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Also admitted in Massachusetts

January 15, 2014

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

Re: **Notice of Exempt Modification – Antenna Swap**
37 Bacon Road, Enfield, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 150-foot level on the existing 180-foot tower at the above-referenced address. The tower is owned by SAI. Cellco's shared use of this tower was approved in 2005. Cellco now intends to add three (3) model BXA-171063-12CF 2100 MHz antennas, for a total of fifteen (15) antennas, at the same 150-foot level. Cellco also intends to install three (3) remote radio heads ("RRHs") behind its 2100 MHz antennas and one (1) HYBRIFLEX™ antenna cable. Included in Attachment 1 are specifications for the additional 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 Matthew W. Coppler, Town Manager for the Town of Enfield. A copy of this letter is also being sent to the Shaker Pines Fire Department, the owner of the property at 371 Terryville Avenue.

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 new antennas and RRHs will be located at the 150-foot level on the 180-foot tower.

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

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

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

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

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

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

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Matthew W. Coppler, Enfield Town Manager
Shaker Pines Fire Department
Sandy M. Carter

ATTACHMENT 1

BXA-171063-12CF-EDIN-X

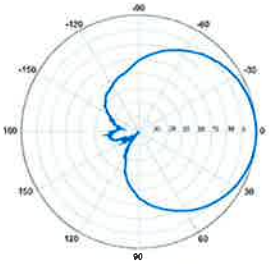
X-Pol | FET Panel | 63° | 19.0 dBi

Replace "X" with desired electrical downtilt.

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

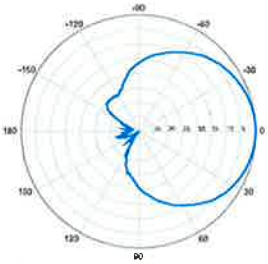
Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	68°	65°	60°
Vertical beamwidth	4.5°	4.5°	4.5°
Gain	16.1 dBd / 18.2 dBi	16.5 dBd / 18.6 dBi	16.9 dBd / 19.0 dBi
Electrical downtilt (X)	0, 2, 5		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back ratio	> 30 dB		
In-band isolation	< -25 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



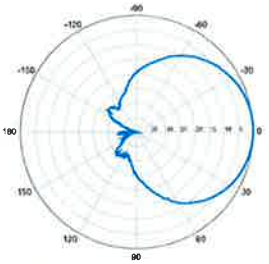
Horizontal | 1710-1880 MHz

BXA-171063-12CF-EDIN-X



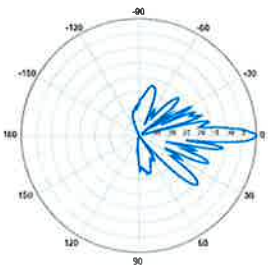
Horizontal | 1850-1990 MHz

BXA-171063-12CF-EDIN-X



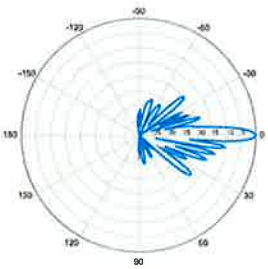
Horizontal | 1920-2170 MHz

BXA-171063-12CF-EDIN-0



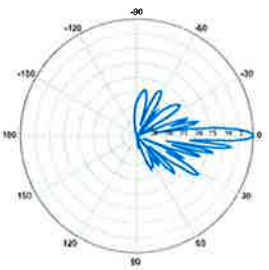
0° | Vertical | 1710-1880 MHz

BXA-171063-12CF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-12CF-EDIN-0

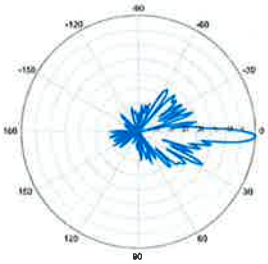


0° | Vertical | 1920-2170 MHz

BXA-171063-12CF-EDIN-X

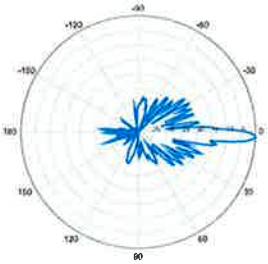
X-Pol | FET Panel | 63° | 19.0 dBi

BXA-171063-12CF-EDIN-2



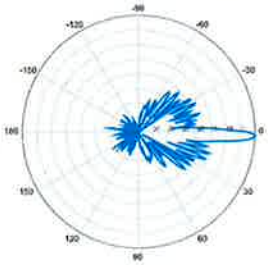
2° | Vertical | 1710-1880 MHz

BXA-171063-12CF-EDIN-2



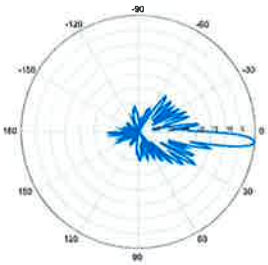
2° | Vertical | 1850-1990 MHz

BXA-171063-12CF-EDIN-2



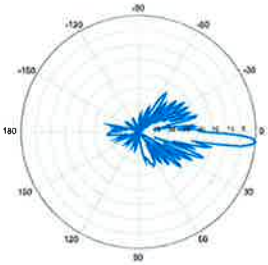
2° | Vertical | 1920-2170 MHz

BXA-171063-12CF-EDIN-5



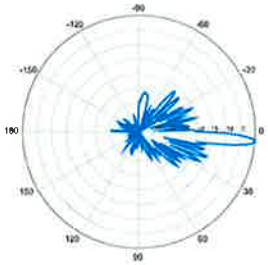
5° | Vertical | 1710-1880 MHz

BXA-171063-12CF-EDIN-5



5° | Vertical | 1850-1990 MHz

BXA-171063-12CF-EDIN-5

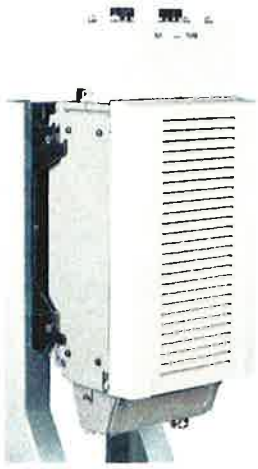


5° | Vertical | 1920-2170 MHz

Alcatel-Lucent RRH2x40-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

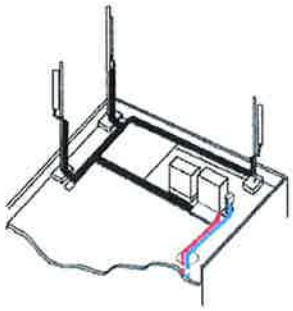
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation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

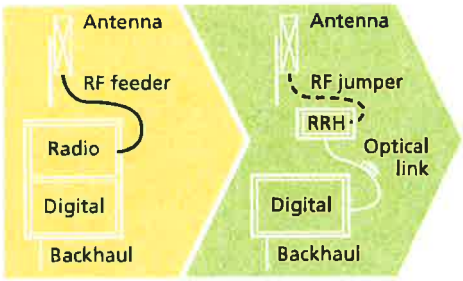
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

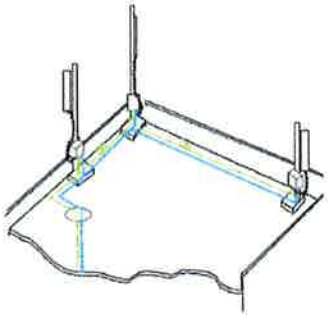
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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

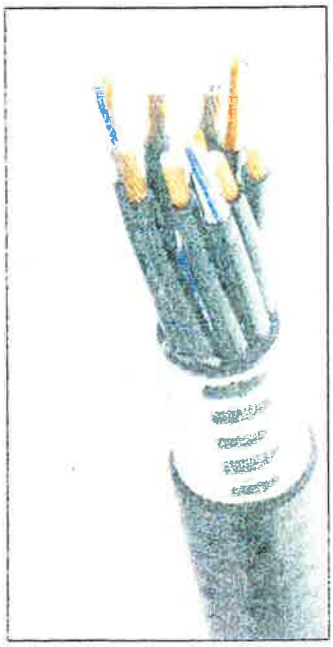


Figure 1: HYBRIFLEX Series

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

Outer Conductor Armor	Corrugated Aluminum	[mm (in)]	46.5 (1.83)
Jacket	Polyethylene, PE	[mm (in)]	50.3 (1.98)
UV-Protection	Individual and External Jacket		Yes
Weight, Approximate		[kg/m (lb/ft)]	1.9 (1.30)
Minimum Bending Radius, Single Bending		[mm (in)]	200 (8)
Minimum Bending Radius, Repeated Bending		[mm (in)]	500 (20)
Recommended/Maximum Clamp Spacing		[m (ft)]	1.0 / 1.2 (3.25 / 4.0)
DC-Resistance Outer Conductor Armor		[Ω/km (Ω/1000ft)]	.068 (0.205)
DC-Resistance Power Cable, 8.4mm² (8AWG)		[Ω/km (Ω/1000ft)]	2.1 (0.307)
Version			Single-mode OM3
Quantity, Fiber Count			16 (8 pairs)
Core/Clad		[µm]	50/125
Primary Coating (Acrylate)		[µm]	245
Buffer Diameter, Nominal		[µm]	900
Secondary Protection, Jacket, Nominal		[mm (in)]	2.0 (0.08)
Minimum Bending Radius		[mm (in)]	104 (4.1)
Insertion Loss @ wavelength 850nm		dB/km	3.0
Insertion Loss @ wavelength 1310nm		dB/km	1.0
Standards (Meets or exceeds)			UL94-V0, UL1666 RoHS Compliant
Size (Power)		[mm² (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm² (AWG)]	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-99-689 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

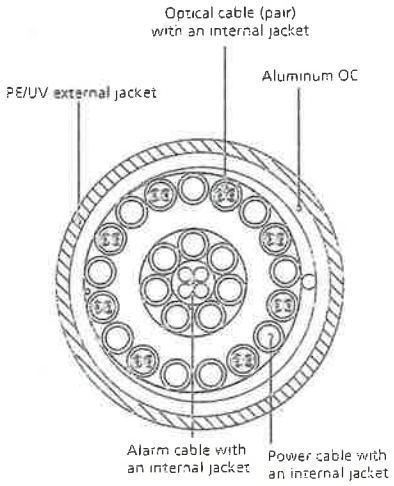


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

	General	Power	Density					
Site Name: Somers W (Enfield)								
Tower Height: Verizon @ 94'								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*Omnipoint	8	199	160	0.0224	1950	1.0000	2.24%	
*Town - UHF	2	250	180	0.0055	450	0.3000	1.85%	
*Town - VHF	1	60	180	0.0007	34	0.2000	0.33%	
*AT&T UMTS	2	565	168	0.0144	880	0.5867	2.45%	
*AT&T UMTS	2	1077	168	0.0274	1900	1.0000	2.74%	
*AT&T GSM	1	647	168	0.0082	880	0.5867	1.40%	
*AT&T GSM	4	934	168	0.0476	1900	1.0000	4.76%	
*AT&T LTE	1	1615	168	0.0206	734	0.4893	4.20%	
Verizon	**11**	**408**	**150**	**0.0717**	**1970**	**1.0000**	**7.17%**	
Verizon	**9**	**386**	**150**	**0.0555**	**869**	**0.5790**	**9.59%**	
Verizon	**1**	**1750**	**150**	**0.0280**	**2145**	**1.0000**	**2.80%**	
Verizon	**1**	**1050**	**150**	**0.0168**	**698**	**0.4650**	**3.61%**	
								43.2%
* Source: Siting Council								

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

180-ft Existing Sabre Monopole

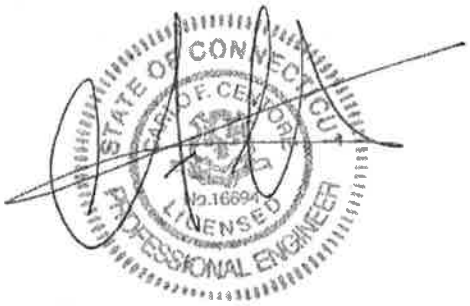
Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Somers West

37 Bacon Road
Enfield, CT

Centek Project No. 13001.097

Date: November 22, 2013



Prepared for:

Verizon Wireless
99 East River Road, 9th Floor
East Hartford, CT 06108

63-2 North Branford Road, Branford, CT 06405 203.488.0580 Fax 203.488.8587 www.CentekEng.com

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Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna upgrade proposed by Verizon Wireless on the existing monopole (tower) located in Enfield, CT.

The host tower is a 180-ft tall, four-section, eighteen sided, tapered monopole, originally designed and manufactured by Sabre Communications Corp. job no; 04-07104, dated July 23, 2003. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned Sabre design documents. The tower was previously reinforced by Hudson Design Group job no. 1103 dated May 29, 2013.

Antenna and appurtenance information were obtained from a previous structural report prepared by Centek engineering job no; 13075.021 dated June 10, 2013 and a Verizon RF data sheet.

The tower is made up of four (4) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 14.40-in at the top and 53.23-in at the base.

Verizon proposes the installation of three (3) panel antennas, three (3) remote radio heads and one (1) main distribution box mounted to the existing low profile platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing, proposed and future loads considered in this analysis consist of the following:

- UNKNOWN (EXISTING):
  Antennas: One (1) 10-ft Omni-directional whip, one (1) 1'x1' panel antenna and one (1) 2-ft dish mounted on two (2) existing 4-ft Dual Standoff Mounts with an elevation of 177-ft above grade.
  Coax Cables: Two (2) 1-1/4" ∅ and two (2) 1/2" ∅ coax cables running on the inside of the existing tower.
- AT&T (EXISTING):
  Antennas: Two (2) KMW AM-X-CD-16-65-00T panel antennas, two (2) Andrew SBNH-1D656C panel antennas, two (2) Powerwave P65-17-XLH-RR panel antennas, three (3) Kathrein 800-10121 panel antennas, six (6) Kathrein 860-10025 remote control units, six (6) Powerwave LGP21401 TMA's, twelve (12) Powerwave LGP21901 diplexers and three (3) DTMABP7819VG12A TMA's mounted on three (3) existing T-Arms with a RAD center elevation of 168-ft above grade.
  Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- AT&T (EXISTING/RESERVED):
  Antennas: Six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor flush mounted with an elevation of 168-ft above grade.
  Cables: One (1) fiber cable and two (2) dc control cables running on the inside of the existing tower.

- T-MOBILE (EXISTING):
  Antennas: Three (3) EMS RR90-17-02DP panel antennas and six (6) 10"x8"x3" TMA's mounted on three (3) existing T-Arms w/ work support platforms with a RAD center elevation of 160-ft above grade.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- VERIZON (EXISTING TO REMAIN):
  Antennas: Three (3) Antel BXA-70063-6CF panel antennas, six (6) Antel LPA-80080-4CF panel antennas, three (3) Antel BXA-171085-8BF panel antennas and six (6) RFS FD9R6004/2C-3L Diplexers mounted on a low profile platform with a RAD center elevation of 150-ft above grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- **VERIZON (Proposed):**
  Antennas: Three (3) BXA-171063-12CF panel antennas, three (3) Alcatel-Lucent RRH2x40-AWS Remote Radio Heads and one (1) RFS DB-T1-6Z-8AB-0Z main distribution box mounted on a low profile platform with a RAD center elevation of 150-ft above grade.
  Coax Cables: One (1) 1-5/8" ∅ fiber cable running on the inside of the existing tower.

Primary Assumptions Used in the Analysis

- The tower structure's theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents or reinforcement drawings.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All existing coax cables to be installed as indicated in this report.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled tnxTower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower shaft, and the model assumes that the shaft members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for the controlling basic wind speed (fastest mile) with no ice and a 75% reduction of wind force with ½ inch accumulative ice to determine stresses in members as per guidelines of TIA/EIA-222-F-96 entitled "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix K of the CSBC[1] and the wind speed data available in the TIA/EIA-222-F-96 Standard. The higher of the two wind speeds is utilized in preparation on the tower analysis.

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA/EIA-222-F, gravity loads of the tower structure and its components, and the application of ½" radial ice on the tower structure and its components.

Basic Wind Speed:	Hartford; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Enfield; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed controls.	
Load Cases:	Load Case 1; 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 69 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 69 mph wind speed velocity represents 75% of the wind pressure generated by the 80 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

[1] The 2005 Connecticut State Building Code as amended by the 2009 CT State Supplement. (CSBC)

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software tnxTower. Allowable stresses were determined based on Table 5 of the TIA/EIA code with a 1/3 increase per Section 3.1.1.1 of the same code.

- Calculated stresses were found to be within allowable limits. In Load Case 1, per tnxTower "Section Capacity Table", this tower was found to be at **98.4%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L5)	21.00'-48.75'	98.4%	**PASS**

Note 1: Equivalent thickness of 0.28" used for section L3 of pole shaft with reinforcement plates.
Note 2: Equivalent thickness of 0.35" used for section L6 of pole shaft with reinforcement plates

Foundation and Anchors

The existing foundation consists of a 7-ft square x 4.5-ft long reinforced concrete pier on a 23.0-ft square x 2.0-ft thick reinforced concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned design documents prepared by Sabre Communications Corp. job no; 04-07104, dated July 23, 2003. The base of the tower is connected to the foundation by means of (16) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 6-ft into the concrete foundation structure.

- The tower base reactions developed from the governing Load Case 1 were used in the verification of the foundation and its anchors:

Location	Vector	Proposed Reactions
Base	Shear	23 kips
	Compression	32 kips
	Moment	2844 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 (FS)[1]	Proposed Loading (FS)[1]	Result
Reinforced Concrete Pad and Pier	OTM[2]	2.0	2.04	**PASS**

Note 1: FS denotes Factor of Safety.
Note 2: OTM denotes Overturning Moment

- The anchor bolts and base plate were found to be within allowable limits.

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Compression	61.5%	**PASS**
Base Plate	Bending	93.8%	**PASS**

Conclusion

This analysis shows that the subject tower **is adequate** to support the proposed modified antenna configuration.

The analysis is based, in part, on the information provided to this office by Verizon Wireless. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Carlo F. Centore, PE
Principal ~ Structural Engineer

STATE OF CONNECTICUT
CARLO F. CENTORE
No. 16084
LICENSED
PROFESSIONAL ENGINEER

Prepared by:

Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

All engineering services are performed on the basis that the information used is current and correct. This information may consist of, but is not necessarily limited to:

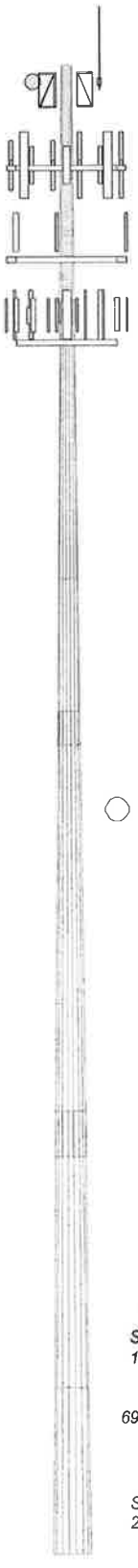
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of CENTEK engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provide to CENTEK engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the "as new" condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. CENTEK engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

General Description of Structural Analysis Program

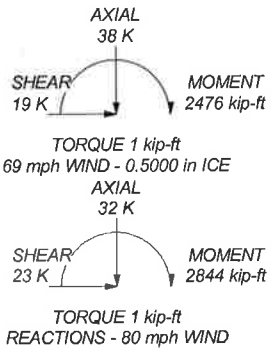
tnxTower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, tnxTower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

tnxTower Features:

- tnxTower can analyze and design 3- and 4-sided guyed towers, 3- and 4-sided self-supporting towers and either round or tapered ground mounted poles with or without guys.
- The program analyzes towers using the TIA-222-G (2005) standard or any of the previous TIA/EIA standards back to RS-222 (1959). Steel design is checked using the AISC ASD 9th Edition or the AISC LRFD specifications.
- Linear and non-linear (P-delta) analyses can be used in determining displacements and forces in the structure. Wind pressures and forces are automatically calculated.
- Extensive graphics plots include material take-off, shear-moment, leg compression, displacement, twist, feed line, guy anchor and stress plots.
- tnxTower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.



Section	1	2	3	4	5	6
Length (ft)	31.00	33.50	20.00	53.50	33.25	20.00
Number of Sides	18	18	18	18	18	18
Thickness (in)	0.1875	0.2500	0.2800	0.3125	0.3125	0.3500
Socket Length (ft)	2.75		4.00	5.50		
Top Dia (in)	14.4000	20.3658	27.9400	30.9800	41.2290	48.9500
Bot Dia (in)	21.3800	27.9400	32.4400	43.1000	48.9500	53.2300
Grade	A572-65					
Weight (K)	1.1	2.2	1.8	6.6	5.0	3.8



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
HP2-4.7	178	(2) TMA 10"x8"x3" (T-Mobile - Existing)	157
4-ft Dual Mount Standoff	177	12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	157
10' x 1" Dia Omni	177	12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	157
1' x 1' Panel	177	12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	157
4-ft Dual Mount Standoff	177	(2) TMA 10"x8"x3" (T-Mobile - Existing)	157
Valmont T-Arm (1) (ATI - Existing)	168	BXA-171085-8BF (Verizon - Existing)	150
Valmont T-Arm (1) (ATI - Existing)	168	BXA-70063/6CF (Verizon - Existing)	150
(2) AM-X-CD-16-65-00T-RET(72") (ATI - Existing)	168	LPA-80080-4CF (Verizon - Existing)	150
(2) SBNH-1D6565C (ATI - Existing)	168	LPA-80080-4CF (Verizon - Existing)	150
(2) P65-17-XLH-RR (ATI - Existing)	168	BXA-171085-8BF (Verizon - Existing)	150
(2) RRUS-11 (ATI - Existing)	168	BXA-70063/6CF (Verizon - Existing)	150
(2) RRUS-11 (ATI - Existing)	168	LPA-80080-4CF (Verizon - Existing)	150
(2) RRUS-11 (ATI - Existing)	168	LPA-80080-4CF (Verizon - Existing)	150
DC6-48-60-18-8F Surge Arrestor (ATI - Existing)	168	BXA-171085-8BF (Verizon - Existing)	150
800 10121 (ATI - Existing)	168	BXA-70063/6CF (Verizon - Existing)	150
800 10121 (ATI - Existing)	168	LPA-80080-4CF (Verizon - Existing)	150
800 10121 (ATI - Existing)	168	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	150
(2) 860 10025 RCU (ATI - Existing)	168	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	150
(2) 860 10025 RCU (ATI - Existing)	168	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	150
(2) 860 10025 RCU (ATI - Existing)	168	BXA-171063-12CF (Verizon - Proposed)	150
(2) LGP21401 TMA (ATI - Existing)	168	BXA-171063-12CF (Verizon - Proposed)	150
(2) LGP21401 TMA (ATI - Existing)	168	BXA-171063-12CF (Verizon - Proposed)	150
(2) LGP21401 TMA (ATI - Existing)	168	RRH2x40-AWS (Verizon - Proposed)	150
(4) LGP21901 Diplexer (ATI - Existing)	168	RRH2x40-AWS (Verizon - Proposed)	150
(4) LGP21901 Diplexer (ATI - Existing)	168	RRH2x40-AWS (Verizon - Proposed)	150
(4) LGP21901 Diplexer (ATI - Existing)	168	DB-T1-6Z-8AB-0Z (Verizon - Proposed)	150
DTMABP7819VG12A TMA (ATI - Existing)	168	LPA-80080-4CF (Verizon - Existing)	150
DTMABP7819VG12A TMA (ATI - Existing)	168	Andrew 12'-6" Low Profile Platform (Verizon - Existing)	147
DTMABP7819VG12A TMA (ATI - Existing)	168		
Valmont T-Arm (1) (ATI - Existing)	168		
RR90-17-02DP (T-Mobile - Existing)	160		
RR90-17-02DP (T-Mobile - Existing)	160		
RR90-17-02DP (T-Mobile - Existing)	160		
(2) TMA 10"x8"x3" (T-Mobile - Existing)	157		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
5. Welds are fabricated with ER-70S-6 electrodes.
6. TOWER RATING: 98.4%

Centek Engineering Inc.
63-2 North Branford Rd.
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587

Job: **13001.097 - Somers West**			
Project: **180' Sabre Monopole - 37 Bacon Rd., Enfield, CT**			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 11/22/13	Scale: NTS	
Path:		Dwg No. E-1	

tnxTower	Job	Page
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	13001.097 - Somers West	1 of 36
	Project 180' Sabre Monopole - 37 Bacon Rd., Enfield, CT	Date 14:09:28 11/22/13
	Client Verizon Wireless	Designed by TJL

Tower Input Data

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

Basic wind speed of 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56.0 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, 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	180.00-149.00	31.00	2.75	18	14.4000	21.3800	0.1875	0.7500	A572-65 (65 ksi)
L2	149.00-118.25	33.50	0.00	18	20.3858	27.9400	0.2500	1.0000	A572-65 (65 ksi)
L3	118.25-98.25	20.00	4.00	18	27.9400	32.4400	0.2800	1.1200	A572-65 (65 ksi)
L4	98.25-48.75	53.50	5.50	18	30.9800	43.1000	0.3125	1.2500	A572-65 (65 ksi)
L5	48.75-21.00	33.25	0.00	18	41.2290	48.9500	0.3125	1.2500	A572-65 (65 ksi)

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
L6	21.00-1.00	20.00		18	48.9500	53.2300	0.3500	1.4000	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	14.6221	8.4582	215.8525	5.0454	7.3152	29.5074	431.9890	4.2299	2.2044	11.757
	21.7098	12.6122	715.6361	7.5233	10.8610	65.8902	1432.2138	6.3073	3.4329	18.309
L2	21.3300	15.9778	818.4487	7.1482	10.3560	79.0314	1637.9743	7.9904	3.1479	12.592
	28.3710	21.9720	2128.4000	9.8300	14.1935	149.9558	4259.6006	10.9881	4.4774	17.91
L3	28.3710	24.5820	2376.0684	9.8193	14.1935	167.4052	4755.2632	12.2933	4.4246	15.802
	32.9404	28.5812	3734.6553	11.4168	16.4795	226.6240	7474.2248	14.2933	5.2166	18.631
L4	32.3781	30.4183	3614.3443	10.8870	15.7378	229.6595	7233.4444	15.2121	4.9025	15.688
	43.7649	42.4399	9816.2392	15.1896	21.8948	448.3366	19645.3948	21.2240	7.0356	22.514
L5	43.1619	40.5841	8584.0141	14.5254	20.9443	409.8488	17179.3232	20.2959	6.7063	21.46
	49.7051	48.2423	14418.1031	17.2663	24.8666	579.8180	28855.1778	24.1257	8.0652	25.809
L6	49.7051	53.9897	16110.9528	17.2530	24.8666	647.8953	32243.1048	27.0000	7.9992	22.855
	54.0512	58.7444	20753.2805	18.7724	27.0408	767.4791	41533.8687	29.3778	8.7525	25.007

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 180.00-149.00				1	1	1		
L2 149.00-118.25				1	1	1		
L3 118.25-98.25				1	1	1		
L4 98.25-48.75				1	1	1		
L5 48.75-21.00				1	1	1		
L6 21.00-1.00				1	1	1		

Monopole Base Plate Data

Base Plate Data	
Base plate is square	
Base plate is grouted	√
Anchor bolt grade	A615-75
Anchor bolt size	2.2500 in
Number of bolts	16
Embedment length	60.0000 in
f'_c	4.000 ksi
Grout space	3.0000 in
Base plate grade	A572-60
Base plate thickness	2.0000 in
Bolt circle diameter	60.0000 in
Outer diameter	66.0000 in
Inner diameter	40.0000 in

Base Plate Data	
Base plate type	Plain Plate

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 1/4	C	No	Inside Pole	180.00 - 1.00	2	No Ice	0.00	0.66
						1/2" Ice	0.00	0.66
1/2	C	No	Inside Pole	180.00 - 1.00	2	No Ice	0.00	0.25
						1/2" Ice	0.00	0.25
1 5/8 (AT&T - Existing)	C	No	Inside Pole	171.00 - 1.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (T-Mobile - Existing)	C	No	Inside Pole	161.00 - 1.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon - Existing)	C	No	Inside Pole	151.00 - 1.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
#8 AWG Copper WIre (AT&T - Existing)	C	No	Inside Pole	171.00 - 1.00	2	No Ice	0.00	0.05
						1/2" Ice	0.00	0.05
RG6-Fiber (AT&T - Existing)	C	No	Inside Pole	171.00 - 1.00	1	No Ice	0.00	1.00
						1/2" Ice	0.00	1.00
HYBRIFLEX 1-5/8" (Verizon - Proposed)	C	No	Inside Pole	151.00 - 1.00	1	No Ice	0.00	1.90
						1/2" Ice	0.00	1.90

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	180.00-149.00	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	0.000	0.46
L2	149.00-118.25	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	0.000	1.11
L3	118.25-98.25	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	0.000	0.72
L4	98.25-48.75	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	0.000	1.78
L5	48.75-21.00	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	0.000	1.00
L6	21.00-1.00	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	0.000	0.72

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	180.00-149.00	A	0.500	0.000	0.000	0.000	0.000	0.00

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.46
L2	149.00-118.25	A	0.500	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	0.000	1.11
L3	118.25-98.25	A	0.500	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	0.000	0.72
L4	98.25-48.75	A	0.500	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	0.000	1.78
L5	48.75-21.00	A	0.500	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	0.000	1.00
L6	21.00-1.00	A	0.500	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	0.000	0.72

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	180.00-149.00	0.0000	0.0000	0.0000	0.0000
L2	149.00-118.25	0.0000	0.0000	0.0000	0.0000
L3	118.25-98.25	0.0000	0.0000	0.0000	0.0000
L4	98.25-48.75	0.0000	0.0000	0.0000	0.0000
L5	48.75-21.00	0.0000	0.0000	0.0000	0.0000
L6	21.00-1.00	0.0000	0.0000	0.0000	0.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight K
4-ft Dual Mount Standoff	A	From Face	2.00 0.00	0.0000	177.00	No Ice 1/2" Ice	5.20 6.30	5.20 6.30	0.05 0.06
			0.00						
4-ft Dual Mount Standoff	B	From Face	2.00 0.00	0.0000	177.00	No Ice 1/2" Ice	5.20 6.30	5.20 6.30	0.05 0.06
			0.00						
10' x 1" Dia Omni	B	From Face	4.00 0.00	0.0000	177.00	No Ice 1/2" Ice	1.00 2.02	1.00 2.02	0.03 0.04
			5.00						
1' x 1' Panel	B	From Face	4.00 0.00	0.0000	177.00	No Ice 1/2" Ice	1.40 1.56	0.35 0.45	0.02 0.03
			1.00						
Valmont T-Arm (1)	A	From Face	4.00	0.0000	168.00	No Ice	10.54	10.54	0.34

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
(AT&T - Existing)			0.00 0.00			1/2" Ice	14.45	14.45	0.41
Valmont T-Arm (1)	B	From Face	4.00	0.0000	168.00	No Ice	10.54	10.54	0.34
(AT&T - Existing)			0.00 0.00			1/2" Ice	14.45	14.45	0.41
Valmont T-Arm (1)	C	From Face	4.00	0.0000	168.00	No Ice	10.54	10.54	0.34
(AT&T - Existing)			0.00 0.00			1/2" Ice	14.45	14.45	0.41
(2) AM-X-CD-16-65-00T-RET(72")	A	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice	8.26 8.81	4.64 5.09	0.05 0.10
(AT&T - Existing)									
(2) SBNH-1D6565C	B	From Face	4.00	0.0000	168.00	No Ice	11.41	7.70	0.06
(AT&T - Existing)			0.00 0.00			1/2" Ice	12.03	8.29	0.13
(2) P65-17-XLH-RR	C	From Face	4.00	0.0000	168.00	No Ice	11.47	6.80	0.06
(AT&T - Existing)			0.00 0.00			1/2" Ice	12.08	7.38	0.12
(2) RRUS-11	A	From Face	0.50	0.0000	168.00	No Ice	0.00	1.25	0.05
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.00	1.41	0.07
(2) RRUS-11	B	From Face	0.50	0.0000	168.00	No Ice	0.00	1.25	0.05
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.00	1.41	0.07
(2) RRUS-11	C	From Face	0.50	0.0000	168.00	No Ice	0.00	1.25	0.05
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.00	1.41	0.07
DC6-48-60-18-8F Surge Arrestor	C	From Face	0.50	0.0000	168.00	No Ice	2.23	2.23	0.02
(AT&T - Existing)			0.00 0.00			1/2" Ice	2.45	2.45	0.04
800 10121	A	From Face	4.00	0.0000	168.00	No Ice	5.46	3.29	0.05
(AT&T - Existing)			0.00 0.00			1/2" Ice	5.88	3.64	0.08
800 10121	B	From Face	4.00	0.0000	168.00	No Ice	5.46	3.29	0.05
(AT&T - Existing)			0.00 0.00			1/2" Ice	5.88	3.64	0.08
800 10121	C	From Face	4.00	0.0000	168.00	No Ice	5.46	3.29	0.05
(AT&T - Existing)			0.00 0.00			1/2" Ice	5.88	3.64	0.08
(2) 860 10025 RCU	A	From Face	4.00	0.0000	168.00	No Ice	0.00	0.00	0.00
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.00	0.00	0.00
(2) 860 10025 RCU	B	From Face	4.00	0.0000	168.00	No Ice	0.00	0.00	0.00
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.00	0.00	0.00
(2) 860 10025 RCU	C	From Face	4.00	0.0000	168.00	No Ice	0.00	0.00	0.00
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.00	0.00	0.00
(2) LGP21401 TMA	A	From Face	4.00	0.0000	168.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00 0.00			1/2" Ice	1.09	0.48	0.02
(2) LGP21401 TMA	B	From Face	4.00	0.0000	168.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00 0.00			1/2" Ice	1.09	0.48	0.02
(2) LGP21401 TMA	C	From Face	4.00	0.0000	168.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00 0.00			1/2" Ice	1.09	0.48	0.02

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(4) LGP21901 Diplexer (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice	0.00 0.00	0.12 0.17	0.01 0.01
(4) LGP21901 Diplexer (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice	0.00 0.00	0.12 0.17	0.01 0.01
(4) LGP21901 Diplexer (AT&T - Existing)	C	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice	0.00 0.00	0.12 0.17	0.01 0.01
DTMABP7819VG12A TMA (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice	0.00 0.00	0.58 0.70	0.02 0.03
DTMABP7819VG12A TMA (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice	0.00 0.00	0.58 0.70	0.02 0.03
DTMABP7819VG12A TMA (AT&T - Existing)	C	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice	0.00 0.00	0.58 0.70	0.02 0.03
RR90-17-02DP (T-Mobile - Existing)	A	From Face	4.00 6.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
RR90-17-02DP (T-Mobile - Existing)	B	From Face	4.00 6.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
RR90-17-02DP (T-Mobile - Existing)	C	From Face	4.00 6.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
(2) TMA 10"x8"x3" (T-Mobile - Existing)	A	From Face	4.00 5.00 0.00	0.0000	157.00	No Ice 1/2" Ice	0.00 0.00	0.00 0.00	0.02 0.02
(2) TMA 10"x8"x3" (T-Mobile - Existing)	A	From Face	4.00 5.00 0.00	0.0000	157.00	No Ice 1/2" Ice	0.00 0.00	0.00 0.00	0.02 0.02
(2) TMA 10"x8"x3" (T-Mobile - Existing)	A	From Face	4.00 5.00 0.00	0.0000	157.00	No Ice 1/2" Ice	0.00 0.00	0.00 0.00	0.02 0.02
12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	A	From Face	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice	14.20 19.70	14.20 19.70	0.49 0.57
12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	B	From Face	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice	14.20 19.70	14.20 19.70	0.49 0.57
12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	C	From Face	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice	14.20 19.70	14.20 19.70	0.49 0.57
LPA-80080-4CF (Verizon - Existing)	A	From Face	4.00 6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
BXA-171085-8BF (Verizon - Existing)	A	From Face	4.00 4.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.94 3.26	2.16 2.46	0.01 0.03
BXA-70063/6CF (Verizon - Existing)	A	From Face	4.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
LPA-80080-4CF (Verizon - Existing)	A	From Face	4.00 -6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05

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
LPA-80080-4CF	B	From Face	4.00	0.0000	150.00	No Ice	2.62	6.06	0.01
(Verizon - Existing)			6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
BXA-171085-8BF	B	From Face	4.00	0.0000	150.00	No Ice	2.94	2.16	0.01
(Verizon - Existing)			4.00			1/2" Ice	3.26	2.46	0.03
			0.00						
BXA-70063/6CF	B	From Face	4.00	0.0000	150.00	No Ice	7.73	4.16	0.02
(Verizon - Existing)			0.00			1/2" Ice	8.27	4.60	0.06
			0.00						
LPA-80080-4CF	B	From Face	4.00	0.0000	150.00	No Ice	2.62	6.06	0.01
(Verizon - Existing)			-6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
LPA-80080-4CF	C	From Face	4.00	0.0000	150.00	No Ice	2.62	6.06	0.01
(Verizon - Existing)			6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
BXA-171085-8BF	C	From Face	4.00	0.0000	150.00	No Ice	2.94	2.16	0.01
(Verizon - Existing)			4.00			1/2" Ice	3.26	2.46	0.03
			0.00						
BXA-70063/6CF	C	From Face	4.00	0.0000	150.00	No Ice	7.73	4.16	0.02
(Verizon - Existing)			0.00			1/2" Ice	8.27	4.60	0.06
			0.00						
LPA-80080-4CF	C	From Face	4.00	0.0000	150.00	No Ice	2.62	6.06	0.01
(Verizon - Existing)			-6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
(2) FD9R6004/2C-3L Diplexer	A	From Face	4.00	0.0000	150.00	No Ice	0.00	0.00	0.00
(Verizon - Existing)			6.00			1/2" Ice	0.00	0.00	0.01
			0.00						
(2) FD9R6004/2C-3L Diplexer	B	From Face	4.00	0.0000	150.00	No Ice	0.00	0.00	0.00
(Verizon - Existing)			6.00			1/2" Ice	0.00	0.00	0.01
			0.00						
(2) FD9R6004/2C-3L Diplexer	C	From Face	4.00	0.0000	150.00	No Ice	0.00	0.00	0.00
(Verizon - Existing)			6.00			1/2" Ice	0.00	0.00	0.01
			0.00						
BXA-171063-12CF	A	From Face	4.00	0.0000	150.00	No Ice	4.79	3.62	0.02
(Verizon - Proposed)			-4.00			1/2" Ice	5.24	4.06	0.04
			0.00						
BXA-171063-12CF	B	From Face	4.00	0.0000	150.00	No Ice	4.79	3.62	0.02
(Verizon - Proposed)			-4.00			1/2" Ice	5.24	4.06	0.04
			0.00						
BXA-171063-12CF	C	From Face	4.00	0.0000	150.00	No Ice	4.79	3.62	0.02
(Verizon - Proposed)			-4.00			1/2" Ice	5.24	4.06	0.04
			0.00						
RRH2x40-AWS	A	From Face	4.00	0.0000	150.00	No Ice	0.00	1.59	0.04
(Verizon - Proposed)			-4.00			1/2" Ice	0.00	1.80	0.06
			0.00						
RRH2x40-AWS	B	From Face	4.00	0.0000	150.00	No Ice	0.00	1.59	0.04
(Verizon - Proposed)			-4.00			1/2" Ice	0.00	1.80	0.06
			0.00						
RRH2x40-AWS	C	From Face	4.00	0.0000	150.00	No Ice	0.00	1.59	0.04
(Verizon - Proposed)			-4.00			1/2" Ice	0.00	1.80	0.06
			0.00						
DB-T1-6Z-8AB-0Z	A	From Face	4.00	0.0000	150.00	No Ice	5.60	2.33	0.04
(Verizon - Proposed)			0.00			1/2" Ice	5.92	2.56	0.08
			0.00						
Andrew 12'-6" Low Profile Platform	C	None		0.0000	147.00	No Ice	14.45	14.45	1.30
(Verizon - Existing)						1/2" Ice	19.00	19.00	1.69

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
HP2-4.7	A	Paraboloid w/Shroud (HP)	From Face	4.00 0.00 0.00	Worst		178.00	2.00	No Ice 1/2" Ice	3.14 3.41	0.03 0.04

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg % %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 180.00-149.00	163.60	1.58	25.88	46.216	A	0.000	46.216	46.216	100.00	0.000	0.000
					B	0.000	46.216		100.00	0.000	0.000
					C	0.000	46.216		100.00	0.000	0.000
L2 149.00-118.25	133.02	1.489	24.39	62.712	A	0.000	62.712	62.712	100.00	0.000	0.000
					B	0.000	62.712		100.00	0.000	0.000
					C	0.000	62.712		100.00	0.000	0.000
L3 118.25-98.25	108.00	1.403	22.99	50.317	A	0.000	50.317	50.317	100.00	0.000	0.000
					B	0.000	50.317		100.00	0.000	0.000
					C	0.000	50.317		100.00	0.000	0.000
L4 98.25-48.75	72.87	1.254	20.44	154.659	A	0.000	154.659	154.659	100.00	0.000	0.000
					B	0.000	154.659		100.00	0.000	0.000
					C	0.000	154.659		100.00	0.000	0.000
L5 48.75-21.00	34.55	1.013	16.60	105.746	A	0.000	105.746	105.746	100.00	0.000	0.000
					B	0.000	105.746		100.00	0.000	0.000
					C	0.000	105.746		100.00	0.000	0.000
L6 21.00-1.00	10.86	1	16.38	85.150	A	0.000	85.150	85.150	100.00	0.000	0.000
					B	0.000	85.150		100.00	0.000	0.000
					C	0.000	85.150		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg % %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 180.00-149.00	163.60	1.58	19.41	0.5000	48.799	A	0.000	48.799	48.799	100.00	0.000	0.000
						B	0.000	48.799		100.00	0.000	0.000
						C	0.000	48.799		100.00	0.000	0.000
L2	133.02	1.489	18.29	0.5000	65.274	A	0.000	65.274	65.274	100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
149.00-118.25						B	0.000	65.274		100.00	0.000	0.000
						C	0.000	65.274		100.00	0.000	0.000
L3 118.25-98.25	108.00	1.403	17.24	0.5000	51.983	A	0.000	51.983	51.983	100.00	0.000	0.000
						B	0.000	51.983		100.00	0.000	0.000
						C	0.000	51.983		100.00	0.000	0.000
L4 98.25-48.75	72.87	1.254	15.33	0.5000	158.784	A	0.000	158.784	158.784	100.00	0.000	0.000
						B	0.000	158.784		100.00	0.000	0.000
						C	0.000	158.784		100.00	0.000	0.000
L5 48.75-21.00	34.55	1.013	12.45	0.5000	108.059	A	0.000	108.059	108.059	100.00	0.000	0.000
						B	0.000	108.059		100.00	0.000	0.000
						C	0.000	108.059		100.00	0.000	0.000
L6 21.00-1.00	10.86	1	12.29	0.5000	86.817	A	0.000	86.817	86.817	100.00	0.000	0.000
						B	0.000	86.817		100.00	0.000	0.000
						C	0.000	86.817		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	163.60	1.58	10.11	46.216	A	0.000	46.216	46.216	100.00	0.000	0.000
180.00-149.00					B	0.000	46.216		100.00	0.000	0.000
					C	0.000	46.216		100.00	0.000	0.000
L2	133.02	1.489	9.53	62.712	A	0.000	62.712	62.712	100.00	0.000	0.000
149.00-118.25					B	0.000	62.712		100.00	0.000	0.000
					C	0.000	62.712		100.00	0.000	0.000
L3	108.00	1.403	8.98	50.317	A	0.000	50.317	50.317	100.00	0.000	0.000
118.25-98.25					B	0.000	50.317		100.00	0.000	0.000
					C	0.000	50.317		100.00	0.000	0.000
L4 98.25-48.75	72.87	1.254	7.98	154.659	A	0.000	154.659	154.659	100.00	0.000	0.000
					B	0.000	154.659		100.00	0.000	0.000
					C	0.000	154.659		100.00	0.000	0.000
L5 48.75-21.00	34.55	1.013	6.48	105.746	A	0.000	105.746	105.746	100.00	0.000	0.000
					B	0.000	105.746		100.00	0.000	0.000
					C	0.000	105.746		100.00	0.000	0.000
L6 21.00-1.00	10.86	1	6.40	85.150	A	0.000	85.150	85.150	100.00	0.000	0.000
					B	0.000	85.150		100.00	0.000	0.000
					C	0.000	85.150		100.00	0.000	0.000

Tower Forces - No 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 ft²	F K	w plf	Ctrl. Face
L1	0.46	1.11	A	1	0.65	1	1	1	46.216	1.31	42.38	C
180.00-149.00			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2	1.11	2.16	A	1	0.65	1	1	1	62.712	1.68	54.63	C

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
149.00-118.25			B	1	0.65	1	1	1	62.712			
			C	1	0.65	1	1	1	62.712			
L3	0.72	1.81	A	1	0.65	1	1	1	50.317	1.27	63.54	C
118.25-98.25			B	1	0.65	1	1	1	50.317			
			C	1	0.65	1	1	1	50.317			
L4	1.78	6.63	A	1	0.65	1	1	1	154.659	3.47	70.14	C
98.25-48.75			B	1	0.65	1	1	1	154.659			
			C	1	0.65	1	1	1	154.659			
L5	1.00	5.03	A	1	0.65	1	1	1	105.746	1.93	69.49	C
48.75-21.00			B	1	0.65	1	1	1	105.746			
			C	1	0.65	1	1	1	105.746			
L6 21.00-1.00	0.72	3.84	A	1	0.65	1	1	1	85.150	1.53	76.63	C
			B	1	0.65	1	1	1	85.150			
			C	1	0.65	1	1	1	85.150			
Sum Weight:	5.79	20.58						OTM	900.67 kip-ft	11.20		

Tower Forces - No Ice - 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	0.46	1.11	A	1	0.65	1	1	1	46.216	1.31	42.38	C
180.00-149.00			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2	1.11	2.16	A	1	0.65	1	1	1	62.712	1.68	54.63	C
149.00-118.25			B	1	0.65	1	1	1	62.712			
			C	1	0.65	1	1	1	62.712			
L3	0.72	1.81	A	1	0.65	1	1	1	50.317	1.27	63.54	C
118.25-98.25			B	1	0.65	1	1	1	50.317			
			C	1	0.65	1	1	1	50.317			
L4	1.78	6.63	A	1	0.65	1	1	1	154.659	3.47	70.14	C
98.25-48.75			B	1	0.65	1	1	1	154.659			
			C	1	0.65	1	1	1	154.659			
L5	1.00	5.03	A	1	0.65	1	1	1	105.746	1.93	69.49	C
48.75-21.00			B	1	0.65	1	1	1	105.746			
			C	1	0.65	1	1	1	105.746			
L6 21.00-1.00	0.72	3.84	A	1	0.65	1	1	1	85.150	1.53	76.63	C
			B	1	0.65	1	1	1	85.150			
			C	1	0.65	1	1	1	85.150			
Sum Weight:	5.79	20.58						OTM	900.67 kip-ft	11.20		

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	0.46	1.11	A	1	0.65	1	1	1	46.216	1.31	42.38	C

tnxTower	Job: 13001.097 - Somers West	Page: 11 of 36
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project: 180' Sabre Monopole - 37 Bacon Rd., Enfield, CT	Date: 14:09:28 11/22/13
	Client: Verizon Wireless	Designed by: TJL

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
180.00-149.00			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2	1.11	2.16	A	1	0.65	1	1	1	62.712	1.68	54.63	C
149.00-118.25			B	1	0.65	1	1	1	62.712			
			C	1	0.65	1	1	1	62.712			
L3	0.72	1.81	A	1	0.65	1	1	1	50.317	1.27	63.54	C
118.25-98.25			B	1	0.65	1	1	1	50.317			
			C	1	0.65	1	1	1	50.317			
L4	1.78	6.63	A	1	0.65	1	1	1	154.659	3.47	70.14	C
98.25-48.75			B	1	0.65	1	1	1	154.659			
			C	1	0.65	1	1	1	154.659			
L5	1.00	5.03	A	1	0.65	1	1	1	105.746	1.93	69.49	C
48.75-21.00			B	1	0.65	1	1	1	105.746			
			C	1	0.65	1	1	1	105.746			
L6 21.00-1.00	0.72	3.84	A	1	0.65	1	1	1	85.150	1.53	76.63	C
			B	1	0.65	1	1	1	85.150			
			C	1	0.65	1	1	1	85.150			
Sum Weight:	5.79	20.58						OTM	900.67 kip-ft	11.20		

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 ft²	F K	w plf	Ctrl. Face
L1	0.46	1.46	A	1	0.65	1	1	1	48.799	1.04	33.56	C
180.00-149.00			B	1	0.65	1	1	1	48.799			
			C	1	0.65	1	1	1	48.799			
L2	1.11	2.64	A	1	0.65	1	1	1	65.274	1.31	42.65	C
149.00-118.25			B	1	0.65	1	1	1	65.274			
			C	1	0.65	1	1	1	65.274			
L3	0.72	2.19	A	1	0.65	1	1	1	51.983	0.98	49.23	C
118.25-98.25			B	1	0.65	1	1	1	51.983			
			C	1	0.65	1	1	1	51.983			
L4	1.78	7.79	A	1	0.65	1	1	1	158.784	2.67	54.01	C
98.25-48.75			B	1	0.65	1	1	1	158.784			
			C	1	0.65	1	1	1	158.784			
L5	1.00	5.82	A	1	0.65	1	1	1	108.059	1.48	53.26	C
48.75-21.00			B	1	0.65	1	1	1	108.059			
			C	1	0.65	1	1	1	108.059			
L6 21.00-1.00	0.72	4.47	A	1	0.65	1	1	1	86.817	1.17	58.59	C
			B	1	0.65	1	1	1	86.817			
			C	1	0.65	1	1	1	86.817			
Sum Weight:	5.79	24.37						OTM	700.91 kip-ft	8.66		

Tower Forces - With Ice - 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 ft²	F K	w plf	Ctrl. Face
L1	0.46	1.46	A	1	0.65	1	1	1	48.799	1.04	33.56	C
180.00-149.00			B	1	0.65	1	1	1	48.799			
			C	1	0.65	1	1	1	48.799			
L2	1.11	2.64	A	1	0.65	1	1	1	65.274	1.31	42.65	C
149.00-118.25			B	1	0.65	1	1	1	65.274			
			C	1	0.65	1	1	1	65.274			
L3	0.72	2.19	A	1	0.65	1	1	1	51.983	0.98	49.23	C
118.25-98.25			B	1	0.65	1	1	1	51.983			
			C	1	0.65	1	1	1	51.983			
L4	1.78	7.79	A	1	0.65	1	1	1	158.784	2.67	54.01	C
98.25-48.75			B	1	0.65	1	1	1	158.784			
			C	1	0.65	1	1	1	158.784			
L5	1.00	5.82	A	1	0.65	1	1	1	108.059	1.48	53.26	C
48.75-21.00			B	1	0.65	1	1	1	108.059			
			C	1	0.65	1	1	1	108.059			
L6 21.00-1.00	0.72	4.47	A	1	0.65	1	1	1	86.817	1.17	58.59	C
			B	1	0.65	1	1	1	86.817			
			C	1	0.65	1	1	1	86.817			
Sum Weight:	5.79	24.37						OTM	700.91 kip-ft	8.66		

Tower Forces - With 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 ft²	F K	w plf	Ctrl. Face
L1	0.46	1.46	A	1	0.65	1	1	1	48.799	1.04	33.56	C
180.00-149.00			B	1	0.65	1	1	1	48.799			
			C	1	0.65	1	1	1	48.799			
L2	1.11	2.64	A	1	0.65	1	1	1	65.274	1.31	42.65	C
149.00-118.25			B	1	0.65	1	1	1	65.274			
			C	1	0.65	1	1	1	65.274			
L3	0.72	2.19	A	1	0.65	1	1	1	51.983	0.98	49.23	C
118.25-98.25			B	1	0.65	1	1	1	51.983			
			C	1	0.65	1	1	1	51.983			
L4	1.78	7.79	A	1	0.65	1	1	1	158.784	2.67	54.01	C
98.25-48.75			B	1	0.65	1	1	1	158.784			
			C	1	0.65	1	1	1	158.784			
L5	1.00	5.82	A	1	0.65	1	1	1	108.059	1.48	53.26	C
48.75-21.00			B	1	0.65	1	1	1	108.059			
			C	1	0.65	1	1	1	108.059			
L6 21.00-1.00	0.72	4.47	A	1	0.65	1	1	1	86.817	1.17	58.59	C
			B	1	0.65	1	1	1	86.817			
			C	1	0.65	1	1	1	86.817			
Sum Weight:	5.79	24.37						OTM	700.91 kip-ft	8.66		

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 ft²	F K	w plf	Ctrl. Face
L1	0.46	1.11	A	1	0.65	1	1	1	46.216	0.51	16.55	C
180.00-149.00			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2	1.11	2.16	A	1	0.65	1	1	1	62.712	0.66	21.34	C
149.00-118.25			B	1	0.65	1	1	1	62.712			
			C	1	0.65	1	1	1	62.712			
L3	0.72	1.81	A	1	0.65	1	1	1	50.317	0.50	24.82	C
118.25-98.25			B	1	0.65	1	1	1	50.317			
			C	1	0.65	1	1	1	50.317			
L4	1.78	6.63	A	1	0.65	1	1	1	154.659	1.36	27.40	C
98.25-48.75			B	1	0.65	1	1	1	154.659			
			C	1	0.65	1	1	1	154.659			
L5	1.00	5.03	A	1	0.65	1	1	1	105.746	0.75	27.14	C
48.75-21.00			B	1	0.65	1	1	1	105.746			
			C	1	0.65	1	1	1	105.746			
L6 21.00-1.00	0.72	3.84	A	1	0.65	1	1	1	85.150	0.60	29.93	C
			B	1	0.65	1	1	1	85.150			
			C	1	0.65	1	1	1	85.150			
Sum Weight:	5.79	20.58						OTM	351.82 kip-ft	4.37		

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 ft²	F K	w plf	Ctrl. Face
L1	0.46	1.11	A	1	0.65	1	1	1	46.216	0.51	16.55	C
180.00-149.00			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2	1.11	2.16	A	1	0.65	1	1	1	62.712	0.66	21.34	C
149.00-118.25			B	1	0.65	1	1	1	62.712			
			C	1	0.65	1	1	1	62.712			
L3	0.72	1.81	A	1	0.65	1	1	1	50.317	0.50	24.82	C
118.25-98.25			B	1	0.65	1	1	1	50.317			
			C	1	0.65	1	1	1	50.317			
L4	1.78	6.63	A	1	0.65	1	1	1	154.659	1.36	27.40	C
98.25-48.75			B	1	0.65	1	1	1	154.659			
			C	1	0.65	1	1	1	154.659			
L5	1.00	5.03	A	1	0.65	1	1	1	105.746	0.75	27.14	C
48.75-21.00			B	1	0.65	1	1	1	105.746			
			C	1	0.65	1	1	1	105.746			
L6 21.00-1.00	0.72	3.84	A	1	0.65	1	1	1	85.150	0.60	29.93	C
			B	1	0.65	1	1	1	85.150			
			C	1	0.65	1	1	1	85.150			
Sum Weight:	5.79	20.58						OTM	351.82 kip-ft	4.37		

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 ft²	F K	w plf	Ctrl. Face
L1	0.46	1.11	A	1	0.65	1	1	1	46.216	0.51	16.55	C
180.00-149.00			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2	1.11	2.16	A	1	0.65	1	1	1	62.712	0.66	21.34	C
149.00-118.25			B	1	0.65	1	1	1	62.712			
			C	1	0.65	1	1	1	62.712			
L3	0.72	1.81	A	1	0.65	1	1	1	50.317	0.50	24.82	C
118.25-98.25			B	1	0.65	1	1	1	50.317			
			C	1	0.65	1	1	1	50.317			
L4	1.78	6.63	A	1	0.65	1	1	1	154.659	1.36	27.40	C
98.25-48.75			B	1	0.65	1	1	1	154.659			
			C	1	0.65	1	1	1	154.659			
L5	1.00	5.03	A	1	0.65	1	1	1	105.746	0.75	27.14	C
48.75-21.00			B	1	0.65	1	1	1	105.746			
			C	1	0.65	1	1	1	105.746			
L6 21.00-1.00	0.72	3.84	A	1	0.65	1	1	1	85.150	0.60	29.93	C
			B	1	0.65	1	1	1	85.150			
			C	1	0.65	1	1	1	85.150			
Sum Weight:	5.79	20.58						OTM	351.82 kip-ft	4.37		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	20.58					
Bracing Weight	0.00					
Total Member Self-Weight	20.58			-1.15	0.21	
Total Weight	31.95			-1.15	0.21	
Wind 0 deg - No Ice		-0.04	-22.49	-2705.04	5.01	0.21
Wind 30 deg - No Ice		11.22	-19.46	-2340.39	-1347.48	-0.33
Wind 60 deg - No Ice		19.46	-11.21	-1348.94	-2338.85	-0.78
Wind 90 deg - No Ice		22.50	0.04	3.65	-2703.48	-1.02
Wind 120 deg - No Ice		19.50	11.28	1354.95	-2343.65	-0.99
Wind 150 deg - No Ice		11.28	19.50	2342.89	-1355.79	-0.70
Wind 180 deg - No Ice		0.04	22.49	2702.74	-4.59	-0.21
Wind 210 deg - No Ice		-11.22	19.46	2338.09	1347.89	0.33
Wind 240 deg - No Ice		-19.46	11.21	1346.64	2339.27	0.78
Wind 270 deg - No Ice		-22.50	-0.04	-5.95	2703.89	1.02
Wind 300 deg - No Ice		-19.50	-11.28	-1357.25	2344.07	0.99
Wind 330 deg - No Ice		-11.28	-19.50	-2345.19	1356.21	0.70
Member Ice	3.79					
Total Weight Ice	37.98			-1.24	0.19	
Wind 0 deg - Ice		-0.03	-18.78	-2317.99	4.19	0.27
Wind 30 deg - Ice		9.37	-16.25	-2005.61	-1155.01	-0.25
Wind 60 deg - Ice		16.25	-9.36	-1156.16	-2004.67	-0.70
Wind 90 deg - Ice		18.79	0.03	2.75	-2317.14	-0.97
Wind 120 deg - Ice		16.28	9.41	1160.60	-2008.67	-0.98
Wind 150 deg - Ice		9.42	16.28	2007.12	-1161.93	-0.72
Wind 180 deg - Ice		0.03	18.78	2315.51	-3.80	-0.27
Wind 210 deg - Ice		-9.37	16.25	2003.13	1155.40	0.25
Wind 240 deg - Ice		-16.25	9.36	1153.67	2005.06	0.70
Wind 270 deg - Ice		-18.79	-0.03	-5.24	2317.52	0.97
Wind 300 deg - Ice		-16.28	-9.41	-1163.08	2009.06	0.98

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 330 deg - Ice		-9.42	-16.28	-2009.61	1162.32	0.72
Total Weight	31.95			-1.15	0.21	
Wind 0 deg - Service		-0.01	-8.79	-1057.36	2.08	0.08
Wind 30 deg - Service		4.38	-7.60	-914.92	-526.23	-0.13
Wind 60 deg - Service		7.60	-4.38	-527.63	-913.49	-0.31
Wind 90 deg - Service		8.79	0.01	0.72	-1055.92	-0.40
Wind 120 deg - Service		7.62	4.41	528.58	-915.36	-0.39
Wind 150 deg - Service		4.41	7.62	914.49	-529.48	-0.27
Wind 180 deg - Service		0.01	8.79	1055.06	-1.67	-0.08
Wind 210 deg - Service		-4.38	7.60	912.61	526.65	0.13
Wind 240 deg - Service		-7.60	4.38	525.33	913.90	0.31
Wind 270 deg - Service		-8.79	-0.01	-3.03	1056.33	0.40
Wind 300 deg - Service		-7.62	-4.41	-530.88	915.78	0.39
Wind 330 deg - Service		-4.41	-7.62	-916.79	529.89	0.27

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	180 - 149	Pole	Max Tension	27	0.00	0.00	-0.00
			Max. Compression	14	-6.89	-0.14	1.07
			Max. Mx	11	-3.92	132.36	0.40
			Max. My	2	-3.91	-0.45	134.19
			Max. Vy	11	-9.52	132.36	0.40
			Max. Vx	2	-9.59	-0.45	134.19
			Max. Torque	10			-1.23
L2	149 - 118.25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-13.48	0.21	1.34
			Max. Mx	11	-8.77	604.76	1.73
			Max. My	2	-8.77	0.81	606.53
			Max. Vy	11	-15.37	604.76	1.73
			Max. Vx	2	-15.37	0.81	606.53
			Max. Torque	6			0.98
L3	118.25 - 98.25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-15.78	0.21	1.35
			Max. Mx	11	-10.99	858.41	2.37
			Max. My	2	-10.98	1.42	860.12
			Max. Vy	11	-16.36	858.41	2.37
			Max. Vx	2	-16.36	1.42	860.12
			Max. Torque	6			0.97
L4	98.25 - 48.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-24.84	0.21	1.35
			Max. Mx	11	-19.58	1719.55	4.26
			Max. My	2	-19.58	3.25	1721.07
			Max. Vy	11	-19.48	1719.55	4.26
			Max. Vx	2	-19.47	3.25	1721.07
			Max. Torque	6			0.97
L5	48.75 - 21	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-32.78	0.21	1.35
			Max. Mx	11	-27.08	2399.63	5.52
			Max. My	2	-27.08	4.51	2401.00
			Max. Vy	11	-21.37	2399.63	5.52
			Max. Vx	2	-21.36	4.51	2401.00
			Max. Torque	6			0.96
L6	21 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-37.98	0.21	1.35
			Max. Mx	11	-31.95	2838.06	6.26
			Max. My	2	-31.95	5.24	2839.33
			Max. Vy	11	-22.51	2838.06	6.26
			Max. Vx	2	-22.50	5.24	2839.33
			Max. Torque	6			0.96

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	37.98	-18.79	-0.03
	Max. H_x	11	31.95	22.50	0.04
	Max. H_z	2	31.95	0.04	22.49
	Max. M_x	2	2839.33	0.04	22.49
	Max. M_z	5	2837.62	-22.50	-0.04
	Max. Torsion	6	0.96	-19.50	-11.28
	Min. Vert	1	31.95	0.00	0.00
	Min. H_x	5	31.95	-22.50	-0.04
	Min. H_z	8	31.95	-0.04	-22.49
	Min. M_x	8	-2836.84	-0.04	-22.49
	Min. M_z	11	-2838.06	22.50	0.04
	Min. Torsion	25	-0.96	16.28	9.41

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	31.95	0.00	-0.00	-1.22	0.22	0.00
Dead+Wind 0 deg - No Ice	31.95	-0.04	-22.49	-2839.33	5.24	0.27
Dead+Wind 30 deg - No Ice	31.95	11.22	-19.46	-2456.62	-1414.35	-0.24
Dead+Wind 60 deg - No Ice	31.95	19.46	-11.21	-1415.96	-2454.93	-0.69
Dead+Wind 90 deg - No Ice	31.95	22.50	0.04	3.77	-2837.62	-0.95
Dead+Wind 120 deg - No Ice	31.95	19.50	11.28	1422.14	-2459.91	-0.96
Dead+Wind 150 deg - No Ice	31.95	11.28	19.50	2459.11	-1423.02	-0.71
Dead+Wind 180 deg - No Ice	31.95	0.04	22.49	2836.84	-4.79	-0.27
Dead+Wind 210 deg - No Ice	31.95	-11.22	19.46	2454.12	1414.81	0.24
Dead+Wind 240 deg - No Ice	31.95	-19.46	11.21	1413.47	2455.37	0.69
Dead+Wind 270 deg - No Ice	31.95	-22.50	-0.04	-6.26	2838.06	0.95
Dead+Wind 300 deg - No Ice	31.95	-19.50	-11.28	-1424.62	2460.35	0.96
Dead+Wind 330 deg - No Ice	31.95	-11.28	-19.50	-2461.58	1423.47	0.71
Dead+Ice+Temp	37.98	-0.00	-0.00	-1.35	0.21	0.00
Dead+Wind 0 deg+Ice+Temp	37.98	-0.03	-18.78	-2472.31	4.46	0.36
Dead+Wind 30 deg+Ice+Temp	37.98	9.37	-16.25	-2139.17	-1231.87	-0.14
Dead+Wind 60 deg+Ice+Temp	37.98	16.25	-9.36	-1233.19	-2138.06	-0.60
Dead+Wind 90 deg+Ice+Temp	37.98	18.79	0.03	2.85	-2471.29	-0.90
Dead+Wind 120 deg+Ice+Temp	37.98	16.28	9.41	1237.74	-2142.27	-0.96
Dead+Wind 150 deg+Ice+Temp	37.98	9.42	16.28	2140.60	-1239.19	-0.76
Dead+Wind 180 deg+Ice+Temp	37.98	0.03	18.78	2469.53	-4.02	-0.36
Dead+Wind 210 deg+Ice+Temp	37.98	-9.37	16.25	2136.38	1232.30	0.14
Dead+Wind 240 deg+Ice+Temp	37.98	-16.25	9.36	1230.41	2138.48	0.60
Dead+Wind 270 deg+Ice+Temp	37.98	-18.79	-0.03	-5.62	2471.70	0.90
Dead+Wind 300 deg+Ice+Temp	37.98	-16.28	-9.41	-1240.51	2142.69	0.96
Dead+Wind 330 deg+Ice+Temp	37.98	-9.42	-16.28	-2143.37	1239.62	0.76
Dead+Wind 0 deg - Service	31.95	-0.01	-8.79	-1113.11	2.19	0.11
Dead+Wind 30 deg - Service	31.95	4.38	-7.60	-963.18	-553.94	-0.10
Dead+Wind 60 deg - Service	31.95	7.60	-4.38	-555.50	-961.59	-0.28
Dead+Wind 90 deg - Service	31.95	8.79	0.01	0.69	-1111.51	-0.38
Dead+Wind 120 deg - Service	31.95	7.62	4.41	556.35	-963.55	-0.39
Dead+Wind 150 deg - Service	31.95	4.41	7.62	962.59	-557.34	-0.29
Dead+Wind 180 deg - Service	31.95	0.01	8.79	1110.55	-1.73	-0.11
Dead+Wind 210 deg - Service	31.95	-4.38	7.60	960.63	554.40	0.10
Dead+Wind 240 deg - Service	31.95	-7.60	4.38	552.95	962.04	0.28
Dead+Wind 270 deg - Service	31.95	-8.79	-0.01	-3.24	1111.97	0.38
Dead+Wind 300 deg - Service	31.95	-7.62	-4.41	-558.90	964.00	0.38
Dead+Wind 330 deg - Service	31.95	-4.41	-7.62	-965.14	557.80	0.29

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	-31.95	0.00	0.00	31.95	0.00	0.000%
2	-0.04	-31.95	-22.49	0.04	31.95	22.49	0.000%
3	11.22	-31.95	-19.46	-11.22	31.95	19.46	0.000%
4	19.46	-31.95	-11.21	-19.46	31.95	11.21	0.000%
5	22.50	-31.95	0.04	-22.50	31.95	-0.04	0.000%
6	19.50	-31.95	11.28	-19.50	31.95	-11.28	0.000%
7	11.28	-31.95	19.50	-11.28	31.95	-19.50	0.000%
8	0.04	-31.95	22.49	-0.04	31.95	-22.49	0.000%
9	-11.22	-31.95	19.46	11.22	31.95	-19.46	0.000%
10	-19.46	-31.95	11.21	19.46	31.95	-11.21	0.000%
11	-22.50	-31.95	-0.04	22.50	31.95	0.04	0.000%
12	-19.50	-31.95	-11.28	19.50	31.95	11.28	0.000%
13	-11.28	-31.95	-19.50	11.28	31.95	19.50	0.000%
14	0.00	-37.98	0.00	0.00	37.98	0.00	0.000%
15	-0.03	-37.98	-18.78	0.03	37.98	18.78	0.000%
16	9.37	-37.98	-16.25	-9.37	37.98	16.25	0.000%
17	16.25	-37.98	-9.36	-16.25	37.98	9.36	0.000%
18	18.79	-37.98	0.03	-18.79	37.98	-0.03	0.000%
19	16.28	-37.98	9.41	-16.28	37.98	-9.41	0.000%
20	9.42	-37.98	16.28	-9.42	37.98	-16.28	0.000%
21	0.03	-37.98	18.78	-0.03	37.98	-18.78	0.000%
22	-9.37	-37.98	16.25	9.37	37.98	-16.25	0.000%
23	-16.25	-37.98	9.36	16.25	37.98	-9.36	0.000%
24	-18.79	-37.98	-0.03	18.79	37.98	0.03	0.000%
25	-16.28	-37.98	-9.41	16.28	37.98	9.41	0.000%
26	-9.42	-37.98	-16.28	9.42	37.98	16.28	0.000%
27	-0.01	-31.95	-8.79	0.01	31.95	8.79	0.000%
28	4.38	-31.95	-7.60	-4.38	31.95	7.60	0.000%
29	7.60	-31.95	-4.38	-7.60	31.95	4.38	0.000%
30	8.79	-31.95	0.01	-8.79	31.95	-0.01	0.000%
31	7.62	-31.95	4.41	-7.62	31.95	-4.41	0.000%
32	4.41	-31.95	7.62	-4.41	31.95	-7.62	0.000%
33	0.01	-31.95	8.79	-0.01	31.95	-8.79	0.000%
34	-4.38	-31.95	7.60	4.38	31.95	-7.60	0.000%
35	-7.60	-31.95	4.38	7.60	31.95	-4.38	0.000%
36	-8.79	-31.95	-0.01	8.79	31.95	0.01	0.000%
37	-7.62	-31.95	-4.41	7.62	31.95	4.41	0.000%
38	-4.41	-31.95	-7.62	4.41	31.95	7.62	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	5	0.00000001	0.00004347
3	Yes	6	0.00000001	0.00044556
4	Yes	6	0.00000001	0.00045329
5	Yes	5	0.00000001	0.00019773
6	Yes	6	0.00000001	0.00044138
7	Yes	6	0.00000001	0.00045564
8	Yes	5	0.00000001	0.00010555

9	Yes	6	0.00000001	0.00044924
10	Yes	6	0.00000001	0.00044143
11	Yes	5	0.00000001	0.00027315
12	Yes	6	0.00000001	0.00045727
13	Yes	6	0.00000001	0.00044311
14	Yes	4	0.00000001	0.00002682
15	Yes	6	0.00000001	0.00013039
16	Yes	7	0.00000001	0.00008642
17	Yes	7	0.00000001	0.00008759
18	Yes	6	0.00000001	0.00013370
19	Yes	7	0.00000001	0.00008556
20	Yes	7	0.00000001	0.00008822
21	Yes	6	0.00000001	0.00013134
22	Yes	7	0.00000001	0.00008672
23	Yes	7	0.00000001	0.00008556
24	Yes	6	0.00000001	0.00013589
25	Yes	7	0.00000001	0.00008853
26	Yes	7	0.00000001	0.00008587
27	Yes	4	0.00000001	0.00059231
28	Yes	6	0.00000001	0.00006904
29	Yes	6	0.00000001	0.00007097
30	Yes	5	0.00000001	0.00006508
31	Yes	6	0.00000001	0.00006747
32	Yes	6	0.00000001	0.00007101
33	Yes	4	0.00000001	0.00063833
34	Yes	6	0.00000001	0.00006943
35	Yes	6	0.00000001	0.00006749
36	Yes	5	0.00000001	0.00007285
37	Yes	6	0.00000001	0.00007233
38	Yes	6	0.00000001	0.00006878

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 149	70.077	38	3.6614	0.0145
L2	151.75 - 118.25	48.823	38	3.4131	0.0056
L3	118.25 - 98.25	27.757	38	2.5013	0.0024
L4	102.25 - 48.75	20.147	38	2.0445	0.0016
L5	54.25 - 21	5.140	38	0.9370	0.0005
L6	21 - 1	0.659	38	0.3191	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
178.00	HP2-4.7	38	68.534	3.6526	0.0138	16540
177.00	4-ft Dual Mount Standoff	38	67.762	3.6482	0.0134	16540
168.00	Valmont T-Arm (1)	38	60.859	3.5993	0.0102	6891
160.00	RR90-17-02DP	38	54.838	3.5299	0.0077	4133
157.00	(2) TMA 10"x8"x3"	38	52.624	3.4938	0.0068	3594
150.00	LPA-80080-4CF	38	47.580	3.3806	0.0053	2829
147.00	Andrew 12'-6" Low Profile Platform	38	45.480	3.3188	0.0048	2656

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 149	177.592	2	9.2776	0.0375
L2	151.75 - 118.25	123.868	2	8.6608	0.0143
L3	118.25 - 98.25	70.575	13	6.3603	0.0060
L4	102.25 - 48.75	51.265	13	5.2025	0.0041
L5	54.25 - 21	13.100	13	2.3879	0.0013
L6	21 - 1	1.680	13	0.8138	0.0004

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
178.00	HP2-4.7	2	173.692	9.2561	0.0356	6899
177.00	4-ft Dual Mount Standoff	2	171.744	9.2452	0.0346	6899
168.00	Valmont T-Arm (1)	2	154.298	9.1270	0.0263	2872
160.00	RR90-17-02DP	2	139.077	8.9541	0.0198	1720
157.00	(2) TMA 10"x8"x3"	2	133.479	8.8635	0.0176	1495
150.00	LPA-80080-4CF	2	120.724	8.5792	0.0134	1172
147.00	Andrew 12'-6" Low Profile Platform	2	115.411	8.4234	0.0121	1097

Base Plate Design Data

Plate Thickness in	Number of Anchor Bolts	Anchor Bolt Size in	Actual Allowable Ratio Bolt Tension K	Actual Allowable Ratio Concrete Stress ksi	Actual Allowable Ratio Plate Stress ksi	Actual Allowable Ratio Stiffener Stress ksi	Controlling Condition	Critical Ratio
2.0000	16	2.2500	107.68 131.21 0.82	1.838 2.800 0.66	56.199 45.000 1.25		Plate	1.25 ✓

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	180 - 178.513	TP21.38x14.4x0.1875	31.00	0.00	0.0	39.000	8.6574	-0.06	337.64	0.000
	178.513 - 177.026					39.000	8.8567	-0.16	345.41	0.000
	177.026 - 175.539					39.000	9.0559	-0.35	353.18	0.001
	175.539 - 174.053					39.000	9.2552	-0.29	360.95	0.001
	174.053 - 172.566					39.000	9.4544	-0.35	368.72	0.001
	172.566 - 171.079					39.000	9.6536	-0.41	376.49	0.001
	171.079 - 169.592					39.000	9.8529	-0.47	384.26	0.001
	169.592 - 168.105					39.000	10.0521	-0.53	392.03	0.001
	168.105 - 166.618					39.000	10.2513	-1.90	399.80	0.005
	166.618 - 165.132					39.000	10.4506	-1.97	407.57	0.005
	165.132 - 163.645					39.000	10.6498	-2.03	415.34	0.005
	163.645 - 162.158					39.000	10.8490	-2.10	423.11	0.005
	162.158 - 160.671					39.000	11.0483	-2.17	430.88	0.005
	160.671 - 159.184					39.000	11.2475	-2.23	438.65	0.005
	159.184 - 157.697					39.000	11.4467	-2.31	446.42	0.005
	157.697 - 156.211					39.000	11.6460	-3.66	454.19	0.008
	156.211 - 154.724					39.000	11.8452	-3.74	461.96	0.008
	154.724 - 153.237					39.000	12.0445	-3.82	469.73	0.008
	153.237 - 151.75					39.000	12.2437	-3.91	477.50	0.008
	151.75 - 149					39.000	12.6122	-1.77	491.88	0.004
L2	151.75 - 149	TP27.94x20.3858x0.25	33.50	0.00	0.0	39.000	16.4698	-2.38	642.32	0.004
	149 - 147.382					39.000	16.7594	-4.30	653.62	0.007
	147.382 - 145.763					39.000	17.0490	-5.65	664.91	0.009
	145.763 - 144.145					39.000	17.3386	-5.82	676.21	0.009
	144.145 - 142.526					39.000	17.6282	-5.98	687.50	0.009
	142.526 - 140.908					39.000	17.9178	-6.15	698.79	0.009
	140.908 - 139.289					39.000	18.2074	-6.32	710.09	0.009
	139.289 - 137.671					39.000	18.4970	-6.49	721.38	0.009
	137.671 - 136.053					39.000	18.7865	-6.67	732.67	0.009
	136.053 - 134.434					39.000	19.0761	-6.85	743.97	0.009
	134.434 - 132.816					39.000	19.3657	-7.03	755.26	0.009
	132.816 - 131.197					39.000	19.6553	-7.22	766.56	0.009

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 $\frac{P}{P_a}$
	131.197 - 129.579					39.000	19.9449	-7.40	777.85	0.010
	129.579 - 127.961					39.000	20.2345	-7.59	789.14	0.010
	127.961 - 126.342					39.000	20.5241	-7.78	800.44	0.010
	126.342 - 124.724					39.000	20.8137	-7.97	811.73	0.010
	124.724 - 123.105					39.000	21.1032	-8.16	823.03	0.010
	123.105 - 121.487					39.000	21.3928	-8.36	834.32	0.010
	121.487 - 119.868					39.000	21.6824	-8.56	845.62	0.010
	119.868 - 118.25					39.000	21.9720	-8.76	856.91	0.010
L3	118.25 - 117.25	TP32.44x27.94x0.28	20.00	0.00	0.0	39.000	24.7820	-8.90	966.50	0.009
	117.25 - 116.25					39.000	24.9819	-9.03	974.29	0.009
	116.25 - 115.25					39.000	25.1819	-9.17	982.09	0.009
	115.25 - 114.25					39.000	25.3818	-9.30	989.89	0.009
	114.25 - 113.25					39.000	25.5818	-9.44	997.69	0.009
	113.25 - 112.25					39.000	25.7818	-9.57	1005.49	0.010
	112.25 - 111.25					39.000	25.9817	-9.71	1013.29	0.010
	111.25 - 110.25					39.000	26.1817	-9.85	1021.09	0.010
	110.25 - 109.25					39.000	26.3817	-9.99	1028.88	0.010
	109.25 - 108.25					39.000	26.5816	-10.13	1036.68	0.010
	108.25 - 107.25					39.000	26.7816	-10.27	1044.48	0.010
	107.25 - 106.25					39.000	26.9815	-10.41	1052.28	0.010
	106.25 - 105.25					39.000	27.1815	-10.55	1060.08	0.010
	105.25 - 104.25					39.000	27.3815	-10.69	1067.88	0.010
	104.25 - 103.25					39.000	27.5814	-10.84	1075.68	0.010
	103.25 - 102.25					39.000	27.7814	-10.98	1083.47	0.010
	102.25 - 98.25					39.000	28.5812	-5.72	1114.67	0.005
L4	102.25 - 98.25	TP43.1x30.98x0.3125	53.50	0.00	0.0	39.000	31.3171	-6.20	1221.37	0.005
	98.25 - 95.8056					39.000	31.8664	-12.31	1242.79	0.010
	95.8056 - 93.3611					39.000	32.4157	-12.70	1264.21	0.010
	93.3611 - 90.9167					39.000	32.9649	-13.09	1285.63	0.010
	90.9167 - 88.4722					39.000	33.5142	-13.49	1307.05	0.010
	88.4722 - 86.0278					39.000	34.0635	-13.89	1328.48	0.010
	86.0278 - 83.5833					39.000	34.6128	-14.30	1349.90	0.011
	83.5833 - 81.1389					39.000	35.1620	-14.71	1371.32	0.011
	81.1389 - 78.6944					39.000	35.7113	-15.13	1392.74	0.011
	78.6944 - 76.25					39.000	36.2606	-15.55	1414.16	0.011
	76.25 - 73.8056					39.000	36.8098	-15.98	1435.58	0.011
	73.8056 - 71.3611					39.000	37.3591	-16.41	1457.01	0.011
	71.3611 - 68.9167					39.000	37.9084	-16.85	1478.43	0.011
	68.9167 - 66.4722					39.000	38.4576	-17.29	1499.85	0.012
	66.4722 - 64.0278					39.000	39.0069	-17.74	1521.27	0.012
	64.0278 -					39.000	39.5562	-18.19	1542.69	0.012

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 $\frac{P}{P_a}$
	61.5833									
	61.5833 - 59.1389					39.000	40.1055	-18.65	1564.11	0.012
	59.1389 - 56.6944					39.000	40.6547	-19.11	1585.53	0.012
	56.6944 - 54.25					39.000	41.2040	-19.57	1606.96	0.012
	54.25 - 48.75					39.000	42.4398	-10.80	1655.15	0.007
L5	54.25 - 48.75	TP48.95x41.229x0.3125	33.25	0.00	0.0	39.000	40.5841	-9.79	1582.78	0.006
	48.75 - 47.2895					39.000	41.8508	-21.40	1632.18	0.013
	47.2895 - 45.8289					39.000	42.1872	-21.68	1645.30	0.013
	45.8289 - 44.3684					39.000	42.5236	-21.97	1658.42	0.013
	44.3684 - 42.9079					39.000	42.8600	-22.26	1671.54	0.013
	42.9079 - 41.4474					39.000	43.1964	-22.55	1684.66	0.013
	41.4474 - 39.9868					39.000	43.5328	-22.84	1697.78	0.013
	39.9868 - 38.5263					39.000	43.8692	-23.14	1710.90	0.014
	38.5263 - 37.0658					39.000	44.2056	-23.43	1724.02	0.014
	37.0658 - 35.6053					39.000	44.5420	-23.73	1737.14	0.014
	35.6053 - 34.1447					39.000	44.8784	-24.03	1750.26	0.014
	34.1447 - 32.6842					39.000	45.2148	-24.33	1763.38	0.014
	32.6842 - 31.2237					39.000	45.5512	-24.63	1776.50	0.014
	31.2237 - 29.7632					39.000	45.8876	-24.93	1789.62	0.014
	29.7632 - 28.3026					39.000	46.2240	-25.24	1802.73	0.014
	28.3026 - 26.8421					38.863	46.8967	-25.83	1822.54	0.014
	26.8421 - 25.3816					38.741	47.2331	-26.14	1829.88	0.014
	25.3816 - 23.9211					38.620	47.5695	-26.45	1837.13	0.014
	23.9211 - 22.4605					38.498	47.9059	-26.77	1844.30	0.015
	22.4605 - 21					38.377	48.2423	-27.08	1851.39	0.015
L6	21 - 20	TP53.23x48.95x0.35	20.00	0.00	0.0	39.000	54.2275	-27.32	2114.87	0.013
	20 - 19					39.000	54.4652	-27.56	2124.14	0.013
	19 - 18					39.000	54.7029	-27.80	2133.41	0.013
	18 - 17					39.000	54.9407	-28.03	2142.69	0.013
	17 - 16					39.000	55.1784	-28.27	2151.96	0.013
	16 - 15					39.000	55.4161	-28.51	2161.23	0.013
	15 - 14					39.000	55.4161	-28.53	2161.23	0.013
	14 - 13					39.000	55.6539	-28.77	2170.50	0.013
	13 - 12					39.000	55.8916	-29.01	2179.77	0.013
	12 - 11					39.000	56.1293	-29.25	2189.04	0.013
	11 - 10					39.000	56.3671	-29.49	2198.32	0.013
	10 - 9					39.000	56.6048	-29.73	2207.59	0.013
	9 - 8					39.000	56.8425	-29.98	2216.86	0.014
	8 - 7					39.000	57.0803	-30.22	2226.13	0.014
	7 - 6					39.000	57.3180	-30.47	2235.40	0.014
	6 - 5					39.000	57.5557	-30.72	2244.67	0.014

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 $\frac{P}{P_a}$
	5 - 4					39.000	57.7935	-30.96	2253.95	0.014
	4 - 3					39.000	58.0312	-31.21	2263.22	0.014
	3 - 2					38.955	58.5067	-31.70	2279.14	0.014
	2 - 1					38.887	58.7444	-31.95	2284.38	0.014

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	180 - 178.513	TP21.38x14.4x0.1875	0.05	0.018	39.000	0.000	0.00	0.000	39.000	0.000
	178.513 - 177.026		0.48	0.179	39.000	0.005	0.00	0.000	39.000	0.000
	177.026 - 175.539		2.31	0.820	39.000	0.021	0.00	0.000	39.000	0.000
	175.539 - 174.053		3.76	1.276	39.000	0.033	0.00	0.000	39.000	0.000
	174.053 - 172.566		5.32	1.729	39.000	0.044	0.00	0.000	39.000	0.000
	172.566 - 171.079		6.98	2.175	39.000	0.056	0.00	0.000	39.000	0.000
	171.079 - 169.592		8.75	2.618	39.000	0.067	0.00	0.000	39.000	0.000
	169.592 - 168.105		10.63	3.055	39.000	0.078	0.00	0.000	39.000	0.000
	168.105 - 166.618		19.49	5.383	39.000	0.138	0.00	0.000	39.000	0.000
	166.618 - 165.132		28.94	7.691	39.000	0.197	0.00	0.000	39.000	0.000
	165.132 - 163.645		38.56	9.865	39.000	0.253	0.00	0.000	39.000	0.000
	163.645 - 162.158		48.28	11.900	39.000	0.305	0.00	0.000	39.000	0.000
	162.158 - 160.671		58.11	13.808	39.000	0.354	0.00	0.000	39.000	0.000
	160.671 - 159.184		68.39	15.678	39.000	0.402	0.00	0.000	39.000	0.000
	159.184 - 157.697		79.07	17.497	39.000	0.449	0.00	0.000	39.000	0.000
	157.697 - 156.211		92.08	19.681	39.000	0.505	0.00	0.000	39.000	0.000
	156.211 - 154.724		106.05	21.908	39.000	0.562	0.00	0.000	39.000	0.000
	154.724 - 153.237		120.13	24.000	39.000	0.615	0.00	0.000	39.000	0.000
	153.237 - 151.75		134.33	25.967	39.000	0.666	0.00	0.000	39.000	0.000
	151.75 - 149		73.48	13.383	39.000	0.343	0.00	0.000	39.000	0.000
L2	151.75 - 149	TP27.94x20.3858x0.25	90.43	12.918	39.000	0.331	0.00	0.000	39.000	0.000
	149 - 147.382		184.62	25.464	39.000	0.653	0.00	0.000	39.000	0.000
	147.382 - 145.763		206.48	27.514	39.000	0.705	0.00	0.000	39.000	0.000
	145.763 - 144.145		228.79	29.472	39.000	0.756	0.00	0.000	39.000	0.000
	144.145 - 142.526		251.26	31.305	39.000	0.803	0.00	0.000	39.000	0.000

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 $\frac{f_{by}}{F_{by}}$
	142.526 - 140.908		273.87	33.023	39.000	0.847	0.00	0.000	39.000	0.000
	140.908 - 139.289		296.64	34.633	39.000	0.888	0.00	0.000	39.000	0.000
	139.289 - 137.671		319.56	36.144	39.000	0.927	0.00	0.000	39.000	0.000
	137.671 - 136.053		342.62	37.561	39.000	0.963	0.00	0.000	39.000	0.000
	136.053 - 134.434		365.84	38.892	39.000	0.997	0.00	0.000	39.000	0.000
	134.434 - 132.816		389.22	40.142	39.000	1.029	0.00	0.000	39.000	0.000
	132.816 - 131.197		412.74	41.318	39.000	1.059	0.00	0.000	39.000	0.000
	131.197 - 129.579		436.42	42.422	39.000	1.088	0.00	0.000	39.000	0.000
	129.579 - 127.961		460.26	43.462	39.000	1.114	0.00	0.000	39.000	0.000
	127.961 - 126.342		484.25	44.440	39.000	1.139	0.00	0.000	39.000	0.000
	126.342 - 124.724		508.41	45.362	39.000	1.163	0.00	0.000	39.000	0.000
	124.724 - 123.105		532.76	46.233	39.000	1.185	0.00	0.000	39.000	0.000
	123.105 - 121.487		557.28	47.054	39.000	1.207	0.00	0.000	39.000	0.000
	121.487 - 119.868		581.94	47.827	39.000	1.226	0.00	0.000	39.000	0.000
	119.868 - 118.25		606.77	48.556	39.000	1.245	0.00	0.000	39.000	0.000
L3	118.25 - 117.25	TP32.44x27.94x0.28	622.19	43.880	39.000	1.125	0.00	0.000	39.000	0.000
	117.25 - 116.25		637.67	44.251	39.000	1.135	0.00	0.000	39.000	0.000
	116.25 - 115.25		653.21	44.609	39.000	1.144	0.00	0.000	39.000	0.000
	115.25 - 114.25		668.81	44.954	39.000	1.153	0.00	0.000	39.000	0.000
	114.25 - 113.25		684.48	45.287	39.000	1.161	0.00	0.000	39.000	0.000
	113.25 - 112.25		700.20	45.608	39.000	1.169	0.00	0.000	39.000	0.000
	112.25 - 111.25		715.99	45.918	39.000	1.177	0.00	0.000	39.000	0.000
	111.25 - 110.25		731.84	46.217	39.000	1.185	0.00	0.000	39.000	0.000
	110.25 - 109.25		747.75	46.505	39.000	1.192	0.00	0.000	39.000	0.000
	109.25 - 108.25		763.72	46.783	39.000	1.200	0.00	0.000	39.000	0.000
	108.25 - 107.25		779.76	47.052	39.000	1.206	0.00	0.000	39.000	0.000
	107.25 - 106.25		795.86	47.311	39.000	1.213	0.00	0.000	39.000	0.000
	106.25 - 105.25		812.02	47.561	39.000	1.220	0.00	0.000	39.000	0.000
	105.25 - 104.25		828.25	47.803	39.000	1.226	0.00	0.000	39.000	0.000
	104.25 - 103.25		844.54	48.035	39.000	1.232	0.00	0.000	39.000	0.000

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 $\frac{f_{by}}{F_{by}}$
	103.25 - 102.25		860.90	48.260	39.000	1.237	0.00	0.000	39.000	0.000
	102.25 - 98.25		451.18	23.891	39.000	0.613	0.00	0.000	39.000	0.000
L4	102.25 - 98.25	TP43.1x30.98x0.3125	475.91	23.453	39.000	0.601	0.00	0.000	39.000	0.000
	98.25 - 95.8056		968.14	46.072	39.000	1.181	0.00	0.000	39.000	0.000
	95.8056 - 93.3611		1009.56	46.421	39.000	1.190	0.00	0.000	39.000	0.000
	93.3611 - 90.9167		1051.35	46.738	39.000	1.198	0.00	0.000	39.000	0.000
	90.9167 - 88.4722		1093.53	47.026	39.000	1.206	0.00	0.000	39.000	0.000
	88.4722 - 86.0278		1136.08	47.285	39.000	1.212	0.00	0.000	39.000	0.000
	86.0278 - 83.5833		1179.00	47.520	39.000	1.218	0.00	0.000	39.000	0.000
	83.5833 - 81.1389		1222.31	47.732	39.000	1.224	0.00	0.000	39.000	0.000
	81.1389 - 78.6944		1265.98	47.922	39.000	1.229	0.00	0.000	39.000	0.000
	78.6944 - 76.25		1310.04	48.093	39.000	1.233	0.00	0.000	39.000	0.000
	76.25 - 73.8056		1354.47	48.245	39.000	1.237	0.00	0.000	39.000	0.000
	73.8056 - 71.3611		1399.28	48.380	39.000	1.241	0.00	0.000	39.000	0.000
	71.3611 - 68.9167		1444.47	48.500	39.000	1.244	0.00	0.000	39.000	0.000
	68.9167 - 66.4722		1490.03	48.605	39.000	1.246	0.00	0.000	39.000	0.000
	66.4722 - 64.0278		1535.97	48.697	39.000	1.249	0.00	0.000	39.000	0.000
	64.0278 - 61.5833		1582.28	48.776	39.000	1.251	0.00	0.000	39.000	0.000
	61.5833 - 59.1389		1628.97	48.845	39.000	1.252	0.00	0.000	39.000	0.000
	59.1389 - 56.6944		1676.05	48.902	39.000	1.254	0.00	0.000	39.000	0.000
	56.6944 - 54.25		1723.49	48.950	39.000	1.255	0.00	0.000	39.000	0.000
	54.25 - 48.75		935.99	25.052	39.000	0.642	0.00	0.000	39.000	0.000
L5	54.25 - 48.75	TP48.95x41.229x0.3125	842.86	24.678	39.000	0.633	0.00	0.000	39.000	0.000
	48.75 - 47.2895		1831.84	50.425	39.000	1.293	0.00	0.000	39.000	0.000
	47.2895 - 45.8289		1860.98	50.411	39.000	1.293	0.00	0.000	39.000	0.000
	45.8289 - 44.3684		1890.23	50.393	39.000	1.292	0.00	0.000	39.000	0.000
	44.3684 - 42.9079		1919.58	50.373	39.000	1.292	0.00	0.000	39.000	0.000
	42.9079 - 41.4474		1949.06	50.350	39.000	1.291	0.00	0.000	39.000	0.000
	41.4474 - 39.9868		1978.63	50.324	39.000	1.290	0.00	0.000	39.000	0.000
	39.9868 - 38.5263		2008.32	50.296	39.000	1.290	0.00	0.000	39.000	0.000
	38.5263 - 37.0658		2038.12	50.266	39.000	1.289	0.00	0.000	39.000	0.000
	37.0658 - 35.6053		2068.03	50.233	39.000	1.288	0.00	0.000	39.000	0.000

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 $\frac{f_{by}}{F_{by}}$
	35.6053 - 34.1447		2098.05	50.199	39.000	1.287	0.00	0.000	39.000	0.000
	34.1447 - 32.6842		2128.19	50.163	39.000	1.286	0.00	0.000	39.000	0.000
	32.6842 - 31.2237		2158.43	50.124	39.000	1.285	0.00	0.000	39.000	0.000
	31.2237 - 29.7632		2188.80	50.085	39.000	1.284	0.00	0.000	39.000	0.000
	29.7632 - 28.3026		2219.28	50.043	39.000	1.283	0.00	0.000	39.000	0.000
	28.3026 - 26.8421		2280.57	49.955	38.863	1.285	0.00	0.000	38.863	0.000
	26.8421 - 25.3816		2311.38	49.910	38.741	1.288	0.00	0.000	38.741	0.000
	25.3816 - 23.9211		2342.32	49.862	38.620	1.291	0.00	0.000	38.620	0.000
	23.9211 - 22.4605		2373.38	49.814	38.498	1.294	0.00	0.000	38.498	0.000
	22.4605 - 21		2404.54	49.765	38.377	1.297	0.00	0.000	38.377	0.000
L6	21 - 20	TP53.23x48.95x0.35	2425.95	44.538	39.000	1.142	0.00	0.000	39.000	0.000
	20 - 19		2447.41	44.539	39.000	1.142	0.00	0.000	39.000	0.000
	19 - 18		2468.93	44.540	39.000	1.142	0.00	0.000	39.000	0.000
	18 - 17		2490.51	44.539	39.000	1.142	0.00	0.000	39.000	0.000
	17 - 16		2512.14	44.539	39.000	1.142	0.00	0.000	39.000	0.000
	16 - 15		2533.83	44.537	39.000	1.142	0.00	0.000	39.000	0.000
	15 - 14		2533.83	44.537	39.000	1.142	0.00	0.000	39.000	0.000
	14 - 13		2555.58	44.535	39.000	1.142	0.00	0.000	39.000	0.000
	13 - 12		2577.39	44.533	39.000	1.142	0.00	0.000	39.000	0.000
	12 - 11		2599.25	44.530	39.000	1.142	0.00	0.000	39.000	0.000
	11 - 10		2621.18	44.526	39.000	1.142	0.00	0.000	39.000	0.000
	10 - 9		2643.15	44.522	39.000	1.142	0.00	0.000	39.000	0.000
	9 - 8		2665.18	44.517	39.000	1.141	0.00	0.000	39.000	0.000
	8 - 7		2687.28	44.511	39.000	1.141	0.00	0.000	39.000	0.000
	7 - 6		2709.43	44.505	39.000	1.141	0.00	0.000	39.000	0.000
	6 - 5		2731.63	44.499	39.000	1.141	0.00	0.000	39.000	0.000
	5 - 4		2753.89	44.492	39.000	1.141	0.00	0.000	39.000	0.000
	4 - 3		2776.22	44.485	39.000	1.141	0.00	0.000	39.000	0.000
	3 - 2		2821.03	44.469	38.955	1.142	0.00	0.000	38.955	0.000
	2 - 1		2843.53	44.460	38.887	1.143	0.00	0.000	38.887	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	180 - 178.513	TP21.38x14.4x0.1875	0.06	0.007	26.000	0.001	0.00	0.000	26.000	0.000
	178.513 - 177.026		0.26	0.029	26.000	0.002	0.00	0.000	26.000	0.000
	177.026 - 175.539		0.87	0.096	26.000	0.007	0.72	0.125	26.000	0.005
	175.539 - 174.053		1.02	0.110	26.000	0.008	0.95	0.157	26.000	0.006
	174.053 - 172.566		1.08	0.114	26.000	0.009	0.95	0.151	26.000	0.006
	172.566 - 171.079		1.15	0.119	26.000	0.009	0.95	0.145	26.000	0.006

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 $\frac{f_{vt}}{F_{vt}}$
	171.079 - 169.592		1.23	0.125	26.000	0.010	1.23	0.179	26.000	0.007
	169.592 - 168.105		1.30	0.130	26.000	0.010	1.23	0.172	26.000	0.007
	168.105 - 166.618		6.32	0.617	26.000	0.047	1.23	0.166	26.000	0.006
	166.618 - 165.132		6.40	0.612	26.000	0.047	0.35	0.046	26.000	0.002
	165.132 - 163.645		6.50	0.610	26.000	0.047	0.18	0.023	26.000	0.001
	163.645 - 162.158		6.58	0.606	26.000	0.047	0.18	0.022	26.000	0.001
	162.158 - 160.671		6.65	0.602	26.000	0.046	0.18	0.021	26.000	0.001
	160.671 - 159.184		7.14	0.635	26.000	0.049	0.18	0.021	26.000	0.001
	159.184 - 157.697		7.22	0.631	26.000	0.049	0.18	0.020	26.000	0.001
	157.697 - 156.211		9.36	0.804	26.000	0.062	0.23	0.024	26.000	0.001
	156.211 - 154.724		9.44	0.797	26.000	0.061	0.23	0.023	26.000	0.001
	154.724 - 153.237		9.52	0.790	26.000	0.061	0.23	0.022	26.000	0.001
	153.237 - 151.75		9.59	0.784	26.000	0.060	0.23	0.022	26.000	0.001
	151.75 - 149		6.84	0.543	26.000	0.042	0.28	0.024	26.000	0.001
L2	151.75 - 149	TP27.94x20.3858x0.25	5.89	0.357	26.000	0.027	0.04	0.002	26.000	0.000
	149 - 147.382		12.86	0.767	26.000	0.059	0.28	0.019	26.000	0.001
	147.382 - 145.763		13.75	0.806	26.000	0.062	0.28	0.018	26.000	0.001
	145.763 - 144.145		13.84	0.798	26.000	0.061	0.28	0.017	26.000	0.001
	144.145 - 142.526		13.93	0.790	26.000	0.061	0.28	0.017	26.000	0.001
	142.526 - 140.908		14.03	0.783	26.000	0.060	0.28	0.016	26.000	0.001
	140.908 - 139.289		14.12	0.775	26.000	0.060	0.28	0.016	26.000	0.001
	139.289 - 137.671		14.21	0.768	26.000	0.059	0.28	0.015	26.000	0.001
	137.671 - 136.053		14.31	0.762	26.000	0.059	0.28	0.015	26.000	0.001
	136.053 - 134.434		14.40	0.755	26.000	0.058	0.28	0.014	26.000	0.001
	134.434 - 132.816		14.50	0.749	26.000	0.058	0.28	0.014	26.000	0.001
	132.816 - 131.197		14.59	0.742	26.000	0.057	0.28	0.014	26.000	0.001
	131.197 - 129.579		14.69	0.736	26.000	0.057	0.28	0.013	26.000	0.001
	129.579 - 127.961		14.78	0.731	26.000	0.056	0.28	0.013	26.000	0.000
	127.961 - 126.342		14.88	0.725	26.000	0.056	0.28	0.012	26.000	0.000
	126.342 - 124.724		15.01	0.721	26.000	0.055	0.72	0.031	26.000	0.001
	124.724 - 123.105		15.11	0.716	26.000	0.055	0.72	0.030	26.000	0.001
	123.105 -		15.20	0.711	26.000	0.055	0.72	0.030	26.000	0.001

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 $\frac{f_{vt}}{F_{vt}}$
	121.487									
	121.487 - 119.868		15.30	0.706	26.000	0.054	0.72	0.029	26.000	0.001
	119.868 - 118.25		15.40	0.701	26.000	0.054	0.72	0.028	26.000	0.001
L3	118.25 - 117.25	TP32.44x27.94x0.28	15.46	0.624	26.000	0.048	0.72	0.025	26.000	0.001
	117.25 - 116.25		15.52	0.621	26.000	0.048	0.72	0.024	26.000	0.001
	116.25 - 115.25		15.58	0.619	26.000	0.048	0.72	0.024	26.000	0.001
	115.25 - 114.25		15.64	0.616	26.000	0.047	0.72	0.023	26.000	0.001
	114.25 - 113.25		15.70	0.614	26.000	0.047	0.72	0.023	26.000	0.001
	113.25 - 112.25		15.76	0.611	26.000	0.047	0.72	0.023	26.000	0.001
	112.25 - 111.25		15.83	0.609	26.000	0.047	0.72	0.022	26.000	0.001
	111.25 - 110.25		15.89	0.607	26.000	0.047	0.72	0.022	26.000	0.001
	110.25 - 109.25		15.95	0.605	26.000	0.046	0.72	0.022	26.000	0.001
	109.25 - 108.25		16.01	0.602	26.000	0.046	0.72	0.021	26.000	0.001
	108.25 - 107.25		16.08	0.600	26.000	0.046	0.72	0.021	26.000	0.001
	107.25 - 106.25		16.14	0.598	26.000	0.046	0.72	0.021	26.000	0.001
	106.25 - 105.25		16.20	0.596	26.000	0.046	0.72	0.020	26.000	0.001
	105.25 - 104.25		16.27	0.594	26.000	0.046	0.72	0.020	26.000	0.001
	104.25 - 103.25		16.33	0.592	26.000	0.046	0.72	0.020	26.000	0.001
	103.25 - 102.25		16.39	0.590	26.000	0.045	0.72	0.020	26.000	0.001
	102.25 - 98.25		8.21	0.287	26.000	0.022	0.35	0.009	26.000	0.000
L4	102.25 - 98.25	TP43.1x30.98x0.3125	8.52	0.272	26.000	0.021	0.37	0.009	26.000	0.000
	98.25 - 95.8056		16.88	0.530	26.000	0.041	0.71	0.017	26.000	0.001
	95.8056 - 93.3611		17.04	0.526	26.000	0.040	0.71	0.016	26.000	0.001
	93.3611 - 90.9167		17.19	0.522	26.000	0.040	0.71	0.015	26.000	0.001
	90.9167 - 88.4722		17.35	0.518	26.000	0.040	0.71	0.015	26.000	0.001
	88.4722 - 86.0278		17.50	0.514	26.000	0.040	0.71	0.014	26.000	0.001
	86.0278 - 83.5833		17.66	0.510	26.000	0.039	0.71	0.014	26.000	0.001
	83.5833 - 81.1389		17.81	0.507	26.000	0.039	0.71	0.014	26.000	0.001
	81.1389 - 78.6944		17.97	0.503	26.000	0.039	0.71	0.013	26.000	0.001
	78.6944 - 76.25		18.12	0.500	26.000	0.038	0.71	0.013	26.000	0.000
	76.25 - 73.8056		18.27	0.496	26.000	0.038	0.71	0.012	26.000	0.000
	73.8056 -		18.43	0.493	26.000	0.038	0.71	0.012	26.000	0.000

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
	71.3611									
	71.3611 - 68.9167		18.58	0.490	26.000	0.038	0.71	0.012	26.000	0.000
	68.9167 - 66.4722		18.74	0.487	26.000	0.037	0.71	0.011	26.000	0.000
	66.4722 - 64.0278		18.89	0.484	26.000	0.037	0.71	0.011	26.000	0.000
	64.0278 - 61.5833		19.05	0.481	26.000	0.037	0.71	0.011	26.000	0.000
	61.5833 - 59.1389		19.20	0.479	26.000	0.037	0.71	0.010	26.000	0.000
	59.1389 - 56.6944		19.35	0.476	26.000	0.037	0.71	0.010	26.000	0.000
	56.6944 - 54.25		19.51	0.473	26.000	0.036	0.71	0.010	26.000	0.000
	54.25 - 48.75		10.29	0.242	26.000	0.019	0.36	0.005	26.000	0.000
L5	54.25 - 48.75	TP48.95x41.229x0.3125	9.65	0.238	26.000	0.018	0.35	0.005	26.000	0.000
	48.75 - 47.2895		20.00	0.478	26.000	0.036	0.71	0.010	26.000	0.000
	47.2895 - 45.8289		20.08	0.476	26.000	0.036	0.71	0.009	26.000	0.000
	45.8289 - 44.3684		20.15	0.474	26.000	0.036	0.71	0.009	26.000	0.000
	44.3684 - 42.9079		20.23	0.472	26.000	0.036	0.71	0.009	26.000	0.000
	42.9079 - 41.4474		20.30	0.470	26.000	0.036	0.71	0.009	26.000	0.000
	41.4474 - 39.9868		20.38	0.468	26.000	0.036	0.71	0.009	26.000	0.000
	39.9868 - 38.5263		20.46	0.466	26.000	0.036	0.71	0.009	26.000	0.000
	38.5263 - 37.0658		20.53	0.465	26.000	0.035	0.71	0.009	26.000	0.000
	37.0658 - 35.6053		20.61	0.463	26.000	0.035	0.71	0.008	26.000	0.000
	35.6053 - 34.1447		20.69	0.461	26.000	0.035	0.71	0.008	26.000	0.000
	34.1447 - 32.6842		20.77	0.459	26.000	0.035	0.71	0.008	26.000	0.000
	32.6842 - 31.2237		20.84	0.458	26.000	0.035	0.71	0.008	26.000	0.000
	31.2237 - 29.7632		20.92	0.456	26.000	0.035	0.71	0.008	26.000	0.000
	29.7632 - 28.3026		21.00	0.454	26.000	0.035	0.71	0.008	26.000	0.000
	28.3026 - 26.8421		21.08	0.449	26.000	0.035	0.71	0.008	26.000	0.000
	26.8421 - 25.3816		21.16	0.448	26.000	0.034	0.71	0.007	26.000	0.000
	25.3816 - 23.9211		21.24	0.446	26.000	0.034	0.71	0.007	26.000	0.000
	23.9211 - 22.4605		21.32	0.445	26.000	0.034	0.71	0.007	26.000	0.000
	22.4605 - 21		21.40	0.444	26.000	0.034	0.71	0.007	26.000	0.000
L6	21 - 20	TP53.23x48.95x0.35	21.45	0.395	26.000	0.030	0.71	0.006	26.000	0.000
	20 - 19		21.50	0.395	26.000	0.030	0.71	0.006	26.000	0.000
	19 - 18		21.56	0.394	26.000	0.030	0.71	0.006	26.000	0.000
	18 - 17		21.62	0.393	26.000	0.030	0.71	0.006	26.000	0.000
	17 - 16		21.67	0.393	26.000	0.030	0.71	0.006	26.000	0.000
	16 - 15		21.73	0.392	26.000	0.030	0.71	0.006	26.000	0.000

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
	15 - 14		21.79	0.393	26.000	0.030	0.71	0.006	26.000	0.000
	14 - 13		21.84	0.393	26.000	0.030	0.71	0.006	26.000	0.000
	13 - 12		21.90	0.392	26.000	0.030	0.71	0.006	26.000	0.000
	12 - 11		21.96	0.391	26.000	0.030	0.71	0.006	26.000	0.000
	11 - 10		22.02	0.391	26.000	0.030	0.71	0.006	26.000	0.000
	10 - 9		22.07	0.390	26.000	0.030	0.71	0.006	26.000	0.000
	9 - 8		22.13	0.389	26.000	0.030	0.71	0.006	26.000	0.000
	8 - 7		22.19	0.389	26.000	0.030	0.71	0.006	26.000	0.000
	7 - 6		22.25	0.388	26.000	0.030	0.71	0.006	26.000	0.000
	6 - 5		22.30	0.388	26.000	0.030	0.71	0.006	26.000	0.000
	5 - 4		22.36	0.387	26.000	0.030	0.71	0.006	26.000	0.000
	4 - 3		22.42	0.386	26.000	0.030	0.71	0.006	26.000	0.000
	3 - 2		22.48	0.384	26.000	0.030	0.71	0.005	26.000	0.000
	2 - 1		22.54	0.384	26.000	0.030	0.71	0.005	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	180 - 178.513	0.000	0.000	0.000	0.001	0.000	0.001 ✓	1.333	H1-3+VT ✓
	178.513 - 177.026	0.000	0.005	0.000	0.002	0.000	0.005 ✓	1.333	H1-3+VT ✓
	177.026 - 175.539	0.001	0.021	0.000	0.007	0.005	0.022 ✓	1.333	H1-3+VT ✓
	175.539 - 174.053	0.001	0.033	0.000	0.008	0.006	0.034 ✓	1.333	H1-3+VT ✓
	174.053 - 172.566	0.001	0.044	0.000	0.009	0.006	0.045 ✓	1.333	H1-3+VT ✓
	172.566 - 171.079	0.001	0.056	0.000	0.009	0.006	0.057 ✓	1.333	H1-3+VT ✓
	171.079 - 169.592	0.001	0.067	0.000	0.010	0.007	0.068 ✓	1.333	H1-3+VT ✓
	169.592 - 168.105	0.001	0.078	0.000	0.010	0.007	0.080 ✓	1.333	H1-3+VT ✓
	168.105 - 166.618	0.005	0.138	0.000	0.047	0.006	0.144 ✓	1.333	H1-3+VT ✓
	166.618 - 165.132	0.005	0.197	0.000	0.047	0.002	0.203 ✓	1.333	H1-3+VT ✓
	165.132 - 163.645	0.005	0.253	0.000	0.047	0.001	0.258 ✓	1.333	H1-3+VT ✓
	163.645 - 162.158	0.005	0.305	0.000	0.047	0.001	0.311 ✓	1.333	H1-3+VT ✓
	162.158 - 160.671	0.005	0.354	0.000	0.046	0.001	0.360 ✓	1.333	H1-3+VT ✓
	160.671 - 159.184	0.005	0.402	0.000	0.049	0.001	0.408 ✓	1.333	H1-3+VT ✓
	159.184 - 157.697	0.005	0.449	0.000	0.049	0.001	0.454 ✓	1.333	H1-3+VT ✓

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	157.697 - 156.211	0.008	0.505	0.000	0.062	0.001	0.514 ✓	1.333	H1-3+VT ✓
	156.211 - 154.724	0.008	0.562	0.000	0.061	0.001	0.571 ✓	1.333	H1-3+VT ✓
	154.724 - 153.237	0.008	0.615	0.000	0.061	0.001	0.624 ✓	1.333	H1-3+VT ✓
	153.237 - 151.75	0.008	0.666	0.000	0.060	0.001	0.675 ✓	1.333	H1-3+VT ✓
	151.75 - 149	0.004	0.343	0.000	0.042	0.001	0.347 ✓	1.333	H1-3+VT ✓
L2	151.75 - 149	0.004	0.331	0.000	0.027	0.000	0.335 ✓	1.333	H1-3+VT ✓
	149 - 147.382	0.007	0.653	0.000	0.059	0.001	0.660 ✓	1.333	H1-3+VT ✓
	147.382 - 145.763	0.009	0.705	0.000	0.062	0.001	0.715 ✓	1.333	H1-3+VT ✓
	145.763 - 144.145	0.009	0.756	0.000	0.061	0.001	0.765 ✓	1.333	H1-3+VT ✓
	144.145 - 142.526	0.009	0.803	0.000	0.061	0.001	0.812 ✓	1.333	H1-3+VT ✓
	142.526 - 140.908	0.009	0.847	0.000	0.060	0.001	0.856 ✓	1.333	H1-3+VT ✓
	140.908 - 139.289	0.009	0.888	0.000	0.060	0.001	0.898 ✓	1.333	H1-3+VT ✓
	139.289 - 137.671	0.009	0.927	0.000	0.059	0.001	0.937 ✓	1.333	H1-3+VT ✓
	137.671 - 136.053	0.009	0.963	0.000	0.059	0.001	0.973 ✓	1.333	H1-3+VT ✓
	136.053 - 134.434	0.009	0.997	0.000	0.058	0.001	1.007 ✓	1.333	H1-3+VT ✓
	134.434 - 132.816	0.009	1.029	0.000	0.058	0.001	1.039 ✓	1.333	H1-3+VT ✓
	132.816 - 131.197	0.009	1.059	0.000	0.057	0.001	1.070 ✓	1.333	H1-3+VT ✓
	131.197 - 129.579	0.010	1.088	0.000	0.057	0.001	1.098 ✓	1.333	H1-3+VT ✓
	129.579 - 127.961	0.010	1.114	0.000	0.056	0.000	1.125 ✓	1.333	H1-3+VT ✓
	127.961 - 126.342	0.010	1.139	0.000	0.056	0.000	1.150 ✓	1.333	H1-3+VT ✓
	126.342 - 124.724	0.010	1.163	0.000	0.055	0.001	1.174 ✓	1.333	H1-3+VT ✓
	124.724 - 123.105	0.010	1.185	0.000	0.055	0.001	1.196 ✓	1.333	H1-3+VT ✓
	123.105 - 121.487	0.010	1.207	0.000	0.055	0.001	1.217 ✓	1.333	H1-3+VT ✓
	121.487 - 119.868	0.010	1.226	0.000	0.054	0.001	1.237 ✓	1.333	H1-3+VT ✓
	119.868 - 118.25	0.010	1.245	0.000	0.054	0.001	1.256 ✓	1.333	H1-3+VT ✓
L3	118.25 - 117.25	0.009	1.125	0.000	0.048	0.001	1.135 ✓	1.333	H1-3+VT ✓

tnxTower	Job: 13001.097 - Somers West	Page: 33 of 36
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project: 180' Sabre Monopole - 37 Bacon Rd., Enfield, CT	Date: 14:09:28 11/22/13
	Client: Verizon Wireless	Designed by: TJL

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
	117.25 - 116.25	0.009	1.135	0.000	0.048	0.001	1.145 ✓	1.333	H1-3+VT ✓
	116.25 - 115.25	0.009	1.144	0.000	0.048	0.001	1.154 ✓	1.333	H1-3+VT ✓
	115.25 - 114.25	0.009	1.153	0.000	0.047	0.001	1.163 ✓	1.333	H1-3+VT ✓
	114.25 - 113.25	0.009	1.161	0.000	0.047	0.001	1.171 ✓	1.333	H1-3+VT ✓
	113.25 - 112.25	0.010	1.169	0.000	0.047	0.001	1.180 ✓	1.333	H1-3+VT ✓
	112.25 - 111.25	0.010	1.177	0.000	0.047	0.001	1.188 ✓	1.333	H1-3+VT ✓
	111.25 - 110.25	0.010	1.185	0.000	0.047	0.001	1.195 ✓	1.333	H1-3+VT ✓
	110.25 - 109.25	0.010	1.192	0.000	0.046	0.001	1.203 ✓	1.333	H1-3+VT ✓
	109.25 - 108.25	0.010	1.200	0.000	0.046	0.001	1.210 ✓	1.333	H1-3+VT ✓
	108.25 - 107.25	0.010	1.206	0.000	0.046	0.001	1.217 ✓	1.333	H1-3+VT ✓
	107.25 - 106.25	0.010	1.213	0.000	0.046	0.001	1.224 ✓	1.333	H1-3+VT ✓
	106.25 - 105.25	0.010	1.220	0.000	0.046	0.001	1.230 ✓	1.333	H1-3+VT ✓
	105.25 - 104.25	0.010	1.226	0.000	0.046	0.001	1.236 ✓	1.333	H1-3+VT ✓
	104.25 - 103.25	0.010	1.232	0.000	0.046	0.001	1.242 ✓	1.333	H1-3+VT ✓
	103.25 - 102.25	0.010	1.237	0.000	0.045	0.001	1.248 ✓	1.333	H1-3+VT ✓
	102.25 - 98.25	0.005	0.613	0.000	0.022	0.000	0.618 ✓	1.333	H1-3+VT ✓
L4	102.25 - 98.25	0.005	0.601	0.000	0.021	0.000	0.607 ✓	1.333	H1-3+VT ✓
	98.25 - 95.8056	0.010	1.181	0.000	0.041	0.001	1.192 ✓	1.333	H1-3+VT ✓
	95.8056 - 93.3611	0.010	1.190	0.000	0.040	0.001	1.201 ✓	1.333	H1-3+VT ✓
	93.3611 - 90.9167	0.010	1.198	0.000	0.040	0.001	1.209 ✓	1.333	H1-3+VT ✓
	90.9167 - 88.4722	0.010	1.206	0.000	0.040	0.001	1.217 ✓	1.333	H1-3+VT ✓
	88.4722 - 86.0278	0.010	1.212	0.000	0.040	0.001	1.223 ✓	1.333	H1-3+VT ✓
	86.0278 - 83.5833	0.011	1.218	0.000	0.039	0.001	1.229 ✓	1.333	H1-3+VT ✓
	83.5833 - 81.1389	0.011	1.224	0.000	0.039	0.001	1.235 ✓	1.333	H1-3+VT ✓
	81.1389 - 78.6944	0.011	1.229	0.000	0.039	0.001	1.240 ✓	1.333	H1-3+VT ✓
	78.6944 - 76.25	0.011	1.233	0.000	0.038	0.000	1.245 ✓	1.333	H1-3+VT ✓

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	76.25 - 73.8056	0.011	1.237	0.000	0.038	0.000	1.249 ✓	1.333	H1-3+VT ✓
	73.8056 - 71.3611	0.011	1.241	0.000	0.038	0.000	1.252 ✓	1.333	H1-3+VT ✓
	71.3611 - 68.9167	0.011	1.244	0.000	0.038	0.000	1.255 ✓	1.333	H1-3+VT ✓
	68.9167 - 66.4722	0.012	1.246	0.000	0.037	0.000	1.258 ✓	1.333	H1-3+VT ✓
	66.4722 - 64.0278	0.012	1.249	0.000	0.037	0.000	1.261 ✓	1.333	H1-3+VT ✓
	64.0278 - 61.5833	0.012	1.251	0.000	0.037	0.000	1.263 ✓	1.333	H1-3+VT ✓
	61.5833 - 59.1389	0.012	1.252	0.000	0.037	0.000	1.265 ✓	1.333	H1-3+VT ✓
	59.1389 - 56.6944	0.012	1.254	0.000	0.037	0.000	1.266 ✓	1.333	H1-3+VT ✓
	56.6944 - 54.25	0.012	1.255	0.000	0.036	0.000	1.268 ✓	1.333	H1-3+VT ✓
	54.25 - 48.75	0.007	0.642	0.000	0.019	0.000	0.649 ✓	1.333	H1-3+VT ✓
L5	54.25 - 48.75	0.006	0.633	0.000	0.018	0.000	0.639 ✓	1.333	H1-3+VT ✓
	48.75 - 47.2895	0.013	1.293	0.000	0.036	0.000	1.306 ✓	1.333	H1-3+VT ✓
	47.2895 - 45.8289	0.013	1.293	0.000	0.036	0.000	1.306 ✓	1.333	H1-3+VT ✓
	45.8289 - 44.3684	0.013	1.292	0.000	0.036	0.000	1.306 ✓	1.333	H1-3+VT ✓
	44.3684 - 42.9079	0.013	1.292	0.000	0.036	0.000	1.305 ✓	1.333	H1-3+VT ✓
	42.9079 - 41.4474	0.013	1.291	0.000	0.036	0.000	1.305 ✓	1.333	H1-3+VT ✓
	41.4474 - 39.9868	0.013	1.290	0.000	0.036	0.000	1.304 ✓	1.333	H1-3+VT ✓
	39.9868 - 38.5263	0.014	1.290	0.000	0.036	0.000	1.304 ✓	1.333	H1-3+VT ✓
	38.5263 - 37.0658	0.014	1.289	0.000	0.035	0.000	1.303 ✓	1.333	H1-3+VT ✓
	37.0658 - 35.6053	0.014	1.288	0.000	0.035	0.000	1.302 ✓	1.333	H1-3+VT ✓
	35.6053 - 34.1447	0.014	1.287	0.000	0.035	0.000	1.301 ✓	1.333	H1-3+VT ✓
	34.1447 - 32.6842	0.014	1.286	0.000	0.035	0.000	1.300 ✓	1.333	H1-3+VT ✓
	32.6842 - 31.2237	0.014	1.285	0.000	0.035	0.000	1.299 ✓	1.333	H1-3+VT ✓
	31.2237 - 29.7632	0.014	1.284	0.000	0.035	0.000	1.298 ✓	1.333	H1-3+VT ✓
	29.7632 - 28.3026	0.014	1.283	0.000	0.035	0.000	1.297 ✓	1.333	H1-3+VT ✓
	28.3026 - 26.8421	0.014	1.285	0.000	0.035	0.000	1.300 ✓	1.333	H1-3+VT ✓

tnxTower	Job: 13001.097 - Somers West	Page: 35 of 36
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project: 180' Sabre Monopole - 37 Bacon Rd., Enfield, CT	Date: 14:09:28 11/22/13
	Client: Verizon Wireless	Designed by: TJL

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
	26.8421 - 25.3816	0.014	1.288	0.000	0.034	0.000	1.303 ✓	1.333	H1-3+VT ✓
	25.3816 - 23.9211	0.014	1.291	0.000	0.034	0.000	1.306 ✓	1.333	H1-3+VT ✓
	23.9211 - 22.4605	0.015	1.294	0.000	0.034	0.000	1.309 ✓	1.333	H1-3+VT ✓
	22.4605 - 21	0.015	1.297	0.000	0.034	0.000	1.312 ✓	1.333	H1-3+VT ✓
L6	21 - 20	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	20 - 19	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	19 - 18	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	18 - 17	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	17 - 16	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	16 - 15	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	15 - 14	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	14 - 13	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	13 - 12	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	12 - 11	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	11 - 10	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	10 - 9	0.013	1.142	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	9 - 8	0.014	1.141	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	8 - 7	0.014	1.141	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	7 - 6	0.014	1.141	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	6 - 5	0.014	1.141	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	5 - 4	0.014	1.141	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	4 - 3	0.014	1.141	0.000	0.030	0.000	1.155 ✓	1.333	H1-3+VT ✓
	3 - 2	0.014	1.142	0.000	0.030	0.000	1.156 ✓	1.333	H1-3+VT ✓
	2 - 1	0.014	1.143	0.000	0.030	0.000	1.158 ✓	1.333	H1-3+VT ✓

tnxTower	Job	Page
	13001.097 - Somers West	36 of 36
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project 180' Sabre Monopole - 37 Bacon Rd., Enfield, CT	Date 14:09:28 11/22/13
	Client Verizon Wireless	Designed by TJL

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	180 - 149	Pole	TP21.38x14.4x0.1875	1	-3.91	636.51	50.6	Pass
L2	149 - 118.25	Pole	TP27.94x20.3858x0.25	2	-8.76	1142.26	94.2	Pass
L3	118.25 - 98.25	Pole	TP32.44x27.94x0.28	3	-10.98	1444.27	93.6	Pass
L4	98.25 - 48.75	Pole	TP43.1x30.98x0.3125	4	-19.57	2142.08	95.1	Pass
L5	48.75 - 21	Pole	TP48.95x41.229x0.3125	5	-27.08	2467.90	98.4	Pass
L6	21 - 1	Pole	TP53.23x48.95x0.35	6	-31.95	3045.08	86.8	Pass
							Summary	
							Pole (L5) 98.4	Pass
							Base Plate 93.7	Pass
							RATING = **98.4**	**Pass**

Program Version 6.0.0.8 - 9/7/2011 File:J:/Jobs/1300100.WI/097 - Somers West/Backup Documentation/Calcs/ERI Files/180' Sabre Monopole Enfield.eri

CENTEK engineering
Centered on Solutions
63-2 North Branford Road
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P: (203) 488-0580
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Subject:		Foundation Analysis
Location:		180-ft Monopole Enfield, CT
Rev. 0: 11/22/13		Prepared by: T.J.L. Checked by: C.F.C. Job No. 13001.097

Standard Monopole Foundation:

Input Data:

Tower Data			
Overturning Moment =	$OM := 2844 \cdot ft \cdot kips$	(User Input from RISATower)	
Shear Force =	$Shear := 23 \cdot kip$	(User Input from RISATower)	
Axial Force =	$Axial := 32 \cdot kip$	(User Input from RISATower)	
Tower Height =	$H_t := 180 \cdot ft$	(User Input)	
Footing Data:			
Overall Depth of Footing =	$D_f := 5.5 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 4.5 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 0.5 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 7.0 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 2.0 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 23.0 \cdot ft$	(User Input)	
Anchor Bolt Data:			
Length of Anchor Bolts =	$L_{st} := 84 \cdot in$	(User Input)	
Projection of Anchor Bolts Above Pier =	$A_{BP} := 12.0 \cdot in$	(User Input)	
Anchor Bolt Diameter =	$d_{anchor} := 2.25 \cdot in$	(User Input)	
Base Plate Bolt Circle =	$MP := 60.0 \cdot in$	(User Input)	
Material Properties:			
Concrete Compressive Strength =	$f_c := 4000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Anchor Bolt Yield Strength =	$f_{ya} := 75000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 32 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 3000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 120 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 0 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.0 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 36$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 0.5 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.0 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 36$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.0 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 36$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =
$$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.785 \cdot in^2$$

Pad Top Reinforcement Bar Area =
$$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.785 \cdot in^2$$

Pad Bottom Reinforcement Bar Area =
$$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.785 \cdot in^2$$

Coefficient of Lateral Soil Pressure =
$$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3.255$$

Load Factor =
$$LF := \begin{cases} 1.333 & \text{if } H_t \le 700 \cdot ft \\ 1.7 & \text{if } H_t \ge 1200 \cdot ft \\ 1.333 + \left(\frac{H_t - 700ft}{1200ft - 700ft} \right) \cdot 0.4 & \text{otherwise} \end{cases} = 1.333$$

Stability of Footing:

Adjusted Concrete Unit Weight =

$$\gamma_c := \text{if}\left(\text{Bouyancy} = 1, \gamma_{conc} - 62.4\text{pcf}, \gamma_{conc}\right) = 150\cdot\text{pcf}$$

Adjusted Soil Unit Weight =

$$\gamma_s := \text{if}\left(\text{Bouyancy} = 1, \gamma_{soil} - 62.4\text{pcf}, \gamma_{soil}\right) = 120\cdot\text{pcf}$$

Passive Pressure =

$$P_{pn} := K_p\cdot\gamma_s\cdot n + c\cdot 2\cdot\sqrt{K_p} = 0\cdot\text{ksf}$$

$$P_{pt} := K_p\cdot\gamma_s\cdot\left(D_f - T_f\right) + c\cdot 2\cdot\sqrt{K_p} = 1.367\cdot\text{ksf}$$

$$P_{top} := \text{if}\left[n < \left(D_f - T_f\right), P_{pt}, P_{pn}\right] = 1.367\cdot\text{ksf}$$

$$P_{bot} := K_p\cdot\gamma_s\cdot D_f + c\cdot 2\cdot\sqrt{K_p} = 2.148\cdot\text{ksf}$$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.757\cdot\text{ksf}$$

$$T_p := \text{if}\left[n < \left(D_f - T_f\right), T_f, \left(D_f - n\right)\right] = 2$$

$$A_p := W_f\cdot T_p = 46$$

Ultimate Shear =

$$S_u := P_{ave}\cdot A_p = 80.844\cdot\text{kip}$$

Weight of Concrete Pad =

$$WT_c := \left[\left(W_f^{\,2}\cdot T_f\right) + d_p^{\,2}\cdot L_p\right]\cdot\gamma_c = 191.775\cdot\text{kip}$$

Weight of Soil Above Footing =

$$WT_{s1} := \left[\left(W_f^{\,2} - d_p^{\,2}\right)\cdot\begin{cases}\left(L_p - L_{pag} - n\right) & \text{if } \left(L_p - L_{pag} - n\right) \geq 0 \\ 0 & \text{if } \left(L_p - L_{pag} - n\right) \leq 0\end{cases}\right]\cdot\gamma_s = 230.4\cdot\text{kip}$$

Weight of Soil Wedge at Back Face =

$$WT_{s2} := \left(\frac{D_f^{\,2}\cdot\tan\left(\Phi_s\right)}{2}\cdot W_f\right)\cdot\gamma_s = 26.085\cdot\text{kip}$$

Weight of Soil Wedge at back face Corners =

$$WT_{s3} := 2\cdot\left[\left(D_f\right)^3\cdot\frac{\tan\left(\Phi_s\right)}{3}\right]\cdot\gamma_s = 8.317\cdot\text{kips}$$

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 454.175\cdot\text{kip}$$

Resisting Moment =

$$M_r := \left(WT_{tot}\right)\cdot\frac{W_f}{2} + S_u\cdot\frac{T_f}{3} + \left[\left(WT_{s2} + WT_{s3}\right)\cdot\left(W_f + \frac{D_f\cdot\tan\left(\Phi_s\right)}{3}\right)\right] = 6108\cdot\text{kip}\cdot\text{ft}$$

Overturning Moment =

$$M_{ot} := \text{OM} + \text{Shear}\cdot\left(L_p + T_f\right) = 2994\cdot\text{kip}\cdot\text{ft}$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.04$$

Factor of Safety Required =

$$FS_{req} := 2$$

$$\text{OverTurning\_Moment\_Check} := \text{if}\left(FS \geq FS_{req}, \text{"Okay"}, \text{"No Good"}\right)$$

$$\text{OverTurning\_Moment\_Check} = \text{"Okay"}$$

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 102.189 \cdot kips$

$Shear\_Check := if(S_p > Shear, "Okay", "No Good")$

$Shear\_Check = "Okay"$

Bearing Pressure Caused by Footing:

Area of the Mat = $A_{mat} := W_f^{\,2} = 529$

Section Modulus of Mat = $S := \frac{W_f^{\,3}}{6} = 2027.83 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{(WT_c + Axial)}{A_{mat}} + \frac{M_{ot}}{S} = 1.899 \cdot ksf$

$Max\_Pressure\_Check := if(P_{max} < q_s, "Okay", "No Good")$

$Max\_Pressure\_Check = "Okay"$

Minimum Pressure in Mat = $P_{min} := \frac{(WT_c + Axial)}{A_{mat}} - \frac{M_{ot}}{S} = -1.053 \cdot ksf$

$Min\_Pressure\_Check := if[(P_{min} \geq 0) \cdot (P_{min} < q_s), "Okay", "No Good"]$

$Min\_Pressure\_Check = "No Good"$

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 4.932$

Distance to Kern = $X_k := \frac{W_f}{6} = 3.833$

Since Resultant Force is Not in Kern, Area to which Pressure is Applied Must be Reduced.

Eccentricity = $e := \frac{M_{ot}}{WT_{tot}} = 6.591$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot (WT_c + Axial)}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.321 \cdot ksf$

$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.321 \cdot ksf$

$Pressure\_Check := if(q_{adj} < q_s, "Okay", "No Good")$

$Pressure\_Check = "Okay"$

Concrete Bearing Capacity:

Strength Reduction Factor = $\Phi_c := 0.65$ (ACI-2008 9.3.2.2)

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.225 \times 10^4 \cdot kips$ (ACI-2008 10.14)

$Bearing\_Check := if\left(P_b > LF \cdot Axial, "Okay", "No Good"\right)$

Bearing_Check = "Okay"

Shear Strength of Concrete:

Beam Shear: (Critical section located at a distance d from the face of Pier) (ACI 11.3.1.1)

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 20 \cdot in$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$

$d_2 := d_1 - d$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$

$V_{req} := LF \cdot \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d$ (ACI-2008 11.2.1.1)

$Beam\_Shear\_Check := if\left(V_{req} < V_{Avail}, "Okay", "No Good"\right)$

Beam_Shear_Check = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.11.1.2)

Critical Perimeter of Punching Shear = $b_o := \left(d_p + d\right) \cdot \pi = 27.2$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 59$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 470$

Guess Value = $v_u := 1ksf$

(From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

Given $d^2 + d_p \cdot d = \frac{WT_{tot}}{\pi \cdot v_u}$

$v_u := \text{Find}(v_u) = 10 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 383.7 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 511.4 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 1405.1 \cdot kip$ (ACI-2008 11.11.2.1)

$Punching\_Shear\_Check := \text{if}(V_{req} < V_{Avail}, \text{"Okay"}, \text{"No Good"})$

$Punching\_Shear\_Check = \text{"Okay"}$

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor = $\phi_m := .90$ (ACI-2008 9.3.2.1)

$q_b := q_{adj} - d_1 \cdot Slope = 0.604 \cdot ksf$

Maximum Bending at Face of Pier = $M_u := LF \cdot \left[\left(q_{adj} - q_b \right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 1061.6 \cdot kip \cdot ft$

$$\beta := \begin{cases} 0.85 & \text{if } 2500 \cdot psi \le f_c \le 4000 \cdot psi \\ 0.65 & \text{if } f_c > 8000 \cdot psi \\ \left[0.85 - \left[\frac{\left(\frac{f_c}{psi} - 4000 \right)}{1000} \right] \cdot 0.5 \right] & \text{otherwise} \end{cases} = 0.85$$

(ACI-200810.2.7.3)

$R_n := \frac{M_u}{\phi_m \cdot W_f \cdot d^2} = 128.2 \cdot psi$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) = 0.0022$

$\rho_{min} := \rho = 0.00218$

Required Reinforcement for Temperature and Shrinkage:

$$\rho_{sh} := \begin{cases} .0018 & \text{if } f_y \geq 60000 \cdot psi \\ .0020 & \text{otherwise} \end{cases}$$ (ACI -2008 7.12.2.1)

Check Bottom Bars:

$$As := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \frac{d}{2} & \text{otherwise} \end{cases} = 12.027 \cdot in^2$$

$$As_{prov} := A_{bbot} \cdot NB_{bot} = 28.3 \cdot in^2$$

$$Pad\_Reinforcement\_Bot := if\left(As_{prov} > As, "Okay", "No Good"\right)$$

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$$As := \rho_{sh} \cdot \left(W_f \cdot \frac{d}{2}\right) = 5 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 28.3 \cdot in^2$$

$$Pad\_Reinforcement\_Top := if\left(As_{prov} > As, "Okay", "No Good"\right)$$

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 6.69 \cdot in$$

Spacing or Cover Dimension =

$$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 3 \cdot in$$

Transverse Reinforcement Index =

$$k_{tr} := 0$$ (ACI-2008 12.2.3)

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 23.7 \cdot in$$

Minimum Development Length =

$$L_{dbmin} := 12 \cdot in$$ (ACI-2008 12.2.1)

$$L_{dbtCheck} := if\left(L_{dbt} \geq L_{dbmin}, "Use\ L.dbt", "Use\ L.dbmin"\right)$$

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 93 \cdot in$$

$$Lpad\_Check := if\left(L_{Pad} > L_{dbt}, "Okay", "No Good"\right)$$

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier = $A_p := \frac{\pi \cdot d_p^2}{4} = 5541.77 \cdot in^2$

$A_{smin} := 0.01 \cdot 0.05 \cdot A_p = 2.77 \cdot in^2$ (ACI-2008 10.8.4 & 10.9.1)

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 28.27 \cdot in^2$

$Steel\_Area\_Check := if(A_{sprov} > A_{smin}, "Okay", "No Good")$

Steel_Area_Check = "Okay"

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 6.33 \cdot in$

Diameter of Reinforcement Cage = $Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 78 \cdot in$

Maximum Moment in Pier = $M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 47332.2 \cdot in \cdot kips$

Pier Check evaluated from outside program and results are listed below;

$(D \ N \ n \ P_u \ M_{xu}) := \left(d_p \cdot 12 \ \ NB_{pier} \ \ BS_{pier} \ \ \frac{Axial \cdot 1.333}{kips} \ \ \frac{M_p}{in \cdot kips} \right)$

$(D \ N \ n \ P_u \ M_{xu}) = (84 \ \ 36 \ \ 8 \ \ 42.656 \ \ 4.733 \times 10^4)$

$(\phi P_n \ \ \phi M_{xn} \ \ f_{sp} \ \ \rho) := (0 \ \ 0 \ \ 0 \ \ 0)$

$(\phi P_n \ \ \phi M_{xn} \ \ f_{sp} \ \ \rho) := \phi P'_n(D, N, n, P_u, M_{xu})^T$

$(\phi P_n \ \ \phi M_{xn} \ \ f_{sp} \ \ \rho) = (50.268 \ \ 5.578 \times 10^4 \ \ -60 \ \ 5.132 \times 10^{-3})$

$Axial\_Load\_Check := if(\phi P_n \geq P_u, "Okay", "No Good")$

Axial_Load_Check = "Okay"

$Bending\_Check := if(\phi M_{xn} \geq M_{xu}, "Okay", "No Good")$

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 51 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 21 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 3 \cdot in$

Transverse Reinforcement = $k_{tr} := 0$ (ACI-2008 12.2.3)

$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 23.72 \cdot in$

Minimum Development Length =

$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 13.282 \cdot in$ (ACI 12.2.1)

Pier reinforcement bars are standard 90 degree hooks and therefore developement in the pad is computed as follows:

$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right)$

$L_{tension\_Check} := if\left(L_{pier} + L_{pad} > L_{dbt}, "Okay", "No Good"\right)$

$L_{tension\_Check} = "Okay"$

Compression: (ACI-2008 12.3.2)

$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 18.974 \cdot in$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 18 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 18.974 \cdot in$

$L_{compression\_Check} := if\left(L_{pier} + L_{pad} > L_{dbc}, "Okay", "No Good"\right)$

$L_{compression\_Check} = "Okay"$

Tie Size and Spacing in Column:

Minimum Tie Size =

$Tie_{min} := if(BS_{pier} \le 10, 3, 4) = 3$

Used #4 Ties

Seismic Factor =

$z := if(Z \le 2, 1, 0.5) = 1$ (ACI-2008 21.10.5)

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 16 \cdot in$

$s_{lim2} := 48 \cdot d_{Tie} \cdot z = 24 \cdot in$

$s_{lim3} := D_f \cdot z = 66 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing =

$$s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) = 16 \cdot in$$

Number of Ties Required =

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 4$$

Check Anchor Steel Embedment:

Depth Available =

$D_{ab} := L_{st} - A_{BP} = 6 \cdot ft$

Length of Anchor Bolt =

$$L_{anchor} := \frac{(0.11 \cdot f_{ya}) \cdot in}{\sqrt{f_c \cdot psi}} = 10.87 \cdot ft$$

$Depth\_Check := if(D_{ab} \ge L_{anchor}, "Okay", "No Good")$

$Depth\_Check = "No Good"$

Note: Anchor plate is provided

SITE NAME	SOMERS WEST CT	ECP - CELL #	8	16
LATITUDE	42-00-57.37 N	LONGITUDE	72-31-43.46 W	
		SAVE BUTTON		
Additional Comments: 2014 AWS ADD.		STRUCTURE TYPE	MONOPOLE	

AWS - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	2100 MHz BBU	2100 MHz BBU	2100 MHz BBU
ANTENNA TYPE	BXA-171063-12CF-EDIN-5	BXA-171063-12CF-EDIN-5	BXA-171063-12CF-EDIN-5
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	5	5	5
RAD CTR (FT AGL)	150	150	150
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
RRH - QTY/MODEL	1 ALU RH_2X40-AWS	1 ALU RH_2X40-AWS	1 ALU RH_2X40-AWS
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX	1		DB-T1-6Z-8AB-0Z

700 Mhz - LTE Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	BXA-70063-4CF-5	SLCP 2X6014	SLCP 2X6014
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	2	0	2
RAD CTR (FT AGL)	150	150	150
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			
RRH - QTY/MODEL			
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			

700 Mhz - LTE Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	BXA-70063-6CF-2	BXA-70063-6CF-2	BXA-70063-6CF-2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	2	0	2
RAD CTR (FT AGL)	150	150	150
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			
RRH - QTY/MODEL			
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0	Cellular Modcell 4.0	Cellular Modcell 4.0
ANTENNA TYPE	LPA-80080-4CF	LPA-80080-4CF-5	LPA-80080-4CF-5
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	150	150	150
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L
DIPLEX WITH LTE CABLE			
MCPA BRICKS (QTY)			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0	Cellular Modcell 4.0	Cellular Modcell 4.0
ANTENNA TYPE	LPA-80080-4CF	LPA-80080-4CF-5	LPA-80080-4CF-5
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	150	150	150
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L
DIPLEX WITH LTE CABLE			
MCPA BRICKS (QTY)			

1900 PCS - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	BXA-171085-8BF-2	BXA-171085-8BF-2	BXA-171085-8BF-2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	150	150	150
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable
MCPA BRICKS (QTY)			

1900 PCS - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	BXA-171085-8BF-2	BXA-171085-8BF-2	BXA-171085-8BF-2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	150	150	150
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable
MCPA BRICKS (QTY)			

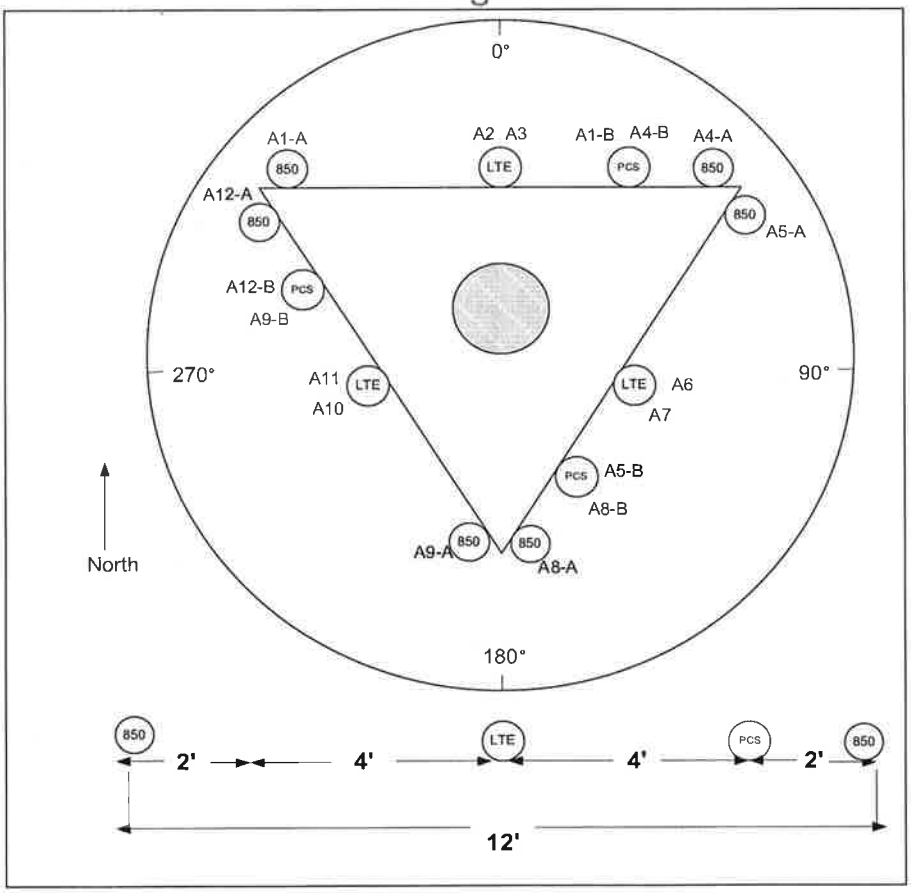
NUMBER OF CABLE'S NEEDED						ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES			12	MAINLINE (FT)			190
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS			18	TOP JUMPER (FT)			12
Equipment Cable Ordering		**MAIN CABLE #**	12	+	6	**TOP JUMPER #**	12	+	6
FIBER LINE SIZE	1 5/8"	TOTAL # OF FIBER LINES			1	FIBER LINE MODEL #			HB158-1-08U8-S8J18
JUMPER SIZE	5/8"	TOTAL # OF TOP JUMPERS			3	TOP JUMPER MODEL #			HB058-1-08U1-S1J18
Fiber Cable Ordering		**FIBER CABLE**	0	+	1	**TOP JUMPER #**	0	+	3

TX / RX FREQUENCIES			TX POWER OUTPUT	
Cellular A-Band	**PCS F-Band**	**700 Mhz C - E**	Cellular (Watts)	20
TX - 869-880,890-891.5 MHz	TX - 1970-1975	TX - 746-757	PCS (Watts)	16
RX - 824-835,845-846.5 MHz	RX - 1890-1895	RX - 776-787	LTE (Watts)	40

ALPHA				BETA				GAMMA			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1-A	800	Tx1/Rx0	RED	A5-A	800	Tx2/Rx0	BLUE	A9-A	800	Tx3/Rx0	GREEN
A1-B	1900	Tx1/Rx0	RED/ WHITE	A5-B	1900	Tx2/Rx0	BLUE/ WHITE	A9-B	1900	Tx3/Rx0	GREEN/WHITE
A2	700	Tx1/Rx0	RED/ ORANGE	A6	700	Tx2/Rx0	BLUE/ ORANGE	A10	700	Tx3/Rx0	GREEN/ORANGE
A3	700	Tx4/Rx1	RED/RED/ ORANGE	A7	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A11	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A4-B	1900	Tx4/Rx1	RED/RED/ WHITE	A8-B	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A12-B	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A4-A	800	Tx4/Rx1	RED/RED	A8-A	800	Tx5/Rx1	BLUE/BLUE	A12-A	800	Tx6/Rx1	GREEN/GREEN

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By : Justin Kober	Robert Hesselbach	JK	11/22/2013

Site Configuration



BXA-171063-12CF-EDIN-X

X-Pol | FET Panel | 63° | 19.0 dBi

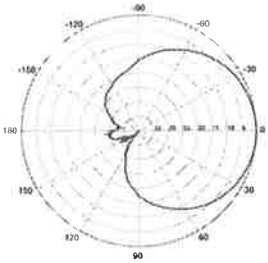
Replace "X" with desired electrical downtilt.

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	< -25 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

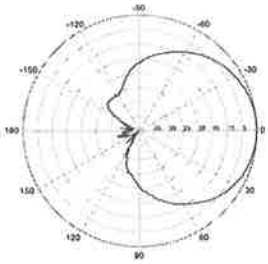
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-12CF-EDIN-X-FP		

BXA-171063-12CF-EDIN-X



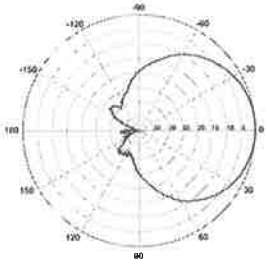
Horizontal | 1710-1880 MHz

BXA-171063-12CF-EDIN-X



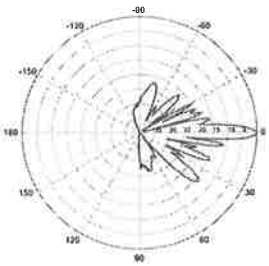
Horizontal | 1850-1990 MHz

BXA-171063-12CF-EDIN-X



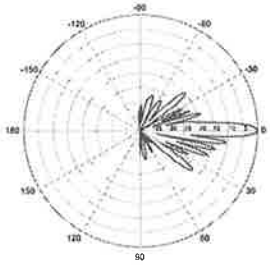
Horizontal | 1920-2170 MHz

BXA-171063-12CF-EDIN-0



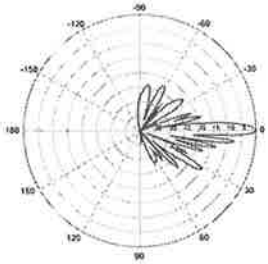
0° | Vertical | 1710-1880 MHz

BXA-171063-12CF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-12CF-EDIN-0

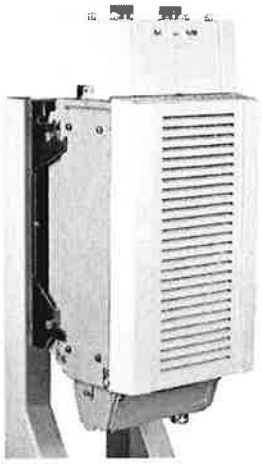


0° | Vertical | 1920-2170 MHz

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

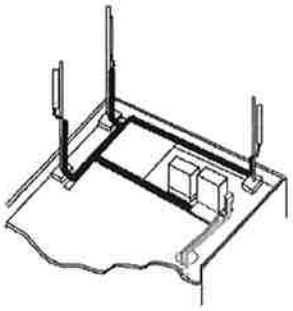
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation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

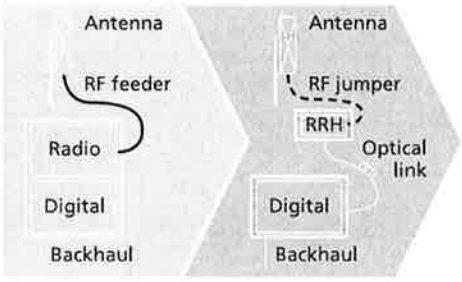
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

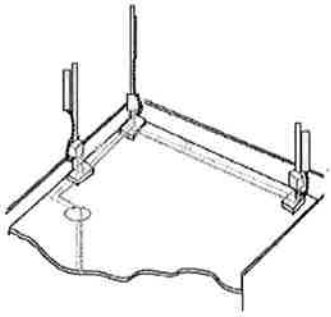
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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

Alcatel·Lucent

Product Data Sheet DB-B1 and DB-T1 Series

DC and Fiber Management Distribution Boxes for HYBRIFLEX™ Cable

Product Description

The RFS Distribution Box design comes with the option for pluggable over voltage protection (OVP) for up to 6 remote radios and the connection for 6 pairs of optical fiber with LC optical fiber cable management. There is a hybrid cable input with a jumper configuration for power and optical fiber to the remote radio heads (RRHs). A custom wall, a 2-inch pole, and an H-Frame mounting bracket are included. Both the compact and standard design are available with lightening protection.

Features/Benefits

- Designed to accommodate varying diameters of HYBRIFLEX™ (combined power and fiber optic) cables – up to 2 inches
- Supports Single- and Multi-Mode Optical fiber
- NEMA 4x rated enclosure – allows **flexibility for indoor or outdoor installation** on a roof or tower top
- Weatherproof enclosure and ports – **improves system reliability**
- Modular design – makes replacement or addition of OVP easy without removal of other components within the box
- Strikesorb OVP technology – protects equipment from damaging surges up to 60 kA on an 8/20 waveform and up to 5 kA on a 10/350 waveform (certain models only)
- Low residual voltage and high impedance – **ideally suited for RRH technology** – won't shut down the RRH the way spark gap technology does (certain models only)

Technical Specifications

Mechanical Specifications

Model Number	DB-B1-6C-8AB-0Z	DB-T1-6Z-8AB-0Z
Enclosure Design	Standard, 6 OVP's	Standard without OVP
Dimensions - H x W x D, mm (in)	610 x 610 x 254 (24 x 24 x 10)	610 x 610 x 254 (24 x 24 x 10)
Weight, kg (lb)	20 (44)	20 (44)
Suppression Connection Method	Compression lug, #2-#14 AWG Copper, #2-#12 Aluminum	
Fiber Connection Method	LC-LC Single- or Multi-mode duplex	
Environmental Rating	NEMA 4x	
Operating Temperature, °C (°F)	-40 to +80 (-40 to +176)	
UV Protection	ISO 4892-2 Method A Xenon-Arc 2160 hrs	

Electrical Specifications

Nominal Operating Voltage	48 VDC	
Nominal Discharge Current (I_n) per UL 1449 3rd Ed	20 kA 8/20 µs	N/A
Maximum Discharge Current (I_{max}) per NEMA LS-1	60 kA 8/20 µs	N/A
Maximum Impulse (Lightning) Current (I_{imp}) per IEC 61643-1	5 kA 10/350 µs	N/A
Maximum Continuous Operating Voltage (U_c)	75 VDC	N/A
Voltage Protection Rating per UL1449 3rd Ed	400 V	N/A
Protection Class as per IEC 61643-1	Class 1	N/A
Strikesorb OVP Compliance	ANSI/UL 1449-3rd Ed	N/A
	IEEE C62.41	N/A
	NEMA LS-1	N/A
	IEC 61643-1	N/A
	IEC 61643-12	N/A
	EN 61643-11	N/A

* This data is provisional and subject to change.