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@po.state.ct.us
www.ct.gov/csc

November 18, 2004

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

RE: **EM-VER-026-041102** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 49 Wig Hill Road, Chester, Connecticut.

Dear Attorney Baldwin:

At a public meeting held on November 17, 2004, the Connecticut Siting Council (Council) acknowledged your notice to modify this existing telecommunications facility, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies.

The proposed modifications are to be implemented as specified here and in your notice dated November 2, 2004, 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. 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,

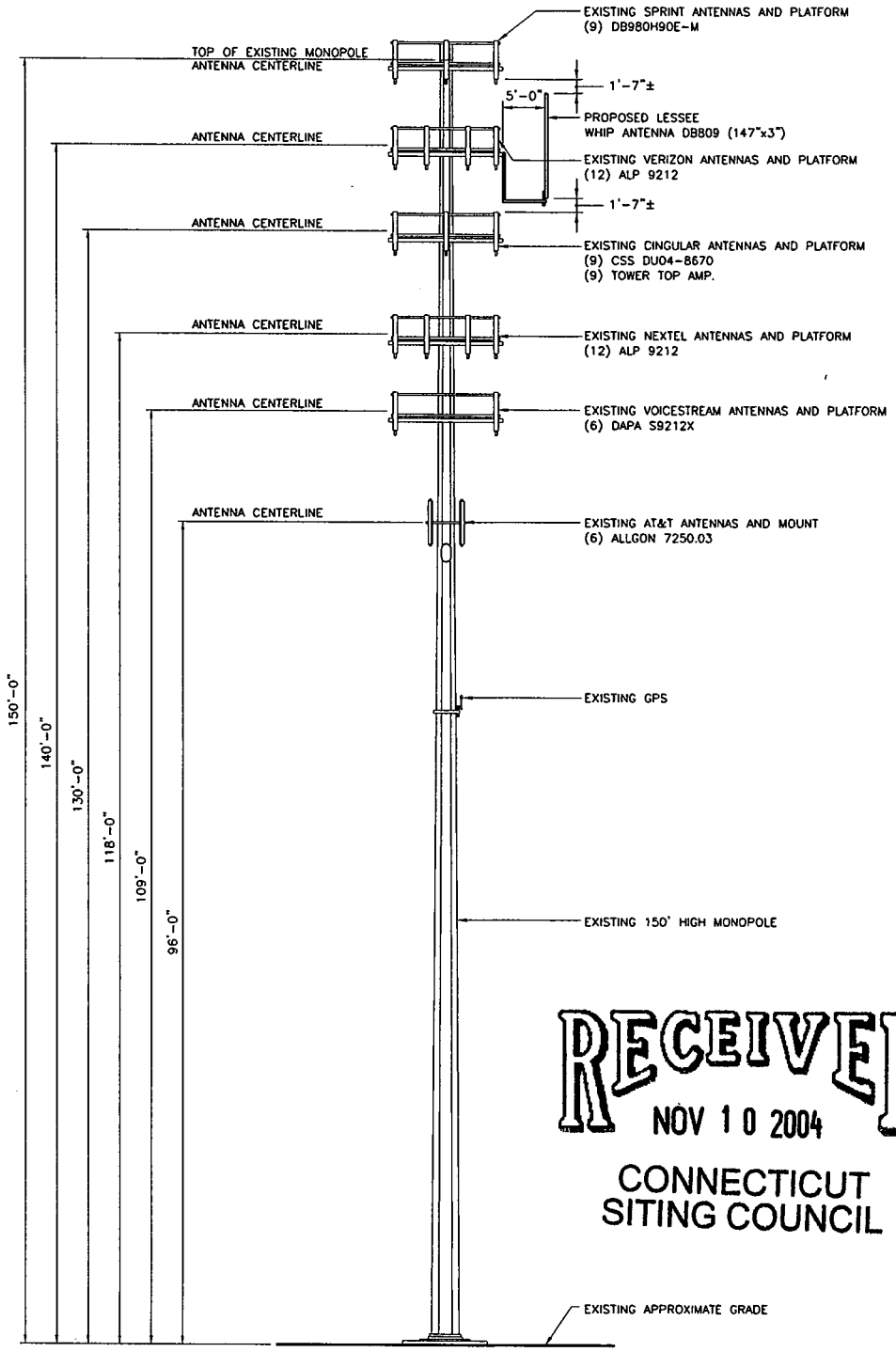
Pamela B. Katz

Pamela B. Katz, P.E.
Chairman

PBK/laf

c: The Honorable Martin L. Heft, First Selectman, Town of Chester
Cathy Jefferson, Zoning Enforcement Officer, Town of Chester
Jeffrey W. Barbadora, Crown Atlantic Company LLC
Christopher B. Fisher, Esq., Cuddy & Feder LLP
Stephen J. Humes, Esq., McCarter & English LLP
Thomas J. Regan, Esq., Brown Rudnick Berlack Israels LLP
Thomas F. Flynn III, Nextel Communications
Michele G. Briggs, Southwestern Bell Mobile Systems, LLC

EM-VER-026-041102



1/L-2 MONOPOLE ELEVATION
SCALE: 1"=20'-0"

0 5 10 20 40

PROJECT NO.	36929232
Designed by:	
Drawn by:	JCF
Checked by:	
Approved by:	

URS CORPORATION AES
795 BROOK STREET, BLDG 5
ROCKY HILL, CONNECTICUT
1-(860)-529-8882

VERIZON WIRELESS MESSAGING SERVICES, LLC
DBA VERIZON WIRELESS
PAGING WIRELESS COMMUNICATIONS FACILITY

SITE ADDRESS:
CHESTER
49 WIG HILL ROAD
CHESTER, CT 06412

REV.	DATE:	DESCRIPTION
3	11-11-04	REVISED-FINAL
2	10-27-04	REVISED
1	07-12-04	REVISED

Scale: AS NOTED | Date: 06-23-04
Job No.VZ1-088 | File No. L-2 | Dwg. 2 of 2

Dwg. No. L-2

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@po.state.ct.us
www.ct.gov/csc

November 3, 2004

The Honorable Martin L. Heft
First Selectman
Town of Chester
206 Middlesex Avenue
Chester, CT 06412-0218

RE: **EM-VER-026-041102** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 49 Wig Hill Road, Chester, Connecticut.

Dear Mr. Heft:

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

The Council will consider this item at the next meeting scheduled for November 17, 2004 at 1:30 p.m. in Hearing Room One, Ten Franklin Square, New Britain, Connecticut.

If you have any questions or comments regarding this proposal, please call me or inform the council by November 16, 2004.

Thank you for your cooperation and consideration.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/cm

Enclosure: Notice of Intent

c: Cathy Jefferson, Zoning Enforcement Officer, Town of Chester

ROBINSON & COLE LLP

KENNETH C. BALDWIN

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

EM-VER-026-041102

November 2, 2004

Via Hand Delivery

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

Re: **Notice of Exempt Modification – Addition of Paging Antennas**
49 Wig Hill Road Telecommunications Facility
Chester, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains a wireless telecommunications facility on an existing tower owned by Crown Atlantic Company, LLC at 49 Wig Hill Road in Chester, Connecticut. This facility consists of twelve (12) panel-type cellular antennas at the 120-foot level of the 150-foot tower. Equipment associated with the antenna is located in a shelter near the base of the tower.

The Connecticut Siting Council ("the Council") approved this tower site in Docket No. 181. Cellco now intends to modify its facility by adding a whip-type paging antenna on their existing antenna platform at the 120-foot level on the tower and installing a new 10' x 12' equipment shelter. On the roof of the new shelter, Cellco will install a 48-inch receive-only dish antenna. Attached behind Tab 1 are Project Plans and specifications for the proposed 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 Chester First Selectman, Martin L. Heft.

The planned modifications to the Wig Hill Road 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 structure. Cellco's paging antenna will be mounted at the same 120-foot level on the 150-foot tower and receive-only dish will be mounted on the roof of the new equipment shelter.

2. The new shelter will be located within the limits of the existing site compound and will not require the extension of the site boundaries.

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

4. The proposed modifications will not result in radio frequency (RF) power density levels at the facility that exceed the Federal Communications Commission (FCC) adopted safety standard. (See Power Density Calculation Table included behind Tab 2).

Also attached, behind Tab 3, is a Structural Analysis which concludes that the existing tower can support the additional paging antenna.

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

Sincerely,

Kenneth C. Baldwin

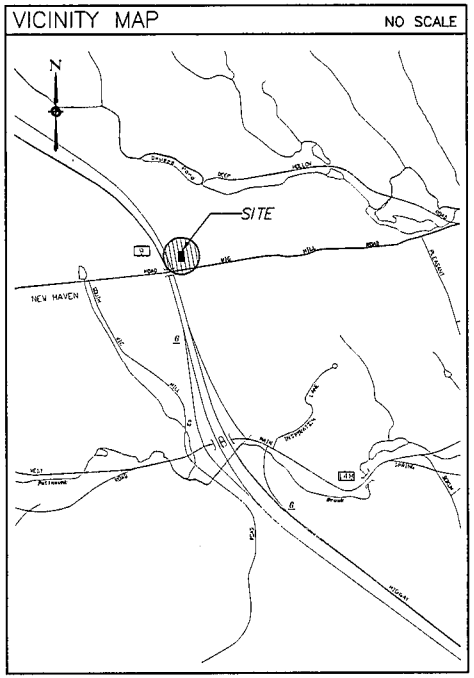
Enclosures
cc: Martin L. Heft, First Selectman
Sandy M. Carter

CELLCO PARTNERSHIP
DBA
verizon wireless

CHESTER

49 WIG HILL ROAD
CHESTER, CONNECTICUT

VICINITY MAP — NO SCALE



PROJECT SUMMARY

SITE NAME:	CHESTER
SITE ADDRESS:	49 WIG HILL ROAD CHESTER, CONNECTICUT
CONTACT PERSON:	CELLCO PARTNERSHIP DBA VERIZON WIRELESS SANDY CARTER (860) 803-8219
GOVERNING CODE:	CONNECTICUT STATE BUILDING AND LIFE SAFETY CODE
APPLICANT:	CELLCO PARTNERSHIP DBA VERIZON WIRELESS 99 EAST RIVER DRIVE EAST HARTFORD, CT 06108
ARCHITECT:	URS CORPORATION A.E.S. 795 BROOK STREET, BLDG 5 ROCKY HILL, CT 06067

LEGEND

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

ABBREVIATIONS

MIN.	MINIMUM
V.I.F.	VERIFY IN FIELD
O.C.	ON CENTER
PSF	POUND/SQUARE FOOT
TYP.	TYPICAL
TOC	TOP OF CONCRETE
TOW	TOP OF WALL

SHEET INDEX

SHT. NO.	DESCRIPTION
T-1	TITLE SHEET - GENERAL NOTES AND LEGENDS
SC-1	SITE PLAN AND TOWER ELEVATION

CELLCO PARTNERSHIP
DBA
verizon wireless

A&E FIRM
URS CORPORATION AES
795 BROOK STREET, BLDG 5
ROCKY HILL, CONNECTICUT
1-(860)-529-8882

A&E SEAL

PROJECT NO: 36929233
JOB NO: VZ1-088
DRAWN BY: BAL
CHECKED BY:

ISSUED FOR

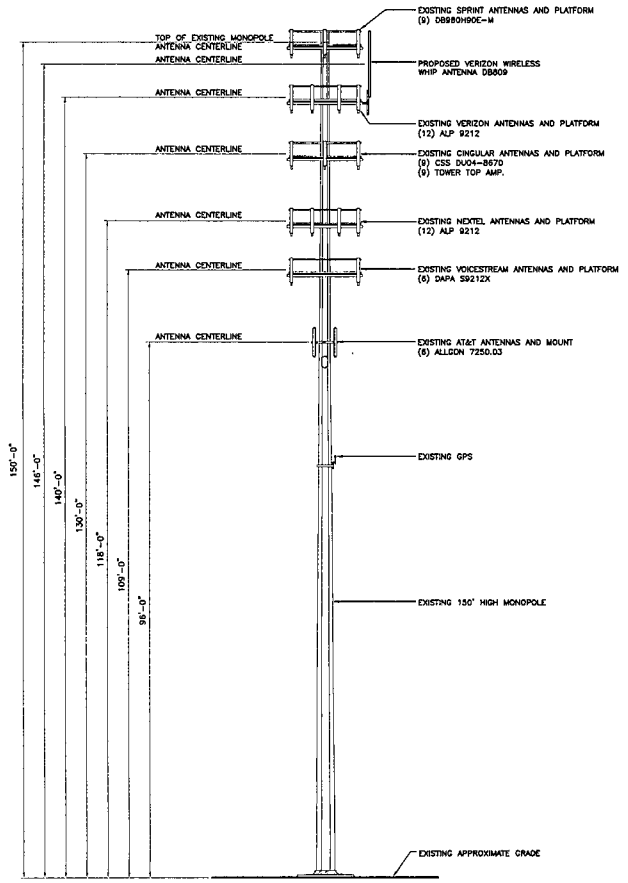
10-29-04	SITING COUNCIL REVIEW

CHESTER
49 WIG HILL ROAD
CHESTER, CONNECTICUT

SCALE: AS NOTED

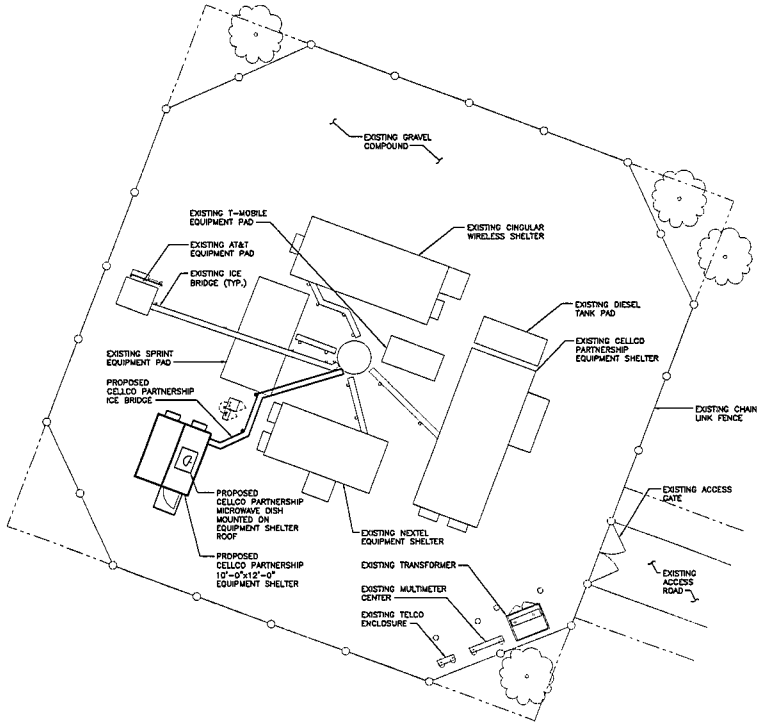
TITLE SHEET-
GENERAL NOTES
AND LEGEND

T-1



2 SC-1 TOWER ELEVATION
SCALE: 1"=10'-0"

0 5 10 20 30



1 SC-1 SITE PLAN
SCALE: 1"=10'-0"

0 5 10 20 30

LATITUDE: 41°-24'-14" (NAD 27)
LONGITUDE: 72°-28'-22" (NAD 27)

CELLCO PARTNERSHIP
DBA
verizon wireless

A&E FIRM
URS CORPORATION AES
795 BROOK STREET, BLDG 5
ROCKY HILL, CONNECTICUT
1-(860)-529-8882

A&E SEAL

PROJECT NO: 36929233
JOB NO: VZ1-088
DRAWN BY: BAL
CHECKED BY:

ISSUED FOR

	10-29-04	SITING COUNCIL REVIEW

CHESTER

49 WIG HILL ROAD
CHESTER, CONNECTICUT

SCALE: AS NOTED

SITE PLAN AND TOWER ELEVATION

SC-1

DECIBEL
Base Station Antennas

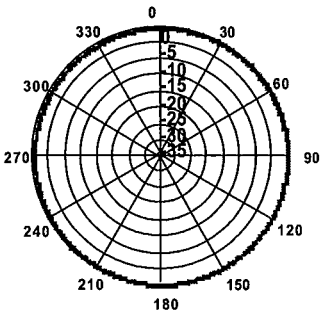
DB809KT3E-Y

9 dBd, Omni Antenna
890-960 MHz

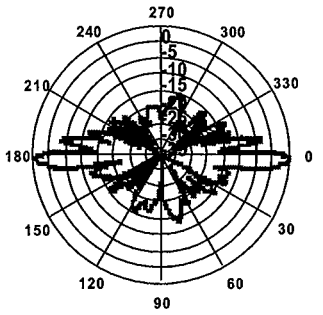
890-960 MHz

360°

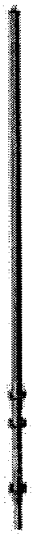
- Omnidirectional coverage
- Rugged, durable construction, heavy duty radome for minimum tip deflection
- Lightning resistant, with large diameter conductor extending top to bottom
- Invert mountable



Azimuth 910 MHz (Tilt=3)



Vertical 910 MHz (Tilt=3)



ELECTRICAL		MECHANICAL	
Frequency (MHz):	890-960	**Weight:**	27 lbs (12.3 kg)
Polarization:	Vertical	**Dimensions (LxUO):**	136.5 X 3 in (3467.1 X 76.2 mm)
Gain (dBd/dBi):	9/11.1	**Max. Wind Area:**	1.51 ft² (0.14 m²)
Azimuth BW:	360°	**Max. Wind Load (@ 100mph):**	82 lbf (365 N)
Elevation BW:	8°	**Max. Wind Speed:**	225 mph (362 km/h)
Beam Tilt:	3°	**Radome Material:**	Fiberglass
VSWR:	<1.5:1	**Mounting Hardware Material:**	Galvanized Steel
Impedance:	50 Ohms	**Connector Type:**	7-16 DIN - Female (Bottom)
Max Input Power:	500 Watts	**Color:**	Horizon Blue
Lightning Protection:	DC Ground	**Standard Mounting Hardware:**	DB5091-3

Andrew Corporation
8635 Stemmons Freeway
Dallas, Texas U.S.A 75247-3701
Tel: 214.631.0310

Fax: 214.631.4706
Toll Free Tel: 1.800.676.5342
Fax: 1.800.229.4706
www.andrew.com

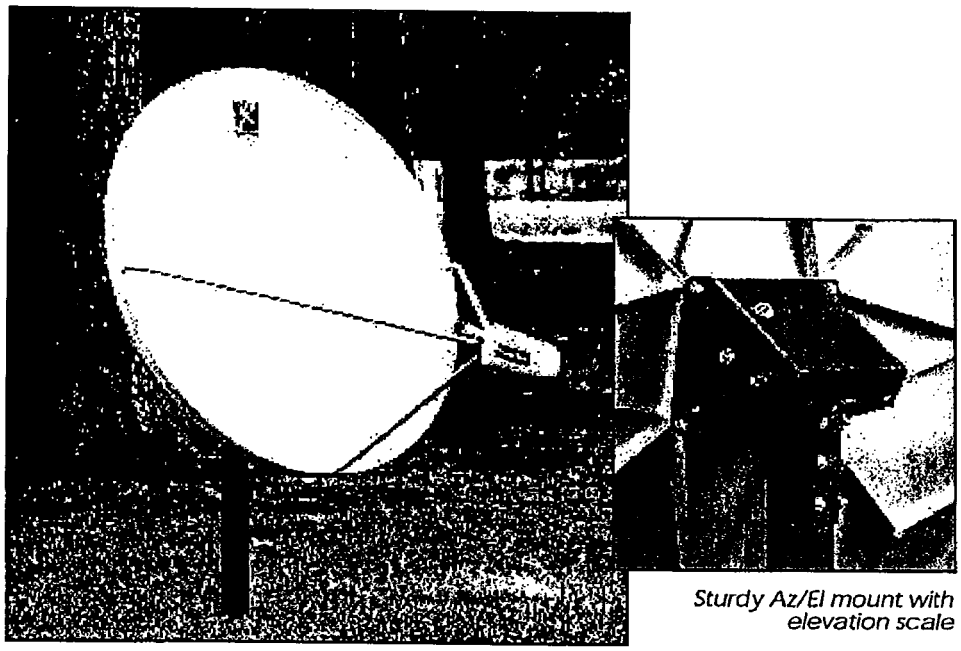
dbtech@andrew.com

Date: 5/3/2004
* - Indicates Typical Values

Channel Master®

TYPE 120

1.2m Receive-Only Offset Antenna System



Sturdy Az/El mount with elevation scale

FEATURES

- One-piece thermoset-molded offset reflector.
- Single bolt fine elevation adjustment.
- Galvanized .75 in. O.D. feed support legs.
- Factory pre-assembled mount.
- Cadmium-plated hardware for maximum corrosion resistance.
- Available with a wide variety of C-Band or Ku-Band feeds.

DESCRIPTION

The Channel Master® Type 120 Offset Antenna is a rugged commercial grade product suitable for the most demanding applications. The reflector is thermoset-molded for strength and surface accuracy. Molded into the rear of the reflector is a network of support ribs which not only strengthens the antenna, but also helps to sustain its critical parabolic shape.

The Az/El mount is constructed from heavy-gauge steel to provide a rigid support to the reflector. The Az/El mount secures the antenna to any 2.88-3.00 in. O.D. mast and prevents slippage in high winds. A specially formulated powder paint process offers excellent protection from weather-related corrosion.

SPECIFICATIONS TYPE 120

1.2m Receive-Only Offset Antenna System

RF PERFORMANCE

	C-Band	Ku-Band
Effective Aperture	1.2m (48 in.)	1.2m (48 in.)
Operating Frequency	3.4 - 4.8 GHz	10.95 - 12.75 GHz
Polarization	Linear (Circular optional)	Linear (Circular optional)
Gain @ 3.95/11.95 GHz	32.0 dBi (Typical)	42.0 dBi (Typical)
3 dB Beamwidth	4.4°	1.6°
Antenna Noise Temperature @ 30° Elevation	32°K	24°K
VSWR	1.4:1 Max.	1.3:1 Max.
Cross-Polarization Discrimination	>30 dB On Axis (Linear)	>30 dB On Axis (Linear)
Feed Interface	CPR-229	WR-75

MECHANICAL PERFORMANCE

Reflector Material		Glass Fiber Reinforced Polyester
Antenna Optics		One-Piece Offset Feed Prime Focus
Mount Type		Elevation over Azimuth
Elevation Adjustment Range		10°-70° Continuous Fine Adjustment
Azimuth Adjustment Range		360° Continuous
Mast Pipe Interface		2.88-3.00 in. (73-76 mm) Diameter
Wind Loading	Operational	50 mi/h (80 km/h)
	Survival	125 mi/h (200 km/h)
Temperature		-50°C to 80°C
Humidity		0 to 100% (Condensing)
Atmosphere		Salt, Pollutants and Contaminants as Encountered in Coastal and Industrial Areas
Solar Radiation		360 BTU/h/ft²
Shock and Vibration		As Encountered During Shipping and Handling

Channel Master®
US Sales Office
Smithfield,North Carolina USA
Phone: (919) 989-2205
Fax: (919) 989-2200
e-mail: cmvsatsales@cmnc.com
Germany Sales Office
Pforzheim,Germany
Tel. +49 (0) 7231-14557-0
Fax +49 (0) 7231-14557-10
e-mail:
cmi@channel-master-int.com
Web: http://www.channelmaster.com

Printed in U.S.A.2/01 (17182) Rev.C

General Power Density

Site Name: Chester, CT
Tower Height: 140 FT

Operator	Operating Frequency	Number of Trans.	ERP Per Trans.	Total ERP	Distance to Target	Calculated Power Density	Maximum Permissable Exposure*	Fraction of MPE
	(MHz)		(watts)	(watts)	(feet)	(mW/cm^2)	(mW/cm^2)	(%)
Verizon	880	9	200	1800	140	0.0330	0.586	5.64%
Verizon	929.4125	1	300	300	140	0.0055	0.6196083	0.89%
Total Percentage of Maximum Permissible Exposure								**6.52%**

Note: The Four Frequencies Below Are Simulcast. Worst Case MPE Used.

Op. Freq. (MHz)	MPE
929.4875	0.6196583
929.9375	0.6199583
929.5125	0.619675

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

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

DETAILED STRUCTURAL ANALYSIS AND EVALUATION OF 150' EXISTING MONOPOLE FOR NEW ANTENNA ARRANGEMENT

49 Wig Hill Road
Chester, Connecticut

prepared for

verizonwireless

Verizon Wireless
99 East River Drive
East Hartford, Connecticut 06108

prepared by

URS

URS CORPORATION
795 BROOK STREET, BUILDING 5
ROCKY HILL, CT 06067
TEL. 860-529-8882

36929238.00000
VZ1-088

November 1, 2004

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

This report summarizes the structural analysis of the existing 150' steel monopole structure located at 49 Wig Hill Road in Chester, Connecticut. The analysis was conducted in accordance with the TIA/EIA-222-F standard for wind velocity of 85 mph and 74 mph concurrent with ½" ice. The antenna loading considered in the analysis consists of all existing and proposed antennas, transmission lines, and ancillary items as outlined on the following page of this report.

The results of the analysis indicate the structure to be in compliance with the loading conditions and the material and member sizes for the monopole and foundation. **The monopole is considered structurally feasible with the TIA/EIA-222-F wind load classification specified above and the entire existing and proposed antenna loading**. The proposed Verizon Wireless addition consists of:

(1) Decibel DB809 whip antenna on existing platform with coax cable within the monopole	Verizon Wireless (proposed)	@ 146' centerline elevation

This analysis is based on:

1. The tower structure's capacity not including any assessment of the condition of the tower.
2. Tower design documents prepared by Engineered Endeavors, Inc., job number 4123, revision one, dated November 6, 1998.
3. Existing antenna configuration as specified on the following page of this report.
4. TIA/EIA-222-F wind load configuration.

This report is only valid 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 assumptions of the antenna and mount configurations. Notify the engineer in writing immediately if any of the assumptions in this report are other than specified.

Should you have any questions, please contact us.

Sincerely,
URS Corporation AES

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

RAS/ddm

cc: Mark Gauger – Verizon Wireless
Doug Roberts, AIA – URS
I.A., A.A. - URS
CF/Book

2. INTRODUCTION

URS Corporation AES (URS) performed a structural analysis of this existing 150' steel monopole structure located at 49 Wig Hill Road in Chester, Connecticut for Verizon Wireless.

The structure is self-supporting and was designed by Engineered Endeavors, Inc., job number 4123, revision one, dated November 6, 1998.

This analysis was conducted to evaluate twist (rotation), sway (deflection), and stress on the monopole. The analysis was also used to find the effect of the forces to the foundation resulting from the antenna arrangement listed below.

Antenna and Mount Configuration:

ANTENNA & MOUNT DESCRIPTION	CARRIER	CENTERLINE ELEVATION
(9) Decibel DB980H90E-M antennas on platform with coaxial cables inside the monopole	Sprint PCS (existing)	150'-0"
(1) Decibel DB809 whip antenna on existing platform with coax cable within the monopole	**Verizon Wireless (proposed)**	**@ 146'-0"**
(12) ALP 9212 antennas on platform with coaxial cables inside the monopole	Verizon Wireless (existing)	140'-0"
(9) CSS DUO4-8670 antenna and (9) amplifiers on platform with coaxial cables inside the monopole	Cingular Wireless (existing)	130'-0"
(12) ALP 9212 antennas on platform with coaxial cables inside the monopole	Nextel (existing)	118'-0"
(6) DAPA S9212X antennas on platform with coaxial cables inside the monopole	T-Mobile (existing)	109'-0"
(6) Allgon 7250.03 antennas on (3) T-arms with coaxial cables inside the monopole	AT&T Wireless (existing)	96'-0"
(1) GPS antenna with coax cable within the monopole	Sprint PCS (existing)	75'-0" (+/-)

3. ANALYSIS METHODOLOGY AND LOADING CONDITIONS

The structural analysis was done in accordance with TIA/EIA-222-F June 1996, Structural Standard for Steel Antenna Towers and Antenna Supporting Structures, the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

The analysis was conducted using ERI Tower 3.0. Two load conditions were evaluated as shown below which were compared to allowable stresses according to AISC and TIA/EIA. The two load combinations were investigated in ERI Tower 3.0 to determine the stress, sway and rotation.

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

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

4. EVALUATION OF MONOPOLE AND FOUNDATION

Combined axial and bending stresses on the steel monopole structure were evaluated to compare with allowable stresses in accordance with AISC. The calculated stresses under the proposed loading were lower than the allowable stresses. The forces transmitted to the foundation were found to be less than the original design values.

Detailed analysis and calculations for the proposed antenna arrangement and load condition are provided in section 6 of this report.

5. CONCLUSIONS

Our analysis determined that the monopole and its foundation will support the proposed antenna loading based upon the information from the tower design documents provided by Engineered Endeavors, Inc.

Detailed analysis for the proposed antenna arrangement and load condition is provided in Section 6 of this report.

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 were 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. 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 co-axial cable is installed within the monopole.

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

1. Adding or relocating antennas and platform

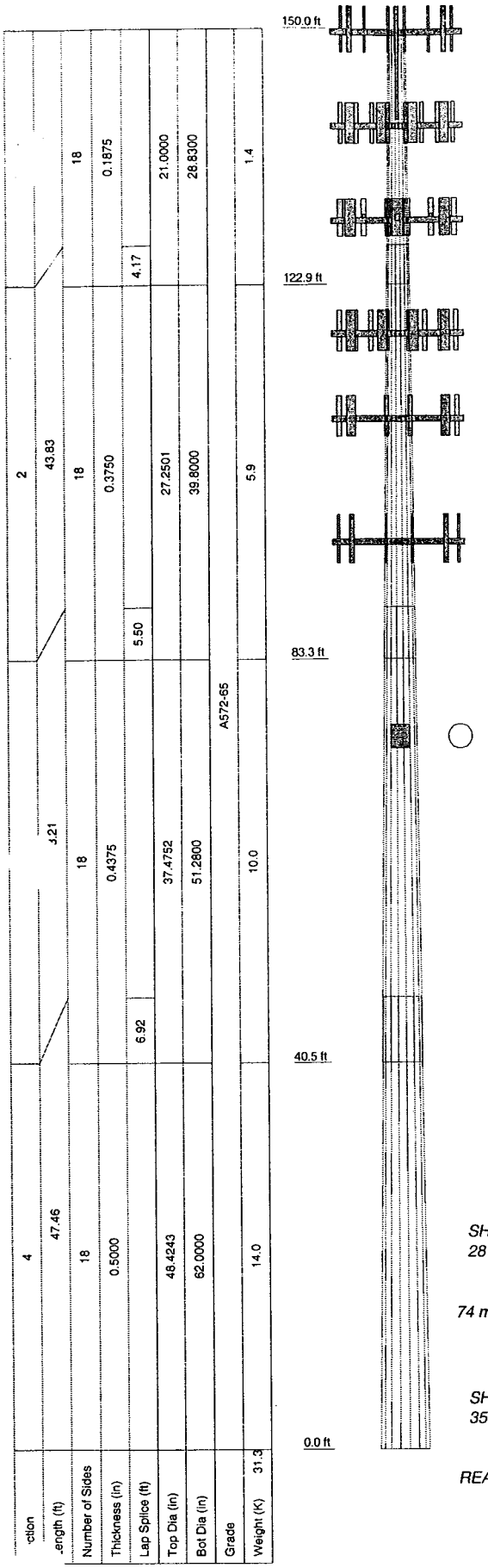
URS hereby states that this document represents the entire report and that it assumes no liability for any factual changes that may occur after the date of this report. All representations, recommendations, and conclusions are based upon information contained and set forth herein. If you are aware of 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.

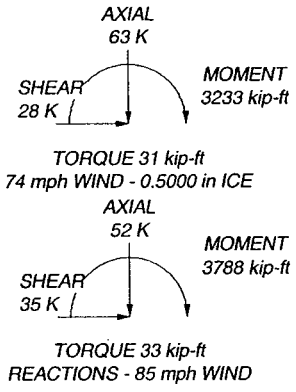
Ongoing and Periodic Inspection and Maintenance:

1. 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, Section 14 and Annex E 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 is 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





APPURTENANCES

TYPE	ELEVATION	TYPE	ELEVATION
(3) DB980H90E-M (Spint PCS)	150	ClearGain TMA (Cingular)	130
(3) DB980H90E-M (Spint PCS)	150	(3) DU04-8670 (Cingular)	130
(3) DB980H90E-M (Spint PCS)	150	(4) ALP 9212-N (Nextel)	118
EEI STD AMPS Platform (Sprint PCS)	150	(4) ALP 9212-N (Nextel)	118
DB809KT3-Y (Verizon)	146	(4) ALP 9212-N (Nextel)	118
(4) ALP 9212-N (Verizon Wireless)	140	EEI STD AMPS Platform (Nextel)	118
(4) ALP 9212-N (Verizon Wireless)	140	EEI STD AMPS Platform (T-Mobile)	109
EEI STD AMPS Platform (Verizon Wireless)	140	(2) ALP 9212-N (T-Mobile)	109
		(2) ALP 9212-N (T-Mobile)	109
(4) ALP 9212-N (Verizon Wireless)	140	(2) ALP 9212-N (T-Mobile)	109
(3) DU04-8670 (Cingular)	130	(2) 7250.03 (ATI Wireless)	96
(3) DU04-8670 (Cingular)	130	(2) 7250.03 (ATI Wireless)	96
EEI STD AMPS Platform (Cingular)	130	EEI 10' T-ARM (ATI Wireless)	96
ClearGain TMA (Cingular)	130	(2) 7250.03 (ATI Wireless)	96
ClearGain TMA (Cingular)	130	GPS Antenna (Sprint PCS)	75

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. TOWER RATING: 65.9%

URS Corp. AES
795 Brook Street
Rocky Hill, CT 06067
Phone: (860) 529-8882
FAX: (860) 529-5566

Job: ***150' Monopole Structure***			
Project: ***49 Wig Hill Road, Chester, CT***			
Client: Verizon Wireless	Drawn by: Daniel D. McClure	App'd:	
Code: TIA/EIA-222-F	Date: 11/01/04	Scale: NTS	
Path: P:\Telecom\F12\ERI Files\150' Monopole - Chester (VZ Whip).eri		Dwg No. E-1	

Tower Input Data

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

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

Options

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

Tapered Pole Section Geometry

Section	*Elevation* ft	*Section Length* ft	*Splice Length* ft	*Number of Sides*	*Top Diameter* in	*Bottom Diameter* in	*Wall Thickness* in	*Bend Radius* in	*Pole Grade*
L1	150.00-122.92	27.08	4.17	18	21.0000	28.8300	0.1875	0.7500	A572-65 (65 ksi)
L2	122.92-83.26	43.83	5.50	18	27.2501	39.8000	0.3750	1.5000	A572-65 (65 ksi)
L3	83.26-40.55	48.21	6.92	18	37.4752	51.2800	0.4375	1.7500	A572-65 (65 ksi)
L4	40.55-0.00	47.46		18	48.4243	62.0000	0.5000	2.0000	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	21.3240	12.3860	677.8263	7.3884	10.6680	63.5383	1356.5444	6.1942	3.3660	17.952
	29.2747	17.0459	1766.7635	10.1681	14.6456	120.6341	3535.8517	8.5246	4.7441	25.302
L2	28.8821	31.9881	2918.9580	9.5407	13.8431	210.8606	5841.7568	15.9971	4.1360	11.029
	40.4140	46.9256	9214.9025	13.9959	20.2184	455.7681	18441.9303	23.4673	6.3448	16.919
L3	39.6525	51.4315	8913.6148	13.1484	19.0374	468.2161	17838.9583	25.7206	5.8256	13.316
	52.0711	70.6012	23057.0171	18.0491	26.0502	885.0981	46144.3732	35.3073	8.2553	18.869
L4	51.1803	76.0559	22068.9990	17.0131	24.5996	897.1298	44167.0370	38.0352	7.6427	15.285
	62.9564	97.6005	46637.9792	21.8325	31.4960	1480.7588	93337.3258	48.8095	10.0320	20.064

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 150.00-122.92				1	1	1		
L2 122.92-83.26				1	1	1		
L3 83.26-40.55				1	1	1		
L4 40.55-0.00				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	C	No	Inside Pole	150.00 - 0.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8	C	No	Inside Pole	140.00 - 0.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8	C	No	Inside Pole	130.00 - 0.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8	C	No	Inside Pole	118.00 - 0.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8	C	No	Inside Pole	109.00 - 0.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8	C	No	Inside Pole	96.00 - 0.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.00-122.92	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.64
L2	122.92-83.26	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	2.40
L3	83.26-40.55	A	0.000	0.000	0.000	0.000	0.00

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.20
L4	40.55-0.00	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	0.000	3.04

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.00-122.92	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.64
L2	122.92-83.26	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	2.40
L3	83.26-40.55	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	3.20
L4	40.55-0.00	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	0.000	3.04

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(4) ALP 9212-N	A	From Face	3.00	0.0000	140.00	No Ice	5.78	5.78	0.02
(Verizon Wireless)			0.00			1/2" Ice	6.20	6.20	0.06
			0.00						
(4) ALP 9212-N	B	From Face	3.00	0.0000	140.00	No Ice	5.78	5.78	0.02
(Verizon Wireless)			0.00			1/2" Ice	6.20	6.20	0.06
			0.00						
(4) ALP 9212-N	C	From Face	3.00	0.0000	140.00	No Ice	5.78	5.78	0.02
(Verizon Wireless)			0.00			1/2" Ice	6.20	6.20	0.06
			0.00						
(3) DB980H90E-M	A	From Face	3.00	0.0000	150.00	No Ice	3.80	2.19	0.01
(Spint PCS)			0.00			1/2" Ice	4.18	2.56	0.03
			0.00						
(3) DB980H90E-M	B	From Face	3.00	0.0000	150.00	No Ice	3.80	2.19	0.01
(Spint PCS)			0.00			1/2" Ice	4.18	2.56	0.03
			0.00						
(3) DB980H90E-M	C	From Face	3.00	0.0000	150.00	No Ice	3.80	2.19	0.01
(Spint PCS)			0.00			1/2" Ice	4.18	2.56	0.03
			0.00						
(3) DU04-8670	A	From Face	3.00	0.0000	130.00	No Ice	6.53	4.20	0.03
(Cingular)			0.00			1/2" Ice	6.94	4.57	0.07
			0.00						

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(3) DU04-8670	B	From Face	3.00	0.0000	130.00	No Ice	6.53	4.20	0.03
(Cingular)			0.00			1/2" Ice	6.94	4.57	0.07
			0.00						
(3) DU04-8670	C	From Face	3.00	0.0000	130.00	No Ice	6.53	4.20	0.03
(Cingular)			0.00			1/2" Ice	6.94	4.57	0.07
			0.00						
(4) ALP 9212-N	A	From Face	3.00	0.0000	118.00	No Ice	5.78	5.78	0.02
(Nextel)			0.00			1/2" Ice	6.20	6.20	0.06
			0.00						
(4) ALP 9212-N	B	From Face	3.00	0.0000	118.00	No Ice	5.78	5.78	0.02
(Nextel)			0.00			1/2" Ice	6.20	6.20	0.06
			0.00						
(4) ALP 9212-N	C	From Face	3.00	0.0000	118.00	No Ice	5.78	5.78	0.02
(Nextel)			0.00			1/2" Ice	6.20	6.20	0.06
			0.00						
(2) ALP 9212-N	A	From Face	3.00	0.0000	109.00	No Ice	5.78	5.78	0.02
(T-Mobile)			0.00			1/2" Ice	6.20	6.20	0.06
			0.00						
(2) ALP 9212-N	B	From Face	3.00	0.0000	109.00	No Ice	5.78	5.78	0.02
(T-Mobile)			0.00			1/2" Ice	6.20	6.20	0.06
			0.00						
(2) ALP 9212-N	C	From Face	3.00	0.0000	109.00	No Ice	5.78	5.78	0.02
(T-Mobile)			0.00			1/2" Ice	6.20	6.20	0.06
			0.00						
(2) 7250.03	A	From Face	3.00	0.0000	96.00	No Ice	4.00	1.87	0.02
(AT&T Wireless)			0.00			1/2" Ice	4.39	2.33	0.04
			0.00						
(2) 7250.03	B	From Face	3.00	0.0000	96.00	No Ice	4.00	1.87	0.02
(AT&T Wireless)			0.00			1/2" Ice	4.39	2.33	0.04
			0.00						
(2) 7250.03	C	From Face	3.00	0.0000	96.00	No Ice	4.00	1.87	0.02
(AT&T Wireless)			0.00			1/2" Ice	4.39	2.33	0.04
			0.00						
EEI STD AMPS Platform	A	From Face	3.00	0.0000	150.00	No Ice	33.75	33.75	2.00
(Sprint PCS)			0.00			1/2" Ice	42.20	42.20	3.00
			0.00						
EEI STD AMPS Platform	A	From Face	3.00	0.0000	140.00	No Ice	33.75	33.75	2.00
(Verizon Wireless)			0.00			1/2" Ice	42.20	42.20	3.00
			0.00						
EEI STD AMPS Platform	A	From Face	3.00	0.0000	130.00	No Ice	33.75	33.75	2.00
(Cingular)			0.00			1/2" Ice	42.20	42.20	3.00
			0.00						
EEI STD AMPS Platform	A	From Face	3.00	0.0000	118.00	No Ice	33.75	33.75	2.00
(Nextel)			0.00			1/2" Ice	42.20	42.20	3.00
			0.00						
EEI STD AMPS Platform	A	From Face	3.00	0.0000	109.00	No Ice	33.75	33.75	2.00
(T-Mobile)			0.00			1/2" Ice	42.20	42.20	3.00
			0.00						
EEI 10' T-ARM	A	From Face	3.00	0.0000	96.00	No Ice	9.90	9.90	0.55
(AT&T Wireless)			0.00			1/2" Ice	12.40	12.40	0.71
			0.00						
ClearGain TMA	A	From Face	3.00	0.0000	130.00	No Ice	0.47	0.47	0.03
(Cingular)			0.00			1/2" Ice	0.56	0.56	0.03
			0.00						
ClearGain TMA	B	From Face	3.00	0.0000	130.00	No Ice	0.47	0.47	0.03
(Cingular)			0.00			1/2" Ice	0.56	0.56	0.03
			0.00						

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
ClearGain TMA	C	From Face	3.00	0.0000	130.00	No Ice	0.47	0.47	0.03
(Cingular)			0.00			1/2" Ice	0.56	0.56	0.03
			0.00						
DB809KT3-Y	C	From Face	3.00	0.0000	146.00	No Ice	3.39	3.39	0.03
(Verizon)			0.00			1/2" Ice	4.55	4.55	0.05
			0.00						
GPS Antenna	C	From Face	0.00	0.0000	75.00	No Ice	4.00	4.00	0.09
(Sprint PCS)			0.00			1/2" Ice	4.31	4.31	0.14
			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 150.00-122.92	135.75	1.498	28	56.225	A	0.000	56.225	56.225	100.00	0.000	0.000
					B	0.000	56.225		100.00		
					C	0.000	56.225		100.00		
L2 122.92-83.26	102.26	1.381	26	112.781	A	0.000	112.781	112.781	100.00	0.000	0.000
					B	0.000	112.781		100.00		
					C	0.000	112.781		100.00		
L3 83.26-40.55	61.47	1.194	22	160.750	A	0.000	160.750	160.750	100.00	0.000	0.000
					B	0.000	160.750		100.00		
					C	0.000	160.750		100.00		
L4 40.55-0.00	19.58	1	18	189.900	A	0.000	189.900	189.900	100.00	0.000	0.000
					B	0.000	189.900		100.00		
					C	0.000	189.900		100.00		

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 150.00-122.92	135.75	1.498	21	0.5000	58.482	A	0.000	58.482	58.482	100.00	0.000	0.000
						B	0.000	58.482		100.00		
						C	0.000	58.482		100.00		
L2 122.92-83.26	102.26	1.381	19	0.5000	116.086	A	0.000	116.086	116.086	100.00	0.000	0.000
						B	0.000	116.086		100.00		
						C	0.000	116.086		100.00		
L3 83.26-40.55	61.47	1.194	16	0.5000	164.309	A	0.000	164.309	164.309	100.00	0.000	0.000
						B	0.000	164.309		100.00		

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L4 40.55-0.00	19.58	1	14	0.5000	193.279	C	0.000	164.309		100.00		
						A	0.000	193.279	193.279	100.00	0.000	0.000
						B	0.000	193.279		100.00		
						C	0.000	193.279		100.00		

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 150.00-122.92	135.75	1.498	10	56.225	A	0.000	56.225	56.225	100.00	0.000	0.000
					B	0.000	56.225		100.00		
					C	0.000	56.225		100.00		
L2 122.92-83.26	102.26	1.381	9	112.781	A	0.000	112.781	112.781	100.00	0.000	0.000
					B	0.000	112.781		100.00		
					C	0.000	112.781		100.00		
L3 83.26-40.55	61.47	1.194	8	160.750	A	0.000	160.750	160.750	100.00	0.000	0.000
					B	0.000	160.750		100.00		
					C	0.000	160.750		100.00		
L4 40.55-0.00	19.58	1	6	189.900	A	0.000	189.900	189.900	100.00	0.000	0.000
					B	0.000	189.900		100.00		
					C	0.000	189.900		100.00		

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.36	A	1	0.65	1	1	1	56.225	1.71	63.19	C
			B	1	0.65	1	1	1	56.225			
			C	1	0.65	1	1	1	56.225			
L2 122.92-83.26	2.40	5.88	A	1	0.65	1	1	1	112.781	3.16	79.68	C
			B	1	0.65	1	1	1	112.781			
			C	1	0.65	1	1	1	112.781			
L3 83.26-40.55	3.20	10.01	A	1	0.65	1	1	1	160.750	3.88	90.84	C
			B	1	0.65	1	1	1	160.750			
			C	1	0.65	1	1	1	160.750			
L4 40.55-0.00	3.04	14.02	A	1	0.65	1	1	1	189.900	3.86	95.16	C
			B	1	0.65	1	1	1	189.900			
			C	1	0.65	1	1	1	189.900			
Sum Weight:	9.27	31.27						OTM	869.46 kip-ft	12.61		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.36	A	1	0.65	1	1	1	56.225	1.71	63.19	C
			B	1	0.65	1	1	1	56.225			
			C	1	0.65	1	1	1	56.225			
L2 122.92-83.26	2.40	5.88	A	1	0.65	1	1	1	112.781	3.16	79.68	C
			B	1	0.65	1	1	1	112.781			
			C	1	0.65	1	1	1	112.781			
L3 83.26-40.55	3.20	10.01	A	1	0.65	1	1	1	160.750	3.88	90.84	C
			B	1	0.65	1	1	1	160.750			
			C	1	0.65	1	1	1	160.750			
L4 40.55-0.00	3.04	14.02	A	1	0.65	1	1	1	189.900	3.86	95.16	C
			B	1	0.65	1	1	1	189.900			
			C	1	0.65	1	1	1	189.900			
Sum Weight:	9.27	31.27						OTM	869.46 kip-ft	12.61		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.36	A	1	0.65	1	1	1	56.225	1.71	63.19	C
			B	1	0.65	1	1	1	56.225			
			C	1	0.65	1	1	1	56.225			
L2 122.92-83.26	2.40	5.88	A	1	0.65	1	1	1	112.781	3.16	79.68	C
			B	1	0.65	1	1	1	112.781			
			C	1	0.65	1	1	1	112.781			
L3 83.26-40.55	3.20	10.01	A	1	0.65	1	1	1	160.750	3.88	90.84	C
			B	1	0.65	1	1	1	160.750			
			C	1	0.65	1	1	1	160.750			
L4 40.55-0.00	3.04	14.02	A	1	0.65	1	1	1	189.900	3.86	95.16	C
			B	1	0.65	1	1	1	189.900			
			C	1	0.65	1	1	1	189.900			
Sum Weight:	9.27	31.27						OTM	869.46 kip-ft	12.61		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.36	A	1	0.65	1	1	1	56.225	1.71	63.19	C
			B	1	0.65	1	1	1	56.225			
			C	1	0.65	1	1	1	56.225			
L2 122.92-83.26	2.40	5.88	A	1	0.65	1	1	1	112.781	3.16	79.68	C
			B	1	0.65	1	1	1	112.781			
			C	1	0.65	1	1	1	112.781			
L3 83.26-40.55	3.20	10.01	A	1	0.65	1	1	1	160.750	3.88	90.84	C
			B	1	0.65	1	1	1	160.750			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
			C	1	0.65	1	1	1	160.750			
L4 40.55-0.00	3.04	14.02	A	1	0.65	1	1	1	189.900	3.86	95.16	C
			B	1	0.65	1	1	1	189.900			
			C	1	0.65	1	1	1	189.900			
Sum Weight:	9.27	31.27						OTM	869.46 kip-ft	12.61		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.78	A	1	0.65	1	1	1	58.482	1.33	49.30	C
			B	1	0.65	1	1	1	58.482			
			C	1	0.65	1	1	1	58.482			
L2 122.92-83.26	2.40	6.73	A	1	0.65	1	1	1	116.086	2.44	61.51	C
			B	1	0.65	1	1	1	116.086			
			C	1	0.65	1	1	1	116.086			
L3 83.26-40.55	3.20	11.21	A	1	0.65	1	1	1	164.309	2.97	69.64	C
			B	1	0.65	1	1	1	164.309			
			C	1	0.65	1	1	1	164.309			
L4 40.55-0.00	3.04	15.44	A	1	0.65	1	1	1	193.279	2.95	72.64	C
			B	1	0.65	1	1	1	193.279			
			C	1	0.65	1	1	1	193.279			
Sum Weight:	9.27	35.17						OTM	671.16 kip-ft	9.69		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.78	A	1	0.65	1	1	1	58.482	1.33	49.30	C
			B	1	0.65	1	1	1	58.482			
			C	1	0.65	1	1	1	58.482			
L2 122.92-83.26	2.40	6.73	A	1	0.65	1	1	1	116.086	2.44	61.51	C
			B	1	0.65	1	1	1	116.086			
			C	1	0.65	1	1	1	116.086			
L3 83.26-40.55	3.20	11.21	A	1	0.65	1	1	1	164.309	2.97	69.64	C
			B	1	0.65	1	1	1	164.309			
			C	1	0.65	1	1	1	164.309			
L4 40.55-0.00	3.04	15.44	A	1	0.65	1	1	1	193.279	2.95	72.64	C
			B	1	0.65	1	1	1	193.279			
			C	1	0.65	1	1	1	193.279			
Sum Weight:	9.27	35.17						OTM	671.16 kip-ft	9.69		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.78	A	1	0.65	1	1	1	58.482	1.33	49.30	C
			B	1	0.65	1	1	1	58.482			
			C	1	0.65	1	1	1	58.482			
L2 122.92-83.26	2.40	6.73	A	1	0.65	1	1	1	116.086	2.44	61.51	C
			B	1	0.65	1	1	1	116.086			
			C	1	0.65	1	1	1	116.086			
L3 83.26-40.55	3.20	11.21	A	1	0.65	1	1	1	164.309	2.97	69.64	C
			B	1	0.65	1	1	1	164.309			
			C	1	0.65	1	1	1	164.309			
L4 40.55-0.00	3.04	15.44	A	1	0.65	1	1	1	193.279	2.95	72.64	C
			B	1	0.65	1	1	1	193.279			
			C	1	0.65	1	1	1	193.279			
Sum Weight:	9.27	35.17						OTM	671.16 kip-ft	9.69		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.78	A	1	0.65	1	1	1	58.482	1.33	49.30	C
			B	1	0.65	1	1	1	58.482			
			C	1	0.65	1	1	1	58.482			
L2 122.92-83.26	2.40	6.73	A	1	0.65	1	1	1	116.086	2.44	61.51	C
			B	1	0.65	1	1	1	116.086			
			C	1	0.65	1	1	1	116.086			
L3 83.26-40.55	3.20	11.21	A	1	0.65	1	1	1	164.309	2.97	69.64	C
			B	1	0.65	1	1	1	164.309			
			C	1	0.65	1	1	1	164.309			
L4 40.55-0.00	3.04	15.44	A	1	0.65	1	1	1	193.279	2.95	72.64	C
			B	1	0.65	1	1	1	193.279			
			C	1	0.65	1	1	1	193.279			
Sum Weight:	9.27	35.17						OTM	671.16 kip-ft	9.69		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.36	A	1	0.65	1	1	1	56.225	0.59	21.87	C
			B	1	0.65	1	1	1	56.225			
			C	1	0.65	1	1	1	56.225			
L2 122.92-83.26	2.40	5.88	A	1	0.65	1	1	1	112.781	1.09	27.57	C
			B	1	0.65	1	1	1	112.781			
			C	1	0.65	1	1	1	112.781			

Section Elevation ft	Add Weight K	Self Weight K	Face e	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L3 83.26-40.55	3.20	10.01	A	1	0.65	1	1	1	160.750	1.34	31.43	C
			B	1	0.65	1	1	1	160.750			
			C	1	0.65	1	1	1	160.750			
L4 40.55-0.00	3.04	14.02	A	1	0.65	1	1	1	189.900	1.34	32.93	C
			B	1	0.65	1	1	1	189.900			
			C	1	0.65	1	1	1	189.900			
Sum Weight:	9.27	31.27						OTM	300.85 kip-ft	4.36		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face e	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.36	A	1	0.65	1	1	1	56.225	0.59	21.87	C
			B	1	0.65	1	1	1	56.225			
			C	1	0.65	1	1	1	56.225			
L2 122.92-83.26	2.40	5.88	A	1	0.65	1	1	1	112.781	1.09	27.57	C
			B	1	0.65	1	1	1	112.781			
			C	1	0.65	1	1	1	112.781			
L3 83.26-40.55	3.20	10.01	A	1	0.65	1	1	1	160.750	1.34	31.43	C
			B	1	0.65	1	1	1	160.750			
			C	1	0.65	1	1	1	160.750			
L4 40.55-0.00	3.04	14.02	A	1	0.65	1	1	1	189.900	1.34	32.93	C
			B	1	0.65	1	1	1	189.900			
			C	1	0.65	1	1	1	189.900			
Sum Weight:	9.27	31.27						OTM	300.85 kip-ft	4.36		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face e	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.36	A	1	0.65	1	1	1	56.225	0.59	21.87	C
			B	1	0.65	1	1	1	56.225			
			C	1	0.65	1	1	1	56.225			
L2 122.92-83.26	2.40	5.88	A	1	0.65	1	1	1	112.781	1.09	27.57	C
			B	1	0.65	1	1	1	112.781			
			C	1	0.65	1	1	1	112.781			
L3 83.26-40.55	3.20	10.01	A	1	0.65	1	1	1	160.750	1.34	31.43	C
			B	1	0.65	1	1	1	160.750			
			C	1	0.65	1	1	1	160.750			
L4 40.55-0.00	3.04	14.02	A	1	0.65	1	1	1	189.900	1.34	32.93	C
			B	1	0.65	1	1	1	189.900			
			C	1	0.65	1	1	1	189.900			
Sum Weight:	9.27	31.27						OTM	300.85 kip-ft	4.36		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 150.00-122.92	0.64	1.36	A	1	0.65	1	1	1	56.225	0.59	21.87	C
			B	1	0.65	1	1	1	56.225			
			C	1	0.65	1	1	1	56.225			
L2 122.92-83.26	2.40	5.88	A	1	0.65	1	1	1	112.781	1.09	27.57	C
			B	1	0.65	1	1	1	112.781			
			C	1	0.65	1	1	1	112.781			
L3 83.26-40.55	3.20	10.01	A	1	0.65	1	1	1	160.750	1.34	31.43	C
			B	1	0.65	1	1	1	160.750			
			C	1	0.65	1	1	1	160.750			
L4 40.55-0.00	3.04	14.02	A	1	0.65	1	1	1	189.900	1.34	32.93	C
			B	1	0.65	1	1	1	189.900			
			C	1	0.65	1	1	1	189.900			
Sum Weight:	9.27	31.27						OTM	300.85 kip-ft	4.36		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	31.27					
Bracing Weight	0.00					
Total Member Self-Weight	31.27			-21.55	37.79	
Total Weight	52.39			-21.55	37.79	
Wind 0 deg - No Ice		0.00	-34.51	-3678.16	37.79	-29.35
Wind 30 deg - No Ice		17.25	-29.88	-3188.27	-1790.51	-33.43
Wind 45 deg - No Ice		24.40	-24.40	-2607.17	-2547.82	-32.09
Wind 60 deg - No Ice		29.88	-17.25	-1849.86	-3128.93	-28.56
Wind 90 deg - No Ice		34.51	0.00	-21.55	-3618.82	-16.04
Wind 120 deg - No Ice		29.88	17.25	1806.76	-3128.93	0.79
Wind 135 deg - No Ice		24.40	24.40	2564.07	-2547.82	9.41
Wind 150 deg - No Ice		17.25	29.88	3145.18	-1790.51	17.40
Wind 180 deg - No Ice		0.00	34.51	3635.07	37.79	29.35
Wind 210 deg - No Ice		-17.25	29.88	3145.18	1866.10	33.43
Wind 225 deg - No Ice		-24.40	24.40	2564.07	2623.41	32.09
Wind 240 deg - No Ice		-29.88	17.25	1806.76	3204.52	28.56
Wind 270 deg - No Ice		-34.51	0.00	-21.55	3694.41	16.04
Wind 300 deg - No Ice		-29.88	-17.25	-1849.86	3204.52	-0.79
Wind 315 deg - No Ice		-24.40	-24.40	-2607.17	2623.41	-9.41
Wind 330 deg - No Ice		-17.25	-29.88	-3188.27	1866.10	-17.40
Member Ice	3.89					
Total Weight Ice	63.45			-32.01	56.24	
Wind 0 deg - Ice		0.00	-28.47	-3094.69	56.24	-27.52
Wind 30 deg - Ice		14.24	-24.66	-2684.37	-1475.10	-31.35
Wind 45 deg - Ice		20.13	-20.13	-2197.65	-2109.40	-30.09
Wind 60 deg - Ice		24.66	-14.24	-1563.35	-2596.12	-26.78
Wind 90 deg - Ice		28.47	0.00	-32.01	-3006.44	-15.03
Wind 120 deg - Ice		24.66	14.24	1499.33	-2596.12	0.75
Wind 135 deg - Ice		20.13	20.13	2133.63	-2109.40	8.83

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 150 deg - Ice		14.24	24.66	2620.35	-1475.10	16.32
Wind 180 deg - Ice		0.00	28.47	3030.67	56.24	27.52
Wind 210 deg - Ice		-14.24	24.66	2620.35	1587.58	31.35
Wind 225 deg - Ice		-20.13	20.13	2133.63	2221.89	30.09
Wind 240 deg - Ice		-24.66	14.24	1499.33	2708.60	26.78
Wind 270 deg - Ice		-28.47	0.00	-32.01	3118.92	15.03
Wind 300 deg - Ice		-24.66	-14.24	-1563.35	2708.60	-0.75
Wind 315 deg - Ice		-20.13	-20.13	-2197.65	2221.89	-8.83
Wind 330 deg - Ice		-14.24	-24.66	-2684.37	1587.58	-16.32
Total Weight	52.39			-21.55	37.79	
Wind 0 deg - Service		0.00	-11.94	-1286.81	37.79	-10.16
Wind 30 deg - Service		5.97	-10.34	-1117.30	-594.84	-11.57
Wind 45 deg - Service		8.44	-8.44	-916.23	-856.88	-11.10
Wind 60 deg - Service		10.34	-5.97	-654.18	-1057.96	-9.88
Wind 90 deg - Service		11.94	0.00	-21.55	-1227.47	-5.55
Wind 120 deg - Service		10.34	5.97	611.09	-1057.96	0.27
Wind 135 deg - Service		8.44	8.44	873.13	-856.88	3.26
Wind 150 deg - Service		5.97	10.34	1074.20	-594.84	6.02
Wind 180 deg - Service		0.00	11.94	1243.72	37.79	10.16
Wind 210 deg - Service		-5.97	10.34	1074.20	670.43	11.57
Wind 225 deg - Service		-8.44	8.44	873.13	932.47	11.10
Wind 240 deg - Service		-10.34	5.97	611.09	1133.55	9.88
Wind 270 deg - Service		-11.94	0.00	-21.55	1303.06	5.55
Wind 300 deg - Service		-10.34	-5.97	-654.18	1133.55	-0.27
Wind 315 deg - Service		-8.44	-8.44	-916.23	932.47	-3.26
Wind 330 deg - Service		-5.97	-10.34	-1117.30	670.43	-6.02

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp

Comb. No.	Description
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	150 - 122.92	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-12.84	31.71	18.09
			Max. Mx	14	-7.50	196.13	11.64
			Max. My	2	-7.51	20.32	187.16
			Max. Vy	14	-14.56	196.13	11.64
			Max. Vx	2	-14.55	20.32	187.16
			Max. Torque	11			-18.89
L2	122.92 - 83.257	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-29.09	58.40	33.49
			Max. Mx	14	-19.71	1042.44	21.96
			Max. My	2	-19.72	38.23	1026.00
			Max. Vy	14	-26.99	1042.44	21.96
			Max. Vx	2	-26.98	38.23	1026.00
			Max. Torque	11			-33.28
L3	83.257 - 40.547	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-42.61	59.49	33.87
			Max. Mx	14	-32.56	2234.63	22.33
			Max. My	2	-32.57	39.15	2217.81
			Max. Vy	14	-30.66	2234.63	22.33
			Max. Vx	2	-30.65	39.15	2217.81
			Max. Torque	11			-33.26
L4	40.547 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-63.45	59.87	34.08
			Max. Mx	14	-52.37	3781.96	22.46
			Max. My	2	-52.37	39.40	3765.05
			Max. Vy	14	-34.53	3781.96	22.46

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vx	2	-34.53	39.40	3765.05
			Max. Torque	11			-33.09

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	63.45	-0.00	-0.00
	Max. H_x	14	52.39	34.51	0.00
	Max. H_z	2	52.39	0.00	34.51
	Max. M_x	2	3765.05	0.00	34.51
	Max. M_z	6	3703.18	-34.51	0.00
	Max. Torsion	3	33.08	-17.25	29.88
	Min. Vert	48	52.39	10.34	5.97
	Min. H_x	6	52.39	-34.51	0.00
	Min. H_z	10	52.39	0.00	-34.51
	Min. M_x	10	-3720.13	0.00	-34.51
	Min. M_z	14	-3781.96	34.51	0.00
	Min. Torsion	11	-33.08	17.25	-29.88

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	52.39	0.00	0.00	-22.47	39.41	0.00
Dead+Wind 0 deg - No Ice	52.39	-0.00	-34.51	-3765.05	39.39	-29.03
Dead+Wind 30 deg - No Ice	52.39	17.25	-29.88	-3263.64	-1831.90	-33.08
Dead+Wind 45 deg - No Ice	52.39	24.40	-24.40	-2668.88	-2607.01	-31.75
Dead+Wind 60 deg - No Ice	52.39	29.88	-17.25	-1893.77	-3201.78	-28.26
Dead+Wind 90 deg - No Ice	52.39	34.51	-0.00	-22.47	-3703.18	-15.87
Dead+Wind 120 deg - No Ice	52.39	29.88	17.25	1848.82	-3201.77	0.78
Dead+Wind 135 deg - No Ice	52.39	24.40	24.40	2623.94	-2607.00	9.32
Dead+Wind 150 deg - No Ice	52.39	17.25	29.88	3218.70	-1831.89	17.22
Dead+Wind 180 deg - No Ice	52.39	-0.00	34.51	3720.13	39.40	29.04
Dead+Wind 210 deg - No Ice	52.39	-17.25	29.88	3218.71	1910.70	33.08
Dead+Wind 225 deg - No Ice	52.39	-24.40	24.40	2623.95	2685.81	31.74
Dead+Wind 240 deg - No Ice	52.39	-29.88	17.25	1848.82	3280.56	28.25
Dead+Wind 270 deg - No Ice	52.39	-34.51	-0.00	-22.46	3781.96	15.86
Dead+Wind 300 deg - No Ice	52.39	-29.88	-17.25	-1893.75	3280.55	-0.78
Dead+Wind 315 deg - No Ice	52.39	-24.40	-24.40	-2668.87	2685.80	-9.31
Dead+Wind 330 deg - No Ice	52.39	-17.25	-29.88	-3263.63	1910.68	-17.21
Dead+Ice+Temp	63.45	0.00	0.00	-34.08	59.87	0.00
Dead+Wind 0 deg+Ice+Temp	63.45	0.00	-28.47	-3198.15	59.80	-27.20
Dead+Wind 30 deg+Ice+Temp	63.45	14.24	-24.66	-2774.24	-1522.24	-30.99
Dead+Wind 45 deg+Ice+Temp	63.45	20.13	-20.13	-2271.41	-2177.55	-29.74
Dead+Wind 60 deg+Ice+Temp	63.45	24.66	-14.24	-1616.11	-2680.38	-26.47
Dead+Wind 90 deg+Ice+Temp	63.45	28.47	0.00	-34.06	-3104.26	-14.86
Dead+Wind 120 deg+Ice+Temp	63.45	24.66	14.24	1547.99	-2680.36	0.74
Dead+Wind 135 deg+Ice+Temp	63.45	20.13	20.13	2203.31	-2177.54	8.74
Dead+Wind 150 deg+Ice+Temp	63.45	14.24	24.66	2706.13	-1522.22	16.14
Dead+Wind 180 deg+Ice+Temp	63.45	0.00	28.47	3130.06	59.82	27.21

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 210 deg+Ice+Temp	63.45	-14.24	24.66	2706.15	1641.87	30.99
Dead+Wind 225 deg+Ice+Temp	63.45	-20.13	20.13	2203.32	2297.17	29.73
Dead+Wind 240 deg+Ice+Temp	63.45	-24.66	14.24	1548.01	2800.00	26.46
Dead+Wind 270 deg+Ice+Temp	63.45	-28.47	0.00	-34.04	3223.88	14.84
Dead+Wind 300 deg+Ice+Temp	63.45	-24.66	-14.24	-1616.09	2799.99	-0.74
Dead+Wind 315 deg+Ice+Temp	63.45	-20.13	-20.13	-2271.40	2297.15	-8.73
Dead+Wind 330 deg+Ice+Temp	63.45	-14.24	-24.66	-2774.23	1641.85	-16.13
Dead+Wind 0 deg - Service	52.39	0.00	-11.94	-1318.19	39.55	-10.09
Dead+Wind 30 deg - Service	52.39	5.97	-10.34	-1144.61	-608.27	-11.49
Dead+Wind 45 deg - Service	52.39	8.44	-8.44	-938.71	-876.61	-11.03
Dead+Wind 60 deg - Service	52.39	10.34	-5.97	-670.37	-1082.51	-9.82
Dead+Wind 90 deg - Service	52.39	11.94	0.00	-22.55	-1256.04	-5.51
Dead+Wind 120 deg - Service	52.39	10.34	5.97	625.17	-1082.33	0.27
Dead+Wind 135 deg - Service	52.39	8.44	8.44	893.46	-876.46	3.24
Dead+Wind 150 deg - Service	52.39	5.97	10.34	1099.46	-608.24	5.98
Dead+Wind 180 deg - Service	52.39	0.00	11.94	1273.09	39.55	10.09
Dead+Wind 210 deg - Service	52.39	-5.97	10.34	1099.51	687.37	11.49
Dead+Wind 225 deg - Service	52.39	-8.44	8.44	893.61	955.71	11.03
Dead+Wind 240 deg - Service	52.39	-10.34	5.97	625.27	1161.61	9.82
Dead+Wind 270 deg - Service	52.39	-11.94	0.00	-22.55	1335.13	5.51
Dead+Wind 300 deg - Service	52.39	-10.34	-5.97	-670.25	1161.40	-0.27
Dead+Wind 315 deg - Service	52.39	-8.44	-8.44	-938.66	955.66	-3.24
Dead+Wind 330 deg - Service	52.39	-5.97	-10.34	-1144.61	687.37	-5.98

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-52.39	0.00	-0.00	52.39	-0.00	0.002%
2	0.00	-52.39	-34.51	0.00	52.39	34.51	0.000%
3	17.25	-52.39	-29.88	-17.25	52.39	29.88	0.000%
4	24.40	-52.39	-24.40	-24.40	52.39	24.40	0.000%
5	29.88	-52.39	-17.25	-29.88	52.39	17.25	0.000%
6	34.51	-52.39	0.00	-34.51	52.39	0.00	0.000%
7	29.88	-52.39	17.25	-29.88	52.39	-17.25	0.000%
8	24.40	-52.39	24.40	-24.40	52.39	-24.40	0.000%
9	17.25	-52.39	29.88	-17.25	52.39	-29.88	0.000%
10	0.00	-52.39	34.51	0.00	52.39	-34.51	0.000%
11	-17.25	-52.39	29.88	17.25	52.39	-29.88	0.000%
12	-24.40	-52.39	24.40	24.40	52.39	-24.40	0.000%
13	-29.88	-52.39	17.25	29.88	52.39	-17.25	0.000%
14	-34.51	-52.39	0.00	34.51	52.39	0.00	0.000%
15	-29.88	-52.39	-17.25	29.88	52.39	17.25	0.000%
16	-24.40	-52.39	-24.40	24.40	52.39	24.40	0.000%
17	-17.25	-52.39	-29.88	17.25	52.39	29.88	0.000%
18	0.00	-63.45	0.00	-0.00	63.45	-0.00	0.001%
19	0.00	-63.45	-28.47	0.00	63.45	28.47	0.000%
20	14.24	-63.45	-24.66	-14.24	63.45	24.66	0.000%
21	20.13	-63.45	-20.13	-20.13	63.45	20.13	0.000%
22	24.66	-63.45	-14.24	-24.66	63.45	14.24	0.000%
23	28.47	-63.45	0.00	-28.47	63.45	-0.00	0.000%
24	24.66	-63.45	14.24	-24.66	63.45	-14.24	0.000%
25	20.13	-63.45	20.13	-20.13	63.45	-20.13	0.000%
26	14.24	-63.45	24.66	-14.24	63.45	-24.66	0.000%
27	0.00	-63.45	28.47	0.00	63.45	-28.47	0.000%
28	-14.24	-63.45	24.66	14.24	63.45	-24.66	0.000%
29	-20.13	-63.45	20.13	20.13	63.45	-20.13	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
30	-24.66	-63.45	14.24	24.66	63.45	-14.24	0.000%
31	-28.47	-63.45	0.00	28.47	63.45	-0.00	0.000%
32	-24.66	-63.45	-14.24	24.66	63.45	14.24	0.000%
33	-20.13	-63.45	-20.13	20.13	63.45	20.13	0.000%
34	-14.24	-63.45	-24.66	14.24	63.45	24.66	0.000%
35	0.00	-52.39	-11.94	-0.00	52.39	11.94	0.000%
36	5.97	-52.39	-10.34	-5.97	52.39	10.34	0.000%
37	8.44	-52.39	-8.44	-8.44	52.39	8.44	0.000%
38	10.34	-52.39	-5.97	-10.34	52.39	5.97	0.000%
39	11.94	-52.39	0.00	-11.94	52.39	-0.00	0.001%
40	10.34	-52.39	5.97	-10.34	52.39	-5.97	0.003%
41	8.44	-52.39	8.44	-8.44	52.39	-8.44	0.003%
42	5.97	-52.39	10.34	-5.97	52.39	-10.34	0.001%
43	0.00	-52.39	11.94	-0.00	52.39	-11.94	0.000%
44	-5.97	-52.39	10.34	5.97	52.39	-10.34	0.000%
45	-8.44	-52.39	8.44	8.44	52.39	-8.44	0.000%
46	-10.34	-52.39	5.97	10.34	52.39	-5.97	0.000%
47	-11.94	-52.39	0.00	11.94	52.39	-0.00	0.001%
48	-10.34	-52.39	-5.97	10.34	52.39	5.97	0.004%
49	-8.44	-52.39	-8.44	8.44	52.39	8.44	0.001%
50	-5.97	-52.39	-10.34	5.97	52.39	10.34	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	9	0.00000001	0.00004156
2	Yes	15	0.00000001	0.00005435
3	Yes	15	0.00000001	0.00005059
4	Yes	15	0.00000001	0.00007069
5	Yes	15	0.00000001	0.00007629
6	Yes	14	0.00000001	0.00008718
7	Yes	14	0.00000001	0.00010882
8	Yes	14	0.00000001	0.00013222
9	Yes	14	0.00000001	0.00009753
10	Yes	15	0.00000001	0.00005300
11	Yes	15	0.00000001	0.00008639
12	Yes	15	0.00000001	0.00007267
13	Yes	14	0.00000001	0.00013713
14	Yes	14	0.00000001	0.00009118
15	Yes	14	0.00000001	0.00012707
16	Yes	15	0.00000001	0.00005160
17	Yes	15	0.00000001	0.00006463
18	Yes	10	0.00000001	0.00008210
19	Yes	15	0.00000001	0.00006761
20	Yes	15	0.00000001	0.00006554
21	Yes	15	0.00000001	0.00008256
22	Yes	15	0.00000001	0.00008590
23	Yes	14	0.00000001	0.00010944
24	Yes	14	0.00000001	0.00013109
25	Yes	15	0.00000001	0.00005306
26	Yes	14	0.00000001	0.00013049
27	Yes	15	0.00000001	0.00006439
28	Yes	15	0.00000001	0.00009853
29	Yes	15	0.00000001	0.00008630
30	Yes	15	0.00000001	0.00006077

31	Yes	14	0.00000001	0.00011927
32	Yes	15	0.00000001	0.00005634
33	Yes	15	0.00000001	0.00006734
34	Yes	15	0.00000001	0.00007850
35	Yes	13	0.00000001	0.00007678
36	Yes	13	0.00000001	0.00006945
37	Yes	13	0.00000001	0.00007306
38	Yes	13	0.00000001	0.00007275
39	Yes	12	0.00000001	0.00010101
40	Yes	11	0.00013395	0.00008409
41	Yes	11	0.00013392	0.00014501
42	Yes	12	0.00000001	0.00008387
43	Yes	13	0.00000001	0.00007069
44	Yes	13	0.00000001	0.00008814
45	Yes	13	0.00000001	0.00007645
46	Yes	13	0.00000001	0.00005954
47	Yes	12	0.00000001	0.00011682
48	Yes	11	0.00013461	0.00012429
49	Yes	12	0.00000001	0.00008553
50	Yes	13	0.00000001	0.00005795

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 122.92	23.443	48	1.5028	0.0691
L2	127.087 - 83.257	16.587	48	1.3059	0.0418
L3	88.757 - 40.547	7.664	48	0.8693	0.0175
L4	47.464 - 0	2.071	48	0.4050	0.0057

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.00	(3) DB980H90E-M	48	23.443	1.5028	0.0691	22026
146.00	DB809KT3-Y	48	22.209	1.4701	0.0639	22026
140.00	(4) ALP 9212-N	48	20.374	1.4204	0.0563	11013
130.00	(3) DU04-8670	48	17.413	1.3330	0.0448	5523
118.00	(4) ALP 9212-N	48	14.145	1.2152	0.0337	4847
109.00	(2) ALP 9212-N	48	11.927	1.1169	0.0275	4888
96.00	(2) 7250.03	48	9.075	0.9617	0.0206	4949
75.00	GPS Antenna	48	5.333	0.6886	0.0123	4893

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 122.92	64.031	15	3.9505	0.1990

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L2	127.087 - 83.257	45.795	15	3.5302	0.1203
L3	88.757 - 40.547	21.412	15	2.4094	0.0503
L4	47.464 - 0	5.826	15	1.1368	0.0164

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.00	(3) DB980H90E-M	15	64.031	3.9505	0.1990	9570
146.00	DB809KT3-Y	15	60.761	3.8847	0.1842	9570
140.00	(4) ALP 9212-N	15	55.893	3.7829	0.1624	4784
130.00	(3) DU04-8670	15	48.008	3.5929	0.1289	2397
118.00	(4) ALP 9212-N	15	39.205	3.3085	0.0970	2024
109.00	(2) ALP 9212-N	15	33.164	3.0557	0.0789	1966
96.00	(2) 7250.03	15	25.318	2.6491	0.0591	1888
75.00	GPS Antenna	15	14.937	1.9481	0.0359	1792

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 K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	150 - 122.92 (1)	TP28.83x21x0.1875	27.08	150.00	184.8	4.373	16.3288	-12.16	71.40	0.170
L2	122.92 - 83.257 (2)	TP39.8x27.2501x0.375	43.83	150.00	134.0	8.321	45.0512	-19.70	374.89	0.053
L3	83.257 - 40.547 (3)	TP51.28x37.4752x0.4375	48.21	150.00	103.8	13.868	67.8508	-32.56	940.93	0.035
L4	40.547 - 0 (4)	TP62x48.4243x0.5	47.46	150.00	89.6	18.478	89.8511	-45.44	1660.27	0.027

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	150 - 122.92 (1)	TP28.83x21x0.1875	189.98	-20.601	39.000	0.528	0.00	0.000	39.000	0.000
L2	122.92 - 83.257 (2)	TP39.8x27.2501x0.375	1048.35	-29.959	39.000	0.768	0.00	0.000	39.000	0.000
L3	83.257 - 40.547 (3)	TP51.28x37.4752x0.4375	2240.55	-32.901	39.000	0.844	0.00	0.000	39.000	0.000
L4	40.547 - 0 (4)	TP62x48.4243x0.5	3210.78	-30.723	39.000	0.788	0.00	0.000	39.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	150 - 122.92 (1)	TP28.83x21x0.1875	0.170	0.528	0.000	0.699 ✔	1.333	H1-3 ✔
L2	122.92 - 83.257 (2)	TP39.8x27.2501x0.375	0.053	0.768	0.000	0.821 ✔	1.333	H1-3 ✔
L3	83.257 - 40.547 (3)	TP51.28x37.4752x0.4375	0.035	0.844	0.000	0.878 ✔	1.333	H1-3 ✔
L4	40.547 - 0 (4)	TP62x48.4243x0.5	0.027	0.788	0.000	0.815 ✔	1.333	H1-3 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	150 - 122.92	Pole	TP28.83x21x0.1875	1	-12.16	95.18	52.4	Pass
L2	122.92 - 83.257	Pole	TP39.8x27.2501x0.375	2	-19.70	499.73	61.6	Pass
L3	83.257 - 40.547	Pole	TP51.28x37.4752x0.4375	3	-32.56	1254.26	65.9	Pass
L4	40.547 - 0	Pole	TP62x48.4243x0.5	4	-45.44	2213.14	61.2	Pass
							Summary	
						Pole (L3)	65.9	Pass
						RATING =	**65.9**	**Pass**

ANCHOR BOLT AND BASEPLATE ANALYSIS

Input Data

Tower Reactions:

Overturning Moment:	$OM := 3788 \cdot kips \cdot ft$	*user input*
Shear Force:	$Shear := 35 \cdot kips$	*user input*
Axial Force:	$Axial := 52 \cdot kips$	*user input*

Anchor Bolt Data:

Use ASTM 615 Grade 75

Number of Anchor Bolts = N	$N := 24$	*user input*
Diameter of Bolt Circle:	$D_{bc} := 71.0in$	*user input*
Bolt "Column" Distance:	$l := 3.25in$	*user input*
Bolt Ultimate Strength:	$F_u := 100 \cdot \frac{kips}{in^2}$	*user input*
Bolt Allowable Strength:	$Fy := 75 \cdot \left(1000 \cdot \frac{lb}{in^2}\right)$	*user input*
Bolt Modulus:	$E := 29000 \cdot ksi$	*user input*
Thickness Of Anchor Bolts	$D := 2.25in$	*user input*
Threads per Inch:	$n := 4.0$	*user input*

Base Plate Data:

Plate Allowable Strength:	$Fy_{bp} := 60 \cdot 10^3 \cdot \frac{lb}{in^2}$	*user input*
Base Plate Thickness:	$PlateThicknessProvide := 2.25 \cdot in$	*user input*
Base Plate Diameter:	$D_{bp} := 77.0 \cdot in$	*user input*
Outer Pole Diameter:	$D_{pole} := 62.0in$	*user input*

Geometric Layout Data:

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

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

Number of Spaces in Quadrant: $N_q := \frac{N}{4}$

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

$$d_i := \left| \begin{array}{l} \theta \leftarrow \frac{360}{N} \cdot \frac{\pi}{180} \\ \text{for } j \in i \\ \quad \left| \begin{array}{l} \theta \leftarrow \theta \cdot i \\ d \leftarrow R \cdot \sin(\theta) \end{array} \right. \end{array} \right. \qquad d = \begin{pmatrix} 9.19 \\ 17.75 \\ 25.10 \\ 30.74 \\ 34.29 \\ 35.50 \end{pmatrix} \text{in}$$

Critical Distances For Bending in Plate:

$MomentArm_1 := d_6 - \frac{D_{pole}}{2}$ $\qquad MomentArm_1 = 4.5\,\text{in}$

$MomentArm_2 := d_5 - \frac{D_{pole}}{2}$ $\qquad MomentArm_2 = 3.29\,\text{in}$

$EffectiveWidth := 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2}$ $\qquad EffectiveWidth = 45.66\,\text{in}$

Anchor Bolt Analysis:

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

$$\Sigma d := (d_1)^2 \cdot 4 + (d_2)^2 \cdot 4 + (d_3)^2 \cdot 4 + (d_4)^2 \cdot 4 + (d_5)^2 \cdot 4 + (d_6)^2 \cdot 2 \quad \Sigma d = 1.51 \times 10^4\,\text{in}^2$$

Gross Area of Bolt:

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

Net Area of Bolt:

$$A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot \text{in}}{n}\right)^2 \qquad A_n = 3.16\,\text{in}^2$$

Net Diameter:

$$D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} \qquad D_n = 2.01\,\text{in}$$

Radius of Gyration of Bolt:

$$r := \frac{D_n}{4} \qquad r = 0.5\,\text{in}$$

Section Modulus of Bolt:

$$S_x := \frac{\pi \cdot D_n^{\,3}}{32} \qquad S_x = 0.79\,\text{in}^3$$

Anchor Bolt Bending Stress:

Maximum Applied Bending:

$$M_x := \left(\frac{\text{Shear}}{N}\right) \cdot l \qquad M_x = 0.39\,\text{kips} \cdot \text{ft}$$

$$f_{bx} := \frac{M_x}{S_x} \qquad f_{bx} = 5.98\,\text{ksi}$$

Allowable Bending

$$F_{bx} := 1.33 \cdot 0.60 \cdot Fy \qquad F_{bx} = 59.85\,\text{ksi}$$

Note: 1.33 increase allowed per TIA/EIA

Check Tensile Forces:

Allowable Tensile Force:

$AllowableTension := 1.33 \cdot (0.33 \cdot A_g \cdot F_u)$ AllowableTension = 174.51 kips

Note: 1.33 increase allowed per TIA/EIA

Applied Tension:

$MaxTension := \frac{OM \cdot d_{N_q}}{\Sigma d} - \frac{Axial}{N}$ MaxTension = 104.54 kips

Check Stresses:

$StressRatio := \frac{MaxTension}{AllowableTension}$ StressRatio = 0.6

$Condition := if(StressRatio \leq 1.0, "Not Overstressed", "Overstressed")$

Condition = "Not Overstressed"

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: (conservative)

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

Allowable Compressive Force:

$$K := 0.65$$

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

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

$F_a := 1.33 \cdot F_a$ Note: 1.33 increase allowed per TIA/EIA $\qquad F_a = 59.85\,\text{ksi}$

Applied Compressive Force:

$$\text{MaxCompression} := \frac{OM \cdot d_{N_q}}{\Sigma d} + \frac{\text{Axial}}{N} \qquad \text{MaxCompression} = 108.87\,\text{kips}$$

$$f_a := \frac{\text{MaxCompression}}{A_n} \qquad f_a = 34.43\,\text{ksi}$$

Check Combined Stresses:

$$\text{StressRatio} := \frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \qquad \text{StressRatio} = 0.675$$

Condition := if(StressRatio ≤ 1.0, "Not Overstressed", "Overstressed")

Condition = "Not Overstressed"

Base Plate Analysis:

Force From Bolt(s):

$$C_1 := \frac{OM \cdot d_6}{\Sigma d} + \frac{Axial}{N} \qquad C_1 = 108.87 \times 10^3\,lb$$

$$C_2 := \frac{OM \cdot d_5}{\Sigma d} + \frac{Axial}{N} \qquad C_2 = 105.24 \times 10^3\,lb$$

Bending Stress In Plate:

$$f_{bp} := \frac{6 \cdot \left(C_1 \cdot MomentArm_1 + 2 \cdot C_2 \cdot MomentArm_2\right)}{EffectiveWidth \cdot PlateThicknessProvide^2} \qquad f_{bp} = 30.69\,ksi$$

Check Stresses:

$$BasePlateRatio := \frac{f_{bp}}{1.33 \cdot 0.75 Fy_{bp}} \qquad BasePlateRatio = 0.51$$

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

BasePlateStress = "Not Over Stress"