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Also admitted in Massachusetts

June 19, 2014

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

Re: **Notice of Exempt Modification – Facility Modification**
811 Blue Hills Avenue, Bloomfield, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the top of the existing 110-foot tower at 811 Blue Hills Avenue in Bloomfield, Connecticut (the "Property"). The tower is owned by Cellco and was approved by the Council in 2007 (Docket No. 336). Cellco now intends to modify its facility by removing three (3) 700 MHz antennas and replacing them with two (2) model LNX-6514DS-VTM, 700 MHz antennas and one (1) model X7C-FRO-660, 700 MHz antenna. Cellco also intends to install three (3) remote radio heads ("RRHs") behind its 700 MHz antennas. Included in Attachment 1 are specifications for Cellco's replacement antennas and RRHs.

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 notice is being sent to Philip K. Schenck, Jr., Town Manager for the Town of Bloomfield. A copy of this letter is also being sent to Samo Realty LLC, the owner of the Property.

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

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's new and replacement antennas and RRHs will be

installed at a centerline height of 107 feet above ground level on the existing 110-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 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 Report 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:
Philip K. Schenck, Jr., Bloomfield Town Manager
Samo Realty LLC
Sandy M. Carter

ATTACHMENT 1

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6514DS-VTM

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

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

Electrical Specifications

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

General Specifications

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

Mechanical Specifications

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

Product Specifications

LNX-6514DS-VTM

Dimensions

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

Remote Electrical Tilt (RET) Information

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

Regulatory Compliance/Certifications

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

Included Products

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

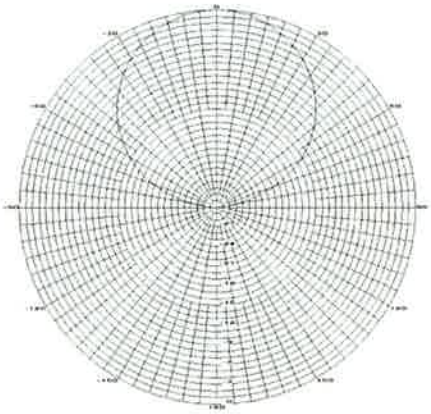
DB5083 — Downtilt Mounting Kit for 2.4"-4.5" (60 - 115 mm) OD round members. Includes a heavy-duty, galvanized steel downtilt mounting bracket assembly and associated hardware. This kit is compatible with the DB380 pipe mount kit for panel antennas that are equipped with two mounting brackets.

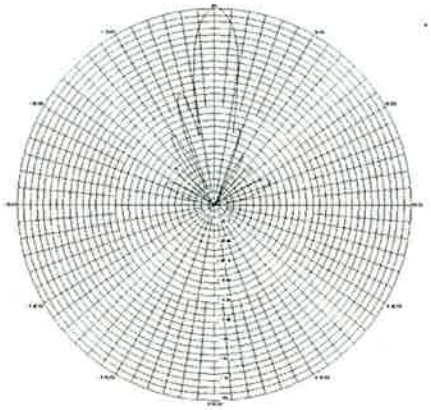
X7C-FRO-660
Xpol, 58° H-Beam

698-896 MHz

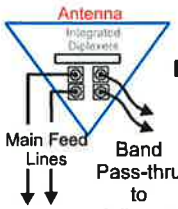
Link to Mechanical Drawing

Electrical Specifications		Mechanical Specifications	
Frequency	698-896 MHz	Input Connector (female)	Back 7/16 DIN or w/bot. opt.
Polarization	Slant +/- 45	Antenna Dimensions (LxWxD)	72.0 x 14.6 x 8.0 in. (1829 x 372 x 203mm)
Gain @ 698 MHz	16.1 dBi	*Antenna Weight	32.2 lbs
Gain @ 782 MHz	16.6 dBi	Bracket Weight	13.2 lbs
Gain @ 896 MHz	17.2 dBi	RF Distribution	Printed Microstrip Substrate
Horizontal Beam (3dB Points)	58°	Radome	Ultra High-Strength Luran
Vertical Beam (3dB Points)	11°	Weatherability	UV Stabilized, ASTM D1925
Elect. Downtilt Range, 2° Increments	0-10°	Radome Water Absorption	ASTM D570, 0.45%
VSWR / Return Loss	≤1.35:1 / 16.5 dB	Environmental	MIL-STD-810E
VSWR w/ip	<1.50:1 / 14.0 dB	Wind Survival	150 mph
Front-to-Back at Horizon	>30 dB	Front Wind Load @100mph	208 lbf
Upper Side Lobe Suppression	<-18 dB	Equivalent Flat Plate @100mph	4.23 sq-ft. (c=2)
Impedance	50 Ohms	Mounting Brackets	Fits 3.5 Inch Max. O.D. Pipe
Power Input Per Connector	500 CW at 800 MHz	Mechanical Downtilt Range	0-12°
Isolation	< -27 dB	Clamps/Bolts	Galvanized Steel/Stainless Steel
Intermodulation (2x20W)	<-150 dBc		





Available with Integrated Pass-Thru Diplexers to reduce mainline cables and eliminate separate external devices



Integrated Pass-Thru Diplexers will work with TMA's

Recommended Connector Coupling Torque
7/16 DIN: 220-265 lbf-in (25-30 N-m)

Return Loss at pass-thru port into 50Ω load ≥17.7 dB

Ordering Information & Options

X7C-FRO-660-x	"-x" is a placeholder for the built-in fixed electrical downtilt in degrees, set to 0, 2, 4, 6, 8 or 10
X7C-FRO-660-xip	"ip" option includes pass-thru integrated diplexer(s) which pass DC to the diplexer port(s)
X7C-FRO-660-xip-bot	for bottom mounted connectors, add "-bot" (otherwise antenna comes standard with back mounted connectors)

*Antenna Weight may vary slightly with options.

Published 120412
Subject to alteration.

Made in USA

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

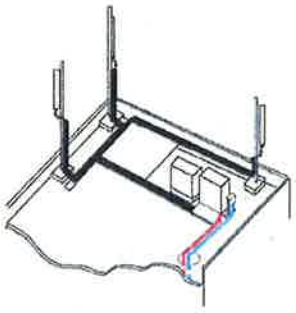
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and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

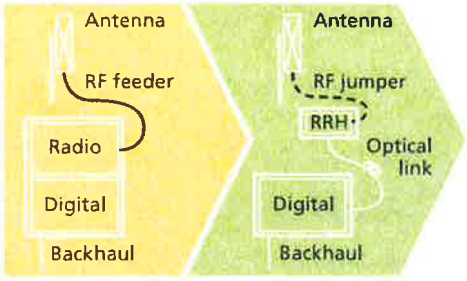
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly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

Benefits

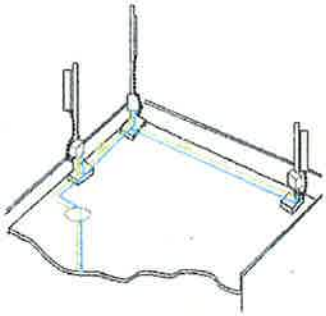
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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

ATTACHMENT 2

General Power Density

Site Name: Bloomfield Blue Hills, CT
Cumulative Power Density

Operator	Operating Frequency	Number of Trans.	ERP Per Trans.	Total ERP	Distance to Target	Calculated Power Density	Maximum Permissable Exposure*	Fraction of MPE
	(MHz)		(watts)	(watts)	(feet)	(mW/cm^2)	(mW/cm^2)	(%)
VZW PCS	1970	11	441	4854.815	107	0.1525	1.0	15.25%
VZW Cellular	869	9	405	3646.712	107	0.1145	0.579333333	19.77%
VZW AWS	2145	1	1750	1750	107	0.0550	1.0	5.50%
VZW 700	746	1	1050	1050	107	0.0330	0.497333333	6.63%

Total Percentage of Maximum Permissible Exposure 47.15%

*Guidelines adopted by the FCC on August 1, 1996, 47 CFR Part 1 based on NCRP Report 86, 1986 and generally on ANSI/IEEE C95.1-1992

MHz = Megahertz
mW/cm^2 = milliwatts per square centimeter
ERP = Effective Radiated Power

Absolute worst case maximum values used.

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

110-ft Existing EEI Monopole

Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Bloomfield Blue Hills

811 Blue Hills Ave
Bloomfield, CT

CENTEK Project No. 14067.015

Date: June 3, 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

Table of Contents

Introduction

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

The host tower is a 110-ft tall extendable to 118-ft, three-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated; project no. 15165 dated December 5, 2007. The tower geometry, structure member sizes and foundation system information were obtained from the original manufacturers design documents.

The tower consists of three (3) tapered vertical steel sections conforming to ASTM A572-65. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 17.00-in at the top and 51.00-in at the base.

Antenna and appurtenance information were obtained from a previous structural report prepared by Centek job no; 12124.CO56 dated December 17, 2012 and a Verizon RF data sheet.

Verizon proposes the replacement of three (3) panel antennas and the installation of three (3) RRH's mounted to the existing T-arms. 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 tower was designed to support several communication antennas. The existing, proposed and future loads considered in this analysis consist of the following:

- VERIZON (Existing to Remain):
  Antennas: Six (6) Antel BXA-171063-12BF panel antennas, six (6) Antel LPA-80063/6CF panel antennas, three (3) Alcatel-Lucent RRH2x40-AWS remote radio heads and one (1) RFS DB-T1-6Z-8AB-0Z main distribution box mounted on three (3) existing T-Arms with a RAD center elevation of 107-ft above grade level.
  Coax Cables: Fourteen (14) 1-5/8" ∅ coax cables and one (1) 1-1/4" ∅ fiber cable running on the inside of the existing tower.
- VERIZON (Existing to Remove):
  Antennas: Three (3) Antel BXA-70063-6CF panel antennas mounted on three (3) existing T-Arms with a RAD center elevation of 107-ft above grade level.
- **VERIZON (Proposed):**
  Antennas: Two (2) Andrew LNX-6514DS panel antennas, one (1) CSS X7C-FRO-660 panel antenna and three (3) Alcatel-Lucent RRH2x40-07U remote radio heads mounted on three (3) existing T-Arms with a RAD center elevation of 107-ft above grade level.

Primary Assumptions Used in the Analysis

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

Analysis

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

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

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

Tower Loading

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

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

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

Tower Capacity

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

- Calculated stresses were found to be within allowable limits. In Load Case 1, per tnxTower "Section Capacity Table", this tower was found to be at **40.0%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L1)	73.96'-110.00'	40.0%	**PASS**
Pole Shaft (L2)	48.71'-73.96'	30.3%	**PASS**
Pole Shaft (L3)	1.00'-48.71'	35.1%	**PASS**

Foundation and Anchors

The existing foundation consists of a 7.0-ft ∅ x 27.0-ft long reinforced concrete caisson. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; project no. 15165 dated December 5, 2007. The base of the tower is connected to the foundation by means of (16) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 7-ft into the concrete foundation structure.

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

Location	Vector	Proposed Reactions
Base	Shear	12 kips
	Compression	16 kips
	Moment	907 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	Proposed Loading	Result
Reinforced Concrete Caisson	Moment Capacity	24.5%	**PASS**
	Lateral Deflection	0.58in.	**PASS**

Note 1: Lateral deflection typically limited to 1.0 in. for monopole tower structures.

- 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	24.2%	**PASS**
Base Plate	Bending	20.4%	**PASS**

Conclusion

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Carlo F. Centore, PE
Principal ~ Structural Engineer

Prepared by:

Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information 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.

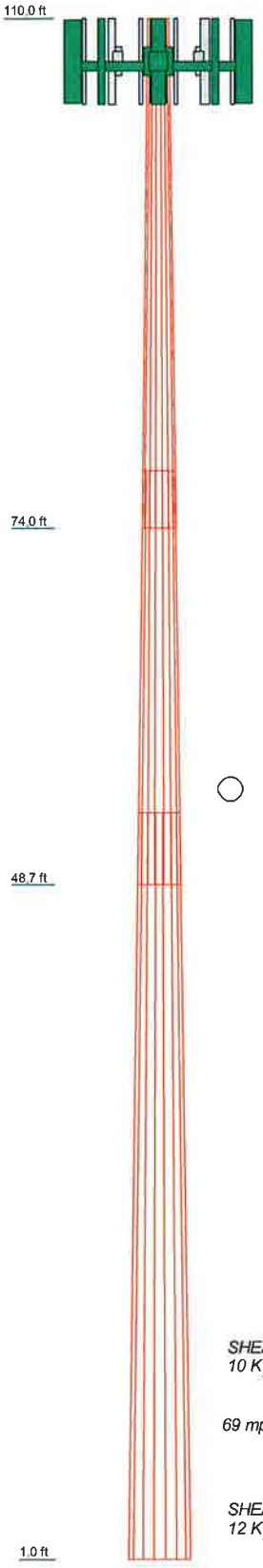
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

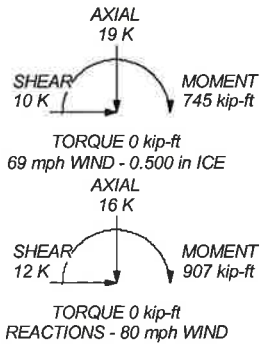
tnxTower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, tnxTower, formerly ERITower and RISATower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

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	36.040	18	0.188	4.083	17.000	28.660	A572-65	1.7
2	29.330	18	0.313	5.083	26.964	36.320		3.1
3	52.796	18	0.313		34.074	51.000		7.5
								12.3





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
LPA-80063/6CF (Verizon - Existing)	107	RRH2x40-AWS (Verizon - Existing)	107
BXA-171063-12BF (Verizon - Existing)	107	RRH2x40-AWS (Verizon - Existing)	107
BXA-171063-12BF (Verizon - Existing)	107	DB-T1-6Z-8AB-0Z (Verizon - Existing)	107
LPA-80063/6CF (Verizon - Existing)	107	Valmont Uni-Tri Bracket (Verizon - Existing)	107
LPA-80063/6CF (Verizon - Existing)	107	LNX-6514DS-VTM (Verizon - Proposed)	107
BXA-171063-12BF (Verizon - Existing)	107	X7C-FRO-660 (Verizon - Proposed)	107
BXA-171063-12BF (Verizon - Existing)	107	LNX-6514DS-VTM (Verizon - Proposed)	107
LPA-80063/6CF (Verizon - Existing)	107	RRH2x40-07-U (Verizon - Proposed)	107
LPA-80063/6CF (Verizon - Existing)	107	RRH2x40-07-U (Verizon - Proposed)	107
BXA-171063-12BF (Verizon - Existing)	107	RRH2x40-07-U (Verizon - Proposed)	107
BXA-171063-12BF (Verizon - Existing)	107		
LPA-80063/6CF (Verizon - Existing)	107		
Valmont T-Arm (3) (Verizon - Existing)	107		
RRH2x40-AWS (Verizon - Existing)	107		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. 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: 40%

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

Job:	***14067.015 - Bloomfield Blue Hills***		
Project:	***110 EEI Monopole - 811 Blue Hills Ave Bloomfield, CT***		
Client: Verizon Wireless		Drawn by: TJL	App'd:
Code: TIA/EIA-222-F		Date: 06/03/14	Scale: NTS
Path:			Dwg No. E-1

tnxTower	Job	Page
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	14067.015 - Bloomfield Blue Hills	1 of 17
	Project 110 EEI Monopole - 811 Blue Hills Ave Bloomfield, CT	Date 08:47:14 06/03/14
	Client Verizon Wireless	Designed by TJL

Tower Input Data

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

Basic wind speed of 80 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
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	110.000-73.960	36.040	4.083	18	17.000	28.660	0.188	0.750	A572-65 (65 ksi)
L2	73.960-48.713	29.330	5.083	18	26.964	36.320	0.313	1.250	A572-65 (65 ksi)
L3	48.713-1.000	52.796		18	34.074	51.000	0.313	1.250	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	17.262	10.006	357.308	5.968	8.636	41.374	715.086	5.004	2.662	14.197
	29.102	16.945	1735.491	10.108	14.559	119.202	3473.266	8.474	4.714	25.142
L2	28.703	26.435	2372.252	9.461	13.698	173.186	4747.625	13.220	4.196	13.426
	36.880	35.715	5850.235	12.783	18.451	317.076	11708.168	17.861	5.842	18.695
L3	36.254	33.487	4822.178	11.985	17.309	278.588	9650.700	16.747	5.447	17.43
	51.787	50.276	16319.130	17.994	25.908	629.888	32659.734	25.143	8.426	26.963

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 110.000-73.960				1	1	1		
L2 73.960-48.713				1	1	1		
L3 48.713-1.000				1	1	1		

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
1 5/8 (Verizon - Existing)	C	No	Inside Pole	107.000 - 4.000	14	No Ice 1/2" Ice	0.000 0.000	0.001 0.001
HYBRIFLEX 1-1/4" (Verizon - Existing)	C	No	Inside Pole	107.000 - 4.000	1	No Ice 1/2" Ice	0.000 0.000	0.001 0.001

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	110.000-73.960	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	0.524
L2	73.960-48.713	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	0.400
L3	48.713-1.000	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	0.709

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	110.000-73.960	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	0.524
L2	73.960-48.713	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	0.400
L3	48.713-1.000	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	0.709

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
LPA-80063/6CF	A	From Face	3.000	0.000	107.000	No Ice	10.308	9.005	0.027
(Verizon - Existing)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
BXA-171063-12BF	A	From Face	3.000	0.000	107.000	No Ice	4.734	3.572	0.015
(Verizon - Existing)			-4.000			1/2" Ice	5.180	4.007	0.042
			0.000						
BXA-171063-12BF	A	From Face	3.000	0.000	107.000	No Ice	4.734	3.572	0.015
(Verizon - Existing)			4.000			1/2" Ice	5.180	4.007	0.042
			0.000						
LPA-80063/6CF	A	From Face	3.000	0.000	107.000	No Ice	10.308	9.005	0.027
(Verizon - Existing)			6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-80063/6CF	B	From Face	3.000	0.000	107.000	No Ice	10.308	9.005	0.027
(Verizon - Existing)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
BXA-171063-12BF	B	From Face	3.000	0.000	107.000	No Ice	4.734	3.572	0.015
(Verizon - Existing)			-4.000			1/2" Ice	5.180	4.007	0.042
			0.000						
BXA-171063-12BF	B	From Face	3.000	0.000	107.000	No Ice	4.734	3.572	0.015
(Verizon - Existing)			4.000			1/2" Ice	5.180	4.007	0.042
			0.000						
LPA-80063/6CF	B	From Face	3.000	0.000	107.000	No Ice	10.308	9.005	0.027
(Verizon - Existing)			6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-80063/6CF	C	From Face	3.000	0.000	107.000	No Ice	10.308	9.005	0.027
(Verizon - Existing)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
BXA-171063-12BF	C	From Face	3.000	0.000	107.000	No Ice	4.734	3.572	0.015
(Verizon - Existing)			-4.000			1/2" Ice	5.180	4.007	0.042
			0.000						
BXA-171063-12BF	C	From Face	3.000	0.000	107.000	No Ice	4.734	3.572	0.015
(Verizon - Existing)			4.000			1/2" Ice	5.180	4.007	0.042
			0.000						
LPA-80063/6CF	C	From Face	3.000	0.000	107.000	No Ice	10.308	9.005	0.027
(Verizon - Existing)			6.000			1/2" Ice	10.868	9.554	0.101

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
			0.000						
Valmont T-Arm (3)	C	None		0.000	107.000	No Ice	21.000	21.000	1.008
(Verizon - Existing)						1/2" Ice	29.000	29.000	1.236
RRH2x40-AWS	A	From Face	2.500	0.000	107.000	No Ice	2.522	1.589	0.044
(Verizon - Existing)			0.000			1/2" Ice	2.753	1.795	0.061
			0.000						
RRH2x40-AWS	B	From Face	2.500	0.000	107.000	No Ice	2.522	1.589	0.044
(Verizon - Existing)			0.000			1/2" Ice	2.753	1.795	0.061
			0.000						
RRH2x40-AWS	C	From Face	2.500	0.000	107.000	No Ice	2.522	1.589	0.044
(Verizon - Existing)			0.000			1/2" Ice	2.753	1.795	0.061
			0.000						
DB-T1-6Z-8AB-0Z	C	From Face	0.500	0.000	107.000	No Ice	5.600	2.333	0.044
(Verizon - Existing)			0.000			1/2" Ice	5.915	2.558	0.080
			0.000						
Valmont Uni-Tri Bracket	A	None		0.000	107.000	No Ice	1.750	1.750	0.290
(Verizon - Existing)						1/2" Ice	1.940	1.940	0.306
LNX-6514DS-VTM	A	From Face	3.000	0.000	107.000	No Ice	8.411	5.405	0.039
(Verizon - Proposed)			0.000			1/2" Ice	8.964	5.863	0.090
			0.000						
X7C-FRO-660	B	From Face	3.000	0.000	107.000	No Ice	10.220	5.867	0.040
(Verizon - Proposed)			0.000			1/2" Ice	10.786	6.325	0.100
			0.000						
LNX-6514DS-VTM	C	From Face	3.000	0.000	107.000	No Ice	8.411	5.405	0.039
(Verizon - Proposed)			0.000			1/2" Ice	8.964	5.863	0.090
			0.000						
RRH2x40-07-U	A	From Face	2.500	0.000	107.000	No Ice	2.246	1.228	0.050
(Verizon - Proposed)			0.000			1/2" Ice	2.447	1.385	0.067
			0.000						
RRH2x40-07-U	B	From Face	2.500	0.000	107.000	No Ice	2.246	1.228	0.050
(Verizon - Proposed)			0.000			1/2" Ice	2.447	1.385	0.067
			0.000						
RRH2x40-07-U	C	From Face	2.500	0.000	107.000	No Ice	2.246	1.228	0.050
(Verizon - Proposed)			0.000			1/2" Ice	2.447	1.385	0.067
			0.000						

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	90.694	1.335	0.022	68.566	A	0.000	68.566	68.566	100.00	0.000	0.000
110.000-73.96					B	0.000	68.566		100.00	0.000	0.000
0					C	0.000	68.566		100.00	0.000	0.000
L2	60.812	1.191	0.020	67.942	A	0.000	67.942	67.942	100.00	0.000	0.000
73.960-48.713					B	0.000	67.942		100.00	0.000	0.000
					C	0.000	67.942		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
L3	23.619	1	0.017	172.370	A	0.000	172.370	172.370	100.00	0.000	0.000
48.713-1.000					B	0.000	172.370		100.00	0.000	0.000
					C	0.000	172.370		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	90.694	1.335	0.016	0.500	71.569	A	0.000	71.569	71.569	100.00	0.000	0.000
110.000-73.960						B	0.000	71.569		100.00	0.000	0.000
						C	0.000	71.569		100.00	0.000	0.000
L2	60.812	1.191	0.015	0.500	70.046	A	0.000	70.046	70.046	100.00	0.000	0.000
73.960-48.713						B	0.000	70.046		100.00	0.000	0.000
						C	0.000	70.046		100.00	0.000	0.000
L3 48.713-1.000	23.619	1	0.012	0.500	176.346	A	0.000	176.346	176.346	100.00	0.000	0.000
						B	0.000	176.346		100.00	0.000	0.000
						C	0.000	176.346		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	90.694	1.335	0.009	68.566	A	0.000	68.566	68.566	100.00	0.000	0.000
110.000-73.96					B	0.000	68.566		100.00	0.000	0.000
0					C	0.000	68.566		100.00	0.000	0.000
L2	60.812	1.191	0.008	67.942	A	0.000	67.942	67.942	100.00	0.000	0.000
73.960-48.713					B	0.000	67.942		100.00	0.000	0.000
					C	0.000	67.942		100.00	0.000	0.000
L3	23.619	1	0.006	172.370	A	0.000	172.370	172.370	100.00	0.000	0.000
48.713-1.000					B	0.000	172.370		100.00	0.000	0.000
					C	0.000	172.370		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	0.524	1.653	A	1	0.65	1	1	1	68.566	1.644	0.046	C
110.000-73.96			B	1	0.65	1	1	1	68.566			
0			C	1	0.65	1	1	1	68.566			

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
L2	0.400	3.101	A	1	0.65	1	1	1	67.942	1.456	0.058	C
73.960-48.713			B	1	0.65	1	1	1	67.942			
			C	1	0.65	1	1	1	67.942			
L3	0.709	7.524	A	1	0.65	1	1	1	172.370	3.142	0.066	C
48.713-1.000			B	1	0.65	1	1	1	172.370			
			C	1	0.65	1	1	1	172.370			
Sum Weight:	1.634	12.278						OTM	305.670 kip-ft	6.243		

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	0.524	1.653	A	1	0.65	1	1	1	68.566	1.644	0.046	C
110.000-73.96			B	1	0.65	1	1	1	68.566			
0			C	1	0.65	1	1	1	68.566			
L2	0.400	3.101	A	1	0.65	1	1	1	67.942	1.456	0.058	C
73.960-48.713			B	1	0.65	1	1	1	67.942			
			C	1	0.65	1	1	1	67.942			
L3	0.709	7.524	A	1	0.65	1	1	1	172.370	3.142	0.066	C
48.713-1.000			B	1	0.65	1	1	1	172.370			
			C	1	0.65	1	1	1	172.370			
Sum Weight:	1.634	12.278						OTM	305.670 kip-ft	6.243		

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	0.524	1.653	A	1	0.65	1	1	1	68.566	1.644	0.046	C
110.000-73.96			B	1	0.65	1	1	1	68.566			
0			C	1	0.65	1	1	1	68.566			
L2	0.400	3.101	A	1	0.65	1	1	1	67.942	1.456	0.058	C
73.960-48.713			B	1	0.65	1	1	1	67.942			
			C	1	0.65	1	1	1	67.942			
L3	0.709	7.524	A	1	0.65	1	1	1	172.370	3.142	0.066	C
48.713-1.000			B	1	0.65	1	1	1	172.370			
			C	1	0.65	1	1	1	172.370			
Sum Weight:	1.634	12.278						OTM	305.670 kip-ft	6.243		

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	0.524	1.653	A	1	0.65	1	1	1	68.566	1.644	0.046	C
110.000-73.96			B	1	0.65	1	1	1	68.566			
0			C	1	0.65	1	1	1	68.566			
L2	0.400	3.101	A	1	0.65	1	1	1	67.942	1.456	0.058	C
73.960-48.713			B	1	0.65	1	1	1	67.942			
			C	1	0.65	1	1	1	67.942			
L3	0.709	7.524	A	1	0.65	1	1	1	172.370	3.142	0.066	C
48.713-1.000			B	1	0.65	1	1	1	172.370			
			C	1	0.65	1	1	1	172.370			
Sum Weight:	1.634	12.278						OTM	305.670 kip-ft	6.243		

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	0.524	2.171	A	1	0.65	1	1	1	71.569	1.287	0.036	C
110.000-73.96			B	1	0.65	1	1	1	71.569			
0			C	1	0.65	1	1	1	71.569			
L2	0.400	3.612	A	1	0.65	1	1	1	70.046	1.126	0.045	C
73.960-48.713			B	1	0.65	1	1	1	70.046			
			C	1	0.65	1	1	1	70.046			
L3	0.709	8.815	A	1	0.65	1	1	1	176.346	2.411	0.051	C
48.713-1.000			B	1	0.65	1	1	1	176.346			
			C	1	0.65	1	1	1	176.346			
Sum Weight:	1.634	14.599						OTM	237.350 kip-ft	4.824		

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 ft²	F K	w klf	Ctrl. Face
L1	0.524	2.171	A	1	0.65	1	1	1	71.569	1.287	0.036	C
110.000-73.96			B	1	0.65	1	1	1	71.569			
0			C	1	0.65	1	1	1	71.569			
L2	0.400	3.612	A	1	0.65	1	1	1	70.046	1.126	0.045	C
73.960-48.713			B	1	0.65	1	1	1	70.046			
			C	1	0.65	1	1	1	70.046			
L3	0.709	8.815	A	1	0.65	1	1	1	176.346	2.411	0.051	C
48.713-1.000			B	1	0.65	1	1	1	176.346			
			C	1	0.65	1	1	1	176.346			
Sum Weight:	1.634	14.599						OTM	237.350 kip-ft	4.824		

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	0.524	2.171	A	1	0.65	1	1	1	71.569	1.287	0.036	C
110.000-73.96			B	1	0.65	1	1	1	71.569			
0			C	1	0.65	1	1	1	71.569			
L2	0.400	3.612	A	1	0.65	1	1	1	70.046	1.126	0.045	C
73.960-48.713			B	1	0.65	1	1	1	70.046			
			C	1	0.65	1	1	1	70.046			
L3	0.709	8.815	A	1	0.65	1	1	1	176.346	2.411	0.051	C
48.713-1.000			B	1	0.65	1	1	1	176.346			
			C	1	0.65	1	1	1	176.346			
Sum Weight:	1.634	14.599						OTM	237.350 kip-ft	4.824		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	0.524	2.171	A	1	0.65	1	1	1	71.569	1.287	0.036	C
110.000-73.96			B	1	0.65	1	1	1	71.569			
0			C	1	0.65	1	1	1	71.569			
L2	0.400	3.612	A	1	0.65	1	1	1	70.046	1.126	0.045	C
73.960-48.713			B	1	0.65	1	1	1	70.046			
			C	1	0.65	1	1	1	70.046			
L3	0.709	8.815	A	1	0.65	1	1	1	176.346	2.411	0.051	C
48.713-1.000			B	1	0.65	1	1	1	176.346			
			C	1	0.65	1	1	1	176.346			
Sum Weight:	1.634	14.599						OTM	237.350 kip-ft	4.824		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	0.524	1.653	A	1	0.65	1	1	1	68.566	0.642	0.018	C
110.000-73.96			B	1	0.65	1	1	1	68.566			
0			C	1	0.65	1	1	1	68.566			
L2	0.400	3.101	A	1	0.65	1	1	1	67.942	0.569	0.023	C
73.960-48.713			B	1	0.65	1	1	1	67.942			
			C	1	0.65	1	1	1	67.942			
L3	0.709	7.524	A	1	0.65	1	1	1	172.370	1.228	0.026	C
48.713-1.000			B	1	0.65	1	1	1	172.370			
			C	1	0.65	1	1	1	172.370			
Sum Weight:	1.634	12.278						OTM	119.402 kip-ft	2.439		

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	0.524	1.653	A	1	0.65	1	1	1	68.566	0.642	0.018	C
110.000-73.96			B	1	0.65	1	1	1	68.566			
0			C	1	0.65	1	1	1	68.566			
L2	0.400	3.101	A	1	0.65	1	1	1	67.942	0.569	0.023	C
73.960-48.713			B	1	0.65	1	1	1	67.942			
			C	1	0.65	1	1	1	67.942			
L3	0.709	7.524	A	1	0.65	1	1	1	172.370	1.228	0.026	C
48.713-1.000			B	1	0.65	1	1	1	172.370			
			C	1	0.65	1	1	1	172.370			
Sum Weight:	1.634	12.278						OTM	119.402 kip-ft	2.439		

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	0.524	1.653	A	1	0.65	1	1	1	68.566	0.642	0.018	C
110.000-73.96			B	1	0.65	1	1	1	68.566			
0			C	1	0.65	1	1	1	68.566			
L2	0.400	3.101	A	1	0.65	1	1	1	67.942	0.569	0.023	C
73.960-48.713			B	1	0.65	1	1	1	67.942			
			C	1	0.65	1	1	1	67.942			
L3	0.709	7.524	A	1	0.65	1	1	1	172.370	1.228	0.026	C
48.713-1.000			B	1	0.65	1	1	1	172.370			
			C	1	0.65	1	1	1	172.370			
Sum Weight:	1.634	12.278						OTM	119.402 kip-ft	2.439		

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	0.524	1.653	A	1	0.65	1	1	1	68.566	0.642	0.018	C
110.000-73.96			B	1	0.65	1	1	1	68.566			
0			C	1	0.65	1	1	1	68.566			
L2	0.400	3.101	A	1	0.65	1	1	1	67.942	0.569	0.023	C
73.960-48.713			B	1	0.65	1	1	1	67.942			
			C	1	0.65	1	1	1	67.942			
L3	0.709	7.524	A	1	0.65	1	1	1	172.370	1.228	0.026	C
48.713-1.000			B	1	0.65	1	1	1	172.370			
			C	1	0.65	1	1	1	172.370			
Sum Weight:	1.634	12.278						OTM	119.402	2.439		

tnxTower	Job	Page
	14067.015 - Bloomfield Blue Hills	10 of 17
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	**Project** 110 EEI Monopole - 811 Blue Hills Ave Bloomfield, CT	**Date** 08:47:14 06/03/14
	Client Verizon Wireless	**Designed by** TJL

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

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	12.278					
Bracing Weight	0.000					
Total Member Self-Weight	12.278			0.053	-0.003	
Total Weight	15.906			0.053	-0.003	
Wind 0 deg - No Ice		0.023	-11.827	-897.524	-2.400	0.058
Wind 30 deg - No Ice		5.883	-10.254	-778.470	-445.543	0.090
Wind 45 deg - No Ice		8.308	-8.379	-636.325	-628.850	0.097
Wind 60 deg - No Ice		10.167	-5.933	-450.811	-769.303	0.098
Wind 90 deg - No Ice		11.727	-0.023	-2.344	-886.930	0.079
Wind 120 deg - No Ice		10.144	5.894	446.766	-766.906	0.040
Wind 135 deg - No Ice		8.276	8.347	633.041	-625.460	0.015
Wind 150 deg - No Ice		5.844	10.231	776.179	-441.391	-0.011
Wind 180 deg - No Ice		-0.023	11.827	897.630	2.394	-0.058
Wind 210 deg - No Ice		-5.883	10.254	778.576	445.536	-0.090
Wind 225 deg - No Ice		-8.308	8.379	636.431	628.844	-0.097
Wind 240 deg - No Ice		-10.167	5.933	450.917	769.297	-0.098
Wind 270 deg - No Ice		-11.727	0.023	2.450	886.924	-0.079
Wind 300 deg - No Ice		-10.144	-5.894	-446.659	766.900	-0.040
Wind 315 deg - No Ice		-8.276	-8.347	-632.935	625.454	-0.015
Wind 330 deg - No Ice		-5.844	-10.231	-776.073	441.384	0.011
Member Ice	2.321					
Total Weight Ice	19.378			0.081	-0.033	
Wind 0 deg - Ice		0.017	-9.512	-734.151	-1.847	0.044
Wind 30 deg - Ice		4.732	-8.246	-636.689	-364.596	0.072
Wind 45 deg - Ice		6.683	-6.738	-520.382	-514.663	0.079
Wind 60 deg - Ice		8.179	-4.771	-368.606	-629.660	0.080
Wind 90 deg - Ice		9.434	-0.017	-1.733	-726.016	0.068
Wind 120 deg - Ice		8.162	4.741	365.626	-627.846	0.037
Wind 135 deg - Ice		6.659	6.714	517.979	-512.098	0.017
Wind 150 deg - Ice		4.702	8.229	635.038	-361.454	-0.004
Wind 180 deg - Ice		-0.017	9.512	734.313	1.781	-0.044
Wind 210 deg - Ice		-4.732	8.246	636.852	364.530	-0.072
Wind 225 deg - Ice		-6.683	6.738	520.544	514.598	-0.079
Wind 240 deg - Ice		-8.179	4.771	368.768	629.594	-0.080
Wind 270 deg - Ice		-9.434	0.017	1.895	725.951	-0.068
Wind 300 deg - Ice		-8.162	-4.741	-365.464	627.780	-0.037
Wind 315 deg - Ice		-6.659	-6.714	-517.817	512.032	-0.017
Wind 330 deg - Ice		-4.702	-8.229	-634.875	361.388	0.004
Total Weight	15.906			0.053	-0.003	
Wind 0 deg - Service		0.009	-4.620	-350.563	-0.940	0.023
Wind 30 deg - Service		2.298	-4.005	-304.057	-174.042	0.035
Wind 45 deg - Service		3.245	-3.273	-248.532	-245.647	0.038
Wind 60 deg - Service		3.971	-2.318	-176.066	-300.511	0.038
Wind 90 deg - Service		4.581	-0.009	-0.883	-346.459	0.031
Wind 120 deg - Service		3.963	2.302	174.550	-299.575	0.016
Wind 135 deg - Service		3.233	3.261	247.314	-244.322	0.006
Wind 150 deg - Service		2.283	3.997	303.227	-172.420	-0.004
Wind 180 deg - Service		-0.009	4.620	350.669	0.933	-0.023

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 210 deg - Service		-2.298	4.005	304.164	174.036	-0.035
Wind 225 deg - Service		-3.245	3.273	248.638	245.640	-0.038
Wind 240 deg - Service		-3.971	2.318	176.172	300.505	-0.038
Wind 270 deg - Service		-4.581	0.009	0.989	346.453	-0.031
Wind 300 deg - Service		-3.963	-2.302	-174.444	299.568	-0.016
Wind 315 deg - Service		-3.233	-3.261	-247.208	244.316	-0.006
Wind 330 deg - Service		-2.283	-3.997	-303.121	172.414	0.004

Load Combinations

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

Comb. No.	Description
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	110 - 73.96	Pole	Max Tension	27	0.000	0.000	0.000
			Max. Compression	18	-5.479	-0.033	-0.081
			Max. Mx	6	-3.707	-182.679	0.611
			Max. My	10	-3.702	0.661	-185.673
			Max. Vy	6	7.002	-182.679	0.611
			Max. Vx	10	7.103	0.661	-185.673
			Max. Torque	13			0.098
L2	73.96 - 48.713	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-9.056	-0.033	-0.081
			Max. Mx	6	-6.852	-368.731	1.166
			Max. My	10	-6.849	1.217	-374.198
			Max. Vy	6	8.374	-368.731	1.166
			Max. Vx	10	8.476	1.217	-374.198
			Max. Torque	13			0.098
L3	48.713 - 1	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-19.378	-0.033	-0.081
			Max. Mx	6	-15.902	-896.402	2.372
			Max. My	10	-15.901	2.423	-907.226
			Max. Vy	6	11.732	-896.402	2.372
			Max. Vx	10	11.833	2.423	-907.226
			Max. Torque	13			0.098

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	27	19.378	0.017	-9.512
	Max. H_x	14	15.906	11.727	-0.023
	Max. H_z	2	15.906	-0.023	11.827
	Max. M_x	2	907.118	-0.023	11.827
	Max. M_z	6	896.402	-11.727	0.023
	Max. Torsion	13	0.098	10.167	-5.933
	Min. Vert	1	15.906	0.000	0.000
	Min. H_x	6	15.906	-11.727	0.023
	Min. H_z	10	15.906	0.023	-11.827
	Min. M_x	10	-907.226	0.023	-11.827
	Min. M_z	14	-896.395	11.727	-0.023
	Min. Torsion	5	-0.097	-10.167	5.933

Tower Mast Reaction Summary

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead Only	15.906	0.000	0.000	0.053	-0.003	0.000
Dead+Wind 0 deg - No Ice	15.906	0.023	-11.827	-907.118	-2.429	0.058
Dead+Wind 30 deg - No Ice	15.906	5.883	-10.254	-786.793	-450.301	0.090
Dead+Wind 45 deg - No Ice	15.906	8.308	-8.379	-643.130	-635.566	0.097
Dead+Wind 60 deg - No Ice	15.906	10.167	-5.933	-455.634	-777.518	0.097
Dead+Wind 90 deg - No Ice	15.906	11.727	-0.023	-2.372	-896.402	0.079
Dead+Wind 120 deg - No Ice	15.906	10.144	5.894	451.541	-775.094	0.040
Dead+Wind 135 deg - No Ice	15.906	8.276	8.347	639.809	-632.136	0.015
Dead+Wind 150 deg - No Ice	15.906	5.844	10.231	784.477	-446.100	-0.010
Dead+Wind 180 deg - No Ice	15.906	-0.023	11.827	907.226	2.423	-0.058
Dead+Wind 210 deg - No Ice	15.906	-5.883	10.254	786.901	450.295	-0.090
Dead+Wind 225 deg - No Ice	15.906	-8.308	8.379	643.238	635.559	-0.097
Dead+Wind 240 deg - No Ice	15.906	-10.167	5.933	455.742	777.512	-0.098
Dead+Wind 270 deg - No Ice	15.906	-11.727	0.023	2.480	896.395	-0.079
Dead+Wind 300 deg - No Ice	15.906	-10.144	-5.894	-451.433	775.087	-0.040
Dead+Wind 315 deg - No Ice	15.906	-8.276	-8.347	-639.700	632.130	-0.015
Dead+Wind 330 deg - No Ice	15.906	-5.844	-10.231	-784.369	446.094	0.011
Dead+Ice+Temp	19.378	0.000	0.000	0.081	-0.033	0.000
Dead+Wind 0 deg+Ice+Temp	19.378	0.017	-9.512	-744.845	-1.877	0.044
Dead+Wind 30 deg+Ice+Temp	19.378	4.732	-8.246	-645.966	-369.903	0.071
Dead+Wind 45 deg+Ice+Temp	19.378	6.683	-6.738	-527.965	-522.154	0.078
Dead+Wind 60 deg+Ice+Temp	19.378	8.179	-4.771	-373.978	-638.824	0.080
Dead+Wind 90 deg+Ice+Temp	19.378	9.434	-0.017	-1.760	-736.582	0.068
Dead+Wind 120 deg+Ice+Temp	19.378	8.162	4.741	370.952	-636.981	0.037
Dead+Wind 135 deg+Ice+Temp	19.378	6.659	6.714	525.525	-519.548	0.017
Dead+Wind 150 deg+Ice+Temp	19.378	4.702	8.229	644.290	-366.710	-0.004
Dead+Wind 180 deg+Ice+Temp	19.378	-0.017	9.512	745.012	1.810	-0.044
Dead+Wind 210 deg+Ice+Temp	19.378	-4.732	8.246	646.133	369.836	-0.071
Dead+Wind 225 deg+Ice+Temp	19.378	-6.683	6.738	528.132	522.087	-0.079
Dead+Wind 240 deg+Ice+Temp	19.378	-8.179	4.771	374.145	638.756	-0.080
Dead+Wind 270 deg+Ice+Temp	19.378	-9.434	0.017	1.927	736.514	-0.068
Dead+Wind 300 deg+Ice+Temp	19.378	-8.162	-4.741	-370.785	636.913	-0.037
Dead+Wind 315 deg+Ice+Temp	19.378	-6.659	-6.714	-525.358	519.480	-0.017
Dead+Wind 330 deg+Ice+Temp	19.378	-4.702	-8.229	-644.123	366.643	0.004
Dead+Wind 0 deg - Service	15.906	0.009	-4.620	-354.364	-0.951	0.023
Dead+Wind 30 deg - Service	15.906	2.298	-4.005	-307.355	-175.928	0.035
Dead+Wind 45 deg - Service	15.906	3.245	-3.273	-251.227	-248.307	0.038
Dead+Wind 60 deg - Service	15.906	3.971	-2.318	-177.976	-303.766	0.038
Dead+Wind 90 deg - Service	15.906	4.581	-0.009	-0.894	-350.211	0.031
Dead+Wind 120 deg - Service	15.906	3.963	2.302	176.443	-302.818	0.016
Dead+Wind 135 deg - Service	15.906	3.233	3.261	249.996	-246.967	0.006
Dead+Wind 150 deg - Service	15.906	2.283	3.997	306.516	-174.286	-0.004
Dead+Wind 180 deg - Service	15.906	-0.009	4.620	354.472	0.944	-0.023
Dead+Wind 210 deg - Service	15.906	-2.298	4.005	307.463	175.921	-0.035
Dead+Wind 225 deg - Service	15.906	-3.245	3.273	251.336	248.301	-0.038
Dead+Wind 240 deg - Service	15.906	-3.971	2.318	178.084	303.759	-0.038
Dead+Wind 270 deg - Service	15.906	-4.581	0.009	1.002	350.204	-0.031
Dead+Wind 300 deg - Service	15.906	-3.963	-2.302	-176.334	302.811	-0.016
Dead+Wind 315 deg - Service	15.906	-3.233	-3.261	-249.887	246.960	-0.006
Dead+Wind 330 deg - Service	15.906	-2.283	-3.997	-306.407	174.279	0.004

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	-15.906	0.000	0.000	15.906	0.000	0.000%
2	0.023	-15.906	-11.827	-0.023	15.906	11.827	0.000%
3	5.883	-15.906	-10.254	-5.883	15.906	10.254	0.000%
4	8.308	-15.906	-8.379	-8.308	15.906	8.379	0.000%
5	10.167	-15.906	-5.933	-10.167	15.906	5.933	0.000%
6	11.727	-15.906	-0.023	-11.727	15.906	0.023	0.000%
7	10.144	-15.906	5.894	-10.144	15.906	-5.894	0.000%
8	8.276	-15.906	8.347	-8.276	15.906	-8.347	0.000%
9	5.844	-15.906	10.231	-5.844	15.906	-10.231	0.000%
10	-0.023	-15.906	11.827	0.023	15.906	-11.827	0.000%
11	-5.883	-15.906	10.254	5.883	15.906	-10.254	0.000%
12	-8.308	-15.906	8.379	8.308	15.906	-8.379	0.000%
13	-10.167	-15.906	5.933	10.167	15.906	-5.933	0.000%
14	-11.727	-15.906	0.023	11.727	15.906	-0.023	0.000%
15	-10.144	-15.906	-5.894	10.144	15.906	5.894	0.000%
16	-8.276	-15.906	-8.347	8.276	15.906	8.347	0.000%
17	-5.844	-15.906	-10.231	5.844	15.906	10.231	0.000%
18	0.000	-19.378	0.000	0.000	19.378	0.000	0.000%
19	0.017	-19.378	-9.512	-0.017	19.378	9.512	0.000%
20	4.732	-19.378	-8.246	-4.732	19.378	8.246	0.000%
21	6.683	-19.378	-6.738	-6.683	19.378	6.738	0.000%
22	8.179	-19.378	-4.771	-8.179	19.378	4.771	0.000%
23	9.434	-19.378	-0.017	-9.434	19.378	0.017	0.000%
24	8.162	-19.378	4.741	-8.162	19.378	-4.741	0.000%
25	6.659	-19.378	6.714	-6.659	19.378	-6.714	0.000%
26	4.702	-19.378	8.229	-4.702	19.378	-8.229	0.000%
27	-0.017	-19.378	9.512	0.017	19.378	-9.512	0.000%
28	-4.732	-19.378	8.246	4.732	19.378	-8.246	0.000%
29	-6.683	-19.378	6.738	6.683	19.378	-6.738	0.000%
30	-8.179	-19.378	4.771	8.179	19.378	-4.771	0.000%
31	-9.434	-19.378	0.017	9.434	19.378	-0.017	0.000%
32	-8.162	-19.378	-4.741	8.162	19.378	4.741	0.000%
33	-6.659	-19.378	-6.714	6.659	19.378	6.714	0.000%
34	-4.702	-19.378	-8.229	4.702	19.378	8.229	0.000%
35	0.009	-15.906	-4.620	-0.009	15.906	4.620	0.000%
36	2.298	-15.906	-4.005	-2.298	15.906	4.005	0.000%
37	3.245	-15.906	-3.273	-3.245	15.906	3.273	0.000%
38	3.971	-15.906	-2.318	-3.971	15.906	2.318	0.000%
39	4.581	-15.906	-0.009	-4.581	15.906	0.009	0.000%
40	3.963	-15.906	2.302	-3.963	15.906	-2.302	0.000%
41	3.233	-15.906	3.261	-3.233	15.906	-3.261	0.000%
42	2.283	-15.906	3.997	-2.283	15.906	-3.997	0.000%
43	-0.009	-15.906	4.620	0.009	15.906	-4.620	0.000%
44	-2.298	-15.906	4.005	2.298	15.906	-4.005	0.000%
45	-3.245	-15.906	3.273	3.245	15.906	-3.273	0.000%
46	-3.971	-15.906	2.318	3.971	15.906	-2.318	0.000%
47	-4.581	-15.906	0.009	4.581	15.906	-0.009	0.000%
48	-3.963	-15.906	-2.302	3.963	15.906	2.302	0.000%
49	-3.233	-15.906	-3.261	3.233	15.906	3.261	0.000%
50	-2.283	-15.906	-3.997	2.283	15.906	3.997	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	0.00000922
3	Yes	4	0.00000001	0.00023975
4	Yes	4	0.00000001	0.00027070
5	Yes	4	0.00000001	0.00023230
6	Yes	4	0.00000001	0.00000001
7	Yes	4	0.00000001	0.00023339
8	Yes	4	0.00000001	0.00026674
9	Yes	4	0.00000001	0.00023321
10	Yes	4	0.00000001	0.00000001
11	Yes	4	0.00000001	0.00023337
12	Yes	4	0.00000001	0.00027063
13	Yes	4	0.00000001	0.00023915
14	Yes	4	0.00000001	0.00001021
15	Yes	4	0.00000001	0.00023049
16	Yes	4	0.00000001	0.00026662
17	Yes	4	0.00000001	0.00023231
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00061804
20	Yes	4	0.00000001	0.00081760
21	Yes	4	0.00000001	0.00087148
22	Yes	4	0.00000001	0.00081366
23	Yes	4	0.00000001	0.00061282
24	Yes	4	0.00000001	0.00080987
25	Yes	4	0.00000001	0.00086566
26	Yes	4	0.00000001	0.00081117
27	Yes	4	0.00000001	0.00061834
28	Yes	4	0.00000001	0.00081576
29	Yes	4	0.00000001	0.00087171
30	Yes	4	0.00000001	0.00081618
31	Yes	4	0.00000001	0.00061272
32	Yes	4	0.00000001	0.00080820
33	Yes	4	0.00000001	0.00086499
34	Yes	4	0.00000001	0.00081043
35	Yes	4	0.00000001	0.00000001
36	Yes	4	0.00000001	0.00002333
37	Yes	4	0.00000001	0.00002607
38	Yes	4	0.00000001	0.00002200
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00002249
41	Yes	4	0.00000001	0.00002563
42	Yes	4	0.00000001	0.00002241
43	Yes	4	0.00000001	0.00000001
44	Yes	4	0.00000001	0.00002215
45	Yes	4	0.00000001	0.00002606
46	Yes	4	0.00000001	0.00002327
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00002195
49	Yes	4	0.00000001	0.00002560
50	Yes	4	0.00000001	0.00002223

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	110 - 73.96	9.358	43	0.850	0.001
L2	78.043 - 48.713	4.377	43	0.558	0.000
L3	53.796 - 1	2.009	43	0.365	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
107.000	LPA-80063/6CF	43	8.847	0.822	0.001	28442

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	110 - 73.96	23.940	10	2.174	0.002
L2	78.043 - 48.713	11.200	10	1.429	0.000
L3	53.796 - 1	5.141	10	0.934	0.000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
107.000	LPA-80063/6CF	10	22.635	2.102	0.002	11147

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	110 - 73.96 (1)	TP28.66x17x0.188	36.040	0.000	0.0	39.000	16.159	-3.702	630.184	0.006
L2	73.96 - 48.713 (2)	TP36.32x26.964x0.313	29.330	0.000	0.0	39.000	34.107	-6.849	1330.160	0.005
L3	48.713 - 1 (3)	TP51x34.074x0.313	52.796	0.000	0.0	37.642	50.276	-15.902	1892.490	0.008

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	110 - 73.96 (1)	TP28.66x17x0.188	185.675	20.561	39.000	0.527	0.000	0.000	39.000	0.000

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L2	73.96 - 48.713 (2)	TP36.32x26.964x0.313	374.200	15.535	39.000	0.398	0.000	0.000	39.000	0.000
L3	48.713 - 1 (3)	TP51x34.074x0.313	907.233	17.284	37.642	0.459	0.000	0.000	37.642	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	110 - 73.96 (1)	TP28.66x17x0.188	7.103	0.440	26.000	0.034	0.058	0.003	26.000	0.000
L2	73.96 - 48.713 (2)	TP36.32x26.964x0.313	8.476	0.249	26.000	0.019	0.058	0.001	26.000	0.000
L3	48.713 - 1 (3)	TP51x34.074x0.313	11.833	0.235	26.000	0.018	0.058	0.001	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	110 - 73.96 (1)	0.006	0.527	0.000	0.034	0.000	0.533 ✔	1.333	H1-3+VT ✔
L2	73.96 - 48.713 (2)	0.005	0.398	0.000	0.019	0.000	0.404 ✔	1.333	H1-3+VT ✔
L3	48.713 - 1 (3)	0.008	0.459	0.000	0.018	0.000	0.468 ✔	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	110 - 73.96	Pole	TP28.66x17x0.188	1	-3.702	840.035	40.0	Pass
L2	73.96 - 48.713	Pole	TP36.32x26.964x0.313	2	-6.849	1773.103	30.3	Pass
L3	48.713 - 1	Pole	TP51x34.074x0.313	3	-15.902	2522.689	35.1	Pass
						Summary		
						Pole (L1)	40.0	Pass
						RATING =	**40.0**	**Pass**

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Subject:		Anchor Bolt and Baseplate Analysis
Location:		110-ft EEI Monopole Bloomfield, CT
Rev. 0: 6/3/14		Prepared by: T.J.L. Checked by: C.F.C. Job No. 14067.015

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 907·ft·kips	(Input From tnxTower)
Shear Force =	Shear := 12·kips	(Input From tnxTower)
Axial Force =	Axial := 16·kips	(Input From tnxTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 16	(User Input)
Diameter of Bolt Circle =	D_{bc} := 59.00·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strength =	F_u := 100·ksi	(User Input)
Bolt Yield Strength =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 50

Plate Yield Strength =	Fy_{bp} := 50·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 2.5·in	(User Input)
Base Plate Diameter =	D_{bp} := 65.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 51.00·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 29.5 \cdot in$

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

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

$d_1 = 11.29 \cdot in$ $d_7 = 11.29 \cdot in$

$d_2 = 20.86 \cdot in$ $d_8 = 0.00 \cdot in$

$d_3 = 27.25 \cdot in$ $d_9 = -11.29 \cdot in$

$d_4 = 29.50 \cdot in$ $d_{10} = -20.86 \cdot in$

$d_5 = 27.25 \cdot in$ $d_{11} = -27.25 \cdot in$

$d_6 = 20.86 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 25.5 \cdot in$

Moment Arms of Bolts about Neutral Axis = $MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$

$MA_1 = 0.00 \cdot in$ $MA_7 = 0.00 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 0.00 \cdot in$

$MA_3 = 1.75 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 4.00 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_5 = 1.75 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_6 = 0.00 \cdot in$ etc

Effective Width of Baseplate for Bending = $B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 32.2 \cdot in$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 6.962 \times 10^3 \cdot in^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot in^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 = 3.248 \cdot in^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 2.033 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.508 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.826 \cdot in^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 45.1 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 174.9 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net} := 1.333 \cdot \left(0.60 \cdot A_n \cdot F_y\right) = 194.812 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} \cdot 100 = 23$ 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 = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.187 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 2.7 \cdot ksi$

Allowable Bending Stress = $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 60 \cdot ksi$ (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 =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 47.1 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 14.5 \cdot ksi$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{F_y}} = 87.364$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^{\,2}}\right] \cdot F_y}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^{\,3}}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} = 45 \cdot ksi$$

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 60 \cdot ksi$$

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) \cdot 100 = 24.2$$

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"

Base Plate Analysis:

Force from Bolts = $C_i := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$

$C_1 = 18.6 \cdot kips$ $C_7 = 18.6 \cdot kips$

$C_2 = 33.6 \cdot kips$ $C_8 = 1.0 \cdot kips$

$C_3 = 43.6 \cdot kips$ $C_9 = -16.6 \cdot kips$

$C_4 = 47.1 \cdot kips$ $C_{10} = -31.6 \cdot kips$

$C_5 = 43.6 \cdot kips$ $C_{11} = -41.6 \cdot kips$

$C_6 = 33.6 \cdot kips$ etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 10.2 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 49.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} \cdot 100 = 20.4$

Condition3 = $Condition3 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$

Condition3 = "Ok"

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Subject: CAISSON FOUNDATION

Location: 110-ft EEI Monopole
Bloomfield, CT

Rev. 0: 5/29/14

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 14067.015

Caisson Foundation:

Input Data:

Shear Force =	S := 12k	*USER INPUT-FROM tnxTower*
Overturning Moment =	M := 907ft·k	*USER INPUT-FROM tnxTower*
Applied Axial Load =	A1 := 16k	*USER INPUT-FROM tnxTower*
Bending Moment =	Mu := 1002ft·k	*USER INPUT–FROM LPILE*
Moment Capacity =	Mn := 5321ft·k	*USER INPUT–FROM LPILE*
Foundation Diameter =	d := 7.0ft	*USER INPUT*
Overall Length of Caisson =	L_c := 27.0ft	*USER INPUT*
Depth From Top of Caisson to Grade =	L_{pag} := 1.0ft	*USER INPUT*
Number of Rebar =	n := 36	*USER INPUT*
Area of Rebar =	Ar := 0.79in^2	*USER INPUT*
Rebar Yield Strength =	fy := 60ksi	*USER INPUT*
Concrete Comp Strength =	f'c := 4ksi	*USER INPUT*

Check Foundation Depth:

Depth of Caisson Below Ground Level = $LD := L_c - L_{pag} = 26\,ft$ (TIA/EIA-222-F 7.2.5)

Depth Required = $LD1 := 2.0ft + \left(\frac{S \cdot ft^2}{3k \cdot d}\right) + 2ft \cdot .5\left(\frac{M \cdot ft}{3 \cdot kd} + \frac{S \cdot ft}{2k} + \frac{S^2 ft^3}{18k^2 d^2}\right)^{.5} = 16.62\,ft$

DepthCheck := if(LD1 ≤ LD, "OK", "NO GOOD")

DepthCheck = "OK"

Check Moment Capacity:

Factor of Safety = $FS := \frac{Mn}{Mu} = 5.3$

Factor of Safety Required = $FS_{reqd} := 1.3$

FOSCheck := if(FS ≥ FS_{reqd}, "OK", "NO GOOD")

FOSCheck = "OK"

Check Axial Capacity:

Concrete Weight = $A2 := .150\frac{k}{ft^3} \cdot LD \cdot \pi \frac{d^2}{4} = 150.1 \cdot kips$

Total Axial Load = $AT := A1 + A2 = 166.1 \cdot kips$

Area of Concrete = $Ag := \pi \cdot \frac{d^2}{4} = 38.48\,ft^2$

Axial Capacity = $Po := n \cdot Ar \cdot fy + (Ag - n \cdot Ar) \cdot 0.85 \cdot f'c = 20451.7 \cdot kips$

AxialCheck := if(AT ≤ Po, "OK", "NO GOOD")

AxialCheck = "OK"

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\1406700.WI\015 - Bloomfield Blue Hills\Backup Documentation\Calcs\LPile\
Name of input data file: Bloomfield Blue Hills Caisson Analysis.lpd
Name of output file: Bloomfield Blue Hills Caisson Analysis.lpo
Name of plot output file: Bloomfield Blue Hills Caisson Analysis.lpp
Name of runtime file: Bloomfield Blue Hills Caisson Analysis.lpr

Time and Date of Analysis

Date: June 3, 2014 Time: 8:49:38

Problem Title

14067.015 - Bloomfield Blue Hills

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:
- User-specified 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
- Analysis includes computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- 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-04 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 8

Pile Structural Properties and Geometry

Pile Length = 324.00 in

Depth of ground surface below top of pile = 12.00 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	84.00000000	2443920.	5541.8000	3000000.
2	324.0000	84.00000000	2443920.	5541.8000	3000000.

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 modelled using user-specified p-y curves
Distance from top of pile to top of layer = 12.000 in
Distance from top of pile to bottom of layer = 60.000 in

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 60.000 in
Distance from top of pile to bottom of layer = 228.000 in
p-y subgrade modulus k for top of soil layer = 35.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 35.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 228.000 in
Distance from top of pile to bottom of layer = 336.000 in
p-y subgrade modulus k for top of soil layer = 100.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 100.000 lbs/in**3

(Depth of lowest layer extends 12.00 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	12.00	0.00000
2	60.00	0.00000
3	60.00	0.07200
4	228.00	0.07200
5	228.00	0.03800
6	336.00	0.03800

**** WARNING - POSSIBLE INPUT DATA ERROR ****

Values entered for effective unit weights of soil were outside the limits of 0.011574 pci (20 pcf) or 0.0810019 pci (140 pcf) This data may be erroneous. Please check your data.

Shear Strength of Soils

Shear strength parameters with depth defined using 4 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	60.000	0.00000	32.00	------	------
2	228.000	0.00000	32.00	------	------
3	228.000	0.00000	32.00	------	------
4	336.000	0.00000	32.00	------	------

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.

User-specified p-y Curves

User-specified p-y curves defined using 2 curves.

User-specified curve number 1 at depth = 12.000in

Point No.	y in	p, lbs/in
1	0.0000	0.000

User-specified curve number 2 at depth = 60.000in

Point No.	y in	p, lbs/in
1	0.0000	0.000

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 = 12000.000 lbs
Bending moment at pile head = 10884000.000 in-lbs
Axial load at pile head = 16000.000 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 = 84.0000 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 = 36
Area of Single Bar = 0.79000 in**2
Number of Rows of Reinforcing Bars = 19
Area of Steel = 28.440 in**2
Area of Shaft = 5541.769 in**2
Percentage of Steel Reinforcement = 0.513 percent
Cover Thickness (edge to bar center) = 4.000 in

Unfactored Axial Squash Load Capacity = 20451.72 kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement in**2	Distance to Centroidal Axis in
1	0.790	38.000
2	1.580	37.423
3	1.580	35.708

4	1.580	32.909
5	1.580	29.110
6	1.580	24.426
7	1.580	19.000
8	1.580	12.997
9	1.580	6.599
10	1.580	0.000
11	1.580	-6.599
12	1.580	-12.997
13	1.580	-19.000
14	1.580	-24.426
15	1.580	-29.110
16	1.580	-32.909
17	1.580	-35.708
18	1.580	-37.423
19	0.790	-38.000

Axial Thrust Force = 16000.00 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
5914929.	9.463887E+12	6.250000E-07	0.00002712	43.39882833	96.35706860	714.10376
11776526.	9.421221E+12	0.00000125	0.00005347	42.77379566	188.56829	1405.55009
17584967.	9.378649E+12	0.00000188	0.00007981	42.56530792	279.47341	2096.98862
23340251.	9.336100E+12	0.00000250	0.00010615	42.46095139	369.07240	2788.41898
29042378.	9.293561E+12	0.00000313	0.00013249	42.39824635	457.36530	3479.84108
29042378.	7.744634E+12	0.00000375	0.00006962	18.56484121	239.26427	6681.07352
29042378.	6.638258E+12	0.00000438	0.00008059	18.41968185	276.07965	7813.00287
29042378.	5.808476E+12	0.00000500	0.00009156	18.31296962	312.71675	8944.61940
29042378.	5.163089E+12	0.00000563	0.00010255	18.23189467	349.17502	10075.92218
29042378.	4.646780E+12	0.00000625	0.00011375	18.19999892	386.12218	11201.25020
29042378.	4.224346E+12	0.00000688	0.00012498	18.17936593	422.97208	12325.48892
29042378.	3.872317E+12	0.00000750	0.00013601	18.13529617	458.91359	13455.57308
29042378.	3.574446E+12	0.00000813	0.00014706	18.09950513	494.67776	14585.30410
29042378.	3.319129E+12	0.00000875	0.00015811	18.07023293	530.26424	15714.67839
29042378.	3.097854E+12	0.00000938	0.00016918	18.04617780	565.67234	16843.69541
29042378.	2.904238E+12	0.00001000	0.00018026	18.02637094	600.90161	17972.35243
29042378.	2.733400E+12	0.00001063	0.00019136	18.01007134	635.95156	19100.64677
29042378.	2.581545E+12	0.00001125	0.00020246	17.99670070	670.82167	20228.57640
29042378.	2.445674E+12	0.00001188	0.00021358	17.98580092	705.51130	21356.13981
29042378.	2.323390E+12	0.00001250	0.00022471	17.97700900	740.01998	22483.33424
29042378.	2.212753E+12	0.00001313	0.00023586	17.97003204	774.34727	23610.15656
29042378.	2.112173E+12	0.00001375	0.00024701	17.96462470	808.49245	24736.60590
29042378.	2.020339E+12	0.00001438	0.00025818	17.96058923	842.45503	25862.67936
29042378.	1.936159E+12	0.00001500	0.00026937	17.95775789	876.23439	26988.37532
29042378.	1.858712E+12	0.00001563	0.00028056	17.95599550	909.83015	28113.68954
29042378.	1.787223E+12	0.00001625	0.00029177	17.95517939	943.24153	29238.62171
29042378.	1.721030E+12	0.00001688	0.00030299	17.95521444	976.46822	30363.16693
29042378.	1.659564E+12	0.00001750	0.00031423	17.95600802	1009.50929	31487.32593
29042378.	1.602338E+12	0.00001813	0.00032548	17.95749253	1042.36451	32611.09299
29042378.	1.548927E+12	0.00001875	0.00033674	17.95959789	1075.03298	33734.46865
29042378.	1.498961E+12	0.00001938	0.00034802	17.96227401	1107.51440	34857.44729
29042378.	1.452119E+12	0.00002000	0.00035931	17.96546835	1139.80798	35980.02836
29042378.	1.408115E+12	0.00002063	0.00037061	17.96913832	1171.91313	37102.20914
29042378.	1.366700E+12	0.00002125	0.00038193	17.97324640	1203.82924	38223.98691
29396641.	1.343846E+12	0.00002188	0.00039326	17.97776002	1235.55575	39345.35849
30212598.	1.342782E+12	0.00002250	0.00040461	17.98264915	1267.09200	40466.32143
31027831.	1.341744E+12	0.00002313	0.00041597	17.98788875	1298.43748	41586.87210
31842329.	1.340730E+12	0.00002375	0.00042734	17.99345130	1329.59126	42707.01042
32656094.	1.339737E+12	0.00002438	0.00043873	17.99931926	1360.55296	43826.73120
34281410.	1.337811E+12	0.00002563	0.00046155	18.01189631	1421.89742	46064.90955
35903740.	1.335953E+12	0.00002688	0.00048443	18.02548724	1482.46545	48301.38588
37523056.	1.334153E+12	0.00002813	0.00050737	18.03998691	1542.25176	50536.13568
39139318.	1.332402E+12	0.00002938	0.00053037	18.05530518	1601.25072	52769.13690
40752498.	1.330694E+12	0.00003063	0.00055344	18.07137197	1659.45694	55000.36277
42362555.	1.329021E+12	0.00003188	0.00057656	18.08812469	1716.86457	57229.78974
43969463.	1.327380E+12	0.00003313	0.00059975	18.10551578	1773.46808	59457.38891
45378921.	1.320114E+12	0.00003438	0.00062202	18.09501904	1826.84043	60000.00000
46491509.	1.305025E+12	0.00003563	0.00064283	18.04426521	1875.76856	60000.00000
47463706.	1.287151E+12	0.00003688	0.00066294	17.97793776	1922.24319	60000.00000
48315523.	1.267292E+12	0.00003813	0.00068243	17.89986187	1966.54947	60000.00000
49089913.	1.246728E+12	0.00003938	0.00070152	17.81628603	2009.22388	60000.00000
49757531.	1.224801E+12	0.00004063	0.00072001	17.72331744	2049.90053	60000.00000
50423819.	1.204151E+12	0.00004188	0.00073853	17.63663739	2090.04326	60000.00000
50995021.	1.182493E+12	0.00004313	0.00075648	17.54155594	2128.29272	60000.00000
51502084.	1.160610E+12	0.00004438	0.00077404	17.44320506	2165.13667	60000.00000
52008050.	1.139902E+12	0.00004563	0.00079163	17.35082477	2201.49630	60000.00000
52512913.	1.120275E+12	0.00004688	0.00080925	17.26394194	2237.36949	60000.00000
52928672.	1.099817E+12	0.00004813	0.00082624	17.16871029	2271.40106	60000.00000
53301816.	1.079530E+12	0.00004938	0.00084296	17.07258493	2304.34463	60000.00000
53674052.	1.060228E+12	0.00005063	0.00085970	16.98166662	2336.84761	60000.00000
54045368.	1.041838E+12	0.00005188	0.00087646	16.89557987	2368.90794	60000.00000
54415758.	1.024297E+12	0.00005313	0.00089324	16.81398672	2400.52379	60000.00000
55060805.	1.012613E+12	0.00005438	0.00091350	16.80000025	2438.37425	60000.00000
55074651.	9.901061E+11	0.00005563	0.00093002	16.71953112	2468.40144	60000.00000

55334185.	9.729088E+11	0.00005688	0.00094545	16.62323052	2495.88774	60000.00000
55593019.	9.564390E+11	0.00005813	0.00096089	16.53141600	2522.99940	60000.00000
55851174.	9.406514E+11	0.00005938	0.00097635	16.44381219	2549.73559	60000.00000
56108638.	9.255033E+11	0.00006063	0.00099183	16.36015874	2576.09457	60000.00000
56365394.	9.109559E+11	0.00006188	0.00100734	16.28021532	2602.07450	60000.00000
56621464.	8.969737E+11	0.00006313	0.00102286	16.20376915	2627.67447	60000.00000
56840432.	8.829582E+11	0.00006438	0.00103799	16.12412864	2652.18054	60000.00000
57017489.	8.688379E+11	0.00006563	0.00105266	16.04058784	2675.52782	60000.00000
57193969.	8.552369E+11	0.00006688	0.00106735	15.96043915	2698.53458	60000.00000
57369868.	8.421265E+11	0.00006813	0.00108206	15.88349730	2721.19950	60000.00000
57545194.	8.294803E+11	0.00006938	0.00109679	15.80959207	2743.52149	60000.00000
57719927.	8.172733E+11	0.00007063	0.00111154	15.73856074	2765.49890	60000.00000
57894084.	8.054829E+11	0.00007188	0.00112630	15.67025810	2787.13077	60000.00000
58067639.	7.940874E+11	0.00007313	0.00114108	15.60454148	2808.41531	60000.00000
58240597.	7.830668E+11	0.00007438	0.00115588	15.54128319	2829.35132	60000.00000
58584744.	7.620780E+11	0.00007688	0.00118554	15.42167348	2870.17300	60000.00000
58925681.	7.423708E+11	0.00007938	0.00122223	15.39817411	2919.14333	60000.00000
59144552.	7.223762E+11	0.00008188	0.00124910	15.25617403	2952.88331	60000.00000
59361676.	7.035458E+11	0.00008438	0.00127603	15.12333387	2985.47597	60000.00000
59577061.	6.857791E+11	0.00008688	0.00130303	14.99887508	3016.91337	60000.00000
59790678.	6.689866E+11	0.00008938	0.00133009	14.88209921	3047.18662	60000.00000
60002518.	6.530886E+11	0.00009188	0.00135721	14.77238792	3076.28711	60000.00000
60212541.	6.380137E+11	0.00009438	0.00138440	14.66918296	3104.20551	60000.00000
60420762.	6.236982E+11	0.00009688	0.00141166	14.57199365	3130.93340	60000.00000
60615364.	6.099659E+11	0.00009938	0.00143873	14.47780341	3156.21292	60000.00000
60748489.	5.963042E+11	0.00010188	0.00146457	14.37613803	3179.10466	60000.00000
60880088.	5.832823E+11	0.00010438	0.00149047	14.27991754	3200.92078	60000.00000
61010141.	5.708551E+11	0.00010688	0.00151642	14.18876392	3221.65319	60000.00000
61138630.	5.589818E+11	0.00010938	0.00154244	14.10233420	3241.29375	60000.00000
61265550.	5.476250E+11	0.00011188	0.00156852	14.02031797	3259.83435	60000.00000
61762700.	5.400018E+11	0.00011438	0.00160125	14.00000042	3281.77398	60000.00000
61762700.	5.284509E+11	0.00011688	0.00163480	13.98762864	3302.35776	60000.00000
61762700.	5.173839E+11	0.00011938	0.00165968	13.90311152	3316.09196	60000.00000
61816170.	5.072096E+11	0.00012188	0.00168462	13.82255727	3328.81746	60000.00000
61926645.	4.979027E+11	0.00012438	0.00170963	13.74573308	3340.52647	60000.00000
62035704.	4.889514E+11	0.00012688	0.00173469	13.67242366	3351.21097	60000.00000
62143333.	4.803349E+11	0.00012938	0.00175981	13.60243124	3360.86285	60000.00000
62249521.	4.720343E+11	0.00013188	0.00178500	13.53557307	3369.47385	60000.00000
62337910.	4.639100E+11	0.00013438	0.00180965	13.46718031	3376.85447	60000.00000
62398691.	4.558808E+11	0.00013688	0.00183339	13.39459437	3382.98047	60000.00000
62458258.	4.481310E+11	0.00013938	0.00185717	13.32501251	3388.17859	60000.00000
62516615.	4.406457E+11	0.00014188	0.00188102	13.25828201	3392.44182	60000.00000
62573761.	4.334113E+11	0.00014438	0.00190492	13.19426018	3395.76295	60000.00000
62629646.	4.264146E+11	0.00014688	0.00192888	13.13280684	3398.13455	60000.00000
62684292.	4.196438E+11	0.00014938	0.00195290	13.07380182	3399.54925	60000.00000
62737480.	4.130863E+11	0.00015188	0.00197698	13.01712495	3399.79019	60000.00000
62784815.	4.067033E+11	0.00015438	0.00200111	12.96266860	3393.87510	60000.00000
62831728.	4.005210E+11	0.00015688	0.00202531	12.91033262	3387.94405	60000.00000
62878182.	3.945298E+11	0.00015938	0.00204957	12.86001688	3381.99707	60000.00000
62924185.	3.887208E+11	0.00016188	0.00207388	12.81163377	3382.03449	60000.00000
62969740.	3.830859E+11	0.00016438	0.00209826	12.76510066	3386.73569	60000.00000
63014833.	3.776170E+11	0.00016688	0.00212271	12.72033745	3390.73704	60000.00000
63059452.	3.723067E+11	0.00016938	0.00214721	12.67726904	3394.03161	60000.00000
63103604.	3.671482E+11	0.00017188	0.00217178	12.63582784	3396.61242	60000.00000
63103604.	3.618845E+11	0.00017438	0.00219712	12.59999925	3398.52625	60000.00000
63103604.	3.517971E+11	0.00017938	0.00226012	12.59999925	3396.41491	60000.00000
63282556.	3.432274E+11	0.00018438	0.00232312	12.59999925	3382.54280	60000.00000
63451240.	3.350561E+11	0.00018938	0.00237394	12.53566450	3375.49664	60000.00000
63523441.	3.268087E+11	0.00019438	0.00242188	12.45984918	3383.99362	60000.00000
63565236.	3.188225E+11	0.00019938	0.00246764	12.37686914	3390.26751	60000.00000
63593590.	3.111613E+11	0.00020438	0.00251253	12.29372388	3394.86743	60000.00000
63621282.	3.038628E+11	0.00020938	0.00255759	12.21535510	3398.02295	60000.00000
63648297.	2.969017E+11	0.00021438	0.00260282	12.14144486	3399.70707	60000.00000
63673886.	2.902513E+11	0.00021938	0.00264838	12.07237619	3397.17387	60000.00000
63697808.	2.838900E+11	0.00022438	0.00269430	12.00802642	3389.66353	60000.00000
63721417.	2.778045E+11	0.00022938	0.00274033	11.94693357	3382.12583	60000.00000
63744699.	2.719774E+11	0.00023438	0.00278646	11.88889486	3374.56042	60000.00000
63767664.	2.663923E+11	0.00023938	0.00283270	11.83372754	3366.96675	60000.00000
63790299.	2.610345E+11	0.00024438	0.00287905	11.78126138	3365.53540	60000.00000
63812585.	2.558901E+11	0.00024938	0.00292550	11.73133868	3373.10584	60000.00000
63834551.	2.509466E+11	0.00025438	0.00297207	11.68382174	3379.77029	60000.00000
63856153.	2.461924E+11	0.00025938	0.00301875	11.63857287	3385.51434	60000.00000
63877391.	2.416166E+11	0.00026438	0.00306555	11.59547192	3390.32377	60000.00000
63898274.	2.372094E+11	0.00026938	0.00311247	11.55440873	3394.18397	60000.00000
63918786.	2.329614E+11	0.00027438	0.00315950	11.51527816	3397.07969	60000.00000
63936188.	2.288544E+11	0.00027938	0.00320725	11.48010296	3399.03200	60000.00000
63952210.	2.248869E+11	0.00028438	0.00325534	11.44736356	3399.93845	60000.00000
63966663.	2.210511E+11	0.00028938	0.00330386	11.41723019	3395.75800	60000.00000
63980354.	2.173430E+11	0.00029438	0.00335261	11.38889426	3389.35179	60000.00000
63993861.	2.137582E+11	0.00029938	0.00340142	11.36173993	3382.92698	60000.00000
64007200.	2.102906E+11	0.00030438	0.00345031	11.33571464	3376.48312	60000.00000
64016523.	2.069221E+11	0.00030938	0.00350020	11.31377989	3369.77364	60000.00000
64022402.	2.036498E+11	0.00031438	0.00355097	11.29532236	3362.83327	60000.00000
64028029.	2.004792E+11	0.00031938	0.00360183	11.27775604	3355.86647	60000.00000
64033399.	1.974055E+11	0.00032438	0.00365280	11.26104587	3348.87270	60000.00000

Unfactored (Nominal) Moment Capacity at Concrete Strain of 0.003 = 63847.47428 in-kip

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 = 12000.000 lbs
Specified moment at pile head = 10884000.000 in-lbs
Specified axial load at pile head = 16000.000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res. p lbs/in	Es*h F/L
0.000	0.578785	1.09E+07	12000.	-0.002379	189.934	9.42E+12	0.000	0.000
25.920	0.517516	1.12E+07	12000.	-0.002349	195.296	9.42E+12	0.000	0.000
51.840	0.457045	1.15E+07	12000.	-0.002317	200.658	9.42E+12	0.000	0.000
77.760	0.397395	1.18E+07	11089.	-0.002285	205.951	9.42E+12	-142.618	1162.781
103.680	0.338587	1.20E+07	1997.294	-0.002252	209.279	9.42E+12	-517.631	4953.312
129.600	0.280633	1.19E+07	-13791.	-0.002219	206.833	9.42E+12	-683.622	7892.640
155.520	0.223523	1.13E+07	-32551.	-0.002187	196.590	9.42E+12	-747.283	10832.
181.440	0.167214	1.02E+07	-51658.	-0.002158	177.814	9.43E+12	-710.726	13771.
207.360	0.111627	8.61E+06	-68538.	-0.002132	150.925	9.44E+12	-575.729	16711.
233.280	0.056652	6.66E+06	-83646.	-0.002111	117.366	9.45E+12	-920.888	52667.
259.200	0.002147	4.27E+06	-96691.	-0.002096	76.342	9.46E+12	-40.456	61065.
285.120	-0.052055	1.88E+06	-83340.	-0.002088	35.112	9.46E+12	1116.029	69463.
311.040	-0.106120	2.41E+05	-36418.	-0.002085	7.031	9.46E+12	2550.191	77861.

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.57878482 in
Computed slope at pile head = -0.00237888
Maximum bending moment = 12013513. lbs-in
Maximum shear force = -96691.08497 lbs
Depth of maximum bending moment = 106.92000 in
Depth of maximum shear force = 259.20000 in
Number of iterations = 6
Number of zero deflection points = 1

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= 12000.	M= 1.09E+07	16000.0000	0.5787848	1.2014E+07	-96691.0850

Computed Pile-head Stiffness Matrix Members
K22, K23, K32, K33 for Superstructure

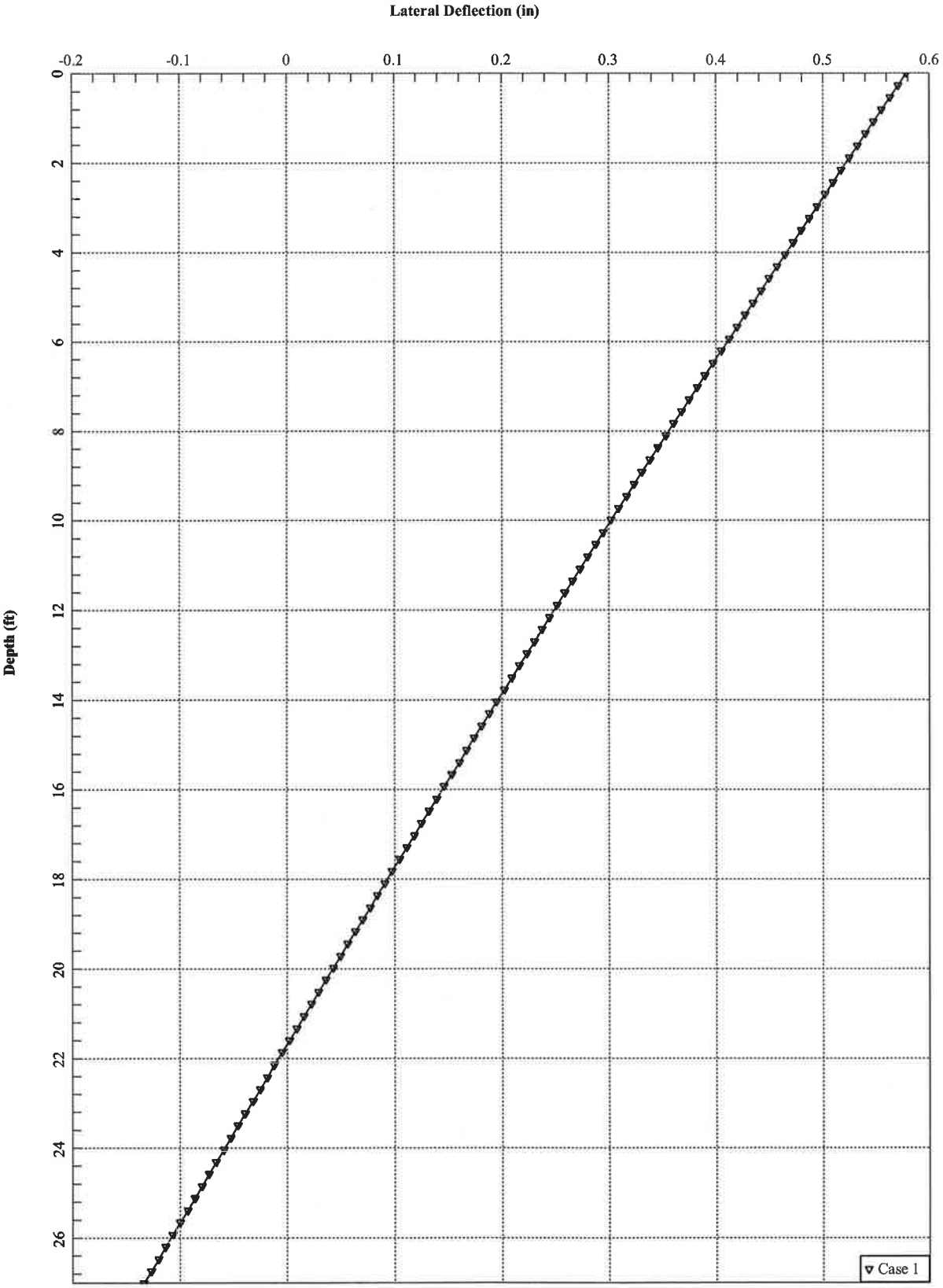
Top y in	Shear React. lbs	Mom. React. in-lbs	K22 lbs/in	K32 in-lbs/in
0.00114303	1200.00002	285390.59464	1049837.	2.496781E+08
0.00344088	3612.35995	859111.28188	1049837.	2.496781E+08
0.00545366	5725.45506	1361659.	1049837.	2.496781E+08
0.00688175	7224.71990	1718223.	1049837.	2.496781E+08

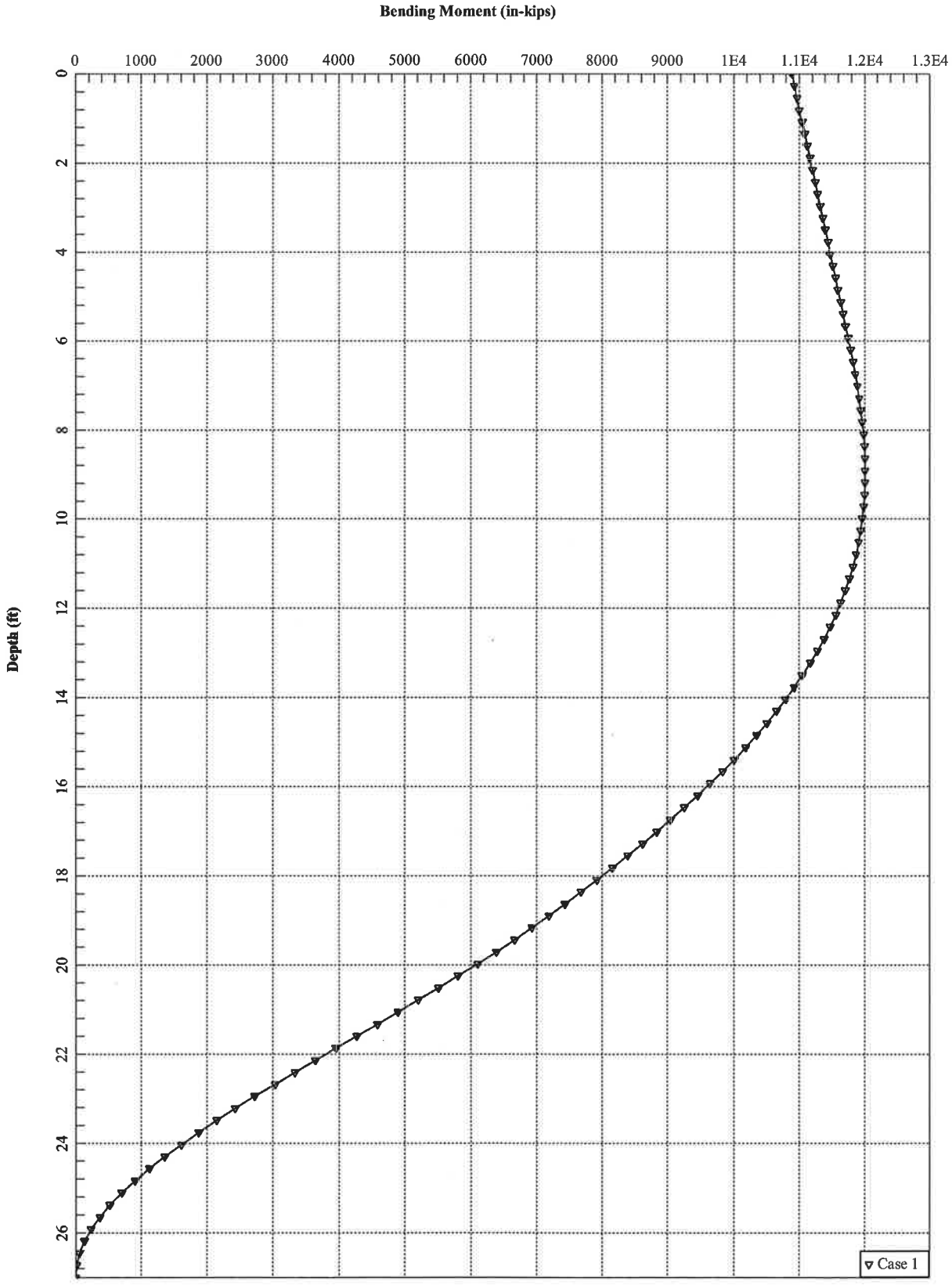
0.00798947	8387.64005	1994795.	1049837.	2.496781E+08
0.00889453	9337.81500	2220770.	1049837.	2.496781E+08
0.00965976	10141.17648	2411830.	1049837.	2.496781E+08
0.01032267	10837.07984	2577342.	1049833.	2.496779E+08
0.01090743	11450.91011	2723339.	1049827.	2.496776E+08
0.01143051	12000.00000	2853939.	1049822.	2.496773E+08

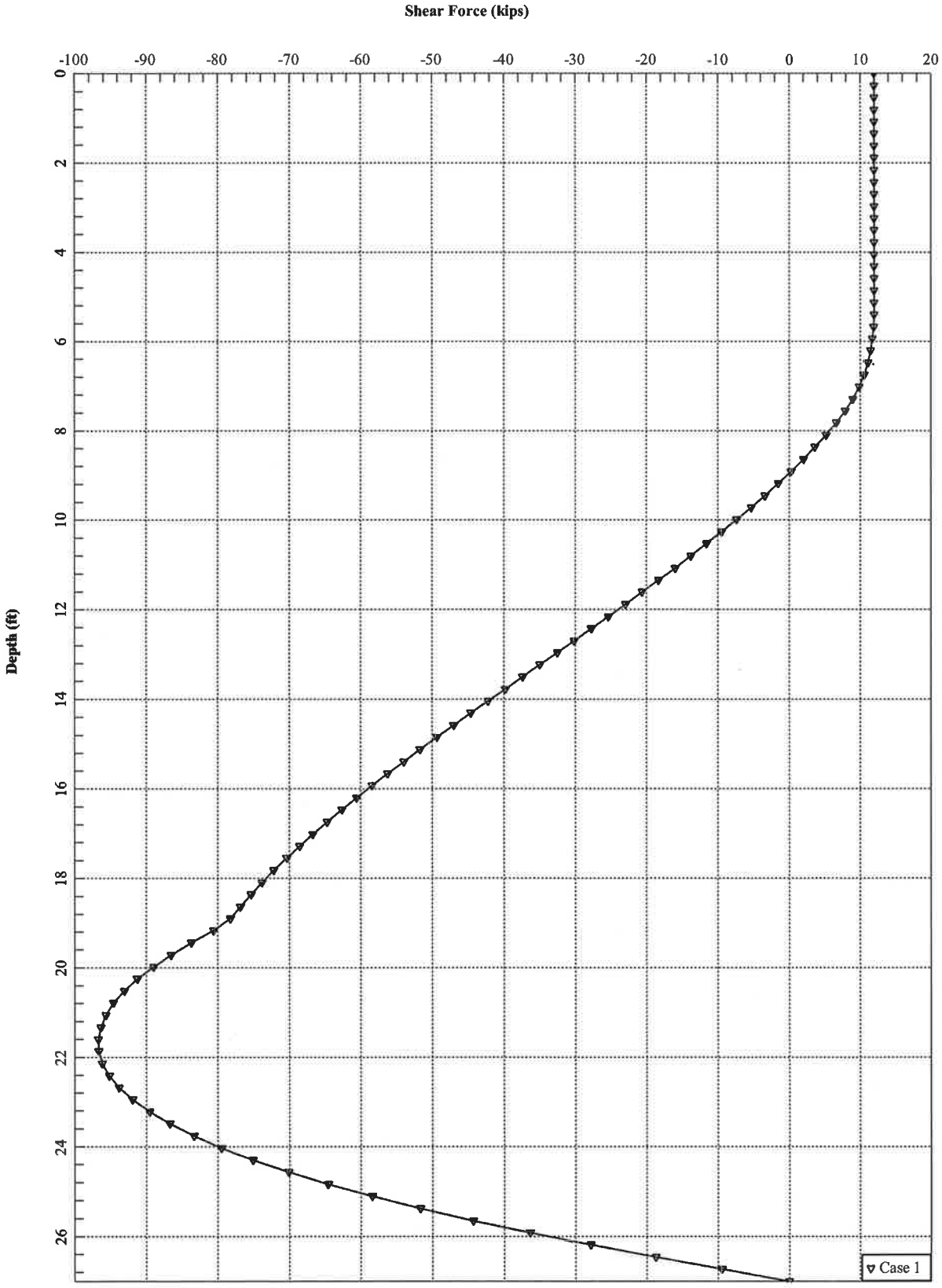
Top Rota. rad	Shear React. lbs	Mom. React. in-lbs	K23 lbs/rad	K33 in-lbs/rad
0.00001665	4157.30642	1088400.	2.496781E+08	6.536676E+10
0.00005012	12514.73914	3276410.	2.496781E+08	6.536676E+10
0.00007944	19835.39225	5192988.	2.496781E+08	6.536676E+10
0.00010025	25029.48475	6552821.	2.496590E+08	6.536174E+10
0.00011643	29058.41286	7607590.	2.495845E+08	6.534205E+10
0.00012965	32350.37698	8469398.	2.495117E+08	6.532271E+10
0.00014084	35133.75619	9198047.	2.494506E+08	6.530638E+10
0.00015054	37544.87242	9829231.	2.494000E+08	6.529280E+10
0.00015910	39671.65762	10385975.	2.493576E+08	6.528142E+10
0.00016675	41574.15322	10884000.	2.493218E+08	6.527177E+10

K22 = abs(Shear Reaction/Top y)
K23 = abs(Shear Reaction/Top Rotation)
K32 = abs(Moment Reaction/Top y)
K33 = abs(Moment Reaction/Top Rotation)

The analysis ended normally.


Lateral Deflection (in)
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Case 1


Bending Moment (in-kips)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
1E4
1.1E4
1.2E4
1.3E4
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Case 1


Shear Force (kips)
-100
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Case 1

SITE NAME	BLOOMFIELD BLUE HILLS, CT		ECP - CELL #		8-0280	
LATITUDE	41-48-34.86 N		LONGITUDE		72-41-47.75 W	
			SAVE BUTTON			
Additional Comments: 700 LTE antenna change, RRH add, all new antennas are RET			STRUCTURE TYPE		MONOPOLE	
700 LTE - Current Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	700 eNodeB		700 eNodeB		700 eNodeB	
ANTENNA TYPE	BXA-70063-6CF_2		BXA-70063-6CF_2		BXA-70063-6CF_2	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (ELEC° + MECH°)	2° Elec + 5° Mech		2° Elec + 0° Mech		2° Elec + 0° Mech	
RAD CTR (FT AGL)	107		107		107	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
RRH - QTY/MODEL						
SECTOR DISTRIBUTION BOX						
MAIN DISTRIBUTION BOX						
700 LTE - Future Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	700 eNodeB		700 eNodeB		700 eNodeB	
ANTENNA TYPE	LNX-6514DS-A1M		X7C-FRO-660-V		LNX-6514DS-A1M	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (ELEC° + MECH°)	5° Elec + 0° Mech		6° Elec + 0° Mech		4° Elec + 0° Mech	
RAD CTR (FT AGL)	107		107		107	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
RRH - QTY/MODEL	1	ALU RH_2X40-700	1	ALU RH_2X40-700	1	ALU RH_2X40-700
SECTOR DISTRIBUTION BOX						
MAIN DISTRIBUTION BOX						
850 Cellular - No Change	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	N/A		N/A		N/A	
ANTENNA TYPE	LPA-80063-6CF_5		LPA-80063-6CF_5		LPA-80063-6CF_5	
QTY OF ANTENNAS PER FACE	2		2		2	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (ELEC° + MECH°)	5° Elec + 3° Mech		5° Elec + 4° Mech		5° Elec + 2° Mech	
RAD CTR (FT AGL)	107		107		107	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
850 Cellular - Future Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	PCS Mod 4.0B		PCS Mod 4.0B		PCS Mod 4.0B	
ANTENNA TYPE	LPA-80063-6CF_5		LPA-80063-6CF_5		LPA-80063-6CF_5	
QTY OF ANTENNAS PER FACE	2		2		2	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (ELEC° + MECH°)	5° Elec + 3° Mech		5° Elec + 4° Mech		5° Elec + 2° Mech	
RAD CTR (FT AGL)	107		107		107	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
1900 PCS CDMA - Current Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	N/A		N/A		N/A	
ANTENNA TYPE	BXA-171063-12BF_2		BXA-171063-12CF_2		BXA-171063-12CF_2	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (ELEC° + MECH°)	2° Elec + 2° Mech		2° Elec + 2° Mech		2° Elec + 2° Mech	
RAD CTR (FT AGL)	107		107		107	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
1900 PCS LTE - Future Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	PCS Mod 4.0B		PCS Mod 4.0B		PCS Mod 4.0B	
ANTENNA TYPE	BXA-171063-12BF_2		BXA-171063-12BF_2		BXA-171063-12CF_2	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (ELEC° + MECH°)	2° Elec + 2° Mech		2° Elec + 2° Mech		2° Elec + 2° Mech	
RAD CTR (FT AGL)	107		107		107	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
2100 AWS LTE - Current Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	N/A		N/A		N/A	
ANTENNA TYPE	BXA-171063-12BF_2		BXA-171063-12BF_2		BXA-171063-12BF_2	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (ELEC° + MECH°)	2° Elec + 0° Mech		2° Elec + 0° Mech		2° Elec + 0° Mech	
RAD CTR (FT AGL)	107		107		107	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
RRH - QTY/MODEL	1	ALU RH_2X40-AWS	1	ALU RH_2X40-AWS	1	ALU RH_2X40-AWS
SECTOR DISTRIBUTION BOX	1	DB-E1-3B-8AB-0Z	1	DB-E1-3B-8AB-0Z	1	DB-E1-3B-8AB-0Z
MAIN DISTRIBUTION BOX	1				DB-T1-6Z-8AB-0Z	
2100 AWS LTE - Future Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	N/A		N/A		N/A	
ANTENNA TYPE	BXA-171063-12BF_2		BXA-171063-12BF_2		BXA-171063-12BF_2	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (ELEC° + MECH°)	2° Elec + 0° Mech		2° Elec + 0° Mech		2° Elec + 0° Mech	
RAD CTR (FT AGL)	107		107		107	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
RRH - QTY/MODEL	1	ALU RH_2X40-AWS	1	ALU RH_2X40-AWS	1	ALU RH_2X40-AWS
SECTOR DISTRIBUTION BOX	1	DB-E1-3B-8AB-0Z	1	DB-E1-3B-8AB-0Z	1	DB-E1-3B-8AB-0Z
MAIN DISTRIBUTION BOX	1				DB-T1-6Z-8AB-0Z	

NUMBER OF CABLE'S NEEDED					Fiber Lines Model number			
TOTAL # FIBER LINES	1	TOTAL # OF MAINLINES		14	FIBER LINE MODEL #			
TOTAL # TOP JUMPERS	6	TOTAL # OF TOP JUMPERS		12	FIBER TOP JUMPER MODEL #			
Equipment Cable Ordering		MAIN CABLE #	14	+ 0	TOP JUMPER #	12	+	0

TX / RX FREQUENCIES			TX POWER OUTPUT	
Cellular A-Band	PCS F / AWS-Band	700 Mhz C - Blo	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	LTE/ AWS (Watts)	40

ALPHA				BETA				GAMMA			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1	800	Tx1/Rx0	RED	A7	800	Tx2/Rx0	BLUE	A13	800	Tx3/Rx0	GREEN
A2	1900	Tx1/Rx0	RED/ WHITE	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/ ORANGE	A9	700	Tx2/Rx0	BLUE/ ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE
A4	700	Tx4/Rx1	RED/RED/ ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A5	1900	Tx4/Rx1	RED/RED/ WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN
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	INITIALS	DATE
Prepared By: Mark Brauer	Robert Hesselbach		6/3/2014

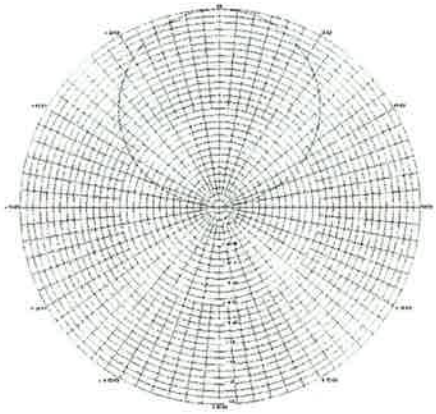
X7C-FRO-660
Xpol, 58° H-Beam

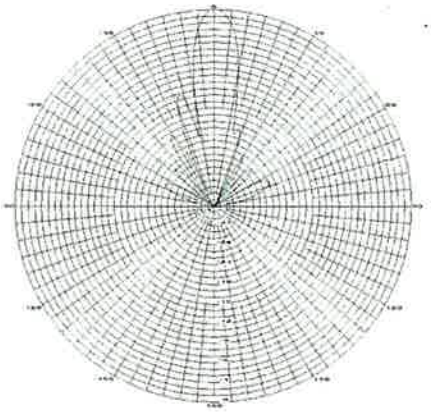
698-896 MHz

Electrical Specifications	
Frequency	698-896 MHz
Polarization	Slant +/- 45
Gain @ 698 MHz	16.1 dBi
Gain @ 782 MHz	16.6 dBi
Gain @ 896 MHz	17.2 dBi
Horizontal Beam (3dB Points)	58°
Vertical Beam (3dB Points)	11°
Elect. Downtilt Range, 2° Increments	0-10°
VSWR / Return Loss	≤1.35:1 / 16.5 dB
VSWR w/ip	<1.50:1 / 14.0 dB
Front-to-Back at Horizon	>30 dB
Upper Side Lobe Suppression	<-18 dB
Impedance	50 Ohms
Power Input Per Connector	500 CW at 800 MHz
Isolation	< -27 dB
Intermodulation (2x20W)	<-150 dBc

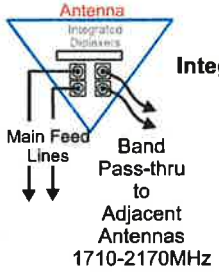
Mechanical Specifications	
Input Connector (female)	Back 7/16 DIN or w/bot. opt.
Antenna Dimensions (LxWxD)	72.0 x 14.6 x 8.0 in. (1829 x 372 x 203mm)
*Antenna Weight	32.2 lbs
Bracket Weight	13.2 lbs
RF Distribution	Printed Microstrip Substrate
Radome	Ultra High-Strength Luran
Weatherability	UV Stabilized, ASTM D1925
Radome Water Absorption	ASTM D570, 0.45%
Environmental	MIL-STD-810E
Wind Survival	150 mph
Front Wind Load @100mph	208 lbf
Equivalent Flat Plate @100mph	4.23 sq-ft. (c=2)
Mounting Brackets	Fits 3.5 Inch Max. O.D. Pipe
Mechanical Downtilt Range	0-12°
Clamps/Bolts	Galvanized Steel/Stainless Steel

Link to Mechanical Drawing





Available with Integrated Pass-Thru Diplexers to reduce mainline cables and eliminate separate external devices



Integrated Pass-Thru Diplexers will work with TMA's

Recommended Connector Coupling Torque
7/16 DIN: 220-265 lbf-in (25-30 N-m)

Return Loss at pass-thru port into 50Ω load ≥17.7 dB

Ordering Information & Options

X7C-FRO-660-x	"-x" is a placeholder for the built-in fixed electrical downtilt in degrees, set to 0, 2, 4, 6, 8 or 10
X7C-FRO-660-xip	"ip" option includes pass-thu integrated diplexer(s) which pass DC to the diplexer port(s)
X7C-FRO-660-xip-bot	for bottom mounted connectors, add "-bot" (otherwise antenna comes standard with back mounted connectors)

*Antenna Weight may vary slightly with options.

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Subject to alteration.

Made in USA

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6514DS-VTM

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

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

Electrical Specifications

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

General Specifications

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

Mechanical Specifications

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

Product Specifications

LNX-6514DS-VTM

Dimensions

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

Remote Electrical Tilt (RET) Information

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

Regulatory Compliance/Certifications

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

Included Products

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

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

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

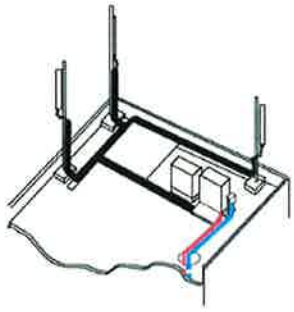
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and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

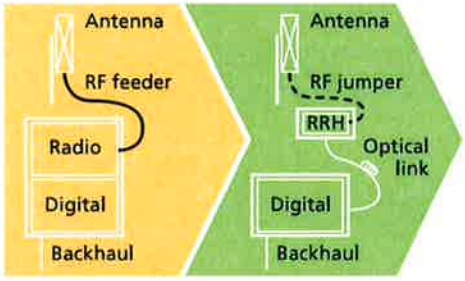
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly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

Benefits

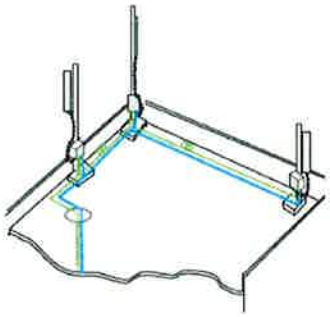
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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