ROBINSON & COLE LLP

EM-VER-062-080213

ORIGINAL

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

February 13, 2008

Via Hand Delivery

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

Re: **Notice of Exempt Modification**
150 Willow Street, Hamden, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") intends to install antennas on the approved 160-foot self-supporting monopole tower owned by Sprint Nextel ("Sprint") at 150 Willow Street in Hamden, Connecticut. Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Craig Henrici, Mayor of the Town of Hamden. Pursuant to a Council directive, a copy of this letter is also being sent to Hamden Fish & Game Protective, the owners of the property on which the tower is located.

The approved Sprint facility will consist of a 160-foot self-supporting monopole tower capable of supporting multiple carriers within a fenced compound at 150 Willow Street in Hamden. The tower is will support Sprint antennas at the 157-foot level on the tower. Cellco intends to install six (6) LPA-80080/4CF and six (6) LPA-185080/8CF antennas at the 147-foot level on the tower and place a 12' x 30' equipment shelter at the base of the tower within the fenced compound. Attached behind Tab 1 are Project Plans for the proposed Cellco facility.

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

1. The proposed modification will not increase the overall height of the existing tower. Once constructed, Cellco's antennas will be mounted with their centerline at the 147-foot level on the 160-foot tower.

2. The proposed installation of a 12' x 30' equipment shelter will not require an extension of the fenced compound or lease area.

3. The proposed installation will not increase the noise levels at the facility by six decibels or more.

4. The operation of the antennas will not increase radio frequency (RF) power density levels at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. The cumulative worst-case RF power density calculations for Sprint and Cellco antennas would be 14.10% of the FCC standard. A copy of cumulative power density calculations table is attached behind Tab 2.

Included behind Tab 3, is a Structural Analysis confirming that the tower can support the approved and proposed Cellco antennas and associated equipment.

For the foregoing reasons, Cellco respectfully submits that the proposed antenna installation at the facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2).

Sincerely,

Kenneth C. Baldwin

Attachments
Copy to:
Craig Henrici, Hamden Mayor
Hamden Fish & Game Protective
Sandy M. Carter

CELLCO PARTNERSHIP
DBA
verizon wireless

HAMDEN NORTH 2

150 WILLOW STREET
HAMDEN, CONNECTICUT 06518

GENERAL NOTES

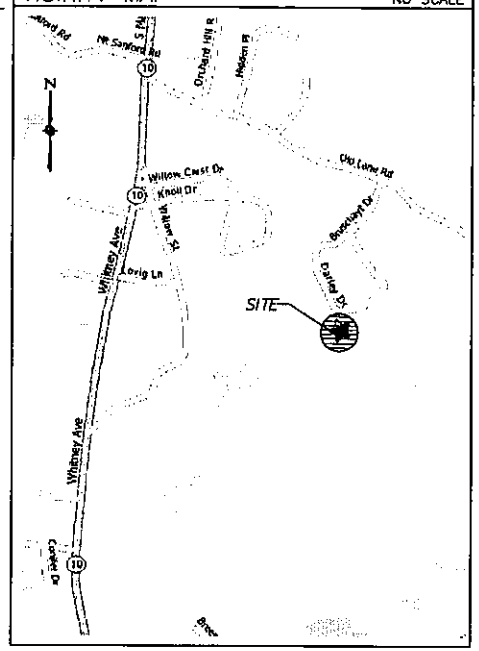
1. THE TYPE, DIMENSIONS, MOUNTING HARDWARE, AND POSITIONS OF ALL PROJECT OWNER'S EQUIPMENT ARE SHOWN IN ILLUSTRATIVE FASHION. THESE DRAWINGS ARE NOT INTENDED FOR CONSTRUCTION. ACTUAL HARDWARE DETAILS AND FINAL LOCATIONS MAY DIFFER SLIGHTLY FROM WHAT IS SHOWN.

2. THE PROJECT OWNER'S PCS FACILITY IS AN UNMANNED PRIVATE AND SECURED EQUIPMENT INSTALLATION. IT IS ONLY ACCESSED BY TRAINED TECHNICIANS FOR PERIODIC ROUTINE MAINTENANCE AND THEREFORE DOES NOT REQUIRE ANY WATER OR SANITARY SEWER SERVICE. THE FACILITY IS NOT GOVERNED BY REGULATIONS REQUIRING PUBLIC ACCESS PER ADA REQUIREMENTS.

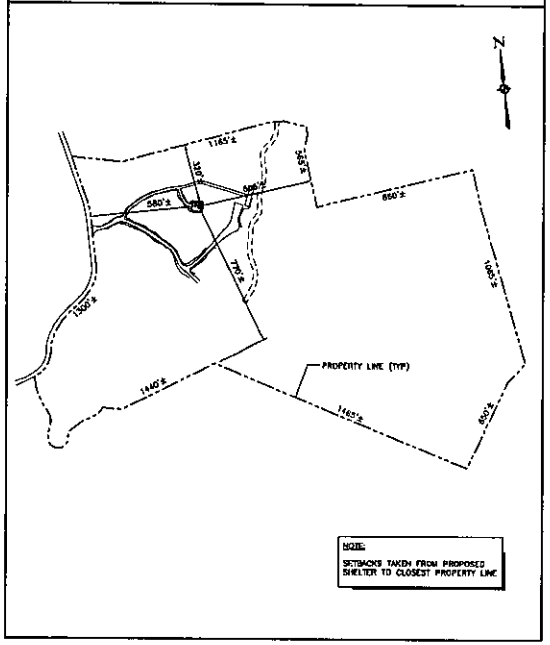
3. THE DESIGN OF THE ANTENNA MOUNTING HARDWARE WILL MEET THE ANSI/EIA/TIA-222-F STANDARDS FOR STRUCTURAL STEEL ANTENNA SUPPORTING STRUCTURES AND STATE BUILDING CODE REQUIREMENTS. DETAILED CONSTRUCTION DRAWINGS AND STRUCTURAL CALCULATIONS WILL BE PREPARED BY A REGISTERED PROFESSIONAL ENGINEER AND SUBMITTED WITH A BUILDING PERMIT APPLICATION FOR REVIEW AND APPROVAL BY THE LOCAL BUILDING CODE ENFORCEMENT OFFICIAL.

4. ONCE THE FACILITY BECOMES FULLY OPERATIONAL, NORMAL AND ROUTINE MAINTENANCE BY PROJECT OWNER'S TECHNICIANS WILL BE PERFORMED ON A MONTHLY BASIS. THEREFORE, THE ESTIMATED VEHICLE TRIP GENERATION RATE IS 2 TRIPS PER MONTH. THE AVERAGE DAILY TRIP GENERATION RATE (ADT) IS 0.07.

VICINITY MAP
NO SCALE



PLOT PLAN
SCALE: 1"=300'-0"



NOTE:
SETBACKS TAKEN FROM PROPOSED SHELTER TO CLOSEST PROPERTY LINE

PROJECT SUMMARY

SITE NAME:	HAMDEN NORTH 2
SITE ADDRESS:	150 WILLOW STREET HAMDEN, CONNECTICUT 06518
CONTACT PERSON:	VERIZON WIRELESS BRIAN RADOZZINE (860) 982-4246
TOWER OWNER:	SPRINT CROSSROADS CORPORATE CENTER INTERNATIONAL BLVD. SUITE 800 MARNAH, NJ 07795
GOVERNING CODE:	CONNECTICUT BUILDING CODES CONNECTICUT LIFE SAFETY CODES
JURISDICTION:	CONNECTICUT SITING COUNCIL
APPLICANT:	VERIZON WIRELESS 99 EAST RIVER DRIVE EAST HARTFORD, CT. 06108
ARCHITECT:	URS CORPORATION A.E.S. 500 ENTERPRISE DRIVE, SUITE 3B ROCKY HILL, CT 06067
M/E/P ENGINEER:	URS CORPORATION A.E.S. 500 ENTERPRISE DRIVE, SUITE 3B ROCKY HILL, CT 06067
LATITUDE:	41° 28' 57.81" NAD 83
LONGITUDE:	72° 54' 4.5" NAD 83

LEGEND

SYMBOL	DESCRIPTION
	SECTION OR DETAIL NUMBER SHEET WHERE DETAIL/SECTION OCCURS
	ELEVATION NUMBER SHEET WHERE ELEVATION OCCURS

ABBREVIATIONS

MIN.	MINIMUM
V.I.F.	VERIFY IN FIELD
O.C.	ON CENTER
PSF	POUND/SQUARE FOOT
TYP.	TYPICAL
TOC	TOP OF CONCRETE
TOW	TOP OF WALL
FT.	FEET
SQ.FT.	SQUARE FOOT
N/A	NOT APPLICABLE

SHEET INDEX

SHT. NO.	DESCRIPTION
T-1	TITLE SHEET - GENERAL NOTES AND LEGENDS
SC-1	COMPOUND PLAN, ELEVATION AND ANTENNA ORIENTATION PLAN

CELLCO PARTNERSHIP
DBA
verizon wireless

A&E FIRM
URS CORPORATION AES
500 ENTERPRISE DRIVE
SUITE 3B
ROCKY HILL, CONNECTICUT
1-(860)-529-8882

A&E SEAL

SITE NAME: HAMDEN NORTH 2
PROJECT ID # 2000018055
PROJECT TYPE: BDGCO
LOCATION CODE: 117615
SITE ADDRESS:
150 WILLOW STREET
HAMDEN, CONNECTICUT
06518

PROJECT NO: 36931108
JOB NO: VZ4-032
DRAWN BY: KAP
CHECKED BY: MJE

ISSUED FOR

A	01-11-08	REVIEW
B	01-21-08	REVIEW
0	01-28-08	SITING COUNCIL

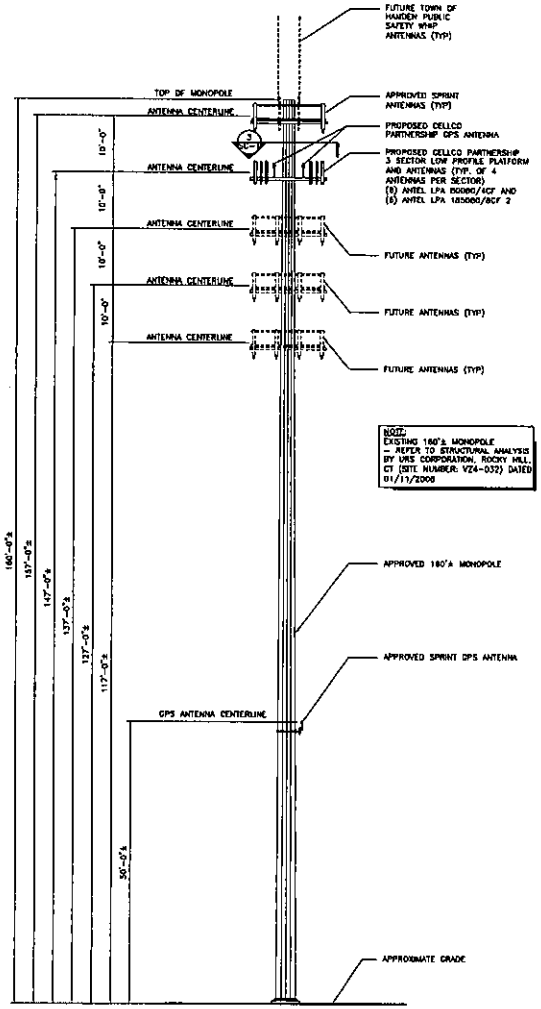
HAMDEN NORTH 2

150 WILLOW STREET
HAMDEN, CONNECTICUT
06518

SCALE: AS NOTED

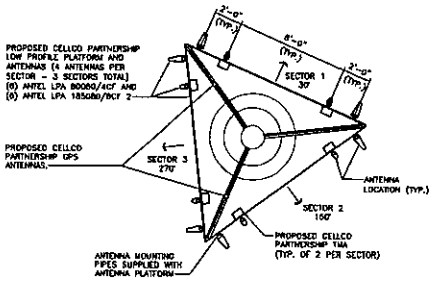
TITLE SHEET - PROJECT SUMMARY AND LEGENDS

T-1

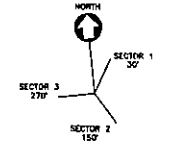


NOTE:
EXISTING 160'± MONOPOLE - REFER TO STRUCTURAL ANALYSIS BY UMS CORPORATION, ROCKY HILL, CT (SITE NUMBER: VZ4-032) DATED 01/11/2008

2 SC-1 MONOPOLE ELEVATION
SCALE: 1"=10'-0"
0 5 10 20 30



3 SC-1 ANTENNA ORIENTATION PLAN
SCALE: N.T.S.

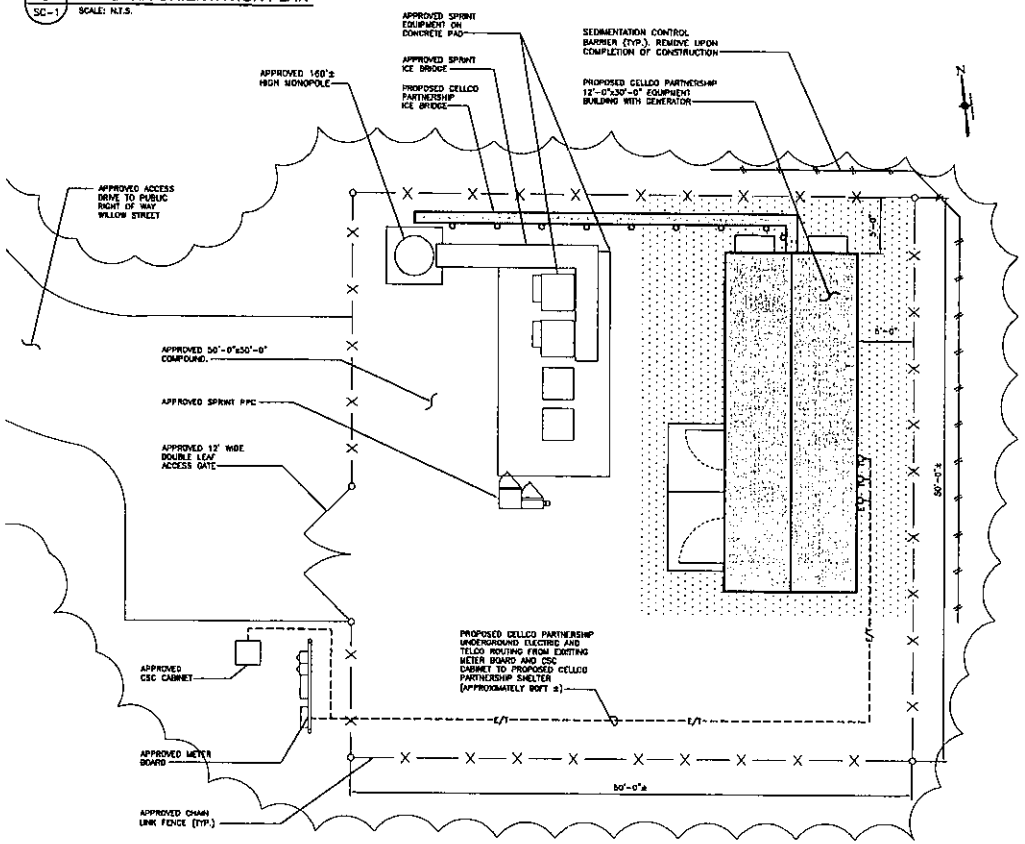


ANTENNA ORIENTATION KEY

LEGEND		
DESCRIPTION	EXISTING	PROPOSED
PROPERTY LINE		
LEASE LINE		
CHAIN LINK FENCE		
CONTOUR LINES	123	
UNDERGROUND UTILITIES		E/T
UTILITY POLE	P	P
TREE LINE		
SEDIMENTATION FENCE		
SPOT ELEVATION	x 124.5	
WOOD FENCE		

SITE PLAN INFORMATION

THIS SITE PLAN DRAWING WAS COMPILED FROM DATA COLLECTED IN THE FIELD AND FROM AVAILABLE EXISTING DRAWINGS OF THE SUBJECT AREA.



1 SC-1 COMPOUND PLAN
SCALE: 1"=5'-0"
0 2.5 5 10 15

CELLCO PARTNERSHIP
DBA
verizon wireless

A&E FIRM
UMS CORPORATION AES
500 ENTERPRISE DRIVE
SUITE 3B
ROCKY HILL, CONNECTICUT
T-(860)-529-8882

A&E SEAL

SITE NAME: HAMDEN NORTH 2
PROJECT ID # 20000018055
PROJECT TYPE: BOCCD
LOCATION CODE: 117815
SITE ADDRESS:
150 WILLOW STREET
HAMDEN, CONNECTICUT
06518

PROJECT NO:	36031108
JOB NO:	V24-032
DRAWN BY:	KAP
CHECKED BY:	MJE

ISSUED FOR		
A	01-11-08	REVIEW
B	01-21-08	REVIEW
0	01-28-08	SITING COUNCIL

HAMDEN NORTH 2

150 WILLOW STREET
HAMDEN, CONNECTICUT
06518

SCALE: AS NOTED

COMPOUND PLAN, ELEVATION AND ANTENNA ORIENTATION PLAN

SC-1

			General	Power	Density		
Site Name: Hamden N 2							
Tower Height: Verizon @ 147Ft.							
		ERP					
Carrier	**channels**	**watt/ch**	**distance (feet)**	**S (mW/cm^2)**	**f (MHz)**	**Smax**	**Percent MPE**
Sprint*	11	299.95	157	0.04816	1962.5	1.0000	**4.82**
Verizon	**9**	**285**	**147**	**0.04271**	**880**	**0.5866**	**7.28**
Verizon	**3**	**400**	**147**	**0.01998**	**1900**	**1.0000**	**2.00**
*Source: Siting Council Records						**Total %MPE**	**14.10**

DETAILED STRUCTURAL ANALYSIS AND EVALUATION OF AN EXISTING 160' MONOPOLE FOR PROPOSED ANTENNA ARRANGEMENT

Site I.D: Hamden North 2
Address: 150 Willow Street
Hamden, CT 06518

prepared for

verizonwireless

Verizon Wireless
99 East River Drive
East Hartford, Connecticut 06108

prepared by

URS

URS CORPORATION
500 ENTERPRISE DRIVE, SUITE 3B
ROCKY HILL, CT 06067
TEL. 860-529-8882

36931108.00000
VZ4-032

Rev 1 February 06, 2008

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

This report summarizes the structural analysis of the existing 160' steel tapered monopole structure, located at 150 Willow Road, Hamden, CT. The analysis was conducted in accordance with the 2005 Connecticut State Building Code and the TIA/EIA-222-F standard for a wind velocity of 85 mph (fastest mile) and 74 mph (fastest mile) concurrent with 0.5" ice. The antenna loading considered in the analysis consists of all existing and proposed antennas, transmission lines, and ancillary items as outlined in the Introduction Section of this report. The proposed Verizon Wireless installation is as follows:

Proposed Antenna and Mount	Carrier	Antenna Center Elevation
Install: **(6) Antel LPA 80080/4CF and** **(6) Antel LPA 185080/8CF_2 panel antennas** **(2) GPS antennas on** **(1) 13' Low Profile Platform** **(Valmont P/N 852206)** **(12) 1 5/8" coaxial cables and** **(2) 1/2" coaxial cables** **(all Verizon coax feed lines shall be located within the existing monopole)**	**Verizon (Proposed)**	**@ 147'**

The results of the analysis indicate that the tower structure has the capacity to support the proposed loading conditions. **The tower and its foundation are considered structurally adequate with the wind load classification specified above and the proposed antenna loading.**

1. EXECUTIVE SUMMARY - *continued*

This analysis is based on:

1) The tower structure's theoretical capacity, not including any assessment of the condition of the tower.
2) Tower geometry and structural member sizes utilized in the preparation of this report obtained from manufacturers original design documents prepared by Engineered Endeavors, Inc., (EEI), job no. 14977, dated July 16, 2007.
3) Site documentation and visual verification of existing appurtenances conducted from existing grade by URS during February 2008.
4) Antenna and mount configuration as specified within Section 2 and 6 of this report.

This report is only valid as per the assumptions and data utilized in this report for antenna inventory, mounts and associated cables. The user of this report shall field verify the assumption of the antenna and mount configuration as well as the physical condition of the tower. Notify the engineer in writing immediately if any of the information in this report is found to be other than specified.

If you should have any questions, please call.

Sincerely,

URS Corporation

Richard A. Sambor, P.E.
Manager Facilities Design

RAS/jrm
cc: AA, DR, ICA – URS, CF/Book

2. INTRODUCTION

The subject tower is located at 150 Willow Road, Hamden, CT. The structure is an existing 160' steel tapered monopole structure, designed and manufactured by Engineered Endeavors, Inc., (EEI).

The inventory is summarized in the table below:

Antenna Type	*Carrier*	*Mount*	*Antenna Centerline Elevation*	*Cable*
(12) Decibel DB950F65E-M panel antennas	Sprint/Nextel (existing/reserved)	(1) 12' Low Profile Platform w/ Handrails	160'	(12) 1 5/8" coax cables (within monopole)
(6) Antel LPA 80080/4CF and (6) Antel LPA 185080/8CF_2 panel antennas	**Verizon (proposed)**	**(1) 13' Low Profile Platform (Valmont P/N 852206)**	**147'**	**(12) 1 5/8" coax cables (within monopole)**
(2) GPS antennas	**Verizon (proposed)**	**Low Profile Platform (same as above)**	**147'**	**(2) 1/2" coax cables (within monopole)**
(1) GPS antenna	Sprint/Nextel (existing)	GPS stand-off	50'	(1) 1/2" coax cables (within monopole)

Note:

I. **Sprint/Nextel antenna inventory indicated in the above table based on original design documents.**

This structural analysis of the communications tower was performed by URS Corporation (URS) for Verizon Wireless. The purpose of this analysis was to investigate the structural integrity of the existing tower with its existing and proposed antenna loads. This analysis was conducted to evaluate stress on the tower and the effect of forces to the foundation of the tower resulting from existing and proposed antenna arrangements.

3. ANALYSIS METHODOLOGY AND LOADING CONDITIONS

The structural analysis was conducted in accordance with the 2005 Connecticut State Building Code, TIA/EIA-222-F - Structural Standard for Steel Antenna Towers and Antenna Supporting Structures, and the American Institute of Steel Construction (AISC) Manual of Steel Construction - Allowable Stress Design (ASD).

The analysis was conducted using RISA Tower 5.0.2. Two load conditions were evaluated as shown below which were compared to allowable stresses according to AISC and TIA/EIA.

Load Condition 1 = 85 mph (fastest mile) Wind Load (without ice) + Tower Dead Load
Load Condition 2 = 74 mph (fastest mile) Wind Load (with ice) + Ice Load + Tower Dead Load

Please note that wind pressure is a function of velocity squared. Under Load Condition 2, a 25 percent reduction in wind pressure is allowed by code to account for the unlikelihood of the full wind pressure and ice load occurring at the same time. The same results may be achieved by utilizing a lower wind pressure without taking the 25 percent reduction, as shown above.

The TIA/EIA standard permits a one-third increase in allowable stresses for towers and monopoles less than 700 feet tall. For the purposes of this analysis, in computing the load capacity the allowable stresses of the tower members were increased by one-third.

4. FINDINGS AND EVALUATION

Combined axial and bending stresses on the monopole structure were evaluated to compare with allowable stresses in accordance with AISC. The calculated stresses under the proposed loading were below the allowable stresses (see table below). Detailed analysis and calculations for the proposed load condition are provided in section 6 of this report. An analysis of the foundation was not performed as the calculated reactions at the base of the structure were less than the original design. Additionally, the anchor bolts and base plate were found to be within the allowable limits.

Tower Reactions:
For detailed proposed tower reactions, see drawing no. E-1 in section 6 of this report.

Proposed Tower Base Reactions vs. Original Design Reactions

Base Reactions	Original Design Reactions EIA-222 Rev G[1]	Original Design Reactions TIA/EIA-222 Rev F[2]	Proposed Reactions TIA/EIA-222 Rev F[3]
Axial Load (kips)	68.76	57.3	41
Shear (kips)	61.24	51.03	21
O.T. Moment (ft-kips)	7151.4	4469.6	2181

Notes:

1) Original Design reactions based on TIA-222G and ASCE 7 with 115mph Basic Wind Speed (3 second gust)
2) Figures indicated are equivalent service loads per TIA/EIA 222 Rev F with 115mph Basic Wind Speed (3 second gust) or equivalent 95mph Basic Wind Speed (fastest mile).
3) Figures indicated are proposed service loads per TIA/EIA 222 Rev F with 85mph Basic Wind Speed (fastest mile).

Tower Component Stress vs. Capacity Summary

Component (Section No.)	Controlling Component / Elevation	Stress Ratio (% capacity)	Pass/Fail	Notes:
Pole Shaft (L4)	131'-158'	40.6%	Pass	
Anchor Bolts	Compression	20%	Pass	
Base Plate	Bending	17%	Pass	

5. CONCLUSIONS AND RECOMMENDATIONS

The results of the analysis indicate that the tower structure has the capacity to support the proposed loading conditions. **The tower and its foundation are considered structurally adequate with the wind load classification specified above and the proposed antenna loading.**

Limitations/Assumptions:

This report is based on the following:

1. Tower inventory as listed in this report.
2. Tower is properly installed and maintained.
3. All members are as specified in the original design documents and are in good condition.
4. All required members are in place.
5. All bolts are in place and are properly tightened.
6. Tower is in plumb condition.
7. All member protective coatings are in good condition.
8. All tower members were properly designed, detailed, fabricated, and installed and have been properly maintained since erection.
9. Foundations were properly constructed to support original design loads as specified in the original design documents.
10. All coaxial cable is installed within the monopole unless specified otherwise.

URS is not responsible for any modifications completed prior to or hereafter in which URS is not or was not directly involved. Modifications include but are not limited to:

A. Adding antennas
B. Removing/replacing antennas
C. Adding coaxial cables

URS hereby states that this document represents the entire report and that it assumes no liability for any factual changes that may occur after the date of this report. All representations, recommendations, and conclusions are based upon information contained and set forth herein. If you are aware of any information which conflicts with that which is contained herein, or you are aware of any defects arising from original design, material, fabrication, or erection deficiencies, you should disregard this report and immediately contact URS. URS disclaims all liability for any representation, recommendation, or conclusion not expressly stated herein.

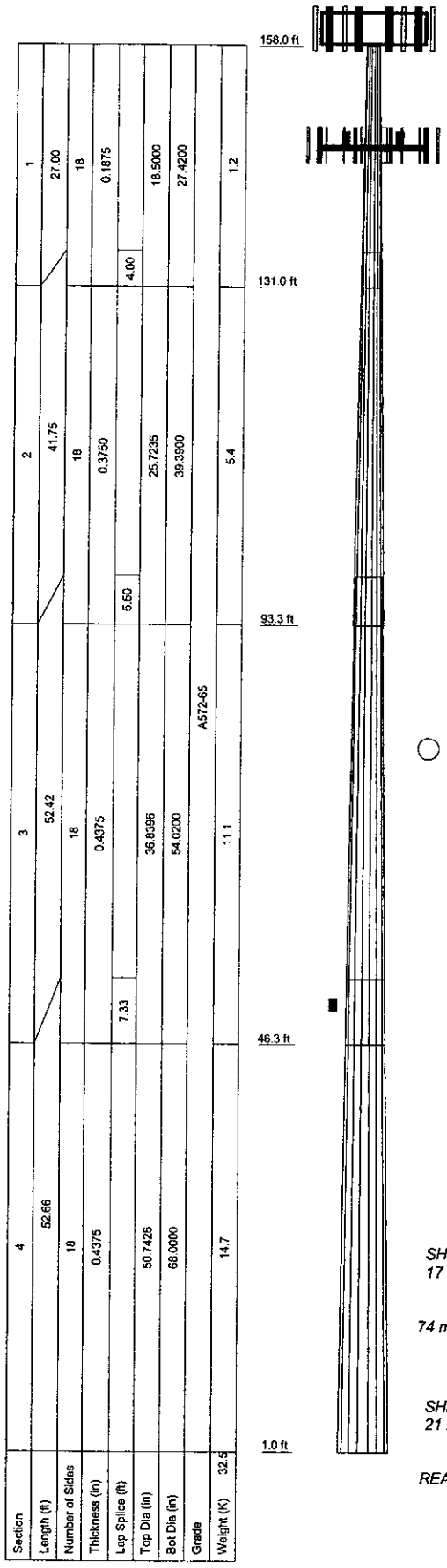
Ongoing and Periodic Inspection and Maintenance:

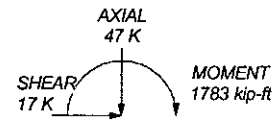
After the Contractor has successfully completed the installation and the work has been accepted, the owner will be responsible for the ongoing and periodic inspection and maintenance of the tower.

The owner shall refer to TIA/EIA-222-F for recommendations for maintenance and inspection. The frequency of the inspection and maintenance intervals is to be determined by the owner based upon actual site and environmental conditions. It is recommended that a complete and thorough inspection of the entire tower structural system be performed at least yearly and more frequently as conditions warrant. According to TIA/EIA-222-F section 14.1, Note 1: It is recommended that the structure be inspected after severe wind and/or ice storms or other extreme loading conditions.

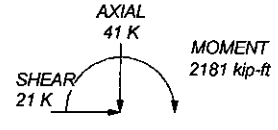
6. DRAWINGS AND DATA

RISA TOWER INPUT/OUTPUT SUMMARY





TORQUE 1 kip-ft
74 mph WIND - 0.5000 in ICE



TORQUE 1 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(4) DB950F65E-M (Sprint/Nextel)	160	LPA-185080/8CF_2 (Verizon - proposed)	147
(4) DB950F65E-M (Sprint/Nextel)	160	LPA-185080/8CF_2 (Verizon - proposed)	147
(4) DB950F65E-M (Sprint/Nextel)	160	LPA-185080/8CF_2 (Verizon - proposed)	147
EEI 12' Platform w/handrails (Sprint/Nextel)	160	LPA-185080/8CF_2 (Verizon - proposed)	147
LPA-80080/4CF (Verizon - proposed)	147	LPA-185080/8CF_2 (Verizon - proposed)	147
LPA-80080/4CF (Verizon - proposed)	147	Valmont 13' Low Profile Platform (Verizon - proposed)	147
LPA-80080/4CF (Verizon - proposed)	147	GPS (Verizon - proposed)	147
LPA-80063/4CF (Verizon - proposed)	147	GPS (Verizon - proposed)	147
LPA-80080/4CF (Verizon - proposed)	147	GPS (Sprint/Nextel)	50
LPA-80080/4CF (Verizon - proposed)	147	Valmont B2069 2' GPS Mount (Sprint/Nextel)	50
LPA-185080/8CF_2 (Verizon - proposed)	147		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. TOWER RATING: 40.6%

URS Corporation
500 Enterprise Drive, Suite 3B
Rocky Hill, CT 06067
Phone: (860) 529-8882
FAX: (860) 529-3991

Job: *157' EEI Monopole - Rev 1*		
Project: *150 Willow Street, Hamden, CT*		
Client: Verizon Wireless	Drawn by: Staff	App'd:
Code: TIA/EIA-222-F	Date: 02/06/08	Scale: NTS
Path: P:\08\Rev 1 Not issued see readme file\EEI Files\157 EEI MonoPole Hamden CT Rev 1.eri		Dwg No. E-1

RISA TOWER DETAILED OUTPUT

Tower Input Data

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

Basic wind speed of 85 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	158.00-131.00	27.00	4.00	18	18.5000	27.4200	0.1875	0.7500	A572-65 (65 ksi)
L2	131.00-93.25	41.75	5.50	18	25.7235	39.3900	0.3750	1.5000	A572-65 (65 ksi)
L3	93.25-46.33	52.42	7.33	18	36.8396	54.0200	0.4375	1.7500	A572-65 (65 ksi)
L4	46.33-1.00	52.66		18	50.7426	68.0000	0.4375	1.7500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	18.7854	10.8982	461.7305	6.5009	9.3980	49.1307	924.0685	5.4501	2.9260	15.605
	27.8430	16.2067	1518.4769	9.6675	13.9294	109.0127	3038.9518	8.1049	4.4959	23.978
L2	27.4499	30.1711	2449.2517	8.9987	13.0675	187.4301	4901.7261	15.0884	3.8673	10.313
	39.9977	46.4376	8930.3910	13.8503	20.0101	446.2937	17872.5328	23.2232	6.2726	16.727
L3	39.2383	50.5489	8462.5771	12.9228	18.7145	452.1929	16936.2895	25.2793	5.7138	13.06
	54.8533	74.4060	26989.2830	19.0218	27.4422	983.4970	54014.0793	37.2101	8.7375	19.971
L4	53.9646	69.8550	22333.6296	17.8583	25.7773	866.4083	44696.6463	34.9341	8.1607	18.653
	69.0490	93.8190	54105.2694	23.9847	34.5440	1566.2711	108281.731 9	46.9184	11.1980	25.595

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 158.00-131.00				1	1	1		
L2 131.00-93.25				1	1	1		
L3 93.25-46.33				1	1	1		
L4 46.33-1.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 5/8 (Sprint/Nextel)	C	No	Inside Pole	156.00 - 8.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon - proposed)	C	No	Inside Pole	146.00 - 8.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1/2 (Sprint/Nextel)	C	No	Inside Pole	50.00 - 8.00	1	No Ice	0.00	0.25
						1/2" Ice	0.00	0.25
1/2 (Verizon - proposed)	C	No	Inside Pole	146.00 - 8.00	2	No Ice	0.00	0.25
						1/2" Ice	0.00	0.25

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	158.00-131.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.51
L2	131.00-93.25	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.96
L3	93.25-46.33	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.20

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 K
L4	46.33-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.99

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L1	158.00-131.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.51
L2	131.00-93.25	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.96
L3	93.25-46.33	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.20
L4	46.33-1.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.99

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight K
(4) DB950F65E-M (Sprint/Nextel)	A	From Face	4.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	6.13 6.59	4.24 4.62	0.02 0.05
(4) DB950F65E-M (Sprint/Nextel)	B	From Face	4.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	6.13 6.59	4.24 4.62	0.02 0.05
(4) DB950F65E-M (Sprint/Nextel)	C	From Face	4.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	6.13 6.59	4.24 4.62	0.02 0.05
EEI 12' Platform w/handrails (Sprint/Nextel)	A	None		0.0000	160.00	No Ice 1/2" Ice	32.00 38.00	32.00 38.00	3.05 4.02
LPA-80080/4CF (Verizon - proposed)	A	From Face	4.00 6.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LPA-80080/4CF (Verizon - proposed)	A	From Face	4.00 -6.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LPA-80080/4CF (Verizon - proposed)	B	From Face	4.00 6.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LPA-80063/4CF (Verizon - proposed)	B	From Face	4.00 -6.00 0.00	0.0000	147.00	No Ice 1/2" Ice	7.01 7.42	6.08 6.48	0.02 0.07

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
LPA-80080/4CF (Verizon - proposed)	C	From Face	4.00 6.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LPA-80080/4CF (Verizon - proposed)	C	From Face	4.00 -6.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LPA-185080/8CF_2 (Verizon - proposed)	A	From Face	4.00 2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	A	From Face	4.00 -2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	B	From Face	4.00 2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	B	From Face	4.00 -2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	C	From Face	4.00 2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	C	From Face	4.00 -2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
Valmont 13' Low Profile Platform (Verizon - proposed)	A	None		0.0000	147.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
GPS (Verizon - proposed)	C	From Face	4.00 3.00 0.00	0.0000	147.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
GPS (Verizon - proposed)	C	From Face	4.00 -3.00 0.00	0.0000	147.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
GPS (Sprint/Nextel)	A	From Face	2.00 0.00 0.00	0.0000	50.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
Valmont B2069 2' GPS Mount (Sprint/Nextel)	A	From Face	1.00 0.00 0.00	0.0000	50.00	No Ice 1/2" Ice	0.78 1.10	0.68 1.10	0.03 0.03

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 158.00-131.00	143.63	1.522	28	51.660	A B	0.000 0.000	51.660 51.660	51.660	100.00 100.00	0.000	0.000

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
					C	0.000	51.660		100.00		
L2 131.00-93.25	111.18	1.415	26	104.478	A	0.000	104.478	104.478	100.00	0.000	0.000
					B	0.000	104.478		100.00		
					C	0.000	104.478		100.00		
L3 93.25-46.33	69.06	1.235	23	181.155	A	0.000	181.155	181.155	100.00	0.000	0.000
					B	0.000	181.155		100.00		
					C	0.000	181.155		100.00		
L4 46.33-1.00	22.82	1	19	228.812	A	0.000	228.812	228.812	100.00	0.000	0.000
					B	0.000	228.812		100.00		
					C	0.000	228.812		100.00		

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 158.00-131.00	143.63	1.522	21	0.5000	53.910	A	0.000	53.910	53.910	100.00	0.000	0.000
						B	0.000	53.910		100.00		
						C	0.000	53.910		100.00		
L2 131.00-93.25	111.18	1.415	20	0.5000	107.623	A	0.000	107.623	107.623	100.00	0.000	0.000
						B	0.000	107.623		100.00		
						C	0.000	107.623		100.00		
L3 93.25-46.33	69.06	1.235	17	0.5000	185.065	A	0.000	185.065	185.065	100.00	0.000	0.000
						B	0.000	185.065		100.00		
						C	0.000	185.065		100.00		
L4 46.33-1.00	22.82	1	14	0.5000	232.590	A	0.000	232.590	232.590	100.00	0.000	0.000
						B	0.000	232.590		100.00		
						C	0.000	232.590		100.00		

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 158.00-131.00	143.63	1.522	10	51.660	A	0.000	51.660	51.660	100.00	0.000	0.000
					B	0.000	51.660		100.00		
					C	0.000	51.660		100.00		
L2 131.00-93.25	111.18	1.415	9	104.478	A	0.000	104.478	104.478	100.00	0.000	0.000
					B	0.000	104.478		100.00		
					C	0.000	104.478		100.00		
L3 93.25-46.33	69.06	1.235	8	181.155	A	0.000	181.155	181.155	100.00	0.000	0.000
					B	0.000	181.155		100.00		
					C	0.000	181.155		100.00		
L4 46.33-1.00	22.82	1	6	228.812	A	0.000	228.812	228.812	100.00	0.000	0.000
					B	0.000	228.812		100.00		
					C	0.000	228.812		100.00		

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	1.60	59.18	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	3.00	79.46	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	4.52	96.36	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	4.68	103.27	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	968.24 kip-ft	13.80		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	1.60	59.18	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	3.00	79.46	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	4.52	96.36	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	4.68	103.27	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	968.24 kip-ft	13.80		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	1.60	59.18	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-	0.96	5.44	A	1	0.65	1	1	1	104.478	3.00	79.46	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
93.25			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	4.52	96.36	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	4.68	103.27	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	968.24 kip-ft	13.80		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	1.60	59.18	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	3.00	79.46	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	4.52	96.36	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	4.68	103.27	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	968.24 kip-ft	13.80		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.64	A	1	0.65	1	1	1	53.910	1.25	46.32	C
			B	1	0.65	1	1	1	53.910			
			C	1	0.65	1	1	1	53.910			
L2 131.00-93.25	0.96	6.23	A	1	0.65	1	1	1	107.623	2.32	61.39	C
			B	1	0.65	1	1	1	107.623			
			C	1	0.65	1	1	1	107.623			
L3 93.25-46.33	1.20	12.50	A	1	0.65	1	1	1	185.065	3.46	73.83	C
			B	1	0.65	1	1	1	185.065			
			C	1	0.65	1	1	1	185.065			
L4 46.33-1.00	0.99	16.37	A	1	0.65	1	1	1	232.590	3.57	78.73	C
			B	1	0.65	1	1	1	232.590			
			C	1	0.65	1	1	1	232.590			
Sum Weight:	3.65	36.74						OTM	747.34	10.60		

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

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.64	A	1	0.65	1	1	1	53.910	1.25	46.32	C
			B	1	0.65	1	1	1	53.910			
			C	1	0.65	1	1	1	53.910			
L2 131.00-93.25	0.96	6.23	A	1	0.65	1	1	1	107.623	2.32	61.39	C
			B	1	0.65	1	1	1	107.623			
			C	1	0.65	1	1	1	107.623			
L3 93.25-46.33	1.20	12.50	A	1	0.65	1	1	1	185.065	3.46	73.83	C
			B	1	0.65	1	1	1	185.065			
			C	1	0.65	1	1	1	185.065			
L4 46.33-1.00	0.99	16.37	A	1	0.65	1	1	1	232.590	3.57	78.73	C
			B	1	0.65	1	1	1	232.590			
			C	1	0.65	1	1	1	232.590			
Sum Weight:	3.65	36.74						OTM	747.34 kip-ft	10.60		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.64	A	1	0.65	1	1	1	53.910	1.25	46.32	C
			B	1	0.65	1	1	1	53.910			
			C	1	0.65	1	1	1	53.910			
L2 131.00-93.25	0.96	6.23	A	1	0.65	1	1	1	107.623	2.32	61.39	C
			B	1	0.65	1	1	1	107.623			
			C	1	0.65	1	1	1	107.623			
L3 93.25-46.33	1.20	12.50	A	1	0.65	1	1	1	185.065	3.46	73.83	C
			B	1	0.65	1	1	1	185.065			
			C	1	0.65	1	1	1	185.065			
L4 46.33-1.00	0.99	16.37	A	1	0.65	1	1	1	232.590	3.57	78.73	C
			B	1	0.65	1	1	1	232.590			
			C	1	0.65	1	1	1	232.590			
Sum Weight:	3.65	36.74						OTM	747.34 kip-ft	10.60		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.64	A	1	0.65	1	1	1	53.910	1.25	46.32	C
			B	1	0.65	1	1	1	53.910			
			C	1	0.65	1	1	1	53.910			
L2 131.00-93.25	0.96	6.23	A	1	0.65	1	1	1	107.623	2.32	61.39	C
			B	1	0.65	1	1	1	107.623			
			C	1	0.65	1	1	1	107.623			
L3 93.25-46.33	1.20	12.50	A	1	0.65	1	1	1	185.065	3.46	73.83	C
			B	1	0.65	1	1	1	185.065			
			C	1	0.65	1	1	1	185.065			
L4 46.33-1.00	0.99	16.37	A	1	0.65	1	1	1	232.590	3.57	78.73	C
			B	1	0.65	1	1	1	232.590			
			C	1	0.65	1	1	1	232.590			
Sum Weight:	3.65	36.74						OTM	747.34 kip-ft	10.60		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	0.55	20.48	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	1.04	27.49	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	1.56	33.34	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	1.62	35.74	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	335.03 kip-ft	4.78		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	0.55	20.48	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	1.04	27.49	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	1.56	33.34	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	1.62	35.74	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	335.03 kip-ft	4.78		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	0.55	20.48	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	1.04	27.49	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	1.56	33.34	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	1.62	35.74	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	335.03 kip-ft	4.78		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	0.55	20.48	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	1.04	27.49	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	1.56	33.34	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	1.62	35.74	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	335.03 kip-ft	4.78		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	32.50					
Bracing Weight	0.00					
Total Member Self-Weight	32.50			-0.04	0.09	
Total Weight	40.90			-0.04	0.09	
Wind 0 deg - No Ice		0.09	-21.33	-2122.01	-13.05	-0.82
Wind 30 deg - No Ice		10.80	-18.52	-1844.29	-1079.95	-1.08
Wind 45 deg - No Ice		15.22	-15.15	-1509.79	-1520.51	-1.10
Wind 60 deg - No Ice		18.61	-10.74	-1072.41	-1857.45	-1.05
Wind 90 deg - No Ice		21.44	-0.09	-13.18	-2137.22	-0.74
Wind 120 deg - No Ice		18.52	10.59	1049.56	-1844.31	-0.23
Wind 135 deg - No Ice		15.10	15.02	1491.12	-1501.92	0.06
Wind 150 deg - No Ice		10.64	18.43	1831.07	-1057.18	0.34
Wind 180 deg - No Ice		-0.09	21.33	2121.93	13.24	0.82
Wind 210 deg - No Ice		-10.80	18.52	1844.21	1080.14	1.08
Wind 225 deg - No Ice		-15.22	15.15	1509.71	1520.70	1.10
Wind 240 deg - No Ice		-18.61	10.74	1072.33	1857.64	1.05
Wind 270 deg - No Ice		-21.44	0.09	13.11	2137.41	0.74
Wind 300 deg - No Ice		-18.52	-10.59	-1049.64	1844.49	0.23
Wind 315 deg - No Ice		-15.10	-15.02	-1491.20	1502.11	-0.06
Wind 330 deg - No Ice		-10.64	-18.43	-1831.14	1057.37	-0.34
Member Ice	4.24					
Total Weight Ice	47.34			-0.15	0.11	
Wind 0 deg - Ice		0.07	-17.02	-1727.68	-10.05	-0.71
Wind 30 deg - Ice		8.61	-14.77	-1501.31	-878.31	-0.83
Wind 45 deg - Ice		12.14	-12.08	-1228.88	-1236.91	-0.81
Wind 60 deg - Ice		14.84	-8.57	-872.71	-1511.21	-0.73
Wind 90 deg - Ice		17.10	-0.07	-10.30	-1739.15	-0.44
Wind 120 deg - Ice		14.77	8.45	854.82	-1501.05	-0.03
Wind 135 deg - Ice		12.04	11.98	1214.22	-1222.55	0.19
Wind 150 deg - Ice		8.49	14.70	1490.86	-860.72	0.39
Wind 180 deg - Ice		-0.07	17.02	1727.39	10.27	0.71
Wind 210 deg - Ice		-8.61	14.77	1501.02	878.53	0.83
Wind 225 deg - Ice		-12.14	12.08	1228.58	1237.13	0.81
Wind 240 deg - Ice		-14.84	8.57	872.41	1511.43	0.73
Wind 270 deg - Ice		-17.10	0.07	10.01	1739.37	0.44
Wind 300 deg - Ice		-14.77	-8.45	-855.12	1501.27	0.03
Wind 315 deg - Ice		-12.04	-11.98	-1214.52	1222.77	-0.19
Wind 330 deg - Ice		-8.49	-14.70	-1491.16	860.94	-0.39
Total Weight	40.90			-0.04	0.09	
Wind 0 deg - Service		0.03	-7.38	-734.28	-4.46	-0.28
Wind 30 deg - Service		3.74	-6.41	-638.19	-373.62	-0.37
Wind 45 deg - Service		5.27	-5.24	-522.44	-526.07	-0.38
Wind 60 deg - Service		6.44	-3.72	-371.10	-642.66	-0.36
Wind 90 deg - Service		7.42	-0.03	-4.59	-739.46	-0.25
Wind 120 deg - Service		6.41	3.66	363.14	-638.11	-0.08
Wind 135 deg - Service		5.22	5.20	515.93	-519.64	0.02
Wind 150 deg - Service		3.68	6.38	633.56	-365.75	0.12
Wind 180 deg - Service		-0.03	7.38	734.21	4.64	0.28
Wind 210 deg - Service		-3.74	6.41	638.11	373.81	0.37
Wind 225 deg - Service		-5.27	5.24	522.37	526.25	0.38
Wind 240 deg - Service		-6.44	3.72	371.02	642.84	0.36
Wind 270 deg - Service		-7.42	0.03	4.51	739.65	0.25
Wind 300 deg - Service		-6.41	-3.66	-363.22	638.29	0.08
Wind 315 deg - Service		-5.22	-5.20	-516.01	519.82	-0.02
Wind 330 deg - Service		-3.68	-6.38	-633.64	365.93	-0.12

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	158 - 131	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-8.70	-0.03	0.06
			Max. Mx	6	-5.86	-169.67	1.08
			Max. My	10	-5.86	1.09	-168.39
			Max. Vy	14	-9.12	169.65	-1.15
			Max. Vx	10	9.01	1.09	-168.39
			Max. Torque	4			0.88
L2	131 - 93.25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-15.12	-0.03	0.06
			Max. Mx	6	-11.61	-549.55	4.44
			Max. My	10	-11.62	4.45	-544.40
			Max. Vy	14	-11.95	549.52	-4.50
			Max. Vx	2	-11.85	-4.49	544.36
			Max. Torque	4			0.88
L3	93.25 - 46.33	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-27.70	-0.03	0.06
			Max. Mx	6	-23.03	-1182.54	8.62
			Max. My	10	-23.04	8.63	-1172.57
			Max. Vy	14	-16.19	1182.51	-8.66
			Max. Vx	2	-16.09	-8.65	1172.53
			Max. Torque	4			0.88
L4	46.33 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-47.34	0.11	0.15
			Max. Mx	14	-40.90	2172.95	-13.36
			Max. My	2	-40.90	-13.30	2157.26
			Max. Vy	14	-21.45	2172.95	-13.36
			Max. Vx	2	-21.34	-13.30	2157.26
			Max. Torque	4			1.10

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	23	47.34	-17.10	0.07
	Max. H_x	14	40.90	21.44	-0.09
	Max. H_z	2	40.90	-0.09	21.33
	Max. M_x	2	2157.26	-0.09	21.33
	Max. M_z	6	2172.76	-21.44	0.09
	Max. Torsion	4	1.10	-15.22	15.15
	Min. Vert	46	40.90	6.44	-3.72
	Min. H_x	6	40.90	-21.44	0.09
	Min. H_z	10	40.90	0.09	-21.33
	Min. M_x	10	-2157.18	0.09	-21.33
	Min. M_z	14	-2172.95	21.44	-0.09
	Min. Torsion	12	-1.10	15.22	-15.15

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	40.90	0.00	0.00	-0.04	0.09	0.00

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 0 deg - No Ice	40.90	0.09	-21.33	-2157.26	-13.30	-0.82
Dead+Wind 30 deg - No Ice	40.90	10.80	-18.52	-1874.94	-1097.93	-1.08
Dead+Wind 45 deg - No Ice	40.90	15.22	-15.15	-1534.89	-1545.82	-1.10
Dead+Wind 60 deg - No Ice	40.90	18.61	-10.74	-1090.24	-1888.35	-1.05
Dead+Wind 90 deg - No Ice	40.90	21.44	-0.09	-13.43	-2172.76	-0.73
Dead+Wind 120 deg - No Ice	40.90	18.52	10.59	1066.97	-1874.96	-0.22
Dead+Wind 135 deg - No Ice	40.90	15.10	15.02	1515.88	-1526.88	0.06
Dead+Wind 150 deg - No Ice	40.90	10.64	18.43	1861.48	-1074.74	0.34
Dead+Wind 180 deg - No Ice	40.90	-0.09	21.33	2157.18	13.49	0.81
Dead+Wind 210 deg - No Ice	40.90	-10.80	18.52	1874.86	1098.12	1.07
Dead+Wind 225 deg - No Ice	40.90	-15.22	15.15	1534.81	1546.00	1.10
Dead+Wind 240 deg - No Ice	40.90	-18.61	10.74	1090.17	1888.53	1.05
Dead+Wind 270 deg - No Ice	40.90	-21.44	0.09	13.36	2172.95	0.74
Dead+Wind 300 deg - No Ice	40.90	-18.52	-10.59	-1067.05	1875.15	0.23
Dead+Wind 315 deg - No Ice	40.90	-15.10	-15.02	-1515.96	1527.07	-0.06
Dead+Wind 330 deg - No Ice	40.90	-10.64	-18.43	-1861.55	1074.93	-0.34
Dead+Ice+Temp	47.34	0.00	0.00	-0.15	0.11	0.00
Dead+Wind 0 deg+Ice+Temp	47.34	0.07	-17.02	-1764.63	-10.29	-0.71
Dead+Wind 30 deg+Ice+Temp	47.34	8.61	-14.77	-1533.43	-897.14	-0.83
Dead+Wind 45 deg+Ice+Temp	47.34	12.14	-12.08	-1255.18	-1263.41	-0.81
Dead+Wind 60 deg+Ice+Temp	47.34	14.84	-8.57	-891.40	-1543.57	-0.73
Dead+Wind 90 deg+Ice+Temp	47.34	17.10	-0.07	-10.55	-1776.38	-0.44
Dead+Wind 120 deg+Ice+Temp	47.34	14.77	8.45	873.08	-1533.18	-0.03
Dead+Wind 135 deg+Ice+Temp	47.34	12.04	11.98	1240.17	-1248.71	0.19
Dead+Wind 150 deg+Ice+Temp	47.34	8.49	14.70	1522.74	-879.13	0.39
Dead+Wind 180 deg+Ice+Temp	47.34	-0.07	17.02	1764.33	10.51	0.70
Dead+Wind 210 deg+Ice+Temp	47.34	-8.61	14.77	1533.13	897.36	0.83
Dead+Wind 225 deg+Ice+Temp	47.34	-12.14	12.08	1254.88	1263.63	0.81
Dead+Wind 240 deg+Ice+Temp	47.34	-14.84	8.57	891.10	1543.79	0.73
Dead+Wind 270 deg+Ice+Temp	47.34	-17.10	0.07	10.25	1776.60	0.44
Dead+Wind 300 deg+Ice+Temp	47.34	-14.77	-8.45	-873.39	1533.40	0.03
Dead+Wind 315 deg+Ice+Temp	47.34	-12.04	-11.98	-1240.48	1248.93	-0.18
Dead+Wind 330 deg+Ice+Temp	47.34	-8.49	-14.70	-1523.04	879.35	-0.39
Dead+Wind 0 deg - Service	40.90	0.03	-7.38	-746.60	-4.54	-0.28
Dead+Wind 30 deg - Service	40.90	3.74	-6.41	-648.90	-379.91	-0.37
Dead+Wind 45 deg - Service	40.90	5.27	-5.24	-531.21	-534.91	-0.38
Dead+Wind 60 deg - Service	40.90	6.44	-3.72	-377.33	-653.45	-0.36
Dead+Wind 90 deg - Service	40.90	7.42	-0.03	-4.67	-751.88	-0.25
Dead+Wind 120 deg - Service	40.90	6.41	3.66	369.23	-648.82	-0.08
Dead+Wind 135 deg - Service	40.90	5.22	5.20	524.58	-528.35	0.02
Dead+Wind 150 deg - Service	40.90	3.68	6.38	644.18	-371.88	0.12
Dead+Wind 180 deg - Service	40.90	-0.03	7.38	746.52	4.73	0.28
Dead+Wind 210 deg - Service	40.90	-3.74	6.41	648.82	380.09	0.37
Dead+Wind 225 deg - Service	40.90	-5.27	5.24	531.14	535.10	0.38
Dead+Wind 240 deg - Service	40.90	-6.44	3.72	377.26	653.64	0.36
Dead+Wind 270 deg - Service	40.90	-7.42	0.03	4.60	752.07	0.25
Dead+Wind 300 deg - Service	40.90	-6.41	-3.66	-369.30	649.00	0.08
Dead+Wind 315 deg - Service	40.90	-5.22	-5.20	-524.66	528.54	-0.02
Dead+Wind 330 deg - Service	40.90	-3.68	-6.38	-644.26	372.07	-0.12

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-40.90	0.00	0.00	40.90	0.00	0.000%
2	0.09	-40.90	-21.33	-0.09	40.90	21.33	0.000%
3	10.80	-40.90	-18.52	-10.80	40.90	18.52	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
4	15.22	-40.90	-15.15	-15.22	40.90	15.15	0.000%
5	18.61	-40.90	-10.74	-18.61	40.90	10.74	0.000%
6	21.44	-40.90	-0.09	-21.44	40.90	0.09	0.000%
7	18.52	-40.90	10.59	-18.52	40.90	-10.59	0.000%
8	15.10	-40.90	15.02	-15.10	40.90	-15.02	0.000%
9	10.64	-40.90	18.43	-10.64	40.90	-18.43	0.000%
10	-0.09	-40.90	21.33	0.09	40.90	-21.33	0.000%
11	-10.80	-40.90	18.52	10.80	40.90	-18.52	0.000%
12	-15.22	-40.90	15.15	15.22	40.90	-15.15	0.000%
13	-18.61	-40.90	10.74	18.61	40.90	-10.74	0.000%
14	-21.44	-40.90	0.09	21.44	40.90	-0.09	0.000%
15	-18.52	-40.90	-10.59	18.52	40.90	10.59	0.000%
16	-15.10	-40.90	-15.02	15.10	40.90	15.02	0.000%
17	-10.64	-40.90	-18.43	10.64	40.90	18.43	0.000%
18	0.00	-47.34	0.00	0.00	47.34	0.00	0.000%
19	0.07	-47.34	-17.02	-0.07	47.34	17.02	0.000%
20	8.61	-47.34	-14.77	-8.61	47.34	14.77	0.000%
21	12.14	-47.34	-12.08	-12.14	47.34	12.08	0.000%
22	14.84	-47.34	-8.57	-14.84	47.34	8.57	0.000%
23	17.10	-47.34	-0.07	-17.10	47.34	0.07	0.000%
24	14.77	-47.34	8.45	-14.77	47.34	-8.45	0.000%
25	12.04	-47.34	11.98	-12.04	47.34	-11.98	0.000%
26	8.49	-47.34	14.70	-8.49	47.34	-14.70	0.000%
27	-0.07	-47.34	17.02	0.07	47.34	-17.02	0.000%
28	-8.61	-47.34	14.77	8.61	47.34	-14.77	0.000%
29	-12.14	-47.34	12.08	12.14	47.34	-12.08	0.000%
30	-14.84	-47.34	8.57	14.84	47.34	-8.57	0.000%
31	-17.10	-47.34	0.07	17.10	47.34	-0.07	0.000%
32	-14.77	-47.34	-8.45	14.77	47.34	8.45	0.000%
33	-12.04	-47.34	-11.98	12.04	47.34	11.98	0.000%
34	-8.49	-47.34	-14.70	8.49	47.34	14.70	0.000%
35	0.03	-40.90	-7.38	-0.03	40.90	7.38	0.000%
36	3.74	-40.90	-6.41	-3.74	40.90	6.41	0.000%
37	5.27	-40.90	-5.24	-5.27	40.90	5.24	0.000%
38	6.44	-40.90	-3.72	-6.44	40.90	3.72	0.000%
39	7.42	-40.90	-0.03	-7.42	40.90	0.03	0.000%
40	6.41	-40.90	3.66	-6.41	40.90	-3.66	0.000%
41	5.22	-40.90	5.20	-5.22	40.90	-5.20	0.000%
42	3.68	-40.90	6.38	-3.68	40.90	-6.38	0.000%
43	-0.03	-40.90	7.38	0.03	40.90	-7.38	0.000%
44	-3.74	-40.90	6.41	3.74	40.90	-6.41	0.000%
45	-5.27	-40.90	5.24	5.27	40.90	-5.24	0.000%
46	-6.44	-40.90	3.72	6.44	40.90	-3.72	0.000%
47	-7.42	-40.90	0.03	7.42	40.90	-0.03	0.000%
48	-6.41	-40.90	-3.66	6.41	40.90	3.66	0.000%
49	-5.22	-40.90	-5.20	5.22	40.90	5.20	0.000%
50	-3.68	-40.90	-6.38	3.68	40.90	6.38	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	0.00005126
3	Yes	4	0.00000001	0.00054800
4	Yes	4	0.00000001	0.00067260

5	Yes	4	0.00000001	0.00062785
6	Yes	4	0.00000001	0.00006846
7	Yes	4	0.00000001	0.00055079
8	Yes	4	0.00000001	0.00064205
9	Yes	4	0.00000001	0.00054866
10	Yes	4	0.00000001	0.00006900
11	Yes	4	0.00000001	0.00062523
12	Yes	4	0.00000001	0.00067125
13	Yes	4	0.00000001	0.00054885
14	Yes	4	0.00000001	0.00005051
15	Yes	4	0.00000001	0.00057175
16	Yes	4	0.00000001	0.00064199
17	Yes	4	0.00000001	0.00057045
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00073681
20	Yes	5	0.00000001	0.00003286
21	Yes	5	0.00000001	0.00003636
22	Yes	5	0.00000001	0.00003377
23	Yes	4	0.00000001	0.00074097
24	Yes	5	0.00000001	0.00003253
25	Yes	5	0.00000001	0.00003550
26	Yes	5	0.00000001	0.00003231
27	Yes	4	0.00000001	0.00073786
28	Yes	5	0.00000001	0.00003375
29	Yes	5	0.00000001	0.00003633
30	Yes	5	0.00000001	0.00003292
31	Yes	4	0.00000001	0.00074012
32	Yes	5	0.00000001	0.00003259
33	Yes	5	0.00000001	0.00003551
34	Yes	5	0.00000001	0.00003273
35	Yes	4	0.00000001	0.00000988
36	Yes	4	0.00000001	0.00003037
37	Yes	4	0.00000001	0.00004041
38	Yes	4	0.00000001	0.00004006
39	Yes	4	0.00000001	0.00001060
40	Yes	4	0.00000001	0.00003097
41	Yes	4	0.00000001	0.00003698
42	Yes	4	0.00000001	0.00003083
43	Yes	4	0.00000001	0.00001064
44	Yes	4	0.00000001	0.00003985
45	Yes	4	0.00000001	0.00004024
46	Yes	4	0.00000001	0.00003034
47	Yes	4	0.00000001	0.00000984
48	Yes	4	0.00000001	0.00003363
49	Yes	4	0.00000001	0.00003697
50	Yes	4	0.00000001	0.00003358

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	158 - 131	12.960	46	0.9059	0.0027
L2	135 - 93.25	8.960	46	0.7139	0.0014
L3	98.75 - 46.33	4.474	46	0.4594	0.0005
L4	53.66 - 1	1.246	46	0.2204	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
160.00	(4) DB950F65E-M	46	12.960	0.9059	0.0027	25064
147.00	LPA-80080/4CF	46	10.975	0.8120	0.0021	11392
50.00	GPS	46	1.089	0.2110	0.0002	10598

Maximum Tower Deflections - Design Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	158 - 131	37.430	13	2.6168	0.0079
L2	135 - 93.25	25.881	13	2.0624	0.0041
L3	98.75 - 46.33	12.924	13	1.3271	0.0015
L4	53.66 - 1	3.601	13	0.6366	0.0005

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
160.00	(4) DB950F65E-M	13	37.430	2.6168	0.0079	8710
147.00	LPA-80080/4CF	13	31.700	2.3462	0.0059	3959
50.00	GPS	13	3.148	0.5958	0.0005	3669

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L_u	Kl/r	F_a	A	Actual P	Allow. P_a	Ratio $\frac{P}{P_a}$
	ft		ft	ft		ksi	in^2	K	K	
L1	158 - 131 (1)	TP27.42x18.5x0.1875	27.00	0.00	0.0	39.000	15.4203	-5.85	601.39	0.010
L2	131 - 93.25 (2)	TP39.39x25.7235x0.375	41.75	0.00	0.0	39.000	44.2947	-11.61	1727.49	0.007
L3	93.25 - 46.33 (3)	TP54.02x36.8396x0.4375	52.42	0.00	0.0	39.000	71.0700	-23.03	2771.73	0.008
L4	46.33 - 1 (4)	TP68x50.7426x0.4375	52.66	0.00	0.0	38.512	93.8190	-40.90	3613.20	0.011

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	158 - 131 (1)	TP27.42x18.5x0.1875	170.30	20.715	39.000	0.531	0.00	0.000	39.000	0.000
L2	131 - 93.25 (2)	TP39.39x25.7235x0.375	552.11	16.324	39.000	0.419	0.00	0.000	39.000	0.000
L3	93.25 - 46.33 (3)	TP54.02x36.8396x0.4375	1187.51	15.887	39.000	0.407	0.00	0.000	39.000	0.000
L4	46.33 - 1 (4)	TP68x50.7426x0.4375	2180.60	16.707	38.512	0.434	0.00	0.000	38.512	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	158 - 131 (1)	TP27.42x18.5x0.1875	9.17	0.595	26.000	0.046	0.85	0.051	26.000	0.002
L2	131 - 93.25 (2)	TP39.39x25.7235x0.375	12.01	0.271	26.000	0.021	0.85	0.012	26.000	0.000
L3	93.25 - 46.33 (3)	TP54.02x36.8396x0.4375	16.25	0.229	26.000	0.018	0.85	0.006	26.000	0.000
L4	46.33 - 1 (4)	TP68x50.7426x0.4375	21.50	0.229	26.000	0.018	1.05	0.004	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	158 - 131 (1)	0.010	0.531	0.000	0.046	0.002	0.542 ✔	1.333	H1-3+VT ✔
L2	131 - 93.25 (2)	0.007	0.419	0.000	0.021	0.000	0.425 ✔	1.333	H1-3+VT ✔
L3	93.25 - 46.33 (3)	0.008	0.407	0.000	0.018	0.000	0.416 ✔	1.333	H1-3+VT ✔
L4	46.33 - 1 (4)	0.011	0.434	0.000	0.018	0.000	0.445 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	158 - 131	Pole	TP27.42x18.5x0.1875	1	-5.85	801.66	40.6	Pass
L2	131 - 93.25	Pole	TP39.39x25.7235x0.375	2	-11.61	2302.74	31.9	Pass
L3	93.25 - 46.33	Pole	TP54.02x36.8396x0.4375	3	-23.03	3694.72	31.2	Pass
L4	46.33 - 1	Pole	TP68x50.7426x0.4375	4	-40.90	4816.40	33.4	Pass
						Summary		
						Pole (L1)	40.6	Pass
						RATING =	**40.6**	**Pass**

Program Version 5.0.2.0 - 6/13/2007 File:P:/08/Rev_1_Not_issued_see_readme_file/ERI Files/157_EEI_MonoPole_Hamden_CT_Rev_1.eri

ANCHOR BOLT AND
BASE PLATE ANALYSIS

ANCHOR BOLT AND BASE PLATE ANALYSIS

Input Data

Tower Reactions:

Overturning Moment:	$OM := 2181 \cdot ft \cdot kips$	*user input*
Shear Force:	$Shear := 21 \cdot kips$	*user input*
Axial Force:	$Axial := 41 \cdot kips$	*user input*

Anchor Bolt Data:

Use ASTM A615 Grade 75	*user input*	
Number of Anchor Bolts = N	$N := 36$	*user input*
Diameter of Bolt Circle:	$D_{bc} := 76in$	*user input*
Bolt "Column" Distance:	$l := 3.0in$	*user input*
Bolt Ultimate Strength:	$F_u := 100 \cdot ksi$	*user input*
Bolt Yield Strength:	$Fy := 75 \cdot ksi$	*user input*
Bolt Modulus:	$E := 29000 \cdot ksi$	*user input*
Anchor Bolt Diameter	$D := 2.25in$	*user input*
Threads per Inch:	$n := 4.5$	*user input*

Base Plate Data:

Use ASTM A572 Grade 60		*user input*
Plate Yield Strength:	$Fy_{bp} := 60 \cdot ksi$	*user input*
Base Plate Thickness:	$PlateThickness := 3.00 \cdot in$	*user input*
Base Plate Diameter:	$D_{bp} := 82.0 \cdot in$	*user input*
Outer Pole Diameter:	$D_{pole} := 68.0in$	*user input*

Geometric Layout Data:

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

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

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

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

$d_1 = 6.60 \cdot in$ $d_7 = 35.71 \cdot in$

$d_2 = 13.00 \cdot in$ $d_8 = 37.42 \cdot in$

$d_3 = 19.00 \cdot in$ $d_9 = 38.00 \cdot in$

$d_4 = 24.43 \cdot in$ $d_{10} = 37.42 \cdot in$

$d_5 = 29.11 \cdot in$ $d_{11} = 35.71 \cdot in$

$d_6 = 32.91 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius: $R_{pole} := \frac{D_{pole}}{2}$ $R_{pole} = 34.00 \cdot in$

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

$MA_1 = 0.00 \cdot in$ $MA_7 = 1.71 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 3.42 \cdot in$

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

$MA_4 = 0.00 \cdot in$ $MA_{10} = 3.42 \cdot in$

$MA_5 = 0.00 \cdot in$ $MA_{11} = 1.71 \cdot in$

$MA_6 = 0.00 \cdot in$ etc.

Effective Width of Baseplate for Bending: $EffectiveWidth := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2}$ $EffectiveWidth = 36.66 \cdot in$

Anchor Bolt Analysis:

Polar Moment of Inertia I_p:

$$I_p := \sum_i \left(d_i\right)^2 \qquad I_p = 2.599 \times 10^4 \cdot in^2$$

Gross Area of Bolt:

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

Net Area of Bolt:

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

Net Diameter:

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

Radius of Gyration of Bolt:

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

Section Modulus of Bolt:

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

Anchor Bolt Bending Stress:

Maximum Applied Bending:

$$M_x := \left(\frac{\text{Shear}}{N}\right) \cdot 1 \qquad M_x = 0.146 \cdot ft \cdot kips$$

$$f_{bx} := \frac{M_x}{S_x} \qquad f_{bx} = 2.1 \cdot ksi$$

Allowable Bending

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

Note: 1.333 increase allowed per TIA/EIA

Check Tensile Forces:

Maximum Tensile Force (Gross Area):

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

Note: 1.333 increase allowed per TIA/EIA

Maximum Tensile Force (Net Area):

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

Note: 1.333 increase allowed per TIA/EIA

Applied Tension:

$$MaxTension := \frac{OM \cdot R_{bc}}{I_p} - \frac{Axial}{N} \qquad MaxTension = 37.1 \cdot kips$$

Check Stresses:

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

$$\frac{MaxTension}{F_{net.area}} = 0.19$$

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

Condition = "OK"

Check Compression & Combined Stresses (if required):

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

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

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

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

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

Allowable Compressive Force:

$$K := 0.65$$

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

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

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

Applied Compressive Force:

$$MaxCompression := \frac{OM \cdot R_{bc}}{I_p} + \frac{Axial}{N} \qquad MaxCompression = 39.4 \cdot kips$$

$$f_a := \frac{MaxCompression}{A_n} \qquad f_a = 12.1 \cdot ksi$$

Check Combined Stresses:

$$\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} = 0.20$$

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

Base Plate Analysis:

Force from Bolt(s):

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

$C_1 = 7.8 \cdot kips$ $C_7 = 37.1 \cdot kips$

$C_2 = 14.2 \cdot kips$ $C_8 = 38.8 \cdot kips$

$C_3 = 20.3 \cdot kips$ $C_9 = 39.4 \cdot kips$

$C_4 = 25.7 \cdot kips$ $C_{10} = 38.8 \cdot kips$

$C_5 = 30.5 \cdot kips$ $C_{11} = 37.1 \cdot kips$

$C_6 = 34.3 \cdot kips$ etc.

Bending Stress in Plate:

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{EffectiveWidth \cdot PlateThickness^2} \qquad f_{bp} = 10.0 \cdot ksi$$

Check Stresses:

$$\frac{f_{bp}}{1.333 \cdot 0.75 Fy_{bp}} = 0.17$$

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

Condition = "OK"

DETAILED STRUCTURAL ANALYSIS AND EVALUATION OF AN EXISTING 160' MONOPOLE FOR PROPOSED ANTENNA ARRANGEMENT

Site I.D: Hamden North 2
Address: 150 Willow Street
Hamden, CT 06518

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VZ4-032

Rev 1 February 06, 2008

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

This report summarizes the structural analysis of the existing 160' steel tapered monopole structure, located at 150 Willow Road, Hamden, CT. The analysis was conducted in accordance with the 2005 Connecticut State Building Code and the TIA/EIA-222-F standard for a wind velocity of 85 mph (fastest mile) and 74 mph (fastest mile) concurrent with 0.5" ice. The antenna loading considered in the analysis consists of all existing and proposed antennas, transmission lines, and ancillary items as outlined in the Introduction Section of this report. The proposed Verizon Wireless installation is as follows:

Proposed Antenna and Mount	Carrier	Antenna Center Elevation
Install: **(6) Antel LPA 80080/4CF and** **(6) Antel LPA 185080/8CF_2 panel antennas** **(2) GPS antennas on** **(1) 13' Low Profile Platform** **(Valmont P/N 852206)** **(12) 1 5/8" coaxial cables and** **(2) 1/2" coaxial cables** **(all Verizon coax feed lines shall be located within the existing monopole)**	**Verizon (Proposed)**	**@ 147'**

The results of the analysis indicate that the tower structure has the capacity to support the proposed loading conditions. **The tower and its foundation are considered structurally adequate with the wind load classification specified above and the proposed antenna loading.**

1. EXECUTIVE SUMMARY - *continued*

This analysis is based on:

1) The tower structure's theoretical capacity, not including any assessment of the condition of the tower.
2) Tower geometry and structural member sizes utilized in the preparation of this report obtained from manufacturers original design documents prepared by Engineered Endeavors, Inc., (EEI), job no. 14977, dated July 16, 2007.
3) Site documentation and visual verification of existing appurtenances conducted from existing grade by URS during February 2008.
4) Antenna and mount configuration as specified within Section 2 and 6 of this report.

This report is only valid as per the assumptions and data utilized in this report for antenna inventory, mounts and associated cables. The user of this report shall field verify the assumption of the antenna and mount configuration as well as the physical condition of the tower. Notify the engineer in writing immediately if any of the information in this report is found to be other than specified.

If you should have any questions, please call.

Sincerely,

URS Corporation

Richard A. Sambor, P.E.
Manager Facilities Design

RAS/jrm
cc: AA, DR, ICA – URS, CF/Book

2. INTRODUCTION

The subject tower is located at 150 Willow Road, Hamden, CT. The structure is an existing 160' steel tapered monopole structure, designed and manufactured by Engineered Endeavors, Inc., (EEI).

The inventory is summarized in the table below:

Antenna Type	*Carrier*	*Mount*	*Antenna Centerline Elevation*	*Cable*
(12) Decibel DB950F65E-M panel antennas	Sprint/Nextel (existing/reserved)	(1) 12' Low Profile Platform w/ Handrails	160'	(12) 1 5/8" coax cables (within monopole)
(6) Antel LPA 80080/4CF and (6) Antel LPA 185080/8CF_2 panel antennas	**Verizon (proposed)**	**(1) 13' Low Profile Platform (Valmont P/N 852206)**	**147'**	**(12) 1 5/8" coax cables (within monopole)**
(2) GPS antennas	**Verizon (proposed)**	**Low Profile Platform (same as above)**	**147'**	**(2) 1/2" coax cables (within monopole)**
(1) GPS antenna	Sprint/Nextel (existing)	GPS stand-off	50'	(1) 1/2" coax cables (within monopole)

Note:

I. **Sprint/Nextel antenna inventory indicated in the above table based on original design documents.**

This structural analysis of the communications tower was performed by URS Corporation (URS) for Verizon Wireless. The purpose of this analysis was to investigate the structural integrity of the existing tower with its existing and proposed antenna loads. This analysis was conducted to evaluate stress on the tower and the effect of forces to the foundation of the tower resulting from existing and proposed antenna arrangements.

3. ANALYSIS METHODOLOGY AND LOADING CONDITIONS

The structural analysis was conducted in accordance with the 2005 Connecticut State Building Code, TIA/EIA-222-F - Structural Standard for Steel Antenna Towers and Antenna Supporting Structures, and the American Institute of Steel Construction (AISC) Manual of Steel Construction - Allowable Stress Design (ASD).

The analysis was conducted using RISA Tower 5.0.2. Two load conditions were evaluated as shown below which were compared to allowable stresses according to AISC and TIA/EIA.

Load Condition 1 = 85 mph (fastest mile) Wind Load (without ice) + Tower Dead Load
Load Condition 2 = 74 mph (fastest mile) Wind Load (with ice) + Ice Load + Tower Dead Load

Please note that wind pressure is a function of velocity squared. Under Load Condition 2, a 25 percent reduction in wind pressure is allowed by code to account for the unlikelihood of the full wind pressure and ice load occurring at the same time. The same results may be achieved by utilizing a lower wind pressure without taking the 25 percent reduction, as shown above.

The TIA/EIA standard permits a one-third increase in allowable stresses for towers and monopoles less than 700 feet tall. For the purposes of this analysis, in computing the load capacity the allowable stresses of the tower members were increased by one-third.

4. FINDINGS AND EVALUATION

Combined axial and bending stresses on the monopole structure were evaluated to compare with allowable stresses in accordance with AISC. The calculated stresses under the proposed loading were below the allowable stresses (see table below). Detailed analysis and calculations for the proposed load condition are provided in section 6 of this report. An analysis of the foundation was not performed as the calculated reactions at the base of the structure were less than the original design. Additionally, the anchor bolts and base plate were found to be within the allowable limits.

Tower Reactions:
For detailed proposed tower reactions, see drawing no. E-1 in section 6 of this report.

Proposed Tower Base Reactions vs. Original Design Reactions

Base Reactions	Original Design Reactions EIA-222 Rev G[1]	Original Design Reactions TIA/EIA-222 Rev F[2]	Proposed Reactions TIA/EIA-222 Rev F[3]
Axial Load (kips)	68.76	57.3	41
Shear (kips)	61.24	51.03	21
O.T. Moment (ft-kips)	7151.4	4469.6	2181

Notes:

1) Original Design reactions based on TIA-222G and ASCE 7 with 115mph Basic Wind Speed (3 second gust)
2) Figures indicated are equivalent service loads per TIA/EIA 222 Rev F with 115mph Basic Wind Speed (3 second gust) or equivalent 95mph Basic Wind Speed (fastest mile).
3) Figures indicated are proposed service loads per TIA/EIA 222 Rev F with 85mph Basic Wind Speed (fastest mile).

Tower Component Stress vs. Capacity Summary

Component (Section No.)	Controlling Component / Elevation	Stress Ratio (% capacity)	Pass/Fail	Notes:
Pole Shaft (L4)	131'-158'	40.6%	Pass	
Anchor Bolts	Compression	20%	Pass	
Base Plate	Bending	17%	Pass	

5. CONCLUSIONS AND RECOMMENDATIONS

The results of the analysis indicate that the tower structure has the capacity to support the proposed loading conditions. **The tower and its foundation are considered structurally adequate with the wind load classification specified above and the proposed antenna loading.**

Limitations/Assumptions:

This report is based on the following:

1. Tower inventory as listed in this report.
2. Tower is properly installed and maintained.
3. All members are as specified in the original design documents and are in good condition.
4. All required members are in place.
5. All bolts are in place and are properly tightened.
6. Tower is in plumb condition.
7. All member protective coatings are in good condition.
8. All tower members were properly designed, detailed, fabricated, and installed and have been properly maintained since erection.
9. Foundations were properly constructed to support original design loads as specified in the original design documents.
10. All coaxial cable is installed within the monopole unless specified otherwise.

URS is not responsible for any modifications completed prior to or hereafter in which URS is not or was not directly involved. Modifications include but are not limited to:

A. Adding antennas
B. Removing/replacing antennas
C. Adding coaxial cables

URS hereby states that this document represents the entire report and that it assumes no liability for any factual changes that may occur after the date of this report. All representations, recommendations, and conclusions are based upon information contained and set forth herein. If you are aware of any information which conflicts with that which is contained herein, or you are aware of any defects arising from original design, material, fabrication, or erection deficiencies, you should disregard this report and immediately contact URS. URS disclaims all liability for any representation, recommendation, or conclusion not expressly stated herein.

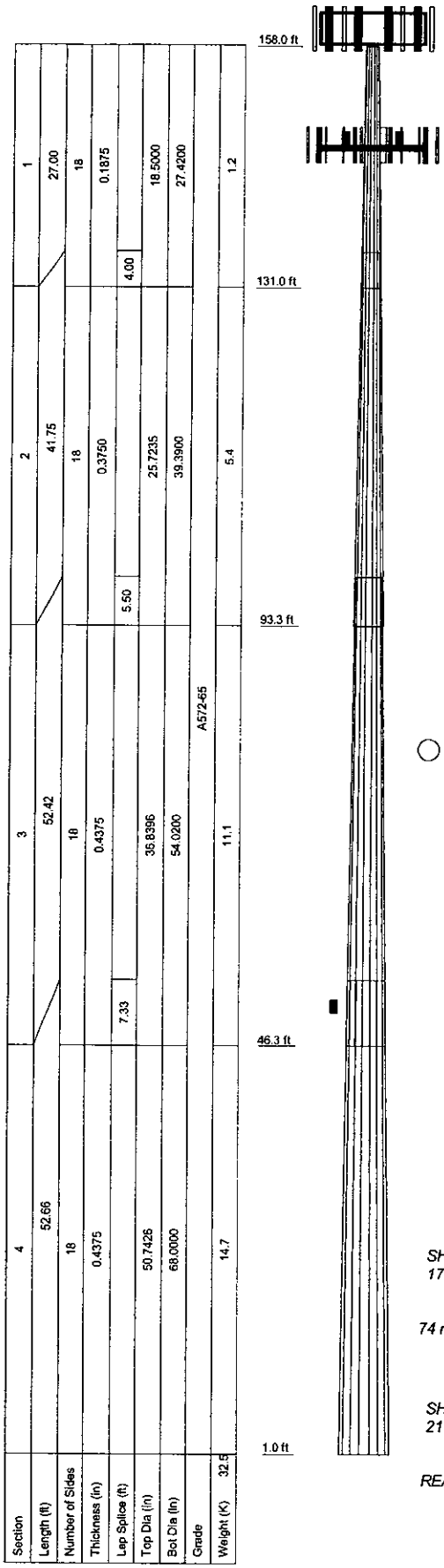
Ongoing and Periodic Inspection and Maintenance:

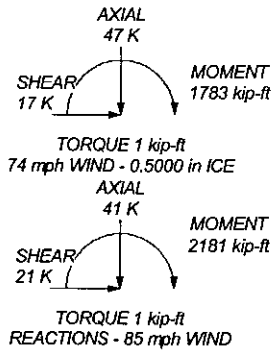
After the Contractor has successfully completed the installation and the work has been accepted, the owner will be responsible for the ongoing and periodic inspection and maintenance of the tower.

The owner shall refer to TIA/EIA-222-F for recommendations for maintenance and inspection. The frequency of the inspection and maintenance intervals is to be determined by the owner based upon actual site and environmental conditions. It is recommended that a complete and thorough inspection of the entire tower structural system be performed at least yearly and more frequently as conditions warrant. According to TIA/EIA-222-F section 14.1, Note 1: It is recommended that the structure be inspected after severe wind and/or ice storms or other extreme loading conditions.

6. DRAWINGS AND DATA

RISA TOWER INPUT/OUTPUT SUMMARY





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(4) DB950F65E-M (Sprint/Nextel)	160	LPA-185080/8CF_2 (Verizon - proposed)	147
(4) DB950F65E-M (Sprint/Nextel)	160	LPA-185080/8CF_2 (Verizon - proposed)	147
(4) DB950F65E-M (Sprint/Nextel)	160	LPA-185080/8CF_2 (Verizon - proposed)	147
EEI 12' Platform w/handrails (Sprint/Nextel)	160	LPA-185080/8CF_2 (Verizon - proposed)	147
LPA-80080/4CF (Verizon - proposed)	147	LPA-185080/8CF_2 (Verizon - proposed)	147
LPA-80080/4CF (Verizon - proposed)	147	Valmont 13' Low Profile Platform (Verizon - proposed)	147
LPA-80080/4CF (Verizon - proposed)	147	GPS (Verizon - proposed)	147
LPA-80063/4CF (Verizon - proposed)	147	GPS (Verizon - proposed)	147
LPA-80080/4CF (Verizon - proposed)	147	GPS (Sprint/Nextel)	50
LPA-80080/4CF (Verizon - proposed)	147	Valmont B2069 2' GPS Mount (Sprint/Nextel)	50
LPA-185080/8CF_2 (Verizon - proposed)	147		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. TOWER RATING: 40.6%

URS Corporation
500 Enterprise Drive, Suite 3B
Rocky Hill, CT 06067
Phone: (860) 529-8882
FAX: (860) 529-3991

Job: ***157' EEI Monopole - Rev 1***		
Project: ***150 Willow Street, Hamden, CT***		
Client: Verizon Wireless	Drawn by: Staff	App'd:
Code: TIA/EIA-222-F	Date: 02/06/08	Scale: NTS
Path: P:\08\Rev 1 Not issued eng mapping Rel\EEI\Revi\157_EEI MonoPole Hamden CT Rev 1.er		Dwg No. E-1

RISA TOWER DETAILED OUTPUT

Tower Input Data

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

Basic wind speed of 85 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	*Elevation* *ft*	*Section Length* *ft*	*Splice Length* *ft*	*Number of Sides*	*Top Diameter* *in*	*Bottom Diameter* *in*	*Wall Thickness* *in*	*Bend Radius* *in*	*Pole Grade*
L1	158.00-131.00	27.00	4.00	18	18.5000	27.4200	0.1875	0.7500	A572-65 (65 ksi)
L2	131.00-93.25	41.75	5.50	18	25.7235	39.3900	0.3750	1.5000	A572-65 (65 ksi)
L3	93.25-46.33	52.42	7.33	18	36.8396	54.0200	0.4375	1.7500	A572-65 (65 ksi)
L4	46.33-1.00	52.66		18	50.7426	68.0000	0.4375	1.7500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	18.7854	10.8982	461.7305	6.5009	9.3980	49.1307	924.0685	5.4501	2.9260	15.605
	27.8430	16.2067	1518.4769	9.6675	13.9294	109.0127	3038.9518	8.1049	4.4959	23.978
L2	27.4499	30.1711	2449.2517	8.9987	13.0675	187.4301	4901.7261	15.0884	3.8673	10.313
	39.9977	46.4376	8930.3910	13.8503	20.0101	446.2937	17872.5328	23.2232	6.2726	16.727
L3	39.2383	50.5489	8462.5771	12.9228	18.7145	452.1929	16936.2895	25.2793	5.7138	13.06
	54.8533	74.4060	26989.2830	19.0218	27.4422	983.4970	54014.0793	37.2101	8.7375	19.971
L4	53.9646	69.8550	22333.6296	17.8583	25.7773	866.4083	44696.6463	34.9341	8.1607	18.653
	69.0490	93.8190	54105.2694	23.9847	34.5440	1566.2711	108281.731 9	46.9184	11.1980	25.595

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 158.00-131.00				1	1	1		
L2 131.00-93.25				1	1	1		
L3 93.25-46.33				1	1	1		
L4 46.33-1.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 5/8 (Sprint/Nextel)	C	No	Inside Pole	156.00 - 8.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon - proposed)	C	No	Inside Pole	146.00 - 8.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1/2 (Sprint/Nextel)	C	No	Inside Pole	50.00 - 8.00	1	No Ice	0.00	0.25
						1/2" Ice	0.00	0.25
1/2 (Verizon - proposed)	C	No	Inside Pole	146.00 - 8.00	2	No Ice	0.00	0.25
						1/2" Ice	0.00	0.25

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	158.00-131.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.51
L2	131.00-93.25	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.96
L3	93.25-46.33	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.20

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L4	46.33-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.99

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	158.00-131.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.51
L2	131.00-93.25	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.96
L3	93.25-46.33	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.20
L4	46.33-1.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.99

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(4) DB950F65E-M	A	From Face	4.00	0.0000	160.00	No Ice	6.13	4.24	0.02
(Sprint/Nextel)			0.00			1/2" Ice	6.59	4.62	0.05
			0.00						
(4) DB950F65E-M	B	From Face	4.00	0.0000	160.00	No Ice	6.13	4.24	0.02
(Sprint/Nextel)			0.00			1/2" Ice	6.59	4.62	0.05
			0.00						
(4) DB950F65E-M	C	From Face	4.00	0.0000	160.00	No Ice	6.13	4.24	0.02
(Sprint/Nextel)			0.00			1/2" Ice	6.59	4.62	0.05
			0.00						
EEI 12' Platform w/handrails	A	None		0.0000	160.00	No Ice	32.00	32.00	3.05
(Sprint/Nextel)						1/2" Ice	38.00	38.00	4.02
LPA-80080/4CF	A	From Face	4.00	0.0000	147.00	No Ice	2.62	6.06	0.01
(Verizon - proposed)			6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
LPA-80080/4CF	A	From Face	4.00	0.0000	147.00	No Ice	2.62	6.06	0.01
(Verizon - proposed)			-6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
LPA-80080/4CF	B	From Face	4.00	0.0000	147.00	No Ice	2.62	6.06	0.01
(Verizon - proposed)			6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
LPA-80063/4CF	B	From Face	4.00	0.0000	147.00	No Ice	7.01	6.08	0.02
(Verizon - proposed)			-6.00			1/2" Ice	7.42	6.48	0.07
			0.00						

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 K
LPA-80080/4CF (Verizon - proposed)	C	From Face	4.00 6.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LPA-80080/4CF (Verizon - proposed)	C	From Face	4.00 -6.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
LPA-185080/8CF_2 (Verizon - proposed)	A	From Face	4.00 2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	A	From Face	4.00 -2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	B	From Face	4.00 2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	B	From Face	4.00 -2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	C	From Face	4.00 2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
LPA-185080/8CF_2 (Verizon - proposed)	C	From Face	4.00 -2.00 0.00	0.0000	147.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	0.01 0.03
Valmont 13' Low Profile Platform (Verizon - proposed)	A	None		0.0000	147.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
GPS (Verizon - proposed)	C	From Face	4.00 3.00 0.00	0.0000	147.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
GPS (Verizon - proposed)	C	From Face	4.00 -3.00 0.00	0.0000	147.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
GPS (Sprint/Nextel)	A	From Face	2.00 0.00 0.00	0.0000	50.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
Valmont B2069 2' GPS Mount (Sprint/Nextel)	A	From Face	1.00 0.00 0.00	0.0000	50.00	No Ice 1/2" Ice	0.78 1.10	0.68 1.10	0.03 0.03

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{Leg} ft^2	Leg % %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 158.00-131.00	143.63	1.522	28	51.660	A B	0.000 0.000	51.660 51.660	51.660	100.00 100.00	0.000	0.000

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
					C	0.000	51.660		100.00		
L2 131.00-93.25	111.18	1.415	26	104.478	A	0.000	104.478	104.478	100.00	0.000	0.000
					B	0.000	104.478		100.00		
					C	0.000	104.478		100.00		
L3 93.25-46.33	69.06	1.235	23	181.155	A	0.000	181.155	181.155	100.00	0.000	0.000
					B	0.000	181.155		100.00		
					C	0.000	181.155		100.00		
L4 46.33-1.00	22.82	1	19	228.812	A	0.000	228.812	228.812	100.00	0.000	0.000
					B	0.000	228.812		100.00		
					C	0.000	228.812		100.00		

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 158.00-131.00	143.63	1.522	21	0.5000	53.910	A	0.000	53.910	53.910	100.00	0.000	0.000
						B	0.000	53.910		100.00		
						C	0.000	53.910		100.00		
L2 131.00-93.25	111.18	1.415	20	0.5000	107.623	A	0.000	107.623	107.623	100.00	0.000	0.000
						B	0.000	107.623		100.00		
						C	0.000	107.623		100.00		
L3 93.25-46.33	69.06	1.235	17	0.5000	185.065	A	0.000	185.065	185.065	100.00	0.000	0.000
						B	0.000	185.065		100.00		
						C	0.000	185.065		100.00		
L4 46.33-1.00	22.82	1	14	0.5000	232.590	A	0.000	232.590	232.590	100.00	0.000	0.000
						B	0.000	232.590		100.00		
						C	0.000	232.590		100.00		

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 158.00-131.00	143.63	1.522	10	51.660	A	0.000	51.660	51.660	100.00	0.000	0.000
					B	0.000	51.660		100.00		
					C	0.000	51.660		100.00		
L2 131.00-93.25	111.18	1.415	9	104.478	A	0.000	104.478	104.478	100.00	0.000	0.000
					B	0.000	104.478		100.00		
					C	0.000	104.478		100.00		
L3 93.25-46.33	69.06	1.235	8	181.155	A	0.000	181.155	181.155	100.00	0.000	0.000
					B	0.000	181.155		100.00		
					C	0.000	181.155		100.00		
L4 46.33-1.00	22.82	1	6	228.812	A	0.000	228.812	228.812	100.00	0.000	0.000
					B	0.000	228.812		100.00		
					C	0.000	228.812		100.00		

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	1.60	59.18	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	3.00	79.46	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	4.52	96.36	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	4.68	103.27	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	968.24 kip-ft	13.80		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	1.60	59.18	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	3.00	79.46	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	4.52	96.36	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	4.68	103.27	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	968.24 kip-ft	13.80		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	1.60	59.18	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-	0.96	5.44	A	1	0.65	1	1	1	104.478	3.00	79.46	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
93.25			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	4.52	96.36	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	4.68	103.27	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	968.24 kip-ft	13.80		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	1.60	59.18	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	3.00	79.46	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	4.52	96.36	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	4.68	103.27	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	968.24 kip-ft	13.80		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.64	A	1	0.65	1	1	1	53.910	1.25	46.32	C
			B	1	0.65	1	1	1	53.910			
			C	1	0.65	1	1	1	53.910			
L2 131.00-93.25	0.96	6.23	A	1	0.65	1	1	1	107.623	2.32	61.39	C
			B	1	0.65	1	1	1	107.623			
			C	1	0.65	1	1	1	107.623			
L3 93.25-46.33	1.20	12.50	A	1	0.65	1	1	1	185.065	3.46	73.83	C
			B	1	0.65	1	1	1	185.065			
			C	1	0.65	1	1	1	185.065			
L4 46.33-1.00	0.99	16.37	A	1	0.65	1	1	1	232.590	3.57	78.73	C
			B	1	0.65	1	1	1	232.590			
			C	1	0.65	1	1	1	232.590			
Sum Weight:	3.65	36.74						OTM	747.34	10.60		

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

Tower Forces - With Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 158.00-131.00	0.51	1.64	A	1	0.65	1	1	1	53.910	1.25	46.32	C
			B	1	0.65	1	1	1	53.910			
			C	1	0.65	1	1	1	53.910			
L2 131.00-93.25	0.96	6.23	A	1	0.65	1	1	1	107.623	2.32	61.39	C
			B	1	0.65	1	1	1	107.623			
			C	1	0.65	1	1	1	107.623			
L3 93.25-46.33	1.20	12.50	A	1	0.65	1	1	1	185.065	3.46	73.83	C
			B	1	0.65	1	1	1	185.065			
			C	1	0.65	1	1	1	185.065			
L4 46.33-1.00	0.99	16.37	A	1	0.65	1	1	1	232.590	3.57	78.73	C
			B	1	0.65	1	1	1	232.590			
			C	1	0.65	1	1	1	232.590			
Sum Weight:	3.65	36.74						OTM	747.34 kip-ft	10.60		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1 158.00-131.00	0.51	1.64	A	1	0.65	1	1	1	53.910	1.25	46.32	C
			B	1	0.65	1	1	1	53.910			
			C	1	0.65	1	1	1	53.910			
L2 131.00-93.25	0.96	6.23	A	1	0.65	1	1	1	107.623	2.32	61.39	C
			B	1	0.65	1	1	1	107.623			
			C	1	0.65	1	1	1	107.623			
L3 93.25-46.33	1.20	12.50	A	1	0.65	1	1	1	185.065	3.46	73.83	C
			B	1	0.65	1	1	1	185.065			
			C	1	0.65	1	1	1	185.065			
L4 46.33-1.00	0.99	16.37	A	1	0.65	1	1	1	232.590	3.57	78.73	C
			B	1	0.65	1	1	1	232.590			
			C	1	0.65	1	1	1	232.590			
Sum Weight:	3.65	36.74						OTM	747.34 kip-ft	10.60		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.64	A	1	0.65	1	1	1	53.910	1.25	46.32	C
			B	1	0.65	1	1	1	53.910			
			C	1	0.65	1	1	1	53.910			
L2 131.00-93.25	0.96	6.23	A	1	0.65	1	1	1	107.623	2.32	61.39	C
			B	1	0.65	1	1	1	107.623			
			C	1	0.65	1	1	1	107.623			
L3 93.25-46.33	1.20	12.50	A	1	0.65	1	1	1	185.065	3.46	73.83	C
			B	1	0.65	1	1	1	185.065			
			C	1	0.65	1	1	1	185.065			
L4 46.33-1.00	0.99	16.37	A	1	0.65	1	1	1	232.590	3.57	78.73	C
			B	1	0.65	1	1	1	232.590			
			C	1	0.65	1	1	1	232.590			
Sum Weight:	3.65	36.74						OTM	747.34 kip-ft	10.60		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	0.55	20.48	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	1.04	27.49	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	1.56	33.34	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	1.62	35.74	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	335.03 kip-ft	4.78		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	0.55	20.48	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	1.04	27.49	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	1.56	33.34	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	1.62	35.74	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	335.03 kip-ft	4.78		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	0.55	20.48	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	1.04	27.49	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	1.56	33.34	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	1.62	35.74	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	335.03 kip-ft	4.78		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 158.00-131.00	0.51	1.25	A	1	0.65	1	1	1	51.660	0.55	20.48	C
			B	1	0.65	1	1	1	51.660			
			C	1	0.65	1	1	1	51.660			
L2 131.00-93.25	0.96	5.44	A	1	0.65	1	1	1	104.478	1.04	27.49	C
			B	1	0.65	1	1	1	104.478			
			C	1	0.65	1	1	1	104.478			
L3 93.25-46.33	1.20	11.14	A	1	0.65	1	1	1	181.155	1.56	33.34	C
			B	1	0.65	1	1	1	181.155			
			C	1	0.65	1	1	1	181.155			
L4 46.33-1.00	0.99	14.66	A	1	0.65	1	1	1	228.812	1.62	35.74	C
			B	1	0.65	1	1	1	228.812			
			C	1	0.65	1	1	1	228.812			
Sum Weight:	3.65	32.50						OTM	335.03 kip-ft	4.78		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	32.50					
Bracing Weight	0.00					
Total Member Self-Weight	32.50			-0.04	0.09	
Total Weight	40.90			-0.04	0.09	
Wind 0 deg - No Ice		0.09	-21.33	-2122.01	-13.05	-0.82
Wind 30 deg - No Ice		10.80	-18.52	-1844.29	-1079.95	-1.08
Wind 45 deg - No Ice		15.22	-15.15	-1509.79	-1520.51	-1.10
Wind 60 deg - No Ice		18.61	-10.74	-1072.41	-1857.45	-1.05
Wind 90 deg - No Ice		21.44	-0.09	-13.18	-2137.22	-0.74
Wind 120 deg - No Ice		18.52	10.59	1049.56	-1844.31	-0.23
Wind 135 deg - No Ice		15.10	15.02	1491.12	-1501.92	0.06
Wind 150 deg - No Ice		10.64	18.43	1831.07	-1057.18	0.34
Wind 180 deg - No Ice		-0.09	21.33	2121.93	13.24	0.82
Wind 210 deg - No Ice		-10.80	18.52	1844.21	1080.14	1.08
Wind 225 deg - No Ice		-15.22	15.15	1509.71	1520.70	1.10
Wind 240 deg - No Ice		-18.61	10.74	1072.33	1857.64	1.05
Wind 270 deg - No Ice		-21.44	0.09	13.11	2137.41	0.74
Wind 300 deg - No Ice		-18.52	-10.59	-1049.64	1844.49	0.23
Wind 315 deg - No Ice		-15.10	-15.02	-1491.20	1502.11	-0.06
Wind 330 deg - No Ice		-10.64	-18.43	-1831.14	1057.37	-0.34
Member Ice	4.24					
Total Weight Ice	47.34			-0.15	0.11	
Wind 0 deg - Ice		0.07	-17.02	-1727.68	-10.05	-0.71
Wind 30 deg - Ice		8.61	-14.77	-1501.31	-878.31	-0.83
Wind 45 deg - Ice		12.14	-12.08	-1228.88	-1236.91	-0.81
Wind 60 deg - Ice		14.84	-8.57	-872.71	-1511.21	-0.73
Wind 90 deg - Ice		17.10	-0.07	-10.30	-1739.15	-0.44
Wind 120 deg - Ice		14.77	8.45	854.82	-1501.05	-0.03
Wind 135 deg - Ice		12.04	11.98	1214.22	-1222.55	0.19
Wind 150 deg - Ice		8.49	14.70	1490.86	-860.72	0.39
Wind 180 deg - Ice		-0.07	17.02	1727.39	10.27	0.71
Wind 210 deg - Ice		-8.61	14.77	1501.02	878.53	0.83
Wind 225 deg - Ice		-12.14	12.08	1228.58	1237.13	0.81
Wind 240 deg - Ice		-14.84	8.57	872.41	1511.43	0.73
Wind 270 deg - Ice		-17.10	0.07	10.01	1739.37	0.44
Wind 300 deg - Ice		-14.77	-8.45	-855.12	1501.27	0.03
Wind 315 deg - Ice		-12.04	-11.98	-1214.52	1222.77	-0.19
Wind 330 deg - Ice		-8.49	-14.70	-1491.16	860.94	-0.39
Total Weight	40.90			-0.04	0.09	
Wind 0 deg - Service		0.03	-7.38	-734.28	-4.46	-0.28
Wind 30 deg - Service		3.74	-6.41	-638.19	-373.62	-0.37
Wind 45 deg - Service		5.27	-5.24	-522.44	-526.07	-0.38
Wind 60 deg - Service		6.44	-3.72	-371.10	-642.66	-0.36
Wind 90 deg - Service		7.42	-0.03	-4.59	-739.46	-0.25
Wind 120 deg - Service		6.41	3.66	363.14	-638.11	-0.08
Wind 135 deg - Service		5.22	5.20	515.93	-519.64	0.02
Wind 150 deg - Service		3.68	6.38	633.56	-365.75	0.12
Wind 180 deg - Service		-0.03	7.38	734.21	4.64	0.28
Wind 210 deg - Service		-3.74	6.41	638.11	373.81	0.37
Wind 225 deg - Service		-5.27	5.24	522.37	526.25	0.38
Wind 240 deg - Service		-6.44	3.72	371.02	642.84	0.36
Wind 270 deg - Service		-7.42	0.03	4.51	739.65	0.25
Wind 300 deg - Service		-6.41	-3.66	-363.22	638.29	0.08
Wind 315 deg - Service		-5.22	-5.20	-516.01	519.82	-0.02
Wind 330 deg - Service		-3.68	-6.38	-633.64	365.93	-0.12

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	158 - 131	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-8.70	-0.03	0.06
			Max. Mx	6	-5.86	-169.67	1.08
			Max. My	10	-5.86	1.09	-168.39
			Max. Vy	14	-9.12	169.65	-1.15
			Max. Vx	10	9.01	1.09	-168.39
			Max. Torque	4			0.88
L2	131 - 93.25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-15.12	-0.03	0.06
			Max. Mx	6	-11.61	-549.55	4.44
			Max. My	10	-11.62	4.45	-544.40
			Max. Vy	14	-11.95	549.52	-4.50
			Max. Vx	2	-11.85	-4.49	544.36
			Max. Torque	4			0.88
L3	93.25 - 46.33	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-27.70	-0.03	0.06
			Max. Mx	6	-23.03	-1182.54	8.62
			Max. My	10	-23.04	8.63	-1172.57
			Max. Vy	14	-16.19	1182.51	-8.66
			Max. Vx	2	-16.09	-8.65	1172.53
			Max. Torque	4			0.88
L4	46.33 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-47.34	0.11	0.15
			Max. Mx	14	-40.90	2172.95	-13.36
			Max. My	2	-40.90	-13.30	2157.26
			Max. Vy	14	-21.45	2172.95	-13.36
			Max. Vx	2	-21.34	-13.30	2157.26
			Max. Torque	4			1.10

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	23	47.34	-17.10	0.07
	Max. H_x	14	40.90	21.44	-0.09
	Max. H_z	2	40.90	-0.09	21.33
	Max. M_x	2	2157.26	-0.09	21.33
	Max. M_z	6	2172.76	-21.44	0.09
	Max. Torsion	4	1.10	-15.22	15.15
	Min. Vert	46	40.90	6.44	-3.72
	Min. H_x	6	40.90	-21.44	0.09
	Min. H_z	10	40.90	0.09	-21.33
	Min. M_x	10	-2157.18	0.09	-21.33
	Min. M_z	14	-2172.95	21.44	-0.09
	Min. Torsion	12	-1.10	15.22	-15.15

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	40.90	0.00	0.00	-0.04	0.09	0.00

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 0 deg - No Ice	40.90	0.09	-21.33	-2157.26	-13.30	-0.82
Dead+Wind 30 deg - No Ice	40.90	10.80	-18.52	-1874.94	-1097.93	-1.08
Dead+Wind 45 deg - No Ice	40.90	15.22	-15.15	-1534.89	-1545.82	-1.10
Dead+Wind 60 deg - No Ice	40.90	18.61	-10.74	-1090.24	-1888.35	-1.05
Dead+Wind 90 deg - No Ice	40.90	21.44	-0.09	-13.43	-2172.76	-0.73
Dead+Wind 120 deg - No Ice	40.90	18.52	10.59	1066.97	-1874.96	-0.22
Dead+Wind 135 deg - No Ice	40.90	15.10	15.02	1515.88	-1526.88	0.06
Dead+Wind 150 deg - No Ice	40.90	10.64	18.43	1861.48	-1074.74	0.34
Dead+Wind 180 deg - No Ice	40.90	-0.09	21.33	2157.18	13.49	0.81
Dead+Wind 210 deg - No Ice	40.90	-10.80	18.52	1874.86	1098.12	1.07
Dead+Wind 225 deg - No Ice	40.90	-15.22	15.15	1534.81	1546.00	1.10
Dead+Wind 240 deg - No Ice	40.90	-18.61	10.74	1090.17	1888.53	1.05
Dead+Wind 270 deg - No Ice	40.90	-21.44	0.09	13.36	2172.95	0.74
Dead+Wind 300 deg - No Ice	40.90	-18.52	-10.59	-1067.05	1875.15	0.23
Dead+Wind 315 deg - No Ice	40.90	-15.10	-15.02	-1515.96	1527.07	-0.06
Dead+Wind 330 deg - No Ice	40.90	-10.64	-18.43	-1861.55	1074.93	-0.34
Dead+Ice+Temp	47.34	0.00	0.00	-0.15	0.11	0.00
Dead+Wind 0 deg+Ice+Temp	47.34	0.07	-17.02	-1764.63	-10.29	-0.71
Dead+Wind 30 deg+Ice+Temp	47.34	8.61	-14.77	-1533.43	-897.14	-0.83
Dead+Wind 45 deg+Ice+Temp	47.34	12.14	-12.08	-1255.18	-1263.41	-0.81
Dead+Wind 60 deg+Ice+Temp	47.34	14.84	-8.57	-891.40	-1543.57	-0.73
Dead+Wind 90 deg+Ice+Temp	47.34	17.10	-0.07	-10.55	-1776.38	-0.44
Dead+Wind 120 deg+Ice+Temp	47.34	14.77	8.45	873.08	-1533.18	-0.03
Dead+Wind 135 deg+Ice+Temp	47.34	12.04	11.98	1240.17	-1248.71	0.19
Dead+Wind 150 deg+Ice+Temp	47.34	8.49	14.70	1522.74	-879.13	0.39
Dead+Wind 180 deg+Ice+Temp	47.34	-0.07	17.02	1764.33	10.51	0.70
Dead+Wind 210 deg+Ice+Temp	47.34	-8.61	14.77	1533.13	897.36	0.83
Dead+Wind 225 deg+Ice+Temp	47.34	-12.14	12.08	1254.88	1263.63	0.81
Dead+Wind 240 deg+Ice+Temp	47.34	-14.84	8.57	891.10	1543.79	0.73
Dead+Wind 270 deg+Ice+Temp	47.34	-17.10	0.07	10.25	1776.60	0.44
Dead+Wind 300 deg+Ice+Temp	47.34	-14.77	-8.45	-873.39	1533.40	0.03
Dead+Wind 315 deg+Ice+Temp	47.34	-12.04	-11.98	-1240.48	1248.93	-0.18
Dead+Wind 330 deg+Ice+Temp	47.34	-8.49	-14.70	-1523.04	879.35	-0.39
Dead+Wind 0 deg - Service	40.90	0.03	-7.38	-746.60	-4.54	-0.28
Dead+Wind 30 deg - Service	40.90	3.74	-6.41	-648.90	-379.91	-0.37
Dead+Wind 45 deg - Service	40.90	5.27	-5.24	-531.21	-534.91	-0.38
Dead+Wind 60 deg - Service	40.90	6.44	-3.72	-377.33	-653.45	-0.36
Dead+Wind 90 deg - Service	40.90	7.42	-0.03	-4.67	-751.88	-0.25
Dead+Wind 120 deg - Service	40.90	6.41	3.66	369.23	-648.82	-0.08
Dead+Wind 135 deg - Service	40.90	5.22	5.20	524.58	-528.35	0.02
Dead+Wind 150 deg - Service	40.90	3.68	6.38	644.18	-371.88	0.12
Dead+Wind 180 deg - Service	40.90	-0.03	7.38	746.52	4.73	0.28
Dead+Wind 210 deg - Service	40.90	-3.74	6.41	648.82	380.09	0.37
Dead+Wind 225 deg - Service	40.90	-5.27	5.24	531.14	535.10	0.38
Dead+Wind 240 deg - Service	40.90	-6.44	3.72	377.26	653.64	0.36
Dead+Wind 270 deg - Service	40.90	-7.42	0.03	4.60	752.07	0.25
Dead+Wind 300 deg - Service	40.90	-6.41	-3.66	-369.30	649.00	0.08
Dead+Wind 315 deg - Service	40.90	-5.22	-5.20	-524.66	528.54	-0.02
Dead+Wind 330 deg - Service	40.90	-3.68	-6.38	-644.26	372.07	-0.12

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-40.90	0.00	0.00	40.90	0.00	0.000%
2	0.09	-40.90	-21.33	-0.09	40.90	21.33	0.000%
3	10.80	-40.90	-18.52	-10.80	40.90	18.52	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
4	15.22	-40.90	-15.15	-15.22	40.90	15.15	0.000%
5	18.61	-40.90	-10.74	-18.61	40.90	10.74	0.000%
6	21.44	-40.90	-0.09	-21.44	40.90	0.09	0.000%
7	18.52	-40.90	10.59	-18.52	40.90	-10.59	0.000%
8	15.10	-40.90	15.02	-15.10	40.90	-15.02	0.000%
9	10.64	-40.90	18.43	-10.64	40.90	-18.43	0.000%
10	-0.09	-40.90	21.33	0.09	40.90	-21.33	0.000%
11	-10.80	-40.90	18.52	10.80	40.90	-18.52	0.000%
12	-15.22	-40.90	15.15	15.22	40.90	-15.15	0.000%
13	-18.61	-40.90	10.74	18.61	40.90	-10.74	0.000%
14	-21.44	-40.90	0.09	21.44	40.90	-0.09	0.000%
15	-18.52	-40.90	-10.59	18.52	40.90	10.59	0.000%
16	-15.10	-40.90	-15.02	15.10	40.90	15.02	0.000%
17	-10.64	-40.90	-18.43	10.64	40.90	18.43	0.000%
18	0.00	-47.34	0.00	0.00	47.34	0.00	0.000%
19	0.07	-47.34	-17.02	-0.07	47.34	17.02	0.000%
20	8.61	-47.34	-14.77	-8.61	47.34	14.77	0.000%
21	12.14	-47.34	-12.08	-12.14	47.34	12.08	0.000%
22	14.84	-47.34	-8.57	-14.84	47.34	8.57	0.000%
23	17.10	-47.34	-0.07	-17.10	47.34	0.07	0.000%
24	14.77	-47.34	8.45	-14.77	47.34	-8.45	0.000%
25	12.04	-47.34	11.98	-12.04	47.34	-11.98	0.000%
26	8.49	-47.34	14.70	-8.49	47.34	-14.70	0.000%
27	-0.07	-47.34	17.02	0.07	47.34	-17.02	0.000%
28	-8.61	-47.34	14.77	8.61	47.34	-14.77	0.000%
29	-12.14	-47.34	12.08	12.14	47.34	-12.08	0.000%
30	-14.84	-47.34	8.57	14.84	47.34	-8.57	0.000%
31	-17.10	-47.34	0.07	17.10	47.34	-0.07	0.000%
32	-14.77	-47.34	-8.45	14.77	47.34	8.45	0.000%
33	-12.04	-47.34	-11.98	12.04	47.34	11.98	0.000%
34	-8.49	-47.34	-14.70	8.49	47.34	14.70	0.000%
35	0.03	-40.90	-7.38	-0.03	40.90	7.38	0.000%
36	3.74	-40.90	-6.41	-3.74	40.90	6.41	0.000%
37	5.27	-40.90	-5.24	-5.27	40.90	5.24	0.000%
38	6.44	-40.90	-3.72	-6.44	40.90	3.72	0.000%
39	7.42	-40.90	-0.03	-7.42	40.90	0.03	0.000%
40	6.41	-40.90	3.66	-6.41	40.90	-3.66	0.000%
41	5.22	-40.90	5.20	-5.22	40.90	-5.20	0.000%
42	3.68	-40.90	6.38	-3.68	40.90	-6.38	0.000%
43	-0.03	-40.90	7.38	0.03	40.90	-7.38	0.000%
44	-3.74	-40.90	6.41	3.74	40.90	-6.41	0.000%
45	-5.27	-40.90	5.24	5.27	40.90	-5.24	0.000%
46	-6.44	-40.90	3.72	6.44	40.90	-3.72	0.000%
47	-7.42	-40.90	0.03	7.42	40.90	-0.03	0.000%
48	-6.41	-40.90	-3.66	6.41	40.90	3.66	0.000%
49	-5.22	-40.90	-5.20	5.22	40.90	5.20	0.000%
50	-3.68	-40.90	-6.38	3.68	40.90	6.38	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	0.00005126
3	Yes	4	0.00000001	0.00054800
4	Yes	4	0.00000001	0.00067260

5	Yes	4	0.00000001	0.00062785
6	Yes	4	0.00000001	0.00006846
7	Yes	4	0.00000001	0.00055079
8	Yes	4	0.00000001	0.00064205
9	Yes	4	0.00000001	0.00054866
10	Yes	4	0.00000001	0.00006900
11	Yes	4	0.00000001	0.00062523
12	Yes	4	0.00000001	0.00067125
13	Yes	4	0.00000001	0.00054885
14	Yes	4	0.00000001	0.00005051
15	Yes	4	0.00000001	0.00057175
16	Yes	4	0.00000001	0.00064199
17	Yes	4	0.00000001	0.00057045
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00073681
20	Yes	5	0.00000001	0.00003286
21	Yes	5	0.00000001	0.00003636
22	Yes	5	0.00000001	0.00003377
23	Yes	4	0.00000001	0.00074097
24	Yes	5	0.00000001	0.00003253
25	Yes	5	0.00000001	0.00003550
26	Yes	5	0.00000001	0.00003231
27	Yes	4	0.00000001	0.00073786
28	Yes	5	0.00000001	0.00003375
29	Yes	5	0.00000001	0.00003633
30	Yes	5	0.00000001	0.00003292
31	Yes	4	0.00000001	0.00074012
32	Yes	5	0.00000001	0.00003259
33	Yes	5	0.00000001	0.00003551
34	Yes	5	0.00000001	0.00003273
35	Yes	4	0.00000001	0.00000988
36	Yes	4	0.00000001	0.00003037
37	Yes	4	0.00000001	0.00004041
38	Yes	4	0.00000001	0.00004006
39	Yes	4	0.00000001	0.00001060
40	Yes	4	0.00000001	0.00003097
41	Yes	4	0.00000001	0.00003698
42	Yes	4	0.00000001	0.00003083
43	Yes	4	0.00000001	0.00001064
44	Yes	4	0.00000001	0.00003985
45	Yes	4	0.00000001	0.00004024
46	Yes	4	0.00000001	0.00003034
47	Yes	4	0.00000001	0.00000984
48	Yes	4	0.00000001	0.00003363
49	Yes	4	0.00000001	0.00003697
50	Yes	4	0.00000001	0.00003358

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	158 - 131	12.960	46	0.9059	0.0027
L2	135 - 93.25	8.960	46	0.7139	0.0014
L3	98.75 - 46.33	4.474	46	0.4594	0.0005
L4	53.66 - 1	1.246	46	0.2204	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
160.00	(4) DB950F65E-M	46	12.960	0.9059	0.0027	25064
147.00	LPA-80080/4CF	46	10.975	0.8120	0.0021	11392
50.00	GPS	46	1.089	0.2110	0.0002	10598

Maximum Tower Deflections - Design Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	158 - 131	37.430	13	2.6168	0.0079
L2	135 - 93.25	25.881	13	2.0624	0.0041
L3	98.75 - 46.33	12.924	13	1.3271	0.0015
L4	53.66 - 1	3.601	13	0.6366	0.0005

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
160.00	(4) DB950F65E-M	13	37.430	2.6168	0.0079	8710
147.00	LPA-80080/4CF	13	31.700	2.3462	0.0059	3959
50.00	GPS	13	3.148	0.5958	0.0005	3669

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L_u	Kl/r	F_a	A	Actual P	Allow. P_a	Ratio $\frac{P}{P_a}$
	ft		ft	ft		ksi	in^2	K	K	
L1	158 - 131 (1)	TP27.42x18.5x0.1875	27.00	0.00	0.0	39.000	15.4203	-5.85	601.39	0.010
L2	131 - 93.25 (2)	TP39.39x25.7235x0.375	41.75	0.00	0.0	39.000	44.2947	-11.61	1727.49	0.007
L3	93.25 - 46.33 (3)	TP54.02x36.8396x0.4375	52.42	0.00	0.0	39.000	71.0700	-23.03	2771.73	0.008
L4	46.33 - 1 (4)	TP68x50.7426x0.4375	52.66	0.00	0.0	38.512	93.8190	-40.90	3613.20	0.011

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	158 - 131 (1)	TP27.42x18.5x0.1875	170.30	20.715	39.000	0.531	0.00	0.000	39.000	0.000
L2	131 - 93.25 (2)	TP39.39x25.7235x0.375	552.11	16.324	39.000	0.419	0.00	0.000	39.000	0.000
L3	93.25 - 46.33 (3)	TP54.02x36.8396x0.4375	1187.51	15.887	39.000	0.407	0.00	0.000	39.000	0.000
L4	46.33 - 1 (4)	TP68x50.7426x0.4375	2180.60	16.707	38.512	0.434	0.00	0.000	38.512	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	158 - 131 (1)	TP27.42x18.5x0.1875	9.17	0.595	26.000	0.046	0.85	0.051	26.000	0.002
L2	131 - 93.25 (2)	TP39.39x25.7235x0.375	12.01	0.271	26.000	0.021	0.85	0.012	26.000	0.000
L3	93.25 - 46.33 (3)	TP54.02x36.8396x0.4375	16.25	0.229	26.000	0.018	0.85	0.006	26.000	0.000
L4	46.33 - 1 (4)	TP68x50.7426x0.4375	21.50	0.229	26.000	0.018	1.05	0.004	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	158 - 131 (1)	0.010	0.531	0.000	0.046	0.002	0.542 ✔	1.333	H1-3+VT ✔
L2	131 - 93.25 (2)	0.007	0.419	0.000	0.021	0.000	0.425 ✔	1.333	H1-3+VT ✔
L3	93.25 - 46.33 (3)	0.008	0.407	0.000	0.018	0.000	0.416 ✔	1.333	H1-3+VT ✔
L4	46.33 - 1 (4)	0.011	0.434	0.000	0.018	0.000	0.445 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	158 - 131	Pole	TP27.42x18.5x0.1875	1	-5.85	801.66	40.6	Pass
L2	131 - 93.25	Pole	TP39.39x25.7235x0.375	2	-11.61	2302.74	31.9	Pass
L3	93.25 - 46.33	Pole	TP54.02x36.8396x0.4375	3	-23.03	3694.72	31.2	Pass
L4	46.33 - 1	Pole	TP68x50.7426x0.4375	4	-40.90	4816.40	33.4	Pass
						Summary		
						Pole (L1)	40.6	Pass
						RATING =	**40.6**	**Pass**

Program Version 5.0.2.0 - 6/13/2007 File:P:/08/Rev_1_Not_issued_see_readme_file/ERI Files/157_EEI_MonoPole_Hamden_CT_Rev_1.eri

ANCHOR BOLT AND
BASE PLATE ANALYSIS

ANCHOR BOLT AND BASE PLATE ANALYSIS

Input Data

Tower Reactions:

Overturning Moment:	OM := 2181·ft·kips	*user input*
Shear Force:	Shear := 21·kips	*user input*
Axial Force:	Axial := 41·kips	*user input*

Anchor Bolt Data:

Use ASTM A615 Grade 75	*user input*	
Number of Anchor Bolts = N	N := 36	*user input*
Diameter of Bolt Circle:	D_{bc} := 76in	*user input*
Bolt "Column" Distance:	l := 3.0in	*user input*
Bolt Ultimate Strength:	F_u := 100·ksi	*user input*
Bolt Yield Strength:	Fy := 75·ksi	*user input*
Bolt Modulus:	E := 29000·ksi	*user input*
Anchor Bolt Diameter	D := 2.25in	*user input*
Threads per Inch:	n := 4.5	*user input*

Base Plate Data:

Use ASTM A572 Grade 60		*user input*
Plate Yield Strength:	Fy_{bp} := 60·ksi	*user input*
Base Plate Thickness:	PlateThickness := 3.00·in	*user input*
Base Plate Diameter:	D_{bp} := 82.0·in	*user input*
Outer Pole Diameter:	D_{pole} := 68.0in	*user input*

Geometric Layout Data:

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

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

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

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

$d_1 = 6.60 \cdot in$ $d_7 = 35.71 \cdot in$

$d_2 = 13.00 \cdot in$ $d_8 = 37.42 \cdot in$

$d_3 = 19.00 \cdot in$ $d_9 = 38.00 \cdot in$

$d_4 = 24.43 \cdot in$ $d_{10} = 37.42 \cdot in$

$d_5 = 29.11 \cdot in$ $d_{11} = 35.71 \cdot in$

$d_6 = 32.91 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius: $R_{pole} := \frac{D_{pole}}{2}$ $R_{pole} = 34.00 \cdot in$

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

$MA_1 = 0.00 \cdot in$ $MA_7 = 1.71 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 3.42 \cdot in$

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

$MA_4 = 0.00 \cdot in$ $MA_{10} = 3.42 \cdot in$

$MA_5 = 0.00 \cdot in$ $MA_{11} = 1.71 \cdot in$

$MA_6 = 0.00 \cdot in$ etc.

Effective Width of Baseplate for Bending: $EffectiveWidth := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2}$ $EffectiveWidth = 36.66 \cdot in$

Anchor Bolt Analysis:

Polar Moment of Inertia I_p:

$$I_p := \sum_i \left(d_i\right)^2 \qquad I_p = 2.599 \times 10^4 \cdot in^2$$

Gross Area of Bolt:

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

Net Area of Bolt:

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

Net Diameter:

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

Radius of Gyration of Bolt:

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

Section Modulus of Bolt:

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

Anchor Bolt Bending Stress:

Maximum Applied Bending:

$$M_x := \left(\frac{Shear}{N}\right) \cdot l \qquad M_x = 0.146 \cdot ft \cdot kips$$

$$f_{bx} := \frac{M_x}{S_x} \qquad f_{bx} = 2.1 \cdot ksi$$

Allowable Bending

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

Note: 1.333 increase allowed per TIA/EIA

Check Tensile Forces:

Maximum Tensile Force (Gross Area):

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

Note: 1.333 increase allowed per TIA/EIA

Maximum Tensile Force (Net Area):

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

Note: 1.333 increase allowed per TIA/EIA

Applied Tension:

$$MaxTension := \frac{OM \cdot R_{bc}}{I_p} - \frac{Axial}{N} \qquad MaxTension = 37.1 \cdot kips$$

Check Stresses:

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

$$\frac{MaxTension}{F_{net.area}} = 0.19$$

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

Condition = "OK"

Check Compression & Combined Stresses (if required):

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

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

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

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

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

Allowable Compressive Force:

$K := 0.65$

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

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

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

Applied Compressive Force:

$MaxCompression := \frac{OM \cdot R_{bc}}{I_p} + \frac{Axial}{N}$ $\quad MaxCompression = 39.4 \cdot kips$

$f_a := \frac{MaxCompression}{A_n}$ $\quad f_a = 12.1 \cdot ksi$

Check Combined Stresses:

$\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} = 0.20$

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

Base Plate Analysis:

Force from Bolt(s):

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

$C_1 = 7.8 \cdot kips$ $C_7 = 37.1 \cdot kips$

$C_2 = 14.2 \cdot kips$ $C_8 = 38.8 \cdot kips$

$C_3 = 20.3 \cdot kips$ $C_9 = 39.4 \cdot kips$

$C_4 = 25.7 \cdot kips$ $C_{10} = 38.8 \cdot kips$

$C_5 = 30.5 \cdot kips$ $C_{11} = 37.1 \cdot kips$

$C_6 = 34.3 \cdot kips$ etc.

Bending Stress in Plate:

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{EffectiveWidth \cdot PlateThickness^2} \qquad f_{bp} = 10.0 \cdot ksi$$

Check Stresses:

$$\frac{f_{bp}}{1.333 \cdot 0.75 Fy_{bp}} = 0.17$$

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

Condition = "OK"