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

March 21, 2011

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

RE: **EM-VER-080-100107** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 119 Empire Avenue, Meriden, Connecticut. Modification of Previous Acknowledgment.

Dear Attorney Baldwin:

In addition to the Connecticut Siting Council (Council) acknowledgement dated February 19, 2010 (filing dated January 7, 2010), 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 with the following conditions:

- Any deviation from the proposed modification as specified in this notice and supporting materials with Council shall render this acknowledgement invalid;
- Any material changes to this modification as proposed shall require the filing of a new notice with the Council;
- Not less than 45 days after completion of construction, the Council shall be notified in writing that construction has been completed;
- The validity of this action shall expire one year from the date of this letter; and
- The applicant may file a request for an extension of time beyond the one year deadline provided that such request is submitted to the Council not less than 60 days prior to the expiration;

The proposed modifications including the placement of all necessary equipment and shelters within the tower compound are to be implemented as specified here and in your notice dated March 7, 2011. 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. Thank you for your attention and cooperation.

Very truly yours,

Linda Roberts
Executive Director

LR/CDM/laf

c: The Honorable Michael S. Rohde, Mayor, City of Meriden
Lawrence Kendzior, City Manager, City of Meriden
Dominick Caruso, City Planner, City of Meriden
Atlas Container, LLC

ROBINSON & COLE LLP

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
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ORIGINAL

March 7, 2011

Michael Perrone
Siting Analyst
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Cellco Partnership d/b/a Verizon Wireless**
EM-VER-080-100107 – 119 Empire Avenue, Meriden, Connecticut

Dear Mr. Perrone:

On February 19, 2010, the Siting Council acknowledged receipt of Cellco's notice of intent to modify the above-referenced telecommunications facility. This modification involved the removal of six (6) of Cellco's existing PCS antennas, replacing them with three (3) new PCS antennas and three (3) new LTE antennas.

In addition to the antenna modifications, Cellco now intends to install six (6) coax cable diplexers on its antenna mounting platform. Attached to this letter is an updated Structural Analysis Report for the previously approved antenna modifications including the coax diplexers and a copy of the diplexer specifications. This analysis confirms that the tower can support all of Cellco's proposed modifications.

If you have any questions regarding any of these materials, please do not hesitate to contact me or Rachel Mayo.

Sincerely,

Kenneth C. Baldwin

Attachment
Copy to:
Sandy M. Carter
Brian Ragozzine
Mark Gauger

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

125-ft Existing EEI Monopole

Proposed Verizon Wireless
LTE Antenna Installation

Verizon Wireless Site Ref:
Meriden North

119 Empire Ave.
Meriden, CT

Centek Project No. 11001.CO19

Date: March 3, 2011

Prepared for:

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

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

Table of Contents

Introduction

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

The host tower is a 125-ft tall, three-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI); project no. 13454 dated September 27, 2005. The tower geometry and structure member sizes were obtained from the original manufacturers design documents. Foundation information was taken from foundation analysis conducted by Gibble Norden Champion Brown Consulting Engineers Inc., project no. 05060; dated May 31, 2005. Antenna and appurtenance information were obtained from a previous structural report prepared by Natcomm job no. 10001.CO2 dated December 17, 2009.

The tower is made up of three (3) 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 22.0-in at the top and 45.5-in at the base.

Verizon Wireless is proposing the installation of six (6) diplexers mounted their existing platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

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

- TOWN (EXISTING):
  Antennas: One (1) lighting rod mounted with an elevation of 125-ft above grade level.
- VERIZON (EXISTING TO REMAIN):
  Antennas: Six (6) Antel LPA-80080/4CF, two (2) Andrew LNX-6514DS-T4M, one (1) Powerwave P65-16-XL-2 and three (3) RYMSA MG D3-800T0 panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 125-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- T-MOBILE (EXISTING):
  Antennas: Three (3) RFS APX16DWV-16DWVS-A20 and three (3) EMS RR90-17-02DP panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 115-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- **VERIZON (PROPOSED):**
  Antennas: Six (6) RFS FD9R6004/2C-3L Diplexers mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 125-ft above grade level.

Primary Assumptions Used in the Analysis

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

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 85 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:	New Haven; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Meriden; v = 100 mph (3 second gust) equivalent to v = 80 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	EIA/TIA wind speed criteria controls.	
Load Cases:	Load Case 1; 85 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design of monopole towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed. This load case typically controls the design of 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 **57.5%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L3)	1.0'-49.46'	57.5%	**PASS**

Foundation and Anchors

The existing foundation consists of a four (4) 7-ft x 4-ft x 4-ft and one (1) 7-ft x 10-ft x 10-ft concrete piers bearing on a 50.0 square x 2.5-ft thick reinforced concrete mat. The existing foundation properties were obtained from the aforementioned GNCB design report; project no. 05060; dated May 31, 2005. The base of the tower is connected to the foundation by means of (12) 2.25"∅, ASTM A615-75 anchor bolts embedded 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. The foundation was found to be within allowable limits.

Base Reactions	Design Load (1)	Proposed Load	Result
Shear	**27.9 kips**	**14 kips**	**PASS**
Axial	**24.9 kips**	**19 kips**	**PASS**
Moment	**2795 k-ft**	**1206 k-ft**	**PASS**

Note: (1) Design Loads taken from aforementioned GNBC foundation analysis dated May 31, 2005.

- 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	46.7%	**PASS**
Base Plate	Bending	39.0%	**PASS**

Conclusion

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Carlo F. Centore, PE
Principal ~ Structural Engineer

Prepared by:

Timothy J. Lynn, 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:

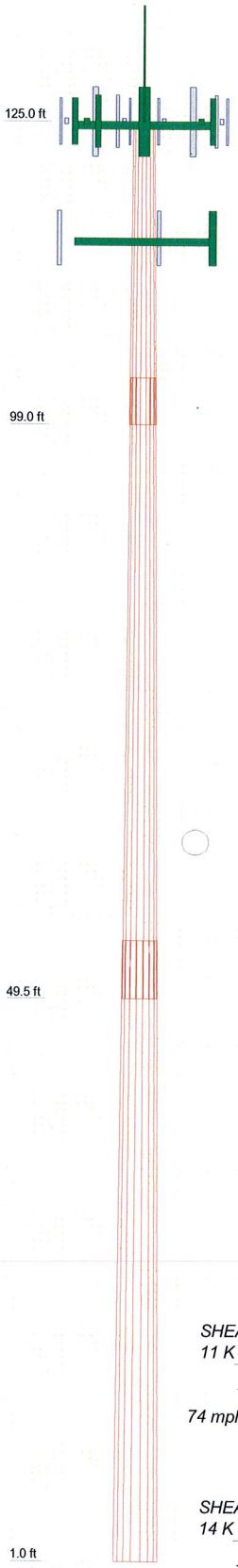
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of CENTEK engineering, Inc. or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

General Description of Structural Analysis Program

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	1	2	3
Length (ft)	25.96	53.50	53.54
Number of Sides	18	18	18
Thickness (in)	0.1875	0.2500	0.3125
Socket Length (ft)	3.92	5.08	
Top Dia (in)	22.0000	26.0058	35.0035
Bot Dia (in)	27.1600	36.5000	45.5000
Grade	A572-65		
Weight (K)	1.3	4.5	7.2

13.0

AXIAL
24 K

SHEAR
11 K

MOMENT
1010 kip-ft

TORQUE 0 kip-ft
74 mph WIND - 0.5000 in ICE

AXIAL
19 K

SHEAR
14 K

MOMENT
1206 kip-ft

TORQUE 0 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod 1"x10'	130	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	125
LPA-80080-4CF (Verizon Existing)	125	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	125
LNX-6514DS-T4M (Verizon Existing)	125	EEI Low Profile Platform (Verizon)	125
MG D3-800T0 (Verizon Existing)	125	APX16DWV-16DWVS-A20 (T-Mobile Existing)	115
LPA-80080-4CF (Verizon Existing)	125	APX16DWV-16DWVS-A20 (T-Mobile Existing)	115
LPA-80080-4CF (Verizon Existing)	125	APX16DWV-16DWVS-A20 (T-Mobile Existing)	115
LNX-6514DS-T4M (Verizon Existing)	125	RR90-17-02DP (T-Mobile Existing)	115
MG D3-800T0 (Verizon Existing)	125	RR90-17-02DP (T-Mobile Existing)	115
LPA-80080-4CF (Verizon Existing)	125	RR90-17-02DP (T-Mobile Existing)	115
LPA-80080-4CF (Verizon Existing)	125	EEI Low Profile Platform (T-Mobile)	115
P65-16-XL-2 (Verizon Existing)	125		
MG D3-800T0 (Verizon Existing)	125		
LPA-80080-4CF (Verizon Existing)	125		
(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	125		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
5. Welds are fabricated with ER-70S-6 electrodes.
6. TOWER RATING: 57.5%

Centek Engineering Inc.
63-2 North Branford Road
Branford, CT 06405
Phone: 203.488.0580
FAX: 203.488.8587

Job: **11001.CO19 - Meriden North**		
Project: **125' EEI Monopole - 119 Empire Ave., Meriden, CT**		
Client: Verizon Wireless	Drawn by: TJL	App'd:
Code: TIA/EIA-222-F	Date: 03/03/11	Scale: NTS
Path: J:\Jobs\1100100 WTC\CO19 - Meriden North - 119 Empire Ave, Meriden, CT\Calcs\ERI Files\125-ft EEI Monopole.eri		Dwg No. E-1

Tower Input Data

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

Basic wind speed of 85 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	125.00-99.04	25.96	3.92	18	22.0000	27.1600	0.1875	0.7500	A572-65 (65 ksi)
L2	99.04-49.46	53.50	5.08	18	26.0058	36.5000	0.2500	1.0000	A572-65 (65 ksi)
L3	49.46-1.00	53.54		18	35.0035	45.5000	0.3125	1.2500	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	22.3394	12.9812	780.3007	7.7434	11.1760	69.8193	1561.6281	6.4918	3.5420	18.891
	27.5790	16.0520	1475.3982	9.5752	13.7973	106.9340	2952.7378	8.0275	4.4502	23.734
L2	27.1878	20.4373	1712.8177	9.1433	13.2110	129.6512	3427.8891	10.2206	4.1370	16.548
	37.0631	28.7644	4775.3853	12.8688	18.5420	257.5442	9557.0541	14.3849	5.9840	23.936
L3	36.5548	34.4092	5231.7442	12.3153	17.7818	294.2190	10470.3725	17.2079	5.6106	17.954
	46.2019	44.8204	11562.4359	16.0416	23.1140	500.2352	23140.0860	22.4144	7.4580	23.866

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 125.00-99.04				1	1	1		
L2 99.04-49.46				1	1	1		
L3 49.46-1.00				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 (Verizon Existing)	C	No	Inside Pole	125.00 - 1.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (T-Mobile Existing)	C	No	Inside Pole	115.00 - 1.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04

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	125.00-99.04	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.52
L2	99.04-49.46	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.24
L3	49.46-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.21

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	125.00-99.04	A	0.500	0.000	0.000	0.000	0.000	0.00

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.52
L2	99.04-49.46	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.24
L3	49.46-1.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.21

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	125.00-99.04	0.0000	0.0000	0.0000	0.0000
L2	99.04-49.46	0.0000	0.0000	0.0000	0.0000
L3	49.46-1.00	0.0000	0.0000	0.0000	0.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
EEI Low Profile Platform (Verizon)	C	None		0.0000	125.00	No Ice	22.50	22.50	1.50
						1/2" Ice	28.20	28.20	2.25
LPA-80080-4CF (Verizon Existing)	A	From Face	4.00 -6.00 0.00	0.0000	125.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LNX-6514DS-T4M (Verizon Existing)	A	From Face	4.00 0.00 0.00	0.0000	125.00	No Ice 1/2" Ice	8.41 8.96	5.41 5.86	0.04 0.09
MG D3-800T0 (Verizon Existing)	A	From Face	4.00 4.00 0.00	0.0000	125.00	No Ice 1/2" Ice	3.45 3.80	2.22 2.55	0.02 0.04
LPA-80080-4CF (Verizon Existing)	A	From Face	4.00 6.00 0.00	0.0000	125.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LPA-80080-4CF (Verizon Existing)	B	From Face	4.00 -6.00 0.00	0.0000	125.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LNX-6514DS-T4M (Verizon Existing)	B	From Face	4.00 0.00 0.00	0.0000	125.00	No Ice 1/2" Ice	8.41 8.96	5.41 5.86	0.04 0.09
MG D3-800T0 (Verizon Existing)	B	From Face	4.00 4.00 0.00	0.0000	125.00	No Ice 1/2" Ice	3.45 3.80	2.22 2.55	0.02 0.04
LPA-80080-4CF (Verizon Existing)	B	From Face	4.00 6.00	0.0000	125.00	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
			0.00						
LPA-80080-4CF	C	From Face	4.00	0.0000	125.00	No Ice	2.62	6.06	0.01
(Verizon Existing)			-6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
P65-16-XL-2	C	From Face	4.00	0.0000	125.00	No Ice	8.40	4.12	0.02
(Verizon Existing)			0.00			1/2" Ice	8.95	4.56	0.06
			0.00						
MG D3-800T0	C	From Face	4.00	0.0000	125.00	No Ice	3.45	2.22	0.02
(Verizon Existing)			4.00			1/2" Ice	3.80	2.55	0.04
			0.00						
LPA-80080-4CF	C	From Face	4.00	0.0000	125.00	No Ice	2.62	6.06	0.01
(Verizon Existing)			6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
(2) FD9R6004/2C-3L	A	From Face	4.00	0.0000	125.00	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	4.00	0.0000	125.00	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	4.00	0.0000	125.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Proposed)			0.00						
EEI Low Profile Platform	C	None		0.0000	115.00	No Ice	22.50	22.50	1.50
(T-Mobile)						1/2" Ice	28.20	28.20	2.25
APX16DWV-16DWVS-A20	A	From Face	4.00	0.0000	115.00	No Ice	7.07	2.15	0.04
(T-Mobile Existing)			6.00			1/2" Ice	7.52	2.49	0.07
			0.00						
APX16DWV-16DWVS-A20	B	From Face	4.00	0.0000	115.00	No Ice	7.07	2.15	0.04
(T-Mobile Existing)			6.00			1/2" Ice	7.52	2.49	0.07
			0.00						
APX16DWV-16DWVS-A20	C	From Face	4.00	0.0000	115.00	No Ice	7.07	2.15	0.04
(T-Mobile Existing)			6.00			1/2" Ice	7.52	2.49	0.07
			0.00						
RR90-17-02DP	A	From Face	4.00	0.0000	115.00	No Ice	4.36	1.97	0.02
(T-Mobile Existing)			-6.00			1/2" Ice	4.77	2.31	0.04
			0.00						
RR90-17-02DP	B	From Face	4.00	0.0000	115.00	No Ice	4.36	1.97	0.02
(T-Mobile Existing)			-6.00			1/2" Ice	4.77	2.31	0.04
			0.00						
RR90-17-02DP	C	From Face	4.00	0.0000	115.00	No Ice	4.36	1.97	0.02
(T-Mobile Existing)			-6.00			1/2" Ice	4.77	2.31	0.04
			0.00						
Lightning Rod 1"x10'	C	None		0.0000	130.00	No Ice	1.00	1.00	0.04
						1/2" Ice	2.02	2.02	0.05

Tower Pressures - No Ice

$G_H = 1.690$

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 125.00-99.04	111.57	1.416	26	53.175	A	0.000	53.175	53.175	100.00	0.000	0.000
					B	0.000	53.175		100.00	0.000	0.000
					C	0.000	53.175		100.00	0.000	0.000
L2 99.04-49.46	73.58	1.257	23	130.715	A	0.000	130.715	130.715	100.00	0.000	0.000
					B	0.000	130.715		100.00	0.000	0.000
					C	0.000	130.715		100.00	0.000	0.000
L3 49.46-1.00	24.49	1	19	164.561	A	0.000	164.561	164.561	100.00	0.000	0.000
					B	0.000	164.561		100.00	0.000	0.000
					C	0.000	164.561		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G 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 125.00-99.04	111.57	1.416	20	0.5000	55.338	A	0.000	55.338	55.338	100.00	0.000	0.000
						B	0.000	55.338		100.00	0.000	0.000
						C	0.000	55.338		100.00	0.000	0.000
L2 99.04-49.46	73.58	1.257	17	0.5000	134.847	A	0.000	134.847	134.847	100.00	0.000	0.000
						B	0.000	134.847		100.00	0.000	0.000
						C	0.000	134.847		100.00	0.000	0.000
L3 49.46-1.00	24.49	1	14	0.5000	168.599	A	0.000	168.599	168.599	100.00	0.000	0.000
						B	0.000	168.599		100.00	0.000	0.000
						C	0.000	168.599		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 125.00-99.04	111.57	1.416	9	53.175	A	0.000	53.175	53.175	100.00	0.000	0.000
					B	0.000	53.175		100.00	0.000	0.000
					C	0.000	53.175		100.00	0.000	0.000
L2 99.04-49.46	73.58	1.257	8	130.715	A	0.000	130.715	130.715	100.00	0.000	0.000
					B	0.000	130.715		100.00	0.000	0.000
					C	0.000	130.715		100.00	0.000	0.000
L3 49.46-1.00	24.49	1	7	164.561	A	0.000	164.561	164.561	100.00	0.000	0.000
					B	0.000	164.561		100.00	0.000	0.000
					C	0.000	164.561		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	1.53	58.94	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	3.32	67.01	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	3.40	70.10	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	490.09 kip-ft	8.25		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	1.53	58.94	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	3.32	67.01	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	3.40	70.10	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	490.09 kip-ft	8.25		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	1.53	58.94	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	3.32	67.01	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	3.40	70.10	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	490.09 kip-ft	8.25		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	1.53	58.94	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	3.32	67.01	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	3.40	70.10	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	490.09 kip-ft	8.25		

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 125.00-99.04	0.52	1.68	A	1	0.65	1	1	1	55.338	1.19	46.01	C
			B	1	0.65	1	1	1	55.338			
			C	1	0.65	1	1	1	55.338			
L2 99.04-49.46	1.24	5.46	A	1	0.65	1	1	1	134.847	2.57	51.84	C
			B	1	0.65	1	1	1	134.847			
			C	1	0.65	1	1	1	134.847			
L3 49.46-1.00	1.21	8.45	A	1	0.65	1	1	1	168.599	2.61	53.87	C
			B	1	0.65	1	1	1	168.599			
			C	1	0.65	1	1	1	168.599			
Sum Weight:	2.97	15.60						OTM	379.91 kip-ft	6.37		

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 125.00-99.04	0.52	1.68	A	1	0.65	1	1	1	55.338	1.19	46.01	C
			B	1	0.65	1	1	1	55.338			
			C	1	0.65	1	1	1	55.338			
L2 99.04-49.46	1.24	5.46	A	1	0.65	1	1	1	134.847	2.57	51.84	C
			B	1	0.65	1	1	1	134.847			
			C	1	0.65	1	1	1	134.847			
L3 49.46-1.00	1.21	8.45	A	1	0.65	1	1	1	168.599	2.61	53.87	C
			B	1	0.65	1	1	1	168.599			
			C	1	0.65	1	1	1	168.599			
Sum Weight:	2.97	15.60						OTM	379.91 kip-ft	6.37		

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 125.00-99.04	0.52	1.68	A	1	0.65	1	1	1	55.338	1.19	46.01	C
			B	1	0.65	1	1	1	55.338			
			C	1	0.65	1	1	1	55.338			
L2 99.04-49.46	1.24	5.46	A	1	0.65	1	1	1	134.847	2.57	51.84	C
			B	1	0.65	1	1	1	134.847			
			C	1	0.65	1	1	1	134.847			
L3 49.46-1.00	1.21	8.45	A	1	0.65	1	1	1	168.599	2.61	53.87	C
			B	1	0.65	1	1	1	168.599			
			C	1	0.65	1	1	1	168.599			
Sum Weight:	2.97	15.60						OTM	379.91 kip-ft	6.37		

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 125.00-99.04	0.52	1.68	A	1	0.65	1	1	1	55.338	1.19	46.01	C
			B	1	0.65	1	1	1	55.338			
			C	1	0.65	1	1	1	55.338			
L2 99.04-49.46	1.24	5.46	A	1	0.65	1	1	1	134.847	2.57	51.84	C
			B	1	0.65	1	1	1	134.847			
			C	1	0.65	1	1	1	134.847			
L3 49.46-1.00	1.21	8.45	A	1	0.65	1	1	1	168.599	2.61	53.87	C
			B	1	0.65	1	1	1	168.599			
			C	1	0.65	1	1	1	168.599			
Sum Weight:	2.97	15.60						OTM	379.91 kip-ft	6.37		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	0.53	20.40	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	1.15	23.19	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	1.18	24.26	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	169.58	2.85		

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

Tower Forces - Service - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	0.53	20.40	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	1.15	23.19	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	1.18	24.26	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	169.58 kip-ft	2.85		

Tower Forces - Service - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	0.53	20.40	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	1.15	23.19	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	1.18	24.26	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	169.58 kip-ft	2.85		

Tower Forces - Service - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	0.53	20.40	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	1.15	23.19	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	1.18	24.26	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	169.58 kip-ft	2.85		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	12.98					
Bracing Weight	0.00					
Total Member Self-Weight	12.98			-0.10	0.00	
Total Weight	19.41			-0.10	0.00	
Wind 0 deg - No Ice		0.00	-13.96	-1178.01	0.00	0.00
Wind 30 deg - No Ice		6.95	-12.09	-1020.20	-585.33	-0.14
Wind 45 deg - No Ice		9.83	-9.87	-833.00	-827.78	-0.20
Wind 60 deg - No Ice		12.04	-6.98	-589.05	-1013.82	-0.25
Wind 90 deg - No Ice		13.90	0.00	-0.10	-1170.66	-0.29
Wind 120 deg - No Ice		12.04	6.98	588.86	-1013.82	-0.25
Wind 135 deg - No Ice		9.83	9.87	832.81	-827.78	-0.20
Wind 150 deg - No Ice		6.95	12.09	1020.00	-585.33	-0.14
Wind 180 deg - No Ice		0.00	13.96	1177.81	0.00	0.00
Wind 210 deg - No Ice		-6.95	12.09	1020.00	585.33	0.14
Wind 225 deg - No Ice		-9.83	9.87	832.81	827.78	0.20
Wind 240 deg - No Ice		-12.04	6.98	588.86	1013.82	0.25
Wind 270 deg - No Ice		-13.90	0.00	-0.10	1170.66	0.29
Wind 300 deg - No Ice		-12.04	-6.98	-589.05	1013.82	0.25
Wind 315 deg - No Ice		-9.83	-9.87	-833.00	827.78	0.20
Wind 330 deg - No Ice		-6.95	-12.09	-1020.20	585.33	0.14
Member Ice	2.62					
Total Weight Ice	24.11			-0.12	0.00	
Wind 0 deg - Ice		0.00	-11.33	-976.73	0.00	0.00
Wind 30 deg - Ice		5.64	-9.81	-845.89	-485.56	-0.11
Wind 45 deg - Ice		7.98	-8.01	-690.69	-686.69	-0.16
Wind 60 deg - Ice		9.77	-5.66	-488.42	-841.02	-0.19
Wind 90 deg - Ice		11.29	0.00	-0.12	-971.13	-0.22
Wind 120 deg - Ice		9.77	5.66	488.19	-841.02	-0.19
Wind 135 deg - Ice		7.98	8.01	690.45	-686.69	-0.16
Wind 150 deg - Ice		5.64	9.81	845.65	-485.56	-0.11
Wind 180 deg - Ice		0.00	11.33	976.49	0.00	0.00
Wind 210 deg - Ice		-5.64	9.81	845.65	485.56	0.11
Wind 225 deg - Ice		-7.98	8.01	690.45	686.69	0.16
Wind 240 deg - Ice		-9.77	5.66	488.19	841.02	0.19
Wind 270 deg - Ice		-11.29	0.00	-0.12	971.13	0.22
Wind 300 deg - Ice		-9.77	-5.66	-488.42	841.02	0.19
Wind 315 deg - Ice		-7.98	-8.01	-690.69	686.69	0.16
Wind 330 deg - Ice		-5.64	-9.81	-845.89	485.56	0.11
Total Weight	19.41			-0.10	0.00	
Wind 0 deg - Service		0.00	-4.83	-407.68	0.00	0.00
Wind 30 deg - Service		2.41	-4.18	-353.07	-202.54	-0.05

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 45 deg - Service		3.40	-3.42	-288.30	-286.43	-0.07
Wind 60 deg - Service		4.17	-2.42	-203.89	-350.80	-0.09
Wind 90 deg - Service		4.81	0.00	-0.10	-405.07	-0.10
Wind 120 deg - Service		4.17	2.42	203.69	-350.80	-0.09
Wind 135 deg - Service		3.40	3.42	288.10	-286.43	-0.07
Wind 150 deg - Service		2.41	4.18	352.88	-202.54	-0.05
Wind 180 deg - Service		0.00	4.83	407.48	0.00	0.00
Wind 210 deg - Service		-2.41	4.18	352.88	202.54	0.05
Wind 225 deg - Service		-3.40	3.42	288.10	286.43	0.07
Wind 240 deg - Service		-4.17	2.42	203.69	350.80	0.09
Wind 270 deg - Service		-4.81	0.00	-0.10	405.07	0.10
Wind 300 deg - Service		-4.17	-2.42	-203.89	350.80	0.09
Wind 315 deg - Service		-3.40	-3.42	-288.30	286.43	0.07
Wind 330 deg - Service		-2.41	-4.18	-353.07	202.54	0.05

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

Comb. No.	Description
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	125 - 99.04	Pole	Max Tension	18	0.00	0.00	0.00
			Max. Compression	18	-7.39	0.00	0.12
			Max. Mx	6	-4.61	-121.97	0.09
			Max. My	2	-4.60	0.00	123.38
			Max. Vy	6	7.18	-121.97	0.09
			Max. Vx	2	-7.24	0.00	123.38
			Max. Torque	6			0.29
L2	99.04 - 49.46	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-13.72	0.00	0.12
			Max. Mx	6	-10.08	-547.58	0.10
			Max. My	2	-10.07	0.00	551.92
			Max. Vy	6	10.42	-547.58	0.10
			Max. Vx	2	-10.48	0.00	551.92
			Max. Torque	6			0.29
L3	49.46 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-24.11	0.00	0.12
			Max. Mx	6	-19.40	-1198.85	0.10
			Max. My	2	-19.40	0.00	1206.39
			Max. Vy	6	13.91	-1198.85	0.10
			Max. Vx	2	-13.97	0.00	1206.39
			Max. Torque	6			0.29

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	19	24.11	0.00	11.33
	Max. H_x	14	19.41	13.90	0.00
	Max. H_z	2	19.41	0.00	13.96
	Max. M_x	2	1206.39	0.00	13.96
	Max. M_z	6	1198.85	-13.90	0.00
	Max. Torsion	6	0.29	-13.90	0.00
	Min. Vert	1	19.41	0.00	0.00
	Min. H_x	6	19.41	-13.90	0.00
	Min. H_z	10	19.41	0.00	-13.96

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
	Min. M_x	10	-1206.18	0.00	-13.96
	Min. M_z	14	-1198.85	13.90	0.00
	Min. Torsion	14	-0.29	13.90	0.00

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	19.41	0.00	0.00	-0.10	0.00	0.00
Dead+Wind 0 deg - No Ice	19.41	0.00	-13.96	-1206.39	0.00	0.00
Dead+Wind 30 deg - No Ice	19.41	6.95	-12.09	-1044.78	-599.42	-0.15
Dead+Wind 45 deg - No Ice	19.41	9.83	-9.87	-853.08	-847.71	-0.21
Dead+Wind 60 deg - No Ice	19.41	12.04	-6.98	-603.25	-1038.23	-0.25
Dead+Wind 90 deg - No Ice	19.41	13.90	-0.00	-0.10	-1198.85	-0.29
Dead+Wind 120 deg - No Ice	19.41	12.04	6.98	603.05	-1038.23	-0.25
Dead+Wind 135 deg - No Ice	19.41	9.83	9.87	852.88	-847.71	-0.21
Dead+Wind 150 deg - No Ice	19.41	6.95	12.09	1044.58	-599.42	-0.15
Dead+Wind 180 deg - No Ice	19.41	0.00	13.96	1206.18	0.00	0.00
Dead+Wind 210 deg - No Ice	19.41	-6.95	12.09	1044.58	599.42	0.15
Dead+Wind 225 deg - No Ice	19.41	-9.83	9.87	852.88	847.71	0.21
Dead+Wind 240 deg - No Ice	19.41	-12.04	6.98	603.05	1038.23	0.25
Dead+Wind 270 deg - No Ice	19.41	-13.90	-0.00	-0.10	1198.85	0.29
Dead+Wind 300 deg - No Ice	19.41	-12.04	-6.98	-603.25	1038.23	0.25
Dead+Wind 315 deg - No Ice	19.41	-9.83	-9.87	-853.08	847.71	0.21
Dead+Wind 330 deg - No Ice	19.41	-6.95	-12.09	-1044.78	599.42	0.15
Dead+Ice+Temp	24.11	0.00	0.00	-0.12	0.00	0.00
Dead+Wind 0 deg+Ice+Temp	24.11	0.00	-11.33	-1010.00	0.00	0.00
Dead+Wind 30 deg+Ice+Temp	24.11	5.64	-9.81	-874.70	-502.09	-0.11
Dead+Wind 45 deg+Ice+Temp	24.11	7.98	-8.01	-714.21	-710.06	-0.16
Dead+Wind 60 deg+Ice+Temp	24.11	9.77	-5.66	-505.06	-869.64	-0.19
Dead+Wind 90 deg+Ice+Temp	24.11	11.29	0.00	-0.13	-1004.18	-0.22
Dead+Wind 120 deg+Ice+Temp	24.11	9.77	5.66	504.81	-869.64	-0.19
Dead+Wind 135 deg+Ice+Temp	24.11	7.98	8.01	713.96	-710.06	-0.16
Dead+Wind 150 deg+Ice+Temp	24.11	5.64	9.81	874.45	-502.09	-0.11
Dead+Wind 180 deg+Ice+Temp	24.11	0.00	11.33	1009.75	0.00	0.00
Dead+Wind 210 deg+Ice+Temp	24.11	-5.64	9.81	874.45	502.09	0.11
Dead+Wind 225 deg+Ice+Temp	24.11	-7.98	8.01	713.96	710.06	0.16
Dead+Wind 240 deg+Ice+Temp	24.11	-9.77	5.66	504.81	869.64	0.19
Dead+Wind 270 deg+Ice+Temp	24.11	-11.29	0.00	-0.13	1004.18	0.22
Dead+Wind 300 deg+Ice+Temp	24.11	-9.77	-5.66	-505.06	869.64	0.19
Dead+Wind 315 deg+Ice+Temp	24.11	-7.98	-8.01	-714.21	710.06	0.16
Dead+Wind 330 deg+Ice+Temp	24.11	-5.64	-9.81	-874.70	502.09	0.11
Dead+Wind 0 deg - Service	19.41	0.00	-4.83	-417.70	0.00	0.00
Dead+Wind 30 deg - Service	19.41	2.41	-4.18	-361.75	-207.51	-0.05
Dead+Wind 45 deg - Service	19.41	3.40	-3.42	-295.39	-293.46	-0.07
Dead+Wind 60 deg - Service	19.41	4.17	-2.42	-208.90	-359.41	-0.09
Dead+Wind 90 deg - Service	19.41	4.81	0.00	-0.10	-415.02	-0.10
Dead+Wind 120 deg - Service	19.41	4.17	2.42	208.69	-359.41	-0.09
Dead+Wind 135 deg - Service	19.41	3.40	3.42	295.18	-293.46	-0.07
Dead+Wind 150 deg - Service	19.41	2.41	4.18	361.54	-207.51	-0.05
Dead+Wind 180 deg - Service	19.41	0.00	4.83	417.49	0.00	0.00
Dead+Wind 210 deg - Service	19.41	-2.41	4.18	361.54	207.51	0.05
Dead+Wind 225 deg - Service	19.41	-3.40	3.42	295.18	293.46	0.07
Dead+Wind 240 deg - Service	19.41	-4.17	2.42	208.69	359.41	0.09
Dead+Wind 270 deg - Service	19.41	-4.81	0.00	-0.10	415.02	0.10
Dead+Wind 300 deg - Service	19.41	-4.17	-2.42	-208.90	359.41	0.09

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead+Wind 315 deg - Service	19.41	-3.40	-3.42	-295.39	293.46	0.07
Dead+Wind 330 deg - Service	19.41	-2.41	-4.18	-361.75	207.51	0.05

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-19.41	0.00	0.00	19.41	0.00	0.000%
2	0.00	-19.41	-13.96	0.00	19.41	13.96	0.000%
3	6.95	-19.41	-12.09	-6.95	19.41	12.09	0.000%
4	9.83	-19.41	-9.87	-9.83	19.41	9.87	0.000%
5	12.04	-19.41	-6.98	-12.04	19.41	6.98	0.000%
6	13.90	-19.41	0.00	-13.90	19.41	0.00	0.000%
7	12.04	-19.41	6.98	-12.04	19.41	-6.98	0.000%
8	9.83	-19.41	9.87	-9.83	19.41	-9.87	0.000%
9	6.95	-19.41	12.09	-6.95	19.41	-12.09	0.000%
10	0.00	-19.41	13.96	0.00	19.41	-13.96	0.000%
11	-6.95	-19.41	12.09	6.95	19.41	-12.09	0.000%
12	-9.83	-19.41	9.87	9.83	19.41	-9.87	0.000%
13	-12.04	-19.41	6.98	12.04	19.41	-6.98	0.000%
14	-13.90	-19.41	0.00	13.90	19.41	0.00	0.000%
15	-12.04	-19.41	-6.98	12.04	19.41	6.98	0.000%
16	-9.83	-19.41	-9.87	9.83	19.41	9.87	0.000%
17	-6.95	-19.41	-12.09	6.95	19.41	12.09	0.000%
18	0.00	-24.11	0.00	0.00	24.11	0.00	0.000%
19	0.00	-24.11	-11.33	0.00	24.11	11.33	0.000%
20	5.64	-24.11	-9.81	-5.64	24.11	9.81	0.000%
21	7.98	-24.11	-8.01	-7.98	24.11	8.01	0.000%
22	9.77	-24.11	-5.66	-9.77	24.11	5.66	0.000%
23	11.29	-24.11	0.00	-11.29	24.11	0.00	0.000%
24	9.77	-24.11	5.66	-9.77	24.11	-5.66	0.000%
25	7.98	-24.11	8.01	-7.98	24.11	-8.01	0.000%
26	5.64	-24.11	9.81	-5.64	24.11	-9.81	0.000%
27	0.00	-24.11	11.33	0.00	24.11	-11.33	0.000%
28	-5.64	-24.11	9.81	5.64	24.11	-9.81	0.000%
29	-7.98	-24.11	8.01	7.98	24.11	-8.01	0.000%
30	-9.77	-24.11	5.66	9.77	24.11	-5.66	0.000%
31	-11.29	-24.11	0.00	11.29	24.11	0.00	0.000%
32	-9.77	-24.11	-5.66	9.77	24.11	5.66	0.000%
33	-7.98	-24.11	-8.01	7.98	24.11	8.01	0.000%
34	-5.64	-24.11	-9.81	5.64	24.11	9.81	0.000%
35	0.00	-19.41	-4.83	0.00	19.41	4.83	0.000%
36	2.41	-19.41	-4.18	-2.41	19.41	4.18	0.000%
37	3.40	-19.41	-3.42	-3.40	19.41	3.42	0.000%
38	4.17	-19.41	-2.42	-4.17	19.41	2.42	0.000%
39	4.81	-19.41	0.00	-4.81	19.41	0.00	0.000%
40	4.17	-19.41	2.42	-4.17	19.41	-2.42	0.000%
41	3.40	-19.41	3.42	-3.40	19.41	-3.42	0.000%
42	2.41	-19.41	4.18	-2.41	19.41	-4.18	0.000%
43	0.00	-19.41	4.83	0.00	19.41	-4.83	0.000%
44	-2.41	-19.41	4.18	2.41	19.41	-4.18	0.000%
45	-3.40	-19.41	3.42	3.40	19.41	-3.42	0.000%
46	-4.17	-19.41	2.42	4.17	19.41	-2.42	0.000%
47	-4.81	-19.41	0.00	4.81	19.41	0.00	0.000%
48	-4.17	-19.41	-2.42	4.17	19.41	2.42	0.000%
49	-3.40	-19.41	-3.42	3.40	19.41	3.42	0.000%
50	-2.41	-19.41	-4.18	2.41	19.41	4.18	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00003191
3	Yes	5	0.00000001	0.00014614
4	Yes	5	0.00000001	0.00016659
5	Yes	5	0.00000001	0.00015099
6	Yes	4	0.00000001	0.00024723
7	Yes	5	0.00000001	0.00014434
8	Yes	5	0.00000001	0.00016652
9	Yes	5	0.00000001	0.00014984
10	Yes	4	0.00000001	0.00003190
11	Yes	5	0.00000001	0.00014984
12	Yes	5	0.00000001	0.00016652
13	Yes	5	0.00000001	0.00014434
14	Yes	4	0.00000001	0.00024723
15	Yes	5	0.00000001	0.00015099
16	Yes	5	0.00000001	0.00016659
17	Yes	5	0.00000001	0.00014614
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00009697
20	Yes	5	0.00000001	0.00032583
21	Yes	5	0.00000001	0.00037197
22	Yes	5	0.00000001	0.00033174
23	Yes	5	0.00000001	0.00009731
24	Yes	5	0.00000001	0.00032345
25	Yes	5	0.00000001	0.00037163
26	Yes	5	0.00000001	0.00033011
27	Yes	5	0.00000001	0.00009692
28	Yes	5	0.00000001	0.00033011
29	Yes	5	0.00000001	0.00037163
30	Yes	5	0.00000001	0.00032345
31	Yes	5	0.00000001	0.00009731
32	Yes	5	0.00000001	0.00033174
33	Yes	5	0.00000001	0.00037197
34	Yes	5	0.00000001	0.00032583
35	Yes	4	0.00000001	0.00001446
36	Yes	4	0.00000001	0.00030194
37	Yes	4	0.00000001	0.00035875
38	Yes	4	0.00000001	0.00032758
39	Yes	4	0.00000001	0.00004247
40	Yes	4	0.00000001	0.00029421
41	Yes	4	0.00000001	0.00035813
42	Yes	4	0.00000001	0.00032028
43	Yes	4	0.00000001	0.00001445
44	Yes	4	0.00000001	0.00032028
45	Yes	4	0.00000001	0.00035813
46	Yes	4	0.00000001	0.00029421
47	Yes	4	0.00000001	0.00004247
48	Yes	4	0.00000001	0.00032758
49	Yes	4	0.00000001	0.00035875
50	Yes	4	0.00000001	0.00030194

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	125 - 99.04	16.489	35	1.1406	0.0017
L2	102.96 - 49.46	11.383	35	1.0383	0.0009
L3	54.54 - 1	3.129	35	0.5375	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.00	Lightning Rod 1"x10'	35	16.489	1.1406	0.0017	33038
125.00	EEI Low Profile Platform	35	16.489	1.1406	0.0017	33038
115.00	EEI Low Profile Platform	35	14.126	1.1020	0.0013	16519

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	125 - 99.04	47.584	2	3.2909	0.0048
L2	102.96 - 49.46	32.858	2	2.9967	0.0025
L3	54.54 - 1	9.034	2	1.5520	0.0007

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.00	Lightning Rod 1"x10'	2	47.584	3.2909	0.0048	11536
125.00	EEI Low Profile Platform	2	47.584	3.2909	0.0048	11536
115.00	EEI Low Profile Platform	2	40.768	3.1800	0.0037	5767

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	125 - 99.04 (1)	TP27.16x22x0.1875	25.96	124.00	160.0	5.832	15.5883	-4.60	90.90	0.051

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 $\frac{P}{P_a}$
L2	99.04 - 49.46 (2)	TP36.5x26.0058x0.25	53.50	124.00	118.9	10.563	27.9737	-10.07	295.50	0.034
L3	49.46 - 1 (3)	TP45.5x35.0035x0.3125	53.54	124.00	92.8	17.347	44.8204	-19.40	777.49	0.025

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	125 - 99.04 (1)	TP27.16x22x0.1875	123.38	-14.685	39.000	0.377	0.00	0.000	39.000	0.000
L2	99.04 - 49.46 (2)	TP36.5x26.0058x0.25	551.92	-27.196	39.000	0.697	0.00	0.000	39.000	0.000
L3	49.46 - 1 (3)	TP45.5x35.0035x0.3125	1206.39	-28.940	39.000	0.742	0.00	0.000	39.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	125 - 99.04 (1)	TP27.16x22x0.1875	0.051	0.377	0.000	0.427 ✔	1.333	H1-3 ✔
L2	99.04 - 49.46 (2)	TP36.5x26.0058x0.25	0.034	0.697	0.000	0.731 ✔	1.333	H1-3 ✔
L3	49.46 - 1 (3)	TP45.5x35.0035x0.3125	0.025	0.742	0.000	0.767 ✔	1.333	H1-3 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	125 - 99.04	Pole	TP27.16x22x0.1875	1	-4.60	121.17	32.0	Pass
L2	99.04 - 49.46	Pole	TP36.5x26.0058x0.25	2	-10.07	393.90	54.9	Pass
L3	49.46 - 1	Pole	TP45.5x35.0035x0.3125	3	-19.40	1036.40	57.5	Pass
							Summary	
						Pole (L3)	57.5	Pass
						RATING =	**57.5**	**Pass**

CENTEK engineering
Centered on Solutions℠
63-2 North Branford Road
Branford, CT 06405
www.centekeng.com
P: (203) 488-0580
F: (203) 488-8587

Subject:		Anchor Bolt and Baseplate Analysis
Location:		125-ft EEI Monopole Meriden, CT
Rev. 0: 3/3/11		Prepared by: T.J.L. Checked by: C.F.C. Job No. 11001. CO19

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 1206·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 14·kips	(Input From RisaTower)
Axial Force =	Axial := 19·kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 12	(User Input)
Diameter of Bolt Circle =	D_{bc} := 54.00·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strenght =	F_u := 100·ksi	(User Input)
Bolt Yeild Strenght =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 GR 60

Plate Yield Strength =	Fy_{bp} := 60·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 2.0·in	(User Input)
Base Plate Diameter =	D_{bp} := 60.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 45.50·in	(User Input)

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Subject: Anchor Bolt and Baseplate Analysis

Location: 125-ft EEI Monopole
Meriden, CT

Rev. 0: 3/3/11

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 11001. CO19

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 = $i := 1 .. N$

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

$d_1 = 13.50 \cdot in$ $d_7 = -13.50 \cdot in$

$d_2 = 23.38 \cdot in$ $d_8 = -23.38 \cdot in$

$d_3 = 27.00 \cdot in$ $d_9 = -27.00 \cdot in$

$d_4 = 23.38 \cdot in$ $d_{10} = -23.38 \cdot in$

$d_5 = 13.50 \cdot in$ $d_{11} = -13.50 \cdot in$

$d_6 = 0.00 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 22.8 \cdot in$

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

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

$MA_2 = 0.63 \cdot in$ $MA_8 = 0.00 \cdot in$

$MA_3 = 4.25 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 0.63 \cdot in$ $MA_{10} = 0.00 \cdot in$

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

$MA_6 = 0.00 \cdot in$ etc

Effective Width of Baseplate for Bending = $B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 31.3 \cdot in$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 4.374 \times 10^3 \cdot in^2$

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

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

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

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

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 87.8 \cdot kips$

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

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 45.0 \cdot \%$ 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 = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.292 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 4.2 \cdot ksi$

Allowable Bending Stress = $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 60 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

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

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 90.9 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 28 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 46.7 \cdot \%$$

Condition 2 =

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

Condition2 = "OK"

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Base Plate Analysis:

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

$C_1 = 46.3 \cdot kips$ $C_7 = -43.1 \cdot kips$

$C_2 = 78.9 \cdot kips$ $C_8 = -75.8 \cdot kips$

$C_3 = 90.9 \cdot kips$ $C_9 = -87.8 \cdot kips$

$C_4 = 78.9 \cdot kips$ $C_{10} = -75.8 \cdot kips$

$C_5 = 46.3 \cdot kips$ $C_{11} = -43.1 \cdot kips$

$C_6 = 1.6 \cdot kips$ etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 23.3 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 59.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 39.0 \cdot \%$

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

Condition3 = "Ok"

GNCB
Gibbie Norden Champion Brown
Consulting Engineers, Inc.

Transmittal

Sent via: Mail

Date: June 16, 2005
Attention: Carlo Centore
Company: Natcomm, LLC
63-2 North Branford Road
Branford, CT 06405
Project: Verizon Tower – Meriden Water Tower
Job Number: #05060

Copies:	Description:	Action:
1	Calcs for Checking Existing Base Mat	
20	GNCB services contract	

Remarks:

Calcs as requested. Also in our haste to get the calcs done we did not execute a contract for this work. Please review the attached contract and if acceptable have executed and return one copy for our records.

Signed: Charles C. Brown P.E.

Copies to: **Sent via:**

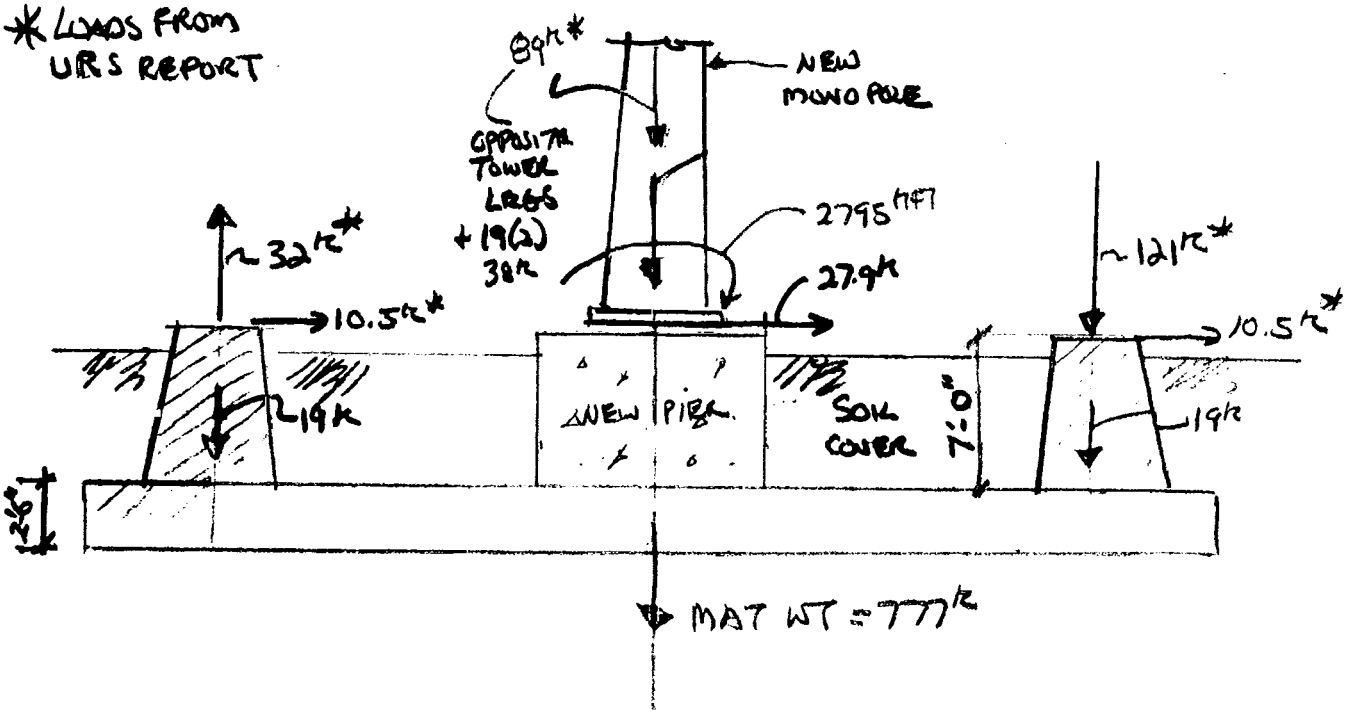
130 ELM STREET
POST OFFICE BOX 802
OLD SAYBROOK
CONNECTICUT 06475
PHONE: 860 388 1224
FAX: 860 388 4613
GNCBENGINEERS.COM

GNCB

GIBBLE NORDEN CHAMPION BROWN
Consulting Engineers Incorporated
130 Elm Street Post Office Box 802
OLD SAYBROOK, CONNECTICUT 06475
Telephone (860) 388-1224

PROJECT NAME: Verizon Tower Meriden Water Tower
PROJECT NO: # 05060 SHEET NO. 1 OF 5
BY: CCB DATE 5/31/05
SCALE:

* LOADS FROM URS REPORT



DISREGARD OVERBURDEN SOIL AND PUMP HOUSE

AXIAL kips: MAT 777 + PIERS 19(4) + TOWER 187 + POLE 29.9 + NEW PIER 105 = 1170 k

SHEAR kips: TOWER 10.5(2) + 27.9 = 48.9 k

OTM AT BASE OF MAT

Sum Mom AT Bottom CENTER

Shears AT TOP OF PIERS

$121 \times 19.25 + 32(19.25) + 2795 + (27.9 + 10.5(2)) \times 9.5'$

$= 6205$ k-FT

GNCB

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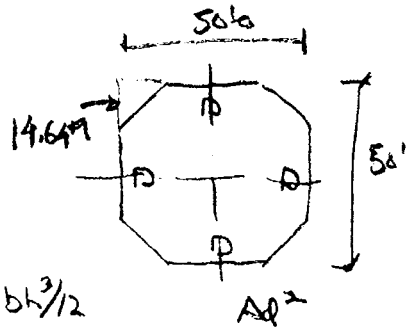
Consulting Engineers Incorporated
130 Elm Street Post Office Box 802
OLD SAYBROOK, CONNECTICUT 06475
Telephone (860) 388-1224

PROJECT NAME: Verizon Tower - Meriden Water Tower
PROJECT NO: # 05060 SHEET NO. 2 OF 5
BY: CB DATE 5/31/05
SCALE:



$$I_{MAT} = \frac{50^4}{12} - 4\left(\frac{14.64^2}{2} \times 20.12^2\right) = 347306\ ft^4$$

178527

$$Area_{MAT} = 50 \times 50 - \frac{14.64^2}{2} \times 4 = 2071\ ft^2$$

429

$$P/A \pm \frac{Mc}{I}$$

$$\frac{1170^K}{2071\ ft^2} \pm \frac{6205(25^{ft})}{347306} = \pm 1.011^{ksf} \text{ or } \pm .719^{ksf}$$

.565 .446 $< 1800\ psf$

NOTE: SINCE POS DOWNWARD PRESSURE RESULTANT within kern of base

CONCLUSION: BEARING PRESSURE OF 1800 PSF IS NOT EXCEEDED
MAT REMAINS TOP & BOTTOM TO TOTAL MOMENTS AND ACT AS RIGID BODY.

GNCB

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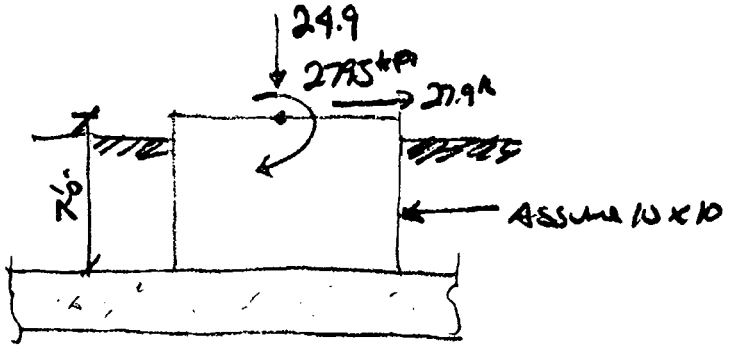
Consulting Engineers Incorporated
130 Elm Street Post Office Box 802
OLD SAYBROOK, CONNECTICUT 06475
Telephone (860) 388-1224

PROJECT NAME: Verizon Tower - Meriden Water Tower
PROJECT NO: #05060 SHEET NO. 3 OF 5
BY: CAB DATE 5/2/05
SCALE:

Transfer Loads into Eng Mat

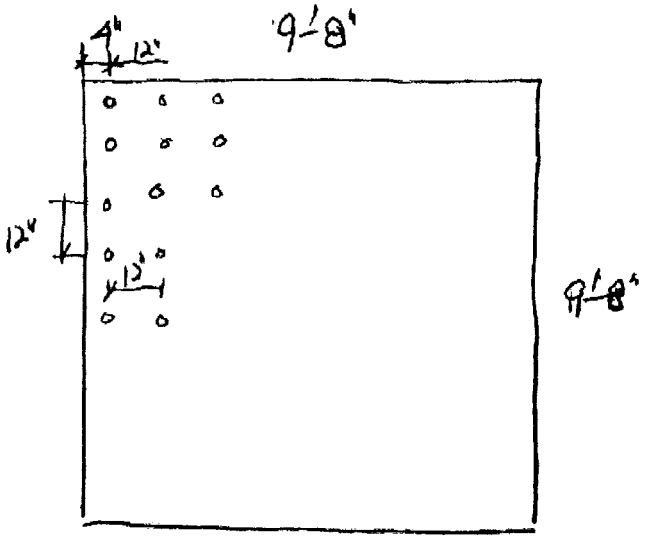


OTM = 2795 + 27.9(7') = 2990 ^FT
AT PIER BASE

− .667 × (10×10×7(150) × 5' + 249(6') = 433 ^FT

SF on DEAD LD

2990 − 433 = 2557 ^FT



Assume existing conc 3000 PSI (per Eng)
USE 7/8" ϕ REBAR W/
HILTI HIT RE 500 EPOXY

7/8" W/ 7 7/8 EMBMENT
(11 13/16 SPACING FOR FULL VALUE)

= 14185^# (.133)
= 18.87^K ← UNIT LOAD INCREASE

GNCB

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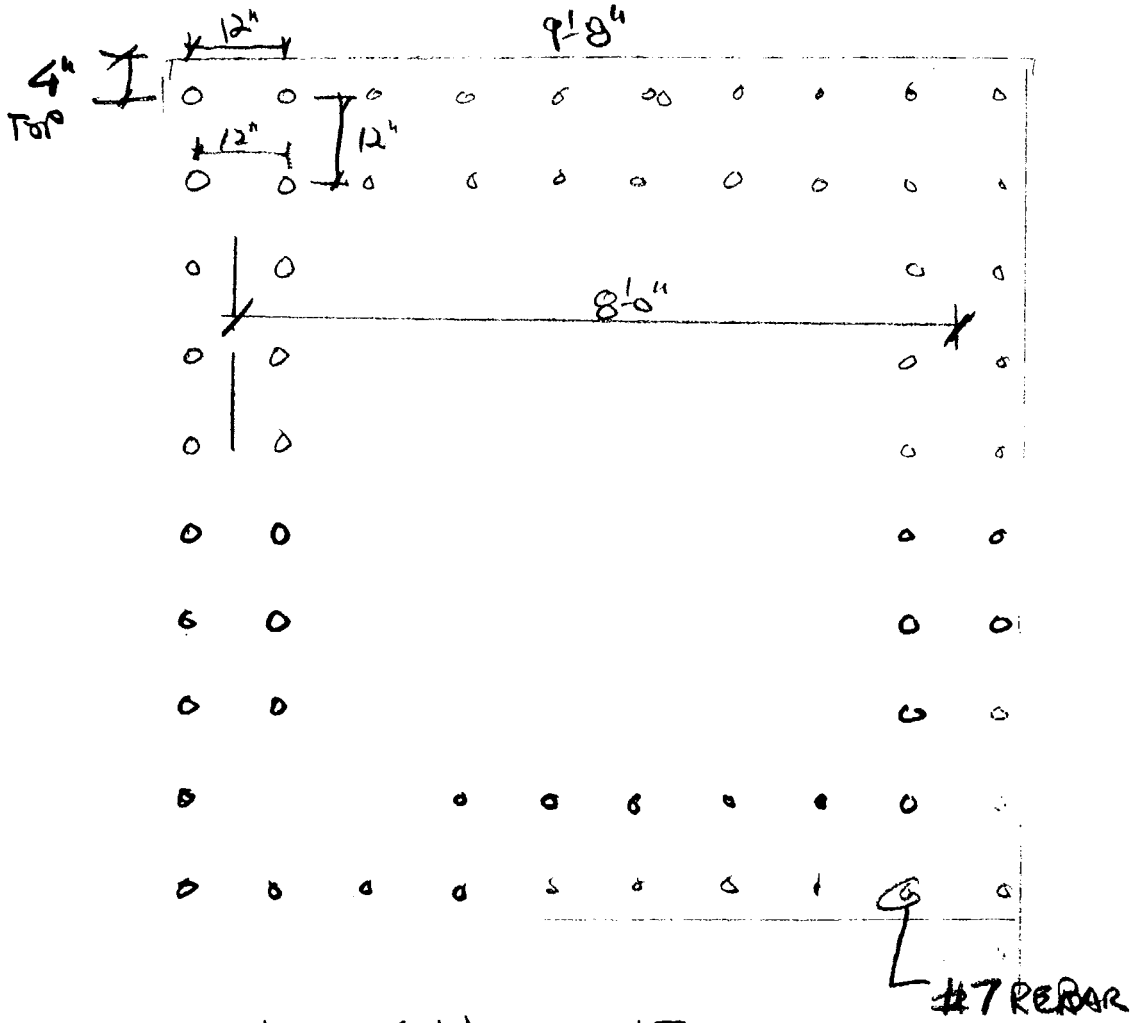
Consulting Engineers Incorporated
130 Elm Street Post Office Box 802
OLD SAYBROOK, CONNECTICUT 06475
Telephone (860) 388-1224

PROJECT NAME: Veterans Tower - Meriden Water Tower
OJECT NO: # 05060 SHEET NO 4 OF 5
08 DATE 5/31/05
SCALE:

OTm = 2557 kft



Resist. Moment $18.87^k \times 20 (8'\text{-}0) > 3019^{kft} > 2557$

Okay

GIBBLE NORDEN CHAMPION BROWN
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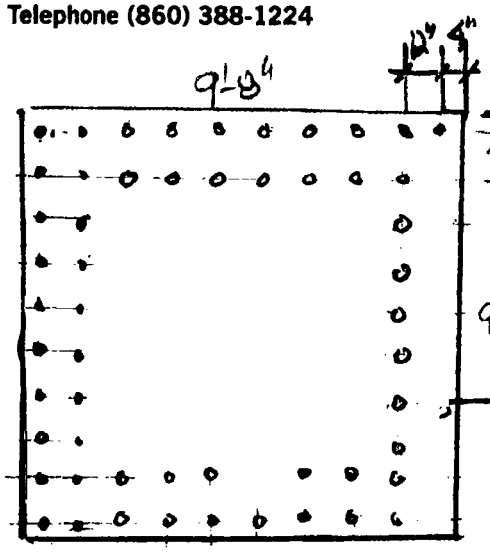
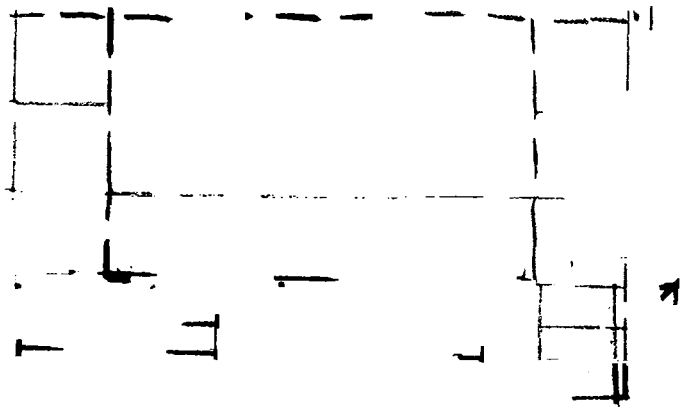
PROJECT NAME: Verizon - Meriden
PROJECT NO: #05060 SHEET NO. 5 OF 5
BY: CAB DATE 5/31/05
SCALE:

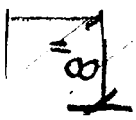


PLAN 1/4"=1'-0"

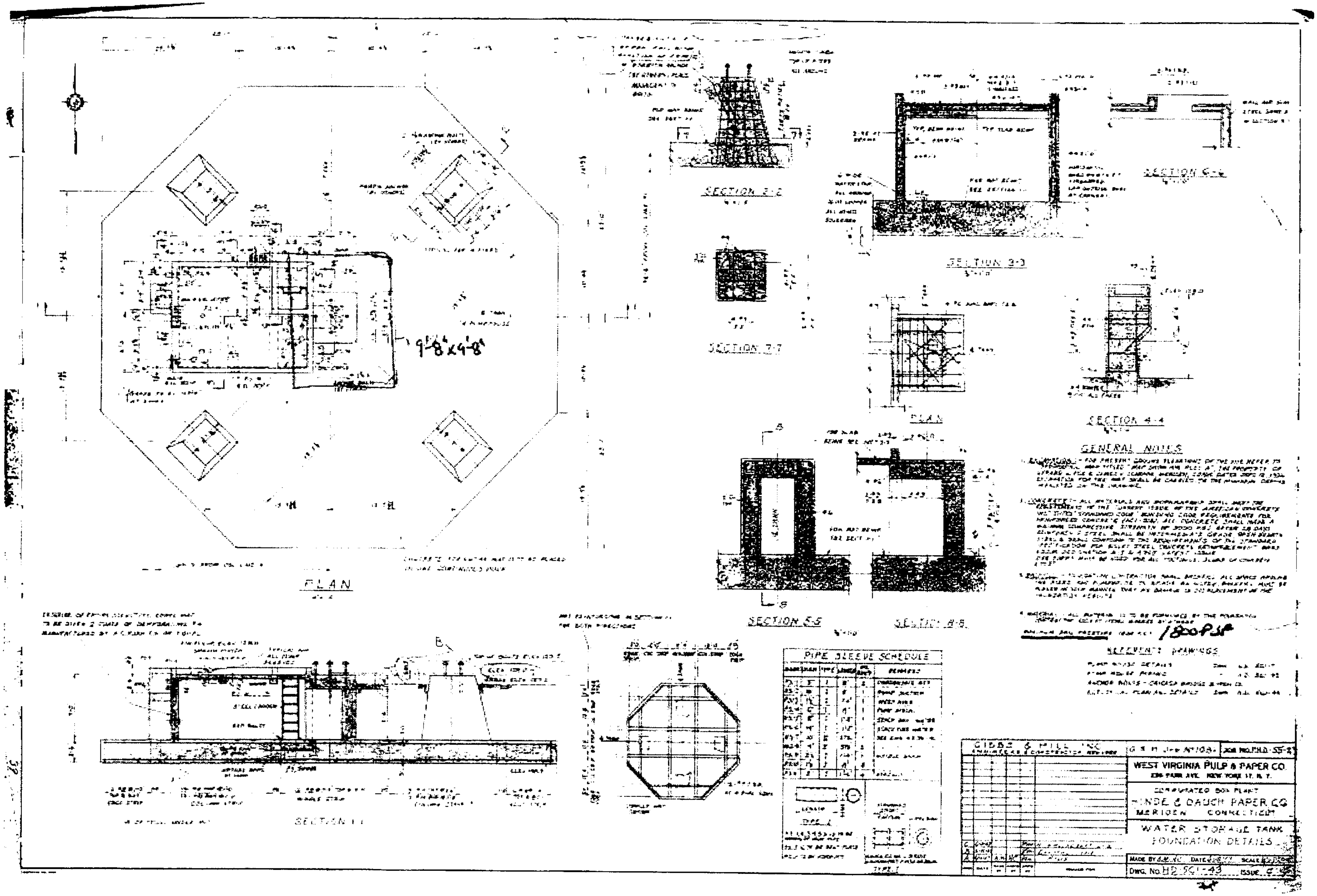
#7 X 4'-2" DRILL AND (64 TOTAL) EPOXY ANCHOR WITH HILTI HIT RE 500 EPOXY ADHESIVE PER MANUFACTURER'S INSTRUCTIONS

NEW MONO POLE





1"=1'-0"


PLAN
SECTION 1-1
SECTION 2-2
SECTION 3-3
SECTION 4-4
SECTION 5-5
SECTION 6-6
SECTION 7-7
SECTION 8-8
PLAN
9'-8"x4'-8"
GENERAL NOTES
1800 PSF
REFERENCE DRAWINGS
PIPE SLEEVE SCHEDULE
GIBBS & HILL INC
G & H Job No 1084
JOB NO. PHLD-55-2
WEST VIRGINIA PULP & PAPER CO.
230 PARK AVE. NEW YORK 17, N. Y.
CORRUGATED BOX PLANT
HINDE & DAUCH PAPER CO
MERIDEN CONNECTICUT
WATER STORAGE TANK
FOUNDATION DETAILS
MADE BY
DATE
SCALE
DWG. No. HD-SSL-43
ISSUE

SITE NAME	MERIDEN NORTH CT	ECP - CELL #	2	193
LATITUDE	41-34-21.95 N	LONGITUDE	72-46-43.95 W	
		SAVE BUTTON		
Additional Comments:		STRUCTURE TYPE	MONOPOLE	

700 Mhz - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	LNX-6514DS-T4M-750_4	LNX-6514DS-T4M-750_4	P65-16-XL-2_2_790_-2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0	Cellular Modcell 4.0	Cellular Modcell 4.0
ANTENNA TYPE	LPA-80080/4CF	LPA-80080/4CF	LPA-80080/4CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	2
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

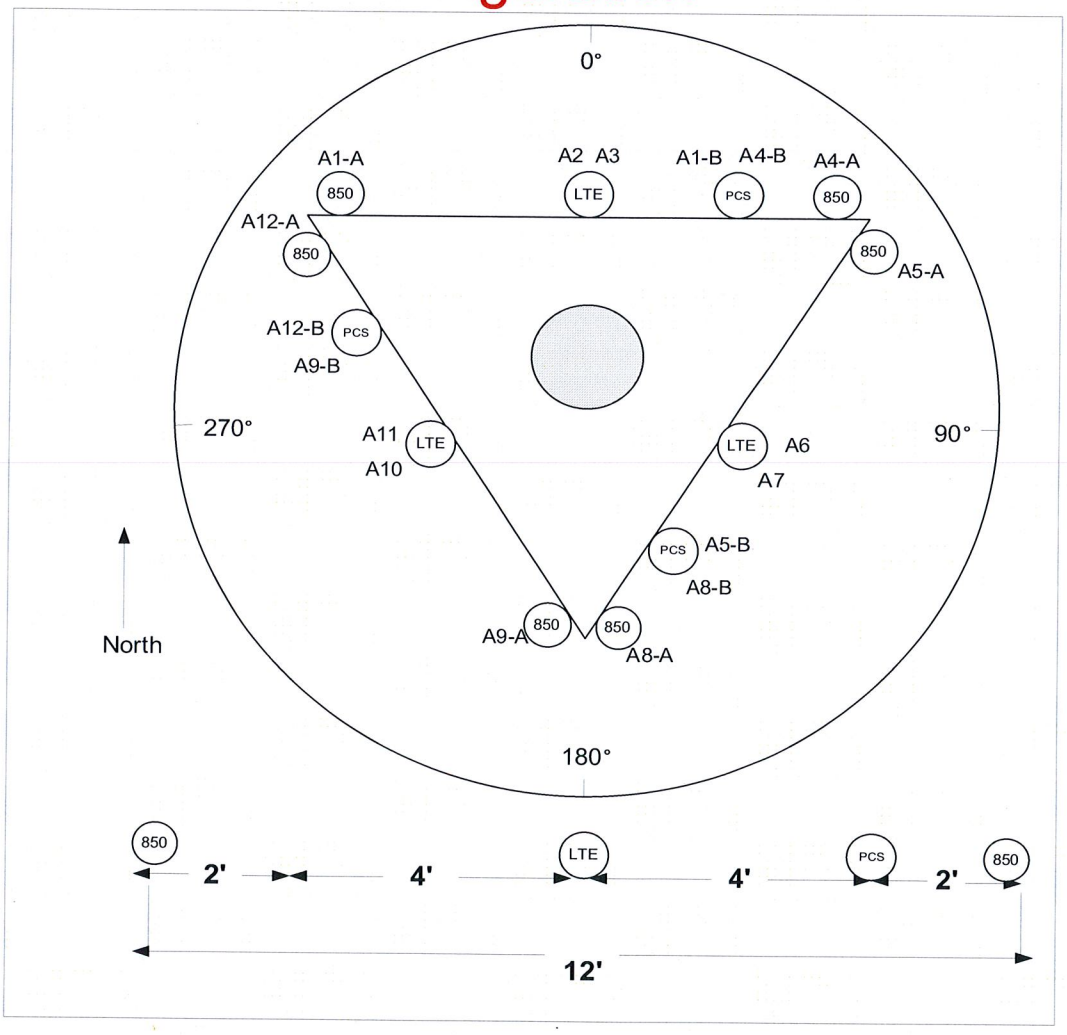
850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0	Cellular Modcell 4.0	Cellular Modcell 4.0
ANTENNA TYPE	LPA-80080/4CF	LPA-80080/4CF	LPA-80080/4CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	2
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 PCS - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0B	PCS Modcell 4.0B	PCS Modcell 4.0B
ANTENNA TYPE	MG D3-800T0	MG D3-800T0	MG D3-800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	2	2	2
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 PCS - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0B	PCS Modcell 4.0B	PCS Modcell 4.0B
ANTENNA TYPE	MG D3-800T0	MG D3-800T0	MG D3-800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	2	2	2
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable
MCPA BRICKS (QTY)			

NUMBER OF CABLE'S NEEDED								ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES			12			MAINLINE (FT)			
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS			18			TOP JUMPER (FT)			12
Equipment Cable Ordering		MAIN CABLE :	12	+				TOP JUMPER #	12	+	6
TX / RX FREQUENCIES								TX POWER OUTPUT			
Cellular A-Band		PCS F-Band		700 Mhz C - E				Cellular (Watts)			20
TX - 869-880,890-891.5 MHz		TX - 1970-1975		TX - 746-757				PCS (Watts)			16
RX - 824-835,845-846.5 MHz		RX - 1890-1895		RX - 776-787				LTE (Watts)			40
ALPHA				BETA				GAMMA			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1-A	800	Tx1/Rx0	RED	A5-A	800	Tx2/Rx0	BLUE	A9-A	800	Tx3/Rx0	GREEN
A1-B	1900	Tx1/Rx0	RED/ WHITE	A5-B	1900	Tx2/Rx0	BLUE/ WHITE	A9-B	1900	Tx3/Rx0	GREEN/WHITE
A2	700	Tx1/Rx0	RED/ ORANGE	A6	700	Tx2/Rx0	BLUE/ ORANGE	A10	700	Tx3/Rx0	GREEN/ORANGE
A3	700	Tx4/Rx1	RED/RED/ ORANGE	A7	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A11	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A4-B	1900	Tx4/Rx1	RED/RED/ WHITE	A8-B	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A12-B	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A4-A	800	Tx4/Rx1	RED/RED	A8-A	800	Tx5/Rx1	BLUE/BLUE	A12-A	800	Tx6/Rx1	GREEN/GREEN
RF ENGINEER				RF MANAGER				INITIALS			DATE
Prepared By : Dany Bustamante				Steve Weatherbee				DB			2/7/2011

Site Configuration



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
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

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

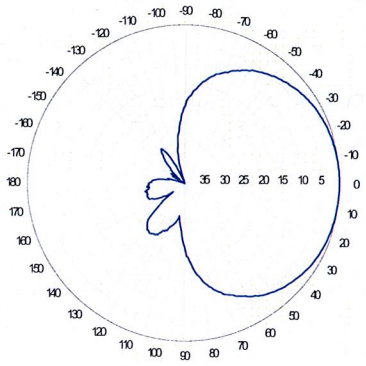
Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in). If the lock-down brace is used, the maximum diameter is Ø88.9 mm (3.5 in).

Mounting Bracket & Downtilt Bracket Kit #21699999

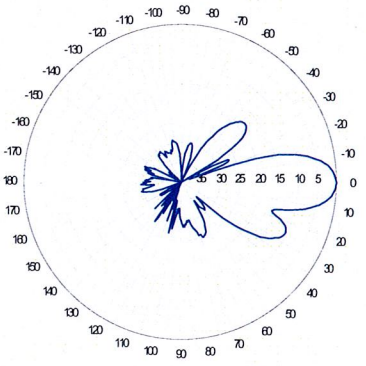
Electrical specifications

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

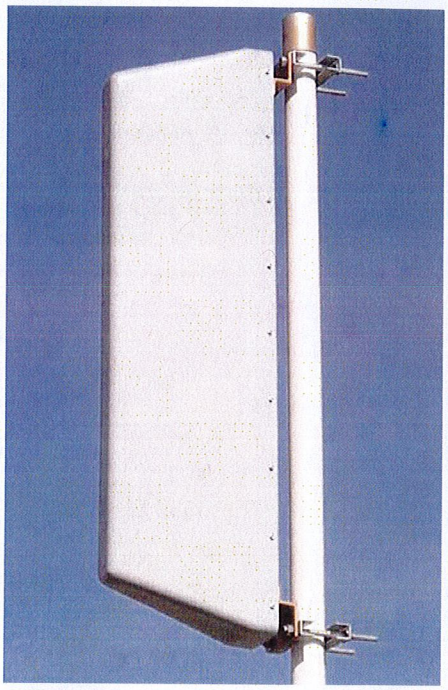


Vertical

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

P65-16-XL -2 Very Low Broadband Antennas

POLARIZATION: Dual linear ±45°
FREQUENCY (MHz): 698-894
HORIZONTAL BEAM WIDTH (°): 65
GAIN (dBi/dBd): 16.0/13.9
TILT: 2
LENGTH: 72"

ELECTRICAL SPECIFICATIONS*

Frequency range (MHz)	698-894		
Frequency band (MHz)	698-806		806-894
Gain (dBi/dBd)	15.5/13.4		16.0/13.9
Polarization			
Nominal Impedance (Ω)			
VSWR			
Horizontal beam width, -3 dB (°)	68		65
Vertical beam width, -3 dB (°)	10.5		9.5
Electrical down tilt (°)			
Side lobe suppression, vertical 1st upper (dB)	> 15		> 15
Isolation between inputs (dB)	> 30		> 30
Tracking, horizontal plane ±60° (dB)	< 2		< 2
First null fill (dB)	-		-
Vertical beam squint (°)	< 0.5		< 0.5
Front to back ratio (dB)	> 30		> 30
Front to back ratio, total power (dB)	> 25		> 25
Cross polar discrimination (XPD) 0° (dB)	> 15	> 15	
Cross polar discrimination (XPD) ±60° (dB)	> 10		> 10
Far field coupling			
IM3, 2xTx@43dBm (dBc)	-153		
IM7, 2xTx@43dBm (dBc)			
Power handling, average per input (W)			
Power handling, average total (W)			

MECHANICAL SPECIFICATIONS*

Connector	2 X 7/16 DIN Female
Connector position	Bottom
Dimensions, HxWxD, mm (ft)	72" x 12" x 5" (1829 x 305 x 125)
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, kg (lbs)	44 (20)
Weight, without brackets, kg (lbs)	33 (15)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.6 (N)	1380
Maximum operational wind speed, m/s (mph)	100 (45)
Survival wind speed, m/s (mph)	125 (55)
Lightning protection	DC Ground
Radome material	PVC
Radome colour	Light Grey
Package size, HxWxD, mm (ft)	82" x 16" x 10" (2082 x 400 x 255)
Shipping weight, kg (lbs)	55 (25)
RET	N/A
Brackets	7256.00, 7454.00, 2210.00

*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

ANTENNA PATTERNS*

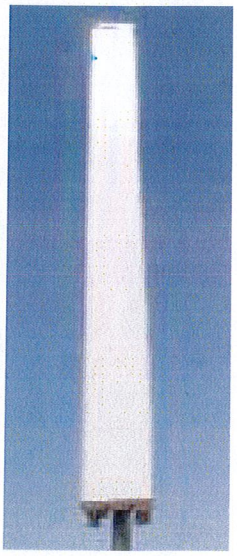
For detailed patterns visit http://www.powerwave.com/rpa/.

MG D3-800Tx

Xpol GSM1800+PCS & UMTS Panel Antenna
15.9 dBd/18 dBi
WIDE BAND 1710-2170 MHz
H 65º V 6.5º

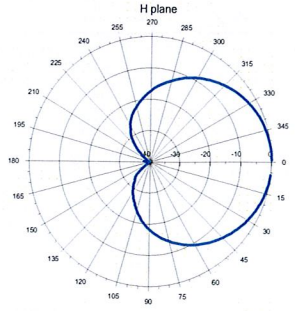
Electrical Specifications

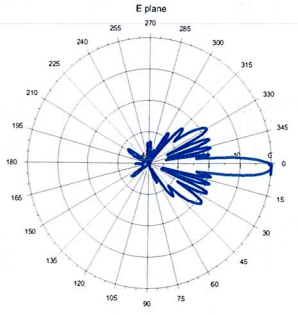
Antenna Model	MG D3-800Tx		
Frequency Range (MHz)	1710-1880	1850-1990	1920-2170
Impedance	50 Ohms		
VSWR	1.40:1		
Polarization	±45º		
Isolation between Ports (dB)	30		
Average Gain (dBd/dBi)	15.7/17.8	15.9/18	16.15/18.25
Horizontal Beamwidth (deg)	65º±5º		
Vertical Beamwidth (deg)	6.5º±0.5º	6.3º±0.5º	6.3º±0.5º
Electrical Tilt (deg)	Fixed 0º-14º		
Sidelobe Suppression (dB)	18	18	18
Front to Back Ratio (dB) @180º±20º	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 (mm)	1380 x 160 x 90
Survival Wind Speed	200 km/h
Front Windload (N) @ 160 km/h	335
Lateral Windload (N) @ 160 km/h	188
Antenna Weight (kg)	7
Clamps Weight (kg)	2
Mast Mounting	50 to 135 mm
Radome Color	Grey
Grounding	All metallic parts are DC grounded
Temperature Range	-55 to +60ºC
Humidity	100 %





Shipping Specifications

Dimensions (mm)	1580 x 340 x 210
Weight (kg)	12
Material	Cardboard and Foam

Ctra. Campo Real, Km 2,100
28500 Arganda del Rey
Madrid-Spain

RYMSA

Phone: 34 91 876 06 81
Fax: 34 91 876 07 09
E-mail: telecom.commercial@rymsa.com
Web: www.rymsa.com

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**

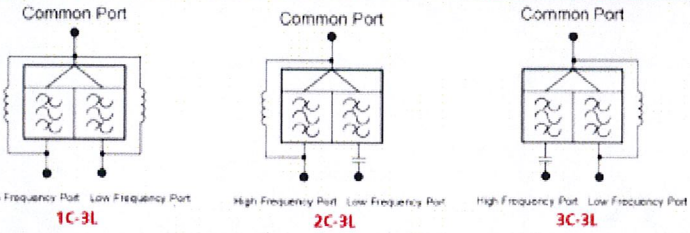
Technical Specifications

Product Type	Diplexer/Cross Band Coupler
Frequency Band, MHz	698-2200
Configuration	Sharelite Single diplexer, outdoor, DC pass in the 1710 - 2170 MHz path, with mounting hardware SEM2-1A
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	In-line long-neck 7-16-Female
Weight, kg (lb)	1.2 (2.6)
Shipping Weight, kg (lb)	3.2 (7) for 2 * single units in 1 * box, 9.8 (21.6) for 6 * units = 3 * Boxes in 1 * overwrap
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)
Shipping Dimensions, H x W x D, mm (in)	254 x 406 x 82 (10 x 16 x 3.2) for 2 * Single Units in 1 * box, 280 x 406 x 241 (11 x 16 x 9.5) for 6 * units = 3 * Boxes in 1 * overwrap
Volume, L	0.43
Housing	Aluminum

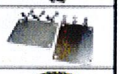
Notes

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

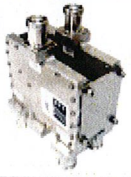
Selection Guide **FD9R6004 Series**					
Single Wideband Diplexer	Model Number	Full DC Pass	DC Pass High Band	DC Pass Low Band	Mounting Hardware Included
Indoor/ Outdoor	**FD9R6004/1C-3L**	■			■
	FD9R6004/2C-3L		■		■
	FD9R6004/3C-3L			■	■



The FD9R6004 Series is upgradeable to a dual diplexer kit by means of 2 diplexers and mounting hardware kits SEM2-1A and SEM2-3

Mounting Hardware and Ground Cable Ordering Information		
Mounting hardware, Wall and pole mount Ø40-110mm (Included with the product)	SEM2-1A	
Assembly kit for 2 pcs of FD9R6004/xC-3L (optional)	SEM2-3	
Ground cable, 2m, includes lugs (optional)	CA020-2	
Ground cable, 3m, includes lugs (optional)	CA030-2	
Mounting Hardware for 6 diplexers, Tower Base (optional)	SEM6	

It is also possible to select double diplexer kits including mounting hardware too

Dual Diplexer Kit Ordering Information		
Kit consisting of (2) in-line long neck connector diplexers (Full DC Pass),(1) mounting hardware SEM2-1A, & (1) assembly kit SEM2-3 disassembled	KIT-FD9R6004/1C-DL	
Kit consisting of (2) in-line long neck connector diplexers (DC Pass High Band), (1) mounting hardware SEM2-1A & (1) assembly kit SEM2-3 disassembled	KIT-FD9R6004/2C-DL	
Kit consisting of (2) in-line long neck connector diplexers (DC Pass Low Band), (1) mounting hardware SEM2-1A & (1) assembly kit SEM2-3 disassembled	KIT-FD9R6004/3C-DL	

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

February 19, 2010

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

RE: **EM-VER-080-100107** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 119 Empire Avenue, Meriden, 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 January 7, 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/MP/laf

c: The Honorable Michael S. Rohde, Mayor, City of Meriden
Lawrence Kendzior, City Manager, City of Meriden
Dominick Caruso, City Planner, City of Meriden
Atlas Container, LLC

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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
www.ct.gov/csc

January 19, 2010

The Honorable Michael S. Rohde
Mayor
City of Meriden
City Hall
142 East Main Street
Room 124
Meriden, CT 06450

RE: **EM-VER-080-100107** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 119 Empire Avenue, Meriden, Connecticut.

Dear Mayor Rohde:

The Connecticut Siting Council (Council) received this request to modify an existing telecommunications facility, pursuant to Regulations of Connecticut State Agencies Section 16-50j-72.

If you have any questions or comments regarding this proposal, please call me or inform the Council by February 2, 2010.

Thank you for your cooperation and consideration.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/jbw

Enclosure: Notice of Intent

c: Lawrence Kendzior, City Manager, City of Meriden
Dominick Caruso, City Planner, City of Meriden

ROBINSON & COLE LLP

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

EM-VER-080-100107

ORIGINAL

January 7, 2010

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**
119 Empire Avenue, Meriden, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains wireless telecommunications antennas at the top of the existing 125-foot tower at the above-referenced address. The Council approved Cellco's use of the existing tower in 2005 through Petition No. 727. The underlying property is owned by Atlas Container, LLC. Cellco now intends to modify its installation by replacing six of its PCS antennas with three (3) model MG D3-800T0 PCS antennas; two (2) model LNX-6514DS-T4M LTE (700 MHz) antennas; and one (1) model P65-16-XL-2 LTE (700 MHz) antenna, all at the same 125-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 Michael S. Rohde, Mayor for the City of Meriden. A copy of this letter is also being sent to Atlas Container, LLC, the owner of the property on which the tower is located.

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 overall height of the existing tower. Cellco's antennas will be located at the same 125-foot level on the existing tower.

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

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 antennas modification. (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

Enclosures
Copy to:
Michael S. Rohde, Meriden Mayor
Atlas Container, LLC
Sandy M. Carter

RYMSA WIRELESS

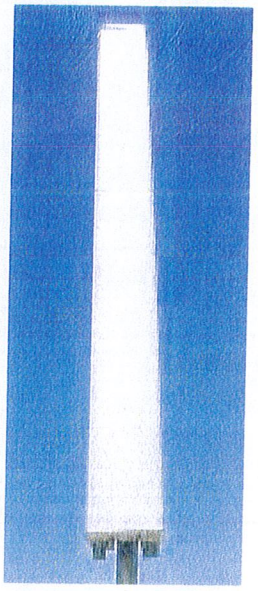
1710-2170 MHz

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%

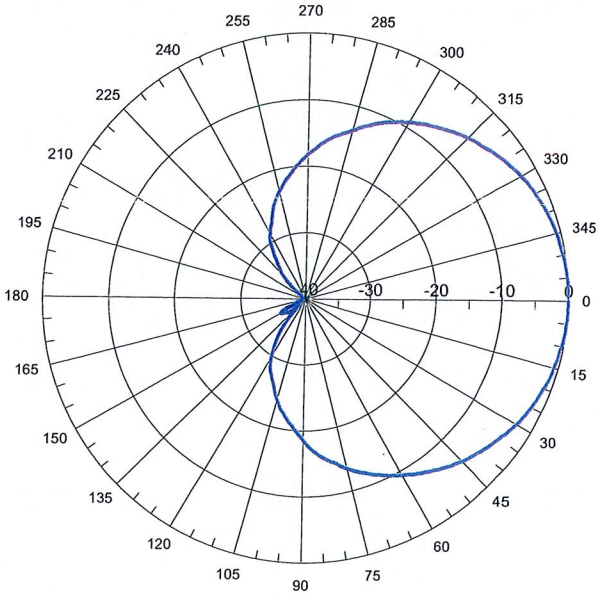
Shipping Specifications	
Dimensions in (mm)	64 x 8.8 x 6.9 (1630 x 225 x 175)
Weight lbs (kg)	27 (12.5)
Material	Cardboard and foam

1710-2170 MHz

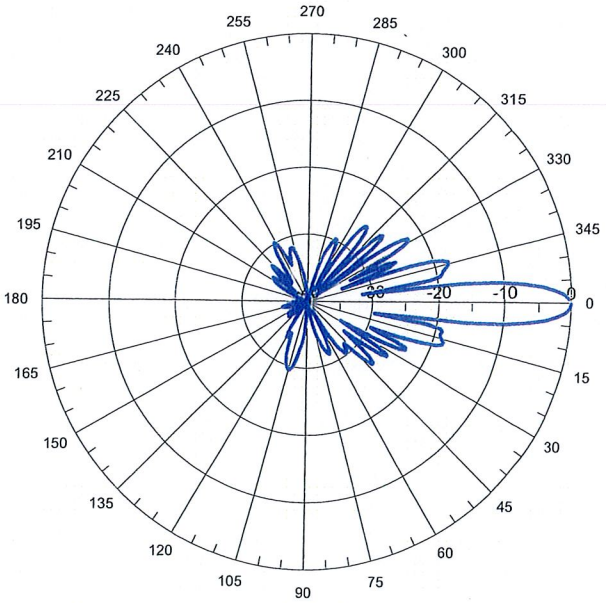
Model # MG D3-800TX

XPol GSM1800+PCS & UMTS Panel Antenna

H plane



E plane



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

Classification
Compliant by Exemption
Above Maximum Concentration Value (MCV)

INCLUDED PRODUCTS

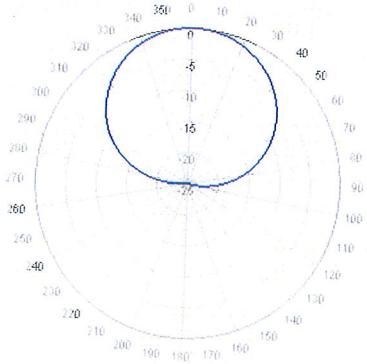
MTG-L-STD
Downtilt Mounting Kit for panel Antennas

Product Specifications

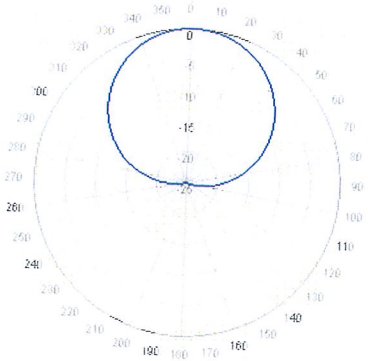
LNX-6514DS-T4M

ANDREW®
A CommScope Company

Horizontal Pattern

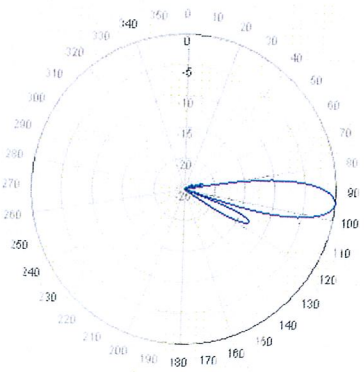


Freq: 750, Tilt 0

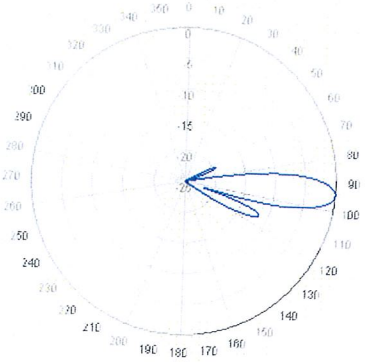


Freq: 850, Tilt 0

Vertical Pattern



Freq: 750, Tilt 0



Freq: 850, Tilt 0

Join the Evolution

P65-16-XL-2 | Very Low Broadband Antennas

POLARIZATION: Dual linear ±45°
FREQUENCY (MHz): 698-894
HORIZONTAL BEAM WIDTH (°): 65
GAIN (dBi/dBd): 16.0/13.9
TILT: 2
LENGTH: 72"

ELECTRICAL SPECIFICATIONS*

Frequency range (MHz)	698-894	
Frequency band (MHz)	698-806	806-894
Gain (dBi/dBd)	15.5/13.4	16.0/13.9
Polarization	Dual Linear +/- 45	
Nominal Impedance (Ω)	50	
VSWR	< 1.33: 1	
Horizontal beam width, -3 dB (°)	68	65
Vertical beam width, -3 dB (°)	10.5	9.5
Side lobe suppression, vertical 1st upper (dB)	> 15	> 15
Isolation between inputs (dB)	> 30	> 30
Tracking, horizontal plane ±60° (dB)	< 2	< 2
Electrical Downtilt Range	2	
Vertical beam squint (°)	< 0.5	< 0.5
Front to back ratio (dB)	> 30	> 30
Front to back ratio, total power (dB)	> 25	> 25
Cross polar discrimination (XPD) 0° (dB)	> 15	> 15
Cross polar discrimination (XPD) ±60° (dB)	> 10	> 10
IM3, 2xTx@43dBm (dBc)	-153	
Power handling, average per input (W)	400	
Power handling, average total (W)	800	

MECHANICAL SPECIFICATIONS*

Connector	2 X 7/16 DIN Female
Connector position	Bottom
Dimensions, HxWxD, in (mm)	72" x 12" x 5" (1829 x 305 x 125)
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, lbs (kg)	44 (20)
Weight, without brackets, lbs (kg)	33 (15)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.0 (N)	1380
Maximum operational wind speed, mph (m/s)	100 (45)
Survival wind speed, mph (m/s)	125 (55)
Lightning protection	DC Ground
Radome material	PVC
Packet size, HxWxD, in (mm)	82" x 16" x 10" (2082 x 400 x 255)
Radome colour	Light Grey
Shipping weight, lbs (kg)	55 (25)
RET	N/A
Brackets	7256.00, 7454.00, 2210.00

*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

ANTENNA PATTERNS*

For detailed patterns visit http://www.powerwave.com/rpa/.

	General	Power	Density					
Site Name: Meriden North								
Tower Height: Verizon @ 125'								
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE	Total
*Sprint	11	200	105	0.0718	1962.5	1.0000	7.18%	
*Cingular	19	100	95	0.0757	880	0.5867	12.90%	
*AT&T	25	76	85	0.0946	1945	1.0000	9.46%	
*Nextel	24	100	75	0.1534	851	0.5673	27.04%	
*T-Mobile GSM	8	134	115	0.0291	1945	1.0000	2.91%	
*T-Mobile UMTS	2	758	115	0.0412	2100	1.0000	4.12%	
Verizon	**3**	**431**	**125**	**0.0298**	**1970**	**1.0000**	**2.98%**	
Verizon	**9**	**252**	**125**	**0.0522**	**869**	**0.5793**	**9.01%**	
Verizon	**1**	**694**	**125**	**0.0160**	**757**	**0.4973**	**3.21%**	
								78.8%
* Source: Siting Council								

NATCOMM INC.
CONSULTING ENGINEERS

Structural Analysis Report

125-ft Existing EEI Monopole

Proposed Verizon Wireless
LTE Antenna Installation

Verizon Wireless Site Ref:
Meriden North

119 Empire Ave.
Meriden, CT

Natcomm Project No. 10001-CO2

Date: December 17, 2009

Prepared for:

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

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

Table of Contents

Introduction

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

The host tower is a 125-ft tall, three-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI); project no. 13454 dated September 27, 2005. The tower geometry and structure member sizes were obtained from the original manufacturers design documents. Foundation information was taken from foundation analysis conducted by Gibble Norden Champion Brown Consulting Engineers Inc., project no. 05060; dated May 31, 2005. Antenna and appurtenance information were obtained from a Verizon RF data sheet and visual inspection from grade conducted by Natcomm personnel on December 17, 2009.

The tower is made up of three (3) 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 22.0-in at the top and 45.5-in at the base.

Verizon Wireless is proposing the removal of six (6) panel antennas and installation of six (6) panel antennas mounted their existing platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

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

- TOWN (EXISTING):
  Antennas: One (1) lighting rod mounted with an elevation of 125-ft above grade level.
- VERIZON (EXISTING TO REMAIN):
  Antennas: Six (6) Antel LPA-80080/4CF panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 125-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- T-MOBILE (EXISTING):
  Antennas: Three (3) RFS APX16DWV-16DWVS-A20 and three (3) EMS RR90-17-02DP panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 115-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- **VERIZON (EXISTING TO REMOVE):**
  Antennas: Six (6) Antel LPA-185080/8CF panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 125-ft above grade level.
- **VERIZON (PROPOSED):**
  Antennas: Two (2) Andrew LNX-6514DS-T4M, one (1) Powerwave P65-16-XL-2 and three (3) RYMSA MG D3-800T0 panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 125-ft above grade level.

Primary Assumptions Used in the Analysis

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

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 85 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:	New Haven; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Meriden; v = 100 mph (3 second gust) equivalent to v = 80 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	EIA/TIA wind speed criteria controls.	
Load Cases:	Load Case 1; 85 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design. This load case typically controls the design of monopole towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed. This load case typically controls the design of 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 **57.2%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L3)	1.0'-49.46'	57.2%	**PASS**

Foundation and Anchors

The existing foundation consists of a four (4) 7-ft x 4-ft x 4-ft and one (1) 7-ft x 10-ft x 10-ft concrete piers bearing on a 50.0 square x 2.5-ft thick reinforced concrete mat. The existing foundation properties were obtained from the aforementioned GNCB design report; project no. 05060; dated May 31, 2005. The base of the tower is connected to the foundation by means of (12) 2.25"Ø, ASTM A615-75 anchor bolts embedded 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. The foundation was found to be within allowable limits.

Base Reactions	Design Load (1)	Proposed Load	Result
Shear	**27.9 kips**	**14 kips**	**PASS**
Axial	**24.9 kips**	**19 kips**	**PASS**
Moment	**2795 k-ft**	**1198 k-ft**	**PASS**

Note: (1) Design Loads taken from aforementioned GNBC foundation analysis dated May 31, 2005.

- 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	46.4%	**PASS**
Base Plate	Bending	38.7%	**PASS**

Conclusion

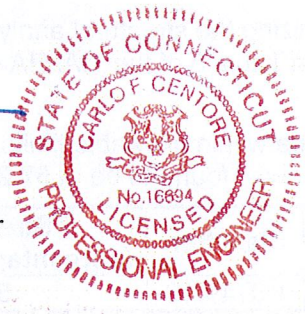
This analysis shows that the subject tower **is adequate** to support the proposed modified antenna configuration.

The analysis is based, in part, on the information provided to this office by Verizon Wireless. If the existing conditions are different than the information in this report, 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.

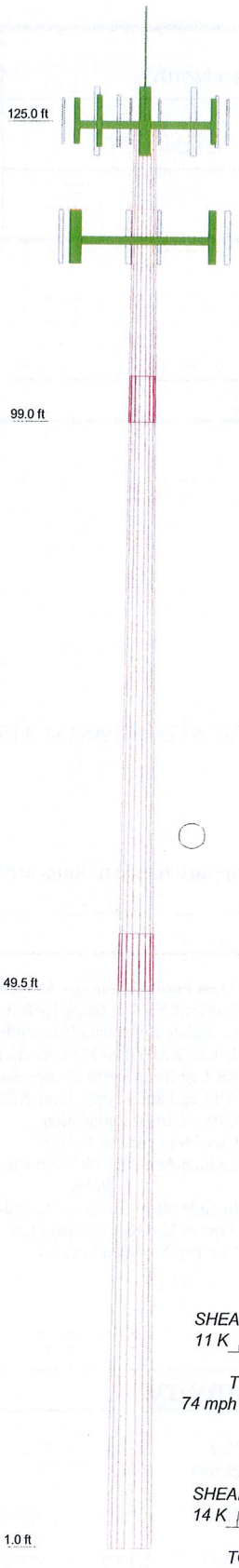
LPILE Plus:

LPILE Plus is a special purpose program based on rational procedures for analyzing a pile under lateral loading. The program computes deflection, shear, bending moment, and soil response with respect to depth in nonlinear soils. Components of the stiffness matrix at the pile head may be computed internally by the program to help the users in their super-structure analysis. Several pile lengths may be automatically checked by the program in order to help the user produce a design with an optimum pile penetration.

Soil behavior is modeled with p-y curves internally generated by the computer program following published recommendations for various types of soils; alternatively, the user can manually introduce other p-y curves. Special procedures are programmed for developing p-y curves for layered soils and for rocks.

Several types of pile-head boundary conditions may be selected, and the properties of the pile can also vary as a function of depth. LPILE Plus has capabilities to compute the ultimate-moment capacity of a pile's section and can provide design information for rebar arrangement. The user may optionally ask the program to generate and take into account nonlinear values of flexural stiffness (EI) which are generated internally based on specified pile dimensions, material properties, and cracked/uncracked concrete behavior.

A single, user-friendly interface written for the Microsoft Windows© environment is provided for the preparation of input, analytical run, and for the graphical observation of data contained in the output file. The program has been written in 32-bit programming codes for compatibility with the latest versions of the Microsoft Windows operating system. The program produces plain-text input and output files that may be observed and/or edited for their inclusion in project reports.



Section	1	2	3
Length (ft)	25.96	53.50	53.54
Number of Sides	18	18	18
Thickness (in)	0.1875	0.2500	0.3125
Lap Splice (ft)	3.92	5.08	
Top Dia (in)	22.0000	26.0058	35.0035
Bot Dia (in)	27.1600	36.5000	45.5000
Grade	A572-65		
Weight (K)	1.3	4.5	7.2

13.0

DESIGNED APPURTENANCE LOADING

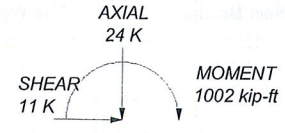
TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod 1"x10'	130	LPA-80080-4CF (Verizon Existing)	125
LPA-80080-4CF (Verizon Existing)	125	EEI Low Profile Platform (Verizon)	125
LNX-6514DS-T4M (Verizon Proposed)	125	APX16DWV-16DWVS-A20 (T-Mobile Existing)	115
MG D3-800T0 (Verizon Proposed)	125	APX16DWV-16DWVS-A20 (T-Mobile Existing)	115
LPA-80080-4CF (Verizon Existing)	125	APX16DWV-16DWVS-A20 (T-Mobile Existing)	115
LPA-80080-4CF (Verizon Existing)	125	RR90-17-02DP (T-Mobile Existing)	115
LNX-6514DS-T4M (Verizon Proposed)	125	RR90-17-02DP (T-Mobile Existing)	115
MG D3-800T0 (Verizon Proposed)	125	RR90-17-02DP (T-Mobile Existing)	115
LPA-80080-4CF (Verizon Existing)	125	EEI Low Profile Platform (T-Mobile)	115
LPA-80080-4CF (Verizon Existing)	125		
P65-16-XL-2 (Verizon Proposed)	125		
MG D3-800T0 (Verizon Proposed)	125		

MATERIAL STRENGTH

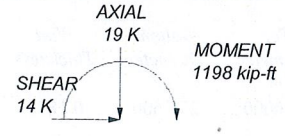
GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
5. Welds are fabricated with ER-70S-6 electrodes.
6. TOWER RATING: 57.2%



TORQUE 0 kip-ft
74 mph WIND - 0.5000 in ICE



TORQUE 0 kip-ft
REACTIONS - 85 mph WIND

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

Job: ***125' EEI Monopole - Meriden North***			
Project: ***10001.CO2 - 119 Empire Ave., Meriden, CT***			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 12/17/09	Scale: NTS	
Path: J:\Jobs\1000100.WI\CO2 - 119 Empire Avenue, Meriden, CT\Calcs\ERI Files\125-ft EEI Monopole.eri		Dwg No. E-1	

Tower Input Data

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

Basic wind speed of 85 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	125.00-99.04	25.96	3.92	18	22.0000	27.1600	0.1875	0.7500	A572-65 (65 ksi)
L2	99.04-49.46	53.50	5.08	18	26.0058	36.5000	0.2500	1.0000	A572-65 (65 ksi)
L3	49.46-1.00	53.54		18	35.0035	45.5000	0.3125	1.2500	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	22.3394	12.9812	780.3007	7.7434	11.1760	69.8193	1561.6281	6.4918	3.5420	18.891
	27.5790	16.0520	1475.3982	9.5752	13.7973	106.9340	2952.7378	8.0275	4.4502	23.734
L2	27.1878	20.4373	1712.8177	9.1433	13.2110	129.6512	3427.8891	10.2206	4.1370	16.548
	37.0631	28.7644	4775.3853	12.8688	18.5420	257.5442	9557.0541	14.3849	5.9840	23.936
L3	36.5548	34.4092	5231.7442	12.3153	17.7818	294.2190	10470.3725	17.2079	5.6106	17.954
	46.2019	44.8204	11562.4359	16.0416	23.1140	500.2352	23140.0860	22.4144	7.4580	23.866

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 125.00-99.04				1	1	1		
L2 99.04-49.46				1	1	1		
L3 49.46-1.00				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 (Verizon Existing)	C	No	Inside Pole	125.00 - 1.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (T-Mobile Existing)	C	No	Inside Pole	115.00 - 1.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04

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	125.00-99.04	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.52
L2	99.04-49.46	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.24
L3	49.46-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.21

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	125.00-99.04	A	0.500	0.000	0.000	0.000	0.000	0.00

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.52
L2	99.04-49.46	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.24
L3	49.46-1.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.21

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	125.00-99.04	0.0000	0.0000	0.0000	0.0000
L2	99.04-49.46	0.0000	0.0000	0.0000	0.0000
L3	49.46-1.00	0.0000	0.0000	0.0000	0.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
EEI Low Profile Platform (Verizon)	C	None		0.0000	125.00	No Ice	22.50	22.50	1.50
						1/2" Ice	28.20	28.20	2.25
LPA-80080-4CF (Verizon Existing)	A	From Face	4.00 -6.00 0.00	0.0000	125.00	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	4.00 0.00 0.00	0.0000	125.00	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	4.00 4.00 0.00	0.0000	125.00	No Ice 1/2" Ice	3.45 3.80	2.22 2.55	0.02 0.04
LPA-80080-4CF (Verizon Existing)	A	From Face	4.00 6.00 0.00	0.0000	125.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LPA-80080-4CF (Verizon Existing)	B	From Face	4.00 -6.00 0.00	0.0000	125.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LNX-6514DS-T4M (Verizon Proposed)	B	From Face	4.00 0.00 0.00	0.0000	125.00	No Ice 1/2" Ice	8.41 8.96	5.41 5.86	0.04 0.09
MG D3-800T0 (Verizon Proposed)	B	From Face	4.00 4.00 0.00	0.0000	125.00	No Ice 1/2" Ice	3.45 3.80	2.22 2.55	0.02 0.04
LPA-80080-4CF (Verizon Existing)	B	From Face	4.00 6.00	0.0000	125.00	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 / Vert	Azimuth Adjustment	Placement		C_AA_A Front	C_AA_A Side	Weight
			ft / ft / ft	°	ft		ft^2	ft^2	K
			0.00						
LPA-80080-4CF	C	From Face	4.00	0.0000	125.00	No Ice	2.62	6.06	0.01
(Verizon Existing)			-6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
P65-16-XL-2	C	From Face	4.00	0.0000	125.00	No Ice	8.40	4.12	0.02
(Verizon Proposed)			0.00			1/2" Ice	8.95	4.56	0.06
			0.00						
MG D3-800T0	C	From Face	4.00	0.0000	125.00	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	4.00	0.0000	125.00	No Ice	2.62	6.06	0.01
(Verizon Existing)			6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
EEI Low Profile Platform	C	None		0.0000	115.00	No Ice	22.50	22.50	1.50
(T-Mobile)						1/2" Ice	28.20	28.20	2.25
APX16DWV-16DWVS-A20	A	From Face	4.00	0.0000	115.00	No Ice	7.07	2.15	0.04
(T-Mobile Existing)			6.00			1/2" Ice	7.52	2.49	0.07
			0.00						
APX16DWV-16DWVS-A20	B	From Face	4.00	0.0000	115.00	No Ice	7.07	2.15	0.04
(T-Mobile Existing)			6.00			1/2" Ice	7.52	2.49	0.07
			0.00						
APX16DWV-16DWVS-A20	C	From Face	4.00	0.0000	115.00	No Ice	7.07	2.15	0.04
(T-Mobile Existing)			6.00			1/2" Ice	7.52	2.49	0.07
			0.00						
RR90-17-02DP	A	From Face	4.00	0.0000	115.00	No Ice	4.36	1.97	0.02
(T-Mobile Existing)			-6.00			1/2" Ice	4.77	2.31	0.04
			0.00						
RR90-17-02DP	B	From Face	4.00	0.0000	115.00	No Ice	4.36	1.97	0.02
(T-Mobile Existing)			-6.00			1/2" Ice	4.77	2.31	0.04
			0.00						
RR90-17-02DP	C	From Face	4.00	0.0000	115.00	No Ice	4.36	1.97	0.02
(T-Mobile Existing)			-6.00			1/2" Ice	4.77	2.31	0.04
			0.00						
Lightning Rod 1"x10'	C	None		0.0000	130.00	No Ice	1.00	1.00	0.04
						1/2" Ice	2.02	2.02	0.05

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation	z	K_Z	q_z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
L1 125.00-99.04	111.57	1.416	26	53.175	A	0.000	53.175	53.175	100.00	0.000	0.000
					B	0.000	53.175		100.00	0.000	0.000
					C	0.000	53.175		100.00	0.000	0.000
L2 99.04-49.46	73.58	1.257	23	130.715	A	0.000	130.715	130.715	100.00	0.000	0.000
					B	0.000	130.715		100.00	0.000	0.000
					C	0.000	130.715		100.00	0.000	0.000

Section Elevation	z	K_Z	q_z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	ft^2	e	ft^2	ft^2	ft^2		ft^2	ft^2
L3 49.46-1.00	24.49	1	19	164.561	A	0.000	164.561	164.561	100.00	0.000	0.000
					B	0.000	164.561		100.00	0.000	0.000
					C	0.000	164.561		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation	z	K_Z	q_z	t_Z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	in	ft^2	e	ft^2	ft^2	ft^2		ft^2	ft^2
L1 125.00-99.04	111.57	1.416	20	0.5000	55.338	A	0.000	55.338	55.338	100.00	0.000	0.000
						B	0.000	55.338		100.00	0.000	0.000
						C	0.000	55.338		100.00	0.000	0.000
L2 99.04-49.46	73.58	1.257	17	0.5000	134.847	A	0.000	134.847	134.847	100.00	0.000	0.000
						B	0.000	134.847		100.00	0.000	0.000
						C	0.000	134.847		100.00	0.000	0.000
L3 49.46-1.00	24.49	1	14	0.5000	168.599	A	0.000	168.599	168.599	100.00	0.000	0.000
						B	0.000	168.599		100.00	0.000	0.000
						C	0.000	168.599		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation	z	K_Z	q_z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	ft^2	e	ft^2	ft^2	ft^2		ft^2	ft^2
L1 125.00-99.04	111.57	1.416	9	53.175	A	0.000	53.175	53.175	100.00	0.000	0.000
					B	0.000	53.175		100.00	0.000	0.000
					C	0.000	53.175		100.00	0.000	0.000
L2 99.04-49.46	73.58	1.257	8	130.715	A	0.000	130.715	130.715	100.00	0.000	0.000
					B	0.000	130.715		100.00	0.000	0.000
					C	0.000	130.715		100.00	0.000	0.000
L3 49.46-1.00	24.49	1	7	164.561	A	0.000	164.561	164.561	100.00	0.000	0.000
					B	0.000	164.561		100.00	0.000	0.000
					C	0.000	164.561		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	1.53	58.94	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			

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
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	3.32	67.01	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	3.40	70.10	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	490.09 kip-ft	8.25		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	1.53	58.94	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	3.32	67.01	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	3.40	70.10	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	490.09 kip-ft	8.25		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	1.53	58.94	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	3.32	67.01	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	3.40	70.10	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	490.09 kip-ft	8.25		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	1.53	58.94	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	3.32	67.01	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	3.40	70.10	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	490.09 kip-ft	8.25		

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 125.00-99.04	0.52	1.68	A	1	0.65	1	1	1	55.338	1.19	46.01	C
			B	1	0.65	1	1	1	55.338			
			C	1	0.65	1	1	1	55.338			
L2 99.04-49.46	1.24	5.46	A	1	0.65	1	1	1	134.847	2.57	51.84	C
			B	1	0.65	1	1	1	134.847			
			C	1	0.65	1	1	1	134.847			
L3 49.46-1.00	1.21	8.45	A	1	0.65	1	1	1	168.599	2.61	53.87	C
			B	1	0.65	1	1	1	168.599			
			C	1	0.65	1	1	1	168.599			
Sum Weight:	2.97	15.60						OTM	379.91 kip-ft	6.37		

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 125.00-99.04	0.52	1.68	A	1	0.65	1	1	1	55.338	1.19	46.01	C
			B	1	0.65	1	1	1	55.338			
			C	1	0.65	1	1	1	55.338			
L2 99.04-49.46	1.24	5.46	A	1	0.65	1	1	1	134.847	2.57	51.84	C
			B	1	0.65	1	1	1	134.847			
			C	1	0.65	1	1	1	134.847			
L3 49.46-1.00	1.21	8.45	A	1	0.65	1	1	1	168.599	2.61	53.87	C
			B	1	0.65	1	1	1	168.599			
			C	1	0.65	1	1	1	168.599			
Sum Weight:	2.97	15.60						OTM	379.91 kip-ft	6.37		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 125.00-99.04	0.52	1.68	A	1	0.65	1	1	1	55.338	1.19	46.01	C
			B	1	0.65	1	1	1	55.338			
			C	1	0.65	1	1	1	55.338			
L2 99.04-49.46	1.24	5.46	A	1	0.65	1	1	1	134.847	2.57	51.84	C
			B	1	0.65	1	1	1	134.847			
			C	1	0.65	1	1	1	134.847			
L3 49.46-1.00	1.21	8.45	A	1	0.65	1	1	1	168.599	2.61	53.87	C
			B	1	0.65	1	1	1	168.599			
			C	1	0.65	1	1	1	168.599			
Sum Weight:	2.97	15.60						OTM	379.91 kip-ft	6.37		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 125.00-99.04	0.52	1.68	A	1	0.65	1	1	1	55.338	1.19	46.01	C
			B	1	0.65	1	1	1	55.338			
			C	1	0.65	1	1	1	55.338			
L2 99.04-49.46	1.24	5.46	A	1	0.65	1	1	1	134.847	2.57	51.84	C
			B	1	0.65	1	1	1	134.847			
			C	1	0.65	1	1	1	134.847			
L3 49.46-1.00	1.21	8.45	A	1	0.65	1	1	1	168.599	2.61	53.87	C
			B	1	0.65	1	1	1	168.599			
			C	1	0.65	1	1	1	168.599			
Sum Weight:	2.97	15.60						OTM	379.91 kip-ft	6.37		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	0.53	20.40	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	1.15	23.19	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	1.18	24.26	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	169.58 kip-ft	2.85		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	0.53	20.40	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	1.15	23.19	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	1.18	24.26	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	169.58 kip-ft	2.85		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	0.53	20.40	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	1.15	23.19	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	1.18	24.26	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	169.58 kip-ft	2.85		

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 125.00-99.04	0.52	1.28	A	1	0.65	1	1	1	53.175	0.53	20.40	C
			B	1	0.65	1	1	1	53.175			
			C	1	0.65	1	1	1	53.175			
L2 99.04-49.46	1.24	4.48	A	1	0.65	1	1	1	130.715	1.15	23.19	C
			B	1	0.65	1	1	1	130.715			
			C	1	0.65	1	1	1	130.715			
L3 49.46-1.00	1.21	7.22	A	1	0.65	1	1	1	164.561	1.18	24.26	C
			B	1	0.65	1	1	1	164.561			
			C	1	0.65	1	1	1	164.561			
Sum Weight:	2.97	12.98						OTM	169.58	2.85		

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

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	12.98					
Bracing Weight	0.00					
Total Member Self-Weight	12.98			-0.10	0.00	
Total Weight	19.39			-0.10	0.00	
Wind 0 deg - No Ice		0.00	-13.90	-1170.33	0.00	0.00
Wind 30 deg - No Ice		6.92	-12.04	-1013.55	-581.49	-0.14
Wind 45 deg - No Ice		9.79	-9.83	-827.58	-822.36	-0.20
Wind 60 deg - No Ice		11.99	-6.95	-585.21	-1007.18	-0.25
Wind 90 deg - No Ice		13.84	0.00	-0.10	-1162.99	-0.29
Wind 120 deg - No Ice		11.99	6.95	585.02	-1007.18	-0.25
Wind 135 deg - No Ice		9.79	9.83	827.38	-822.36	-0.20
Wind 150 deg - No Ice		6.92	12.04	1013.35	-581.49	-0.14
Wind 180 deg - No Ice		0.00	13.90	1170.13	0.00	0.00
Wind 210 deg - No Ice		-6.92	12.04	1013.35	581.49	0.14
Wind 225 deg - No Ice		-9.79	9.83	827.38	822.36	0.20
Wind 240 deg - No Ice		-11.99	6.95	585.02	1007.18	0.25
Wind 270 deg - No Ice		-13.84	0.00	-0.10	1162.99	0.29
Wind 300 deg - No Ice		-11.99	-6.95	-585.21	1007.18	0.25
Wind 315 deg - No Ice		-9.79	-9.83	-827.58	822.36	0.20
Wind 330 deg - No Ice		-6.92	-12.04	-1013.55	581.49	0.14
Member Ice	2.62					
Total Weight Ice	24.08			-0.12	0.00	
Wind 0 deg - Ice		0.00	-11.27	-969.24	0.00	0.00
Wind 30 deg - Ice		5.61	-9.76	-839.40	-481.82	-0.11
Wind 45 deg - Ice		7.94	-7.97	-685.39	-681.40	-0.16
Wind 60 deg - Ice		9.72	-5.63	-484.68	-834.54	-0.19
Wind 90 deg - Ice		11.23	0.00	-0.12	-963.64	-0.22
Wind 120 deg - Ice		9.72	5.63	484.44	-834.54	-0.19
Wind 135 deg - Ice		7.94	7.97	685.16	-681.40	-0.16
Wind 150 deg - Ice		5.61	9.76	839.17	-481.82	-0.11
Wind 180 deg - Ice		0.00	11.27	969.01	0.00	0.00
Wind 210 deg - Ice		-5.61	9.76	839.17	481.82	0.11
Wind 225 deg - Ice		-7.94	7.97	685.16	681.40	0.16
Wind 240 deg - Ice		-9.72	5.63	484.44	834.54	0.19
Wind 270 deg - Ice		-11.23	0.00	-0.12	963.64	0.22
Wind 300 deg - Ice		-9.72	-5.63	-484.68	834.54	0.19
Wind 315 deg - Ice		-7.94	-7.97	-685.39	681.40	0.16
Wind 330 deg - Ice		-5.61	-9.76	-839.40	481.82	0.11
Total Weight	19.39			-0.10	0.00	
Wind 0 deg - Service		0.00	-4.81	-405.02	0.00	0.00
Wind 30 deg - Service		2.39	-4.16	-350.77	-201.21	-0.05
Wind 45 deg - Service		3.39	-3.40	-286.42	-284.55	-0.07
Wind 60 deg - Service		4.15	-2.40	-202.56	-348.50	-0.09
Wind 90 deg - Service		4.79	0.00	-0.10	-402.42	-0.10
Wind 120 deg - Service		4.15	2.40	202.36	-348.50	-0.09
Wind 135 deg - Service		3.39	3.40	286.23	-284.55	-0.07
Wind 150 deg - Service		2.39	4.16	350.58	-201.21	-0.05
Wind 180 deg - Service		0.00	4.81	404.83	0.00	0.00

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 210 deg - Service		-2.39	4.16	350.58	201.21	0.05
Wind 225 deg - Service		-3.39	3.40	286.23	284.55	0.07
Wind 240 deg - Service		-4.15	2.40	202.36	348.50	0.09
Wind 270 deg - Service		-4.79	0.00	-0.10	402.42	0.10
Wind 300 deg - Service		-4.15	-2.40	-202.56	348.50	0.09
Wind 315 deg - Service		-3.39	-3.40	-286.42	284.55	0.07
Wind 330 deg - Service		-2.39	-4.16	-350.77	201.21	0.05

Load Combinations

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

Comb. No.	Description
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	125 - 99.04	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-7.36	0.00	0.12
			Max. Mx	6	-4.59	-120.55	0.09
			Max. My	2	-4.59	0.00	121.97
			Max. Vy	6	7.12	-120.55	0.09
			Max. Vx	2	-7.18	0.00	121.97
			Max. Torque	6			0.29
L2	99.04 - 49.46	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-13.68	0.00	0.12
			Max. Mx	6	-10.06	-543.02	0.10
			Max. My	2	-10.06	0.00	547.37
			Max. Vy	6	10.36	-543.02	0.10
			Max. Vx	2	-10.42	0.00	547.37
			Max. Torque	6			0.29
L3	49.46 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-24.08	0.00	0.12
			Max. Mx	6	-19.38	-1190.90	0.10
			Max. My	2	-19.38	0.00	1198.44
			Max. Vy	6	13.85	-1190.90	0.10
			Max. Vx	2	-13.91	0.00	1198.44
			Max. Torque	6			0.29

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	19	24.08	0.00	11.27
	Max. H_x	14	19.39	13.84	0.00
	Max. H_z	2	19.39	0.00	13.90
	Max. M_x	2	1198.44	0.00	13.90
	Max. M_z	6	1190.90	-13.84	0.00
	Max. Torsion	6	0.29	-13.84	0.00
	Min. Vert	1	19.39	0.00	0.00
	Min. H_x	6	19.39	-13.84	0.00
	Min. H_z	10	19.39	0.00	-13.90
	Min. M_x	10	-1198.23	0.00	-13.90
	Min. M_z	14	-1190.90	13.84	0.00
	Min. Torsion	14	-0.29	13.84	0.00

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	19.39	0.00	0.00	-0.10	0.00	0.00
Dead+Wind 0 deg - No Ice	19.39	0.00	-13.90	-1198.44	0.00	0.00
Dead+Wind 30 deg - No Ice	19.39	6.92	-12.04	-1037.89	-595.45	-0.15
Dead+Wind 45 deg - No Ice	19.39	9.79	-9.83	-847.46	-842.09	-0.21
Dead+Wind 60 deg - No Ice	19.39	11.99	-6.95	-599.27	-1031.35	-0.25
Dead+Wind 90 deg - No Ice	19.39	13.84	-0.00	-0.10	-1190.90	-0.29
Dead+Wind 120 deg - No Ice	19.39	11.99	6.95	599.07	-1031.34	-0.25
Dead+Wind 135 deg - No Ice	19.39	9.79	9.83	847.25	-842.09	-0.21
Dead+Wind 150 deg - No Ice	19.39	6.92	12.04	1037.69	-595.44	-0.15
Dead+Wind 180 deg - No Ice	19.39	0.00	13.90	1198.23	0.00	0.00
Dead+Wind 210 deg - No Ice	19.39	-6.92	12.04	1037.69	595.44	0.15
Dead+Wind 225 deg - No Ice	19.39	-9.79	9.83	847.25	842.09	0.21
Dead+Wind 240 deg - No Ice	19.39	-11.99	6.95	599.07	1031.34	0.25
Dead+Wind 270 deg - No Ice	19.39	-13.84	-0.00	-0.10	1190.90	0.29
Dead+Wind 300 deg - No Ice	19.39	-11.99	-6.95	-599.27	1031.35	0.25
Dead+Wind 315 deg - No Ice	19.39	-9.79	-9.83	-847.46	842.09	0.21
Dead+Wind 330 deg - No Ice	19.39	-6.92	-12.04	-1037.89	595.45	0.15
Dead+Ice+Temp	24.08	0.00	0.00	-0.12	0.00	0.00
Dead+Wind 0 deg+Ice+Temp	24.08	0.00	-11.27	-1002.11	0.00	0.00
Dead+Wind 30 deg+Ice+Temp	24.08	5.61	-9.76	-867.87	-498.14	-0.11
Dead+Wind 45 deg+Ice+Temp	24.08	7.94	-7.97	-708.64	-704.48	-0.16
Dead+Wind 60 deg+Ice+Temp	24.08	9.72	-5.63	-501.12	-862.81	-0.19
Dead+Wind 90 deg+Ice+Temp	24.08	11.23	0.00	-0.12	-996.29	-0.22
Dead+Wind 120 deg+Ice+Temp	24.08	9.72	5.63	500.87	-862.81	-0.19
Dead+Wind 135 deg+Ice+Temp	24.08	7.94	7.97	708.39	-704.48	-0.16
Dead+Wind 150 deg+Ice+Temp	24.08	5.61	9.76	867.62	-498.14	-0.11
Dead+Wind 180 deg+Ice+Temp	24.08	0.00	11.27	1001.86	0.00	0.00
Dead+Wind 210 deg+Ice+Temp	24.08	-5.61	9.76	867.62	498.14	0.11
Dead+Wind 225 deg+Ice+Temp	24.08	-7.94	7.97	708.39	704.48	0.16
Dead+Wind 240 deg+Ice+Temp	24.08	-9.72	5.63	500.87	862.81	0.19
Dead+Wind 270 deg+Ice+Temp	24.08	-11.23	0.00	-0.12	996.29	0.22
Dead+Wind 300 deg+Ice+Temp	24.08	-9.72	-5.63	-501.12	862.81	0.19
Dead+Wind 315 deg+Ice+Temp	24.08	-7.94	-7.97	-708.64	704.48	0.16
Dead+Wind 330 deg+Ice+Temp	24.08	-5.61	-9.76	-867.87	498.14	0.11
Dead+Wind 0 deg - Service	19.39	0.00	-4.81	-414.94	0.00	0.00
Dead+Wind 30 deg - Service	19.39	2.39	-4.16	-359.36	-206.13	-0.05
Dead+Wind 45 deg - Service	19.39	3.39	-3.40	-293.44	-291.51	-0.07
Dead+Wind 60 deg - Service	19.39	4.15	-2.40	-207.52	-357.03	-0.09
Dead+Wind 90 deg - Service	19.39	4.79	0.00	-0.10	-412.26	-0.10
Dead+Wind 120 deg - Service	19.39	4.15	2.40	207.32	-357.03	-0.09
Dead+Wind 135 deg - Service	19.39	3.39	3.40	293.23	-291.51	-0.07
Dead+Wind 150 deg - Service	19.39	2.39	4.16	359.16	-206.13	-0.05
Dead+Wind 180 deg - Service	19.39	0.00	4.81	414.74	0.00	0.00
Dead+Wind 210 deg - Service	19.39	-2.39	4.16	359.16	206.13	0.05
Dead+Wind 225 deg - Service	19.39	-3.39	3.40	293.23	291.51	0.07
Dead+Wind 240 deg - Service	19.39	-4.15	2.40	207.32	357.03	0.09
Dead+Wind 270 deg - Service	19.39	-4.79	0.00	-0.10	412.26	0.10
Dead+Wind 300 deg - Service	19.39	-4.15	-2.40	-207.52	357.03	0.09
Dead+Wind 315 deg - Service	19.39	-3.39	-3.40	-293.44	291.51	0.07
Dead+Wind 330 deg - Service	19.39	-2.39	-4.16	-359.36	206.13	0.05

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	-19.39	0.00	0.00	19.39	0.00	0.000%
2	0.00	-19.39	-13.90	0.00	19.39	13.90	0.000%
3	6.92	-19.39	-12.04	-6.92	19.39	12.04	0.000%
4	9.79	-19.39	-9.83	-9.79	19.39	9.83	0.000%
5	11.99	-19.39	-6.95	-11.99	19.39	6.95	0.000%
6	13.84	-19.39	0.00	-13.84	19.39	0.00	0.000%
7	11.99	-19.39	6.95	-11.99	19.39	-6.95	0.000%
8	9.79	-19.39	9.83	-9.79	19.39	-9.83	0.000%
9	6.92	-19.39	12.04	-6.92	19.39	-12.04	0.000%
10	0.00	-19.39	13.90	0.00	19.39	-13.90	0.000%
11	-6.92	-19.39	12.04	6.92	19.39	-12.04	0.000%
12	-9.79	-19.39	9.83	9.79	19.39	-9.83	0.000%
13	-11.99	-19.39	6.95	11.99	19.39	-6.95	0.000%
14	-13.84	-19.39	0.00	13.84	19.39	0.00	0.000%
15	-11.99	-19.39	-6.95	11.99	19.39	6.95	0.000%
16	-9.79	-19.39	-9.83	9.79	19.39	9.83	0.000%
17	-6.92	-19.39	-12.04	6.92	19.39	12.04	0.000%
18	0.00	-24.08	0.00	0.00	24.08	0.00	0.000%
19	0.00	-24.08	-11.27	0.00	24.08	11.27	0.000%
20	5.61	-24.08	-9.76	-5.61	24.08	9.76	0.000%
21	7.94	-24.08	-7.97	-7.94	24.08	7.97	0.000%
22	9.72	-24.08	-5.63	-9.72	24.08	5.63	0.000%
23	11.23	-24.08	0.00	-11.23	24.08	0.00	0.000%
24	9.72	-24.08	5.63	-9.72	24.08	-5.63	0.000%
25	7.94	-24.08	7.97	-7.94	24.08	-7.97	0.000%
26	5.61	-24.08	9.76	-5.61	24.08	-9.76	0.000%
27	0.00	-24.08	11.27	0.00	24.08	-11.27	0.000%
28	-5.61	-24.08	9.76	5.61	24.08	-9.76	0.000%
29	-7.94	-24.08	7.97	7.94	24.08	-7.97	0.000%
30	-9.72	-24.08	5.63	9.72	24.08	-5.63	0.000%
31	-11.23	-24.08	0.00	11.23	24.08	0.00	0.000%
32	-9.72	-24.08	-5.63	9.72	24.08	5.63	0.000%
33	-7.94	-24.08	-7.97	7.94	24.08	7.97	0.000%
34	-5.61	-24.08	-9.76	5.61	24.08	9.76	0.000%
35	0.00	-19.39	-4.81	0.00	19.39	4.81	0.000%
36	2.39	-19.39	-4.16	-2.39	19.39	4.16	0.000%
37	3.39	-19.39	-3.40	-3.39	19.39	3.40	0.000%
38	4.15	-19.39	-2.40	-4.15	19.39	2.40	0.000%
39	4.79	-19.39	0.00	-4.79	19.39	0.00	0.000%
40	4.15	-19.39	2.40	-4.15	19.39	-2.40	0.000%
41	3.39	-19.39	3.40	-3.39	19.39	-3.40	0.000%
42	2.39	-19.39	4.16	-2.39	19.39	-4.16	0.000%
43	0.00	-19.39	4.81	0.00	19.39	-4.81	0.000%
44	-2.39	-19.39	4.16	2.39	19.39	-4.16	0.000%
45	-3.39	-19.39	3.40	3.39	19.39	-3.40	0.000%
46	-4.15	-19.39	2.40	4.15	19.39	-2.40	0.000%
47	-4.79	-19.39	0.00	4.79	19.39	0.00	0.000%
48	-4.15	-19.39	-2.40	4.15	19.39	2.40	0.000%
49	-3.39	-19.39	-3.40	3.39	19.39	3.40	0.000%
50	-2.39	-19.39	-4.16	2.39	19.39	4.16	0.000%

Non-Linear Convergence Results

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

2	Yes	4	0.00000001	0.00003143
3	Yes	5	0.00000001	0.00014207
4	Yes	5	0.00000001	0.00016205
5	Yes	5	0.00000001	0.00014686
6	Yes	4	0.00000001	0.00024476
7	Yes	5	0.00000001	0.00014030
8	Yes	5	0.00000001	0.00016198
9	Yes	5	0.00000001	0.00014573
10	Yes	4	0.00000001	0.00003141
11	Yes	5	0.00000001	0.00014573
12	Yes	5	0.00000001	0.00016198
13	Yes	5	0.00000001	0.00014030
14	Yes	4	0.00000001	0.00024476
15	Yes	5	0.00000001	0.00014686
16	Yes	5	0.00000001	0.00016205
17	Yes	5	0.00000001	0.00014207
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00009537
20	Yes	5	0.00000001	0.00031587
21	Yes	5	0.00000001	0.00036058
22	Yes	5	0.00000001	0.00032166
23	Yes	5	0.00000001	0.00009569
24	Yes	5	0.00000001	0.00031356
25	Yes	5	0.00000001	0.00036025
26	Yes	5	0.00000001	0.00032006
27	Yes	5	0.00000001	0.00009532
28	Yes	5	0.00000001	0.00032006
29	Yes	5	0.00000001	0.00036025
30	Yes	5	0.00000001	0.00031356
31	Yes	5	0.00000001	0.00009569
32	Yes	5	0.00000001	0.00032166
33	Yes	5	0.00000001	0.00036058
34	Yes	5	0.00000001	0.00031587
35	Yes	4	0.00000001	0.00001423
36	Yes	4	0.00000001	0.00029318
37	Yes	4	0.00000001	0.00034854
38	Yes	4	0.00000001	0.00031851
39	Yes	4	0.00000001	0.00004192
40	Yes	4	0.00000001	0.00028559
41	Yes	4	0.00000001	0.00034793
42	Yes	4	0.00000001	0.00031130
43	Yes	4	0.00000001	0.00001421
44	Yes	4	0.00000001	0.00031130
45	Yes	4	0.00000001	0.00034793
46	Yes	4	0.00000001	0.00028559
47	Yes	4	0.00000001	0.00004192
48	Yes	4	0.00000001	0.00031851
49	Yes	4	0.00000001	0.00034854
50	Yes	4	0.00000001	0.00029318

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	125 - 99.04	16.358	35	1.1306	0.0017
L2	102.96 - 49.46	11.296	35	1.0296	0.0009
L3	54.54 - 1	3.106	35	0.5336	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.00	Lightning Rod 1"x10'	35	16.358	1.1306	0.0017	33447
125.00	EEI Low Profile Platform	35	16.358	1.1306	0.0017	33447
115.00	EEI Low Profile Platform	35	14.015	1.0957	0.0013	16724

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	125 - 99.04	47.206	2	3.2620	0.0048
L2	102.96 - 49.46	32.606	2	2.9718	0.0025
L3	54.54 - 1	8.970	2	1.5407	0.0007

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.00	Lightning Rod 1"x10'	2	47.206	3.2620	0.0048	11677
125.00	EEI Low Profile Platform	2	47.206	3.2620	0.0048	11677
115.00	EEI Low Profile Platform	2	40.449	3.1560	0.0037	5838

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	125 - 99.04 (1)	TP27.16x22x0.1875	25.96	124.00	160.0	5.832	15.5883	-4.59	90.90	0.050
L2	99.04 - 49.46 (2)	TP36.5x26.0058x0.25	53.50	124.00	118.9	10.563	27.9737	-10.06	295.50	0.034
L3	49.46 - 1 (3)	TP45.5x35.0035x0.3125	53.54	124.00	92.8	17.347	44.8204	-19.38	777.49	0.025

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	125 - 99.04 (1)	TP27.16x22x0.1875	121.97	-14.516	39.000	0.372	0.00	0.000	39.000	0.000
L2	99.04 - 49.46 (2)	TP36.5x26.0058x0.25	547.37	-26.971	39.000	0.692	0.00	0.000	39.000	0.000
L3	49.46 - 1 (3)	TP45.5x35.0035x0.3125	1198.43	-28.749	39.000	0.737	0.00	0.000	39.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	125 - 99.04 (1)	TP27.16x22x0.1875	0.050	0.372	0.000	0.423 ✔	1.333	H1-3 ✔
L2	99.04 - 49.46 (2)	TP36.5x26.0058x0.25	0.034	0.692	0.000	0.726 ✔	1.333	H1-3 ✔
L3	49.46 - 1 (3)	TP45.5x35.0035x0.3125	0.025	0.737	0.000	0.762 ✔	1.333	H1-3 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	125 - 99.04	Pole	TP27.16x22x0.1875	1	-4.59	121.17	31.7	Pass
L2	99.04 - 49.46	Pole	TP36.5x26.0058x0.25	2	-10.06	393.90	54.4	Pass
L3	49.46 - 1	Pole	TP45.5x35.0035x0.3125	3	-19.38	1036.40	57.2	Pass
							Summary	
						Pole (L3)	57.2	Pass
						RATING =	**57.2**	**Pass**

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 1198·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 14·kips	(Input From RisaTower)
Axial Force =	Axial := 19·kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 12	(User Input)
Diameter of Bolt Circle =	D_{bc} := 54.00·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strenght =	F_u := 100·ksi	(User Input)
Bolt Yeild Strenght =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 GR 60

Plate Yield Strength =	Fy_{bp} := 60·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 2.0·in	(User Input)
Base Plate Diameter =	D_{bp} := 60.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 45.50·in	(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 = $i := 1 .. N$

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

$d_1 = 13.50 \cdot in$ $d_7 = -13.50 \cdot in$

$d_2 = 23.38 \cdot in$ $d_8 = -23.38 \cdot in$

$d_3 = 27.00 \cdot in$ $d_9 = -27.00 \cdot in$

$d_4 = 23.38 \cdot in$ $d_{10} = -23.38 \cdot in$

$d_5 = 13.50 \cdot in$ $d_{11} = -13.50 \cdot in$

$d_6 = 0.00 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 22.8 \cdot in$

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

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

$MA_2 = 0.63 \cdot in$ $MA_8 = 0.00 \cdot in$

$MA_3 = 4.25 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 0.63 \cdot in$ $MA_{10} = 0.00 \cdot in$

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

$MA_6 = 0.00 \cdot in$ etc

Effective Width of Baseplate for Bending = $B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 31.3 \cdot in$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 4.374 \times 10^3 \cdot in^2$

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

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

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

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

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 87.2 \cdot kips$

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

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 44.7 \cdot \%$ 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 = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.292 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 4.2 \cdot ksi$

Allowable Bending Stress = $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 60 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

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

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 90.3 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 27.8 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 46.4 \cdot \%$$

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

$C_1 = 46.0 \cdot kips$ $C_7 = -42.8 \cdot kips$

$C_2 = 78.4 \cdot kips$ $C_8 = -75.3 \cdot kips$

$C_3 = 90.3 \cdot kips$ $C_9 = -87.2 \cdot kips$

$C_4 = 78.4 \cdot kips$ $C_{10} = -75.3 \cdot kips$

$C_5 = 46.0 \cdot kips$ $C_{11} = -42.8 \cdot kips$

$C_6 = 1.6 \cdot kips$ etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} t_{bp}^2\right)} = 23.2 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 59.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 38.7 \cdot \%$

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

Condition3 = "Ok"

GNCB
Gibble Norden Champion Brown
Consulting Engineers, Inc.

Transmittal

Sent via: Mail

Date: June 16, 2005
Attention: Carlo Centore
Company: Natcomm, LLC
63-2 North Branford Road
Branford, CT 06405
Project: Verizon Tower – Meriden Water Tower
Job Number: #05060

Copies:	Description:	Action:
1	Calcs for Checking Existing Base Mat	
20	GNCB services contract	

Remarks:

Calcs as requested. Also in our haste to get the calcs done we did not execute a contract for this work. Please review the attached contract and if acceptable have executed and return one copy for our records.

Signed: Charles C. Brown P.E.

Copies to: **Sent via:**

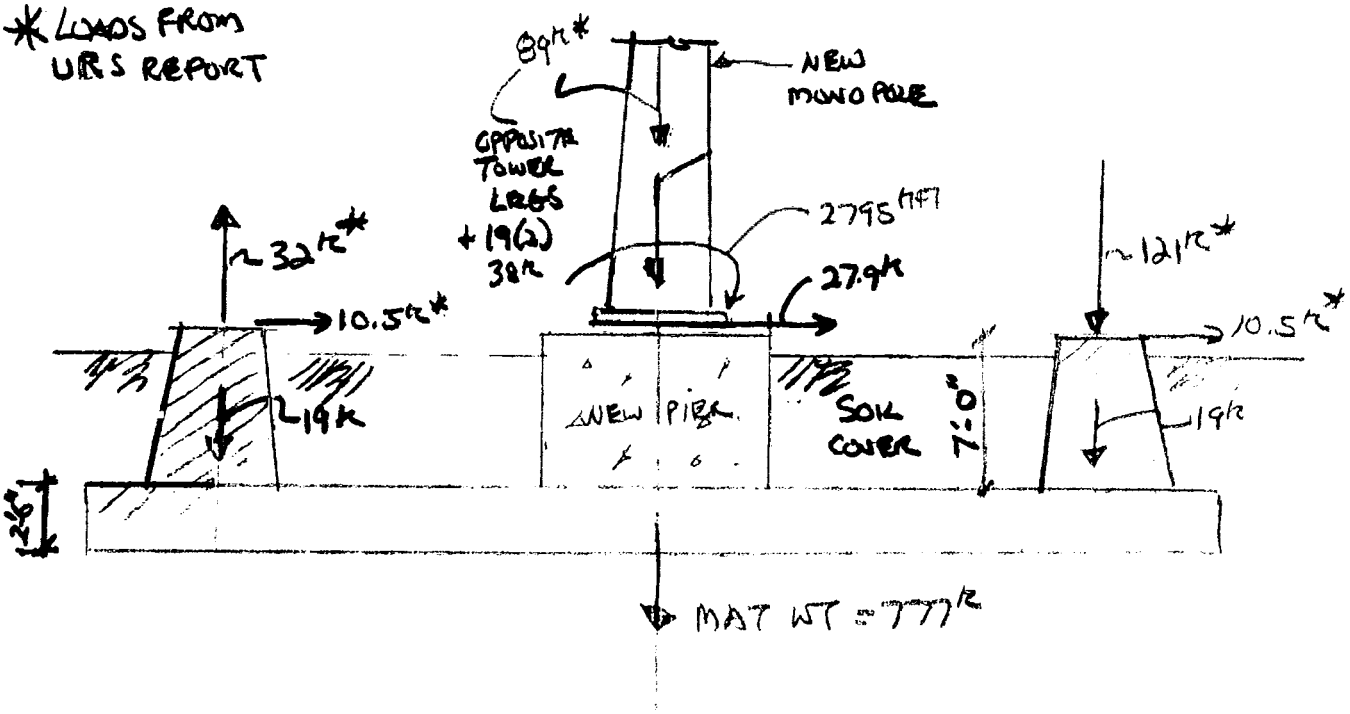
130 ELM STREET
POST OFFICE BOX 802
OLD SAYBROOK
CONNECTICUT 06475
PHONE: 860 388 1224
FAX: 860 388 4613
GNCBENGINEERS.COM

GNCB

GIBBLE NORDEN CHAMPION BROWN
Consulting Engineers Incorporated
130 Elm Street Post Office Box 802
OLD SAYBROOK, CONNECTICUT 06475
Telephone (860) 388-1224

PROJECT NAME: Verizon Tower Meriden Water Tower
PROJECT NO: # 05060 SHEET NO. 1 OF 5
BY: CCB DATE 5/31/05
SCALE:

* LOADS FROM URS REPORT



DISREGARD OVERBURDEN SOIL AND PUMP HOUSE

	MAT	PIERS	Tower	Pole	NEW PIER	
AXIAL kips	777k	+ 19(4) +	187 +	29.9 +	105k	= 1170k

	Tower		
SHEAR	10.5(2) + 27.9k =		48.9k

OTM AT BASE OF MAT

Sum Mom AT Bottom CENTER

Shears AT TOP OF PIERS

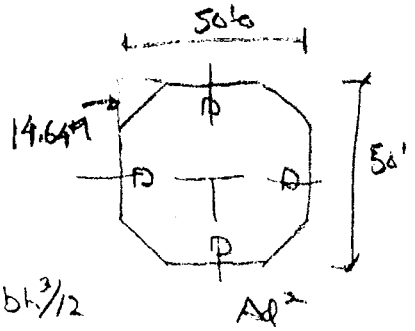
$121 \times 19.25 + 32(19.25) + 279.5 + (27.9 + 10.5(2)) \times 9.5'$

$= 6205^{k}FT$

GNCB

GIBBLE NORDEN CHAMPION BROWN
Consulting Engineers Incorporated
130 Elm Street Post Office Box 802
OLD SAYBROOK, CONNECTICUT 06475
Telephone (860) 388-1224

PROJECT NAME: Verizon Tower - Meriden Water Tower
PROJECT NO: # 05060 SHEET NO. 2 OF 5
BY: CB DATE 5/31/05
SCALE:



$$I_{MAT} = \frac{50^4}{12} - 4\left(\frac{19.64^2}{2} \times 20.12^2\right) = 347306 \text{ FT}^4$$

173527

$$\text{Area}_{MAT} = 50 \times 50 - \frac{19.64^2}{2} \times 4 = 2071 \text{ ft}^2$$

429

$$P/A \pm \frac{Mc}{I}$$

$$\frac{1170^K}{2071 \text{ ft}^2} \pm \frac{6205(25^{FT})}{347306} = \pm 1.011^{TSF} \text{ or } \pm .719^{TSF}$$

.565 .446 < 1800 PSF

NOTE: SINCE POS DOWNWARD PRESSURE RESULTANT within kern of base

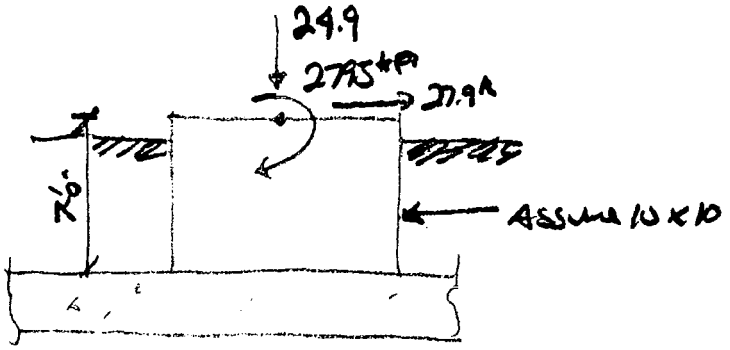
CONCLUSION: BEARING PRESSURE OF 1800 PSF IS NOT EXCEEDED
MAT REMAINS TOP & BOTTOM TO TAKE MOMENTS AND ACT AS RIGID BODY.

GNCB

GIBBLE NORDEN CHAMPION BROWN
Consulting Engineers Incorporated
130 Elm Street Post Office Box 802
OLD SAYBROOK, CONNECTICUT 06475
Telephone (860) 388-1224

PROJECT NAME: Verizon Tower - Meriden Water Tower
PROJECT NO: #05080 SHEET NO. 3 OF 5
BY: CAB DATE 5/3/05
SCALE:

Transfer Loads into Eng Mat

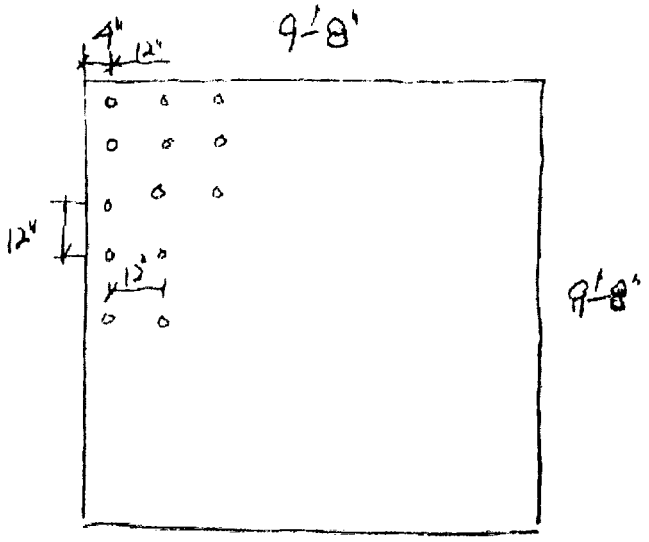


OTM = 2795 + 27.9(7') = 2990 ft-k
AT PIER BASE

− .667 × (10 × 10 × 7(150) × 5' + 249(5') = 433 ft-k

SP on Dead Ld

2990 − 433 = 2557 ft-k



Assume existing rock 3000 psf (per Eng)

USE 7/8" ϕ REBAR w/
HILTI HIT RE 500 EPOXY

7/8" w/ 7/8 EMBEDMENT
(11 13/16 SPACING FOR Full Value)

= 14185# (1.33)

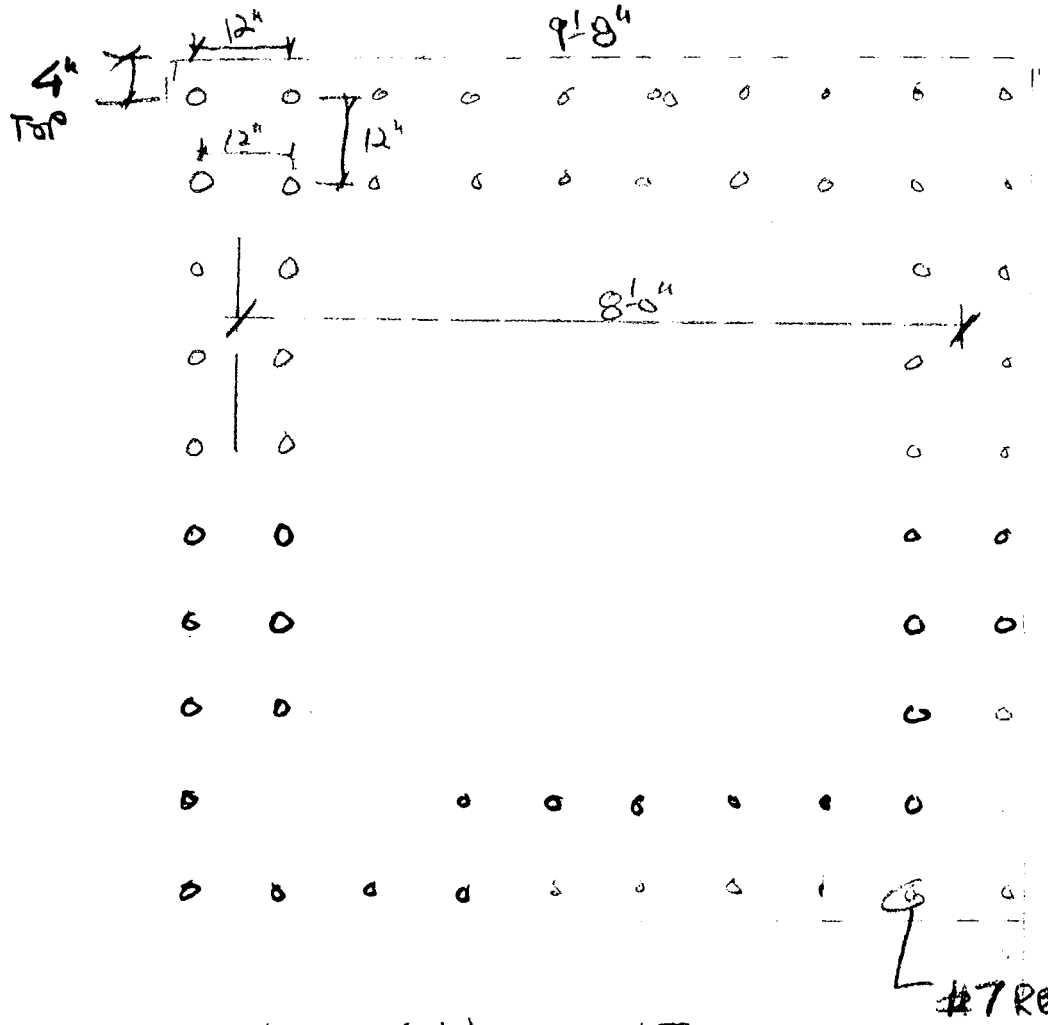
= 18.87 k ← WIND LOAD INCREASE

GNCB

GIBBLE NORDEN CHAMPION BROWN
Consulting Engineers Incorporated
130 Elm Street Post Office Box 802
OLD SAYBROOK, CONNECTICUT 06475
Telephone (860) 388-1224

PROJECT NAME Veterans Tower - Marcedes Water Tower
PROJECT NO # 05060 SHEET NO 4 OF 5
BY QB DATE 5/31/05
SCALE:

OTm = 2557 kft

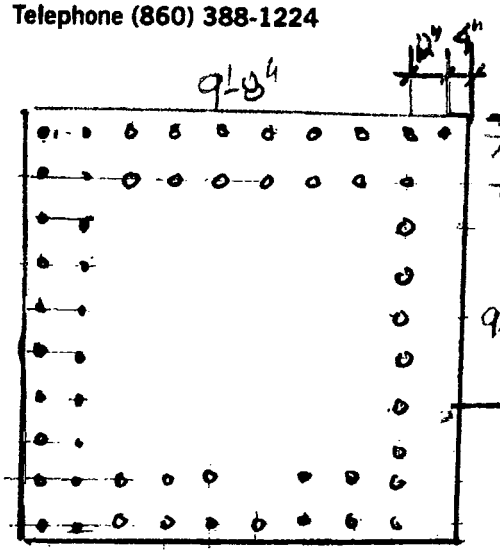


Resist. Moment $18.87^k \times 20 (8'-0") = 3019^{kft} > 2557$

Okay.

GIBBLE NORDEN CHAMPION BROWN
Consulting Engineers Incorporated
130 Elm Street Post Office Box 802
OLD SAYBROOK, CONNECTICUT 06475
Telephone (860) 388-1224

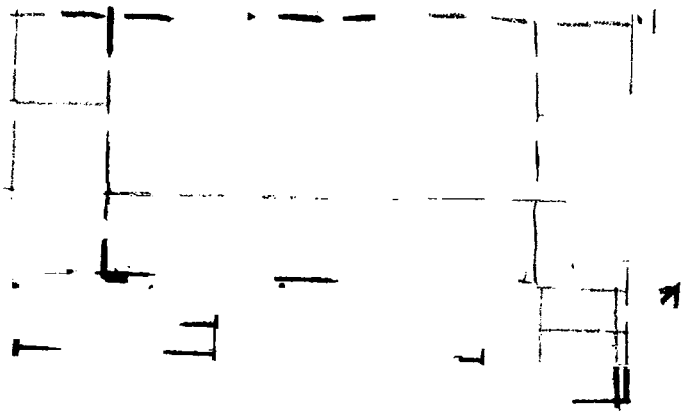
PROJECT NAME: Verizon - Meriden
PROJECT NO: #05060 SHEET NO. 5 OF 5
BY: CAB DATE 5/31/05
SCALE:



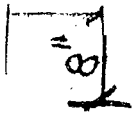
#7 x 4'-2" DRILL AND (64 TOTAL) EPOXY ANCHOR WITH HILTI HIT RE 500 EPOXY ADHESIVE PER MANUFACTURER'S INSTRUCTIONS

PLAN 1/4"=1'-0"

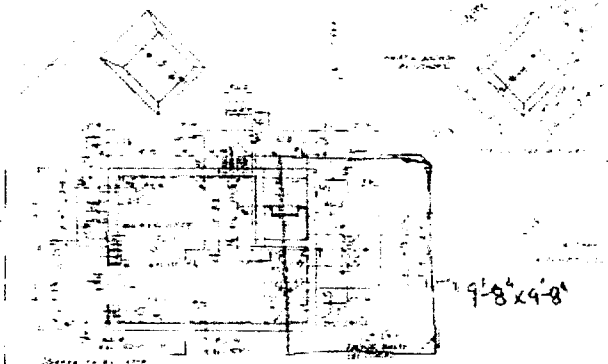
NEW MONO POLE

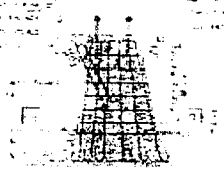


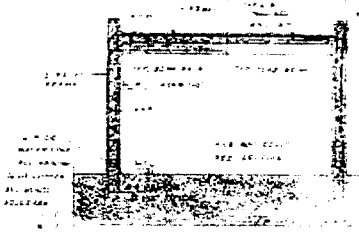
-4-#5 AT 8" OC

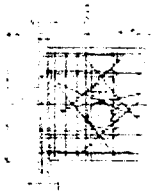


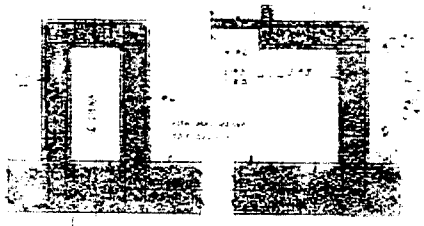
1/2"=1'-0"



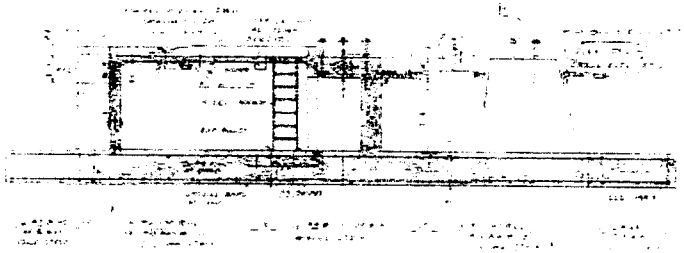


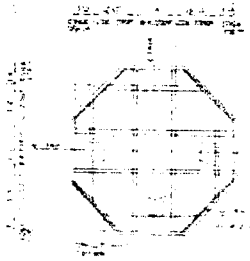


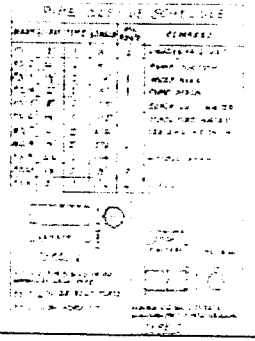




1800PSF







WEST VIRGINIA PULP & PAPER CO

MADE BY

SITE NAME	MERIDEN NORTH CT	ECP - CELL #	2	193
LATITUDE	41-34-21.95 N	LONGITUDE	72-46-43.95 W	
Additional Comments:		SAVE BUTTON		
		STRUCTURE TYPE	MONOPOLE	

700 Mhz - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Lucent	Lucent	Lucent
ANTENNA TYPE	LNX-6514DS-T4M	LNX-6514DS-T4M	P65-16-XL-2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0	Cellular Modcell 4.0	Cellular Modcell 4.0
ANTENNA TYPE	LPA-80080/4CF	LPA-80080/4CF	LPA-80080/4CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0	Cellular Modcell 4.0	Cellular Modcell 4.0
ANTENNA TYPE	LPA-80080/4CF	LPA-80080/4CF	LPA-80080/4CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	2
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 Cellular - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0B	PCS Modcell 4.0B	PCS Modcell 4.0B
ANTENNA TYPE	LPA-185080/8CF 2	LPA-185080/8CF 2	LPA-185080/8CF 2
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 Cellular - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0B	PCS Modcell 4.0B	PCS Modcell 4.0B
ANTENNA TYPE	MG D3-800T0	MG D3-800T0	MG D3-800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	2	2	2
RAD CTR (FT AGL)	125	125	125
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

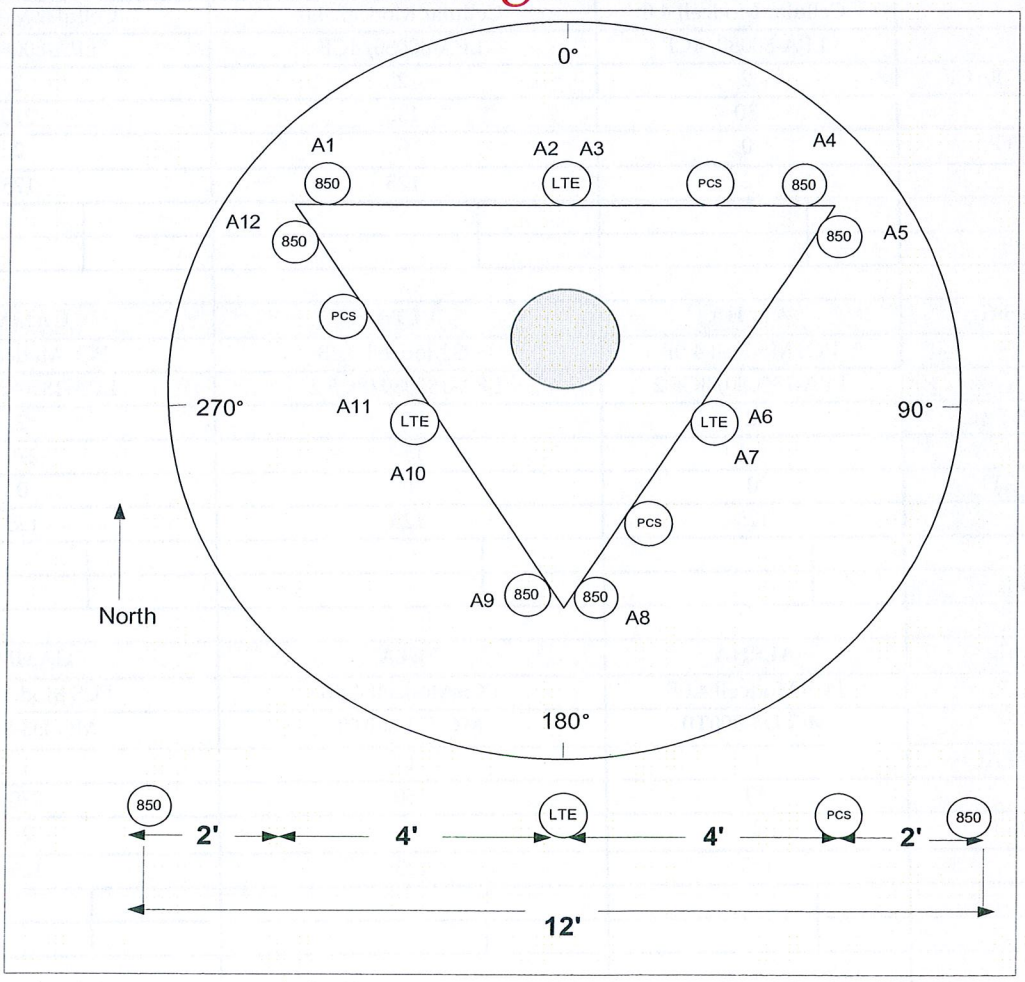
NUMBER OF CABLE'S NEEDED				ESTIMATED CABLE LENGTH	
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES	12	MAINLINE (FT)	150
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS	12	TOP JUMPER (FT)	10

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

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

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By : Dany Bustamante	Steve Weatherbee	DB	11/11/2009

Site Configuration



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
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

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

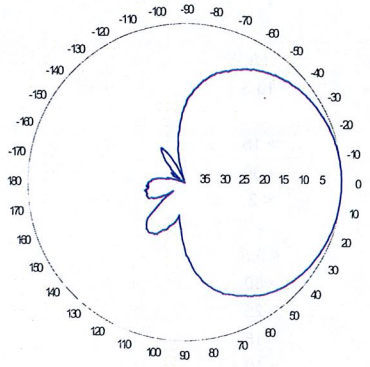
Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in). If the lock-down brace is used, the maximum diameter is Ø88.9 mm (3.5 in).

Mounting Bracket & Downtilt Bracket Kit #21699999

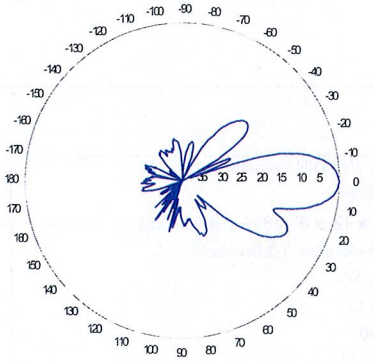
Electrical specifications

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

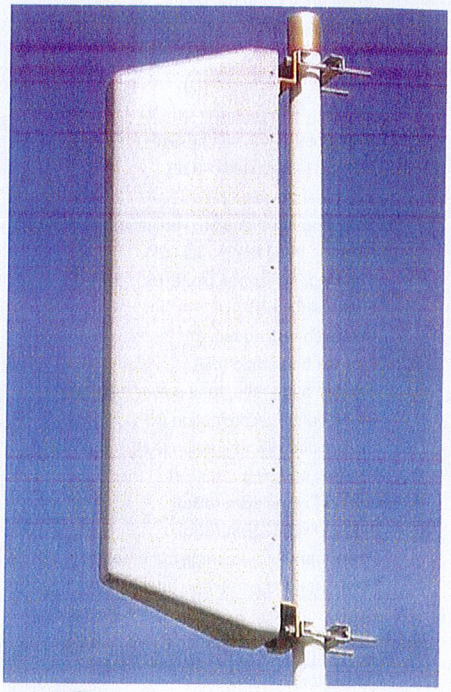


Vertical

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

P65-16-XL -2 Very Low Broadband Antennas

POLARIZATION: Dual linear ±45°
FREQUENCY (MHz): 698-894
HORIZONTAL BEAM WIDTH (°): 65
GAIN (dBi/dBd): 16.0/13.9
TILT: 2
LENGTH: 72"

ELECTRICAL SPECIFICATIONS*

Frequency range (MHz)	698-894		
Frequency band (MHz)	698-806		806-894
Gain (dBi/dBd)	15.5/13.4		16.0/13.9
Polarization			
Nominal Impedance (Ω)			
VSWR			
Horizontal beam width, -3 dB (°)	68		65
Vertical beam width, -3 dB (°)	10.5		9.5
Electrical down tilt (°)			
Side lobe suppression, vertical 1st upper (dB)	> 15		> 15
Isolation between inputs (dB)	> 30		> 30
Tracking, horizontal plane ±60° (dB)	< 2		< 2
First null fill (dB)	-		-
Vertical beam squint (°)	< 0.5		< 0.5
Front to back ratio (dB)	> 30		> 30
Front to back ratio, total power (dB)	> 25		> 25
Cross polar discrimination (XPD) 0° (dB)	> 15	> 15	
Cross polar discrimination (XPD) ±60° (dB)	> 10		> 10
Far field coupling			
IM3, 2xTx@43dBm (dBc)	-153		
IM7, 2xTx@43dBm (dBc)			
Power handling, average per input (W)			
Power handling, average total (W)			

MECHANICAL SPECIFICATIONS*

Connector	2 X 7/16 DIN Female
Connector position	Bottom
Dimensions, HxWxD, mm (ft)	72" x 12" x 5" (1829 x 305 x 125)
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, kg (lbs)	44 (20)
Weight, without brackets, kg (lbs)	33 (15)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.6 (N)	1380
Maximum operational wind speed, m/s (mph)	100 (45)
Survival wind speed, m/s (mph)	125 (55)
Lightning protection	DC Ground
Radome material	PVC
Radome colour	Light Grey
Package size, HxWxD, mm (ft)	82" x 16" x 10" (2082 x 400 x 255)
Shipping weight, kg (lbs)	55 (25)
RET	N/A
Brackets	7256.00, 7454.00, 2210.00

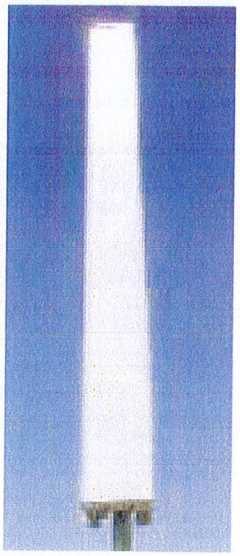
*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

ANTENNA PATTERNS*

For detailed patterns visit http://www.powerwave.com/rpa/.

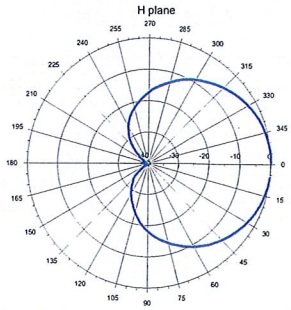
MG D3-800Tx

Xpol GSM1800+PCS & UMTS Panel Antenna
15.9 dBd/18 dBi
WIDE BAND 1710-2170 MHz
H 65º V 6.5º



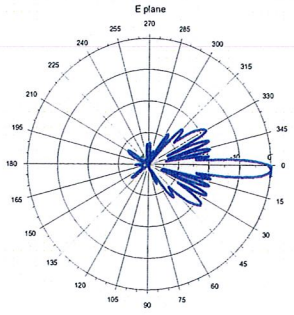
Electrical Specifications

Antenna Model	MG D3-800Tx		
Frequency Range (MHz)	1710-1880	1850-1990	1920-2170
Impedance	50 Ohms		
VSWR	1.40:1		
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		
Sidelobe Suppression (dB)	18	18	18
Front to Back Ratio (dB) @180º±20º	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 (mm)	1380 x 160 x 90
Survival Wind Speed	200 km/h
Front Windload (N) @ 160 km/h	335
Lateral Windload (N) @ 160 km/h	188
Antenna Weight (kg)	7
Clamps Weight (kg)	2
Mast Mounting	50 to 135 mm
Radome Color	Grey
Grounding	All metallic parts are DC grounded
Temperature Range	-55 to +60ºC
Humidity	100 %



Shipping Specifications

Dimensions (mm)	1580 x 340 x 210
Weight (kg)	12
Material	Cardboard and Foam

Ctra. Campo Real, Km 2,100
28500 Arganda del Rey
Madrid-Spain

RYMSA

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