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 25, 2008

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

RE: **EM-VER-029-080125** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 382 Colebrook Road, Colebrook, Connecticut.

Dear Attorney Baldwin:

At a public meeting held on February 14, 2008, the Connecticut Siting Council (Council) acknowledged your notice to modify this existing telecommunications facility, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies.

The proposed modifications are to be implemented as specified here and in your notice dated January 25, 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 an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

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

Thank you for your attention and cooperation.

Very truly yours,

Daniel F. Caruso
Chairman

DFC/MP/cm

c: The Honorable Thomas D. McKeon, First Selectman, Town of Colebrook
Karl Nilsen, Zoning Enforcement Officer, Town of Colebrook

STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

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Phone: (860) 827-2935 Fax: (860) 827-2950
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Daniel F. Caruso
Chairman

January 28, 2008

The Honorable Thomas D. McKeon
First Selectman
Town of Colebrook
Town Hall
558 Colebrook Road
P. O. Box 5
Colebrook, CT 06021

RE: **EM-VER-029-080125** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 382 Colebrook Road, Colebrook, Connecticut.

Dear Mr. McKeon:

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.

The Council will consider this item at the next meeting scheduled for February 14, 2008, at 1:30 p.m. in Hearing Room One, Ten Franklin Square, New Britain, Connecticut.

If you have any questions or comments regarding this proposal, please call me or inform the Council by February 13, 2008.

Thank you for your cooperation and consideration.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/jb

Enclosure: Notice of Intent

c: Karl Nilsen, Zoning Enforcement Officer, Town of Colebrook

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-029-080125

ORIGINAL

January 25, 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**
382 Colebrook Road, Colebrook, 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 use of this facility on October 10, 2006. Cellco intends to modify its installation by replacing six (6) LPA-185080/12CF antennas with six (6) LPA-80080/6CF antennas at the same 127-foot level on the tower. Attached behind Tab 1 are the specifications for the existing and 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 Jerome F. Rathbun, First Selectman of the Town of Colebrook. Pursuant to a Council directive, a copy of this letter is also being sent to Frederick and Carmela Chatfield, the owners 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 same height and location as the existing antennas.

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 Detailed Structural Analysis confirming that the tower, with structural modifications, 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:
Jerome F. Rathbun, Colebrook First Selectman
Frederick and Carmela Chatfield
Sandy M. Carter

Vertically Polarized, Log Periodic 80° / 17.5 dBi

LPA-185080/12CF __ 2°

When ordering replace "___" with connector type.

Mechanical specifications

Length	1806 mm	71.1 in
Width	104 mm	4.1 in
Depth	150 mm	5.9 in
Depth with t-bracket	178 mm	7.0 in
[4] Weight	4.8 kg	10.5 lbs
Wind Area		
Fore/Aft	0.19 m^2	2.0 ft^2
Side	0.27 m^2	2.9 ft^2
Rated Wind Velocity (Safety factor 2.0)	>270 km/hr	>168 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	325 N	73.1 lbs
Side	440 N	98.9 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).

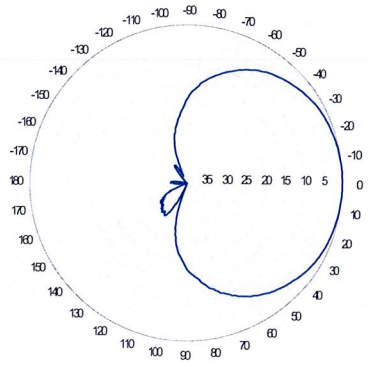
Mounting bracket kit #26799997
Downtilt bracket kit #26799999

The downtil bracket kit includes the mounting bracket kit.

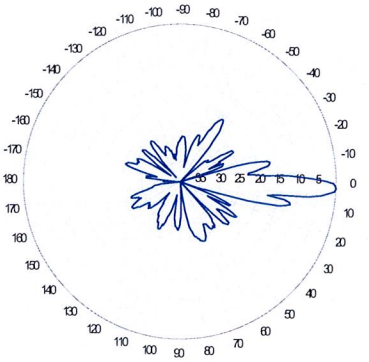
Electrical specifications

Frequency Range	1850-1990 MHz
Impedance	50Ω
[3] Connector(s)	NE or E-DIN 1 port / center
[1] VSWR	≤ 1.4:1
Polarization	Vertical
[1] Gain	17.5 dBi
[2] Power Rating	250 W
[1] Half Power Angle	
H-Plane	80°
E-Plane	5°
[1] Electrical Downtilt	2°
[1] Null Fill	10%
Lightning Protection	Direct Ground

Radiation pattern[1]



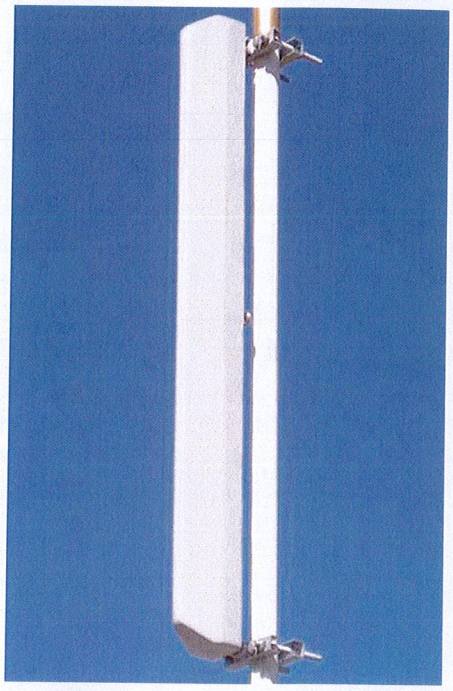
Horizontal



Vertical

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

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



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.

1850-1990 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: 7/12/07

Vertically Polarized, Log Periodic 80° / 14 dBd

LPA-80080/6CF ___

When ordering replace "___" with connector type.

Mechanical specifications

Length	1800	mm	70.9	in
Width	140	mm	5.5	in
Depth	335	mm	13.2	in
Depth with z-bracket	375	mm	14.8	in
[4] Weight	9.5	kg	21.0	lbs
Wind Area				
Fore/Aft	0.25	m^2	2.7	ft^2
Side	0.60	m^2	6.5	ft^2
Rated Wind Velocity (Safety factor 2.0)	>295	km/hr	>183	mph
Wind Load @ 100 mph (161 km/hr)				
Fore/Aft	415	N	93.3	lbs
Side	870	N	195.6	lbs

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

Mounting and Downtilting

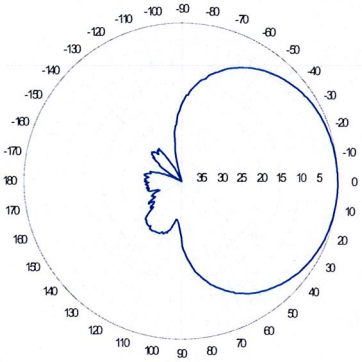
Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in). If the lock-down brace is used, the maximum diameter is Ø88.9 mm (3.5 in)

Mounting Bracket & Downtilt Bracket Kit #21699999

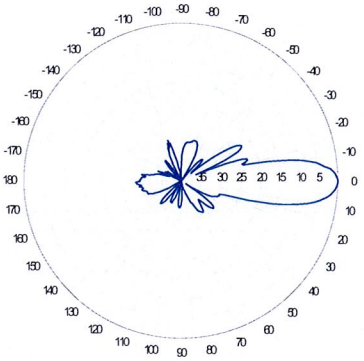
Electrical specifications

	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	14 dBd
[2]	Power Rating	500 W
[1]	Half Power Angle	
	H-Plane	80°
	E-Plane	10°
[1]	Electrical Downtilt	0°
[1]	Null Fill	10%
	Lightning Protection	Direct Ground

Radiation pattern[1]



Horizontal

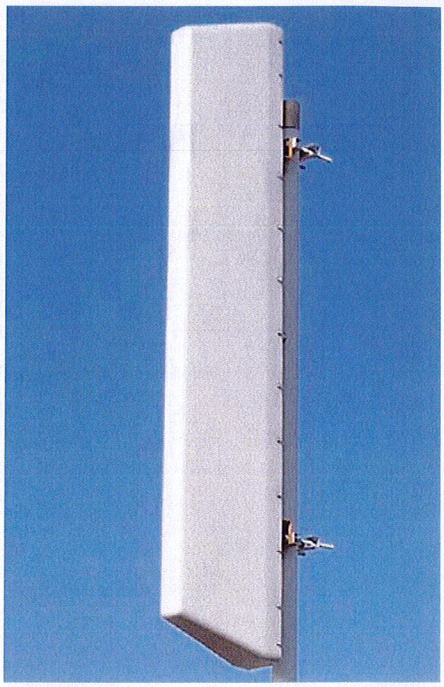


Vertical

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.

CF Denotes a Center-Fed Connector.

806-960 MHz

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.

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: Colebrook							
Tower Height: Verizon @ 127Ft.							
		ERP					
Carrier	**channels**	**watt/ch**	**distance (feet)**	**S (mW/cm^2)**	**f (MHz)**	**Smax**	**Percent MPE**
*Nextel	12	100	147.5	0.0198	851	0.5673	3.50
*Cingular	6	296	137.5	0.0338	880	0.5867	5.76
*Cingular	3	427	137.5	0.0244	1930	1.0000	2.44
Verizon	**9**	**485**	**127**	**0.09737**	**1970**	**1.0000**	**9.74**
Verizon	**9**	**200**	**127**	**0.04015**	**875**	**0.5830**	**6.89**
*Source: Siting Council Records						**Total %MPE**	**28.31**

NATCOMM INC.
CONSULTING ENGINEERS

Structural Analysis Report

150' AGL Existing Monopole

382 Colebrook River Road
Colebrook, CT

Natcomm Project No. 07132.CO1

Date: January 21, 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 on the existing monopole (tower) located in Colebrook, Connecticut. The host tower is a 150-ft AGL, three section, eighteen sided, tapered monopole originally designed by Paul J. Ford and Company (PJF) and manufactured by PennSummit Tubular, LLC (PST); PJF job no. 29205-0113, PST design no. 24458 dated May 24, 2005 (revision 0). PJF's original structure and foundation design calculations are available for reference in Section 4 of this report.

Verizon Wireless is proposing the removal of six (6) existing PCS antennas on their low profile platform and replacing them with six (6) Cellular antennas at the same location. 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 Verizon Wireless' existing and proposed antenna configuration.

Antenna and Appurtenance Summary

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

- NEXTEL (Existing):
  Antennas: Twelve (12) Decibel DB846G90A-XY panel antennas mounted on a low profile platform with a RAD center elevation of 147-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- AT&T (Existing):
  Antennas: Six (6) Powerwave 7770.00 panel antennas, six (6) Powerwave LGP21401 TMAs and six (6) Powerwave LGP13519 diplexers mounted on a low profile platform with a RAD center elevation of 137.5-ft above grade level .
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- VERIZON (Existing):
  Antennas: Twelve (12) Amphenol Antel, Inc. (Antel) LPA-185080/12CF panel antennas mounted on a low profile platform with a RAD center elevation of 127-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- **VERIZON (Proposed):**
  Antennas: Six (6) Antel LPA-185080/12CF (Existing) and six (6) Antel LPA-80080/6CF panel antennas mounted on a low profile platform with a RAD center elevation of 127-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- FUTURE CARRIER:
  Antennas: Twelve (12) 6-ft tall by 1-ft wide by 8-in deep panel antennas mounted on a low profile platform with a RAD center elevation of 117-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- FUTURE CARRIER:
  Antennas: Twelve (12) 6-ft tall by 1-ft wide by 8-in deep panel antennas mounted on a low profile platform with a RAD center elevation of 107-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- FUTURE CARRIER:
  Antennas: Twelve (12) 6-ft tall by 1-ft wide by 8-in deep panel antennas mounted on a low profile platform with a RAD center elevation of 97-ft above grade level.
  Coax Cables: Twelve (12) 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 80mph 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:	Litchfield; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Colebrook; v = 90 mph (3 second gust) equivalent to v = 75 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed Controls	
Load Cases:	Load Case 1; 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 69 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 69 mph wind speed velocity represents 75% of the wind pressure generated by the 80 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1610.1.3 of State Bldg. Code 1999] does not control in the design of this structure type*

Natcomm, Inc.
Structural Monopole Analysis
150' AGL Existing PennSummit Monopole
Colebrook, CT

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 **81.7%** of its total capacity.

Foundation and Anchors

The existing foundation consists of a 31-ft square reinforced concrete pad with a 7.5-ft square over-excavation reinforced concrete haunch bearing directly on existing sub grade. The sub grade conditions used in the analysis of the existing foundation were obtained from PJF's original foundation drawings and calculations available in section 4 of this report. The monopole tower is connected to the pedestal by means of twenty (20) 2 1/4" diameter, A615-GR75 anchor bolts embedded 6-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 = **32.4** kips
  - Moment @ top of pedestal = **3,414.0** ft-kips
  - Axial Force @ top of pedestal = **39.3** 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).

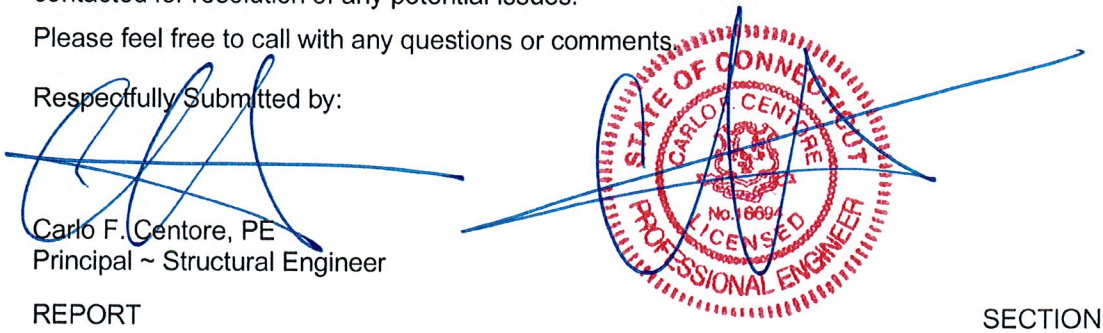
Conclusions

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

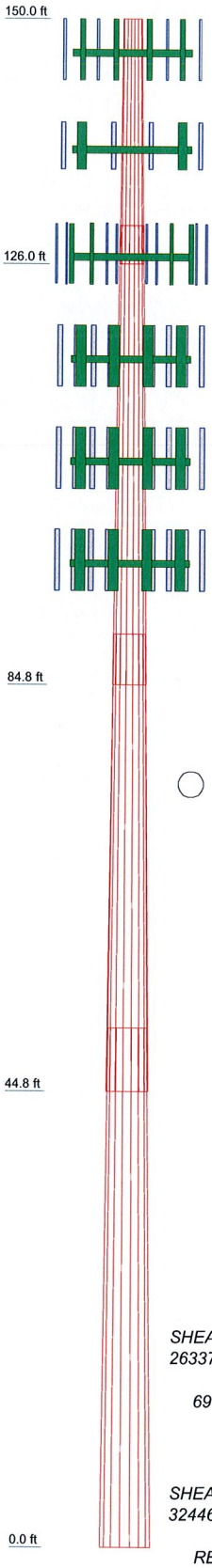
RISATower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, RISATower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

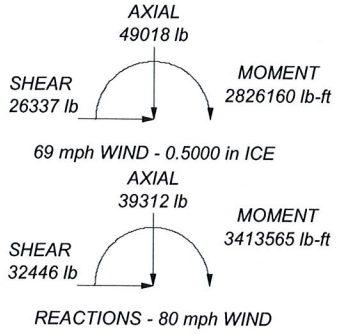
RISATower Features:

- 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	4
Length (ft)	24.00	45.00	45.00	51.00
Number of Sides	18	18	18	18
Thickness (in)	0.1875	0.2500	0.3125	0.4375
Lap Splice (ft)	3.75	5.00	6.25	
Top Dia (in)	22.5000	27.3900	37.2900	46.7400
Bot Dia (in)	28.7400	39.0900	48.9900	60.0000
Grade	A572-65			
Weight (lb)	1236.1	4008.4	6504.7	12755.9

Total Weight (lb): 24505.1





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
14' Low Profile Platform (Sprint Nextel)	147	LPA-185080/12CF (Verizon)	127
(4) DB846G90A-XY (Sprint Nextel)	147	LPA-185080/12CF (Verizon)	127
(4) DB846G90A-XY (Sprint Nextel)	147	LPA-80080-6CF (Verizon)	127
(4) DB846G90A-XY (Sprint Nextel)	147	LPA-80080-6CF (Verizon)	127
14' Low Profile Platform (Cingular ATT)	137.5	LPA-185080/12CF (Verizon)	127
(2) 7770.00 (Cingular ATT)	137.5	LPA-185080/12CF (Verizon)	127
(2) LPG21401 TMA (Cingular ATT)	137.5	LPA-80080-6CF (Verizon)	127
(2) LPG13519 Diplexer (Cingular ATT)	137.5	14' Low Profile Platform (Future)	117
(2) 7770.00 (Cingular ATT)	137.5	(4) 72" x 12" x 8" Panel (Future)	117
(2) LPG21401 TMA (Cingular ATT)	137.5	(4) 72" x 12" x 8" Panel (Future)	117
(2) LPG13519 Diplexer (Cingular ATT)	137.5	(4) 72" x 12" x 8" Panel (Future)	117
(2) 7770.00 (Cingular ATT)	137.5	14' Low Profile Platform (Future)	107
(2) LPG21401 TMA (Cingular ATT)	137.5	(4) 72" x 12" x 8" Panel (Future)	107
(2) LPG13519 Diplexer (Cingular ATT)	137.5	(4) 72" x 12" x 8" Panel (Future)	107
14' Low Profile Platform (Verizon)	127	(4) 72" x 12" x 8" Panel (Future)	107
LPA-80080-6CF (Verizon)	127	14' Low Profile Platform (Future)	97
LPA-185080/12CF (Verizon)	127	(4) 72" x 12" x 8" Panel (Future)	97
LPA-185080/12CF (Verizon)	127	(4) 72" x 12" x 8" Panel (Future)	97
LPA-80080-6CF (Verizon)	127	(4) 72" x 12" x 8" Panel (Future)	97
LPA-80080-6CF (Verizon)	127		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Tower 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: 81.7%

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

Job: ***150' Summit Monopole***			
Project: ***07132 - Colebrook, CT***			
Client: Verizon	Drawn by: Staff	App'd:	
Code: TIA/EIA-222-F	Date: 01/14/08	Scale: NTS	
Path: C:\Users\kiernan214\Documents\Natcomm\07132 Colebrook\ER\ Files\150 Summit Colebrook.eri		Dwg No. E-1	

Tower Input Data

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

Basic wind speed of 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
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*	*Section Length*	*Splice Length*	*Number of Sides*	*Top Diameter*	*Bottom Diameter*	*Wall Thickness*	*Bend Radius*	*Pole Grade*
	ft	*ft*	*ft*		*in*	*in*	*in*	*in*	
L1	150.00-126.00	24.00	3.75	18	22.5000	28.7400	0.1875	0.7500	A572-65 (65 ksi)
L2	126.00-84.75	45.00	5.00	18	27.3900	39.0900	0.2500	1.0000	A572-65 (65 ksi)
L3	84.75-44.75	45.00	6.25	18	37.2900	48.9900	0.3125	1.2500	A572-65 (65 ksi)
L4	44.75-0.00	51.00		18	46.7400	60.0000	0.4375	1.7500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	22.8471	13.2787	835.1997	7.9209	11.4300	73.0708	1671.4984	6.6406	3.6300	19.36
	29.1834	16.9923	1750.1613	10.1361	14.5999	119.8747	3502.6254	8.4978	4.7282	25.217
L2	28.8026	21.5356	2004.0747	9.6347	13.9141	144.0317	4010.7865	10.7698	4.3806	17.523
	39.6930	30.8195	5873.8391	13.7882	19.8577	295.7962	11755.4071	15.4127	6.4398	25.759
L3	39.1853	36.6771	6335.8813	13.1270	18.9433	334.4652	12680.0995	18.3420	6.0130	19.242
	49.7457	48.2820	14453.7051	17.2805	24.8869	580.7752	28926.4288	24.1456	8.0722	25.831
L4	49.1111	64.2968	17415.4921	16.4374	23.7439	733.4716	34853.9000	32.1545	7.4562	17.043
	60.9256	82.7100	37071.5875	21.1447	30.4800	1216.2594	74191.9547	41.3628	9.7900	22.377

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 150.00-126.00				1	1	1		
L2 126.00-84.75				1	1	1		
L3 84.75-44.75				1	1	1		
L4 44.75-0.00				1	1	1		

Monopole Base Plate Data

Base Plate Data	
Base plate is square	√
Base plate is grouted	
Anchor bolt grade	A615-75
Anchor bolt size	2.2500 in
Number of bolts	20
Embedment length	72.0000 in
f'_c	4 ksi
Grout space	3.0000 in
Base plate grade	A572-50
Base plate thickness	2.7500 in
Bolt circle diameter	67.0000 in
Outer diameter	66.0000 in
Inner diameter	30.0000 in
Corner clipped	12.0000 in
Base plate type	Plain Plate

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 (Sprint Nextel)	A	No	Inside Pole	147.00 - 3.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Cingular ATT)	B	No	Inside Pole	137.50 - 3.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 5/8 (Verizon)	C	No	Inside Pole	127.00 - 3.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L1	150.00-126.00	A	0.000	0.000	0.000	0.000	262.08
		B	0.000	0.000	0.000	0.000	143.52
		C	0.000	0.000	0.000	0.000	12.48
L2	126.00-84.75	A	0.000	0.000	0.000	0.000	514.80
		B	0.000	0.000	0.000	0.000	514.80
		C	0.000	0.000	0.000	0.000	514.80
L3	84.75-44.75	A	0.000	0.000	0.000	0.000	499.20
		B	0.000	0.000	0.000	0.000	499.20
		C	0.000	0.000	0.000	0.000	499.20
L4	44.75-0.00	A	0.000	0.000	0.000	0.000	521.04
		B	0.000	0.000	0.000	0.000	521.04
		C	0.000	0.000	0.000	0.000	521.04

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	150.00-126.00	A	0.500	0.000	0.000	0.000	0.000	262.08
		B		0.000	0.000	0.000	0.000	143.52
		C		0.000	0.000	0.000	0.000	12.48
L2	126.00-84.75	A	0.500	0.000	0.000	0.000	0.000	514.80
		B		0.000	0.000	0.000	0.000	514.80
		C		0.000	0.000	0.000	0.000	514.80
L3	84.75-44.75	A	0.500	0.000	0.000	0.000	0.000	499.20
		B		0.000	0.000	0.000	0.000	499.20
		C		0.000	0.000	0.000	0.000	499.20
L4	44.75-0.00	A	0.500	0.000	0.000	0.000	0.000	521.04
		B		0.000	0.000	0.000	0.000	521.04
		C		0.000	0.000	0.000	0.000	521.04

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	150.00-126.00	0.0000	0.0000	0.0000	0.0000
L2	126.00-84.75	0.0000	0.0000	0.0000	0.0000
L3	84.75-44.75	0.0000	0.0000	0.0000	0.0000
L4	44.75-0.00	0.0000	0.0000	0.0000	0.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
14' Low Profile Platform	C	None		0.0000	147.00	No Ice	19.50	19.50	1300.00
(Sprint Nextel)						1/2" Ice	24.00	24.00	1765.00
(4) DB846G90A-XY	A	From Face	4.00	0.0000	147.00	No Ice	4.99	5.87	15.40
(Sprint Nextel)			0.00			1/2" Ice	5.44	6.32	53.75
			0.00						
(4) DB846G90A-XY	B	From Face	4.00	0.0000	147.00	No Ice	4.99	5.87	15.40
(Sprint Nextel)			0.00			1/2" Ice	5.44	6.32	53.75
			0.00						
(4) DB846G90A-XY	C	From Face	4.00	0.0000	147.00	No Ice	4.99	5.87	15.40
(Sprint Nextel)			0.00			1/2" Ice	5.44	6.32	53.75
			0.00						
14' Low Profile Platform	C	None		0.0000	137.50	No Ice	19.50	19.50	1300.00
(Cingular ATT)						1/2" Ice	24.00	24.00	1765.00
(2) 7770.00	A	From Face	4.00	0.0000	137.50	No Ice	5.88	2.93	35.00
(Cingular ATT)			0.00			1/2" Ice	6.31	3.27	67.63
			0.00						
(2) LPG21401 TMA	A	From Face	4.00	0.0000	137.50	No Ice	0.95	0.37	17.50
(Cingular ATT)			0.00			1/2" Ice	1.09	0.48	23.31
			0.00						
(2) LPG13519 Diplexer	A	From Face	4.00	0.0000	137.50	No Ice	0.27	0.18	5.30
(Cingular ATT)			0.00			1/2" Ice	0.34	0.25	7.71
			0.00						
(2) 7770.00	B	From Face	4.00	0.0000	137.50	No Ice	5.88	2.93	35.00
(Cingular ATT)			0.00			1/2" Ice	6.31	3.27	67.63
			0.00						
(2) LPG21401 TMA	B	From Face	4.00	0.0000	137.50	No Ice	0.95	0.37	17.50
(Cingular ATT)			0.00			1/2" Ice	1.09	0.48	23.31
			0.00						
(2) LPG13519 Diplexer	B	From Face	4.00	0.0000	137.50	No Ice	0.27	0.18	5.30
(Cingular ATT)			0.00			1/2" Ice	0.34	0.25	7.71
			0.00						
(2) 7770.00	C	From Face	4.00	0.0000	137.50	No Ice	5.88	2.93	35.00
(Cingular ATT)			0.00			1/2" Ice	6.31	3.27	67.63
			0.00						
(2) LPG21401 TMA	C	From Face	4.00	0.0000	137.50	No Ice	0.95	0.37	17.50
(Cingular ATT)			0.00			1/2" Ice	1.09	0.48	23.31
			0.00						
(2) LPG13519 Diplexer	C	From Face	4.00	0.0000	137.50	No Ice	0.27	0.18	5.30
(Cingular ATT)			0.00			1/2" Ice	0.34	0.25	7.71
			0.00						
14' Low Profile Platform	C	None		0.0000	127.00	No Ice	19.50	19.50	1300.00
(Verizon)						1/2" Ice	24.00	24.00	1765.00
LPA-80080-6CF	A	From Face	4.00	0.0000	127.00	No Ice	4.33	9.09	21.00
(Verizon)			-6.00			1/2" Ice	4.76	9.64	69.24
			0.00						
LPA-185080/12CF	A	From Face	4.00	0.0000	127.00	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	A	From Face	4.00	0.0000	127.00	No Ice	3.53	4.57	11.00
(Verizon)			4.00			1/2" Ice	3.96	5.01	37.49
			0.00						
LPA-80080-6CF	A	From Face	4.00	0.0000	127.00	No Ice	4.33	9.09	21.00

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
(Verizon)			6.00 0.00			1/2" Ice	4.76	9.64	69.24
LPA-80080-6CF	B	From Face	4.00	0.0000	127.00	No Ice	4.33	9.09	21.00
(Verizon)			-6.00 0.00			1/2" Ice	4.76	9.64	69.24
LPA-185080/12CF	B	From Face	4.00	0.0000	127.00	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	B	From Face	4.00	0.0000	127.00	No Ice	3.53	4.57	11.00
(Verizon)			4.00 0.00			1/2" Ice	3.96	5.01	37.49
LPA-80080-6CF	B	From Face	4.00	0.0000	127.00	No Ice	4.33	9.09	21.00
(Verizon)			6.00 0.00			1/2" Ice	4.76	9.64	69.24
LPA-80080-6CF	C	From Face	4.00	0.0000	127.00	No Ice	4.33	9.09	21.00
(Verizon)			-6.00 0.00			1/2" Ice	4.76	9.64	69.24
LPA-185080/12CF	C	From Face	4.00	0.0000	127.00	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	C	From Face	4.00	0.0000	127.00	No Ice	3.53	4.57	11.00
(Verizon)			4.00 0.00			1/2" Ice	3.96	5.01	37.49
LPA-80080-6CF	C	From Face	4.00	0.0000	127.00	No Ice	4.33	9.09	21.00
(Verizon)			6.00 0.00			1/2" Ice	4.76	9.64	69.24
14' Low Profile Platform	C	None		0.0000	117.00	No Ice	19.50	19.50	1300.00
(Future)						1/2" Ice	24.00	24.00	1765.00
(4) 72" x 12" x 8" Panel	A	From Face	4.00	0.0000	117.00	No Ice	8.40	5.87	35.00
(Future)			0.00 0.00			1/2" Ice	8.95	6.32	87.79
(4) 72" x 12" x 8" Panel	B	From Face	4.00	0.0000	117.00	No Ice	8.40	5.87	35.00
(Future)			0.00 0.00			1/2" Ice	8.95	6.32	87.79
(4) 72" x 12" x 8" Panel	C	From Face	4.00	0.0000	117.00	No Ice	8.40	5.87	35.00
(Future)			0.00 0.00			1/2" Ice	8.95	6.32	87.79
14' Low Profile Platform	C	None		0.0000	107.00	No Ice	19.50	19.50	1300.00
(Future)						1/2" Ice	24.00	24.00	1765.00
(4) 72" x 12" x 8" Panel	A	From Face	4.00	0.0000	107.00	No Ice	8.40	5.87	35.00
(Future)			0.00 0.00			1/2" Ice	8.95	6.32	87.79
(4) 72" x 12" x 8" Panel	B	From Face	4.00	0.0000	107.00	No Ice	8.40	5.87	35.00
(Future)			0.00 0.00			1/2" Ice	8.95	6.32	87.79
(4) 72" x 12" x 8" Panel	C	From Face	4.00	0.0000	107.00	No Ice	8.40	5.87	35.00
(Future)			0.00 0.00			1/2" Ice	8.95	6.32	87.79
14' Low Profile Platform	C	None		0.0000	97.00	No Ice	19.50	19.50	1300.00
(Future)						1/2" Ice	24.00	24.00	1765.00
(4) 72" x 12" x 8" Panel	A	From Face	4.00	0.0000	97.00	No Ice	8.40	5.87	35.00
(Future)			0.00 0.00			1/2" Ice	8.95	6.32	87.79
(4) 72" x 12" x 8" Panel	B	From Face	4.00	0.0000	97.00	No Ice	8.40	5.87	35.00
(Future)			0.00 0.00			1/2" Ice	8.95	6.32	87.79
(4) 72" x 12" x 8" Panel	C	From Face	4.00	0.0000	97.00	No Ice	8.40	5.87	35.00

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
(Future)			0.00 0.00		1/2" Ice	8.95	6.32	87.79

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 150.00-126.00	137.51	1.503	25	51.240	A	0.000	51.240	51.240	100.00	0.000	0.000
					B	0.000	51.240		100.00		
					C	0.000	51.240		100.00		
L2 126.00-84.75	104.57	1.39	23	115.938	A	0.000	115.938	115.938	100.00	0.000	0.000
					B	0.000	115.938		100.00		
					C	0.000	115.938		100.00		
L3 84.75-44.75	64.40	1.211	20	145.967	A	0.000	145.967	145.967	100.00	0.000	0.000
					B	0.000	145.967		100.00		
					C	0.000	145.967		100.00		
L4 44.75-0.00	21.59	1	16	202.056	A	0.000	202.056	202.056	100.00	0.000	0.000
					B	0.000	202.056		100.00		
					C	0.000	202.056		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 150.00-126.00	137.51	1.503	18	0.5000	53.240	A	0.000	53.240	53.240	100.00	0.000	0.000
						B	0.000	53.240		100.00		
						C	0.000	53.240		100.00		
L2 126.00-84.75	104.57	1.39	17	0.5000	119.376	A	0.000	119.376	119.376	100.00	0.000	0.000
						B	0.000	119.376		100.00		
						C	0.000	119.376		100.00		
L3 84.75-44.75	64.40	1.211	15	0.5000	149.300	A	0.000	149.300	149.300	100.00	0.000	0.000
						B	0.000	149.300		100.00		
						C	0.000	149.300		100.00		
L4 44.75-0.00	21.59	1	12	0.5000	205.785	A	0.000	205.785	205.785	100.00	0.000	0.000
						B	0.000	205.785		100.00		
						C	0.000	205.785		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 150.00-126.00	137.51	1.503	10	51.240	A	0.000	51.240	51.240	100.00	0.000	0.000
					B	0.000	51.240		100.00		
					C	0.000	51.240		100.00		
L2 126.00-84.75	104.57	1.39	9	115.938	A	0.000	115.938	115.938	100.00	0.000	0.000
					B	0.000	115.938		100.00		
					C	0.000	115.938		100.00		
L3 84.75-44.75	64.40	1.211	8	145.967	A	0.000	145.967	145.967	100.00	0.000	0.000
					B	0.000	145.967		100.00		
					C	0.000	145.967		100.00		
L4 44.75-0.00	21.59	1	6	202.056	A	0.000	202.056	202.056	100.00	0.000	0.000
					B	0.000	202.056		100.00		
					C	0.000	202.056		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 150.00-126.00	418.08	1236.07	A	1	0.65	1	1	1	51.240	1386.51	57.77	C
			B	1	0.65	1	1	1	51.240			
			C	1	0.65	1	1	1	51.240			
L2 126.00-84.75	1544.40	4008.44	A	1	0.65	1	1	1	115.938	2895.94	70.20	C
			B	1	0.65	1	1	1	115.938			
			C	1	0.65	1	1	1	115.938			
L3 84.75-44.75	1497.60	6504.68	A	1	0.65	1	1	1	145.967	3165.97	79.15	C
			B	1	0.65	1	1	1	145.967			
			C	1	0.65	1	1	1	145.967			
L4 44.75-0.00	1563.12	12755.90	A	1	0.65	1	1	1	202.056	3641.77	81.38	C
			B	1	0.65	1	1	1	202.056			
			C	1	0.65	1	1	1	202.056			
Sum Weight:	5023.20	24505.09						OTM	776016.98 lb-ft	11090.19		

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 150.00-126.00	418.08	1236.07	A	1	0.65	1	1	1	51.240	1386.51	57.77	C
			B	1	0.65	1	1	1	51.240			
			C	1	0.65	1	1	1	51.240			
L2 126.00-84.75	1544.40	4008.44	A	1	0.65	1	1	1	115.938	2895.94	70.20	C
			B	1	0.65	1	1	1	115.938			
			C	1	0.65	1	1	1	115.938			

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
L3 84.75-44.75	1497.60	6504.68	A	1	0.65	1	1	1	145.967	3165.97	79.15	C
			B	1	0.65	1	1	1	145.967			
			C	1	0.65	1	1	1	145.967			
L4 44.75-0.00	1563.12	12755.90	A	1	0.65	1	1	1	202.056	3641.77	81.38	C
			B	1	0.65	1	1	1	202.056			
			C	1	0.65	1	1	1	202.056			
Sum Weight:	5023.20	24505.09						OTM	776016.98 lb-ft	11090.19		

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 ft²	F lb	w plf	Ctrl. Face
L1 150.00-126.00	418.08	1236.07	A	1	0.65	1	1	1	51.240	1386.51	57.77	C
			B	1	0.65	1	1	1	51.240			
			C	1	0.65	1	1	1	51.240			
L2 126.00-84.75	1544.40	4008.44	A	1	0.65	1	1	1	115.938	2895.94	70.20	C
			B	1	0.65	1	1	1	115.938			
			C	1	0.65	1	1	1	115.938			
L3 84.75-44.75	1497.60	6504.68	A	1	0.65	1	1	1	145.967	3165.97	79.15	C
			B	1	0.65	1	1	1	145.967			
			C	1	0.65	1	1	1	145.967			
L4 44.75-0.00	1563.12	12755.90	A	1	0.65	1	1	1	202.056	3641.77	81.38	C
			B	1	0.65	1	1	1	202.056			
			C	1	0.65	1	1	1	202.056			
Sum Weight:	5023.20	24505.09						OTM	776016.98 lb-ft	11090.19		

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 ft²	F lb	w plf	Ctrl. Face
L1 150.00-126.00	418.08	1622.96	A	1	0.65	1	1	1	53.240	1080.47	45.02	C
			B	1	0.65	1	1	1	53.240			
			C	1	0.65	1	1	1	53.240			
L2 126.00-84.75	1544.40	4879.81	A	1	0.65	1	1	1	119.376	2236.35	54.21	C
			B	1	0.65	1	1	1	119.376			
			C	1	0.65	1	1	1	119.376			
L3 84.75-44.75	1497.60	7598.05	A	1	0.65	1	1	1	149.300	2428.70	60.72	C
			B	1	0.65	1	1	1	149.300			
			C	1	0.65	1	1	1	149.300			
L4 44.75-0.00	1563.12	14266.13	A	1	0.65	1	1	1	205.785	2781.73	62.16	C
			B	1	0.65	1	1	1	205.785			
			C	1	0.65	1	1	1	205.785			
Sum Weight:	5023.20	28366.95						OTM	598908.22 lb-ft	8527.25		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	lb	lb							ft^2	lb	plf	
L1 150.00-126.00	418.08	1622.96	A	1	0.65	1	1	1	53.240	1080.47	45.02	C
			B	1	0.65	1	1	1	53.240			
			C	1	0.65	1	1	1	53.240			
L2 126.00-84.75	1544.40	4879.81	A	1	0.65	1	1	1	119.376	2236.35	54.21	C
			B	1	0.65	1	1	1	119.376			
			C	1	0.65	1	1	1	119.376			
L3 84.75-44.75	1497.60	7598.05	A	1	0.65	1	1	1	149.300	2428.70	60.72	C
			B	1	0.65	1	1	1	149.300			
			C	1	0.65	1	1	1	149.300			
L4 44.75-0.00	1563.12	14266.13	A	1	0.65	1	1	1	205.785	2781.73	62.16	C
			B	1	0.65	1	1	1	205.785			
			C	1	0.65	1	1	1	205.785			
Sum Weight:	5023.20	28366.95						OTM	598908.22 lb-ft	8527.25		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	lb	lb							ft^2	lb	plf	
L1 150.00-126.00	418.08	1622.96	A	1	0.65	1	1	1	53.240	1080.47	45.02	C
			B	1	0.65	1	1	1	53.240			
			C	1	0.65	1	1	1	53.240			
L2 126.00-84.75	1544.40	4879.81	A	1	0.65	1	1	1	119.376	2236.35	54.21	C
			B	1	0.65	1	1	1	119.376			
			C	1	0.65	1	1	1	119.376			
L3 84.75-44.75	1497.60	7598.05	A	1	0.65	1	1	1	149.300	2428.70	60.72	C
			B	1	0.65	1	1	1	149.300			
			C	1	0.65	1	1	1	149.300			
L4 44.75-0.00	1563.12	14266.13	A	1	0.65	1	1	1	205.785	2781.73	62.16	C
			B	1	0.65	1	1	1	205.785			
			C	1	0.65	1	1	1	205.785			
Sum Weight:	5023.20	28366.95						OTM	598908.22 lb-ft	8527.25		

Tower Forces - Service - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	lb	lb							ft^2	lb	plf	
L1 150.00-126.00	418.08	1236.07	A	1	0.65	1	1	1	51.240	541.61	22.57	C
			B	1	0.65	1	1	1	51.240			
			C	1	0.65	1	1	1	51.240			
L2 126.00-	1544.40	4008.44	A	1	0.65	1	1	1	115.938	1131.23	27.42	C

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
84.75			B	1	0.65	1	1	1	115.938			
			C	1	0.65	1	1	1	115.938			
L3 84.75-44.75	1497.60	6504.68	A	1	0.65	1	1	1	145.967	1236.71	30.92	C
			B	1	0.65	1	1	1	145.967			
			C	1	0.65	1	1	1	145.967			
L4 44.75-0.00	1563.12	12755.90	A	1	0.65	1	1	1	202.056	1422.57	31.79	C
			B	1	0.65	1	1	1	202.056			
			C	1	0.65	1	1	1	202.056			
Sum Weight:	5023.20	24505.09						OTM	303131.63 lb-ft	4332.10		

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 ft²	F lb	w plf	Ctrl. Face
L1 150.00-126.00	418.08	1236.07	A	1	0.65	1	1	1	51.240	541.61	22.57	C
			B	1	0.65	1	1	1	51.240			
			C	1	0.65	1	1	1	51.240			
L2 126.00-84.75	1544.40	4008.44	A	1	0.65	1	1	1	115.938	1131.23	27.42	C
			B	1	0.65	1	1	1	115.938			
			C	1	0.65	1	1	1	115.938			
L3 84.75-44.75	1497.60	6504.68	A	1	0.65	1	1	1	145.967	1236.71	30.92	C
			B	1	0.65	1	1	1	145.967			
			C	1	0.65	1	1	1	145.967			
L4 44.75-0.00	1563.12	12755.90	A	1	0.65	1	1	1	202.056	1422.57	31.79	C
			B	1	0.65	1	1	1	202.056			
			C	1	0.65	1	1	1	202.056			
Sum Weight:	5023.20	24505.09						OTM	303131.63 lb-ft	4332.10		

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 150.00-126.00	418.08	1236.07	A	1	0.65	1	1	1	51.240	541.61	22.57	C
			B	1	0.65	1	1	1	51.240			
			C	1	0.65	1	1	1	51.240			
L2 126.00-84.75	1544.40	4008.44	A	1	0.65	1	1	1	115.938	1131.23	27.42	C
			B	1	0.65	1	1	1	115.938			
			C	1	0.65	1	1	1	115.938			
L3 84.75-44.75	1497.60	6504.68	A	1	0.65	1	1	1	145.967	1236.71	30.92	C
			B	1	0.65	1	1	1	145.967			
			C	1	0.65	1	1	1	145.967			
L4 44.75-0.00	1563.12	12755.90	A	1	0.65	1	1	1	202.056	1422.57	31.79	C
			B	1	0.65	1	1	1	202.056			
			C	1	0.65	1	1	1	202.056			
Sum Weight:	5023.20	24505.09						OTM	303131.63	4332.10		

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
									lb-ft			

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	24505.09					
Bracing Weight	0.00					
Total Member Self-Weight	24505.09			0.00	0.00	
Total Weight	39311.89			0.00	0.00	
Wind 0 deg - No Ice		0.00	-32446.14	-3340427.43	0.00	0.00
Wind 30 deg - No Ice		16223.07	-28099.18	-2892895.01	-1670213.71	0.00
Wind 60 deg - No Ice		28099.18	-16223.07	-1670213.71	-2892895.01	0.00
Wind 90 deg - No Ice		32446.14	0.00	0.00	-3340427.43	0.00
Wind 120 deg - No Ice		28099.18	16223.07	1670213.71	-2892895.01	0.00
Wind 150 deg - No Ice		16223.07	28099.18	2892895.01	-1670213.71	0.00
Wind 180 deg - No Ice		0.00	32446.14	3340427.43	0.00	0.00
Wind 210 deg - No Ice		-16223.07	28099.18	2892895.01	1670213.71	0.00
Wind 240 deg - No Ice		-28099.18	16223.07	1670213.71	2892895.01	0.00
Wind 270 deg - No Ice		-32446.14	0.00	0.00	3340427.43	0.00
Wind 300 deg - No Ice		-28099.18	-16223.07	-1670213.71	2892895.01	0.00
Wind 330 deg - No Ice		-16223.07	-28099.18	-2892895.01	1670213.71	0.00
Member Ice	3861.86					
Total Weight Ice	49018.03			0.00	0.00	
Wind 0 deg - Ice		0.00	-26336.84	-2740629.81	0.00	0.00
Wind 30 deg - Ice		13168.42	-22808.37	-2373455.03	-1370314.90	0.00
Wind 60 deg - Ice		22808.37	-13168.42	-1370314.90	-2373455.03	0.00
Wind 90 deg - Ice		26336.84	0.00	0.00	-2740629.81	0.00
Wind 120 deg - Ice		22808.37	13168.42	1370314.90	-2373455.03	0.00
Wind 150 deg - Ice		13168.42	22808.37	2373455.03	-1370314.90	0.00
Wind 180 deg - Ice		0.00	26336.84	2740629.81	0.00	0.00
Wind 210 deg - Ice		-13168.42	22808.37	2373455.03	1370314.90	0.00
Wind 240 deg - Ice		-22808.37	13168.42	1370314.90	2373455.03	0.00
Wind 270 deg - Ice		-26336.84	0.00	0.00	2740629.81	0.00
Wind 300 deg - Ice		-22808.37	-13168.42	-1370314.90	2373455.03	0.00
Wind 330 deg - Ice		-13168.42	-22808.37	-2373455.03	1370314.90	0.00
Total Weight	39311.89			0.00	0.00	
Wind 0 deg - Service		0.00	-12674.27	-1304854.46	0.00	0.00
Wind 30 deg - Service		6337.14	-10976.24	-1130037.11	-652427.23	0.00
Wind 60 deg - Service		10976.24	-6337.14	-652427.23	-1130037.11	0.00
Wind 90 deg - Service		12674.27	0.00	0.00	-1304854.46	0.00
Wind 120 deg - Service		10976.24	6337.14	652427.23	-1130037.11	0.00
Wind 150 deg - Service		6337.14	10976.24	1130037.11	-652427.23	0.00
Wind 180 deg - Service		0.00	12674.27	1304854.46	0.00	0.00
Wind 210 deg - Service		-6337.14	10976.24	1130037.11	652427.23	0.00
Wind 240 deg - Service		-10976.24	6337.14	652427.23	1130037.11	0.00
Wind 270 deg - Service		-12674.27	0.00	0.00	1304854.46	0.00
Wind 300 deg - Service		-10976.24	-6337.14	-652427.23	1130037.11	0.00
Wind 330 deg - Service		-6337.14	-10976.24	-1130037.11	652427.23	0.00

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
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	150 - 126	Pole	Max Tension	2	0.00	0.00	-0.00
			Max. Compression	14	-6463.07	0.00	-0.00
			Max. Mx	5	-4026.62	-93108.83	0.00
			Max. My	8	-4026.62	0.00	-93108.83
			Max. Vy	5	7165.12	-93108.83	0.00
			Max. Vx	8	7165.12	0.00	-93108.83
			Max. Torque	20			0.00
L2	126 - 84.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-23270.18	0.00	-0.00
			Max. Mx	5	-15012.86	-785080.02	0.00
			Max. My	8	-15012.86	0.00	-785080.02
			Max. Vy	5	26029.50	-785080.02	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
L3	84.75 - 44.75	Pole	Max. Vx	8	26029.50	0.00	-785080.02
			Max. Torque	20			0.00
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-31757.32	0.00	-0.00
			Max. Mx	5	-23047.40	-1849415.62	0.00
			Max. My	8	-23047.40	0.00	-1849415.62
			Max. Vy	5	28862.66	-1849415.62	0.00
			Max. Vx	8	28862.66	0.00	-1849415.62
			Max. Torque	20			0.01
L4	44.75 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-49018.03	0.00	0.00
			Max. Mx	5	-39294.27	-3413563.24	0.00
			Max. My	8	-39294.27	0.00	-3413563.24
			Max. Vy	5	32467.47	-3413563.24	0.00
			Max. Vx	2	-32467.47	0.00	3413563.24
			Max. Torque	20			0.01

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Pole	Max. Vert	21	49018.03	0.00	-26336.85
	Max. H_x	11	39311.89	32446.14	0.00
	Max. H_z	2	39311.89	0.00	32446.14
	Max. M_x	2	3413563.24	0.00	32446.14
	Max. M_z	5	3413563.24	-32446.14	0.00
	Max. Torsion	20	0.01	-13168.42	-22808.38
	Min. Vert	1	39311.89	0.00	0.00
	Min. H_x	5	39311.89	-32446.14	0.00
	Min. H_z	8	39311.89	0.00	-32446.14
	Min. M_x	8	-3413563.24	0.00	-32446.14
	Min. M_z	11	-3413563.24	32446.14	0.00
	Min. Torsion	22	-0.01	13168.42	-22808.38

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	39311.89	0.00	0.00	0.00	0.00	0.00
Dead+Wind 0 deg - No Ice	39311.89	0.00	-32446.14	-3413563.24	0.00	0.00
Dead+Wind 30 deg - No Ice	39311.89	16223.07	-28099.18	-2956233.80	-1706782.39	0.00
Dead+Wind 60 deg - No Ice	39311.89	28099.18	-16223.07	-1706782.39	-2956233.80	-0.00
Dead+Wind 90 deg - No Ice	39311.89	32446.14	0.00	0.00	-3413563.24	0.00
Dead+Wind 120 deg - No Ice	39311.89	28099.18	16223.07	1706782.39	-2956233.80	0.00

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	lb-ft	lb-ft	lb-ft
Dead+Wind 150 deg - No Ice	39311.89	16223.07	28099.18	2956233.80	-1706782.39	-0.00
Dead+Wind 180 deg - No Ice	39311.89	0.00	32446.14	3413563.24	0.00	0.00
Dead+Wind 210 deg - No Ice	39311.89	-16223.07	28099.18	2956233.80	1706782.39	0.00
Dead+Wind 240 deg - No Ice	39311.89	-28099.18	16223.07	1706782.39	2956233.80	-0.00
Dead+Wind 270 deg - No Ice	39311.89	-32446.14	0.00	0.00	3413563.24	0.00
Dead+Wind 300 deg - No Ice	39311.89	-28099.18	-16223.07	-1706782.39	2956233.80	0.00
Dead+Wind 330 deg - No Ice	39311.89	-16223.07	-28099.18	-2956233.80	1706782.39	-0.00
Dead+Ice+Temp	49018.03	0.00	0.00	0.00	0.00	0.00
Dead+Wind 0 deg+Ice+Temp	49018.03	0.00	-26336.85	-2826159.61	0.00	0.00
Dead+Wind 30 deg+Ice+Temp	49018.03	13168.42	-22808.38	-2447526.02	-1413079.82	0.01
Dead+Wind 60 deg+Ice+Temp	49018.03	22808.38	-13168.42	-1413079.82	-2447526.02	-0.01
Dead+Wind 90 deg+Ice+Temp	49018.03	26336.85	0.00	0.00	-2826159.61	0.00
Dead+Wind 120 deg+Ice+Temp	49018.03	22808.38	13168.42	1413079.82	-2447526.02	0.01
Dead+Wind 150 deg+Ice+Temp	49018.03	13168.42	22808.38	2447526.02	-1413079.82	-0.01
Dead+Wind 180 deg+Ice+Temp	49018.03	0.00	26336.85	2826159.61	0.00	0.00
Dead+Wind 210 deg+Ice+Temp	49018.03	-13168.42	22808.38	2447526.02	1413079.82	0.01
Dead+Wind 240 deg+Ice+Temp	49018.03	-22808.38	13168.42	1413079.82	2447526.02	-0.01
Dead+Wind 270 deg+Ice+Temp	49018.03	-26336.85	0.00	0.00	2826159.61	0.00
Dead+Wind 300 deg+Ice+Temp	49018.03	-22808.38	-13168.42	-1413079.82	2447526.02	0.01
Dead+Wind 330 deg+Ice+Temp	49018.03	-13168.42	-22808.38	-2447526.02	1413079.82	-0.01
Dead+Wind 0 deg - Service	39311.89	0.00	-12674.27	-1334210.47	0.00	0.00
Dead+Wind 30 deg - Service	39311.89	6337.14	-10976.24	-1155460.17	-667105.24	0.00
Dead+Wind 60 deg - Service	39311.89	10976.24	-6337.14	-667105.24	-1155460.17	-0.00
Dead+Wind 90 deg - Service	39311.89	12674.27	0.00	0.00	-1334210.47	0.00
Dead+Wind 120 deg - Service	39311.89	10976.24	6337.14	667105.24	-1155460.17	0.00
Dead+Wind 150 deg - Service	39311.89	6337.14	10976.24	1155460.17	-667105.24	-0.00
Dead+Wind 180 deg - Service	39311.89	0.00	12674.27	1334210.47	0.00	0.00
Dead+Wind 210 deg - Service	39311.89	-6337.14	10976.24	1155460.17	667105.24	0.00
Dead+Wind 240 deg - Service	39311.89	-10976.24	6337.14	667105.24	1155460.17	-0.00
Dead+Wind 270 deg - Service	39311.89	-12674.27	0.00	0.00	1334210.47	0.00
Dead+Wind 300 deg - Service	39311.89	-10976.24	-6337.14	-667105.24	1155460.17	0.00
Dead+Wind 330 deg - Service	39311.89	-6337.14	-10976.24	-1155460.17	667105.24	-0.00

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	-39311.89	0.00	0.00	39311.89	0.00	0.000%
2	0.00	-39311.89	-32446.14	0.00	39311.89	32446.14	0.000%
3	16223.07	-39311.89	-28099.18	-16223.07	39311.89	28099.18	0.000%
4	28099.18	-39311.89	-16223.07	-28099.18	39311.89	16223.07	0.000%
5	32446.14	-39311.89	0.00	-32446.14	39311.89	0.00	0.000%
6	28099.18	-39311.89	16223.07	-28099.18	39311.89	-16223.07	0.000%
7	16223.07	-39311.89	28099.18	-16223.07	39311.89	-28099.18	0.000%
8	0.00	-39311.89	32446.14	0.00	39311.89	-32446.14	0.000%
9	-16223.07	-39311.89	28099.18	16223.07	39311.89	-28099.18	0.000%
10	-28099.18	-39311.89	16223.07	28099.18	39311.89	-16223.07	0.000%
11	-32446.14	-39311.89	0.00	32446.14	39311.89	0.00	0.000%
12	-28099.18	-39311.89	-16223.07	28099.18	39311.89	16223.07	0.000%
13	-16223.07	-39311.89	-28099.18	16223.07	39311.89	28099.18	0.000%
14	0.00	-49018.03	0.00	0.00	49018.03	0.00	0.000%
15	0.00	-49018.03	-26336.84	0.00	49018.03	26336.85	0.000%
16	13168.42	-49018.03	-22808.37	-13168.42	49018.03	22808.38	0.000%
17	22808.37	-49018.03	-13168.42	-22808.38	49018.03	13168.42	0.000%
18	26336.84	-49018.03	0.00	-26336.85	49018.03	0.00	0.000%
19	22808.37	-49018.03	13168.42	-22808.38	49018.03	-13168.42	0.000%
20	13168.42	-49018.03	22808.37	-13168.42	49018.03	-22808.38	0.000%

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
21	0.00	-49018.03	26336.84	0.00	49018.03	-26336.85	0.000%
22	-13168.42	-49018.03	22808.37	13168.42	49018.03	-22808.38	0.000%
23	-22808.37	-49018.03	13168.42	22808.38	49018.03	-13168.42	0.000%
24	-26336.84	-49018.03	0.00	26336.85	49018.03	0.00	0.000%
25	-22808.37	-49018.03	-13168.42	22808.38	49018.03	13168.42	0.000%
26	-13168.42	-49018.03	-22808.37	13168.42	49018.03	22808.38	0.000%
27	0.00	-39311.89	-12674.27	0.00	39311.89	12674.27	0.000%
28	6337.14	-39311.89	-10976.24	-6337.14	39311.89	10976.24	0.000%
29	10976.24	-39311.89	-6337.14	-10976.24	39311.89	6337.14	0.000%
30	12674.27	-39311.89	0.00	-12674.27	39311.89	0.00	0.000%
31	10976.24	-39311.89	6337.14	-10976.24	39311.89	-6337.14	0.000%
32	6337.14	-39311.89	10976.24	-6337.14	39311.89	-10976.24	0.000%
33	0.00	-39311.89	12674.27	0.00	39311.89	-12674.27	0.000%
34	-6337.14	-39311.89	10976.24	6337.14	39311.89	-10976.24	0.000%
35	-10976.24	-39311.89	6337.14	10976.24	39311.89	-6337.14	0.000%
36	-12674.27	-39311.89	0.00	12674.27	39311.89	0.00	0.000%
37	-10976.24	-39311.89	-6337.14	10976.24	39311.89	6337.14	0.000%
38	-6337.14	-39311.89	-10976.24	6337.14	39311.89	10976.24	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	0.00004592
3	Yes	5	0.00000001	0.00015786
4	Yes	5	0.00000001	0.00015786
5	Yes	4	0.00000001	0.00004592
6	Yes	5	0.00000001	0.00015786
7	Yes	5	0.00000001	0.00015786
8	Yes	4	0.00000001	0.00004592
9	Yes	5	0.00000001	0.00015786
10	Yes	5	0.00000001	0.00015786
11	Yes	4	0.00000001	0.00004592
12	Yes	5	0.00000001	0.00015786
13	Yes	5	0.00000001	0.00015786
14	Yes	4	0.00000001	0.00000001
15	Yes	5	0.00000001	0.00009446
16	Yes	5	0.00000001	0.00034214
17	Yes	5	0.00000001	0.00034214
18	Yes	5	0.00000001	0.00009446
19	Yes	5	0.00000001	0.00034214
20	Yes	5	0.00000001	0.00034214
21	Yes	5	0.00000001	0.00009446
22	Yes	5	0.00000001	0.00034214
23	Yes	5	0.00000001	0.00034214
24	Yes	5	0.00000001	0.00009446
25	Yes	5	0.00000001	0.00034214
26	Yes	5	0.00000001	0.00034214
27	Yes	4	0.00000001	0.00002687
28	Yes	4	0.00000001	0.00056305
29	Yes	4	0.00000001	0.00056305
30	Yes	4	0.00000001	0.00002687
31	Yes	4	0.00000001	0.00056305
32	Yes	4	0.00000001	0.00056305
33	Yes	4	0.00000001	0.00002687

34	Yes	4	0.00000001	0.00056305
35	Yes	4	0.00000001	0.00056305
36	Yes	4	0.00000001	0.00002687
37	Yes	4	0.00000001	0.00056305
38	Yes	4	0.00000001	0.00056305

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 126	27.749	33	1.5886	0.0000
L2	129.75 - 84.75	21.084	33	1.5306	0.0000
L3	89.75 - 44.75	9.719	33	1.0973	0.0000
L4	51 - 0	2.933	33	0.5352	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
147.00	14' Low Profile Platform	33	26.750	1.5834	0.0000	39382
137.50	14' Low Profile Platform	33	23.603	1.5616	0.0000	15753
127.00	14' Low Profile Platform	33	20.207	1.5152	0.0000	8847
117.00	14' Low Profile Platform	33	17.109	1.4392	0.0000	6642
107.00	14' Low Profile Platform	33	14.193	1.3344	0.0000	5319
97.00	14' Low Profile Platform	33	11.503	1.2047	0.0000	4435

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 126	70.931	8	4.0618	0.0000
L2	129.75 - 84.75	53.901	8	3.9135	0.0000
L3	89.75 - 44.75	24.855	8	2.8061	0.0000
L4	51 - 0	7.504	8	1.3691	0.0000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
147.00	14' Low Profile Platform	8	68.377	4.0488	0.0000	15549
137.50	14' Low Profile Platform	8	60.336	3.9940	0.0000	6219
127.00	14' Low Profile Platform	8	51.659	3.8731	0.0000	3490
117.00	14' Low Profile Platform	8	43.744	3.6730	0.0000	2617

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
107.00	14' Low Profile Platform	8	36.292	3.4011	0.0000	2094
97.00	14' Low Profile Platform	8	29.415	3.0720	0.0000	1744

Base Plate Design Data

Plate Thickness in	Number of Anchor Bolts	Anchor Bolt Size in	Actual Allowable Ratio Bolt Tension lb	Actual Allowable Ratio Bolt Compression lb	Actual Allowable Ratio Plate Stress ksi	Actual Allowable Ratio Stiffener Stress ksi	Controlling Condition	Ratio
2.7500	20	2.2500	120312.23 131210.58 0.92	124241.66 217809.56 0.57	36.606 37.500 0.98		Plate	0.98 ✔

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	150 - 148.934	TP28.74x22.5x0.1875	24.00	150.00	224.5	2.964	13.4436	-82.24	39847.10	0.002*
	148.934 - 147.868					3.037	13.6086	-165.26	41331.60	0.004*
	147.868 - 146.803					3.111	13.7735	-2659.12	42852.50	0.062*
	146.803 - 145.737					3.111	13.7735	-2659.12	42852.50	0.062*
	145.737 - 144.671					3.262	14.1033	-2632.14	46005.30	0.057
	144.671 - 143.605					3.339	14.2682	-2715.60	47638.10	0.057
	143.605 - 142.539					3.416	14.4331	-2799.87	49309.00	0.057
	142.539 - 141.474					3.495	14.5980	-2884.96	51018.60	0.057
	141.474 - 140.408					3.574	14.7629	-2970.85	52767.30	0.056
	140.408 - 139.342					3.655	14.9278	-3057.56	54555.50	0.056
	139.342 - 138.276					3.736	15.0928	-3145.08	56383.60	0.056
	138.276 - 137.211					3.818	15.2577	-5477.44	58252.10	0.094
	137.211 - 136.145					3.901	15.4226	-5566.88	60161.40	0.093
	136.145 - 135.079					3.985	15.5875	-5657.20	62112.00	0.091
	135.079 -					4.069	15.7524	-5748.40	64104.40	0.090

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 $\frac{P}{P_a}$
	134.013									
	134.013 - 132.947					4.155	15.9173	-5840.47	66138.80	0.088
	132.947 - 131.882					4.242	16.0822	-3877.00	68215.90	0.057
	131.882 - 130.816					4.329	16.2471	-3951.45	70336.00	0.056
	130.816 - 129.75					4.417	16.4121	-4026.61	72499.60	0.056
	129.75 - 126					4.735	16.9923	-4838.02	80464.30	0.060
L2	129.75 - 126	TP39.09x27.39x0.25	45.00	150.00	180.3	4.591	22.3093	-2782.22	102429.00	0.027
	126 - 123.986					4.764	22.7247	-6053.03	108259.00	0.056
	123.986 - 121.972					4.940	23.1402	-6283.44	114307.00	0.055
	121.972 - 119.958					5.119	23.5557	-6517.41	120575.00	0.054
	119.958 - 117.944					5.301	23.9712	-6754.90	127069.00	0.053
	117.944 - 115.931					5.486	24.3867	-8442.23	133791.00	0.063
	115.931 - 113.917					5.675	24.8022	-8690.41	140747.00	0.062
	113.917 - 111.903					5.866	25.2177	-8942.60	147939.00	0.060
	111.903 - 109.889					6.061	25.6331	-9198.73	155373.00	0.059
	109.889 - 107.875					6.259	26.0486	-9458.74	163051.00	0.058
	107.875 - 105.861					6.461	26.4641	-11195.50	170978.00	0.065
	105.861 - 103.847					6.665	26.8796	-11467.90	179158.00	0.064
	103.847 - 101.833					6.873	27.2951	-11744.60	187595.00	0.063
	101.833 - 99.8194					7.084	27.7106	-12025.50	196293.00	0.061
	99.8194 - 97.8056					7.298	28.1260	-12310.40	205256.00	0.060
	97.8056 - 95.7917					7.515	28.5415	-14103.60	214487.00	0.066
	95.7917 - 93.7778					7.735	28.9570	-14402.30	223991.00	0.064
	93.7778 - 91.7639					7.959	29.3725	-14705.40	233772.00	0.063
	91.7639 - 89.75					8.186	29.7880	-15012.80	243833.00	0.062
	89.75 - 84.75					8.762	30.8195	-7382.65	270052.00	0.027
L3	89.75 - 84.75	TP48.99x37.29x0.3125	45.00	150.00	132.5	8.510	37.9665	-8988.81	323110.00	0.028
	84.75 - 82.875					8.729	38.4500	-16717.90	335613.00	0.050
	82.875 - 81					8.949	38.9336	-17060.90	348435.00	0.049
	81 - 79.125					9.173	39.4171	-17407.80	361579.00	0.048
	79.125 - 77.25					9.400	39.9007	-17758.50	375050.00	0.047
	77.25 - 75.375					9.629	40.3842	-18112.90	388851.00	0.047
	75.375 - 73.5					9.861	40.8677	-18471.00	402987.00	0.046
	73.5 - 71.625					10.095	41.3513	-18832.80	417461.00	0.045
	71.625 - 69.75					10.333	41.8348	-19198.30	432277.00	0.044
	69.75 - 67.875					10.573	42.3183	-19567.40	447440.00	0.044
	67.875 - 66					10.816	42.8019	-19940.00	462954.00	0.043
	66 - 64.125					11.062	43.2854	-20316.20	478822.00	0.042
	64.125 - 62.25					11.310	43.7690	-20696.00	495049.00	0.042
	62.25 - 60.375					11.562	44.2525	-21079.20	511638.00	0.041

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 $\frac{P}{P_a}$
	60.375 - 58.5					11.816	44.7360	-21466.00	528593.00	0.041
	58.5 - 56.625					12.073	45.2196	-21856.20	545919.00	0.040
	56.625 - 54.75					12.332	45.7031	-22249.80	563620.00	0.039
	54.75 - 52.875					12.595	46.1867	-22646.90	581699.00	0.039
	52.875 - 51					12.860	46.6702	-23047.40	600161.00	0.038
	51 - 44.75					13.763	48.2820	-10878.00	664515.00	0.016
L4	51 - 44.75	TP60x46.74x0.4375	51.00	150.00	105.8	13.342	66.5533	-14837.70	887978.00	0.017
	44.75 - 42.3947					13.685	67.4037	-26376.80	922452.00	0.029
	42.3947 - 40.0395					14.033	68.2540	-27035.20	957806.00	0.028
	40.0395 - 37.6842					14.385	69.1044	-27700.60	994053.00	0.028
	37.6842 - 35.3289					14.741	69.9547	-28373.00	1031200.00	0.028
	35.3289 - 32.9737					15.102	70.8051	-29052.40	1069270.00	0.027
	32.9737 - 30.6184					15.467	71.6554	-29738.70	1108260.00	0.027
	30.6184 - 28.2632					15.836	72.5058	-30432.10	1148180.00	0.027
	28.2632 - 25.9079					16.209	73.3561	-31132.40	1189060.00	0.026
	25.9079 - 23.5526					16.587	74.2065	-31839.70	1230890.00	0.026
	23.5526 - 21.1974					16.970	75.0568	-32553.90	1273690.00	0.026
	21.1974 - 18.8421					17.348	75.9072	-33275.10	1316810.00	0.025
	18.8421 - 16.4868					17.714	76.7575	-34003.20	1359680.00	0.025
	16.4868 - 14.1316					18.069	77.6079	-34738.20	1402300.00	0.025
	14.1316 - 11.7763					18.414	78.4582	-35480.20	1444710.00	0.025
	11.7763 - 9.42105					18.748	79.3086	-36229.20	1486890.00	0.024
	9.42105 - 7.06579					19.073	80.1589	-36985.00	1528860.00	0.024
	7.06579 - 4.71053					19.388	81.0093	-37747.90	1570630.00	0.024
	4.71053 - 2.35526					19.695	81.8596	-38517.60	1612210.00	0.024
	2.35526 - 0					19.993	82.7100	-39294.30	1653610.00	0.024

* 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	150 - 148.934	TP28.74x22.5x0.1875	0.00	0.000	39.000	0.000	0.00	0.000	39.000	0.000
	148.934 - 147.868		0.00	0.000	39.000	0.000	0.00	0.000	39.000	0.000
	147.868 - 146.803		0.00	0.000	39.000	0.000	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 $\frac{f_{by}}{F_{by}}$
	146.803 - 145.737		0.00	0.000	39.000	0.000	0.00	0.000	39.000	0.000
	145.737 - 144.671		7971.06	-1.160	39.000	0.030	0.00	0.000	39.000	0.000
	144.671 - 143.605		11610.67	-1.651	39.000	0.042	0.00	0.000	39.000	0.000
	143.605 - 142.539		15303.67	-2.126	39.000	0.055	0.00	0.000	39.000	0.000
	142.539 - 141.474		19050.75	-2.587	39.000	0.066	0.00	0.000	39.000	0.000
	141.474 - 140.408		22852.33	-3.034	39.000	0.078	0.00	0.000	39.000	0.000
	140.408 - 139.342		26709.00	-3.467	39.000	0.089	0.00	0.000	39.000	0.000
	139.342 - 138.276		30621.25	-3.889	39.000	0.100	0.00	0.000	39.000	0.000
	138.276 - 137.211		35164.67	-4.369	39.000	0.112	0.00	0.000	39.000	0.000
	137.211 - 136.145		41305.50	-5.023	39.000	0.129	0.00	0.000	39.000	0.000
	136.145 - 135.079		47503.08	-5.654	39.000	0.145	0.00	0.000	39.000	0.000
	135.079 - 134.013		53757.92	-6.265	39.000	0.161	0.00	0.000	39.000	0.000
	134.013 - 132.947		60070.42	-6.856	39.000	0.176	0.00	0.000	39.000	0.000
	132.947 - 131.882		77987.17	-8.719	39.000	0.224	0.00	0.000	39.000	0.000
	131.882 - 130.816		85510.83	-9.366	39.000	0.240	0.00	0.000	39.000	0.000
	130.816 - 129.75		93109.17	-9.994	39.000	0.256	0.00	0.000	39.000	0.000
	129.75 - 126		47423.92	-4.747	38.753	0.123	0.00	0.000	38.753	0.000
L2	129.75 - 126	TP39.09x27.39x0.25	68352.33	-5.305	39.000	0.136	0.00	0.000	39.000	0.000
	126 - 123.986		146197.50	-10.934	39.000	0.280	0.00	0.000	39.000	0.000
	123.986 - 121.972		168669.17	-12.164	39.000	0.312	0.00	0.000	39.000	0.000
	121.972 - 119.958		191420.83	-13.320	39.000	0.342	0.00	0.000	39.000	0.000
	119.958 - 117.944		214455.00	-14.408	39.000	0.369	0.00	0.000	39.000	0.000
	117.944 - 115.931		242350.83	-15.729	39.000	0.403	0.00	0.000	39.000	0.000
	115.931 - 113.917		274574.17	-17.226	39.000	0.442	0.00	0.000	39.000	0.000
	113.917 - 111.903		307083.33	-18.634	39.000	0.478	0.00	0.000	39.000	0.000
	111.903 - 109.889		339880.00	-19.958	39.000	0.512	0.00	0.000	39.000	0.000
	109.889 - 107.875		372966.67	-21.206	39.000	0.544	0.00	0.000	39.000	0.000
	107.875 - 105.861		411090.00	-22.642	39.000	0.581	0.00	0.000	39.000	0.000
	105.861 - 103.847		453151.67	-24.191	39.000	0.620	0.00	0.000	39.000	0.000
	103.847 - 101.833		495502.50	-25.649	39.000	0.658	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 $\frac{f_{by}}{F_{by}}$
	101.833 - 99.8194		538145.00	-27.025	39.000	0.693	0.00	0.000	39.000	0.000
	99.8194 - 97.8056		581080.00	-28.322	39.000	0.726	0.00	0.000	39.000	0.000
	97.8056 - 95.7917		629198.33	-29.778	39.000	0.764	0.00	0.000	39.000	0.000
	95.7917 - 93.7778		680868.33	-31.302	39.000	0.803	0.00	0.000	39.000	0.000
	93.7778 - 91.7639		732828.33	-32.742	39.000	0.840	0.00	0.000	39.000	0.000
	91.7639 - 89.75		785080.83	-34.101	38.990	0.875	0.00	0.000	38.990	0.000
	89.75 - 84.75		417390.83	-16.933	38.408	0.441	0.00	0.000	38.408	0.000
L3	89.75 - 84.75	TP48.99x37.29x0.3125	498841.67	-16.698	39.000	0.428	0.00	0.000	39.000	0.000
	84.75 - 82.875		965941.67	-31.522	39.000	0.808	0.00	0.000	39.000	0.000
	82.875 - 81		1015900.00	-32.330	39.000	0.829	0.00	0.000	39.000	0.000
	81 - 79.125		1066108.33	-33.098	39.000	0.849	0.00	0.000	39.000	0.000
	79.125 - 77.25		1116575.00	-33.826	39.000	0.867	0.00	0.000	39.000	0.000
	77.25 - 75.375		1167291.67	-34.518	39.000	0.885	0.00	0.000	39.000	0.000
	75.375 - 73.5		1218266.67	-35.174	39.000	0.902	0.00	0.000	39.000	0.000
	73.5 - 71.625		1269483.33	-35.798	39.000	0.918	0.00	0.000	39.000	0.000
	71.625 - 69.75		1320958.33	-36.390	39.000	0.933	0.00	0.000	39.000	0.000
	69.75 - 67.875		1372683.33	-36.953	39.000	0.948	0.00	0.000	39.000	0.000
	67.875 - 66		1424650.00	-37.487	39.000	0.961	0.00	0.000	39.000	0.000
	66 - 64.125		1476875.00	-37.995	39.000	0.974	0.00	0.000	39.000	0.000
	64.125 - 62.25		1529350.00	-38.477	39.000	0.987	0.00	0.000	39.000	0.000
	62.25 - 60.375		1582075.00	-38.936	39.000	0.998	0.00	0.000	39.000	0.000
	60.375 - 58.5		1635041.67	-39.371	39.000	1.010	0.00	0.000	39.000	0.000
	58.5 - 56.625		1688266.67	-39.785	39.000	1.020	0.00	0.000	39.000	0.000
	56.625 - 54.75		1741733.33	-40.178	39.000	1.030	0.00	0.000	39.000	0.000
	54.75 - 52.875		1795450.00	-40.552	39.000	1.040	0.00	0.000	39.000	0.000
	52.875 - 51		1849416.67	-40.907	38.945	1.050	0.00	0.000	38.945	0.000
	51 - 44.75		870025.00	-17.977	38.362	0.469	0.00	0.000	38.362	0.000
L4	51 - 44.75	TP60x46.74x0.4375	1161350.00	-17.728	39.000	0.455	0.00	0.000	39.000	0.000
	44.75 - 42.3947		2100750.00	-31.261	39.000	0.802	0.00	0.000	39.000	0.000
	42.3947 - 40.0395		2170491.67	-31.495	39.000	0.808	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 $\frac{f_{by}}{F_{by}}$
	40.0395 - 37.6842		2240591.67	-31.714	39.000	0.813	0.00	0.000	39.000	0.000
	37.6842 - 35.3289		2311066.67	-31.917	39.000	0.818	0.00	0.000	39.000	0.000
	35.3289 - 32.9737		2381908.33	-32.107	39.000	0.823	0.00	0.000	39.000	0.000
	32.9737 - 30.6184		2453116.67	-32.283	39.000	0.828	0.00	0.000	39.000	0.000
	30.6184 - 28.2632		2524700.00	-32.447	39.000	0.832	0.00	0.000	39.000	0.000
	28.2632 - 25.9079		2596658.33	-32.600	39.000	0.836	0.00	0.000	39.000	0.000
	25.9079 - 23.5526		2669000.00	-32.742	39.000	0.840	0.00	0.000	39.000	0.000
	23.5526 - 21.1974		2741716.67	-32.873	39.000	0.843	0.00	0.000	39.000	0.000
	21.1974 - 18.8421		2814816.67	-32.994	39.000	0.846	0.00	0.000	39.000	0.000
	18.8421 - 16.4868		2888291.67	-33.107	39.000	0.849	0.00	0.000	39.000	0.000
	16.4868 - 14.1316		2962158.33	-33.211	39.000	0.852	0.00	0.000	39.000	0.000
	14.1316 - 11.7763		3036416.67	-33.306	39.000	0.854	0.00	0.000	39.000	0.000
	11.7763 - 9.42105		3111058.33	-33.395	39.000	0.856	0.00	0.000	39.000	0.000
	9.42105 - 7.06579		3186091.67	-33.475	39.000	0.858	0.00	0.000	39.000	0.000
	7.06579 - 4.71053		3261525.00	-33.550	39.000	0.860	0.00	0.000	39.000	0.000
	4.71053 - 2.35526		3337341.67	-33.618	39.000	0.862	0.00	0.000	39.000	0.000
	2.35526 - 0		3413566.67	-33.679	39.000	0.864	0.00	0.000	39.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	150 - 148.934	TP28.74x22.5x0.1875	0.002	0.000	0.000	0.002* ✔	1.000	H1-3 ✔
	148.934 - 147.868		0.004	0.000	0.000	0.004* ✔	1.000	H1-3 ✔
	147.868 - 146.803		0.062	0.000	0.000	0.062* ✔	1.000	H1-3 ✔
	146.803 - 145.737		0.062	0.000	0.000	0.062* ✔	1.000	H1-3 ✔
	145.737 - 144.671		0.057	0.030	0.000	0.087 ✔	1.333	H1-3 ✔
	144.671 - 143.605		0.057	0.042	0.000	0.099 ✔	1.333	H1-3 ✔
	143.605 - 142.539		0.057	0.055	0.000	0.111 ✔	1.333	H1-3 ✔
	142.539 - 141.474		0.057	0.066	0.000	0.123 ✔	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
	141.474 - 140.408		0.056	0.078	0.000	0.134 ✓	1.333	H1-3 ✓
	140.408 - 139.342		0.056	0.089	0.000	0.145 ✓	1.333	H1-3 ✓
	139.342 - 138.276		0.056	0.100	0.000	0.155 ✓	1.333	H1-3 ✓
	138.276 - 137.211		0.094	0.112	0.000	0.206 ✓	1.333	H1-3 ✓
	137.211 - 136.145		0.093	0.129	0.000	0.221 ✓	1.333	H1-3 ✓
	136.145 - 135.079		0.091	0.145	0.000	0.236 ✓	1.333	H1-3 ✓
	135.079 - 134.013		0.090	0.161	0.000	0.250 ✓	1.333	H1-3 ✓
	134.013 - 132.947		0.088	0.176	0.000	0.264 ✓	1.333	H1-3 ✓
	132.947 - 131.882		0.057	0.224	0.000	0.280 ✓	1.333	H1-3 ✓
	131.882 - 130.816		0.056	0.240	0.000	0.296 ✓	1.333	H1-3 ✓
	130.816 - 129.75		0.056	0.256	0.000	0.312 ✓	1.333	H1-3 ✓
	129.75 - 126		0.060	0.123	0.000	0.183 ✓	1.333	H1-3 ✓
L2	129.75 - 126	TP39.09x27.39x0.25	0.027	0.136	0.000	0.163 ✓	1.333	H1-3 ✓
	126 - 123.986		0.056	0.280	0.000	0.336 ✓	1.333	H1-3 ✓
	123.986 - 121.972		0.055	0.312	0.000	0.367 ✓	1.333	H1-3 ✓
	121.972 - 119.958		0.054	0.342	0.000	0.396 ✓	1.333	H1-3 ✓
	119.958 - 117.944		0.053	0.369	0.000	0.423 ✓	1.333	H1-3 ✓
	117.944 - 115.931		0.063	0.403	0.000	0.466 ✓	1.333	H1-3 ✓
	115.931 - 113.917		0.062	0.442	0.000	0.503 ✓	1.333	H1-3 ✓
	113.917 - 111.903		0.060	0.478	0.000	0.538 ✓	1.333	H1-3 ✓
	111.903 - 109.889		0.059	0.512	0.000	0.571 ✓	1.333	H1-3 ✓
	109.889 - 107.875		0.058	0.544	0.000	0.602 ✓	1.333	H1-3 ✓
	107.875 - 105.861		0.065	0.581	0.000	0.646 ✓	1.333	H1-3 ✓
	105.861 - 103.847		0.064	0.620	0.000	0.684 ✓	1.333	H1-3 ✓
	103.847 - 101.833		0.063	0.658	0.000	0.720 ✓	1.333	H1-3 ✓
	101.833 - 99.8194		0.061	0.693	0.000	0.754 ✓	1.333	H1-3 ✓
	99.8194 - 97.8056		0.060	0.726	0.000	0.786 ✓	1.333	H1-3 ✓
	97.8056 - 95.7917		0.066	0.764	0.000	0.829 ✓	1.333	H1-3 ✓
	95.7917 - 93.7778		0.064	0.803	0.000	0.867 ✓	1.333	H1-3 ✓
	93.7778 - 91.7639		0.063	0.840	0.000	0.902 ✓	1.333	H1-3 ✓
	91.7639 - 89.75		0.062	0.875	0.000	0.936 ✓	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
	89.75 - 84.75		0.027	0.441	0.000	0.468 ✔	1.333	H1-3 ✔
L3	89.75 - 84.75	TP48.99x37.29x0.3125	0.028	0.428	0.000	0.456 ✔	1.333	H1-3 ✔
	84.75 - 82.875		0.050	0.808	0.000	0.858 ✔	1.333	H1-3 ✔
	82.875 - 81		0.049	0.829	0.000	0.878 ✔	1.333	H1-3 ✔
	81 - 79.125		0.048	0.849	0.000	0.897 ✔	1.333	H1-3 ✔
	79.125 - 77.25		0.047	0.867	0.000	0.915 ✔	1.333	H1-3 ✔
	77.25 - 75.375		0.047	0.885	0.000	0.932 ✔	1.333	H1-3 ✔
	75.375 - 73.5		0.046	0.902	0.000	0.948 ✔	1.333	H1-3 ✔
	73.5 - 71.625		0.045	0.918	0.000	0.963 ✔	1.333	H1-3 ✔
	71.625 - 69.75		0.044	0.933	0.000	0.977 ✔	1.333	H1-3 ✔
	69.75 - 67.875		0.044	0.948	0.000	0.991 ✔	1.333	H1-3 ✔
	67.875 - 66		0.043	0.961	0.000	1.004 ✔	1.333	H1-3 ✔
	66 - 64.125		0.042	0.974	0.000	1.017 ✔	1.333	H1-3 ✔
	64.125 - 62.25		0.042	0.987	0.000	1.028 ✔	1.333	H1-3 ✔
	62.25 - 60.375		0.041	0.998	0.000	1.040 ✔	1.333	H1-3 ✔
	60.375 - 58.5		0.041	1.010	0.000	1.050 ✔	1.333	H1-3 ✔
	58.5 - 56.625		0.040	1.020	0.000	1.060 ✔	1.333	H1-3 ✔
	56.625 - 54.75		0.039	1.030	0.000	1.070 ✔	1.333	H1-3 ✔
	54.75 - 52.875		0.039	1.040	0.000	1.079 ✔	1.333	H1-3 ✔
	52.875 - 51		0.038	1.050	0.000	1.089 ✔	1.333	H1-3 ✔
	51 - 44.75		0.016	0.469	0.000	0.485 ✔	1.333	H1-3 ✔
L4	51 - 44.75	TP60x46.74x0.4375	0.017	0.455	0.000	0.471 ✔	1.333	H1-3 ✔
	44.75 - 42.3947		0.029	0.802	0.000	0.830 ✔	1.333	H1-3 ✔
	42.3947 - 40.0395		0.028	0.808	0.000	0.836 ✔	1.333	H1-3 ✔
	40.0395 - 37.6842		0.028	0.813	0.000	0.841 ✔	1.333	H1-3 ✔
	37.6842 - 35.3289		0.028	0.818	0.000	0.846 ✔	1.333	H1-3 ✔
	35.3289 - 32.9737		0.027	0.823	0.000	0.850 ✔	1.333	H1-3 ✔
	32.9737 - 30.6184		0.027	0.828	0.000	0.855 ✔	1.333	H1-3 ✔
	30.6184 - 28.2632		0.027	0.832	0.000	0.858 ✔	1.333	H1-3 ✔
	28.2632 - 25.9079		0.026	0.836	0.000	0.862 ✔	1.333	H1-3 ✔
	25.9079 - 23.5526		0.026	0.840	0.000	0.865 ✔	1.333	H1-3 ✔
	23.5526 - 21.1974		0.026	0.843	0.000	0.868 ✔	1.333	H1-3 ✔
	21.1974 - 18.8421		0.025	0.846	0.000	0.871 ✔	1.333	H1-3 ✔
	18.8421 - 16.4868		0.025	0.849	0.000	0.874 ✔	1.333	H1-3 ✔
	16.4868 - 14.1316		0.025	0.852	0.000	0.876 ✔	1.333	H1-3 ✔
	14.1316 - 11.7763		0.025	0.854	0.000	0.879 ✔	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
	11.7763 - 9.42105		0.024	0.856	0.000	0.881 ✔	1.333	H1-3 ✔
	9.42105 - 7.06579		0.024	0.858	0.000	0.883 ✔	1.333	H1-3 ✔
	7.06579 - 4.71053		0.024	0.860	0.000	0.884 ✔	1.333	H1-3 ✔
	4.71053 - 2.35526		0.024	0.862	0.000	0.886 ✔	1.333	H1-3 ✔
	2.35526 - 0		0.024	0.864	0.000	0.887 ✔	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	150 - 126	Pole	TP28.74x22.5x0.1875	1	-4026.61	96641.96	23.4	Pass
L2	126 - 84.75	Pole	TP39.09x27.39x0.25	2	-15012.80	325029.38	70.2	Pass
L3	84.75 - 44.75	Pole	TP48.99x37.29x0.3125	3	-23047.40	800014.58	81.7	Pass
L4	44.75 - 0	Pole	TP60x46.74x0.4375	4	-39294.30	2204262.04	66.6	Pass
							Summary	
						Pole (L3)	81.7	Pass
						Base Plate	73.2	Pass
						RATING =	**81.7**	**Pass**

NATCOMM

Job Description	150' Summit Monopole – Colebrook, CT Foundation Analysis	**Project No.** **Computed by**	07132 JEK	**Page** **Date**	1 of 9 1/2/2007

MONOPOLE FOUNDATION ANALYSIS

TOWER FORCES:

Moment Caused by Tower	$M_t := 3414 \cdot ft \cdot kips$
Shear at Base of Tower	$S_t := 32.4 kip$
Max Compressive Force	$C_t := 39.3 \cdot kip$
Height of Tower	$H_t := 150 \cdot ft$
Base Plate Bolt Circle	$MP := 67 in$

FOOTING DIMENSIONS:

Overall Depth of Footing	$D_f := 3.5 ft$
Length of Pier	$L_p := 2.5 \cdot ft$
Extension of Pier Above Grade	$L_{pag} := 0.5 \cdot ft$
Diameter of Pier	$d_p := 7.5 \cdot ft$
Thickness of Footing	$T_f := 4 \cdot ft$
Width of Footing:	$W_f := 31 ft$
Length of Anchor Bolts:	$L_{st} := 96 in$
Projection of anchor bolts above pier	$A_{BP} := 12 \cdot in$

PROPERTIES:

Compressive Strength of Concrete	$f'c := 3000 psi$
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	$q_s := 6000 \cdot psf$
Unit Weight of Soil	$\gamma_s := 100 \cdot pcf$
Unit Weight of Concrete	$\gamma_c := 150 \cdot pcf$
Depth to Neglect	$n := 0 ft$
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	$d_{anchor} := 2.25 in$
Anchor bolt area	$A_{anchor} := 3.97 \cdot in^2$

PIER REINFORCEMENT:

Bar Size	$BSpier := 10$	Bar Diameter	$d_{bpier} := 1.27 \cdot in$
Number of Bars	$NBpier := 28$	Bar Area	$A_{bpier} := 1.27 \cdot in^2$

PAD REINFORCEMENT:

TOP:	Bar Size	$BS_{top} := 10$	Bar Diameter	$d_{btop} := 1.27 \cdot in$
	Number of Bars	$NB_{top} := 31$	Bar Area	$A_{btop} := 1.27 \cdot in^2$
BOTTOM:	Bar Size	$BS_{bot} := 10$	Bar Diameter	$d_{bbot} := 1.27 \cdot in$
	Number of Bars	$NB_{bot} := 31$	Bar Area	$A_{bot} := 1.27 \cdot in^2$

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

CHECK ANCHOR STEEL EMBEDMENT

Depth:

$D_{ab} := L_{st} - A_{BP}$ $D_{ab} = 7 \cdot ft$

$L_{anchor} := \frac{(0.11 \cdot fy) \cdot in}{\sqrt{f'c \cdot psi}}$ $L_{anchor} = 10.0416 \cdot ft$

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

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

STABILITY OF FOOTING

Passive Pressure:

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

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p}$ $P_{pt} = -0.05 \cdot ksf$

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

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p}$ $P_{bot} = 0.35 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2}$ $P_{ave} = 0.175 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)]$ $T_p = 3.5 \cdot ft$

$A_p := W_f \cdot T_p$ $A_p = 108.5 \cdot ft^2$

Ultimate Shear:

$S_u := P_{ave} \cdot A_p$ $S_u = 18.9875 \cdot kip$

Weight of Concrete Pad:

$WT_c := [(W_f^2 \cdot T_f) + d_p^2 L_p] \cdot \gamma_c$ $WT_c = 597.6937 \cdot kip$

Weight of Soil: above Footing:

$WT_{s1} := \left[W_f^2 \cdot (|L_p - L_{pag}|) - \frac{d_p^2 \cdot \pi}{4} \cdot (|L_p - L_{pag}|) \right] \cdot \gamma_s$ $WT_{s1} = 183.3643 \cdot kip$

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:

$WT_{tot} := WT_c + WT_{s1} + C_t$ $WT_{tot} = 820.358 \cdot kip$

Resisting Moment:

$M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + WT_{s2} \cdot \left(W_f + \frac{D_f \cdot \tan(\phi_s)}{3} \right)$ $M_r = 12740.866 \cdot kip \cdot ft$

Overturning Moment:

$M_{ot} := M_t + S_t \cdot (L_p + T_f)$ $M_{ot} = 3624.6 \cdot kip \cdot ft$

Factor of Safety:

$FS := \frac{M_r}{M_{ot}}$ $FS_{req} := 2$ $FS = 3.52$

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

SHEAR CAPACITY IN PIER

$FS := 2$

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

$S_p = 194.0743 \cdot kips$

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

$ShearCheck = "Okay"$

BEARING PRESSURE CAUSED BY FOOTING

$A_{mat} := W_f^2$ $\quad A_{mat} = 961 \cdot ft^2$

$S := \frac{W_f^3}{6}$ $\quad S = 4965.1667 \cdot ft^3$

$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S}$ $\quad P_{max} = 1.5837 \cdot ksf$

$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S}$ $\quad P_{min} = 0.1236 \cdot ksf$

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

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

Distance to Resultant of Pressure Distribution:

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

$X_p = 11.2084 \cdot ft$

Distance to Kern: $X_k := \frac{W_f}{6}$ $\quad X_k = 5.1667 \cdot ft$

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

Eccentricity: $e := \frac{M_{ot}}{WT_{tot}}$ $\quad e = 4.4183$

Adjusted Soil Pressure: $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)}$ $\quad P_a = 1.592 \cdot ksf$

$q_{adj} := if\left(P_{min} < 0, P_a, \frac{P_{max}}{ft^2}\right)$ $\quad q_{adj} = 1.5837 \cdot ksf$

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

CONCRETE BEARING CAPACITY (ACI 10.17)

$\phi_c := 0.75$ (ACI 9.3.2.2)

$P_b := \phi_c \cdot 0.85 \cdot f'c \cdot \frac{d_p^{\,2} \cdot \pi}{4}$ $P_b = 12166.7993 \cdot kip$

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

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)

$d := T_f - Cvr_{pad} - d_{bbot}$ $d = 43.73 \cdot in$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$ $d_1 = 11.75 \cdot ft$

$d_2 := d_1 - d$ $d_2 = 8.1058 \cdot ft$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$ $L = 33.2451 \cdot ft$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$ $Slope = 0.0471 \cdot kcf$

$V_{req} := LF \cdot \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$ $V_{req} = 618.8784 \cdot kip$

ACI 11.3.1.1 $V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f'c \cdot psi} \cdot W_f \cdot d$ $V_{Avail} = 1514.7186 \cdot kip$

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

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

$b_o := \left(d_p + d\right) \cdot \pi$ $b_o = 35.0104 \cdot ft$

Area included inside bo: $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4}$ $A_{bo} = 97.5405 \cdot ft^2$

Area outside of bo: $A_{out} := A_{mat} - A_{bo}$ $A_{out} = 863.4595 \cdot ft^2$

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

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

$v_u := \text{Find}(v_u)$ $v_u = 6.43 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f$ $V_u = 726.3863 \cdot kips$

$V_{req} := LF \cdot V_u$ $V_{req} = 944.3022 \cdot kips$

$V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f'c \cdot psi} \cdot b_o \cdot d$ $V_{Avail} = 3421.3518 \cdot kips$

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

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

Take Maximum Bending at face of Pier:

$q_b := q_{adj} - d_1 \cdot Slope$ $q_b = 1.0303 \cdot ksf$

$M_n := \frac{LF}{\phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{{d_1}^2}{3} + q_b \cdot \frac{{d_1}^2}{2} \right] \cdot W_f$ $M_n = 4324.9957 \cdot kip \cdot ft$

ACI 10.2.7.3 $\beta := \text{if}\left[f'c \le 4000 \cdot psi, .85, \text{if}\left[f'c \ge 8000 \cdot psi, .65, .85 - \left(\frac{\frac{f'c}{psi} - 4000}{1000} \right) \cdot .05 \right] \right]$ $\beta = 0.85$

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2}$ $R_u = 11673.1 \text{ lbf}$

$\rho := \frac{0.85 \cdot f'c}{fy} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f'c}} \right)$ $\rho = 0.0014$

$\rho_{min} := 1.333 \cdot \rho$ $\rho_{min} = 0.00183$

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

(ACI 7.12.2.1b)

FOR BOTTOM BARS: $As := \max(\rho, \rho_{min}, \rho_{sh}) \cdot W_f \cdot d$ $As = 29.7781 \cdot in^2$

$As_{prov} := A_{bot} \cdot NB_{bot}$ $As_{prov} = 39.37 \cdot in^2$

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

FOR TOP BARS: $As := \rho_{sh} \cdot (W_f \cdot d)$ $As = 29.2816 \cdot in^2$

$As_{prov} := A_{btop} \cdot NB_{top}$ $As_{prov} = 39.37 \cdot in^2$

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

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

Bar Spacing: $B_{sPad} := \dfrac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1}$ $B_{sPad} = 10.8877 \cdot in$

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: $c := \text{if}\left(Cvr_{pad} < \dfrac{B_{sPad}}{2}, Cvr_{pad}, \dfrac{B_{sPad}}{2}\right)$ $c = 3 \cdot in$

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

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \gamma \cdot \lambda}{\frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} \qquad L_{dbt} = 44.1711 \cdot in$$

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

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

Available Length in Pad: $L_{Pad} := \dfrac{W_f}{2} - \dfrac{d_p}{2} - Cvr_{pad}$ $L_{Pad} = 138 \cdot in$

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

REINFORCEMENT IN PIER

Pier Area: $A_p := \frac{\pi \cdot d_p^2}{4}$ $A_p = 6361.7251 \cdot in^2$

(ACI 10.8.4 and 10.9.1) $A_{smin} := 0.01 \cdot 0.05 \cdot A_p$ $A_{smin} = 3.1809 \cdot in^2$

$A_{sprov} := NBpier \cdot A_{bpier}$ $A_{sprov} = 35.56 \cdot in^2$

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

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: $B_{sPier} := \frac{d_p \cdot \pi}{NBpier} - d_{bpier}$ $B_{sPier} = 8.828 \cdot in$

Diamter of Reinforcement Cage: $Diam_{cage} := d_p - 2 \cdot Cvr_{pier}$ $Diam_{cage} = 84 \cdot in$

Maximum Moment in Pier: $M_p := \left[M_t + S_t \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF$ $M_p = 54774.72 \cdot in \cdot kips$

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:

$(D \ N \ n \ P_u \ M_{xu}) := (90 \ 28 \ 10 \ 40 \ 54775)$

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: $(\phi P_n \ \phi M_{xn} \ f_{sp} \ \rho) = (54.0588 \ 74026.759 \ -60 \ 0.0056)$

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

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

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \gamma \cdot \lambda}{\frac{c + k_{tr}}{d_{bpier}}} \cdot d_{bpier} \qquad L_{dbt} = 44.1711 \cdot in$$

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:

$$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f'c}{psi}}} \cdot .7 \qquad L_{dh} = 19.477 \cdot in$$

$$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right) \qquad L_{db} = 44.1711 \cdot in$$

COMPRESSION: (ACI 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot fy}{\sqrt{f'c \cdot psi}} \qquad L_{dbc1} = 27.8243 \cdot in$$

$$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot fy\right) \qquad L_{dbmin} = 22.86 \cdot in$$

$$L_{dbc} := \text{if}\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) \qquad L_{dbc} = 27.8243 \cdot in$$

Available Length in Foundation:

$$L_{pier} := L_p - Cvr_{pier} \qquad L_{pier} = 27 \cdot in$$

$$L_{pad} := T_f - Cvr_{pad} \qquad L_{pad} = 45 \cdot in$$

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

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

NOTE: Anchor bolts and plate provided, OK

TIE SIZE AND SPACING IN COLUMN

Minimum Tie Size:

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

Used #4 Ties

$d_{Tie} := 4$

Seismic factor:
(ACI 21.10.5)

$z := if(Z \le 2, 1, 0.5)$ → $z = 1$

$s_{lim1} := 16 \cdot d_{bpier} \cdot z$ → $s_{lim1} = 20.32 \cdot in$

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

$s_{lim3} := D_f \cdot z$ → $s_{lim3} = 42 \cdot in$

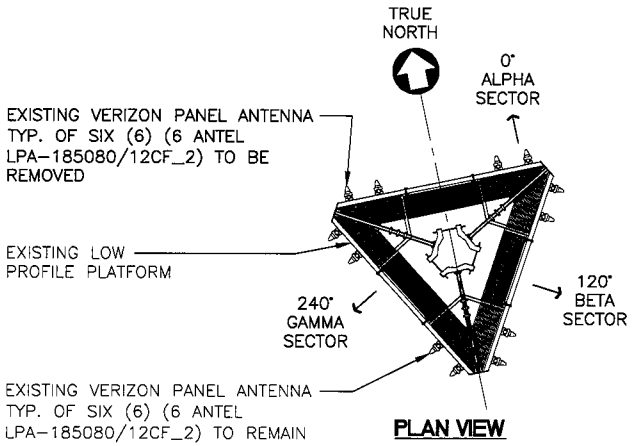
$s_{lim4} := 18in$ → $s_{lim4} = 18 \cdot in$

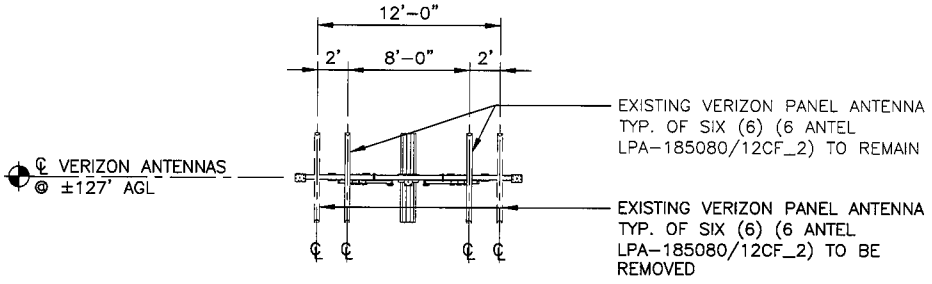
Maximum Spacing:

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

Number of Ties Required:

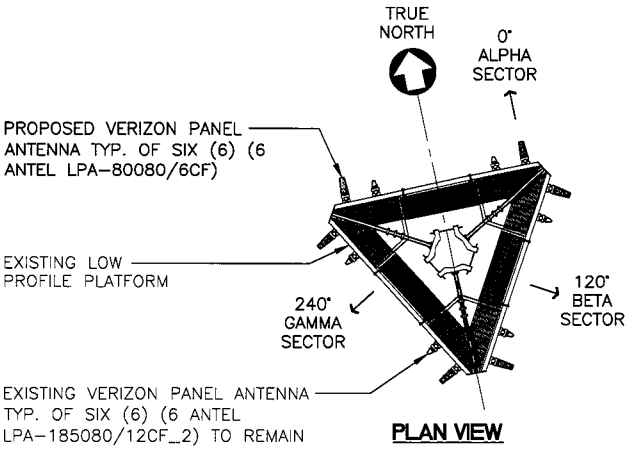
$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1$ → $n_{tie} = 2.3333$

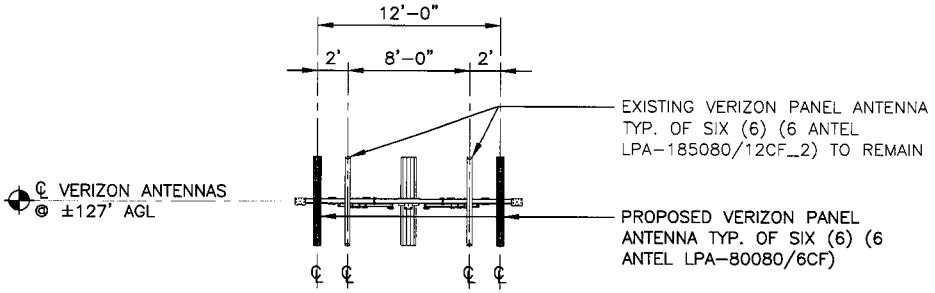




1 / ANT-1 EXISTING ANTENNA MOUNTING CONFIGURATION

NOT TO SCALE





2 / ANT-1 PROPOSED ANTENNA MOUNTING CONFIGURATION

NOT TO SCALE

REVISIONS		
00	01/02/08	ANTENNA LAYOUT

Cellco Partnership
d.b.a. verizon wireless

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

COLEBROOK

382 COLEBROOK RIVER ROAD
COLEBROOK, CT 06021

PROJECT NO:	07132.C01
DRAWN BY:	DEB
CHECKED BY:	CFC
SCALE:	AS NOTED
DATE:	01/02/08

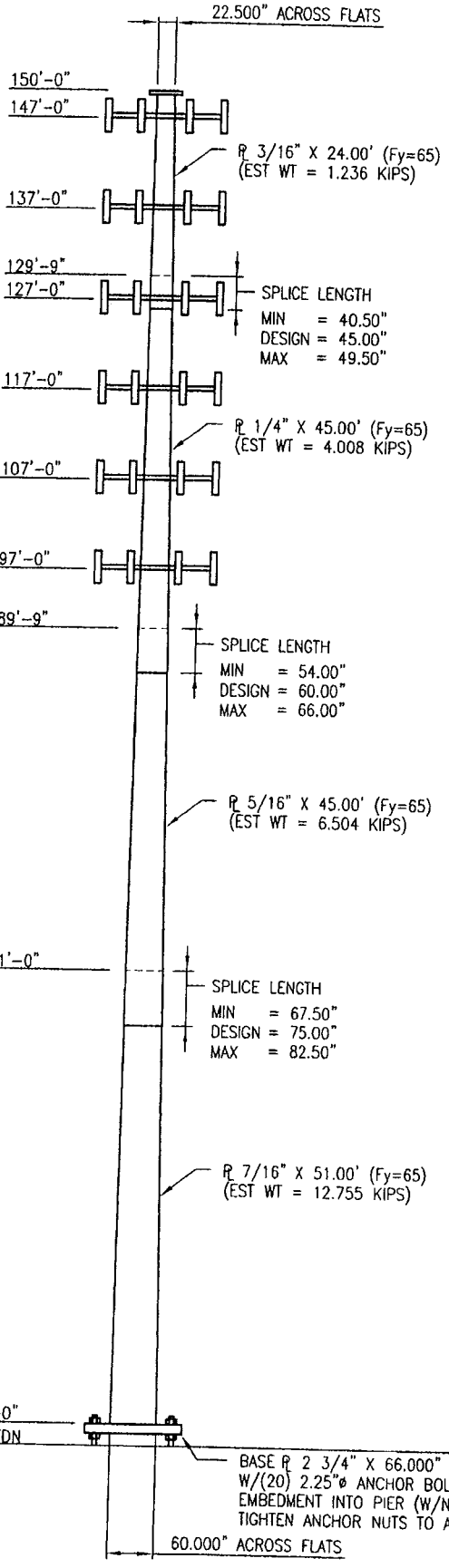
ANTENNA REPLACEMENT DETAILS

ANT-1

DWG. 1 OF 1

PennSummit Tubular, LLC
www.pennsummit.com
225 Kiwanis Boulevard, West Hazleton, PA 18202
Phone: (888) 847-6537 Fax: (888) 460-6885

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street, Suite 1500, Columbus, Ohio 43215
(614) 221-6679 Fax: (614) 448-4105 www.PJFweb.com



G:\TOWER\DRAWINGS\MONOPOLE\292-PENNSUMMIT\292-2005\29205011 3MOOD.DWG MPLAHOVNSAK TUE 24-MAY-2005 9:06:40 AM

JOB DATA

Page 1 of 2		Job No.	29205-0113
By	MFP	Design No.	#24458
Chk'd By	MFP	Date	05-24-2005
		Rev. No.	Rev. Date
Pole	150-FT MONOPOLE		
Site	COLEBROOK, LITCHFIELD CO., CT		
Owner	ATLANTIC WESTERN CONSULTING, INC.		
Ref. No.			
Design	80 MPH / 69 MPH + 1/2" RADIAL ICE ACCORDING TO TIA/EIA-222-F 1996		

LOAD CASES

CASE 1	80 MPH WITH NO ICE	DESIGN WIND
CASE 2	69 MPH WITH 1/2" RADIAL ICE	REDUCED WIND WITH ICE
CASE 3	50 MPH WITH NO ICE	OPERATIONAL WIND

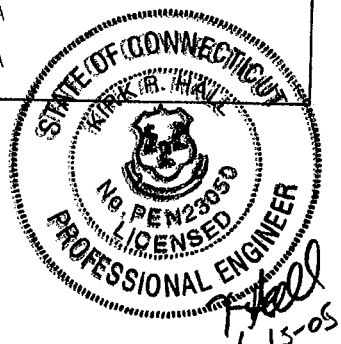
POLE SPECIFICATIONS

Pole Shape Type:	18-SIDED POLYGON
Taper:	0.260000 IN/FT
Shaft Steel:	ASTM A572 GRADE 65
Base PL Steel:	ASTM A572 GRADE 50 (50 KSI)
Anchor Bolts:	2 1/4"ø x 7'-0" LONG #18J ASTM A615 GRADE 75

ANTENNA LIST

No.	Elev.	Description
-	TOP	5/8"ø LIGHTNING ROD
1-12	147.00	(12) 72" X 12" X 8" PANEL ANTENNA
-	147.00	14' LOW PROFILE PLATFORM
13-24	137.00	(12) 72" X 12" X 8" PANEL ANTENNA
-	137.00	14' LOW PROFILE PLATFORM
25-36	127.00	(12) 72" X 12" X 8" PANEL ANTENNA
-	127.00	14' LOW PROFILE PLATFORM
37-48	117.00	(12) 72" X 12" X 8" PANEL ANTENNA
-	117.00	14' LOW PROFILE PLATFORM
49-60	107.00	(12) 72" X 12" X 8" PANEL ANTENNA
-	107.00	14' LOW PROFILE PLATFORM
61-72	97.00	(12) 72" X 12" X 8" PANEL ANTENNA
-	97.00	14' LOW PROFILE PLATFORM

STEP BOLTS FULL HEIGHT.
ANTENNA FEED LINES RUN INSIDE OF POLE.



6-15-05

Elevation	80 MPH WIND		50 MPH WIND	
	Lateral Deflection (Inches)	Rotation (sway) (degrees)	Lateral Deflection (Inches)	Rotation (sway) (degrees)
TOP	91.4	5.282	35.6	2.063

SHAFT SECTION DATA

Shaft Section	Section Length (feet)	Plate Thickness (in.)	Lap Splice (in.)	Diameter Across Flats (inches) @ Top	Diameter Across Flats (inches) @ Bottom
1	24.00	0.1875	45.00	22.500	28.740
2	45.00	0.2500	60.00	27.390	39.090
3	45.00	0.3125	75.00	37.290	48.990
4	51.00	0.4375		46.740	60.000

NOTE: DIMENSIONS SHOWN DO NOT INCLUDE GALVANIZING TOLERANCES

BASE REACTIONS FOR FOUNDATION DESIGN

MOMENT =	4200 ft-kips
SHEAR =	39 kips
AXIAL =	36 kips

PennSummit Tubular, LLC
www.pennsummit.com
225 Kiwanis Boulevard, West Hazleton, PA 18202
Phone: (888) 847-6537 Fax: (888) 460-6885

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street, Suite 1500, Columbus, Ohio 43215
(614) 221-6679 Fax: (614) 448-4105 www.PJFweb.com

NOTES:

1. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT 28 DAYS.

2. REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A-615 (GRADE 60) EXCEPT THAT PIER TIES MAY BE ASTM A-615 (GRADE 40).

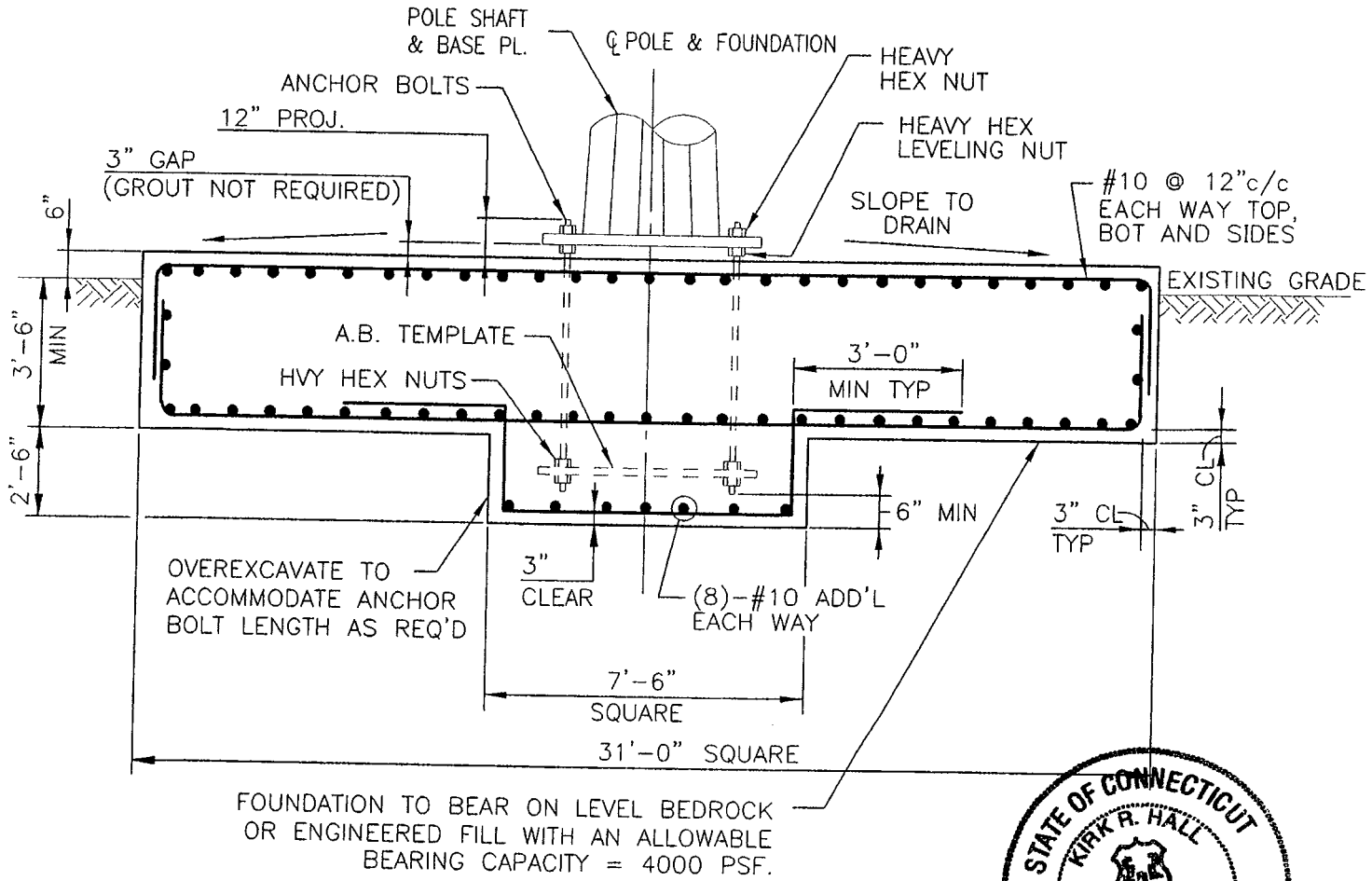
3. SEE PAGE 1 FOR ANCHOR BOLT QUANTITY, SIZE, LENGTH, AND BOLT CIRCLE.

4. CONTRACTOR SHALL READ THE GEOTECHNICAL REPORT AND CONSULT THE GEOTECHNICAL ENGINEER AS NECESSARY PRIOR TO CONSTRUCTION.

JOB DATA		
Page 2 of 2	Job No.	29205-0113
By MFP	Design No.	#24458
Chk'd By MFP	Date	05-24-2005
	Rev. No. Rev. Date	
Pole	150-FT MONOPOLE	
Site	COLEBROOK, LITCHFIELD CO., CT	
Owner	ATLANTIC WESTERN CONSULTING, INC.	
Ref. No.		
Design	80 MPH / 69 MPH + 1/2" RADIAL ICE ACCORDING TO TIA/EIA-222-F 1996	

FOUNDATION SPECIFICATIONS	
Volume Concrete Required:	148 CUBIC YARDS
Soils Report:	JGI EASTERN, INC. #05268G 05-16-2005

DESIGN CRITERIA	
Moment:	4200 FT-KIPS
Shear:	39 KIPS
Axial:	36 KIPS



STATE OF CONNECTICUT
KIRK R. HALL
No. PEN23050
LICENSED
PROFESSIONAL ENGINEER
6-15-05

MAT FOUNDATION

G:\TOWER\DRAWINGS\MONOPOLE\292-PennSummit\292-2005\29205011 3F000.dwg | 24-May-2005 09:42 am |

PJF_Pole (tm) - Monopole Design Program
Windows Version 3.04.0000 Tue May 24, 2005 - 9:05:25 am
(c) 1993 to 2000 PAUL J. FORD AND COMPANY, Columbus, Ohio

Job No.....: 29205-0113 Design No: #24458 Engineer : MFP
Description : 150-ft Monopole - COLEBROOK, LITCHFIELD CO., CT
Design..... : 80 MPH / 69 MPH + 1/2" RADIAL ICE
Owner..... : -
Status..... : Final Design Client: PennSummit Tubular, LLC
Revision: Rev. Date :

S U M M A R Y O F A N A L Y S I S R E S U L T S

Pole Height.....: 150.00 ft
Top Diameter.....: 22.500 in
Bottom Diameter.....: 60.000 in
Pole Shape.....: 18-Sided Polygon
Splice Joint Type.....: Taper shaft - Slip Joint
Shaft Taper.....: 0.260000 (in/ft)
Shaft Steel Weight.....: 24.504 kips

POLE SHAFT PROPERTIES:

Shaft Section Number	Section Length (ft)	Wall Thickness [t] (in)	Steel Yield [Fy] (ksi)	Top Diameter [Dt] (in)	Bottom Diameter [Db] (in)	Slip Joint Overlap (in)
1.	24.000	0.18750	65	22.500	28.740	45.00
2.	45.000	0.25000	65	27.390	39.090	60.00
3.	45.000	0.31250	65	37.290	48.990	75.00
4.	51.000	0.43750	65	46.740	60.000	

POLE SHAFT SECTION MAXIMUM FORCES AND MOMENTS:

Shaft Section Number	Wind Load No.	Wind Speed (mph)	Radial Ice (in)	At Base of Section: Sect. Elev. (ft)	Axial Load (kips)	Horiz. Shear (kips)	Bending Moment (ft-kips)	Max. Ratio Actual/ Allowable [Ftot/Fb]
1.	1	80.0	0.00	129.75	4.465	10.142	126.676	0.2763
2.	1	80.0	0.00	89.75	14.865	29.550	989.639	0.8434
3.	1	80.0	0.00	51.00	22.091	32.617	2223.838	0.9595
4.	1	80.0	0.00	0.00	35.881	36.715	4008.957	0.7697
>> MAXIMUM BASE REACTIONS :					35.881	36.715	4008.957 <<	

POLE DEFLECTION AND ROTATION AT TOP AND AT HIGHEST MICROWAVE DISH ELEVATION:

Wind Load No.	Wind Speed (mph)	Radial Ice (in)	Location	Elev (ft)	Deflection (in)	Rotation (deg)	Max. Allowable Rotation Limit (deg)
1.	80.0	0.00	Top	150.00	91.367	5.282	
2.	69.3	0.50	Top	150.00	76.530	4.441	
3.	50.0	0.00	Top	150.00	35.636	2.063	

PJF_Pole (tm) - Monopole Design Program
Windows Version 3.04.0000 Tue May 24, 2005 - 9:05:29 am

Job No.....: 29205-0113 Design No: #24458 Engineer : MFP
Description : 150-ft Monopole - COLEBROOK, LITCHFIELD CO., CT
Design..... : 80 MPH / 69 MPH + 1/2" RADIAL ICE
Owner..... : - Client: PennSummit Tubular, LLC
Status..... : Final Design Revision: Rev. Date :

Pole Height : 150 ft
Pole Shape : 18-Sided Polygon
Pole Type : Taper shaft - Slip Joint
Pole Taper : 0.260000 (in/ft)

INPUT TUBE PROPERTIES:

Tube Sect No.	Top / Splice Elev (ft)	Bot Tube Elev (ft)	Tube Length (ft)	Wall Thick [t] (in)	Steel [Fy] (ksi)	Top Diam [Dt] (in)	Bot Diam [Db] (in)	Slip Joint Overlap (in)
1.	150.00	126.00	24.000	0.18750	65	22.500	28.740	45.00
2.	129.75	84.75	45.000	0.25000	65	27.390	39.090	60.00
3.	89.75	44.75	45.000	0.31250	65	37.290	48.990	75.00
4.	51.00	0.00	51.000	0.43750	65	46.740	60.000	

TUBE SECTION PROPERTIES:

Tube Sect No.	Section Weight (kips)	Location	Elev (ft)	Diam. Across Flats (in)	Wall Thick [t] (in)	[W/t] Ratio	Diam/ Thick [D/t] Ratio	Area (in^2)	Ix (in^4)
1	1.236	@Top	150.0	22.500	0.1875	19.40	120.00	13.28	834.9
		@Splice	129.8	27.765		24.35	148.08	16.41	1576.4
		@Bot	126.0	28.740		25.26	153.28	16.99	1749.6
2	4.008	@Top	129.8	27.390	0.2500	17.56	109.56	21.53	2003.5
		@Splice	89.8	37.790		24.89	151.16	29.79	5301.8
		@Bot	84.8	39.090		25.81	156.36	30.82	5871.8
3	6.504	@Top	89.8	37.290	0.3125	19.28	119.33	36.68	6333.9
		@Splice	51.0	47.365		24.96	151.57	46.67	13049.6
		@Bot	44.8	48.990		25.88	156.77	48.28	14448.8
4	12.755	@Top	51.0	46.740	0.4375	17.07	106.83	64.29	17410.4
		@Bot	0.0	60.000		22.42	137.14	82.71	37059.5

Total Shaft Steel Weight = 24.504 kips

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Job No.....: 29205-0113 Design No: #24458 Engineer : MFP
Description : 150-ft Monopole - COLEBROOK, LITCHFIELD CO., CT
Design..... : 80 MPH / 69 MPH + 1/2" RADIAL ICE
Owner..... : -
Status..... : Final Design Client: PennSummit Tubular, LLC
Revision: Rev. Date :

Segment Properties:

(@ Max Segment = 10 ft)

Tube Segmt No.	Segment Feature Location	Segment Elev. (ft)	Diam. Across Flats (in)	Wall Thick [t] (in)	[W/t] Ratio	Diam/ Thick [D/t] Ratio	Area (in^2)	Ix (in^4)
1.	top	150.000	22.500	0.18750	19.40	120.00	13.28	834.9
2.	<arm [1]>	150.000	22.500	0.18750	19.40	120.00	13.28	834.9
3.	<arm [2]>	147.000	23.280	0.18750	20.13	124.16	13.74	925.6
4.	<arm [3]>	147.000	23.280	0.18750	20.13	124.16	13.74	925.6
5.		140.000	25.100	0.18750	21.84	133.87	14.83	1162.1
6.	<arm [4]>	137.000	25.880	0.18750	22.57	138.03	15.29	1274.7
7.	<arm [5]>	137.000	25.880	0.18750	22.57	138.03	15.29	1274.7
8.		130.000	27.700	0.18750	24.29	147.73	16.37	1565.3
9.	top sec(2)	129.750	27.765	0.18750	24.35	148.08	16.41	1576.4
10.	<arm [6]>	127.000	28.105	0.25000	18.06	112.42	22.10	2166.0
11.	<arm [7]>	127.000	28.105	0.25000	18.06	112.42	22.10	2166.0
12.	bot sec(1)	126.000	28.740	0.25000	18.51	114.96	22.61	2317.6
13.		120.000	29.925	0.25000	19.34	119.70	23.55	2618.9
14.	<arm [8]>	117.000	30.705	0.25000	19.89	122.82	24.17	2830.9
15.	<arm [9]>	117.000	30.705	0.25000	19.89	122.82	24.17	2830.9
16.		110.000	32.525	0.25000	21.18	130.10	25.61	3369.3
17.	<arm [10]>	107.000	33.305	0.25000	21.73	133.22	26.23	3619.6
18.	<arm [11]>	107.000	33.305	0.25000	21.73	133.22	26.23	3619.6
19.		100.000	35.125	0.25000	23.01	140.50	27.67	4250.9
20.	<arm [12]>	97.000	35.905	0.25000	23.56	143.62	28.29	4542.6
21.	<arm [13]>	97.000	35.905	0.25000	23.56	143.62	28.29	4542.6
22.		90.000	37.725	0.25000	24.84	150.90	29.74	5274.3
23.	top sec(3)	89.750	37.790	0.25000	24.89	151.16	29.79	5301.8
24.	bot sec(2)	84.750	38.590	0.31250	20.01	123.49	37.97	7025.7
25.		80.000	39.825	0.31250	20.71	127.44	39.19	7727.9
26.		70.000	42.425	0.31250	22.17	135.76	41.77	9355.9
27.		60.000	45.025	0.31250	23.64	144.08	44.35	11197.9
28.	top sec(4)	51.000	47.365	0.31250	24.96	151.57	46.67	13049.6
29.		50.000	47.000	0.43750	17.18	107.43	64.66	17705.3
30.	bot sec(3)	44.750	48.365	0.43750	17.73	110.55	66.55	19308.5
31.		40.000	49.600	0.43750	18.23	113.37	68.27	20839.8
32.		30.000	52.200	0.43750	19.28	119.31	71.88	24323.9
33.		20.000	54.800	0.43750	20.32	125.26	75.49	28176.3
34.		10.000	57.400	0.43750	21.37	131.20	79.10	32415.3
35.	base	0.000	60.000	0.43750	22.42	137.14	82.71	37059.5

Total Number of Antennas / Arms = 13

PJF_Pole (tm) - Monopole Design Program
Windows Version 3.04.0000 Tue May 24, 2005 - 9:05:29 am
(c) 1993 to 2000 PAUL J. FORD AND COMPANY, Columbus, Ohio

Job No.....: 29205-0113 Design No: #24458 Engineer : MFP
Description : 150-ft Monopole - COLEBROOK, LITCHFIELD CO., CT
Design..... : 80 MPH / 69 MPH + 1/2" RADIAL ICE
Owner..... : - Client: PennSummit Tubular, LLC
Status..... : Final Design Revision: Rev. Date :

ANTENNA AND ARM PROPERTIES AND LOAD DATA:

LOAD CASE 1: BASIC WIND VELOCITY = 80.00 mph

Ant Arm No.	Arm Mount. Elev. (ft)	Load Applic. Elev. (ft)	Arm Length (ft)	Ice Load Case	Antenna Area [CaAa] (sf)	Antenna Force [qzGhCaAa] (lbs)	Antenna Weight (lbs)
[1]	150.000	153.000	2.0000	No Ice:	0.63	27.04	75.00
Description: 5/8"Ø Lightning Rod							
		[Gh]	[Kz]		[qz] (psf)	[qz][Gh] (psf)	
		1.69	1.550	No Ice:	25.395	42.918	
[2]	147.000	147.000	2.0000	No Ice:	86.69	3678.31	192.00
Description: (12) 72" x 12" x 8" Panel Antenna							
		[Gh]	[Kz]		[qz] (psf)	[qz][Gh] (psf)	
		1.69	1.532	No Ice:	25.107	42.431	
[3]	147.000	147.000	2.0000	No Ice:	19.43	824.43	1300.00
Description: 14' Low Profile Platform							
		[Gh]	[Kz]		[qz] (psf)	[qz][Gh] (psf)	
		1.69	1.532	No Ice:	25.107	42.431	
[4]	137.000	137.000	2.0000	No Ice:	86.69	3605.01	192.00
Description: (12) 72" x 12" x 8" Panel Antenna							
		[Gh]	[Kz]		[qz] (psf)	[qz][Gh] (psf)	
		1.69	1.502	No Ice:	24.607	41.585	
[5]	137.000	137.000	2.0000	No Ice:	19.43	808.00	1300.00
Description: 14' Low Profile Platform							
		[Gh]	[Kz]		[qz] (psf)	[qz][Gh] (psf)	
		1.69	1.502	No Ice:	24.607	41.585	
[6]	127.000	127.000	2.0000	No Ice:	86.69	3527.78	192.00
Description: (12) 72" x 12" x 8" Panel Antenna							
		[Gh]	[Kz]		[qz] (psf)	[qz][Gh] (psf)	
		1.69	1.470	No Ice:	24.079	40.694	
[7]	127.000	127.000	2.0000	No Ice:	19.43	790.69	1300.00
Description: 14' Low Profile Platform							
		[Gh]	[Kz]		[qz] (psf)	[qz][Gh] (psf)	
		1.69	1.470	No Ice:	24.079	40.694	
[8]	117.000	117.000	2.0000	No Ice:	86.69	3446.08	192.00

Description: (12) 72" x 12" x 8" Panel Antenna

				[qz] (psf)	[qz][Gh] (psf)	
	[Gh] 1.69	[Kz] 1.436	No Ice:	23.522	39.752	
[9]	117.000	117.000	2.0000	No Ice:	19.43	772.38	1300.00

Description: 14' Low Profile Platform

				[qz] (psf)	[qz][Gh] (psf)	
	[Gh] 1.69	[Kz] 1.436	No Ice:	23.522	39.752	
[10]	107.000	107.000	2.0000	No Ice:	86.69	3359.22	192.00

Description: (12) 72" x 12" x 8" Panel Antenna

				[qz] (psf)	[qz][Gh] (psf)	
	[Gh] 1.69	[Kz] 1.399	No Ice:	22.929	38.750	
[11]	107.000	107.000	2.0000	No Ice:	19.43	752.91	1300.00

Description: 14' Low Profile Platform

				[qz] (psf)	[qz][Gh] (psf)	
	[Gh] 1.69	[Kz] 1.399	No Ice:	22.929	38.750	
[12]	97.000	97.000	2.0000	No Ice:	86.69	3266.36	192.00

Description: (12) 72" x 12" x 8" Panel Antenna

				[qz] (psf)	[qz][Gh] (psf)	
	[Gh] 1.69	[Kz] 1.361	No Ice:	22.295	37.679	
[13]	97.000	97.000	2.0000	No Ice:	19.43	732.10	1300.00

Description: 14' Low Profile Platform

				[qz] (psf)	[qz][Gh] (psf)	
	[Gh] 1.69	[Kz] 1.361	No Ice:	22.295	37.679	

PJF_Pole (tm) - Monopole Design Program
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Job No.....: 29205-0113 Design No: #24458 Engineer : MFP
Description : 150-ft Monopole - COLEBROOK, LITCHFIELD CO., CT
Design..... : 80 MPH / 69 MPH + 1/2" RADIAL ICE
Owner..... : - Client: PennSummit Tubular, LLC
Status..... : Final Design Revision: Rev. Date :

POLE SHAFT LOADS:

LOAD CASE 1: BASIC WIND VELOCITY = 80.00 mph

Design Loads per TIA/EIA-222-F Standard; Gust Factor ..... Gh = 1.69
Pole DL Overload Factor = 1.1
Per TIA/EIA Table 1: Note 3: For all cross sectional shapes,
Force Coefficient [Cf] need not exceed 1.2
for any value of C. (Where C=sqrt(Kz)*V*D.)

Top of Segment Elev. (ft)	Expos Coeff [Kz]	Veloc Press [qz] (psf)	Pole Veloc Coeff [C]	Force Coeff [Cf]	Projected Area Shaft [Ae] (sf)	Projected Area Segment [Cf Ae] (sf)	Segment Wind Force (lbs)	Shaft Segment Weight (lbs)
150.000	1.541	25.25	186.22	0.650	0.000	0.000	0.00	0.00
150.000	1.541	25.25	186.22	0.650	1.886	1.226	52.31	49.99
147.000	1.532	25.11	192.12	0.650	3.837	2.494	106.12	101.72
147.000	1.532	25.11	192.12	0.650	1.951	1.268	53.80	51.73
140.000	1.511	24.76	205.70	0.650	14.263	9.271	390.23	378.31
137.000	1.502	24.61	211.44	0.650	4.270	2.776	115.78	113.30
137.000	1.502	24.61	211.44	0.650	2.168	1.409	58.59	57.52
130.000	1.480	24.24	224.62	0.650	14.038	9.125	376.50	372.62
129.750	1.479	24.23	225.09	0.650	1.730	1.124	46.03	280.35
127.000	1.470	24.08	227.15	0.650	4.641	3.017	123.17	163.91
127.000	1.470	24.08	227.15	0.650	2.369	1.540	62.65	83.67
126.000	1.466	24.03	232.02	0.650	2.390	1.554	63.08	84.44
120.000	1.446	23.69	239.90	0.650	14.703	9.557	384.88	519.54
117.000	1.436	23.52	245.27	0.650	5.074	3.298	131.59	179.36
117.000	1.436	23.52	245.27	0.650	2.570	1.670	66.39	90.84
110.000	1.411	23.11	257.53	0.650	18.594	12.086	475.63	657.49
107.000	1.399	22.93	262.66	0.650	5.508	3.580	139.27	194.80
107.000	1.399	22.93	262.66	0.650	2.786	1.811	70.18	98.56
100.000	1.373	22.49	274.35	0.650	20.110	13.072	500.98	711.54
97.000	1.361	22.30	279.23	0.650	5.941	3.862	146.14	210.25
97.000	1.361	22.30	279.23	0.650	3.003	1.952	73.54	106.28
90.000	1.332	21.82	290.26	0.650	19.259	12.518	466.50	681.76
89.750	1.331	21.81	290.64	0.650	2.352	1.529	56.35	650.40
84.750	1.309	21.45	294.38	0.650	15.890	10.328	377.17	702.08
80.000	1.288	21.10	301.30	0.650	16.431	10.680	383.53	726.21
70.000	1.240	20.31	314.91	0.650	34.488	22.417	783.01	1524.82
60.000	1.186	19.44	326.93	0.650	36.654	23.825	798.58	1621.35
51.000	1.132	18.55	336.03	0.650	34.815	22.630	724.77	2651.20
50.000	1.126	18.45	332.50	0.650	3.928	2.553	79.60	242.68
44.750	1.091	17.87	336.77	0.650	19.963	12.976	397.32	1233.70
40.000	1.057	17.31	339.88	0.650	20.504	13.328	395.28	1267.48
30.000	1.000	16.38	348.00	0.650	42.633	27.712	780.46	2636.31
20.000	1.000	16.38	365.33	0.650	44.800	29.120	806.30	2771.44
10.000	1.000	16.38	382.67	0.650	46.967	30.528	845.30	2906.58
1.000	1.000	16.38	398.27	0.650	44.123	28.680	794.11	2731.46
					Summation TOTAL =		11125.15	26853.71

---------(END LOAD CASE 1 -- POLE SHAFT LOADS)----------

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Design..... : 80 MPH / 69 MPH + 1/2" RADIAL ICE
Owner..... : - Client: PennSummit Tubular, LLC
Status..... : Final Design Revision: Rev. Date :

POLE SHAFT SEGMENTS -- AXIAL AND SHEAR FORCES:

LOAD CASE 1: BASIC WIND VELOCITY = 80.00 mph

Tube Segment No.	Segment Elevation (ft)	Axial Load (kips)	Cumulative Axial Load (kips)	Horiz. Shear (kips)	Cumulative Horiz. Shear (kips)
1.	150.000	0.000	0.000	0.000	0.000
2.	150.000	0.125	0.125	0.079	0.079
3.	147.000	0.294	0.419	3.784	3.864
4.	147.000	1.352	1.770	0.878	4.742
5.	140.000	0.378	2.149	0.390	5.132
6.	137.000	0.305	2.454	3.721	8.853
7.	137.000	1.358	3.812	0.867	9.720
8.	130.000	0.373	4.184	0.377	10.096
9.	129.750	0.280	4.465	0.046	10.142
10.	127.000	0.356	4.820	3.651	13.793
11.	127.000	1.384	6.204	0.853	14.646
12.	126.000	0.084	6.289	0.063	14.710
13.	120.000	0.520	6.808	0.385	15.094
14.	117.000	0.371	7.179	3.578	18.672
15.	117.000	1.391	8.570	0.839	19.511
16.	110.000	0.657	9.228	0.476	19.986
17.	107.000	0.387	9.615	3.498	23.485
18.	107.000	1.399	11.013	0.823	24.308
19.	100.000	0.712	11.725	0.501	24.809
20.	97.000	0.402	12.127	3.412	28.222
21.	97.000	1.406	13.533	0.806	29.027
22.	90.000	0.682	14.215	0.466	29.494
23.	89.750	0.650	14.865	0.056	29.550
24.	84.750	0.702	15.567	0.377	29.927
25.	80.000	0.726	16.294	0.384	30.311
26.	70.000	1.525	17.819	0.783	31.094
27.	60.000	1.621	19.440	0.799	31.892
28.	51.000	2.651	22.091	0.725	32.617
29.	50.000	0.243	22.334	0.080	32.697
30.	44.750	1.234	23.567	0.397	33.094
31.	40.000	1.267	24.835	0.395	33.489
32.	30.000	2.636	27.471	0.780	34.270
33.	20.000	2.771	30.243	0.806	35.076
34.	10.000	2.907	33.149	0.845	35.921
35.	1.000	2.731	35.881	0.794	36.715
Base	0.000		35.881		36.715

---------(END LOAD CASE 1 -- AXIAL AND SHEAR FORCE)----------

PJF_Pole (tm) - Monopole Design Program
Windows Version 3.04.0000 Tue May 24, 2005 - 9:05:29 am
(c) 1993 to 2000 PAUL J. FORD AND COMPANY, Columbus, Ohio

Job No.....: 29205-0113 Design No: #24458 Engineer : MFP
Description : 150-ft Monopole - COLEBROOK, LITCHFIELD CO., CT
Design..... : 80 MPH / 69 MPH + 1/2" RADIAL ICE
Owner..... : -
Status..... : Final Design Client: PennSummit Tubular, LLC
Revision: Rev. Date :

POLE SHAFT SEGMENTS -- MOMENTS and DEFLECTIONS:

LOAD CASE 1: BASIC WIND VELOCITY = 80.00 mph

Segmnt Elev (ft)	[-------- MOMENTS (ft-kips) ---------] From Ant/ Arm	From Shaft Wind	From P-Delta Effects	Total Moment	[--DEFLECTIONS (inch)-------] No P-Delta Effects	Total W/ P-Delta Effects	Total Rotation (deg)
150.00	0.081	0.000	0.000	0.081	88.701	91.367	5.282
150.00	0.081	0.000	0.000	0.081	87.626	90.258	5.282
147.00	0.162	0.316	0.028	0.506	85.476	88.039	5.282
147.00	0.162	0.316	0.066	0.545	84.401	86.929	5.282
140.00	31.871	2.959	1.313	36.142	76.894	79.181	5.249
137.00	45.460	4.940	1.712	52.112	74.760	76.979	5.218
137.00	45.460	4.940	1.936	52.336	73.699	75.883	5.218
130.00	108.059	11.633	4.180	123.873	67.122	69.096	5.095
129.75	110.295	11.922	4.459	126.676	66.345	68.294	5.090
127.00	134.888	15.405	5.260	155.552	64.279	66.162	5.035
127.00	134.888	15.405	5.685	155.977	63.254	65.105	5.035
126.00	148.149	16.790	6.230	171.169	62.232	64.050	5.014
120.00	227.717	26.434	9.603	263.754	56.198	57.824	4.862
117.00	267.500	32.131	10.763	310.395	54.228	55.792	4.772
117.00	267.500	32.131	11.363	310.994	53.257	54.790	4.772
110.00	389.858	47.765	16.403	454.026	46.627	47.953	4.527
107.00	442.297	55.494	17.862	515.654	44.796	46.065	4.408
107.00	442.297	55.494	18.604	516.395	43.899	45.140	4.408
100.00	593.440	76.001	24.499	693.940	37.831	38.885	4.102
97.00	658.215	85.871	26.174	770.261	36.175	37.179	3.960
97.00	658.215	85.871	27.014	771.100	35.369	36.348	3.960
90.00	837.347	111.491	32.758	981.597	30.524	31.358	3.604
89.75	843.745	112.467	33.428	989.639	29.975	30.793	3.591
84.75	971.696	133.097	38.037	1142.831	26.428	27.140	3.361
80.00	1093.250	154.462	42.544	1290.256	23.113	23.729	3.138
70.00	1349.153	205.174	51.124	1605.451	17.208	17.655	2.655
60.00	1605.056	263.792	58.918	1927.766	12.292	12.603	2.166
51.00	1835.368	323.410	65.060	2223.838	8.718	8.934	1.727
50.00	1860.958	330.437	65.718	2257.113	8.370	8.577	1.685
44.75	1995.307	368.625	68.893	2432.825	6.743	6.908	1.496
40.00	2116.861	405.059	71.862	2593.782	5.299	5.427	1.327
30.00	2372.764	487.566	77.076	2937.406	2.946	3.015	0.978
20.00	2628.667	577.957	81.110	3287.733	1.294	1.323	0.640
10.00	2884.569	676.586	83.716	3644.871	0.319	0.327	0.314
0.00	3140.472	783.843	84.641	4008.957	0.000	0.000	0.000

---------(END LOAD CASE 1 -- MOMENTS AND DEFLECTIONS)----------

PJF_Pole (tm) - Monopole Design Program
Windows Version 3.04.0000 Tue May 24, 2005 - 9:05:29 am
(c) 1993 to 2000 PAUL J. FORD AND COMPANY, Columbus, Ohio

Job No.....: 29205-0113 Design No: #24458 Engineer : MFP
Description : 150-ft Monopole - COLEBROOK, LITCHFIELD CO., CT
Design..... : 80 MPH / 69 MPH + 1/2" RADIAL ICE
Owner..... : - Client: PennSummit Tubular, LLC
Status..... : Final Design Revision: Rev. Date :

POLE SHAFT SEGMENTS -- ACTUAL VS. ALLOWABLE STRESSES:

LOAD CASE 1: BASIC WIND VELOCITY = 80.00 mph
Note: Per TIA/EIA Sec. 3.1.1.1: Allow a 1/3 stress increase for poles under 700 feet in height. The allowable stresses shown include the factor of 1.333

Segmnt Elev (ft)	[---------- ACTUAL STRESSES ----------] Bending [fb] (ksi)	Axial [fa] (ksi)	Torsion [ft] (ksi)	Shear [fv] (ksi)	Combined [Ftot] (ksi)	Allow. Stress [Fb] (ksi)	Actual/ Allowable [Ftot/Fb] Ratio
150.00	0.013	0.000	0.000	0.000	0.013	52.00	0.0003
150.00	0.013	0.009	0.004	0.012	0.036	52.00	0.0007
147.00	0.078	0.030	0.553	0.561	1.933	52.00	0.0372
147.00	0.083	0.129	0.676	0.689	2.373	52.00	0.0456
140.00	4.756	0.145	0.581	0.691	5.373	52.00	0.1033
137.00	6.446	0.161	0.981	1.155	7.572	52.00	0.1456
137.00	6.474	0.249	1.079	1.268	7.856	52.00	0.1511
130.00	13.356	0.256	0.941	1.230	14.121	52.00	0.2716
129.75	13.593	0.272	0.936	1.233	14.366	52.00	0.2763
127.00	12.297	0.218	0.960	1.245	13.085	52.00	0.2516
127.00	12.330	0.281	1.021	1.322	13.248	52.00	0.2548
126.00	12.932	0.278	0.976	1.298	13.785	52.00	0.2651
120.00	18.362	0.289	0.899	1.279	19.029	52.00	0.3659
117.00	20.512	0.297	1.076	1.542	21.297	52.00	0.4096
117.00	20.551	0.355	1.125	1.611	21.436	52.00	0.4122
110.00	26.703	0.360	1.002	1.557	27.424	52.00	0.5274
107.00	28.908	0.367	1.139	1.787	29.709	52.00	0.5713
107.00	28.949	0.420	1.180	1.849	29.834	52.00	0.5737
100.00	34.934	0.424	1.060	1.789	35.701	52.00	0.6866
97.00	37.093	0.429	1.168	1.990	37.918	52.00	0.7292
97.00	37.133	0.478	1.202	2.047	38.030	52.00	0.7314
90.00	42.776	0.478	1.088	1.979	43.579	51.97	0.8386
89.75	42.977	0.499	1.084	1.980	43.798	51.93	0.8434
84.75	38.244	0.410	0.834	1.573	38.879	52.00	0.7477
80.00	40.511	0.416	0.783	1.543	41.124	52.00	0.7909
70.00	44.354	0.427	0.689	1.485	44.939	52.00	0.8642
60.00	47.225	0.438	0.611	1.435	47.795	52.00	0.9191
51.00	49.177	0.473	0.552	1.395	49.765	51.87	0.9595
50.00	36.505	0.345	0.403	1.009	36.931	52.00	0.7102
44.75	37.127	0.354	0.380	0.992	37.557	52.00	0.7222
40.00	37.612	0.364	0.361	0.979	38.046	52.00	0.7317
30.00	38.406	0.382	0.326	0.951	38.851	52.00	0.7471
20.00	38.958	0.401	0.295	0.927	39.415	52.00	0.7580
10.00	39.323	0.419	0.269	0.906	39.794	52.00	0.7653
0.00	39.544	0.434	0.246	0.886	40.026	52.00	0.7697

---------(END LOAD CASE 1 -- ACTUAL VS. ALLOWABLE STRESSES)------------------

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MONOPOLE ANCHOR BOLT & BASE PLATE ANALYSIS

TITLE:
SITE:
OWNER:
COMM. NO: 29205-113
DATE: 24-May-05

Shaft Shape	18-Sided	Stress Increase	1.3333
Base Dia, DF	60.00 in.	Base Plate Shape	Square
PT-to-PT, DP	60.93 in.		
Min Bolt Circle	66.93 in.	Actual Bolt Circle	67.00 in.

Base Reactions

Moment	4008.957 ft-kips
Axial Load	35.9 kips

Anchor Bolt Details

Number of Bolts	20
Bolt Diameter	2.25 inches
Bolt Type	#18J ASTM A615
Mom. Of Inertia	11222.50 $inches^4$
Bolt Tension, T	143.60 kips
Allowable Tension	194.81 kips
Bolt Compression, C	145.40 kips
Actual / Allowable Ratio	73.7% ☑

Base Plate Details

Plate Moment, MPL	1726.61 inch-kips
Bend Plane, W	33.34 inches
Plate Thickness, t	2.75 inches
Plate Width	66.00 inches
Plate Steel Spec.	ASTM A572
Plate Steel Grade	50.00 ksi
Actual Stress	41.09 ksi
Allowable Stress	50.00 ksi
Actual / Allowable Ratio	82.2% ☑

Base Plate Analysis Summary

Plate Thickness	2.75 in.	Bolt Circle	67.00 in.
Plate Diameter	66.00 in.	Bolt Diameter	2.25 in.
Number of Bolts	20	Bolt Type	#18J ASTM A615

MAT FOOTING FOR TOWERS PROGRAM BY PAUL J. FORD and COMPANY

JOB NO. 29205-113 DATE 05-24-2005 PAGE 1

INPUT: MAT FOOTING FOR TOWERS

TOWER LOADS: TOWER WEIGHT = 36.00 kips (including ice,antenna etc)
OVERTURNING MOMENT = 4200.00 ft-k at base of tower
TOTAL HORIZONTAL = 39.00 kips total for entire tower

DESIGN SAFETY FACTOR AGAINST OVERTURNING = 2.00

CONCRETE: CONCRETE STRENGTH = 3000 psi at 28 days
REINFORCING STEEL STRENGTH = 60000 psi (ASTM A615)

SOIL: WATER TABLE BELOW BOTTOM OF FOOTING
SOIL WT = 100 pcf (dry)
ALLOWABLE SOIL BEARING = 4000 psf

FOOTING SIZE: WIDTH = 31.0 ft LENGTH = 31.0 ft
THICKNESS = 4.00 ft DEPTH = 3.50 ft below grade
CONCRETE WEIGHT = 150 pcf

OUTPUT: MAT FOOTING FOR TOWERS

VOLUME OF CONCRETE = 3844 ft^3 (142.37 cubic yards)

WEIGHT OF TOWER ====> 36.00 kips
WEIGHT OF CONCRETE => 576.60 kips (3844 x 0.150)
TOTAL WEIGHT = 612.60 kips

OVERTURNING MOMENT =4200.00 ft-k + (39.00 k x 4.00 ft) = 4356 ft-kips
RESISTING MOMENT = 612.60 k x 31.00 ft/2 = 9495 ft-kips

SAFETY FACTOR = Mresist / O.T.M. = 9495 / 4356 = 2.18 > 2.00 O.K.

GROSS SOIL BEARING = 1570 psf (includes soil overburden)
NET SOIL BEARING = 1220 psf < 4000 psf O.K.

BENDING MOMENT IN FOOTING = 2865 ft-kips
FOOTING REINFORCING = 0.61 in^2/ft = 62 no. 5 bars @ 6.09 in. o.c.
(.18 % = 1.04 in^2/ft) half top and half bottom

BENDING SHEAR IN THE FOOTING = 609.63 kips
ALLOWABLE BENDING SHEAR =1180.69 kips O.K.