Robinson+Cole

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March 11, 2015

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

Re: **Notice of Exempt Modification – Facility Modification**
59 Westwood Drive, New London, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) antennas (four (4) antennas at the 67-foot level, four (4) at the 72-foot level and four (4) at the 77-foot level) on an 80-foot lattice tower at 59 Westwood Drive in New London (the "Property"). The tower and underlying property are owned by Metrocast Communications of CT LLC. The Council approved Cellco's shared use of this tower in 1990. Cellco now intends to modify its facility by replacing nine (9) of its existing antennas with three (3) model LNX-6514DS-VTM, 700 MHz antennas; three (3) model HBXX-6516DS-VTM, 1900 MHz antennas; and three (3) model HBXX-6517DS-VTM, 2100 MHz antennas, at the 67-foot, 72-foot and 77-foot levels on the tower. Cellco also intends to install six (6) remote radio heads ("RRHs") behind its 700 MHz and 1900 MHz antennas and one (1) new HYBRIFLEX™ antenna cable. Included in Attachment 1 are specifications for Cellco's replacement antennas, RRHs and HYBRIFLEX™ cable.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent Daryl J. Finizio, Mayor for the City of New London. A copy of this letter is also being sent to Metrocast Communications of CT LLC, the owner of the Property.

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

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's replacement antennas and RRHs will be installed on the existing antenna mounting frames at the 67-foot, 72-foot and 77-foot levels on the 80-foot tower.

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

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

4. The operation of the replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. Far Field Approximation tables for RF emissions at each of Cellco's operating frequencies, as modified, are included behind Attachment 2. These tables demonstrate how the modified facility will comply with the RF emissions standards established by the FCC.

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, with certain modifications, can support Cellco's proposed modifications. (*See* Structural Analysis Report and Reinforcement Design 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:
Daryl J. Finizio, New London Mayor
Metrocast Communications of CT LLC
Timothy Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6514DS-VTM

Andrew® Antenna, 698–896 MHz, 65° horizontal beamwidth, RET compatible

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Gain, dBi	15.7	16.3
Beamwidth, Horizontal, degrees	65	65
Beamwidth, Vertical, degrees	12.5	11.2
Beam Tilt, degrees	0–10	0–10
USLS, typical, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	20	20
CPR at Sector, dB	10	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°

Electrical Specifications, BASTA*

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

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

Mechanical Specifications

Color | Radome Material	Light gray | Fiberglass, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 2
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph
Antenna Dimensions, L x W x D	1847.0 mm x 301.0 mm x 181.0 mm | 72.7 in x 11.9 in x 7.1 in
Net Weight	14.2 kg | 31.3 lb
Model with factory installed AISG 2.0 RET	LNX-6514DS-A1M

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6516DS-VTM

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

- Each DualPol® array can be independently adjusted for greater flexibility
- Excellent gain, VSWR, front-to-back ratio, and PIM specifications for robust network performance
- Ideal choice for site collocations and tough zoning restrictions
- Great solution to maximize network coverage and capacity
- The values presented on this datasheet have been calculated based on N-P-BASTA White Paper version 9.6 by the NGMN Alliance

Electrical Specifications

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain by all Beam Tilts, average, dBi	17.2	17.2	17.5
Gain by all Beam Tilts Tolerance, dB	±0.3	±0.3	±0.5
Gain by Beam Tilt, average, dBi	0 ° | 17.0 5 ° | 17.3 10 ° | 17.0	0 ° | 17.1 5 ° | 17.4 10 ° | 17.0	0 ° | 17.4 5 ° | 17.7 10 ° | 17.2
Beamwidth, Horizontal, degrees	67	66	64
Beamwidth, Horizontal Tolerance, degrees	±2.7	±2.3	±3.5
Beamwidth, Vertical, degrees	7.5	7.0	6.6
Beamwidth, Vertical Tolerance, degrees	±0.5	±0.4	±0.4
Beam Tilt, degrees	0–10	0–10	0–10
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	26	26	26
CPR at Boresight, dB	22	22	22
CPR at Sector, dB	9	9	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® single band, quad
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2180 MHz
Number of Ports, all types	4

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Low loss circuit board
Radome Material	PVC, UV resistant
RF Connector Interface	7-16 DIN Female

RF Connector Location	Bottom
RF Connector Quantity, total	4
Wind Loading, maximum	419.0 N @ 150 km/h 94.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	166.0 mm | 6.5 in
Length	1294.0 mm | 50.9 in
Width	305.0 mm | 12.0 in
Net Weight	13.9 kg | 30.6 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	HBXX-6516DS-R2M
Model with Factory Installed AISG 2.0 Actuator	HBXX-6516DS-A2M
RET System	Teletilt®

Regulatory Compliance/Certifications

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

Included Products

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

Product Specifications

HBXX-6517DS-VTM

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

Electrical Specifications

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°

**Values calculated using NGMN Alliance N-P-BASTA v9.6*

Mechanical Specifications

Color | Radome Material	Light gray | PVC, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph
Antenna Dimensions, L x W x D	1903.0 mm x 305.0 mm x 166.0 mm | 74.9 in x 12.0 in x 6.5 in
Net Weight	19.5 kg | 43.0 lb
Model with factory installed AISG 2.0 RET	HBXX-6517DS-A2M

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Alcatel-Lucent RRH2x40-07-U

REMOTE RADIO HEAD

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

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

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

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

Fast, low-cost installation and deployment

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

Excellent RF performance

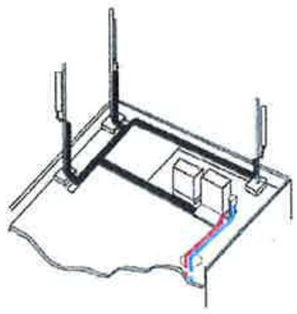
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and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

Features

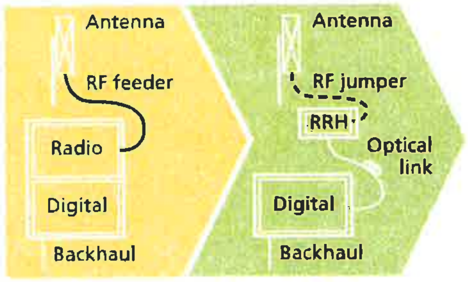
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly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

Benefits

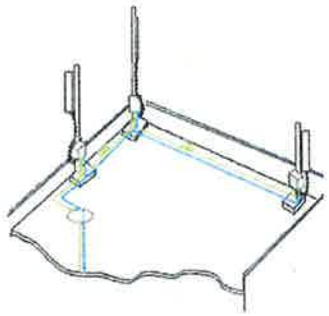
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

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

Power

- Power supply: -48V

Operating environment

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

RF characteristics

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

Optical characteristics

Type/number of fibers

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

Optical fiber length

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

Alarms and ports

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

www.alcatel-lucent.com
CPG2809100913 (09)

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ALCATEL-LUCENT WIRELESS PRODUCT DATASHEET

RRH2X60-AWS FOR BAND 4 APPLICATIONS

The Alcatel-Lucent RRH2x60-AWS is a high power, small form factor Remote Radio Head operating in the AWS frequency band (3GPP Band 4) for LTE technology. It is designed with an eco-efficient approach, providing operators with the means to achieve high quality and high capacity coverage with minimum site requirements and efficient operation.

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

The Alcatel-Lucent RRH2x60-AWS is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information.

SUPERIOR RF PERFORMANCE

The Alcatel-Lucent RRH2x60-AWS integrates all the latest technologies. This allows to offer best-in-class characteristics.

It delivers an outstanding 120 watts of total RF power thanks to its two transmit RF paths of 60 W each.

It is ideally suited to support multiple-input multiple-output (MIMO) 2x2 operation.

It includes four RF receivers to natively support 4-way uplink reception diversity. This improves the radio uplink coverage and this can be used to extend the cell radius commensurate with 2x2MIMO 2x60 W for the downlink.

It supports multiple discontinuous LTE carriers within an instantaneous bandwidth of 45 MHz corresponding to the entire AWS B4 spectrum.

The latest generation power amplifiers (PA) used in this product achieve high efficiency (>40%), resulting in improved power consumption figures.

OPTIMIZED TCO

The Alcatel-Lucent RRH2x60-AWS is designed to make available all the benefits of a distributed Node B, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX).

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

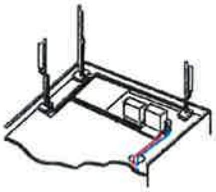
EASY INSTALLATION

The RRH2x60-AWS includes a reversible mounting bracket which allows for ease of installation behind an antenna, or on a rooftop knee wall while providing easy access to the mid body RF connectors.

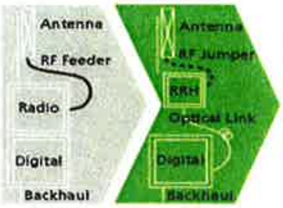
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation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

The Alcatel-Lucent RRH2x60-AWS is a zero-footprint solution and is convection cooled without fans for silent operation, simplifying negotiations with site property owners and minimizing environmental impacts.

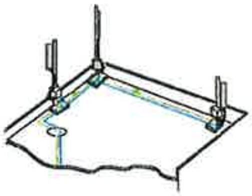
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

FEATURES

- RRH2x60-AWS integrates two power amplifiers of 60W rating (at each antenna connector)
- Support multiple carriers over the entire 3GPP band 4
- RRH2x60-AWS is optimized for LTE operation
- RRH2x60-AWS is a very compact and lightweight product
- Advanced power management techniques are embedded to provide power savings, such as PA bias control

BENEFITS

- MIMO LTE operation with only one single unit per sector
- Improved uplink coverage with built-in 4-way receive diversity capability
- RRH can be mounted close to the antenna, eliminating nearly all losses in RF cables and thus reducing power consumption by 50% compared to conventional solutions
- Distributed configurations provide easily deployable and cost-effective solutions, near zero footprint and silent solutions, with minimum impact on the neighborhood, which ease the deployment
- RETA and TMA support without additional hardware thanks to the AISG v2.0 port and the integrated Bias-Tees. Bias-Tees support AISG DC supply and signaling.

TECHNICAL SPECIFICATIONS

Specifications listed are hardware capabilities. Some capabilities depend on support in a specific software release or future release.

Dimensions and weights

- HxWxD : 510x285x186mm (27 l with solar shield)
- Weight : 20 kg (44 lbs)

Electrical Data

- Power Supply : -48V DC (-40.5 to -57V)
- Power Consumption (ETSI average traffic load reference) : 250W @2x60W

RF Characteristics

- Frequency band: 1710-1755, UL / 2110-2155 MHz, DL (3GPP band 4)
- Output power: 2x60W at antenna connectors
- Technology supported: LTE
- Instantaneous bandwidth: 45 MHz
- Rx diversity: 2-way and 4-way uplink reception
- Typical sensitivity without Rx diversity: -105 dBm for LTE

Connectivity

- Two CPRI optical ports for daisychaining and up to six RRHs per fiber
- Type of optical fiber: Single-Mode (SM) and Multi-Mode (MM) SFPs
- Optical fiber length: up to 500m using MM fiber, up to 20km using SM fiber
- TMA/RETA : AISG 2.0 (RS485 connector and internal Bias-Tee)
- Six external alarms
- Surge protection for all external ports (DC and RF)

Environmental specifications

- Operating temperature: -40°C to 55°C including solar load
- Operating relative humidity: 8% to 100%
- Environmental Conditions : ETS 300 019-1-4 class 4.1E
- Ingress Protection : IEC 60529 IP65
- Acoustic Noise : Noiseless (natural convection cooling)

Safety and Regulatory Data

- EMC : 3GPP 25113, EN 301 489-1, EN 301 489-23, GR 1089, GR 3108, OET-65
- Safety : IEC60950-1, EN 60825-1, UL, ANSI/NFPA 70, CAN/CSA-C22.2
- Regulatory : FCC Part 15 Class B, CE Mark – European Directive : 2002/95/EC (ROHS); 2002/96/EC (WEEE); 1999/5/EC (R&TTE)
- Health : EN 50385

Alcatel·Lucent

AT THE SPEED OF IDEAS™

Product Data Sheet HB158-1-08U8-S8J18

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

Product Description

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

It was developed to reduce installation complexity and costs at Cellular sites. HYBRIFLEX allows mobile operators deploying an RRH architecture to standardize the RRH installation process and eliminate the need for and cost of cable grounding. HYBRIFLEX combines optical fiber (multi-mode or single-mode) and power in a single corrugated cable. It eliminates the need for junction boxes and can connect multiple RRHs with a single feeder. Standard RFS 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)		[mm (AWG)]	8 4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm (AWG)]	0 8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6 8 (0 27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-95-658 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

* This data is provisional and subject to change

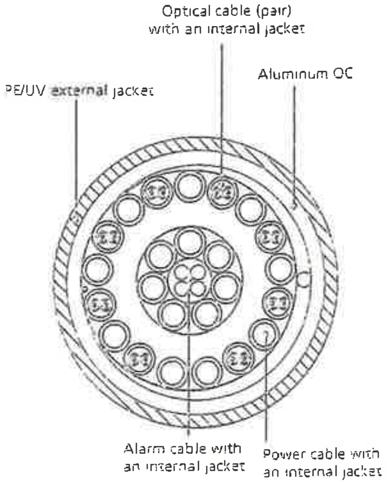


Figure 2: Construction Detail

ATTACHMENT 2

Far Field Approximation
with downtilt variation

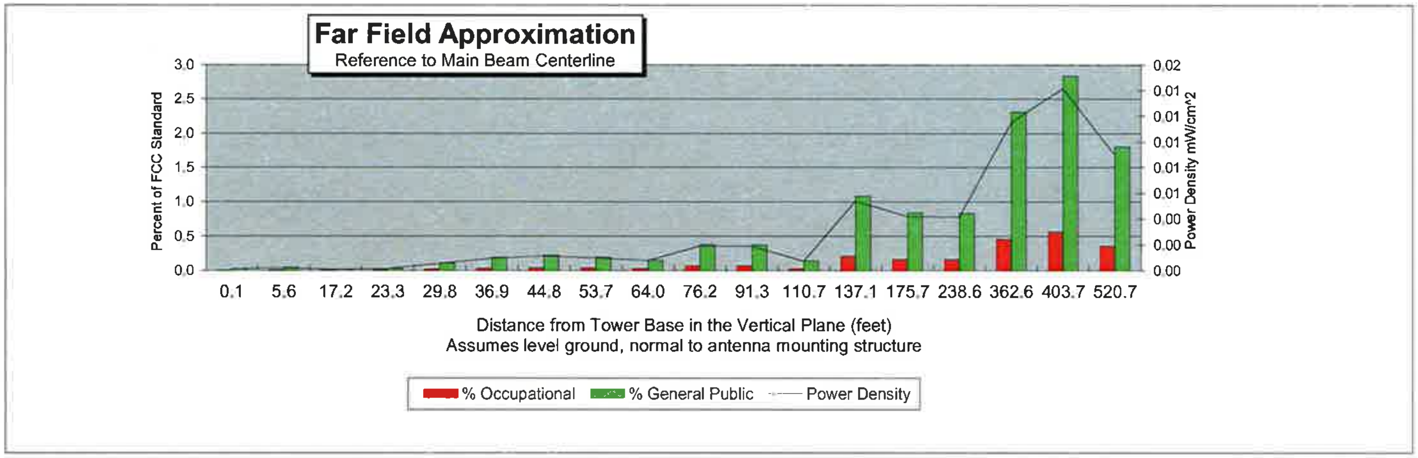
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	New London, CT
Site #:	
Date:	02/17/15
Name:	Ray Paradis
File Name:	New London, CT - FF Power

Operating Freq. (MHz)	**746.0**
Antenna Height (ft):	**66.9**
Antenna Gain (dBi):	**13.6**
Antenna Size (in.):	**72.7**
Downtilt (degrees):	**5.0**
Feedline Loss (dB):	**2.0**
Power @ J4 (w):	**772.0**



Calc Angle	90.0	85.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	9.0	7.0	
Solve for r, dx to antenna	63.9	64.1	66.2	68.0	70.5	73.8	78.0	83.4	90.4	99.5	111.5	127.9	151.3	186.9	247.0	368.2	408.7	524.6	
Distance from Antenna Structure Base in Horizontal plane	0.1	5.6	17.2	23.3	29.8	36.9	44.8	53.7	64.0	76.2	91.3	110.7	137.1	175.7	238.6	362.6	403.7	520.7	
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.01	
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.2	0.2	0.2	0.5	0.6	0.4	
Percent of General Population Standard	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.4	0.4	0.1	1.1	0.8	0.8	2.3	2.8	1.8	

Antenna Type	LNX-6514DS-A1M
Max%	2.84%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 Pc
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

Far Field Approximation
with downtilt variation

Estimated Radiated Emission

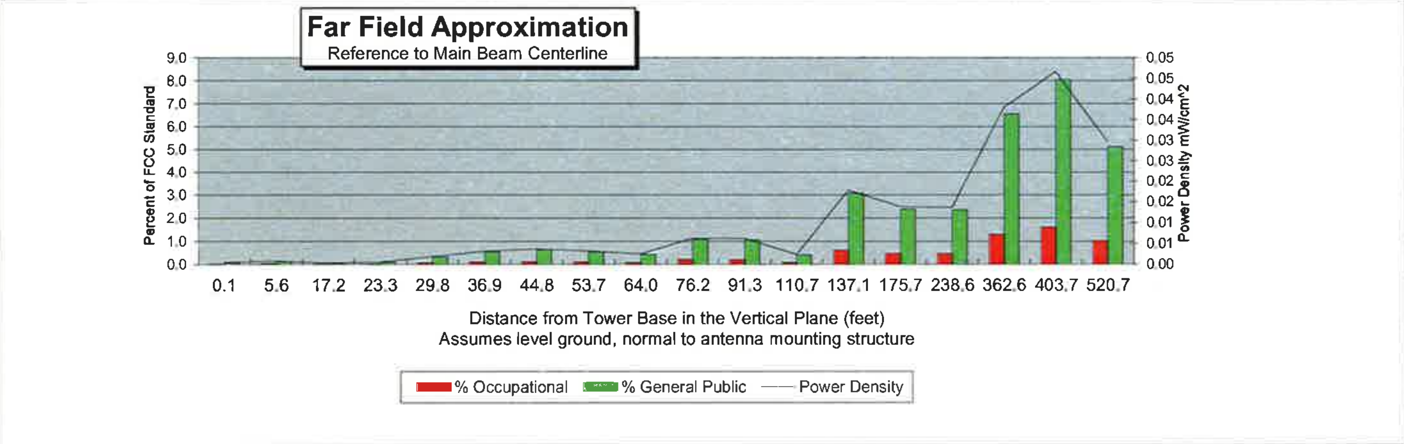
Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

verizonwireless

Location:	New London, CT
Site #:	
Date:	02/17/15
Name:	Ray Paradis
File Name:	New London, CT - FF Power

Operating Freq. (MHz)	869.0
Antenna Height (ft):	66.9
Antenna Gain (dBi):	13.0
Antenna Size (in.):	47.4
Downtilt (degrees):	5.0
Feedline Loss (dB):	2.0
Power @ J4 (w):	2952.0



Calc Angle	90.0	85.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	9.0	7.0	
Solve for r, dx to antenna	63.9	64.1	66.2	68.0	70.5	73.8	78.0	83.4	90.4	99.5	111.5	127.9	151.3	186.9	247.0	368.2	408.7	524.6	
Distance from Antenna Structure Base in Horizontal plane	0.1	5.6	17.2	23.3	29.8	36.9	44.8	53.7	64.0	76.2	91.3	110.7	137.1	175.7	238.6	362.6	403.7	520.7	
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.01	0.01	0.04	0.05	0.03	
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.6	0.5	0.5	1.3	1.6	1.0	
Percent of General Population Standard	0.1	0.1	0.0	0.1	0.3	0.5	0.6	0.6	0.4	1.1	1.1	0.4	3.1	2.4	2.3	6.6	8.0	5.1	

Antenna Type	BXA-80063/4CF
Max%	8.05%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 P
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

Far Field Approximation
with downtilt variation

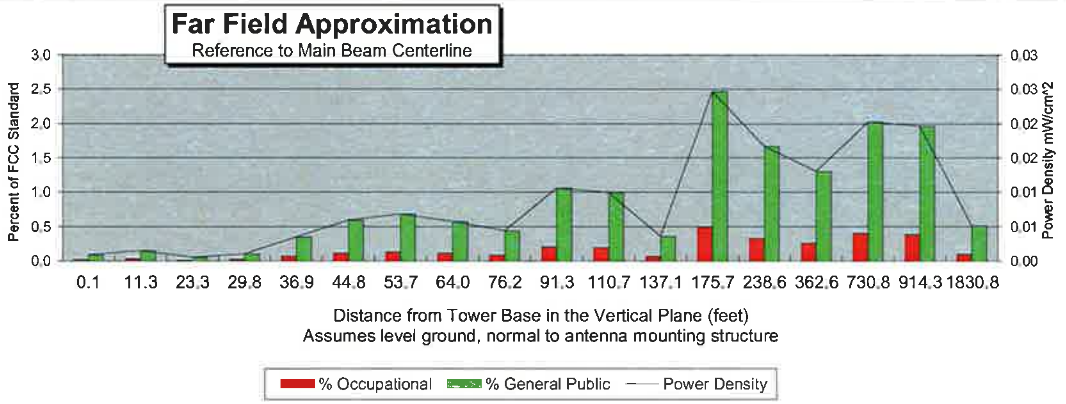
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	New London, CT
Site #:	
Date:	02/17/15
Name:	Ray Paradis
File Name:	New London, CT - FF Power

Operating Freq. (MHz)	1970.0
Antenna Height (ft):	66.9
Antenna Gain (dBi):	14.9
Antenna Size (in.):	50.9
Downtilt (degrees):	0.0
Feedline Loss (dB):	2.0
Power @ J4 (w):	4059.0



Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0
Solve for r, dx to antenna	63.9	64.9	68.0	70.5	73.8	78.0	83.4	90.4	99.5	111.5	127.9	151.3	186.9	247.0	368.2	733.5	916.5	1831.9
Distance from Antenna Structure Base in Horizontal plane	0.1	11.3	23.3	29.8	36.9	44.8	53.7	64.0	76.2	91.3	110.7	137.1	175.7	238.6	362.6	730.8	914.3	1830.8
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.02	0.01	0.02	0.02	0.01
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.5	0.3	0.3	0.4	0.4	0.1
Percent of General Population Standard	0.1	0.2	0.1	0.1	0.4	0.6	0.7	0.6	0.4	1.1	1.0	0.4	2.5	1.7	1.3	2.0	2.0	0.5

Antenna Type	HBXX-6516DS-A2M
Max%	2.46%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 P
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

Far Field Approximation
with downtilt variation

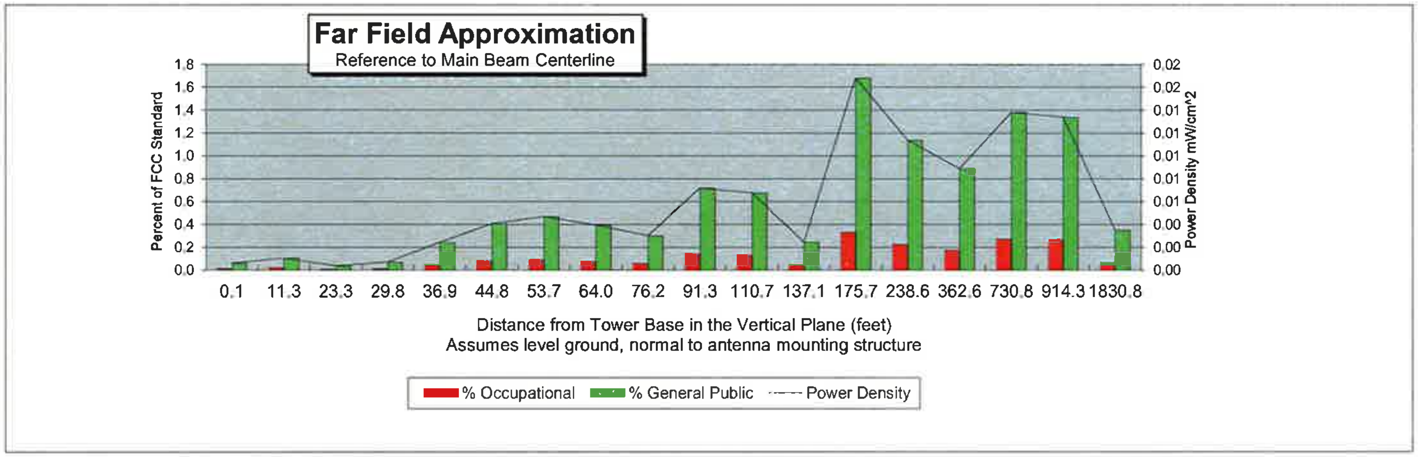
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	New London, CT
Site #:	
Date:	02/17/15
Name:	Ray Paradis
File Name:	New London, CT - FF Power

Operating Freq. (MHz)	2145.0
Antenna Height (ft):	66.9
Antenna Gain (dBi):	16.8
Antenna Size (in.):	74.9
Downtilt (degrees):	0.0
Feedline Loss (dB):	2.0
Power @ J4 (w):	1783.0



Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0
Solve for r, dx to antenna	63.9	64.9	68.0	70.5	73.8	78.0	83.4	90.4	99.5	111.5	127.9	151.3	186.9	247.0	368.2	733.5	916.5	1831.9
Distance from Antenna Structure Base in Horizontal plane	0.1	11.3	23.3	29.8	36.9	44.8	53.7	64.0	76.2	91.3	110.7	137.1	175.7	238.6	362.6	730.8	914.3	1830.8
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.00
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.2	0.2	0.3	0.3	0.1
Percent of General Population Standard	0.1	0.1	0.0	0.1	0.2	0.4	0.5	0.4	0.3	0.7	0.7	0.2	1.7	1.1	0.9	1.4	1.3	0.4

Antenna Type	HBXX-6517DS-A2M
Max%	1.68%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 P
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report and Reinforcement Design

80-ft Existing SSV Lattice Tower

Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: New London

59 Westwood Avenue
New London, CT

Centek Project No. 15001.013

~~Date: February 11, 2015~~
Rev 1: February 17, 2015

STATE OF CONNECTICUT
TIMOTHY J. LYNN
No 29336
LICENSED
PROFESSIONAL ENGINEER

Prepared for:

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

Table of Contents

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 lattice (tower) located in New London, CT.

The host tower is an 80-ft three-legged, tapered steel self-support lattice tower originally designed and manufactured by Utility Tower Company, circa 1987. The manufacturer's original design documents were not available for reference. The tower geometry, structure member sizes and foundation information were obtained from a previous structural analysis and reinforcement design report prepared by Centek Engineering, Inc., Project No. 13001.CO9, dated March 19, 2013.

Antenna and appurtenance inventory were taken from the aforementioned Centek structural report and a Verizon RF data sheet.

The tower consists of three (3) tapered and one (1) straight vertical steel sections consisting of ASTM A53-Gr B (35ksi) pipe legs. Horizontal and diagonal lateral support bracing consists of ASTM A53-Gr B (35ksi) pipe and ASTM A36 steel angle construction. The vertical tower sections are connected by bolted flange plates while the bracing is connected by bolted and welded connections. The tower face width is 2.50-ft at the top and 7.00-ft at the bottom.

Verizon proposes the removal of nine (9) panel antennas and the installation of nine (9) panel antennas, six (6) remote radio heads and one (1) main distribution box to be mounted to three (3) existing universal sector frames. 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:

- VERIZON (EXISTING TO REMAIN)
  Antennas: Three (3) Antel BXA-80063-4CF panel antennas and six (6) RFS FD9R6004/2C-3L Diplexers mounted to three (3) existing 10-ft-6in. universal sector frames with respective RAD center elevations of 67-ft, 72-ft and 77-ft above the tower base.
  Coax Cables: Six (6) 1-5/8" Ø coax cables bundled two (2) at each leg
- VERIZON (EXISTING TO REMOVE)
  Antennas: Three (3) Antel BXA-70063-6CF, three (3) Antel BXA-171063-8BF and three (3) Antel BXA-171063-12CF panel antennas mounted to three (3) existing 10-ft-6in. universal sector frames with respective RAD center elevations of 67-ft, 72-ft and 77-ft above the tower base.
  Coax Cables: Six (6) 1-5/8" Ø coax cables bundled two (2) at each leg

- **VERIZON (PROPOSED):**
  <u>Antennas</u>: Three (3) Andrew HBXX-6517DS panel antennas, three (3) Andrew HBXX-6516DS panel antennas, three (3) Andrew LNX-6514DS panel antennas, three (3) Alcatel-Lucent RRH-2x40-07U remote radio heads, three (3) Alcatel-Lucent RRH-2x60-AWS remote radio heads and one (1) RFS DB-T1-6Z-8AB-0Z main distribution box mounted to three (3) existing 10-ft-6in universal sector frames with respective RAD center elevations of 67-ft, 72-ft and 77-ft above the tower base.
  <u>Coax Cables:</u> One (1) 1-5/8" Ø fiber cable mounted to a leg of the 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 coax cables routed as specified within Section 4 of this report.**
- **All reinforcements per the drawings located in section 4 of this report must be completed prior to the antenna upgrade**

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 of 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:	New London; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	New London; v = 120 mph (3 second gust) equivalent to v = 100 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	Appendix-K wind speed controls.	
Load Cases:	Load Case 1; 100 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 87 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 87 mph wind speed velocity represents 75% of the wind pressure generated by the 100 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*

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[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 **with the proposed reinforcements outlined in the drawings within section 4 of this report were found** to be within allowable limits. In Load Case 1, per tnxtower "Section Capacity Table", this tower was found to be at **94.5%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Leg (T2)	40'-0"-60'-0"	94.5%	**PASS**
Diagonal (T1)	60'-0"-80'-0"	69.3%	**PASS**
Bottom Girt (T2)	40'-0"-60'-0"	28.0%	**PASS**

Foundation and Anchors

The existing foundation system consists of a 14-ft square by 5.0-ft thick concrete mat. The foundation information system was based on the aforementioned Centek structural report and reinforcement design. The existing anchor bolts are embedded within 2-ft square concrete foundation caps and were assumed to conform to ASTM A36.

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

Reactions	Vector	Proposed Base Reactions
Base	Shear	**9 kips**
	Compression	**6 kips**
	Moment	**464 kip-ft**
Leg	Shear	**7 kips**
	Uplift	**73 kips**
	Compression	**78 kips**

- The existing foundation system was found to be within allowable limits.

Foundation	**Design Limit**	**Allowable Limit/FS**	**Proposed Loading**	**Result**
Concrete Mat Foundation	Bearing Pressure	4.0ksf (3)	1.98ksf	**PASS**
	OM(4)	2.0 (2)	2.48(2)	**PASS**

Note 2: Min required Factor of Safety (FS) of 2.0 required per IBC 2003/2005 CSBC Section 3108.4.2.
Note 3: Allowable soil bearing pressure may be increased by 1/3rd for transient load effects.
Note 4: OM denotes Overturning Moment

Conclusion

This analysis shows that the subject tower **with the proposed reinforcements outlined in the drawings within section 4 of this report 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:

TIMOTHY J. LYNN
No. 29336

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 provided 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.

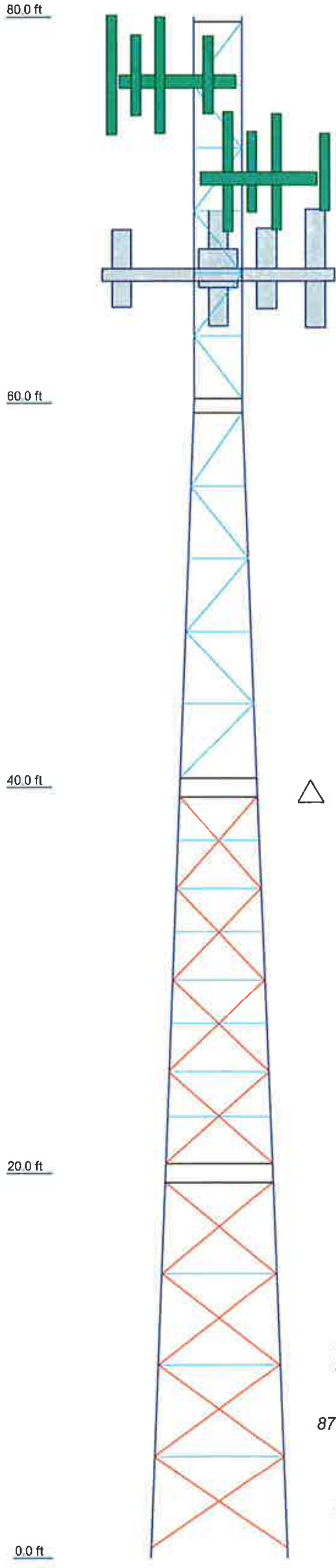
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

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

RISATower Features:

- RISATower 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.
- RISATower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.

Section	T1	T2	T3	T4
Legs	SR 1 1/2	P2.0X0.218 W/ P2.5x0.276 Split Pipe	P2.5X0.203 W/ P3.0x0.300 Split Pipe	P3.0x0.300 w/ P3.5X0.318 Split Pipe
Leg Grade	A572-50	A53-B-35		
Diagonals	SR 1	P1.25x.14	SR 1/2	
Diagonal Grade	A36	A53-B-35	A36	
Top Girts	SR 1	P.75x.154	P1.25x.14	P1.5x.145
Bottom Girts	SR 1	P.75x.154	P1.25x.140	N.A.
Horizontals	SR 1	P.75x.154	P1.25x.140	P1.5x.145
Sec. Horizontals	N.A.		L2x2x1/4	N.A.
Face Width (ft)	2.5	4	5.5	7
# Panels @ (ft)	6 @ 3.25	5 @ 3.8	8 @ 4.75	
Weight (K) 3.7	0.7	0.7	1.1	1.2



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
BXA-80063/4CF (Verizon - Existing)	77	BXA-80063/4CF (Verizon - Existing)	72
(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	77	RRH2x60-AWS (Verizon - Proposed)	72
LNX-6514DS-T4M (Verizon - Proposed)	77	PiROD 10' Lightweight T-Frame (Verizon - Existing)	72
HBXX-6516DS (Verizon - Proposed)	77	BXA-80063/4CF (Verizon - Existing)	67
HBXX-6517DS (Verizon - Proposed)	77	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	67
RRH2x40-07-U (Verizon - Proposed)	77	RRH2x60-AWS (Verizon - Proposed)	67
RRH2x60-AWS (Verizon - Proposed)	77	HBXX-6517DS (Verizon - Proposed)	67
PiROD 10' Lightweight T-Frame (Verizon - Existing)	77	LNX-6514DS-T4M (Verizon - Proposed)	67
LNX-6514DS-T4M (Verizon - Proposed)	72	DB-T1-6Z-8AB-0Z (Verizon - Proposed)	67
HBXX-6516DS (Verizon - Proposed)	72	PiROD 10' Lightweight T-Frame (Verizon - Existing)	67
HBXX-6517DS (Verizon - Proposed)	72	RRH2x40-07-U (Verizon - Proposed)	67
(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	72	HBXX-6516DS (Verizon - Proposed)	67
RRH2x40-07-U (Verizon - Proposed)	72		

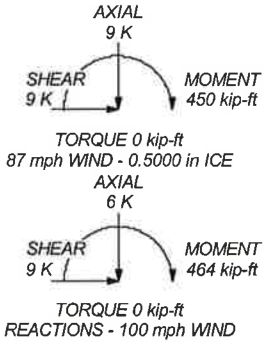
MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A53-B-35	35 ksi	63 ksi
A36	36 ksi	58 ksi			

TOWER DESIGN NOTES

1. Tower designed for a 100 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 87 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 94.5%

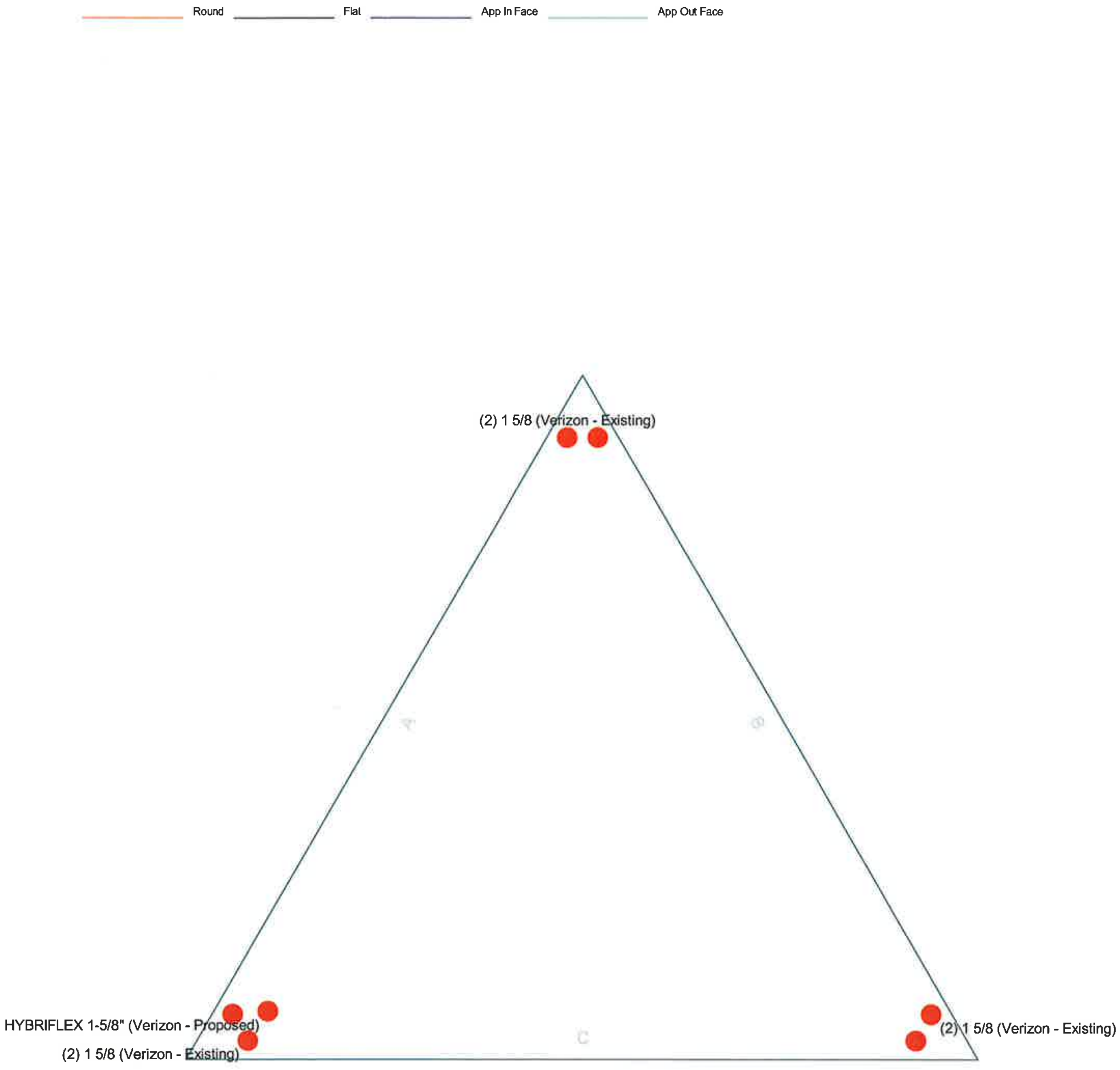
MAX. CORNER REACTIONS AT BASE:
DOWN: 78 K
UPLIFT: -73 K
SHEAR: 7 K



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

Job: **15001.013 - New London**		
Project: **80-ft SSV Lattice Tower - Westwood Ave., New London, CT**		
Client: Verizon Wireless	Drawn by: TJL	App'd:
Code: TIA/EIA-222-F	Date: 02/11/15	Scale: NTS
Path:		Dwg No. E-1

Feedline Plan



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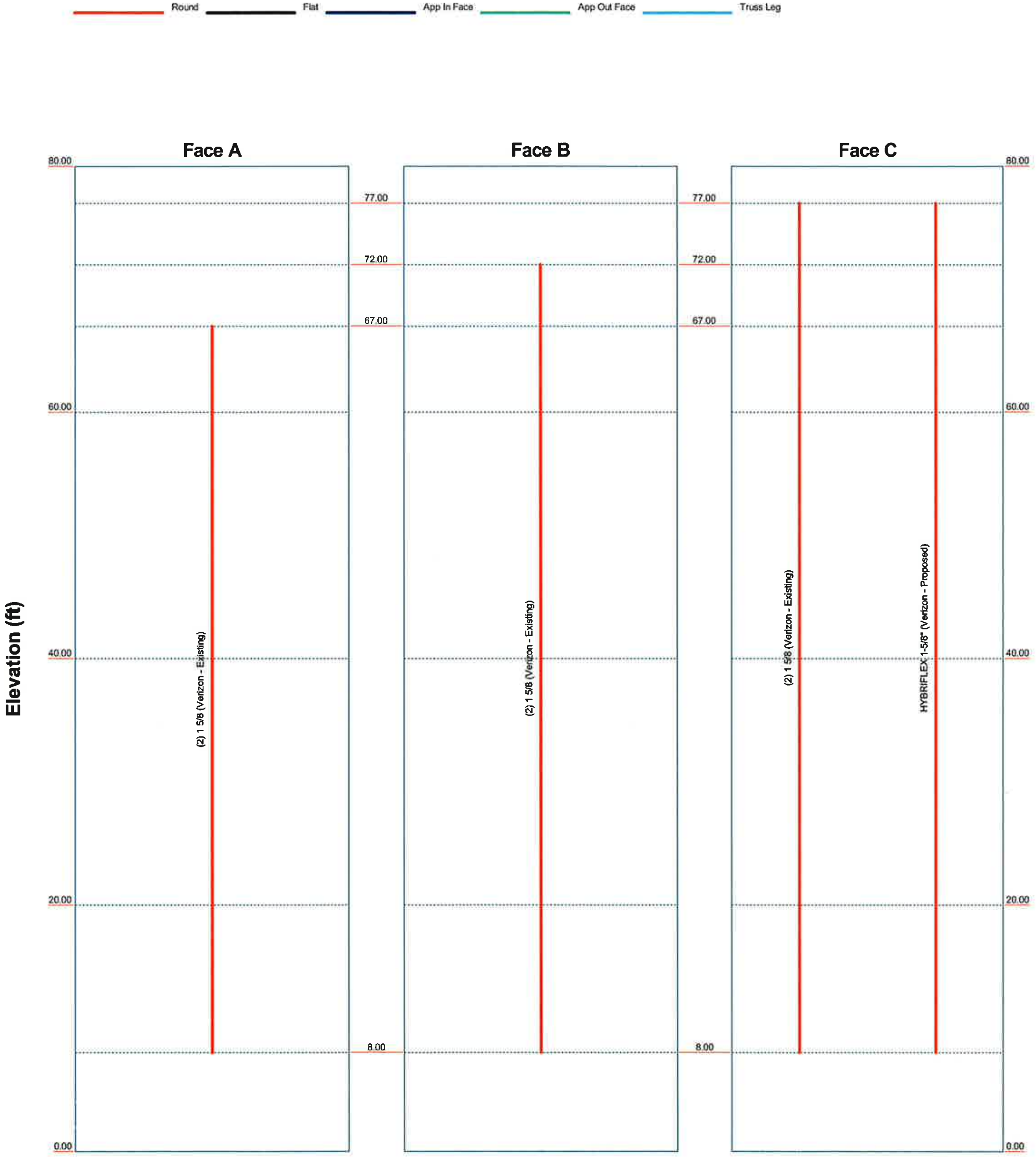
Code: TIA/EIA-222-F
Date: 02/11/15
Scale: NTS
Path:
Dwg No. E-7

Feedline Distribution Chart
0' - 80'



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Drawn by: TJL
App'd:
Code: TIA/EIA-222-F
Date: 02/11/15
Scale: NTS
Path: [illegible]
Dwg No. E-7

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 80.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 2.50 ft at the top and 7.00 ft at the base.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

- Basic wind speed of 100 mph.
- Nominal ice thickness of 0.5000 in.
- Ice density of 56 pcf.
- A wind speed of 87 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 50 mph.
- Weld together tower sections have flange connections..
- Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
- Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
- Welds are fabricated with ER-70S-6 electrodes..
- Tension only take-up is 0.0313 in.
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in tower member design is 1.333.
- Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

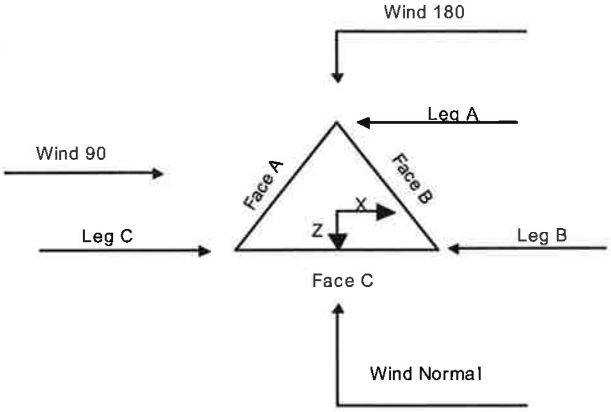
Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
√ Use Code Stress Ratios
√ Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
√ Include Bolts In Member Capacity
Leg Bolts Are At Top Of Section
√ Secondary Horizontal Braces Leg
Use Diamond Inner Bracing (4 Sided)
Add IBC .6D+W Combination

Distribute Leg Loads As Uniform
Assume Legs Pinned
√ Assume Rigid Index Plate
√ Use Clear Spans For Wind Area
√ Use Clear Spans For KL/r
Retension Guys To Initial Tension
Bypass Mast Stability Checks
Use Azimuth Dish Coefficients
√ Project Wind Area of Appurt.
Autocalc Torque Arm Areas
√ SR Members Have Cut Ends
√ Sort Capacity Reports By Component
Triangulate Diamond Inner Bracing

Treat Feedline Bundles As Cylinder
Use ASCE 10 X-Brace Ly Rules
√ Calculate Redundant Bracing Forces
Ignore Redundant Members in FEA
√ SR Leg Bolts Resist Compression
√ All Leg Panels Have Same Allowable
Offset Girt At Foundation
√ Consider Feedline Torque
Include Angle Block Shear Check

Poles

Include Shear-Torsion Interaction
Always Use Sub-Critical Flow
Use Top Mounted Sockets



Triangular Tower

Tower Section Geometry

Tower Section	*Tower Elevation* *ft*	*Assembly Database*	*Description*	*Section Width* *ft*	*Number of Sections*	*Section Length* *ft*
T1	80.00-60.00			2.50	1	20.00
T2	60.00-40.00			2.50	1	20.00
T3	40.00-20.00			4.00	1	20.00
T4	20.00-0.00			5.50	1	20.00

Tower Section Geometry *(cont'd)*

Tower Section	*Tower Elevation* *ft*	*Diagonal Spacing* *ft*	*Bracing Type*	*Has K Brace End Panels*	*Has Horizontals*	*Top Girt Offset* *in*	*Bottom Girt Offset* *in*
T1	80.00-60.00	3.25	K Brace Right	No	Yes	3.0000	3.0000
T2	60.00-40.00	3.80	K Brace Left	No	Yes	6.0000	6.0000
T3	40.00-20.00	4.75	TX Brace	No	Yes	6.0000	6.0000
T4	20.00-0.00	4.75	TX Brace	No	Yes	6.0000	6.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Leg Type*	*Leg Size*	*Leg Grade*	*Diagonal Type*	*Diagonal Size*	*Diagonal Grade*
T1 80.00-60.00	Solid Round	1 1/2	A572-50 (50 ksi)	Solid Round	1	A36 (36 ksi)
T2 60.00-40.00	Arbitrary Shape	P2.0X0.218 W/ P2.5x0.276 Split Pipe	A53-B-35 (35 ksi)	Pipe	P1.25x.14	A53-B-35 (35 ksi)
T3 40.00-20.00	Arbitrary Shape	P2.5X0.203 W/ P3.0x0.300 Split Pipe	A53-B-35 (35 ksi)	Solid Round	1/2	A36 (36 ksi)
T4 20.00-0.00	Arbitrary Shape	P3.0x0.300 w/ P3.5X0.318 Split Pipe	A53-B-35 (35 ksi)	Solid Round	1/2	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Top Girt Type*	*Top Girt Size*	*Top Girt Grade*	*Bottom Girt Type*	*Bottom Girt Size*	*Bottom Girt Grade*
T1 80.00-60.00	Solid Round	1	A36 (36 ksi)	Solid Round	1	A36 (36 ksi)
T2 60.00-40.00	Pipe	P.75x.154	A53-B-35 (35 ksi)	Pipe	P.75x.154	A53-B-35 (35 ksi)
T3 40.00-20.00	Pipe	P1.25x.14	A53-B-35 (35 ksi)	Pipe	P1.25x.140	A53-B-35 (35 ksi)
T4 20.00-0.00	Pipe	P1.5x.145	A53-B-35 (35 ksi)	Pipe		A53-B-35 (35 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*No. of Mid Girts*	*Mid Girt Type*	*Mid Girt Size*	*Mid Girt Grade*	*Horizontal Type*	*Horizontal Size*	*Horizontal Grade*
T1 80.00-60.00	None	Solid Round		A572-50 (50 ksi)	Solid Round	1	A36 (36 ksi)
T2 60.00-40.00	None	Single Angle		A36 (36 ksi)	Pipe	P.75x.154	A53-B-35 (35 ksi)
T3 40.00-20.00	None	Single Angle		A36 (36 ksi)	Pipe	P1.25x.140	A53-B-35 (35 ksi)
T4 20.00-0.00	None	Single Angle		A36 (36 ksi)	Pipe	P1.5x.145	A53-B-35 (35 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Secondary Horizontal Type*	*Secondary Horizontal Size*	*Secondary Horizontal Grade*	*Inner Bracing Type*	*Inner Bracing Size*	*Inner Bracing Grade*
T3 40.00-20.00	Equal Angle	L2x2x1/4	A36 (36 ksi)	Single Angle		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

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*
T1 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T2 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T3 40.00-20.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T4 20.00-0.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000

Tower Section Geometry *(cont'd)*

			K Factors[1]							
Tower Elevation *ft*	*Calc K Single Angles*	*Calc K Solid Rounds*	*Legs*	*X Brace Diags* *X* *Y*	*K Brace Diags* *X* *Y*	*Single Diags* *X* *Y*	*Girts* *X* *Y*	*Horiz.* *X* *Y*	*Sec. Horiz.* *X* *Y*	*Inner Brace* *X* *Y*
T1 80.00-60.00	Yes	Yes	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T2 60.00-40.00	Yes	Yes	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T3 40.00-20.00	Yes	Yes	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T4 20.00-0.00	Yes	Yes	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1

[1] *Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Section Geometry *(cont'd)*

Tower Elevation *ft*	*Leg*		*Diagonal*		*Top Girt*		*Bottom Girt*		*Mid Girt*		*Long Horizontal*		*Short Horizontal*	
	Net Width Deduct in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*
T1 80.00-60.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T2 60.00-40.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T3 40.00-20.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T4 20.00-0.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Leg Connection Type*	*Leg*		*Diagonal*		*Top Girt*		*Bottom Girt*		*Mid Girt*		*Long Horizontal*		*Short Horizontal*	
		Bolt Size in	*No.*	*Bolt Size in*	*No.*	*Bolt Size in*	*No.*	*Bolt Size in*	*No.*	*Bolt Size in*	*No.*	*Bolt Size in*	*No.*	*Bolt Size in*	*No.*
T1 80.00-60.00	Flange	0.6250 A325N	4	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 60.00-40.00	Flange	0.6250 A325N	4	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 40.00-20.00	Flange	0.7500 A325N	4	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 20.00-0.00	Flange	0.7500 A449	0	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	*Face or Leg*	*Allow Shield*	*Component Type*	*Placement ft*	*Face Offset in*	*Lateral Offset (Frac FW)*	*#*	*# Per Row*	*Clear Spacing in*	*Width or Diameter in*	*Perimeter in*	*Weight plf*
1 5/8 (Verizon - Existing)	A	No	Ar (Leg)	67.00 - 8.00	0.0000	0.08	2	1	1.0000	1.9800		1.04
1 5/8 (Verizon - Existing)	B	No	Ar (Leg)	72.00 - 8.00	0.0000	0.08	2	1	1.0000	1.9800		1.04
1 5/8 (Verizon - Existing)	C	No	Ar (Leg)	77.00 - 8.00	0.0000	0.08	2	1	1.0000	1.9800		1.04
HYBRIFLEX 1-5/8" (Verizon - Proposed)	C	No	Ar (Leg)	77.00 - 8.00	0.0000	0.12	1	1	1.9800	1.9800		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*
T1	80.00-60.00	A	6.765	0.000	0.000	0.000	0.01
		B	3.135	0.000	0.000	0.000	0.02
		C	7.590	0.000	0.000	0.000	0.07
T2	60.00-40.00	A	9.900	0.000	0.000	0.000	0.04
		B	6.600	0.000	0.000	0.000	0.04
		C	9.900	0.000	0.000	0.000	0.08
T3	40.00-20.00	A	9.900	0.000	0.000	0.000	0.04
		B	6.600	0.000	0.000	0.000	0.04
		C	9.900	0.000	0.000	0.000	0.08
T4	20.00-0.00	A	5.940	0.000	0.000	0.000	0.02
		B	3.960	0.000	0.000	0.000	0.02
		C	5.940	0.000	0.000	0.000	0.05

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*
T1	80.00-60.00	A	0.500	10.182	0.000	0.000	0.000	0.04
		B		4.718	0.000	0.000	0.000	0.06
		C		11.423	0.000	0.000	0.000	0.14
T2	60.00-40.00	A	0.500	14.900	0.000	0.000	0.000	0.10
		B		9.933	0.000	0.000	0.000	0.10
		C		14.900	0.000	0.000	0.000	0.17
T3	40.00-20.00	A	0.500	14.900	0.000	0.000	0.000	0.10
		B		9.933	0.000	0.000	0.000	0.10
		C		14.900	0.000	0.000	0.000	0.17
T4	20.00-0.00	A	0.500	8.940	0.000	0.000	0.000	0.06
		B		5.960	0.000	0.000	0.000	0.06
		C		8.940	0.000	0.000	0.000	0.10

Feed Line Center of Pressure

Section	*Elevation* *ft*	CP_X *in*	CP_Z *in*	CP_X *Ice* *in*	CP_Z *Ice* *in*
T1	80.00-60.00	-1.0353	0.8875	-0.9283	0.7957
T2	60.00-40.00	-0.7530	0.4347	-0.7818	0.4514
T3	40.00-20.00	-0.8673	0.5008	-0.8502	0.4909
T4	20.00-0.00	-0.7656	0.4420	-0.7531	0.4348

Discrete Tower Loads

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		C_AA_A *Front* ft^2	C_AA_A *Side* ft^2	*Weight* *K*
BXA-80063/4CF (Verizon - Existing)	A	From Leg	2.00 -5.00 0.00	0.0000	67.00	No Ice 1/2" Ice	5.16 5.55	2.25 2.55	0.01 0.04
BXA-80063/4CF (Verizon - Existing)	B	From Leg	2.00 -5.00 0.00	0.0000	72.00	No Ice 1/2" Ice	5.16 5.55	2.25 2.55	0.01 0.04
BXA-80063/4CF (Verizon - Existing)	C	From Leg	2.00 -5.00 0.00	0.0000	77.00	No Ice 1/2" Ice	5.16 5.55	2.25 2.55	0.01 0.04
(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	A	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice 1/2" Ice	0.37 0.45	0.08 0.14	0.00 0.01
(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	B	From Leg	2.00 0.00 0.00	0.0000	72.00	No Ice 1/2" Ice	0.37 0.45	0.08 0.14	0.00 0.01
(2) FD9R6004/2C-3L	C	From Leg	2.00	0.0000	77.00	No Ice	0.37	0.08	0.00

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
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Existing)			0.00						
LNX-6514DS-T4M	A	From Leg	2.00	0.0000	67.00	No Ice	8.41	5.41	0.04
(Verizon - Proposed)			0.00			1/2" Ice	8.96	5.86	0.09
			0.00						
HBXX-6516DS	A	From Leg	2.00	0.0000	67.00	No Ice	5.94	3.28	0.04
(Verizon - Proposed)			2.50			1/2" Ice	6.35	3.61	0.07
			0.00						
HBXX-6517DS	A	From Leg	2.00	0.0000	67.00	No Ice	8.74	5.24	0.05
(Verizon - Proposed)			5.00			1/2" Ice	9.31	5.71	0.10
			0.00						
LNX-6514DS-T4M	B	From Leg	2.00	0.0000	72.00	No Ice	8.41	5.41	0.04
(Verizon - Proposed)			0.00			1/2" Ice	8.96	5.86	0.09
			0.00						
HBXX-6516DS	B	From Leg	2.00	0.0000	72.00	No Ice	5.94	3.28	0.04
(Verizon - Proposed)			2.50			1/2" Ice	6.35	3.61	0.07
			0.00						
HBXX-6517DS	B	From Leg	2.00	0.0000	72.00	No Ice	8.74	5.24	0.05
(Verizon - Proposed)			5.00			1/2" Ice	9.31	5.71	0.10
			0.00						
LNX-6514DS-T4M	C	From Leg	2.00	0.0000	77.00	No Ice	8.41	5.41	0.04
(Verizon - Proposed)			0.00			1/2" Ice	8.96	5.86	0.09
			0.00						
HBXX-6516DS	C	From Leg	2.00	0.0000	77.00	No Ice	5.94	3.28	0.04
(Verizon - Proposed)			2.50			1/2" Ice	6.35	3.61	0.07
			0.00						
HBXX-6517DS	C	From Leg	2.00	0.0000	77.00	No Ice	8.74	5.24	0.05
(Verizon - Proposed)			5.00			1/2" Ice	9.31	5.71	0.10
			0.00						
RRH2x40-07-U	A	From Leg	2.00	0.0000	67.00	No Ice	0.00	1.23	0.05
(Verizon - Proposed)			0.00			1/2" Ice	0.00	1.39	0.07
			0.00						
RRH2x40-07-U	B	From Leg	2.00	0.0000	72.00	No Ice	0.00	1.23	0.05
(Verizon - Proposed)			0.00			1/2" Ice	0.00	1.39	0.07
			0.00						
RRH2x40-07-U	C	From Leg	2.00	0.0000	77.00	No Ice	0.00	1.23	0.05
(Verizon - Proposed)			0.00			1/2" Ice	0.00	1.39	0.07
			0.00						
RRH2x60-AWS	A	From Leg	2.00	0.0000	67.00	No Ice	0.00	1.43	0.05
(Verizon - Proposed)			0.00			1/2" Ice	0.00	1.61	0.07
			0.00						
RRH2x60-AWS	B	From Leg	2.00	0.0000	72.00	No Ice	0.00	1.43	0.05
(Verizon - Proposed)			0.00			1/2" Ice	0.00	1.61	0.07
			0.00						
RRH2x60-AWS	C	From Leg	2.00	0.0000	77.00	No Ice	0.00	1.43	0.05
(Verizon - Proposed)			0.00			1/2" Ice	0.00	1.61	0.07
			0.00						
DB-T1-6Z-8AB-0Z	A	From Leg	2.00	0.0000	67.00	No Ice	5.60	2.33	0.04
(Verizon - Proposed)			0.00			1/2" Ice	5.92	2.56	0.08
			0.00						
PiROD 10' Lightweight	A	From Leg	1.00	0.0000	67.00	No Ice	9.30	9.30	0.25
T-Frame			0.00			1/2" Ice	14.50	14.50	0.34
(Verizon - Existing)			0.00						
PiROD 10' Lightweight	B	From Leg	1.00	0.0000	72.00	No Ice	9.30	9.30	0.25
T-Frame			0.00			1/2" Ice	14.50	14.50	0.34
(Verizon - Existing)			0.00						
PiROD 10' Lightweight	C	From Leg	1.00	0.0000	77.00	No Ice	9.30	9.30	0.25

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft ft ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		C_AA_A *Front* *ft²*	C_AA_A *Side* *ft²*	*Weight* *K*
T-Frame (Verizon - Existing)			0.00 0.00			1/2" Ice	14.50	14.50	0.34

Tower Pressures - No Ice

$G_H = 1.179$

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*
T1 80.00-60.00	70.00	1.24	32	52.500	A	0.000	15.098	5.000	33.12	0.000	0.000
					B	0.000	11.468		43.60	0.000	0.000
					C	0.000	15.923		31.40	0.000	0.000
T2 60.00-40.00	50.00	1.126	29	69.152	A	8.926	14.740	8.926	37.72	0.000	0.000
					B	8.926	11.440		43.83	0.000	0.000
					C	8.926	14.740		37.72	0.000	0.000
T3 40.00-20.00	30.00	1	26	100.854	A	2.968	26.765	11.678	39.28	0.000	0.000
					B	2.968	23.465		44.18	0.000	0.000
					C	2.968	26.765		39.28	0.000	0.000
T4 20.00-0.00	10.00	1	26	130.837	A	0.000	25.039	12.942	51.69	0.000	0.000
					B	0.000	23.059		56.13	0.000	0.000
					C	0.000	25.039		51.69	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.179$

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*
T1 80.00-60.00	70.00	1.24	24	0.5000	54.167	A	0.000	25.181	8.333	33.09	0.000	0.000
						B	0.000	19.718		42.26	0.000	0.000
						C	0.000	26.423		31.54	0.000	0.000
T2 60.00-40.00	50.00	1.126	22	0.5000	70.820	A	11.151	23.214	11.151	32.45	0.000	0.000
						B	11.151	18.247		37.93	0.000	0.000
						C	11.151	23.214		32.45	0.000	0.000
T3 40.00-20.00	30.00	1	19	0.5000	102.521	A	2.968	42.649	15.014	32.91	0.000	0.000
						B	2.968	37.683		36.93	0.000	0.000
						C	2.968	42.649		32.91	0.000	0.000
T4 20.00-0.00	10.00	1	19	0.5000	132.505	A	0.000	38.294	16.279	42.51	0.000	0.000
						B	0.000	35.314		46.10	0.000	0.000
						C	0.000	38.294		42.51	0.000	0.000

Tower Pressure - Service

$G_H = 1.179$

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
T1 80.00-60.00	70.00	1.24	8	52.500	A	0.000	15.098	5.000	33.12	0.000	0.000
					B	0.000	11.468		43.60	0.000	0.000
					C	0.000	15.923		31.40	0.000	0.000
T2 60.00-40.00	50.00	1.126	7	69.152	A	8.926	14.740	8.926	37.72	0.000	0.000
					B	8.926	11.440		43.83	0.000	0.000
					C	8.926	14.740		37.72	0.000	0.000
T3 40.00-20.00	30.00	1	6	100.854	A	2.968	26.765	11.678	39.28	0.000	0.000
					B	2.968	23.465		44.18	0.000	0.000
					C	2.968	26.765		39.28	0.000	0.000
T4 20.00-0.00	10.00	1	6	130.837	A	0.000	25.039	12.942	51.69	0.000	0.000
					B	0.000	23.059		56.13	0.000	0.000
					C	0.000	25.039		51.69	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
T1 80.00-60.00	0.11	0.70	A	0.288	2.33	0.612	1	1	9.243	0.84	42.02	C
			B	0.218	2.536	0.594	1	1	6.816			
			C	0.303	2.287	0.617	1	1	9.823			
T2 60.00-40.00	0.16	0.72	A	0.342	2.19	0.63	1	1	18.208	1.35	67.74	C
			B	0.295	2.311	0.614	1	1	15.953			
			C	0.342	2.19	0.63	1	1	18.208			
T3 40.00-20.00	0.16	1.11	A	0.295	2.31	0.614	1	1	19.410	1.35	67.64	C
			B	0.262	2.402	0.605	1	1	17.165			
			C	0.295	2.31	0.614	1	1	19.410			
T4 20.00-0.00	0.10	1.19	A	0.191	2.625	0.589	1	1	14.740	1.17	58.38	C
			B	0.176	2.677	0.586	1	1	13.509			
			C	0.191	2.625	0.589	1	1	14.740			
Sum Weight:	0.53	3.72						OTM	178.83 kip-ft	4.72		

Tower Forces - No Ice - Wind 45 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
T1 80.00-60.00	0.11	0.70	A	0.288	2.33	0.612	0.825	1	9.243	0.84	42.02	C
			B	0.218	2.536	0.594	0.825	1	6.816			
			C	0.303	2.287	0.617	0.825	1	9.823			
T2 60.00-40.00	0.16	0.72	A	0.342	2.19	0.63	0.825	1	16.646	1.24	61.93	C
			B	0.295	2.311	0.614	0.825	1	14.391			
			C	0.342	2.19	0.63	0.825	1	16.646			

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*
T3 40.00-20.00	0.16	1.11	A	0.295	2.31	0.614	0.825	1	18.891	1.32	65.83	C
			B	0.262	2.402	0.605	0.825	1	16.645			
			C	0.295	2.31	0.614	0.825	1	18.891			
T4 20.00-0.00	0.10	1.19	A	0.191	2.625	0.589	0.825	1	14.740	1.17	58.38	C
			B	0.176	2.677	0.586	0.825	1	13.509			
			C	0.191	2.625	0.589	0.825	1	14.740			
Sum Weight:	0.53	3.72						OTM	171.94 kip-ft	4.56		

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*
T1 80.00-60.00	0.11	0.70	A	0.288	2.33	0.612	0.8	1	9.243	0.84	42.02	C
			B	0.218	2.536	0.594	0.8	1	6.816			
			C	0.303	2.287	0.617	0.8	1	9.823			
T2 60.00-40.00	0.16	0.72	A	0.342	2.19	0.63	0.8	1	16.423	1.22	61.10	C
			B	0.295	2.311	0.614	0.8	1	14.168			
			C	0.342	2.19	0.63	0.8	1	16.423			
T3 40.00-20.00	0.16	1.11	A	0.295	2.31	0.614	0.8	1	18.816	1.31	65.58	C
			B	0.262	2.402	0.605	0.8	1	16.571			
			C	0.295	2.31	0.614	0.8	1	18.816			
T4 20.00-0.00	0.10	1.19	A	0.191	2.625	0.589	0.8	1	14.740	1.17	58.38	C
			B	0.176	2.677	0.586	0.8	1	13.509			
			C	0.191	2.625	0.589	0.8	1	14.740			
Sum Weight:	0.53	3.72						OTM	170.95 kip-ft	4.54		

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*
T1 80.00-60.00	0.11	0.70	A	0.288	2.33	0.612	0.85	1	9.243	0.84	42.02	C
			B	0.218	2.536	0.594	0.85	1	6.816			
			C	0.303	2.287	0.617	0.85	1	9.823			
T2 60.00-40.00	0.16	0.72	A	0.342	2.19	0.63	0.85	1	16.869	1.26	62.76	C
			B	0.295	2.311	0.614	0.85	1	14.614			
			C	0.342	2.19	0.63	0.85	1	16.869			
T3 40.00-20.00	0.16	1.11	A	0.295	2.31	0.614	0.85	1	18.965	1.32	66.09	C
			B	0.262	2.402	0.605	0.85	1	16.719			
			C	0.295	2.31	0.614	0.85	1	18.965			
T4 20.00-0.00	0.10	1.19	A	0.191	2.625	0.589	0.85	1	14.740	1.17	58.38	C
			B	0.176	2.677	0.586	0.85	1	13.509			
			C	0.191	2.625	0.589	0.85	1	14.740			
Sum Weight:	0.53	3.72						OTM	172.92 kip-ft	4.59		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
T1 80.00-60.00	0.24	0.89	A	0.465	1.95	0.68	1	1	17.129	0.98	49.11	C
			B	0.364	2.14	0.638	1	1	12.572			
			C	0.488	1.916	0.691	1	1	18.268			
T2 60.00-40.00	0.37	1.11	A	0.485	1.92	0.69	1	1	27.170	1.33	66.47	C
			B	0.415	2.035	0.658	1	1	23.155			
			C	0.485	1.92	0.69	1	1	27.170			
T3 40.00-20.00	0.37	1.63	A	0.445	1.982	0.671	1	1	31.584	1.42	70.83	C
			B	0.397	2.071	0.65	1	1	27.468			
			C	0.445	1.982	0.671	1	1	31.584			
T4 20.00-0.00	0.22	1.74	A	0.289	2.326	0.613	1	1	23.458	1.23	61.73	C
			B	0.267	2.389	0.606	1	1	21.408			
			C	0.289	2.326	0.613	1	1	23.458			
Sum Weight:	1.22	5.37						OTM	190.06 kip-ft	4.96		

Tower Forces - With Ice - Wind 45 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*
T1 80.00-60.00	0.24	0.89	A	0.465	1.95	0.68	0.825	1	17.129	0.98	49.11	C
			B	0.364	2.14	0.638	0.825	1	12.572			
			C	0.488	1.916	0.691	0.825	1	18.268			
T2 60.00-40.00	0.37	1.11	A	0.485	1.92	0.69	0.825	1	25.219	1.23	61.69	C
			B	0.415	2.035	0.658	0.825	1	21.204			
			C	0.485	1.92	0.69	0.825	1	25.219			
T3 40.00-20.00	0.37	1.63	A	0.445	1.982	0.671	0.825	1	31.065	1.39	69.67	C
			B	0.397	2.071	0.65	0.825	1	26.949			
			C	0.445	1.982	0.671	0.825	1	31.065			
T4 20.00-0.00	0.22	1.74	A	0.289	2.326	0.613	0.825	1	23.458	1.23	61.73	C
			B	0.267	2.389	0.606	0.825	1	21.408			
			C	0.289	2.326	0.613	0.825	1	23.458			
Sum Weight:	1.22	5.37						OTM	184.59 kip-ft	4.84		

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 ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
T1 80.00-60.00	0.24	0.89	A	0.465	1.95	0.68	0.8	1	17.129	0.98	49.11	C
			B	0.364	2.14	0.638	0.8	1	12.572			
			C	0.488	1.916	0.691	0.8	1	18.268			
T2	0.37	1.11	A	0.485	1.92	0.69	0.8	1	24.940	1.22	61.01	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*
60.00-40.00			B	0.415	2.035	0.658	0.8	1	20.925			
			C	0.485	1.92	0.69	0.8	1	24.940			
T3	0.37	1.63	A	0.445	1.982	0.671	0.8	1	30.991	1.39	69.50	C
40.00-20.00			B	0.397	2.071	0.65	0.8	1	26.875			
			C	0.445	1.982	0.671	0.8	1	30.991			
T4 20.00-0.00	0.22	1.74	A	0.289	2.326	0.613	0.8	1	23.458	1.23	61.73	C
			B	0.267	2.389	0.606	0.8	1	21.408			
			C	0.289	2.326	0.613	0.8	1	23.458			
Sum Weight:	1.22	5.37						OTM	183.81 kip-ft	4.83		

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 ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
T1	0.24	0.89	A	0.465	1.95	0.68	0.85	1	17.129	0.98	49.11	C
80.00-60.00			B	0.364	2.14	0.638	0.85	1	12.572			
			C	0.488	1.916	0.691	0.85	1	18.268			
T2	0.37	1.11	A	0.485	1.92	0.69	0.85	1	25.498	1.25	62.38	C
60.00-40.00			B	0.415	2.035	0.658	0.85	1	21.483			
			C	0.485	1.92	0.69	0.85	1	25.498			
T3	0.37	1.63	A	0.445	1.982	0.671	0.85	1	31.139	1.40	69.83	C
40.00-20.00			B	0.397	2.071	0.65	0.85	1	27.023			
			C	0.445	1.982	0.671	0.85	1	31.139			
T4 20.00-0.00	0.22	1.74	A	0.289	2.326	0.613	0.85	1	23.458	1.23	61.73	C
			B	0.267	2.389	0.606	0.85	1	21.408			
			C	0.289	2.326	0.613	0.85	1	23.458			
Sum Weight:	1.22	5.37						OTM	185.37 kip-ft	4.86		

Tower Forces - Service - Wind Normal To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
T1	0.11	0.70	A	0.288	2.33	0.612	1	1	9.243	0.21	10.51	C
80.00-60.00			B	0.218	2.536	0.594	1	1	6.816			
			C	0.303	2.287	0.617	1	1	9.823			
T2	0.16	0.72	A	0.342	2.19	0.63	1	1	18.208	0.34	16.93	C
60.00-40.00			B	0.295	2.311	0.614	1	1	15.953			
			C	0.342	2.19	0.63	1	1	18.208			
T3	0.16	1.11	A	0.295	2.31	0.614	1	1	19.410	0.34	16.91	C
40.00-20.00			B	0.262	2.402	0.605	1	1	17.165			
			C	0.295	2.31	0.614	1	1	19.410			
T4 20.00-0.00	0.10	1.19	A	0.191	2.625	0.589	1	1	14.740	0.29	14.59	C
			B	0.176	2.677	0.586	1	1	13.509			
			C	0.191	2.625	0.589	1	1	14.740			
Sum Weight:	0.53	3.72						OTM	44.71	1.18		

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*
									kip-ft			

Tower Forces - Service - Wind 45 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*
T1	0.11	0.70	A	0.288	2.33	0.612	0.825	1	9.243	0.21	10.51	C
80.00-60.00			B	0.218	2.536	0.594	0.825	1	6.816			
			C	0.303	2.287	0.617	0.825	1	9.823			
T2	0.16	0.72	A	0.342	2.19	0.63	0.825	1	16.646	0.31	15.48	C
60.00-40.00			B	0.295	2.311	0.614	0.825	1	14.391			
			C	0.342	2.19	0.63	0.825	1	16.646			
T3	0.16	1.11	A	0.295	2.31	0.614	0.825	1	18.891	0.33	16.46	C
40.00-20.00			B	0.262	2.402	0.605	0.825	1	16.645			
			C	0.295	2.31	0.614	0.825	1	18.891			
T4 20.00-0.00	0.10	1.19	A	0.191	2.625	0.589	0.825	1	14.740	0.29	14.59	C
			B	0.176	2.677	0.586	0.825	1	13.509			
			C	0.191	2.625	0.589	0.825	1	14.740			
Sum Weight:	0.53	3.72						OTM	42.98 kip-ft	1.14		

Tower Forces - Service - Wind 60 To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
T1	0.11	0.70	A	0.288	2.33	0.612	0.8	1	9.243	0.21	10.51	C
80.00-60.00			B	0.218	2.536	0.594	0.8	1	6.816			
			C	0.303	2.287	0.617	0.8	1	9.823			
T2	0.16	0.72	A	0.342	2.19	0.63	0.8	1	16.423	0.31	15.27	C
60.00-40.00			B	0.295	2.311	0.614	0.8	1	14.168			
			C	0.342	2.19	0.63	0.8	1	16.423			
T3	0.16	1.11	A	0.295	2.31	0.614	0.8	1	18.816	0.33	16.39	C
40.00-20.00			B	0.262	2.402	0.605	0.8	1	16.571			
			C	0.295	2.31	0.614	0.8	1	18.816			
T4 20.00-0.00	0.10	1.19	A	0.191	2.625	0.589	0.8	1	14.740	0.29	14.59	C
			B	0.176	2.677	0.586	0.8	1	13.509			
			C	0.191	2.625	0.589	0.8	1	14.740			
Sum Weight:	0.53	3.72						OTM	42.74 kip-ft	1.14		

Tower Forces - Service - Wind 90 To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
T1 80.00-60.00	0.11	0.70	A	0.288	2.33	0.612	0.85	1	9.243	0.21	10.51	C
			B	0.218	2.536	0.594	0.85	1	6.816			
			C	0.303	2.287	0.617	0.85	1	9.823			
T2 60.00-40.00	0.16	0.72	A	0.342	2.19	0.63	0.85	1	16.869	0.31	15.69	C
			B	0.295	2.311	0.614	0.85	1	14.614			
			C	0.342	2.19	0.63	0.85	1	16.869			
T3 40.00-20.00	0.16	1.11	A	0.295	2.31	0.614	0.85	1	18.965	0.33	16.52	C
			B	0.262	2.402	0.605	0.85	1	16.719			
			C	0.295	2.31	0.614	0.85	1	18.965			
T4 20.00-0.00	0.10	1.19	A	0.191	2.625	0.589	0.85	1	14.740	0.29	14.59	C
			B	0.176	2.677	0.586	0.85	1	13.509			
			C	0.191	2.625	0.589	0.85	1	14.740			
Sum Weight:	0.53	3.72						OTM	43.23 kip-ft	1.15		

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	2.35					
Bracing Weight	1.37					
Total Member Self-Weight	3.72			0.00	0.22	
Total Weight	5.79			0.00	0.22	
Wind 0 deg - No Ice		0.00	-8.68	-462.23	-0.84	-0.42
Wind 30 deg - No Ice		4.22	-7.41	-395.71	-226.62	-0.36
Wind 45 deg - No Ice		5.96	-6.03	-322.71	-319.34	-0.30
Wind 60 deg - No Ice		7.27	-4.26	-228.09	-389.91	-0.22
Wind 90 deg - No Ice		8.44	-0.00	-1.06	-451.63	-0.01
Wind 120 deg - No Ice		7.42	4.34	230.20	-395.68	0.21
Wind 135 deg - No Ice		5.95	6.03	321.22	-317.84	0.28
Wind 150 deg - No Ice		4.22	7.40	394.65	-224.79	0.35
Wind 180 deg - No Ice		-0.00	8.51	454.34	1.27	0.41
Wind 210 deg - No Ice		-4.22	7.41	395.71	227.06	0.36
Wind 225 deg - No Ice		-5.96	6.03	322.71	319.77	0.30
Wind 240 deg - No Ice		-7.43	4.34	232.03	397.18	0.22
Wind 270 deg - No Ice		-8.44	0.00	1.06	452.06	0.01
Wind 300 deg - No Ice		-7.27	-4.25	-226.26	389.29	-0.19
Wind 315 deg - No Ice		-5.95	-6.03	-321.22	318.28	-0.28
Wind 330 deg - No Ice		-4.22	-7.40	-394.65	225.22	-0.35
Member Ice	1.64					
Total Weight Ice	9.02			-0.01	0.40	
Wind 0 deg - Ice		0.00	-8.56	-447.45	-0.40	-0.42
Wind 30 deg - Ice		4.19	-7.33	-383.84	-219.92	-0.34
Wind 45 deg - Ice		5.91	-5.97	-313.09	-310.21	-0.26
Wind 60 deg - Ice		7.22	-4.21	-221.30	-379.05	-0.17
Wind 90 deg - Ice		8.37	-0.00	-0.81	-438.85	0.04
Wind 120 deg - Ice		7.34	4.28	223.01	-383.66	0.25
Wind 135 deg - Ice		5.91	5.97	311.93	-309.08	0.32
Wind 150 deg - Ice		4.18	7.32	383.01	-218.53	0.38
Wind 180 deg - Ice		-0.00	8.42	441.16	1.20	0.41
Wind 210 deg - Ice		-4.19	7.33	383.81	220.71	0.34
Wind 225 deg - Ice		-5.91	5.97	313.06	311.00	0.26
Wind 240 deg - Ice		-7.34	4.28	224.39	385.26	0.17
Wind 270 deg - Ice		-8.37	0.00	0.79	439.64	-0.04

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 300 deg - Ice		-7.22	-4.21	-219.91	379.04	-0.24
Wind 315 deg - Ice		-5.91	-5.97	-311.96	309.87	-0.32
Wind 330 deg - Ice		-4.18	-7.32	-383.04	219.33	-0.38
Total Weight	5.79			0.00	0.22	
Wind 0 deg - Service		0.00	-2.17	-115.69	-0.26	-0.11
Wind 30 deg - Service		1.06	-1.85	-99.06	-56.71	-0.09
Wind 45 deg - Service		1.49	-1.51	-80.82	-79.89	-0.08
Wind 60 deg - Service		1.82	-1.06	-57.16	-97.53	-0.05
Wind 90 deg - Service		2.11	-0.00	-0.40	-112.96	-0.00
Wind 120 deg - Service		1.86	1.08	57.41	-98.98	0.05
Wind 135 deg - Service		1.49	1.51	80.17	-79.51	0.07
Wind 150 deg - Service		1.05	1.85	98.53	-56.25	0.09
Wind 180 deg - Service		-0.00	2.13	113.45	0.26	0.10
Wind 210 deg - Service		-1.06	1.85	98.79	56.71	0.09
Wind 225 deg - Service		-1.49	1.51	80.54	79.89	0.08
Wind 240 deg - Service		-1.86	1.09	57.87	99.24	0.05
Wind 270 deg - Service		-2.11	0.00	0.13	112.96	0.00
Wind 300 deg - Service		-1.82	-1.06	-56.70	97.27	-0.05
Wind 315 deg - Service		-1.49	-1.51	-80.44	79.51	-0.07
Wind 330 deg - Service		-1.05	-1.85	-98.80	56.25	-0.09

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 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp

Comb. No.	Description
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	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
T1	80 - 60	Leg	Max Tension	5	25.04	0.14	-0.13
			Max. Compression	13	-26.53	0.27	-0.15
			Max. Mx	6	-5.64	0.43	0.12
			Max. My	3	-0.86	-0.15	-0.51
			Max. Vy	6	1.86	-0.27	-0.10
			Max. Vx	2	-1.98	-0.03	0.30
		Diagonal	Max Tension	14	6.33	0.00	0.00
			Max. Compression	6	-6.32	0.00	0.00
			Max. Mx	31	2.01	0.00	0.00
			Max. My	24	0.18	0.00	-0.00
			Max. Vy	31	-0.00	0.00	0.00
			Max. Vx	24	0.00	0.00	0.00
		Horizontal	Max Tension	10	1.33	0.00	0.00
			Max. Compression	2	-1.33	0.00	0.00
			Max. Mx	18	0.02	0.00	0.00
			Max. My	26	0.38	0.00	-0.00
			Max. Vy	18	-0.00	0.00	0.00
			Max. Vx	26	0.00	0.00	0.00
		Top Girt	Max Tension	16	0.15	0.00	0.00
			Max. Compression	8	-0.15	0.00	0.00
			Max. Mx	22	-0.03	0.00	0.00
			Max. My	26	-0.00	0.00	-0.00
			Max. Vy	22	-0.00	0.00	0.00
			Max. Vx	26	0.00	0.00	0.00
		Bottom Girt	Max Tension	12	1.66	0.00	0.00
			Max. Compression	4	-1.57	0.00	0.00
			Max. Mx	32	0.49	0.00	0.00
			Max. My	29	1.58	0.00	0.00
			Max. Vy	32	-0.00	0.00	0.00
			Max. Vx	29	-0.00	0.00	0.00
T2	60 - 40	Leg	Max Tension	5	46.14	0.26	0.08
			Max. Compression	13	-48.67	0.25	-0.05
			Max. Mx	2	-28.53	0.73	-0.02
			Max. My	17	0.94	-0.12	0.82

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	2	-1.25	0.26	-0.05
			Max. Vx	9	1.30	0.11	-0.81
		Diagonal	Max Tension	11	4.58	0.00	0.00
			Max. Compression	3	-4.55	0.00	0.00
			Max. Mx	28	3.19	0.01	0.00
			Max. My	30	0.20	0.00	-0.00
			Max. Vy	28	-0.01	0.00	0.00
			Max. Vx	30	0.00	0.00	0.00
		Horizontal	Max Tension	13	0.84	0.00	0.00
			Max. Compression	13	-0.84	0.00	0.00
			Max. Mx	18	0.03	0.00	0.00
			Max. My	28	0.71	0.00	0.00
			Max. Vy	18	-0.00	0.00	0.00
			Max. Vx	28	-0.00	0.00	0.00
		Top Girt	Max Tension	16	1.48	0.00	0.00
			Max. Compression	13	-1.61	0.00	0.00
			Max. Mx	18	-0.01	0.00	0.00
			Max. My	28	-1.26	0.00	0.00
			Max. Vy	18	-0.00	0.00	0.00
			Max. Vx	28	-0.00	0.00	0.00
		Bottom Girt	Max Tension	2	1.10	0.00	0.00
			Max. Compression	10	-1.23	0.00	0.00
			Max. Mx	18	-0.10	0.00	0.00
			Max. My	19	-0.50	0.00	-0.00
			Max. Vy	18	-0.00	0.00	0.00
			Max. Vx	19	0.00	0.00	0.00
T3	40 - 20	Leg	Max Tension	10	60.85	0.46	0.01
			Max. Compression	2	-64.75	0.28	0.01
			Max. Mx	2	-53.13	0.88	0.04
			Max. My	9	-4.23	0.01	-0.74
			Max. Vy	10	1.37	-0.22	-0.00
			Max. Vx	9	1.04	0.01	-0.74
		Diagonal	Max Tension	4	3.90	0.00	0.00
		Horizontal	Max Tension	2	1.12	0.00	0.00
			Max. Compression	2	-3.36	0.00	0.00
			Max. Mx	18	0.08	0.01	0.00
			Max. My	19	1.10	0.00	-0.00
			Max. Vy	18	-0.01	0.00	0.00
			Max. Vx	19	-0.00	0.00	0.00
		Secondary Horizontal	Max Tension	2	1.12	0.00	0.00
			Max. Compression	2	-1.12	0.00	0.00
			Max. Mx	18	0.08	-0.02	0.00
			Max. My	19	1.10	0.00	0.00
			Max. Vy	18	0.01	0.00	0.00
			Max. Vx	19	0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	13	-1.46	0.00	0.00
			Max. Mx	18	-1.18	0.01	0.00
			Max. My	19	-1.13	0.00	0.00
			Max. Vy	18	0.01	0.00	0.00
			Max. Vx	19	0.00	0.00	0.00
		Bottom Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-1.98	0.00	0.00
			Max. Mx	18	-1.10	0.01	0.00
			Max. Vy	18	-0.01	0.00	0.00
T4	20 - 0	Leg	Max Tension	10	73.52	1.73	0.02
			Max. Compression	2	-78.51	-0.00	0.00
			Max. Mx	27	70.40	1.97	0.01
			Max. My	9	-1.84	-0.02	-0.81
			Max. Vy	27	3.93	-0.00	0.00

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Force K*	*Major Axis Moment kip-ft*	*Minor Axis Moment kip-ft*
			Max. Vx	26	0.97	-0.03	-0.81
		Diagonal	Max Tension	20	3.49	0.00	0.00
		Horizontal	Max Tension	2	1.36	0.00	0.00
			Max. Compression	19	-3.31	0.00	0.00
			Max. Mx	18	0.09	0.02	0.00
			Max. Vy	18	0.01	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-1.61	0.00	0.00
			Max. Mx	18	-1.37	0.02	0.00
			Max. Vy	18	0.01	0.00	0.00

Maximum Reactions

Location	*Condition*	*Gov. Load Comb.*	*Vertical K*	*Horizontal, X K*	*Horizontal, Z K*
Leg C	Max. Vert	13	78.07	2.87	-1.65
	Max. H_x	13	78.07	2.87	-1.65
	Max. H_z	21	-67.48	-6.04	3.66
	Min. Vert	5	-72.84	-5.89	3.43
	Min. H_x	22	-69.76	-6.25	3.63
	Min. H_z	13	78.07	2.87	-1.65
Leg B	Max. Vert	7	77.70	-2.85	-1.65
	Max. H_x	32	-69.64	6.26	3.59
	Max. H_z	33	-67.34	6.06	3.61
	Min. Vert	15	-72.60	5.90	3.39
	Min. H_x	7	77.70	-2.85	-1.65
	Min. H_z	7	77.70	-2.85	-1.65
Leg A	Max. Vert	2	78.44	0.00	3.32
	Max. H_x	13	-36.48	0.55	-4.44
	Max. H_z	2	78.44	0.00	3.32
	Min. Vert	10	-73.28	0.05	-6.88
	Min. H_x	7	-36.17	-0.50	-4.40
	Min. H_z	27	-70.13	0.03	-7.26

Tower Mast Reaction Summary

Load Combination	*Vertical K*	*Shear$_x$ K*	*Shear$_z$ K*	*Overturning Moment, M_x kip-ft*	*Overturning Moment, M_z kip-ft*	*Torque kip-ft*
Dead Only	5.79	0.00	0.00	0.00	0.22	0.00
Dead+Wind 0 deg - No Ice	5.79	0.00	-8.68	-463.81	-0.84	-0.42
Dead+Wind 30 deg - No Ice	5.79	4.22	-7.41	-397.07	-227.40	-0.37
Dead+Wind 45 deg - No Ice	5.79	5.96	-6.03	-323.83	-320.43	-0.30
Dead+Wind 60 deg - No Ice	5.79	7.27	-4.26	-228.88	-391.26	-0.22
Dead+Wind 90 deg - No Ice	5.79	8.44	-0.00	-1.07	-453.19	-0.01
Dead+Wind 120 deg - No Ice	5.79	7.42	4.34	230.98	-397.05	0.20
Dead+Wind 135 deg - No Ice	5.79	5.95	6.03	322.32	-318.94	0.28
Dead+Wind 150 deg - No Ice	5.79	4.22	7.40	396.01	-225.56	0.35
Dead+Wind 180 deg - No Ice	5.79	-0.00	8.51	455.90	1.29	0.41
Dead+Wind 210 deg - No Ice	5.79	-4.22	7.41	397.06	227.85	0.37
Dead+Wind 225 deg - No Ice	5.79	-5.96	6.03	323.82	320.88	0.30
Dead+Wind 240 deg - No Ice	5.79	-7.43	4.34	232.82	398.55	0.21

Load Combination	*Vertical* *K*	*Shear$_x$* *K*	*Shear$_z$* *K*	*Overturning Moment, M_x* *kip-ft*	*Overturning Moment, M_z* *kip-ft*	*Torque* *kip-ft*
Dead+Wind 270 deg - No Ice	5.79	-8.44	0.00	1.06	453.62	0.01
Dead+Wind 300 deg - No Ice	5.79	-7.27	-4.25	-227.03	390.63	-0.19
Dead+Wind 315 deg - No Ice	5.79	-5.95	-6.03	-322.32	319.37	-0.28
Dead+Wind 330 deg - No Ice	5.79	-4.22	-7.40	-396.00	226.00	-0.35
Dead+Ice+Temp	9.02	0.00	0.00	-0.01	0.40	-0.00
Dead+Wind 0 deg+Ice+Temp	9.02	0.00	-8.56	-449.67	-0.40	-0.42
Dead+Wind 30 deg+Ice+Temp	9.02	4.19	-7.33	-385.76	-221.01	-0.34
Dead+Wind 45 deg+Ice+Temp	9.02	5.91	-5.97	-314.66	-311.76	-0.26
Dead+Wind 60 deg+Ice+Temp	9.02	7.22	-4.21	-222.40	-380.94	-0.17
Dead+Wind 90 deg+Ice+Temp	9.02	8.37	-0.00	-0.82	-441.04	0.04
Dead+Wind 120 deg+Ice+Temp	9.02	7.34	4.28	224.12	-385.58	0.25
Dead+Wind 135 deg+Ice+Temp	9.02	5.91	5.97	313.49	-310.62	0.33
Dead+Wind 150 deg+Ice+Temp	9.02	4.18	7.32	384.92	-219.62	0.38
Dead+Wind 180 deg+Ice+Temp	9.02	-0.00	8.42	443.36	1.21	0.41
Dead+Wind 210 deg+Ice+Temp	9.02	-4.19	7.33	385.72	221.83	0.34
Dead+Wind 225 deg+Ice+Temp	9.02	-5.91	5.97	314.62	312.57	0.26
Dead+Wind 240 deg+Ice+Temp	9.02	-7.34	4.28	225.51	387.19	0.17
Dead+Wind 270 deg+Ice+Temp	9.02	-8.37	0.00	0.79	441.84	-0.05
Dead+Wind 300 deg+Ice+Temp	9.02	-7.22	-4.21	-221.00	380.94	-0.24
Dead+Wind 315 deg+Ice+Temp	9.02	-5.91	-5.97	-313.51	311.43	-0.32
Dead+Wind 330 deg+Ice+Temp	9.02	-4.18	-7.32	-384.94	220.43	-0.38
Dead+Wind 0 deg - Service	5.79	0.00	-2.17	-115.95	-0.05	-0.10
Dead+Wind 30 deg - Service	5.79	1.06	-1.85	-99.27	-56.69	-0.09
Dead+Wind 45 deg - Service	5.79	1.49	-1.51	-80.96	-79.95	-0.07
Dead+Wind 60 deg - Service	5.79	1.82	-1.06	-57.22	-97.66	-0.05
Dead+Wind 90 deg - Service	5.79	2.11	-0.00	-0.27	-113.13	-0.00
Dead+Wind 120 deg - Service	5.79	1.86	1.08	57.75	-99.10	0.05
Dead+Wind 135 deg - Service	5.79	1.49	1.51	80.58	-79.57	0.07
Dead+Wind 150 deg - Service	5.79	1.05	1.85	99.00	-56.23	0.09
Dead+Wind 180 deg - Service	5.79	-0.00	2.13	113.98	0.48	0.10
Dead+Wind 210 deg - Service	5.79	-1.06	1.85	99.27	57.12	0.09
Dead+Wind 225 deg - Service	5.79	-1.49	1.51	80.96	80.39	0.08
Dead+Wind 240 deg - Service	5.79	-1.86	1.09	58.21	99.80	0.05
Dead+Wind 270 deg - Service	5.79	-2.11	0.00	0.27	113.57	0.00
Dead+Wind 300 deg - Service	5.79	-1.82	-1.06	-56.76	97.83	-0.05
Dead+Wind 315 deg - Service	5.79	-1.49	-1.51	-80.58	80.01	-0.07
Dead+Wind 330 deg - Service	5.79	-1.05	-1.85	-99.00	56.66	-0.09

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	-5.79	0.00	0.00	5.79	0.00	0.000%
2	0.00	-5.79	-8.68	-0.00	5.79	8.68	0.000%
3	4.22	-5.79	-7.41	-4.22	5.79	7.41	0.000%
4	5.96	-5.79	-6.03	-5.96	5.79	6.03	0.000%
5	7.27	-5.79	-4.26	-7.27	5.79	4.26	0.000%
6	8.44	-5.79	-0.00	-8.44	5.79	0.00	0.000%
7	7.42	-5.79	4.34	-7.42	5.79	-4.34	0.000%
8	5.95	-5.79	6.03	-5.95	5.79	-6.03	0.000%
9	4.22	-5.79	7.40	-4.22	5.79	-7.40	0.000%
10	-0.00	-5.79	8.51	0.00	5.79	-8.51	0.000%
11	-4.22	-5.79	7.41	4.22	5.79	-7.41	0.000%
12	-5.96	-5.79	6.03	5.96	5.79	-6.03	0.000%
13	-7.43	-5.79	4.34	7.43	5.79	-4.34	0.000%
14	-8.44	-5.79	0.00	8.44	5.79	-0.00	0.000%
15	-7.27	-5.79	-4.25	7.27	5.79	4.25	0.000%

	Sum of Applied Forces			*Sum of Reactions*			
Load Comb.	*PX K*	*PY K*	*PZ K*	*PX K*	*PY K*	*PZ K*	*% Error*
16	-5.95	-5.79	-6.03	5.95	5.79	6.03	0.000%
17	-4.22	-5.79	-7.40	4.22	5.79	7.40	0.000%
18	0.00	-9.02	0.00	0.00	9.02	0.00	0.000%
19	0.00	-9.02	-8.56	-0.00	9.02	8.56	0.000%
20	4.19	-9.02	-7.33	-4.19	9.02	7.33	0.000%
21	5.91	-9.02	-5.97	-5.91	9.02	5.97	0.000%
22	7.22	-9.02	-4.21	-7.22	9.02	4.21	0.000%
23	8.37	-9.02	-0.00	-8.37	9.02	0.00	0.000%
24	7.34	-9.02	4.28	-7.34	9.02	-4.28	0.000%
25	5.91	-9.02	5.97	-5.91	9.02	-5.97	0.000%
26	4.18	-9.02	7.32	-4.18	9.02	-7.32	0.000%
27	-0.00	-9.02	8.42	0.00	9.02	-8.42	0.000%
28	-4.19	-9.02	7.33	4.19	9.02	-7.33	0.000%
29	-5.91	-9.02	5.97	5.91	9.02	-5.97	0.000%
30	-7.34	-9.02	4.28	7.34	9.02	-4.28	0.000%
31	-8.37	-9.02	0.00	8.37	9.02	-0.00	0.000%
32	-7.22	-9.02	-4.21	7.22	9.02	4.21	0.000%
33	-5.91	-9.02	-5.97	5.91	9.02	5.97	0.000%
34	-4.18	-9.02	-7.32	4.18	9.02	7.32	0.000%
35	0.00	-5.79	-2.17	-0.00	5.79	2.17	0.000%
36	1.06	-5.79	-1.85	-1.06	5.79	1.85	0.000%
37	1.49	-5.79	-1.51	-1.49	5.79	1.51	0.000%
38	1.82	-5.79	-1.06	-1.82	5.79	1.06	0.000%
39	2.11	-5.79	-0.00	-2.11	5.79	0.00	0.000%
40	1.86	-5.79	1.08	-1.86	5.79	-1.08	0.000%
41	1.49	-5.79	1.51	-1.49	5.79	-1.51	0.000%
42	1.05	-5.79	1.85	-1.05	5.79	-1.85	0.000%
43	-0.00	-5.79	2.13	0.00	5.79	-2.13	0.000%
44	-1.06	-5.79	1.85	1.06	5.79	-1.85	0.000%
45	-1.49	-5.79	1.51	1.49	5.79	-1.51	0.000%
46	-1.86	-5.79	1.09	1.86	5.79	-1.09	0.000%
47	-2.11	-5.79	0.00	2.11	5.79	-0.00	0.000%
48	-1.82	-5.79	-1.06	1.82	5.79	1.06	0.000%
49	-1.49	-5.79	-1.51	1.49	5.79	1.51	0.000%
50	-1.05	-5.79	-1.85	1.05	5.79	1.85	0.000%

Non-Linear Convergence Results

Load Combination	*Converged?*	*Number of Cycles*	*Displacement Tolerance*	*Force Tolerance*
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00000818
3	Yes	4	0.00000001	0.00000397
4	Yes	4	0.00000001	0.00000245
5	Yes	4	0.00000001	0.00000001
6	Yes	4	0.00000001	0.00000646
7	Yes	4	0.00000001	0.00000998
8	Yes	4	0.00000001	0.00000258
9	Yes	4	0.00000001	0.00000293
10	Yes	4	0.00000001	0.00000001
11	Yes	4	0.00000001	0.00000417
12	Yes	4	0.00000001	0.00000778
13	Yes	4	0.00000001	0.00001167
14	Yes	4	0.00000001	0.00000655
15	Yes	4	0.00000001	0.00000267
16	Yes	4	0.00000001	0.00000001

17	Yes	4	0.00000001	0.00000412
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00000437
20	Yes	4	0.00000001	0.00000001
21	Yes	4	0.00000001	0.00000001
22	Yes	4	0.00000001	0.00000001
23	Yes	4	0.00000001	0.00000797
24	Yes	4	0.00000001	0.00000868
25	Yes	4	0.00000001	0.00000001
26	Yes	4	0.00000001	0.00000001
27	Yes	4	0.00000001	0.00000001
28	Yes	4	0.00000001	0.00000001
29	Yes	4	0.00000001	0.00000563
30	Yes	4	0.00000001	0.00000262
31	Yes	4	0.00000001	0.00000780
32	Yes	4	0.00000001	0.00000001
33	Yes	4	0.00000001	0.00000001
34	Yes	4	0.00000001	0.00000001
35	Yes	4	0.00000001	0.00000001
36	Yes	4	0.00000001	0.00000001
37	Yes	4	0.00000001	0.00000001
38	Yes	4	0.00000001	0.00000001
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00000001
41	Yes	4	0.00000001	0.00000001
42	Yes	4	0.00000001	0.00000001
43	Yes	4	0.00000001	0.00000001
44	Yes	4	0.00000001	0.00000001
45	Yes	4	0.00000001	0.00000001
46	Yes	4	0.00000001	0.00000001
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00000001
49	Yes	4	0.00000001	0.00000001
50	Yes	4	0.00000001	0.00000001

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	80 - 60	2.009	46	0.2237	0.0596
T2	60 - 40	1.102	35	0.1848	0.0202
T3	40 - 20	0.468	35	0.1018	0.0074
T4	20 - 0	0.128	35	0.0430	0.0028

Critical Deflections and Radius of Curvature - Service Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* °	*Twist* °	*Radius of Curvature* *ft*
77.00	BXA-80063/4CF	46	1.865	0.2198	0.0514	57102
72.00	BXA-80063/4CF	46	1.627	0.2126	0.0383	35689
67.00	BXA-80063/4CF	46	1.398	0.2034	0.0289	21962

Maximum Tower Deflections - Design Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	80 - 60	8.014	13	0.8799	0.2179
T2	60 - 40	4.416	2	0.7374	0.0770
T3	40 - 20	1.889	2	0.4056	0.0417
T4	20 - 0	0.529	2	0.1708	0.0237

Critical Deflections and Radius of Curvature - Design Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* °	*Twist* °	*Radius of Curvature* *ft*
77.00	BXA-80063/4CF	13	7.441	0.8668	0.1842	14654
72.00	BXA-80063/4CF	13	6.498	0.8419	0.1380	9159
67.00	BXA-80063/4CF	13	5.588	0.8085	0.0994	5636

Bolt Design Data

Section No.	*Elevation* *ft*	*Component Type*	*Bolt Grade*	*Bolt Size* *in*	*Number Of Bolts*	*Maximum Load per Bolt* *K*	*Allowable Load* *K*	*Ratio* $\frac{Load}{Allowable}$	*Allowable Ratio*	*Criteria*
T1	80	Leg	A325N	0.6250	4	6.26	13.46	0.465 ✓	1.333	Bolt Tension
T2	60	Leg	A325N	0.6250	4	11.54	13.49	0.855 ✓	1.333	Bolt Tension
T3	40	Leg	A325N	0.7500	4	15.21	19.43	0.783 ✓	1.333	Bolt Tension

Compression Checks

Leg Design Data (Compression)

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* $\frac{P}{P_a}$
T1	80 - 60	1 1/2	20.00	3.25	104.0 K=1.00	13.767	1.7672	-26.53	24.33	1.090 ✓
T2	60 - 40	P2.0X0.218 W/ P2.5x0.276 Split Pipe	20.02	3.80	61.1 K=1.00	16.924	2.2840	-48.67	38.65	1.259 ✓
T3	40 - 20	P2.5X0.203 W/ P3.0x0.300 Split Pipe	20.02	2.48	32.4 K=1.00	19.250	3.2300	-64.75	62.18	1.041 ✓
T4	20 - 0	P3.0x0.300 w/ P3.5X0.318	20.02	4.75	51.9	17.738	4.2410	-78.51	75.23	1.044

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* $\frac{P}{P_a}$
		Split Pipe			K=1.00					✓

Diagonal Design Data (Compression)

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* $\frac{P}{P_a}$
T1	80 - 60	1	4.10	3.90	130.9 K=0.70	8.718	0.7854	-6.32	6.85	0.923 ✓
T2	60 - 40	P1.25x.14	4.65	4.36	96.9 K=1.00	13.158	0.6685	-4.55	8.80	0.518 ✓

Horizontal Design Data (Compression)

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* $\frac{P}{P_a}$
T1	80 - 60	1	2.50	2.38	84.9 K=0.75	14.797	0.7854	-1.33	11.62	0.115 ✓
T2	60 - 40	P.75x.154	3.68	3.47	129.5 K=1.00	8.898	0.4335	-0.84	3.86	0.219 ✓
T3	40 - 20	P1.25x.140	5.11	4.81	107.1 K=1.00	11.921	0.6685	-2.33	7.97	0.293* ✓
T4	20 - 0	P1.5x.145	6.61	6.31	121.7 K=1.00	9.996	0.7995	-2.70	7.99	0.337* ✓

* DL controls

Secondary Horizontal Design Data (Compression)

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* $\frac{P}{P_a}$
T3	40 - 20	L2x2x1/4	5.28	4.99	140.3 K=0.92	7.584	0.9380	-1.12	7.11	0.158 ✓

Top Girt Design Data (Compression)

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* $\frac{P}{P_a}$

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* $\frac{P}{P_a}$
T1	80 - 60	1	2.50	2.38	84.9 K=0.75	14.797	0.7854	-0.15	11.62	0.013 ✓
T2	60 - 40	P.75x.154	2.54	2.33	87.0 K=1.00	14.292	0.4335	-1.61	6.20	0.260 ✓
T3	40 - 20	P1.25x.14	4.04	3.75	83.3 K=1.00	14.697	0.6685	-1.19	9.83	0.121* ✓
T4	20 - 0	P1.5x.145	5.54	5.25	101.1 K=1.00	12.655	0.7995	-1.38	10.12	0.136* ✓

* DL controls

Bottom Girt Design Data (Compression)

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* $\frac{P}{P_a}$
T1	80 - 60	1	2.50	2.38	84.9 K=0.75	14.797	0.7854	-1.57	11.62	0.135 ✓
T2	60 - 40	P.75x.154	3.96	3.76	140.2 K=1.00	7.599	0.4335	-1.23	3.29	0.373 ✓
T3	40 - 20	P1.25x.140	5.46	5.17	115.0 K=1.00	10.902	0.6685	-1.98	7.29	0.272 ✓

Tension Checks

Leg Design Data (Tension)

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* $\frac{P}{P_a}$
T1	80 - 60	1 1/2	20.00	3.25	104.0	30.000	1.7672	25.04	53.01	0.472 ✓
T2	60 - 40	P2.0X0.218 W/ P2.5x0.276 Split Pipe	20.02	3.80	61.1	21.000	2.2840	46.14	47.96	0.962 ✓
T3	40 - 20	P2.5X0.203 W/ P3.0x0.300 Split Pipe	20.02	2.48	32.4	21.000	3.2300	60.85	67.83	0.897 ✓
T4	20 - 0	P3.0x0.300 w/ P3.5X0.318 Split Pipe	20.02	4.75	51.9	21.000	4.2410	73.52	89.06	0.826 ✓

Diagonal Design Data (Tension)

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 $\frac{P}{P_a}$
T1	80 - 60	1	4.10	3.90	187.0	21.600	0.7854	6.33	16.96	0.373 ✓
T2	60 - 40	P1.25x.14	4.65	4.36	96.9	21.000	0.6685	4.58	14.04	0.326 ✓
T3	40 - 20	1/2	6.35	5.96	572.1	21.600	0.1963	3.90	4.24	0.919 ✓
T4	20 - 0	1/2	8.28	7.93	760.9	21.600	0.1963	3.49	4.24	0.823 ✓

Horizontal Design Data (Tension)

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 $\frac{P}{P_a}$
T1	80 - 60	1	2.50	2.38	114.0	21.600	0.7854	1.33	16.96	0.079 ✓
T2	60 - 40	P.75x.154	3.68	3.47	129.5	21.000	0.4335	0.84	9.10	0.093 ✓
T3	40 - 20	P1.25x.140	5.11	4.81	107.1	21.000	0.6685	1.12	14.04	0.080 ✓
T4	20 - 0	P1.5x.145	6.61	6.31	121.7	21.000	0.7995	1.36	16.79	0.081 ✓

Secondary Horizontal Design Data (Tension)

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 $\frac{P}{P_a}$
T3	40 - 20	L2x2x1/4	5.28	4.99	98.3	21.600	0.9380	1.12	20.26	0.055 ✓

Top Girt Design Data (Tension)

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 $\frac{P}{P_a}$
T1	80 - 60	1	2.50	2.38	114.0	21.600	0.7854	0.15	16.96	0.009 ✓
T2	60 - 40	P.75x.154	2.54	2.33	87.0	21.000	0.4335	1.48	9.10	0.163 ✓

Bottom Girt Design Data (Tension)

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 $\frac{P}{P_a}$
T1	80 - 60	1	2.50	2.38	114.0	21.600	0.7854	1.66	16.96	0.098 ✓
T2	60 - 40	P.75x.154	3.96	3.76	140.2	21.000	0.4335	1.10	9.10	0.121 ✓

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	SF*P_{allow} K	% Capacity	Pass Fail
T1	80 - 60	Leg	1 1/2	1	-26.53	32.43	81.8	Pass
T2	60 - 40	Leg	P2.0X0.218 W/ P2.5x0.276 Split Pipe	43	-48.67	51.53	94.5	Pass
T3	40 - 20	Leg	P2.5X0.203 W/ P3.0x0.300 Split Pipe	81	-64.75	82.88	78.1	Pass
T4	20 - 0	Leg	P3.0x0.300 w/ P3.5X0.318 Split Pipe	135	-78.51	100.28	78.3	Pass
T1	80 - 60	Diagonal	1	22	-6.32	9.13	69.3	Pass
T2	60 - 40	Diagonal	P1.25x.14	78	-4.55	11.73	38.8	Pass
T3	40 - 20	Diagonal	1/2	129	3.90	5.65	68.9	Pass
T4	20 - 0	Diagonal	1/2	144	3.49	5.65	61.7	Pass
T1	80 - 60	Horizontal	1	39	-1.33	15.49	8.6	Pass
T2	60 - 40	Horizontal	P.75x.154	55	-0.84	5.14	16.4	Pass
T3	40 - 20	Horizontal	P1.25x.140	95	-2.33	7.97	29.3	Pass
T4	20 - 0	Horizontal	P1.5x.145	146	-2.70	7.99	33.7	Pass
T3	40 - 20	Secondary Horizontal	L2x2x1/4	98	-1.12	9.48	11.8	Pass
T1	80 - 60	Top Girt	1	4	-0.15	15.49	0.9	Pass
T2	60 - 40	Top Girt	P.75x.154	48	-1.61	8.26	19.5	Pass
T3	40 - 20	Top Girt	P1.25x.14	82	-1.19	9.83	12.1	Pass
T4	20 - 0	Top Girt	P1.5x.145	137	-1.38	10.12	13.6	Pass
T1	80 - 60	Bottom Girt	1	9	-1.57	15.49	10.1	Pass
T2	60 - 40	Bottom Girt	P.75x.154	51	-1.23	4.39	28.0	Pass
T3	40 - 20	Bottom Girt	P1.25x.140	85	-1.98	9.72	20.4	Pass
							Summary	
						Leg (T2)	94.5	Pass
						Diagonal (T1)	69.3	Pass
						Horizontal (T4)	33.7	Pass
						Secondary Horizontal (T3)	11.8	Pass
						Top Girt (T2)	19.5	Pass
						Bottom Girt (T2)	28.0	Pass
						Bolt Checks	64.1	Pass
						RATING =	**94.5**	**Pass**

tnxTower *Centek Engineering Inc.* *63-2 North Branford Rd.* *Branford, CT 06405* *Phone: (203) 488-0580* *FAX: (203) 488-8587*	**Job** 15001.013 - New London	**Page** 27 of 27
	Project 80-ft SSV Lattice Tower - Westwood Ave., New London, CT	**Date** 10:47:44 02/11/15
	Client Verizon Wireless	**Designed by** TJL

Program Version 6.0.0.8 - 9/7/2011 File:J:/Jobs/1500100.WI/013 - New London CT/Backup Documentation/ERI Files/Reinforced/80' SSV Tower_w_Reinf - New London.eri

Mat Foundation Analysis:

Input Data:

Tower Data

Overturning Moment = $OM := 464 \cdot ft \cdot kips$ (User Input from tnxTower)

Shear Force = $S_t := 9 \cdot kip$ (User Input from tnxTower)

Axial Force = $WT_t := 6 \cdot kip$ (User Input from tnxTower)

Max Compression Force = $C_t := 78 \cdot kip$ (User Input from tnxTower)

Max Uplift Force = $U_t := 73 \cdot kip$ (User Input from tnxTower)

Tower Height = $H_t := 80 \cdot ft$ (User Input)

Tower Width = $W_t := 7 \cdot ft$ (User Input)

Tower Position on Foundation (1=offset, 2=centered) = $Pos_t := 2$ (User Input)

Footing Data:

Overall Depth of Footing = $D_f := 4.33 \cdot ft$ (User Input)

Thickness of Footing = $T_f := 5.0 \cdot ft$ (User Input)

Width of Footing = $W_f := 14.0 \cdot ft$ (User Input)

Length of Pier = $L_p := 0 \cdot ft$ (User Input)

Extension of Pier Above Grade = $L_{pag} := 0 \cdot ft$ (User Input)

Diameter of Pier = $d_p := 0 \cdot ft$ (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)

Internal Friction Angle of Soil = $\Phi_s := 32 \cdot deg$ (User Input)

Allowable Soil Bearing Capacity = $q_s := 4000 \cdot psf$ (User Input)

Unit Weight of Soil = $\gamma_{soil} := 125 \cdot pcf$ (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)

Pad Reinforcement:

Bar Size =	$BS_{top} := 6$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 0.75 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 16$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 6$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 0.75 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 16$	(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:

Pad Top Reinforcement Bar Area = $A_{btop} := \frac{\pi \cdot d_{btop}^{2}}{4} = 0.442 \cdot in^{2}$

Pad Bottom Reinforcement Bar Area = $A_{bbot} := \frac{\pi \cdot d_{bbot}^{2}}{4} = 0.442 \cdot in^{2}$

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

Load Factor =

$$LF := \left| \begin{array}{l} 1.333 \ \text{ if } \ H_t \le 700 \cdot ft \\ 1.7 \ \text{ if } \ H_t \ge 1200 \cdot ft \\ 1.333 + \left(\frac{H_t - 700ft}{1200ft - 700ft} \right) \cdot 0.4 \ \text{ otherwise} \end{array} \right. = 1.333$$

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 = $\gamma_s := \text{if}\left(\text{Bouyancy} = 1, \gamma_{soil} - 62.4\text{pcf}, \gamma_{soil}\right) = 125 \cdot \text{pcf}$

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

$$P_{pt} := K_p \cdot \gamma_s \cdot \left(D_f - T_f\right) + c \cdot 2 \cdot \sqrt{K_p} = -0.273 \cdot \text{ksf}$$

$$P_{top} := \text{if}\left[n < \left(D_f - T_f\right), P_{pt}, P_{pn}\right] = 0 \cdot \text{ksf}$$

$$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 1.762 \cdot \text{ksf}$$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 0.881 \cdot \text{ksf}$$

$$T_p := \text{if}\left[n < \left(D_f - T_f\right), T_f, \left(D_f - n\right)\right] = 4.33$$

$$A_p := W_f \cdot T_p = 60.62$$

Ultimate Shear = $S_u := P_{ave} \cdot A_p = 53.392 \cdot \text{kip}$

Weight of Concrete Pad = $WT_{pad} := \left(W_f^{\,2} \cdot T_f\right) \cdot \gamma_c = 147 \cdot \text{kip}$

Weight of Concrete Piers = $WT_{pier} := 3 \cdot \left[\left(L_p \cdot \frac{d_p^{\,2} \cdot \pi}{4}\right) \cdot \gamma_c\right] = 0 \cdot \text{kip}$

Total Weight of Concrete = $WT_c := WT_{pad} + WT_{pier} = 147 \cdot \text{kip}$

Weight of Soil Above Footing = $WT_{s1} := \left(W_f^{\,2} - 3 \cdot \frac{d_p^{\,2} \cdot \pi}{4}\right) \cdot \left(L_p - L_{pag}\right) \cdot \gamma_s = 0 \cdot \text{kip}$

Weight of Soil Back Face = $WT_{s2} := \left[\frac{\tan\left(\Phi_s\right) \cdot \left(D_f\right)^2}{2} \cdot W_f\right] \cdot \gamma_s = 10 \cdot \text{kip}$

Tower Offset = $X_{t1} := \left[\frac{W_f}{2} - \frac{\left(W_t \cdot \cos(30 \cdot \text{deg})\right)}{2}\right]$ $\quad X_{t2} := \frac{W_f}{2} - \frac{\left(W_t \cdot \cos(30 \cdot \text{deg})\right)}{3}$

$$X_t := \text{if}\left(Pos_t, X_{t1}, X_{t2}\right) = 3.969$$

$$X_{off} := \frac{W_f}{2} - \left[\frac{\left(W_t \cdot \cos(30 \cdot \text{deg})\right)}{3} + X_t\right] = 1.01$$

Resisting Moment = $M_r := \left(WT_c + WT_{s1}\right) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + WT_{s2} \cdot \left[W_f + \frac{\tan\left(\Phi_s\right) \cdot \left(L_p - L_{pag}\right)}{3}\right] = 1262 \cdot \text{kip}$

Overturning Moment = $M_{ot} := OM + S_t \cdot \left(L_p + T_f\right) = 509 \cdot \text{kip} \cdot \text{ft}$

Factor of Safety Actual = $FS := \frac{M_r}{M_{ot}} = 2.48$

Factor of Safety Required = $FS_{req} := 2$

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

OverTurning_Moment_Check = "Okay"

Bearing Pressure Caused by Footing:

Total Load = $\text{Load}_{tot} := WT_c + WT_{s1} + WT_t = 153 \cdot \text{kip}$

Area of the Mat = $A_{mat} := W_f^{\,2} = 196$

Section Modulus of Mat = $S := \dfrac{W_f^{\,3}}{6} = 457.33 \cdot \text{ft}^3$

Maximum Pressure in Mat = $P_{max} := \dfrac{\text{Load}_{tot}}{A_{mat}} + \dfrac{M_{ot}}{S} = 1.894 \cdot \text{ksf}$

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

$\text{Max\_Pressure\_Check} = \text{"Okay"}$

Minimum Pressure in Mat = $P_{min} := \dfrac{\text{Load}_{tot}}{A_{mat}} - \dfrac{M_{ot}}{S} = -0.332 \cdot \text{ksf}$

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

$\text{Min\_Pressure\_Check} = \text{"No Good"}$

Distance to Resultant of Pressure Distribution = $X_p := \dfrac{P_{max}}{\dfrac{P_{max} - P_{min}}{W_f}} \cdot \dfrac{1}{3} = 3.97$

Distance to Kern = $X_k := \dfrac{W_f}{6} = 2.333$

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

Eccentricity = $e := \dfrac{M_{ot}}{\text{Load}_{tot}} = 3.327$

Adjusted Soil Pressure = $P_a := \dfrac{2 \cdot \text{Load}_{tot}}{3 \cdot W_f \left(\dfrac{W_f}{2} - e\right)} = 1.983 \cdot \text{ksf}$

$q_{adj} := \text{if}\left(P_{min} < 0, P_a, P_{max}\right) = 1.983 \cdot \text{ksf}$

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

$\text{Pressure\_Check} = \text{"Okay"}$

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)

$d := T_f - Cvr_{pad} - \frac{d_{bbot}}{2} = 56.625 \cdot in$

$FL := \frac{C_t}{W_f^2} = 0.398 \cdot ksf$

$V_{req} := LF \cdot FL \cdot \left(X_t - 0.5 \cdot d_p - d\right) \cdot W_f = -5.569 \cdot kip$

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d = 1023 \cdot kip$ (ACI-2008 11.2.1.1)

Beam_Shear_Check := if($V_{req} < V_{Avail}$, "Okay", "No Good")

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 = $b_o := \left(d_p + d\right) \cdot \pi = 14.8$

Required Shear Strength = $V_{req} := LF \cdot FL \cdot \left[W_f^2 - \left(d_p + d\right)^2 \cdot \frac{\pi}{4}\right] = 94.7 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 2166.1 \cdot kip$ (ACI-2008 11.11.2.1)

Punching_Shear_Check := if($V_{req} < V_{Avail}$, "Okay", "No Good")

Punching_Shear_Check = "Okay"

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

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

$$M_{nT} := LF\cdot\left[U_t\cdot\left(W_t\cdot\sin(60\cdot deg) - \frac{d_p}{2}\right) + S_t\cdot\left(D_f + L_{pag}\right)\right] - WT_t\cdot X_{off} = 636\cdot ft\cdot k$$

$$M_{nS} := -1\cdot\left[\frac{1}{2}\cdot\left(\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2}\right)^2\cdot W_t\cdot\left[\gamma_s\cdot\left(T_f - T_f\right)\right]\right]$$

$$M_{nC} := -1\cdot\left[\frac{1}{2}\cdot\left(\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2}\right)^2\cdot W_t\cdot\left(\gamma_c\cdot T_f\right)\right]$$

Design Moment = $M_n := \dfrac{M_{nT} + M_{nS} + M_{nC}}{\phi_m} = 469.093\cdot kips\cdot ft$

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

(ACI-200810.2.7.3)

$$b_{eff} := W_t\cdot\cos(30\cdot deg) + d_p = 72.746\cdot in$$

$$d := T_f - Cvr_{pad} - d_{bbot} = 56.25\cdot in$$

$$A_s := \frac{M_n}{\left(f_y\cdot d\right)} = 1.668\cdot in^2$$

$$a := \frac{A_s\cdot f_y}{\beta\cdot f_c\cdot b_{eff}} = 0.405\cdot in$$

$$A_s := \frac{M_n}{f_y\cdot\left(d - \frac{a}{2}\right)} = 1.674\cdot in^2$$

$$\rho := \frac{A_s}{b_{eff}\cdot d} = 0.00041$$

Required Reinforcement for Temperature and Shrinkage:

$$\rho_{sh} := \begin{vmatrix} .0018 \ \text{ if } \ f_y \geq 60000 \cdot psi \\ .0020 \ \text{ otherwise} \end{vmatrix} = 0.0018$$ (ACI -2008 7.12.2.1)

Check Bottom Bars:

$$As := \begin{vmatrix} (\rho \cdot b_{eff} \cdot d) \ \text{ if } \ (\rho \cdot b_{eff} \cdot d) > \rho_{sh} \cdot \frac{b_{eff}}{2} \cdot d \\ \rho_{sh} \cdot \frac{b_{eff}}{2} \cdot d \ \text{ otherwise} \end{vmatrix} = 3.683 \cdot in^2$$

$$As_{prov} := A_{bbot} \cdot NB_{bot} = 7.1 \cdot in^2$$

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

$$Pad\_Reinforcement\_Bot = \text{"Okay"}$$

Check top Bars:

$$As := if\left(\rho \geq \rho_{sh}, A_s, \rho_{sh} \cdot \frac{b_{eff}}{2} \cdot d\right) = 3.7 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 7.1 \cdot in^2$$

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

$$Pad\_Reinforcement\_Top = \text{"Okay"}$$

Developement Length Pad Reinforcement:

Bar Spacing = $$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 10 \cdot in$$

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)

$$L_{dbt} := \frac{3 \cdot f_y \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 13.3 \cdot in$$

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

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

Available Length in Pad = $$L_{Pad} := \frac{W_f}{2} - \frac{W_t}{2} - Cvr_{pad} = 39 \cdot in$$

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

$$Lpad\_Check = \text{"Okay"}$$

verizonwireless

TOWER REINFORCEMENT DESIGN

VERIZON SITE REF: NEW LONDON
88 WESTWOOD AVE
NEW LONDON, CT 06320

VICINITY MAP

PROJECT SUMMARY

SITE ADDRESS:	88 WESTWOOD AVE NEW LONDON, CT 06320
PROJECT COORDINATES:	LAT: 41°-20'-48.50"N LON: 72°-06'-47.20"W ELEV:±108' AMSL
VERIZON SITE REF.:	NEW LONDON
VERIZON CONTACT:	JEFF YORK 860.550.0513
ANTENNA CL HEIGHT:	67'-0" / 72'-0" / 77'-0"
ENGINEER OF RECORD:	CENTEK ENGINEERING, INC. 63-2 NORTH BRANFORD ROAD BRANFORD, CT 06405
CENTEK CONTACT:	CARLO F. CENTORE, PE 203.488.0580 ext. 122

SHEET INDEX

SHT. NO.	DESCRIPTION	REV.
T-1	TITLE SHEET	0
N-1	DESIGN BASIS & GENERAL NOTES	0
N-2	STRUCTURAL STEEL NOTES	0
MI-1	MODIFICATION INSPECTION REQUIREMENTS	0
S-1	TOWER ELEVATION & FEEDLINE PLAN	0
S-2	TOWER REINFORCEMENT DETAILS	0

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
0	2/11/15	T.A.	CFC	ISSUED FOR CONSTRUCTION

PROFESSIONAL ENGINEER SEAL

CENTEK engineering
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www.CentekEng.com

VERIZON WIRELESS
TOWER REINFORCEMENT DESIGN

NEW LONDON

88 WESTWOOD AVE
NEW LONDON, CT 06320

DATE:	2/10/15
SCALE:	AS SHOWN
JOB NO.	15001.013

TITLE SHEET

SHEET NO.
T-1
Sheet No. 1 of 5

DESIGN BASIS

1. GOVERNING CODE: 2003 INTERNATIONAL BUILDING CODE AS MODIFIED BY THE 2005 CT STATE BUILDING CODE AND 2009 AMENDMENTS.

2. TIA/EIA-222-F-1996 "STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND ANTENNA SUPPORTING STRUCTURES".

3. DESIGN CRITERIA

   WIND LOAD: (TIA/EIA-222-F-1996)
   BASIC WIND SPEED (V) = 85 MPH (FASTEST MILE)

   WIND LOAD: (2005 CT STATE BUILDING CODE APPENDIX K)
   BASIC WIND SPEED (V) = 120 MPH (3-SECOND GUST)
   EQUIVALENT TO (V) = 100 MPH (FASTEST MILE)

   APPENDIX-K WIND SPEED CONTROLS

GENERAL NOTES

1. REFER TO STRUCTURAL ANALYSIS AND REINFORCEMENT DESIGN PREPARED BY CENTEK ENGINEERING, INC., DATED 2/11/15.

2. THE TOWER GEOMETRY, STRUCTURE MEMBER SIZES AND FOUNDATION INFORMATION WERE OBTAINED FROM A PREVIOUS STRUCTURAL REPORT PREPARED BY CENTEK JOB NO. 13001.C09, MARKED REVISION #1, DATED MARCH 19, 2013.

3. ALL STEEL REINFORCEMENT SHOWN HEREIN APPLIES TO ALL SIDES OF THE TOWER.

4. PROVIDE TEMPORARY ANCHORS, GUYING AND/OR BRACING AS REQUIRED TO SAFELY CONDUCT THE WORK.

5. ALL WORK SHALL BE IN ACCORDANCE WITH TIA-222-F "STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND ANTENNA SUPPORTING STRUCTURES".

6. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE AND TO INSURE THE SAFETY OF THE TOWER STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, TEMPORARY BRACING, GUYS OR TIE-DOWNS, WHICH MIGHT BE NECESSARY.

7. DRAWINGS INDICATE THE MINIMUM STANDARDS, BUT IF ANY WORK SHOULD BE INDICATED TO BE SUBSTANDARD TO ANY ORDINANCES, LAWS, CODES, RULES, OR REGULATIONS BEARING ON THE WORK, THE CONTRACTOR SHALL INCLUDE IN HIS SCOPE OF WORK AND SHALL EXECUTE THE WORK CORRECTLY IN ACCORDANCE WITH SUCH ORDINANCES, LAWS, CODES, RULES OR REGULATIONS WITH NO INCREASE IN COSTS.

8. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, ELEVATIONS, ANGLES, AND EXISTING CONDITIONS AT THE SITE, PRIOR TO FABRICATION AND/OR INSTALLATION OF ANY WORK IN THE CONTRACT AREA.

9 ALL DAMAGE CAUSED TO ANY EXISTING STRUCTURE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE HELD LIABLE FOR ALL REPAIRS REQUIRED FOR EXISTING STRUCTURES IF DAMAGED DURING CONSTRUCTION ACTIVITIES.

10. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ON-SITE SAFETY FROM THE TIME THE JOB IS AWARDED UNTIL ALL WORK IS COMPLETE AND ACCEPTED BY THE OWNER.

11. TOWER REINFORCING SHALL BE CONDUCTED BY FIELD CREWS EXPERIENCED IN THE ASSEMBLY AND ERECTION OF RADIO ANTENNAS AND SUPPORT STRUCTURES. ALL SAFETY PROCEDURES, RIGGING AND ERECTION METHODS SHALL BE STANDARD TO THE INDUSTRY AND IN COMPLIANCE WITH OSHA.

12. EXISTING COAXIAL CABLES AND ALL ACCESSORIES SHALL BE RELOCATED AS NECESSARY AND REINSTALLED BY THE CONTRACTOR WITHOUT INTERRUPTION IN SERVICE WHERE THEY ARE IN CONFLICT WITH TOWER REINFORCEMENT.

13. IF ANY FIELD CONDITIONS EXIST WHICH PRECLUDE COMPLIANCE WITH THE DRAWINGS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER AND SHALL PROCEED WITH AFFECTED WORK AFTER CONFLICT IS SATISFACTORILY RESOLVED.

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
0	2/11/15	T.A.	CFC	ISSUED FOR CONSTRUCTION

CENTEK engineering

www.CentekEng.com

VERIZON WIRELESS

NEW LONDON

DATE: 2/10/15
SCALE: AS SHOWN
JOB NO. 15001.013

DESIGN BASIS AND GENERAL NOTES

SHEET NO.
N-1
Sheet No. 2 of 8

STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL IS DESIGNED BY ALLOWABLE STRESS DESIGN (ASD).

2. MATERIAL SPECIFICATIONS

   A. STRUCTURAL STEEL (SOLID ROUND – LEGS) –––ASTM A572-50 (FY = 50 KSI)
   B. STRUCTURAL STEEL (SOLID ROUND – BRACING) –––ASTM A36 (FY = 36 KSI)
   C. STRUCTURAL STEEL (W SHAPES)–––ASTM A992 (FY = 50 KSI)
   D. STRUCTURAL STEEL (OTHER SHAPES)–––ASTM A36 (FY = 36 KSI).
   E. STRUCTURAL HSS (RECTANGULAR SHAPES)–––ASTM A500 GRADE B, (FY = 46 KSI)
   F. STRUCTURAL HSS (ROUND SHAPES)–––ASTM A500 GRADE B, (FY = 42 KSI)
   G. PIPE–––ASTM A53 GRADE B (FY = 35 KSI)

3. FASTENER SPECIFICATIONS

   A. CONNECTION BOLTS–––ASTM A325-N, UNLESS OTHERWISE SCHEDULED.
   B. U-BOLTS–––ASTM A307
   C. ANCHOR RODS–––ASTM F1554
   D. WELDING ELECTRODES–––ASTM E70XX FOR A36 & A572_GR50 STEELS, ASTM E80XX FOR A572_GR65 STEEL.

4. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ENGINEER FOR APPROVAL. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTING TO THE ENGINEER FOR REVIEW. SHOP DRAWINGS SHALL INCLUDE THE FOLLOWING: SECTION PROFILES, SIZES, CONNECTION ATTACHMENTS, REINFORCING, ANCHORAGE, SIZE AND TYPE OF FASTENERS AND ACCESSORIES. INCLUDE ERECTION DRAWINGS, ELEVATIONS AND DETAILS.

5. STRUCTURAL STEEL SHALL BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST PROVISIONS OF AISC MANUAL OF STEEL CONSTRUCTION.

6. PROVIDE ALL PLATES, CLIP ANGLES, CLOSURE PIECES, STRAP ANCHORS, MISCELLANEOUS PIECES AND HOLES REQUIRED TO COMPLETE THE STRUCTURE.

7. FIT AND SHOP ASSEMBLE FABRICATIONS IN THE LARGEST PRACTICAL SECTIONS FOR DELIVERY TO SITE.

8. INSTALL FABRICATIONS PLUMB AND LEVEL, ACCURATELY FITTED, AND FREE FROM DISTORTIONS OR DEFECTS.

9. AFTER ERECTION OF STRUCTURES, TOUCHUP ALL WELDS, ABRASIONS AND NON-GALVANIZED SURFACES WITH A 95% ORGANIC ZINC RICH PAINT IN ACCORDANCE WITH ASTM 780.

10. ALL STEEL MATERIAL (EXPOSED TO WEATHER) SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 "ZINC (HOT DIPPED GALVANIZED) COATINGS" ON IRONS AND STEEL PRODUCTS.

11. ALL BOLTS, ANCHORS AND MISCELLANEOUS HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 "ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE".

12. CONTRACTOR SHALL COMPLY WITH AWS CODE FOR PROCEDURES APPEARANCE AND QUALITY OF WELDS, AND WELDING PROCESSES SHALL BE QUALIFIED IN ACCORDANCE WITH AWS "STANDARD QUALIFICATION PROCEDURES". ALL WELDING SHALL BE DONE USING THE SCHEDULED ELECTRODES AND WELDING SHALL CONFORM TO AISC AND D1.1 WHERE FILLET WELD SIZES ARE NOT SHOWN, PROVIDE THE MINIMUM SIZE PER TABLET J2.4 IN THE AISC "MANUAL OF STEEL CONSTRUCTION" 9TH EDITION. AT THE COMPLETION OF WELDING, ALL DAMAGE TO GALVANIZED COATING SHALL BE REPAIRED.

13. THE ENGINEER SHALL BE NOTIFIED OF ANY INCORRECTLY FABRICATED, DAMAGED OR OTHERWISE MISFITTING OR NON CONFORMING MATERIALS OR CONDITIONS TO REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE ENGINEER REVIEW.

14. CONNECTION ANGLES SHALL HAVE A MINIMUM THICKNESS OF 1/4 INCHES.

15. STRUCTURAL CONNECTION BOLTS SHALL CONFORM TO ASTM A325. ALL BOLTS SHALL BE 3/4" DIAMETER MINIMUM AND SHALL HAVE A MINIMUM OF TWO BOLTS, UNLESS OTHERWISE ON THE DRAWINGS.

16. LOCK WASHER ARE NOT PERMITTED FOR A325 BOLTED STEEL ASSEMBLIES.

17. SHOP CONNECTIONS SHALL BE WELDED OR HIGH STRENGTH BOLTED.

18. MILL BEARING ENDS OF COLUMNS, STIFFENERS, AND OTHER BEARING SURFACES TO TRANSFER LOAD OVER ENTIRE CROSS SECTION.

19. FABRICATE BEAMS WITH MILL CAMBER UP.

20. LEVEL AND PLUMB INDIVIDUAL MEMBERS OF THE STRUCTURE TO AN ACCURACY OF 1:500, BUT NOT TO EXCEED 1/4" IN THE FULL HEIGHT OF THE COLUMN.

21. COMMENCEMENT OF STRUCTURAL STEEL WORK WITHOUT NOTIFYING THE ENGINEER OF ANY DISCREPANCIES WILL BE CONSIDERED ACCEPTANCE OF PRECEDING WORK.

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STRUCTURAL STEEL NOTES

SHEET NO.
N-2
Sheet No. 3 of 5

MODIFICATION INSPECTION REPORT REQUIREMENTS

PRE-CONSTUCTION		DURING CONSTRUCTION		POST-CONSTRUCTION	
SCHEDULED ITEM	REPORT ITEM	SCHEDULED ITEM	REPORT ITEM	SCHEDULED ITEM	REPORT ITEM
X	EOR MODIFICATION INSPECTION DRAWING	–	FOUNDATIONS	X	MODIFICATION INSPECTOR RECORD REDLINE DRAWING
X	EOR APPROVED SHOP DRAWINGS	–	EARTHWORK: BACKFILL MATERIAL & COMPACTION	–	POST–INSTALLED ANCHOR ROD PULL–OUT TEST
–	EOR APPROVED POST–INSTALLED ANCHOR MPII	–	REBAR & FORMWORK GEOMETRY VERIFICATION	X	PHOTOGRAPHS
–	FABRICATION INSPECTION	–	CONCRETE TESTING		
–	FABRICATOR CERTIFIED WELDER INSPECTION	X	STEEL INSPECTION		
X	MATERIAL CERTIFICATIONS	–	POST INSTALLED ANCHOR ROD VERIFICATION		
		–	BASE PLATE GROUT VERIFICATION		
		–	CONTRACTOR'S CERTIFIED WELD INSPECTION		
		X	ON–SITE COLD GALVANIZING VERIFICATION		
		X	CONTRACTOR AS–BUILT REDLINE DRAWINGS		

NOTES:

1. REFER TO MODIFICATION INSPECTION NOTES FOR ADDITIONAL REQUIREMENTS
2. "X" DENOTES DOCUMENT REQUIRED FOR INCLUSION IN MODIFICATION INSPECTION FINAL REPORT.
3. "–" DENOTES DOCUMENT NOT REQUIRED FOR INCLUSION IN MODIFICATION INSPECTION FINAL REPORT.
4. EOR – ENGINEER OF RECORD
4. MPII – "MANUFACTURER'S PRINTED INSTALLATION GUIDELINES"

GENERAL

1. THE MODIFICATION INSPECTION IS A VISUAL INSPECTION OF STRUCTURAL MODIFICATIONS, TO INCLUDE A REVIEW AND COMPILATION OF SPECIFIED SUBMITTALS AND CONSTRUCTION INSPECTIONS, AS AN ASSURANCE OF COMPLIANCE WITH THE CONSTRUCTION DOCUMENTS PREPARED UNDER THE DIRECTION OF THE ENGINEER OF RECORD (EOR).

2. THE MODIFICATION INSPECTION IS TO CONFIRM INSTALLATION CONFIGURATION AND GENERAL WORKMANSHIP AND IS NOT A REVIEW OF THE MODIFICATION DESIGN. OWNERSHIP OF THE MODIFICATION DESIGN EFFECTIVENESS AND INTENT RESIDES WITH THE ENGINEER OF RECORD.

3. TO ENSURE COMPLIANCE WITH THE MODIFICATION INSPECTION REQUIREMENTS THE GENERAL CONTRACTOR (GC) AND THE MODIFICATION INSPECTOR (MI) COMMENCE COMMUNICATION UPON AUTHORIZATION TO PROCEED BY THE CLIENT. EACH PARTY SHALL BE PROACTIVE IN CONTACTING THE OTHER. THE EOR SHALL BE CONTACTED IF SPECIFIC GC/MI CONTACT INFORMATION IS NOT MADE AVAILABLE.

4. THE GC SHALL PROVIDE THE MI WITH A MINIMUM OF 5 BUSINESS DAYS NOTICE OF IMPENDING INSPECTIONS.

5. WHEN POSSIBLE, THE GC AND MI SHALL BE ON SITE DURING THE MODIFICATION INSPECTION TO HAVE ANY NOTED DEFICIENCIES ADDRESSED DURING THE INITIAL MODIFICATION INSPECTION.

MODIFICATION INSPECTOR (MI)

1. THE MI SHALL CONTACT THE GC UPON AUTHORIZATION BY THE CLIENT TO:

   - REVIEW THE MODIFICATION INSPECTION REPORT REQUIREMENTS.
   - WORK WITH THE GC IN DEVELOPMENT OF A SCHEDULE FOR ON–SITE INSPECTIONS.
   - DISCUSS CRITICAL INSPECTIONS AND PROJECT CONCERNS.

2. THE MI IS RESPONSIBLE FOR COLLECTION OF ALL INSPECTION AND TEST REPORTS, REVIEWING REPORTS FOR ADHERENCE TO THE CONTRACT DOCUMENTS, CONDUCTING ON–SITE INSPECTIONS AND COMPILATION & SUBMISSION OF THE MODIFICATION INSPECTION REPORT TO THE CLIENT AND THE EOR.

GENERAL CONTRACTOR (GC)

1. THE GC IS REQUIRED TO CONTACT THE GC UPON AUTHORIZATION TO PROCEED WITH CONSTRUCTION BY THE CLIENT TO:

   - REVIEW THE MODIFICATION INSPECTION REPORT REQUIREMENTS.
   - WORK WITH THE MI IN DEVELOPMENT OF A SCHEDULE FOR ON–SITE INSPECTIONS.
   - DISCUSS CRITICAL INSPECTIONS AND PROJECT CONCERNS.

2. THE GC IS RESPONSIBLE FOR COORDINATING AND SCHEDULING IN ADVANCE ALL REQUIRED INSPECTIONS AND TESTS WITH THE MI.

CORRECTION OF FAILING MODIFICATION INSPECTION

1. SHOULD THE STRUCTURAL MODIFICATION NOT COMPLY WITH THE REQUIREMENTS OF THE CONSTRUCTION DOCUMENTS, THE GC SHALL WORK WITH THE MODIFICATION INSPECTOR IN A VIABLE REMEDIATION PLAN AS FOLLOWS:

   - CORRECT ALL DEFICIENCIES TO COMPLY WITH THE CONTRACT DOCUMENTS AND COORDINATE WITH THE MI FOR A FOLLOW UP INSPECTION.
   - WITH CLIENT AUTHORIZATION, THE GC MAY WORK WITH THE EOR TO REANALYZE THE MODIFICATION USING THE AS–BUILT CONDITION.

REQUIRED PHOTOGRAPHS

1. THE GC AND MI SHALL AT MINIMUM PHOTO DOCUMENT THE FOLLOWING FOR INCLUSION IN THE MODIFICATION INSPECTION REPORT:

   - PRE–CONSTRUCTION: GENERAL CONDITION OF THE SITE.
   - DURING CONSTRUCTION: RAW MATERIALS, CRITICAL DETAILS, WELD PREPARATION, BOLT INSTALLATION & TORQUE, FINAL INSTALLED CONDITION & SURFACE COATING REPAIRS.
   - POST–CONSTRUCTION: FINAL CONDITION OF THE SITE

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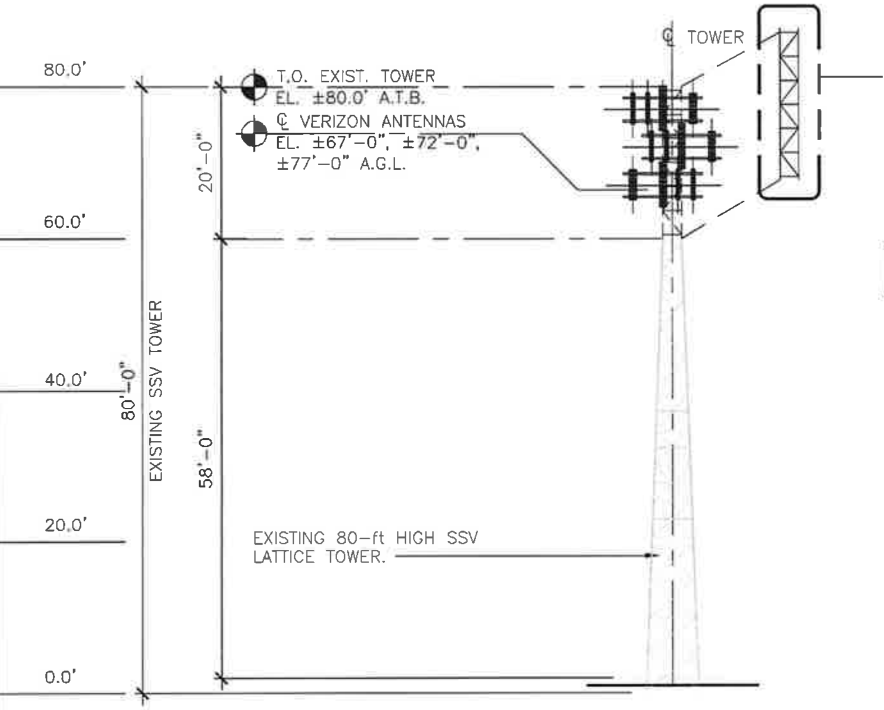
MODIFICATION
INSPECTION
REQUIREMENTS

SHEET NO.
MI–1
Sheet No. 4 of 6

SECTION	LEGS	LEG GRADE	DIAGONALS	DIAGONAL GRADE	TOP GIRTS	BOTTOM GIRTS	HORIZONTALS
T1	SR 1-1/2	A572-50	SR 1	A36	SR 1	SR 1	SR 1
T2	P2.0X0.218 W/ SP	A53-B-35	P1.25X0.14	A53-B-35	P.75X0.154	P.75X0.154	P.75X0.154
T3	P2.5X0.203 W/ SP		SR 1/2	A36	P1.25X0.140	P1.25X0.140	P1.25X0.140
T4	P3.0X0.300 W/ SP				P1.50X0.145	P1.50X0.145	P1.50X0.145



LEGEND:
1. A.G.L.= ABOVE GROUND LEVEL
2. A.T.B.= ABOVE TOWER BASE

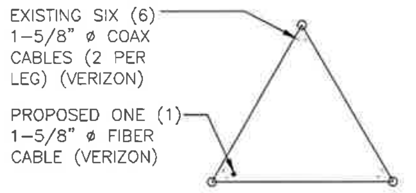
TXX DENOTES RISA TOWER OUTPUT SECTION NUMBER

MAX. TOWER STEEL USAGE w/ ABOVE REINFORCEMENTS:
LOAD CASE #1 = 94.5%
(LEG SECTION T2 40'-0"-60'-0")

1 / S-1 TOWER ELEVATION

SCALE: 1/20" = 1'-0"

NOTE: REMOVE SIX (6) 1-5/8" ø COAX CABLES (2 PER LEG) (VERIZON)



2 / S-1 FEEDLINE PLAN

SCALE: 1/4" = 1'-0"

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NEW LONDON
88 WESTWOOD AVE
NEW LONDON, CT 06320

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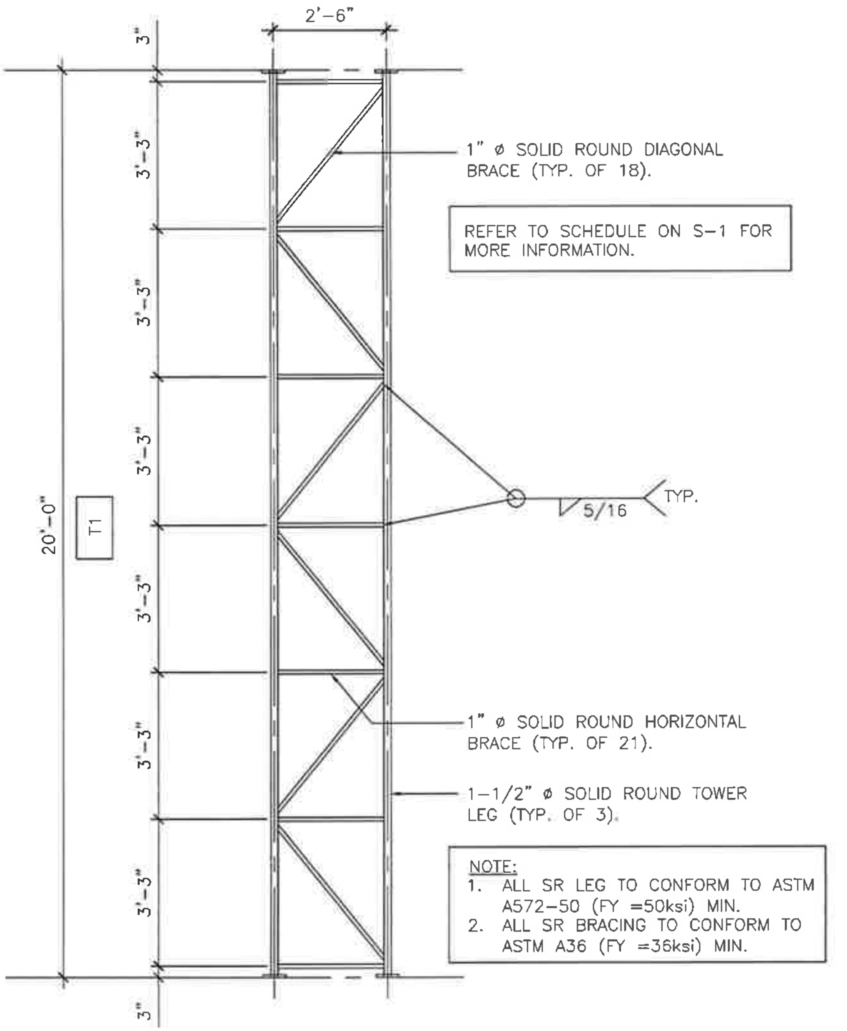
TOWER ELEVATION AND FEEDLINE PLAN

SHEET NO.
S-1
Sheet No. 1 of 5

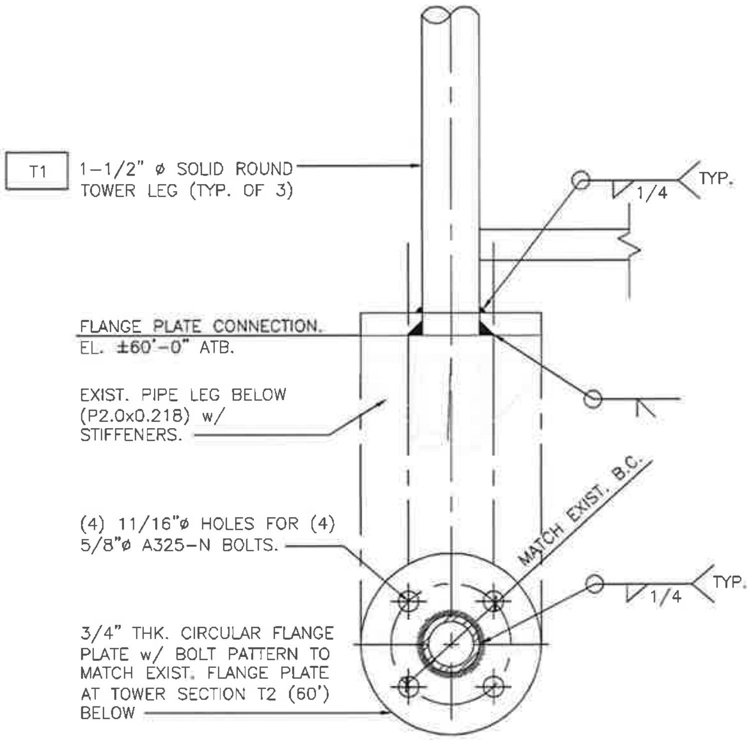


REFER TO SCHEDULE ON S-1 FOR MORE INFORMATION.

NOTE:
1. ALL SR LEG TO CONFORM TO ASTM A572-50 (FY =50ksi) MIN.
2. ALL SR BRACING TO CONFORM TO ASTM A36 (FY =36ksi) MIN.

1 / S-2 TOWER SECTION T-1 ELEVATION

SCALE: 3/8" = 1'-0"



2 / S-2 TOWER SECTION T-1 FLANGE CONNECTION

SCALE: 3" = 1'-0"

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TOWER
REINFORCEMENT
DETAILS

SHEET NO.
S-2
Sheet No. of

SITE NAME		**NEW LONDON CT**	**ECP - CELL #**		**2**	**133**
LATITUDE		**41-20-48.00 N**	**LONGITUDE**			**72-06-47.00 W**
Notes: Change 700,AWS and PCS to RET Add RRH 2X60 AWS Add RRH 2X40 700 Add F Block Move Diplex from 700 + AWS to PCS + 850			**SAVE BUTTON** **STRUCTURE TYPE**			**Lattice**
700 Mhz - LTE Current 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		160		260
DOWN TILT (MECH/ELEC)		5/0		0/0		0/0
RAD CTR (FT AGL)		76		66.9		72
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
700 Mhz - LTE Future Config		**ALPHA**		**BETA**		**GAMMA**
EQUIPMENT TYPE		eNodeB		eNodeB		eNodeB
ANTENNA TYPE		LNX-6514DS-A1M		LNX-6514DS-A1M		LNX-6514DS-A1M
QTY OF ANTENNAS PER FACE		1		1		1
ORIENTATION (DEG)		30		160		260
DOWN TILT (MECH/ELEC)		0/5		0		0
RAD CTR (FT AGL)		76		66.9		72
TMA - QTY / MODEL	1	ALU RH_2X40 700	1	ALU RH_2X40 700	1	ALU RH_2X40 700
DIPLEXER - QTY / MODEL						
850 Celluar - Current Config		**ALPHA**		**BETA**		**GAMMA**
EQUIPMENT TYPE		#N/A		#N/A		#N/A
ANTENNA TYPE		BXA-80063/4CF 5		BXA-80063/4CF		BXA-80063/4CF
QTY OF ANTENNAS PER FACE		1		1		1
ORIENTATION (DEG)		30		160		260
DOWN TILT (MECH/ELEC)		0		0		0
RAD CTR (FT AGL)		76		66.9		72
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
850 Celluar - Future Config		**ALPHA**		**BETA**		**GAMMA**
EQUIPMENT TYPE		#N/A		#N/A		#N/A
ANTENNA TYPE		#N/A		#N/A		#N/A
QTY OF ANTENNAS PER FACE		BXA-80063/4CF 5		BXA-80063/4CF		BXA-80063/4CF
ORIENTATION (DEG)		1		1		1
DOWN TILT (MECH/ELEC)		30		160		260
RAD CTR (FT AGL)		0		0		0
TMA - QTY / MODEL		76		66.9		72
DIPLEXER - QTY / MODEL	2	FD9R6004/2C-3L	2	FD9R6004/2C-3L	2	FD9R6004/2C-3L
		PCS + Cellular		PCS + Cellular		PCS + Cellular
1900 PCS - Current Config		**ALPHA**		**BETA**		**GAMMA**
EQUIPMENT TYPE		PCS Modcell 4.0B		PCS Modcell 4.0B		PCS Modcell 4.0B
ANTENNA TYPE		BXA-171063-8BF_2		BXA-171063-8BF_2		BXA-171063-8BF_2
QTY OF ANTENNAS PER FACE		1		1		1
ORIENTATION (DEG)		30		160		260
DOWN TILT (MECH/ELEC)		0/0		0/0		0/0
RAD CTR (FT AGL)		76		66.9		72
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
1900 PCS - Future Config		**ALPHA**		**BETA**		**GAMMA**
EQUIPMENT TYPE		PCS Modcell 4.0B		PCS Modcell 4.0B		PCS Modcell 4.0B
ANTENNA TYPE		HBXX-6516DS-A2M		HBXX-6516DS-A2M		HBXX-6516DS-A2M
QTY OF ANTENNAS PER FACE		1		1		1
ORIENTATION (DEG)		30		160		260
DOWN TILT (MECH/ELEC)		0/0		0/0		0/0
RAD CTR (FT AGL)		76		66.9		72
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL	2	FD9R6004/2C-3L	2	FD9R6004/2C-3L	2	FD9R6004/2C-3L
		Cellular + PCS		Cellular + PCS		Cellular + PCS
AWS - LTE Current Config		**ALPHA**		**BETA**		**GAMMA**
EQUIPMENT TYPE		2100 MHz BBU		2100 MHz BBU		2100 MHz BBU
ANTENNA TYPE		BXA-171063-12CF_2		BXA-171063-12CF_2		BXA-171063-12CF_2
QTY OF ANTENNAS PER FACE		1		1		1
ORIENTATION (DEG)		30		160		260
DOWN TILT (MECH/ELEC)		0/0		0/0		0/0
RAD CTR (FT AGL)		76		66.9		72
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL	2	FD9R6004/2C-3L	2	FD9R6004/2C-3L	2	FD9R6004/2C-3L
SECTOR DISTRIBUTION BOX						
MAIN DISTRIBUTION BOX		1				DB-T1-6Z-8AB-0Z
AWS - LTE Future Config		**ALPHA**		**BETA**		**GAMMA**
EQUIPMENT TYPE		2100 MHz BBU		2100 MHz BBU		2100 MHz BBU
ANTENNA TYPE		HBXX-6517DS-A2M		HBXX-6517DS-A2M		HBXX-6517DS-A2M
QTY OF ANTENNAS PER FACE		1		1		1
ORIENTATION (DEG)		30		160		260
DOWN TILT (MECH/ELEC)		0/0		0/0		0/0
RAD CTR (FT AGL)		76		66.9		72
TMA - QTY / MODEL						
RRH - QTY/MODEL	1	ALU RH_2X60-AWS	1	ALU RH_2X60-AWS	1	ALU RH_2X60-AWS
SECTOR DISTRIBUTION BOX						
MAIN DISTRIBUTION BOX		2				DB-T1-6Z-8AB-0Z

NUMBER OF CABLE'S NEEDED						**ESTIMATED CABLE LENGTH**			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES			6	MAINLINE (FT)			
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS			6	TOP JUMPER (FT)			0
Equipment Cable Ordering		**MAIN CABLE**	12	-	6	**TOP JUMPER #**	3	+	3
FIBER LINE SIZE	1 5/8"	TOTAL # OF FIBER LINES			1	FIBER LINE MODEL #			158-1-08U8-S8
JUMPER SIZE	5/8"	TOTAL # OF TOP JUMPERS			6	TOP JUMPER MODEL #			058-1-08U1-S1
Fiber Cable Ordering		**FIBER CABLE**	0	+	1	**TOP JUMPER #**	3	+	3

TX / RX FREQUENCIES			**TX POWER OUTPUT**	
Cellular A-Band	**PCS F / AWS-Band**	**700 Mhz C -**	Cellular (Watts)	20
TX - 869-880,890-891.5 MHz	TX - 1970-1975 / 2145-21	TX - 746-757	PCS (Watts)	60
RX - 824-835,845-846.5 MHz	RX - 1890-1895 / 1745-17	RX - 776-787	LTE (Watts)	40
			AWS(Watts)	60

ALPHA				**BETA**				**GAMMA**			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1	800	Tx1/Rx0	RED	A7	800	Tx2/Rx0	BLUE	A13	800	Tx3/Rx0	GREEN
A2	1900	Tx1/Rx0	RED/ WHITE	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/ ORANGE	A9	700	Tx2/Rx0	BLUE/ ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE
A4	700	Tx4/Rx1	RED/RED/ ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A5	1900	Tx4/Rx1	RED/RED/ WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN

RF ENGINEER	**RF MANAGER**	**INITIALS**	**DATE**
Prepared By: Ray Paradis	Rob Hesselbach	RLP	12/26/2014

Site Configuration

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6514DS-VTM

Andrew® Antenna, 698–896 MHz, 65° horizontal beamwidth, RET compatible

- Great solution to maximize network coverage and capacity
- Excellent gain, VSWR, front-to-back ratio, and PIM specifications for robust network performance
- Ideal choice for site collocations and tough zoning restrictions
- Excellent solution for site sharing and maximizing capacity
- Fully compatible with Andrew remote electrical tilt system for greater OpEx savings
- The RF connectors are designed for IP67 rating and the radome for IP56 rating

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Gain, dBi	15.7	16.3
Beamwidth, Horizontal, degrees	65	65
Beamwidth, Horizontal Tolerance, degrees	±3	±3
Beamwidth, Vertical, degrees	12.5	11.2
Beam Tilt, degrees	0–10	0–10
USLS, typical, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	20	20
CPR at Sector, dB	10	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°
Impedance	50 ohm	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol®
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	698 – 896 MHz

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Bottom
Connector Quantity, total	2
Lightning Protection	dc Ground
Radiator Material	Aluminum
Radome Material	Fiberglass, UV resistant
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	181.0 mm | 7.1 in
Length	1847.0 mm | 72.7 in
Width	301.0 mm | 11.9 in
Net Weight	17.6 kg | 38.8 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	LNX-6514DS-R2M
Model with Factory Installed AISG 2.0 Actuator	LNX-6514DS-A1M
RET System	Teletilt®

Regulatory Compliance/Certifications

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

Included Products

DB380 — Pipe Mounting Kit for 2.4"-4.5" (60-115mm) OD round members on wide panel antennas. Includes 2 clamp sets and double nuts.

DB5083 — Downtilt Mounting Kit for 2.4"-4.5" (60 - 115 mm) OD round members. Includes a heavy-duty, galvanized steel downtilt mounting bracket assembly and associated hardware. This kit is compatible with the DB380 pipe mount kit for panel antennas that are equipped with two mounting brackets.

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6516DS-VTM

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

- Each DualPol® array can be independently adjusted for greater flexibility
- Excellent gain, VSWR, front-to-back ratio, and PIM specifications for robust network performance
- Ideal choice for site collocations and tough zoning restrictions
- Great solution to maximize network coverage and capacity

Electrical Specifications

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain, dBi	17.7	18.0	18.0
Beamwidth, Horizontal, degrees	67	66	64
Beamwidth, Vertical, degrees	7.5	7.0	6.6
Beam Tilt, degrees	0–10	0–10	0–10
USLS, dB	18	18	18
Front-to-Back Ratio at 180°, dB	30	30	30
CPR at Boresight, dB	22	22	21
CPR at Sector, dB	8	9	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain by all Beam Tilts, average, dBi	17.2	17.2	17.5
Gain by all Beam Tilts Tolerance, dB	±0.3	±0.3	±0.5
Gain by Beam Tilt, average, dBi	0 ° | 17.0 5 ° | 17.3 10 ° | 17.0	0 ° | 17.1 5 ° | 17.4 10 ° | 17.0	0 ° | 17.4 5 ° | 17.7 10 ° | 17.2
Beamwidth, Horizontal Tolerance, degrees	±2.7	±2.3	±3.5
Beamwidth, Vertical Tolerance, degrees	±0.5	±0.4	±0.4
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	26	26	26
CPR at Boresight, dB	22	22	22
CPR at Sector, dB	9	9	9

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

General Specifications

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

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Low loss circuit board
Radome Material	PVC, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	4
Wind Loading, maximum	419.0 N @ 150 km/h 94.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	166.0 mm | 6.5 in
Length	1294.0 mm | 50.9 in
Width	305.0 mm | 12.0 in
Net Weight	13.9 kg | 30.6 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	HBXX-6516DS-R2M
Model with Factory Installed AISG 2.0 Actuator	HBXX-6516DS-A2M
RET System	Teletilt®

Regulatory Compliance/Certifications

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

Included Products

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

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6517DS-VTM

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

- Superior azimuth tracking and pattern symmetry with excellent passive intermodulation suppression
- The values presented on this datasheet have been calculated based on N-P-BASTA White Paper version 9.6 by the NGMN Alliance

Electrical Specifications

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® single band, quad
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2180 MHz
Number of Ports, all types	4

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Low loss circuit board
Radome Material	PVC, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom

RF Connector Quantity, total	4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

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

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	HBXX-6517DS-R2M
Model with Factory Installed AISG 2.0 Actuator	HBXX-6517DS-A2M
RET System	Teletilt®

Regulatory Compliance/Certifications

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

Included Products

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

ALCATEL-LUCENT WIRELESS PRODUCT DATASHEET

RRH2X60-AWS FOR BAND 4 APPLICATIONS

The Alcatel-Lucent RRH2x60-AWS is a high power, small form factor Remote Radio Head operating in the AWS frequency band (3GPP Band 4) for LTE technology. It is designed with an eco-efficient approach, providing operators with the means to achieve high quality and high capacity coverage with minimum site requirements and efficient operation.

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

The Alcatel-Lucent RRH2x60-AWS is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information.

SUPERIOR RF PERFORMANCE

The Alcatel-Lucent RRH2x60-AWS integrates all the latest technologies. This allows to offer best-in-class characteristics.

It delivers an outstanding 120 watts of total RF power thanks to its two transmit RF paths of 60 W each.

It is ideally suited to support multiple-input multiple-output (MIMO) 2x2 operation.

It includes four RF receivers to natively support 4-way uplink reception diversity. This improves the radio uplink coverage and this can be used to extend the cell radius commensurate with 2x2MIMO 2x60 W for the downlink.

It supports multiple discontinuous LTE carriers within an instantaneous bandwidth of 45 MHz corresponding to the entire AWS B4 spectrum.

The latest generation power amplifiers (PA) used in this product achieve high efficiency (>40%), resulting in improved power consumption figures.

OPTIMIZED TCO

The Alcatel-Lucent RRH2x60-AWS is designed to make available all the benefits of a distributed Node B, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX).

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

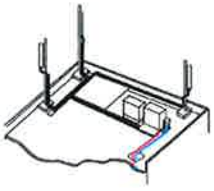
EASY INSTALLATION

The RRH2x60-AWS includes a reversible mounting bracket which allows for ease of installation behind an antenna, or on a rooftop knee wall while providing easy access to the mid body RF connectors.

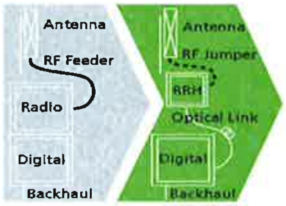
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation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

The Alcatel-Lucent RRH2x60-AWS is a zero-footprint solution and is convection cooled without fans for silent operation, simplifying negotiations with site property owners and minimizing environmental impacts.

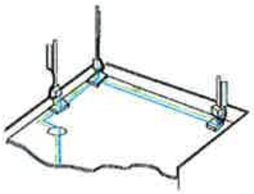
Installation can easily be done by a single person as the Alcatel–Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

FEATURES

- RRH2x60-AWS integrates two power amplifiers of 60W rating (at each antenna connector)
- Support multiple carriers over the entire 3GPP band 4
- RRH2x60-AWS is optimized for LTE operation
- RRH2x60-AWS is a very compact and lightweight product
- Advanced power management techniques are embedded to provide power savings, such as PA bias control

BENEFITS

- MIMO LTE operation with only one single unit per sector
- Improved uplink coverage with built-in 4-way receive diversity capability
- RRH can be mounted close to the antenna, eliminating nearly all losses in RF cables and thus reducing power consumption by 50% compared to conventional solutions
- Distributed configurations provide easily deployable and cost-effective solutions, near zero footprint and silent solutions, with minimum impact on the neighborhood, which ease the deployment
- RETA and TMA support without additional hardware thanks to the AISG v2.0 port and the integrated Bias-Tees. Bias-Tees support AISG DC supply and signaling.

TECHNICAL SPECIFICATIONS

Specifications listed are hardware capabilities. Some capabilities depend on support in a specific software release or future release.

Dimensions and weights

- HxWxD : 510x285x186mm (27 l with solar shield)
- Weight : 20 kg (44 lbs)

Electrical Data

- Power Supply : -48V DC (-40.5 to -57V)
- Power Consumption (ETSI average traffic load reference) : 250W @2x60W

RF Characteristics

- Frequency band: 1710-1755, UL / 2110-2155 MHz, DL (3GPP band 4)
- Output power: 2x60W at antenna connectors
- Technology supported: LTE
- Instantaneous bandwidth: 45 MHz
- Rx diversity: 2-way and 4-way uplink reception
- Typical sensitivity without Rx diversity: -105 dBm for LTE

Connectivity

- Two CPRI optical ports for daisychaining and up to six RRHs per fiber
- Type of optical fiber: Single-Mode (SM) and Multi-Mode (MM) SFPs
- Optical fiber length: up to 500m using MM fiber, up to 20km using SM fiber
- TMA/RETA : AISG 2.0 (RS485 connector and internal Bias-Tee)
- Six external alarms
- Surge protection for all external ports (DC and RF)

Environmental specifications

- Operating temperature: -40°C to 55°C including solar load
- Operating relative humidity: 8% to 100%
- Environmental Conditions : ETS 300 019-1-4 class 4.1E
- Ingress Protection : IEC 60529 IP65
- Acoustic Noise : Noiseless (natural convection cooling)

Safety and Regulatory Data

- EMC : 3GPP 25113, EN 301 489-1, EN 301 489-23, GR 1089, GR 3108, OET-65
- Safety : IEC60950-1, EN 60825-1, UL, ANSI/NFPA 70, CAN/CSA-C22.2
- Regulatory : FCC Part 15 Class B, CE Mark – European Directive : 2002/95/EC (ROHS); 2002/96/EC (WEEE); 1999/5/EC (R&TTE)
- Health : EN 50385

Alcatel·Lucent

AT THE SPEED OF IDEAS™

Product Data Sheet 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 IEEE C62.41 NEMA LS-1 IEC 61643-1 IEC 61643-12 EN 61643-11	N/A N/A N/A N/A N/A N/A

* This data is provisional and subject to change.