EM-VER-098-120306

ROBINSON & COLE

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March 5, 2012

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

Re: **Notice of Exempt Modification – Antenna Swap**
599 Greenwoods Road East, Norfolk, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 160-foot level on an existing 180-foot tower at the above-referenced address. The tower is owned by Message Center Management. Cellco's use of the tower was approved by the Council in 2007 (Docket No. 320). Cellco now intends to replace six (6) of its existing antennas with three (3) model BXA-171085-12BF PCS antennas; two (2) model BXA-70080-6CF LTE antennas; and one (1) model APX75-868011-CT0 LTE antenna, all at the same 160-foot level. Cellco also intends to install six (6) coax cable diplexers to its existing antenna platform. Attached behind Tab 1 are the specifications for the replacement antennas and cable diplexers.

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 Susan M. Dyer, First Selectwoman of the Town of Norfolk. The Town of Norfolk is the owner 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 height of the existing tower. Cellco's replacement antennas and diplexers will be located at the 160-foot level on the existing 180-foot tower.

2. The proposed modifications will not involve any change to any 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 cumulative power density table for Cellco's modified facility is included behind Tab 2.

Also attached is a Detailed Structural Analysis 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:
Susan M. Dyer, Norfolk First Selectwoman
Sandy M. Carter

BXA-171085-12BF-EDIN-X

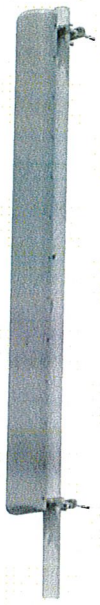
Replace "X" with desired electrical downtilt.

X-Pol | FET Panel | 85° | 18.0 dBi

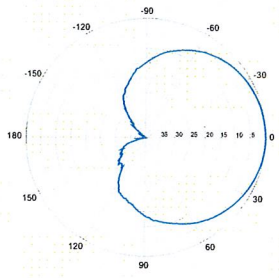
Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	88°	85°	80°
Vertical beamwidth	4.5°	4.5°	4.5°
Gain	15.1 dBd / 17.2 dBi	15.5 dBd / 17.6 dBi	15.9 dBd / 18.0 dBi
Electrical downtilt (X)	0, 2, 4		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back ratio	> 30 dB		
In-band isolation	> 28 dB		
IM3 (20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN / Female / Bottom		
Operating temperature	-40° to +60° C / -40° to +140° F		

Mechanical Characteristics		
Dimensions Length x Width x Depth	1820 x 154 x 105 mm	71.7 x 6.1 x 4.1 in
Depth with z-brackets	133 mm	5.2 in
Weight without mounting brackets	6.8 kg	15 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.28 m² Side: 0.19 m²	Front: 3.1 ft² Side: 2.1 ft²
Wind load @ 161 km/hr (100 mph)	Front: 460 N Side: 304 N	Front: 103 lbf Side: 68 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 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171085-12BF-EDIN-X-FP		

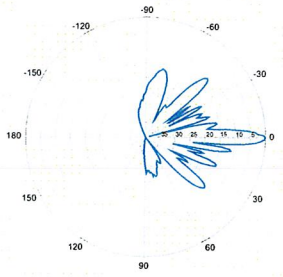


BXA-171085-12BF-EDIN-X



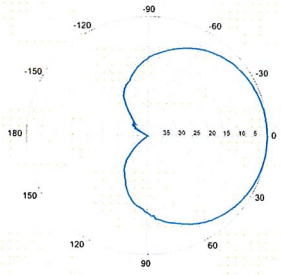
Horizontal | 1710-1880 MHz

BXA-171085-12BF-EDIN-0



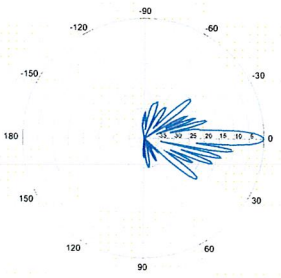
0° | Vertical | 1710-1880 MHz

BXA-171085-12BF-EDIN-X



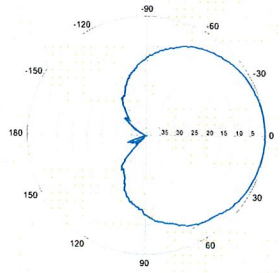
Horizontal | 1850-1990 MHz

BXA-171085-12BF-EDIN-0



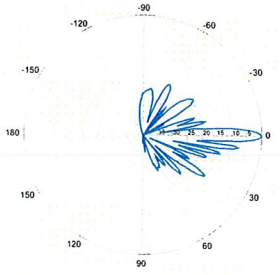
0° | Vertical | 1850-1990 MHz

BXA-171085-12BF-EDIN-X



Horizontal | 1920-2170 MHz

BXA-171085-12BF-EDIN-0

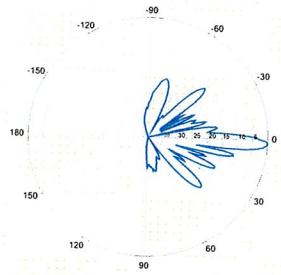


0° | Vertical | 1920-2170 MHz

BXA-171085-12BF-EDIN-X

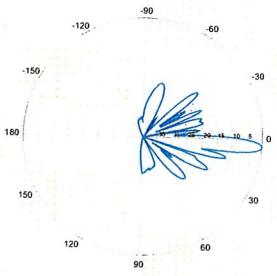
X-Pol | FET Panel | 85° | 18.0 dBi

BXA-171085-12BF-EDIN-2



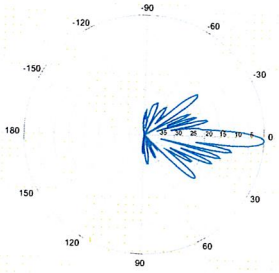
2° | Vertical | 1710-1880 MHz

BXA-171085-12BF-EDIN-4



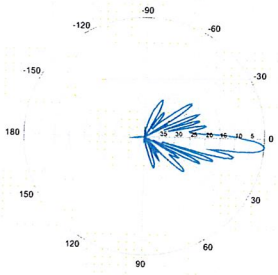
4° | Vertical | 1710-1880 MHz

BXA-171085-12BF-EDIN-2



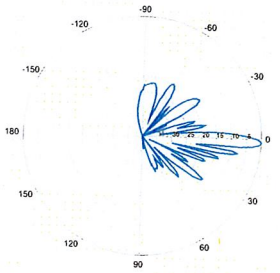
2° | Vertical | 1850-1990 MHz

BXA-171085-12BF-EDIN-4



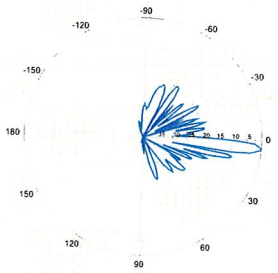
4° | Vertical | 1850-1990 MHz

BXA-171085-12BF-EDIN-2



2° | Vertical | 1920-2170 MHz

BXA-171085-12BF-EDIN-4



4° | Vertical | 1920-2170 MHz

Amphenol ANTENNA SOLUTIONS

BXA-70080-6CF-EDIN-X

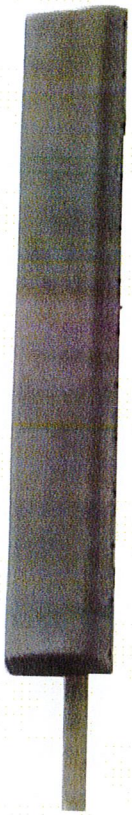
X-Pol | FET Panel | 80° | 13.5 dBd

Replace "X" with desired electrical downtilt.

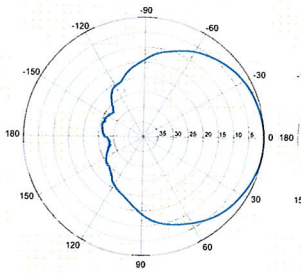
Antenna is also available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

Electrical Characteristics	696-900 MHz	
Frequency bands	696-806 MHz	806-900 MHz
Polarization	±45°	
Horizontal beamwidth	82°	80°
Vertical beamwidth	12°	10°
Gain	13.0 dBd (15.1 dBi)	13.5 dBd (15.6 dBi)
Electrical downtilt (X)	0, 2, 4, 6, 8, 10	
Impedance	50Ω	
VSWR	≤1.35:1	
Upper sidelobe suppression (0°)	-18.3 dB	-18.6 dB
Front-to-back ratio (+/-30°)	-26.9 dB	-25.6 dB
Null fill	5% (-26.02 dB)	
Isolation between ports	< -30 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 204 x 151 mm	71.0 x 8.0 x 5.9 in
Depth with z-brackets	191 mm	7.5 in
Weight without mounting brackets	8.2 kg	18 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.37 m² Side: 0.27 m²	Front: 3.9 ft² Side: 2.9 ft²
Wind load @ 161 km/hr (100 mph)	Front: 531 N Side: 475 N	Front: 119 lbf Side: 104 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-70080-6CF-EDIN-X-FP		

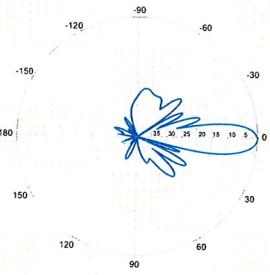


BXA-70080-6CF-EDIN-X



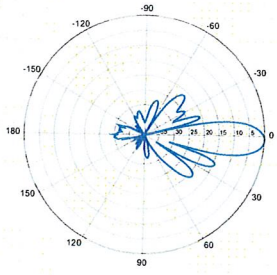
Horizontal | 750 MHz

BXA-70080-6CF-EDIN-0



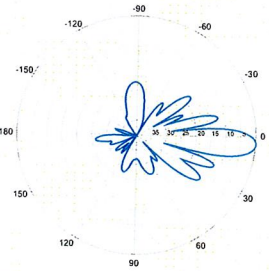
0° | Vertical | 750 MHz

BXA-70080-6CF-EDIN-2

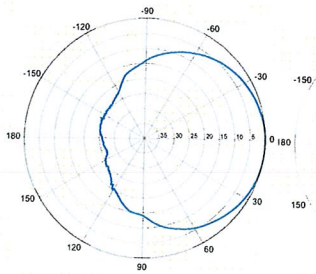


2° | Vertical | 750 MHz

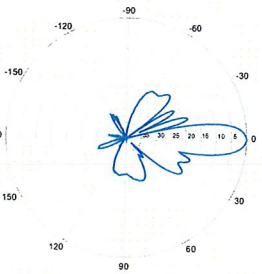
BXA-70080-6CF-EDIN-4



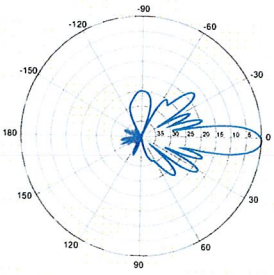
4° | Vertical | 750 MHz



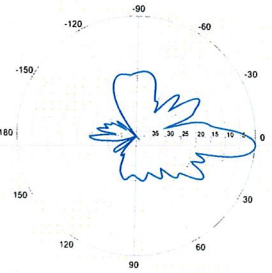
Horizontal | 850 MHz



0° | Vertical | 850 MHz



2° | Vertical | 850 MHz

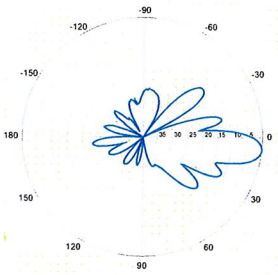


4° | Vertical | 850 MHz

BXA-70080-6CF-EDIN-X

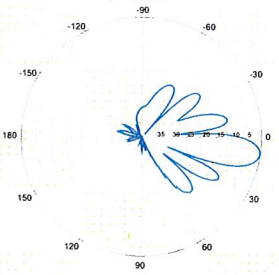
X-Pol | FET Panel | 80° | 13.5 dBd

BXA-70080-6CF-EDIN-6



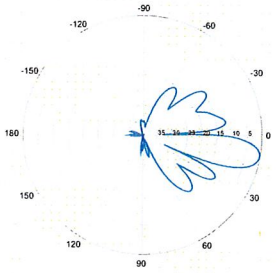
6° | Vertical | 750 MHz

BXA-70080-6CF-EDIN-8

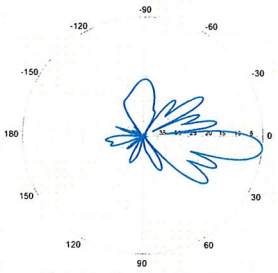


8° | Vertical | 750 MHz

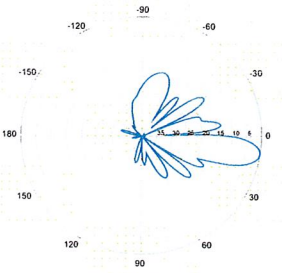
BXA-70080-6CF-EDIN-10



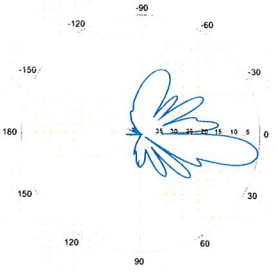
10° | Vertical | 750 MHz



6° | Vertical | 850 MHz



8° | Vertical | 850 MHz



10° | Vertical | 850 MHz

Product Data Sheet APX75-868011-CT0

Optimizer® Dual Polarized Antenna, 698-896, 80deg, 13.1dBi, 1.3m, FET, 0deg

Product Description

Wideband antenna for dense networks where site aspect is essential.

Features/Benefits

- **Wideband performance 698-896 MHz**
- **High sidelobe suppression**
- **Null fill**
- **Dual polarization**
- **High front-to-back ratio**

Technical Specifications

Electrical Specifications

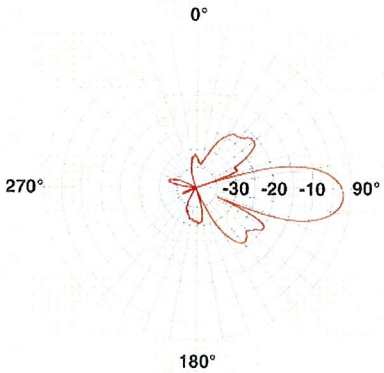
Frequency Range, MHz	698-896
Horizontal Beamwidth, deg	80 +/-5
Vertical Beamwidth, deg	15-19
Electrical Downtilt, deg	0
Gain, dBi (dBd)	13.1 (11)
1st Upper Sidelobe Suppression, dB	>18
Upper Sidelobe Suppression, dB	>18
Front-To-Back Ratio, dB	>30
Polarization	Slant +/-45 degrees
VSWR	1.40:1
Isolation between Ports, dB	>30
3rd Order IMP @ 2 x 43 dBm, dBc	>150
Impedance, Ohms	50
Maximum Power Input, W	500
Lightning Protection	Chassis Ground

Mechanical Specifications

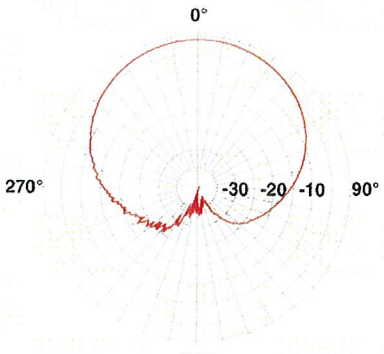
Dimensions - HxWxD, mm (in)	1320.8 x 266.7 x 139.7 (52 x 10.5 x 5.5)
Weight w/o Mtg Hardware, kg (lb)	8 (17.6)
Mounting Hardware Material	Diecasted Aluminum

Ordering Information

Mounting Hardware	APM40-2
Mounting Pipe Diameter, mm (in)	60-120 (2.36-4.72)
Mounting Hardware Weight, kg (lb)	3.4 (7.5)



Vertical Pattern



Horizontal Pattern

Other Documentation

APM40 Series Datasheet
APM40 Series Installation Instructions

Product Data Sheet **FD9R6004/2C-3L**

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

Product Description

The ShareLite FD9R6004 Series of diplexers are designed to enable feeder sharing between systems in the 698-960 MHz range and in the 1710-2200 MHz range. The diplexer is equipped with in-line connector placement so it can be installed in the BTS cabinet or at the tower top. This is especially valuable in crowded sites or when the feeders are not easily accessible. Due to its wideband design, the FD9R6004 Series can accommodate many combining solutions between 698-960 MHz and 1710-2200 MHz systems such as LTE 700 MHz, Cellular 800 MHz with PCS, GSM900 with GSM1800, or GSM900 with UMTS. This diplexer features a highly selective filter. It provides a high level of isolation between ports, while keeping the insertion loss on both paths at an extremely low level. The FD9R6004 diplexers are available with various DC pass options, helpful in configurations with or without the Tower Mount Amplifiers installed.

Features/Benefits

- **LTE ready design**
- **Extremely Low Insertion Loss**
- **High level of Rejection between bands – Protection against interferences**
- **Extremely High Power Handling Capability**
- **Integrated DC block/bypass versions available**
- **Very compact & small size design – Easy installation and reduced tower load**
- **In-line long-neck connectors for easy connection & waterproofing**
- **Exceptional reliability & environmental protection (IP 67)**
- **Equipped with 1 * Breathable Vent – Prevent any humidity inside the product**
- **Mounting hardware for Wall and Pole mount provided (P/N SEM2-1A)**
- **Grounding already provided through the mounting bracket**
- **Kit available for easy dual mount**

Technical Specifications

Product Type	Diplexer/Cross Band Coupler
Frequency Range 1, MHz	698-960
Frequency Range 2, MHz	1710-2200
Application	LTE700, GSM900, UMTS, GSM1800, Cellular 800, PCS
Configuration	Sharelite Single diplexer, outdoor, DC pass in the 1710-2170MHz path, with mounting hardware SEM2-1A
Mounting	Wall Mounting: With 4 screws (maximum 6mm diameter); Pole Mounting: With included clamp set 40-110mm (1.57-4.33)
Return Loss All Ports Min/Typ, dB	19/23
Power Handling Continuous, Max, W	1250 at common port; 750 in low frequency path & 500 in high frequency path
Power Handling Peak, Max, W	15000 in low frequency path & 8000 in high frequency path
Impedance, Ohms	50
Insertion Loss, Path 1, dB	0.07 typ.
Insertion Loss, Path 2, dB	0.13 typ.
Rejection Between Bands Min/Typ, dB	58/64@698-960MHz; 60/70@1710-2200MHz
IMP Level at the COM Port, Typ, dBm	-112 @ 2x43
DC Pass in Low Frequency Path	No
DC Pass in High Frequency Path	Yes
Temperature Range, °C (°F)	-40 to +60 (-40 to +140)
Environmental	ETSI 300-019-2-4 Class 4.1E
Ingress Protection	IP 67
Lightning Protection	EN/IEC61000-4-5 Level 4
Connectors	In-line long-neck 7-16-Female
Weight, kg (lb)	1.2 (2.6)
Shipping Weight, kg (lb)	3.2 (7) for 2 * single units in 1 * box, 9.8 (21.6) for 6 * units = 3 * Boxes in 1 * overwrap
Dimensions, H x W x D, mm (in)	147 x 164 x 37 (5.8 x 6.5 x 1.5)
Shipping Dimensions, H x W x D, mm (in)	254 x 406 x 82 (10 x 16 x 3.2) for 2 * Single Units in 1 * box, 280 x 406 x 241 (11 x 16 x 9.5) for 6 * units = 3 * Boxes in 1 * overwrap
Volume, L	0.43
Housing	Aluminum

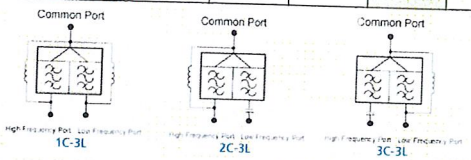
Notes

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

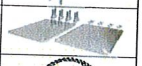
Other Documentation

FD9R6004/2C-3L Installation Instructions: Wideband_Diplexer_Installation_Rev5.pdf

Selection Guide Diplexer 698-960 / 1710-2200MHz					
	Model Number	Full DC Pass	DC Pass High Band	DC Pass Low Band	Mounting Hardware Included
Single	FD9R6004/1C-3L				X
	FD9R6004/2C-3L				X
	FD9R6004/3C-3L				X
Dual	KIT-FD9R6004/1C-DL				X
	KIT-FD9R6004/2C-DL				X
	KIT-FD9R6004/3C-DL				X



The FD9R6004 Series is upgradeable to a Dual Diplexer kit by means of 2 diplexers and mounting hardware kits SEM2-1A and SEM2-3

Mounting Hardware and Ground Cable Ordering Information		
Model Number	**Description**	
SEM2-1A	Mounting Hardware, Pole mount ø40-110mm (Included with the Single and Dual Diplexer) Wall Screws M6 (Not included with the product)	
SEM2-3	Assembly kit for 2 pcs of FD9R6004/xC-3L (Can be ordered separately but included with the Dual Diplexer Kit)	
CA020-2	Ground Cable, 2m, includes lugs (Optional)	
CA030-2	Ground Cable, 2m, includes lugs (Optional)	
SEM6	Mounting Hardware for 6 Diplexers, Tower Base (Optional)	

	General	Power	Density					
Site Name: Norfolk E								
Tower Height: Verizon @ 160ft								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*Cingular	6	296	180	0.0197	880	0.5867	3.36%	
*Cingular	3	427	180	0.0142	1930	1.0000	1.42%	
Verizon PCS	**7**	**317**	**160**	**0.0312**	**1970**	**1.0000**	**3.12%**	
Verizon Cellular	**9**	**339**	**160**	**0.0429**	**869**	**0.5793**	**7.40%**	
Verizon AWS	**1**	**670**	**160**	**0.0094**	**2145**	**1.0000**	**0.94%**	
Verizon 700	**1**	**561**	**160**	**0.0079**	**698**	**0.4653**	**1.69%**	
* Source: Siting Council								**17.93%**

DETAILED STRUCTURAL ANALYSIS AND EVALUATION OF AN EXISTING 180' MONOPOLE FOR PROPOSED ANTENNA ARRANGEMENT

Site Name: Norfolk East CT
Address: Greenwoods Road East (Route 44)
Norfolk, Connecticut

prepared for

verizonwireless

Verizon Wireless
99 East River Drive
East Hartford, Connecticut 06108

prepared by

URS

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

36922265.00000
VZ5-107 (Rev1)

January 31, 2012

1. EXECUTIVE SUMMARY

This report summarizes the structural analysis of the existing 180' steel tapered monopole structure, located at Greenwoods Road East (Route 44) in Norfolk, Connecticut. The analysis was conducted in accordance with the 2005 Connecticut State Building Code and the TIA/EIA-222-F standard for a wind velocity of 80 mph (fastest mile) and 69 mph (fastest mile) concurrent with ½" ice. The antenna loading considered in the analysis consists of all existing and proposed antennas, transmission lines, and ancillary items as outlined in the Introduction Section of this report. The proposed Verizon Wireless installation is as follows:

Proposed Antenna and Mount	Carrier	Antenna Center Elevation
Remove: (6) Amphenol LPA-185080-12CF-EDIN-2	Verizon (Existing)	@ 160'
Install: (1) RFS APX75-868011-CT0 (1 per Alpha Sector) (2) Amphenol BXA-70080-6CF-EDIN (1 per Beta & Gamma Sectors) (3) Amphenol BXA-171085-12BF-EDIN (6) Diplexers	Verizon (Proposed)	@ 160'

The results of the analysis indicate that the tower structure has the capacity to support the proposed loading conditions. **The tower, base plate, anchor bolts, and its foundation are considered structurally adequate with the wind load classification specified above and the proposed antenna loading.**

This analysis is based on:

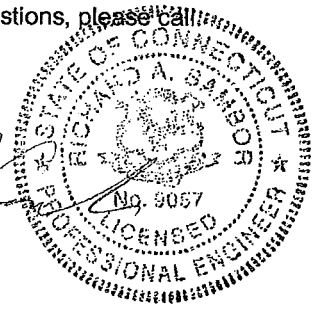
1) The tower structure's theoretical capacity, not including any assessment of the condition of the tower.
2) Tower and foundation design documents prepared by Valmont Communications (Order #11004-67), signed and sealed July 19, 2007.
3) Geotechnical report prepared by Dr. Clarence Welti, P.E., P.C., dated March 4, 2007.
4) Antenna and mount configuration as specified within Section 2 and 6 of this report.

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

If you should have any questions, please call.

Sincerely,

URS Corporation



Richard A. Sambor, P.E.
Senior Structural Engineer

RAS/mjk

4. FINDINGS AND EVALUATION

Combined axial and bending stresses on the monopole structure were evaluated to compare with allowable stresses in accordance with AISC. The calculated stresses under the proposed loading were below the allowable stresses (see table below). Detailed analysis and calculations for the proposed load condition are provided in section 6 of this report. Additionally, the anchor bolts, base plate and foundation were found to be within the allowable limits.

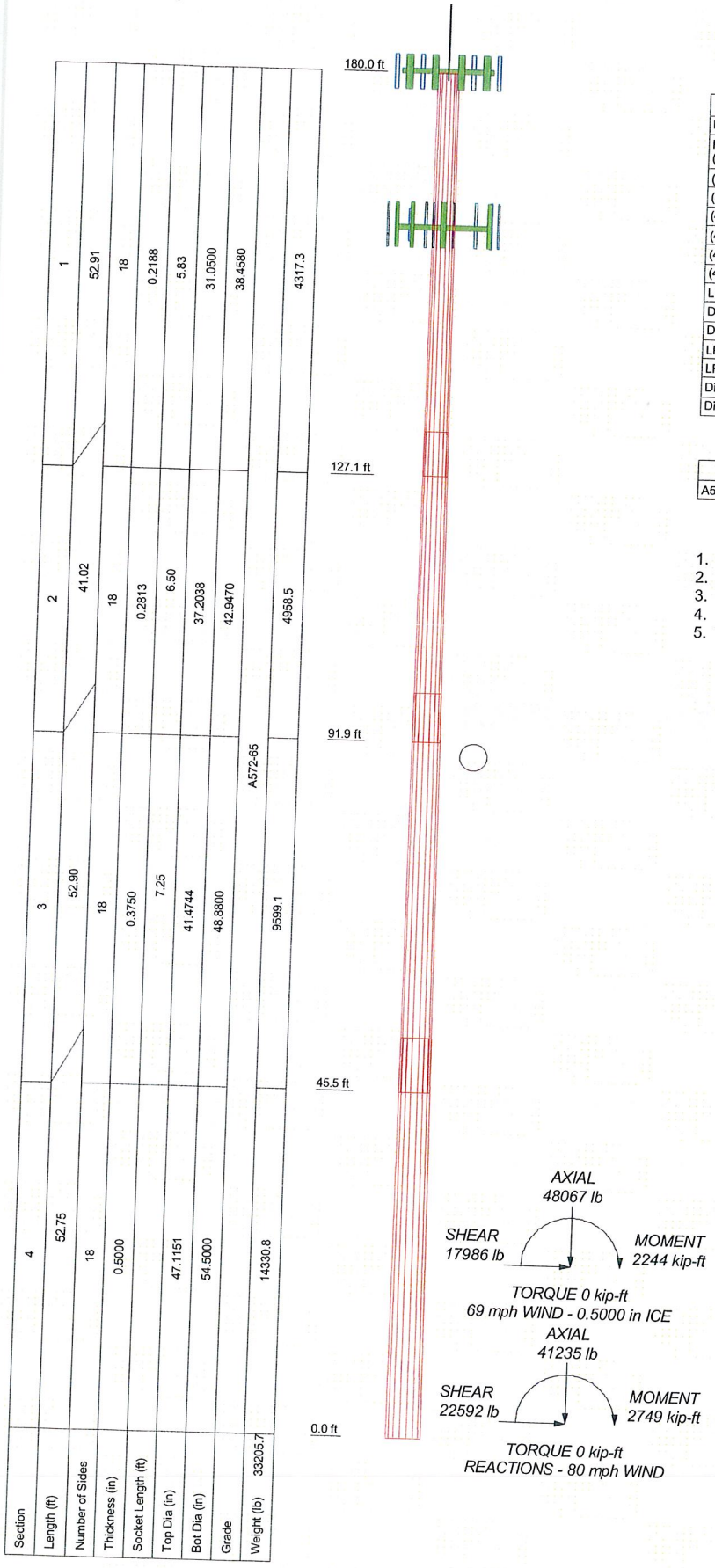
Tower Component Stress vs. Capacity Summary

Component (Section No.)	Controlling Component / Elevation	Stress Ratio (% capacity)	Pass/Fail	Notes:
Pole Shaft (L3)	TP48.88x41.4744x0.375 / 45.5'-91.9'	60.9%	**Pass**	
Anchor Bolts	Compression	56%	**Pass**	
Base Plate	Bending	30%	**Pass**	

Foundation Summary

Foundation	Component	Stress (% capacity / FOS)	Pass/Fail	Comments:
Reinforced Concrete Pad	Overturning	55.9% / 3.58	**Pass**	Min. F.O.S of 2.0 req'd per IBC 2003 Section 3108.4.2

6. DRAWINGS AND DATA



Section	1	2	3	4
Length (ft)	52.91	41.02	52.90	52.75
Number of Sides	18	18	18	18
Thickness (in)	0.2188	0.2813	0.3750	0.5000
Socket Length (ft)	5.83	6.50	7.25	47.1151
Top Dia (in)	31.0500	37.2038	41.4744	54.5000
Bot Dia (in)	38.4580	42.9470	48.8800	
Grade	A572-65			
Weight (lb)	4317.3	4958.5	9599.1	14330.8
				33205.7

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod 2"x8'	184	APX75-868011-CT0 (Verizon)	160
PiROD 13' Low Profile Platform (Monopole) (Carrier)	180.5	BXA-70080-6CF-EDIN (Verizon)	160
(4) 7770 (ATI)	180	BXA-70080-6CF-EDIN (Verizon)	160
(4) TMA (ATI)	180	BXA-171085-12BF-EDIN (Verizon)	160
(4) 7770 (ATI)	180	(2) TMA (Verizon)	160
(4) TMA (ATI)	180	BXA-171085-12BF-EDIN (Verizon)	160
(4) 7770 (ATI)	180	(2) TMA (Verizon)	160
(4) TMA (ATI)	180	BXA-171085-12BF-EDIN (Verizon)	160
LPA-80080-6CF-EDIN (Verizon)	160	(2) TMA (Verizon)	160
Diplexer (Verizon)	160	PiROD 13' Low Profile Platform (Monopole) (Carrier)	160
Diplexer (Verizon)	160	LPA-80080-6CF-EDIN (Verizon)	160
LPA-80080-6CF-EDIN (Verizon)	160	LPA-80080-6CF-EDIN (Verizon)	160
LPA-80080-6CF-EDIN (Verizon)	160	Diplexer (Verizon)	160
Diplexer (Verizon)	160	Diplexer (Verizon)	160
Diplexer (Verizon)	160	LPA-80080-6CF-EDIN (Verizon)	160

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Litchfield County, Connecticut.
2. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 60.9%

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

Job: Valmont 180' Monopole			
Project: Greenwood Road East, Norfolk, CT			
Client: Verizon	Drawn by: Matthew Kapinos	App'd:	
Code: TIA/EIA-222-F	Date: 01/31/12	Scale: NTS	
Path: P:\08\Rev1\ERI Files\180' Monopole_Norfolk, CT_VZ5107.eri		Dwg No. E-1	

tnxTower

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

Job	Page
Valmont 180' Monopole	1 of 20
Project	**Date**
Greenwood Road East, Norfolk, CT	09:55:49 01/31/12
Client	**Designed by**
Verizon	Matthew Kapinos

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 Litchfield County, Connecticut.
Basic wind speed of 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

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	180.00-127.09	52.91	5.83	18	31.0500	38.4580	0.2188	0.8750	A572-65 (65 ksi)
L2	127.09-91.90	41.02	6.50	18	37.2038	42.9470	0.2813	1.1250	A572-65 (65 ksi)
L3	91.90-45.50	52.90	7.25	18	41.4744	48.8800	0.3750	1.5000	A572-65 (65 ksi)
L4	45.50-0.00	52.75		18	47.1151	54.5000	0.5000	2.0000	A572-65 (65 ksi)

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L1	180.00-127.09	A	0.500	0.000	0.000	0.000	0.000	1071.108
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.000
L2	127.09-91.90	A	0.500	0.000	0.000	0.000	0.000	878.260
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.000
L3	91.90-45.50	A	0.500	0.000	0.000	0.000	0.000	1158.144
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	1135.687
L4	45.50-0.00	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.000

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	180.00-127.09	0.0000	0.0000	0.0000	0.0000
L2	127.09-91.90	0.0000	0.0000	0.0000	0.0000
L3	91.90-45.50	0.0000	0.0000	0.0000	0.0000
L4	45.50-0.00	0.0000	0.0000	0.0000	0.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
Lightning Rod 2"x8'	C	None		0.0000	184.00	No Ice	2.00	2.00	80.000
						1/2" Ice	3.02	3.02	95.501
PiROD 13' Low Profile Platform (Monopole) (Carrier)	A	None		0.0000	180.50	No Ice	15.70	15.70	1300.000
						1/2" Ice	20.10	20.10	1765.000
PiROD 13' Low Profile Platform (Monopole) (Carrier)	A	None		0.0000	160.00	No Ice	15.70	15.70	1300.000
						1/2" Ice	20.10	20.10	1765.000
LPA-80080-6CF-EDIN (Verizon)	A	From Face	3.50 6.00 0.00	0.0000	160.00	No Ice	4.32	9.10	21.000
						1/2" Ice	4.76	9.65	69.256
LPA-80080-6CF-EDIN (Verizon)	A	From Face	3.50 -6.00 0.00	0.0000	160.00	No Ice	4.32	9.10	21.000
						1/2" Ice	4.76	9.65	69.256
Diplexer (Verizon)	A	From Face	3.50 6.00	0.0000	160.00	No Ice	0.52	0.14	15.000
						1/2" Ice	0.62	0.20	18.242

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Azimuth Adjustment ° / Vert ft	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
(4) TMA (AT&T)	A	From Face	0.00 3.50 0.00	0.0000	180.00	No Ice 1/2" Ice	2.18 2.38	0.37 0.49	18.000 28.150
(4) 7770 (AT&T)	B	From Face	0.00 3.50 0.00	0.0000	180.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	39.000 71.634
(4) TMA (AT&T)	B	From Face	0.00 3.50 0.00	0.0000	180.00	No Ice 1/2" Ice	2.18 2.38	0.37 0.49	18.000 28.150
(4) 7770 (AT&T)	C	From Face	0.00 3.50 0.00	0.0000	180.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	39.000 71.634
(4) TMA (AT&T)	C	From Face	0.00 3.50 0.00	0.0000	180.00	No Ice 1/2" Ice	2.18 2.38	0.37 0.49	18.000 28.150

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 180.00-127.09	152.93	1.55	25	153.245	A	0.000	153.245	153.245	100.00	0.000	0.000
					B	0.000	153.245		100.00	0.000	0.000
					C	0.000	153.245		100.00	0.000	0.000
L2 127.09-91.90	109.34	1.408	23	118.708	A	0.000	118.708	118.708	100.00	0.000	0.000
					B	0.000	118.708		100.00	0.000	0.000
					C	0.000	118.708		100.00	0.000	0.000
L3 91.90-45.50	68.72	1.233	20	176.444	A	0.000	176.444	176.444	100.00	0.000	0.000
					B	0.000	176.444		100.00	0.000	0.000
					C	0.000	176.444		100.00	0.000	0.000
L4 45.50-0.00	22.33	1	16	194.571	A	0.000	194.571	194.571	100.00	0.000	0.000
					B	0.000	194.571		100.00	0.000	0.000
					C	0.000	194.571		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	152.93	1.55	19	0.5000	157.654	A	0.000	157.654	157.654	100.00	0.000	0.000

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
									kip-ft			

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 180.00-127.09	1071.108	4317.331	A	1	0.65	1	1	1	153.245	4268.642	80.67	C
			B	1	0.65	1	1	1	153.245			
			C	1	0.65	1	1	1	153.245			
L2 127.09-91.90	878.260	4958.495	A	1	0.65	1	1	1	118.708	3004.880	85.40	C
			B	1	0.65	1	1	1	118.708			
			C	1	0.65	1	1	1	118.708			
L3 91.90-45.50	1158.144	9599.062	A	1	0.65	1	1	1	176.444	3895.161	83.95	C
			B	1	0.65	1	1	1	176.444			
			C	1	0.65	1	1	1	176.444			
L4 45.50-0.00	1135.687	14330.794	A	1	0.65	1	1	1	194.571	3516.437	77.28	C
			B	1	0.65	1	1	1	194.571			
			C	1	0.65	1	1	1	194.571			
Sum Weight:	4243.200	33205.682						OTM	1327.52 kip-ft	14685.120		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 180.00-127.09	1071.108	4317.331	A	1	0.65	1	1	1	153.245	4268.642	80.67	C
			B	1	0.65	1	1	1	153.245			
			C	1	0.65	1	1	1	153.245			
L2 127.09-91.90	878.260	4958.495	A	1	0.65	1	1	1	118.708	3004.880	85.40	C
			B	1	0.65	1	1	1	118.708			
			C	1	0.65	1	1	1	118.708			
L3 91.90-45.50	1158.144	9599.062	A	1	0.65	1	1	1	176.444	3895.161	83.95	C
			B	1	0.65	1	1	1	176.444			
			C	1	0.65	1	1	1	176.444			
L4 45.50-0.00	1135.687	14330.794	A	1	0.65	1	1	1	194.571	3516.437	77.28	C
			B	1	0.65	1	1	1	194.571			
			C	1	0.65	1	1	1	194.571			
Sum Weight:	4243.200	33205.682						OTM	1327.52 kip-ft	14685.120		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L4 45.50-0.00	1135.687	15785.826	A	1	0.65	1	1	1	198.362	2688.720	59.09	C
			B	1	0.65	1	1	1	198.362			
Sum Weight:	4243.200	38023.045	C	1	0.65	1	1	1	198.362			
								OTM	1021.36 kip-ft	11277.031		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 180.00-127.09	1071.108	5468.591	A	1	0.65	1	1	1	157.654	3293.597	62.25	C
			B	1	0.65	1	1	1	157.654			
			C	1	0.65	1	1	1	157.654			
L2 127.09-91.90	878.260	5848.500	A	1	0.65	1	1	1	121.640	2309.326	65.63	C
			B	1	0.65	1	1	1	121.640			
			C	1	0.65	1	1	1	121.640			
L3 91.90-45.50	1158.144	10920.128	A	1	0.65	1	1	1	180.311	2985.388	64.34	C
			B	1	0.65	1	1	1	180.311			
			C	1	0.65	1	1	1	180.311			
L4 45.50-0.00	1135.687	15785.826	A	1	0.65	1	1	1	198.362	2688.720	59.09	C
			B	1	0.65	1	1	1	198.362			
Sum Weight:	4243.200	38023.045	C	1	0.65	1	1	1	198.362			
								OTM	1021.36 kip-ft	11277.031		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 180.00-127.09	1071.108	5468.591	A	1	0.65	1	1	1	157.654	3293.597	62.25	C
			B	1	0.65	1	1	1	157.654			
			C	1	0.65	1	1	1	157.654			
L2 127.09-91.90	878.260	5848.500	A	1	0.65	1	1	1	121.640	2309.326	65.63	C
			B	1	0.65	1	1	1	121.640			
			C	1	0.65	1	1	1	121.640			
L3 91.90-45.50	1158.144	10920.128	A	1	0.65	1	1	1	180.311	2985.388	64.34	C
			B	1	0.65	1	1	1	180.311			
			C	1	0.65	1	1	1	180.311			
L4 45.50-0.00	1135.687	15785.826	A	1	0.65	1	1	1	198.362	2688.720	59.09	C
			B	1	0.65	1	1	1	198.362			
Sum Weight:	4243.200	38023.045	C	1	0.65	1	1	1	198.362			
								OTM	1021.36 kip-ft	11277.031		

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L3 91.90-45.50	1158.144	9599.062	A	1	0.65	1	1	1	176.444	1521.547	32.79	C
			B	1	0.65	1	1	1	176.444			
			C	1	0.65	1	1	1	176.444			
L4 45.50-0.00	1135.687	14330.794	A	1	0.65	1	1	1	194.571	1373.608	30.19	C
			B	1	0.65	1	1	1	194.571			
			C	1	0.65	1	1	1	194.571			
Sum Weight:	4243.200	33205.682						OTM	518.56 kip-ft	5736.375		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1 180.00-127.09	1071.108	4317.331	A	1	0.65	1	1	1	153.245	1667.438	31.51	C
			B	1	0.65	1	1	1	153.245			
			C	1	0.65	1	1	1	153.245			
L2 127.09-91.90	878.260	4958.495	A	1	0.65	1	1	1	118.708	1173.781	33.36	C
			B	1	0.65	1	1	1	118.708			
			C	1	0.65	1	1	1	118.708			
L3 91.90-45.50	1158.144	9599.062	A	1	0.65	1	1	1	176.444	1521.547	32.79	C
			B	1	0.65	1	1	1	176.444			
			C	1	0.65	1	1	1	176.444			
L4 45.50-0.00	1135.687	14330.794	A	1	0.65	1	1	1	194.571	1373.608	30.19	C
			B	1	0.65	1	1	1	194.571			
			C	1	0.65	1	1	1	194.571			
Sum Weight:	4243.200	33205.682						OTM	518.56 kip-ft	5736.375		

Force Totals

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	33205.682					
Bracing Weight	0.000					
Total Member Self-Weight	33205.682					
Total Weight	41235.482			0.00	-0.00	
Wind 0 deg - No Ice		-21.784	-22554.249	0.00	-0.00	
Wind 30 deg - No Ice		11270.836	-19521.661	-2664.51	3.48	0.30
Wind 45 deg - No Ice		15950.645	-15932.859	-2305.79	-1331.25	0.35
Wind 60 deg - No Ice		19543.445	-11258.259	-1881.63	-1884.48	0.33
Wind 90 deg - No Ice		22579.403	21.784	-1329.24	-2309.28	0.30
Wind 120 deg - No Ice		19565.228	11295.990	3.49	-2668.54	0.17
Wind 135 deg - No Ice		15981.452	15963.666	1335.28	-2312.76	0.00
Wind 150 deg - No Ice		11308.567	19543.445	1886.56	-1889.41	-0.09
Wind 180 deg - No Ice		21.784	22554.249	2309.28	-1337.29	-0.17
Wind 210 deg - No Ice		-11270.836	19521.661	2664.51	-3.49	-0.30
Wind 225 deg - No Ice		-15950.645	15932.859	2305.79	1331.25	-0.35
				1881.63	1884.47	-0.33

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	180 - 127.087	Pole	Max Tension	1	0.000	0.00	0.00
			Max. Compression	18	-11562.108	-0.02	-0.01
			Max. Mx	6	-7872.085	-393.20	-0.61
			Max. My	10	-7874.653	-0.60	-392.50
			Max. Vy	6	12120.935	-393.20	-0.61
			Max. Vx	2	-12095.061	0.62	392.50
			Max. Torque	3			-0.34
L2	127.087 - 91.9003	Pole	Max Tension	1	0.000	0.00	0.00
			Max. Compression	18	-17898.972	-0.02	-0.01
			Max. Mx	6	-13400.100	-864.91	-1.39
			Max. My	10	-13402.196	-1.39	-863.30
			Max. Vy	6	15168.287	-864.91	-1.39
			Max. Vx	2	-15142.221	1.39	863.30

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	kip-ft	kip-ft	kip-ft
Dead+Wind 270 deg - No Ice	41235.482	-22579.406	-21.784	-3.60	2746.56	-0.17
Dead+Wind 300 deg - No Ice	41235.482	-19565.229	-11295.990	-1374.32	2380.39	0.00
Dead+Wind 315 deg - No Ice	41235.482	-15981.453	-15963.666	-1941.72	1944.66	0.09
Dead+Wind 330 deg - No Ice	41235.482	-11308.567	-19543.445	-2376.79	1376.40	0.17
Dead+Ice+Temp	48066.896	0.000	0.000	0.01	-0.02	0.00
Dead+Wind 0 deg+Ice+Temp	48066.896	-17.294	-17955.796	-2239.20	2.86	0.24
Dead+Wind 30 deg+Ice+Temp	48066.896	8972.905	-15541.528	-1937.76	-1118.80	0.28
Dead+Wind 45 deg+Ice+Temp	48066.896	12698.556	-12684.436	-1581.31	-1583.70	0.27
Dead+Wind 60 deg+Ice+Temp	48066.896	15558.822	-8962.920	-1117.10	-1940.68	0.24
Dead+Wind 90 deg+Ice+Temp	48066.896	17975.765	17.294	2.90	-2242.56	0.14
Dead+Wind 120 deg+Ice+Temp	48066.896	15576.117	8992.875	1122.11	-1943.56	0.00
Dead+Wind 135 deg+Ice+Temp	48066.896	12723.014	12708.894	1585.41	-1587.78	-0.07
Dead+Wind 150 deg+Ice+Temp	48066.896	9002.860	15558.822	1940.67	-1123.79	-0.14
Dead+Wind 180 deg+Ice+Temp	48066.896	17.294	17955.796	2239.23	-2.91	-0.24
Dead+Wind 210 deg+Ice+Temp	48066.896	-8972.905	15541.528	1937.79	1118.75	-0.28
Dead+Wind 225 deg+Ice+Temp	48066.896	-12698.556	12684.436	1581.34	1583.65	-0.27
Dead+Wind 240 deg+Ice+Temp	48066.896	-15558.822	8962.920	1117.12	1940.63	-0.24
Dead+Wind 270 deg+Ice+Temp	48066.896	-17975.765	-17.294	-2.87	2242.51	-0.14
Dead+Wind 300 deg+Ice+Temp	48066.896	-15576.117	-8992.875	-1122.08	1943.51	0.00
Dead+Wind 315 deg+Ice+Temp	48066.896	-12723.014	-12708.894	-1585.38	1587.72	0.07
Dead+Wind 330 deg+Ice+Temp	48066.896	-9002.860	-15558.822	-1940.64	1123.74	0.14
Dead+Wind 0 deg - Service	41235.482	-8.509	-8810.255	-1071.85	1.40	0.12
Dead+Wind 30 deg - Service	41235.482	4402.671	-7625.650	-927.55	-535.52	0.13
Dead+Wind 45 deg - Service	41235.482	6230.722	-6223.774	-756.92	-758.07	0.13
Dead+Wind 60 deg - Service	41235.482	7634.159	-4397.758	-534.71	-928.96	0.12
Dead+Wind 90 deg - Service	41235.482	8820.081	8.509	1.41	-1073.48	0.07
Dead+Wind 120 deg - Service	41235.482	7642.668	4412.497	537.15	-930.36	0.00
Dead+Wind 135 deg - Service	41235.482	6242.756	6235.808	758.91	-760.06	-0.03
Dead+Wind 150 deg - Service	41235.482	4417.410	7634.159	928.96	-537.96	-0.07
Dead+Wind 180 deg - Service	41235.482	8.509	8810.255	1071.85	-1.41	-0.12
Dead+Wind 210 deg - Service	41235.482	-4402.671	7625.650	927.55	535.52	-0.13
Dead+Wind 225 deg - Service	41235.482	-6230.722	6223.774	756.92	758.07	-0.13
Dead+Wind 240 deg - Service	41235.482	-7634.159	4397.758	534.71	928.95	-0.12
Dead+Wind 270 deg - Service	41235.482	-8820.081	-8.509	-1.41	1073.48	-0.07
Dead+Wind 300 deg - Service	41235.482	-7642.668	-4412.497	-537.14	930.36	0.00
Dead+Wind 315 deg - Service	41235.482	-6242.756	-6235.808	-758.91	760.06	0.03
Dead+Wind 330 deg - Service	41235.482	-4417.410	-7634.159	-928.95	537.95	0.07

Solution Summary

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
1	0.000	-41235.482	0.000	-4.262	41235.482	-2.461	0.012%
2	-21.784	-41235.482	-22554.249	21.784	41235.482	22554.252	0.000%
3	11270.836	-41235.482	-19521.661	-11270.836	41235.482	19521.661	0.000%
4	15950.645	-41235.482	-15932.859	-15950.645	41235.482	15932.859	0.000%
5	19543.445	-41235.482	-11258.259	-19543.445	41235.482	11258.259	0.000%
6	22579.403	-41235.482	21.784	-22579.406	41235.482	-21.784	0.000%
7	19565.228	-41235.482	11295.990	-19565.229	41235.482	-11295.990	0.000%
8	15981.452	-41235.482	15963.666	-15981.453	41235.482	-15963.666	0.000%
9	11308.567	-41235.482	19543.445	-11308.567	41235.482	-19543.445	0.000%
10	21.784	-41235.482	22554.249	-21.784	41235.482	-22554.252	0.000%
11	-11270.836	-41235.482	19521.661	11270.836	41235.482	-19521.661	0.000%
12	-15950.645	-41235.482	15932.859	15950.645	41235.482	-15932.859	0.000%
13	-19543.445	-41235.482	11258.259	19543.445	41235.482	-11258.259	0.000%
14	-22579.403	-41235.482	-21.784	22579.406	41235.482	21.784	0.000%
15	-19565.228	-41235.482	-11295.990	19565.229	41235.482	11295.990	0.000%

17	Yes	5	0.00000001	0.00025794
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00017277
20	Yes	5	0.00000001	0.00045927
21	Yes	5	0.00000001	0.00051606
22	Yes	5	0.00000001	0.00045538
23	Yes	5	0.00000001	0.00017296
24	Yes	5	0.00000001	0.00046008
25	Yes	5	0.00000001	0.00051900
26	Yes	5	0.00000001	0.00046103
27	Yes	5	0.00000001	0.00017284
28	Yes	5	0.00000001	0.00045498
29	Yes	5	0.00000001	0.00051606
30	Yes	5	0.00000001	0.00045910
31	Yes	5	0.00000001	0.00017292
32	Yes	5	0.00000001	0.00046002
33	Yes	5	0.00000001	0.00051894
34	Yes	5	0.00000001	0.00045884
35	Yes	4	0.00000001	0.00004607
36	Yes	4	0.00000001	0.00063607
37	Yes	4	0.00000001	0.00071947
38	Yes	4	0.00000001	0.00061385
39	Yes	4	0.00000001	0.00004406
40	Yes	4	0.00000001	0.00062957
41	Yes	4	0.00000001	0.00072507
42	Yes	4	0.00000001	0.00063522
43	Yes	4	0.00000001	0.00004791
44	Yes	4	0.00000001	0.00061192
45	Yes	4	0.00000001	0.00071955
46	Yes	4	0.00000001	0.00063488
47	Yes	4	0.00000001	0.00004290
48	Yes	4	0.00000001	0.00062956
49	Yes	4	0.00000001	0.00072508
50	Yes	4	0.00000001	0.00062316

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 127.087	31.169	40	1.4515	0.0008
L2	132.92 - 91.9003	17.523	40	1.2391	0.0005
L3	98.4003 - 45.5003	9.578	40	0.9184	0.0003
L4	52.7503 - 0	2.759	40	0.4685	0.0001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
184.00	Lightning Rod 2"x8'	40	31.169	1.4515	0.0008	63299
180.50	PiROD 13' Low Profile Platform (Monopole)	40	31.169	1.4515	0.0008	63299
180.00	(4) 7770	40	31.169	1.4515	0.0008	63299
160.00	PiROD 13' Low Profile Platform	40	25.142	1.3841	0.0007	15824

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	180 - 127.087 (1)	TP38.458x31.05x0.2188	393.56	19.644	36.649	0.536	0.00	0.000	36.649	0.000
L2	127.087 - 91.9003 (2)	TP42.947x37.2038x0.2813	865.71	27.019	39.000	0.693	0.00	0.000	39.000	0.000
L3	91.9003 - 45.5003 (3)	TP48.88x41.4744x0.375	1648.22	29.860	39.000	0.766	0.00	0.000	39.000	0.000
L4	45.5003 - 0 (4)	TP54.5x47.1151x0.5	2748.64	28.924	39.000	0.742	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V lb	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	180 - 127.087 (1)	TP38.458x31.05x0.2188	12134.000	0.467	26.000	0.036	0.00	0.000	26.000	0.000
L2	127.087 - 91.9003 (2)	TP42.947x37.2038x0.2813	15181.400	0.407	26.000	0.031	0.00	0.000	26.000	0.000
L3	91.9003 - 45.5003 (3)	TP48.88x41.4744x0.375	18982.801	0.336	26.000	0.026	0.00	0.000	26.000	0.000
L4	45.5003 - 0 (4)	TP54.5x47.1151x0.5	22613.400	0.264	26.000	0.020	0.00	0.000	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	180 - 127.087 (1)	0.054	0.536	0.000	0.036	0.000	0.590 ✔	1.333	H1-3+VT ✔
L2	127.087 - 91.9003 (2)	0.051	0.693	0.000	0.031	0.000	0.744 ✔	1.333	H1-3+VT ✔
L3	91.9003 - 45.5003 (3)	0.046	0.766	0.000	0.026	0.000	0.812 ✔	1.333	H1-3+VT ✔
L4	45.5003 - 0 (4)	0.041	0.742	0.000	0.020	0.000	0.783 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
L1	180 - 127.087	Pole	TP38.458x31.05x0.2188	1	-7870.780	195652.400	44.3	Pass
L2	127.087 - 91.9003	Pole	TP42.947x37.2038x0.2813	2	-13399.000	349443.269	55.8	Pass
L3	91.9003 -	Pole	TP48.88x41.4744x0.375	3	-23776.600	685451.233	60.9	Pass

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	180 - 127.087 (1)	TP38.458x31.05x0.2188	393.56	19.644	36.649	0.536	0.00	0.000	36.649	0.000
L2	127.087 - 91.9003 (2)	TP42.947x37.2038x0.2813	865.71	27.019	39.000	0.693	0.00	0.000	39.000	0.000
L3	91.9003 - 45.5003 (3)	TP48.88x41.4744x0.375	1648.22	29.860	39.000	0.766	0.00	0.000	39.000	0.000
L4	45.5003 - 0 (4)	TP54.5x47.1151x0.5	2748.64	28.924	39.000	0.742	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V lb	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	180 - 127.087 (1)	TP38.458x31.05x0.2188	12134.000	0.467	26.000	0.036	0.00	0.000	26.000	0.000
L2	127.087 - 91.9003 (2)	TP42.947x37.2038x0.2813	15181.400	0.407	26.000	0.031	0.00	0.000	26.000	0.000
L3	91.9003 - 45.5003 (3)	TP48.88x41.4744x0.375	18982.801	0.336	26.000	0.026	0.00	0.000	26.000	0.000
L4	45.5003 - 0 (4)	TP54.5x47.1151x0.5	22613.400	0.264	26.000	0.020	0.00	0.000	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	180 - 127.087 (1)	0.054	0.536	0.000	0.036	0.000	0.590 ✔	1.333	H1-3+VT ✔
L2	127.087 - 91.9003 (2)	0.051	0.693	0.000	0.031	0.000	0.744 ✔	1.333	H1-3+VT ✔
L3	91.9003 - 45.5003 (3)	0.046	0.766	0.000	0.026	0.000	0.812 ✔	1.333	H1-3+VT ✔
L4	45.5003 - 0 (4)	0.041	0.742	0.000	0.020	0.000	0.783 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
L1	180 - 127.087	Pole	TP38.458x31.05x0.2188	1	-7870.780	195652.400	44.3	Pass
L2	127.087 - 91.9003	Pole	TP42.947x37.2038x0.2813	2	-13399.000	349443.269	55.8	Pass
L3	91.9003 -	Pole	TP48.88x41.4744x0.375	3	-23776.600	685451.233	60.9	Pass

ANCHOR BOLT AND
BASE PLATE ANALYSIS

Geometric Layout Data:

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

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

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

$$d_i := \left| \begin{array}{l} \theta \leftarrow 2 \cdot \pi \cdot \left(\frac{i}{N} \right) \\ d \leftarrow R_{bc} \cdot \sin(\theta) \end{array} \right.$$

$d_1 = 9.55 \cdot in$ $d_7 = 25.01 \cdot in$

$d_2 = 18.17 \cdot in$ $d_8 = 18.17 \cdot in$

$d_3 = 25.01 \cdot in$ $d_9 = 9.55 \cdot in$

$d_4 = 29.41 \cdot in$ $d_{10} = 0.00 \cdot in$

$d_5 = 30.92 \cdot in$ $d_{11} = -9.55 \cdot in$

$d_6 = 29.41 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius: $R_{pole} := \frac{D_{pole}}{2}$ $R_{pole} = 27.25 \cdot in$

Moment Arms of Bolts about Neutral Axis: $MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$

$MA_1 = 0.00 \cdot in$ $MA_7 = 0.00 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 0.00 \cdot in$

$MA_3 = 0.00 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 2.16 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_5 = 3.67 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_6 = 2.16 \cdot in$ etc.

Effective Width of Baseplate for Bending: $EffectiveWidth := .90 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2}$ $EffectiveWidth = 37.92 \cdot in$

Check Tensile Forces:

Maximum Tensile Force (Gross Area):

$AllowableTension := 1.33 \cdot (0.33 \cdot A_g \cdot F_u)$ $AllowableTension = 174.5 \cdot kips$

Note: 1.33 increase allowed per TIA/EIA

Maximum Tensile Force (Net Area):

$F_{net.area} := 1.33 \cdot (0.60 \cdot A_n \cdot Fy)$ $F_{net.area} = 194.4 \cdot kips$

Note: 1.33 increase allowed per TIA/EIA

Applied Tension:

$$MaxTension := \frac{OM \cdot R_{bc}}{I_p} - \frac{Axial}{N}$$ $MaxTension = 104.6 \cdot kips$

Check Stresses:

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

$$\frac{MaxTension}{F_{net.area}} = 0.5$$

$$Condition := if\left(\frac{MaxTension}{F_{net.area}} \le 1.00, "OK", "Overstressed"\right)$$

Condition = "OK"

URS

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Base Plate Analysis:

Force from Bolt(s):

$$C_i := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$$

$C_1 = 35.0 \cdot kips$ $C_7 = 88.4 \cdot kips$

$C_2 = 64.8 \cdot kips$ $C_8 = 64.8 \cdot kips$

$C_3 = 88.4 \cdot kips$ $C_9 = 35.0 \cdot kips$

$C_4 = 103.5 \cdot kips$ $C_{10} = 2.1 \cdot kips$

$C_5 = 108.7 \cdot kips$ $C_{11} = -30.9 \cdot kips$

$C_6 = 103.5 \cdot kips$ etc.

Bending Stress in Plate:

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{EffectiveWidth \cdot PlateThickness^2}$$

$f_{bp} = 17.7 \cdot ksi$

Check Stresses:

$$\frac{f_{bp}}{1.33 \cdot 0.75 Fy_{bp}} = 0.30$$

$$Condition := if\left(\frac{f_{bp}}{1.33 \cdot 0.75 Fy_{bp}} < 1.00, "OK", "Overstressed"\right)$$

Condition = "OK"

URS

Job	180' Monopole - Norfolk, CT	Project No.	VZ5-107	Page	of
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MONOPOLE FOUNDATION ANALYSIS

TOWER FORCES:

Moment Caused by Tower	$M_t := 2749 \cdot ft \cdot kips$
Shear at Base of Tower	$S_t := 22.6kip$
Max Compressive Force	$C_t := 41.2 \cdot kip$
Height of Tower	$H_t := 180 \cdot ft$
Base Plate Bolt Circle	$MP := 61.84in$

FOOTING DIMENSIONS:

Overall Depth of Footing	$D_f := 4.5ft$
Length of Pier	$L_p := 0 \cdot ft$
Extension of Pier Above Grade	$L_{pag} := 0 \cdot ft$
Diameter of Pier	$d_p := 0 \cdot ft$
Thickness of Footing	$T_f := 4.5 \cdot ft$
Width of Footing:	$W_f := 30.5ft$
Length of Anchor Bolts:	$L_{st} := 48in$
Projection of anchor bolts above pier	$A_{BP} := 9.75 \cdot in$

PROPERTIES:

Compressive Strength of Concrete	$f'c := 3000psi$
Yield Strength of Steel Reinforcement	$fy := 60000 \cdot psi$
Yield Strength of Anchor Bolt	$fya := 75000 \cdot psi$
Internal Friction Angle of Soil	$\phi_s := 0 \cdot deg$
Allowable Bearing Capacity	$q_s := 6000 \cdot psf$
Unit Weight of Soil	$\gamma_s := 0 \cdot pcf$
Unit Weight of Concrete	$\gamma_c := 150 \cdot pcf$
Depth to Neglect	$n := 4.5ft$
Cohesion of Clay Type Soil Note: Use 0 for Sandy Soil	$c := 0 \cdot ksf$
Seismic Zone Factor: UBC Fig 23-2	$Z := 2$
Coefficient of Friction between Concrete:	$\mu := .20$
Clear Cover of Reinforcement Pier:	$Cvr_{pier} := 3 \cdot in$
Clear Cover of Reinforcement Pad:	$Cvr_{pad} := 3 \cdot in$
Anchor Bolt Diameter	$d_{anchor} := 2.25in$
Anchor bolt area	$A_{anchor} := 3.97 \cdot in^2$

PIER REINFORCEMENT:

Bar Size	$BSpier := 0$	Bar Diameter	$d_{bpier} := 0 \cdot in$
Number of Bars	$NBpier := 0$	Bar Area	$A_{bpier} := 0 \cdot in^2$

PAD REINFORCEMENT:

TOP:	Bar Size	$BS_{top} := 8$	Bar Diameter	$d_{btop} := 1.00 \cdot in$
	Number of Bars	$NB_{top} := 46$	Bar Area	$A_{btop} := 0.79 \cdot in^2$
BOTTOM:	Bar Size	$BS_{bot} := 8$	Bar Diameter	$d_{bbot} := 1.00 \cdot in$
	Number of Bars	$NB_{bot} := 46$	Bar Area	$A_{bot} := 0.79 \cdot in^2$

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

Load Factor (EIA 3.1.1): $LF := if\left[H_t \le 700 \cdot ft, 1.3, if\left[H_t \ge 1200, 1.7, 1.3 + \left(\frac{H_t - 700}{1200 - 700}\right) \cdot 0.4\right]\right]$ $LF = 1.3$

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SHEAR CAPACITY IN PIER

$FS := 2$

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

$S_p = 66.9119 \cdot kips$

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

$ShearCheck = "Okay"$

BEARING PRESSURE CAUSED BY FOOTING

$A_{mat} := W_f^2$

$A_{mat} = 930.25 \cdot ft^2$

$S := \frac{W_f^3}{6}$

$S = 4728.7708 \cdot ft^3$

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

$P_{max} = 1.3221 \cdot ksf$

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

$P_{min} = 0.1164 \cdot ksf$

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

$MaxPressure = "Okay"$

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

$MinPressure = "Okay"$

Distance to Resultant of Pressure Distribution:

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

$X_p = 11.1486 \cdot ft$

Distance to Kern:

$$X_k := \frac{W_f}{6}$$

$X_k = 5.0833 \cdot ft$

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

Eccentricity:

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

$e = 4.2604$

Adjusted Soil Pressure:

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

$P_a = 1.3309 \cdot ksf$

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

$q_{adj} = 1.3221 \cdot ksf$

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

$PressureCheck = "Okay"$

Guess Value: $v_u := 1ksf$

(From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

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

$v_u := \text{Find}(v_u)$ $\quad v_u = 12.2681 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f$ $\quad V_u = 1559.0657 \cdot kips$

$V_{req} := LF \cdot V_u$ $\quad V_{req} = 2026.7854 \cdot kips$

$V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f'c \cdot psi} \cdot b_o \cdot d$ $\quad V_{Avail} = 1462.613 \cdot kips$

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

Note: Above result not applicable due to absence of pier.

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

Take Maximum Bending at face of Pier:

$q_b := q_{adj} - d_1 \cdot Slope$ $\quad q_b = 0.7193 \cdot ksf$

$M_n := \frac{LF}{\phi_m} \cdot \left[\left(q_{adj} - q_b\right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f$ $\quad M_n = 5743.6387 \cdot kip \cdot ft$

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

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2}$ $\quad R_u = 12052.2 \, lbf$

$\rho := \frac{0.85 \cdot f'c}{fy} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f'c}} \right)$ $\quad \rho = 0.0014$

$\rho_{min} := 1.0 \cdot \rho$ $\quad \rho_{min} = 0.0014$

ANCHOR BOLT AND
BASE PLATE ANALYSIS

Geometric Layout Data:

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

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

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

$$d_i := \left| \begin{array}{l} \theta \leftarrow 2 \cdot \pi \cdot \left(\frac{i}{N} \right) \\ d \leftarrow R_{bc} \cdot \sin(\theta) \end{array} \right.$$

$d_1 = 9.55 \cdot in$ $d_7 = 25.01 \cdot in$

$d_2 = 18.17 \cdot in$ $d_8 = 18.17 \cdot in$

$d_3 = 25.01 \cdot in$ $d_9 = 9.55 \cdot in$

$d_4 = 29.41 \cdot in$ $d_{10} = 0.00 \cdot in$

$d_5 = 30.92 \cdot in$ $d_{11} = -9.55 \cdot in$

$d_6 = 29.41 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius: $R_{pole} := \frac{D_{pole}}{2}$ $R_{pole} = 27.25 \cdot in$

Moment Arms of Bolts about Neutral Axis: $MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$

$MA_1 = 0.00 \cdot in$ $MA_7 = 0.00 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 0.00 \cdot in$

$MA_3 = 0.00 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 2.16 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_5 = 3.67 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_6 = 2.16 \cdot in$ etc.

Effective Width of Baseplate for Bending: $EffectiveWidth := .90 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2}$ $EffectiveWidth = 37.92 \cdot in$

Check Tensile Forces:

Maximum Tensile Force (Gross Area):

$AllowableTension := 1.33 \cdot (0.33 \cdot A_g \cdot F_u)$ $AllowableTension = 174.5 \cdot kips$

Note: 1.33 increase allowed per TIA/EIA

Maximum Tensile Force (Net Area):

$F_{net.area} := 1.33 \cdot (0.60 \cdot A_n \cdot Fy)$ $F_{net.area} = 194.4 \cdot kips$

Note: 1.33 increase allowed per TIA/EIA

Applied Tension:

$$MaxTension := \frac{OM \cdot R_{bc}}{I_p} - \frac{Axial}{N}$$ $MaxTension = 104.6 \cdot kips$

Check Stresses:

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

$$\frac{MaxTension}{F_{net.area}} = 0.5$$

$$Condition := if\left(\frac{MaxTension}{F_{net.area}} \le 1.00, "OK", "Overstressed"\right)$$

Condition = "OK"

URS

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Base Plate Analysis:

Force from Bolt(s):

$$C_i := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$$

$C_1 = 35.0 \cdot kips$ $C_7 = 88.4 \cdot kips$

$C_2 = 64.8 \cdot kips$ $C_8 = 64.8 \cdot kips$

$C_3 = 88.4 \cdot kips$ $C_9 = 35.0 \cdot kips$

$C_4 = 103.5 \cdot kips$ $C_{10} = 2.1 \cdot kips$

$C_5 = 108.7 \cdot kips$ $C_{11} = -30.9 \cdot kips$

$C_6 = 103.5 \cdot kips$ etc.

Bending Stress in Plate:

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{EffectiveWidth \cdot PlateThickness^2}$$

$f_{bp} = 17.7 \cdot ksi$

Check Stresses:

$$\frac{f_{bp}}{1.33 \cdot 0.75 Fy_{bp}} = 0.30$$

$$Condition := if\left(\frac{f_{bp}}{1.33 \cdot 0.75 Fy_{bp}} < 1.00, "OK", "Overstressed"\right)$$

Condition = "OK"

URS

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Description	Spread Footing w/ Pier Analysis	Computed by	MJK	Sheet	1 of 6
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MONOPOLE FOUNDATION ANALYSIS

TOWER FORCES:

Moment Caused by Tower	$M_t := 2749 \cdot ft \cdot kips$
Shear at Base of Tower	$S_t := 22.6kip$
Max Compressive Force	$C_t := 41.2 \cdot kip$
Height of Tower	$H_t := 180 \cdot ft$
Base Plate Bolt Circle	$MP := 61.84in$

FOOTING DIMENSIONS:

Overall Depth of Footing	$D_f := 4.5ft$
Length of Pier	$L_p := 0 \cdot ft$
Extension of Pier Above Grade	$L_{pag} := 0 \cdot ft$
Diameter of Pier	$d_p := 0 \cdot ft$
Thickness of Footing	$T_f := 4.5 \cdot ft$
Width of Footing:	$W_f := 30.5ft$
Length of Anchor Bolts:	$L_{st} := 48in$
Projection of anchor bolts above pier	$A_{BP} := 9.75 \cdot in$

PROPERTIES:

Compressive Strength of Concrete	$f'c := 3000psi$
Yield Strength of Steel Reinforcement	$fy := 60000 \cdot psi$
Yield Strength of Anchor Bolt	$fya := 75000 \cdot psi$
Internal Friction Angle of Soil	$\phi_s := 0 \cdot deg$
Allowable Bearing Capacity	$q_s := 6000 \cdot psf$
Unit Weight of Soil	$\gamma_s := 0 \cdot pcf$
Unit Weight of Concrete	$\gamma_c := 150 \cdot pcf$
Depth to Neglect	$n := 4.5ft$
Cohesion of Clay Type Soil Note: Use 0 for Sandy Soil	$c := 0 \cdot ksf$
Seismic Zone Factor: UBC Fig 23-2	$Z := 2$
Coefficient of Friction between Concrete:	$\mu := .20$
Clear Cover of Reinforcement Pier:	$Cvr_{pier} := 3 \cdot in$
Clear Cover of Reinforcement Pad:	$Cvr_{pad} := 3 \cdot in$
Anchor Bolt Diameter	$d_{anchor} := 2.25in$
Anchor bolt area	$A_{anchor} := 3.97 \cdot in^2$

PIER REINFORCEMENT:

Bar Size	$BSpier := 0$	Bar Diameter	$d_{bpier} := 0 \cdot in$
Number of Bars	$NBpier := 0$	Bar Area	$A_{bpier} := 0 \cdot in^2$

PAD REINFORCEMENT:

TOP:	Bar Size	$BS_{top} := 8$	Bar Diameter	$d_{btop} := 1.00 \cdot in$
	Number of Bars	$NB_{top} := 46$	Bar Area	$A_{btop} := 0.79 \cdot in^2$
BOTTOM:	Bar Size	$BS_{bot} := 8$	Bar Diameter	$d_{bbot} := 1.00 \cdot in$
	Number of Bars	$NB_{bot} := 46$	Bar Area	$A_{bot} := 0.79 \cdot in^2$

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

Load Factor (EIA 3.1.1): $LF := if\left[H_t \le 700 \cdot ft, 1.3, if\left[H_t \ge 1200, 1.7, 1.3 + \left(\frac{H_t - 700}{1200 - 700}\right) \cdot 0.4\right]\right]$ $LF = 1.3$

URS

Job	180' Monopole - Norfolk, CT	Project No.	VZ5-107	Page	of
Description	Spread Footing w/ Pier Analysis	Computed by	MJK	Sheet 3	of 6
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SHEAR CAPACITY IN PIER

$FS := 2$

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

$S_p = 66.9119 \cdot kips$

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

$ShearCheck = "Okay"$

BEARING PRESSURE CAUSED BY FOOTING

$A_{mat} := W_f^2$

$A_{mat} = 930.25 \cdot ft^2$

$S := \frac{W_f^3}{6}$

$S = 4728.7708 \cdot ft^3$

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

$P_{max} = 1.3221 \cdot ksf$

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

$P_{min} = 0.1164 \cdot ksf$

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

$MaxPressure = "Okay"$

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

$MinPressure = "Okay"$

Distance to Resultant of Pressure Distribution:

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

$X_p = 11.1486 \cdot ft$

Distance to Kern:

$$X_k := \frac{W_f}{6}$$

$X_k = 5.0833 \cdot ft$

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

Eccentricity:

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

$e = 4.2604$

Adjusted Soil Pressure:

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

$P_a = 1.3309 \cdot ksf$

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

$q_{adj} = 1.3221 \cdot ksf$

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

$PressureCheck = "Okay"$

Guess Value: $v_u := 1ksf$

(From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

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

$v_u := \text{Find}(v_u)$ $\quad v_u = 12.2681 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f$ $\quad V_u = 1559.0657 \cdot kips$

$V_{req} := LF \cdot V_u$ $\quad V_{req} = 2026.7854 \cdot kips$

$V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f'c \cdot psi} \cdot b_o \cdot d$ $\quad V_{Avail} = 1462.613 \cdot kips$

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

Note: Above result not applicable due to absence of pier.

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

Take Maximum Bending at face of Pier:

$q_b := q_{adj} - d_1 \cdot Slope$ $\quad q_b = 0.7193 \cdot ksf$

$M_n := \frac{LF}{\phi_m} \cdot \left[\left(q_{adj} - q_b\right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f$ $\quad M_n = 5743.6387 \cdot kip \cdot ft$

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

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2}$ $\quad R_u = 12052.2 \, lbf$

$\rho := \frac{0.85 \cdot f'c}{fy} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f'c}} \right)$ $\quad \rho = 0.0014$

$\rho_{min} := 1.0 \cdot \rho$ $\quad \rho_{min} = 0.0014$

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

March 7, 2012

The Honorable Susan M. Dyer
First Selectman
Town of Norfolk
19 Maple Avenue
P. O. Box 552
Norfolk, CT 06058

RE: **EM-VER-098-120306** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 599 Greenwoods Road East, Norfolk, Connecticut.

Dear First Selectman Dyer:

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

If you have any questions or comments regarding this proposal, please call me or inform the Council by March 21, 2012.

Thank you for your cooperation and consideration.

Very truly yours,

Linda Roberts

Linda Roberts
Executive Director

LR/jbw

Enclosure: Notice of Intent

c: Michael Halloran, Planning & Zoning Official, Town of Norfolk

CSC
CONNECTICUT SITING COUNCIL