Robinson+Cole

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Also admitted in Massachusetts

December 11, 2014

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

Re: **Notice of Exempt Modification – Facility Modification**
14 Thompson Hill Road, Columbia, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) antennas at the 147-foot level of the existing 180-foot tower at 14 Thompson Hill Road in Columbia, Connecticut (the Property"). The tower is owned by Crown Castle. The Council approved Cellco's use of this tower in 2002. Cellco now intends to modify its facility by replacing all twelve (12) of its existing antennas with three (3) model LNX-6514DS-VTM, 700 MHz antennas; three (3) model LNX-6514DS-VTM, 850 MHZ antennas; three (3) model HBXX-6517DS-VTM, 1900 MHz antennas; and three (3) model HBXX-6517DS-VTM, 2100 MHz antennas, at the same level on the tower. Cellco also intends to install six (6) remote radio heads ("RRHs") behind its new 1900 MHz and 2100 MHz antennas and two (2) HYBRIFLEX™ antenna cables attached to the outside of the monopole tower. Attached behind Tab 1 are the specifications for the replacement antennas, RRHs and HYBRIFLEX™ cables.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Carmen L. Vance, First Selectman for the Town of Columbia. A copy of this letter is also being sent to Joshua and Eileen Lanati, the owners of the Property.

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

Robinson+Cole

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's replacement antennas and RRHs will be installed on its existing antenna platform at the 147-foot level of the 180-foot tower.

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

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

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

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

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

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

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Carmen L. Vance, Columbia First Selectman
Joshua and Eileen Lanati
Sandy M. Carter

ATTACHMENT 1

Product Specifications

COMMSCOPE®

LNX-6514DS-VTM

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

POWERED BY ANDREW.

Electrical Specifications

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

Mechanical Specifications

Color | Radome Material	Light gray | Fiberglass, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 2
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph
Antenna Dimensions, L x W x D	1847.0 mm x 301.0 mm x 181.0 mm | 72.7 in x 11.9 in x 7.1 in
Net Weight	17.6 kg | 38.8 lb
Model with factory installed AISG 2.0 RET	LNX-6514DS-A1M

Product Specifications

COMMSCOPE®

HBXX-6517DS-VTM

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

POWERED BY ANDREW.

Electrical Specifications

Frequency Band, MHz	1710–1880	1850–1990	1920–2180
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°

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

Mechanical Specifications

Color | Radome Material	Light gray | PVC, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph
Antenna Dimensions, L x W x D	1903.0 mm x 305.0 mm x 166.0 mm | 74.9 in x 12.0 in x 6.5 in
Net Weight	19.5 kg | 43.0 lb
Model with factory installed AISG 2.0 RET	HBXX-6517DS-A2M

PCS RF MODULES
RRH1900 2X60 - HW CHARACTERISTICS

LA6.0.1/13.3

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

** Not a Verizon Wireless deployed product

NEW PCS RF MODULES FOR VZW
RRH2X60 - HW CHARACTERISTICS

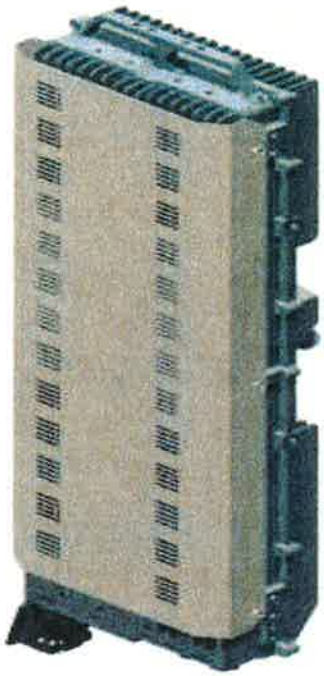
LR14.3

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

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

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

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



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

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

SUPERIOR RF PERFORMANCE

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

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

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

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

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

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

OPTIMIZED TCO

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

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

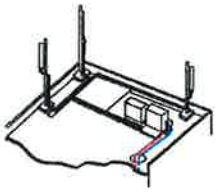
EASY INSTALLATION

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

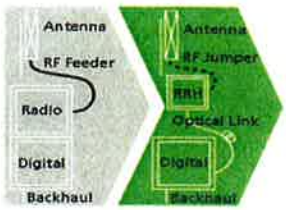
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation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

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

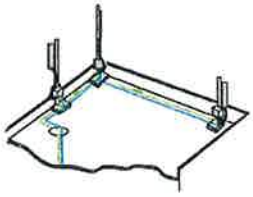
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

FEATURES

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

BENEFITS

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

TECHNICAL SPECIFICATIONS

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

Dimensions and weights

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

Electrical Data

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

RF Characteristics

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

Connectivity

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

Environmental specifications

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

Safety and Regulatory Data

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

AT THE SPEED OF IDEAS™

Alcatel·Lucent

Product Data Sheet HB158-1-08U8-S8J18

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

Product Description

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

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

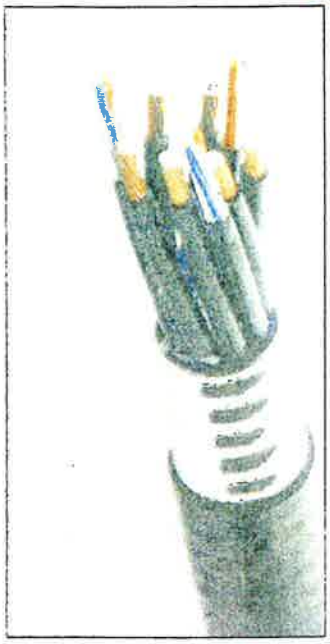


Figure 1: HYBRIFLEX Series

Features/Benefits

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

Technical Specifications

Outer Conductor Armor	Corrugated Aluminum	[mm (in)]	46.5 (1.83)
Jacket	Polyethylene, PE	[mm (in)]	50.3 (1.98)
UV-Protection	Individual and External Jacket		Yes
Weight, Approximate		[kg/m (lb/ft)]	1.9 (1.30)
Minimum Bending Radius, Single Bending		[mm (in)]	200 (8)
Minimum Bending Radius, Repeated Bending		[mm (in)]	500 (20)
Recommended/Maximum Clamp Spacing		[m (ft)]	1.0 / 1.2 (3.25 / 4.0)
DC-Resistance Outer Conductor Armor		[Ω/km (Ω/1000ft)]	.068 (0.205)
DC-Resistance Power Cable, 8.4mm²/8AWG)		[Ω/km (Ω/1000ft)]	2.1 (0.307)
Version			Single-mode OM3
Quantity, Fiber Count			16 (8 pairs)
Core/Clad		[µm]	50/125
Primary Coating (Acrylate)		[µm]	245
Buffer Diameter, Nominal		[µm]	900
Secondary Protection, Jacket, Nominal		[mm (in)]	2.0 (0.08)
Minimum Bending Radius		[mm (in)]	104 (4.1)
Insertion Loss @ wavelength 850nm		dB/km	3.0
Insertion Loss @ wavelength 1310nm		dB/km	1.0
Standards (Meets or exceeds)			UL94-V0 UL1666 RoHS Compliant
Size (Power)		[mm² (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm² (AWG)]	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-93-639 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

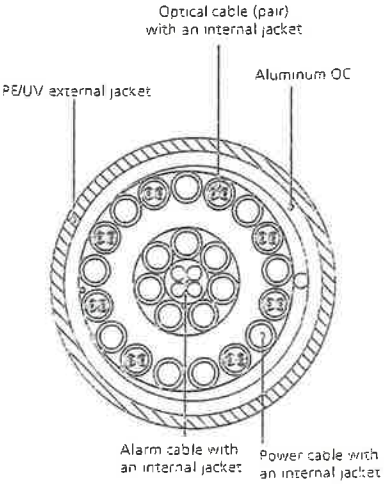


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

	General	Power	Density					
Site Name: Coventry S (Columbia)								
Tower Height: 180ft								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*AT&T UMTS	2	565	140	0.0207	880	0.5867	3.53%	
*AT&T UMTS	2	875	140	0.0321	1900	1.0000	3.21%	
*AT&T GSM	1	283	140	0.0052	880	0.5867	0.88%	
*AT&T GSM	4	525	140	0.0385	1900	1.0000	3.85%	
*AT&T LTE	1	1313	140	0.0241	734	0.4893	4.92%	
*Sprint	4	250	178	0.0113	1950	1.0000	1.13%	
*Nextel	9	100	170	0.0112	851	0.5673	1.97%	
*T-Mobile	8	247	160	0.0278	1935	1.0000	2.78%	
Verizon PCS	**11**	**411**	**147**	**0.0752**	**1970**	**1.0000**	**7.52%**	
Verizon Cellular	**9**	**388**	**147**	**0.0581**	**869**	**0.5793**	**10.03%**	
Verizon AWS	**1**	**1750**	**147**	**0.0291**	**2145**	**1.0000**	**2.91%**	
Verizon 700	**1**	**1050**	**147**	**0.0175**	**746**	**0.4973**	**3.51%**	
								46.27%
* Source: Siting Council								

ATTACHMENT 3

Date: **November 07, 2014**

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

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

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Name:	Coventry S, CT
Crown Castle Designation:	**Crown Castle BU Number:**	876391
	Crown Castle Site Name:	COLUMBIA / DEOJAY
	Crown Castle JDE Job Number:	313329
	Crown Castle Work Order Number:	958994
	Crown Castle Application Number:	271018 Rev. 1
Engineering Firm Designation:	**FDH Engineering, Inc. Project Number:**	146GC81400
Site Data:	**14 Thompson Hill Rd, COLUMBIA, Tolland County, CT** **Latitude *41° 43' 3.44"*, Longitude *-72° 17' 59.09"*** **180 Foot - Monopole Tower**	

Dear Sean Dempsey,

FDH Engineering, Inc. is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 725104, in accordance with application 271018, revision 1.

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

LC5: Existing + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing loading, respectively.

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

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

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

Respectfully submitted by:

Jeffrey B. Ray, EI
Project Engineer

Reviewed by:

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

STATE OF CONNECTICUT
DENNIS D. ABEL
No. 23247
LICENSED
PROFESSIONAL ENGINEER

11-07-2014

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 180 ft Monopole tower designed by ENGINEERED ENDEAVORS, INC. in December of 1999. The tower was originally designed for a wind speed of 90 mph per TIA/EIA-222-F.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 85 mph with no ice, 28 mph with 1 inch ice thickness and 50 mph under service loads.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
147.0	150.0	3	alcatel lucent	RRH2X60-AWS	2	1 5/8	--
		3	alcatel lucent	RRH2X60-PCS			
		6	andrew	HBXX-6517DS-A2M w/ Mount Pipe			
		6	andrew	LNX-6514DS-A1M w/ Mount Pipe			
		2	rfs celwave	DB-T1-6Z-8AB-0Z			

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
180.0	181.0	2	decibel	950F65T2ZE-M w/ Mount Pipe	6	1 5/8	1
		4	decibel	DB980H90E-M w/ Mount Pipe			
	180.0	1	crown mounts	Platform Mount [LP 712-1]			
169.0	170.0	12	decibel	DB844H90E-XY w/ Mount Pipe	12	1 1/4	1
	169.0	1	crown mounts	Platform Mount [LP 303-1]			
161.0	162.0	3	ems wireless	RR90-17-02DP w/ Mount Pipe	6	1 5/8	1
	161.0	1	crown mounts	Platform Mount [LP 305-1]			
147.0	150.0	1	lucent	KS24019-L112A	12 1	1 5/8 1/2	1
		3	rfs celwave	FD9R6004/1C-3L			
	147.0	1	crown mounts	Platform Mount [LP 1201-1]			
		6	decibel	DB844H80E-XY w/ Mount Pipe	--	--	2
		6	decibel	DB948F85T2E-M w/ Mount Pipe			
	146.0	3	rfs celwave	FD9R6004/1C-3L	--	--	1
141.0	141.0	1	crown mounts	Side Arm Mount [SO 102-3]	--	--	1
	138.0	6	ericsson	TME-RRUS-11			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
140.0	140.0	1	crown mounts	Platform Mount [LP 303-1]	1 2 12	3/8 7/8 1 5/8	1
		3	kmw communications	AM-X-CD-16-65-00T-RET w/ Mount Pipe			
		6	powerwave technologies	7770.00 w/ Mount Pipe			
		6	powerwave technologies	LGP 17201			
		6	powerwave technologies	LGP13519			
		1	raycap	DC6-48-60-18-8F			
83.0	84.0	2	kathrein	OG-860/1920/GPS-A	2	1/2	1
	83.0	2	crown mounts	Side Arm Mount [SO 702-1]			
78.0	79.0	1	lucent	KS24019-L112A	1	1/2	1
	78.0	1	crown mounts	Side Arm Mount [SO 702-1]			

Notes:
1) Existing Equipment
2) Existing Equipment to be removed; not considered in this analysis

Table 3 - Design Antenna and Cable Information

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

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
Original Tower Drawings	EEI	Doc ID#: 1614546	Crown DMZ
Foundation Drawings	EEI	Doc ID#: 1613632	Crown DMZ
Geotechnical Report	Sprint Spectrum L.P.	Doc ID#: 1613526	Crown DMZ

3.1) Analysis Method

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

3.2) Assumptions

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

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

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	180 - 131.91	Pole	TP31.375x21x0.25	1	-11.97	1244.62	63.2	Pass
L2	131.91 - 86.84	Pole	TP40.4688x29.9214x0.375	2	-20.67	2407.45	85.4	Pass
L3	86.84 - 43.32	Pole	TP48.9688x38.5317x0.4375	3	-32.71	3401.90	89.5	Pass
L4	43.32 - 0	Pole	TP57.25x46.6863x0.5	4	-51.17	4682.07	86.0	Pass
							Summary	
						Pole (L3)	89.5	Pass
						RATING =	**89.5**	**Pass**

Table 6 - Tower Component Stresses vs. Capacity – LC5

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	67.2	Pass
1	Base Plate	0	73.4	Pass
1	Base Foundation	0	71.9	Pass

Structure Rating (max from all components) =	**89.5%**

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

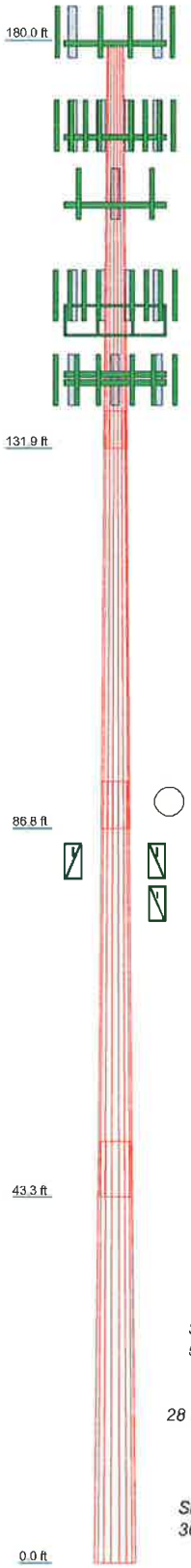
4.1) Recommendations

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

APPENDIX A

TNXTOWER OUTPUT

Section	1	2	3	4
Length (ft)	48.09	49.49	49.09	49.94
Number of Sides	18	18	18	18
Thickness (in)	0.2500	0.3750	0.4375	0.5000
Socket Length (ft)	4.42	5.57	6.62	
Top Dia (in)	21.0000	29.9214	38.5317	46.6863
Bot Dia (in)	31.3750	40.4688	48.9688	57.2500
Grade	A572-65			
Weight (K)	3.4	7.0	10.0	13.9



AXIAL
71 K
SHEAR
5 K
MOMENT
680 kip-ft
TORQUE 0 kip-ft
28 mph WIND - 1.0000 in ICE

AXIAL
51 K
SHEAR
36 K
MOMENT
4636 kip-ft
TORQUE 1 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) 950F65T2ZE-M w/ Mount Pipe	180	RRH2X60-PCS	147
(2) DB980H90E-M w/ Mount Pipe	180	RRH2X60-PCS	147
(2) DB980H90E-M w/ Mount Pipe	180	RRH2X60-PCS	147
(2) Empty Mount Pipe	180	DB-T1-6Z-8AB-0Z	147
(2) Empty Mount Pipe	180	DB-T1-6Z-8AB-0Z	147
(2) Empty Mount Pipe	180	Platform Mount [LP 1201-1]	147
Platform Mount [LP 712-1]	180	(2) TME-RRUS-11	141
(4) DB844H90E-XY w/ Mount Pipe	169	(2) TME-RRUS-11	141
(4) DB844H90E-XY w/ Mount Pipe	169	(2) TME-RRUS-11	141
(4) DB844H90E-XY w/ Mount Pipe	169	Side Arm Mount [SO 102-3]	141
Platform Mount [LP 303-1]	169	AM-X-CD-16-65-00T-RET w/ Mount Pipe	140
RR90-17-02DP w/ Mount Pipe	161	AM-X-CD-16-65-00T-RET w/ Mount Pipe	140
RR90-17-02DP w/ Mount Pipe	161	AM-X-CD-16-65-00T-RET w/ Mount Pipe	140
RR90-17-02DP w/ Mount Pipe	161	(2) 7770.00 w/ Mount Pipe	140
Empty Mount Pipe	161	(2) 7770.00 w/ Mount Pipe	140
Empty Mount Pipe	161	(2) 7770.00 w/ Mount Pipe	140
Empty Mount Pipe	161	(2) LGP 17201	140
Platform Mount [LP 305-1]	161	(2) LGP 17201	140
FD9R6004/1C-3L	147	(2) LGP 17201	140
FD9R6004/1C-3L	147	(2) LGP13519	140
FD9R6004/1C-3L	147	(2) LGP13519	140
FD9R6004/1C-3L	147	(2) LGP13519	140
FD9R6004/1C-3L	147	DC6-48-60-18-8F	140
FD9R6004/1C-3L	147	Platform Mount [LP 303-1]	140
KS24019-L112A	147	OG-860/1920/GPS-A	83
(2) HBXX-6517DS-A2M w/ Mount Pipe	147	OG-860/1920/GPS-A	83
(2) HBXX-6517DS-A2M w/ Mount Pipe	147	Side Arm Mount [SO 702-1]	83
(2) HBXX-6517DS-A2M w/ Mount Pipe	147	Side Arm Mount [SO 702-1]	83
(2) LNX-6514DS-A1M w/ Mount Pipe	147	KS24019-L112A	78
(2) LNX-6514DS-A1M w/ Mount Pipe	147	Side Arm Mount [SO 702-1]	78
(2) LNX-6514DS-A1M w/ Mount Pipe	147		
RRH2X60-AWS	147		
RRH2X60-AWS	147		
RRH2X60-AWS	147		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Tolland 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 28 mph basic wind with 1.00 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 89.5%

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

Job: Columbia/ DEOJAY, 876391			
Project: 146GC81400			
Client: Crown Castle, Inc.	Drawn by: Jeffrey B. Ray	App'd:	
Code: TIA/EIA-222-F	Date: 11/07/14	Scale: NTS	
Path:		Dwg No. E-1	

Tower Input Data

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

Tower is located in Tolland County, Connecticut.
Basic wind speed of 85 mph.
Nominal ice thickness of 1.0000 in.
Ice density of 56 pcf.
A wind speed of 28 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 pole design is 1.333.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs	Distribute Leg Loads As Uniform	Treat Feedline Bundles As Cylinder
Consider Moments - Horizontals	Assume Legs Pinned	Use ASCE 10 X-Brace Ly Rules
Consider Moments - Diagonals	√ **Assume Rigid Index Plate**	Calculate Redundant Bracing Forces
Use Moment Magnification	√ **Use Clear Spans For Wind Area**	Ignore Redundant Members in FEA
√ **Use Code Stress Ratios**	Use Clear Spans For KL/r	SR Leg Bolts Resist Compression
√ **Use Code Safety Factors - Guys**	Retension Guys To Initial Tension	All Leg Panels Have Same Allowable
Escalate Ice	√ **Bypass Mast Stability Checks**	Offset Girt At Foundation
Always Use Max Kz	√ **Use Azimuth Dish Coefficients**	√ **Consider Feedline Torque**
Use Special Wind Profile	√ **Project Wind Area of Appurt.**	Include Angle Block Shear Check
Include Bolts In Member Capacity	Autocalc Torque Arm Areas	Poles
Leg Bolts Are At Top Of Section	SR Members Have Cut Ends	√ **Include Shear-Torsion Interaction**
Secondary Horizontal Braces Leg	√ **Sort Capacity Reports By Component**	Always Use Sub-Critical Flow
Use Diamond Inner Bracing (4 Sided)	Triangulate Diamond Inner Bracing	Use Top Mounted Sockets
Add IBC .6D+W Combination	Use TIA-222-G Tension Splice Capacity Exemption	

Tapered Pole Section Geometry

Section	*Elevation*	*Section Length*	*Splice Length*	*Number of Sides*	*Top Diameter*	*Bottom Diameter*	*Wall Thickness*	*Bend Radius*	*Pole Grade*
	ft	*ft*	*ft*		*in*	*in*	*in*	*in*	
L1	180.00-131.91	48.09	4.42	18	21.0000	31.3750	0.2500	1.0000	A572-65 (65 ksi)
L2	131.91-86.84	49.49	5.57	18	29.9214	40.4688	0.3750	1.5000	A572-65 (65 ksi)
L3	86.84-43.32	49.09	6.62	18	38.5317	48.9688	0.4375	1.7500	A572-65 (65 ksi)
L4	43.32-0.00	49.94		18	46.6863	57.2500	0.5000	2.0000	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	21.3240	16.4651	895.6507	7.3663	10.6680	83.9568	1792.4800	8.2341	3.2560	13.024
	31.8590	24.6977	3022.8212	11.0494	15.9385	189.6553	6049.6199	12.3512	5.0820	20.328
L2	31.3395	35.1676	3878.7374	10.4890	15.2001	255.1787	7762.5785	17.5872	4.6062	12.283
	41.0931	47.7216	9691.8637	14.2333	20.5582	471.4366	19396.4803	23.8654	6.4625	17.233
L3	40.3286	52.8986	9698.3864	13.5234	19.5741	495.4701	19409.5341	26.4543	6.0116	13.741
	49.7242	67.3918	20053.4087	17.2286	24.8762	806.1299	40133.2041	33.7023	7.8485	17.939
L4	48.8284	73.2977	19753.9654	16.3961	23.7166	832.9156	39533.9235	36.6558	7.3368	14.674
	58.1332	90.0622	36644.7678	20.1462	29.0830	1260.0065	73337.7538	45.0397	9.1960	18.392

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 180.00-131.91				1	1	1		
L2 131.91-86.84				1	1	1		
L3 86.84-43.32				1	1	1		
L4 43.32-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight klf
Safety Line 3/8	C	Surface Ar (CaAa)	180.00 - 8.00	1	1	-0.010 0.010	0.3750		0.00
Climbing Ladder	A	Surface Af (CaAa)	175.00 - 180.00	1	1	-0.010 0.010	2.5000	10.0000	0.01
HB158-1-08U8-S8J18(1-5/8) *	C	Surface Ar (CaAa)	147.00 - 0.00	2	1	0.000 0.040	1.9800		0.00
LDF4-50A(1/2") *	C	Surface Ar (CaAa)	83.00 - 0.00	2	1	-0.480 -0.460	0.6300		0.00
LDF4-50A(1/2")	B	Surface Ar (CaAa)	78.00 - 0.00	1	1	-0.480 -0.470	0.6300		0.00

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
*** LDF7-50A(1-5/8")	A	No	Inside Pole	180.00 - 0.00	6	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.00 0.00 0.00
* LDF6-50A(1-1/4")	B	No	Inside Pole	169.00 - 0.00	12	No Ice	0.00	0.00

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
*								
LDF7-50A(1-5/8")	B	No	Inside Pole	161.00 - 0.00	6	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
*								
LDF4-50A(1/2")	C	No	Inside Pole	147.00 - 0.00	1	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
LDF7-50A(1-5/8")	C	No	Inside Pole	147.00 - 0.00	12	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
*								
LDF7-50A(1-5/8")	C	No	Inside Pole	140.00 - 0.00	12	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
ICE 200(2")	C	No	Inside Pole	140.00 - 0.00	1	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
FB-L98B-002-75000(3/8")	C	No	Inside Pole	140.00 - 0.00	1	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
WR-VG122ST-BRDA(7/ 16)	C	No	Inside Pole	140.00 - 0.00	2	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	180.00-131.91	A	0.000	0.000	2.083	0.000	0.28
		B	0.000	0.000	0.000	0.000	0.44
		C	0.000	0.000	4.791	0.000	0.28
L2	131.91-86.84	A	0.000	0.000	0.000	0.000	0.22
		B	0.000	0.000	0.000	0.000	0.58
		C	0.000	0.000	10.614	0.000	1.05
L3	86.84-43.32	A	0.000	0.000	0.000	0.000	0.21
		B	0.000	0.000	2.185	0.000	0.56
		C	0.000	0.000	12.749	0.000	1.02
L4	43.32-0.00	A	0.000	0.000	0.000	0.000	0.21
		B	0.000	0.000	2.729	0.000	0.56
		C	0.000	0.000	12.631	0.000	1.02

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	180.00-131.91	A	1.000	0.000	0.000	3.750	0.000	0.30
		B		0.000	0.000	0.000	0.000	0.44
		C		0.000	0.000	17.427	0.000	0.48
L2	131.91-86.84	A	1.000	0.000	0.000	0.000	0.000	0.22
		B		0.000	0.000	0.000	0.000	0.58

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
		C		0.000	0.000	28.642	0.000	1.45
L3	86.84-43.32	A	1.000	0.000	0.000	0.000	0.000	0.21
		B		0.000	0.000	9.121	0.000	0.63
		C		0.000	0.000	38.093	0.000	1.57
L4	43.32-0.00	A	1.000	0.000	0.000	0.000	0.000	0.21
		B		0.000	0.000	11.393	0.000	0.65
		C		0.000	0.000	37.023	0.000	1.56

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	180.00-131.91	-0.0774	0.1241	-0.1170	0.4082
L2	131.91-86.84	-0.0128	0.3581	-0.0219	0.8053
L3	86.84-43.32	0.0604	0.3223	0.2278	0.6673
L4	43.32-0.00	0.0677	0.2990	0.2587	0.5854

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(2) 950F65T2ZE-M w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	180.00	No Ice 1/2" Ice 1" Ice	4.23 4.70 5.15	4.20 5.07 5.81	0.03 0.07 0.12
(2) DB980H90E-M w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	180.00	No Ice 1/2" Ice 1" Ice	4.04 4.50 4.95	3.62 4.48 5.22	0.03 0.07 0.11
(2) DB980H90E-M w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	180.00	No Ice 1/2" Ice 1" Ice	4.04 4.50 4.95	3.62 4.48 5.22	0.03 0.07 0.11
(2) Empty Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	180.00	No Ice 1/2" Ice 1" Ice	1.40 2.13 2.68	1.40 2.13 2.68	0.03 0.04 0.06
(2) Empty Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	180.00	No Ice 1/2" Ice 1" Ice	1.40 2.13 2.68	1.40 2.13 2.68	0.03 0.04 0.06
(2) Empty Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	180.00	No Ice 1/2" Ice 1" Ice	1.40 2.13 2.68	1.40 2.13 2.68	0.03 0.04 0.06
Platform Mount [LP 712-1]	C	None		0.0000	180.00	No Ice 1/2" Ice 1" Ice	24.53 29.94 35.35	24.53 29.94 35.35	1.34 1.65 1.96
// (4) DB844H90E-XY w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	169.00	No Ice 1/2" Ice 1" Ice	3.30 3.69 4.12	4.92 5.60 6.28	0.03 0.07 0.12

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(4) DB844H90E-XY w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	169.00	No Ice 1/2" Ice 1" Ice	3.30 3.69 4.12	4.92 5.60 6.28	0.03 0.07 0.12
(4) DB844H90E-XY w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	169.00	No Ice 1/2" Ice 1" Ice	3.30 3.69 4.12	4.92 5.60 6.28	0.03 0.07 0.12
Platform Mount [LP 303-1]	C	None		0.0000	169.00	No Ice 1/2" Ice 1" Ice	14.66 18.87 23.08	14.66 18.87 23.08	1.25 1.48 1.71
//									
RR90-17-02DP w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	161.00	No Ice 1/2" Ice 1" Ice	4.59 5.09 5.58	3.32 4.09 4.78	0.03 0.07 0.12
RR90-17-02DP w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	161.00	No Ice 1/2" Ice 1" Ice	4.59 5.09 5.58	3.32 4.09 4.78	0.03 0.07 0.12
RR90-17-02DP w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	161.00	No Ice 1/2" Ice 1" Ice	4.59 5.09 5.58	3.32 4.09 4.78	0.03 0.07 0.12
Empty Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	161.00	No Ice 1/2" Ice 1" Ice	1.40 2.13 2.68	1.40 2.13 2.68	0.03 0.04 0.06
Empty Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	161.00	No Ice 1/2" Ice 1" Ice	1.40 2.13 2.68	1.40 2.13 2.68	0.03 0.04 0.06
Empty Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	161.00	No Ice 1/2" Ice 1" Ice	1.40 2.13 2.68	1.40 2.13 2.68	0.03 0.04 0.06
Platform Mount [LP 305-1]	C	None		0.0000	161.00	No Ice 1/2" Ice 1" Ice	18.01 23.33 28.65	18.01 23.33 28.65	1.12 1.35 1.58
//									
FD9R6004/1C-3L	A	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	0.37 0.45 0.54	0.08 0.14 0.20	0.00 0.00 0.01
FD9R6004/1C-3L	B	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	0.37 0.45 0.54	0.08 0.14 0.20	0.00 0.00 0.01
FD9R6004/1C-3L	C	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	0.37 0.45 0.54	0.08 0.14 0.20	0.00 0.00 0.01
FD9R6004/1C-3L	A	From Leg	4.00 0.00 -1.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	0.37 0.45 0.54	0.08 0.14 0.20	0.00 0.00 0.01
FD9R6004/1C-3L	B	From Leg	4.00 0.00 -1.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	0.37 0.45 0.54	0.08 0.14 0.20	0.00 0.00 0.01
FD9R6004/1C-3L	C	From Leg	4.00 0.00 -1.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	0.37 0.45 0.54	0.08 0.14 0.20	0.00 0.00 0.01
KS24019-L112A	B	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	0.16 0.22 0.30	0.16 0.22 0.30	0.01 0.01 0.01
(2) HBXX-6517DS-A2M w/ Mount Pipe	A	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	8.98 9.65 10.29	6.96 8.18 9.14	0.07 0.14 0.21
(2) HBXX-6517DS-A2M w/	B	From Leg	4.00	0.0000	147.00	No Ice	8.98	6.96	0.07

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Mount Pipe			0.00			1/2" Ice	9.65	8.18	0.14
			3.00			1" Ice	10.29	9.14	0.21
(2) HBXX-6517DS-A2M w/ Mount Pipe	C	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	8.98 9.65 10.29	6.96 8.18 9.14	0.07 0.14 0.21
(2) LNX-6514DS-A1M w/ Mount Pipe	A	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	8.65 9.31 9.93	7.08 8.27 9.18	0.06 0.13 0.21
(2) LNX-6514DS-A1M w/ Mount Pipe	B	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	8.65 9.31 9.93	7.08 8.27 9.18	0.06 0.13 0.21
(2) LNX-6514DS-A1M w/ Mount Pipe	C	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	8.65 9.31 9.93	7.08 8.27 9.18	0.06 0.13 0.21
RRH2X60-AWS	A	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	3.96 4.27 4.60	1.82 2.08 2.36	0.06 0.08 0.11
RRH2X60-AWS	B	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	3.96 4.27 4.60	1.82 2.08 2.36	0.06 0.08 0.11
RRH2X60-AWS	C	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	3.96 4.27 4.60	1.82 2.08 2.36	0.06 0.08 0.11
RRH2X60-PCS	A	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	2.57 2.79 3.02	2.01 2.22 2.43	0.06 0.08 0.10
RRH2X60-PCS	B	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	2.57 2.79 3.02	2.01 2.22 2.43	0.06 0.08 0.10
RRH2X60-PCS	C	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	2.57 2.79 3.02	2.01 2.22 2.43	0.06 0.08 0.10
DB-T1-6Z-8AB-0Z	A	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	5.60 5.92 6.24	2.33 2.56 2.79	0.04 0.08 0.12
DB-T1-6Z-8AB-0Z	B	From Leg	4.00 0.00 3.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice	5.60 5.92 6.24	2.33 2.56 2.79	0.04 0.08 0.12
Platform Mount [LP 1201-1]	C	None		0.0000	147.00	No Ice 1/2" Ice 1" Ice	23.10 26.80 30.50	23.10 26.80 30.50	2.10 2.50 2.90
//									
(2) TME-RRUS-11	A	From Leg	4.00 0.00 -3.00	0.0000	141.00	No Ice 1/2" Ice 1" Ice	3.31 3.58 3.85	1.72 2.03 2.37	0.05 0.08 0.11
(2) TME-RRUS-11	B	From Leg	4.00 0.00 -3.00	0.0000	141.00	No Ice 1/2" Ice 1" Ice	3.31 3.58 3.85	1.72 2.03 2.37	0.05 0.08 0.11
(2) TME-RRUS-11	C	From Leg	4.00 0.00 -3.00	0.0000	141.00	No Ice 1/2" Ice 1" Ice	3.31 3.58 3.85	1.72 2.03 2.37	0.05 0.08 0.11
Side Arm Mount [SO 102-3]	C	None		0.0000	141.00	No Ice 1/2" Ice 1" Ice	3.00 3.48 3.96	3.00 3.48 3.96	0.08 0.11 0.14
//									
AM-X-CD-16-65-00T-RET w/ Mount Pipe	A	From Leg	4.00 0.00	0.0000	140.00	No Ice 1/2" Ice	8.50 9.15	6.30 7.48	0.07 0.14

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00			1" Ice	9.77	8.37	0.21
AM-X-CD-16-65-00T-RET w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	8.50 9.15 9.77	6.30 7.48 8.37	0.07 0.14 0.21
AM-X-CD-16-65-00T-RET w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	8.50 9.15 9.77	6.30 7.48 8.37	0.07 0.14 0.21
(2) 7770.00 w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) 7770.00 w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) 7770.00 w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) LGP 17201	A	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	1.95 2.13 2.33	0.52 0.64 0.77	0.03 0.04 0.06
(2) LGP 17201	C	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	1.95 2.13 2.33	0.52 0.64 0.77	0.03 0.04 0.06
(2) LGP 17201	B	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	1.95 2.13 2.33	0.52 0.64 0.77	0.03 0.04 0.06
(2) LGP13519	A	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	0.34 0.42 0.51	0.21 0.28 0.36	0.01 0.01 0.01
(2) LGP13519	B	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	0.34 0.42 0.51	0.21 0.28 0.36	0.01 0.01 0.01
(2) LGP13519	C	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	0.34 0.42 0.51	0.21 0.28 0.36	0.01 0.01 0.01
DC6-48-60-18-8F	C	From Leg	4.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice 1" Ice	2.57 2.80 3.04	4.32 4.60 4.88	0.03 0.06 0.10
Platform Mount [LP 303-1]	C	None		0.0000	140.00	No Ice 1/2" Ice 1" Ice	14.66 18.87 23.08	14.66 18.87 23.08	1.25 1.48 1.71
// OG-860/1920/GPS-A	B	From Leg	4.00 0.00 1.00	0.0000	83.00	No Ice 1/2" Ice 1" Ice	0.33 0.43 0.55	0.40 0.51 0.63	0.00 0.01 0.01
OG-860/1920/GPS-A	C	From Leg	4.00 0.00 1.00	0.0000	83.00	No Ice 1/2" Ice 1" Ice	0.33 0.43 0.55	0.40 0.51 0.63	0.00 0.01 0.01
Side Arm Mount [SO 702-1]	B	From Leg	4.00 0.00 0.00	0.0000	83.00	No Ice 1/2" Ice 1" Ice	1.00 1.00 1.00	1.43 2.05 2.67	0.03 0.04 0.05
Side Arm Mount [SO 702-1]	C	From Leg	4.00 0.00 0.00	0.0000	83.00	No Ice 1/2" Ice 1" Ice	1.00 1.00 1.00	1.43 2.05 2.67	0.03 0.04 0.05
// KS24019-L112A	B	From Leg	4.00 0.00 1.00	0.0000	78.00	No Ice 1/2" Ice 1" Ice	0.16 0.22 0.30	0.16 0.22 0.30	0.01 0.01 0.01

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight K
Side Arm Mount [SO 702-1]	B	From Leg	4.00 0.00 0.00	0.0000	78.00	No Ice 1/2" Ice 1" Ice	1.00 1.00 1.00	1.43 2.05 2.67	0.03 0.04 0.05
*****									

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	34.27					
Bracing Weight	0.00					
Total Member Self-Weight	34.27			1.02	-0.19	
Total Weight	51.19			1.02	-0.19	
Wind 0 deg - No Ice		-0.10	-36.30	-4445.42	14.47	-0.05
Wind 30 deg - No Ice		18.01	-31.39	-3842.38	-2204.31	0.44
Wind 60 deg - No Ice		31.30	-18.07	-2209.51	-3832.49	0.82
Wind 90 deg - No Ice		36.19	0.10	15.67	-4433.81	0.97
Wind 120 deg - No Ice		31.39	18.24	2236.93	-3847.14	0.87
Wind 150 deg - No Ice		18.18	31.49	3859.07	-2229.69	0.53
Wind 180 deg - No Ice		0.10	36.30	4447.46	-14.84	0.05
Wind 210 deg - No Ice		-18.01	31.39	3844.42	2203.93	-0.44
Wind 240 deg - No Ice		-31.30	18.07	2211.55	3832.11	-0.82
Wind 270 deg - No Ice		-36.19	-0.10	-13.63	4433.43	-0.97
Wind 300 deg - No Ice		-31.39	-18.24	-2234.89	3846.77	-0.87
Wind 330 deg - No Ice		-18.18	-31.49	-3857.03	2229.31	-0.53
Member Ice	8.96					
Total Weight Ice	70.88			3.76	-0.86	
Wind 0 deg - Ice		-0.01	-5.12	-628.12	0.64	0.04
Wind 30 deg - Ice		2.54	-4.43	-542.71	-314.43	0.16
Wind 60 deg - Ice		4.42	-2.55	-310.88	-545.47	0.23
Wind 90 deg - Ice		5.10	0.01	5.26	-630.59	0.24
Wind 120 deg - Ice		4.42	2.57	321.00	-546.97	0.19
Wind 150 deg - Ice		2.56	4.44	551.74	-317.03	0.08
Wind 180 deg - Ice		0.01	5.12	635.64	-2.36	-0.04
Wind 210 deg - Ice		-2.54	4.43	550.24	312.71	-0.16
Wind 240 deg - Ice		-4.42	2.55	318.40	543.76	-0.23
Wind 270 deg - Ice		-5.10	-0.01	2.26	628.87	-0.24
Wind 300 deg - Ice		-4.42	-2.57	-313.48	545.26	-0.19
Wind 330 deg - Ice		-2.56	-4.44	-544.21	315.31	-0.08
Total Weight	51.19			1.02	-0.19	
Wind 0 deg - Service		-0.03	-12.56	-1538.32	4.85	-0.02
Wind 30 deg - Service		6.23	-10.86	-1329.65	-762.90	0.15
Wind 60 deg - Service		10.83	-6.25	-764.65	-1326.28	0.28
Wind 90 deg - Service		12.52	0.03	5.31	-1534.35	0.34
Wind 120 deg - Service		10.86	6.31	773.91	-1331.35	0.30
Wind 150 deg - Service		6.29	10.90	1335.21	-771.68	0.18
Wind 180 deg - Service		0.03	12.56	1538.80	-5.29	0.02
Wind 210 deg - Service		-6.23	10.86	1330.14	762.45	-0.15
Wind 240 deg - Service		-10.83	6.25	765.13	1325.83	-0.28

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 270 deg - Service		-12.52	-0.03	-4.83	1533.90	-0.34
Wind 300 deg - Service		-10.86	-6.31	-773.43	1330.90	-0.30
Wind 330 deg - Service		-6.29	-10.90	-1334.72	771.23	-0.18

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	180 - 131.91	Pole	Max Tension	33	0.00	-0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	14	-24.70	-0.04	-0.13
			Max. Mx	5	-11.99	-478.56	-1.19
			Max. My	8	-11.98	-1.20	-478.07
			Max. Vy	5	23.82	-478.56	-1.19
			Max. Vx	8	23.90	-1.20	-478.07
			Max. Torque	6			0.72
L2	131.91 - 86.84	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-35.17	-0.01	-0.91
			Max. Mx	5	-20.69	-1616.42	-6.19
			Max. My	8	-20.68	-5.97	-1619.80
			Max. Vy	5	28.01	-1616.42	-6.19
			Max. Vx	8	28.09	-5.97	-1619.80
			Max. Torque	13			0.42
L3	86.84 - 43.32	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-49.43	-0.50	-2.42
			Max. Mx	5	-32.72	-2899.68	-11.07
			Max. My	8	-32.72	-10.52	-2907.88
			Max. Vy	5	32.22	-2899.68	-11.07
			Max. Vx	8	32.33	-10.52	-2907.88
			Max. Torque	11			0.85
L4	43.32 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-70.88	-0.86	-3.76
			Max. Mx	5	-51.17	-4611.76	-16.33
			Max. My	8	-51.17	-15.47	-4625.84
			Max. Vy	5	36.23	-4611.76	-16.33
			Max. Vx	8	36.34	-15.47	-4625.84
			Max. Torque	11			0.98

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	20	70.88	-2.56	-4.44
	Max. H_x	11	51.19	36.19	0.10
	Max. H_z	2	51.19	0.10	36.30
	Max. M_x	2	4623.72	0.10	36.30
	Max. M_z	5	4611.76	-36.19	-0.10
	Max. Torsion	11	0.98	36.19	0.10
	Min. Vert	1	51.19	0.00	0.00
	Min. H_x	5	51.19	-36.19	-0.10
	Min. H_z	8	51.19	-0.10	-36.30
	Min. M_x	8	-4625.84	-0.10	-36.30
	Min. M_z	11	-4611.37	36.19	0.10
	Min. Torsion	5	-0.96	-36.19	-0.10

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	51.19	0.00	0.00	1.02	-0.19	0.00
Dead+Wind 0 deg - No Ice	51.19	-0.10	-36.30	-4623.72	15.07	-0.05

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead+Wind 30 deg - No Ice	51.19	18.01	-31.39	-3996.56	-2292.78	0.45
Dead+Wind 60 deg - No Ice	51.19	31.30	-18.07	-2298.16	-3986.35	0.82
Dead+Wind 90 deg - No Ice	51.19	36.19	0.10	16.33	-4611.76	0.96
Dead+Wind 120 deg - No Ice	51.19	31.39	18.24	2326.67	-4001.53	0.86
Dead+Wind 150 deg - No Ice	51.19	18.18	31.49	4013.85	-2319.17	0.53
Dead+Wind 180 deg - No Ice	51.19	0.10	36.30	4625.84	-15.47	0.06
Dead+Wind 210 deg - No Ice	51.19	-18.01	31.39	3998.67	2292.38	-0.43
Dead+Wind 240 deg - No Ice	51.19	-31.30	18.07	2300.27	3985.96	-0.81
Dead+Wind 270 deg - No Ice	51.19	-36.19	-0.10	-14.21	4611.37	-0.98
Dead+Wind 300 deg - No Ice	51.19	-31.39	-18.24	-2324.56	4001.14	-0.88
Dead+Wind 330 deg - No Ice	51.19	-18.18	-31.49	-4011.74	2318.78	-0.54
Dead+Ice+Temp	70.88	0.00	0.00	3.76	-0.86	0.00
Dead+Wind 0 deg+Ice+Temp	70.88	-0.01	-5.12	-671.20	0.71	0.04
Dead+Wind 30 deg+Ice+Temp	70.88	2.54	-4.43	-579.93	-335.98	0.16
Dead+Wind 60 deg+Ice+Temp	70.88	4.42	-2.55	-332.20	-582.89	0.23
Dead+Wind 90 deg+Ice+Temp	70.88	5.10	0.01	5.62	-673.85	0.24
Dead+Wind 120 deg+Ice+Temp	70.88	4.42	2.57	343.00	-584.50	0.19
Dead+Wind 150 deg+Ice+Temp	70.88	2.56	4.44	589.55	-338.78	0.08
Dead+Wind 180 deg+Ice+Temp	70.88	0.01	5.12	679.20	-2.52	-0.04
Dead+Wind 210 deg+Ice+Temp	70.88	-2.54	4.43	587.94	334.17	-0.16
Dead+Wind 240 deg+Ice+Temp	70.88	-4.42	2.55	340.21	581.07	-0.23
Dead+Wind 270 deg+Ice+Temp	70.88	-5.10	-0.01	2.39	672.04	-0.24
Dead+Wind 300 deg+Ice+Temp	70.88	-4.42	-2.57	-335.00	582.69	-0.19
Dead+Wind 330 deg+Ice+Temp	70.88	-2.56	-4.44	-581.55	336.96	-0.08
Dead+Wind 0 deg - Service	51.19	-0.03	-12.56	-1601.91	5.10	-0.02
Dead+Wind 30 deg - Service	51.19	6.23	-10.86	-1384.52	-794.81	0.15
Dead+Wind 60 deg - Service	51.19	10.83	-6.25	-795.85	-1381.80	0.28
Dead+Wind 90 deg - Service	51.19	12.52	0.03	6.35	-1598.58	0.34
Dead+Wind 120 deg - Service	51.19	10.86	6.31	807.13	-1387.09	0.30
Dead+Wind 150 deg - Service	51.19	6.29	10.90	1391.93	-803.97	0.19
Dead+Wind 180 deg - Service	51.19	0.03	12.56	1604.03	-5.49	0.02
Dead+Wind 210 deg - Service	51.19	-6.23	10.86	1386.64	794.42	-0.15
Dead+Wind 240 deg - Service	51.19	-10.83	6.25	797.97	1381.41	-0.28
Dead+Wind 270 deg - Service	51.19	-12.52	-0.03	-4.23	1598.19	-0.34
Dead+Wind 300 deg - Service	51.19	-10.86	-6.31	-805.01	1386.70	-0.30
Dead+Wind 330 deg - Service	51.19	-6.29	-10.90	-1389.81	803.58	-0.19

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-51.19	0.00	0.00	51.19	0.00	0.000%
2	-0.10	-51.19	-36.30	0.10	51.19	36.30	0.000%
3	18.01	-51.19	-31.39	-18.01	51.19	31.39	0.000%
4	31.30	-51.19	-18.07	-31.30	51.19	18.07	0.000%
5	36.19	-51.19	0.10	-36.19	51.19	-0.10	0.000%
6	31.39	-51.19	18.24	-31.39	51.19	-18.24	0.000%
7	18.18	-51.19	31.49	-18.18	51.19	-31.49	0.000%
8	0.10	-51.19	36.30	-0.10	51.19	-36.30	0.000%
9	-18.01	-51.19	31.39	18.01	51.19	-31.39	0.000%
10	-31.30	-51.19	18.07	31.30	51.19	-18.07	0.000%
11	-36.19	-51.19	-0.10	36.19	51.19	0.10	0.000%
12	-31.39	-51.19	-18.24	31.39	51.19	18.24	0.000%
13	-18.18	-51.19	-31.49	18.18	51.19	31.49	0.000%
14	0.00	-70.88	0.00	0.00	70.88	0.00	0.000%
15	-0.01	-70.88	-5.12	0.01	70.88	5.12	0.000%
16	2.54	-70.88	-4.43	-2.54	70.88	4.43	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
17	4.42	-70.88	-2.55	-4.42	70.88	2.55	0.000%
18	5.10	-70.88	0.01	-5.10	70.88	-0.01	0.000%
19	4.42	-70.88	2.57	-4.42	70.88	-2.57	0.000%
20	2.56	-70.88	4.44	-2.56	70.88	-4.44	0.000%
21	0.01	-70.88	5.12	-0.01	70.88	-5.12	0.000%
22	-2.54	-70.88	4.43	2.54	70.88	-4.43	0.000%
23	-4.42	-70.88	2.55	4.42	70.88	-2.55	0.000%
24	-5.10	-70.88	-0.01	5.10	70.88	0.01	0.000%
25	-4.42	-70.88	-2.57	4.42	70.88	2.57	0.000%
26	-2.56	-70.88	-4.44	2.56	70.88	4.44	0.000%
27	-0.03	-51.19	-12.56	0.03	51.19	12.56	0.000%
28	6.23	-51.19	-10.86	-6.23	51.19	10.86	0.000%
29	10.83	-51.19	-6.25	-10.83	51.19	6.25	0.000%
30	12.52	-51.19	0.03	-12.52	51.19	-0.03	0.000%
31	10.86	-51.19	6.31	-10.86	51.19	-6.31	0.000%
32	6.29	-51.19	10.90	-6.29	51.19	-10.90	0.000%
33	0.03	-51.19	12.56	-0.03	51.19	-12.56	0.000%
34	-6.23	-51.19	10.86	6.23	51.19	-10.86	0.000%
35	-10.83	-51.19	6.25	10.83	51.19	-6.25	0.000%
36	-12.52	-51.19	-0.03	12.52	51.19	0.03	0.000%
37	-10.86	-51.19	-6.31	10.86	51.19	6.31	0.000%
38	-6.29	-51.19	-10.90	6.29	51.19	10.90	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00049964
3	Yes	6	0.00000001	0.00005006
4	Yes	6	0.00000001	0.00004989
5	Yes	4	0.00000001	0.00059110
6	Yes	6	0.00000001	0.00005092
7	Yes	6	0.00000001	0.00005036
8	Yes	4	0.00000001	0.00040598
9	Yes	6	0.00000001	0.00005005
10	Yes	6	0.00000001	0.00005024
11	Yes	4	0.00000001	0.00040962
12	Yes	6	0.00000001	0.00005029
13	Yes	6	0.00000001	0.00005083
14	Yes	4	0.00000001	0.00000001
15	Yes	5	0.00000001	0.00014449
16	Yes	5	0.00000001	0.00015806
17	Yes	5	0.00000001	0.00015794
18	Yes	5	0.00000001	0.00014511
19	Yes	5	0.00000001	0.00016036
20	Yes	5	0.00000001	0.00016045
21	Yes	5	0.00000001	0.00014603
22	Yes	5	0.00000001	0.00015928
23	Yes	5	0.00000001	0.00015911
24	Yes	5	0.00000001	0.00014480
25	Yes	5	0.00000001	0.00015856
26	Yes	5	0.00000001	0.00015875
27	Yes	4	0.00000001	0.00011203
28	Yes	5	0.00000001	0.00008688
29	Yes	5	0.00000001	0.00008621

30	Yes	4	0.00000001	0.00012087
31	Yes	5	0.00000001	0.00008984
32	Yes	5	0.00000001	0.00008798
33	Yes	4	0.00000001	0.00010801
34	Yes	5	0.00000001	0.00008693
35	Yes	5	0.00000001	0.00008752
36	Yes	4	0.00000001	0.00011248
37	Yes	5	0.00000001	0.00008750
38	Yes	5	0.00000001	0.00008945

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 131.91	47.411	32	2.3156	0.0006
L2	136.33 - 86.84	27.255	32	1.9706	0.0007
L3	92.41 - 43.32	12.037	32	1.2773	0.0004
L4	49.94 - 0	3.413	32	0.6300	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.00	(2) 950F65T2ZE-M w/ Mount Pipe	32	47.411	2.3156	0.0007	33715
169.00	(4) DB844H90E-XY w/ Mount Pipe	32	42.101	2.2504	0.0006	15325
161.00	RR90-17-02DP w/ Mount Pipe	32	38.293	2.1979	0.0005	8871
147.00	FD9R6004/1C-3L	32	31.859	2.0847	0.0006	5107
141.00	(2) TME-RRUS-11	32	29.232	2.0241	0.0007	4320
140.00	AM-X-CD-16-65-00T-RET w/ Mount Pipe	32	28.803	2.0131	0.0007	4214
83.00	OG-860/1920/GPS-A	32	9.593	1.1226	0.0004	3562
78.00	KS24019-L112A	32	8.415	1.0431	0.0004	3523

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 131.91	136.273	7	6.6663	0.0018
L2	136.33 - 86.84	78.427	7	5.6747	0.0019
L3	92.41 - 43.32	34.675	7	3.6803	0.0012
L4	49.94 - 0	9.839	7	1.8161	0.0006

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.00	(2) 950F65T2ZE-M w/ Mount Pipe	7	136.273	6.6663	0.0022	11997
169.00	(4) DB844H90E-XY w/ Mount Pipe	7	121.037	6.4789	0.0017	5452
161.00	RR90-17-02DP w/ Mount Pipe	7	110.111	6.3281	0.0016	3154
147.00	FD9R6004/1C-3L	7	91.647	6.0026	0.0018	1812
141.00	(2) TME-RRUS-11	7	84.103	5.8285	0.0019	1532
140.00	AM-X-CD-16-65-00T-RET w/ Mount Pipe	7	82.873	5.7970	0.0019	1494
83.00	OG-860/1920/GPS-A	7	27.639	3.2350	0.0012	1246
78.00	KS24019-L112A	7	24.248	3.0060	0.0011	1231

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	180 - 131.91 (1)	TP31.375x21x0.25	48.09	0.00	0.0	39.000	23.9410	-11.97	933.70	0.013
L2	131.91 - 86.84 (2)	TP40.4688x29.9214x0.375	49.49	0.00	0.0	39.000	46.3087	-20.67	1806.04	0.011
L3	86.84 - 43.32 (3)	TP48.9688x38.5317x0.4375	49.09	0.00	0.0	39.000	65.4373	-32.71	2552.06	0.013
L4	43.32 - 0 (4)	TP57.25x46.6863x0.5	49.94	0.00	0.0	39.000	90.0622	-51.17	3512.43	0.015

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	180 - 131.91 (1)	TP31.375x21x0.25	479.43	32.291	39.000	0.828	0.00	0.000	39.000	0.000
L2	131.91 - 86.84 (2)	TP40.4688x29.9214x0.375	1624.09	43.913	39.000	1.126	0.00	0.000	39.000	0.000
L3	86.84 - 43.32 (3)	TP48.9688x38.5317x0.4375	2914.88	46.034	39.000	1.180	0.00	0.000	39.000	0.000
L4	43.32 - 0 (4)	TP57.25x46.6863x0.5	4635.68	44.149	39.000	1.132	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	180 - 131.91 (1)	TP31.375x21x0.25	23.93	1.000	26.000	0.077	0.20	0.007	26.000	0.000
L2	131.91 - 86.84 (2)	TP40.4688x29.9214x0.375	28.16	0.608	26.000	0.047	0.42	0.005	26.000	0.000
L3	86.84 - 43.32	TP48.9688x38.5317x0.4375	32.39	0.495	26.000	0.038	0.49	0.004	26.000	0.000

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L4	(3) 43.32 - 0 (4)	TP57.25x46.6863x0.5	36.40	0.404	26.000	0.031	0.53	0.002	26.000	0.000

Pole Interaction Design Data

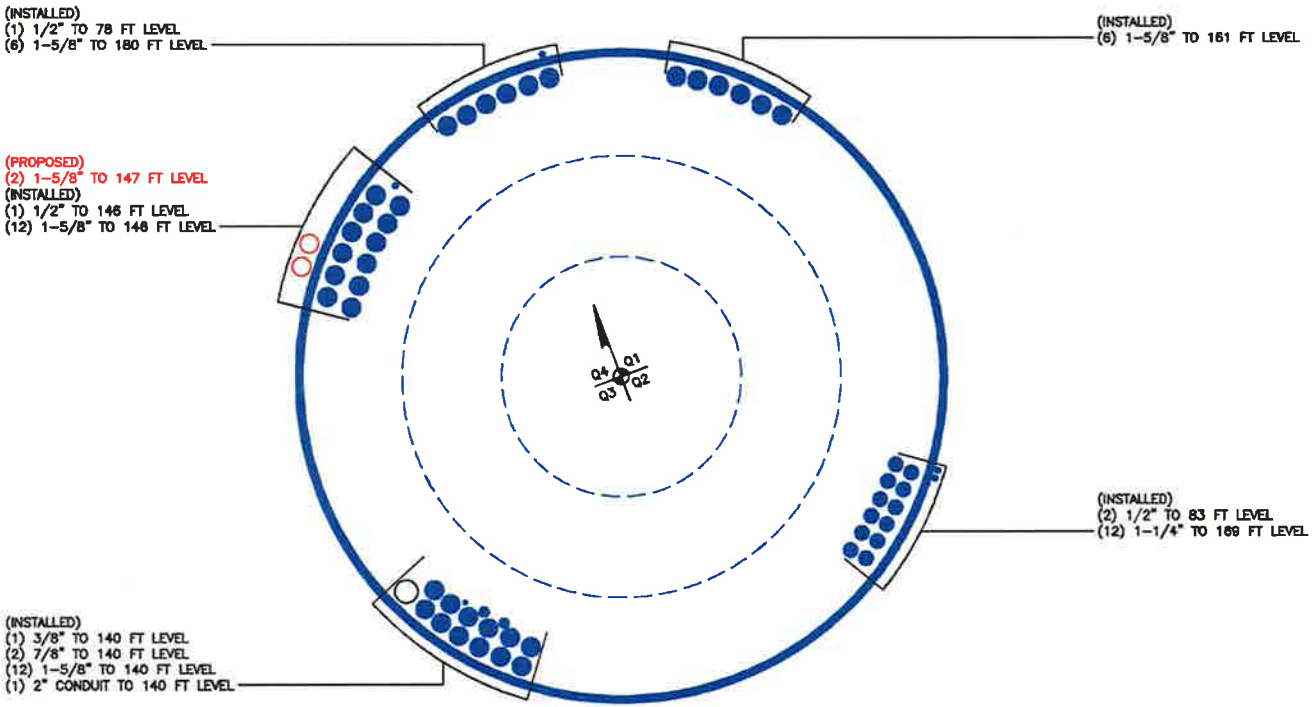
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	180 - 131.91 (1)	0.013	0.828	0.000	0.077	0.000	0.842 ✔	1.333	H1-3+VT ✔
L2	131.91 - 86.84 (2)	0.011	1.126	0.000	0.047	0.000	1.138 ✔	1.333	H1-3+VT ✔
L3	86.84 - 43.32 (3)	0.013	1.180	0.000	0.038	0.000	1.194 ✔	1.333	H1-3+VT ✔
L4	43.32 - 0 (4)	0.015	1.132	0.000	0.031	0.000	1.147 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	180 - 131.91	Pole	TP31.375x21x0.25	1	-11.97	1244.62	63.2	Pass
L2	131.91 - 86.84	Pole	TP40.4688x29.9214x0.375	2	-20.67	2407.45	85.4	Pass
L3	86.84 - 43.32	Pole	TP48.9688x38.5317x0.4375	3	-32.71	3401.90	89.5	Pass
L4	43.32 - 0	Pole	TP57.25x46.6863x0.5	4	-51.17	4682.07	86.0	Pass
							Summary	
						Pole (L3)	89.5	Pass
						RATING =	**89.5**	**Pass**

APPENDIX B

BASE LEVEL DRAWING



BUSINESS UNIT: 876381 TOWER ID: C_BASELEVEL

APPENDIX C

ADDITIONAL CALCULATIONS

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

TIA Rev G Assumption: Clear space between bottom of leveling nut and top of concrete **not** exceeding (1)*(Rod Diameter)

Site Data

BU#:	
Site Name:	
App #:	
Pole Manufacturer:	*Other*

Anchor Rod Data		
Qty:	20	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	66	in

Plate Data		
Diam:	72	in
Thick:	2.25	in
Grade:	60	ksi
Single-Rod B-eff:	9.09	in

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

Pole Data		
Diam:	57.25	in
Thick:	0.5	in
Grade:	65	ksi
# of Sides:	18	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Reactions		
Mu:	4636	ft-kips
Axial, Pu:	51	kips
Shear, Vu:	36	kips
Eta Factor, η	0.5	TIA G (Fig. 4-4)

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

Anchor Rod Results

Max Rod (Cu+ Vu/ή):	174.7 Kips	Rigid
Allowable Axial, Φ*Fu*Anet:	260.0 Kips	AISC LRFD
Anchor Rod Stress Ratio:	67.2% Pass	φ*Tn

Base Plate Results Flexural Check

Base Plate Stress:	39.6 ksi	Rigid
Allowable Plate Stress:	54.0 ksi	AISC LRFD
Base Plate Stress Ratio:	73.4% Pass	φ*Fy
		Y.L. Length: 32.84

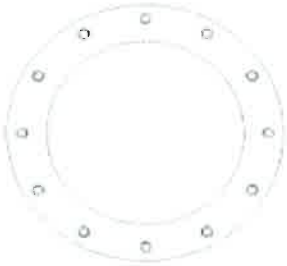
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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

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

Site Data

Site ID:
Site Name:
Job No.:

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:	3	in
Pier Dist. Above Grade:	12	in
Pad Bearing Depth, D:	7	ft
Pad Thickness, T:	3	ft
Pad Width=Length, L:	26	ft
Pier Cross Section Shape:	Round	<--Pull Down
Enter Pier Diameter:	7	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	38.48	ft^2
Pier Height:	5.00	ft
Soil (above pad) Height:	4.00	ft

Soil Parameters		
Unit Weight, γ:	130.0	pcf
Ultimate Bearing Capacity, qn:	30.00	ksf
Strength Reduct. factor, ϕ:	0.75	
Angle of Friction, Φ:	38.0	degrees
Undrained Shear Strength, Cu:	0.00	ksf
Allowable Bearing: ϕ*qn:	22.50	ksf
Passive Pres. Coeff., Kp	4.20	

Forces/Moments due to Wind and Lateral Soil		
Minimum of (φ*Ultimate Pad Passive Force, Vu):	48.6	kips
Pad Force Location Above D:	1.36	ft
ϕ(Passive Pressure Moment):	66.27	ft-kips
Factored O.T. M(WL), "1.6W":	6659.6	ft-kips
Factored OT (MW-Msoil), M1	6593.28	ft-kips

Resistance due to Foundation Gravity		
Soil Wedge Projection grade, a:	3.13	ft
Sum of Soil Wedges Wt:	53.51	kips
Soil Wedges ecc, K1:	8.65	ft
Ftg+Soil above Pad wt:	664.6	kips
Unfactored (Total ftg-soil Wt):	718.09	kips
1.2D. **No Soil Wedges.**	858.69	kips
0.9D. **With Soil Wedges**	692.18	kips

Resistance due to Cohesion (Vertical)		
ϕ*(1/2*Cu)(Total Vert. Planes)	0.00	kips
Cohesion Force Eccentricity, K2	0.00	ft

Monopole Base Reaction Forces		
TIA Revision:	F	<--Pull Down
Unfactored DL Axial, PD:	51	kips
Unfactored WL Axial, PW:		kips
Unfactored WL Shear, V:	36	kips
Unfactored WL Moment, M:	4636	ft-kips

Load Factor	Shaft Factored Loads		
1.20	1.2D+1.6W, Pu:	61.2	kips
0.90	0.9D+1.6W, Pu:	45.9	kips
1.35	Vu:	48.6	kips
	Mu:	6258.6	ft-kips

1.2D+1.6W Load Combination, Bearing Results:

(**No Soil Wedges**) [Reaction+Conc+Soil]	858.69	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	6593.28	ft-kips

Orthogonal Direction:

ecc1 = M1/P1 =	7.68	ft
Orthogonal qu=	3.10	ksf
qu/ϕ*qn Ratio=	**13.79%**	Pass

Diagonal Direction:

ecc2 = (0.707M1)/P1 =	5.43	ft
Diagonal qu=	3.74	ksf
qu/ϕ*qn Ratio=	**16.64%**	Pass

Run <-- Press Upon Completing All Input

Overturning Stability Check

0.9D+1.6W Load Combination, Bearing Results:

(**w/ Soil Wedges**) [Reaction+Conc+Soil]	692.18	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	6176.71	ft-kips

Orthogonal ecc3 = M2/P2 =	8.92	ft
Ortho Non Bearing Length,NBL=	17.85	ft
Orthogonal qu=	3.27	ksf
Diagonal qu=	3.87	ksf

Max Reaction Moment (ft-kips) so that qu=φ*qn = 100% Capacity Rating			
Actual M:	4636.00		
M Orthogonal:	6448.99	**71.89%**	Pass
M Diagonal:	6448.99	**71.89%**	Pass