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

ORIGINAL

January 6, 2011

Linda Roberts
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **EM-VER-097-100824 – 8 Ferris Road, Newtown, Connecticut**
EM-VER-034-100330 – 48 Newtown Road, Danbury, Connecticut

Dear Ms. Roberts:

The purpose of this letter is to notify you that construction activity associated with the above-referenced facility modifications has been completed.

If you have any questions or need any additional information regarding any of these facilities, please do not hesitate to contact me.

Sincerely,

Kenneth C. Baldwin

KCB/kmd
Copy to:
Sandy M. Carter

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

November 30, 2010

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

RE: **EM-VER-034-100330-** Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 48 Newtown Road, Danbury, Connecticut. Modification of Previous Acknowledgment.

Dear Attorney Baldwin:

In addition to the Connecticut Siting Council (Council) acknowledgement dated May 25, 2010 (filing dated March 30, 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 November 10, 2010. 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,

Linda Roberts

Linda Roberts
Executive Director

LR/CDM/laf

c: The Honorable Mark D. Boughton, Mayor, City of Danbury
Dennis Elpern, City Planner, City of Danbury
Wireless Capital Partners LLC

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

ORIGINAL

November 10, 2010

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

Re: **EM-VER-034-100330 – Cellco Partnership d/b/a Verizon Wireless**
48 Newtown Road, Danbury, Connecticut

Dear Mr. Perrone:

On May 25, 2010, the Siting Council acknowledged receipt of Cellco's notice of intent to modify the above-referenced telecommunications facility. This modification involved the replacement of Cellco's existing antennas with newer model cellular, PCS and LTE antennas.

In addition to these antenna modifications, Cellco now intends to install six (6) antenna cable diplexers on its antenna platform. Attached to this letter is a Structural Analysis Report verifying that the tower can support all of the previously approved antenna modifications and the addition of the antenna cable diplexers.

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

96-ft Existing EEI Monopole with
Future 14-ft Addition

Proposed Verizon Wireless
Antenna Change-Out

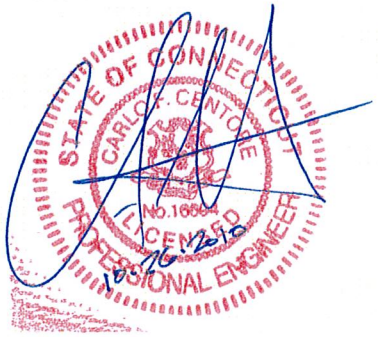
Verizon Wireless Site Ref:
Germantown

48 Newtown Road
Danbury, CT

Centek Project No. 10001-CO41

~~Date: March 3, 2010~~

Rev 1: October 25, 2010



Prepared for:

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

Table of Contents

Introduction

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

The host tower is a 96-ft tall, two-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI); project no. 5246 dated July 6, 1999. The tower geometry, structure member sizes and foundation system information were obtained from the original manufacturers design documents.

The tower is made up of two (2) 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 17.49-in at the top and 37.0-in at the base.

A future 14-ft extension to accommodate a MetroPCS antenna installation was also considered in this analysis. The pole extension and additional antenna loading required reinforcements to the existing monopole as outlined the structural analysis report prepared by Structural Components job no. 090239 dated October 6, 2009 for MetroPCS.

Antenna and appurtenance information were obtained from the CT Siting Council Database, the Verizon RF data sheet and visual verification conducted from grade by Centek Personnel on February 12, 2010.

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

- METRO PCS (FUTURE):
  Antennas: Three (3) Kathrein 800-10504 and three (3) Kathrein 742-351 panel antenna mounted on three (3) T-Arms with a RAD center elevation of 108-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the outside of the existing tower in a 2x6 cable configuration.
- AT&T (EXISTING):
  Antennas: Six (6) Powerwave 7770.00 panel antennas and six (6) TMA's mounted on an EEI standard platform with a RAD center elevation of 100-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the outside of the existing tower in a 2x6 cable configuration.

- NEXTEL (EXISTING):
  Antennas: Twelve (12) 4-ft panel antennas mounted on an EEI standard platform with a RAD center elevation of 78-ft above grade level.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower and six (6) 1-5/8" ∅ coax cables running on the outside of the existing tower in a 1x6 cable configuration.
- VERIZON (EXISTING TO REMAIN):
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- **VERIZON (EXISTING TO REMOVE):**
  Antennas: Six (6) Allgon 7129 and six (6) Decibel 948F85T2E-M panel antennas mounted on an existing EEI standard platform with a RAD center elevation of 90-ft above grade level.
- **VERIZON (PROPOSED):**
  Antennas: Two (2) Powerwave P65-16-XL-2, one (1) Antel BXA-70063-4CF, three (3) RYMSA MG D3-800T0, four (4) Decibel DB846H80E-SX and two (2) Decibel DB844G65ZAXY panel antennas and six (6) RFS FD9R6004/2C-3L Diplexers mounted on an existing EEI standard platform with a RAD center elevation of 90-ft above grade level.

Primary Assumptions Used in the Analysis

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

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:	Fairfield; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Danbury; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed 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 **96.3%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L2)	47.00'-97.00'	96.3%	**PASS**

Note: The wall thickness of the bottom 20-ft of the monopole was increased in the RisaTower analysis to reflect the reinforcements designed in the aforementioned structural analysis report prepared by Structural Components job no. 090239 dated October 6, 2009.

Foundation and Anchors

The existing foundation consists of a 5.5-ft ∅ x 21.0-ft long reinforced concrete caisson. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; project no. 5246 dated July 6, 1999. The base of the tower is connected to the foundation by means of (8) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 5-ft into the concrete foundation structure. Three (3) proposed 2-3/4" "∅ ASTM A193 Gr. B7 anchor rods as required by the aforementioned structural analysis report prepared by Structural Components were also considered is the analysis.

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

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

Base Reactions	Vector	Proposed Load (kips/ft-kips)
Base	Shear	**19**
	Axial	**20**
	Moment	**1439**

- The foundation was found to be within allowable limits.

Foundation	Design Limit	Proposed Loading	Result
Reinforced Concrete Caisson	Moment Capacity	76.5%	**PASS**
	Lateral Deflection	0.75 in.(1)	**PASS**

(1) Lateral deflection typically limited to 1.0 in. for monopole tower structures.

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts (ASTM-A615)	Compression	61.1%	**PASS**
Anchor Bolts (ASTM-A193)	Compression	54.4%	**PASS**
Base Plate	Bending	41.0%	**PASS**

Conclusion

Provided the proposed MetroPCS tower reinforcements outlined in the structural analysis report by Structural Components, LLC are implemented, this analysis finds the subject tower **adequate** to support the Verizon modified antenna configuration and MetroPCS proposed antenna installation.

Should the MetroPCS installation not occur, the outlined reinforcements will not be required to accommodate Verizon's 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

STATE OF CONNECTICUT
CARLO F. CENTORE
No. 18684
LICENSED
PROFESSIONAL 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.

LPILE Plus:

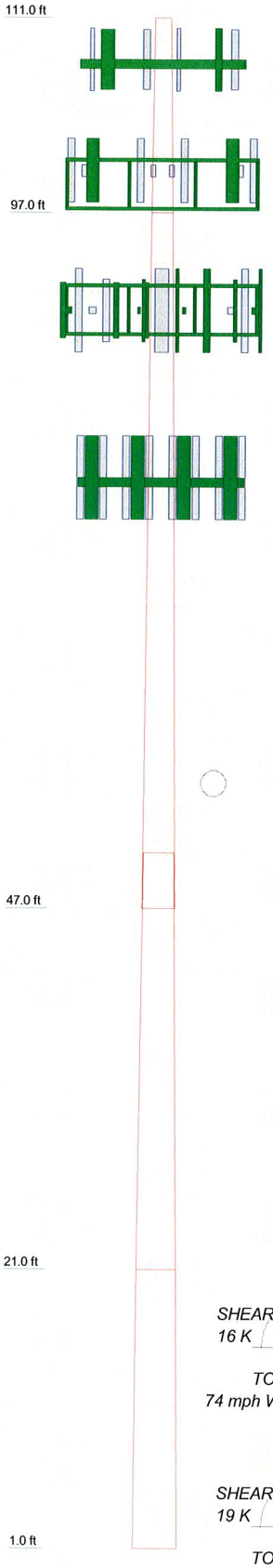
LPILE Plus is a special purpose program based on rational procedures for analyzing a pile under lateral loading. The program computes deflection, shear, bending moment, and soil response with respect to depth in nonlinear soils. Components of the stiffness matrix at the pile head may be computed internally 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	4
Length (ft)	14.00	50.00	30.00	20.00
Number of Sides	1	18	18	18
Thickness (in)	0.3750	0.2500	0.3125	0.4000
Lap Splice (ft)		4.00		
Top Dia (in)	14.5000	17.5000	26.6416	33.3920
Bot Dia (in)	17.5000	27.9800	33.3920	37.0000
Grade	A500-42		A572-65	
Weight (K)	0.9	3.0	3.0	3.0



AXIAL 29 K
SHEAR 16 K
MOMENT 1298 kip-ft
TORQUE 1 kip-ft
74 mph WIND - 0.5000 in ICE

AXIAL 20 K
SHEAR 19 K
MOMENT 1439 kip-ft
TORQUE 1 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
800-10504 (MetroPCS - Reserved)	108	MG D3-800T0 (Verizon - Proposed)	90
800-10504 (MetroPCS - Reserved)	108	P65-16-XL-2 (Verizon - Proposed)	90
800-10504 (MetroPCS - Reserved)	108	DB846H80E-SX (Verizon - Proposed)	90
742-351 (MetroPCS - Reserved)	108	DB844G65ZAXY (Verizon - Proposed)	90
742-351 (MetroPCS - Reserved)	108	MG D3-800T0 (Verizon - Proposed)	90
742-351 (MetroPCS - Reserved)	108	BXA-70063/4CF (Verizon - Proposed)	90
Valmont T-Arm (3) (MetroPCS - Reserved)	108	DB844G65ZAXY (Verizon - Proposed)	90
(2) 7770.00 (ATI - Existing)	100	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	90
(2) 7770.00 (ATI - Existing)	100	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	90
(2) 7770.00 (ATI - Existing)	100	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	90
(2) TMA 10"x8"x3" (ATI - Existing)	100	EEI Standard Platform (Verizon - Existing)	90
(2) TMA 10"x8"x3" (ATI - Existing)	100	(4) 4' Panel (Nextel - Existing)	78
(2) TMA 10"x8"x3" (ATI - Existing)	100	(4) 4' Panel (Nextel - Existing)	78
EEI Standard Platform (ATI - Existing)	99	(4) 4' Panel (Nextel - Existing)	78
DB846H80E-SX (Verizon - Proposed)	90	EEI Low Profile Platform (Nextel - Existing)	78
MG D3-800T0 (Verizon - Proposed)	90		
P65-16-XL-2 (Verizon - Proposed)	90		
DB846H80E-SX (Verizon - Proposed)	90		
DB846H80E-SX (Verizon - Proposed)	90		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A500-42	42 ksi	58 ksi	A572-65	65 ksi	80 ksi

TOWER DESIGN NOTES

1. Tower is located in Fairfield County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
6. Welds are fabricated with ER-70S-6 electrodes.
7. Analysis considers all reinforcements proposed and designed by Structural Components, LLC dated October 6, 2009.
8. TOWER RATING: 96.3%

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

Job:	***100' EEI Monopole - Germantown***		
Project:	***10001.CO41~ Rev.1 - 48 Newton Rd., Danbury, CT***		
Client: Verizon Wireless		Drawn by: TJL	App'd:
Code: TIA/EIA-222-F		Date: 10/25/10	Scale: NTS
Path: J:\Jobs\1000100.WTC\041 - Germantown, 50 Newtown Rd, Danbury, CT\Rev (1)\Calcs\ERI\100 EEI Monopole w extension.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:

Tower is located in Fairfield County, Connecticut.
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..
Analysis considers all reinforcements proposed and designed by Structural Components, LLC dated October 6, 2009..
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	111.00-97.00	14.00	0.00	Round	14.5000	17.5000	0.3750		A500-42 (42 ksi)
L2	97.00-47.00	50.00	4.00	18	17.5000	27.9800	0.2500	1.0000	A572-65 (65 ksi)
L3	47.00-21.00	30.00	0.00	18	26.6416	33.3920	0.3125	1.2500	A572-65 (65 ksi)

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L4	21.00-1.00	20.00		18	33.3920	37.0000	0.4000	1.6000	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	14.5000	16.6322	415.3261	5.0003	7.2500	57.2864	829.5207	8.3153	0.0000	0
	17.5000	20.1647	740.1429	6.0622	8.7500	84.5878	1478.2694	10.0814	0.0000	0
L2	17.7700	13.6879	514.5786	6.1238	8.8900	57.8829	1029.8342	6.8452	2.6400	10.56
	28.4116	22.0038	2137.6372	9.8442	14.2138	150.3912	4278.0871	11.0040	4.4845	17.938
L3	27.9665	26.1152	2287.1910	9.3468	13.5339	168.9968	4577.3916	13.0601	4.1389	13.245
	33.9071	32.8107	4535.9808	11.7432	16.9631	267.4023	9077.9301	16.4085	5.3270	17.046
L4	33.9071	41.8866	5760.1036	11.7122	16.9631	339.5660	11527.7865	20.9473	5.1730	12.932
	37.5708	46.4674	7864.0745	12.9930	18.7960	418.3909	15738.4968	23.2381	5.8080	14.52

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 111.00-97.00				1	1	1		
L2 97.00-47.00				1	1	1		
L3 47.00-21.00				1	1	1		
L4 21.00-1.00				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 (AT&T - Existing)	C	No	CaAa (Out Of Face)	101.00 - 16.00	2	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (AT&T - Existing)	C	No	CaAa (Out Of Face)	101.00 - 16.00	10	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55
1 5/8 (Verizon - Existing)	A	No	Inside Pole	91.00 - 16.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Sprint - Existing)	B	No	Inside Pole	79.00 - 16.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Sprint - Existing)	B	No	CaAa (Out Of Face)	79.00 - 16.00	1	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (Sprint - Existing)	B	No	CaAa (Out Of Face)	79.00 - 16.00	5	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55
1 5/8 (MetroPCS - Reserved)	A	No	CaAa (Out Of Face)	109.00 - 16.00	2	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (MetroPCS - Reserved)	A	No	CaAa (Out Of Face)	109.00 - 16.00	10	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	111.00-97.00	A	0.000	0.000	0.000	4.752	0.15
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	1.584	0.05
L2	97.00-47.00	A	0.000	0.000	0.000	19.800	1.17
		B	0.000	0.000	0.000	6.336	0.40
		C	0.000	0.000	0.000	19.800	0.62
L3	47.00-21.00	A	0.000	0.000	0.000	10.296	0.65
		B	0.000	0.000	0.000	5.148	0.32
		C	0.000	0.000	0.000	10.296	0.32
L4	21.00-1.00	A	0.000	0.000	0.000	1.980	0.12
		B	0.000	0.000	0.000	0.990	0.06
		C	0.000	0.000	0.000	1.980	0.06

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	111.00-97.00	A	0.500	0.000	0.000	0.000	7.152	0.37
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	2.384	0.12
L2	97.00-47.00	A	0.500	0.000	0.000	0.000	29.800	2.08
		B		0.000	0.000	0.000	9.536	0.69
		C		0.000	0.000	0.000	29.800	1.53
L3	47.00-21.00	A	0.500	0.000	0.000	0.000	15.496	1.12
		B		0.000	0.000	0.000	7.748	0.56
		C		0.000	0.000	0.000	15.496	0.80
L4	21.00-1.00	A	0.500	0.000	0.000	0.000	2.980	0.22
		B		0.000	0.000	0.000	1.490	0.11
		C		0.000	0.000	0.000	2.980	0.15

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	111.00-97.00	-0.1171	-0.3176	-0.1500	-0.4069
L2	97.00-47.00	-0.2264	-0.1307	-0.2852	-0.1647
L3	47.00-21.00	-0.1851	-0.1068	-0.2390	-0.1380
L4	21.00-1.00	-0.0570	-0.0329	-0.0805	-0.0465

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
800-10504	A	From Face	3.00	0.0000	108.00	No Ice	3.66	2.26	0.02
(MetroPCS - Reserved)			-4.00			1/2" Ice	4.01	2.59	0.04
			0.00						
800-10504	B	From Face	3.00	0.0000	108.00	No Ice	3.66	2.26	0.02
(MetroPCS - Reserved)			-4.00			1/2" Ice	4.01	2.59	0.04
			0.00						
800-10504	C	From Face	3.00	0.0000	108.00	No Ice	3.66	2.26	0.02
(MetroPCS - Reserved)			-4.00			1/2" Ice	4.01	2.59	0.04
			0.00						
742-351	A	From Face	3.00	0.0000	108.00	No Ice	5.89	1.73	0.03
(MetroPCS - Reserved)			4.00			1/2" Ice	6.30	2.04	0.06
			0.00						
742-351	B	From Face	3.00	0.0000	108.00	No Ice	5.89	1.73	0.03
(MetroPCS - Reserved)			4.00			1/2" Ice	6.30	2.04	0.06
			0.00						
742-351	C	From Face	3.00	0.0000	108.00	No Ice	5.89	1.73	0.03
(MetroPCS - Reserved)			4.00			1/2" Ice	6.30	2.04	0.06
			0.00						
Valmont T-Arm (3)	C	None		0.0000	108.00	No Ice	21.00	21.00	1.01
(MetroPCS - Reserved)						1/2" Ice	29.00	29.00	1.24
(2) 7770.00	A	From Face	4.00	0.0000	100.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	B	From Face	4.00	0.0000	100.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	C	From Face	4.00	0.0000	100.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) TMA 10"x8"x3"	A	From Face	3.00	0.0000	100.00	No Ice	0.78	0.29	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.90	0.38	0.02
			0.00						
(2) TMA 10"x8"x3"	B	From Face	3.00	0.0000	100.00	No Ice	0.78	0.29	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.90	0.38	0.02
			0.00						
(2) TMA 10"x8"x3"	C	From Face	3.00	0.0000	100.00	No Ice	0.78	0.29	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.90	0.38	0.02
			0.00						
EEI Standard Platform	C	None		0.0000	99.00	No Ice	30.00	30.00	1.60
(AT&T - Existing)						1/2" Ice	35.00	35.00	2.00
DB846H80E-SX	A	From Leg	4.00	0.0000	90.00	No Ice	5.09	6.06	0.02
(Verizon - Proposed)			-6.00			1/2" Ice	5.55	6.52	0.05
			0.00						
MG D3-800T0	A	From Leg	3.00	0.0000	90.00	No Ice	3.45	2.22	0.02
(Verizon - Proposed)			-4.00			1/2" Ice	3.80	2.55	0.04
			0.00						
P65-16-XL-2	A	From Leg	3.00	0.0000	90.00	No Ice	8.40	4.12	0.02
(Verizon - Proposed)			0.00			1/2" Ice	8.95	4.56	0.06
			0.00						
DB846H80E-SX	A	From Leg	4.00	0.0000	90.00	No Ice	5.09	6.06	0.02
(Verizon - Proposed)			6.00			1/2" Ice	5.55	6.52	0.05
			0.00						
DB846H80E-SX	B	From Leg	4.00	0.0000	90.00	No Ice	5.09	6.06	0.02
(Verizon - Proposed)			-6.00			1/2" Ice	5.55	6.52	0.05
			0.00						
MG D3-800T0	B	From Leg	3.00	0.0000	90.00	No Ice	3.45	2.22	0.02
(Verizon - Proposed)			-4.00			1/2" Ice	3.80	2.55	0.04

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						
P65-16-XL-2	B	From Leg	3.00	0.0000	90.00	No Ice	8.40	4.12	0.02
(Verizon - Proposed)			0.00			1/2" Ice	8.95	4.56	0.06
			0.00						
DB846H80E-SX	B	From Leg	4.00	0.0000	90.00	No Ice	5.09	6.06	0.02
(Verizon - Proposed)			6.00			1/2" Ice	5.55	6.52	0.05
			0.00						
DB844G65ZAXY	C	From Leg	4.00	0.0000	90.00	No Ice	4.67	3.73	0.02
(Verizon - Proposed)			-6.00			1/2" Ice	5.05	4.10	0.05
			0.00						
MG D3-800T0	C	From Leg	3.00	0.0000	90.00	No Ice	3.45	2.22	0.02
(Verizon - Proposed)			-4.00			1/2" Ice	3.80	2.55	0.04
			0.00						
BXA-70063/4CF	C	From Leg	3.00	0.0000	90.00	No Ice	5.16	2.44	0.01
(Verizon - Proposed)			0.00			1/2" Ice	5.55	2.74	0.04
			0.00						
DB844G65ZAXY	C	From Leg	4.00	0.0000	90.00	No Ice	4.67	3.73	0.02
(Verizon - Proposed)			6.00			1/2" Ice	5.05	4.10	0.05
			0.00						
(2) FD9R6004/2C-3L	A	From Leg	4.00	0.0000	90.00	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 Leg	4.00	0.0000	90.00	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 Leg	4.00	0.0000	90.00	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 Standard Platform	C	None		0.0000	90.00	No Ice	30.00	30.00	1.60
(Verizon - Existing)						1/2" Ice	35.00	35.00	2.00
(4) 4' Panel	A	From Face	3.00	0.0000	78.00	No Ice	1.92	3.26	0.01
(Nextel - Existing)			0.00			1/2" Ice	2.22	3.62	0.03
			0.00						
(4) 4' Panel	B	From Face	3.00	0.0000	78.00	No Ice	1.92	3.26	0.01
(Nextel - Existing)			0.00			1/2" Ice	2.22	3.62	0.03
			0.00						
(4) 4' Panel	C	From Face	3.00	0.0000	78.00	No Ice	1.92	3.26	0.01
(Nextel - Existing)			0.00			1/2" Ice	2.22	3.62	0.03
			0.00						
EEI Low Profile Platform	C	None		0.0000	78.00	No Ice	22.50	22.50	1.50
(Nextel - Existing)						1/2" Ice	28.20	28.20	2.25

Tower Pressures - No Ice

$G_H = 1.690$

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

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 111.00-97.00	103.78	1.387	26	18.667	A	0.000	18.667	18.667	100.00	0.000	4.752
					B	0.000	18.667		100.00	0.000	0.000
					C	0.000	18.667		100.00	0.000	1.584
L2 97.00-47.00	70.70	1.243	23	94.750	A	0.000	94.750	94.750	100.00	0.000	19.800
					B	0.000	94.750		100.00	0.000	6.336
					C	0.000	94.750		100.00	0.000	19.800
L3 47.00-21.00	33.58	1.005	19	66.011	A	0.000	66.011	66.011	100.00	0.000	10.296
					B	0.000	66.011		100.00	0.000	5.148
					C	0.000	66.011		100.00	0.000	10.296
L4 21.00-1.00	10.83	1	18	58.660	A	0.000	58.660	58.660	100.00	0.000	1.980
					B	0.000	58.660		100.00	0.000	0.990
					C	0.000	58.660		100.00	0.000	1.980

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 111.00-97.00	103.78	1.387	19	0.5000	19.833	A	0.000	19.833	19.833	100.00	0.000	7.152
						B	0.000	19.833		100.00	0.000	0.000
						C	0.000	19.833		100.00	0.000	2.384
L2 97.00-47.00	70.70	1.243	17	0.5000	98.917	A	0.000	98.917	98.917	100.00	0.000	29.800
						B	0.000	98.917		100.00	0.000	9.536
						C	0.000	98.917		100.00	0.000	29.800
L3 47.00-21.00	33.58	1.005	14	0.5000	68.178	A	0.000	68.178	68.178	100.00	0.000	15.496
						B	0.000	68.178		100.00	0.000	7.748
						C	0.000	68.178		100.00	0.000	15.496
L4 21.00-1.00	10.83	1	14	0.5000	60.327	A	0.000	60.327	60.327	100.00	0.000	2.980
						B	0.000	60.327		100.00	0.000	1.490
						C	0.000	60.327		100.00	0.000	2.980

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 111.00-97.00	103.78	1.387	9	18.667	A	0.000	18.667	18.667	100.00	0.000	4.752
					B	0.000	18.667		100.00	0.000	0.000
					C	0.000	18.667		100.00	0.000	1.584
L2 97.00-47.00	70.70	1.243	8	94.750	A	0.000	94.750	94.750	100.00	0.000	19.800
					B	0.000	94.750		100.00	0.000	6.336
					C	0.000	94.750		100.00	0.000	19.800
L3 47.00-21.00	33.58	1.005	6	66.011	A	0.000	66.011	66.011	100.00	0.000	10.296
					B	0.000	66.011		100.00	0.000	5.148
					C	0.000	66.011		100.00	0.000	10.296
L4 21.00-1.00	10.83	1	6	58.660	A	0.000	58.660	58.660	100.00	0.000	1.980

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
					B	0.000	58.660		100.00	0.000	0.990
					C	0.000	58.660		100.00	0.000	1.980

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.75	53.74	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.20	3.04	A	1	0.65	1	1	1	94.750	4.15	83.10	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.30	3.01	A	1	0.65	1	1	1	66.011	2.16	82.95	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.25	3.01	A	1	0.65	1	1	1	58.660	1.35	67.33	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.94	9.93						OTM	450.42 kip-ft	8.41		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.75	53.74	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.20	3.04	A	1	0.65	1	1	1	94.750	4.15	83.10	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.30	3.01	A	1	0.65	1	1	1	66.011	2.16	82.95	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.25	3.01	A	1	0.65	1	1	1	58.660	1.35	67.33	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.94	9.93						OTM	450.42 kip-ft	8.41		

Tower Forces - No Ice - 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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.75	53.74	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.20	3.04	A	1	0.65	1	1	1	94.750	4.15	83.10	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.30	3.01	A	1	0.65	1	1	1	66.011	2.16	82.95	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.25	3.01	A	1	0.65	1	1	1	58.660	1.35	67.33	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.94	9.93						OTM	450.42 kip-ft	8.41		

Tower Forces - No Ice - 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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.75	53.74	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.20	3.04	A	1	0.65	1	1	1	94.750	4.15	83.10	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.30	3.01	A	1	0.65	1	1	1	66.011	2.16	82.95	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.25	3.01	A	1	0.65	1	1	1	58.660	1.35	67.33	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.94	9.93						OTM	450.42 kip-ft	8.41		

Tower Forces - With 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 111.00-97.00	0.49	1.02	A	1	0.59	1	1	1	19.833	0.69	49.34	C
			B	1	0.59	1	1	1	19.833			
			C	1	0.59	1	1	1	19.833			
L2 97.00-47.00	4.30	3.75	A	1	0.65	1	1	1	98.917	3.87	77.34	C
			B	1	0.65	1	1	1	98.917			
			C	1	0.65	1	1	1	98.917			
L3 47.00-21.00	2.48	3.50	A	1	0.65	1	1	1	68.178	1.96	75.27	C
			B	1	0.65	1	1	1	68.178			
			C	1	0.65	1	1	1	68.178			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L4 21.00-1.00	0.48	3.45	A	1	0.65	1	1	1	60.327	1.09	54.70	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	7.74	11.72						OTM	415.03 kip-ft	7.61		

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 111.00-97.00	0.49	1.02	A	1	0.59	1	1	1	19.833	0.69	49.34	C
			B	1	0.59	1	1	1	19.833			
			C	1	0.59	1	1	1	19.833			
L2 97.00-47.00	4.30	3.75	A	1	0.65	1	1	1	98.917	3.87	77.34	C
			B	1	0.65	1	1	1	98.917			
			C	1	0.65	1	1	1	98.917			
L3 47.00-21.00	2.48	3.50	A	1	0.65	1	1	1	68.178	1.96	75.27	C
			B	1	0.65	1	1	1	68.178			
			C	1	0.65	1	1	1	68.178			
L4 21.00-1.00	0.48	3.45	A	1	0.65	1	1	1	60.327	1.09	54.70	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	7.74	11.72						OTM	415.03 kip-ft	7.61		

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 111.00-97.00	0.49	1.02	A	1	0.59	1	1	1	19.833	0.69	49.34	C
			B	1	0.59	1	1	1	19.833			
			C	1	0.59	1	1	1	19.833			
L2 97.00-47.00	4.30	3.75	A	1	0.65	1	1	1	98.917	3.87	77.34	C
			B	1	0.65	1	1	1	98.917			
			C	1	0.65	1	1	1	98.917			
L3 47.00-21.00	2.48	3.50	A	1	0.65	1	1	1	68.178	1.96	75.27	C
			B	1	0.65	1	1	1	68.178			
			C	1	0.65	1	1	1	68.178			
L4 21.00-1.00	0.48	3.45	A	1	0.65	1	1	1	60.327	1.09	54.70	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	7.74	11.72						OTM	415.03 kip-ft	7.61		

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 111.00-97.00	0.49	1.02	A	1	0.59	1	1	1	19.833	0.69	49.34	C
			B	1	0.59	1	1	1	19.833			
			C	1	0.59	1	1	1	19.833			
L2 97.00-47.00	4.30	3.75	A	1	0.65	1	1	1	98.917	3.87	77.34	C
			B	1	0.65	1	1	1	98.917			
			C	1	0.65	1	1	1	98.917			
L3 47.00-21.00	2.48	3.50	A	1	0.65	1	1	1	68.178	1.96	75.27	C
			B	1	0.65	1	1	1	68.178			
			C	1	0.65	1	1	1	68.178			
L4 21.00-1.00	0.48	3.45	A	1	0.65	1	1	1	60.327	1.09	54.70	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	7.74	11.72						OTM	415.03 kip-ft	7.61		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.26	18.59	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.20	3.04	A	1	0.65	1	1	1	94.750	1.44	28.75	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.30	3.01	A	1	0.65	1	1	1	66.011	0.75	28.70	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.25	3.01	A	1	0.65	1	1	1	58.660	0.47	23.30	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.94	9.93						OTM	155.86 kip-ft	2.91		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.26	18.59	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.20	3.04	A	1	0.65	1	1	1	94.750	1.44	28.75	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L3 47.00-21.00	1.30	3.01	A	1	0.65	1	1	1	66.011	0.75	28.70	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.25	3.01	A	1	0.65	1	1	1	58.660	0.47	23.30	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.94	9.93						OTM	155.86 kip-ft	2.91		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.26	18.59	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.20	3.04	A	1	0.65	1	1	1	94.750	1.44	28.75	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.30	3.01	A	1	0.65	1	1	1	66.011	0.75	28.70	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.25	3.01	A	1	0.65	1	1	1	58.660	0.47	23.30	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.94	9.93						OTM	155.86 kip-ft	2.91		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.26	18.59	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.20	3.04	A	1	0.65	1	1	1	94.750	1.44	28.75	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.30	3.01	A	1	0.65	1	1	1	66.011	0.75	28.70	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.25	3.01	A	1	0.65	1	1	1	58.660	0.47	23.30	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.94	9.93						OTM	155.86 kip-ft	2.91		

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	9.93					
Bracing Weight	0.00					
Total Member Self-Weight	9.93			-0.42	0.55	
Total Weight	20.44			-0.42	0.55	
Wind 0 deg - No Ice		0.04	-18.51	-1381.07	-3.05	0.91
Wind 30 deg - No Ice		9.31	-16.05	-1197.89	-694.97	0.44
Wind 45 deg - No Ice		13.15	-13.12	-979.23	-981.20	0.16
Wind 60 deg - No Ice		16.09	-9.29	-693.86	-1200.52	-0.14
Wind 90 deg - No Ice		18.56	-0.04	-4.02	-1384.25	-0.68
Wind 120 deg - No Ice		16.05	9.22	686.79	-1196.92	-1.05
Wind 135 deg - No Ice		13.09	13.06	973.30	-976.11	-1.13
Wind 150 deg - No Ice		9.24	16.01	1193.45	-688.73	-1.13
Wind 180 deg - No Ice		-0.04	18.51	1380.22	4.15	-0.91
Wind 210 deg - No Ice		-9.31	16.05	1197.05	696.07	-0.44
Wind 225 deg - No Ice		-13.15	13.12	978.39	982.30	-0.16
Wind 240 deg - No Ice		-16.09	9.29	693.02	1201.62	0.14
Wind 270 deg - No Ice		-18.56	0.04	3.18	1385.35	0.68
Wind 300 deg - No Ice		-16.05	-9.22	-687.63	1198.02	1.05
Wind 315 deg - No Ice		-13.09	-13.06	-974.14	977.21	1.13
Wind 330 deg - No Ice		-9.24	-16.01	-1194.30	689.83	1.13
Member Ice	1.80					
Total Weight Ice	28.72			-1.06	1.29	
Wind 0 deg - Ice		0.03	-16.39	-1225.52	-1.43	0.67
Wind 30 deg - Ice		8.24	-14.21	-1062.84	-614.87	0.29
Wind 45 deg - Ice		11.63	-11.61	-868.81	-868.68	0.07
Wind 60 deg - Ice		14.24	-8.22	-615.65	-1063.20	-0.16
Wind 90 deg - Ice		16.42	-0.03	-3.78	-1226.31	-0.57
Wind 120 deg - Ice		14.21	8.17	608.81	-1060.48	-0.83
Wind 135 deg - Ice		11.59	11.56	862.84	-864.83	-0.88
Wind 150 deg - Ice		8.18	14.17	1057.99	-610.15	-0.86
Wind 180 deg - Ice		-0.03	16.39	1223.40	4.02	-0.67
Wind 210 deg - Ice		-8.24	14.21	1060.72	617.45	-0.29
Wind 225 deg - Ice		-11.63	11.61	866.69	871.27	-0.07
Wind 240 deg - Ice		-14.24	8.22	613.53	1065.79	0.16
Wind 270 deg - Ice		-16.42	0.03	1.66	1228.90	0.57
Wind 300 deg - Ice		-14.21	-8.17	-610.93	1063.07	0.83
Wind 315 deg - Ice		-11.59	-11.56	-864.96	867.42	0.88
Wind 330 deg - Ice		-8.18	-14.17	-1060.11	612.74	0.86
Total Weight	20.44			-0.42	0.55	
Wind 0 deg - Service		0.01	-6.41	-477.75	-1.28	0.31
Wind 30 deg - Service		3.22	-5.55	-414.37	-240.70	0.15
Wind 45 deg - Service		4.55	-4.54	-338.71	-339.74	0.05
Wind 60 deg - Service		5.57	-3.21	-239.96	-415.63	-0.05
Wind 90 deg - Service		6.42	-0.01	-1.26	-479.20	-0.24
Wind 120 deg - Service		5.55	3.19	237.77	-414.38	-0.36
Wind 135 deg - Service		4.53	4.52	336.91	-337.98	-0.39
Wind 150 deg - Service		3.20	5.54	413.09	-238.54	-0.39
Wind 180 deg - Service		-0.01	6.41	477.71	1.21	-0.31
Wind 210 deg - Service		-3.22	5.55	414.33	240.63	-0.15
Wind 225 deg - Service		-4.55	4.54	338.67	339.67	-0.05
Wind 240 deg - Service		-5.57	3.21	239.93	415.56	0.05
Wind 270 deg - Service		-6.42	0.01	1.23	479.14	0.24
Wind 300 deg - Service		-5.55	-3.19	-237.81	414.32	0.36
Wind 315 deg - Service		-4.53	-4.52	-336.95	337.91	0.39

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 330 deg - Service		-3.20	-5.54	-413.12	238.47	0.39

Load Combinations

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

Comb. No.	Description
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	111 - 97	Pole	Max Tension	47	0.00	-0.00	-0.00
			Max. Compression	18	-5.56	0.08	0.21
			Max. Mx	14	-3.65	33.77	0.08
			Max. My	2	-3.65	0.02	33.82
			Max. Vy	14	-5.52	33.77	0.08
			Max. Vx	2	-5.52	0.02	33.82
			Max. Torque	22			0.02
L2	97 - 47	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-18.10	0.75	0.77
			Max. Mx	14	-11.58	582.61	-1.38
			Max. My	2	-11.59	-1.33	580.67
			Max. Vy	14	-15.33	582.61	-1.38
			Max. Vx	2	-15.29	-1.33	580.67
			Max. Torque	9			1.19
L3	47 - 21	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-24.79	1.25	1.06
			Max. Mx	14	-16.85	1076.39	-2.51
			Max. My	2	-16.85	-2.38	1072.91
			Max. Vy	14	-17.54	1076.39	-2.51
			Max. Vx	2	-17.49	-2.38	1072.91
			Max. Torque	9			1.14
L4	21 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-28.72	1.35	1.12
			Max. Mx	14	-20.43	1437.23	-3.30
			Max. My	2	-20.43	-3.16	1432.79
			Max. Vy	14	-18.57	1437.23	-3.30
			Max. Vx	2	-18.52	-3.16	1432.79
			Max. Torque	9			1.12

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	28.72	16.42	-0.03
	Max. H_x	14	20.44	18.56	-0.04
	Max. H_z	2	20.44	-0.04	18.51
	Max. M_x	2	1432.79	-0.04	18.51
	Max. M_z	6	1436.08	-18.56	0.04
	Max. Torsion	9	1.12	-9.24	-16.01
	Min. Vert	1	20.44	0.00	0.00
	Min. H_x	6	20.44	-18.56	0.04
	Min. H_z	10	20.44	0.04	-18.51
	Min. M_x	10	-1431.91	0.04	-18.51
	Min. M_z	14	-1437.23	18.56	-0.04
	Min. Torsion	17	-1.12	9.24	16.01

Tower Mast Reaction Summary

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead Only	20.44	0.00	0.00	-0.42	0.55	0.00
Dead+Wind 0 deg - No Ice	20.44	0.04	-18.51	-1432.79	-3.15	0.90
Dead+Wind 30 deg - No Ice	20.44	9.31	-16.05	-1242.76	-720.99	0.44
Dead+Wind 45 deg - No Ice	20.44	13.15	-13.12	-1015.90	-1017.93	0.16
Dead+Wind 60 deg - No Ice	20.44	16.09	-9.29	-719.85	-1245.47	-0.14
Dead+Wind 90 deg - No Ice	20.44	18.56	-0.04	-4.18	-1436.08	-0.68
Dead+Wind 120 deg - No Ice	20.44	16.05	9.22	712.50	-1241.74	-1.04
Dead+Wind 135 deg - No Ice	20.44	13.09	13.06	1009.75	-1012.66	-1.11
Dead+Wind 150 deg - No Ice	20.44	9.24	16.01	1238.15	-714.52	-1.12
Dead+Wind 180 deg - No Ice	20.44	-0.04	18.51	1431.91	4.33	-0.90
Dead+Wind 210 deg - No Ice	20.44	-9.31	16.05	1241.86	722.15	-0.44
Dead+Wind 225 deg - No Ice	20.44	-13.15	13.12	1015.01	1019.09	-0.16
Dead+Wind 240 deg - No Ice	20.44	-16.09	9.29	718.96	1246.62	0.14
Dead+Wind 270 deg - No Ice	20.44	-18.56	0.04	3.30	1437.23	0.68
Dead+Wind 300 deg - No Ice	20.44	-16.05	-9.22	-713.37	1242.90	1.03
Dead+Wind 315 deg - No Ice	20.44	-13.09	-13.06	-1010.62	1013.82	1.11
Dead+Wind 330 deg - No Ice	20.44	-9.24	-16.01	-1239.02	715.68	1.12
Dead+Ice+Temp	28.72	-0.00	-0.00	-1.12	1.35	0.00
Dead+Wind 0 deg+Ice+Temp	28.72	0.03	-16.39	-1293.77	-1.49	0.66
Dead+Wind 30 deg+Ice+Temp	28.72	8.24	-14.21	-1122.03	-649.08	0.29
Dead+Wind 45 deg+Ice+Temp	28.72	11.63	-11.61	-917.21	-917.02	0.07
Dead+Wind 60 deg+Ice+Temp	28.72	14.24	-8.22	-649.95	-1122.38	-0.16
Dead+Wind 90 deg+Ice+Temp	28.72	16.42	-0.03	-4.02	-1294.57	-0.57
Dead+Wind 120 deg+Ice+Temp	28.72	14.21	8.17	642.68	-1119.51	-0.83
Dead+Wind 135 deg+Ice+Temp	28.72	11.59	11.56	910.86	-912.96	-0.87
Dead+Wind 150 deg+Ice+Temp	28.72	8.18	14.17	1116.88	-644.09	-0.86
Dead+Wind 180 deg+Ice+Temp	28.72	-0.03	16.39	1291.48	4.28	-0.66
Dead+Wind 210 deg+Ice+Temp	28.72	-8.24	14.21	1119.73	651.86	-0.29
Dead+Wind 225 deg+Ice+Temp	28.72	-11.63	11.61	914.91	919.79	-0.07
Dead+Wind 240 deg+Ice+Temp	28.72	-14.24	8.22	647.65	1125.14	0.16
Dead+Wind 270 deg+Ice+Temp	28.72	-16.42	0.03	1.74	1297.33	0.57
Dead+Wind 300 deg+Ice+Temp	28.72	-14.21	-8.17	-644.95	1122.28	0.83
Dead+Wind 315 deg+Ice+Temp	28.72	-11.59	-11.56	-913.13	915.73	0.87
Dead+Wind 330 deg+Ice+Temp	28.72	-8.18	-14.17	-1119.15	646.88	0.86
Dead+Wind 0 deg - Service	20.44	0.01	-6.41	-496.78	-0.72	0.31
Dead+Wind 30 deg - Service	20.44	3.22	-5.55	-430.93	-249.46	0.15
Dead+Wind 45 deg - Service	20.44	4.55	-4.54	-352.32	-352.36	0.05
Dead+Wind 60 deg - Service	20.44	5.57	-3.21	-249.73	-431.21	-0.05
Dead+Wind 90 deg - Service	20.44	6.42	-0.01	-1.74	-497.25	-0.24
Dead+Wind 120 deg - Service	20.44	5.55	3.19	246.60	-429.91	-0.36
Dead+Wind 135 deg - Service	20.44	4.53	4.52	349.60	-350.53	-0.39
Dead+Wind 150 deg - Service	20.44	3.20	5.54	428.75	-247.22	-0.39
Dead+Wind 180 deg - Service	20.44	-0.01	6.41	495.89	1.87	-0.31
Dead+Wind 210 deg - Service	20.44	-3.22	5.55	430.04	250.62	-0.15
Dead+Wind 225 deg - Service	20.44	-4.55	4.54	351.43	353.51	-0.05
Dead+Wind 240 deg - Service	20.44	-5.57	3.21	248.84	432.36	0.05
Dead+Wind 270 deg - Service	20.44	-6.42	0.01	0.85	498.41	0.24
Dead+Wind 300 deg - Service	20.44	-5.55	-3.19	-247.49	431.06	0.36
Dead+Wind 315 deg - Service	20.44	-4.53	-4.52	-350.49	351.68	0.39
Dead+Wind 330 deg - Service	20.44	-3.20	-5.54	-429.64	248.37	0.39

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	-20.44	0.00	0.00	20.44	0.00	0.000%
2	0.04	-20.44	-18.51	-0.04	20.44	18.51	0.000%
3	9.31	-20.44	-16.05	-9.31	20.44	16.05	0.000%
4	13.15	-20.44	-13.12	-13.15	20.44	13.12	0.000%
5	16.09	-20.44	-9.29	-16.09	20.44	9.29	0.000%
6	18.56	-20.44	-0.04	-18.56	20.44	0.04	0.000%
7	16.05	-20.44	9.22	-16.05	20.44	-9.22	0.000%
8	13.09	-20.44	13.06	-13.09	20.44	-13.06	0.000%
9	9.24	-20.44	16.01	-9.24	20.44	-16.01	0.000%
10	-0.04	-20.44	18.51	0.04	20.44	-18.51	0.000%
11	-9.31	-20.44	16.05	9.31	20.44	-16.05	0.000%
12	-13.15	-20.44	13.12	13.15	20.44	-13.12	0.000%
13	-16.09	-20.44	9.29	16.09	20.44	-9.29	0.000%
14	-18.56	-20.44	0.04	18.56	20.44	-0.04	0.000%
15	-16.05	-20.44	-9.22	16.05	20.44	9.22	0.000%
16	-13.09	-20.44	-13.06	13.09	20.44	13.06	0.000%
17	-9.24	-20.44	-16.01	9.24	20.44	16.01	0.000%
18	0.00	-28.72	0.00	0.00	28.72	0.00	0.000%
19	0.03	-28.72	-16.39	-0.03	28.72	16.39	0.000%
20	8.24	-28.72	-14.21	-8.24	28.72	14.21	0.000%
21	11.63	-28.72	-11.61	-11.63	28.72	11.61	0.000%
22	14.24	-28.72	-8.22	-14.24	28.72	8.22	0.000%
23	16.42	-28.72	-0.03	-16.42	28.72	0.03	0.000%
24	14.21	-28.72	8.17	-14.21	28.72	-8.17	0.000%
25	11.59	-28.72	11.56	-11.59	28.72	-11.56	0.000%
26	8.18	-28.72	14.17	-8.18	28.72	-14.17	0.000%
27	-0.03	-28.72	16.39	0.03	28.72	-16.39	0.000%
28	-8.24	-28.72	14.21	8.24	28.72	-14.21	0.000%
29	-11.63	-28.72	11.61	11.63	28.72	-11.61	0.000%
30	-14.24	-28.72	8.22	14.24	28.72	-8.22	0.000%
31	-16.42	-28.72	0.03	16.42	28.72	-0.03	0.000%
32	-14.21	-28.72	-8.17	14.21	28.72	8.17	0.000%
33	-11.59	-28.72	-11.56	11.59	28.72	11.56	0.000%
34	-8.18	-28.72	-14.17	8.18	28.72	14.17	0.000%
35	0.01	-20.44	-6.41	-0.01	20.44	6.41	0.000%
36	3.22	-20.44	-5.55	-3.22	20.44	5.55	0.000%
37	4.55	-20.44	-4.54	-4.55	20.44	4.54	0.000%
38	5.57	-20.44	-3.21	-5.57	20.44	3.21	0.000%
39	6.42	-20.44	-0.01	-6.42	20.44	0.01	0.000%
40	5.55	-20.44	3.19	-5.55	20.44	-3.19	0.000%
41	4.53	-20.44	4.52	-4.53	20.44	-4.52	0.000%
42	3.20	-20.44	5.54	-3.20	20.44	-5.54	0.000%
43	-0.01	-20.44	6.41	0.01	20.44	-6.41	0.000%
44	-3.22	-20.44	5.55	3.22	20.44	-5.55	0.000%
45	-4.55	-20.44	4.54	4.55	20.44	-4.54	0.000%
46	-5.57	-20.44	3.21	5.57	20.44	-3.21	0.000%
47	-6.42	-20.44	0.01	6.42	20.44	-0.01	0.000%
48	-5.55	-20.44	-3.19	5.55	20.44	3.19	0.000%
49	-4.53	-20.44	-4.52	4.53	20.44	4.52	0.000%
50	-3.20	-20.44	-5.54	3.20	20.44	5.54	0.000%

Non-Linear Convergence Results

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

2	Yes	5	0.00000001	0.00012635
3	Yes	6	0.00000001	0.00007691
4	Yes	6	0.00000001	0.00008000
5	Yes	6	0.00000001	0.00007532
6	Yes	5	0.00000001	0.00009243
7	Yes	6	0.00000001	0.00007076
8	Yes	6	0.00000001	0.00007975
9	Yes	6	0.00000001	0.00007872
10	Yes	5	0.00000001	0.00010290
11	Yes	6	0.00000001	0.00007325
12	Yes	6	0.00000001	0.00008000
13	Yes	6	0.00000001	0.00007475
14	Yes	5	0.00000001	0.00006904
15	Yes	6	0.00000001	0.00007853
16	Yes	6	0.00000001	0.00008001
17	Yes	6	0.00000001	0.00007065
18	Yes	4	0.00000001	0.00001033
19	Yes	5	0.00000001	0.00054368
20	Yes	6	0.00000001	0.00024560
21	Yes	6	0.00000001	0.00026983
22	Yes	6	0.00000001	0.00024303
23	Yes	5	0.00000001	0.00053096
24	Yes	6	0.00000001	0.00023083
25	Yes	6	0.00000001	0.00026690
26	Yes	6	0.00000001	0.00024768
27	Yes	5	0.00000001	0.00052982
28	Yes	6	0.00000001	0.00023840
29	Yes	6	0.00000001	0.00026964
30	Yes	6	0.00000001	0.00024087
31	Yes	5	0.00000001	0.00052101
32	Yes	6	0.00000001	0.00024939
33	Yes	6	0.00000001	0.00026942
34	Yes	6	0.00000001	0.00023257
35	Yes	4	0.00000001	0.00046337
36	Yes	5	0.00000001	0.00013437
37	Yes	5	0.00000001	0.00014680
38	Yes	5	0.00000001	0.00012888
39	Yes	4	0.00000001	0.00034181
40	Yes	5	0.00000001	0.00011424
41	Yes	5	0.00000001	0.00014623
42	Yes	5	0.00000001	0.00014115
43	Yes	4	0.00000001	0.00043306
44	Yes	5	0.00000001	0.00012205
45	Yes	5	0.00000001	0.00014679
46	Yes	5	0.00000001	0.00012679
47	Yes	4	0.00000001	0.00031478
48	Yes	5	0.00000001	0.00014138
49	Yes	5	0.00000001	0.00014832
50	Yes	5	0.00000001	0.00011514

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	111 - 97	27.112	46	2.0557	0.0069
L2	97 - 47	21.105	46	2.0324	0.0069
L3	51 - 21	5.334	46	1.0576	0.0017
L4	21 - 1	0.764	46	0.3661	0.0004

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

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
108.00	800-10504	46	25.811	2.0570	0.0070	16338
100.00	(2) 7770.00	46	22.372	2.0467	0.0070	7442
99.00	EEI Standard Platform	46	21.948	2.0428	0.0070	6852
90.00	DB846H80E-SX	46	18.224	1.9674	0.0065	4552
78.00	(4) 4' Panel	46	13.601	1.7665	0.0052	3300

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	111 - 97	77.985	13	5.9215	0.0199
L2	97 - 47	60.729	13	5.8544	0.0199
L3	51 - 21	15.375	13	3.0487	0.0048
L4	21 - 1	2.203	13	1.0560	0.0012

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
108.00	800-10504	13	74.248	5.9267	0.0200	5812
100.00	(2) 7770.00	13	64.369	5.8975	0.0201	2646
99.00	EEI Standard Platform	13	63.151	5.8857	0.0200	2436
90.00	DB846H80E-SX	13	52.448	5.6574	0.0186	1610
78.00	(4) 4' Panel	13	39.157	5.0553	0.0148	1163

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	111 - 97 (1)	TP17.5x14.5x0.375	14.00	0.00	0.0	25.200	20.1647	-3.65	508.15	0.007
L2	97 - 47 (2)	TP27.98x17.5x0.25	50.00	0.00	0.0	39.000	21.3385	-11.58	832.20	0.014

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 $\frac{P}{P_a}$
L3	47 - 21 (3)	TP33.392x26.6416x0.3125	30.00	0.00	0.0	39.000	32.8107	-16.85	1279.62	0.013
L4	21 - 1 (4)	TP37x33.392x0.4	20.00	0.00	0.0	39.000	46.4674	-20.43	1812.23	0.011

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	111 - 97 (1)	TP17.5x14.5x0.375	33.82	-4.798	27.720	0.173	0.00	0.000	27.720	0.000
L2	97 - 47 (2)	TP27.98x17.5x0.25	583.38	-49.511	39.000	1.270	0.00	0.000	39.000	0.000
L3	47 - 21 (3)	TP33.392x26.6416x0.3125	1077.79	-48.367	39.000	1.240	0.00	0.000	39.000	0.000
L4	21 - 1 (4)	TP37x33.392x0.4	1439.08	-41.275	39.000	1.058	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	111 - 97 (1)	TP17.5x14.5x0.375	0.007	0.173	0.000	0.180 ✔	1.333	H1-3 ✔
L2	97 - 47 (2)	TP27.98x17.5x0.25	0.014	1.270	0.000	1.283 ✔	1.333	H1-3 ✔
L3	47 - 21 (3)	TP33.392x26.6416x0.3125	0.013	1.240	0.000	1.253 ✔	1.333	H1-3 ✔
L4	21 - 1 (4)	TP37x33.392x0.4	0.011	1.058	0.000	1.070 ✔	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	111 - 97	Pole	TP17.5x14.5x0.375	1	-3.65	677.36	13.5	Pass
L2	97 - 47	Pole	TP27.98x17.5x0.25	2	-11.58	1109.32	96.3	Pass
L3	47 - 21	Pole	TP33.392x26.6416x0.3125	3	-16.85	1705.73	94.0	Pass
L4	21 - 1	Pole	TP37x33.392x0.4	4	-20.43	2415.70	80.2	Pass
							Summary	
						Pole (L2)	96.3	Pass
						RATING =	**96.3**	**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:	96-ft EEI Monopole w/ 14-ft Extension Danbury, CT
Rev. 1: 10/25/10	Prepared by: T.J.L. Checked by: C.F.C. Job No. 10001. CO41

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 1439·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 19·kips	(Input From RisaTower)
Axial Force =	Axial := 20·kips	(Input From RisaTower)

Existing Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 8	(User Input)
Diameter of Bolt Circle =	D_{bc} := 45.00·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strength =	F_u := 100·ksi	(User Input)
Bolt Yield Strength =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Proposed Anchor Bolt Data:

Use ASTM A193 GR.B7

Number of Anchor Bolts =	N2 := 3	(User Input)
Diameter of Bolt Circle =	D_{bc2} := 59.00·in	(User Input)
Bolt "Column" Distance =	l2 := 8.0·in	(User Input)
Bolt Ultimate Strenght =	F_{u2} := 115·ksi	(User Input)
Bolt Yield Strenght =	F_{y2} := 95·ksi	(User Input)
Bolt Modulus =	E2 := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D2 := 2.75·in	(User Input)
Threads per Inch =	n2 := 4.0	(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} := 51.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 37·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Distance to Bolts =

$d_1 := 14.75 \cdot in$ (User Input)

$d_2 := 15.9375 \cdot in$ (User Input)

$d_3 := 22.5 \cdot in$ (User Input)

$d_4 := 29.5 \cdot in$ (User Input)

Number of Bolts per Group =

$N_1 := 2$ (User Input)

$N_2 := 4$ (User Input)

$N_3 := 2$ (User Input)

$N_4 := 1$ (User Input)

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 18.5 \cdot in$$

Moment Arms of Bolts about Neutral Axis =

$MA_1 := 0 \cdot in$ (User Input)

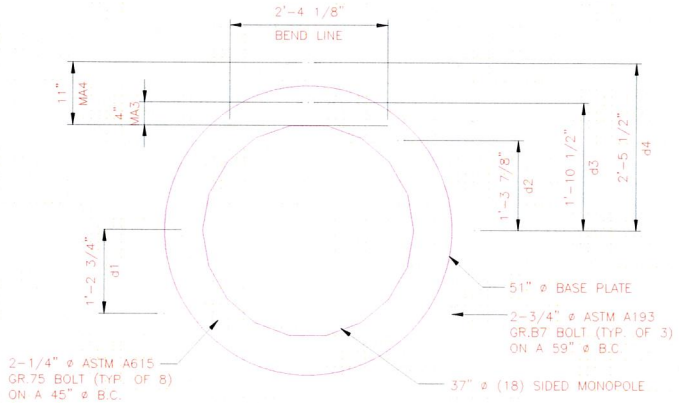
$MA_2 := 0 \cdot in$ (User Input)

$MA_3 := 4 \cdot in$ (User Input)

$MA_4 := 11 \cdot in$ (User Input)

Effective Width of Baseplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 28.1 \cdot in$$



Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Existing Anchor Bolts:

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

Proposed Anchor Bolts:

Gross Area of Bolt = $A_{g2} := \frac{\pi}{4} \cdot D2^2 = 5.94 \cdot in^2$

Net Area of Bolt = $A_{n2} := \frac{\pi}{4} \cdot \left(D2 - \frac{0.9743 \cdot in}{n2} \right)^2 = 4.934 \cdot in^2$

Net Diameter = $D_{n2} := \frac{2 \cdot \sqrt{A_{n2}}}{\sqrt{\pi}} = 2.506 \cdot in$

Radius of Gyration of Bolt = $r2 := \frac{D_{n2}}{4} = 0.627 \cdot in$

Section Modulus of Bolt = $S_{x2} := \frac{\pi \cdot D_{n2}^3}{32} = 1.546 \cdot in^3$

Total Polar Moment of Inertia = $I_p := d_1^2 \cdot N_1 + d_2^2 \cdot N_2 + d_3^2 \cdot N_3 + d_4^2 \cdot N_4 = 3333.9 \cdot in^2$

ASTM A615 GR. 65 Bolts:

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{d_3}{l_p} - \frac{Axial}{N + N2} = 114.7 \cdot kips$

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

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 58.9 \cdot \%$ 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 = $M_x := \left(\frac{Shear}{N + N2}\right) \cdot l = 0.432 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 6.3 \cdot ksi$

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 =

$$C_{Max} := OM \cdot \frac{d_3}{I_p} + \frac{Axial}{N} = 119 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 36.7 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 61.1 \cdot \%$$

Condition 2 =

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

Condition2 = "OK"

ASTM A193 Gr.B7 Bolts:

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max2} := OM \cdot \frac{d_4}{I_p} - \frac{Axial}{N + N2} = 151 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross2} := 1.333 \cdot (0.33 \cdot A_{g2} \cdot F_{u2}) = 300.5 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net2} := 1.333 \cdot (0.60 \cdot A_{n2} \cdot F_{y2}) = 374.89 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max2}}{T_{ALL.Net2}} = 40.3 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

Condition 3 = $Condition3 := if\left(\frac{T_{Max}}{T_{ALL.Net}} \le 1.00, "OK", "Overstressed"\right)$

Condition3 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_{x2} := \left(\frac{Shear}{N + N2}\right) \cdot l2 = 1.152 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx2} := \frac{M_{x2}}{S_{x2}} = 8.9 \cdot ksi$

Allowable Bending Stress = $F_{bx2} := 1.333 \cdot 0.6 \cdot F_{y2} = 76 \cdot ksi$ (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.

$l2 := \begin{cases} l2 & \text{if } l2 > 2 \cdot D_{n2} \\ 0 & \text{otherwise} \end{cases} = 8 \cdot in$

$f_{bx2} := \begin{cases} f_{bx2} & \text{if } l2 > 2 \cdot D_{n2} \\ 0 & \text{otherwise} \end{cases} = 8.9 \cdot ksi$

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

Subject: Anchor Bolt and Baseplate Analysis

Location: 96-ft EEI Monopole w/ 14-ft Extension
Danbury, CT

Rev. 1: 10/25/10

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 10001. CO41

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max2} := OM \cdot \frac{d_4}{I_p} + \frac{Axial}{N} = 155.3 \cdot kips$$

Maximum Compressive Stress =

$$f_{a2} := \frac{C_{Max2}}{A_{n2}} = 31.5 \cdot ksi$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E2}{F_{y2}}} = 77.625$$

$$F_{a2} := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l2}{r2}\right)^2}{2 \cdot C_c^{\,2}}\right] \cdot F_{y2}}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l2}{r2}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l2}{r2}\right)^3}{8 \cdot C_c^{\,3}}} & \text{if } \dfrac{K \cdot l2}{r2} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E2}{23 \cdot \left(\frac{K \cdot l2}{r2}\right)^2} & \text{if } \dfrac{K \cdot l2}{r2} > C_c \end{cases} = 55.348 \cdot ksi$$

Allowable Compressive Stress =

$$F_{a2} := 1.333 \cdot F_{a2} = 73.8 \cdot ksi$$

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_{a2}}{F_{a2}} + \frac{f_{bx2}}{F_{bx2}}\right) = 54.4 \cdot \%$$

Condition 4 =

$$Condition4 := if\left(\frac{f_{a2}}{F_{a2}} + \frac{f_{bx2}}{F_{bx2}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$$

Condition4 = "OK"

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

Subject: Anchor Bolt and Baseplate Analysis

Location: 96-ft EEI Monopole w/ 14-ft Extension
Danbury, CT

Rev. 1: 10/25/10

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 10001. CO41

Base Plate Analysis:

Note: Only the force from the original anchor bolts attribuites to the baseplate bending.
The proposed anchor bolts will be installed outside the edge of the baseplate.

Force from Bolts = $C_1 := T_{Max} = 114.721 \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \frac{6 \cdot (C_1 \cdot MA_3)}{(B_{eff} \cdot t_{bp}^2)} = 24.5 \cdot ksi$

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

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 41.0 \cdot \%$

Condition5 = $Condition5 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$

Condition5 = "Ok"

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: CAISSON FOUNDATION

Location: 96-ft EEI Monopole w/ 14-ft Extension
Danbury, CT

Rev. 1: 10/25/10

Prepared by: TJL Checked by: C.F.C.
Job No. 10001.CO41

Caisson Foundation:

Input Data:

Shear Force =	$S := 19k$	*USER INPUT-FROM RISATower*
Overturning Moment =	$M := 1439ft \cdot k$	*USER INPUT-FROM RISATower*
Applied Axial Load =	$A1 := 20k$	*USER INPUT-FROM RISATower*
Bending Moment =	$Mu := 1528ft \cdot k$	*USER INPUT--FROM LPILE*
Moment Capacity =	$Mn := 2664ft \cdot k$	*USER INPUT--FROM LPILE*
Foundation Diameter =	$d := 5.5ft$	*USER INPUT*
Overall Length of Caisson =	$L_c := 21.0ft$	*USER INPUT*
Depth From Top of Caisson to Grade =	$L_{pag} := 1.0ft$	*USER INPUT*
Number of Rebar =	$n := 24$	*USER INPUT*
Area of Rebar =	$Ar := 0.79in^2$	*USER INPUT*
Rebar Yield Strength =	$fy := 60ksi$	*USER INPUT*
Concrete Comp Strength =	$f'c := 3ksi$	*USER INPUT*

Check Foundation Depth:

Depth of Caisson Below Ground Level = $LD := L_c - L_{pag} = 20ft$ (TIA/EIA-222-F 7.2.5)

Depth Required = $LD1 := 2.0ft + \left(\frac{S \cdot ft^2}{3k \cdot d}\right) + 2ft \cdot .5\left(\frac{M \cdot ft}{3 \cdot k \cdot d} + \frac{S \cdot ft}{2k} + \frac{S^2 ft^3}{18k^2 d^2}\right)^{.5} = 22.89ft$

$DepthCheck := if(LD1 \le LD, "OK", "NO GOOD")$

$DepthCheck = "NO GOOD"$

Note: Result not applicable. Actual soil is better than normal soil as defined in TIA/EIA 222 F. Refer to L-Pile analysis.

Check Moment Capacity:

Factor of Safety = $FS := \frac{Mn}{Mu} = 1.7$

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

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

$FOSCheck = "OK"$

Check Axial Capacity:

Concrete Weight = $A2 := .150\frac{k}{ft^3} \cdot LD \cdot \pi \frac{d^2}{4} = 71.3 \cdot kips$

Total Axial Load = $AT := A1 + A2 = 91.3 \cdot kips$

Area of Concrete = $Ag := \pi \cdot \frac{d^2}{4} = 23.76ft^2$

Axial Capacity = $Po := n \cdot Ar \cdot fy + (Ag - n \cdot Ar) \cdot 0.85 \cdot f'c = 9813.3 \cdot kips$

$AxialCheck := if(AT \le Po, "OK", "NO GOOD")$

$AxialCheck = "OK"$

LPILE Plus for Windows, Version 5.0 (5.0.39)

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

This program is licensed to:

Staff
Natcomm, Inc.

Path to file locations: J:\Jobs\1000100.WI\CO41 - Germantown; 50 Newtown Rd, Danbury, CT\Rev (1)\Calcs\MathCAD\Foundation\
Name of input data file: Germantown Caisson Analysis.lpd
Name of output file: Germantown Caisson Analysis.lpo
Name of plot output file: Germantown Caisson Analysis.lpp
Name of runtime file: Germantown Caisson Analysis.lpr

Time and Date of Analysis

Date: October 25, 2010 Time: 9:02:27

Problem Title

Germantown

Program Options

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

Basic Program Options:

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

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- Analysis includes computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-04 in
- Maximum allowable deflection = 1.0000E+02 in

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

Pile Structural Properties and Geometry

Pile Length = 252.00 in

Depth of ground surface below top of pile = 12.00 in

Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	66.00000000	931420.0000	3421.2000	3600000.
2	252.0000	66.00000000	931420.0000	3421.2000	3600000.

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

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 12.000 in
Distance from top of pile to bottom of layer = 48.000 in
p-y subgrade modulus k for top of soil layer = 1.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 1.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 48.000 in
Distance from top of pile to bottom of layer = 168.000 in
p-y subgrade modulus k for top of soil layer = 122.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 122.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 168.000 in
Distance from top of pile to bottom of layer = 360.000 in
p-y subgrade modulus k for top of soil layer = 100.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 100.000 lbs/in**3

(Depth of lowest layer extends 108.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	12.00	.05800
2	48.00	.05800
3	48.00	.07800
4	168.00	.07800
5	168.00	.04300
6	360.00	.04300

Shear Strength of Soils

Shear strength parameters with depth defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	12.000	.00000	28.00	------	------
2	48.000	.00000	28.00	------	------
3	48.000	.00000	38.00	------	------
4	168.000	.00000	38.00	------	------
5	168.000	.00000	38.00	------	------
6	360.000	.00000	38.00	------	------

Notes:

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

Loading Type

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

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)

Shear force at pile head = 18582.000 lbs
Bending moment at pile head = 17268984.000 in-lbs
Axial load at pile head = 20439.000 lbs

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

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Number of sections = 1

Pile Section No. 1

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

Outside Diameter = 66.0000 in

Material Properties:

Compressive Strength of Concrete	=	3.000 kip/in**2
Yield Stress of Reinforcement	=	60. kip/in**2
Modulus of Elasticity of Reinforcement	=	29000. kip/in**2
Number of Reinforcing Bars	=	24
Area of Single Bar	=	.79000 in**2
Number of Rows of Reinforcing Bars	=	13
Area of Steel	=	18.960 in**2
Area of Shaft	=	3421.194 in**2
Percentage of Steel Reinforcement	=	.554 percent
Cover Thickness (edge to bar center)	=	4.000 in

Unfactored Axial Squash Load Capacity = 9813.30 kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement in**2	Distance to Centroidal Axis in
1	.790	29.000
2	1.580	28.012
3	1.580	25.115
4	1.580	20.506
5	1.580	14.500
6	1.580	7.506
7	1.580	0.000
8	1.580	-7.506
9	1.580	-14.500
10	1.580	-20.506
11	1.580	-25.115
12	1.580	-28.012
13	.790	-29.000

Axial Thrust Force = 20439.00 lbs

Bending	Bending	Bending	Maximum	Neutral Axis	Max. Concrete

Max. Steel Moment in-lbs	Stiffness lb-in2	Curvature rad/in	Strain in/in	Position inches	Stress psi	Stress psi
2629024.	3.154829E+12	8.333333E-07	.00002941	35.29747421	90.37953855	756.35563
5230099.	3.138059E+12	.00000167	.00005702	34.21136981	173.62811	1460.21621
7803282.	3.121313E+12	.00000250	.00008466	33.86471003	255.55834	2165.19148
10347755.	3.104326E+12	.00000333	.00011227	33.67978495	335.93791	2869.04588
12863929.	3.087343E+12	.00000417	.00013987	33.56877404	414.88365	3572.89353
12863929.	2.572786E+12	.00000500	.00008210	16.41905397	243.76829	6609.23717
12863929.	2.205245E+12	.00000583	.00009442	16.18663090	279.17827	7750.09494
12863929.	1.929589E+12	.00000667	.00010676	16.01463658	314.35997	8890.50360
12863929.	1.715191E+12	.00000750	.00011912	15.88294119	349.31260	10030.46029
12863929.	1.543671E+12	.00000833	.00013150	15.77947158	384.03548	11169.96104
12863929.	1.403338E+12	.00000917	.00014388	15.69654089	418.52780	12309.00288
12863929.	1.286393E+12	.00001000	.00015629	15.62902325	452.78873	13447.58326
12863929.	1.187440E+12	.00001083	.00016871	15.57337421	486.81753	14585.69827
12863929.	1.102622E+12	.00001167	.00018115	15.52706033	520.61341	15723.34459
12863929.	1.029114E+12	.00001250	.00019360	15.48822087	554.17545	16860.51993
12863929.	9.647947E+11	.00001333	.00020607	15.45546716	587.50298	17997.21936
12863929.	9.080421E+11	.00001417	.00021856	15.42772919	620.59502	19133.44126
12863929.	8.575953E+11	.00001500	.00023106	15.40418082	653.45080	20269.18134
12863929.	8.124587E+11	.00001583	.00024383	15.39999908	686.74435	21397.16709
12863929.	7.718357E+11	.00001667	.00025667	15.39999908	719.91043	22523.33378
12863929.	7.350817E+11	.00001750	.00026947	15.39815408	752.69330	23650.43680
12863929.	7.016689E+11	.00001833	.00028206	15.38500303	784.62872	24783.64006
12863929.	6.711615E+11	.00001917	.00029467	15.37398022	816.32687	25916.29599
12863929.	6.431965E+11	.00002000	.00030730	15.36482602	847.78676	27048.40091
12863929.	6.174686E+11	.00002083	.00031994	15.35732800	879.00765	28179.94767
12863929.	5.937198E+11	.00002167	.00033261	15.35129732	909.98830	29310.93485
12863929.	5.717302E+11	.00002250	.00034530	15.34658450	940.72811	30441.35361
12863929.	5.513112E+11	.00002333	.00035800	15.34305185	971.22587	31571.20158

12863929.	5.323005E+11	.00002417	.00037073	15.34058136	1001.48042
32700.47590					
13121151.	5.248460E+11	.00002500	.00038348	15.33907467	1031.49083
33829.17086					
13538078.	5.240546E+11	.00002583	.00039624	15.33844918	1061.25632
34957.27849					
13954485.	5.232932E+11	.00002667	.00040903	15.33862621	1090.77568
36084.79573					
14370365.	5.225587E+11	.00002750	.00042184	15.33953494	1120.04760
37211.72089					
14785722.	5.218490E+11	.00002833	.00043467	15.34112424	1149.07149
38338.04292					
15200549.	5.211617E+11	.00002917	.00044751	15.34333903	1177.84607
39463.75907					
15614836.	5.204945E+11	.00003000	.00046038	15.34612817	1206.36990
40588.86850					
16028591.	5.198462E+11	.00003083	.00047328	15.34946018	1234.64251
41713.35768					
16441803.	5.192148E+11	.00003167	.00048619	15.35329181	1262.66232
42837.22702					
16854468.	5.185990E+11	.00003250	.00049912	15.35759157	1290.42828
43960.46995					
17678148.	5.174092E+11	.00003417	.00052506	15.36748534	1345.19436
46205.04994					
18499597.	5.162678E+11	.00003583	.00055108	15.37893695	1398.93112
48447.05469					
19318786.	5.151676E+11	.00003750	.00057719	15.39178509	1451.62915
50686.43372					
20127689.	5.138984E+11	.00003917	.00060317	15.39999908	1502.81259
52929.83438					
20920643.	5.123423E+11	.00004083	.00062883	15.39999908	1552.16810
55182.16775					
21708410.	5.107861E+11	.00004250	.00065450	15.39999908	1600.33227
57434.50113					
22575220.	5.111371E+11	.00004417	.00068018	15.40040821	1647.33895
59686.31049					
23196262.	5.061003E+11	.00004583	.00070583	15.39999908	1693.08657
60000.00000					
23819295.	5.014588E+11	.00004750	.00073150	15.39999908	1737.67671
60000.00000					
24318236.	4.946082E+11	.00004917	.00075485	15.35278040	1777.05526
60000.00000					
24722755.	4.863493E+11	.00005083	.00077694	15.28398818	1813.33422
60000.00000					
25126092.	4.785922E+11	.00005250	.00079908	15.22063655	1848.83422
60000.00000					
25512985.	4.710090E+11	.00005417	.00082107	15.15827233	1883.20367
60000.00000					
25786353.	4.618451E+11	.00005583	.00084153	15.07213551	1914.29770
60000.00000					
26058842.	4.531972E+11	.00005750	.00086203	14.99176973	1944.71794
60000.00000					
26330443.	4.450216E+11	.00005917	.00088257	14.91669506	1974.45997
60000.00000					
26601151.	4.372792E+11	.00006083	.00090316	14.84648663	2003.51950
60000.00000					
26870957.	4.299353E+11	.00006250	.00092380	14.78076285	2031.89196
60000.00000					
27082314.	4.220620E+11	.00006417	.00094351	14.70399266	2058.22563
60000.00000					
27252883.	4.139678E+11	.00006583	.00096258	14.62139243	2083.01073
60000.00000					
27422773.	4.062633E+11	.00006750	.00098168	14.54342240	2107.20383

60000.00000					
27591987.	3.989203E+11	.00006917	.00100082	14.46975607	2130.80171
60000.00000					
27760520.	3.919132E+11	.00007083	.00102001	14.40009445	2153.80076
60000.00000					
27928364.	3.852188E+11	.00007250	.00103923	14.33416611	2176.19736
60000.00000					
28168009.	3.797934E+11	.00007417	.00106058	14.30000013	2200.43745
60000.00000					
28279866.	3.729213E+11	.00007583	.00108238	14.27315515	2224.36187
60000.00000					
28443597.	3.670142E+11	.00007750	.00110127	14.20993727	2244.27495
60000.00000					
28582186.	3.610381E+11	.00007917	.00111960	14.14234096	2262.97121
60000.00000					
28676944.	3.547663E+11	.00008083	.00113691	14.06487840	2280.03048
60000.00000					
28771227.	3.487422E+11	.00008250	.00115425	13.99093276	2296.59887
60000.00000					
28865027.	3.429508E+11	.00008417	.00117162	13.92029554	2312.67333
60000.00000					
28958352.	3.373789E+11	.00008583	.00118903	13.85278183	2328.25143
60000.00000					
29051192.	3.320136E+11	.00008750	.00120647	13.78821462	2343.33014
60000.00000					
29143537.	3.268434E+11	.00008917	.00122394	13.72642869	2357.90631
60000.00000					
29235404.	3.218577E+11	.00009083	.00124144	13.66728240	2371.97762
60000.00000					
29326761.	3.170461E+11	.00009250	.00125898	13.61062628	2385.54032
60000.00000					
29417626.	3.123996E+11	.00009417	.00127656	13.55633837	2398.59192
60000.00000					
29507989.	3.079095E+11	.00009583	.00129416	13.50429672	2411.12921
60000.00000					
29597841.	3.035676E+11	.00009750	.00131180	13.45438725	2423.14893
60000.00000					
29687182.	2.993665E+11	.00009917	.00132948	13.40650767	2434.64807
60000.00000					
29864310.	2.913591E+11	.00010250	.00136494	13.31645268	2456.07160
60000.00000					
30014772.	2.836041E+11	.00010583	.00139969	13.22537094	2474.91359
60000.00000					
30346511.	2.779833E+11	.00010917	.00144100	13.20000118	2494.73485
60000.00000					
30346511.	2.697468E+11	.00011250	.00147299	13.09325069	2507.83268
60000.00000					
30346511.	2.619843E+11	.00011583	.00150474	12.99058753	2519.07919
60000.00000					
30394588.	2.550595E+11	.00011917	.00153662	12.89467889	2528.61953
60000.00000					
30476737.	2.487897E+11	.00012250	.00156861	12.80498976	2536.43304
60000.00000					
30557416.	2.428404E+11	.00012583	.00160073	12.72104412	2542.49856
60000.00000					
30636595.	2.371865E+11	.00012917	.00163298	12.64241320	2546.79426
60000.00000					
30714255.	2.318057E+11	.00013250	.00166535	12.56871539	2549.29778
60000.00000					
30790087.	2.266755E+11	.00013583	.00169786	12.49960452	2549.33344
60000.00000					
30862803.	2.217686E+11	.00013917	.00173051	12.43476981	2543.92930
60000.00000					

30934700.	2.170856E+11	.00014250	.00176328	12.37392801	2541.91305
60000.00000					
31005768.	2.126110E+11	.00014583	.00179620	12.31682736	2546.04501
60000.00000					
31076001.	2.083307E+11	.00014917	.00182927	12.26323968	2548.72491
60000.00000					
31145346.	2.042318E+11	.00015250	.00186247	12.21294469	2549.92974
60000.00000					
31207336.	2.002610E+11	.00015583	.00189550	12.16364497	2546.66345
60000.00000					
31236393.	1.962496E+11	.00015917	.00192648	12.10354668	2542.19411
60000.00000					
31236393.	1.922240E+11	.00016250	.00196625	12.09999830	2540.27990
60000.00000					
31325193.	1.888956E+11	.00016583	.00200588	12.09578115	2545.30143
60000.00000					
31349615.	1.853179E+11	.00016917	.00203560	12.03311402	2547.66906
60000.00000					
31373692.	1.818765E+11	.00017250	.00206542	11.97342879	2549.22059
60000.00000					
31397449.	1.785637E+11	.00017583	.00209533	11.91657597	2549.94443
60000.00000					
31420461.	1.753700E+11	.00017917	.00212544	11.86290175	2547.65416
60000.00000					
31443024.	1.722905E+11	.00018250	.00215567	11.81188291	2543.95915
60000.00000					
31465380.	1.693204E+11	.00018583	.00218597	11.76307100	2540.25186
60000.00000					
31487540.	1.664540E+11	.00018917	.00221634	11.71635979	2536.53195
60000.00000					
31509495.	1.636857E+11	.00019250	.00224679	11.67164308	2537.43163
60000.00000					
31531247.	1.610106E+11	.00019583	.00227731	11.62882644	2541.03816
60000.00000					
31552777.	1.584240E+11	.00019917	.00230791	11.58781546	2544.04755
60000.00000					
31574098.	1.559215E+11	.00020250	.00233858	11.54853147	2546.45238
60000.00000					
31595191.	1.534989E+11	.00020583	.00236933	11.51089185	2548.24472
60000.00000					
31616073.	1.511525E+11	.00020917	.00240015	11.47482973	2549.41668
60000.00000					
31636716.	1.488787E+11	.00021250	.00243106	11.44027036	2549.95998
60000.00000					
31656772.	1.466723E+11	.00021583	.00246214	11.40761894	2547.92467
60000.00000					
31676473.	1.445314E+11	.00021917	.00249334	11.37646240	2544.70357
60000.00000					
31696070.	1.424542E+11	.00022250	.00252459	11.34647423	2541.47331
60000.00000					
31715541.	1.404378E+11	.00022583	.00255589	11.31759936	2538.23401
60000.00000					
31734891.	1.384795E+11	.00022917	.00258724	11.28979450	2534.98547
60000.00000					
31754120.	1.365769E+11	.00023250	.00261865	11.26301640	2531.72757
60000.00000					
31792189.	1.329290E+11	.00023917	.00268163	11.21237522	2535.62069
60000.00000					
31829755.	1.294770E+11	.00024583	.00274482	11.16538471	2541.87558
60000.00000					
31866783.	1.262051E+11	.00025250	.00280825	11.12177342	2546.38394
60000.00000					
31903271.	1.230994E+11	.00025917	.00287191	11.08130926	2549.10596

60000.00000					
31939166.	1.201473E+11	.00026583	.00293581	11.04379946	2549.89818
60000.00000					
31973671.	1.173346E+11	.00027250	.00300024	11.01005441	2544.38518
60000.00000					
31973671.	1.145326E+11	.00027917	.00307083	10.99999934	2537.79106
60000.00000					
31973671.	1.118612E+11	.00028583	.00314417	10.99999934	2530.71632
60000.00000					
31973671.	1.093117E+11	.00029250	.00321750	10.99999934	2523.64158
60000.00000					
32041219.	1.071016E+11	.00029917	.00329083	10.99999934	2531.35243
60000.00000					
32053520.	1.048071E+11	.00030583	.00335055	10.95546752	2536.20680
60000.00000					
32055555.	1.025778E+11	.00031250	.00340918	10.90936607	2540.11924
60000.00000					
32057491.	1.004412E+11	.00031917	.00346792	10.86555809	2543.39944
60000.00000					
32059324.	9.839179E+10	.00032583	.00352679	10.82390982	2546.03507
60000.00000					
32061051.	9.642421E+10	.00033250	.00358578	10.78429931	2548.01344
60000.00000					
32062664.	9.453365E+10	.00033917	.00364489	10.74661249	2549.32134
60000.00000					
32064173.	9.271568E+10	.00034583	.00370413	10.71075100	2549.94522
60000.00000					
32065312.	9.096542E+10	.00035250	.00376375	10.67730492	2547.93538
60000.00000					
32066240.	8.927955E+10	.00035917	.00382359	10.64572352	2544.51395
60000.00000					

Unfactored (Nominal) Moment Capacity at Concrete Strain of 0.003 = 31973.54228 in-kip

---

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

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 18582.000 lbs
Specified moment at pile head = 17268984.000 in-lbs
Specified axial load at pile head = 20439.000 lbs

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

Depth X	Deflect. y	Moment M	Shear V	Slope S	Total Stress	Flx. Rig. EI	Soil Res. Es*h p
in	in	lbs-in	lbs	Rad.	lbs/in**2	lbs-in**2	F/L lbs/in
0.000	.751066	1.73E+07	18582.	-.007181	617.810	5.18E+11	0.000 0.000
20.160	.613133	1.76E+07	18561.	-.006501	631.181	5.17E+11	-5.003 20.563
40.320	.489059	1.80E+07	18363.	-.005806	644.468	5.17E+11	-13.850

71.366							
60.480	.379153	1.83E+07	5880.721	-.005096	655.319	5.16E+11	-1317.598
8757.278							
80.640	.283633	1.81E+07	-28629.	-.004382	648.200	5.17E+11	-2034.458
18076.							
100.800	.202314	1.71E+07	-69248.	-.003692	613.196	5.18E+11	-1948.766
24274.							
120.960	.134385	1.54E+07	-1.06E+05	-.003059	550.402	5.21E+11	-1624.972
30472.							
141.120	.078326	1.29E+07	-1.34E+05	-.002566	464.388	2.29E+12	-1139.761
36670.							
161.280	.027427	1.01E+07	-1.50E+05	-.002489	362.189	3.11E+12	-466.567
42868.							
181.440	-.022157	6.99E+06	-1.51E+05	-.002434	253.540	3.13E+12	345.909
39341.							
201.600	-.070831	4.07E+06	-1.35E+05	-.002398	150.048	3.14E+12	1248.585
44421.							
221.760	-.118974	1.66E+06	-99661.	-.002380	64.754	3.15E+12	2337.074
49502.							
241.920	-.166893	2.08E+05	-39982.	-.002375	13.336	3.15E+12	3614.826
54582.							

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

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.75106627 in
Computed slope at pile head	=	-.00718053
Maximum bending moment	=	18340413. lbs-in
Maximum shear force	=	-152785.94370 lbs
Depth of maximum bending moment	=	65.52000000 in
Depth of maximum shear force	=	171.36000 in
Number of iterations	=	35
Number of zero deflection points	=	1

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

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

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs

1	V=	18582.	M=	1.73E+07	20439.0000	.7510663	1.8340E+07	-152786.

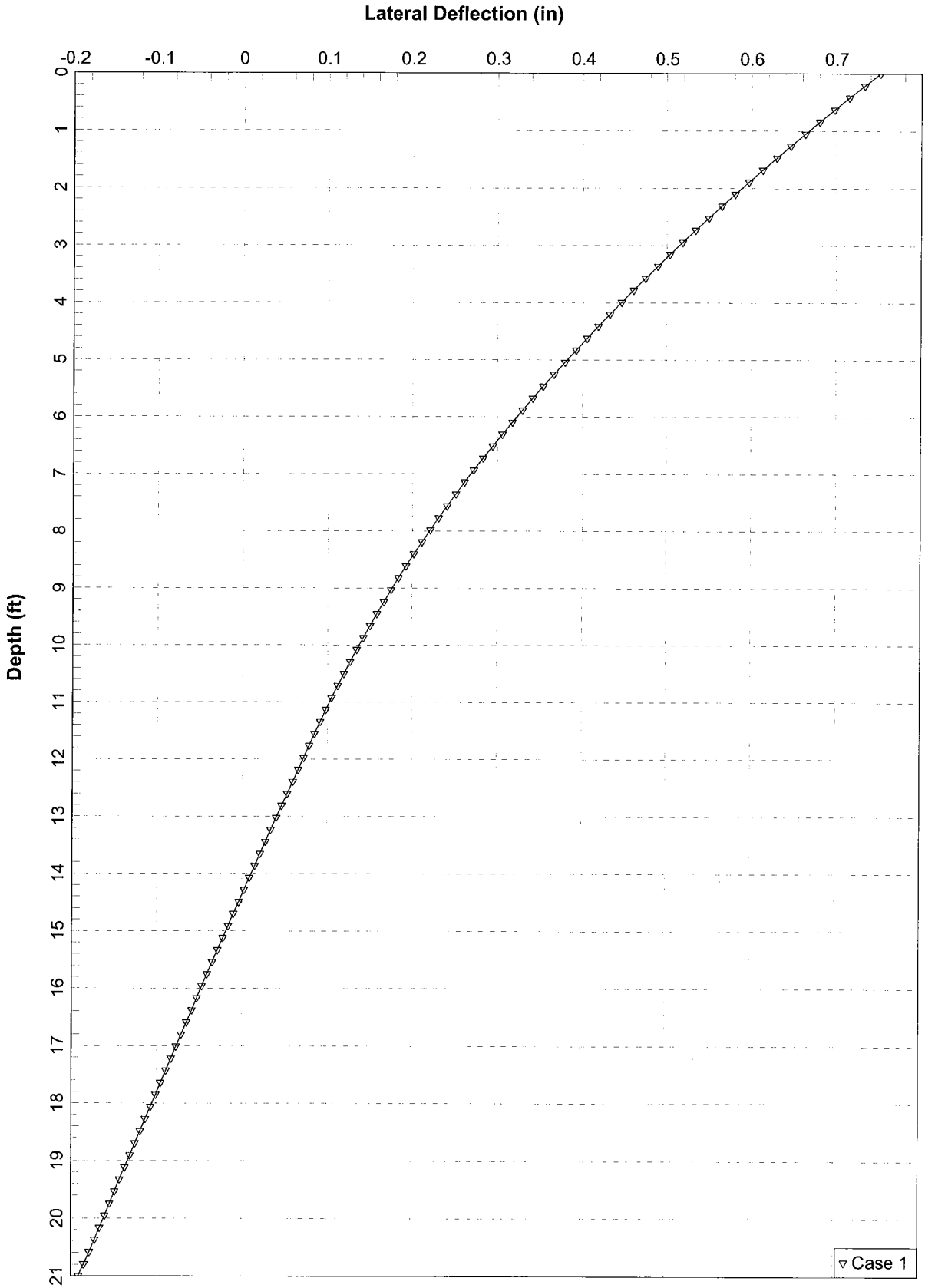
Computed Pile-head Stiffness Matrix Members
K22, K23, K32, K33 for Superstructure

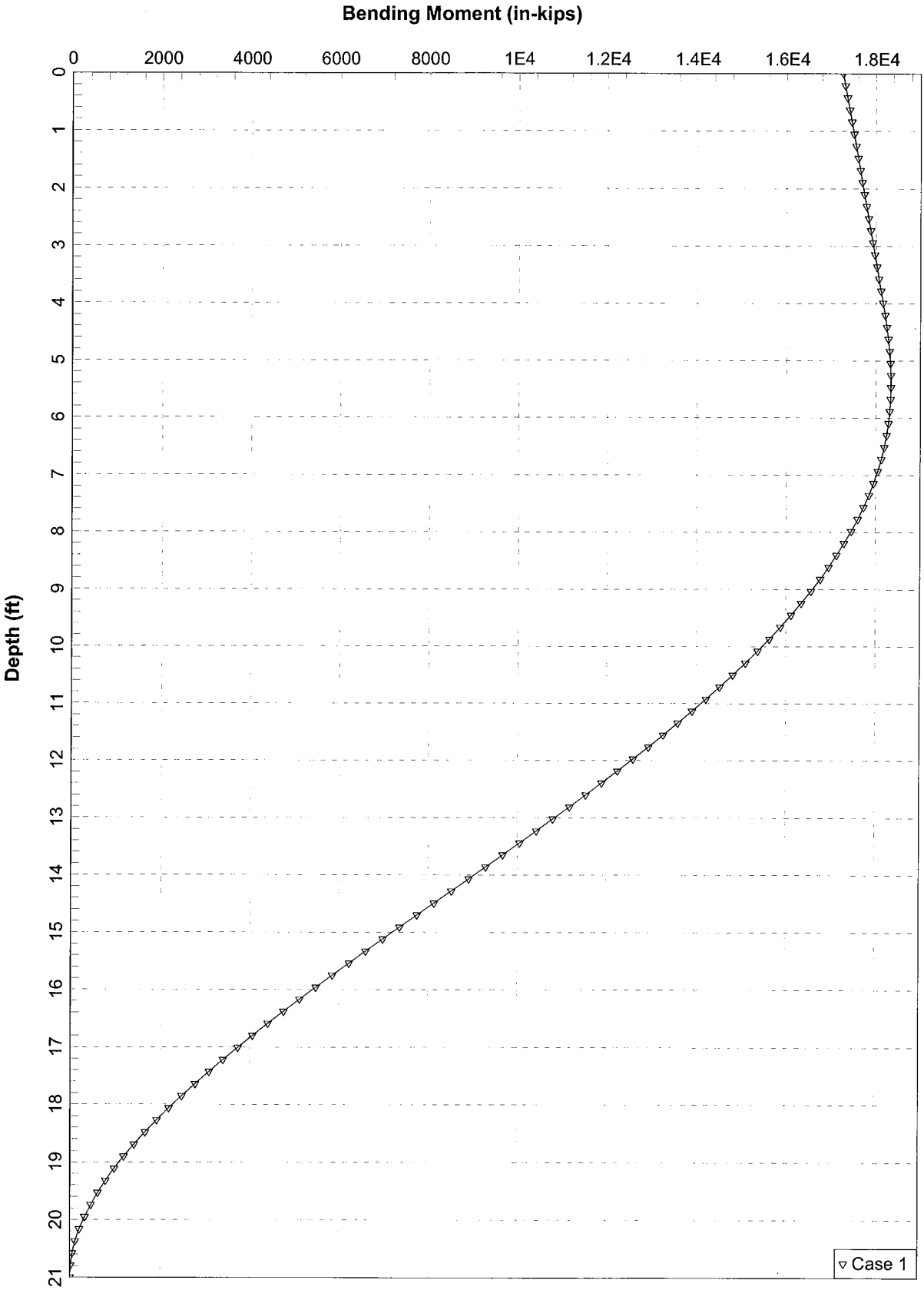
Top y in	Shear React. lbs	Mom. React. in-lbs	K22 lbs/in	K32 in-lbs/in
.00146230	1858.20003	269012.26101	1270741.	1.839656E+08
.00440195	5593.73938	809807.58556	1270741.	1.839656E+08
.00697693	8865.86716	1283515.	1270741.	1.839656E+08
.00880390	11187.47876	1619615.	1270741.	1.839656E+08
.01022102	12988.26062	1880315.	1270741.	1.839656E+08
.01137888	14459.60653	2093322.	1270741.	1.839656E+08
.01235784	15703.61178	2273417.	1270741.	1.839656E+08
.01320586	16781.21814	2429423.	1270741.	1.839656E+08
.01395386	17731.73431	2567029.	1270741.	1.839656E+08
.01462301	18582.00000	2690121.	1270737.	1.839649E+08

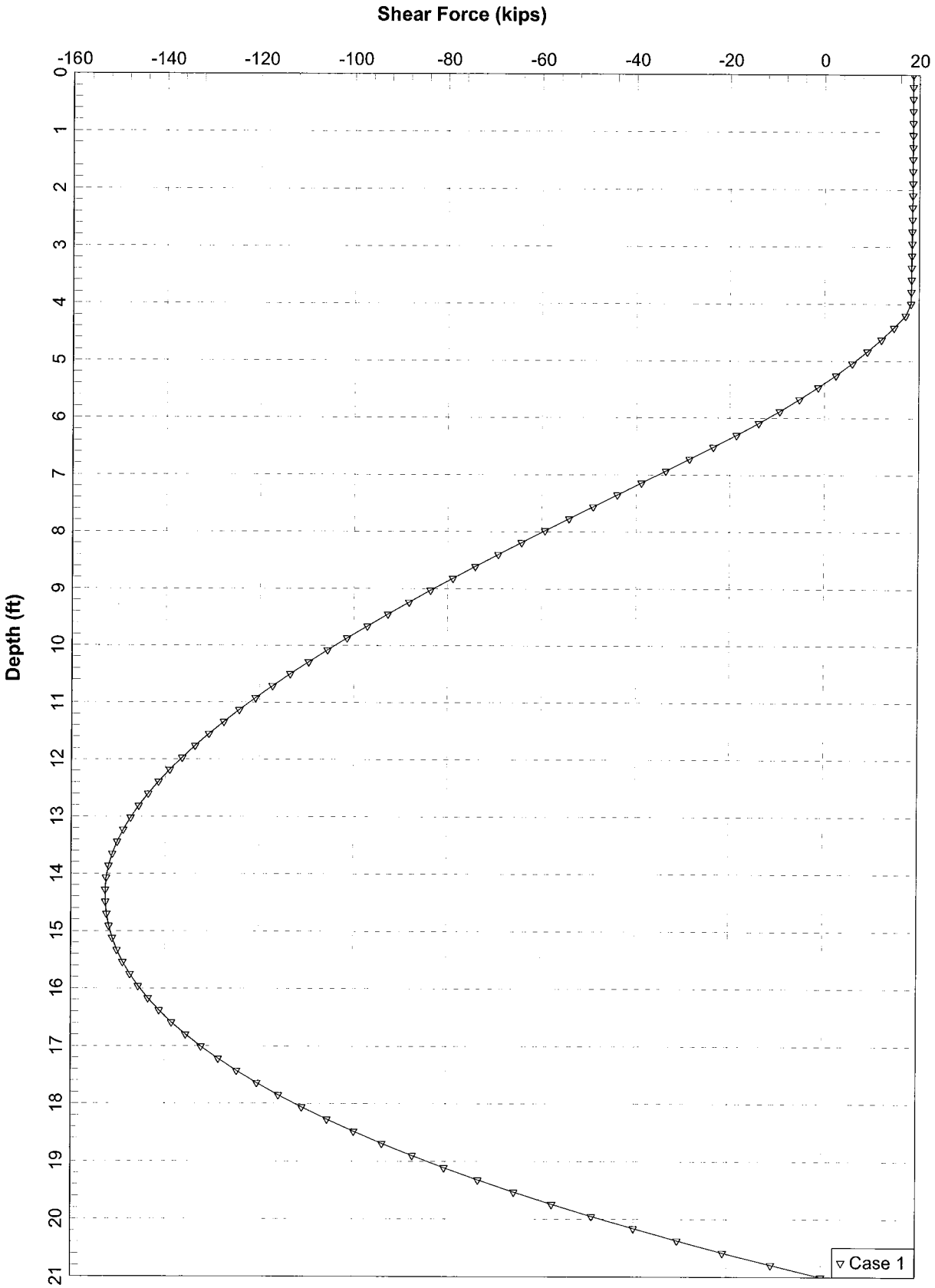
Top Rota. rad	Shear React. lbs	Mom. React. in-lbs	K23 lbs/rad	K33 in-lbs/rad
.00005310	9769.38628	1726898.	1.839656E+08	3.251892E+10
.00016018	29411.33409	5198482.	1.836138E+08	3.245392E+10
.00025457	46623.84593	8239399.	1.831446E+08	3.236544E+10
.00032190	58840.59707	10396964.	1.827916E+08	3.229874E+10
.00037433	68319.13554	12070502.	1.825117E+08	3.224584E+10
.00042034	76067.45868	13437881.	1.809685E+08	3.196944E+10
.00048553	82658.95042	14593985.	1.702433E+08	3.005758E+10
.00100561	89814.59285	15595447.	89313620.	1.550846E+10
.00118520	95808.67380	16478799.	80837776.	1.390385E+10
.00137336	101679.06301	17268984.	74036909.	1.257429E+10

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

The analysis ended normally.


Lateral Deflection (in)
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Case 1


Bending Moment (in-kips)
0
2000
4000
6000
8000
1E4
1.2E4
1.4E4
1.6E4
1.8E4
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Case 1


Shear Force (kips)
-160
-140
-120
-100
-80
-60
-40
-20
0
20
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Case 1

SITE NAME	GERMANTOWN CT	ECP - CELL #	5	293
LATITUDE	41-24-12.33 N	LONGITUDE	73-25-26.43 W	
Additional Comments:		SAVE BUTTON		
		STRUCTURE TYPE	MONOPOLE	

700 Mhz - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	P65-16-XL-2	P65-16-XL-2	BXA-70063-4CF
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	4
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Modcell 4.0 HD	Modcell 4.0 HD	Modcell 4.0 HD
ANTENNA TYPE	DB846H80E-SX	DB846H80E-SX	DB844G65ZAXY
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	3
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Modcell 4.0 HD	Modcell 4.0 HD	Modcell 4.0 HD
ANTENNA TYPE	DB846H80E-SX	DB846H80E-SX	DB844G65ZAXY
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	3
RAD CTR (FT AGL)	90	90	90
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 Cellular - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	MG D3800T0	MG D3800T0	MG D3800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	330
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 Cellular - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	MG D3800T0	MG D3800T0	MG D3800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	330
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable
MCPA BRICKS (QTY)			

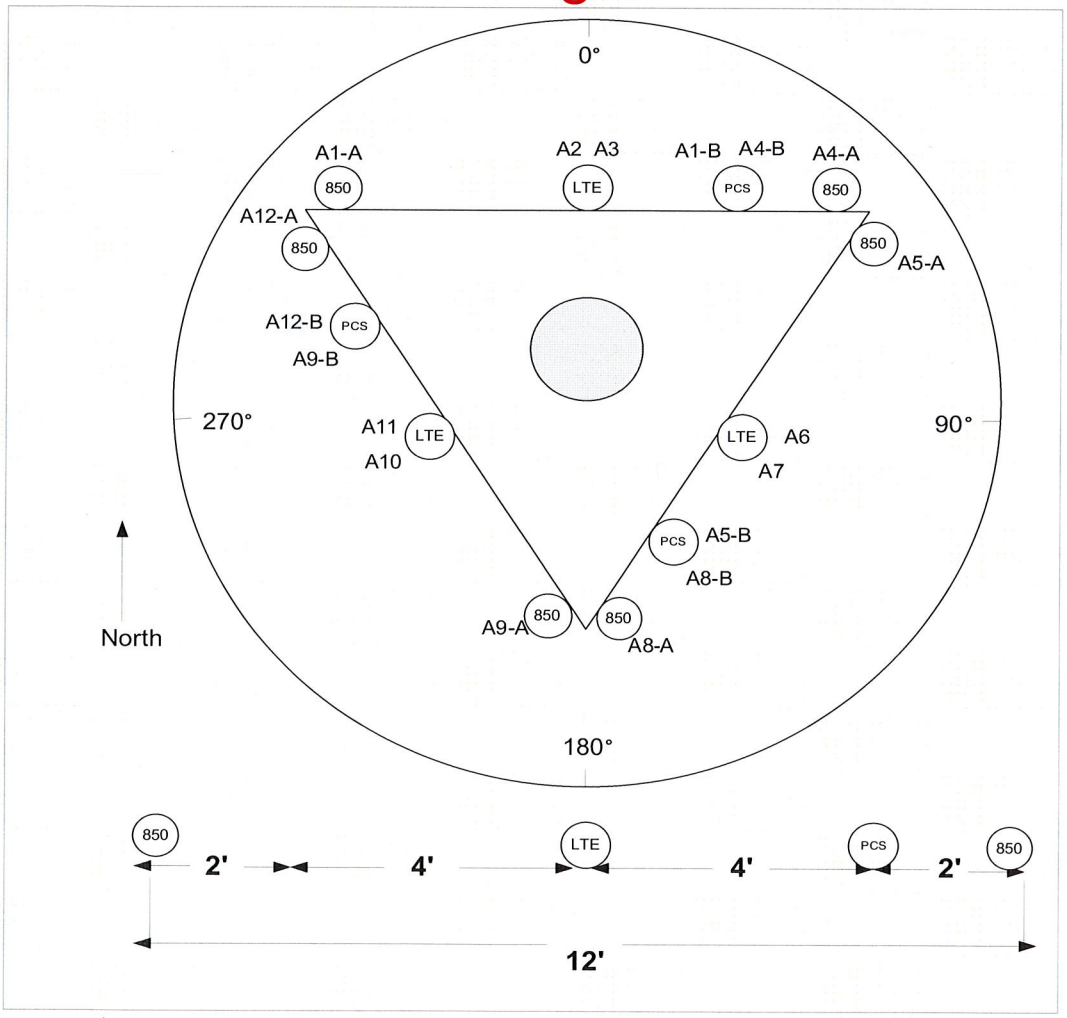
NUMBER OF CABLE'S NEEDED						ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES			12	MAINLINE (FT)			120
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS			18	TOP JUMPER (FT)			6
Equipment Cable Ordering		MAIN CABLE #	12	+	0	TOP JUMPER #	12	+	6

TX / RX FREQUENCIES			TX POWER OUTPUT	
Cellular A-Band	PCS F-Band	700 Mhz C - B	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	10/14/2010

Site Configuration



Slant +/- 45° Dual Polarized, Panel 63° / 13 dBd

BXA-70063/4CF ___

When ordering replace "___" with connector type.

Mechanical specifications

Length	1205 mm	47.4 in
Width	285 mm	11.2 in
Depth	126 mm	5.0 in
Depth with z-bracket	166 mm	6.5 in
[4] Weight	4.5 kg	9.9 lbs
Wind Area		
Fore/Aft	0.36 m^2	3.9 ft^2
Side	0.15 m^2	1.7 ft^2
Rated Wind Velocity (Safety factor 2.0)	>653 km/hr	>406 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	522 N	117 lbs
Side	244 N	54.5 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 Ø50-160 mm (2.0-6.3 in).

Mounting bracket kit #36210002
Downtilt bracket kit #36114003

Electrical specifications

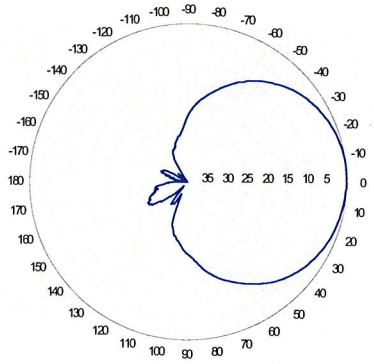
	Frequency Range	696-900 MHz
	Impedance	50Ω
[3]	Connector(s)	NE or E-DIN 2 ports / center
[1]	VSWR	≤ 1.4:1
	Polarization	Slant ± 45°
[1]	Isolation Between Ports	< -30 dB
[1]	Gain	13 dBd
[2]	Power Rating	500 W
[1]	Half Power Angle	
	H-Plane	63°
	E-Plane	15°
[1]	Electrical Downtilt	0°
[1]	Null Fill	5%
	Lightning Protection	Direct Ground

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

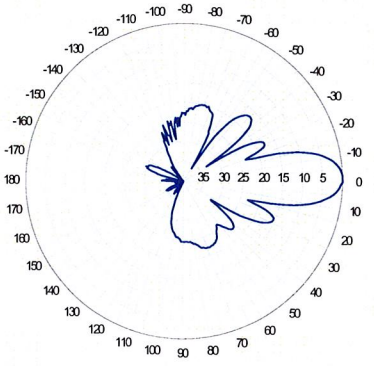
1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector.
E-DIN indicates an elongated DIN connector.
4) The antenna weight listed above does not include the bracket weight.

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

Radiation pattern[1]



Horizontal



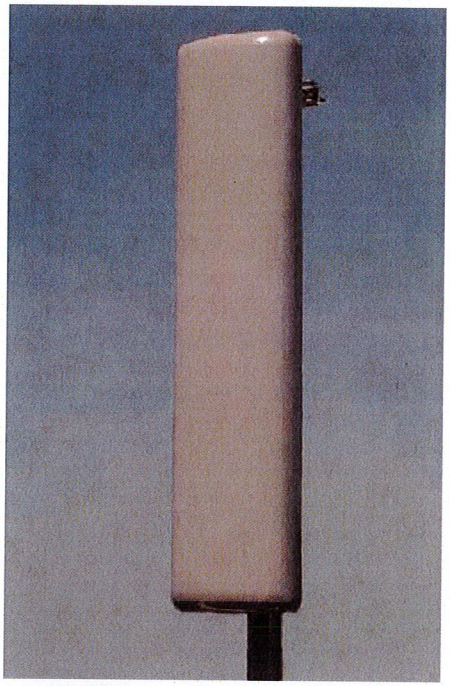
Vertical

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

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

CF Denotes a Center-Fed Connector.

696-900 MHz



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

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

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

Antenna available with center-fed connectors only.

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: 2/12/08

DB844G65ZAXY

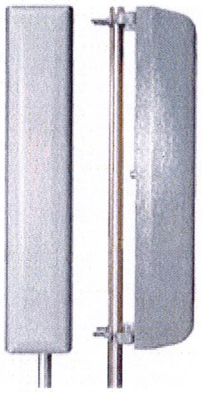
Directed Dipole™ Antenna

Base Station Antenna
Directed Dipole™

- Exceptional azimuth roll-off, reducing sector-to-sector interference and softer hand-offs
- Air dielectric feed system, no screws, rivets, welds or solder in RF element feed path
- Strong upper side lobe suppression
- Low profile appearance and low wind loading for easier zoning approvals

ELECTRICAL

Frequency (MHz) :	806 - 896	870 - 960
Polarization :	Vertical	Vertical
Gain (dBd/dBi) :	13.5/15.6	13.8/15.9
Azimuth BW (Deg.):	65	65
Elevation BW (Deg.):	15	15
Beam Tilt (Deg.):	0	0
USLS* (dB) :	15	15
Null Fill (dB) :	<20-25	<20-25
Front-To-Back Ratio* (dB) :	40	40
VSWR :	<1.33:1	<1.33:1
PIM3 @ 2 x 20w (dBc) :	-150	-150
Max. Input Power (Watts) :	500	500
Impedance (Ohms) :	50	50
Lightning Protection :	dc Ground	dc Ground



MECHANICAL

Weight :	5.4 kg (12 lb)
Dimensions (LxWxD) :	1,219 x 254 x 203 mm (48 x 10 x 8 in)
Max. Wind Area :	0.09 m² (1 ft²)
Max. Wind Load (@ 100 mph) :	235.7 N (53 lbf)
Max. Wind Speed :	241 km/h (150 mph)
Hardware Material :	Galvanized steel
Connector Type :	7-16 DIN Female (1, Back)
Color :	Light gray
Standard Mounting Hardware :	DB380
Standard Downtilt Mounting Hardware :	DB5083

Andrew Corporation
2601 Telecom Parkway
Richardson, Texas U.S.A 75082-3521
Tel: 214.631.0310

Fax: 214.631.4706
Toll Free Tel: 1.800.676.5342
Fax: 1.800.229.4706
www.andrew.com

* - Indicates Typical

10/11/2007

dbtech@andrew.com

DB846H80E-SX

Directed Dipole Antenna

Decibel®
Base Station Antennas

- Excellent azimuth roll-off, 15-20% reduction in cell to cell overlap
- Superior front to back ratio
- Low profile, low wind load for easy zoning
- Outstanding field record, with thousands of units deployed, world wide

ELECTRICAL

Frequency (MHz) :	806 - 896
Polarization :	Vertical
Gain (dBd/dBi) :	14/16.1
Azimuth BW (Deg.):	80
Elevation BW (Deg.):	10
Beam Tilt (Deg.):	0
USLS* (dB) :	15
Front-To-Back Ratio* (dB) :	40
VSWR :	<1.5:1
Max. Input Power (Watts) :	500
Impedance (Ohms) :	50
Lightning Protection :	DC Ground

MECHANICAL

Weight :	7.2 kg (16 lb)
Dimensions (LxWxD) :	1,829 x 165 x 203 mm (72 x 6.5 x 8 in)
Max. Wind Area :	0.16 m² (1.7 ft²)
Max. Wind Load (@ 100 mph) :	425.2 N (95.6 lbf)
Max. Wind Speed :	241 km/h (150 mph)
Hardware Material :	Galvanized Steel
Connector Type :	7-16 DIN - Female (1, Back)
Color :	Light Gray
Standard Mounting Hardware :	DB380
Standard Downtilt Mounting Hardware :	DB5083

Andrew Corporation
2601 Telecom Parkway
Richardson, Texas U.S.A 75082-3521
Tel: 214.631.0310

Fax: 214.631.4706
Toll Free Tel: 1.800.676.5342
Fax: 1.800.229.4706
www.andrew.com

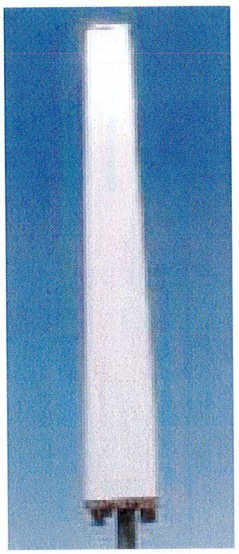
* - Indicates Typical

6/12/2006

dbtech@andrew.com

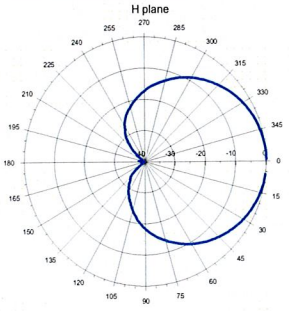
MG D3-800Tx

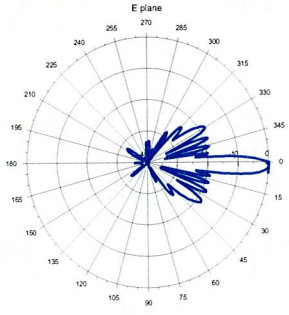
Xpol GSM1800+PCS & UMTS Panel Antenna
15.9 dBd/18 dBi
WIDE BAND 1710-2170 MHz
H 65º V 6.5º



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

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/.

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

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

April 5, 2010

The Honorable Mark D. Boughton
Mayor
City of Danbury
City Hall
155 Deer Hill Avenue
Danbury, CT 06810

RE: **EM-VER-034-100330-** Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 48 Newtown Road, Danbury, Connecticut.

Dear Mayor Boughton:

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 April 19, 2010.

Thank you for your cooperation and consideration.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/jbw

Enclosure: Notice of Intent

c: Dennis Elpern, City Planner, City of Danbury

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

May 25, 2010

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

RE: **EM-VER-034-100330-** Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 48 Newtown Road, Danbury, 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 with the following conditions:

- If Verizon Wireless performs its installation after MetroPCS, not more than 45 days after completion of construction a signed letter from a Professional Engineer duly licensed in the State of Connecticut shall be submitted to the Council to certify that the tower reinforcements were properly completed and the tower does not exceed 100 percent of its post-construction structural rating; and

- If Verizon Wireless performs its installation before MetroPCS, no reinforcement or letter is necessary from Verizon Wireless per the structural analysis report dated March 3, 2010 and sealed by Carlo Centore, P.E.

The proposed modifications are to be implemented as specified here and in your notice dated March 30, 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 Mark D. Boughton, Mayor, City of Danbury
Dennis Elpern, City Planner, City of Danbury
Wireless Capital Partners LLC

ROBINSON & COLE LLP

EM-VER-034-100330

KENNETH C. BALDWIN

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

ORIGINAL

March 30, 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**
48 Newtown Road, Danbury, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains wireless telecommunications antennas at the 90-foot level on the existing 96-foot tower referenced above. The tower is owned by Wireless Capital Partners LLC and is shared by multiple wireless carriers. The Council approved Cellco's use of the existing facility in 1999. Cellco now intends to modify its installation by replacing all of its existing antennas with four (4) model DB846H80E-SX cellular antennas; two (2) model DB844G65ZAXY cellular antennas; three (3) model MG D3800T0 PCS antennas; two (2) model P65-16-Xl-2 LTE antennas; and one (1) model BXA-70063/4CF LTE antenna, all at the 90-foot level on the tower. Attached behind Tab 1 are the specifications for the new 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 Mark D. Boughton, Mayor for the City of Danbury. A copy of this letter is also being sent to 48 Newtown Road Corporation, 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 height of the existing tower. Cellco's antennas will be located at the same 90-foot levels on the existing 96-foot 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.

A Structural Analysis Report confirming that the tower and foundation can support Cellco's proposed antenna modifications behind Tab 3. Please note that the Structural Report takes into consideration future modifications by MetroPCS, including a tower extension. The tower will require modifications due to MetroPCS' installation not Cellco's antenna swap.

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:
Mark D. Boughton, Danbury Mayor
48 Newtown Road Corporation
Sandy M. Carter

Vertically Polarized Directed Dipole® Panel Antennas

80° HORIZONTAL BEAMWIDTH

ANDREW®

806 - 960 MHz

HORIZONTAL BEAMWIDTH	80°		80°	80°
FREQUENCY RANGE	806-960 MHz		806-896 MHz	806-896 MHz
	12.3 & 12.5 dBd / 6° Tilt		12.5 dBd / 0-16° Tilt	14 dBd / 0° Tilt
MODEL	844H80T6E-XY		844G80VTA-SX	DB846H80E-SX
TYPE	Directed Dipole®		Directed Dipole®	Directed Dipole®
ELECTRICAL SPECIFICATIONS				
Frequency Range (MHz)	806-896	870-960	806-896	806-896
Gain (dBd/dBi)	12.3 / 14.4	12.5 / 14.6	12.5 / 14.6	14 / 16.1
Horizontal Beamwidth (Deg.)	80	80	80	80
Elevation Beamwidth (Deg.)	15	15	16	10
USLS (dB)	>15	>15	>15	N/A
Null Fill (dB) – Below Peak	N/A	N/A	N/A	N/A
Beam Tilt (Deg.)	6	6	0-16	0
VSWR	<1.5:1	<1.5:1	<1.4:1	<1.5:1
Front-To-Back Ratio (dB)	40	40	35	40
Isolation (dB)	N/A	N/A	N/A	N/A
Max. Input Power (Watts)	500	500	500	500
Polarization	Vertical	Vertical	Vertical	Vertical
Connector Location	Back	Back	Back	Back
Connector Type	7-16 DIN - Female	7-16 DIN - Female	7-16 DIN - Female	7-16 DIN - Female
Optional Connectors	N/A	N/A	N/A	N/A
MECHANICAL SPECIFICATIONS				
Length (inch/mm)	48 / 1,219	48 / 1,219	48 / 1,219	72 / 1,829
Width (inch/mm)	6.5 / 165	6.5 / 165	10 / 254	6.5 / 165
Depth (inch/mm)	8 / 203	8 / 203	8.5 / 216	8 / 203
Net Weight (lbs/kg)	14 / 6.3	14 / 6.3	11.5 / 5.2	16 / 7.2
Max. Flat Plate Area (ft^2/m^2)	1.08 / 0.10	1.08 / 0.10	0.97 / 0.09	1.72 / 0.16
Max. Wind Load at 100 mph (lbf/N)	59 / 262	59 / 262	53 / 233	95.6 / 425
Max. Wind Speed (mph/kmh)	125 / 201	125 / 201	125 / 201	125 / 201
Radome Material	ABS, UV Resistant	ABS, UV Resistant	ABS, UV Resistant	ABS, UV Resistant
Reflector Material	Pass. Aluminum	Pass. Aluminum	Pass. Aluminum	Pass. Aluminum
Radiator Material	Brass	Brass	Aluminum	Brass
Hardware Material	Galvanized Steel	Galvanized Steel	Galvanized Steel	Galvanized Steel
Color	Light Gray	Light Gray	Light Gray	Light Gray
Std. Mounting Hardware	DB380	DB380	DB380	DB380
Optional Downtilt Kit	DB5083	DB5083	DB5083	DB5083
Optional Special Mounting	DB5084-AZ	DB5084-AZ	DB5084-AZ	DB5084-AZ

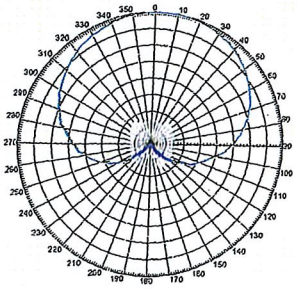
Specifications are subject to change. Please see our website for the latest information.

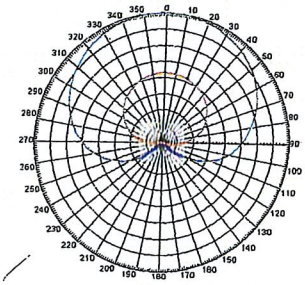
844H80T6E-XY

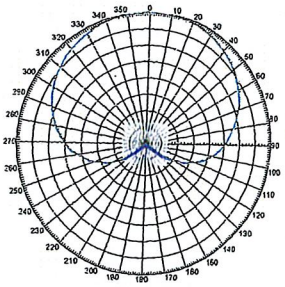
844G80VTA-SX

DB846H80E-SX

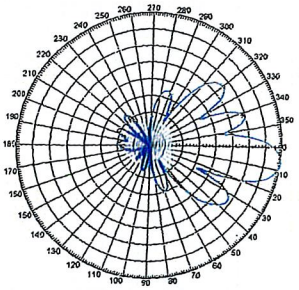
Azimuth Pattern

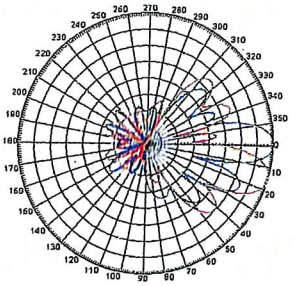


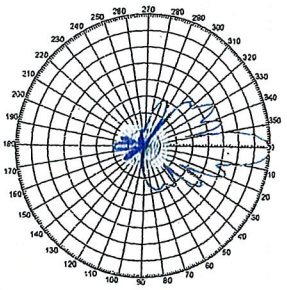




Elevation Pattern







Scale: 10° radials, 5 dB per division

XPol

VERTICAL Directed Dipole®

VERTICAL Panel

Omni

Yagi

Product Specifications

ANDREW®
A CommScope Company

DB844G65ZAXY

Directed Dipole™ Antenna, 806–960 MHz, 65° horizontal beamwidth, fixed electrical tilt

- Excellent azimuth roll-off, reducing sector-to-sector interference and soft hand-offs
- Air dielectric feed system with no screws, rivets, solder, or welding in dipole feed point
- Low profile for ease of zoning approval
- Excellent upper sidelobe suppression

CHARACTERISTICS

General Specifications

Antenna Type	Directed Dipole™
Brand	Directed Dipole™
Operating Frequency Band	806 – 960 MHz

Electrical Specifications

Frequency Band, MHz	**806–896**	**870–960**
Beamwidth, Horizontal, degrees	65	65
Gain, dBd	13.5	13.8
Gain, dBi	15.6	15.9
Beamwidth, Vertical, degrees	15.0	15.0
Beam Tilt, degrees	0	0
Upper Sidelobe Suppression (USLS), typical, dB	15	15
Null Fill, dB	20	20
Front-to-Back Ratio at 180°, dB	40	40
VSWR | Return Loss, db	1.33:1 | 17.0	1.33:1 | 17.0
Intermodulation Products, 3rd Order, 2 x 20 W, dBc	-150	-150
Input Power, maximum, watts	500	500
Polarization	Vertical	Vertical
Impedance, ohms	50	50
Lightning Protection	dc Ground	dc Ground

Product Specifications

DB844G65ZAXY

ANDREW®
A CommScope Company

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Back
Connector Quantity	1
Wind Loading, maximum	235.8 N @ 100 mph 53.0 lbf @ 100 mph
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	203.2 mm | 8.0 in
Length	1219.2 mm | 48.0 in
Width	254.0 mm | 10.0 in
Net Weight	5.4 kg | 12.0 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

DB5083
Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members

DB380
Pipe Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members

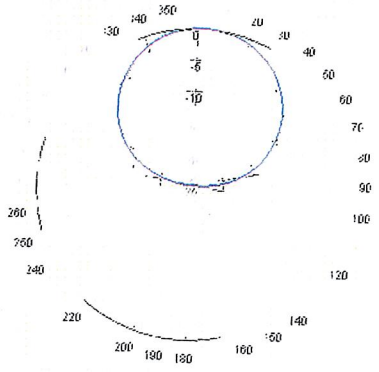
DB382NS
Side Offset Bracket for 4.5 in (114.3 mm) OD round members

Product Specifications

DB844G65ZAXY

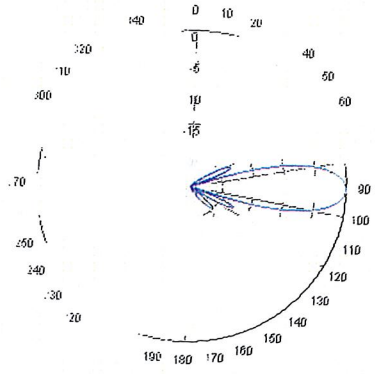
ANDREW®
A CommScope Company

Horizontal Pattern

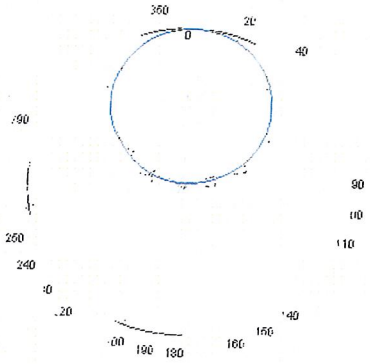


Freq: 850 MHz, Tilt: 0°

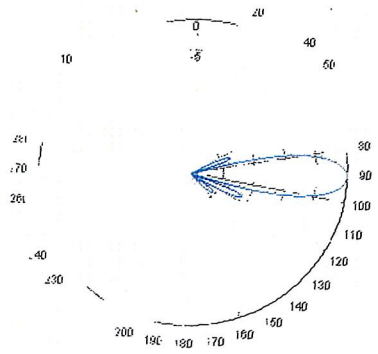
Vertical Pattern



Freq: 850 MHz, Tilt: 0°



Freq: 935 MHz, Tilt: 0°



Freq: 935 MHz, Tilt: 0°

SINGLE-BAND PANEL ANTENNA

BROADBAND 1700-2170 MHZ

MGD3-800TX

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

ELECTRICAL SPECIFICATIONS

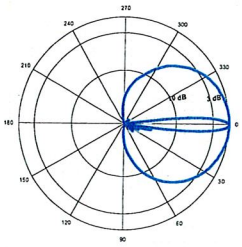
BROADBAND *1710-2170 MHz*

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

MECHANICAL SPECIFICATIONS

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

H&V Pattern



RYMSA Telecom Group (Headquarters)

RYMSA TELECOM GROUP

www.rymsawireless.com

RYMSA México

Phone

RYMSA Wireless U.S.A.

Phone

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/.

Slant ±45° Dual Polarized FET Panel 63° / 13 dBd
696-900 MHz

Mechanical specifications

Length	1205	mm	47.4	in
Width	285	mm	11.2	in
Depth	126	mm	5.0	in
Depth with z-bracket	166	mm	6.5	in
Weight [4]	4.5	kg	9.9	lbs
Wind Area Fore/Aft	0.36	m^2	3.9	ft^2
Wind Area Side	0.15	m^2	1.7	ft^2
Max Wind Survivability	>201	km/hr	>125	mph
Wind Load @ 100 mph (161 km/hr)				
Fore/Aft	522	N	117	lbf
Side	244	N	55	lbf

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

Mounting & Downtilting

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

Mounting Bracket Kit	36210002
Downtilt Bracket Kit	36114003

Electrical specifications

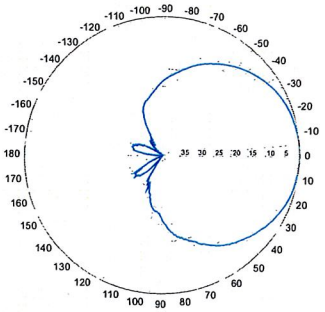
Frequency Range	696-900 MHz
Impedance	50Ω
Connector [3]	NE or E-DIN Female 2 ports / Center
VSWR [1]	≤ 1.4:1
Polarization	Slant ±45°
Isolation Between Ports [1]	< -30 dB
Gain [1]	13.0 dBd 15.0 dBi
Power Rating [2]	500 W
Half Power Angle [1]	
Horizontal Beamwidth	63°
Vertical Beamwidth	15°
Electrical downtilt [5]	0°
Null fill [1]	5%
Lightning protection	Direct ground

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

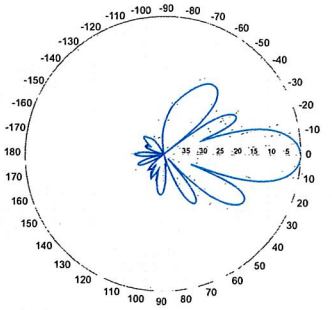
1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) Antenna weight does not include brackets.
5) Add'l downtilts may be available. Check website for details.

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

Radiation-pattern
750 MHz

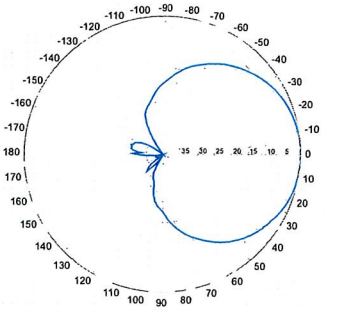


Horizontal

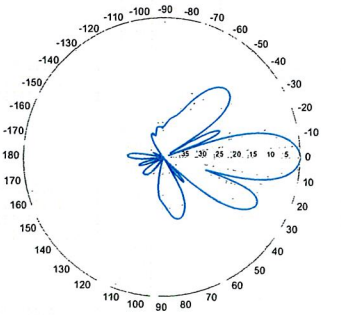


Vertical

850 MHz



Horizontal

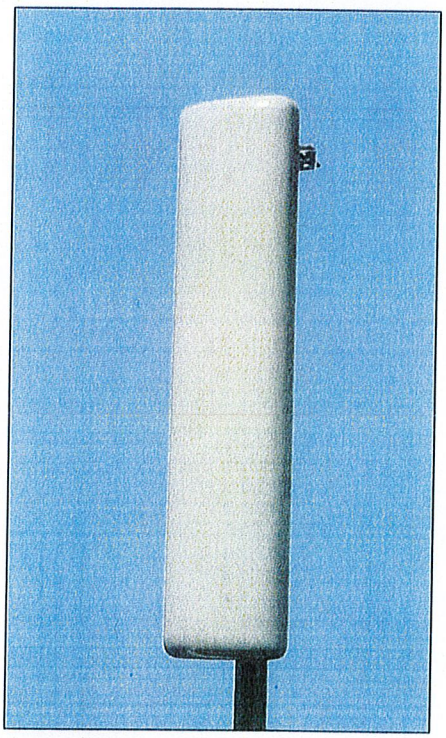


Vertical

696-900 MHz

BXA-70063/4CF __

When ordering replace "__" with connector type.



Featuring our Exclusive 3T Technology™ Antenna Design:

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

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

Revision Date: 10/27/06

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

Amphenol Antel, Inc. The Antenna Technology Company

	General	Power	Density					
Site Name: Germantown (Danbury)								
Tower Height: Verizon @ 90Ft.								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*Cingular GSM	6	296	100	0.0639	880	0.5867	10.89%	
*Cingular GSM	1	427	100	0.0154	1900	1.0000	1.54%	
*Cingular UMTS	1	500	100	0.0180	880	0.5867	3.06%	
*MetroPCS	3	443.61	108	0.0410	2140	1.0000	4.10%	
*Nextel iDEN	12	100	78	0.0709	851	0.5673	12.50%	
*Sprint/Nextel WiMAX	3	562	78	0.0996	2657	1.0000	9.96%	
*Sprint/Nextel Microwave	2	4.42	78	0.0005	22500	1.0000	0.05%	
Verizon	**3**	**457**	**90**	**0.0609**	**1970**	**1.0000**	**6.09%**	
Verizon	**9**	**329**	**90**	**0.1314**	**869**	**0.5793**	**22.69%**	
Verizon	**1**	**170**	**90**	**0.0075**	**757**	**0.4973**	**1.52%**	
								72.40%
* Source: Siting Council								

NATCOMM INC.
CONSULTING ENGINEERS

Structural Analysis Report

96-ft Existing EEI Monopole with Future 14-ft Addition

Proposed Verizon Wireless Antenna Change-Out

Verizon Wireless Site Ref: Germantown

48 Newtown Road
Danbury, CT

Natcomm Project No. 10001-CO41

Date: March 3, 2010

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

Natcomm, Inc.
Structural Analysis – 96' EEI Monopole w/ 14' Extension
Verizon LTE Upgrade - Germantown
Danbury, CT
March 3, 2010

Table of Contents

Natcomm, Inc.
Structural Analysis – 96' EEI Monopole w/ 14' Extension
Verizon LTE Upgrade - Germantown
Danbury, CT
March 3, 2010

Introduction

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

The host tower is a 96-ft tall, two-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI); project no. 5246 dated July 6, 1999. The tower geometry, structure member sizes and foundation system information were obtained from the original manufacturers design documents.

The tower is made up of two (2) 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 17.49-in at the top and 37.0-in at the base.

A future 14-ft extension to accommodate a MetroPCS antenna installation was also considered in this analysis. The pole extension and additional antenna loading required reinforcements to the existing monopole as outlined the structural analysis report prepared by Structural Components job no. 090239 dated October 6, 2009 for MetroPCS.

Antenna and appurtenance information were obtained from the CT Siting Council Database, the Verizon RF data sheet and visual verification conducted from grade by Natcomm Personnel on February 12, 2010.

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

- METRO PCS (FUTURE):
  Antennas: Three (3) Kathrein 800-10504 and three (3) Kathrein 742-351 panel antenna mounted on three (3) T-Arms with a RAD center elevation of 108-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the outside of the existing tower in a 2x6 cable configuration.
- AT&T (EXISTING):
  Antennas: Six (6) Powerwave 7770.00 panel antennas and six (6) TMA's mounted on an EEI standard platform with a RAD center elevation of 100-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the outside of the existing tower in a 2x6 cable configuration.

- NEXTEL (EXISTING):
  Antennas: Twelve (12) 4-ft panel antennas mounted on an EEI standard platform with a RAD center elevation of 78-ft above grade level.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower and six (6) 1-5/8" ∅ coax cables running on the outside of the existing tower in a 1x6 cable configuration.
- VERIZON (EXISTING TO REMAIN):
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- **VERIZON (EXISTING TO REMOVE):**
  Antennas: Six (6) Allgon 7129 and six (6) Decibel 948F85T2E-M panel antennas mounted on an existing EEI standard platform with a RAD center elevation of 90-ft above grade level.
- **VERIZON (PROPOSED):**
  Antennas: Two (2) Powerwave P65-16-XL-2, one (1) Antel BXA-70063-4CF, three (3) RYMSA MG D3-800T0, four (4) Decibel DB846H80E-SX and two (2) Decibel DB844G65ZAXY panel antennas mounted on an existing EEI standard platform with a RAD center elevation of 90-ft above grade level.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the outside of the existing tower in a 1x6 cable configuration.

Natcomm, Inc.
Structural Analysis – 96' EEI Monopole w/ 14' Extension
Verizon LTE Upgrade - Germantown
Danbury, CT
March 3, 2010

Primary Assumptions Used in the Analysis

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

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:	Fairfield; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Danbury; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed 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 **97.1%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L2)	47.00'-97.00'	97.1%	**PASS**

Note: The wall thickness of the bottom 20-ft of the monopole was increased in the RisaTower analysis to reflect the reinforcements designed in the aforementioned structural analysis report prepared by Structural Components job no. 090239 dated October 6, 2009.

Foundation and Anchors

The existing foundation consists of a 5.5-ft ∅ x 21.0-ft long reinforced concrete caisson. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; project no. 5246 dated July 6, 1999. The base of the tower is connected to the foundation by means of (8) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 5-ft into the concrete foundation structure. Three (3) proposed 2-3/4" "∅ ASTM A193 Gr. B7 anchor rods as required by the aforementioned structural analysis report prepared by Structural Components were also considered is the analysis.

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

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

Base Reactions	Vector	Proposed Load (kips/ft-kips)
Base	Shear	**19**
	Axial	**21**
	Moment	**1464**

- The foundation was found to be within allowable limits.

Foundation	Design Limit	Proposed Loading	Result
Reinforced Concrete Caisson	Moment Capacity	76.5%	**PASS**
	Lateral Deflection	0.77 in.(1)	**PASS**

(1) Lateral deflection typically limited to 1.0 in. for monopole tower structures.

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts (ASTM-A615)	Compression	62.2%	**PASS**
Anchor Bolts (ASTM-A193)	Compression	55.2%	**PASS**
Base Plate	Bending	41.6%	**PASS**

Conclusion

Provided the proposed MetroPCS tower reinforcements outlined in the structural analysis report by Structural Components, LLC are implemented, this analysis finds the subject tower **adequate** to support the Verizon modified antenna configuration and MetroPCS proposed antenna installation.

Should the MetroPCS installation not occur, the outlined reinforcements will not be required to accommodate Verizon's 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

STATE OF CONNECTICUT
CARLO F. CENTORE
No. 18684
LICENSED
PROFESSIONAL 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.

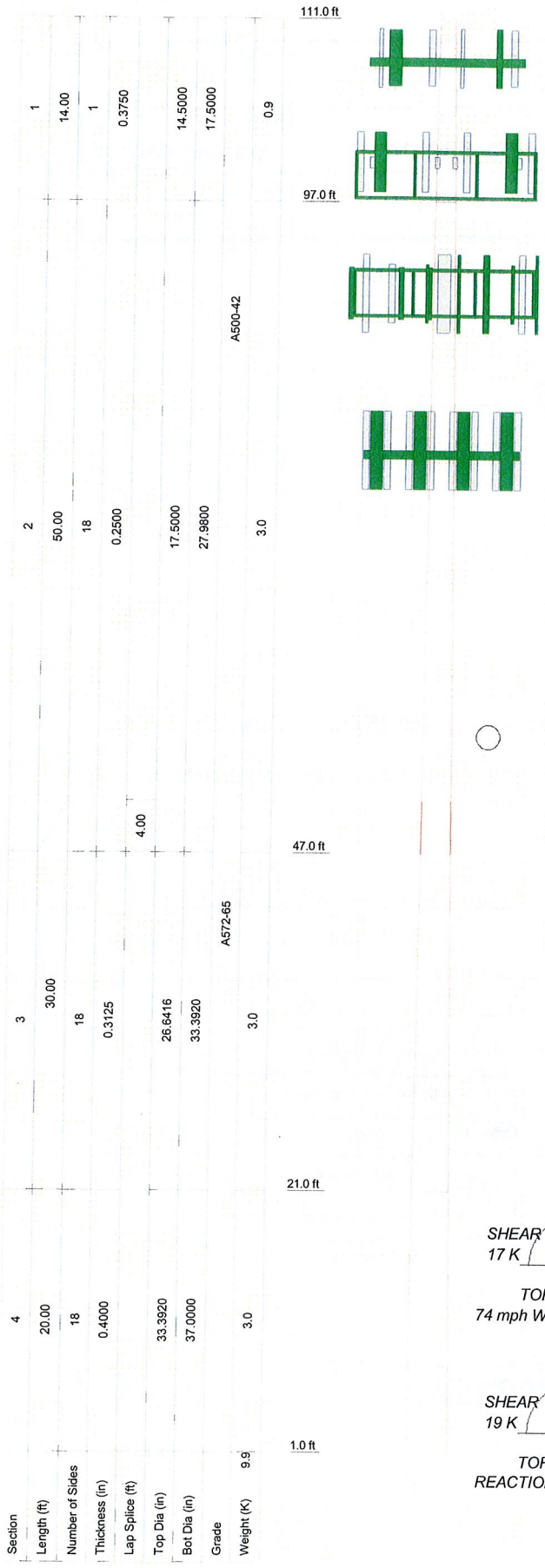
LPILE Plus:

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.



DESIGNED APPURTENANCE LOADING

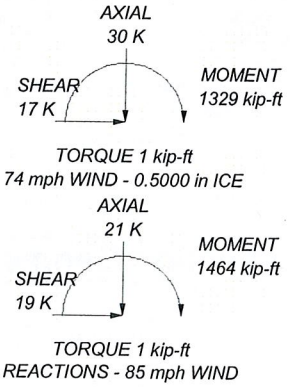
TYPE	ELEVATION	TYPE	ELEVATION
800-10504 (MetroPCS - Reserved)	108	P65-16-XL-2 (Verizon - Proposed)	90
800-10504 (MetroPCS - Reserved)	108	DB846H80E-SX (Verizon - Proposed)	90
800-10504 (MetroPCS - Reserved)	108	DB846H80E-SX (Verizon - Proposed)	90
742-351 (MetroPCS - Reserved)	108	MG D3-800T0 (Verizon - Proposed)	90
742-351 (MetroPCS - Reserved)	108	P65-16-XL-2 (Verizon - Proposed)	90
742-351 (MetroPCS - Reserved)	108	DB846H80E-SX (Verizon - Proposed)	90
Valmont T-Arm (3) (MetroPCS - Reserved)	108	DB844G65ZAXY (Verizon - Proposed)	90
		MG D3-800T0 (Verizon - Proposed)	90
(2) 7770.00 (ATI - Existing)	100	BXA-70063/4CF (Verizon - Proposed)	90
(2) 7770.00 (ATI - Existing)	100	DB844G65ZAXY (Verizon - Proposed)	90
(2) 7770.00 (ATI - Existing)	100	EEI Standard Platform (Verizon - Existing)	90
(2) TMA 10"x8"x3" (ATI - Existing)	100		
(2) TMA 10"x8"x3" (ATI - Existing)	100	(4) 4' Panel (Nextel - Existing)	78
(2) TMA 10"x8"x3" (ATI - Existing)	100	(4) 4' Panel (Nextel - Existing)	78
EEI Standard Platform (ATI - Existing)	99	(4) 4' Panel (Nextel - Existing)	78
DB846H80E-SX (Verizon - Proposed)	90	EEI Low Profile Platform (Nextel - Existing)	78
MG D3-800T0 (Verizon - Proposed)	90		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A500-42	42 ksi	58 ksi	A572-65	65 ksi	80 ksi

TOWER DESIGN NOTES

1. Tower is located in Fairfield County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
6. Welds are fabricated with ER-70S-6 electrodes.
7. Analysis considers all reinforcements proposed and designed by Structural Components, LLC dated October 6, 2009.
8. TOWER RATING: 97.1%



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

Job: 100' EEI Monopole - Germantown			
Project: 10001.CO41 - 48 Newton Rd., Danbury, CT			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 03/03/10	Scale: NTS	
Path: J:\Jobs\1000100 WtCO41 - Germantown, 50 Newtown Rd, Danbury, CT\Calcs\ER\100' EEI Monopole w extension.eri		Dwg No. E-1	

RISATower	Job	Page
NATCOMM 63-2 N. Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	100' EEI Monopole - Germantown	1 of 19
	Project 10001.CO41 - 48 Newton Rd., Danbury, CT	Date 09:15:46 03/03/10
	Client Verizon Wireless	Designed by TJL

Tower Input Data

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

Tower is located in Fairfield County, Connecticut.
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..
Analysis considers all reinforcements proposed and designed by Structural Components, LLC dated October 6, 2009..
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	111.00-97.00	14.00	0.00	Round	14.5000	17.5000	0.3750		A500-42 (42 ksi)
L2	97.00-47.00	50.00	4.00	18	17.5000	27.9800	0.2500	1.0000	A572-65 (65 ksi)
L3	47.00-21.00	30.00	0.00	18	26.6416	33.3920	0.3125	1.2500	A572-65 (65 ksi)

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L4	21.00-1.00	20.00		18	33.3920	37.0000	0.4000	1.6000	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	14.5000	16.6322	415.3261	5.0003	7.2500	57.2864	829.5207	8.3153	0.0000	0
	17.5000	20.1647	740.1429	6.0622	8.7500	84.5878	1478.2694	10.0814	0.0000	0
L2	17.7700	13.6879	514.5786	6.1238	8.8900	57.8829	1029.8342	6.8452	2.6400	10.56
	28.4116	22.0038	2137.6372	9.8442	14.2138	150.3912	4278.0871	11.0040	4.4845	17.938
L3	27.9665	26.1152	2287.1910	9.3468	13.5339	168.9968	4577.3916	13.0601	4.1389	13.245
	33.9071	32.8107	4535.9808	11.7432	16.9631	267.4023	9077.9301	16.4085	5.3270	17.046
L4	33.9071	41.8866	5760.1036	11.7122	16.9631	339.5660	11527.7865	20.9473	5.1730	12.932
	37.5708	46.4674	7864.0745	12.9930	18.7960	418.3909	15738.4968	23.2381	5.8080	14.52

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 111.00-97.00				1	1	1		
L2 97.00-47.00				1	1	1		
L3 47.00-21.00				1	1	1		
L4 21.00-1.00				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 (AT&T - Existing)	C	No	CaAa (Out Of Face)	101.00 - 16.00	2	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (AT&T - Existing)	C	No	CaAa (Out Of Face)	101.00 - 16.00	10	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55
1 5/8 (Verizon - Existing)	A	No	Inside Pole	91.00 - 16.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Sprint - Existing)	B	No	Inside Pole	79.00 - 16.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Sprint - Existing)	B	No	CaAa (Out Of Face)	79.00 - 16.00	1	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (Sprint - Existing)	B	No	CaAa (Out Of Face)	79.00 - 16.00	5	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55
1 5/8 (MetroPCS - Reserved)	A	No	CaAa (Out Of Face)	109.00 - 16.00	2	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (MetroPCS - Reserved)	A	No	CaAa (Out Of Face)	109.00 - 16.00	10	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55
1 5/8 (Verizon - Proposed)	A	No	CaAa (Out Of Face)	91.00 - 16.00	1	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (Verizon - Proposed)	A	No	CaAa (Out Of Face)	91.00 - 16.00	5	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	111.00-97.00	A	0.000	0.000	0.000	4.752	0.15
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	1.584	0.05
L2	97.00-47.00	A	0.000	0.000	0.000	28.512	1.45
		B	0.000	0.000	0.000	6.336	0.40
		C	0.000	0.000	0.000	19.800	0.62
L3	47.00-21.00	A	0.000	0.000	0.000	15.444	0.81
		B	0.000	0.000	0.000	5.148	0.32
		C	0.000	0.000	0.000	10.296	0.32
L4	21.00-1.00	A	0.000	0.000	0.000	2.970	0.16
		B	0.000	0.000	0.000	0.990	0.06
		C	0.000	0.000	0.000	1.980	0.06

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	111.00-97.00	A	0.500	0.000	0.000	0.000	7.152	0.37
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	2.384	0.12
L2	97.00-47.00	A	0.500	0.000	0.000	0.000	42.911	2.75
		B		0.000	0.000	0.000	9.536	0.69
		C		0.000	0.000	0.000	29.800	1.53
L3	47.00-21.00	A	0.500	0.000	0.000	0.000	23.244	1.52
		B		0.000	0.000	0.000	7.748	0.56
		C		0.000	0.000	0.000	15.496	0.80
L4	21.00-1.00	A	0.500	0.000	0.000	0.000	4.470	0.29
		B		0.000	0.000	0.000	1.490	0.11
		C		0.000	0.000	0.000	2.980	0.15

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	111.00-97.00	-0.1171	-0.3176	-0.1500	-0.4069
L2	97.00-47.00	-0.2132	-0.2934	-0.2646	-0.3642
L3	47.00-21.00	-0.1752	-0.3035	-0.2229	-0.3860
L4	21.00-1.00	-0.0561	-0.0972	-0.0788	-0.1365

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
800-10504	A	From Face	3.00	0.0000	108.00	No Ice	3.66	2.26	0.02
(MetroPCS - Reserved)			-4.00			1/2" Ice	4.01	2.59	0.04
			0.00						
800-10504	B	From Face	3.00	0.0000	108.00	No Ice	3.66	2.26	0.02
(MetroPCS - Reserved)			-4.00			1/2" Ice	4.01	2.59	0.04
			0.00						
800-10504	C	From Face	3.00	0.0000	108.00	No Ice	3.66	2.26	0.02
(MetroPCS - Reserved)			-4.00			1/2" Ice	4.01	2.59	0.04
			0.00						
742-351	A	From Face	3.00	0.0000	108.00	No Ice	5.89	1.73	0.03
(MetroPCS - Reserved)			4.00			1/2" Ice	6.30	2.04	0.06
			0.00						
742-351	B	From Face	3.00	0.0000	108.00	No Ice	5.89	1.73	0.03
(MetroPCS - Reserved)			4.00			1/2" Ice	6.30	2.04	0.06
			0.00						
742-351	C	From Face	3.00	0.0000	108.00	No Ice	5.89	1.73	0.03
(MetroPCS - Reserved)			4.00			1/2" Ice	6.30	2.04	0.06
			0.00						
Valmont T-Arm (3)	C	None		0.0000	108.00	No Ice	21.00	21.00	1.01
(MetroPCS - Reserved)						1/2" Ice	29.00	29.00	1.24
(2) 7770.00	A	From Face	4.00	0.0000	100.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	B	From Face	4.00	0.0000	100.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	C	From Face	4.00	0.0000	100.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) TMA 10"x8"x3"	A	From Face	3.00	0.0000	100.00	No Ice	0.78	0.29	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.90	0.38	0.02
			0.00						
(2) TMA 10"x8"x3"	B	From Face	3.00	0.0000	100.00	No Ice	0.78	0.29	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.90	0.38	0.02
			0.00						
(2) TMA 10"x8"x3"	C	From Face	3.00	0.0000	100.00	No Ice	0.78	0.29	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.90	0.38	0.02
			0.00						
EEI Standard Platform	C	None		0.0000	99.00	No Ice	30.00	30.00	1.60
(AT&T - Existing)						1/2" Ice	35.00	35.00	2.00
DB846H80E-SX	A	From Leg	4.00	0.0000	90.00	No Ice	5.09	6.06	0.02
(Verizon - Proposed)			-6.00			1/2" Ice	5.55	6.52	0.05
			0.00						
MG D3-800T0	A	From Leg	3.00	0.0000	90.00	No Ice	3.45	2.22	0.02
(Verizon - Proposed)			-4.00			1/2" Ice	3.80	2.55	0.04
			0.00						
P65-16-XL-2	A	From Leg	3.00	0.0000	90.00	No Ice	8.40	4.12	0.02
(Verizon - Proposed)			0.00			1/2" Ice	8.95	4.56	0.06
			0.00						
DB846H80E-SX	A	From Leg	4.00	0.0000	90.00	No Ice	5.09	6.06	0.02
(Verizon - Proposed)			6.00			1/2" Ice	5.55	6.52	0.05
			0.00						
DB846H80E-SX	B	From Leg	4.00	0.0000	90.00	No Ice	5.09	6.06	0.02
(Verizon - Proposed)			-6.00			1/2" Ice	5.55	6.52	0.05
			0.00						
MG D3-800T0	B	From Leg	3.00	0.0000	90.00	No Ice	3.45	2.22	0.02
(Verizon - Proposed)			-4.00			1/2" Ice	3.80	2.55	0.04

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Offsets: Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00							
P65-16-XL-2	B	From Leg	3.00		0.0000	90.00	No Ice	8.40	4.12	0.02
(Verizon - Proposed)			0.00				1/2" Ice	8.95	4.56	0.06
			0.00							
DB846H80E-SX	B	From Leg	4.00		0.0000	90.00	No Ice	5.09	6.06	0.02
(Verizon - Proposed)			6.00				1/2" Ice	5.55	6.52	0.05
			0.00							
DB844G65ZAXY	C	From Leg	4.00		0.0000	90.00	No Ice	4.67	3.73	0.02
(Verizon - Proposed)			-6.00				1/2" Ice	5.05	4.10	0.05
			0.00							
MG D3-800T0	C	From Leg	3.00		0.0000	90.00	No Ice	3.45	2.22	0.02
(Verizon - Proposed)			-4.00				1/2" Ice	3.80	2.55	0.04
			0.00							
BXA-70063/4CF	C	From Leg	3.00		0.0000	90.00	No Ice	5.16	2.44	0.01
(Verizon - Proposed)			0.00				1/2" Ice	5.55	2.74	0.04
			0.00							
DB844G65ZAXY	C	From Leg	4.00		0.0000	90.00	No Ice	4.67	3.73	0.02
(Verizon - Proposed)			6.00				1/2" Ice	5.05	4.10	0.05
			0.00							
EEI Standard Platform	C	None			0.0000	90.00	No Ice	30.00	30.00	1.60
(Verizon - Existing)							1/2" Ice	35.00	35.00	2.00
(4) 4' Panel	A	From Face	3.00		0.0000	78.00	No Ice	1.92	3.26	0.01
(Nextel - Existing)			0.00				1/2" Ice	2.22	3.62	0.03
			0.00							
(4) 4' Panel	B	From Face	3.00		0.0000	78.00	No Ice	1.92	3.26	0.01
(Nextel - Existing)			0.00				1/2" Ice	2.22	3.62	0.03
			0.00							
(4) 4' Panel	C	From Face	3.00		0.0000	78.00	No Ice	1.92	3.26	0.01
(Nextel - Existing)			0.00				1/2" Ice	2.22	3.62	0.03
			0.00							
EEI Low Profile Platform	C	None			0.0000	78.00	No Ice	22.50	22.50	1.50
(Nextel - Existing)							1/2" Ice	28.20	28.20	2.25

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 111.00-97.00	103.78	1.387	26	18.667	A	0.000	18.667	18.667	100.00	0.000	4.752
					B	0.000	18.667		100.00	0.000	0.000
					C	0.000	18.667		100.00	0.000	1.584
L2 97.00-47.00	70.70	1.243	23	94.750	A	0.000	94.750	94.750	100.00	0.000	28.512
					B	0.000	94.750		100.00	0.000	6.336
					C	0.000	94.750		100.00	0.000	19.800
L3 47.00-21.00	33.58	1.005	19	66.011	A	0.000	66.011	66.011	100.00	0.000	15.444
					B	0.000	66.011		100.00	0.000	5.148
					C	0.000	66.011		100.00	0.000	10.296

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
L4 21.00-1.00	10.83	1	18	58.660	A	0.000	58.660	58.660	100.00	0.000	2.970
					B	0.000	58.660		100.00	0.000	0.990
					C	0.000	58.660		100.00	0.000	1.980

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		ft^2	ft^2	ft^2		ft^2	ft^2
L1 111.00-97.00	103.78	1.387	19	0.5000	19.833	A	0.000	19.833	19.833	100.00	0.000	7.152
						B	0.000	19.833		100.00	0.000	0.000
						C	0.000	19.833		100.00	0.000	2.384
L2 97.00-47.00	70.70	1.243	17	0.5000	98.917	A	0.000	98.917	98.917	100.00	0.000	42.911
						B	0.000	98.917		100.00	0.000	9.536
						C	0.000	98.917		100.00	0.000	29.800
L3 47.00-21.00	33.58	1.005	14	0.5000	68.178	A	0.000	68.178	68.178	100.00	0.000	23.244
						B	0.000	68.178		100.00	0.000	7.748
						C	0.000	68.178		100.00	0.000	15.496
L4 21.00-1.00	10.83	1	14	0.5000	60.327	A	0.000	60.327	60.327	100.00	0.000	4.470
						B	0.000	60.327		100.00	0.000	1.490
						C	0.000	60.327		100.00	0.000	2.980

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		ft^2	ft^2	ft^2		ft^2	ft^2
L1 111.00-97.00	103.78	1.387	9	18.667	A	0.000	18.667	18.667	100.00	0.000	4.752
					B	0.000	18.667		100.00	0.000	0.000
					C	0.000	18.667		100.00	0.000	1.584
L2 97.00-47.00	70.70	1.243	8	94.750	A	0.000	94.750	94.750	100.00	0.000	28.512
					B	0.000	94.750		100.00	0.000	6.336
					C	0.000	94.750		100.00	0.000	19.800
L3 47.00-21.00	33.58	1.005	6	66.011	A	0.000	66.011	66.011	100.00	0.000	15.444
					B	0.000	66.011		100.00	0.000	5.148
					C	0.000	66.011		100.00	0.000	10.296
L4 21.00-1.00	10.83	1	6	58.660	A	0.000	58.660	58.660	100.00	0.000	2.970
					B	0.000	58.660		100.00	0.000	0.990
					C	0.000	58.660		100.00	0.000	1.980

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.75	53.74	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.47	3.04	A	1	0.65	1	1	1	94.750	4.49	89.83	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.46	3.01	A	1	0.65	1	1	1	66.011	2.32	89.17	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.28	3.01	A	1	0.65	1	1	1	58.660	1.38	68.88	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	4.41	9.93						OTM	479.46 kip-ft	8.94		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.75	53.74	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.47	3.04	A	1	0.65	1	1	1	94.750	4.49	89.83	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.46	3.01	A	1	0.65	1	1	1	66.011	2.32	89.17	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.28	3.01	A	1	0.65	1	1	1	58.660	1.38	68.88	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	4.41	9.93						OTM	479.46 kip-ft	8.94		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.75	53.74	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.47	3.04	A	1	0.65	1	1	1	94.750	4.49	89.83	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.46	3.01	A	1	0.65	1	1	1	66.011	2.32	89.17	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L4 21.00-1.00	0.28	3.01	A	1	0.65	1	1	1	58.660	1.38	68.88	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	4.41	9.93						OTM	479.46 kip-ft	8.94		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.75	53.74	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.47	3.04	A	1	0.65	1	1	1	94.750	4.49	89.83	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.46	3.01	A	1	0.65	1	1	1	66.011	2.32	89.17	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.28	3.01	A	1	0.65	1	1	1	58.660	1.38	68.88	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	4.41	9.93						OTM	479.46 kip-ft	8.94		

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 111.00-97.00	0.49	1.02	A	1	0.59	1	1	1	19.833	0.69	49.34	C
			B	1	0.59	1	1	1	19.833			
			C	1	0.59	1	1	1	19.833			
L2 97.00-47.00	4.97	3.75	A	1	0.65	1	1	1	98.917	4.25	84.94	C
			B	1	0.65	1	1	1	98.917			
			C	1	0.65	1	1	1	98.917			
L3 47.00-21.00	2.87	3.50	A	1	0.65	1	1	1	68.178	2.14	82.29	C
			B	1	0.65	1	1	1	68.178			
			C	1	0.65	1	1	1	68.178			
L4 21.00-1.00	0.55	3.45	A	1	0.65	1	1	1	60.327	1.13	56.44	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	8.89	11.72						OTM	447.81 kip-ft	8.21		

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 111.00-97.00	0.49	1.02	A	1	0.59	1	1	1	19.833	0.69	49.34	C
			B	1	0.59	1	1	1	19.833			
			C	1	0.59	1	1	1	19.833			
L2 97.00-47.00	4.97	3.75	A	1	0.65	1	1	1	98.917	4.25	84.94	C
			B	1	0.65	1	1	1	98.917			
			C	1	0.65	1	1	1	98.917			
L3 47.00-21.00	2.87	3.50	A	1	0.65	1	1	1	68.178	2.14	82.29	C
			B	1	0.65	1	1	1	68.178			
			C	1	0.65	1	1	1	68.178			
L4 21.00-1.00	0.55	3.45	A	1	0.65	1	1	1	60.327	1.13	56.44	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	8.89	11.72						OTM	447.81 kip-ft	8.21		

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 111.00-97.00	0.49	1.02	A	1	0.59	1	1	1	19.833	0.69	49.34	C
			B	1	0.59	1	1	1	19.833			
			C	1	0.59	1	1	1	19.833			
L2 97.00-47.00	4.97	3.75	A	1	0.65	1	1	1	98.917	4.25	84.94	C
			B	1	0.65	1	1	1	98.917			
			C	1	0.65	1	1	1	98.917			
L3 47.00-21.00	2.87	3.50	A	1	0.65	1	1	1	68.178	2.14	82.29	C
			B	1	0.65	1	1	1	68.178			
			C	1	0.65	1	1	1	68.178			
L4 21.00-1.00	0.55	3.45	A	1	0.65	1	1	1	60.327	1.13	56.44	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	8.89	11.72						OTM	447.81 kip-ft	8.21		

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 111.00-97.00	0.49	1.02	A	1	0.59	1	1	1	19.833	0.69	49.34	C
			B	1	0.59	1	1	1	19.833			
			C	1	0.59	1	1	1	19.833			
L2 97.00-47.00	4.97	3.75	A	1	0.65	1	1	1	98.917	4.25	84.94	C
			B	1	0.65	1	1	1	98.917			
			C	1	0.65	1	1	1	98.917			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L3 47.00-21.00	2.87	3.50	A	1	0.65	1	1	1	68.178	2.14	82.29	C
			B	1	0.65	1	1	1	68.178			
			C	1	0.65	1	1	1	68.178			
L4 21.00-1.00	0.55	3.45	A	1	0.65	1	1	1	60.327	1.13	56.44	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	8.89	11.72						OTM	447.81 kip-ft	8.21		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.26	18.59	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.47	3.04	A	1	0.65	1	1	1	94.750	1.55	31.08	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.46	3.01	A	1	0.65	1	1	1	66.011	0.80	30.85	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.28	3.01	A	1	0.65	1	1	1	58.660	0.48	23.83	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	4.41	9.93						OTM	165.90 kip-ft	3.09		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.26	18.59	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.47	3.04	A	1	0.65	1	1	1	94.750	1.55	31.08	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.46	3.01	A	1	0.65	1	1	1	66.011	0.80	30.85	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.28	3.01	A	1	0.65	1	1	1	58.660	0.48	23.83	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	4.41	9.93						OTM	165.90 kip-ft	3.09		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.26	18.59	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.47	3.04	A	1	0.65	1	1	1	94.750	1.55	31.08	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.46	3.01	A	1	0.65	1	1	1	66.011	0.80	30.85	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.28	3.01	A	1	0.65	1	1	1	58.660	0.48	23.83	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	4.41	9.93						OTM	165.90 kip-ft	3.09		

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 111.00-97.00	0.20	0.88	A	1	0.59	1	1	1	18.667	0.26	18.59	C
			B	1	0.59	1	1	1	18.667			
			C	1	0.59	1	1	1	18.667			
L2 97.00-47.00	2.47	3.04	A	1	0.65	1	1	1	94.750	1.55	31.08	C
			B	1	0.65	1	1	1	94.750			
			C	1	0.65	1	1	1	94.750			
L3 47.00-21.00	1.46	3.01	A	1	0.65	1	1	1	66.011	0.80	30.85	C
			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L4 21.00-1.00	0.28	3.01	A	1	0.65	1	1	1	58.660	0.48	23.83	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	4.41	9.93						OTM	165.90 kip-ft	3.09		

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	9.93					
Bracing Weight	0.00					
Total Member Self-Weight	9.93			-0.94	0.55	
Total Weight	20.89			-0.94	0.55	

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 0 deg - No Ice		0.04	-18.98	-1405.61	-3.05	0.91
Wind 30 deg - No Ice		9.55	-16.46	-1219.22	-706.98	0.39
Wind 45 deg - No Ice		13.49	-13.45	-996.73	-998.18	0.08
Wind 60 deg - No Ice		16.50	-9.53	-706.39	-1221.33	-0.24
Wind 90 deg - No Ice		19.03	-0.04	-4.54	-1408.27	-0.80
Wind 120 deg - No Ice		16.46	9.46	698.28	-1217.73	-1.14
Wind 135 deg - No Ice		13.43	13.40	989.77	-993.10	-1.20
Wind 150 deg - No Ice		9.48	16.42	1213.74	-700.75	-1.18
Wind 180 deg - No Ice		-0.04	18.98	1403.73	4.15	-0.91
Wind 210 deg - No Ice		-9.55	16.46	1217.34	708.08	-0.39
Wind 225 deg - No Ice		-13.49	13.45	994.86	999.28	-0.08
Wind 240 deg - No Ice		-16.50	9.53	704.51	1222.43	0.24
Wind 270 deg - No Ice		-19.03	0.04	2.66	1409.37	0.80
Wind 300 deg - No Ice		-16.46	-9.46	-700.16	1218.83	1.14
Wind 315 deg - No Ice		-13.43	-13.40	-991.64	994.19	1.20
Wind 330 deg - No Ice		-9.48	-16.42	-1215.62	701.84	1.18
Member Ice	1.80					
Total Weight Ice	29.83			-2.33	1.29	
Wind 0 deg - Ice		0.03	-16.93	-1254.68	-1.43	0.66
Wind 30 deg - Ice		8.51	-14.68	-1088.25	-628.81	0.22
Wind 45 deg - Ice		12.02	-11.99	-889.80	-888.40	-0.03
Wind 60 deg - Ice		14.71	-8.49	-630.86	-1087.35	-0.28
Wind 90 deg - Ice		16.96	-0.03	-5.05	-1254.20	-0.70
Wind 120 deg - Ice		14.68	8.44	621.49	-1084.63	-0.94
Wind 135 deg - Ice		11.97	11.95	881.29	-884.55	-0.97
Wind 150 deg - Ice		8.46	14.64	1080.87	-624.09	-0.93
Wind 180 deg - Ice		-0.03	16.93	1250.02	4.02	-0.66
Wind 210 deg - Ice		-8.51	14.68	1083.60	631.40	-0.22
Wind 225 deg - Ice		-12.02	11.99	885.14	890.99	0.03
Wind 240 deg - Ice		-14.71	8.49	626.20	1089.94	0.28
Wind 270 deg - Ice		-16.96	0.03	0.39	1256.78	0.70
Wind 300 deg - Ice		-14.68	-8.44	-626.14	1087.22	0.94
Wind 315 deg - Ice		-11.97	-11.95	-885.95	887.13	0.97
Wind 330 deg - Ice		-8.46	-14.64	-1085.53	626.68	0.93
Total Weight	20.89			-0.94	0.55	
Wind 0 deg - Service		0.01	-6.57	-486.06	-1.28	0.31
Wind 30 deg - Service		3.30	-5.70	-421.57	-244.85	0.13
Wind 45 deg - Service		4.67	-4.65	-344.58	-345.62	0.03
Wind 60 deg - Service		5.71	-3.30	-244.12	-422.83	-0.08
Wind 90 deg - Service		6.59	-0.01	-1.26	-487.52	-0.28
Wind 120 deg - Service		5.70	3.27	241.92	-421.58	-0.40
Wind 135 deg - Service		4.65	4.64	342.79	-343.85	-0.42
Wind 150 deg - Service		3.28	5.68	420.29	-242.70	-0.41
Wind 180 deg - Service		-0.01	6.57	486.03	1.21	-0.31
Wind 210 deg - Service		-3.30	5.70	421.53	244.79	-0.13
Wind 225 deg - Service		-4.67	4.65	344.55	345.55	-0.03
Wind 240 deg - Service		-5.71	3.30	244.08	422.76	0.08
Wind 270 deg - Service		-6.59	0.01	1.23	487.45	0.28
Wind 300 deg - Service		-5.70	-3.27	-241.96	421.52	0.40
Wind 315 deg - Service		-4.65	-4.64	-342.82	343.79	0.42
Wind 330 deg - Service		-3.28	-5.68	-420.32	242.63	0.41

Load Combinations

Comb. No.	Description

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
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	111 - 97	Pole	Max Tension	47	0.00	-0.00	-0.00
			Max. Compression	18	-5.56	0.08	0.21
			Max. Mx	14	-3.64	33.79	0.08

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	2	-3.65	0.02	33.84
			Max. Vy	14	-5.52	33.79	0.08
			Max. Vx	2	-5.52	0.02	33.84
			Max. Torque	22			0.02
L2	97 - 47	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-18.69	0.76	1.44
			Max. Mx	14	-11.79	587.82	-1.12
			Max. My	2	-11.80	-1.33	586.14
			Max. Vy	14	-15.61	587.82	-1.12
			Max. Vx	2	-15.56	-1.33	586.14
			Max. Torque	9			1.19
L3	47 - 21	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-25.83	1.28	2.31
			Max. Mx	14	-17.25	1092.55	-2.01
			Max. My	2	-17.26	-2.38	1089.56
			Max. Vy	14	-17.99	1092.55	-2.01
			Max. Vx	2	-17.95	-2.38	1089.56
			Max. Torque	8			1.19
L4	21 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-29.83	1.37	2.47
			Max. Mx	14	-20.88	1462.66	-2.77
			Max. My	2	-20.88	-3.16	1458.76
			Max. Vy	14	-19.04	1462.66	-2.77
			Max. Vx	2	-18.99	-3.16	1458.76
			Max. Torque	8			1.19

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	29.83	16.96	-0.03
	Max. H_x	14	20.89	19.03	-0.04
	Max. H_z	2	20.89	-0.04	18.98
	Max. M_x	2	1458.76	-0.04	18.98
	Max. M_z	6	1461.52	-19.03	0.04
	Max. Torsion	8	1.19	-13.43	-13.40
	Min. Vert	1	20.89	0.00	0.00
	Min. H_x	6	20.89	-19.03	0.04
	Min. H_z	10	20.89	0.04	-18.98
	Min. M_x	10	-1456.80	0.04	-18.98
	Min. M_z	14	-1462.66	19.03	-0.04
	Min. Torsion	16	-1.19	13.43	13.40

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	20.89	0.00	0.00	-0.95	0.55	-0.00
Dead+Wind 0 deg - No Ice	20.89	0.04	-18.98	-1458.76	-3.16	0.90
Dead+Wind 30 deg - No Ice	20.89	9.55	-16.46	-1265.32	-733.71	0.38
Dead+Wind 45 deg - No Ice	20.89	13.49	-13.45	-1034.43	-1035.92	0.08

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 60 deg - No Ice	20.89	16.50	-9.53	-733.11	-1267.50	-0.23
Dead+Wind 90 deg - No Ice	20.89	19.03	-0.04	-4.72	-1461.52	-0.79
Dead+Wind 120 deg - No Ice	20.89	16.46	9.46	724.68	-1263.77	-1.13
Dead+Wind 135 deg - No Ice	20.89	13.43	13.40	1027.19	-1030.64	-1.19
Dead+Wind 150 deg - No Ice	20.89	9.48	16.42	1259.64	-727.23	-1.17
Dead+Wind 180 deg - No Ice	20.89	-0.04	18.98	1456.80	4.33	-0.89
Dead+Wind 210 deg - No Ice	20.89	-9.55	16.46	1263.35	734.87	-0.38
Dead+Wind 225 deg - No Ice	20.89	-13.49	13.45	1032.46	1037.07	-0.08
Dead+Wind 240 deg - No Ice	20.89	-16.50	9.53	731.14	1268.65	0.23
Dead+Wind 270 deg - No Ice	20.89	-19.03	0.04	2.77	1462.66	0.79
Dead+Wind 300 deg - No Ice	20.89	-16.46	-9.46	-726.62	1264.93	1.13
Dead+Wind 315 deg - No Ice	20.89	-13.43	-13.40	-1029.14	1031.80	1.19
Dead+Wind 330 deg - No Ice	20.89	-9.48	-16.42	-1261.59	728.40	1.17
Dead+Ice+Temp	29.83	-0.00	-0.00	-2.47	1.37	0.00
Dead+Wind 0 deg+Ice+Temp	29.83	0.03	-16.93	-1326.01	-1.49	0.66
Dead+Wind 30 deg+Ice+Temp	29.83	8.51	-14.68	-1150.13	-664.52	0.22
Dead+Wind 45 deg+Ice+Temp	29.83	12.02	-11.99	-940.40	-938.86	-0.03
Dead+Wind 60 deg+Ice+Temp	29.83	14.71	-8.49	-666.75	-1149.13	-0.28
Dead+Wind 90 deg+Ice+Temp	29.83	16.96	-0.03	-5.38	-1325.45	-0.70
Dead+Wind 120 deg+Ice+Temp	29.83	14.68	8.44	656.77	-1146.25	-0.94
Dead+Wind 135 deg+Ice+Temp	29.83	11.97	11.95	931.34	-934.79	-0.96
Dead+Wind 150 deg+Ice+Temp	29.83	8.46	14.64	1142.27	-659.53	-0.92
Dead+Wind 180 deg+Ice+Temp	29.83	-0.03	16.93	1321.01	4.28	-0.66
Dead+Wind 210 deg+Ice+Temp	29.83	-8.51	14.68	1145.13	667.31	-0.22
Dead+Wind 225 deg+Ice+Temp	29.83	-12.02	11.99	935.39	941.64	0.03
Dead+Wind 240 deg+Ice+Temp	29.83	-14.71	8.49	661.74	1151.90	0.28
Dead+Wind 270 deg+Ice+Temp	29.83	-16.96	0.03	0.39	1328.22	0.70
Dead+Wind 300 deg+Ice+Temp	29.83	-14.68	-8.44	-661.75	1149.02	0.94
Dead+Wind 315 deg+Ice+Temp	29.83	-11.97	-11.95	-936.32	937.57	0.96
Dead+Wind 330 deg+Ice+Temp	29.83	-8.46	-14.64	-1147.25	662.32	0.92
Dead+Wind 0 deg - Service	20.89	0.01	-6.57	-506.14	-0.72	0.31
Dead+Wind 30 deg - Service	20.89	3.30	-5.70	-439.12	-253.87	0.13
Dead+Wind 45 deg - Service	20.89	4.67	-4.65	-359.11	-358.60	0.03
Dead+Wind 60 deg - Service	20.89	5.71	-3.30	-254.69	-438.85	-0.08
Dead+Wind 90 deg - Service	20.89	6.59	-0.01	-2.28	-506.08	-0.28
Dead+Wind 120 deg - Service	20.89	5.70	3.27	250.47	-437.55	-0.40
Dead+Wind 135 deg - Service	20.89	4.65	4.64	355.30	-356.77	-0.42
Dead+Wind 150 deg - Service	20.89	3.28	5.68	435.85	-251.63	-0.41
Dead+Wind 180 deg - Service	20.89	-0.01	6.57	504.17	1.88	-0.31
Dead+Wind 210 deg - Service	20.89	-3.30	5.70	437.14	255.03	-0.13
Dead+Wind 225 deg - Service	20.89	-4.67	4.65	357.13	359.75	-0.03
Dead+Wind 240 deg - Service	20.89	-5.71	3.30	252.72	440.00	0.08
Dead+Wind 270 deg - Service	20.89	-6.59	0.01	0.31	507.23	0.28
Dead+Wind 300 deg - Service	20.89	-5.70	-3.27	-252.44	438.71	0.40
Dead+Wind 315 deg - Service	20.89	-4.65	-4.64	-357.27	357.92	0.42
Dead+Wind 330 deg - Service	20.89	-3.28	-5.68	-437.82	252.78	0.41

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	-20.89	0.00	0.00	20.89	0.00	0.000%
2	0.04	-20.89	-18.98	-0.04	20.89	18.98	0.000%
3	9.55	-20.89	-16.46	-9.55	20.89	16.46	0.000%
4	13.49	-20.89	-13.45	-13.49	20.89	13.45	0.000%
5	16.50	-20.89	-9.53	-16.50	20.89	9.53	0.000%
6	19.03	-20.89	-0.04	-19.03	20.89	0.04	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
7	16.46	-20.89	9.46	-16.46	20.89	-9.46	0.000%
8	13.43	-20.89	13.40	-13.43	20.89	-13.40	0.000%
9	9.48	-20.89	16.42	-9.48	20.89	-16.42	0.000%
10	-0.04	-20.89	18.98	0.04	20.89	-18.98	0.000%
11	-9.55	-20.89	16.46	9.55	20.89	-16.46	0.000%
12	-13.49	-20.89	13.45	13.49	20.89	-13.45	0.000%
13	-16.50	-20.89	9.53	16.50	20.89	-9.53	0.000%
14	-19.03	-20.89	0.04	19.03	20.89	-0.04	0.000%
15	-16.46	-20.89	-9.46	16.46	20.89	9.46	0.000%
16	-13.43	-20.89	-13.40	13.43	20.89	13.40	0.000%
17	-9.48	-20.89	-16.42	9.48	20.89	16.42	0.000%
18	0.00	-29.83	0.00	0.00	29.83	0.00	0.000%
19	0.03	-29.83	-16.93	-0.03	29.83	16.93	0.000%
20	8.51	-29.83	-14.68	-8.51	29.83	14.68	0.000%
21	12.02	-29.83	-11.99	-12.02	29.83	11.99	0.000%
22	14.71	-29.83	-8.49	-14.71	29.83	8.49	0.000%
23	16.96	-29.83	-0.03	-16.96	29.83	0.03	0.000%
24	14.68	-29.83	8.44	-14.68	29.83	-8.44	0.000%
25	11.97	-29.83	11.95	-11.97	29.83	-11.95	0.000%
26	8.46	-29.83	14.64	-8.46	29.83	-14.64	0.000%
27	-0.03	-29.83	16.93	0.03	29.83	-16.93	0.000%
28	-8.51	-29.83	14.68	8.51	29.83	-14.68	0.000%
29	-12.02	-29.83	11.99	12.02	29.83	-11.99	0.000%
30	-14.71	-29.83	8.49	14.71	29.83	-8.49	0.000%
31	-16.96	-29.83	0.03	16.96	29.83	-0.03	0.000%
32	-14.68	-29.83	-8.44	14.68	29.83	8.44	0.000%
33	-11.97	-29.83	-11.95	11.97	29.83	11.95	0.000%
34	-8.46	-29.83	-14.64	8.46	29.83	14.64	0.000%
35	0.01	-20.89	-6.57	-0.01	20.89	6.57	0.000%
36	3.30	-20.89	-5.70	-3.30	20.89	5.70	0.000%
37	4.67	-20.89	-4.65	-4.67	20.89	4.65	0.000%
38	5.71	-20.89	-3.30	-5.71	20.89	3.30	0.000%
39	6.59	-20.89	-0.01	-6.59	20.89	0.01	0.000%
40	5.70	-20.89	3.27	-5.70	20.89	-3.27	0.000%
41	4.65	-20.89	4.64	-4.65	20.89	-4.64	0.000%
42	3.28	-20.89	5.68	-3.28	20.89	-5.68	0.000%
43	-0.01	-20.89	6.57	0.01	20.89	-6.57	0.000%
44	-3.30	-20.89	5.70	3.30	20.89	-5.70	0.000%
45	-4.67	-20.89	4.65	4.67	20.89	-4.65	0.000%
46	-5.71	-20.89	3.30	5.71	20.89	-3.30	0.000%
47	-6.59	-20.89	0.01	6.59	20.89	-0.01	0.000%
48	-5.70	-20.89	-3.27	5.70	20.89	3.27	0.000%
49	-4.65	-20.89	-4.64	4.65	20.89	4.64	0.000%
50	-3.28	-20.89	-5.68	3.28	20.89	5.68	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	5	0.00000001	0.00012870
3	Yes	6	0.00000001	0.00008051
4	Yes	6	0.00000001	0.00008381
5	Yes	6	0.00000001	0.00007912
6	Yes	5	0.00000001	0.00010167
7	Yes	6	0.00000001	0.00007404

8	Yes	6	0.00000001	0.00008347
9	Yes	6	0.00000001	0.00008245
10	Yes	5	0.00000001	0.00010459
11	Yes	6	0.00000001	0.00007681
12	Yes	6	0.00000001	0.00008372
13	Yes	6	0.00000001	0.00007814
14	Yes	5	0.00000001	0.00007766
15	Yes	6	0.00000001	0.00008242
16	Yes	6	0.00000001	0.00008383
17	Yes	6	0.00000001	0.00007407
18	Yes	4	0.00000001	0.00003029
19	Yes	5	0.00000001	0.00056675
20	Yes	6	0.00000001	0.00026587
21	Yes	6	0.00000001	0.00029248
22	Yes	6	0.00000001	0.00026404
23	Yes	5	0.00000001	0.00056202
24	Yes	6	0.00000001	0.00024896
25	Yes	6	0.00000001	0.00028827
26	Yes	6	0.00000001	0.00026761
27	Yes	5	0.00000001	0.00055136
28	Yes	6	0.00000001	0.00025784
29	Yes	6	0.00000001	0.00029119
30	Yes	6	0.00000001	0.00025960
31	Yes	5	0.00000001	0.00054999
32	Yes	6	0.00000001	0.00027076
33	Yes	6	0.00000001	0.00029204
34	Yes	6	0.00000001	0.00025208
35	Yes	4	0.00000001	0.00046897
36	Yes	5	0.00000001	0.00013959
37	Yes	5	0.00000001	0.00015299
38	Yes	5	0.00000001	0.00013486
39	Yes	4	0.00000001	0.00037232
40	Yes	5	0.00000001	0.00011820
41	Yes	5	0.00000001	0.00015164
42	Yes	5	0.00000001	0.00014637
43	Yes	4	0.00000001	0.00043707
44	Yes	5	0.00000001	0.00012690
45	Yes	5	0.00000001	0.00015216
46	Yes	5	0.00000001	0.00013093
47	Yes	4	0.00000001	0.00034470
48	Yes	5	0.00000001	0.00014764
49	Yes	5	0.00000001	0.00015459
50	Yes	5	0.00000001	0.00011999

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	111 - 97	27.419	37	2.0755	0.0071
L2	97 - 47	21.354	37	2.0520	0.0071
L3	51 - 21	5.413	37	1.0718	0.0018
L4	21 - 1	0.777	37	0.3720	0.0005

Critical Deflections and Radius of Curvature - Service Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
108.00	800-10504	37	26.106	2.0769	0.0071	16332
100.00	(2) 7770.00	37	22.634	2.0664	0.0071	7438
99.00	EEI Standard Platform	37	22.205	2.0625	0.0071	6848
90.00	DB846H80E-SX	37	18.444	1.9868	0.0066	4537
78.00	(4) 4' Panel	37	13.774	1.7852	0.0053	3283

Maximum Tower Deflections - Design Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	111 - 97	78.860	5	5.9766	0.0202
L2	97 - 47	61.444	5	5.9094	0.0202
L3	51 - 21	15.603	13	3.0898	0.0050
L4	21 - 1	2.240	13	1.0731	0.0013

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
108.00	800-10504	5	75.089	5.9818	0.0204	5818
100.00	(2) 7770.00	5	65.119	5.9526	0.0204	2649
99.00	EEI Standard Platform	5	63.889	5.9408	0.0204	2438
90.00	DB846H80E-SX	5	53.083	5.7119	0.0190	1608
78.00	(4) 4' Panel	13	39.658	5.1080	0.0151	1158

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L_u	Kl/r	F_a	A	Actual P	Allow. P_a	Ratio $\frac{P}{P_a}$
	ft		ft	ft		ksi	in^2	K	K	
L1	111 - 97 (1)	TP17.5x14.5x0.375	14.00	0.00	0.0	25.200	20.1647	-3.65	508.15	0.007
L2	97 - 47 (2)	TP27.98x17.5x0.25	50.00	0.00	0.0	39.000	21.3385	-11.79	832.20	0.014
L3	47 - 21 (3)	TP33.392x26.6416x0.3125	30.00	0.00	0.0	39.000	32.8107	-17.25	1279.62	0.013
L4	21 - 1 (4)	TP37x33.392x0.4	20.00	0.00	0.0	39.000	46.4674	-20.88	1812.23	0.012

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	111 - 97 (1)	TP17.5x14.5x0.375	33.84	-4.801	27.720	0.173	0.00	0.000	27.720	0.000
L2	97 - 47 (2)	TP27.98x17.5x0.25	588.46	-49.942	39.000	1.281	0.00	0.000	39.000	0.000
L3	47 - 21 (3)	TP33.392x26.6416x0.3125	1093.70	-49.081	39.000	1.258	0.00	0.000	39.000	0.000
L4	21 - 1 (4)	TP37x33.392x0.4	1464.25	-41.997	39.000	1.077	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	111 - 97 (1)	TP17.5x14.5x0.375	0.007	0.173	0.000	0.180 ✓	1.333	H1-3 ✓
L2	97 - 47 (2)	TP27.98x17.5x0.25	0.014	1.281	0.000	1.295 ✓	1.333	H1-3 ✓
L3	47 - 21 (3)	TP33.392x26.6416x0.3125	0.013	1.258	0.000	1.272 ✓	1.333	H1-3 ✓
L4	21 - 1 (4)	TP37x33.392x0.4	0.012	1.077	0.000	1.088 ✓	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	111 - 97	Pole	TP17.5x14.5x0.375	1	-3.65	677.36	13.5	Pass
L2	97 - 47	Pole	TP27.98x17.5x0.25	2	-11.79	1109.32	97.1	Pass
L3	47 - 21	Pole	TP33.392x26.6416x0.3125	3	-17.25	1705.73	95.4	Pass
L4	21 - 1	Pole	TP37x33.392x0.4	4	-20.88	2415.70	81.6	Pass
							Summary	
						Pole (L2)	97.1	Pass
						RATING =	**97.1**	**Pass**

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

Subject: Anchor Bolt and Baseplate Analysis

Location: 96-ft EEI Monopole
Danbury, CT

Rev. 0: 3/2/10

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 10001. CO41

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 1464·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 19·kips	(Input From RisaTower)
Axial Force =	Axial := 21·kips	(Input From RisaTower)

Existing Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 8	(User Input)
Diameter of Bolt Circle =	D_{bc} := 45.00·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strength =	F_u := 100·ksi	(User Input)
Bolt Yield Strength =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Proposed Anchor Bolt Data:

Use ASTM A193 GR.B7

Number of Anchor Bolts =	N2 := 3	(User Input)
Diameter of Bolt Circle =	D_{bc2} := 59.00·in	(User Input)
Bolt "Column" Distance =	l2 := 8.0·in	(User Input)
Bolt Ultimate Strenght =	F_{u2} := 115·ksi	(User Input)
Bolt Yield Strenght =	F_{y2} := 95·ksi	(User Input)
Bolt Modulus =	E2 := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D2 := 2.75·in	(User Input)
Threads per Inch =	n2 := 4.0	(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} := 51.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 37·in	(User Input)

NATCOMM ENG. CONSULTING ENGINEERS
p: 203.488.0580 f: 203.488.8587 www.natcomm.com
63-2 N. Branford Rd., Branford, CT 06405

Subject:	Anchor Bolt and Baseplate Analysis
Location:	96-ft EEI Monopole Danbury, CT
Rev. 0: 3/2/10	Prepared by: T.J.L. Checked by: C.F.C. Job No. 10001. CO41

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Distance to Bolts =

$d_1 := 14.75 \cdot in$ (User Input)

$d_2 := 15.9375 \cdot in$ (User Input)

$d_3 := 22.5 \cdot in$ (User Input)

$d_4 := 29.5 \cdot in$ (User Input)

Number of Bolts per Group =

$N_1 := 2$ (User Input)

$N_2 := 4$ (User Input)

$N_3 := 2$ (User Input)

$N_4 := 1$ (User Input)

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 18.5 \cdot in$$

Moment Arms of Bolts about Neutral Axis =

$MA_1 := 0 \cdot in$ (User Input)

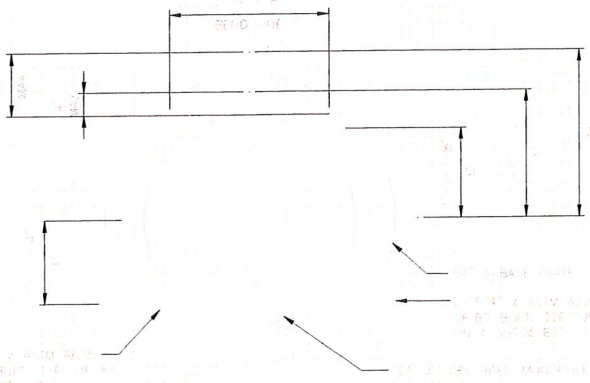
$MA_2 := 0 \cdot in$ (User Input)

$MA_3 := 4 \cdot in$ (User Input)

$MA_4 := 11 \cdot in$ (User Input)

Effective Width of Baseplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 28.1 \cdot in$$



Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Existing Anchor Bolts:

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

Proposed Anchor Bolts:

Gross Area of Bolt = $A_{g2} := \frac{\pi}{4} \cdot D2^2 = 5.94 \cdot in^2$

Net Area of Bolt = $A_{n2} := \frac{\pi}{4} \cdot \left(D2 - \frac{0.9743 \cdot in}{n2} \right)^2 = 4.934 \cdot in^2$

Net Diameter = $D_{n2} := \frac{2 \cdot \sqrt{A_{n2}}}{\sqrt{\pi}} = 2.506 \cdot in$

Radius of Gyration of Bolt = $r2 := \frac{D_{n2}}{4} = 0.627 \cdot in$

Section Modulus of Bolt = $S_{x2} := \frac{\pi \cdot D_{n2}^3}{32} = 1.546 \cdot in^3$

Total Polar Moment of Inertia = $I_p := d_1^2 \cdot N_1 + d_2^2 \cdot N_2 + d_3^2 \cdot N_3 + d_4^2 \cdot N_4 = 3333.9 \cdot in^2$

ASTM A615 GR. 65 Bolts:

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{d_3}{I_p} - \frac{Axial}{N + N2} = 116.7 \cdot kips$

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

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 59.9 \cdot \%$ 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 = $M_x := \left(\frac{Shear}{N + N2}\right) \cdot l = 0.432 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 6.3 \cdot ksi$

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 =

$$C_{Max} := OM \cdot \frac{d_3}{I_p} + \frac{Axial}{N} = 121.2 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 37.3 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 62.2 \cdot \%$$

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"

ASTM A193 Gr.B7 Bolts:

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max2} := OM \cdot \frac{d_4}{I_p} - \frac{Axial}{N + N2} = 153.5 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross2} := 1.333 \cdot (0.33 \cdot A_{g2} \cdot F_{u2}) = 300.5 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net2} := 1.333 \cdot (0.60 \cdot A_{n2} \cdot F_{y2}) = 374.89 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max2}}{T_{ALL.Net2}} = 41.0 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

Condition 3 = $Condition3 := if\left(\frac{T_{Max}}{T_{ALL.Net}} \le 1.00, "OK", "Overstressed"\right)$

Condition3 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_{x2} := \left(\frac{Shear}{N + N2}\right) \cdot l2 = 1.152 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx2} := \frac{M_{x2}}{S_{x2}} = 8.9 \cdot ksi$

Allowable Bending Stress = $F_{bx2} := 1.333 \cdot 0.6 \cdot F_{y2} = 76 \cdot ksi$ (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.

$l2 := \begin{cases} l2 & \text{if } l2 > 2 \cdot D_{n2} \\ 0 & \text{otherwise} \end{cases} = 8 \cdot in$

$f_{bx2} := \begin{cases} f_{bx2} & \text{if } l2 > 2 \cdot D_{n2} \\ 0 & \text{otherwise} \end{cases} = 8.9 \cdot ksi$

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max2} := OM \cdot \frac{d_4}{I_p} + \frac{Axial}{N} = 158.1 \cdot kips$$

Maximum Compressive Stress =

$$f_{a2} := \frac{C_{Max2}}{A_{n2}} = 32 \cdot ksi$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E2}{F_{y2}}} = 77.625$$

$$F_{a2} := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l2}{r2}\right)^2}{2 \cdot C_c^{\,2}}\right] \cdot F_{y2}}{\frac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l2}{r2}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l2}{r2}\right)^3}{8 \cdot C_c^{\,3}}} & \text{if } \dfrac{K l2}{r2} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E2}{23 \cdot \left(\frac{K \cdot l2}{r2}\right)^2} & \text{if } \dfrac{K \cdot l2}{r2} > C_c \end{cases} = 55.348 \cdot ksi$$

Allowable Compressive Stress =

$$F_{a2} := 1.333 \cdot F_{a2} = 73.8 \cdot ksi$$ (1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_{a2}}{F_{a2}} + \frac{f_{bx2}}{F_{bx2}}\right) = 55.2 \cdot \%$$

Condition 4 =

$$Condition4 := if\left(\frac{f_{a2}}{F_{a2}} + \frac{f_{bx2}}{F_{bx2}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$$

Condition4 = "OK"

Base Plate Analysis:

Note: Only the force from the original anchor bolts attribuites to the baseplate bending.
The proposed anchor bolts will be installed outside the edge of the baseplate.

Force from Bolts = $C_1 := T_{Max} = 116.655 \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \frac{6 \cdot (C_1 \cdot MA_3)}{(B_{eff} \cdot t_{bp}^2)} = 24.9 \cdot ksi$

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

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 41.6 \cdot \%$

Condition5 = $Condition5 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$

Condition5 = "Ok"

NATCOMM INC. CONSULTING ENGINEERS
ph:203.488.0580 fx:203.488.8587 www.natcomm.com
63-2 N. Branford Rd., Branford, CT 06405

Subject:	CAISSON FOUNDATION
Location:	96-ft EEI Monopole w/ 14-ft Extension Germantown, CT
Rev. 0: 3/3/10	Prepared by: TJL Checked by: C.F.C. Job No. 10001.CO41

Caisson Foundation:

Input Data:

Shear Force =	$S := 19k$	*USER INPUT-FROM RISATower*
Overturning Moment =	$M := 1454ft \cdot k$	*USER INPUT-FROM RISATower*
Applied Axial Load =	$A1 := 21k$	*USER INPUT-FROM RISATower*
Bending Moment =	$Mu := 1556ft \cdot k$	*USER INPUT--FROM LPILE*
Moment Capacity =	$Mn := 2666ft \cdot k$	*USER INPUT--FROM LPILE*
Foundation Diameter =	$d := 5.5ft$	*USER INPUT*
Overall Length of Caisson =	$L_c := 21.0ft$	*USER INPUT*
Depth From Top of Caisson to Grade =	$L_{pag} := 1.0ft$	*USER INPUT*
Number of Rebar =	$n := 24$	*USER INPUT*
Area of Rebar =	$Ar := 0.79in^2$	*USER INPUT*
Rebar Yield Strength =	$fy := 60ksi$	*USER INPUT*
Concrete Comp Strength =	$f'c := 3ksi$	*USER INPUT*

Check Foundation Depth:

Depth of Caisson Below Ground Level = $LD := L_c - L_{pag} = 20ft$ (TIA/EIA-222-F 7.2.5)

Depth Required = $LD1 := 2.0ft + \left(\frac{S \cdot ft^2}{3k \cdot d}\right) + 2ft \cdot .5\left(\frac{M \cdot ft}{3 \cdot kd} + \frac{S \cdot ft}{2k} + \frac{S^2 ft^3}{18k^2 d^2}\right)^{.5} = 22.98ft$

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

DepthCheck = "NO GOOD"

Note: Result not applicable. Actual soil is better than normal soil as defined in TIA/EIA 222 F. Refer to L-Pile analysis.

Check Moment Capacity:

Factor of Safety = $FS := \frac{Mn}{Mu} = 1.7$

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

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

FOSCheck = "OK"

Check Axial Capacity:

Concrete Weight = $A2 := .150\frac{k}{ft^3} \cdot LD \cdot \pi \frac{d^2}{4} = 71.3 \cdot kips$

Total Axial Load = $AT := A1 + A2 = 92.3 \cdot kips$

Area of Concrete = $Ag := \pi \cdot \frac{d^2}{4} = 23.76ft^2$

Axial Capacity = $Po := n \cdot Ar \cdot fy + (Ag - n \cdot Ar) \cdot 0.85 \cdot f'c = 9813.3 \cdot kips$

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

AxialCheck = "OK"

LPILE Plus for Windows, Version 5.0 (5.0.39)

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

This program is licensed to:

Staff
Natcomm, Inc.

Path to file locations: J:\Jobs\1000100.WI\CO41 - Germantown; 50 Newtown Rd, Danbury, CT\Calcs\MathCAD\Foundation\
Name of input data file: Germantown Caisson Analysis.lpd
Name of output file: Germantown Caisson Analysis.lpo
Name of plot output file: Germantown Caisson Analysis.lpp
Name of runtime file: Germantown Caisson Analysis.lpr

Time and Date of Analysis

Date: March 3, 2010 Time: 9:19:05

Problem Title

Germantown

Program Options

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

Basic Program Options:

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

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- Analysis includes computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-04 in
- Maximum allowable deflection = 1.0000E+02 in

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

Pile Structural Properties and Geometry

Pile Length = 252.00 in

Depth of ground surface below top of pile = 12.00 in

Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	66.00000000	931420.0000	3421.2000	3600000.
2	252.0000	66.00000000	931420.0000	3421.2000	3600000.

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

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 12.000 in
Distance from top of pile to bottom of layer = 48.000 in
p-y subgrade modulus k for top of soil layer = 1.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 1.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 48.000 in
Distance from top of pile to bottom of layer = 168.000 in
p-y subgrade modulus k for top of soil layer = 122.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 122.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 168.000 in
Distance from top of pile to bottom of layer = 360.000 in
p-y subgrade modulus k for top of soil layer = 100.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 100.000 lbs/in**3

(Depth of lowest layer extends 108.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	12.00	.05800
2	48.00	.05800
3	48.00	.07800
4	168.00	.07800
5	168.00	.04300
6	360.00	.04300

Shear Strength of Soils

Shear strength parameters with depth defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	12.000	.00000	28.00	------	------
2	48.000	.00000	28.00	------	------
3	48.000	.00000	38.00	------	------
4	168.000	.00000	38.00	------	------
5	168.000	.00000	38.00	------	------
6	360.000	.00000	38.00	------	------

Notes:

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

Loading Type

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

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)

Shear force at pile head = 19116.000 lbs
Bending moment at pile head = 17568000.000 in-lbs
Axial load at pile head = 21120.000 lbs

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

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Number of sections = 1

Pile Section No. 1

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

Outside Diameter = 66.0000 in

Material Properties:

Compressive Strength of Concrete	=	3.000 kip/in**2
Yield Stress of Reinforcement	=	60. kip/in**2
Modulus of Elasticity of Reinforcement	=	29000. kip/in**2
Number of Reinforcing Bars	=	24
Area of Single Bar	=	.79000 in**2
Number of Rows of Reinforcing Bars	=	13
Area of Steel	=	18.960 in**2
Area of Shaft	=	3421.194 in**2
Percentage of Steel Reinforcement	=	.554 percent
Cover Thickness (edge to bar center)	=	4.000 in

Unfactored Axial Squash Load Capacity = 9813.30 kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement in**2	Distance to Centroidal Axis in
1	.790	29.000
2	1.580	28.012
3	1.580	25.115
4	1.580	20.506
5	1.580	14.500
6	1.580	7.506
7	1.580	0.000
8	1.580	-7.506
9	1.580	-14.500
10	1.580	-20.506
11	1.580	-25.115
12	1.580	-28.012
13	.790	-29.000

Axial Thrust Force = 21120.00 lbs

Bending	Bending	Bending	Maximum	Neutral Axis	Max. Concrete

Max. Steel Moment in-lbs	Stiffness lb-in2	Curvature rad/in	Strain in/in	Position inches	Stress psi	Stress psi
2629051.	3.154862E+12	8.333333E-07	.00002948	35.37186831	90.57129115	758.15348
5230111.	3.138066E+12	.00000167	.00005708	34.24882847	173.81792	1462.02671
7803277.	3.121311E+12	.00000250	.00008472	33.88985950	255.74617	2167.01481
10347749.	3.104325E+12	.00000333	.00011233	33.69878572	336.12377	2870.88262
12863923.	3.087341E+12	.00000417	.00013993	33.58408087	415.06744	3574.74311
12863923.	2.572785E+12	.00000500	.00008238	16.47626084	244.62491	6600.94218
12863923.	2.205244E+12	.00000583	.00009471	16.23577327	280.03016	7741.78169
12863923.	1.929588E+12	.00000667	.00010705	16.05773252	315.20712	8882.17171
12863923.	1.715190E+12	.00000750	.00011941	15.92133611	350.15502	10022.10940
12863923.	1.543671E+12	.00000833	.00013178	15.81410962	384.87323	11161.59017
12863923.	1.403337E+12	.00000917	.00014417	15.72809869	419.36067	12300.61376
12863923.	1.286392E+12	.00001000	.00015658	15.65802008	453.61684	13439.17418
12863923.	1.187439E+12	.00001083	.00016900	15.60020345	487.64083	14577.26941
12863923.	1.102622E+12	.00001167	.00018144	15.55202883	521.43175	15714.89691
12863923.	1.029114E+12	.00001250	.00019389	15.51158041	554.98893	16852.05210
12863923.	9.647942E+11	.00001333	.00020637	15.47741836	588.31155	17988.73157
12863923.	9.080416E+11	.00001417	.00021885	15.44843727	621.39861	19124.93369
12863923.	8.575949E+11	.00001500	.00023136	15.42378348	654.24935	20260.65419
12863923.	8.124583E+11	.00001583	.00024388	15.40278429	686.86306	21395.88821
12863923.	7.718354E+11	.00001667	.00025667	15.39999908	719.91043	22523.33378
12863923.	7.350813E+11	.00001750	.00026950	15.39999908	752.77867	23649.50047
12863923.	7.016685E+11	.00001833	.00028233	15.39999908	785.34908	24775.66715
12863923.	6.711612E+11	.00001917	.00029499	15.39092356	817.17008	25906.87832
12863923.	6.431961E+11	.00002000	.00030762	15.38110846	848.62460	27038.95709
12863923.	6.174683E+11	.00002083	.00032027	15.37300068	879.83997	28170.47875
12863923.	5.937195E+11	.00002167	.00033294	15.36641139	910.81529	29301.43818
12863923.	5.717299E+11	.00002250	.00034563	15.36117536	941.54937	30431.83308
12863923.	5.513110E+11	.00002333	.00035833	15.35715884	972.04146	31561.65585

12863923.	5.323003E+11	.00002417	.00037106	15.35423988	1002.29041
32690.90355					
13133543.	5.253417E+11	.00002500	.00038381	15.35231620	1032.29526
33819.57075					
13550452.	5.245336E+11	.00002583	.00039658	15.35130125	1062.05516
34947.65014					
13966837.	5.237564E+11	.00002667	.00040936	15.35110849	1091.56859
36075.14277					
14382703.	5.230074E+11	.00002750	.00042217	15.35167891	1120.83511
37202.03607					
14798037.	5.222837E+11	.00002833	.00043500	15.35294169	1149.85299
38328.33291					
15212842.	5.215831E+11	.00002917	.00044785	15.35484964	1178.62158
39454.02302					
15627114.	5.209038E+11	.00003000	.00046072	15.35735554	1207.13980
40579.10068					
16040849.	5.202437E+11	.00003083	.00047361	15.36041611	1235.40650
41703.56126					
16454037.	5.196012E+11	.00003167	.00048653	15.36398810	1263.42016
42827.40426					
16866685.	5.189749E+11	.00003250	.00049946	15.36804789	1291.18037
43950.61486					
17690322.	5.177655E+11	.00003417	.00052540	15.37748927	1345.93417
46195.13772					
18511731.	5.166065E+11	.00003583	.00055142	15.38853568	1399.65880
48437.08001					
19329548.	5.154546E+11	.00003750	.00057750	15.39999908	1452.26574
50677.50100					
20127689.	5.138984E+11	.00003917	.00060317	15.39999908	1502.81259
52929.83438					
20920643.	5.123423E+11	.00004083	.00062883	15.39999908	1552.16810
55182.16775					
21708410.	5.107861E+11	.00004250	.00065450	15.39999908	1600.33227
57434.50113					
22587180.	5.114079E+11	.00004417	.00068051	15.40772134	1647.94408
59676.94358					
23196262.	5.061003E+11	.00004583	.00070583	15.39999908	1693.08657
60000.00000					
23819295.	5.014588E+11	.00004750	.00073150	15.39999908	1737.67671
60000.00000					
24331984.	4.948878E+11	.00004917	.00075523	15.36059314	1777.72117
60000.00000					
24736470.	4.866191E+11	.00005083	.00077732	15.29157668	1813.98706
60000.00000					
25139783.	4.788530E+11	.00005250	.00079947	15.22802049	1849.47428
60000.00000					
25527386.	4.712748E+11	.00005417	.00082147	15.16565233	1883.84730
60000.00000					
25800724.	4.621025E+11	.00005583	.00084193	15.07931882	1914.92822
60000.00000					
26073191.	4.534468E+11	.00005750	.00086243	14.99877208	1945.33559
60000.00000					
26344773.	4.452638E+11	.00005917	.00088298	14.92352825	1975.06473
60000.00000					
26615458.	4.375144E+11	.00006083	.00090357	14.85315853	2004.11109
60000.00000					
26885237.	4.301638E+11	.00006250	.00092421	14.78728133	2032.47015
60000.00000					
27097252.	4.222948E+11	.00006417	.00094393	14.71054262	2058.80674
60000.00000					
27267793.	4.141943E+11	.00006583	.00096300	14.62779289	2083.57846
60000.00000					
27437665.	4.064839E+11	.00006750	.00098210	14.54968518	2107.75845

60000.00000					
27606864.	3.991354E+11	.00006917	.00100125	14.47588903	2131.34320
60000.00000					
27775375.	3.921229E+11	.00007083	.00102043	14.40610152	2154.32881
60000.00000					
27943192.	3.854233E+11	.00007250	.00103965	14.34005123	2176.71166
60000.00000					
28168009.	3.797934E+11	.00007417	.00106058	14.30000013	2200.43745
60000.00000					
28294862.	3.731191E+11	.00007583	.00108287	14.27957135	2224.90924
60000.00000					
28458572.	3.672074E+11	.00007750	.00110176	14.21623939	2244.80733
60000.00000					
28597831.	3.612358E+11	.00007917	.00112011	14.14874536	2263.50669
60000.00000					
28692561.	3.549595E+11	.00008083	.00113742	14.07116479	2280.55096
60000.00000					
28786825.	3.489312E+11	.00008250	.00115476	13.99710900	2297.10448
60000.00000					
28880603.	3.431359E+11	.00008417	.00117214	13.92636555	2313.16394
60000.00000					
28973904.	3.375600E+11	.00008583	.00118954	13.85874957	2328.72690
60000.00000					
29066721.	3.321911E+11	.00008750	.00120698	13.79408401	2343.79035
60000.00000					
29159052.	3.270174E+11	.00008917	.00122446	13.73220760	2358.35146
60000.00000					
29250896.	3.220282E+11	.00009083	.00124196	13.67297083	2372.40733
60000.00000					
29342242.	3.172134E+11	.00009250	.00125950	13.61623210	2385.95479
60000.00000					
29433087.	3.125638E+11	.00009417	.00127708	13.56186157	2398.99079
60000.00000					
29523421.	3.080705E+11	.00009583	.00129468	13.50973731	2411.51214
60000.00000					
29613256.	3.037257E+11	.00009750	.00131233	13.45975310	2423.51616
60000.00000					
29702574.	2.995218E+11	.00009917	.00133000	13.41179878	2434.99927
60000.00000					
29879653.	2.915088E+11	.00010250	.00136546	13.32160217	2456.39037
60000.00000					
30030647.	2.837541E+11	.00010583	.00140024	13.23057550	2475.21097
60000.00000					
30346511.	2.779833E+11	.00010917	.00144100	13.20000118	2494.73485
60000.00000					
30346511.	2.697468E+11	.00011250	.00147364	13.09904927	2508.09646
60000.00000					
30346511.	2.619843E+11	.00011583	.00150540	12.99625629	2519.30649
60000.00000					
30410625.	2.551941E+11	.00011917	.00153728	12.90022177	2528.80959
60000.00000					
30492736.	2.489203E+11	.00012250	.00156928	12.81041461	2536.58527
60000.00000					
30573366.	2.429671E+11	.00012583	.00160140	12.72635490	2542.61228
60000.00000					
30652498.	2.373097E+11	.00012917	.00163365	12.64761776	2546.86889
60000.00000					
30730116.	2.319254E+11	.00013250	.00166603	12.57382160	2549.33270
60000.00000					
30805850.	2.267915E+11	.00013583	.00169854	12.50461632	2549.21403
60000.00000					
30878541.	2.218817E+11	.00013917	.00173119	12.43969506	2543.80907
60000.00000					

30950409.	2.171959E+11	.00014250	.00176397	12.37877065	2542.03497
60000.00000					
31021458.	2.127186E+11	.00014583	.00179690	12.32159525	2546.13078
60000.00000					
31091643.	2.084356E+11	.00014917	.00182997	12.26792890	2548.77370
60000.00000					
31160978.	2.043343E+11	.00015250	.00186318	12.21757096	2549.94092
60000.00000					
31223439.	2.003643E+11	.00015583	.00189625	12.16844827	2546.53215
60000.00000					
31252478.	1.963506E+11	.00015917	.00192723	12.10827130	2542.06221
60000.00000					
31252478.	1.923229E+11	.00016250	.00196625	12.09999830	2540.27990
60000.00000					
31337281.	1.889685E+11	.00016583	.00200658	12.09999830	2545.39550
60000.00000					
31365925.	1.854143E+11	.00016917	.00203655	12.03873163	2547.75867
60000.00000					
31389998.	1.819710E+11	.00017250	.00206637	11.97897559	2549.27239
60000.00000					
31413728.	1.786563E+11	.00017583	.00209629	11.92204803	2549.95769
60000.00000					
31436692.	1.754606E+11	.00017917	.00212641	11.86833841	2547.48331
60000.00000					
31459240.	1.723794E+11	.00018250	.00215665	11.81724483	2543.78751
60000.00000					
31481581.	1.694076E+11	.00018583	.00218695	11.76836210	2540.07939
60000.00000					
31503731.	1.665395E+11	.00018917	.00221733	11.72158402	2536.35860
60000.00000					
31525665.	1.637697E+11	.00019250	.00224778	11.67680043	2537.65018
60000.00000					
31547399.	1.610931E+11	.00019583	.00227831	11.63392085	2541.22346
60000.00000					
31568916.	1.585050E+11	.00019917	.00230891	11.59285086	2544.19917
60000.00000					
31590215.	1.560011E+11	.00020250	.00233959	11.55350786	2546.56977
60000.00000					
31611304.	1.535772E+11	.00020583	.00237034	11.51581711	2548.32749
60000.00000					
31632159.	1.512294E+11	.00020917	.00240117	11.47969991	2549.46420
60000.00000					
31652796.	1.489543E+11	.00021250	.00243208	11.44509333	2549.97175
60000.00000					
31672798.	1.467466E+11	.00021583	.00246318	11.41243011	2547.74252
60000.00000					
31692499.	1.446046E+11	.00021917	.00249438	11.38122243	2544.52058
60000.00000					
31712076.	1.425262E+11	.00022250	.00252564	11.35117918	2541.28968
60000.00000					
31731532.	1.405086E+11	.00022583	.00255694	11.32225317	2538.04966
60000.00000					
31750876.	1.385493E+11	.00022917	.00258830	11.29440111	2534.80030
60000.00000					
31770092.	1.366456E+11	.00023250	.00261971	11.26757580	2531.54163
60000.00000					
31808145.	1.329957E+11	.00023917	.00268270	11.21684808	2535.87257
60000.00000					
31845672.	1.295417E+11	.00024583	.00274590	11.16977102	2542.06614
60000.00000					
31882681.	1.262680E+11	.00025250	.00280934	11.12608498	2546.51190
60000.00000					
31919145.	1.231607E+11	.00025917	.00287301	11.08555001	2549.16960

60000.00000					
31954980.	1.202068E+11	.00026583	.00293693	11.04802054	2549.70135
60000.00000					
31989475.	1.173926E+11	.00027250	.00300137	11.01420075	2544.18699
60000.00000					
31989475.	1.145892E+11	.00027917	.00307083	10.99999934	2537.79106
60000.00000					
31989475.	1.119165E+11	.00028583	.00314417	10.99999934	2530.71632
60000.00000					
31989475.	1.093657E+11	.00029250	.00321750	10.99999934	2523.64158
60000.00000					
32041219.	1.071016E+11	.00029917	.00329083	10.99999934	2531.35243
60000.00000					
32069856.	1.048606E+11	.00030583	.00335249	10.96182472	2536.65347
60000.00000					
32071883.	1.026300E+11	.00031250	.00341114	10.91563278	2540.49944
60000.00000					
32073806.	1.004923E+11	.00031917	.00346990	10.87173826	2543.71172
60000.00000					
32075635.	9.844185E+10	.00032583	.00352878	10.83001131	2546.27812
60000.00000					
32077345.	9.647322E+10	.00033250	.00358778	10.79032212	2548.18558
60000.00000					
32078949.	9.458167E+10	.00033917	.00364691	10.75256449	2549.42110
60000.00000					
32080438.	9.276271E+10	.00034583	.00370617	10.71663219	2549.97090
60000.00000					
32081524.	9.101142E+10	.00035250	.00376584	10.68323725	2547.56858
60000.00000					
32082448.	8.932468E+10	.00035917	.00382569	10.65156931	2544.14566
60000.00000					

Unfactored (Nominal) Moment Capacity at Concrete Strain of 0.003 = 31988.74192 in-kip

---

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

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 19116.000 lbs
Specified moment at pile head = 17568000.000 in-lbs
Specified axial load at pile head = 21120.000 lbs

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

Depth X	Deflect. y	Moment M	Shear V	Slope S	Total Stress	Flx. Rig. EI	Soil Res. Es*h p
in	in	lbs-in	lbs	Rad.	lbs/in**2	lbs-in**2	F/L lbs/in
0.000	.771366	1.76E+07	19116.	-.007358	628.604	5.18E+11	0.000
0.000							
20.160	.629968	1.80E+07	19094.	-.006667	642.361	5.17E+11	-5.141
20.563							
40.320	.502675	1.83E+07	18891.	-.005959	656.033	5.17E+11	-14.236

71.366							
60.480	.389804	1.87E+07	6307.830	-.005236	667.246	5.16E+11	-1328.065
8585.656							
80.640	.291582	1.85E+07	-28530.	-.004509	660.345	5.17E+11	-2091.480
18076.							
100.800	.207829	1.75E+07	-70276.	-.003806	625.008	5.18E+11	-2001.889
24274.							
120.960	.137724	1.57E+07	-1.08E+05	-.003161	561.126	5.21E+11	-1665.341
30472.							
141.120	.079796	1.32E+07	-1.36E+05	-.002621	473.450	1.23E+12	-1161.152
36670.							
161.280	.027924	1.02E+07	-1.53E+05	-.002536	369.265	3.10E+12	-475.015
42868.							
181.440	-.022608	7.12E+06	-1.54E+05	-.002480	258.512	3.12E+12	352.948
39341.							
201.600	-.072212	4.14E+06	-1.38E+05	-.002444	153.022	3.14E+12	1272.920
44421.							
221.760	-.121274	1.69E+06	-1.02E+05	-.002426	66.083	3.15E+12	2382.252
49502.							
241.920	-.170108	2.12E+05	-40752.	-.002420	13.676	3.15E+12	3684.459
54582.							

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

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.77136589 in
Computed slope at pile head	=	-.00735831
Maximum bending moment	=	18673487. lbs-in
Maximum shear force	=	-155745.45623 lbs
Depth of maximum bending moment	=	65.52000000 in
Depth of maximum shear force	=	171.36000 in
Number of iterations	=	38
Number of zero deflection points	=	1

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,
Type 2 = Shear and Slope,
Type 3 = Shear and Rot. Stiffness,
Type 4 = Deflection and Moment,
Type 5 = Deflection and Slope,

y = pile-head displacment in
M = Pile-head Moment lbs-in
V = Pile-head Shear Force lbs
S = Pile-head Slope, radians
R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs

1	V=	19116.	M=	1.76E+07	21120.0000	.7713659	1.8673E+07	-155745.

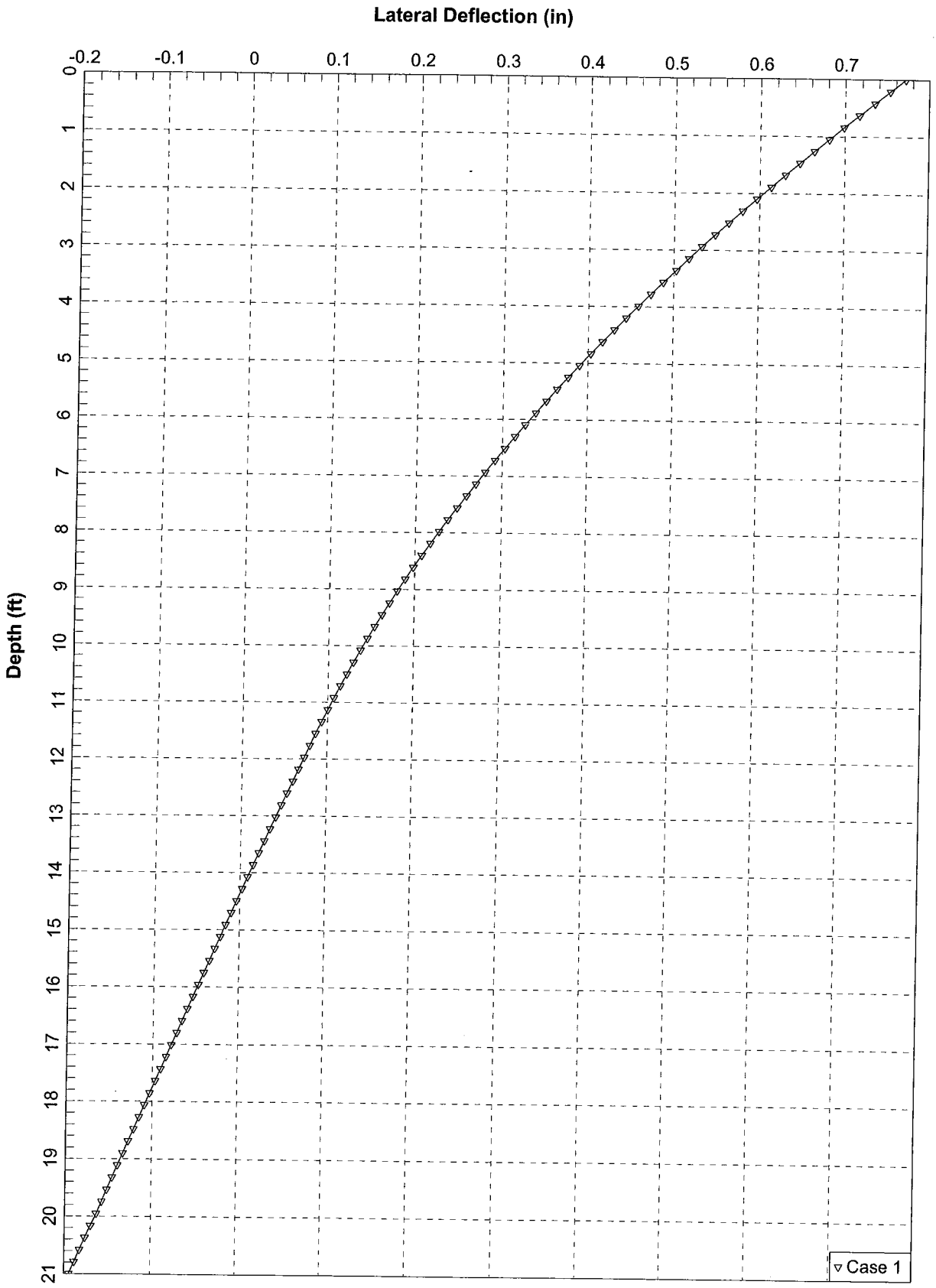
Computed Pile-head Stiffness Matrix Members
K22, K23, K32, K33 for Superstructure

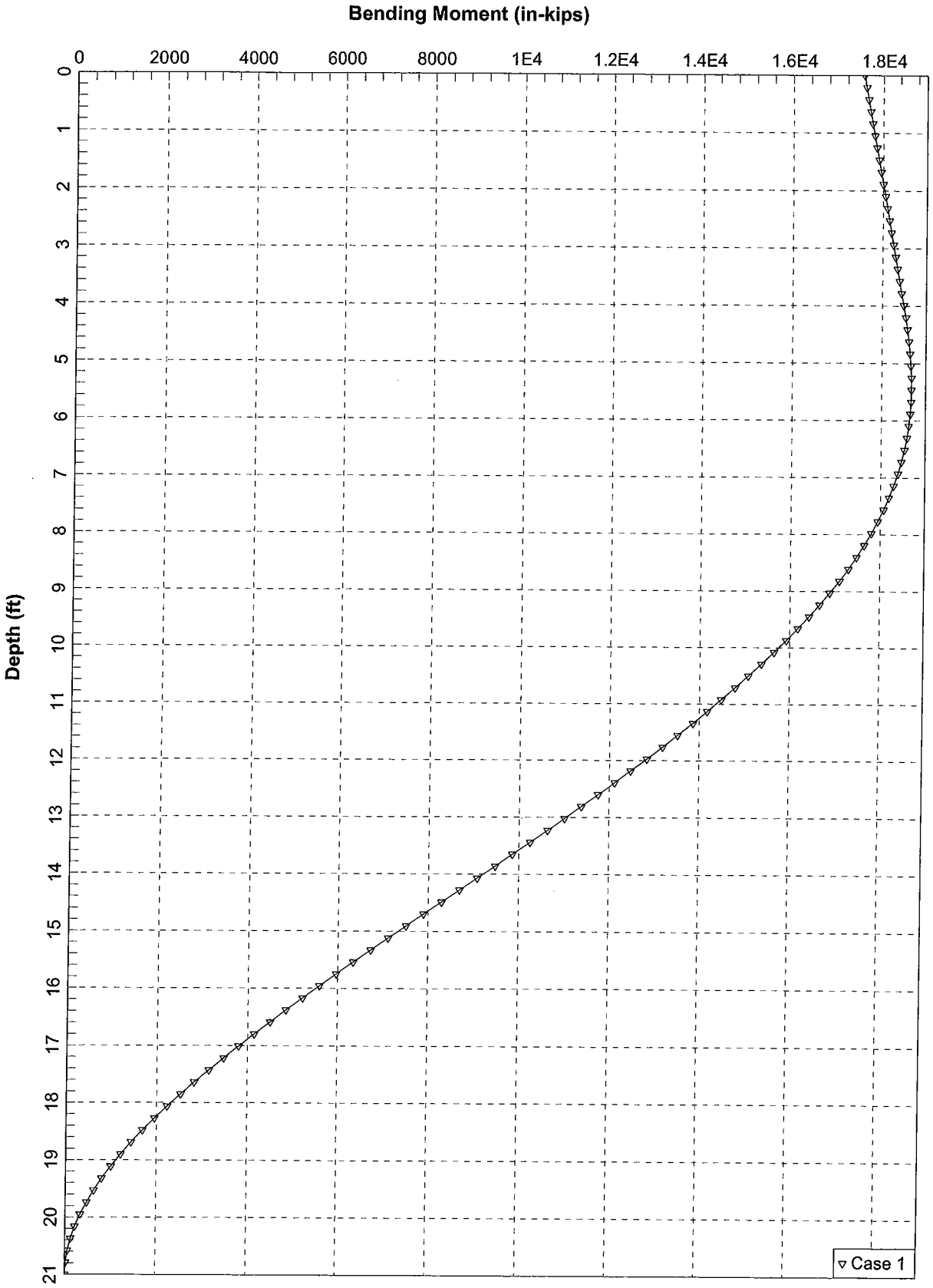
Top y in	Shear React. lbs	Mom. React. in-lbs	K22 lbs/in	K32 in-lbs/in
.00150432	1911.60003	276744.12844	1270744.	1.839668E+08
.00452844	5754.48940	833082.82542	1270744.	1.839668E+08
.00717741	9120.64991	1320405.	1270744.	1.839668E+08
.00905688	11508.97879	1666166.	1270744.	1.839668E+08
.01051472	13361.51060	1934358.	1270744.	1.839668E+08
.01170585	14875.13930	2153488.	1270744.	1.839668E+08
.01271294	16154.89413	2338759.	1270744.	1.839668E+08
.01358532	17263.46819	2499248.	1270744.	1.839668E+08
.01435482	18241.29981	2640810.	1270744.	1.839668E+08
.01504343	19116.00000	2767430.	1270721.	1.839627E+08

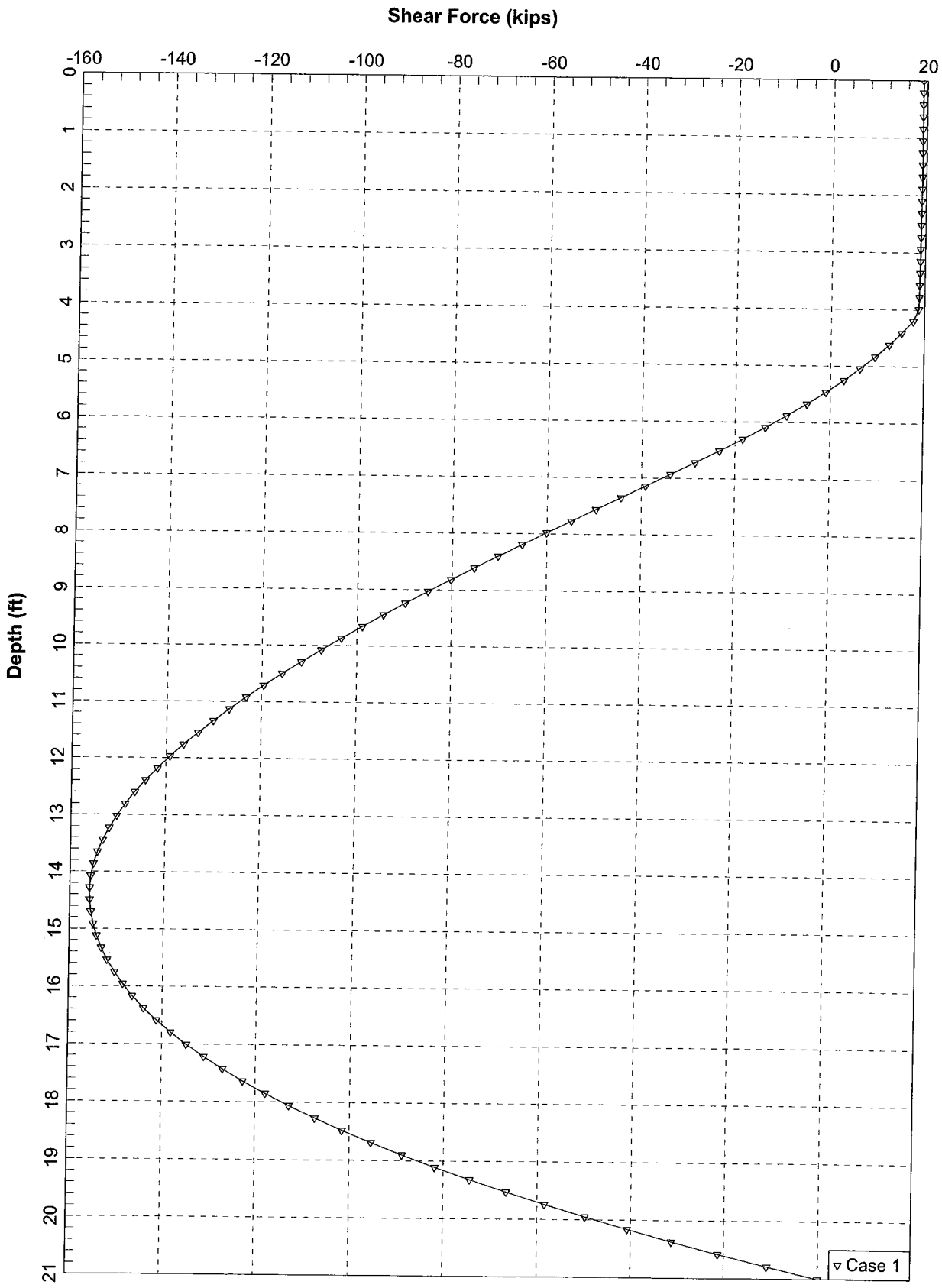
Top Rota. rad	Shear React. lbs	Mom. React. in-lbs	K23 lbs/rad	K33 in-lbs/rad
.00005402	9938.55310	1756800.	1.839668E+08	3.251910E+10
.00016296	29920.76283	5288495.	1.836036E+08	3.245194E+10
.00025902	47431.60794	8382066.	1.831219E+08	3.236112E+10
.00032753	59860.18961	10576990.	1.827628E+08	3.229325E+10
.00038089	69503.13024	12279505.	1.824767E+08	3.223917E+10
.00043044	77388.47523	13670561.	1.797910E+08	3.175983E+10
.00050741	84114.88847	14846682.	1.657727E+08	2.925968E+10
.00106858	91681.13512	15865485.	85796959.	1.484722E+10
.00124757	97842.19563	16764132.	78426031.	1.343740E+10
.00143687	103901.70386	17568000.	72311045.	1.222656E+10

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

The analysis ended normally.


Lateral Deflection (in)
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Case 1


Bending Moment (in-kips)
0
2000
4000
6000
8000
1E4
1.2E4
1.4E4
1.6E4
1.8E4
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Case 1


Shear Force (kips)
-160
-140
-120
-100
-80
-60
-40
-20
0
20
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Case 1

SITE NAME	GERMANTOWN CT	ECP - CELL #	5	293
LATITUDE	41-24-12.33 N	LONGITUDE	73-25-26.43 W	
Additional Comments:		SAVE BUTTON		
		STRUCTURE TYPE	MONOPOLE	

700 Mhz - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	P65-16-XL-2	P65-16-XL-2	BXA-70063-4CF
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	4
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Modcell 4.0 HD	Modcell 4.0 HD	Modcell 4.0 HD
ANTENNA TYPE	7129_16A	7129_16A	7129_16A
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Modcell 4.0 HD	Modcell 4.0 HD	Modcell 4.0 HD
ANTENNA TYPE	DB846H80E-SX	DB846H80E-SX	DB844G65ZAXY
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	3
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 Cellular - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	948F85T2E-M_2	948F85T2E-M_2	948F85T2E-M_2
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	330
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 Cellular - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	MG D3800T0	MG D3800T0	MG D3800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	330
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE			
MCPA BRICKS (QTY)			

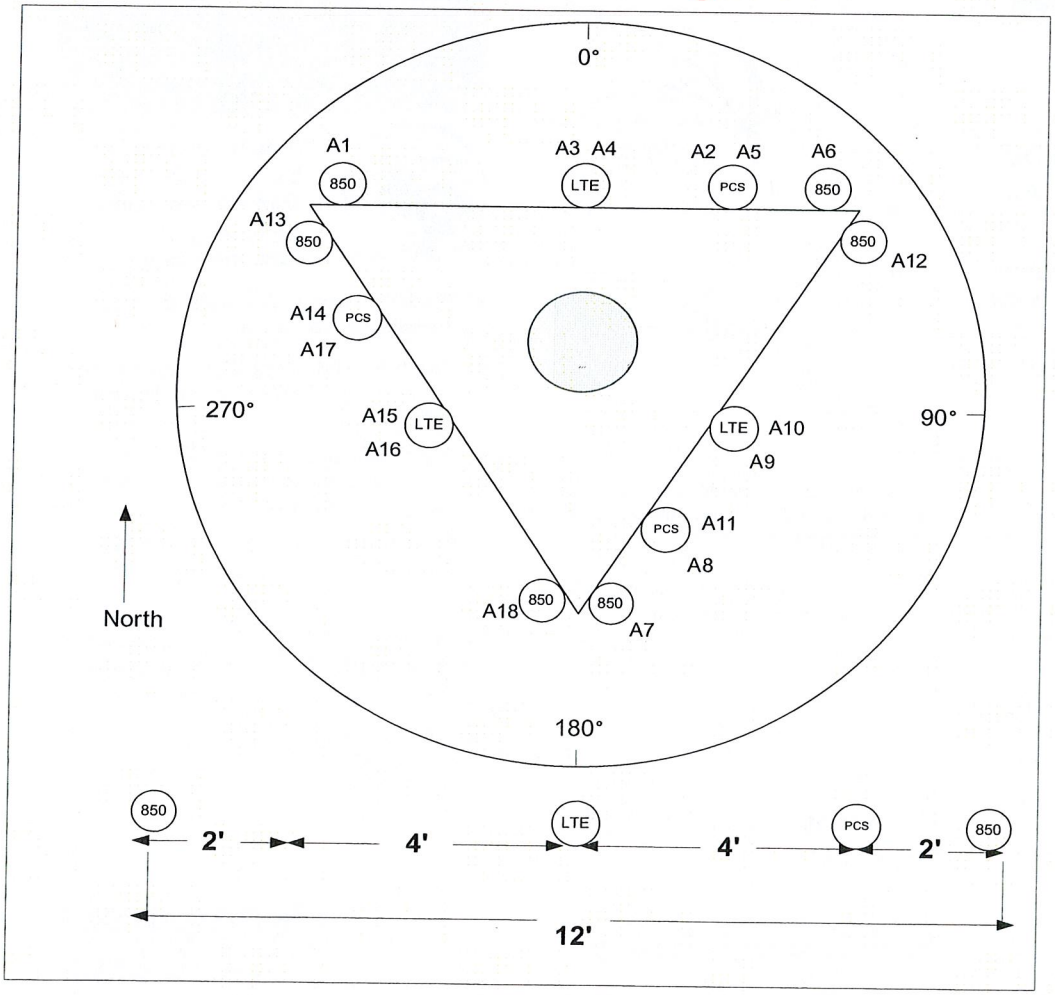
NUMBER OF CABLE'S NEEDED					ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES		18	MAINLINE (FT)			120
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS		18	TOP JUMPER (FT)			6
Equipment Cable Ordering		MAIN CABLE	12	+ 6	TOP JUMPER #	12	+	6

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	800	Tx1/Rx0	RED	A7	800	Tx2/Rx0	BLUE	A13	800	Tx3/Rx0	GREEN
A2	1900	Tx1/Rx0	RED/ WHITE	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/ ORANGE	A9	700	Tx2/Rx0	BLUE/ ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE
A4	700	Tx4/Rx1	RED/RED/ ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A5	1900	Tx4/Rx1	RED/RED/ WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By : Dany Bustamante	Steve Weatherbee	DB	1/6/2010

Site Configuration



Slant +/- 45° Dual Polarized, Panel 63° / 13 dBd

BXA-70063/4CF ___

When ordering replace "___" with connector type.

Mechanical specifications

Length	1205 mm	47.4 in
Width	285 mm	11.2 in
Depth	126 mm	5.0 in
Depth with z-bracket	166 mm	6.5 in
[4] Weight	4.5 kg	9.9 lbs
Wind Area		
Fore/Aft	0.36 m^2	3.9 ft^2
Side	0.15 m^2	1.7 ft^2
Rated Wind Velocity (Safety factor 2.0)	>653 km/hr	>406 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	522 N	117 lbs
Side	244 N	54.5 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 Ø50-160 mm (2.0-6.3 in).

Mounting bracket kit #36210002
Downtilt bracket kit #36114003

Electrical specifications

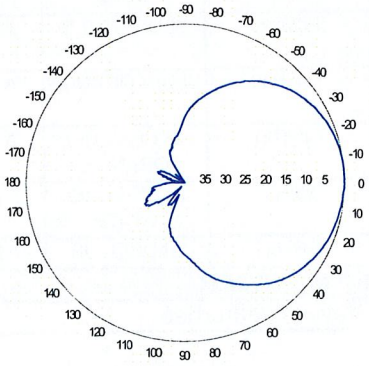
	Frequency Range	696-900 MHz
	Impedance	50Ω
[3]	Connector(s)	NE or E-DIN 2 ports / center
[1]	VSWR	≤ 1.4:1
	Polarization	Slant ± 45°
[1]	Isolation Between Ports	< -30 dB
[1]	Gain	13 dBd
[2]	Power Rating	500 W
[1]	Half Power Angle	
	H-Plane	63°
	E-Plane	15°
[1]	Electrical Downtilt	0°
[1]	Null Fill	5%
	Lightning Protection	Direct Ground

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

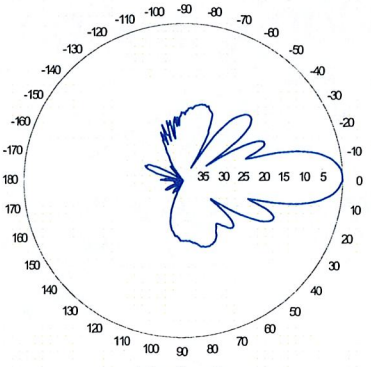
1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector.
   E-DIN indicates an elongated DIN connector.
4) The antenna weight listed above does not include the bracket weight.

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

Radiation pattern[1]



Horizontal



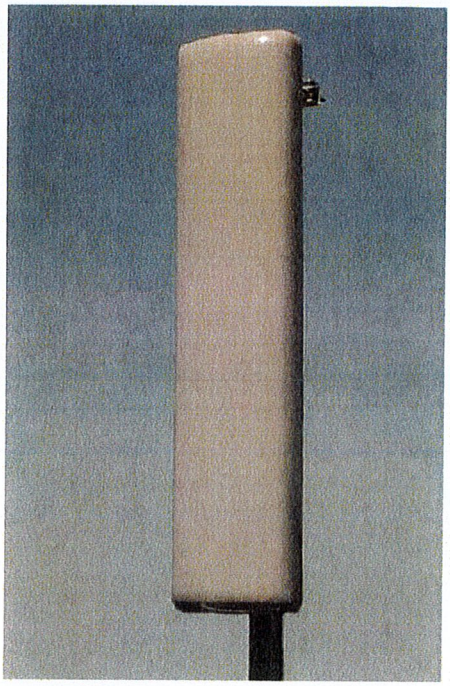
Vertical

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

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

CF Denotes a Center-Fed Connector.

696-900 MHz



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

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

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

Antenna available with center-fed connectors only.

Amphenol Antel, Inc.
The Antenna Technology Company

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

Revision Date: 2/12/08

DB844G65ZAXY

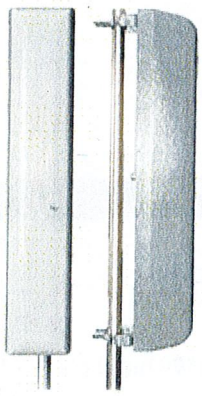
Directed Dipole™ Antenna

Base Station Antenna
Directed Dipole™

- Exceptional azimuth roll-off, reducing sector-to-sector interference and softer hand-offs
- Air dielectric feed system, no screws, rivets, welds or solder in RF element feed path
- Strong upper side lobe suppression
- Low profile appearance and low wind loading for easier zoning approvals

ELECTRICAL

Frequency (MHz) :	806 - 896	870 - 960
Polarization :	Vertical	Vertical
Gain (dBd/dBi) :	13.5/15.6	13.8/15.9
Azimuth BW (Deg.):	65	65
Elevation BW (Deg.):	15	15
Beam Tilt (Deg.):	0	0
USLS* (dB) :	15	15
Null Fill (dB) :	<20-25	<20-25
Front-To-Back Ratio* (dB) :	40	40
VSWR :	<1.33:1	<1.33:1
PIM3 @ 2 x 20w (dBc) :	-150	-150
Max. Input Power (Watts) :	500	500
Impedance (Ohms) :	50	50
Lightning Protection :	dc Ground	dc Ground



MECHANICAL

Weight :	5.4 kg (12 lb)
Dimensions (LxWxD) :	1,219 x 254 x 203 mm (48 x 10 x 8 in)
Max. Wind Area :	0.09 m² (1 ft²)
Max. Wind Load (@ 100 mph) :	235.7 N (53 lbf)
Max. Wind Speed :	241 km/h (150 mph)
Hardware Material :	Galvanized steel
Connector Type :	7-16 DIN Female (1, Back)
Color :	Light gray
Standard Mounting Hardware :	DB380
Standard Downtilt Mounting Hardware :	DB5083

Andrew Corporation
2601 Telecom Parkway
Richardson, Texas U.S.A 75082-3521
Tel: 214.631.0310

Fax: 214.631.4706
Toll Free Tel: 1.800.676.5342
Fax: 1.800.229.4706
www.andrew.com

* - Indicates Typical

10/11/2007

dbtech@andrew.com

DB846H80E-SX

Directed Dipole Antenna

Decibel®
Base Station Antennas

- Excellent azimuth roll-off, 15-20% reduction in cell to cell overlap
- Superior front to back ratio
- Low profile, low wind load for easy zoning
- Outstanding field record, with thousands of units deployed, world wide

ELECTRICAL

Frequency (MHz) :	806 - 896
Polarization :	Vertical
Gain (dBd/dBi) :	14/16.1
Azimuth BW (Deg.):	80
Elevation BW (Deg.):	10
Beam Tilt (Deg.):	0
USLS* (dB) :	15
Front-To-Back Ratio* (dB) :	40
VSWR :	<1.5:1
Max. Input Power (Watts) :	500
Impedance (Ohms) :	50
Lightning Protection :	DC Ground

MECHANICAL

Weight :	7.2 kg (16 lb)
Dimensions (LxWxD) :	1,829 x 165 x 203 mm (72 x 6.5 x 8 in)
Max. Wind Area :	0.16 m² (1.7 ft²)
Max. Wind Load (@ 100 mph) :	425.2 N (95.6 lbf)
Max. Wind Speed :	241 km/h (150 mph)
Hardware Material :	Galvanized Steel
Connector Type :	7-16 DIN - Female (1, Back)
Color :	Light Gray
Standard Mounting Hardware :	DB380
Standard Downtilt Mounting Hardware :	DB5083

Andrew Corporation
2601 Telecom Parkway
Richardson, Texas U.S.A 75082-3521
Tel: 214.631.0310

Fax: 214.631.4706
Toll Free Tel: 1.800.676.5342
Fax: 1.800.229.4706
www.andrew.com

* - Indicates Typical

6/12/2006

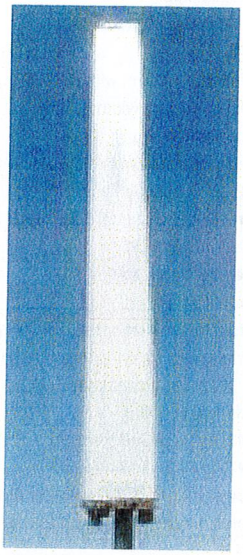
dbtech@andrew.com

MG D3-800Tx

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

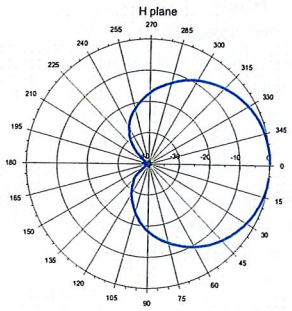
Electrical Specifications

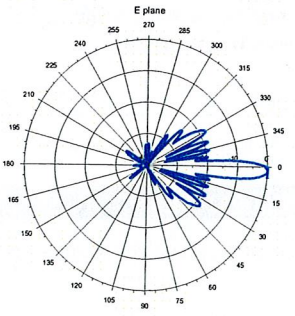
Antenna Model	MG D3-800Tx		
Frequency Range (MHz)	1710-1880	1850-1990	1920-2170
Impedance	50 Ohms		
VSWR	1.40:1		
Polarization	±45º		
Isolation between Ports (dB)	30		
Average Gain (dBd/dBi)	15.7/17.8	15.9/18	16.15/18.25
Horizontal Beamwidth (deg)	65º±5º		
Vertical Beamwidth (deg)	6.5º±0.5º	6.3º±0.5º	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

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/.