

# Robinson+Cole

KENNETH C. BALDWIN

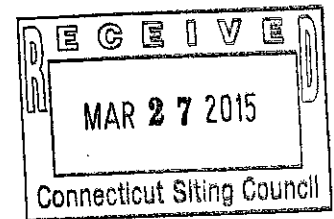
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Also admitted in Massachusetts

March 25, 2015

Melanie A. Bachman  
Acting Executive Director  
Connecticut Siting Council  
10 Franklin Square  
New Britain, CT 06051

ORIGINAL



Re: **EM-VER-108-150209 – Cellco Partnership d/b/a Verizon Wireless  
85 Quaker Farms Road, Seymour, Connecticut**

Dear Ms. Bachman:

On March 2, 2015, the Council acknowledged the above-referenced notice of exempt modification regarding Cellco's facility at 85 Quaker Farms Road in Seymour. The Structural Report, dated October 24, 2014, and submitted with that filing concluded that certain tower modifications would be required to support Cellco's proposed antenna swap. We were recently contacted by Crown Castle and told that the October 29, 2014 Structural Modification Report was incorrect, and that the tower was capable of supporting Cellco's modifications without the need for any structural reinforcement. A new Structural Analysis, dated February 10, 2015, was provided to verify this fact.

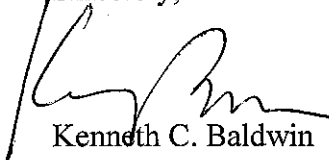
Attached to this letter is a copy of the February 10, 2015 Structural Analysis Report and a March 18, 2015 letter from Crown castle explaining the error. Based on this new information, Cellco will not be providing a P.E. certification letter regarding tower modifications, previously thought to be necessary. We will notify the Council once Cellco's antenna modifications have been completed.

# Robinson+Cole

Melanie A. Bachman  
March 25, 2015  
Page 2

If you have any questions please do not hesitate to contact me.

Sincerely,



Kenneth C. Baldwin

Attachment

Copy to:

Tim Parks  
Brian Ragozzine  
Mark Gauger

Date: February 10, 2015

James Williams  
Crown Castle  
3530 Toringdon Way, Suite 300  
Charlotte, NC 28277



Crown Castle  
2000 Corporate Drive  
Canonsburg, PA 15317  
(724) 416-2000

Subject: Structural Analysis Report

**Carrier Designation:** Verizon Wireless Co-Locate  
Carrier Site Number: N/A  
Carrier Site Name: Seymour West, CT

**Crown Castle Designation:** Crown Castle BU Number: 845455  
Crown Castle Site Name: OXFORD-QUAKER FARMS  
Crown Castle JDE Job Number: 305601  
Crown Castle Work Order Number: 1005855  
Crown Castle Application Number: 263999 Rev. 2

**Engineering Firm Designation:** Crown Castle Project Number: 1005855

**Site Data:** 85 QUAKER FARMS ROAD, OXFORD, New Haven County, CT  
Latitude 41° 23' 2.36", Longitude -73° 8' 14.54"  
149 Foot - Monopole Tower

Dear James Williams,

Crown Castle is pleased to submit this "Structural Analysis Report" to determine the structural integrity of the above mentioned 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 1005855, in accordance with application 263999, revision 2.

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:

LC5: Existing + Proposed Equipment

Sufficient Capacity

Note: See Table I and Table II for the proposed and existing loading, respectively.

The analysis has been performed in accordance with the TIA/EIA-222-F Standard and the 2005 Connecticut State Building Code with 2009 Amendments based upon a wind speed of 85 mph fastest mile.

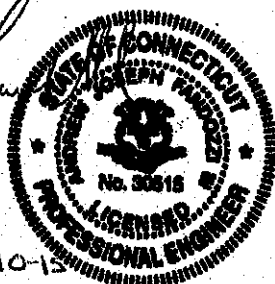
All modifications and equipment proposed in this report shall be installed in accordance with the attached drawings for the determined available structural capacity to be effective.

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

Structural analysis prepared by: Nathan Martinak, EIT / JGK

Respectfully submitted by:

Andrew J. Fandozzi, P.E.  
Engineering Supervisor



tnxTower Report - version 6.1.4.1

2-10-15

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## 1) INTRODUCTION

This tower is a 149 ft Monopole tower designed by PennSummit Tubular, LLC in April of 2005. The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-F.

The modification drawings designed by CCI on October 31, 2014 were not considered in this analysis.

## 2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 85 mph with no ice, 37.6 mph with 0.75 inch ice thickness and 50 mph under service loads.

**Table 1 - Proposed Antenna and Cable Information**

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
120	120	3	alcatel lucent	RRH2X60-AWS	2	1-5/8	-
		3	alcatel lucent	RRH2X60-PCS			
		3	andrew	HBXX-6517DS-A2M w/ Mount Pipe			
		3	andrew	SBNHH-1D65B w/ Mount Pipe			
		2	rfs celwave	DB-T1-6Z-8AB-0Z			

**Table 2 - Existing and Reserved Antenna and Cable Information**

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
149	150	2	andrew	SBNH-1D6565C w/ Mount Pipe	6 3	1-5/8 1/2	1
		3	ericsson	RRUS-11			
		1	kmw communications	AM-X-CD-16-65-00T-RET w/ Mount Pipe			
		3	powerwave technologies	7770.00 w/ Mount Pipe			
		6	powerwave technologies	LGP21401			
	1	raycap	DC6-48-60-18-8F				
	149	1	tower mounts	Side Arm Mount [SO 103-3]			
139	140	3	powerwave technologies	7770.00 w/ Mount Pipe	6	1-5/8	1
		6	powerwave technologies	TMA DD 1900 with 850 BYPASS			
	139	1	tower mounts	Side Arm Mount [SO 104-3]			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
129	132	3	powerwave technologies	LGP 13901	6	1-5/8	1
		3	rfs celwave	APXV18-209014-C w/ Mount Pipe			
	129	1	tower mounts	Side Arm Mount [SO 104-3]			
120	120	6	andrew	850/1900 dual band TMA	18	1-5/8	1
		3	antel	BXA-185085/12CF w/ Mount Pipe			
		3	antel	BXA-70063/4CF w/ Mount Pipe			
		3	antel	BXA-80080/6CF w/ Mount Pipe			
		1	tower mounts	Side Arm Mount [SO 104-3]			
109	109	1	tower mounts	Side Arm Mount [SO 104-3]	-	-	3
99	99	1	tower mounts	Side Arm Mount [SO 104-3]	-	-	3
80	80	1	antenna systems and solutions inc	FO150-3	3	1/2	1
		1	pctel	MPRD2449			
		1	tower mounts	Pipe Mount [PM 601-1]			

Notes:

- 1) Existing Equipment
- 2) Equipment to Be Removed; not considered in this analysis
- 3) Empty Mount; considered in this analysis

**Table 3 - Design Antenna and Cable Information**

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
148.5	148.5	6	allgon	7920 Panel	-	-
139	139	9	generic	48" x 12" x 3" Panel Antenna	-	-
129	129	9	generic	48" x 12" x 3" Panel Antenna	-	-
119	119	9	generic	48" x 12" x 3" Panel Antenna	-	-
109	109	6	generic	48" x 12" x 3" Panel Antenna	-	-
99	99	6	generic	48" x 12" x 3" Panel Antenna	-	-

**3) ANALYSIS PROCEDURE**

**Table 4 - Documents Provided**

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	WEI Geotechnical Engineers	4911888	CCISITES
4-TOWER MANUFACTURER DRAWINGS	PennSummit Tubular, LLC / Paul J. Ford and Company	5113082	CCISITES

### 3.1) Analysis Method

tnxTower (version 6.1.4.1), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

### 3.2) Assumptions

- 1) Tower and structures were built in accordance with the manufacturer's specifications.
- 2) The tower and structures have been maintained in accordance with the manufacturer's specification.
- 3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
- 4) When applicable, transmission cables are considered as structural components for calculating wind loads as allowed by TIA/EIA-222-F.

This analysis may be affected if any assumptions are not valid or have been made in error. Crown Castle should be notified to determine the effect on the structural integrity of the tower.

## 4) ANALYSIS RESULTS

**Table 5 - Section Capacity (Summary)**

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	-4.98	879.47	44.5	Pass
L2	111.5 - 75.25	Pole	TP35.383x28.4633x0.2188	2	-10.15	1215.80	88.6	Pass
L3	75.25 - 39.75	Pole	TP41.086x34.167x0.2813	3	-16.04	1851.52	92.4	Pass
L4	39.75 - 0	Pole	TP47.4x39.6154x0.375	4	-26.73	2909.79	84.3	Pass
							Summary	
						Pole (L3)	92.4	Pass
						Rating =	92.4	Pass

**Table 6 - Tower Component Stresses vs. Capacity – LC5**

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	88.0	Pass
1	Base Plate	0	71.3	Pass
1	Base Foundation Soil Interaction	0	65.7	Pass

<b>Structure Rating (max from all components) =</b>	<b>92.4%</b>
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**Notes:**

- 1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

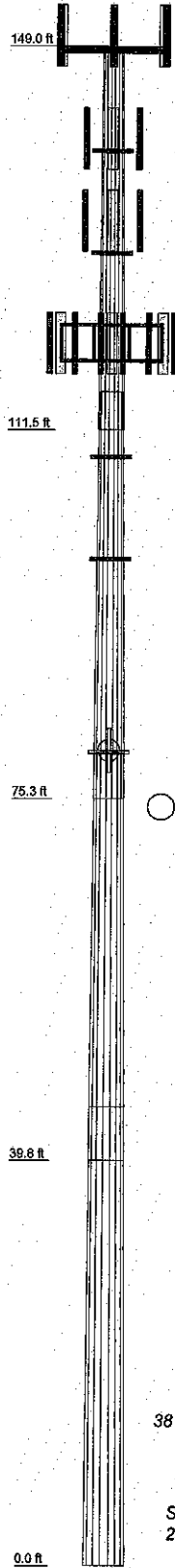
### 4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the existing and proposed loads. No modifications are required at this time.

**APPENDIX A**  
**TNXTOWER OUTPUT**



Section	1	2	3	4
Length (ft)	37.6'	40'	40'	45'
Number of Sides	18	18	18	18
Thickness (in)	0.1875	0.2188	0.2813	0.3750
Socket Length (ft)	3.9'	4.6'	5.3'	
Top Dia (in)	23.0000	28.4633	34.1670	39.6154
Bot Dia (in)	29.4870	35.3830	41.0860	47.4000
Grade		A607-65		
Weight (K)	2.0	3.0	4.5	7.9



### DESIGNED APPURTENANCE LOADING

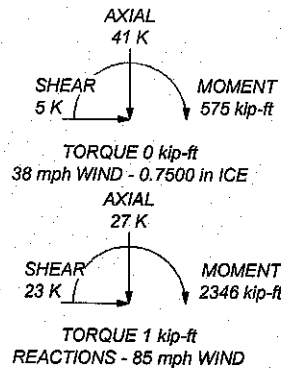
TYPE	ELEVATION	TYPE	ELEVATION
FO150-3	149	BXA-80080/6CF w/ Mount Pipe	120
SBNH-1D8565C w/ Mount Pipe	149	BXA-80080/6CF w/ Mount Pipe	120
SBNH-1D8565C w/ Mount Pipe	149	BXA-80080/6CF w/ Mount Pipe	120
AM-X-CD-16-65-00T-RET w/ Mount Pipe	149	HBXX-6517DS-A2M w/ Mount Pipe	120
7770.00 w/ Mount Pipe	149	HBXX-6517DS-A2M w/ Mount Pipe	120
7770.00 w/ Mount Pipe	149	HBXX-6517DS-A2M w/ Mount Pipe	120
7770.00 w/ Mount Pipe	149	SBNHH-1D65B w/ Mount Pipe	120
(2) LGP21401	149	SBNHH-1D65B w/ Mount Pipe	120
(2) LGP21401	149	RRH2X60-AWS	120
(2) LGP21401	149	RRH2X60-AWS	120
RRUS-11	149	RRH2X60-AWS	120
RRUS-11	149	RRH2X60-PCS	120
RRUS-11	149	RRH2X60-PCS	120
DCS-48-6D-18-8F	149	RRH2X60-PCS	120
Side Arm Mount [SO 103-3]	149	RRH2X60-PCS	120
4' x 2" Pipe Mount	147	DB-T1-6Z-8AB-0Z	120
4' x 2" Pipe Mount	147	DB-T1-6Z-8AB-0Z	120
4' x 2" Pipe Mount	147	(2) 4' x 2" Pipe Mount	120
Side Arm Mount [SO 102-3]	147	(2) 4' x 2" Pipe Mount	120
7770.00 w/ Mount Pipe	139	(2) 4' x 2" Pipe Mount	120
7770.00 w/ Mount Pipe	139	(2) 6' x 2" Horizontal Mount Pipe	120
7770.00 w/ Mount Pipe	139	(2) 6' x 2" Horizontal Mount Pipe	120
(2) TMA DD 1900 with 850 BYPASS	139	(2) 6' x 2" Horizontal Mount Pipe	120
(2) TMA DD 1900 with 850 BYPASS	139	Side Arm Mount [SO 104-3]	120
(2) TMA DD 1900 with 850 BYPASS	139	(2) 4' x 2" Pipe Mount	109
4' x 2" Pipe Mount	139	(2) 4' x 2" Pipe Mount	109
4' x 2" Pipe Mount	139	(2) 4' x 2" Pipe Mount	109
4' x 2" Pipe Mount	139	Side Arm Mount [SO 104-3]	109
4' x 2" Pipe Mount	139	(2) 4' x 2" Pipe Mount	99
Side Arm Mount [SO 104-3]	139	(2) 4' x 2" Pipe Mount	99
APXV18-209014-C w/ Mount Pipe	129	(2) 4' x 2" Pipe Mount	99
APXV18-209014-C w/ Mount Pipe	129	Side Arm Mount [SO 104-3]	99
APXV18-209014-C w/ Mount Pipe	129	FO150-3	80
LGP 13901	129	6' x 2" Mount Pipe	80
LGP 13901	129	Pipe Mount [FM 601-1]	80
LGP 13901	129	MFRD2449	80
Side Arm Mount [SO 104-3]	129		

### MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A607-65	85 ksi	80 ksi			

### TOWER DESIGN NOTES

1. Tower is located in New Haven County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 92.4%



<b>CROWN CASTLE</b> The Foundation for a Wireless World	<b>Crown Castle</b> 2000 Corporate Drive Canonsburg, PA 15317 Phone: (724) 416-2000 FAX: (724) 416-2254		Job: <b>BU #845455</b>
	Project:	Client: <b>Crown Castle</b>	App'd:
	Code: <b>TIA/EIA-222-F</b>	Drawn by: <b>JKazmierczak</b>	Scale: <b>NTS</b>
	Path: X:\ENG Work Area\N\Martha\845455\WO100885UG\845455.dwg	Date: <b>02/09/15</b>	Dwg No. <b>E-1</b>

### Tower Input Data

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

- 4) Tower is located in New Haven County, Connecticut.
- 5) Basic wind speed of 85 mph.
- 6) Nominal ice thickness of 0.7500 in.
- 7) Ice thickness is considered to increase with height.
- 8) Ice density of 56 pcf.
- 9) A wind speed of 38 mph is used in combination with ice.
- 10) Temperature drop of 50 °F.
- 11) Deflections calculated using a wind speed of 50 mph.
- 12) A non-linear (P-delta) analysis was used.
- 13) Pressures are calculated at each section.
- 14) Stress ratio used in pole design is 1.333.
- 15) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

### Options

- |  |  |   |
|--|--|---|
| <ul style="list-style-type: none"> <li>Consider Moments - Legs</li> <li>Consider Moments - Horizontals</li> <li>Consider Moments - Diagonals</li> <li>Use Moment Magnification</li> <li>√ Use Code Stress Ratios</li> <li>√ Use Code Safety Factors - Guys</li> <li>√ Escalate Ice</li> <li>Always Use Max Kz</li> <li>Use Special Wind Profile</li> <li>Include Bolts In Member Capacity</li> <li>Leg Bolts Are At Top Of Section</li> <li>Secondary Horizontal Braces Leg</li> <li>Use Diamond Inner Bracing (4 Sided)</li> <li>Add IBC .6D+W Combination</li> </ul> | <ul style="list-style-type: none"> <li>Distribute Leg Loads As Uniform</li> <li>Assume Legs Pinned</li> <li>√ Assume Rigid Index Plate</li> <li>√ Use Clear Spans For Wind Area</li> <li>Use Clear Spans For KL/r</li> <li>Retension Guys To Initial Tension</li> <li>√ Bypass Mast Stability Checks</li> <li>√ Use Azimuth Dish Coefficients</li> <li>√ Project Wind Area of Appurt.</li> <li>Autocalc Torque Arm Areas</li> <li>SR Members Have Cut Ends</li> <li>Sort Capacity Reports By Component</li> <li>Triangulate Diamond Inner Bracing</li> <li>Use TIA-222-G Tension Splice</li> <li>Capacity Exemption</li> </ul> | <ul style="list-style-type: none"> <li>Treat Feedline Bundles As Cylinder</li> <li>Use ASCE 10 X-Brace Ly Rules</li> <li>Calculate Redundant Bracing Forces</li> <li>Ignore Redundant Members in FEA</li> <li>SR Leg Bolts Resist Compression</li> <li>All Leg Panels Have Same Allowable</li> <li>Offset Girt At Foundation</li> <li>√ Consider Feedline Torque</li> <li>Include Angle Block Shear Check</li> <li style="padding-left: 40px;">Poles</li> <li>√ Include Shear-Torsion Interaction</li> <li>Always Use Sub-Critical Flow</li> <li>Use Top Mounted Sockets</li> </ul> |
|--|--|---|

### 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'-11'6"	37'6"	3'9"	18	23.0000	29.4870	0.1875	0.7500	A607-65 (65 ksi)
L2	111'6"-75'3"	40'	4'6"	18	28.4633	35.3830	0.2188	0.8750	A607-65 (65 ksi)
L3	75'3"-39'9"	40'	5'3"	18	34.1670	41.0860	0.2813	1.1250	A607-65 (65 ksi)
L4	39'9"-0'	45'		18	39.6154	47.4000	0.3750	1.5000	A607-65 (65 ksi)

### Tapered Pole Properties

Section	Tip Dia. in	Area in <sup>2</sup>	I in <sup>4</sup>	r in	C in	I/C in <sup>3</sup>	J in <sup>4</sup>	I/Q in <sup>2</sup>	w in	w/t
---------	----------------	-------------------------	----------------------	---------	---------	------------------------	----------------------	------------------------	---------	-----

Section	Tip Dia. in	Area in <sup>2</sup>	I in <sup>4</sup>	r in	C in	I/C in <sup>3</sup>	J in <sup>4</sup>	I/Q in <sup>2</sup>	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	19.6105	1976.4982	10.0268	14.4594	136.6934	3955.5970	9.8071	4.6245	21.141
	35.9288	24.4150	3814.1390	12.4833	17.9746	212.1965	7633.2967	12.2098	5.8424	26.708
L3	35.4845	30.2494	4388.2313	12.0295	17.3569	252.8241	8782.2367	15.1276	5.5184	19.621
	41.7198	36.4259	7662.4750	14.4857	20.8717	367.1229	15335.032	18.2164	6.7361	23.951
L4	41.1487	46.7059	9086.0567	13.9303	20.1246	451.4897	18184.069	23.3574	6.3123	16.833
	48.1312	55.9715	15637.310	16.6939	24.0792	649.4115	31295.196	27.9911	7.6824	20.486

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A <sub>r</sub>	Adjust. Factor A <sub>r</sub>	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals
ft	ft <sup>2</sup>	in					in	in
L1 149'-111'6"				1	1	1		
L2 111'6"-75'3"				1	1	1		
L3 75'3"-39'9"				1	1	1		
L4 39'9"-0'				1	1	1		

**Feed Line/Linear Appurtenances - Entered As Round Or Flat**

Description	Face or Leg	Allow Shield	Component Type	Placement	Total Number	Number Per Row	Clear Spacing	Width or Diameter	Perimeter	Weight
				ft			in	r	r	plf
***										

**Feed Line/Linear Appurtenances - Entered As Area**

Description	Face or Leg	Allow Shield	Component Type	Placement	Total Number	C <sub>A</sub> A <sub>A</sub>	Weight
				ft		ft <sup>2</sup> /ft	plf
***							
LDF4-50A(1/2")	C	No	Inside Pole	149' - 0'	3	No Ice	0.00
						1/2" Ice	0.00
						1" Ice	0.00
						2" Ice	0.00
						4" Ice	0.00
LDF7-50A(1-5/8")	C	No	Inside Pole	149' - 0'	6	No Ice	0.00
						1/2" Ice	0.00
						1" Ice	0.00
						2" Ice	0.00
						4" Ice	0.00
***							
LDF7-50A(1-5/8")	C	No	Inside Pole	139' - 0'	6	No Ice	0.00
						1/2" Ice	0.00
						1" Ice	0.00
						2" Ice	0.00
						4" Ice	0.00
***							
LDF7-50A(1-5/8")	B	No	Inside Pole	129' - 0'	6	No Ice	0.00
						1/2" Ice	0.00
						1" Ice	0.00
						2" Ice	0.00
						4" Ice	0.00
***							
LDF7-50A(1-5/8")	C	No	Inside Pole	120' - 0'	12	No Ice	0.00
						1/2" Ice	0.00

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C <sub>A</sub> A <sub>A</sub>		Weight plf	
						ft <sup>2</sup> /ft	plf		
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	120' - 0'	7	1" Ice	0.00	0.82	
						2" Ice	0.00	0.82	
						4" Ice	0.00	0.82	
						No Ice	0.00	0.82	
						1/2" Ice	0.00	2.33	
						1" Ice	0.00	4.46	
						2" Ice	0.00	10.54	
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	120' - 0'	1	4" Ice	0.00	30.04	
						No Ice	0.20	0.82	
						1/2" Ice	0.30	2.33	
						1" Ice	0.40	4.46	
						2" Ice	0.60	10.54	
						4" Ice	1.00	30.04	
						No Ice	0.00	2.80	
2" Rigid Conduit	C	No	Inside Pole	120' - 0'	1	1/2" Ice	0.00	2.80	
						1" Ice	0.00	2.80	
						2" Ice	0.00	2.80	
						4" Ice	0.00	2.80	
						No Ice	0.00	2.80	
						1" Ice	0.00	2.80	
						2" Ice	0.00	2.80	
***	LDF4-50A(1/2")	A	No	Inside Pole	80' - 0'	3	No Ice	0.00	0.15
1/2" Ice							0.00	0.15	
1" Ice							0.00	0.15	
2" Ice							0.00	0.15	
4" Ice							0.00	0.15	
***									

### Feed Line/Linear Appurtenances Section Areas

Tower Section n	Tower Elevation ft	Face	A <sub>R</sub> ft <sup>2</sup>	A <sub>F</sub> ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> In Face ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Out Face ft <sup>2</sup>	Weight
							K
L1	149'-111'6"	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.09
		C	0.000	0.000	0.000	1.683	0.50
L2	111'6"-75'3"	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.18
		C	0.000	0.000	0.000	7.178	1.07
L3	75'3"-39'9"	A	0.000	0.000	0.000	0.000	0.02
		B	0.000	0.000	0.000	0.000	0.17
		C	0.000	0.000	0.000	7.029	1.05
L4	39'9"-0'	A	0.000	0.000	0.000	0.000	0.02
		B	0.000	0.000	0.000	0.000	0.20
		C	0.000	0.000	0.000	7.871	1.17

### Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section n	Tower Elevation ft	Face or Leg	Ice Thickness in	A <sub>R</sub> ft <sup>2</sup>	A <sub>F</sub> ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> In Face ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Out Face ft <sup>2</sup>	Weight
								K
L1	149'-111'6"	A	0.884	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.09
		C		0.000	0.000	0.000	3.186	0.71
L2	111'6"-75'3"	A	0.849	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.18
		C		0.000	0.000	0.000	13.586	1.98
L3	75'3"-39'9"	A	0.802	0.000	0.000	0.000	0.000	0.02
		B		0.000	0.000	0.000	0.000	0.17
		C		0.000	0.000	0.000	13.059	1.90
L4	39'9"-0'	A	0.750	0.000	0.000	0.000	0.000	0.02
		B		0.000	0.000	0.000	0.000	0.20
		C		0.000	0.000	0.000	14.243	2.06

### Feed Line Center of Pressure

Section	Elevation	CP <sub>x</sub>	CP <sub>z</sub>	CP <sub>x</sub> Ice	CP <sub>z</sub> Ice
	ft	in	in	in	in
L1	149'-111'6"	-0.0626	0.0361	-0.1093	0.0631
L2	111'6"-75'3"	-0.2396	0.1383	-0.4076	0.2354
L3	75'3"-39'9"	-0.2421	0.1398	-0.4117	0.2377
L4	39'9"-0'	-0.2440	0.1409	-0.4104	0.2369

### Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustmen t	Placement  ft	C <sub>AA</sub> A Front  ft <sup>2</sup>	C <sub>AA</sub> A Side  ft <sup>2</sup>	Weight  K
			ft ft ft	°				
***								
FO150-3	C	From Leg	2.00 0' 1'	0.0000	149'	No Ice 1.09 1/2" 1.35 Ice 1.62 1" Ice 2.20 2" Ice 3.61 4" Ice	1.09 1.35 1.62 2.20 3.61	0.00 0.01 0.02 0.06 0.17
SBNH-1D6565C w/ Mount Pipe	A	From Leg	2.00 0' 1'	0.0000	149'	No Ice 11.68 1/2" 12.40 Ice 13.14 1" Ice 14.60 2" Ice 17.87 4" Ice	9.84 11.37 12.91 15.27 20.14	0.09 0.18 0.28 0.52 1.16
SBNH-1D6565C w/ Mount Pipe	B	From Leg	2.00 0' 1'	0.0000	149'	No Ice 11.68 1/2" 12.40 Ice 13.14 1" Ice 14.60 2" Ice 17.87 4" Ice	9.84 11.37 12.91 15.27 20.14	0.09 0.18 0.28 0.52 1.16
AM-X-CD-16-65-00T-RET w/ Mount Pipe	C	From Leg	2.00 0' 1'	0.0000	149'	No Ice 8.50 1/2" 9.15 Ice 9.77 1" Ice 11.03 2" Ice 13.68 4" Ice	6.30 7.48 8.37 10.18 14.02	0.07 0.14 0.21 0.38 0.87
7770.00 w/ Mount Pipe	A	From Leg	2.00 0' 1'	0.0000	149'	No Ice 6.12 1/2" 6.63 Ice 7.13 1" Ice 8.16 2" Ice 10.36 4" Ice	4.25 5.01 5.71 7.16 10.41	0.06 0.10 0.16 0.29 0.66
7770.00 w/ Mount Pipe	B	From Leg	2.00 0' 1'	0.0000	149'	No Ice 6.12 1/2" 6.63 Ice 7.13 1" Ice 8.16 2" Ice 10.36 4" Ice	4.25 5.01 5.71 7.16 10.41	0.06 0.10 0.16 0.29 0.66
7770.00 w/ Mount Pipe	C	From Leg	2.00 0' 1'	0.0000	149'	No Ice 6.12 1/2" 6.63 Ice 7.13 1" Ice 8.16 2" Ice 10.36 4" Ice	4.25 5.01 5.71 7.16 10.41	0.06 0.10 0.16 0.29 0.66
(2) LGP21401	A	From Leg	2.00 0' 1'	0.0000	149'	No Ice 1.29 1/2" 1.45 Ice 1.61	0.23 0.31 0.40	0.01 0.02 0.03

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C <sub>AA</sub> Front ft <sup>2</sup>	C <sub>AA</sub> Side ft <sup>2</sup>	Weight K	
(2) LGP21401	B	From Leg	2.00 0' 1'	0.0000	149'	1" Ice	1.97	0.61	0.05
						2" Ice	2.79	1.12	0.14
						4" Ice			
						No Ice	1.29	0.23	0.01
						1/2" Ice	1.45	0.31	0.02
						Ice	1.61	0.40	0.03
(2) LGP21401	C	From Leg	2.00 0' 1'	0.0000	149'	1" Ice	1.97	0.61	0.05
						2" Ice	2.79	1.12	0.14
						4" Ice			
						No Ice	1.29	0.23	0.01
						1/2" Ice	1.45	0.31	0.02
						Ice	1.61	0.40	0.03
RRUS-11	A	From Leg	2.00 0' 1'	0.0000	149'	1" Ice	1.97	0.61	0.05
						2" Ice	2.79	1.12	0.14
						4" Ice			
						No Ice	3.25	1.37	0.05
						1/2" Ice	3.49	1.55	0.07
						Ice	3.74	1.74	0.09
RRUS-11	B	From Leg	2.00 0' 1'	0.0000	149'	1" Ice	4.27	2.14	0.15
						2" Ice	5.43	3.04	0.31
						4" Ice			
						No Ice	3.25	1.37	0.05
						1/2" Ice	3.49	1.55	0.07
						Ice	3.74	1.74	0.09
RRUS-11	C	From Leg	2.00 0' 1'	0.0000	149'	1" Ice	4.27	2.14	0.15
						2" Ice	5.43	3.04	0.31
						4" Ice			
						No Ice	3.25	1.37	0.05
						1/2" Ice	3.49	1.55	0.07
						Ice	3.74	1.74	0.09
DC6-48-60-18-8F	A	From Leg	2.00 0' 1'	0.0000	149'	1" Ice	4.27	2.14	0.15
						2" Ice	5.43	3.04	0.31
						4" Ice			
						No Ice	1.27	1.27	0.02
						1/2" Ice	1.46	1.46	0.04
						Ice	1.66	1.66	0.05
Side Arm Mount [SO 103-3]	C	None		0.0000	149'	1" Ice	2.09	2.09	0.10
						2" Ice	3.10	3.10	0.21
						4" Ice			
						No Ice	9.50	9.50	0.22
						1/2" Ice	11.80	11.80	0.32
						Ice	14.10	14.10	0.41
*** 4' x 2" Pipe Mount	A	From Leg	1.00 0' 0'	0.0000	147'	1" Ice	18.70	18.70	0.60
						2" Ice	27.90	27.90	0.97
						4" Ice			
						No Ice	0.79	0.79	0.03
						1/2" Ice	1.03	1.03	0.04
						Ice	1.28	1.28	0.04
4' x 2" Pipe Mount	B	From Leg	1.00 0' 0'	0.0000	147'	1" Ice	1.81	1.81	0.07
						2" Ice	3.11	3.11	0.17
						4" Ice			
						No Ice	0.79	0.79	0.03
						1/2" Ice	1.03	1.03	0.04
						Ice	1.28	1.28	0.04
4' x 2" Pipe Mount	C	From Leg	1.00 0' 0'	0.0000	147'	1" Ice	1.81	1.81	0.07
						2" Ice	3.11	3.11	0.17
						4" Ice			
						No Ice	0.79	0.79	0.03
						1/2" Ice	1.03	1.03	0.04
						Ice	1.28	1.28	0.04
Side Arm Mount [SO 102-	C	None		0.0000	147'	1" Ice	1.81	1.81	0.07
						2" Ice	3.11	3.11	0.17
						4" Ice			
						No Ice	3.00	3.00	0.08

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment t	Placement ft		C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K
3]						1/2"	3.48	3.48	0.11
						Ice	3.96	3.96	0.14
						1" Ice	4.92	4.92	0.20
						2" Ice	6.84	6.84	0.32
						4" Ice			
***									
7770.00 w/ Mount Pipe	A	From Leg	2.00 0' 1'	0.0000	139'	No Ice	6.12	4.25	0.06
						1/2"	6.63	5.01	0.10
						Ice	7.13	5.71	0.16
						1" Ice	8.16	7.16	0.29
						2" Ice	10.36	10.41	0.66
						4" Ice			
7770.00 w/ Mount Pipe	B	From Leg	2.00 0' 1'	0.0000	139'	No Ice	6.12	4.25	0.06
						1/2"	6.63	5.01	0.10
						Ice	7.13	5.71	0.16
						1" Ice	8.16	7.16	0.29
						2" Ice	10.36	10.41	0.66
						4" Ice			
7770.00 w/ Mount Pipe	C	From Leg	2.00 0' 1'	0.0000	139'	No Ice	6.12	4.25	0.06
						1/2"	6.63	5.01	0.10
						Ice	7.13	5.71	0.16
						1" Ice	8.16	7.16	0.29
						2" Ice	10.36	10.41	0.66
						4" Ice			
(2) TMA DD 1900 with 850 BYPASS	A	From Leg	2.00 0' 1'	0.0000	139'	No Ice	0.36	0.17	0.02
						1/2"	0.48	0.24	0.02
						Ice	0.60	0.32	0.03
						1" Ice	0.87	0.49	0.05
						2" Ice	1.52	0.95	0.12
						4" Ice			
(2) TMA DD 1900 with 850 BYPASS	B	From Leg	2.00 0' 1'	0.0000	139'	No Ice	0.36	0.17	0.02
						1/2"	0.48	0.24	0.02
						Ice	0.60	0.32	0.03
						1" Ice	0.87	0.49	0.05
						2" Ice	1.52	0.95	0.12
						4" Ice			
(2) TMA DD 1900 with 850 BYPASS	C	From Leg	2.00 0' 1'	0.0000	139'	No Ice	0.36	0.17	0.02
						1/2"	0.48	0.24	0.02
						Ice	0.60	0.32	0.03
						1" Ice	0.87	0.49	0.05
						2" Ice	1.52	0.95	0.12
						4" Ice			
4' x 2" Pipe Mount	A	From Leg	2.00 0' 0'	0.0000	139'	No Ice	0.79	0.79	0.03
						1/2"	1.03	1.03	0.04
						Ice	1.28	1.28	0.04
						1" Ice	1.81	1.81	0.07
						2" Ice	3.11	3.11	0.17
						4" Ice			
4' x 2" Pipe Mount	B	From Leg	2.00 0' 0'	0.0000	139'	No Ice	0.79	0.79	0.03
						1/2"	1.03	1.03	0.04
						Ice	1.28	1.28	0.04
						1" Ice	1.81	1.81	0.07
						2" Ice	3.11	3.11	0.17
						4" Ice			
4' x 2" Pipe Mount	C	From Leg	2.00 0' 0'	0.0000	139'	No Ice	0.79	0.79	0.03
						1/2"	1.03	1.03	0.04
						Ice	1.28	1.28	0.04
						1" Ice	1.81	1.81	0.07
						2" Ice	3.11	3.11	0.17
						4" Ice			
Side Arm Mount [SO 104-3]	C	None		0.0000	139'	No Ice	3.30	3.30	0.29
						1/2"	4.13	4.13	0.32
						Ice	4.96	4.96	0.35
						1" Ice	6.62	6.62	0.41
						2" Ice	9.94	9.94	0.53

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustmen t °	Placement ft		C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K
						4" Ice			
*** APXV18-209014-C w/ Mount Pipe	A	From Leg	2.00 0' 3'	0.0000	129'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.72 4.13 4.56 5.51 7.55	3.31 4.02 4.68 6.07 9.05	0.04 0.07 0.11 0.21 0.52
APXV18-209014-C w/ Mount Pipe	B	From Leg	2.00 0' 3'	0.0000	129'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.72 4.13 4.56 5.51 7.55	3.31 4.02 4.68 6.07 9.05	0.04 0.07 0.11 0.21 0.52
APXV18-209014-C w/ Mount Pipe	C	From Leg	2.00 0' 3'	0.0000	129'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.72 4.13 4.56 5.51 7.55	3.31 4.02 4.68 6.07 9.05	0.04 0.07 0.11 0.21 0.52
LGP 13901	A	From Leg	2.00 0' 3'	0.0000	129'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.59 0.69 0.81 1.06 1.68	0.28 0.36 0.46 0.67 1.19	0.01 0.01 0.02 0.04 0.09
LGP 13901	B	From Leg	2.00 0' 3'	0.0000	129'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.59 0.69 0.81 1.06 1.68	0.28 0.36 0.46 0.67 1.19	0.01 0.01 0.02 0.04 0.09
LGP 13901	C	From Leg	2.00 0' 3'	0.0000	129'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.59 0.69 0.81 1.06 1.68	0.28 0.36 0.46 0.67 1.19	0.01 0.01 0.02 0.04 0.09
Side Arm Mount [SO 104- 3]	C	None		0.0000	129'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.30 4.13 4.96 6.62 9.94	3.30 4.13 4.96 6.62 9.94	0.29 0.32 0.35 0.41 0.53
* BXA-80080/6CF w/ Mount Pipe	A	From Leg	3.00 0' 0'	0.0000	120'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	8.14 8.79 9.41 10.68 13.32	5.60 6.78 7.67 9.48 13.30	0.05 0.11 0.18 0.34 0.81
BXA-80080/6CF w/ Mount Pipe	B	From Leg	3.00 0' 0'	0.0000	120'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	8.14 8.79 9.41 10.68 13.32	5.60 6.78 7.67 9.48 13.30	0.05 0.11 0.18 0.34 0.81
BXA-80080/6CF w/ Mount Pipe	C	From Leg	3.00 0' 0'	0.0000	120'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	8.14 8.79 9.41 10.68 13.32	5.60 6.78 7.67 9.48 13.30	0.05 0.11 0.18 0.34 0.81
HBXX-6517DS-A2M w/ Mount Pipe	A	From Leg	3.00 0'	0.0000	120'	No Ice 1/2"	8.98 9.65	6.96 8.18	0.07 0.14



Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C <sub>A</sub> A <sub>A</sub> Front	C <sub>A</sub> A <sub>A</sub> Side	Weight	
			Horz	Vert						
			ft	ft	°	ft	ft <sup>2</sup>	ft <sup>2</sup>	K	
			0'			Ice	10.29	9.14	0.21	
						1" Ice	11.59	11.02	0.40	
						2" Ice	14.32	15.03	0.91	
						4" Ice				
HBXX-6517DS-A2M w/ Mount Pipe	B	From Leg	3.00	0'	0.0000	120'	No Ice	8.98	6.96	0.07
			0'				1/2"	9.65	8.18	0.14
			0'				Ice	10.29	9.14	0.21
							1" Ice	11.59	11.02	0.40
							2" Ice	14.32	15.03	0.91
							4" Ice			
HBXX-6517DS-A2M w/ Mount Pipe	C	From Leg	3.00	0'	0.0000	120'	No Ice	8.98	6.96	0.07
			0'				1/2"	9.65	8.18	0.14
			0'				Ice	10.29	9.14	0.21
							1" Ice	11.59	11.02	0.40
							2" Ice	14.32	15.03	0.91
							4" Ice			
SBNHH-1D65B w/ Mount Pipe	A	From Leg	3.00	0'	0.0000	120'	No Ice	8.62	7.08	0.08
			0'				1/2"	9.27	8.28	0.15
			0'				Ice	9.90	9.19	0.22
							1" Ice	11.17	11.03	0.40
							2" Ice	13.84	15.07	0.91
							4" Ice			
SBNHH-1D65B w/ Mount Pipe	B	From Leg	3.00	0'	0.0000	120'	No Ice	8.62	7.08	0.08
			0'				1/2"	9.27	8.28	0.15
			0'				Ice	9.90	9.19	0.22
							1" Ice	11.17	11.03	0.40
							2" Ice	13.84	15.07	0.91
							4" Ice			
SBNHH-1D65B w/ Mount Pipe	C	From Leg	3.00	0'	0.0000	120'	No Ice	8.62	7.08	0.08
			0'				1/2"	9.27	8.28	0.15
			0'				Ice	9.90	9.19	0.22
							1" Ice	11.17	11.03	0.40
							2" Ice	13.84	15.07	0.91
							4" Ice			
RRH2X60-AWS	A	From Leg	3.00	0'	0.0000	120'	No Ice	3.96	1.82	0.06
			0'				1/2"	4.27	2.08	0.08
			0'				Ice	4.60	2.36	0.11
							1" Ice	5.27	2.96	0.17
							2" Ice	6.72	4.25	0.35
							4" Ice			
RRH2X60-AWS	B	From Leg	3.00	0'	0.0000	120'	No Ice	3.96	1.82	0.06
			0'				1/2"	4.27	2.08	0.08
			0'				Ice	4.60	2.36	0.11
							1" Ice	5.27	2.96	0.17
							2" Ice	6.72	4.25	0.35
							4" Ice			
RRH2X60-AWS	C	From Leg	3.00	0'	0.0000	120'	No Ice	3.96	1.82	0.06
			0'				1/2"	4.27	2.08	0.08
			0'				Ice	4.60	2.36	0.11
							1" Ice	5.27	2.96	0.17
							2" Ice	6.72	4.25	0.35
							4" Ice			
RRH2X60-PCS	A	From Leg	3.00	0'	0.0000	120'	No Ice	2.57	2.01	0.06
			0'				1/2"	2.79	2.22	0.08
			0'				Ice	3.02	2.43	0.10
							1" Ice	3.52	2.89	0.16
							2" Ice	4.61	3.92	0.31
							4" Ice			
RRH2X60-PCS	B	From Leg	3.00	0'	0.0000	120'	No Ice	2.57	2.01	0.06
			0'				1/2"	2.79	2.22	0.08
			0'				Ice	3.02	2.43	0.10
							1" Ice	3.52	2.89	0.16
							2" Ice	4.61	3.92	0.31
							4" Ice			
RRH2X60-PCS	C	From Leg	3.00	0'	0.0000	120'	No Ice	2.57	2.01	0.06

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment	Placement ft	C <sub>AA</sub> Front ft <sup>2</sup>	C <sub>AA</sub> Side ft <sup>2</sup>	Weight K
			0'			1/2"	2.79	0.08
			0'			Ice	3.02	0.10
						1" Ice	3.52	0.16
						2" Ice	4.61	0.31
						4" Ice		
DB-T1-6Z-8AB-0Z	A	From Leg	3.00	0.0000	120'	No Ice	5.60	0.04
			0'			1/2"	5.92	0.08
			0'			Ice	6.24	0.12
						1" Ice	6.91	0.21
						2" Ice	8.37	0.45
						4" Ice		
DB-T1-6Z-8AB-0Z	B	From Leg	3.00	0.0000	120'	No Ice	5.60	0.04
			0'			1/2"	5.92	0.08
			0'			Ice	6.24	0.12
						1" Ice	6.91	0.21
						2" Ice	8.37	0.45
						4" Ice		
(2) 4' x 2" Pipe Mount	A	From Leg	3.00	0.0000	120'	No Ice	0.79	0.03
			0'			1/2"	1.03	0.04
			0'			Ice	1.28	0.04
						1" Ice	1.81	0.07
						2" Ice	3.11	0.17
						4" Ice		
(2) 4' x 2" Pipe Mount	B	From Leg	3.00	0.0000	120'	No Ice	0.79	0.03
			0'			1/2"	1.03	0.04
			0'			Ice	1.28	0.04
						1" Ice	1.81	0.07
						2" Ice	3.11	0.17
						4" Ice		
(2) 4' x 2" Pipe Mount	C	From Leg	3.00	0.0000	120'	No Ice	0.79	0.03
			0'			1/2"	1.03	0.04
			0'			Ice	1.28	0.04
						1" Ice	1.81	0.07
						2" Ice	3.11	0.17
						4" Ice		
(2) 6' x 2" Horizontal Mount Pipe	A	From Leg	3.00	0.0000	120'	No Ice	0.80	0.03
			0'			1/2"	1.22	0.17
			0'			Ice	1.64	0.32
						1" Ice	2.53	0.65
						2" Ice	4.44	1.39
						4" Ice		
(2) 6' x 2" Horizontal Mount Pipe	B	From Leg	3.00	0.0000	120'	No Ice	0.80	0.03
			0'			1/2"	1.22	0.17
			0'			Ice	1.64	0.32
						1" Ice	2.53	0.65
						2" Ice	4.44	1.39
						4" Ice		
(2) 6' x 2" Horizontal Mount Pipe	C	From Leg	3.00	0.0000	120'	No Ice	0.80	0.03
			0'			1/2"	1.22	0.17
			0'			Ice	1.64	0.32
						1" Ice	2.53	0.65
						2" Ice	4.44	1.39
						4" Ice		
Side Arm Mount [SO 104-3]	C	None		0.0000	120'	No Ice	3.30	0.29
						1/2"	4.13	0.32
						Ice	4.96	0.35
						1" Ice	6.62	0.41
						2" Ice	9.94	0.53
						4" Ice		
***								
(2) 4' x 2" Pipe Mount	A	From Leg	1.00	0.0000	109'	No Ice	0.79	0.03
			0'			1/2"	1.03	0.04
			0'			Ice	1.28	0.04
						1" Ice	1.81	0.07
						2" Ice	3.11	0.17

Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C <sub>A</sub> A <sub>A</sub> Front	C <sub>A</sub> A <sub>A</sub> Side	Weight	
			Horz	Vert						
			ft	ft		ft	ft <sup>2</sup>	ft <sup>2</sup>	K	
(2) 4' x 2" Pipe Mount	B	From Leg	1.00	0'	0.0000	109'	4" Ice			
							No Ice	0.79	0.79	0.03
							1/2" Ice	1.03	1.03	0.04
							1" Ice	1.28	1.28	0.04
							2" Ice	1.81	1.81	0.07
(2) 4' x 2" Pipe Mount	C	From Leg	1.00	0'	0.0000	109'	4" Ice			
							No Ice	0.79	0.79	0.03
							1/2" Ice	1.03	1.03	0.04
							1" Ice	1.28	1.28	0.04
							2" Ice	1.81	1.81	0.07
Side Arm Mount [SO 104-3]	C	None			0.0000	109'	4" Ice			
							No Ice	3.30	3.30	0.29
							1/2" Ice	4.13	4.13	0.32
							1" Ice	4.96	4.96	0.35
							2" Ice	6.62	6.62	0.41
***										
(2) 4' x 2" Pipe Mount	A	From Leg	1.00	0'	0.0000	99'	4" Ice			
							No Ice	0.79	0.79	0.03
							1/2" Ice	1.03	1.03	0.04
							1" Ice	1.28	1.28	0.04
							2" Ice	1.81	1.81	0.07
(2) 4' x 2" Pipe Mount	B	From Leg	1.00	0'	0.0000	99'	4" Ice			
							No Ice	0.79	0.79	0.03
							1/2" Ice	1.03	1.03	0.04
							1" Ice	1.28	1.28	0.04
							2" Ice	1.81	1.81	0.07
(2) 4' x 2" Pipe Mount	C	From Leg	1.00	0'	0.0000	99'	4" Ice			
							No Ice	0.79	0.79	0.03
							1/2" Ice	1.03	1.03	0.04
							1" Ice	1.28	1.28	0.04
							2" Ice	1.81	1.81	0.07
Side Arm Mount [SO 104-3]	C	None			0.0000	99'	4" Ice			
							No Ice	3.30	3.30	0.29
							1/2" Ice	4.13	4.13	0.32
							1" Ice	4.96	4.96	0.35
							2" Ice	6.62	6.62	0.41
***										
FO150-3	A	From Leg	1.00	0'	0.0000	80'	4" Ice			
							No Ice	1.09	1.09	0.00
							1/2" Ice	1.35	1.35	0.01
							1" Ice	1.62	1.62	0.02
							2" Ice	2.20	2.20	0.06
6' x 2" Mount Pipe	A	From Leg	0.50	0'	0.0000	80'	4" Ice			
							No Ice	1.43	1.43	0.02
							1/2" Ice	1.92	1.92	0.03
							1" Ice	2.29	2.29	0.05
							2" Ice	3.06	3.06	0.09
Pipe Mount [PM 601-1]	A	From Leg	0.50	0'	0.0000	80'	4" Ice			
							No Ice	3.00	0.90	0.07
							1/2" Ice	3.74	1.12	0.08
							1" Ice	4.48	1.34	0.09
							2" Ice	5.96	1.78	0.12
***										
							2" Ice	8.92	2.66	0.18
							4" Ice			

<b>Dishes</b>											
Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	3 dB Beam Width	Elevation	Outside Diameter	Aperture Area	Weight	
				ft	°	°	ft	ft	ft <sup>2</sup>	K	
MPRD2449	A	Paraboloid w/Radome	From Leg	1.00 0' 0'	0.0000		80'	2.17	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.69 3.98 4.27 4.84 6.00	0.04 0.06 0.08 0.12 0.20

### Load Combinations

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

### Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force 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	14	-12.36	-0.23	0.29
			Max. Mx	5	-4.99	-227.51	0.04
			Max. My	2	-4.98	-0.02	227.61
			Max. Vy	11	-12.76	227.24	0.18
			Max. Vx	8	12.83	-0.17	-227.33
			Max. Torque	7			0.87
L2	111.5 - 75.25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-19.93	1.04	0.06
			Max. Mx	11	-10.17	751.38	2.37
			Max. My	2	-10.15	2.28	754.09
			Max. Vy	11	-16.67	751.38	2.37
			Max. Vx	8	16.89	-2.01	-753.58
			Max. Torque	6			1.21
L3	75.25 - 39.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-27.73	2.51	-0.78
			Max. Mx	11	-16.05	1379.71	3.55
			Max. My	8	-16.04	-3.74	-1389.50
			Max. Vy	11	-19.40	1379.71	3.55
			Max. Vx	8	19.62	-3.74	-1389.50
			Max. Torque	6			1.20
L4	39.75 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-40.88	4.55	-1.96
			Max. Mx	11	-26.73	2324.64	4.97
			Max. My	8	-26.73	-5.87	-2344.15
			Max. Vy	11	-22.52	2324.64	4.97
			Max. Vx	8	22.74	-5.87	-2344.15
			Max. Torque	6			1.14

### Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	21	40.88	-0.01	-5.30
	Max. H <sub>x</sub>	11	26.75	22.50	0.04
	Max. H <sub>z</sub>	2	26.75	0.06	22.70
	Max. M <sub>x</sub>	2	2341.71	0.06	22.70
	Max. M <sub>z</sub>	5	2322.84	-22.50	-0.08
	Max. Torsion	6	1.07	-19.54	-11.41
	Min. Vert	1	26.75	0.00	0.00
	Min. H <sub>x</sub>	5	26.75	-22.50	-0.08
	Min. H <sub>z</sub>	8	26.75	-0.06	-22.72
	Min. M <sub>x</sub>	8	-2344.15	-0.06	-22.72
	Min. M <sub>z</sub>	11	-2324.64	22.50	0.04
	Min. Torsion	12	-1.06	19.52	11.37

### Tower Mast Reaction Summary

Load Combination	Vertical K	Shear <sub>x</sub> K	Shear <sub>z</sub> K	Overturing Moment, M <sub>x</sub> kip-ft	Overturing Moment, M <sub>z</sub> kip-ft	Torque kip-ft
Dead Only	26.75	0.00	0.00	0.18	0.88	0.00
Dead+Wind 0 deg - No Ice	26.75	-0.06	-22.70	-2341.71	7.67	0.48
Dead+Wind 30 deg - No Ice	26.75	11.21	-19.62	-2023.64	-1155.96	-0.07
Dead+Wind 60 deg - No Ice	26.75	19.46	-11.27	-1162.73	-2008.10	-0.59
Dead+Wind 90 deg - No Ice	26.75	22.50	0.08	8.57	-2322.84	-0.95
Dead+Wind 120 deg - No Ice	26.75	19.54	11.41	1177.88	-2016.68	-1.07
Dead+Wind 150 deg - No Ice	26.75	11.33	19.71	2033.67	-1169.32	-0.90

Load Combination	Vertical	Shear <sub>x</sub>	Shear <sub>z</sub>	Overturning Moment, M <sub>x</sub>	Overturning Moment, M <sub>z</sub>	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 180 deg - No Ice	26.75	0.06	22.72	2344.15	-5.87	-0.48
Dead+Wind 210 deg - No Ice	26.75	-11.23	19.65	2026.93	1159.41	0.08
Dead+Wind 240 deg - No Ice	26.75	-19.48	11.31	1166.16	2011.73	0.59
Dead+Wind 270 deg - No Ice	26.75	-22.50	-0.04	-4.97	2324.64	0.94
Dead+Wind 300 deg - No Ice	26.75	-19.52	-11.37	-1174.43	2016.63	1.06
Dead+Wind 330 deg - No Ice	26.75	-11.31	-19.67	-2030.38	1169.47	0.91
Dead+Ice+Temp	40.88	-0.00	0.00	1.96	4.55	0.00
Dead+Wind 0 deg+Ice+Temp	40.88	-0.01	-5.30	-569.96	5.61	0.08
Dead+Wind 30 deg+Ice+Temp	40.88	2.62	-4.58	-492.63	-278.77	-0.04
Dead+Wind 60 deg+Ice+Temp	40.88	4.54	-2.63	-282.64	-486.86	-0.15
Dead+Wind 90 deg+Ice+Temp	40.88	5.25	0.01	3.33	-563.47	-0.22
Dead+Wind 120 deg+Ice+Temp	40.88	4.56	2.66	289.01	-488.24	-0.24
Dead+Wind 150 deg+Ice+Temp	40.88	2.64	4.60	498.26	-280.82	-0.19
Dead+Wind 180 deg+Ice+Temp	40.88	0.01	5.30	574.42	3.68	-0.08
Dead+Wind 210 deg+Ice+Temp	40.88	-2.63	4.59	497.29	288.43	0.04
Dead+Wind 240 deg+Ice+Temp	40.88	-4.55	2.64	287.33	496.56	0.15
Dead+Wind 270 deg+Ice+Temp	40.88	-5.25	-0.00	1.39	572.75	0.22
Dead+Wind 300 deg+Ice+Temp	40.88	-4.55	-2.65	-284.32	497.11	0.24
Dead+Wind 330 deg+Ice+Temp	40.88	-2.64	-4.59	-493.60	289.73	0.19
Dead+Wind 0 deg - Service	26.75	-0.02	-7.85	-811.30	3.25	0.17
Dead+Wind 30 deg - Service	26.75	3.88	-6.79	-701.08	-399.96	-0.03
Dead+Wind 60 deg - Service	26.75	6.73	-3.90	-402.77	-695.22	-0.20
Dead+Wind 90 deg - Service	26.75	7.79	0.03	3.08	-804.28	-0.33
Dead+Wind 120 deg - Service	26.75	6.76	3.95	408.25	-698.20	-0.37
Dead+Wind 150 deg - Service	26.75	3.92	6.82	704.80	-404.59	-0.32
Dead+Wind 180 deg - Service	26.75	0.02	7.86	812.38	-1.45	-0.17
Dead+Wind 210 deg - Service	26.75	-3.89	6.80	702.45	402.33	0.03
Dead+Wind 240 deg - Service	26.75	-6.74	3.91	404.19	697.66	0.21
Dead+Wind 270 deg - Service	26.75	-7.79	-0.01	-1.61	806.08	0.33
Dead+Wind 300 deg - Service	26.75	-6.75	-3.93	-406.83	699.36	0.37
Dead+Wind 330 deg - Service	26.75	-3.91	-6.81	-703.43	405.82	0.32

### Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.00	-26.75	0.00	0.00	26.75	0.00	0.000%
2	-0.06	-26.75	-22.70	0.06	26.75	22.70	0.000%
3	11.21	-26.75	-19.62	-11.21	26.75	19.62	0.000%
4	19.46	-26.75	-11.27	-19.46	26.75	11.27	0.000%
5	22.50	-26.75	0.08	-22.50	26.75	-0.08	0.000%
6	19.54	-26.75	11.41	-19.54	26.75	-11.41	0.000%
7	11.33	-26.75	19.71	-11.33	26.75	19.71	0.000%
8	0.06	-26.75	22.72	-0.06	26.75	-22.72	0.000%
9	-11.23	-26.75	19.65	11.23	26.75	-19.65	0.000%

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
10	-19.48	-26.75	11.31	19.48	26.75	-11.31	0.000%
11	-22.50	-26.75	-0.04	22.50	26.75	0.04	0.000%
12	-19.52	-26.75	-11.37	19.52	26.75	11.37	0.000%
13	-11.31	-26.75	-19.67	11.31	26.75	19.67	0.000%
14	0.00	-40.88	0.00	0.00	40.88	-0.00	0.000%
15	-0.01	-40.88	-5.30	0.01	40.88	5.30	0.000%
16	2.62	-40.88	-4.58	-2.62	40.88	4.58	0.000%
17	4.54	-40.88	-2.63	-4.54	40.88	2.63	0.000%
18	5.25	-40.88	0.01	-5.25	40.88	-0.01	0.000%
19	4.56	-40.88	2.66	-4.56	40.88	-2.66	0.000%
20	2.64	-40.88	4.60	-2.64	40.88	-4.60	0.000%
21	0.01	-40.88	5.30	-0.01	40.88	-5.30	0.000%
22	-2.63	-40.88	4.59	2.63	40.88	-4.59	0.000%
23	-4.55	-40.88	2.64	4.55	40.88	-2.64	0.000%
24	-5.25	-40.88	-0.00	5.25	40.88	0.00	0.000%
25	-4.55	-40.88	-2.65	4.55	40.88	2.65	0.000%
26	-2.64	-40.88	-4.59	2.64	40.88	4.59	0.000%
27	-0.02	-26.75	-7.85	0.02	26.75	7.85	0.000%
28	3.88	-26.75	-6.79	-3.88	26.75	6.79	0.000%
29	6.73	-26.75	-3.90	-6.73	26.75	3.90	0.000%
30	7.79	-26.75	0.03	-7.79	26.75	-0.03	0.000%
31	6.76	-26.75	3.95	-6.76	26.75	-3.95	0.000%
32	3.92	-26.75	6.82	-3.92	26.75	-6.82	0.000%
33	0.02	-26.75	7.86	-0.02	26.75	-7.86	0.000%
34	-3.89	-26.75	6.80	3.89	26.75	-6.80	0.000%
35	-6.74	-26.75	3.91	6.74	26.75	-3.91	0.000%
36	-7.79	-26.75	-0.01	7.79	26.75	0.01	0.000%
37	-6.75	-26.75	-3.93	6.75	26.75	3.93	0.000%
38	-3.91	-26.75	-6.81	3.91	26.75	6.81	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	0.00034729
3	Yes	5	0.00000001	0.00059574
4	Yes	5	0.00000001	0.00060049
5	Yes	4	0.00000001	0.00048856
6	Yes	5	0.00000001	0.00058551
7	Yes	5	0.00000001	0.00061541
8	Yes	4	0.00000001	0.00059489
9	Yes	5	0.00000001	0.00059340
10	Yes	5	0.00000001	0.00058898
11	Yes	4	0.00000001	0.00074197
12	Yes	5	0.00000001	0.00061644
13	Yes	5	0.00000001	0.00058621
14	Yes	4	0.00000001	0.00002007
15	Yes	5	0.00000001	0.00017840
16	Yes	5	0.00000001	0.00023100
17	Yes	5	0.00000001	0.00023132
18	Yes	5	0.00000001	0.00017692
19	Yes	5	0.00000001	0.00023165
20	Yes	5	0.00000001	0.00023470
21	Yes	5	0.00000001	0.00017918
22	Yes	5	0.00000001	0.00023563
23	Yes	5	0.00000001	0.00023449
24	Yes	5	0.00000001	0.00017927
25	Yes	5	0.00000001	0.00023657
26	Yes	5	0.00000001	0.00023429
27	Yes	4	0.00000001	0.00009768
28	Yes	5	0.00000001	0.00005238
29	Yes	5	0.00000001	0.00005315
30	Yes	4	0.00000001	0.00012398
31	Yes	5	0.00000001	0.00005026

32	Yes	5	0.00000001	0.00005593
33	Yes	4	0.00000001	0.00011218
34	Yes	5	0.00000001	0.00005198
35	Yes	5	0.00000001	0.00005102
36	Yes	4	0.00000001	0.00013978
37	Yes	5	0.00000001	0.00005608
38	Yes	5	0.00000001	0.00005061

### Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	149 - 111.5	35.790	38	2.0392	0.0044
L2	115.25 - 75.25	21.892	38	1.8275	0.0027
L3	79.75 - 39.75	10.191	32	1.2460	0.0014
L4	45 - 0	3.164	32	0.6429	0.0005

### Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
149'	FO150-3	38	35.790	2.0392	0.0044	31233
147'	4' x 2" Pipe Mount	38	34.937	2.0317	0.0043	31233
139'	7770.00 w/ Mount Pipe	38	31.539	1.9995	0.0039	15616
129'	APXV18-209014-C w/ Mount Pipe	38	27.364	1.9466	0.0033	7807
120'	BXA-80080/6CF w/ Mount Pipe	38	23.737	1.8765	0.0029	5384
109'	(2) 4' x 2" Pipe Mount	38	19.552	1.7485	0.0024	4289
99'	(2) 4' x 2" Pipe Mount	32	16.041	1.5940	0.0020	3840
80'	MPRD2449	32	10.259	1.2507	0.0014	3214

### Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	149 - 111.5	103.022	7	5.8750	0.0129
L2	115.25 - 75.25	63.073	7	5.2673	0.0078
L3	79.75 - 39.75	29.392	7	3.5937	0.0039
L4	45 - 0	9.130	7	1.8553	0.0014

### Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
149'	FO150-3	7	103.022	5.8750	0.0129	11056
147'	4' x 2" Pipe Mount	7	100.571	5.8535	0.0126	11056
139'	7770.00 w/ Mount Pipe	7	90.805	5.7614	0.0113	5527
129'	APXV18-209014-C w/ Mount Pipe	7	78.808	5.6095	0.0098	2761
120'	BXA-80080/6CF w/ Mount Pipe	7	68.379	5.4082	0.0084	1902
109'	(2) 4' x 2" Pipe Mount	7	56.345	5.0401	0.0070	1512
99'	(2) 4' x 2" Pipe Mount	7	46.240	4.5956	0.0058	1350



Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
80'	MPRD2449	7	29.586	3.6071	0.0040	1126

### Compression Checks

### Pole Design Data

Section No.	Elevation	Size	L	L <sub>u</sub>	Kl/r	F <sub>a</sub>	A	Actual P	Allow. P <sub>a</sub>	Ratio P
	ft		ft	ft		ksi	in <sup>2</sup>	K	K	P <sub>a</sub>
L1	149 - 111.5 (1)	TP29.487x23x0.1875	37'6"	0'	0.0	38.694	17.0508	-4.98	659.77	0.008
L2	111.5 - 75.25 (2)	TP35.383x28.4633x0.2188	40'	0'	0.0	38.203	23.8745	-10.15	912.08	0.011
L3	75.25 - 39.75 (3)	TP41.086x34.167x0.2813	40'	0'	0.0	39.000	35.6152	-16.04	1388.99	0.012
L4	39.75 - 0 (4)	TP47.4x39.6154x0.375	45'	0'	0.0	39.000	55.9715	-26.73	2182.89	0.012

### Pole Bending Design Data

Section No.	Elevation	Size	Actual M <sub>x</sub>	Actual f <sub>bx</sub>	Allow. F <sub>bx</sub>	Ratio f <sub>bx</sub>	Actual M <sub>y</sub>	Actual f <sub>by</sub>	Allow. F <sub>by</sub>	Ratio f <sub>by</sub>
	ft		kip-ft	ksi	ksi	F <sub>bx</sub>	kip-ft	ksi	ksi	F <sub>by</sub>
L1	149 - 111.5 (1)	TP29.487x23x0.1875	227.61	22.628	38.694	0.585	0.00	0.000	38.694	0.000
L2	111.5 - 75.25 (2)	TP35.383x28.4633x0.2188	755.32	44.676	38.203	1.169	0.00	0.000	38.203	0.000
L3	75.25 - 39.75 (3)	TP41.086x34.167x0.2813	1390.9	47.566	39.000	1.220	0.00	0.000	39.000	0.000
L4	39.75 - 0 (4)	TP47.4x39.6154x0.375	2345.8	43.348	39.000	1.111	0.00	0.000	39.000	0.000

### Pole Shear Design Data

Section No.	Elevation	Size	Actual V	Actual f <sub>v</sub>	Allow. F <sub>v</sub>	Ratio f <sub>v</sub>	Actual T	Actual f <sub>vt</sub>	Allow. F <sub>vt</sub>	Ratio f <sub>vt</sub>
	ft		K	ksi	ksi	F <sub>v</sub>	kip-ft	ksi	ksi	F <sub>vt</sub>
L1	149 - 111.5 (1)	TP29.487x23x0.1875	12.83	0.753	26.000	0.058	0.67	0.033	26.000	0.001
L2	111.5 - 75.25 (2)	TP35.383x28.4633x0.2188	16.86	0.706	26.000	0.054	1.06	0.031	26.000	0.001
L3	75.25 - 39.75 (3)	TP41.086x34.167x0.2813	19.63	0.551	26.000	0.042	0.99	0.017	26.000	0.001
L4	39.75 - 0 (4)	TP47.4x39.6154x0.375	22.75	0.407	26.000	0.031	0.91	0.008	26.000	0.000

### Pole Interaction Design Data

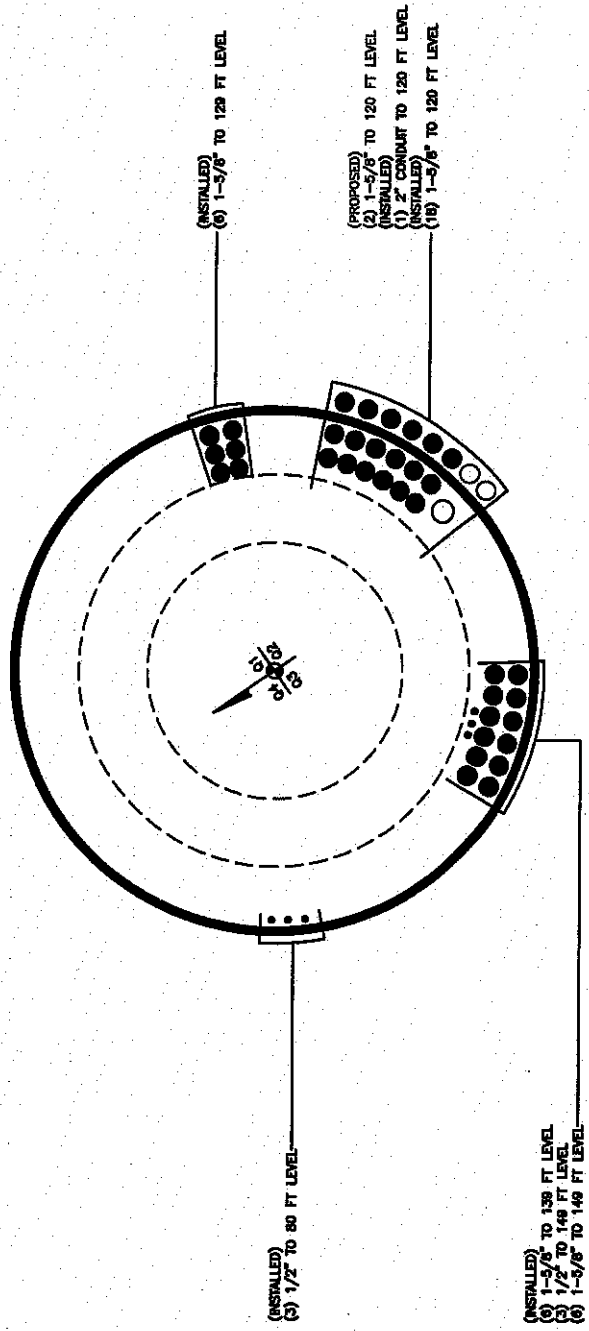
Section No.	Elevation	Ratio P	Ratio f <sub>bx</sub>	Ratio f <sub>by</sub>	Ratio f <sub>v</sub>	Ratio f <sub>vt</sub>	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	ft	P <sub>a</sub>	F <sub>bx</sub>	F <sub>by</sub>	F <sub>v</sub>	F <sub>vt</sub>			

Section No.	Elevation ft	Ratio	Ratio	Ratio	Ratio	Ratio	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
		P	$f_{bx}$	$f_{by}$	$f_v$	$f_{vt}$			
		$P_a$	$F_{bx}$	$F_{by}$	$F_v$	$F_{vt}$			
L1	149 - 111.5 (1)	0.008	0.585	0.000	0.058	0.001	0.593	1.333	H1-3+VT ✓
L2	111.5 - 75.25 (2)	0.011	1.169	0.000	0.054	0.001	1.181	1.333	H1-3+VT ✓
L3	75.25 - 39.75 (3)	0.012	1.220	0.000	0.042	0.001	1.232	1.333	H1-3+VT ✓
L4	39.75 - 0 (4)	0.012	1.111	0.000	0.031	0.000	1.124	1.333	H1-3+VT ✓

### Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	SF*P <sub>allow</sub> K	% Capacity	Pass Fail	
L1	149 - 111.5	Pole	TP29.487x23x0.1875	1	-4.98	879.47	44.5	Pass	
L2	111.5 - 75.25	Pole	TP35.383x28.4633x0.2188	2	-10.15	1215.80	88.6	Pass	
L3	75.25 - 39.75	Pole	TP41.086x34.167x0.2813	3	-16.04	1851.52	92.4	Pass	
L4	39.75 - 0	Pole	TP47.4x39.6154x0.375	4	-26.73	2909.79	84.3	Pass	
							Summary		
							Pole (L3)	92.4	Pass
							<b>RATING =</b>	<b>92.4</b>	<b>Pass</b>

**APPENDIX B**  
**BASE LEVEL DRAWING**



BUSINESS UNIT: 848488 TOWER ID: G\_BASLEVEL

**APPENDIX C**  
**ADDITIONAL CALCULATIONS**

## Square, Stiffened / Unstiffened Base Plate, Any Rod Material - Rev. F / G

- Assumptions:**
- 1) Rod groups at corners. Total # rods divisible by 4. Maximum total # of rods = 48 (12 per Corner).
  - 2) Rod Spacing = Straight Center-to-Center distance between any (2) adjacent rods (same corner)
  - 3) Clear space between bottom of leveling nut and top of concrete **not** exceeding (1)\*(Rod Diameter)

### Site Data

BU#: 845455  
 Site Name: OXFORD-QUAKER FARM  
 App #: 263999, Rev. 2

### Anchor Rod Data

Qty:	12	
Diam:	2.25	in
Rod Material:	A615-J	
Yield, Fy:	75	ksi
Strength, Fu:	100	ksi
Bolt Circle:	54	in
Anchor Spacing:	6	in

### Plate Data

W=Side:	53	in
Thick:	2.75	in
Grade:	60	ksi
Clip Distance:	10	in

### Stiffener Data (Welding at both sides)

Configuration:	Unstiffened	
Weld Type:		**
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

### Pole Data

Diam:	47.4	in
Thick:	0.375	in
Grade:	65	ksi
# of Sides:	18	"0" IF Round

### Stress Increase Factor

ASD ASIF:	1.333	
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\*\* Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

### Base Reactions

TIA Revision:	F	
Unfactored Moment, M:	2346	ft-kips
Unfactored Axial, P:	27	kips
Unfactored Shear, V:	23	kips

### Anchor Rod Results

TIA F --> Maximum Rod Tension: 171.5 Kips  
 Allowable Tension: 195.0 Kips  
 Anchor Rod Stress Ratio: 88.0% Pass

### Base Plate Results

Base Plate Stress: 42.8 ksi  
 Allowable PL Bending Stress: 60.0 ksi  
 Base Plate Stress Ratio: 71.3% Pass

### Flexural Check

### PL Ref. Data

Yield Line (in):	27.55
Max PL Length:	27.55

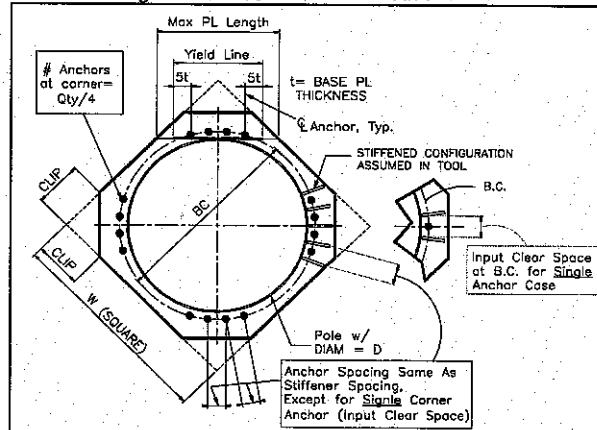
### N/A - Unstiffened

### Stiffener Results

Horizontal Weld: N/A  
 Vertical Weld: N/A  
 Plate Flex+Shear,  $f_b/F_b + (f_v/F_v)^2$ : N/A  
 Plate Tension+Shear,  $f_t/F_t + (f_v/F_v)^2$ : N/A  
 Plate Comp. (AISC Bracket): N/A

### Pole Results

Pole Punching Shear Check: N/A



# Monopole Pier and Pad Foundation

BU #: 845455

Site Name: OXFORD-QUAKER FARMS

App. Number: 263999 Rev. 2

TIA-222 Revision: **F**



Design Reactions		
Shear, S:	23	kips
Moment, M:	2346	ft-kips
Tower Height, H:	149	ft
Tower Weight, Wt:	27	kips
Base Diameter, BD:	3.95	ft

Foundation Dimensions		
Depth, D:	7	ft
Pad Width, W:	21.5	ft
Neglected Depth, N:	3	ft
Thickness, T:	3.00	ft
Pier Diameter, Pd:	7.00	ft
Ext. Above Grade, E:	0.50	ft
BP Dist. Above Pier:	3	in.
Clear Cover, Cc:	3.0	in

Soil Properties		
Soil Unit Weight, $\gamma$ :	0.125	kcf
Ult. Bearing Capacity, Bc:	30.0	ksf
Angle of Friction, $\Phi$ :	36	deg
Cohesion, Cc:	0.000	ksf
Passive Pressure, Pp:	0.000	ksf
Base Friction, $\mu$ :	0.55	

Material Properties		
Rebar Yield Strength, Fy:	60000	psi
Concrete Strength, F'c:	3000	psi
Concrete Unit Weight, $\delta_c$ :	0.150	kcf
Seismic Zone, z:	1	

Rebar Properties		
Pier Rebar Size, Sp:	11	
Pier Rebar Quantity, mp:	24	18
Pad Rebar Size, Spad:	10	
Pad Rebar Quantity, mpad:	21	7
Pier Tie Size, St:	5	4
Tie Quantity, mt:	10	5

Design Checks			
	Capacity/ Availability	Demand/ Limits	Check
Req'd Pier Diam. (ft)	7	5.45	OK
Overturing (ft-kips)	3573.43	2346.00	65.7%
Shear Capacity (kips)	148.77	23.00	15.5%
Bearing (ksf)	22.50	3.30	14.7%
Pad Shear - 1-way (kips)	686.04	306.64	44.7%
Pad Shear - 2-way (kips)	1944.15	91.38	4.7%
Pad Moment Capacity (k-ft)	3738.33	937.79	25.1%
Pier Moment Capacity (k-ft)	4540.35	2449.50	53.9%

## Maximum Allowable Moment of a Circular Pier

Axial Load (Negative for Compression) =  kips

Pier Properties		Material Properties	
<b>Concrete:</b>		Concrete compressive strength =	<input type="text" value="3000"/> psi
Pier Diameter =	<input type="text" value="7.0"/> ft	Reinforcement yield strength =	<input type="text" value="60000"/> psi
Concrete Area =	5541.8 in <sup>2</sup>	Modulus of elasticity =	<input type="text" value="29000"/> ksi
<b>Reinforcement:</b>		Reinforcement yield strain =	<input type="text" value="0.00207"/>
Clear Cover =	<input type="text" value="3.00"/> in	Limiting compressive strain =	<input type="text" value="0.003"/>
Cage Diameter =	<input type="text" value="6.38"/> ft	<b>Seismic Properties</b>	
Bar Size =	<input type="text" value="11"/>	Seismic Zone =	<input type="text" value="1"/>
Bar Diameter =	1.41 in		
Bar Area =	1.56 in <sup>2</sup>		
Number of Bars =	<input type="text" value="24"/>		

### Minimum Area of Steel

Required area of steel = 27.71 in<sup>2</sup>  
 Provided area of steel = 37.44 in<sup>2</sup>      **OK**

### Axial Loading

Load factor =   
 Reduction factor = 0.9  
 Factored axial load = -39 kips

### Neutral Axis

Distance from extreme edge to neutral axis = 14.31 in  
 Equivalent compression zone factor = 0.85  
 Distance from extreme edge to  
 equivalent compression zone factor = 12.16 in  
 Distance from centroid to neutral axis = 27.69 in

### Compression Zone

Area of steel in compression zone = 7.80 in<sup>2</sup>  
 Angle from centroid of pier to intersection of  
 equivalent compression zone and edge of pier = 44.73 deg  
 Area of concrete in compression = 495.20 in<sup>2</sup>  
 Force in concrete =  $0.85 * f'c * Acc$  = 1262.76 kips  
 Total reinforcement forces = -1223.76 kips  
 Factored axial load = -39.00 kips  
 Force in concrete = -1262.76 kips  
 Sum of the forces in concrete = 0.00 kips      **OK**

### Maximum Moment

First moment of the concrete  
 area in compression about the centroid = 17217.35 in<sup>3</sup>  
 Distance between centroid of concrete  
 in compression and centroid of pier = 34.77 in  
 Moment of concrete in compression = 43904.24 in-kips  
 Total reinforcement moment = 34795.23 in-kips  
 Nominal moment strength of column = 78699.47 in-kips  
 Factored moment strength of column = 54484.25 in-kips

Maximum Allowable Moment =  ft-kips



### Individual Bars

Bar #	Angle from first bar (deg)	Distance to centroid (in)	Distance to neutral axis (in)	Distance to equivalent comp zone (in)	Strain	Area of steel in compression (in <sup>2</sup> )	Stress (ksi)	Axial force (kips)
1	0.00	0.00	-27.69	-29.84	-0.005806	0.00	-60.00	-93.60
2	15.00	9.91	-17.78	-19.93	-0.003728	0.00	-60.00	-93.60
3	30.00	19.15	-8.54	-10.69	-0.001791	0.00	-51.95	-81.04
4	45.00	27.08	-0.61	-2.76	-0.000128	0.00	-3.72	-5.81
5	60.00	33.16	5.47	3.33	0.0011475	1.56	33.28	47.94
6	75.00	36.99	9.30	7.15	0.0019496	1.56	56.54	84.22
7	90.00	38.30	10.60	8.46	0.002232	1.56	60.00	89.62
8	105.00	36.99	9.30	7.15	0.0019496	1.56	56.54	84.22
9	120.00	33.16	5.47	3.33	0.0011475	1.56	33.28	47.94
10	135.00	27.08	-0.61	-2.76	-0.000128	0.00	-3.72	-5.81
11	150.00	19.15	-8.54	-10.69	-0.001791	0.00	-51.95	-81.04
12	165.00	9.91	-17.78	-19.93	-0.003728	0.00	-60.00	-93.60
13	180.00	0.00	-27.69	-29.84	-0.005806	0.00	-60.00	-93.60
14	195.00	-9.91	-37.60	-39.75	-0.007884	0.00	-60.00	-93.60
15	210.00	-19.15	-46.84	-48.99	-0.00982	0.00	-60.00	-93.60
16	225.00	-27.08	-54.77	-56.92	-0.011483	0.00	-60.00	-93.60
17	240.00	-33.16	-60.86	-63.00	-0.012759	0.00	-60.00	-93.60
18	255.00	-36.99	-64.68	-66.83	-0.013561	0.00	-60.00	-93.60
19	270.00	-38.30	-65.99	-68.13	-0.013835	0.00	-60.00	-93.60
20	285.00	-36.99	-64.68	-66.83	-0.013561	0.00	-60.00	-93.60
21	300.00	-33.16	-60.86	-63.00	-0.012759	0.00	-60.00	-93.60
22	315.00	-27.08	-54.77	-56.92	-0.011483	0.00	-60.00	-93.60
23	330.00	-19.15	-46.84	-48.99	-0.00982	0.00	-60.00	-93.60
24	345.00	-9.91	-37.60	-39.75	-0.007884	0.00	-60.00	-93.60



Aaron C Poot, P.E.  
Manager Engineering  
Operations

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Crown Castle  
2000 Corporate Drive  
Canonsburg, PA 15317

March 18, 2015

Attn: Tim Parks  
Verizon Wireless – Network Real Estate  
99 East River Drive, 9<sup>th</sup> Floor  
East Hartford, CT 06108

RE: BU# 845455 (Oxford-Quaker Farms); Explanation of SA Revision

Dear Mr. Parks:

I have reviewed the previous analyses provided to Verizon Wireless on the above referenced tower site.

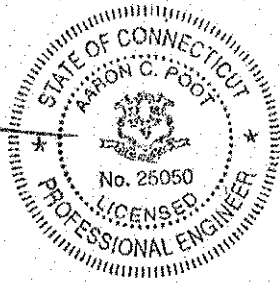
Initially, Paul J. Ford (PJF) provided a structural analysis (SA) report, dated September 10, 2014, which showed the tower to be insufficient for the combined existing and proposed load configuration. Modifications were designed by Crown Castle and a SA, dated October 29, 2014, showing sufficient tower capacity with the modifications was provided to Verizon Wireless. Unfortunately, there was an error in the load configuration in both of these analyses.

Crown Castle has discovered that equipment labeled RBS 6102 and thought to be remote radio heads at a height of 149 feet are actually ground mounted cabinets. Since there are 6 and each has approximately 20 square feet of frontal area, this mistake had a significant effect on the results of the analyses. The base moment of the PJF analysis changed from 3266 kip-feet to 2346 kip-feet in the corrected Crown SA report, dated February 10, 2015. This eliminated the need for modifications as the worst combined stress ratio was reduced to 92.4% without them.

Naturally, we apologize for any confusion and inconvenience this mistake has caused. We are communicating within our organization and with our engineering vendors to be sure that all parties are aware of and learn from this incident.

Please let me know if I may be of any further assistance.  
Sincerely yours,

  
Aaron C Poot, P.E.  
Manager Engineering



3/18/15