STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

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

Daniel F. Caruso
Chairman

November 15, 2007

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

RE: **EM-VER-085-091-108-071011** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify existing telecommunications facilities located at 474 Main Street, Monroe; 29 Bogus Hill Road, New Fairfield; and 85 Quaker Farms Road, Oxford, Connecticut.

Dear Attorney Baldwin:

At a public meeting held on November 5, 2007, the Connecticut Siting Council (Council) acknowledged your notice to modify these existing telecommunications facilities, 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[s] dated October 11, 2007, including the placement of all necessary equipment and shelters within the tower compounds. 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 existing facility sites that would not increase tower heights, extend the boundaries of the tower sites, increase noise levels at the tower site boundaries by six decibels, and increase the total radio frequencies electromagnetic radiation power densities measured at the tower site boundaries to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. These facilities have also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on these towers.

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

Thank you for your attention and cooperation.

Very truly yours,

Daniel F. Caruso

Daniel F. Caruso
Chairman

DFC/MP/cm

c: The Honorable August A. Palmer, First Selectman, Town of Oxford
Vincent Vizzo, Planning & Zoning Chairman, Town of Oxford
The Honorable Andrew J. Nunn, First Selectman, Town of Monroe
Daniel A. Tuba, Planning Administrator, Town of Monroe
The Honorable John E. Hodge, First Selectman, Town of New Fairfield
Maria Haussherr-Hughes, Zoning Enforcement Officer, Town of New Fairfield
Thomas J. Regan, Esq., Brown Rudnick Berlack Israels LLP
Christopher B. Fisher, Esq., Cuddy & Feder LLP
Optasite

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Daniel F. Caruso
Chairman

October 12, 2007

The Honorable Andrew J. Nunn
First Selectman
Town of Monroe
Town Hall
7 Fan Hill Road
Monroe, CT 06468-1800

RE: **EM-VER-085-091-108-071011** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify existing telecommunications facilities located at 474 Main Street, Monroe; 29 Bogus Hill Road, New Fairfield; and 85 Quaker Farms Road, Oxford, Connecticut.

Dear Mr. Nunn:

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 5, 2007, at 1:30 p.m. in Hearing Room Two, 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 2, 2007.

Thank you for your cooperation and consideration.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/cm

Enclosure: Notice of Intent

c: Daniel A. Tuba, Planning Administrator, Town of Monroe

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-085-091-108-071011

October 11, 2007

Via Hand Delivery

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

Re: **Notice of Exempt Modification**
85 Quaker Farms Road, Oxford, Connecticut
29 Bogus Hill Road, New Fairfield, Connecticut
474 Main Street, Monroe, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") intends to install antennas on each of the existing self-supporting monopole towers at the telecommunications facilities referenced above. 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 the Chief Elected Officials of each affected municipality. Pursuant to Siting Council directive a copy of the letter is also being sent to each of the owners of the property on which the towers are located.

Oxford Facility

The Oxford facility consists of an existing 150-foot self-supporting monopole tower capable of supporting multiple carriers within a fenced compound at 85 Quaker Farms Road in Oxford. The tower is currently shared by AT&T with antennas located at the 150-foot level and at the 140-foot level; and T-Mobile with antennas at the 130-foot level on the tower. Cellco intends to install twelve (12) panel-type antennas (six cellular and six PCS) at the 120-foot level on the tower and place a 12' x 30' equipment shelter on the ground near the base of the tower within the existing fenced compound. Attached behind Tab 1 are Project Plans for the proposed Cellco

facility; a new cumulative power density table; and a structural analysis stating that the tower can support the proposed modifications.

New Fairfield Facility

The New Fairfield facility consists of an existing 130-foot self-supporting monopole tower capable of supporting multiple carriers within a fenced compound at 29 Bogus Hill Road in New Fairfield. The tower is currently shared by AT&T with antennas located at the 130-foot level on the tower. Cellco intends to install twelve (12) panel-type antennas (six cellular and six PCS) at the 120-foot level on the tower and place a 12' x 30' equipment shelter on the ground near the base of the tower within the existing fenced compound. Attached behind Tab 2 are Project Plans for the proposed Cellco facility; a new cumulative power density table; and a structural analysis stating that the tower can support the proposed modifications.

Monroe Facility

The Monroe facility consists of an existing 195-foot self-supporting monopole tower capable of supporting multiple carriers within a fenced compound at 474 Main Street in Monroe. The tower is currently shared by T-Mobile with antennas located at the 195-foot level, AT&T with antennas at the 140-foot level; and Sprint Nextel with antennas at the 150-foot level on the tower. Cellco intends to install twelve (12) panel-type antennas (six cellular and six PCS) at the 160-foot level on the tower and place a 12' x 30' equipment shelter on the ground near the base of the tower within the existing fenced compound. Attached behind Tab 3 are Project Plans for the proposed Cellco facility; a new cumulative power density table; and a structural analysis stating that the tower can support the proposed modifications.

The planned modifications at each of these existing facilities falls 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 the increase in the overall height of any of the existing structures.

2. Cellco's proposed 12' x 30' equipment shelter will be placed within the existing fenced compound at the Oxford or New Fairfield facilities. At the Monroe facility the installation of Cellco's equipment structure will require an extension to the fenced compound but will not require the expansion of the leased area. The proposed modifications will not, therefore, require an expansion of the site boundary.

3. The proposed modifications will not increase noise levels at the facilities 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.

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

Sincerely,

Kenneth C. Baldwin

Attachments
Copy to:

August A. Palmer III, Oxford First Selectman
William and Elaine W. Shiavi
John Hodge, New Fairfield First Selectman
Southwestern CT Girl Scouts Council
Andrew Nunn, Monroe First Selectman
Birdseys Plain LLC
Sandy M. Carter
Michelle Kababik

Cellco Partnership

d.b.a. verizon wireless

WIRELESS COMMUNICATIONS FACILITY

SEYMOUR WEST CT

85 QUAKER FARMS ROAD

OXFORD, CT 06478

SITE DIRECTIONS

FROM: 99 EAST RIVER DRIVE, EAST HARTFORD, CONNECTICUT TO: 85 QUAKER FARMS ROAD, OXFORD, CONNECTICUT

1. START AT 99 E RIVER DR TOWARD E RIVER DR	<0.1 MI.
2. TURN LEFT ON E RIVER DR.	0.3 MI.
3. TURN LEFT ON CONNECTICUT BLVD (US-44).	0.2 MI.
4. TAKE RAMP ONTO I-84 W.	38.0 MI.
5. TAKE EXIT #16/SOUTHFORD.	0.2 MI.
6. TURN LEFT ON CT-188.	8.3 MI.
7. ARRIVE AT 85 QUAKER FARMS RD.	

GENERAL NOTES

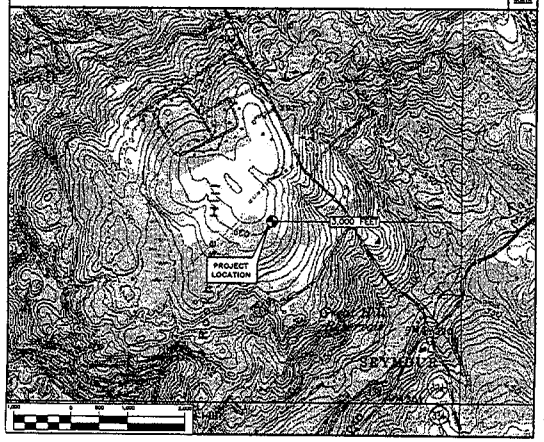
1. PROPOSED ANTENNA LOCATIONS AND HEIGHTS PROVIDED BY CELLCO PARTNERSHIP.

PROJECT SCOPE

1. THE PROPOSED SCOPE OF WORK GENERALLY INCLUDES THE INSTALLATION OF A 12'x30' PREFABRICATED WIRELESS EQUIPMENT SHELTER ON A CONCRETE FOUNDATION WITHIN THE EXISTING WIRELESS COMMUNICATIONS COMPOUND.
2. A TOTAL OF SIX (6) DIRECTIONAL PANEL ANTENNAS ARE PROPOSED TO BE MOUNTED ON AN EXISTING 149' TALL MONOPOLE TOWER AT A RAD CENTER ELEVATION OF 120' ABOVE THE EXISTING TOWER BASE PLATE.
3. ELECTRIC AND TELCO UTILITIES SHALL BE ROUTED UNDERGROUND TO THE PROPOSED EQUIPMENT SHELTER FROM AN EXISTING UTILITY BACKBOARD LOCATED OUTSIDE THE ENTRANCE TO THE FENCED COMPOUND.

VICINITY MAP

SCALE: 1" = 1000'



PROJECT SUMMARY

SITE NAME:	SEYMOUR WEST CT
SITE ADDRESS:	85 QUAKER FARMS ROAD OXFORD, CT 06478
LESSEE/ TENANT:	CELLCO PARTNERSHIP d.b.a. VERIZON WIRELESS 99 EAST RIVER DRIVE EAST HARTFORD, CT 06108
CONTACT PERSON:	SANDY CARTER CELLCO PARTNERSHIP (860) 803-6219
TOWER COORDINATES:	LATITUDE: 41°-23'-2.39" LONGITUDE: 73°-08'-14.53" COORDINATES BASED ON 2C CERTIFICATION LETTER PREPARED BY MARTINEZ COUCH AND ASSOCIATES L.L.C., DATED 9/19/2007.

SHEET INDEX

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

REVISIONS		
A	09/13/07	CSC - REVIEW
00	10/09/07	CSC

Cellco Partnership d.b.a. verizon wireless

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

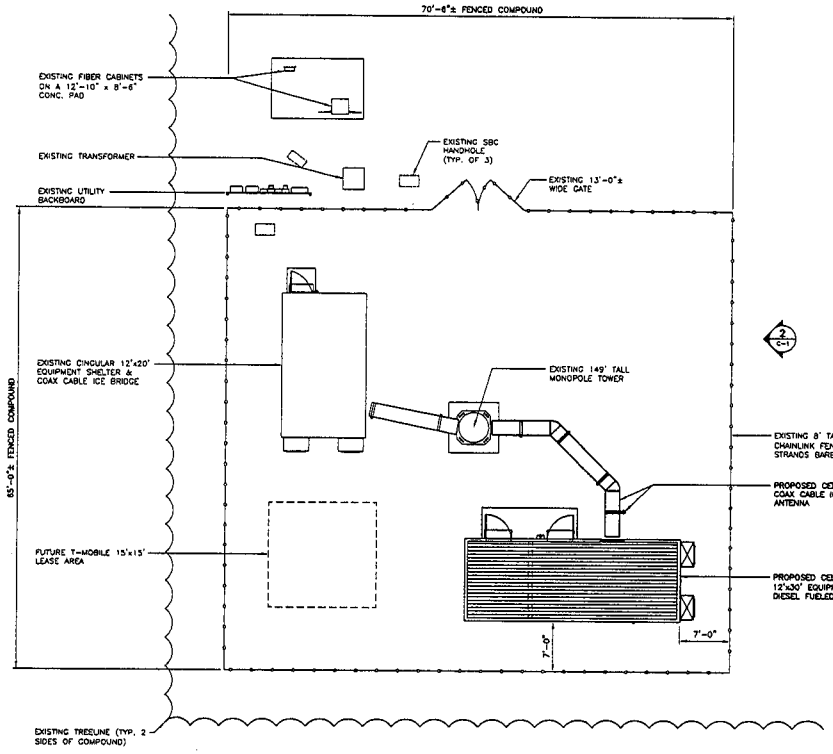
SEYMOUR WEST CT
85 QUAKER FARMS ROAD
OXFORD, CT 06478

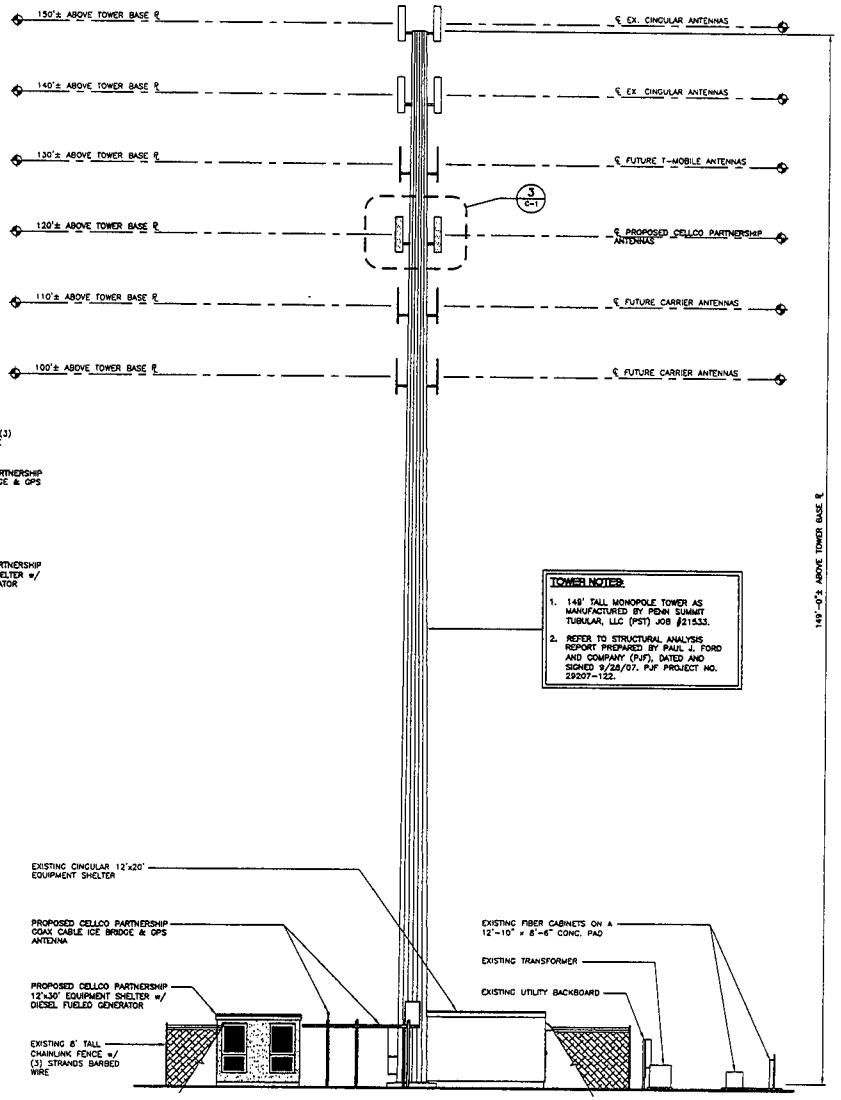
PROJECT NO:	07066
DRAWN BY:	DEB
CHECKED BY:	CFC
SCALE:	AS NOTED
DATE:	08/06/07

TITLE SHEET

T-1

DWG. 1 OF 2

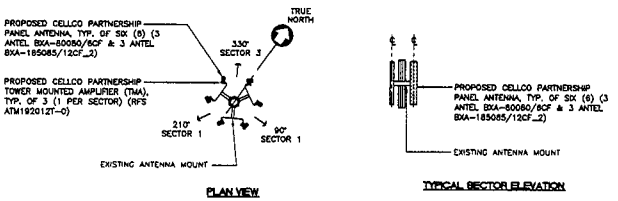




1 C-1 **COMPOUND PLAN**
SCALE: 1/8" = 1'-0"

TRUE NORTH

GRAPHIC SCALE
(IN FEET)
1/8 inch = 1 ft.



PLAN VIEW

TYPICAL SECTOR ELEVATION

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

2 C-1 **EAST ELEVATION**
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE
(IN FEET)
1/4 inch = 1 ft.

REVISIONS		
A	08/13/07	CSC - REVIEW
00	10/09/07	CSC

Cellco Partnership
d.b.a. verizon wireless

NATCOMM
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p: 203.488.0580
f: 203.488.8587
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e: info@nat-eng.com
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Branford, CT 06405

SEYMOUR WEST CT

85 QUAKER FARMS ROAD
OXFORD, CT 06478

PROJECT NO:	07066
DRAWN BY:	DEB
CHECKED BY:	CFC
SCALE:	AS NOTED
DATE:	08/06/07

COMPOUND PLAN AND ELEVATION

C-1
DWG. 2 OF 2

	General	Power	Density					
Site Name: Seymour W								
Tower Height: Verizon @ 120Ft.								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*New Cingular	2	296	150	0.0095	850	0.5667	1.67%	
*New Cingular	1	427	150	0.0068	1900	1.0000	0.68%	
*New Cingular	2	296	140	0.0109	850	0.5667	1.92%	
*New Cingular	1	427	140	0.0078	1900	1.0000	0.78%	
*T-Mobile	8	113	129	0.0195	1945	1.0000	1.95%	
Verizon	**9**	**285**	**120**	**0.0640**	**880**	**0.5866**	**10.92%**	
Verizon PCS	**3**	**400**	**120**	**0.0300**	**1900**	**1.0000**	**3.00%**	
								16.65%
* Source: Siting Council								

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street · Suite 1500 · Columbus, Ohio 43215

Structural Analysis Report

PJF Project No.: **29207-122**
PennSummit: 70071 / 21533

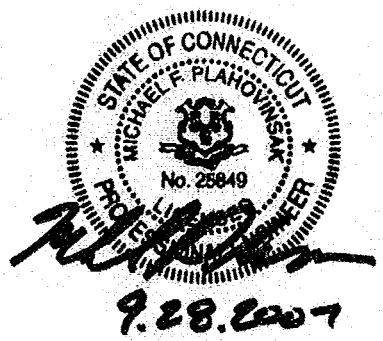
Structure: Existing 149-ft Monopole

Owner: AT&T Wireless
Manufacturer: PennSummit Tubular, LLC (2004)
Location: New Haven Co., Connecticut
Site Name: Seymour West

Prepared For:

Natcomm, Inc.
63-2 North Branford Road
Branford, CT 06405
Attn: Dan Bolan

September 28, 2007



Analyzed by:
Michael F. Plahovinsak, P.E.
Project Manager
mplahovinsak@pjfweb.com

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215

Executive Summary

Design Standard:

Paul J. Ford and Company has analyzed the existing monopole in accordance with the 2000-2006 International Building Code and the Telecommunications Industry Association Standard TIA/EIA-222-F for the following *fastest mile* design wind velocities:

80 mph Basic Wind Velocity without ice
69 mph Basic Wind Velocity with 1/2" radial ice
50 mph (Operational) Basic Wind Velocity without ice

Antenna Loads:

The existing monopole was analyzed for the following antenna loading:

Status	Elevation	Description	Coax	Owner
Existing	150'	(6) Allgon 7920 Panel Flush Mounts	(6) 1 5/8"	Cingular
Existing	140'	(6) Allgon 7920 Panel Flush Mounts	(6) 1 5/8"	Cingular
Existing	130'	(3) RFS APX16DWV-16DWV Panel w/ (12) TMA Flush Mounts	(12) 1 5/8"	T-Mobile
Proposed	120'	(3) Antel BXA-80080/6 + (3) 185085/12 w/ (3) TMA Flush Mounts	(6) 1 5/8"	Verizon
Existing	109'	<empty> Flush Mounts		Future
Existing	99'	<empty> Flush Mounts		Future

Coaxial cable for this analysis was assumed internally mounted and not exposed to the wind.

Results:

The monopole and foundation have sufficient capacity to support the above antenna loading while meeting the local minimum wind requirements.

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215

Project Description:

Paul J. Ford and Company has analyzed the existing monopole in accordance with the 2000-2006 International Building Code (Sec. 3108.4) and the Telecommunications Industry Association / Electronic Industry Association, TIA/EIA-222-F, "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures." The TIA/EIA standard was developed by professional engineers experienced in the design of communication structures.

Pole History:

Paul J. Ford and Company designed the monopole and foundation for PennSummit Tubular, LLC in 2004 per PJF #29205-063. The monopole was designed in accordance with TIA/EIA-222-F for an 85 mph design wind for the following antenna loading:

Elevation	Description
149'	(6) Allgon 7820 Panel 10' T-Arm Mounts
139'	(9) 48" x 12" x 3" Panel 10' T-Arm Mounts
129'	(9) 48" x 12" x 3" Panel 10' T-Arm Mounts
119'	(9) 48" x 12" x 3" Panel 10' T-Arm Mounts
109'	(6) 48" x 12" x 3" Panel Tri-Arm Support Assembly
99'	(6) 48" x 12" x 3" Panel Tri-Arm Support Assembly

Paul J. Ford and Company completed a subsequent analysis of the structure in 2006 per PJF #31206-105.

Structural Analysis:

Our analysis was completed according to the requirements of the 2000-2006 International Building Code (Sec. 3108.4) and the recommendations of the TIA/EIA-222-F 1996. This standard recommends a minimum design wind velocity of 80 mph (no ice) for New Haven County. If ice accumulation is considered, the TIA/EIA standard allows the design wind pressure reduced by 25% in conjunction with ½" radial ice. Our analysis was completed in compliance with the minimum wind requirements under the following load cases:

80 mph Basic Wind Velocity without ice
69 mph Basic Wind Velocity with 1/2" radial ice
50 mph (Operational) Basic Wind Velocity without ice

Existing & Proposed Antenna Loading:

Our analysis was completed using the following existing and proposed antenna loading:

Status	Elevation	Description	Coax	Owner
Existing	150'	(6) Allgon 7920 Panel Flush Mounts	(6) 1 5/8"	Cingular
Existing	140'	(6) Allgon 7920 Panel Flush Mounts	(6) 1 5/8"	Cingular
Existing	130'	(3) RFS APX16DWV-16DWV Panel w/ (12) TMA Flush Mounts	(12) 1 5/8"	T-Mobile
Proposed	120'	(3) Antel BXA-80080/6 + (3) 185085/12 w/ (3) TMA Flush Mounts	(6) 1 5/8"	Verizon
Existing	109'	<empty> Flush Mounts		Future
Existing	99'	<empty> Flush Mounts		Future

Coaxial cable for this analysis was assumed internally mounted and not exposed to the wind.

Results:

When the new antenna configuration is considered, the monopole has the following stress characteristics under the minimum wind criteria:

Member	Percent Capacity
Shaft #1	26.2%
Shaft #2	51.6%
Shaft #3	54.8%
Shaft #4	51.7%
Base Plate	33.8%
Anchor Bolts	54.4%

The existing pad & pier foundation has sufficient capacity to support the new loading while maintaining the minimum required safety factors. ☑

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215

Conclusion:

The existing monopole and foundation have sufficient capacity to support the new antenna loading while meeting the minimum wind requirements of this analysis.

If you have any questions concerning our analysis, or if we can be of further service to you, please feel free to contact us at (614) 221-6679.

Sincerely,

Paul J. Ford and Company

Michael F. Plahovinsak, P.E.
Project Manager

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215

STANDARD CONDITIONS FOR FURNISHING OF PROFESSIONAL ENGINEERING SERVICES ON EXISTING STRUCTURES BY PAUL J. FORD AND COMPANY

1. Paul J. Ford and Company has not made a field inspection to verify the monopole dimensions or the antenna/coax loading. If the existing conditions are not as represented on these sketches, we should be contacted immediately to reevaluate any conclusions stated in this report.

2. No allowance was made for any damaged, missing, or rusted monopole parts. The analysis of this pole assumes that no physical deterioration has occurred in any of the structural components of the pole and that all the pole members have the same capacity as the day the pole was erected.

3. It is not possible to have all of the very detailed information to perform a thorough analysis of every structural sub-component of an existing monopole. The structural analysis provided by Paul J. Ford and Company verifies the adequacy of the main structural members of the monopole. Paul J. Ford and Company provides a limited scope of service in that we cannot verify the adequacy of every weld, plate, connection detail, etc.

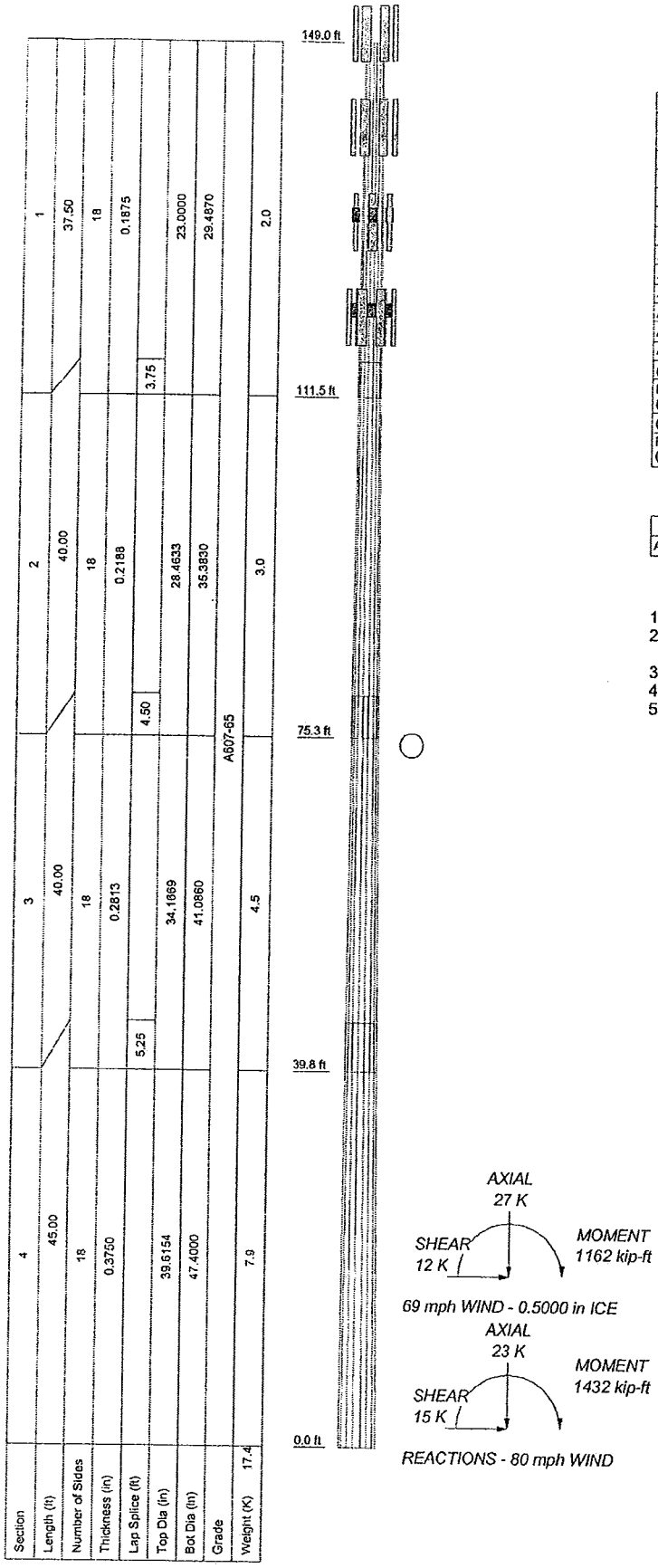
4. It is the owner's responsibility to determine the amount of ice accumulation, if any, that shall be used in the structural analysis.

5. The monopole has been analyzed according to the minimum basic design wind velocity recommended by the Electronics Industry Association Standard ANSI/EIA-222-F. If the owner or local or state agencies require a higher design wind velocity, Paul J. Ford and Company should be made aware of this requirement.

6. The enclosed sketches are a schematic representation of the monopole we have analyzed. If any material is fabricated from these sketches, the fabricator shall be responsible for field verifying the existing conditions and for proper fit and clearance in the field.

7. Miscellaneous items such as antenna mounts, etc., have not been designed or detailed as part of our work. We recommend that material of adequate size and strength be purchased from a reputable tower manufacturer.

8. Installation of new hand hole ports and/or cable access ports will not reduce the structural capacity of the monopole shaft, if the hand hole frames and/or cable access ports are properly designed and installed in accordance to proper procedures. Paul J. Ford and Company recommends that new hand holes and/or cable access port hole frames be purchased from the original pole manufacturer. The new hand hole and/or cable access frames shall be installed per the original manufacturer's installation procedures. Paul J. Ford and Company will design and provide installation procedures for new hand holes and/or cable access ports if required, as an additional scope of services.



Section	1	2	3	4
Length (ft)	37.50	40.00	40.00	45.00
Number of Sides	18	18	18	18
Thickness (in)	0.1875	0.2188	0.2813	0.3750
Lap Splice (ft)	3.75	4.50	5.25	
Top Dia (in)	23.0000	28.4633	34.1669	39.6154
Bot Dia (in)	29.4870	35.3830	41.0860	47.4000
Grade	A607-65			
Weight (K)	17.4	2.0	3.0	4.5	7.9

69 mph WIND - 0.5000 in ICE

REACTIONS - 80 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Allgon 7920.xx (Cingular)	150	(4) Remec G20057A1 (T-Mobile)	130
Allgon 7920.xx (Cingular)	150	RFS APX16DWV-16DWVL (T-Mobile)	130
Allgon 7920.xx (Cingular)	150		
Allgon 7920.xx (Cingular)	150	(4) Remec G20057A1 (T-Mobile)	130
Allgon 7920.xx (Cingular)	150	(3) Antenna Flush Mount	130
Allgon 7920.xx (Cingular)	150	Antel BXA-80080/6CF (Verizon)	120
(3) Antenna Flush Mount	150	Antel BXA-185085/12CF (Verizon)	120
Allgon 7920.xx (Cingular)	140	TMA (Verizon)	120
Allgon 7920.xx (Cingular)	140	Antel BXA-80080/6CF (Verizon)	120
Allgon 7920.xx (Cingular)	140	Antel BXA-185085/12CF (Verizon)	120
Allgon 7920.xx (Cingular)	140	TMA (Verizon)	120
Allgon 7920.xx (Cingular)	140	Antel BXA-80080/6CF (Verizon)	120
Allgon 7920.xx (Cingular)	140	Antel BXA-185085/12CF (Verizon)	120
(3) Antenna Flush Mount	140	TMA (Verizon)	120
RFS APX16DWV-16DWVL (T-Mobile)	130	(3) Antenna Flush Mount	120
		(3) Antenna Flush Mount	109
(4) Remec G20057A1 (T-Mobile)	130	(3) 2.5" OD X 6' Antenna Mount Pipe	109
RFS APX16DWV-16DWVL (T-Mobile)	130	(3) Antenna Flush Mount	99
		(3) 2.5" OD X 6' Antenna Mount Pipe	99

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A607-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower is located in New Haven County, Connecticut.
2. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 54.8%

Paul J Ford and Company
250 E. Broad Street Suite 1500
Columbus, OH 43215
Phone: 614.221.6679
FAX: 614.448.4105

Job: *149-ft Monopole / 29207-122*			
Project: *Seymour West*			
Client: PennSummit (70071 / 21533)	Drawn by: Michael Plahovinsak	App'd:	
Code: TIA/EIA-222-F	Date: 09/28/07	Scale: NTS	
Path: G:\TOWER\292 PennSummit\29207-122.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:

Tower is located in New Haven County, Connecticut.
Basic wind speed of 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
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.

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	149.00-111.50	37.50	3.75	18	23.0000	29.4870	0.1875	0.7500	A607-65 (65 ksi)
L2	111.50-75.25	40.00	4.50	18	28.4633	35.3830	0.2188	0.8752	A607-65 (65 ksi)
L3	75.25-39.75	40.00	5.25	18	34.1669	41.0860	0.2813	1.1250	A607-65 (65 ksi)
L4	39.75-0.00	45.00		18	39.6154	47.4000	0.3750	1.5000	A607-65 (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	23.3548	13.5763	892.6152	8.0984	11.6840	76.3964	1786.4050	6.7894	3.7180	19.829
	29.9419	17.4369	1891.1513	10.4013	14.9794	126.2502	3784.7910	8.7201	4.8597	25.918
L2	29.5611	19.6150	1976.9394	10.0268	14.4594	136.7239	3956.4802	9.8094	4.6245	21.136
	35.9288	24.4205	3814.9945	12.4833	17.9746	212.2441	7635.0088	12.2126	5.8423	26.702
L3	35.4844	30.2493	4388.1924	12.0294	17.3568	252.8226	8782.1590	15.1275	5.5184	19.621
	41.7198	36.4259	7662.4750	14.4857	20.8717	367.1229	15335.0324	18.2164	6.7361	23.951
L4	41.1487	46.7059	9086.0476	13.9303	20.1246	451.4894	18184.0508	23.3574	6.3123	16.833
	48.1312	55.9715	15637.3103	16.6939	24.0792	649.4115	31295.1965	27.9911	7.6824	20.486

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

Tower Elevation ft	Gusset Area (per face) ft²	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 149.00-111.50				1	1	1		
L2 111.50-75.25				1	1	1		
L3 75.25-39.75				1	1	1		
L4 39.75-0.00				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 ft²/ft	Weight plf
LDF7-50A (1 5/8" foam) (Cingular) ***	C	No	Inside Pole	149.00 - 0.00	6	No Ice	0.00	0.92
						1/2" Ice	0.00	0.92
LDF7-50A (1 5/8" foam) (Cingular) ***	C	No	Inside Pole	140.00 - 0.00	6	No Ice	0.00	0.92
						1/2" Ice	0.00	0.92
LDF7-50A (1 5/8" foam) (T-Mobile) ***	C	No	Inside Pole	130.00 - 0.00	12	No Ice	0.00	0.92
						1/2" Ice	0.00	0.92
LDF7-50A (1 5/8" foam) (Verizon)	C	No	Inside Pole	120.00 - 0.00	6	No Ice	0.00	0.92
						1/2" Ice	0.00	0.92

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L1	149.00-111.50	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	0.62
L2	111.50-75.25	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.00
L3	75.25-39.75	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	0.000	0.98
L4	39.75-0.00	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	0.000	1.10

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L1	149.00-111.50	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
		C		0.000	0.000	0.000	0.000	0.62
L2	111.50-75.25	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.00
L3	75.25-39.75	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	0.000	0.98
L4	39.75-0.00	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	0.000	1.10

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight K
Allgon 7920.xx (Cingular)	A	From Face	1.00 1.00 0.00	0.0000	150.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx (Cingular)	A	From Face	1.00 -1.00 0.00	0.0000	150.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx (Cingular)	B	From Face	1.00 1.00 0.00	0.0000	150.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx (Cingular)	B	From Face	1.00 -1.00 0.00	0.0000	150.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx (Cingular)	C	From Face	1.00 1.00 0.00	0.0000	150.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx (Cingular)	C	From Face	1.00 -1.00 0.00	0.0000	150.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
(3) Antenna Flush Mount	C	None		0.0000	150.00	No Ice 1/2" Ice	0.30 0.40	0.30 0.40	0.02 0.02
***									
Allgon 7920.xx (Cingular)	A	From Face	1.00 1.00 0.00	0.0000	140.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx (Cingular)	A	From Face	1.00 -1.00 0.00	0.0000	140.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx (Cingular)	B	From Face	1.00 1.00 0.00	0.0000	140.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx (Cingular)	B	From Face	1.00 -1.00 0.00	0.0000	140.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx (Cingular)	C	From Face	1.00 1.00 0.00	0.0000	140.00	No Ice 1/2" Ice	7.95 8.39	2.07 2.39	0.06 0.10
Allgon 7920.xx	C	From Face	1.00	0.0000	140.00	No Ice	7.95	2.07	0.06

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
(Cingular)			-1.00 0.00			1/2" Ice	8.39	2.39	0.10
(3) Antenna Flush Mount	C	None		0.0000	140.00	No Ice	0.30	0.30	0.02
						1/2" Ice	0.40	0.40	0.02
***									
RFS APX16DWV-16DWVL (T-Mobile)	A	From Face	1.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	6.65 7.08	2.80 3.13	0.04 0.07
(4) Remec G20057A1 (T-Mobile)	A	From Face	1.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.82 0.95	0.39 0.49	0.01 0.02
RFS APX16DWV-16DWVL (T-Mobile)	B	From Face	1.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	6.65 7.08	2.80 3.13	0.04 0.07
(4) Remec G20057A1 (T-Mobile)	B	From Face	1.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.82 0.95	0.39 0.49	0.01 0.02
RFS APX16DWV-16DWVL (T-Mobile)	C	From Face	1.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	6.65 7.08	2.80 3.13	0.04 0.07
(4) Remec G20057A1 (T-Mobile)	C	From Face	1.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.82 0.95	0.39 0.49	0.01 0.02
(3) Antenna Flush Mount	C	None		0.0000	130.00	No Ice	0.30	0.30	0.02
						1/2" Ice	0.40	0.40	0.02
***									
Antel BXA-80080/6CF (Verizon)	A	From Face	1.00 1.00 0.00	0.0000	120.00	No Ice 1/2" Ice	7.91 8.45	3.93 4.37	0.02 0.06
Antel BXA-185085/12CF (Verizon)	A	From Face	1.00 -1.00 0.00	0.0000	120.00	No Ice 1/2" Ice	4.77 5.22	3.64 4.08	0.02 0.04
TMA (Verizon)	A	From Face	1.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	1.50 2.00	1.50 2.00	0.05 0.07
Antel BXA-80080/6CF (Verizon)	B	From Face	1.00 1.00 0.00	0.0000	120.00	No Ice 1/2" Ice	7.91 8.45	3.93 4.37	0.02 0.06
Antel BXA-185085/12CF (Verizon)	B	From Face	1.00 -1.00 0.00	0.0000	120.00	No Ice 1/2" Ice	4.77 5.22	3.64 4.08	0.02 0.04
TMA (Verizon)	B	From Face	1.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	1.50 2.00	1.50 2.00	0.05 0.07
Antel BXA-80080/6CF (Verizon)	C	From Face	1.00 1.00 0.00	0.0000	120.00	No Ice 1/2" Ice	7.91 8.45	3.93 4.37	0.02 0.06
Antel BXA-185085/12CF (Verizon)	C	From Face	1.00 -1.00 0.00	0.0000	120.00	No Ice 1/2" Ice	4.77 5.22	3.64 4.08	0.02 0.04
TMA (Verizon)	C	From Face	1.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	1.50 2.00	1.50 2.00	0.05 0.07
(3) Antenna Flush Mount	C	None		0.0000	120.00	No Ice	0.30	0.30	0.02
						1/2" Ice	0.40	0.40	0.02
***									
(3) Antenna Flush Mount	C	None		0.0000	109.00	No Ice	0.30	0.30	0.02

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
(3) 2.5" OD X 6' Antenna Mount Pipe ***	C	None		0.0000	109.00	1/2" Ice	0.40	0.40	0.02
						No Ice	1.50	1.50	0.05
						1/2" Ice	1.97	1.97	0.06
(3) Antenna Flush Mount	C	None		0.0000	99.00	No Ice	0.30	0.30	0.02
						1/2" Ice	0.40	0.40	0.02
(3) 2.5" OD X 6' Antenna Mount Pipe	C	None		0.0000	99.00	No Ice	1.50	1.50	0.05
						1/2" Ice	1.97	1.97	0.06

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 90 deg - No Ice
4	Dead+Wind 180 deg - No Ice
5	Dead+Ice+Temp
6	Dead+Wind 0 deg+Ice+Temp
7	Dead+Wind 90 deg+Ice+Temp
8	Dead+Wind 180 deg+Ice+Temp
9	Dead+Wind 0 deg - Service
10	Dead+Wind 90 deg - Service
11	Dead+Wind 180 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	149 - 111.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	5	-5.28	0.00	0.00
			Max. Mx	3	-3.40	-133.86	0.00
			Max. My	2	-3.40	0.00	133.86
			Max. Vy	3	7.10	-133.86	0.00
			Max. Vx	2	-7.10	0.00	133.86
L2	111.5 - 75.25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	5	-10.28	0.00	0.00
			Max. Mx	3	-7.62	-438.45	0.00
			Max. My	4	-7.62	0.00	-438.45
			Max. Vy	3	9.90	-438.45	0.00
			Max. Vx	4	9.90	0.00	-438.45
L3	75.25 - 39.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	5	-16.31	0.00	0.00
			Max. Mx	3	-12.97	-822.74	0.00
			Max. My	2	-12.97	0.00	822.74
			Max. Vy	3	12.18	-822.74	0.00
			Max. Vx	2	-12.18	0.00	822.74

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L4	39.75 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	5	-27.28	0.00	0.00
			Max. Mx	3	-22.95	-1432.37	0.00
			Max. My	2	-22.95	0.00	1432.37
			Max. Vy	3	14.90	-1432.37	0.00
			Max. Vx	2	-14.90	0.00	1432.37

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	5	27.28	0.00	0.00
	Max. H_x	11	22.96	0.00	-5.82
	Max. H_z	2	22.96	0.00	14.89
	Max. M_x	2	1432.37	0.00	14.89
	Max. M_z	3	1432.37	-14.89	0.00
	Max. Torsion	10	0.00	-5.82	0.00
	Min. Vert	4	22.96	0.00	-14.89
	Min. H_x	3	22.96	-14.89	0.00
	Min. H_z	4	22.96	0.00	-14.89
	Min. M_x	4	-1432.37	0.00	-14.89
	Min. M_z	2	0.00	0.00	14.89
	Min. Torsion	3	0.00	-14.89	0.00

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	22.96	0.00	0.00	0.00	0.00	0.00
Dead+Wind 0 deg - No Ice	22.96	0.00	-14.89	-1432.37	0.00	0.00
Dead+Wind 90 deg - No Ice	22.96	14.89	0.00	0.00	-1432.37	0.00
Dead+Wind 180 deg - No Ice	22.96	0.00	14.89	1432.37	0.00	0.00
Dead+Ice+Temp	27.28	0.00	0.00	0.00	0.00	0.00
Dead+Wind 0 deg+Ice+Temp	27.28	0.00	-11.86	-1162.49	0.00	0.00
Dead+Wind 90 deg+Ice+Temp	27.28	11.86	0.00	0.00	-1162.49	0.00
Dead+Wind 180 deg+Ice+Temp	27.28	0.00	11.86	1162.49	0.00	0.00
Dead+Wind 0 deg - Service	22.96	0.00	-5.82	-559.77	0.00	0.00
Dead+Wind 90 deg - Service	22.96	5.82	0.00	0.00	-559.77	0.00
Dead+Wind 180 deg - Service	22.96	0.00	5.82	559.77	0.00	0.00

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-22.96	0.00	0.00	22.96	0.00	0.000%
2	0.00	-22.96	-14.89	0.00	22.96	14.89	0.009%
3	14.89	-22.96	0.00	-14.89	22.96	0.00	0.009%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
4	0.00	-22.96	14.89	0.00	22.96	-14.89	0.009%
5	0.00	-27.28	0.00	0.00	27.28	0.00	0.000%
6	0.00	-27.28	-11.87	0.00	27.28	11.86	0.002%
7	11.87	-27.28	0.00	-11.86	27.28	0.00	0.002%
8	0.00	-27.28	11.87	0.00	27.28	-11.86	0.002%
9	0.00	-22.96	-5.82	0.00	22.96	5.82	0.004%
10	5.82	-22.96	0.00	-5.82	22.96	0.00	0.004%
11	0.00	-22.96	5.82	0.00	22.96	-5.82	0.004%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	14	0.00010820	0.00012714
3	Yes	14	0.00010820	0.00012714
4	Yes	14	0.00010820	0.00012714
5	Yes	6	0.00000001	0.00000001
6	Yes	16	0.00000001	0.00009124
7	Yes	16	0.00000001	0.00009124
8	Yes	16	0.00000001	0.00009124
9	Yes	14	0.00011053	0.00006311
10	Yes	14	0.00011053	0.00006311
11	Yes	14	0.00011053	0.00006311

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	149 - 111.5	23.881	9	1.3435	0.0000
L2	115.25 - 75.25	14.678	9	1.2130	0.0000
L3	79.75 - 39.75	6.886	9	0.8343	0.0000
L4	45 - 0	2.156	9	0.4361	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.00	Allgon 7920.xx	9	23.881	1.3435	0.0000	48348
140.00	Allgon 7920.xx	9	21.348	1.3216	0.0000	26860
130.00	RFS APX16DWV-16DWVL	9	18.577	1.2901	0.0000	12723
120.00	Antel BXA-80080/6CF	9	15.902	1.2431	0.0000	8335
109.00	(3) Antenna Flush Mount	9	13.125	1.1643	0.0000	6625
99.00	(3) Antenna Flush Mount	9	10.790	1.0675	0.0000	5915

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	149 - 111.5	61.066	2	3.4361	0.0000
L2	115.25 - 75.25	37.540	2	3.1025	0.0000
L3	79.75 - 39.75	17.616	2	2.1343	0.0000
L4	45 - 0	5.517	2	1.1159	0.0000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.00	Allgon 7920.xx	2	61.066	3.4361	0.0000	19024
140.00	Allgon 7920.xx	2	54.591	3.3822	0.0000	10568
130.00	RFS APX16DWV-16DWVL	2	47.510	3.3027	0.0000	5005
120.00	Antel BXA-80080/6CF	2	40.669	3.1812	0.0000	3277
109.00	(3) Antenna Flush Mount	2	33.570	2.9746	0.0000	2603
99.00	(3) Antenna Flush Mount	2	27.600	2.7216	0.0000	2322

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	149 - 111.5 (1)	TP29.487x23x0.1875	37.50	0.00	0.0	38.694	17.0508	-3.40	659.77	0.005
L2	111.5 - 75.25 (2)	TP35.383x28.4633x0.2188	40.00	0.00	0.0	38.207	23.8799	-7.62	912.38	0.008
L3	75.25 - 39.75 (3)	TP41.086x34.1669x0.2813	40.00	0.00	0.0	39.000	35.6152	-12.97	1388.99	0.009
L4	39.75 - 0 (4)	TP47.4x39.6154x0.375	45.00	0.00	0.0	39.000	55.9715	-22.95	2182.89	0.011

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	149 - 111.5 (1)	TP29.487x23x0.1875	133.86	13.308	38.694	0.344	0.00	0.000	38.694	0.000
L2	111.5 - 75.25 (2)	TP35.383x28.4633x0.2188	438.45	25.928	38.207	0.679	0.00	0.000	38.207	0.000
L3	75.25 - 39.75 (3)	TP41.086x34.1669x0.2813	822.74	28.135	39.000	0.721	0.00	0.000	39.000	0.000
L4	39.75 - 0 (4)	TP47.4x39.6154x0.375	1432.37	26.468	39.000	0.679	0.00	0.000	39.000	0.000

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 $\frac{f_{by}}{F_{by}}$

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	149 - 111.5 (1)	TP29.487x23x0.1875	7.10	0.417	26.000	0.032	0.00	0.000	26.000	0.000
L2	111.5 - 75.25 (2)	TP35.383x28.4633x0.2188	9.90	0.415	26.000	0.032	0.00	0.000	26.000	0.000
L3	75.25 - 39.75 (3)	TP41.086x34.1669x0.2813	12.18	0.342	26.000	0.026	0.00	0.000	26.000	0.000
L4	39.75 - 0 (4)	TP47.4x39.6154x0.375	14.90	0.266	26.000	0.020	0.00	0.000	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	149 - 111.5 (1)	0.005	0.344	0.000	0.032	0.000	0.349 ✓	1.333	H1-3+VT ✓
L2	111.5 - 75.25 (2)	0.008	0.679	0.000	0.032	0.000	0.687 ✓	1.333	H1-3+VT ✓
L3	75.25 - 39.75 (3)	0.009	0.721	0.000	0.026	0.000	0.731 ✓	1.333	H1-3+VT ✓
L4	39.75 - 0 (4)	0.011	0.679	0.000	0.020	0.000	0.689 ✓	1.333	H1-3+VT ✓

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	149 - 111.5	Pole	TP29.487x23x0.1875	1	-3.40	879.47	26.2	Pass
L2	111.5 - 75.25	Pole	TP35.383x28.4633x0.2188	2	-7.62	1216.20	51.6	Pass
L3	75.25 - 39.75	Pole	TP41.086x34.1669x0.2813	3	-12.97	1851.52	54.8	Pass
L4	39.75 - 0	Pole	TP47.4x39.6154x0.375	4	-22.95	2909.79	51.7	Pass
						Summary		
						Pole (L3)	54.8	Pass
						RATING =	54.8	Pass

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 500 • Columbus, Ohio 43215
Ph: (614) 221-6679 • Fax1: (614) 221-2540 • Fax2: (614) 221-0166

MONOPOLE BASE PLATE ANALYSIS

TITLE:
SITE:
OWNER:
COMM. NO:
DATE: 28-Sep-07

Number of Sides	18	Stress Increase	1.33
Shaft Dia, DF	47.400 in.	Base Plate Shape	SQUARE
PT-to-PT, DP	48.131 in.		
Min Bolt Circle	51.40 in.	Actual Bolt Circle	54.00 in.

Base Reactions

Moment	1432.0 ft-kips
Axial Load	23.0 kips
Base Elevation	0.0 ft

Bolt Details

Number of Bolts	12
Bolt Diameter	2 1/4 inches
Bolt Type	A615 #18J
Mom. Of Inertia	4374.00 inches^4
Bolt Tension, T	106.07 kips
Allowable Tension	195.00 kips
Bolt Compression, C	107.99 kips
Actual / Allowable Ratio	54.4% ☑

Base Plate Details

Plate Moment, MPL	704.64 inch-kips
Bend Plane, W	27.55 inches
Plate Thickness, t	2.75 inches
Plate Width	53.00 inches
Plate Steel Spec.	ASTM A572 GRADE 60
Plate Steel Grade	60.00 ksi
Actual Stress	20.29 ksi
Allowable Stress	60.00 ksi
Actual / Allowable Ratio	33.8% ☑

Base Plate Analysis Summary

Plate Thickness	2.75 in.	Bolt Circle	54.00 in.
Plate Length	53.00 in.	Bolt Diameter	2.25 in.
Number of Bolts	12	Bolt Type	A615 #18J

SPREAD FOOTING FOR POLES PROGRAM BY PAUL J. FORD and COMPANY

JOB NO. 29207-122 DATE 09-28-2007

INPUT: SPREAD FOOTING (PAD and PIER) FOR POLES

POLE LOADS: POLE WEIGHT = 23.00 kips (pole,antenna,ice,mounts,etc.)
OVERTURNING MOMENT = 1432.00 ft-k (at the top of the pier)
TOTAL HORIZONTAL = 15.00 kips (at the top of the pier)
DESIGN SAFETY FACTOR AGAINST OVERTURNING = 1.50

CONCRETE: CONCRETE STRENGTH = 3000 psi at 28 days
REINFORCING STEEL STRENGTH = 60000 psi (ASTM A615 grade 60)

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

FOOTING SIZE: WIDTH = 21.5 ft LENGTH = 21.5 ft
THICKNESS = 3.00 ft DEPTH = 7.00 ft to bottom
PIERS = 7.00 ft square PIER 0.5 ft above grade
CONCRETE WEIGHT = 150 pcf

OUTPUT: SPREAD FOOTING (PAD and PIER) FOR POLES

VOLUME OF CONCRETE = 1607 ft^3 (59.53 cubic yards)

WEIGHT OF POLE =====> 23.00 kips
WEIGHT OF CONCRETE => 241.09 kips (1607 x 0.150)
WEIGHT OF SOIL =====> 165.30 kips (1653 x 0.100)
TOTAL WEIGHT = 429.39 kips

OVERTURNING MOMENT = 1432.00 ft-k + (15.00 k x 7.50 ft) = 1545 ft-kips
RESISTING MOMENT = 429.39 k x (21.50 ft / 2) = 4616 ft-kips

SAFETY FACTOR = Mresist / O.T.M. = 4616 / 1545 = 2.99 > 1.50 O.K. 50% ✓

ULTIMATE OVERTURNING MOMENT = 1545 ft-k x 1.50 = 2317 ft-kips
ULTIMATE NET SOIL BEARING PRESSURE = 1787 psf

GROSS SOIL BEARING = 2248 psf (includes soil overburden)
SOIL OVERBURDEN = 700 psf (soil overburden)
NET SOIL BEARING = 1548 psf < 4000 psf O.K. 39% ✓

BENDING MOMENT IN PIER = 1432 ft-k +(15.00 k x 4.50 ft) = 1500 ft-kips
AREA OF REINF STEEL REQUIRED IN THE PIER = 15.72 sq in
(.5 % = 35.28 sq in) (24) # 11 42% ✓

BENDING MOMENT IN FOOTING = 1384 ft-kips
FOOTING REINFORCING = 0.60 in^2/ft =
(.18 % = 0.78 in^2/ft) # 10 @ 12" c.c 47% ✓

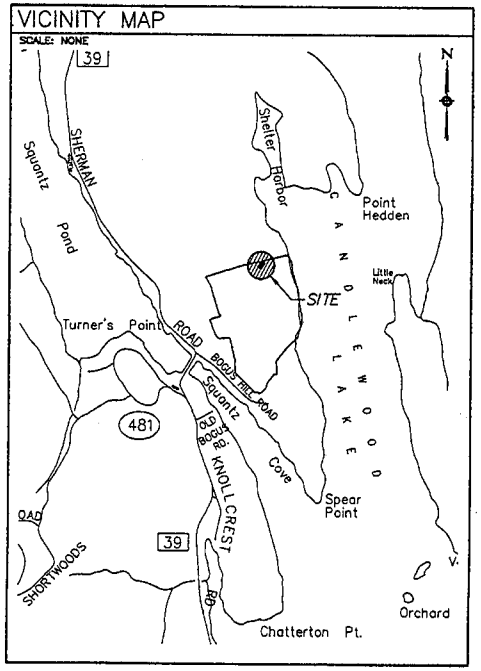
BENDING SHEAR IN THE FOOTING = 322.45 kips
ALLOWABLE BENDING SHEAR = 582.10 kips O.K. 55% ✓

CELLCO PARTNERSHIP
DBA
verizon wireless

NEW FAIRFIELD GIRL SCOUT CAMP

29 BOGUS HILL ROAD
NEW FAIRFIELD, CONNECTICUT 06812

VICINITY MAP



PROJECT SUMMARY

SITE NAME:	NEW FAIRFIELD GIRL SCOUT CAMP
SITE ADDRESS:	29 BOGUS HILL ROAD NEW FAIRFIELD, CONNECTICUT 06812
CONTACT PERSON:	CELLCO PARTNERSHIP DBA VERIZON WIRELESS SANDY CARTER (860) 803-8219
TOWER OWNER:	OPTASITE TOWERS LLC
JURISDICTION:	CONNECTICUT SITING COUNCIL
ARCHITECT:	URS CORPORATION A.E.S. 500 ENTERPRISE DRIVE, SUITE 3B ROCKY HILL, CT 06067
M/E/P ENGINEER:	URS CORPORATION A.E.S. 500 ENTERPRISE DRIVE, SUITE 3B ROCKY HILL, CT 06067

LEGEND

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

ABBREVIATIONS

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

SHEET INDEX

SHT. NO.	DESCRIPTION
T-1	TITLE SHEET – GENERAL NOTES AND LEGEND
SC-1	COMPOUND PLAN, MONOPOLE ELEVATION AND LEGEND

CELLCO PARTNERSHIP
DBA
verizon wireless

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

A&E SEAL

PROJECT NO: 36931091
JOB NO: VZ4-015
DRAWN BY: KAP
CHECKED BY:

ISSUED FOR

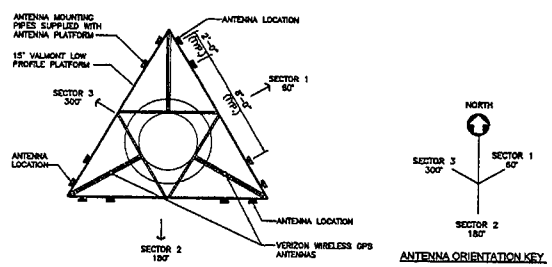
0	09-26-07	REVIEW
1	10-05-07	SITING COUNCIL APPROVAL

NEW FAIRFIELD
GIRL SCOUT CAMP
29 BOGUS HILL ROAD
NEW FAIRFIELD, CONNECTICUT
06812

SCALE: AS NOTED

TITLE SHEET-
GENERAL NOTES
AND LEGEND

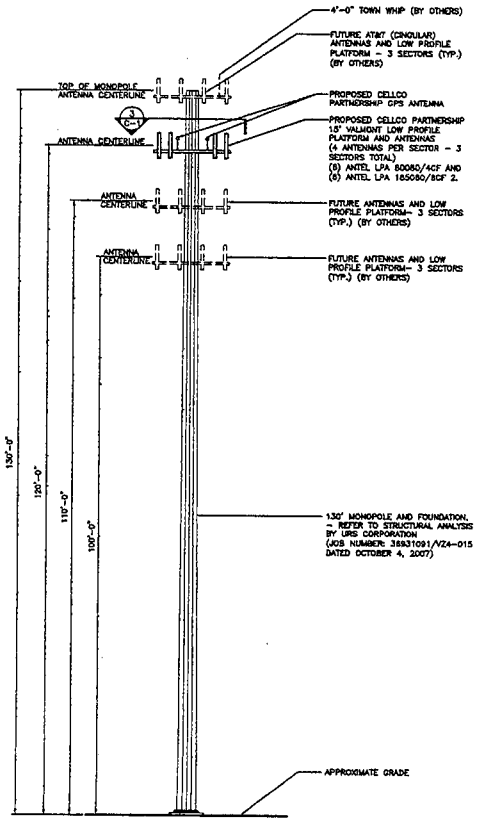
T-1



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

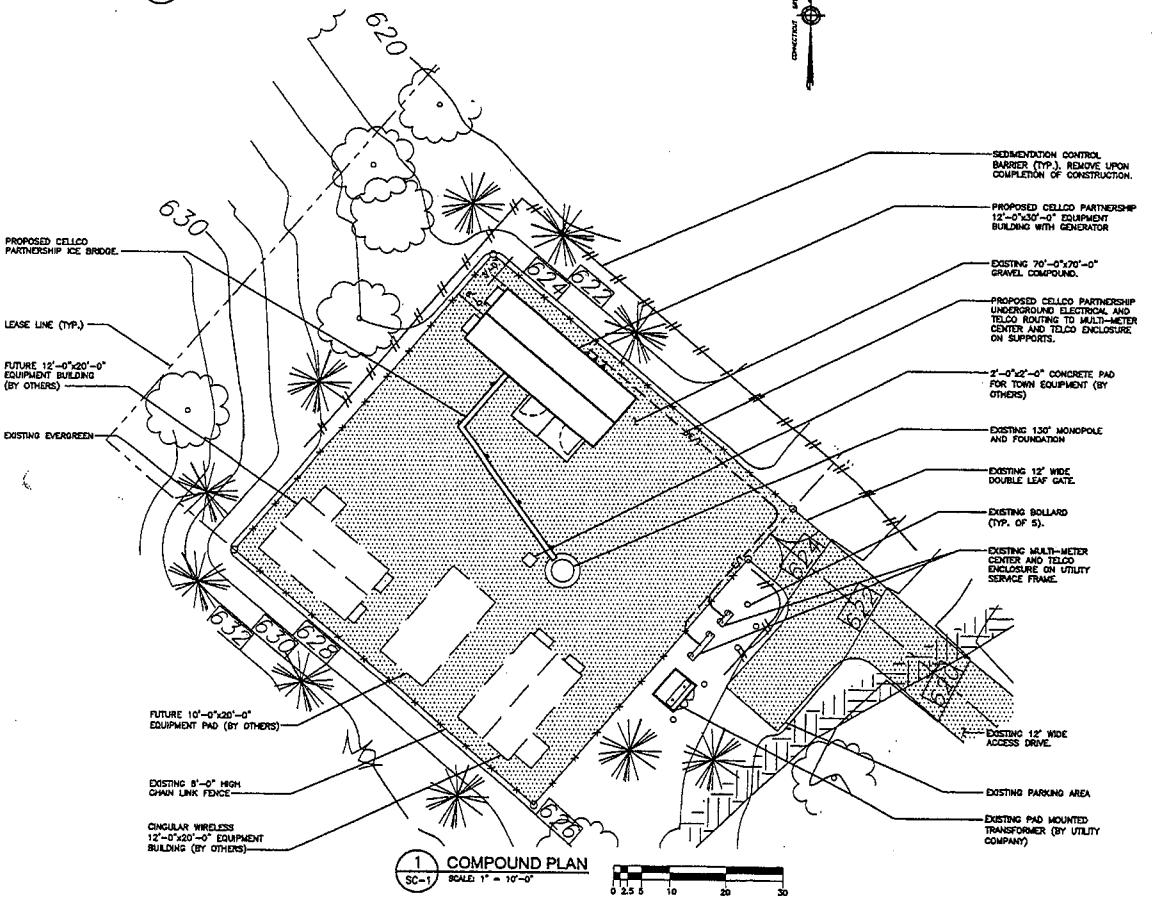
ANTENNA ORIENTATION KEY

LEGEND		
DESCRIPTION	EXISTING	NEW
PROPERTY LINE		
LEASE LINE		
CHAIN LINK FENCE		
CONTOUR LINES	625	
UNDERGROUND UTILITIES		E/T
UTILITY POLE		
TREE LINE		
SEDIMENTATION FENCE		
SPOT ELEVATION	x 400.8	x 800.10
WOOD FENCE		
ROCK/LEDGE		



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

0 2.5 5 10 20 30



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

0 2.5 5 10 20 30

CELLCO PARTNERSHIP
DBA
verizon wireless

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

PROJECT NO: 36931091
JOB NO: VZ4-015
DRAWN BY: KAP
CHECKED BY:

ISSUED FOR		
0	09-26-07	REVIEW
1	10-05-07	SITING COUNCIL APPROVAL

NEW FAIRFIELD GIRL SCOUT CAMP

29 BOGUS HILL ROAD
NEW FAIRFIELD, CONNECTICUT
06812

SCALE: AS NOTED

COMPOUND PLAN, MONOPOLE ELEVATION AND LEGEND

SC-1

	General	Power	Density					
Site Name: Monroe W								
Tower Height: Verizon @ 160Ft.								
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE	Total
*Cingular	6	296	130	0.0378	880	0.5867	6.44%	
*Cingular	3	427	130	0.0273	1930	1.0000	2.73%	
Verizon	**9**	**285**	**160**	**0.0360**	**880**	**0.5866**	**6.14%**	
Verizon PCS	**3**	**400**	**160**	**0.0169**	**1900**	**1.0000**	**1.69%**	
								16.99%
* Source: Siting Council								

DETAILED STRUCTURAL ANALYSIS AND EVALUATION OF EXISTING 130' MONOPOLE TOWER FOR PROPOSED ANTENNA ARRANGEMENT

Site Name: Bogus Hill
29 Bogus Hill Road
New Fairfield, CT 06812

prepared for

verizonwireless

Verizon Wireless
99 East River Drive
East Hartford, Connecticut 06108

prepared by

URS

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

36931091.00000
VZ4-015

October 4, 2007

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

This report summarizes the structural analysis of the existing 130' steel monopole structure, located at 29 Bogus Hill Road in New Fairfield, 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 ½" ice. The antenna loading considered in the analysis consists of all existing and proposed antennas, transmission lines, and ancillary items as outlined in the Introduction Section of this report. The proposed Verizon Wireless installation is as follows:

Proposed Antenna and Mount	Carrier	Antenna Center Elevation
Install: **(6) Antel LPA 80080/4CF,** **(6) Antel LPA 185080/8CF_2 antennas and** **(2) GPS antennas on** **(1) 15' Low Profile antenna platform (Valmont)** **(12) 1 5/8" dia coaxial cables (located within interior of monopole)**	**Verizon (Proposed)**	**@ 120'**

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 geometry and structural member sizes taken from structural design report for a 130' extendable to 150' monopole, prepared by Sabre Communications Corporation on behalf of OPTASITE, Inc., Job number 07-11088, signed and sealed November 8, 2006.

3) Geotechnical evaluation prepared by JGI Eastern, Inc., for Optasite, Inc., dated October 12, 2006.

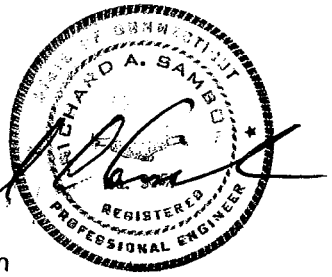
4) Antenna and mount configuration as specified on the following page of this report.

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

If you should have any questions, please call.

Sincerely,

URS Corporation



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

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

2. INTRODUCTION

The subject tower is located at 29 Bogus Hill Road in New Fairfield, CT. The structure is an existing 130' steel monopole extendable to 150', designed and manufactured by Sabre Communications Corporation.

The inventory is summarized in the table below:

Antenna Type	*Carrier*	*Mount*	*Antenna Centerline Elevation*	*Cable*
(12) RFS APX16PV-16PVL antennas (per original design)	(Future)	12' Low Profile Platform with handrail	130'	(15) 1 5/8" coax cables (within monopole)
(6) Antel LPA 80080/4CF and (6) Antel LPA 185080-8CF_2 antennas	**Verizon (proposed)**	**(1) 15' Low-Profile Platform (Valmont)**	**120'**	**(12) 1 5/8" coax cables (within monopole)**
(2) GPS antennas	**Verizon (proposed)**	**(1) 15' Low-Profile Platform (same as above)**	**123' (est)**	**(2) 1/2" coax cables (within monopole)**

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

3. ANALYSIS METHODOLOGY AND LOADING CONDITIONS

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

The analysis was conducted using RISA Tower 5.0. 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. Detailed analysis and calculations for the proposed load condition are provided in section 6 of this report. Additionally, the anchor bolts, base plate, and foundation were found to be structurally adequate.

5. CONCLUSIONS

The results of the analysis indicate that the tower structure is in compliance with 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:

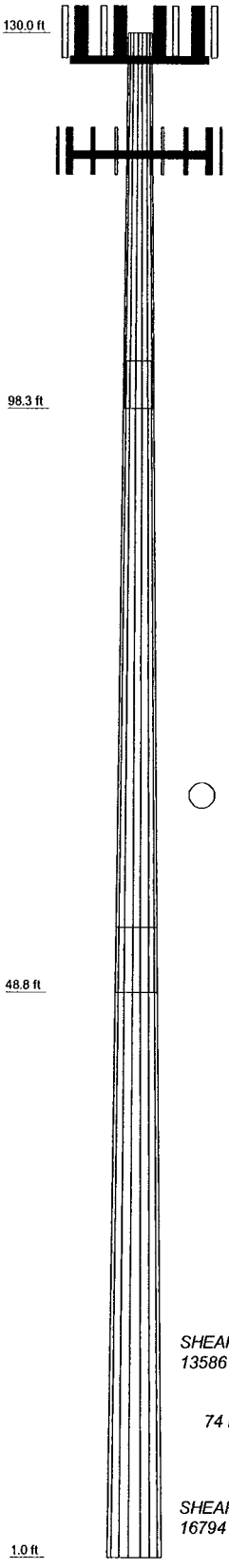
After the Contractor has successfully completed the installation and the work has been accepted, the owner will be responsible for the ongoing and periodic inspection and maintenance of the tower.

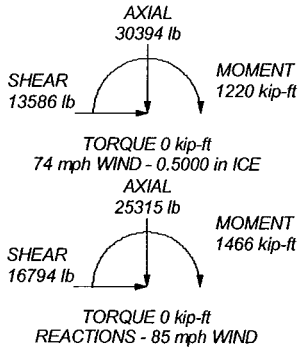
The owner shall refer to TIA/EIA-222-F for recommendations for maintenance and inspection. The frequency of the inspection and maintenance intervals is to be determined by the owner based upon actual site and environmental conditions. It is recommended that a complete and thorough inspection of the entire 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	Length (ft)	Number of Sides	Thickness (in)	Lap Splice (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (lb)
1	31.75	18	0.2500	4.00	24.2200	32.3000		2401.2
2	53.50	18	0.3125	5.50	30.7820	44.3900	A572-65	6730.5
3	53.25	18	0.3125		42.3661	55.9200		8776.1
								17907.8





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(4) APX16PV-16PVL-X (Future)	130	LPA-185080-8CF_2 (VERIZON - proposed)	120
(4) APX16PV-16PVL-X (Future)	130	LPA-185080-8CF_2 (VERIZON - proposed)	120
(4) APX16PV-16PVL-X (Future)	130	LPA-185080-8CF_2 (VERIZON - proposed)	120
Low Profile Platform w/handrails (Future)	128	LPA-185080-8CF_2 (VERIZON - proposed)	120
GPS (VERIZON - proposed)	123	LPA-185080-8CF_2 (VERIZON - proposed)	120
GPS (VERIZON - proposed)	123	Valmont 15' Low Profile Platform (VERIZON - proposed)	120
LPA-80080-4CF (VERIZON - proposed)	120	LPA-80080/4CF (VERIZON - proposed)	120
LPA-80080-4CF (VERIZON - proposed)	120	LPA-80080/4CF (VERIZON - proposed)	120
LPA-80080-4CF (VERIZON - proposed)	120		
LPA-80080/4CF (VERIZON - proposed)	120		
LPA-185080-8CF_2 (VERIZON - proposed)	120		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Fairfield 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: 49.5%

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

Job: ***Existing 130' Monopole***			
Project: ***29 Bogus hill Road, New Fairfield, CT***			
Client: Verizon Wireless	Drawn by: Staff	App'd:	
Code: TIA/EIA-222-F	Date: 10/04/07	Scale: NTS	
Path: P:\08\130 Monopole\ERI Files\VZ4-015 New Fairfield 36931091.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 Fairfield 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 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	130.00-98.25	31.75	4.00	18	24.2200	32.3000	0.2500	1.0000	A572-65 (65 ksi)
L2	98.25-48.75	53.50	5.50	18	30.7820	44.3900	0.3125	1.2500	A572-65 (65 ksi)
L3	48.75-1.00	53.25		18	42.3661	55.9200	0.3125	1.2500	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	24.5936	19.0202	1380.6655	8.5093	12.3038	112.2149	2763.1478	9.5119	3.8227	15.291
	32.7983	25.4317	3300.4145	11.3777	16.4084	201.1418	6605.1717	12.7183	5.2448	20.979
L2	32.2900	30.2220	3544.8053	10.8167	15.6373	226.6894	7094.2750	15.1139	4.8676	15.576
	45.0748	43.7194	10731.1251	15.6475	22.5501	475.8788	21476.3704	21.8638	7.2626	23.24
L3	44.4412	41.7119	9319.7110	14.9290	21.5220	433.0327	18651.6851	20.8599	6.9064	22.101
	56.7827	55.1557	21547.3817	19.7407	28.4074	758.5141	43123.1161	27.5831	9.2919	29.734

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 130.00-98.25				1	1	1		
L2 98.25-48.75				1	1	1		
L3 48.75-1.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 5/8 (Future)	C	No	Inside Pole	130.00 - 4.00	15	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon - proposed)	C	No	Inside Pole	120.00 - 4.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1/2 (Verizon - proposed)	C	No	Inside Pole	120.00 - 4.00	2	No Ice	0.00	0.25
						1/2" Ice	0.00	0.25

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L1	130.00-98.25	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	777.62
L2	98.25-48.75	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	0.000	1414.71
L3	48.75-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1278.95

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	130.00-98.25	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	777.62
L2	98.25-48.75	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	0.000	1414.71
L3	48.75-1.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1278.95

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
(4) APX16PV-16PVL-X (Future)	A	From Face	3.50 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	6.70 7.13	2.00 2.33	40.00 71.34
(4) APX16PV-16PVL-X (Future)	B	From Face	3.50 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	6.70 7.13	2.00 2.33	40.00 71.34
(4) APX16PV-16PVL-X (Future)	C	From Face	3.50 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	6.70 7.13	2.00 2.33	40.00 71.34
Low Profile Platform w/handrails (Future)	C	None		0.0000	128.00	No Ice 1/2" Ice	31.30 40.20	31.30 40.20	1822.00 2452.00
LPA-80080/4CF (VERIZON - proposed)	A	From Face	3.50 6.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	12.00 45.12
LPA-80080/4CF (VERIZON - proposed)	A	From Face	3.50 -6.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	12.00 45.12
LPA-80080-4CF (VERIZON - proposed)	B	From Face	3.50 6.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	12.00 45.12
LPA-80080-4CF (VERIZON - proposed)	B	From Face	3.50 -6.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	12.00 45.12
LPA-80080-4CF (VERIZON - proposed)	C	From Face	3.50 6.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	12.00 45.12
LPA-80080/4CF (VERIZON - proposed)	C	From Face	3.50 -6.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	12.00 45.12
LPA-185080-8CF_2 (VERIZON - proposed)	A	From Face	3.50 4.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	7.00 25.04
LPA-185080-8CF_2 (VERIZON - proposed)	A	From Face	3.50 -4.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	7.00 25.04
LPA-185080-8CF_2 (VERIZON - proposed)	B	From Face	3.50 4.00	0.0000	120.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	7.00 25.04

Description	Face or Leg	Offset Type	Offsets: Horz Lateral / Vert (ft / ft / ft)	Azimuth Adjustment (°)	Placement (ft)		C_AA_A Front (ft^2)	C_AA_A Side (ft^2)	Weight (lb)
			0.00						
LPA-185080-8CF_2 (VERIZON - proposed)	B	From Face	3.50 -4.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	7.00 25.04
LPA-185080-8CF_2 (VERIZON - proposed)	C	From Face	3.50 4.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	7.00 25.04
LPA-185080-8CF_2 (VERIZON - proposed)	C	From Face	3.50 -4.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.09 2.39	2.79 3.09	7.00 25.04
Valmont 15' Low Profile Platform (VERIZON - proposed)	C	None		0.0000	120.00	No Ice 1/2" Ice	17.30 22.10	17.30 22.10	1500.00 2030.00
GPS (VERIZON - proposed)	A	From Face	3.00 0.00 0.00	0.0000	123.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	10.00 15.00
GPS (VERIZON - proposed)	C	From Face	3.00 0.00 0.00	0.0000	123.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	10.00 15.00

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 130.00-98.25	113.53	1.423	26	74.771	A	0.000	74.771	74.771	100.00	0.000	0.000
					B	0.000	74.771		100.00		
					C	0.000	74.771		100.00		
L2 98.25-48.75	72.74	1.253	23	157.141	A	0.000	157.141	157.141	100.00	0.000	0.000
					B	0.000	157.141		100.00		
					C	0.000	157.141		100.00		
L3 48.75-1.00	24.08	1	19	198.334	A	0.000	198.334	198.334	100.00	0.000	0.000
					B	0.000	198.334		100.00		
					C	0.000	198.334		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 130.00-98.25	113.53	1.423	20	0.5000	77.417	A	0.000	77.417	77.417	100.00	0.000	0.000

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
						B	0.000	77.417		100.00		
						C	0.000	77.417		100.00		
L2 98.25-48.75	72.74	1.253	17	0.5000	161.266	A	0.000	161.266	161.266	100.00	0.000	0.000
						B	0.000	161.266		100.00		
						C	0.000	161.266		100.00		
L3 48.75-1.00	24.08	1	14	0.5000	202.313	A	0.000	202.313	202.313	100.00	0.000	0.000
						B	0.000	202.313		100.00		
						C	0.000	202.313		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 130.00-98.25	113.53	1.423	9	74.771	A	0.000	74.771	74.771	100.00	0.000	0.000
					B	0.000	74.771		100.00		
					C	0.000	74.771		100.00		
L2 98.25-48.75	72.74	1.253	8	157.141	A	0.000	157.141	157.141	100.00	0.000	0.000
					B	0.000	157.141		100.00		
					C	0.000	157.141		100.00		
L3 48.75-1.00	24.08	1	6	198.334	A	0.000	198.334	198.334	100.00	0.000	0.000
					B	0.000	198.334		100.00		
					C	0.000	198.334		100.00		

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 130.00-98.25	777.62	2401.25	A	1	0.65	1	1	1	74.771	2160.40	68.04	C
			B	1	0.65	1	1	1	74.771			
			C	1	0.65	1	1	1	74.771			
L2 98.25-48.75	1414.71	6730.46	A	1	0.65	1	1	1	157.141	3980.36	80.41	C
			B	1	0.65	1	1	1	157.141			
			C	1	0.65	1	1	1	157.141			
L3 48.75-1.00	1278.95	8776.10	A	1	0.65	1	1	1	198.334	4085.82	85.57	C
			B	1	0.65	1	1	1	198.334			
			C	1	0.65	1	1	1	198.334			
Sum Weight:	3471.28	17907.81						OTM	622.93 kip-ft	10226.59		

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 130.00-98.25	777.62	2401.25	A	1	0.65	1	1	1	74.771	2160.40	68.04	C
			B	1	0.65	1	1	1	74.771			
			C	1	0.65	1	1	1	74.771			
L2 98.25-48.75	1414.71	6730.46	A	1	0.65	1	1	1	157.141	3980.36	80.41	C
			B	1	0.65	1	1	1	157.141			
			C	1	0.65	1	1	1	157.141			
L3 48.75-1.00	1278.95	8776.10	A	1	0.65	1	1	1	198.334	4085.82	85.57	C
			B	1	0.65	1	1	1	198.334			
			C	1	0.65	1	1	1	198.334			
Sum Weight:	3471.28	17907.81						OTM	622.93 kip-ft	10226.59		

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 130.00-98.25	777.62	2401.25	A	1	0.65	1	1	1	74.771	2160.40	68.04	C
			B	1	0.65	1	1	1	74.771			
			C	1	0.65	1	1	1	74.771			
L2 98.25-48.75	1414.71	6730.46	A	1	0.65	1	1	1	157.141	3980.36	80.41	C
			B	1	0.65	1	1	1	157.141			
			C	1	0.65	1	1	1	157.141			
L3 48.75-1.00	1278.95	8776.10	A	1	0.65	1	1	1	198.334	4085.82	85.57	C
			B	1	0.65	1	1	1	198.334			
			C	1	0.65	1	1	1	198.334			
Sum Weight:	3471.28	17907.81						OTM	622.93 kip-ft	10226.59		

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 130.00-98.25	777.62	2401.25	A	1	0.65	1	1	1	74.771	2160.40	68.04	C
			B	1	0.65	1	1	1	74.771			
			C	1	0.65	1	1	1	74.771			
L2 98.25-48.75	1414.71	6730.46	A	1	0.65	1	1	1	157.141	3980.36	80.41	C
			B	1	0.65	1	1	1	157.141			
			C	1	0.65	1	1	1	157.141			
L3 48.75-1.00	1278.95	8776.10	A	1	0.65	1	1	1	198.334	4085.82	85.57	C
			B	1	0.65	1	1	1	198.334			
			C	1	0.65	1	1	1	198.334			
Sum Weight:	3471.28	17907.81						OTM	622.93 kip-ft	10226.59		

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 130.00-98.25	777.62	2964.80	A	1	0.65	1	1	1	77.417	1677.64	52.84	C
			B	1	0.65	1	1	1	77.417			
			C	1	0.65	1	1	1	77.417			
L2 98.25-48.75	1414.71	7909.52	A	1	0.65	1	1	1	161.266	3063.64	61.89	C
			B	1	0.65	1	1	1	161.266			
			C	1	0.65	1	1	1	161.266			
L3 48.75-1.00	1278.95	10259.69	A	1	0.65	1	1	1	202.313	3125.85	65.46	C
			B	1	0.65	1	1	1	202.313			
			C	1	0.65	1	1	1	202.313			
Sum Weight:	3471.28	21134.02						OTM	480.69 kip-ft	7867.13		

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 130.00-98.25	777.62	2964.80	A	1	0.65	1	1	1	77.417	1677.64	52.84	C
			B	1	0.65	1	1	1	77.417			
			C	1	0.65	1	1	1	77.417			
L2 98.25-48.75	1414.71	7909.52	A	1	0.65	1	1	1	161.266	3063.64	61.89	C
			B	1	0.65	1	1	1	161.266			
			C	1	0.65	1	1	1	161.266			
L3 48.75-1.00	1278.95	10259.69	A	1	0.65	1	1	1	202.313	3125.85	65.46	C
			B	1	0.65	1	1	1	202.313			
			C	1	0.65	1	1	1	202.313			
Sum Weight:	3471.28	21134.02						OTM	480.69 kip-ft	7867.13		

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 130.00-98.25	777.62	2964.80	A	1	0.65	1	1	1	77.417	1677.64	52.84	C
			B	1	0.65	1	1	1	77.417			
			C	1	0.65	1	1	1	77.417			
L2 98.25-48.75	1414.71	7909.52	A	1	0.65	1	1	1	161.266	3063.64	61.89	C
			B	1	0.65	1	1	1	161.266			
			C	1	0.65	1	1	1	161.266			
L3 48.75-1.00	1278.95	10259.69	A	1	0.65	1	1	1	202.313	3125.85	65.46	C
			B	1	0.65	1	1	1	202.313			
			C	1	0.65	1	1	1	202.313			
Sum Weight:	3471.28	21134.02						OTM	480.69 kip-ft	7867.13		

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 130.00-98.25	777.62	2964.80	A	1	0.65	1	1	1	77.417	1677.64	52.84	C
			B	1	0.65	1	1	1	77.417			
			C	1	0.65	1	1	1	77.417			
L2 98.25-48.75	1414.71	7909.52	A	1	0.65	1	1	1	161.266	3063.64	61.89	C
			B	1	0.65	1	1	1	161.266			
			C	1	0.65	1	1	1	161.266			
L3 48.75-1.00	1278.95	10259.69	A	1	0.65	1	1	1	202.313	3125.85	65.46	C
			B	1	0.65	1	1	1	202.313			
			C	1	0.65	1	1	1	202.313			
Sum Weight:	3471.28	21134.02						OTM	480.69 kip-ft	7867.13		

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 130.00-98.25	777.62	2401.25	A	1	0.65	1	1	1	74.771	747.54	23.54	C
			B	1	0.65	1	1	1	74.771			
			C	1	0.65	1	1	1	74.771			
L2 98.25-48.75	1414.71	6730.46	A	1	0.65	1	1	1	157.141	1377.29	27.82	C
			B	1	0.65	1	1	1	157.141			
			C	1	0.65	1	1	1	157.141			
L3 48.75-1.00	1278.95	8776.10	A	1	0.65	1	1	1	198.334	1413.78	29.61	C
			B	1	0.65	1	1	1	198.334			
			C	1	0.65	1	1	1	198.334			
Sum Weight:	3471.28	17907.81						OTM	215.55 kip-ft	3538.61		

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 130.00-98.25	777.62	2401.25	A	1	0.65	1	1	1	74.771	747.54	23.54	C
			B	1	0.65	1	1	1	74.771			
			C	1	0.65	1	1	1	74.771			
L2 98.25-48.75	1414.71	6730.46	A	1	0.65	1	1	1	157.141	1377.29	27.82	C
			B	1	0.65	1	1	1	157.141			
			C	1	0.65	1	1	1	157.141			
L3 48.75-1.00	1278.95	8776.10	A	1	0.65	1	1	1	198.334	1413.78	29.61	C
			B	1	0.65	1	1	1	198.334			
			C	1	0.65	1	1	1	198.334			
Sum Weight:	3471.28	17907.81						OTM	215.55	3538.61		

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
									kip-ft			

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 130.00-98.25	777.62	2401.25	A	1	0.65	1	1	1	74.771	747.54	23.54	C
			B	1	0.65	1	1	1	74.771			
			C	1	0.65	1	1	1	74.771			
L2 98.25-48.75	1414.71	6730.46	A	1	0.65	1	1	1	157.141	1377.29	27.82	C
			B	1	0.65	1	1	1	157.141			
			C	1	0.65	1	1	1	157.141			
L3 48.75-1.00	1278.95	8776.10	A	1	0.65	1	1	1	198.334	1413.78	29.61	C
			B	1	0.65	1	1	1	198.334			
			C	1	0.65	1	1	1	198.334			
Sum Weight:	3471.28	17907.81						OTM	215.55 kip-ft	3538.61		

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 130.00-98.25	777.62	2401.25	A	1	0.65	1	1	1	74.771	747.54	23.54	C
			B	1	0.65	1	1	1	74.771			
			C	1	0.65	1	1	1	74.771			
L2 98.25-48.75	1414.71	6730.46	A	1	0.65	1	1	1	157.141	1377.29	27.82	C
			B	1	0.65	1	1	1	157.141			
			C	1	0.65	1	1	1	157.141			
L3 48.75-1.00	1278.95	8776.10	A	1	0.65	1	1	1	198.334	1413.78	29.61	C
			B	1	0.65	1	1	1	198.334			
			C	1	0.65	1	1	1	198.334			
Sum Weight:	3471.28	17907.81						OTM	215.55 kip-ft	3538.61		

Mast Vectors - No Ice

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
L1	130.00-98.25	0	Wind Normal	2160.40	0.00	-2160.40	-243.10	0.00	0.00
		30	Wind 90	2160.40	1080.20	-1870.96	-210.53	-121.55	0.00
		45	Wind 45	2160.40	1527.64	-1527.64	-171.90	-171.90	0.00
		60	Wind 60	2160.40	1870.96	-1080.20	-121.55	-210.53	0.00

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
		90	Wind 90	2160.40	2160.40	0.00	0.00	-243.10	0.00
		120	Wind Normal	2160.40	1870.96	1080.20	121.55	-210.53	0.00
		135	Wind 45	2160.40	1527.64	1527.64	171.90	-171.90	0.00
		150	Wind 90	2160.40	1080.20	1870.96	210.53	-121.55	0.00
		180	Wind 60	2160.40	0.00	2160.40	243.10	0.00	0.00
		210	Wind 90	2160.40	-1080.20	1870.96	210.53	121.55	0.00
		225	Wind 45	2160.40	-1527.64	1527.64	171.90	171.90	0.00
		240	Wind Normal	2160.40	-1870.96	1080.20	121.55	210.53	0.00
		270	Wind 90	2160.40	-2160.40	0.00	0.00	243.10	0.00
		300	Wind 60	2160.40	-1870.96	-1080.20	-121.55	210.53	0.00
		315	Wind 45	2160.40	-1527.64	-1527.64	-171.90	171.90	0.00
		330	Wind 90	2160.40	-1080.20	-1870.96	-210.53	121.55	0.00
L2	98.25-48.75	0	Wind Normal	3980.36	0.00	-3980.36	-285.53	0.00	0.00
		30	Wind 90	3980.36	1990.18	-3447.09	-247.28	-142.77	0.00
		45	Wind 45	3980.36	2814.54	-2814.54	-201.90	-201.90	0.00
		60	Wind 60	3980.36	3447.09	-1990.18	-142.77	-247.28	0.00
		90	Wind 90	3980.36	3980.36	0.00	0.00	-285.53	0.00
		120	Wind Normal	3980.36	3447.09	1990.18	142.77	-247.28	0.00
		135	Wind 45	3980.36	2814.54	2814.54	201.90	-201.90	0.00
		150	Wind 90	3980.36	1990.18	3447.09	247.28	-142.77	0.00
		180	Wind 60	3980.36	0.00	3980.36	285.53	0.00	0.00
		210	Wind 90	3980.36	-1990.18	3447.09	247.28	142.77	0.00
		225	Wind 45	3980.36	-2814.54	2814.54	201.90	201.90	0.00
		240	Wind Normal	3980.36	-3447.09	1990.18	142.77	247.28	0.00
		270	Wind 90	3980.36	-3980.36	0.00	0.00	285.53	0.00
		300	Wind 60	3980.36	-3447.09	-1990.18	-142.77	247.28	0.00
		315	Wind 45	3980.36	-2814.54	-2814.54	-201.90	201.90	0.00
		330	Wind 90	3980.36	-1990.18	-3447.09	-247.28	142.77	0.00
L3	48.75-1.00	0	Wind Normal	4085.82	0.00	-4085.82	-94.29	0.00	0.00
		30	Wind 90	4085.82	2042.91	-3538.43	-81.66	-47.15	0.00
		45	Wind 45	4085.82	2889.11	-2889.11	-66.68	-66.68	0.00
		60	Wind 60	4085.82	3538.43	-2042.91	-47.15	-81.66	0.00
		90	Wind 90	4085.82	4085.82	0.00	0.00	-94.29	0.00
		120	Wind Normal	4085.82	3538.43	2042.91	47.15	-81.66	0.00
		135	Wind 45	4085.82	2889.11	2889.11	66.68	-66.68	0.00
		150	Wind 90	4085.82	2042.91	3538.43	81.66	-47.15	0.00
		180	Wind 60	4085.82	0.00	4085.82	94.29	0.00	0.00
		210	Wind 90	4085.82	-2042.91	3538.43	81.66	47.15	0.00
		225	Wind 45	4085.82	-2889.11	2889.11	66.68	66.68	0.00
		240	Wind Normal	4085.82	-3538.43	2042.91	47.15	81.66	0.00
		270	Wind 90	4085.82	-4085.82	0.00	0.00	94.29	0.00
		300	Wind 60	4085.82	-3538.43	-2042.91	-47.15	81.66	0.00
		315	Wind 45	4085.82	-2889.11	-2889.11	-66.68	66.68	0.00
		330	Wind 90	4085.82	-2042.91	-3538.43	-81.66	47.15	0.00

Mast Totals - No Ice

Wind Azimuth °	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
0	0.00	-10226.59	-622.93	0.00	0.00
30	5113.29	-8856.48	-539.47	-311.46	0.00
45	7231.29	-7231.29	-440.48	-440.48	0.00
60	8856.48	-5113.29	-311.46	-539.47	0.00
90	10226.59	0.00	0.00	-622.93	0.00
120	8856.48	5113.29	311.46	-539.47	0.00
135	7231.29	7231.29	440.48	-440.48	0.00

Wind Azimuth °	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
150	5113.29	8856.48	539.47	-311.46	0.00
180	0.00	10226.59	622.93	0.00	0.00
210	-5113.29	8856.48	539.47	311.46	0.00
225	-7231.29	7231.29	440.48	440.48	0.00
240	-8856.48	5113.29	311.46	539.47	0.00
270	-10226.59	0.00	0.00	622.93	0.00
300	-8856.48	-5113.29	-311.46	539.47	0.00
315	-7231.29	-7231.29	-440.48	440.48	0.00
330	-5113.29	-8856.48	-539.47	311.46	0.00

Mast Vectors - With Ice

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
L1	130.00-98.25	0	Wind Normal	1677.64	0.00	-1677.64	-188.78	0.00	0.00
		30	Wind 90	1677.64	838.82	-1452.88	-163.49	-94.39	0.00
		45	Wind 45	1677.64	1186.27	-1186.27	-133.49	-133.49	0.00
		60	Wind 60	1677.64	1452.88	-838.82	-94.39	-163.49	0.00
		90	Wind 90	1677.64	1677.64	0.00	0.00	-188.78	0.00
		120	Wind Normal	1677.64	1452.88	838.82	94.39	-163.49	0.00
		135	Wind 45	1677.64	1186.27	1186.27	133.49	-133.49	0.00
		150	Wind 90	1677.64	838.82	1452.88	163.49	-94.39	0.00
		180	Wind 60	1677.64	0.00	1677.64	188.78	0.00	0.00
		210	Wind 90	1677.64	-838.82	1452.88	163.49	94.39	0.00
		225	Wind 45	1677.64	-1186.27	1186.27	133.49	133.49	0.00
		240	Wind Normal	1677.64	-1452.88	838.82	94.39	163.49	0.00
		270	Wind 90	1677.64	-1677.64	0.00	0.00	188.78	0.00
		300	Wind 60	1677.64	-1452.88	-838.82	-94.39	163.49	0.00
		315	Wind 45	1677.64	-1186.27	-1186.27	-133.49	133.49	0.00
		330	Wind 90	1677.64	-838.82	-1452.88	-163.49	94.39	0.00
L2	98.25-48.75	0	Wind Normal	3063.64	0.00	-3063.64	-219.77	0.00	0.00
		30	Wind 90	3063.64	1531.82	-2653.19	-190.33	-109.89	0.00
		45	Wind 45	3063.64	2166.32	-2166.32	-155.40	-155.40	0.00
		60	Wind 60	3063.64	2653.19	-1531.82	-109.89	-190.33	0.00
		90	Wind 90	3063.64	3063.64	0.00	0.00	-219.77	0.00
		120	Wind Normal	3063.64	2653.19	1531.82	109.89	-190.33	0.00
		135	Wind 45	3063.64	2166.32	2166.32	155.40	-155.40	0.00
		150	Wind 90	3063.64	1531.82	2653.19	190.33	-109.89	0.00
		180	Wind 60	3063.64	0.00	3063.64	219.77	0.00	0.00
		210	Wind 90	3063.64	-1531.82	2653.19	190.33	109.89	0.00
		225	Wind 45	3063.64	-2166.32	2166.32	155.40	155.40	0.00
		240	Wind Normal	3063.64	-2653.19	1531.82	109.89	190.33	0.00
		270	Wind 90	3063.64	-3063.64	0.00	0.00	219.77	0.00
		300	Wind 60	3063.64	-2653.19	-1531.82	-109.89	190.33	0.00
		315	Wind 45	3063.64	-2166.32	-2166.32	-155.40	155.40	0.00
		330	Wind 90	3063.64	-1531.82	-2653.19	-190.33	109.89	0.00
L3	48.75-1.00	0	Wind Normal	3125.85	0.00	-3125.85	-72.14	0.00	0.00
		30	Wind 90	3125.85	1562.93	-2707.07	-62.47	-36.07	0.00
		45	Wind 45	3125.85	2210.31	-2210.31	-51.01	-51.01	0.00
		60	Wind 60	3125.85	2707.07	-1562.93	-36.07	-62.47	0.00
		90	Wind 90	3125.85	3125.85	0.00	0.00	-72.14	0.00
		120	Wind Normal	3125.85	2707.07	1562.93	36.07	-62.47	0.00
		135	Wind 45	3125.85	2210.31	2210.31	51.01	-51.01	0.00
		150	Wind 90	3125.85	1562.93	2707.07	62.47	-36.07	0.00
		180	Wind 60	3125.85	0.00	3125.85	72.14	0.00	0.00
		210	Wind 90	3125.85	-1562.93	2707.07	62.47	36.07	0.00

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
		225	Wind 45	3125.85	-2210.31	2210.31	51.01	51.01	0.00
		240	Wind Normal	3125.85	-2707.07	1562.93	36.07	62.47	0.00
		270	Wind 90	3125.85	-3125.85	0.00	0.00	72.14	0.00
		300	Wind 60	3125.85	-2707.07	-1562.93	-36.07	62.47	0.00
		315	Wind 45	3125.85	-2210.31	-2210.31	-51.01	51.01	0.00
		330	Wind 90	3125.85	-1562.93	-2707.07	-62.47	36.07	0.00

Mast Totals - With Ice

Wind Azimuth °	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
0	0.00	-7867.13	-480.69	0.00	0.00
30	3933.56	-6813.13	-416.29	-240.34	0.00
45	5562.90	-5562.90	-339.90	-339.90	0.00
60	6813.13	-3933.56	-240.34	-416.29	0.00
90	7867.13	0.00	0.00	-480.69	0.00
120	6813.13	3933.56	240.34	-416.29	0.00
135	5562.90	5562.90	339.90	-339.90	0.00
150	3933.56	6813.13	416.29	-240.34	0.00
180	0.00	7867.13	480.69	0.00	0.00
210	-3933.56	6813.13	416.29	240.34	0.00
225	-5562.90	5562.90	339.90	339.90	0.00
240	-6813.13	3933.56	240.34	416.29	0.00
270	-7867.13	0.00	0.00	480.69	0.00
300	-6813.13	-3933.56	-240.34	416.29	0.00
315	-5562.90	-5562.90	-339.90	339.90	0.00
330	-3933.56	-6813.13	-416.29	240.34	0.00

Mast Vectors - Service

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
L1	130.00-98.25	0	Wind Normal	747.54	0.00	-747.54	-84.12	0.00	0.00
		30	Wind 90	747.54	373.77	-647.39	-72.85	-42.06	0.00
		45	Wind 45	747.54	528.59	-528.59	-59.48	-59.48	0.00
		60	Wind 60	747.54	647.39	-373.77	-42.06	-72.85	0.00
		90	Wind 90	747.54	747.54	0.00	0.00	-84.12	0.00
		120	Wind Normal	747.54	647.39	373.77	42.06	-72.85	0.00
		135	Wind 45	747.54	528.59	528.59	59.48	-59.48	0.00
		150	Wind 90	747.54	373.77	647.39	72.85	-42.06	0.00
		180	Wind 60	747.54	0.00	747.54	84.12	0.00	0.00
		210	Wind 90	747.54	-373.77	647.39	72.85	42.06	0.00
		225	Wind 45	747.54	-528.59	528.59	59.48	59.48	0.00
		240	Wind Normal	747.54	-647.39	373.77	42.06	72.85	0.00
		270	Wind 90	747.54	-747.54	0.00	0.00	84.12	0.00
		300	Wind 60	747.54	-647.39	-373.77	-42.06	72.85	0.00
		315	Wind 45	747.54	-528.59	-528.59	-59.48	59.48	0.00
		330	Wind 90	747.54	-373.77	-647.39	-72.85	42.06	0.00
L2	98.25-48.75	0	Wind Normal	1377.29	0.00	-1377.29	-98.80	0.00	0.00
		30	Wind 90	1377.29	688.64	-1192.77	-85.56	-49.40	0.00

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
		45	Wind 45	1377.29	973.89	-973.89	-69.86	-69.86	0.00
		60	Wind 60	1377.29	1192.77	-688.64	-49.40	-85.56	0.00
		90	Wind 90	1377.29	1377.29	0.00	0.00	-98.80	0.00
		120	Wind Normal	1377.29	1192.77	688.64	49.40	-85.56	0.00
		135	Wind 45	1377.29	973.89	973.89	69.86	-69.86	0.00
		150	Wind 90	1377.29	688.64	1192.77	85.56	-49.40	0.00
		180	Wind 60	1377.29	0.00	1377.29	98.80	0.00	0.00
		210	Wind 90	1377.29	-688.64	1192.77	85.56	49.40	0.00
		225	Wind 45	1377.29	-973.89	973.89	69.86	69.86	0.00
		240	Wind Normal	1377.29	-1192.77	688.64	49.40	85.56	0.00
		270	Wind 90	1377.29	-1377.29	0.00	0.00	98.80	0.00
		300	Wind 60	1377.29	-1192.77	-688.64	-49.40	85.56	0.00
		315	Wind 45	1377.29	-973.89	-973.89	-69.86	69.86	0.00
		330	Wind 90	1377.29	-688.64	-1192.77	-85.56	49.40	0.00
L3	48.75-1.00	0	Wind Normal	1413.78	0.00	-1413.78	-32.63	0.00	0.00
		30	Wind 90	1413.78	706.89	-1224.37	-28.26	-16.31	0.00
		45	Wind 45	1413.78	999.69	-999.69	-23.07	-23.07	0.00
		60	Wind 60	1413.78	1224.37	-706.89	-16.31	-28.26	0.00
		90	Wind 90	1413.78	1413.78	0.00	0.00	-32.63	0.00
		120	Wind Normal	1413.78	1224.37	706.89	16.31	-28.26	0.00
		135	Wind 45	1413.78	999.69	999.69	23.07	-23.07	0.00
		150	Wind 90	1413.78	706.89	1224.37	28.26	-16.31	0.00
		180	Wind 60	1413.78	0.00	1413.78	32.63	0.00	0.00
		210	Wind 90	1413.78	-706.89	1224.37	28.26	16.31	0.00
		225	Wind 45	1413.78	-999.69	999.69	23.07	23.07	0.00
		240	Wind Normal	1413.78	-1224.37	706.89	16.31	28.26	0.00
		270	Wind 90	1413.78	-1413.78	0.00	0.00	32.63	0.00
		300	Wind 60	1413.78	-1224.37	-706.89	-16.31	28.26	0.00
		315	Wind 45	1413.78	-999.69	-999.69	-23.07	23.07	0.00
		330	Wind 90	1413.78	-706.89	-1224.37	-28.26	16.31	0.00

Mast Totals - Service

Wind Azimuth °	V_x lb	V_z lb	OTM_x kip-ft	OTM_z kip-ft	Torque kip-ft
0	0.00	-3538.61	-215.55	0.00	0.00
30	1769.31	-3064.53	-186.67	-107.77	0.00
45	2502.18	-2502.18	-152.41	-152.41	0.00
60	3064.53	-1769.31	-107.77	-186.67	0.00
90	3538.61	0.00	0.00	-215.55	0.00
120	3064.53	1769.31	107.77	-186.67	0.00
135	2502.18	2502.18	152.41	-152.41	0.00
150	1769.31	3064.53	186.67	-107.77	0.00
180	0.00	3538.61	215.55	0.00	0.00
210	-1769.31	3064.53	186.67	107.77	0.00
225	-2502.18	2502.18	152.41	152.41	0.00
240	-3064.53	1769.31	107.77	186.67	0.00
270	-3538.61	0.00	0.00	215.55	0.00
300	-3064.53	-1769.31	-107.77	186.67	0.00
315	-2502.18	-2502.18	-152.41	152.41	0.00
330	-1769.31	-3064.53	-186.67	107.77	0.00

Force Totals

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	17907.81					
Bracing Weight	0.00					
Total Member Self-Weight	17907.81			0.02	0.04	
Total Weight	25315.09			0.02	0.04	
Wind 0 deg - No Ice		0.00	-16793.64	-1440.34	0.04	-0.16
Wind 30 deg - No Ice		8396.82	-14543.72	-1247.36	-720.14	-0.09
Wind 45 deg - No Ice		11874.90	-11874.90	-1018.46	-1018.45	-0.05
Wind 60 deg - No Ice		14543.72	-8396.82	-720.16	-1247.35	0.00
Wind 90 deg - No Ice		16793.64	0.00	0.02	-1440.32	0.09
Wind 120 deg - No Ice		14543.72	8396.82	720.20	-1247.35	0.16
Wind 135 deg - No Ice		11874.90	11874.90	1018.51	-1018.45	0.18
Wind 150 deg - No Ice		8396.82	14543.72	1247.40	-720.14	0.19
Wind 180 deg - No Ice		0.00	16793.64	1440.38	0.04	0.16
Wind 210 deg - No Ice		-8396.82	14543.72	1247.40	720.21	0.09
Wind 225 deg - No Ice		-11874.90	11874.90	1018.51	1018.52	0.05
Wind 240 deg - No Ice		-14543.72	8396.82	720.20	1247.42	0.00
Wind 270 deg - No Ice		-16793.64	0.00	0.02	1440.39	-0.09
Wind 300 deg - No Ice		-14543.72	-8396.82	-720.16	1247.42	-0.16
Wind 315 deg - No Ice		-11874.90	-11874.90	-1018.46	1018.52	-0.18
Wind 330 deg - No Ice		-8396.82	-14543.72	-1247.36	720.21	-0.19
Member Ice	3226.21					
Total Weight Ice	30394.35			0.03	0.05	
Wind 0 deg - Ice		0.00	-13586.21	-1192.32	0.05	-0.18
Wind 30 deg - Ice		6793.10	-11766.00	-1032.58	-596.12	-0.10
Wind 45 deg - Ice		9606.90	-9606.90	-843.09	-843.07	-0.05
Wind 60 deg - Ice		11766.00	-6793.10	-596.15	-1032.56	0.00
Wind 90 deg - Ice		13586.21	0.00	0.03	-1192.30	0.10
Wind 120 deg - Ice		11766.00	6793.10	596.21	-1032.56	0.18
Wind 135 deg - Ice		9606.90	9606.90	843.15	-843.07	0.20
Wind 150 deg - Ice		6793.10	11766.00	1032.64	-596.12	0.21
Wind 180 deg - Ice		0.00	13586.21	1192.38	0.05	0.18
Wind 210 deg - Ice		-6793.10	11766.00	1032.64	596.23	0.10
Wind 225 deg - Ice		-9606.90	9606.90	843.15	843.17	0.05
Wind 240 deg - Ice		-11766.00	6793.10	596.21	1032.66	0.00
Wind 270 deg - Ice		-13586.21	0.00	0.03	1192.41	-0.10
Wind 300 deg - Ice		-11766.00	-6793.10	-596.15	1032.66	-0.18
Wind 315 deg - Ice		-9606.90	-9606.90	-843.09	843.17	-0.20
Wind 330 deg - Ice		-6793.10	-11766.00	-1032.58	596.23	-0.21
Total Weight	25315.09			0.02	0.04	
Wind 0 deg - Service		0.00	-5810.95	-498.37	0.04	-0.06
Wind 30 deg - Service		2905.47	-5032.43	-431.60	-249.16	-0.03
Wind 45 deg - Service		4108.96	-4108.96	-352.40	-352.38	-0.02
Wind 60 deg - Service		5032.43	-2905.47	-249.18	-431.59	0.00
Wind 90 deg - Service		5810.95	0.00	0.02	-498.36	0.03
Wind 120 deg - Service		5032.43	2905.47	249.22	-431.59	0.06
Wind 135 deg - Service		4108.96	4108.96	352.44	-352.38	0.06
Wind 150 deg - Service		2905.47	5032.43	431.64	-249.16	0.06
Wind 180 deg - Service		0.00	5810.95	498.41	0.04	0.06
Wind 210 deg - Service		-2905.47	5032.43	431.64	249.23	0.03
Wind 225 deg - Service		-4108.96	4108.96	352.44	352.45	0.02
Wind 240 deg - Service		-5032.43	2905.47	249.22	431.66	0.00
Wind 270 deg - Service		-5810.95	0.00	0.02	498.43	-0.03
Wind 300 deg - Service		-5032.43	-2905.47	-249.18	431.66	-0.06
Wind 315 deg - Service		-4108.96	-4108.96	-352.40	352.45	-0.06
Wind 330 deg - Service		-2905.47	-5032.43	-431.60	249.23	-0.06

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	130 - 98.25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-9013.13	0.05	-0.03
			Max. Mx	14	-6393.19	181.87	-0.02
			Max. My	10	-6393.20	0.03	-181.85
			Max. Vy	14	-8645.02	181.87	-0.02
			Max. Vx	10	8645.01	0.03	-181.85
			Max. Torque	34			0.21
L2	98.25 - 48.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-17743.27	0.05	-0.03
			Max. Mx	14	-14071.16	687.52	-0.02
			Max. My	10	-14071.17	0.04	-687.50
			Max. Vy	14	-12489.03	687.52	-0.02
			Max. Vx	10	12489.03	0.04	-687.50
			Max. Torque	34			0.21
L3	48.75 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-30394.35	0.05	-0.03
			Max. Mx	14	-25307.90	1466.14	-0.02
			Max. My	10	-25307.90	0.04	-1466.13
			Max. Vy	14	-16804.47	1466.14	-0.02
			Max. Vx	10	16804.47	0.04	-1466.13
			Max. Torque	34			0.21

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Pole	Max. Vert	31	30394.35	13586.23	0.00
	Max. H_x	14	25315.09	16793.64	-0.00
	Max. H_z	2	25315.09	0.00	16793.64
	Max. M_x	2	1466.09	0.00	16793.64
	Max. M_z	6	1466.07	-16793.64	-0.00
	Max. Torsion	34	0.21	6793.11	11766.00
	Min. Vert	1	25315.09	0.00	0.00
	Min. H_x	6	25315.09	-16793.64	-0.00
	Min. H_z	10	25315.09	0.00	-16793.64
	Min. M_x	10	-1466.13	0.00	-16793.64
	Min. M_z	14	-1466.14	16793.64	-0.00
	Min. Torsion	26	-0.21	-6793.11	-11766.00

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	25315.09	0.00	0.00	0.02	0.04	0.00
Dead+Wind 0 deg - No Ice	25315.09	-0.00	-16793.64	-1466.09	0.04	-0.16
Dead+Wind 30 deg - No Ice	25315.09	8396.82	-14543.72	-1269.67	-733.02	-0.09
Dead+Wind 45 deg - No Ice	25315.09	11874.90	-11874.90	-1036.67	-1036.66	-0.05
Dead+Wind 60 deg - No Ice	25315.09	14543.72	-8396.82	-733.03	-1269.65	-0.00
Dead+Wind 90 deg - No Ice	25315.09	16793.64	0.00	0.02	-1466.07	0.09
Dead+Wind 120 deg - No Ice	25315.09	14543.72	8396.82	733.07	-1269.65	0.16
Dead+Wind 135 deg - No Ice	25315.09	11874.90	11874.90	1036.72	-1036.66	0.18

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	kip-ft	kip-ft	kip-ft
Dead+Wind 150 deg - No Ice	25315.09	8396.82	14543.72	1269.71	-733.02	0.19
Dead+Wind 180 deg - No Ice	25315.09	-0.00	16793.64	1466.13	0.04	0.16
Dead+Wind 210 deg - No Ice	25315.09	-8396.82	14543.72	1269.71	733.09	0.09
Dead+Wind 225 deg - No Ice	25315.09	-11874.90	11874.90	1036.72	1036.73	0.05
Dead+Wind 240 deg - No Ice	25315.09	-14543.72	8396.82	733.07	1269.72	-0.00
Dead+Wind 270 deg - No Ice	25315.09	-16793.64	0.00	0.02	1466.14	-0.09
Dead+Wind 300 deg - No Ice	25315.09	-14543.72	-8396.82	-733.03	1269.72	-0.16
Dead+Wind 315 deg - No Ice	25315.09	-11874.90	-11874.90	-1036.67	1036.73	-0.18
Dead+Wind 330 deg - No Ice	25315.09	-8396.82	-14543.72	-1269.67	733.09	-0.19
Dead+Ice+Temp	30394.35	0.00	0.00	0.03	0.05	0.00
Dead+Wind 0 deg+Ice+Temp	30394.35	0.00	-13586.23	-1220.12	0.06	-0.18
Dead+Wind 30 deg+Ice+Temp	30394.35	6793.11	-11766.00	-1056.65	-610.02	-0.10
Dead+Wind 45 deg+Ice+Temp	30394.35	9606.90	-9606.90	-862.74	-862.72	-0.05
Dead+Wind 60 deg+Ice+Temp	30394.35	11766.00	-6793.11	-610.04	-1056.62	-0.00
Dead+Wind 90 deg+Ice+Temp	30394.35	13586.23	-0.00	0.03	-1220.09	0.10
Dead+Wind 120 deg+Ice+Temp	30394.35	11766.00	6793.11	610.11	-1056.62	0.18
Dead+Wind 135 deg+Ice+Temp	30394.35	9606.90	9606.90	862.81	-862.72	0.20
Dead+Wind 150 deg+Ice+Temp	30394.35	6793.11	11766.00	1056.71	-610.02	0.21
Dead+Wind 180 deg+Ice+Temp	30394.35	0.00	13586.23	1220.18	0.06	0.18
Dead+Wind 210 deg+Ice+Temp	30394.35	-6793.11	11766.00	1056.71	610.13	0.10
Dead+Wind 225 deg+Ice+Temp	30394.35	-9606.90	9606.90	862.81	862.83	0.05
Dead+Wind 240 deg+Ice+Temp	30394.35	-11766.00	6793.11	610.11	1056.74	-0.00
Dead+Wind 270 deg+Ice+Temp	30394.35	-13586.23	-0.00	0.03	1220.20	-0.10
Dead+Wind 300 deg+Ice+Temp	30394.35	-11766.00	-6793.11	-610.04	1056.74	-0.18
Dead+Wind 315 deg+Ice+Temp	30394.35	-9606.90	-9606.90	-862.74	862.83	-0.20
Dead+Wind 330 deg+Ice+Temp	30394.35	-6793.11	-11766.00	-1056.65	610.13	-0.21
Dead+Wind 0 deg - Service	25315.09	-0.00	-5810.95	-507.38	0.04	-0.06
Dead+Wind 30 deg - Service	25315.09	2905.47	-5032.43	-439.40	-253.67	-0.03
Dead+Wind 45 deg - Service	25315.09	4108.96	-4108.96	-358.77	-358.75	-0.02
Dead+Wind 60 deg - Service	25315.09	5032.43	-2905.47	-253.68	-439.39	-0.00
Dead+Wind 90 deg - Service	25315.09	5810.95	0.00	0.02	-507.37	0.03
Dead+Wind 120 deg - Service	25315.09	5032.43	2905.47	253.72	-439.39	0.06
Dead+Wind 135 deg - Service	25315.09	4108.96	4108.96	358.81	-358.75	0.06
Dead+Wind 150 deg - Service	25315.09	2905.47	5032.43	439.45	-253.67	0.06
Dead+Wind 180 deg - Service	25315.09	-0.00	5810.95	507.43	0.04	0.06
Dead+Wind 210 deg - Service	25315.09	-2905.47	5032.43	439.45	253.74	0.03
Dead+Wind 225 deg - Service	25315.09	-4108.96	4108.96	358.81	358.83	0.02
Dead+Wind 240 deg - Service	25315.09	-5032.43	2905.47	253.72	439.46	-0.00
Dead+Wind 270 deg - Service	25315.09	-5810.95	0.00	0.02	507.44	-0.03
Dead+Wind 300 deg - Service	25315.09	-5032.43	-2905.47	-253.68	439.46	-0.06
Dead+Wind 315 deg - Service	25315.09	-4108.96	-4108.96	-358.77	358.83	-0.06
Dead+Wind 330 deg - Service	25315.09	-2905.47	-5032.43	-439.40	253.74	-0.06

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	-25315.09	0.00	0.00	25315.09	0.00	0.000%
2	0.00	-25315.09	-16793.64	0.00	25315.09	16793.64	0.000%
3	8396.82	-25315.09	-14543.72	-8396.82	25315.09	14543.72	0.000%
4	11874.90	-25315.09	-11874.90	-11874.90	25315.09	11874.90	0.000%
5	14543.72	-25315.09	-8396.82	-14543.72	25315.09	8396.82	0.000%
6	16793.64	-25315.09	0.00	-16793.64	25315.09	-0.00	0.000%
7	14543.72	-25315.09	8396.82	-14543.72	25315.09	-8396.82	0.000%
8	11874.90	-25315.09	11874.90	-11874.90	25315.09	-11874.90	0.000%
9	8396.82	-25315.09	14543.72	-8396.82	25315.09	-14543.72	0.000%
10	0.00	-25315.09	16793.64	0.00	25315.09	-16793.64	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	-8396.82	-25315.09	14543.72	8396.82	25315.09	-14543.72	0.000%
12	-11874.90	-25315.09	11874.90	11874.90	25315.09	-11874.90	0.000%
13	-14543.72	-25315.09	8396.82	14543.72	25315.09	-8396.82	0.000%
14	-16793.64	-25315.09	0.00	16793.64	25315.09	-0.00	0.000%
15	-14543.72	-25315.09	-8396.82	14543.72	25315.09	8396.82	0.000%
16	-11874.90	-25315.09	-11874.90	11874.90	25315.09	11874.90	0.000%
17	-8396.82	-25315.09	-14543.72	8396.82	25315.09	14543.72	0.000%
18	0.00	-30394.35	0.00	0.00	30394.35	0.00	0.000%
19	0.00	-30394.35	-13586.21	-0.00	30394.35	13586.23	0.000%
20	6793.10	-30394.35	-11766.00	-6793.11	30394.35	11766.00	0.000%
21	9606.90	-30394.35	-9606.90	-9606.90	30394.35	9606.90	0.000%
22	11766.00	-30394.35	-6793.10	-11766.00	30394.35	6793.11	0.000%
23	13586.21	-30394.35	0.00	-13586.23	30394.35	0.00	0.000%
24	11766.00	-30394.35	6793.10	-11766.00	30394.35	-6793.11	0.000%
25	9606.90	-30394.35	9606.90	-9606.90	30394.35	-9606.90	0.000%
26	6793.10	-30394.35	11766.00	-6793.11	30394.35	-11766.00	0.000%
27	0.00	-30394.35	13586.21	-0.00	30394.35	-13586.23	0.000%
28	-6793.10	-30394.35	11766.00	6793.11	30394.35	-11766.00	0.000%
29	-9606.90	-30394.35	9606.90	9606.90	30394.35	-9606.90	0.000%
30	-11766.00	-30394.35	6793.10	11766.00	30394.35	-6793.11	0.000%
31	-13586.21	-30394.35	0.00	13586.23	30394.35	0.00	0.000%
32	-11766.00	-30394.35	-6793.10	11766.00	30394.35	6793.11	0.000%
33	-9606.90	-30394.35	-9606.90	9606.90	30394.35	9606.90	0.000%
34	-6793.10	-30394.35	-11766.00	6793.11	30394.35	11766.00	0.000%
35	0.00	-25315.09	-5810.95	0.00	25315.09	5810.95	0.000%
36	2905.47	-25315.09	-5032.43	-2905.47	25315.09	5032.43	0.000%
37	4108.96	-25315.09	-4108.96	-4108.96	25315.09	4108.96	0.000%
38	5032.43	-25315.09	-2905.47	-5032.43	25315.09	2905.47	0.000%
39	5810.95	-25315.09	0.00	-5810.95	25315.09	-0.00	0.000%
40	5032.43	-25315.09	2905.47	-5032.43	25315.09	-2905.47	0.000%
41	4108.96	-25315.09	4108.96	-4108.96	25315.09	-4108.96	0.000%
42	2905.47	-25315.09	5032.43	-2905.47	25315.09	-5032.43	0.000%
43	0.00	-25315.09	5810.95	0.00	25315.09	-5810.95	0.000%
44	-2905.47	-25315.09	5032.43	2905.47	25315.09	-5032.43	0.000%
45	-4108.96	-25315.09	4108.96	4108.96	25315.09	-4108.96	0.000%
46	-5032.43	-25315.09	2905.47	5032.43	25315.09	-2905.47	0.000%
47	-5810.95	-25315.09	0.00	5810.95	25315.09	-0.00	0.000%
48	-5032.43	-25315.09	-2905.47	5032.43	25315.09	2905.47	0.000%
49	-4108.96	-25315.09	-4108.96	4108.96	25315.09	4108.96	0.000%
50	-2905.47	-25315.09	-5032.43	2905.47	25315.09	5032.43	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	0.00002710
3	Yes	4	0.00000001	0.00080062
4	Yes	4	0.00000001	0.00092506
5	Yes	4	0.00000001	0.00080753
6	Yes	4	0.00000001	0.00001851
7	Yes	4	0.00000001	0.00082008
8	Yes	4	0.00000001	0.00092560
9	Yes	4	0.00000001	0.00079404
10	Yes	4	0.00000001	0.00002710
11	Yes	4	0.00000001	0.00081499

12	Yes	4	0.00000001	0.00092546
13	Yes	4	0.00000001	0.00080789
14	Yes	4	0.00000001	0.00001851
15	Yes	4	0.00000001	0.00079592
16	Yes	4	0.00000001	0.00092570
17	Yes	4	0.00000001	0.00082215
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00079523
20	Yes	5	0.00000001	0.00004172
21	Yes	5	0.00000001	0.00004639
22	Yes	5	0.00000001	0.00004186
23	Yes	4	0.00000001	0.00079466
24	Yes	5	0.00000001	0.00004214
25	Yes	5	0.00000001	0.00004641
26	Yes	5	0.00000001	0.00004158
27	Yes	4	0.00000001	0.00079531
28	Yes	5	0.00000001	0.00004204
29	Yes	5	0.00000001	0.00004641
30	Yes	5	0.00000001	0.00004188
31	Yes	4	0.00000001	0.00079481
32	Yes	5	0.00000001	0.00004163
33	Yes	5	0.00000001	0.00004642
34	Yes	5	0.00000001	0.00004219
35	Yes	4	0.00000001	0.00000656
36	Yes	4	0.00000001	0.00004617
37	Yes	4	0.00000001	0.00005428
38	Yes	4	0.00000001	0.00004711
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00004894
41	Yes	4	0.00000001	0.00005445
42	Yes	4	0.00000001	0.00004534
43	Yes	4	0.00000001	0.00000656
44	Yes	4	0.00000001	0.00004819
45	Yes	4	0.00000001	0.00005435
46	Yes	4	0.00000001	0.00004717
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00004558
49	Yes	4	0.00000001	0.00005447
50	Yes	4	0.00000001	0.00004925

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 98.25	11.369	46	0.7406	0.0005
L2	102.25 - 48.75	7.233	46	0.6533	0.0003
L3	54.25 - 1	2.052	46	0.3548	0.0001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.00	(4) APX16PV-16PVL-X	46	11.369	0.7406	0.0005	63129
128.00	Low Profile Platform w/handrails	46	11.062	0.7361	0.0005	63129

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
123.00	GPS	46	10.294	0.7244	0.0004	45092
120.00	LPA-80080/4CF	46	9.836	0.7169	0.0004	31565

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 98.25	32.839	14	2.1389	0.0016
L2	102.25 - 48.75	20.894	14	1.8871	0.0009
L3	54.25 - 1	5.928	14	1.0251	0.0003

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.00	(4) APX16PV-16PVL-X	14	32.839	2.1389	0.0016	21921
128.00	Low Profile Platform w/handrails	14	31.950	2.1248	0.0015	21921
123.00	GPS	14	29.733	2.0886	0.0014	15658
120.00	LPA-80080/4CF	14	28.412	2.0657	0.0013	10960

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	130 - 98.25 (1)	TP32.3x24.22x0.25	31.75	0.00	0.0	39.000	24.6239	-6393.19	960333.00	0.007
L2	98.25 - 48.75 (2)	TP44.39x30.782x0.3125	53.50	0.00	0.0	39.000	42.3318	-14071.20	1650940.00	0.009
L3	48.75 - 1 (3)	TP55.92x42.3661x0.3125	53.25	0.00	0.0	35.880	55.1557	-25307.90	1978960.00	0.013

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	130 - 98.25 (1)	TP32.3x24.22x0.25	181.87	11.577	39.000	0.297	0.00	0.000	39.000	0.000
L2	98.25 - 48.75 (2)	TP44.39x30.782x0.3125	687.52	18.496	39.000	0.474	0.00	0.000	39.000	0.000
L3	48.75 - 1 (3)	TP55.92x42.3661x0.3125	1466.15	23.195	35.880	0.646	0.00	0.000	35.880	0.000

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 $\frac{f_{by}}{F_{by}}$

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V lb	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	130 - 98.25 (1)	TP32.3x24.22x0.25	8645.51	0.351	26.000	0.027	0.00	0.000	26.000	0.000
L2	98.25 - 48.75 (2)	TP44.39x30.782x0.3125	12489.10	0.295	26.000	0.023	0.00	0.000	26.000	0.000
L3	48.75 - 1 (3)	TP55.92x42.3661x0.3125	16804.50	0.305	26.000	0.023	0.00	0.000	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	130 - 98.25 (1)	0.007	0.297	0.000	0.027	0.000	0.304 ✔	1.333	H1-3+VT ✔
L2	98.25 - 48.75 (2)	0.009	0.474	0.000	0.023	0.000	0.483 ✔	1.333	H1-3+VT ✔
L3	48.75 - 1 (3)	0.013	0.646	0.000	0.023	0.000	0.659 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
L1	130 - 98.25	Pole	TP32.3x24.22x0.25	1	-6393.19	1280123.84	22.8	Pass
L2	98.25 - 48.75	Pole	TP44.39x30.782x0.3125	2	-14071.20	2200702.93	36.2	Pass
L3	48.75 - 1	Pole	TP55.92x42.3661x0.3125	3	-25307.90	2637953.57	49.5	Pass
							Summary	
						Pole (L3)	49.5	Pass
						RATING =	**49.5**	**Pass**

ANCHOR BOLT AND BASE PLATE ANALYSIS

ANCHOR BOLT AND BASEPLATE ANALYSIS

Input Data

Tower Reactions:

Overturning Moment:	$OM := 1466 \cdot kips \cdot ft$	*user input*
Shear Force:	$Shear := 16.8 \cdot kips$	*user input*
Axial Force:	$Axial := 25.3 \cdot kips$	*user input*

Anchor Bolt Data:

Use ASTM 615 Grade 75

Number of Anchor Bolts = N	$N := 12$	*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 572 Grade 60

Plate Yield Strength:	$Fy_{bp} := 60 \cdot 10^3 \cdot \frac{lb}{in^2}$	*user input*
Base Plate Thickness:	$PlateThicknessProvide := 2.75 \cdot in$	*user input*

Geometric Layout Data:

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

Distances for loading condition (see detail):

$d_1 := 31.125 \cdot in$ *user input*

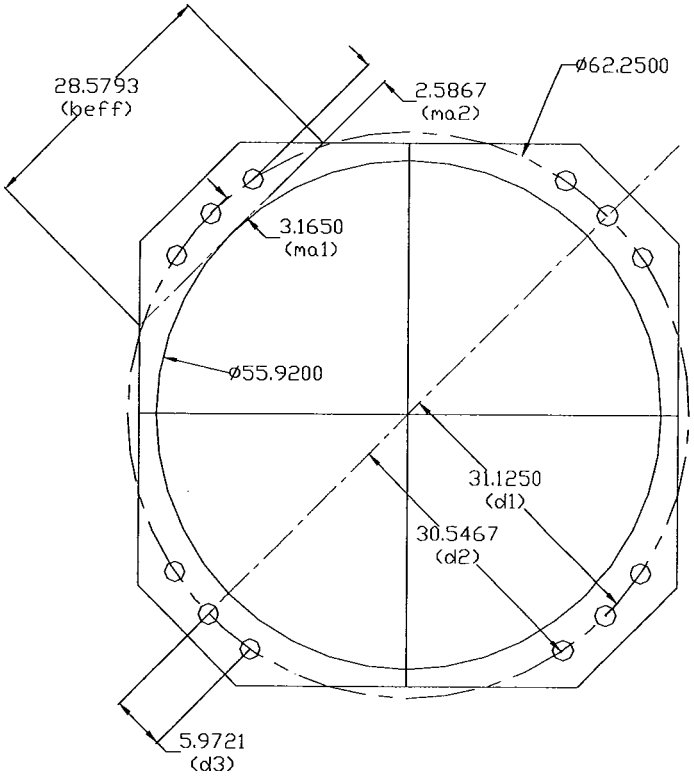
$d_2 := 30.5467 \cdot in$ *user input*

$d_3 := 5.9721 \cdot in$ *user input*

$MomentArm_1 := 3.1650 \cdot in$ *user input*

$MomentArm_2 := 2.5867 \cdot in$ *user input*

$EffectiveWidth := 28.5793 \cdot in$ *user input*



DETAIL - ANCHOR BOLT AND PLATE

Anchor Bolt Section Properties:

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

$$\Sigma d := (d_1)^2 \cdot 2 + (d_2)^2 \cdot 4 + (d_3)^2 \cdot 4 \qquad \Sigma d = 5.81 \times 10^3 \cdot in^2$$

Gross Area of Bolt:

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

Net Area of Bolt:

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

Net Diameter:

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

Radius of Gyration of Bolt:

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

Section Modulus of Bolt:

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

Anchor Bolt Bending Stress:

Maximum Applied Bending:

$$M_x := \left(\frac{Shear}{N} \right) \cdot 1 \qquad M_x = 0.35 \cdot kips \cdot ft$$

$$f_{bx} := \frac{M_x}{S_x} \qquad f_{bx} = 5.09 \cdot ksi$$

Allowable Bending

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

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:

$$MaxTension := \frac{OM \cdot d_1}{\Sigma d} - \frac{Axial}{N} \qquad MaxTension = 92.09 \cdot kips$$

Check Stresses:

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

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

$AnchorBoltStress = "Not Overstressed"$

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

$PercentStressed = 47.27$

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:

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

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

Allowable Compressive Force:

$$K := 0.65$$

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

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

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

Applied Compressive Force:

$$\text{MaxCompression} := \frac{OM \cdot d_l}{\Sigma d} + \frac{\text{Axial}}{N} \qquad \text{MaxCompression} = 96.31 \cdot \text{kips}$$

$$f_a := \frac{\text{MaxCompression}}{A_{net}} \qquad f_a = 29.65 \cdot \text{ksi}$$

Check Combined Stresses:

$$\text{StressRatio} := \frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \qquad \text{StressRatio} = 0.494$$

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

Condition = "Not Overstressed"

Base Plate Analysis:

Force From Bolt(s):

$$C_1 := \frac{OM \cdot d_1}{\Sigma d} + \frac{Axial}{N} \qquad C_1 = 96.31 \times 10^3 \cdot lb$$

$$C_2 := \frac{OM \cdot d_2}{\Sigma d} + \frac{Axial}{N} \qquad C_2 = 94.56 \times 10^3 \cdot lb$$

Bending Stress In Plate:

$$f_{bp} := \frac{6 \cdot \left(1 \cdot C_1 \cdot MomentArm_1 + 2 \cdot C_2 \cdot MomentArm_2\right)}{EffectiveWidth \cdot PlateThicknessProvide^2} \qquad f_{bp} = 22.04 \cdot ksi$$

Check Stresses:

$$BasePlateRatio := \frac{f_{bp}}{1.333 \cdot 0.75 Fy_{bp}} \qquad BasePlateRatio = 0.37$$

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

BasePlateStress = "Not Over Stress"

FOUNDATION ANALYSIS

URS

Job	130' Monopole - New Fairfield, CT	Project No.	VZ4-015	Page / Sheet	of / 1 of 9
Description	Spread Footing w/ Pier Analysis	Computed by	JRM	Date	10/04/07
		Checked by		Date	

MONOPOLE FOUNDATION ANALYSIS

TOWER FORCES:

Moment Caused by Tower	$M_t := 1466 \cdot ft \cdot kips$
Shear at Base of Tower	$S_t := 16.8kip$
Max Compressive Force	$C_t := 25.3 \cdot kip$
Height of Tower	$H_t := 129 \cdot ft$
Base Plate Bolt Circle	$MP := 62.25in$

FOOTING DIMENSIONS:

Overall Depth of Footing	$D_f := 5.5ft$
Length of Pier	$L_p := 4.5 \cdot ft$
Extension of Pier Above Grade	$L_{pag} := 1.0 \cdot ft$
Diameter of Pier	$d_p := 7.0 \cdot ft$
Thickness of Footing	$T_f := 2.0 \cdot ft$
Width of Footing:	$W_f := 21.5ft$
Length of Anchor Bolts:	$L_{st} := 84in$
Projection of anchor bolts above pier	$A_{BP} := 12 \cdot in$

PROPERTIES:

Compressive Strength of Concrete	$f'c := 4000psi$
Yield Strength of Steel Reinforcement	$fy := 60000 \cdot psi$
Yield Strength of Anchor Bolt	$fya := 75000 \cdot psi$
Internal Friction Angle of Soil	$\Sigma_s := 30 \cdot deg$
Allowable Bearing Capacity	$q_s := 6000 \cdot psf$
Unit Weight of Soil	$\pi_s := 120 \cdot pcf$
Unit Weight of Concrete	$\pi_c := 150 \cdot pcf$
Depth to Neglect	$n := 1ft$
Cohesion of Clay Type Soil Note: Use 0 for Sandy Soil	$c := 0 \cdot ksf$
Seismic Zone Factor: UBC Fig 23-2	$Z := 2$
Coefficient of Friction between Concrete:	$\mu := 0.45$
Clear Cover of Reinforcement Pier:	$Cvr_{pier} := 3 \cdot in$
Clear Cover of Reinforcement Pad:	$Cvr_{pad} := 3 \cdot in$
Anchor Bolt Diameter	$d_{anchor} := 2.25in$
Anchor bolt area	$A_{anchor} := 3.97 \cdot in^2$

PIER REINFORCEMENT:

Bar Size	$BSpier := 8$	Bar Diameter	$d_{bpier} := 1.000 \cdot in$
Number of Bars	$NBpier := 36$	Bar Area	$A_{bpier} := 0.790 \cdot in^2$

PAD REINFORCEMENT:

TOP:	Bar Size	$BS_{top} := 8$	Bar Diameter	$d_{btop} := 1.000 \cdot in$
	Number of Bars	$NB_{top} := 22$	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	$NB_{bot} := 22$	Bar Area	$A_{bot} := 0.790 \cdot in^2$

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

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

URS

Job	130' Monopole - New Fairfield, CT	Project No.	VZ4-015	Page / Sheet	of / 2 of 9
Description	Spread Footing w/ Pier Analysis	Computed by	JRM	Date	10/04/07
		Checked by		Date	

CHECK ANCHOR STEEL EMBEDMENT

Depth:

$D_{ab} := L_{st} - A_{BP}$ $D_{ab} = 6 \cdot ft$ $L_{anchor} := \frac{(0.11 \cdot fy) \cdot in}{\sqrt{fc \cdot psi}}$ $L_{anchor} = 8.6963 \cdot ft$

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

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

STABILITY OF FOOTING

Passive Pressure:

$P_{pn} := K_p \cdot \pi_s \cdot n + c \cdot 2 \cdot \sqrt{K_p}$ $P_{pn} = 0.36 \cdot ksf$

$P_{pt} := K_p \cdot \pi_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p}$ $P_{pt} = 1.26 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}]$ $P_{top} = 1.26 \cdot ksf$

$P_{bot} := K_p \cdot \pi_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p}$ $P_{bot} = 1.98 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2}$ $P_{ave} = 1.62 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)]$ $T_p = 2 \cdot ft$

$A_p := W_f \cdot T_p$ $A_p = 43 \cdot ft^2$

Ultimate Shear:

$S_u := P_{ave} \cdot A_p$ $S_u = 69.66 \cdot kip$

Weight of Concrete Pad:

$WT_c := \left[\left(W_f^2 \cdot T_f \right) + d_p^2 L_p \right] \cdot \pi_c$ $WT_c = 171.75 \cdot kip$

Weight of Soil: above Footing:

$WT_{s1} := \left[W_f^2 \cdot \left(\left| L_p - L_{pag} \right| \right) - \frac{d_p^2 \cdot \pi}{4} \cdot \left(\left| L_p - L_{pag} \right| \right) \right] \cdot \pi_s$ $WT_{s1} = 177.9815 \cdot kip$

Weight of Soil Wedge at back face:

$WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Sigma_s)}{2} \cdot W_f \right) \cdot \pi_s$ $WT_{s2} = 22.5297 \cdot kip$

Total Weight:

$WT_{tot} := WT_c + WT_{s1} + C_t$ $WT_{tot} = 375.0315 \cdot kip$

Resisting Moment:

$M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + WT_{s2} \cdot \left(W_f + \frac{D_f \cdot \tan(\Sigma_s)}{3} \right)$ $M_r = 4586.2633 \cdot kip \cdot ft$

Overturning Moment:

$M_{ot} := M_t + S_t \cdot (L_p + T_f)$ $M_{ot} = 1575.2 \cdot kip \cdot ft$

Factor of Safety:

$FS := \frac{M_r}{M_{ot}}$ $FS_{req} := 2$ $FS = 2.91$

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

SHEAR CAPACITY IN PIER

$FS := 2$

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

$S_p = 119.2121 \cdot kips$

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

$ShearCheck = "Okay"$

BEARING PRESSURE CAUSED BY FOOTING

$A_{mat} := W_f^2$ $\quad A_{mat} = 462.25 \cdot ft^2$

$S := \frac{W_f^3}{6}$ $\quad S = 1656.3958 \cdot ft^3$

$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S}$ $\quad P_{max} = 1.7623 \cdot ksf$

$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S}$ $\quad P_{min} = -0.1397 \cdot ksf$

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

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

Distance to Resultant of Pressure Distribution:

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

$X_p = 6.6404 \cdot ft$

Distance to Kern: $X_k := \frac{W_f}{6}$ $\quad X_k = 3.5833 \cdot ft$

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

Eccentricity: $e := \frac{M_{ot}}{WT_{tot}}$ $\quad e = 4.2002$

Adjusted Soil Pressure:

$$P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)}$$

$P_a = 1.7755 \cdot ksf$

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

$q_{adj} = 1.7755 \cdot ksf$

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

CONCRETE BEARING CAPACITY (ACI 10.17)

$\Sigma_c := 0.75$ (ACI 9.3.2.2)

$P_b := \Sigma_c \cdot 0.85 \cdot fc \cdot \frac{d_p^2 \cdot \pi}{4}$ $P_b = 14131.5121 \cdot kip$

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

SHEAR STRENGTH OF CONCRETE

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

$\Sigma_{shear} := .85$ (ACI 9.3.2.3)

$d := T_f - Cvr_{pad} - d_{bbot}$ $d = 20 \cdot in$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$ $d_1 = 7.25 \cdot ft$

$d_2 := d_1 - d$ $d_2 = 5.5833 \cdot ft$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$ $L = 19.6495 \cdot ft$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$ $Slope = 0.0904 \cdot kcf$

$V_{req} := LF \cdot \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$ $V_{req} = 300.8487 \cdot kip$

ACI 11.3.1.1 $V_{Avail} := \Sigma_c \cdot 2 \cdot \sqrt{fc \cdot psi} \cdot W_f \cdot d$ $V_{Avail} = 554.79 \cdot kip$

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

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

$b_o := (d_p + d) \cdot \pi$ $b_o = 27.2271 \cdot ft$

Area included inside bo: $A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4}$ $A_{bo} = 58.9921 \cdot ft^2$

Area outside of bo: $A_{out} := A_{mat} - A_{bo}$ $A_{out} = 403.2579 \cdot ft^2$

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

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

$v_u := \text{Find}(v_u)$ $v_u = 8.2645 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f$ $V_u = 296.1449 \cdot kips$

$V_{req} := LF \cdot V_u$ $V_{req} = 394.7611 \cdot kips$

$V_{Avail} := \Sigma_c \cdot 4 \cdot \sqrt{f'c \cdot psi} \cdot b_o \cdot d$ $V_{Avail} = 1405.1482 \cdot kips$

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

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

Take Maximum Bending at face of Pier:

$q_b := q_{adj} - d_1 \cdot Slope$ $q_b = 1.1204 \cdot ksf$

$M_n := \frac{1}{LF \cdot \Sigma_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f$ $M_n = 733.3741 \cdot kip \cdot ft$

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

$R_u := \frac{M_n}{\Sigma_m \cdot W_f \cdot d^2}$ $R_u = 13644.2\ lbf$

$\rho := \frac{0.85 \cdot f'c}{fy} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f'c}} \right)$ $\rho = 0.0016$

$\rho_{min} := 1.333 \cdot \rho$ $\rho_{min} = 0.00214$

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

(ACI 7.12.2.1b)

FOR BOTTOM BARS: $As := \max(\rho\rho_{min}, \rho_{sh}) \cdot W_f \cdot d$ $As = 11.0178 \cdot in^2$

$As_{prov} := A_{bot} \cdot NB_{bot}$ $As_{prov} = 17.38 \cdot in^2$

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

FOR TOP BARS: $As := \rho_{sh} \cdot (W_f \cdot d)$ $As = 9.288 \cdot in^2$

$As_{prov} := A_{btop} \cdot NB_{top}$ $As_{prov} = 17.38 \cdot in^2$

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

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

Bar Spacing: $B_{sPad} := \dfrac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1}$ $B_{sPad} = 10.9524 \cdot in$

Development Length Factors:

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

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

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

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

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

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

Available Length in Pad: $L_{Pad} := \dfrac{W_f}{2} - \dfrac{d_p}{2} - Cvr_{pad}$ $L_{Pad} = 84 \cdot in$

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

REINFORCEMENT IN PIER

Pier Area: $A_{pv} := \frac{\pi \cdot d_p^2}{4}$ $A_p = 5541.7694 \cdot in^2$

(ACI 10.8.4 and 10.9.1) $A_{smin} := 0.01 \cdot 0.05 \cdot A_p$ $A_{smin} = 2.7709 \cdot in^2$

$A_{sprov} := NBpier \cdot A_{bpier}$ $A_{sprov} = 28.44 \cdot in^2$

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

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

Bar Spacing In Pier: $B_{sPier} := \frac{d_p \cdot \pi}{NBpier} - d_{bpier}$ $B_{sPier} = 6.3304 \cdot in$

Diamter of Reinforcement Cage: $Diam_{cage} := d_p - 2 \cdot Cvr_{pier}$ $Diam_{cage} = 78 \cdot in$

Maximum Moment in Pier: $M_p := \left[M_t + S_t \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF$ $M_p = 24793.8 \cdot in \cdot kips$

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: $(D \ N \ n \ P_u \ M_{xu}) := (84 \ 36 \ 8 \ 33.8 \ 24794)$

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

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

The Output is given as useable axial load in kips, moment capacity in kip inches, splicing stress in ksi, and reinforcement ratio: $(\Sigma P_n \ \Sigma M_{xn} \ f_{sp} \ \rho) = (76.9583 \ 56452.7647 \ -60 \ 0.0051)$

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

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

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

DEVELOPMENT LENGTH OF PIER REINFORCEMENT

TENSION (ACI 12.2.3)

Factors for development:

Reinforcement Location Factor $\alpha := 1.0$

Coating Factor $\beta := 1.0$

Concrete strength Factor $\lambda := 1.0$

Reinforcement Size Factor $\pi := 1.0$

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 $k_{tr} := 0$

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

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

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

$$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{fc}{psi}}} \cdot .7 \qquad L_{dh} = 13.2816 \cdot in$$

$$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right) \qquad L_{db} = 23.7171 \cdot in$$

COMPRESSION: (ACI 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot fy}{\sqrt{fc \cdot psi}} \qquad L_{dbc1} = 18.9737 \cdot in$$

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

$$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) \qquad L_{dbc} = 18.9737 \cdot in$$

Available Length in Foundation:

$$L_{pier} := L_p - Cvr_{pier} \qquad L_{pier} = 51 \cdot in$$

$$L_{pad} := T_f - Cvr_{pad} \qquad L_{pad} = 21 \cdot in$$

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

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

NOTE: Anchor bolts and plate provided, OK

TIE SIZE AND SPACING IN COLUMN

Minimum Tie Size:

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

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

Seismic factor:
(ACI 21.10.5)

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

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

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

$s_{lim3} := D_f z$ $\quad s_{lim3} = 66 \cdot in$

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

Maximum Spacing:

$$s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) \quad s_{tie} = 16 \cdot in$$

Number of Ties Required:

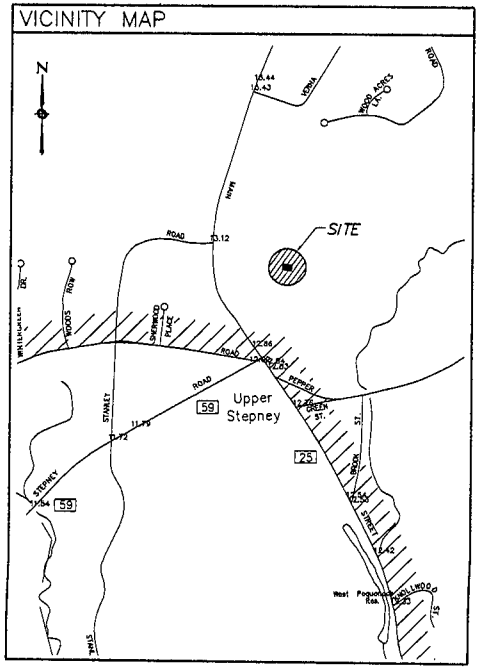
$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 \quad n_{tie} = 4$$

CELLCO PARTNERSHIP
DBA
verizon wireless

CROWN MONROE WEST

474 MAIN STREET
MONROE, CT 06468

VICINITY MAP



PROJECT SUMMARY

SITE NAME:	CROWN MONROE WEST
SITE ADDRESS:	474 MAIN STREET MONROE, CT 06468
CONTACT PERSON	CELLCO PARTNERSHIP DBA VERIZON WIRELESS SANDY CARTER (860) 803-8219
TOWER OWNER:	CROWN CASTLE 500 WEST CUMMINGS ROAD WOBURN, MA 01801
JURISDICTION:	CONNECTICUT SITING COUNCIL
ARCHITECT:	URS CORPORATION A.E.S. 500 ENTERPRISE DRIVE, SUITE 3B ROCKY HILL, CT 06067
M/E/P ENGINEER:	URS CORPORATION A.E.S. 500 ENTERPRISE DRIVE, SUITE 3B ROCKY HILL, CT 06067

LEGEND

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

ABBREVIATIONS

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

SHEET INDEX

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

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

A&E SEAL

PROJECT NO: 36931092
JOB NO: VZ4-016
DRAWN BY: KAP
CHECKED BY:

ISSUED FOR

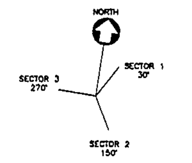
0	10-05-07	REVIEW

CROWN
MONROE WEST
474 MAIN STREET
MONROE, CT 06468

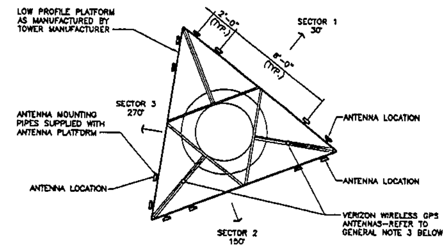
SCALE: AS NOTED

TITLE SHEET -
PROJECT SUMMARY
AND LEGENDS

T-1



ANTENNA ORIENTATION KEY

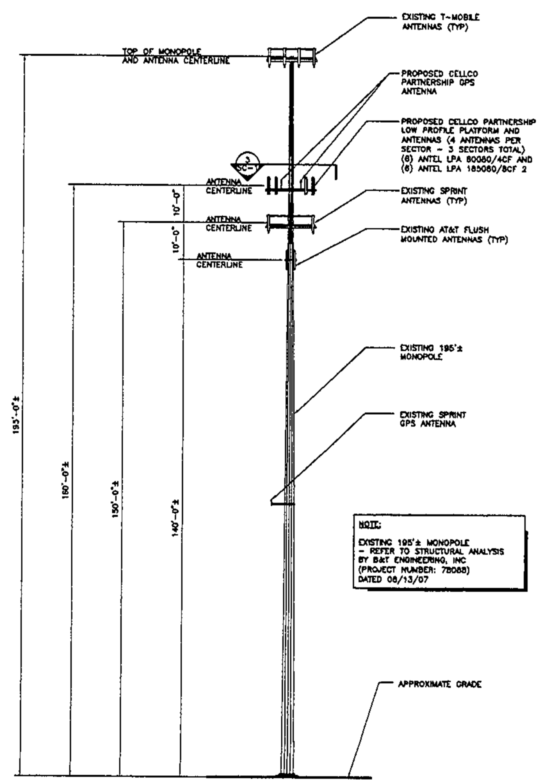


3 SC-1 ANTENNA ORIENTATION PLAN
SCALE: 1/4"=1'-0"

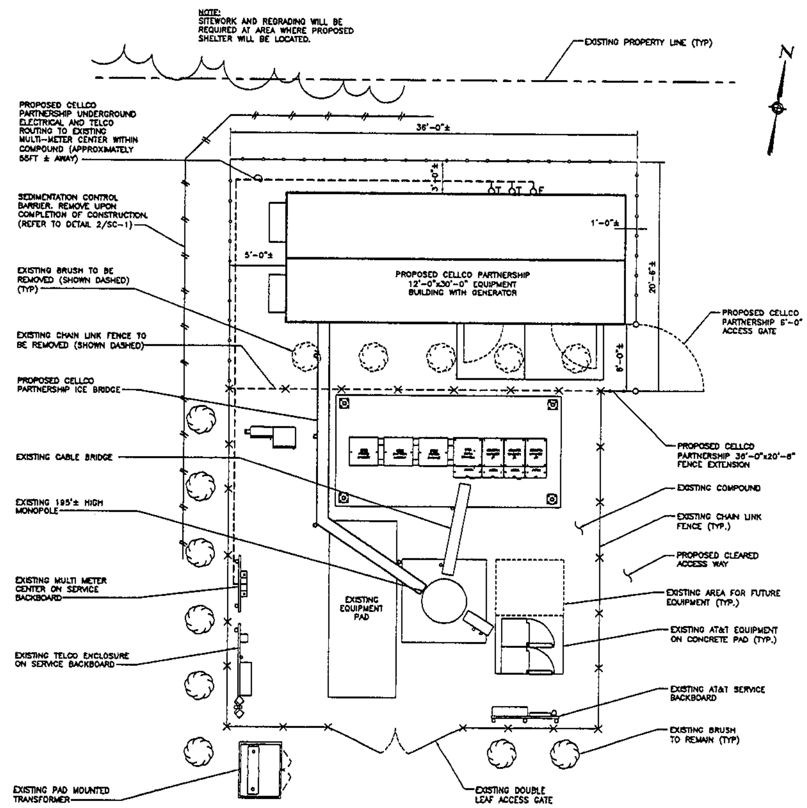
LEGEND		
DESCRIPTION	EXISTING	PROPOSED
PROPERTY LINE		
LEASE LINE		
CHAIN LINK FENCE		
CONTOUR LINES		
UNDERGROUND UTILITIES		E/T
UTILITY POLE		
TREE LINE		
SEDIMENTATION FENCE		
SPOT ELEVATION	x XXX.X	
WOOD FENCE		

SITE PLAN INFORMATION

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



2 SC-1 MONOPOLE ELEVATION
SCALE: 1"=15'-0"



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

CELLCO PARTNERSHIP
DBA
verizon wireless

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

A&E SEAL

PROJECT NO: 36931092
JOB NO: VZ4-016
DRAWN BY: KAP
CHECKED BY:

ISSUED FOR		
0	10-05-07	REVIEW

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CROWN
MONROE WEST
474 MAIN STREET
MONROE, CT 06468

SCALE: AS NOTED

COMPOUND PLAN, ELEVATION AND ANTENNA SECTOR PLAN

SC-1

	General	Power	Density					
Site Name: Monroe W								
Tower Height: Verizon @ 160Ft.								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*T-Mobile	8	250.26	195	0.0189	1935	1.0000	1.89%	
*AT&T	8	126	140	0.0185	1900	1.0000	1.85%	
*Sprint	11	126	150	0.0221	1900	1.0000	2.21%	
Verizon	**9**	**285**	**160**	**0.0360**	**880**	**0.5866**	**6.14%**	
Verizon PCS	**3**	**400**	**160**	**0.0169**	**1900**	**1.0000**	**1.69%**	
								13.78%
* Source: Siting Council								

August 13, 2007

Mr. Andy Gering
Crown Castle International
9105 Monroe Road, Suite 150
Charlotte, NC 28270
(704)3215369

B&T Engineering, Inc.
1717 S. Boulder, Suite 300
Tulsa, OK 74119
(918) 587-4630
ctuttle@btengineering.com

Subject:	**Structural Analysis Report**	
Carrier Designation:	**Verizon Wireless Co-Locate**	
	Carrier Site Number:	*N/A*
	Carrier Site Name:	*Monroe West, CT*
Crown Castle Designation:	**Crown Castle BU Number:**	*876355*
	Crown Castle Site Name:	*Upper Stepney-TLC*
	Crown Castle JDE Job Number:	*92678*
Engineering Firm Designation:	**B&T Engineering Project Number:**	***78088***
Site Data:	**474-480 Main St, Monroe, CT, Fairfield County**	
	Latitude 41°-*19'-33.6"*, Longitude -*73°-15'-5.00"*	
	191.5 Foot – Monopole Tower	

Dear Mr. Gering,

B&T Engineering is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the aforementioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 250334, in accordance with Application 49673, Revision 0.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC1: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table 1 and Table 2 for the proposed and existing/reserved loading.

The analysis has been performed in accordance with the TIA/EIA-222-F standard and the Connecticut State Building Code based upon a wind speed of 85 mph fastest mile (105 mph 3-second gust).

All equipment proposed in this report shall be installed in accordance with the attached drawings for the determined available structural capacity to be effective.

We at B&T Engineering appreciate the opportunity of providing our continuing professional services to you and Crown Castle International. If you have any questions or need further assistance on this or any other projects please give us a call.

Respectfully submitted,

Jeff Roberts
Project Engineer

Chad E. Tuttle, P.E.
President

STATE OF CONNECTICUT ★ CHAD E. TUTTLE ★ No. 23924 LICENSED PROFESSIONAL ENGINEER 8/13/07

TABLE OF CONTENTS

1) INTRODUCTION

The subject tower is a 191.5 foot tapered monopole manufactured in 2000 by Engineered Endeavors Inc.

2) ANALYSIS CRITERIA

Specific code

- TIA/EIA-222-F – 85 mph fastest mile wind speed
- Connecticut State Building Code – 100 mph 3-second gust

The controlling wind loads for this analysis were derived from TIA/EIA-222-F therefore the tower was analyzed for a fastest mile wind speed of 85 mph with no ice and 74 mph with ½" of radial ice. The tower was originally designed for a fastest mile wind speed of 90 mph with no ice and 78 mph with ½" of radial ice per the TIA/EIA-222-F standard.

Table 1 – Proposed Antenna and Cable Information

Center Line Elev. (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Mount	Number of Feed Lines	Feed Line Size (in)
160	6 6	Antel	LPA-80080/4CF LPA-185080/8CFx2	(3) Sectored Frames	12	1 5/8

Table 2 – Existing and Reserved Antenna and Cable Information

Center Line Elev. (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Mount	Number of Feed Lines	Feed Line Size (in)
197	12	EMS Wireless	RR90-17-02DP	(3) T-Arms	24	1 5/8
152#	6 9 (MLA)	EMS Wireless --	FV65-14-00NA2 6' x 1' Panel	LP Platform	6 9 (MLA)	1 5/8 1 5/8
140	3 3 (r)	Allgon	7250.00	(3) T-Arms (r)	6 6 (r)	1 5/8
80	2 (r)	Andrew	PC1N0F-0190B-002M	(2) Standoff	2 (r)	1 5/8
52	1	Kathrein	OG-860/1920/GPS-A	(1) Standoff	1	1/2

(r) - reserved
*Refer to Cable Routing Drawing in Appendix B for Feedline Placement.
Structural Analysis performed using MLA loading with 152 ft centerline and not with existing loading.

Table 3 – Design Antenna and Cable Information

Center Line Elev. (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Mount	Number of Feed Lines	Feed Line Size (in)
191.5	12	DAPA	48000	LP Platform	--	--
181.5	12	DAPA	48000	LP Platform	--	--
171.5	12	DAPA	48000	LP Platform	--	--
161.5	12	DAPA	48000	LP Platform	--	--
150	12	DAPA	48000	LP Platform	--	--
140	12	DAPA	48000	LP Platform	--	--
50	1	--	GPS Antenna	--	--	--

3) ANALYSIS PROCEDURE

Table 4 – Documents Provided

Document	Remarks	Reference	Source
Tower Manufacturing Drawings	Engineered Endeavors Inc.	CCI Doc ID# 1440569	CCIsites
Foundation Drawings	Engineered Endeavors Inc.	CCI Doc ID# 1631625	CCIsites
Geotech Report	Dr.Clearence Welti, P.E., P.C.	CCI Doc ID# 1531885	CCIsites
Antenna Configuration	Configuration Change Check List		CCI

3.1) Analysis Method

RISA Tower (version 5.0.2.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various dead, live, wind, and ice load cases. All loads were computed in accordance with the TIA/EIA-222-F or the local building code requirements. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1. This structural analysis **does not** include a grouted base plate.
2. Tower and structures were built in accordance with the manufacturer's specifications.
3. The tower and structures have been maintained in accordance with manufacturer's specifications.
4. The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
5. When applicable, transmission cables are considered to be structural components for calculating wind loads, as allowed by TIA/EIA-222-F.

If any of these assumptions are not valid or have been made in error, this analysis may be affected, and B&T Engineering, Inc. should be allowed to review any new information to determine its effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 5 – Tower Component Stresses vs. Capacity – LC1

Notes	Component	Elevation (ft)	% Capacity	Pass/Fail
RISA Tower Analysis Summary:				
			Summary	
Notes:	**Component**	**Elevation (ft)**	**% Capacity**	**Pass/Fail**
	L1	191.507 - 173.507	29.2	Pass
	L2	173.507 - 130.837	53.2	Pass
	L3	130.837 - 86.13	56.8	Pass
	L4	86.13 - 42.5	55.7	Pass
	L5	42.5 - 0	58.4	Pass
Individual Components:				
Notes:	**Component**	**Elevation**	**% Capacity**	**Pass/Fail**
1	Base Plate	Base	86.7	Pass
1	Anchor Bolts	Base	51.8	Pass
	Base Foundation (Comparing design loads with actual loads)	Base	70.4	Pass
Structure Rating (max from all components) =				**86.7 %**

*Notes:

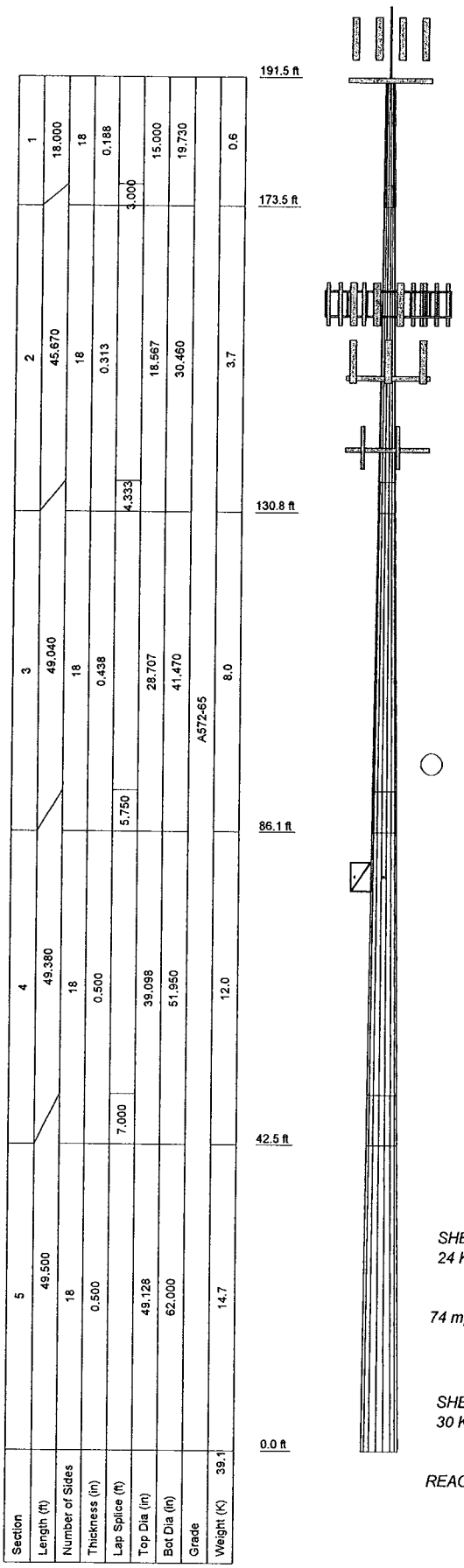
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity listed.
2) Capacities up to 105% are considered acceptable based on analysis procedures used.

4.1) Recommendations

N/A

APPENDIX A

RISA TOWER OUTPUT



Section	1	2	3	4	5
Length (ft)	18.000	45.670	49.040	49.380	49.500
Number of Sides	18	18	18	18	18
Thickness (in)	0.188	0.313	0.438	0.500	0.500
Lap Splice (ft)	3.000	4.333	5.750	7.000	
Top Dia (in)	15.000	18.567	28.707	39.098	49.128
Bot Dia (in)	19.730	30.460	41.470	51.950	62.000
Grade	0.6	3.7	8.0	12.0	14.7
Weight (K)	39.1				

DESIGNED APPURTENANCE LOADING

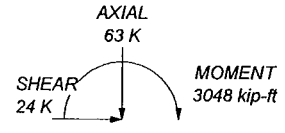
TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod	196.5	(3) 6' x 1' Panel (MLA)	152
(4) RR90-17-02DP (E)	191.5	(3) 6' x 1' Panel (MLA)	152
(4) RR90-17-02DP (E)	191.5	Low Profile Platform (E)	150
(4) RR90-17-02DP (E)	191.5	(2) 7250.00 (E/R)	140
(3) T-Arms (E)	191.5	(2) 7250.00 (E/R)	140
(2) LPA-185080/8CFx2 (P)	160	(2) 7250.00 (E/R)	140
(2) LPA-185080/8CFx2 (P)	160	(3) T-Arms (R)	140
(2) LPA-185080/8CFx2 (P)	160	PC1N0F-0190B-002M (R)	80
(2) LPA-80080/4CF (P)	160	PC1N0F-0190B-002M (R)	80
(2) LPA-80080/4CF (P)	160	6' Standoff (R)	80
(2) LPA-80080/4CF (P)	160	6' Standoff (R)	80
(3) Sectored Frames (P)	160	OG-860/1920/GPS-A (E)	52 - 50
(3) 6' x 1' Panel (MLA)	152	6' Standoff (R)	52 - 50

MATERIAL STRENGTH

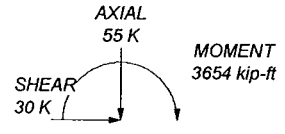
GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower is located in Fairfield 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: 58.4%



TORQUE 2 kip-ft
74 mph WIND - 0.500 in ICE



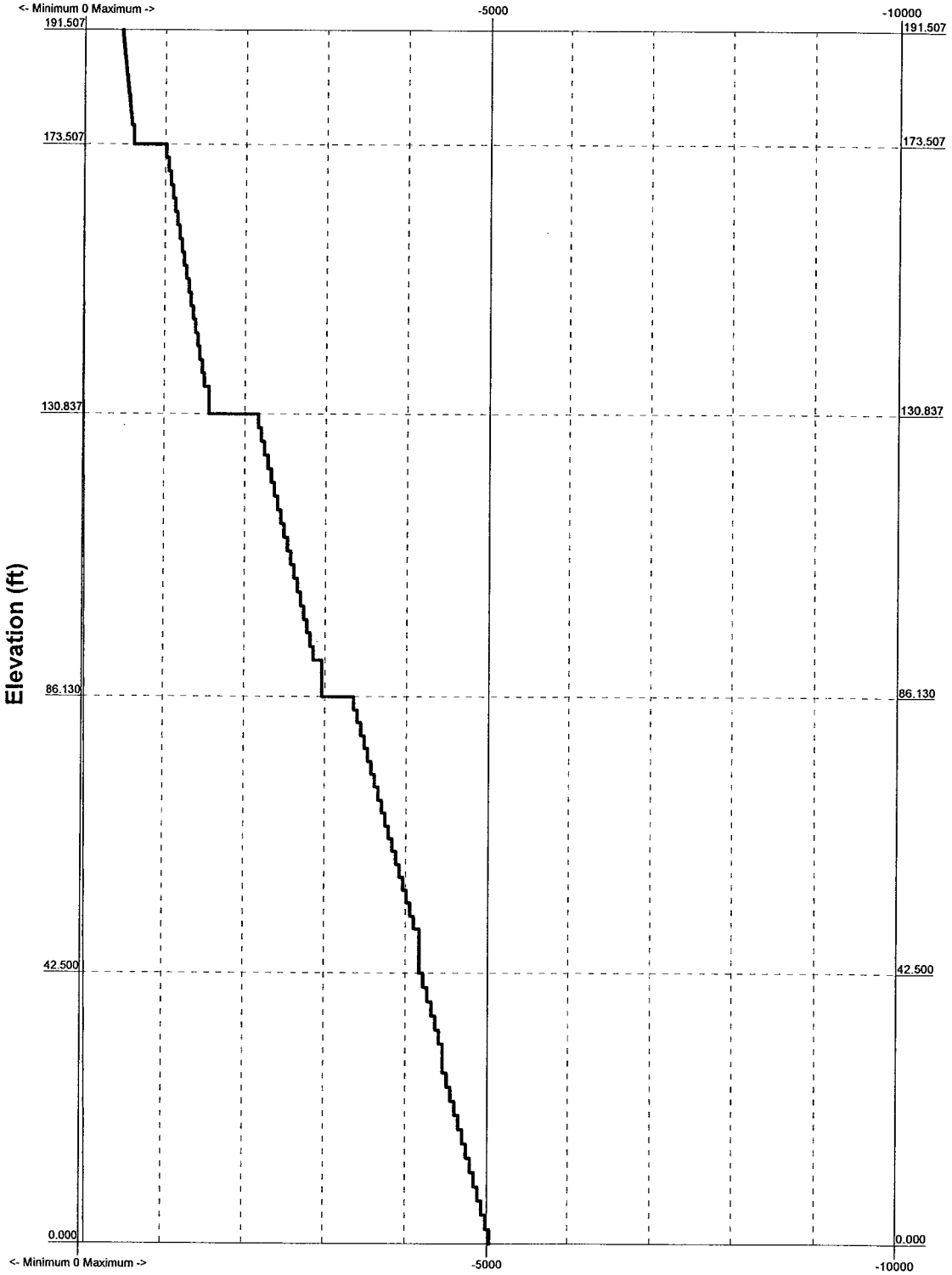
TORQUE 2 kip-ft
REACTIONS - 85 mph WIND

B&T Engineering, Inc.
1717 S. Boulder, Suite 300
Tulsa, OK 74119
Phone: 918.587.4630
FAX: 918.295.0265

Job:	*78088 - Upper Stepney, CT (BU# 876355)*		
Project:	*192' EEI Monopole / App ID: 49673 Rev 0*		
Client: Crown Castle International		Drawn by: jr	App'd:
Code: TIA/EIA-222-F		Date: 08/13/07	Scale: NTS
Path:			Dwg No. E-1

TIA/EIA-222-F - 85 mph/74 mph 0.500 in Ice

Leg Capacity ——— **Leg Compression (K)**



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Phone: 918.587.4630
FAX: 918.295.0265

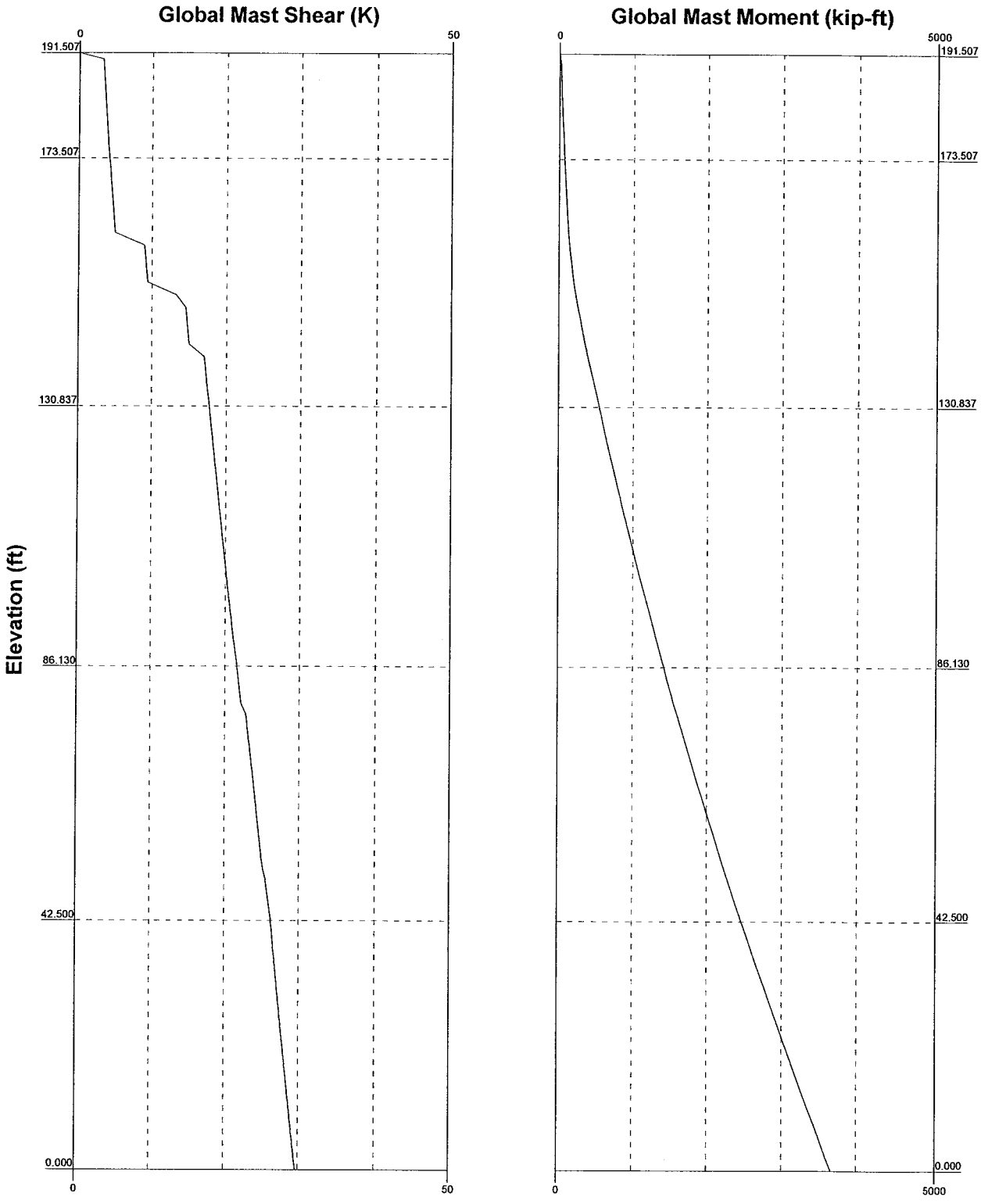
Job:	***78088 - Upper Stepney, CT (BU# 876355)***		
Project:	***192' EEI Monopole / App ID: 49673 Rev 0***		
Client: Crown Castle International		Drawn by: jr	App'd:
Code: TIA/EIA-222-F		Date: 08/13/07	Scale: NTS
Path:			Dwg No. E-3

TIA/EIA-222-F - 85 mph/74 mph 0.500 in Ice

Vx ..... Vz

Maximum Values

Mx ..... Mz



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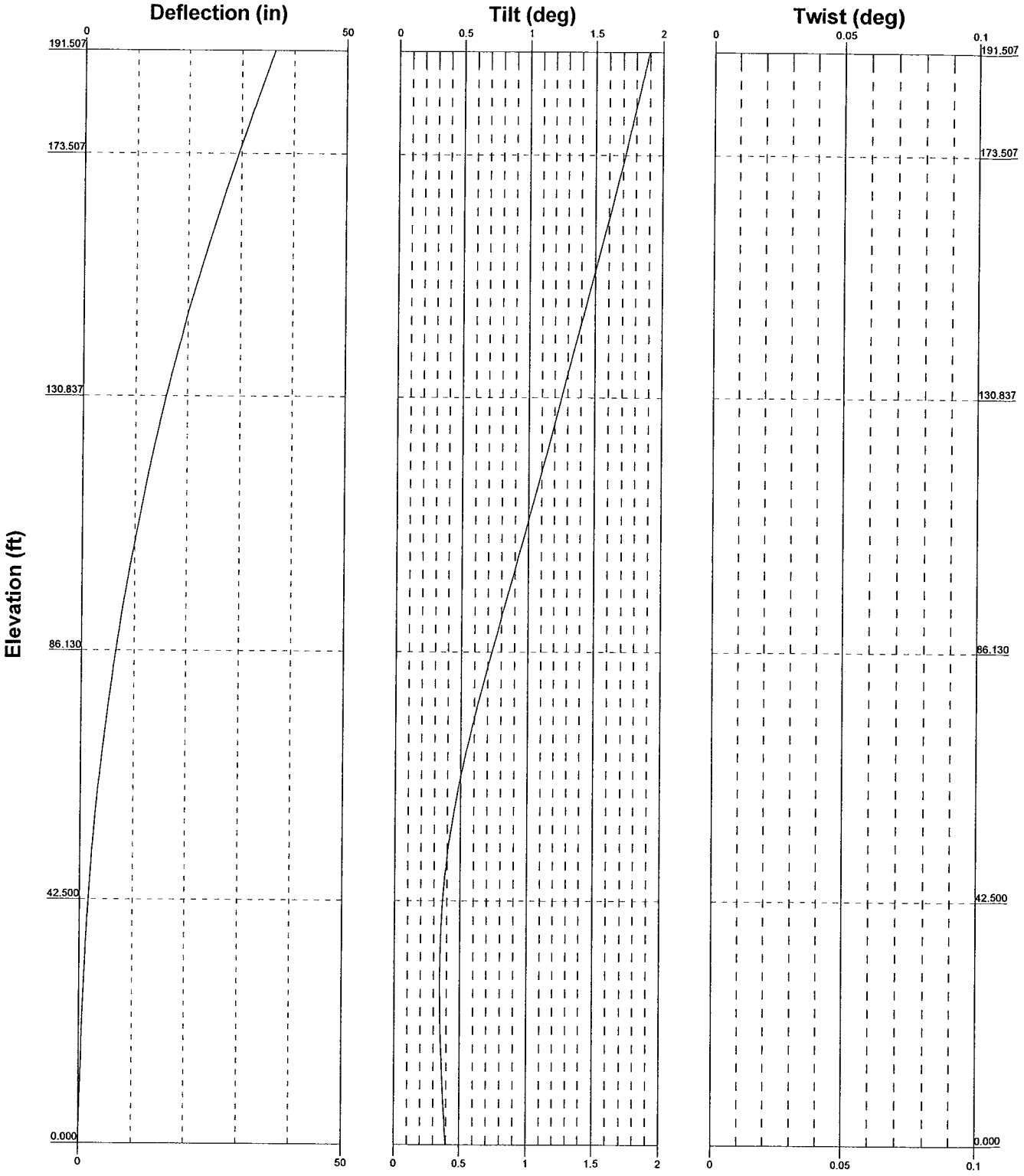
Tulsa, OK 74119
Phone: 918.587.4630
FAX: 918.295.0265

Job: 78088 - Upper Stepney, CT (BU# 876355)			
Project: 192' EEI Monopole / App ID: 49673 Rev 0			
Client: Crown Castle International	Drawn by: jr	App'd:	
Code: TIA/EIA-222-F	Date: 08/13/07	Scale: NTS	
Path: S:\B&T Engineering\Projects\Crown Castle\78088_876355 Upper Stepney\Engineering\RISA\78088 Upper Stepney.r3d		Dwg No. E-4	

TIA/EIA-222-F - Service - 50 mph

Maximum Values



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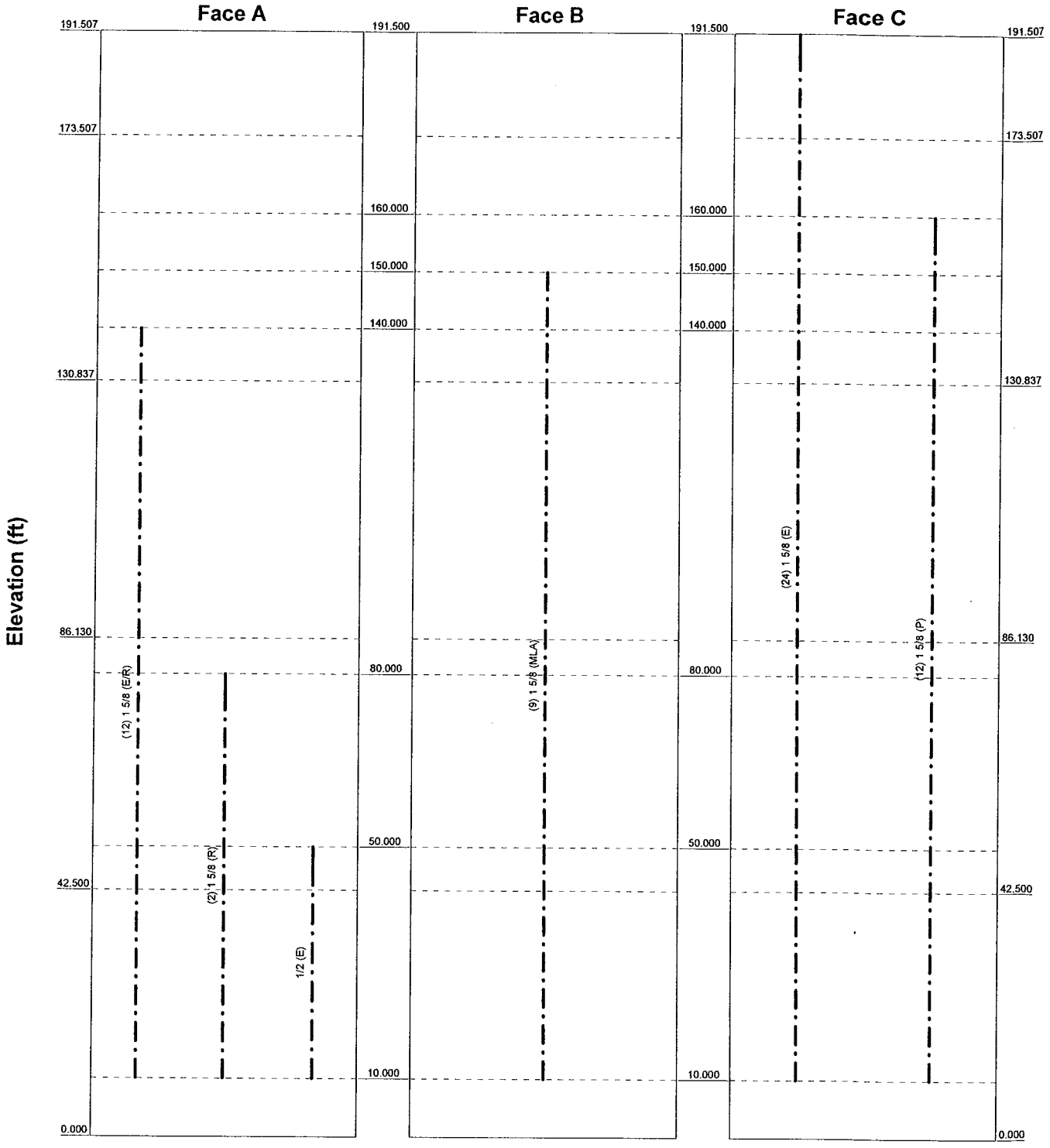
FAX: 918.295.0265

Job: 78088 - Upper Stepney, CT (BU# 876355)			
Project: 192' EEI Monopole / App ID: 49673 Rev 0			
Client: Crown Castle International	Drawn by: jr	App'd:	
Code: TIA/EIA-222-F	Date: 08/13/07	Scale: NTS	
Path:		Dwg No. E-5	

Feedline Distribution Chart
0' - 191'6-3/32"

Round — Flat — App In Face — App Out Face — Truss Leg



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Tulsa, OK 74119
Phone: 918.587.4630
FAX: 918.295.0265

Job: 78088 - Upper Stepney, CT (BU# 876355)		
Project: 192' EEI Monopole / App ID: 49673 Rev 0		
Client: Crown Castle International	Drawn by: jr	App'd:
Code: TIA/EIA-222-F	Date: 08/13/07	Scale: NTS
Path:		Dwg No. E-7

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 Fairfield County, Connecticut.
Basic wind speed of 85 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
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	191.507-173.507	18.000	3.000	18	15.000	19.730	0.188	0.750	A572-65 (65 ksi)
L2	173.507-130.837	45.670	4.333	18	18.567	30.460	0.313	1.250	A572-65 (65 ksi)
L3	130.837-86.130	49.040	5.750	18	28.707	41.470	0.438	1.750	A572-65 (65 ksi)
L4	86.130-42.500	49.380	7.000	18	39.098	51.950	0.500	2.000	A572-65 (65 ksi)
L5	42.500-0.000	49.500		18	49.128	62.000	0.500	2.000	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	15.231	8.815	244.360	5.258	7.620	32.068	489.042	4.408	2.310	12.32
	20.034	11.630	561.159	6.938	10.023	55.988	1123.057	5.816	3.142	16.76
L2	19.646	18.106	762.220	6.480	9.432	80.813	1525.443	9.055	2.718	8.697
	30.930	29.903	3433.589	10.702	15.474	221.899	6871.696	14.954	4.811	15.395
L3	30.295	39.255	3963.279	10.036	14.583	271.776	7931.772	19.631	4.282	9.788
	42.110	56.979	12120.105	14.567	21.067	575.319	24256.157	28.495	6.529	14.923
L4	41.221	61.256	11529.873	13.702	19.862	580.498	23074.917	30.634	6.001	12.003
	52.751	81.651	27306.781	18.265	26.391	1034.716	54649.494	40.833	8.263	16.526
L5	51.734	77.173	23055.727	17.263	24.957	923.814	46141.792	38.594	7.767	15.533
	62.956	97.600	46637.979	21.833	31.496	1480.759	93337.326	48.810	10.032	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 191.507-173.507				1	1	1		
L2 173.507-130.837				1	1	1		
L3 130.837-86.130				1	1	1		
L4 86.130-42.500				1	1	1		
L5 42.500-0.000				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 klf
1 5/8 (E)	C	No	Inside Pole	191.500 - 10.000	24	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (P)	C	No	Inside Pole	160.000 - 10.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (MLA)	B	No	Inside Pole	150.000 - 10.000	9	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (E/R)	A	No	Inside Pole	140.000 - 10.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (R)	A	No	Inside Pole	80.000 - 10.000	2	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1/2 (E)	A	No	Inside Pole	50.000 - 10.000	1	No Ice	0.000	0.000
						1/2" Ice	0.000	0.000

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	191.507-173.507	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.449
L2	173.507-130.837	A	0.000	0.000	0.000	0.000	0.114
		B	0.000	0.000	0.000	0.000	0.179
		C	0.000	0.000	0.000	0.000	1.429
L3	130.837-86.130	A	0.000	0.000	0.000	0.000	0.558
		B	0.000	0.000	0.000	0.000	0.418
		C	0.000	0.000	0.000	0.000	1.674
L4	86.130-42.500	A	0.000	0.000	0.000	0.000	0.624
		B	0.000	0.000	0.000	0.000	0.408
		C	0.000	0.000	0.000	0.000	1.634
L5	42.500-0.000	A	0.000	0.000	0.000	0.000	0.481
		B	0.000	0.000	0.000	0.000	0.304
		C	0.000	0.000	0.000	0.000	1.217

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	191.507-173.507	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.449
L2	173.507-130.837	A	0.500	0.000	0.000	0.000	0.000	0.114
		B		0.000	0.000	0.000	0.000	0.179
		C		0.000	0.000	0.000	0.000	1.429
L3	130.837-86.130	A	0.500	0.000	0.000	0.000	0.000	0.558
		B		0.000	0.000	0.000	0.000	0.418
		C		0.000	0.000	0.000	0.000	1.674
L4	86.130-42.500	A	0.500	0.000	0.000	0.000	0.000	0.624
		B		0.000	0.000	0.000	0.000	0.408
		C		0.000	0.000	0.000	0.000	1.634
L5	42.500-0.000	A	0.500	0.000	0.000	0.000	0.000	0.481
		B		0.000	0.000	0.000	0.000	0.304
		C		0.000	0.000	0.000	0.000	1.217

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	191.507-173.507	0.000	0.000	0.000	0.000
L2	173.507-130.837	0.000	0.000	0.000	0.000
L3	130.837-86.130	0.000	0.000	0.000	0.000
L4	86.130-42.500	0.000	0.000	0.000	0.000
L5	42.500-0.000	0.000	0.000	0.000	0.000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Lightning Rod	C	None		0.000	196.500	No Ice	0.500	0.500	0.100
*						1/2" Ice	0.750	0.750	0.200
(4) RR90-17-02DP	C	From Face	0.000	0.000	191.500	No Ice	4.356	1.974	0.018
(E)			0.000			1/2" Ice	4.775	2.312	0.040
			5.500						
(4) RR90-17-02DP	B	From Face	0.000	0.000	191.500	No Ice	4.356	1.974	0.018
(E)			0.000			1/2" Ice	4.775	2.312	0.040
			5.500						
(4) RR90-17-02DP	A	From Face	0.000	0.000	191.500	No Ice	4.356	1.974	0.018
(E)			0.000			1/2" Ice	4.775	2.312	0.040
			5.500						
(3) T-Arms	C	None		0.000	191.500	No Ice	21.000	21.000	0.900
(E)						1/2" Ice	24.000	24.000	1.200
*									
(2) LPA-185080/8CFx2	C	From Face	0.000	0.000	160.000	No Ice	2.095	2.786	0.007
(P)			0.000			1/2" Ice	2.391	3.092	0.025
			0.000						
(2) LPA-185080/8CFx2	B	From Face	0.000	0.000	160.000	No Ice	2.095	2.786	0.007
(P)			0.000			1/2" Ice	2.391	3.092	0.025
			0.000						
(2) LPA-185080/8CFx2	A	From Face	0.000	0.000	160.000	No Ice	2.095	2.786	0.007
(P)			0.000			1/2" Ice	2.391	3.092	0.025
			0.000						
(2) LPA-80080/4CF	C	From Face	0.000	0.000	160.000	No Ice	2.619	6.057	0.012
(P)			0.000			1/2" Ice	2.922	6.453	0.045
			0.000						
(2) LPA-80080/4CF	B	From Face	0.000	0.000	160.000	No Ice	2.619	6.057	0.012
(P)			0.000			1/2" Ice	2.922	6.453	0.045
			0.000						
(2) LPA-80080/4CF	A	From Face	0.000	0.000	160.000	No Ice	2.619	6.057	0.012
(P)			0.000			1/2" Ice	2.922	6.453	0.045
			0.000						
(3) Sectored Frames	C	None		0.000	160.000	No Ice	35.000	35.000	1.500
(P)						1/2" Ice	45.000	45.000	2.000
*									
(3) 6' x 1' Panel	C	None		0.000	152.000	No Ice	8.400	8.400	0.035
(MLA)						1/2" Ice	9.230	9.230	0.060
(3) 6' x 1' Panel	B	None		0.000	152.000	No Ice	8.400	8.400	0.035
(MLA)						1/2" Ice	9.230	9.230	0.060
(3) 6' x 1' Panel	A	None		0.000	152.000	No Ice	8.400	8.400	0.035
(MLA)						1/2" Ice	9.230	9.230	0.060
Low Profile Platform	C	None		0.000	150.000	No Ice	21.000	21.000	1.500
(E)						1/2" Ice	24.000	24.000	2.000
*									
(2) 7250.00	C	From Leg	0.000	0.000	140.000	No Ice	3.999	1.873	0.015
(E/R)			0.000			1/2" Ice	4.386	2.328	0.035
			0.000						
(2) 7250.00	B	From Leg	0.000	0.000	140.000	No Ice	3.999	1.873	0.015
(E/R)			0.000			1/2" Ice	4.386	2.328	0.035
			0.000						
(2) 7250.00	A	From Leg	0.000	0.000	140.000	No Ice	3.999	1.873	0.015

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
(E/R)			0.000 0.000			1/2" Ice	4.386	2.328	0.035
(3) T-Arms	C	None		0.000	140.000	No Ice	21.000	21.000	0.900
(R)						1/2" Ice	24.000	24.000	1.200
*									
PC1N0F-0190B-002M	C	From Leg	3.000	0.000	80.000	No Ice	0.035	0.035	0.001
(R)			0.000			1/2" Ice	0.071	0.071	0.001
			0.000						
PC1N0F-0190B-002M	A	From Leg	3.000	0.000	80.000	No Ice	0.035	0.035	0.001
(R)			0.000			1/2" Ice	0.071	0.071	0.001
			0.000						
6' Standoff	C	From Leg	2.000	0.000	80.000	No Ice	6.000	6.000	0.250
(R)			0.000			1/2" Ice	8.000	8.000	0.400
			0.000						
6' Standoff	A	From Leg	2.000	0.000	80.000	No Ice	6.000	6.000	0.250
(R)			0.000			1/2" Ice	8.000	8.000	0.400
			0.000						
*									
OG-860/1920/GPS-A	A	From Leg	3.000	0.000	50.000 - 52.000	No Ice	1.000	1.000	0.005
(E)			0.000			1/2" Ice	2.000	2.000	0.010
			0.000						
6' Standoff	A	From Leg	2.000	0.000	50.000 - 52.000	No Ice	6.000	6.000	0.250
(R)			0.000			1/2" Ice	8.000	8.000	0.400
			0.000						

Load Combinations

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

Comb. No.	Description
23	Dead+Wind 240 deg+Ice
24	Dead+Wind 270 deg+Ice
25	Dead+Wind 300 deg+Ice
26	Dead+Wind 330 deg+Ice
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	Dead+Wind 330 deg - Service

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	14	62.690	0.000	0.000
	Max. H_x	11	54.993	29.609	0.000
	Max. H_z	2	54.993	0.000	29.609
	Max. M_x	2	3653.849	0.000	29.609
	Max. M_z	5	3651.448	-29.609	0.000
	Max. Torsion	17	1.810	-20.890	12.061
	Min. Vert	2	54.993	0.000	29.609
	Min. H_x	5	54.993	-29.609	0.000
	Min. H_z	8	54.993	0.000	-29.609
	Min. M_x	8	-3650.739	0.000	-29.609
	Min. M_z	11	-3653.140	29.609	0.000
	Min. Torsion	23	-1.810	20.890	-12.061

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	54.994	0.000	0.000	-1.515	0.817	0.000
Dead+Wind 0 deg - No Ice	54.993	-0.000	-29.609	-3653.849	0.845	-0.816
Dead+Wind 30 deg - No Ice	54.994	14.805	-25.644	-3164.812	-1825.463	-1.464
Dead+Wind 60 deg - No Ice	54.994	25.644	-14.805	-1827.862	-3162.412	-1.719
Dead+Wind 90 deg - No Ice	54.993	29.609	-0.000	-1.554	-3651.448	-1.514
Dead+Wind 120 deg - No Ice	54.994	25.644	14.805	1824.753	-3162.411	-0.903
Dead+Wind 150 deg - No Ice	54.994	14.805	25.644	3161.702	-1825.462	-0.050
Dead+Wind 180 deg - No Ice	54.993	-0.000	29.609	3650.739	0.845	0.816
Dead+Wind 210 deg - No Ice	54.994	-14.805	25.644	3161.703	1827.153	1.464
Dead+Wind 240 deg - No Ice	54.994	-25.644	14.805	1824.754	3164.103	1.719
Dead+Wind 270 deg - No Ice	54.993	-29.609	-0.000	-1.554	3653.140	1.514
Dead+Wind 300 deg - No Ice	54.994	-25.644	-14.805	-1827.863	3164.103	0.903
Dead+Wind 330 deg - No Ice	54.994	-14.805	-25.644	-3164.813	1827.154	0.050
Dead+Ice	62.690	0.000	0.000	-2.435	1.308	0.000
Dead+Wind 0 deg+Ice	62.690	-0.000	-24.120	-3047.342	1.364	-0.829

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 30 deg+Ice	62.690	12.061	-20.890	-2639.743	-1521.242	-1.524
Dead+Wind 60 deg+Ice	62.690	20.890	-12.061	-1525.118	-2635.865	-1.810
Dead+Wind 90 deg+Ice	62.690	24.120	-0.000	-2.513	-3043.464	-1.612
Dead+Wind 120 deg+Ice	62.690	20.890	12.061	1520.092	-2635.864	-0.981
Dead+Wind 150 deg+Ice	62.690	12.061	20.890	2634.715	-1521.241	-0.088
Dead+Wind 180 deg+Ice	62.690	-0.000	24.120	3042.315	1.364	0.829
Dead+Wind 210 deg+Ice	62.690	-12.061	20.890	2634.716	1523.969	1.523
Dead+Wind 240 deg+Ice	62.690	-20.890	12.061	1520.093	2638.594	1.810
Dead+Wind 270 deg+Ice	62.690	-24.120	-0.000	-2.513	3046.193	1.612
Dead+Wind 300 deg+Ice	62.690	-20.890	-12.061	-1525.119	2638.595	0.981
Dead+Wind 330 deg+Ice	62.690	-12.061	-20.890	-2639.743	1523.970	0.088
Dead+Wind 0 deg - Service	54.994	0.000	-10.245	-1266.293	0.847	-0.283
Dead+Wind 30 deg - Service	54.994	5.123	-8.873	-1096.851	-631.522	-0.508
Dead+Wind 60 deg - Service	54.994	8.873	-5.123	-633.925	-1094.447	-0.596
Dead+Wind 90 deg - Service	54.994	10.245	0.000	-1.557	-1263.889	-0.525
Dead+Wind 120 deg - Service	54.994	8.873	5.123	630.812	-1094.447	-0.313
Dead+Wind 150 deg - Service	54.994	5.123	8.873	1093.737	-631.521	-0.017
Dead+Wind 180 deg - Service	54.994	0.000	10.245	1263.179	0.847	0.283
Dead+Wind 210 deg - Service	54.994	-5.123	8.873	1093.737	633.215	0.508
Dead+Wind 240 deg - Service	54.994	-8.873	5.123	630.812	1096.141	0.596
Dead+Wind 270 deg - Service	54.994	-10.245	0.000	-1.557	1265.583	0.525
Dead+Wind 300 deg - Service	54.994	-8.873	-5.123	-633.925	1096.141	0.313
Dead+Wind 330 deg - Service	54.994	-5.123	-8.873	-1096.851	633.215	0.017

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	0.000	-54.994	0.000	0.000	54.994	0.000	0.000%
2	0.000	-54.994	-29.611	0.000	54.993	29.609	0.003%
3	14.806	-54.994	-25.644	-14.805	54.994	25.644	0.000%
4	25.644	-54.994	-14.806	-25.644	54.994	14.805	0.000%
5	29.611	-54.994	0.000	-29.609	54.993	0.000	0.003%
6	25.644	-54.994	14.806	-25.644	54.994	-14.805	0.000%
7	14.806	-54.994	25.644	-14.805	54.994	-25.644	0.000%
8	0.000	-54.994	29.611	0.000	54.993	-29.609	0.003%
9	-14.806	-54.994	25.644	14.805	54.994	-25.644	0.000%
10	-25.644	-54.994	14.806	25.644	54.994	-14.805	0.000%
11	-29.611	-54.994	0.000	29.609	54.993	0.000	0.003%
12	-25.644	-54.994	-14.806	25.644	54.994	14.805	0.000%
13	-14.806	-54.994	-25.644	14.805	54.994	25.644	0.000%
14	0.000	-62.690	0.000	0.000	62.690	0.000	0.000%
15	0.000	-62.690	-24.122	0.000	62.690	24.120	0.003%
16	12.061	-62.690	-20.890	-12.061	62.690	20.890	0.000%
17	20.890	-62.690	-12.061	-20.890	62.690	12.061	0.000%
18	24.122	-62.690	0.000	-24.120	62.690	0.000	0.003%
19	20.890	-62.690	12.061	-20.890	62.690	-12.061	0.000%
20	12.061	-62.690	20.890	-12.061	62.690	-20.890	0.000%
21	0.000	-62.690	24.122	0.000	62.690	-24.120	0.003%
22	-12.061	-62.690	20.890	12.061	62.690	-20.890	0.000%
23	-20.890	-62.690	12.061	20.890	62.690	-12.061	0.000%
24	-24.122	-62.690	0.000	24.120	62.690	0.000	0.003%
25	-20.890	-62.690	-12.061	20.890	62.690	12.061	0.000%
26	-12.061	-62.690	-20.890	12.061	62.690	20.890	0.000%
27	0.000	-54.994	-10.246	-0.000	54.994	10.245	0.001%
28	5.123	-54.994	-8.873	-5.123	54.994	8.873	0.001%
29	8.873	-54.994	-5.123	-8.873	54.994	5.123	0.001%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
30	10.246	-54.994	0.000	-10.245	54.994	-0.000	0.001%
31	8.873	-54.994	5.123	-8.873	54.994	-5.123	0.001%
32	5.123	-54.994	8.873	-5.123	54.994	-8.873	0.001%
33	0.000	-54.994	10.246	-0.000	54.994	-10.245	0.001%
34	-5.123	-54.994	8.873	5.123	54.994	-8.873	0.001%
35	-8.873	-54.994	5.123	8.873	54.994	-5.123	0.001%
36	-10.246	-54.994	0.000	10.245	54.994	-0.000	0.001%
37	-8.873	-54.994	-5.123	8.873	54.994	5.123	0.001%
38	-5.123	-54.994	-8.873	5.123	54.994	8.873	0.001%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	7	0.00006755	0.00007319
3	Yes	10	0.00000001	0.00008679
4	Yes	10	0.00000001	0.00008810
5	Yes	7	0.00006755	0.00007509
6	Yes	10	0.00000001	0.00008708
7	Yes	10	0.00000001	0.00008721
8	Yes	7	0.00006755	0.00007315
9	Yes	10	0.00000001	0.00008804
10	Yes	10	0.00000001	0.00008674
11	Yes	7	0.00006755	0.00007513
12	Yes	10	0.00000001	0.00008773
13	Yes	10	0.00000001	0.00008760
14	Yes	4	0.00000001	0.00000001
15	Yes	7	0.00009524	0.00007610
16	Yes	10	0.00000001	0.00007014
17	Yes	10	0.00000001	0.00007167
18	Yes	7	0.00009524	0.00007866
19	Yes	10	0.00000001	0.00007042
20	Yes	10	0.00000001	0.00007060
21	Yes	7	0.00009524	0.00007602
22	Yes	10	0.00000001	0.00007159
23	Yes	10	0.00000001	0.00007007
24	Yes	7	0.00009524	0.00007873
25	Yes	10	0.00000001	0.00007128
26	Yes	10	0.00000001	0.00007109
27	Yes	7	0.00007047	0.00002977
28	Yes	7	0.00007027	0.00007609
29	Yes	7	0.00007027	0.00008021
30	Yes	7	0.00007047	0.00002983
31	Yes	7	0.00007027	0.00007700
32	Yes	7	0.00007027	0.00007740
33	Yes	7	0.00007047	0.00002972
34	Yes	7	0.00007027	0.00008004
35	Yes	7	0.00007027	0.00007595
36	Yes	7	0.00007047	0.00002987
37	Yes	7	0.00007027	0.00007897
38	Yes	7	0.00007027	0.00007854

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	191.507 - 173.507	36.276	38	1.894	0.000
L2	176.507 - 130.837	30.521	38	1.750	0.000
L3	135.17 - 86.13	17.063	38	1.302	0.000
L4	91.88 - 42.5	7.469	38	0.795	0.000
L5	49.5 - 0	2.121	38	0.396	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
196.500	Lightning Rod	38	36.276	1.894	0.000	16913
191.500	(4) RR90-17-02DP	38	36.273	1.894	0.000	16913
160.000	(2) LPA-185080/8CFx2	38	24.663	1.579	0.000	5163
152.000	(3) 6' x 1' Panel	38	22.049	1.492	0.000	4961
150.000	Low Profile Platform	38	21.420	1.470	0.000	4913
140.000	(2) 7250.00	38	18.420	1.357	0.000	4685
80.000	PC1N0F-0190B-002M	38	5.576	0.659	0.000	5563
52.000	OG-860/1920/GPS-A	38	2.328	0.410	0.000	5410
51.000	OG-860/1920/GPS-A	38	2.243	0.404	0.000	5425
50.000	OG-860/1920/GPS-A	38	2.162	0.399	0.000	5457

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	191.507 - 173.507	104.537	2	5.461	0.002
L2	176.507 - 130.837	87.965	2	5.046	0.002
L3	135.17 - 86.13	49.192	2	3.754	0.001
L4	91.88 - 42.5	21.536	13	2.294	0.001
L5	49.5 - 0	6.119	13	1.143	0.001

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
196.500	Lightning Rod	2	104.537	5.461	0.002	5960
191.500	(4) RR90-17-02DP	2	104.530	5.461	0.002	5960
160.000	(2) LPA-185080/8CFx2	2	71.092	4.556	0.001	1812
152.000	(3) 6' x 1' Panel	2	63.561	4.305	0.001	1739
150.000	Low Profile Platform	2	61.747	4.241	0.001	1722
140.000	(2) 7250.00	2	53.104	3.915	0.001	1639
80.000	PC1N0F-0190B-002M	13	16.080	1.927	0.001	1933
52.000	OG-860/1920/GPS-A	13	6.713	1.196	0.001	1878

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
51.000	OG-860/1920/GPS-A	13	6.471	1.175	0.001	1883
50.000	OG-860/1920/GPS-A	13	6.235	1.153	0.001	1894

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	191.507 - 173.507 (1)	TP19.73x15x0.188	18.000	0.000	0.0	39.000	11.161	-1.757	435.282	0.004
L2	173.507 - 130.837 (2)	TP30.46x18.567x0.313	45.670	0.000	0.0	39.000	28.783	-10.430	1122.550	0.009
L3	130.837 - 86.13 (3)	TP41.47x28.707x0.438	49.040	0.000	0.0	39.000	54.901	-20.570	2141.120	0.010
L4	86.13 - 42.5 (4)	TP51.95x39.098x0.5	49.380	0.000	0.0	39.000	78.760	-35.419	3071.640	0.012
L5	42.5 - 0 (5)	TP62x49.128x0.5	49.500	0.000	0.0	39.000	85.600	-44.246	3338.410	0.013

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	191.507 - 173.507 (1)	TP19.73x15x0.188	64.427	-15.000	39.000	0.385	0.000	0.000	39.000	0.000
L2	173.507 - 130.837 (2)	TP30.46x18.567x0.313	467.500	-27.297	39.000	0.700	0.000	0.000	39.000	0.000
L3	130.837 - 86.13 (3)	TP41.47x28.707x0.438	1296.458	-29.139	39.000	0.747	0.000	0.000	39.000	0.000
L4	86.13 - 42.5 (4)	TP51.95x39.098x0.5	2286.825	-28.514	39.000	0.731	0.000	0.000	39.000	0.000
L5	42.5 - 0 (5)	TP62x49.128x0.5	2827.675	-29.824	39.000	0.765	0.000	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	191.507 - 173.507 (1)	TP19.73x15x0.188	0.004	0.385	0.000	0.389 ✔	1.333	H1-3 ✔
L2	173.507 - 130.837 (2)	TP30.46x18.567x0.313	0.009	0.700	0.000	0.709 ✔	1.333	H1-3 ✔
L3	130.837 - 86.13 (3)	TP41.47x28.707x0.438	0.010	0.747	0.000	0.757 ✔	1.333	H1-3 ✔

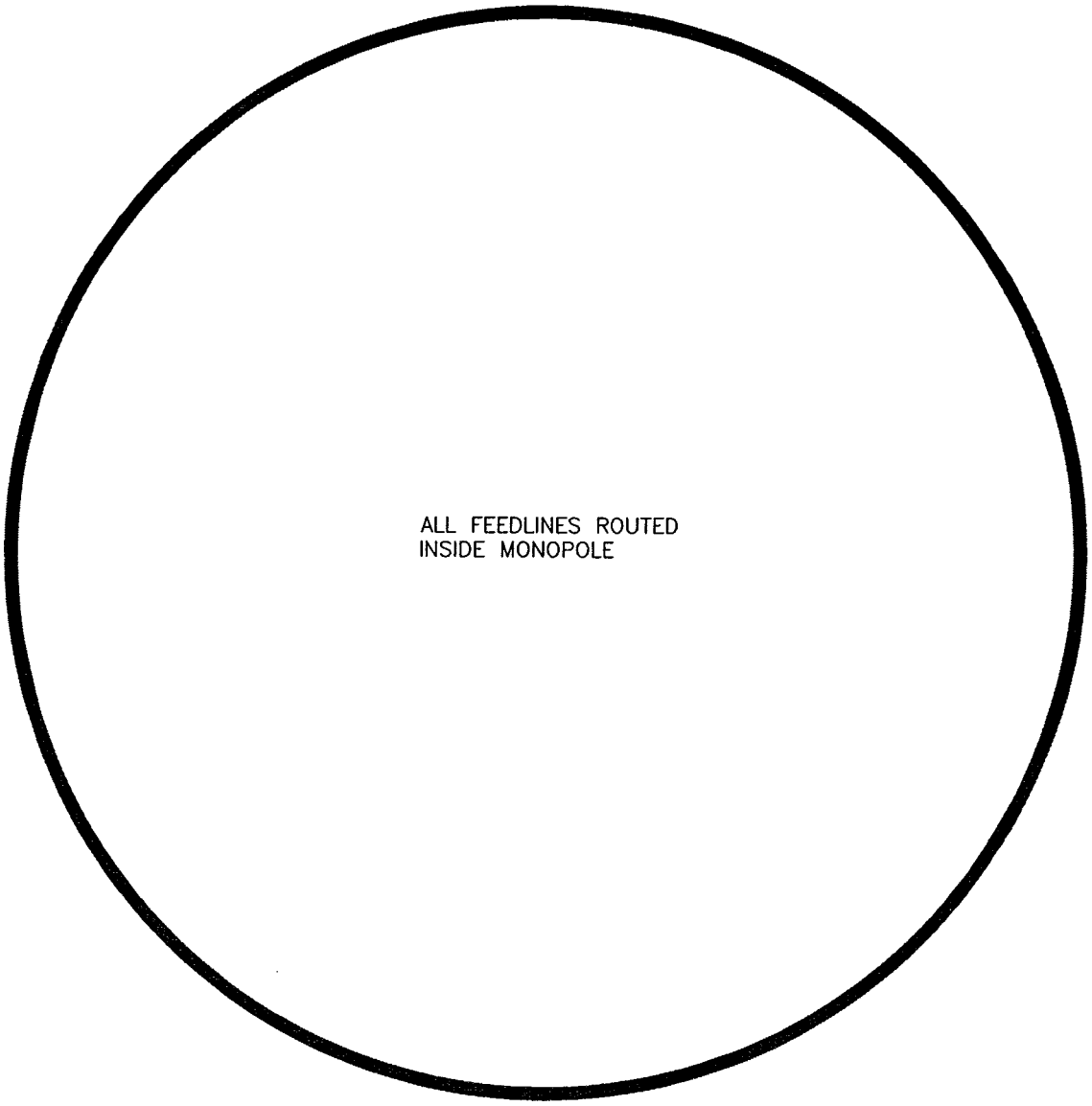
Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L4	86.13 - 42.5 (4)	TP51.95x39.098x0.5	0.012	0.731	0.000	0.743 ✔	1.333	H1-3 ✔
L5	42.5 - 0 (5)	TP62x49.128x0.5	0.013	0.765	0.000	0.778 ✔	1.333	H1-3 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	191.507 - 173.507	Pole	TP19.73x15x0.188	1	-1.757	580.231	29.2	Pass
L2	173.507 - 130.837	Pole	TP30.46x18.567x0.313	2	-10.430	1496.359	53.2	Pass
L3	130.837 - 86.13	Pole	TP41.47x28.707x0.438	3	-20.570	2854.113	56.8	Pass
L4	86.13 - 42.5	Pole	TP51.95x39.098x0.5	4	-35.419	4094.496	55.7	Pass
L5	42.5 - 0	Pole	TP62x49.128x0.5	5	-44.246	4450.100	58.4	Pass
							Summary	
						Pole (L5)	58.4	Pass
						RATING =	**58.4**	**Pass**

APPENDIX B

BASE LEVEL DRAWING



BUSINESS UNIT: 876355

APPENDIX C

ADDITIONAL CALCULATIONS

PROJECT	**78088 - Upper Stepney, CT (BU 876355)**		
SUBJECT	**Existing 194' Monopole**		
DATE	**08/13/07**	BY	**CT/jr**

B&T Engineering, Inc.
1325 E. 15th St., Suite 202
Tulsa, OK 74120
(918) 587-4630

Base Plate / Anchor Bolt Check - Circular Plate No Stiffeners

Input:

Tower Reactions:

Moment:	**3654 k-ft**
Axial:	**55.0 kips**
Shear:	**30.0 kips**

Allowable Stress Increase

Stress Incr.:	**1.33**

Pole Information:

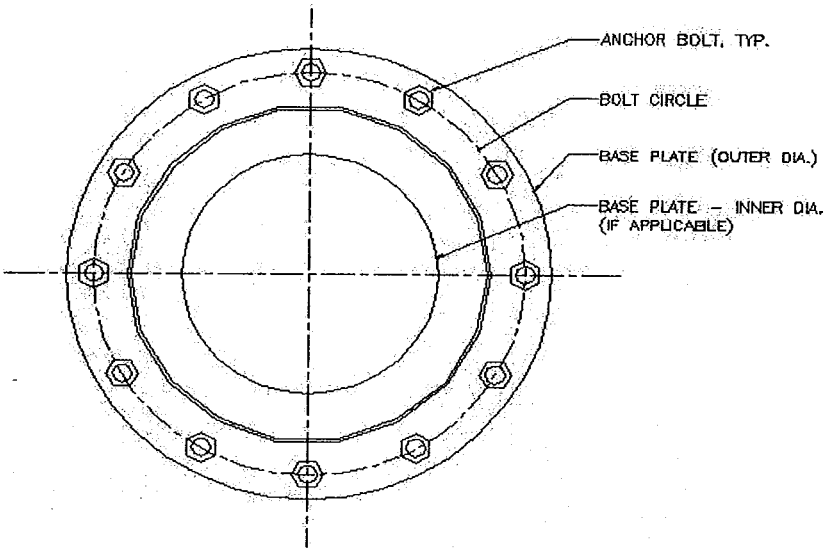
Outer Dia.:	**62.00 in**

Bolt Information:

# of Bolts:	**24**
Bolt diameter:	**2.25 in**
Bolt Grade:	**A615-75**
Bolt Fy:	**75 ksi**
Bolt Circle dia:	**71.00 in**

Plate Information:

Thickness:	**2.25 in**	
Plate Fy:	**60 ksi**	
Outer Dia.:	**77.00 in**	
Inner Dia.:	**56.00 in**	
Grouted?	**N**	Y/N
Grout Height:	**2.00 in**	If Grouted



Anchor Bolt Check:

	Actual	Allowable	Stress Ratio	Result
Tension:	100.6 k	194.4 k	**51.8%**	**PASS**
Compression	105.2 k	238.0 k	**44.2%**	**PASS**

Base Plate Check:

Plate Moment:	355.12 k-in	
Eff. Width at Pole:	8.12 in	
S plate	6.85 in^3	
Actual Stress:	51.86 ksi	
Allowable Stress:	59.85 ksi	Result
Stress Ratio:	**86.7%**	**PASS**