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

June 20, 2014

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

Re: **Completion of Construction Activity**

Dear Ms. Bachman:

The purpose of this letter is to notify the Siting Council that construction activity associated with the Cellco Partnership d/b/a Verizon Wireless telecommunications facility modifications listed below has been completed.

EM-VER-007-130226 – 260 Beckley Road, Berlin, Connecticut
EM-VER-011-130125 – 811 Blue Hills Avenue, Bloomfield, Connecticut
EM-VER-011-130214 – 785 Park Avenue, Bloomfield, Connecticut
EM-VER-012-130107 – 130 Vernon Road, Bolton, Connecticut
EM-VER-043-130220 – 148 Roberts Road, East Hartford, Connecticut
EM-VER-057-130214 – Butternut Hollow Road, Greenwich, Connecticut
EM-VER-059-130220 – 68 Groton Long Point Road, Groton, Connecticut
EM-VER-062-130128 – 265 Benham Street, Hamden, Connecticut
EM-VER-062-130220 – 890 Evergreen Avenue, Hamden, Connecticut
EM-VER-064-130125 – 590-600 Asylum Avenue, Hartford, Connecticut
EM-VER-064-130220 – 439-455 Homestead Avenue, Hartford, Connecticut
EM-VER-077-130220A – 60 Adams Street, Manchester, Connecticut
EM-VER-077-130220B – 266 Center Street, Manchester, Connecticut
EM-VER-080-130128 – 38 Elm Street, Meriden, Connecticut
EM-VER-096-130125 – 586 Danbury Road, New Milford, Connecticut
EM-VER-094-130114 – 605 Willard Avenue, Newington, Connecticut
EM-VER-094-130220 – 123 Costello Road, Newington, Connecticut
EM-VER-144-130227 – Indian Ledge Road, Trumbull, Connecticut
EM-VER-146-130123 – 777 Talcottville Road, Vernon, Connecticut
EM-VER-152-130301 – 41 Manitock Hill Road, Waterford, Connecticut
EM-VER-156-130227 – 85 Plainfield Avenue, West Haven, Connecticut

EM-VER-164-130128 – 482 Pigeon Hill Road, Windsor, Connecticut
EM-VER-169-130220 – 445 Prospect Street, Woodstock, Connecticut

If you have any questions or need any additional information regarding this facility please do not hesitate to contact me.

Sincerely,

Kenneth C. Baldwin

Copy to:
Sandy M. Carter

STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
www.ct.gov/csc

March 12, 2013

Kenneth C. Baldwin, Esq.
Robinson & Cole
280 Trumbull Street
Hartford, CT 06103-3597

RE: **EM-VER-077-130220B** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 266 Center Street, Manchester, Connecticut.

Dear Attorney Baldwin:

The Connecticut Siting Council (Council) hereby acknowledges your notice to modify this existing telecommunications facility, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies with the following conditions:

- Any deviation from the proposed modification as specified in this notice and supporting materials with Council shall render this acknowledgement invalid;
- Any material changes to this modification as proposed shall require the filing of a new notice with the Council;
- Within 45 days after completion of construction, the Council shall be notified in writing that construction has been completed;
- The validity of this action shall expire one year from the date of this letter; and
- The applicant may file a request for an extension of time beyond the one year deadline provided that such request is submitted to the Council not less than 60 days prior to the expiration;

The proposed modifications including the placement of all necessary equipment and shelters within the tower compound are to be implemented as specified here and in your notice dated February 20, 2013. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

This decision is under the exclusive jurisdiction of the Council. Please be advised that the validity of this action shall expire one year from the date of this letter. Any additional change to this facility will require explicit notice to this agency pursuant to Regulations of Connecticut State Agencies Section 16-50j-73. Such notice shall include all relevant information regarding the proposed change with cumulative worst-case modeling of radio frequency exposure at the closest point of uncontrolled access to the tower base, consistent with Federal Communications Commission, Office of Engineering and Technology, Bulletin 65. Thank you for your attention and cooperation.

Very truly yours,

LRoberts

Linda Roberts
Executive Director

LR/CDM/jb

c: The Honorable Leo V. Diana, Mayor, Town of Manchester
Scott A. Shanley, General Manager, Town of Manchester
James Davis, Zoning Enforcement Officer, Town of Manchester
Crown Castle

ROBINSON & COL

EM-VER-077-130220B

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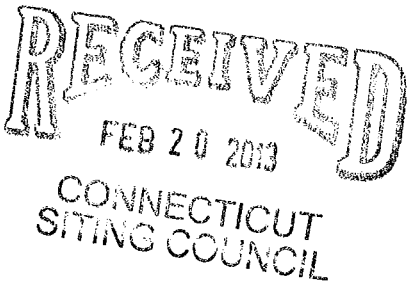
Also admitted in Massachusetts

February 20, 2013



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

Re: **Notice of Exempt Modification – Antenna Swap**
266 Center Street, Manchester, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains fifteen (15) wireless telecommunications antennas at the top of the existing 115-foot tower at the above-referenced address. The tower is owned by Crown. The Council approved Cellco's shared use of this tower in 1990. Cellco now intends to replace five (5) of its antennas with three (3) model BXA-185085-12CF PCS antennas and two (2) model BXA-171085-12BF AWS antennas, at the same level on the tower. Cellco also intends to install three (3) remote radio heads ("RRHs") behind its antennas and one (1) HYBRIFLEX™ fiber cable. 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 Leo V. Diana, Mayor for the Town of Manchester. A copy of this letter is also being sent to M Stephens Co LLC, 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 top of the 115-foot tower.

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

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

4. The operation of the replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A cumulative worst-case 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:
Leo V. Diana, Mayor
M Stephens Co LLC
Sandy M. Carter

Slant +/- 45° Dual Polarized, Panel 85° / 18 dBi

BXA-185085/12CF __ 2°

When ordering replace "___" with connector type.

Mechanical specifications

Length	1840 mm	72.4 in
Width	154 mm	6.1 in
Depth	105 mm	4.1 in
Depth with t-bracket	133 mm	5.2 in
[4] Weight	5.9 kg	13.0 lbs
Wind Area		
Fore/Aft	0.28 m^2	3.1 ft^2
Side	0.19 m^2	2.1 ft^2
Rated Wind Velocity (Safety factor 2.0)	>201 km/hr	>125 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	460 N	103.4 lbs
Side	304 N	68.3 lbs

Antenna consisting of aluminum alloy with brass feedlines covered by a UV safe fiberglass radome.

Mounting and Downtilting

Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in).

Mounting bracket kit #26799997
Downtilt bracket kit #26799999

The downtilt bracket kit includes the mounting bracket kit.

Electrical specifications

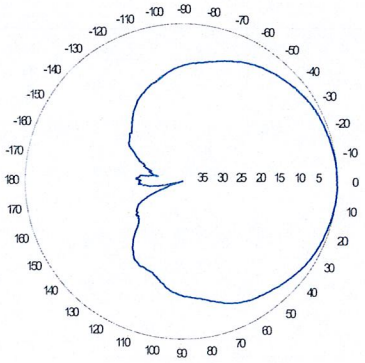
	Frequency Range	1850-1990 MHz
	Impedance	50Ω
[3]	Connector(s)	NE or E-DIN 2 ports / center
[1]	VSWR	≤ 1.4:1
	Polarization	Slant ± 45°
[1]	Isolation Between Ports	< -30 dB
[1]	Gain	18 dBi
[2]	Power Rating	250 W
[1]	Half Power Angle	
	H-Plane	85°
	E-Plane	5°
[1]	Electrical Downtilt	2°
[1]	Null Fill	5%
	Lightning Protection	Direct Ground

Patented Dipole Design: U.S. Patent No. 6,597,324 B2

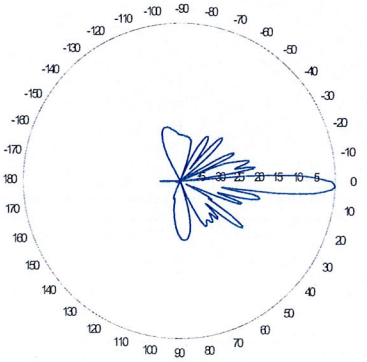
1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) The antenna weight listed above does not include the bracket weight.

Improvements to mechanical and/or electrical performance of the antenna may be made without notice.

Radiation pattern[1]



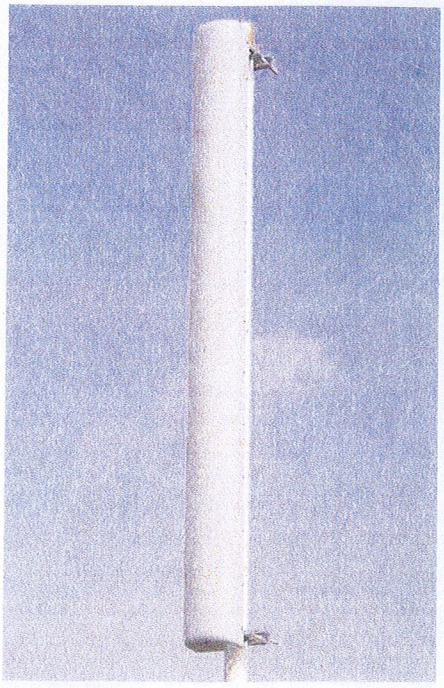
Horizontal



Vertical

Radiation patterns for all antennas are measured with the antenna mounted on a fiberglass pole.

Mounting on a metal pole will typically improve the Front-to-Back ratio.



Amphenol Antel's Exclusive 3T (True Transmission Line Technology) Antenna Design:

- Watercut brass feedline assembly for consistent performance.
- Unique feedline design eliminates the need for conventional solder joints in the signal path.
- A non-collinear system with access to every radiating element for broad band-width and superior performance.
- Air as insulation for virtually no internal signal loss.

This Amphenol Antel antenna is under a five-year limited warranty for repair or replacement.

Antenna available with center-fed connectors only.

CF Denotes a Center-Fed Connector.

1850-1990 MHz

Amphenol Antel, Inc.
The Antenna Technology Company

Revision Date: 7/11/07

Amphenol Antel, Inc. 1300 Capital Drive Rockford, Illinois 61109 USA Tel. (815) 399-0001
Toll-Free (888) 417-9562 Fax. (815) 399-0156 antel@antelinc.com www.antelinc.com

BXA-171085-12BF-EDIN-X

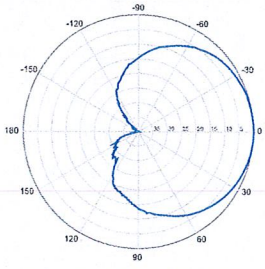
Replace "X" with desired electrical downtilt.

X-Pol | FET Panel | 85° | 18.0 dBi

Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	88°	85°	80°
Vertical beamwidth	4.5°	4.5°	4.5°
Gain	15.1 dBd / 17.2 dBi	15.5 dBd / 17.6 dBi	15.9 dBd / 18.0 dBi
Electrical downtilt (X)	0, 2, 4		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back ratio	> 30 dB		
In-band isolation	> 28 dB		
IM3 (2x20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN / Female / Bottom		
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

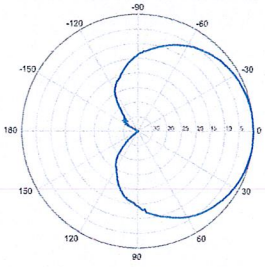
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171085-12BF-EDIN-X-FP		

BXA-171085-12BF-EDIN-X



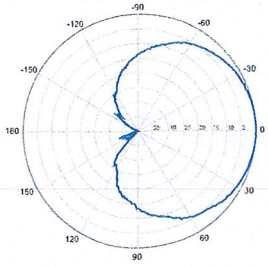
Horizontal | 1710-1880 MHz

BXA-171085-12BF-EDIN-X



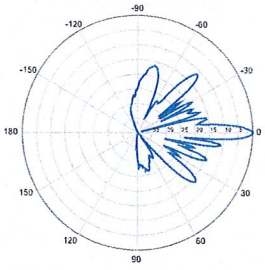
Horizontal | 1850-1990 MHz

BXA-171085-12BF-EDIN-X



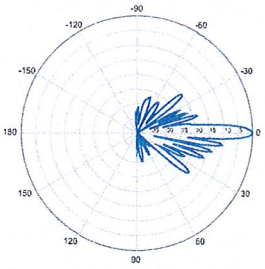
Horizontal | 1920-2170 MHz

BXA-171085-12BF-EDIN-0



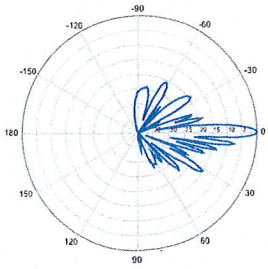
0° | Vertical | 1710-1880 MHz

BXA-171085-12BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171085-12BF-EDIN-0

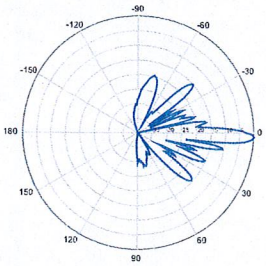


0° | Vertical | 1920-2170 MHz

BXA-171085-12BF-EDIN-X

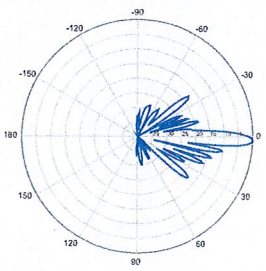
X-Pol | FET Panel | 85° | 18.0 dBi

BXA-171085-12BF-EDIN-2



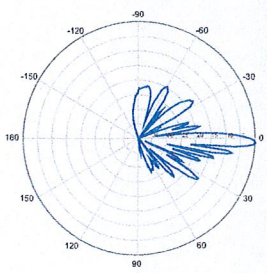
2° | Vertical | 1710-1880 MHz

BXA-171085-12BF-EDIN-2



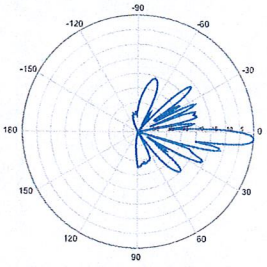
2° | Vertical | 1850-1990 MHz

BXA-171085-12BF-EDIN-2



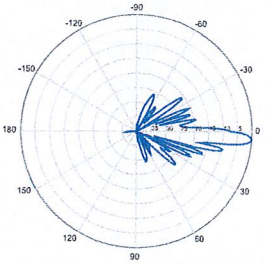
2° | Vertical | 1920-2170 MHz

BXA-171085-12BF-EDIN-4



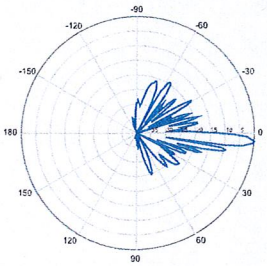
4° | Vertical | 1710-1880 MHz

BXA-171085-12BF-EDIN-4



4° | Vertical | 1850-1990 MHz

BXA-171085-12BF-EDIN-4

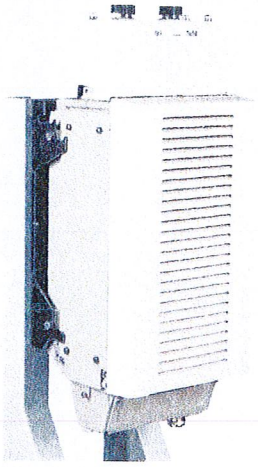


4° | Vertical | 1920-2170 MHz

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

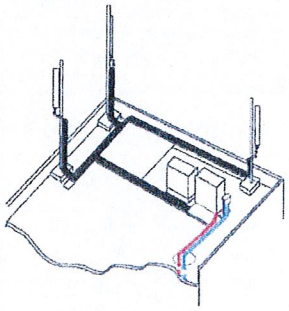
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation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

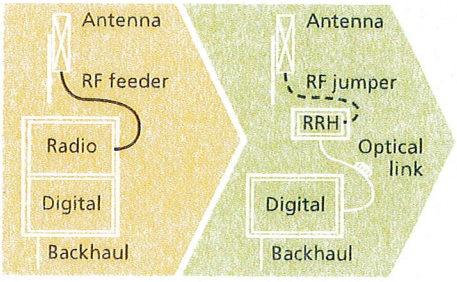
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

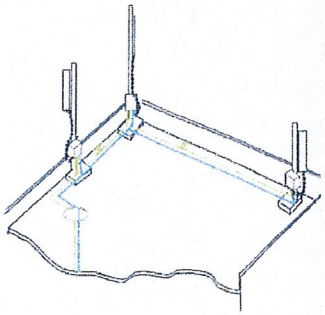
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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

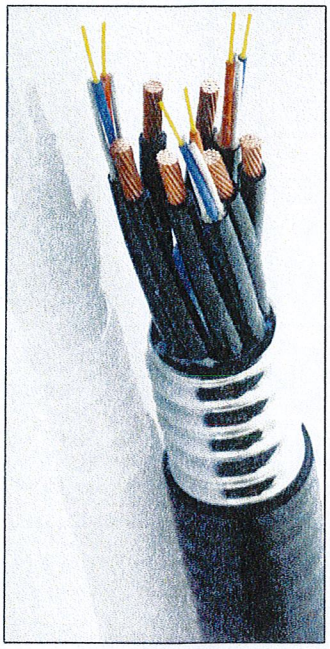


Figure 1: HYBRIFLEX Series

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)

* This data is provisional and subject to change.

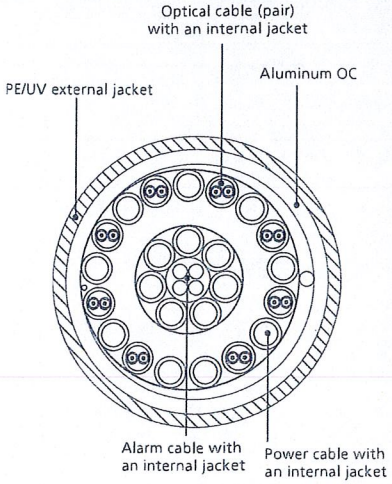


Figure 2: Construction Detail

	General	Power	Density					
Site Name: Machester								
Tower Height: Verizon @ 116ft								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*Clearwire	2	153	110	0.0091	2496	1.0000	0.91%	
*Clearwire	1	211	110	0.0063	18 GHz	1.0000	0.63%	
*XM Sat Radio	2	3141	125	0.1446	2337.49	1.0000	14.46%	
Verizon PCS	**11**	**395**	**116**	**0.1161**	**1970**	**1.0000**	**11.61%**	
Verizon Cellular	**9**	**323**	**116**	**0.0777**	**869**	**0.5793**	**13.41%**	
Verizon AWS	**1**	**1828**	**116**	**0.0488**	**2145**	**1.0000**	**4.88%**	
Verizon 700	**1**	**840**	**116**	**0.0224**	**698**	**0.4653**	**4.82%**	
								50.72%
* Source: Siting Council								

Date: **November 27, 2012**

MORRISON HERSHFIELD

Ms. Veronica Harris
Crown Castle USA Inc.
1200 McArthur Blvd
Mahwah, NJ 07430

Morrison Hershfield Corp
66 Perimeter Center East Ste. 600
Atlanta, GA 30346
(770) 379-8500

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Number:	N/A
	Carrier Site Name:	Manchester, CT
Crown Castle Designation:	**Crown Castle BU Number:**	806372
	Crown Castle Site Name:	HRT 093 943228
	Crown Castle JDE Job Number:	211977
	Crown Castle Work Order Number:	551903
	Crown Castle Application Number:	171009 Rev. 0
Engineering Firm Designation:	**Morrison Hershfield Corp Project Number:**	CN3-041/6130027
Site Data:	**Center & Pine Street, Manchester, Hartford County, CT** **Latitude *41° 46' 19"*, Longitude *-72° 31' 48.8"*** **115 Foot - Monopole Tower**	

Dear Ms. Harris,

Morrison Hershfield Corp 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 504695, in accordance with application 171009, revision 0.

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

LC7: Existing + Reserved + Proposed for all applicants (2 or more Active Applicant) **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA/EIA-222-F standard and 2005 Connecticut State Building Code with 2009 Amendments (IBC 2003) based upon a wind speed of 85-mph fastest mile equivalent to a 100-mph 3-second gust wind speed.

We at *Morrison Hershfield Corp* 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:

G. Lance Cooke, PE (CT License No. PEN.0028133)
Senior Engineer

tnxTower Report - version 6.0.4.0

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1) INTRODUCTION

This tower is a 115 ft Monopole tower designed by Valmont in May of 1990. The tower was originally designed for a wind speed of 90 mph per EIA-222-D.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 85.2 mph with no ice, 37.5 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
115.0	116.0	3	Alcatel Lucent	RRH2x40-AWS	1	1-5/8"	1
		2	Antel	BXA-171085-12BF w/ pipe mount			
		3	Antel	BXA-185085/12CF w/pipe mount			
		1	RFS	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
115.0	116.0	1	Antel	BXA-171063/12BF w/pipe mount	18	1-5/8"	1
		3	Antel	BXA-70063/6CF w/ pipe mount			
		6	Decibel	DB844G65ZAXY w/Mount Pipe			
	115.0	1	-	Platform Mount [LP 301-1]			
		5	Antel	BSA-185090/16CF			2
105.0	108.0	2	Andrew	VHLP1-23	3 2	1/2" 2-1/2"	1
		1	Andrew	VHLP2-11			
		3	Dragonwave	Horizon Compact			
		1	Motorola	Timing 2000 GPS			
	107.0	1	Andrew	VHLP1-23			
		2	Samsung	WiMax DAP Head			
	105.0	3	-	Side Arm Mount [SO 701-1]			
		3	Argus	LLPX310R w/ pipe mount	5	5/16"	3
		2	Samsung	WiMax DAP Head	5	1/4"	3

Notes:
1) Existing Equipment
2) The existing antennas are to be removed and replaced by the proposed equipment.
3) The existing 5/16" and 1/4" feedlines are installed inside the (2) two 2-1/2" conduits inside the monopole shaft.

Table 3 - Design Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
115	115	4	-	PD10017		
112	112	1	-	Platform		
106	106	12	-	PD1132		
99	99	1	-	Platform		

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	FDH Enginnering, Inc. Project # 10-06100E N1, dated 06/21/2010	2668863	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Valmont Order # 10665-90, dated 05/01/1990	262172	CCISITES
4-GEOTECHNICAL REPORTS	Testwell Craig Laboratories of CT, Inc., dated 04/12/1990	262174	CCISITES

3.1) Analysis Method

tnxTower (version 6.0.4.0), 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) The tower and structures were built in accordance with the manufacturer's specifications and applicable ANSI/TIA/EIA standards.
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) The foundation was properly designed and constructed for the original design loads.

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

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	115 - 72.3333	Pole	TP30.45x21.91x0.218	1	-5.71	236.49	63.8	Pass
L2	72.3333 - 29.3333	Pole	TP38.61x29.0799x0.313	2	-12.41	693.04	73.2	Pass
L3	29.3333 - 0	Pole	TP43.85x36.8511x0.375	3	-20.38	1314.68	76.9	Pass
							Summary	
						Pole (L3)	76.9	Pass
						Rating =	76.9	Pass

Table 6 - Tower Component Stresses vs. Capacity - LC1

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	70.9	Pass
1	Base Plate	0	44.9	Pass
1	Base Foundation	0	79.4	Pass
1	Base Foundation Soil Interaction	0	85.1	Pass

Structure Rating (max from all components) =	85.1%

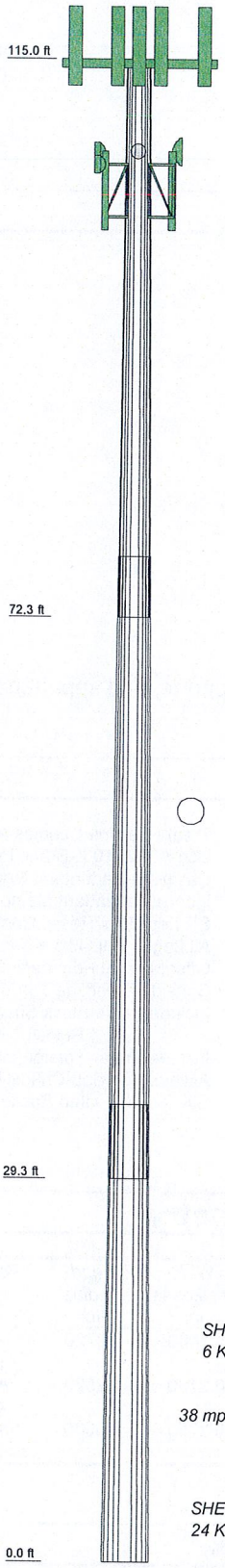
Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

4.1) Recommendations

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

APPENDIX A

TNXTOWER OUTPUT



Section	1	2	3
Length (ft)	42'8-1/32"	47'8-1/32"	35'
Number of Sides	12	12	12
Thickness (in)	0.2180	0.3130	0.3750
Socket Length (ft)	4'8-1/32"	5'8-1/32"	
Top Dia (in)	21.9100	29.0799	36.8511
Bot Dia (in)	30.4500	38.6100	43.8500
Grade		A572-65	
Weight (K)	2.6	5.5	5.7

13.9

AXIAL
32 K

SHEAR
6 K

MOMENT
492 kip-ft

TORQUE 1 kip-ft
38 mph WIND - 1.0000 in ICE

AXIAL
20 K

SHEAR
24 K

MOMENT
1818 kip-ft

TORQUE 2 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) DB844G65ZAXY w/Mount Pipe	115	LLPX310R w/ pipe mount	105
(2) DB844G65ZAXY w/Mount Pipe	115	LLPX310R w/ pipe mount	105
(2) DB844G65ZAXY w/Mount Pipe	115	LLPX310R w/ pipe mount	105
BXA-185085/12CF w/pipe mount	115	WiMax DAP Head	105
BXA-185085/12CF w/pipe mount	115	WiMax DAP Head	105
BXA-171085-12BF w/ pipe mount	115	(2) WiMax DAP Head	105
BXA-171085-12BF w/ pipe mount	115	Timing 2000 GPS	105
BXA-185085/12CF w/pipe mount	115	Horizon Compact	105
BXA-171063-12BF w/ pipe mount	115	Horizon Compact	105
BXA-70063/6CF w/ pipe mount	115	Horizon Compact	105
BXA-70063/6CF w/ pipe mount	115	Side Arm Mount [SO 701-1]	105
BXA-70063/6CF w/ pipe mount	115	Side Arm Mount [SO 701-1]	105
RRH2x40-AWS	115	Side Arm Mount [SO 701-1]	105
RRH2x40-AWS	115	VHLP1-23	105
RRH2x40-AWS	115	VHLP2-11	105
DB-T1-6Z-8AB-0Z	115	VHLP1-23	105
Platform Mount [LP 301-1]	115	VHLP1-23	105

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 76.9%

Morrison Hershfield Corp
66 Perimeter Center East Ste. 600
Atlanta, GA 30346
Phone: (770) 379-8500
FAX: (770) 379-8501
Consulting Engineers

Job: CN3-041 / 6130027			
Project: 806372 / HRT 093 943228			
Client: Crown Castle USA	Drawn by: cmackay	App'd:	
Code: TIA/EIA-222-F	Date: 11/28/12	Scale: NTS	
Path:		Dwg No. E-1	

Tower Input Data

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

4) Tower is located in Hartford County, Connecticut.
5) Basic wind speed of 85 mph.
6) Nominal ice thickness of 1.0000 in.
7) Ice thickness is considered to increase with height.
8) Ice density of 56 pcf.
9) A wind speed of 38 mph is used in combination with ice.
10) Temperature drop of 50 °F.
11) Deflections calculated using a wind speed of 50 mph.
12) A non-linear (P-delta) analysis was used.
13) Pressures are calculated at each section.
14) Stress ratio used in pole design is 1.333.
15) Local bending stresses due to climbing loads, 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		

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	115'-72'3-31/32"	42'8-1/32"	4'8-1/32"	12	21.9100	30.4500	0.2180	0.8720	A572-65 (65 ksi)
L2	72'3-31/32"-29'3-31/32"	47'8-1/32"	5'8-1/32"	12	29.0799	38.6100	0.3130	1.2520	A572-65 (65 ksi)
L3	29'3-31/32"-0'	35'		12	36.8511	43.8500	0.3750	1.5000	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	22.6829	15.2269	914.5282	7.7657	11.3494	80.5796	1853.0821	7.4942	5.2876	24.255
	31.5242	21.2217	2475.7053	10.8231	15.7731	156.9574	5016.4502	10.4447	7.5764	34.754
L2	31.0717	28.9930	3062.4364	10.2986	15.0634	203.3030	6205.3263	14.2695	6.9546	22.219
	39.9720	38.5980	7225.7083	13.7103	20.0000	361.2858	14641.2440	18.9968	9.5086	30.379
L3	39.3242	44.0448	7479.9158	13.0584	19.0888	391.8474	15156.337	21.6775	8.8711	23.656

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
	45.3969	52.4961	12664.6112	15.5641	22.7143	557.5611	25661.9358	25.8370	10.7468	28.658

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 115'-72'3-31/32"				1	1	1		
L2 72'3-31/32"-29'3-31/32"				1	1	1		
L3 29'3-31/32"-0'				1	1	1		

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight plf
1 5/8	B	Surface Ar (CaAa)	115' - 4'	7	7	-0.188 0.188	1.9800		1.04

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 5/8	B	No	Inside Pole	115' - 4'	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
						1" Ice	0.00	1.04
						2" Ice	0.00	1.04
						4" Ice	0.00	1.04
**********								
2 1/2" PVC Conduit	C	No	Inside Pole	105' - 4'	1	No Ice	0.00	5.79
						1/2" Ice	0.00	5.79
						1" Ice	0.00	5.79
						2" Ice	0.00	5.79
						4" Ice	0.00	5.79
2 1/2" PVC Conduit	C	No	Inside Pole	105' - 4'	1	No Ice	0.00	5.79
						1/2" Ice	0.00	5.79
						1" Ice	0.00	5.79
						2" Ice	0.00	5.79
						4" Ice	0.00	5.79
1/2	C	No	Inside Pole	105' - 4'	3	No Ice	0.00	0.25
						1/2" Ice	0.00	0.25
						1" Ice	0.00	0.25
						2" Ice	0.00	0.25
						4" Ice	0.00	0.25
5/8	C	No	Inside Pole	105' - 4'	3	No Ice	0.00	0.40
						1/2" Ice	0.00	0.40
						1" Ice	0.00	0.40
						2" Ice	0.00	0.40
						4" Ice	0.00	0.40
1/4	C	No	Inside Pole	105' - 4'	5	No Ice	0.00	0.06
						1/2" Ice	0.00	0.06
						1" Ice	0.00	0.06
						2" Ice	0.00	0.06
						4" Ice	0.00	0.06

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
5/16	C	No	Inside Pole	105' - 4'	5	No Ice	0.00	0.03
						1/2" Ice	0.00	0.03
						1" Ice	0.00	0.03
						2" Ice	0.00	0.03
						4" Ice	0.00	0.03

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	115'-72'3-31/32"	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	59.136	0.000	0.84
		C	0.000	0.000	0.000	0.000	0.46
L2	72'3-31/32"-29'3-31/32"	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	59.598	0.000	0.85
		C	0.000	0.000	0.000	0.000	0.60
L3	29'3-31/32"-0'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	35.112	0.000	0.50
		C	0.000	0.000	0.000	0.000	0.35

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	115'-72'3-31/32"	A	1.132	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	132.771	0.000	1.56
		C		0.000	0.000	0.000	0.000	0.46
L2	72'3-31/32"-29'3-31/32"	A	1.053	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	133.809	0.000	1.57
		C		0.000	0.000	0.000	0.000	0.60
L3	29'3-31/32"-0'	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	77.758	0.000	0.90
		C		0.000	0.000	0.000	0.000	0.35

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	115'-72'3-31/32"	1.1843	-0.6837	1.4943	-0.8628
L2	72'3-31/32"-29'3-31/32"	1.2826	-0.7405	1.7140	-0.9896
L3	29'3-31/32"-0'	1.1954	-0.6901	1.6953	-0.9788

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
(2) DB844G65ZAXY	A	From Face	3.00	0.0000	115'	No Ice	5.38	5.40	0.04

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
w/Mount Pipe			0' 1'			1/2" Ice	6.07 6.65	6.49 7.30	0.09 0.15
						1" Ice	7.83	8.96	0.29
						2" Ice	10.34	12.49	0.69
						4" Ice			
(2) DB844G65ZAXY w/Mount Pipe	B	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	5.38 6.07 6.65	5.40 6.49 7.30	0.04 0.09 0.15
						1" Ice	7.83	8.96	0.29
						2" Ice	10.34	12.49	0.69
						4" Ice			
(2) DB844G65ZAXY w/Mount Pipe	C	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	5.38 6.07 6.65	5.40 6.49 7.30	0.04 0.09 0.15
						1" Ice	7.83	8.96	0.29
						2" Ice	10.34	12.49	0.69
						4" Ice			
BXA-185085/12CF w/pipe mount	A	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	4.77 5.22 5.68	5.06 6.00 6.82	0.03 0.08 0.13
						1" Ice	6.62	8.50	0.25
						2" Ice	8.61	12.07	0.64
						4" Ice			
BXA-185085/12CF w/pipe mount	B	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	4.77 5.22 5.68	5.06 6.00 6.82	0.03 0.08 0.13
						1" Ice	6.62	8.50	0.25
						2" Ice	8.61	12.07	0.64
						4" Ice			
BXA-171085-12BF w/ pipe mount	B	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	4.79 5.24 5.70	5.04 5.98 6.80	0.05 0.09 0.15
						1" Ice	6.64	8.48	0.27
						2" Ice	8.64	12.04	0.66
						4" Ice			
BXA-171085-12BF w/ pipe mount	C	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	4.79 5.24 5.70	5.04 5.98 6.80	0.05 0.09 0.15
						1" Ice	6.64	8.48	0.27
						2" Ice	8.64	12.04	0.66
						4" Ice			
BXA-185085/12CF w/pipe mount	C	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	4.77 5.22 5.68	5.06 6.00 6.82	0.03 0.08 0.13
						1" Ice	6.62	8.50	0.25
						2" Ice	8.61	12.07	0.64
						4" Ice			
BXA-171063-12BF w/ pipe mount	A	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	4.79 5.24 5.70	5.04 5.98 6.80	0.05 0.09 0.15
						1" Ice	6.64	8.48	0.27
						2" Ice	8.64	12.04	0.66
						4" Ice			
BXA-70063/6CF w/ pipe mount	A	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	7.75 8.29 8.85	5.18 6.11 6.92	0.04 0.10 0.16
						1" Ice	9.97	8.59	0.32
						2" Ice	12.34	12.13	0.76
						4" Ice			
BXA-70063/6CF w/ pipe mount	B	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice	7.75 8.29 8.85	5.18 6.11 6.92	0.04 0.10 0.16
						1" Ice	9.97	8.59	0.32
						2" Ice	12.34	12.13	0.76
						4" Ice			

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
BXA-70063/6CF w/ pipe mount	C	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	7.75 8.29 8.85 9.97 12.34	5.18 6.11 6.92 8.59 12.13	0.04 0.10 0.16 0.32 0.76
RRH2x40-AWS	A	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.52 2.75 2.99 3.50 4.61	1.59 1.80 2.01 2.46 3.48	0.05 0.07 0.09 0.14 0.28
RRH2x40-AWS	B	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.52 2.75 2.99 3.50 4.61	1.59 1.80 2.01 2.46 3.48	0.05 0.07 0.09 0.14 0.28
RRH2x40-AWS	C	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.52 2.75 2.99 3.50 4.61	1.59 1.80 2.01 2.46 3.48	0.05 0.07 0.09 0.14 0.28
DB-T1-6Z-8AB-0Z	A	From Face	3.00 0' 1'	0.0000	115'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.13 4.40 4.68 5.27 6.55	1.11 1.29 1.48 1.89 2.80	0.06 0.08 0.10 0.16 0.33
Platform Mount [LP 301-1]	C	None		0.0000	115'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	30.10 40.80 51.50 72.90 115.70	30.10 40.80 51.50 72.90 115.70	1.59 2.03 2.47 3.35 5.11
**********									
LLPX310R w/ pipe mount	A	From Leg	2.00 0' 0'	0.0000	105'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.96 5.34 5.74 6.55 8.33	2.93 3.45 3.98 5.16 7.94	0.05 0.09 0.13 0.24 0.55
LLPX310R w/ pipe mount	B	From Leg	2.00 0' 0'	0.0000	105'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.96 5.34 5.74 6.55 8.33	2.93 3.45 3.98 5.16 7.94	0.05 0.09 0.13 0.24 0.55
LLPX310R w/ pipe mount	C	From Leg	2.00 0' 0'	0.0000	105'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.96 5.34 5.74 6.55 8.33	2.93 3.45 3.98 5.16 7.94	0.05 0.09 0.13 0.24 0.55
WiMax DAP Head	A	From Leg	2.00 0' 0'	0.0000	105'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.08 2.31 2.55 3.05 4.16	1.56 1.78 2.00 2.48 3.54	0.02 0.04 0.05 0.10 0.23
WiMax DAP Head	B	From Leg	2.00 0' 0'	0.0000	105'	No Ice 1/2" Ice 1" Ice	2.08 2.31 2.55 3.05	1.56 1.78 2.00 2.48	0.02 0.04 0.05 0.10

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						2" Ice	4.16	3.54	0.23
						4" Ice			
(2) WiMax DAP Head	C	From Leg	2.00	0.0000	105'	No Ice	2.08	1.56	0.02
			0'			1/2" Ice	2.31	1.78	0.04
			2'			1" Ice	2.55	2.00	0.05
						2" Ice	3.05	2.48	0.10
						4" Ice	4.16	3.54	0.23
Timing 2000 GPS	C	From Leg	2.00	0.0000	105'	No Ice	0.08	0.08	0.00
			0'			1/2" Ice	0.12	0.12	0.00
			3'			1" Ice	0.18	0.18	0.00
						2" Ice	0.33	0.33	0.01
						4" Ice	0.76	0.76	0.04
Horizon Compact	A	From Leg	2.00	0.0000	105'	No Ice	0.84	0.43	0.01
			0'			1/2" Ice	0.97	0.52	0.02
			3'			1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
Horizon Compact	B	From Leg	2.00	0.0000	105'	No Ice	0.84	0.43	0.01
			0'			1/2" Ice	0.97	0.52	0.02
			3'			1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
Horizon Compact	C	From Leg	2.00	0.0000	105'	No Ice	0.84	0.43	0.01
			0'			1/2" Ice	0.97	0.52	0.02
			3'			1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
Side Arm Mount [SO 701-1]	A	From Leg	1.00	0.0000	105'	No Ice	0.85	1.67	0.07
			0'			1/2" Ice	1.14	2.34	0.08
			0'			1" Ice	1.43	3.01	0.09
						2" Ice	2.01	4.35	0.12
						4" Ice	3.17	7.03	0.18
Side Arm Mount [SO 701-1]	B	From Leg	1.00	0.0000	105'	No Ice	0.85	1.67	0.07
			0'			1/2" Ice	1.14	2.34	0.08
			0'			1" Ice	1.43	3.01	0.09
						2" Ice	2.01	4.35	0.12
						4" Ice	3.17	7.03	0.18
Side Arm Mount [SO 701-1]	C	From Leg	1.00	0.0000	105'	No Ice	0.85	1.67	0.07
			0'			1/2" Ice	1.14	2.34	0.08
			0'			1" Ice	1.43	3.01	0.09
						2" Ice	2.01	4.35	0.12
						4" Ice	3.17	7.03	0.18

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
VHLP1-23	A	Paraboloid w/Shroud (HP)	From Leg	2.00 0'	0.0000		105'	1.27	No Ice	1.28	0.01
									1/2" Ice	1.45	0.02

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
				3'					1" Ice	1.62	0.03
									2" Ice	1.97	0.04
									4" Ice	2.66	0.07
VHLP2-11	B	Paraboloid w/o Radome	From Leg	2.00	0.0000		105'	2.17	No Ice	3.72	0.03
				0'					1/2" Ice	4.01	0.05
				3'					1" Ice	4.30	0.07
									2" Ice	4.88	0.11
									4" Ice	6.04	0.19
VHLP1-23	C	Paraboloid w/Shroud (HP)	From Leg	2.00	0.0000		105'	1.27	No Ice	1.28	0.01
				0'					1/2" Ice	1.45	0.02
				3'					1" Ice	1.62	0.03
									2" Ice	1.97	0.04
									4" Ice	2.66	0.07
VHLP1-23	C	Paraboloid w/Shroud (HP)	From Leg	2.00	0.0000		105'	1.27	No Ice	1.28	0.01
				0'					1/2" Ice	1.45	0.02
				2'					1" Ice	1.62	0.03
									2" Ice	1.97	0.04
									4" Ice	2.66	0.07

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	115 - 72.3333	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-12.36	-0.44	0.57
			Max. Mx	11	-5.71	367.87	5.45
			Max. My	2	-5.73	6.52	363.78
			Max. Vy	11	-12.94	367.87	5.45
			Max. Vx	2	-12.82	6.52	363.78
			Max. Torque	11			-0.39
L2	72.3333 - 29.3333	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-21.68	-1.73	1.32
			Max. Mx	11	-12.41	1048.13	12.15
			Max. My	2	-12.42	14.36	1039.50
			Max. Vy	11	-19.38	1048.13	12.15
			Max. Vx	2	-19.25	14.36	1039.50
			Max. Torque	7			1.15
L3	29.3333 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-31.80	-2.80	1.94
			Max. Mx	11	-20.38	1812.81	17.66
			Max. My	2	-20.38	20.81	1800.45
			Max. Vy	11	-24.31	1812.81	17.66
			Max. Vx	2	-24.19	20.81	1800.45
			Max. Torque	7			1.76

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	31.80	-6.44	0.00
	Max. H_x	11	20.40	24.30	0.15
	Max. H_z	2	20.40	0.19	24.18
	Max. M_x	2	1800.45	0.19	24.18
	Max. M_z	5	1809.06	-24.25	-0.01
	Max. Torsion	7	1.76	-12.13	-20.95
	Min. Vert	1	20.40	0.00	0.00
	Min. H_x	5	20.40	-24.25	-0.01
	Min. H_z	8	20.40	-0.03	-24.12
	Min. M_x	8	-1792.63	-0.03	-24.12
	Min. M_z	11	-1812.81	24.30	0.15
	Min. Torsion	13	-1.50	12.29	20.92

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	20.40	0.00	0.00	-0.62	-0.78	0.00
Dead+Wind 0 deg - No Ice	20.40	-0.19	-24.18	-1800.45	20.81	1.36
Dead+Wind 30 deg - No Ice	20.40	12.08	-20.84	-1547.52	-898.80	0.81
Dead+Wind 60 deg - No Ice	20.40	20.96	-12.03	-893.34	-1562.01	0.01
Dead+Wind 90 deg - No Ice	20.40	24.25	0.01	0.44	-1809.06	-0.83
Dead+Wind 120 deg - No Ice	20.40	21.05	12.10	900.44	-1571.51	-1.52
Dead+Wind 150 deg - No Ice	20.40	12.13	20.95	1558.86	-905.75	-1.76
Dead+Wind 180 deg - No Ice	20.40	0.03	24.12	1792.63	-4.75	-1.51
Dead+Wind 210 deg - No Ice	20.40	-12.05	20.83	1545.85	894.88	-0.81
Dead+Wind 240 deg - No Ice	20.40	-21.09	11.90	877.88	1574.05	0.16
Dead+Wind 270 deg - No Ice	20.40	-24.30	-0.15	-17.66	1812.81	1.09

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 300 deg - No Ice	20.40	-21.10	-12.15	-906.93	1576.05	1.50
Dead+Wind 330 deg - No Ice	20.40	-12.29	-20.92	-1557.64	922.18	1.50
Dead+Ice+Temp	31.80	0.00	-0.00	-1.94	-2.80	-0.00
Dead+Wind 0 deg+Ice+Temp	31.80	-0.04	-6.43	-489.30	1.86	0.50
Dead+Wind 30 deg+Ice+Temp	31.80	3.21	-5.54	-421.37	-246.19	0.29
Dead+Wind 60 deg+Ice+Temp	31.80	5.57	-3.20	-244.17	-425.42	-0.01
Dead+Wind 90 deg+Ice+Temp	31.80	6.44	-0.00	-1.99	-492.00	-0.32
Dead+Wind 120 deg+Ice+Temp	31.80	5.59	3.21	241.75	-427.48	-0.55
Dead+Wind 150 deg+Ice+Temp	31.80	3.22	5.57	420.21	-247.39	-0.63
Dead+Wind 180 deg+Ice+Temp	31.80	0.01	6.41	483.83	-3.53	-0.53
Dead+Wind 210 deg+Ice+Temp	31.80	-3.21	5.54	417.30	239.88	-0.29
Dead+Wind 240 deg+Ice+Temp	31.80	-5.60	3.17	236.91	422.81	0.05
Dead+Wind 270 deg+Ice+Temp	31.80	-6.45	-0.03	-5.74	487.46	0.38
Dead+Wind 300 deg+Ice+Temp	31.80	-5.60	-3.22	-246.94	423.15	0.54
Dead+Wind 330 deg+Ice+Temp	31.80	-3.26	-5.56	-423.52	245.92	0.57
Dead+Wind 0 deg - Service	20.40	-0.07	-8.33	-620.87	6.66	0.47
Dead+Wind 30 deg - Service	20.40	4.16	-7.18	-533.71	-310.25	0.28
Dead+Wind 60 deg - Service	20.40	7.22	-4.14	-308.27	-538.80	0.00
Dead+Wind 90 deg - Service	20.40	8.35	0.00	-0.27	-623.94	-0.29
Dead+Wind 120 deg - Service	20.40	7.25	4.17	309.89	-542.08	-0.52
Dead+Wind 150 deg - Service	20.40	4.18	7.21	536.78	-312.65	-0.61
Dead+Wind 180 deg - Service	20.40	0.01	8.31	617.34	-2.16	-0.52
Dead+Wind 210 deg - Service	20.40	-4.15	7.17	532.29	307.86	-0.28
Dead+Wind 240 deg - Service	20.40	-7.26	4.10	302.11	541.92	0.05
Dead+Wind 270 deg - Service	20.40	-8.37	-0.05	-6.51	624.20	0.38
Dead+Wind 300 deg - Service	20.40	-7.27	-4.18	-312.96	542.62	0.52
Dead+Wind 330 deg - Service	20.40	-4.23	-7.21	-537.20	317.28	0.52

Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.00	-20.40	0.00	0.00	20.40	0.00	0.000%
2	-0.19	-20.40	-24.18	0.19	20.40	24.18	0.000%
3	12.08	-20.40	-20.84	-12.08	20.40	20.84	0.000%
4	20.96	-20.40	-12.03	-20.96	20.40	12.03	0.000%
5	24.25	-20.40	0.01	-24.25	20.40	-0.01	0.000%
6	21.05	-20.40	12.10	-21.05	20.40	-12.10	0.000%
7	12.13	-20.40	20.95	-12.13	20.40	-20.95	0.000%
8	0.03	-20.40	24.12	-0.03	20.40	-24.12	0.000%
9	-12.05	-20.40	20.83	12.05	20.40	-20.83	0.000%
10	-21.09	-20.40	11.90	21.09	20.40	-11.90	0.000%
11	-24.30	-20.40	-0.15	24.30	20.40	0.15	0.000%
12	-21.10	-20.40	-12.15	21.10	20.40	12.15	0.000%
13	-12.29	-20.40	-20.92	12.29	20.40	20.92	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
14	0.00	-31.80	0.00	-0.00	31.80	0.00	0.000%
15	-0.04	-31.80	-6.43	0.04	31.80	6.43	0.000%
16	3.21	-31.80	-5.54	-3.21	31.80	5.54	0.000%
17	5.57	-31.80	-3.20	-5.57	31.80	3.20	0.000%
18	6.44	-31.80	-0.00	-6.44	31.80	0.00	0.000%
19	5.59	-31.80	3.21	-5.59	31.80	-3.21	0.000%
20	3.22	-31.80	5.57	-3.22	31.80	-5.57	0.000%
21	0.01	-31.80	6.41	-0.01	31.80	-6.41	0.000%
22	-3.21	-31.80	5.54	3.21	31.80	-5.54	0.000%
23	-5.60	-31.80	3.17	5.60	31.80	-3.17	0.000%
24	-6.45	-31.80	-0.03	6.45	31.80	0.03	0.000%
25	-5.60	-31.80	-3.22	5.60	31.80	3.22	0.000%
26	-3.26	-31.80	-5.56	3.26	31.80	5.56	0.000%
27	-0.07	-20.40	-8.33	0.07	20.40	8.33	0.000%
28	4.16	-20.40	-7.18	-4.16	20.40	7.18	0.000%
29	7.22	-20.40	-4.14	-7.22	20.40	4.14	0.000%
30	8.35	-20.40	0.00	-8.35	20.40	-0.00	0.000%
31	7.25	-20.40	4.17	-7.25	20.40	-4.17	0.000%
32	4.18	-20.40	7.21	-4.18	20.40	-7.21	0.000%
33	0.01	-20.40	8.31	-0.01	20.40	-8.31	0.000%
34	-4.15	-20.40	7.17	4.15	20.40	-7.17	0.000%
35	-7.26	-20.40	4.10	7.26	20.40	-4.10	0.000%
36	-8.37	-20.40	-0.05	8.37	20.40	0.05	0.000%
37	-7.27	-20.40	-4.18	7.27	20.40	4.18	0.000%
38	-4.23	-20.40	-7.21	4.23	20.40	7.21	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00003412
3	Yes	5	0.00000001	0.00003094
4	Yes	5	0.00000001	0.00003065
5	Yes	4	0.00000001	0.00004324
6	Yes	5	0.00000001	0.00003023
7	Yes	5	0.00000001	0.00003215
8	Yes	4	0.00000001	0.00009185
9	Yes	5	0.00000001	0.00002991
10	Yes	5	0.00000001	0.00003019
11	Yes	4	0.00000001	0.00011624
12	Yes	5	0.00000001	0.00003243
13	Yes	5	0.00000001	0.00003089
14	Yes	4	0.00000001	0.00000545
15	Yes	4	0.00000001	0.00069271
16	Yes	4	0.00000001	0.00078022
17	Yes	4	0.00000001	0.00078302
18	Yes	4	0.00000001	0.00069614
19	Yes	4	0.00000001	0.00078100
20	Yes	4	0.00000001	0.00078256
21	Yes	4	0.00000001	0.00068394
22	Yes	4	0.00000001	0.00076266
23	Yes	4	0.00000001	0.00076823
24	Yes	4	0.00000001	0.00069093
25	Yes	4	0.00000001	0.00078856
26	Yes	4	0.00000001	0.00078278
27	Yes	4	0.00000001	0.00001346
28	Yes	4	0.00000001	0.00011731
29	Yes	4	0.00000001	0.00011464
30	Yes	4	0.00000001	0.00001242
31	Yes	4	0.00000001	0.00011024
32	Yes	4	0.00000001	0.00012625
33	Yes	4	0.00000001	0.00001926
34	Yes	4	0.00000001	0.00010873
35	Yes	4	0.00000001	0.00011091
36	Yes	4	0.00000001	0.00002029

37	Yes	4	0.00000001	0.00012760
38	Yes	4	0.00000001	0.00011445

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	115 - 72.3333	18.494	37	1.3849	0.0017
L2	77 - 29.3333	8.503	37	1.0262	0.0012
L3	35 - 0	1.784	37	0.4542	0.0005

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
115'	(2) DB844G65ZAXY w/Mount Pipe	37	18.494	1.3849	0.0017	30863
108'	VHLP1-23	37	16.527	1.3264	0.0016	22045
107'	VHLP1-23	37	16.247	1.3179	0.0016	19289
105'	LLPX310R w/ pipe mount	37	15.690	1.3009	0.0016	15431

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	115 - 72.3333	53.607	12	4.0145	0.0048
L2	77 - 29.3333	24.664	12	2.9772	0.0034
L3	35 - 0	5.177	12	1.3182	0.0015

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
115'	(2) DB844G65ZAXY w/Mount Pipe	12	53.607	4.0145	0.0048	10750
108'	VHLP1-23	12	47.910	3.8454	0.0044	7678
107'	VHLP1-23	12	47.100	3.8209	0.0044	6718
105'	LLPX310R w/ pipe mount	12	45.487	3.7718	0.0044	5374

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	115 - 72.3333 (1)	TP30.45x21.91x0.218	42'8-1/32"	115'	131.6	8.626	20.5660	-5.71	177.41	0.032
L2	72.3333 -	TP38.61x29.0799x0.313	47'8-	115'	103.7	13.881	37.4562	-12.41	519.91	0.024

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 $\frac{P}{P_a}$
L3	29.3333 (2) 29.3333 - 0 (3)	TP43.85x36.8511x0.375	1/32" 35'	115'	88.7	18.787	52.4961	-20.38	986.25	0.021

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	115 - 72.3333 (1)	TP30.45x21.91x0.218	369.65	30.099	36.785	0.818	0.00	0.000	36.785	0.000
L2	72.3333 - 29.3333 (2)	TP38.61x29.0799x0.313	1051.97	37.113	39.000	0.952	0.00	0.000	39.000	0.000
L3	29.3333 - 0 (3)	TP43.85x36.8511x0.375	1818.36	39.135	39.000	1.003	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	115 - 72.3333 (1)	TP30.45x21.91x0.218	12.99	0.632	26.000	0.049	0.29	0.011	26.000	0.000
L2	72.3333 - 29.3333 (2)	TP38.61x29.0799x0.313	19.42	0.518	26.000	0.041	0.97	0.016	26.000	0.001
L3	29.3333 - 0 (3)	TP43.85x36.8511x0.375	24.36	0.464	26.000	0.036	1.50	0.015	26.000	0.001

Pole Interaction Design Data

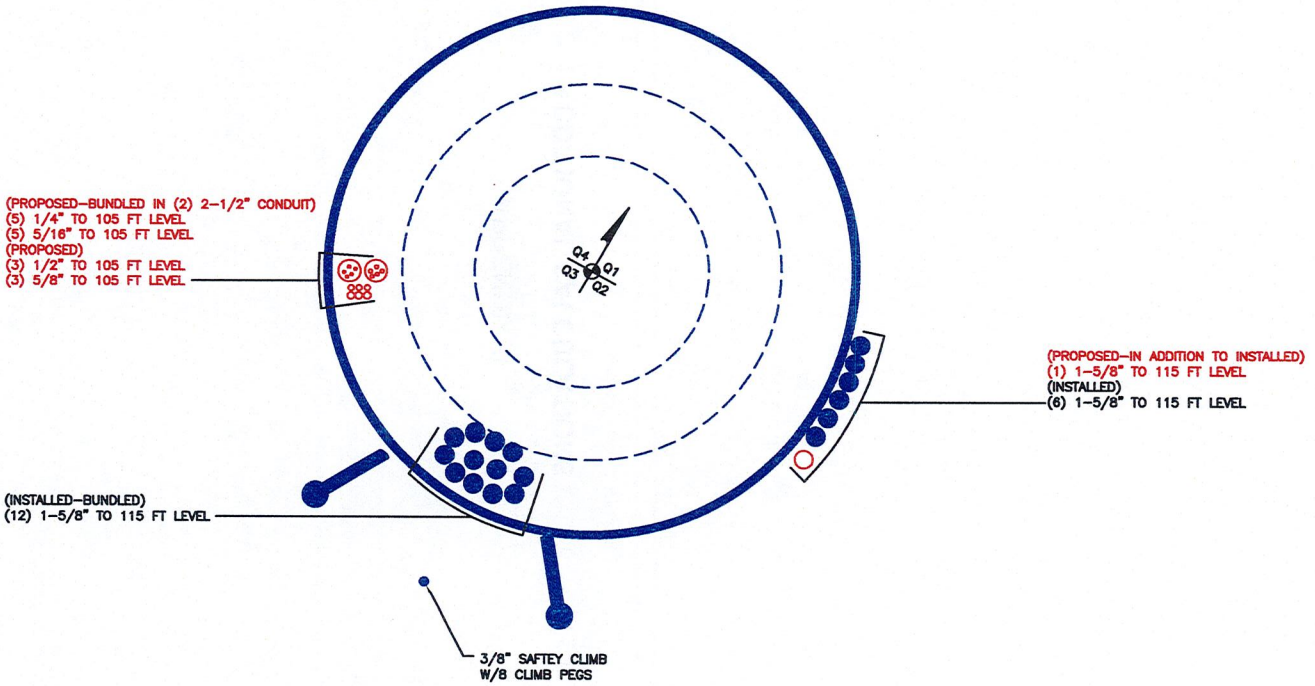
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	115 - 72.3333 (1)	0.032	0.818	0.000	0.049	0.000	0.851 ✔	1.333	H1-3+VT ✔
L2	72.3333 - 29.3333 (2)	0.024	0.952	0.000	0.041	0.001	0.976 ✔	1.333	H1-3+VT ✔
L3	29.3333 - 0 (3)	0.021	1.003	0.000	0.036	0.001	1.024 ✔	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	115 - 72.3333	Pole	TP30.45x21.91x0.218	1	-5.71	236.49	63.8	Pass
L2	72.3333 - 29.3333	Pole	TP38.61x29.0799x0.313	2	-12.41	693.04	73.2	Pass
L3	29.3333 - 0	Pole	TP43.85x36.8511x0.375	3	-20.38	1314.68	76.9	Pass
						Summary		
						Pole (L3)	76.9	Pass
						RATING =	**76.9**	**Pass**

APPENDIX B

BASE LEVEL DRAWING



0 1 2 3FT

: SCALE :

BUSINESS UNIT: 806372 TOWER ID: C_BASELEVEL

APPENDIX C

ADDITIONAL CALCULATIONS

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

TIA Rev F

Site Data

BU#: *806372*
Site Name: *HRT 093 943228*
App #: *171009 Rev 0*

Pole Manufacturer:	*Other*

Reactions		
Moment:	1816	ft-kips
Axial:	20	kips
Shear:	24	kips

Anchor Rod Data		
Qty:	12	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	51.9	in

Plate Data		
Diam:	66.25	in
Thick:	2.625	in
Grade:	60	ksi
Single-Rod B-eff:	11.75	in

Stiffener Data (Welding at both sides)		
Config:	0	*
Weld Type:	Both	
Groove Depth:	0.25	in **
Groove Angle:	45	degrees
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	5	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	50	ksi
Weld str.:	70	ksi

Pole Data		
Diam:	43.85	in
Thick:	0.375	in
Grade:	65	ksi
# of Sides:	12	"0" IF Round
Fu	80	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:	138.3 Kips	Rigid
Allowable Tension:	195.0 Kips	Service, ASD
Anchor Rod Stress Ratio:	70.9% Pass	Fty*ASIF

Base Plate Results

	Flexural Check	
Base Plate Stress:	27.0 ksi	Rigid
Allowable Plate Stress:	60.0 ksi	Service ASD
Base Plate Stress Ratio:	44.9% Pass	0.75*Fy*ASIF
		Y.L. Length: 27.76

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

CAISSON Version 4.57 8:48:37 AM Wednesday, November 28, 2012
Morrison Hershfield Ltd.

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*************************************************************************
*                                                                       *
*  PIER FOUNDATIONS ANALYSIS AND DESIGN - (C) 1995, POWER LINE SYSTEMS, INC.*
*                                                                       *
*************************************************************************
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*** ANALYSIS IDENTIFICATION : CN3-041 / 6130027 : BU 806372 HRT 093 943228
NOTES :

*** PIER PROPERTIES CONCRETE STRENGTH (ksi) = 3.00 STEEL STRENGTH (ksi) = 60.00
DIAMETER (ft) = 6.000 DISTANCE FROM TOP OF PIER TO GROUND LEVEL (ft) = 0.50

*** SOIL PROPERTIES

LAYER	TYPE	THICKNESS (ft)	DEPTH AT TOP OF LAYER (ft)	DENSITY (pcf)	CU (psf)	KP	PHI (degrees)
1	S	5.00	0.00	120.0		1.000	-0.00
2	S	9.00	5.00	120.0		3.000	30.00
3	S	4.00	14.00	120.0		4.396	39.00
4	S	20.00	18.00	120.0		3.000	30.00
5	S	10.00	38.00	120.0		3.537	34.00
6	S	19.00	48.00	120.0		2.882	29.00

*** DESIGN (FACTORED) LOADS AT TOP OF PIER MOMENT (ft-k) = 1818.0 VERTICAL (k) = 20.0 SHEAR (k) = 24.0
ADDITIONAL SAFETY FACTOR AGAINST SOIL FAILURE = 2.35

*** CALCULATED PIER LENGTH (ft) = 21.500

*** CHECK OF SOILS PROPERTIES AND ULTIMATE RESISTING FORCES ALONG PIER

TYPE	TOP OF LAYER BELOW TOP OF PIER (ft)	THICKNESS (ft)	DENSITY (pcf)	CU (psf)	KP	FORCE (k)	ARM (ft)
S	0.50	5.00	120.0		1.000	27.00	3.83
S	5.50	9.00	120.0		3.000	554.04	10.71
S	14.50	1.64	120.0		4.396	231.34	15.34
S	16.14	2.36	120.0		4.396	-376.30	17.35
S	18.50	3.00	120.0		3.000	-379.08	20.04

*** SHEAR AND MOMENTS ALONG PIER

DISTANCE BELOW TOP OF PIER (ft)	WITH THE ADDITIONAL SAFETY FACTOR SHEAR (k)	MOMENT (ft-k)	WITHOUT ADDITIONAL SAFETY FACTOR SHEAR (k)	MOMENT (ft-k)
0.00	57.0	4539.2	24.3	1931.6
2.15	54.1	4660.1	23.0	1983.0
4.30	41.4	4764.5	17.6	2027.4
6.45	-3.7	4820.6	-1.6	2051.3
8.60	-101.6	4712.8	-43.2	2005.4
10.75	-229.4	4362.3	-97.6	1856.3
12.90	-387.2	3704.9	-164.8	1576.5
15.05	-598.6	2669.5	-254.7	1136.0
17.20	-593.2	1216.9	-252.4	517.8
19.35	-277.6	303.8	-118.1	129.3
21.50	-0.0	0.0	-0.0	0.0

*** TOTAL REINFORCEMENT PCT = 0.40 REINFORCEMENT AREA (in^2) = 16.29
*** USABLE AXIAL CAP. (k) = 20.0 USABLE MOMENT CAP. (ft-k) = 2141.9

*** US Standard Re-Bars (Select one of the following):
82 BARS #4 (AREA = 0.20 in^2 DIA = 0.500 in) AT SPACING (in) = 2.38
53 BARS #5 (AREA = 0.31 in^2 DIA = 0.625 in) AT SPACING (in) = 3.68
38 BARS #6 (AREA = 0.44 in^2 DIA = 0.750 in) AT SPACING (in) = 5.13
28 BARS #7 (AREA = 0.60 in^2 DIA = 0.875 in) AT SPACING (in) = 6.96
21 BARS #8 (AREA = 0.79 in^2 DIA = 1.000 in) AT SPACING (in) = 9.28
17 BARS #9 (AREA = 1.00 in^2 DIA = 1.128 in) AT SPACING (in) = 11.46
13 BARS #10 (AREA = 1.27 in^2 DIA = 1.270 in) AT SPACING (in) = 14.98
11 BARS #11 (AREA = 1.56 in^2 DIA = 1.410 in) AT SPACING (in) = 17.71
8 BARS #14 (AREA = 2.25 in^2 DIA = 1.693 in) AT SPACING (in) = 24.35

*** PRESSURE UNDER CAISSON DUE TO DESIGN AXIAL LOAD (psf) = 707.4

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#: *806372*
Site Name: *HRT 093 943228*
App #: *171009 Rev 0*

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

Pier Properties

Concrete:

Pier Diameter =	6.0	ft
Concrete Area =	4071.5	in^2

Reinforcement:

Clear Cover to **Tie**=	4.00	in
Horiz. **Tie** Bar Size=	4	
Vert. Cage Diameter =	5.14	ft
Vert. Cage Diameter =	61.73	in
Vertical Bar Size =	10	
Bar Diameter =	1.27	in
Bar Area =	1.27	in^2
Number of Bars =	20	
As Total=	25.4	in^2
A s/ Aconc, Rho:	0.0062	0.62%

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

Minimum Rho Check:

Actual Req'd Min. Rho:	0.33%	Flexural
Provided Rho:	0.62%	OK

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn.		
Pn per ACI 318 (10-2)	6157.61	kips
at Mu=(ϕ=0.65)Mn=	3177.55	ft-kips
Max Tu, (φ=0.9) Tn =	1371.6	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Maximum Shaft Superimposed Forces

TIA Revision:	F	
Max. Service Shaft M:	2051.3	ft-kips **(* Note)**
Max. Service Shaft P:	20	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:	2666.69	ft-kips
1.30	Pu:	26	kips

Material Properties

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

ACI 318 Code

Select Analysis ACI Code= 2008

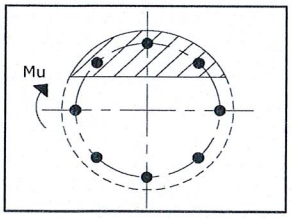
Seismic Properties

Seismic Design Category = B
Seismic Risk = **Low**

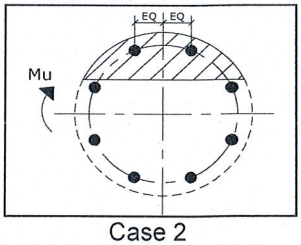
Solve (Run) <-- Press Upon Completing All Input

Results:

Governing Orientation Case: **1**



Case 1



Case 2

Dist. From Edge to Neutral Axis: **12.35** in
Extreme Steel Strain, εt: **0.0132**
εt > 0.0050, Tension Controlled
Reduction Factor,φ: **0.900**

Output Note: Negative Pu=Tension

For Axial Compression, φ Pn = Pu:	26.00	kips
Drilled Shaft Moment Capacity, φMn:	**3359.52**	ft-kips
Drilled Shaft Superimposed Mu:	**2666.69**	ft-kips

(Mu/φMn, Drilled Shaft Flexure CSR:	**79.4%**