STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

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

April 23, 2010

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

RE: **EM-VER-025-100309-** Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 500 Highland Avenue, Cheshire, Connecticut.

Dear Attorney Baldwin:

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

The proposed modifications are to be implemented as specified here and in your notice dated March 9, 2010, including the placement of all necessary equipment and shelters within the tower compound. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

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

Thank you for your attention and cooperation.

Very truly yours,

S. Derek Phelps

S. Derek Phelps
Executive Director

SDP/MP/laf

c: The Honorable Matt Hall, Council Chairman, Town of Cheshire
Michael A. Milone, Town Manager, Town of Cheshire
William S. Voelker, AICP, Town Planner, Town of Cheshire

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Phone: (860) 827-2935 Fax: (860) 827-2950

E-Mail: siting.council@ct.gov

Internet: ct.gov/csc

Daniel F. Caruso
Chairman

March 10, 2010

The Honorable Matt Hall
Council Chairman
Town of Cheshire
Town Hall
84 South Main Street
Cheshire, CT 06410

RE: **EM-VER-025-100309-** Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 500 Highland Avenue, Cheshire, Connecticut.

Dear Council Chairman Hall:

The Connecticut Siting Council (Council) received this request to modify an existing telecommunications facility, pursuant to Regulations of Connecticut State Agencies Section 16-50j-72.

If you have any questions or comments regarding this proposal, please call me or inform the Council by March 24, 2010.

Thank you for your cooperation and consideration.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/jbw

Enclosure: Notice of Intent

c: Michael A. Milone, Town Manager, Town of Cheshire
William S. Voelker, AICP, Town Planner, Town of Cheshire

ROBINSON & COLE LLP

EM-VER-025-100309

KENNETH C. BALDWIN

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

ORIGINAL

March 9, 2010

Via Hand Delivery

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

Re: **Notice of Exempt Modification – Antenna Swap**
500 Highland Avenue, Cheshire, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains wireless telecommunications antennas at the 117-foot level on the existing 160-foot tower at the above-referenced address. The tower and underlying property are owned by the Town of Cheshire. The Council approved Cellco's use of the existing tower in 2005 through EM-VER-025-050617. Cellco now intends to modify its installation by replacing four (4) of its six (6) existing cellular antennas with model DB844G65ZAXY cellular antennas; six (6) of its existing PCS antennas with three (3) model BXA-185063/8CF PCS antennas; and three (3) model P65-16-XL-2 LTE antennas. All antennas will remain at the same 117-foot level on the tower. Attached behind Tab 1 are the specifications for the proposed replacement antennas.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Michael A. Milone, Town Manager for the Town of Cheshire.

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

1. The proposed modifications will not result in any increase in the height of the existing tower. Cellco's replacement antennas will be located at the same 117-foot level on the existing 160-foot tower.

2. The proposed modifications will not involve any modifications to ground-mounted equipment and, therefore, will not require the extension of the site boundary.

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

4. The operation of the replacement antennas will not increase radio frequency (RF) power density levels at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A cumulative power density table for Cellco's modified facility is included behind Tab 2.

Also attached is a Detailed Structural Analysis and Evaluation Report confirming that the tower and foundation can support Cellco's proposed antennas modification. (See Tab 3).

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

Sincerely,

Kenneth C. Baldwin

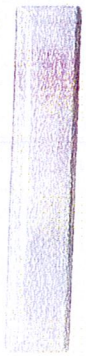
Enclosures
Copy to:
Michael A. Milone, Cheshire Town Manager
Sandy M. Carter

Product Specifications

ANDREW®
A CommScope Company

DB844G65ZAXY

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



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

CHARACTERISTICS

General Specifications

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

Electrical Specifications

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

Product Specifications

DB844G65ZAXY

ANDREW®
A CommScope Company

Mechanical Specifications

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

Dimensions

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

Regulatory Compliance/Certifications

Agency
RoHS 2002/95/EC
China RoHS SJ/T 11364-2006

Classification
Compliant by Exemption
Above Maximum Concentration Value (MCV)

INCLUDED PRODUCTS

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

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

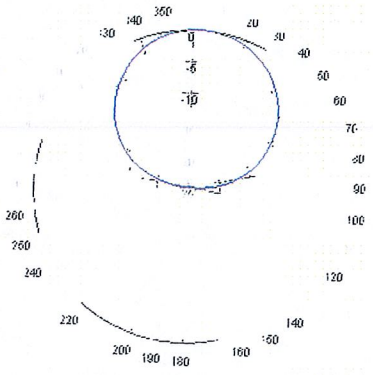
DB382NS
Side Offset Bracket for 4.5 in (114.3 mm) OD round members

Product Specifications

DB844G65ZAXY

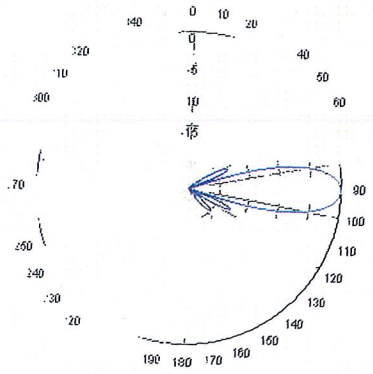
ANDREW®
A CommScope Company

Horizontal Pattern

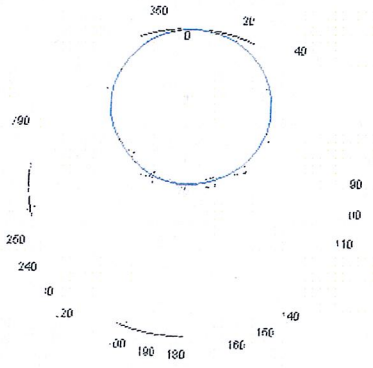


Freq: 850 MHz, Tilt: 0°

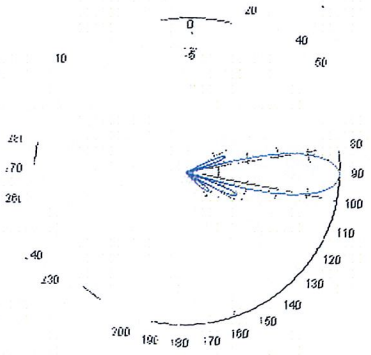
Vertical Pattern



Freq: 850 MHz, Tilt: 0°



Freq: 935 MHz, Tilt: 0°



Freq: 935 MHz, Tilt: 0°

Slant +/- 45° Dual Polarized, Panel 63° / 18.5 dBi

BXA-185063/8CF ___

When ordering replace "___" with connector type.

Mechanical specifications

Length	1238 mm	48.8 in
Width	154 mm	6.1 in
Depth	80 mm	3.2 in
Depth with t-bracket	108 mm	4.3 in
[4] Weight	4.5 kg	10.0 lbs
Wind Area		
Fore/Aft	0.19 m^2	2.1 ft^2
Side	0.10 m^2	1.1 ft^2
Rated Wind Velocity (Safety factor 2.0)	>322 km/hr	>200 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	288 N	65 lbs
Side	170 N	38 lbs

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

Mounting and Downtilting

Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in).

Mounting bracket kit #26799997
Downtilt bracket kit #26799999

The downtilt bracket kit includes the mounting bracket kit.

Electrical specifications

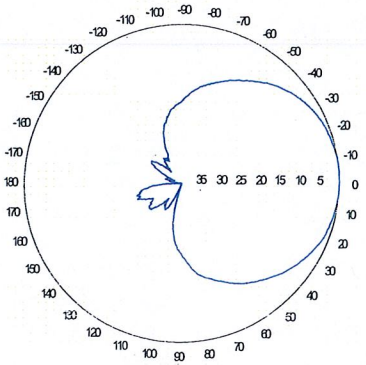
Frequency Range	1850-1990 MHz
Impedance	50Ω
[3] Connector(s)	NE or E-DIN 2 ports / center or bottom
[1] VSWR	≤ 1.4:1
Polarization	Slant ± 45°
[1] Isolation Between Ports	< -30 dB
[1] Gain	18.5 dBi
[2] Power Rating	250 W
[1] Half Power Angle	
H-Plane	63°
E-Plane	7°
[1] Electrical Downtilt	0°
[1] Null Fill	5%
Lightning Protection	Direct Ground

Patented Dipole Design: U.S. Patent No. 6,597,324 B2

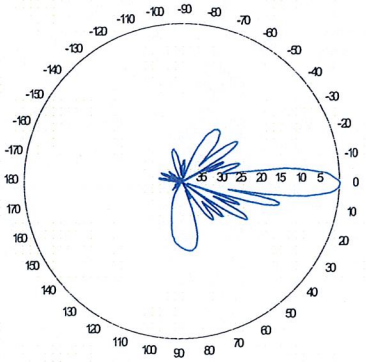
1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) The antenna weight listed above does not include the bracket weight.

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

Radiation pattern[1]



Horizontal



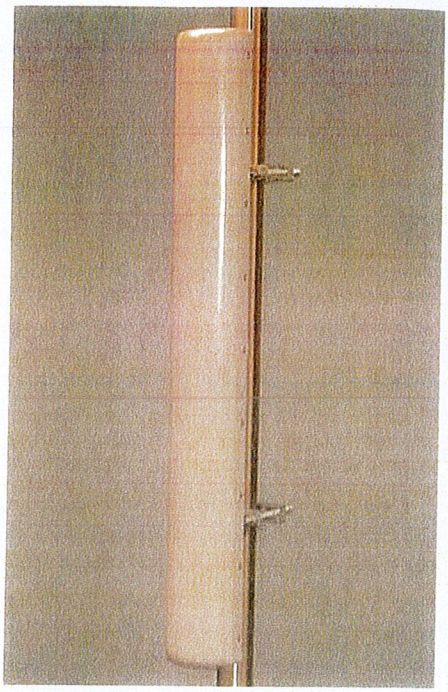
Vertical

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

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

CF Denotes a Center-Fed Connector.

1850-1990 MHz



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

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

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

Antenna can be ordered with center-fed or bottom-fed connectors.

Center-fed: BXA-185063/8CF + (NE or E-DIN)
Bottom-fed: BXA-185063/8BF + (NE or E-DIN)

Amphenol Antel, Inc.
The Antenna Technology Company

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

Revision Date: 7/11/07

P65-16-XL -2 | Very Low Broadband Antennas

POLARIZATION: Dual linear ±45°
FREQUENCY (MHz): 698-894
HORIZONTAL BEAM WIDTH (°): 65
GAIN (dBi/dBd): 16.0/13.9
TILT: 2
LENGTH: 72"

ELECTRICAL SPECIFICATIONS*

Frequency range (MHz)	698-894	
Frequency band (MHz)	698-806	806-894
Gain (dBi/dBd)	15.5/13.4	16.0/13.9
Polarization		
Nominal Impedance (Ω)		
VSWR		
Horizontal beam width, -3 dB (°)	68	65
Vertical beam width, -3 dB (°)	10.5	9.5
Electrical down tilt (°)		
Side lobe suppression, vertical 1st upper (dB)	> 15	> 15
Isolation between inputs (dB)	> 30	> 30
Tracking, horizontal plane ±60° (dB)	< 2	< 2
First null fill (dB)	-	-
Vertical beam squint (°)	< 0.5	< 0.5
Front to back ratio (dB)	> 30	> 30
Front to back ratio, total power (dB)	> 25	> 25
Cross polar discrimination (XPD) 0° (dB)	> 15	> 15
Cross polar discrimination (XPD) ±60° (dB)	> 10	> 10
Far field coupling		
IM3, 2xTx@43dBm (dBc)	-153	
IM7, 2xTx@43dBm (dBc)		
Power handling, average per input (W)		
Power handling, average total (W)		

MECHANICAL SPECIFICATIONS*

Connector	2 X 7/16 DIN Female
Connector position	Bottom
Dimensions, HxWxD, mm (ft)	72" x 12" x 5" (1829 x 305 x 125)
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, kg (lbs)	44 (20)
Weight, without brackets, kg (lbs)	33 (15)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.6 (N)	1380
Maximum operational wind speed, m/s (mph)	100 (45)
Survival wind speed, m/s (mph)	125 (55)
Lightning protection	DC Ground
Radome material	PVC
Radome colour	Light Grey
Package size, HxWxD, mm (ft)	82" x 16" x 10" (2082 x 400 x 255)
Shipping weight, kg (lbs)	55 (25)
RET	N/A
Brackets	7256.00, 7454.00, 2210.00

*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

ANTENNA PATTERNS*

For detailed patterns visit http://www.powerwave.com/rpa/.

	General	Power	Density					
Site Name: Cheshire NE								
Tower Height: Verizon @ 117Ft.								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*Sprint CDMA	11	411	157.5	0.0655	1962.5	1.0000	6.55%	
*Sprint WiMAX	3	562	157.5	0.0244	2657	1.0000	2.44%	
*Sprint microwave antenna	2	4.42	157.5	0.0001	22500	1.0000	0.01%	
*Pocket	3	631	137.5	0.0360	2130	1.0000	3.60%	
*Town Emergency Svcs	1	1200	167.5	0.0154	450	0.3000	5.13%	
*T-Mobile GSM	8	123	147.5	0.0163	1945	1.0000	1.63%	
*T-Mobile UMTS	2	692	147.5	0.0229	2100	1.0000	2.29%	
*Cingular GSM	2	296	127	0.0132	880	0.5867	2.25%	
*Cingular GSM	2	427	127	0.0190	1930	1.0000	1.90%	
*Cingular UMTS	1	500	127	0.0111	880	0.5867	1.90%	
*Nextel	12	100	107	0.0377	851	0.5673	6.64%	
Verizon	**3**	**436**	**117**	**0.0344**	**970**	**1.0000**	**3.44%**	
Verizon	**9**	**319**	**117**	**0.0754**	**869**	**0.5793**	**13.02%**	
Verizon	**1**	**692**	**117**	**0.0182**	**757**	**0.4973**	**3.65%**	
								54.45%
* Source: Siting Council								

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

Site: Cheshire Police Station
Address: 500 Highland Avenue,
Cheshire, CT

prepared for

Verizon Wireless
99 East River Drive
East Hartford, Connecticut 06108

prepared by

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

36915667.00000
VZ5-056 (Rev 1)

March 3, 2010

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

This report summarizes the structural analysis of the existing 160' steel tapered monopole structure, located at 500 Highland Avenue in Cheshire, 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
Remove: **(4) LPA-80090/4CF panel antennas (two per sectors Alpha and Beta, Gamma sector to remain)** **(6) LPA-185080 / 8CF 2 panel antennas (two per sector)**	**Verizon Wireless (Existing)**	**@ 117'** (113' above base plate)
Install: **(3) P65-16-XL-2 (one per sector)** **(4) DB844G65ZAXY (two per sectors Alpha and Beta)** **(3) BXA-185063/8CF** **Mounted on existing platform**	**Verizon Wireless (Proposed)**	

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.**

This analysis is based on:

1) The tower structure's theoretical capacity, not including any assessment of the condition of the tower.
2) Tower member sizes and foundation dimensions taken from manufacturers original design prepared by Sabre Communications Corporation, job number 04-09077 signed and sealed September 12, 2003.
3) Structural letter prepared by Sabre Communications Corporation signed and sealed April 15, 2005.
4) Geotechnical information obtained through geotechnical report prepared by Jaworski Geotech, Inc, project number 03349G, dated June 24, 2003.
5) Existing inventory taken from previous structural analysis performed by Morrison Hershfield for Pocket Wireless, project number 6090074: MISC-036, signed and sealed January 19, 2009.
6) Site visit performed from grade by URS Corporation in March 2010 to verify existing conditions. The base plate was measured to be 3" thick.

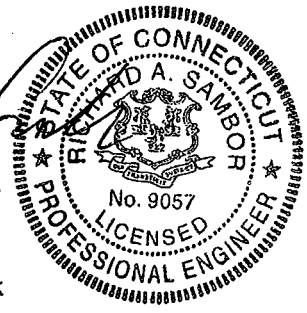
1. EXECUTIVE SUMMARY - continued

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.
Senior Structural Engineer

RAS/kab
cc: MJE, ICA – URS, CF/Book

2. INTRODUCTION

The subject tower is located at 500 Highland Ave in Cheshire, CT. The structure is an existing 160' steel tapered monopole structure, designed and manufactured by Sabre Communications Corporation

The inventory is summarized in the table below:

Antenna Type	*Carrier*	*Mount*	*Antenna Centerline Elevation*	*Cable*
(3) Andrew 932LG65R2E (3) KMW AM-X-WM-17-65 (1) VHLP800-11 Dish	Sprint (existing)	Low Profile Platform	157.5'	(10) 1-5/8" coax
(2) DB224 Dipoles (1) 20' Omni	Town (existing)	(3) T-Arms	157.5'	(3) 1-5/8" coax
(6) EMS RR90-18-XXDP	T-Mobile (existing)	Low Profile Platform	147.5'	(12) 1-5/8" coax
(3) EMS RR90-18-XXDP	T-Mobile (reserved)	Low Profile Platform (same as above)	147.5'	(6) 1-5/8" coax
(3) RFS APXV18-206517S-C	Pocket (existing)	(3) T-Arms	137.5'	(6) 1-5/8" coax (outside of monopole)
(6) CSS DUO4-8686 (3) 7770 Panel Antennas (3) Powerwave 7060 CILOC (3) Powerwave 7020 RET (6) TMAs	Cingular (existing)	Low Profile Platform	127'	(9) 1-5/8" coax
(3) CSS DUO4-8686	Cingular (future)	Low Profile Platform (same as above)	127'	(3) 1-5/8" coax
(2) LPA-80090/4CF	Verizon (existing)	Low Profile Platform	117'	(12) 1-5/8" coax
(3) P65-16-XL-2 (4) DB844G65ZAXY (3) BXA-185063/8CF	**Verizon (proposed)**	**Low Profile Platform (same as above)**	**117'**	**Same as above**
(12) 844G65VTZASX	Nextel (existing)	Low Profile Platform	107'	(12) 1-5/8" coax
(1) Dipole Antenna (3) EHF/VHF Antennas (1) GPS Unit	Town (existing)	Chain Mount	80'	(4) 7/8" coax (1) 2" coax

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 arrangement.

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 5.3. 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. The anchor bolts, base plate and foundation were all found to be within the allowable limits.

TABLE 1: Proposed Tower Component Stress vs. Capacity Summary

Component (Section No.)	Controlling Component / Elevation	Stress Ratio (% capacity)	Pass/Fail	Comments:
Pole Shaft (L3)	46.75'-95.75'	80.3%	**Pass**	
Anchor Bolts	Compression	79%	**Pass**	
Base Plate	Bending	87%	**Pass**	
Pier and Pad Foundation	Overturning Moment	91.7% / 2.18	**Pass**	Min OTM FOS is 2.0 per IBC 3108.4.2

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.

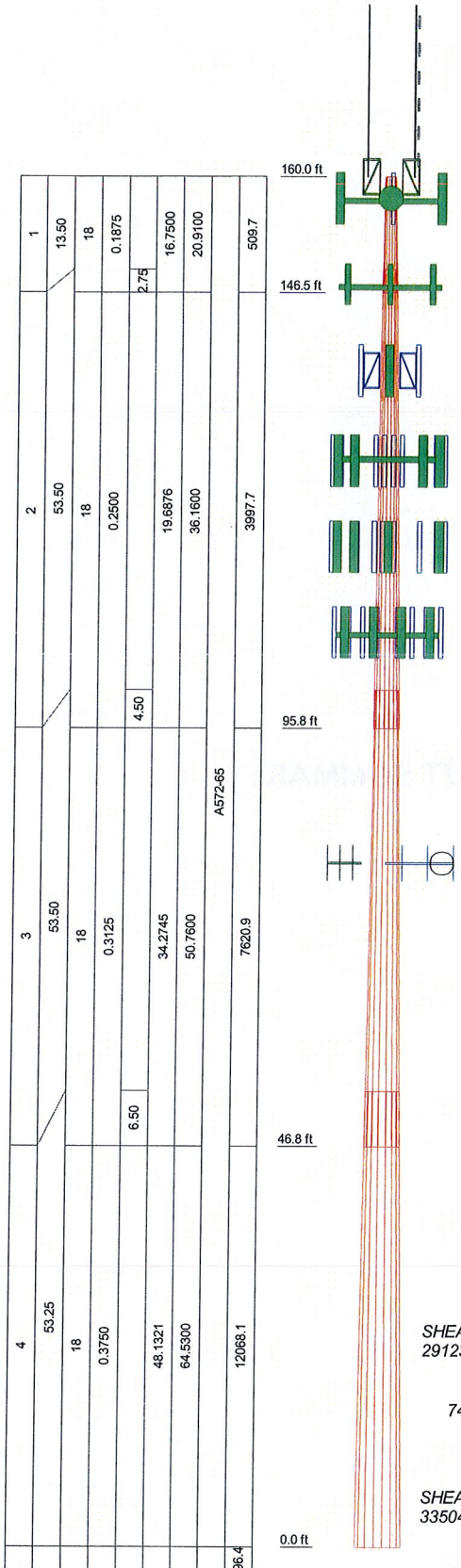
Ongoing and Periodic Inspection and Maintenance:

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



Section	1	2	3	4
Length (ft)	13.50	53.50	53.50	53.25
Number of Sides	18	18	18	18
Thickness (in)	0.1875	0.2500	0.3125	0.3750
Lap Splice (ft)	2.75	4.50	6.50	
Top Dia (in)	16.7500	19.6876	34.2745	48.1321
Bot Dia (in)	20.9100	36.1600	50.7600	64.5300
Grade			A572-65	
Weight (lb)	509.7	3997.7	7620.9	12068.1
			24196.4	

DESIGNED APPURTENANCE LOADING

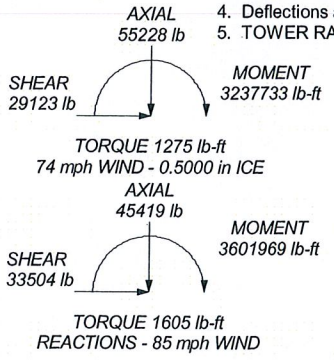
TYPE	ELEVATION	TYPE	ELEVATION
DB224 (Town)	170	DUO4-8686 w/Mount Pipe (Cingular)	127
DB224 (Town)	170		
2.5" x 20'6" Whip (Town)	170	7770 w mount pipe (Cingular)	127
3' Stand-off (Town)	160	7060 CILOC (Cingular)	127
3' Stand-off (Town)	160	7060 CILOC (Cingular)	127
3' Stand-off (Town)	160	7060 CILOC (Cingular)	127
932LG65R2E (Sprint)	157.5	7020 RCU/RETs (Cingular)	127
932LG65R2E (Sprint)	157.5	7020 RCU/RETs (Cingular)	127
932LG65R2E (Sprint)	157.5	7020 RCU/RETs (Cingular)	127
AM-X-WM-17-65 (Sprint)	157.5	(2) TMA (Cingular)	127
AM-X-WM-17-65 (Sprint)	157.5	(2) TMA (Cingular)	127
AM-X-WM-17-65 (Sprint)	157.5	(2) TMA (Cingular)	127
SABRE 12' Low Profile Platform (Sprint)	157.5	DUO4-8686 w/Mount Pipe (Cingular)	127
VHLP800-11 (Sprint)	157.5	DUO4-8686 w/Mount Pipe (Cingular)	127
(3) RR65-18-02DP w/Mount Pipe (T-Mobile)	147.5	P65-16-XL-2 (Verizon)	117
(3) RR65-18-02DP w/Mount Pipe (T-Mobile)	147.5	P65-16-XL-2 (Verizon)	117
SABRE 12' Low Profile Platform (T-Mobile)	147.5	DB844G65ZAXY w/Mount Pipe (Verizon)	117
(3) RR65-18-02DP w/Mount Pipe (T-Mobile)	147.5	DB844G65ZAXY w/Mount Pipe (Verizon)	117
APXV18-206517S-C w/ mounting hardware (Pocket)	137.5	DB844G65ZAXY w/Mount Pipe (Verizon)	117
APXV18-206517S-C w/ mounting hardware (Pocket)	137.5	DB844G65ZAXY w/Mount Pipe (Verizon)	117
3' Stand-off (Pocket)	137.5	LPA-80090/4CF w/Mount Pipe (Verizon)	117
3' Stand-off (Pocket)	137.5	LPA-80090/4CF w/Mount Pipe (Verizon)	117
3' Stand-off (Pocket)	137.5	BXA-185063/8CF (Verizon)	117
APXV18-206517S-C w/ mounting hardware (Pocket)	137.5	BXA-185063/8CF (Verizon)	117
SABRE 12' Low Profile Platform (Cingular)	127.5	BXA-185063/8CF (Verizon)	117
		P65-16-XL-2 (Verizon)	117
DUO4-8686 w/Mount Pipe (Cingular)	127	(4) 844G65VTZASX w/Mount Pipe (Nextel)	107
7770 w mount pipe (Cingular)	127	(4) 844G65VTZASX w/Mount Pipe (Nextel)	107
DUO4-8686 w/Mount Pipe (Cingular)	127	SABRE 12' Low Profile Platform (Nextel)	107
DUO4-8686 w/Mount Pipe (Cingular)	127	(4) 844G65VTZASX w/Mount Pipe (Nextel)	107
DUO4-8686 w/Mount Pipe (Cingular)	127	14' Dipole (Town)	85
7770 w mount pipe (Cingular)	127	3' Yagi (Town)	80
DUO4-8686 w/Mount Pipe (Cingular)	127	3' Yagi (Town)	80
		GPS (Town)	80
DUO4-8686 w/Mount Pipe (Cingular)	127	3' Yagi (Town)	80

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in New Haven County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 80.3%



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

Job: ***160' Monopole***			
Project: ***Cheshire Police Department***			
Client: Verizon Wireless	Drawn by: Kevin Barker	App'd:	
Code: TIA/EIA-222-F	Date: 03/03/10	Scale: NTS	
Path: P:\08\ERI Files\160' Sabre Monopole - Cheshire, CT.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:

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

Options

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

Tapered Pole Section Geometry

Section	Elevation	Section Length	Splice Length	Number of Sides	Top Diameter	Bottom Diameter	Wall Thickness	Bend Radius	Pole Grade
	ft	ft	ft		in	in	in	in	
L1	160.00-146.50	13.50	2.75	18	16.7500	20.9100	0.1875	0.7500	A572-65 (65 ksi)
L2	146.50-95.75	53.50	4.50	18	19.6876	36.1600	0.2500	1.0000	A572-65 (65 ksi)
L3	95.75-46.75	53.50	6.50	18	34.2745	50.7600	0.3125	1.2500	A572-65 (65 ksi)
L4	46.75-0.00	53.25		18	48.1321	64.5300	0.3750	1.5000	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	17.0084	9.8568	341.6043	5.8797	8.5090	40.1462	683.6581	4.9293	2.6180	13.963
	21.2326	12.3325	669.0708	7.3565	10.6223	62.9875	1339.0220	6.1674	3.3502	17.868
L2	20.8511	15.4237	736.2272	6.9003	10.0013	73.6132	1473.4231	7.7133	3.0250	12.1
	36.7178	28.4946	4642.2721	12.7480	18.3693	252.7193	9290.6527	14.2500	5.9242	23.697
L3	36.2112	33.6860	4908.7738	12.0565	17.4114	281.9282	9824.0066	16.8462	5.4823	17.543
	51.5431	50.0376	16088.4180	17.9089	25.7861	623.9187	32198.0056	25.0236	8.3838	26.828
L4	50.9071	56.8429	16379.0637	16.9538	24.4511	669.8702	32779.6794	28.4268	7.8112	20.83
	65.5255	76.3605	39707.0084	22.7750	32.7812	1211.2723	79466.2644	38.1875	10.6973	28.526

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 160.00-146.50				1	1	1		
L2 146.50-95.75				1	1	1		
L3 95.75-46.75				1	1	1		
L4 46.75-0.00				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)	C	No	Inside Pole	157.50 - 0.00	10	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (T-Mobile)	C	No	Inside Pole	147.00 - 0.00	18	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Cingular)	C	No	Inside Pole	127.50 - 0.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Nextel)	C	No	Inside Pole	107.50 - 0.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon)	C	No	Inside Pole	117.50 - 0.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Town)	C	No	Inside Pole	160.00 - 0.00	3	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Pocket)	C	No	CaAa (Out Of Face)	137.50 - 0.00	1	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (Pocket)	C	No	CaAa (Out Of Face)	137.50 - 0.00	5	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55
7/8 (Town)	C	No	Inside Pole	80.00 - 0.00	3	No Ice	0.00	0.54
						1/2" Ice	0.00	0.54
2 1/4 (Town)	C	No	Inside Pole	80.00 - 0.00	1	No Ice	0.00	1.16
						1/2" Ice	0.00	1.16

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L1	160.00-146.50	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	165.88
L2	146.50-95.75	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	8.267	2711.02
L3	95.75-46.75	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	9.702	3812.51
L4	46.75-0.00	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	9.257	3679.22

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L1	160.00-146.50	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	165.88
L2	146.50-95.75	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	12.441	3089.28
L3	95.75-46.75	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	14.602	4256.45
L4	46.75-0.00	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	13.931	4102.78

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 lb
DB224	A	From Leg	2.50	0.0000	170.00	No Ice	3.15	3.15	32.00
(Town)			0.00			1/2" Ice	5.67	5.67	41.60
			0.00						
DB224	B	From Leg	2.50	0.0000	170.00	No Ice	3.15	3.15	32.00
(Town)			0.00			1/2" Ice	5.67	5.67	41.60
			0.00						
2.5" x 20'6" Whip	C	From Leg	2.50	0.0000	170.00	No Ice	5.14	5.14	150.30
(Town)			0.00			1/2" Ice	7.24	7.24	188.59
			0.00						
3' Stand-off	A	From Leg	2.00	0.0000	160.00	No Ice	1.00	2.00	50.00
(Town)			0.00			1/2" Ice	1.20	2.70	75.00
			0.00						
3' Stand-off	B	From Leg	2.00	0.0000	160.00	No Ice	1.00	2.00	50.00
(Town)			0.00			1/2" Ice	1.20	2.70	75.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
			0.00						
3' Stand-off (Town)	C	From Leg	2.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice	1.00 1.20	2.00 2.70	50.00 75.00
932LG65R2E (Sprint)	A	From Face	3.00 6.00 0.00	0.0000	157.50	No Ice 1/2" Ice	1.00 1.40	1.00 1.40	20.00 49.44
932LG65R2E (Sprint)	B	From Face	3.00 6.00 0.00	0.0000	157.50	No Ice 1/2" Ice	1.00 1.40	1.00 1.40	20.00 49.44
932LG65R2E (Sprint)	C	From Face	3.00 6.00 0.00	0.0000	157.50	No Ice 1/2" Ice	1.00 1.40	1.00 1.40	20.00 49.44
AM-X-WM-17-65 (Sprint)	A	From Face	3.00 -6.00 0.00	0.0000	157.50	No Ice 1/2" Ice	3.08 3.41	1.54 1.84	14.20 30.85
AM-X-WM-17-65 (Sprint)	B	From Face	3.00 -6.00 0.00	0.0000	157.50	No Ice 1/2" Ice	3.08 3.41	1.54 1.84	14.20 30.85
AM-X-WM-17-65 (Sprint)	C	From Face	3.00 -6.00 0.00	0.0000	157.50	No Ice 1/2" Ice	3.08 3.41	1.54 1.84	14.20 30.85
SABRE 12' Low Profile Platform (Sprint)	C	None		0.0000	157.50	No Ice 1/2" Ice	26.30 35.60	26.30 35.60	1920.00 2340.00
(3) RR65-18-02DP w/Mount Pipe (T-Mobile)	C	From Face	2.30 0.00 0.00	0.0000	147.50	No Ice 1/2" Ice	4.91 5.57	3.64 4.70	43.55 81.64
(3) RR65-18-02DP w/Mount Pipe (T-Mobile)	B	From Face	2.30 0.00 0.00	0.0000	147.50	No Ice 1/2" Ice	4.91 5.57	3.64 4.70	43.55 81.64
(3) RR65-18-02DP w/Mount Pipe (T-Mobile)	A	From Face	2.30 0.00 0.00	0.0000	147.50	No Ice 1/2" Ice	4.91 5.57	3.64 4.70	43.55 81.64
SABRE 12' Low Profile Platform (T-Mobile)	C	None		0.0000	147.50	No Ice 1/2" Ice	26.30 35.60	26.30 35.60	1920.00 2340.00
APXV18-206517S-C w/ mounting hardware (Pocket)	A	From Face	3.00 0.00 0.00	0.0000	137.50	No Ice 1/2" Ice	5.08 5.53	4.46 5.39	47.20 86.89
APXV18-206517S-C w/ mounting hardware (Pocket)	B	From Face	3.00 0.00 0.00	0.0000	137.50	No Ice 1/2" Ice	5.08 5.53	4.46 5.39	47.20 86.89
APXV18-206517S-C w/ mounting hardware (Pocket)	C	From Face	3.00 0.00 0.00	0.0000	137.50	No Ice 1/2" Ice	5.08 5.53	4.46 5.39	47.20 86.89
3' Stand-off (Pocket)	A	From Face	1.50 0.00 0.00	0.0000	137.50	No Ice 1/2" Ice	1.00 1.20	2.00 2.70	50.00 75.00
3' Stand-off (Pocket)	B	From Face	1.50 0.00 0.00	0.0000	137.50	No Ice 1/2" Ice	1.00 1.20	2.00 2.70	50.00 75.00
3' Stand-off (Pocket)	C	From Face	1.50 0.00 0.00	0.0000	137.50	No Ice 1/2" Ice	1.00 1.20	2.00 2.70	50.00 75.00
DUO4-8686 w/Mount Pipe (Cingular)	A	From Face	3.00 -6.00	0.0000	127.00	No Ice 1/2" Ice	7.25 7.96	5.86 6.96	56.95 114.81

Description	Face or Leg	Offset Type	Offsets: Horz Lateral / Vert (ft / ft / ft)	Azimuth Adjustment (°)	Placement (ft)		C_AA_A Front (ft^2)	C_AA_A Side (ft^2)	Weight (lb)
			0.00						
DUO4-8686 w/Mount Pipe (Cingular)	A	From Face	3.00 -4.00 0.00	0.0000	127.00	No Ice 1/2" Ice	7.25 7.96	5.86 6.96	56.95 114.81
DUO4-8686 w/Mount Pipe (Cingular)	A	From Face	3.00 4.00 0.00	0.0000	127.00	No Ice 1/2" Ice	7.25 7.96	5.86 6.96	56.95 114.81
7770 w mount pipe (Cingular)	A	From Face	3.00 6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	5.88 6.31	3.98 4.60	51.73 94.70
DUO4-8686 w/Mount Pipe (Cingular)	B	From Face	3.00 -6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	7.25 7.96	5.86 6.96	56.95 114.81
DUO4-8686 w/Mount Pipe (Cingular)	B	From Face	3.00 -4.00 0.00	0.0000	127.00	No Ice 1/2" Ice	7.25 7.96	5.86 6.96	56.95 114.81
DUO4-8686 w/Mount Pipe (Cingular)	B	From Face	3.00 4.00 0.00	0.0000	127.00	No Ice 1/2" Ice	7.25 7.96	5.86 6.96	56.95 114.81
7770 w mount pipe (Cingular)	B	From Face	3.00 6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	5.88 6.31	3.98 4.60	51.73 94.70
DUO4-8686 w/Mount Pipe (Cingular)	C	From Face	3.00 -6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	7.25 7.96	5.86 6.96	56.95 114.81
DUO4-8686 w/Mount Pipe (Cingular)	C	From Face	3.00 -4.00 0.00	0.0000	127.00	No Ice 1/2" Ice	7.25 7.96	5.86 6.96	56.95 114.81
DUO4-8686 w/Mount Pipe (Cingular)	C	From Face	3.00 4.00 0.00	0.0000	127.00	No Ice 1/2" Ice	7.25 7.96	5.86 6.96	56.95 114.81
7770 w mount pipe (Cingular)	C	From Face	3.00 6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	5.88 6.31	3.98 4.60	51.73 94.70
7060 CILOC (Cingular)	A	From Face	3.00 6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	0.07 0.11	0.06 0.09	1.65 2.75
7060 CILOC (Cingular)	B	From Face	3.00 6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	0.07 0.11	0.06 0.09	1.65 2.75
7060 CILOC (Cingular)	C	From Face	3.00 6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	0.07 0.11	0.06 0.09	1.65 2.75
7020 RCU/RETs (Cingular)	A	From Face	3.00 6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	0.40 0.49	0.12 0.17	2.20 5.13
7020 RCU/RETs (Cingular)	B	From Face	3.00 6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	0.40 0.49	0.12 0.17	2.20 5.13
7020 RCU/RETs (Cingular)	C	From Face	3.00 6.00 0.00	0.0000	127.00	No Ice 1/2" Ice	0.40 0.49	0.12 0.17	2.20 5.13
(2) TMA (Cingular)	A	From Face	3.00 0.00 0.00	0.0000	127.00	No Ice 1/2" Ice	2.18 2.38	0.37 0.49	17.50 28.15
(2) TMA (Cingular)	B	From Face	3.00 0.00	0.0000	127.00	No Ice 1/2" Ice	2.18 2.38	0.37 0.49	17.50 28.15

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
			0.00						
(2) TMA (Cingular)	C	From Face	3.00 0.00 0.00	0.0000	127.00	No Ice 1/2" Ice	2.18 2.38	0.37 0.49	17.50 28.15
SABRE 12' Low Profile Platform (Cingular)	C	None		0.0000	127.50	No Ice 1/2" Ice	26.30 35.60	26.30 35.60	1920.00 2340.00
P65-16-XL-2 (Verizon)	A	From Face	3.00 0.00 0.00	0.0000	117.00	No Ice 1/2" Ice	8.54 9.13	5.99 6.89	81.64 144.34
P65-16-XL-2 (Verizon)	B	From Face	3.00 0.00 0.00	0.0000	117.00	No Ice 1/2" Ice	8.54 9.13	5.99 6.89	81.64 144.34
P65-16-XL-2 (Verizon)	C	From Face	3.00 0.00 0.00	0.0000	117.00	No Ice 1/2" Ice	8.54 9.13	5.99 6.89	81.64 144.34
DB844G65ZAXY w/Mount Pipe (Verizon)	A	From Face	3.00 6.00 0.00	0.0000	117.00	No Ice 1/2" Ice	5.38 6.07	5.40 6.49	41.55 89.98
DB844G65ZAXY w/Mount Pipe (Verizon)	A	From Face	3.00 -6.00 0.00	0.0000	117.00	No Ice 1/2" Ice	5.38 6.07	5.40 6.49	41.55 89.98
DB844G65ZAXY w/Mount Pipe (Verizon)	B	From Face	3.00 6.00 0.00	0.0000	117.00	No Ice 1/2" Ice	5.38 6.07	5.40 6.49	41.55 89.98
DB844G65ZAXY w/Mount Pipe (Verizon)	B	From Face	3.00 -6.00 0.00	0.0000	117.00	No Ice 1/2" Ice	5.38 6.07	5.40 6.49	41.55 89.98
LPA-80090/4CF w/Mount Pipe (Verizon)	C	From Face	3.00 6.00 0.00	0.0000	117.00	No Ice 1/2" Ice	3.35 3.97	5.98 7.08	36.55 78.73
LPA-80090/4CF w/Mount Pipe (Verizon)	C	From Face	3.00 -6.00 0.00	0.0000	117.00	No Ice 1/2" Ice	3.35 3.97	5.98 7.08	36.55 78.73
BXA-185063/8CF (Verizon)	A	From Face	3.00 4.00 0.00	0.0000	117.00	No Ice 1/2" Ice	2.10 2.40	1.10 1.40	10.00 27.26
BXA-185063/8CF (Verizon)	B	From Face	3.00 4.00 0.00	0.0000	117.00	No Ice 1/2" Ice	2.10 2.40	1.10 1.40	10.00 27.26
BXA-185063/8CF (Verizon)	C	From Face	3.00 4.00 0.00	0.0000	117.00	No Ice 1/2" Ice	2.10 2.40	1.10 1.40	10.00 27.26
(4) 844G65VTZASX w/Mount Pipe (Nextel)	A	From Face	3.00 0.00 0.00	0.0000	107.00	No Ice 1/2" Ice	6.55 7.25	5.63 6.73	41.55 95.60
(4) 844G65VTZASX w/Mount Pipe (Nextel)	B	From Face	3.00 0.00 0.00	0.0000	107.00	No Ice 1/2" Ice	6.55 7.25	5.63 6.73	41.55 95.60
(4) 844G65VTZASX w/Mount Pipe (Nextel)	C	From Face	3.00 0.00 0.00	0.0000	107.00	No Ice 1/2" Ice	6.55 7.25	5.63 6.73	41.55 95.60
SABRE 12' Low Profile Platform (Nextel)	C	None		0.0000	107.00	No Ice 1/2" Ice	26.30 35.60	26.30 35.60	1920.00 2340.00
3' Yagi (Town)	A	From Leg	1.50 0.00	0.0000	80.00	No Ice 1/2" Ice	2.08 3.79	2.08 3.79	30.95 51.64

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Offsets: Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
				0.00						
3' Yagi	A	From Face	1.50	0.00	0.0000	80.00	No Ice	2.08	2.08	30.95
(Town)			0.00	0.00			1/2" Ice	3.79	3.79	51.64
3' Yagi	C	From Leg	1.50	0.00	0.0000	80.00	No Ice	2.08	2.08	30.95
(Town)			0.00	0.00			1/2" Ice	3.79	3.79	51.64
14' Dipole	C	From Face	1.00	0.00	0.0000	85.00	No Ice	2.80	2.80	75.00
(Town)			0.00	0.00			1/2" Ice	4.22	4.22	97.50
GPS	B	From Face	1.00	0.00	0.0000	80.00	No Ice	1.00	1.00	10.00
(Town)			0.00	0.00			1/2" Ice	1.50	1.50	15.00

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft	Offsets: Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight lb
VHLP800-11	C	Paraboloid	From	3.00		Worst		157.50	3.00	No Ice	7.07	49.00
(Sprint)		w/Radome	Face	0.00						1/2" Ice	7.47	87.35
				0.00								

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 160.00-146.50	153.00	1.55	29	21.184	A	0.000	21.184	21.184	100.00	0.000	0.000
					B	0.000	21.184		100.00	0.000	0.000
					C	0.000	21.184		100.00	0.000	0.000
L2 146.50-95.75	119.17	1.443	27	119.885	A	0.000	119.885	119.885	100.00	0.000	0.000
					B	0.000	119.885		100.00	0.000	0.000
					C	0.000	119.885		100.00	0.000	8.267
L3 95.75-46.75	70.43	1.242	23	176.443	A	0.000	176.443	176.443	100.00	0.000	0.000
					B	0.000	176.443		100.00	0.000	0.000
					C	0.000	176.443		100.00	0.000	9.702
L4 46.75-0.00	22.49	1	19	223.355	A	0.000	223.355	223.355	100.00	0.000	0.000
					B	0.000	223.355		100.00	0.000	0.000
					C	0.000	223.355		100.00	0.000	9.257

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation	z	K_Z	q_z	t_Z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	in	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
L1 160.00-146.50	153.00	1.55	22	0.5000	22.309	A	0.000	22.309	22.309	100.00	0.000	0.000
						B	0.000	22.309		100.00	0.000	0.000
						C	0.000	22.309		100.00	0.000	0.000
L2 146.50-95.75	119.17	1.443	20	0.5000	124.114	A	0.000	124.114	124.114	100.00	0.000	0.000
						B	0.000	124.114		100.00	0.000	0.000
						C	0.000	124.114		100.00	0.000	12.441
L3 95.75-46.75	70.43	1.242	17	0.5000	180.526	A	0.000	180.526	180.526	100.00	0.000	0.000
						B	0.000	180.526		100.00	0.000	0.000
						C	0.000	180.526		100.00	0.000	14.602
L4 46.75-0.00	22.49	1	14	0.5000	227.251	A	0.000	227.251	227.251	100.00	0.000	0.000
						B	0.000	227.251		100.00	0.000	0.000
						C	0.000	227.251		100.00	0.000	13.931

Tower Pressure - Service

$G_H = 1.690$

Section Elevation	z	K_Z	q_z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
L1 160.00-146.50	153.00	1.55	10	21.184	A	0.000	21.184	21.184	100.00	0.000	0.000
					B	0.000	21.184		100.00	0.000	0.000
					C	0.000	21.184		100.00	0.000	0.000
L2 146.50-95.75	119.17	1.443	9	119.885	A	0.000	119.885	119.885	100.00	0.000	0.000
					B	0.000	119.885		100.00	0.000	0.000
					C	0.000	119.885		100.00	0.000	8.267
L3 95.75-46.75	70.43	1.242	8	176.443	A	0.000	176.443	176.443	100.00	0.000	0.000
					B	0.000	176.443		100.00	0.000	0.000
					C	0.000	176.443		100.00	0.000	9.702
L4 46.75-0.00	22.49	1	6	223.355	A	0.000	223.355	223.355	100.00	0.000	0.000
					B	0.000	223.355		100.00	0.000	0.000
					C	0.000	223.355		100.00	0.000	9.257

Tower Forces - No Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	lb	lb							ft^2	lb	plf	
L1 160.00-146.50	165.88	509.66	A	1	0.65	1	1	1	21.184	667.14	49.42	C
			B	1	0.65	1	1	1	21.184			
			C	1	0.65	1	1	1	21.184			
L2 146.50-95.75	2711.02	3997.65	A	1	0.65	1	1	1	119.885	3880.46	76.46	C
			B	1	0.65	1	1	1	119.885			
			C	1	0.65	1	1	1	119.885			
L3 95.75-	3812.51	7620.92	A	1	0.65	1	1	1	176.443	4801.81	98.00	C

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
46.75			B	1	0.65	1	1	1	176.443			
			C	1	0.65	1	1	1	176.443			
L4 46.75-0.00	3679.22	12068.14	A	1	0.65	1	1	1	223.355	4862.06	104.00	C
			B	1	0.65	1	1	1	223.355			
			C	1	0.65	1	1	1	223.355			
Sum Weight:	10368.64	24196.37						OTM	1012000.2 1 lb-ft	14211.47		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	509.66	A	1	0.65	1	1	1	21.184	667.14	49.42	C
			B	1	0.65	1	1	1	21.184			
			C	1	0.65	1	1	1	21.184			
L2 146.50-95.75	2711.02	3997.65	A	1	0.65	1	1	1	119.885	3880.46	76.46	C
			B	1	0.65	1	1	1	119.885			
			C	1	0.65	1	1	1	119.885			
L3 95.75-46.75	3812.51	7620.92	A	1	0.65	1	1	1	176.443	4801.81	98.00	C
			B	1	0.65	1	1	1	176.443			
			C	1	0.65	1	1	1	176.443			
L4 46.75-0.00	3679.22	12068.14	A	1	0.65	1	1	1	223.355	4862.06	104.00	C
			B	1	0.65	1	1	1	223.355			
			C	1	0.65	1	1	1	223.355			
Sum Weight:	10368.64	24196.37						OTM	1012000.2 1 lb-ft	14211.47		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	509.66	A	1	0.65	1	1	1	21.184	667.14	49.42	C
			B	1	0.65	1	1	1	21.184			
			C	1	0.65	1	1	1	21.184			
L2 146.50-95.75	2711.02	3997.65	A	1	0.65	1	1	1	119.885	3880.46	76.46	C
			B	1	0.65	1	1	1	119.885			
			C	1	0.65	1	1	1	119.885			
L3 95.75-46.75	3812.51	7620.92	A	1	0.65	1	1	1	176.443	4801.81	98.00	C
			B	1	0.65	1	1	1	176.443			
			C	1	0.65	1	1	1	176.443			
L4 46.75-0.00	3679.22	12068.14	A	1	0.65	1	1	1	223.355	4862.06	104.00	C
			B	1	0.65	1	1	1	223.355			
			C	1	0.65	1	1	1	223.355			
Sum Weight:	10368.64	24196.37						OTM	1012000.2 1 lb-ft	14211.47		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	509.66	A	1	0.65	1	1	1	21.184	667.14	49.42	C
			B	1	0.65	1	1	1	21.184			
			C	1	0.65	1	1	1	21.184			
L2 146.50-95.75	2711.02	3997.65	A	1	0.65	1	1	1	119.885	3880.46	76.46	C
			B	1	0.65	1	1	1	119.885			
			C	1	0.65	1	1	1	119.885			
L3 95.75-46.75	3812.51	7620.92	A	1	0.65	1	1	1	176.443	4801.81	98.00	C
			B	1	0.65	1	1	1	176.443			
			C	1	0.65	1	1	1	176.443			
L4 46.75-0.00	3679.22	12068.14	A	1	0.65	1	1	1	223.355	4862.06	104.00	C
			B	1	0.65	1	1	1	223.355			
			C	1	0.65	1	1	1	223.355			
Sum Weight:	10368.64	24196.37						OTM	1012000.2 lb-ft	14211.47		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	670.71	A	1	0.65	1	1	1	22.309	526.93	39.03	C
			B	1	0.65	1	1	1	22.309			
			C	1	0.65	1	1	1	22.309			
L2 146.50-95.75	3089.28	4901.18	A	1	0.65	1	1	1	124.114	3144.14	61.95	C
			B	1	0.65	1	1	1	124.114			
			C	1	0.65	1	1	1	124.114			
L3 95.75-46.75	4256.45	8942.78	A	1	0.65	1	1	1	180.526	3820.06	77.96	C
			B	1	0.65	1	1	1	180.526			
			C	1	0.65	1	1	1	180.526			
L4 46.75-0.00	4102.78	13736.73	A	1	0.65	1	1	1	227.251	3816.72	81.64	C
			B	1	0.65	1	1	1	227.251			
			C	1	0.65	1	1	1	227.251			
Sum Weight:	11614.39	28251.40						OTM	810155.59 lb-ft	11307.85		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	670.71	A	1	0.65	1	1	1	22.309	526.93	39.03	C
			B	1	0.65	1	1	1	22.309			
			C	1	0.65	1	1	1	22.309			
L2 146.50-95.75	3089.28	4901.18	A	1	0.65	1	1	1	124.114	3144.14	61.95	C
			B	1	0.65	1	1	1	124.114			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
			C	1	0.65	1	1	1	124.114			
L3 95.75-46.75	4256.45	8942.78	A	1	0.65	1	1	1	180.526	3820.06	77.96	C
			B	1	0.65	1	1	1	180.526			
			C	1	0.65	1	1	1	180.526			
L4 46.75-0.00	4102.78	13736.73	A	1	0.65	1	1	1	227.251	3816.72	81.64	C
			B	1	0.65	1	1	1	227.251			
			C	1	0.65	1	1	1	227.251			
Sum Weight:	11614.39	28251.40						OTM	810155.59 lb-ft	11307.85		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	670.71	A	1	0.65	1	1	1	22.309	526.93	39.03	C
			B	1	0.65	1	1	1	22.309			
			C	1	0.65	1	1	1	22.309			
L2 146.50-95.75	3089.28	4901.18	A	1	0.65	1	1	1	124.114	3144.14	61.95	C
			B	1	0.65	1	1	1	124.114			
			C	1	0.65	1	1	1	124.114			
L3 95.75-46.75	4256.45	8942.78	A	1	0.65	1	1	1	180.526	3820.06	77.96	C
			B	1	0.65	1	1	1	180.526			
			C	1	0.65	1	1	1	180.526			
L4 46.75-0.00	4102.78	13736.73	A	1	0.65	1	1	1	227.251	3816.72	81.64	C
			B	1	0.65	1	1	1	227.251			
			C	1	0.65	1	1	1	227.251			
Sum Weight:	11614.39	28251.40						OTM	810155.59 lb-ft	11307.85		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	670.71	A	1	0.65	1	1	1	22.309	526.93	39.03	C
			B	1	0.65	1	1	1	22.309			
			C	1	0.65	1	1	1	22.309			
L2 146.50-95.75	3089.28	4901.18	A	1	0.65	1	1	1	124.114	3144.14	61.95	C
			B	1	0.65	1	1	1	124.114			
			C	1	0.65	1	1	1	124.114			
L3 95.75-46.75	4256.45	8942.78	A	1	0.65	1	1	1	180.526	3820.06	77.96	C
			B	1	0.65	1	1	1	180.526			
			C	1	0.65	1	1	1	180.526			
L4 46.75-0.00	4102.78	13736.73	A	1	0.65	1	1	1	227.251	3816.72	81.64	C
			B	1	0.65	1	1	1	227.251			
			C	1	0.65	1	1	1	227.251			
Sum Weight:	11614.39	28251.40						OTM	810155.59 lb-ft	11307.85		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	509.66	A	1	0.65	1	1	1	21.184	230.85	17.10	C
			B	1	0.65	1	1	1	21.184			
			C	1	0.65	1	1	1	21.184			
L2 146.50-95.75	2711.02	3997.65	A	1	0.65	1	1	1	119.885	1342.72	26.46	C
			B	1	0.65	1	1	1	119.885			
			C	1	0.65	1	1	1	119.885			
L3 95.75-46.75	3812.51	7620.92	A	1	0.65	1	1	1	176.443	1661.53	33.91	C
			B	1	0.65	1	1	1	176.443			
			C	1	0.65	1	1	1	176.443			
L4 46.75-0.00	3679.22	12068.14	A	1	0.65	1	1	1	223.355	1682.37	35.99	C
			B	1	0.65	1	1	1	223.355			
			C	1	0.65	1	1	1	223.355			
Sum Weight:	10368.64	24196.37						OTM	350173.08 lb-ft	4917.46		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	509.66	A	1	0.65	1	1	1	21.184	230.85	17.10	C
			B	1	0.65	1	1	1	21.184			
			C	1	0.65	1	1	1	21.184			
L2 146.50-95.75	2711.02	3997.65	A	1	0.65	1	1	1	119.885	1342.72	26.46	C
			B	1	0.65	1	1	1	119.885			
			C	1	0.65	1	1	1	119.885			
L3 95.75-46.75	3812.51	7620.92	A	1	0.65	1	1	1	176.443	1661.53	33.91	C
			B	1	0.65	1	1	1	176.443			
			C	1	0.65	1	1	1	176.443			
L4 46.75-0.00	3679.22	12068.14	A	1	0.65	1	1	1	223.355	1682.37	35.99	C
			B	1	0.65	1	1	1	223.355			
			C	1	0.65	1	1	1	223.355			
Sum Weight:	10368.64	24196.37						OTM	350173.08 lb-ft	4917.46		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	509.66	A	1	0.65	1	1	1	21.184	230.85	17.10	C
			B	1	0.65	1	1	1	21.184			
			C	1	0.65	1	1	1	21.184			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L2 146.50-95.75	2711.02	3997.65	A	1	0.65	1	1	1	119.885	1342.72	26.46	C
			B	1	0.65	1	1	1	119.885			
			C	1	0.65	1	1	1	119.885			
L3 95.75-46.75	3812.51	7620.92	A	1	0.65	1	1	1	176.443	1661.53	33.91	C
			B	1	0.65	1	1	1	176.443			
			C	1	0.65	1	1	1	176.443			
L4 46.75-0.00	3679.22	12068.14	A	1	0.65	1	1	1	223.355	1682.37	35.99	C
			B	1	0.65	1	1	1	223.355			
			C	1	0.65	1	1	1	223.355			
Sum Weight:	10368.64	24196.37						OTM	350173.08 lb-ft	4917.46		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 160.00-146.50	165.88	509.66	A	1	0.65	1	1	1	21.184	230.85	17.10	C
			B	1	0.65	1	1	1	21.184			
			C	1	0.65	1	1	1	21.184			
L2 146.50-95.75	2711.02	3997.65	A	1	0.65	1	1	1	119.885	1342.72	26.46	C
			B	1	0.65	1	1	1	119.885			
			C	1	0.65	1	1	1	119.885			
L3 95.75-46.75	3812.51	7620.92	A	1	0.65	1	1	1	176.443	1661.53	33.91	C
			B	1	0.65	1	1	1	176.443			
			C	1	0.65	1	1	1	176.443			
L4 46.75-0.00	3679.22	12068.14	A	1	0.65	1	1	1	223.355	1682.37	35.99	C
			B	1	0.65	1	1	1	223.355			
			C	1	0.65	1	1	1	223.355			
Sum Weight:	10368.64	24196.37						OTM	350173.08 lb-ft	4917.46		

Force Totals

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M_x lb-ft	Sum of Overturning Moments, M_z lb-ft	Sum of Torques lb-ft
Leg Weight	24196.37					
Bracing Weight	0.00					
Total Member Self-Weight	24196.37			414.27	475.25	
Total Weight	45419.42			414.27	475.25	
Wind 0 deg - No Ice		0.00	-33269.09	-3470298.89	475.25	-644.18
Wind 30 deg - No Ice		16751.76	-28811.88	-3005311.50	-1748596.18	177.60
Wind 45 deg - No Ice		23690.57	-23524.80	-2453750.54	-2473085.30	584.61
Wind 60 deg - No Ice		29014.91	-16634.54	-1734942.31	-3029005.34	951.79
Wind 90 deg - No Ice		33503.53	0.00	414.27	-3497667.62	1470.95
Wind 120 deg - No Ice		29014.91	16634.54	1735770.85	-3029005.34	1595.98
Wind 135 deg - No Ice		23690.57	23524.80	2454579.08	-2473085.30	1495.63
Wind 150 deg - No Ice		16751.76	28811.88	3006140.03	-1748596.18	1293.36

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M_x lb-ft	Sum of Overturning Moments, M_z lb-ft	Sum of Torques lb-ft
Wind 180 deg - No Ice		0.00	33269.09	3471127.43	475.25	644.18
Wind 210 deg - No Ice		-16751.76	28811.88	3006140.03	1749546.69	-177.60
Wind 225 deg - No Ice		-23690.57	23524.80	2454579.08	2474035.80	-584.61
Wind 240 deg - No Ice		-29014.91	16634.54	1735770.85	3029955.85	-951.79
Wind 270 deg - No Ice		-33503.53	0.00	414.27	3498618.13	-1470.95
Wind 300 deg - No Ice		-29014.91	-16634.54	-1734942.31	3029955.85	-1595.98
Wind 315 deg - No Ice		-23690.57	-23524.80	-2453750.54	2474035.80	-1495.63
Wind 330 deg - No Ice		-16751.76	-28811.88	-3005311.50	1749546.69	-1293.36
Member Ice	4055.03					
Total Weight Ice	55227.87			536.61	657.29	
Wind 0 deg - Ice		0.00	-28942.22	-3092480.60	657.29	-688.92
Wind 30 deg - Ice		14561.53	-25064.70	-2678094.87	-1556429.98	-68.26
Wind 45 deg - Ice		20593.11	-20465.24	-2186556.84	-2201396.65	260.07
Wind 60 deg - Ice		25221.31	-14471.11	-1545972.00	-2696296.98	570.68
Wind 90 deg - Ice		29123.05	0.00	536.61	-3113517.26	1056.71
Wind 120 deg - Ice		25221.31	14471.11	1547045.21	-2696296.98	1259.60
Wind 135 deg - Ice		20593.11	20465.24	2187630.05	-2201396.65	1234.35
Wind 150 deg - Ice		14561.53	25064.70	2679168.09	-1556429.98	1124.98
Wind 180 deg - Ice		0.00	28942.22	3093553.82	657.29	688.92
Wind 210 deg - Ice		-14561.53	25064.70	2679168.09	1557744.57	68.26
Wind 225 deg - Ice		-20593.11	20465.24	2187630.05	2202711.24	-260.07
Wind 240 deg - Ice		-25221.31	14471.11	1547045.21	2697611.57	-570.68
Wind 270 deg - Ice		-29123.05	0.00	536.61	3114831.85	-1056.71
Wind 300 deg - Ice		-25221.31	-14471.11	-1545972.00	2697611.57	-1259.60
Wind 315 deg - Ice		-20593.11	-20465.24	-2186556.84	2202711.24	-1234.35
Wind 330 deg - Ice		-14561.53	-25064.70	-2678094.87	1557744.57	-1124.98
Total Weight	45419.42			414.27	475.25	
Wind 0 deg - Service		0.00	-11511.80	-1200524.54	475.25	-222.90
Wind 30 deg - Service		5796.46	-9969.51	-1039629.25	-604739.78	61.45
Wind 45 deg - Service		8197.43	-8140.07	-848777.71	-855428.05	202.29
Wind 60 deg - Service		10039.76	-5755.90	-600055.14	-1047787.93	329.34
Wind 90 deg - Service		11592.92	0.00	414.27	-1209954.81	508.98
Wind 120 deg - Service		10039.76	5755.90	600883.67	-1047787.93	552.24
Wind 135 deg - Service		8197.43	8140.07	849606.24	-855428.05	517.52
Wind 150 deg - Service		5796.46	9969.51	1040457.79	-604739.78	447.53
Wind 180 deg - Service		0.00	11511.80	1201353.08	475.25	222.90
Wind 210 deg - Service		-5796.46	9969.51	1040457.79	605690.28	-61.45
Wind 225 deg - Service		-8197.43	8140.07	849606.24	856378.56	-202.29
Wind 240 deg - Service		-10039.76	5755.90	600883.67	1048738.44	-329.34
Wind 270 deg - Service		-11592.92	0.00	414.27	1210905.31	-508.98
Wind 300 deg - Service		-10039.76	-5755.90	-600055.14	1048738.44	-552.24
Wind 315 deg - Service		-8197.43	-8140.07	-848777.71	856378.56	-517.52
Wind 330 deg - Service		-5796.46	-9969.51	-1039629.25	605690.28	-447.53

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

Comb. No.	Description
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 lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
L1	160 - 146.5	Pole	Max Tension	10	0.00	-0.35	0.00
			Max. Compression	18	-4261.88	182.77	-251.58
			Max. Mx	31	-3536.38	38105.86	-492.35
			Max. My	27	-3537.74	397.29	-38247.63
			Max. Vy	14	-4468.47	22868.14	-123.66
			Max. Vx	10	4467.01	137.25	-22880.57
			Max. Torque	6			-1277.32
L2	146.5 - 95.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-23120.00	413.66	-473.68
			Max. Mx	14	-15994.95	706553.43	-300.50
			Max. My	10	-16019.65	341.81	-702400.51

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Vy	14	-24008.83	706553.43	-300.50
			Max. Vx	10	23767.54	341.81	-702400.51
			Max. Torque	6			-1496.83
L3	95.75 - 46.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-35537.34	663.87	-544.72
			Max. Mx	14	-27327.23	1946215.00	-426.34
			Max. My	10	-27339.52	497.57	- 1930661.73
			Max. Vy	14	-28687.05	1946215.00	-426.34
			Max. Vx	10	28446.89	497.57	- 1930661.73
			Max. Torque	6			-1789.85
L4	46.75 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-55227.87	663.87	-544.72
			Max. Mx	14	-45400.66	3601968.99	-431.47
			Max. My	10	-45400.93	502.32	- 3573747.72
			Max. Vy	14	-33528.95	3601968.99	-431.47
			Max. Vx	10	33294.31	502.32	- 3573747.72
			Max. Torque	7			-1606.10

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Pole	Max. Vert	31	55227.87	29123.07	0.00
	Max. H_x	14	45419.42	33503.54	-0.00
	Max. H_z	2	45419.42	0.00	33269.09
	Max. M_x	2	3572866.61	0.00	33269.09
	Max. M_z	6	3600961.98	-33503.54	-0.00
	Max. Torsion	15	1601.93	29014.91	16634.54
	Min. Vert	1	45419.42	0.00	0.00
	Min. H_x	6	45419.42	-33503.54	-0.00
	Min. H_z	10	45419.42	0.00	-33269.09
	Min. M_x	10	-3573747.72	0.00	-33269.09
	Min. M_z	14	-3601968.99	33503.54	-0.00
	Min. Torsion	7	-1605.12	-29014.91	-16634.54

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x lb-ft	Overturning Moment, M_z lb-ft	Torque lb-ft
Dead Only	45419.42	0.00	0.00	415.75	476.62	0.02
Dead+Wind 0 deg - No Ice	45419.42	-0.00	-33269.09	-3572866.61	502.21	-666.35
Dead+Wind 30 deg - No Ice	45419.42	16751.77	-28811.88	-3094131.42	-1800246.72	154.90
Dead+Wind 45 deg - No Ice	45419.42	23690.57	-23524.80	-2526261.34	-2546133.99	564.34
Dead+Wind 60 deg - No Ice	45419.42	29014.91	-16634.54	-1786205.36	-3118468.85	935.66
Dead+Wind 90 deg - No Ice	45419.42	33503.54	0.00	431.23	-3600961.98	1466.93
Dead+Wind 120 deg - No Ice	45419.42	29014.91	16634.54	1787072.42	-3118476.88	1605.12
Dead+Wind 135 deg - No Ice	45419.42	23690.57	23524.80	2527133.09	-2546143.26	1510.26

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	lb-ft	lb-ft	lb-ft
Dead+Wind 150 deg - No Ice	45419.42	16751.77	28811.88	3095007.85	-1800254.75	1312.11
Dead+Wind 180 deg - No Ice	45419.42	-0.00	33269.09	3573747.72	502.20	666.38
Dead+Wind 210 deg - No Ice	45419.42	-16751.77	28811.88	3095009.02	1801259.79	-157.93
Dead+Wind 225 deg - No Ice	45419.42	-23690.57	23524.80	2527134.44	2547148.96	-567.89
Dead+Wind 240 deg - No Ice	45419.42	-29014.91	16634.54	1787073.59	3119483.24	-938.76
Dead+Wind 270 deg - No Ice	45419.42	-33503.54	0.00	431.22	3601968.99	-1466.88
Dead+Wind 300 deg - No Ice	45419.42	-29014.91	-16634.54	-1786206.54	3119475.21	-1601.93
Dead+Wind 315 deg - No Ice	45419.42	-23690.57	-23524.80	-2526262.70	2547139.69	-1506.63
Dead+Wind 330 deg - No Ice	45419.42	-16751.77	-28811.88	-3094132.60	1801251.77	-1309.00
Dead+Ice+Temp	55227.87	-0.00	0.00	544.72	663.87	0.05
Dead+Wind 0 deg+Ice+Temp	55227.87	0.00	-28942.24	-3214526.55	706.69	-715.28
Dead+Wind 30 deg+Ice+Temp	55227.87	14561.53	-25064.71	-2783778.02	-1617813.44	-91.84
Dead+Wind 45 deg+Ice+Temp	55227.87	20593.12	-20465.25	-2272834.57	-2288221.64	240.69
Dead+Wind 60 deg+Ice+Temp	55227.87	25221.32	-14471.12	-1606964.50	-2802641.06	557.13
Dead+Wind 90 deg+Ice+Temp	55227.87	29123.07	-0.00	577.51	-3236316.44	1057.93
Dead+Wind 120 deg+Ice+Temp	55227.87	25221.32	14471.12	1608123.44	-2802647.78	1275.31
Dead+Wind 135 deg+Ice+Temp	55227.87	20593.12	20465.25	2273997.44	-2288229.40	1255.53
Dead+Wind 150 deg+Ice+Temp	55227.87	14561.53	25064.71	2784944.81	-1617820.17	1149.87
Dead+Wind 180 deg+Ice+Temp	55227.87	0.00	28942.24	3215697.25	706.69	715.35
Dead+Wind 210 deg+Ice+Temp	55227.87	-14561.53	25064.71	2784945.98	1619234.20	89.16
Dead+Wind 225 deg+Ice+Temp	55227.87	-20593.12	20465.25	2273998.79	2289644.10	-243.86
Dead+Wind 240 deg+Ice+Temp	55227.87	-25221.32	14471.12	1608124.60	2804063.14	-559.93
Dead+Wind 270 deg+Ice+Temp	55227.87	-29123.07	-0.00	577.49	3237732.46	-1057.84
Dead+Wind 300 deg+Ice+Temp	55227.87	-25221.32	-14471.12	-1606965.70	2804056.42	-1272.33
Dead+Wind 315 deg+Ice+Temp	55227.87	-20593.12	-20465.25	-2272835.95	2289636.34	-1252.19
Dead+Wind 330 deg+Ice+Temp	55227.87	-14561.53	-25064.71	-2783779.21	1619227.48	-1147.04
Dead+Wind 0 deg - Service	45419.42	-0.00	-11511.80	-1236969.69	505.56	-231.85
Dead+Wind 30 deg - Service	45419.42	5796.46	-9969.51	-1071187.57	-623083.25	54.93
Dead+Wind 45 deg - Service	45419.42	8197.43	-8140.07	-874539.60	-881381.95	197.74
Dead+Wind 60 deg - Service	45419.42	10039.76	-5755.90	-618263.19	-1079581.39	327.11
Dead+Wind 90 deg - Service	45419.42	11592.92	0.00	442.33	-1246671.46	511.79
Dead+Wind 120 deg - Service	45419.42	10039.76	5755.90	619148.42	-1079582.35	559.34
Dead+Wind 135 deg - Service	45419.42	8197.43	8140.07	875425.39	-881383.06	526.05
Dead+Wind 150 deg - Service	45419.42	5796.46	9969.51	1072073.93	-623084.22	456.88
Dead+Wind 180 deg - Service	45419.42	-0.00	11511.80	1237856.61	505.56	231.89
Dead+Wind 210 deg - Service	45419.42	-5796.46	9969.51	1072074.07	624095.41	-55.23
Dead+Wind 225 deg - Service	45419.42	-8197.43	8140.07	875425.55	882394.34	-198.10
Dead+Wind 240 deg - Service	45419.42	-10039.76	5755.90	619148.56	1080593.71	-327.43
Dead+Wind 270 deg - Service	45419.42	-11592.92	0.00	442.33	1247682.89	-511.75
Dead+Wind 300 deg - Service	45419.42	-10039.76	-5755.90	-618263.34	1080592.74	-558.94
Dead+Wind 315 deg - Service	45419.42	-8197.43	-8140.07	-874539.76	882393.22	-525.61
Dead+Wind 330 deg - Service	45419.42	-5796.46	-9969.51	-1071187.72	624094.45	-456.50

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	lb	lb	lb	lb	lb	lb	
1	0.00	-45419.42	0.00	0.00	45419.42	0.00	0.000%
2	0.00	-45419.42	-33269.09	0.00	45419.42	33269.09	0.000%
3	16751.76	-45419.42	-28811.88	-16751.77	45419.42	28811.88	0.000%
4	23690.57	-45419.42	-23524.80	-23690.57	45419.42	23524.80	0.000%
5	29014.91	-45419.42	-16634.54	-29014.91	45419.42	16634.54	0.000%
6	33503.53	-45419.42	0.00	-33503.54	45419.42	-0.00	0.000%
7	29014.91	-45419.42	16634.54	-29014.91	45419.42	-16634.54	0.000%
8	23690.57	-45419.42	23524.80	-23690.57	45419.42	-23524.80	0.000%
9	16751.76	-45419.42	28811.88	-16751.77	45419.42	-28811.88	0.000%
10	0.00	-45419.42	33269.09	0.00	45419.42	-33269.09	0.000%

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
11	-16751.76	-45419.42	28811.88	16751.77	45419.42	-28811.88	0.000%
12	-23690.57	-45419.42	23524.80	23690.57	45419.42	-23524.80	0.000%
13	-29014.91	-45419.42	16634.54	29014.91	45419.42	-16634.54	0.000%
14	-33503.53	-45419.42	0.00	33503.54	45419.42	-0.00	0.000%
15	-29014.91	-45419.42	-16634.54	29014.91	45419.42	16634.54	0.000%
16	-23690.57	-45419.42	-23524.80	23690.57	45419.42	23524.80	0.000%
17	-16751.76	-45419.42	-28811.88	16751.77	45419.42	28811.88	0.000%
18	0.00	-55227.87	0.00	0.00	55227.87	-0.00	0.000%
19	0.00	-55227.87	-28942.22	-0.00	55227.87	28942.24	0.000%
20	14561.53	-55227.87	-25064.70	-14561.53	55227.87	25064.71	0.000%
21	20593.11	-55227.87	-20465.24	-20593.12	55227.87	20465.25	0.000%
22	25221.31	-55227.87	-14471.11	-25221.32	55227.87	14471.12	0.000%
23	29123.05	-55227.87	0.00	-29123.07	55227.87	0.00	0.000%
24	25221.31	-55227.87	14471.11	-25221.32	55227.87	-14471.12	0.000%
25	20593.11	-55227.87	20465.24	-20593.12	55227.87	-20465.25	0.000%
26	14561.53	-55227.87	25064.70	-14561.53	55227.87	-25064.71	0.000%
27	0.00	-55227.87	28942.22	-0.00	55227.87	-28942.24	0.000%
28	-14561.53	-55227.87	25064.70	14561.53	55227.87	-25064.71	0.000%
29	-20593.11	-55227.87	20465.24	20593.12	55227.87	-20465.25	0.000%
30	-25221.31	-55227.87	14471.11	25221.32	55227.87	-14471.12	0.000%
31	-29123.05	-55227.87	0.00	29123.07	55227.87	0.00	0.000%
32	-25221.31	-55227.87	-14471.11	25221.32	55227.87	14471.12	0.000%
33	-20593.11	-55227.87	-20465.24	20593.12	55227.87	20465.25	0.000%
34	-14561.53	-55227.87	-25064.70	14561.53	55227.87	25064.71	0.000%
35	0.00	-45419.42	-11511.80	0.00	45419.42	11511.80	0.000%
36	5796.46	-45419.42	-9969.51	-5796.46	45419.42	9969.51	0.000%
37	8197.43	-45419.42	-8140.07	-8197.43	45419.42	8140.07	0.000%
38	10039.76	-45419.42	-5755.90	-10039.76	45419.42	5755.90	0.000%
39	11592.92	-45419.42	0.00	-11592.92	45419.42	-0.00	0.000%
40	10039.76	-45419.42	5755.90	-10039.76	45419.42	-5755.90	0.000%
41	8197.43	-45419.42	8140.07	-8197.43	45419.42	-8140.07	0.000%
42	5796.46	-45419.42	9969.51	-5796.46	45419.42	-9969.51	0.000%
43	0.00	-45419.42	11511.80	0.00	45419.42	-11511.80	0.000%
44	-5796.46	-45419.42	9969.51	5796.46	45419.42	-9969.51	0.000%
45	-8197.43	-45419.42	8140.07	8197.43	45419.42	-8140.07	0.000%
46	-10039.76	-45419.42	5755.90	10039.76	45419.42	-5755.90	0.000%
47	-11592.92	-45419.42	0.00	11592.92	45419.42	-0.00	0.000%
48	-10039.76	-45419.42	-5755.90	10039.76	45419.42	5755.90	0.000%
49	-8197.43	-45419.42	-8140.07	8197.43	45419.42	8140.07	0.000%
50	-5796.46	-45419.42	-9969.51	5796.46	45419.42	9969.51	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	0.00022804
3	Yes	5	0.00000001	0.00028646
4	Yes	5	0.00000001	0.00031306
5	Yes	5	0.00000001	0.00027102
6	Yes	4	0.00000001	0.00075950
7	Yes	5	0.00000001	0.00030020
8	Yes	5	0.00000001	0.00031480
9	Yes	5	0.00000001	0.00027173
10	Yes	4	0.00000001	0.00022819
11	Yes	5	0.00000001	0.00027909

12	Yes	5	0.00000001	0.00031449
13	Yes	5	0.00000001	0.00029595
14	Yes	4	0.00000001	0.00076004
15	Yes	5	0.00000001	0.00026795
16	Yes	5	0.00000001	0.00031451
17	Yes	5	0.00000001	0.00029505
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00012352
20	Yes	5	0.00000001	0.00055490
21	Yes	5	0.00000001	0.00062003
22	Yes	5	0.00000001	0.00053716
23	Yes	5	0.00000001	0.00013084
24	Yes	5	0.00000001	0.00057195
25	Yes	5	0.00000001	0.00062285
26	Yes	5	0.00000001	0.00053867
27	Yes	5	0.00000001	0.00012361
28	Yes	5	0.00000001	0.00054834
29	Yes	5	0.00000001	0.00062360
30	Yes	5	0.00000001	0.00056774
31	Yes	5	0.00000001	0.00013096
32	Yes	5	0.00000001	0.00053417
33	Yes	5	0.00000001	0.00062241
34	Yes	5	0.00000001	0.00056585
35	Yes	4	0.00000001	0.00004699
36	Yes	4	0.00000001	0.00047051
37	Yes	4	0.00000001	0.00052709
38	Yes	4	0.00000001	0.00041951
39	Yes	4	0.00000001	0.00013114
40	Yes	4	0.00000001	0.00052905
41	Yes	4	0.00000001	0.00053909
42	Yes	4	0.00000001	0.00042210
43	Yes	4	0.00000001	0.00004711
44	Yes	4	0.00000001	0.00044611
45	Yes	4	0.00000001	0.00053515
46	Yes	4	0.00000001	0.00051168
47	Yes	4	0.00000001	0.00013143
48	Yes	4	0.00000001	0.00041332
49	Yes	4	0.00000001	0.00053774
50	Yes	4	0.00000001	0.00050605

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	160 - 146.5	30.577	47	1.7827	0.0089
L2	149.25 - 95.75	26.601	47	1.7408	0.0060
L3	100.25 - 46.75	11.212	47	1.1586	0.0014
L4	53.25 - 0	2.893	47	0.5128	0.0004

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
170.00	DB224	47	30.577	1.7827	0.0089	17120

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
160.00	3' Stand-off	47	30.577	1.7827	0.0089	17120
157.50	VHLP800-11	47	29.646	1.7745	0.0082	17120
147.50	(3) RR65-18-02DP w/Mount Pipe	47	25.966	1.7310	0.0056	7781
137.50	APXV18-206517S-C w/ mounting hardware	47	22.431	1.6552	0.0038	6294
127.50	SABRE 12' Low Profile Platform	47	19.086	1.5493	0.0026	5340
127.00	DUO4-8686 w/Mount Pipe	47	18.925	1.5434	0.0026	5299
117.00	P65-16-XL-2	47	15.817	1.4128	0.0019	4604
107.00	(4) 844G65VTZASX w/Mount Pipe	47	12.969	1.2650	0.0016	4067
85.00	14' Dipole	47	7.770	0.9126	0.0011	3871
80.00	3' Yagi	47	6.799	0.8348	0.0010	3906

Maximum Tower Deflections - Design Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	160 - 146.5	88.099	14	5.1312	0.0256
L2	149.25 - 95.75	76.664	14	5.0145	0.0173
L3	100.25 - 46.75	32.343	14	3.3418	0.0041
L4	53.25 - 0	8.350	14	1.4798	0.0011

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
170.00	DB224	14	88.099	5.1312	0.0259	5891
160.00	3' Stand-off	14	88.099	5.1312	0.0259	5891
157.50	VHLP800-11	14	85.422	5.1090	0.0238	5891
147.50	(3) RR65-18-02DP w/Mount Pipe	14	74.836	4.9865	0.0162	2694
137.50	APXV18-206517S-C w/ mounting hardware	14	64.663	4.7648	0.0109	2235
127.50	SABRE 12' Low Profile Platform	14	55.032	4.4546	0.0075	1885
127.00	DUO4-8686 w/Mount Pipe	14	54.567	4.4371	0.0074	1870
117.00	P65-16-XL-2	14	45.613	4.0584	0.0056	1616
107.00	(4) 844G65VTZASX w/Mount Pipe	14	37.408	3.6378	0.0046	1423
85.00	14' Dipole	14	22.417	2.6730	0.0032	1349
80.00	3' Yagi	14	19.617	2.4606	0.0028	1360

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
L1	160 - 146.5 (1)	TP20.91x16.75x0.1875	13.50	0.00	0.0	39.000	11.8282	-3537.30	461298.00	0.008
L2	146.5 - 95.75 (2)	TP36.16x19.6876x0.25	53.50	0.00	0.0	39.000	27.3952	-15995.00	1068410.00	0.015
L3	95.75 - 46.75 (3)	TP50.76x34.2745x0.3125	53.50	0.00	0.0	38.446	48.0510	-27327.20	1847360.00	0.015
L4	46.75 - 0 (4)	TP64.53x48.1321x0.375	53.25	0.00	0.0	36.648	76.3605	-45400.70	2798470.00	0.016

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x lb-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y lb-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	160 - 146.5 (1)	TP20.91x16.75x0.1875	38381.08	-7.952	39.000	0.204	0.00	0.000	39.000	0.000
L2	146.5 - 95.75 (2)	TP36.16x19.6876x0.25	706553.33	-36.307	39.000	0.931	0.00	0.000	39.000	0.000
L3	95.75 - 46.75 (3)	TP50.76x34.2745x0.3125	1946216.67	-40.602	38.446	1.056	0.00	0.000	38.446	0.000
L4	46.75 - 0 (4)	TP64.53x48.1321x0.375	3601966.67	-35.685	36.648	0.974	0.00	0.000	36.648	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	160 - 146.5 (1)	TP20.91x16.75x0.1875	0.008	0.204	0.000	0.212 ✔	1.333	H1-3 ✔
L2	146.5 - 95.75 (2)	TP36.16x19.6876x0.25	0.015	0.931	0.000	0.946 ✔	1.333	H1-3 ✔
L3	95.75 - 46.75 (3)	TP50.76x34.2745x0.3125	0.015	1.056	0.000	1.071 ✔	1.333	H1-3 ✔
L4	46.75 - 0 (4)	TP64.53x48.1321x0.375	0.016	0.974	0.000	0.990 ✔	1.333	H1-3 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
L1	160 - 146.5	Pole	TP20.91x16.75x0.1875	1	-3537.30	614910.21	15.9	Pass
L2	146.5 - 95.75	Pole	TP36.16x19.6876x0.25	2	-15995.00	1424190.47	71.0	Pass
L3	95.75 - 46.75	Pole	TP50.76x34.2745x0.3125	3	-27327.20	2462530.78	80.3	Pass
L4	46.75 - 0	Pole	TP64.53x48.1321x0.375	4	-45400.70	3730360.36	74.3	Pass
							Summary	
						Pole (L3)	80.3	Pass
						RATING =	**80.3**	**Pass**

ANCHOR BOLT AND
BASE PLATE ANALYSIS

ANCHOR BOLT AND BASEPLATE ANALYSIS

Input Data

Tower Reactions:

Overturning Moment:	$OM := 3602 \cdot kips \cdot ft$	*user input*
Shear Force:	$Shear := 33.5 \cdot kips$	*user input*
Axial Force:	$Axial := 45.4 \cdot kips$	*user input*

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts = N	$N := 16$	*user input*
Bolt Ultimate Strength:	$F_u := 100 \cdot ksi$	*user input*
Bolt Allowable Strength:	$Fy := 75 \cdot ksi$	*user input*
Diameter Of Anchor Bolts	$D := 2.25in$	*user input*
Threaded length per inch	$n := 4.5$	*user input*
Bolt "Column" Distance:	$l := 3in$	*user input*
Bolt Modulus:	$E := 29000 \cdot ksi$	*user input*

Base Plate Data:

Use ASTM A633-60

Plate Yield Strength:	$Fy_{bp} := 60 \cdot ksi$	*user input*
Base Plate Thickness:	$PlateThicknessProvide := 3.0 \cdot in$	*user input*

Note: Base plate measured to be 3.0" during site visit on 3/2/2010 not 2.75" per manufacturers drawing number 04-09077-01 signed and sealed 9/12/2003.

Geometric Layout Data:

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

Distances for loading condition (see detail):

$d_1 := 35.8254 \cdot in$ *user input*

$d_2 := 34.7189 \cdot in$ *user input*

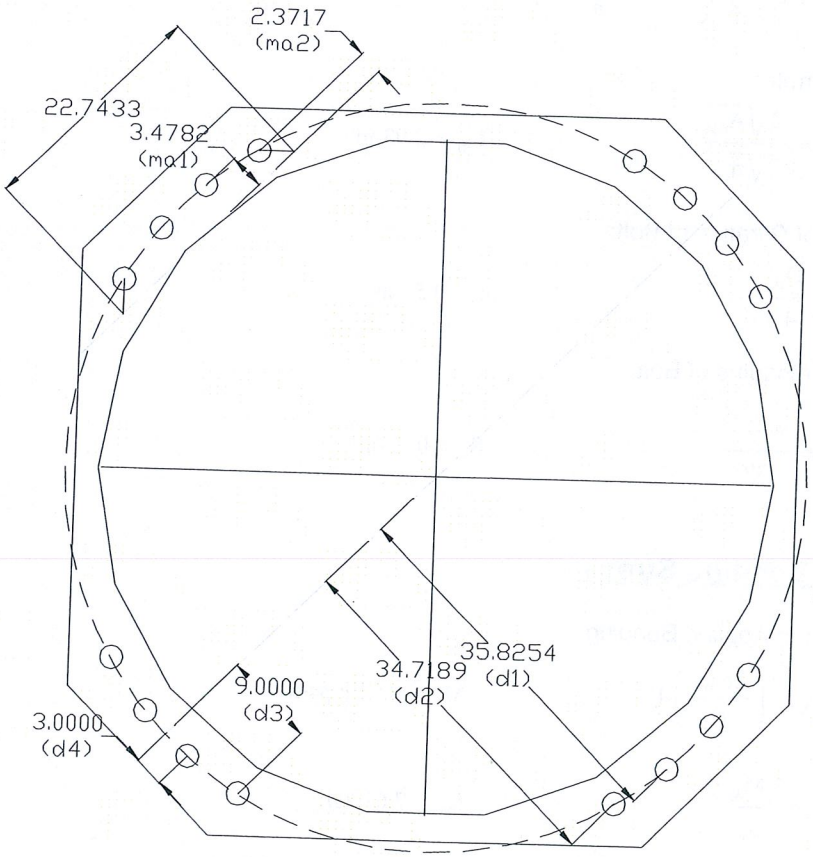
$d_3 := 9.000 \cdot in$ *user input*

$d_4 := 3.000 \cdot in$ *user input*

$MomentArm_1 := 3.4782 \cdot in$ *user input*

$MomentArm_2 := 2.3717 \cdot in$ *user input*

$EffectiveWidth := 22.7433 \cdot in$ *user input*



DETAIL - ANCHOR BOLT AND PLATE

Anchor Bolt Section Properties:

Polar Moment of Inertia (J) divided by Area (A) = Σd

$\Sigma d := (d_1)^2 \cdot 4 + (d_2)^2 \cdot 4 + (d_3)^2 \cdot 4 + (d_4)^2 \cdot 4$ $\quad \Sigma d = 1.03 \times 10^4 \cdot in^2$

Gross Area of Bolt:

$A_g := \frac{\pi}{4} \cdot D^2$ $\quad A_g = 3.98 \cdot in^2$

Net Area of Bolt:

$A_{net} := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n} \right)^2$ $\quad A_{net} = 3.25 \cdot in^2$

Net Diameter:

$D_n := \frac{2 \cdot \sqrt{A_{net}}}{\sqrt{\pi}}$ $\quad D_n = 2.03 \cdot in$

Radius of Gyration of Bolt:

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

Section Modulus of Bolt:

$S_x := \frac{\pi \cdot D_n^3}{32}$ $\quad S_x = 0.83 \cdot in^3$

Anchor Bolt Bending Stress:

Maximum Applied Bending:

$M_x := \left(\frac{Shear}{N} \right) \cdot 1$ $\quad M_x = 0.52 \cdot kips \cdot ft$

$f_{bx} := \frac{M_x}{S_x}$ $\quad f_{bx} = 7.61 \cdot ksi$

Allowable Bending

$F_{bx} := 1.333 \cdot 0.60 \cdot Fy$ $\quad F_{bx} = 59.98 \cdot ksi$

Note: 1.333 increase allowed per TIA/EIA

Anchor Bolt Tensile Stress Check:

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):

$F_{net.area} := 1.333 \cdot (0.60 \cdot A_{net} \cdot Fy)$ $F_{net.area} = 194.81 \cdot kips$

Note: 1.333 increase allowed per TIA/EIA

Maximum Applied Tension:

$$MaxTension := \frac{OM \cdot d_1}{\Sigma d} - \frac{Axial}{N} \qquad MaxTension = 147.75 \cdot kips$$

Check Stresses:

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

$AnchorBoltStress := if(F_{net.area} > MaxTension, "Not Overstressed", "Overstressed")$

$AnchorBoltStress = "Not Overstressed"$

$$PercentStressed := 100 \cdot \frac{MaxTension}{F_{net.area}}$$

$PercentStressed = 75.8$

Note: Shear Stress is negligible

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 if a combined stress analysis is not required and set the bending stress to zero:

$$l := \begin{cases} 1 & \text{if } 1 > 2 \cdot D_n \\ 0.0\,\text{in} & \text{otherwise} \end{cases} \qquad l = 0$$

$$f_{bx} := \begin{cases} f_{bx} & \text{if } 1 > 2 \cdot D_n \\ 0.0\,\text{ksi} & \text{otherwise} \end{cases} \qquad f_{bx} = 0 \cdot \text{ksi}$$

Allowable Compressive Force:

$$K := 0.65$$

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

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

$$F_a := 1.333 \cdot F_a \qquad \text{Note: 1.333 increase allowed per TIA/EIA} \qquad F_a = 59.98 \cdot \text{ksi}$$

Applied Compressive Force:

$$\text{MaxCompression} := \frac{OM \cdot d_1}{\Sigma d} + \frac{\text{Axial}}{N} \qquad \text{MaxCompression} = 153.43 \cdot \text{kips}$$

$$f_a := \frac{\text{MaxCompression}}{A_{net}} \qquad f_a = 47.24 \cdot \text{ksi}$$

Check Combined Stresses:

$$\text{StressRatio} := \frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \qquad \text{StressRatio} = 0.79$$

$$\text{Condition} := \text{if}(\text{StressRatio} \le 1.0, \text{"Not Overstressed"}, \text{"Overstressed"})$$

Condition = "Not Overstressed"

Base Plate Analysis:

Force From Bolt(s):

$$C_1 := \frac{OM \cdot d_1}{\Sigma d} + \frac{Axial}{N} \qquad C_1 = 153.43 \cdot kips$$

$$C_2 := \frac{OM \cdot d_2}{\Sigma d} + \frac{Axial}{N} \qquad C_2 = 148.78 \cdot kips$$

Bending Stress In Plate:

$$f_{bp} := \frac{6 \cdot \left(2C_1 \cdot MomentArm_1 + 2C_2 \cdot MomentArm_2\right)}{EffectiveWidth \cdot PlateThicknessProvide^2} \qquad f_{bp} = 51.97 \cdot ksi$$

Check Stresses:

$$BasePlateRatio := \frac{f_{bp}}{1.333 \cdot 0.75 Fy_{bp}} \qquad BasePlateRatio = 0.87$$

BasePlateStress := if(BasePlateRatio < 1, "Not Over Stress", "Is Over Stress")

BasePlateStress = "Not Over Stress"

FOUNDATION ANALYSIS

URS

Job	160' Sabre Monopole - Cheshire, CT	Project No.	VZ5-056 (Rev 1)	Page	of
Description	Spread Footing w/ Pier Analysis	Computed by	KAB	Sheet	1 of 9
		Checked by		Date	03/03/10

MONOPOLE FOUNDATION ANALYSIS

TOWER FORCES:

Moment Caused by Tower	$M_t := 3602 \cdot ft \cdot kips$
Shear at Base of Tower	$S_t := 33.5 kip$
Max Compressive Force	$C_t := 45.4 \cdot kip$
Height of Tower	$H_t := 160 \cdot ft$
Base Plate Bolt Circle	$MP := 72 in$

FOOTING DIMENSIONS:

Overall Depth of Footing	$D_f := 13.25 ft$
Length of Pier	$L_p := 7.9166 \cdot ft$
Extension of Pier Above Grade	$L_{pag} := 0.0 \cdot ft$
Diameter of Pier	$d_p := 8 \cdot ft$
Thickness of Footing	$T_f := 5 \cdot ft$
Width of Footing:	$W_f := 27 ft$
Length of Anchor Bolts:	$L_{st} := 84 in$
Projection of anchor bolts above pier	$A_{BP} := 12.0 \cdot in$
Anchor Bolt Diameter	$d_{anchor} := 2.25 in$
Anchor bolt area	$A_{anchor} := 3.98 \cdot in^2$

PIER REINFORCEMENT:

Bar Size	$BSpier := 9$	Bar Diameter	$d_{bpier} := 1.125 \cdot in$
Number of Bars	$NBpier := 38$	Bar Area	$A_{bpier} := 1.0 \cdot in^2$

PAD REINFORCEMENT:

TOP:	Bar Size	$BS_{top} := 8$	Bar Diameter	$d_{btop} := 1.000 \cdot in$
	Number of Bars	$NB_{top} := 42$	Bar Area	$A_{btop} := 0.790 \cdot in^2$
BOTTOM:	Bar Size	$BS_{bot} := 8$	Bar Diameter	$d_{bbot} := 1.000 \cdot in$
	Number of Bars	$NB_{bot} := 42$	Bar Area	$A_{bot} := 0.790 \cdot in^2$

PROPERTIES:

Compressive Strength of Concrete	$fc := 4000 psi$
Yield Strength of Steel Reinforcement	$fy := 60000 \cdot psi$
Yield Strength of Anchor Bolt	$fya := 75000 \cdot psi$
Internal Friction Angle of Soil	$\phi_s := 35 \cdot deg$
Allowable Bearing Capacity	$q_s := 4000 \cdot psf$
Unit Weight of Soil (See Note Below)	$\gamma_{soil} := 0 \cdot pcf$
Unit Weight of Concrete	$\gamma_{conc} := 150 \cdot pcf$
Is foundation subject to bouyancy (Yes=1/N=0):	$Bouyancy := 0$
Depth to Neglect	$n := 1.0 ft$
Cohesion of Clay Type Soil Note: Use 0 for Sandy Soil	$c := 0 \cdot ksf$
Seismic Zone Factor: IBC Fig 23-2	$Z := 2$
Coefficient of Friction between Concrete:	$\mu := 0.45$
Clear Cover of Reinforcement Pier:	$Cvr_{pier} := 3 \cdot in$
Clear Cover of Reinforcement Pad:	$Cvr_{pad} := 3 \cdot in$

NOTE: Geotech report does not give values for the top 9' and in the analysis by Sabre the soil is not included in the resistance of the foundation.

Coefficient of Lateral Soil Pressure: $K_p := \frac{1 + \sin(\phi_s)}{1 - \sin(\phi_s)}$ $K_p = 3.6902$

Load Factor (EIA 3.1.1): $LF := \text{if}\left[H_t \le 700 \cdot ft, 1.333, \text{if}\left[H_t \ge 1200, 1.7, 1.333 + \left(\frac{H_t - 700}{1200 - 700}\right) \cdot 0.4\right]\right]$ $LF = 1.333$

STABILITY OF FOOTING

Adjusted Unit Weights: $\gamma_c := if(Bouyancy = 1, \gamma_{conc} - 62.4pcf, \gamma_{conc})$ $\gamma_c = 150 \cdot pcf$

$\gamma_s := if(Bouyancy = 1, \gamma_{soil} - 62.4pcf, \gamma_{soil})$ $\gamma_s = 0 \cdot pcf$

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

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

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

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

$P_{ave} := \frac{P_{top} + P_{bot}}{2}$ $P_{ave} = 0 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)]$ $T_p = 5 \cdot ft$

$A_p := W_f \cdot T_p$ $A_p = 135 \cdot ft^2$

Ultimate Shear: $S_u := P_{ave} \cdot A_p$ $S_u = 0 \cdot kip$

Weight of Concrete Pad: $WT_c := \left[\left(W_f^2 \cdot T_f \right) + \frac{d_p^2 \cdot \pi}{4} L_p \right] \cdot \gamma_c$ $WT_c = 606.4398 \cdot kip$

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

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

Total Weight: $WT_{tot} := WT_c + WT_{s1} + C_t$ $WT_{tot} = 651.8398 \cdot kip$

Resisting Moment: $M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + WT_{s2} \cdot \left(W_f + \frac{D_f \cdot \tan(\phi_s)}{3} \right)$ $M_r = 8799.8367 \cdot kip \cdot ft$

Overturning Moment: $M_{ot} := M_t + S_t \cdot (L_p + T_f)$ $M_{ot} = 4034.7061 \cdot kip \cdot ft$

Factor of Safety: $FS := \frac{M_r}{M_{ot}}$ $FS_{req} := 2$ $FS = 2.18$

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

SHEAR CAPACITY IN PIER

$$S_p := \frac{P_{ave} \cdot A_p + \mu \cdot WT_{tot}}{FS_{req}} \qquad S_p = 146.6639 \cdot kips$$

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

BEARING PRESSURE CAUSED BY FOOTING

$$A_{mat} := W_f^{\,2} \qquad A_{mat} = 729 \cdot ft^2$$

$$S := \frac{W_f^{\,3}}{6} \qquad S = 3280.5 \cdot ft^3$$

$$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} \qquad P_{max} = 2.1241 \cdot ksf$$

$$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} \qquad P_{min} = -0.3357 \cdot ksf$$

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

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

Distance to Resultant of Pressure Distribution:

$$X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} \qquad X_p = 7.7716 \cdot ft$$

Distance to Kern: $X_k := \frac{W_f}{6}$ $\qquad X_k = 4.5 \cdot ft$

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

Eccentricity: $e := \frac{M_{ot}}{WT_{tot}}$ $\qquad e = 6.1897$

Adjusted Soil Pressure: $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)}$ $\qquad P_a = 2.2017 \cdot ksf$

$$q_{adj} := if\left(P_{min} < 0, P_a, \frac{P_{max}}{ft^2}\right) \qquad q_{adj} = 2.2017 \cdot ksf$$

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

CONCRETE BEARING CAPACITY (ACI 10.17)

(ACI 9.3.2.2) $\phi_c := 0.75$

$P_b := \phi_c \cdot 0.85 \cdot fc \cdot \frac{d_p^2 \cdot \pi}{4}$ $P_b = 18457.4852 \cdot kip$

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

SHEAR STRENGTH OF CONCRETE

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

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

$d := T_f - Cvr_{pad} - d_{bbot}$ $d = 56 \cdot in$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$ $d_1 = 9.5 \cdot ft$

$d_2 := d_1 - d$ $d_2 = 4.8333 \cdot ft$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$ $L = 21.9308 \cdot ft$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$ $Slope = 0.1004 \cdot kcf$

$V_{req} := LF \cdot \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$ $V_{req} = 589.7372 \cdot kip$

ACI 11.3.1.1 $V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{fc \cdot psi} \cdot W_f \cdot d$ $V_{Avail} = 1950.7964 \cdot kip$

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

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

$b_o := (d_p + d) \cdot \pi$ $b_o = 39.7935 \cdot ft$

Area included inside bo: $A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4}$ $A_{bo} = 126.0128 \cdot ft^2$

Area outside of bo: $A_{out} := A_{mat} - A_{bo}$ $A_{out} = 602.9872 \cdot ft^2$

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

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

$v_u := \text{Find}(v_u)$ $v_u = 3.5101 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f$ $V_u = 442.275 \cdot kips$

$V_{req} := LF \cdot V_u$ $V_{req} = 589.5526 \cdot kips$

$V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f'c \cdot psi} \cdot b_o \cdot d$ $V_{Avail} = 5750.2986 \cdot kips$

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

STEEL REINFORCEMENT IN THE PAD

ACI 9.3.2.2 $\phi_m := .90$

Take Maximum Bending at face of Pier:

$q_b := q_{adj} - d_1 \cdot Slope$ $q_b = 1.2479 \cdot ksf$

$M_n := \frac{1}{LF \cdot \phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f$ $M_n = 1913.0853 \cdot kip \cdot ft$

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

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2}$ $R_u = 3615.1 \, lbf$

$\rho := \frac{0.85 \cdot f'c}{fy} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f'c}} \right)$ $\rho = 0.0004$

$\rho_{min} := 1.333 \cdot \rho$ $\rho_{min} = 0.00056$

TEMPERATURE AND SHRINKAGE

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

(ACI 7.12.2.1b)

FOR BOTTOM BARS:

$As := \max(\rho, \rho_{min}, \rho_{sh}) \cdot W_f \cdot d$ $\quad As = 32.6592 \cdot in^2$

$As_{prov} := A_{bot} \cdot NB_{bot}$ $\quad As_{prov} = 33.18 \cdot in^2$

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

FOR TOP BARS:

$As := \rho_{sh} \cdot (W_f \cdot d)$ $\quad As = 32.6592 \cdot in^2$

$As_{prov} := A_{btop} \cdot NB_{top}$ $\quad As_{prov} = 33.18 \cdot in^2$

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

DEVELOPMENT LENGTH OF PAD REINFORCEMENT

TENSION (ACI 12.2.3)

Bar Spacing:

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} \qquad B_{sPad} = 6.7317 \cdot in$$

Development Length Factors:

Reinforcement Location Factor $\alpha := 1.0$

Coating Factor $\beta := 1.0$

Concrete strength Factor $\lambda := 1.0$

Reinforcement Size Factor $\gamma := 1.0$

Spacing or Cover Dimension:

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

Transverse Reinforcement Index:

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

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{fc \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \gamma \cdot \lambda}{\frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} \qquad L_{dbt} = 23.7171 \cdot in$$

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

Minimum Development Length: (ACI 12.2.1)

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

Available Length in Pad:

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} \qquad L_{Pad} = 111 \cdot in$$

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

REINFORCEMENT IN PIER

Pier Area:

$$A_p := \frac{\pi \cdot d_p^{\,2}}{4} \qquad A_p = 7238.2295 \cdot in^2$$

(ACI 10.8.4 and 10.9.1)

$$A_{smin} := 0.01 \cdot 0.05 \cdot A_p \qquad A_{smin} = 3.6191 \cdot in^2$$

$$A_{sprov} := NBpier \cdot A_{bpier} \qquad A_{sprov} = 38 \cdot in^2$$

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

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

Bar Spacing In Pier:

$$B_{sPier} := \frac{d_p \cdot \pi}{NBpier} - d_{bpier} \qquad B_{sPier} = 6.8117 \cdot in$$

Diameter of Reinforcement Cage:

$$Diam_{cage} := d_p - 2 \cdot Cvr_{pier} \qquad Diam_{cage} = 90 \cdot in$$

Maximum Moment in Pier:

$$M_p := \left[M_t + S_t \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF \qquad M_p = 62127.7618 \cdot in \cdot kips$$

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

(defined variables)

$$(f_c \;\; f_y \;\; cl \;\; Spiral) = (3 \;\; 60 \;\; 3 \;\; 0)$$

The required input is column diameter in inches, number of reinforcing bars, bar size number, factored axial load in kips and moment in kip inches:

$$(D \;\; N \;\; n \;\; P_u \;\; M_{xu}) := (96 \;\; 38 \;\; 8 \;\; 45.4 \;\; 43224)$$

Clears any previous output:

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

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

The Output is given as useable axial load in kips, moment capacity in kip inches, splicing stress in ksi, and reinforcement ratio:

$$(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho) = (72.9323 \;\; 69436.6555 \;\; -60 \;\; 0.0041)$$

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

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

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

DEVELOPMENT LENGTH OF PIER REINFORCEMENT

TENSION (ACI 12.2.3)

Factors for development:

Reinforcement Location Factor $\alpha := 1.0$

Coating Factor $\beta := 1.0$

Concrete strength Factor $\lambda := 1.0$

Reinforcement Size Factor $\gamma := 1.0$

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

Transverse Reinforcement:

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

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \gamma \cdot \lambda}{\frac{c + k_{tr}}{d_{bpier}}} \cdot d_{bpier} \qquad L_{dbt} = 30.0169 \cdot in$$

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

Minimum Development Length: (ACI 12.2.1)

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

$$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f'c}{psi}}} \cdot .7 \qquad L_{dh} = 14.9418 \cdot in$$

$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right)$ $L_{db} = 30.0169 \cdot in$

COMPRESSION: (ACI 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot fy}{\sqrt{f'c \cdot psi}} \qquad L_{dbc1} = 21.3454 \cdot in$$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot fy\right)$ $L_{dbmin} = 20.25 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right)$ $L_{dbc} = 21.3454 \cdot in$

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier}$ $L_{pier} = 91.9992 \cdot in$

$L_{pad} := T_f - Cvr_{pad}$ $L_{pad} = 57 \cdot in$

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

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

NOTE: Anchor bolts and plate provided

TIE SIZE AND SPACING IN COLUMN

Minimum Tie Size:

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

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

Seismic factor:
(ACI 21.10.5)

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

$s_{lim1} := 16 \cdot d_{bpier} \cdot z$ $\quad s_{lim1} = 18 \cdot in$

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

$s_{lim3} := D_f \cdot z$ $\quad s_{lim3} = 159 \cdot in$

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

Maximum Spacing:

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

Number of Ties Required:

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 \quad n_{tie} = 5.9444$$

CHECK ANCHOR STEEL EMBEDMENT

Depth:

$D_{ab} := L_{st} - A_{BP}$ $\quad D_{ab} = 6 \cdot ft$ $\quad L_{anchor} := \frac{(0.11 \cdot fya) \cdot in}{\sqrt{f'c \cdot psi}}$ $\quad L_{anchor} = 10.8703 \cdot ft$

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

$DepthCheck = "No Good"$

Note: Anchor plate is provided