STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

Ten Franklin Square, New Britain, CT 06051

Phone: (860) 827-2935 Fax: (860) 827-2950

E-Mail: siting.council@ct.gov

Internet: ct.gov/csc

Daniel F. Caruso
Chairman

July 8, 2010

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

RE: **EM-VER-155-100614 -** Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 457 South Quaker Lane, West Hartford, Connecticut.

Dear Attorney Baldwin:

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

The proposed modifications are to be implemented as specified here and in your notice dated June 14, 2010, including the placement of all necessary equipment and shelters within the tower compound. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

This decision is under the exclusive jurisdiction of the Council. Please be advised that the validity of this action shall expire one year from the date of this letter. Any additional change to this facility will require explicit notice to this agency pursuant to Regulations of Connecticut State Agencies Section 16-50j-73. Such notice shall include all relevant information regarding the proposed change with cumulative worst-case modeling of radio frequency exposure at the closest point of uncontrolled access to the tower base, consistent with Federal Communications Commission, Office of Engineering and Technology, Bulletin 65. Any deviation from this format may result in the Council implementing enforcement proceedings pursuant to General Statutes § 16-50u including, without limitation, imposition of expenses resulting from such failure and of civil penalties in an amount not less than one thousand dollars per day for each day of construction or operation in material violation.

Thank you for your attention and cooperation.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/CDM/laf

c: The Honorable Scott Slifka, Mayor, Town of West Hartford
Barry M. Feldman, Town Manager, Town of West Hartford
Mila Limson, Town Planner, Town of West Hartford
Hans Fiedler, T-Mobile
Julie Kohler, Esq., Cohen and Wolf P.C.

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ROBINSON & COLE LLP

KENNETH C. BALDWIN

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:d, CT 06103-3597
860) 275-8200
60) 275-8299
win@rc.com
Direct (860) 275-8345

EM-VER-155-100614

ORIGINAL

June 14, 2010

RECEIVED
JUN 14 2010
CONNECTICUT
SITING COUNCIL

Via Hand Delivery

S. Derek Phelps
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Antenna Swap**
457 South Quaker Lane, West Hartford, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains wireless telecommunications antennas at the 100-foot level of the existing 120-foot tower at the above-referenced address. The tower and underlying property are owned by T-Mobile. The Council approved Cellco's use of the tower in TS-VER-155-010417. Cellco now intends to modify its installation by replacing all of its antennas with six (6) model LPA-80080/4CF cellular antennas; three (3) model MG D3800T0 PCS antennas; two (2) model LNX-6514DS-T4M LTE antennas; and one (1) model BXA-70063/6CF LTE antenna, all at the same 100-foot level on the tower. Attached behind Tab 1 are the specifications for the proposed replacement antennas.

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

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 any increase in the height of the existing tower. Cellco's antennas will be located at the same 100-foot level on the existing structure.

2. The proposed modifications will not involve any changes 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.

4. The operation of the replacement antennas will not increase radio frequency (RF) power density levels at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A cumulative power density table for Cellco's modified facility is included behind Tab 2.

Also attached is a Structural Analysis Report confirming that the tower and foundation can support Cellco's proposed antenna and equipment modifications. (See Tab 3).

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

Sincerely,

Kenneth C. Baldwin

Attachments
Copy to:
Scott Slifka, West Hartford Mayor
Sandy M. Carter

Scott Slifka
Mayor
Town of West Hartford
50 South Main Street
West Hartford, CT 06107

Sandy M. Carter
Regulatory Manager
Verizon Wireless
99 East River Drive
East Hartford, CT 06108

Vertically Polarized, Log Periodic 80° / 12.5 dBd

LPA-80080/4CF ___

When ordering replace "___" with connector type.

Mechanical specifications

Length	1200 mm	47.2 in
Width	140 mm	5.5 in
Depth	335 mm	13.2 in
Depth with z-bracket	375 mm	14.8 in
[4] Weight	5.4 kg	12.0 lbs
Wind Area		
Fore/Aft	0.17 m^2	1.8 ft^2
Side	0.40 m^2	4.3 ft^2
Rated Wind Velocity (Safety factor 2.0)	>369 km/hr	>229 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	254 N	57.1 lbs
Side	574 N	129.0 lbs

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

Mounting and Downtilting

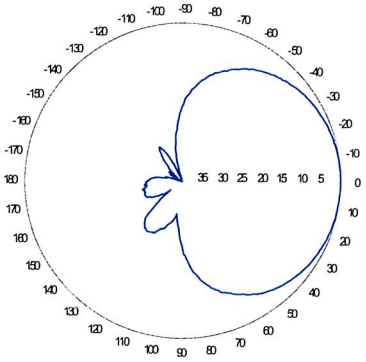
Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in). If the lock-down brace is used, the maximum diameter is Ø88.9 mm (3.5 in).

Mounting Bracket & Downtilt Bracket Kit #21699999

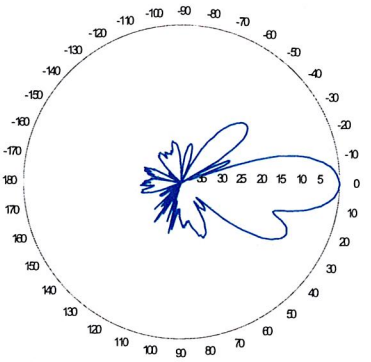
Electrical specifications

Frequency Range	806-960 MHz
Impedance	50Ω
[3] Connector(s)	NE or E-DIN 1 port / center
[1] VSWR	≤ 1.4:1
Polarization	Vertical
[1] Gain	12.5 dBd
[2] Power Rating	500 W
[1] Half Power Angle	
H-Plane	80°
E-Plane	15°
[1] Electrical Downtilt	0°
[1] Null Fill	15%
Lightning Protection	Direct Ground

Radiation pattern[1]



Horizontal

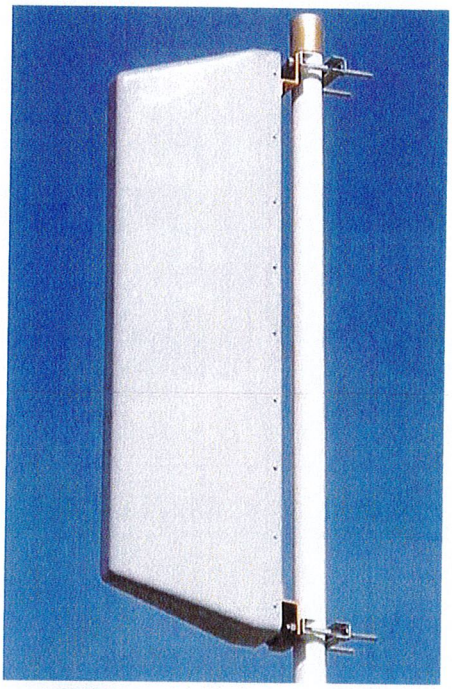


Vertical

Featuring upper side lobe suppression.

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

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



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

- True log-periodic design allows for superior front-to-side characteristics to minimize sector overlap.
- Unique feedline design eliminates the need for conventional solder joints in the signal path.
- A non-collinear system with access to every radiating element for broad band-width and superior performance.
- Air as insulation for virtually no internal signal loss.

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

Antenna available with center-fed connector only.

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

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

CF Denotes a Center-Fed Connector.

806-960 MHz

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

Amphenol Antel, Inc. The Antenna Technology Company

Revision Date: 7/5/07

SINGLE-BAND PANEL ANTENNA

BROADBAND 1700-2170 MHZ

MGD3-800TX

1710-1880	1850-1990	1920-2170
H66° V7.2°	H64° V6.6°	H63° V6.3°
Fixed Tilt 0°2,°4,°6,°	Fixed Tilt 0°2,°4,°6,°	Fixed Tilt 0°2,°4,°6,°

ELECTRICAL SPECIFICATIONS

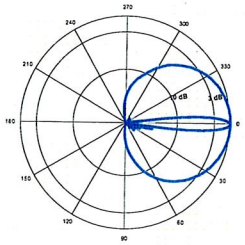
BROADBAND 1710-2170 MHz

Antenna Model	MGD3-800TX		
Polarization	± 45°		
Frequency	1710 - 1880	1850 - 1990	1920 - 2170
Horizontal Beamwidth	66°	64°	63°
Vertical Beamwidth	7.2°	6.6°	6.3°
Gain (dBi)	17.9	18	18.5
Vertical Electrical Tilt	FIXED 0°, 2°, 4°, 6°	FIXED 0°, 2°, 4°, 6°	FIXED 0°, 2°, 4°, 6°
Upper Sidelobe Suppression for the 1st lobe above main beam (dB)	20	20	20
Front-to-Back Ratio /Cpol @ ± 20° (dB)	> 30	> 30	> 30
VSWR	< 1.4 : 1	< 1.4 : 1	< 1.4 : 1
Cross Polar Ratio @ ± 60° (dB)	> 10	> 10	> 10
Isolation Between Ports (dB)	> 30	> 30	> 30
Maximum Power Per Input (W)	250		
Intermodulation (dBc)	< - 150		
Impedance (Ω)	50		

MECHANICAL SPECIFICATIONS

Connectors	2 X 7/16 Female
Connector Position	Bottom
Survival Wind Speed mph (km/h)	124 (200)
Front Windload lbs (N) @ 160 km/h	83 (370)
Lateral Windload lbs (N) @ 160 km/h	38 (170)
Radome Color	Grey, paintable
Temperature Range F (°C)	-67° to 140° (-55° to +60°)
Humidity	100%
Antenna Weight lbs (kg)	15.43 (7)
Antenna Dimension in (mm) H X W X D	53 X 6.29 X 3.54 (1340 X 160 X 90)

H&V Pattern



RYMSA Telecom Group (Headquarters)

RYMSA TELECOM GROUP

www.rymsawireless.com

RYMSA México:

RYMSA Wireless U.S.A.

Product Specifications

ANDREW®
A CommScope Company

LNX-6514DS-T4M

DualPol® Antenna, 698–896 MHz, 65° horizontal beamwidth, fixed electrical tilt

- Broadband, providing future-ready single antenna for application in 700 MHz and existing 850 MHz cellular operation
- Air dielectric design provides superior PIM performance with repeatable antenna-to-antenna gain and pattern consistency
- Single piece radome provides long term mechanical stability
- Proven core design technology, with over 1,000,000 similar antennas deployed
- Exceptional USLS pattern shaping for optimizing coverage and interference mitigation for LTE applications
- Specifically designed to have physical dimensions similar to most existing cellular antennas

CHARACTERISTICS

General Specifications

Antenna Type	DualPol®
Brand	DualPol®
Operating Frequency Band	698 – 896 MHz

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Beamwidth, Horizontal, degrees	66	64
Gain, dBd	13.8	14.5
Gain, dBi	15.9	16.6
Beamwidth, Vertical, degrees	12.0	11.0
Beam Tilt, degrees	4	4
Upper Sidelobe Suppression (USLS), typical, dB	18	18
Front-to-Back Ratio at 180°, dB	33	33
Isolation, dB	30	30
VSWR | Return Loss, db	1.35:1 | 16.5	1.35:1 | 16.5
Intermodulation Products, 3rd Order, 2 x 20 W, dBc	-150	-150
Input Power, maximum, watts	500	500
Polarization	±45°	±45°
Impedance, ohms	50	50
Lightning Protection	dc Ground	dc Ground

Product Specifications

LNX-6514DS-T4M

ANDREW®
A CommScope Company

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Bottom
Connector Quantity	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

Dimensions

Depth	181.0 mm | 7.1 in
Length	1847.0 mm | 72.7 in
Width	301.0 mm | 11.9 in
Net Weight	17.4 kg | 38.4 lb

Regulatory Compliance/Certifications

Agency
RoHS 2002/95/EC
China RoHS SJ/T 11364-2006

Classification
Compliant by Exemption
Above Maximum Concentration Value (MCV)

INCLUDED PRODUCTS

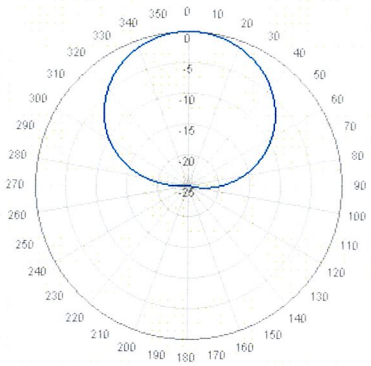
MTG-L-STD
Downtilt Mounting Kit for panel Antennas

Product Specifications

LNX-6514DS-T4M

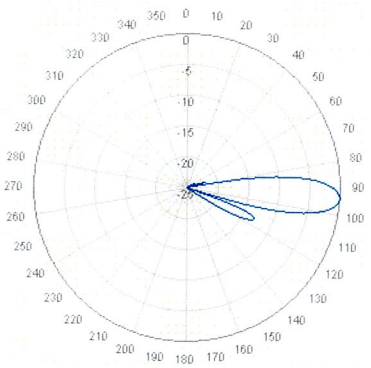
ANDREW®
A CommScope Company

Horizontal Pattern

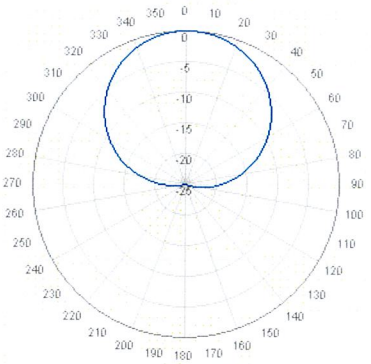


Freq: 750, Tilt 0

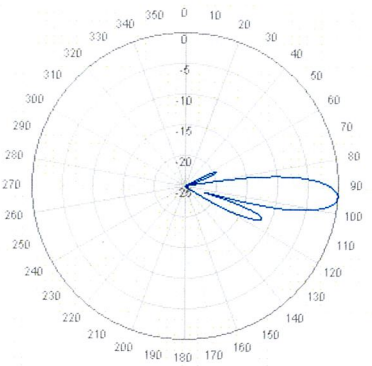
Vertical Pattern



Freq: 750, Tilt 0



Freq: 850, Tilt 0



Freq: 850, Tilt 0

Slant ±45° Dual Polarized FET Panel 63° / 14.5 dBd
696-900 MHz

Mechanical specifications

Length	1804	mm	71.0	in
Width	285	mm	11.2	in
Depth	114	mm	4.5	in
Depth with z-bracket	154	mm	6.1	in
Weight [4]	7.9	kg	17.0	lbs
Wind Area Fore/Aft	0.51	m^2	5.5	ft^2
Wind Area Side	0.21	m^2	2.2	ft^2
Max Wind Survivability	>201	km/hr	>125	mph
Wind Load @ 100 mph (161 km/hr)				
Fore/Aft	753	N	169	lbf
Side	351	N	79	lbf

Antenna consisting of aluminum alloy with brass feedlines covered by a UV safe fiber-glass radome.

Mounting & Downtilting

Mounting hardware attaches to pipe diameter Ø50-160 mm; Ø2.0-6.3 in

Mounting Bracket Kit	36210002
Downtilt Bracket Kit	36114003

Electrical specifications

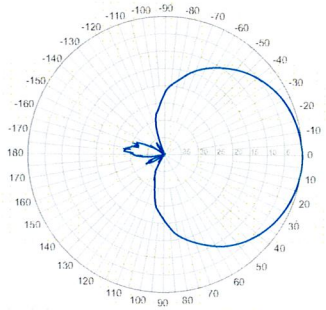
Frequency Range	696-900 MHz
Impedance	50Ω
Connector [3]	NE or E-DIN Female 2 ports / Center
VSWR [1]	≤ 1.35:1
Polarization	Slant ±45°
Isolation Between Ports [1]	< -25 dB
Gain [1]	14.5 dBd 16.5 dBi
Power Rating [2]	500 W
Half Power Angle [1]	
Horizontal Beamwidth	63°
Vertical Beamwidth	11°
Electrical downtilt [5]	0°
Null fill [1]	5%
Lightning protection	Direct ground

Patented Dipole Design: U.S. Patent No. 6,608,600 B2

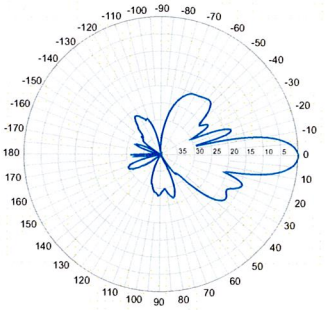
1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) Antenna weight does not include brackets.
5) Add'l downtilts may be available. Check website for details.

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

Radiation-pattern[1]
750 MHz

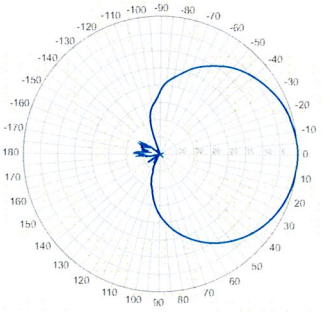


Horizontal

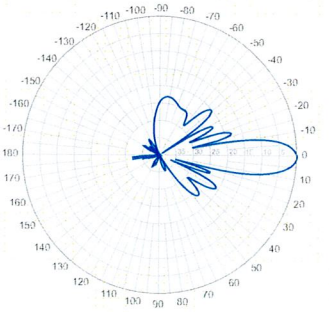


Vertical

850 MHz



Horizontal

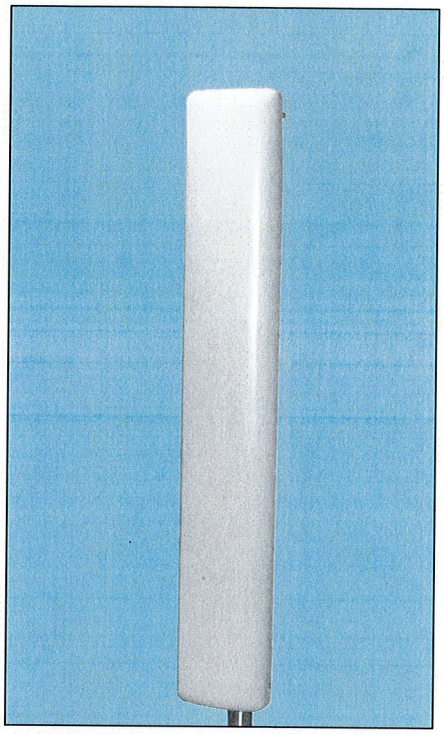


Vertical

696-900 MHz

BXA-70063/6CF __

When ordering replace "__" with connector type.



Featuring our Exclusive 3T Technology™ Antenna Design:

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

Warranty:
This antenna is under a five-year limited warranty for repair or replacement.

Revision Date: 01/08/09

815.399.0001 • antel@antelinc.com • www.antelinc.com

	General	Power	Density					
Site Name: West Hartford 2								
Tower Height: Verizon @ 100Ft.								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*AT&T UMTS	1	500	107	0.0157	880	0.5867	2.68%	
*AT&T GSM	2	427	107	0.0268	1900	1.0000	2.68%	
*AT&T GSM	4	296	107	0.0372	880	0.5867	6.34%	
*Clearwire	2	153	80	0.0172	2496	1.0000	1.72%	
*Clearwire	1	211	80	0.0119	11 GHz	1.0000	1.19%	
*T-Mobile GSM	8	236	120	0.0471	1945	1.0000	4.71%	
*T-Mobile UMTS	2	944	120	0.0471	2100	1.0000	4.71%	
*Pocket	3	631	90	0.0840	2130	1.0000	8.40%	
Verizon	**3**	**433**	**100**	**0.0467**	**1970**	**1.0000**	**4.67%**	
Verizon	**9**	**274**	**100**	**0.0887**	**869**	**0.5793**	**15.31%**	
Verizon	**1**	**736**	**100**	**0.0265**	**757**	**0.4973**	**5.32%**	
								57.73%
* Source: Siting Council								

NATCOMM INC.
CONSULTING ENGINEERS

Structural Analysis Report

120-ft Existing PiROD Monopole

Proposed Verizon Antenna Modification

T-Mobile Site Ref: CT11178D

457 Quaker Lane South
West Hartford, CT

Natcomm Project No. 10003-CO3

Date: March 8, 2010

Prepared for:

T-Mobile Towers
4 Sylvan Way
Parsippany, NJ 07054

p: 203.488.0580
f: 203.488.8587
w: nat-eng.com
63-2 N. Branford Rd.
Branford, CT 06405

Table of Contents

Natcomm, Inc.
Verizon Antenna Upgrade
Structural Analysis – 120-ft PiROD Monopole
West Hartford, CT
March 8, 2010

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna installation/modification proposed by T-Mobile on behalf of Verizon Wireless on the existing monopole (tower) located in West Hartford, Connecticut.

The host tower is a 120-ft, four-section, sixteen sided, tapered monopole originally designed and manufactured by PiROD Inc., eng file no. A-116876, Revision B, dated May 05, 2000. The tower geometry and structure member sizes were obtained from a previous structural report prepared by Natcomm Inc., job no. 10003.CO2 dated February 15, 2010.

The tower is made up of four (4) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 22.27-in at the top and 49.06-in at the base.

Foundation reinforcement information was taken from Natcomm's Reinforcement drawing; 'S-1' prepared by Natcomm, Inc., dated May 29, 2007.

Antenna and Appurtenance information were taken from the aforementioned Natcomm structural report and a T-Mobile structural analysis worksheet dated March 3, 2010.

Verizon Wireless is proposing the replacement of twelve (12) existing panel antennas with twelve (12) new panel antennas mounted on the existing platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna configuration.

Antenna and Appurtenance Summary

The existing tower was designed to support several communication antennas. The existing and proposed loads considered in this analysis consist of the following:

- T-MOBILE (Existing/Reserved):
  Antennas: Twelve (12) EMS RR90-17-00DP panel antennas, twelve (12) TMA's and one (1) 4-ft Dish mounted on an existing 13-ft Low Profile Platform with a RAD center elevation of 120-ft above the existing tower base plate.
  Coax Cables: Twenty-five (25) 1-5/8" ∅ coax cables; (16) existing cables running inside the monopole, (2) existing cables running outside the monopole and (7) reserved cables running outside the monopole.
- AT&T (Existing):
  Antennas: Six (6) Powerwave 7770.00 panel antennas and twelve (12) TMA's mounted on a 13-ft Low Profile Platform with a RAD center elevation of 110-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing monopole.

- VERIZON (Existing to Remain):
  Antennas: One (1) GPS antenna mounted on an existing 13-ft Low Profile Platform with a RAD center elevation of 100-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ and one (1) 7/8" ∅ coax cables running on the inside of the existing monopole.
- POCKET WIRELESS (Existing):
  Antennas: Three (3) Kathrein 742-213 panel antennas flush mounted on a universal tri-bracket assembly at a RAD center elevation of 90-ft above the existing tower base plate.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the outside of the existing monopole.
- CLEARWIRE (Reserved):
  Antennas: Three (3) Argus LLPX310R panel antennas, three (3) Samsung RRUs, and three (3) Dragonwave A-Ant-18G-2 dishes mounted on a universal tri-bracket assembly with an elevation of 80-ft above the existing tower base plate.
  Coax Cables: Three (3) 5/8", three (3) 1/2", three (3) 1/4", and one (1) 5/16" ∅ coax cable running on the outside of the existing monopole.
- VERIZON (Existing to Remove):
  Antennas: Six (6) Antel WPA-80090/4CF and six (6) Andrew DB948F85T2E-M panel antennas mounted on a 13-ft Low Profile Platform with a RAD center elevation of 100-ft above the existing tower base plate.
- **VERIZON (Proposed):**
  Antennas: Six (6) Antel LPA-80080/4CF, three (3) RYMSA MG D3-800TX, two (2) Andrew LNX-6514DS-T4M, one (1) Antel BXA-70063/6CF panel antennas and six (6) RFS FD9R6004/2C-3L diplexers mounted on an existing 13-ft Low Profile Platform with a RAD center elevation of 100-ft above the existing tower base plate.

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 installed within tower, unless noted otherwise.
- A new porthole will not be required.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled RISATower. 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 80 mph basic wind speed (fastest mile) with no ice and 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).

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 tower structure and its components.

Basic Wind Speed:	Hartford; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	West Hartford; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed controls.	
Load Cases:	Load Case 1; 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design on monopoles.	*[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. This load case typically controls the design on lattice towers.	*[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*

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software RISATower. 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 RISATower "Section Capacity Table", this tower was found to be at **60.9%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L4)	0'-32.83'	60.9%	**PASS**

Foundation and Anchors

The existing foundation consists of a 6-ft square reinforced concrete pedestal and 16.5-ft square reinforced concrete pad bearing directly on existing sub grade. The existing foundation was previously reinforced by installing four (4) helical anchor details of which are outlined in design drawing 'S-1' prepared by Natcomm, LLC., dated May 29, 2007 available in Section 4 of this report. The sub-grade conditions used in the analysis of the existing foundation were obtained from Jaworski Geotech, Inc's (JGI) geotechnical report JGI project no. J2075170G, dated April 24, 2007 also available in Section 4 of this report. The monopole tower is connected to the pedestal by means of thirty-three (33) 1-1/4" diameter, A687 anchor bolts embedded approximately 4-ft 3-in into the concrete foundation structure.

Review of the foundation and anchor design consisted of verification of applied loads obtained from the tower design calculations and code checks of allowable stresses:

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

Base Reactions	Vector	Proposed Load (kips/ft-kips)
Base	Shear	**23**
	Axial	**30**
	Moment	**1808**

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 FS[1]	Proposed Loading FS[1]	Result
Reinf. Conc. Pad and Pier w/ Rock Anchors	OTM[2]	2.0	2.25	**PASS**

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

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Compression	81.0%	**PASS**
Base Plate	Bending	29.4%	**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 T-Mobile. If the existing conditions are different than the information in this report, Natcomm, 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, EIT
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:

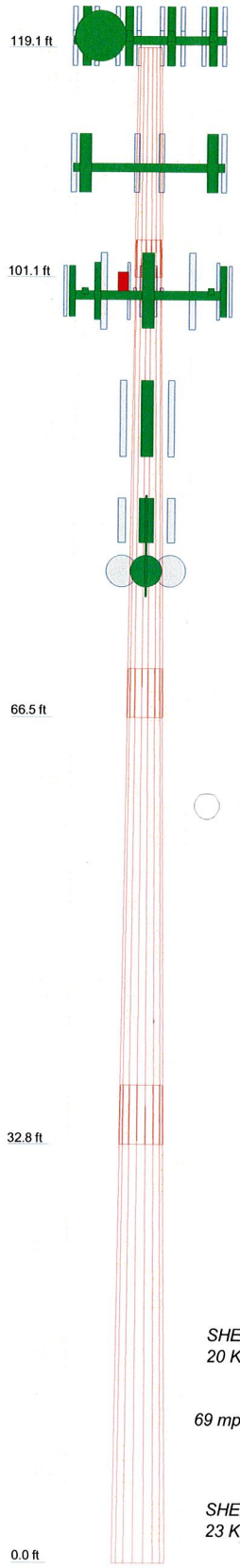
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Natcomm, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provide to Natcomm, 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. Natcomm, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

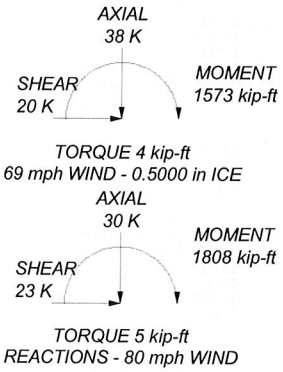
RISATower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, RISATower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

RISATower Features:

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



Section	Length (ft)	Number of Sides	Thickness (in)	Lap Splice (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	18.00	16	0.2500	2.92	22.2700	26.0000		1.2
2	37.50	16	0.3125	3.83	24.8949	34.0625		3.7
3	37.50	16	0.3750	4.67	32.5012	41.7500	A572-65	5.6
4	37.50	16	0.3750		39.8482	49.0625		6.7
								17.2



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Valmont 13' Low Profile Platform (T-Mobile)	120	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	100
(4) RR90-17-00DP (T-Mobile)	120	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	100
(4) RR90-17-00DP (T-Mobile)	120	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	100
(4) RR90-17-00DP (T-Mobile)	120	GPS (Verizon)	100
(4) TMA 10"x8"x3" (T-Mobile)	120	Valmont 13' Low Profile Platform (Verizon)	100
(4) TMA 10"x8"x3" (T-Mobile)	120	742-213 (Pocket)	90
(4) TMA 10"x8"x3" (T-Mobile)	120	742-213 (Pocket)	90
4 FT DISH (T-Mobile)	120	Uni-Tri Bracket (Pocket)	90
(2) 7770.00 (ATI)	110	742-213 (Pocket)	90
(2) 7770.00 (ATI)	110	LLPX310R (Clearwire - Reserved)	80
(2) 7770.00 (ATI)	110	LLPX310R (Clearwire - Reserved)	80
(4) TMA 10"x8"x3" (ATI)	110	RRU (Clearwire - Reserved)	80
(4) TMA 10"x8"x3" (ATI)	110	RRU (Clearwire - Reserved)	80
(4) TMA 10"x8"x3" (ATI)	110	RRU (Clearwire - Reserved)	80
Valmont 13' Low Profile Platform (ATI)	110	Uni-Tri Bracket (Clearwire - Reserved)	80
LPA-80080-4CF (Verizon - Proposed)	100	Uni-Tri Bracket (Clearwire - Reserved)	80
LNX-6514DS-T4M (Verizon - Proposed)	100	8'x2 1/2" Pipe Mount (Clearwire - Reserved)	80
MG D3-800T0 (Verizon - Proposed)	100	8'x2 1/2" Pipe Mount (Clearwire - Reserved)	80
LPA-80080-4CF (Verizon - Proposed)	100	8'x2 1/2" Pipe Mount (Clearwire - Reserved)	80
LPA-80080-4CF (Verizon - Proposed)	100	LLPX310R (Clearwire - Reserved)	80
LNX-6514DS-T4M (Verizon - Proposed)	100	ANT-18G-2-C (Clearwire - Reserved)	80
MG D3-800T0 (Verizon - Proposed)	100	ANT-18G-2-C (Clearwire - Reserved)	80
LPA-80080-4CF (Verizon - Proposed)	100	ANT-18G-2-C (Clearwire - Reserved)	80
LPA-80080-4CF (Verizon - Proposed)	100		
BXA-70063/6CF (Verizon - Proposed)	100		
MG D3-800T0 (Verizon - Proposed)	100		
LPA-80080-4CF (Verizon - Proposed)	100		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. TOWER RATING: 60.9%

NATCOMM
63-2 N. Branford Rd.
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587

Job:	**120' PiROD Monopole**		
Project:	**457 Quaker Lane South, West Hartford, CT**		
Client: T-Mobile (Verizon)		Drawn by: TJL	App'd:
Code: TIA/EIA-222-F		Date: 03/08/10	Scale: NTS
Path: J:\Jobs\1000300.WTC03 - Verizon; Quaker Lane South, West Hartford, CT\Cad\ERI Files\120' PiROD Monopole W Hartford, CT.eri			Dwg No. E-1

RISATower	Job	Page
	120' PiROD Monopole	1 of 21
NATCOMM 63-2 N. Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project 457 Quaker Lane South, West Hartford, CT	Date 16:14:40 03/08/10
	Client T-Mobile (Verizon)	Designed by TJL

Tower Input Data

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

Basic wind speed of 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 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.
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	119.08-101.08	18.00	2.92	16	22.2700	26.0000	0.2500	1.0000	A572-65 (65 ksi)
L2	101.08-66.50	37.50	3.83	16	24.8949	34.0625	0.3125	1.2500	A572-65 (65 ksi)
L3	66.50-32.83	37.50	4.67	16	32.5012	41.7500	0.3750	1.5000	A572-65 (65 ksi)
L4	32.83-0.00	37.50		16	39.8482	49.0625	0.3750	1.5000	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	22.7063	17.5609	1075.7144	7.8391	11.3577	94.7123	2167.7165	8.6830	3.9342	15.737
	26.5094	20.5356	1720.1913	9.1670	13.2600	129.7279	3466.4285	10.1538	4.6765	18.706
L2	26.1105	24.5056	1870.8049	8.7513	12.6964	147.3492	3769.9360	12.1167	4.3322	13.863
	34.7298	33.6445	4841.4606	12.0150	17.3719	278.6953	9756.2268	16.6354	6.1566	19.701
L3	34.1010	38.4309	5010.8770	11.4369	16.5756	302.3043	10097.6248	19.0021	5.7215	15.257
	42.5679	49.4948	10704.1044	14.7295	21.2925	502.7171	21570.2819	24.4726	7.5620	20.165
L4	41.7989	47.2198	9294.8799	14.0525	20.3226	457.3669	18730.4955	23.3477	7.1835	19.156
	50.0237	58.2424	17441.6971	17.3328	25.0219	697.0580	35147.4826	28.7978	9.0172	24.046

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 119.08-101.08				1	1	1		
L2 101.08-66.50				1	1	1		
L3 66.50-32.83				1	1	1		
L4 32.83-0.00				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 plf
1 5/8 (T-Mobile)	C	No	Inside Pole	119.08 - 3.00	16	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (AT&T)	B	No	Inside Pole	110.00 - 3.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon)	A	No	Inside Pole	100.00 - 3.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
7/8 (Verizon)	A	No	Inside Pole	100.00 - 3.00	1	No Ice	0.00	0.54
						1/2" Ice	0.00	0.54
LCF158-50J (1 5/8 FOAM) (Pocket)	B	No	CaAa (Out Of Face)	90.00 - 3.00	1	No Ice	0.20	0.92
						1/2" Ice	0.30	2.45
LCF158-50J (1 5/8 FOAM) (Pocket)	B	No	CaAa (Out Of Face)	90.00 - 3.00	5	No Ice	0.00	0.92
						1/2" Ice	0.00	2.45
FSJ4-50B (1/2 SUFERFLEX. FOAM) (Clearwire - Reserved)	A	No	CaAa (Out Of Face)	80.00 - 3.00	1	No Ice	0.05	0.14
						1/2" Ice	0.15	0.76
FSJ4-50B (1/2 SUFERFLEX. FOAM) (Clearwire - Reserved)	A	No	CaAa (Out Of Face)	80.00 - 3.00	2	No Ice	0.00	0.14
						1/2" Ice	0.00	0.76
HJ4.5-50 (5/8 AIR) (Clearwire - Reserved)	A	No	CaAa (Out Of Face)	80.00 - 3.00	1	No Ice	0.09	0.40
						1/2" Ice	0.19	1.24
HJ4.5-50 (5/8 AIR) (Clearwire - Reserved)	A	No	CaAa (Out Of Face)	80.00 - 3.00	2	No Ice	0.00	0.40
						1/2" Ice	0.00	1.24
FSJ1-50A (1/4) (Clearwire - Reserved)	A	No	CaAa (Out Of Face)	80.00 - 3.00	1	No Ice	0.13	0.10
						1/2" Ice	0.23	1.17
FSJ1-50A (1/4) (Clearwire - Reserved)	A	No	CaAa (Out Of Face)	80.00 - 3.00	2	No Ice	0.00	0.10
						1/2" Ice	0.00	1.17

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
9207 (5/16 FOEM) (Clearwire - Reserved)	A	No	CaAa (Out Of Face)	80.00 - 3.00	1	No Ice	0.00	1.00
						1/2" Ice	0.10	1.32
1 5/8 (T-Mobile)	C	No	CaAa (Out Of Face)	119.08 - 3.00	2	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (T-Mobile)	C	No	CaAa (Out Of Face)	119.08 - 3.00	7	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55

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	119.08-101.08	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.11
		C	0.000	0.000	0.000	7.128	0.47
L2	101.08-66.50	A	0.000	0.000	0.000	3.618	0.48
		B	0.000	0.000	0.000	4.723	0.56
		C	0.000	0.000	0.000	13.694	0.90
L3	66.50-32.83	A	0.000	0.000	0.000	9.024	0.54
		B	0.000	0.000	0.000	6.768	0.61
		C	0.000	0.000	0.000	13.333	0.88
L4	32.83-0.00	A	0.000	0.000	0.000	7.995	0.48
		B	0.000	0.000	0.000	5.996	0.54
		C	0.000	0.000	0.000	11.813	0.78

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	119.08-101.08	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.11
		C		0.000	0.000	0.000	10.728	0.71
L2	101.08-66.50	A	0.500	0.000	0.000	0.000	9.018	0.58
		B		0.000	0.000	0.000	7.073	0.78
		C		0.000	0.000	0.000	20.609	1.37
L3	66.50-32.83	A	0.500	0.000	0.000	0.000	22.492	0.80
		B		0.000	0.000	0.000	10.135	0.92
		C		0.000	0.000	0.000	20.067	1.33
L4	32.83-0.00	A	0.500	0.000	0.000	0.000	19.927	0.71
		B		0.000	0.000	0.000	8.979	0.81
		C		0.000	0.000	0.000	17.778	1.18

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Valmont 13' Low Profile Platform (T-Mobile)	C	None		0.0000	120.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
(4) RR90-17-00DP (T-Mobile)	A	From Face	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
(4) RR90-17-00DP (T-Mobile)	B	From Face	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
(4) RR90-17-00DP (T-Mobile)	C	From Face	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
(4) TMA 10"x8"x3" (T-Mobile)	A	From Face	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	0.78 0.90	0.29 0.38	0.02 0.02
(4) TMA 10"x8"x3" (T-Mobile)	B	From Face	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	0.78 0.90	0.29 0.38	0.02 0.02
(4) TMA 10"x8"x3" (T-Mobile)	C	From Face	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	0.78 0.90	0.29 0.38	0.02 0.02
Valmont 13' Low Profile Platform (AT&T)	C	None		0.0000	110.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
(2) 7770.00 (AT&T)	A	From Face	3.00 0.00 0.00	0.0000	110.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
(2) 7770.00 (AT&T)	B	From Face	3.00 0.00 0.00	0.0000	110.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
(2) 7770.00 (AT&T)	C	From Face	3.00 0.00 0.00	0.0000	110.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
(4) TMA 10"x8"x3" (AT&T)	A	From Face	3.00 0.00 0.00	0.0000	110.00	No Ice 1/2" Ice	0.00 0.00	0.29 0.38	0.02 0.02
(4) TMA 10"x8"x3" (AT&T)	B	From Face	3.00 0.00 0.00	0.0000	110.00	No Ice 1/2" Ice	0.00 0.00	0.29 0.38	0.02 0.02
(4) TMA 10"x8"x3" (AT&T)	C	From Face	3.00 0.00 0.00	0.0000	110.00	No Ice 1/2" Ice	0.00 0.00	0.29 0.38	0.02 0.02
Valmont 13' Low Profile Platform (Verizon)	C	None		0.0000	100.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
LPA-80080-4CF (Verizon - Proposed)	A	From Face	3.00 -6.00 0.00	0.0000	100.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LNX-6514DS-T4M (Verizon - Proposed)	A	From Face	3.00 0.00 0.00	0.0000	100.00	No Ice 1/2" Ice	8.41 8.96	5.41 5.86	0.04 0.09
MG D3-800T0 (Verizon - Proposed)	A	From Face	3.00 4.00 0.00	0.0000	100.00	No Ice 1/2" Ice	3.45 3.80	2.22 2.55	0.02 0.04
LPA-80080-4CF (Verizon - Proposed)	A	From Face	3.00 6.00 0.00	0.0000	100.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
LPA-80080-4CF	B	From Face	3.00	0.0000	100.00	No Ice	2.62	6.06	0.01
(Verizon - Proposed)			-6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
LNX-6514DS-T4M	B	From Face	3.00	0.0000	100.00	No Ice	8.41	5.41	0.04
(Verizon - Proposed)			0.00			1/2" Ice	8.96	5.86	0.09
			0.00						
MG D3-800T0	B	From Face	3.00	0.0000	100.00	No Ice	3.45	2.22	0.02
(Verizon - Proposed)			4.00			1/2" Ice	3.80	2.55	0.04
			0.00						
LPA-80080-4CF	B	From Face	3.00	0.0000	100.00	No Ice	2.62	6.06	0.01
(Verizon - Proposed)			6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
LPA-80080-4CF	C	From Face	3.00	0.0000	100.00	No Ice	2.62	6.06	0.01
(Verizon - Proposed)			-6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
BXA-70063/6CF	C	From Face	3.00	0.0000	100.00	No Ice	7.73	3.76	0.02
(Verizon - Proposed)			0.00			1/2" Ice	8.27	4.19	0.06
			0.00						
MG D3-800T0	C	From Face	3.00	0.0000	100.00	No Ice	3.45	2.22	0.02
(Verizon - Proposed)			4.00			1/2" Ice	3.80	2.55	0.04
			0.00						
LPA-80080-4CF	C	From Face	3.00	0.0000	100.00	No Ice	2.62	6.06	0.01
(Verizon - Proposed)			6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
(2) FD9R6004/2C-3L	A	From Face	3.00	0.0000	100.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Proposed)			0.00						
(2) FD9R6004/2C-3L	B	From Face	3.00	0.0000	100.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Proposed)			0.00						
(2) FD9R6004/2C-3L	C	From Face	3.00	0.0000	100.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Proposed)			0.00						
GPS	C	From Face	3.00	0.0000	100.00	No Ice	1.00	1.00	0.01
(Verizon)			2.00			1/2" Ice	1.50	1.50	0.01
			0.00						
742-213	A	From Face	1.00	0.0000	90.00	No Ice	5.14	2.87	0.02
(Pocket)			0.00			1/2" Ice	5.61	3.48	0.05
			0.00						
742-213	B	From Face	1.00	0.0000	90.00	No Ice	5.14	2.87	0.02
(Pocket)			0.00			1/2" Ice	5.61	3.48	0.05
			0.00						
742-213	C	From Face	1.00	0.0000	90.00	No Ice	5.14	2.87	0.02
(Pocket)			0.00			1/2" Ice	5.61	3.48	0.05
			0.00						
Uni-Tri Bracket	C	None		0.0000	90.00	No Ice	1.75	1.75	0.29
(Pocket)						1/2" Ice	1.94	1.94	0.31
LLPX310R	A	From Face	1.00	0.0000	80.00	No Ice	5.32	1.95	0.03
(Clearwire - Reserved)			0.00			1/2" Ice	5.68	2.21	0.06
			2.00						
LLPX310R	B	From Face	1.00	0.0000	80.00	No Ice	5.32	1.95	0.03
(Clearwire - Reserved)			0.00			1/2" Ice	5.68	2.21	0.06
			2.00						
LLPX310R	C	From Face	1.00	0.0000	80.00	No Ice	5.32	1.95	0.03
(Clearwire - Reserved)			0.00			1/2" Ice	5.68	2.21	0.06
			2.00						
RRU	A	From Face	1.00	0.0000	80.00	No Ice	1.80	0.78	0.03

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
(Clearwire - Reserved)			0.00 0.00			1/2" Ice	2.00	0.92	0.04
RRU	A	From Face	1.00	0.0000	80.00	No Ice	1.80	0.78	0.03
(Clearwire - Reserved)			0.00 0.00			1/2" Ice	2.00	0.92	0.04
RRU	A	From Face	1.00	0.0000	80.00	No Ice	1.80	0.78	0.03
(Clearwire - Reserved)			0.00 0.00			1/2" Ice	2.00	0.92	0.04
Uni-Tri Bracket	C	None		0.0000	80.00	No Ice	1.75	1.75	0.29
(Clearwire - Reserved)						1/2" Ice	1.94	1.94	0.31
Uni-Tri Bracket	C	None		0.0000	80.00	No Ice	1.75	1.75	0.29
(Clearwire - Reserved)						1/2" Ice	1.94	1.94	0.31
8'x2 1/2" Pipe Mount	A	None		0.0000	80.00	No Ice	2.30	2.30	0.04
(Clearwire - Reserved)						1/2" Ice	3.13	3.13	0.06
8'x2 1/2" Pipe Mount	B	None		0.0000	80.00	No Ice	2.30	2.30	0.04
(Clearwire - Reserved)						1/2" Ice	3.13	3.13	0.06
8'x2 1/2" Pipe Mount	C	None		0.0000	80.00	No Ice	2.30	2.30	0.04
(Clearwire - Reserved)						1/2" Ice	3.13	3.13	0.06

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
4 FT DISH	C	Paraboloid w/o	From	4.00	Worst		120.00	4.00	No Ice	12.56	0.17
(T-Mobile)		Radome	Face	4.00 0.00					1/2" Ice	13.09	0.24
ANT-18G-2-C	A	Paraboloid	From	1.00	Worst		80.00	2.50	No Ice	4.91	0.04
(Clearwire -		w/Radome	Face	0.00					1/2" Ice	5.24	0.07
Reserved)				-2.00							
ANT-18G-2-C	B	Paraboloid	From	1.00	Worst		80.00	2.50	No Ice	4.91	0.04
(Clearwire -		w/Radome	Face	0.00					1/2" Ice	5.24	0.07
Reserved)				-2.00							
ANT-18G-2-C	C	Paraboloid	From	1.00	Worst		80.00	2.50	No Ice	4.91	0.04
(Clearwire -		w/Radome	Face	0.00					1/2" Ice	5.24	0.07
Reserved)				-2.00							

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 119.08-101.08	109.85	1.41	23	36.203	A	0.000	36.203	36.203	100.00	0.000	0.000
					B	0.000	36.203		100.00	0.000	0.000
					C	0.000	36.203		100.00	0.000	7.128
L2 101.08-66.50	83.23	1.303	21	85.976	A	0.000	85.976	85.976	100.00	0.000	3.618
					B	0.000	85.976		100.00	0.000	4.723
					C	0.000	85.976		100.00	0.000	13.694
L3 66.50-32.83	49.46	1.123	18	105.493	A	0.000	105.493	105.493	100.00	0.000	9.024
					B	0.000	105.493		100.00	0.000	6.768
					C	0.000	105.493		100.00	0.000	13.333
L4 32.83-0.00	15.92	1	16	123.192	A	0.000	123.192	123.192	100.00	0.000	7.995
					B	0.000	123.192		100.00	0.000	5.996
					C	0.000	123.192		100.00	0.000	11.813

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 119.08-101.08	109.85	1.41	17	0.5000	37.703	A	0.000	37.703	37.703	100.00	0.000	0.000
						B	0.000	37.703		100.00	0.000	0.000
						C	0.000	37.703		100.00	0.000	10.728
L2 101.08-66.50	83.23	1.303	16	0.5000	88.858	A	0.000	88.858	88.858	100.00	0.000	9.018
						B	0.000	88.858		100.00	0.000	7.073
						C	0.000	88.858		100.00	0.000	20.609
L3 66.50-32.83	49.46	1.123	14	0.5000	108.299	A	0.000	108.299	108.299	100.00	0.000	22.492
						B	0.000	108.299		100.00	0.000	10.135
						C	0.000	108.299		100.00	0.000	20.067
L4 32.83-0.00	15.92	1	12	0.5000	125.928	A	0.000	125.928	125.928	100.00	0.000	19.927
						B	0.000	125.928		100.00	0.000	8.979
						C	0.000	125.928		100.00	0.000	17.778

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 119.08-101.08	109.85	1.41	9	36.203	A	0.000	36.203	36.203	100.00	0.000	0.000
					B	0.000	36.203		100.00	0.000	0.000
					C	0.000	36.203		100.00	0.000	7.128
L2 101.08-66.50	83.23	1.303	8	85.976	A	0.000	85.976	85.976	100.00	0.000	3.618
					B	0.000	85.976		100.00	0.000	4.723
					C	0.000	85.976		100.00	0.000	13.694
L3 66.50-32.83	49.46	1.123	7	105.493	A	0.000	105.493	105.493	100.00	0.000	9.024
					B	0.000	105.493		100.00	0.000	6.768
					C	0.000	105.493		100.00	0.000	13.333
L4 32.83-0.00	15.92	1	6	123.192	A	0.000	123.192	123.192	100.00	0.000	7.995

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
					B	0.000	123.192		100.00	0.000	5.996
					C	0.000	123.192		100.00	0.000	11.813

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 119.08-101.08	0.58	1.17	A	1	0.964	1	1	1	36.203	1.64	91.16	C
			B	1	0.964	1	1	1	36.203			
			C	1	0.964	1	1	1	36.203			
L2 101.08-66.50	1.94	3.71	A	1	0.963	1	1	1	85.976	3.77	109.09	C
			B	1	0.963	1	1	1	85.976			
			C	1	0.963	1	1	1	85.976			
L3 66.50-32.83	2.02	5.61	A	1	0.968	1	1	1	105.493	4.06	120.53	C
			B	1	0.968	1	1	1	105.493			
			C	1	0.968	1	1	1	105.493			
L4 32.83-0.00	1.79	6.73	A	1	0.987	1	1	1	123.192	4.08	124.28	C
			B	1	0.987	1	1	1	123.192			
			C	1	0.987	1	1	1	123.192			
Sum Weight:	6.32	17.22						OTM	759.90 kip-ft	13.55		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 119.08-101.08	0.58	1.17	A	1	0.964	1	1	1	36.203	1.64	91.16	C
			B	1	0.964	1	1	1	36.203			
			C	1	0.964	1	1	1	36.203			
L2 101.08-66.50	1.94	3.71	A	1	0.963	1	1	1	85.976	3.77	109.09	C
			B	1	0.963	1	1	1	85.976			
			C	1	0.963	1	1	1	85.976			
L3 66.50-32.83	2.02	5.61	A	1	0.968	1	1	1	105.493	4.06	120.53	C
			B	1	0.968	1	1	1	105.493			
			C	1	0.968	1	1	1	105.493			
L4 32.83-0.00	1.79	6.73	A	1	0.987	1	1	1	123.192	4.08	124.28	C
			B	1	0.987	1	1	1	123.192			
			C	1	0.987	1	1	1	123.192			
Sum Weight:	6.32	17.22						OTM	759.90 kip-ft	13.55		

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 plf	Ctrl. Face
L1 119.08-101.08	0.58	1.17	A	1	0.964	1	1	1	36.203	1.64	91.16	C
			B	1	0.964	1	1	1	36.203			
			C	1	0.964	1	1	1	36.203			
L2 101.08-66.50	1.94	3.71	A	1	0.963	1	1	1	85.976	3.77	109.09	C
			B	1	0.963	1	1	1	85.976			
			C	1	0.963	1	1	1	85.976			
L3 66.50-32.83	2.02	5.61	A	1	0.968	1	1	1	105.493	4.06	120.53	C
			B	1	0.968	1	1	1	105.493			
			C	1	0.968	1	1	1	105.493			
L4 32.83-0.00	1.79	6.73	A	1	0.987	1	1	1	123.192	4.08	124.28	C
			B	1	0.987	1	1	1	123.192			
			C	1	0.987	1	1	1	123.192			
Sum Weight:	6.32	17.22						OTM	759.90 kip-ft	13.55		

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 plf	Ctrl. Face
L1 119.08-101.08	0.58	1.17	A	1	0.964	1	1	1	36.203	1.64	91.16	C
			B	1	0.964	1	1	1	36.203			
			C	1	0.964	1	1	1	36.203			
L2 101.08-66.50	1.94	3.71	A	1	0.963	1	1	1	85.976	3.77	109.09	C
			B	1	0.963	1	1	1	85.976			
			C	1	0.963	1	1	1	85.976			
L3 66.50-32.83	2.02	5.61	A	1	0.968	1	1	1	105.493	4.06	120.53	C
			B	1	0.968	1	1	1	105.493			
			C	1	0.968	1	1	1	105.493			
L4 32.83-0.00	1.79	6.73	A	1	0.987	1	1	1	123.192	4.08	124.28	C
			B	1	0.987	1	1	1	123.192			
			C	1	0.987	1	1	1	123.192			
Sum Weight:	6.32	17.22						OTM	759.90 kip-ft	13.55		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 119.08-101.08	0.82	1.44	A	1	0.964	1	1	1	37.703	1.38	76.57	C
			B	1	0.964	1	1	1	37.703			
			C	1	0.964	1	1	1	37.703			
L2 101.08-66.50	2.73	4.36	A	1	0.963	1	1	1	88.858	3.30	95.43	C
			B	1	0.963	1	1	1	88.858			
			C	1	0.963	1	1	1	88.858			
L3 66.50-32.83	3.05	6.41	A	1	0.968	1	1	1	108.299	3.65	108.50	C
			B	1	0.968	1	1	1	108.299			
			C	1	0.968	1	1	1	108.299			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L4 32.83-0.00	2.70	7.66	A	1	0.987	1	1	1	125.928	3.55	108.13	C
			B	1	0.987	1	1	1	125.928			
			C	1	0.987	1	1	1	125.928			
Sum Weight:	9.31	19.86						OTM	663.28 kip-ft	11.88		

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 plf	Ctrl. Face
L1 119.08-101.08	0.82	1.44	A	1	0.964	1	1	1	37.703	1.38	76.57	C
			B	1	0.964	1	1	1	37.703			
			C	1	0.964	1	1	1	37.703			
L2 101.08-66.50	2.73	4.36	A	1	0.963	1	1	1	88.858	3.30	95.43	C
			B	1	0.963	1	1	1	88.858			
			C	1	0.963	1	1	1	88.858			
L3 66.50-32.83	3.05	6.41	A	1	0.968	1	1	1	108.299	3.65	108.50	C
			B	1	0.968	1	1	1	108.299			
			C	1	0.968	1	1	1	108.299			
L4 32.83-0.00	2.70	7.66	A	1	0.987	1	1	1	125.928	3.55	108.13	C
			B	1	0.987	1	1	1	125.928			
			C	1	0.987	1	1	1	125.928			
Sum Weight:	9.31	19.86						OTM	663.28 kip-ft	11.88		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 119.08-101.08	0.82	1.44	A	1	0.964	1	1	1	37.703	1.38	76.57	C
			B	1	0.964	1	1	1	37.703			
			C	1	0.964	1	1	1	37.703			
L2 101.08-66.50	2.73	4.36	A	1	0.963	1	1	1	88.858	3.30	95.43	C
			B	1	0.963	1	1	1	88.858			
			C	1	0.963	1	1	1	88.858			
L3 66.50-32.83	3.05	6.41	A	1	0.968	1	1	1	108.299	3.65	108.50	C
			B	1	0.968	1	1	1	108.299			
			C	1	0.968	1	1	1	108.299			
L4 32.83-0.00	2.70	7.66	A	1	0.987	1	1	1	125.928	3.55	108.13	C
			B	1	0.987	1	1	1	125.928			
			C	1	0.987	1	1	1	125.928			
Sum Weight:	9.31	19.86						OTM	663.28 kip-ft	11.88		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 119.08-101.08	0.82	1.44	A	1	0.964	1	1	1	37.703	1.38	76.57	C
			B	1	0.964	1	1	1	37.703			
			C	1	0.964	1	1	1	37.703			
L2 101.08-66.50	2.73	4.36	A	1	0.963	1	1	1	88.858	3.30	95.43	C
			B	1	0.963	1	1	1	88.858			
			C	1	0.963	1	1	1	88.858			
L3 66.50-32.83	3.05	6.41	A	1	0.968	1	1	1	108.299	3.65	108.50	C
			B	1	0.968	1	1	1	108.299			
			C	1	0.968	1	1	1	108.299			
L4 32.83-0.00	2.70	7.66	A	1	0.987	1	1	1	125.928	3.55	108.13	C
			B	1	0.987	1	1	1	125.928			
			C	1	0.987	1	1	1	125.928			
Sum Weight:	9.31	19.86						OTM	663.28 kip-ft	11.88		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 119.08-101.08	0.58	1.17	A	1	0.964	1	1	1	36.203	0.64	35.61	C
			B	1	0.964	1	1	1	36.203			
			C	1	0.964	1	1	1	36.203			
L2 101.08-66.50	1.94	3.71	A	1	0.963	1	1	1	85.976	1.47	42.61	C
			B	1	0.963	1	1	1	85.976			
			C	1	0.963	1	1	1	85.976			
L3 66.50-32.83	2.02	5.61	A	1	0.968	1	1	1	105.493	1.59	47.08	C
			B	1	0.968	1	1	1	105.493			
			C	1	0.968	1	1	1	105.493			
L4 32.83-0.00	1.79	6.73	A	1	0.987	1	1	1	123.192	1.59	48.55	C
			B	1	0.987	1	1	1	123.192			
			C	1	0.987	1	1	1	123.192			
Sum Weight:	6.32	17.22						OTM	296.83 kip-ft	5.29		

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 plf	Ctrl. Face
L1 119.08-101.08	0.58	1.17	A	1	0.964	1	1	1	36.203	0.64	35.61	C
			B	1	0.964	1	1	1	36.203			
			C	1	0.964	1	1	1	36.203			
L2 101.08-66.50	1.94	3.71	A	1	0.963	1	1	1	85.976	1.47	42.61	C
			B	1	0.963	1	1	1	85.976			
			C	1	0.963	1	1	1	85.976			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L3 66.50-32.83	2.02	5.61	A	1	0.968	1	1	1	105.493	1.59	47.08	C
			B	1	0.968	1	1	1	105.493			
			C	1	0.968	1	1	1	105.493			
L4 32.83-0.00	1.79	6.73	A	1	0.987	1	1	1	123.192	1.59	48.55	C
			B	1	0.987	1	1	1	123.192			
			C	1	0.987	1	1	1	123.192			
Sum Weight:	6.32	17.22						OTM	296.83 kip-ft	5.29		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 119.08-101.08	0.58	1.17	A	1	0.964	1	1	1	36.203	0.64	35.61	C
			B	1	0.964	1	1	1	36.203			
			C	1	0.964	1	1	1	36.203			
L2 101.08-66.50	1.94	3.71	A	1	0.963	1	1	1	85.976	1.47	42.61	C
			B	1	0.963	1	1	1	85.976			
			C	1	0.963	1	1	1	85.976			
L3 66.50-32.83	2.02	5.61	A	1	0.968	1	1	1	105.493	1.59	47.08	C
			B	1	0.968	1	1	1	105.493			
			C	1	0.968	1	1	1	105.493			
L4 32.83-0.00	1.79	6.73	A	1	0.987	1	1	1	123.192	1.59	48.55	C
			B	1	0.987	1	1	1	123.192			
			C	1	0.987	1	1	1	123.192			
Sum Weight:	6.32	17.22						OTM	296.83 kip-ft	5.29		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 119.08-101.08	0.58	1.17	A	1	0.964	1	1	1	36.203	0.64	35.61	C
			B	1	0.964	1	1	1	36.203			
			C	1	0.964	1	1	1	36.203			
L2 101.08-66.50	1.94	3.71	A	1	0.963	1	1	1	85.976	1.47	42.61	C
			B	1	0.963	1	1	1	85.976			
			C	1	0.963	1	1	1	85.976			
L3 66.50-32.83	2.02	5.61	A	1	0.968	1	1	1	105.493	1.59	47.08	C
			B	1	0.968	1	1	1	105.493			
			C	1	0.968	1	1	1	105.493			
L4 32.83-0.00	1.79	6.73	A	1	0.987	1	1	1	123.192	1.59	48.55	C
			B	1	0.987	1	1	1	123.192			
			C	1	0.987	1	1	1	123.192			
Sum Weight:	6.32	17.22						OTM	296.83 kip-ft	5.29		

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	17.22					
Bracing Weight	0.00					
Total Member Self-Weight	17.22			0.68	0.90	
Total Weight	30.17			0.68	0.90	
Wind 0 deg - No Ice		-0.05	-23.10	-1764.38	4.70	-3.59
Wind 30 deg - No Ice		11.52	-19.98	-1526.01	-878.70	-1.14
Wind 45 deg - No Ice		16.31	-16.30	-1244.72	-1245.00	0.24
Wind 60 deg - No Ice		20.00	-11.51	-878.56	-1526.40	1.61
Wind 90 deg - No Ice		23.12	0.05	4.49	-1764.87	3.93
Wind 120 deg - No Ice		20.04	11.59	886.51	-1530.21	5.20
Wind 135 deg - No Ice		16.38	16.37	1251.46	-1250.38	5.31
Wind 150 deg - No Ice		11.60	20.03	1531.18	-885.28	5.07
Wind 180 deg - No Ice		0.05	23.10	1765.75	-2.91	3.59
Wind 210 deg - No Ice		-11.52	19.98	1527.37	880.49	1.14
Wind 225 deg - No Ice		-16.31	16.30	1246.09	1246.79	-0.24
Wind 240 deg - No Ice		-20.00	11.51	879.92	1528.20	-1.61
Wind 270 deg - No Ice		-23.12	-0.05	-3.12	1766.66	-3.93
Wind 300 deg - No Ice		-20.04	-11.59	-885.14	1532.00	-5.20
Wind 315 deg - No Ice		-16.38	-16.37	-1250.09	1252.17	-5.31
Wind 330 deg - No Ice		-11.60	-20.03	-1529.81	887.07	-5.07
Member Ice	2.65					
Total Weight Ice	38.49			0.96	1.26	
Wind 0 deg - Ice		-0.04	-20.06	-1523.36	4.26	-2.85
Wind 30 deg - Ice		10.00	-17.35	-1317.64	-758.65	-0.91
Wind 45 deg - Ice		14.17	-14.16	-1074.78	-1074.96	0.19
Wind 60 deg - Ice		17.37	-10.00	-758.60	-1317.94	1.28
Wind 90 deg - Ice		20.07	0.04	3.97	-1523.75	3.12
Wind 120 deg - Ice		17.40	10.06	765.73	-1320.94	4.13
Wind 135 deg - Ice		14.22	14.21	1080.95	-1079.21	4.22
Wind 150 deg - Ice		10.07	17.39	1322.57	-763.85	4.03
Wind 180 deg - Ice		0.04	20.06	1525.29	-1.75	2.85
Wind 210 deg - Ice		-10.00	17.35	1319.57	761.16	0.91
Wind 225 deg - Ice		-14.17	14.16	1076.70	1077.48	-0.19
Wind 240 deg - Ice		-17.37	10.00	760.53	1320.45	-1.28
Wind 270 deg - Ice		-20.07	-0.04	-2.04	1526.26	-3.12
Wind 300 deg - Ice		-17.40	-10.06	-763.80	1323.45	-4.13
Wind 315 deg - Ice		-14.22	-14.21	-1079.02	1081.72	-4.22
Wind 330 deg - Ice		-10.07	-17.39	-1320.64	766.36	-4.03
Total Weight	30.17			0.68	0.90	
Wind 0 deg - Service		-0.02	-9.02	-688.79	2.38	-1.40
Wind 30 deg - Service		4.50	-7.81	-595.68	-342.69	-0.45
Wind 45 deg - Service		6.37	-6.37	-485.80	-485.78	0.09
Wind 60 deg - Service		7.81	-4.50	-342.77	-595.71	0.63
Wind 90 deg - Service		9.03	0.02	2.17	-688.86	1.53
Wind 120 deg - Service		7.83	4.53	346.71	-597.19	2.03
Wind 135 deg - Service		6.40	6.39	489.27	-487.88	2.08
Wind 150 deg - Service		4.53	7.82	598.53	-345.27	1.98
Wind 180 deg - Service		0.02	9.02	690.16	-0.59	1.40
Wind 210 deg - Service		-4.50	7.81	597.05	344.49	0.45
Wind 225 deg - Service		-6.37	6.37	487.17	487.57	-0.09
Wind 240 deg - Service		-7.81	4.50	344.14	597.50	-0.63
Wind 270 deg - Service		-9.03	-0.02	-0.80	690.65	-1.53
Wind 300 deg - Service		-7.83	-4.53	-345.34	598.98	-2.03
Wind 315 deg - Service		-6.40	-6.39	-487.90	489.68	-2.08

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 330 deg - Service		-4.53	-7.82	-597.16	347.06	-1.98

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
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

Comb. No.	Description
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	119.08 - 101.08	Pole	Max Tension	18	0.00	-0.00	0.00
			Max. Compression	18	-7.03	0.97	-1.19
			Max. Mx	14	-4.88	75.21	-0.68
			Max. My	10	-4.88	0.55	-75.37
			Max. Vy	14	-6.55	75.21	-0.68
			Max. Vx	10	6.55	0.55	-75.37
			Max. Torque	16			5.33
L2	101.08 - 66.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-17.85	1.28	-0.98
			Max. Mx	14	-12.87	463.58	-0.16
			Max. My	10	-12.87	0.38	-463.94
			Max. Vy	14	-14.98	463.58	-0.16
			Max. Vx	10	14.96	0.38	-463.94
			Max. Torque	8			-5.36
L3	66.5 - 32.83	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-26.81	1.28	-0.98
			Max. Mx	14	-20.25	1018.97	1.38
			Max. My	10	-20.25	-1.16	-1018.73
			Max. Vy	14	-18.85	1018.97	1.38
			Max. Vx	10	18.83	-1.16	-1018.73
			Max. Torque	8			-5.36
L4	32.83 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-38.49	1.28	-0.98
			Max. Mx	14	-30.16	1805.33	3.17
			Max. My	10	-30.16	-2.95	-1804.41
			Max. Vy	14	-23.13	1805.33	3.17
			Max. Vx	10	23.11	-2.95	-1804.41
			Max. Torque	8			-5.35

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	38.49	20.07	0.04
	Max. H_x	14	30.17	23.12	0.05
	Max. H_z	2	30.17	0.05	23.10
	Max. M_x	2	1802.99	0.05	23.10
	Max. M_z	6	1803.47	-23.12	-0.05
	Max. Torsion	16	5.35	16.38	16.37
	Min. Vert	1	30.17	0.00	0.00
	Min. H_x	6	30.17	-23.12	-0.05
	Min. H_z	10	30.17	-0.05	-23.10
	Min. M_x	10	-1804.41	-0.05	-23.10
	Min. M_z	14	-1805.33	23.12	0.05
	Min. Torsion	8	-5.35	-16.38	-16.37

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	30.17	0.00	0.00	0.69	0.90	0.00
Dead+Wind 0 deg - No Ice	30.17	-0.05	-23.10	-1802.99	4.80	-3.61
Dead+Wind 30 deg - No Ice	30.17	11.52	-19.98	-1559.40	-897.91	-1.14
Dead+Wind 45 deg - No Ice	30.17	16.31	-16.30	-1271.96	-1272.23	0.25
Dead+Wind 60 deg - No Ice	30.17	20.00	-11.51	-897.78	-1559.79	1.62
Dead+Wind 90 deg - No Ice	30.17	23.12	0.05	4.58	-1803.47	3.96
Dead+Wind 120 deg - No Ice	30.17	20.04	11.59	905.91	-1563.67	5.23
Dead+Wind 135 deg - No Ice	30.17	16.38	16.37	1278.85	-1277.72	5.35
Dead+Wind 150 deg - No Ice	30.17	11.60	20.03	1564.69	-904.64	5.10
Dead+Wind 180 deg - No Ice	30.17	0.05	23.10	1804.41	-2.95	3.61
Dead+Wind 210 deg - No Ice	30.17	-11.52	19.98	1560.83	899.77	1.14
Dead+Wind 225 deg - No Ice	30.17	-16.31	16.30	1273.38	1274.10	-0.25
Dead+Wind 240 deg - No Ice	30.17	-20.00	11.51	899.20	1561.66	-1.63
Dead+Wind 270 deg - No Ice	30.17	-23.12	-0.05	-3.17	1805.33	-3.96
Dead+Wind 300 deg - No Ice	30.17	-20.04	-11.59	-904.50	1565.52	-5.23
Dead+Wind 315 deg - No Ice	30.17	-16.38	-16.37	-1277.44	1279.57	-5.35
Dead+Wind 330 deg - No Ice	30.17	-11.60	-20.03	-1563.28	906.48	-5.10
Dead+Ice+Temp	38.49	0.00	0.00	0.98	1.28	-0.00
Dead+Wind 0 deg+Ice+Temp	38.49	-0.04	-20.06	-1568.08	4.40	-2.88
Dead+Wind 30 deg+Ice+Temp	38.49	10.00	-17.35	-1356.32	-780.90	-0.91
Dead+Wind 45 deg+Ice+Temp	38.49	14.17	-14.16	-1106.32	-1106.50	0.20
Dead+Wind 60 deg+Ice+Temp	38.49	17.37	-10.00	-780.87	-1356.60	1.30
Dead+Wind 90 deg+Ice+Temp	38.49	20.07	0.04	4.09	-1568.46	3.16
Dead+Wind 120 deg+Ice+Temp	38.49	17.40	10.06	788.23	-1359.69	4.18
Dead+Wind 135 deg+Ice+Temp	38.49	14.22	14.21	1112.71	-1110.86	4.27
Dead+Wind 150 deg+Ice+Temp	38.49	10.07	17.39	1361.44	-786.24	4.07
Dead+Wind 180 deg+Ice+Temp	38.49	0.04	20.06	1570.12	-1.76	2.88
Dead+Wind 210 deg+Ice+Temp	38.49	-10.00	17.35	1358.37	783.55	0.91
Dead+Wind 225 deg+Ice+Temp	38.49	-14.17	14.16	1108.37	1109.15	-0.20
Dead+Wind 240 deg+Ice+Temp	38.49	-17.37	10.00	782.90	1359.26	-1.30
Dead+Wind 270 deg+Ice+Temp	38.49	-20.07	-0.04	-2.07	1571.11	-3.16
Dead+Wind 300 deg+Ice+Temp	38.49	-17.40	-10.06	-786.21	1362.33	-4.18
Dead+Wind 315 deg+Ice+Temp	38.49	-14.22	-14.21	-1110.69	1113.50	-4.27
Dead+Wind 330 deg+Ice+Temp	38.49	-10.07	-17.39	-1359.40	788.88	-4.07
Dead+Wind 0 deg - Service	30.17	-0.02	-9.02	-704.08	2.45	-1.41
Dead+Wind 30 deg - Service	30.17	4.50	-7.81	-608.89	-350.29	-0.45
Dead+Wind 45 deg - Service	30.17	6.37	-6.37	-496.58	-496.55	0.10
Dead+Wind 60 deg - Service	30.17	7.81	-4.50	-350.37	-608.91	0.64
Dead+Wind 90 deg - Service	30.17	9.03	0.02	2.23	-704.13	1.55
Dead+Wind 120 deg - Service	30.17	7.83	4.53	354.42	-610.43	2.05
Dead+Wind 135 deg - Service	30.17	6.40	6.39	500.15	-498.69	2.10
Dead+Wind 150 deg - Service	30.17	4.53	7.82	611.84	-352.91	2.00
Dead+Wind 180 deg - Service	30.17	0.02	9.02	705.50	-0.58	1.41
Dead+Wind 210 deg - Service	30.17	-4.50	7.81	610.32	352.15	0.45
Dead+Wind 225 deg - Service	30.17	-6.37	6.37	498.01	498.42	-0.10
Dead+Wind 240 deg - Service	30.17	-7.81	4.50	351.80	610.78	-0.64
Dead+Wind 270 deg - Service	30.17	-9.03	-0.02	-0.80	706.00	-1.55
Dead+Wind 300 deg - Service	30.17	-7.83	-4.53	-352.99	612.29	-2.05
Dead+Wind 315 deg - Service	30.17	-6.40	-6.39	-498.72	500.56	-2.10
Dead+Wind 330 deg - Service	30.17	-4.53	-7.82	-610.41	354.78	-2.00

Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.00	-30.17	0.00	0.00	30.17	0.00	0.000%
2	-0.05	-30.17	-23.10	0.05	30.17	23.10	0.000%
3	11.52	-30.17	-19.98	-11.52	30.17	19.98	0.000%
4	16.31	-30.17	-16.30	-16.31	30.17	16.30	0.000%
5	20.00	-30.17	-11.51	-20.00	30.17	11.51	0.000%
6	23.12	-30.17	0.05	-23.12	30.17	-0.05	0.000%
7	20.04	-30.17	11.59	-20.04	30.17	-11.59	0.000%
8	16.38	-30.17	16.37	-16.38	30.17	-16.37	0.000%
9	11.60	-30.17	20.03	-11.60	30.17	-20.03	0.000%
10	0.05	-30.17	23.10	-0.05	30.17	-23.10	0.000%
11	-11.52	-30.17	19.98	11.52	30.17	-19.98	0.000%
12	-16.31	-30.17	16.30	16.31	30.17	-16.30	0.000%
13	-20.00	-30.17	11.51	20.00	30.17	-11.51	0.000%
14	-23.12	-30.17	-0.05	23.12	30.17	0.05	0.000%
15	-20.04	-30.17	-11.59	20.04	30.17	11.59	0.000%
16	-16.38	-30.17	-16.37	16.38	30.17	16.37	0.000%
17	-11.60	-30.17	-20.03	11.60	30.17	20.03	0.000%
18	0.00	-38.49	0.00	0.00	38.49	0.00	0.000%
19	-0.04	-38.49	-20.06	0.04	38.49	20.06	0.000%
20	10.00	-38.49	-17.35	-10.00	38.49	17.35	0.000%
21	14.17	-38.49	-14.16	-14.17	38.49	14.16	0.000%
22	17.37	-38.49	-10.00	-17.37	38.49	10.00	0.000%
23	20.07	-38.49	0.04	-20.07	38.49	-0.04	0.000%
24	17.40	-38.49	10.06	-17.40	38.49	-10.06	0.000%
25	14.22	-38.49	14.21	-14.22	38.49	-14.21	0.000%
26	10.07	-38.49	17.39	-10.07	38.49	-17.39	0.000%
27	0.04	-38.49	20.06	-0.04	38.49	-20.06	0.000%
28	-10.00	-38.49	17.35	10.00	38.49	-17.35	0.000%
29	-14.17	-38.49	14.16	14.17	38.49	-14.16	0.000%
30	-17.37	-38.49	10.00	17.37	38.49	-10.00	0.000%
31	-20.07	-38.49	-0.04	20.07	38.49	0.04	0.000%
32	-17.40	-38.49	-10.06	17.40	38.49	10.06	0.000%
33	-14.22	-38.49	-14.21	14.22	38.49	14.21	0.000%
34	-10.07	-38.49	-17.39	10.07	38.49	17.39	0.000%
35	-0.02	-30.17	-9.02	0.02	30.17	9.02	0.000%
36	4.50	-30.17	-7.81	-4.50	30.17	7.81	0.000%
37	6.37	-30.17	-6.37	-6.37	30.17	6.37	0.000%
38	7.81	-30.17	-4.50	-7.81	30.17	4.50	0.000%
39	9.03	-30.17	0.02	-9.03	30.17	-0.02	0.000%
40	7.83	-30.17	4.53	-7.83	30.17	-4.53	0.000%
41	6.40	-30.17	6.39	-6.40	30.17	-6.39	0.000%
42	4.53	-30.17	7.82	-4.53	30.17	-7.82	0.000%
43	0.02	-30.17	9.02	-0.02	30.17	-9.02	0.000%
44	-4.50	-30.17	7.81	4.50	30.17	-7.81	0.000%
45	-6.37	-30.17	6.37	6.37	30.17	-6.37	0.000%
46	-7.81	-30.17	4.50	7.81	30.17	-4.50	0.000%
47	-9.03	-30.17	-0.02	9.03	30.17	0.02	0.000%
48	-7.83	-30.17	-4.53	7.83	30.17	4.53	0.000%
49	-6.40	-30.17	-6.39	6.40	30.17	6.39	0.000%
50	-4.53	-30.17	-7.82	4.53	30.17	7.82	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001

2	Yes	5	0.00000001	0.00003775
3	Yes	5	0.00000001	0.00006903
4	Yes	5	0.00000001	0.00008403
5	Yes	5	0.00000001	0.00006665
6	Yes	5	0.00000001	0.00004329
7	Yes	5	0.00000001	0.00011502
8	Yes	5	0.00000001	0.00010383
9	Yes	5	0.00000001	0.00006809
10	Yes	5	0.00000001	0.00003715
11	Yes	5	0.00000001	0.00008102
12	Yes	5	0.00000001	0.00008495
13	Yes	5	0.00000001	0.00008584
14	Yes	5	0.00000001	0.00004271
15	Yes	5	0.00000001	0.00006880
16	Yes	5	0.00000001	0.00010392
17	Yes	5	0.00000001	0.00011340
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00009134
20	Yes	5	0.00000001	0.00015892
21	Yes	5	0.00000001	0.00018323
22	Yes	5	0.00000001	0.00015695
23	Yes	5	0.00000001	0.00009663
24	Yes	5	0.00000001	0.00020696
25	Yes	5	0.00000001	0.00020417
26	Yes	5	0.00000001	0.00016007
27	Yes	5	0.00000001	0.00009111
28	Yes	5	0.00000001	0.00017115
29	Yes	5	0.00000001	0.00018567
30	Yes	5	0.00000001	0.00017597
31	Yes	5	0.00000001	0.00009641
32	Yes	5	0.00000001	0.00016083
33	Yes	5	0.00000001	0.00020432
34	Yes	5	0.00000001	0.00020512
35	Yes	4	0.00000001	0.00027452
36	Yes	4	0.00000001	0.00020349
37	Yes	4	0.00000001	0.00026500
38	Yes	4	0.00000001	0.00020458
39	Yes	4	0.00000001	0.00031475
40	Yes	4	0.00000001	0.00055606
41	Yes	4	0.00000001	0.00049441
42	Yes	4	0.00000001	0.00035173
43	Yes	4	0.00000001	0.00027396
44	Yes	4	0.00000001	0.00028179
45	Yes	4	0.00000001	0.00027276
46	Yes	4	0.00000001	0.00032155
47	Yes	4	0.00000001	0.00031469
48	Yes	4	0.00000001	0.00036461
49	Yes	4	0.00000001	0.00049504
50	Yes	4	0.00000001	0.00054291

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	119.08 - 101.08	15.842	47	1.0931	0.0225
L2	104 - 66.5	12.445	48	1.0493	0.0138
L3	70.33 - 32.83	5.883	48	0.7667	0.0054
L4	37.5 - 0	1.728	48	0.4187	0.0021

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
120.00	4 FT DISH	47	15.842	1.0931	0.0225	30845
110.00	Valmont 13' Low Profile Platform	48	13.779	1.0710	0.0170	16985
100.00	Valmont 13' Low Profile Platform	48	11.577	1.0296	0.0121	9379
90.00	742-213	48	9.499	0.9623	0.0088	7762
80.00	LLPX310R	48	7.574	0.8720	0.0068	6621
78.00	ANT-18G-2-C	48	7.209	0.8515	0.0065	6432

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	119.08 - 101.08	40.477	15	2.7840	0.0576
L2	104 - 66.5	31.811	15	2.6788	0.0353
L3	70.33 - 32.83	15.042	15	1.9604	0.0138
L4	37.5 - 0	4.419	16	1.0708	0.0053

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
120.00	4 FT DISH	15	40.477	2.7840	0.0576	12385
110.00	Valmont 13' Low Profile Platform	15	35.217	2.7324	0.0435	6819
100.00	Valmont 13' Low Profile Platform	15	29.594	2.6279	0.0308	3750
90.00	742-213	15	24.285	2.4511	0.0225	3079
80.00	LLPX310R	15	19.364	2.2189	0.0173	2611
78.00	ANT-18G-2-C	15	18.433	2.1675	0.0165	2534

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 $\frac{P}{P_a}$

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	119.08 - 101.08 (1)	TP26x22.27x0.25	18.00	0.00	0.0	39.000	20.0531	-4.88	782.07	0.006
L2	101.08 - 66.5 (2)	TP34.0625x24.8949x0.3125	37.50	0.00	0.0	39.000	32.7111	-12.87	1275.73	0.010
L3	66.5 - 32.83 (3)	TP41.75x32.5012x0.375	37.50	0.00	0.0	39.000	48.1170	-20.24	1876.56	0.011
L4	32.83 - 0 (4)	TP49.0625x39.8482x0.375	37.50	0.00	0.0	39.000	58.2424	-30.16	2271.45	0.013

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	119.08 - 101.08 (1)	TP26x22.27x0.25	75.60	7.336	39.000	0.188	0.00	0.000	39.000	0.000
L2	101.08 - 66.5 (2)	TP34.0625x24.8949x0.3125	463.94	21.138	39.000	0.542	0.00	0.000	39.000	0.000
L3	66.5 - 32.83 (3)	TP41.75x32.5012x0.375	1020.28	25.776	39.000	0.661	0.00	0.000	39.000	0.000
L4	32.83 - 0 (4)	TP49.0625x39.8482x0.375	1808.08	31.127	39.000	0.798	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	119.08 - 101.08 (1)	TP26x22.27x0.25	6.55	0.327	26.000	0.025	0.55	0.026	26.000	0.001
L2	101.08 - 66.5 (2)	TP34.0625x24.8949x0.3125	14.96	0.457	26.000	0.036	3.61	0.079	26.000	0.003
L3	66.5 - 32.83 (3)	TP41.75x32.5012x0.375	18.88	0.392	26.000	0.031	5.23	0.064	26.000	0.002
L4	32.83 - 0 (4)	TP49.0625x39.8482x0.375	23.17	0.398	26.000	0.031	5.35	0.044	26.000	0.002

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	119.08 - 101.08 (1)	0.006	0.188	0.000	0.025	0.001	0.195 ✔	1.333	H1-3+VT ✔
L2	101.08 - 66.5 (2)	0.010	0.542	0.000	0.036	0.003	0.553 ✔	1.333	H1-3+VT ✔
L3	66.5 - 32.83 (3)	0.011	0.661	0.000	0.031	0.002	0.672 ✔	1.333	H1-3+VT ✔
L4	32.83 - 0 (4)	0.013	0.798	0.000	0.031	0.002	0.812 ✔	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	119.08 - 101.08	Pole	TP26x22.27x0.25	1	-4.88	1042.50	14.6	Pass
L2	101.08 - 66.5	Pole	TP34.0625x24.8949x0.3125	2	-12.87	1700.55	41.4	Pass
L3	66.5 - 32.83	Pole	TP41.75x32.5012x0.375	3	-20.24	2501.45	50.4	Pass
L4	32.83 - 0	Pole	TP49.0625x39.8482x0.375	4	-30.16	3027.84	60.9	Pass
							Summary	
						Pole (L4)	60.9	Pass
						RATING =	**60.9**	**Pass**

NATCOMM INC
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63-2 N. Branford Rd., Branford, CT 06405

Subject:	Anchor Bolt and Baseplate Analysis
Location:	120-ft PiRODMonopole West Hartford,CT
Rev. 0: 3/8/10	Prepared by: T.J.L. Checked by: C.F.C. Job No. 10003.CO3

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	$OM := 1808 \cdot ft \cdot kips$	(Input From RisaTower)
Shear Force =	$Shear := 23 \cdot kips$	(Input From RisaTower)
Axial Force =	$Axial := 30 \cdot kips$	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A687

Number of Anchor Bolts =	$N := 33$	(User Input)
Diameter of Bolt Circle =	$D_{bc} := 54.0 \cdot in$	(User Input)
Bolt "Column" Distance =	$l := 3.0 \cdot in$	(User Input)
Bolt Ultimate Strength =	$F_u := 150 \cdot ksi$	(User Input)
Bolt Yeild Strength =	$F_y := 105 \cdot ksi$	(User Input)
Bolt Modulus =	$E := 29000 \cdot ksi$	(User Input)
Diameter of Anchor Bolts =	$D := 1.25 \cdot in$	(User Input)
Threads per Inch =	$n := 7$	(User Input)

Base Plate Data:

Use ASTM A572 Grade 50

Plate Yield Strength =	$Fy_{bp} := 50 \cdot ksi$	(User Input)
Base Plate Thickness =	$t_{bp} := 1.25 \cdot in$	(User Input)
Base Plate Diameter =	$D_{bp} := 58.0 \cdot in$	(User Input)
Outer Pole Diameter =	$D_{pole} := 49.0625 \cdot in$	(User Input)

Gusset Data:

Gussset Thickness =	$t_{Gusset} := 0.75 \cdot in$	(User Input)
Gussset Height =	$H_{Gusset} := 12 \cdot in$	(User Input)
Total Number of Gussets =	$N_{Gusset.tot} := 33$	(User Input)
Effective Number of Gussets =	$N_{Gusset} := 4$	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 27 \cdot in$$

Distance to Bolts =

$$i := 1 .. N$$

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

$d_1 = 5.11 \cdot in$ $d_7 = 26.24 \cdot in$

$d_2 = 10.03 \cdot in$ $d_8 = 26.97 \cdot in$

$d_3 = 14.60 \cdot in$ $d_9 = 26.73 \cdot in$

$d_4 = 18.63 \cdot in$ $d_{10} = 25.52 \cdot in$

$d_5 = 21.99 \cdot in$ $d_{11} = 23.38 \cdot in$

$d_6 = 24.56 \cdot in$ $d_{12} = 20.41 \cdot in$

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 24.5 \cdot in$$

Moment Arms of Bolts about Neutral Axis =

$$MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$$

$MA_1 = 0.00 \cdot in$ $MA_7 = 1.71 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 2.44 \cdot in$

$MA_3 = 0.00 \cdot in$ $MA_9 = 2.19 \cdot in$

$MA_4 = 0.00 \cdot in$ $MA_{10} = 0.98 \cdot in$

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

$MA_6 = 0.03 \cdot in$ $MA_{12} = 0.00 \cdot in$

Effective Width of Baseplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 24.7 \cdot in$$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 1.203 \times 10^4 \cdot in^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 1.227 \cdot in^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 = 0.969 \cdot in^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 1.111 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.278 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.135 \cdot in^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 47.8 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 81 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net} := 1.333 \cdot \left(0.60 \cdot A_n \cdot F_y\right) = 81.385 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 58.7 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.174 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 15.5 \cdot ksi$

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

Check Combined Stress Requirement:

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

$$l := \begin{cases} l & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 3 \cdot in$$

$$f_{bx} := \begin{cases} f_{bx} & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 15.5 \cdot ksi$$

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 49.6 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 51.2 \cdot ksi$$

$$K := 0.65$$

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

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^2}\right] \cdot F_y}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^3}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} = 61.405 \cdot ksi$$

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 81.9 \cdot ksi$$ (1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 81 \cdot \%$$

Condition 2 =

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

Condition2 = "OK"

Base Plate Analysis:

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

$C_1 = 10.1 \cdot kips$ $C_7 = 48.2 \cdot kips$

$C_2 = 19.0 \cdot kips$ $C_8 = 49.6 \cdot kips$

$C_3 = 27.2 \cdot kips$ $C_9 = 49.1 \cdot kips$

$C_4 = 34.5 \cdot kips$ $C_{10} = 46.9 \cdot kips$

$C_5 = 40.6 \cdot kips$ $C_{11} = 43.1 \cdot kips$

$C_6 = 45.2 \cdot kips$ $C_{12} = 37.7 \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left[B_{eff} \cdot t_{bp}^{\,2} + N_{Gusset} \cdot t_{Gusset} \cdot \left(0.5 \cdot H_{Gusset}\right)^2\right]} = 14.7 \cdot ksi$

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

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 29.4 \cdot \%$

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

Condition3 = "Ok"

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Subject:	Foundation Analysis
Location:	120-ft PiROD Monopole West Hartford, CT
Rev. 0: 3/8/10	Prepared by: T.J.L. Checked by: C.F.C. Job No. 10003.CO3

Pad and Pier with Rock Anchors:

Reactions in Footing:

Axial = Axial := 30·kips

Shear = Shear := 23·kips

Moment = Moment := 1808·ft·kips

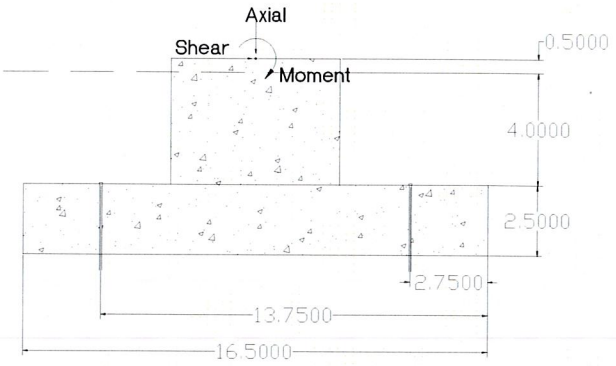
Footing Properties:

Lenght of Footing = $L_f := 16.5 \cdot ft$

Width of Footing = $W_f := 16.5 \cdot ft$

Thickness of Footing = $t_f := 2.5 \cdot ft$

Depth of Footing = $d_f := 6.5 \cdot ft$



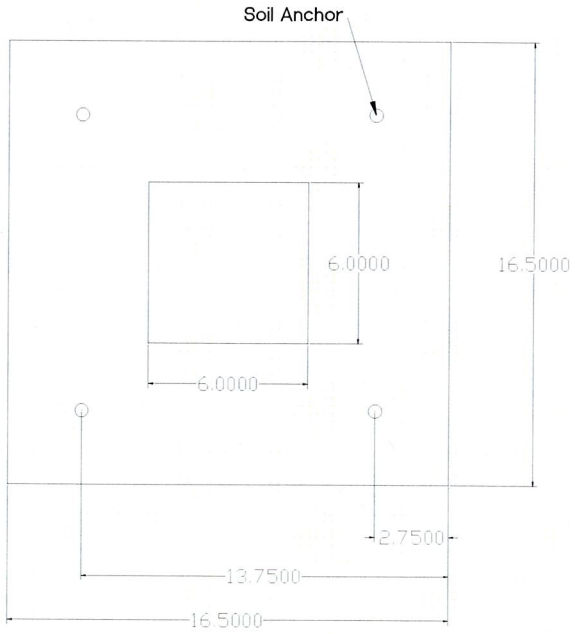
Pier Properties:

Lenght of Pier = $L_p := 6 \cdot ft$

Width of Pier = $W_p := 6ft$

Height of Pier = $H_p := 4.5 \cdot ft$

Height of Pier Below Grade = $H_{p.bg} := 4 \cdot ft$



Anchor Properties:

Tensile Strength of Anchor = $T := 45 \cdot kips$

Number of Anchors in Group 1 = $N_1 := 2$

Anchor Placement from Edge = $d_1 := 2.75 \cdot ft$

Number of Anchors in Group 2 = $N_2 := 2$

Anchor Placement from Edge = $d_2 := 13.75 \cdot ft$

NATCOMM INC. CONSULTING ENGINEERS
p: 203.488.0580 f: 203.488.8587 w: nat-eng.com
63-2 N. Branford Rd., Branford, CT 06405

Subject: Foundation Analysis

Location: 120-ft PiROD Monopole
West Hartford, CT

Rev. 0: 3/8/10

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 10003.CO3

General Properties:

Unit Weight of Concrete = $\gamma_c := 150 \cdot pcf$

Unit Weight of Soil = $\gamma_s := 120 \cdot pcf$

Internal Friction Angle of Soil = $\Phi_s := 30 \cdot deg$

Allowable Soil Bearing Capacity = $q_s := 6000 \cdot psf$

Depth to Neglect = $n := 0 \cdot ft$

Cohesion of Clay Type Soil = $c := 0 \cdot ksf$

Seismic Zone Factor = $Z := 2$

Coefficient of Friction Between Concrete = $\mu := 0.45$

Coefficient of Lateral Soil Pressure = $K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$

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

$P_{pt} := K_p \cdot \gamma_s \cdot (d_f - t_f) + c \cdot 2 \cdot \sqrt{K_p} = 1.44 \cdot ksf$

$P_{top} := if[n < (d_f - t_f), P_{pt}, P_{pn}] = 1.44 \cdot ksf$

$P_{bot} := K_p \cdot \gamma_s \cdot d_f + c \cdot 2 \cdot \sqrt{K_p} = 2.34 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.89 \cdot ksf$

$T_p := if[n < (d_f - t_f), t_f, (d_f - n)] = 2.5ft$

$A_p := W_f \cdot T_p = 41.25ft^2$

Ultimate Shear = $S_u := P_{ave} \cdot A_p = 77.962 \cdot kips$

Area of Footing = $A_f := L_f \cdot W_f \cdot t_f = 680.625 \cdot ft^3$

Area of Pier = $A_p := L_p \cdot W_p \cdot H_p = 162 \cdot ft^3$

Weight of Concrete = $WT_c := \gamma_c \cdot (A_f + A_p) = 126 \cdot kips$

Weight of Soil Above Footing = $WT_{s1} := \left[\left(W_f^2 - W_p^2\right) \cdot \left(H_{p.bg}\right)\right] \cdot \gamma_s = 113.4 \cdot kips$

Total Weight = $WT_{tot} := (Axial + WT_c + WT_{s1}) = 269.794 \cdot kips$

Weight of Soil Wedge at Back Face = $WT_{s2} := \left(\frac{d_f^2 \cdot \tan(\Phi_s)}{2} \cdot W_f\right) \cdot \gamma_s = 24.15 \cdot kips$

Weight of Soil Wedge at Back Corners = $WT_{s3} := 2 \cdot \left[(d_f)^3 \cdot \frac{\tan(\Phi_s)}{3}\right] \cdot \gamma_s = 12.68 \cdot kips$

Note: On the two sides of the foundation where the equipment shelters are located the weight of the shelter and its foundation will account for the weight of the soil wedge cut off by the shelter foundation wall.

Check Overturing Moment:

Overturing Moment = $M_{ot} := Moment + Shear \cdot (t_f + H_p) = 1969 \cdot ft \cdot kips$

Resisting Moment =

$$M_r := (WT_{tot}) \cdot \left(\frac{L_f}{2}\right) + T \cdot (N_1 \cdot d_1 + N_2 \cdot d_2) + S_u \cdot \frac{t_f}{3} + \left[(WT_{s2} + WT_{s3}) \cdot \left(W_f + \frac{d_f \cdot \tan(\Phi_s)}{3}\right)\right] = 4430 \cdot ft \cdot kips$$

$$FS := \frac{M_r}{M_{ot}} = 2.25$$

Condition := if(FS ≥ 2, "OK" , "NG")

Condition = "OK"

T · ·Mobile· TOWERS

Structural Analysis Worksheet (SAW)

Date: 03.03.10	**TMO Site ID: CT11178D**	**TMO Site Name: West Hartford**

Project Manager: Aaron Chandler	**Specialist: Marlin Castillo**	**Coordinator: Maurine Irvine-Trujillo**
Applicant: Verizon		

SA Fee Received from Applicant:	**Date SAW Approved by Applicant: 11/05/2009**

Analysis Request: Initial	**Previous Analysis by: Natcomm**	**Previous Analysis Date: 2/22/2010**

Structure Type: Monopole	**Structure Height: 120'**	**Tower Manufacturer: PiROD**

Foundation Type: pad & Pier	**Manufacturer ID#: A-116876 / 206198 B**	**FCC ID#:**

Proposed Tower Extension? Yes ☐ No ☒	**Size & location of any new ports:**

If tower was previously reinforced provide description of reinforcement, who designed it and confirm it was installed: Please see reinforcement data provided by Natcomm 5/27/2007.

Additional Structure info:

T · ·Mobile· TOWERS

Structural Loading:

***Existing carrier loadings should reflect all leased loading.**

****If SAW is for a MOD, only list the final proposed loading. Do not include carrier's existing loading.**

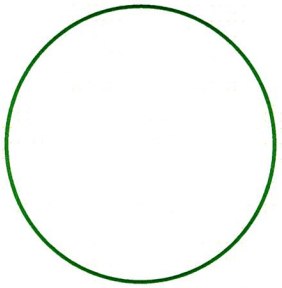
Existing/ Proposed	Elevation (Ft)	Qty	Antenna Model (Provide cut-sheet if non-standard)	Mount Type	Qty Coax	Coax Size	Coax Location*	Owner/Tenant
Existing	120'	12	Standard T-Mobile loading including (12) LNAs	13' LP Pltfm	25	1 5/8	(23) Internal, (2) External	T Mobile
Existing	110'	12	Allgon 7184.14	LP platform	12	1 5/8	Internal	AT&T
Proposed	100'	12	(2) Andrew LNX-6514DS-T4M (1) Antel BXA-70063/6CF (6) Antel LPA-80080/4CF (3) Rymsa MG D3-/800T2 (6) RFS FD9R6004 2C-3L	LP Platform	12	1 5/8"	Internal	Verizon
Existing	100'	1	GPS	On platform	1	7/8	Internal	Verizon
Existing	90'	3	Kathrein 7421 213	Flush Mount	6	1 5/8"	External	Pocket
Existing	80'	3	Argus LLPX310R antennas, (3) Dragonwave A-ANT-18G-2-C microwave antennas, (3) Samsung BTS units.	Flush mount	10	(3) FSJ4-50B 1/2"; (3) FSJ1-50A 1/4"; (3) HJ4.5-50 5/8" and (1) Belden 9207 5/16"	External	Clearwire

*** See coax diagram below for SST and Guy towers**

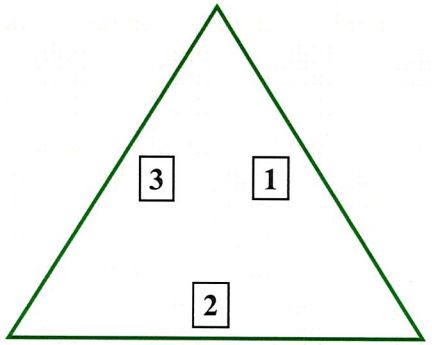
Additional Loading Notes:

Tower Diagrams for Coax stacking detail (North towards top of page)

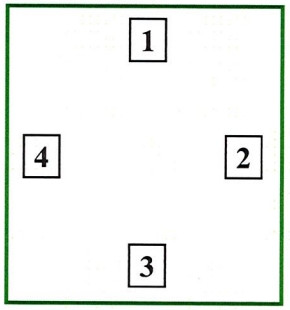
Monopole



3 Leg SST/Guy Tower



4 Leg SST



Slant ±45° Dual Polarized FET Panel 63° / 14.5 dBd
696-900 MHz

BXA-70063/6CF __
When ordering replace "__" with connector type.

Mechanical specifications

Length	1804	mm	71.0	in
Width	285	mm	11.2	in
Depth	114	mm	4.5	in
Depth with z-bracket	154	mm	6.1	in
Weight [4]	7.9	kg	17.0	lbs
Wind Area Fore/Aft	0.51	m^2	5.5	ft^2
Wind Area Side	0.21	m^2	2.2	ft^2
Max Wind Survivability	>201	km/hr	>125	mph
Wind Load @ 100 mph (161 km/hr)				
Fore/Aft	753	N	169	lbf
Side	351	N	79	lbf

Antenna consisting of aluminum alloy with brass feedlines covered by a UV safe fiber-glass radome.

Mounting & Downtilting

Mounting hardware attaches to pipe diameter Ø50-160 mm; Ø2.0-6.3 in

Mounting Bracket Kit	36210002
Downtilt Bracket Kit	36114003

Electrical specifications

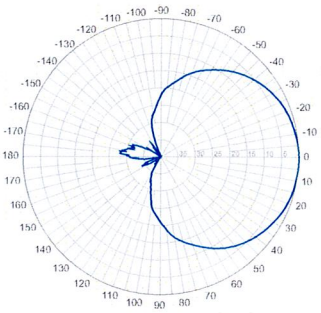
Frequency Range	696-900 MHz
Impedance	50Ω
Connector [3]	NE or E-DIN Female 2 ports / Center
VSWR [1]	≤ 1.4:1
Polarization	Slant ±45°
Isolation Between Ports [1]	< -25 dB
Gain [1]	14.5 dBd
Power Rating [2]	500 W
Half Power Angle [1]	
Horizontal Beamwidth	63°
Vertical Beamwidth	11°
Electrical downtilt [5]	0°
Null fill [1]	5%
Lightning protection	Direct ground

Patented Dipole Design: U.S. Patent No. 6,608,600 B2

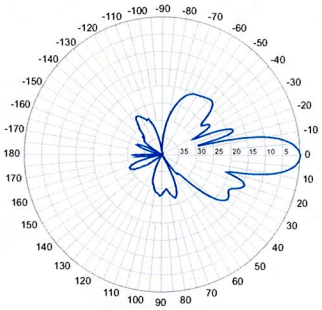
1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) Antenna weight does not include brackets.
5) Add'l downtilts may be available. Check website for details.

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

Radiation-pattern[1]
750 MHz

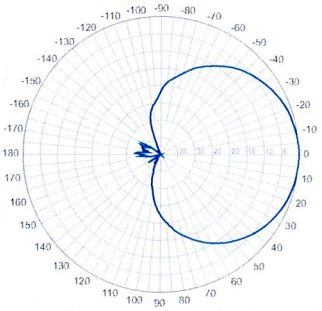


Horizontal

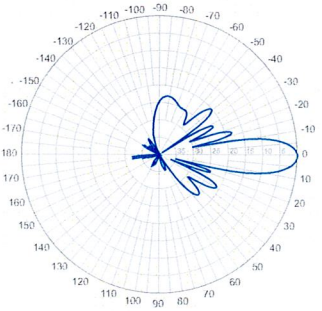


Vertical

850 MHz

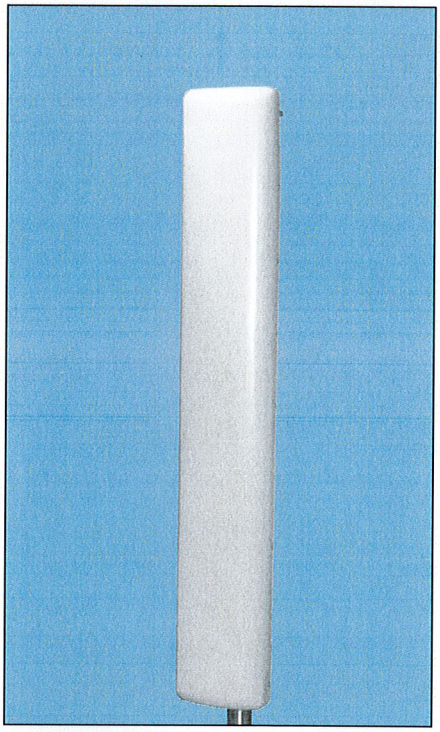


Horizontal



Vertical

696-900 MHz



Featuring our Exclusive 3T Technology™ Antenna Design:

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

Warranty:
This antenna is under a five-year limited warranty for repair or replacement.

Revision Date: 08/07/08

815.399.0001 • antel@antelinc.com • www.antelinc.com

Amphenol Antel, Inc. The Antenna Technology Company

Product Data Sheet **FD9R6004/2C-3L**

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

Product Description

The ShareLite FD9R6004 Series of diplexers are designed to enable feeder sharing between systems in the 698-960 MHz range and in the 1710-2200 MHz range. The diplexer is equipped with in-line connector placement so it can be installed in the BTS cabinet or at the tower top. This is especially valuable in crowded sites or when the feeders are not easily accessible. Due to its wideband design, the FD9R6004 Series can accommodate many combining solutions between 698-960 MHz and 1710-2200 MHz systems such as LTE 700 MHz, Cellular 800 MHz with PCS, GSM900 with GSM1800, or GSM900 with UMTS. This diplexer features a highly selective filter. It provides a high level of isolation between ports, while keeping the insertion loss on both paths at an extremely low level. The FD9R6004 diplexers are available with various DC pass options, helpful in configurations with or without the Tower Mount Amplifiers installed.

Features/Benefits

- **LTE ready design**
- **Extremely Low Insertion Loss**
- **High level of Rejection between bands – Protection against interferences**
- **Extremely High Power Handling Capability**
- **Integrated DC block/bypass versions available**
- **Very compact & small size design – Easy installation and reduced tower load**
- **In-line long-neck connectors for easy connection & waterproofing**
- **Exceptional reliability & environmental protection (IP 67)**
- **Mounting hardware for Wall and Pole mount provided (P/N SEM2-1A)**
- **Grounding already provided through the mounting bracket**
- **Kit available for easy dual mount**

Technical Specifications

Product Type	Diplexer/Cross Band Coupler
Frequency Band, MHz	698-2200
Configuration	Single indoor/outdoor diplexer, DC pass in high frequency path
Mounting	Wall, pole
Frequency Range Low Frequency Path, MHz	698-960
Frequency Range High Frequency Path, MHz	1710-2200
Return Loss All Ports, Min, dB	19
Power Handling Continuous, Max, W	1250 at common port; 750 in low frequency path & 500 in high frequency path
Power Handling Peak, Max, W	15000 in low frequency path & 8000 in high frequency path
Impedance, Ohms	50
Insertion Loss 698-960 MHz Path, Typ, dB	0.07
Insertion Loss 1710-2200MHz path, Typ, dB	0.13
Rejection Between Bands Min/Typ, dB	58/64@698-960MHz; 60/70@1710-2200MHz
Rejection between Bands, Min, dB	60
IMP Level at the COM Port, Typ, dBm	-112 @ 2x43
DC Pass in Low Frequency Path	No
DC Pass in High Frequency Path	Yes
Temperature Range, °C (°F)	-40 to +60 (-40 to +140)
Environmental	ETSI 300-019-2-4 Class 4.1E
Ingress Protection	IP 67
Lightning Protection	EN/IEC61000-4-5 Level 4
Connectors	7/16-Female Long-neck
Weight, kg (lb)	1.4 (3.1)
Application	LTE 700MHz, GSM900/3G/UMTS, GSM900/GSM1800, Cellular 800/PCS
Dimensions, H x W x D, mm (in)	147 x 164 x 37 (5.8 x 6.5 x 1.5)
Volume, L	0.43

Notes

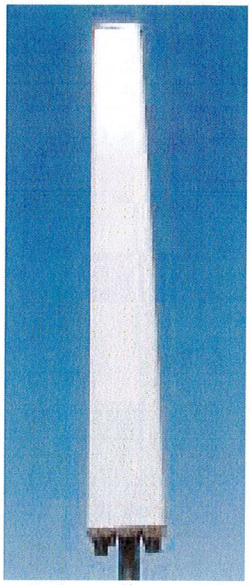
1710-2170 MHz

Model # MG D3-800TX

XPol GSM1800+PCS & UMTS Panel Antenna

Beamwidth: H 65º/V 6.5º
Gain: 16.15 dBd/18.25 dBi
Length: 52.7 in

Electrical Specifications			
Antenna model	MG D3-800TX		
Frequency range (MHz)	1710-1880	1850-1990	1920-2170
Impedance	50 ohms		
VSWR	1.4		
Polarization	±45º		
Isolation between ports (dB)	30		
Average gain (dBd/dBi)	15.7/17.8	15.9/18	16.15/18.25
Horizontal beamwidth (deg)	65º±5º		
Vertical beamwidth (deg)	6.5º±0.5º	6.3º±0.5º	6.3º±0.5º
Electrical tilt (deg)	Fixed 0º-14º		
Upper sidelobe suppression (dB)	18		
Front-to-back ratio (db) @180º±30º	30		
Polarization isolation (dB) @3 dB beamwidth	20		
Maximum power per input (w)	250		
Intermodulation products (dBc)	-150		
Connectors	2 X 7/16 female		
Connector position	Antenna bottom		



Mechanical & Environmental Specifications	
Dimensions in (mm)	52.7 x 6.3 x 3.5 (1380 x 160 x 90)
Survival wind speed mph (kph)	124 (200)
Front windload lbs (N) @100 mph/160 kph	74 (335)
Lateral windload lbs (N) @100 mph/160 kph	42 (188)
Antenna weight lbs (kg)	15 (7)
Clamps weight lbs (kg)	7.7 (3.5)
Mast mounting in (cm)	2.0 to 5.3 (50 to 135)
Radome color	Gray
Grounding	All metallic parts DC grounded
Temperature range F (ºC)	-67º to 140º (-55 to +60º)
Humidity	100%

Shipping Specifications	
Dimensions in (mm)	64 x 8.8 x 6.9 (1630 x 225 x 175)
Weight lbs (kg)	27 (12.5)
Material	Cardboard and foam

Vertically Polarized, Log Periodic 80° / 12.5 dBd

LPA-80080/4CF ___

When ordering, replace "___" with connector type.

Mechanical specifications

	Length	1200 mm	47.2	in
	Width	140 mm	5.5	in
	Depth	335 mm	13.2	in
4)	Weight	5.44 kg	12	lbs
	Wind Area			
	Front	0.168 m^2	1.8	ft^2
	Side	0.402 m^2	4.3	ft^2
	Rated Wind Velocity (Safety factor 2.0)			
		>369 km/hr	>229	mph
	Wind load @ 100 mph (161 km/hr)			
	Front	254 N	57.1	lbs
	Side	574 N	129.0	lbs

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

Mounting & Downtilting:

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

Mounting bracket kit #21699999

Downtilt bracket kit #21699999
The downtilt bracket kit includes the mounting bracket kit.

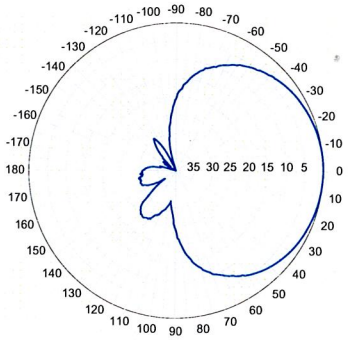
Electrical specifications

	Frequency Range	806-960 MHz
	Impedance	50Ω
3)	Connector	NE, E-DIN
1)	VSWR	≤1.4:1
	Polarization	Vertical
1)	Gain	12.5 dBd
2)	Power Rating	500 W
1)	Half Power Angle	
	H-Plane	80°
	E-Plane	15°
1)	Electrical Downtilt	0°
1)	Null Fill	15%
	Lightning Protection	Direct Ground

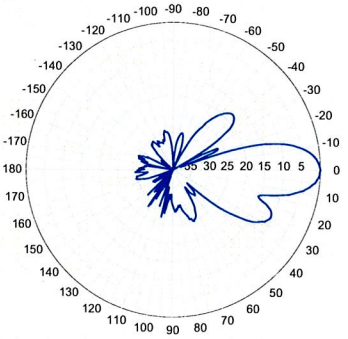
1) Typical Values
2) Power Rating limited by connector only.
3) NE indicates an elongated N Connector.
E-DIN indicates an elongated DIN Connector.
4) The antenna weight listed above does not include the bracket weight.

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

Radiation-pattern[1)]



Horizontal



Vertical

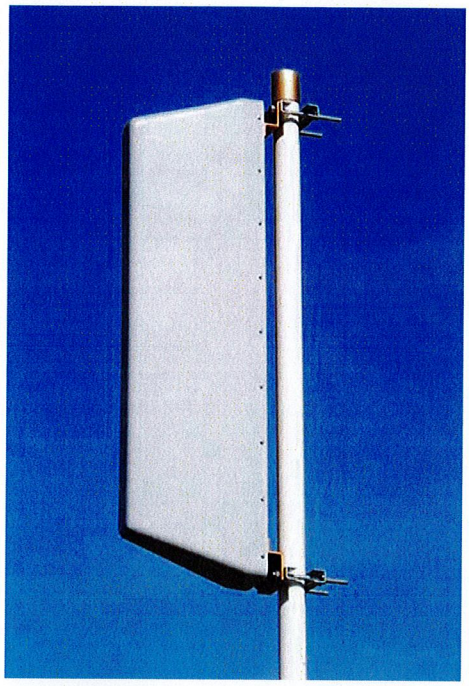
Featuring upper side lobe suppression.

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

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

CF Denotes a Center-Fed Connector.

806-960 MHz



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

- True log-periodic design allows for superior front-to-side characteristics to minimize sector overlap.
- Unique feedline design eliminates the need for conventional solder joints in the signal path.
- A non-collinear system with access to every radiating element for broad bandwidth and superior performance.
- Air as insulation for virtually no internal signal loss.

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

Antenna available with center-fed connector only.

Amphenol Antel, Inc.
The Antenna Technology Company

1300 Capital Drive Rockford, IL 61109 Toll-Free (888) 417-9562 Tel. (815) 399-0001
Fax. (815) 399-0156 Email: antel@antelinc.com www.antelinc.com

Revision Date: 12/1/05

Product Specifications

ANDREW®
A CommScope Company

LNX-6514DS-T4M

DualPol® Antenna, 698–896 MHz, 65° horizontal beamwidth, fixed electrical tilt

- Broadband, providing future-ready single antenna for application in 700 MHz and existing 850 MHz cellular operation
- Air dielectric design provides superior PIM performance with repeatable antenna-to-antenna gain and pattern consistency
- Single piece radome provides long term mechanical stability
- Proven core design technology, with over 1,000,000 similar antennas deployed
- Exceptional USLS pattern shaping for optimizing coverage and interference mitigation for LTE applications
- Specifically designed to have physical dimensions similar to most existing cellular antennas

CHARACTERISTICS

General Specifications

Antenna Type	DualPol®
Brand	DualPol®
Operating Frequency Band	698 – 896 MHz

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Beamwidth, Horizontal, degrees	66	64
Gain, dBd	13.8	14.5
Gain, dBi	15.9	16.6
Beamwidth, Vertical, degrees	12.0	11.0
Beam Tilt, degrees	4	4
Upper Sidelobe Suppression (USLS), typical, dB	18	18
Front-to-Back Ratio at 180°, dB	33	33
Isolation, dB	30	30
VSWR | Return Loss, db	1.35:1 | 16.5	1.35:1 | 16.5
Intermodulation Products, 3rd Order, 2 x 20 W, dBc	-150	-150
Input Power, maximum, watts	500	500
Polarization	±45°	±45°
Impedance, ohms	50	50
Lightning Protection	dc Ground	dc Ground

Product Specifications

LNX-6514DS-T4M

ANDREW®
A CommScope Company

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Bottom
Connector Quantity	2
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

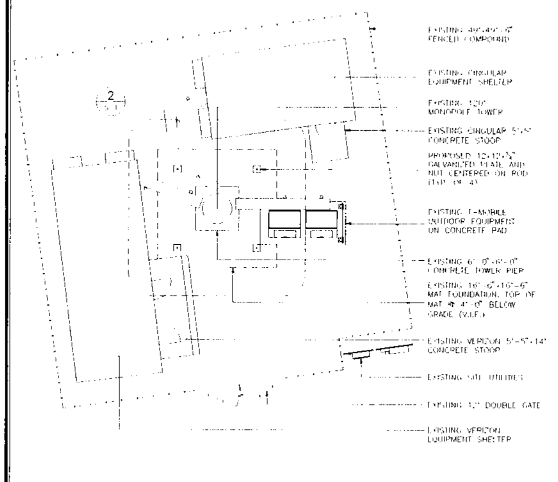
Depth	181.0 mm | 7.1 in
Length	1847.0 mm | 72.7 in
Width	301.0 mm | 11.9 in
Net Weight	17.0 kg | 37.5 lb

Regulatory Compliance/Certifications

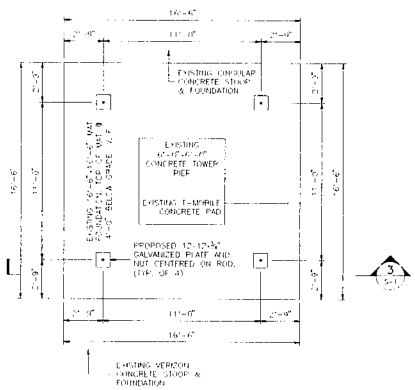
Agency	Classification
RoHS 2002/95/EC	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)

INCLUDED PRODUCTS

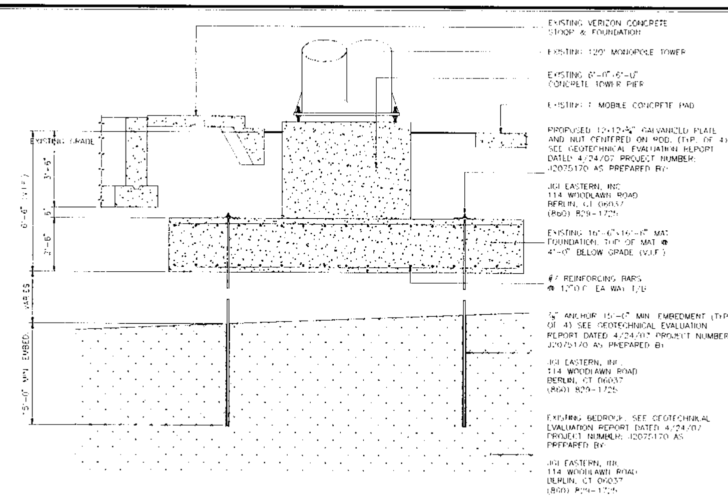
MTG-L-STD
Downtilt Mounting Kit for panel Antennas



1 COMPOUND PLAN
SCALE: 1/8" = 1'-0"

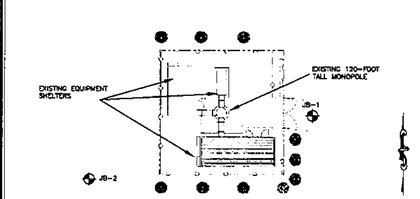


2 TOWER FOUNDATION PLAN
SCALE: 1/8" = 1'-0"



2 TOWER FOUNDATION SECTION
SCALE: 1/8" = 1'-0"

INTERSTATE 84



LEGEND
JB-1 TEST BORING LOCATION

GRAPHIC SCALE

NOTES:
1. THIS PLAN WAS PREPARED FROM A PDF DOCUMENT PROVIDED BY NATCOMM, LLC.
2. THE TEST BORINGS SHOWN AS JB-1 AND JB-2 WERE ADVANCED ON FEBRUARY 15, 2007 UNDER THE DIRECTION OF JGI WITH EQUIPMENT OWNED AND OPERATED BY NEW ENGLAND BORING CONTRACTORS, INC. OF GLASTONBURY, CONNECTICUT.
3. THE APPROXIMATE LOCATIONS OF THE TEST BORINGS WERE TAPED FROM EXISTING SITE FEATURES. THE LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
4. USE OF THIS PLAN IS LIMITED TO THE ILLUSTRATION OF THE APPROXIMATE LOCATIONS OF THE TEST BORINGS AND OTHER PERTINENT SITE FEATURES. ANY OTHER USE OF THIS PLAN WITHOUT PERMISSION FROM JGI EASTERN INC. IS PROHIBITED.

THIS CHART TAKEN FROM GEOTECHNICAL EVALUATION REPORT DATED 4/24/07 PROJECT NUMBER J2075170 AS PREPARED BY:
JGI EASTERN, INC.
114 WOODLAWN ROAD
BERLIN, CT 06037
(860) 829-1725

TEST BORING LOG

PROJ. NAME: West Hartford CT1 780
LOCATION: West Hartford, CT
PROJECT NO.: J2075170
DATE START: February 15, 2007
DATE END: February 15, 2007
BORING CO.: New England Boring, Inc
CO. LOCATION: Glastonbury, CT
FOREMAN: Tim Carpenter
JGI REP.: Doug Yates

	HAMMER	SAMPLER	CASING
TYPE	Safety	SS	H.S.A
SIZE	140 lbs.	2" OD	4" ID
FALL	30"		

BORING: JB-1
LOCATION: See Plan
SURF. EL.: Unknown

GROUNDWATER OBSERVATIONS: 2/15/07 Not Encountered

SAMPLING No.	Depth (ft.)	Blows/6"	Penet./Rec. (in)	Sample Description	Strata Change Depth (ft)	Notes
SS-1	[illegible]	[illegible]	[illegible]	[illegible]		
SS-2	[illegible]	[illegible]	[illegible]	Dense, brown, medium to fine SAND, some Silt, trace Gravel		
SS-3	[illegible]	[illegible]	24/14	Similar to SS-2, except medium dense (Fill)	[illegible]	
SS-4	[illegible]	[illegible]	[illegible]	Very dense, brown, coarse to fine SAND, little Gravel and Silt		
SS-5	[illegible]	[illegible]	[illegible]	Similar to SS-4 (Glacial Till)	[illegible]	
				Auger refusal at [illegible], probably on Bedrock		

TEST BORING LOG

PROJ. NAME: West Hartford CT1 780
LOCATION: West Hartford, CT
PROJECT NO.: J2075170
DATE START: February 15, 2007
DATE END: February 15, 2007
BORING CO.: New England Boring, Inc
CO. LOCATION: Glastonbury, CT
FOREMAN: Tim Carpenter
JGI REP.: Doug Yates

BORING: JB-2
LOCATION: See Plan
SURF. EL.: Unknown

GROUNDWATER OBSERVATIONS: 2/15/07 Not Encountered

SAMPLING No.	Depth (ft.)	Blows/6"	Penet./Rec. (in)	Sample Description	Strata Change Depth (ft)	Notes
SS-1	[illegible]	[illegible]	[illegible]	Loose, brown, medium to fine SAND, some Silt		
SS-2	[illegible]	[illegible]	[illegible]	Medium dense, brown, fine SAND, some Silt, trace Gravel		
SS-3	[illegible]	[illegible]	[illegible]	[illegible] (Fill)	[illegible]	
SS-4	[illegible]	[illegible]	[illegible]	Very dense, brown, medium to fine SAND, little Gravel (Glacial Till)	[illegible]	
				Auger refusal at [illegible], probably on Bedrock		

JGI EASTERN, Inc.

NOTES:

1. TEMPORARY CONSTRUCTION SLOPES SHALL BE DESIGNED IN COMPLIANCE WITH CURRENT GOVERNING REGULATIONS. CONSTRUCTION SLOPES SHALL BE CUT TO A STABLE INCLINE OR BRACED, DEPENDING ON THE EXCAVATION DEPTH AND SUBSURFACE CONDITIONS.
2. WHEN EXCAVATING TO EXPOSE THE TOP OF THE EXISTING TOWER FOUNDATION, SHORING WILL BE USED TO PREVENT UNDERMINING OF EXISTING FOUNDATIONS AND SLABS.
3. THE CONTRACTOR IS RESPONSIBLE FOR CUT SLOPES AND SHORING FOR SAFE CONSTRUCTION PRACTICES DURING CONSTRUCTION.
4. ALL EXCAVATION WORK WILL BE DONE BY HAND AS TO NOT DISTURB THE EXISTING GROUND RINGS, AND UTILITIES. ALL EXPOSED GROUND RINGS SHALL BE TESTED PRIOR TO BACKFILL UPON COMPLETION OF CONSTRUCTION.
5. EXISTING FOUNDATION CONDITIONS ARE ASSUMED TO BE ACCURATE AND WERE TAKEN FROM PIROD, INC. OF PLYMOUTH INDIANA. PROJECT NO. A 110876 DRAWING NO 206198-B TITLED "TOWER FOUNDATION" DATED 05/01/00

REVISIONS		
00	05/29/07	CONSTRUCTION

Cellco Partnership
d.b.a. verizon wireless

Natcomm, L.L.C.
63-2 North Branford Road
Branford, Connecticut 06405
Tel (203) 488-0580
Fax (203) 488-8587
Consulting Engineers • Project Management
Civil • Structural • Mechanical • Electrical

WEST HARTFORD II
457 QUAKER LANE SOUTH
WEST HARTFORD, CT 06110

PROJECT NO:	06115
DRAWN BY:	AAJ
CHECKED BY:	CFC
SCALE:	AS NOTED
DATE:	11/29/06

TOWER FOUNDATION REINFORCEMENT

S-1
DWG. 1 OF 1

EASTERN, Inc.

SERVICES
- Geotechnical
- Environmental
- Construction Monitoring
- Materials Testing

April 24, 2007

Mr. Carlo Centore
NATCOMM, LLC
63-2 North Branford Road
Branford, CT 06405

Advance Copy by Email

Re: Geotechnical Evaluation
T Mobile Communications Tower - West Hartford CT11178D
457 South Quaker Lane
West Hartford, Connecticut

JGI Project No. J2075170

Dear Mr. Centore:

This report, prepared by JGI EASTERN, Inc. (JGI), a Terracon Company, presents our geotechnical engineering evaluation of subsurface conditions as they relate to foundation design and earthwork construction for the proposed communications tower addition. Our services were conducted in accordance with our general agreement and your email authorization dated February 12, 2007. This report is subject to the limitations contained herein.

SITE AND PROJECT DESCRIPTION

The existing tower site is located approximately 300 feet northwest of St. Mark the Evangelist Church in West Hartford, Connecticut. An approximately 120-foot steel monopole tower and associated equipment shelters are located within the existing fenced compound area. We understand the existing tower was constructed in 2000. The area surrounding the tower is wooded and relatively flat.

The project involves adding additional communications antennas to the existing tower. Access to the site is provided by an existing gravel drive that extends from the church parking lot. The proposed tower development and exploration locations are shown on Figure 1, Subsurface Exploration Location Plan.

77 Sundial Avenue, Suite 401W
Manchester, NH 03103
(603) 647-9700 Fax 647-4432

114 Woodlawn Road
Berlin, CT 06037-1535
(860) 829-1725 Fax 829-1745

15 Holly Street, Unit 105
Scarborough, ME 04074
(207) 396-5374 Fax 396-5394

www.jgieastern.com

SUBSURFACE EXPLORATIONS AND CONDITIONS

Two test borings (JB-1 and JB-2) were advanced on February 15, 2007, under the supervision of JGI, using an ATV mounted drill rig owned and operated by New England Boring Contractors, Inc. of Glastonbury, Connecticut. The test borings were advanced to refusal on bedrock at depths ranging from 9.0 to 10.3 feet below existing grade.

The test borings were advanced to the east and southwest of the tower center with 4-inch inside diameter hollow stem augers (HSA). Soil samples were obtained semi-continuously with a standard 2.0-inch outside diameter split-barrel sampler. Standard Penetration Tests (SPTs) were performed at sampling intervals, in general accordance with ASTM D1586. The approximate exploration locations shown on Figure 1.

The subsurface profile consists of fill underlain by glacial till over bedrock. The fill has a thickness of about 5.5 to 6.0 feet and consists of loose to very dense, brown, medium to fine sand, little to some silt, and trace gravel. The glacial till was encountered below the fill, extending to depths ranging from 9.0 to 10.3 feet. The glacial till consists of medium dense to very dense, brown, course to fine sand, little to some silt, trace to little gravel. The bedrock was implied by consistent auger refusal at both boring locations at depths ranging from 9.0 to 10.3 feet.

At the time of the exploration program, groundwater was not observed. Groundwater levels vary depending upon season, precipitation and other conditions that may be different from those at the time of drilling. In addition, groundwater may seasonally perch above the relatively impermeable bedrock surface.

Because of approximately 18 inches of frost at the time of drilling, field resistivity testing could not be completed. A bulk sample of the on-site soil was collected and submitted for laboratory resistivity testing, in accordance with ASTM G57 using a soil test box and a 16gl Earth Resistivity Meter. The test results indicated that the bulk sample of fill has a saturated resistivity value of about 128,700 ohm-cm and a dry resistivity value of about 300,000 ohm-cm.

FOUNDATION TYPE AND DESIGN RECOMMENDATIONS

Tower

Based on available plans, the existing tower foundation is a 16.5-foot square, 2.5-foot thick, double reinforced concrete pad buried 6.5-feet below grade and extended to the surface with a 4-foot square reinforced concrete pier. Based on our analysis of the overturning factor of safety (FOS), using the new tower loadings for moment (1,530 kips*ft), shear (19 kips), and compression (26 kips), the FOS for the existing foundation is below the minimum FOS of 1.5. As such, we recommend that rock anchors be installed to provide additional uplift (overturning) and sliding resistance. Rock anchors (epoxied full length with RE500, or equivalent) should be drilled through the existing concrete footing, soil, and bedrock to a minimum depth of 15 feet into the underlying bedrock, which was

encountered at depths ranging from 9 to 10.3 feet below existing grade. Total rock anchor length should be around 25 feet. Spin-Lock Rock Anchors, or equivalent, should be used to mechanically connect the anchor to the bedrock. Following installation, the anchors should be proof tested in accordance with manufacturers specifications to a load of 60 kips. Following proof testing, the anchors should be post-tensioned to a load of 20 kips. The rock anchor details are shown on Figure 2, Rock Anchor Location and Detail Plan. 12-inch square, ¾-inch thick steel plates will transmit the load from the rock anchors to the foundation.

In order to install the anchors, soil from above the existing foundation will be excavated to uncover the footing. As such, weight will be removed from above the foundation, decreasing the temporary overturning resistance of the existing foundation. Temporary guy wires, or additional other appropriate means of temporary support, should be used to maintain the towers integrity during construction activities. The responsibility to maintain the tower integrity during construction lies solely with the contractor. Furthermore, the anchors were designed to increase the overturning moment of the foundation (in addition to the soil placed as backfill over the foundation) and were not designed to provide all of the overturning resistance. Control of backfill compaction above the foundation following anchor installation will be required to provide sufficient uplift resistance.

Seismic Design Criteria

Seismic design requirements for the State of Connecticut are based on the Connecticut State Building Code, which incorporates the Seismic Design Category approach from the 20003 International Building Code. The Seismic Design Category determination is based on:

- Building Importance (grouping based on use of building)
- Mapping factors (expected maximum considered ground motions)
- Site classification (soil type)

From our test borings, we consider that the site subsurface conditions match the General Soil Description of "rock". The Site Class is therefore B. We understand that this particular tower will not be designated for emergency preparedness or communications in the event of an earthquake. Therefore we expect that the communications tower will be classified as Category I Seismic Use Group. Based on the above, and a review of USGS National Seismic Hazard Mapping, we consider the facility to be in Seismic Design Category B. This determination should be confirmed by the structural engineer. The site is not susceptible to liquefaction in the event of an earthquake.

CONSTRUCTION RECOMMENDATIONS

Temporary Excavation and Dewatering

Excavations greater than 4 feet deep will be required during rock anchor installation. Temporary construction slopes should be designed in compliance with recent governing regulations. Construction slopes should be cut to a stable incline or braced, depending upon the excavation depth and encountered subsurface conditions. When excavating to expose the top of the existing tower foundation, care should be taken to prevent undermining or disturbing of the existing equipment cabinet slabs and/or foundations.

Construction slopes should be reviewed for signs of mass movement. If movement/potential stability problems are observed, work should cease; the geotechnical engineer should be immediately contacted. The responsibility for excavation safety and stability of temporary construction slopes should lie solely with the contractor.

We do not anticipate significant construction dewatering. The contractor should prevent groundwater, if encountered, and surface water runoff from collecting in excavations.

LIMITATIONS

The analyses and recommendations submitted in this report are based upon the data obtained from both test borings. The nature and extent of variations from the conditions observed within the explorations may not become evident until construction. If variations then appear evident, JGI should re-evaluate the recommendations of this report.

We request the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of our recommendations. In the event that changes in the nature, design, or location of the proposed development are planned, the conclusions and recommendations contained in this report shall not be considered valid unless we review the changes, and conclusions of the report are modified or verified by us in writing.

A geotechnical engineer should be retained to provide testing and monitoring services during the earthwork phases of the project. This is to observe compliance with our design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

This report has been prepared for the exclusive use of NATCOMM, LLC. in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. This report has been prepared for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to evaluation only.

If you have questions, please contact us. It was a pleasure working with you on this project and we look forward to working with you in the future.

Very truly yours,

JGI EASTERN, Inc.

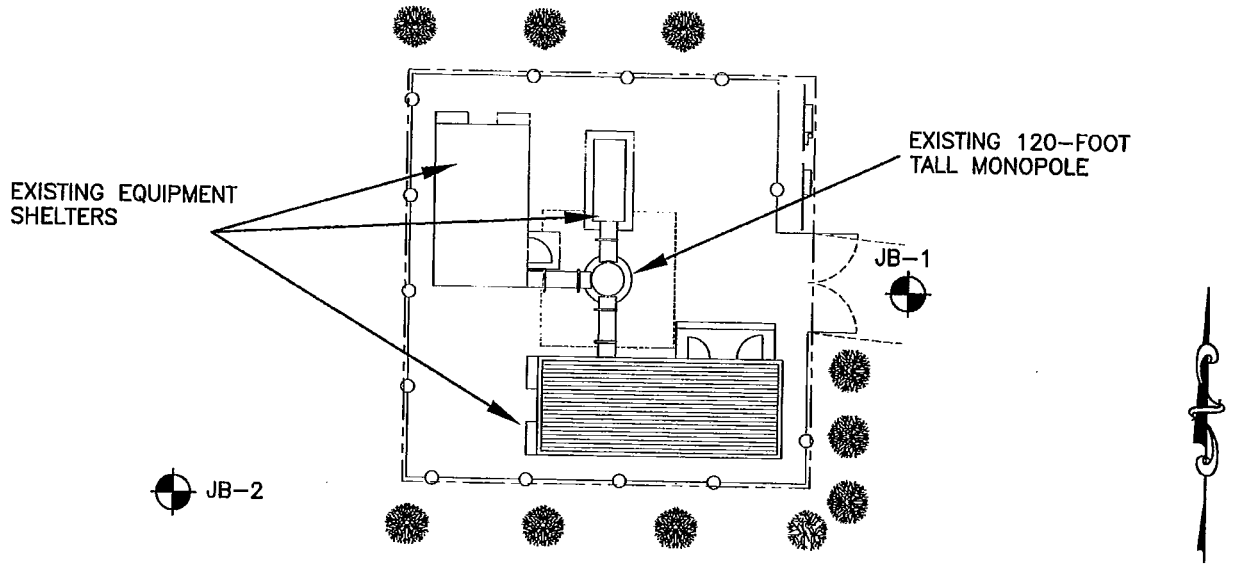
Robert W. Olah, EIT
Engineer II

Ryan R. Roy, P.E.
Principal/Senior Engineer

/ekc/J2075170

Attachments: Figure 1 – Subsurface Exploration Location Plan
Figure 2 – Rock Anchor Location and Detail Plan
Test Boring Logs, JB-1 and JB-2

INTERSTATE 84



NOTES:

1. THIS PLAN WAS PREPARED FROM A PDF DOCUMENT PROVIDED BY NATCOMM, LLC.
2. THE TEST BORINGS SHOWN AS JB-1 AND JB-2 WERE ADVANCED ON FEBRUARY 15, 2007 UNDER THE DIRECTION OF JGI WITH EQUIPMENT OWNED AND OPERATED BY NEW ENGLAND BORING CONTRACTORS, INC. OF GLASTONBURY, CONNECTICUT.
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LEGEND

JB-1 ⊕ TEST BORING LOCATION

GRAPHIC SCALE

10 0 10 20 40

(IN FEET)

T MOBILE COMMUNICATIONS TOWER – WEST HARTFORD CT1178D
WEST HARTFORD, CONNECTICUT

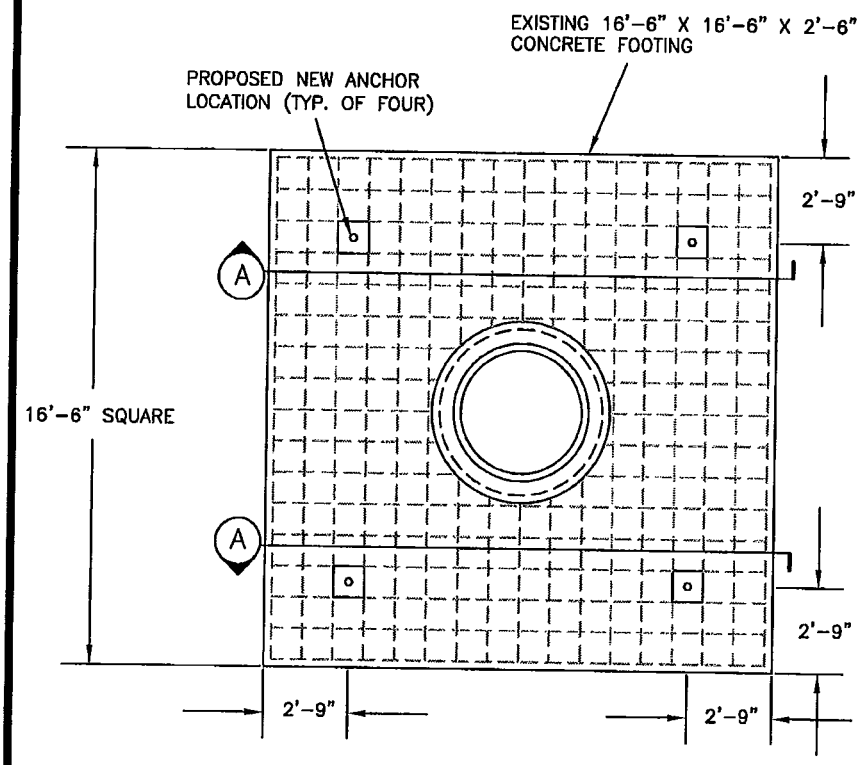
PREPARED FOR:
NATCOMM, LLC
63-2 NORTH BRANFORD RD
BRANFORD, CT 06405

DATE: APRIL 2007
SCALE: 1" = 20'
PROJECT NO: J2075170

FIGURE 1
SUBSURFACE EXPLORATION LOCATION PLAN

JGI EASTERN, Inc.
114 Woodlawn Road
Berlin, Connecticut 06037

J2075170



PLAN VIEW – EXISTING TOWER CONCRETE FOOTING
NOT TO SCALE

NOTES:

1. EXISTING FOUNDATION CONDITIONS ARE ASSUMED TO BE ACCURATE AND WERE TAKEN FROM PIROD, INC. OF PLYMOUTH, INDIANA PROJECT NUMBER: A-116876 DRAWING NUMBER: 206198-B TITLED: "TOWER FOUNDATION" DATED: 5/1/2000.

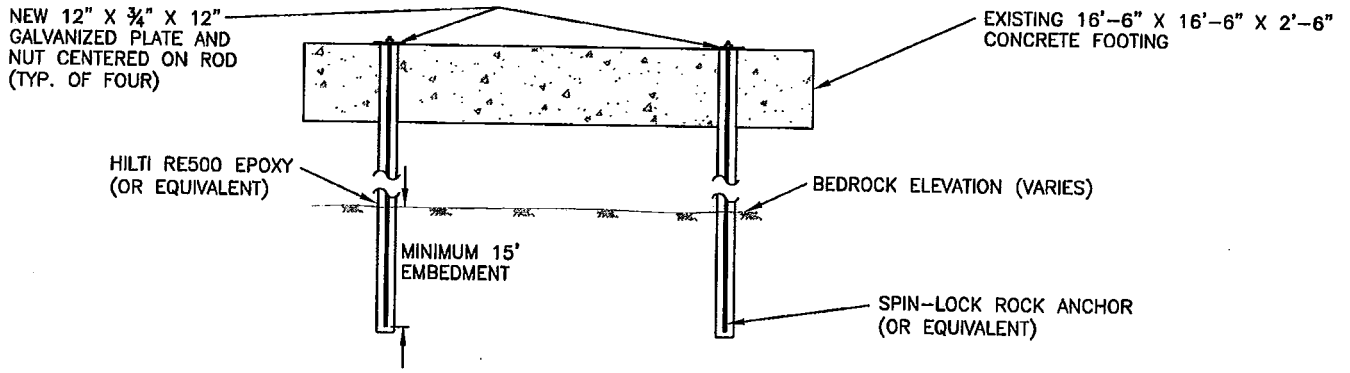
2. ANCHORS TO BE MINIMUM NO. 7 REINFORCING STEEL (TOP 5" THREADED) OR ⅞" THREADED ROD (FyMin = 60ksi), GALVANIZED.

3. HOLE SHALL BE DRILLED THROUGH EXISTING CONCRETE FOOTING, SOIL, AND BEDROCK TO A MINIMUM DEPTH OF 15' BELOW BEDROCK SURFACE. HOLE SHALL HAVE A MINIMUM ½" CLEARANCE ON ALL SIDES. EXISTING REINFORCING STEEL SHALL NOT BE CUT DURING DRILLING OPERATIONS. IF SLOUGHING OR CAVING SOILS ARE ENCOUNTERED DURING DRILLING THROUGH THE EXISTING SOILS, THE HOLE(S) SHALL BE CASED.

4. ANCHORS SHALL BE EPOXIED FULL LENGTH, WITH HILTI RE500, OR EQUIVALENT.

5. NEW GALVANIZED STEEL PLATE TO BE ASTM A36.

6. ALL ANCHORS SHALL BE PROOF-TESTED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS TO A LOAD OF 60 KIPS. FOLLOWING PROOF-TESTING, ANCHORS SHALL BE LOCKED OFF AT 20 KIPS.



SECTION A
NOT TO SCALE

T MOBILE COMMUNICATIONS TOWER – WEST HARTFORD CT1178D
WEST HARTFORD, CONNECTICUT

PREPARED FOR:
NATCOMM, LLC
63-2 NORTH BRANFORD RD
BRANFORD, CT 06405

DATE: APRIL 2007
SCALE: N.T.S.
PROJECT NO: J2075170

FIGURE 2
ROCK ANCHOR LOCATION AND DETAIL PLAN

JGI EASTERN, Inc.
114 Woodlawn Road
Berlin, Connecticut 06037

J2075170

TEST BORING LOG

PROJ. NAME:	West Hartford CT1178D	HAMMER	SAMPLER	CASING	SHEET 1 OF 1	
LOCATION:	West Hartford, CT	TYPE: Safety	SS	H S A	BORING:	JB-1
PROJECT NO.:	J2075170	SIZE: 140 lbs.	2" OD	4" ID	LOCATION:	See Plan
DATE START:	February 15, 2007	FALL: 30"	Drop Method:	Winch/Cable		
DATE END:	February 15, 2007				SURF. EL.:	Unknown
BORING CO.:	New England Boring, Inc.	GROUNDWATER OBSERVATIONS				
CO. LOCATION:	Glastonbury, CT	DATE	DEPTH	CASING AT	DURATION AFTER DRILLING	
FOREMAN:	Tim Carpenter	2/15/07	Not Encountered			
JGI REP:	Doug Yates					

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./ Rec. (in)	Sample Description	Strata Change Depth (ft)	Notes
						0.3	
	SS-1	0-2	28-59	24/14	SS-1: Very dense, brown, medium to fine SAND, little Silt, trace Gravel.		
			23-8				
	SS-2	2-4	8-32	24/7	SS-2: Dense, brown, medium to fine SAND, some Silt, trace Gravel.		
			11-5				
5							
	SS-3	5-7	5-8	24/14	SS-3: Similar to SS-2, except medium dense. (Fill)	6.0	
			9-18				
	SS-4	7-9	24-49	24/18	SS-4: Very dense, brown, coarse to fine SAND, little Gravel and Silt.		
			66-26				
10							
	SS-5	10-10.3	70/3"	3/3	SS-5: Similar to SS-4. (Glacial Till)	10.5	
					Auger refusal at 10.5', probably on Bedrock.		
15							
20							
25							
30							

JGI EASTERN, Inc.

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
medium stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

Boring No. JB-1

TEST BORING LOG

PROJ. NAME:	West Hartford CT1178D	HAMMER	SAMPLER	CASING	SHEET 1 OF 1	
LOCATION:	West Hartford, CT	TYPE: Safety	SS	H S A	BORING:	JB-2
PROJECT NO.:	J2075170	SIZE: 140 lbs.	2" OD	4" ID	LOCATION:	See Plan
DATE START:	February 15, 2007	FALL: 30"	Drop Method:	Winch/Cable		
DATE END:	February 15, 2007				SURF. EL:	Unknown
BORING CO.:	New England Boring, Inc.	GROUNDWATER OBSERVATIONS				
CO. LOCATION:	Glastonbury, CT	DATE	DEPTH	CASING AT	DURATION AFTER DRILLING	
FOREMAN:	Tim Carpenter	2/15/07	Not Encountered			
JGI REP:	Doug Yates					

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./ Rec. (in)	Sample Description	Strata Change Depth (ft)	Notes
	SS-1	0-2	3-4	24/10	SS-1: Loose, brown, medium to fine SAND, little Silt.	0.3	
			3-4				
	SS-2	2-4	5-9	24/8	SS-2: Medium dense, brown, fine SAND, some Silt, trace Gravel.		
			11-18				
5					(Fill)	5.5	
	SS-3	5-7	3-10	24/12	SS-3: Medium dense, brown, medium to fine SAND, some Silt, trace Gravel.		
			14-32				
	SS-4	7-8.9	26-37	22/10	SS-4: Very dense, brown, medium to fine SAND, some Silt, little Gravel.		
			34-100/4"		(Glacial Till)	9.0	
10					Auger refusal at 9.0', probably on Bedrock.		
15							
20							
25							
30							

EASTERN, Inc.

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
medium stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

Boring No. JB-2