.1 (b)	Pass	
T14	60.625 - 40.4167	Leg	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	207	-	231066.00	317539.25	72.8	Pass
		Diagonal	2L3x3x1/4x1/4	210	-8985.00	30009.96	29.9 76.5 (b)	Pass	
		Secondary Horizontal	L3x3x1/4	216	-4007.49	5133.41	78.1	Pass	
T15	40.4167 - 30.3125	Leg	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	228	-	238175.00	287697.38	82.8	Pass
		Diagonal	2L3 1/2x3 1/2x1/4	231	-9553.42	48775.54	19.6 81.0 (b)	Pass	
T16	30.3125 - 20.2083	Leg	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	237	-	261615.00	351489.42	74.4	Pass
		Diagonal	2L3 1/2x3 1/2x1/4	240	-9873.55	44974.75	22.0 83.9 (b)	Pass	
		Secondary Horizontal	L3 1/2x3 1/2x1/4	245	-4536.91	6705.92	67.7	Pass	
T17	20.2083 - 0	Leg	ROHN 6 EH Reinforced w/ 2" B7 S.R. (3' Span)	249	-	290663.00	340169.59	85.4	Pass
		Diagonal	L4x4x1/4	252	-10396.00	11747.93	88.5	Pass	
							Summary		
							Leg (T7)	93.6	Pass
							Diagonal (T4)	92.8	Pass
							Horizontal (T8)	20.2	Pass
							Secondary Horizontal (T14)	78.1	Pass
							Top Girt (T1)	16.1	Pass
							Redund Horz 1 Bracing (T8)	8.8	Pass
							Redund Diag 1 Bracing (T8)	6.1	Pass
							Bolt Checks	87.5	Pass
							Rating =	93.6	Pass

**Table 6 - Tower Component Stresses vs. Capacity – LC7**

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	74.3	Pass
1	Base Foundation Soil Interaction	0	89.9	Pass
1	Leg Reinforcement Bulkhead Shear Collection	107	88.4	Pass

<b>Structure Rating (max from all components) =</b>	<b>93.6%</b>
---	--------------

Notes:

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

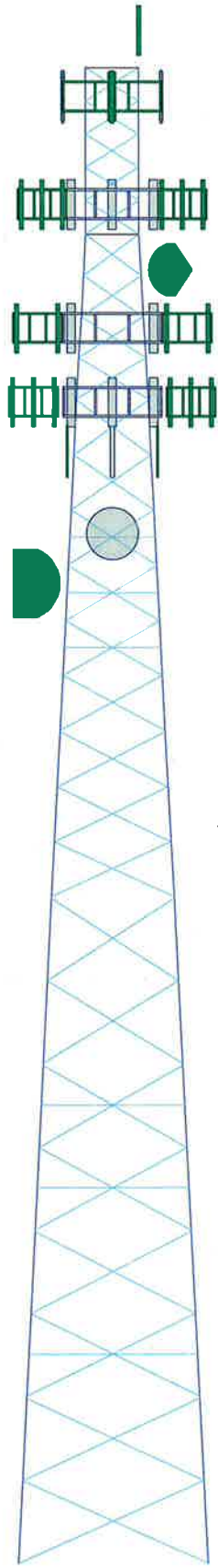
#### 4.1) Recommendations

N/A

**APPENDIX A**  
**TNXTOWER OUTPUT**

Section	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	
Legs																							
Log Grade																							
Diagonals																							
Diagonal Grade																							
Top Girts																							
Horizontals																							
Sec. Horizontals																							
Rec. Diagonals																							
# Panels (ft)																							
Weight (lb)																							

181.6 ft  
161.5 ft  
156.4 ft  
151.4 ft  
146.4 ft  
141.3 ft  
134.6 ft  
127.9 ft  
121.2 ft  
114.4 ft  
107.6 ft  
101.0 ft  
80.8 ft  
60.6 ft  
40.4 ft  
30.3 ft  
20.2 ft  
0.0 ft



**DESIGNED APPURTENANCE LOADING**

TYPE	ELEVATION	TYPE	ELEVATION
18" Accelerator (VSI)	182	6' x 2" Antenna Mount Pipe (VSI)	165
(3) RR90-17-02DP w/Mount Pipe	182	(2) 7770.00 w/ mount pipe	165
Sector Mount [SM 506-3] (Verizon Wireless)	178	(2) LGP21401 TMA (VSI)	165
(2) LPA-800806CF w/Mount Pipe (Verizon Wireless)	178	(2) LGP21903 TMA	165
(2) LPA-800806CF w/Mount Pipe (Verizon Wireless)	178	6' x 2" Antenna Mount Pipe (VSI)	165
LPA-800806CF w/Mount Pipe (Verizon Wireless)	178	DBXNH-05658-R2M w/ Mount Pipe	165
LPA-800806CF w/Mount Pipe (Verizon Wireless)	178	AM-X-CD-16-05-00T-RET w/ Mount Pipe	165
SXA-70063-6CF-2 w/ Mount Pipe (Verizon Wireless)	178	AM-X-CD-16-05-00T-RET w/ Mount Pipe	165
SXA-70063-6CF-2 w/ Mount Pipe (Verizon Wireless)	178	(2) RRUS-11 BTS (10.69 x 16.97 x 7.17)	165
SXA-70063-6CF-2 w/ Mount Pipe (Verizon Wireless)	178	(2) RRUS-11 BTS (10.69 x 16.97 x 7.17)	165
SXA-70063-6CF-2 w/ Mount Pipe (Verizon Wireless)	178	(2) RRUS-11 BTS (10.69 x 16.97 x 7.17)	165
SXA-171085-12BF-2 w/ Mount Pipe (Verizon Wireless)	178	DC6-46-60-18-8F	105
SXA-171085-12BF-2 w/ Mount Pipe (Verizon Wireless)	178	Sector Mount [SM 506-3]	165
SXA-171085-12BF-2 w/ Mount Pipe (Verizon Wireless)	178	(2) 7770.00 w/ mount pipe	165
SXA-171085-12BF-2 w/ Mount Pipe (Verizon Wireless)	178	Pipe Mount [PM 601-1] (Verizon Wireless)	157
742 213 w/ Mount Pipe (Verizon Wireless)	178	PAR0-59 (Verizon Wireless)	157
742 213 w/ Mount Pipe (Verizon Wireless)	178	Sector Mount [SM 504-3]	150
742 213 w/ Mount Pipe (Verizon Wireless)	178	(2) DB680H90E-M w/Mount Pipe	150
(2) FDR90004/2C-3L Diplexer (Verizon Wireless)	178	(2) DB680H90E-M w/Mount Pipe	150
(2) FDR90004/2C-3L Diplexer (Verizon Wireless)	178	(2) DB680H90E-M w/Mount Pipe	150
(2) FDR90004/2C-3L Diplexer (Verizon Wireless)	178	6' x 2" Antenna Mount Pipe (VSI)	150
RRH2X40-AWS BTS (Verizon Wireless)	178	6' x 2" Antenna Mount Pipe (VSI)	150
RRH2X40-AWS BTS (Verizon Wireless)	178	6' x 2" Antenna Mount Pipe (VSI)	150
RRH2X40-AWS BTS (Verizon Wireless)	178	(3) DB844H90E-XY w/Mount Pipe	141
RRH2X40-AWS BTS (Verizon Wireless)	178	(3) DB844H90E-XY w/Mount Pipe	141
DB-T1-62-8AB-02 BTS (Verizon Wireless)	178	(3) DB844H90E-XY w/Mount Pipe	141
(2) LGP21401 TMA (VSI)	165	6' x 2" Antenna Mount Pipe (VSI)	141
(2) LGP21903 TMA	165	6' x 2" Antenna Mount Pipe (VSI)	141
6' x 2" Antenna Mount Pipe (VSI)	165	6' x 2" Antenna Mount Pipe (VSI)	141
(2) 7770.00 w/ mount pipe	165	Sector Mount [SM 506-3]	141
(2) LGP21401 TMA (VSI)	165	742 213 w/ Mount Pipe	135
(2) LGP21903 TMA	165	742 213 w/ Mount Pipe	135
6' x 2" Antenna Mount Pipe (VSI)	165	742 213 w/ Mount Pipe	135
(2) 7770.00 w/ mount pipe	165	Pipe Mount [PM 601-1] (Verizon Wireless)	125
(2) LGP21401 TMA (VSI)	165	PAR0-59 (Verizon Wireless)	125
(2) LGP21903 TMA	165	HP8-57W (Verizon Wireless)	119
6' x 2" Antenna Mount Pipe (VSI)	165	Pipe Mount [PM 601-1] (Verizon Wireless)	119
(2) 7770.00 w/ mount pipe	165	Generic GPS (VSI)	50
(2) LGP21401 TMA (VSI)	165	16" Side Arm	50
(2) LGP21903 TMA	165		

**SYMBOL LIST**

MARK	SIZE	MARK	SIZE
A	ROHN 3.5 EH Reinforced w/ 2" B7 S.R. (3' Span)	D	ROHN 6 EH Reinforced w/ 2" B7 S.R. (3' Span)
B	ROHN 4 EH Reinforced w/ 2" B7 S.R. (3' Span)	E	2L 3/4x1 3/4x3/16x3/16
C	ROHN 6 EH Reinforced w/ 2" B7 S.R. (3' Span)	F	L2 1/2x2 1/2x1/4

**MATERIAL STRENGTH**

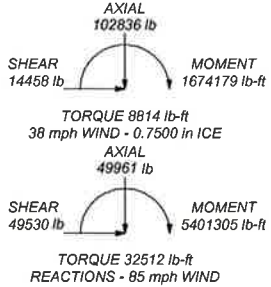
GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

**TOWER DESIGN NOTES**

1. Tower is located in Middlesex County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 93.6%

**MAX. CORNER REACTIONS AT BASE:**

DOWN: 289425 lb  
SHEAR: 30292 lb  
UPLIFT: -246520 lb  
SHEAR: 26658 lb



TORQUE 8814 lb-ft  
38 mph WIND - 0.7500 in ICE  
AXIAL 49961 lb  
TORQUE 32512 lb-ft  
REACTIONS - 85 mph WIND

<b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	Job: <b>HRT 080, CT BU#806478</b> Project: <b>Vertical Structures Job No. 2014-004-005</b> Client: <b>Crown Castle</b> Drawn by: <b>chymore</b> App'd: Code: <b>TIA/EIA-222-F</b> Date: <b>01/29/14</b> Scale: <b>NTS</b> Path:
	Scale: <b>NTS</b> Dwg No. <b>E-1</b>

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr. Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 1 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

## Tower Input Data

The main tower is a 3x free standing tower with an overall height of 181.58 ft above the ground line.

The base of the tower is set at an elevation of 0.00 ft above the ground line.

The face width of the tower is 6.52 ft at the top and 22.86 ft at the base.

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

The following design criteria apply:

Tower is located in Middlesex County, Connecticut.

Basic wind speed of 85 mph.

Nominal ice thickness of 0.7500 in.

Ice thickness is considered to increase with height.

Ice density of 56 pcf.

A wind speed of 38 mph is used in combination with ice.

Temperature drop of 50 °F.

Deflections calculated using a wind speed of 50 mph.

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

Pressures are calculated at each section.

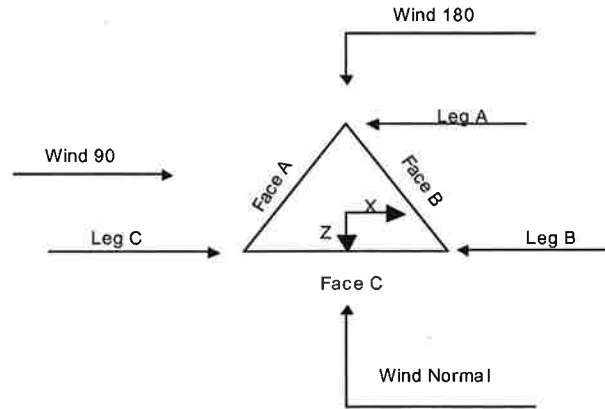
Stress ratio used in tower member design is 1.333.

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

## Options

- |  |   |   |
|--|---|---|
| <ul style="list-style-type: none"> <li>Consider Moments - Legs</li> <li>Consider Moments - Horizontals</li> <li>Consider Moments - Diagonals</li> <li>Use Moment Magnification</li> <li>√ Use Code Stress Ratios</li> <li>√ Use Code Safety Factors - Guys</li> <li>√ Escalate Ice</li> <li>Always Use Max Kz</li> <li>Use Special Wind Profile</li> <li>√ Include Bolts In Member Capacity</li> <li>Leg Bolts Are At Top Of Section</li> <li>√ Secondary Horizontal Braces Leg</li> <li>Use Diamond Inner Bracing (4 Sided)</li> <li>Add IBC .6D+W Combination</li> </ul> | <ul style="list-style-type: none"> <li>Distribute Leg Loads As Uniform</li> <li>Assume Legs Pinned</li> <li>√ Assume Rigid Index Plate</li> <li>√ Use Clear Spans For Wind Area</li> <li>Use Clear Spans For KL/r</li> <li>√ Retension Guys To Initial Tension</li> <li>√ Bypass Mast Stability Checks</li> <li>√ Use Azimuth Dish Coefficients</li> <li>√ Project Wind Area of Appurt.</li> <li>√ Autocalc Torque Arm Areas</li> <li>√ SR Members Have Cut Ends</li> <li>Sort Capacity Reports By Component</li> <li>√ Triangulate Diamond Inner Bracing</li> <li>Use TIA-222-G Tension Splice Capacity Exemption</li> </ul> | <ul style="list-style-type: none"> <li>Treat Feedline Bundles As Cylinder</li> <li>Use ASCE 10 X-Brace Ly Rules</li> <li>√ Calculate Redundant Bracing Forces</li> <li>Ignore Redundant Members in FEA</li> <li>√ SR Leg Bolts Resist Compression</li> <li>√ All Leg Panels Have Same Allowable</li> <li>Offset Girt At Foundation</li> <li>√ Consider Feedline Torque</li> <li>Include Angle Block Shear Check</li> <li style="text-align: center;">Poles</li> <li>Include Shear-Torsion Interaction</li> <li>Always Use Sub-Critical Flow</li> <li>Use Top Mounted Sockets</li> </ul> |
|--|---|---|

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 2 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore



**Triangular Tower**

**Tower Section Geometry**

Tower Section	Tower Elevation <i>ft</i>	Assembly Database	Description	Section Width <i>ft</i>	Number of Sections	Section Length <i>ft</i>
T1	181.58-161.46			6.52	1	20.13
T2	161.46-156.40			6.56	1	5.06
T3	156.40-151.40			7.07	1	5.00
T4	151.40-146.40			7.58	1	5.00
T5	146.40-141.33			8.09	1	5.06
T6	141.33-134.60			8.60	1	6.73
T7	134.60-127.94			9.28	1	6.67
T8	127.94-121.19			9.96	1	6.75
T9	121.19-114.44			10.64	1	6.75
T10	114.44-107.77			11.32	1	6.67
T11	107.77-101.02			12.00	1	6.75
T12	101.02-80.83			12.68	1	20.19
T13	80.83-60.62			14.77	1	20.21
T14	60.62-40.42			16.77	1	20.21
T15	40.42-30.31			18.85	1	10.10
T16	30.31-20.21			19.86	1	10.10
T17	20.21-0.00			20.86	1	20.21

**Tower Section Geometry (cont'd)**

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr. Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 3 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

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	181.58-161.46	4.00	X Brace	No	No	0.7500	0.7500
T2	161.46-156.40	5.00	X Brace	No	No	0.7500	0.0000
T3	156.40-151.40	5.00	X Brace	No	No	0.0000	0.0000
T4	151.40-146.40	5.00	X Brace	No	No	0.0000	0.0000
T5	146.40-141.33	5.00	X Brace	No	No	0.0000	0.7500
T6	141.33-134.60	6.67	X Brace	No	No	0.7500	0.0000
T7	134.60-127.94	6.67	X Brace	No	No	0.0000	0.0000
T8	127.94-121.19	3.33	Double K1	No	Yes	0.0000	1.0000
T9	121.19-114.44	6.67	X Brace	No	Yes	1.0000	0.0000
T10	114.44-107.77	6.67	X Brace	No	Yes	0.0000	0.0000
T11	107.77-101.02	6.67	X Brace	No	No	0.0000	1.0000
T12	101.02-80.83	6.67	X Brace	No	No	1.0000	1.2500
T13	80.83-60.62	10.00	X Brace	No	No	1.2500	1.2500
T14	60.62-40.42	10.00	X Brace	No	Yes	1.2500	1.2500
T15	40.42-30.31	10.00	X Brace	No	No	1.2500	0.0000
T16	30.31-20.21	10.00	X Brace	No	Yes	0.0000	1.2500
T17	20.21-0.00	10.00	X Brace	No	No	1.2500	1.2500

### Tower Section Geometry (cont'd)

Tower Elevation	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
ft						
T1 181.58-161.46	Pipe	ROHN 2 STD	A572-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T2 161.46-156.40	Pipe	ROHN 2.5 EH	A572-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T3 156.40-151.40	Pipe	ROHN 2.5 EH	A572-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T4 151.40-146.40	Pipe	ROHN 2.5 EH	A572-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T5 146.40-141.33	Pipe	ROHN 2.5 EH	A572-50 (50 ksi)	Double Equal Angle	2L1 3/4x1 3/4x3/16x3/16	A36 (36 ksi)
T6 141.33-134.60	Pipe	ROHN 3 EH	A572-50 (50 ksi)	Double Equal Angle	2L2x2x3/16x1/2	A36 (36 ksi)
T7 134.60-127.94	Pipe	ROHN 3 EH	A572-50 (50 ksi)	Double Equal Angle	2L2x2x3/16x1/2	A36 (36 ksi)
T8 127.94-121.19	Pipe	ROHN 3 EH	A572-50 (50 ksi)	Double Equal Angle	2L2x2x3/16x1/2	A36 (36 ksi)
T9 121.19-114.44	Pipe	ROHN 3.5 EH	A572-50 (50 ksi)	Double Equal Angle	2L2 1/2x2 1/2x3/16x1/2	A36 (36 ksi)
T10 114.44-107.77	Pipe	ROHN 3.5 EH	A572-50 (50 ksi)	Double Equal Angle	2L2 1/2x2 1/2x3/16x1/2	A36 (36 ksi)
T11 107.77-101.02	Arbitrary Shape	ROHN 3.5 EH Reinforced w/ 2" B7 S.R. (3' Span)	A572-50 (50 ksi)	Double Equal Angle	2L2 1/2x2 1/2x3/16x1/2	A36 (36 ksi)
T12 101.02-80.83	Arbitrary Shape	ROHN 4 EH Reinforced w/ 2" B7 S.R. (3' Span)	A572-50 (50 ksi)	Double Equal Angle	2L3x3x3/16x1/2	A36 (36 ksi)
T13 80.83-60.62	Arbitrary Shape	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	A572-50 (50 ksi)	Double Equal Angle	2L3x3x3/16x1/4	A36 (36 ksi)
T14 60.62-40.42	Arbitrary Shape	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	A572-50 (50 ksi)	Double Equal Angle	2L3x3x1/4x1/4	A572-50 (50 ksi)
T15 40.42-30.31	Arbitrary Shape	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	A572-50 (50 ksi)	Double Equal Angle	2L3 1/2x3 1/2x1/4	A572-50 (50 ksi)
T16 30.31-20.21	Arbitrary Shape	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	A572-50 (50 ksi)	Double Equal Angle	2L3 1/2x3 1/2x1/4	A572-50 (50 ksi)
T17 20.21-0.00	Arbitrary Shape	ROHN 6 EH Reinforced w/ 2"	A572-50	Equal Angle	L4x4x1/4	A572-50



<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 4 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
		B7 S.R. (3' Span)	(50 ksi)			(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 181.58-161.46	Single Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T2 161.46-156.40	Single Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		A36 (36 ksi)

### Tower Section Geometry (cont'd)

Tower Elevation ft	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T8 127.94-121.19	None	Solid Round		A36 (36 ksi)	Equal Angle	L2 1/2x2 1/2x1/4	A36 (36 ksi)

### Tower Section Geometry (cont'd)

Tower Elevation ft	Secondary Horizontal Type	Secondary Horizontal Size	Secondary Horizontal Grade	Inner Bracing Type	Inner Bracing Size	Inner Bracing Grade
T9 121.19-114.44	Equal Angle	L2 1/2x2 1/2x1/4	A36 (36 ksi)	Solid Round		A36 (36 ksi)
T10 114.44-107.77	Equal Angle	L2 1/2x2 1/2x1/4	A36 (36 ksi)	Solid Round		A36 (36 ksi)
T14 60.62-40.42	Equal Angle	L3x3x1/4	A36 (36 ksi)	Solid Round		A36 (36 ksi)
T16 30.31-20.21	Equal Angle	L3 1/2x3 1/2x1/4	A36 (36 ksi)	Solid Round		A36 (36 ksi)

### Tower Section Geometry (cont'd)

Tower Elevation ft	Redundant Bracing Grade	Redundant Type	Redundant Size	K Factor
-----------------------	-------------------------	----------------	----------------	----------





<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY.40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>	HRT 080, CT BU#806478	<b>Page</b>	7 of 28
	<b>Project</b>	Vertical Structures Job No. 2014-004-005	<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>	Crown Castle	<b>Designed by</b>	chymore

Tower Elevation ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T5 146.40-141.33	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 141.33-134.60	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T7 134.60-127.94	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T8 127.94-121.19	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T9 121.19-114.44	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T10 114.44-107.77	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T11 107.77-101.02	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T12 101.02-80.83	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T13 80.83-60.62	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T14 60.62-40.42	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T15 40.42-30.31	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T16 30.31-20.21	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T17 20.21-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

### Tower Section Geometry (cont'd)

Tower Elevation ft	Connection Offsets							
	Diagonal				K-Bracing			
	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.
in	in	in	in	in	in	in	in	
T1 181.58-161.46	2.5000	2.7500	2.5000	2.7500	0.0000	0.0000	0.0000	0.0000
T2 161.46-156.40	2.5000	3.0000	2.5000	3.0000	0.0000	0.0000	0.0000	0.0000
T3 156.40-151.40	2.5000	3.3125	2.5000	3.3125	0.0000	0.0000	0.0000	0.0000
T4 151.40-146.40	2.5000	3.3125	2.5000	3.3125	0.0000	0.0000	0.0000	0.0000
T5 146.40-141.33	2.5000	3.3125	2.5000	3.3125	0.0000	0.0000	0.0000	0.0000
T6 141.33-134.60	2.5000	3.5630	2.5000	3.5630	0.0000	0.0000	0.0000	0.0000
T7 134.60-127.94	2.5000	3.5630	2.5000	3.5630	0.0000	0.0000	0.0000	0.0000
T8 127.94-121.19	2.5000	3.5630	2.5000	3.5630	0.0000	0.0000	0.0000	0.0000



<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 9 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

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.
T14 60.62-40.42	Flange	1.0000	0	0.6250	1	0.6250	0	0.6250	0	0.6250	0	0.6250	0	0.6250	1
T15 40.42-30.31	Flange	1.0000	0	0.6250	1	0.6250	0	0.0000	0	0.6250	0	0.6250	0	0.6250	0
T16 30.31-20.21	Flange	1.0000	0	0.6250	1	0.6250	0	0.6250	0	0.6250	0	0.6250	0	0.6250	1
T17 20.21-0.00	Flange	1.0000	0	0.6250	1	0.6250	0	0.6250	0	0.6250	0	0.6250	0	0.6250	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
LDF7-50A (1-5/8 FOAM)	C	Yes	Ar (CfAe)	141.00 - 8.00	-2.0000	-0.45	15	9	0.2700	1.9800		0.82
LDF7-50A (1-5/8 FOAM)	C	Yes	Ar (CfAe)	152.00 - 141.00	1.0000	-0.45	6	6	0.2700	1.9800		0.82
LDF7-50A (1-5/8 FOAM)	C	Yes	Ar (CfAe)	181.58 - 8.00	-1.0000	-0.35	6	6	0.2700	1.9800		0.82
LDF4-50A (1/2 FOAM)	C	Yes	Ar (CfAe)	50.00 - 8.00	1.0000	-0.35	1	1	0.0000	0.0000		0.15
Feedline Ladder (1-1/2" Rails) (Af)	C	Yes	Af (CfAe)	152.00 - 8.00	-0.5000	-0.4	2	1	3.0000	3.0000	12.0000	3.66
Feedline Ladder (1-1/2" Rails) (Af)	C	Yes	Af (CfAe)	181.58 - 152.00	-0.5000	-0.4	1	1	3.0000	3.0000	12.0000	3.66
** Feedline Ladder (1-1/2" Rails) (Af)	A	Yes	Af (CfAe)	181.58 - 8.00	0.5000	0.35	1	1	1.5000	1.5000	12.0000	3.66
FLC 158-50J (1 5/8 FOAM) (Verizon Wireless)	A	Yes	Ar (CfAe)	178.00 - 8.00	1.0000	0.4	13	7	1.0000	2.0200		0.92
LDF7-50A (1-5/8 FOAM)	A	Yes	Ar (CfAe)	119.00 - 8.00	1.0000	0.3	9	6	1.0000	1.9800		0.82
LDF7-50A (1-5/8 FOAM)	A	Yes	Ar (CfAe)	125.00 - 119.00	1.0000	0.3	8	6	1.0000	1.9800		0.82
LDF7-50A (1-5/8 FOAM)	A	Yes	Ar (CfAe)	135.00 - 125.00	1.0000	0.3	7	6	1.0000	1.9800		0.82
EW52 (Verizon Wireless)	A	Yes	Ar (CfAe)	157.00 - 135.00	1.0000	0.3	1	1	1.7426	1.7426		0.59
** Feedline Ladder (1-1/2" Rails) (Af)	B	Yes	Af (CfAe)	167.00 - 8.00	1.0000	-0.42	1	1	3.0000	3.0000	12.0000	3.66
LDF6-50A (1-1/4 FOAM)	B	Yes	Ar (CfAe)	167.00 - 8.00	1.0000	-0.45	12	6	0.7000	1.5500		0.66
FB-L98B-002-75000 (3/8")	B	Yes	Ar (CfAe)	167.00 - 8.00	1.0000	-0.45	1	1	0.3937	0.3937		0.10
WR-VG122S	B	Yes	Ar (CfAe)	167.00 - 8.00	1.0000	-0.45	2	2	0.0000	0.0000		0.12

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 10 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

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
T-BRDA (Power Cable)												
2" Rigid Conduit **	B	Yes	Ar (CfAe)	167.00 - 8.00	1.0000	-0.45	1	1	2.0000	2.0000		2.80
2" Solid Rod Reinf (Ar) (VSI)	A	No	Ar (Leg)	110.00 - 0.00	0.0000	-0.07	1	1	2.0000	2.5000		0.00
2" Solid Rod Reinf (Ar) (VSI)	B	No	Ar (Leg)	110.00 - 0.00	0.0000	-0.07	1	1	2.0000	2.5000		0.00
2" Solid Rod Reinf (Ar) (VSI) **	C	No	Ar (Leg)	110.00 - 0.00	0.0000	-0.07	1	1	2.0000	2.5000		0.00
Climbing Ladder (Af)	A	Yes	Af (CfAe)	181.58 - 0.00	0.5000	0	1	1	1.8000	1.8000	7.2000	7.90

### Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A <sub>R</sub> ft <sup>2</sup>	A <sub>F</sub> ft <sup>2</sup>	C <sub>AA</sub> In Face ft <sup>2</sup>	C <sub>AA</sub> Out Face ft <sup>2</sup>	Weight lb
T1	181.58-161.46	A	19.492	5.534	0.000	0.000	430.47
		B	5.400	1.385	0.000	0.000	81.57
		C	19.924	5.031	0.000	0.000	172.67
T2	161.46-156.40	A	6.053	1.392	0.000	0.000	119.43
		B	4.933	1.266	0.000	0.000	74.52
		C	5.012	1.266	0.000	0.000	43.44
T3	156.40-151.40	A	6.618	1.375	0.000	0.000	120.55
		B	4.872	1.250	0.000	0.000	73.60
		C	5.548	1.250	0.000	0.000	48.08
T4	151.40-146.40	A	6.618	1.375	0.000	0.000	120.55
		B	4.872	1.250	0.000	0.000	73.60
		C	9.900	1.250	0.000	0.000	85.80
T5	146.40-141.33	A	6.700	1.392	0.000	0.000	122.06
		B	4.933	1.266	0.000	0.000	74.52
		C	10.024	1.266	0.000	0.000	86.87
T6	141.33-134.60	A	9.241	1.851	0.000	0.000	164.28
		B	6.557	1.682	0.000	0.000	99.05
		C	16.490	1.682	0.000	0.000	162.67
T7	134.60-127.94	A	14.456	1.833	0.000	0.000	195.07
		B	6.497	1.667	0.000	0.000	98.13
		C	16.500	1.667	0.000	0.000	163.60
T8	127.94-121.19	A	14.636	1.856	0.000	0.000	200.63
		B	6.578	1.688	0.000	0.000	99.36
		C	16.706	1.688	0.000	0.000	165.65
T9	121.19-114.44	A	14.636	1.856	0.000	0.000	206.78
		B	6.578	1.688	0.000	0.000	99.36
		C	16.706	1.688	0.000	0.000	165.65
T10	114.44-107.77	A	15.384	1.833	0.000	0.000	206.00
		B	7.425	1.667	0.000	0.000	98.13
		C	17.429	1.667	0.000	0.000	163.60
T11	107.77-101.02	A	17.449	1.856	0.000	0.000	208.57
		B	9.390	1.688	0.000	0.000	99.36
		C	19.519	1.688	0.000	0.000	165.65
T12	101.02-80.83	A	52.185	5.552	0.000	0.000	623.79

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>	HRT 080, CT BU#806478	<b>Page</b>	11 of 28
	<b>Project</b>	Vertical Structures Job No. 2014-004-005	<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>	Crown Castle	<b>Designed by</b>	chymore

Tower Section	Tower Elevation ft	Face	$A_R$ ft <sup>2</sup>	$A_F$ ft <sup>2</sup>	$C_{AA}$ In Face ft <sup>2</sup>	$C_{AA}$ Out Face ft <sup>2</sup>	Weight lb
		B	28.084	5.047	0.000	0.000	297.16
		C	58.376	5.047	0.000	0.000	495.40
T13	80.83-60.62	A	52.239	5.557	0.000	0.000	624.44
		B	28.113	5.052	0.000	0.000	297.47
		C	58.436	5.052	0.000	0.000	495.91
T14	60.62-40.42	A	52.239	5.557	0.000	0.000	624.44
		B	28.113	5.052	0.000	0.000	297.47
		C	58.436	5.052	0.000	0.000	497.35
T15	40.42-30.31	A	26.119	2.779	0.000	0.000	312.22
		B	14.056	2.526	0.000	0.000	148.73
		C	29.218	2.526	0.000	0.000	249.47
T16	30.31-20.21	A	26.119	2.779	0.000	0.000	312.22
		B	14.056	2.526	0.000	0.000	148.73
		C	29.218	2.526	0.000	0.000	249.47
T17	20.21-0.00	A	34.892	4.557	0.000	0.000	440.44
		B	20.317	3.052	0.000	0.000	179.71
		C	38.636	3.052	0.000	0.000	301.42

### Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	$A_R$ ft <sup>2</sup>	$A_F$ ft <sup>2</sup>	$C_{AA}$ In Face ft <sup>2</sup>	$C_{AA}$ Out Face ft <sup>2</sup>	Weight lb
T1	181.58-161.46	A	0.914	5.304	34.599	0.000	0.000	1235.65
		B		5.198	7.144	0.000	0.000	276.61
		C		6.386	25.942	0.000	0.000	563.10
T2	161.46-156.40	A	0.906	1.795	10.055	0.000	0.000	356.02
		B		4.720	6.521	0.000	0.000	251.36
		C		1.599	6.521	0.000	0.000	140.78
T3	156.40-151.40	A	0.902	3.071	9.927	0.000	0.000	366.47
		B		4.651	6.439	0.000	0.000	247.70
		C		1.767	7.005	0.000	0.000	155.43
T4	151.40-146.40	A	0.899	3.065	9.923	0.000	0.000	365.79
		B		4.639	6.437	0.000	0.000	247.13
		C		3.148	11.124	0.000	0.000	276.61
T5	146.40-141.33	A	0.895	3.098	10.043	0.000	0.000	369.66
		B		4.684	6.515	0.000	0.000	249.63
		C		3.181	11.261	0.000	0.000	279.30
T6	141.33-134.60	A	0.890	4.115	13.835	0.000	0.000	499.74
		B		6.206	8.657	0.000	0.000	330.86
		C		4.218	18.563	0.000	0.000	547.85
T7	134.60-127.94	A	0.885	4.189	21.489	0.000	0.000	644.37
		B		6.125	8.572	0.000	0.000	326.68
		C		4.167	18.572	0.000	0.000	550.23
T8	127.94-121.19	A	0.880	4.229	21.749	0.000	0.000	662.21
		B		6.177	8.675	0.000	0.000	329.58
		C		4.207	18.800	0.000	0.000	555.29
T9	121.19-114.44	A	0.874	4.216	21.741	0.000	0.000	683.25
		B		6.150	8.671	0.000	0.000	328.34
		C		4.193	18.796	0.000	0.000	553.38
T10	114.44-107.77	A	0.868	5.724	21.463	0.000	0.000	687.31
		B		7.621	8.559	0.000	0.000	330.96
		C		5.702	18.559	0.000	0.000	552.53
T11	107.77-101.02	A	0.861	8.938	21.722	0.000	0.000	709.48
		B		10.844	8.661	0.000	0.000	349.55
		C		8.915	18.786	0.000	0.000	573.14
T12	101.02-80.83	A	0.847	26.540	64.901	0.000	0.000	2105.73
		B		32.145	25.873	0.000	0.000	1035.07



<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 12 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	$A_R$ ft <sup>2</sup>	$A_F$ ft <sup>2</sup>	$C_{AA}$ In Face ft <sup>2</sup>	$C_{AA}$ Out Face ft <sup>2</sup>	Weight lb
T13	80.83-60.62	C	0.822	26.473	56.154	0.000	0.000	1698.90
		A		26.228	64.855	0.000	0.000	2079.35
		B		31.670	25.843	0.000	0.000	1017.88
T14	60.62-40.42	C	0.789	26.161	56.155	0.000	0.000	1673.71
		A		25.790	64.709	0.000	0.000	2042.68
		B		31.012	25.770	0.000	0.000	994.56
T15	40.42-30.31	C	0.756	26.984	56.082	0.000	0.000	1647.84
		A		12.672	32.280	0.000	0.000	1002.83
		B		15.172	12.848	0.000	0.000	485.59
T16	30.31-20.21	C	0.750	13.912	28.004	0.000	0.000	810.68
		A		12.630	32.266	0.000	0.000	999.35
		B		15.109	12.841	0.000	0.000	483.40
T17	20.21-0.00	C	0.750	13.860	27.997	0.000	0.000	807.28
		A		20.594	40.852	0.000	0.000	1317.91
		B		23.589	15.515	0.000	0.000	607.89
		C		22.079	33.827	0.000	0.000	999.22

### Feed Line Shielding

Section	Elevation ft	Face	$A_R$ ft <sup>2</sup>	$A_R$ Ice ft <sup>2</sup>	$A_F$ ft <sup>2</sup>	$A_F$ Ice ft <sup>2</sup>
T1	181.58-161.46	A	0.000	4.040	2.333	3.911
		B	0.000	1.216	0.633	1.177
		C	0.000	3.212	2.327	3.109
T2	161.46-156.40	A	0.000	1.283	0.777	1.290
		B	0.000	1.193	0.647	1.200
		C	0.000	0.869	0.655	0.874
T3	156.40-151.40	A	0.000	0.983	0.564	0.953
		B	0.000	0.826	0.432	0.801
		C	0.000	0.657	0.480	0.637
T4	151.40-146.40	A	0.000	0.959	0.553	0.933
		B	0.000	0.805	0.424	0.784
		C	0.000	1.032	0.771	1.005
T5	146.40-141.33	A	0.000	0.937	0.544	0.916
		B	0.000	0.787	0.416	0.769
		C	0.000	1.009	0.758	0.987
T6	141.33-134.60	A	0.000	1.024	0.685	1.150
		B	0.000	0.836	0.509	0.939
		C	0.000	1.271	1.123	1.428
T7	134.60-127.94	A	0.000	1.418	0.991	1.602
		B	0.000	0.809	0.497	0.914
		C	0.000	1.242	1.105	1.403
T8	127.94-121.19	A	0.000	4.494	3.265	5.273
		B	0.000	2.561	1.636	3.005
		C	0.000	3.937	3.641	4.620
T9	121.19-114.44	A	0.000	1.917	1.700	2.743
		B	0.000	1.091	0.852	1.561
		C	0.000	1.680	1.896	2.403
T10	114.44-107.77	A	0.000	1.882	1.682	2.711
		B	0.000	1.070	0.843	1.541
		C	0.000	1.649	1.876	2.376
T11	107.77-101.02	A	0.000	1.284	1.157	1.863
		B	0.000	0.729	0.580	1.058
		C	0.000	1.125	1.291	1.633
T12	101.02-80.83	A	0.000	3.697	4.076	6.548
		B	0.000	2.093	2.043	3.707

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 13 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

Section	Elevation	Face	$A_R$	$A_R$ Ice	$A_F$	$A_F$ Ice
	ft		ft <sup>2</sup>	ft <sup>2</sup>	ft <sup>2</sup>	ft <sup>2</sup>
T13	80.83-60.62	C	0.000	3.242	4.546	5.741
		A	0.000	2.536	2.894	4.629
		B	0.000	1.428	1.450	2.607
T14	60.62-40.42	C	0.000	2.225	3.228	4.061
		A	0.000	3.368	4.024	6.401
		B	0.000	1.884	2.017	3.581
T15	40.42-30.31	C	0.000	3.011	4.488	5.723
		A	0.000	1.096	1.604	2.537
		B	0.000	0.609	0.804	1.409
T16	30.31-20.21	C	0.000	0.999	1.789	2.312
		A	0.000	1.558	2.301	3.634
		B	0.000	0.864	1.153	2.016
T17	20.21-0.00	C	0.000	1.419	2.566	3.312
		A	0.000	1.342	2.251	3.579
		B	0.000	0.711	1.085	1.897
		C	0.000	1.168	2.414	3.116

### Feed Line Center of Pressure

Section	Elevation	$CP_x$	$CP_z$	$CP_x$ Ice	$CP_z$ Ice
	ft	in	in	in	in
T1	181.58-161.46	4.0418	-5.3919	1.8650	-4.6303
T2	161.46-156.40	3.6457	-10.4906	1.7537	-8.2611
T3	156.40-151.40	4.6505	-12.0889	2.2919	-10.4960
T4	151.40-146.40	8.7444	-8.3982	4.5365	-8.5952
T5	146.40-141.33	9.2725	-8.8653	4.8275	-9.0889
T6	141.33-134.60	11.3224	-7.6825	6.6697	-8.6535
T7	134.60-127.94	10.0971	-11.1237	5.8940	-10.9550
T8	127.94-121.19	7.8529	-8.5813	3.4752	-6.4020
T9	121.19-114.44	9.5379	-10.3482	5.4309	-9.9369
T10	114.44-107.77	9.6319	-10.3838	5.4572	-9.9185
T11	107.77-101.02	10.5371	-11.2955	6.2173	-11.2326
T12	101.02-80.83	10.7683	-11.4301	6.5004	-11.6152
T13	80.83-60.62	12.7523	-13.3825	8.0391	-14.1652
T14	60.62-40.42	12.7103	-13.2214	8.0748	-13.5147
T15	40.42-30.31	14.0187	-14.5034	9.6090	-15.3616
T16	30.31-20.21	12.8095	-13.2114	8.5944	-13.6846
T17	20.21-0.00	9.9662	-10.7116	6.8434	-11.5528

### Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	Placement ft	$C_{AA}$ Front ft <sup>2</sup>	$C_{AA}$ Side ft <sup>2</sup>	Weight lb	
Pipe Mount [PM 601-1] (Verizon Wireless)	C	From Leg	0.50	0.0000	119.00	No Ice	3.00	0.90	65.00
			0.00			1/2" Ice	3.74	1.12	79.14
			0.00			1" Ice	4.48	1.34	93.27

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>	HRT 080, CT BU#806478	<b>Page</b>	14 of 28
	<b>Project</b>	Vertical Structures Job No. 2014-004-005	<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>	Crown Castle	<b>Designed by</b>	chymore

Description	Face or Leg	Offset Type	Offsets:			Placement	C <sub>AA</sub> Front	C <sub>AA</sub> Side	Weight
			Horz	Lateral	Vert				
Pipe Mount [PM 601-1] (Verizon Wireless)	A	From Leg	0.50	0.0000	125.00	2" Ice	5.96	1.78	121.55
						4" Ice	8.92	2.66	178.10
						No Ice	3.00	0.90	65.00
						1/2" Ice	3.74	1.12	79.14
						1" Ice	4.48	1.34	93.27
						2" Ice	5.96	1.78	121.55
** 742 213 w/ Mount Pipe	A	From Leg	1.00	-60.0000	135.00	4" Ice	8.92	2.66	178.10
						No Ice	5.28	4.53	47.55
						1/2" Ice	5.82	5.87	91.19
						1" Ice	6.34	6.77	142.43
						2" Ice	7.40	8.60	271.36
						4" Ice	9.63	12.45	669.00
742 213 w/ Mount Pipe	B	From Leg	1.00	-60.0000	135.00	No Ice	5.28	4.53	47.55
						1/2" Ice	5.82	5.87	91.19
						1" Ice	6.34	6.77	142.43
						2" Ice	7.40	8.60	271.36
						4" Ice	9.63	12.45	669.00
						No Ice	5.28	4.53	47.55
742 213 w/ Mount Pipe	C	From Leg	1.00	-60.0000	135.00	1/2" Ice	5.82	5.87	91.19
						1" Ice	6.34	6.77	142.43
						2" Ice	7.40	8.60	271.36
						4" Ice	9.63	12.45	669.00
						No Ice	5.28	4.53	47.55
						1/2" Ice	5.82	5.87	91.19
** Sector Mount [SM 506-3]	A	None	0.0000	141.00	No Ice	35.47	35.47	1742.40	
					1/2" Ice	50.60	50.60	2347.80	
					1" Ice	65.73	65.73	2953.20	
					2" Ice	95.99	95.99	4164.00	
					4" Ice	156.51	156.51	6585.60	
					No Ice	3.58	5.40	35.55	
(3) DB844H90E-XY w/Mount Pipe	A	From Face	5.00	0.0000	141.00	1/2" Ice	4.20	6.49	79.42
						1" Ice	4.73	7.30	129.38
						2" Ice	5.86	8.96	251.21
						4" Ice	8.27	12.49	616.53
						No Ice	3.58	5.40	35.55
						1/2" Ice	4.20	6.49	79.42
(3) DB844H90E-XY w/Mount Pipe	B	From Face	5.00	0.0000	141.00	1" Ice	4.73	7.30	129.38
						2" Ice	5.86	8.96	251.21
						4" Ice	8.27	12.49	616.53
						No Ice	3.58	5.40	35.55
						1/2" Ice	4.20	6.49	79.42
						1" Ice	4.73	7.30	129.38
(3) DB844H90E-XY w/Mount Pipe	C	From Face	5.00	0.0000	141.00	2" Ice	5.86	8.96	251.21
						4" Ice	8.27	12.49	616.53
						No Ice	3.58	5.40	35.55
						1/2" Ice	4.20	6.49	79.42
						1" Ice	4.73	7.30	129.38
						2" Ice	5.86	8.96	251.21
6' x 2" Antenna Mount Pipe (VSI)	A	From Face	5.00	0.0000	141.00	4" Ice	8.27	12.49	616.53
						No Ice	1.43	1.43	23.00
						1/2" Ice	1.92	1.92	33.83
						1" Ice	2.29	2.29	48.71
						2" Ice	3.06	3.06	91.28
						4" Ice	4.70	4.70	231.84
6' x 2" Antenna Mount Pipe (VSI)	B	From Face	5.00	0.0000	141.00	No Ice	1.43	1.43	23.00
						1/2" Ice	1.92	1.92	33.83
						1" Ice	2.29	2.29	48.71
						2" Ice	3.06	3.06	91.28
						4" Ice	4.70	4.70	231.84
						No Ice	1.43	1.43	23.00
6' x 2" Antenna Mount Pipe (VSI)	C	From Face	5.00	0.0000	141.00	1/2" Ice	1.92	1.92	33.83
						1" Ice	2.29	2.29	48.71
						No Ice	1.43	1.43	23.00
						1/2" Ice	1.92	1.92	33.83
						1" Ice	2.29	2.29	48.71
						No Ice	1.43	1.43	23.00

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>		HRT 080, CT BU#806478		<b>Page</b>		15 of 28	
	<b>Project</b>		Vertical Structures Job No. 2014-004-005		<b>Date</b>		11:48:43 01/29/14	
	<b>Client</b>		Crown Castle		<b>Designed by</b>		chymore	

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C <sub>AA</sub> Front ft <sup>2</sup>	C <sub>AA</sub> Side ft <sup>2</sup>	Weight lb
						2" Ice	3.06	3.06	91.28
						4" Ice	4.70	4.70	231.84
** Sector Mount [SM 504-3]	A	None		0.0000	150.00	No Ice	34.25	34.25	1707.90
						1/2" Ice	48.98	48.98	2286.00
						1" Ice	63.71	63.71	2864.10
						2" Ice	93.17	93.17	4020.30
						4" Ice	152.09	152.09	6332.70
(2) DB980H90E-M w/Mount Pipe	A	From Leg	4.33 -2.50 2.00	-30.0000	150.00	No Ice	4.27	3.86	34.05
						1/2" Ice	4.86	4.95	72.67
						1" Ice	5.37	5.75	117.82
						2" Ice	6.42	7.39	231.39
						4" Ice	8.86	10.87	585.55
(2) DB980H90E-M w/Mount Pipe	B	From Leg	4.33 2.50 2.00	30.0000	150.00	No Ice	4.27	3.86	34.05
						1/2" Ice	4.86	4.95	72.67
						1" Ice	5.37	5.75	117.82
						2" Ice	6.42	7.39	231.39
						4" Ice	8.86	10.87	585.55
(2) DB980H90E-M w/Mount Pipe	C	From Leg	4.33 -2.50 2.00	-30.0000	150.00	No Ice	4.27	3.86	34.05
						1/2" Ice	4.86	4.95	72.67
						1" Ice	5.37	5.75	117.82
						2" Ice	6.42	7.39	231.39
						4" Ice	8.86	10.87	585.55
6' x 2" Antenna Mount Pipe (VSI)	A	From Leg	4.33 -2.50 2.00	0.0000	150.00	No Ice	1.43	1.43	23.00
						1/2" Ice	1.92	1.92	33.83
						1" Ice	2.29	2.29	48.71
						2" Ice	3.06	3.06	91.28
						4" Ice	4.70	4.70	231.84
6' x 2" Antenna Mount Pipe (VSI)	B	From Leg	4.33 2.50 2.00	0.0000	150.00	No Ice	1.43	1.43	23.00
						1/2" Ice	1.92	1.92	33.83
						1" Ice	2.29	2.29	48.71
						2" Ice	3.06	3.06	91.28
						4" Ice	4.70	4.70	231.84
6' x 2" Antenna Mount Pipe (VSI)	C	From Leg	4.33 -2.50 2.00	0.0000	150.00	No Ice	1.43	1.43	23.00
						1/2" Ice	1.92	1.92	33.83
						1" Ice	2.29	2.29	48.71
						2" Ice	3.06	3.06	91.28
						4" Ice	4.70	4.70	231.84
** Pipe Mount [PM 601-1] (Verizon Wireless)	B	From Leg	0.50 0.00 0.00	0.0000	157.00	No Ice	3.00	0.90	65.00
						1/2" Ice	3.74	1.12	79.14
						1" Ice	4.48	1.34	93.27
						2" Ice	5.96	1.78	121.55
						4" Ice	8.92	2.66	178.10
** Sector Mount [SM 506-3]	A	None		0.0000	165.00	No Ice	35.47	35.47	1742.40
						1/2" Ice	50.60	50.60	2347.80
						1" Ice	65.73	65.73	2953.20
						2" Ice	95.99	95.99	4164.00
						4" Ice	156.51	156.51	6585.60
(2) 7770.00 w/ mount pipe	A	From Face	5.00 0.00 2.00	-45.0000	165.00	No Ice	6.22	4.35	56.90
						1/2" Ice	6.77	5.20	105.42
						1" Ice	7.30	5.92	160.42
						2" Ice	8.38	7.41	293.10
						4" Ice	10.69	10.76	679.83
(2) LGP21401 TMA (VSI)	A	From Face	5.00 0.00	-45.0000	165.00	No Ice	0.00	0.36	14.10
						1/2" Ice	0.00	0.48	21.26

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>	HRT 080, CT BU#806478	<b>Page</b>	16 of 28
	<b>Project</b>	Vertical Structures Job No. 2014-004-005	<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>	Crown Castle	<b>Designed by</b>	chymore

Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C <sub>AA</sub> Front	C <sub>AA</sub> Side	Weight
			Horz	Lateral					
			Vert		°	ft	ft <sup>2</sup>	ft <sup>2</sup>	lb
			ft	ft					
			ft						
			2.00			1" Ice	0.00	0.60	30.32
						2" Ice	0.00	0.87	54.89
						4" Ice	0.00	1.52	135.29
(2) LGP21903 TMA	A	From Face	5.00		-45.0000	No Ice	0.00	0.18	11.02
			0.00			1/2" Ice	0.00	0.25	13.44
			2.00			1" Ice	0.00	0.32	16.93
						2" Ice	0.00	0.49	27.95
						4" Ice	0.00	0.94	71.54
6' x 2" Antenna Mount Pipe (VSI)	A	From Face	5.00		0.0000	No Ice	1.43	1.43	23.00
			0.00			1/2" Ice	1.92	1.92	33.83
			0.00			1" Ice	2.29	2.29	48.71
						2" Ice	3.06	3.06	91.28
						4" Ice	4.70	4.70	231.84
(2) 7770.00 w/ mount pipe	B	From Face	5.00		-35.0000	No Ice	6.22	4.35	56.90
			0.00			1/2" Ice	6.77	5.20	105.42
			2.00			1" Ice	7.30	5.92	160.42
						2" Ice	8.38	7.41	293.10
						4" Ice	10.69	10.76	679.83
(2) LGP21401 TMA (VSI)	B	From Face	5.00		-35.0000	No Ice	0.00	0.36	14.10
			0.00			1/2" Ice	0.00	0.48	21.26
			2.00			1" Ice	0.00	0.60	30.32
						2" Ice	0.00	0.87	54.89
						4" Ice	0.00	1.52	135.29
(2) LGP21903 TMA	B	From Face	5.00		-35.0000	No Ice	0.00	0.18	11.02
			0.00			1/2" Ice	0.00	0.25	13.44
			2.00			1" Ice	0.00	0.32	16.93
						2" Ice	0.00	0.49	27.95
						4" Ice	0.00	0.94	71.54
6' x 2" Antenna Mount Pipe (VSI)	B	From Face	5.00		0.0000	No Ice	1.43	1.43	23.00
			0.00			1/2" Ice	1.92	1.92	33.83
			0.00			1" Ice	2.29	2.29	48.71
						2" Ice	3.06	3.06	91.28
						4" Ice	4.70	4.70	231.84
(2) 7770.00 w/ mount pipe	C	From Face	5.00		-35.0000	No Ice	6.22	4.35	56.90
			0.00			1/2" Ice	6.77	5.20	105.42
			2.00			1" Ice	7.30	5.92	160.42
						2" Ice	8.38	7.41	293.10
						4" Ice	10.69	10.76	679.83
(2) LGP21401 TMA (VSI)	C	From Face	5.00		-35.0000	No Ice	0.00	0.36	14.10
			0.00			1/2" Ice	0.00	0.48	21.26
			2.00			1" Ice	0.00	0.60	30.32
						2" Ice	0.00	0.87	54.89
						4" Ice	0.00	1.52	135.29
(2) LGP21903 TMA	C	From Face	5.00		-35.0000	No Ice	0.00	0.18	11.02
			0.00			1/2" Ice	0.00	0.25	13.44
			2.00			1" Ice	0.00	0.32	16.93
						2" Ice	0.00	0.49	27.95
						4" Ice	0.00	0.94	71.54
6' x 2" Antenna Mount Pipe (VSI)	C	From Face	5.00		0.0000	No Ice	1.43	1.43	23.00
			0.00			1/2" Ice	1.92	1.92	33.83
			0.00			1" Ice	2.29	2.29	48.71
						2" Ice	3.06	3.06	91.28
						4" Ice	4.70	4.70	231.84
DBXNH-6565B-R2M w/ Mount Pipe	A	From Face	5.00		-45.0000	No Ice	8.70	7.13	79.55
			0.00			1/2" Ice	9.35	8.32	149.00
			0.00			1" Ice	9.97	9.22	226.52
						2" Ice	11.24	11.06	409.37

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr. Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>		HRT 080, CT BU#806478		<b>Page</b>	17 of 28
	<b>Project</b>		Vertical Structures Job No. 2014-004-005		<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>		Crown Castle		<b>Designed by</b>	chymore

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	Ice 4" No 1/2" 1" 2" 4"	C <sub>AA</sub> Front ft <sup>2</sup>	C <sub>AA</sub> Side ft <sup>2</sup>	Weight lb
AM-X-CD-16-65-00T-RET w/ Mount Pipe	B	From Face	5.00 0.00 0.00	-35.0000	165.00	4" Ice	13.90	15.10	920.39
						No Ice	8.73	6.54	77.70
						1/2" Ice	9.49	7.82	145.29
						1" Ice	10.21	8.94	220.98
						2" Ice	11.60	10.87	400.61
AM-X-CD-16-65-00T-RET w/ Mount Pipe	C	From Face	5.00 0.00 0.00	-35.0000	165.00	4" Ice	14.51	14.94	910.38
						No Ice	8.73	6.54	77.70
						1/2" Ice	9.49	7.82	145.29
						1" Ice	10.21	8.94	220.98
						2" Ice	11.60	10.87	400.61
(2) RRUS-11 BTS (19.69 x 16.97 x 7.17)	A	From Face	5.00 0.00 0.00	-45.0000	165.00	4" Ice	14.51	14.94	910.38
						No Ice	3.25	1.37	47.62
						1/2" Ice	3.49	1.55	68.42
						1" Ice	3.74	1.74	92.25
						2" Ice	4.27	2.14	149.81
(2) RRUS-11 BTS (19.69 x 16.97 x 7.17)	B	From Face	5.00 0.00 0.00	-35.0000	165.00	4" Ice	5.43	3.04	309.89
						No Ice	3.25	1.37	47.62
						1/2" Ice	3.49	1.55	68.42
						1" Ice	3.74	1.74	92.25
						2" Ice	4.27	2.14	149.81
(2) RRUS-11 BTS (19.69 x 16.97 x 7.17)	C	From Face	5.00 0.00 0.00	-35.0000	165.00	4" Ice	5.43	3.04	309.89
						No Ice	3.25	1.37	47.62
						1/2" Ice	3.49	1.55	68.42
						1" Ice	3.74	1.74	92.25
						2" Ice	4.27	2.14	149.81
DC6-48-60-18-8F	C	From Face	5.00 0.00 0.00	-35.0000	165.00	4" Ice	5.43	3.04	309.89
						No Ice	2.57	4.32	18.90
						1/2" Ice	2.80	4.60	50.21
						1" Ice	3.04	4.88	85.17
						2" Ice	3.54	5.49	166.87
** Sector Mount [SM 506-3] (Verizon Wireless)	A	None		0.0000	178.00	4" Ice	4.66	6.80	382.77
						No Ice	35.47	35.47	1742.40
						1/2" Ice	50.60	50.60	2347.80
						1" Ice	65.73	65.73	2953.20
						2" Ice	95.99	95.99	4164.00
(2) LPA-80080/6CF w/Mount Pipe (Verizon Wireless)	A	From Face	5.00 0.00 0.00	0.0000	178.00	4" Ice	156.51	156.51	6585.60
						No Ice	4.35	10.51	42.90
						1/2" Ice	4.79	11.56	104.60
						1" Ice	5.25	12.49	177.42
						2" Ice	6.17	14.40	348.65
LPA-80080/6CF w/Mount Pipe (Verizon Wireless)	B	From Face	5.00 0.00 0.00	0.0000	178.00	4" Ice	8.11	18.43	824.28
						No Ice	4.35	10.51	42.90
						1/2" Ice	4.79	11.56	104.60
						1" Ice	5.25	12.49	177.42
						2" Ice	6.17	14.40	348.65
LPA-80080/6CF w/Mount Pipe (Verizon Wireless)	C	From Face	5.00 0.00 0.00	0.0000	178.00	4" Ice	8.11	18.43	824.28
						No Ice	4.35	10.51	42.90
						1/2" Ice	4.79	11.56	104.60
						1" Ice	5.25	12.49	177.42
						2" Ice	6.17	14.40	348.65
BXA-70063-6CF-2 w/ Mount Pipe (Verizon Wireless)	A	From Face	5.00 0.00 0.00	0.0000	178.00	4" Ice	8.11	18.43	824.28
						No Ice	8.23	6.00	46.20
						1/2" Ice	8.98	7.27	109.52
						1" Ice	9.70	8.38	180.77
						2" Ice	11.08	10.29	351.06
						4" Ice	13.96	14.30	840.30

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>		HRT 080, CT BU#806478		<b>Page</b>	18 of 28
	<b>Project</b>		Vertical Structures Job No. 2014-004-005		<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>		Crown Castle		<b>Designed by</b>	chymore

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	Ice	C <sub>AA</sub> Front ft <sup>2</sup>	C <sub>AA</sub> Side ft <sup>2</sup>	Weight lb
BXA-70063-6CF-2 w/ Mount Pipe (Verizon Wireless)	B	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	8.23	6.00	46.20
						1/2" Ice	8.98	7.27	109.52
						1" Ice	9.70	8.38	180.77
						2" Ice	11.08	10.29	351.06
						4" Ice	13.96	14.30	840.30
BXA-70063-6CF-2 w/ Mount Pipe (Verizon Wireless)	C	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	8.23	6.00	46.20
						1/2" Ice	8.98	7.27	109.52
						1" Ice	9.70	8.38	180.77
						2" Ice	11.08	10.29	351.06
						4" Ice	13.96	14.30	840.30
BXA-171085-12BF-2 w/ Mount Pipe (Verizon Wireless)	A	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	5.21	5.47	44.20
						1/2" Ice	5.87	6.74	92.50
						1" Ice	6.49	7.85	148.38
						2" Ice	7.67	9.75	286.88
						4" Ice	10.21	13.76	708.34
BXA-171085-12BF-2 w/ Mount Pipe (Verizon Wireless)	B	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	5.21	5.47	44.20
						1/2" Ice	5.87	6.74	92.50
						1" Ice	6.49	7.85	148.38
						2" Ice	7.67	9.75	286.88
						4" Ice	10.21	13.76	708.34
BXA-171085-12BF-2 w/ Mount Pipe (Verizon Wireless)	C	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	5.21	5.47	44.20
						1/2" Ice	5.87	6.74	92.50
						1" Ice	6.49	7.85	148.38
						2" Ice	7.67	9.75	286.88
						4" Ice	10.21	13.76	708.34
742 213 w/ Mount Pipe (Verizon Wireless)	A	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	5.28	4.53	47.55
						1/2" Ice	5.82	5.87	91.19
						1" Ice	6.34	6.77	142.43
						2" Ice	7.40	8.60	271.36
						4" Ice	9.63	12.45	669.00
742 213 w/ Mount Pipe (Verizon Wireless)	B	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	5.28	4.53	47.55
						1/2" Ice	5.82	5.87	91.19
						1" Ice	6.34	6.77	142.43
						2" Ice	7.40	8.60	271.36
						4" Ice	9.63	12.45	669.00
742 213 w/ Mount Pipe (Verizon Wireless)	C	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	5.28	4.53	47.55
						1/2" Ice	5.82	5.87	91.19
						1" Ice	6.34	6.77	142.43
						2" Ice	7.40	8.60	271.36
						4" Ice	9.63	12.45	669.00
(2) FD9R6004/2C-3L Diplexer (Verizon Wireless)	A	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	0.00	0.08	3.10
						1/2" Ice	0.00	0.14	5.40
						1" Ice	0.00	0.20	8.79
						2" Ice	0.00	0.34	19.61
						4" Ice	0.00	0.74	62.87
(2) FD9R6004/2C-3L Diplexer (Verizon Wireless)	B	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	0.00	0.08	3.10
						1/2" Ice	0.00	0.14	5.40
						1" Ice	0.00	0.20	8.79
						2" Ice	0.00	0.34	19.61
						4" Ice	0.00	0.74	62.87
(2) FD9R6004/2C-3L Diplexer (Verizon Wireless)	C	From Face	5.00 0.00 0.00	0.0000	178.00	No Ice	0.00	0.08	3.10
						1/2" Ice	0.00	0.14	5.40
						1" Ice	0.00	0.20	8.79
						2" Ice	0.00	0.34	19.61
						4" Ice	0.00	0.74	62.87
RRH2X40-AWS BTS (Verizon Wireless)	A	From Face	5.00 0.00	0.0000	178.00	No Ice	2.52	1.59	44.00
						1/2" Ice	2.75	1.80	61.40

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>	HRT 080, CT BU#806478	<b>Page</b>	19 of 28
	<b>Project</b>	Vertical Structures Job No. 2014-004-005	<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>	Crown Castle	<b>Designed by</b>	chymore

Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C <sub>AA</sub> Front	C <sub>AA</sub> Side	Weight
			Horz Lateral	Vert					
				0.00					
						1" Ice	2.99	2.01	81.69
						2" Ice	3.50	2.46	131.76
						4" Ice	4.61	3.48	275.24
RRH2X40-AWS BTS (Verizon Wireless)	B	From Face	5.00	0.0000	178.00	No Ice	2.52	1.59	44.00
			0.00			1/2" Ice	2.75	1.80	61.40
			0.00			1" Ice	2.99	2.01	81.69
						2" Ice	3.50	2.46	131.76
						4" Ice	4.61	3.48	275.24
RRH2X40-AWS BTS (Verizon Wireless)	C	From Face	5.00	0.0000	178.00	No Ice	2.52	1.59	44.00
			0.00			1/2" Ice	2.75	1.80	61.40
			0.00			1" Ice	2.99	2.01	81.69
						2" Ice	3.50	2.46	131.76
						4" Ice	4.61	3.48	275.24
DB-T1-6Z-8AB-0Z BTS (Verizon Wireless)	C	From Face	5.00	0.0000	178.00	No Ice	5.60	2.33	44.00
			0.00			1/2" Ice	5.92	2.56	80.13
			0.00			1" Ice	6.24	2.79	120.22
						2" Ice	6.91	3.28	213.04
						4" Ice	8.37	4.37	454.67
** 19" Accelerator (VSI)	B	From Leg	0.00	0.0000	182.00	No Ice	7.60	7.60	250.00
			0.00			1/2" Ice	8.11	8.11	331.65
			4.00			1" Ice	8.63	8.63	419.06
						2" Ice	9.71	9.71	611.73
						4" Ice	12.00	12.00	1072.84
(3) RR90-17-02DP w/Mount Pipe	B	From Leg	0.00	0.0000	182.00	No Ice	0.00	0.00	43.55
			0.00			1/2" Ice	0.00	0.00	43.55
			4.00			1" Ice	0.00	0.00	43.55
						2" Ice	0.00	0.00	43.55
						4" Ice	0.00	0.00	43.55
** Generic GPS (VSI)	C	From Leg	1.50	0.0000	50.00	No Ice	1.40	1.40	25.00
			0.00			1/2" Ice	1.70	1.70	30.00
			0.00			1" Ice	1.90	1.90	35.00
						2" Ice	2.20	2.20	40.00
						4" Ice	2.50	2.50	45.00
18" Side Arm	C	From Leg	0.75	0.0000	50.00	No Ice	0.40	0.80	15.00
			0.00			1/2" Ice	0.60	1.30	20.00
			0.00			1" Ice	0.80	1.80	25.00
						2" Ice	1.20	2.80	35.00
						4" Ice	2.00	4.80	55.00

### Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets:		Azimuth Adjustment	3 dB Beam Width	Elevation	Outside Diameter	Aperture Area	Weight	
				Horz Lateral	Vert							ft
HP8-57W (Verizon Wireless)	C	Paraboloid w/Shroud (HP)	From Leg	1.00	0.00	27.0000	°	119.00	8.38	No Ice	55.09	500.00
				0.00						1/2" Ice	56.19	788.44
				0.00						1" Ice	57.29	1076.88



<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 20 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	3 dB Beam Width	Elevation	Outside Diameter	Aperture Area	Weight	
				ft	°	°	ft	ft	ft <sup>2</sup>	lb	
PAR6-59 (Verizon Wireless)	A	Paraboloid w/Radome	From Leg	1.00	27.0000		125.00	6.36	2" Ice	59.50	1653.77
				0.00					4" Ice	63.90	2807.54
				0.00					No Ice	31.75	143.00
									1/2" Ice	32.59	310.29
									1" Ice	33.43	191.58
PAR6-59 (Verizon Wireless)	B	Paraboloid w/Radome	From Leg	1.00	27.0000		157.00	6.36	2" Ice	35.10	240.16
				0.00					4" Ice	38.45	337.32
				0.00					No Ice	31.75	143.00
									1/2" Ice	32.59	310.29
									1" Ice	33.43	191.58
								2" Ice	35.10	240.16	
								4" Ice	38.45	337.32	

### Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load lb	Ratio Load Allowable	Allowable Ratio	Criteria
T1	181.583	Leg	A325N	0.6250	4	4572.92	13170.40	0.347	✓	1.333 Bolt Tension
		Diagonal	A325N	0.5000	1	4232.09	4078.13	1.038	✓	1.333 Member Bearing
		Top Girt	A325N	0.5000	1	392.35	2718.75	0.144	✓	1.333 Member Bearing
T2	161.458	Diagonal	A325N	0.5000	1	4052.99	4123.34	0.983	✓	1.333 Bolt Shear
		Top Girt	A325N	0.5000	1	276.66	2718.75	0.102	✓	1.333 Member Bearing
T3	156.396	Diagonal	A325N	0.5000	1	4168.00	4078.13	1.022	✓	1.333 Member Bearing
T4	151.396	Diagonal	A325N	0.5000	1	4755.92	4123.34	1.153	✓	1.333 Bolt Shear
T5	146.396	Leg	A325N	0.7500	4	12158.00	19211.40	0.633	✓	1.333 Bolt Tension
		Diagonal	A325N	0.5000	1	4956.99	4757.81	1.042	✓	1.333 Gusset Bearing
T6	141.333	Diagonal	A325N	0.5000	1	6209.43	6301.52	0.985	✓	1.333 Gusset Bearing
T7	134.604	Diagonal	A325N	0.5000	1	6412.60	6301.52	1.018	✓	1.333 Gusset Bearing
T8	127.937	Leg	A325N	0.8750	4	20468.50	26130.10	0.783	✓	1.333 Bolt Tension
		Diagonal	A325N	0.5000	1	7610.16	6525.00	1.166	✓	1.333 Gusset Bearing
		Horizontal	A325N	0.6250	1	1693.28	6301.52	0.269	✓	1.333 Gusset Bearing
T9	121.187	Diagonal	A325N	0.5000	1	6793.51	6301.52	1.078	✓	1.333 Gusset Bearing
		Secondary Horizontal	A325N	0.6250	1	1789.52	6301.52	0.284	✓	1.333 Gusset Bearing
T10	114.437	Diagonal	A325N	0.5000	1	6752.76	6301.52	1.072	✓	1.333 Gusset Bearing
		Secondary Horizontal	A325N	0.6250	1	2003.39	6301.52	0.318	✓	1.333 Gusset Bearing
T11	107.771	Diagonal	A325N	0.5000	1	6945.68	6301.52	1.102	✓	1.333 Gusset Bearing
T12	101.021	Diagonal	A325N	0.5000	1	7307.74	6301.52	1.160	✓	1.333 Gusset Bearing
T13	80.8333	Diagonal	A325N	0.6250	1	8504.05	8609.38	0.988	✓	1.333 Gusset Bearing
T14	60.625	Diagonal	A325N	0.6250	1	8784.46	8609.38	1.020	✓	1.333 Gusset Bearing
		Secondary Horizontal	A325N	0.6250	1	4007.49	6442.72	0.622	✓	1.333 Bolt Shear

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 21 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load lb	Ratio Load Allowable	Allowable Ratio	Criteria
T15	40.4167	Diagonal	A325N	0.6250	1	9292.19	8609.38	1.079 ✓	1.333	Gusset Bearing
T16	30.3125	Diagonal	A325N	0.6250	1	9624.78	8609.38	1.118 ✓	1.333	Gusset Bearing
		Secondary Horizontal	A325N	0.6250	1	4536.91	6442.72	0.704 ✓	1.333	Bolt Shear
T17	20.2083	Diagonal	A325X	0.6250	1	9958.91	8609.38	1.157 ✓	1.333	Gusset Bearing

### Compression Checks

### Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T1	181.583 - 161.458	ROHN 2 STD	20.13	4.00	61.0 K=1.00	22.549	1.0745	-23308.40	24229.90	0.962 ✓
T2	161.458 - 156.396	ROHN 2.5 EH	5.07	5.01	65.0 K=1.00	21.838	2.2535	-27429.60	49213.50	0.557 ✓
T3	156.396 - 151.396	ROHN 2.5 EH	5.01	5.01	65.0 K=1.00	21.838	2.2535	-35744.60	49212.40	0.726 ✓
T4	151.396 - 146.396	ROHN 2.5 EH	5.01	5.01	65.0 K=1.00	21.838	2.2535	-44695.80	49212.40	0.908 ✓
T5	146.396 - 141.333	ROHN 2.5 EH	5.07	5.01	65.0 K=1.00	21.838	2.2535	-58383.70	49213.50	1.186 ✓
T6	141.333 - 134.604	ROHN 3 EH	6.74	6.68	70.5 K=1.00	20.841	3.0159	-64832.30	62855.40	1.031 ✓
T7	134.604 - 127.937	ROHN 3 EH	6.68	6.68	70.5 K=1.00	20.841	3.0159	-78380.80	62854.10	1.247 ✓
T8	127.937 - 121.187	ROHN 3 EH	6.76	1.67	17.6 K=1.00	28.544	3.0159	-97639.10	86087.10	1.134 ✓
T9	121.187 - 114.437	ROHN 3.5 EH	6.76	3.44	31.6 K=1.00	26.952	3.6784	-103187.00	99141.90	1.041 ✓
T10	114.437 - 107.771	ROHN 3.5 EH	6.68	3.44	31.6 K=1.00	26.958	3.6784	-115515.00	99161.40	1.165 ✓
T11	107.771 - 101.021	ROHN 3.5 EH Reinforced w/ 2" B7 S.R. (3' Span)	6.76	6.68	78.7 K=1.00	19.264	6.8204	-134435.00	131390.00	1.023 ✓
T12	101.021 - 80.8333	ROHN 4 EH Reinforced w/ 2" B7 S.R. (3' Span)	20.22	6.68	68.5 K=1.00	21.214	7.5490	-167974.00	160146.00	1.049 ✓
T13	80.8333 - 60.625	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	20.24	10.02	78.9 K=1.00	19.227	9.2540	-200473.00	177930.00	1.127 ✓
T14	60.625 - 40.4167	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	20.24	5.16	40.6 K=1.00	25.742	9.2540	-231066.00	238214.00	0.970 ✓
T15	40.4167 - 30.3125	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	10.12	10.02	64.7 K=1.00	21.901	9.8549	-238175.00	215827.00	1.104 ✓
T16	30.3125 - 20.2083	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	10.12	5.13	33.1 K=1.00	26.757	9.8549	-261615.00	263683.00	0.992 ✓
T17	20.2083 - 0	ROHN 6 EH Reinforced w/	20.24	10.02	63.6	22.100	11.5470	-290663.00	255191.00	1.139 ✓

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>	HRT 080, CT BU#806478	<b>Page</b>	22 of 28
	<b>Project</b>	Vertical Structures Job No. 2014-004-005	<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>	Crown Castle	<b>Designed by</b>	chymore

Section No.	Elevation	Size	L	L <sub>u</sub>	Kl/r	F <sub>a</sub>	A	Actual P	Allow. P <sub>a</sub>	Ratio P
	ft		ft	ft		ksi	in <sup>2</sup>	lb	lb	$\frac{P}{P_a}$
		2" B7 S.R. (3' Span)			K=1.00					✓

### Diagonal Design Data (Compression)

Section No.	Elevation	Size	L	L <sub>u</sub>	Kl/r	F <sub>a</sub>	A	Actual P	Allow. P <sub>a</sub>	Ratio P
	ft		ft	ft		ksi	in <sup>2</sup>	lb	lb	$\frac{P}{P_a}$
T1	181.583 - 161.458	L1 3/4x1 3/4x3/16	7.07	3.54	123.6 K=1.00	9.765	0.6211	-4189.51	6064.73	0.691 ✓
T2	161.458 - 156.396	L1 3/4x1 3/4x3/16	7.80	4.05	141.4 K=1.00	7.469	0.6211	-4052.99	4638.71	0.874 ✓
T3	156.396 - 151.396	L1 3/4x1 3/4x3/16	8.18	4.23	147.9 K=1.00	6.829	0.6211	-4108.67	4241.67	0.969 ✓
T4	151.396 - 146.396	L1 3/4x1 3/4x3/16	8.61	4.44	155.3 K=1.00	6.193	0.6211	-4755.92	3846.60	1.236 ✓
T5	146.396 - 141.333	2L1 3/4x1 3/4x3/16x3/16	9.04	4.66	174.3 K=1.00	4.914	1.2422	-4951.03	6104.43	0.811 ✓
T6	141.333 - 134.604	2L 'a' > 26.8145 in - 73 2L2x2x3/16x1/2	10.43	5.41	105.2 K=1.00	12.308	1.4297	-6379.95	17596.20	0.363 ✓
T7	134.604 - 127.937	2L2x2x3/16x1/2	10.98	5.68	110.5 K=1.00	11.607	1.4297	-6475.86	16594.90	0.390 ✓
T8	127.937 - 121.187	2L2x2x3/16x1/2	6.27	6.27	107.6 K=1.00	11.989	1.4297	-7610.16	17140.60	0.444 ✓
T9	121.187 - 114.437	2L 'a' > 21.6754 in - 105 2L2 1/2x2 1/2x3/16x1/2	12.09	6.23	96.0 K=1.00	13.473	1.8047	-6980.88	24314.40	0.287 ✓
T10	114.437 - 107.771	2L2 1/2x2 1/2x3/16x1/2	12.52	6.44	99.3 K=1.00	13.064	1.8047	-6882.74	23575.80	0.292 ✓
T11	107.771 - 101.021	2L2 1/2x2 1/2x3/16x1/2	13.11	6.73	103.8 K=1.00	12.490	1.8047	-7038.72	22540.80	0.312 ✓
T12	101.021 - 80.8333	2L3x3x3/16x1/2	14.89	7.62	97.4 K=1.00	13.054	2.1797	-7373.47	28454.20	0.259 ✓
T13	80.8333 - 60.625	2L3x3x3/16x1/4	18.11	9.33	126.3 K=1.00	9.358	2.1797	-8726.87	20397.00	0.428 ✓
T14	60.625 - 40.4167	2L 'a' > 53.3096 in - 195 2L3x3x1/4x1/4	19.89	10.22	138.1 K=1.00	7.831	2.8750	-8985.00	22513.10	0.399 ✓
T15	40.4167 - 30.3125	2L 'a' > 58.5933 in - 210 2L3 1/2x3 1/2x1/4	20.80	10.67	117.4 K=1.00	10.826	3.3800	-9553.42	36590.80	0.261 ✓
T16	30.3125 - 20.2083	2L3 1/2x3 1/2x1/4	21.69	11.11	122.3 K=1.00	9.982	3.3800	-9873.55	33739.50	0.293 ✓
T17	20.2083 - 0	L4x4x1/4	23.50	12.01	181.3 K=1.00	4.543	1.9400	-10396.00	8813.15	1.180 ✓

### Horizontal Design Data (Compression)

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 23 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T8	127.937 - 121.187	L2 1/2x2 1/2x1/4	10.29	10.29	160.6 K=1.00	5.789	1.1900	-1693.28	6888.58	0.246 ✓

### Secondary Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T9	121.187 - 114.437	L2 1/2x2 1/2x1/4	10.97	10.97	171.2 K=1.00	5.096	1.1900	-1789.52	6064.65	0.295 ✓
T10	114.437 - 107.771	L2 1/2x2 1/2x1/4	11.65	11.65	181.7 K=1.00	4.521	1.1900	-2003.39	5380.36	0.372 ✓
T14	60.625 - 40.4167	L3x3x1/4	18.31	18.31	236.3 K=1.00	2.674	1.4400	-4007.49	3851.02	1.041 ✓
T16	30.3125 - 20.2083	L3 1/2x3 1/2x1/4	20.34	20.34	224.0 K=1.00	2.977	1.6900	-4536.91	5030.70	0.902 ✓

### Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T1	181.583 - 161.458	L2x2x1/8	6.52	6.52	196.8 K=1.00	3.854	0.4844	-399.47	1866.88	0.214 ✓
T2	161.458 - 156.396	L2x2x1/8	6.56	6.56	198.1 K=1.00	3.805	0.4844	-174.82	1843.27	0.095 ✓

### Redundant Horizontal (1) Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T8	127.937 - 121.187	L2x2x1/4	2.57	2.57	79.0 K=1.00	15.469	0.9380	-1693.28	14510.20	0.117 ✓

### Redundant Diagonal (1) Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T8	127.937 -	L2x2x1/4	3.14	3.14	96.3	13.445	0.9380	-1032.04	12611.50	0.082

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 24 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

Section No.	Elevation	Size	L	L <sub>u</sub>	Kl/r	F <sub>a</sub>	A	Actual P	Allow. P <sub>a</sub>	Ratio P/P <sub>a</sub>
	ft		ft	ft		ksi	in <sup>2</sup>	lb	lb	
	121.187				K=1.00					✓

**Tension Checks**

**Leg Design Data (Tension)**

Section No.	Elevation	Size	L	L <sub>u</sub>	Kl/r	F <sub>a</sub>	A	Actual P	Allow. P <sub>a</sub>	Ratio P/P <sub>a</sub>
	ft		ft	ft		ksi	in <sup>2</sup>	lb	lb	
T1	181.583 - 161.458	ROHN 2 STD	20.13	4.00	61.0	30.000	1.0745	18291.70	32235.90	0.567
T2	161.458 - 156.396	ROHN 2.5 EH	5.07	5.01	65.0	30.000	2.2535	22085.40	67606.20	0.327
T3	156.396 - 151.396	ROHN 2.5 EH	5.01	5.01	65.0	30.000	2.2535	29440.80	67606.20	0.435
T4	151.396 - 146.396	ROHN 2.5 EH	5.01	5.01	65.0	30.000	2.2535	36779.80	67606.20	0.544
T5	146.396 - 141.333	ROHN 2.5 EH	5.07	5.01	65.0	30.000	2.2535	48632.00	67606.20	0.719
T6	141.333 - 134.604	ROHN 3 EH	6.74	6.68	70.5	30.000	3.0159	53841.60	90477.90	0.595
T7	134.604 - 127.937	ROHN 3 EH	6.68	6.68	70.5	30.000	3.0159	65225.90	90477.90	0.721
T8	127.937 - 121.187	ROHN 3 EH	6.76	1.67	17.6	30.000	3.0159	81874.00	90477.90	0.905
T9	121.187 - 114.437	ROHN 3.5 EH	6.76	3.44	31.6	30.000	3.6784	86882.50	110352.00	0.787
T10	114.437 - 107.771	ROHN 3.5 EH	6.68	3.44	31.6	30.000	3.6784	97963.50	110352.00	0.888
T11	107.771 - 101.021	ROHN 3.5 EH Reinforced w/ 2" B7 S.R. (3' Span)	6.76	6.68	78.7	30.000	6.8204	114883.00	204612.00	0.561
T12	101.021 - 80.8333	ROHN 4 EH Reinforced w/ 2" B7 S.R. (3' Span)	20.22	6.68	68.5	30.000	7.5490	144650.00	226470.00	0.639
T13	80.8333 - 60.625	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	20.24	10.02	78.9	30.000	9.2540	173085.00	277620.00	0.623
T14	60.625 - 40.4167	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	20.24	5.16	40.6	30.000	9.2540	198539.00	277620.00	0.715
T15	40.4167 - 30.3125	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	10.12	10.02	64.7	30.000	9.8549	204379.00	295647.00	0.691
T16	30.3125 - 20.2083	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	10.12	5.13	33.1	30.000	9.8549	223401.00	295647.00	0.756
T17	20.2083 - 0	ROHN 6 EH Reinforced w/ 2" B7 S.R. (3' Span)	20.24	10.02	63.6	30.000	11.5470	247657.00	346410.00	0.715

**Diagonal Design Data (Tension)**

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 25 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P/P <sub>a</sub>
T1	181.583 - 161.458	L1 3/4x1 3/4x3/16	7.07	3.54	79.0	29.000	0.3779	4232.09	10960.00	0.386
T2	161.458 - 156.396	L1 3/4x1 3/4x3/16	7.80	4.05	90.4	29.000	0.3779	3969.52	10960.00	0.362
T3	156.396 - 151.396	L1 3/4x1 3/4x3/16	8.18	4.23	94.6	29.000	0.3779	4168.00	10960.00	0.380
T4	151.396 - 146.396	L1 3/4x1 3/4x3/16	8.61	4.44	99.3	29.000	0.3779	4572.03	10960.00	0.417
T5	146.396 - 141.333	2L1 3/4x1 3/4x3/16x3/16	9.04	4.66	104.1	29.000	0.7559	4956.99	21919.90	0.226
T6	141.333 - 134.604	2L 'a' > 26.8145 in - 72 2L2x2x3/16x1/2	10.43	5.41	105.2	29.000	0.8965	6209.43	25998.00	0.239
T7	134.604 - 127.937	2L2x2x3/16x1/2	10.98	5.68	110.5	29.000	0.8965	6412.60	25998.00	0.247
T8	127.937 - 121.187	2L2x2x3/16x1/2	6.27	6.27	73.4	29.000	0.8965	7209.60	25998.00	0.277
T9	121.187 - 114.437	2L 'a' > 21.6754 in - 105 2L2 1/2x2 1/2x3/16x1/2	12.09	6.23	96.0	29.000	1.1777	6793.51	34154.30	0.199
T10	114.437 - 107.771	2L2 1/2x2 1/2x3/16x1/2	12.52	6.44	99.3	29.000	1.1777	6752.76	34154.30	0.198
T11	107.771 - 101.021	2L2 1/2x2 1/2x3/16x1/2	13.11	6.73	103.8	29.000	1.1777	6945.68	34154.30	0.203
T12	101.021 - 80.8333	2L3x3x3/16x1/2	14.89	7.62	97.4	29.000	1.4590	7307.74	42310.50	0.173
T13	80.8333 - 60.625	2L3x3x3/16x1/4	18.11	9.33	119.2	29.000	1.4238	8504.05	41291.00	0.206
T14	60.625 - 40.4167	2L 'a' > 53.3096 in - 196 2L3x3x1/4x1/4	19.89	10.22	131.9	32.500	1.8750	8784.46	60937.50	0.144
T15	40.4167 - 30.3125	2L 'a' > 58.5933 in - 211 2L3 1/2x3 1/2x1/4	20.80	10.67	117.4	32.500	2.2538	9292.19	73246.90	0.127
T16	30.3125 - 20.2083	2L3 1/2x3 1/2x1/4	21.69	11.11	122.3	32.500	2.2538	9624.78	73246.90	0.131
T17	20.2083 - 0	L4x4x1/4	23.50	12.01	115.3	32.500	1.3144	9958.91	42717.20	0.233

### Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P/P <sub>a</sub>
T8	127.937 - 121.187	L2 1/2x2 1/2x1/4	10.29	10.29	160.6	29.000	0.7519	1693.28	21804.40	0.078

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b> HRT 080, CT BU#806478	<b>Page</b> 26 of 28
	<b>Project</b> Vertical Structures Job No. 2014-004-005	<b>Date</b> 11:48:43 01/29/14
	<b>Client</b> Crown Castle	<b>Designed by</b> chymore

### Secondary Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	KI/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T9	121,187 - 114.437	L2 1/2x2 1/2x1/4	10.97	10.97	171.2	29,000	0.7519	1789.52	21804.40	0.082 ✓
T10	114.437 - 107.771	L2 1/2x2 1/2x1/4	11.65	11.65	181.7	29,000	0.7519	2003.39	21804.40	0.092 ✓
T14	60.625 - 40.4167	L3x3x1/4	18.31	18.31	236.3	29,000	0.9394	4007.49	27241.90	0.147 ✓
T16	30.3125 - 20.2083	L3 1/2x3 1/2x1/4	20.34	20.34	224.0	29,000	1.1269	4536.91	32679.40	0.139 ✓

### Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	KI/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T1	181.583 - 161.458	L2x2x1/8	6.52	6.52	125.0	29,000	0.3047	392.35	8835.94	0.044 ✓
T2	161.458 - 156.396	L2x2x1/8	6.56	6.56	125.8	29,000	0.3047	276.66	8835.94	0.031 ✓

### Redundant Horizontal (1) Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	KI/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T8	127.937 - 121.187	L2x2x1/4	2.57	2.57	50.7	21,600	0.9380	1693.28	20260.80	0.084 ✓

### Redundant Diagonal (1) Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	KI/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P lb	Allow. P <sub>a</sub> lb	Ratio P P <sub>a</sub>
T8	127.937 - 121.187	L2x2x1/4	3.14	3.14	61.8	21,600	0.9380	1032.04	20260.80	0.051 ✓

### Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	SF*P <sub>allow</sub> lb	% Capacity	Pass Fail
-------------	-----------------	----------------	------	------------------	---------	-----------------------------	---------------	--------------

<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr, Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>	HRT 080, CT BU#806478	<b>Page</b>	27 of 28
	<b>Project</b>	Vertical Structures Job No. 2014-004-005	<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>	Crown Castle	<b>Designed by</b>	chymore

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	SF*P <sub>allow</sub> lb	% Capacity	Pass Fail
T1	181.583 - 161.458	Leg	ROHN 2 STD	3	-23308.40	32298.46	72.2	Pass
		Diagonal	L1 3/4x1 3/4x3/16	12	-4189.51	8084.28	51.8 77.9 (b)	Pass
T2	161.458 - 156.396	Top Girt	L2x2x1/8	4	-399.47	2488.55	16.1	Pass
		Leg	ROHN 2.5 EH	39	-27429.60	65601.59	41.8	Pass
		Diagonal	L1 3/4x1 3/4x3/16	48	-4052.99	6183.40	65.5 73.7 (b)	Pass
		Top Girt	L2x2x1/8	40	-174.82	2457.08	7.1 7.6 (b)	Pass
T3	156.396 - 151.396	Leg	ROHN 2.5 EH	51	-35744.60	65600.12	54.5	Pass
		Diagonal	L1 3/4x1 3/4x3/16	55	-4108.67	5654.15	72.7 76.7 (b)	Pass
T4	151.396 - 146.396	Leg	ROHN 2.5 EH	60	-44695.80	65600.12	68.1	Pass
T5	146.396 - 141.333	Diagonal	L1 3/4x1 3/4x3/16	64	-4755.92	5127.52	92.8	Pass
		Leg	ROHN 2.5 EH	69	-58383.70	65601.59	89.0	Pass
T6	141.333 - 134.604	Diagonal	2L1 3/4x1 3/4x3/16x3/16	73	-4951.03	8137.21	60.8 78.2 (b)	Pass
		Leg	ROHN 3 EH	78	-64832.30	83786.24	77.4	Pass
T7	134.604 - 127.937	Diagonal	2L2x2x3/16x1/2	82	-6379.95	23455.73	27.2 73.9 (b)	Pass
		Leg	ROHN 3 EH	87	-78380.80	83784.51	93.6	Pass
T8	127.937 - 121.187	Diagonal	2L2x2x3/16x1/2	91	-6475.86	22121.00	29.3 76.3 (b)	Pass
		Leg	ROHN 3 EH	96	-97639.10	114754.10	85.1	Pass
		Diagonal	2L2x2x3/16x1/2	105	-7610.16	22848.42	33.3 87.5 (b)	Pass
		Horizontal	L2 1/2x2 1/2x1/4	104	-1693.28	9182.48	18.4 20.2 (b)	Pass
		Redund Horz 1 Bracing	L2x2x1/4	128	-1693.28	19342.10	8.8	Pass
		Redund Diag 1 Bracing	L2x2x1/4	129	-1032.04	16811.13	6.1	Pass
T9	121.187 - 114.437	Leg	ROHN 3.5 EH	138	-103187.00	132156.15	78.1	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x1/2	141	-6980.88	32411.09	21.5 80.9 (b)	Pass
T10	114.437 - 107.771	Secondary Horizontal	L2 1/2x2 1/2x1/4	146	-1789.52	8084.18	22.1	Pass
		Leg	ROHN 3.5 EH	150	-115515.00	132182.14	87.4	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x1/2	152	-6882.74	31426.54	21.9 80.4 (b)	Pass
		Secondary Horizontal	L2 1/2x2 1/2x1/4	158	-2003.39	7172.02	27.9	Pass
T11	107.771 - 101.021	Leg	ROHN 3.5 EH Reinforced w/ 2" B7 S.R. (3' Span)	162	-134435.00	175142.86	76.8	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x1/2	165	-7038.72	30046.89	23.4 82.7 (b)	Pass
T12	101.021 - 80.8333	Leg	ROHN 4 EH Reinforced w/ 2" B7 S.R. (3' Span)	171	-167974.00	213474.61	78.7	Pass
		Diagonal	2L3x3x3/16x1/2	174	-7373.47	37929.45	19.4 87.0 (b)	Pass
T13	80.8333 - 60.625	Leg	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	192	-200473.00	237180.68	84.5	Pass
		Diagonal	2L3x3x3/16x1/4	195	-8726.87	27189.20	32.1	Pass



<b>tnxTower</b>  <b>Vertical Structures, Inc.</b> 309 Spangler Dr. Suite E Richmond, KY 40475 Phone: (859) 624-8360 FAX: (859) 624-8369	<b>Job</b>	HRT 080, CT BU#806478	<b>Page</b>	28 of 28
	<b>Project</b>	Vertical Structures Job No. 2014-004-005	<b>Date</b>	11:48:43 01/29/14
	<b>Client</b>	Crown Castle	<b>Designed by</b>	chymore

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	SF*P <sub>allow</sub> lb	% Capacity	Pass Fail	
T14	60.625 - 40.4167	Leg	ROHN 5 EH Reinforced w/ 2" B7 S.R. (3' Span)	207	-231066.00	317539.25	74.1 (b) 72.8	Pass	
		Diagonal	2L3x3x1/4x1/4	210	-8985.00	30009.96	29.9	Pass	
		Secondary Horizontal	L3x3x1/4	216	-4007.49	5133.41	78.1	Pass	
T15	40.4167 - 30.3125	Leg	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	228	-238175.00	287697.38	82.8	Pass	
		Diagonal	2L3 1/2x3 1/2x1/4	231	-9553.42	48775.54	19.6	Pass	
							81.0 (b)		
T16	30.3125 - 20.2083	Leg	ROHN 6 EHS Reinforced w/ 2" B7 S.R. (3' Span)	237	-261615.00	351489.42	74.4	Pass	
		Diagonal	2L3 1/2x3 1/2x1/4	240	-9873.55	44974.75	22.0	Pass	
							83.9 (b)		
T17	20.2083 - 0	Secondary Horizontal	L3 1/2x3 1/2x1/4	245	-4536.91	6705.92	67.7	Pass	
		Leg	ROHN 6 EH Reinforced w/ 2" B7 S.R. (3' Span)	249	-290663.00	340169.59	85.4	Pass	
		Diagonal	L4x4x1/4	252	-10396.00	11747.93	88.5	Pass	
							Summary		
							Leg (T7)	93.6	Pass
							Diagonal (T4)	92.8	Pass
							Horizontal (T8)	20.2	Pass
							Secondary Horizontal (T14)	78.1	Pass
							Top Girt (T1)	16.1	Pass
							Redund Horz 1	8.8	Pass
							Bracing (T8)		
							Redund Diag 1	6.1	Pass
							Bracing (T8)		
							Bolt Checks	87.5	Pass
							RATING =	93.6	Pass

**APPENDIX B**  
**BASE LEVEL DRAWING**



**APPENDIX C**  
**ADDITIONAL CALCULATIONS**



## ANCHOR BOLT CALCULATIONS

**Customer:** Crown Castle  
**Site Name:** HRT 080, CT BU#806478  
**Job Number:** 2014-004-005  
**Tower Model:** 180' Rohn SSV Self-Supporting Tower  
**Date:** 1/29/2014

### *Input Information:*

# Bolts	6		2	
Bolt Diameter	1	in	1	in
Bolt Ultimate Tensile Strength, $F_u$	120	ksi	125	ksi
Steel Grade	A449		A193 Gr. B7	
Applied Shear	26.658	kips		
Uplift per Leg	246.52	kips		

---

Bolt Cross-Sectional Area, $A$	0.785	in <sup>2</sup>	0.785	in <sup>2</sup>
Applied Shear, $f_v$	5.66	ksi	0.00	ksi
Maximum Allowable Tensile Stress, $F_t$	39.60	ksi	39.60	ksi
Allowable Tension Force	186.61	kips	62.20	kips
Maximum Allowable	248.75	kips	82.92	kips
<b>% Capacity</b>	<b>74.3%</b>			

**The Bolt Group is sufficient for the applied Uplift Force**

Maximum Allowable Tensile Stress,  $F_t$

$$0.43F_u - 1.8f_v \leq 0.33F_u$$

This equation is for threaded parts, A449 bolts over 1 1/2" dia. (threads included in shear plane) Manual of Steel Construction ASD, 9th Edition, pg. 5-74, Table J3.3



309 Spangler Drive, Suite E  
 Richmond, Kentucky 40475  
 Phone: (859) 624-8360  
 Fax: (859) 624-8369

Subject: Foundation Analysis

Design By: NDC

Cust: Crown

Job No.

Date: 8/23/12

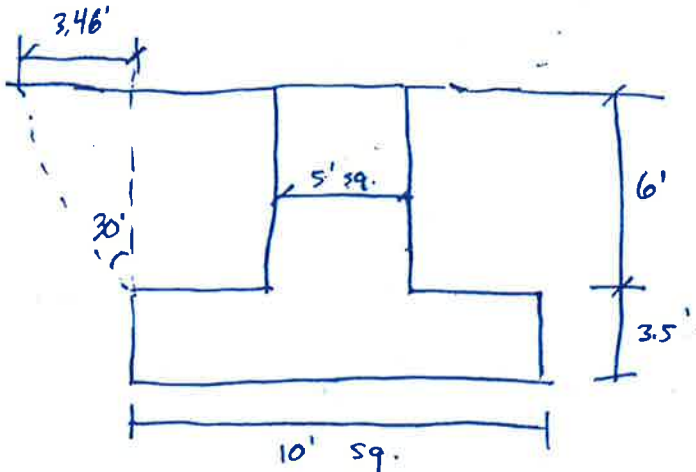
Location: HRT 080, CT

2012-004-064

Chk'd By: BCG

Page 1/1

- Foundation information per 2006 FPH Report Dated Oct. 9, 2006  
 ↳ On File



$\gamma_c = 125 \text{ pcf}$   
 $\phi = 30'$   
 $q_u = 13.5 \text{ ksf}$   
 $C = 6 \text{ ksf}$

$$\text{Wt. Concrete} = [5^2 \times 6 + 10^2 \times 3.5] \times 0.15 = 75 \text{ k}$$

$$\text{Vol. Soil} = \frac{6}{3} \left( 10^2 + (10 + 2 \times 3.46)^2 + \sqrt{100 \times 286.6} \right) - 5^2 \times 6 = 961.692 \text{ ft}^3$$

$$\text{Wt Soil} = 961.692 \times 0.125 = 120.21 \text{ k}$$

Sk. friction on pad [Use Crown's method]

$$\text{Adhesion} = C_a = \alpha \times C_u$$

$$\alpha = 0.31 + \frac{0.34}{6} = 0.367$$

$$C_a = 0.367 \times 6 = 2.2 \text{ ksf}$$

$$\text{Ultimate } f_r = 2.2 \text{ ksf}$$

$$\text{Skin Friction} = 10 \times 4 \times 3.5 \times 2.2 = 308 \text{ k}$$

$$\text{Uplift Allowable} = \frac{75}{1.25} + \frac{(120.2 + 308)}{2} = 274.11 \text{ k}$$

Use spreadsheet for down

**(Bearing and Stability Checks) Tool for TIA Rev F or G - Application (MP, SST with unitbase)**

**Site Data**

BU#: 806478
Site Name: HRT 080, CT
App #: 212081, Rev. 1

**Enter Load Factors Below:**

For P (DL)	1.2	<-- Enter Factor
For P,V, and M (WL)	1.35	<-- Enter Factor

**Pad & Pier Data**

Base PL Dist. Above Pier:	0	in
Pier Dist. Above Grade:	0	in
Pad Bearing Depth, D:	9.5	ft
Pad Thickness, T:	3.5	ft
Pad Width=Length, L:	10	ft
Pier Cross Section Shape:	Square	<--Pull Down
Enter Pier Side Width:	5	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	25.00	ft^2
Pier Height:	6.00	ft
Soil (above pad) Height:	6.00	ft

**Soil Parameters**

Unit Weight, $\gamma$ :	115.0	pcf
Ultimate Bearing Capacity, $q_n$ :	13.50	ksf
Strength Reduct. factor, $\phi$ :	0.75	
Angle of Friction, $\phi$ :	0.0	degrees
Undrained Shear Strength, $C_u$ :	32.00	ksf
Allowable Bearing: $\phi * q_n$ :	10.13	ksf
Passive Pres. Coeff., $K_p$ :	1.00	

**Forces/Moments due to Wind and Lateral Soil**

Minimum of ( $\phi * \text{Ultimate Pad Passive Force, } V_u$ ):	40.9	kip
Pad Force Location Above D:	1.75	ft
$\phi$ (Passive Pressure Moment):	71.49	ft-kips
Factored O.T. M(WL), "1.6W":	388.5	ft-kips
Factored OT (MW-Msoil), M1	317.00	ft-kips

**Resistance due to Foundation Gravity**

Soil Wedge Projection grade, a:	0.00	ft
Sum of Soil Wedges Wt:	0.00	kip
Soil Wedges ecc, K1:	0.00	ft
Ftg+Soil above Pad wt:	126.8	kip
Unfactored (Total ftg-soil Wt):	126.75	kip
1.2D. No Soil Wedges.	542.82	kip
0.9D. With Soil Wedges	504.80	kip

**Resistance due to Cohesion (Vertical)**

$\phi * (1/2 * C_u)$ (Total Vert. Planes)	720.00	kip
Cohesion Force Eccentricity, K2	5.00	ft

**Monopole Base Reaction Forces**

TIA Revision:	F	<--Pull Down
Unfactored DL Axial, PD:	0	kip
Unfactored WL Axial, PW:	289.425	kip
Unfactored WL Shear, V:	30.292	kip
Unfactored WL Moment, M:	0	ft-kips

**Load Factor Shaft Factored Loads**

1.20	1.2D+1.6W, Pu:	390.7238	kip
0.90	0.9D+1.6W, Pu:	390.7238	kip
1.35	Vu:	40.8942	kip
	Mu:	0	ft-kips

**1.2D+1.6W Load Combination, Bearing Results:**

<b>(No Soil Wedges)</b> [Reaction+Conc+Soil]	542.82	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	317.00	ft-kips

Orthogonal Direction:

ecc1 = M1/P1 = 0.58 ft  
 Orthogonal qu = 6.70 ksf  
 qu/ $\phi * q_n$  Ratio = 66.14% Pass

Diagonal Direction:

ecc2 = (0.707M1)/P1 = 0.41 ft  
 Diagonal qu = 6.45 ksf  
 qu/ $\phi * q_n$  Ratio = 63.70% Pass

**Run**

<-- Press Upon Completing All Input

**Overturning Stability Check**

**0.9D+1.6W Load Combination, Bearing Results:**

<b>(w/ Soil Wedges)</b> [Reaction+Conc+Soil]	504.80	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	0.00	ft-kips

Orthogonal ecc3 = M2/P2 = 0.00 ft  
 Ortho Non Bearing Length, NBL = 0.00 ft  
 Orthogonal qu = 5.05 ksf  
 Diagonal qu = 5.05 ksf

**Max Reaction Moment (ft-kips) so that qu= $\phi * q_n$  = 100% Capacity Rating**

Actual M:	0.00		
M Orthogonal:	4302.67	0.00%	Pass
M Diagonal:	4105.80	0.00%	Pass



## Bulkhead Shear Collection Calculations

**Customer:** Crown Castle  
**Site Name:** HRT 080, CT BU#806478  
**Job Number:** 2014-004-005  
**Tower Model:** 180' Rohn SSV Self-Supporting Tower  
**Date:** 1/29/2014

<i>Elevation</i>	<i>Leg</i>	<i>Composite Leg</i>	<i>Reinforcement</i>	<i>Reinforcing Rod</i>	<i>Bulkhead U-Bolt</i>	<i>Member</i>
<i>ft</i>	<i>Load</i>	<i>Area</i>	<i>Area</i>	<i>Compression Load</i>	<i>Allowable Slip</i>	<i>%</i>
	<i>lb</i>	<i>in<sup>2</sup></i>	<i>in<sup>2</sup></i>	<i>lb</i>	<i>lb</i>	<i>Capacity</i>
107	134435.00	6.82	3.14	61891.66	70000.00	88.4%