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KENNETH C. BALDWIN

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February 21, 2012

Linda Roberts
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **EM-VER-027-111130 – 48 Cow Hill Road, Clinton, Connecticut**
EM-VER-038-111108 – 101 Old Blue Hill, Durham, Connecticut
EM-VER-042-111101 – 94 High Street, East Hampton, Connecticut
EM-VER-060-111101 – 1919 Boston Post Road, Guilford, Connecticut
EM-VER-061-111107 – 539 Plains Road, Haddam, Connecticut
EM-VER-070-111108 – Route 80, Killingworth, Connecticut
Completion of Construction Activity

Dear Ms. Roberts:

The purpose of this letter is to notify you and the Connecticut Siting Council that construction activity associated with each of the above-referenced modification filings has now been completed.

If you have any questions or need any additional information regarding these facilities please do not hesitate to contact me.

Sincerely,

Kenneth C. Baldwin

Copy to:
Sandy M. Carter

STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

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

November 25, 2011

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

RE: **EM-VER-038-111108** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at Old Blue Hills Road, Durham, Connecticut.

Dear Attorney Baldwin:

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

- Any deviation from the proposed modification as specified in this notice and supporting materials with Council shall render this acknowledgement invalid;
- Any material changes to this modification as proposed shall require the filing of a new notice with the Council;
- Not less than 45 days after completion of construction, the Council shall be notified in writing that construction has been completed;
- The validity of this action shall expire one year from the date of this letter; and
- The applicant may file a request for an extension of time beyond the one year deadline provided that such request is submitted to the Council not less than 60 days prior to the expiration;

The proposed modifications including the placement of all necessary equipment and shelters within the tower compound are to be implemented as specified here and in your notice dated November 4, 2011. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

This decision is under the exclusive jurisdiction of the Council. Please be advised that the validity of this action shall expire one year from the date of this letter. Any additional change to this facility will require explicit notice to this agency pursuant to Regulations of Connecticut State Agencies Section 16-50j-73. Such notice shall include all relevant information regarding the proposed change with cumulative worst-case modeling of radio frequency exposure at the closest point of uncontrolled access to the tower base, consistent with Federal Communications Commission, Office of Engineering and Technology, Bulletin 65. Thank you for your attention and cooperation.

Very truly yours,

Linda Roberts

Linda Roberts
Executive Director

LR/CDM/laf

c: The Honorable Laura L. Francis, First Selectman, Town of Durham
Geoffrey Colegrove, Town Planner, Town of Durham
Crown Castle USA, Inc.

ROBINSON & COLE LLP

EM-VER-038-111108

KENNETH C. BALDWIN

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ORIGINAL

November 4, 2011

Linda Roberts
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Antenna Swap**
Old Blue Hills Road, Durham, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 100-foot level on the existing 120-foot tower at the above-referenced address. The tower is owned by Crown Castle. Cellco intends to remove six of its existing antennas and replace them with six (6) model LPA-171080-12CF PCS antennas and three (3) model BXA 70063/6CF LTE antennas, for a total of fifteen (15) antennas. All replacement antennas will be installed at the same 100-foot level on the tower. Cellco will also install three (3) additional coax cables inside the monopole tower. Attached behind Tab 1 of this filing are the specifications for each of the proposed replacement antennas.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to the Durham First Selectwoman, Laura L. Francis. A copy of this letter is also being sent to Francis and Marie Behrens, the owners of the property on which the tower is located.

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

1. The proposed modifications will not result in an increase in the overall height of the existing tower. Cellco's replacement antennas will be located at the 100-foot level on the 120-foot tower.

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

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

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

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

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

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Laura L. Francis, Durham First Selectwoman
Francis and Marie Behrens
Sandy M. Carter

Amphenol ANTENNA SOLUTIONS

LPA-171080-12CF-EDIN-X

V-Pol | Log Periodic | 80° | 17.5 dBi

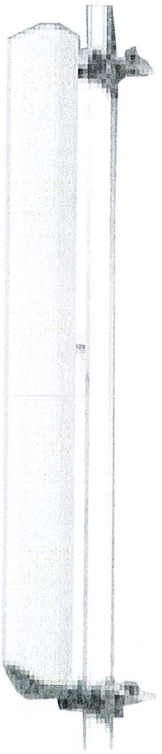
Replace "X" with desired electrical downtilt

Antenna is available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

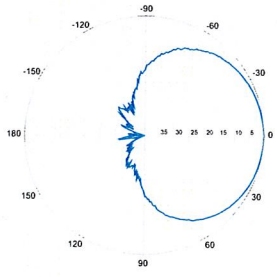
Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	Vertical		
Horizontal beamwidth	80°	82°	80°
Vertical beamwidth	3°	4°	3°
Gain	14.9 dBd (17.0 dBi)	15.4 dBd (17.5 dBi)	14.9 dBd (17.0 dBi)
Electrical downtilt (X)	0, 2		
Impedance	50Ω		
VSWR	≤ 1.5:1		
Null fill	5% (-26.02 dB)		
Input power	250 W		
Lightning protection	Direct Ground		
Connector(s)	1 Port / EDIN or NE / Female / Center (Back)		

Mechanical Characteristics		
Dimensions Length x Width x Depth	1876 x 105 x 175 mm	73.9 x 4.1 x 6.9 in
Depth with +- Bracket	203 mm	8.0 in
Weight without mounting brackets	4.8 kg	11 lbs
Survival wind speed	>201 km/hr	>125 mph
Wind area	Front: 0.20 m² Side: 0.32 m²	Front: 2.1 ft² Side: 3.5 ft²
Wind load @ 161 km/hr (100 mph)	Front: 265 N Side: 504 N	Front: 60 lbf Side: 113 lbf

Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5.0 lbs
2-Point Mounting and Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	2.3 kg 5.0 lbs



1710-1880 MHz



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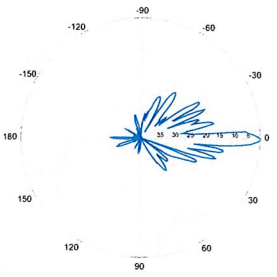
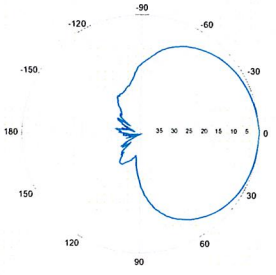


0° | Vertical

1850-1990 MHz



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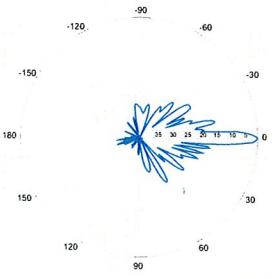
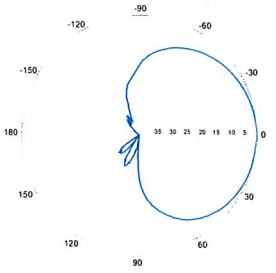


0° | Vertical

1920-2170 MHz



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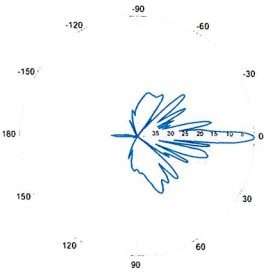
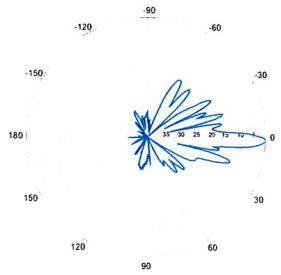


0° | Vertical

LPA-171080-12CF-EDIN-X

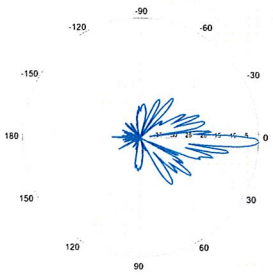
V-Pol | Log Periodic | 80° | 17.5 dBi

1710-1880 MHz



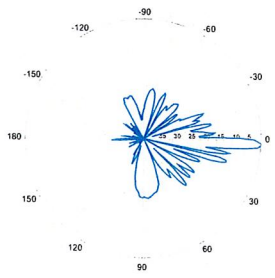
2° | Vertical

1850-1990 MHz



2° | Vertical

1920-2170 MHz



2° | Vertical

Amphenol ANTENNA SOLUTIONS

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

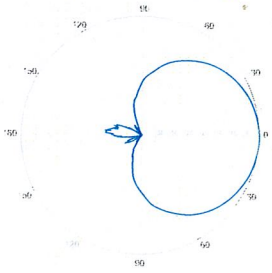
Replace "X" with desired electrical downtilt.

Antenna is also available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

Electrical Characteristics	696-900 MHz	
Frequency bands	696-806 MHz	806-900 MHz
Polarization	±45°	
Horizontal beamwidth	65°	63°
Vertical beamwidth	13°	11°
Gain	14.0 dBd (16.1 dBi)	14.5 dBd (16.6 dBi)
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 10	
Impedance	50Ω	
VSWR	≤1.35:1	
Upper sidelobe suppression (0°)	-18.3 dB	-18.2 dB
Front-to-back ratio (+/-30°)	-33.4 dB	-36.3 dB
Null fill	5% (-26.02 dB)	
Isolation between ports	< -25 dB	
Input power with EDIN connectors	500 W	
Input power with NE connectors	300 W	
Lightning protection	Direct Ground	
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)	
Mechanical Characteristics		
Dimensions Length x Width x Depth	1804 x 285 x 132 mm	71.0 x 11.2 x 5.2 in
Depth with z-brackets	172 mm	6.8 in
Weight without mounting brackets	7.9 kg	17 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.51 m² Side: 0.24 m²	Front: 5.5 ft² Side: 2.6 ft²
Wind load @ 161 km/hr (100 mph)	Front: 759 N Side: 391 N	Front: 169 lbf Side: 89 lbf

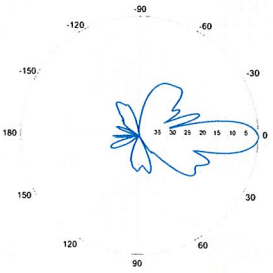
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



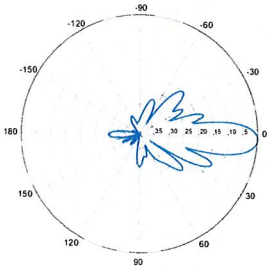
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

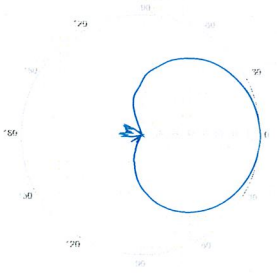


0° | Vertical | 750 MHz

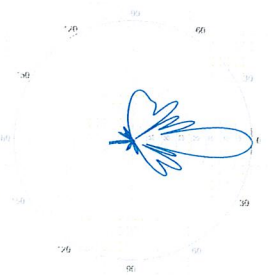
BXA-70063-6CF-EDIN-2



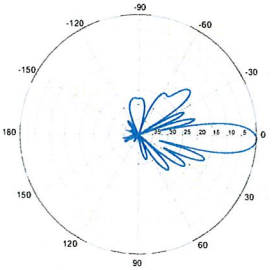
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz

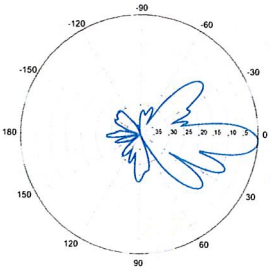


2° | Vertical | 850 MHz

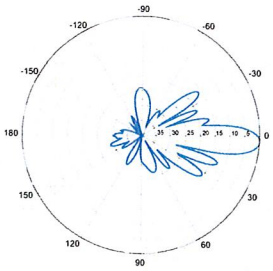
BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

BXA-70063-6CF-EDIN-3

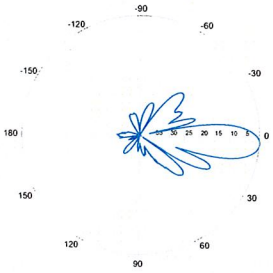


3° | Vertical | 750 MHz

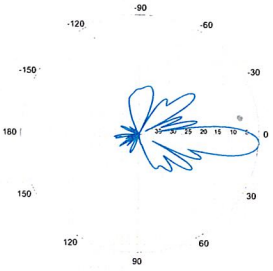


3° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-4

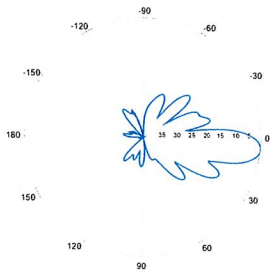


4° | Vertical | 750 MHz

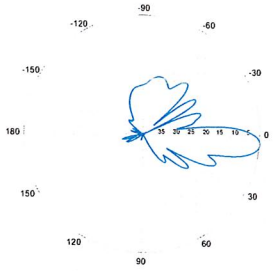


4° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-5

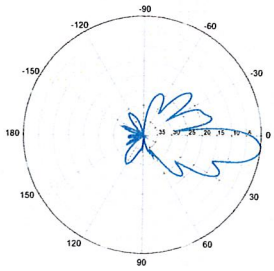


5° | Vertical | 750 MHz

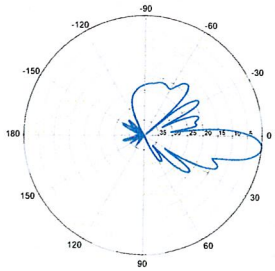


5° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-6

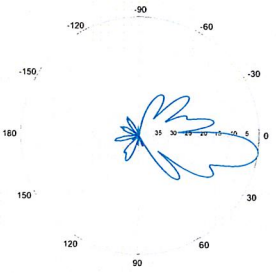


6° | Vertical | 750 MHz

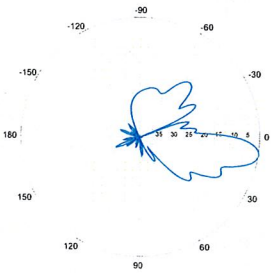


6° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-8

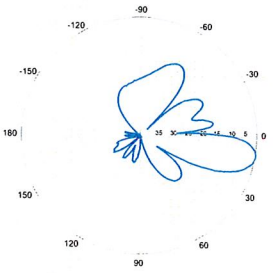


8° | Vertical | 750 MHz

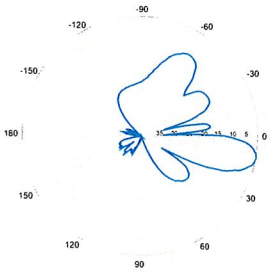


8° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-10



10° | Vertical | 750 MHz



10° | Vertical | 850 MHz

C Squared Systems, LLC
65 Dartmouth Drive, Unit A3
Auburn, NH 03032
(603) 644-2800
support@csquaredsystems.com

Calculated Radio Frequency Emissions

verizonwireless

Durham CT

143R Old Blue Hill Road, Durham, CT 06422

October 20, 2011

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1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed modifications to the existing Verizon Wireless antenna arrays on the monopole tower located at 143 Old Blue Hill Road in Durham, CT. Verizon Wireless, AT&T, Sprint-Nextel and the Town of Durham all have antennas mounted on the tower. The coordinates of the tower are 41-27-33.67 N, 72-39-45.83 W.

Verizon Wireless is proposing the following modifications:

1) Install three 750 MHz LTE antennas (one per sector);
2) Modify the azimuth of the alpha sector 850 MHz Cellular and 1900 MHz PCS antennas;
3) Remove six existing 1900 MHz PCS antennas (two per sector);
4) Install six replacement 1900 MHz PCS antennas (two per sector).

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

In 1985, the FCC established rules to regulate radio frequency (RF) exposure from FCC licensed antenna facilities. In 1996, the FCC updated these rules, which were further amended in August 1997 by OET Bulletin 65 Edition 97-01. These new rules include Maximum Permissible Exposure (MPE) limits for transmitters operating between 300 kHz and 100 GHz. The FCC MPE limits are based upon those recommended by the National Council on Radiation Protection and Measurements (NCRP), developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI).

The FCC general population/uncontrolled limits set the maximum exposure to which most people may be subjected. General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter (mW/cm^2). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report.

Higher exposure limits are permitted under the occupational/controlled exposure category, but only for persons who are exposed as a consequence of their employment and who have been made fully aware of the potential for exposure, and they must be able to exercise control over their exposure. General population/uncontrolled limits are five times more stringent than the levels that are acceptable for occupational, or radio frequency trained individuals. Attachment B contains excerpts from OET Bulletin 65 and defines the Maximum Exposure Limit.

Finally, it should be noted that the MPE limits adopted by the FCC for both general population/uncontrolled exposure and for occupational/controlled exposure incorporate a substantial margin of safety and have been established to be well below levels generally accepted as having the potential to cause adverse health effects.

3. RF Exposure Prediction Methods

The emission field calculation results displayed in the following figures were generated using the following formula as outlined in FCC bulletin OET 65:

$$\text{Power Density} = \left(\frac{1.6^2 \times EIRP}{4\pi \times R^2} \right) \text{x Off Beam Loss}$$

Where:

EIRP = Effective Isotropic Radiated Power

R = Radial Distance = $\sqrt{(H^2 + V^2)}$

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna patterns

These calculations assume that the antennas are operating at 100 percent capacity and power, and that all channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not take into account actual terrain elevations which could attenuate the signal. As a result, the predicted signal levels reported below are much higher than the actual signal levels will be from the finished modifications.

4. Calculation Results

Table 1 below outlines the power density information for the site. All information for carriers other than Verizon Wireless comes directly from the current CSC database. Because the Verizon antennas are directional in nature, the majority of the RF power is focused out towards the horizon. As a result, there will be less RF power directed below the antennas relative to the horizon, and consequently lower power density levels around the base of the tower. Please refer to Attachment C for the vertical patterns of the Verizon antennas. The calculated results for Verizon in Table 1 include a nominal 10 dB off-beam pattern loss to account for the lower relative gain below the antennas.

Carrier	Antenna Height (Feet)	Operating Frequency (MHz)	Number of Trans.	ERP Per Transmitter (Watts)	Power Density (mW/cm^2)	Limit (mW/cm^2)	%MPE
AT&T GSM	73	880	3	296.0	0.059917	0.587	10.21%
AT&T GSM	73	1900	2	427.0	0.057622	1.000	5.76%
AT&T UMTS	73	880	1	500.0	0.033737	0.587	5.75%
Nextel	120	880	12	100.0	0.029964	0.567	5.28%
Town	75	450	4	400.0	0.102277	0.300	34.09%
Sprint	90	1950	11	250.0	0.122075	1.000	12.21%
Verizon CDMA/EVDO	100	869	9	358.0	0.115852	0.579	2.00%
Verizon AWS	100	2145	1	687.0	0.024702	1.000	0.25%
Verizon CDMA/EVDO	100	1970	7	275.0	0.069217	1.000	0.69%
Verizon LTE	100	698	2	741.0	0.053288	0.465	1.15%
						Total	**77.39%**

Table 1: Carrier Information[1]

[1] %MPE calculations for Verizon include a nominal -10 dB antenna off-beam loss factor.

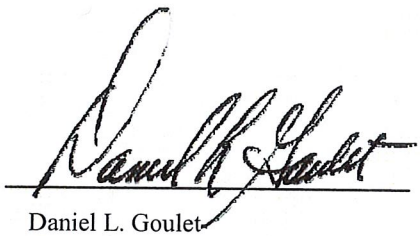
5. Conclusion

The above analysis verifies that emissions from the existing site will be below the maximum power density levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. Even when using conservative methods, the power density from the proposed antenna configuration is below the limits for the general public. The highest expected percent of Maximum Permissible Exposure at the base of the tower is 77.39% of the FCC limit.

As noted in the introduction, obstructions (trees, buildings etc.) that would normally attenuate the signal are not taken into account. As a result, the predicted signal levels are more conservative (higher) than the actual signal levels will be from the finished modifications.

6. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate. The calculations follow guidelines set forth in ANSI/IEEE Std. C95.3, ANSI/IEE Std. C95.1 and FCC OET Bulletin 65 Edition 97-01.



Daniel L. Goulet
C Squared Systems, LLC

October 20, 2011
Date

Attachment A: References

OET Bulletin 65 - Edition 97-01 - August 1997 Federal Communications Commission Office of Engineering & Technology

ANSI C95.1-1982, American National Standard Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz IEEE-SA Standards Board

IEEE Std C95.3-1991 (Reaff 1997), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave IEEE-SA Standards Board

Attachment B: FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure[2]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	f/300	6
1500-100,000	-	-	5	6

(B) Limits for General Population/Uncontrolled Exposure[3]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

f = frequency in MHz * Plane-wave equivalent power density

Table 2: FCC Limits for Maximum Permissible Exposure (MPE)

[2] Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

[3] General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

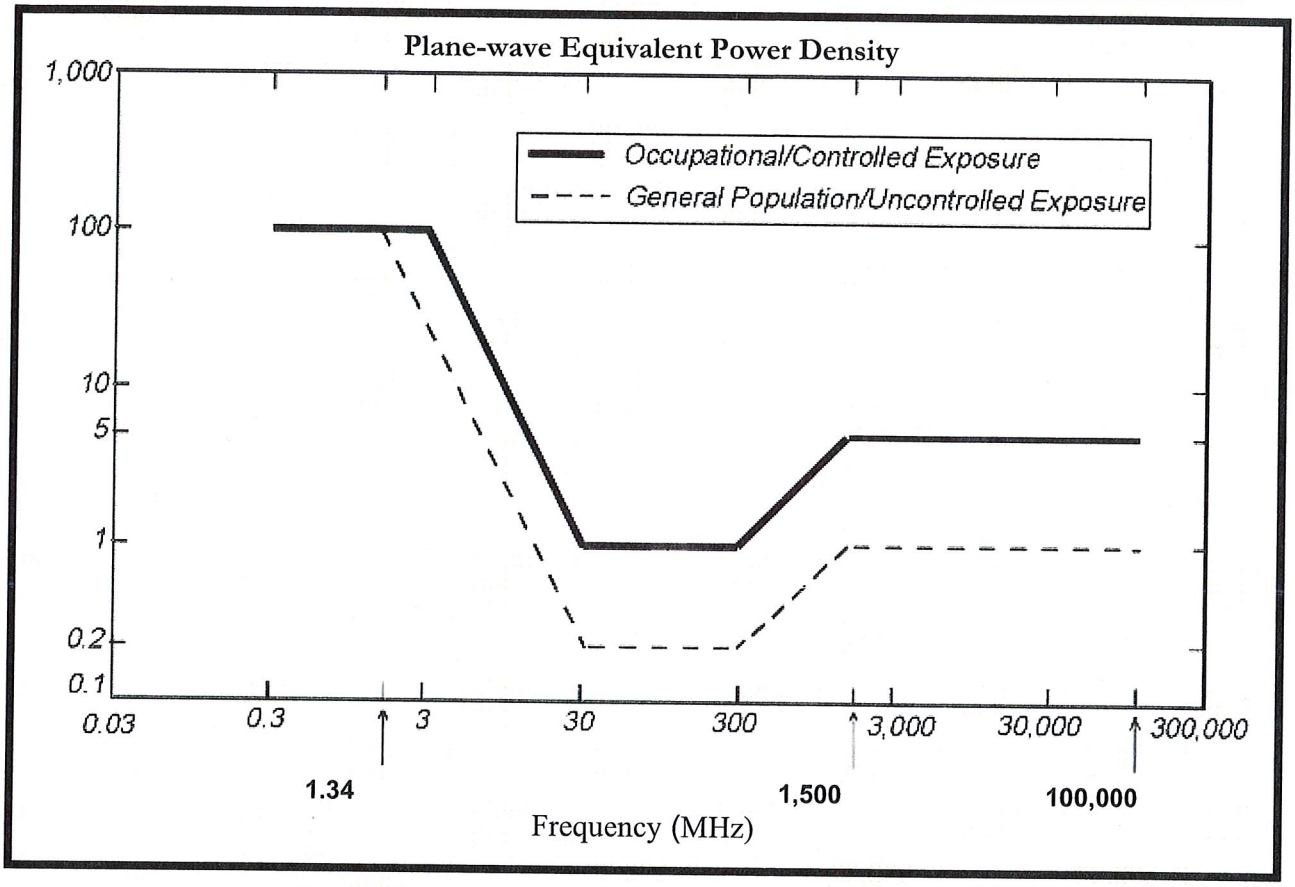
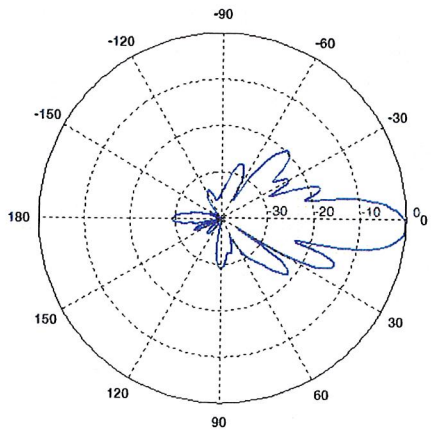


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Verizon Wireless' Antenna Model Data Sheets and Electrical Patterns

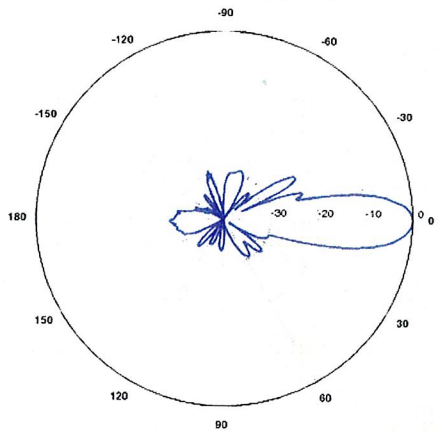
750 MHz

Manufacturer:	Amphenol
Model #:	BXA-70063/6CF_2
Frequency Band:	696-806 MHz
Gain:	14.0 dBd
Vertical Beamwidth:	13°
Horizontal Beamwidth:	65°
Polarization:	±45°
Size L x W x D:	71.0" x 11.2" x 5.2"



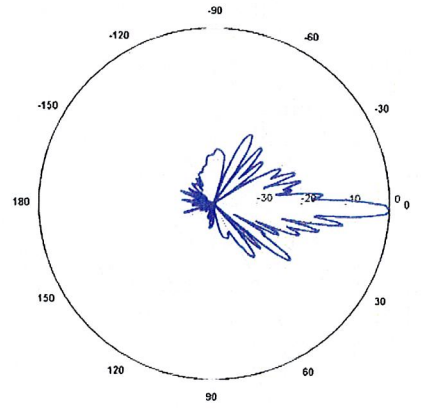
850 MHz

Manufacturer:	Amphenol
Model #:	LPA-80080/6CF
Frequency Band:	806-960 MHz
Gain:	14.0 dBd
Vertical Beamwidth:	10°
Horizontal Beamwidth:	80°
Polarization:	Vertical
Size L x W x D:	70.9" x 5.5" x 13.2"

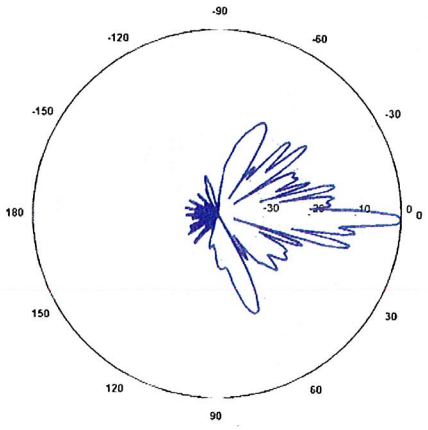


1900 MHz

Manufacturer:	Amphenol
Model #:	LPA-171063/12CF_2
Frequency Band:	1850-1990 MHz
Gain:	16.9 dBd
Vertical Beamwidth:	4°
Horizontal Beamwidth:	63°
Polarization:	Vertical
Size L x W x D:	73.9" x 7.9" x 8.0"



2100 MHz	
Manufacturer:	Amphenol
Model #:	LPA-171063/12CF_2
Frequency Band:	1920-2170 MHz
Gain:	16.4 dBd
Vertical Beamwidth:	3°
Horizontal Beamwidth:	65°
Polarization:	Vertical
Size L x W x D:	73.9" x 7.9" x 8.0"



Date: **October 08, 2011**

Eva Morales
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 Name:**	 Durham, CT
Crown Castle Designation:	**Crown Castle BU Number:** **Crown Castle Site Name:** **Crown Castle JDE Job Number:** **Crown Castle Work Order Number:**	806364 HRT 106(B) 943202 167372 440424
Engineering Firm Designation:	**Crown Castle Project Number:**	440424
Site Data:	**101 R OLD BLUE HILL ROAD, DURHAM, Middlesex County, CT** **Latitude *41° 27' 33.67"*, Longitude *-72° 39' 45.83"*** **120 Foot - Monopole Tower**	

Dear Eva Morales,

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 440424, in accordance with application 131488, 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 I and Table II for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA/EIA-222-F standard and local code requirements based upon a wind speed of 85 mph fastest mile.

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 *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: Jeffrey Fesko, E.I.T. /FAA

Respectfully submitted by:

Aaron C. Poot, P.E.
Engineering Supervisor

STATE OF CONNECTICUT
AARON C. POOT
No. 25050
LICENSED
PROFESSIONAL ENGINEER

RISA Tower Report - version 5.4.2.0 10/8/11

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1) INTRODUCTION

This tower is a 120 ft Monopole tower designed by VALMONT in March of 1994. The tower was originally designed for a wind speed of 90 mph per TIA/EIA-222-E. The tower was extended 20' in May of 2004.

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
98	100	3	antel	BXA-70063/6CF-2 w/ Mount Pipe	18	1-5/8	-
		6	antel	LPA-171063-12CF-EDIN-2 w/ Mount Pipe			

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
118	125	1	decibel	DB809MT3-XT	2	7/8	1
	123	1	decibel	DB201-A			
	118	2	tower mounts	Side Arm Mount [SO 701-1]			
115	115	12	decibel	DB844H90 w/ Mount Pipe	12	1-1/4	1
		1	tower mounts	Platform Mount [LP 304-1]			
107	107	1	andrew	KP6-17B	1	1/2	1
		1	tower mounts	Pipe Mount [PM 601-1]			
98	100	6	decibel	DB950F85T2E-M w/ Mount Pipe	16	7/8	2
		3	swedcom	ALP 9212-N w/ Mount Pipe			
		6	antel	LPA-80080/6CF w/ Mount Pipe	-	-	1
	98	1	tower mounts	Platform Mount [LP 602-1]			
87	89	6	decibel	DB980H90E-M w/ Mount Pipe	6	7/8	1
	87	1	tower mounts	Platform Mount [LP 602-1]			
73	79	1	decibel	DB809K-YP	13	7/8	1
	74	6	powerwave technologies	7770.00 w/ Mount Pipe			
		6	powerwave technologies	LGP21401			
		6	powerwave	LGP21903			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
			technologies				
	73	1	tower mounts	Platform Mount [LP 712-1]			
50	57	1	rfs celwave	PD1142-1	3 1	7/8 1/2	1
	54	1	decibel	ASP-655			
	53	1	rfs celwave	PD1121-6			
	50	1	decibel	DB492A			
		1	tower mounts	Side Arm Mount [SO 701-3]			
40	41	1	tekelec systemes	EPSILON GPS ANTENNA 35 DB	1	1/2	1
	40	1	tower mounts	Side Arm Mount [SO 701-1]			

Notes:
1) Existing equipment
2) Equipment to be removed

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)
97	97	12	-	8RL41OC4R105	-	-
87	87	9	-	8RL41OC4R105	-	-
75	75	1	-	A8P710	-	-
		1	Telewave	450F6 Antenna		
50	50	1	-	A8P701	-	-
		1	-	A8P710		

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Dr. Clarence Welti, P.E., P.C.	262150	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	SAC Engineering, Inc.	297341	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Valmont	262153	CCISITES
4-TOWER STRUCTURAL ANALYSIS REPORTS	Valmont	942187	CCISITES

3.1) Analysis Method

RISATower (version 5.4.2.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various 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.
5) The base plate grout was not considered in this analysis.

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	120 - 100	Pole	TP20.263x15.403x0.1875	1	-2.50	630.11	29.1	Pass
L2	100 - 47.0833	Pole	TP33.13x20.263x0.281	2	-12.78	1488.95	93.4	Pass
L3	47.0833 - 0	Pole	TP44x31.3725x0.375	3	-24.26	2738.53	88.3	Pass
							Summary	
						Pole (L2)	93.4	Pass
						Rating =	93.4	Pass

Table 6 - Tower Component Stresses vs. Capacity - LC1

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	82.8	Pass
1	Base Plate	0	47.7	Pass
1	Base Foundation Soil Interaction	0	41.2	Pass

Structure Rating (max from all components) =	93.4%

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

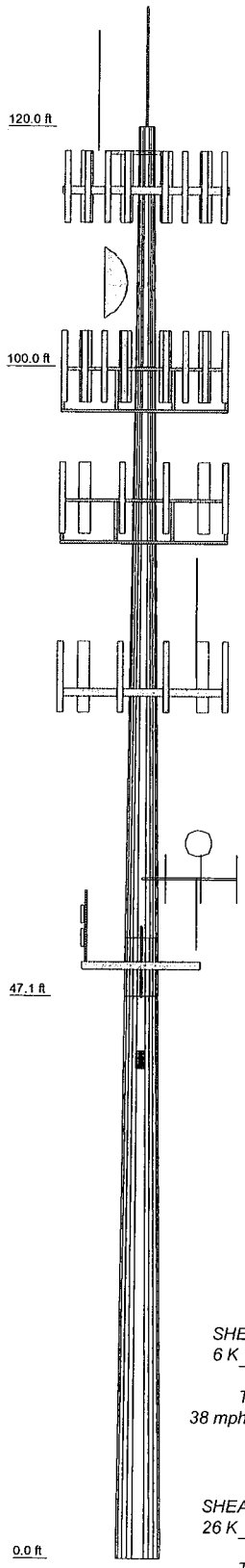
4.1) Recommendations

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

APPENDIX A

RISA TOWER OUTPUT

Section	1	2	3
Length (ft)	20'	52'11-1/32"	52'
Number of Sides	12	12	12
Thickness (in)	0.1875	0.2810	0.3750
Socket Length (ft)		4'11-1/32"	
Top Dia (in)	15.4030	20.2630	31.3725
Bot Dia (in)	20.2630	33.1300	44.0000
Grade		S-22	
Weight (K)	0.7	4.3	8.0



AXIAL
35 K
SHEAR
6 K
MOMENT
551 kip-ft
TORQUE 1 kip-ft
38 mph WIND - 0.7500 in ICE

AXIAL
24 K
SHEAR
26 K
MOMENT
2126 kip-ft
TORQUE 1 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
DB809MT3-XT	118	(2) DB980H90E-M w/ Mount Pipe	87
DB201-A	118	5' x 2' Pipe Mount	87
Side Arm Mount [SO 701-1]	118	5' x 2' Pipe Mount	87
Side Arm Mount [SO 701-1]	118	5' x 2' Pipe Mount	87
(4) DB844H90 w/ Mount Pipe	115	Platform Mount [LP 602-1]	87
(4) DB844H90 w/ Mount Pipe	115	(2) DB980H90E-M w/ Mount Pipe	87
(4) DB844H90 w/ Mount Pipe	115	(2) LGP21401	73
Platform Mount [LP 304-1]	115	(2) LGP21903	73
Pipe Mount [PM 601-1]	107	DB809K-YP	73
KP6-17B	107	(2) 7770.00 w/ Mount Pipe	73
BXA-70063/6CF-2 w/ Mount Pipe	98	(2) LGP21401	73
(2) LPA-171063-12CF-EDIN-2 w/ Mount Pipe	98	(2) LGP21903	73
(2) LPA-80080/6CF w/ Mount Pipe	98	(2) 7770.00 w/ Mount Pipe	73
BXA-70063/6CF-2 w/ Mount Pipe	98	(2) LGP21401	73
(2) LPA-171063-12CF-EDIN-2 w/ Mount Pipe	98	(2) LGP21903	73
(2) LPA-80080/6CF w/ Mount Pipe	98	Platform Mount [LP 712-1]	73
BXA-70063/6CF-2 w/ Mount Pipe	98	(2) 7770.00 w/ Mount Pipe	73
(2) LPA-171063-12CF-EDIN-2 w/ Mount Pipe	98	DB492A	50
Platform Mount [LP 602-1]	98	ASP-655	50
(2) LPA-80080/6CF w/ Mount Pipe	98	PD1121-6	50
(2) DB980H90E-M w/ Mount Pipe	87	Side Arm Mount [SO 701-3]	50
		PD1142-1	50
		Side Arm Mount [SO 701-1]	40
		EPSILON GPS ANTENNA 35 DB	40

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
S-22	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower is located in Middlesex 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: 93.4%

CROWN CASTLE
We Are Solutions
Crown Castle
2000 Corporate Drive
Canonsburg, PA 15317
Phone: 724-416-2000
FAX:

Job: **BU#806364**			
Project:			
Client: Crown Castle	Drawn by: JFesko		App'd:
Code: TIA/EIA-222-F	Date: 10/05/11		Scale: NTS
Path: R:\SA Models - Letters\Work Area\JFesko\806364\806364.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 Middlesex County, Connecticut.
Basic wind speed of 85 mph.
Nominal ice thickness of 0.7500 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 38 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	120'-100'	20'	0'	12	15.4030	20.2630	0.1875	0.7500	S-22 (65 ksi)
L2	100'-47'31/32"	52'11-1/32"	4'11-1/32"	12	20.2630	33.1300	0.2810	1.1240	S-22 (65 ksi)
L3	47'31/32"-0'	52'		12	31.3725	44.0000	0.3750	1.5000	S-22 (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	15.9464	9.1864	271.4575	5.4471	7.9788	34.0225	550.0464	4.5212	3.6255	19.336
	20.9778	12.1206	623.5083	7.1870	10.4962	59.4030	1263.3968	5.9654	4.9280	26.283
L2	20.9778	18.0801	921.4356	7.1536	10.4962	87.7873	1867.0784	8.8985	4.6774	16.646
	34.2987	29.7224	4093.6867	11.7599	17.1613	238.5412	8294.9191	14.6285	8.1258	28.917
L3	33.7153	37.4295	4590.4198	11.0971	16.2509	282.4709	9301.4350	18.4216	7.4028	19.741
	45.5522	52.6772	12796.1526	15.6177	22.7920	561.4318	25928.4743	25.9261	10.7870	28.765

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 120'-100'				1	1	1		
L2 100'-47'31/32"				1	1	1		
L3 47'31/32"-0'				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
LDF5-50A(7/8")	C	No	Inside Pole	118' - 0'	2	No Ice	0.00	0.33
						1/2" Ice	0.00	0.33
						1" Ice	0.00	0.33
						2" Ice	0.00	0.33
						4" Ice	0.00	0.33
***								
LDF6-50A(1-1/4")	A	No	Inside Pole	115' - 0'	12	No Ice	0.00	0.66
						1/2" Ice	0.00	0.66
						1" Ice	0.00	0.66
						2" Ice	0.00	0.66
						4" Ice	0.00	0.66
***								
LDF4-50A(1/2")	C	No	Inside Pole	107' - 0'	1	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
***								
HJ7-50A(1-5/8")	C	No	Inside Pole	98' - 0'	18	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
						1" Ice	0.00	1.04
						2" Ice	0.00	1.04
						4" Ice	0.00	1.04
***								
LDF5-50A(7/8")	B	No	Inside Pole	87' - 0'	6	No Ice	0.00	0.33
						1/2" Ice	0.00	0.33
						1" Ice	0.00	0.33
						2" Ice	0.00	0.33
						4" Ice	0.00	0.33
***								
LDF5-50A(7/8")	B	No	Inside Pole	73' - 0'	13	No Ice	0.00	0.33
						1/2" Ice	0.00	0.33

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft²/ft	Weight plf
						1" Ice	0.00	0.33
						2" Ice	0.00	0.33
						4" Ice	0.00	0.33
***								
LDF4-50A(1/2")	C	No	Inside Pole	50' - 0'	1	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
LDF5-50A(7/8")	C	No	Inside Pole	50' - 0'	3	No Ice	0.00	0.33
						1/2" Ice	0.00	0.33
						1" Ice	0.00	0.33
						2" Ice	0.00	0.33
						4" Ice	0.00	0.33
***								
LDF4-50A(1/2")	B	No	Inside Pole	40' - 0'	1	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	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	120'-100'	A	0.000	0.000	0.000	0.000	0.12
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.01
L2	100'-47'31/32"	A	0.000	0.000	0.000	0.000	0.42
		B	0.000	0.000	0.000	0.000	0.19
		C	0.000	0.000	0.000	0.000	1.00
L3	47'31/32"-0'	A	0.000	0.000	0.000	0.000	0.37
		B	0.000	0.000	0.000	0.000	0.30
		C	0.000	0.000	0.000	0.000	0.97

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	120'-100'	A	0.866	0.000	0.000	0.000	0.000	0.12
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.01
L2	100'-47'31/32"	A	0.824	0.000	0.000	0.000	0.000	0.42
		B		0.000	0.000	0.000	0.000	0.19
		C		0.000	0.000	0.000	0.000	1.00
L3	47'31/32"-0'	A	0.750	0.000	0.000	0.000	0.000	0.37
		B		0.000	0.000	0.000	0.000	0.30
		C		0.000	0.000	0.000	0.000	0.97

Feed Line Center of Pressure

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
L1	120'-100'	0.0000	0.0000	0.0000	0.0000
L2	100'-47'31/32"	0.0000	0.0000	0.0000	0.0000
L3	47'31/32"-0'	0.0000	0.0000	0.0000	0.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
DB809MT3-XT	A	From Leg	4.00 0' 7'	0.0000	118'	No Ice	2.84	2.84	0.03
						1/2" Ice	4.29	4.29	0.05
						1" Ice	5.75	5.75	0.08
						2" Ice	8.72	8.72	0.17
						4" Ice	12.90	12.90	0.46
DB201-A	C	From Leg	4.00 0' 5'	0.0000	118'	No Ice	1.10	1.10	0.03
						1/2" Ice	1.98	1.98	0.03
						1" Ice	2.86	2.86	0.04
						2" Ice	4.62	4.62	0.06
						4" Ice	8.14	8.14	0.09
Side Arm Mount [SO 701-1]	A	From Leg	2.00 0' 0'	0.0000	118'	No Ice	0.85	1.67	0.07
						1/2" Ice	1.14	2.34	0.08
						1" Ice	1.43	3.01	0.09
						2" Ice	2.01	4.35	0.12
						4" Ice	3.17	7.03	0.18
Side Arm Mount [SO 701-1]	C	From Leg	2.00 0' 0'	0.0000	118'	No Ice	0.85	1.67	0.07
						1/2" Ice	1.14	2.34	0.08
						1" Ice	1.43	3.01	0.09
						2" Ice	2.01	4.35	0.12
						4" Ice	3.17	7.03	0.18
***									
(4) DB844H90 w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	115'	No Ice	3.30	4.92	0.03
						1/2" Ice	3.69	5.60	0.07
						1" Ice	4.12	6.28	0.11
						2" Ice	5.01	7.71	0.22
						4" Ice	6.92	10.83	0.55
(4) DB844H90 w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	115'	No Ice	3.30	4.92	0.03
						1/2" Ice	3.69	5.60	0.07
						1" Ice	4.12	6.28	0.11
						2" Ice	5.01	7.71	0.22
						4" Ice	6.92	10.83	0.55
(4) DB844H90 w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	115'	No Ice	3.30	4.92	0.03
						1/2" Ice	3.69	5.60	0.07
						1" Ice	4.12	6.28	0.11
						2" Ice	5.01	7.71	0.22
						4" Ice	6.92	10.83	0.55
Platform Mount [LP 304-1]	C	None		0.0000	115'	No Ice	17.46	17.46	1.35
						1/2" Ice	22.44	22.44	1.62
						1" Ice	27.42	27.42	1.90
						2" Ice	37.38	37.38	2.45

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						4" Ice	57.30	57.30	3.55
***									
Pipe Mount [PM 601-1]	C	From Leg	0.50 0' 0'	0.0000	107'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.00 3.74 4.48 5.96 8.92	0.90 1.12 1.34 1.78 2.66	0.07 0.08 0.09 0.12 0.18
***									
(2) LPA-80080/6CF w/ Mount Pipe	A	From Leg	4.00 0' 2'	0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.56 5.11 5.61 6.65 8.83	10.73 11.99 12.97 14.98 19.22	0.05 0.11 0.19 0.36 0.86
BXA-70063/6CF-2 w/ Mount Pipe	A	From Leg	4.00 0' 2'	0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	7.97 8.61 9.22 10.46 13.07	5.40 6.55 7.41 9.18 12.93	0.04 0.10 0.17 0.33 0.79
(2) LPA-171063-12CF-EDIN-2 w/ Mount Pipe	A	From Leg	4.00 0' 2'	0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.23 6.80 7.35 8.44 10.99	7.75 8.97 9.91 11.79 15.99	0.04 0.10 0.17 0.34 0.82
(2) LPA-80080/6CF w/ Mount Pipe	B	From Leg	4.00 0' 2'	0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.56 5.11 5.61 6.65 8.83	10.73 11.99 12.97 14.98 19.22	0.05 0.11 0.19 0.36 0.86
BXA-70063/6CF-2 w/ Mount Pipe	B	From Leg	4.00 0' 2'	0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	7.97 8.61 9.22 10.46 13.07	5.40 6.55 7.41 9.18 12.93	0.04 0.10 0.17 0.33 0.79
(2) LPA-171063-12CF-EDIN-2 w/ Mount Pipe	B	From Leg	4.00 0' 2'	0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.23 6.80 7.35 8.44 10.99	7.75 8.97 9.91 11.79 15.99	0.04 0.10 0.17 0.34 0.82
(2) LPA-80080/6CF w/ Mount Pipe	C	From Leg	4.00 0' 2'	0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.56 5.11 5.61 6.65 8.83	10.73 11.99 12.97 14.98 19.22	0.05 0.11 0.19 0.36 0.86
BXA-70063/6CF-2 w/ Mount Pipe	C	From Leg	4.00 0' 2'	0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	7.97 8.61 9.22 10.46 13.07	5.40 6.55 7.41 9.18 12.93	0.04 0.10 0.17 0.33 0.79
(2) LPA-171063-12CF-EDIN-2 w/ Mount Pipe	C	From Leg	4.00 0' 2'	0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.23 6.80 7.35 8.44 10.99	7.75 8.97 9.91 11.79 15.99	0.04 0.10 0.17 0.34 0.82
Platform Mount [LP 602-1]	C	None		0.0000	98'	No Ice 1/2" Ice 1" Ice 2" Ice	32.03 38.71 45.39 58.75	32.03 38.71 45.39 58.75	1.34 1.80 2.26 3.17

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
***						4" Ice	85.47	85.47	5.00
(2) DB980H90E-M w/ Mount Pipe	A	From Leg	4.00 0' 2'	0.0000	87'	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.06
						1" Ice	4.95	5.22	0.11
						2" Ice	5.87	6.74	0.22
						4" Ice	8.05	10.00	0.55
(2) DB980H90E-M w/ Mount Pipe	B	From Leg	4.00 0' 2'	0.0000	87'	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.06
						1" Ice	4.95	5.22	0.11
						2" Ice	5.87	6.74	0.22
						4" Ice	8.05	10.00	0.55
(2) DB980H90E-M w/ Mount Pipe	C	From Leg	4.00 0' 2'	0.0000	87'	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.06
						1" Ice	4.95	5.22	0.11
						2" Ice	5.87	6.74	0.22
						4" Ice	8.05	10.00	0.55
5' x 2' Pipe Mount	A	From Leg	4.00 0' 0'	0.0000	87'	No Ice	1.00	1.00	0.03
						1/2" Ice	1.39	1.39	0.04
						1" Ice	1.70	1.70	0.05
						2" Ice	2.35	2.35	0.08
						4" Ice	3.78	3.78	0.20
5' x 2' Pipe Mount	B	From Leg	4.00 0' 0'	0.0000	87'	No Ice	1.00	1.00	0.03
						1/2" Ice	1.39	1.39	0.04
						1" Ice	1.70	1.70	0.05
						2" Ice	2.35	2.35	0.08
						4" Ice	3.78	3.78	0.20
5' x 2' Pipe Mount	C	From Leg	4.00 0' 0'	0.0000	87'	No Ice	1.00	1.00	0.03
						1/2" Ice	1.39	1.39	0.04
						1" Ice	1.70	1.70	0.05
						2" Ice	2.35	2.35	0.08
						4" Ice	3.78	3.78	0.20
Platform Mount [LP 602-1]	C	None		0.0000	87'	No Ice	32.03	32.03	1.34
						1/2" Ice	38.71	38.71	1.80
						1" Ice	45.39	45.39	2.26
						2" Ice	58.75	58.75	3.17
						4" Ice	85.47	85.47	5.00
***									
(2) 7770.00 w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.0000	73'	No Ice	6.12	4.25	0.06
						1/2" Ice	6.63	5.01	0.10
						1" Ice	7.13	5.71	0.16
						2" Ice	8.16	7.16	0.29
						4" Ice	10.36	10.41	0.66
(2) LGP21401	A	From Leg	4.00 0' 1'	0.0000	73'	No Ice	1.29	0.23	0.01
						1/2" Ice	1.45	0.31	0.02
						1" Ice	1.61	0.40	0.03
						2" Ice	1.97	0.61	0.05
						4" Ice	2.79	1.12	0.14
(2) LGP21903	A	From Leg	4.00 0' 1'	0.0000	73'	No Ice	0.27	0.18	0.01
						1/2" Ice	0.34	0.25	0.01
						1" Ice	0.43	0.32	0.02
						2" Ice	0.62	0.49	0.03
						4" Ice	1.10	0.94	0.07
DB809K-YP	B	From Leg	4.00 0' 6'	0.0000	73'	No Ice	2.67	2.67	0.03
						1/2" Ice	3.76	3.76	0.05
						1" Ice	4.88	4.88	0.08
						2" Ice	6.53	6.53	0.15

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
						4" Ice	9.25	9.25	0.39
(2) 7770.00 w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.0000	73'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.12 6.63 7.13 8.16 10.36	4.25 5.01 5.71 7.16 10.41	0.06 0.10 0.16 0.29 0.66
(2) LGP21401	B	From Leg	4.00 0' 1'	0.0000	73'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.29 1.45 1.61 1.97 2.79	0.23 0.31 0.40 0.61 1.12	0.01 0.02 0.03 0.05 0.14
(2) LGP21903	B	From Leg	4.00 0' 1'	0.0000	73'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.27 0.34 0.43 0.62 1.10	0.18 0.25 0.32 0.49 0.94	0.01 0.01 0.02 0.03 0.07
(2) 7770.00 w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.0000	73'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.12 6.63 7.13 8.16 10.36	4.25 5.01 5.71 7.16 10.41	0.06 0.10 0.16 0.29 0.66
(2) LGP21401	C	From Leg	4.00 0' 1'	0.0000	73'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.29 1.45 1.61 1.97 2.79	0.23 0.31 0.40 0.61 1.12	0.01 0.02 0.03 0.05 0.14
(2) LGP21903	C	From Leg	4.00 0' 1'	0.0000	73'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.27 0.34 0.43 0.62 1.10	0.18 0.25 0.32 0.49 0.94	0.01 0.01 0.02 0.03 0.07
Platform Mount [LP 712-1]	C	None		0.0000	73'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	24.53 29.94 35.35 46.17 67.81	24.53 29.94 35.35 46.17 67.81	1.34 1.65 1.96 2.58 3.82
***									
PD1142-1	A	From Leg	4.00 0' 7'	0.0000	50'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.32 3.21 5.12 8.99 16.94	1.32 3.21 5.12 8.99 16.94	0.01 0.02 0.05 0.14 0.46
DB492A	A	From Leg	4.00 0' 0'	0.0000	50'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.10 1.98 2.86 4.62 8.14	1.10 1.98 2.86 4.62 8.14	0.01 0.01 0.01 0.01 0.02
ASP-655	B	From Leg	4.00 0' 4'	0.0000	50'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.56 1.02 1.30 1.88 3.19	0.56 1.02 1.30 1.88 3.19	0.00 0.01 0.01 0.04 0.13
PD1121-6	C	From Leg	4.00 0' 3'	0.0000	50'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.23 0.41 0.60 0.97 1.70	0.23 0.41 0.60 0.97 1.70	0.00 0.00 0.00 0.01 0.01

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
Side Arm Mount [SO 701-3]	C	None		0.0000	50'	No Ice	2.83	2.83	0.20
						1/2" Ice	3.92	3.92	0.24
						1" Ice	5.01	5.01	0.28
						2" Ice	7.19	7.19	0.36
						4" Ice	11.55	11.55	0.53
***									
EPSILON GPS ANTENNA 35 DB	A	From Leg	4.00 0' 1'	0.0000	40'	No Ice	0.13	0.13	0.00
						1/2" Ice	0.19	0.19	0.00
						1" Ice	0.25	0.25	0.00
						2" Ice	0.39	0.39	0.01
						4" Ice	0.79	0.79	0.05
Side Arm Mount [SO 701-1]	A	From Leg	2.00 0' 0'	0.0000	40'	No Ice	0.85	1.67	0.07
						1/2" Ice	1.14	2.34	0.08
						1" Ice	1.43	3.01	0.09
						2" Ice	2.01	4.35	0.12
						4" Ice	3.17	7.03	0.18

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
KP6-17B	C	Grid	From Leg	1.00 0' 0'	0.0000		107'	6.00	No Ice	28.27	0.20
									1/2" Ice	29.05	0.35
									1" Ice	35.48	0.50
									2" Ice	48.34	0.79
									4" Ice	74.06	1.39

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

Comb. No.	Description
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	120 - 100	Pole	Max Tension	11	0.00	-0.00	-0.00
			Max. Compression	14	-5.13	1.18	-0.11
			Max. Mx	11	-2.52	73.39	-0.59
			Max. My	8	-2.55	1.34	-70.89
			Max. Vy	11	-5.63	73.39	-0.59
			Max. Vx	8	5.39	1.34	-70.89
			Max. Torque	2			1.48
L2	100 - 47.0833	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-21.99	0.90	-0.28
			Max. Mx	11	-12.79	881.39	-5.67
			Max. My	8	-12.81	8.11	-867.23
			Max. Vy	11	-21.12	881.39	-5.67
			Max. Vx	8	20.87	8.11	-867.23
			Max. Torque	2			1.48
L3	47.0833 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-34.71	0.87	0.25
			Max. Mx	11	-24.26	2115.82	-10.75
			Max. My	8	-24.26	15.40	-2087.57
			Max. Vy	5	26.18	-2114.78	6.82
			Max. Vx	8	25.91	15.40	-2087.57
			Max. Torque	3			1.18

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	17	34.71	-5.58	3.21
	Max. H_x	11	24.29	26.16	-0.10
	Max. H_z	2	24.29	-0.10	25.87
	Max. M_x	2	2086.26	-0.10	25.87
	Max. M_z	5	2114.78	-26.16	0.06
	Max. Torsion	3	1.18	-13.13	22.57
	Min. Vert	1	24.29	0.00	0.00
	Min. H_x	5	24.29	-26.16	0.06
	Min. H_z	8	24.29	0.14	-25.89
	Min. M_x	8	-2087.57	0.14	-25.89
	Min. M_z	11	-2115.82	26.16	-0.10
	Min. Torsion	9	-1.11	13.17	-22.55

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	24.29	0.00	0.00	-0.17	0.51	0.00
Dead+Wind 0 deg - No Ice	24.29	0.10	-25.87	-2086.26	-10.39	-0.95
Dead+Wind 30 deg - No Ice	24.29	13.13	-22.57	-1823.94	-1062.88	-1.18
Dead+Wind 60 deg - No Ice	24.29	22.69	-13.07	-1057.15	-1835.04	-0.74
Dead+Wind 90 deg - No Ice	24.29	26.16	-0.06	-6.82	-2114.78	-0.10
Dead+Wind 120 deg - No Ice	24.29	22.51	12.85	1033.40	-1816.36	0.21
Dead+Wind 150 deg - No Ice	24.29	12.83	22.30	1794.73	-1030.57	0.36
Dead+Wind 180 deg - No Ice	24.29	-0.14	25.89	2087.57	15.40	0.92
Dead+Wind 210 deg - No Ice	24.29	-13.17	22.55	1821.44	1067.64	1.11
Dead+Wind 240 deg - No Ice	24.29	-22.75	13.10	1060.78	1842.99	0.74
Dead+Wind 270 deg - No Ice	24.29	-26.16	0.10	10.75	2115.82	0.17
Dead+Wind 300 deg - No Ice	24.29	-22.54	-12.83	-1031.16	1820.83	-0.18
Dead+Wind 330 deg - No Ice	24.29	-12.94	-22.24	-1788.17	1043.60	-0.36
Dead+Ice+Temp	34.71	-0.00	0.00	-0.25	0.87	0.00
Dead+Wind 0 deg+Ice+Temp	34.71	0.38	-6.26	-533.02	-42.04	0.01
Dead+Wind 30 deg+Ice+Temp	34.71	3.39	-5.38	-457.20	-294.69	-0.12
Dead+Wind 60 deg+Ice+Temp	34.71	5.58	-3.21	-275.50	-477.55	-0.35
Dead+Wind 90 deg+Ice+Temp	34.71	6.37	-0.24	-26.91	-544.11	-0.49
Dead+Wind 120 deg+Ice+Temp	34.71	5.63	2.80	228.93	-483.68	-0.36
Dead+Wind 150 deg+Ice+Temp	34.71	3.04	5.25	441.66	-254.77	0.22
Dead+Wind 180 deg+Ice+Temp	34.71	-0.05	6.14	519.23	6.90	0.50
Dead+Wind 210 deg+Ice+Temp	34.71	-3.14	5.37	455.89	267.72	0.60
Dead+Wind 240 deg+Ice+Temp	34.71	-5.45	3.14	266.95	465.45	0.35
Dead+Wind 270 deg+Ice+Temp	34.71	-6.24	0.02	1.87	530.84	0.01
Dead+Wind 300 deg+Ice+Temp	34.71	-5.36	-3.02	-254.81	455.52	-0.15
Dead+Wind 330 deg+Ice+Temp	34.71	-3.04	-5.24	-441.78	257.28	-0.22
Dead+Wind 0 deg - Service	24.29	0.03	-8.95	-722.79	-3.25	-0.33
Dead+Wind 30 deg - Service	24.29	4.54	-7.81	-631.94	-367.84	-0.41
Dead+Wind 60 deg - Service	24.29	7.85	-4.52	-366.32	-635.33	-0.26
Dead+Wind 90 deg - Service	24.29	9.05	-0.02	-2.48	-732.23	-0.03
Dead+Wind 120 deg - Service	24.29	7.79	4.45	357.85	-628.83	0.07
Dead+Wind 150 deg - Service	24.29	4.44	7.72	621.56	-356.62	0.13
Dead+Wind 180 deg - Service	24.29	-0.05	8.96	723.01	5.69	0.32
Dead+Wind 210 deg - Service	24.29	-4.56	7.80	630.84	370.19	0.39
Dead+Wind 240 deg - Service	24.29	-7.87	4.53	367.35	638.79	0.26
Dead+Wind 270 deg - Service	24.29	-9.05	0.03	3.61	733.29	0.06
Dead+Wind 300 deg - Service	24.29	-7.80	-4.44	-357.31	631.09	-0.07
Dead+Wind 330 deg - Service	24.29	-4.48	-7.69	-619.51	361.84	-0.13

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	-24.29	0.00	0.00	24.29	0.00	0.000%
2	0.10	-24.29	-25.87	-0.10	24.29	25.87	0.000%
3	13.13	-24.29	-22.57	-13.13	24.29	22.57	0.000%
4	22.69	-24.29	-13.07	-22.69	24.29	13.07	0.000%
5	26.16	-24.29	-0.06	-26.16	24.29	0.06	0.000%
6	22.51	-24.29	12.85	-22.51	24.29	-12.85	0.000%
7	12.83	-24.29	22.30	-12.83	24.29	-22.30	0.000%
8	-0.14	-24.29	25.89	0.14	24.29	-25.89	0.000%
9	-13.17	-24.29	22.55	13.17	24.29	-22.55	0.000%
10	-22.75	-24.29	13.10	22.75	24.29	-13.10	0.000%
11	-26.16	-24.29	0.10	26.16	24.29	-0.10	0.000%
12	-22.54	-24.29	-12.83	22.54	24.29	12.83	0.000%
13	-12.94	-24.29	-22.24	12.94	24.29	22.24	0.000%
14	0.00	-34.71	0.00	0.00	34.71	0.00	0.000%
15	0.38	-34.71	-6.26	-0.38	34.71	6.26	0.000%
16	3.39	-34.71	-5.38	-3.39	34.71	5.38	0.000%
17	5.58	-34.71	-3.21	-5.58	34.71	3.21	0.000%
18	6.37	-34.71	-0.24	-6.37	34.71	0.24	0.000%
19	5.63	-34.71	2.80	-5.63	34.71	-2.80	0.000%
20	3.04	-34.71	5.25	-3.04	34.71	-5.25	0.000%
21	-0.05	-34.71	6.14	0.05	34.71	-6.14	0.000%
22	-3.14	-34.71	5.37	3.14	34.71	-5.37	0.000%
23	-5.45	-34.71	3.14	5.45	34.71	-3.14	0.000%
24	-6.24	-34.71	0.02	6.24	34.71	-0.02	0.000%
25	-5.36	-34.71	-3.02	5.36	34.71	3.02	0.000%
26	-3.04	-34.71	-5.24	3.04	34.71	5.24	0.000%
27	0.03	-24.29	-8.95	-0.03	24.29	8.95	0.000%
28	4.54	-24.29	-7.81	-4.54	24.29	7.81	0.000%
29	7.85	-24.29	-4.52	-7.85	24.29	4.52	0.000%
30	9.05	-24.29	-0.02	-9.05	24.29	0.02	0.000%
31	7.79	-24.29	4.45	-7.79	24.29	-4.45	0.000%
32	4.44	-24.29	7.72	-4.44	24.29	-7.72	0.000%
33	-0.05	-24.29	8.96	0.05	24.29	-8.96	0.000%
34	-4.56	-24.29	7.80	4.56	24.29	-7.80	0.000%
35	-7.87	-24.29	4.53	7.87	24.29	-4.53	0.000%
36	-9.05	-24.29	0.03	9.05	24.29	-0.03	0.000%
37	-7.80	-24.29	-4.44	7.80	24.29	4.44	0.000%
38	-4.48	-24.29	-7.69	4.48	24.29	7.69	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	0.00096686
3	Yes	5	0.00000001	0.00027081
4	Yes	5	0.00000001	0.00030085
5	Yes	4	0.00000001	0.00010896
6	Yes	5	0.00000001	0.00029149
7	Yes	5	0.00000001	0.00026602
8	Yes	5	0.00000001	0.00003957

9	Yes	5	0.00000001	0.00031120
10	Yes	5	0.00000001	0.00028278
11	Yes	4	0.00000001	0.00024457
12	Yes	5	0.00000001	0.00027434
13	Yes	5	0.00000001	0.00029239
14	Yes	4	0.00000001	0.00000001
15	Yes	5	0.00000001	0.00006034
16	Yes	5	0.00000001	0.00009829
17	Yes	5	0.00000001	0.00010167
18	Yes	5	0.00000001	0.00006347
19	Yes	5	0.00000001	0.00008455
20	Yes	5	0.00000001	0.00008236
21	Yes	5	0.00000001	0.00006314
22	Yes	5	0.00000001	0.00010054
23	Yes	5	0.00000001	0.00009235
24	Yes	5	0.00000001	0.00005902
25	Yes	5	0.00000001	0.00008611
26	Yes	5	0.00000001	0.00009021
27	Yes	4	0.00000001	0.00021871
28	Yes	4	0.00000001	0.00072470
29	Yes	4	0.00000001	0.00088009
30	Yes	4	0.00000001	0.00003093
31	Yes	4	0.00000001	0.00082887
32	Yes	4	0.00000001	0.00069104
33	Yes	4	0.00000001	0.00024088
34	Yes	4	0.00000001	0.00095182
35	Yes	4	0.00000001	0.00078209
36	Yes	4	0.00000001	0.00003550
37	Yes	4	0.00000001	0.00073621
38	Yes	4	0.00000001	0.00084165

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	120 - 100	27.058	35	1.9164	0.0096
L2	100 - 47.0833	19.163	35	1.8094	0.0051
L3	52 - 0	4.953	35	0.8967	0.0009

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
118'	DB809MT3-XT	35	26.252	1.9102	0.0095	19736
115'	(4) DB844H90 w/ Mount Pipe	35	25.046	1.9003	0.0088	19736
107'	KP6-17B	35	21.865	1.8638	0.0069	7590
98'	(2) LPA-80080/6CF w/ Mount Pipe	35	18.410	1.7883	0.0050	4712
87'	(2) DB980H90E-M w/ Mount Pipe	35	14.470	1.6304	0.0035	3697
73'	(2) 7770.00 w/ Mount Pipe	35	10.035	1.3563	0.0020	2911
50'	PD1142-1	35	4.584	0.8551	0.0009	2308
40'	EPSILON GPS ANTENNA 35 DB	35	3.040	0.6592	0.0006	2869

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	120 - 100	77.817	10	5.5096	0.0273
L2	100 - 47.0833	55.161	10	5.2075	0.0144
L3	52 - 0	14.282	10	2.5858	0.0025

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
118'	DB809MT3-XT	10	75.506	5.4923	0.0275	7078
115'	(4) DB844H90 w/ Mount Pipe	10	72.045	5.4647	0.0253	7078
107'	KP6-17B	10	62.918	5.3623	0.0198	2721
98'	(2) LPA-80080/6CF w/ Mount Pipe	10	53.001	5.1473	0.0145	1684
87'	(2) DB980H90E-M w/ Mount Pipe	10	41.679	4.6951	0.0101	1310
73'	(2) 7770.00 w/ Mount Pipe	10	28.920	3.9081	0.0060	1023
50'	PD1142-1	10	13.220	2.4662	0.0025	804
40'	EPSILON GPS ANTENNA 35 DB	10	8.769	1.9017	0.0017	998

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	120 - 100 (1)	TP20.263x15.403x0.1875	20'	0'	0.0	39.000	12.1206	-2.50	472.70	0.005
L2	100 - 47.0833 (2)	TP33.13x20.263x0.281	52'11-1/3 2"	0'	0.0	39.000	28.6407	-12.78	1116.99	0.011
L3	47.0833 - 0 (3)	TP44x31.3725x0.375	52'	0'	0.0	39.000	52.6772	-24.26	2054.41	0.012

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	120 - 100 (1)	TP20.263x15.403x0.1875	73.87	14.922	39.000	0.383	0.00	0.000	39.000	0.000
L2	100 - 47.0833 (2)	TP33.13x20.263x0.281	886.99	48.071	39.000	1.233	0.00	0.000	39.000	0.000
L3	47.0833 - 0 (3)	TP44x31.3725x0.375	2126.47	45.451	39.000	1.165	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	120 - 100 (1)	TP20.263x15.403x0.1875	5.73	0.473	26.000	0.037	0.72	0.069	26.000	0.003
L2	100 - 47.0833 (2)	TP33.13x20.263x0.281	21.23	0.741	26.000	0.058	0.25	0.006	26.000	0.000
L3	47.0833 - 0 (3)	TP44x31.3725x0.375	26.28	0.499	26.000	0.039	0.74	0.007	26.000	0.000

Pole Interaction Design Data

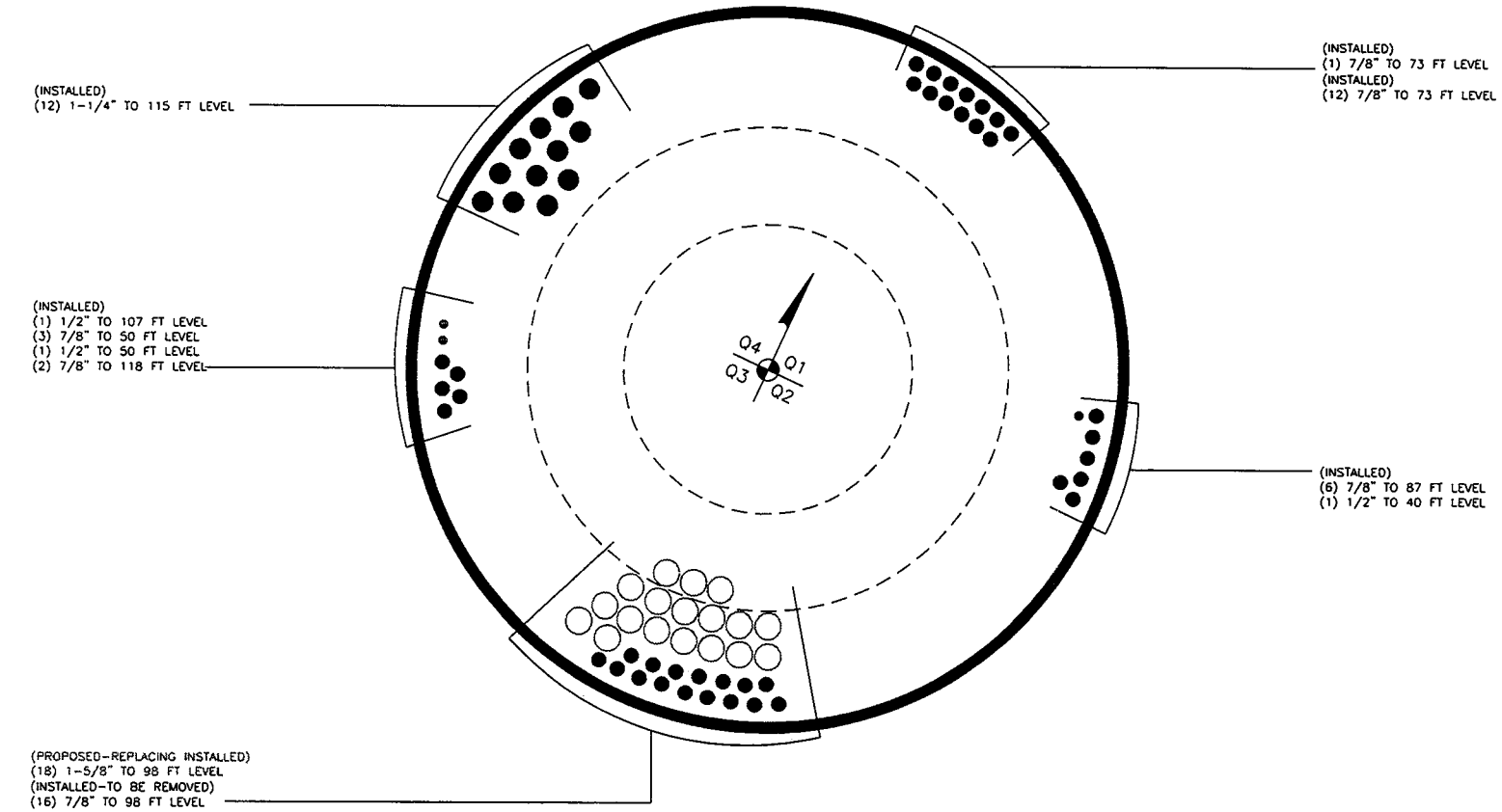
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	120 - 100 (1)	0.005	0.383	0.000	0.037	0.003	0.388 ✓	1.333	H1-3+VT ✓
L2	100 - 47.0833 (2)	0.011	1.233	0.000	0.058	0.000	1.245 ✓	1.333	H1-3+VT ✓
L3	47.0833 - 0 (3)	0.012	1.165	0.000	0.039	0.000	1.178 ✓	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	120 - 100	Pole	TP20.263x15.403x0.1875	1	-2.50	630.11	29.1	Pass
L2	100 - 47.0833	Pole	TP33.13x20.263x0.281	2	-12.78	1488.95	93.4	Pass
L3	47.0833 - 0	Pole	TP44x31.3725x0.375	3	-24.26	2738.53	88.3	Pass
							Summary	
							Pole (L2) 93.4	Pass
							RATING = **93.4**	**Pass**

APPENDIX B

BASE LEVEL DRAWING



BUSINESS UNIT: 806364 TOWER ID: C_BASELEVEL

APPENDIX C

ADDITIONAL CALCULATIONS

(Bearing and Stability Checks) Tool for TIA Rev F or G - Application (MP, SST with unitbase)

Site Data

BU#: 806364
Site Name: HRT 106(B) 943202
App #: 131488

Enter Load Factors Below:		
For P (DL)	1.2	<---- Enter Factor
For P,V, and M (WL)	1.35	<---- Enter Factor

Pad & Pier Data		
Base PL Dist. Above Pier:	6	in
Pier Dist. Above Grade:	9.75	in
Pad Bearing Depth, D:	6	ft
Pad Thickness, T:	6	ft
Pad Width=Length, L:	27	ft
Pier Cross Section Shape:	Square	<--Pull Down
Enter Pier Side Width:	6	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	36.00	ft^2
Pier Height:	0.81	ft
Soil (above pad) Height:	0.00	ft

Soil Parameters		
Unit Weight, γ:	125.0	pcf
Ultimate Bearing Capacity, qn:	8.00	ksf
Strength Reduct. factor, ϕ:	0.75	
Angle of Friction, Φ:	34.0	degrees
Undrained Shear Strength, Cu:	0.00	ksf
Allowable Bearing: ϕ*qn:	6.00	ksf
Passive Pres. Coeff., Kp	3.54	

Forces/Moments due to Wind and Lateral Soil		
Minimum of (φ*Ultimate Pad Passive Force, Vu):	35.1	kips
Pad Force Location Above D:	2.00	ft
ϕ(Passive Pressure Moment):	70.20	ft-kips
Factored O.T. M(WL), "1.6W":	3126.8	ft-kips
Factored OT (MW-Msoil), M1	3056.57	ft-kips

Resistance due to Foundation Gravity		
Soil Wedge Projection grade, a:	0.00	ft
Sum of Soil Wedges Wt:	0.00	kips
Soil Wedges ecc, K1:	0.00	ft
Ftg+Soil above Pad wt:	660.5	kips
Unfactored (Total ftg-soil Wt):	660.49	kips
1.2D. **No Soil Wedges.**	821.39	kips
0.9D. **With Soil Wedges**	616.04	kips

Resistance due to Cohesion (Vertical)		
ϕ*(1/2*Cu)(Total Vert. Planes)	0.00	kips
Cohesion Force Eccentricity, K2	0.00	ft

Monopole Base Reaction Forces		
TIA Revision:	F	<--Pull Down
Unfactored DL Axial, PD:	24	kips
Unfactored WL Axial, PW:	0	kips
Unfactored WL Shear, V:	26	kips
Unfactored WL Moment, M:	2126	ft-kips

Load Factor	Shaft Factored Loads		
1.20	1.2D+1.6W, Pu:	28.8	kips
0.90	0.9D+1.6W, Pu:	21.6	kips
1.35	Vu:	35.1	kips
	Mu:	2870.1	ft-kips

1.2D+1.6W Load Combination, Bearing Results:

(**No Soil Wedges**) [Reaction+Conc+Soil]	821.39	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	3056.57	ft-kips

Orthogonal Direction:

ecc1 = M1/P1 =	3.72	ft
Orthogonal qu=	1.75	ksf
qu/ϕ*qn Ratio=	**29.13%**	**Pass**

Diagonal Direction:

ecc2 = (0.707M1)/P1 =	2.63	ft
Diagonal qu=	1.74	ksf
qu/ϕ*qn Ratio=	**28.97%**	**Pass**

Run <-- Press Upon Completing All Input

Overturning Stability Check

0.9D+1.6W Load Combination, Bearing Results:

(**w/ Soil Wedges**) [Reaction+Conc+Soil]	616.04	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	3056.57	ft-kips

Orthogonal ecc3 = M2/P2 =	4.96	ft
Ortho Non Bearing Length,NBL=	9.92	ft
Orthogonal qu=	1.47	ksf
Diagonal qu=	1.54	ksf

Max Reaction Moment (ft-kips) so that qu=φ*qn = 100% Capacity Rating			
Actual M:	2126.00		
M Orthogonal:	5154.63	**41.24%**	**Pass**
M Diagonal:	5154.63	**41.24%**	**Pass**

Monopole Block Foundation

Checks capacity of monolithic block foundation for a monopole tower per TIA/EIA-222-F

BU #: 806364
Site Name: HRT 106(B) 943202
App No.: 131488

CROWN CASTLE

Design Reactions		
Shear, S:	26.00	kips
Moment, M:	2126.00	ft*kips
Height, H:	120.00	ft
Weight, Wt:	24.00	kips
Base Diameter, BD:	44.0	in

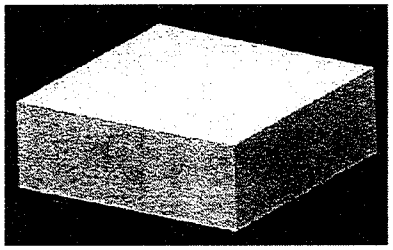
Foundation Dimensions		
Depth, D:	6.0	ft
Block Width, W:	27.0	ft
Neglected Depth, N:	2.0	ft
Ext. Above Grade, E:	0.0	ft
Anchor Steel Length, Lst:	97.0	in
Clear Cover, cc:	4.0	in

Soil Properties		
Soil Unit Weight, γ:	0.125	kcf
Allowable Bearing, Bc:	4.000	ksf
Int. Angle of Friction, Φ:	34.00	deg
Cohesion, Co:	0.000	ksf
Passive Pressure, Pp:	0.000	kcf
Base Friction, μ:	0.2	
Seismic Zone, z:	1	

Material Properties		
Rebar Yield Strength, Fy:	60000	psi
Concrete Strength, F'c:	4000	psi
Concrete Density, δc:	0.150	kcf

Rebar Properties		
Pad Rebar Size, sp:	11	
Rebar Quanity, mp:	26	14

Design Checks	Capacity/ Availability	Demands/ Limits	Check	%
Shear (ksf)	68.01	26.00	OK	38.2%
Shear - 1-Way (kips):	2757.96	725.07	OK	26.3%
Pad Rebar Area (in²):	40.60	21.00	OK	N/A
Bar Spacing (in):	11.17	18 > Bs > 2	OK	N/A
Development Length (in):	158.00	52.17	OK	N/A



Modification Checks	Capacity/ Availibility	Demands/ Limits	Check
Minimum Extra Thickness (in):	0.00	0.00	Not Used
Pad Rebar Area-short (in²):	8.84	0.00	Not Used
Pad Rebar Area-long (in2):	2.21	0.00	Not Used
Pad Rebar Spacing-short (in2):	15.84	18 > Bs > 2	Not Used
Pad Rebar Spacing-long (in2):	78.06	18 > Bs > 2	Not Used
End Cap Width (in):	0.00	0.00	Not Used
End Cap Rebar Area (in2):	4.81	0.00	Not Used
EC Rebar Spacing (in):	-2.02	18 > Bs > 2	Not Used
Tie Spacing (in):	16.13	316 > s > 4.5	Not Used
Dowel Area (in2):	8.84	0.00	Not Used
Dowel Embedment (in):	15.00	6.00	Not Used
Shear Strength of Cone (kips):	68.73	23.86	Not Used
Dowel Edge Distance (in):	12.00	14.51	Not Used
Dowel Spacing (in):	33.33	30.00	Not Used
Dowel Edge Distance (vert) (in):	36.00	14.51	Not Used
Dowel Devel. Length (in):	-4.00	13.32	Not Used

Modifications					
Pad Thickness, Te:	0	in	End Cap Width, Wec:	0	in
Revised Pad Thickness, Tx:	6	ft	Revised Width, Wx:	27	ft
Pad Rebar Size, Se:	6		EC Rebar Size, Sec:	7	per side, top & bottom
Rebar Quanity (long), me:	20		EC Rebar Quanity, mec:	8	
Rebar Quanity (short), mex:	5		EC Tie Size, Sect:	4	per side
Dowel Size, Sed:	7		Tie Quanity, mect:	20	
Dowel Quanity, med:	20		EC Dowel Size, Secd:	6	per side
			Dowel Quanity, mecd:	20	
			Rows of Dowels, Nd:	2	
			Dowel Depth, decd:	15	in
			Edge Distance, eecd:	12	in

Stiffened or Unstiffened, Ungrouted, Circular Base Plate - Any Rod Material

TIA Rev F

Site Data

BU#: *806364*
Site Name: *HRT 106(B) 943202*
App #: *131488*

Pole Manufacturer:	*Other*

Reactions		
Moment:	2126	ft-kips
Axial:	24	kips
Shear:	26	kips

Anchor Rod Data		
Qty:	12	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	52.05	in

Plate Data		
Diam:	58.05	in
Thick:	2.75	in
Grade:	60	ksi
Single-Rod B-eff:	11.79	in

Stiffener Data (Welding at both sides)		
Config:	0	*
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:	44	in
Thick:	0.375	in
Grade:	65	ksi
# of Sides:	12	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

If No stiffeners, Criteria:	AISC ASD	<-Only Applcable to Unstiffened Cases

Anchor Rod Results

		Rigid
Maximum Rod Tension:	161.4 Kips	Service, ASD
Allowable Tension:	195.0 Kips	Fty*ASIF
Anchor Rod Stress Ratio:	82.8% **Pass**	

Base Plate Results

	Flexural Check	Rigid
Base Plate Stress:	28.6 ksi	Service ASD
Allowable Plate Stress:	60.0 ksi	0.75*Fy*ASIF
Base Plate Stress Ratio:	47.7% **Pass**	Y.L. Length: 27.81

n/a

Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

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