Robinson+Cole

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

Also admitted in Massachusetts

May 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**
725 Flanders Road, Groton, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 110-foot level on an existing 130-foot monopole tower at 725 Flanders Road in Groton, Connecticut (the "Property"). The tower is owned by Crown Castle. Cellco's use of the tower was approved by the Council in 2008. Cellco now intends to modify its facility by replacing six (6) of its existing antennas with three (3) model HBXX-6517DS-VTM, 1900 MHz antennas; and three (3) model HBXX-6517DS-VTM, 700 MHz antennas, and adding three (3) model HBXX-6517DS-VTM, 2100 MHz antennas for a total of fifteen (15) antennas, all at the 110-foot level on the tower. Cellco also intends to install six (6) remote radio heads ("RRHs") behind its 1900 MHz and 2100 MHz antennas and two (2) HYBRIFLEX™ antenna cables attached to the outside of the monopole. 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 Groton's Mayor, Rita M. Schmidt. The Town of Groton owns 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. The replacement antennas and RRHs will be installed on Cellco's existing antenna height of 110 feet.

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

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

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

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

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

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

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Mayor Rita M. Schmidt
Tim Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6517DS-VTM

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

- Superior azimuth tracking and pattern symmetry with excellent passive intermodulation suppression

Electrical Specifications

Frequency Band, MHz	1710–1880	1850–1990	1920–2180
Gain, dBi	19.0	19.1	19.2
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	18	18
Front-to-Back Ratio at 180°, dB	30	30	30
CPR at Boresight, dB	21	22	21
CPR at Sector, dB	10	11	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	1710–1880	1850–1990	1920–2180
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4	0 ° | 18.4	0 ° | 18.7
	3 ° | 18.7	3 ° | 18.7	3 ° | 18.9
	6 ° | 18.4	6 ° | 18.5	6 ° | 18.6
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	9

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

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® quad
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2180 MHz

Product Specifications

HBXX-6517DS-VTM

Performance Note	Outdoor usage

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Low loss circuit board
Radome Material	PVC, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	166.0 mm | 6.5 in
Length	1903.0 mm | 74.9 in
Width	305.0 mm | 12.0 in
Net Weight	19.5 kg | 43.0 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 2.0 Actuator	HBXX-6517DS-A2M
RET System	Teletilt®

Regulatory Compliance/Certifications

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

Included Products

600899A-2 — Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

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, 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°

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896
Beamwidth, Horizontal Tolerance, degrees	±3	±3

* 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.

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	14.2 kg | 31.3 lb
Model with factory installed AISG 2.0 RET	LNX-6514DS-A1M

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

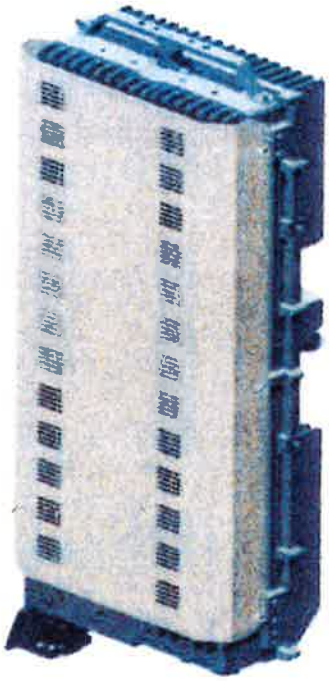
LR14.3

	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.

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).

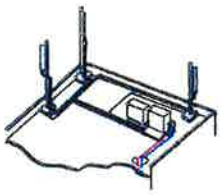
The Alcatel-Lucent RRH2x60-AWS is a very cost-effective solution to deploy LTE MIMO.

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.

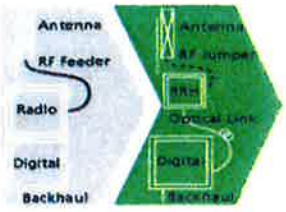
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation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

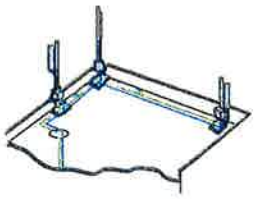
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



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

Alcatel·Lucent

AT THE SPEED OF IDEAS™

Product Data Sheet HB158-1-08U8-S8J18

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

Product Description

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

It was developed to reduce installation complexity and costs at Cellular sites. HYBRIFLEX allows mobile operators deploying an RRH architecture to standardize the RRH installation process and eliminate the need for and cost of cable grounding. HYBRIFLEX combines optical fiber (multi-mode or single-mode) and power in a single corrugated cable. It eliminates the need for junction boxes and can connect multiple RRHs with a single feeder. Standard RFS CELLFLEX² accessories can be used with HYBRIFLEX cable. Both pre-connectorized and on-site options are available.

Figure 1: HYBRIFLEX Series

Features/Benefits

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

Technical Specifications

Outer Conductor Armor	Corrugated Aluminum	[mm (in)]	46.5 (1.83)
Jacket	Polyethylene, PE	[mm (in)]	50.3 (1.98)
UV-Protection	Individual and External Jacket		Yes
Weight, Approximate		[kg/m (lb/ft)]	1.9 (1.30)
Minimum Bending Radius, Single Bending		[mm (in)]	200 (8)
Minimum Bending Radius, Repeated Bending		[mm (in)]	500 (20)
Recommended/Maximum Clamp Spacing		[m (ft)]	1.0 / 1.2 (3.25 / 4.0)
DC-Resistance Outer Conductor Armor		[Ω/km (Ω/1000ft)]	068 (0.205)
DC-Resistance Power Cable, 8.4mm² (8AWG)		[Ω/km (Ω/1000ft)]	2.1 (0.307)
Version			Single-mode OM3
Quantity, Fiber Count			16 (8 pairs)
Core/Clad		[µm]	50/125
Primary Coating (Acrylate)		[µm]	245
Buffer Diameter, Nominal		[µm]	900
Secondary Protection, Jacket, Nominal		[mm (in)]	2.0 (0.08)
Minimum Bending Radius		[mm (in)]	104 (4.1)
Insertion Loss @ wavelength 850nm		dB/km	3.0
Insertion Loss @ wavelength 1310nm		dB/km	1.0
Standards (Meets or exceeds)			UL94-V0, UL1666 RoHS Compliant
Size (Power)		[mm² (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm² (AWG)]	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-95-658 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

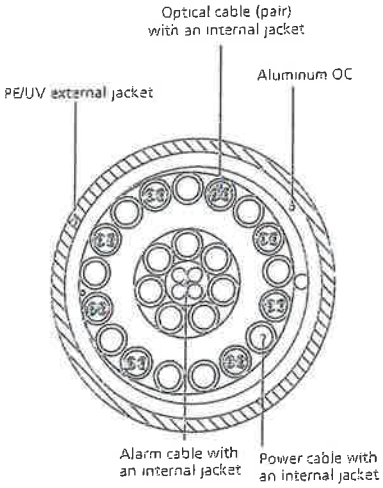


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

	General	Power	Density					
Site Name: Groton 4								
Tower Height: 130Ft.								
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE	Total
T-Mobile GSM/UMTS*	2	2334	132	0.0963	1950	1.0000	9.63%	
T-Mobile UMTS*	4	1167	132	0.0963	2100	1.0000	9.63%	
T-Mobile LTE*	1	865	132	0.0179	865	0.5767	3.10%	
AT&T UMTS*	2	565	121	0.0278	880	0.5867	4.73%	
AT&T UMTS*	2	875	121	0.0430	1900	1.0000	4.30%	
AT&T GSM *	1	283	121	0.0070	880	0.5867	1.18%	
AT&T GSM *	4	525	121	0.0516	1900	1.0000	5.16%	
AT&T LTE*	1	1771	121	0.0435	734	0.4893	8.89%	
Verizon PCS	11	497	110	0.1625	1970	1.0000	16.25%	
Verizon Cellular	9	434	110	0.1161	869	0.5793	20.04%	
Verizon AWS	1	2832	110	0.0842	2145	1.0000	8.42%	
Verizon 700	1	734	110	0.0218	746	0.4973	4.39%	
* Source: Siting Council								
								95.70%

ATTACHMENT 3

Date: **March 04, 2015**

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

AeroSolutions LLC
Optimizing Your Tower Infrastructure

Aero Solutions, LLC
5500 Flatiron Parkway, Suite 100
Boulder, CO 80301
720-381-2843

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Number:	117742
	Carrier Site Name:	Groton 4 CT
Crown Castle Designation:	**Crown Castle BU Number:**	824359
	Crown Castle Site Name:	Groton/ I-95/ X89/ Noa_1
	Crown Castle JDE Job Number:	325035
	Crown Castle Work Order Number:	1018973
	Crown Castle Application Number:	282601 Rev. 0
Engineering Firm Designation:	**Aero Solutions, LLC Project Number:**	003-15-0212
Site Data:	**725 Flanders Rd, Groton, New London County, CT** **Latitude *41° 22' 11.74"*, Longitude *-72° 0' 29.77"*** **130 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 762354, in accordance with application 282601, revision 0.

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

LC7: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved 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 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 *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: Benjamin Ude

Respectfully submitted by:

3.9.2015

Shraddha Dharia, P.E.
Structural Engineer
CT PE#: PEN0028187
Expires: 1/31/2016

tnxTower Report - version 6.1.4.1

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 130 ft Monopole tower designed by PIROD MANUFACTURES INC. in October of 2002. The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-F.

The tower has been modified per reinforcement drawings prepared by Structural Components, in October of 2009. Reinforcement consists of guy wires. There modifications were determined to be ineffective and were not considered in the analysis.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 85 mph with no ice, 37.6 mph with 0.75 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
110.0	110.0	3	alcatel lucent	RRH2X60-AWS	2	1-5/8	
		3	alcatel lucent	RRH2X60-PCS			
		6	commscope	HBXX-6517DS-A2M w/ Mount Pipe			
		3	commscope	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
131.0	132.0	3	commscope	LNX-6514DS-VTM w/ Mount Pipe	13	1-5/8	2
		3	ericsson	ERICSSON AIR 21 B2A B4P w/ Mount Pipe			1
		3	ericsson	ERICSSON AIR 21 B4A B2P w/ Mount Pipe			
		3	ericsson	RRUS 11 B12			2
	131.0	3	ericsson	KRY 112 144/1			1
		1	tower mounts	Platform Mount [LP 405-1]			
122.0	122.0	3	ericsson	RRUS 11			1
		1	tower mounts	Side Arm Mount [SO 102-3]			
119.0	121.0	2	andrew	SBNH-1D6565C w/ Mount Pipe	1 12	3/8 1-5/8	1
		6	powerwave technologies	7770.00 w/ Mount Pipe			
		6	powerwave technologies	LGP 17201			
		6	powerwave technologies	LGP13519			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
		6	powerwave technologies	LGP21401			
		1	powerwave technologies	P65-17-XLH-RR w/ Mount Pipe			
		1	raycap	DC6-48-60-18-8F			
	119.0	1	tower mounts	T-Arm Mount [TA 602-3]			
110.0	111.0	6	antel	LPA-185063/8CF w/ Mount Pipe	6	1-5/8	3
	110.0	3	antel	BXA-70063/6CF w/ Mount Pipe			
		6	antel	LPA-80063/6CF w/ Mount Pipe	18	1-5/8	1
		1	tower mounts	Platform Mount [LP 303-1]			

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)
130	130	1	decibel	DB853	11	1-5/8
		9	ems wireless	RR90-17-00DP		
		1	rfs celwave	PD1610		
116	116	9	ems wireless	RR90-17-00DP	9	1-5/8

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	French & Parrello Associates, P.A.	3472178	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	FDH Engineering, Inc. (Mapping)	3804602	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Pirod Manufacturers, Inc.	3472179	CCISITES

3.1) Analysis Method

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

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.

2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) When applicable, transmission cables are considered as structural components for calculating wind loads as allowed by TIA/EIA-222-F.
5) The base plate and flange plate connection geometry for all elevations are from previous experience with Pirod towers.

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	130 - 120	Pole	P30x3/8	1	-4.34	1166.57	8.6	Pass
L2	120 - 100	Pole	P36x3/8	2	-11.91	1325.68	38.3	Pass
L3	100 - 80	Pole	P42x3/8	3	-16.20	1484.55	62.7	Pass
L4	80 - 60	Pole	P48x3/8	4	-22.17	1643.28	79.0	Pass
L5	60 - 40	Pole	P54x3/8	5	-27.51	1801.92	90.5	Pass
L6	40 - 20	Pole	P60x3/8	6	-33.36	1960.48	98.6	Pass
L7	20 - 0	Pole	P60x3/4	7	-43.90	4666.27	52.8	Pass
							Summary	
						Pole (L6)	98.6	Pass
						Rating =	98.6	Pass

Table 6 - Tower Component Stresses vs. Capacity – LC7

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	49.1	Pass
1	Base Plate	0	52.8	Pass
1	Base Foundation	0	64.2	Pass
1	Base Foundation Soil Interaction	0	91.8	Pass
1	Flange Connection	120	8.6	Pass
1	Flange Connection	100	38.3	Pass
1	Flange Connection	80	62.7	Pass
1	Flange Connection	60	79.0	Pass
1	Flange Connection	40	90.5	Pass
1	Flange Connection	20	98.6	Pass

Structure Rating (max from all components) =	98.6%

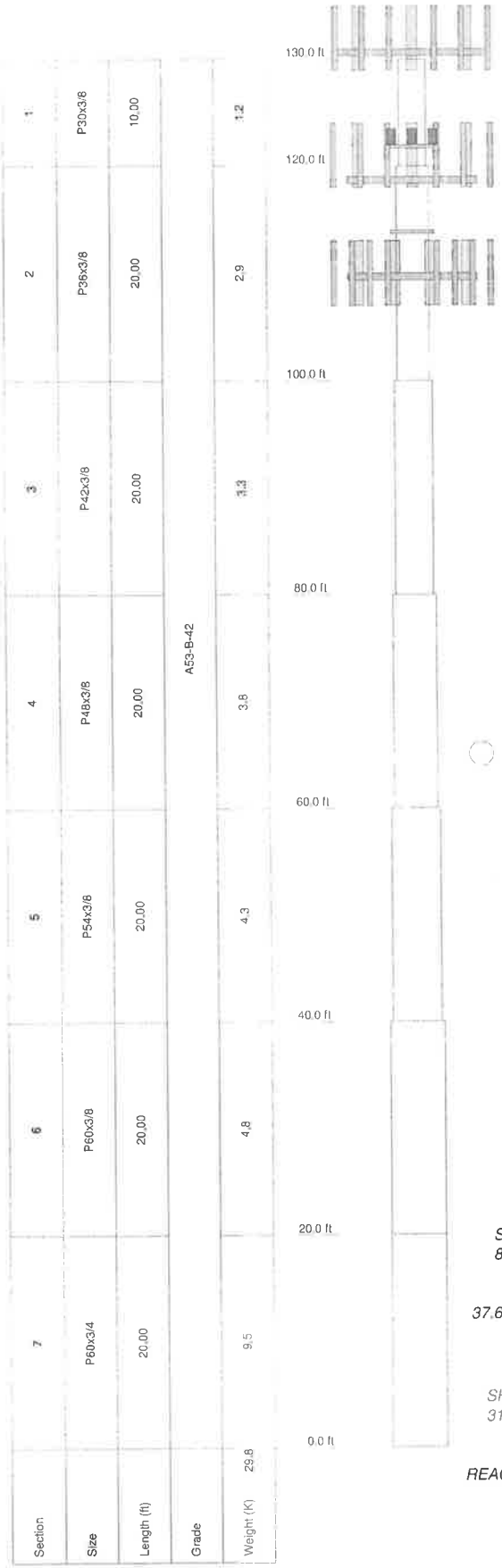
Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

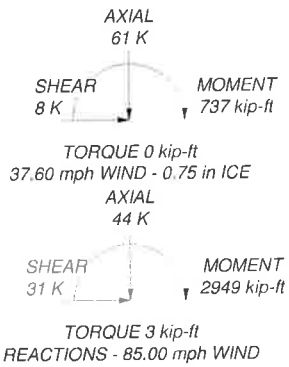
4.1) Recommendations

The tower and its base and anchor foundations have sufficient capacity to carry the existing, reserved, and proposed loads. No modifications are required at this time.

APPENDIX A

TNXTOWER OUTPUT





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
4' x 2" Pipe Mount	131	(2) LGP13519	119
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	131	(2) LGP13519	119
		(2) LGP21401	119
ERICSSON AIR 21 B4A B2P w/ Mount Pipe	131	(2) LGP21401	119
		(2) LGP21401	119
KRY 112 144/1	131	P65-17-XLH-RR w/ Mount Pipe	119
LNX-6514DS-VTM w/ Mount Pipe	131	SBNH-1D6565C w/ Mount Pipe	119
RRUS 11 B12	131	SBNH-1D6565C w/ Mount Pipe	119
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	131	(2) LGP 17201	119
		(2) LGP 17201	119
ERICSSON AIR 21 B4A B2P w/ Mount Pipe	131	(2) LGP 17201	119
KRY 112 144/1	131	DC6-48-60-18-8F	119
LNX-6514DS-VTM w/ Mount Pipe	131	T-Arm Mount [TA 602-3]	119
RRUS 11 B12	131	Side Arm Mount [SO 102-3]	114
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	131	(2) LPA-80063/6CF w/ Mount Pipe	110
		(2) LPA-80063/6CF w/ Mount Pipe	110
ERICSSON AIR 21 B4A B2P w/ Mount Pipe	131	(2) LPA-80063/6CF w/ Mount Pipe	110
		RRH2X60-AWS	110
KRY 112 144/1	131	RRH2X60-AWS	110
LNX-6514DS-VTM w/ Mount Pipe	131	RRH2X60-AWS	110
RRUS 11 B12	131	RRH2X60-PCS	110
Platform Mount [LP 405-1]	131	RRH2X60-PCS	110
RRUS 11	122	RRH2X60-PCS	110
RRUS 11	122	(2) HBXX-6517DS-A2M w/ Mount Pipe	110
RRUS 11	122	(2) HBXX-6517DS-A2M w/ Mount Pipe	110
Side Arm Mount [SO 102-3]	122	(2) HBXX-6517DS-A2M w/ Mount Pipe	110
4' x 2" Pipe Mount	122	LNX-6514DS-A1M w/ Mount Pipe	110
4' x 2" Pipe Mount	122	LNX-6514DS-A1M w/ Mount Pipe	110
4' x 2" Pipe Mount	122	LNX-6514DS-A1M w/ Mount Pipe	110
(2) 7770.00 w/ Mount Pipe	119	(2) DB-T1-6Z-8AB-0Z	110
(2) 7770.00 w/ Mount Pipe	119	Platform Mount [LP 303-1]	110
(2) 7770.00 w/ Mount Pipe	119	torque arm	68
(2) LGP13519	119	torque arm	68
		torque arm	68

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A53-B-42	42 ksi	63 ksi			

TOWER DESIGN NOTES

1. Tower is located in New London County, Connecticut.
2. Tower designed for a 85.00 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 37.60 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50.00 mph wind.
5. TOWER RATING: 98.6%

Aero Solutions, LLC
5500 Flatiron Parkway, Suite 100
Boulder, CO 80301
Phone: 720-381-2843
FAX: 720-304-6883

Job:	***BU#824359 Groton- I-95- X89- Noa_1***		
Project:	***Existing 130FT Monopole***		
Client: Crown Castle	Drawn by: Benjamin Ude	App'd:	
Code: TIA/EIA-222-F	Date: 03/04/15	Scale: NTS	
Path:		Dwg No. E-1	

Tower Input Data

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

4) Tower is located in New London County, Connecticut.
5) Basic wind speed of 85.00 mph.
6) Nominal ice thickness of 0.75 in.
7) Ice thickness is considered to increase with height.
8) Ice density of 56.00 pcf.
9) A wind speed of 37.60 mph is used in combination with ice.
10) Temperature drop of 50 °F.
11) Deflections calculated using a wind speed of 50.00 mph.
12) A non-linear (P-delta) analysis was used.
13) Pressures are calculated at each section.
14) Stress ratio used in pole design is 1.333.
15) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

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

Pole Section Geometry

Section	Elevation ft	Section Length ft	Pole Size	Pole Grade	Socket Length ft
L1	130.00-120.00	10.00	P30x3/8	A53-B-42 (42 ksi)	
L2	120.00-100.00	20.00	P36x3/8	A53-B-42 (42 ksi)	
L3	100.00-80.00	20.00	P42x3/8	A53-B-42 (42 ksi)	
L4	80.00-60.00	20.00	P48x3/8	A53-B-42 (42 ksi)	
L5	60.00-40.00	20.00	P54x3/8	A53-B-42 (42 ksi)	
L6	40.00-20.00	20.00	P60x3/8	A53-B-42 (42 ksi)	
L7	20.00-0.00	20.00	P60x3/4	A53-B-42 (42 ksi)	

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 130.00-120.00				1	1	1		
L2 120.00-100.00				1	1	1		
L3 100.00-80.00				1	1	1		
L4 80.00-60.00				1	1	1		
L5 60.00-40.00				1	1	1		
L6 40.00-20.00				1	1	1		
L7 20.00-0.00				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 klf
**										

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")	C	No	Inside Pole	130.00 - 0.00	12	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
						2" Ice	0.00	0.00
						4" Ice	0.00	0.00
MLE Hybrid 9Power/18Fiber RL 2(1 5/8)	C	No	CaAa (Out Of Face)	130.00 - 0.00	1	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
						2" Ice	0.00	0.01
						4" Ice	0.00	0.03
**								
AVA7-50(1-5/8)	B	No	Inside Pole	119.00 - 0.00	12	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
						2" Ice	0.00	0.00
						4" Ice	0.00	0.00
LDF2-50(3/8")	B	No	Inside Pole	119.00 - 0.00	1	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
						2" Ice	0.00	0.00
						4" Ice	0.00	0.00
2" Rigid Conduit	B	No	Inside Pole	119.00 - 0.00	1	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
						2" Ice	0.00	0.00
						4" Ice	0.00	0.00
**								
LDF7-50A(1-5/8")	A	No	CaAa (Out Of Face)	110.00 - 0.00	1	No Ice	0.20	0.00
						1/2" Ice	0.30	0.00
						1" Ice	0.40	0.00
						2" Ice	0.60	0.01
						4" Ice	1.00	0.03
LDF7-50A(1-5/8")	A	No	CaAa (Out Of	110.00 - 0.00	5	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
			Face)			1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
						2" Ice	0.00	0.01
						4" Ice	0.00	0.03
LDF7-50A(1-5/8")	A	No	Inside Pole	110.00 - 0.00	12	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
						2" Ice	0.00	0.00
						4" Ice	0.00	0.00
HB158-1-08U8-S8J18(1-5/8)	A	No	CaAa (Out Of Face)	110.00 - 0.00	2	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
						1" Ice	0.00	0.00
						2" Ice	0.00	0.01
						4" Ice	0.00	0.03
**								
Climbing Ladder (Round)	B	No	CaAa (Out Of Face)	130.00 - 0.00	1	No Ice	0.23	0.01
						1/2" Ice	0.55	0.01
						1" Ice	0.86	0.01
						2" Ice	1.48	0.03
						4" Ice	2.73	0.09
Torque Arm Channel	C	No	CaAa (Out Of Face)	79.50 - 60.50	1	No Ice	0.42	0.02
						1/2" Ice	0.42	0.02
						1" Ice	0.42	0.02
						2" Ice	0.42	0.02
						4" Ice	0.42	0.02
Guy Wires	C	No	CaAa (Out Of Face)	78.00 - 0.00	3	No Ice	0.06	0.00
						1/2" Ice	0.16	0.00
						1" Ice	0.26	0.00
						2" Ice	0.46	0.01
						4" Ice	0.86	0.02
**								

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	130.00-120.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	2.344	0.05
		C	0.000	0.000	0.000	0.000	0.11
L2	120.00-100.00	A	0.000	0.000	0.000	1.980	0.17
		B	0.000	0.000	0.000	4.688	0.32
		C	0.000	0.000	0.000	0.000	0.22
L3	100.00-80.00	A	0.000	0.000	0.000	3.960	0.35
		B	0.000	0.000	0.000	4.688	0.33
		C	0.000	0.000	0.000	0.000	0.22
L4	80.00-60.00	A	0.000	0.000	0.000	3.960	0.35
		B	0.000	0.000	0.000	4.688	0.33
		C	0.000	0.000	0.000	11.420	0.58
L5	60.00-40.00	A	0.000	0.000	0.000	3.960	0.35
		B	0.000	0.000	0.000	4.688	0.33
		C	0.000	0.000	0.000	3.780	0.23
L6	40.00-20.00	A	0.000	0.000	0.000	3.960	0.35
		B	0.000	0.000	0.000	4.688	0.33
		C	0.000	0.000	0.000	3.780	0.23
L7	20.00-0.00	A	0.000	0.000	0.000	3.960	0.35
		B	0.000	0.000	0.000	4.688	0.33
		C	0.000	0.000	0.000	3.780	0.23

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	130.00-120.00	A	0.880	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	7.844	0.12
		C		0.000	0.000	0.000	0.000	0.14
L2	120.00-100.00	A	0.867	0.000	0.000	0.000	3.713	0.42
		B		0.000	0.000	0.000	15.520	0.44
		C		0.000	0.000	0.000	0.000	0.27
L3	100.00-80.00	A	0.846	0.000	0.000	0.000	7.344	0.82
		B		0.000	0.000	0.000	15.262	0.45
		C		0.000	0.000	0.000	0.000	0.27
L4	80.00-60.00	A	0.821	0.000	0.000	0.000	7.243	0.81
		B		0.000	0.000	0.000	14.948	0.45
		C		0.000	0.000	0.000	20.285	0.71
L5	60.00-40.00	A	0.788	0.000	0.000	0.000	7.113	0.79
		B		0.000	0.000	0.000	14.542	0.44
		C		0.000	0.000	0.000	13.240	0.36
L6	40.00-20.00	A	0.750	0.000	0.000	0.000	6.960	0.76
		B		0.000	0.000	0.000	14.063	0.43
		C		0.000	0.000	0.000	12.780	0.35
L7	20.00-0.00	A	0.750	0.000	0.000	0.000	6.960	0.76
		B		0.000	0.000	0.000	14.063	0.43
		C		0.000	0.000	0.000	12.780	0.35

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	130.00-120.00	0.28	0.16	0.74	0.43
L2	120.00-100.00	0.27	0.02	0.74	0.22
L3	100.00-80.00	0.27	-0.11	0.73	0.02
L4	80.00-60.00	-0.35	0.25	-0.22	0.50
L5	60.00-40.00	0.05	0.02	0.06	0.36
L6	40.00-20.00	0.05	0.02	0.06	0.36
L7	20.00-0.00	0.05	0.02	0.06	0.36

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
4' x 2" Pipe Mount	C	From Leg	4.00 0.00 0.00	0.000	131.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.79 1.03 1.28 1.81 3.11	0.79 1.03 1.28 1.81 3.11	0.03 0.04 0.04 0.07 0.17
**									
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	80.000	131.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.83 7.35 7.86 8.93 11.18	5.64 6.48 7.26 8.86 12.29	0.11 0.17 0.23 0.38 0.81
ERICSSON AIR 21 B4A B2P w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	80.000	131.00	No Ice 1/2" Ice 1" Ice	6.83 7.35 7.86 8.93	5.64 6.48 7.26 8.86	0.11 0.17 0.23 0.38

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
						2" Ice	11.18	12.29	0.81
						4" Ice			
KRY 112 144/1	A	From Leg	4.00 0.00 0.00	80.000	131.00	No Ice	0.41	0.17	0.01
						1/2" Ice	0.50	0.24	0.01
						1" Ice	0.59	0.31	0.02
						2" Ice	0.81	0.48	0.03
						4" Ice	1.36	0.92	0.08
LNX-6514DS-VTM w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	80.000	131.00	No Ice	8.65	7.08	0.06
						1/2" Ice	9.31	8.27	0.13
						1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
RRUS 11 B12	A	From Leg	4.00 0.00 1.00	80.000	131.00	No Ice	3.31	1.36	0.05
						1/2" Ice	3.55	1.54	0.07
						1" Ice	3.80	1.73	0.10
						2" Ice	4.33	2.13	0.15
						4" Ice	5.50	3.04	0.31
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	60.000	131.00	No Ice	6.83	5.64	0.11
						1/2" Ice	7.35	6.48	0.17
						1" Ice	7.86	7.26	0.23
						2" Ice	8.93	8.86	0.38
						4" Ice	11.18	12.29	0.81
ERICSSON AIR 21 B4A B2P w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	-20.000	131.00	No Ice	6.83	5.64	0.11
						1/2" Ice	7.35	6.48	0.17
						1" Ice	7.86	7.26	0.23
						2" Ice	8.93	8.86	0.38
						4" Ice	11.18	12.29	0.81
KRY 112 144/1	B	From Leg	4.00 0.00 0.00	60.000	131.00	No Ice	0.41	0.17	0.01
						1/2" Ice	0.50	0.24	0.01
						1" Ice	0.59	0.31	0.02
						2" Ice	0.81	0.48	0.03
						4" Ice	1.36	0.92	0.08
LNX-6514DS-VTM w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	60.000	131.00	No Ice	8.65	7.08	0.06
						1/2" Ice	9.31	8.27	0.13
						1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
RRUS 11 B12	B	From Leg	4.00 0.00 1.00	60.000	131.00	No Ice	3.31	1.36	0.05
						1/2" Ice	3.55	1.54	0.07
						1" Ice	3.80	1.73	0.10
						2" Ice	4.33	2.13	0.15
						4" Ice	5.50	3.04	0.31
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	10.000	131.00	No Ice	6.83	5.64	0.11
						1/2" Ice	7.35	6.48	0.17
						1" Ice	7.86	7.26	0.23
						2" Ice	8.93	8.86	0.38
						4" Ice	11.18	12.29	0.81
ERICSSON AIR 21 B4A B2P w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	10.000	131.00	No Ice	6.83	5.64	0.11
						1/2" Ice	7.35	6.48	0.17
						1" Ice	7.86	7.26	0.23
						2" Ice	8.93	8.86	0.38
						4" Ice	11.18	12.29	0.81
KRY 112 144/1	C	From Leg	4.00 0.00 0.00	10.000	131.00	No Ice	0.41	0.17	0.01
						1/2" Ice	0.50	0.24	0.01
						1" Ice	0.59	0.31	0.02

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	0.81	0.48	0.03
						2" Ice	1.36	0.92	0.08
						4" Ice			
LNX-6514DS-VTM w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	10.000	131.00	No Ice	8.65	7.08	0.06
						1/2" Ice	9.31	8.27	0.13
						1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
RRUS 11 B12	C	From Leg	4.00 0.00 1.00	10.000	131.00	No Ice	3.31	1.36	0.05
						1/2" Ice	3.55	1.54	0.07
						1" Ice	3.80	1.73	0.10
						2" Ice	4.33	2.13	0.15
						4" Ice	5.50	3.04	0.31
Platform Mount [LP 405-1]	C	None		0.000	131.00	No Ice	20.80	20.80	1.80
						1/2" Ice	28.10	28.10	2.07
						1" Ice	35.40	35.40	2.33
						2" Ice	50.00	50.00	2.86
						4" Ice	79.20	79.20	3.93
**									
RRUS 11	A	From Leg	1.00 0.00 0.00	35.000	122.00	No Ice	3.25	1.37	0.05
						1/2" Ice	3.49	1.55	0.07
						1" Ice	3.74	1.74	0.10
						2" Ice	4.27	2.14	0.15
						4" Ice	5.43	3.04	0.31
RRUS 11	B	From Leg	1.00 0.00 0.00	25.000	122.00	No Ice	3.25	1.37	0.05
						1/2" Ice	3.49	1.55	0.07
						1" Ice	3.74	1.74	0.10
						2" Ice	4.27	2.14	0.15
						4" Ice	5.43	3.04	0.31
RRUS 11	C	From Leg	1.00 0.00 0.00	31.000	122.00	No Ice	3.25	1.37	0.05
						1/2" Ice	3.49	1.55	0.07
						1" Ice	3.74	1.74	0.10
						2" Ice	4.27	2.14	0.15
						4" Ice	5.43	3.04	0.31
Side Arm Mount [SO 102-3]	C	None		0.000	122.00	No Ice	3.00	3.00	0.08
						1/2" Ice	3.48	3.48	0.11
						1" Ice	3.96	3.96	0.14
						2" Ice	4.92	4.92	0.20
						4" Ice	6.84	6.84	0.32
4' x 2" Pipe Mount	A	From Leg	0.50 0.00 0.00	0.000	122.00	No Ice	0.79	0.79	0.03
						1/2" Ice	1.03	1.03	0.04
						1" Ice	1.28	1.28	0.04
						2" Ice	1.81	1.81	0.07
						4" Ice	3.11	3.11	0.17
4' x 2" Pipe Mount	B	From Leg	0.50 0.00 0.00	0.000	122.00	No Ice	0.79	0.79	0.03
						1/2" Ice	1.03	1.03	0.04
						1" Ice	1.28	1.28	0.04
						2" Ice	1.81	1.81	0.07
						4" Ice	3.11	3.11	0.17
4' x 2" Pipe Mount	C	From Leg	0.50 0.00 0.00	0.000	122.00	No Ice	0.79	0.79	0.03
						1/2" Ice	1.03	1.03	0.04
						1" Ice	1.28	1.28	0.04
						2" Ice	1.81	1.81	0.07
						4" Ice	3.11	3.11	0.17
**									

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(2) 7770.00 w/ Mount Pipe	A	From Leg	4.00 0.00 2.00		35.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.12 6.63 7.13 8.16 10.36	4.25 5.01 5.71 7.16 10.41	0.06 0.10 0.16 0.29 0.66
(2) 7770.00 w/ Mount Pipe	B	From Leg	4.00 0.00 2.00		25.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.12 6.63 7.13 8.16 10.36	4.25 5.01 5.71 7.16 10.41	0.06 0.10 0.16 0.29 0.66
(2) 7770.00 w/ Mount Pipe	C	From Leg	4.00 0.00 2.00		31.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.12 6.63 7.13 8.16 10.36	4.25 5.01 5.71 7.16 10.41	0.06 0.10 0.16 0.29 0.66
(2) LGP13519	A	From Leg	4.00 0.00 2.00		35.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.34 0.42 0.51 0.73 1.25	0.21 0.28 0.36 0.55 1.03	0.01 0.01 0.01 0.02 0.07
(2) LGP13519	B	From Leg	4.00 0.00 2.00		25.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.34 0.42 0.51 0.73 1.25	0.21 0.28 0.36 0.55 1.03	0.01 0.01 0.01 0.02 0.07
(2) LGP13519	C	From Leg	4.00 0.00 2.00		31.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.34 0.42 0.51 0.73 1.25	0.21 0.28 0.36 0.55 1.03	0.01 0.01 0.01 0.02 0.07
(2) LGP21401	A	From Leg	4.00 0.00 2.00		35.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.29 1.45 1.61 1.97 2.79	0.23 0.31 0.40 0.61 1.12	0.01 0.02 0.03 0.05 0.14
(2) LGP21401	B	From Leg	4.00 0.00 2.00		25.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.29 1.45 1.61 1.97 2.79	0.23 0.31 0.40 0.61 1.12	0.01 0.02 0.03 0.05 0.14
(2) LGP21401	C	From Leg	4.00 0.00 2.00		31.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.29 1.45 1.61 1.97 2.79	0.23 0.31 0.40 0.61 1.12	0.01 0.02 0.03 0.05 0.14
P65-17-XLH-RR w/ Mount Pipe	A	From Leg	4.00 0.00 2.00		35.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.70 12.42 13.15 14.64 17.91	8.94 10.45 11.99 14.31 19.14	0.09 0.18 0.27 0.50 1.13
SBNH-1D6565C w/ Mount Pipe	B	From Leg	4.00 0.00 2.00		25.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice	11.68 12.40 13.14 14.60 17.87	9.84 11.37 12.91 15.27 20.14	0.10 0.19 0.29 0.52 1.17

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
						4" Ice			
SBNH-1D6565C w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	31.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.68 12.40 13.14 14.60 17.87	9.84 11.37 12.91 15.27 20.14	0.10 0.19 0.29 0.52 1.17
(2) LGP 17201	A	From Leg	4.00 0.00 2.00	35.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.95 2.13 2.33 2.75 3.69	0.52 0.64 0.77 1.06 1.73	0.03 0.04 0.06 0.09 0.19
(2) LGP 17201	B	From Leg	4.00 0.00 2.00	25.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.95 2.13 2.33 2.75 3.69	0.52 0.64 0.77 1.06 1.73	0.03 0.04 0.06 0.09 0.19
(2) LGP 17201	C	From Leg	4.00 0.00 2.00	31.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.95 2.13 2.33 2.75 3.69	0.52 0.64 0.77 1.06 1.73	0.03 0.04 0.06 0.09 0.19
DC6-48-60-18-8F	B	From Leg	4.00 0.00 2.00	25.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.57 2.80 3.04 3.54 4.66	2.57 2.80 3.04 3.54 4.66	0.03 0.06 0.08 0.14 0.31
T-Arm Mount [TA 602-3]	C	None		0.000	119.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.59 15.44 19.29 26.99 42.39	11.59 15.44 19.29 26.99 42.39	0.77 0.99 1.21 1.64 2.50
** Side Arm Mount [SO 102-3]	C	None		0.000	114.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.00 3.48 3.96 4.92 6.84	3.00 3.48 3.96 4.92 6.84	0.08 0.11 0.14 0.20 0.32
** (2) LPA-80063/6CF w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	10.33 10.90 11.47 12.65 15.11	10.43 11.48 12.40 14.31 18.34	0.05 0.14 0.24 0.46 1.05
(2) LPA-80063/6CF w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	10.33 10.90 11.47 12.65 15.11	10.43 11.48 12.40 14.31 18.34	0.05 0.14 0.24 0.46 1.05
(2) LPA-80063/6CF w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	10.33 10.90 11.47 12.65 15.11	10.43 11.48 12.40 14.31 18.34	0.05 0.14 0.24 0.46 1.05
RRH2X60-AWS	A	From Leg	4.00 0.00	60.000	110.00	No Ice 1/2"	3.96 4.27	1.82 2.08	0.06 0.08

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			Ice	4.60	2.36	0.11
						1" Ice	5.27	2.96	0.17
						2" Ice	6.72	4.25	0.35
						4" Ice			
RRH2X60-AWS	B	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	3.96	1.82	0.06
						1/2" Ice	4.27	2.08	0.08
						1" Ice	4.60	2.36	0.11
						2" Ice	5.27	2.96	0.17
						4" Ice	6.72	4.25	0.35
RRH2X60-AWS	C	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	3.96	1.82	0.06
						1/2" Ice	4.27	2.08	0.08
						1" Ice	4.60	2.36	0.11
						2" Ice	5.27	2.96	0.17
						4" Ice	6.72	4.25	0.35
RRH2X60-PCS	A	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
RRH2X60-PCS	B	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
RRH2X60-PCS	C	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
(2) HBXX-6517DS-A2M w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	8.98	6.96	0.07
						1/2" Ice	9.65	8.18	0.14
						1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
(2) HBXX-6517DS-A2M w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	8.98	6.96	0.07
						1/2" Ice	9.65	8.18	0.14
						1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
(2) HBXX-6517DS-A2M w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	8.98	6.96	0.07
						1/2" Ice	9.65	8.18	0.14
						1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
LNX-6514DS-A1M w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	8.65	7.08	0.06
						1/2" Ice	9.31	8.27	0.13
						1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
LNX-6514DS-A1M w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice	8.65	7.08	0.06
						1/2" Ice	9.31	8.27	0.13
						1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
LNX-6514DS-A1M w/	C	From Leg	4.00	60.000	110.00	No Ice	8.65	7.08	0.06

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
Mount Pipe			0.00 0.00			1/2" Ice	9.31 9.93	8.27 9.18	0.13 0.21
						1" Ice	11.20	11.02	0.39
						2" Ice	13.87	15.06	0.90
						4" Ice			
(2) DB-T1-6Z-8AB-0Z	A	From Leg	4.00 0.00 0.00	60.000	110.00	No Ice 1/2" Ice	5.60 5.92	2.33 2.56	0.04 0.08
						1" Ice	6.24	2.79	0.12
						2" Ice	6.91	3.28	0.21
						4" Ice	8.37	4.37	0.45
Platform Mount [LP 303-1]	C	None		0.000	110.00	No Ice	14.66	14.66	1.25
						1/2" Ice	18.87	18.87	1.48
						1" Ice	23.08	23.08	1.71
						2" Ice	31.50	31.50	2.18
						4" Ice	48.34	48.34	3.10
**									
torque arm	A	From Leg	5.00 0.00 0.00	0.000	68.00	No Ice 1/2" Ice	5.83 6.65	0.24 0.31	0.27 0.31
						1" Ice	7.47	0.39	0.37
						2" Ice	9.14	0.57	0.50
						4" Ice	12.59	1.04	0.87
torque arm	B	From Leg	5.00 0.00 0.00	0.000	68.00	No Ice 1/2" Ice	5.83 6.65	0.24 0.31	0.27 0.31
						1" Ice	7.47	0.39	0.37
						2" Ice	9.14	0.57	0.50
						4" Ice	12.59	1.04	0.87
torque arm	C	From Leg	5.00 0.00 0.00	0.000	68.00	No Ice 1/2" Ice	5.83 6.65	0.24 0.31	0.27 0.31
						1" Ice	7.47	0.39	0.37
						2" Ice	9.14	0.57	0.50
						4" Ice	12.59	1.04	0.87
**									

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp

Comb. No.	Description
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	130 - 120	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-6.82	0.11	-0.21
			Max. Mx	11	-4.34	57.46	-1.71
			Max. My	8	-4.35	1.68	-53.72
			Max. Vy	11	-5.85	57.46	-1.71
			Max. Vx	2	-5.51	-1.46	53.48
			Max. Torque	6			1.22
L2	120 - 100	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-20.59	-0.45	0.97
			Max. Mx	5	-11.91	-360.77	5.85
			Max. My	2	-11.95	-5.86	345.82
			Max. Vy	11	-19.87	360.45	-5.55
			Max. Vx	2	-19.25	-5.86	345.82
			Max. Torque	5			3.02
L3	100 - 80	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-26.36	-0.68	1.81
			Max. Mx	5	-16.20	-779.68	11.43
			Max. My	2	-16.23	-11.38	752.18
			Max. Vy	11	-21.99	779.10	-10.76
			Max. Vx	2	-21.36	-11.38	752.18
			Max. Torque	5			3.03
L4	80 - 60	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-34.16	-0.16	2.29
			Max. Mx	11	-22.17	1248.41	-16.33
			Max. My	2	-22.19	-16.29	1208.23
			Max. Vy	11	-24.95	1248.41	-16.33
			Max. Vx	2	-24.32	-16.29	1208.23
			Max. Torque	5			3.03
L5	60 - 40	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-41.11	-0.26	3.19
			Max. Mx	11	-27.51	1769.53	-21.51
			Max. My	2	-27.53	-21.82	1717.13
			Max. Vy	5	27.17	-1769.43	22.23
			Max. Vx	2	-26.54	-21.82	1717.13
			Max. Torque	5			2.98
L6	40 - 20	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-48.54	-0.37	4.14
			Max. Mx	5	-33.37	-2333.80	27.78
			Max. My	2	-33.37	-27.33	2269.06
			Max. Vy	5	29.24	-2333.80	27.78

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vx	2	-28.62	-27.33	2269.06
			Max. Torque	5			2.98
L7	20 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-60.70	-0.48	5.10
			Max. Mx	5	-43.90	-2939.84	33.30
			Max. My	2	-43.90	-32.81	2862.75
			Max. Vy	5	31.33	-2939.84	33.30
			Max. Vx	2	-30.72	-32.81	2862.75
			Max. Torque	5			2.97

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	14	60.70	0.00	0.00
	Max. H_x	11	43.90	31.33	-0.26
	Max. H_z	2	43.90	-0.26	30.71
	Max. M_x	2	2862.75	-0.26	30.71
	Max. M_z	5	2939.84	-31.33	0.26
	Max. Torsion	5	2.97	-31.33	0.26
	Min. Vert	29	43.90	-9.43	5.39
	Min. H_x	5	43.90	-31.33	0.26
	Min. H_z	8	43.90	0.26	-30.71
	Min. M_x	8	-2861.20	0.26	-30.71
	Min. M_z	11	-2939.28	31.33	-0.26
	Min. Torsion	11	-2.96	31.33	-0.26

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	43.90	0.00	0.00	-0.77	-0.28	0.00
Dead+Wind 0 deg - No Ice	43.90	0.26	-30.71	-2862.75	-32.81	0.13
Dead+Wind 30 deg - No Ice	43.90	15.89	-26.73	-2495.57	-1498.24	-1.36
Dead+Wind 60 deg - No Ice	43.90	27.26	-15.58	-1459.92	-2562.28	-2.50
Dead+Wind 90 deg - No Ice	43.90	31.33	-0.26	-33.30	-2939.84	-2.97
Dead+Wind 120 deg - No Ice	43.90	27.00	15.13	1402.03	-2529.76	-2.64
Dead+Wind 150 deg - No Ice	43.90	15.43	26.46	2461.50	-1441.90	-1.60
Dead+Wind 180 deg - No Ice	43.90	-0.26	30.71	2861.20	32.25	-0.13
Dead+Wind 210 deg - No Ice	43.90	-15.89	26.73	2494.02	1497.68	1.38
Dead+Wind 240 deg - No Ice	43.90	-27.26	15.58	1458.37	2561.72	2.51
Dead+Wind 270 deg - No Ice	43.90	-31.33	0.26	31.76	2939.28	2.96
Dead+Wind 300 deg - No Ice	43.90	-27.00	-15.13	-1403.58	2529.21	2.63
Dead+Wind 330 deg - No Ice	43.90	-15.43	-26.46	-2463.05	1441.35	1.59
Dead+Ice+Temp	60.70	0.00	0.00	-5.10	-0.48	0.00
Dead+Wind 0 deg+Ice+Temp	60.70	0.05	-7.74	-725.43	-6.21	0.05
Dead+Wind 30 deg+Ice+Temp	60.70	3.96	-6.72	-631.79	-371.69	-0.19
Dead+Wind 60 deg+Ice+Temp	60.70	6.81	-3.91	-370.26	-637.71	-0.38
Dead+Wind 90 deg+Ice+Temp	60.70	7.84	-0.05	-10.92	-732.99	-0.47
Dead+Wind 120 deg+Ice+Temp	60.70	6.76	3.83	349.96	-632.00	-0.43
Dead+Wind 150 deg+Ice+Temp	60.70	3.88	6.68	615.67	-361.80	-0.28
Dead+Wind 180 deg+Ice+Temp	60.70	-0.05	7.74	715.02	5.21	-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 210 deg+Ice+Temp	60.70	-3.96	6.72	621.38	370.70	0.19
Dead+Wind 240 deg+Ice+Temp	60.70	-6.81	3.91	359.85	636.72	0.38
Dead+Wind 270 deg+Ice+Temp	60.70	-7.84	0.05	0.51	732.00	0.47
Dead+Wind 300 deg+Ice+Temp	60.70	-6.76	-3.83	-360.37	631.01	0.43
Dead+Wind 330 deg+Ice+Temp	60.70	-3.88	-6.68	-626.08	360.81	0.28
Dead+Wind 0 deg - Service	43.90	0.09	-10.63	-991.21	-11.54	0.05
Dead+Wind 30 deg - Service	43.90	5.50	-9.25	-864.15	-518.68	-0.47
Dead+Wind 60 deg - Service	43.90	9.43	-5.39	-505.74	-886.91	-0.87
Dead+Wind 90 deg - Service	43.90	10.84	-0.09	-12.03	-1017.58	-1.03
Dead+Wind 120 deg - Service	43.90	9.34	5.23	484.69	-875.66	-0.91
Dead+Wind 150 deg - Service	43.90	5.34	9.16	851.34	-499.18	-0.55
Dead+Wind 180 deg - Service	43.90	-0.09	10.63	989.66	10.98	-0.04
Dead+Wind 210 deg - Service	43.90	-5.50	9.25	862.60	518.12	0.48
Dead+Wind 240 deg - Service	43.90	-9.43	5.39	504.19	886.35	0.87
Dead+Wind 270 deg - Service	43.90	-10.84	0.09	10.48	1017.02	1.03
Dead+Wind 300 deg - Service	43.90	-9.34	-5.23	-486.24	875.10	0.91
Dead+Wind 330 deg - Service	43.90	-5.34	-9.16	-852.89	498.62	0.55

Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.00	-43.90	0.00	0.00	43.90	0.00	0.000%
2	0.26	-43.90	-30.71	-0.26	43.90	30.71	0.000%
3	15.89	-43.90	-26.73	-15.89	43.90	26.73	0.000%
4	27.26	-43.90	-15.58	-27.26	43.90	15.58	0.000%
5	31.33	-43.90	-0.26	-31.33	43.90	0.26	0.000%
6	27.00	-43.90	15.13	-27.00	43.90	-15.13	0.000%
7	15.43	-43.90	26.46	-15.43	43.90	-26.46	0.000%
8	-0.26	-43.90	30.71	0.26	43.90	-30.71	0.000%
9	-15.89	-43.90	26.73	15.89	43.90	-26.73	0.000%
10	-27.26	-43.90	15.58	27.26	43.90	-15.58	0.000%
11	-31.33	-43.90	0.26	31.33	43.90	-0.26	0.000%
12	-27.00	-43.90	-15.13	27.00	43.90	15.13	0.000%
13	-15.43	-43.90	-26.46	15.43	43.90	26.46	0.000%
14	0.00	-60.70	0.00	0.00	60.70	0.00	0.000%
15	0.05	-60.70	-7.74	-0.05	60.70	7.74	0.000%
16	3.96	-60.70	-6.72	-3.96	60.70	6.72	0.000%
17	6.81	-60.70	-3.91	-6.81	60.70	3.91	0.000%
18	7.84	-60.70	-0.05	-7.84	60.70	0.05	0.000%
19	6.76	-60.70	3.83	-6.76	60.70	-3.83	0.000%
20	3.88	-60.70	6.68	-3.88	60.70	-6.68	0.000%
21	-0.05	-60.70	7.74	0.05	60.70	-7.74	0.000%
22	-3.96	-60.70	6.72	3.96	60.70	-6.72	0.000%
23	-6.81	-60.70	3.91	6.81	60.70	-3.91	0.000%
24	-7.84	-60.70	0.05	7.84	60.70	-0.05	0.000%
25	-6.76	-60.70	-3.83	6.76	60.70	3.83	0.000%
26	-3.88	-60.70	-6.68	3.88	60.70	6.68	0.000%
27	0.09	-43.90	-10.63	-0.09	43.90	10.63	0.000%
28	5.50	-43.90	-9.25	-5.50	43.90	9.25	0.000%
29	9.43	-43.90	-5.39	-9.43	43.90	5.39	0.000%
30	10.84	-43.90	-0.09	-10.84	43.90	0.09	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
31	9.34	-43.90	5.23	-9.34	43.90	-5.23	0.000%
32	5.34	-43.90	9.16	-5.34	43.90	-9.16	0.000%
33	-0.09	-43.90	10.63	0.09	43.90	-10.63	0.000%
34	-5.50	-43.90	9.25	5.50	43.90	-9.25	0.000%
35	-9.43	-43.90	5.39	9.43	43.90	-5.39	0.000%
36	-10.84	-43.90	0.09	10.84	43.90	-0.09	0.000%
37	-9.34	-43.90	-5.23	9.34	43.90	5.23	0.000%
38	-5.34	-43.90	-9.16	5.34	43.90	9.16	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	0.00006765
3	Yes	5	0.00000001	0.00001596
4	Yes	5	0.00000001	0.00001933
5	Yes	4	0.00000001	0.00032978
6	Yes	4	0.00000001	0.00090258
7	Yes	5	0.00000001	0.00001713
8	Yes	4	0.00000001	0.00005163
9	Yes	5	0.00000001	0.00001789
10	Yes	4	0.00000001	0.00098181
11	Yes	4	0.00000001	0.00026986
12	Yes	5	0.00000001	0.00001850
13	Yes	4	0.00000001	0.00093696
14	Yes	4	0.00000001	0.00000001
15	Yes	4	0.00000001	0.00086760
16	Yes	4	0.00000001	0.00090612
17	Yes	4	0.00000001	0.00091336
18	Yes	4	0.00000001	0.00087905
19	Yes	4	0.00000001	0.00088936
20	Yes	4	0.00000001	0.00087938
21	Yes	4	0.00000001	0.00085390
22	Yes	4	0.00000001	0.00089289
23	Yes	4	0.00000001	0.00090217
24	Yes	4	0.00000001	0.00087677
25	Yes	4	0.00000001	0.00089669
26	Yes	4	0.00000001	0.00088991
27	Yes	4	0.00000001	0.00002356
28	Yes	4	0.00000001	0.00007202
29	Yes	4	0.00000001	0.00010115
30	Yes	4	0.00000001	0.00005547
31	Yes	4	0.00000001	0.00006726
32	Yes	4	0.00000001	0.00008479
33	Yes	4	0.00000001	0.00002316
34	Yes	4	0.00000001	0.00008679
35	Yes	4	0.00000001	0.00007168
36	Yes	4	0.00000001	0.00005237
37	Yes	4	0.00000001	0.00009822
38	Yes	4	0.00000001	0.00006676

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 120	9.86	29	0.640	0.003
L2	120 - 100	8.53	29	0.632	0.003
L3	100 - 80	5.96	29	0.577	0.002

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L4	80 - 60	3.74	29	0.471	0.001
L5	60 - 40	2.01	29	0.346	0.001
L6	40 - 20	0.82	29	0.215	0.000
L7	20 - 0	0.18	29	0.085	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
131.00	4' x 2" Pipe Mount	29	9.86	0.640	0.003	102566
122.00	RRUS 11	29	8.79	0.635	0.003	63493
119.00	(2) 7770.00 w/ Mount Pipe	29	8.39	0.631	0.003	44173
114.00	Side Arm Mount [SO 102-3]	29	7.74	0.622	0.002	27626
110.00	(2) LPA-80063/6CF w/ Mount Pipe	29	7.22	0.612	0.002	21112
68.00	torque arm	29	2.64	0.397	0.001	9029

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 120	28.48	4	1.849	0.009
L2	120 - 100	24.63	4	1.826	0.008
L3	100 - 80	17.23	4	1.665	0.006
L4	80 - 60	10.81	4	1.360	0.003
L5	60 - 40	5.82	4	0.998	0.002
L6	40 - 20	2.38	4	0.620	0.001
L7	20 - 0	0.53	4	0.245	0.000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
131.00	4' x 2" Pipe Mount	4	28.48	1.849	0.009	35768
122.00	RRUS 11	4	25.39	1.833	0.008	22135
119.00	(2) 7770.00 w/ Mount Pipe	4	24.24	1.822	0.008	15379
114.00	Side Arm Mount [SO 102-3]	4	22.34	1.795	0.007	9591
110.00	(2) LPA-80063/6CF w/ Mount Pipe	4	20.85	1.766	0.007	7324
68.00	torque arm	4	7.63	1.146	0.003	3129

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	130 - 120 (1)	P30x3/8	10.00	0.00	0.0	25.07	34.90	-4.34	875.15	0.005
L2	120 - 100 (2)	P36x3/8	20.00	0.00	0.0	23.70	41.97	-11.91	994.51	0.012
L3	100 - 80 (3)	P42x3/8	20.00	0.00	0.0	22.71	49.04	-16.20	1113.69	0.015
L4	80 - 60 (4)	P48x3/8	20.00	0.00	0.0	21.97	56.11	-22.17	1232.77	0.018
L5	60 - 40 (5)	P54x3/8	20.00	0.00	0.0	21.40	63.18	-27.51	1351.78	0.020
L6	40 - 20 (6)	P60x3/8	20.00	0.00	0.0	20.94	70.24	-33.36	1470.73	0.023
L7	20 - 0 (7)	P60x3/4	20.00	0.00	0.0	25.07	139.60	-43.90	3500.58	0.013

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	130 - 120 (1)	P30x3/8	57.93	2.72	25.07	0.109	0.00	0.00	25.07	0.000
L2	120 - 100 (2)	P36x3/8	362.06	11.74	23.70	0.496	0.00	0.00	23.70	0.000
L3	100 - 80 (3)	P42x3/8	782.56	18.57	22.71	0.818	0.00	0.00	22.71	0.000
L4	80 - 60 (4)	P48x3/8	1252.56	22.68	21.97	1.032	0.00	0.00	21.97	0.000
L5	60 - 40 (5)	P54x3/8	1775.41	25.33	21.40	1.184	0.00	0.00	21.40	0.000
L6	40 - 20 (6)	P60x3/8	2341.38	27.00	20.94	1.290	0.00	0.00	20.94	0.000
L7	20 - 0 (7)	P60x3/4	2949.01	17.33	25.07	0.691	0.00	0.00	25.07	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	130 - 120 (1)	P30x3/8	5.88	0.34	16.80	0.020	0.54	0.01	15.64	0.001
L2	120 - 100 (2)	P36x3/8	19.95	0.95	16.80	0.057	2.54	0.04	12.03	0.003
L3	100 - 80 (3)	P42x3/8	22.07	0.90	16.80	0.054	2.53	0.03	10.72	0.003
L4	80 - 60 (4)	P48x3/8	25.03	0.89	16.80	0.053	2.53	0.02	9.70	0.002
L5	60 - 40 (5)	P54x3/8	27.24	0.86	16.80	0.051	2.52	0.02	8.88	0.002
L6	40 - 20 (6)	P60x3/8	29.32	0.83	16.80	0.050	2.51	0.01	8.20	0.002
L7	20 - 0 (7)	P60x3/4	31.41	0.45	16.80	0.027	2.50	0.01	16.80	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	130 - 120 (1)	0.005	0.109	0.000	0.020	0.001	0.114 ✓	1.333	H1-3+VT ✓
L2	120 - 100 (2)	0.012	0.496	0.000	0.057	0.003	0.511 ✓	1.333	H1-3+VT ✓
L3	100 - 80 (3)	0.015	0.818	0.000	0.054	0.003	0.835 ✓	1.333	H1-3+VT ✓
L4	80 - 60 (4)	0.018	1.032	0.000	0.053	0.002	1.053 ✓	1.333	H1-3+VT ✓
L5	60 - 40 (5)	0.020	1.184	0.000	0.051	0.002	1.207 ✓	1.333	H1-3+VT ✓

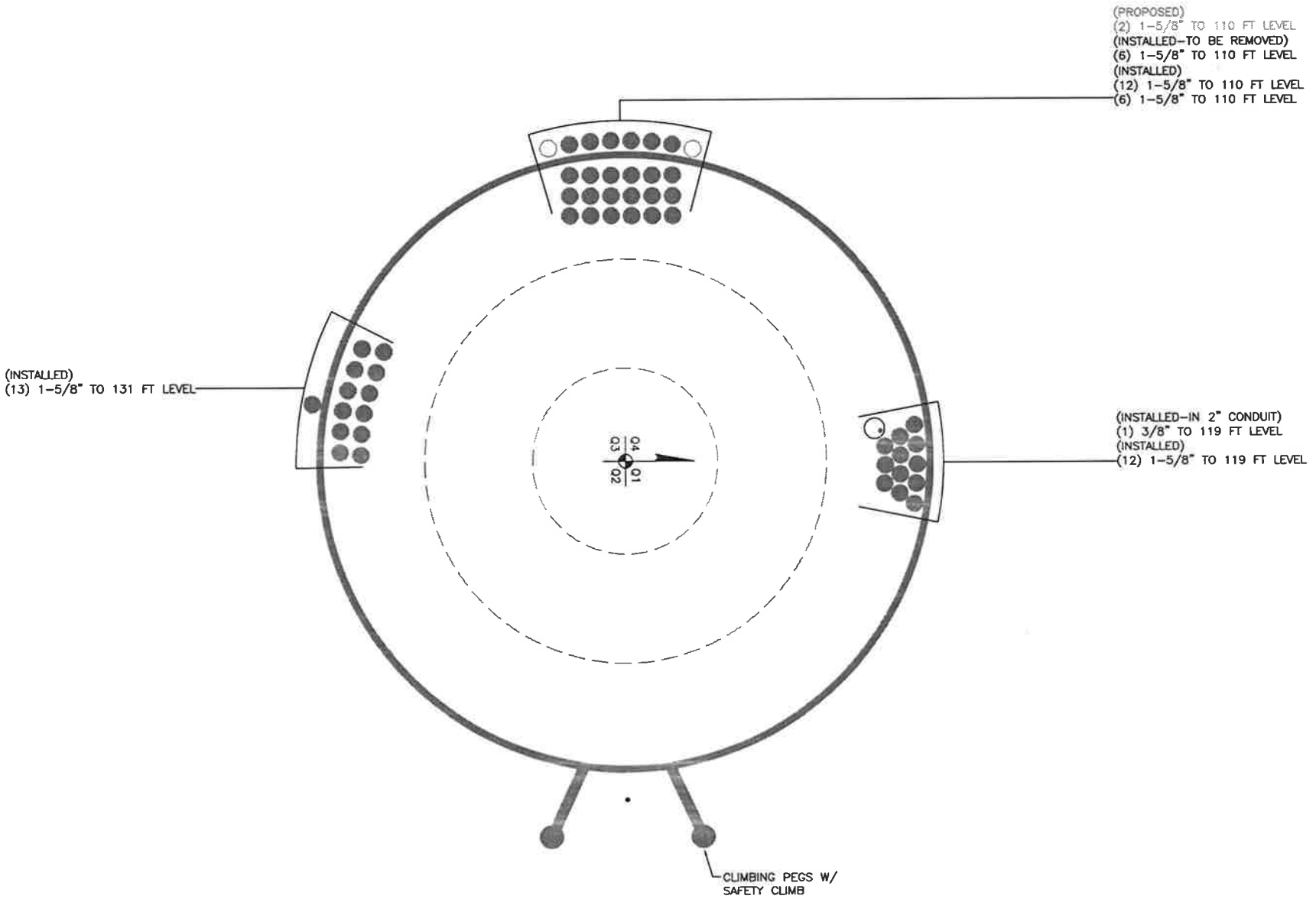
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L6	40 - 20 (6)	0.023	1.290	0.000	0.050	0.002	1.315 ✓	1.333	H1-3+VT ✓
L7	20 - 0 (7)	0.013	0.691	0.000	0.027	0.000	0.704 ✓	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	130 - 120	Pole	P30x3/8	1	-4.34	1166.57	8.6	Pass
L2	120 - 100	Pole	P36x3/8	2	-11.91	1325.68	38.3	Pass
L3	100 - 80	Pole	P42x3/8	3	-16.20	1484.55	62.7	Pass
L4	80 - 60	Pole	P48x3/8	4	-22.17	1643.28	79.0	Pass
L5	60 - 40	Pole	P54x3/8	5	-27.51	1801.92	90.5	Pass
L6	40 - 20	Pole	P60x3/8	6	-33.36	1960.48	98.6	Pass
L7	20 - 0	Pole	P60x3/4	7	-43.90	4666.27	52.8	Pass
							Summary	
						Pole (L6)	98.6	Pass
						RATING =	**98.6**	**Pass**

APPENDIX B

BASE LEVEL DRAWING


(PROPOSED)
(2) 1-5/8" TO 110 FT LEVEL
(INSTALLED-TO BE REMOVED)
(6) 1-5/8" TO 110 FT LEVEL
(INSTALLED)
(12) 1-5/8" TO 110 FT LEVEL
(6) 1-5/8" TO 110 FT LEVEL
(INSTALLED)
(13) 1-5/8" TO 131 FT LEVEL
(INSTALLED-IN 2" CONDUIT)
(1) 3/8" TO 119 FT LEVEL
(INSTALLED)
(12) 1-5/8" TO 119 FT LEVEL
Q4
Q3
Q1
Q2
CLIMBING PEGS W/
SAFETY CLIMB

APPENDIX C

ADDITIONAL CALCULATIONS

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Re

Site Data

BU#: *824359*
Site Name: *Groton- I-95- X89- Noa_1*
App #: *282650 R0*

Pole Manufacturer:	Pirod

Bolt Data			
Qty:	21		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	Bolt Fty:
N/A:		<-- Disregard	44.00
Circle (in.):	33		

Plate Data		
Diam:	36	in
Thick, t:	1.25	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	4.49	in

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

Pole Data		
Diam:	30	in
Thick:	0.375	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	57	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Reactions		
Moment:	57.927171	ft-kips
Axial:	4.3352	kips
Shear:	5.876494	kips
Elevation:	120	feet

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

Flange Bolt Results

Bolt Tension Capacity, B:	46.07 kips
Max Bolt directly applied T:	3.81 Kips
Min. PL "tc" for B cap. w/o Pry:	1.308 in
Min PL "treq" for actual T w/ Pry:	0.283 in
Min PL "t1" for actual T w/o Pry:	0.376 in
T allowable with Prying:	44.73 kips
Prying Force, Q:	0.00 kips
Total Bolt Tension=T+Q:	3.81 kips
Prying Bolt Stress Ratio=(T+Q)/(B):	8.3% Pass

Exterior Flange Plate Results Flexural Check

Compression Side Plate Stress:	Rohn/Pirod, OK
Allowable Plate Stress:	36.0 ksi
Compression Plate Stress Ratio:	Rohn/Pirod, OK

No Prying

Tension Side Stress Ratio, (treq/t)^2: 5.1% Pass

n/a

Stiffener Results	N/A for Rohn / Pirod
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

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Re

Site Data

BU#: *824359*
Site Name: *Groton- I-95- X89- Noa_1*
App #: *282650 R0*

Pole Manufacturer:	Pirod

Bolt Data			
Qty:	25		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	Bolt Fty:
N/A:		<-- Disregard	44.00
Circle (in.):	39		

Plate Data		
Diam:	42	in
Thick, t:	1.25	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	4.52	in

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

Pole Data		
Diam:	36	in
Thick:	0.375	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	57	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Reactions		
Moment:	362.05496	ft-kips
Axial:	11.9077	kips
Shear:	19.951167	kips
Elevation:	100	feet

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

Flange Bolt Results

Bolt Tension Capacity, B:	46.07 kips
Max Bolt directly applied T:	17.35 Kips
Min. PL "tc" for B cap. w/o Pry:	1.303 in
Min PL "treq" for actual T w/ Pry:	0.602 in
Min PL "t1" for actual T w/o Pry:	0.800 in
T allowable with Prying:	44.84 kips
Prying Force, Q:	0.00 kips
Total Bolt Tension=T+Q:	17.35 kips
Prying Bolt Stress Ratio=(T+Q)/(B):	37.7% Pass

Exterior Flange Plate Results	Flexural Check
Compression Side Plate Stress:	Rohn/Pirod, OK
Allowable Plate Stress:	36.0 ksi
Compression Plate Stress Ratio:	Rohn/Pirod, OK
No Prying	
Tension Side Stress Ratio, (treq/t)^2:	23.2% Pass

n/a

Stiffener Results	N/A for Rohn / Pirod
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

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Re

Site Data

BU#: *824359*
Site Name: *Groton- I-95- X89- Noa_1*
App #: *282650 R0*

Pole Manufacturer:	Pirod

Bolt Data			
Qty:	29		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	Bolt Fty:
N/A:		<-- Disregard	44.00
Circle (in.):	45		

Plate Data		
Diam:	48	in
Thick, t:	1.25	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	4.55	in

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

Pole Data		
Diam:	42	in
Thick:	0.375	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	57	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Reactions		
Moment:	782.55551	ft-kips
Axial:	16.1953	kips
Shear:	22.068331	kips
Elevation:	80	feet

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

Flange Bolt Results

Bolt Tension Capacity, B:	46.07 kips
Max Bolt directly applied T:	28.23 Kips
Min. PL "tc" for B cap. w/o Pry:	1.299 in
Min PL "treq" for actual T w/ Pry:	0.765 in
Min PL "t1" for actual T w/o Pry:	1.017 in
T allowable with Prying:	44.92 kips
Prying Force, Q:	0.00 kips
Total Bolt Tension=T+Q:	28.23 kips
Prying Bolt Stress Ratio=(T+Q)/(B):	61.3% Pass

Exterior Flange Plate Results	Flexural Check
Compression Side Plate Stress:	Rohn/Pirod, OK
Allowable Plate Stress:	36.0 ksi
Compression Plate Stress Ratio:	Rohn/Pirod, OK
No Prying	
Tension Side Stress Ratio, (treq/t)^2:	37.5% Pass

n/a

Stiffener Results	N/A for Rohn / Pirod
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

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Re

Site Data

BU#: *824359*
Site Name: *Groton- I-95- X89- Noa_1*
App #: *282650 R0*

Pole Manufacturer:	Pirod

Bolt Data			
Qty:	33		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	Bolt Fty:
N/A:		<-- Disregard	44.00
Circle (in.):	51		

Plate Data		
Diam:	54	in
Thick, t:	1.25	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	4.57	in

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

Pole Data		
Diam:	48	in
Thick:	0.375	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	57	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Reactions		
Moment:	1252.5605	ft-kips
Axial:	22.1687	kips
Shear:	25.026094	kips
Elevation:	60	feet

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

Flange Bolt Results

Bolt Tension Capacity, B:	46.07 kips
Max Bolt directly applied T:	35.05 Kips
Min. PL "tc" for B cap. w/o Pry:	1.296 in
Min PL "treq" for actual T w/ Pry:	0.851 in
Min PL "t1" for actual T w/o Pry:	1.131 in
T allowable with Prying:	44.99 kips
Prying Force, Q:	0.00 kips
Total Bolt Tension=T+Q:	35.05 kips
Prying Bolt Stress Ratio=(T+Q)/(B):	76.1% Pass

Exterior Flange Plate Results	Flexural Check
Compression Side Plate Stress:	Rohn/Pirod, OK
Allowable Plate Stress:	36.0 ksi
Compression Plate Stress Ratio:	Rohn/Pirod, OK
No Prying	
Tension Side Stress Ratio, (treq/t)^2:	46.3% Pass

n/a

Stiffener Results	N/A for Rohn / Pirod
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

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Re

Site Data

BU#: *824359*
Site Name: *Groton- I-95- X89- Noa_1*
App #: *282650 R0*

Pole Manufacturer:	Pirod

Bolt Data			
Qty:	45		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	Bolt Fty:
N/A:		<-- Disregard	44.00
Circle (in.):	57		

Plate Data		
Diam:	60	in
Thick, t:	1.25	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	3.77	in

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

Pole Data		
Diam:	54	in
Thick:	0.375	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	57	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Reactions		
Moment:	1775.4081	ft-kips
Axial:	27.5118	kips
Shear:	27.24251	kips
Elevation:	40	feet

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

Flange Bolt Results

Bolt Tension Capacity, B:	46.07 kips
Max Bolt directly applied T:	32.61 Kips
Min. PL "tc" for B cap. w/o Pry:	1.427 in
Min PL "treq" for actual T w/ Pry:	0.916 in
Min PL "t1" for actual T w/o Pry:	1.201 in
T allowable with Prying:	42.49 kips
Prying Force, Q:	0.00 kips
Total Bolt Tension=T+Q:	32.61 kips
Prying Bolt Stress Ratio=(T+Q)/(B):	70.8% Pass

Exterior Flange Plate Results	Flexural Check
Compression Side Plate Stress:	Rohn/Pirod, OK
Allowable Plate Stress:	36.0 ksi
Compression Plate Stress Ratio:	Rohn/Pirod, OK
No Prying	
Tension Side Stress Ratio, (treq/t)^2:	53.7% Pass

n/a

Stiffener Results	N/A for Rohn / Pirod
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

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Re

Site Data

BU#: *824359*
Site Name: *Groton- I-95- X89- Noa_1*
App #: *282650 R0*

Pole Manufacturer:	Pirod

Reactions		
Moment:	2341.3782	ft-kips
Axial:	33.3728	kips
Shear:	29.310537	kips
Elevation:	20	feet

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

Bolt Data

Qty:	64		
Diameter (in.):	1.25	Bolt Fu:	105
Bolt Material:	A325	Bolt Fy:	81
N/A:		<-- Disregard	Bolt Fty:
N/A:		<-- Disregard	44.00
Circle (in.):	63		

Flange Bolt Results

Bolt Tension Capacity, B:	71.98 kips
Max Bolt directly applied T:	27.35 Kips
Min. PL "tc" for B cap. w/o Pry:	1.888 in
Min PL "treq" for actual T w/ Pry:	0.934 in
Min PL "t1" for actual T w/o Pry:	1.164 in
T allowable with Prying:	49.04 kips
Prying Force, Q:	0.00 kips
Total Bolt Tension=T+Q:	27.35 kips
Prying Bolt Stress Ratio=(T+Q)/(B):	38.0% Pass

Plate Data

Diam:	66	in
Thick, t:	1.25	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	2.95	in

Exterior Flange Plate Results Flexural Check

Compression Side Plate Stress:	Rohn/Pirod, OK
Allowable Plate Stress:	36.0 ksi
Compression Plate Stress Ratio:	Rohn/Pirod, OK

No Prying

Tension Side Stress Ratio, (treq/t)^2: 55.8% Pass

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 N/A for Rohn / Pirod

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:	60	in
Thick:	0.375	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	57	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

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

TIA Rev F

Site Data

BU#: *824359*
Site Name: *Groton- I-95- X89- Noa_1*
App #: *282650 R0*

Pole Manufacturer:	*Pirod*

Reactions		
Moment:	2949.005	ft-kips
Axial:	43.897	kips
Shear:	31.408535	kips

Anchor Rod Data		
Qty:	52	
Diam:	1.25	in
Rod Material:	Other	
Strength (Fu):	150	ksi
Yield (Fy):	105	ksi
Bolt Circle:	67	in

Plate Data		
Diam:	70	in
Thick:	1.25	in
Grade:	36	ksi
Single-Rod B-eff:	3.62	in

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

Pole Data		
Diam:	60	in
Thick:	0.75	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	57	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

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

Anchor Rod Results

		Rigid
Maximum Rod Tension:	39.8 Kips	Service, ASD
Allowable Tension:	81.0 Kips	Fty*ASIF
Anchor Rod Stress Ratio:	49.1% Pass	

Base Plate Results

		Rigid
Base Plate Stress:	Flexural Check	Service ASD
Allowable Plate Stress:	Rohn/Pirod, OK	0.75*Fy*ASIF
Base Plate Stress Ratio:	36.0 ksi	Y.L. Length:
	Rohn/Pirod, OK	29.82

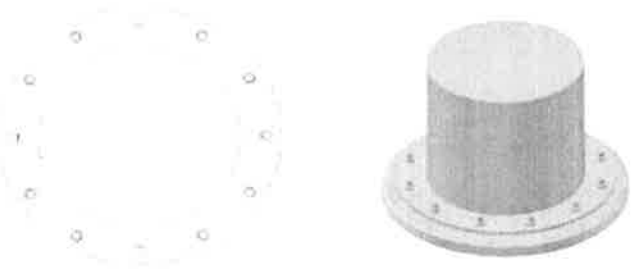
n/a

Stiffener Results N/A for Rohn / Pirod

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

BU#: *824359*
Site Name: *Groton- I-95- X89- Noa_1*
App #: *????*

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:	6.6	ft
Pad Thickness, T:	2.3	ft
Pad Width=Length, L:	20.7	ft
Pier Cross Section Shape:	Square	<--Pull Down
Enter Pier Side Width:	7	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	49.00	ft^2
Pier Height:	4.80	ft
Soil (above pad) Height:	4.30	ft

Soil Parameters		
Unit Weight, γ:	130.0	pcf
Ultimate Bearing Capacity, qn:	32.00	ksf
Strength Reduct. factor, ϕ:	0.75	
Angle of Friction, Φ:	34.0	degrees
Undrained Shear Strength, Cu:	0.00	ksf
Allowable Bearing: ϕ*qn:	24.00	ksf
Passive Pres. Coeff., Kp	3.54	

Forces/Moments due to Wind and Lateral Soil		
Minimum of (φ*Ultimate Pad Passive Force, Vu):	42.4	kips
Pad Force Location Above D:	1.07	ft
ϕ(Passive Pressure Moment):	45.33	ft-kips
Factored O.T. M(WL), "1.6W":	4282.2	ft-kips
Factored OT (MW-Msoil), M1	4236.88	ft-kips

Resistance due to Foundation Gravity		
Soil Wedge Projection grade, a:	2.90	ft
Sum of Soil Wedges Wt:	49.42	kips
Soil Wedges ecc, K1:	5.32	ft
Ftg+Soil above Pad wt:	395.2	kips
Unfactored (Total ftg-soil Wt):	444.66	kips
1.2D. **No Soil Wedges.**	526.97	kips
0.9D. **With Soil Wedges**	439.70	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:	43.897	kips
Unfactored WL Axial, PW:	0	kips
Unfactored WL Shear, V:	31.40854	kips
Unfactored WL Moment, M:	2949.005	ft-kips

Load Factor	Shaft Factored Loads		
1.20	1.2D+1.6W, Pu:	52.6764	kips
0.90	0.9D+1.6W, Pu:	39.5073	kips
1.35	Vu:	42.40152	kips
	Mu:	3981.157	ft-kips

1.2D+1.6W Load Combination, Bearing Results:

(No Soil Wedges) [Reaction+Conc+Soil]	526.97	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	4236.88	ft-kips

Orthogonal Direction:

ecc1 = M1/P1 =	8.04	ft
Orthogonal qu=	5.51	ksf
qu/ϕ*qn Ratio=	**22.96%**	Pass

Diagonal Direction:

ecc2 = (0.707M1)/P1 =	5.68	ft
Diagonal qu=	6.05	ksf
qu/ϕ*qn Ratio=	**25.22%**	Pass

Run <-- Press Upon Completing All Input

Overturning Stability Check

0.9D+1.6W Load Combination, Bearing Results:

(w/ Soil Wedges) [Reaction+Conc+Soil]	439.70	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	4000.45	ft-kips

Orthogonal ecc3 = M2/P2 =	9.10	ft
Ortho Non Bearing Length,NBL=	18.20	ft
Orthogonal qu=	8.48	ksf
Diagonal qu=	7.17	ksf

Max Reaction Moment (ft-kips) so that qu=φ*qn = 100% Capacity Rating			
Actual M:	2949.00		
M Orthogonal:	3214.04	**91.75%**	Pass
M Diagonal:	3214.04	**91.75%**	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#: *824359*
Site Name: *Groton- I-95- X89- Noa_1*
App #: *282650 R0*

Maximum Shaft Superimposed Forces		
TIA Revision:	F	
Max. Service Shaft M:	3099.766	ft-kips **(* Note)**
Max. Service Shaft P:	43.897	kips
Max Axial Force Type:	Comp.	

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

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

Load Factor	Shaft Factored Loads		
1.30	Mu:	4029.696	ft-kips
1.30	Pu:	57.0661	kips

Pier Properties		
Concrete:		
Pier Diameter =	7.0	ft
Concrete Area =	5541.8	in^2
Reinforcement:		
Clear Cover to **Tie**=	3.00	in
Horiz. **Tie** Bar Size=	4	
Vert. Cage Diameter =	6.32	ft
Vert. Cage Diameter =	75.87	in
Vertical Bar Size =	9	
Bar Diameter =	1.13	in
Bar Area =	1	in^2
Number of Bars =	40	
As Total=	40	in^2
A s/ Aconc, Rho:	0.0072	0.72%

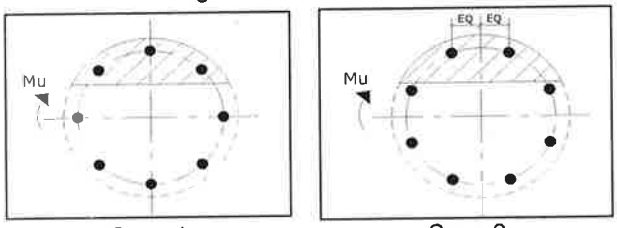
Material Properties		
Concrete Comp. strength, f'c =	3000	psi
Reinforcement yield strength, Fy =	60	ksi
Reinforcing Modulus of Elasticity, E =	29000	ksi
Reinforcement yield strain =	0.00207	
Limiting compressive strain =	0.003	
ACI 318 Code		
Select Analysis ACI Code=	2002	
Seismic Properties		
Seismic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

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

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

Results:

Governing Orientation Case: **2**



Case 1 Case 2

Dist. From Edge to Neutral Axis: **14.95** in
Extreme Steel Strain, εt: **0.0130**
εt > 0.0050, Tension Controlled
Reduction Factor,φ: **0.900**

Minimum Rho Check:
Actual Req'd Min. Rho: 0.33% Flexural
Provided Rho: 0.72% OK

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn.		
Pn per ACI 318 (10-2)	8543.35	kips
at Mu=(ϕ=0.65)Mn=	5212.45	ft-kips
Max Tu, (φ=0.9) Tn =	2160	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Output Note: Negative Pu=Tension
For Axial Compression, φ Pn = Pu: 57.07 kips
Drilled Shaft Moment Capacity, φMn: **6281.07** ft-kips
Drilled Shaft Superimposed Mu: **4029.70** ft-kips

(Mu/φMn, Drilled Shaft Flexure CSR:	64.2%