Robinson+Cole

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Also admitted in Massachusetts

July 28, 2015

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

Re: **Notice of Exempt Modification – Facility Modification**
848 East Street, Suffield, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) antennas at the 153-foot level of the existing 165.5 foot tower at 848 East Street in Suffield, Connecticut (the "Property"). The tower is owned by Crown Castle. The Council approved Cellco's use of this tower in 2007. Cellco now intends to replace six (6) of its existing antennas with three (3) model SBNHH-1DS65B, 700/2100 MHz antennas and three (3) model SBNHH-1DS65B, 1900 MHz antennas, all at the same 153-foot level on the tower. Cellco also intends to and install nine (9) remote radio heads ("RRHs") behind its antennas and two (2) HYBRIFLEX™ antenna cables. Included in Attachment 1 are specifications for Cellco's 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 Edward McAnaney, First Selectman of the Town of Suffield. The Town of Suffield is the owner of the Property.

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

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's replacement antennas and RRH's will be located at the 153-foot level on the 165.5 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 worst-case 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:
Edward McAnaney, Suffield First Selectman
Tim Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

SBNHH-1D65B

Andrew® Tri-band Antenna, 698–896 and 2x 1695–2360 MHz, 65° horizontal beamwidth, internal RET. Both high bands share the same electrical tilt.

- Interleaved dipole technology providing for attractive, low wind load mechanical package

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain, dBi	14.9	14.7	17.7	18.2	18.6	18.6
Beamwidth, Horizontal, degrees	68	66	69	66	63	58
Beamwidth, Vertical, degrees	12.1	10.7	5.6	5.2	5.0	4.5
Beam Tilt, degrees	0–14	0–14	0–7	0–7	0–7	0–7
USLS, dB	14	13	15	15	15	13
Front-to-Back Ratio at 180°, dB	27	29	28	28	28	27
CPR at Boresight, dB	20	23	20	20	17	21
CPR at Sector, dB	14	10	12	10	9	1
Isolation, dB	25	25	25	25	25	25
Isolation, Intersystem, dB	30	30	30	30	30	30
VSWR | Return Loss, dB	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350	350	350	300
Polarization	±45°	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain by all Beam Tilts, average, dBi	14.5	14.3	17.4	17.9	18.2	18.3
Gain by all Beam Tilts Tolerance, dB	±0.5	±0.8	±0.4	±0.3	±0.5	±0.3
Gain by Beam Tilt, average, dBi	0 ° | 14.6	0 ° | 14.5	0 ° | 17.4	0 ° | 17.8	0 ° | 18.1	0 ° | 18.2
	7 ° | 14.6	7 ° | 14.4	3 ° | 17.5	3 ° | 17.9	3 ° | 18.3	3 ° | 18.4
	14 ° | 14.2	14 ° | 13.6	7 ° | 17.4	7 ° | 17.9	7 ° | 18.2	7 ° | 18.4
Beamwidth, Horizontal Tolerance, degrees	±2.2	±3.4	±2	±4.6	±5.7	±4.3
Beamwidth, Vertical Tolerance, degrees	±0.8	±1	±0.3	±0.2	±0.3	±0.2
USLS, dB	16	14	16	16	16	15
Front-to-Back Total Power at 180° ± 30°, dB	25	26	27	26	26	26
CPR at Boresight, dB	22	23	21	20	20	22
CPR at Sector, dB	13	11	16	12	11	4

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

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® multiband with internal RET
Band	Multiband
Brand	DualPol® | Teletilt®
Operating Frequency Band	1695 – 2360 MHz | 698 – 896 MHz
Performance Note	Outdoor usage

Product Specifications

SBNHH-1D65B

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	181.0 mm | 7.1 in
Length	1851.0 mm | 72.9 in
Width	301.0 mm | 11.9 in
Net Weight	18.4 kg | 40.6 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male
RET System	Teletilt®

Regulatory Compliance/Certifications

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

Included Products

BSAMNT-1 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

ALCATEL-LUCENT B13 RRH4X30-4R

Alcatel-Lucent B13 Remote Radio Head 4x30-4R is the newest addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering.

Supporting 2Tx/4Tx MIMO and 4-way Rx diversity, Alcatel-Lucent B13 RRH4x30-4R allows operators to have a compact radio solution to deploy LTE in the 700U band (700 MHz, 3GPP band 13), providing them with the means to achieve high capacity, high quality and high coverage with minimum site requirements.

The Alcatel-Lucent B13 RRH4x30-4R product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x60 W or 4x30 W RF output power. It supports also 4-way Rx diversity and up to 10MHz instantaneous bandwidth.

The Alcatel-Lucent B13 RRH4x30-4R is a near zero-footprint solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

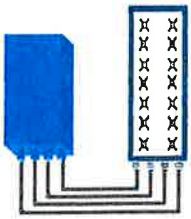
Its compactness and slim design makes the Alcatel-Lucent B13 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

FEATURES

- Supporting LTE in 700 MHz band (700U, 3GPP band 13)
- LTE 2Tx or 4Tx MIMO (SW switchable)
- Output power: Up to 2x60W or 4x30W
- 10MHz LTE carrier with 4Rx Diversity
- Convection-cooled (fan-less)
- Supports AISG 2.0 ALD devices (RET, TMA) through RS485 or RF ports

BENEFITS

- Compact to reduce additional footprint when adding LTE in 700U band
- MIMO scheme operation selection (2Tx or 4Tx) by software only
- Improves downlink spectral efficiency through MIMO4
- Increases LTE coverage thanks to 4Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options: Pole or Wall



4x30W with 4T4R
or
2x60W with 2T4R

Can be switched between modes via SW w/o site visit

Alcatel·Lucent

Features & performance	
Number of TX/RX paths	4 duplexed (either 4T4R or 2T4R by SW)
Frequency band	U700 (C) (3GPP bands 13): DL: 746 - 756 MHz / UL: 777 - 787 MHz
Instantaneous bandwidth - #carriers	10MHz – 1 LTE carrier (in 10MHz occupied bandwidth)
LTE carrier bandwidth	10 MHz
RF output power	2x60W or 4x30W (by SW)
Noise figure – RX Diversity scheme	2 dB typ. (<2.5 dB max) – 2 or 4 way Rx diversity
Sizes (HxWxD) in mm (in.) Volume in L Weight in kg (lb) (w/o mounting HW)	550 x 305 x 230 (21.6" x 12.0" x 9") (with solar shield) 38 (with solar shield) 26 (57.2) (with solar shield)
DC voltage range DC power consumption	-40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption 550W typical @100% RF load (in 2Tx or 4TX mode)
Environmental conditions Wind load (@150km/h or 93mph)	-40°C (-40°F) /+55°C (+131°F) IP65 Frontal:<200N / Lateral :<150N
Antenna ports	4 ports 7/16 DIN female (50 ohms) VSWR < 1.5
CPRI ports	2 CPRI ports (HW ready for Rate7, 9.8 Gbps) SFP single mode dual fiber
AISG interfaces	1 AISG2.0 output (RS485) Integrated Smart Bias Tees (x2)
Misc. Interfaces	4 external alarms (1 connector) – 4 RF Tx & 4 RF Rx monitor ports - 1 DC connector (2 pins)
Installation conditions	Pole and wall mounting
Regulatory compliance	3GPP 36.141 / 3GPP 36.113 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27

PCS RF MODULES

RRH1900 2X60 - HW CHARACTERISTICS

LA6.0.1/13.3

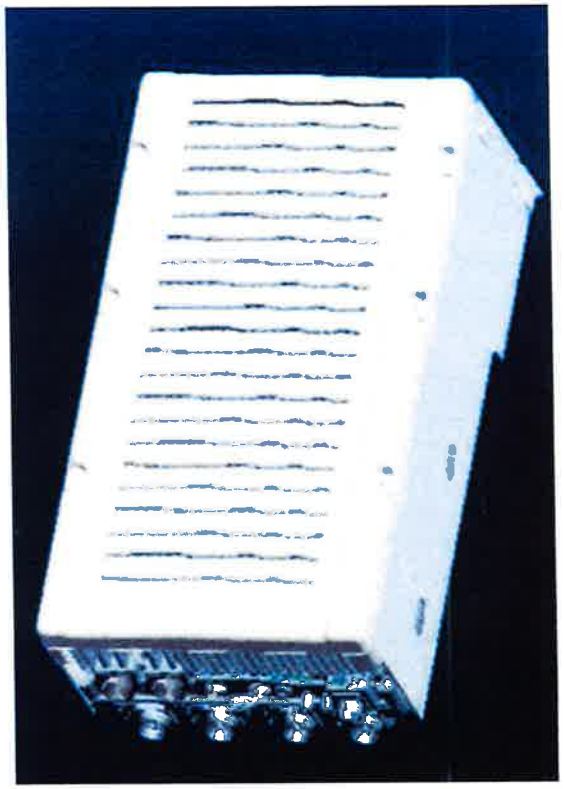
	RRH2x60
RF Output Power	2x60W
Instantaneous Bandwidth	20MHz
Transmitter	2 TX
Receiver 1900 HW version 1900A HW version	2 Branch RX – LA6.0.1 4 Branch RX – LR13.3
Features	AISG 2.0 for RET/TMA
	Internal Smart Bias-T
Power	-48VDC
CPRI Ports	2 CPRI Rate 3 Ports
External Alarms	4 External User Alarms
Monitor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

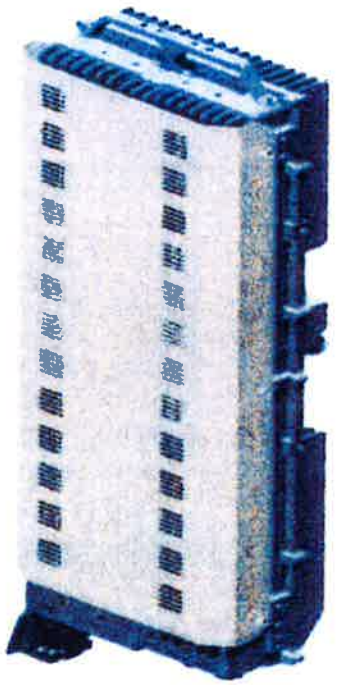
	RRH2x60
RF Output Power	2x60W (4x30W HW Ready)
Instantaneous Bandwidth	60MHz
Target Reliability (Annual Return Rate)	<2%
Receiver	4 Branch Rx
Features	AISG 2.0 for RET/TMA
Power	-48VDC
	Internal Smart Bias-T
CPRI Ports	2 CPRI Rate 5 Ports
External Alarms	4 External User Alarms
Monitor Ports	TX, RX
Environmental	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

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.

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.

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).

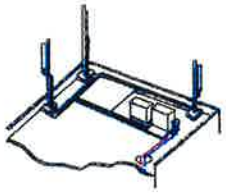
The Alcatel-Lucent RRH2x60-AWS is a very cost-effective solution to deploy LTE MIMO.

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.

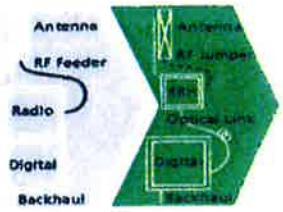
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation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

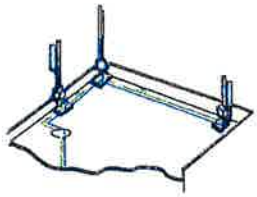
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

- 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
- 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.

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
Mechanical Properties			
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)
Electrical Properties			
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)
Fiber Optic Cable Properties			
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
DC Power Cable Properties			
Size (Power)		[mm² (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm² (AWG)]	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-95-658 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Environmental			
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

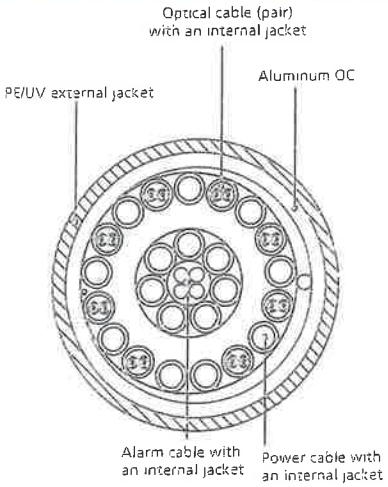


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

	General	Power	Density					
Site Name: Suffield 4								
Tower Height: 165.5Ft.								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*T-Mobile GSM	8	153	165	0.0162	1945	1.0000	1.62%	
*T-Mobile UMTS	2	610	165	0.0161	2100	1.0000	1.61%	
*Clearwire	2	153	136	0.0059	2496	1.0000	0.59%	
*Clearwire	1	211	136	0.0041	11 GHz	1.0000	0.41%	
*MetroPCS CDMA	3	727	145	0.0373	2135	1.0000	3.73%	
*MetroPCS LTE	1	1200	145	0.0205	2130	1.0000	2.05%	
Verizon PCS	**11**	**406**	**153**	**0.0686**	**1970**	**1.0000**	**6.86%**	
Verizon Cellular	**9**	**384**	**153**	**0.0531**	**869**	**0.5793**	**9.16%**	
Verizon AWS	**1**	**3500**	**153**	**0.0538**	**2145**	**1.0000**	**5.38%**	
Verizon 700	**1**	**2100**	**153**	**0.0323**	**746**	**0.4973**	**6.49%**	
								37.90%
* Source: Siting Council								

ATTACHMENT 3

Date: **June 23, 2015**

Marianne Dunst
Crown Castle
3530 Toringdon Way, Suite 300
Charlotte, NC 28277

Aero Solutions, LLC
5500 Flatiron Parkway, Suite 100
Boulder, CO 80301
720-304-6882

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Name:	Suffield 4
Crown Castle Designation:	**Crown Castle BU Number:**	801487
	Crown Castle Site Name:	CT SUFFIELD 3 CAC 801487
	Crown Castle JDE Job Number:	338052
	Crown Castle Work Order Number:	1079436
	Crown Castle Application Number:	300766 Rev. 1
Engineering Firm Designation:	**Aero Solutions, LLC Project Number:**	003-15-0487
Site Data:	**848 East Street, Suffield, Hartford County, CT**	
	Latitude 41° 57' 25.2", Longitude -72° 37' 32.6"	
	165.5 Foot - Monopole Tower	

Dear Marianne Dunst,

Aero Solutions, LLC 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 798972, in accordance with application 300766, 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.

This analysis has been performed in accordance with the TIA/EIA-222-F standard and 2005 CT State Building Code with 2009 amendment based upon a wind speed of 80 mph fastest mile.

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

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

Structural analysis prepared by: Marcus Benson, E.I.

Respectfully submitted by:

Shraddha Dharia, P.E.
Structural Engineer
CT PE# PEN0028187
Expires: 01/31/2016

6.24.2015

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1) INTRODUCTION

This tower is a 165.5 ft Monopole tower designed by FWT INC. in May of 2000. The tower was originally designed for a wind speed of 80 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 80 mph with no ice, 37.6 mph with 1 inch ice thickness and 50 mph under service loads.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
153.0	153.0	3	alcatel lucent	RRH2X60-AWS	2	1-5/8"	
		3	alcatel lucent	RRH2X60-PCS			
		3	alcatel lucent	RRH2x60-700			
		6	commscope	SBNHH-1D65B w/ Mount Pipe			
		2	rfs celwave	DB-T1-6Z-8AB-0Z			

Table 2 - Existing 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
164.0	164.0	6	remec	S20057A-1	12	1-5/8"	1
		3	rfs celwave	APX16PV-16PVL w/ Mount Pipe			
		1	tower mounts	T-Arm Mount [TA 602-3]			
153.0	153.0	3	antel	BXA-171063-12BF w/ Mount Pipe			3
		1	antel	BXA-70080-6CF-EDIN-4 w/ Mount Pipe			
		6	antel	LPA-80080/6CF w/ Mount Pipe	12	1-5/8"	1
		2	rfs celwave	APX75-866514-CT2 w/ Mount Pipe			3
		1	tower mounts	Platform Mount [LP 303-1]			1
145.0	145.0	3	kathrein	742 213 w/ Mount Pipe	6	1-5/8"	1
136.0	138.0	1	dragonwave	A-ANT-18G-2-C	3 2	1/2" 1/4"	1
		1	dragonwave	A-ANT-23G-1-C			
		2	dragonwave	HORIZON COMPACT			
	136.0	1	tower mounts	Side Arm Mount [SO 101-3]			
	134.0	2	argus technologies	LLPX310R w/ Mount Pipe			
		1	kathrein	840 10054 w/ Mount Pipe			
		3	samsung telecommunications	WIMAX DAP HEAD			

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)
165	167	24	Swedcom	ALP-9212-N		
155	155	12	Swedcom	ALP-9212-N		
145	145	12	Swedcom	ALP-9212-N		
135	135	12	Swedcom	ALP-9212-N		
125	125	12	Swedcom	ALP-9212-N		
115	115	12	Swedcom	ALP-9212-N		

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Clough, Harbour & Associates	2373668	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	FWT	1118795	CCISITES
4-TOWER MANUFACTURER DRAWINGS	FWT	961597	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. Aero Solutions, LLC 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	165.5 - 136.83	Pole	TP24.279x17x0.1875	1	-4.45	720.46	41.7	Pass
L2	136.83 - 95.5	Pole	TP34.4x23.0992x0.3125	2	-10.13	1698.78	56.0	Pass
L3	95.5 - 47	Pole	TP46.09x32.6322x0.375	3	-19.56	2734.46	56.5	Pass

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L4	47 - 0	Pole	TP57.275x43.8165x0.375	4	-33.40	3504.06	60.2	Pass
							Summary	
						Pole (L4)	60.2	Pass
						Rating =	60.2	Pass

Table 6 - Tower Component Stresses vs. Capacity – LC5

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	57.4	Pass
1	Base Plate	0	29.0	Pass
1	Base Foundation	0	58.9	Pass
1	Base Foundation Soil Interaction	0	58.5	Pass

Structure Rating (max from all components) =	60.2%

Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.
2) It is unknown whether the foundation is a drilled shaft or pier and pad. Both designs were analyzed and determined to be sufficient.

4.1) Recommendations

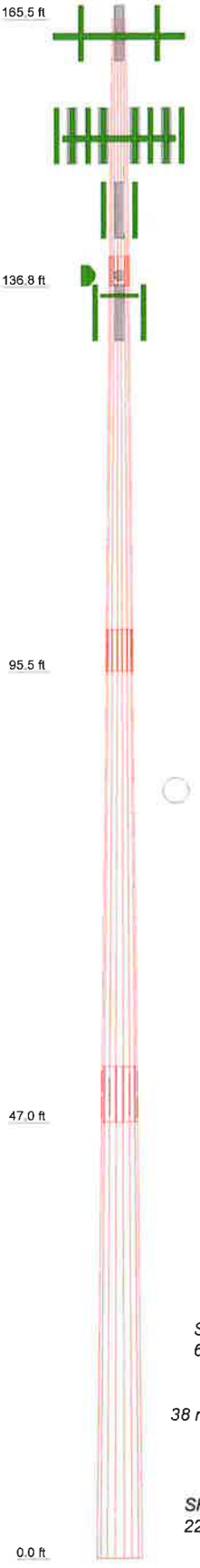
The tower and its foundation have sufficient capacity to carry the existing and proposed loads. No modifications are required at this time.

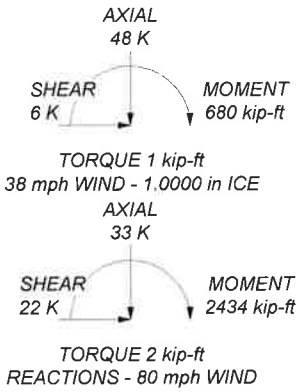
APPENDIX A

TNXTOWER OUTPUT

Section	1	2	3	4
Length (ft)	28.67	44.50	53.00	53.00
Number of Sides	18	18	18	18
Thickness (in)	0.1875	0.3125	0.3750	0.3750
Socket Length (ft)	3.17	4.50	6.00	
Top Dia (in)	17.0000	23.0992	32.6322	43.8165
Bot Dia (in)	24.2790	34.4000	46.0900	57.2750
Grade	A572-65			
Weight (K)	1.2	4.3	8.4	10.8

Total Weight (K) 24.6





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
APX16PV-16PVL w/ Mount Pipe	164	RRH2X60-AWS	153
(2) S20057A-1	164	RRH2X60-PCS	153
APX16PV-16PVL w/ Mount Pipe	164	(2) SBNHH-1D65B w/ Mount Pipe	153
(2) S20057A-1	164	(2) DB-T1-6Z-8AB-0Z	153
APX16PV-16PVL w/ Mount Pipe	164	Platform Mount [LP 303-1]	153
(2) S20057A-1	164	742 213 w/ Mount Pipe	145
T-Arm Mount [TA 602-3]	164	742 213 w/ Mount Pipe	145
(2) 6' x 2" Mount Pipe	164	742 213 w/ Mount Pipe	145
(2) 6' x 2" Mount Pipe	164	840 10054 w/ Mount Pipe	136
(2) 6' x 2" Mount Pipe	164	HORIZON COMPACT	136
(2) LPA-80080/6CF w/ Mount Pipe	153	WIMAX DAP HEAD	136
RRH2x60-700	153	LLPX310R w/ Mount Pipe	136
RRH2X60-AWS	153	WIMAX DAP HEAD	136
RRH2X60-PCS	153	LLPX310R w/ Mount Pipe	136
(2) SBNHH-1D65B w/ Mount Pipe	153	HORIZON COMPACT	136
(2) LPA-80080/6CF w/ Mount Pipe	153	WIMAX DAP HEAD	136
RRH2x60-700	153	Side Arm Mount [SO 101-3]	136
RRH2X60-AWS	153	4' x 3" Pipe Mount	136
RRH2X60-PCS	153	4' x 3" Pipe Mount	136
(2) SBNHH-1D65B w/ Mount Pipe	153	4' x 3" Pipe Mount	136
(2) LPA-80080/6CF w/ Mount Pipe	153	A-ANT-23G-1-C	136
RRH2x60-700	153	A-ANT-18G-2-C	136

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 1.00 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 60.2%

Aero Solutions, LLC
5500 Flatiron Parkway, Suite 100
Boulder, CO 80301
Phone: 720-304-6882
FAX:

Job:	***BU#801487 CT SUFFIELD***		
Project:	***Existing 165.5' Monopole Tower***		
Client:	Crown Castle USA, Inc.	Drawn by: MBenson	App'd:
Code:	TIA/EIA-222-F	Date: 06/23/15	Scale: N
Path:			Dwg No.

Tower Input Data

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

4) Tower is located in Hartford County, Connecticut.
5) Basic wind speed of 80 mph.
6) Nominal ice thickness of 1.0000 in.
7) Ice density of 56 pcf.
8) A wind speed of 38 mph is used in combination with ice.
9) Temperature drop of 50 °F.
10) Deflections calculated using a wind speed of 50 mph.
11) A non-linear (P-delta) analysis was used.
12) Pressures are calculated at each section.
13) Stress ratio used in pole design is 1.333.
14) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	165.50-136.83	28.67	3.17	18	17.0000	24.2790	0.1875	0.7500	A572-65 (65 ksi)
L2	136.83-95.50	44.50	4.50	18	23.0992	34.4000	0.3125	1.2500	A572-65 (65 ksi)
L3	95.50-47.00	53.00	6.00	18	32.6322	46.0900	0.3750	1.5000	A572-65 (65 ksi)
L4	47.00-0.00	53.00		18	43.8165	57.2750	0.3750	1.5000	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	17.2623	10.0055	357.3078	5.9684	8.6360	41.3742	715.0858	5.0037	2.6620	14.197
	24.6535	14.3375	1051.3254	8.5525	12.3337	85.2398	2104.0342	7.1701	3.9431	21.03

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L2	24.2730	22.6015	1482.6447	8.0893	11.7344	126.3505	2967.2404	11.3029	3.5155	11.249
	34.9307	33.8105	4963.4065	12.1011	17.4752	284.0257	9933.3440	16.9085	5.5044	17.614
L3	34.2959	38.3942	5047.2690	11.4513	16.5772	304.4711	10101.1793	19.2007	5.0833	13.555
	46.8010	54.4123	14366.5276	16.2288	23.4137	613.5944	28751.9591	27.2113	7.4518	19.872
L4	46.0395	51.7062	12327.9090	15.4217	22.2588	553.8450	24672.0393	25.8580	7.0517	18.805
	58.1586	67.7252	27702.0839	20.1995	29.0957	952.1023	55440.6188	33.8690	9.4204	25.121

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_r	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 165.50-136.83				1	1	1		
L2 136.83-95.50				1	1	1		
L3 95.50-47.00				1	1	1		
L4 47.00-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	Number Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
***										

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
AL7-50(1 5/8)	B	No	Inside Pole	164.00 - 0.00	12	No Ice	0.00	0.52
						1/2" Ice	0.00	0.52
						1" Ice	0.00	0.52
***								
AVA7-50(1-5/8)	C	No	Inside Pole	153.00 - 0.00	12	No Ice	0.00	0.70
						1/2" Ice	0.00	0.70
						1" Ice	0.00	0.70
HB158-1-08U8-S8J18(1-5/8)	C	No	Inside Pole	153.00 - 0.00	2	No Ice	0.00	1.30
						1/2" Ice	0.00	1.30
						1" Ice	0.00	1.30
***								
LCF158-50J(1-5/8")	A	No	Inside Pole	145.00 - 0.00	6	No Ice	0.00	0.92
						1/2" Ice	0.00	0.92
						1" Ice	0.00	0.92
***								
FSJ1-50A(1/4")	B	No	Inside Pole	136.00 - 0.00	2	No Ice	0.00	0.04
						1/2" Ice	0.00	0.04
						1" Ice	0.00	0.04
FSJ4-50B(1/2")	B	No	CaAa (Out Of Face)	136.00 - 0.00	3	No Ice	0.00	0.14
						1/2" Ice	0.00	0.76
						1" Ice	0.00	2.00
2 1/4" Conduit	B	No	CaAa (Out Of Face)	136.00 - 0.00	1	No Ice	0.20	3.00
						1/2" Ice	0.30	4.33
						1" Ice	0.40	6.47
2 1/4" Conduit	B	No	CaAa (Out Of Face)	136.00 - 0.00	1	No Ice	0.00	3.00
						1/2" Ice	0.00	4.33

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
***						1" Ice	0.00	6.47

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	165.50-136.83	A	0.000	0.000	0.000	0.000	0.05
		B	0.000	0.000	0.000	0.000	0.17
		C	0.000	0.000	0.000	0.000	0.18
L2	136.83-95.50	A	0.000	0.000	0.000	0.000	0.23
		B	0.000	0.000	0.000	8.100	0.52
		C	0.000	0.000	0.000	0.000	0.45
L3	95.50-47.00	A	0.000	0.000	0.000	0.000	0.27
		B	0.000	0.000	0.000	9.700	0.62
		C	0.000	0.000	0.000	0.000	0.53
L4	47.00-0.00	A	0.000	0.000	0.000	0.000	0.26
		B	0.000	0.000	0.000	9.400	0.60
		C	0.000	0.000	0.000	0.000	0.52

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	165.50-136.83	A	1.000	0.000	0.000	0.000	0.000	0.05
		B		0.000	0.000	0.000	0.000	0.17
		C		0.000	0.000	0.000	0.000	0.18
L2	136.83-95.50	A	1.000	0.000	0.000	0.000	0.000	0.23
		B		0.000	0.000	0.000	16.200	1.03
		C		0.000	0.000	0.000	0.000	0.45
L3	95.50-47.00	A	1.000	0.000	0.000	0.000	0.000	0.27
		B		0.000	0.000	0.000	19.400	1.22
		C		0.000	0.000	0.000	0.000	0.53
L4	47.00-0.00	A	1.000	0.000	0.000	0.000	0.000	0.26
		B		0.000	0.000	0.000	18.800	1.19
		C		0.000	0.000	0.000	0.000	0.52

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	165.50-136.83	0.0000	0.0000	0.0000	0.0000
L2	136.83-95.50	0.2364	0.1365	0.4155	0.2399
L3	95.50-47.00	0.2451	0.1415	0.4440	0.2563
L4	47.00-0.00	0.2482	0.1433	0.4588	0.2649

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
APX16PV-16PVL w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	30.0000	164.00	No Ice 1/2" Ice 1" Ice	6.88 7.39 7.89	3.27 3.97 4.64	0.06 0.10 0.16
(2) S20057A-1	A	From Leg	4.00 0.00 0.00	30.0000	164.00	No Ice 1/2" Ice 1" Ice	0.83 0.96 1.10	0.39 0.50 0.62	0.01 0.01 0.02
APX16PV-16PVL w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	80.0000	164.00	No Ice 1/2" Ice 1" Ice	6.88 7.39 7.89	3.27 3.97 4.64	0.06 0.10 0.16
(2) S20057A-1	B	From Leg	4.00 0.00 0.00	80.0000	164.00	No Ice 1/2" Ice 1" Ice	0.83 0.96 1.10	0.39 0.50 0.62	0.01 0.01 0.02
APX16PV-16PVL w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	60.0000	164.00	No Ice 1/2" Ice 1" Ice	6.88 7.39 7.89	3.27 3.97 4.64	0.06 0.10 0.16
(2) S20057A-1	C	From Leg	4.00 0.00 0.00	60.0000	164.00	No Ice 1/2" Ice 1" Ice	0.83 0.96 1.10	0.39 0.50 0.62	0.01 0.01 0.02
T-Arm Mount [TA 602-3]	C	None		0.0000	164.00	No Ice 1/2" Ice 1" Ice	11.59 15.44 19.29	11.59 15.44 19.29	0.77 0.99 1.21
(2) 6' x 2" Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	164.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
(2) 6' x 2" Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	164.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
(2) 6' x 2" Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	164.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
***									
(2) LPA-80080/6CF w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	60.0000	153.00	No Ice 1/2" Ice 1" Ice	4.56 5.11 5.61	10.73 11.99 12.97	0.05 0.11 0.19
RRH2x60-700	A	From Leg	4.00 0.00 0.00	60.0000	153.00	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	A	From Leg	4.00 0.00 0.00	60.0000	153.00	No Ice 1/2" Ice 1" Ice	2.19 2.40 2.61	1.43 1.61 1.80	0.04 0.06 0.08
RRH2X60-PCS	A	From Leg	4.00 0.00 0.00	60.0000	153.00	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
(2) SBNHH-1D65B w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	60.0000	153.00	No Ice 1/2" Ice 1" Ice	8.57 9.22 9.84	7.00 8.19 9.08	0.07 0.13 0.21
(2) LPA-80080/6CF w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	60.0000	153.00	No Ice 1/2" Ice 1" Ice	4.56 5.11 5.61	10.73 11.99 12.97	0.05 0.11 0.19

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
RRH2x60-700	B	From Leg	4.00 0.00 0.00	60.0000	153.00	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 0.00	60.0000	153.00	No Ice 1/2" Ice 1" Ice	2.19 2.40 2.61	1.43 1.61 1.80	0.04 0.06 0.08
RRH2X60-PCS	B	From Leg	4.00 0.00 0.00	60.0000	153.00	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
(2) SBNHH-1D65B w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	60.0000	153.00	No Ice 1/2" Ice 1" Ice	8.57 9.22 9.84	7.00 8.19 9.08	0.07 0.13 0.21
(2) LPA-80080/6CF w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	60.0000	153.00	No Ice 1/2" Ice 1" Ice	4.56 5.11 5.61	10.73 11.99 12.97	0.05 0.11 0.19
RRH2x60-700	C	From Leg	4.00 0.00 0.00	60.0000	153.00	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 0.00	60.0000	153.00	No Ice 1/2" Ice 1" Ice	2.19 2.40 2.61	1.43 1.61 1.80	0.04 0.06 0.08
RRH2X60-PCS	C	From Leg	4.00 0.00 0.00	60.0000	153.00	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
(2) SBNHH-1D65B w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	60.0000	153.00	No Ice 1/2" Ice 1" Ice	8.57 9.22 9.84	7.00 8.19 9.08	0.07 0.13 0.21
(2) DB-T1-6Z-8AB-0Z	C	From Leg	4.00 0.00 0.00	60.0000	153.00	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 303-1]	C	None		0.0000	153.00	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
***									
742 213 w/ Mount Pipe	A	From Leg	1.00 0.00 0.00	30.0000	145.00	No Ice 1/2" Ice 1" Ice	5.37 5.95 6.50	4.62 6.00 6.98	0.05 0.09 0.15
742 213 w/ Mount Pipe	B	From Leg	1.00 0.00 0.00	30.0000	145.00	No Ice 1/2" Ice 1" Ice	5.37 5.95 6.50	4.62 6.00 6.98	0.05 0.09 0.15
742 213 w/ Mount Pipe	C	From Leg	1.00 0.00 0.00	30.0000	145.00	No Ice 1/2" Ice 1" Ice	5.37 5.95 6.50	4.62 6.00 6.98	0.05 0.09 0.15
***									
840 10054 w/ Mount Pipe	A	From Leg	2.00 0.00 -2.00	-90.0000	136.00	No Ice 1/2" Ice 1" Ice	5.41 5.83 6.26	2.39 2.92 3.47	0.05 0.09 0.13
HORIZON COMPACT	A	From Leg	2.00 0.00 2.00	90.0000	136.00	No Ice 1/2" Ice	0.43 0.52 0.63	0.43 0.52 0.63	0.01 0.02 0.03

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						1" Ice			
WIMAX DAP HEAD	A	From Leg	2.00	-90.0000	136.00	No Ice	1.80	0.78	0.03
			0.00			1/2"	1.99	0.92	0.04
			-2.00			Ice	2.18	1.07	0.06
						1" Ice			
LLPX310R w/ Mount Pipe	B	From Leg	2.00	30.0000	136.00	No Ice	5.07	2.98	0.05
			0.00			1/2"	5.48	3.53	0.08
			-2.00			Ice	5.91	4.09	0.13
						1" Ice			
WIMAX DAP HEAD	B	From Leg	2.00	30.0000	136.00	No Ice	1.80	0.78	0.03
			0.00			1/2"	1.99	0.92	0.04
			-2.00			Ice	2.18	1.07	0.06
						1" Ice			
LLPX310R w/ Mount Pipe	C	From Leg	2.00	0.0000	136.00	No Ice	5.07	2.98	0.05
			0.00			1/2"	5.48	3.53	0.08
			-2.00			Ice	5.91	4.09	0.13
						1" Ice			
HORIZON COMPACT	C	From Leg	2.00	0.0000	136.00	No Ice	0.43	0.43	0.01
			0.00			1/2"	0.52	0.52	0.02
			2.00			Ice	0.63	0.63	0.03
						1" Ice			
WIMAX DAP HEAD	C	From Leg	2.00	0.0000	136.00	No Ice	1.80	0.78	0.03
			0.00			1/2"	1.99	0.92	0.04
			-2.00			Ice	2.18	1.07	0.06
						1" Ice			
Side Arm Mount [SO 101-3]	C	None		0.0000	136.00	No Ice	7.50	7.50	0.25
						1/2"	8.90	8.90	0.33
						Ice	10.30	10.30	0.41
						1" Ice			
4' x 3" Pipe Mount	A	From Leg	2.00	0.0000	136.00	No Ice	1.00	1.00	0.03
			0.00			1/2"	1.25	1.25	0.04
			0.00			Ice	1.50	1.50	0.05
						1" Ice			
4' x 3" Pipe Mount	B	From Leg	2.00	0.0000	136.00	No Ice	1.00	1.00	0.03
			0.00			1/2"	1.25	1.25	0.04
			0.00			Ice	1.50	1.50	0.05
						1" Ice			
4' x 3" Pipe Mount	C	From Leg	2.00	0.0000	136.00	No Ice	1.00	1.00	0.03
			0.00			1/2"	1.25	1.25	0.04
			0.00			Ice	1.50	1.50	0.05
						1" Ice			
***									

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
A-ANT-23G-1-C	A	Paraboloid w/Shroud (HP)	From Leg	2.00	90.0000		136.00	1.27	No Ice	1.28	0.01
				0.00					1/2" Ice	1.45	0.01
				2.00					1" Ice	1.62	0.01
A-ANT-18G-2-C	C	Paraboloid w/Shroud (HP)	From Leg	2.00	0.0000		136.00	2.17	No Ice	3.72	0.03
				0.00					1/2" Ice	4.01	0.03
				2.00					1" Ice	4.30	0.36

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	165.5 - 136.83	Pole	Max Tension	2	0.00	-0.00	-0.00
			Max. Compression	14	-9.76	1.04	-0.61
			Max. Mx	11	-4.44	139.73	0.01
			Max. My	8	-4.45	0.20	-141.33
			Max. Vy	5	9.74	-139.06	-0.12
			Max. Vx	8	9.75	0.20	-141.33
			Max. Torque	12			2.64
L2	136.83 - 95.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-18.23	1.35	-1.55
			Max. Mx	5	-10.13	-636.36	-0.35
			Max. My	8	-10.15	-0.12	-629.81
			Max. Vy	5	14.07	-636.36	-0.35
			Max. Vx	2	-13.83	-1.47	629.44
			Max. Torque	12			2.69
L3	95.5 - 47	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-30.27	0.10	-2.27
			Max. Mx	5	-19.56	-1385.45	-0.43
			Max. My	8	-19.57	-0.66	-1366.88

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	5	17.79	-1385.45	-0.43
			Max. Vx	2	-17.55	-4.11	1366.42
			Max. Torque	12			2.15
L4	47 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-47.73	-1.71	-3.32
			Max. Mx	5	-33.40	-2433.59	-0.57
			Max. My	8	-33.40	-1.42	-2401.56
			Max. Vy	5	21.74	-2433.59	-0.57
			Max. Vx	2	-21.50	-7.20	2400.85
			Max. Torque	12			2.15

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	47.73	-5.77	0.00
	Max. H_x	11	33.41	21.70	0.01
	Max. H_z	2	33.41	-0.05	21.49
	Max. M_x	2	2400.85	-0.05	21.49
	Max. M_z	5	2433.59	-21.72	0.00
	Max. Torsion	12	2.15	18.83	10.73
	Min. Vert	1	33.41	0.00	0.00
	Min. H_x	5	33.41	-21.72	0.00
	Min. H_z	8	33.41	-0.00	-21.48
	Min. M_x	8	-2401.56	-0.00	-21.48
	Min. M_z	11	-2428.27	21.70	0.01
	Min. Torsion	6	-2.10	-18.84	-10.70

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	33.41	0.00	0.00	0.94	-0.84	0.00
Dead+Wind 0 deg - No Ice	33.41	0.05	-21.49	-2400.85	-7.20	-1.19
Dead+Wind 30 deg - No Ice	33.41	10.88	-18.59	-2076.76	-1219.12	-0.15
Dead+Wind 60 deg - No Ice	33.41	18.80	-10.72	-1196.74	-2105.86	0.94
Dead+Wind 90 deg - No Ice	33.41	21.72	-0.00	0.57	-2433.59	1.76
Dead+Wind 120 deg - No Ice	33.41	18.84	10.70	1196.04	-2112.34	2.10
Dead+Wind 150 deg - No Ice	33.41	10.87	18.62	2082.49	-1218.08	1.99
Dead+Wind 180 deg - No Ice	33.41	0.00	21.48	2401.56	-1.42	1.23
Dead+Wind 210 deg - No Ice	33.41	-10.86	18.56	2074.27	1215.00	0.22
Dead+Wind 240 deg - No Ice	33.41	-18.78	10.71	1196.42	2101.39	-0.88
Dead+Wind 270 deg - No Ice	33.41	-21.70	-0.01	-0.32	2428.27	-1.73
Dead+Wind 300 deg - No Ice	33.41	-18.83	-10.73	-1198.48	2108.85	-2.15
Dead+Wind 330 deg - No Ice	33.41	-10.91	-18.60	-2077.61	1222.31	-1.97
Dead+Ice+Temp	47.73	-0.00	0.00	3.32	-1.71	-0.00
Dead+Wind 0 deg+Ice+Temp	47.73	0.01	-5.71	-667.28	-3.30	-0.26
Dead+Wind 30 deg+Ice+Temp	47.73	2.89	-4.94	-576.75	-341.47	-0.01
Dead+Wind 60 deg+Ice+Temp	47.73	5.00	-2.85	-330.98	-588.90	0.25
Dead+Wind 90 deg+Ice+Temp	47.73	5.77	-0.00	3.43	-680.32	0.43
Dead+Wind 120 deg+Ice+Temp	47.73	5.01	2.85	337.33	-590.69	0.50
Dead+Wind 150 deg+Ice+Temp	47.73	2.89	4.95	584.71	-341.36	0.46
Dead+Wind 180	47.73	0.00	5.71	673.83	-1.98	0.27

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
deg+Ice+Temp Dead+Wind 210 deg+Ice+Temp	47.73	-2.89	4.94	582.45	337.44	0.03
Dead+Wind 240 deg+Ice+Temp	47.73	-4.99	2.85	337.27	584.78	-0.23
Dead+Wind 270 deg+Ice+Temp	47.73	-5.77	-0.00	3.00	675.98	-0.43
Dead+Wind 300 deg+Ice+Temp	47.73	-5.00	-2.85	-331.61	586.83	-0.51
Dead+Wind 330 deg+Ice+Temp	47.73	-2.90	-4.95	-577.06	339.51	-0.45
Dead+Wind 0 deg - Service	33.41	0.02	-8.39	-937.93	-3.33	-0.47
Dead+Wind 30 deg - Service	33.41	4.25	-7.26	-811.24	-477.09	-0.06
Dead+Wind 60 deg - Service	33.41	7.34	-4.19	-467.23	-823.73	0.37
Dead+Wind 90 deg - Service	33.41	8.49	-0.00	0.82	-951.85	0.69
Dead+Wind 120 deg - Service	33.41	7.36	4.18	468.15	-826.26	0.83
Dead+Wind 150 deg - Service	33.41	4.24	7.27	814.67	-476.68	0.78
Dead+Wind 180 deg - Service	33.41	0.00	8.39	939.39	-1.07	0.48
Dead+Wind 210 deg - Service	33.41	-4.24	7.25	811.45	474.44	0.09
Dead+Wind 240 deg - Service	33.41	-7.34	4.18	468.29	820.95	-0.35
Dead+Wind 270 deg - Service	33.41	-8.48	-0.00	0.47	948.74	-0.68
Dead+Wind 300 deg - Service	33.41	-7.36	-4.19	-467.91	823.87	-0.84
Dead+Wind 330 deg - Service	33.41	-4.26	-7.26	-811.57	477.30	-0.77

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	-33.41	0.00	0.00	33.41	0.00	0.000%
2	0.05	-33.41	-21.49	-0.05	33.41	21.49	0.000%
3	10.88	-33.41	-18.59	-10.88	33.41	18.59	0.000%
4	18.80	-33.41	-10.72	-18.80	33.41	10.72	0.000%
5	21.72	-33.41	-0.00	-21.72	33.41	0.00	0.000%
6	18.84	-33.41	10.70	-18.84	33.41	-10.70	0.000%
7	10.87	-33.41	18.62	-10.87	33.41	-18.62	0.000%
8	0.00	-33.41	21.48	-0.00	33.41	-21.48	0.000%
9	-10.86	-33.41	18.56	10.86	33.41	-18.56	0.000%
10	-18.78	-33.41	10.71	18.78	33.41	-10.71	0.000%
11	-21.70	-33.41	-0.01	21.70	33.41	0.01	0.000%
12	-18.83	-33.41	-10.73	18.83	33.41	10.73	0.000%
13	-10.91	-33.41	-18.60	10.91	33.41	18.60	0.000%
14	0.00	-47.73	0.00	0.00	47.73	-0.00	0.000%
15	0.01	-47.73	-5.71	-0.01	47.73	5.71	0.000%
16	2.89	-47.73	-4.94	-2.89	47.73	4.94	0.000%
17	5.00	-47.73	-2.85	-5.00	47.73	2.85	0.000%
18	5.77	-47.73	-0.00	-5.77	47.73	0.00	0.000%
19	5.01	-47.73	2.85	-5.01	47.73	-2.85	0.000%
20	2.89	-47.73	4.95	-2.89	47.73	-4.95	0.000%
21	0.00	-47.73	5.71	-0.00	47.73	-5.71	0.000%
22	-2.89	-47.73	4.94	2.89	47.73	-4.94	0.000%
23	-4.99	-47.73	2.85	4.99	47.73	-2.85	0.000%
24	-5.77	-47.73	-0.00	5.77	47.73	0.00	0.000%
25	-5.00	-47.73	-2.85	5.00	47.73	2.85	0.000%
26	-2.90	-47.73	-4.95	2.90	47.73	4.95	0.000%
27	0.02	-33.41	-8.39	-0.02	33.41	8.39	0.000%
28	4.25	-33.41	-7.26	-4.25	33.41	7.26	0.000%
29	7.34	-33.41	-4.19	-7.34	33.41	4.19	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
30	8.49	-33.41	-0.00	-8.49	33.41	0.00	0.000%
31	7.36	-33.41	4.18	-7.36	33.41	-4.18	0.000%
32	4.24	-33.41	7.27	-4.24	33.41	-7.27	0.000%
33	0.00	-33.41	8.39	-0.00	33.41	-8.39	0.000%
34	-4.24	-33.41	7.25	4.24	33.41	-7.25	0.000%
35	-7.34	-33.41	4.18	7.34	33.41	-4.18	0.000%
36	-8.48	-33.41	-0.00	8.48	33.41	0.00	0.000%
37	-7.36	-33.41	-4.19	7.36	33.41	4.19	0.000%
38	-4.26	-33.41	-7.26	4.26	33.41	7.26	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	0.00063524
3	Yes	5	0.00000001	0.00023337
4	Yes	5	0.00000001	0.00022607
5	Yes	4	0.00000001	0.00097350
6	Yes	5	0.00000001	0.00025977
7	Yes	5	0.00000001	0.00021912
8	Yes	4	0.00000001	0.00068921
9	Yes	5	0.00000001	0.00023762
10	Yes	5	0.00000001	0.00024336
11	Yes	4	0.00000001	0.00095438
12	Yes	5	0.00000001	0.00021689
13	Yes	5	0.00000001	0.00025868
14	Yes	4	0.00000001	0.00000781
15	Yes	5	0.00000001	0.00008255
16	Yes	5	0.00000001	0.00010486
17	Yes	5	0.00000001	0.00010457
18	Yes	5	0.00000001	0.00008415
19	Yes	5	0.00000001	0.00010990
20	Yes	5	0.00000001	0.00010584
21	Yes	5	0.00000001	0.00008370
22	Yes	5	0.00000001	0.00010755
23	Yes	5	0.00000001	0.00010837
24	Yes	5	0.00000001	0.00008450
25	Yes	5	0.00000001	0.00010525
26	Yes	5	0.00000001	0.00010874
27	Yes	4	0.00000001	0.00013929
28	Yes	4	0.00000001	0.00060371
29	Yes	4	0.00000001	0.00057185
30	Yes	4	0.00000001	0.00020504
31	Yes	4	0.00000001	0.00076771
32	Yes	4	0.00000001	0.00055073
33	Yes	4	0.00000001	0.00014556
34	Yes	4	0.00000001	0.00063038
35	Yes	4	0.00000001	0.00066835
36	Yes	4	0.00000001	0.00020199
37	Yes	4	0.00000001	0.00054425
38	Yes	4	0.00000001	0.00075308

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	165.5 - 136.83	33.199	30	1.8694	0.0157
L2	140 - 95.5	23.481	30	1.6985	0.0071

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L3	100 - 47	11.427	30	1.1334	0.0025
L4	53 - 0	3.101	30	0.5490	0.0008

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
164.00	APX16PV-16PVL w/ Mount Pipe	30	32.610	1.8618	0.0155	21499
153.00	(2) LPA-80080/6CF w/ Mount Pipe	30	28.323	1.8011	0.0114	8599
145.00	742 213 w/ Mount Pipe	30	25.301	1.7437	0.0087	5243
138.00	A-ANT-23G-1-C	30	22.772	1.6780	0.0068	4246
136.00	840 10054 w/ Mount Pipe	30	22.074	1.6560	0.0064	4219

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	165.5 - 136.83	84.834	5	4.7741	0.0393
L2	140 - 95.5	60.003	5	4.3429	0.0177
L3	100 - 47	29.207	5	2.8972	0.0063
L4	53 - 0	7.927	5	1.4034	0.0021

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
164.00	APX16PV-16PVL w/ Mount Pipe	5	83.329	4.7550	0.0401	8540
153.00	(2) LPA-80080/6CF w/ Mount Pipe	5	72.375	4.6027	0.0294	3415
145.00	742 213 w/ Mount Pipe	5	64.653	4.4580	0.0226	2081
138.00	A-ANT-23G-1-C	5	58.191	4.2903	0.0177	1683
136.00	840 10054 w/ Mount Pipe	5	56.406	4.2340	0.0165	1672

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	165.5 - 136.83 (1)	TP24.279x17x0.1875	28.67	0.00	0.0	39.000	13.8585	-4.45	540.48	0.008
L2	136.83 - 95.5 (2)	TP34.4x23.0992x0.3125	44.50	0.00	0.0	39.000	32.6770	-10.13	1274.40	0.008
L3	95.5 - 47 (3)	TP46.09x32.6322x0.375	53.00	0.00	0.0	39.000	52.5989	-19.56	2051.36	0.010
L4	47 - 0 (4)	TP57.275x43.8165x0.375	53.00	0.00	0.0	38.814	67.7252	-33.40	2628.70	0.013

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_e ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$

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	165.5 - 136.83 (1)	TP24.279x17x0.1875	141.33	21.301	39.000	0.546	0.00	0.000	39.000	0.000
L2	136.83 - 95.5 (2)	TP34.4x23.0992x0.3125	636.36	28.793	39.000	0.738	0.00	0.000	39.000	0.000
L3	95.5 - 47 (3)	TP46.09x32.6322x0.375	1385.45	29.004	39.000	0.744	0.00	0.000	39.000	0.000
L4	47 - 0 (4)	TP57.275x43.8165x0.375	2433.58	30.672	38.814	0.790	0.00	0.000	38.814	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	165.5 - 136.83 (1)	TP24.279x17x0.1875	9.75	0.703	26.000	0.055	1.36	0.100	26.000	0.004
L2	136.83 - 95.5 (2)	TP34.4x23.0992x0.3125	14.07	0.431	26.000	0.033	1.67	0.037	26.000	0.001
L3	95.5 - 47 (3)	TP46.09x32.6322x0.375	17.79	0.338	26.000	0.026	1.71	0.017	26.000	0.001
L4	47 - 0 (4)	TP57.275x43.8165x0.375	21.74	0.321	26.000	0.025	1.76	0.011	26.000	0.000

Pole Interaction Design Data

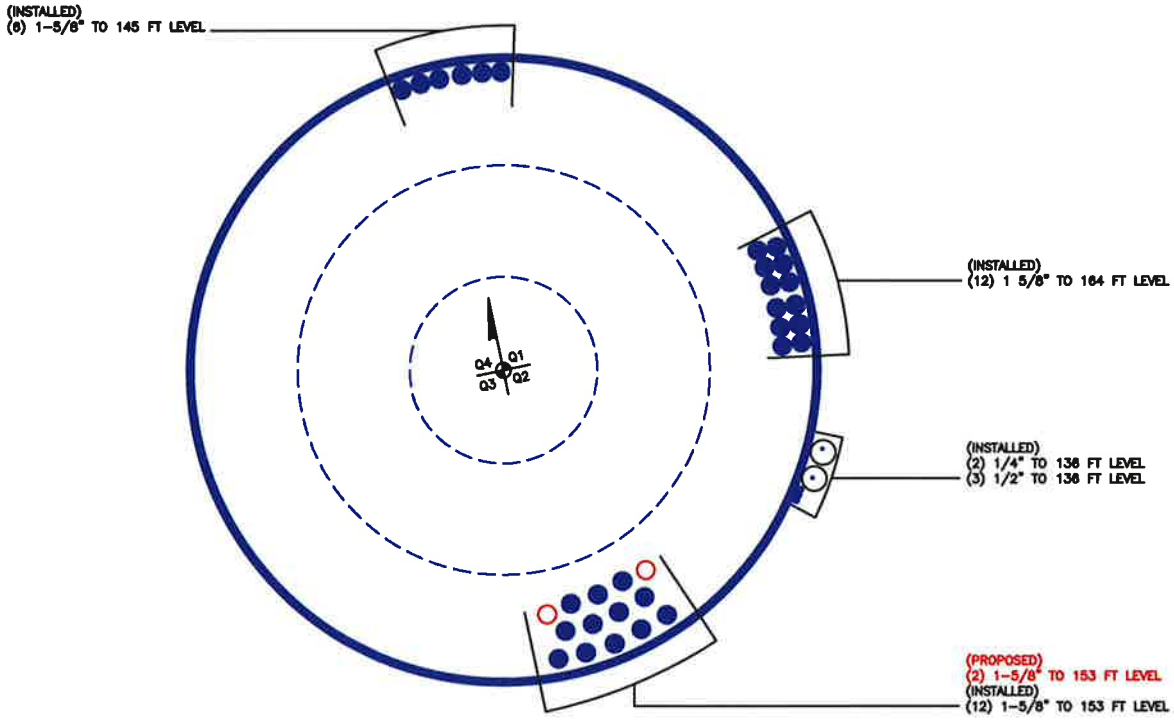
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	165.5 - 136.83 (1)	0.008	0.546	0.000	0.055	0.004	0.555 ✔	1.333	H1-3+VT ✔
L2	136.83 - 95.5 (2)	0.008	0.738	0.000	0.033	0.001	0.747 ✔	1.333	H1-3+VT ✔
L3	95.5 - 47 (3)	0.010	0.744	0.000	0.026	0.001	0.753 ✔	1.333	H1-3+VT ✔
L4	47 - 0 (4)	0.013	0.790	0.000	0.025	0.000	0.803 ✔	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	165.5 - 136.83	Pole	TP24.279x17x0.1875	1	-4.45	720.46	41.7	Pass
L2	136.83 - 95.5	Pole	TP34.4x23.0992x0.3125	2	-10.13	1698.78	56.0	Pass
L3	95.5 - 47	Pole	TP46.09x32.6322x0.375	3	-19.56	2734.46	56.5	Pass
L4	47 - 0	Pole	TP57.275x43.8165x0.375	4	-33.40	3504.06	60.2	Pass
						Summary		
						Pole (L4)	60.2	Pass
						RATING =	**60.2**	**Pass**

APPENDIX B

BASE LEVEL DRAWING


(INSTALLED)
(8) 1-5/8" TO 145 FT LEVEL
(INSTALLED)
(12) 1 5/8" TO 164 FT LEVEL
(INSTALLED)
(2) 1/4" TO 136 FT LEVEL
(3) 1/2" TO 136 FT LEVEL
(PROPOSED)
(2) 1-5/8" TO 153 FT LEVEL
(INSTALLED)
(12) 1-5/8" TO 153 FT LEVEL
Q4
Q1
Q3
Q2

APPENDIX C

ADDITIONAL CALCULATIONS

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

TIA Rev F

Site Data

BU#: *801487*
Site Name: *CT SUFFIELD 3 CAC 8014*
App #: *300766 R1*

Pole Manufacturer:	*Other*

Reactions		
Moment:	2433.5859	ft-kips
Axial:	33.4002	kips
Shear:	21.7405	kips

Anchor Rod Data		
Qty:	16	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	64	in

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

Anchor Rod Results

Maximum Rod Tension:	112.0 Kips	Rigid
Allowable Tension:	195.0 Kips	Service, ASD
Anchor Rod Stress Ratio:	57.4% Pass	Fty*ASIF

Plate Data		
Diam:	70	in
Thick:	2.75	in
Grade:	60	ksi
Single-Rod B-eff:	11.36	in

Base Plate Results

	Flexural Check	Rigid
Base Plate Stress:	17.4 ksi	Service ASD
Allowable Plate Stress:	60.0 ksi	0.75*Fy*ASIF
Base Plate Stress Ratio:	29.0% Pass	Y.L. Length: 28.56

Stiffener Data (Welding at both sides)		
Config:	0	*
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

n/a

Stiffener Results

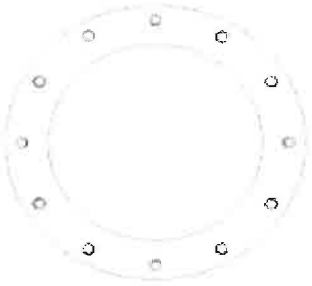
Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check:	n/a

Pole Data		
Diam:	57.275	in
Thick:	0.375	in
Grade:	65	ksi
# of Sides:	18	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	



* 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

BU#: *801487*
Site Name: *CT SUFFIELD 3 CAC 801487*
App #: *300766 R1*

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:	6	in
Pad Bearing Depth, D:	6.5	ft
Pad Thickness, T:	2.5	ft
Pad Width=Length, L:	30	ft
Pier Cross Section Shape:	Round	<--Pull Down
Enter Pier Diameter:	7.5	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	44.18	ft^2
Pier Height:	4.50	ft
Soil (above pad) Height:	4.00	ft

Soil Parameters		
Unit Weight, γ:	120.0	pcf
Ultimate Bearing Capacity, qn:	12.00	ksf
Strength Reduct. factor, ϕ:	0.75	
Angle of Friction, Φ:	32.0	degrees
Undrained Shear Strength, Cu:	0.00	ksf
Allowable Bearing: ϕ*qn:	9.00	ksf
Passive Pres. Coeff., Kp	3.25	

Forces/Moments due to Wind and Lateral Soil		
Minimum of (φ*Ultimate Pad Passive Force, Vu):	29.3	kips
Pad Force Location Above D:	1.15	ft
ϕ(Passive Pressure Moment):	33.78	ft-kips
Factored O.T. M(WL), "1.6W":	3490.8	ft-kips
Factored OT (MW-Msoil), M1	3457.01	ft-kips

Resistance due to Foundation Gravity		
Soil Wedge Projection grade, a:	2.50	ft
Sum of Soil Wedges Wt:	29.74	kips
Soil Wedges ecc, K1:	14.24	ft
Ftg+Soil above Pad wt:	778.1	kips
Unfactored (Total ftg-soil Wt):	807.86	kips
1.2D. **No Soil Wedges**.	973.82	kips
0.9D. **With Soil Wedges**	757.13	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:	33.4002	kips
Unfactored WL Axial, PW:	0	kips
Unfactored WL Shear, V:	21.7405	kips
Unfactored WL Moment, M:	2433.586	ft-kips

Load Factor	Shaft Factored Loads		
1.20	1.2D+1.6W, Pu:	40.08024	kips
0.90	0.9D+1.6W, Pu:	30.06018	kips
1.35	Vu:	29.34968	kips
	Mu:	3285.341	ft-kips

1.2D+1.6W Load Combination, Bearing Results:

(**No Soil Wedges**) [Reaction+Conc+Soil]	973.82	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	3457.01	ft-kips

Orthogonal Direction:

ecc1 = M1/P1 =	3.55	ft
Orthogonal qu=	1.59	ksf
qu/ϕ*qn Ratio=	**17.71%**	**Pass**

Diagonal Direction:

ecc2 = (0.707M1)/P1 =	2.51	ft
Diagonal qu=	1.56	ksf
qu/ϕ*qn Ratio=	**17.34%**	**Pass**

Run <-- Press Upon Completing All Input

Overturning Stability Check

0.9D+1.6W Load Combination, Bearing Results:

(**w/ Soil Wedges**) [Reaction+Conc+Soil]	757.13	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	3075.94	ft-kips

Orthogonal ecc3 = M2/P2 =	4.06	ft
Ortho Non Bearing Length,NBL=	8.13	ft
Orthogonal qu=	1.30	ksf
Diagonal qu=	1.29	ksf

Max Reaction Moment (ft-kips) so that qu=φ*qn = 100% Capacity Rating			
Actual M:	2433.59		
M Orthogonal:	7926.21	**30.70%**	**Pass**
M Diagonal:	7926.21	**30.70%**	**Pass**

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

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

Site Data

BU#: *801487*
Site Name: *CT SUFFIELD 3 CAC 801487*
App #: *300766 R1*

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

Pier Properties

Concrete:

Pier Diameter =	7.5	ft
Concrete Area =	6361.7	in^2

Reinforcement:

Clear Cover to **Tie**=	4.00	in
Horiz. **Tie** Bar Size=	5	
Vert. Cage Diameter =	6.64	ft
Vert. Cage Diameter =	79.62	in
Vertical Bar Size =	9	
Bar Diameter =	1.13	in
Bar Area =	1	in^2
Number of Bars =	38	
As Total=	38	in^2
A s/ Aconc, Rho:	0.0060	0.60%

ACI 10.5 , ACI 21.10.4, and IBC 1810.
Min As for Flexural, Tension Controlled, Shafts:

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

Minimum Rho Check:

Actual Req'd Min. Rho:	0.33%	Flexural
Provided Rho:	0.60%	OK

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn.		
Pn per ACI 318 (10-2)	9570.86	kips
at Mu=(ϕ=0.65)Mn=	6230.37	ft-kips
Max Tu, (φ=0.9) Tn =	2052	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Maximum Shaft Superimposed Forces

TIA Revision:	F	
Max. Service Shaft M:	2531.418	ft-kips (* Note)
Max. Service Shaft P:	33.4002	kips
Max Axial Force Type:	Comp.	

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

Load Factor	Shaft Factored Loads		
1.30	Mu:	3290.844	ft-kips
1.30	Pu:	43.42026	kips

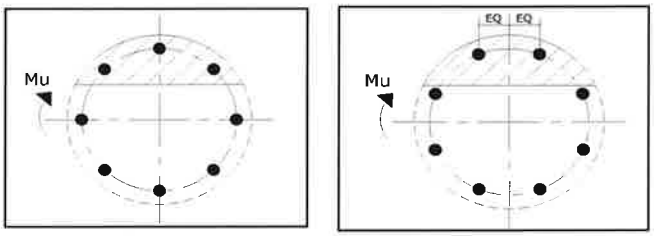
Material Properties

Concrete Comp. strength, f'c =	3000	psi
Reinforcement yield strength, Fy =	60	ksi
Reinforcing Modulus of Elasticity, E =	29000	ksi
Reinforcement yield strain =	0.00207	
Limiting compressive strain =	0.003	
ACI 318 Code		
Select Analysis ACI Code=	2002	
Seismic Properties		
Seismic Design Category =	D	
Seismic Risk =	**High**	

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

Results:

Governing Orientation Case: **1**



Case 1 Case 2

Dist. From Edge to Neutral Axis: **14.82** in
Extreme Steel Strain, εt: **0.0142**
εt > 0.0050, Tension Controlled
Reduction Factor,φ: **0.900**

Output Note: Negative Pu=Tension

For Axial Compression, φ Pn = Pu:	43.42	kips
Drilled Shaft Moment Capacity, φMn:	**6416.79**	ft-kips
Drilled Shaft Superimposed Mu:	**3290.84**	ft-kips

(Mu/φMn, Drilled Shaft Flexure CSR:	**51.3%**

AeroSolutions LLC
Optimizing Your Tower Infrastructure

Site Number	801487
Site Name	CT SUFFIELD 3 CAC 801487

Caisson Analysis

Pier Properties		
Moment	2434	kip-ft
Shear	22	kip
Pier Diameter	7.5	ft
Height Above Grade	0.50	ft
Depth Below Grade	23.50	ft
Donut Diameter		ft
Donut Depth		ft

Analysis Properties		
TIA Code	F	
Soil Safety Factor	2.00	
Water Table Depth	15.0	ft
Ignored Soil Depth	3.8	ft
Cohesion Based on	PLS Caisson	
Max Soil Capacity	110%	

Soil Properties

Layer	Top of Soil Layer (ft)	Layer Thickness (ft)	Bottom of Soil Layer (ft)	Soil Unit Weight (pcf)	Cohesion (psf)	Friction Angle (degrees)
Soil.Layer	*Soil.Top*	*Soil.Thick*	*Soil.Bottom*	*Soil.Weight*	*Soil.Cohesion*	*Soil.Phi*
1	0.00	2	2.00	115	0	
2	2.00	4	6.00	120	750	
3	6.00	27	33.00	120	0	32
4						
5						
6						
7						
8						
9						
10						

Critical Depths Below Grade		
Rotation Axis	16.55	ft
Zero Shear	5.40	ft

Results		
Soil Capacity	58.5%	OK
Max Pier Moment	2544	kip-ft

Moment At User Defined Depths Below Grade			
	kip-ft		kip-ft
	kip-ft		kip-ft

V1.0

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

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

Site Data

BU#: *801487*
Site Name: *CT SUFFIELD 3 CAC 801487*
App #: *300766 R1*

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

Pier Properties

Concrete:

Pier Diameter =	7.5	ft
Concrete Area =	6361.7	in^2

Reinforcement:

Clear Cover to **Tie**=	4.00	in
Horiz. **Tie** Bar Size=	5	
Vert. Cage Diameter =	6.61	ft
Vert. Cage Diameter =	79.34	in
Vertical Bar Size =	11	
Bar Diameter =	1.41	in
Bar Area =	1.56	in^2
Number of Bars =	21	
As Total=	32.76	in^2
A s/ Aconc, Rho:	0.0051	0.51%

ACI 10.5 , ACI 21.10.4, and IBC 1810.
Min As for Flexural, Tension Controlled, Shafts:
(3)*(Sqrt(f'c)/Fy: 0.0027
200 / Fy: 0.0033

Minimum Rho Check:

Actual Req'd Min. Rho:	0.33%	Flexural
Provided Rho:	0.51%	OK

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn.		
Pn per ACI 318 (10-2)	9414.32	kips
at Mu=(ϕ=0.65)Mn=	6130.65	ft-kips
Max Tu, (φ=0.9) Tn =	1769.04	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Maximum Shaft Superimposed Forces

TIA Revision:	F	
Max. Service Shaft M:	2543.94	ft-kips **(* Note)**
Max. Service Shaft P:	33.4002	kips
Max Axial Force Type:	Comp.	

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

Load Factor	**Shaft Factored Loads**		
1.30	Mu:	3307.121	ft-kips
1.30	Pu:	43.42026	kips

Material Properties

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

ACI 318 Code

Select Analysis ACI Code=	2002

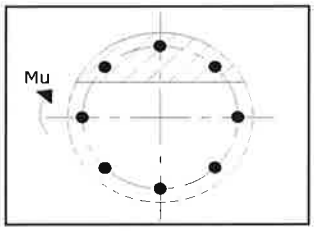
Seismic Properties

Seismic Design Category =	D
Seismic Risk =	**High**

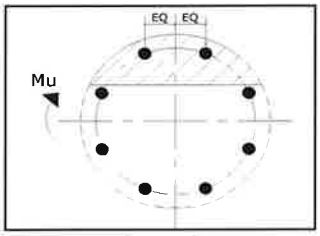
Solve (Run) <-- Press Upon Completing All Input

Results:

Governing Orientation Case: **1**



Case 1



Case 2

Dist. From Edge to Neutral Axis:	**13.84**	in
Extreme Steel Strain, εt:	**0.0153**	
	εt > 0.0050, Tension Controlled	
Reduction Factor,φ:	**0.900**	

Output Note: Negative Pu=Tension

For Axial Compression, φ Pn = Pu:	43.42	kips
Drilled Shaft Moment Capacity, φMn:	**5612.26**	ft-kips
Drilled Shaft Superimposed Mu:	**3307.12**	ft-kips

(Mu/φMn, Drilled Shaft Flexure CSR:	**58.9%**