ROBINSON & COLE LLP

KENNETH C. BALDWIN

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Hartford, CT 06103-3597
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Direct (860) 275-8345

July 21, 2008

ORIGINAL

RECEIVED
JUL 23 2008
CONNECTICUT
SITING COUNCIL

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

Re: **TS-VER-065-080201**
22 Welsh Road, East Hartland, Connecticut

Dear Mr. Phelps:

On February 28, 2008, the Connecticut Siting Council (the "Council") granted the request of Cellco Partnership d/b/a Verizon Wireless ("Cellco") to share the Town of Hartland ("Town") owned wireless telecommunications facility at the above referenced location. Cellco was approved to install antennas at the top (180' level) of the tower. Cellco was recently informed by the Town that the top of the tower was no longer available. The 180-foot level is being reserved for Town emergency service antennas. Cellco now intends to install its antennas at the 170-foot level on the Town tower.

In an effort to keep the Council's records up-to-date, I have enclosed a new set of project plans, a new structural report and a new power density calculation table all showing Cellco antennas at the 170-foot level.

Please contact me with any questions.

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Sandy M. Carter

Law Offices
BOSTON
HARTFORD
NEW LONDON
STAMFORD
WHITE PLAINS
NEW YORK CITY
SARASOTA
www.rc.com

Cellco Partnership

d.b.a. verizon wireless

WIRELESS COMMUNICATIONS FACILITY

EAST HARTLAND
22 WELSH ROAD
EAST HARTLAND, CT 06027

SITE DIRECTIONS

FROM: 99 EAST RIVER DRIVE, EAST HARTFORD, CONNECTICUT **TO:** 22 WELSH ROAD, EAST HARTLAND, CONNECTICUT

1. START AT 99 E RIVER DR	0.3 MI.
2. TURN LEFT TO STAY ON E RIVER DR	<0.1 MI.
3. TURN LEFT (WEST) ONTO US-44[CONNECTICUT BLVD]	0.2 MI.
4. TAKE RAMP ONTO I-84[US-44]	0.3 MI.
5. AT EXIT 50, TAKE RAMP (RIGHT) ONTO I-91	9.4 MI.
6. AT EXIT 40, TAKE RAMP (RIGHT) ONTO SR-20[BRADLEY FIELD CONNECTOR]	3.5 MI.
7. TAKE RAMP (RIGHT) ONTO SR-20	6.0 MI.
8. ROAD NAME CHANGES TO SR-189[SR-20]	0.2 MI.
9. KEEP STRAIGHT ONTO SR-189[NORTH GRANBY RD	3.5 MI.
10. TURN LEFT (WEST) ONTO MOUNTAIN RD	3.1 MI.
11. ARRIVE AT 22 WELSH RD	

GENERAL NOTES

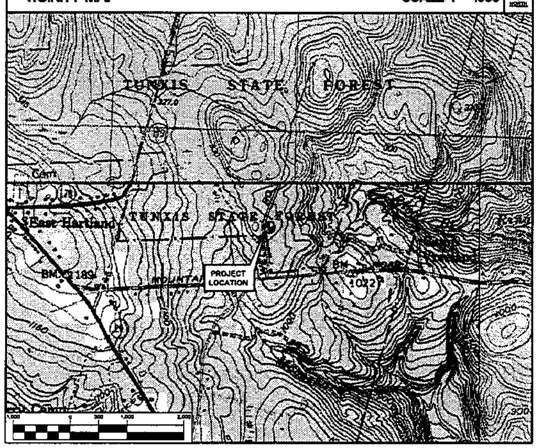
1. PROPOSED ANTENNA LOCATIONS AND HEIGHTS PROVIDED BY CELLCO PARTNERSHIP.

PROJECT SCOPE

1. THE PROPOSED SCOPE OF WORK GENERALLY INCLUDES THE INSTALLATION OF A 12'x30' PREFABRICATED WIRELESS EQUIPMENT SHELTER ON A CONCRETE FOUNDATION WITHIN THE EXISTING WIRELESS COMMUNICATIONS LEASE AREA.
2. A TOTAL OF TWELVE (12) DIRECTIONAL PANEL ANTENNAS ARE PROPOSED TO BE MOUNTED ON AN EXISTING 180' LATTICE TOWER AT A RAD CENTER ELEVATION OF 180' ABOVE THE EXISTING TOWER BASE PLATE.
3. ELECTRIC AND TELCO UTILITIES SHALL BE ROUTED UNDERGROUND TO THE PROPOSED EQUIPMENT SHELTER FROM AN EXISTING UTILITY BACKBOARD LOCATED WITHIN THE FENCED COMPOUND.

VICINITY MAP

SCALE: 1" = 1000'



PROJECT SUMMARY

SITE NAME:	EAST HARTLAND
SITE ADDRESS:	22 WELSH ROAD EAST HARTLAND, CT 06027
LESSEE/ TENANT:	CELLCO PARTNERSHIP d.b.a. VERIZON WIRELESS 99 EAST RIVER DRIVE EAST HARTFORD, CT 06108
CONTACT PERSON:	SANDY CARTER CELLCO PARTNERSHIP (860) 803-8219
TOWER COORDINATES:	LATITUDE: 41°-59'-51.09" LONGITUDE: 72°-53'-15.84" COORDINATES BASED ON 2C CERTIFICATION LETTER PREPARED BY MARTINEZ COUCH AND ASSOCIATES L.L.C., DATED 11/7/2007.

SHEET INDEX

SHT. NO.	DESCRIPTION	REV. NO.
T-1	TITLE SHEET	00
C-1	COMPOUND PLAN AND ELEVATION	00

REVISIONS		
A	11/20/07	CSC - REVIEW
00	07/16/08	FINAL CSC

Cellco Partnership d.b.a. verizon wireless

NATCOMM INC
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

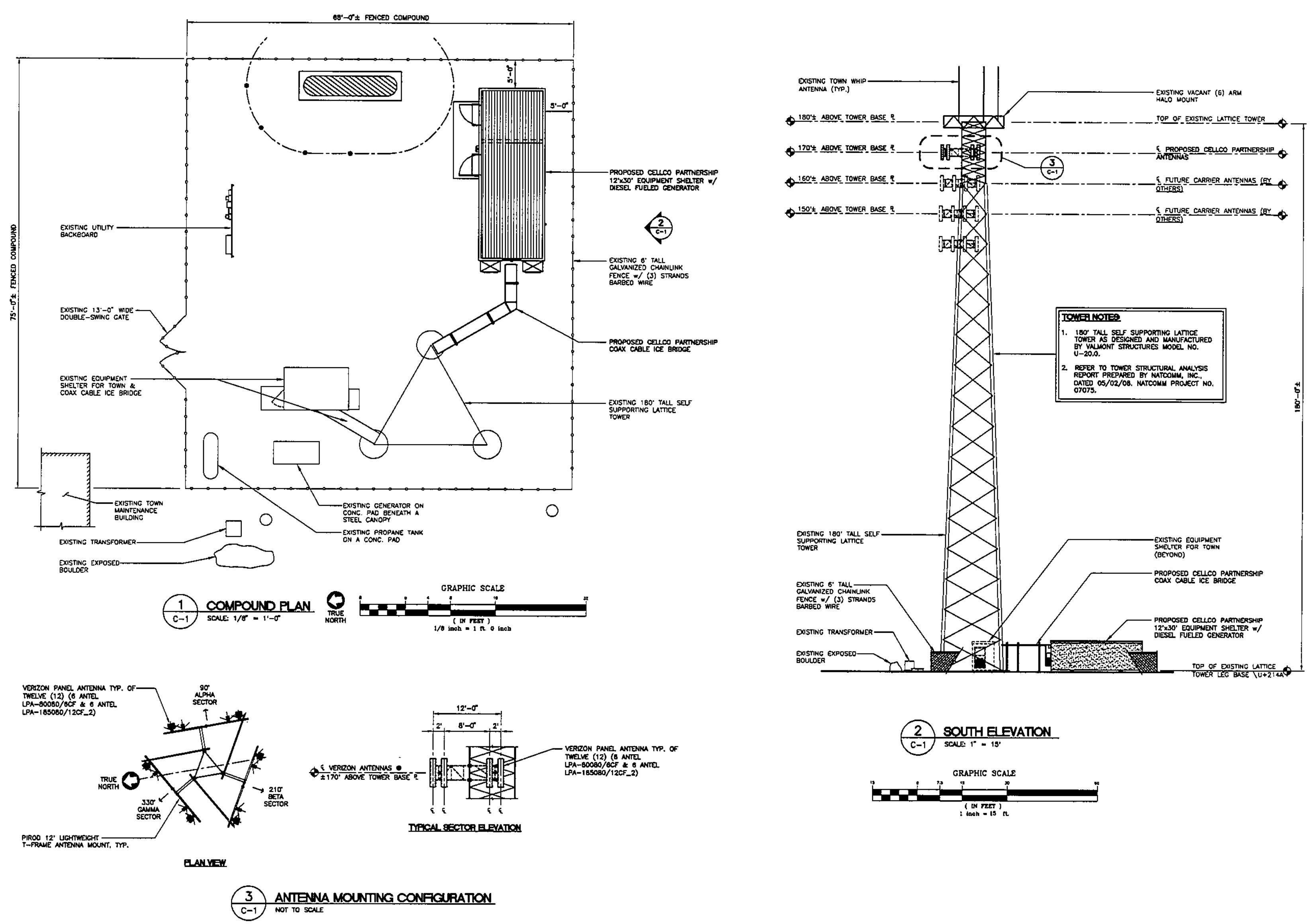
EAST HARTLAND
22 WELSH ROAD
EAST HARTLAND, CT 06027

PROJECT NO:	07075
DRAWN BY:	DEB
CHECKED BY:	CFC
SCALE:	AS NOTED
DATE:	10/23/07

TITLE SHEET

T-1

DWG. 1 OF 2



REVISIONS		
A	11/20/07	CSC - REVIEW
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22 WELSH ROAD
EAST HARTLAND, CT 06027

PROJECT NO:	07075
DRAWN BY:	DEB
CHECKED BY:	CFC
SCALE:	AS NOTED
DATE:	10/23/07

COMPOUND PLAN AND ELEVATION

C-1
DWG. 2 OF 2

Site Name: East Hartland, CT
Cumulative Power Density

Operator	Operating Frequency	Number of Trans.	ERP Per Trans.	Total ERP	Distance to Target	Calculated Power Density	Maximum Permissable Exposure*	Fraction of MPE
	(MHz)		(watts)	(watts)	(feet)	(mW/cm^2)	(mW/cm^2)	(%)
VZW	1970	3	485	1455	170	0.0181	1.0	1.81%
VZW	875	9	300	2700	170	0.0336	0.583	5.76%

Total Percentage of Maximum Permissible Exposure 7.57%

*Guidelines adopted by the FCC on August 1, 1996, 47 CFR Part 1 based on NCRP Report 86, 1986 and generally on ANSI/IEEE C95.1-1992

MHz = Megahertz
mW/cm^2 = milliwatts per square centimeter
ERP = Effective Radiated Power

Absolute worst case maximum values used.

NATCOMM INC.
CONSULTING ENGINEERS

Structural Analysis Report

180' Existing Self Supporting Lattice Tower

22 Welsh Road
East Hartland, CT

Natcomm Project No. 07075

~~*Date: November 21, 2007*~~

Rev. 1: May 2, 2008

STATE OF CONNECTICUT
CARLO F. CENTORE
No.16694
LICENSED
PROFESSIONAL ENGINEER

Prepared for:

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

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w: nat-eng.com
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Branford, CT 06405

Table of Contents

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna installation proposed by Verizon Wireless on the existing self supporting lattice tower located in East Hartland, Connecticut. The host tower is a 180-ft, three legged, tapered lattice tower originally designed and manufactured by Valmont Structures; drawing no. 198204 dated April 4, 2006.

The tower is constructed of pipe legs, diagonal angle braces and horizontal angle braces. The tower members are all bolted together. The width of the tower face is 4-ft at the top and 20-ft at the base. The tower geometry and structure member sizes were taken from Valmont Structures' original design documents available in Section 4 of this report.

Antenna and Appurtenance Summary

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

- TOWN (Existing):
  Antennas: Two (2) 20-ft x 3"∅ omnidirectional whip antennas and one (1) 20-ft 4-bay dipole (Yagi) antenna mounted on a 6 arm halo mount with a mount elevation of 180-ft above the existing tower base.
  Coax Cables: Three (3) 1-5/8" ∅ coax cables running on a leg/face of the existing tower as specified in Section 3 of this report.
- **VERIZON (Proposed):**
  Antennas: Six (6) Amphenol Antel, Inc. (Antel) LPA-80080/6CF and six (6) Antel LPA-185080/12CF panel antennas mounted on (3) PiROD 12-ft lightweight T-Frames with a RAD center elevation of 170-ft above the existing tower base.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg/face of the existing tower as specified in Section 3 of this report.
- FUTURE CARRIER:
  Antennas: Twelve (12) RR90-17-00DP panel antennas mounted on (3) PiROD 12-ft lightweight T-Frames with a RAD center elevation of 160-ft above the existing tower base.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg/face of the existing tower as specified in Section 3 of this report.
- FUTURE CARRIER:
  Antennas: Twelve (12) RR90-17-00DP panel antennas mounted on (3) PiROD 12-ft lightweight T-Frames with a RAD center elevation of 150-ft above the existing tower base.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg/face of the existing tower as specified in Section 3 of this report.

- FUTURE CARRIER:
  Antennas: Twelve (12) RR90-17-00DP panel antennas mounted on (3) PiROD 12-ft lightweight T-Frames with a RAD center elevation of 140-ft above the existing tower base.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg/face of the existing tower as specified in Section 3 of this report.

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 routed as specified in Section 3 of this report.

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 legs, and the model assumes that the leg members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for 80 mph basic wind speed (fastest mile) with no ice and 75% reduction of wind force with ½ inch accumulative ice to determine stresses in members as per guidelines of TIA/EIA-222-F-96 entitled "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA/EIA-222-F, gravity loads of the tower structure and its components, and the application of ½" radial ice tower structure and its components.

Basic Wind Speed:	Hartford; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Hartland; 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 2005] does not control in the design of this structure type*

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software RISATower. Allowable stresses were determined based on Table 5 of the TIA/EIA code with a 1/3 increase per Section 3.1.1.1 of the same code.

Calculated stresses were found to be within allowable limits. In Load Case 2, per RISATower "Section Capacity Table", this tower was found to be at **86.2%** of its total capacity.

Foundation and Anchors

The existing foundation consists of three (3) 5-ft∅ reinforced concrete piers with a 28.5-ft square reinforced concrete pad concentrically bearing directly on existing sub grade. The sub grade conditions used in the analysis of the existing foundation were derived from Valmont Structures original design documents available in Section 4 of this report. Tower legs are connected to the three (3) piers by means of (6) 1 1/4"∅, ASTM A687 anchor bolts per leg, embedded approximately 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 2 were used in the verification of the foundation and its anchors:
  - Uplift @ top of pedestal = **237.2** kips
  - Shear @ top of pedestal = **30.7** kips
  - Compression @ top of pedestal = **307.2** kips
- Base plates, anchor bolts and the foundation were found to be 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).

Conclusion

This analysis shows that the subject tower **is adequate** to support the proposed antennas and associated hardware.

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Carlo F. Centore, PE
Principal ~ Structural Engineer

STATE OF CONNECTICUT
CARLO F. CENTORE
No. 16694
LICENSED
PROFESSIONAL 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.

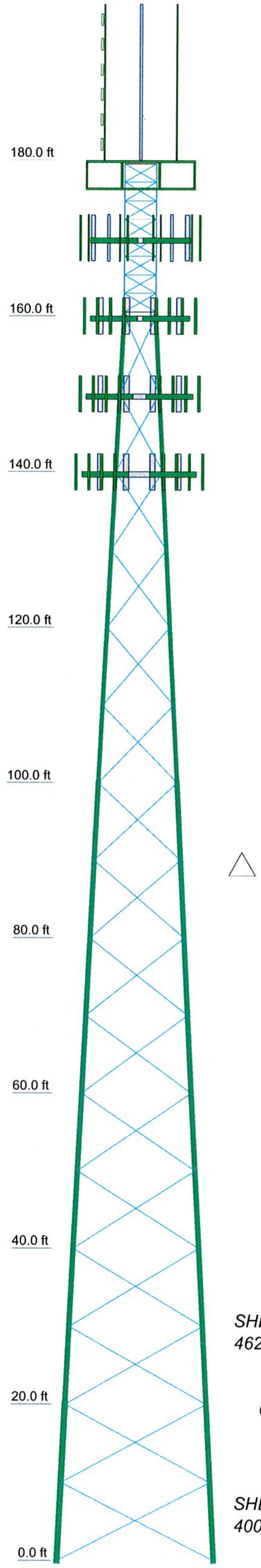
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

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	T1	T2	T3	T4	T5	T6	T7	T8	T9	
Legs	SR 1 1/2	Pirod 105216		Pirod 105217	Pirod 105218		Pirod 105219		Pirod 105220	
Leg Grade	A572-50									
Diagonals	SR 3/4	L2 1/2x2 1/2x3/16			L3x3x3/16		L3x3x5/16		L3 1/2x3 1/2x5/16	
Diagonal Grade	A572-50	A36								
Top Girts	SR 7/8	N.A.								
Bottom Girts	SR 7/8	N.A.								
Horizontals	SR 3/4	N.A.								
Face Width (ft)	4		6	8	10	12	14	16	18	20
# Panels @ (ft)	8 @ 2.375	16 @ 10								
Weight (lb)	803.4	1951.1	1990.7	2381.8	2962.4	3034.1	4213.7	4343.0	5293.3	26973.5



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
20' x 3" Dia Omni	190	PiROD 12' Lightweight T-Frame (Future)	160
20' x 3" Dia Omni	190	(4) RR90-17-00DP (Future)	160
20' 4-Bay Dipole	190	(4) RR90-17-00DP (Future)	160
6 Arm Halo Mount	178	(4) RR90-17-00DP (Future)	160
LPA-80080/6CF (Verizon)	170	PiROD 12' Lightweight T-Frame (Future)	150
LPA-185080/12CF (Verizon)	170	PiROD 12' Lightweight T-Frame (Future)	150
LPA-185080/12CF (Verizon)	170	PiROD 12' Lightweight T-Frame (Future)	150
LPA-80080/6CF (Verizon)	170	(4) RR90-17-00DP (Future)	150
LPA-80080/6CF (Verizon)	170	(4) RR90-17-00DP (Future)	150
LPA-185080/12CF (Verizon)	170	(4) RR90-17-00DP (Future)	150
LPA-185080/12CF (Verizon)	170	(4) RR90-17-00DP (Future)	140
LPA-80080/6CF (Verizon)	170	(4) RR90-17-00DP (Future)	140
LPA-80080/6CF (Verizon)	170	(4) RR90-17-00DP (Future)	140
LPA-185080/12CF (Verizon)	170	PiROD 12' Lightweight T-Frame (Future)	140
LPA-185080/12CF (Verizon)	170	PiROD 12' Lightweight T-Frame (Future)	140
LPA-80080/6CF (Verizon)	170	PiROD 12' Lightweight T-Frame (Future)	140
PiROD 12' Lightweight T-Frame (Verizon)	170		
PiROD 12' Lightweight T-Frame (Verizon)	170		
PiROD 12' Lightweight T-Frame (Verizon)	170		
PiROD 12' Lightweight T-Frame (Future)	160		
PiROD 12' Lightweight T-Frame (Future)	160		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 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. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 86.2%

MAX. CORNER REACTIONS AT BASE:
DOWN: 307181 lb
UPLIFT: -237232 lb
SHEAR: 30683 lb

AXIAL 72897 lb
SHEAR 46260 lb
MOMENT 4899655 lb-ft
TORQUE 10122 lb-ft
69 mph WIND - 0.5000 in ICE

AXIAL 41545 lb
SHEAR 40011 lb
MOMENT 4247190 lb-ft
TORQUE 9246 lb-ft
REACTIONS - 80 mph WIND

NATCOMM 63-2 N. Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job: 180' U20.0 Valmont Self-Support Lattice		
	Project: 07075 - 22 Welsh Rd, East Hartland		
	Client: Verizon	Drawn by: Staff	App'd:
	Code: TIA/EIA-222-F	Date: 04/22/08	Scale: NTS
	Path: C:\Users\kerman214\Documents\Natcomm\07075 East Hartland\Rev 1 04 22 08\ERI Files\180 Lattice Hartland.eri		Dwg No. E-1

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 180.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 4.00 ft at the top and 20.00 ft at the base.
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.
- Weld together tower sections have flange connections..
- Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
- 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 tower member design is 1.333.
- Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

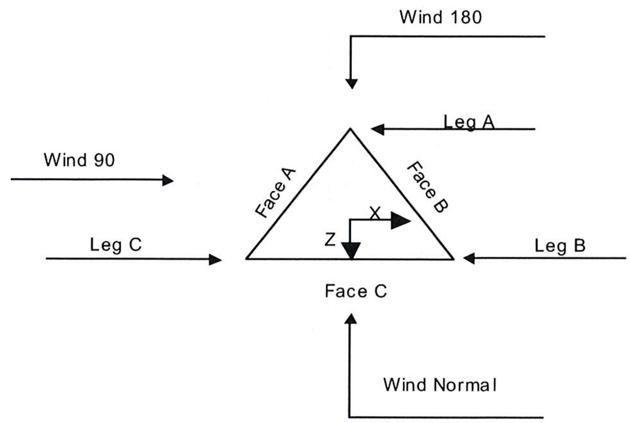
Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
√ Use Code Stress Ratios
√ Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
√ Include Bolts In Member Capacity
√ Leg Bolts Are At Top Of Section
Secondary Horizontal Braces Leg
Use Diamond Inner Bracing (4 Sided)
Add IBC .6D+W Combination

Distribute Leg Loads As Uniform
Assume Legs Pinned
√ Assume Rigid Index Plate
√ Use Clear Spans For Wind Area
√ Use Clear Spans For KL/r
Retension Guys To Initial Tension
Bypass Mast Stability Checks
Use Azimuth Dish Coefficients
√ Project Wind Area of Appurt.
Autocalc Torque Arm Areas
SR Members Have Cut Ends
√ Sort Capacity Reports By Component
Triangulate Diamond Inner Bracing

Treat Feedline Bundles As Cylinder
Use ASCE 10 X-Brace Ly Rules
√ Calculate Redundant Bracing Forces
Ignore Redundant Members in FEA
√ SR Leg Bolts Resist Compression
√ All Leg Panels Have Same Allowable
Offset Girt At Foundation
√ Consider Feedline Torque
Include Angle Block Shear Check

Poles

Include Shear-Torsion Interaction
Always Use Sub-Critical Flow
Use Top Mounted Sockets



Triangular Tower

Tower Section Geometry

Tower Section	*Tower Elevation* *ft*	*Assembly Database*	*Description*	*Section Width* *ft*	*Number of Sections*	*Section Length* *ft*
T1	180.00-160.00	pirod	V4 106778	4.00	1	20.00
T2	160.00-140.00		U6.0 105245	4.00	1	20.00
T3	140.00-120.00	pirod	U8.0 105216	6.00	1	20.00
T4	120.00-100.00	pirod	U10.0 105217 L2 1/2x3/16	8.00	1	20.00
T5	100.00-80.00	pirod	U12.0 105218	10.00	1	20.00
T6	80.00-60.00	pirod	U14.0 105218	12.00	1	20.00
T7	60.00-40.00	pirod	U16.0 105219	14.00	1	20.00
T8	40.00-20.00	pirod	U18.0 105219	16.00	1	20.00
T9	20.00-0.00		U20.0 105219 L3.5x5/16	18.00	1	20.00

Tower Section Geometry *(cont'd)*

Tower Section	*Tower Elevation* *ft*	*Diagonal Spacing* *ft*	*Bracing Type*	*Has K Brace End Panels*	*Has Horizontals*	*Top Girt Offset* *in*	*Bottom Girt Offset* *in*
T1	180.00-160.00	2.38	X Brace	No	Steps	6.0000	6.0000
T2	160.00-140.00	10.00	X Brace	No	No	0.0000	0.0000
T3	140.00-120.00	10.00	X Brace	No	No	0.0000	0.0000
T4	120.00-100.00	10.00	X Brace	No	No	0.0000	0.0000
T5	100.00-80.00	10.00	X Brace	No	No	0.0000	0.0000
T6	80.00-60.00	10.00	X Brace	No	No	0.0000	0.0000

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T7	60.00-40.00	10.00	X Brace	No	No	0.0000	0.0000
T8	40.00-20.00	10.00	X Brace	No	No	0.0000	0.0000
T9	20.00-0.00	10.00	X Brace	No	No	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 180.00-160.00	Solid Round	1 1/2	A572-50 (50 ksi)	Solid Round	3/4	A572-50 (50 ksi)
T2 160.00-140.00	Truss Leg	Pirod 105216	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T3 140.00-120.00	Truss Leg	Pirod 105216	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T4 120.00-100.00	Truss Leg	Pirod 105217	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 100.00-80.00	Truss Leg	Pirod 105218	A572-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T6 80.00-60.00	Truss Leg	Pirod 105218	A572-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T7 60.00-40.00	Truss Leg	Pirod 105219	A572-50 (50 ksi)	Single Angle	L3x3x5/16	A36 (36 ksi)
T8 40.00-20.00	Truss Leg	Pirod 105219	A572-50 (50 ksi)	Single Angle	L3x3x5/16	A36 (36 ksi)
T9 20.00-0.00	Truss Leg	Pirod 105220	A572-50 (50 ksi)	Single Angle	L3 1/2x3 1/2x5/16	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 180.00-160.00	Solid Round	7/8	A572-50 (50 ksi)	Solid Round	7/8	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T1 180.00-160.00	None	Solid Round		A572-50 (50 ksi)	Solid Round	3/4	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation *ft*	Gusset Area (per face) *ft²*	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*
T1 180.00-160.00	0.00	0.0000	A36 (36 ksi)	1	1	1.02	36.0000	36.0000
T2 160.00-140.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T3 140.00-120.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T4 120.00-100.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T5 100.00-80.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T6 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T7 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T8 40.00-20.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T9 20.00-0.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000

Tower Section Geometry *(cont'd)*

			K Factors[1]							
Tower Elevation *ft*	Calc K Single Angles	Calc K Solid Rounds	Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 180.00-160.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 160.00-140.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 140.00-120.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 120.00-100.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 100.00-80.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 80.00-60.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 60.00-40.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 40.00-20.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T9 20.00-0.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1

[1]Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.

Tower Section Geometry *(cont'd)*

	Truss-Leg K Factors					
	Truss-Legs Used As Leg Members			Truss-Legs Used As Inner Members		
Tower Elevation ft	*Leg Panels*	*X Brace Diagonals*	*Z Brace Diagonals*	*Leg Panels*	*X Brace Diagonals*	*Z Brace Diagonals*
T2 160.00-140.00	1	0.5	0.85	1	0.5	0.85
T3 140.00-120.00	1	0.5	0.85	1	0.5	0.85
T4 120.00-100.00	1	0.5	0.85	1	0.5	0.85
T5 100.00-80.00	1	0.5	0.85	1	0.5	0.85
T6 80.00-60.00	1	0.5	0.85	1	0.5	0.85
T7 60.00-40.00	1	0.5	0.85	1	0.5	0.85
T8 40.00-20.00	1	0.5	0.85	1	0.5	0.85
T9 20.00-0.00	1	0.5	0.85	1	0.5	0.85

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Leg*		*Diagonal*		*Top Girt*		*Bottom Girt*		*Mid Girt*		*Long Horizontal*		*Short Horizontal*	
	Net Width Deduct in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*	*Net Width Deduct* in	*U*
T1 180.00-160.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T2 160.00-140.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T3 140.00-120.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T4 120.00-100.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T5 100.00-80.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T6 80.00-60.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T7 60.00-40.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T8 40.00-20.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T9 20.00-0.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 180.00-160.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 160.00-140.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 140.00-120.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 120.00-100.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 100.00-80.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 80.00-60.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0
T7 60.00-40.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0
T8 40.00-20.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0
T9 20.00-0.00	Flange	1.2500 A325N	6	1.2500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
1 5/8	A	No	Ar (Leg)	170.00 - 3.00	0.0000	0.08	12	6	0.5000 1.0000	1.9800		1.04
1 5/8	C	No	Ar (Leg)	180.00 - 140.00	0.0000	0.08	3	3	0.5000 1.0000	1.9800		1.04
1 5/8	B	No	Ar (Leg)	150.00 - 3.00	0.0000	0.08	24	12	0.5000 1.0000	1.9800		1.04
1 5/8	B	No	Ar (Leg)	160.00 - 150.00	0.0000	0.08	12	12	0.5000 1.0000	1.9800		1.04
1 5/8	C	No	Ar (Leg)	140.00 - 3.00	0.0000	0.08	15	8	0.5000 1.0000	1.9800		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
T1	180.00-160.00	A	19.800	0.000	0.000	0.000	124.80
		B	9.900	0.000	0.000	0.000	0.00
		C	9.900	0.000	0.000	0.000	62.40
T2	160.00-140.00	A	29.700	0.000	0.000	0.000	249.60
		B	59.400	0.000	0.000	0.000	374.40
		C	49.500	0.000	0.000	0.000	62.40
T3	140.00-120.00	A	46.200	0.000	0.000	0.000	249.60
		B	59.400	0.000	0.000	0.000	499.20
		C	66.000	0.000	0.000	0.000	312.00
T4	120.00-100.00	A	46.200	0.000	0.000	0.000	249.60

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
		B	59.400	0.000	0.000	0.000	499.20
		C	66.000	0.000	0.000	0.000	312.00
T5	100.00-80.00	A	46.200	0.000	0.000	0.000	249.60
		B	59.400	0.000	0.000	0.000	499.20
		C	66.000	0.000	0.000	0.000	312.00
T6	80.00-60.00	A	46.200	0.000	0.000	0.000	249.60
		B	59.400	0.000	0.000	0.000	499.20
		C	66.000	0.000	0.000	0.000	312.00
T7	60.00-40.00	A	46.200	0.000	0.000	0.000	249.60
		B	59.400	0.000	0.000	0.000	499.20
		C	66.000	0.000	0.000	0.000	312.00
T8	40.00-20.00	A	46.200	0.000	0.000	0.000	249.60
		B	59.400	0.000	0.000	0.000	499.20
		C	66.000	0.000	0.000	0.000	312.00
T9	20.00-0.00	A	39.270	0.000	0.000	0.000	212.16
		B	50.490	0.000	0.000	0.000	424.32
		C	56.100	0.000	0.000	0.000	265.20

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
T1	180.00-160.00	A	0.500	7.450	18.600	0.000	0.000	322.76
		B		2.483	10.333	0.000	0.000	0.00
		C		4.967	8.267	0.000	0.000	159.76
T2	160.00-140.00	A	0.500	9.933	28.933	0.000	0.000	645.52
		B		9.933	66.133	0.000	0.000	973.14
		C		9.933	53.733	0.000	0.000	159.76
T3	140.00-120.00	A	0.500	9.933	49.600	0.000	0.000	645.52
		B		9.933	66.133	0.000	0.000	1297.51
		C		9.933	74.400	0.000	0.000	738.99
T4	120.00-100.00	A	0.500	9.933	49.600	0.000	0.000	645.52
		B		9.933	66.133	0.000	0.000	1297.51
		C		9.933	74.400	0.000	0.000	738.99
T5	100.00-80.00	A	0.500	9.933	49.600	0.000	0.000	645.52
		B		9.933	66.133	0.000	0.000	1297.51
		C		9.933	74.400	0.000	0.000	738.99
T6	80.00-60.00	A	0.500	9.933	49.600	0.000	0.000	645.52
		B		9.933	66.133	0.000	0.000	1297.51
		C		9.933	74.400	0.000	0.000	738.99
T7	60.00-40.00	A	0.500	9.933	49.600	0.000	0.000	645.52
		B		9.933	66.133	0.000	0.000	1297.51
		C		9.933	74.400	0.000	0.000	738.99
T8	40.00-20.00	A	0.500	9.933	49.600	0.000	0.000	645.52
		B		9.933	66.133	0.000	0.000	1297.51
		C		9.933	74.400	0.000	0.000	738.99
T9	20.00-0.00	A	0.500	8.443	42.160	0.000	0.000	548.69
		B		8.443	56.213	0.000	0.000	1102.89
		C		8.443	63.240	0.000	0.000	628.14

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	180.00-160.00	-2.8622	-1.6525	-1.4704	-1.2734
T2	160.00-140.00	3.3116	0.6373	2.9263	0.5632
T3	140.00-120.00	1.7869	2.0634	1.6022	1.8501
T4	120.00-100.00	2.2278	2.5725	2.0015	2.3112
T5	100.00-80.00	2.5800	2.9791	2.3361	2.6975
T6	80.00-60.00	2.9989	3.4628	2.7170	3.1373
T7	60.00-40.00	3.3333	3.8490	3.0205	3.4878
T8	40.00-20.00	3.7147	4.2894	3.3682	3.8892
T9	20.00-0.00	3.5636	4.1149	3.2428	3.7445

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight lb
6 Arm Halo Mount	C	None		0.0000	178.00	No Ice 1/2" Ice	41.70 53.60	41.70 53.60	2400.00 3200.00
PiROD 12' Lightweight T-Frame (Verizon)	A	From Leg	1.50 0.00 0.00	0.0000	170.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Verizon)	B	From Leg	1.50 0.00 0.00	0.0000	170.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Verizon)	C	From Leg	1.50 0.00 0.00	0.0000	170.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	A	From Leg	1.50 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	B	From Leg	1.50 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	C	From Leg	1.50 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
(4) RR90-17-00DP (Future)	A	From Leg	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	B	From Leg	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	C	From Leg	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
PiROD 12' Lightweight T-Frame (Future)	A	From Leg	1.50 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	B	From Leg	1.50 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame	C	From Leg	1.50 0.00	0.0000	150.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00

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*
(Future)			0.00						
(4) RR90-17-00DP (Future)	A	From Leg	3.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	B	From Leg	3.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	C	From Leg	3.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
PiROD 12' Lightweight T-Frame (Future)	A	From Leg	1.50 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	B	From Leg	1.50 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	C	From Leg	1.50 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
(4) RR90-17-00DP (Future)	A	From Leg	3.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	B	From Leg	3.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	C	From Leg	3.00 0.00 0.00	0.0000	140.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
LPA-80080/6CF (Verizon)	A	From Leg	3.00 -6.00 0.00	0.0000	170.00	No Ice 1/2" Ice	4.33 4.76	9.09 9.64	21.00 69.24
LPA-185080/12CF (Verizon)	A	From Leg	3.00 -4.00 0.00	0.0000	170.00	No Ice 1/2" Ice	3.53 3.96	4.57 5.01	11.00 37.49
LPA-185080/12CF (Verizon)	A	From Leg	3.00 4.00 0.00	0.0000	170.00	No Ice 1/2" Ice	3.53 3.96	4.57 5.01	11.00 37.49
LPA-80080/6CF (Verizon)	A	From Leg	3.00 6.00 0.00	0.0000	170.00	No Ice 1/2" Ice	4.33 4.76	9.09 9.64	21.00 69.24
LPA-80080/6CF (Verizon)	B	From Leg	3.00 -6.00 0.00	0.0000	170.00	No Ice 1/2" Ice	4.33 4.76	9.09 9.64	21.00 69.24
LPA-185080/12CF (Verizon)	B	From Leg	3.00 -4.00 0.00	0.0000	170.00	No Ice 1/2" Ice	3.53 3.96	4.57 5.01	11.00 37.49
LPA-185080/12CF (Verizon)	B	From Leg	3.00 4.00 0.00	0.0000	170.00	No Ice 1/2" Ice	3.53 3.96	4.57 5.01	11.00 37.49
LPA-80080/6CF (Verizon)	B	From Leg	3.00 6.00 0.00	0.0000	170.00	No Ice 1/2" Ice	4.33 4.76	9.09 9.64	21.00 69.24
LPA-80080/6CF (Verizon)	C	From Leg	3.00 -6.00 0.00	0.0000	170.00	No Ice 1/2" Ice	4.33 4.76	9.09 9.64	21.00 69.24
LPA-185080/12CF (Verizon)	C	From Leg	3.00 -4.00	0.0000	170.00	No Ice 1/2" Ice	3.53 3.96	4.57 5.01	11.00 37.49

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
			0.00						
LPA-185080/12CF (Verizon)	C	From Leg	3.00 4.00 0.00	0.0000	170.00	No Ice 1/2" Ice	3.53 3.96	4.57 5.01	11.00 37.49
LPA-80080/6CF (Verizon)	C	From Leg	3.00 6.00 0.00	0.0000	170.00	No Ice 1/2" Ice	4.33 4.76	9.09 9.64	21.00 69.24
20' x 3" Dia Omni	A	From Leg	3.00 0.00 0.00	0.0000	190.00	No Ice 1/2" Ice	6.00 8.03	6.00 8.03	50.00 93.17
20' x 3" Dia Omni	B	From Leg	3.00 0.00 0.00	0.0000	190.00	No Ice 1/2" Ice	6.00 8.03	6.00 8.03	50.00 93.17
20' 4-Bay Dipole	C	From Leg	3.00 0.00 0.00	0.0000	190.00	No Ice 1/2" Ice	4.00 6.00	4.00 6.00	55.00 100.00

Truss-Leg Properties

Section Designation	Area in^2	Area Ice in^2	Self Weight lb	Ice Weight lb	Equiv. Diameter in	Equiv. Diameter Ice in	Leg Area in^2
Pirod 105216	1998.0891	3357.4497	505.25	428.24	6.9378	11.6578	3.6816
Pirod 105216	1998.0891	3357.4497	505.25	428.24	6.9378	11.6578	3.6816
Pirod 105217	2130.7479	3520.4599	619.35	443.34	7.3984	12.2238	5.3014
Pirod 105218	2263.4687	3690.8612	754.52	458.46	7.8593	12.8155	7.2158
Pirod 105218	2263.4687	3690.8612	754.52	458.46	7.8593	12.8155	7.2158
Pirod 105219	2441.8688	3942.2854	944.27	485.72	8.4787	13.6885	9.4248
Pirod 105219	2441.8688	3942.2854	944.27	485.72	8.4787	13.6885	9.4248
Pirod 105220	2578.8005	4132.5504	1121.16	500.74	8.9542	14.3491	11.9282

Tower Pressures - No Ice

$G_H = 1.121$

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
T1 180.00-160.00	170.00	1.597	26	82.500	A	0.000	29.872	5.000	16.74	0.000	0.000
					B	0.000	19.972		25.04		
					C	0.000	21.667		23.08		
T2 160.00-140.00	150.00	1.541	25	122.111	A	7.894	52.865	23.165	38.13	0.000	0.000
					B	7.894	82.565		25.61		
					C	7.894	72.665		28.76		
T3 140.00-	130.00	1.48	24	162.111	A	8.723	69.365	23.165	29.66	0.000	0.000

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
120.00					B	8.723	82.565		25.38		
					C	8.723	89.165		23.66		
T4 120.00-100.00	110.00	1.411	23	202.528	A	9.970	70.903	24.703	30.54	0.000	0.000
					B	9.970	84.103		26.26		
					C	9.970	90.703		24.54		
T5 100.00-80.00	90.00	1.332	22	242.945	A	13.520	72.441	26.241	30.53	0.000	0.000
					B	13.520	85.641		26.46		
					C	13.520	92.241		24.81		
T6 80.00-60.00	70.00	1.24	20	282.945	A	15.144	72.441	26.241	29.96	0.000	0.000
					B	15.144	85.641		26.04		
					C	15.144	92.241		24.44		
T7 60.00-40.00	50.00	1.126	18	323.362	A	16.830	74.509	28.309	30.99	0.000	0.000
					B	16.830	87.709		27.08		
					C	16.830	94.309		25.47		
T8 40.00-20.00	30.00	1	16	363.362	A	18.566	74.509	28.309	30.42	0.000	0.000
					B	18.566	87.709		26.64		
					C	18.566	94.309		25.08		
T9 20.00-0.00	10.00	1	16	403.780	A	23.735	69.167	29.897	32.18	0.000	0.000
					B	23.735	80.387		28.71		
					C	23.735	85.997		27.25		

Tower Pressure - With Ice

$G_H = 1.121$

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
T1 180.00-160.00	170.00	1.597	20	0.5000	84.167	A	18.600	27.510	8.333	18.07	0.000	0.000
						B	10.333	22.543		25.35		
						C	8.267	28.982		22.37		
T2 160.00-140.00	150.00	1.541	19	0.5000	123.780	A	36.827	52.015	38.924	43.81	0.000	0.000
						B	74.027	52.015		30.88		
						C	61.627	52.015		34.25		
T3 140.00-120.00	130.00	1.48	18	0.5000	163.780	A	58.323	52.346	38.924	35.17	0.000	0.000
						B	74.856	52.346		30.60		
						C	83.123	52.346		28.73		
T4 120.00-100.00	110.00	1.411	17	0.5000	204.197	A	59.570	54.735	40.814	35.71	0.000	0.000
						B	76.104	54.735		31.19		
						C	84.370	54.735		29.34		
T5 100.00-80.00	90.00	1.332	16	0.5000	244.614	A	63.120	57.229	42.789	35.55	0.000	0.000
						B	79.653	57.229		31.26		
						C	87.920	57.229		29.48		
T6 80.00-60.00	70.00	1.24	15	0.5000	284.614	A	64.744	57.771	42.789	34.93	0.000	0.000
						B	81.278	57.771		30.77		
						C	89.544	57.771		29.05		
T7 60.00-40.00	50.00	1.126	14	0.5000	325.031	A	66.430	61.248	45.704	35.80	0.000	0.000
						B	82.963	61.248		31.69		
						C	91.230	61.248		29.97		
T8 40.00-20.00	30.00	1	12	0.5000	365.031	A	68.166	61.826	45.704	35.16	0.000	0.000
						B	84.700	61.826		31.19		
						C	92.966	61.826		29.53		
T9 20.00-0.00	10.00	1	12	0.5000	405.448	A	65.895	63.135	47.910	37.13	0.000	0.000
						B	79.948	63.135		33.48		
						C	86.975	63.135		31.92		

Tower Pressure - Service

$G_H = 1.121$

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
T1 180.00-160.00	170.00	1.597	10	82.500	A	0.000	29.872	5.000	16.74	0.000	0.000
					B	0.000	19.972		25.04		
					C	0.000	21.667		23.08		
T2 160.00-140.00	150.00	1.541	10	122.111	A	7.894	52.865	23.165	38.13	0.000	0.000
					B	7.894	82.565		25.61		
					C	7.894	72.665		28.76		
T3 140.00-120.00	130.00	1.48	9	162.111	A	8.723	69.365	23.165	29.66	0.000	0.000
					B	8.723	82.565		25.38		
					C	8.723	89.165		23.66		
T4 120.00-100.00	110.00	1.411	9	202.528	A	9.970	70.903	24.703	30.54	0.000	0.000
					B	9.970	84.103		26.26		
					C	9.970	90.703		24.54		
T5 100.00-80.00	90.00	1.332	9	242.945	A	13.520	72.441	26.241	30.53	0.000	0.000
					B	13.520	85.641		26.46		
					C	13.520	92.241		24.81		
T6 80.00-60.00	70.00	1.24	8	282.945	A	15.144	72.441	26.241	29.96	0.000	0.000
					B	15.144	85.641		26.04		
					C	15.144	92.241		24.44		
T7 60.00-40.00	50.00	1.126	7	323.362	A	16.830	74.509	28.309	30.99	0.000	0.000
					B	16.830	87.709		27.08		
					C	16.830	94.309		25.47		
T8 40.00-20.00	30.00	1	6	363.362	A	18.566	74.509	28.309	30.42	0.000	0.000
					B	18.566	87.709		26.64		
					C	18.566	94.309		25.08		
T9 20.00-0.00	10.00	1	6	403.780	A	23.735	69.167	29.897	32.18	0.000	0.000
					B	23.735	80.387		28.71		
					C	23.735	85.997		27.25		

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
T1 180.00-160.00	187.20	803.42	A	0.362	2.144	0.637	1	1	19.024	1196.49	59.82	A
			B	0.242	2.461	0.6	1	1	11.981			
			C	0.263	2.4	0.605	1	1	13.112			
T2 160.00-140.00	686.40	1951.13	A	0.498	1.903	0.696	1	1	44.701	3942.01	197.10	B
			B	0.741	1.784	0.85	1	1	78.063			
			C	0.66	1.779	0.792	1	1	65.441			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	1	1	56.468	3726.58	186.33	C
			B	0.563	1.831	0.732	1	1	69.137			
			C	0.604	1.802	0.756	1	1	76.127			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	1	1	56.151	3605.09	180.25	C
			B	0.464	1.95	0.68	1	1	67.163			
			C	0.497	1.904	0.696	1	1	73.101			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	1	1	59.437	3666.58	183.33	C
			B	0.408	2.048	0.655	1	1	69.612			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.435	1.998	0.667	1	1	75.012			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	1	1	59.976	3571.73	178.59	C
			B	0.356	2.157	0.635	1	1	69.501			
			C	0.38	2.106	0.643	1	1	74.498			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	1	1	62.332	3448.07	172.40	C
			B	0.323	2.236	0.623	1	1	71.499			
			C	0.344	2.186	0.63	1	1	76.268			
T8 40.00-20.00	1060.80	4343.02	A	0.256	2.419	0.603	1	1	63.530	3205.68	160.28	C
			B	0.292	2.316	0.614	1	1	72.387			
			C	0.311	2.268	0.619	1	1	76.964			
T9 20.00-0.00	901.68	5293.34	A	0.23	2.499	0.597	1	1	65.027	3312.77	165.64	C
			B	0.258	2.414	0.604	1	1	72.281			
			C	0.272	2.374	0.608	1	1	75.992			
Sum Weight:	8140.08	26973.54						OTM	2557435.59 lb-ft	29675.01		

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 ft^2	F lb	w plf	Ctrl. Face
T1 180.00-160.00	187.20	803.42	A	0.362	2.144	0.637	0.8	1	19.024	1196.49	59.82	A
			B	0.242	2.461	0.6	0.8	1	11.981			
			C	0.263	2.4	0.605	0.8	1	13.112			
T2 160.00-140.00	686.40	1951.13	A	0.498	1.903	0.696	0.8	1	43.122	3862.29	193.11	B
			B	0.741	1.784	0.85	0.8	1	76.484			
			C	0.66	1.779	0.792	0.8	1	63.863			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	0.8	1	54.724	3641.18	182.06	C
			B	0.563	1.831	0.732	0.8	1	67.392			
			C	0.604	1.802	0.756	0.8	1	74.382			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	0.8	1	54.157	3506.75	175.34	C
			B	0.464	1.95	0.68	0.8	1	65.169			
			C	0.497	1.904	0.696	0.8	1	71.107			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	0.8	1	56.733	3534.41	176.72	C
			B	0.408	2.048	0.655	0.8	1	66.908			
			C	0.435	1.998	0.667	0.8	1	72.308			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	0.8	1	56.947	3426.51	171.33	C
			B	0.356	2.157	0.635	0.8	1	66.473			
			C	0.38	2.106	0.643	0.8	1	71.469			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	0.8	1	58.966	3295.90	164.79	C
			B	0.323	2.236	0.623	0.8	1	68.133			
			C	0.344	2.186	0.63	0.8	1	72.902			
T8 40.00-20.00	1060.80	4343.02	A	0.256	2.419	0.603	0.8	1	59.817	3051.02	152.55	C
			B	0.292	2.316	0.614	0.8	1	68.674			
			C	0.311	2.268	0.619	0.8	1	73.251			
T9 20.00-0.00	901.68	5293.34	A	0.23	2.499	0.597	0.8	1	60.280	3105.83	155.29	C
			B	0.258	2.414	0.604	0.8	1	67.534			
			C	0.272	2.374	0.608	0.8	1	71.245			
Sum Weight:	8140.08	26973.54						OTM	2487179.71 lb-ft	28620.39		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation *ft*	Add Weight *lb*	Self Weight *lb*	Face	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *lb*	*w* *plf*	Ctrl. Face
T1 180.00-160.00	187.20	803.42	A	0.362	2.144	0.637	0.85	1	19.024	1196.49	59.82	A
			B	0.242	2.461	0.6	0.85	1	11.981			
			C	0.263	2.4	0.605	0.85	1	13.112			
T2 160.00-140.00	686.40	1951.13	A	0.498	1.903	0.696	0.85	1	43.517	3882.22	194.11	B
			B	0.741	1.784	0.85	0.85	1	76.879			
			C	0.66	1.779	0.792	0.85	1	64.257			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	0.85	1	55.160	3662.53	183.13	C
			B	0.563	1.831	0.732	0.85	1	67.828			
			C	0.604	1.802	0.756	0.85	1	74.818			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	0.85	1	54.655	3531.34	176.57	C
			B	0.464	1.95	0.68	0.85	1	65.667			
			C	0.497	1.904	0.696	0.85	1	71.605			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	0.85	1	57.409	3567.45	178.37	C
			B	0.408	2.048	0.655	0.85	1	67.584			
			C	0.435	1.998	0.667	0.85	1	72.984			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	0.85	1	57.704	3462.82	173.14	C
			B	0.356	2.157	0.635	0.85	1	67.230			
			C	0.38	2.106	0.643	0.85	1	72.226			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	0.85	1	59.808	3333.94	166.70	C
			B	0.323	2.236	0.623	0.85	1	68.975			
			C	0.344	2.186	0.63	0.85	1	73.744			
T8 40.00-20.00	1060.80	4343.02	A	0.256	2.419	0.603	0.85	1	60.745	3089.69	154.48	C
			B	0.292	2.316	0.614	0.85	1	69.602			
			C	0.311	2.268	0.619	0.85	1	74.179			
T9 20.00-0.00	901.68	5293.34	A	0.23	2.499	0.597	0.85	1	61.467	3157.57	157.88	C
			B	0.258	2.414	0.604	0.85	1	68.721			
			C	0.272	2.374	0.608	0.85	1	72.432			
Sum Weight:	8140.08	26973.54						OTM	2504743.68 lb-ft	28884.04		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation *ft*	Add Weight *lb*	Self Weight *lb*	Face	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *lb*	*w* *plf*	Ctrl. Face
T1 180.00-160.00	482.53	1088.77	A	0.548	1.846	0.723	1	1	38.491	1562.94	78.15	A
			B	0.391	2.083	0.648	1	1	24.937			
			C	0.443	1.986	0.67	1	1	27.681			
T2 160.00-140.00	1778.42	3550.45	A	0.718	1.778	0.833	1	1	80.141	5255.26*	262.76	B
			B	1	2.1	1	1	1	126.042			
			C	0.918	1.951	1	1	1	113.636			
T3 140.00-120.00	2682.02	3618.62	A	0.676	1.777	0.803	1	1	100.350	4916.54	245.83	C
			B	0.777	1.801	0.878	1	1	120.797			
			C	0.827	1.839	0.919	1	1	131.225			
T4 120.00-100.00	2682.02	4089.79	A	0.56	1.834	0.73	1	1	99.517	4434.81	221.74	C
			B	0.641	1.784	0.779	1	1	118.764			
			C	0.681	1.776	0.807	1	1	128.524			
T5 100.00-80.00	2682.02	4824.60	A	0.492	1.911	0.693	1	1	102.806	4339.64	216.98	C
			B	0.56	1.835	0.73	1	1	121.413			
			C	0.593	1.808	0.75	1	1	130.817			
T6 80.00-60.00	2682.02	4946.27	A	0.43	2.007	0.665	1	1	103.133	4180.70	209.04	C
			B	0.489	1.915	0.692	1	1	121.239			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.518	1.878	0.707	1	1	130.367			
T7 60.00-40.00	2682.02	6260.79	A	0.393	2.078	0.649	1	1	106.161	4009.18	200.46	C
			B	0.444	1.984	0.67	1	1	124.023			
			C	0.469	1.943	0.682	1	1	133.015			
T8 40.00-20.00	2682.02	6445.33	A	0.356	2.157	0.635	1	1	107.406	3721.67	186.08	C
			B	0.401	2.061	0.652	1	1	125.021			
			C	0.424	2.018	0.662	1	1	133.877			
T9 20.00-0.00	2279.72	7597.94	A	0.318	2.249	0.622	1	1	105.142	3729.70	186.48	C
			B	0.353	2.165	0.634	1	1	119.945			
			C	0.37	2.126	0.64	1	1	127.375			
Sum Weight:	20632.81	42422.56			*$2A_g$ limit			OTM	3213591.45 lb-ft	36150.45		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 180.00-160.00	482.53	1088.77	A	0.548	1.846	0.723	0.8	1	34.771	1411.89	70.59	A
			B	0.391	2.083	0.648	0.8	1	22.870			
			C	0.443	1.986	0.67	0.8	1	26.028			
T2 160.00-140.00	1778.42	3550.45	A	0.718	1.778	0.833	0.8	1	72.776	4958.85	247.94	B
			B	1	2.1	1	0.8	1	111.236			
			C	0.918	1.951	1	0.8	1	101.310			
T3 140.00-120.00	2682.02	3618.62	A	0.676	1.777	0.803	0.8	1	88.685	4293.68	214.68	C
			B	0.777	1.801	0.878	0.8	1	105.826			
			C	0.827	1.839	0.919	0.8	1	114.600			
T4 120.00-100.00	2682.02	4089.79	A	0.56	1.834	0.73	0.8	1	87.603	3852.56	192.63	C
			B	0.641	1.784	0.779	0.8	1	103.543			
			C	0.681	1.776	0.807	0.8	1	111.650			
T5 100.00-80.00	2682.02	4824.60	A	0.492	1.911	0.693	0.8	1	90.182	3756.32	187.82	C
			B	0.56	1.835	0.73	0.8	1	105.483			
			C	0.593	1.808	0.75	0.8	1	113.233			
T6 80.00-60.00	2682.02	4946.27	A	0.43	2.007	0.665	0.8	1	90.184	3606.39	180.32	C
			B	0.489	1.915	0.692	0.8	1	104.984			
			C	0.518	1.878	0.707	0.8	1	112.458			
T7 60.00-40.00	2682.02	6260.79	A	0.393	2.078	0.649	0.8	1	92.875	3459.24	172.96	C
			B	0.444	1.984	0.67	0.8	1	107.431			
			C	0.469	1.943	0.682	0.8	1	114.769			
T8 40.00-20.00	2682.02	6445.33	A	0.356	2.157	0.635	0.8	1	93.773	3204.79	160.24	C
			B	0.401	2.061	0.652	0.8	1	108.081			
			C	0.424	2.018	0.662	0.8	1	115.284			
T9 20.00-0.00	2279.72	7597.94	A	0.318	2.249	0.622	0.8	1	91.963	3220.35	161.02	C
			B	0.353	2.165	0.634	0.8	1	103.955			
			C	0.37	2.126	0.64	0.8	1	109.980			
Sum Weight:	20632.81	42422.56						OTM	2857634.61 lb-ft	31764.08		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 180.00-160.00	482.53	1088.77	A	0.548	1.846	0.723	0.85	1	35.701	1449.65	72.48	A
			B	0.391	2.083	0.648	0.85	1	23.387			
			C	0.443	1.986	0.67	0.85	1	26.441			
T2 160.00-140.00	1778.42	3550.45	A	0.718	1.778	0.833	0.85	1	74.617	5123.86	256.19	B
			B	1	2.1	1	0.85	1	114.938			
			C	0.918	1.951	1	0.85	1	104.392			
T3 140.00-120.00	2682.02	3618.62	A	0.676	1.777	0.803	0.85	1	91.601	4449.39	222.47	C
			B	0.777	1.801	0.878	0.85	1	109.569			
			C	0.827	1.839	0.919	0.85	1	118.757			
T4 120.00-100.00	2682.02	4089.79	A	0.56	1.834	0.73	0.85	1	90.581	3998.12	199.91	C
			B	0.641	1.784	0.779	0.85	1	107.348			
			C	0.681	1.776	0.807	0.85	1	115.869			
T5 100.00-80.00	2682.02	4824.60	A	0.492	1.911	0.693	0.85	1	93.338	3902.15	195.11	C
			B	0.56	1.835	0.73	0.85	1	109.465			
			C	0.593	1.808	0.75	0.85	1	117.629			
T6 80.00-60.00	2682.02	4946.27	A	0.43	2.007	0.665	0.85	1	93.421	3749.97	187.50	C
			B	0.489	1.915	0.692	0.85	1	109.048			
			C	0.518	1.878	0.707	0.85	1	116.935			
T7 60.00-40.00	2682.02	6260.79	A	0.393	2.078	0.649	0.85	1	96.196	3596.72	179.84	C
			B	0.444	1.984	0.67	0.85	1	111.579			
			C	0.469	1.943	0.682	0.85	1	119.331			
T8 40.00-20.00	2682.02	6445.33	A	0.356	2.157	0.635	0.85	1	97.181	3334.01	166.70	C
			B	0.401	2.061	0.652	0.85	1	112.316			
			C	0.424	2.018	0.662	0.85	1	119.932			
T9 20.00-0.00	2279.72	7597.94	A	0.318	2.249	0.622	0.85	1	95.258	3347.69	167.38	C
			B	0.353	2.165	0.634	0.85	1	107.952			
			C	0.37	2.126	0.64	0.85	1	114.329			
Sum Weight:	20632.81	42422.56						OTM	2960259.21 lb-ft	32951.57		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 180.00-160.00	187.20	803.42	A	0.362	2.144	0.637	1	1	19.024	467.38	23.37	A
			B	0.242	2.461	0.6	1	1	11.981			
			C	0.263	2.4	0.605	1	1	13.112			
T2 160.00-140.00	686.40	1951.13	A	0.498	1.903	0.696	1	1	44.701	1539.85	76.99	B
			B	0.741	1.784	0.85	1	1	78.063			
			C	0.66	1.779	0.792	1	1	65.441			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	1	1	56.468	1455.69	72.78	C
			B	0.563	1.831	0.732	1	1	69.137			
			C	0.604	1.802	0.756	1	1	76.127			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	1	1	56.151	1408.24	70.41	C
			B	0.464	1.95	0.68	1	1	67.163			
			C	0.497	1.904	0.696	1	1	73.101			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	1	1	59.437	1432.26	71.61	C
			B	0.408	2.048	0.655	1	1	69.612			
			C	0.435	1.998	0.667	1	1	75.012			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	1	1	59.976	1395.21	69.76	C
			B	0.356	2.157	0.635	1	1	69.501			
			C	0.38	2.106	0.643	1	1	74.498			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	1	1	62.332	1346.90	67.35	C
			B	0.323	2.236	0.623	1	1	71.499			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.344	2.186	0.63	1	1	76.268			
T8 40.00-20.00	1060.80	4343.02	A	0.256	2.419	0.603	1	1	63.530	1252.22	62.61	C
			B	0.292	2.316	0.614	1	1	72.387			
			C	0.311	2.268	0.619	1	1	76.964			
T9 20.00-0.00	901.68	5293.34	A	0.23	2.499	0.597	1	1	65.027	1294.05	64.70	C
			B	0.258	2.414	0.604	1	1	72.281			
			C	0.272	2.374	0.608	1	1	75.992			
Sum Weight:	8140.08	26973.54						OTM	998998.28 lb-ft	11591.80		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 180.00-160.00	187.20	803.42	A	0.362	2.144	0.637	0.8	1	19.024	467.38	23.37	A
			B	0.242	2.461	0.6	0.8	1	11.981			
			C	0.263	2.4	0.605	0.8	1	13.112			
T2 160.00-140.00	686.40	1951.13	A	0.498	1.903	0.696	0.8	1	43.122	1508.71	75.44	B
			B	0.741	1.784	0.85	0.8	1	76.484			
			C	0.66	1.779	0.792	0.8	1	63.863			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	0.8	1	54.724	1422.34	71.12	C
			B	0.563	1.831	0.732	0.8	1	67.392			
			C	0.604	1.802	0.756	0.8	1	74.382			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	0.8	1	54.157	1369.83	68.49	C
			B	0.464	1.95	0.68	0.8	1	65.169			
			C	0.497	1.904	0.696	0.8	1	71.107			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	0.8	1	56.733	1380.63	69.03	C
			B	0.408	2.048	0.655	0.8	1	66.908			
			C	0.435	1.998	0.667	0.8	1	72.308			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	0.8	1	56.947	1338.48	66.92	C
			B	0.356	2.157	0.635	0.8	1	66.473			
			C	0.38	2.106	0.643	0.8	1	71.469			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	0.8	1	58.966	1287.46	64.37	C
			B	0.323	2.236	0.623	0.8	1	68.133			
			C	0.344	2.186	0.63	0.8	1	72.902			
T8 40.00-20.00	1060.80	4343.02	A	0.256	2.419	0.603	0.8	1	59.817	1191.80	59.59	C
			B	0.292	2.316	0.614	0.8	1	68.674			
			C	0.311	2.268	0.619	0.8	1	73.251			
T9 20.00-0.00	901.68	5293.34	A	0.23	2.499	0.597	0.8	1	60.280	1213.22	60.66	C
			B	0.258	2.414	0.604	0.8	1	67.534			
			C	0.272	2.374	0.608	0.8	1	71.245			
Sum Weight:	8140.08	26973.54						OTM	971554.57 lb-ft	11179.84		

Tower Forces - Service - Wind 90 To Face

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

Section Elevation *ft*	*Add Weight* *lb*	*Self Weight* *lb*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *lb*	*w* *plf*	*Ctrl. Face*
T1 180.00-160.00	187.20	803.42	A	0.362	2.144	0.637	0.85	1	19.024	467.38	23.37	A
			B	0.242	2.461	0.6	0.85	1	11.981			
			C	0.263	2.4	0.605	0.85	1	13.112			
T2 160.00-140.00	686.40	1951.13	A	0.498	1.903	0.696	0.85	1	43.517	1516.49	75.82	B
			B	0.741	1.784	0.85	0.85	1	76.879			
			C	0.66	1.779	0.792	0.85	1	64.257			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	0.85	1	55.160	1430.68	71.53	C
			B	0.563	1.831	0.732	0.85	1	67.828			
			C	0.604	1.802	0.756	0.85	1	74.818			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	0.85	1	54.655	1379.43	68.97	C
			B	0.464	1.95	0.68	0.85	1	65.667			
			C	0.497	1.904	0.696	0.85	1	71.605			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	0.85	1	57.409	1393.54	69.68	C
			B	0.408	2.048	0.655	0.85	1	67.584			
			C	0.435	1.998	0.667	0.85	1	72.984			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	0.85	1	57.704	1352.66	67.63	C
			B	0.356	2.157	0.635	0.85	1	67.230			
			C	0.38	2.106	0.643	0.85	1	72.226			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	0.85	1	59.808	1302.32	65.12	C
			B	0.323	2.236	0.623	0.85	1	68.975			
			C	0.344	2.186	0.63	0.85	1	73.744			
T8 40.00-20.00	1060.80	4343.02	A	0.256	2.419	0.603	0.85	1	60.745	1206.91	60.35	C
			B	0.292	2.316	0.614	0.85	1	69.602			
			C	0.311	2.268	0.619	0.85	1	74.179			
T9 20.00-0.00	901.68	5293.34	A	0.23	2.499	0.597	0.85	1	61.467	1233.42	61.67	C
			B	0.258	2.414	0.604	0.85	1	68.721			
			C	0.272	2.374	0.608	0.85	1	72.432			
Sum Weight:	8140.08	26973.54						OTM	978415.50 lb-ft	11282.83		

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	18844.43					
Bracing Weight	8129.11					
Total Member Self-Weight	26973.54			6594.37	-7665.59	
Total Weight	41544.62			6594.37	-7665.59	
Wind 0 deg - No Ice		0.00	-40011.21	-4211919.33	-7665.59	6920.02
Wind 30 deg - No Ice		19610.13	-33965.73	-3601113.13	-2090576.48	9022.44
Wind 60 deg - No Ice		33737.40	-19478.30	-2067534.54	-3600162.24	8812.86
Wind 90 deg - No Ice		39220.25	0.00	6594.37	-4173487.37	6408.86
Wind 120 deg - No Ice		34650.73	20005.61	2115851.22	-3661005.62	2278.43
Wind 150 deg - No Ice		19610.13	33965.73	3614301.86	-2090576.48	-2613.58
Wind 180 deg - No Ice		0.00	38956.60	4154852.18	-7665.59	-6650.74
Wind 210 deg - No Ice		-19610.13	33965.73	3614301.86	2075245.30	-9022.44
Wind 240 deg - No Ice		-34650.73	20005.61	2115851.22	3645674.44	-9198.45
Wind 270 deg - No Ice		-39220.25	0.00	6594.37	4158156.20	-6408.86
Wind 300 deg - No Ice		-33737.40	-19478.30	-2067534.54	3584831.06	-2162.13
Wind 330 deg - No Ice		-19610.13	-33965.73	-3601113.13	2075245.30	2613.58
Member Ice	15449.03					
Total Weight Ice	72897.10			15695.91	-22690.19	
Wind 0 deg - Ice		0.00	-46259.80	-4820782.42	-22690.19	7551.57
Wind 30 deg - Ice		21530.46	-37291.86	-3953425.03	-2314263.23	9199.36

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M_x lb-ft	Sum of Overturning Moments, M_z lb-ft	Sum of Torques lb-ft
Wind 60 deg - Ice		36263.46	-20936.72	-2224564.83	-3902935.62	8696.19
Wind 90 deg - Ice		43060.93	0.00	15695.91	-4605836.28	6448.19
Wind 120 deg - Ice		40062.16	23129.90	2433935.08	-4211203.29	2437.21
Wind 150 deg - Ice		21530.46	37291.86	3984816.85	-2314263.23	-2751.17
Wind 180 deg - Ice		0.00	41873.43	4496217.40	-22690.19	-6652.78
Wind 210 deg - Ice		-21530.46	37291.86	3984816.85	2268882.86	-9199.36
Wind 240 deg - Ice		-40062.16	23129.90	2433935.08	4165822.91	-9988.77
Wind 270 deg - Ice		-43060.93	0.00	15695.91	4560455.91	-6448.19
Wind 300 deg - Ice		-36263.46	-20936.72	-2224564.83	3857555.24	-2043.42
Wind 330 deg - Ice		-21530.46	-37291.86	-3953425.03	2268882.86	2751.17
Total Weight	41544.62			6594.37	-7665.59	
Wind 0 deg - Service		0.00	-15629.38	-1647843.64	22.99	2703.13
Wind 30 deg - Service		7660.21	-13267.86	-1409247.47	-813614.08	3524.39
Wind 60 deg - Service		13178.67	-7608.71	-810193.33	-1403296.01	3442.52
Wind 90 deg - Service		15320.41	0.00	13.27	-1627251.14	2503.46
Wind 120 deg - Service		13535.44	7814.69	823941.73	-1427062.96	890.01
Wind 150 deg - Service		7660.21	13267.86	1409274.01	-813614.08	-1020.93
Wind 180 deg - Service		0.00	15217.42	1620426.48	22.99	-2597.94
Wind 210 deg - Service		-7660.21	13267.86	1409274.01	813660.06	-3524.39
Wind 240 deg - Service		-13535.44	7814.69	823941.73	1427108.94	-3593.15
Wind 270 deg - Service		-15320.41	0.00	13.27	1627297.13	-2503.46
Wind 300 deg - Service		-13178.67	-7608.71	-810193.33	1403341.99	-844.58
Wind 330 deg - Service		-7660.21	-13267.86	-1409247.47	813660.06	1020.93

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

Comb. No.	Description
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
T1	180 - 160	Leg	Max Tension	12	20401.51	-229.57	-133.62
			Max. Compression	15	-24762.36	2.67	1198.88
			Max. Mx	23	-24670.03	1030.12	-612.43
			Max. My	15	-24762.36	2.67	1198.88
			Max. Vy	23	-2558.85	1030.12	-612.43
			Max. Vx	15	-2963.53	2.67	1198.88
		Diagonal	Max Tension	26	2409.86	0.00	0.00
			Max. Compression	20	-2447.24	0.00	0.00
			Max. Mx	19	267.32	-2.67	0.01
			Max. My	11	-2010.34	-0.60	-1.03
			Max. Vy	15	3.45	-2.63	-0.09
			Max. Vx	11	0.44	-0.60	-1.03
		Horizontal	Max Tension	21	564.02	0.00	0.00
			Max. Compression	2	-363.40	0.00	0.00
			Max. Mx	14	117.04	4.59	0.00
			Max. My	23	4.81	0.00	0.00
			Max. Vy	14	-4.59	0.00	0.00
			Max. Vx	23	-0.00	0.00	0.00
		Top Girt	Max Tension	19	134.75	0.00	0.00
			Max. Compression	25	-176.44	0.00	0.00
			Max. Mx	14	-7.23	5.85	0.00
			Max. My	15	-71.47	0.00	0.00
			Max. Vy	14	5.85	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
		Bottom Girt	Max Tension	21	477.37	0.00	0.00
			Max. Compression	2	-391.75	0.00	0.00
			Max. Mx	14	13.46	5.85	0.00
			Max. My	22	37.19	0.00	-0.00
			Max. Vy	14	5.85	0.00	0.00
			Max. Vx	22	-0.00	0.00	0.00
T2	160 - 140	Leg	Max Tension	17	43073.86	-2064.38	-5.57
			Max. Compression	19	-52751.72	3106.92	0.36
			Max. Mx	15	-52657.22	3114.52	-9.61
			Max. My	16	-3063.84	-206.95	-2971.02
			Max. Vy	25	-753.38	-2067.59	-20.34
			Max. Vx	16	-887.02	-206.98	-2971.02
		Diagonal	Max Tension	26	6746.11	0.00	0.00
			Max. Compression	26	-6889.00	0.00	0.00
			Max. Mx	15	5140.72	57.27	-1.95
			Max. My	26	-5317.05	-20.98	-18.01
			Max. Vy	15	-18.16	57.27	-1.95
			Max. Vx	26	4.07	0.00	0.00
T3	140 - 120	Leg	Max Tension	17	80818.45	-3317.70	-28.66

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Force lb*	*Major Axis Moment lb-ft*	*Minor Axis Moment lb-ft*
			Max. Compression	19	-97303.00	3814.93	-6.17
			Max. Mx	19	-97303.00	3814.93	-6.17
			Max. My	16	-6630.41	-128.99	-4167.29
			Max. Vy	25	-749.03	-2855.17	-21.19
			Max. Vx	16	-587.66	107.24	-2350.74
		Diagonal	Max Tension	26	7346.84	0.00	0.00
			Max. Compression	26	-7637.10	0.00	0.00
			Max. Mx	19	5844.75	79.09	-2.76
			Max. My	21	-6318.60	-13.74	9.88
			Max. Vy	19	-23.43	79.09	-2.76
			Max. Vx	21	-2.30	0.00	0.00
T4	120 - 100	Leg	Max Tension	17	113755.10	-3773.06	-25.16
			Max. Compression	19	-137302.03	4272.65	-4.56
			Max. Mx	19	-137302.03	4272.65	-4.56
			Max. My	16	-10257.68	-23.95	-4292.38
			Max. Vy	25	154.86	-4122.39	0.23
			Max. Vx	22	-166.50	-25.33	3818.41
		Diagonal	Max Tension	26	6829.65	0.00	0.00
			Max. Compression	26	-7020.14	0.00	0.00
			Max. Mx	19	5466.12	65.16	-3.34
			Max. My	15	-305.84	38.43	-6.44
			Max. Vy	19	-22.58	65.16	-3.34
			Max. Vx	15	-1.62	0.00	0.00
T5	100 - 80	Leg	Max Tension	17	142277.68	-3948.73	-23.46
			Max. Compression	19	-173784.55	4233.45	-3.28
			Max. Mx	19	-155582.31	4272.65	-4.56
			Max. My	16	-10938.65	-23.96	-4292.38
			Max. Vy	25	-137.80	-4122.39	0.23
			Max. Vx	16	-183.35	-23.96	-4292.38
		Diagonal	Max Tension	24	6715.59	0.00	0.00
			Max. Compression	24	-6927.73	0.00	0.00
			Max. Mx	19	5702.42	86.73	-4.61
			Max. My	22	-3262.12	35.25	9.21
			Max. Vy	17	30.35	82.91	-6.68
			Max. Vx	22	-2.00	0.00	0.00
T6	80 - 60	Leg	Max Tension	21	167594.66	-3626.55	19.25
			Max. Compression	19	-207208.51	5393.89	-15.63
			Max. Mx	19	-207208.51	5393.89	-15.63
			Max. My	22	-15724.94	37.06	4719.94
			Max. Vy	15	-269.46	5381.24	-58.13
			Max. Vx	23	-149.14	-2636.44	4288.19
		Diagonal	Max Tension	24	6757.96	0.00	0.00
			Max. Compression	24	-7026.74	0.00	0.00
			Max. Mx	19	5732.16	95.18	-6.51
			Max. My	17	-5841.57	18.31	-10.19
			Max. Vy	21	33.42	89.14	8.09
			Max. Vx	17	2.08	0.00	0.00
T7	60 - 40	Leg	Max Tension	21	190946.40	-3685.78	15.90
			Max. Compression	19	-239690.59	3581.14	-2.14
			Max. Mx	19	-222847.58	5393.89	-15.63
			Max. My	22	-16437.37	37.05	4719.94
			Max. Vy	25	-242.47	-4946.04	13.37
			Max. Vx	16	-209.67	37.06	-4718.48
		Diagonal	Max Tension	24	7124.72	0.00	0.00
			Max. Compression	24	-7373.83	0.00	0.00
			Max. Mx	19	6238.04	131.39	-10.25
			Max. My	17	-5977.68	58.05	-14.58
			Max. Vy	21	49.97	129.78	11.90
			Max. Vx	17	2.82	0.00	0.00
T8	40 - 20	Leg	Max Tension	21	211552.19	-1588.04	23.51
			Max. Compression	19	-271098.51	-274.79	-7.95

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Mx	21	210953.54	-9384.63	38.17
			Max. My	20	-20137.51	2052.15	-4391.99
			Max. Vy	25	883.83	-9360.91	8.81
			Max. Vx	22	211.08	2077.07	4371.16
		Diagonal	Max Tension	24	8264.62	0.00	0.00
			Max. Compression	24	-7779.63	0.00	0.00
			Max. Mx	19	7258.76	140.39	-11.92
			Max. My	17	-6518.59	70.28	-16.02
			Max. Vy	21	54.02	136.50	12.49
			Max. Vx	17	2.95	0.00	0.00
T9	20 - 0	Leg	Max Tension	21	228960.46	4296.04	34.07
			Max. Compression	19	-302480.56	-0.00	-0.05
			Max. Mx	19	-283646.47	12194.44	2.86
			Max. My	20	-25464.26	8075.49	-6770.30
			Max. Vy	25	-1479.79	-9360.91	8.81
			Max. Vx	22	771.73	8101.89	6735.25
		Diagonal	Max Tension	24	11575.20	0.00	0.00
			Max. Compression	24	-9823.19	0.00	0.00
			Max. Mx	21	3078.24	216.51	22.04
			Max. My	17	-8860.12	137.10	-26.33
			Max. Vy	21	70.25	216.51	22.04
			Max. Vx	17	4.13	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Leg C	Max. Vert	23	304896.09	21500.62	-12046.69
	Max. H_x	10	258290.06	22758.19	-12822.55
	Max. H_z	17	-237000.72	-26681.46	15140.69
	Min. Vert	17	-237000.72	-26681.46	15140.69
	Min. H_x	17	-237000.72	-26681.46	15140.69
	Min. H_z	10	258290.06	22758.19	-12822.55
Leg B	Max. Vert	19	307180.69	-21419.19	-12283.39
	Max. H_x	25	-234716.74	26553.79	15264.80
	Max. H_z	25	-234716.74	26553.79	15264.80
	Min. Vert	25	-234716.74	26553.79	15264.80
	Min. H_x	6	259059.82	-22668.42	-13009.93
	Min. H_z	6	259059.82	-22668.42	-13009.93
Leg A	Max. Vert	15	304664.97	245.69	24638.61
	Max. H_x	24	23384.14	1470.13	-4252.74
	Max. H_z	2	258097.54	207.16	26116.46
	Min. Vert	21	-237231.69	-171.27	-30682.09
	Min. H_x	19	-117257.49	-1548.24	-18767.58
	Min. H_z	21	-237231.69	-171.27	-30682.09

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	41544.62	-0.00	-0.00	6644.06	-7665.76	0.03

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+Wind 0 deg - No Ice	41544.62	0.00	-40011.21	-4230522.62	-7714.88	6962.69
Dead+Wind 30 deg - No Ice	41544.44	19610.07	-33965.59	-3617059.43	-2099890.53	9079.03
Dead+Wind 60 deg - No Ice	41544.62	33737.40	-19478.30	-2076680.47	-3616205.78	8858.30
Dead+Wind 90 deg - No Ice	41544.62	39220.25	-0.00	6672.84	-4192039.80	6425.77
Dead+Wind 120 deg - No Ice	41544.62	34650.73	20005.61	2125264.57	-3677210.26	2282.91
Dead+Wind 150 deg - No Ice	41544.62	19610.12	33965.73	3630412.07	-2099868.52	-2623.21
Dead+Wind 180 deg - No Ice	41544.62	0.00	38956.60	4173398.52	-7716.00	-6691.71
Dead+Wind 210 deg - No Ice	41544.44	-19610.02	33965.61	3630421.03	2084445.66	-9078.62
Dead+Wind 240 deg - No Ice	41544.62	-34650.73	20005.61	2125279.66	3661806.37	-9245.60
Dead+Wind 270 deg - No Ice	41544.62	-39220.25	-0.00	6670.95	4176646.56	-6425.86
Dead+Wind 300 deg - No Ice	41544.62	-33737.40	-19478.30	-2076698.01	3600804.40	-2166.59
Dead+Wind 330 deg - No Ice	41544.62	-19610.13	-33965.73	-3617079.53	2084476.58	2622.88
Dead+Ice+Temp	72897.10	-0.00	-0.00	15771.35	-22695.45	-0.07
Dead+Wind 0 deg+Ice+Temp	72897.09	-0.00	-46259.68	-4856080.51	-22865.66	7688.02
Dead+Wind 30 deg+Ice+Temp	72897.09	21530.44	-37291.77	-3982730.67	-2331491.36	9369.99
Dead+Wind 60 deg+Ice+Temp	72897.09	36263.45	-20936.56	-2241113.47	-3932087.58	8826.73
Dead+Wind 90 deg+Ice+Temp	72897.09	43060.83	-0.03	15852.18	-4640051.81	6499.76
Dead+Wind 120 deg+Ice+Temp	72897.09	40062.06	23129.84	2451830.86	-4242067.99	2434.20
Dead+Wind 150 deg+Ice+Temp	72897.09	21530.40	37291.79	4014479.67	-2331438.99	-2807.86
Dead+Wind 180 deg+Ice+Temp	72897.10	-0.00	41873.43	4529845.03	-22868.39	-6784.46
Dead+Wind 210 deg+Ice+Temp	72897.09	-21530.40	37291.79	4014497.20	2285711.21	-9369.57
Dead+Wind 240 deg+Ice+Temp	72897.09	-40062.06	23129.84	2451849.05	4196365.44	-10122.25
Dead+Wind 270 deg+Ice+Temp	72897.09	-43060.84	-0.02	15846.30	4594365.97	-6499.99
Dead+Wind 300 deg+Ice+Temp	72897.10	-36263.45	-20936.71	-2241137.91	3886393.98	-2041.74
Dead+Wind 330 deg+Ice+Temp	72897.09	-21530.44	-37291.77	-3982754.12	2285776.48	2807.63
Dead+Wind 0 deg - Service	41544.62	0.00	-15629.38	-1648526.85	-7699.60	2719.88
Dead+Wind 30 deg - Service	41544.62	7660.21	-13267.86	-1408888.82	-824976.25	3544.47
Dead+Wind 60 deg - Service	41544.62	13178.67	-7608.71	-807163.46	-1417299.37	3460.55
Dead+Wind 90 deg - Service	41544.62	15320.41	-0.00	6665.85	-1642244.33	2514.57
Dead+Wind 120 deg - Service	41544.62	13535.44	7814.69	834263.46	-1441137.13	891.81
Dead+Wind 150 deg - Service	41544.62	7660.21	13267.86	1422225.68	-824969.61	-1029.13
Dead+Wind 180 deg - Service	41544.62	-0.00	15217.42	1634331.82	-7700.36	-2614.23
Dead+Wind 210 deg - Service	41544.62	-7660.21	13267.86	1422227.84	809570.27	-3544.41
Dead+Wind 240 deg - Service	41544.62	-13535.44	7814.69	834265.29	1425741.00	-3611.68
Dead+Wind 270 deg - Service	41544.62	-15320.41	-0.00	6665.10	1626850.01	-2514.57
Dead+Wind 300 deg - Service	41544.62	-13178.67	-7608.71	-807166.53	1401904.06	-846.30
Dead+Wind 330 deg - Service	41544.62	-7660.21	-13267.86	-1408891.67	809578.28	1029.07

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX lb	PY lb	PZ lb	PX lb	PY lb	PZ lb	% Error
1	-0.00	-41544.62	-0.00	0.00	41544.62	0.00	0.000%
2	0.00	-41544.62	-40011.21	-0.00	41544.62	40011.21	0.000%
3	19610.13	-41544.62	-33965.73	-19610.07	41544.44	33965.59	0.000%
4	33737.40	-41544.62	-19478.30	-33737.40	41544.62	19478.30	0.000%
5	39220.25	-41544.62	-0.00	-39220.25	41544.62	0.00	0.000%
6	34650.73	-41544.62	20005.61	-34650.73	41544.62	-20005.61	0.000%
7	19610.13	-41544.62	33965.73	-19610.12	41544.62	-33965.73	0.000%
8	0.00	-41544.62	38956.60	-0.00	41544.62	-38956.60	0.000%
9	-19610.13	-41544.62	33965.73	19610.02	41544.44	-33965.61	0.000%
10	-34650.73	-41544.62	20005.61	34650.73	41544.62	-20005.61	0.000%
11	-39220.25	-41544.62	-0.00	39220.25	41544.62	0.00	0.000%
12	-33737.40	-41544.62	-19478.30	33737.40	41544.62	19478.30	0.000%
13	-19610.13	-41544.62	-33965.73	19610.13	41544.62	33965.73	0.000%
14	-0.00	-72897.10	-0.00	0.00	72897.10	0.00	0.000%
15	0.00	-72897.10	-46259.80	0.00	72897.09	46259.68	0.000%

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
16	21530.46	-72897.10	-37291.86	-21530.44	72897.09	37291.77	0.000%
17	36263.46	-72897.10	-20936.72	-36263.45	72897.09	20936.56	0.000%
18	43060.93	-72897.10	-0.00	-43060.83	72897.09	0.03	0.000%
19	40062.16	-72897.10	23129.90	-40062.06	72897.09	-23129.84	0.000%
20	21530.46	-72897.10	37291.86	-21530.40	72897.09	-37291.79	0.000%
21	-0.00	-72897.10	41873.43	0.00	72897.10	-41873.43	0.000%
22	-21530.46	-72897.10	37291.86	21530.40	72897.09	-37291.79	0.000%
23	-40062.16	-72897.10	23129.90	40062.06	72897.09	-23129.84	0.000%
24	-43060.93	-72897.10	-0.00	43060.84	72897.09	0.02	0.000%
25	-36263.46	-72897.10	-20936.72	36263.45	72897.10	20936.71	0.000%
26	-21530.46	-72897.10	-37291.86	21530.44	72897.09	37291.77	0.000%
27	0.00	-41544.62	-15629.38	-0.00	41544.62	15629.38	0.000%
28	7660.21	-41544.62	-13267.86	-7660.21	41544.62	13267.86	0.000%
29	13178.67	-41544.62	-7608.71	-13178.67	41544.62	7608.71	0.000%
30	15320.41	-41544.62	-0.00	-15320.41	41544.62	0.00	0.000%
31	13535.44	-41544.62	7814.69	-13535.44	41544.62	-7814.69	0.000%
32	7660.21	-41544.62	13267.86	-7660.21	41544.62	-13267.86	0.000%
33	-0.00	-41544.62	15217.42	0.00	41544.62	-15217.42	0.000%
34	-7660.21	-41544.62	13267.86	7660.21	41544.62	-13267.86	0.000%
35	-13535.44	-41544.62	7814.69	13535.44	41544.62	-7814.69	0.000%
36	-15320.41	-41544.62	-0.00	15320.41	41544.62	0.00	0.000%
37	-13178.67	-41544.62	-7608.71	13178.67	41544.62	7608.71	0.000%
38	-7660.21	-41544.62	-13267.86	7660.21	41544.62	13267.86	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	0.00000001
3	Yes	4	0.00000001	0.00000096
4	Yes	4	0.00000001	0.00000001
5	Yes	4	0.00000001	0.00000001
6	Yes	4	0.00000001	0.00000001
7	Yes	4	0.00000001	0.00000001
8	Yes	4	0.00000001	0.00000001
9	Yes	4	0.00000001	0.00000095
10	Yes	4	0.00000001	0.00000001
11	Yes	4	0.00000001	0.00000001
12	Yes	4	0.00000001	0.00000001
13	Yes	4	0.00000001	0.00000001
14	Yes	4	0.00000001	0.00000001
15	Yes	4	0.00000001	0.00000125
16	Yes	4	0.00000001	0.00000196
17	Yes	4	0.00000001	0.00000279
18	Yes	4	0.00000001	0.00000176
19	Yes	4	0.00000001	0.00000122
20	Yes	4	0.00000001	0.00000175
21	Yes	4	0.00000001	0.00000177
22	Yes	4	0.00000001	0.00000196
23	Yes	4	0.00000001	0.00000126
24	Yes	4	0.00000001	0.00000177
25	Yes	4	0.00000001	0.00000177
26	Yes	4	0.00000001	0.00000176
27	Yes	4	0.00000001	0.00000001
28	Yes	4	0.00000001	0.00000001

29	Yes	4	0.00000001	0.00000001
30	Yes	4	0.00000001	0.00000001
31	Yes	4	0.00000001	0.00000001
32	Yes	4	0.00000001	0.00000001
33	Yes	4	0.00000001	0.00000001
34	Yes	4	0.00000001	0.00000001
35	Yes	4	0.00000001	0.00000001
36	Yes	4	0.00000001	0.00000001
37	Yes	4	0.00000001	0.00000001
38	Yes	4	0.00000001	0.00000001

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	180 - 160	7.226	31	0.3998	0.0184
T2	160 - 140	5.565	31	0.3664	0.0152
T3	140 - 120	4.074	31	0.3177	0.0131
T4	120 - 100	2.846	31	0.2446	0.0098
T5	100 - 80	1.903	31	0.1866	0.0071
T6	80 - 60	1.182	31	0.1420	0.0051
T7	60 - 40	0.647	31	0.0967	0.0032
T8	40 - 20	0.292	31	0.0618	0.0021
T9	20 - 0	0.080	31	0.0271	0.0010

Critical Deflections and Radius of Curvature - Service Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* °	*Twist* °	*Radius of Curvature* *ft*
190.00	20' x 3" Dia Omni	31	7.226	0.3998	0.0184	100344
178.00	6 Arm Halo Mount	31	7.057	0.3967	0.0181	100344
170.00	PiROD 12' Lightweight T-Frame	31	6.384	0.3839	0.0168	50172
160.00	PiROD 12' Lightweight T-Frame	31	5.565	0.3664	0.0152	25733
150.00	PiROD 12' Lightweight T-Frame	31	4.791	0.3454	0.0141	20878
140.00	PiROD 12' Lightweight T-Frame	31	4.074	0.3177	0.0131	17887

Maximum Tower Deflections - Design Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	180 - 160	20.796	19	1.1288	0.0531
T2	160 - 140	16.106	19	1.0402	0.0467
T3	140 - 120	11.860	19	0.9102	0.0382
T4	120 - 100	8.324	19	0.7079	0.0279
T5	100 - 80	5.582	19	0.5434	0.0201
T6	80 - 60	3.473	19	0.4150	0.0145
T7	60 - 40	1.905	19	0.2834	0.0092
T8	40 - 20	0.860	19	0.1814	0.0059

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T9	20 - 0	0.235	19	0.0795	0.0027

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
190.00	20' x 3" Dia Omni	19	20.796	1.1288	0.0531	38999
178.00	6 Arm Halo Mount	19	20.319	1.1205	0.0526	38999
170.00	PiROD 12' Lightweight T-Frame	19	18.420	1.0865	0.0503	19499
160.00	PiROD 12' Lightweight T-Frame	19	16.106	1.0402	0.0467	9970
150.00	PiROD 12' Lightweight T-Frame	19	13.907	0.9847	0.0424	7898
140.00	PiROD 12' Lightweight T-Frame	19	11.860	0.9102	0.0382	6647

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load lb	Ratio Load / Allowable	Allowable Ratio	Criteria
T2	160	Leg	A325N	1.0000	6	4366.03	34556.70	0.126 ✔	1.333	Bolt Tension
		Diagonal	A325N	1.0000	1	6746.11	8156.25	0.827 ✔	1.333	Member Bearing
T9	20	Leg	A325N	1.2500	6	37497.00	53993.70	0.694 ✔	1.333	Bolt Tension
		Diagonal	A325N	1.2500	1	11575.20	16992.20	0.681 ✔	1.333	Member Bearing

Compression Checks

Leg Design Data (Compression)

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 P/P_a
T1	180 - 160	1 1/2	20.00	2.38	76.0 K=1.00	19.800	1.7672	-24762.40	34989.80	0.708 ✔
T2	160 - 140	Pirod 105216	20.03	10.02	45.4 K=1.00	25.051	3.6816	-52751.70	92228.10	0.572 ✔
T3	140 - 120	Pirod 105216	20.03	10.02	45.4 K=1.00	25.051	3.6816	-97303.00	92228.10	1.055 ✔
T4	120 - 100	Pirod 105217	20.03	10.02	37.8 K=1.00	26.132	5.3014	-137302.00	138539.00	0.991 ✔
T5	100 - 80	Pirod 105218	20.03	10.02	32.4	26.848	7.2158	-173785.00	193727.00	0.897

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 $\frac{P}{P_a}$
					K=1.00					✓
T6	80 - 60	Pirod 105218	20.03	10.02	32.4 K=1.00	26.848	7.2158	-207209.00	193727.00	1.070 ✓
T7	60 - 40	Pirod 105219	20.03	10.02	28.4 K=1.00	27.351	9.4248	-239691.00	257781.00	0.930 ✓
T8	40 - 20	Pirod 105219	20.03	10.02	28.4 K=1.00	27.351	9.4248	-271099.00	257781.00	1.052 ✓
T9	20 - 0	Pirod 105220	20.03	10.02	25.2 K=1.00	27.723	11.9282	-302481.00	330691.00	0.915 ✓

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	F_a ksi	A in^2	Actual V lb	Allow. V_a lb	Stress Ratio
T2	160 - 140	0.5	1.48	121.0	10.133	0.1963	748.44	2226.75	0.336 ✓
T3	140 - 120	0.5	1.48	121.0	10.133	0.1963	749.07	2226.75	0.336 ✓
T4	120 - 100	0.5	1.47	120.0	10.279	0.1963	185.78	2258.95	0.082 ✓
T5	100 - 80	0.5	1.46	119.0	10.423	0.1963	193.65	2290.46	0.085 ✓
T6	80 - 60	0.5	1.46	119.0	10.423	0.1963	270.13	2290.46	0.118 ✓
T7	60 - 40	0.625	1.45	94.4	13.671	0.3068	249.60	4694.36	0.053 ✓
T8	40 - 20	0.625	1.45	94.4	13.671	0.3068	883.84	4694.36	0.188 ✓
T9	20 - 0	0.625	1.43	93.6	13.766	0.3068	1480.97	4726.89	0.313 ✓

Diagonal Design Data (Compression)

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 $\frac{P}{P_a}$
T1	180 - 160	3/4	4.65	2.25	129.8 K=0.90	8.865	0.4418	-2447.24	3916.38	0.625 ✓
T2	160 - 140	L2 1/2x2 1/2x3/16	11.42	5.00	121.3 K=1.00	10.097	0.9020	-6889.00	9107.43	0.756 ✓
T3	140 - 120	L2 1/2x2 1/2x3/16	12.50	5.84	136.4 K=0.96	8.027	0.9020	-7466.26	7240.08	1.031 ✓
T4	120 - 100	L2 1/2x2 1/2x3/16	13.80	6.54	149.3 K=0.94	6.697	0.9020	-6940.11	6040.72	1.149 ✓
T5	100 - 80	L3x3x3/16	15.24	7.29	140.4 K=0.96	7.571	1.0900	-6918.29	8251.92	0.838 ✓

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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 $\frac{P}{P_a}$
T6	80 - 60	L3x3x3/16	16.80	8.09	152.7 K=0.94	6.402	1.0900	-7026.74	6978.45	1.007 ✔
T7	60 - 40	L3x3x5/16	18.45	8.93	167.2 K=0.92	5.343	1.7800	-7279.76	9510.22	0.765 ✔
T8	40 - 20	L3x3x5/16	19.30	9.36	174.0 K=0.91	4.933	1.7800	-7779.63	8781.58	0.886 ✔
T9	20 - 0	L3 1/2x3 1/2x5/16	21.03	10.01	174.1 K=1.00	4.928	2.0900	-9823.19	10300.30	0.954 ✔

Horizontal Design Data (Compression)

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 $\frac{P}{P_a}$
T1	180 - 160	3/4	4.00	3.88	173.6 K=0.70	4.955	0.4418	-363.40	2189.09	0.166 ✔

Top Girt Design Data (Compression)

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 $\frac{P}{P_a}$
T1	180 - 160	7/8	4.00	3.88	148.8 K=0.70	6.744	0.6013	-176.44	4055.56	0.044 ✔

Bottom Girt Design Data (Compression)

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 $\frac{P}{P_a}$
T1	180 - 160	7/8	4.00	3.88	148.8 K=0.70	6.744	0.6013	-391.75	4055.56	0.097 ✔

Tension Checks

Leg Design Data (Tension)

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 $\frac{P}{P_a}$

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 $\frac{P}{P_a}$
T1	180 - 160	1 1/2	20.00	2.38	76.0	30.000	1.7672	20401.50	53014.40	0.385 ✔
T2	160 - 140	Pirod 105216	20.03	10.02	45.4	30.000	3.6816	42627.90	110447.00	0.386 ✔
T3	140 - 120	Pirod 105216	20.03	10.02	45.4	30.000	3.6816	80818.50	110447.00	0.732 ✔
T4	120 - 100	Pirod 105217	20.03	10.02	37.8	30.000	5.3014	113755.00	159043.00	0.715 ✔
T5	100 - 80	Pirod 105218	20.03	10.02	32.4	30.000	7.2158	142278.00	216475.00	0.657 ✔
T6	80 - 60	Pirod 105218	20.03	10.02	32.4	30.000	7.2158	167595.00	216475.00	0.774 ✔
T7	60 - 40	Pirod 105219	20.03	10.02	28.4	30.000	9.4248	190946.00	282743.00	0.675 ✔
T8	40 - 20	Pirod 105219	20.03	10.02	28.4	30.000	9.4248	211552.00	282743.00	0.748 ✔
T9	20 - 0	Pirod 105220	20.03	10.02	25.2	30.000	11.9282	228960.00	357847.00	0.640 ✔

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	F_a ksi	A in^2	Actual V lb	Allow. V_a lb	Stress Ratio
T2	160 - 140	0.5	1.48	121.0	10.133	0.1963	748.44	2226.75	0.336 ✔
T3	140 - 120	0.5	1.48	121.0	10.133	0.1963	749.07	2226.75	0.336 ✔
T4	120 - 100	0.5	1.47	120.0	10.279	0.1963	185.78	2258.95	0.082 ✔
T5	100 - 80	0.5	1.46	119.0	10.423	0.1963	193.65	2290.46	0.085 ✔
T6	80 - 60	0.5	1.46	119.0	10.423	0.1963	270.13	2290.46	0.118 ✔
T7	60 - 40	0.625	1.45	94.4	13.671	0.3068	249.60	4694.36	0.053 ✔
T8	40 - 20	0.625	1.45	94.4	13.671	0.3068	883.84	4694.36	0.188 ✔
T9	20 - 0	0.625	1.43	93.6	13.766	0.3068	1480.97	4726.89	0.313 ✔

Diagonal Design Data (Tension)

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 $\frac{P}{P_a}$
T1	180 - 160	3/4	4.65	2.25	144.2	30.000	0.4418	2409.86	13253.60	0.182

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 $\frac{P}{P_a}$
T2	160 - 140	L2 1/2x2 1/2x3/16	11.42	5.00	80.1	21.600	0.9020	6746.11	19483.20	0.346 ✔
T3	140 - 120	L2 1/2x2 1/2x3/16	11.93	5.59	86.2	21.600	0.9020	7346.84	19483.20	0.377 ✔
T4	120 - 100	L2 1/2x2 1/2x3/16	13.13	6.22	96.0	21.600	0.9020	6829.65	19483.20	0.351 ✔
T5	100 - 80	L3x3x3/16	14.50	6.93	88.6	21.600	1.0900	6715.59	23544.00	0.285 ✔
T6	80 - 60	L3x3x3/16	16.01	7.70	98.4	21.600	1.0900	6757.96	23544.00	0.287 ✔
T7	60 - 40	L3x3x5/16	18.45	8.93	116.2	21.600	1.7800	7124.72	38448.00	0.185 ✔
T8	40 - 20	L3x3x5/16	20.16	9.79	127.4	21.600	1.7800	8264.62	38448.00	0.215 ✔
T9	20 - 0	L3 1/2x3 1/2x5/16	21.92	10.45	118.6	21.600	2.0900	11575.20	45144.00	0.256 ✔

Horizontal Design Data (Tension)

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 $\frac{P}{P_a}$
T1	180 - 160	3/4	4.00	3.88	248.0	30.000	0.4418	564.02	13253.60	0.043 ✔

Top Girt Design Data (Tension)

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 $\frac{P}{P_a}$
T1	180 - 160	7/8	4.00	3.88	212.6	30.000	0.6013	134.75	18039.60	0.007 ✔

Bottom Girt Design Data (Tension)

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 $\frac{P}{P_a}$
T1	180 - 160	7/8	4.00	3.88	212.6	30.000	0.6013	477.37	18039.60	0.026 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
T1	180 - 160	Leg	1 1/2	3	-24762.40	46641.40	53.1	Pass
T2	160 - 140	Leg	Pirod 105216	66	-52751.70	122940.05	42.9	Pass
T3	140 - 120	Leg	Pirod 105216	81	-97303.00	122940.05	79.1	Pass
T4	120 - 100	Leg	Pirod 105217	96	-137302.00	184672.48	74.3	Pass
T5	100 - 80	Leg	Pirod 105218	111	-173785.00	258238.08	67.3	Pass
T6	80 - 60	Leg	Pirod 105218	126	-207209.00	258238.08	80.2	Pass
T7	60 - 40	Leg	Pirod 105219	141	-239691.00	343622.06	69.8	Pass
T8	40 - 20	Leg	Pirod 105219	156	-271099.00	343622.06	78.9	Pass
T9	20 - 0	Leg	Pirod 105220	171	-302481.00	440811.08	68.6	Pass
T1	180 - 160	Diagonal	3/4	12	-2447.24	5220.53	46.9	Pass
T2	160 - 140	Diagonal	L2 1/2x2 1/2x3/16	71	-6889.00	12140.20	56.7 62.0 (b)	Pass
T3	140 - 120	Diagonal	L2 1/2x2 1/2x3/16	86	-7466.26	9651.03	77.4	Pass
T4	120 - 100	Diagonal	L2 1/2x2 1/2x3/16	101	-6940.11	8052.28	86.2	Pass
T5	100 - 80	Diagonal	L3x3x3/16	113	-6918.29	10999.81	62.9	Pass
T6	80 - 60	Diagonal	L3x3x3/16	128	-7026.74	9302.27	75.5	Pass
T7	60 - 40	Diagonal	L3x3x5/16	143	-7279.76	12677.12	57.4	Pass
T8	40 - 20	Diagonal	L3x3x5/16	164	-7779.63	11705.85	66.5	Pass
T9	20 - 0	Diagonal	L3 1/2x3 1/2x5/16	179	-9823.19	13730.30	71.5	Pass
T1	180 - 160	Horizontal	3/4	16	-363.40	2918.06	12.5	Pass
T1	180 - 160	Top Girt	7/8	6	-176.44	5406.06	3.3	Pass
T1	180 - 160	Bottom Girt	7/8	7	-391.75	5406.06	7.2	Pass
							Summary	
						Leg (T6)	80.2	Pass
						Diagonal (T4)	86.2	Pass
						Horizontal (T1)	12.5	Pass
						Top Girt (T1)	3.3	Pass
						Bottom Girt (T1)	7.2	Pass
						Bolt Checks	62.0	Pass
						RATING =	**86.2**	**Pass**

ANCHOR BOLT ANALYSIS

Input Data

Max Pier Reactions:

Uplift:	Uplift := 238·kips	*user input*
Shear:	Shear := 31·kips	*user input*
Compression:	Compression := 308·kips	*user input*

Anchor Bolt Data:

Use ASTM A687

Number of Anchor Bolts = N	N := 6	*user input*	
Bolt Ultimate Strength:	F_u := 150·ksi	*user input*	
Bolt Yield Strength:	Fy := 105·ksi	*user input*	
Bolt Modulus:	E := 29000·ksi	*user input*	
Thickness of Anchor Bolts	D := 1.25in	*user input*	
Threads per Inch:	n := 8	*user input*	
Coefficient of Friction:	μ := 0.55	*user input*	(for baseplate with grout ASCE 10-97)

Anchor Bolt Area:

Gross Area of Bolt:

$$A_g := \frac{\pi}{4} \cdot D^2 \qquad A_g = 1.227 \cdot in^2$$

Net Area of Bolt:

$$A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 \qquad A_n = 1.000 \cdot in^2$$

Check Tensile Forces:

Maximum Tensile Force (Gross Area):

$$AllowableTension := 1.33 \cdot \left(0.33 \cdot A_g \cdot F_u\right) \qquad AllowableTension = 80.8 \cdot kips$$

Note: 1.33 increase allowed per TIA/EIA

Maximum Tensile Force (Net Area):

$$F_{net.area} := 1.33 \cdot \left(0.60 \cdot A_n \cdot Fy\right) \qquad F_{net.area} = 83.8 \cdot kips$$

Note: 1.33 increase allowed per TIA/EIA

Applied Tension:

$$MaxTension := \frac{Uplift}{N} \qquad MaxTension = 39.7 \cdot kips$$

Check Stresses:

$$\frac{MaxTension}{F_{net.area}} = 0.47$$

$$Condition1 := if\left(\frac{MaxTension}{F_{net.area}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$$

$$\boxed{Condition1 = \text{"OK"}}$$

Check Anchor Bolt Area:

Based on the ASCE 10-97 Design of Latticed Steel Transmission Structures

Required Area:

$$A_{s1} := \frac{Uplift}{Fy} + \frac{Shear}{\mu \cdot 0.85 \cdot Fy} \qquad A_{s1} = 2.9 \cdot in^2$$

$$A_{s2} := \left| \frac{Shear - (0.3 \cdot Compression)}{\mu \cdot 0.85 \cdot Fy} \right| \qquad A_{s2} = 1.3 \cdot in^2$$

Provided Area:

$$A_{sprovided} := A_n \cdot N \qquad A_{sprovided} = 6.0 \cdot in^2$$

$$Condition2 := if\left(\frac{A_{s1}}{A_{sprovided}} \le 1.00, "OK", "Overstressed"\right) \qquad \frac{A_{s1}}{A_{sprovided}} = 0.5$$

$$Condition2 = "OK"$$

$$Condition3 := if\left(\frac{A_{s2}}{A_{sprovided}} \le 1.00, "OK", "Overstressed"\right) \qquad \frac{A_{s2}}{A_{sprovided}} = 0.2$$

$$Condition3 = "OK"$$

PIER AND MAT FOUNDATION ANALYSIS - 3 PIERS

TOWER FORCES:

Moment Caused by Tower	$M_t := 4900 \cdot kip \cdot ft$
Shear at Base of Tower	$S_t := 46.3 \cdot kip$
Max Compressive Force	$C_t := 308 \cdot kip$
Max Uplift	$U_t := 238 \cdot kip$
Height of Tower	$H_t := 180 \cdot ft$
Width of Tower at Base	$W_t := 20 \cdot ft$
Weight of Tower	$WT_t := 73 \cdot kip$

FOOTING DIMENSIONS:

Width of Footing	$W_f := 28.5 \cdot ft$
Overall Depth of Footing	$D_f := 6ft$
Length of Pier	$L_p := 3.75 \cdot ft$
Extension of Pier Above Grade	$L_{pag} := 0.5 \cdot ft$
Diameter of Pier	$d_p := 5.0 \cdot ft$
Thickness of Footing	$T_f := 2.75 \cdot ft$
Reinforement Cover:	$Cvr := 3in$

MATERIAL PROPERTIES:

Compressive Strength of Concrete	$f'c := 3500 \cdot psi$	Unit Weight of Soil	$\gamma_s := 120 \cdot pcf$
Yield Strength of Steel Reinforcement	$fy := 60000 \cdot psi$	Unit Weight of Concrete	$\gamma_c := 150 \cdot pcf$
Internal Friction Angle of Soil	$\phi_s := 30 \cdot deg$	Depth to Neglect	$n := 0 \cdot ft$
Allowable Bearing Capacity	$q_s := 3000 \cdot psf$	Cohesion of Clay Type Soil Note: Use 0 for Sandy Soil	$c := 0 \cdot ksf$

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

What is Position of Center of Tower with respect to Center of Pad? 1=Offset 2=Not Offset $Pos_{tower} := 1$

STEEL REINFORCING:

PIER REINFORCEMENT:

Bar Size	$BSpier := 8$	Bar Diameter	$d_{bpier} := 1.0 \cdot in$
Number of Bars	$NBpier := 18$	Bar Area	$A_{bpier} := 0.79 \cdot in^2$

PAD REINFORCEMENT:

Bar Size	$BS_{pad} := 9$	Bar Diameter	$d_{bpad} := 1.128 \cdot in$
Number of Bars	$NB_{pad} := 35$	Bar Area	$A_{bpad} := 1.00 \cdot in^2$

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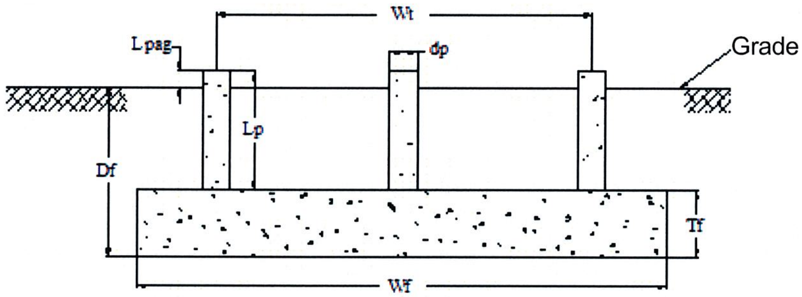
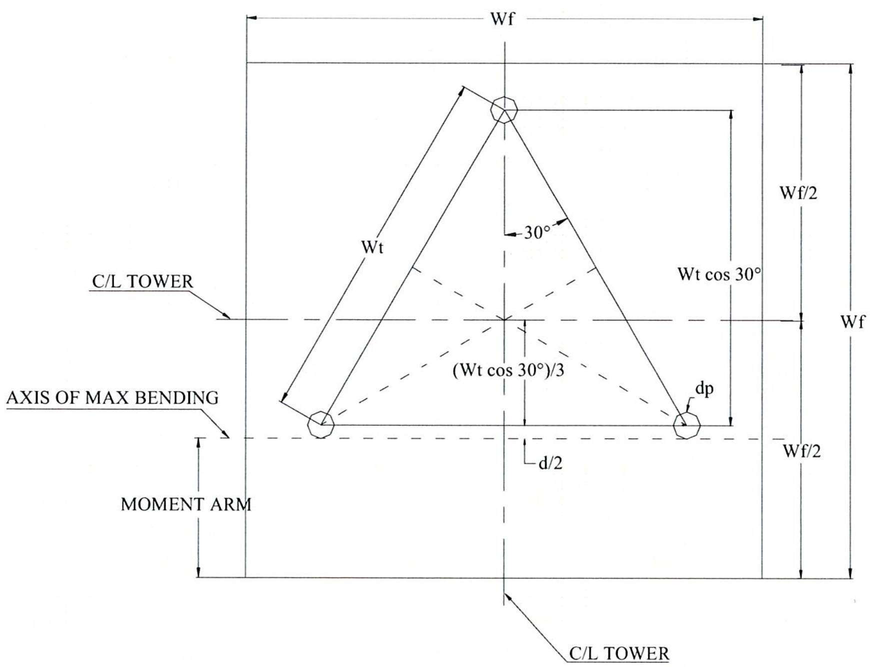
Job	180' Valmont Lattice – E. Hartland	**Project No.**	07075	**Page**	2 of 10
Description	Foundation Analysis	**Computed by**	JEK	**Date**	4/22/2008

FOUNDATION OVERVIEW



ELEVATION



PLAN

STABILITY OF FOOTING

Factor of Safety Req'd: $FS_{req} := 2.0$

Passive Pressure:

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

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p}$ $\qquad P_{pt} = 1.17 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}]$ $\qquad P_{top} = 1.17 \cdot ksf$

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p}$ $\qquad P_{bot} = 2.16 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2}$ $\qquad P_{ave} = 1.665 \cdot ksf$

Shear:

$T_{pp} := if[n < (D_f - T_f), T_f, (D_f - n)]$ $\qquad T_{pp} = 2.75 \cdot ft$

$A_{pp} := W_f \cdot T_{pp}$ $\qquad A_{pp} = 78.375 \cdot ft^2$

Ultimate Shear: $S_u := P_{ave} \cdot A_{pp}$ $\qquad S_u = 130.4944 \cdot kip$

Weight of Concrete Pad: $WT_c := (W_f^2 \cdot T_f) \cdot \gamma_c$ $\qquad WT_c = 335.0531 \cdot kip$

Weight of Soil: above Footing: $WT_{s1} := W_f^2 (|D_f - T_f|) \cdot \gamma_s$ $\qquad WT_{s1} = 316.7775 \cdot kip$

Weight of Soil Wedge at back face: $WT_{s2} := \left[\frac{(D_f - n)^2 \cdot \tan(\phi_s)}{2} \cdot W_f\right] \cdot \gamma_s$ $\qquad WT_{s2} = 35.5417 \cdot kip$

Distance to center of Tower Leg from Edge of Footing:

$X_{t1} := \frac{W_f}{2} - \frac{W_t \cdot \cos(30 \cdot deg)}{2}$ $\qquad X_{t2} := \frac{W_f}{2} - \frac{W_t \cdot \cos(30 \cdot deg)}{3}$

$X_t := if(Pos_{tower} = 1, X_{t1}, X_{t2})$ $\qquad X_t = 5.5897 \cdot ft$

Additional Offset of Footing:

$X_{off1} := \frac{W_f}{2} - \left(\frac{W_t \cdot \cos(30 \cdot deg)}{3} + X_t\right)$ $\qquad X_{off2} := 0$

$X_{off} := if(Pos_{tower} = 1, X_{off1}, X_{off2})$ $\qquad X_{off} = 2.8868 \cdot ft$

Resisting Moment:

$M_r := (WT_c + WT_{s1}) \cdot \frac{W_f}{2} + WT_t \cdot \left(\frac{W_f}{2} - X_{off}\right) + S_u \cdot \frac{T_{pp}}{3} + WT_{s2} \cdot \left(W_f + \frac{T_{pp} \cdot \tan(\phi_s)}{3}\right)$

$M_r = 11269.4714 \cdot kip \cdot ft$

Overturning Moment: $M_{ot} := M_t + S_t \cdot (L_p + T_f) + WT_t \cdot X_{off}$ $\qquad M_{ot} = 5411.6828 \cdot kip \cdot ft$

Factor of Safety: $FS := \frac{M_r}{M_{ot}}$ $\qquad FS = 2.0824$

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

BEARING PRESSURE CHECK:

Pressure Applied:

$LOAD_{tot} := WT_c + WT_{s1} + WT_t$ $\quad LOAD_{tot} = 724.8306 \cdot kip$

$A_{mat} := W_f^{\,2}$ $\quad A_{mat} = 812.25 \cdot ft^2$

$S := \frac{W_f^{\,3}}{6}$ $\quad S = 3858.1875 \cdot ft^3$

$P_{max} := \frac{LOAD_{tot}}{A_{mat}} + \frac{M_{ot}}{S}$ $\quad P_{max} = 2.295 \cdot ksf$

$P_{min} := \frac{LOAD_{tot}}{A_{mat}} - \frac{M_{ot}}{S}$ $\quad P_{min} = -0.5103 \cdot ksf$

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

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

Distance to Resultant of Pressure Distribution:

$X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3}$ $\quad X_p = 7.772 \cdot ft$

Distance to Kern: $X_k := \frac{W_f}{3}$ $\quad X_k = 9.5 \cdot ft$

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

Eccentricity: $e := \frac{M_{ot}}{LOAD_{tot}}$ $\quad e = 7.4661$

Adjusted Soil Pressure: $q_a := \frac{2 \cdot LOAD_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)}$ $\quad q_a = 2.4993 \cdot ksf$

Revised Maximum: $q_{max} := if(X_p < X_k, q_a, P_{max})$ $\quad q_{max} = 2.4993 \cdot kip$

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

CHECK PUNCHING AND BEAM SHEAR:

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

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

$\phi_c := .85$ (ACI 9.3.2.3)

$d := T_f - Cvr - .5 \cdot in$ $d = 29.5 \cdot in$

Factored load: $FL := LF \cdot \frac{C_t}{W_f^2}$ $FL = 0.493 \cdot ksf$

$V_{req} := \frac{FL \cdot (X_t - 0.5 \cdot d_p - d) \cdot W_f}{\phi_c}$ $V_{req} = 10.4362 \cdot kip$

ACI 11.3.1.1 $V_{Avail} := 2 \cdot \sqrt{f'c \cdot psi} \cdot W_f \cdot d$ $V_{Avail} = 1193.7466 \cdot kip$

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

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

$b_o := (d_p + d) \cdot \pi$ $b_o = 23.431 \cdot ft$

$V_{req} := FL \cdot \frac{W_f^2 - (d_p + d)^2 \cdot \frac{\pi}{4}}{\phi_c}$ $V_{req} = 445.7216 \cdot kip$

$V_{Avail} := 4 \cdot \sqrt{f'c \cdot psi} \cdot b_o \cdot d$ $V_{Avail} = 1962.8582 \cdot kip$

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

TENSILE REINFORCEMENT IN PAD:

$\phi_m := .90$ per ACI 9.3.2.2

Applied Moments:

$$M_{nT} := LF\cdot\left[U_t\cdot\left(W_t\cdot\sin(60\cdot deg) - \frac{d_p}{2}\right) + S_t\cdot\left(D_f + L_{pag}\right)\right] - WT_t\cdot X_{off}$$

$$M_{nS} := -1\cdot\left[\frac{1}{2}\cdot\left(\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2}\right)^2\cdot W_t\cdot\left[\gamma_s\cdot\left(T_{pp} - T_f\right)\right] + WT_{s2}\cdot\left[\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2} + \left(D_f - n\right)\cdot\tan\left(\phi_s\right)\right]\right]$$

$$M_{nC} := -1\cdot\left[\frac{1}{2}\cdot\left(\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2}\right)^2\cdot W_t\cdot\left(\gamma_c\cdot T_f\right)\right]$$

Design Moment: $M_n := \dfrac{M_{nT} + M_{nS} + M_{nC}}{\phi_m}$ $\quad M_n = 3059.2843\cdot kips\cdot ft$

Required Reinforcement:

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

Effective Width: $b_{eff} := W_t\cdot\cos(30\cdot deg) + d_p$ $\quad b_{eff} = 267.8461\cdot in$

$A_s := \dfrac{M_n}{\phi_m\cdot fy\cdot d}$ $\quad A_s = 23.0455\cdot in^2$

$a := \dfrac{A_s\cdot fy}{\beta\cdot f'c\cdot b_{eff}}$ $\quad a = 1.7353\cdot in$

$A_s := \dfrac{M_n}{fy\cdot\left(d - \frac{a}{2}\right)}$ $\quad A_s = 21.3694\cdot in^2$

$\rho := \dfrac{A_s}{b_{eff}\cdot d}$ $\quad \rho = 0.0027$

Temperature and Shrinkage: (ACI 7.12.2.1b) $\rho_{sh} := \text{if}(fy \geq 60000 \cdot psi, 0.0018, 0.0020)$ $\rho_{sh} = 0.0018$

Area Required: $As := \text{if}\left(\rho \geq \rho_{sh}, A_s, \rho_{sh} \cdot \frac{b_{eff}}{2} \cdot d\right)$ $As = 21.3694 \cdot in^2$

Area Provided: $As_{prov} := A_{bpad} \cdot NB_{pad}$ $As_{prov} = 35 \cdot in^2$

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

DEVELOPMENT LENGTH OF PAD REINFORCEMENT:

TENSION (ACI 12.2.3)

Bar Spacing: $B_{sPad} := \frac{W_f - 2 \cdot Cvr - NB_{pad} \cdot d_{bpad}}{NB_{pad} - 1}$ $B_{sPad} = 8.7212 \cdot in$

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

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

Development Length: $L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \gamma \cdot \lambda}{\frac{c + k_{tr}}{d_{bpad}}} \cdot d_{bpad}$ $L_{dbt} = 32.2608 \cdot in$

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

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

Available Length in Pad: $L_{Pad} := \frac{W_f}{2} - \frac{W_t}{2} - Cvr$ $L_{Pad} = 48 \cdot in$

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

REINFORCEMENT IN PIER:

Pier Area: $A_p := \frac{\pi \cdot d_p^2}{4}$ $\quad A_p = 2827.4334 \cdot in^2$

(ACI 10.8.4 and 10.9.1) $A_{smin} := 0.01 \cdot 0.5 \cdot A_p$ $\quad A_{smin} = 14.1372 \cdot in^2$

$A_{sprov} := NBpier \cdot A_{bpier}$ $\quad A_{sprov} = 14.22 \cdot in^2$

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

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: $B_{sPier} := \frac{d_p \cdot \pi}{NBpier} - d_{bpier}$ $\quad B_{sPier} = 9.472 \cdot in$

Diamter of Reinforcement Cage: $Diam_{cage} := d_p - 2 \cdot Cvr$ $\quad Diam_{cage} = 54 \cdot in$

Maximum Moment in Pier: $M_p := (S_t \cdot L_p) \cdot LF$ $\quad M_p = 2708.55 \cdot kips \cdot in$

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

(defined variables) $\quad (f'_c \;\; f_y \;\; cl \;\; Spiral) = (3 \;\; 60 \;\; 4 \;\; 0)$

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: $\quad (D \;\; N \;\; n \;\; P_u \;\; M_{xu}) := (60 \;\; 18 \;\; 8 \;\; 308 \;\; 2708)$

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

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

The Output is given as useable axial load in kips, moment capacity in kip inches, splicing stress in ksi, and reinforcement ratio: $\quad (\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho) = (3753.8785 \;\; 33004.8799 \;\; -32.7131 \;\; 0.005)$

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

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

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

DEVELOPMENT LENGTH OF PIER REINFORCEMENT:

TENSION (ACI 12.2.3)

Spacing and Cover: $Cvr = 3 \cdot in$ $\quad B_{sPier} = 9.472 \cdot in$

Factors for development:

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

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

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

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \gamma \cdot \lambda}{\frac{c + k_{tr}}{d_{bpier}}} \cdot d_{bpier} \qquad L_{dbt} = 25.3546 \cdot in$$

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

$L_{dbtCheck} := if\left(L_{dbt} \geq L_{dbmin}, \text{"Use L.dbt"}, \text{"Use L.dbmin"}\right)$ $\quad L_{dbtCheck} = \text{"Use L.dbt"}$

COMPRESSION: (ACI 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot fy}{\sqrt{f'c \cdot psi}} \qquad L_{dbc1} = 20.2837 \cdot in$$

$$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot fy\right) \qquad L_{dbmin} = 18 \cdot in$$

$$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) \qquad L_{dbc} = 20.2837 \cdot in$$

Available Length in Pier:

$L_{pier} := L_p - 3\cdot in$ $\quad$ $L_{pier} = 42\cdot in$

$L_{piertension} := if(L_{pier} > L_{dbt}, \text{"Okay"}, \text{"No Good"})$ $\quad$ $L_{piertension} = \text{"Okay"}$

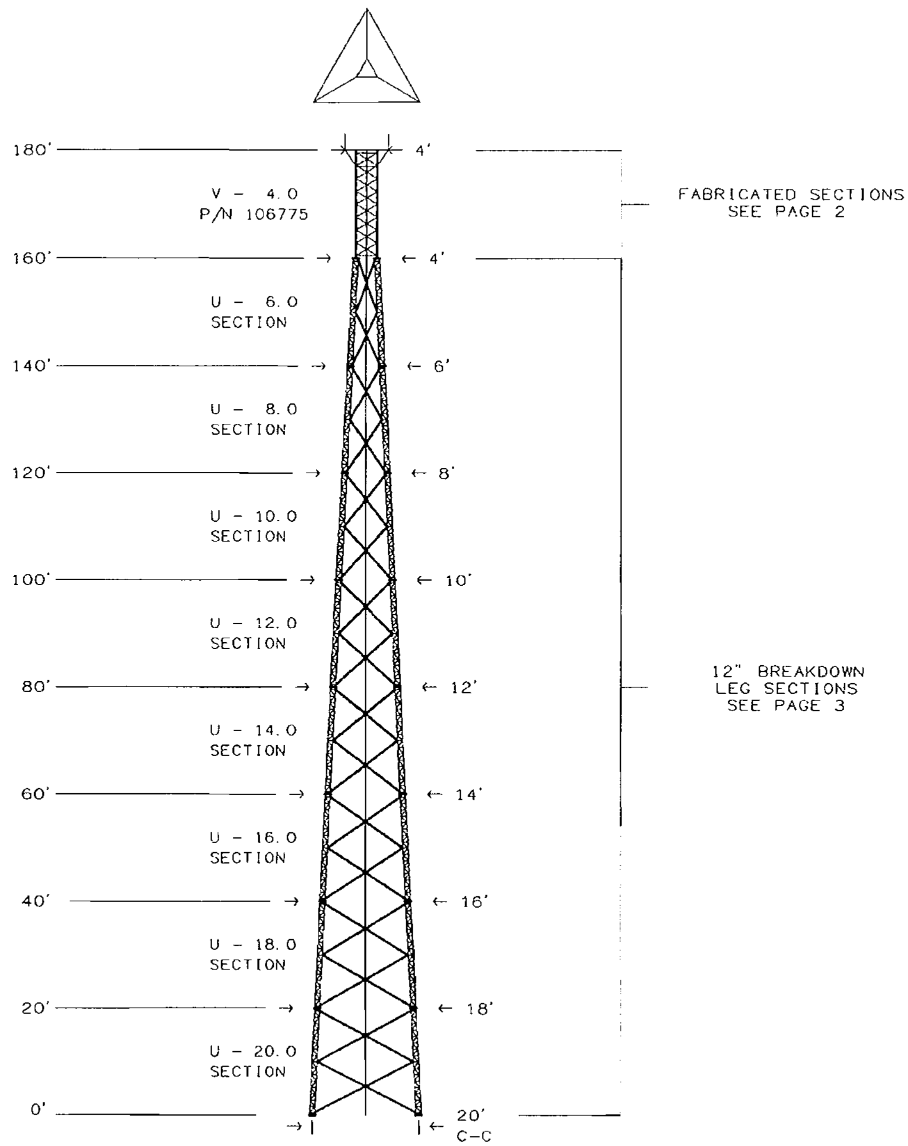
$L_{piercompression} := if(L_{pier} > L_{dbc}, \text{"Okay"}, \text{"No Good"})$ $\quad$ $L_{piercompression} = \text{"Okay"}$

Available Length in Pad:

$L_{pad} := T_f - 3\cdot in$ $\quad$ $L_{pad} = 30\cdot in$

$L_{padtension} := if(L_{pad} > L_{dbt}, \text{"Okay"}, \text{"No Good"})$ $\quad$ $L_{padtension} = \text{"Okay"}$

$L_{padcompression} := if(L_{pad} > L_{dbc}, \text{"Okay"}, \text{"No Good"})$ $\quad$ $L_{padcompression} = \text{"Okay"}$



ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

A	FOUNDATION PER SOIL REPORT	TMW	04/12/2006
REV	DESCRIPTION OF REVISIONS	INI	DATE

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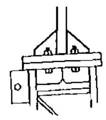
FABRICATED SECTION DATA 160' - 180' ELEVATION								
SECT LEN	SEC #	SECTION PART#	LEG SIZE	BRACE SIZE	SECT WT. *	BOLTS AT BOTTOM DIAM	LENGTH	#
20'	V- 4.0	106775	1- 1/2 "	3/4 "	828#	1 "	3-1/2"	18

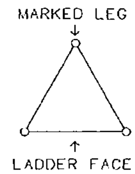
* THE WEIGHTS LISTED ARE THEORETICAL. THE ACTUAL WEIGHTS WILL VARY. ALL WEIGHTS SHOULD BE CONFIRMED IN THE FIELD PRIOR TO ERECTION.

FABRICATED SECTIONS
TRANSITION SIDE VIEW
AT 160' ELEVATION



USE 1 FLATWASHER UNDER EACH LOCKNUT ON LEG CONNECTION.

FABRICATED SECTIONS
GENERAL SECTION ASSEMBLY
TOP VIEW



THE MARKED LEG OF EACH SECTION IS STAMPED WITH THE 6 DIGITS OF THE TOWER SERIAL #. ASSEMBLE THE TOWER WITH MARKED LEGS TOGETHER. THE MARKED LEG MAY ALSO CONTAIN JOINT NUMBERS STARTING WITH 1 AT THE TOP OF THE BASE SECTION. IF SO, ERECT WITH JOINTS IN THE PROPER SEQUENCE.

ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

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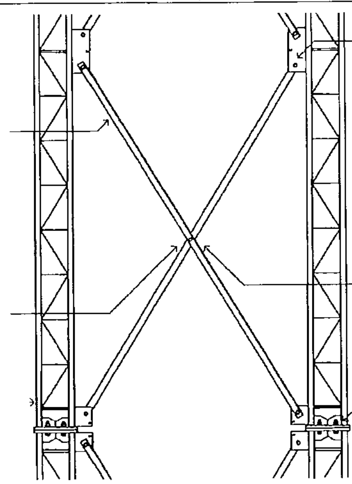
BREAKDOWN SECTION DATA (12" LEG) 0' - 160' ELEVATION

SEC #	SECTION LENGTH	LEG SIZE	LEG PART#	TOP DIAG PART#	BOT DIAG PART#	DIAGONAL ANGLE FACE	DIAGONAL ANGLE THICK	SECTION WEIGHT	LEG CONNECT+ DIAM	LEG CONNECT+ LENGTH	DIAG CONNECT DIAM	DIAG CONNECT LENGTH
U- 6. 0	20'	1- 1/4"	195554	105898	105556	2-1/2"	3/16"	1921#	1 "	3-1/2"	1 "	2-1/4"
U- 8. 0	20'	1- 1/4"	195554	105558	105561	2-1/2"	3/16"	1950#	1 "	3-1/2"	1 "	2-1/4"
U-10. 0	20'	1- 1/2"	195555	105564	105567	2-1/2"	3/16"	2346#	1 "	3-1/2"	1 "	2-1/4"
U-12. 0	20'	1- 3/4"	195557	105571	105574	3"	3/16"	2914#	1 "	3-1/2"	1 "	2-1/4"
U-14. 0	20'	1- 3/4"	195557	105576	105579	3"	3/16"	2980#	1 "	4-1/4"	1 "	2-1/4"
U-16. 0	20'	2 "	195559	113411	113412	3"	5/16"	4215#	1-1/4"	4-1/2"	1-1/4"	2-3/4"
U-18. 0	20'	2 "	195559	128185	128186	3"	5/16"	4335#	1-1/4"	4-1/2"	1-1/4"	2-3/4"
U-20. 0	20'	2- 1/4"	195560	105598	105601	3-1/2"	5/16"	5256#			1-1/4"	2-3/4"

* THE WEIGHTS LISTED ARE THEORETICAL. THE ACTUAL WEIGHTS WILL VARY. ALL WEIGHTS SHOULD BE CONFIRMED IN THE FIELD PRIOR TO ERECTION.

\+ USE 1 FLATWASHER UNDER EACH LOCKNUT, FOR LEG CONNECTION ONLY. ALSO USE 1 FLATWASHER UNDER EACH BOLT HEAD WHERE BUSHINGS ARE REQUIRED.

TYPICAL BREAKDOWN SECTION ASSEMBLY (12" LEG) 0' - 160' ELEVATION



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ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

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GENERAL NOTES

1. TOWER DESIGN CONFORMS TO STANDARD TIA-222-G UTILIZING AN 100 MPH 3-SEC GUST BASIC WIND SPEED WITH A STRUCTURE CLASS II, EXPOSURE B CRITERIA AND TOPOGRAPHIC CATEGORY 3, CREST HEIGHT=300', WITH NO ICE.
   TOWER DESIGN CONFORMS TO STANDARD TIA-222-G UTILIZING AN 40 MPH 3-SEC GUST BASIC WIND SPEED WITH A STRUCTURE CLASS II, EXPOSURE B CRITERIA AND TOPOGRAPHIC CATEGORY 3, CREST HEIGHT=300', WITH 1" RADIAL ICE.
2. NO TWIST AND SWAY LIMITATIONS SPECIFIED OR USED FOR THIS TOWER.
3. MATERIAL:
   (A) SOLID RODS TO ASTM A572 GRADE 50.
   (B) ANGLES TO ASTM A36.
   (C) PIPE TO ASTM A500 GRADE B.
   (D) STEEL PLATES TO ASTM A36.
   (E) CONNECTION BOLTS TO ASTM A325 OR ASTM A449 (Fu=120 KSI AND Fy=92 KSI) AND ANCHOR BOLTS TO ASTM A687 (Fu=150 KSI AND Fy=105 KSI).
4. BASE REACTIONS PER TIA-222-G FOR 100 MPH BASIC WIND SPEED WITH NO ICE:
   TOTAL WEIGHT = 53.1 KIPS. MAXIMUM COMPRESSION = 395.6 KIPS PER LEG.
   MOMENT = 6545.2 KIP-FT. MAXIMUM UPLIFT = 354.8 KIPS PER LEG.
   MAXIMUM SHEAR = 67.4 KIPS TOTAL.
5. BASE REACTIONS PER TIA-222-G FOR 40 MPH BASIC WIND SPEED WITH ICE:
   TOTAL WEIGHT = 223.2 KIPS.
   MOMENT = 1441.5 KIP-FT.
   MAXIMUM SHEAR = 13.8 KIPS TOTAL.
6. FINISH: ALL BOLTS ARE GALVANIZED IN ACCORDANCE WITH ASTM A153 (HOT DIPPED) OR ASTM B695 CLASS 50 (MECHANICAL). ALL OTHER STRUCTURAL MATERIALS ARE GALVANIZED IN ACCORDANCE WITH ASTM123.
7. ANTENNAS:
   180'-(5) DECIBEL -DB809K ON (1) 6 ARM HALO MOUNT WITH 1-5/8" LINES
   180'-(4) DECIBEL -DB224 ON SAME HALO MOUNT WITH 7/8" LINES
   180'-(2) DECIBEL -BD420 ON SAME HALO MOUNT WITH 1-1/4" LINES
   180'-(1) SCALA -PR950 ON SAME HALO MOUNT WITH 1-5/8" LINE
   170'-(12) EMS -FV90-1700 ON (3) 12' T-FRAMES WITH 1-5/8" LINES
   160'-(12) EMS -FV90-1700 ON (3) 12' T-FRAMES WITH 1-5/8" LINES
   150'-(12) EMS -FV90-1700 ON (3) 12' T-FRAMES WITH 1-5/8" LINES
   140'-(12) EMS -FV90-1700 ON (3) 12' T-FRAMES WITH 1-5/8" LINES
   130'-(12) EMS -FV90-1700 ON (3) 12' T-FRAMES WITH 1-5/8" LINES

   NOTE: (A) ELEVATIONS ARE TO THE BOTTOM OF THE ANTENNAS, EXCEPT FOR MICROWAVE DISHES, WHICH ARE TO THE CENTERLINE.
   (B) ALL TRANSMISSION LINES MUST BE PLACED ON PIROD SUPPLIED LINE BRACKETS PART # 125495 MOUNTED INSIDE THE TOWER WITH LINES PLACED IN A BACK-TO-BACK CONFIGURATION FOR WIND SHELTERING.
8. REMOVE FOUNDATION TEMPLATE PRIOR TO ERECTING TOWER. INSTALL BASE SECTION WITH MINIMUM OF 2" CLEARANCE ABOVE CONCRETE. SEE BASE SECTION PLACEMENT ON PAGE 7. PACK NON-SHRINK STRUCTURAL GROUT UNDER BASE SECTION AFTER LEVELING TOWER.
9. MIN. WELDS 5/16" UNLESS OTHERWISE SPECIFIED. ALL WELDING TO CONFORM TO AWS D1.1
10. ALL BOLTS AND NUTS MUST BE IN PLACE BEFORE THE ADJOINING SECTIONS ARE INSTALLED.
11. ALL STRUCTURAL BOLTS ARE TO BE TIGHTENED TO A SNUG TIGHT CONDITION AS DEFINED BY AISC SPECIFICATION UNLESS OTHERWISE NOTED. A MORE QUANTITATIVE ALTERNATIVE APPROACH TO ACHIEVING A SNUG TIGHT CONDITION IS TO TIGHTEN USING THE TORQUE VALUES FROM DRAWING 123107-A.
12. EIA GROUNDING FOR TOWER.

ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

CONNECTICUT C.O.A. PEC 797		
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DRAWING NO. 198204

PAGE 4 OF 9

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FOUNDATION NOTES

1. SOIL AS PER REPORT DR CLARENCE WELTI, DATED: 9/22/05
2. CONCRETE TO BE 3500 PSI @28 DAYS. REINFORCING BAR TO CONFORM TO ASTM A615 GRADE 60 SPECIFICATIONS. CONCRETE INSTALLATION TO CONFORM TO ACI-318 (2002) BUILDING REQUIREMENTS FOR REINFORCED CONCRETE. ALL CONCRETE TO BE PLACED AGAINST UNDISTURBED EARTH FREE OF WATER AND ALL FOREIGN OBJECTS AND MATERIALS. A MINIMUM OF THREE INCHES OF CONCRETE SHALL COVER ALL REINFORCEMENT. WELDING OF REBAR NOT PERMITTED.
3. A COLD JOINT IS PERMISSIBLE UPON CONSULTATION WITH PIROD. ALL COLD JOINTS SHALL BE COATED WITH BONDING AGENTS PRIOR TO SECOND POUR.
4. ALL FILL SHOULD BE PLACED IN LOOSE LEVEL LIFTS OF NO MORE THAN 12" THICK. FILL MATERIALS SHOULD BE CLEAN AND FREE OF ORGANIC AND FROZEN MATERIALS OR ANY OTHER DELETERIOUS MATERIALS. COMPACT FILL TO 95% OF MODIFIED PROCTOR MAXIMUM DRY DENSITY IN ACCORDANCE WITH ASTM D1557.
5. BENDING, STRAIGHTENING OR REALIGNING (HOT OR COLD) OF THE ANCHOR BOLTS BY ANY METHOD IS PROHIBITED.
6. CROWN TOP OF FOUNDATION FOR PROPER DRAINAGE.
7. FOUNDATION IS TO BEAR ON BEDROCK/INSITU CLAY AT APPROXIMATELY 6.0' BELOW GRADE. THE BEARING SURFACE IS TO BE FREE OF ANY LOOSE MATERIAL & SUBSEQUENTLY INSPECTED BY A QUALIFIED ON-SITE GEOTECHNICAL ENGINEER.
8. DIFFICULTIES DURING EXCAVATION MAY ARISE DUE TO THE PRESENCE OF BOULDERS, COBBLES, AND/OR SHALLOW BEDROCK. THE BOULDERS, COBBLES, AND/OR ROCK MUST BE REMOVED FROM THE EXCAVATION.
9. PNEUMATIC HAMMERS, RIPPERS, AND/OR BLASTING MAY BE REQUIRED TO REMOVE MATERIAL FROM THE EXCAVATION.
10. THE FOUNDATION MUST BEAR ENTIRELY ON COMPETENT BEDROCK OR SOIL. THE FOUNDATION IS NOT TO BEAR ON ANY COMBINATION OF SOIL AND BEDROCK AS THIS MAY CAUSE EXCESSIVE DIFFERENTIAL SETTLEMENT.
11. THE TOWER FOUNDATION MUST BEAR BELOW ALL EXISTING UNCONTROLLED FILL AT THIS SITE. A QUALIFIED ON-SITE GEOTECHNICAL ENGINEER MUST INSPECT THE BEARING SURFACE TO ENSURE THAT THE CAPACITY MEETS OR EXCEEDS THAT DISCLOSED IN THE REFERENCED SOIL REPORT.
12. ANY FILL DETECTED BENEATH THE BEARING SHOULD BE REMOVED AND REPLACED WITH COMPACTED FILL, AS DETAILED IN THE SOIL REPORT AND AS DIRECTED BY THE ON-SITE GEOTECHNICAL ENGINEER.
13. THE ON-SITE GEOTECHNICAL ENGINEER SHALL CONFIRM THAT THE INSITU SOIL STRENGTHS MEET OR EXCEED THOSE PARAMETERS GIVEN IN THE SOIL REPORT.

REV	DESCRIPTION OF REVISIONS	INI	DATE
A	FOUNDATION PER SOIL REPORT	TMW	04/12/2006

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ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

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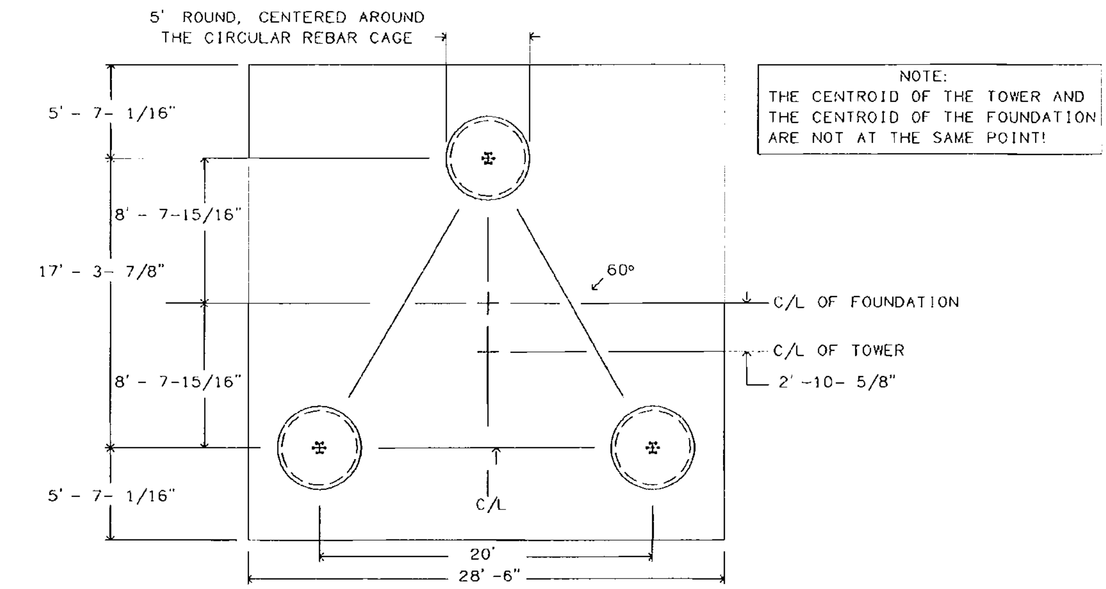
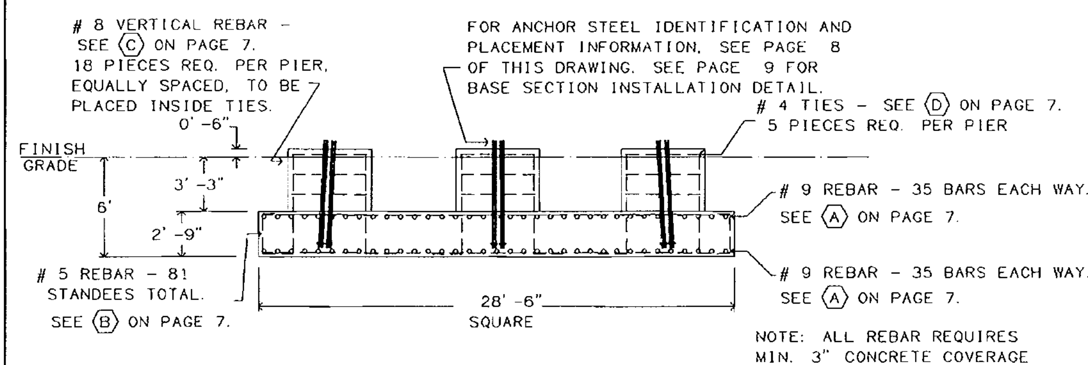
PAGE 5 OF 9





TOWER FOUNDATION

90.9 CUBIC YARDS CONCRETE REQUIRED

FOR INSTALLATION SPECIFICATIONS AND ADDITIONAL INFORMATION, SEE PAGE 5 OF THIS DRAWING.

				ROADRUNNER INSTALLATION SVCS. EAST HARTLAND, CT U-20.0 X 180'		
				CONNECTICUT C.O.A. PEC. 797		valmont STRUCTURES
A	FOUNDATION PER SOIL REPORT	TMW	04/12/2006	APPROVED/ENG.	TMW 4/12/2006	
REV	DESCRIPTION OF REVISIONS	INI	DATE	APPROVED/FOUND.	TMW 4/12/2006	
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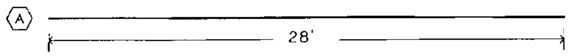
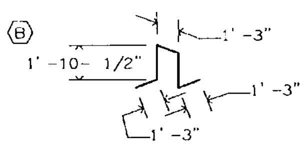
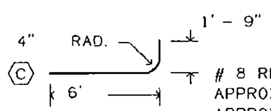


9 REBAR – 140 PIECES REQ. TOTAL
APPROX WT = 95.2# EACH, 13328# TOTAL

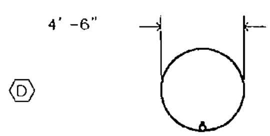
REBAR SUPPORTS MAY CONSIST OF ANY ACCEPTABLE MEANS OF SECURELY SUPPORTING THE TOP REINFORCEMENT GRID ABOVE THE BOTTOM REINFORCEMENT GRID WHILE MAINTAINING A SEPARATION OF 2'-3" (OUTSIDE REBAR TO OUTSIDE REBAR).



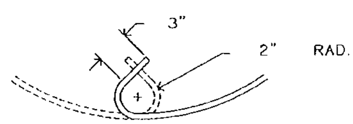
5 REBAR – 81 PIECES REQUIRED TOTAL
TYPE 26 STANDEE PLACED BETWEEN REBAR GRIDS ON NOMINAL 4' SPACING THROUGHOUT
APPROX UNBENT LENGTH = 7' - 5- 3/4"
APPROX WT = 7.8# EACH, 632# TOTAL



8 REBAR – 54 PIECES REQUIRED TOTAL
APPROX UNBENT LENGTH = 7' - 7- 3/8"
APPROX WT = 20.3# EACH, 1096# TOTAL



4 REBAR – 15 PIECES REQUIRED TOTAL
WITH 135 DEGREE HOOK ON EACH END
APPROX UNBENT LENGTH = 15' - 5- 1/8"
APPROX WT = 10.3# EACH, 155# TOTAL



DETAIL OF 135 DEGREE HOOKS

PLACE CIRCULAR TIES SO THAT HOOKS ON ADJACENT TIES ARE 180 DEGREES APART AND HOOKS ENCIRCLE A VERTICAL BAR. PLACE ONE TIE AT TOP OF PAD AND TWO TIES AT TOP OF PIER REBAR. EQUALLY SPACE REMAINING TIES ALONG PIER.

REBAR DETAIL

TOTAL APPROX REBAR WEIGHT = 15211#
REINFORCING BAR TO CONFORM TO
ASTM A615 GRADE 60 SPECIFICATIONS.

ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

REV	DESCRIPTION OF REVISIONS	INI	DATE
A	FOUNDATION PER SOIL REPORT	TMW	04/12/2006

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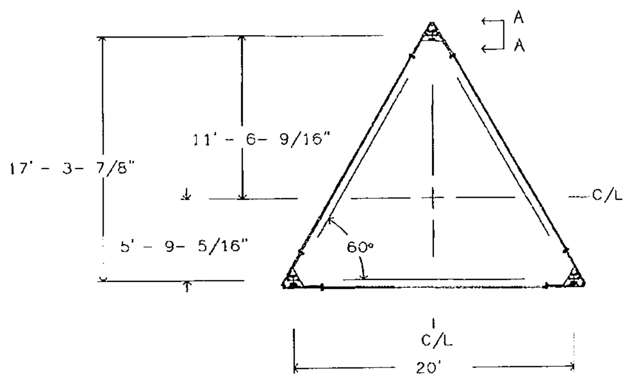
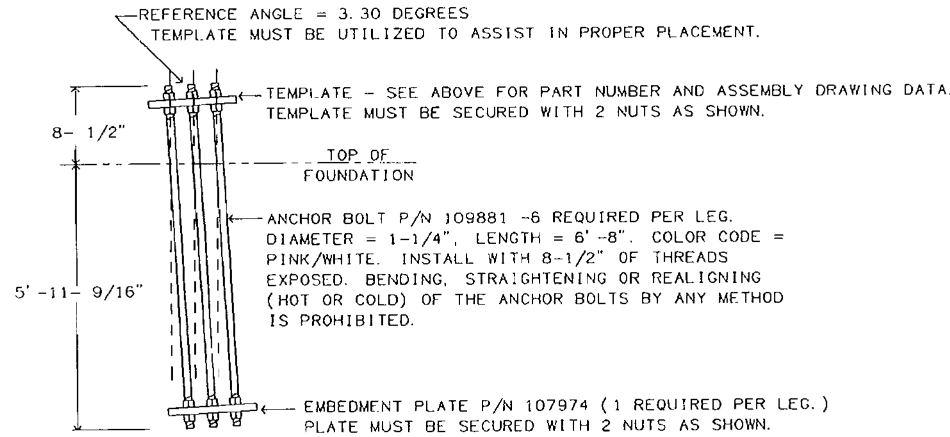


TEMPLATE ASSEMBLY P/N 159427 INCLUDES CORNER PLATE P/N 158387, IS REQUIRED FOR INSTALLATION AND MUST BE PLACED AS SHOWN. SEE DRAWING # 159394 FOR TEMPLATE ASSEMBLY DETAILS. CENTER OF TEMPLATE MUST BE PLACED OVER CENTER OF FOUNDATION +/- 3". EACH LEG MUST BE CENTERED IN PIER WITHIN +/- 10% OF PIER DIAMETER. TEMPLATE MUST BE LEVEL +/- 1 DEGREE. INSTALL TEMPLATE WITH SUFFICIENT SPACE BENEATH (2" MINIMUM) TO PERMIT FINISHING OF CONCRETE AND TO FACILITATE TEMPLATE REMOVAL PRIOR TO TOWER ERECTION.

SEE PAGE 9 FOR BASE SECTION INSTALLATION DETAIL.

TOWER ANCHOR STEEL PLACEMENT - TOP VIEW



VIEW A - A - ANCHOR BOLT INSTALLATION DETAIL (NOT TO SCALE)

ATTENTION CONTRACTOR INSTALLING THE ANCHOR BOLTS!

1-1/4" DIAMETER ANCHOR BOLTS FOR TAPERED TOWER.

VERIFY THE PART NUMBERS AND SIZES FOR ALL COMPONENTS ON THIS PAGE AND PAGE 9.

IF THERE ARE ANY DISCREPANCIES, PLEASE NOTIFY PIROD, INC., PRIOR TO INSTALLATION!!

A	FOUNDATION PER SOIL REPORT	TMW	04/12/2006
REV	DESCRIPTION OF REVISIONS	INI	DATE

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ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

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DRAWING NO 198204

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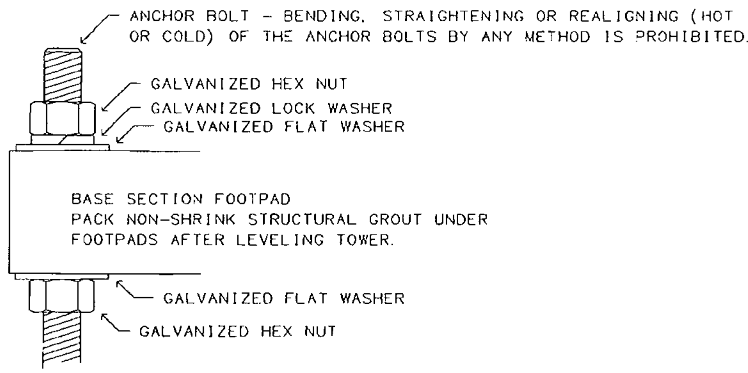

BASE SECTION INSTALLATION DETAIL

ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

A	FOUNDATION PER SOIL REPORT	TMW	04/12/2006	CONNECTICUT C.O.A. PEC.797		
REV	DESCRIPTION OF REVISIONS	INI	DATE	APPROVED/ENG.	TMW	4/12/2006
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DRAWING NO. 198204

PAGE 9 OF 9

ROBINSON & COLE

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

TS-VER-065-080201

ORIGINAL

February 1, 2008

Via Hand Delivery

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

Re: **Request of Cellco Partnership d/b/a Verizon Wireless for an Order to Approve the Shared Use of a Tower Facility at 22 Welsh Road, East Hartland, Connecticut**

Dear Mr. Phelps:

Pursuant to Connecticut General Statutes §16-50aa, as amended, Cellco Partnership d/b/a Verizon Wireless ("Cellco") hereby requests an order from the Connecticut Siting Council ("Council") to approve the proposed shared use by Cellco of an existing telecommunications tower, owned by the Town of Hartland (the "Town"), located at 22 Welsh in East Hartland, Connecticut. Cellco requests that the Council find that the proposed shared use of the tower satisfies the criteria stated in Connecticut General Statutes § 16-50aa and issue an order approving the proposed use. In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Wade E. Cole, First Selectman of the Town of Hartland. The Town is the owner of the property on which the tower is located.

Background

The Town tower is a 180-foot self-supporting lattice structure. The Town's emergency services whip antennas are mounted at the top of the tower. Cellco is licensed by the Federal Communications Commission (FCC) to provide wireless telecommunications services in the State of Connecticut, which includes the area to be served by Cellco's proposed Hartland installation. Cellco and the Town have agreed to the proposed shared use of this tower pursuant to mutually acceptable terms and conditions, and the Town has authorized Cellco to act on its behalf to apply for

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all necessary local, state and federal permits, approvals, and authorizations which may be required for the proposed shared use of this facility.

Cellco proposes to install six (6) LPA-80080/6CF antennas and six (6) LPA-185080/12CF antennas at the 180-foot level on the tower and place a 12' x 30' equipment building within the fenced compound at the base of the tower. See Project Plans included behind Tab 1.

C.G.S. § 16-50aa(c)(1) provides that, upon written request for approval of a proposed shared use, "if the council finds that the proposed shared use of the facility is technically, legally, environmentally and economically feasible and meets public safety concerns, the council shall issue an order approving such shared use." The shared use of the tower satisfies those criteria as follows:

A. **Technical Feasibility.** The existing tower is structurally capable of supporting the proposed Cellco antennas. The proposed shared use of this tower therefore is technically feasible. A Structural Analysis Report verifying the structural integrity of the existing tower is included behind Tab 2.

B. **Legal Feasibility.** Under C.G.S. § 16-50aa, the Council has been authorized to issue orders approving the proposed shared use of existing towers like the Town facility in Hartland. This authority compliments the Council's existing authority under C.G.S. § 16-50p to issue orders approving the construction of new towers that are subject to the Council's jurisdiction. In addition, § 16-50x(a) directs the Council to "give such consideration to other state laws and municipal regulations as it shall deem appropriate" in ruling on requests for the shared use of existing towers facilities. Under the statutory authority vested in the Council, an order by the Council approving the requested shared use would permit the Applicant to obtain a building permit for the proposed installations.

C. **Environmental Feasibility.** The proposed shared use would have a minimal environmental effect, for the following reasons:

1. The proposed installations would have an insignificant incremental visual impact, and would not cause any significant change or alteration in the physical or environmental characteristics of the existing site. In particular, the proposed installations would not increase the height of the existing

tower, and would not extend the boundaries of the tower site outside the limits of the existing compound or Town property.

2. The proposed installations would not increase the noise levels at the existing facility by six decibels or more.

3. Operation of Cellco antennas at this site would not exceed the total radio frequency (RF) electromagnetic radiation power density level adopted by the Federal Communications Commission. The "worst-case" exposure calculated for operation of Cellco's facility (i.e., calculated at the base of the tower), would be 6.76% of the standard). See Power Density Calculation Table behind Tab 3.

4. The proposed installations, would not require any water or sanitary facilities, or generate air emissions or discharges to water or sanitary facilities, or generate air emissions or discharges to water bodies. After construction is complete the proposed installations would not generate any traffic other than periodic maintenance visits.

The proposed use of the Town facility would therefore have a minimal environmental effect, and is environmentally feasible.

E. Economic Feasibility. As previously mentioned, the Town and Cellco have entered into a mutual agreement to share the use of the tower on terms agreeable to the parties. The proposed tower sharing is therefore economically feasible.

F. Public Safety Concerns. As stated above, the tower is structurally capable of supporting the Cellco antennas. Cellco is not aware of any public safety concerns relative to the proposed sharing of the existing tower. In fact, the provision of new or improved telecommunications service through shared use of the existing tower is expected to enhance the safety and welfare of area residents.

Conclusion

For the reasons discussed above, the proposed shared use of the existing Town tower in Hartland, Connecticut satisfies the criteria stated in C.G.S. § 16-50aa and advances the General Assembly's and the Siting Council's goal of preventing the proliferation of towers in Connecticut. The Applicant therefore requests that the Siting Council issue an order approving the proposed shared use.

Thank you for your consideration of this matter.

Very truly yours,

Kenneth C. Baldwin

Enclosures
Copy to:
Wade E. Cole, Hartland First Selectman
Sandy M. Carter
Michelle Kababik

Cellco Partnership

d.b.a. verizon wireless

WIRELESS COMMUNICATIONS FACILITY

EAST HARTLAND
22 WELSH ROAD
EAST HARTLAND, CT 06027

SITE DIRECTIONS

FROM: 99 EAST RIVER DRIVE, EAST HARTFORD, CONNECTICUT TO: 22 WELSH ROAD, EAST HARTLAND, CONNECTICUT

1.	START AT 99 E RIVER DR	0.3 MI.
2.	TURN LEFT TO STAY ON E RIVER DR	<0.1 MI.
3.	TURN LEFT (WEST) ONTO US-44[CONNECTICUT BLVD]	0.2 MI.
4.	TAKE RAMP ONTO I-84[US-44]	0.3 MI.
5.	AT EXIT 50, TAKE RAMP (RIGHT) ONTO I-91	9.4 MI.
6.	AT EXIT 40, TAKE RAMP (RIGHT) ONTO SR-20[BRADLEY FIELD CONNECTOR]	3.5 MI.
7.	TAKE RAMP (RIGHT) ONTO SR-20	6.0 MI.
8.	ROAD NAME CHANGES TO SR-189[SR-20]	0.2 MI.
9.	KEEP STRAIGHT ONTO SR-189[NORTH GRANBY RD	3.5 MI.
10.	TURN LEFT (WEST) ONTO MOUNTAIN RD	3.1 MI.
11.	ARRIVE AT 22 WELSH RD	

GENERAL NOTES

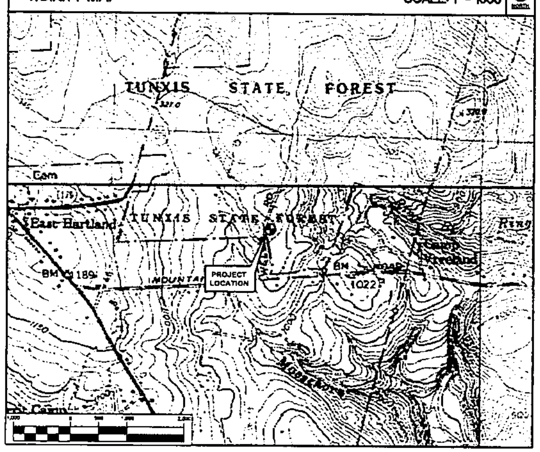
1. PROPOSED ANTENNA LOCATIONS AND HEIGHTS PROVIDED BY CELLCO PARTNERSHIP.

PROJECT SCOPE

1. THE PROPOSED SCOPE OF WORK GENERALLY INCLUDES THE INSTALLATION OF A 12'x30' PREFABRICATED WIRELESS EQUIPMENT SHELTER ON A CONCRETE FOUNDATION WITHIN THE EXISTING WIRELESS COMMUNICATIONS LEASE AREA.
2. A TOTAL OF TWELVE (12) DIRECTIONAL PANEL ANTENNAS ARE PROPOSED TO BE MOUNTED ON AN EXISTING 180' LATTICE TOWER AT A RAD CENTER ELEVATION OF 180' ABOVE THE EXISTING TOWER BASE PLATE.
3. ELECTRIC AND TELCO UTILITIES SHALL BE ROUTED UNDERGROUND TO THE PROPOSED EQUIPMENT SHELTER FROM AN EXISTING UTILITY BACKBOARD LOCATED WITHIN THE FENCED COMPOUND.

VICINITY MAP

SCALE: 1" = 1000'



PROJECT SUMMARY

SITE NAME:	EAST HARTLAND
SITE ADDRESS:	22 WELSH ROAD EAST HARTLAND, CT 06027
LESSEE/ TENANT:	CELLCO PARTNERSHIP d.b.a. VERIZON WIRELESS 99 EAST RIVER DRIVE EAST HARTFORD, CT 06108
CONTACT PERSON:	SANDY CARTER CELLCO PARTNERSHIP (860) 803-8219
TOWER COORDINATES:	LATITUDE: 41°-59'-51.09" LONGITUDE: 72°-53'-15.84" COORDINATES BASED ON 2C CERTIFICATION LETTER PREPARED BY MARTINEZ COUCH AND ASSOCIATES L.L.C., DATED 11/7/2007.

SHEET INDEX

SHT. NO.	DESCRIPTION	REV. NO.
T-1	TITLE SHEET	A
C-1	COMPOUND PLAN AND ELEVATION	A

REVISIONS		
A	11/20/07	CSC - REVIEW

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

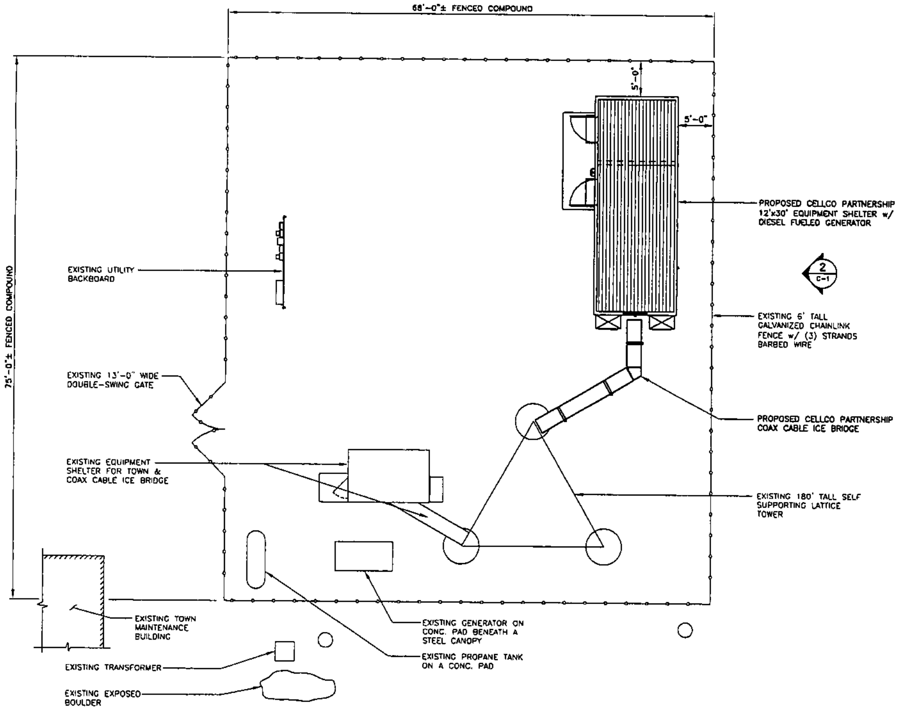
EAST HARTLAND
22 WELSH ROAD
EAST HARTLAND, CT 06027

PROJECT NO:	07075
DRAWN BY:	DEB
CHECKED BY:	CFC
SCALE:	AS NOTED
DATE:	10/23/07

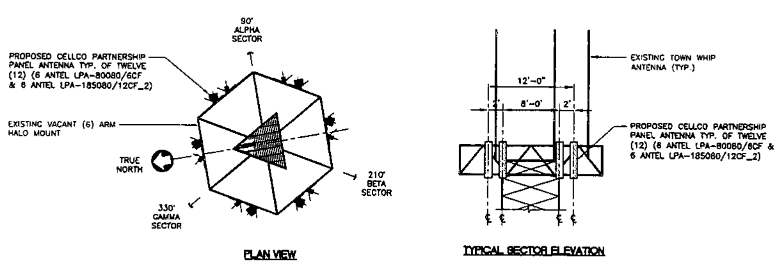
TITLE SHEET

T-1

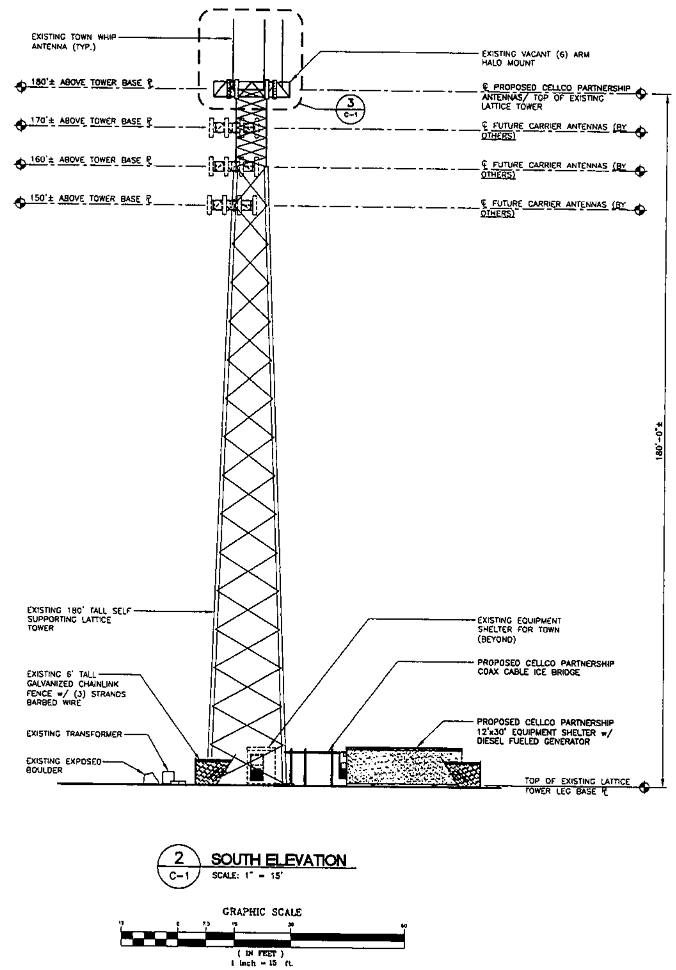
DWG. 1 OF 2



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



3 C-1 **ANTENNA MOUNTING CONFIGURATION**
NOT TO SCALE



2 C-1 **SOUTH ELEVATION**
SCALE: 1" = 15'

REVISIONS		
A	11/20/07	CSC-REVIEW

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

PROFESSIONAL ENGINEER SEAL

EAST HARTLAND
22 WELSH ROAD
EAST HARTLAND, CT 06027

PROJECT NO:	07075
DRAWN BY:	DEB
CHECKED BY:	CFC
SCALE:	AS NOTED
DATE:	10/23/07

COMPOUND PLAN AND ELEVATION

C-1
DWG. 2 OF 2

NATCOMM INC.
CONSULTING ENGINEERS

Structural Analysis Report

180' Existing Self Supporting
Lattice Tower

22 Welsh Road
East Hartland, CT

Natcomm Project No. 07075

Date: November 21, 2007

Prepared for:

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

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Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna installation proposed on the existing self supporting lattice tower located in East Hartland, Connecticut. The host tower is a 180-ft, three legged, tapered lattice tower originally designed and manufactured by Valmont Structures; drawing no. 198204 dated April 4, 2006.

The tower is constructed of pipe legs, diagonal angle braces and horizontal angle braces. The tower members are all bolted together. The width of the tower face is 4-ft at the top and 20-ft at the base. The tower geometry and structure member sizes were taken from Valmont Structures' original design documents available in Section 4 of this report.

Antenna and Appurtenance Summary

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

- TOWN (Existing):
  Antennas: Two (2) 20-ft x 3"∅ omnidirectional whip antennas and one (1) 20-ft 4-bay dipole (Yagi) antenna mounted on a 6 arm halo mount with a RAD center elevation of 190-ft above the existing tower base plate.
  Coax Cables: Three (3) 1-5/8" ∅ coax cables running on a leg of the existing tower as specified in section 3 of this report.
- **VERIZON (Proposed):**
  Antennas: Six (6) Amphenol Antel, Inc. (Antel) LPA-80080/6CF and six (6) Antel LPA-185080/12CF_2 panel antennas mounted on the existing 6 arm halo mount with a RAD center elevation of 180-ft above the existing tower base plate .
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg of the existing tower as specified in section 3 of this report.
- FUTURE CARRIER:
  Antennas: Twelve (12) RR90-17-00DP panel antennas mounted on (3) PiROD 12-ft lightweight T-Frames with a RAD center elevation of 170-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg of the existing tower as specified in section 3 of this report.
- FUTURE CARRIER:
  Antennas: Twelve (12) RR90-17-00DP panel antennas mounted on (3) PiROD 12-ft lightweight T-Frames with a RAD center elevation of 160-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg of the existing tower as specified in Section 3 of this report.

- FUTURE CARRIER:
  Antennas: Twelve (12) RR90-17-00DP panel antennas mounted on (3) PiROD 12-ft lightweight T-Frames with a RAD center elevation of 150-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg of the existing tower as specified in section 3 of this report.

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 routed as specified in section 3 of this report.

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 legs, and the model assumes that the leg members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for 80 mph basic wind speed (fastest mile) with no ice and 75% reduction of wind force with ½ inch accumulative ice to determine stresses in members as per guidelines of TIA/EIA-222-F-96 entitled "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA/EIA-222-F, gravity loads of the tower structure and its components, and the application of ½" radial ice tower structure and its components.

Basic Wind Speed:	Hartford; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Hartland; 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*

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 **88.3%** of its total capacity.

Foundation and Anchors

The existing foundation consists of three (3) 5-ft∅ reinforced concrete piers with a 28.5-ft square reinforced concrete pad concentrically bearing directly on existing sub grade. The sub grade conditions used in the analysis of the existing foundation were derived from Valmont Structures original design documents available in section 4 of this report. Tower legs are connected to the three (3) piers by means of (6) 1 1/4"∅, ASTM A687 anchor bolts per leg, embedded approximately 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:
  - Uplift @ top of pedestal = **243.0** kips
  - Shear @ top of pedestal = **31.0** kips
  - Compression @ top of pedestal = **312.0** kips
- Base plates, anchor bolts and the foundation were found to be 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).

Conclusion

This analysis shows that the subject tower and 6 arm halo mount **is adequate** to support the proposed antennas and associated hardware.

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.

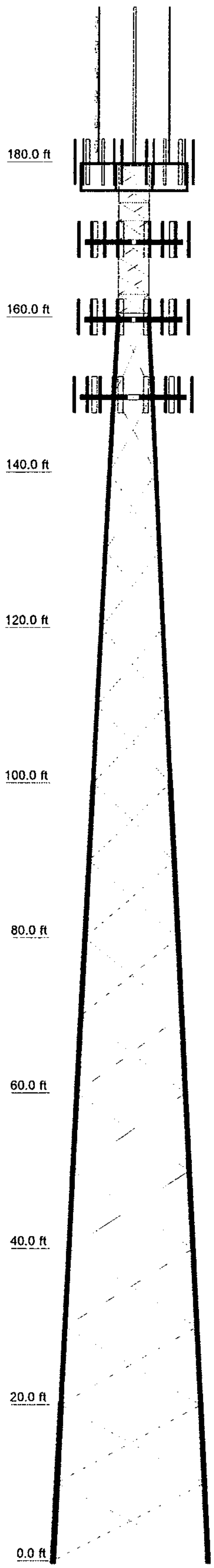
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

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.

Leg Grade	Diagonals	Diagonal Grade	Top Girts	Bottom Girts	Horizontals	Face Width (ft)	# Panels @ (ft)	Weight (lb)
1/2	SR 3/4	A572-50	SR 7/8	SR 7/8	SR 3/4	4	8 @ 2.375	803.4
								1951.1
Pi... .0521	L2 1/2x2 1/2x3/16					6		1990.7
P... .052						8		2351.6
A572-50						10		2962.4
F... .052	L3x3x3/16	A36	N.A.	N.A.	N.A.	12	16 @ 10	3034.1
						14		4213.7
Piro .219	L3x3x5/16					16		4343.0
Pir... .220	L3 1/2x3 1/2x5/16					18		5293.3
						20		26973.5



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
20' x 3" Dia Omni	190	PiROD 12' Lightweight T-Frame (Future)	170
20' x 3" Dia Omni	190	PiROD 12' Lightweight T-Frame (Future)	160
20' 4-Bay Dipole	190	PiROD 12' Lightweight T-Frame (Future)	160
LPA-80080/6CF (Verizon)	180	PiROD 12' Lightweight T-Frame (Future)	160
LPA-185080/12CF (Verizon)	180	(4) RR90-17-00DP (Future)	160
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LPA-185080/12CF (Verizon)	180		
LPA-80080/6CF (Verizon)	180		
6 Arm Halo Mount	178		
PiROD 12' Lightweight T-Frame (Future)	170		
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(4) RR90-17-00DP (Future)	170		
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PiROD 12' Lightweight T-Frame (Future)	170		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

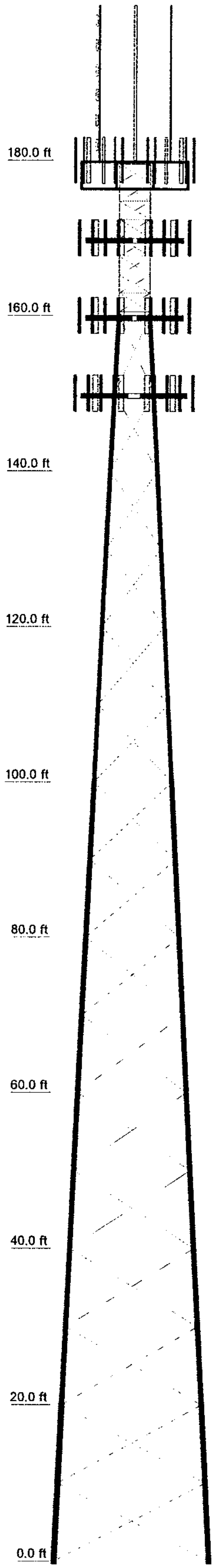
1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 88.3%

MAX. CORNER REACTIONS AT BASE:
DOWN: 311893 lb
UPLIFT: -243003 lb
SHEAR: 30892 lb

AXIAL 72991 lb
SHEAR 46303 lb
MOMENT 4980738 lb-ft
TORQUE 9984 lb-ft
69 mph WIND - 0.5000 in ICE

AXIAL 41285 lb
SHEAR 40423 lb
MOMENT 4383357 lb-ft
TORQUE 9233 lb-ft
REACTIONS - 80 mph WIND

NATCOMM	Job: 180' U20.0 Valmont Self-Support Lattice		
63-2 N. Branford Rd.	Project: 07075 - 22 Welsh Rd, East Hartland		
Branford, CT 06405	Client: Verizon	Drawn by: Staff	App'd:
Phone: (203) 488-0580	Code: TIA/EIA-222-F	Date: 10/21/07	Scale:
FAX: (203) 488-8587	Path: C:\Users\kiernan214\Documents\Natcomm\07075 East Hartland\ERI Files\180 Lattice Hartland.eri		Dwg N



Legs	Pi... ...1/2; Pi... ...521; Pi... ...521; Pi... ...521; Piro... ...219; Piro... ...220
Leg Grade	A572-50
Diagonals	SR 3/4; L2 1/2x2 1/2x3/16; L3x3x3/16; L3x3x5/16; L3 1/2x3 1/2x5/16
Diagonal Grade	A572-50; A36
Top Girts	SR 7/8; N.A.
Bottom Girts	SR 7/8; N.A.
Horizontals	SR 3/4; N.A.
Face Width (ft)	4; 6; 8; 10; 12; 14; 16; 18; 20
# Panels @ (ft)	8 @ 2.375; 16 @ 10
Weight (lb) 26973.5	803.4; 1951.1; 1990.7; 2381.8; 2962.4; 3034.1; 4213.7; 4343.0; 5293.3

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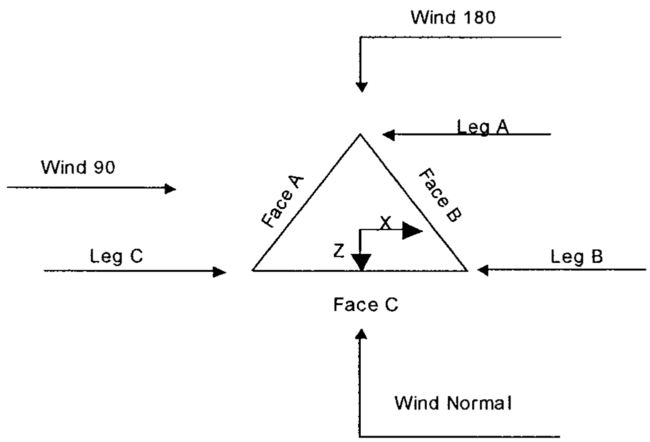


Triangular Tower

Tower Section Geometry

Tower Section	*Tower Elevation* *ft*	*Assembly Database*	*Description*	*Section Width* *ft*	*Number of Sections*	*Section Length* *ft*
T1	180.00-160.00	pirod	V4 106778	4.00	1	20.00
T2	160.00-140.00		U6.0 105245	4.00	1	20.00
T3	140.00-120.00	pirod	U8.0 105216	6.00	1	20.00
T4	120.00-100.00	pirod	U10.0 105217 L2 1/2x3/16	8.00	1	20.00
T5	100.00-80.00	pirod	U12.0 105218	10.00	1	20.00
T6	80.00-60.00	pirod	U14.0 105218	12.00	1	20.00
T7	60.00-40.00	pirod	U16.0 105219	14.00	1	20.00
T8	40.00-20.00	pirod	U18.0 105219	16.00	1	20.00
T9	20.00-0.00		U20.0 105219 L3.5x5/16	18.00	1	20.00

Tower Section Geometry *(cont'd)*

Tower Section	*Tower Elevation* *ft*	*Diagonal Spacing* *ft*	*Bracing Type*	*Has K Brace End Panels*	*Has Horizontals*	*Top Girt Offset* *in*	*Bottom Girt Offset* *in*
T1	180.00-160.00	2.38	X Brace	No	Steps	6.0000	6.0000
T2	160.00-140.00	10.00	X Brace	No	No	0.0000	0.0000
T3	140.00-120.00	10.00	X Brace	No	No	0.0000	0.0000
T4	120.00-100.00	10.00	X Brace	No	No	0.0000	0.0000
T5	100.00-80.00	10.00	X Brace	No	No	0.0000	0.0000
T6	80.00-60.00	10.00	X Brace	No	No	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation *ft*	*Gusset Area (per face)* *ft²*	*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*
T1 180.00-160.00	0.00	0.0000	A36 (36 ksi)	1	1	1.02	36.0000	36.0000
T2 160.00-140.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T3 140.00-120.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T4 120.00-100.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T5 100.00-80.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T6 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T7 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T8 40.00-20.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000
T9 20.00-0.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000

Tower Section Geometry *(cont'd)*

			K Factors[1]								
Tower Elevation *ft*	*Calc K Single Angles*	*Calc K Solid Rounds*	*Legs*	*X Brace Diags* *X* *Y*	*K Brace Diags* *X* *Y*	*Single Diags* *X* *Y*	*Girts* *X* *Y*	*Horiz.* *X* *Y*	*Sec. Horiz.* *X* *Y*	*Inner Brace* *X* *Y*
T1 180.00-160.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 160.00-140.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 140.00-120.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 120.00-100.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 100.00-80.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 80.00-60.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 60.00-40.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 40.00-20.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T9 20.00-0.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Elevation ft	Leg Connection Type	Leg Bolt Size in	Leg No.	Diagonal Bolt Size in	Diagonal No.	Top Girt Bolt Size in	Top Girt No.	Bottom Girt Bolt Size in	Bottom Girt No.	Mid Girt Bolt Size in	Mid Girt No.	Long Horizontal Bolt Size in	Long Horizontal No.	Short Horizontal Bolt Size in	Short Horizontal No.
T1 180.00-160.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 160.00-140.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 140.00-120.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 120.00-100.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 100.00-80.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 80.00-60.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0
T7 60.00-40.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0
T8 40.00-20.00	Flange	1.0000 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0	0.6250 A325X	0
T9 20.00-0.00	Flange	1.2500 A325N	6	1.2500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
1 5/8	A	No	Ar (Leg)	170.00 - 3.00	0.0000	0.08	12	6	0.5000 1.0000	1.9800		1.04
1 5/8	C	No	Ar (Leg)	180.00 - 3.00	0.0000	0.08	15	8	0.5000 1.0000	1.9800		1.04
1 5/8	B	No	Ar (Leg)	150.00 - 3.00	0.0000	0.08	24	12	0.5000 1.0000	1.9800		1.04
1 5/8	B	No	Ar (Leg)	160.00 - 150.00	0.0000	0.08	12	12	0.5000 1.0000	1.9800		1.04

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight lb
T1	180.00-160.00	A	36.300	0.000	0.000	0.000	124.80
		B	9.900	0.000	0.000	0.000	0.00
		C	26.400	0.000	0.000	0.000	312.00
T2	160.00-140.00	A	46.200	0.000	0.000	0.000	249.60
		B	59.400	0.000	0.000	0.000	374.40
		C	66.000	0.000	0.000	0.000	312.00
T3	140.00-120.00	A	46.200	0.000	0.000	0.000	249.60
		B	59.400	0.000	0.000	0.000	499.20
		C	66.000	0.000	0.000	0.000	312.00
T4	120.00-100.00	A	46.200	0.000	0.000	0.000	249.60
		B	59.400	0.000	0.000	0.000	499.20
		C	66.000	0.000	0.000	0.000	312.00

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	180.00-160.00	-5.2225	0.7538	-3.7963	0.6262
T2	160.00-140.00	1.2884	1.4877	1.1552	1.3339
T3	140.00-120.00	1.7869	2.0634	1.6022	1.8501
T4	120.00-100.00	2.2278	2.5725	2.0015	2.3112
T5	100.00-80.00	2.5800	2.9791	2.3361	2.6975
T6	80.00-60.00	2.9989	3.4628	2.7170	3.1373
T7	60.00-40.00	3.3333	3.8490	3.0205	3.4878
T8	40.00-20.00	3.7147	4.2894	3.3682	3.8892
T9	20.00-0.00	3.5636	4.1149	3.2428	3.7445

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
6 Arm Halo Mount	C	None		0.0000	178.00	No Ice 1/2" Ice	41.70 53.60	41.70 53.60	2400.00 3200.00
PiROD 12' Lightweight T-Frame (Future)	A	From Leg	1.50 0.00 0.00	0.0000	170.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	B	From Leg	1.50 0.00 0.00	0.0000	170.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	C	From Leg	1.50 0.00 0.00	0.0000	170.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
(4) RR90-17-00DP (Future)	A	From Leg	3.00 0.00 0.00	0.0000	170.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	B	From Leg	3.00 0.00 0.00	0.0000	170.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	C	From Leg	3.00 0.00 0.00	0.0000	170.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
PiROD 12' Lightweight T-Frame (Future)	A	From Leg	1.50 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	B	From Leg	1.50 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
PiROD 12' Lightweight T-Frame (Future)	C	From Leg	1.50 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	10.20 16.20	10.20 16.20	253.00 355.00
(4) RR90-17-00DP (Future)	A	From Leg	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	B	From Leg	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42
(4) RR90-17-00DP (Future)	C	From Leg	3.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	18.00 40.42

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft ft ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft²*	*C_AA_A Side* *ft²*	*Weight* *lb*
20' x 3" Dia Omni	B	From Leg	0.00 3.00 0.00	0.0000	190.00	No Ice 1/2" Ice	6.00 8.03	6.00 8.03	50.00 93.17
20' 4-Bay Dipole	C	From Leg	0.00 3.00 0.00 0.00	0.0000	190.00	No Ice 1/2" Ice	4.00 6.00	4.00 6.00	55.00 100.00

Truss-Leg Properties

Section Designation	*Area* *in²*	*Area Ice* *in²*	*Self Weight* *lb*	*Ice Weight* *lb*	*Equiv. Diameter* *in*	*Equiv. Diameter Ice* *in*	*Leg Area* *in²*
Pirod 105216	1998.0891	3357.4497	505.25	428.24	6.9378	11.6578	3.6816
Pirod 105216	1998.0891	3357.4497	505.25	428.24	6.9378	11.6578	3.6816
Pirod 105217	2130.7479	3520.4599	619.35	443.34	7.3984	12.2238	5.3014
Pirod 105218	2263.4687	3690.8612	754.52	458.46	7.8593	12.8155	7.2158
Pirod 105218	2263.4687	3690.8612	754.52	458.46	7.8593	12.8155	7.2158
Pirod 105219	2441.8688	3942.2854	944.27	485.72	8.4787	13.6885	9.4248
Pirod 105219	2441.8688	3942.2854	944.27	485.72	8.4787	13.6885	9.4248
Pirod 105220	2578.8005	4132.5504	1121.16	500.74	8.9542	14.3491	11.9282

Tower Pressures - No Ice

$G_H = 1.121$

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*
T1 180.00-160.00	170.00	1.597	26	82.500	A	0.000	46.372	5.000	10.78	0.000	0.000
					B	0.000	19.972		25.04		
					C	0.000	38.167		13.10		
T2 160.00-140.00	150.00	1.541	25	122.111	A	7.894	69.365	23.165	29.98	0.000	0.000
					B	7.894	82.565		25.61		
					C	7.894	89.165		23.87		
T3 140.00-120.00	130.00	1.48	24	162.111	A	8.723	69.365	23.165	29.66	0.000	0.000
					B	8.723	82.565		25.38		
					C	8.723	89.165		23.66		
T4 120.00-100.00	110.00	1.411	23	202.528	A	9.970	70.903	24.703	30.54	0.000	0.000
					B	9.970	84.103		26.26		
					C	9.970	90.703		24.54		
T5 100.00-80.00	90.00	1.332	22	242.945	A	13.520	72.441	26.241	30.53	0.000	0.000
					B	13.520	85.641		26.46		
					C	13.520	92.241		24.81		
T6 80.00-60.00	70.00	1.24	20	282.945	A	15.144	72.441	26.241	29.96	0.000	0.000

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
T1 180.00-160.00	170.00	1.597	10	82.500	A	0.000	46.372	5.000	10.78	0.000	0.000
					B	0.000	19.972		25.04		
					C	0.000	38.167		13.10		
T2 160.00-140.00	150.00	1.541	10	122.111	A	7.894	69.365	23.165	29.98	0.000	0.000
					B	7.894	82.565		25.61		
					C	7.894	89.165		23.87		
T3 140.00-120.00	130.00	1.48	9	162.111	A	8.723	69.365	23.165	29.66	0.000	0.000
					B	8.723	82.565		25.38		
					C	8.723	89.165		23.66		
T4 120.00-100.00	110.00	1.411	9	202.528	A	9.970	70.903	24.703	30.54	0.000	0.000
					B	9.970	84.103		26.26		
					C	9.970	90.703		24.54		
T5 100.00-80.00	90.00	1.332	9	242.945	A	13.520	72.441	26.241	30.53	0.000	0.000
					B	13.520	85.641		26.46		
					C	13.520	92.241		24.81		
T6 80.00-60.00	70.00	1.24	8	282.945	A	15.144	72.441	26.241	29.96	0.000	0.000
					B	15.144	85.641		26.04		
					C	15.144	92.241		24.44		
T7 60.00-40.00	50.00	1.126	7	323.362	A	16.830	74.509	28.309	30.99	0.000	0.000
					B	16.830	87.709		27.08		
					C	16.830	94.309		25.47		
T8 40.00-20.00	30.00	1	6	363.362	A	18.566	74.509	28.309	30.42	0.000	0.000
					B	18.566	87.709		26.64		
					C	18.566	94.309		25.08		
T9 20.00-0.00	10.00	1	6	403.780	A	23.735	69.167	29.897	32.18	0.000	0.000
					B	23.735	80.387		28.71		
					C	23.735	85.997		27.25		

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 ft^2	F lb	w plf	Ctrl. Face
T1 180.00-160.00	436.80	803.42	A	0.562	1.832	0.731	1	1	33.904	1822.43	91.12	A
			B	0.242	2.461	0.6	1	1	11.981			
			C	0.463	1.953	0.679	1	1	25.921			
T2 160.00-140.00	936.00	1951.13	A	0.633	1.787	0.774	1	1	61.592	4485.57	224.28	C
			B	0.741	1.784	0.85	1	1	78.063			
			C	0.795	1.812	0.892	1	1	87.446			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	1	1	56.468	3726.58	186.33	C
			B	0.563	1.831	0.732	1	1	69.137			
			C	0.604	1.802	0.756	1	1	76.127			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	1	1	56.151	3605.09	180.25	C
			B	0.464	1.95	0.68	1	1	67.163			
			C	0.497	1.904	0.696	1	1	73.101			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	1	1	59.437	3666.58	183.33	C
			B	0.408	2.048	0.655	1	1	69.612			
			C	0.435	1.998	0.667	1	1	75.012			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	1	1	59.976	3571.73	178.59	C
			B	0.356	2.157	0.635	1	1	69.501			
			C	0.38	2.106	0.643	1	1	74.498			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	1	1	62.332	3448.07	172.40	C
			B	0.323	2.236	0.623	1	1	71.499			
			C	0.344	2.186	0.63	1	1	76.268			
T8 40.00-20.00	1060.80	4343.02	A	0.256	2.419	0.603	1	1	63.530	3205.68	160.28	C
			B	0.292	2.316	0.614	1	1	72.387			

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
			C	0.463	1.953	0.679	0.85	1	25.921			
T2 160.00-140.00	936.00	1951.13	A	0.633	1.787	0.774	0.85	1	60.408	4424.84	221.24	C
			B	0.741	1.784	0.85	0.85	1	76.879			
			C	0.795	1.812	0.892	0.85	1	86.262			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	0.85	1	55.160	3662.53	183.13	C
			B	0.563	1.831	0.732	0.85	1	67.828			
			C	0.604	1.802	0.756	0.85	1	74.818			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	0.85	1	54.655	3531.34	176.57	C
			B	0.464	1.95	0.68	0.85	1	65.667			
			C	0.497	1.904	0.696	0.85	1	71.605			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	0.85	1	57.409	3567.45	178.37	C
			B	0.408	2.048	0.655	0.85	1	67.584			
			C	0.435	1.998	0.667	0.85	1	72.984			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	0.85	1	57.704	3462.82	173.14	C
			B	0.356	2.157	0.635	0.85	1	67.230			
			C	0.38	2.106	0.643	0.85	1	72.226			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	0.85	1	59.808	3333.94	166.70	C
			B	0.323	2.236	0.623	0.85	1	68.975			
			C	0.344	2.186	0.63	0.85	1	73.744			
T8 40.00-20.00	1060.80	4343.02	A	0.256	2.419	0.603	0.85	1	60.745	3089.69	154.48	C
			B	0.292	2.316	0.614	0.85	1	69.602			
			C	0.311	2.268	0.619	0.85	1	74.179			
T9 20.00-0.00	901.68	5293.34	A	0.23	2.499	0.597	0.85	1	61.467	3157.57	157.88	C
			B	0.258	2.414	0.604	0.85	1	68.721			
			C	0.272	2.374	0.608	0.85	1	72.432			
Sum Weight:	8639.28	26973.54						OTM	2692545.72 lb-ft	30052.60		

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
T1 180.00-160.00	1061.75	1088.77	A	0.793	1.811	0.891	1	1	63.778	2541.54	127.08	A
			B	0.391	2.083	0.648	1	1	24.937			
			C	0.688	1.776	0.811	1	1	52.452			
T2 160.00-140.00	2357.65	3550.45	A	0.885	1.903	0.969	1	1	107.905	5255.26*	262.76	C
			B	1	2.1	1	1	1	126.042			
			C	1	2.1	1	1	1	134.309			
T3 140.00-120.00	2682.02	3618.62	A	0.676	1.777	0.803	1	1	100.350	4916.54	245.83	C
			B	0.777	1.801	0.878	1	1	120.797			
			C	0.827	1.839	0.919	1	1	131.225			
T4 120.00-100.00	2682.02	4089.79	A	0.56	1.834	0.73	1	1	99.517	4434.81	221.74	C
			B	0.641	1.784	0.779	1	1	118.764			
			C	0.681	1.776	0.807	1	1	128.524			
T5 100.00-80.00	2682.02	4824.60	A	0.492	1.911	0.693	1	1	102.806	4339.64	216.98	C
			B	0.56	1.835	0.73	1	1	121.413			
			C	0.593	1.808	0.75	1	1	130.817			
T6 80.00-60.00	2682.02	4946.27	A	0.43	2.007	0.665	1	1	103.133	4180.70	209.04	C
			B	0.489	1.915	0.692	1	1	121.239			
			C	0.518	1.878	0.707	1	1	130.367			
T7 60.00-40.00	2682.02	6260.79	A	0.393	2.078	0.649	1	1	106.161	4009.18	200.46	C
			B	0.444	1.984	0.67	1	1	124.023			
			C	0.469	1.943	0.682	1	1	133.015			
T8 40.00-	2682.02	6445.33	A	0.356	2.157	0.635	1	1	107.406	3721.67	186.08	C

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
160.00			B	0.391	2.083	0.648	0.85	1	23.387			
			C	0.688	1.776	0.811	0.85	1	48.112			
T2 160.00-140.00	2357.65	3550.45	A	0.885	1.903	0.969	0.85	1	99.281	5255.26*	262.76	C
			B	1	2.1	1	0.85	1	114.938			
			C	1	2.1	1	0.85	1	121.964			
T3 140.00-120.00	2682.02	3618.62	A	0.676	1.777	0.803	0.85	1	91.601	4449.39	222.47	C
			B	0.777	1.801	0.878	0.85	1	109.569			
			C	0.827	1.839	0.919	0.85	1	118.757			
T4 120.00-100.00	2682.02	4089.79	A	0.56	1.834	0.73	0.85	1	90.581	3998.12	199.91	C
			B	0.641	1.784	0.779	0.85	1	107.348			
			C	0.681	1.776	0.807	0.85	1	115.869			
T5 100.00-80.00	2682.02	4824.60	A	0.492	1.911	0.693	0.85	1	93.338	3902.15	195.11	C
			B	0.56	1.835	0.73	0.85	1	109.465			
			C	0.593	1.808	0.75	0.85	1	117.629			
T6 80.00-60.00	2682.02	4946.27	A	0.43	2.007	0.665	0.85	1	93.421	3749.97	187.50	C
			B	0.489	1.915	0.692	0.85	1	109.048			
			C	0.518	1.878	0.707	0.85	1	116.935			
T7 60.00-40.00	2682.02	6260.79	A	0.393	2.078	0.649	0.85	1	96.196	3596.72	179.84	C
			B	0.444	1.984	0.67	0.85	1	111.579			
			C	0.469	1.943	0.682	0.85	1	119.331			
T8 40.00-20.00	2682.02	6445.33	A	0.356	2.157	0.635	0.85	1	97.181	3334.01	166.70	C
			B	0.401	2.061	0.652	0.85	1	112.316			
			C	0.424	2.018	0.662	0.85	1	119.932			
T9 20.00-0.00	2279.72	7597.94	A	0.318	2.249	0.622	0.85	1	95.258	3347.69	167.38	C
			B	0.353	2.165	0.634	0.85	1	107.952			
			C	0.37	2.126	0.64	0.85	1	114.329			
Sum Weight:	21791.26	42422.56			*$2A_g$ limit			OTM	3125689.10 lb-ft	33940.15		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 180.00-160.00	436.80	803.42	A	0.562	1.832	0.731	1	1	33.904	711.89	35.59	A
			B	0.242	2.461	0.6	1	1	11.981			
			C	0.463	1.953	0.679	1	1	25.921			
T2 160.00-140.00	936.00	1951.13	A	0.633	1.787	0.774	1	1	61.592	1752.18	87.61	C
			B	0.741	1.784	0.85	1	1	78.063			
			C	0.795	1.812	0.892	1	1	87.446			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	1	1	56.468	1455.69	72.78	C
			B	0.563	1.831	0.732	1	1	69.137			
			C	0.604	1.802	0.756	1	1	76.127			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	1	1	56.151	1408.24	70.41	C
			B	0.464	1.95	0.68	1	1	67.163			
			C	0.497	1.904	0.696	1	1	73.101			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	1	1	59.437	1432.26	71.61	C
			B	0.408	2.048	0.655	1	1	69.612			
			C	0.435	1.998	0.667	1	1	75.012			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	1	1	59.976	1395.21	69.76	C
			B	0.356	2.157	0.635	1	1	69.501			
			C	0.38	2.106	0.643	1	1	74.498			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	1	1	62.332	1346.90	67.35	C
			B	0.323	2.236	0.623	1	1	71.499			
			C	0.344	2.186	0.63	1	1	76.268			

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*
T1 180.00-160.00	436.80	803.42	A	0.562	1.832	0.731	0.85	1	33.904	711.89	35.59	A
			B	0.242	2.461	0.6	0.85	1	11.981			
			C	0.463	1.953	0.679	0.85	1	25.921			
T2 160.00-140.00	936.00	1951.13	A	0.633	1.787	0.774	0.85	1	60.408	1728.45	86.42	C
			B	0.741	1.784	0.85	0.85	1	76.879			
			C	0.795	1.812	0.892	0.85	1	86.262			
T3 140.00-120.00	1060.80	1990.73	A	0.482	1.925	0.688	0.85	1	55.160	1430.68	71.53	C
			B	0.563	1.831	0.732	0.85	1	67.828			
			C	0.604	1.802	0.756	0.85	1	74.818			
T4 120.00-100.00	1060.80	2381.77	A	0.399	2.065	0.651	0.85	1	54.655	1379.43	68.97	C
			B	0.464	1.95	0.68	0.85	1	65.667			
			C	0.497	1.904	0.696	0.85	1	71.605			
T5 100.00-80.00	1060.80	2962.37	A	0.354	2.163	0.634	0.85	1	57.409	1393.54	69.68	C
			B	0.408	2.048	0.655	0.85	1	67.584			
			C	0.435	1.998	0.667	0.85	1	72.984			
T6 80.00-60.00	1060.80	3034.06	A	0.31	2.271	0.619	0.85	1	57.704	1352.66	67.63	C
			B	0.356	2.157	0.635	0.85	1	67.230			
			C	0.38	2.106	0.643	0.85	1	72.226			
T7 60.00-40.00	1060.80	4213.69	A	0.282	2.344	0.611	0.85	1	59.808	1302.32	65.12	C
			B	0.323	2.236	0.623	0.85	1	68.975			
			C	0.344	2.186	0.63	0.85	1	73.744			
T8 40.00-20.00	1060.80	4343.02	A	0.256	2.419	0.603	0.85	1	60.745	1206.91	60.35	C
			B	0.292	2.316	0.614	0.85	1	69.602			
			C	0.311	2.268	0.619	0.85	1	74.179			
T9 20.00-0.00	901.68	5293.34	A	0.23	2.499	0.597	0.85	1	61.467	1233.42	61.67	C
			B	0.258	2.414	0.604	0.85	1	68.721			
			C	0.272	2.374	0.608	0.85	1	72.432			
Sum Weight:	8639.28	26973.54						OTM	1051775.67 lb-ft	11739.30		

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	18844.43					
Bracing Weight	8129.11					
Total Member Self-Weight	26973.54			7152.99	-6698.02	
Total Weight	41284.82			7152.99	-6698.02	
Wind 0 deg - No Ice		0.00	-40422.79	-4346796.89	-6698.02	5806.00
Wind 30 deg - No Ice		19815.44	-34321.35	-3717723.05	-2157256.21	8377.12
Wind 60 deg - No Ice		34092.75	-19683.46	-2134599.61	-3716322.35	8799.59
Wind 90 deg - No Ice		39630.89	0.00	7152.99	-4307814.40	7030.48
Wind 120 deg - No Ice		35007.17	20211.40	2184127.93	-3777329.22	3377.56
Wind 150 deg - No Ice		19815.44	34321.35	3732029.03	-2157256.21	-1346.64
Wind 180 deg - No Ice		0.00	39366.92	4290658.19	-6698.02	-5550.02
Wind 210 deg - No Ice		-19815.44	34321.35	3732029.03	2143860.16	-8377.12
Wind 240 deg - No Ice		-35007.17	20211.40	2184127.93	3763933.18	-9183.56
Wind 270 deg - No Ice		-39630.89	0.00	7152.99	4294418.35	-7030.48
Wind 300 deg - No Ice		-34092.75	-19683.46	-2134599.61	3702926.30	-3249.57
Wind 330 deg - No Ice		-19815.44	-34321.35	-3717723.05	2143860.16	1346.64
Member Ice	15449.03					
Total Weight Ice	72990.55			16992.26	-20444.85	
Wind 0 deg - Ice		0.00	-46302.73	-4899363.63	-20444.85	6163.42
Wind 30 deg - Ice		21556.92	-37337.67	-4020497.36	-2351490.56	8386.19

Comb. No.	*Description*
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*
T1	180 - 160	Leg	Max Tension	12	30883.85	1209.16	683.95
			Max. Compression	23	-35405.32	1353.01	-803.26
			Max. Mx	19	-34753.96	-1370.57	-771.89
			Max. My	15	-34995.53	-35.94	1574.56
			Max. Vy	19	3394.94	-1370.57	-771.89
			Max. Vx	15	-3881.34	-35.94	1574.56
		Diagonal	Max Tension	16	3186.48	0.00	0.00
			Max. Compression	22	-3235.88	0.00	0.00
			Max. Mx	15	2837.53	-3.10	-0.12
			Max. My	24	-2637.00	-0.84	-1.12
			Max. Vy	15	3.66	-3.10	-0.12
			Max. Vx	24	0.48	-0.84	-1.12
		Horizontal	Max Tension	21	780.99	0.00	0.00
			Max. Compression	2	-574.46	0.00	0.00
			Max. Mx	14	138.96	4.59	0.00
			Max. My	18	96.04	0.00	0.00
			Max. Vy	14	-4.59	0.00	0.00
			Max. Vx	18	-0.00	0.00	0.00
		Top Girt	Max Tension	6	646.52	0.00	0.00
			Max. Compression	12	-692.19	0.00	0.00
			Max. Mx	14	-6.39	5.85	0.00
			Max. My	19	-194.58	0.00	0.00
			Max. Vy	14	5.85	0.00	0.00
			Max. Vx	19	-0.00	0.00	0.00
		Bottom Girt	Max Tension	8	752.74	0.00	0.00
			Max. Compression	2	-662.57	0.00	0.00
			Max. Mx	14	9.87	5.85	0.00
			Max. My	23	427.27	0.00	0.00
			Max. Vy	14	5.85	0.00	0.00
			Max. Vx	23	-0.00	0.00	0.00
T2	160 - 140	Leg	Max Tension	12	56529.87	-2617.65	25.84
			Max. Compression	23	-66535.14	3950.12	5.96
			Max. Mx	23	-66535.14	3950.12	5.96
			Max. My	24	-3226.62	-217.15	-3890.62
			Max. Vy	25	-735.47	-2752.97	35.47
			Max. Vx	22	847.74	-212.15	3872.30
		Diagonal	Max Tension	18	7184.84	0.00	0.00
			Max. Compression	18	-7393.20	0.00	0.00
			Max. Mx	23	5896.50	71.74	1.32
			Max. My	16	-6051.93	-31.92	23.80
			Max. Vy	23	-20.97	71.74	1.32
			Max. Vx	16	-5.27	0.00	0.00
T3	140 - 120	Leg	Max Tension	21	92319.56	-3798.08	11.94

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Mx	21	217259.85	-9480.77	32.46
			Max. My	20	-20346.66	2055.15	-4490.74
			Max. Vy	25	882.28	-9457.05	14.27
			Max. Vx	22	215.69	2075.31	4474.67
		Diagonal	Max Tension	24	8128.10	0.00	0.00
			Max. Compression	24	-7641.20	0.00	0.00
			Max. Mx	19	7068.02	141.45	-11.99
			Max. My	17	-6397.93	69.56	-16.00
			Max. Vy	21	54.13	137.66	12.44
			Max. Vx	17	2.94	0.00	0.00
T9	20 - 0	Leg	Max Tension	21	234814.57	4199.74	31.47
			Max. Compression	19	-307285.56	-0.00	0.07
			Max. Mx	19	-288698.59	12273.92	7.71
			Max. My	20	-25653.20	8077.53	-6896.26
			Max. Vy	25	-1479.78	-9457.05	14.27
			Max. Vx	22	784.90	8099.99	6866.65
		Diagonal	Max Tension	24	11463.40	0.00	0.00
			Max. Compression	24	-9697.59	0.00	0.00
			Max. Mx	21	2990.62	217.86	21.96
			Max. My	17	-8758.06	136.42	-26.34
			Max. Vy	21	70.37	217.86	21.96
			Max. Vx	17	4.14	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Leg C	Max. Vert	23	309837.21	21608.77	-12113.76
	Max. H_x	10	266162.94	23072.84	-13004.79
	Max. H_z	17	-242542.97	-26858.07	15245.20
	Min. Vert	17	-242542.97	-26858.07	15245.20
	Min. H_x	17	-242542.97	-26858.07	15245.20
	Min. H_z	10	266162.94	23072.84	-13004.79
Leg B	Max. Vert	19	311893.09	-21544.72	-12310.74
	Max. H_x	25	-240487.80	26751.81	15342.06
	Max. H_z	25	-240487.80	26751.81	15342.06
	Min. Vert	25	-240487.80	26751.81	15342.06
	Min. H_x	6	266834.80	-22997.91	-13162.39
	Min. H_z	6	266834.80	-22997.91	-13162.39
Leg A	Max. Vert	15	309376.83	202.60	24760.95
	Max. H_x	24	23338.89	1357.96	-4252.86
	Max. H_z	2	265872.44	173.94	26478.03
	Min. Vert	21	-243002.83	-137.02	-30892.14
	Min. H_x	19	-119681.84	-1432.22	-18828.64
	Min. H_z	21	-243002.83	-137.02	-30892.14

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	41284.82	-0.00	0.00	7202.67	-6698.15	0.04

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX lb	PY lb	PZ lb	PX lb	PY lb	PZ lb	% Error
16	21556.92	-72990.55	-37337.67	-21556.89	72990.54	37337.59	0.000%
17	36415.74	-72990.55	-21024.64	-36415.73	72990.54	21024.49	0.000%
18	43113.83	-72990.55	0.00	-43113.74	72990.54	0.03	0.000%
19	40099.34	-72990.55	23151.37	-40099.23	72990.54	-23151.30	0.000%
20	21556.92	-72990.55	37337.67	-21556.85	72990.54	-37337.60	0.000%
21	-0.00	-72990.55	42049.28	-0.11	72990.54	-42049.20	0.000%
22	-21556.92	-72990.55	37337.67	21556.85	72990.54	-37337.61	0.000%
23	-40099.34	-72990.55	23151.37	40099.24	72990.54	-23151.30	0.000%
24	-43113.83	-72990.55	0.00	43113.74	72990.54	0.03	0.000%
25	-36415.74	-72990.55	-21024.64	36415.74	72990.55	21024.64	0.000%
26	-21556.92	-72990.55	-37337.67	21556.89	72990.54	37337.58	0.000%
27	0.00	-41284.82	-15790.15	-0.00	41284.82	15790.15	0.000%
28	7740.41	-41284.82	-13406.78	-7740.41	41284.82	13406.78	0.000%
29	13317.48	-41284.82	-7688.85	-13317.48	41284.82	7688.85	0.000%
30	15480.81	-41284.82	0.00	-15480.81	41284.82	0.00	0.000%
31	13674.67	-41284.82	7895.08	-13674.67	41284.82	-7895.08	0.000%
32	7740.41	-41284.82	13406.78	-7740.41	41284.82	-13406.78	0.000%
33	-0.00	-41284.82	15377.70	0.00	41284.82	-15377.70	0.000%
34	-7740.41	-41284.82	13406.78	7740.41	41284.82	-13406.78	0.000%
35	-13674.67	-41284.82	7895.08	13674.67	41284.82	-7895.08	0.000%
36	-15480.81	-41284.82	0.00	15480.81	41284.82	0.00	0.000%
37	-13317.48	-41284.82	-7688.85	13317.48	41284.82	7688.85	0.000%
38	-7740.41	-41284.82	-13406.78	7740.41	41284.82	13406.78	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	0.00000001
3	Yes	4	0.00000001	0.00000123
4	Yes	4	0.00000001	0.00000001
5	Yes	4	0.00000001	0.00000105
6	Yes	4	0.00000001	0.00000001
7	Yes	4	0.00000001	0.00000109
8	Yes	4	0.00000001	0.00000001
9	Yes	4	0.00000001	0.00000136
10	Yes	4	0.00000001	0.00000001
11	Yes	4	0.00000001	0.00000106
12	Yes	4	0.00000001	0.00000001
13	Yes	4	0.00000001	0.00000114
14	Yes	4	0.00000001	0.00000001
15	Yes	4	0.00000001	0.00000145
16	Yes	4	0.00000001	0.00000243
17	Yes	4	0.00000001	0.00000308
18	Yes	4	0.00000001	0.00000220
19	Yes	4	0.00000001	0.00000148
20	Yes	4	0.00000001	0.00000224
21	Yes	4	0.00000001	0.00000297
22	Yes	4	0.00000001	0.00000240
23	Yes	4	0.00000001	0.00000151
24	Yes	4	0.00000001	0.00000222
25	Yes	4	0.00000001	0.00000216
26	Yes	4	0.00000001	0.00000229
27	Yes	4	0.00000001	0.00000001
28	Yes	4	0.00000001	0.00000001

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T9	20 - 0	0.237	19	0.0811	0.0027

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
190.00	20' x 3" Dia Omni	19	22.261	1.2880	0.0267	21587
180.00	LPA-80080/6CF	19	22.261	1.2880	0.0267	21587
178.00	6 Arm Halo Mount	19	21.712	1.2744	0.0273	21587
170.00	PiROD 12' Lightweight T-Frame	19	19.534	1.2206	0.0296	10793
160.00	PiROD 12' Lightweight T-Frame	19	16.912	1.1505	0.0318	5635
150.00	PiROD 12' Lightweight T-Frame	19	14.485	1.0725	0.0330	5400

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load lb	Ratio Load / Allowable	Allowable Ratio	Criteria
T2	160	Leg	A325N	1.0000	6	6186.68	34556.80	0.179 ✔	1.333	Bolt Tension
		Diagonal	A325N	1.0000	1	7184.84	8156.25	0.881 ✔	1.333	Member Bearing
T9	20	Leg	A325N	1.2500	6	38511.30	53993.70	0.713 ✔	1.333	Bolt Tension
		Diagonal	A325N	1.2500	1	11463.40	16992.20	0.675 ✔	1.333	Member Bearing

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in²	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	180 - 160	1 1/2	20.00	2.38	76.0 K=1.00	19.800	1.7672	-35405.30	34989.80	1.012 ✔
T2	160 - 140	Pirod 105216	20.03	10.02	45.4 K=1.00	25.051	3.6816	-66535.10	92228.10	0.721 ✔
T3	140 - 120	Pirod 105216	20.03	10.02	45.4 K=1.00	25.051	3.6816	-108615.00	92228.10	1.178 ✔
T4	120 - 100	Pirod 105217	20.03	10.02	37.8 K=1.00	26.132	5.3014	-146474.00	138539.00	1.057 ✔
T5	100 - 80	Pirod 105218	20.03	10.02	32.4	26.848	7.2158	-181507.00	193727.00	0.937

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 $\frac{P}{P_a}$
T6	80 - 60	L3x3x3/16	16.80	8.09	152.7 K=0.94	6.402	1.0900	-6854.72	6978.45	0.982 ✓
T7	60 - 40	L3x3x5/16	18.45	8.93	167.2 K=0.92	5.343	1.7800	-7130.04	9510.22	0.750 ✓
T8	40 - 20	L3x3x5/16	19.30	9.36	174.0 K=0.91	4.933	1.7800	-7641.20	8781.58	0.870 ✓
T9	20 - 0	L3 1/2x3 1/2x5/16	21.03	10.01	174.1 K=1.00	4.928	2.0900	-9697.59	10300.30	0.941 ✓

Horizontal Design Data (Compression)

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 $\frac{P}{P_a}$
T1	180 - 160	3/4	4.00	3.88	173.6 K=0.70	4.955	0.4418	-574.46	2189.09	0.262 ✓

Top Girt Design Data (Compression)

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 $\frac{P}{P_a}$
T1	180 - 160	7/8	4.00	3.88	148.8 K=0.70	6.744	0.6013	-692.19	4055.56	0.171 ✓

Bottom Girt Design Data (Compression)

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 $\frac{P}{P_a}$
T1	180 - 160	7/8	4.00	3.88	148.8 K=0.70	6.744	0.6013	-662.57	4055.56	0.163 ✓

Tension Checks

Leg Design Data (Tension)

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 $\frac{P}{P_a}$

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 $\frac{P}{P_a}$
T2	160 - 140	L2 1/2x2 1/2x3/16	11.42	5.00	80.1	21.600	0.9020	7184.84	19483.20	0.369 ✔
T3	140 - 120	L2 1/2x2 1/2x3/16	11.93	5.59	86.2	21.600	0.9020	6723.03	19483.20	0.345 ✔
T4	120 - 100	L2 1/2x2 1/2x3/16	13.13	6.22	96.0	21.600	0.9020	6411.23	19483.20	0.329 ✔
T5	100 - 80	L3x3x3/16	14.50	6.93	88.6	21.600	1.0900	6443.56	23544.00	0.274 ✔
T6	80 - 60	L3x3x3/16	16.01	7.70	98.4	21.600	1.0900	6543.75	23544.00	0.278 ✔
T7	60 - 40	L3x3x5/16	18.45	8.93	116.2	21.600	1.7800	6964.90	38448.00	0.181 ✔
T8	40 - 20	L3x3x5/16	20.16	9.79	127.4	21.600	1.7800	8128.10	38448.00	0.211 ✔
T9	20 - 0	L3 1/2x3 1/2x5/16	21.92	10.45	118.6	21.600	2.0900	11463.40	45144.00	0.254 ✔

Horizontal Design Data (Tension)

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 $\frac{P}{P_a}$
T1	180 - 160	3/4	4.00	3.88	248.0	30.000	0.4418	780.99	13253.60	0.059 ✔

Top Girt Design Data (Tension)

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 $\frac{P}{P_a}$
T1	180 - 160	7/8	4.00	3.88	212.6	30.000	0.6013	646.52	18039.60	0.036 ✔

Bottom Girt Design Data (Tension)

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 $\frac{P}{P_a}$
T1	180 - 160	7/8	4.00	3.88	212.6	30.000	0.6013	752.74	18039.60	0.042 ✔

ANCHOR BOLT ANALYSIS

Input Data

Max Pier Reactions:

Uplift:	$Uplift := 243 \cdot kips$	*user input*
Shear:	$Shear := 31 \cdot kips$	*user input*
Compression:	$Compression := 312 \cdot kips$	*user input*

Anchor Bolt Data:

Use ASTM A687

Number of Anchor Bolts = N	$N := 6$	*user input*	
Bolt Ultimate Strength:	$F_u := 150 \cdot ksi$	*user input*	
Bolt Yield Strength:	$Fy := 105 \cdot ksi$	*user input*	
Bolt Modulus:	$E := 29000 \cdot ksi$	*user input*	
Thickness of Anchor Bolts	$D := 1.25in$	*user input*	
Threads per Inch:	$n := 8$	*user input*	
Coefficient of Friction:	$\mu := 0.55$	*user input*	(for baseplate with grout ASCE 10-97)

Check Anchor Bolt Area:

Based on the ASCE 10-97 Design of Latticed Steel Transmission Structures

Required Area:

$$A_{s1} := \frac{Uplift}{Fy} + \frac{Shear}{\mu \cdot 0.85 \cdot Fy} \qquad A_{s1} = 2.9 \cdot in^2$$

$$A_{s2} := \left| \frac{Shear - (0.3 \cdot Compression)}{\mu \cdot 0.85 \cdot Fy} \right| \qquad A_{s2} = 1.3 \cdot in^2$$

Provided Area:

$$A_{sprovided} := A_n \cdot N \qquad A_{sprovided} = 6.0 \cdot in^2$$

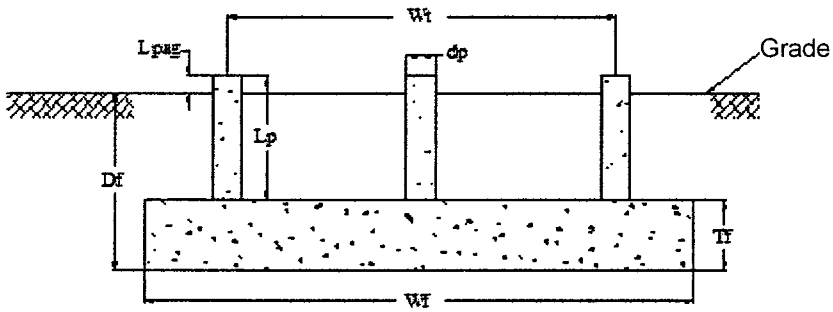
$$Condition2 := if\left(\frac{A_{s1}}{A_{sprovided}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right) \qquad \frac{A_{s1}}{A_{sprovided}} = 0.5$$

$$\boxed{Condition2 = \text{"OK"}}$$

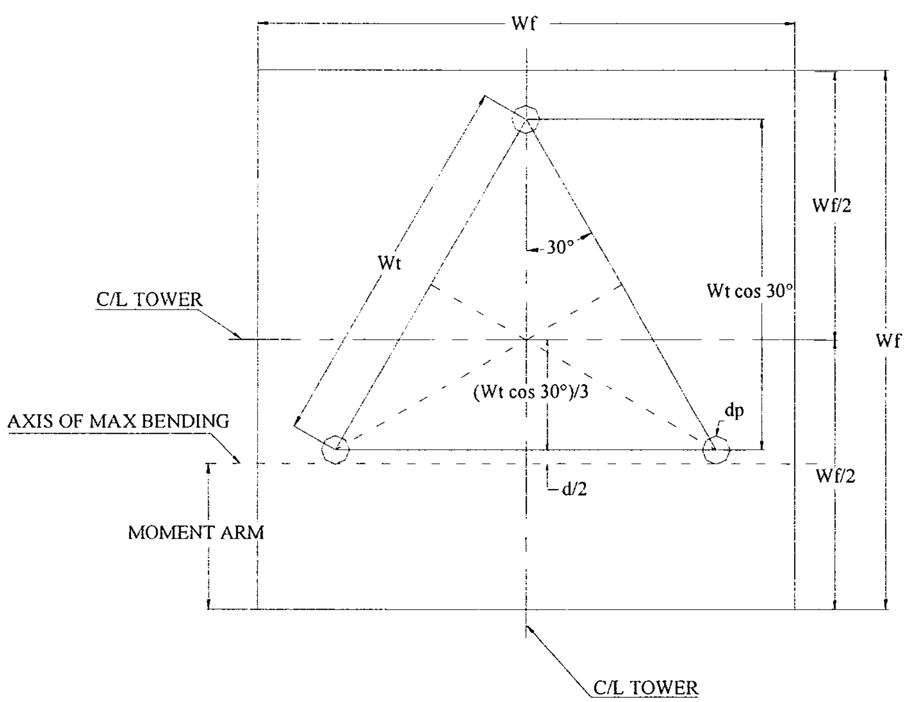
$$Condition3 := if\left(\frac{A_{s2}}{A_{sprovided}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right) \qquad \frac{A_{s2}}{A_{sprovided}} = 0.2$$

$$\boxed{Condition3 = \text{"OK"}}$$

FOUNDATION OVERVIEW



ELEVATION



PLAN

BEARING PRESSURE CHECK:

Pressure Applied:

$LOAD_{tot} := WT_c + WT_{s1} + WT_t$ $\qquad LOAD_{tot} = 724.8306 \cdot kip$

$A_{mat} := W_f^{\,2}$ $\qquad A_{mat} = 812.25 \cdot ft^2$

$S := \dfrac{W_f^{\,3}}{6}$ $\qquad S = 3858.1875 \cdot ft^3$

$P_{max} := \dfrac{LOAD_{tot}}{A_{mat}} + \dfrac{M_{ot}}{S}$ $\qquad P_{max} = 2.316 \cdot ksf$

$P_{min} := \dfrac{LOAD_{tot}}{A_{mat}} - \dfrac{M_{ot}}{S}$ $\qquad P_{min} = -0.5313 \cdot ksf$

$MaxPressure := if\left(P_{max} < q_s, \text{"Okay"}, \text{"No Good"}\right)$ $\qquad MaxPressure = \text{"Okay"}$

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

Distance to Resultant of Pressure Distribution:

$X_p := \dfrac{P_{max}}{\dfrac{P_{max} - P_{min}}{W_f}} \cdot \dfrac{1}{3}$ $\qquad X_p = 7.7274 \cdot ft$

Distance to Kern: $X_k := \dfrac{W_f}{3}$ $\qquad X_k = 9.5 \cdot ft$

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

Eccentricity: $e := \dfrac{M_{ot}}{LOAD_{tot}}$ $\qquad e = 7.5779$

Adjusted Soil Pressure: $q_a := \dfrac{2 \cdot LOAD_{tot}}{3 \cdot W_f \cdot \left(\dfrac{W_f}{2} - e\right)}$ $\qquad q_a = 2.5412 \cdot ksf$

Revised Maximum: $q_{max} := if\left(X_p < X_k, q_a, P_{max}\right)$ $\qquad q_{max} = 2.5412 \cdot kip$

$PressureCheck := if\left(q_{max} < q_s, \text{"Okay"}, \text{"No Good"}\right)$ $\qquad PressureCheck = \text{"Okay"}$

TENSILE REINFORCEMENT IN PAD:

$\phi_m := .90$ per ACI 9.3.2.2

Applied Moments:

$$M_{nT} := LF\cdot\left[U_t\cdot\left(W_t\cdot\sin(60\cdot deg) - \frac{d_p}{2}\right) + S_t\cdot\left(D_f + L_{pag}\right)\right] - WT_t\cdot X_{off}$$

$$M_{nS} := -1\cdot\left[\frac{1}{2}\cdot\left(\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2}\right)^2\cdot W_t\cdot\left[\gamma_s\cdot\left(T_{pp} - T_f\right)\right] + WT_{s2}\cdot\left[\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2} + \left(D_f - n\right)\cdot\tan\left(\phi_s\right)\right]\right]$$

$$M_{nC} := -1\cdot\left[\frac{1}{2}\cdot\left(\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2}\right)^2\cdot W_t\cdot\left(\gamma_c\cdot T_f\right)\right]$$

Design Moment: $M_n := \dfrac{M_{nT} + M_{nS} + M_{nC}}{\phi_m}$ $\quad M_n = 3166.3213\cdot kips\cdot ft$

Required Reinforcement:

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

Effective Width: $\quad b_{eff} := W_t\cdot\cos(30\cdot deg) + d_p$ $\quad b_{eff} = 267.8461\cdot in$

$$A_s := \frac{M_n}{\phi_m\cdot fy\cdot d} \qquad A_s = 23.8518\cdot in^2$$

$$a := \frac{A_s\cdot fy}{\beta\cdot f'c\cdot b_{eff}} \qquad a = 1.796\cdot in$$

$$A_s := \frac{M_n}{fy\cdot\left(d - \frac{a}{2}\right)} \qquad A_s = 22.1405\cdot in^2$$

$$\rho := \frac{A_s}{b_{eff}\cdot d} \qquad \rho = 0.0028$$

REINFORCEMENT IN PIER:

Pier Area: $A_p := \frac{\pi \cdot d_p^{\,2}}{4}$ $\qquad A_p = 2827.4334 \cdot in^2$

(ACI 10.8.4 and 10.9.1) $A_{smin} := 0.01 \cdot 0.5 \cdot A_p$ $\qquad A_{smin} = 14.1372 \cdot in^2$

$A_{sprov} := NBpier \cdot A_{bpier}$ $\qquad A_{sprov} = 14.22 \cdot in^2$

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

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: $B_{sPier} := \frac{d_p \cdot \pi}{NBpier} - d_{bpier}$ $\qquad B_{sPier} = 9.472 \cdot in$

Diamter of Reinforcement Cage: $Diam_{cage} := d_p - 2 \cdot Cvr$ $\qquad Diam_{cage} = 54 \cdot in$

Maximum Moment in Pier: $M_p := (S_t \cdot L_p) \cdot LF$ $\qquad M_p = 2708.55 \cdot kips \cdot in$

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

(defined variables) $(f'_c \;\; f_y \;\; cl \;\; Spiral) = (3 \;\; 60 \;\; 4 \;\; 0)$

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: $(D \;\; N \;\; n \;\; P_u \;\; M_{xu}) := (60 \;\; 18 \;\; 8 \;\; 311 \;\; 2708)$

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: $(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho) = (3770.5037 \;\; 32831.267 \;\; -32.2869 \;\; 0.005)$

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

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

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

Available Length in Pier: $L_{pier} := L_p - 3\cdot in$ $\qquad L_{pier} = 42\cdot in$

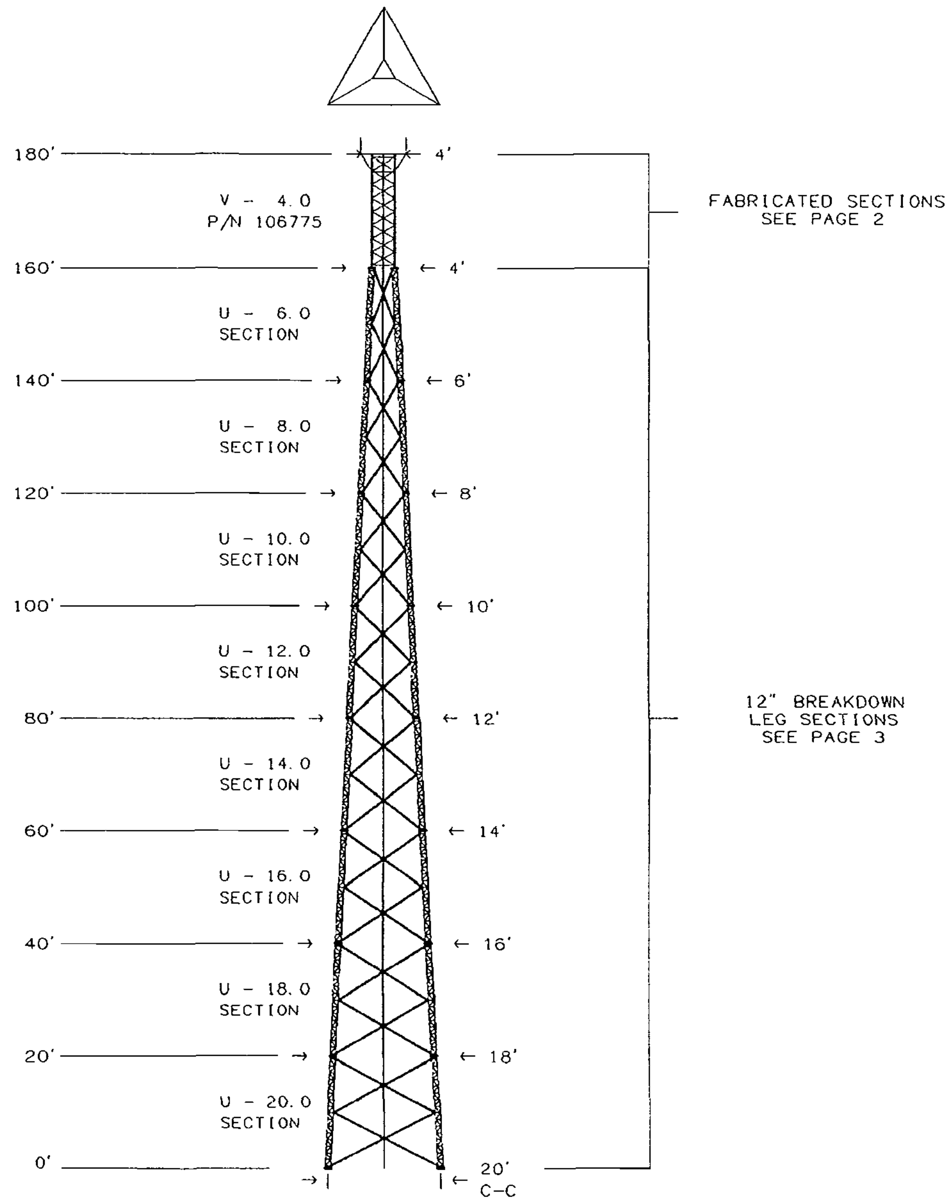
$L_{piertension} := if(L_{pier} > L_{dbt}, \text{"Okay"}, \text{"No Good"})$ $\qquad L_{piertension} = \text{"Okay"}$

$L_{piercompression} := if(L_{pier} > L_{dbc}, \text{"Okay"}, \text{"No Good"})$ $\qquad L_{piercompression} = \text{"Okay"}$

Available Length in Pad: $L_{pad} := T_f - 3\cdot in$ $\qquad L_{pad} = 30\cdot in$

$L_{padtension} := if(L_{pad} > L_{dbt}, \text{"Okay"}, \text{"No Good"})$ $\qquad L_{padtension} = \text{"Okay"}$

$L_{padcompression} := if(L_{pad} > L_{dbc}, \text{"Okay"}, \text{"No Good"})$ $\qquad L_{padcompression} = \text{"Okay"}$



ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

A	FOUNDATION PER SOIL REPORT	TMW	04/12/2006
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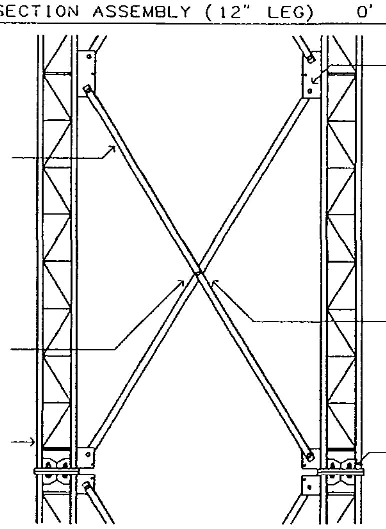
BREAKDOWN SECTION DATA (12" LEG) 0' - 160' ELEVATION

SEC #	SECTION LENGTH	LEG SIZE	LEG PART#	TOP DIAG PART#	BOT DIAG PART#	DIAGONAL ANGLE FACE	DIAGONAL ANGLE THICK	SECTION WEIGHT	LEG CONNECT+ DIAM	LEG CONNECT+ LENGTH	DIAG CONNECT DIAM	DIAG CONNECT LENGTH
U- 6.0	20'	1- 1/4"	195554	105898	105556	2-1/2"	3/16"	1921#	1 "	3-1/2"	1 "	2-1/4"
U- 8.0	20'	1- 1/4"	195554	105558	105561	2-1/2"	3/16"	1950#	1 "	3-1/2"	1 "	2-1/4"
U-10.0	20'	1- 1/2"	195555	105564	105567	2-1/2"	3/16"	2346#	1 "	3-1/2"	1 "	2-1/4"
U-12.0	20'	1- 3/4"	195557	105571	105574	3"	3/16"	2914#	1 "	3-1/2"	1 "	2-1/4"
U-14.0	20'	1- 3/4"	195557	105576	105579	3"	3/16"	2980#	1 "	4-1/4"	1 "	2-1/4"
U-16.0	20'	2 "	195559	113411	113412	3"	5/16"	4215#	1-1/4"	4-1/2"	1-1/4"	2-3/4"
U-18.0	20'	2 "	195559	128185	128186	3"	5/16"	4335#	1-1/4"	4-1/2"	1-1/4"	2-3/4"
U-20.0	20'	2- 1/4"	195560	105598	105601	3-1/2"	5/16"	5256#			1-1/4"	2-3/4"

* THE WEIGHTS LISTED ARE THEORETICAL. THE ACTUAL WEIGHTS WILL VARY. ALL WEIGHTS SHOULD BE CONFIRMED IN THE FIELD PRIOR TO ERECTION.

\+ USE 1 FLATWASHER UNDER EACH LOCKNUT, FOR LEG CONNECTION ONLY. ALSO USE 1 FLATWASHER UNDER EACH BOLT HEAD WHERE BUSHINGS ARE REQUIRED.

TYPICAL BREAKDOWN SECTION ASSEMBLY (12" LEG) 0' - 160' ELEVATION



ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 130'

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FOUNDATION NOTES

1. SOIL AS PER REPORT DR CLARENCE WELTI, DATED: 9/22/05
2. CONCRETE TO BE 3500 PSI @28 DAYS. REINFORCING BAR TO CONFORM TO ASTM A615 GRADE 60 SPECIFICATIONS. CONCRETE INSTALLATION TO CONFORM TO ACI-318 (2002) BUILDING REQUIREMENTS FOR REINFORCED CONCRETE. ALL CONCRETE TO BE PLACED AGAINST UNDISTURBED EARTH FREE OF WATER AND ALL FOREIGN OBJECTS AND MATERIALS. A MINIMUM OF THREE INCHES OF CONCRETE SHALL COVER ALL REINFORCEMENT. WELDING OF REBAR NOT PERMITTED.
3. A COLD JOINT IS PERMISSIBLE UPON CONSULTATION WITH PIROD. ALL COLD JOINTS SHALL BE COATED WITH BONDING AGENTS PRIOR TO SECOND POUR.
4. ALL FILL SHOULD BE PLACED IN LOOSE LEVEL LIFTS OF NO MORE THAN 12" THICK. FILL MATERIALS SHOULD BE CLEAN AND FREE OF ORGANIC AND FROZEN MATERIALS OR ANY OTHER DELETERIOUS MATERIALS. COMPACT FILL TO 95% OF MODIFIED PROCTOR MAXIMUM DRY DENSITY IN ACCORDANCE WITH ASTM D1557.
5. BENDING, STRAIGHTENING OR REALIGNING (HOT OR COLD) OF THE ANCHOR BOLTS BY ANY METHOD IS PROHIBITED.
6. CROWN TOP OF FOUNDATION FOR PROPER DRAINAGE.
7. FOUNDATION IS TO BEAR ON BEDROCK/INSITU CLAY AT APPROXIMATELY 6.0' BELOW GRADE. THE BEARING SURFACE IS TO BE FREE OF ANY LOOSE MATERIAL & SUBSEQUENTLY INSPECTED BY A QUALIFIED ON-SITE GEOTECHNICAL ENGINEER.
8. DIFFICULTIES DURING EXCAVATION MAY ARISE DUE TO THE PRESENCE OF BOULDERS, COBBLES, AND/OR SHALLOW BEDROCK. THE BOULDERS, COBBLES, AND/OR ROCK MUST BE REMOVED FROM THE EXCAVATION.
9. PNEUMATIC HAMMERS, RIPPERS, AND/OR BLASTING MAY BE REQUIRED TO REMOVE MATERIAL FROM THE EXCAVATION.
10. THE FOUNDATION MUST BEAR ENTIRELY ON COMPETENT BEDROCK OR SOIL. THE FOUNDATION IS NOT TO BEAR ON ANY COMBINATION OF SOIL AND BEDROCK AS THIS MAY CAUSE EXCESSIVE DIFFERENTIAL SETTLEMENT.
11. THE TOWER FOUNDATION MUST BEAR BELOW ALL EXISTING UNCONTROLLED FILL AT THIS SITE. A QUALIFIED ON-SITE GEOTECHNICAL ENGINEER MUST INSPECT THE BEARING SURFACE TO ENSURE THAT THE CAPACITY MEETS OR EXCEEDS THAT DISCLOSED IN THE REFERENCED SOIL REPORT.
12. ANY FILL DETECTED BENEATH THE BEARING SHOULD BE REMOVED AND REPLACED WITH COMPACTED FILL, AS DETAILED IN THE SOIL REPORT AND AS DIRECTED BY THE ON-SITE GEOTECHNICAL ENGINEER.
13. THE ON-SITE GEOTECHNICAL ENGINEER SHALL CONFIRM THAT THE INSITU SOIL STRENGTHS MEET OR EXCEED THOSE PARAMETERS GIVEN IN THE SOIL REPORT.

ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

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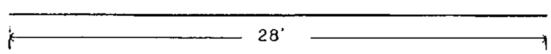
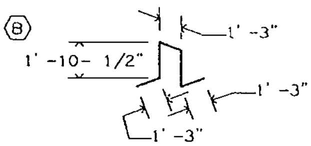
(A)



9 REBAR - 140 PIECES REQ. TOTAL
APPROX WT = 95.2# EACH, 13328# TOTAL

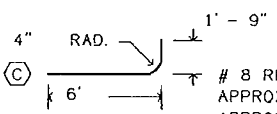
REBAR SUPPORTS MAY CONSIST OF ANY ACCEPTABLE MEANS OF SECURELY SUPPORTING THE TOP REINFORCEMENT GRID ABOVE THE BOTTOM REINFORCEMENT GRID WHILE MAINTAINING A SEPARATION OF 2'-3" (OUTSIDE REBAR TO OUTSIDE REBAR).

(B)



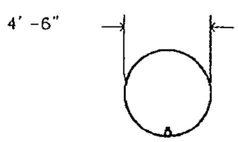
5 REBAR - 81 PIECES REQUIRED TOTAL
TYPE 26 STANDEE PLACED BETWEEN REBAR GRIDS ON NOMINAL 4' SPACING THROUGHOUT
APPROX UNBENT LENGTH = 7' - 5- 3/4"
APPROX WT = 7.8# EACH, 632# TOTAL

(C)

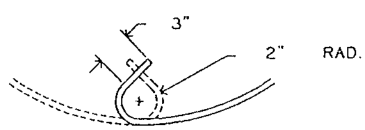


8 REBAR - 54 PIECES REQUIRED TOTAL
APPROX UNBENT LENGTH = 7' - 7- 3/8"
APPROX WT = 20.3# EACH, 1096# TOTAL

(D)



4 REBAR - 15 PIECES REQUIRED TOTAL
WITH 135 DEGREE HOOK ON EACH END
APPROX UNBENT LENGTH = 15' - 5- 1/8"
APPROX WT = 10.3# EACH, 155# TOTAL



DETAIL OF 135 DEGREE HOOKS

PLACE CIRCULAR TIES SO THAT HOOKS ON ADJACENT TIES ARE 180 DEGREES APART AND HOOKS ENCIRCLE A VERTICAL BAR. PLACE ONE TIE AT TOP OF PAD AND TWO TIES AT TOP OF PIER REBAR. EQUALLY SPACE REMAINING TIES ALONG PIER.

REBAR DETAIL

TOTAL APPROX REBAR WEIGHT = 15211#
REINFORCING BAR TO CONFORM TO
ASTM A615 GRADE 60 SPECIFICATIONS.

ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

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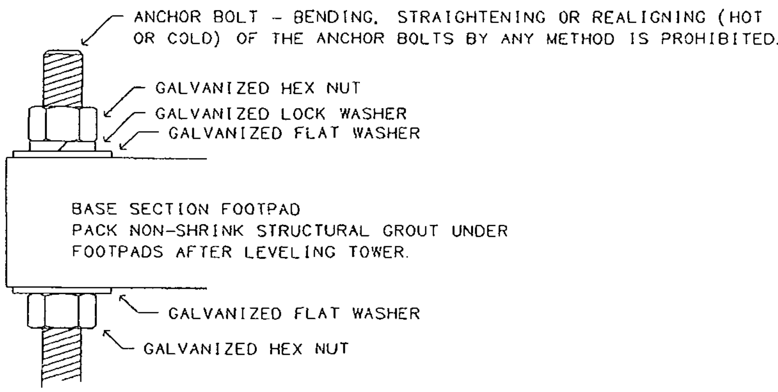

BASE SECTION INSTALLATION DETAIL

ROADRUNNER INSTALLATION SVCS.
EAST HARTLAND, CT
U-20.0 X 180'

REV	DESCRIPTION OF REVISIONS	INI	DATE
A	FOUNDATION PER SOIL REPORT	TMW	04/12/2006

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Site Name: East Hartland, CT
Cumulative Power Density

Operator	Operating Frequency	Number of Trans.	ERP Per Trans.	Total ERP	Distance to Target	Calculated Power Density	Maximum Permissable Exposure*	Fraction of MPE
	(MHz)		(watts)	(watts)	(feet)	(mW/cm^2)	(mW/cm^2)	(%)
VZW	1970	3	485	1455	180	0.0161	1.0	1.61%
VZW	875	9	300	2700	180	0.0300	0.583	5.14%
Total Percentage of Maximum Permissible Exposure								6.76%

*Guidelines adopted by the FCC on August 1, 1996, 47 CFR Part 1 based on NCRP Report 86, 1986 and generally on ANSI/IEEE C95.1-1992

MHz = Megahertz
mW/cm^2 = milliwatts per square centimeter
ERP = Effective Radiated Power

Absolute worst case maximum values used.