ROBINSON & COLE LLP

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

EM-VER-155-130322

March 20, 2013

Linda Roberts
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Antenna Swap**
1358 New Britain Avenue (a/k/a 7 Berkshire Road), West Hartford, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 105-foot level on the existing 130-foot tower at the above-referenced address. The tower is owned by Crown. The Council approved Cellco's shared use of this tower in 1998. Cellco now intends to replace six (6) of its antennas with three (3) model BXA-80063-4CF cellular antennas and three (3) model BXA-171063-12CF AWS antennas, at the same level on the tower. Cellco also intends to install six (6) remote radio heads ("RRHs") behind its antennas and one (1) HYBRIFLEX™ fiber cable on the outside of the tower. Attached behind Tab 1 are the specifications for the replacement antennas, RRHs and HYBRIFLEX™ cable.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Ronald Van Winkle, Town Manager for the Town of West Hartford. A copy of this letter is also being sent to West Hartford Methodist Church, the owner of the property on which the tower is located.

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

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's replacement antennas and RRHs will be located at the 105-foot level of the 130-foot tower.

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

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

4. The operation of the modified facility will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A cumulative General Power Density table for Cellco's modified facility is included behind Tab 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 attached behind Tab 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:
Ronald Van Winkle, Town Manager
West Hartford Methodist Church
Sandy M. Carter

Amphenol ANTENNA SOLUTIONS

BXA-80063-4CF-EDIN-X

X-Pol | FET Panel | 63° | 13.0 dBd

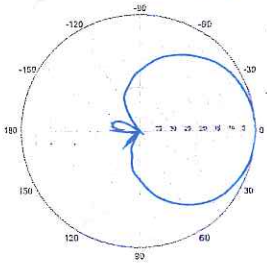
Replace "X" with desired electrical downtilt.

Antenna is also available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

Electrical Characteristics		
Frequency bands	806-900 MHz*	
*Optional frequency band for iDEN	806-941 MHz (specify when ordering)	
Polarization	±45°	
Horizontal beamwidth	63°	
Vertical beamwidth	15°	
Gain	13.0 dBd (15.1 dBi)	
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 9, 10, 12, 14	
Impedance	50Ω	
VSWR	≤1.4:1	
Upper sidelobe suppression (0°)	-22.1 dB	
Front-to-back ratio (+/-30°)	-34.9 dB	
Null fill	5% (-26.02 dB)	
Isolation between ports	< -30 dB	
Input power with EDIN connectors	500 W	
Input power with NE connectors	300 W	
Lightning protection	Direct Ground	
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)	
Mechanical Characteristics		
Dimensions Length x Width x Depth	1205 x 285 x 133 mm	47.4 x 11.2 x 5.2 in
Depth with z-brackets	173 mm	6.8 in
Weight without mounting brackets	4.5 kg	9.9 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.34 m^2 Side: 0.16 m^2	Front: 3.7 ft^2 Side: 1.7 ft^2
Wind load @ 161 km/hr (100 mph)	Front: 498 N Side: 260 N	Front: 111 lbf Side: 55 lbf

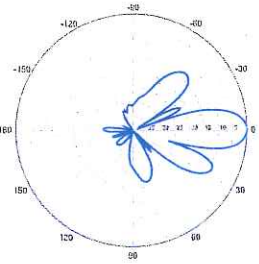
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting & Downtilt Bracket Kit	36210006	40-115 mm 1.57-4.5 in	4.1 kg 9 lbs
Concealment Configurations	For concealment configurations, order BXA-80063-4CF-EDIN-X-FP		

BXA-80063-4CF-EDIN-X



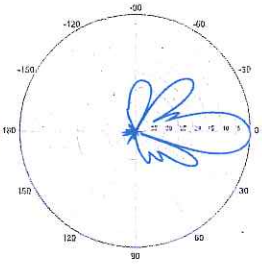
Horizontal

BXA-80063-4CF-EDIN-0



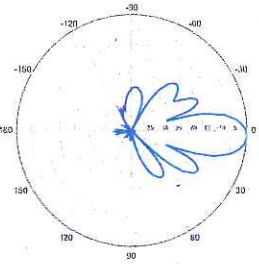
0° | Vertical

BXA-80063-4CF-EDIN-2



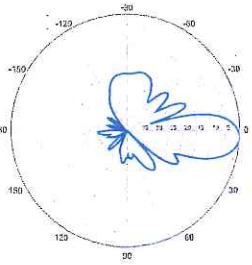
2° | Vertical

BXA-80063-4CF-EDIN-3



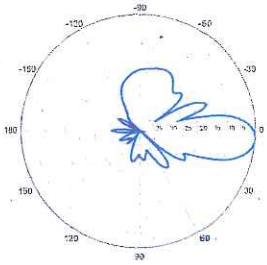
3° | Vertical

BXA-80063-4CF-EDIN-4



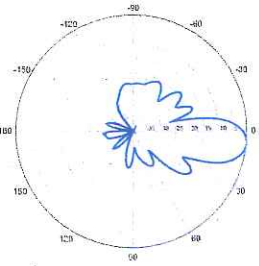
4° | Vertical

BXA-80063-4CF-EDIN-5



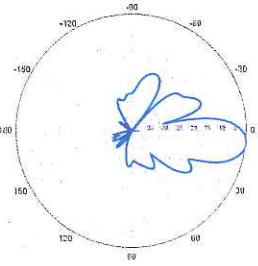
5° | Vertical

BXA-80063-4CF-EDIN-6



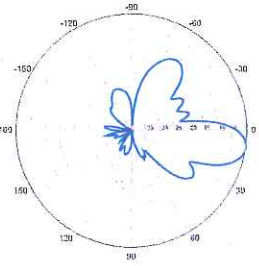
6° | Vertical

BXA-80063-4CF-EDIN-8



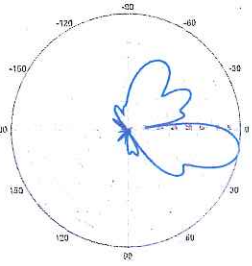
8° | Vertical

BXA-80063-4CF-EDIN-9



9° | Vertical

BXA-80063-4CF-EDIN-10

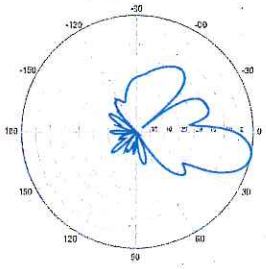


10° | Vertical

BXA-80063-4CF-EDIN-X

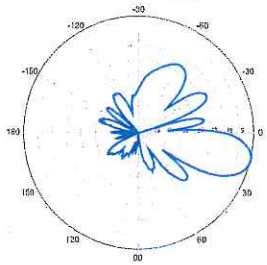
X-Pol | FET Panel | 63° | 13.0 dBd

BXA-80063-4CF-EDIN-12



12° | Vertical

BXA-80063-4CF-EDIN-14



14° | Vertical

Amphenol ANTENNA SOLUTIONS

BXA-171063-12CF-EDIN-X

X-Pol | FET Panel | 63° | 19.0 dBi

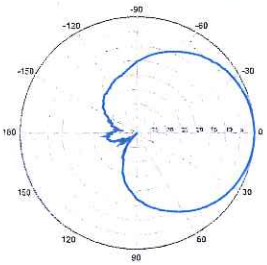
Replace "X" with desired electrical downtilt.

Antenna is also available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	68°	65°	60°
Vertical beamwidth	4.5°	4.5°	4.5°
Gain	16.1 dBd / 18.2 dBi	16.5 dBd / 18.6 dBi	16.9 dBd / 19.0 dBi
Electrical downtilt (X)	0, 2, 5		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back ratio	> 30 dB		
In-band isolation	> 28 dB		
IM3 (20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)		
Operating temperature	-40° to +60° C / -40° to +140° F		
Mechanical Characteristics			
Dimensions Length x Width x Depth	1842 x 154 x 105 mm		72.5 x 6.1 x 4.1 in
Depth with z-brackets	133 mm		5.2 in
Weight without mounting brackets	5.8 kg		12.8 lbs
Survival wind speed	> 201 km/hr		> 125 mph
Wind area	Front: 0.28 m² Side: 0.19 m²		Front: 3.1 ft² Side: 2.1 ft²
Wind load @ 161 km/hr (100 mph)	Front: 460 N Side: 304 N		Front: 103 lbf Side: 68 lbf

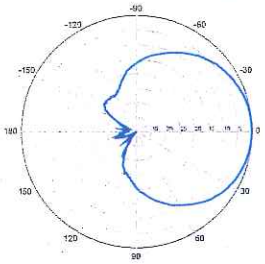
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-12CF-EDIN-X-FP		

BXA-171063-12CF-EDIN-X



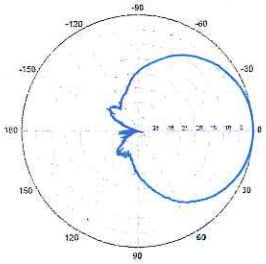
Horizontal | 1710-1880 MHz

BXA-171063-12CF-EDIN-X



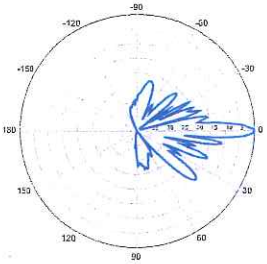
Horizontal | 1850-1990 MHz

BXA-171063-12CF-EDIN-X



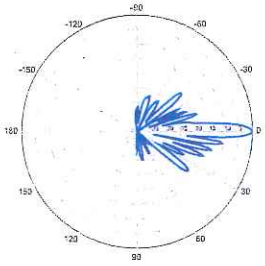
Horizontal | 1920-2170 MHz

BXA-171063-12CF-EDIN-0



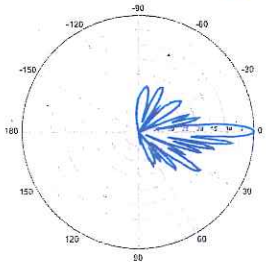
0° | Vertical | 1710-1880 MHz

BXA-171063-12CF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-12CF-EDIN-0

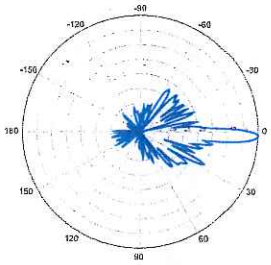


0° | Vertical | 1920-2170 MHz

BXA-171063-12CF-EDIN-X

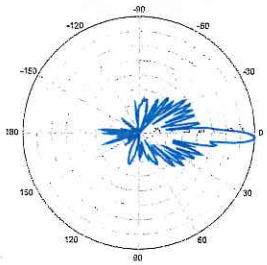
X-Pol | FET Panel | 63° | 19.0 dBi

BXA-171063-12CF-EDIN-2



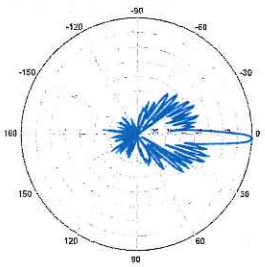
2° | Vertical | 1710-1880 MHz

BXA-171063-12CF-EDIN-2



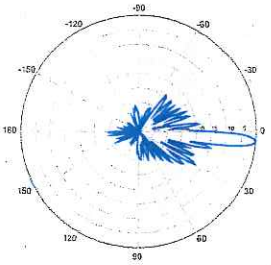
2° | Vertical | 1850-1990 MHz

BXA-171063-12CF-EDIN-2



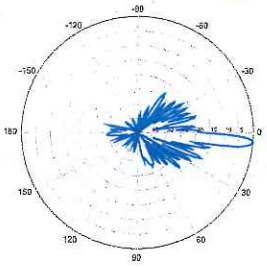
2° | Vertical | 1920-2170 MHz

BXA-171063-12CF-EDIN-5



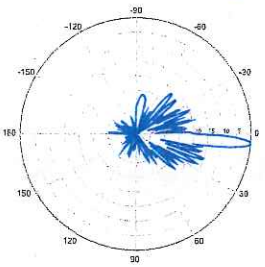
5° | Vertical | 1710-1880 MHz

BXA-171063-12CF-EDIN-5



5° | Vertical | 1850-1990 MHz

BXA-171063-12CF-EDIN-5

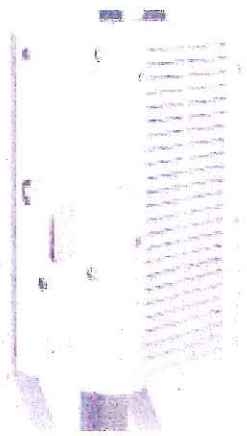


5° | Vertical | 1920-2170 MHz

Alcatel-Lucent RRH2x40-07-U

REMOTE RADIO HEAD

The Alcatel-Lucent RRH2x40-07-U is a high-power, small form-factor Remote Radio Head (RRH) operating in the North American Digital Dividend / 700MHz frequency band (3GPP Band 13). The Alcatel-Lucent RRH2x40-07-U is designed with an eco-efficient approach, providing operators with the means to achieve high quality and capacity coverage with minimum site requirements.



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

The Alcatel-Lucent RRH2x40-07-U is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information. The Alcatel-Lucent RRH2x40-07-U has two transmit RF paths, 40 W RF output power per transmit path, and is designed to manage up to two-way receive diversity. The device is ideally suited to support macro coverage, with multiple-input multiple-output (MIMO) 2x2 operation in up to 10 MHz of bandwidth.

The Alcatel-Lucent RRH2x40-07-U is designed to make available all the benefits of a distributed eNodeB, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX). The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment or require costly cranes to be employed, leaving coverage holes. However, many of these sites can host an Alcatel-Lucent RRH2x40-07-U installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

Fast, low-cost installation and deployment

The Alcatel-Lucent RRH2x40-07-U is a zero-footprint solution and operates noise-free, simplifying negotiations with site property owners and minimizing environmental impacts. Installation can easily be done by a single person because the Alcatel-Lucent RRH2x40-07-U is compact and weights less than 23 kg (50 lb), eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day — a fraction of the time required for a traditional BTS.

Excellent RF performance

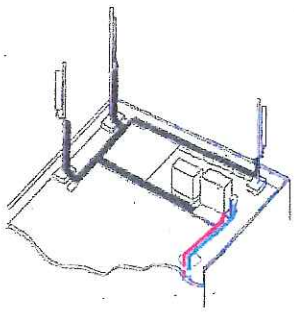
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation costs are reduced or eliminated, and there is no need for a Tower Mounted Amplifier (TMA) because losses introduced by the RF feeder are greatly reduced. The Alcatel-Lucent RRH2x40-07-U provides more RF power while at the same time consuming less electricity.

Features

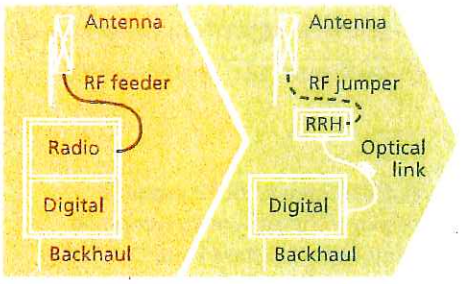
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

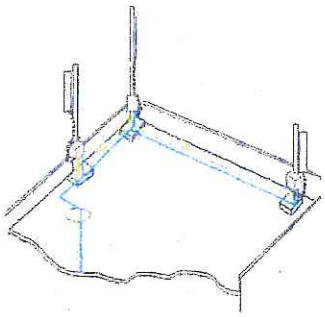
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility to network planning



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

- Height: 390 mm (15.4 in.)
- Width: 380 mm (15 in.)
- Depth: 210 mm (8.2 in.)
- Weight (without mounting kit): less than 23 kg (50 lb)

Power

- Power supply: -48V

Operating environment

- Outdoor temperature range:
  - ¬ With solar load: -40°C to +50°C (-40°F to +122°F)
  - ¬ Without solar load: -40°C to +55°C (-40°F to +131°F)
- Passive convection cooling (no fans)
- Enclosure protection
  - ¬ IP65 (International Protection rating)

RF characteristics

- Frequency band: 700 MHz; 3GPP Band 13
- Bandwidth: up to 10 MHz
- RF output power at antenna port:
  - ¬ 40 W nominal RF power for each Tx port
- Rx diversity: 2-way or 4-way
- Noise figure: below 2.5 dB typical
- ALD features
  - ¬ TMA
  - ¬ Remote electrical tilt (RET) support (AISG v2.0)

Optical characteristics

Type/number of fibers

- Up to 3.12 Gb/s line bit rate
- Single-mode variant
  - ¬ One SM fiber (9/125 µm) per RRH2x, carrying UL and DL using CWDM (at 1550/1310 nm)
- Multi-mode variant
  - ¬ Two MM fibers (50/125 µm) per RRH2x: one carrying UL, the other carrying DL (at 850 nm)

Optical fiber length

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

Alarms and ports

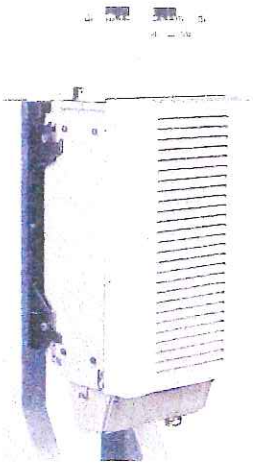
- Six external alarms
- Two optical ports to support daisy-chaining

Alcatel·Lucent

Alcatel-Lucent RRH2x40-AWS

REMOTE RADIO HEAD

The Alcatel-Lucent RRH2x40-AWS is a high-power, small form-factor Remote Radio Head (RRH) operating in the AWS frequency band (1700/2100MHz - 3GPP Band 4). The Alcatel-Lucent RRH2x40-AWS is designed with an eco-efficient approach, providing operators with the means to achieve high quality and capacity coverage with minimum site requirements.



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

The Alcatel-Lucent RRH2x40-AWS is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information. The Alcatel-Lucent RRH2x40-AWS has two transmit RF paths, 40 W RF output power per transmit path, and is designed to manage up to four-way receive diversity. The device is ideally suited to support macro coverage, with multiple-input multiple-output (MIMO) 2x2 operation in up to 20 MHz of bandwidth.

The Alcatel-Lucent RRH2x40-AWS is designed to make available all the benefits of a distributed eNodeB, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX). The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment or require costly cranes to be employed, leaving coverage holes. However, many of these sites can host an Alcatel-Lucent RRH2x40-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

Fast, low-cost installation and deployment

The Alcatel-Lucent RRH2x40-AWS is a zero-footprint solution and operates noise-free, simplifying negotiations with site property owners and minimizing environmental impacts. Installation can easily be done by a single person because the Alcatel-Lucent RRH2x40-AWS is compact and weighs less than 20 kg (44 lb), eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day — a fraction of the time required for a traditional BTS.

Excellent RF performance

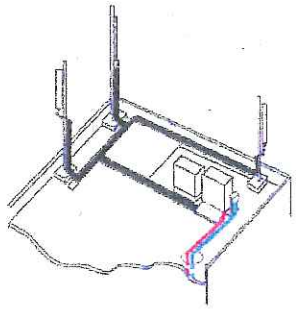
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation costs are reduced or eliminated, and there is no need for a Tower Mounted Amplifier (TMA) because losses introduced by the RF feeder are greatly reduced. The Alcatel-Lucent RRH2x40-AWS provides more RF power while at the same time consuming less electricity.

Features

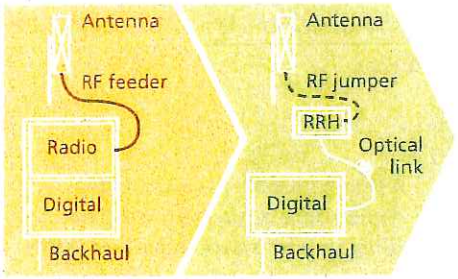
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

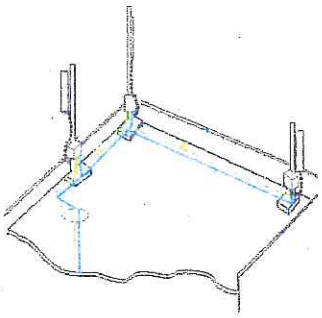
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility to network planning



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

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

Power

- Power supply: -48VDC

Operating environment

- Outdoor temperature range:
  - With solar load: -40°C to +50°C (-40°F to +122°F)
  - Without solar load: -40°C to +55°C (-40°F to +131°F)
- Passive convection cooling (no fans)
- Enclosure protection
  - IP65 (International Protection rating)

RF characteristics

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

Optical characteristics

Type/number of fibers

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

Optical fiber length

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

Digital Ports and Alarms

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

CPG2809100912 (09)

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.

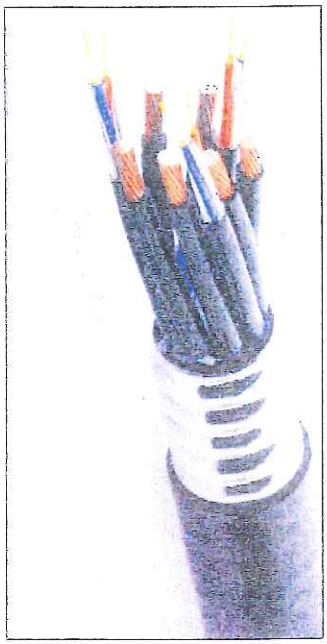


Figure 1: HYBRIFLEX Series

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

Structure			
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 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
Environment			
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

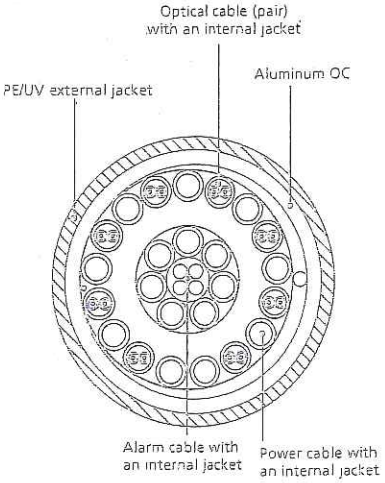


Figure 2: Construction Detail

* This data is provisional and subject to change

	General	Power	Density					
Site Name: Corbins Corner (West Hartford)								
Tower Height: Verizon @ 105ft								
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE	Total
*Nextel	9	100	116	0.0240	851	0.5673	4.24%	
*Clearwire	2	153	125	0.0070	2496	1.0000	0.70%	
*Clearwire	1	211	125	0.0049	23 GHz	1.0000	0.49%	
*AT&T	4	275	95	0.0438	1900	1.0000	4.38%	
*Sprint CDMA/LTE	3	693	116	0.0556	1900	1.0000	5.56%	
*Sprint CDMA/LTE	1	390	116	0.0104	850	0.5667	1.84%	
*MetroPCS CDMA	3	727	96	0.0851	2135	1.0000	8.51%	
*MetroPCS LTE	1	1200	96	0.0468	2130	1.0000	4.68%	
*VoiceStream	4	288	85	0.0573	1930	1.0000	5.73%	
Verizon PCS	**11**	**264**	**105**	**0.0947**	**1970**	**1.0000**	**9.47%**	
Verizon Cellular	**9**	**266**	**105**	**0.0781**	**869**	**0.5793**	**13.48%**	
Verizon AWS	**1**	**1750**	**105**	**0.0571**	**2145**	**1.0000**	**5.71%**	
Verizon 700	**1**	**1050**	**105**	**0.0342**	**698**	**0.4653**	**7.36%**	
								72.15%
* Source: Siting Council								

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215-3708

Date: **January 14, 2013**

Cheryl Schultz
Crown Castle USA Inc.
3530 Toringdon Way, Suite 300
Charlotte, NC 28277

Paul J Ford and Company
250 E. Broad Street Suite 1500
Columbus, OH 43215
614.221.6679
jwoolley@pjfweb.com

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Number:	N/A
	Carrier Site Name:	Corbins Corner, CT
Crown Castle Designation:	**Crown Castle BU Number:**	876324
	Crown Castle Site Name:	WEST HARTFORD UNITED METHODIST
	Crown Castle JDE Job Number:	212901
	Crown Castle Work Order Number:	567286
	Crown Castle Application Number:	172291 Rev. 10
Engineering Firm Designation:	**Paul J Ford and Company Project Number:**	37513-0205
Site Data:	**1358 New Britain Avenue, WEST HARTFORD, Hartford County, CT**	
	Latitude *41° 43' 50.37"*, Longitude *-72° 45' 13.17"*	
	130 Foot - Monopole Tower	

Dear Cheryl Schultz,

Paul J Ford and Company 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 515460, in accordance with application 172291, revision 10.

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

LC7: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The structural analysis was performed for this tower in accordance with the requirements the 2005 Connecticut State Building Code 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.

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

Respectfully submitted by:

John J. Woolley, E.I.T.
Structural Engineer

STATE OF CONNECTICUT
ZACHICARAH JACOBS
No. PEN 22731
LICENSED PROFESSIONAL ENGINEER

tnxTower Report - version 6.0.3.0

JAN 16 2013

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 130 ft Monopole tower designed by ROHN in January of 1997. The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-E.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements the 2005 Connecticut State Building Code 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
105.0	105.0	3	alcatel lucent	RRH 2x40-700 W/SOLAR	1	1-5/8	-
		3	alcatel lucent	RRH2x40-AWS			
		3	antel	BXA-171063-12CF-EDIN-2 w/ Mount Pipe			
		3	antel	BXA-80063-4CF-EDIN-2 w/ Mount Pipe			
		1	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
127.0	127.0	3	argus technologies	LLPX310R w/ Mount Pipe	3 3 3	5/16 1/4 1/2	1
		3	dragonwave	A-ANT-18G-2-C			
		3	dragonwave	HORIZON COMPACT			
		3	samsung telecommunications	WIMAX DAP HEAD			
		1	tower mounts	Side Arm Mount [SO 102-3]			
116.0	116.0	3	rfs celwave	APXVSPP18-C-A20 w/ Mount Pipe	3	1-1/4	2
		1	tower mounts	Platform Mount [LP 404-1]	-	-	1
114.0	114.0	3	alcatel lucent	800MHz 2X50W RRH W/FILTER	-	-	2
		3	alcatel lucent	PCS 1900MHz 4x45W-65MHz			
		1	tower mounts	Side Arm Mount [SO 102-3]			
105.0	105.0	3	antel	BXA-70063/4CF w/ Mount Pipe	12	7/8	1
		6	antel	LPA-80063/4CF w/ Mount Pipe	-	-	3
		6	rfs celwave	FD9R6004/2C-3L			
		3	rymsa wireless	MG D3-800Tx w/ Mount Pipe	-	-	1
		1	tower mounts	Platform Mount [LP 404-1]			
96.0	96.0	3	rfs celwave	APX18-206517-CT2 w/ Mount Pipe	6	1-5/8	1
		1	tower mounts	Pipe Mount [PM 601-3]			
60.0	60.0	2	kathrein	OG-860/1920/GPS-A	2	1/2	1
		2	tower mounts	Side Arm Mount [SO 701-1]			
50.0	50.0	1	lucent	KS24019-L112A	1	1/2	1
		1	tower mounts	Side Arm Mount [SO 701-1]			

Notes:
1) Existing Equipment
2) Reserved Equipment
3) Equipment To Be Removed

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	SEA Consultants, 12/4/1996	1529734	CCISITES
4-POST-MODIFICATION INSPECTION	Vertical Solutions, 080497.15, 11/25/2008	2364340	CCISITES
4-POST-MODIFICATION INSPECTION	Sabre, 11-05047, 11/3/2010	2745780	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Rohn, 34738SW, 1/13/1997	1615437	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Roh, 34738SW, 1/13/1997	1771422	CCISITES

3.1) Analysis Method

tnxTower (version 6.0.3.0), 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) Monopole has been reinforced in conformance with the referenced modification drawings.
5) The Vertical Solutions bridge stiffener system is ineffective and has been ignored.
6) The capacity of the Sabre shaft reinforcement spliced to the anchor rod bracket is limited by the splice welds. The shaft reinforcement has been downgraded to account for the capacity of the splice welds.
7) The Post-Modification Inspection as-built drawings completed by Sabre for the 2010 modifications contain different extension pipe thicknesses (.1875" and .375"). This analysis has assumed .375" since it is the more commonly used plate thickness for extensions.
8) The existing top plate at 120' flange has been estimated as .75" thick from pictures on CCISITES. The grade has been assumed as A36 (36 ksi).

This analysis may be affected if any assumptions are not valid or have been made in error. Paul J Ford and Company should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 4 - 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	P16x.375	1	-0.99	618.35	5.5	Pass
L2	120 - 90	Pole	P24x1/4	2	-8.49	589.19	88.4	Pass
L3	90 - 73.7	Pole	P24x3/8	3	-10.44	934.94	92.4	Pass
L4	73.7 - 60	Pole	RPS 24" x 0.59485"	4	-12.85	1442.33	85.3	Pass
L5	60 - 41.75	Pole	RPS 30" x 0.54289"	5	-17.41	1526.12	91.0	Pass
L6	41.75 - 30	Pole	RPS 30" x 0.70222"	6	-20.32	1822.21	92.5	Pass
L7	30 - 20.75	Pole	RPS 36" x 0.55688"	7	-23.31	1778.92	88.9	Pass
L8	20.75 - 0	Pole	RPS 36" x 0.69004"	8	-29.28	2196.01	93.5	Pass
							Summary	
						Pole (L8)	93.5	Pass
						RATING =	**93.5**	**Pass**

Table 5 - Tower Component Stresses vs. Capacity

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	83.4	Pass
1	Base Plate	0	83.5	Pass
1	Base Foundation Structural Steel	0	88.0	Pass
1, 2	Base Foundation Soil Interaction	0	34.9	Pass
1	Flange Connection	30	84.1	Pass
1	Flange Connection	60	84.5	Pass
1	Flange Connection	90	59.8	Pass
1	Flange Connection	120	30.3	Pass

Structure Rating (max from all components) =	**93.5%**

Notes:

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

2) Foundation Analysis Notes: According to the procedures prescribed and agreed to by the Crown Castle Engineering Foundation Committee, held in January 2010, the existing caisson foundation was analyzed using the methodology in the software 'PLS-Caisson' (Version 8.10, or newer, by Power Line Systems, Inc.). Per the methods in PLS-Caisson, the soil reactions of cohesive soils are calculated using 8CD independent of the depth of the soil layer. The depth of soil to be ignored at the top of the caisson is the greater of the geotechnical report's recommendation, the frost depth of the site or half of the caisson diameter.

APPENDIX A

TNXTOWER OUTPUT

Tower Input Data

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

1) Tower is located in Hartford County, Connecticut.
2) Basic wind speed of 80 mph.
3) Nominal ice thickness of 1.0000 in.
4) Ice density of 56 pcf.
5) A wind speed of 38 mph is used in combination with ice.
6) Temperature drop of 50 °F.
7) Deflections calculated using a wind speed of 50 mph.
8) A non-linear (P-delta) analysis was used.
9) Pressures are calculated at each section.
10) Stress ratio used in pole design is 1.333.
11) Local bending stresses due to climbing loads, feedline 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		

Pole Section Geometry

Section	Elevation ft	Section Length ft	Pole Size	Pole Grade	Socket Length ft
L1	130.00-120.00	10.00	P16x.375	A53-B-42 (42 ksi)	5.00
L2	115.00-85.00	30.00	P24x1/4	A53-B-42 (42 ksi)	5.00
L3	85.00-68.70	16.30	P24x3/8	A53-B-42 (42 ksi)	5.00
L4	68.70-55.00	13.70	RPS 24" x 0.59485"	Reinf 41.23 ksi (41 ksi)	5.00
L5	55.00-36.75	18.25	RPS 30" x 0.54289"	Reinf 37.98 ksi (38 ksi)	5.00
L6	36.75-25.00	11.75	RPS 30" x 0.70222"	Reinf 35.25 ksi (35 ksi)	5.00
L7	25.00-15.75	9.25	RPS 36" x 0.55688"	Reinf 35.87 ksi (36 ksi)	5.00
L8	15.75-5.00	20.75	RPS 36" x 0.69004"	Reinf 35.87 ksi (36 ksi)	

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals
ft	ft^2	in					in	in
L1 130.00-120.00				1	1	1		
L2 120.00-90.00				1	1	1		
L3 90.00-73.70				1	1	1		
L4 73.70-60.00				1	1	1		
L5 60.00-41.75				1	1	1		
L6 41.75-30.00				1	1	1		
L7 30.00-20.75				1	1	1		
L8 20.75-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement	Total Number		C_AA_A	Weight
				ft			ft^2/ft	plf
FSJ1-50A(1/4")	C	No	CaAa (Out Of Face)	127.00 - 0.00	3	No Ice	0.00	0.04
						1/2" Ice	0.00	0.53
						1" Ice	0.00	1.62
FSJ4-50B(1/2")	C	No	Inside Pole	127.00 - 0.00	3	No Ice	0.00	0.14
						1/2" Ice	0.00	0.14
						1" Ice	0.00	0.14
9207(5/16")	C	No	Inside Pole	127.00 - 0.00	3	No Ice	0.00	0.60
						1/2" Ice	0.00	0.60
						1" Ice	0.00	0.60
2" Conduit	C	No	CaAa (Out Of Face)	127.00 - 0.00	1	No Ice	0.20	0.95
						1/2" Ice	0.30	2.48
						1" Ice	0.40	4.62
2" Conduit	C	No	Inside Pole	127.00 - 0.00	1	No Ice	0.00	0.95
						1/2" Ice	0.00	0.95
						1" Ice	0.00	0.95
HB114-1-08U4-M5J(1 1/4")	C	No	CaAa (Out Of Face)	116.00 - 0.00	2	No Ice	0.00	1.08
						1/2" Ice	0.00	2.33
						1" Ice	0.00	4.18
HB114-1-08U4-M5J(1 1/4")	C	No	CaAa (Out Of Face)	116.00 - 0.00	1	No Ice	0.15	1.08
						1/2" Ice	0.25	2.33
						1" Ice	0.35	4.18
LCF78-50A(7/8")	C	No	Inside Pole	105.00 - 0.00	12	No Ice	0.00	0.34
						1/2" Ice	0.00	0.34
						1" Ice	0.00	0.34
HB158-1-08U8-S8J18(1-5/8)	C	No	CaAa (Out Of Face)	105.00 - 0.00	1	No Ice	0.00	1.30
						1/2" Ice	0.00	2.81
						1" Ice	0.00	4.94
AVA7-50(1-5/8)	C	No	Inside Pole	96.00 - 0.00	6	No Ice	0.00	0.70
						1/2" Ice	0.00	0.70
						1" Ice	0.00	0.70
LDF4-50A(1/2")	C	No	CaAa (Out Of Face)	60.00 - 0.00	2	No Ice	0.00	0.15
						1/2" Ice	0.00	0.84
						1" Ice	0.00	2.14
LDF4-50A(1/2")	C	No	CaAa (Out Of Face)	50.00 - 0.00	1	No Ice	0.00	0.15
						1/2" Ice	0.00	0.84
						1" Ice	0.00	2.14

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation	Face	A_R	A_F	C_AA_A In Face	C_AA_A Out Face	Weight
	ft		ft^2	ft^2	ft^2	ft^2	K
L1	130.00-120.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	1.400	0.03

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
L2	120.00-90.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	10.004	0.32
L3	90.00-73.70	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	5.770	0.28
L4	73.70-60.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	4.850	0.23
L5	60.00-41.75	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	6.461	0.32
L6	41.75-30.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	4.160	0.21
L7	30.00-20.75	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	3.275	0.16
L8	20.75-0.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	7.346	0.36

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	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	2.800	0.09
L2	120.00-90.00	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	21.204	0.87
L3	90.00-73.70	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	12.290	0.63
L4	73.70-60.00	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	10.330	0.53
L5	60.00-41.75	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	13.760	0.80
L6	41.75-30.00	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	8.859	0.53
L7	30.00-20.75	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	6.974	0.41
L8	20.75-0.00	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	15.645	0.93

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	-0.1646	0.0950	-0.2725	0.1573
L2	120.00-90.00	-0.3713	0.2144	-0.6391	0.3690
L3	90.00-73.70	-0.3907	0.2256	-0.6707	0.3872
L4	73.70-60.00	-0.3907	0.2256	-0.6707	0.3872
L5	60.00-41.75	-0.4028	0.2326	-0.7158	0.4133
L6	41.75-30.00	-0.4028	0.2326	-0.7158	0.4133
L7	30.00-20.75	-0.4113	0.2375	-0.7495	0.4327
L8	20.75-0.00	-0.4113	0.2375	-0.7495	0.4327

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
***										
LLPX310R w/ Mount Pipe	A	From Leg	1.00	0.00	30.0000	127.00	No Ice	4.96	2.85	0.04
			0.00				1/2" Ice	5.35	3.37	0.08
			0.00				1" Ice	5.75	3.90	0.12
LLPX310R w/ Mount Pipe	B	From Leg	1.00	0.00	30.0000	127.00	No Ice	4.96	2.85	0.04
			0.00				1/2" Ice	5.35	3.37	0.08
			0.00				1" Ice	5.75	3.90	0.12
LLPX310R w/ Mount Pipe	C	From Leg	1.00	0.00	30.0000	127.00	No Ice	4.96	2.85	0.04
			0.00				1/2" Ice	5.35	3.37	0.08
			0.00				1" Ice	5.75	3.90	0.12
HORIZON COMPACT	A	From Leg	1.00	0.00	30.0000	127.00	No Ice	0.84	0.43	0.01
			0.00				1/2" Ice	0.97	0.52	0.02
			0.00				1" Ice	1.10	0.63	0.03
HORIZON COMPACT	B	From Leg	1.00	0.00	30.0000	127.00	No Ice	0.84	0.43	0.01
			0.00				1/2" Ice	0.97	0.52	0.02
			0.00				1" Ice	1.10	0.63	0.03
HORIZON COMPACT	C	From Leg	1.00	0.00	30.0000	127.00	No Ice	0.84	0.43	0.01
			0.00				1/2" Ice	0.97	0.52	0.02
			0.00				1" Ice	1.10	0.63	0.03
WIMAX DAP HEAD	A	From Leg	1.00	0.00	30.0000	127.00	No Ice	1.80	0.78	0.03
			0.00				1/2" Ice	1.99	0.92	0.04
			0.00				1" Ice	2.18	1.07	0.06
WIMAX DAP HEAD	B	From Leg	1.00	0.00	30.0000	127.00	No Ice	1.80	0.78	0.03
			0.00				1/2" Ice	1.99	0.92	0.04
			0.00				1" Ice	2.18	1.07	0.06
WIMAX DAP HEAD	C	From Leg	1.00	0.00	30.0000	127.00	No Ice	1.80	0.78	0.03
			0.00				1/2" Ice	1.99	0.92	0.04
			0.00				1" Ice	2.18	1.07	0.06
Side Arm Mount [SO 102-3]	C	None			0.0000	127.00	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
6' x 2" Mount Pipe	C	From Leg	1.00	0.00	0.0000	127.00	No Ice	1.43	1.43	0.02
			0.00				1/2" Ice	1.92	1.92	0.03
			0.00				1" Ice	2.29	2.29	0.05
6' x 2" Mount Pipe	B	From Leg	1.00	0.00	0.0000	127.00	No Ice	1.43	1.43	0.02
			0.00				1/2" Ice	1.92	1.92	0.03
			0.00				1" Ice	2.29	2.29	0.05
6' x 2" Mount Pipe	A	From Leg	1.00	0.00	0.0000	127.00	No Ice	1.43	1.43	0.02
			0.00				1/2" Ice	1.92	1.92	0.03
			0.00				1" Ice	2.29	2.29	0.05
****										
***										
APXVSPP18-C-A20 w/ Mount Pipe	A	From Leg	4.00	0.00	60.0000	116.00	No Ice	8.50	6.95	0.08
			0.00				1/2" Ice	9.15	8.13	0.15
			0.00				1" Ice	9.77	9.02	0.22
APXVSPP18-C-A20 w/ Mount Pipe	B	From Leg	4.00	0.00	60.0000	116.00	No Ice	8.50	6.95	0.08
			0.00				1/2" Ice	9.15	8.13	0.15
			0.00				1" Ice	9.77	9.02	0.22
APXVSPP18-C-A20 w/ Mount Pipe	C	From Leg	4.00	0.00	70.0000	116.00	No Ice	8.50	6.95	0.08
			0.00				1/2"	9.15	8.13	0.15

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
			0.00			Ice	9.77	9.02	0.22
						1" Ice			
Platform Mount [LP 404-1]	C	None		0.0000	116.00	No Ice	32.79	32.79	2.04
						1/2" Ice	44.63	44.63	2.48
						1" Ice	56.47	56.47	2.91
***									
800MHz 2X50W RRH W/FILTER	A	From Leg	2.00 0.00 0.00	60.0000	114.00	No Ice 1/2" Ice 1" Ice	2.40 2.61 2.83	2.25 2.46 2.68	0.06 0.09 0.11
PCS 1900MHz 4x45W-65MHz	A	From Leg	2.00 0.00 0.00	60.0000	114.00	No Ice 1/2" Ice 1" Ice	2.71 2.95 3.20	2.61 2.85 3.09	0.06 0.08 0.11
800MHz 2X50W RRH W/FILTER	B	From Leg	2.00 0.00 0.00	60.0000	114.00	No Ice 1/2" Ice 1" Ice	2.40 2.61 2.83	2.25 2.46 2.68	0.06 0.09 0.11
PCS 1900MHz 4x45W-65MHz	B	From Leg	2.00 0.00 0.00	60.0000	114.00	No Ice 1/2" Ice 1" Ice	2.71 2.95 3.20	2.61 2.85 3.09	0.06 0.08 0.11
800MHz 2X50W RRH W/FILTER	C	From Leg	2.00 0.00 0.00	70.0000	114.00	No Ice 1/2" Ice 1" Ice	2.40 2.61 2.83	2.25 2.46 2.68	0.06 0.09 0.11
PCS 1900MHz 4x45W-65MHz	C	From Leg	2.00 0.00 0.00	70.0000	114.00	No Ice 1/2" Ice 1" Ice	2.71 2.95 3.20	2.61 2.85 3.09	0.06 0.08 0.11
Side Arm Mount [SO 102-3]	C	None		0.0000	114.00	No Ice 1/2" Ice 1" Ice	3.00 3.48 3.96	3.00 3.48 3.96	0.08 0.11 0.14
(2) 6' x 2" Mount Pipe	A	From Leg	2.00 0.00 0.00	0.0000	114.00	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	2.00 0.00 0.00	0.0000	114.00	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	2.00 0.00 0.00	0.0000	114.00	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
****									
BXA-70063/4CF w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	30.0000	105.00	No Ice 1/2" Ice 1" Ice	5.40 5.84 6.30	3.62 4.22 4.83	0.03 0.07 0.12
BXA-70063/4CF w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	30.0000	105.00	No Ice 1/2" Ice 1" Ice	5.40 5.84 6.30	3.62 4.22 4.83	0.03 0.07 0.12
BXA-70063/4CF w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	30.0000	105.00	No Ice 1/2" Ice 1" Ice	5.40 5.84 6.30	3.62 4.22 4.83	0.03 0.07 0.12
MG D3-800Tx w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	30.0000	105.00	No Ice 1/2" Ice 1" Ice	3.57 3.98 4.39	3.42 4.12 4.78	0.03 0.07 0.11
MG D3-800Tx w/ Mount	B	From Leg	4.00	30.0000	105.00	No Ice	3.57	3.42	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
Pipe			0.00			1/2"	3.98	4.12	0.07
			0.00			Ice	4.39	4.78	0.11
						1" Ice			
MG D3-800Tx w/ Mount Pipe	C	From Leg	4.00	30.0000	105.00	No Ice	3.57	3.42	0.03
			0.00			1/2"	3.98	4.12	0.07
			0.00			Ice	4.39	4.78	0.11
						1" Ice			
BXA-171063-12CF-EDIN-2 w/ Mount Pipe	A	From Leg	4.00	30.0000	105.00	No Ice	5.03	5.29	0.04
			0.00			1/2"	5.58	6.46	0.08
			0.00			Ice	6.10	7.35	0.14
						1" Ice			
BXA-171063-12CF-EDIN-2 w/ Mount Pipe	B	From Leg	4.00	30.0000	105.00	No Ice	5.03	5.29	0.04
			0.00			1/2"	5.58	6.46	0.08
			0.00			Ice	6.10	7.35	0.14
						1" Ice			
BXA-171063-12CF-EDIN-2 w/ Mount Pipe	C	From Leg	4.00	30.0000	105.00	No Ice	5.03	5.29	0.04
			0.00			1/2"	5.58	6.46	0.08
			0.00			Ice	6.10	7.35	0.14
						1" Ice			
BXA-80063-4CF-EDIN-2 w/ Mount Pipe	A	From Leg	4.00	30.0000	105.00	No Ice	5.40	3.69	0.03
			0.00			1/2"	5.84	4.29	0.07
			0.00			Ice	6.30	4.91	0.12
						1" Ice			
BXA-80063-4CF-EDIN-2 w/ Mount Pipe	B	From Leg	4.00	30.0000	105.00	No Ice	5.40	3.69	0.03
			0.00			1/2"	5.84	4.29	0.07
			0.00			Ice	6.30	4.91	0.12
						1" Ice			
BXA-80063-4CF-EDIN-2 w/ Mount Pipe	C	From Leg	4.00	30.0000	105.00	No Ice	5.40	3.69	0.03
			0.00			1/2"	5.84	4.29	0.07
			0.00			Ice	6.30	4.91	0.12
						1" Ice			
RRH2x40-AWS	A	From Leg	4.00	30.0000	105.00	No Ice	2.52	1.59	0.04
			0.00			1/2"	2.75	1.80	0.06
			0.00			Ice	2.99	2.01	0.08
						1" Ice			
RRH2x40-AWS	B	From Leg	4.00	30.0000	105.00	No Ice	2.52	1.59	0.04
			0.00			1/2"	2.75	1.80	0.06
			0.00			Ice	2.99	2.01	0.08
						1" Ice			
RRH2x40-AWS	C	From Leg	4.00	30.0000	105.00	No Ice	2.52	1.59	0.04
			0.00			1/2"	2.75	1.80	0.06
			0.00			Ice	2.99	2.01	0.08
						1" Ice			
DB-T1-6Z-8AB-0Z	B	From Leg	4.00	30.0000	105.00	No Ice	5.60	2.33	0.04
			0.00			1/2"	5.92	2.56	0.08
			0.00			Ice	6.24	2.79	0.12
						1" Ice			
RRH 2x40-700 W/SOLAR	A	From Leg	4.00	30.0000	105.00	No Ice	3.31	1.94	0.05
			0.00			1/2"	3.55	2.14	0.08
			0.00			Ice	3.80	2.35	0.10
						1" Ice			
RRH 2x40-700 W/SOLAR	B	From Leg	4.00	30.0000	105.00	No Ice	3.31	1.94	0.05
			0.00			1/2"	3.55	2.14	0.08
			0.00			Ice	3.80	2.35	0.10
						1" Ice			
RRH 2x40-700 W/SOLAR	C	From Leg	4.00	30.0000	105.00	No Ice	3.31	1.94	0.05
			0.00			1/2"	3.55	2.14	0.08
			0.00			Ice	3.80	2.35	0.10
						1" Ice			
Platform Mount [LP 404-1]	C	None		0.0000	105.00	No Ice	32.79	32.79	2.04
						1/2"	44.63	44.63	2.48
						Ice	56.47	56.47	2.91
						1" Ice			
***									
APX18-206517-CT2 w/	A	From Leg	4.00	60.0000	96.00	No Ice	5.36	4.73	0.05

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Offsets: Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Mount Pipe			0.00				1/2" Ice	5.91	5.90	0.09
			0.00				1" Ice	6.44	6.79	0.15
APX18-206517-CT2 w/ Mount Pipe	B	From Leg	4.00		60.0000	96.00	No Ice	5.36	4.73	0.05
			0.00				1/2" Ice	5.91	5.90	0.09
			0.00				1" Ice	6.44	6.79	0.15
APX18-206517-CT2 w/ Mount Pipe	C	From Leg	4.00		60.0000	96.00	No Ice	5.36	4.73	0.05
			0.00				1/2" Ice	5.91	5.90	0.09
			0.00				1" Ice	6.44	6.79	0.15
Pipe Mount [PM 601-3]	C	None			0.0000	96.00	No Ice	4.39	4.39	0.20
							1/2" Ice	5.48	5.48	0.24
							1" Ice	6.57	6.57	0.28
****										
OG-860/1920/GPS-A	A	From Leg	4.00		60.0000	60.00	No Ice	0.33	0.40	0.00
			0.00				1/2" Ice	0.43	0.51	0.01
			0.00				1" Ice	0.55	0.63	0.01
OG-860/1920/GPS-A	A	From Leg	4.00		-60.0000	60.00	No Ice	0.33	0.40	0.00
			0.00				1/2" Ice	0.43	0.51	0.01
			0.00				1" Ice	0.55	0.63	0.01
Side Arm Mount [SO 701-1]	C	From Leg	0.00		60.0000	60.00	No Ice	0.85	1.67	0.07
			0.00				1/2" Ice	1.14	2.34	0.08
			0.00				1" Ice	1.43	3.01	0.09
Side Arm Mount [SO 701-1]	C	From Leg	0.00		-60.0000	60.00	No Ice	0.85	1.67	0.07
			0.00				1/2" Ice	1.14	2.34	0.08
			0.00				1" Ice	1.43	3.01	0.09
****										
KS24019-L112A	B	From Leg	4.00		60.0000	50.00	No Ice	0.16	0.16	0.01
			0.00				1/2" Ice	0.22	0.22	0.01
			0.00				1" Ice	0.30	0.30	0.01
Side Arm Mount [SO 701-1]	B	From Leg	0.00		60.0000	50.00	No Ice	0.85	1.67	0.07
			0.00				1/2" Ice	1.14	2.34	0.08
			0.00				1" Ice	1.43	3.01	0.09
***										
(2) Bridge Stiffener (63" x 15" x 1.25")	C	None			0.0000	60.00	No Ice	9.19	1.09	0.40
							1/2" Ice	9.70	1.69	0.44
							1" Ice	10.22	2.30	0.48
(2) Bridge Stiffener (63" x 15" x 1.25")	C	None			0.0000	30.00	No Ice	9.19	1.09	0.40
							1/2" Ice	9.70	1.69	0.44
							1" Ice	10.22	2.30	0.48

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft	Offsets: Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
A-ANT-18G-2-C	A	Paraboloid w/Radome	From Leg	1.00		30.0000		127.00	2.17	No Ice	3.72	0.03
				0.00						1/2" Ice	4.01	0.04
				0.00						1" Ice	4.30	0.05
A-ANT-18G-2-C	B	Paraboloid w/Radome	From Leg	1.00		30.0000		127.00	2.17	No Ice	3.72	0.03
				0.00						1/2" Ice	4.01	0.04
				0.00						1" Ice	4.30	0.05
A-ANT-18G-2-C	C	Paraboloid	From	1.00		30.0000		127.00	2.17	No Ice	3.72	0.03

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	3 dB Beam Width	Elevation	Outside Diameter		Aperture Area	Weight
				ft	°	°	ft	ft		ft^2	K
		w/Radome	Leg	0.00					1/2" Ice	4.01	0.04
				0.00					1" Ice	4.30	0.05

Tower Forces - No Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 130.00-120.00	0.03	0.63	A	1	0.59	1	1	1	13.333	0.38	37.54	C
			B	1	0.59	1	1	1	13.333			
			C	1	0.59	1	1	1	13.333			
L2 120.00-90.00	0.32	1.90	A	1	0.59	1	1	1	60.000	1.75	58.33	C
			B	1	0.59	1	1	1	60.000			
			C	1	0.59	1	1	1	60.000			
L3 90.00-73.70	0.28	1.54	A	1	0.59	1	1	1	32.600	0.90	55.06	C
			B	1	0.59	1	1	1	32.600			
			C	1	0.59	1	1	1	32.600			
L4 73.70-60.00	0.23	2.04	A	1	0.59	1	1	1	27.400	0.71	51.97	C
			B	1	0.59	1	1	1	27.400			
			C	1	0.59	1	1	1	27.400			
L5 60.00-41.75	0.32	3.12	A	1	0.59	1	1	1	45.625	1.05	57.31	C
			B	1	0.59	1	1	1	45.625			
			C	1	0.59	1	1	1	45.625			
L6 41.75-30.00	0.21	2.58	A	1	0.59	1	1	1	29.375	0.61	51.87	C
			B	1	0.59	1	1	1	29.375			
			C	1	0.59	1	1	1	29.375			
L7 30.00-20.75	0.16	1.95	A	1	0.59	1	1	1	27.750	0.54	58.81	C
			B	1	0.59	1	1	1	27.750			
			C	1	0.59	1	1	1	27.750			
L8 20.75-0.00	0.36	5.40	A	1	0.59	1	1	1	62.250	1.22	58.81	C
			B	1	0.59	1	1	1	62.250			
			C	1	0.59	1	1	1	62.250			
Sum Weight:	1.91	19.17						OTM	453.26 kip-ft	7.15		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 130.00-120.00	0.03	0.63	A	1	0.59	1	1	1	13.333	0.38	37.54	C
			B	1	0.59	1	1	1	13.333			
			C	1	0.59	1	1	1	13.333			
L2 120.00-90.00	0.32	1.90	A	1	0.59	1	1	1	60.000	1.75	58.33	C
			B	1	0.59	1	1	1	60.000			
			C	1	0.59	1	1	1	60.000			
L3 90.00-73.70	0.28	1.54	A	1	0.59	1	1	1	32.600	0.90	55.06	C
			B	1	0.59	1	1	1	32.600			
			C	1	0.59	1	1	1	32.600			
L4 73.70-60.00	0.23	2.04	A	1	0.59	1	1	1	27.400	0.71	51.97	C
			B	1	0.59	1	1	1	27.400			
			C	1	0.59	1	1	1	27.400			
L5 60.00-41.75	0.32	3.12	A	1	0.59	1	1	1	45.625	1.05	57.31	C
			B	1	0.59	1	1	1	45.625			
			C	1	0.59	1	1	1	45.625			
L6 41.75-30.00	0.21	2.58	A	1	0.59	1	1	1	29.375	0.61	51.87	C
			B	1	0.59	1	1	1	29.375			
			C	1	0.59	1	1	1	29.375			
L7 30.00-20.75	0.16	1.95	A	1	0.59	1	1	1	27.750	0.54	58.81	C
			B	1	0.59	1	1	1	27.750			
			C	1	0.59	1	1	1	27.750			
L8 20.75-0.00	0.36	5.40	A	1	0.59	1	1	1	62.250	1.22	58.81	C
			B	1	0.59	1	1	1	62.250			
			C	1	0.59	1	1	1	62.250			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
Sum Weight:	1.91	19.17						OTM	453.26 kip-ft	7.15		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 130.00-120.00	0.03	0.63	A	1	0.59	1	1	1	13.333	0.38	37.54	C
			B	1	0.59	1	1	1	13.333			
			C	1	0.59	1	1	1	13.333			
L2 120.00-90.00	0.32	1.90	A	1	0.59	1	1	1	60.000	1.75	58.33	C
			B	1	0.59	1	1	1	60.000			
			C	1	0.59	1	1	1	60.000			
L3 90.00-73.70	0.28	1.54	A	1	0.59	1	1	1	32.600	0.90	55.06	C
			B	1	0.59	1	1	1	32.600			
			C	1	0.59	1	1	1	32.600			
L4 73.70-60.00	0.23	2.04	A	1	0.59	1	1	1	27.400	0.71	51.97	C
			B	1	0.59	1	1	1	27.400			
			C	1	0.59	1	1	1	27.400			
L5 60.00-41.75	0.32	3.12	A	1	0.59	1	1	1	45.625	1.05	57.31	C
			B	1	0.59	1	1	1	45.625			
			C	1	0.59	1	1	1	45.625			
L6 41.75-30.00	0.21	2.58	A	1	0.59	1	1	1	29.375	0.61	51.87	C
			B	1	0.59	1	1	1	29.375			
			C	1	0.59	1	1	1	29.375			
L7 30.00-20.75	0.16	1.95	A	1	0.59	1	1	1	27.750	0.54	58.81	C
			B	1	0.59	1	1	1	27.750			
			C	1	0.59	1	1	1	27.750			
L8 20.75-0.00	0.36	5.40	A	1	0.59	1	1	1	62.250	1.22	58.81	C
			B	1	0.59	1	1	1	62.250			
			C	1	0.59	1	1	1	62.250			
Sum Weight:	1.91	19.17						OTM	453.26 kip-ft	7.15		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 130.00-120.00	0.09	0.83	A	1	0.626	1	1	1	15.000	0.11	10.90	C
			B	1	0.626	1	1	1	15.000			
			C	1	0.626	1	1	1	15.000			
L2 120.00-90.00	0.87	2.82	A	1	0.59	1	1	1	65.000	0.51	16.90	C
			B	1	0.59	1	1	1	65.000			
			C	1	0.59	1	1	1	65.000			
L3 90.00-73.70	0.63	2.04	A	1	0.59	1	1	1	35.317	0.26	16.11	C
			B	1	0.59	1	1	1	35.317			
			C	1	0.59	1	1	1	35.317			
L4 73.70-60.00	0.53	2.46	A	1	0.59	1	1	1	29.683	0.21	15.21	C
			B	1	0.59	1	1	1	29.683			
			C	1	0.59	1	1	1	29.683			
L5 60.00-41.75	0.80	3.81	A	1	0.59	1	1	1	48.667	0.29	16.11	C
			B	1	0.59	1	1	1	48.667			
			C	1	0.59	1	1	1	48.667			
L6 41.75-30.00	0.53	3.03	A	1	0.59	1	1	1	31.333	0.17	14.58	C
			B	1	0.59	1	1	1	31.333			
			C	1	0.59	1	1	1	31.333			
L7 30.00-20.75	0.41	2.37	A	1	0.59	1	1	1	29.292	0.15	16.04	C
			B	1	0.59	1	1	1	29.292			
			C	1	0.59	1	1	1	29.292			
L8 20.75-0.00	0.93	6.34	A	1	0.59	1	1	1	65.708	0.33	16.04	C
			B	1	0.59	1	1	1	65.708			
			C	1	0.59	1	1	1	65.708			
Sum Weight:	4.78	23.71						OTM	130.62	2.03		

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
									kip-ft			

Tower Forces - With Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 130.00-120.00	0.09	0.83	A	1	0.626	1	1	1	15.000	0.11	10.90	C
			B	1	0.626	1	1	1	15.000			
			C	1	0.626	1	1	1	15.000			
L2 120.00-90.00	0.87	2.82	A	1	0.59	1	1	1	65.000	0.51	16.90	C
			B	1	0.59	1	1	1	65.000			
			C	1	0.59	1	1	1	65.000			
L3 90.00-73.70	0.63	2.04	A	1	0.59	1	1	1	35.317	0.26	16.11	C
			B	1	0.59	1	1	1	35.317			
			C	1	0.59	1	1	1	35.317			
L4 73.70-60.00	0.53	2.46	A	1	0.59	1	1	1	29.683	0.21	15.21	C
			B	1	0.59	1	1	1	29.683			
			C	1	0.59	1	1	1	29.683			
L5 60.00-41.75	0.80	3.81	A	1	0.59	1	1	1	48.667	0.29	16.11	C
			B	1	0.59	1	1	1	48.667			
			C	1	0.59	1	1	1	48.667			
L6 41.75-30.00	0.53	3.03	A	1	0.59	1	1	1	31.333	0.17	14.58	C
			B	1	0.59	1	1	1	31.333			
			C	1	0.59	1	1	1	31.333			
L7 30.00-20.75	0.41	2.37	A	1	0.59	1	1	1	29.292	0.15	16.04	C
			B	1	0.59	1	1	1	29.292			
			C	1	0.59	1	1	1	29.292			
L8 20.75-0.00	0.93	6.34	A	1	0.59	1	1	1	65.708	0.33	16.04	C
			B	1	0.59	1	1	1	65.708			
			C	1	0.59	1	1	1	65.708			
Sum Weight:	4.78	23.71						OTM	130.62 kip-ft	2.03		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 130.00-120.00	0.09	0.83	A	1	0.626	1	1	1	15.000	0.11	10.90	C
			B	1	0.626	1	1	1	15.000			
			C	1	0.626	1	1	1	15.000			
L2 120.00-90.00	0.87	2.82	A	1	0.59	1	1	1	65.000	0.51	16.90	C
			B	1	0.59	1	1	1	65.000			
			C	1	0.59	1	1	1	65.000			
L3 90.00-73.70	0.63	2.04	A	1	0.59	1	1	1	35.317	0.26	16.11	C
			B	1	0.59	1	1	1	35.317			
			C	1	0.59	1	1	1	35.317			
L4 73.70-60.00	0.53	2.46	A	1	0.59	1	1	1	29.683	0.21	15.21	C
			B	1	0.59	1	1	1	29.683			
			C	1	0.59	1	1	1	29.683			
L5 60.00-41.75	0.80	3.81	A	1	0.59	1	1	1	48.667	0.29	16.11	C
			B	1	0.59	1	1	1	48.667			
			C	1	0.59	1	1	1	48.667			
L6 41.75-30.00	0.53	3.03	A	1	0.59	1	1	1	31.333	0.17	14.58	C
			B	1	0.59	1	1	1	31.333			
			C	1	0.59	1	1	1	31.333			
L7 30.00-20.75	0.41	2.37	A	1	0.59	1	1	1	29.292	0.15	16.04	C
			B	1	0.59	1	1	1	29.292			
			C	1	0.59	1	1	1	29.292			
L8 20.75-0.00	0.93	6.34	A	1	0.59	1	1	1	65.708	0.33	16.04	C
			B	1	0.59	1	1	1	65.708			
			C	1	0.59	1	1	1	65.708			
Sum Weight:	4.78	23.71						OTM	130.62 kip-ft	2.03		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 130.00-120.00	0.03	0.63	A	1	0.59	1	1	1	13.333	0.15	14.66	C
			B	1	0.59	1	1	1	13.333			
			C	1	0.59	1	1	1	13.333			
L2 120.00-90.00	0.32	1.90	A	1	0.59	1	1	1	60.000	0.68	22.79	C
			B	1	0.59	1	1	1	60.000			
			C	1	0.59	1	1	1	60.000			
L3 90.00-73.70	0.28	1.54	A	1	0.59	1	1	1	32.600	0.35	21.51	C
			B	1	0.59	1	1	1	32.600			
			C	1	0.59	1	1	1	32.600			
L4 73.70-60.00	0.23	2.04	A	1	0.59	1	1	1	27.400	0.28	20.30	C
			B	1	0.59	1	1	1	27.400			
			C	1	0.59	1	1	1	27.400			
L5 60.00-41.75	0.32	3.12	A	1	0.59	1	1	1	45.625	0.41	22.39	C
			B	1	0.59	1	1	1	45.625			
			C	1	0.59	1	1	1	45.625			
L6 41.75-30.00	0.21	2.58	A	1	0.59	1	1	1	29.375	0.24	20.26	C
			B	1	0.59	1	1	1	29.375			
			C	1	0.59	1	1	1	29.375			
L7 30.00-20.75	0.16	1.95	A	1	0.59	1	1	1	27.750	0.21	22.97	C
			B	1	0.59	1	1	1	27.750			
			C	1	0.59	1	1	1	27.750			
L8 20.75-0.00	0.36	5.40	A	1	0.59	1	1	1	62.250	0.48	22.97	C
			B	1	0.59	1	1	1	62.250			
			C	1	0.59	1	1	1	62.250			
Sum Weight:	1.91	19.17						OTM	177.06 kip-ft	2.79		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 130.00-120.00	0.03	0.63	A	1	0.59	1	1	1	13.333	0.15	14.66	C
			B	1	0.59	1	1	1	13.333			
			C	1	0.59	1	1	1	13.333			
L2 120.00-90.00	0.32	1.90	A	1	0.59	1	1	1	60.000	0.68	22.79	C
			B	1	0.59	1	1	1	60.000			
			C	1	0.59	1	1	1	60.000			
L3 90.00-73.70	0.28	1.54	A	1	0.59	1	1	1	32.600	0.35	21.51	C
			B	1	0.59	1	1	1	32.600			
			C	1	0.59	1	1	1	32.600			
L4 73.70-60.00	0.23	2.04	A	1	0.59	1	1	1	27.400	0.28	20.30	C
			B	1	0.59	1	1	1	27.400			
			C	1	0.59	1	1	1	27.400			
L5 60.00-41.75	0.32	3.12	A	1	0.59	1	1	1	45.625	0.41	22.39	C
			B	1	0.59	1	1	1	45.625			
			C	1	0.59	1	1	1	45.625			
L6 41.75-30.00	0.21	2.58	A	1	0.59	1	1	1	29.375	0.24	20.26	C
			B	1	0.59	1	1	1	29.375			
			C	1	0.59	1	1	1	29.375			
L7 30.00-20.75	0.16	1.95	A	1	0.59	1	1	1	27.750	0.21	22.97	C
			B	1	0.59	1	1	1	27.750			
			C	1	0.59	1	1	1	27.750			
L8 20.75-0.00	0.36	5.40	A	1	0.59	1	1	1	62.250	0.48	22.97	C
			B	1	0.59	1	1	1	62.250			
			C	1	0.59	1	1	1	62.250			
Sum Weight:	1.91	19.17						OTM	177.06 kip-ft	2.79		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 130.00-120.00	0.03	0.63	A	1	0.59	1	1	1	13.333	0.15	14.66	C
			B	1	0.59	1	1	1	13.333			
			C	1	0.59	1	1	1	13.333			
L2 120.00-90.00	0.32	1.90	A	1	0.59	1	1	1	60.000	0.68	22.79	C
			B	1	0.59	1	1	1	60.000			
			C	1	0.59	1	1	1	60.000			
L3 90.00-73.70	0.28	1.54	A	1	0.59	1	1	1	32.600	0.35	21.51	C
			B	1	0.59	1	1	1	32.600			
			C	1	0.59	1	1	1	32.600			
L4 73.70-60.00	0.23	2.04	A	1	0.59	1	1	1	27.400	0.28	20.30	C
			B	1	0.59	1	1	1	27.400			
			C	1	0.59	1	1	1	27.400			
L5 60.00-41.75	0.32	3.12	A	1	0.59	1	1	1	45.625	0.41	22.39	C
			B	1	0.59	1	1	1	45.625			
			C	1	0.59	1	1	1	45.625			
L6 41.75-30.00	0.21	2.58	A	1	0.59	1	1	1	29.375	0.24	20.26	C
			B	1	0.59	1	1	1	29.375			
			C	1	0.59	1	1	1	29.375			
L7 30.00-20.75	0.16	1.95	A	1	0.59	1	1	1	27.750	0.21	22.97	C
			B	1	0.59	1	1	1	27.750			
			C	1	0.59	1	1	1	27.750			
L8 20.75-0.00	0.36	5.40	A	1	0.59	1	1	1	62.250	0.48	22.97	C
			B	1	0.59	1	1	1	62.250			
			C	1	0.59	1	1	1	62.250			
Sum Weight:	1.91	19.17						OTM	177.06 kip-ft	2.79		

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

Comb. No.	Description
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	11	0.00	-0.00	-0.00
			Max. Compression	14	-1.98	0.04	-0.02
			Max. Mx	11	-0.99	11.50	-0.00
			Max. My	8	-1.00	-0.14	-11.38
			Max. Vy	11	-1.76	11.50	-0.00
			Max. Vx	8	1.75	-0.14	-11.38
			Max. Torque	9			-0.07
L2	120 - 90	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-16.07	0.13	-0.69
			Max. Mx	11	-8.51	247.24	0.80
			Max. My	8	-8.50	-1.77	-248.43
			Max. Vy	11	-11.98	247.24	0.80
			Max. Vx	8	12.05	-1.77	-248.43
			Max. Torque	2			-0.62
L3	90 - 73.7	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-18.74	0.52	-0.93
			Max. Mx	11	-10.46	449.70	1.75
			Max. My	8	-10.45	-3.03	-452.03
			Max. Vy	11	-12.84	449.70	1.75
			Max. Vx	8	12.92	-3.03	-452.03
			Max. Torque	2			-0.60
L4	73.7 - 60	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-21.72	0.85	-1.12
			Max. Mx	11	-12.86	630.33	2.54
			Max. My	8	-12.85	-4.08	-633.63
			Max. Vy	11	-13.51	630.33	2.54
			Max. Vx	8	13.59	-4.08	-633.63
			Max. Torque	2			-0.57
L5	60 - 41.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-27.60	1.49	-1.54
			Max. Mx	11	-17.42	900.16	3.26
			Max. My	8	-17.42	-5.22	-904.39
			Max. Vy	11	-15.28	900.16	3.26
			Max. Vx	8	15.32	-5.22	-904.39
			Max. Torque	2			-0.54
L6	41.75 - 30	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-31.15	1.91	-1.78
			Max. Mx	11	-20.33	1082.81	3.79
			Max. My	8	-20.32	-5.95	-1087.43
			Max. Vy	11	-15.80	1082.81	3.79
			Max. Vx	8	15.83	-5.95	-1087.43
			Max. Torque	2			-0.49
L7	30 - 20.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-34.89	2.30	-2.00
			Max. Mx	11	-23.31	1235.89	4.19
			Max. My	8	-23.31	-6.51	-1240.80
			Max. Vy	11	-16.77	1235.89	4.19
			Max. Vx	8	16.81	-6.51	-1240.80
			Max. Torque	2			-0.47
L8	20.75 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-42.17	3.18	-2.49
			Max. Mx	11	-29.28	1594.01	5.08
			Max. My	8	-29.28	-7.75	-1599.57
			Max. Vy	11	-17.71	1594.01	5.08
			Max. Vx	8	17.74	-7.75	-1599.57
			Max. Torque	2			-0.45

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	14	42.17	-0.00	0.00
	Max. H_x	11	29.29	17.70	0.05
	Max. H_z	2	29.29	0.03	17.73
	Max. M_x	2	1598.31	0.03	17.73
	Max. M_z	5	1586.00	-17.65	-0.05
	Max. Torsion	9	0.34	8.78	-15.31
	Min. Vert	11	29.29	17.70	0.05
	Min. H_x	5	29.29	-17.65	-0.05
	Min. H_z	8	29.29	-0.07	-17.73
	Min. M_x	8	-1599.57	-0.07	-17.73
	Min. M_z	11	-1594.01	17.70	0.05
	Min. Torsion	3	-0.42	-8.81	15.35

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	29.29	-0.00	0.00	0.61	0.55	0.00
Dead+Wind 0 deg - No Ice	29.29	-0.03	-17.73	-1598.31	3.68	0.41
Dead+Wind 30 deg - No Ice	29.29	8.81	-15.35	-1383.45	-791.41	0.42
Dead+Wind 60 deg - No Ice	29.29	15.28	-8.84	-796.25	-1373.56	0.38
Dead+Wind 90 deg - No Ice	29.29	17.65	0.05	6.34	-1586.00	0.23
Dead+Wind 120 deg - No Ice	29.29	15.33	8.93	807.40	-1379.25	-0.01
Dead+Wind 150 deg - No Ice	29.29	8.89	15.40	1390.40	-801.29	-0.22
Dead+Wind 180 deg - No Ice	29.29	0.07	17.73	1599.57	-7.75	-0.32
Dead+Wind 210 deg - No Ice	29.29	-8.78	15.31	1378.73	789.08	-0.34
Dead+Wind 240 deg - No Ice	29.29	-15.30	8.81	793.00	1377.28	-0.29
Dead+Wind 270 deg - No Ice	29.29	-17.70	-0.05	-5.08	1594.01	-0.15
Dead+Wind 300 deg - No Ice	29.29	-15.35	-8.89	-801.63	1382.98	0.10
Dead+Wind 330 deg - No Ice	29.29	-8.87	-15.35	-1383.16	798.97	0.31
Dead+Ice+Temp	42.17	0.00	-0.00	2.49	3.18	-0.00
Dead+Wind 0 deg+Ice+Temp	42.17	-0.00	-5.24	-489.49	3.83	0.06
Dead+Wind 30 deg+Ice+Temp	42.17	2.61	-4.54	-423.50	-241.48	0.09
Dead+Wind 60 deg+Ice+Temp	42.17	4.53	-2.62	-242.99	-420.99	0.11
Dead+Wind 90 deg+Ice+Temp	42.17	5.23	0.01	3.84	-486.51	0.10
Dead+Wind 120 deg+Ice+Temp	42.17	4.54	2.63	250.37	-422.19	0.06
Dead+Wind 150 deg+Ice+Temp	42.17	2.63	4.54	430.04	-243.52	0.00
Dead+Wind 180 deg+Ice+Temp	42.17	0.01	5.24	494.82	1.49	-0.04
Dead+Wind 210 deg+Ice+Temp	42.17	-2.61	4.52	427.29	247.27	-0.07
Dead+Wind 240 deg+Ice+Temp	42.17	-4.53	2.61	247.16	428.38	-0.09
Dead+Wind 270 deg+Ice+Temp	42.17	-5.24	-0.01	1.50	495.00	-0.08
Dead+Wind 300 deg+Ice+Temp	42.17	-4.54	-2.62	-243.85	429.55	-0.03
Dead+Wind 330 deg+Ice+Temp	42.17	-2.62	-4.53	-423.10	249.28	0.02
Dead+Wind 0 deg - Service	29.29	-0.01	-6.93	-624.35	1.78	0.16
Dead+Wind 30 deg - Service	29.29	3.44	-6.00	-540.37	-309.00	0.17
Dead+Wind 60 deg - Service	29.29	5.97	-3.45	-310.85	-536.54	0.15
Dead+Wind 90 deg - Service	29.29	6.89	0.02	2.86	-619.65	0.09
Dead+Wind 120 deg - Service	29.29	5.99	3.49	315.98	-538.78	-0.00
Dead+Wind 150 deg - Service	29.29	3.47	6.01	543.87	-312.87	-0.09
Dead+Wind 180 deg - Service	29.29	0.03	6.93	625.61	-2.69	-0.13

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 - Service	29.29	-3.43	5.98	539.29	308.77	-0.13
Dead+Wind 240 deg - Service	29.29	-5.98	3.44	310.35	538.68	-0.11
Dead+Wind 270 deg - Service	29.29	-6.91	-0.02	-1.60	623.47	-0.06
Dead+Wind 300 deg - Service	29.29	-6.00	-3.47	-312.95	540.92	0.04
Dead+Wind 330 deg - Service	29.29	-3.46	-6.00	-540.26	312.64	0.12

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	-29.29	0.00	0.00	29.29	-0.00	0.000%
2	-0.03	-29.29	-17.74	0.03	29.29	17.73	0.005%
3	8.81	-29.29	-15.35	-8.81	29.29	15.35	0.000%
4	15.28	-29.29	-8.84	-15.28	29.29	8.84	0.000%
5	17.65	-29.29	0.05	-17.65	29.29	-0.05	0.011%
6	15.33	-29.29	8.93	-15.33	29.29	-8.93	0.000%
7	8.89	-29.29	15.40	-8.89	29.29	-15.40	0.000%
8	0.07	-29.29	17.74	-0.07	29.29	-17.73	0.005%
9	-8.78	-29.29	15.31	8.78	29.29	-15.31	0.000%
10	-15.30	-29.29	8.81	15.30	29.29	-8.81	0.000%
11	-17.70	-29.29	-0.05	17.70	29.29	0.05	0.011%
12	-15.35	-29.29	-8.89	15.35	29.29	8.89	0.000%
13	-8.87	-29.29	-15.35	8.87	29.29	15.35	0.000%
14	0.00	-42.17	0.00	-0.00	42.17	0.00	0.003%
15	-0.00	-42.17	-5.24	0.00	42.17	5.24	0.001%
16	2.61	-42.17	-4.54	-2.61	42.17	4.54	0.001%
17	4.53	-42.17	-2.62	-4.53	42.17	2.62	0.001%
18	5.23	-42.17	0.01	-5.23	42.17	-0.01	0.001%
19	4.54	-42.17	2.63	-4.54	42.17	-2.63	0.001%
20	2.63	-42.17	4.54	-2.63	42.17	-4.54	0.001%
21	0.01	-42.17	5.24	-0.01	42.17	-5.24	0.001%
22	-2.61	-42.17	4.52	2.61	42.17	-4.52	0.001%
23	-4.53	-42.17	2.61	4.53	42.17	-2.61	0.001%
24	-5.24	-42.17	-0.01	5.24	42.17	0.01	0.001%
25	-4.54	-42.17	-2.62	4.54	42.17	2.62	0.001%
26	-2.62	-42.17	-4.53	2.62	42.17	4.53	0.001%
27	-0.01	-29.29	-6.93	0.01	29.29	6.93	0.005%
28	3.44	-29.29	-6.00	-3.44	29.29	6.00	0.002%
29	5.97	-29.29	-3.45	-5.97	29.29	3.45	0.002%
30	6.89	-29.29	0.02	-6.89	29.29	-0.02	0.005%
31	5.99	-29.29	3.49	-5.99	29.29	-3.49	0.002%
32	3.47	-29.29	6.01	-3.47	29.29	-6.01	0.003%
33	0.03	-29.29	6.93	-0.03	29.29	-6.93	0.005%
34	-3.43	-29.29	5.98	3.43	29.29	-5.98	0.002%
35	-5.98	-29.29	3.44	5.98	29.29	-3.44	0.002%
36	-6.92	-29.29	-0.02	6.91	29.29	0.02	0.005%
37	-6.00	-29.29	-3.47	6.00	29.29	3.47	0.002%
38	-3.46	-29.29	-6.00	3.46	29.29	6.00	0.002%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	16	0.00006487	0.00007845
3	Yes	20	0.00000001	0.00008943
4	Yes	20	0.00000001	0.00008574
5	Yes	15	0.00012887	0.00013749
6	Yes	20	0.00000001	0.00008894
7	Yes	20	0.00000001	0.00009098

8	Yes	16	0.00006487	0.00008775
9	Yes	20	0.00000001	0.00008515
10	Yes	20	0.00000001	0.00008810
11	Yes	15	0.00012881	0.00012370
12	Yes	20	0.00000001	0.00008951
13	Yes	20	0.00000001	0.00008684
14	Yes	6	0.00000001	0.00004432
15	Yes	17	0.00000001	0.00012382
16	Yes	17	0.00000001	0.00014878
17	Yes	17	0.00000001	0.00014757
18	Yes	17	0.00000001	0.00012314
19	Yes	18	0.00000001	0.00008014
20	Yes	18	0.00000001	0.00008046
21	Yes	17	0.00000001	0.00012533
22	Yes	18	0.00000001	0.00007993
23	Yes	18	0.00000001	0.00008044
24	Yes	17	0.00000001	0.00012497
25	Yes	18	0.00000001	0.00007993
26	Yes	17	0.00000001	0.00014986
27	Yes	15	0.00013274	0.00006286
28	Yes	16	0.00000001	0.00009458
29	Yes	16	0.00000001	0.00008352
30	Yes	15	0.00013274	0.00006040
31	Yes	16	0.00000001	0.00008953
32	Yes	16	0.00000001	0.00009544
33	Yes	15	0.00013274	0.00006289
34	Yes	16	0.00000001	0.00008338
35	Yes	16	0.00000001	0.00009170
36	Yes	15	0.00013273	0.00006014
37	Yes	16	0.00000001	0.00009232
38	Yes	16	0.00000001	0.00008487

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 120	26.875	32	1.7452	0.0026
L2	120 - 90	23.225	32	1.7372	0.0025
L3	90 - 73.7	12.796	32	1.4793	0.0016
L4	73.7 - 60	8.252	32	1.1514	0.0009
L5	60 - 41.75	5.324	32	0.8742	0.0005
L6	41.75 - 30	2.499	32	0.5871	0.0003
L7	30 - 20.75	1.279	32	0.3988	0.0002
L8	20.75 - 0	0.623	32	0.2753	0.0001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
127.00	A-ANT-18G-2-C	32	25.780	1.7443	0.0026	315228
116.00	APXVSPP18-C-A20 w/ Mount Pipe	32	21.765	1.7266	0.0025	27939
114.00	800MHz 2X50W RRH W/FILTER	32	21.037	1.7191	0.0024	17761
105.00	BXA-70063/4CF w/ Mount Pipe	32	17.809	1.6639	0.0022	6697
96.00	APX18-206517-CT2 w/ Mount Pipe	32	14.726	1.5686	0.0018	4126
60.00	OG-860/1920/GPS-A	32	5.324	0.8742	0.0005	3326
50.00	KS24019-L112A	32	3.632	0.7129	0.0004	3443
30.00	(2) Bridge Stiffener (63" x 15" x 1.25")	32	1.279	0.3988	0.0002	3943

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 120	68.607	7	4.4579	0.0064
L2	120 - 90	59.297	7	4.4377	0.0063
L3	90 - 73.7	32.690	7	3.7798	0.0040
L4	73.7 - 60	21.089	7	2.9427	0.0023
L5	60 - 41.75	13.609	7	2.2348	0.0013
L6	41.75 - 30	6.390	7	1.5009	0.0007
L7	30 - 20.75	3.271	7	1.0196	0.0004
L8	20.75 - 0	1.594	7	0.7041	0.0003

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
127.00	A-ANT-18G-2-C	7	65.815	4.4558	0.0064	122582
116.00	APXVSPP18-C-A20 w/ Mount Pipe	7	55.572	4.4107	0.0062	11067
114.00	800MHz 2X50W RRH W/FILTER	7	53.715	4.3914	0.0061	7045
105.00	BXA-70063/4CF w/ Mount Pipe	7	45.481	4.2506	0.0055	2654
96.00	APX18-206517-CT2 w/ Mount Pipe	7	37.615	4.0077	0.0047	1633
60.00	OG-860/1920/GPS-A	7	13.609	2.2348	0.0013	1306
50.00	KS24019-L112A	7	9.286	1.8225	0.0010	1350
30.00	(2) Bridge Stiffener (63" x 15" x 1.25")	7	3.271	1.0196	0.0004	1543

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)	P16x.375	10.00	0.00	0.0	25.200	18.4078	-0.99	463.88	0.002
L2	120 - 90 (2)	P24x1/4	30.00	0.00	0.0	23.696	18.6532	-8.49	442.00	0.019
L3	90 - 73.7 (3)	P24x3/8	16.30	0.00	0.0	25.200	27.8325	-10.44	701.38	0.015
L4	73.7 - 60 (4)	RPS 24" x 0.59485"	13.70	0.00	0.0	24.738	43.7390	-12.85	1082.02	0.012
L5	60 - 41.75 (5)	RPS 30" x 0.54289"	18.25	0.00	0.0	22.788	50.2403	-17.41	1144.88	0.015
L6	41.75 - 30 (6)	RPS 30" x 0.70222"	11.75	0.00	0.0	21.150	64.6335	-20.32	1367.00	0.015
L7	30 - 20.75 (7)	RPS 36" x 0.55688"	9.25	0.00	0.0	21.522	62.0074	-23.31	1334.52	0.017
L8	20.75 - 0 (8)	RPS 36" x 0.69004"	20.75	0.00	0.0	21.522	76.5458	-29.28	1647.42	0.018

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)	P16x.375	11.50	1.965	27.720	0.071	0.00	0.000	27.720	0.000
L2	120 - 90 (2)	P24x1/4	249.59	27.325	23.696	1.153	0.00	0.000	23.696	0.000
L3	90 - 73.7 (3)	P24x3/8	453.97	33.657	27.720	1.214	0.00	0.000	27.720	0.000
L4	73.7 - 60 (4)	RPS 24" x 0.59485"	636.22	30.570	27.212	1.123	0.00	0.000	27.212	0.000
L5	60 - 41.75 (5)	RPS 30" x 0.54289"	907.73	29.974	25.067	1.196	0.00	0.000	25.067	0.000
L6	41.75 - 30 (6)	RPS 30" x 0.70222"	1091.30	28.310	23.265	1.217	0.00	0.000	23.265	0.000
L7	30 - 20.75 (7)	RPS 36" x 0.55688"	1245.09	27.614	23.674	1.166	0.00	0.000	23.674	0.000
L8	20.75 - 0 (8)	RPS 36" x 0.69004"	1604.77	29.045	23.674	1.227	0.00	0.000	23.674	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)	P16x.375	1.77	0.192	16.800	0.011	0.02	0.002	16.800	0.000
L2	120 - 90 (2)	P24x1/4	12.10	1.298	16.800	0.077	0.42	0.023	11.901	0.002
L3	90 - 73.7 (3)	P24x3/8	12.97	0.932	16.800	0.055	0.38	0.014	16.800	0.001
L4	73.7 - 60 (4)	RPS 24" x 0.59485"	13.64	0.624	16.492	0.038	0.35	0.009	16.492	0.001
L5	60 - 41.75 (5)	RPS 30" x 0.54289"	15.37	0.612	15.192	0.040	0.32	0.005	15.192	0.000
L6	41.75 - 30 (6)	RPS 30" x 0.70222"	15.88	0.491	14.100	0.035	0.30	0.004	14.100	0.000
L7	30 - 20.75 (7)	RPS 36" x 0.55688"	16.86	0.544	14.348	0.038	0.27	0.003	14.348	0.000
L8	20.75 - 0 (8)	RPS 36" x 0.69004"	17.79	0.465	14.348	0.032	0.23	0.002	14.348	0.000

Pole Interaction Design Data

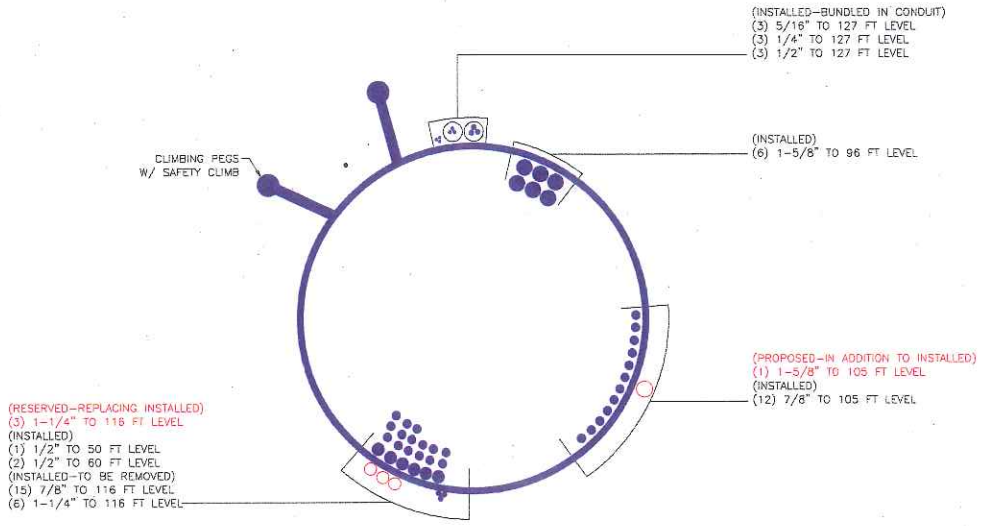
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	130 - 120 (1)	0.002	0.071	0.000	0.011	0.000	0.073 ✓	1.333	H1-3+VT ✓
L2	120 - 90 (2)	0.019	1.153	0.000	0.077	0.002	1.179 ✓	1.333	H1-3+VT ✓
L3	90 - 73.7 (3)	0.015	1.214	0.000	0.055	0.001	1.232 ✓	1.333	H1-3+VT ✓
L4	73.7 - 60 (4)	0.012	1.123	0.000	0.038	0.001	1.137 ✓	1.333	H1-3+VT ✓
L5	60 - 41.75 (5)	0.015	1.196	0.000	0.040	0.000	1.213 ✓	1.333	H1-3+VT ✓
L6	41.75 - 30 (6)	0.015	1.217	0.000	0.035	0.000	1.233 ✓	1.333	H1-3+VT ✓
L7	30 - 20.75 (7)	0.017	1.166	0.000	0.038	0.000	1.185 ✓	1.333	H1-3+VT ✓
L8	20.75 - 0 (8)	0.018	1.227	0.000	0.032	0.000	1.246 ✓	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	P16x.375	1	-0.99	618.35	5.5	Pass
L2	120 - 90	Pole	P24x1/4	2	-8.49	589.19	88.4	Pass
L3	90 - 73.7	Pole	P24x3/8	3	-10.44	934.94	92.4	Pass
L4	73.7 - 60	Pole	RPS 24" x 0.59485"	4	-12.85	1442.33	85.3	Pass
L5	60 - 41.75	Pole	RPS 30" x 0.54289"	5	-17.41	1526.12	91.0	Pass
L6	41.75 - 30	Pole	RPS 30" x 0.70222"	6	-20.32	1822.21	92.5	Pass
L7	30 - 20.75	Pole	RPS 36" x 0.55688"	7	-23.31	1778.92	88.9	Pass
L8	20.75 - 0	Pole	RPS 36" x 0.69004"	8	-29.28	2196.01	93.5	Pass
							Summary	
						Pole (L8)	93.5	Pass
						RATING =	**93.5**	**Pass**

APPENDIX B

BASE LEVEL DRAWING

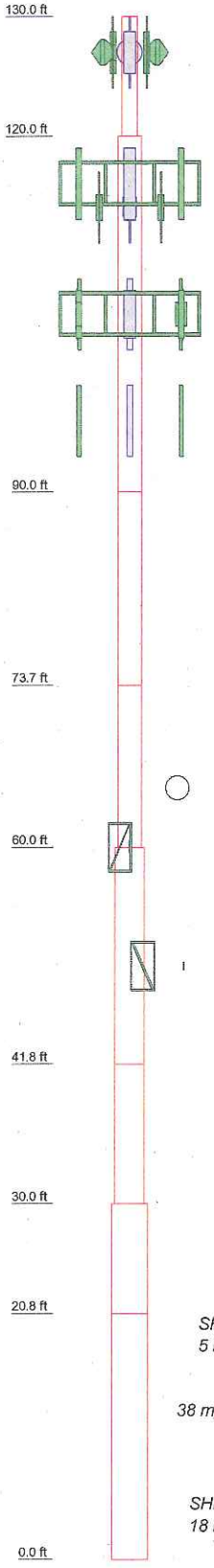

(INSTALLED-BUNDLED IN CONDUIT)
(3) 5/16" TO 127 FT LEVEL
(3) 1/4" TO 127 FT LEVEL
(3) 1/2" TO 127 FT LEVEL
(INSTALLED)
(6) 1-5/8" TO 96 FT LEVEL
CLIMBING PEGS W/ SAFETY CLIMB
(PROPOSED-IN ADDITION TO INSTALLED)
(1) 1-5/8" TO 105 FT LEVEL
(INSTALLED)
(12) 7/8" TO 105 FT LEVEL
(RESERVED-REPLACING INSTALLED)
(3) 1-1/4" TO 116 FT LEVEL
(INSTALLED)
(1) 1/2" TO 50 FT LEVEL
(2) 1/2" TO 60 FT LEVEL
(INSTALLED-TO BE REMOVED)
(15) 7/8" TO 116 FT LEVEL
(6) 1-1/4" TO 116 FT LEVEL

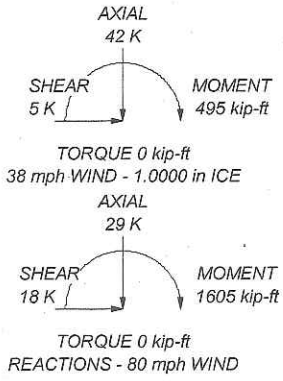
APPENDIX C

ADDITIONAL CALCULATIONS

Program Version 6.0.3.0 - 12/7/2011 File:G:/TOWER/375_Crown_Castle/2013/37513-0205 BU 876324/37513-0205 Reinforced.eri

Section	Size	Length (ft)	Socket Length (ft)	Grade	Weight (K)
1	P16x.375	10.00	5.00	A53-B-42	0.6
2	P24x1/4	30.00	5.00	A53-B-42	1.9
3	P24x3/8	16.30	5.00	A53-B-42	1.5
4	RPS 24" x 0.59485"	13.70	5.00	Reinf 41.23 ksi	2.0
5	RPS 30" x 0.54289"	18.25	5.00	Reinf 37.98 ksi	3.1
6	RPS 30" x 0.70222"	11.75	5.00	Reinf 35.25 ksi	2.8
7	RPS 36" x 0.55688"	9.25	5.00	Reinf 35.87 ksi	2.0
8	RPS 36" x 0.69004"	20.75			5.4
					19.2





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
LLPX310R w/ Mount Pipe	127	BXA-171063-12CF-EDIN-2 w/ Mount Pipe	105
LLPX310R w/ Mount Pipe	127		
LLPX310R w/ Mount Pipe	127	BXA-171063-12CF-EDIN-2 w/ Mount Pipe	105
HORIZON COMPACT	127		
HORIZON COMPACT	127	BXA-80063-4CF-EDIN-2 w/ Mount Pipe	105
HORIZON COMPACT	127		
WIMAX DAP HEAD	127	BXA-80063-4CF-EDIN-2 w/ Mount Pipe	105
WIMAX DAP HEAD	127		
WIMAX DAP HEAD	127	BXA-80063-4CF-EDIN-2 w/ Mount Pipe	105
Side Arm Mount [SO 102-3]	127	RRH2x40-AWS	105
6' x 2" Mount Pipe	127	RRH2x40-AWS	105
6' x 2" Mount Pipe	127	RRH2x40-AWS	105
6' x 2" Mount Pipe	127	DB-T1-6Z-8AB-0Z	105
A-ANT-18G-2-C	127	RRH 2x40-700 W/SOLAR	105
A-ANT-18G-2-C	127	RRH 2x40-700 W/SOLAR	105
A-ANT-18G-2-C	127	RRH 2x40-700 W/SOLAR	105
Platform Mount [LP 404-1]	116	Platform Mount [LP 404-1]	105
APXVSPP18-C-A20 w/ Mount Pipe	116	BXA-70063/4CF w/ Mount Pipe	105
APXVSPP18-C-A20 w/ Mount Pipe	116	BXA-70063/4CF w/ Mount Pipe	105
APXVSPP18-C-A20 w/ Mount Pipe	116	BXA-70063/4CF w/ Mount Pipe	105
PCS 1900MHz 4x45W-65MHz	114	Pipe Mount [PM 601-3]	96
800MHz 2X50W RRH W/FILTER	114	APX18-206517-CT2 w/ Mount Pipe	96
PCS 1900MHz 4x45W-65MHz	114	APX18-206517-CT2 w/ Mount Pipe	96
Side Arm Mount [SO 102-3]	114	APX18-206517-CT2 w/ Mount Pipe	96
(2) 6' x 2" Mount Pipe	114	Side Arm Mount [SO 701-1]	60
(2) 6' x 2" Mount Pipe	114	(2) Bridge Stiffener (63" x 15" x 1.25")	60
(2) 6' x 2" Mount Pipe	114	OG-860/1920/GPS-A	60
800MHz 2X50W RRH W/FILTER	114	OG-860/1920/GPS-A	60
PCS 1900MHz 4x45W-65MHz	114	Side Arm Mount [SO 701-1]	60
800MHz 2X50W RRH W/FILTER	114	Side Arm Mount [SO 701-1]	50
MG D3-800Tx w/ Mount Pipe	105	KS24019-L112A	50
MG D3-800Tx w/ Mount Pipe	105	(2) Bridge Stiffener (63" x 15" x 1.25")	30
MG D3-800Tx w/ Mount Pipe	105		
BXA-171063-12CF-EDIN-2 w/ Mount Pipe	105		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A53-B-42	42 ksi	63 ksi	Reinf 35.25 ksi	35 ksi	45 ksi
Reinf 41.23 ksi	41 ksi	65 ksi	Reinf 35.87 ksi	36 ksi	65 ksi
Reinf 37.98 ksi	38 ksi	65 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: 93.5%

Paul J Ford and Company
250 E. Broad Street Suite 1500
Columbus, OH 43215
Phone: 614.221.6679
FAX: 614.448.4105

Job: *120' Monopole / West Hartford United Methodist*		
Project: *PJF 37512-3059 / BU 876324*		
Client: CCI	Drawn by: John J Woolley	App'd:
Code: TIA/EIA-222-F	Date: 01/16/13	Scale: NTS
Path: G:\TOWER\375 Crown Castle\2013\37513-0205 BU 876324\37513-0205 Reinforced an		Dwg No. E-1

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215-3708
Phone 614-221-6679 • Fax 614-448-4105 • www.PJFweb.com

Date: 1/16/2013
PJF Project: 37513-0205
Client Ref. # 876324
Site Name:
Description:
Owner:
Engineer: JJW

v4.1 - Effective 7-3-12

Asymmetric Anchor Rod Analysis

Moment =	1605	k-ft	TIA Ref.	F	Location =	Base Plate		
Axial =	29.0	kips	ASIF =	1.3333	η =	N/A	for BP, Rev. G Sect. 4.9.9	
Shear =	18.0	kips	Max Ratio =	105.0%	Threads =	N/A	for FP, Rev. G	
Anchor Qty =	19							

** For Post Installed Anchors: Check anchors for embedment, epoxy/grout bond, and capacity based on proof load. **

Item	Nominal Anchor Dia, in	Spec	Fy, ksi	Fu, ksi	Location, degrees	Anchor Circle, in	Area Override, in^2	Area, in^2	Max Net Compression, kips	Max Net Tension, kips	Load for Capacity Calc, kips	Capacity Override, kips	Capacity, kips	Capacity Ratio
1	1.750	Williams R71	127.7	150	0.0	49.50	0.00	2.66	150.88	146.62	146.62	0.00	175.76	83.4%
2	1.750	Williams R71	127.7	150	120.0	49.50	0.00	2.66	150.88	146.62	146.62	0.00	175.76	83.4%
3	1.750	Williams R71	127.7	150	240.0	49.50	0.00	2.66	150.88	146.62	146.62	0.00	175.76	83.4%
4	1.500	A354 Gr BC	109	125	0.0	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
5	1.500	A354 Gr BC	109	125	22.5	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
6	1.500	A354 Gr BC	109	125	45.0	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
7	1.500	A354 Gr BC	109	125	67.5	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
8	1.500	A354 Gr BC	109	125	90.0	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
9	1.500	A354 Gr BC	109	125	112.5	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
10	1.500	A354 Gr BC	109	125	135.0	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
11	1.500	A354 Gr BC	109	125	157.5	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
12	1.500	A354 Gr BC	109	125	180.0	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
13	1.500	A354 Gr BC	109	125	202.5	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
14	1.500	A354 Gr BC	109	125	225.0	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
15	1.500	A354 Gr BC	109	125	247.5	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
16	1.500	A354 Gr BC	109	125	270.0	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
17	1.500	A354 Gr BC	109	125	292.5	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
18	1.500	A354 Gr BC	109	125	315.0	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
19	1.500	A354 Gr BC	109	125	337.5	41.50	0.00	1.77	84.17	81.34	81.34	0.00	97.19	83.7%
								36.26						

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

TIA Rev F

Site Data

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

Reactions		
Moment:	1144.8	ft-kips
Axial:	22.6	kips
Shear:	14	kips

Reactions adjusted to account for additional anchors

Anchor Rod Data		
Qty:	16	
Diam:	1.5	in
Rod Material:	Other	
Strength (Fu):	125	ksi
Yield (Fy):	109	ksi
Bolt Circle:	41.5	in

Plate Data		
Diam:	47	in
Thick:	2	in
Grade:	36	ksi
Single-Rod B-eff:	7.07	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	60	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

Maximum Rod Tension:	81.3 Kips	Rigid
Allowable Tension:	97.2 Kips	Service, ASD
Anchor Rod Stress Ratio:	83.7% Pass	Fty*ASIF

Base Plate Results Flexural Check

Base Plate Stress:	30.1 ksi	Rigid
Allowable Plate Stress:	36.0 ksi	Service ASD
Base Plate Stress Ratio:	83.5% Pass	0.75*Fy*ASIF
		Y.L. Length: 20.65

n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a

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

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

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215-3708
Phone 614-221-6679 • Fax 614-448-4105 • www.PJFweb.com

Date: 1/16/2013
PJF Project: 37513-0205
Client Ref. # 876324
Site Name:
Description: Flange at 30'
Owner:
Engineer: JJW

v4.1 - Effective 7-3-12

Asymmetric Bolt Analysis

Moment =	1091	k-ft	TIA Ref.	F	Location =	Flange Plate		
Axial =	20.3	kips	ASIF =	1.3333	η =	N/A	for BP, Rev. G Sect. 4.9.9	
Shear =	15.9	kips	Max Ratio =	105.0%	Threads =	N/A	for FP, Rev. G	
Anchor Qty =	3							

** For Flange Plates: Prying action is not considered in the bolt loads. **

Item	Nominal Bolt Dia, in	Spec	Fy, ksi	Fu, ksi	Location, degrees	Bolt Circle, in	Area Override, in^2	Area, in^2	Max Net Compression, kips	Max Net Tension, kips	Load for Capacity Calc, kips	Capacity Override, kips	Capacity, kips	Capacity Ratio
1	0.000	Other			0.0	51.50	9.13	9.13	345.82	332.27	345.82	410.98	410.98	84.1%
2	0.000	Other			120.0	51.50	9.13	9.13	345.82	332.27	345.82	410.98	410.98	84.1%
3	0.000	Other			240.0	51.50	9.13	9.13	345.82	332.27	345.82	410.98	410.98	84.1%
								27.38						

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Date: 1/16/2013
PJF Project: 37512-3059
Client Ref. # 876324
Site Name:
Description: Flange at 60'
Owner:
Engineer: JJW

Asymmetric Bolt Analysis

Moment =	636	k-ft	TIA Ref.	F	Location =	Flange Plate		
Axial =	12.9	kips	ASIF =	1.3333	η =	N/A	for BP, Rev. G Sect. 4.9.9	
Shear =	13.6	kips	Max Ratio =	105.0%	Threads =	N/A	for FP, Rev. G	
Anchor Qty =	3							

** For Flange Plates: Prying action is not considered in the bolt loads. **

Item	Nominal Bolt Dia, in	Spec	Fy, ksi	Fu, ksi	Location, degrees	Bolt Circle, in	Area Override, in^2	Area, in^2	Max Net Compression, kips	Max Net Tension, kips	Load for Capacity Calc, kips	Capacity Override, kips	Capacity, kips	Capacity Ratio
1	0.000	Other	65	80	0.0	46.00	6.00	6.00	225.58	217.01	225.58	267.05	267.05	84.5%
2	0.000	Other	65	80	120.0	46.00	6.00	6.00	225.58	217.01	225.58	267.05	267.05	84.5%
3	0.000	Other	65	80	240.0	46.00	6.00	6.00	225.58	217.01	225.58	267.05	267.05	84.5%
								18.00						

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

Site Data

BU#:
Site Name:
App #:

Pole Manufacturer:	Other

Reactions		
Moment:	249.59	ft-kips
Axial:	8.49	kips
Shear:	12.1	kips
Elevation:	90	feet

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

Bolt Data			
Qty:	20		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:	75	<-- Disregard	Bolt Fty: 44.00
N/A:	55	<-- Disregard	
Circle (in.):	29		

Plate Data		
Diam:	32	in
Thick, t:	1.5	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:	24	in
Thick:	0.5	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	60	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Flange Bolt Results

Bolt Tension Capacity, B:	46.07	kips	Rigid
Max Bolt directly applied T:	20.23	Kips	Service, ASD
Min. PL "tc" for B cap. w/o Pry:	2.018	in	Fty*ASIF
Min PL "treq" for actual T w/ Pry:	1.020	in	
Min PL "t1" for actual T w/o Pry:	1.338	in	
T allowable with Prying:	35.75	kips	0≤α'≤1 case
Prying Force, Q:	0.00	kips	
Total Bolt Tension=T+Q:	20.23	kips	
Prying Bolt Stress Ratio=(T+Q)/(B):	43.9%	Pass	

Exterior Flange Plate Results Flexural Check

Compression Side Plate Stress:	21.5	ksi	Rigid
Allowable Plate Stress:	36.0	ksi	Service ASD
Compression Plate Stress Ratio:	59.8%	Pass	0.75*Fy*ASIF
No Prying			Comp. Y.L. Length:
Tension Side Stress Ratio, (treq/t)^2:	46.3%	Pass	16.28

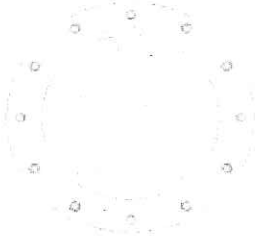
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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

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Phone 614-221-6679 • Fax 614-448-4105 • www.PJFweb.com

v4.1 - Effective 7-3-12

Date: 1/16/2013
PJF Project: 37513-0205
Client Ref. # 876324
Site Name:
Description: 120' Flange
Owner:
Engineer: JJW

Asymmetric Bolt Analysis

Moment =	12	k-ft	TIA Ref.	F	Location =	Flange Plate		
Axial =	1.0	kips	ASIF =	1.3333	η =	N/A	for BP, Rev. G Sect. 4.9.9	
Shear =	1.8	kips	Max Ratio =	105.0%	Threads =	N/A	for FP, Rev. G	
Anchor Qty =	9							

** For Flange Plates: Prying action is not considered in the bolt loads. **

Item	Nominal Bolt Dia, in	Spec	Fy, ksi	Fu, ksi	Location, degrees	Bolt Circle, in	Area Override, in^2	Area, in^2	Max Net Compression, kips	Max Net Tension, kips	Load for Capacity Calc, kips	Capacity Override, kips	Capacity, kips	Capacity Ratio
1	0.750	A325	92	120	0.0	26.00	0.00	0.44	2.47	2.25	2.25	0.00	25.92	8.7%
2	0.750	A325	92	120	30.0	26.00	0.00	0.44	2.47	2.25	2.25	0.00	25.92	8.7%
3	0.750	A325	92	120	60.0	26.00	0.00	0.44	2.47	2.25	2.25	0.00	25.92	8.7%
4	0.750	A325	92	120	120.0	26.00	0.00	0.44	2.47	2.25	2.25	0.00	25.92	8.7%
5	0.750	A325	92	120	150.0	26.00	0.00	0.44	2.47	2.25	2.25	0.00	25.92	8.7%
6	0.750	A325	92	120	180.0	26.00	0.00	0.44	2.47	2.25	2.25	0.00	25.92	8.7%
7	0.750	A325	92	120	240.0	26.00	0.00	0.44	2.47	2.25	2.25	0.00	25.92	8.7%
8	0.750	A325	92	120	270.0	26.00	0.00	0.44	2.47	2.25	2.25	0.00	25.92	8.7%
9	0.750	A325	92	120	300.0	26.00	0.00	0.44	2.47	2.25	2.25	0.00	25.92	8.7%
								3.98						

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

Site Data	LOWER PLATE
BU#:	
Site Name:	
App #:	

Pole Manufacturer:	Other

Bolt Data			
Qty:	12		
Diameter (in.):	0.75	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:	75	<-- Disregard	Bolt Fty: 44.00
N/A:	55	<-- Disregard	
Circle (in.):	26		

Plate Data		
Diam:	28	in
Thick, t:	0.75	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	4.71	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:	18	in
Thick:	0.25	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	60	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Reactions		
Moment:	15.166667	ft-kips
Axial:	1	kips
Shear:	1.8	kips
Elevation:	120	feet

Reactions adjusted to account for mouse hole configuration.

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

Flange Bolt Results

		Non-Rigid
Bolt Tension Capacity, B:	25.91 kips	Service, ASD
Max Bolt directly applied T:	2.25 Kips	Fty*ASIF
Min. PL "tc" for B cap. w/o Pry:	1.823 in	
Min PL "treq" for actual T w/ Pry:	0.397 in	
Min PL "t1" for actual T w/o Pry:	0.537 in	
T allowable with Prying:	8.02 kips	α'>1 case
Prying Force, Q:	0.00 kips	
Total Bolt Tension=T+Q:	2.25 kips	
Prying Bolt Stress Ratio=(T+Q)/(B):	8.7% Pass	

Exterior Flange Plate Results	Flexural Check	Non-Rigid
Compression Side Plate Stress:	10.9 ksi	Service ASD
Allowable Plate Stress:	36.0 ksi	0.75*Fy*ASIF
Compression Plate Stress Ratio:	30.3% Pass	Comp. Y.L. Length:
No Prying		18.76
Tension Side Stress Ratio, (treq/t)^2:	28.1% Pass	

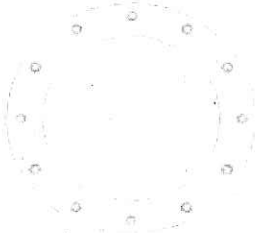
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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

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

Site Data	TOP PLATE
BU#:	
Site Name:	
App #:	

Pole Manufacturer:	Other

Bolt Data			
Qty:	12		
Diameter (in.):	0.75	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:	75	<-- Disregard	Bolt Fty: 44.00
N/A:	55	<-- Disregard	
Circle (in.):	26		

Plate Data		
Diam:	28	in
Thick, t:	1.5	in
Grade (Fy):	50	ksi
Strength, Fu:	65	ksi
Single-Rod B-eff:	4.19	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:	16	in
Thick:	0.375	in
Grade:	50	ksi
# of Sides:	0	"0" IF Round
Fu	65	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor	
ASIF:	1.333

Reactions		
Moment:	15.166667	ft-kips
Axial:	1	kips
Shear:	1.8	kips
Elevation:	120	feet

Reactions adjusted to account for mouse hole configuration

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

Flange Bolt Results

		Non-Rigid
Bolt Tension Capacity, B:	25.91 kips	Service, ASD
Max Bolt directly applied T:	2.25 Kips	Fty*ASIF
Min. PL "tc" for B cap. w/o Pry:	1.853 in	
Min PL "treq" for actual T w/ Pry:	0.406 in	
Min PL "t1" for actual T w/o Pry:	0.546 in	
T allowable with Prying:	19.02 kips	0≤α'≤1 case
Prying Force, Q:	0.00 kips	
Total Bolt Tension=T+Q:	2.25 kips	
Prying Bolt Stress Ratio=(T+Q)/(B):	8.7% Pass	

Exterior Flange Plate Results	Flexural Check	Non-Rigid
Compression Side Plate Stress:	3.4 ksi	Service ASD
Allowable Plate Stress:	50.0 ksi	0.75*Fy*ASIF
Compression Plate Stress Ratio:	6.7% Pass	Comp. Y.L. Length: 20.49
No Prying		
Tension Side Stress Ratio, (treq/t)^2:	7.3% Pass	

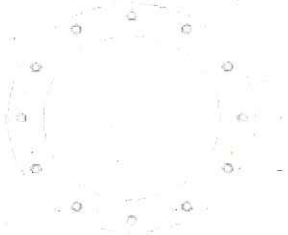
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215-3708
Phone 614-221-6679 • Fax 614-448-4105 • www.PJFweb.com

Job Number: 37513-0205
Site Number: 876324
Site Name: Site Name

Page: 1
By: JJW
Date: 1/16/2013

DRILLED PIER SOIL AND STEEL ANALYSIS - TIA/EIA-222-F

Unfactored Base Reactions from RISA

	Comp. (+)	Tension (-)	
Moment, M =	1605.0		k-ft
Shear, V =	18.0		kips
Axial Load, P =	29.0		kips
OTM =	1614.0	0.0	k-ft @ Ground

Safety Factors / Load Factors / Φ Factors

Tower Type =	Monopole DP
ACI Code =	ACI 318-02
Seismic Design Category =	D
Reference Standard =	TIA/EIA-222-F
Use 1.3 Load Factor?	Yes
Load Factor =	1.30

Drilled Pier Parameters

Diameter =	5.5	ft
Height Above Grade =	0.5	ft
Depth Below Grade =	24	ft
fc' =	3.5	ksi
εc =	0.003	in/in
Mat Ftdn. Cap Width =		ft
Mat Ftdn. Cap Length =		ft
Depth Below Grade =		ft

	Safety Factor	Φ Factor
Soil Lateral Resistance =	2.00	0.75
Skin Friction =	2.00	0.75
End Bearing =	2.00	0.75
Concrete Wt. Resist Uplift =	1.25	

Load Combinations Checked per TIA/EIA-222-F

1. Ult. Skin Friction/2.00 + Ult. End Bearing/2.00 + Effective Soil Wt. - Buoyant Conc. Wt. ≥ Compression
2. Ult. Skin Friction/2.00 + Buoyant Conc. Wt./1.25 ≥ Uplift
3. Ult. Skin Friction/1.50 + Buoyant Conc. Wt./1.50 ≥ Uplift

Steel Parameters

Number of Bars =	20	
Rebar Size =	#9	
Rebar Fy =	60	ksi
Rebar MOE =	29000	ksi
Tie Size =	#5	
Side Clear Cover to Ties =	3	in

Soil Parameters

Water Table Depth =	7.00	ft
Depth to Ignore Soil =	8.25	ft
Depth to Full Cohesion =	0	ft
Full Cohesion Starts at?	Ground	

Above Full Cohesion Lateral Resistance = 4(Cohesion)(Dia)(H)
Below Full Cohesion Lateral Resistance = 8(Cohesion)(Dia)(H)

Direct Embed Pole Shaft Parameters

Dia @ Grade =		in
Dia @ Depth Below Grade =		in
Number of Sides =		
Thickness =		in
Fy =		ksi
Backfill Condition =		

Maximum Capacity Ratios

Maximum Soil Ratio =	110.0%
Maximum Steel Ratio =	105.0%

Define Soil Layers

Note: Cohesion = Undrained Shear Strengh = Unconfined Compressive Strength / 2

Layer	Thickness ft	Unit Weight pcf	Cohesion psf	Friction Angle degrees	Soil Type	Ultimate End Bearing psf	Comp. Ult. Skin Friction psf	Tension Ult. Skin Friction psf	Depth ft
1	35	125	4000		Clay	8000			35
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

Soil Results: Overturning

Depth to COR =	16.42	ft, from Grade
Bending Moment, M =	1909.52	k-ft, from COR
Resisting Moment, Ma =	5464.91	k-ft, from COR

MOMENT RATIO = 34.9% OK

Shear, V =	18.00	kips
Resisting Shear, Va =	51.51	kips

SHEAR RATIO = 34.9% OK

Soil Results: Uplift

Uplift, T =	0.00	kips
Allowable Uplift Cap., Ta =	49.69	kips

UPLIFT RATIO = 0.0% OK

Soil Results: Compression

Compression, C =	29.00	kips
Allowable Comp. Cap., Ca =	79.00	kips

COMPRESSION RATIO = 36.7% OK

Steel Results (ACI 318-02):

Minimum Steel Area =	11.40	sq in
Actual Steel Area =	20.00	sq in
Allowable Min Axial, Pa =	-830.77	kips, Where Ma = 0 k-ft
Allowable Max Axial, Pa =	4527.42	kips, Where Ma = 0 k-ft

Axial Load, P =	59.37	kips @ 8.75 ft Below Grade
Moment, M =	1767.66	k-ft @ 8.75 ft Below Grade
Allowable Moment, Ma =	2007.75	k-ft

MOMENT RATIO = 88.0% OK

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#: *876324*
Site Name: *Site Name*
App #:

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

Pier Properties

Concrete:

Pier Diameter =	5.5	ft
Concrete Area =	3421.2	in^2

Reinforcement:

Clear Cover to **Tie**=	3.00	in
Horiz. **Tie** Bar Size=	5	
Vert. Cage Diameter =	4.80	ft
Vert. Cage Diameter =	57.62	in
Vertical Bar Size =	9	
Bar Diameter =	1.13	in
Bar Area =	1	in^2
Number of Bars =	20	
As Total=	20	in^2
A s/ Aconc, Rho:	0.0058	0.58%

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

(3)*(Sqrt(f'c)/Fy:	0.0030
200 / Fy:	0.0033

Minimum Rho Check:

Actual Req'd Min. Rho:	0.33%	Flexural
Provided Rho:	0.58%	OK

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn.		
Pn per ACI 318 (10-2)	5885.65	kips
at Mu=(ϕ=0.65)Mn=	2805.54	ft-kips
Max Tu, (φ=0.9) Tn =	1080	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Maximum Shaft Superimposed Forces

TIA Revision:	F	
Max. Service Shaft M:	1767.66	ft-kips (* Note)
Max. Service Shaft P:	59.37	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:	2297.958	ft-kips
1.30	Pu:	77.181	kips

Material Properties

Concrete Comp. strength, f'c =	3500	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	

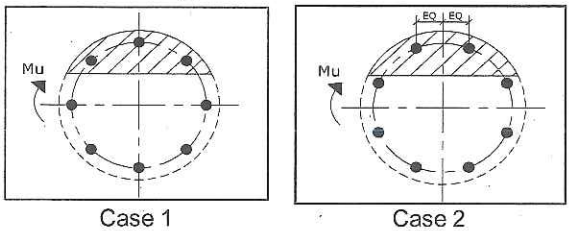
Seismic Properties

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:	**10.48**	in
Extreme Steel Strain, εt:	**0.0147**	
	εt > 0.0050, Tension Controlled	
Reduction Factor,φ:	**0.900**	

Output Note: Negative Pu=Tension

For Axial Compression, φ Pn = Pu:	77.18	kips
Drilled Shaft Moment Capacity, φMn:	**2610.08**	ft-kips
Drilled Shaft Superimposed Mu:	**2297.96**	ft-kips

(Mu/φMn, Drilled Shaft Flexure CSR:	**88.0%**