Robinson+Cole

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Also admitted in Massachusetts

August 27, 2014

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

Re: **Notice of Exempt Modification – Facility Modification**
79 Putnam Turnpike, Killingly, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 108-foot level on the existing 150-foot tower at 79 Putnam Turnpike in Killingly, Connecticut (the "Property"). The tower and the Property are owned by the Town of Killingly. The Council approved Cellco's use of this tower in 2008. Cellco now intends to modify its facility by replacing all twelve (12) of its antennas with three (3) model X7C-FRO-660-V, 700 MHz antennas; three (3) model X7C-FRO-660-V, 850 MHz antennas; three (3) model HBXX-6517DS-VTM, 1900 MHz antennas; and three (3) model HBXX-6517DS-VTM, 2100 MHz antennas, all at the same 108-foot level on the tower. Cellco also intends to install nine (9) remote radio heads ("RRHs"), three (3) each behind its 700, 1900 and 2100 MHz antennas and two (2) HYBRIFLEX™ antenna cables. Included in Attachment 1 are specifications for Cellco's replacement antennas, RRHs and HYBRIFLEX™ cables.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Sean Hendricks, Town Manager for the Town of Killingly.

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

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1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's new antennas and RRHs will be installed at the 108-foot level of the existing 150-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. A cumulative General Power Density table for Cellco's modified facility is included in Attachment 2.

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

6. The tower and its foundation can support Cellco's proposed modifications. (*See* Structural Analysis Evaluation 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,

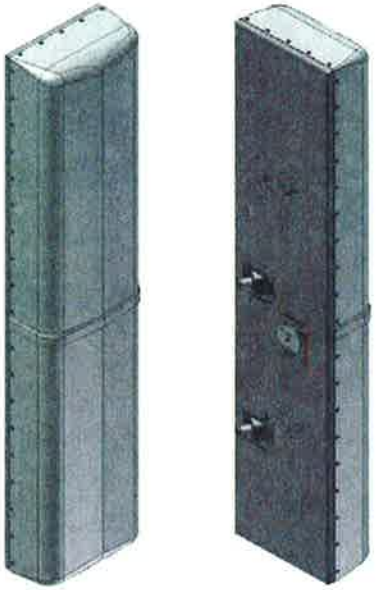
Kenneth C. Baldwin

Enclosures
Copy to:
Sean Hendricks, Killingly Town Manager
Sandy M. Carter

ATTACHMENT 1

X7C-FRO-660-V

X-Pol Antenna, 698-896MHz, Fast-Roll-Off 60° H-Beam
RET/MET



- Designed to improve SNR
- Greatly increases LTE data rates
- Broadband radiator
- Macro Cell, high gain antenna
- Suitable for LTE/CDMA/UMTS/GSM
- AISG 2.0 RET or manual MET tilt control

Electrical Specifications

Frequency Band, MHz	**698-824**	**824-896**
Horizontal Beamwidth, 3dB points	62	58
Gain, dBi	15.9	16.0
Vertical Beamwidth, 3dB points	12.0	10.5
Front-to-Back at 180°, dB	>28	
Upper Sidelobe Suppression, Typical, dB	<-18	
Polarization	+/-45°	
Electrical Downtilt	0-10° or 4-14°	
VSWR/Return Loss, dB, Maximum	1.5:1/14.0	
Isolation Between Ports, dB, Mimimum	-28	
Intermodulation (2x20w), IM3, dBc, Maximum	-150	
Impedance, ohms	50	
Maximum Power Per Connector, CW	500	

www.cssantenna.com
410-612-0080
customerservice@cssantenna.com

X7C-FRO-660-V

X-Pol Antenna, 698-896MHz, Fast-Roll-Off 60° H-Beam
RET/MET

Mechanical Specifications

Dimensions, Length/Width/Depth	72.0/14.6/8.0 in (1829/372/204 mm)
Connector (Quantity) Type	(2) 7-16 DIN Female
Connector Torque	220-265 lbf-in (25-30 N-m)
Connector Location	Back
Antenna Weight	35.0 lbs
Bracket Weight	13.2 lbs (6.0 kg)
Standard Bracket Kit	CSS P/N 919011
Mechanical Downtilt Range	0-12°
Radome Material	Ultra High Strength Luran, UV Stabilized, ASTM D1925
Wind Survival	150 mph (241 km/h)
Front Wind Load	205.39 lbf (913.65 N) @100mph
Equivalent Flat Plate	4.09 sq-ft (c=2) @ 100mph

RET Information

Model	CSS-RET-200
Mounting Location	Rear of Antenna
Weight	1.2 lb (0.54 kg)
Communication Standard	AISG 2.0
Control System	CSS-PCU-220

Order Information

Model	*Description*
X7C-FRO-660-VR0	Antenna with manual RET adjust electrical downtilt 0-10°
X7C-FRO-660-VR4	Antenna with manual RET adjust electrical downtilt 4-14°
X7C-FRO-660-VM0	Antenna with remote MET adjust electrical downtilt 0-10°
X7C-FRO-660-VM4	Antenna with remote MET adjust electrical downtilt 4-14°

Optional Bracket Kit

919036	Bracket Kit, 2-Point, 12 deg D-tilt, For 4.5" OD Pole

Product Specifications

COMMSCOPE®

HBXX-6517DS-VTM

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

POWERED BY ANDREW.

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

Product Data Sheet HB158-1-08U8-S8J18

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

Product Description

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

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

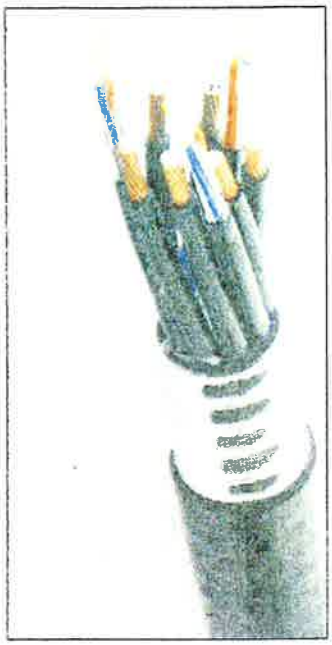


Figure 1: HYBRIFLEX Series

Features/Benefits

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

Technical Specifications

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

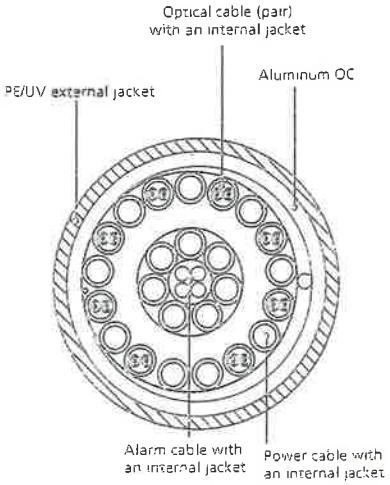


Figure 2: Construction Detail

* This data is provisional and subject to change

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

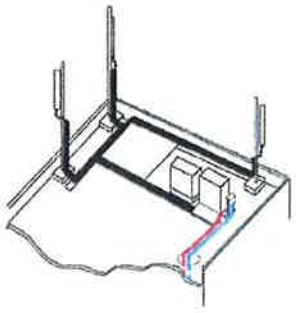
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and 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

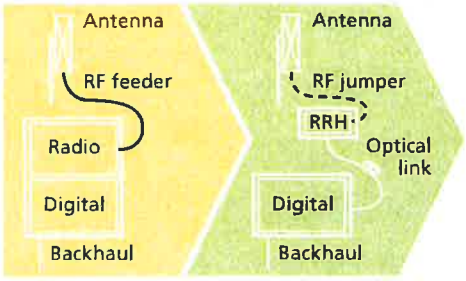
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly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

Benefits

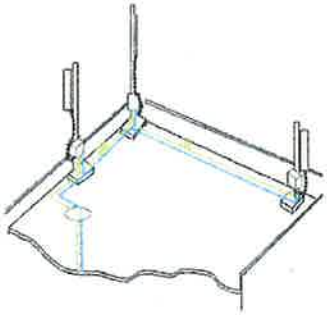
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility 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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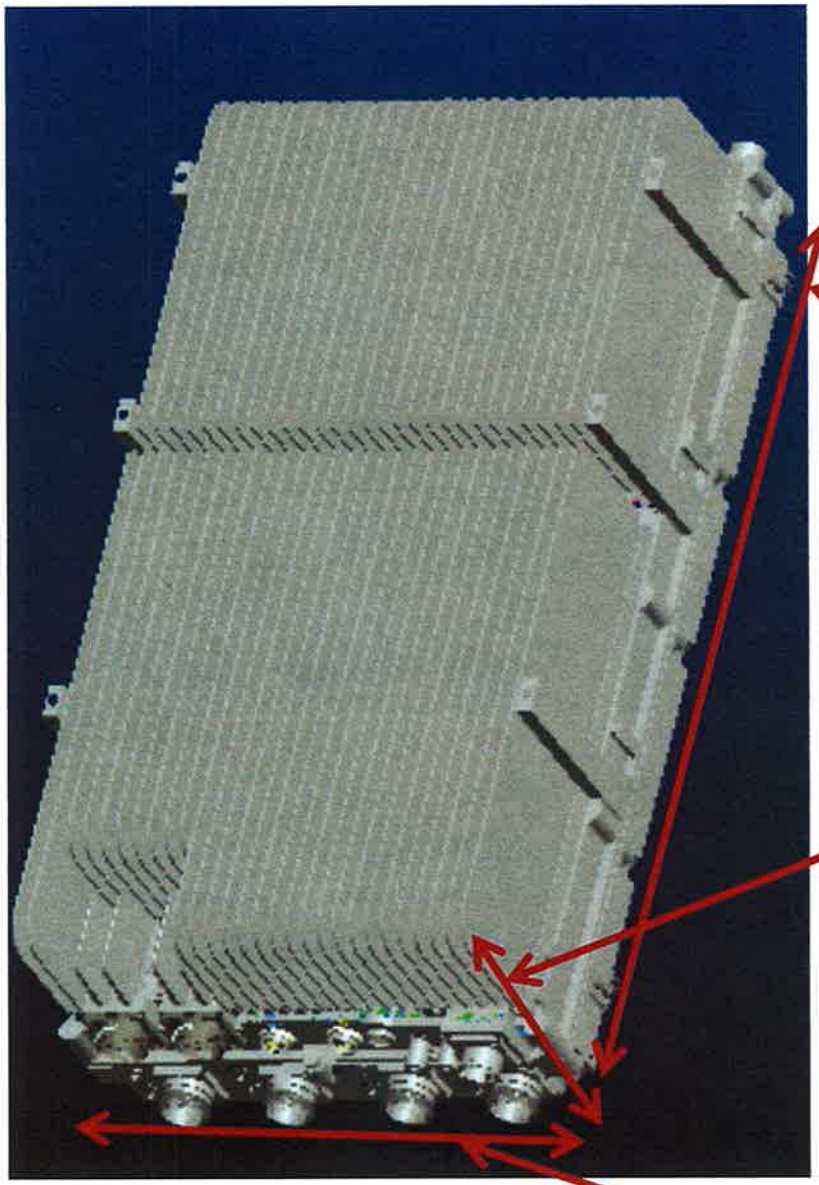
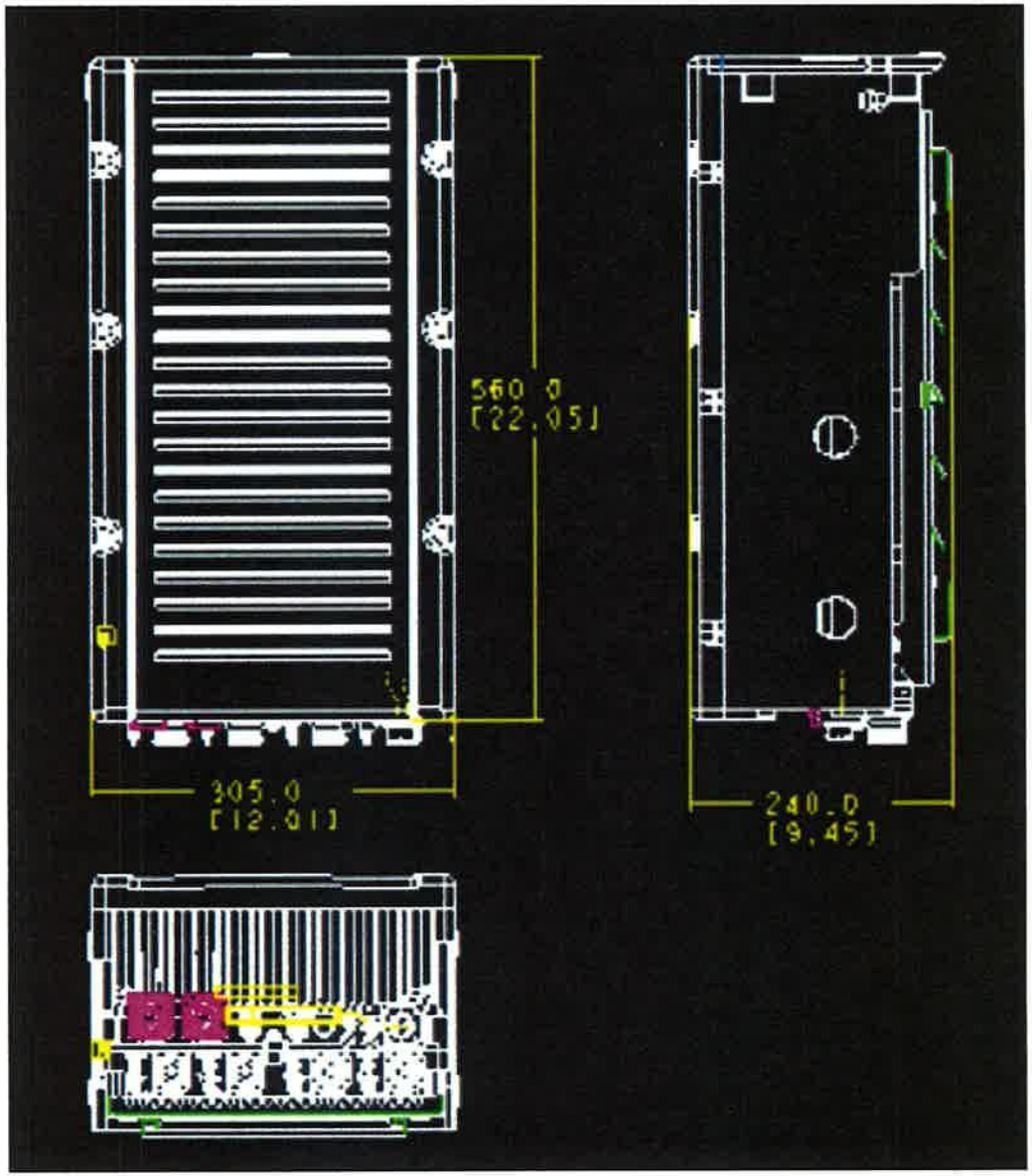
Size without solar shield or mounting brackets



525 mm tall not counting connectors or lifting features

160 mm thick

290 mm wide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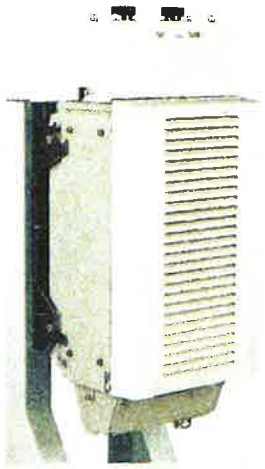
Alcatel-Lucent RRH2x40-AWS

REMOTE RADIO HEAD

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



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

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

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

Fast, low-cost installation and deployment

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

Excellent RF performance

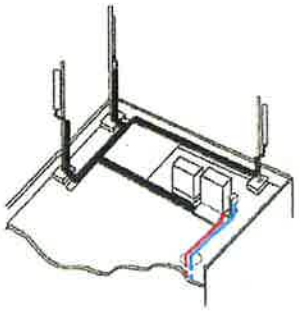
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation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

Features

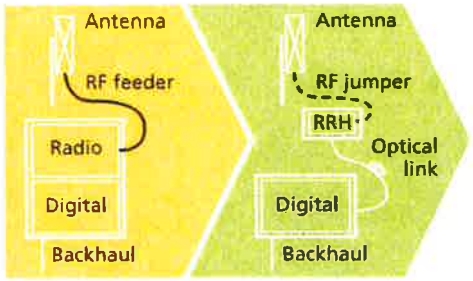
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

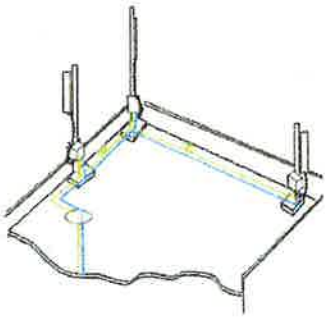
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

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

Power

- Power supply: -48VDC

Operating environment

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

RF characteristics

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

Optical characteristics

Type/number of fibers

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

Optical fiber length

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

Digital Ports and Alarms

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

Alcatel·Lucent

ATTACHMENT 2

	General	Power	Density					
Site Name: Killingly Center								
Tower Height: 150ft								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*AT&T UMTS	2	500	130	0.0213	880	0.5867	3.63%	
*AT&T UMTS	1	500	130	0.0106	1900	1.0000	1.06%	
*AT&T LTE	1	500	130	0.0106	700	0.4667	2.28%	
*AT&T LTE	1	500	130	0.0106	1900	1.0000	1.06%	
*AT&T LTE	1	500	130	0.0106	2300	1.0000	1.06%	
*MetroPCS	3	443.61	98	0.0498	2140	1.0000	4.98%	
*VoiceStream	4	250	150	0.0160	1930	1.0000	1.60%	
*Sprint	4	250	140	0.0183	1962.5	1.0000	1.83%	
*Town	4	200	118	0.0207	155.72	0.2000	10.33%	
*Town	4	200	86	0.0389	155.74	0.2000	19.45%	
Verizon	**11**	**451**	**108**	**0.1529**	**1970**	**1.0000**	**15.29%**	
Verizon	**9**	**411**	**108**	**0.1140**	**869**	**0.5793**	**19.68%**	
Verizon	**1**	**1750**	**108**	**0.0539**	**2145**	**1.0000**	**5.39%**	
Verizon	**1**	**1050**	**108**	**0.0324**	**698**	**0.4973**	**6.51%**	
								94.17%
* Source: Siting Council								

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

150-ft Existing Nudd Monopole

Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Killingly Center

79 Putnam Turnpike
Dayville (Killingly), CT

Centek Project No. 14152.000

Date: August 8, 2014

Prepared for:

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

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

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Introduction

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

The host tower is a 150-ft tall, five-section, twelve sided, tapered monopole, originally designed and manufactured by Fred A. Nudd; dated July 24, 1998. The original manufacturers design documents were unavailable for use in this report. The tower geometry and structure member sizes were obtained from a previous structural report prepared by Hudson Design Group dated May 1, 2014. Antenna and appurtenance information were obtained from the aforementioned Hudson structural report and a Verizon RF data sheet.

The tower is made up of five (5) tapered vertical sections consisting of A36M-45 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 27.813-in at the top and 73.813-in at the base.

Verizon proposes the removal of twelve (12) existing panel antennas and the installation of twelve (12) panel antennas, nine (9) RRH's and two (2) distribution boxes mounted to the existing low profile platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

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

- TOWN (EXISTING):
  Antennas: Two (2) 4-ft omni-directional antennas mounted on the existing T-Mobile low profile platform with an elevation of 153-ft above grade.
  Coax Cables: Two (2) 7/8" ∅ coax cables running on the inside of the existing tower.
- T-MOBILE (EXISTING):
  Antennas: Six (6) EMS RV90-17-02DP panel antennas and six (6) TMA's mounted on three (3) 12-ft T-Frames with a RAD center elevation of 149-ft above grade.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- SPRINT (EXISTING):
  Antennas: Six (6) Decibel DB980H90E-M panel antennas mounted on three (3) 12-ft T-Frames with a RAD center elevation of 138-ft above grade.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- AT&T (EXISTING):
  Antennas: Three (3) Powerwave 7770.00 panel antennas, nine (9) CCI HPA-65R-BUU-H8 panel antennas, six (6) Ericsson RRUS-11 remote radio heads, six (6) Ericsson RRUS-12 remote radio heads, three (3) Ericsson RRUS-E2 remote radio heads, three (3) Ericsson RRUS-32 remote radio heads, six (6) Ericsson A2 units, three (3) CCI DTMABp7819VG12A TMA's, six (6) diplexers and three (3) Raycap DC6-48-60-18-8F surge arrestors mounted on an existing low profile platform with a RAD center elevation of 130-ft above grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables, one (1) fiber trunk and two (2) DC trunks running on the inside of the existing tower.
- TOWN (EXISTING):
  Antennas: Two (2) 4-ft omni-directional antennas mounted on the two (2) 6-ft side arms with an elevation of 124-ft above grade.
  Coax Cables: Two (2) 1/2" ∅ coax cables running on the inside of the existing tower.
- VERIZON (EXISTING TO REMOVE):
  Antennas: Six (6) Antel LPA-1850623-12CF and six (6) Antel LPA-80063-6CF mounted on an existing low profile platform with a RAD center elevation of 108-ft above grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- **VERIZON (PROPOSED):**
  Antennas: Six (6) CSS X7C-FRO-660 panel antennas, six (6) Andrew HBXX-6517DS panel antennas, three (3) RRH2x40-AWS Remote Radio Heads, three (3) RRH2x40-07U Remote Radio Heads, three (3) RRH2x60-PCS Remote Radio Heads and two (2) RFS DB-T1-6Z-8AB-0Z main distribution boxes mounted on an existing low profile platform with a RAD center elevation of 108-ft above grade.
  Coax Cables: Two (2) 1-5/8" ∅ Hybriflex fiber line running on the interior of the monopole.

Primary Assumptions Used in the Analysis

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

Analysis

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

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

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

Tower Loading

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

Basic Wind Speed:	Windham; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Dayville (Killingly); v = 105 mph (3 second gust) equivalent to v = 85 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA-222-F and Appendix-K wind speeds are equal.	
Load Cases:	Load Case 1; 85 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

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

Tower Capacity

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

- Calculated stresses were found to be within allowable limits. In Load Case 1, per tnxTower "Section Capacity Table", this tower was found to be at **90.6%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L6)	40.00'-51.00'	90.6%	**PASS**

Foundation and Anchors

The existing foundation consists of a 7.5-ft ∅ x 27.75-ft long reinforced concrete caisson. The sub-grade conditions used in the analysis of the existing foundation were obtained from a previous structural analysis report prepared by Malouf Engineering; project no: CT01125M-08V1, dated July 7, 2008. The base of the tower is connected to the foundation by means of (24) 2.00"∅, ASTM A687 anchor bolts embedded the concrete foundation structure.

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

Location	Vector	Proposed Reactions
Base	Shear	46 kips
	Compression	50 kips
	Moment	4449 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	Proposed Loading	Result
Reinforced Concrete Caisson	Moment Capacity	59.1%	**PASS**

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Combined Compression and Bending	61.6%	**PASS**
Base Plate	Bending	67.8%	**PASS**

Conclusion

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

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.

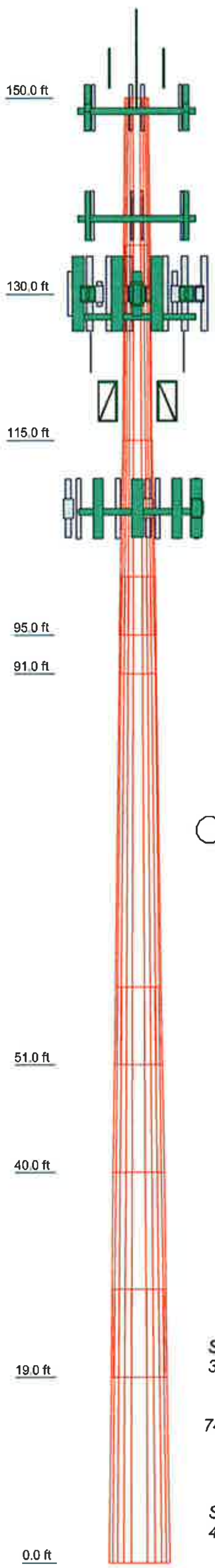
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

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

tnxTower Features:

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

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	20.000	12	0.250	5.000	27.813	34.313	A36M-45	1.7
2	20.000	12	0.250		32.188	36.688	A36M-45	1.9
3	20.000	12	0.313	6.000	36.688	45.188	A36M-45	2.8
4	10.000	12	0.313		42.013	45.813	A36M-45	1.5
5	40.000	12	0.375	8.000	45.813	58.875	A36M-45	8.5
6	19.000	12	0.375		55.513	61.688	A36M-45	4.5
7	21.000	12	0.438	9.000	61.688	68.500	A36M-45	6.5
8	28.000	12	0.438		64.705	73.813	A36M-45	9.2
								36.7



DESIGNED APPURTENANCE LOADING

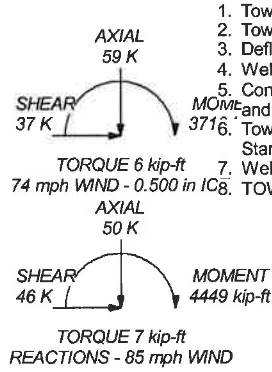
TYPE	ELEVATION	TYPE	ELEVATION
4' x 3" DIA Omni	153	(2) A2 (ATT - Existing)	130
4' x 3" DIA Omni	153	DTMABP7819VG12A TMA (ATT - Existing)	130
Lightning Rod 3/4"x8'	150	DTMABP7819VG12A TMA (ATT - Existing)	130
Pirod 12' T-Frame Sector Mount (1) (T-Mobile - Existing)	149	DTMABP7819VG12A TMA (ATT - Existing)	130
Pirod 12' T-Frame Sector Mount (1) (T-Mobile - Existing)	149	(2) DBC2055F1V1 (ATT - Existing)	130
Pirod 12' T-Frame Sector Mount (1) (T-Mobile - Existing)	149	(2) DBC2055F1V1 (ATT - Existing)	130
(2) RV90-17-02DP (T-Mobile - Existing)	149	(2) DBC2055F1V1 (ATT - Existing)	130
(2) RV90-17-02DP (T-Mobile - Existing)	149	DC6-48-60-18-8F Surge Arrestor (ATT - Existing)	130
(2) RV90-17-02DP (T-Mobile - Existing)	149	DC6-48-60-18-8F Surge Arrestor (ATT - Existing)	130
(2) TMA 10"x8"x3" (T-Mobile - Existing)	149	DC6-48-60-18-8F Surge Arrestor (ATT - Existing)	130
(2) TMA 10"x8"x3" (T-Mobile - Existing)	149	Valmont 13' Low Profile Platform (ATT - Existing)	128
(2) TMA 10"x8"x3" (T-Mobile - Existing)	149	4' x 3" DIA Omni	124
Pirod 12' T-Frame Sector Mount (1) (Sprint - Existing)	138	4' x 3" DIA Omni	124
Pirod 12' T-Frame Sector Mount (1) (Sprint - Existing)	138	Pirod 6' Side Mount Standoff (1)	119
Pirod 12' T-Frame Sector Mount (1) (Sprint - Existing)	138	Pirod 6' Side Mount Standoff (1)	119
(2) DB980H90E-M (Sprint - Existing)	138	2-ft Stand Off	119
(2) DB980H90E-M (Sprint - Existing)	138	Valmont 13' Low Profile Platform (Verizon - Proposed)	108
(2) DB980H90E-M (Sprint - Existing)	138	X7C-FRO-660 (Verizon - Proposed)	108
7770.00 (ATT - Existing)	130	HBXX-6517DS (Verizon - Proposed)	108
HPA-65R-BUU-H8 (ATT - Existing)	130	X7C-FRO-660 (Verizon - Proposed)	108
HPA-65R-BUU-H8 (ATT - Existing)	130	HBXX-6517DS (Verizon - Proposed)	108
HPA-65R-BUU-H8 (ATT - Existing)	130	X7C-FRO-660 (Verizon - Proposed)	108
7770.00 (ATT - Existing)	130	HBXX-6517DS (Verizon - Proposed)	108
HPA-65R-BUU-H8 (ATT - Existing)	130	X7C-FRO-660 (Verizon - Proposed)	108
HPA-65R-BUU-H8 (ATT - Existing)	130	HBXX-6517DS (Verizon - Proposed)	108
HPA-65R-BUU-H8 (ATT - Existing)	130	X7C-FRO-660 (Verizon - Proposed)	108
7770.00 (ATT - Existing)	130	HBXX-6517DS (Verizon - Proposed)	108
HPA-65R-BUU-H8 (ATT - Existing)	130	X7C-FRO-660 (Verizon - Proposed)	108
HPA-65R-BUU-H8 (ATT - Existing)	130	HBXX-6517DS (Verizon - Proposed)	108
HPA-65R-BUU-H8 (ATT - Existing)	130	RRH2x40-07-U (Verizon - Proposed)	108
(2) RRUS-11 (ATT - Existing)	130	RRH2x40-07-U (Verizon - Proposed)	108
(2) RRUS-11 (ATT - Existing)	130	RRH2x40-07-U (Verizon - Proposed)	108
(2) RRUS-11 (ATT - Existing)	130	RRH2x40-AWS (Verizon - Proposed)	108
(2) RRUS-12 (ATT - Existing)	130	RRH2x40-AWS (Verizon - Proposed)	108
(2) RRUS-12 (ATT - Existing)	130	RRH2x40-AWS (Verizon - Proposed)	108
(2) RRUS-12 (ATT - Existing)	130	RRH2x60-PCS (Verizon - Proposed)	108
RRUS-32 (ATT - Existing)	130	RRH2x60-PCS (Verizon - Proposed)	108
RRUS-32 (ATT - Existing)	130	RRH2x60-PCS (Verizon - Proposed)	108
RRUS-32 (ATT - Existing)	130	DB-T1-6Z-8AB-0Z (Verizon - Proposed)	108
RRUS-E2 (ATT - Existing)	130	DB-T1-6Z-8AB-0Z (Verizon - Proposed)	108
RRUS-E2 (ATT - Existing)	130		
RRUS-E2 (ATT - Existing)	130		
(2) A2 (ATT - Existing)	130		
(2) A2 (ATT - Existing)	130		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A36M-45	45 ksi	60 ksi			

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 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: 90.6%



Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job: **14152.000 - Killingly Center**		
	Project: **150ft Nudd Monopole - 79 Putnam Pike Dayville, CT**		
	Client: Verizon Wireless	Drawn by: TJL	App'd:
	Code: TIA/EIA-222-F	Date: 08/08/14	Scale: NTS
	Path: [illegible]		Dwg No. E-1

Tower Input Data

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

Basic wind speed of 85 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 74 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..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	*Elevation* *ft*	*Section Length* *ft*	*Splice Length* *ft*	*Number of Sides*	*Top Diameter* *in*	*Bottom Diameter* *in*	*Wall Thickness* *in*	*Bend Radius* *in*	*Pole Grade*
L1	150.000-130.000	20.000	5.000	12	27.813	34.313	0.250	1.000	A36M-45 (45 ksi)
L2	130.000-115.000	20.000	0.000	12	32.188	36.688	0.250	1.000	A36M-45 (45 ksi)
L3	115.000-95.000	20.000	6.000	12	36.688	45.188	0.313	1.250	A36M-45 (45 ksi)

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L4	95.000-91.000	10.000	0.000	12	42.013	45.813	0.313	1.250	A36M-45 (45 ksi)
L5	91.000-51.000	40.000	8.000	12	45.813	58.875	0.375	1.500	A36M-45 (45 ksi)
L6	51.000-40.000	19.000	0.000	12	55.513	61.688	0.375	1.500	A36M-45 (45 ksi)
L7	40.000-19.000	21.000	9.000	12	61.688	68.500	0.438	1.750	A36M-45 (45 ksi)
L8	19.000-0.000	28.000		12	64.705	73.813	0.438	1.750	A36M-45 (45 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	28.794	22.188	2151.482	9.867	14.407	149.337	4359.485	10.920	6.784	27.135
	35.523	27.420	4060.798	12.194	17.774	228.470	8228.278	13.495	8.526	34.103
L2	34.488	25.710	3347.223	11.434	16.673	200.756	6782.380	12.654	7.956	31.825
	37.982	29.332	4970.814	13.045	19.004	261.565	10072.218	14.436	9.162	36.649
L3	37.982	36.602	6181.599	13.022	19.004	325.277	12525.596	18.015	8.995	28.783
	46.782	45.155	11606.606	16.065	23.407	495.858	23518.130	22.224	11.273	36.073
L4	45.855	41.961	9313.223	14.929	21.762	427.949	18871.115	20.652	10.422	33.35
	47.429	45.784	12098.347	16.289	23.731	509.815	24514.531	22.534	11.440	36.609
L5	47.429	54.866	14458.271	16.267	23.731	609.260	29296.378	27.003	11.273	30.061
	60.952	70.639	30856.075	20.943	30.497	1011.766	62522.774	34.766	14.774	39.396
L6	60.162	66.579	25835.347	19.739	28.755	898.450	52349.418	32.768	13.872	36.993
	63.864	74.035	35523.861	21.950	31.954	1111.714	71980.974	36.438	15.527	41.406
L7	63.864	86.286	41317.892	21.927	31.954	1293.038	83721.251	42.467	15.360	35.108
	70.916	95.883	56694.845	24.366	35.483	1597.803	114879.126	47.191	17.186	39.281
L8	70.018	90.537	47731.088	23.008	33.517	1424.070	96716.125	44.560	16.169	36.957
	76.416	103.367	71033.665	26.268	38.235	1857.824	143933.463	50.874	18.609	42.535

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 150.000-130.000				1	1	1		
L2 130.000-115.000				1	1	1		
L3 115.000-95.000				1	1	1		
L4 95.000-91.000				1	1	1		
L5 91.000-51.000				1	1	1		
L6 51.000-40.000				1	1	1		
L7 40.000-19.000				1	1	1		
L8				1	1	1		

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals
ft	ft^2	in					in	in
19.000-0.000								

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
7/8	C	No	Inside Pole	150.000 - 7.000	2	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (T-Mobile - Existing)	C	No	Inside Pole	149.000 - 7.000	6	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (Sprint - Existing)	C	No	Inside Pole	138.000 - 7.000	6	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (AT&T - Existing)	C	No	Inside Pole	130.000 - 7.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
Fiber Trunk (AT&T - Existing)	C	No	Inside Pole	130.000 - 7.000	1	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
DC Trunk (AT&T - Existing)	C	No	Inside Pole	130.000 - 7.000	2	No Ice	0.000	0.000
						1/2" Ice	0.000	0.000
1/2	C	No	Inside Pole	120.000 - 7.000	2	No Ice	0.000	0.000
						1/2" Ice	0.000	0.000
HYBRIFLEX 1-5/8" (Verizon - Proposed)	C	No	Inside Pole	108.000 - 7.000	2	No Ice	0.000	0.002
						1/2" Ice	0.000	0.002

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.000-130.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.190
L2	130.000-115.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.411
L3	115.000-95.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.605
L4	95.000-91.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.126
L5	91.000-51.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	1.262
L6	51.000-40.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.347
L7	40.000-19.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.663
L8	19.000-0.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000

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
		C	0.000	0.000	0.000	0.000	0.379

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.000-130.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.190
L2	130.000-115.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.411
L3	115.000-95.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.605
L4	95.000-91.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.126
L5	91.000-51.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	1.262
L6	51.000-40.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.347
L7	40.000-19.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.663
L8	19.000-0.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.379

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Lightning Rod 3/4"x8'	C	From Face	3.500	4.000	0.000	150.000	No Ice	0.600	0.600	0.014
			0.000				1/2" Ice	1.415	1.415	0.020
4' x 3" DIA Omni	C	From Leg	2.000	0.000	0.000	153.000	No Ice	1.000	1.000	0.015
			0.000				1/2" Ice	1.248	1.248	0.024
4' x 3" DIA Omni	B	From Leg	2.000	0.000	0.000	153.000	No Ice	1.000	1.000	0.015
			0.000				1/2" Ice	1.248	1.248	0.024
Pirod 12' T-Frame Sector Mount (1) (T-Mobile - Existing)	A	From Face	1.000	0.000	0.000	149.000	No Ice	13.600	13.600	0.465
			0.000				1/2" Ice	18.400	18.400	0.600
Pirod 12' T-Frame Sector	B	From Face	1.000	0.000	0.000	149.000	No Ice	13.600	13.600	0.465

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Mount (1)			0.000			1/2" Ice	18.400	18.400	0.600
(T-Mobile - Existing)			0.000						
Pirod 12' T-Frame Sector	C	From Face	1.000	0.000	149.000	No Ice	13.600	13.600	0.465
Mount (1)			0.000			1/2" Ice	18.400	18.400	0.600
(T-Mobile - Existing)			0.000						
(2) RV90-17-02DP	A	From Face	1.000	0.000	149.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			0.000			1/2" Ice	4.775	2.312	0.040
			0.000						
(2) RV90-17-02DP	B	From Face	1.000	0.000	149.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			0.000			1/2" Ice	4.775	2.312	0.040
			0.000						
(2) RV90-17-02DP	C	From Face	1.000	0.000	149.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			0.000			1/2" Ice	4.775	2.312	0.040
			0.000						
(2) TMA 10"x8"x3"	A	From Face	1.000	0.000	149.000	No Ice	0.778	0.292	0.015
(T-Mobile - Existing)			0.000			1/2" Ice	0.899	0.380	0.020
			0.000						
(2) TMA 10"x8"x3"	B	From Face	1.000	0.000	149.000	No Ice	0.778	0.292	0.015
(T-Mobile - Existing)			0.000			1/2" Ice	0.899	0.380	0.020
			0.000						
(2) TMA 10"x8"x3"	C	From Face	1.000	0.000	149.000	No Ice	0.778	0.292	0.015
(T-Mobile - Existing)			0.000			1/2" Ice	0.899	0.380	0.020
			0.000						
Pirod 12' T-Frame Sector	A	From Face	1.000	0.000	138.000	No Ice	13.600	13.600	0.465
Mount (1)			0.000			1/2" Ice	18.400	18.400	0.600
(Sprint - Existing)			0.000						
Pirod 12' T-Frame Sector	B	From Face	1.000	0.000	138.000	No Ice	13.600	13.600	0.465
Mount (1)			0.000			1/2" Ice	18.400	18.400	0.600
(Sprint - Existing)			0.000						
Pirod 12' T-Frame Sector	C	From Face	1.000	0.000	138.000	No Ice	13.600	13.600	0.465
Mount (1)			0.000			1/2" Ice	18.400	18.400	0.600
(Sprint - Existing)			0.000						
(2) DB980H90E-M	A	From Face	1.000	0.000	138.000	No Ice	3.799	2.194	0.009
(Sprint - Existing)			0.000			1/2" Ice	4.178	2.556	0.029
			0.000						
(2) DB980H90E-M	B	From Face	1.000	0.000	138.000	No Ice	3.799	2.194	0.009
(Sprint - Existing)			0.000			1/2" Ice	4.178	2.556	0.029
			0.000						
(2) DB980H90E-M	C	From Face	1.000	0.000	138.000	No Ice	3.799	2.194	0.009
(Sprint - Existing)			0.000			1/2" Ice	4.178	2.556	0.029
			0.000						
7770.00	A	From Face	3.000	0.000	130.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			-6.000			1/2" Ice	6.314	3.273	0.068
			0.000						
HPA-65R-BUU-H8	A	From Face	3.000	0.000	130.000	No Ice	13.295	7.516	0.068
(AT&T - Existing)			-2.000			1/2" Ice	13.994	8.087	0.142
			0.000						
HPA-65R-BUU-H8	A	From Face	3.000	0.000	130.000	No Ice	13.295	7.516	0.068
(AT&T - Existing)			2.000			1/2" Ice	13.994	8.087	0.142
			0.000						
HPA-65R-BUU-H8	A	From Face	3.000	0.000	130.000	No Ice	13.295	7.516	0.068
(AT&T - Existing)			6.000			1/2" Ice	13.994	8.087	0.142
			0.000						
7770.00	B	From Face	3.000	0.000	130.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
HPA-65R-BUU-H8	B	From Face	3.000	0.000	130.000	No Ice	13.295	7.516	0.068

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(AT&T - Existing)			-2.000	0.000			1/2" Ice	13.994	8.087	0.142
HPA-65R-BUU-H8	B	From Face	3.000	0.000	0.000	130.000	No Ice	13.295	7.516	0.068
(AT&T - Existing)			2.000	0.000			1/2" Ice	13.994	8.087	0.142
HPA-65R-BUU-H8	B	From Face	3.000	0.000	0.000	130.000	No Ice	13.295	7.516	0.068
(AT&T - Existing)			6.000	0.000			1/2" Ice	13.994	8.087	0.142
7770.00	C	From Face	3.000	0.000	0.000	130.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			0.000	0.000			1/2" Ice	6.314	3.273	0.068
HPA-65R-BUU-H8	C	From Face	3.000	0.000	0.000	130.000	No Ice	13.295	7.516	0.068
(AT&T - Existing)			-2.000	0.000			1/2" Ice	13.994	8.087	0.142
HPA-65R-BUU-H8	C	From Face	3.000	0.000	0.000	130.000	No Ice	13.295	7.516	0.068
(AT&T - Existing)			2.000	0.000			1/2" Ice	13.994	8.087	0.142
HPA-65R-BUU-H8	C	From Face	3.000	0.000	0.000	130.000	No Ice	13.295	7.516	0.068
(AT&T - Existing)			6.000	0.000			1/2" Ice	13.994	8.087	0.142
(2) RRUS-11	A	From Face	3.000	0.000	0.000	130.000	No Ice	2.994	1.246	0.050
(AT&T - Existing)			0.000	0.000			1/2" Ice	3.226	1.412	0.070
(2) RRUS-11	B	From Face	3.000	0.000	0.000	130.000	No Ice	2.994	1.246	0.050
(AT&T - Existing)			0.000	0.000			1/2" Ice	3.226	1.412	0.070
(2) RRUS-11	C	From Face	3.000	0.000	0.000	130.000	No Ice	2.994	1.246	0.050
(AT&T - Existing)			0.000	0.000			1/2" Ice	3.226	1.412	0.070
(2) RRUS-12	A	From Face	3.000	0.000	0.000	130.000	No Ice	3.669	1.488	0.058
(AT&T - Existing)			0.000	0.000			1/2" Ice	3.926	1.673	0.081
(2) RRUS-12	B	From Face	3.000	0.000	0.000	130.000	No Ice	3.669	1.488	0.058
(AT&T - Existing)			0.000	0.000			1/2" Ice	3.926	1.673	0.081
(2) RRUS-12	C	From Face	3.000	0.000	0.000	130.000	No Ice	3.669	1.488	0.058
(AT&T - Existing)			0.000	0.000			1/2" Ice	3.926	1.673	0.081
RRUS-32	A	From Face	3.000	0.000	0.000	130.000	No Ice	3.866	2.762	0.077
(AT&T - Existing)			0.000	0.000			1/2" Ice	4.151	3.021	0.105
RRUS-32	B	From Face	3.000	0.000	0.000	130.000	No Ice	3.866	2.762	0.077
(AT&T - Existing)			0.000	0.000			1/2" Ice	4.151	3.021	0.105
RRUS-32	C	From Face	3.000	0.000	0.000	130.000	No Ice	3.866	2.762	0.077
(AT&T - Existing)			0.000	0.000			1/2" Ice	4.151	3.021	0.105
RRUS-E2	A	From Face	3.000	0.000	0.000	130.000	No Ice	3.669	1.488	0.058
(AT&T - Existing)			0.000	0.000			1/2" Ice	3.926	1.673	0.081
RRUS-E2	B	From Face	3.000	0.000	0.000	130.000	No Ice	3.669	1.488	0.058
(AT&T - Existing)			0.000	0.000			1/2" Ice	3.926	1.673	0.081
RRUS-E2	C	From Face	3.000	0.000	0.000	130.000	No Ice	3.669	1.488	0.058
(AT&T - Existing)			0.000	0.000			1/2" Ice	3.926	1.673	0.081
(2) A2	A	From Face	3.000	0.000	0.000	130.000	No Ice	2.424	0.542	0.022

tnxTower	Job: 14152.000 - Killingly Center	Page: 7 of 27
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project: 150ft Nudd Monopole - 79 Putnam Pike Dayville, CT	Date: 08:35:36 08/08/14
	Client: Verizon Wireless	Designed by: TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(AT&T - Existing)			0.000 0.000			1/2" Ice	2.633	0.675	0.035
(2) A2 (AT&T - Existing)	B	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.424 2.633	0.542 0.675	0.022 0.035
(2) A2 (AT&T - Existing)	C	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.424 2.633	0.542 0.675	0.022 0.035
DTMABP7819VG12A TMA (AT&T - Existing)	A	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	1.588 1.759	0.578 0.701	0.020 0.030
DTMABP7819VG12A TMA (AT&T - Existing)	B	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	1.588 1.759	0.578 0.701	0.020 0.030
DTMABP7819VG12A TMA (AT&T - Existing)	C	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	1.588 1.759	0.578 0.701	0.020 0.030
(2) DBC2055F1V1 (AT&T - Existing)	A	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	0.475 0.577	0.243 0.330	0.007 0.010
(2) DBC2055F1V1 (AT&T - Existing)	B	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	0.475 0.577	0.243 0.330	0.007 0.010
(2) DBC2055F1V1 (AT&T - Existing)	C	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	0.475 0.577	0.243 0.330	0.007 0.010
DC6-48-60-18-8F Surge Arrestor (AT&T - Existing)	A	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.228 2.447	2.228 2.447	0.020 0.039
DC6-48-60-18-8F Surge Arrestor (AT&T - Existing)	B	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.228 2.447	2.228 2.447	0.020 0.039
DC6-48-60-18-8F Surge Arrestor (AT&T - Existing)	C	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.228 2.447	2.228 2.447	0.020 0.039
Valmont 13' Low Profile Platform (AT&T - Existing)	C	From Face	1.000 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	15.700 20.100	15.700 20.100	1.300 1.765
4' x 3" DIA Omni	C	From Leg	4.000 0.000 0.000	0.000	124.000	No Ice 1/2" Ice	1.000 1.248	1.000 1.248	0.015 0.024
4' x 3" DIA Omni	B	From Leg	4.000 0.000 0.000	0.000	124.000	No Ice 1/2" Ice	1.000 1.248	1.000 1.248	0.015 0.024
Pirod 6' Side Mount Standoff (1)	C	From Leg	2.000 0.000 0.000	0.000	119.000	No Ice 1/2" Ice	4.970 6.120	4.970 6.120	0.070 0.130
Pirod 6' Side Mount Standoff (1)	B	From Leg	2.000 0.000 0.000	0.000	119.000	No Ice 1/2" Ice	4.970 6.120	4.970 6.120	0.070 0.130
2-ft Stand Off	A	From Leg	2.000 0.000 0.000	0.000	119.000	No Ice 1/2" Ice	1.070 1.620	1.070 1.620	0.020 0.028
Valmont 13' Low Profile Platform (Verizon - Proposed)	C	From Face	2.000 0.000 0.000	0.000	108.000	No Ice 1/2" Ice	15.700 20.100	15.700 20.100	1.300 1.765
X7C-FRO-660	A	From Face	3.000	0.000	108.000	No Ice	10.220	5.867	0.040

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	10.786	6.325	0.100
HBXX-6517DS	A	From Face	3.000	0.000	108.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			-4.000 0.000			1/2" Ice	9.306	5.709	0.100
X7C-FRO-660	A	From Face	3.000	0.000	108.000	No Ice	10.220	5.867	0.040
(Verizon - Proposed)			0.000 0.000			1/2" Ice	10.786	6.325	0.100
HBXX-6517DS	A	From Face	3.000	0.000	108.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			4.000 0.000			1/2" Ice	9.306	5.709	0.100
X7C-FRO-660	B	From Face	3.000	0.000	108.000	No Ice	10.220	5.867	0.040
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	10.786	6.325	0.100
HBXX-6517DS	B	From Face	3.000	0.000	108.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			-4.000 0.000			1/2" Ice	9.306	5.709	0.100
X7C-FRO-660	B	From Face	3.000	0.000	108.000	No Ice	10.220	5.867	0.040
(Verizon - Proposed)			0.000 0.000			1/2" Ice	10.786	6.325	0.100
HBXX-6517DS	B	From Face	3.000	0.000	108.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			4.000 0.000			1/2" Ice	9.306	5.709	0.100
X7C-FRO-660	C	From Face	3.000	0.000	108.000	No Ice	10.220	5.867	0.040
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	10.786	6.325	0.100
HBXX-6517DS	C	From Face	3.000	0.000	108.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			-4.000 0.000			1/2" Ice	9.306	5.709	0.100
X7C-FRO-660	C	From Face	3.000	0.000	108.000	No Ice	10.220	5.867	0.040
(Verizon - Proposed)			0.000 0.000			1/2" Ice	10.786	6.325	0.100
HBXX-6517DS	C	From Face	3.000	0.000	108.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			4.000 0.000			1/2" Ice	9.306	5.709	0.100
RRH2x40-07-U	A	From Face	3.000	0.000	108.000	No Ice	2.246	1.228	0.050
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	2.447	1.385	0.067
RRH2x40-07-U	B	From Face	3.000	0.000	108.000	No Ice	2.246	1.228	0.050
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	2.447	1.385	0.067
RRH2x40-07-U	C	From Face	3.000	0.000	108.000	No Ice	2.246	1.228	0.050
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	2.447	1.385	0.067
RRH2x40-AWS	A	From Face	3.000	0.000	108.000	No Ice	2.522	1.589	0.044
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	2.753	1.795	0.061
RRH2x40-AWS	B	From Face	3.000	0.000	108.000	No Ice	2.522	1.589	0.044
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	2.753	1.795	0.061
RRH2x40-AWS	C	From Face	3.000	0.000	108.000	No Ice	2.522	1.589	0.044
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	2.753	1.795	0.061
RRH2x60-PCS	A	From Face	3.000	0.000	108.000	No Ice	2.578	2.030	0.063
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	2.804	2.239	0.083
RRH2x60-PCS	B	From Face	3.000	0.000	108.000	No Ice	2.578	2.030	0.063

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	2.804	2.239	0.083
RRH2x60-PCS	C	From Face	3.000	0.000	108.000	No Ice	2.578	2.030	0.063
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	2.804	2.239	0.083
DB-T1-6Z-8AB-0Z	A	From Face	3.000	0.000	108.000	No Ice	5.600	2.333	0.044
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	5.915	2.558	0.080
DB-T1-6Z-8AB-0Z	B	From Face	3.000	0.000	108.000	No Ice	5.600	2.333	0.044
(Verizon - Proposed)			-6.000 0.000			1/2" Ice	5.915	2.558	0.080

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	139.651	1.51	0.028	51.771	A	0.000	51.771	51.771	100.00	0.000	0.000
150.000-130.0					B	0.000	51.771		100.00	0.000	0.000
00					C	0.000	51.771		100.00	0.000	0.000
L2	122.379	1.454	0.027	43.750	A	0.000	43.750	43.750	100.00	0.000	0.000
130.000-115.0					B	0.000	43.750		100.00	0.000	0.000
00					C	0.000	43.750		100.00	0.000	0.000
L3	104.654	1.391	0.026	68.229	A	0.000	68.229	68.229	100.00	0.000	0.000
115.000-95.00					B	0.000	68.229		100.00	0.000	0.000
0					C	0.000	68.229		100.00	0.000	0.000
L4	92.989	1.344	0.025	15.018	A	0.000	15.018	15.018	100.00	0.000	0.000
95.000-91.000					B	0.000	15.018		100.00	0.000	0.000
					C	0.000	15.018		100.00	0.000	0.000
L5	70.573	1.243	0.023	174.479	A	0.000	174.479	174.479	100.00	0.000	0.000
91.000-51.000					B	0.000	174.479		100.00	0.000	0.000
					C	0.000	174.479		100.00	0.000	0.000
L6	45.445	1.096	0.020	54.908	A	0.000	54.908	54.908	100.00	0.000	0.000
51.000-40.000					B	0.000	54.908		100.00	0.000	0.000
					C	0.000	54.908		100.00	0.000	0.000
L7	29.317	1	0.018	113.914	A	0.000	113.914	113.914	100.00	0.000	0.000
40.000-19.000					B	0.000	113.914		100.00	0.000	0.000
					C	0.000	113.914		100.00	0.000	0.000
L8	9.362	1	0.018	111.977	A	0.000	111.977	111.977	100.00	0.000	0.000
19.000-0.000					B	0.000	111.977		100.00	0.000	0.000
					C	0.000	111.977		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	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
L1 150.000-130.000	139.651	1.51	0.021	0.500	53.438	A	0.000	53.438	53.438	100.00	0.000	0.000
						B	0.000	53.438		100.00	0.000	0.000
						C	0.000	53.438		100.00	0.000	0.000
L2 130.000-115.000	122.379	1.454	0.020	0.500	45.000	A	0.000	45.000	45.000	100.00	0.000	0.000
						B	0.000	45.000		100.00	0.000	0.000
						C	0.000	45.000		100.00	0.000	0.000
L3 115.000-95.000	104.654	1.391	0.019	0.500	69.896	A	0.000	69.896	69.896	100.00	0.000	0.000
						B	0.000	69.896		100.00	0.000	0.000
						C	0.000	69.896		100.00	0.000	0.000
L4 95.000-91.000	92.989	1.344	0.019	0.500	15.351	A	0.000	15.351	15.351	100.00	0.000	0.000
						B	0.000	15.351		100.00	0.000	0.000
						C	0.000	15.351		100.00	0.000	0.000
L5 91.000-51.000	70.573	1.243	0.017	0.500	177.813	A	0.000	177.813	177.813	100.00	0.000	0.000
						B	0.000	177.813		100.00	0.000	0.000
						C	0.000	177.813		100.00	0.000	0.000
L6 51.000-40.000	45.445	1.096	0.015	0.500	55.825	A	0.000	55.825	55.825	100.00	0.000	0.000
						B	0.000	55.825		100.00	0.000	0.000
						C	0.000	55.825		100.00	0.000	0.000
L7 40.000-19.000	29.317	1	0.014	0.500	115.664	A	0.000	115.664	115.664	100.00	0.000	0.000
						B	0.000	115.664		100.00	0.000	0.000
						C	0.000	115.664		100.00	0.000	0.000
L8 19.000-0.000	9.362	1	0.014	0.500	113.561	A	0.000	113.561	113.561	100.00	0.000	0.000
						B	0.000	113.561		100.00	0.000	0.000
						C	0.000	113.561		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 150.000-130.0 00	139.651	1.51	0.010	51.771	A	0.000	51.771	51.771	100.00	0.000	0.000
					B	0.000	51.771		100.00	0.000	0.000
					C	0.000	51.771		100.00	0.000	0.000
L2 130.000-115.0 00	122.379	1.454	0.009	43.750	A	0.000	43.750	43.750	100.00	0.000	0.000
					B	0.000	43.750		100.00	0.000	0.000
					C	0.000	43.750		100.00	0.000	0.000
L3 115.000-95.00 0	104.654	1.391	0.009	68.229	A	0.000	68.229	68.229	100.00	0.000	0.000
					B	0.000	68.229		100.00	0.000	0.000
					C	0.000	68.229		100.00	0.000	0.000
L4 95.000-91.000	92.989	1.344	0.009	15.018	A	0.000	15.018	15.018	100.00	0.000	0.000
					B	0.000	15.018		100.00	0.000	0.000
					C	0.000	15.018		100.00	0.000	0.000
L5 91.000-51.000	70.573	1.243	0.008	174.479	A	0.000	174.479	174.479	100.00	0.000	0.000
					B	0.000	174.479		100.00	0.000	0.000
					C	0.000	174.479		100.00	0.000	0.000
L6 51.000-40.000	45.445	1.096	0.007	54.908	A	0.000	54.908	54.908	100.00	0.000	0.000
					B	0.000	54.908		100.00	0.000	0.000
					C	0.000	54.908		100.00	0.000	0.000
L7 40.000-19.000	29.317	1	0.006	113.914	A	0.000	113.914	113.914	100.00	0.000	0.000
					B	0.000	113.914		100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z ksf	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
L8 19.000-0.000	9.362	1	0.006	111.977	C	0.000	113.914		100.00	0.000	0.000
					A	0.000	111.977	111.977	100.00	0.000	0.000
					B	0.000	111.977		100.00	0.000	0.000
					C	0.000	111.977		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1 150.000-130.000	0.190	1.688	A	1	1.03	1	1	1	51.771	2.517	0.126	C
			B	1	1.03	1	1	1	51.771			
			C	1	1.03	1	1	1	51.771			
L2 130.000-115.000	0.411	1.873	A	1	1.03	1	1	1	43.750	2.048	0.137	C
			B	1	1.03	1	1	1	43.750			
			C	1	1.03	1	1	1	43.750			
L3 115.000-95.000	0.605	2.782	A	1	1.03	1	1	1	68.229	3.055	0.153	C
			B	1	1.03	1	1	1	68.229			
			C	1	1.03	1	1	1	68.229			
L4 95.000-91.000	0.126	1.493	A	1	1.03	1	1	1	15.018	0.650	0.163	C
			B	1	1.03	1	1	1	15.018			
			C	1	1.03	1	1	1	15.018			
L5 91.000-51.000	1.262	8.541	A	1	1.03	1	1	1	174.479	6.954	0.174	C
			B	1	1.03	1	1	1	174.479			
			C	1	1.03	1	1	1	174.479			
L6 51.000-40.000	0.347	4.546	A	1	1.03	1	1	1	54.908	1.937	0.176	C
			B	1	1.03	1	1	1	54.908			
			C	1	1.03	1	1	1	54.908			
L7 40.000-19.000	0.663	6.509	A	1	1.03	1	1	1	113.914	3.668	0.175	C
			B	1	1.03	1	1	1	113.914			
			C	1	1.03	1	1	1	113.914			
L8 19.000-0.000	0.379	9.237	A	1	1.03	1	1	1	111.977	3.605	0.190	C
			B	1	1.03	1	1	1	111.977			
			C	1	1.03	1	1	1	111.977			
Sum Weight:	3.983	36.669						OTM	1702.429 kip-ft	24.435		

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 klf	Ctrl. Face
L1 150.000-130.000	0.190	1.688	A	1	1.03	1	1	1	51.771	2.517	0.126	C
			B	1	1.03	1	1	1	51.771			
			C	1	1.03	1	1	1	51.771			
L2 130.000-115.000	0.411	1.873	A	1	1.03	1	1	1	43.750	2.048	0.137	C
			B	1	1.03	1	1	1	43.750			
			C	1	1.03	1	1	1	43.750			
L3 115.000-95.000	0.605	2.782	A	1	1.03	1	1	1	68.229	3.055	0.153	C
			B	1	1.03	1	1	1	68.229			
			C	1	1.03	1	1	1	68.229			

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 klf	Ctrl. Face
L4	0.126	1.493	A	1	1.03	1	1	1	15.018	0.650	0.163	C
95.000-91.000			B	1	1.03	1	1	1	15.018			
			C	1	1.03	1	1	1	15.018			
L5	1.262	8.541	A	1	1.03	1	1	1	174.479	6.954	0.174	C
91.000-51.000			B	1	1.03	1	1	1	174.479			
			C	1	1.03	1	1	1	174.479			
L6	0.347	4.546	A	1	1.03	1	1	1	54.908	1.937	0.176	C
51.000-40.000			B	1	1.03	1	1	1	54.908			
			C	1	1.03	1	1	1	54.908			
L7	0.663	6.509	A	1	1.03	1	1	1	113.914	3.668	0.175	C
40.000-19.000			B	1	1.03	1	1	1	113.914			
			C	1	1.03	1	1	1	113.914			
L8	0.379	9.237	A	1	1.03	1	1	1	111.977	3.605	0.190	C
19.000-0.000			B	1	1.03	1	1	1	111.977			
			C	1	1.03	1	1	1	111.977			
Sum Weight:	3.983	36.669						OTM	1702.429 kip-ft	24.435		

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 ft²	F K	w klf	Ctrl. Face
L1	0.190	1.688	A	1	1.03	1	1	1	51.771	2.517	0.126	C
150.000-130.0			B	1	1.03	1	1	1	51.771			
00			C	1	1.03	1	1	1	51.771			
L2	0.411	1.873	A	1	1.03	1	1	1	43.750	2.048	0.137	C
130.000-115.0			B	1	1.03	1	1	1	43.750			
00			C	1	1.03	1	1	1	43.750			
L3	0.605	2.782	A	1	1.03	1	1	1	68.229	3.055	0.153	C
115.000-95.00			B	1	1.03	1	1	1	68.229			
0			C	1	1.03	1	1	1	68.229			
L4	0.126	1.493	A	1	1.03	1	1	1	15.018	0.650	0.163	C
95.000-91.000			B	1	1.03	1	1	1	15.018			
			C	1	1.03	1	1	1	15.018			
L5	1.262	8.541	A	1	1.03	1	1	1	174.479	6.954	0.174	C
91.000-51.000			B	1	1.03	1	1	1	174.479			
			C	1	1.03	1	1	1	174.479			
L6	0.347	4.546	A	1	1.03	1	1	1	54.908	1.937	0.176	C
51.000-40.000			B	1	1.03	1	1	1	54.908			
			C	1	1.03	1	1	1	54.908			
L7	0.663	6.509	A	1	1.03	1	1	1	113.914	3.668	0.175	C
40.000-19.000			B	1	1.03	1	1	1	113.914			
			C	1	1.03	1	1	1	113.914			
L8	0.379	9.237	A	1	1.03	1	1	1	111.977	3.605	0.190	C
19.000-0.000			B	1	1.03	1	1	1	111.977			
			C	1	1.03	1	1	1	111.977			
Sum Weight:	3.983	36.669						OTM	1702.429 kip-ft	24.435		

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 ft²	F K	w klf	Ctrl. Face
L1	0.190	1.688	A	1	1.03	1	1	1	51.771	2.517	0.126	C
150.000-130.0			B	1	1.03	1	1	1	51.771			
00			C	1	1.03	1	1	1	51.771			
L2	0.411	1.873	A	1	1.03	1	1	1	43.750	2.048	0.137	C
130.000-115.0			B	1	1.03	1	1	1	43.750			
00			C	1	1.03	1	1	1	43.750			
L3	0.605	2.782	A	1	1.03	1	1	1	68.229	3.055	0.153	C
115.000-95.00			B	1	1.03	1	1	1	68.229			
0			C	1	1.03	1	1	1	68.229			
L4	0.126	1.493	A	1	1.03	1	1	1	15.018	0.650	0.163	C
95.000-91.000			B	1	1.03	1	1	1	15.018			
			C	1	1.03	1	1	1	15.018			
L5	1.262	8.541	A	1	1.03	1	1	1	174.479	6.954	0.174	C
91.000-51.000			B	1	1.03	1	1	1	174.479			
			C	1	1.03	1	1	1	174.479			
L6	0.347	4.546	A	1	1.03	1	1	1	54.908	1.937	0.176	C
51.000-40.000			B	1	1.03	1	1	1	54.908			
			C	1	1.03	1	1	1	54.908			
L7	0.663	6.509	A	1	1.03	1	1	1	113.914	3.668	0.175	C
40.000-19.000			B	1	1.03	1	1	1	113.914			
			C	1	1.03	1	1	1	113.914			
L8	0.379	9.237	A	1	1.03	1	1	1	111.977	3.605	0.190	C
19.000-0.000			B	1	1.03	1	1	1	111.977			
			C	1	1.03	1	1	1	111.977			
Sum Weight:	3.983	36.669						OTM	1702.429 kip-ft	24.435		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.190	2.083	A	1	1.03	1	1	1	53.438	1.949	0.097	C
150.000-130.0			B	1	1.03	1	1	1	53.438			
00			C	1	1.03	1	1	1	53.438			
L2	0.411	2.206	A	1	1.03	1	1	1	45.000	1.580	0.105	C
130.000-115.0			B	1	1.03	1	1	1	45.000			
00			C	1	1.03	1	1	1	45.000			
L3	0.605	3.301	A	1	1.03	1	1	1	69.896	2.347	0.117	C
115.000-95.00			B	1	1.03	1	1	1	69.896			
0			C	1	1.03	1	1	1	69.896			
L4	0.126	1.607	A	1	1.03	1	1	1	15.351	0.498	0.125	C
95.000-91.000			B	1	1.03	1	1	1	15.351			
			C	1	1.03	1	1	1	15.351			
L5	1.262	9.865	A	1	1.03	1	1	1	177.813	5.315	0.133	C
91.000-51.000			B	1	1.03	1	1	1	177.813			
			C	1	1.03	1	1	1	177.813			
L6	0.347	4.962	A	1	1.03	1	1	1	55.825	1.477	0.134	C
51.000-40.000			B	1	1.03	1	1	1	55.825			
			C	1	1.03	1	1	1	55.825			
L7	0.663	7.371	A	1	1.03	1	1	1	115.664	2.793	0.133	C
40.000-19.000			B	1	1.03	1	1	1	115.664			
			C	1	1.03	1	1	1	115.664			
L8	0.379	10.085	A	1	1.03	1	1	1	113.561	2.742	0.144	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 klf	Ctrl. Face
19.000-0.000			B	1	1.03	1	1	1	113.561			
			C	1	1.03	1	1	1	113.561			
Sum Weight:	3.983	41.480						OTM	1307.276 kip-ft	18.702		

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 klf	Ctrl. Face
L1	0.190	2.083	A	1	1.03	1	1	1	53.438	1.949	0.097	C
150.000-130.0			B	1	1.03	1	1	1	53.438			
00			C	1	1.03	1	1	1	53.438			
L2	0.411	2.206	A	1	1.03	1	1	1	45.000	1.580	0.105	C
130.000-115.0			B	1	1.03	1	1	1	45.000			
00			C	1	1.03	1	1	1	45.000			
L3	0.605	3.301	A	1	1.03	1	1	1	69.896	2.347	0.117	C
115.000-95.00			B	1	1.03	1	1	1	69.896			
0			C	1	1.03	1	1	1	69.896			
L4	0.126	1.607	A	1	1.03	1	1	1	15.351	0.498	0.125	C
95.000-91.000			B	1	1.03	1	1	1	15.351			
			C	1	1.03	1	1	1	15.351			
L5	1.262	9.865	A	1	1.03	1	1	1	177.813	5.315	0.133	C
91.000-51.000			B	1	1.03	1	1	1	177.813			
			C	1	1.03	1	1	1	177.813			
L6	0.347	4.962	A	1	1.03	1	1	1	55.825	1.477	0.134	C
51.000-40.000			B	1	1.03	1	1	1	55.825			
			C	1	1.03	1	1	1	55.825			
L7	0.663	7.371	A	1	1.03	1	1	1	115.664	2.793	0.133	C
40.000-19.000			B	1	1.03	1	1	1	115.664			
			C	1	1.03	1	1	1	115.664			
L8	0.379	10.085	A	1	1.03	1	1	1	113.561	2.742	0.144	C
19.000-0.000			B	1	1.03	1	1	1	113.561			
			C	1	1.03	1	1	1	113.561			
Sum Weight:	3.983	41.480						OTM	1307.276 kip-ft	18.702		

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 klf	Ctrl. Face
L1	0.190	2.083	A	1	1.03	1	1	1	53.438	1.949	0.097	C
150.000-130.0			B	1	1.03	1	1	1	53.438			
00			C	1	1.03	1	1	1	53.438			
L2	0.411	2.206	A	1	1.03	1	1	1	45.000	1.580	0.105	C
130.000-115.0			B	1	1.03	1	1	1	45.000			
00			C	1	1.03	1	1	1	45.000			
L3	0.605	3.301	A	1	1.03	1	1	1	69.896	2.347	0.117	C

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 klf	Ctrl. Face
115.000-95.00			B	1	1.03	1	1	1	69.896			
0			C	1	1.03	1	1	1	69.896			
L4	0.126	1.607	A	1	1.03	1	1	1	15.351	0.498	0.125	C
95.000-91.000			B	1	1.03	1	1	1	15.351			
			C	1	1.03	1	1	1	15.351			
L5	1.262	9.865	A	1	1.03	1	1	1	177.813	5.315	0.133	C
91.000-51.000			B	1	1.03	1	1	1	177.813			
			C	1	1.03	1	1	1	177.813			
L6	0.347	4.962	A	1	1.03	1	1	1	55.825	1.477	0.134	C
51.000-40.000			B	1	1.03	1	1	1	55.825			
			C	1	1.03	1	1	1	55.825			
L7	0.663	7.371	A	1	1.03	1	1	1	115.664	2.793	0.133	C
40.000-19.000			B	1	1.03	1	1	1	115.664			
			C	1	1.03	1	1	1	115.664			
L8	0.379	10.085	A	1	1.03	1	1	1	113.561	2.742	0.144	C
19.000-0.000			B	1	1.03	1	1	1	113.561			
			C	1	1.03	1	1	1	113.561			
Sum Weight:	3.983	41.480						OTM	1307.276 kip-ft	18.702		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.190	2.083	A	1	1.03	1	1	1	53.438	1.949	0.097	C
150.000-130.0			B	1	1.03	1	1	1	53.438			
00			C	1	1.03	1	1	1	53.438			
L2	0.411	2.206	A	1	1.03	1	1	1	45.000	1.580	0.105	C
130.000-115.0			B	1	1.03	1	1	1	45.000			
00			C	1	1.03	1	1	1	45.000			
L3	0.605	3.301	A	1	1.03	1	1	1	69.896	2.347	0.117	C
115.000-95.00			B	1	1.03	1	1	1	69.896			
0			C	1	1.03	1	1	1	69.896			
L4	0.126	1.607	A	1	1.03	1	1	1	15.351	0.498	0.125	C
95.000-91.000			B	1	1.03	1	1	1	15.351			
			C	1	1.03	1	1	1	15.351			
L5	1.262	9.865	A	1	1.03	1	1	1	177.813	5.315	0.133	C
91.000-51.000			B	1	1.03	1	1	1	177.813			
			C	1	1.03	1	1	1	177.813			
L6	0.347	4.962	A	1	1.03	1	1	1	55.825	1.477	0.134	C
51.000-40.000			B	1	1.03	1	1	1	55.825			
			C	1	1.03	1	1	1	55.825			
L7	0.663	7.371	A	1	1.03	1	1	1	115.664	2.793	0.133	C
40.000-19.000			B	1	1.03	1	1	1	115.664			
			C	1	1.03	1	1	1	115.664			
L8	0.379	10.085	A	1	1.03	1	1	1	113.561	2.742	0.144	C
19.000-0.000			B	1	1.03	1	1	1	113.561			
			C	1	1.03	1	1	1	113.561			
Sum Weight:	3.983	41.480						OTM	1307.276 kip-ft	18.702		

tnxTower	Job: 14152.000 - Killingly Center	Page: 16 of 27
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project: 150ft Nudd Monopole - 79 Putnam Pike Dayville, CT	Date: 08:35:36 08/08/14
	Client: Verizon Wireless	Designed by: TJL

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.190	1.688	A	1	1.03	1	1	1	51.771	0.871	0.044	C
150.000-130.0			B	1	1.03	1	1	1	51.771			
00			C	1	1.03	1	1	1	51.771			
L2	0.411	1.873	A	1	1.03	1	1	1	43.750	0.709	0.047	C
130.000-115.0			B	1	1.03	1	1	1	43.750			
00			C	1	1.03	1	1	1	43.750			
L3	0.605	2.782	A	1	1.03	1	1	1	68.229	1.057	0.053	C
115.000-95.00			B	1	1.03	1	1	1	68.229			
0			C	1	1.03	1	1	1	68.229			
L4	0.126	1.493	A	1	1.03	1	1	1	15.018	0.225	0.056	C
95.000-91.000			B	1	1.03	1	1	1	15.018			
			C	1	1.03	1	1	1	15.018			
L5	1.262	8.541	A	1	1.03	1	1	1	174.479	2.406	0.060	C
91.000-51.000			B	1	1.03	1	1	1	174.479			
			C	1	1.03	1	1	1	174.479			
L6	0.347	4.546	A	1	1.03	1	1	1	54.908	0.670	0.061	C
51.000-40.000			B	1	1.03	1	1	1	54.908			
			C	1	1.03	1	1	1	54.908			
L7	0.663	6.509	A	1	1.03	1	1	1	113.914	1.269	0.060	C
40.000-19.000			B	1	1.03	1	1	1	113.914			
			C	1	1.03	1	1	1	113.914			
L8	0.379	9.237	A	1	1.03	1	1	1	111.977	1.247	0.066	C
19.000-0.000			B	1	1.03	1	1	1	111.977			
			C	1	1.03	1	1	1	111.977			
Sum Weight:	3.983	36.669						OTM	589.076 kip-ft	8.455		

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 ft²	F K	w klf	Ctrl. Face
L1	0.190	1.688	A	1	1.03	1	1	1	51.771	0.871	0.044	C
150.000-130.0			B	1	1.03	1	1	1	51.771			
00			C	1	1.03	1	1	1	51.771			
L2	0.411	1.873	A	1	1.03	1	1	1	43.750	0.709	0.047	C
130.000-115.0			B	1	1.03	1	1	1	43.750			
00			C	1	1.03	1	1	1	43.750			
L3	0.605	2.782	A	1	1.03	1	1	1	68.229	1.057	0.053	C
115.000-95.00			B	1	1.03	1	1	1	68.229			
0			C	1	1.03	1	1	1	68.229			
L4	0.126	1.493	A	1	1.03	1	1	1	15.018	0.225	0.056	C
95.000-91.000			B	1	1.03	1	1	1	15.018			
			C	1	1.03	1	1	1	15.018			
L5	1.262	8.541	A	1	1.03	1	1	1	174.479	2.406	0.060	C
91.000-51.000			B	1	1.03	1	1	1	174.479			
			C	1	1.03	1	1	1	174.479			
L6	0.347	4.546	A	1	1.03	1	1	1	54.908	0.670	0.061	C
51.000-40.000			B	1	1.03	1	1	1	54.908			
			C	1	1.03	1	1	1	54.908			
L7	0.663	6.509	A	1	1.03	1	1	1	113.914	1.269	0.060	C
40.000-19.000			B	1	1.03	1	1	1	113.914			

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 klf	Ctrl. Face
			C	1	1.03	1	1	1	113.914			
L8	0.379	9.237	A	1	1.03	1	1	1	111.977	1.247	0.066	C
19.000-0.000			B	1	1.03	1	1	1	111.977			
			C	1	1.03	1	1	1	111.977			
Sum Weight:	3.983	36.669						OTM	589.076 kip-ft	8.455		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.190	1.688	A	1	1.03	1	1	1	51.771	0.871	0.044	C
150.000-130.0			B	1	1.03	1	1	1	51.771			
00			C	1	1.03	1	1	1	51.771			
L2	0.411	1.873	A	1	1.03	1	1	1	43.750	0.709	0.047	C
130.000-115.0			B	1	1.03	1	1	1	43.750			
00			C	1	1.03	1	1	1	43.750			
L3	0.605	2.782	A	1	1.03	1	1	1	68.229	1.057	0.053	C
115.000-95.00			B	1	1.03	1	1	1	68.229			
0			C	1	1.03	1	1	1	68.229			
L4	0.126	1.493	A	1	1.03	1	1	1	15.018	0.225	0.056	C
95.000-91.000			B	1	1.03	1	1	1	15.018			
			C	1	1.03	1	1	1	15.018			
L5	1.262	8.541	A	1	1.03	1	1	1	174.479	2.406	0.060	C
91.000-51.000			B	1	1.03	1	1	1	174.479			
			C	1	1.03	1	1	1	174.479			
L6	0.347	4.546	A	1	1.03	1	1	1	54.908	0.670	0.061	C
51.000-40.000			B	1	1.03	1	1	1	54.908			
			C	1	1.03	1	1	1	54.908			
L7	0.663	6.509	A	1	1.03	1	1	1	113.914	1.269	0.060	C
40.000-19.000			B	1	1.03	1	1	1	113.914			
			C	1	1.03	1	1	1	113.914			
L8	0.379	9.237	A	1	1.03	1	1	1	111.977	1.247	0.066	C
19.000-0.000			B	1	1.03	1	1	1	111.977			
			C	1	1.03	1	1	1	111.977			
Sum Weight:	3.983	36.669						OTM	589.076 kip-ft	8.455		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.190	1.688	A	1	1.03	1	1	1	51.771	0.871	0.044	C
150.000-130.0			B	1	1.03	1	1	1	51.771			
00			C	1	1.03	1	1	1	51.771			
L2	0.411	1.873	A	1	1.03	1	1	1	43.750	0.709	0.047	C
130.000-115.0			B	1	1.03	1	1	1	43.750			

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 klf	Ctrl. Face
00			C	1	1.03	1	1	1	43.750			
L3	0.605	2.782	A	1	1.03	1	1	1	68.229	1.057	0.053	C
115.000-95.00			B	1	1.03	1	1	1	68.229			
0			C	1	1.03	1	1	1	68.229			
L4	0.126	1.493	A	1	1.03	1	1	1	15.018	0.225	0.056	C
95.000-91.000			B	1	1.03	1	1	1	15.018			
			C	1	1.03	1	1	1	15.018			
L5	1.262	8.541	A	1	1.03	1	1	1	174.479	2.406	0.060	C
91.000-51.000			B	1	1.03	1	1	1	174.479			
			C	1	1.03	1	1	1	174.479			
L6	0.347	4.546	A	1	1.03	1	1	1	54.908	0.670	0.061	C
51.000-40.000			B	1	1.03	1	1	1	54.908			
			C	1	1.03	1	1	1	54.908			
L7	0.663	6.509	A	1	1.03	1	1	1	113.914	1.269	0.060	C
40.000-19.000			B	1	1.03	1	1	1	113.914			
			C	1	1.03	1	1	1	113.914			
L8	0.379	9.237	A	1	1.03	1	1	1	111.977	1.247	0.066	C
19.000-0.000			B	1	1.03	1	1	1	111.977			
			C	1	1.03	1	1	1	111.977			
Sum Weight:	3.983	36.669						OTM	589.076 kip-ft	8.455		

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	36.669					
Bracing Weight	0.000					
Total Member Self-Weight	36.669			8.223	0.369	
Total Weight	49.691			8.223	0.369	
Wind 0 deg - No Ice		0.000	-45.423	-4371.935	0.369	-2.290
Wind 30 deg - No Ice		22.783	-39.338	-3785.105	-2197.447	1.189
Wind 45 deg - No Ice		32.220	-32.119	-3089.016	-3107.813	2.866
Wind 60 deg - No Ice		39.462	-22.712	-2181.856	-3806.360	4.349
Wind 90 deg - No Ice		45.566	0.000	8.223	-4395.264	6.343
Wind 120 deg - No Ice		39.462	22.712	2198.302	-3806.360	6.639
Wind 135 deg - No Ice		32.220	32.119	3105.463	-3107.813	6.105
Wind 150 deg - No Ice		22.783	39.338	3801.551	-2197.447	5.155
Wind 180 deg - No Ice		0.000	45.423	4388.381	0.369	2.290
Wind 210 deg - No Ice		-22.783	39.338	3801.551	2198.185	-1.189
Wind 225 deg - No Ice		-32.220	32.119	3105.463	3108.551	-2.866
Wind 240 deg - No Ice		-39.462	22.712	2198.302	3807.098	-4.349
Wind 270 deg - No Ice		-45.566	0.000	8.223	4396.002	-6.343
Wind 300 deg - No Ice		-39.462	-22.712	-2181.856	3807.098	-6.639
Wind 315 deg - No Ice		-32.220	-32.119	-3089.016	3108.551	-6.105
Wind 330 deg - No Ice		-22.783	-39.338	-3785.105	2198.185	-5.155
Member Ice	4.811					
Total Weight Ice	58.947			11.328	0.684	
Wind 0 deg - Ice		0.000	-36.862	-3625.578	0.684	-1.825
Wind 30 deg - Ice		18.486	-31.924	-3138.325	-1823.734	1.409
Wind 45 deg - Ice		26.144	-26.065	-2560.353	-2579.432	2.938
Wind 60 deg - Ice		32.019	-18.431	-1807.125	-3159.300	4.266
Wind 90 deg - Ice		36.973	0.000	11.328	-3648.151	5.979
Wind 120 deg - Ice		32.019	18.431	1829.782	-3159.300	6.090

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 135 deg - Ice		26.144	26.065	2583.010	-2579.432	5.518
Wind 150 deg - Ice		18.486	31.924	3160.982	-1823.734	4.570
Wind 180 deg - Ice		0.000	36.862	3648.235	0.684	1.825
Wind 210 deg - Ice		-18.486	31.924	3160.982	1825.101	-1.409
Wind 225 deg - Ice		-26.144	26.065	2583.010	2580.799	-2.938
Wind 240 deg - Ice		-32.019	18.431	1829.782	3160.667	-4.266
Wind 270 deg - Ice		-36.973	0.000	11.328	3649.518	-5.979
Wind 300 deg - Ice		-32.019	-18.431	-1807.125	3160.667	-6.090
Wind 315 deg - Ice		-26.144	-26.065	-2560.353	2580.799	-5.518
Wind 330 deg - Ice		-18.486	-31.924	-3138.325	1825.101	-4.570
Total Weight	49.691			8.223	0.369	
Wind 0 deg - Service		0.000	-15.717	-1507.403	0.369	-0.792
Wind 30 deg - Service		7.883	-13.612	-1304.347	-760.121	0.411
Wind 45 deg - Service		11.149	-11.114	-1063.486	-1075.126	0.992
Wind 60 deg - Service		13.655	-7.859	-749.590	-1316.838	1.505
Wind 90 deg - Service		15.767	0.000	8.223	-1520.611	2.195
Wind 120 deg - Service		13.655	7.859	766.036	-1316.838	2.297
Wind 135 deg - Service		11.149	11.114	1079.932	-1075.126	2.112
Wind 150 deg - Service		7.883	13.612	1320.794	-760.121	1.784
Wind 180 deg - Service		0.000	15.717	1523.849	0.369	0.792
Wind 210 deg - Service		-7.883	13.612	1320.794	760.859	-0.411
Wind 225 deg - Service		-11.149	11.114	1079.932	1075.864	-0.992
Wind 240 deg - Service		-13.655	7.859	766.036	1317.576	-1.505
Wind 270 deg - Service		-15.767	0.000	8.223	1521.349	-2.195
Wind 300 deg - Service		-13.655	-7.859	-749.590	1317.576	-2.297
Wind 315 deg - Service		-11.149	-11.114	-1063.486	1075.864	-2.112
Wind 330 deg - Service		-7.883	-13.612	-1304.347	760.859	-1.784

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

Comb. No.	Description
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
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
L1	150 - 130	Pole	Max Tension	18	0.000	-0.000	0.000
			Max. Compression	18	-5.866	0.001	-0.185
			Max. Mx	14	-4.137	67.920	-0.128
			Max. My	10	-4.136	0.006	-68.037
			Max. Vy	14	-7.937	67.920	-0.128
			Max. Vx	10	7.937	0.006	-68.037
			Max. Torque	31			0.389
L2	130 - 115	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-14.614	0.208	-5.342
			Max. Mx	14	-10.060	389.278	-3.640
			Max. My	10	-10.059	0.102	-392.873
			Max. Vy	14	-20.217	389.278	-3.640
			Max. Vx	10	20.218	0.102	-392.873
			Max. Torque	14			4.450
L3	115 - 95	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-21.037	0.692	-11.474
			Max. Mx	14	-14.607	728.494	-8.190
			Max. My	10	-14.611	0.334	-735.377
			Max. Vy	14	-28.255	728.494	-8.190
			Max. Vx	10	28.112	0.334	-735.377
			Max. Torque	7			-6.904
L4	95 - 91	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-24.014	0.695	-11.515
			Max. Mx	14	-17.333	1019.455	-8.244
			Max. My	10	-17.337	0.346	-1024.909
			Max. Vy	14	-29.926	1019.455	-8.244
			Max. Vx	10	29.783	0.346	-1024.909

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Torque	7			-6.903
L5	91 - 51	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-32.718	0.698	-11.577
			Max. Mx	14	-25.259	2062.544	-8.354
			Max. My	10	-25.262	0.368	-2063.409
			Max. Vy	14	-35.346	2062.544	-8.354
			Max. Vx	10	35.202	0.368	-2063.409
			Max. Torque	7			-6.903
L6	51 - 40	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-40.450	0.698	-11.577
			Max. Mx	14	-32.454	2766.298	-8.391
			Max. My	10	-32.456	0.374	-2764.432
			Max. Vy	14	-38.675	2766.298	-8.391
			Max. Vx	10	38.532	0.374	-2764.432
			Max. Torque	15			6.899
L7	40 - 19	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-44.946	0.698	-11.577
			Max. Mx	14	-36.606	3241.932	-8.403
			Max. My	10	-36.607	0.376	-3238.341
			Max. Vy	14	-40.626	3241.932	-8.403
			Max. Vx	10	40.482	0.376	-3238.341
			Max. Torque	15			6.898
L8	19 - 0	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-58.947	0.698	-11.577
			Max. Mx	14	-49.684	4448.275	-8.410
			Max. My	10	-49.684	0.375	-4440.665
			Max. Vy	14	-45.574	4448.275	-8.410
			Max. Vx	10	45.431	0.375	-4440.665
			Max. Torque	15			6.897

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	27	58.947	0.000	-36.862
	Max. H_x	14	49.691	45.566	0.000
	Max. H_z	2	49.691	0.000	45.423
	Max. M_x	2	4423.848	0.000	45.423
	Max. M_z	6	4447.521	-45.566	0.000
	Max. Torsion	15	6.897	39.462	22.712
	Min. Vert	43	49.691	0.000	-15.717
	Min. H_x	6	49.691	-45.566	0.000
	Min. H_z	10	49.691	0.000	-45.423
	Min. M_x	10	-4440.665	0.000	-45.423
	Min. M_z	14	-4448.275	45.566	0.000
	Min. Torsion	7	-6.897	-39.462	-22.712

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

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	49.691	0.000	0.000	8.333	0.374	0.000
Dead+Wind 0 deg - No Ice	49.691	0.000	-45.423	-4423.848	0.375	-2.299
Dead+Wind 30 deg - No Ice	49.691	22.783	-39.338	-3830.036	-2223.577	1.328
Dead+Wind 45 deg - No Ice	49.691	32.220	-32.119	-3125.666	-3144.766	3.067
Dead+Wind 60 deg - No Ice	49.691	39.462	-22.712	-2207.715	-3851.618	4.598
Dead+Wind 90 deg - No Ice	49.691	45.566	0.000	8.410	-4447.521	6.637
Dead+Wind 120 deg - No Ice	49.691	39.462	22.712	2224.534	-3851.617	6.897
Dead+Wind 135 deg - No Ice	49.691	32.220	32.119	3142.484	-3144.765	6.319
Dead+Wind 150 deg - No Ice	49.691	22.783	39.338	3846.853	-2223.575	5.309
Dead+Wind 180 deg - No Ice	49.691	0.000	45.423	4440.665	0.375	2.299
Dead+Wind 210 deg - No Ice	49.691	-22.783	39.338	3846.855	2224.327	-1.328
Dead+Wind 225 deg - No Ice	49.691	-32.220	32.119	3142.487	3145.517	-3.067
Dead+Wind 240 deg - No Ice	49.691	-39.462	22.712	2224.536	3852.370	-4.598
Dead+Wind 270 deg - No Ice	49.691	-45.566	0.000	8.410	4448.275	-6.637
Dead+Wind 300 deg - No Ice	49.691	-39.462	-22.712	-2207.717	3852.372	-6.897
Dead+Wind 315 deg - No Ice	49.691	-32.220	-32.119	-3125.668	3145.518	-6.319
Dead+Wind 330 deg - No Ice	49.691	-22.783	-39.338	-3830.037	2224.328	-5.309
Dead+Ice+Temp	58.947	-0.000	0.000	11.577	0.698	0.000
Dead+Wind 0 deg+Ice+Temp	58.947	0.000	-36.862	-3682.487	0.702	-1.843
Dead+Wind 30 deg+Ice+Temp	58.947	18.486	-31.924	-3187.562	-1852.428	1.569
Dead+Wind 45 deg+Ice+Temp	58.947	26.144	-26.065	-2600.490	-2620.019	3.173
Dead+Wind 60 deg+Ice+Temp	58.947	32.019	-18.431	-1835.405	-3209.011	4.561
Dead+Wind 90 deg+Ice+Temp	58.947	36.973	0.000	11.672	-3705.554	6.331
Dead+Wind 120 deg+Ice+Temp	58.947	32.019	18.431	1858.749	-3209.010	6.404
Dead+Wind 135 deg+Ice+Temp	58.947	26.144	26.065	2623.834	-2620.018	5.780
Dead+Wind 150 deg+Ice+Temp	58.947	18.486	31.924	3210.905	-1852.427	4.762
Dead+Wind 180 deg+Ice+Temp	58.947	0.000	36.862	3705.830	0.702	1.843
Dead+Wind 210 deg+Ice+Temp	58.947	-18.486	31.924	3210.907	1853.832	-1.569
Dead+Wind 225 deg+Ice+Temp	58.947	-26.144	26.065	2623.836	2621.424	-3.173
Dead+Wind 240 deg+Ice+Temp	58.947	-32.019	18.431	1858.751	3210.417	-4.561
Dead+Wind 270 deg+Ice+Temp	58.947	-36.973	0.000	11.672	3706.962	-6.331
Dead+Wind 300 deg+Ice+Temp	58.947	-32.019	-18.431	-1835.406	3210.418	-6.404
Dead+Wind 315 deg+Ice+Temp	58.947	-26.144	-26.065	-2600.492	2621.425	-5.780
Dead+Wind 330 deg+Ice+Temp	58.947	-18.486	-31.924	-3187.563	1853.833	-4.762
Dead+Wind 0 deg - Service	49.691	0.000	-15.717	-1525.553	0.377	-0.797
Dead+Wind 30 deg - Service	49.691	7.883	-13.612	-1320.040	-769.315	0.460
Dead+Wind 45 deg - Service	49.691	11.149	-11.114	-1076.263	-1088.132	1.063
Dead+Wind 60 deg - Service	49.691	13.655	-7.859	-758.568	-1332.769	1.594
Dead+Wind 90 deg - Service	49.691	15.767	0.000	8.417	-1539.007	2.300
Dead+Wind 120 deg - Service	49.691	13.655	7.859	775.401	-1332.769	2.391
Dead+Wind 135 deg - Service	49.691	11.149	11.114	1093.096	-1088.132	2.190
Dead+Wind 150 deg - Service	49.691	7.883	13.612	1336.873	-769.315	1.840
Dead+Wind 180 deg - Service	49.691	0.000	15.717	1542.386	0.377	0.797
Dead+Wind 210 deg - Service	49.691	-7.883	13.612	1336.873	770.070	-0.460
Dead+Wind 225 deg - Service	49.691	-11.149	11.114	1093.097	1088.887	-1.063
Dead+Wind 240 deg - Service	49.691	-13.655	7.859	775.401	1333.524	-1.594
Dead+Wind 270 deg - Service	49.691	-15.767	0.000	8.417	1539.762	-2.300
Dead+Wind 300 deg - Service	49.691	-13.655	-7.859	-758.568	1333.524	-2.391
Dead+Wind 315 deg - Service	49.691	-11.149	-11.114	-1076.263	1088.887	-2.190
Dead+Wind 330 deg - Service	49.691	-7.883	-13.612	-1320.040	770.070	-1.840

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	0.000	-49.691	0.000	0.000	49.691	0.000	0.000%
2	0.000	-49.691	-45.423	0.000	49.691	45.423	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
3	22.783	-49.691	-39.338	-22.783	49.691	39.338	0.000%
4	32.220	-49.691	-32.119	-32.220	49.691	32.119	0.000%
5	39.462	-49.691	-22.712	-39.462	49.691	22.712	0.000%
6	45.566	-49.691	0.000	-45.566	49.691	0.000	0.000%
7	39.462	-49.691	22.712	-39.462	49.691	-22.712	0.000%
8	32.220	-49.691	32.119	-32.220	49.691	-32.119	0.000%
9	22.783	-49.691	39.338	-22.783	49.691	-39.338	0.000%
10	0.000	-49.691	45.423	0.000	49.691	-45.423	0.000%
11	-22.783	-49.691	39.338	22.783	49.691	-39.338	0.000%
12	-32.220	-49.691	32.119	32.220	49.691	-32.119	0.000%
13	-39.462	-49.691	22.712	39.462	49.691	-22.712	0.000%
14	-45.566	-49.691	0.000	45.566	49.691	0.000	0.000%
15	-39.462	-49.691	-22.712	39.462	49.691	22.712	0.000%
16	-32.220	-49.691	-32.119	32.220	49.691	32.119	0.000%
17	-22.783	-49.691	-39.338	22.783	49.691	39.338	0.000%
18	0.000	-58.947	0.000	0.000	58.947	-0.000	0.000%
19	0.000	-58.947	-36.862	0.000	58.947	36.862	0.000%
20	18.486	-58.947	-31.924	-18.486	58.947	31.924	0.000%
21	26.144	-58.947	-26.065	-26.144	58.947	26.065	0.000%
22	32.019	-58.947	-18.431	-32.019	58.947	18.431	0.000%
23	36.973	-58.947	0.000	-36.973	58.947	0.000	0.000%
24	32.019	-58.947	18.431	-32.019	58.947	-18.431	0.000%
25	26.144	-58.947	26.065	-26.144	58.947	-26.065	0.000%
26	18.486	-58.947	31.924	-18.486	58.947	-31.924	0.000%
27	0.000	-58.947	36.862	0.000	58.947	-36.862	0.000%
28	-18.486	-58.947	31.924	18.486	58.947	-31.924	0.000%
29	-26.144	-58.947	26.065	26.144	58.947	-26.065	0.000%
30	-32.019	-58.947	18.431	32.019	58.947	-18.431	0.000%
31	-36.973	-58.947	0.000	36.973	58.947	0.000	0.000%
32	-32.019	-58.947	-18.431	32.019	58.947	18.431	0.000%
33	-26.144	-58.947	-26.065	26.144	58.947	26.065	0.000%
34	-18.486	-58.947	-31.924	18.486	58.947	31.924	0.000%
35	0.000	-49.691	-15.717	0.000	49.691	15.717	0.000%
36	7.883	-49.691	-13.612	-7.883	49.691	13.612	0.000%
37	11.149	-49.691	-11.114	-11.149	49.691	11.114	0.000%
38	13.655	-49.691	-7.859	-13.655	49.691	7.859	0.000%
39	15.767	-49.691	0.000	-15.767	49.691	0.000	0.000%
40	13.655	-49.691	7.859	-13.655	49.691	-7.859	0.000%
41	11.149	-49.691	11.114	-11.149	49.691	-11.114	0.000%
42	7.883	-49.691	13.612	-7.883	49.691	-13.612	0.000%
43	0.000	-49.691	15.717	0.000	49.691	-15.717	0.000%
44	-7.883	-49.691	13.612	7.883	49.691	-13.612	0.000%
45	-11.149	-49.691	11.114	11.149	49.691	-11.114	0.000%
46	-13.655	-49.691	7.859	13.655	49.691	-7.859	0.000%
47	-15.767	-49.691	0.000	15.767	49.691	0.000	0.000%
48	-13.655	-49.691	-7.859	13.655	49.691	7.859	0.000%
49	-11.149	-49.691	-11.114	11.149	49.691	11.114	0.000%
50	-7.883	-49.691	-13.612	7.883	49.691	13.612	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	0.00014194
3	Yes	5	0.00000001	0.00001821

4	Yes	5	0.00000001	0.00001994
5	Yes	5	0.00000001	0.00001555
6	Yes	4	0.00000001	0.00043579
7	Yes	5	0.00000001	0.00002215
8	Yes	5	0.00000001	0.00002109
9	Yes	5	0.00000001	0.00001579
10	Yes	4	0.00000001	0.00014312
11	Yes	5	0.00000001	0.00001705
12	Yes	5	0.00000001	0.00002033
13	Yes	5	0.00000001	0.00002062
14	Yes	4	0.00000001	0.00043595
15	Yes	5	0.00000001	0.00001518
16	Yes	5	0.00000001	0.00002072
17	Yes	5	0.00000001	0.00002060
18	Yes	4	0.00000001	0.00001847
19	Yes	5	0.00000001	0.00003363
20	Yes	5	0.00000001	0.00005212
21	Yes	5	0.00000001	0.00005617
22	Yes	5	0.00000001	0.00005001
23	Yes	5	0.00000001	0.00003592
24	Yes	5	0.00000001	0.00005634
25	Yes	5	0.00000001	0.00005797
26	Yes	5	0.00000001	0.00005097
27	Yes	5	0.00000001	0.00003408
28	Yes	5	0.00000001	0.00005166
29	Yes	5	0.00000001	0.00005731
30	Yes	5	0.00000001	0.00005507
31	Yes	5	0.00000001	0.00003595
32	Yes	5	0.00000001	0.00005000
33	Yes	5	0.00000001	0.00005694
34	Yes	5	0.00000001	0.00005404
35	Yes	4	0.00000001	0.00003258
36	Yes	4	0.00000001	0.00009231
37	Yes	4	0.00000001	0.00010231
38	Yes	4	0.00000001	0.00007735
39	Yes	4	0.00000001	0.00008088
40	Yes	4	0.00000001	0.00014057
41	Yes	4	0.00000001	0.00012339
42	Yes	4	0.00000001	0.00008282
43	Yes	4	0.00000001	0.00003340
44	Yes	4	0.00000001	0.00008299
45	Yes	4	0.00000001	0.00010774
46	Yes	4	0.00000001	0.00012164
47	Yes	4	0.00000001	0.00008097
48	Yes	4	0.00000001	0.00008591
49	Yes	4	0.00000001	0.00011842
50	Yes	4	0.00000001	0.00012065

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 130	14.585	43	0.845	0.006
L2	135 - 115	11.945	43	0.831	0.006
L3	115 - 95	8.600	43	0.740	0.004
L4	101 - 91	6.569	43	0.642	0.003
L5	91 - 51	5.272	43	0.585	0.002
L6	59 - 40	2.147	44	0.345	0.001
L7	40 - 19	0.970	44	0.229	0.001

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L8	28 - 0	0.494	44	0.150	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
153.000	4' x 3" DIA Omni	43	14.585	0.845	0.006	132318
150.000	Lightning Rod 3/4"x8'	43	14.585	0.845	0.006	132318
149.000	Pirod 12' T-Frame Sector Mount (1)	43	14.408	0.844	0.006	132318
138.000	Pirod 12' T-Frame Sector Mount (1)	43	12.470	0.837	0.006	54453
130.000	7770.00	43	11.077	0.817	0.005	19441
128.000	Valmont 13' Low Profile Platform	43	10.734	0.810	0.005	15887
124.000	4' x 3" DIA Omni	43	10.056	0.792	0.005	11634
119.000	Pirod 6' Side Mount Standoff (1)	43	9.233	0.765	0.005	8721
108.000	Valmont 13' Low Profile Platform	43	7.550	0.690	0.003	8723

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 130	41.778	12	2.412	0.017
L2	135 - 115	34.244	12	2.374	0.016
L3	115 - 95	24.693	13	2.117	0.012
L4	101 - 91	18.882	13	1.841	0.008
L5	91 - 51	15.164	13	1.678	0.007
L6	59 - 40	6.185	13	0.993	0.003
L7	40 - 19	2.794	13	0.658	0.002
L8	28 - 0	1.424	13	0.433	0.001

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
153.000	4' x 3" DIA Omni	12	41.778	2.412	0.017	46598
150.000	Lightning Rod 3/4"x8'	12	41.778	2.412	0.017	46598
149.000	Pirod 12' T-Frame Sector Mount (1)	12	41.274	2.412	0.017	46598
138.000	Pirod 12' T-Frame Sector Mount (1)	12	35.742	2.390	0.017	19179
130.000	7770.00	13	31.767	2.335	0.016	6877
128.000	Valmont 13' Low Profile Platform	13	30.787	2.314	0.015	5623
124.000	4' x 3" DIA Omni	13	28.854	2.264	0.014	4121
119.000	Pirod 6' Side Mount Standoff (1)	13	26.504	2.189	0.013	3090
108.000	Valmont 13' Low Profile Platform	13	21.693	1.977	0.010	3093

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	150 - 130 (1)	TP34.313x27.813x0.25	20.000	0.000	0.0	27.000	26.112	-4.136	705.029	0.006
L2	130 - 115 (2)	TP36.688x32.188x0.25	20.000	0.000	0.0	26.734	29.332	-10.059	784.160	0.013
L3	115 - 95 (3)	TP45.188x36.688x0.313	20.000	0.000	0.0	27.000	42.590	-14.611	1149.920	0.013
L4	95 - 91 (4)	TP45.813x42.013x0.313	10.000	0.000	0.0	26.747	45.784	-17.337	1224.610	0.014
L5	91 - 51 (5)	TP58.875x45.813x0.375	40.000	0.000	0.0	26.436	67.484	-25.259	1783.990	0.014
L6	51 - 40 (6)	TP61.688x55.513x0.375	19.000	0.000	0.0	25.122	74.035	-32.454	1859.910	0.017
L7	40 - 19 (7)	TP68.5x61.688x0.438	21.000	0.000	0.0	26.448	91.770	-36.606	2427.130	0.015
L8	19 - 0 (8)	TP73.813x64.705x0.438	28.000	0.000	0.0	24.740	103.367	-49.684	2557.250	0.019

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	150 - 130 (1)	TP34.313x27.813x0.25	68.037	3.942	27.000	0.146	0.000	0.000	27.000	0.000
L2	130 - 115 (2)	TP36.688x32.188x0.25	392.873	18.024	26.734	0.674	0.000	0.000	26.734	0.000
L3	115 - 95 (3)	TP45.188x36.688x0.313	735.377	20.014	27.000	0.741	0.000	0.000	27.000	0.000
L4	95 - 91 (4)	TP45.813x42.013x0.313	1024.908	24.124	26.747	0.902	0.000	0.000	26.747	0.000
L5	91 - 51 (5)	TP58.875x45.813x0.375	2064.900	26.842	26.436	1.015	0.000	0.000	26.436	0.000
L6	51 - 40 (6)	TP61.688x55.513x0.375	2767.975	29.878	25.122	1.189	0.000	0.000	25.122	0.000
L7	40 - 19 (7)	TP68.5x61.688x0.438	3243.175	26.597	26.448	1.006	0.000	0.000	26.448	0.000
L8	19 - 0 (8)	TP73.813x64.705x0.438	4448.517	28.734	24.740	1.161	0.000	0.000	24.740	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	150 - 130 (1)	TP34.313x27.813x0.25	7.937	0.304	18.000	0.034	0.000	0.000	18.000	0.000
L2	130 - 115 (2)	TP36.688x32.188x0.25	20.218	0.689	18.000	0.078	0.819	0.018	18.000	0.001
L3	115 - 95 (3)	TP45.188x36.688x0.313	28.112	0.660	18.000	0.075	2.301	0.030	18.000	0.002
L4	95 - 91 (4)	TP45.813x42.013x0.313	29.783	0.650	18.000	0.073	2.301	0.026	18.000	0.001
L5	91 - 51 (5)	TP58.875x45.813x0.375	35.310	0.523	18.000	0.059	4.600	0.028	18.000	0.002
L6	51 - 40 (6)	TP61.688x55.513x0.375	38.640	0.522	18.000	0.059	4.599	0.024	18.000	0.001
L7	40 - 19 (7)	TP68.5x61.688x0.438	40.590	0.442	18.000	0.050	4.599	0.018	18.000	0.001
L8	19 - 0 (8)	TP73.813x64.705x0.438	45.538	0.441	18.000	0.050	4.598	0.014	18.000	0.001

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	150 - 130 (1)	0.006	0.146	0.000	0.034	0.000	0.152 ✔	1.333	H1-3+VT ✔
L2	130 - 115 (2)	0.013	0.674	0.000	0.078	0.001	0.689 ✔	1.333	H1-3+VT ✔
L3	115 - 95 (3)	0.013	0.741	0.000	0.075	0.002	0.755 ✔	1.333	H1-3+VT ✔
L4	95 - 91 (4)	0.014	0.902	0.000	0.073	0.001	0.917 ✔	1.333	H1-3+VT ✔
L5	91 - 51 (5)	0.014	1.015	0.000	0.059	0.002	1.030 ✔	1.333	H1-3+VT ✔
L6	51 - 40 (6)	0.017	1.189	0.000	0.059	0.001	1.208 ✔	1.333	H1-3+VT ✔
L7	40 - 19 (7)	0.015	1.006	0.000	0.050	0.001	1.021 ✔	1.333	H1-3+VT ✔
L8	19 - 0 (8)	0.019	1.161	0.000	0.050	0.001	1.182 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	150 - 130	Pole	TP34.313x27.813x0.25	1	-4.136	939.804	11.4	Pass
L2	130 - 115	Pole	TP36.688x32.188x0.25	2	-10.059	1045.285	51.7	Pass
L3	115 - 95	Pole	TP45.188x36.688x0.313	3	-14.611	1532.843	56.7	Pass
L4	95 - 91	Pole	TP45.813x42.013x0.313	4	-17.337	1632.405	68.8	Pass
L5	91 - 51	Pole	TP58.875x45.813x0.375	5	-25.259	2378.059	77.3	Pass
L6	51 - 40	Pole	TP61.688x55.513x0.375	6	-32.454	2479.260	90.6	Pass
L7	40 - 19	Pole	TP68.5x61.688x0.438	7	-36.606	3235.364	76.6	Pass
L8	19 - 0	Pole	TP73.813x64.705x0.438	8	-49.684	3408.814	88.6	Pass
							Summary	
						Pole (L6)	90.6	Pass
						RATING =	**90.6**	**Pass**

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Subject: Anchor Bolt and Baseplate Analysis

Location: 150-ft NUDD Monopole
New Fairfield, CT

Rev. 0: 8/8/14

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 14152.000

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 4449·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 46·kips	(Input From RisaTower)
Axial Force =	Axial := 50·kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A687

Number of Anchor Bolts =	N := 24	(User Input)
Diameter of Bolt Circle =	D_{bc} := 70.0·in	(User Input)
Bolt "Column" Distance =	l := 3.00·in	(User Input)
Bolt Ultimate Strength =	F_u := 125·ksi	(User Input)
Bolt Yield Strength =	F_y := 105·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.00·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)
Nut Outside Diameter (Across Flats) =	Nut_{OD} := 3.00in	(User Input)
Anchor Bolt Hole Outside Diameter =	$Hole_{OD}$:= 2.25in	(User Input)
Thickness of Monopole Shell at Base Plate =	$Wall_{thk}$:= 0.4375in	(User Input)

Stiffened Base Plate Data:

Use ASTM A36 Mod 42

Plate Yield Strength =	Fy_{bp} := 42·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 2.00·in	(User Input)
Base Plate Inside Diameter =	D_{bpi} := 64.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 73.813·in	(User Input)
Base Plate Outside Diameter =	$D_{bp} := D_{pole} - (Wall_{thk})$ = 73.38·in	(User Input)
Gussets Yield Strength =	F_{yg} := 36ksi	(User Input)
Gussets Per Bolt =	n_g := 1	(User Input)
Gusset Height =	h_g := 20.0in	(User Input)
Gusset Thickness =	t_g := 0.75in	(User Input)
Gusset Depth =	t_{gl} := 3.5·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 35 \cdot in$

Distance to Bolts = $i := 1 .. N$

$$d_i := \left| \begin{array}{l} \theta \leftarrow 2 \cdot \pi \cdot \left(\frac{i}{N} \right) \\ d \leftarrow R_{bc} \cdot \sin(\theta) \end{array} \right.$$

$d_1 = 9.06 \cdot in$
$d_2 = 17.50 \cdot in$
$d_3 = 24.75 \cdot in$
$d_4 = 30.31 \cdot in$
$d_5 = 33.81 \cdot in$
$d_6 = 35.00 \cdot in$
$d_7 = 33.81 \cdot in$
$d_8 = 30.31 \cdot in$
$d_9 = 24.75 \cdot in$
$d_{10} = 17.50 \cdot in$
$d_{11} = 9.06 \cdot in$
etc.

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 14700 \cdot in^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 3.142 \cdot in^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 = 2.498 \cdot in^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 1.783 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.446 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.557 \cdot in^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 125 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 172.7 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net} := 1.333 \cdot \left(0.60 \cdot A_n \cdot F_y\right) = 209.798 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 59.6 \%$ Bolts are "upset bolts". Use net area per AISC

Condition1 = $Condition1 := if\left(\frac{T_{Max}}{T_{ALL.Net}} \le 1.00, "OK", "Overstressed"\right)$

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.479 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 10.3 \cdot ksi$

Allowable Bending Stress = $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 84 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

Per ASCE Manual 72: "If the clearance between the base plate and concrete does not exceed two times the bolt diameter a bending stress analysis of the bolts is NOT normally required.

$$l := \begin{cases} l & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 0 \cdot in$$

$$f_{bx} := \begin{cases} f_{bx} & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 0 \cdot ksi$$

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 129.2 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 51.7 \cdot ksi$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{F_y}} = 73.836$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^{\,2}}\right] \cdot F_y}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^{\,3}}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} = 63 \cdot ksi$$

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 84 \cdot ksi$$

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 61.6 \cdot \%$$

Condition 2 =

$$Condition2 := if\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \le 1.00, "OK", "Overstressed"\right)$$

Condition2 = "OK"

BASE PLATE ANALYSIS per AISC 9th Ed - ASD

Internally Located NUDD Base Plate Assembly w/ Gussets
Analayis Based on Theory Developed For Monopole Compression Ring Plate
Required Thickness Calculations per Process Equipment Design by Brownell And Young Chapter 10 ' Design of Vertical Vessels:

Anchor Bolt Forces = $C_i := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$

$C_1 = 35.0 \cdot kips$ $C_7 = 124.9 \cdot kips$

$C_2 = 65.6 \cdot kips$ $C_8 = 112.2 \cdot kips$

$C_3 = 92.0 \cdot kips$ $C_9 = 92.0 \cdot kips$

$C_4 = 112.2 \cdot kips$ $C_{10} = 65.6 \cdot kips$

$C_5 = 124.9 \cdot kips$ $C_{11} = 35.0 \cdot kips$

$C_6 = 129.2 \cdot kips$ etc.

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 36.91 \cdot in$

Angle Between Bolts = $\alpha := \left(\frac{2 \cdot \pi}{N}\right) = 15 \cdot deg$

Input Data:

Maximum Bolt Force (P) = $P := (C_6) = 129.2 \cdot kips$ (User Input)

Poissons ratio (μ) = $\mu := 0.30$ (User Input)

Radial Distance From Face of Monopole Shell to Bolt Circle in inches (a) = $a := \frac{\left(\left|D_{bc} - D_{pole}\right| - Wall_{thk}\right)}{2} = 1.688 \cdot in$

Radial Distance From Face of Monopole Shell to Edge of Base Plate in inches (l) = $l := \frac{\left(\left|D_{bpi} - D_{bp}\right|\right)}{2} = 4.69 \cdot in$

Gusset Spacing in inches (b) = $b := \alpha \cdot \left(\frac{D_{bc}}{2}\right) = 9.16 \cdot in$ $b := 5.715in$

Radius of Action of Concentrated Load, (One Half Distance Across Flats of Anchor Bolt Nut (e) = $e := (0.5 \cdot Nut_{OD}) = 1.5 \cdot in$

Allowable Bending Stress (f.allow) = $f_{allow} := 0.75 \cdot Fy_{bp} \cdot 1.3333 = 42 \cdot ksi$

Plate Thickness Provided (t) = $t := t_{bp} = 2 \cdot in$

Gusset L/b Ratio per *Theory of Plates and Shells* byTimenshenko $\frac{b}{l} = 1.219$

If b/l ratio >1 then My controls, otherwise Mx and My are equal. Use My equation 10.38 for simplicity.

Note: If b/l if <1 invert b/l and flip axes 90 degrees

γ1,γ2 constants from Table 10.6

$\gamma1 := 0.5113$ (User Input)

$\gamma2 := 0.1290$ (User Input)

$$My := \left[\left(\frac{P}{4\cdot\pi}\right)\cdot\left[(1+\mu)\cdot\ln\left[\frac{\left(2\cdot l\cdot\sin\left(\pi\cdot\frac{a}{l}\right)\right)}{\pi\cdot e}\right]+1\right]-\left(\frac{\gamma1\cdot P}{4\cdot\pi}\right)\right]\cdot in \qquad \text{Eq - 10.38}$$

$$Mx := \left[\left(\frac{P}{4\cdot\pi}\right)\cdot\left[(1+\mu)\cdot\ln\left[\frac{\left(2\cdot l\cdot\sin\left(\pi\cdot\frac{a}{l}\right)\right)}{\pi\cdot e}\right]+1\right]-(1-\mu-\gamma2)\cdot\left(\frac{P}{4\cdot\pi}\right)\right]\cdot in \qquad \text{Eq - 10.39}$$

Maximum Moments in Plate =

$Mx = 12268.86\cdot in\cdot lb$

$My = 12882.65\cdot in\cdot lb$

Minimum Thicknesss Required (t) = $t_{reqd} := \left(\frac{6\cdot My}{f_{allow}\cdot in}\right)^{0.5} = 1.357\cdot in$

Base Plate Ratio = $ThicknessRatio := \frac{t_{reqd}}{t} = 0.678$

Condition 3 = $Condition3 := if\left(\frac{t_{reqd}}{t} \le 1.0, "Okay", "No\ Good"\right)$

$Condition3 = "Okay"$

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Subject: Anchor Bolt and Baseplate Analysis

Location: 150-ft Nudd Monopole
Dayville (Killingly), CT

Rev. 0: 8/8/14

Prepared by: TJL Checked by: C.F.C.
Job No. 14152.000

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 4449·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 46·kips	(Input From RisaTower)
Axial Force =	Axial := 50·kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A687

Number of Anchor Bolts =	N := 24	(User Input)
Diameter of Bolt Circle =	D_{bc} := 70.0·in	(User Input)
Bolt "Column" Distance =	l := 3.00·in	(User Input)
Bolt Ultimate Strength =	F_u := 125·ksi	(User Input)
Bolt Yield Strength =	F_y := 105·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.00·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)
Nut Outside Diameter (Across Flats) =	Nut_{OD} := 3.00in	(User Input)
Anchor Bolt Hole Outside Diameter =	$Hole_{OD}$:= 2.25in	(User Input)
Thickness of Monopole Shell at Base Plate =	$Wall_{thk}$:= 0.4375in	(User Input)

Stiffened Base Plate Data:

Use ASTM A36 Mod 42

Plate Yield Strength =	Fy_{bp} := 42·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 2.00·in	(User Input)
Base Plate Inside Diameter =	D_{bpi} := 64.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 73.813·in	(User Input)
Base Plate Outside Diameter =	$D_{bp} := D_{pole} - (Wall_{thk})$ = 73.38·in	(User Input)
Gussets Yield Strength =	F_{yg} := 36ksi	(User Input)
Gussets Per Bolt =	n_g := 1	(User Input)
Gusset Height =	h_g := 20.0in	(User Input)
Gusset Thickness =	t_g := 0.75in	(User Input)
Gusset Depth =	t_{gl} := 3.5·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 35 \cdot in$

Distance to Bolts = $i := 1 .. N$

$$d_i := \left| \begin{array}{l} \theta \leftarrow 2 \cdot \pi \cdot \left(\frac{i}{N} \right) \\ d \leftarrow R_{bc} \cdot \sin(\theta) \end{array} \right.$$

$d_1 = 9.06 \cdot in$
$d_2 = 17.50 \cdot in$
$d_3 = 24.75 \cdot in$
$d_4 = 30.31 \cdot in$
$d_5 = 33.81 \cdot in$
$d_6 = 35.00 \cdot in$
$d_7 = 33.81 \cdot in$
$d_8 = 30.31 \cdot in$
$d_9 = 24.75 \cdot in$
$d_{10} = 17.50 \cdot in$
$d_{11} = 9.06 \cdot in$
etc.

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 14700 \cdot in^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 3.142 \cdot in^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 = 2.498 \cdot in^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 1.783 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.446 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.557 \cdot in^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 125 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 172.7 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net} := 1.333 \cdot \left(0.60 \cdot A_n \cdot F_y\right) = 209.798 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 59.6 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

Condition1 = $Condition1 := if\left(\frac{T_{Max}}{T_{ALL.Net}} \le 1.00, "OK", "Overstressed"\right)$

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.479 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 10.3 \cdot ksi$

Allowable Bending Stress = $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 84 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

Per ASCE Manual 72: "If the clearance between the base plate and concrete does not exceed two times the bolt diameter a bending stress analysis of the bolts is NOT normally required.

$$l := \begin{cases} l & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 0 \cdot in$$

$$f_{bx} := \begin{cases} f_{bx} & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 0 \cdot ksi$$

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 129.2 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 51.7 \cdot ksi$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{F_y}} = 73.836$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^2}\right] \cdot F_y}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^3}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} = 63 \cdot ksi$$

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 84 \cdot ksi$$

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 61.6 \cdot \%$$

Condition 2 =

$$Condition2 := if\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$$

Condition2 = "OK"

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Subject:	Anchor Bolt and Baseplate Analysis
Location:	150-ft Nudd Monopole Dayville (Killingly), CT
Rev. 0: 8/8/14	Prepared by: TJL Checked by: C.F.C. Job No. 14152.000

BASE PLATE ANALYSIS per AISC 9th Ed - ASD

Internally Located NUDD Base Plate Assembly w/ Gussets
Analayis Based on Theory Developed For Monopole Compression Ring Plate
Required Thickness Calculations per Process Equipment Design by Brownell
And Young Chapter 10 ' Design of Vertical Vessels:

Anchor Bolt Forces = $C_i := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$

$C_1 = 35.0 \cdot kips$ $C_7 = 124.9 \cdot kips$

$C_2 = 65.6 \cdot kips$ $C_8 = 112.2 \cdot kips$

$C_3 = 92.0 \cdot kips$ $C_9 = 92.0 \cdot kips$

$C_4 = 112.2 \cdot kips$ $C_{10} = 65.6 \cdot kips$

$C_5 = 124.9 \cdot kips$ $C_{11} = 35.0 \cdot kips$

$C_6 = 129.2 \cdot kips$ etc.

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 36.91 \cdot in$

Angle Between Bolts = $\alpha := \left(\frac{2 \cdot \pi}{N}\right) = 15 \cdot deg$

Input Data:

Maximum Bolt Force (P) = $P := (C_6) = 129.2 \cdot kips$ (User Input)

Poissons ratio (μ) = $\mu := 0.30$ (User Input)

Radial Distance From Face of Monopole Shell to Bolt Circle in inches (a) = $a := \frac{\left(\left|D_{bc} - D_{pole}\right| - Wall_{thk}\right)}{2} = 1.688 \cdot in$

Radial Distance From Face of Monopole Shell to Edge of Base Plate in inches (l) = $l := \frac{\left(\left|D_{bpi} - D_{bp}\right|\right)}{2} = 4.69 \cdot in$

Gusset Spacing in inches (b) = $b := \alpha \cdot \left(\frac{D_{bc}}{2}\right) = 9.16 \cdot in$ $b := 5.715in$

Radius of Action of Concentrated Load, (One Half Distance Across Flats of Anchor Bolt Nut (e) = $e := \left(0.5 \cdot Nut_{OD}\right) = 1.5 \cdot in$

Allowable Bending Stress (f.allow) = $f_{allow} := 0.75 \cdot Fy_{bp} \cdot 1.3333 = 42 \cdot ksi$

Plate Thickness Provided (t) = $t := t_{bp} = 2 \cdot in$

Gusset L/b Ratio per *Theory of Plates and Shells* byTimenshenko $\frac{b}{l} = 1.219$

If b/l ratio >1 then My controls, otherwise Mx and My are equal. Use My equation 10.38 for simplicity.

Note: If b/l if <1 invert b/l and flip axes 90 degrees

γ1,γ2 constants from Table 10.6

$\gamma 1 := 0.5113$ (User Input)

$\gamma 2 := 0.1290$ (User Input)

$$My := \left[\left(\frac{P}{4\cdot\pi}\right)\cdot\left[(1+\mu)\cdot\ln\left[\frac{\left(2\cdot l\cdot\sin\left(\pi\cdot\frac{a}{l}\right)\right)}{\pi\cdot e}\right]+1\right]-\left(\frac{\gamma 1\cdot P}{4\cdot\pi}\right)\right]\cdot in \qquad \text{Eq - 10.38}$$

$$Mx := \left[\left(\frac{P}{4\cdot\pi}\right)\cdot\left[(1+\mu)\cdot\ln\left[\frac{\left(2\cdot l\cdot\sin\left(\pi\cdot\frac{a}{l}\right)\right)}{\pi\cdot e}\right]+1\right]-(1-\mu-\gamma 2)\cdot\left(\frac{P}{4\cdot\pi}\right)\right]\cdot in \qquad \text{Eq - 10.39}$$

Maximum Moments in Plate =

$Mx = 12268.86\cdot in\cdot lb$

$My = 12882.65\cdot in\cdot lb$

Minimum Thicknesss Required (t) = $t_{reqd} := \left(\frac{6\cdot My}{f_{allow}\cdot in}\right)^{0.5} = 1.357\cdot in$

Base Plate Ratio = $ThicknessRatio := \frac{t_{reqd}}{t} = 0.678$

Condition 3 = $Condition3 := if\left(\frac{t_{reqd}}{t} \le 1.0, "Okay", "No\ Good"\right)$

Condition3 = "Okay"

LPILE Plus for Windows, Version 5.0 (5.0.47)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

This program is licensed to:

TJL
Centek Engineering

Files Used for Analysis

Path to file locations: J:\Jobs\1415200.WI\04_Structural\Backup Documentation\Calcs\LPile\
Name of input data file: Killingly Center Drilled Foundation.lpd
Name of output file: Killingly Center Drilled Foundation.lpo
Name of plot output file: Killingly Center Drilled Foundation.lpp
Name of runtime file: Killingly Center Drilled Foundation.lpr

Time and Date of Analysis

Date: August 8, 2014 Time: 10:02:49

Problem Title

14152.000 - Killingly Center

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 3:
- Computation of Nonlinear Bending Stiffness and Ultimate Bending Moment Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output summary table of values for pile-head deflection, maximum bending moment, and shear force only
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Only summary tables of pile-head deflection, maximum bending moment, and maximum shear force are to be printed in output file.

Pile Structural Properties and Geometry

Pile Length = 333.00 in

Depth of ground surface below top of pile = 3.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point No.	Point Depth in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	90.00000000	3220623.	6361.7000	3604996.
2	333.0000	90.00000000	3220623.	6361.7000	3604996.

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of moment of inertia and modulus of are not used for any computations other than total stress due to combined axial loading and bending.

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 3.000 in
Distance from top of pile to bottom of layer = 90.000 in
p-y subgrade modulus k for top of soil layer = 25.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 25.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 90.000 in
Distance from top of pile to bottom of layer = 180.000 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 180.000 in
Distance from top of pile to bottom of layer = 333.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

(Depth of lowest layer extends 0.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	3.00	0.05800
2	90.00	0.05800
3	90.00	0.06100
4	180.00	0.06100
5	180.00	0.02500
6	333.00	0.02500

Shear Strength of Soils

Shear strength parameters with depth defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	3.000	0.00000	30.00	------	------
2	90.000	0.00000	30.00	------	------
3	90.000	0.00000	30.00	------	------
4	180.000	0.00000	30.00	------	------
5	180.000	0.00000	33.00	------	------
6	333.000	0.00000	33.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 46000.000 lbs
Bending moment at pile head = 53388000.000 in-lbs
Axial load at pile head = 50000.000 lbs

Non-zero moment at pile head for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Number of sections = 1

Pile Section No. 1

The sectional shape is a circular drilled shaft (bored pile).

Outside Diameter = 90.0000 in

Material Properties:

Compressive Strength of Concrete	=	4.000 kip/in**2
Yield Stress of Reinforcement	=	60. kip/in**2
Modulus of Elasticity of Reinforcement	=	29000. kip/in**2
Number of Reinforcing Bars	=	66
Area of Single Bar	=	0.79000 in**2
Number of Rows of Reinforcing Bars	=	33
Area of Steel	=	52.140 in**2
Area of Shaft	=	6361.725 in**2
Percentage of Steel Reinforcement	=	0.820 percent
Cover Thickness (edge to bar center)	=	3.000 in

Unfactored Axial Squash Load Capacity = 24580.99 kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement in**2	Distance to Centroidal Axis in
1	1.580	41.952
2	1.580	41.573
3	1.580	40.816
4	1.580	39.690
5	1.580	38.205
6	1.580	36.373
7	1.580	34.212
8	1.580	31.741
9	1.580	28.983
10	1.580	25.963
11	1.580	22.707
12	1.580	19.246
13	1.580	15.610
14	1.580	11.833
15	1.580	7.949
16	1.580	3.992
17	1.580	0.000
18	1.580	-3.992
19	1.580	-7.949
20	1.580	-11.833
21	1.580	-15.610
22	1.580	-19.246
23	1.580	-22.707
24	1.580	-25.963
25	1.580	-28.983
26	1.580	-31.741
27	1.580	-34.212
28	1.580	-36.373

29	1.580	-38.205
30	1.580	-39.690
31	1.580	-40.816
32	1.580	-41.573
33	1.580	-41.952

Axial Thrust Force = 50000.00 lbs

Bending Moment in-lbs	Bending Stiffness lb-in2	Bending Curvature rad/in	Maximum Strain in/in	Neutral Axis Position inches	Max. Concrete Stress psi	Max. Steel Stress psi
8134337.	1.301494E+13	6.250000E-07	0.00003027	48.42922434	107.50597	822.54245
16194222.	1.295538E+13	0.00000125	0.00005850	46.79859951	206.10465	1585.97476
24180272.	1.289615E+13	0.00000188	0.00008677	46.27568677	303.33870	2350.52875
32090169.	1.283607E+13	0.00000250	0.00011500	45.99866554	398.93676	3113.95430
32090169.	1.026885E+13	0.00000313	0.00007565	24.20889035	261.37101	5686.13312
32090169.	8.557378E+12	0.00000375	0.00008941	23.84272859	307.63060	6863.17984
32090169.	7.334896E+12	0.00000438	0.00010296	23.53470907	352.84676	8046.12312
32090169.	6.418034E+12	0.00000500	0.00011653	23.30686614	397.78411	9228.60651
32090169.	5.704919E+12	0.00000563	0.00013012	23.13249305	442.44179	10410.62693
32090169.	5.134427E+12	0.00000625	0.00014372	22.99556360	486.81889	11592.18172
32090169.	4.667661E+12	0.00000688	0.00015734	22.88588002	530.91449	12773.26805
32090169.	4.278689E+12	0.00000750	0.00017097	22.79664829	574.72780	13953.88214
32090169.	3.949559E+12	0.00000813	0.00018463	22.72315577	618.25775	15134.02233
32090169.	3.667448E+12	0.00000875	0.00019829	22.66204700	661.50358	16313.68424
32090169.	3.422951E+12	0.00000938	0.00021198	22.61085704	704.46438	17492.86467
32090169.	3.209017E+12	0.00001000	0.00022568	22.56773248	747.13907	18671.56177
32090169.	3.020251E+12	0.00001063	0.00023939	22.53126249	789.52678	19849.77170
32090169.	2.852459E+12	0.00001125	0.00025313	22.50035003	831.62664	21027.49052
32675293.	2.751604E+12	0.00001188	0.00026719	22.49999866	874.40074	22195.80544
34351972.	2.748158E+12	0.00001250	0.00028125	22.49999866	916.82793	23364.00573
36004208.	2.743178E+12	0.00001313	0.00029515	22.48759344	958.39400	24536.92775
37642656.	2.737648E+12	0.00001375	0.00030897	22.47062579	999.37016	25712.11873
39279364.	2.732477E+12	0.00001438	0.00032281	22.45645568	1040.05715	26886.75856
40914316.	2.727621E+12	0.00001500	0.00033667	22.44473979	1080.45376	28060.84448
42547510.	2.723041E+12	0.00001563	0.00035055	22.43519649	1120.55911	29234.37064
44178925.	2.718703E+12	0.00001625	0.00036445	22.42757902	1160.37188	30407.33520
45808553.	2.714581E+12	0.00001688	0.00037837	22.42168352	1199.89104	31579.73320
47436388.	2.710651E+12	0.00001750	0.00039230	22.41733566	1239.11558	32751.55949
49062410.	2.706892E+12	0.00001813	0.00040626	22.41437986	1278.04419	33922.81168
50686620.	2.703286E+12	0.00001875	0.00042024	22.41269007	1316.67600	35093.48263
52308998.	2.699819E+12	0.00001938	0.00043424	22.41214827	1355.00969	36263.56981
53929536.	2.696477E+12	0.00002000	0.00044825	22.41265520	1393.04414	37433.06836
55548220.	2.693247E+12	0.00002063	0.00046229	22.41412237	1430.77812	38601.97420
57165042.	2.690120E+12	0.00002125	0.00047635	22.41647467	1468.21059	39770.28139
58779989.	2.687085E+12	0.00002188	0.00049043	22.41964236	1505.34027	40937.98605
60393046.	2.684135E+12	0.00002250	0.00050453	22.42356375	1542.16588	42105.08408
62004208.	2.681263E+12	0.00002313	0.00051865	22.42818788	1578.68640	43271.56870
63613456.	2.678461E+12	0.00002375	0.00053279	22.43346378	1614.90041	44437.43677
65220779.	2.675724E+12	0.00002438	0.00054696	22.43934855	1650.80668	45602.68321
68429600.	2.670423E+12	0.00002563	0.00057535	22.45279446	1721.69098	47931.29036
71630579.	2.665324E+12	0.00002688	0.00060383	22.46826276	1791.32922	50257.34647
74823594.	2.660394E+12	0.00002813	0.00063241	22.48553082	1859.71049	52580.81321
77994152.	2.655120E+12	0.00002938	0.00066094	22.49999866	1926.51307	54905.41345
81101994.	2.648228E+12	0.00003063	0.00068906	22.49999866	1990.88227	57241.81403
84192607.	2.641337E+12	0.00003188	0.00071719	22.49999866	2053.81391	59578.21460
86984218.	2.625939E+12	0.00003313	0.00074531	22.49999866	2115.30800	60000.00000
89269238.	2.596923E+12	0.00003438	0.00077206	22.46005252	2172.36574	60000.00000
91149678.	2.558587E+12	0.00003563	0.00079694	22.37011805	2224.10874	60000.00000
92815535.	2.517031E+12	0.00003688	0.00082111	22.26726338	2273.27007	60000.00000
94323024.	2.474047E+12	0.00003813	0.00084475	22.15741619	2320.30866	60000.00000
95664679.	2.429579E+12	0.00003938	0.00086782	22.03982010	2365.18156	60000.00000
96884588.	2.384851E+12	0.00004063	0.00089045	21.91868886	2408.24277	60000.00000
98040024.	2.341254E+12	0.00004188	0.00091287	21.79983750	2449.99034	60000.00000
99053881.	2.296902E+12	0.00004313	0.00093473	21.67486534	2489.78479	60000.00000
1.000396E+08	2.254413E+12	0.00004438	0.00095652	21.55534878	2528.59837	60000.00000
1.009244E+08	2.212041E+12	0.00004563	0.00097789	21.43319830	2565.81175	60000.00000
1.017574E+08	2.170825E+12	0.00004688	0.00099907	21.31345376	2601.87378	60000.00000
1.025824E+08	2.131582E+12	0.00004813	0.00102026	21.20012239	2637.15498	60000.00000
1.032801E+08	2.091749E+12	0.00004938	0.00104085	21.08046904	2670.63602	60000.00000
1.041700E+08	2.057678E+12	0.00005063	0.00106313	21.00000009	2706.13599	60000.00000
1.047281E+08	2.018855E+12	0.00005188	0.00108566	20.92836097	2741.16161	60000.00000
1.053164E+08	1.982426E+12	0.00005313	0.00110528	20.80536023	2770.73933	60000.00000
1.058810E+08	1.947236E+12	0.00005438	0.00112481	20.68616554	2799.48413	60000.00000
1.064438E+08	1.913597E+12	0.00005563	0.00114437	20.57291731	2827.60587	60000.00000
1.070048E+08	1.881404E+12	0.00005688	0.00116396	20.46522930	2855.10149	60000.00000
1.074660E+08	1.848877E+12	0.00005813	0.00118292	20.35135075	2881.02700	60000.00000
1.079244E+08	1.817674E+12	0.00005938	0.00120191	20.24265960	2906.35293	60000.00000
1.083812E+08	1.787731E+12	0.00006063	0.00122092	20.13895735	2931.08685	60000.00000
1.088364E+08	1.758972E+12	0.00006188	0.00123997	20.03994897	2955.22611	60000.00000
1.092646E+08	1.730924E+12	0.00006313	0.00125886	19.94232729	2978.52269	60000.00000
1.096334E+08	1.703043E+12	0.00006438	0.00127734	19.84218702	3000.68657	60000.00000
1.100008E+08	1.676202E+12	0.00006563	0.00129585	19.74630877	3022.28741	60000.00000
1.103666E+08	1.650342E+12	0.00006688	0.00131439	19.65445384	3043.32223	60000.00000
1.107311E+08	1.625410E+12	0.00006813	0.00133296	19.56640497	3063.78835	60000.00000
1.107311E+08	1.596123E+12	0.00006938	0.00135281	19.49999884	3085.06960	60000.00000

1.115165E+08	1.578994E+12	0.00007063	0.00137599	19.48309556	3109.20760	60000.00000
1.117969E+08	1.555436E+12	0.00007188	0.00139338	19.38608810	3126.43330	60000.00000
1.120762E+08	1.532666E+12	0.00007313	0.00141078	19.29276332	3143.15988	60000.00000
1.123543E+08	1.510646E+12	0.00007438	0.00142822	19.20293882	3159.38498	60000.00000
1.129069E+08	1.468707E+12	0.00007688	0.00146317	19.03311476	3190.32087	60000.00000
1.134478E+08	1.429264E+12	0.00007938	0.00149816	18.87443259	3219.15849	60000.00000
1.138784E+08	1.390881E+12	0.00008188	0.00153209	18.71251032	3245.04287	60000.00000
1.143047E+08	1.354722E+12	0.00008438	0.00156612	18.56141612	3269.00329	60000.00000
1.147265E+08	1.320593E+12	0.00008688	0.00160026	18.42022732	3291.02091	60000.00000
1.151439E+08	1.288323E+12	0.00008938	0.00163450	18.28812853	3311.07679	60000.00000
1.155188E+08	1.257347E+12	0.00009188	0.00166836	18.15900698	3328.89156	60000.00000
1.158404E+08	1.227448E+12	0.00009438	0.00170168	18.03105757	3344.46864	60000.00000
1.169061E+08	1.206773E+12	0.00009688	0.00174375	18.00000027	3361.57814	60000.00000
1.169061E+08	1.176414E+12	0.00009938	0.00177749	17.88671449	3372.91010	60000.00000
1.169061E+08	1.147545E+12	0.00010188	0.00180964	17.76332483	3381.84545	60000.00000
1.171459E+08	1.122356E+12	0.00010438	0.00184189	17.64681771	3389.01958	60000.00000
1.174114E+08	1.098587E+12	0.00010688	0.00187390	17.53355339	3394.36467	60000.00000
1.176243E+08	1.075422E+12	0.00010938	0.00190512	17.41827741	3397.87246	60000.00000
1.178338E+08	1.053263E+12	0.00011188	0.00193645	17.30901495	3399.70809	60000.00000
1.180367E+08	1.032015E+12	0.00011438	0.00196787	17.20538512	3396.77233	60000.00000
1.182326E+08	1.011616E+12	0.00011688	0.00199938	17.10703656	3388.93948	60000.00000
1.184270E+08	9.920584E+11	0.00011938	0.00203100	17.01364741	3388.77124	60000.00000
1.186197E+08	9.732896E+11	0.00012188	0.00206272	16.92492262	3393.56279	60000.00000
1.188107E+08	9.552621E+11	0.00012438	0.00209455	16.84059665	3397.04103	60000.00000
1.189881E+08	9.378372E+11	0.00012688	0.00212621	16.75827429	3399.17486	60000.00000
1.191276E+08	9.207933E+11	0.00012938	0.00215714	16.67355135	3399.98589	60000.00000
1.192634E+08	9.043672E+11	0.00013188	0.00218828	16.59359470	3394.26825	60000.00000
1.193978E+08	8.885419E+11	0.00013438	0.00221952	16.51733950	3387.50072	60000.00000
1.193978E+08	8.723128E+11	0.00013688	0.00225844	16.49999902	3384.87575	60000.00000
1.197216E+08	8.589889E+11	0.00013938	0.00229969	16.49999902	3391.61895	60000.00000
1.198997E+08	8.451078E+11	0.00014188	0.00233063	16.42735139	3395.06083	60000.00000
1.200191E+08	8.313011E+11	0.00014438	0.00236062	16.35059461	3397.50465	60000.00000
1.201377E+08	8.179591E+11	0.00014688	0.00239068	16.27697602	3399.12672	60000.00000
1.202555E+08	8.050580E+11	0.00014938	0.00242082	16.20634004	3399.91774	60000.00000
1.203712E+08	7.925673E+11	0.00015188	0.00245114	16.13918021	3396.89861	60000.00000
1.204851E+08	7.804706E+11	0.00015438	0.00248159	16.07507542	3391.32948	60000.00000
1.205750E+08	7.686056E+11	0.00015688	0.00251125	16.00796387	3385.96968	60000.00000
1.206537E+08	7.570429E+11	0.00015938	0.00254057	15.94085231	3380.69854	60000.00000
1.207289E+08	7.458154E+11	0.00016188	0.00257017	15.87752268	3378.25497	60000.00000
1.207977E+08	7.348908E+11	0.00016438	0.00260025	15.81899151	3382.90458	60000.00000
1.208660E+08	7.242909E+11	0.00016688	0.00263038	15.76254979	3387.00817	60000.00000
1.209294E+08	7.139740E+11	0.00016938	0.00266090	15.71012601	3390.62567	60000.00000
1.209877E+08	7.039287E+11	0.00017188	0.00269182	15.66149220	3393.71521	60000.00000
1.210456E+08	6.941683E+11	0.00017438	0.00272280	15.61462328	3396.19701	60000.00000
1.211597E+08	6.754546E+11	0.00017938	0.00278496	15.52590385	3399.31058	60000.00000
1.212675E+08	6.577220E+11	0.00018438	0.00284773	15.44532493	3397.38578	60000.00000
1.213561E+08	6.408245E+11	0.00018938	0.00291219	15.37789151	3387.29047	60000.00000
1.214434E+08	6.247892E+11	0.00019438	0.00297685	15.31496152	3377.14204	60000.00000
1.215149E+08	6.094791E+11	0.00019938	0.00304086	15.25196448	3370.29117	60000.00000
1.215615E+08	5.947963E+11	0.00020438	0.00310367	15.18615380	3379.34855	60000.00000
1.216070E+08	5.808096E+11	0.00020938	0.00316667	15.12438253	3386.80610	60000.00000
1.216432E+08	5.674320E+11	0.00021438	0.00323070	15.07030651	3392.77406	60000.00000
1.216730E+08	5.546348E+11	0.00021938	0.00329547	15.02209112	3397.03937	60000.00000
1.218982E+08	5.432790E+11	0.00022438	0.00336563	15.00000045	3399.65732	60000.00000
1.222746E+08	5.330773E+11	0.00022938	0.00344063	15.00000045	3394.06154	60000.00000
1.226234E+08	5.231930E+11	0.00023438	0.00351563	15.00000045	3383.16202	60000.00000
1.229589E+08	5.136665E+11	0.00023938	0.00359063	15.00000045	3372.26250	60000.00000
1.232813E+08	5.044758E+11	0.00024438	0.00366563	15.00000045	3361.36299	60000.00000
1.235904E+08	4.956008E+11	0.00024938	0.00374063	15.00000045	3366.14527	60000.00000
1.238548E+08	4.868984E+11	0.00025438	0.00381563	15.00000045	3377.28498	60000.00000

Unfactored (Nominal) Moment Capacity at Concrete Strain of 0.003 = 121469.26200 in-kip

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Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Moment (Pile-head Condition Type 1)
Specified shear force at pile head = 46000.000 lbs
Specified moment at pile head = 53388000.000 in-lbs
Specified axial load at pile head = 50000.000 lbs

Output Verification:

Computed forces and moments are within specified convergence limits.

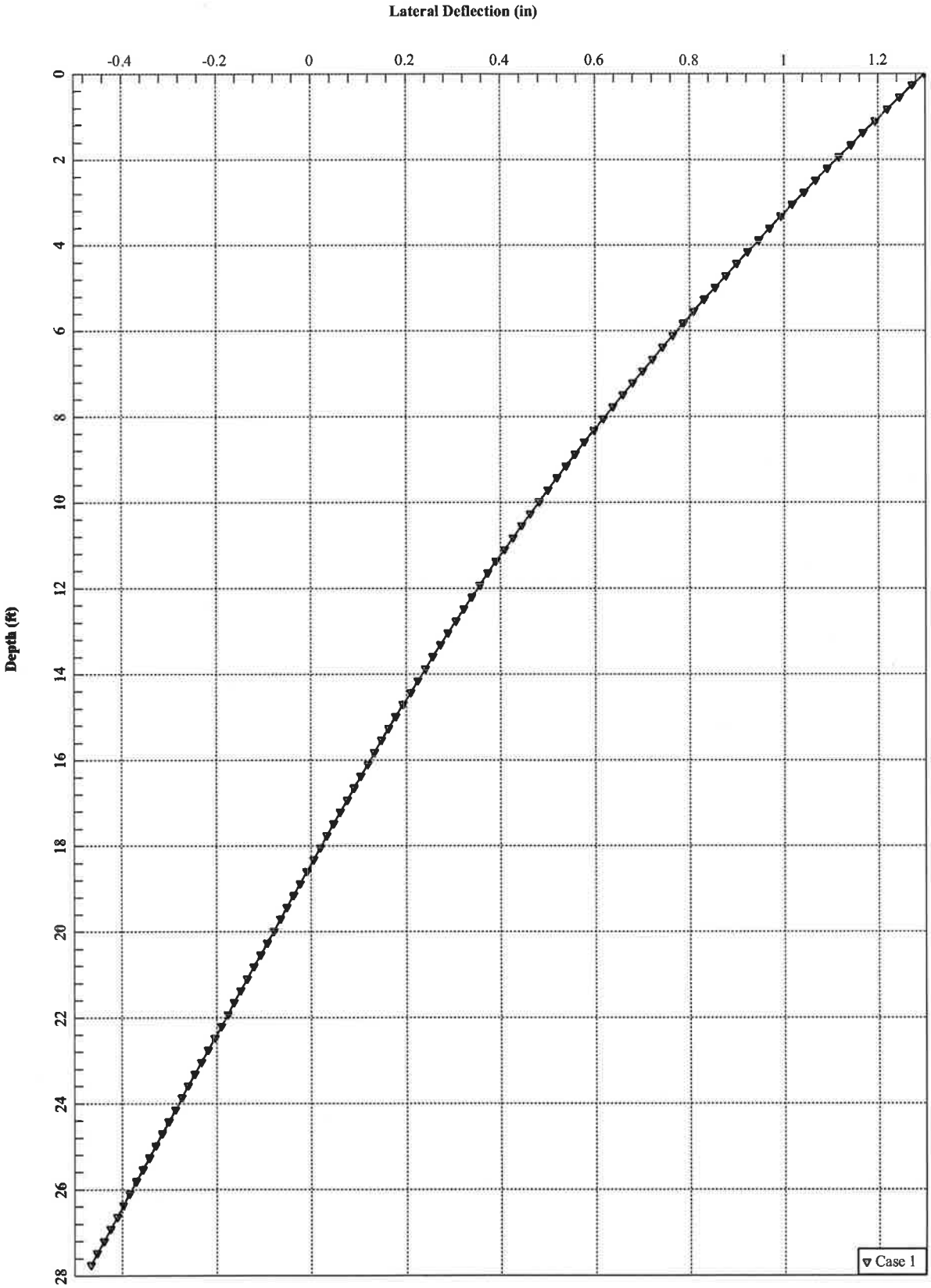
Summary of Pile Response(s)

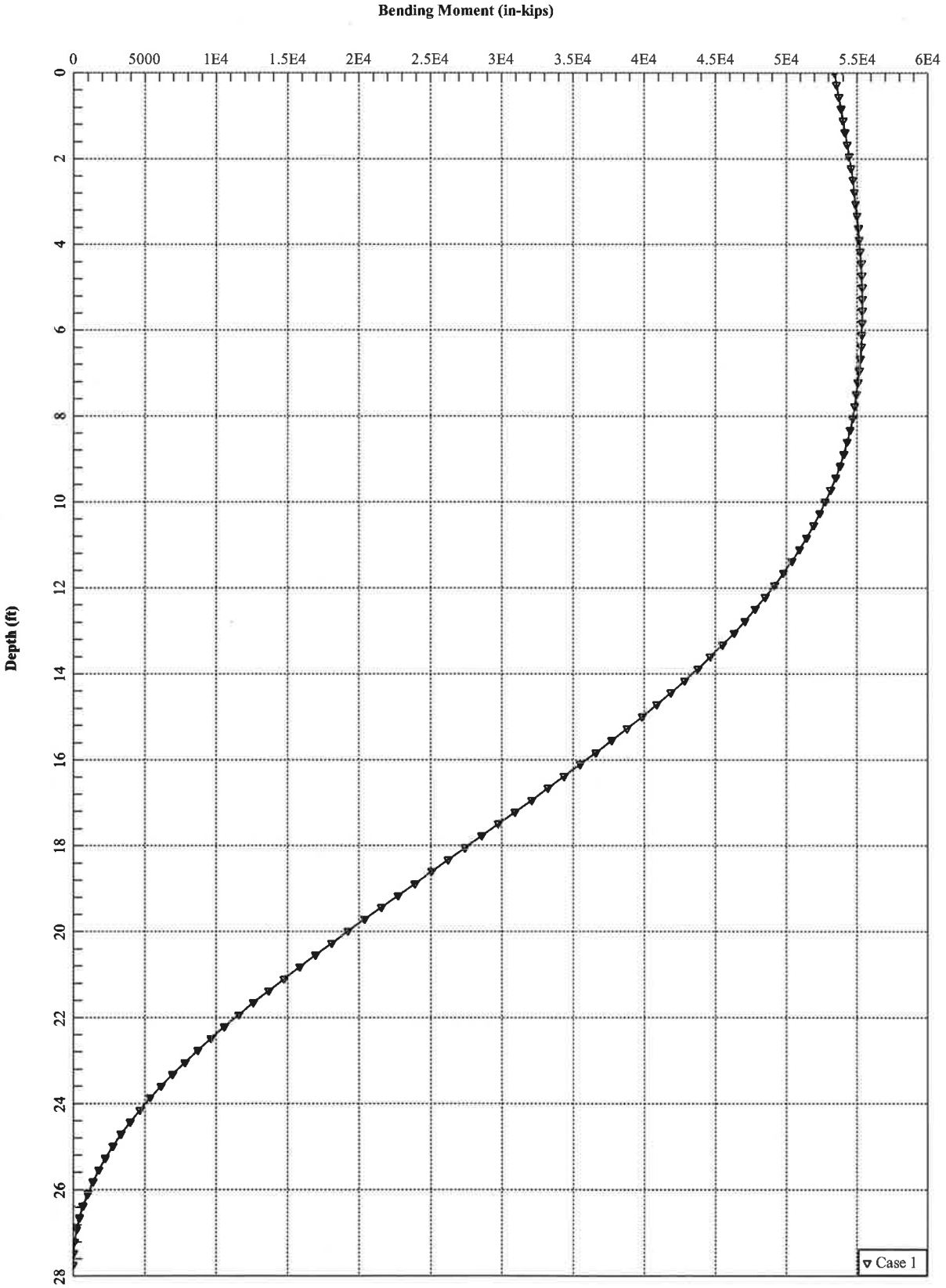
Definition of Symbols for Pile-Head Loading Conditions:

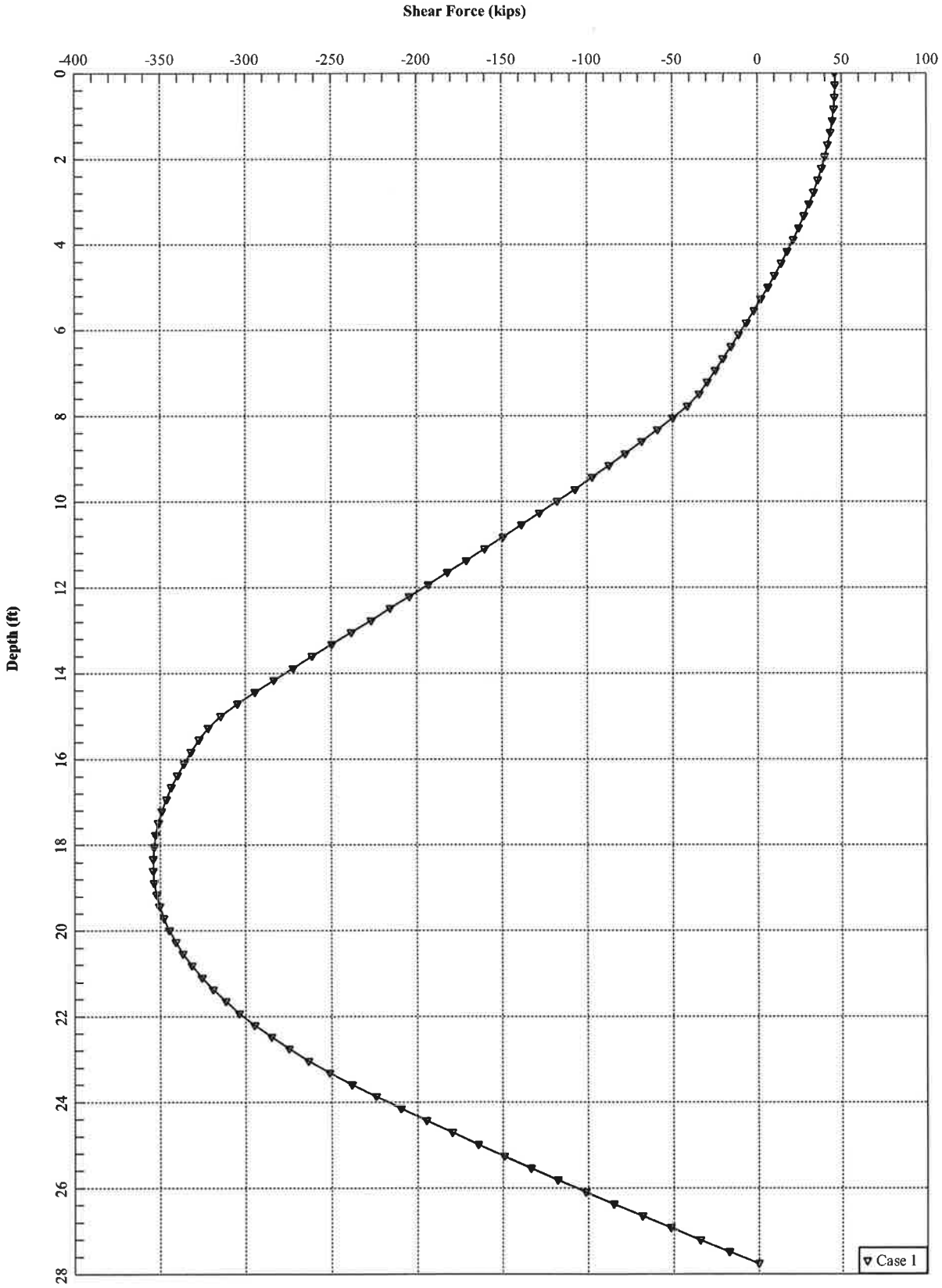
Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1	V= 46000.	M= 5.34E+07	50000.0000	1.2992	5.5375E+07	-353919.

The analysis ended normally.


Lateral Deflection (in)
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Case 1


Bending Moment (in-kips)
0
5000
1E4
1.5E4
2E4
2.5E4
3E4
3.5E4
4E4
4.5E4
5E4
5.5E4
6E4
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Case 1


Shear Force (kips)
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Case 1

Site Name	KILLINGLY CENTER CT	Site #	2 - 0234
Latitude	41-50-50.63 N	Longitude	71-52-44.37 W
Notes: All antennas RET variable tilt		GEL (Feet)	300

Remote BBU?	NO	Remote Site Name: Facilities populated			Site #	Facilities populated	
700 MHz LTE Site Info		**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE		ALU 700MHz RRH		ALU 700MHz RRH		ALU 700MHz RRH	
ANTENNA TYPE		X7C-FRO-660-VR0		X7C-FRO-660-VR0		X7C-FRO-660-VR0	
QUANTITY PER FACE		1		1		1	
ORIENTATION		0		180		270	
DOWN TILT (DEG.)		6 electrical		4 electrical		0 electrical	
RAD CTR (FT AGL)		108		108		108	
TOWER MOUNTED AMPS (QTY)		N/A		N/A		N/A	
DIPLEXER - QTY/MODEL							
RRH - QTY/MODEL		1	ALU RRH_2X40-700U	1	ALU RRH_2X40-700U	1	ALU RRH_2X40-700U
SECTOR DISTRIBUTION BOX							
MAIN DISTRIBUTION BOX							
850 MHz Cellular Site Info		**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE		N/A		N/A		N/A	
ANTENNA TYPE		X7C-FRO-660-VR0		X7C-FRO-660-VR0		X7C-FRO-660-VR0	
QUANTITY PER FACE		1		1		1	
ORIENTATION		0		180		270	
DOWN TILT (DEG.)		6 electrical		4 electrical		0 electrical	
RAD CTR (FT AGL)		108		108		108	
TOWER MOUNTED AMPS (QTY)		N/A		N/A		N/A	
DIPLEXER - QTY/MODEL							
1900 MHz PCS Site Info		**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE		N/A		N/A		N/A	
ANTENNA TYPE		HBXX-6517DS-A2M		HBXX-6517DS-A2M		HBXX-6517DS-A2M	
QUANTITY PER FACE		1		1		1	
ORIENTATION		0		180		270	
DOWN TILT (DEG.)		1 electrical		1 electrical		1 electrical	
RAD CTR (FT AGL)		108		108		108	
TOWER MOUNTED AMPS (QTY)		N/A		N/A		N/A	
DIPLEXER - QTY/MODEL							
RRH - QTY/MODEL		1	ALU RRH_2X60-PCS	1	ALU RRH_2X60-PCS	1	ALU RRH_2X60-PCS
SECTOR DISTRIBUTION BOX							
2100 MHz LTE Site Info		**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE		2100 MHz RRH		2100 MHz RRH		2100 MHz RRH	
ANTENNA TYPE		HBXX-6517DS-A2M		HBXX-6517DS-A2M		HBXX-6517DS-A2M	
QUANTITY PER FACE		1		1		1	
ORIENTATION		0		180		270	
DOWN TILT (DEG.)		1 electrical		1 electrical		1 electrical	
RAD CTR (FT AGL)		108		108		108	
TOWER MOUNTED AMPS (QTY)		N/A		N/A		N/A	
DIPLEXER - QTY/MODEL							
RRH - QTY/MODEL		1	ALU RRH_2X40-AWS	1	ALU RRH_2X40-AWS	1	ALU RRH_2X40-AWS
SECTOR DISTRIBUTION BOX							
MAIN DISTRIBUTION BOX		2				DB-T1-6Z-8AB-0Z	

Coax Cable Ordering					
MAINLINE SIZE	1 5/8"	TOTAL # OF COAX MAIN LINES	0	COAX LINE MODEL #	equipment populated
JUMPER SIZE	1/2 "	TOTAL # OF COAX TOP JUMPERS	12	TOP JUMPER MODEL #	equipment populated
Fiber Cable Ordering					
FIBER LINE SIZE	1 5/8"	TOTAL # OF HYBRID FIBER LINES	2	FIBER LINE MODEL #	equipment populated
JUMPER SIZE	5/8"	TOTAL # OF HYBRID TOP JUMPERS	6	TOP JUMPER MODEL #	equipment populated

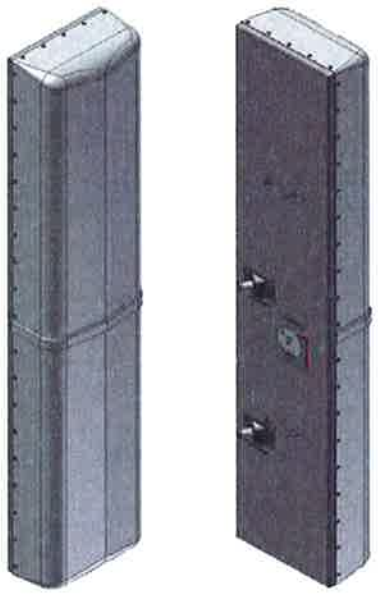
TX / RX FREQUENCIES				**TX POWER OUTPUT**	
Cellular A-Band		**PCS F / AWS-Band**	**700 Mhz C - Block**	Cellular (Watts)	20
TX - 869-880,890-891.5 MHz		TX - 1970-1975 / 2145-2155	TX - 746-757	PCS (Watts)	16
RX - 824-835,845-846.5 MHz		RX - 1890-1895 / 1745-1755	RX - 776-787	700 MHz / 2100 MHz (Watts)	40

ALPHA				**BETA**				**GAMMA**			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color	Ant.	Freq.	Func.	Color Code
A1-A	800	Tx1/Rx0	RED	A5-A	800	Tx2/Rx0	BLUE	A9-A	800	Tx3/Rx0	GREEN
A1-B	1900	Tx1/Rx0	RED/ WHITE	A5-B	1900	Tx2/Rx0	BLUE/ WHITE	A9-B	1900	Tx3/Rx0	GREEN/WHITE
A2	700	Tx1/Rx0	RED/ ORANGE	A6	700	Tx2/Rx0	BLUE/ ORANGE	A10	700	Tx3/Rx0	GREEN/ORANGE
A3	700	Tx4/Rx1	RED/RED/ ORANGE	A7	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A11	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A4-B	1900	Tx4/Rx1	RED/RED/ WHITE	A8-B	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A12-B	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A4-A	800	Tx4/Rx1	RED/RED	A8-A	800	Tx5/Rx1	BLUE/BLUE	A12-A	800	Tx6/Rx1	GREEN/GREEN
F1-A	1700	Tx/Rx	RED/ BROWN	F1-B	1700	Tx/Rx	BLUE/BROWN	F1-C	1700	Tx/Rx	GREEN/BROWN
F1-D	1700	Tx/Rx	RED/RED/ BROWN	F1-E	1700	Tx/Rx	BLUE/BLUE/BROWN	F1-F	1700	Tx/Rx	GREEN/GREEN/BROWN

RF ENGINEER	**RF MANAGER**	**RF INITIALS**	**DATE**
Prepared By: Mark Brauer	Robert Hesselbach	MB	5/29/2014

X7C-FRO-660-V

X-Pol Antenna, 698-896MHz, Fast-Roll-Off 60° H-Beam
RET/MET



- Designed to improve SNR
- Greatly increases LTE data rates
- Broadband radiator
- Macro Cell, high gain antenna
- Suitable for LTE/CDMA/UMTS/GSM
- AISG 2.0 RET or manual MET tilt control

Electrical Specifications

Frequency Band, MHz	**698-824**	**824-896**
Horizontal Beamwidth, 3dB points	62	58
Gain, dBi	15.9	16.0
Vertical Beamwidth, 3dB points	12.0	10.5
Front-to-Back at 180°, dB	>28	
Upper Sidelobe Suppression, Typical, dB	<-18	
Polarization	+/-45°	
Electrical Downtilt	0-10° or 4-14°	
VSWR/Return Loss, dB, Maximum	1.5:1/14.0	
Isolation Between Ports, dB, Mimimum	-28	
Intermodulation (2x20w), IM3, dBc, Maximum	-150	
Impedance, ohms	50	
Maximum Power Per Connector, CW	500	

X7C-FRO-660-V

X-Pol Antenna, 698-896MHz, Fast-Roll-Off 60° H-Beam
RET/MET

Mechanical Specifications

Dimensions, Length/Width/Depth	72.0/14.6/8.0 in (1829/372/204 mm)
Connector (Quantity) Type	(2) 7-16 DIN Female
Connector Torque	220-265 lbf-in (25-30 N-m)
Connector Location	Back
Antenna Weight	35.0 lbs
Bracket Weight	13.2 lbs (6.0 kg)
Standard Bracket Kit	CSS P/N 919011
Mechanical Downtilt Range	0-12°
Radome Material	Ultra High Strength Luran, UV Stabilized, ASTM D1925
Wind Survival	150 mph (241 km/h)
Front Wind Load	205.39 lbf (913.65 N) @100mph
Equivalent Flat Plate	4.09 sq-ft (c=2) @ 100mph

RET Information

Model	CSS-RET-200
Mounting Location	Rear of Antenna
Weight	1.2 lb (0.54 kg)
Communication Standard	AISG 2.0
Control System	CSS-PCU-220

Order Information

Model	*Description*
X7C-FRO-660-VR0	Antenna with manual RET adjust electrical downtilt 0-10°
X7C-FRO-660-VR4	Antenna with manual RET adjust electrical downtilt 4-14°
X7C-FRO-660-VM0	Antenna with remote MET adjust electrical downtilt 0-10°
X7C-FRO-660-VM4	Antenna with remote MET adjust electrical downtilt 4-14°

Optional Bracket Kit

919036	Bracket Kit, 2-Point, 12 deg D-tilt, For 4.5" OD Pole

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

Product Specifications

HBXX-6517DS-VTM

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 RRH2x40-AWS

REMOTE RADIO HEAD

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

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

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

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

Fast, low-cost installation and deployment

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

Excellent RF performance

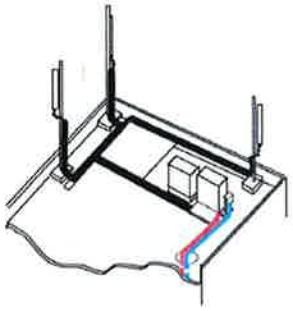
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation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

Features

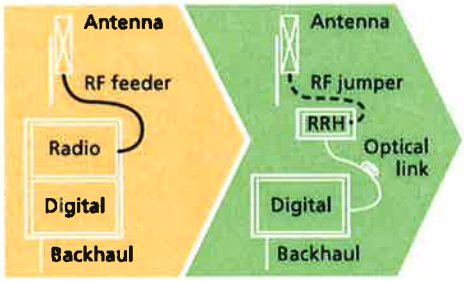
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

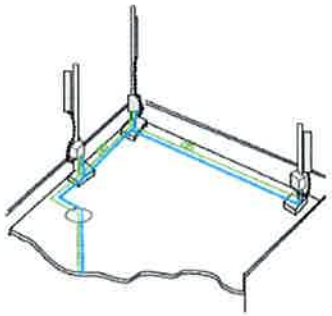
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

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

Power

- Power supply: -48VDC

Operating environment

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

RF characteristics

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

Optical characteristics

Type/number of fibers

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

Optical fiber length

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

Digital Ports and Alarms

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

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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

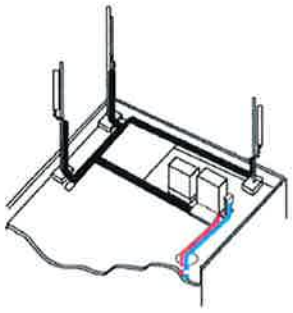
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and 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

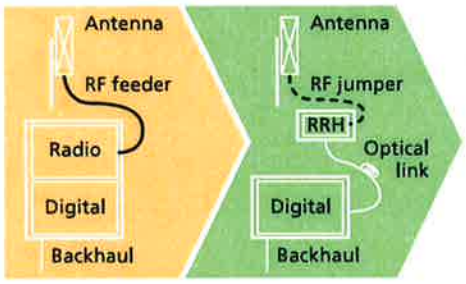
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly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

Benefits

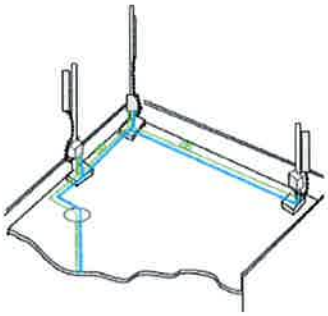
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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

Alcatel·Lucent

Product Data Sheet DB-B1 and DB-T1 Series

DC and Fiber Management Distribution Boxes for HYBRIFLEX™ Cable

Product Description

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

Features/Benefits

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

Technical Specifications

Mechanical Specifications

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

Electrical Specifications

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

* This data is provisional and subject to change.

Product Data Sheet HB158-1-08U8-S8J18

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

Product Description

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

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

Figure 1: HYBRIFLEX Series

Features/Benefits

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

Technical Specifications

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

* This data is provisional and subject to change.

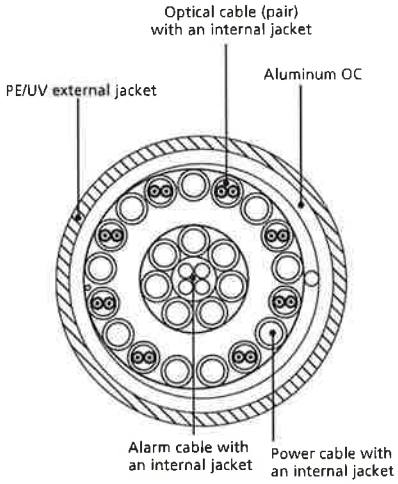


Figure 2: Construction Detail