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

April 3, 2008

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

RE: **EM-VER-009-080214** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 38 Spring Hill Lane, Bethel, Connecticut.

Dear Attorney Baldwin:

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

The proposed modifications are to be implemented as specified here and in your notice dated February 14, 2008, 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 a 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.

The Council is in receipt of a letter dated February 28, 2008 from the Town of Bethel Planning and Zoning Department expressing concerns regarding dead and/or dying evergreen trees at the site, a broken gate at the access drive, and a gravel driveway washed out from stormwater. Council staff has recently inspected the site and is satisfied that these concerns have been resolved.

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

c: Honorable Robert E. Burke, First Selectman, Town of Bethel
Steve Palmer, Town Planner, Town of Bethel
Valley Communications

PLANNING & ZONING DEPARTMENT

Clifford J. Hurgin Municipal Center, 1 School Street
Bethel, Connecticut 06801
(203) 794-8578

ORIGINAL

February 28, 2008

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

Re: **EM-VER-009-080214**- Celco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at **38 Spring Hill Lane, Bethel, CT**

Dear Mr. Phelps,

This office is in receipt of a request by Celco Partnership to perform modifications to an existing telecommunications tower located at 38 Spring Hill Road in Bethel. It is my understanding from the application that there will be no modifications to the height or location of the existing tower and no expansion of the equipment area is required as a result of the modifications.

In your review of this request, its important to know that this office issued a zoning permit to replace the monopole on September 16, 2005, with conditions based on the Siting Council's approval to replace the existing structure in that same year. One of the conditions required a landscaped evergreen buffer to screen the equipment platform from an abutting residential neighbor. The filed plan called for certain evergreens (arborvitae), which this office did not approve of, as they are susceptible to the large dear population in the area. The zoning permit required a substitution, replacing them with 8-10 ft. height spruce trees. This was also communicated with the applicant who pulled the permit. It should be noted that this office was not asked by the application to perform a final inspection to determine compliance with the permit.

A complaint received this past fall from a neighbor of the tower site informed me that the each of the evergreens planted were dead or dying, the gate at the base of the driveway was broken and inoperable and that the steep gravel driveway was partially washed out from stormwater. An inspection by this office revealed what the neighbor explained and that the applicant planted arborvitae trees, not spruce trees as required by the zoning permit.

I have contacted the applicant and the owners representative several times who acknowledged the problems, however, no work to correct problems has been done. I am writing you to ask that in consideration of the current application, the Siting Council not approve it until the problems are corrected or require that prior to any work that the items be corrected and inspected by this office.

Thank you for the opportunity to comment and please don't hesitate to contact me with any questions.

Sincerely,

Steven Palmer
Town Planner

Cc: Robert Burke, First Selectman
Jim Kelleher, 42 Spring Hill Road

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STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
Internet: ct.gov/csc

Daniel F. Caruso
Chairman

February 19, 2008

The Honorable Robert E. Burke
First Selectman
Town of Bethel
1 School Street
Bethel Municipal Center
Bethel, CT 06801-2105

RE: **EM-VER-009-080214** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 38 Spring Hill Lane, Bethel, Connecticut.

Dear Mr. Burke:

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 March 4, 2008.

Thank you for your cooperation and consideration.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/jb

Enclosure: Notice of Intent

c: Steve Palmer, Planning & Zoning Official, Town of Bethel

ROBINSON & COLE LLP

KENNETH C. BALDWIN

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

EM-VER-009-080214

ORIGINAL

February 14, 2008

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**
38 Spring Hill Lane, Bethel, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains a wireless telecommunications facility at the above referenced location. The Council approved Cellco's shared use of this facility on April 12, 2006. Cellco intends to modify its installation by replacing two (2) LPA-80080/8CF antennas with two (2) LPA-80063/8CF antennas at the 92-foot level on the 125-foot tower. Attached behind Tab 1 are the specifications for the proposed replacement antennas.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Robert E. Burke, First Selectman of the Town of Bethel. Pursuant to a Council directive a copy of this letter is also being sent to Valley Communications, the owner of the property on which the facility is located.

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

1. The proposed modifications will not result in any increase in the overall height of the existing structures. Cellco's replacement antennas will be located at the 92-foot level of the 125-foot tower.

2. The proposed modifications will not involve any 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 the facility is included behind Tab 2.

Also attached is a Structural Analysis Report confirming that the tower can support the proposed modifications. (See Tab 3).

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

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Robert E. Burke, Bethel First Selectman
Valley Communications
Sandy M. Carter

Vertically Polarized, Log Periodic 63° / 16 dBd

LPA-80063/8CF ___

When ordering replace "___" with connector type.

Mechanical specifications

Length	2400 mm	94.5 in
Width	386 mm	15.2 in
Depth	335 mm	13.2 in
Depth with z-bracket	375 mm	14.8 in
[4] Weight	17.2 kg	38.0 lbs
Wind Area		
Fore/Aft	0.93 m^2	10.0 ft^2
Side	0.80 m^2	8.7 ft^2
Rated Wind Velocity (Safety factor 2.0)	>276 km/hr	>172 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	1357 N	305 lbs
Side	1197 N	269 lbs

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

Mounting and Downtilting

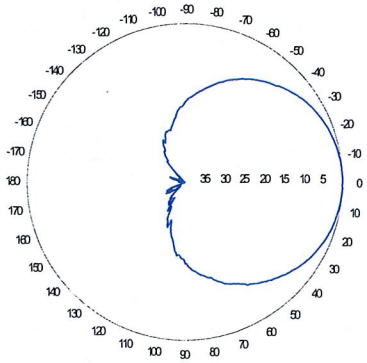
Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in). If the lock-down brace is used, the maximum diameter is Ø88.9 mm (3.5 in)

Mounting Bracket & Downtilt Bracket Kit #21699999

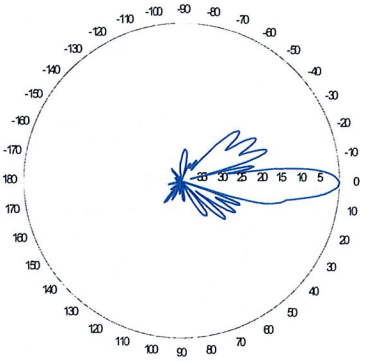
Electrical specifications

	Frequency Range	806-960 MHz
	Impedance	50Ω
[3]	Connector(s)	NE or E-DIN 1 port / center
[1]	VSWR	≤ 1.4:1
	Polarization	Vertical
[1]	Gain	16 dBd
[2]	Power Rating	500 W
[1]	Half Power Angle	
	H-Plane	63°
	E-Plane	7°
[1]	Electrical Downtilt	0°
[1]	Null Fill	10%
	Lightning Protection	Direct Ground

Radiation pattern[1]



Horizontal

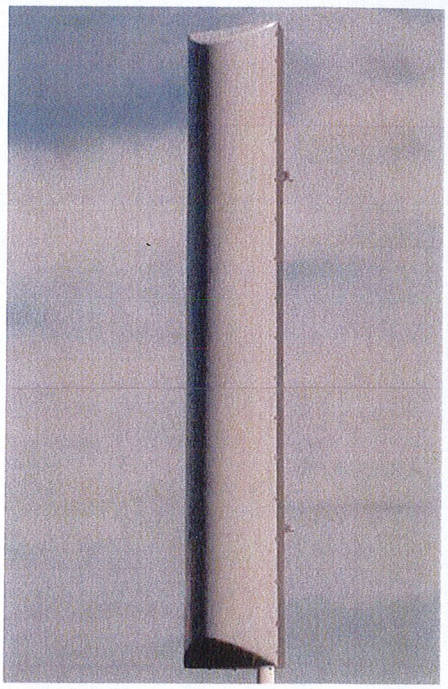


Vertical

Featuring upper side lobe suppression.

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

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



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

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

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

Antenna available with center-fed connector only.

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

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

CF Denotes a Center-Fed Connector.

806-960 MHz

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

Amphenol Antel, Inc. The Antenna Technology Company

Revision Date: 7/5/07

	General	Power	Density					
Site Name: Bethel								
Tower Height: Verizon @ 92Ft.								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*Sprint	11	233.27	115	0.0698	1962.5	1.0000	6.98%	
*T-Mobile	8	224	105	0.0584	1930	1.0000	5.84%	
*Bethel PD								
*Thomas Refuse								
*Utilty Cmcns								
*Valley Cmcns		no RF information available for town and small co. antennas						
*Yankee Gas								
*AT&T (Cingular)	3	427	122	0.0309	1945	1.0000	3.09%	
*Nextel	24	100	85	0.11944	851	0.5673	21.05%	
Verizon	**9**	**285**	**92**	**0.1090**	**880**	**0.5866**	**18.58%**	
Verizon	**3**	**400**	**92**	**0.0510**	**1900**	**1.0000**	**5.10%**	
								60.64%
* Source: Siting Council								

NATCOMM INC.
CONSULTING ENGINEERS

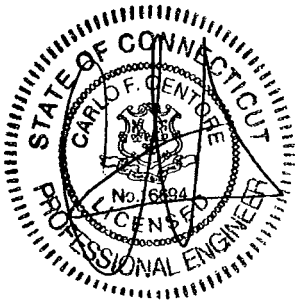
Structural Analysis Report

125' AGL Existing Monopole

38 Spring Hill Lane
Bethel, CT

Natcomm Project No. 08007.CO3

Date: January 28, 2008



Prepared for:

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

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

Table of Contents

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna exchange proposed by Verizon Wireless on the existing monopole (tower) located in Bethel, Connecticut. The host tower is a 125-ft AGL, three-section, eighteen-sided, tapered monopole originally designed and manufactured by Engineered Endeavors, Inc. (EEI); EEI job no. 14009-E01. Subsequently, EEI analyzed the tower for the addition of antennas by Verizon in a report dated March 9, 2006 (EEI job no. 14009-E01). EEI's structural analysis report is available for reference in Section 4 of this report.

Verizon Wireless is proposing the replacement of two (2) existing Cellular antennas mounted on a low profile platform. Refer to the Antenna and Appurtenance Summary below and "Antenna Replacement Details" drawing "ANT-1" available for reference in Section 4 of this report for a detailed description and layout of the Verizon Wireless existing and proposed antenna configuration.

Antenna and Appurtenance Summary

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

- TOWN (Existing):
  Antennas: One (1) 10-ft long by 3" ∅ omni-directional (whip) antenna and one (1) ANT150D6-9 mounted with a RAD center elevation of 122-ft above grade level.
  Coax Cables: Two (2) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- AT&T/CINGULAR (Existing):
  Antennas: Twelve (12) Powerwave 7770.00 panel antennas and twelve (12) Powerwave LPG21401 TMA's mounted on a low profile platform with a RAD center elevation of 122-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- SPRINT (Existing):
  Antennas: Twelve (12) 950G65VTZE-M panel antennas mounted on a low profile platform with a RAD center elevation of 112-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- T-MOBILE (Existing):
  Antennas: Six (6) APX16PV16PVL-X panel antennas and eighteen (18) G20057A1 TMA's mounted on a low profile platform with a RAD center elevation of 102-ft above grade level.
  Coax Cables: Eighteen (18) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- TOWN (Existing):
  Antennas: Two (2) 10-ft long by 3" ∅ omni-directional (whip) antennas mounted with a RAD center elevation of 102-ft above the tower base plate.
  Coax Cables: Two (2) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- VERIZON (Existing Removed/Reconfigured):
  Antennas: Six (6) Antel LPA-80080/8CF and six (6) Antel LPA-185080/12CF panel antennas mounted on a low profile platform with a RAD center elevation of 92-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- **VERIZON (Proposed/Reconfigured):**
  Antennas: Four (4) Antel LPA-80080/8CF (existing to remain), six (6) Antel LPA-185080/12CF (existing to remain) and two (2) Antel LPA-80063/8CF panel antennas (proposed) mounted on a low profile platform with a RAD center elevation of 92-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- NEXTEL (Existing):
  Antennas: Twelve (12) Decibel DB844H90E-XY panel antennas mounted on a low profile platform with a RAD center elevation of 82-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- TOWN (Existing):
  Antennas: One (1) ANT150D6-9 and six (6) 48000 antennas mounted on a low profile platform with a RAD center elevation of 72-ft above grade level.
  Coax Cables: Four (4) 1-5/8" ∅ coax cables running on the inside of the existing tower.

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.
- 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 coax cables to be installed within tower.
- A new porthole will not be required.

Analysis

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

The existing tower was analyzed for 85mph 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]*
	Bethel; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed Controls	
Load Cases:	Load Case 1; 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.	*[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 69 mph wind speed velocity represents 75% of the wind pressure generated by the 80 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1610.1.3 of State Bldg. Code 1999] 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 **85.0%** of its total capacity.

Foundation and Anchors

The existing foundation consists of a 7-ft square reinforced concrete pedestal with a 25-ft square reinforced concrete pad bearing directly on existing sub grade. The sub grade conditions used in the analysis of the existing foundation were obtained from EEI's original foundation design calculations which are available for reference in Section 4 of this report. The monopole tower is connected to the pedestal by means of twelve (12) 2 1/4" diameter, A615-GR75 anchor bolts embedded 5-ft into the concrete foundation structure.

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

- The tower base reactions developed from the governing Load Case 1 were used in the verification of the foundation and its anchors:
  - Shear Force @ top of pedestal = **27.0** kips
  - Moment @ top of pedestal = **2,365.0** ft-kips
  - Axial Force @ top of pedestal = **33.0** kips
- The base plate, anchor bolts and the foundation are within allowable limits.
- Foundation resists two times the calculated wind load per the requirements of Section 3108.4.2 of the 2005 CT State Building Code Supplement to the 2003 International Building Code (IBC).

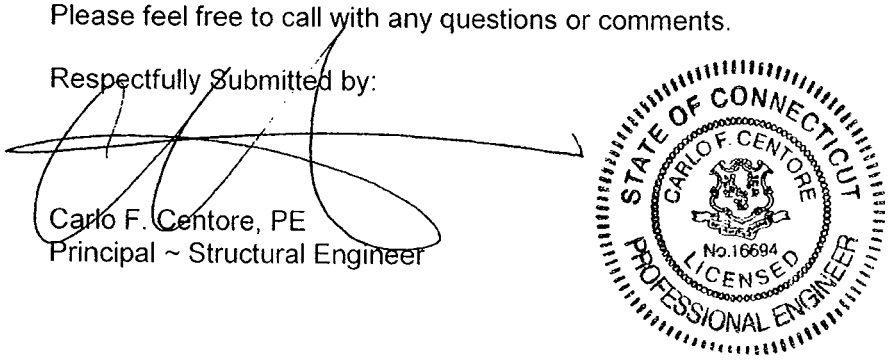
Conclusions

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:



Carlo F. Centore, PE
Principal ~ Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

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

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

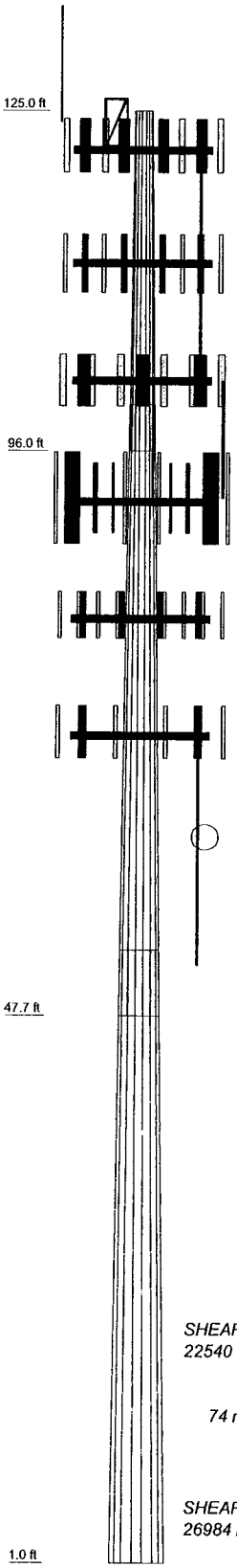
RISATower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, RISATower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

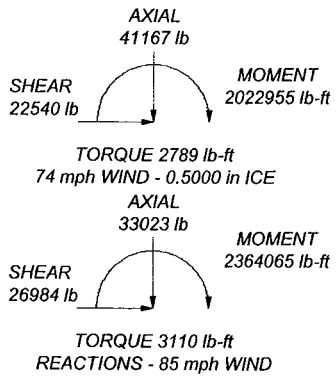
RISATower Features:

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

Section	1	2	3
Length (ft)	28.96	52.29	52.34
Number of Sides	18	18	18
Thickness (in)	0.1875	0.2500	0.3125
Lap Splice (ft)	3.92	5.67	39.0494
Top Dia (in)	18.0000	25.3203	
Bot Dia (in)	26.9000	41.2800	55.0000
Grade	A572-65		
Weight (lb)	1305.6	4666.3	8251.9

14223.8





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
10' x 3" Dia Omni (Town)	129	LPA-80080/8CF (Verizon)	92
Sidearm (Town)	124	LPA-185080/12CF (Verizon)	92
(4) LPG21401 TMA (Cingular)	122	LPA-185080/12CF (Verizon)	92
(4) 7770.00 (Cingular)	122	LPA-80080/8CF (Verizon)	92
(4) LPG21401 TMA (Cingular)	122	LPA-80063-8CF (Verizon)	92
(4) 7770.00 (Cingular)	122	LPA-185080/12CF (Verizon)	92
(4) LPG21401 TMA (Cingular)	122	LPA-185080/12CF (Verizon)	92
Low Profile Platform (Sprint)	122 - 112	LPA-80063-8CF (Verizon)	92
Low Profile Platform (T-Mobile)	122 - 102	Low Profile Platform (Verizon)	92
Low Profile Platform (ATT)	122	LPA-80080/8CF (Verizon)	92
(4) 7770.00 (Cingular)	122	LPA-185080/12CF (Verizon)	92
ANT150D6-9 (Town)	122 - 102	LPA-185080/12CF (Verizon)	92
(4) 950G65VTZE-M (Sprint)	112	LPA-80080/8CF (Verizon)	92
(4) 950G65VTZE-M (Sprint)	112	Low Profile Platform (Nextel)	82
(4) 950G65VTZE-M (Sprint)	112	(4) DB844H90E-XY (Nextel)	82
(6) G20057A1 TMA (T-Mobile)	102	(4) DB844H90E-XY (Nextel)	82
(3) APX16PV-16PVL-X (T-Mobile)	102	(4) DB844H90E-XY (Nextel)	82
(6) G20057A1 TMA (T-Mobile)	102	ANT150D6-9 (Town)	72 - 52
10' x 3" Dia Omni (Town)	102 - 92	(2) 48000 (Future)	72
10' x 3" Dia Omni (Town)	102 - 92	(2) 48000 (Future)	72
(3) APX16PV-16PVL-X (T-Mobile)	102	(2) 48000 (Future)	72
(6) G20057A1 TMA (T-Mobile)	102	Low Profile Platform (Town)	72
(3) APX16PV-16PVL-X (T-Mobile)	102		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

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

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

Job: 125' EEI Monopole		
Project: 08007.CO3 - Spring Hill Lane, Bethel, CT		
Client: Verizon	Drawn by: Staff	App'd:
Code: TIA/EIA-222-F	Date: 01/23/08	Scale: NTS
Path: C:\Users\kleman214\Documents\Natcomm\08007.CO3 Bethel\ERI Files\125 EEI Bethel.eri		Dwg No. E-1

RISATower	Job	Page
	125' EEI Monopole	1 of 23
NATCOMM 63-2 N. Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project 08007.CO3 - Spring Hill Lane, Bethel, CT	Date 20:16:27 01/23/08
	Client Verizon	Designed by Staff

Tower Input Data

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

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

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	125.00-96.04	28.96	3.92	18	18.0000	26.9000	0.1875	0.7500	A572-65 (65 ksi)
L2	96.04-47.67	52.29	5.67	18	25.3203	41.2800	0.2500	1.0000	A572-65 (65 ksi)
L3	47.67-1.00	52.34		18	39.0494	55.0000	0.3125	1.2500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	18.2777	10.6007	424.9328	6.3234	9.1440	46.4712	850.4248	5.3013	2.8380	15.136
	27.3150	15.8973	1433.1421	9.4829	13.6652	104.8753	2868.1699	7.9501	4.4044	23.49
L2	26.9258	19.8933	1579.6584	8.9000	12.8627	122.8091	3161.3953	9.9485	4.0164	16.065
	41.9168	32.5573	6924.5082	14.5657	20.9702	330.2064	13858.1278	16.2817	6.8253	27.301
L3	41.4064	38.4222	7284.0012	13.7516	19.8371	367.1906	14577.5869	19.2147	6.3227	20.233
	55.8485	54.2432	20495.5041	19.4141	27.9400	733.5542	41017.9768	27.1267	9.1300	29.216

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 125.00-96.04				1	1	1		
L2 96.04-47.67				1	1	1		
L3 47.67-1.00				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 (ATT)	A	No	Inside Pole	122.00 - 4.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Sprint)	B	No	Inside Pole	112.00 - 4.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (T-Mobile)	C	No	Inside Pole	102.00 - 4.00	18	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon)	A	No	Inside Pole	92.00 - 4.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Nextel)	B	No	Inside Pole	82.00 - 4.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Future)	C	No	Inside Pole	72.00 - 4.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Town)	C	No	Inside Pole	124.00 - 4.00	1	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Town)	C	No	Inside Pole	102.00 - 4.00	1	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Town)	C	No	Inside Pole	92.00 - 4.00	2	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Town)	C	No	Inside Pole	72.00 - 4.00	1	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L1	125.00-96.04	A	0.000	0.000	0.000	0.000	323.98
		B	0.000	0.000	0.000	0.000	199.18
		C	0.000	0.000	0.000	0.000	146.85

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 lb
L2	96.04-47.67	A	0.000	0.000	0.000	0.000	1156.90
		B	0.000	0.000	0.000	0.000	1032.10
		C	0.000	0.000	0.000	0.000	1275.42
L3	47.67-1.00	A	0.000	0.000	0.000	0.000	1090.00
		B	0.000	0.000	0.000	0.000	1090.00
		C	0.000	0.000	0.000	0.000	1317.09

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 lb
L1	125.00-96.04	A	0.500	0.000	0.000	0.000	0.000	323.98
		B		0.000	0.000	0.000	0.000	199.18
		C		0.000	0.000	0.000	0.000	146.85
L2	96.04-47.67	A	0.500	0.000	0.000	0.000	0.000	1156.90
		B		0.000	0.000	0.000	0.000	1032.10
		C		0.000	0.000	0.000	0.000	1275.42
L3	47.67-1.00	A	0.500	0.000	0.000	0.000	0.000	1090.00
		B		0.000	0.000	0.000	0.000	1090.00
		C		0.000	0.000	0.000	0.000	1317.09

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	125.00-96.04	0.0000	0.0000	0.0000	0.0000
L2	96.04-47.67	0.0000	0.0000	0.0000	0.0000
L3	47.67-1.00	0.0000	0.0000	0.0000	0.0000

Discrete Tower Loads

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 lb
Low Profile Platform (ATT)	C	None		0.0000	122.00	No Ice	15.00	15.00	1500.00	
						1/2" Ice	20.00	20.00	2000.00	
(4) 7770.00 (Cingular)	A	From Face	4.00	0.0000	122.00	No Ice	5.88	2.93	35.00	
			0.00			1/2" Ice	6.31	3.27	67.63	
			0.00							
(4) LPG21401 TMA (Cingular)	A	From Face	4.00	0.0000	122.00	No Ice	0.95	0.37	17.50	
			0.00			1/2" Ice	1.09	0.48	23.31	
			0.00							
(4) 7770.00	B	From Face	4.00	0.0000	122.00	No Ice	5.88	2.93	35.00	

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 lb
(Cingular)			0.00 0.00			1/2" Ice	6.31	3.27	67.63
(4) LPG21401 TMA	B	From Face	4.00	0.0000	122.00	No Ice	0.95	0.37	17.50
(Cingular)			0.00 0.00			1/2" Ice	1.09	0.48	23.31
(4) 7770.00	C	From Face	4.00	0.0000	122.00	No Ice	5.88	2.93	35.00
(Cingular)			0.00 0.00			1/2" Ice	6.31	3.27	67.63
(4) LPG21401 TMA	C	From Face	4.00	0.0000	122.00	No Ice	0.95	0.37	17.50
(Cingular)			0.00 0.00			1/2" Ice	1.09	0.48	23.31
Low Profile Platform	C	None		0.0000	122.00 - 112.00	No Ice	15.00	15.00	1500.00
(Sprint)						1/2" Ice	20.00	20.00	2000.00
(4) 950G65VTZE-M	A	From Face	4.00	0.0000	112.00	No Ice	3.99	2.78	10.00
(Sprint)			0.00 0.00			1/2" Ice	4.37	3.15	33.58
(4) 950G65VTZE-M	B	From Face	4.00	0.0000	112.00	No Ice	3.99	2.78	10.00
(Sprint)			0.00 0.00			1/2" Ice	4.37	3.15	33.58
(4) 950G65VTZE-M	C	From Face	4.00	0.0000	112.00	No Ice	3.99	2.78	10.00
(Sprint)			0.00 0.00			1/2" Ice	4.37	3.15	33.58
Low Profile Platform	C	None		0.0000	122.00 - 102.00	No Ice	15.00	15.00	1500.00
(T-Mobile)						1/2" Ice	20.00	20.00	2000.00
(3) APX16PV-16PVL-X	A	From Face	4.00	0.0000	102.00	No Ice	6.70	2.00	40.00
(T-Mobile)			0.00 0.00			1/2" Ice	7.13	2.33	71.34
(6) G20057A1 TMA	A	From Face	4.00	0.0000	102.00	No Ice	0.82	0.39	11.00
(T-Mobile)			0.00 0.00			1/2" Ice	0.95	0.49	16.41
(3) APX16PV-16PVL-X	B	From Face	4.00	0.0000	102.00	No Ice	6.70	2.00	40.00
(T-Mobile)			0.00 0.00			1/2" Ice	7.13	2.33	71.34
(6) G20057A1 TMA	B	From Face	4.00	0.0000	102.00	No Ice	0.82	0.39	11.00
(T-Mobile)			0.00 0.00			1/2" Ice	0.95	0.49	16.41
(3) APX16PV-16PVL-X	C	From Face	4.00	0.0000	102.00	No Ice	6.70	2.00	40.00
(T-Mobile)			0.00 0.00			1/2" Ice	7.13	2.33	71.34
(6) G20057A1 TMA	C	From Face	4.00	0.0000	102.00	No Ice	0.82	0.39	11.00
(T-Mobile)			0.00 0.00			1/2" Ice	0.95	0.49	16.41
Low Profile Platform	C	None		0.0000	92.00	No Ice	15.00	15.00	1500.00
(Verizon)						1/2" Ice	20.00	20.00	2000.00
LPA-80080/8CF	A	From Face	4.00	0.0000	92.00	No Ice	6.28	12.17	24.00
(Verizon)			-6.00 0.00			1/2" Ice	6.85	12.83	87.32
LPA-185080/12CF	A	From Face	4.00	0.0000	92.00	No Ice	3.53	4.57	11.00
(Verizon)			-4.00 0.00			1/2" Ice	3.96	5.01	37.49
LPA-185080/12CF	A	From Face	4.00	0.0000	92.00	No Ice	3.53	4.57	11.00
(Verizon)			4.00 0.00			1/2" Ice	3.96	5.01	37.49
LPA-80080/8CF	A	From Face	4.00	0.0000	92.00	No Ice	6.28	12.17	24.00
(Verizon)			6.00 0.00			1/2" Ice	6.85	12.83	87.32
LPA-80080/8CF	B	From Face	4.00	0.0000	92.00	No Ice	6.28	12.17	24.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
(Verizon)			-6.00			1/2" Ice	6.85	12.83	87.32
			0.00						
LPA-185080/12CF	B	From Face	4.00	0.0000	92.00	No Ice	3.53	4.57	11.00
(Verizon)			-4.00			1/2" Ice	3.96	5.01	37.49
			0.00						
LPA-185080/12CF	B	From Face	4.00	0.0000	92.00	No Ice	3.53	4.57	11.00
(Verizon)			4.00			1/2" Ice	3.96	5.01	37.49
			0.00						
LPA-80080/8CF	B	From Face	4.00	0.0000	92.00	No Ice	6.28	12.17	24.00
(Verizon)			6.00			1/2" Ice	6.85	12.83	87.32
			0.00						
LPA-80063-8CF	C	From Face	4.00	0.0000	92.00	No Ice	13.97	12.17	38.00
(Verizon)			-6.00			1/2" Ice	14.68	12.83	135.49
			0.00						
LPA-185080/12CF	C	From Face	4.00	0.0000	92.00	No Ice	3.53	4.57	11.00
(Verizon)			-4.00			1/2" Ice	3.96	5.01	37.49
			0.00						
LPA-185080/12CF	C	From Face	4.00	0.0000	92.00	No Ice	3.53	4.57	11.00
(Verizon)			4.00			1/2" Ice	3.96	5.01	37.49
			0.00						
LPA-80063-8CF	C	From Face	4.00	0.0000	92.00	No Ice	13.97	12.17	38.00
(Verizon)			6.00			1/2" Ice	14.68	12.83	135.49
			0.00						
Low Profile Platform	C	None		0.0000	82.00	No Ice	15.00	15.00	1500.00
(Nextel)						1/2" Ice	20.00	20.00	2000.00
(4) DB844H90E-XY	A	From Face	4.00	0.0000	82.00	No Ice	2.87	3.73	10.00
(Nextel)			0.00			1/2" Ice	3.18	4.10	35.38
			0.00						
(4) DB844H90E-XY	B	From Face	4.00	0.0000	82.00	No Ice	2.87	3.73	10.00
(Nextel)			0.00			1/2" Ice	3.18	4.10	35.38
			0.00						
(4) DB844H90E-XY	C	From Face	4.00	0.0000	82.00	No Ice	2.87	3.73	10.00
(Nextel)			0.00			1/2" Ice	3.18	4.10	35.38
			0.00						
Low Profile Platform	C	None		0.0000	72.00	No Ice	15.00	15.00	1500.00
(Town)						1/2" Ice	20.00	20.00	2000.00
ANT150D6-9	C	From Face	4.00	0.0000	52.00 - 72.00	No Ice	6.40	6.40	74.00
(Town)			-5.00			1/2" Ice	7.50	7.50	96.20
			0.00						
(2) 48000	A	From Face	4.00	0.0000	72.00	No Ice	4.51	1.82	18.30
(Future)			0.00			1/2" Ice	4.91	2.15	40.88
			0.00						
(2) 48000	B	From Face	4.00	0.0000	72.00	No Ice	4.51	1.82	18.30
(Future)			0.00			1/2" Ice	4.91	2.15	40.88
			0.00						
(2) 48000	C	From Face	4.00	0.0000	72.00	No Ice	4.51	1.82	18.30
(Future)			0.00			1/2" Ice	4.91	2.15	40.88
			0.00						
10' x 3" Dia Omni	C	From Face	4.00	0.0000	102.00 - 92.00	No Ice	3.00	3.00	30.00
(Town)			-7.00			1/2" Ice	4.03	4.03	51.79
			0.00						
10' x 3" Dia Omni	B	From Face	4.00	0.0000	102.00 - 92.00	No Ice	3.00	3.00	30.00
(Town)			-7.00			1/2" Ice	4.03	4.03	51.79
			0.00						
10' x 3" Dia Omni	A	From Face	4.00	0.0000	129.00	No Ice	3.00	3.00	30.00
(Town)			-6.00			1/2" Ice	4.03	4.03	51.79
			0.00						

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 lb
Sidearm	A	From Face	2.00	0.0000	124.00	No Ice	5.90	5.90	130.00
(Town)			0.00			1/2" Ice	6.60	6.60	145.60
			0.00						
ANT150D6-9	C	From Face	4.00	0.0000	122.00 - 102.00	No Ice	6.40	6.40	74.00
(Town)			-5.00			1/2" Ice	7.50	7.50	96.20
			0.00						

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 125.00-96.04	109.56	1.409	26	54.179	A	0.000	54.179	54.179	100.00	0.000	0.000
					B	0.000	54.179		100.00		
					C	0.000	54.179		100.00		
L2 96.04-47.67	70.68	1.243	23	136.639	A	0.000	136.639	136.639	100.00	0.000	0.000
					B	0.000	136.639		100.00		
					C	0.000	136.639		100.00		
L3 47.67-1.00	23.31	1	19	186.247	A	0.000	186.247	186.247	100.00	0.000	0.000
					B	0.000	186.247		100.00		
					C	0.000	186.247		100.00		

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	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 125.00-96.04	109.56	1.409	20	0.5000	56.593	A	0.000	56.593	56.593	100.00	0.000	0.000
						B	0.000	56.593		100.00		
						C	0.000	56.593		100.00		
L2 96.04-47.67	70.68	1.243	17	0.5000	140.670	A	0.000	140.670	140.670	100.00	0.000	0.000
						B	0.000	140.670		100.00		
						C	0.000	140.670		100.00		
L3 47.67-1.00	23.31	1	14	0.5000	190.136	A	0.000	190.136	190.136	100.00	0.000	0.000
						B	0.000	190.136		100.00		
						C	0.000	190.136		100.00		

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 125.00-96.04	109.56	1.409	9	54.179	A	0.000	54.179	54.179	100.00	0.000	0.000
					B	0.000	54.179		100.00		
					C	0.000	54.179		100.00		
L2 96.04-47.67	70.68	1.243	8	136.639	A	0.000	136.639	136.639	100.00	0.000	0.000
					B	0.000	136.639		100.00		
					C	0.000	136.639		100.00		
L3 47.67-1.00	23.31	1	6	186.247	A	0.000	186.247	186.247	100.00	0.000	0.000
					B	0.000	186.247		100.00		
					C	0.000	186.247		100.00		

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 125.00-96.04	670.01	1305.61	A	1	0.65	1	1	1	54.179	1551.00	53.56	C
			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2 96.04-47.67	3464.42	4666.30	A	1	0.65	1	1	1	136.639	3432.86	70.97	C
			B	1	0.65	1	1	1	136.639			
			C	1	0.65	1	1	1	136.639			
L3 47.67-1.00	3497.09	8251.91	A	1	0.65	1	1	1	186.247	3823.81	81.93	C
			B	1	0.65	1	1	1	186.247			
			C	1	0.65	1	1	1	186.247			
Sum Weight:	7631.52	14223.83						OTM	492895.35 lb-ft	8807.67		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 125.00-96.04	670.01	1305.61	A	1	0.65	1	1	1	54.179	1551.00	53.56	C
			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2 96.04-47.67	3464.42	4666.30	A	1	0.65	1	1	1	136.639	3432.86	70.97	C
			B	1	0.65	1	1	1	136.639			
			C	1	0.65	1	1	1	136.639			
L3 47.67-1.00	3497.09	8251.91	A	1	0.65	1	1	1	186.247	3823.81	81.93	C
			B	1	0.65	1	1	1	186.247			
			C	1	0.65	1	1	1	186.247			
Sum Weight:	7631.52	14223.83						OTM	492895.35 lb-ft	8807.67		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 125.00-96.04	670.01	1305.61	A	1	0.65	1	1	1	54.179	1551.00	53.56	C
			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2 96.04-47.67	3464.42	4666.30	A	1	0.65	1	1	1	136.639	3432.86	70.97	C
			B	1	0.65	1	1	1	136.639			
			C	1	0.65	1	1	1	136.639			
L3 47.67-1.00	3497.09	8251.91	A	1	0.65	1	1	1	186.247	3823.81	81.93	C
			B	1	0.65	1	1	1	186.247			
			C	1	0.65	1	1	1	186.247			
Sum Weight:	7631.52	14223.83						OTM	492895.35 lb-ft	8807.67		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 125.00-96.04	670.01	1715.80	A	1	0.65	1	1	1	56.593	1215.07	41.96	C
			B	1	0.65	1	1	1	56.593			
			C	1	0.65	1	1	1	56.593			
L2 96.04-47.67	3464.42	5693.17	A	1	0.65	1	1	1	140.670	2650.60	54.80	C
			B	1	0.65	1	1	1	140.670			
			C	1	0.65	1	1	1	140.670			
L3 47.67-1.00	3497.09	9645.66	A	1	0.65	1	1	1	190.136	2927.75	62.73	C
			B	1	0.65	1	1	1	190.136			
			C	1	0.65	1	1	1	190.136			
Sum Weight:	7631.52	17054.63						OTM	381925.61 lb-ft	6793.41		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 125.00-96.04	670.01	1715.80	A	1	0.65	1	1	1	56.593	1215.07	41.96	C
			B	1	0.65	1	1	1	56.593			
			C	1	0.65	1	1	1	56.593			
L2 96.04-47.67	3464.42	5693.17	A	1	0.65	1	1	1	140.670	2650.60	54.80	C
			B	1	0.65	1	1	1	140.670			
			C	1	0.65	1	1	1	140.670			
L3 47.67-1.00	3497.09	9645.66	A	1	0.65	1	1	1	190.136	2927.75	62.73	C
			B	1	0.65	1	1	1	190.136			
			C	1	0.65	1	1	1	190.136			
Sum Weight:	7631.52	17054.63						OTM	381925.61 lb-ft	6793.41		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 125.00-96.04	670.01	1715.80	A	1	0.65	1	1	1	56.593	1215.07	41.96	C
			B	1	0.65	1	1	1	56.593			
			C	1	0.65	1	1	1	56.593			
L2 96.04-47.67	3464.42	5693.17	A	1	0.65	1	1	1	140.670	2650.60	54.80	C
			B	1	0.65	1	1	1	140.670			
			C	1	0.65	1	1	1	140.670			
L3 47.67-1.00	3497.09	9645.66	A	1	0.65	1	1	1	190.136	2927.75	62.73	C
			B	1	0.65	1	1	1	190.136			
			C	1	0.65	1	1	1	190.136			
Sum Weight:	7631.52	17054.63						OTM	381925.61 lb-ft	6793.41		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 125.00-96.04	670.01	1305.61	A	1	0.65	1	1	1	54.179	536.68	18.53	C
			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2 96.04-47.67	3464.42	4666.30	A	1	0.65	1	1	1	136.639	1187.84	24.56	C
			B	1	0.65	1	1	1	136.639			
			C	1	0.65	1	1	1	136.639			
L3 47.67-1.00	3497.09	8251.91	A	1	0.65	1	1	1	186.247	1323.12	28.35	C
			B	1	0.65	1	1	1	186.247			
			C	1	0.65	1	1	1	186.247			
Sum Weight:	7631.52	14223.83						OTM	170552.03 lb-ft	3047.64		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 125.00-96.04	670.01	1305.61	A	1	0.65	1	1	1	54.179	536.68	18.53	C
			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2 96.04-47.67	3464.42	4666.30	A	1	0.65	1	1	1	136.639	1187.84	24.56	C
			B	1	0.65	1	1	1	136.639			
			C	1	0.65	1	1	1	136.639			
L3 47.67-1.00	3497.09	8251.91	A	1	0.65	1	1	1	186.247	1323.12	28.35	C
			B	1	0.65	1	1	1	186.247			
			C	1	0.65	1	1	1	186.247			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
Sum Weight:	7631.52	14223.83						OTM	170552.03 lb-ft	3047.64		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 125.00-96.04	670.01	1305.61	A	1	0.65	1	1	1	54.179	536.68	18.53	C
			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2 96.04-47.67	3464.42	4666.30	A	1	0.65	1	1	1	136.639	1187.84	24.56	C
			B	1	0.65	1	1	1	136.639			
			C	1	0.65	1	1	1	136.639			
L3 47.67-1.00	3497.09	8251.91	A	1	0.65	1	1	1	186.247	1323.12	28.35	C
			B	1	0.65	1	1	1	186.247			
			C	1	0.65	1	1	1	186.247			
Sum Weight:	7631.52	14223.83						OTM	170552.03 lb-ft	3047.64		

Force Totals

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M_x lb-ft	Sum of Overturning Moments, M_z lb-ft	Sum of Torques lb-ft
Leg Weight	14223.83					
Bracing Weight	0.00					
Total Member Self-Weight	14223.83			676.38	-546.16	
Total Weight	32999.15			676.38	-546.16	
Wind 0 deg - No Ice		0.00	-26983.59	-2302498.69	-546.16	2393.36
Wind 30 deg - No Ice		13169.74	-23368.48	-1993931.74	-1122826.32	3130.68
Wind 60 deg - No Ice		22810.65	-13491.80	-1150911.16	-1944392.42	3029.13
Wind 90 deg - No Ice		26339.47	0.00	676.38	-2245106.49	2115.93
Wind 120 deg - No Ice		22810.65	13491.80	1152263.91	-1944392.42	635.77
Wind 150 deg - No Ice		13169.74	23368.48	1995284.50	-1122826.32	-1014.74
Wind 180 deg - No Ice		0.00	26983.59	2303851.45	-546.16	-2393.36
Wind 210 deg - No Ice		-13169.74	23368.48	1995284.50	1121734.01	-3130.68
Wind 240 deg - No Ice		-22810.65	13491.80	1152263.91	1943300.11	-3029.13
Wind 270 deg - No Ice		-26339.47	0.00	676.38	2244014.17	-2115.93
Wind 300 deg - No Ice		-22810.65	-13491.80	-1150911.16	1943300.11	-635.77
Wind 330 deg - No Ice		-13169.74	-23368.48	-1993931.74	1121734.01	1014.74
Member Ice	2830.81					
Total Weight Ice	41126.20			1194.24	-815.95	
Wind 0 deg - Ice		0.00	-22539.59	-1949967.63	-815.95	2183.81
Wind 30 deg - Ice		11023.78	-19519.86	-1688561.51	-954009.30	2813.41
Wind 60 deg - Ice		19093.74	-11269.80	-974386.69	-1651795.26	2689.17
Wind 90 deg - Ice		22047.56	0.00	1194.24	-1907202.64	1844.36
Wind 120 deg - Ice		19093.74	11269.80	976775.18	-1651795.26	505.36
Wind 150 deg - Ice		11023.78	19519.86	1690949.99	-954009.30	-969.05

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M_x lb-ft	Sum of Overturning Moments, M_z lb-ft	Sum of Torques lb-ft
Wind 180 deg - Ice		0.00	22539.59	1952356.11	-815.95	-2183.81
Wind 210 deg - Ice		-11023.78	19519.86	1690949.99	952377.39	-2813.41
Wind 240 deg - Ice		-19093.74	11269.80	976775.18	1650163.35	-2689.17
Wind 270 deg - Ice		-22047.56	0.00	1194.24	1905570.74	-1844.36
Wind 300 deg - Ice		-19093.74	-11269.80	-974386.69	1650163.35	-505.36
Wind 330 deg - Ice		-11023.78	-19519.86	-1688561.51	952377.39	969.05
Total Weight	32999.15			676.38	-546.16	
Wind 0 deg - Service		0.00	-9336.88	-796270.01	-546.16	828.15
Wind 30 deg - Service		4557.00	-8085.98	-689499.44	-388878.39	1083.28
Wind 60 deg - Service		7892.96	-4668.44	-397796.82	-673157.32	1048.14
Wind 90 deg - Service		9114.00	0.00	676.38	-777210.63	732.16
Wind 120 deg - Service		7892.96	4668.44	399149.57	-673157.32	219.99
Wind 150 deg - Service		4557.00	8085.98	690852.20	-388878.39	-351.12
Wind 180 deg - Service		0.00	9336.88	797622.77	-546.16	-828.15
Wind 210 deg - Service		-4557.00	8085.98	690852.20	387786.08	-1083.28
Wind 240 deg - Service		-7892.96	4668.44	399149.57	672065.01	-1048.14
Wind 270 deg - Service		-9114.00	0.00	676.38	776118.32	-732.16
Wind 300 deg - Service		-7892.96	-4668.44	-397796.82	672065.01	-219.99
Wind 330 deg - Service		-4557.00	-8085.98	-689499.44	387786.08	351.12

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 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service

Comb. No.	Description
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
L1	125 - 96.04	Pole	Max Tension	5	0.00	0.00	0.36
			Max. Compression	14	-10769.43	152.30	-380.75
			Max. Mx	11	-7014.14	158655.22	-188.16
			Max. My	8	-6997.56	77.33	-158953.76
			Max. Vy	5	11267.05	-158445.55	-188.06
			Max. Vx	8	11277.01	77.33	-158953.76
			Max. Torque	2			1637.93
L2	96.04 - 47.67	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-26853.42	-783.72	-1158.56
			Max. Mx	5	-19522.85	-1021245.62	-655.21
			Max. My	8	-19482.22	-518.25	-1047138.15
			Max. Vy	5	22689.95	-1021245.62	-655.21
			Max. Vx	8	23350.23	-518.25	-1047138.15
			Max. Torque	9			2999.57
L3	47.67 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-41166.80	-815.94	-1194.26
			Max. Mx	5	-33004.40	-2303938.95	-697.21
			Max. My	8	-33003.47	-557.69	-2364065.15
			Max. Vy	5	26362.36	-2303938.95	-697.21
			Max. Vx	8	27007.08	-557.69	-2364065.15
			Max. Torque	9			3113.14

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Pole	Max. Vert	21	41166.80	0.00	-22539.60
	Max. H_x	11	33022.67	26339.48	-0.00
	Max. H_z	2	33022.67	-0.00	26983.59
	Max. M_x	2	2362659.91	-0.00	26983.59
	Max. M_z	5	2303938.95	-26339.48	-0.00
	Max. Torsion	9	3110.24	13169.74	-23368.48
	Min. Vert	1	33022.67	0.00	0.00
	Min. H_x	5	33022.67	-26339.48	-0.00

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
	Min. H_z	8	33022.67	-0.00	-26983.59
	Min. M_x	8	-2364065.15	-0.00	-26983.59
	Min. M_z	11	-2302810.69	26339.48	-0.00
	Min. Torsion	3	-3105.29	-13169.74	23368.48

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x lb-ft	Overturning Moment, M_z lb-ft	Torque lb-ft
Dead Only	33022.67	0.00	0.00	676.38	-546.16	0.00
Dead+Wind 0 deg - No Ice	33022.67	0.00	-26983.59	-2362659.91	-557.19	2369.44
Dead+Wind 30 deg - No Ice	33022.67	13169.74	-23368.48	-2046053.03	-1152215.33	3105.29
Dead+Wind 60 deg - No Ice	33022.67	22810.65	-13491.80	-1181017.17	-1995325.73	3011.09
Dead+Wind 90 deg - No Ice	33022.67	26339.48	0.00	696.76	-2303938.95	2111.74
Dead+Wind 120 deg - No Ice	33022.67	22810.65	13491.80	1182413.60	-1995331.03	646.35
Dead+Wind 150 deg - No Ice	33022.67	13169.74	23368.48	2047455.33	-1152220.62	-993.85
Dead+Wind 180 deg - No Ice	33022.67	0.00	26983.59	2364065.15	-557.18	-2369.41
Dead+Wind 210 deg - No Ice	33022.67	-13169.74	23368.48	2047449.53	1151102.82	-3110.24
Dead+Wind 240 deg - No Ice	33022.67	-22810.65	13491.80	1182407.80	1994206.26	-3016.08
Dead+Wind 270 deg - No Ice	33022.67	-26339.48	0.00	696.77	2302810.69	-2111.75
Dead+Wind 300 deg - No Ice	33022.67	-22810.65	-13491.80	-1181011.36	1994200.96	-641.35
Dead+Wind 330 deg - No Ice	33022.67	-13169.74	-23368.48	-2046047.22	1151097.51	998.84
Dead+Ice+Temp	41166.80	0.00	0.00	1194.26	-815.94	-0.04
Dead+Wind 0 deg+Ice+Temp	41166.80	-0.00	-22539.60	-2020426.36	-848.67	2154.90
Dead+Wind 30 deg+Ice+Temp	41166.80	11023.78	-19519.86	-1749585.81	-988551.67	2785.49
Dead+Wind 60 deg+Ice+Temp	41166.80	19093.75	-11269.80	-1009605.89	-1711624.48	2670.99
Dead+Wind 90 deg+Ice+Temp	41166.80	22047.56	-0.00	1258.71	-1976297.73	1841.92
Dead+Wind 120 deg+Ice+Temp	41166.80	19093.75	11269.80	1012126.02	-1711629.38	519.23
Dead+Wind 150 deg+Ice+Temp	41166.80	11023.78	19519.86	1752111.36	-988556.57	-943.69
Dead+Wind 180 deg+Ice+Temp	41166.80	-0.00	22539.60	2022954.62	-848.64	-2154.83
Dead+Wind 210 deg+Ice+Temp	41166.80	-11023.78	19519.86	1752105.17	986855.57	-2788.70
Dead+Wind 240 deg+Ice+Temp	41166.80	-19093.75	11269.80	1012119.83	1709920.96	-2674.26
Dead+Wind 270 deg+Ice+Temp	41166.80	-22047.56	-0.00	1258.73	1974585.58	-1841.90
Dead+Wind 300 deg+Ice+Temp	41166.80	-19093.75	-11269.80	-1009599.68	1709916.03	-515.89
Dead+Wind 330 deg+Ice+Temp	41166.80	-11023.78	-19519.86	-1749579.61	986850.62	947.03
Dead+Wind 0 deg - Service	33022.67	0.00	-9336.88	-817604.23	-565.15	822.93
Dead+Wind 30 deg - Service	33022.67	4557.00	-8085.98	-707972.85	-399322.16	1079.16
Dead+Wind 60 deg - Service	33022.67	7892.96	-4668.44	-408451.81	-691234.45	1046.47
Dead+Wind 90 deg - Service	33022.67	9114.01	0.00	704.19	-798082.65	733.60
Dead+Wind 120 deg - Service	33022.67	7892.96	4668.44	409860.54	-691235.08	224.16
Dead+Wind 150 deg - Service	33022.67	4557.00	8085.98	709382.29	-399322.79	-345.57
Dead+Wind 180 deg - Service	33022.67	0.00	9336.88	819014.03	-565.15	-822.92
Dead+Wind 210 deg - Service	33022.67	-4557.00	8085.98	709381.60	398192.08	-1079.78
Dead+Wind 240 deg - Service	33022.67	-7892.96	4668.44	409859.85	690103.53	-1047.09
Dead+Wind 270 deg - Service	33022.67	-9114.01	0.00	704.20	796950.68	-733.59
Dead+Wind 300 deg - Service	33022.67	-7892.96	-4668.44	-408451.11	690102.90	-223.52
Dead+Wind 330 deg - Service	33022.67	-4557.00	-8085.98	-707972.15	398191.44	346.21

Solution Summary

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
1	0.00	-33022.67	0.00	0.00	33022.67	0.00	0.000%
2	0.00	-33022.67	-26983.59	-0.00	33022.67	26983.59	0.000%
3	13169.74	-33022.67	-23368.48	-13169.74	33022.67	23368.48	0.000%
4	22810.65	-33022.67	-13491.80	-22810.65	33022.67	13491.80	0.000%
5	26339.47	-33022.67	0.00	-26339.48	33022.67	-0.00	0.000%
6	22810.65	-33022.67	13491.80	-22810.65	33022.67	-13491.80	0.000%
7	13169.74	-33022.67	23368.48	-13169.74	33022.67	-23368.48	0.000%
8	0.00	-33022.67	26983.59	-0.00	33022.67	-26983.59	0.000%
9	-13169.74	-33022.67	23368.48	13169.74	33022.67	-23368.48	0.000%
10	-22810.65	-33022.67	13491.80	22810.65	33022.67	-13491.80	0.000%
11	-26339.47	-33022.67	0.00	26339.48	33022.67	-0.00	0.000%
12	-22810.65	-33022.67	-13491.80	22810.65	33022.67	13491.80	0.000%
13	-13169.74	-33022.67	-23368.48	13169.74	33022.67	23368.48	0.000%
14	0.00	-41166.80	0.00	0.00	41166.80	0.00	0.000%
15	0.00	-41166.80	-22539.59	0.00	41166.80	22539.60	0.000%
16	11023.78	-41166.80	-19519.86	-11023.78	41166.80	19519.86	0.000%
17	19093.74	-41166.80	-11269.80	-19093.75	41166.80	11269.80	0.000%
18	22047.56	-41166.80	0.00	-22047.56	41166.80	0.00	0.000%
19	19093.74	-41166.80	11269.80	-19093.75	41166.80	-11269.80	0.000%
20	11023.78	-41166.80	19519.86	-11023.78	41166.80	-19519.86	0.000%
21	0.00	-41166.80	22539.59	0.00	41166.80	-22539.60	0.000%
22	-11023.78	-41166.80	19519.86	11023.78	41166.80	-19519.86	0.000%
23	-19093.74	-41166.80	11269.80	19093.75	41166.80	-11269.80	0.000%
24	-22047.56	-41166.80	0.00	22047.56	41166.80	0.00	0.000%
25	-19093.74	-41166.80	-11269.80	19093.75	41166.80	11269.80	0.000%
26	-11023.78	-41166.80	-19519.86	11023.78	41166.80	19519.86	0.000%
27	0.00	-33022.67	-9336.88	-0.00	33022.67	9336.88	0.000%
28	4557.00	-33022.67	-8085.98	-4557.00	33022.67	8085.98	0.000%
29	7892.96	-33022.67	-4668.44	-7892.96	33022.67	4668.44	0.000%
30	9114.00	-33022.67	0.00	-9114.01	33022.67	-0.00	0.000%
31	7892.96	-33022.67	4668.44	-7892.96	33022.67	-4668.44	0.000%
32	4557.00	-33022.67	8085.98	-4557.00	33022.67	-8085.98	0.000%
33	0.00	-33022.67	9336.88	-0.00	33022.67	-9336.88	0.000%
34	-4557.00	-33022.67	8085.98	4557.00	33022.67	-8085.98	0.000%
35	-7892.96	-33022.67	4668.44	7892.96	33022.67	-4668.44	0.000%
36	-9114.00	-33022.67	0.00	9114.01	33022.67	-0.00	0.000%
37	-7892.96	-33022.67	-4668.44	7892.96	33022.67	4668.44	0.000%
38	-4557.00	-33022.67	-8085.98	4557.00	33022.67	8085.98	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00038297
3	Yes	5	0.00000001	0.00016896
4	Yes	5	0.00000001	0.00014805
5	Yes	4	0.00000001	0.00050246
6	Yes	5	0.00000001	0.00016282
7	Yes	5	0.00000001	0.00015899
8	Yes	4	0.00000001	0.00038330
9	Yes	5	0.00000001	0.00014845
10	Yes	5	0.00000001	0.00016979
11	Yes	4	0.00000001	0.00050222
12	Yes	5	0.00000001	0.00015312
13	Yes	5	0.00000001	0.00015659

14	Yes	4	0.00000001	0.00000001
15	Yes	5	0.00000001	0.00007977
16	Yes	5	0.00000001	0.00032891
17	Yes	5	0.00000001	0.00029931
18	Yes	5	0.00000001	0.00008169
19	Yes	5	0.00000001	0.00032090
20	Yes	5	0.00000001	0.00031538
21	Yes	5	0.00000001	0.00007992
22	Yes	5	0.00000001	0.00030067
23	Yes	5	0.00000001	0.00033057
24	Yes	5	0.00000001	0.00008162
25	Yes	5	0.00000001	0.00030578
26	Yes	5	0.00000001	0.00031107
27	Yes	4	0.00000001	0.00006838
28	Yes	4	0.00000001	0.00036709
29	Yes	4	0.00000001	0.00027580
30	Yes	4	0.00000001	0.00008760
31	Yes	4	0.00000001	0.00033442
32	Yes	4	0.00000001	0.00031831
33	Yes	4	0.00000001	0.00006859
34	Yes	4	0.00000001	0.00027780
35	Yes	4	0.00000001	0.00036951
36	Yes	4	0.00000001	0.00008744
37	Yes	4	0.00000001	0.00029044
38	Yes	4	0.00000001	0.00030664

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	125 - 96.04	20.897	33	1.4719	0.0054
L2	99.96 - 47.67	13.442	33	1.3141	0.0044
L3	53.34 - 1	3.546	33	0.6400	0.0016

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
129.00	10' x 3" Dia Omni	33	20.897	1.4719	0.0054	25756
124.00	Sidearm	33	20.590	1.4677	0.0053	25756
122.00	Low Profile Platform	33	19.975	1.4594	0.0051	25756
117.00	Low Profile Platform	33	18.445	1.4372	0.0046	16097
112.00	Low Profile Platform	33	16.934	1.4107	0.0044	9906
107.00	Low Profile Platform	33	15.453	1.3775	0.0044	7154
102.00	Low Profile Platform	33	14.014	1.3348	0.0044	5626
97.00	10' x 3" Dia Omni	33	12.628	1.2803	0.0046	4952
92.00	Low Profile Platform	33	11.303	1.2145	0.0045	4638
82.00	Low Profile Platform	33	8.851	1.0603	0.0041	4126
72.00	Low Profile Platform	33	6.690	0.8955	0.0032	3715
67.00	ANT150D6-9	33	5.729	0.8165	0.0028	3539
62.00	ANT150D6-9	33	4.852	0.7435	0.0023	3379
57.00	ANT150D6-9	33	4.064	0.6795	0.0019	3234
52.00	ANT150D6-9	33	3.369	0.6274	0.0015	3245

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	125 - 96.04	60.234	8	4.2427	0.0159
L2	99.96 - 47.67	38.758	8	3.7890	0.0124
L3	53.34 - 1	10.232	8	1.8465	0.0046

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
129.00	10' x 3" Dia Omni	8	60.234	4.2427	0.0159	9047
124.00	Sidearm	8	59.348	4.2299	0.0154	9047
122.00	Low Profile Platform	8	57.578	4.2040	0.0147	9047
117.00	Low Profile Platform	8	53.172	4.1357	0.0131	5654
112.00	Low Profile Platform	8	48.819	4.0574	0.0129	3478
107.00	Low Profile Platform	8	44.553	3.9625	0.0128	2511
102.00	Low Profile Platform	8	40.407	3.8450	0.0128	1974
97.00	10' x 3" Dia Omni	8	36.415	3.6987	0.0133	1734
92.00	Low Profile Platform	8	32.596	3.5243	0.0133	1622
82.00	Low Profile Platform	8	25.528	3.1136	0.0120	1440
72.00	Low Profile Platform	8	19.298	2.6582	0.0096	1294
67.00	ANT150D6-9	8	16.526	2.4280	0.0082	1232
62.00	ANT150D6-9	8	13.998	2.2038	0.0068	1175
57.00	ANT150D6-9	8	11.726	1.9913	0.0055	1124
52.00	ANT150D6-9	8	9.722	1.7962	0.0043	1127

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 lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
L1	125 - 123.682	TP26.9x18x0.1875	28.96	124.00	230.1	2.821	10.8417	-291.17	30582.80	0.010*
	123.682 - 122.364					2.948	11.0827	-356.72	32668.30	0.011
	122.364 - 121.046					3.077	11.3238	-3865.03	34846.50	0.111*
	121.046 - 119.728					3.210	11.5648	-4117.89	37119.40	0.111
	119.728 - 118.411					3.345	11.8058	-4606.08	39489.00	0.117
	118.411 - 117.093					3.483	12.0469	-5095.91	41957.40	0.121

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
	117.093 - 115.775					3.624	12.2879	-5587.41	44526.60	0.125
	115.775 - 114.457					3.767	12.5289	-6080.59	47198.60	0.129
	114.457 - 113.139					3.914	12.7700	-6573.79	49975.40	0.132
	113.139 - 111.821					4.063	13.0110	-7344.50	52859.00	0.139
	111.821 - 110.503					4.215	13.2521	-7585.77	55851.50	0.136
	110.503 - 109.185					4.369	13.4931	-7828.84	58954.80	0.133
	109.185 - 107.867					4.527	13.7341	-8073.71	62171.10	0.130
	107.867 - 106.549					4.687	13.9752	-5752.96	65502.20	0.088
	106.549 - 105.232					4.850	14.2162	-5945.86	68950.20	0.086
	105.232 - 103.914					5.016	14.4572	-6140.29	72517.10	0.085
	103.914 - 102.596					5.185	14.6983	-6336.22	76205.00	0.083
	102.596 - 101.278					5.356	14.9393	-6894.67	80015.90	0.086
	101.278 - 99.96					5.530	15.1803	-6997.56	83951.70	0.083
	99.96 - 96.04					6.065	15.8973	-3308.70	96417.00	0.034
L2	99.96 - 96.04	TP41.28x25.3203x0.25	52.29	124.00	159.6	5.864	20.8427	-4285.93	122227.00	0.035
	96.04 - 93.6678					6.192	21.4172	-7954.38	132616.00	0.060
	93.6678 - 91.2956					6.529	21.9917	-9754.05	143577.00	0.068
	91.2956 - 88.9233					6.874	22.5662	-10118.60	155126.00	0.065
	88.9233 - 86.5511					7.229	23.1408	-10489.70	167279.00	0.063
	86.5511 - 84.1789					7.592	23.7153	-10867.10	180050.00	0.060
	84.1789 - 81.8067					7.964	24.2898	-12743.00	193455.00	0.066
	81.8067 - 79.4344					8.346	24.8643	-13136.80	207510.00	0.063
	79.4344 - 77.0622					8.736	25.4389	-13536.80	222229.00	0.061
	77.0622 - 74.69					9.135	26.0134	-13942.90	237629.00	0.059
	74.69 - 72.3178					9.543	26.5879	-14355.00	253723.00	0.057
	72.3178 - 69.9456					9.960	27.1624	-16324.60	270529.00	0.060
	69.9456 - 67.5733					10.386	27.7370	-16758.60	288061.00	0.058
	67.5733 - 65.2011					10.820	28.3115	-17198.40	306334.00	0.056
	65.2011 - 62.8289					11.264	28.8860	-17644.10	325365.00	0.054
	62.8289 - 60.4567					11.716	29.4605	-18095.40	345167.00	0.052
	60.4567 - 58.0844					12.178	30.0350	-18552.20	365757.00	0.051
	58.0844 - 55.7122					12.648	30.6096	-19014.50	387151.00	0.049
	55.7122 - 53.34					13.127	31.1841	-19482.20	409362.00	0.048
	53.34 - 47.67					14.309	32.5573	-9649.30	465858.00	0.021

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
L3	53.34 - 47.67	TP55x39.0494x0.3125	52.34	124.00	103.6	13.917	40.1361	-11650.20	558590.00	0.021
	47.67 - 45.2137					14.437	40.8786	-21863.80	590167.00	0.037
	45.2137 - 42.7574					14.966	41.6210	-22428.80	622912.00	0.036
	42.7574 - 40.3011					15.505	42.3635	-23000.30	656847.00	0.035
	40.3011 - 37.8447					16.053	43.1060	-23578.10	691992.00	0.034
	37.8447 - 35.3884					16.611	43.8485	-24162.30	728369.00	0.033
	35.3884 - 32.9321					17.176	44.5910	-24752.80	765878.00	0.032
	32.9321 - 30.4758					17.721	45.3334	-25349.70	803356.00	0.032
	30.4758 - 28.0195					18.242	46.0759	-25952.90	840525.00	0.031
	28.0195 - 25.5632					18.741	46.8184	-26562.50	877406.00	0.030
	25.5632 - 23.1068					19.218	47.5609	-27178.30	914016.00	0.030
	23.1068 - 20.6505					19.675	48.3033	-27800.40	950371.00	0.029
	20.6505 - 18.1942					20.114	49.0458	-28428.80	986488.00	0.029
	18.1942 - 15.7379					20.535	49.7883	-29063.50	1022380.00	0.028
	15.7379 - 13.2816					20.939	50.5308	-29704.40	1058060.00	0.028
	13.2816 - 10.8253					21.328	51.2733	-30351.70	1093530.00	0.028
	10.8253 - 8.36895					21.701	52.0157	-31005.20	1128820.00	0.027
	8.36895 - 5.91263					22.061	52.7582	-31665.00	1163920.00	0.027
	5.91263 - 3.45632					22.408	53.5007	-32331.10	1198860.00	0.027
	3.45632 - 1					22.743	54.2432	-33003.50	1233630.00	0.027

* DL controls

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x lb-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y lb-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	125 - 123.682	TP26.9x18x0.1875	718.88	-0.177	39.000	0.005	0.00	0.000	39.000	0.000
	123.682 - 122.364		2168.98	-0.512	39.000	0.013	0.00	0.000	39.000	0.000
	122.364 - 121.046		694.60	-0.157	39.000	0.004	0.00	0.000	39.000	0.000
	121.046 - 119.728		11016.58	-2.388	39.000	0.061	0.00	0.000	39.000	0.000
	119.728 - 118.411		16456.42	-3.422	39.000	0.088	0.00	0.000	39.000	0.000
	118.411 - 117.093		22197.50	-4.433	39.000	0.114	0.00	0.000	39.000	0.000

Section No.	Elevation ft	Size	Actual M_x lb-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y lb-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
	117.093 - 115.775		28240.83	-5.420	39.000	0.139	0.00	0.000	39.000	0.000
	115.775 - 114.457		34587.08	-6.383	39.000	0.164	0.00	0.000	39.000	0.000
	114.457 - 113.139		41261.33	-7.329	39.000	0.188	0.00	0.000	39.000	0.000
	113.139 - 111.821		48509.42	-8.299	39.000	0.213	0.00	0.000	39.000	0.000
	111.821 - 110.503		57709.00	-9.516	39.000	0.244	0.00	0.000	39.000	0.000
	110.503 - 109.185		67076.00	-10.667	39.000	0.274	0.00	0.000	39.000	0.000
	109.185 - 107.867		76611.00	-11.758	39.000	0.301	0.00	0.000	39.000	0.000
	107.867 - 106.549		96795.83	-14.345	39.000	0.368	0.00	0.000	39.000	0.000
	106.549 - 105.232		107961.67	-15.460	39.000	0.396	0.00	0.000	39.000	0.000
	105.232 - 103.914		119321.67	-16.520	39.000	0.424	0.00	0.000	39.000	0.000
	103.914 - 102.596		130877.50	-17.528	39.000	0.449	0.00	0.000	39.000	0.000
	102.596 - 101.278		144184.17	-18.690	39.000	0.479	0.00	0.000	39.000	0.000
	101.278 - 99.96		158954.17	-19.953	39.000	0.512	0.00	0.000	39.000	0.000
	99.96 - 96.04		90040.00	-10.303	39.000	0.264	0.00	0.000	39.000	0.000
L2	99.96 - 96.04	TP41.28x25.3203x0.25	113957.50	-10.139	39.000	0.260	0.00	0.000	39.000	0.000
	96.04 - 93.6678		232101.67	-19.553	39.000	0.501	0.00	0.000	39.000	0.000
	93.6678 - 91.2956		264197.50	-21.104	39.000	0.541	0.00	0.000	39.000	0.000
	91.2956 - 88.9233		304420.83	-23.089	39.000	0.592	0.00	0.000	39.000	0.000
	88.9233 - 86.5511		345015.83	-24.880	39.000	0.638	0.00	0.000	39.000	0.000
	86.5511 - 84.1789		385982.50	-26.496	39.000	0.679	0.00	0.000	39.000	0.000
	84.1789 - 81.8067		427770.00	-27.986	39.000	0.718	0.00	0.000	39.000	0.000
	81.8067 - 79.4344		474941.67	-29.648	39.000	0.760	0.00	0.000	39.000	0.000
	79.4344 - 77.0622		522485.00	-31.154	39.000	0.799	0.00	0.000	39.000	0.000
	77.0622 - 74.69		570400.83	-32.519	39.000	0.834	0.00	0.000	39.000	0.000
	74.69 - 72.3178		618691.67	-33.759	39.000	0.866	0.00	0.000	39.000	0.000
	72.3178 - 69.9456		670306.67	-35.039	39.000	0.898	0.00	0.000	39.000	0.000
	69.9456 - 67.5733		722812.50	-36.229	39.000	0.929	0.00	0.000	39.000	0.000
	67.5733 - 65.2011		775757.50	-37.315	39.000	0.957	0.00	0.000	39.000	0.000
	65.2011 - 62.8289		829145.00	-38.307	39.000	0.982	0.00	0.000	39.000	0.000
	62.8289 - 60.4567		882975.00	-39.214	39.000	1.005	0.00	0.000	39.000	0.000

Section No.	Elevation ft	Size	Actual M_x lb-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y lb-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
	60.4567 - 58.0844		937250.00	-40.042	38.851	1.031	0.00	0.000	38.851	0.000
	58.0844 - 55.7122		991966.67	-40.798	38.527	1.059	0.00	0.000	38.527	0.000
	55.7122 - 53.34		1047141.67	-41.490	38.202	1.086	0.00	0.000	38.202	0.000
	53.34 - 47.67		537319.17	-19.527	37.427	0.522	0.00	0.000	37.427	0.000
L3	53.34 - 47.67	TP55x39.0494x0.3125	643527.50	-19.267	39.000	0.494	0.00	0.000	39.000	0.000
	47.67 - 45.2137		1239525.00	-35.769	39.000	0.917	0.00	0.000	39.000	0.000
	45.2137 - 42.7574		1298583.33	-36.143	39.000	0.927	0.00	0.000	39.000	0.000
	42.7574 - 40.3011		1358016.67	-36.480	39.000	0.935	0.00	0.000	39.000	0.000
	40.3011 - 37.8447		1417841.67	-36.782	39.000	0.943	0.00	0.000	39.000	0.000
	37.8447 - 35.3884		1478058.33	-37.052	39.000	0.950	0.00	0.000	39.000	0.000
	35.3884 - 32.9321		1538675.00	-37.293	39.000	0.956	0.00	0.000	39.000	0.000
	32.9321 - 30.4758		1599675.00	-37.508	39.000	0.962	0.00	0.000	39.000	0.000
	30.4758 - 28.0195		1661083.33	-37.698	39.000	0.967	0.00	0.000	39.000	0.000
	28.0195 - 25.5632		1722900.00	-37.867	38.891	0.974	0.00	0.000	38.891	0.000
	25.5632 - 23.1068		1785116.67	-38.015	38.623	0.984	0.00	0.000	38.623	0.000
	23.1068 - 20.6505		1847750.00	-38.144	38.355	0.995	0.00	0.000	38.355	0.000
	20.6505 - 18.1942		1910791.67	-38.257	38.087	1.004	0.00	0.000	38.087	0.000
	18.1942 - 15.7379		1974258.33	-38.354	37.818	1.014	0.00	0.000	37.818	0.000
	15.7379 - 13.2816		2038150.00	-38.437	37.550	1.024	0.00	0.000	37.550	0.000
	13.2816 - 10.8253		2102466.67	-38.506	37.282	1.033	0.00	0.000	37.282	0.000
	10.8253 - 8.36895		2167208.33	-38.563	37.014	1.042	0.00	0.000	37.014	0.000
	8.36895 - 5.91263		2232391.67	-38.610	36.746	1.051	0.00	0.000	36.746	0.000
	5.91263 - 3.45632		2298008.33	-38.646	36.477	1.059	0.00	0.000	36.477	0.000
	3.45632 - 1		2364066.67	-38.673	36.209	1.068	0.00	0.000	36.209	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	125 - 123.682	TP26.9x18x0.1875	0.010	0.005	0.000	0.014 ✔	1.000	H1-3 ✔

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
	123.682 - 122.364		0.011	0.013	0.000	0.024 ✔	1.333	H1-3 ✔
	122.364 - 121.046		0.111	0.004	0.000	0.115 ✔	1.000	H1-3 ✔
	121.046 - 119.728		0.111	0.061	0.000	0.172 ✔	1.333	H1-3 ✔
	119.728 - 118.411		0.117	0.088	0.000	0.204 ✔	1.333	H1-3 ✔
	118.411 - 117.093		0.121	0.114	0.000	0.235 ✔	1.333	H1-3 ✔
	117.093 - 115.775		0.125	0.139	0.000	0.264 ✔	1.333	H1-3 ✔
	115.775 - 114.457		0.129	0.164	0.000	0.293 ✔	1.333	H1-3 ✔
	114.457 - 113.139		0.132	0.188	0.000	0.319 ✔	1.333	H1-3 ✔
	113.139 - 111.821		0.139	0.213	0.000	0.352 ✔	1.333	H1-3 ✔
	111.821 - 110.503		0.136	0.244	0.000	0.380 ✔	1.333	H1-3 ✔
	110.503 - 109.185		0.133	0.274	0.000	0.406 ✔	1.333	H1-3 ✔
	109.185 - 107.867		0.130	0.301	0.000	0.431 ✔	1.333	H1-3 ✔
	107.867 - 106.549		0.088	0.368	0.000	0.456 ✔	1.333	H1-3 ✔
	106.549 - 105.232		0.086	0.396	0.000	0.483 ✔	1.333	H1-3 ✔
	105.232 - 103.914		0.085	0.424	0.000	0.508 ✔	1.333	H1-3 ✔
	103.914 - 102.596		0.083	0.449	0.000	0.533 ✔	1.333	H1-3 ✔
	102.596 - 101.278		0.086	0.479	0.000	0.565 ✔	1.333	H1-3 ✔
	101.278 - 99.96		0.083	0.512	0.000	0.595 ✔	1.333	H1-3 ✔
	99.96 - 96.04		0.034	0.264	0.000	0.298 ✔	1.333	H1-3 ✔
L2	99.96 - 96.04	TP41.28x25.3203x0.25	0.035	0.260	0.000	0.295 ✔	1.333	H1-3 ✔
	96.04 - 93.6678		0.060	0.501	0.000	0.561 ✔	1.333	H1-3 ✔
	93.6678 - 91.2956		0.068	0.541	0.000	0.609 ✔	1.333	H1-3 ✔
	91.2956 - 88.9233		0.065	0.592	0.000	0.657 ✔	1.333	H1-3 ✔
	88.9233 - 86.5511		0.063	0.638	0.000	0.701 ✔	1.333	H1-3 ✔
	86.5511 - 84.1789		0.060	0.679	0.000	0.740 ✔	1.333	H1-3 ✔
	84.1789 - 81.8067		0.066	0.718	0.000	0.783 ✔	1.333	H1-3 ✔
	81.8067 - 79.4344		0.063	0.760	0.000	0.824 ✔	1.333	H1-3 ✔
	79.4344 - 77.0622		0.061	0.799	0.000	0.860 ✔	1.333	H1-3 ✔
	77.0622 - 74.69		0.059	0.834	0.000	0.893 ✔	1.333	H1-3 ✔
	74.69 - 72.3178		0.057	0.866	0.000	0.922 ✔	1.333	H1-3 ✔
	72.3178 -		0.060	0.898	0.000	0.959 ✔	1.333	H1-3 ✔

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
	69.9456							
	69.9456 - 67.5733		0.058	0.929	0.000	0.987 ✔	1.333	H1-3 ✔
	67.5733 - 65.2011		0.056	0.957	0.000	1.013 ✔	1.333	H1-3 ✔
	65.2011 - 62.8289		0.054	0.982	0.000	1.036 ✔	1.333	H1-3 ✔
	62.8289 - 60.4567		0.052	1.005	0.000	1.058 ✔	1.333	H1-3 ✔
	60.4567 - 58.0844		0.051	1.031	0.000	1.081 ✔	1.333	H1-3 ✔
	58.0844 - 55.7122		0.049	1.059	0.000	1.108 ✔	1.333	H1-3 ✔
	55.7122 - 53.34		0.048	1.086	0.000	1.134 ✔	1.333	H1-3 ✔
	53.34 - 47.67		0.021	0.522	0.000	0.542 ✔	1.333	H1-3 ✔
L3	53.34 - 47.67	TP55x39.0494x0.3125	0.021	0.494	0.000	0.515 ✔	1.333	H1-3 ✔
	47.67 - 45.2137		0.037	0.917	0.000	0.954 ✔	1.333	H1-3 ✔
	45.2137 - 42.7574		0.036	0.927	0.000	0.963 ✔	1.333	H1-3 ✔
	42.7574 - 40.3011		0.035	0.935	0.000	0.970 ✔	1.333	H1-3 ✔
	40.3011 - 37.8447		0.034	0.943	0.000	0.977 ✔	1.333	H1-3 ✔
	37.8447 - 35.3884		0.033	0.950	0.000	0.983 ✔	1.333	H1-3 ✔
	35.3884 - 32.9321		0.032	0.956	0.000	0.989 ✔	1.333	H1-3 ✔
	32.9321 - 30.4758		0.032	0.962	0.000	0.993 ✔	1.333	H1-3 ✔
	30.4758 - 28.0195		0.031	0.967	0.000	0.997 ✔	1.333	H1-3 ✔
	28.0195 - 25.5632		0.030	0.974	0.000	1.004 ✔	1.333	H1-3 ✔
	25.5632 - 23.1068		0.030	0.984	0.000	1.014 ✔	1.333	H1-3 ✔
	23.1068 - 20.6505		0.029	0.995	0.000	1.024 ✔	1.333	H1-3 ✔
	20.6505 - 18.1942		0.029	1.004	0.000	1.033 ✔	1.333	H1-3 ✔
	18.1942 - 15.7379		0.028	1.014	0.000	1.043 ✔	1.333	H1-3 ✔
	15.7379 - 13.2816		0.028	1.024	0.000	1.052 ✔	1.333	H1-3 ✔
	13.2816 - 10.8253		0.028	1.033	0.000	1.061 ✔	1.333	H1-3 ✔
	10.8253 - 8.36895		0.027	1.042	0.000	1.069 ✔	1.333	H1-3 ✔
	8.36895 - 5.91263		0.027	1.051	0.000	1.078 ✔	1.333	H1-3 ✔
	5.91263 - 3.45632		0.027	1.059	0.000	1.086 ✔	1.333	H1-3 ✔
	3.45632 - 1		0.027	1.068	0.000	1.095 ✔	1.333	H1-3 ✔

* DL controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
L1	125 - 96.04	Pole	TP26.9x18x0.1875	1	-6997.56	111907.62	44.6	Pass
L2	96.04 - 47.67	Pole	TP41.28x25.3203x0.25	2	-19482.20	545679.52	85.0	Pass
L3	47.67 - 1	Pole	TP55x39.0494x0.3125	3	-33003.50	1644428.72	82.1	Pass
							Summary	
						Pole (L2)	85.0	Pass
						RATING =	**85.0**	**Pass**

ANCHOR BOLT AND BASE PLATE ANALYSIS

Input Data

Tower Reactions:

Overturning Moment:	$OM := 2365 \cdot ft \cdot kips$	*user input*
Shear Force:	$Shear := 27.0 \cdot kips$	*user input*
Axial Force:	$Axial := 33.0 \cdot kips$	*user input*

Anchor Bolt Data:

Use ASTM A615 Grade 75	*user input*	
Number of Anchor Bolts = N	$N := 12$	*user input*
Diameter of Bolt Circle:	$D_{bc} := 63in$	*user input*
Bolt "Column" Distance:	$L := 3.0in$	*user input*
Bolt Ultimate Strength:	$F_u := 100 \cdot ksi$	*user input*
Bolt Yield Strength:	$Fy := 75 \cdot ksi$	*user input*
Bolt Modulus:	$E := 29000 \cdot ksi$	*user input*
Anchor Bolt Diameter	$D := 2.25in$	*user input*
Threads per Inch:	$n := 4.5$	*user input*

Base Plate Data:

Use ASTM A572 (60 ksi)		*user input*
Plate Yield Strength:	$Fy_{bp} := 60 \cdot ksi$	*user input*
Base Plate Thickness:	$PlateThickness := 1.75 \cdot in$	*user input*
Base Plate Diameter:	$D_{bp} := 69 \cdot in$	*user input*
Outer Pole Diameter:	$D_{pole} := 55in$	*user input*

Geometric Layout Data:

Distance from the center of gravity of the group to bolt in question = d(i)

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

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

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

$d_1 = 15.75 \cdot in$ $d_7 = -15.75 \cdot in$

$d_2 = 27.28 \cdot in$ $d_8 = -27.28 \cdot in$

$d_3 = 31.50 \cdot in$ $d_9 = -31.50 \cdot in$

$d_4 = 27.28 \cdot in$ $d_{10} = -27.28 \cdot in$

$d_5 = 15.75 \cdot in$ $d_{11} = -15.75 \cdot in$

$d_6 = 0.00 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius: $R_{pole} := \frac{D_{pole}}{2}$ $R_{pole} = 27.50 \cdot in$

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

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

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

$MA_3 = 4.00 \cdot in$ $MA_9 = 0.00 \cdot in$

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

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

$MA_6 = 0.00 \cdot in$ etc.

Effective Width of Baseplate for Bending: $EffectiveWidth := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2}$ $EffectiveWidth = 33.33 \cdot in$

Anchor Bolt Analysis:

Polar Moment of Inertia I_p:

$$I_p := \sum_i \left(d_i\right)^2 \qquad I_p = 5.953 \times 10^3 \cdot in^2$$

Gross Area of Bolt:

$$A_g := \frac{\pi}{4} \cdot D^2 \qquad A_g = 3.976 \cdot in^2$$

Net Area of Bolt:

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

Net Diameter:

$$D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} \qquad D_n = 2.03 \cdot in$$

Radius of Gyration of Bolt:

$$r := \frac{D_n}{4} \qquad r = 0.51 \cdot in$$

Section Modulus of Bolt:

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

Anchor Bolt Bending Stress:

Maximum Applied Bending:

$$M_x := \left(\frac{Shear}{N}\right) \cdot l \qquad M_x = 0.562 \cdot ft \cdot kips$$

$$f_{bx} := \frac{M_x}{S_x} \qquad f_{bx} = 8.2 \cdot ksi$$

Allowable Bending

$$F_{bx} := 1.333 \cdot 0.60 \cdot Fy \qquad F_{bx} = 60.0 \cdot ksi$$

Note: 1.333 increase allowed per TIA/EIA

Check Tensile Forces:

Maximum Tensile Force (Gross Area):

$AllowableTension := 1.333 \cdot (0.33 \cdot A_g \cdot F_u)$ $\quad AllowableTension = 174.9 \cdot kips$

Note: 1.333 increase allowed per TIA/EIA

Maximum Tensile Force (Net Area):

$F_{net.area} := 1.333 \cdot (0.60 \cdot A_n \cdot Fy)$ $\quad F_{net.area} = 194.8 \cdot kips$

Note: 1.333 increase allowed per TIA/EIA

Applied Tension:

$$MaxTension := \frac{OM \cdot R_{bc}}{I_p} - \frac{Axial}{N} \qquad MaxTension = 147.4 \cdot kips$$

Check Stresses:

Note: Bolts supplied are "upset bolts." Use net area for checking per AISC

$$\frac{MaxTension}{F_{net.area}} = 0.76$$

$$Condition := if\left(\frac{MaxTension}{F_{net.area}} \le 1.00, "OK", "Overstressed"\right)$$

Condition = "OK"

Check Compression & Combined Stresses (if required):

Check to see if a complete combined stress analysis is required:

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."

Set the clear space between the plate and bolt to zero and remove bending stresses if a combined stress analysis is not required:

$$l := \begin{cases} l & \text{if } l > 2 \cdot D_n \\ 0.00\,in & \text{otherwise} \end{cases} \qquad l = 0.00 \cdot in$$

$$f_{bx} := \begin{cases} f_{bx} & \text{if } l > 2 \cdot D_n \\ 0.0\,ksi & \text{otherwise} \end{cases} \qquad f_{bx} = 0.0 \cdot ksi$$

Allowable Compressive Force:

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{Fy}} \qquad C_c = 87.36$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^{\,2}}\right] \cdot Fy}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^{\,3}}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} \qquad F_a = 45.0 \cdot ksi$$

$$F_a := 1.333 \cdot F_a \quad \text{Note: 1.333 increase allowed per TIA/EIA} \qquad F_a = 60.0 \cdot ksi$$

Applied Compressive Force:

$$MaxCompression := \frac{OM \cdot R_{bc}}{I_p} + \frac{Axial}{N} \qquad MaxCompression = 152.9 \cdot kips$$

$$f_a := \frac{MaxCompression}{A_n} \qquad f_a = 47.1 \cdot ksi$$

Check Combined Stresses:

$$\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} = 0.78$$

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

Base Plate Analysis:

Force from Bolt(s):

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

$C_1 = 77.8 \cdot kips$ $C_7 = -72.3 \cdot kips$

$C_2 = 132.8 \cdot kips$ $C_8 = -127.3 \cdot kips$

$C_3 = 152.9 \cdot kips$ $C_9 = -147.4 \cdot kips$

$C_4 = 132.8 \cdot kips$ $C_{10} = -127.3 \cdot kips$

$C_5 = 77.8 \cdot kips$ $C_{11} = -72.3 \cdot kips$

$C_6 = 2.8 \cdot kips$ etc.

Bending Stress in Plate:

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{EffectiveWidth \cdot PlateThickness^2} \qquad f_{bp} = 36.0 \cdot ksi$$

Check Stresses:

$$\frac{f_{bp}}{1.333 \cdot 0.75 Fy_{bp}} = 0.60$$

$$Condition := if\left(\frac{f_{bp}}{1.333 \cdot 0.75 Fy_{bp}} < 1.00, "OK", "Overstressed"\right)$$

Condition = "OK"

NATCOMM

Job	125' EEI Monopole – Bethel, CT	**Project No.**	08007.CO3	**Page**	1 of 9
Description	Foundation Analysis	**Computed by**	JEK	**Date**	1/23/2008

MONOPOLE FOUNDATION ANALYSIS

TOWER FORCES:

Moment Caused by Tower	$M_t := 2365 \cdot ft \cdot kips$
Shear at Base of Tower	$S_t := 27.0 kip$
Max Compressive Force	$C_t := 33.0 \cdot kip$
Height of Tower	$H_t := 125 \cdot ft$
Base Plate Bolt Circle	$MP := 63in$

FOOTING DIMENSIONS:

Overall Depth of Footing	$D_f := 4.5ft$
Length of Pier	$L_p := 1 \cdot ft$
Extension of Pier Above Grade	$L_{pag} := 1 \cdot ft$
Diameter of Pier	$d_p := 7 \cdot ft$
Thickness of Footing	$T_f := 4.5 \cdot ft$
Width of Footing:	$W_f := 25ft$
Length of Anchor Bolts:	$L_{st} := 72in$
Projection of anchor bolts above pier	$A_{BP} := 12 \cdot in$

PROPERTIES:

Compressive Strength of Concrete	$f'c := 3000psi$
Yield Strength of Steel Reinforcement	$fy := 60000 \cdot psi$
Yield Strength of Anchor Bolt	$fya := 75000 \cdot psi$
Internal Friction Angle of Soil	$\phi_s := 0 \cdot deg$
Allowable Bearing Capacity	$q_s := 3000 \cdot psf$
Unit Weight of Soil	$\gamma_s := 100 \cdot pcf$
Unit Weight of Concrete	$\gamma_c := 150 \cdot pcf$
Depth to Neglect	$n := 0ft$
Cohesion of Clay Type Soil Note: Use 0 for Sandy Soil	$c := 0 \cdot ksf$
Seismic Zone Factor: UBC Fig 23-2	$Z := 2$
Coefficient of Friction between Concrete:	$\mu := 0.45$
Clear Cover of Reinforcement Pier:	$Cvr_{pier} := 3 \cdot in$
Clear Cover of Reinforcement Pad:	$Cvr_{pad} := 3 \cdot in$
Anchor Bolt Diameter	$d_{anchor} := 2.25in$
Anchor bolt area	$A_{anchor} := 3.97 \cdot in^2$

PIER REINFORCEMENT:

Bar Size	$BSpier := 9$	Bar Diameter	$d_{bpier} := 1.128 \cdot in$
Number of Bars	$NBpier := 24$	Bar Area	$A_{bpier} := 1.000 \cdot in^2$

PAD REINFORCEMENT:

TOP:	Bar Size	$BS_{top} := 9$	Bar Diameter	$d_{btop} := 1.128 \cdot in$
	Number of Bars	$NB_{top} := 28$	Bar Area	$A_{btop} := 1.000 \cdot in^2$
BOTTOM:	Bar Size	$BS_{bot} := 9$	Bar Diameter	$d_{bbot} := 1.128 \cdot in$
	Number of Bars	$NB_{bot} := 28$	Bar Area	$A_{bot} := 1.000 \cdot in^2$

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

Load Factor (EIA 3.1.1): $LF := if\left[H_t \le 700 \cdot ft, 1.3, if\left[H_t \ge 1200, 1.7, 1.3 + \left(\frac{H_t - 700}{1200 - 700}\right) \cdot 0.4\right]\right]$ $LF = 1.3$

CHECK ANCHOR STEEL EMBEDMENT

Depth: $D_{ab} := L_{st} - A_{BP}$ $D_{ab} = 5 \cdot ft$ $L_{anchor} := \frac{(0.11 \cdot fy) \cdot in}{\sqrt{f'c \cdot psi}}$ $L_{anchor} = 10.0416 \cdot ft$

$DepthCheck := if(D_{ab} \geq L_{anchor}, "Okay", "No Good")$

DepthCheck = "No Good" **Note:** anchor plate is provided

STABILITY OF FOOTING

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

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p}$ $P_{pt} = 0 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}]$ $P_{top} = 0 \cdot ksf$

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p}$ $P_{bot} = 0.45 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2}$ $P_{ave} = 0.225 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)]$ $T_p = 4.5 \cdot ft$

$A_p := W_f \cdot T_p$ $A_p = 112.5 \cdot ft^2$

Ultimate Shear: $S_u := P_{ave} \cdot A_p$ $S_u = 25.3125 \cdot kip$

Weight of Concrete Pad: $WT_c := [(W_f^2 \cdot T_f) + d_p^2 L_p] \cdot \gamma_c$ $WT_c = 429.225 \cdot kip$

Weight of Soil: above Footing: $WT_{s1} := \left[W_f^2 \cdot (|L_p - L_{pag}|) - \frac{d_p^2 \cdot \pi}{4} \cdot (|L_p - L_{pag}|) \right] \cdot \gamma_s$ $WT_{s1} = 0 \cdot kip$

Weight of Soil Wedge at back face: $WT_{s2} := \left(\frac{D_f \cdot \tan(\phi_s)}{2} \cdot W_f \right) \cdot \gamma_s$ $WT_{s2} = 0 \cdot kip$

Total Weight: $WT_{tot} := WT_c + WT_{s1} + C_t$ $WT_{tot} = 462.225 \cdot kip$

Resisting Moment: $M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + WT_{s2} \cdot \left(W_f + \frac{D_f \cdot \tan(\phi_s)}{3} \right)$ $M_r = 5815.7813 \cdot kip \cdot ft$

Overturning Moment: $M_{ot} := M_t + S_t \cdot (L_p + T_f)$ $M_{ot} = 2513.5 \cdot kip \cdot ft$

Factor of Safety: $FS := \frac{M_r}{M_{ot}}$ $FS_{req} := 2$ $FS = 2.31$

$SafetyCheck := if(FS > FS_{req}, "Okay", "No Good")$ SafetyCheck = "Okay"

SHEAR CAPACITY IN PIER

$FS := 2$

$$S_p := \frac{P_{ave} \cdot A_p + \mu \cdot WT_{tot}}{FS}$$

$S_p = 116.6569 \cdot kips$

ShearCheck := if($S_p > S_t$, "Okay", "No Good")

ShearCheck = "Okay"

BEARING PRESSURE CAUSED BY FOOTING

$A_{mat} := W_f^2$ $\quad A_{mat} = 625 \cdot ft^2$

$S := \frac{W_f^3}{6}$ $\quad S = 2604.1667 \cdot ft^3$

$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S}$ $\quad P_{max} = 1.7047 \cdot ksf$

$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S}$ $\quad P_{min} = -0.2256 \cdot ksf$

MaxPressure := if($P_{max} < q_s$, "Okay", "No Good") $\quad$ MaxPressure = "Okay"

MinPressure := if[$(P_{min} \geq 0) \cdot (P_{min} < q_s)$, "Okay", "No Good"] $\quad$ MinPressure = "No Good"

Distance to Resultant of Pressure Distribution:

$$X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3}$$

$X_p = 7.3593 \cdot ft$

Distance to Kern: $X_k := \frac{W_f}{6}$ $\quad X_k = 4.1667 \cdot ft$

Since Resultant Force is Not in Kern, Area to which Pressure is Applied Must be Reduced.

Eccentricity: $e := \frac{M_{ot}}{WT_{tot}}$ $\quad e = 5.4378$

Adjusted Soil Pressure:

$$P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)}$$

$P_a = 1.7454 \cdot ksf$

$$q_{adj} := \text{if}\left(P_{min} < 0, P_a, \frac{P_{max}}{ft^2}\right)$$

$q_{adj} = 1.7454 \cdot ksf$

PressureCheck := if($q_{adj} < q_s$, "Okay", "No Good") $\quad$ PressureCheck = "Okay"

CONCRETE BEARING CAPACITY (ACI 10.17)

$\phi_c := 0.75$ (ACI 9.3.2.2)

$P_b := \phi_c \cdot 0.85 \cdot f'c \cdot \frac{d_p^2 \cdot \pi}{4}$ $P_b = 10598.6341 \cdot kip$

$BearingCheck := if(P_b > LF \cdot C_t, "Okay", "No Good")$ BearingCheck = "Okay"

SHEAR STRENGTH OF CONCRETE

Beam Shear: (Critical section located at a distance d from the face of Pier) (ACI 11.3.1.1)

$\phi_{vc} := .85$ (ACI 9.3.2.3)

$d := T_f - Cvr_{pad} - d_{bbot}$ $d = 49.872 \cdot in$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$ $d_1 = 9 \cdot ft$

$d_2 := d_1 - d$ $d_2 = 4.844 \cdot ft$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$ $L = 21.1865 \cdot ft$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$ $Slope = 0.0824 \cdot kcf$

$V_{req} := LF \cdot \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$ $V_{req} = 402.0831 \cdot kip$

ACI 11.3.1.1 $V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f'c \cdot psi} \cdot W_f \cdot d$ $V_{Avail} = 1393.117 \cdot kip$

$BeamShearCheck := if(V_{req} < V_{Avail}, "Okay", "No Good")$ BeamShearCheck = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.12.2.1)

$b_o := (d_p + d) \cdot \pi$ $b_o = 35.0476 \cdot ft$

Area included inside bo: $A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4}$ $A_{bo} = 97.7478 \cdot ft^2$

Area outside of bo: $A_{out} := A_{mat} - A_{bo}$ $A_{out} = 527.2522 \cdot ft^2$

Guess Value: $v_u := 1\,ksf$ (From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

Given $d^2 + d_p \cdot d = \frac{WT_{tot}}{\pi \cdot v_u}$

$v_u := \text{Find}(v_u)$ $v_u = 3.1734 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f$ $V_u = 329.7122 \cdot kips$

$V_{req} := LF \cdot V_u$ $V_{req} = 428.6259 \cdot kips$

$V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f'c \cdot psi} \cdot b_o \cdot d$ $V_{Avail} = 3906.0334 \cdot kips$

$PunchingShearCheck := \text{if}(V_{req} < V_{Avail}, \text{"Okay"}, \text{"No Good"})$ $PunchingShearCheck = \text{"Okay"}$

STEEL REINFORCEMENT IN THE PAD $\phi_m := .90$ ACI 9.3.2.2

Take Maximum Bending at face of Pier:

$q_b := q_{adj} - d_1 \cdot Slope$ $q_b = 1.0039 \cdot ksf$

$M_n := \frac{LF}{\phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f$ $M_n = 2191.1379 \cdot kip \cdot ft$

ACI 10.2.7.3 $\beta := \text{if}\left[f'c \le 4000 \cdot psi, .85, \text{if}\left[f'c \ge 8000 \cdot psi, .65, .85 - \left(\frac{f'c}{psi} - 4000 \right) \cdot .05 \right] \right]$ $\beta = 0.85$

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2}$ $R_u = 5638.1\,lbf$

$\rho := \frac{0.85 \cdot f'c}{fy} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f'c}} \right)$ $\rho = 0.0007$

$\rho_{min} := 1.333 \cdot \rho$ $\rho_{min} = 0.00088$

Temperature and Shrinkage: $\rho_{sh} := if(fy \geq 60000 \cdot psi, 0.0018, 0.0020)$ $\rho_{sh} = 0.0018$

(ACI 7.12.2.1b)

FOR BOTTOM BARS: $As := \max(\rho, \rho_{min}, \rho_{sh}) \cdot W_f \cdot d$ $As = 26.9309 \cdot in^2$

$As_{prov} := A_{bot} \cdot NB_{bot}$ $As_{prov} = 28 \cdot in^2$

$PadReinforcement := if(As_{prov} > As, "Okay", "No Good")$ $PadReinforcement = "Okay"$

FOR TOP BARS: $As := \rho_{sh} \cdot (W_f \cdot d)$ $As = 26.9309 \cdot in^2$

$As_{prov} := A_{btop} \cdot NB_{top}$ $As_{prov} = 28 \cdot in^2$

$PadReinforcement := if(As_{prov} > As, "Okay", "No Good")$ $PadReinforcement = "Okay"$

TENSION (ACI 12.2.3) **DEVELOPMENT LENGTH OF PAD REINFORCEMENT**

Bar Spacing: $B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1}$ $B_{sPad} = 9.7191 \cdot in$

Development Length Factors:

Reinforcement Location Factor	$\alpha := 1.0$	
Coating Factor	$\beta := 1.0$	
Concrete strength Factor	$\lambda := 1.0$	
Reinforcement Size Factor	$\gamma := 1.0$	

Spacing or Cover Dimension: $c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right)$ $c = 3 \cdot in$

Transverse Reinforcement Index: As allowed by ACI 12.2.4 $k_{tr} := 0$

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{fc \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \gamma \cdot \lambda}{\frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot}$$ $L_{dbt} = 34.8457 \cdot in$

$L_{dbmin} := 12 \cdot in$

Minimum Development Length: (ACI 12.2.1) $L_{dbtCheck} := if(L_{dbt} \geq L_{dbmin}, "Use\ L.dbt", "Use\ L.dbmin")$ $L_{dbtCheck} = "Use\ L.dbt"$

Available Length in Pad: $L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad}$ $L_{Pad} = 105 \cdot in$

$LpadTension := if(L_{Pad} > L_{dbt}, "Okay", "No Good")$ $LpadTension = "Okay"$

REINFORCEMENT IN PIER

Pier Area: $A_{pv} := \frac{\pi \cdot d_p^{\,2}}{4}$ $A_p = 5541.7694 \cdot in^2$

(ACI 10.8.4 and 10.9.1) $A_{smin} := 0.01 \cdot 0.05 \cdot A_p$ $A_{smin} = 2.7709 \cdot in^2$

$A_{sprov} := NBpier \cdot A_{bpier}$ $A_{sprov} = 24 \cdot in^2$

$SteelAreaCheck := if(A_{sprov} > A_{smin}, "Okay", "No Good")$ $SteelAreaCheck = "Okay"$

NOTE: Anchor Bolts are not accounted for in reinforcement calculation and will provide additional reinforcement to satisfy minimum requirement of steel.

Bar Spacing In Pier: $B_{sPier} := \frac{d_p \cdot \pi}{NBpier} - d_{bpier}$ $B_{sPier} = 9.8676 \cdot in$

Diamter of Reinforcement Cage: $Diam_{cage} := d_p - 2 \cdot Cvr_{pier}$ $Diam_{cage} = 78 \cdot in$

Maximum Moment in Pier: $M_p := \left[M_t + S_t \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF$ $M_p = 37525.8 \cdot in \cdot kips$

Pier Check evaluated from outside program and results are listed below;

(defined variables) $(f'_c \; f_y \; cl \; Spiral) = (3 \;\; 60 \;\; 3 \;\; 0)$

The required input is column diameter in inches, number of reinforcing bars, bar size number, factored axial load in kips and moment in kip inches: $(D \; N \; n \; P_u \; M_{xu}) := (84 \;\; 24 \;\; 9 \;\; 33 \;\; 37526)$

Clears any previous output: $(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho) := (0 \;\; 0 \;\; 0 \;\; 0)$

$(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho) := \phi P'_n(D, N, n, P_u, M_{xu})^T$

The Output is given as useable axial load in kips, moment capacity in kip inches, splicing stress in ksi, and reinforcement ratio: $(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho) = (41.9627 \;\; 47717.9237 \;\; -60 \;\; 0.0043)$

Column size and reinforcement may be changed to match capacity to the applied load.

$AxialLoadCheck := if(\phi P_n \geq P_u, "Okay", "No Good")$ $AxialLoadCheck = "Okay"$

$BendingCheck := if(\phi M_{xn} \geq M_{xu}, "Okay", "No Good")$ $BendingCheck = "Okay"$

DEVELOPMENT LENGTH OF PIER REINFORCEMENT

TENSION (ACI 12.2.3)

Factors for development:

Reinforcement Location Factor $\alpha := 1.0$

Coating Factor $\beta := 1.0$

Concrete strength Factor $\lambda := 1.0$

Reinforcement Size Factor $\gamma := 1.0$

Spacing or Cover Dimension: $c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right)$ $c = 3 \cdot in$

Transverse Reinforcement: As allowed by ACI 12.2.4 $k_{tr} := 0$

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \gamma \cdot \lambda}{\frac{c + k_{tr}}{d_{bpier}}} \cdot d_{bpier} \qquad L_{dbt} = 34.8457 \cdot in$$

Minimum Development Length: (ACI 12.2.1) $L_{dbmin} := 12 \cdot in$

Pier reinforcement bars are standard 90 degree hooks and therefore developement in the pad is computed as follows:

$$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f'c}{psi}}} \cdot .7 \qquad L_{dh} = 17.2993 \cdot in$$

$$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right) \qquad L_{db} = 34.8457 \cdot in$$

COMPRESSION: (ACI 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot fy}{\sqrt{f'c \cdot psi}} \qquad L_{dbc1} = 24.7132 \cdot in$$

$$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot fy\right) \qquad L_{dbmin} = 20.304 \cdot in$$

$$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) \qquad L_{dbc} = 24.7132 \cdot in$$

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier}$ $L_{pier} = 9 \cdot in$

$L_{pad} := T_f - Cvr_{pad}$ $L_{pad} = 51 \cdot in$

$L_{tension} := if\left(L_{pier} + L_{pad} > L_{dbt}, "Okay", "No\ Good"\right) = "Okay"$ $L_{tension} = "Okay"$

$L_{compression} := if\left(L_{pier} + L_{pad} > L_{dbc}, "Okay", "No\ Good"\right)$ $L_{compression} = "Okay"$

NOTE: Anchor bolts and plate provided, OK

TIE SIZE AND SPACING IN COLUMN

Minimum Tie Size:

$Tie_{min} := if(BSpier \le 10, 3, 4)$ $\quad Tie_{min} = 3$

Used #4 Ties $\quad d_{Tie} := 4$

Seismic factor:
(ACI 21.10.5)

$z := if(Z \le 2, 1, 0.5)$ $\quad z = 1$

$s_{lim1} := 16 \cdot d_{bpier} \cdot z$ $\quad s_{lim1} = 18.048 \cdot in$

$s_{lim2} := \frac{48 \cdot d_{Tie} \cdot in}{8} \cdot z$ $\quad s_{lim2} = 24 \cdot in$

$s_{lim3} := D_f \cdot z$ $\quad s_{lim3} = 54 \cdot in$

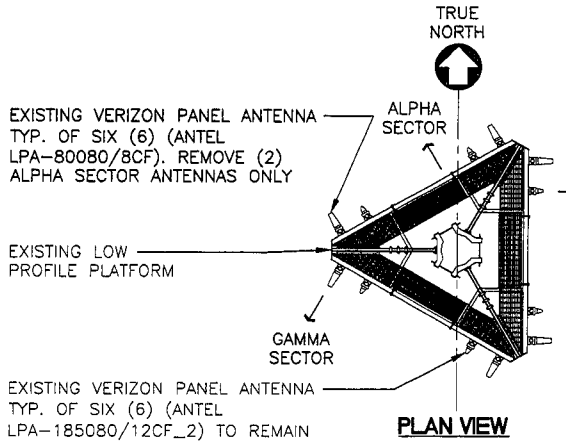
$s_{lim4} := 18in$ $\quad s_{lim4} = 18 \cdot in$

Maximum Spacing:

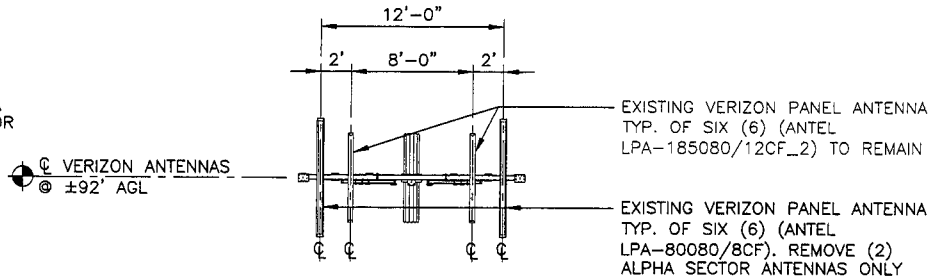
$$s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) \quad s_{tie} = 18 \cdot in$$

Number of Ties Required:

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 \quad n_{tie} = 1.3333$$



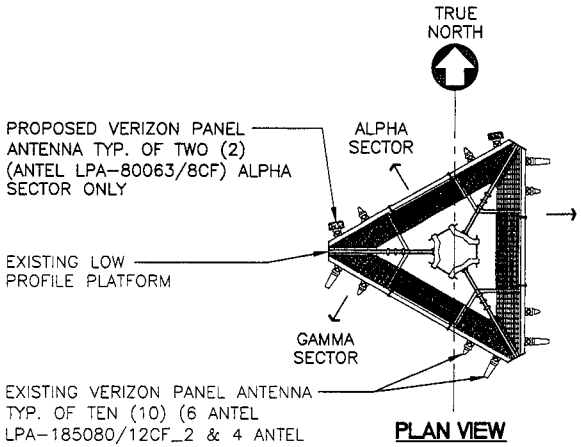
PLAN VIEW



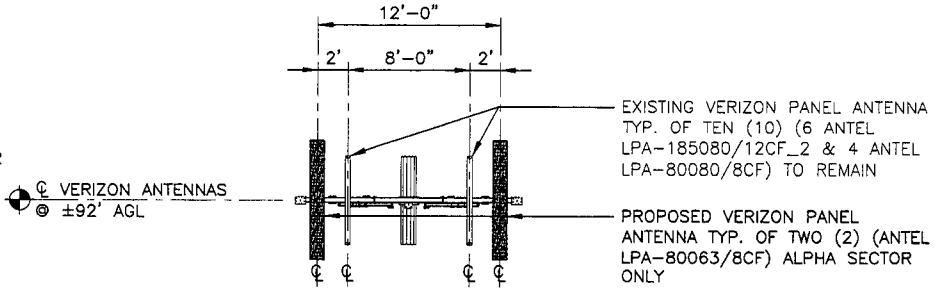
TYPICAL SECTOR ELEVATION

1 / ANT-1 **EXISTING ANTENNA MOUNTING CONFIGURATION**

NOT TO SCALE



PLAN VIEW



ALPHA SECTOR ELEVATION

2 / ANT-1 **PROPOSED ANTENNA MOUNTING CONFIGURATION**

NOT TO SCALE

REVISIONS		
00	01/28/08	ANTENNA LAYOUT

Cellco Partnership d.b.a. verizonwireless

NATCOMM
CONSULTING ENGINEERS
p: 203.488.0580
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w: netcomm.com
e: info@net-eng.com
63-2 N. Branford Rd.
Branford, CT 06405

BETHEL

38 SPRING HILL LANE
BETHEL, CT

PROJECT NO:	08007 CO3
DRAWN BY:	DEB
CHECKED BY:	CFC
SCALE:	AS NOTED
DATE:	01/28/08

ANTENNA REPLACEMENT DETAILS

ANT-1

DWG. 1 OF 1

NatComm
Structural Analysis
125' Monopole
Site: Bethel/05135
EEI Job #: 14009-E01

ENGINEERED ENDEAVORS INCORPORATED

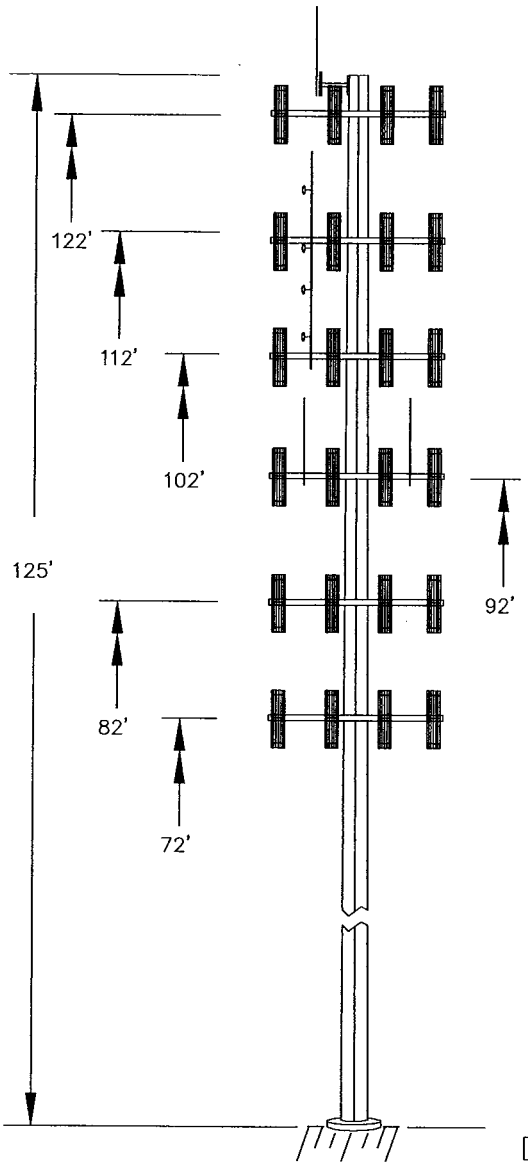
Customer NATCOMM By MRM 3/9/06 (Date)

Structure 125' MONOPOLE Checked ____ 14009-E01 (Job/Quote No.)

SITE LOCATION – FAIRFIELD COUNTY, CT

SITE NAME – BETHEL

ANALYSIS



ANTENNA LOADING:

(1) BETHEL OMNIDIRECTIONAL ANTENNA
3' CABLED-ON SIDE ARM @ 124'

(12) KATHREIN DIRECTIONAL ANTENNAS
(12) AMPLIFIERS
12' LOW PROFILE PLATFORM @ 122' (CINGULAR)

(12) 950G65VTZE-M DIRECTIONAL ANTENNAS
12' LOW PROFILE PLATFORM @ 112' (SPRINT)

(12) RR90-17-02DPL2 DIRECTIONAL ANTENNAS
(1) ANT150D6-9 OMNIDIRECTIONAL ANTENNA
12' LOW PROFILE PLATFORM @ 102' (T-MOBILE)

(6) LPA 185080/12CF-2 DIRECTIONAL ANTENNAS
(6) LPA 80080/8CF DIRECTIONAL ANTENNAS
(2) BETHEL OMNIDIRECTIONAL ANTENNAS
12' LOW PROFILE PLATFORM @ 92' (VERIZON/BETHEL)

(9) LR65-13-XXXB2 DIRECTIONAL ANTENNAS
(3) DB844H90E-XY DIRECTIONAL ANTENNA
12' LOW PROFILE PLATFORM @ 82' (NEXTEL)

(6) FUTURE DIRECTIONAL ANTENNAS
12' LOW PROFILE PLATFORM @ 72' (FUTURE)

DESIGN NOTES:

DESIGNED IN ACCORDANCE WITH TIA/EIA 222 F
85 MPH FASTEST MILE WIND SPEED AND
2003 IBC 110 MPH 3-SECOND GUST WIND.
1/2" RADIAL ICE.

NOTE: IT IS THE RESPONSIBILITY OF THE PURCHASER TO VERIFY THAT THE WIND LOADS AND DESIGN CRITERIA SPECIFIED MEET THE REQUIREMENTS OF ALL LOCAL BUILDING CODES

REFER TO EEI JOB 13252 & DRAWING GS55688

ENGINEERED ENDEAVORS, INC.

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Communications Structure Nonlinear Analysis and Design Program

14:53:12 03-10-2006
Revision 1.3 - 2/07/00
Engineer: MRM

Customer **NATCOMM**
Job Name **14009-E01**
Structure **125' MONOPOLE**
Location **FAIRFIELD COUNTY, CT**
Site **BETHEL**

OD BOT	OD TOP	NUM. SIDES	THICK INCH	TAPER IN/FT	LENGTH FT	JOINT INCH	JOINT TYPE	YIELD KSI	WEIGHT LBS	JOINT HEIGHT
26.90	18.00	18	0.1875	0.307	28.96	47.00	SLIP	65.0	1290.	97.00
41.28	25.20	18	0.2500	0.307	52.29	68.00	SLIP	65.0	4601.	49.50
55.00	38.91	18	0.3125	0.307	52.33	0.00	BASEPL	65.0	8138.	-0.00
			TOTAL TUBE WEIGHT				14029.	POUNDS		
			POLE SHAFT LENGTH				124.00	FEET		

E = 29600.0 KSI
UNIT WGT = 0.283 LBS/CU IN
AISC constants are used for stress reductions.
TUBE SECTIONS HAVE 18 SIDES AND ARE TREATED AS ROUND
Internal bend radius = 3 X T
Tube diameters are measured flat to flat.
Tube diameters are increased by 1.000 for wind across points.
Drag coefficients are increase by 1.300 for steps on the pole.
AISC Tube Shape Coefficient of 1.000 is applied.
REVISED DATA FILE NAME 14009125

APPURTENANCES

DESCRIPTION	NUM.	ELEV.	Kz	AREA	WGT	Ca	AREA	WGT	Ca	FACTOR
				< WITHOUT ICE >			< WITH ICE >			
DB 810K	1	124.	1.460	2.00	30.	1.2000	3.50	60.	1.2000	1.00
3' ARM (4" SQ. X 1/4	1	124.	1.460	1.00	40.	1.4000	1.25	80.	1.4000	1.00
KATHREIN	12	121.	1.450	3.68	22.	1.4000	4.12	51.	1.4000	0.90
AMPIFIERS	12	121.	1.450	1.50	33.	1.4000	2.00	70.	1.4000	0.95
12' LOW PROFILE PLAT	1	121.	1.450	7.50	1500.	2.0000	9.20	1750.	2.0000	1.00
DB950G65	12	111.	1.414	2.71	10.	1.4000	3.18	20.	1.4000	1.00
12' LOW PROFILE PLAT	1	111.	1.414	7.50	1500.	2.0000	9.20	1750.	2.0000	1.00
RR90-17-xxxP	12	101.	1.377	3.11	18.	1.4000	3.56	40.	1.4000	0.85
ANT150D6-9	1	111.	1.414	3.20	26.	1.2000	5.00	60.	1.2000	1.00
12' LOW PROFILE PLAT	1	101.	1.377	7.50	1500.	2.0000	9.20	1750.	2.0000	1.00
LPA 8080/8CF	6	91.	1.336	3.61	24.	1.7400	4.31	87.	1.6600	2.05
DB 810K	2	91.	1.336	2.00	30.	1.8000	3.50	60.	1.8000	1.00
12' LOW PROFILE PLAT	1	91.	1.336	7.50	1500.	2.0000	9.20	1750.	2.0000	1.00
6' PANELS	9	81.	1.292	6.00	26.	1.4000	6.59	76.	1.4000	0.85
DB 844H90E-XY	3	81.	1.292	2.17	19.	1.4300	2.55	40.	1.4300	1.38
12' LOW PROFILE PLAT	1	81.	1.292	7.50	1500.	2.0000	9.20	1750.	2.0000	1.00
48000	6	71.	1.245	3.20	18.	1.4000	3.65	41.	1.4000	0.85
12' LOW PROFILE PLAT	1	71.	1.245	7.50	1500.	2.0000	9.20	1750.	2.0000	1.00
LPA 185080/12CF-2	6	91.	1.336	2.02	11.	1.7400	2.55	37.	1.6400	1.50

LOAD CASE 1

BASIC LOADING

DEAD LOAD FACTOR 1.00 WIND PSF REDUCTION 1.00 RADIAL ICE 0.00 IN.

WIND VELOCITY 85 BOTTOM 18.29 PSF TOP 26.60 PSF
MAX BASE ROTATION 0.00 DEG

	APPLIED APPURTENANCE FORCES ELEVATION FT	WEIGHT KIPS	WIND KIPS
DB 810K	124.00	0.030	0.110
3' ARM (4" SQ. X 1/4")	124.00	0.040	0.064
KATHREIN	121.00	0.264	2.521
AMPIFIERS	121.00	0.396	1.085
12' LOW PROFILE PLAT	121.00	1.500	0.680
DB950G65	111.00	0.120	2.013
12' LOW PROFILE PLAT	111.00	1.500	0.663
RR90-17-xxxP	101.00	0.216	1.911
ANT150D6-9	111.00	0.026	0.170
12' LOW PROFILE PLAT	101.00	1.500	0.645
LPA 8080/8CF	91.00	0.146	3.227
DB 810K	91.00	0.060	0.301
12' LOW PROFILE PLAT	91.00	1.500	0.626
6' PANELS	81.00	0.230	2.596
DB 844H90E-XY	81.00	0.057	0.519
12' LOW PROFILE PLAT	81.00	1.500	0.606
48000	71.00	0.110	0.889
12' LOW PROFILE PLAT	71.00	1.500	0.584
LPA 185080/12CF-2	91.00	0.063	1.321

LOAD CASE 1

BASIC LOADING

TUBE PROPERTIES			MEMBER FORCES			STRESSES			STRESS	TOTAL	
ELEV FT	DIAM IN	WALL IN	SHEAR K	BENDING K-FT	AXIAL K	AXIAL KSI	BEND. KSI	ALLOW KSI	RATIOS	DEFL IN	TILT DEG
124.00	18.00	0.1875	0.25	0.00	0.11	0.01	0.00	51.39	0.00	65.5	4.60
121.00	18.92	0.1875	5.00	0.73	2.16	0.20	0.17	50.66	0.00	62.6	4.60
111.00	22.00	0.1875	5.00	50.53	2.16	0.17	8.73	48.66	0.18	53.1	4.48
101.00	25.07	0.1875	8.46	134.84	4.00	0.27	17.88	47.16	0.38	44.0	4.22
97.00	26.30	0.1875	11.50	180.70	5.87	0.38	21.75	46.65	0.47	40.6	4.07
			TYPE OF JOINT: SLIP JOINT								
97.00	25.80	0.2500	11.80	180.70	6.46	0.32	17.08	50.34	0.34	40.6	4.07
91.00	27.65	0.2500	11.80	251.31	6.46	0.30	20.65	49.41	0.42	35.6	3.88
81.00	30.72	0.2500	17.83	429.25	8.51	0.36	28.49	48.11	0.60	27.9	3.49
71.00	33.80	0.2500	22.24	651.28	10.99	0.42	35.63	47.04	0.76	21.0	3.03
59.50	37.33	0.2500	24.42	931.81	13.67	0.47	41.69	46.03	0.91	14.4	2.45
49.50	40.41	0.2500	25.05	1182.12	14.94	0.47	45.08	45.30	1.00	9.8	1.94
			TYPE OF JOINT: SLIP JOINT								
49.50	39.78	0.3125	25.79	1182.13	18.10	0.47	37.39	47.70	0.79	9.8	1.94
36.00	43.93	0.3125	25.79	1530.15	18.10	0.42	39.60	46.63	0.86	5.1	1.37
24.00	47.62	0.3125	26.54	1848.57	19.95	0.43	40.65	45.84	0.89	2.2	0.89
12.00	51.31	0.3125	27.27	2175.78	21.85	0.44	41.15	45.16	0.92	0.6	0.43
0.00	55.00	0.3125	28.53	2512.32	24.97	0.47	41.30	44.57	0.94	0.0	0.00

REACTION COMPONENTS (KIPS AND FT-KIPS)

TRANSVERSE SHEAR	VERTICAL FORCE	WIND SHEAR	MOMENT ABOUT TRANSVERSE	MOMENT ABOUT VERTICAL	MOMENT ABOUT WIND AXIS
0.000	24.968	-28.532	2512.320	0.000	0.000

LOAD CASE 2

BASIC LOADING PLUS ICE

DEAD LOAD FACTOR 1.00 WIND PSF REDUCTION 0.75 RADIAL ICE 0.50 IN.

WIND VELOCITY 85 BOTTOM 13.71 PSF TOP 19.95 PSF
MAX BASE ROTATION 0.00 DEG

	APPLIED APPURTENANCE FORCES ELEVATION FT	WEIGHT KIPS	WIND KIPS
DB 810K	124.00	0.060	0.144
3' ARM (4" SQ. X 1/4")	124.00	0.080	0.060
KATHREIN	121.00	0.606	2.117
AMPIFIERS	121.00	0.840	1.085
12' LOW PROFILE PLAT	121.00	1.750	0.625
DB950G65	111.00	0.240	1.771
12' LOW PROFILE PLAT	111.00	1.750	0.610
RR90-17-xxxP	101.00	0.485	1.641
ANT150D6-9	111.00	0.060	0.199
12' LOW PROFILE PLAT	101.00	1.750	0.594
LPA 8080/8CF	91.00	0.524	2.757
DB 810K	91.00	0.120	0.395
12' LOW PROFILE PLAT	91.00	1.750	0.576
6' PANELS	81.00	0.681	2.139
DB 844H90E-XY	81.00	0.120	0.457
12' LOW PROFILE PLAT	81.00	1.750	0.558
48000	71.00	0.245	0.760
12' LOW PROFILE PLAT	71.00	1.750	0.537
LPA 185080/12CF-2	91.00	0.222	1.179

LOAD CASE 2

BASIC LOADING PLUS ICE

TUBE PROPERTIES			MEMBER FORCES			STRESSES			STRESS	TOTAL	
ELEV FT	DIAM IN	WALL IN	SHEAR K	BENDING K-FT	AXIAL K	AXIAL KSI	BEND. KSI	ALLOW KSI	RATIOS	DEFL IN	TILT DEG
124.00	18.00	0.1875	0.26	0.01	0.18	0.02	0.00	51.39	0.00	58.0	4.09
121.00	18.92	0.1875	4.56	0.80	3.34	0.30	0.19	50.66	0.00	55.5	4.09
111.00	22.00	0.1875	4.56	46.25	3.34	0.26	7.99	48.66	0.17	47.0	3.99
101.00	25.07	0.1875	7.66	122.66	5.64	0.38	16.26	47.16	0.35	38.9	3.75
97.00	26.30	0.1875	10.31	163.83	8.07	0.52	19.72	46.65	0.43	35.8	3.62
			TYPE OF JOINT: SLIP JOINT								
97.00	25.80	0.2500	10.54	163.83	8.66	0.43	15.48	50.34	0.31	35.8	3.62
91.00	27.65	0.2500	10.54	226.93	8.66	0.40	18.65	49.41	0.38	31.4	3.44
81.00	30.72	0.2500	15.94	386.03	11.62	0.49	25.62	48.11	0.54	24.6	3.09
71.00	33.80	0.2500	19.65	582.23	14.91	0.57	31.86	47.04	0.69	18.5	2.68
59.50	37.33	0.2500	21.48	829.03	17.96	0.62	37.10	46.03	0.82	12.7	2.16
49.50	40.41	0.2500	21.92	1048.07	19.19	0.61	39.97	45.30	0.89	8.6	1.71
			TYPE OF JOINT: SLIP JOINT								
49.50	39.78	0.3125	22.44	1048.08	22.12	0.57	33.15	47.70	0.71	8.6	1.71
36.00	43.93	0.3125	22.44	1350.89	22.12	0.52	34.96	46.63	0.76	4.4	1.20
24.00	47.62	0.3125	22.97	1626.43	23.97	0.52	35.76	45.84	0.79	1.9	0.78
12.00	51.31	0.3125	23.48	1908.15	25.88	0.52	36.09	45.16	0.81	0.5	0.38
0.00	55.00	0.3125	24.40	2196.46	28.99	0.54	36.11	44.57	0.82	0.0	0.00

REACTION COMPONENTS (KIPS AND FT-KIPS)

TRANSVERSE SHEAR	VERTICAL FORCE	WIND SHEAR	MOMENT ABOUT TRANSVERSE	MOMENT ABOUT VERTICAL	MOMENT ABOUT WIND AXIS
0.000	28.992	-24.398	2196.460	0.000	0.000

SUMMARY TABLE

ELEV	STRESS RATIO	AXIAL	BENDING	LOADING
124.00	0.00	0.18	0.0	2 BASIC LOADING PLUS ICE
121.00	0.01	3.34	0.8	2 BASIC LOADING PLUS ICE
111.00	0.18	2.16	50.5	1 BASIC LOADING
101.00	0.38	4.00	134.8	1 BASIC LOADING
97.00	0.47	5.87	180.7	1 BASIC LOADING
91.00	0.42	6.46	251.3	1 BASIC LOADING
81.00	0.60	8.51	429.3	1 BASIC LOADING
71.00	0.76	10.99	651.3	1 BASIC LOADING
59.50	0.91	13.67	931.8	1 BASIC LOADING
49.50	1.00	14.94	1182.1	1 BASIC LOADING
36.00	0.86	18.10	1530.1	1 BASIC LOADING
24.00	0.89	19.95	1848.6	1 BASIC LOADING
12.00	0.92	21.85	2175.8	1 BASIC LOADING
0.00	0.94	24.97	2512.3	1 BASIC LOADING

MAXIMUM SUPPORT MOMENT K-FT	2512.32
CORRESPONDING AXIAL FORCE KIPS	24.97
CORRESPONDING SHEAR FORCE KIPS	28.53

BASE PLATE AT ELEVATION 0.00 FEET

TUBE DIAMETER	55.00	INCHES
DESIGN MOMENT	2512.3	KIP FT
DESIGN MOMENT IS	0.	DEGREES FROM THE WIND DIRECTION
BOLTS ARE ON THE KNUCKLES OF THE TUBE		
APPLIED AXIAL FORCE	25.0	KIPS
APPLIED SHEAR	28.53	KIPS

BOLT DATA

BOLT TYPE	A615 GR75	
BOLTS ARE EVENLY SPACED		
DIAMETER	2.250	INCHES
EFFECTIVE AREA	3.250	SQ IN
TOTAL LENGTH	6.0	FEET
End plates are required.		
MINIMUM EMBEDMENT	5.0	FEET
NUMBER OF BOLTS	12	
BOLT CIRCLE DIAMETER	63.00	INCHES
ALLOWABLE STRESS	60.0	KSI
APPLIED AXIAL STRESS	49.7	KSI
MAX BOLT FORCE	161.6	KIPS
BOLT BENDING STRESS	3.5	KSI
COMBINED BOLT STRESS	53.2	KSI
CLEARANCE UNDER PLATE	3.25	INCHES
BOLT WEIGHT	1353.6	POUNDS

PLATE DATA

DIAMETER OF PLATE	69.00	INCHES
MATERIAL	A572 GR60	
PROVIDED THICKNESS	1.750	INCHES
REQUIRED THICKNESS	1.718	INCHES
BOLT HOLE DIAMETER	2.625	INCHES
CENTER HOLE SIZE	55.00	INCHES
NET WEIGHT	643.1	POUNDS
RAW STOCK WEIGHT	2357.9	POUNDS
SURFACE AREA	18.03	SQ FT
ALLOWABLE STRESS	36.00	KSI
MAX APPLIED STRESS	34.70	KSI

CONCRETE STRENGTH 3000. PSI

Base Plate - use 69.00 inch ROUND x 1.750 inch A572 GR60 with (12) 2.250 diameter x 6.00 foot caged A615 GR75 bolts on a 63.00 inch bolt circle. End plates required.

ENGINEERED
ENDEAVORS
INCORPORATED
The Experienced Point of View

EMERSON.
Network Power

DESIGN CALCULATIONS

FOR A

SPREAD FOOTER FOUNDATION

NatComm

125' MONOPOLE

Bethel

Fairfield County, CT

EEI JOB NUMBER: 14009-E01

March 6, 2006

7610 Jenther Drive • Mentor, Ohio 44060-4872
Phone: (440) 918-1101 • Phone: (888) 270-3855
Fax: (440) 918-1108 • www.engend.com

FOUNDATION DESIGN CALCULATIONS FOR A SPREAD FOOTER FOUNDATION

ENGINEERED ENDEAVORS INCORPORATED
The Experienced Point of View

ENGINEERED ENDEAVORS INCORPORATED
*7610 Jenther Drive * Mentor, Ohio 44060*
*Tel:(440)918-1101 * Fax:(440)918-1108*

CUSTOMER: NatComm
STRUCTURE: 125' MONOPOLE
JOB NUMBER: 14009-E01
LOCATION: Fairfield County, CT
SITE NAME: Bethel

SERVICE LOADS AT BASE OF THE MONOPOLE

DESIGN LOADING	
MOMENT	2512.3 ft-kips
SHEAR	29.0 kips
AXIAL	25.0 kips

ANCHOR BOLTS

QUANTITY	12.0
LENGTH	6.0 ft
BOLT CIRCLE	63.0 in
PROJECTION	12.0 in

FOUNDATION PARAMETERS

		ACTUAL FOUNDATION
MINIMUM PEDESTAL WIDTH	83.0 in	84.00
PEDESTAL PROJECTION	12.0 in	
MINIMUM FOUNDATION HEIGHT	5.5 ft	5.50

	HEIGHT	WIDTH		
FOOTING	4.50 ft	25.00 ft	SOIL UNIT WEIGHT	100 pcf
PEDESTAL	1.00 ft	7.00 ft	CONCRETE WEIGHT	150 pcf
			ANGLE OF FRICTION	30 degrees

FOUNDATION WEIGHT	429.23 kips	
CONCRETE VOLUME	105.98 yds^3	
SOIL WEIGHT	0.00 kips	H= 0.00
TOTAL VERTICAL LOAD	454.23 kips	B= 25.00
KERN OF ECCENTRICITY	4.17 ft	
ACTUAL ECCENTRICITY	5.88 ft	
OVERTURNING MOMENT	2671.8 ft-kips	
RESISTING MOMENT	5677.8 ft-kips	
ALLOWABLE GROSS SOIL PRESSURE	3.0 ksf	
ALLOWABLE NET SOIL PRESSURE	3.0 ksf	

		GROSS	NET
SOIL PRESSURE	MAXIMUM q=	1.83 ksf	1.14 ksf
	MINIMUM q=	0.00 ksf	

SAFETY FACTOR **Sf = 2.13**

SUMMARY

STEEL	8319.72 lbs
CONCRETE	105.98 cubic yards

ULTIMATE STRENGTH DESIGN OF FOOTING

CONCRETE, psi	3000
STEEL, KSI	60

SHEAR IN FOOTING

1. CASE I -DEAD LOAD, TWO-WAY SHEAR — U= 1.4*D

Ultimate Vertical Load, kips		635.92	
Ultimate Pressure, ksf		1.02	
Ultimate shear V, kips		**512.80**	
Design shear Vn, kips		**4719.70**	**O.K.**

2. CASE II - WIND LOAD, ONE-WAY SHEAR — U=0.9*D+1.3*W

Ultimate Moment, kip-ft		3473.34	
Ultimate Vertical Load, kips		408.80	
Eccentricity, ft		8.50	
Ultimate Pressure, ksf	qult=	2.72	
Dist. from edge to critical sect., ft		5.00	
Pressure distance ft	c=	12.01	
Pressure @ critical section, ksf		1.59	
Ultimate Shear, kips		**269.52**	
Design Shear, kips		**1340.82**	**O.K.**

FLEXURE STRENGTH DESIGN

Ultimate Moment, kip-ft		Case I	1030.18		
		Case II	3445.53	q1=	0.68
Coefficient of Resistance		Rn=	66.5		
Reinforcement Ratio		r=	0.00112		
Min. Reinforcement Ratio		r min	0.00180		
Min. Steel Area, sq.in.		A1	25.92		
Type of Bars		#	9		
		Ab,in^2=	1.00	Total Number of	
BOTTOM	Min. Number of Bars		25.92	Bars for Foundation	
	Actual Number of Bars in Design		28.00	60	
	Actual Steel Area, sq.in.		28.00	for the BOTTOM & SIDES	
	Steel Ratio Actual	ra=	0.00194		
	Revised Coef. of Resist	Rn=	116.66		
	Design Moment, kip-ft		**6047.65**		
	Horizontal Spacing, in	shor=	10.89		
TOP	Min. Steel Area, sq.in		25.92	Total Number of	
	Min. Number of Bars		25.92	Bars for Foundation	
	Actual Number of Bars in Design		28.00	56	
	Top Steel Area, sq.in		28.00	for the TOP	
	Horizontal Spacing, in	shor=	10.89		

PEDESTAL DESIGN

Pedestal Width, in		84
Concrete, ksi		3
Reinforcement, ksi		60
Rebars , #9	Q-ty	24
Design Rebars	Q-ty	12
Minimum reinforcement ratio		0.0033
Actual reinforcement ratio		0.0034
Concrete cover , in		4.5
Rebar layout radius, in		37.00

Ultim. Moment	3303.7
Area, sq.in	1
Area, sq.in	2.00
Rebar space, ir	9.69

Bending about the major axis

No.	Angle, deg	Coord., in	Edge Dist., in	No.	Angle, deg	Coord., in	Edge Dist., in
1	0	37.00	5.00	7	180	-37.00	79.00
2	30	32.04	9.96	8	210	-32.04	74.04
3	60	18.50	23.50	9	240	-18.50	60.50
4	90	0.00	42.00	10	270	0.00	42.00
5	120	-18.50	60.50	11	300	18.50	23.50
6	150	-32.04	74.04	12	330	32.04	9.96

Location of neutral axis c=, ir **6.67**
Compression zone, a= **5.67**

		No.	e	Force *kips*
		1	0.0008	38.47
eu=	0.003			
	Concrete, kips			1214.41
	Total compression			**1252.87**

Tension zone		No.	e	Force *kips*
		2	0.0015	85.75
ey=	0.00207	3	0.0076	120.00
		4	0.0159	120.00
		5	0.0242	120.00
		6	0.0303	120.00
		7	0.0325	120.00
		8	0.0303	120.00
		9	0.0242	120.00
		10	0.0159	120.00
		11	0.0076	120.00
		12	0.0015	85.75
	Total tension, kips			**1251.50**

Moment due to compression

Rebars	Force *kips*	Mom. Arm. *in*	Moment *k-ft*
1	38.47	37.00	118.60
Concrete	1214.41	39.17	3963.55
Total in compressior			**4082.15**

Moment due to tension

Rebars	Force *kips*	Mom. Arm. *in*	Moment *k-ft*
2	85.75	32.04	-228.97
3	120.00	18.50	-185.00
4	120.00	0.00	0.00
5	120.00	-18.50	185.00
6	120.00	-32.04	320.43
7	120.00	-37.00	370.00
8	120.00	-32.04	320.43
9	120.00	-18.50	185.00
10	120.00	0.00	0.00
11	120.00	18.50	-185.00
12	85.75	32.04	-228.97
Total in tension			**552.92**

Design moment about the major axis, kip-f **4171.56**

Bending about the diagonal

No.	Angle, deg phi	Coord., in c1	Edge Dist., in di
1	0	37.00	22.40
2	30	32.04	27.35
3	60	18.50	40.90
4	90	0.00	59.40
5	120	-18.50	77.90
6	150	-32.04	91.44
7	180	-37.00	96.40
8	210	-32.04	91.44
9	240	-18.50	77.90
10	270	0.00	59.40
11	300	18.50	40.90
12	330	32.04	27.35

Location of neutral axis c=, ir **24.5**

Compression zone, a= **20.83**

		No.	e	Force kips
		1	0.000257514	9.84
eu=	0.003	2	-0.000349473	-20.27
		12	-0.000349473	-20.27
	Concrete, kips			1105.89
	Total compression			**1075.18**

Tension zone		No.	e	Force kips
		2		
		3	0.0020	116.45
ey=	0.00207	4	0.0043	120.00
		5	0.0065	120.00
		6	0.0082	120.00
		7	0.0088	120.00
		8	0.0082	120.00
		9	0.0065	120.00
		10	0.0043	120.00
		11	0.0020	116.45
		12		
	Total tension, kips			**1072.904**

Moment due to compression

Rebars	Force kips	Mom. Arm. in	Moment k-ft
1	9.84	37.00	30.33
2	-20.27	32.04	-54.12
12	-20.27	32.04	-54.12
Concrete	1105.89	52.46	4834.13
Total in compressior			**4756.21**

Moment due to tension

Rebars	Force kips	Mom. Arm. in	Moment k-ft
3	116.45	18.50	-179.53
4	120.00	18.50	-185.00
5	120.00	0.00	0.00
6	120.00	-18.50	185.00
7	120.00	-37.00	370.00
8	120.00	-32.04	320.43
9	120.00	-18.50	185.00
10	120.00	0.00	0.00
11	116.45	18.50	-179.53
Total in tension			**516.37**

Design Moment, kip-ft **4745.32**

Pedestal Design Moment, kip-ft **4171.56**

ENGINEERED ENDEAVORS INCORPORATED

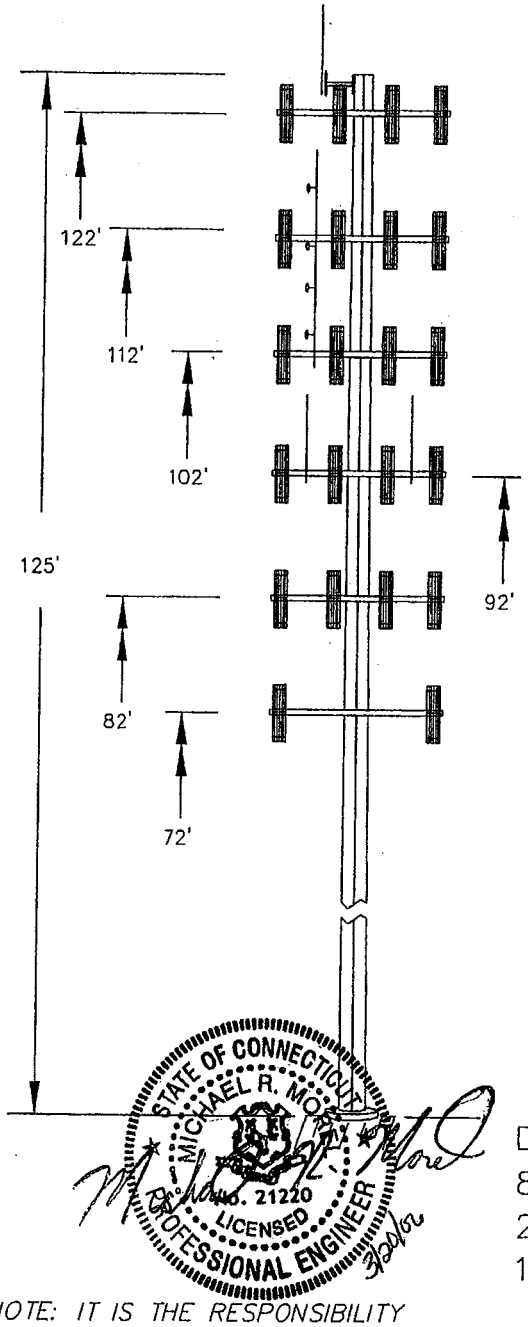
Customer NATCOMM By MRM 3/9/06 Date

Structure 125' MONOPOLE Checked ____ 14009-E01 Job/Quote No.

SITE LOCATION – FAIRFIELD COUNTY, CT

SITE NAME – BETHEL

ANALYSIS



ANTENNA LOADING:

(1) BETHEL OMNIDIRECTIONAL ANTENNA
3' CABLED-ON SIDE ARM @ 124'

(12) KATHREIN DIRECTIONAL ANTENNAS
(12) AMPLIFIERS
12' LOW PROFILE PLATFORM @ 122' (CINGULAR)

(12) 950G65VTZE-M DIRECTIONAL ANTENNAS
12' LOW PROFILE PLATFORM @ 112' (SPRINT)

(12) RR90-17-02DPL2 DIRECTIONAL ANTENNAS
(1) ANT150D6-9 OMNIDIRECTIONAL ANTENNA
12' LOW PROFILE PLATFORM @ 102' (T-MOBILE)

(6) LPA 185080/12CF-2 DIRECTIONAL ANTENNAS
(6) LPA 80080/8CF DIRECTIONAL ANTENNAS
(2) BETHEL OMNIDIRECTIONAL ANTENNAS
12' LOW PROFILE PLATFORM @ 92' (VERIZON/BETHEL)

(9) LR65-13-XXXB2 DIRECTIONAL ANTENNAS
(3) DB844H90E-XY DIRECTIONAL ANTENNA
12' LOW PROFILE PLATFORM @ 82' (NEXTEL)

(6) FUTURE DIRECTIONAL ANTENNAS
12' LOW PROFILE PLATFORM @ 72' (FUTURE)

DESIGN NOTES:

DESIGNED IN ACCORDANCE WITH TIA/EIA 222 F
85 MPH FASTEST MILE WIND SPEED AND
2003 IBC 110 MPH 3-SECOND GUST WIND.
1/2" RADIAL ICE.

STATE OF CONNECTICUT MICHAEL R. MORE No. 21220 LICENSED PROFESSIONAL ENGINEER

NOTE: IT IS THE RESPONSIBILITY OF THE PURCHASER TO VERIFY THAT THE WIND LOADS AND DESIGN CRITERIA SPECIFIED MEET THE REQUIREMENTS OF ALL LOCAL BUILDING CODES

REFER TO EEI JOB 13252 & DRAWING GS55688