



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 23, 2012

Melanie Howlett
HPC Wireless Services
46 Mill Plain Road, Floor 2
Danbury, CT 06811

RE: **EM-CING-096-121108** - New Cingular Wireless PCS, LLC notice of intent to modify an existing telecommunications facility located at 33 Boardman Road, New Milford, Connecticut.

Dear Ms. Howlett:

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 6, 2012. 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,

A handwritten signature in cursive script that reads "Linda Roberts". To the right of the signature, the letters "NAB" are handwritten in a smaller, more upright script.

Linda Roberts
Executive Director

LR/CDM/cm

c: The Honorable Patricia A. Murphy, Mayor, Town of New Milford
Laura Regan, Zoning Enforcement Officer, Town of New Milford



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November 9, 2012

The Honorable Patricia A. Murphy
Mayor
Town of New Milford
10 Main Street
New Milford, CT 06776

RE: **EM-CING-096-121108** - New Cingular Wireless PCS, LLC notice of intent to modify an existing telecommunications facility located at 33 Broadman Road, New Milford, Connecticut.

Dear Mayor Murphy:

The Connecticut Siting Council (Council) received a request to modify an existing telecommunications facility, pursuant to Regulations of Connecticut State Agencies Section 16-50j-72. A copy of which has already been provided to you.

If you have any questions or comments regarding the proposal, please call me or inform the Council by November 23, 2012.

Thank you for your cooperation and consideration.

Very truly yours,

Linda Roberts
Executive Director

LR/cm

c: Laura Regan, Zoning Enforcement Officer, Town of New Milford

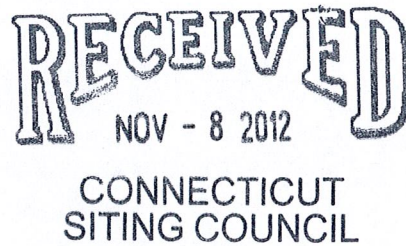


HPC Wireless Services
46 Mill Plain Rd.
Floor 2
Danbury, CT, 06811
P.: 203.797.1112

November 6, 2012

VIA OVERNIGHT COURIER

Connecticut Siting Council
10 Franklin Square
New Britain, Connecticut 06051
Attn: Ms. Linda Roberts, Executive Director



Re: New Cingular Wireless PCS, LLC – Exempt Modification
33 Broadman Road, New Milford, Connecticut

Dear Ms. Roberts:

This letter and attachments are submitted on behalf of New Cingular Wireless PCS, LLC ("AT&T"). AT&T is making modifications to certain existing sites in its Connecticut system in order to implement LTE technology. Please accept this letter and attachments as notification, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies ("R.C.S.A."), of construction that constitutes an exempt modification pursuant to R.C.S.A. Section 16-50j-72(b)(2). In compliance with R.C.S.A. Section 16-50j-73, a copy of this letter and attachments is being sent to the First Selectman of the Town of New Milford.

AT&T plans to modify the existing wireless communications facility owned by Quarry Stone & Gravel, LLC and located at 33 Broadman Road, New Milford (coordinates 41° -35'-57.85" N, 73-26'-14.09" W). Attached are a compound plan and elevation depicting the planned changes, and documentation of the structural sufficiency of the structure to accommodate the revised antenna configuration. Also included is a power density report reflecting the modification to AT&T's operations at the site.

The changes to the facility do not constitute a modification as defined in Connecticut General Statutes ("C.G.S.") Section 16-50i(d) because the general physical characteristics of the facility will not be significantly changed. Rather, the planned changes to the facility fall squarely within those activities explicitly provided for in R.C.S.A. Section 16-50j-72(b)(2).

1. AT&T will add three (3) LTE panel antennas, and six (6) RRUs behind the LTEs, all on new pipe mounts and attached to existing T-arms at a centerline height of approximately 120'. AT&T will also relocate twelve (12) TMAs/Piplexers, and one (1) Surge Arrestor will be placed on a new mounting pipe on the platform support arm, all at

a centerline height of approximately 120'. AT&T will also place DC power and fiber runs along the existing coaxial cable run. These changes will not extend the height of the approximately 153' structure.

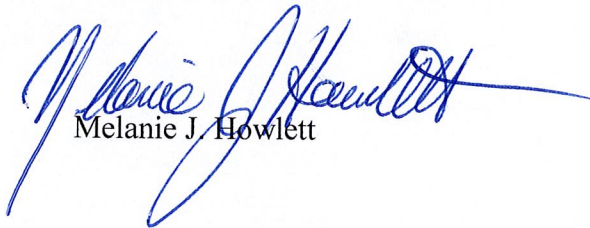
2. AT&T will mount a new GPS antenna on the existing Ice Bridge Post; and place related equipment in the existing Equipment Shelter. These changes will be within the existing compound and will have no effect on the site boundaries.

3. The proposed changes will not increase the noise level at the existing facility by six (6) decibels or more. The incremental effect of the proposed changes will be negligible.

4. The changes to the facility will not increase the calculated "worst case" power density for the combined operations at the site to a level at or above the applicable standard for uncontrolled environments as calculated for a mixed frequency site. As indicated on the attached report prepared by C Squared Systems, LLC, AT&T's operations at the site will result in a power density of approximately 2.38%; the combined site operations will result in a total power density of approximately 28.98%.

Please do not hesitate to contact me by phone at (203) 610-1071, or by e-mail at mjhowlett@optonline.net, if there are any questions concerning this matter. Thank you for your consideration.

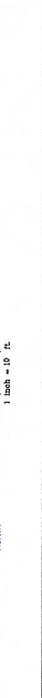
Respectfully yours,



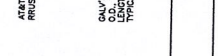
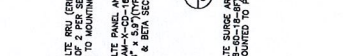
Melanie J. Howlett

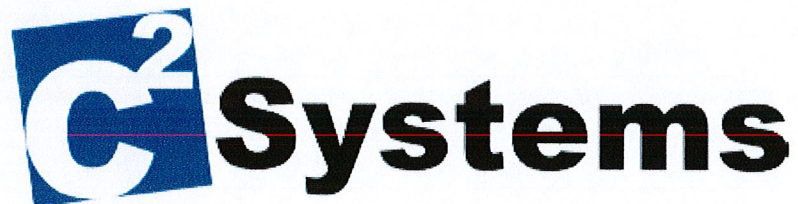
Attachments

cc: Honorable Pat Murphy, Mayor, Town of New Milford
Quarry Stone & Gravel, LLC (underlying property owner)



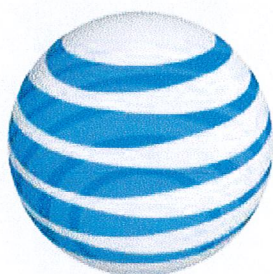
PLATEAU
CTOR / 12
1 PER
1 TOTAL





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

Calculated Radio Frequency Emissions



at&t

CT2001

(1253-New Milford)

86 Boardman Road, New Milford, CT 06776

(a.k.a. 33 Boardman Road)

October 25, 2012

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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 AT&T antenna arrays mounted on the stealth monopole tower located at 86 Boardman Road in New Milford, CT. The coordinates of the tower are 41° 35' 57.87" N, 73° 26' 14.95" W.

AT&T is proposing the following modifications:

- 1) Install three multi-band (700/850/1900/2100 MHz) antennas (one per sector) for their LTE network.

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:

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

Where:

EIRP = Effective Isotropic Radiated Power

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

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 pattern

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. Because the proposed AT&T 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 pattern of the proposed AT&T antennas. The calculated results for AT&T 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	%MPE
Cingular	120	880	6	296	0.0443	0.5867	7.56%
Cingular	120	1930	3	427	0.0320	1.0000	3.20%
Sprint	150	1962.5	11	286.5	0.0504	1.0000	5.04%
Verizon PCS	130	1970	11	256	0.0599	1.0000	5.99%
Verizon cellular	130	869	9	261	0.0500	0.5793	8.63%
Verizon AWS	130	2145	1	670	0.0143	1.0000	1.43%
Verizon LTE	130	698	1	852	0.0181	0.4653	3.90%
T-Mobile	140	1945	8	110	0.0161	1.0000	1.61%
AT&T UMTS	120	880	2	565	0.0028	0.5867	0.48%
AT&T UMTS	120	1900	2	875	0.0044	1.0000	0.44%
AT&T LTE	120	734	1	1615	0.0040	0.4893	0.82%
AT&T GSM	120	880	1	283	0.0007	0.5867	0.12%
AT&T GSM	120	1900	4	525	0.0052	1.0000	0.52%
						Total	28.98%

Table 1: Carrier Information^{1 2 3}

¹ The existing CSC filing for Cingular should be removed and replaced with the updated AT&T technologies and values provided in Table 1. The power density information for carriers other than AT&T was taken directly from the CSC database dated 7/26/2012. Please note that %MPE values listed are rounded to two decimal points. The total %MPE listed is a summation of each unrounded contribution. Therefore, summing each rounded value may not reflect the total value listed in the table.

² In the case where antenna models are not uniform across all 3 sectors for the same frequency band, the antenna model with the highest gain was used for the calculations to present a worse-case scenario.

³ Antenna height listed for AT&T is in reference to the Centek Engineering Structural Analysis dated October 16, 2012.

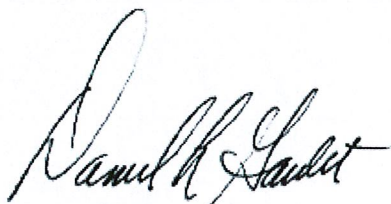
5. Conclusion

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 cumulative power density from the proposed transmit antennas at the existing facility is well below the limits for the general public. The highest expected percent of Maximum Permissible Exposure at ground level is **28.98% of the FCC limit**.

As noted previously, 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/IEEE Std. C95.1 and FCC OET Bulletin 65 Edition 97-01.



Daniel L. Goulet
C Squared Systems, LLC

October 25, 2012

Date

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12063.CO44 - CT2001	Page	1 of 21
	Project	153-ft EEI Monopine - 86 Boardman Rd., New Milford, CT	Date	16:08:32 10/16/12
	Client	AT&T Mobility	Designed by	TJL

Tower Input Data

There is a pole section.

This tower is designed using the TIA/EIA-222-F standard.

The following design criteria apply:

Basic wind speed of 80 mph.

Nominal ice thickness of 0.500 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.

Weld together tower sections have flange connections..

Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..

Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..

Welds are fabricated with ER-70S-6 electrodes..

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

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

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	154.000-134.830	19.170	4.330	18	25.250	30.030	0.188	0.750	A572-65 (65 ksi)
L2	134.830-89.160	50.000	5.670	18	28.575	40.910	0.313	1.250	A572-65 (65 ksi)
L3	89.160-44.540	50.290	6.920	18	38.886	51.280	0.500	2.000	A572-65 (65 ksi)

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12063.CO44 - CT2001	Page	2 of 21
	Project	153-ft EEI Monopine - 86 Boardman Rd., New Milford, CT	Date	16:08:32 10/16/12
	Client	AT&T Mobility	Designed by	TJL

Section	Elevation	Section Length	Splice Length	Number of Sides	Top Diameter	Bottom Diameter	Wall Thickness	Bend Radius	Pole Grade
	ft	ft	ft		in	in	in	in	
L4	44.540-1.000	50.460		18	48.575	61.000	0.563	2.250	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia.	Area	I	r	C	I/C	J	It/Q	w	w/t
	in	in ²	in ⁴	in	in	in ³	in ⁴	in ²	in	
L1	25.640	14.915	1183.638	8.897	12.827	92.277	2368.833	7.459	4.114	21.941
	30.493	17.760	1998.257	10.594	15.255	130.988	3999.143	8.882	4.955	26.428
L2	30.101	28.033	2829.053	10.033	14.516	194.888	5661.828	14.019	4.479	14.334
	41.541	40.268	8384.791	14.412	20.782	403.459	16780.616	20.138	6.650	21.281
L3	40.905	60.919	11340.739	13.627	19.754	574.092	22696.401	30.465	5.964	11.928
	52.071	80.588	26253.818	18.027	26.050	1007.815	52542.181	40.302	8.145	16.291
L4	51.054	85.720	24964.271	17.044	24.676	1011.687	49961.392	42.868	7.559	13.438
	61.941	107.904	49795.073	21.455	30.988	1606.915	99655.668	53.962	9.746	17.326

Tower Elevation	Gusset Area	Gusset Thickness	Gusset Grade	Adjust. Factor	Adjust. Factor	Weight Mult.	Double Angle	Double Angle
	(per face)			A _f	A _r		Stitch Bolt	Stitch Bolt
ft	ft ²	in					Spacing	Spacing
							Diagonals	Horizontals
							in	in
L1				1	1	1		
154.000-134.8								
30								
L2				1	1	1		
134.830-89.16								
0								
L3				1	1	1		
89.160-44.540								
L4				1	1	1		
44.540-1.000								

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement	Total Number	C _A A _A	Weight
				ft		ft ² /ft	klf
7/8	B	No	Inside Pole	151.000 - 4.000	1	No Ice	0.000
(Town - Existing)						1/2" Ice	0.000
1 5/8	B	No	Inside Pole	151.000 - 4.000	9	No Ice	0.000
(Sprint - Existing)						1/2" Ice	0.000
1 5/8	B	No	Inside Pole	141.000 - 4.000	6	No Ice	0.000
(T-Mobile - Existing)						1/2" Ice	0.000
1 5/8	B	No	Inside Pole	131.000 - 4.000	12	No Ice	0.000
(Verizon - Existing)						1/2" Ice	0.000
1 5/8	B	No	Inside Pole	121.000 - 4.000	12	No Ice	0.000
(AT&T - Existing)						1/2" Ice	0.000
RG6-Fiber	C	No	Inside Pole	121.000 - 4.000	1	No Ice	0.000
(AT&T - Proposed)						1/2" Ice	0.000
#8 AWG Copper Wire	C	No	Inside Pole	121.000 - 4.000	2	No Ice	0.000
(AT&T - Proposed)						1/2" Ice	0.000
HYBRIFLEX 1-1/4"	C	No	Inside Pole	151.000 - 4.000	3	No Ice	0.000

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12063.CO44 - CT2001	Page 3 of 21
	Project	153-ft EEI Monopine - 86 Boardman Rd., New Milford, CT	Date 16:08:32 10/16/12
	Client	AT&T Mobility	Designed by TJL

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C _{AA} ft ² /ft	Weight klf
(Sprint - Existing)					1/2" Ice	0.000	0.001

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _{AA} In Face ft ²	C _{AA} Out Face ft ²	Weight K
L1	154.000-134.830	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.199
		C	0.000	0.000	0.000	0.000	0.063
L2	134.830-89.160	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	1.657
		C	0.000	0.000	0.000	0.000	0.213
L3	89.160-44.540	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	1.834
		C	0.000	0.000	0.000	0.000	0.223
L4	44.540-1.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	1.666
		C	0.000	0.000	0.000	0.000	0.203

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} In Face ft ²	C _{AA} Out Face ft ²	Weight K
L1	154.000-134.830	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.199
		C		0.000	0.000	0.000	0.000	0.063
L2	134.830-89.160	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	1.657
		C		0.000	0.000	0.000	0.000	0.213
L3	89.160-44.540	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	1.834
		C		0.000	0.000	0.000	0.000	0.223
L4	44.540-1.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	1.666
		C		0.000	0.000	0.000	0.000	0.203

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
EEI Pine Branches	C	None		0.000	150.000	No Ice 1/2" Ice	90.000 130.000	1.500 1.900
EEI Pine Branches	C	None		0.000	140.000	No Ice 1/2" Ice	90.000 130.000	1.500 1.900

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	Project	153-ft EEI Monopine - 86 Boardman Rd., New Milford, CT	Date 16:08:32 10/16/12
	Client	AT&T Mobility	Designed by TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
EEI Pine Branches	C	None		0.000	130.000	No Ice	90.000	90.000	1.500
						1/2" Ice	130.000	130.000	1.900
EEI Pine Branches	C	None		0.000	120.000	No Ice	90.000	90.000	1.500
						1/2" Ice	130.000	130.000	1.900
EEI Pine Branches	C	None		0.000	110.000	No Ice	90.000	90.000	1.500
						1/2" Ice	130.000	130.000	1.900
EEI Pine Branches	C	None		0.000	100.000	No Ice	90.000	90.000	1.500
						1/2" Ice	130.000	130.000	1.900
EEI Pine Branches	C	None		0.000	90.000	No Ice	90.000	90.000	1.500
						1/2" Ice	130.000	130.000	1.900
EEI Pine Branches	C	None		0.000	80.000	No Ice	90.000	90.000	1.500
						1/2" Ice	130.000	130.000	1.900
10' Dipole	A	From Face	2.000	0.000	150.000	No Ice	4.000	4.000	0.050
			0.000			1/2" Ice	6.000	6.000	0.072
			5.000						
(2) 72"x6.5"x8" Panel (Sprint - Existing)	A	From Face	3.000	0.000	150.000	No Ice	5.093	6.063	0.015
			0.000			1/2" Ice	5.547	6.525	0.055
			0.000						
(2) 72"x6.5"x8" Panel (Sprint - Existing)	B	From Face	3.000	0.000	150.000	No Ice	5.093	6.063	0.015
			0.000			1/2" Ice	5.547	6.525	0.055
			0.000						
(2) 72"x6.5"x8" Panel (Sprint - Existing)	C	From Face	3.000	0.000	150.000	No Ice	5.093	6.063	0.015
			0.000			1/2" Ice	5.547	6.525	0.055
			0.000						
APXVSPP18-C-A20 (Sprint - Existing)	A	From Face	3.000	0.000	150.000	No Ice	8.260	5.283	0.057
			0.000			1/2" Ice	8.807	5.736	0.107
			0.000						
APXVSPP18-C-A20 (Sprint - Existing)	B	From Face	3.000	0.000	150.000	No Ice	8.260	5.283	0.057
			0.000			1/2" Ice	8.807	5.736	0.107
			0.000						
APXVSPP18-C-A20 (Sprint - Existing)	C	From Face	3.000	0.000	150.000	No Ice	8.260	5.283	0.057
			0.000			1/2" Ice	8.807	5.736	0.107
			0.000						
FD-RRH 2x50 800 (Sprint - Existing)	A	From Face	3.000	0.000	150.000	No Ice	2.477	2.058	0.053
			0.000			1/2" Ice	2.693	2.259	0.074
			0.000						
FD-RRH 2x50 800 (Sprint - Existing)	B	From Face	3.000	0.000	150.000	No Ice	2.477	2.058	0.053
			0.000			1/2" Ice	2.693	2.259	0.074
			0.000						
FD-RRH 2x50 800 (Sprint - Existing)	C	From Face	3.000	0.000	150.000	No Ice	2.477	2.058	0.053
			0.000			1/2" Ice	2.693	2.259	0.074
			0.000						
FD-RRH 4x40 1900 (Sprint - Existing)	A	From Face	3.000	0.000	150.000	No Ice	2.822	2.822	0.044
			0.000			1/2" Ice	3.062	3.062	0.069
			0.000						
FD-RRH 4x40 1900 (Sprint - Existing)	B	From Face	3.000	0.000	150.000	No Ice	2.822	2.822	0.044
			0.000			1/2" Ice	3.062	3.062	0.069
			0.000						
FD-RRH 4x40 1900 (Sprint - Existing)	C	From Face	3.000	0.000	150.000	No Ice	2.822	2.822	0.044
			0.000			1/2" Ice	3.062	3.062	0.069
			0.000						
EEI 10' Universal T-Arm (Sprint - Existing)	A	None		0.000	150.000	No Ice	13.340	13.340	0.450
						1/2" Ice	16.800	16.800	0.600
EEI 10' Universal T-Arm (Sprint - Existing)	B	None		0.000	150.000	No Ice	13.340	13.340	0.450
						1/2" Ice	16.800	16.800	0.600
EEI 10' Universal T-Arm (Sprint - Existing)	C	None		0.000	150.000	No Ice	13.340	13.340	0.450
						1/2" Ice	16.800	16.800	0.600

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	Project	153-ft EEI Monopine - 86 Boardman Rd., New Milford, CT	Date	16:08:32 10/16/12
	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
53"x7"x3" Panel (T-Mobile - Existing)	A	From Face	3.000 -6.000 0.000	0.000	140.000	No Ice 1/2" Ice	3.506 3.848	2.003 2.326	0.019 0.039
53"x7"x3" Panel (T-Mobile - Existing)	B	From Face	3.000 -6.000 0.000	0.000	140.000	No Ice 1/2" Ice	3.506 3.848	2.003 2.326	0.019 0.039
53"x7"x3" Panel (T-Mobile - Existing)	C	From Face	3.000 -6.000 0.000	0.000	140.000	No Ice 1/2" Ice	3.506 3.848	2.003 2.326	0.019 0.039
(2) TMA 10"x8"x3" (T-Mobile - Existing)	A	From Face	3.000 0.000 0.000	0.000	140.000	No Ice 1/2" Ice	0.778 0.899	0.292 0.380	0.015 0.020
(2) TMA 10"x8"x3" (T-Mobile - Existing)	A	From Face	3.000 0.000 0.000	0.000	140.000	No Ice 1/2" Ice	0.778 0.899	0.292 0.380	0.015 0.020
(2) TMA 10"x8"x3" (T-Mobile - Existing)	A	From Face	3.000 0.000 0.000	0.000	140.000	No Ice 1/2" Ice	0.778 0.899	0.292 0.380	0.015 0.020
EEI 10' Universal T-Arm (T-Mobile - Existing)	A	None		0.000	140.000	No Ice 1/2" Ice	13.340 16.800	13.340 16.800	0.450 0.600
EEI 10' Universal T-Arm (T-Mobile - Existing)	B	None		0.000	140.000	No Ice 1/2" Ice	13.340 16.800	13.340 16.800	0.450 0.600
EEI 10' Universal T-Arm (T-Mobile - Existing)	C	None		0.000	140.000	No Ice 1/2" Ice	13.340 16.800	13.340 16.800	0.450 0.600
LPA-80080-4CF (Verizon - Existing)	A	From Face	3.000 6.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.619 2.922	6.057 6.453	0.012 0.045
BXA-171085-8BF (Verizon - Existing)	A	From Face	3.000 4.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.941 3.255	2.156 2.458	0.011 0.029
BXA-70063/6CF (Verizon - Existing)	A	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
LPA-80080-4CF (Verizon - Existing)	A	From Face	3.000 -6.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.619 2.922	6.057 6.453	0.012 0.045
LPA-80080-4CF (Verizon - Existing)	B	From Face	3.000 6.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.619 2.922	6.057 6.453	0.012 0.045
BXA-171085-8BF (Verizon - Existing)	B	From Face	3.000 4.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.941 3.255	2.156 2.458	0.011 0.029
BXA-70063/6CF (Verizon - Existing)	B	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
LPA-80080-4CF (Verizon - Existing)	B	From Face	3.000 -6.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.619 2.922	6.057 6.453	0.012 0.045
LPA-80080-4CF (Verizon - Existing)	C	From Face	3.000 6.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.619 2.922	6.057 6.453	0.012 0.045
BXA-171085-8BF (Verizon - Existing)	C	From Face	3.000 4.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.941 3.255	2.156 2.458	0.011 0.029
BXA-70063/6CF (Verizon - Existing)	C	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059

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	Project	153-ft EEI Monopine - 86 Boardman Rd., New Milford, CT	Date	16:08:32 10/16/12
	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
LPA-80080-4CF (Verizon - Existing)	C	From Face	3.000 -6.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.619 2.922	6.057 6.453	0.012 0.045
(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	A	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	0.367 0.451	0.085 0.136	0.003 0.005
(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	B	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	0.367 0.451	0.085 0.136	0.003 0.005
(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	C	From Face	3.000 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	0.367 0.451	0.085 0.136	0.003 0.005
EEI 10' Universal T-Arm (Verizon - Existing)	A	None		0.000	130.000	No Ice 1/2" Ice	13.340 16.800	13.340 16.800	0.450 0.600
EEI 10' Universal T-Arm (Verizon - Existing)	B	None		0.000	130.000	No Ice 1/2" Ice	13.340 16.800	13.340 16.800	0.450 0.600
EEI 10' Universal T-Arm (Verizon - Existing)	C	None		0.000	130.000	No Ice 1/2" Ice	13.340 16.800	13.340 16.800	0.450 0.600
(2) 7770.00 (AT&T - Existing)	A	From Face	3.000 0.000 0.000	0.000	120.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
(2) 7770.00 (AT&T - Existing)	B	From Face	3.000 0.000 0.000	0.000	120.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
(2) 7770.00 (AT&T - Existing)	C	From Face	3.000 0.000 0.000	0.000	120.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
(2) LGP21401 TMA (AT&T - Existing)	A	From Face	3.000 0.000 0.000	0.000	120.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21401 TMA (AT&T - Existing)	B	From Face	3.000 0.000 0.000	0.000	120.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21401 TMA (AT&T - Existing)	C	From Face	3.000 0.000 0.000	0.000	120.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21901 Diplexer (AT&T - Existing)	A	From Face	3.000 0.000 0.000	0.000	120.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
(2) LGP21901 Diplexer (AT&T - Existing)	B	From Face	3.000 0.000 0.000	0.000	120.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
(2) LGP21901 Diplexer (AT&T - Existing)	C	From Face	3.000 0.000 0.000	0.000	120.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
EEI 10' Universal T-Arm (AT&T - Existing)	A	None		0.000	120.000	No Ice 1/2" Ice	13.340 16.800	13.340 16.800	0.450 0.600
EEI 10' Universal T-Arm (AT&T - Existing)	B	None		0.000	120.000	No Ice 1/2" Ice	13.340 16.800	13.340 16.800	0.450 0.600
EEI 10' Universal T-Arm (AT&T - Existing)	C	None		0.000	120.000	No Ice 1/2" Ice	13.340 16.800	13.340 16.800	0.450 0.600
AM-X-CD-16-65-00T-RET(7 2") (AT&T - Proposed)	A	From Face	3.000 2.000 0.000	0.000	120.000	No Ice 1/2" Ice	8.260 8.807	4.642 5.088	0.050 0.096
AM-X-CD-16-65-00T-RET(7 2") (AT&T - Proposed)	B	From Face	3.000 2.000 0.000	0.000	120.000	No Ice 1/2" Ice	8.260 8.807	4.642 5.088	0.050 0.096

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	Project	153-ft EEI Monopine - 86 Boardman Rd., New Milford, CT	Date	16:08:32 10/16/12
	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
P65-17-XLH-RR (AT&T - Proposed)	C	From Face	3.000 2.000 0.000	0.000	120.000	No Ice 1/2" Ice 11.467 12.083	6.800 7.384	0.062 0.124
(2) RRUS-11 (AT&T - Proposed)	A	From Face	1.000 2.000 0.000	0.000	120.000	No Ice 1/2" Ice 2.994 3.226	1.246 1.412	0.050 0.070
(2) RRUS-11 (AT&T - Proposed)	B	From Face	1.000 2.000 0.000	0.000	120.000	No Ice 1/2" Ice 2.994 3.226	1.246 1.412	0.050 0.070
(2) RRUS-11 (AT&T - Proposed)	C	From Face	1.000 2.000 0.000	0.000	120.000	No Ice 1/2" Ice 2.994 3.226	1.246 1.412	0.050 0.070
DC6-48-60-18-8F Surge Arrestor (AT&T - Proposed)	C	From Face	0.500 0.000 0.000	0.000	120.000	No Ice 1/2" Ice 2.228 2.447	2.228 2.447	0.020 0.039

Tower Pressures - No Ice

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _{AA} In Face ft ²	C _{AA} Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²		ft ²	ft ²
L1 154.000-134.8	144.139	1.524	0.025	44.155	A	0.000	44.155	44.155	100.00	0.000	0.000
30					B	0.000	44.155		100.00	0.000	0.000
L2 134.830-89.16	111.111	1.415	0.023	134.257	C	0.000	44.155		100.00	0.000	0.000
0					A	0.000	134.257	134.257	100.00	0.000	0.000
L3 89.160-44.540	66.493	1.222	0.020	170.232	B	0.000	134.257		100.00	0.000	0.000
					C	0.000	134.257		100.00	0.000	0.000
L4 44.540-1.000	22.093	1	0.016	201.878	A	0.000	170.232	170.232	100.00	0.000	0.000
					B	0.000	170.232		100.00	0.000	0.000
					C	0.000	170.232		100.00	0.000	0.000
					A	0.000	201.878	201.878	100.00	0.000	0.000
					B	0.000	201.878		100.00	0.000	0.000
					C	0.000	201.878		100.00	0.000	0.000

Tower Pressure - With Ice

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	t _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _{AA} In Face ft ²	C _{AA} Out Face ft ²
ft	ft		ksf	in	ft ²		ft ²	ft ²	ft ²		ft ²	ft ²
L1 154.000-134.830	144.139	1.524	0.019	0.500	45.752	A	0.000	45.752	45.752	100.00	0.000	0.000
						B	0.000	45.752		100.00	0.000	0.000

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	Project	153-ft EEI Monopine - 86 Boardman Rd., New Milford, CT	Date	16:08:32 10/16/12
	Client	AT&T Mobility	Designed by	TJL

Section Elevation	z	K _Z	q _z	t _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	in	ft ²		ft ²	ft ²	ft ²			
L2 134.830-89.160	111.111	1.415	0.017	0.500	138.063	C	0.000	45.752		100.00	0.000	0.000
						A	0.000	138.063	138.063	100.00	0.000	0.000
						B	0.000	138.063		100.00	0.000	0.000
						C	0.000	138.063		100.00	0.000	0.000
L3 89.160-44.540	66.493	1.222	0.015	0.500	173.950	A	0.000	173.950	173.950	100.00	0.000	0.000
						B	0.000	173.950		100.00	0.000	0.000
						C	0.000	173.950		100.00	0.000	0.000
L4 44.540-1.000	22.093	1	0.012	0.500	205.506	A	0.000	205.506	205.506	100.00	0.000	0.000
						B	0.000	205.506		100.00	0.000	0.000
						C	0.000	205.506		100.00	0.000	0.000

Tower Pressure - Service

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²			
L1 154.000-134.830	144.139	1.524	0.010	44.155	A	0.000	44.155	44.155	100.00	0.000	0.000
					B	0.000	44.155		100.00	0.000	0.000
					C	0.000	44.155		100.00	0.000	0.000
L2 134.830-89.160	111.111	1.415	0.009	134.257	A	0.000	134.257	134.257	100.00	0.000	0.000
					B	0.000	134.257		100.00	0.000	0.000
					C	0.000	134.257		100.00	0.000	0.000
L3 89.160-44.540	66.493	1.222	0.008	170.232	A	0.000	170.232	170.232	100.00	0.000	0.000
					B	0.000	170.232		100.00	0.000	0.000
					C	0.000	170.232		100.00	0.000	0.000
L4 44.540-1.000	22.093	1	0.006	201.878	A	0.000	201.878	201.878	100.00	0.000	0.000
					B	0.000	201.878		100.00	0.000	0.000
					C	0.000	201.878		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1 154.000-134.830	0.262	1.066	A	1	0.65	1	1	1	44.155	1.211	0.063	C
			B	1	0.65	1	1	1	44.155			
			C	1	0.65	1	1	1	44.155			
L2 134.830-89.160	1.870	5.810	A	1	0.65	1	1	1	134.257	3.412	0.075	C
			B	1	0.65	1	1	1	134.257			
			C	1	0.65	1	1	1	134.257			
L3 89.160-44.540	2.057	12.108	A	1	0.65	1	1	1	170.232	3.723	0.083	C
			B	1	0.65	1	1	1	170.232			
			C	1	0.65	1	1	1	170.232			
L4 44.540-1.000	1.869	16.623	A	1	0.65	1	1	1	201.878	3.640	0.084	C
			B	1	0.65	1	1	1	201.878			
			C	1	0.65	1	1	1	201.878			
Sum Weight:	6.057	35.607						OTM	869.635 kip-ft	11.986		

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 Exposure⁴

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 Exposure⁵

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)

⁴ 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

⁵ 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

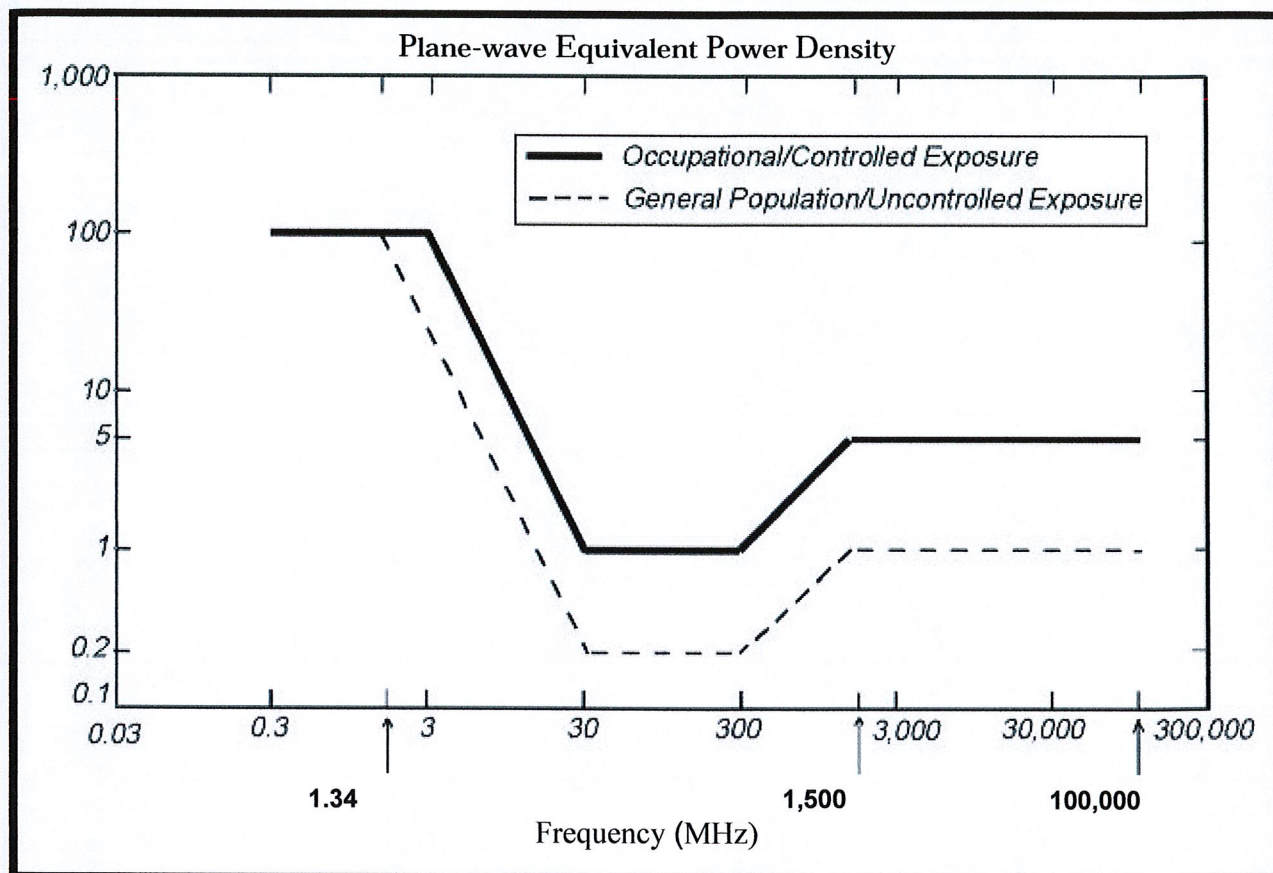
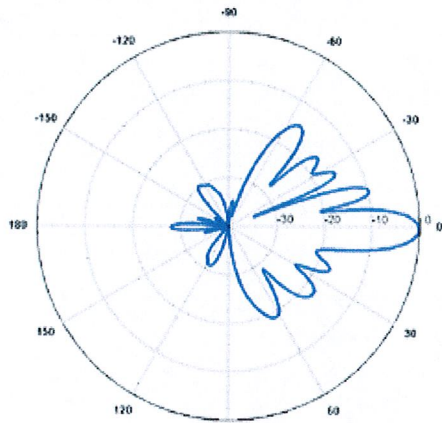
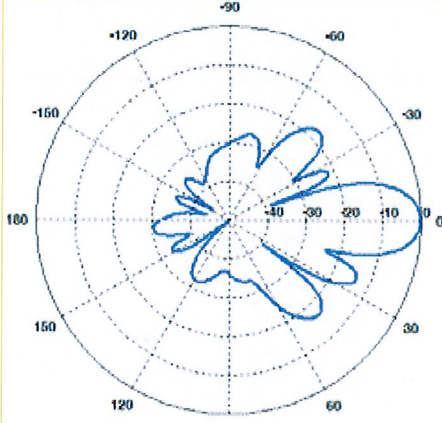
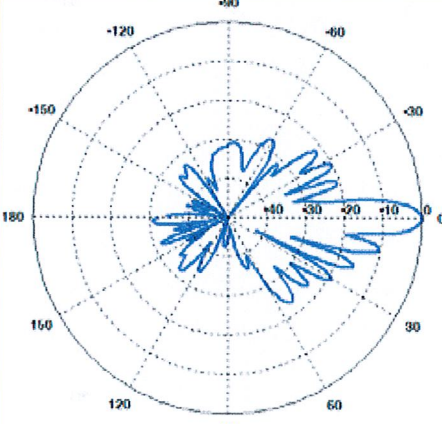


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: AT&T Antenna Data Sheets and Electrical Patterns

700 MHz Manufacturer: Powerwave Model #: P65-17-XLH-RR Frequency Band: 698-806 MHz Gain: 14.3 dBd Vertical Beamwidth: 8.4° Horizontal Beamwidth: 70° Polarization: Dual Linear $\pm 45^\circ$ Size L x W x D: 96.0" x 12.0" x 6.0"	
850 MHz Manufacturer: Powerwave Model #: 7770.00 Frequency Band: 824-896 MHz Gain: 11.5 dBd Vertical Beamwidth: 15° Horizontal Beamwidth: 82° Polarization: Dual Linear $\pm 45^\circ$ Size L x W x D: 55.0" x 11.0" x 5.0"	
1900 MHz Manufacturer: Powerwave Model #: 7770.00 Frequency Band: 1850-1990 MHz Gain: 13.4 dBd Vertical Beamwidth: 7° Horizontal Beamwidth: 86° Polarization: Dual Linear $\pm 45^\circ$ Size L x W x D: 55.0" x 11.0" x 5.0"	

Structural Analysis Report

153-ft Existing EEl Monopine

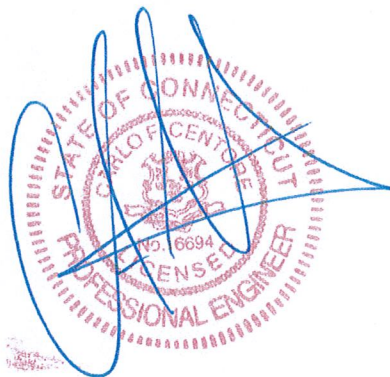
*Proposed AT&T Mobility
Antenna Upgrade*

AT&T Site Ref: CT2001

*86 Boardman Road
New Milford, CT*

Centek Project No. 12063.CO44

Date: October 16, 2012



Prepared for:
AT&T Mobility
500 Enterprise Drive, Suite 3A
Rocky Hill, CT 06067

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Introduction

The purpose of this report is to summarize the results of the non-linear, P- Δ structural analysis of the antenna upgrade proposed by AT&T Mobility on the existing monopine (tower) located in New Milford, CT.

The host tower is a 153-ft tall, four-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Inc., job no; 13200, dated March 2, 2005. The tower geometry, structure member sizes and foundation system information were obtained from a previous structural report prepared by Centek job no. 12001.CO1 dated December 19, 2011.

Antenna and appurtenance information were obtained from the a previous structural report prepared by KM Consulting Engineers, Inc. job no. 120834 dated August 22, 2012 and a AT&T scope of work sheet

The tower is made up of four (4) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 25.25-in at the top and 61.0-in at the base.

AT&T Mobility proposes the installation of three (3) panel antennas, six (6) Remote Radio Units (RRU's) and one (1) surge arrestor mounted to the existing three (3) 10-ft T-Arms. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing, proposed and future loads considered in this analysis consist of the following:

- UNKNOWN (EXISTING):
Antennas: One (1) 10-ft dipole antenna mounted on a 1-ft standoff arm with an elevation of 150-ft above grade.
Coax Cables: One (1) 7/8" $\varnothing$ coax cable running on the inside of the existing tower.
- SPRINT (EXISTING/RESERVED):
Antennas: Six (6) 72"x6.5"x8" panel antennas, three (3) RFS APXVSPP18-C-A20 panel antennas, three (3) ALU 1900 MHz RRH's and three (3) ALU 800 MHz RRH's mounted on three (3) existing 10-ft T-Arms with a RAD center elevation of 150-ft above grade.
Coax Cables: Nine (9) 1-5/8" $\varnothing$ coax cables and three (3) 1-1/4" $\varnothing$ Hybriflex cables running on the inside of the existing tower.
- T-MOBILE (EXISTING):
Antennas: Three (3) 53"x7"x3" panel antennas and six (6) TMA's mounted on three (3) existing 10-ft T-Arms with a RAD center elevation of 140-ft above grade.
Coax Cables: Six (6) 1-5/8" $\varnothing$ coax cables running on the inside of the existing tower.

- VERIZON (EXISTING):
Antennas: Six (6) Antel LPA-80080-4CF panel antennas, three (3) Antel BXA-70063-6CF panel antennas, three (3) Antel BXA-171085-8BF panel antennas and six (6) RFS FD9R6004/2C-3L Diplexers mounted on three (3) existing 10-ft T-Arms with a RAD center elevation of 130-ft above grade.
Coax Cables: Twelve (12) 1-5/8" Ø coax cables running on the inside of the existing tower.
- AT&T (EXISTING TO REMAIN):
Antennas: Six (6) Powerwave 7770 panel antennas, six (6) Powerwave LGP21401 TMA's and six (6) Powerwave LGP21901 Diplexers mounted on three (3) existing 10-ft T-Arms with a RAD center elevation of 120-ft above grade.
Coax Cables: Twelve (12) 1-5/8" Ø coax cables running on the inside of the existing tower.
- AT&T (PROPOSED):
Antennas: Two (2) KMW AM-X-CD-16-65-00T-RET panel antennas, one (1) Powerwave P65-17-XLH-RR panel antenna, six (6) Ericsson RRUS-11, one (1) Raycap DC6-48-60-18-8F surge mounted on three (3) existing 10-ft T-Arms with a RAD center elevation of 120-ft above grade.
Coax Cables: One (1) fiber cable and two (2) dc control cables running within the interior of the existing monopole.

Primary Assumptions Used in the Analysis

- The tower structure's theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents or reinforcement drawings.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All existing coax cables to be installed as indicated in this report.

A n a l y s i s

The existing tower was analyzed using a comprehensive computer program entitled RISATower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower shaft, and the model assumes that the shaft members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for the controlling basic wind speed (fastest mile) with no ice and a 75% reduction of wind force with ½ inch accumulative ice to determine stresses in members as per guidelines of TIA/EIA-222-F-96 entitled "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix K of the CSBC¹ and the wind speed data available in the TIA/EIA-222-F-96 Standard. The higher of the two wind speeds is utilized in preparation on the tower analysis.

T o w e r L o a d i n g

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA/EIA-222-F, gravity loads of the tower structure and its components, and the application of ½" radial ice on the tower structure and its components.

Basic Wind Speed:	Litchfield; v = 80 mph (fastest mile)	[Section 16 of TIA/EIA-222-F-96]
	New Milford; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	[Appendix K of the 2005 CT Building Code Supplement]
	<i>TIA/EIA-222-F wind speed controls.</i>	
Load Cases:	<u>Load Case 1</u> : 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	[Section 2.3.16 of TIA/EIA-222-F-96]
	<u>Load Case 2</u> : 69 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 69 mph wind speed velocity represents 75% of the wind pressure generated by the 80 mph wind speed.	[Section 2.3.16 of TIA/EIA-222-F-96]
	<u>Load Case 3</u> : Seismic – not checked	[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type

¹ The 2005 Connecticut State Building Code as amended by the 2009 CT State Supplement. (CSBC)

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software RISATower. Allowable stresses were determined based on Table 5 of the TIA/EIA code with a 1/3 increase per Section 3.1.1.1 of the same code.

- Calculated stresses were found to be within allowable limits. In Load Case 1, per RISATower "Section Capacity Table", this tower was found to be at **92.1%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L4)	1.00'-44.54'	92.1%	PASS

Foundation and Anchors

The existing foundation consists of a 7.5-ft square x 3.5-ft long reinforced concrete pier on a 32.0-ft square x 4.0-ft thick reinforced concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned structural report prepared by Centek job no. 12001.CO1 dated December 19, 2011. The base of the tower is connected to the foundation by means of (28) 2.25"Ø, ASTM A615-75 anchor bolts embedded approximately 7-ft into the concrete foundation structure.

Review of the foundation and anchor design consisted of verification of applied loads obtained from the tower design calculations and code checks of allowable stresses:

- The tower base reactions developed from the governing Load Case 1 were used in the verification of the foundation and its anchors:

Location	Vector	Proposed Reactions
Base	Shear	56 kips
	Compression	61 kips
	Moment	6334 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 (FS) ⁽¹⁾	Proposed Loading (FS) ⁽¹⁾	Result
Reinforced Concrete Pad and Pier	OTM ⁽²⁾	2.0	2.09	PASS

Note 1: FS denotes Factor of Safety.

Note 2: OTM denotes Overturning Moment

CEN TEK Engineering, Inc.
Structural Analysis - 153-ft EEI Monopine
AT&T Antenna Upgrade – CT2001
New Milford, CT
October 16, 2012

- The anchor bolts and base plate were found to be within allowable limits.

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Compression	83.1%	PASS
Base Plate	Bending	47.9%	PASS

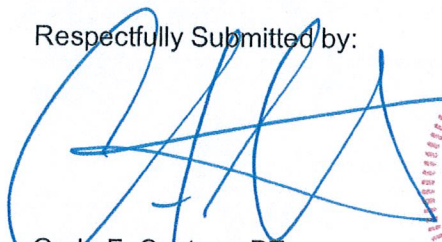
Conclusion

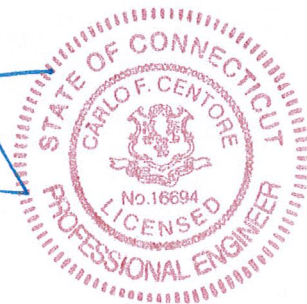
This analysis shows that the subject tower **is adequate** to support the proposed modified antenna configuration.

The analysis is based, in part, on the information provided to this office by Verizon Wireless. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

Respectfully Submitted by:


Carlo F. Centore, PE
Principal ~ Structural Engineer



Prepared by:



Timothy J. Lynn, EIT
Structural Engineer

CEN TEK Engineering, Inc.
Structural Analysis - 153-ft EEI Monopine
AT&T Antenna Upgrade – CT2001
New Milford, CT
October 16, 2012

Standard Conditions for Furnishing of
Professional Engineering Services on
Existing Structures

All engineering services are performed on the basis that the information used is current and correct. This information may consist of, but is not necessarily limited to:

- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provided to Centek Engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the "as new" condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. Centek Engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

RISATower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, RISATower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

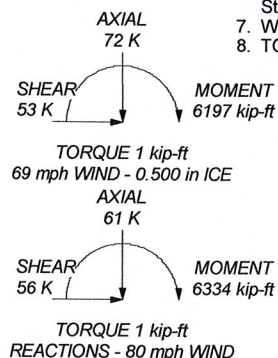
RISATower Features:

- RISATower can analyze and design 3- and 4-sided guyed towers, 3- and 4-sided self-supporting towers and either round or tapered ground mounted poles with or without guys.
- The program analyzes towers using the TIA-222-G (2005) standard or any of the previous TIA/EIA standards back to RS-222 (1959). Steel design is checked using the AISC ASD 9th Edition or the AISC LRFD specifications.
- Linear and non-linear (P-delta) analyses can be used in determining displacements and forces in the structure. Wind pressures and forces are automatically calculated.
- Extensive graphics plots include material take-off, shear-moment, leg compression, displacement, twist, feed line, guy anchor and stress plots.
- RISATower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.

Side elevation drawing of the tower structure. The drawing shows the vertical profile of the tower with various structural elements and dimensions. The dimensions are as follows:

- 154.0 ft (Total height)
- 134.8 ft (Height to the top of the main tower section)
- 89.2 ft (Height to the top of the lower section)
- 44.5 ft (Height to the top of the base section)
- 1.0 ft (Base width)

The drawing includes a cross-section of the tower at the top, showing the internal structure and the placement of the antenna. The tower is shown with a series of vertical lines representing the tower's structure. The dimensions are indicated by horizontal lines and arrows.



TYPE	ELEVATION	TYPE	ELEVATION
EEl Pine Branches	150	BXA-70063/6CF (Verizon - Existing)	130
10' Dipole	150	LPA-80080-4CF (Verizon - Existing)	130
(2) 72"x6.5"x8" Panel (Sprint - Existing)	150	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	130
(2) 72"x6.5"x8" Panel (Sprint - Existing)	150		
(2) 72"x6.5"x8" Panel (Sprint - Existing)	150	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	130
APXVSP18-C-A20 (Sprint - Existing)	150	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	130
APXVSP18-C-A20 (Sprint - Existing)	150		
FD-RRH 2x50 800 (Sprint - Existing)	150	EEl 10' Universal T-Arm (Verizon - Existing)	130
FD-RRH 2x50 800 (Sprint - Existing)	150		
FD-RRH 2x50 800 (Sprint - Existing)	150	EEl 10' Universal T-Arm (Verizon - Existing)	130
FD-RRH 4x40 1900 (Sprint - Existing)	150		
FD-RRH 4x40 1900 (Sprint - Existing)	150	EEl 10' Universal T-Arm (Verizon - Existing)	130
FD-RRH 4x40 1900 (Sprint - Existing)	150		
EEl 10' Universal T-Arm (Sprint - Existing)	150	EEl Pine Branches	120
		(2) 7770.00 (ATTI - Existing)	120
EEl 10' Universal T-Arm (Sprint - Existing)	150	(2) 7770.00 (ATTI - Existing)	120
		(2) 7770.00 (ATTI - Existing)	120
EEl 10' Universal T-Arm (Sprint - Existing)	150	(2) LGP21401 TMA (ATTI - Existing)	120
		(2) LGP21401 TMA (ATTI - Existing)	120
EEl Pine Branches	140	(2) LGP21401 TMA (ATTI - Existing)	120
53"x7"x3" Panel (T-Mobile - Existing)	140	(2) LGP21901 Diplexer (ATTI - Existing)	120
53"x7"x3" Panel (T-Mobile - Existing)	140	(2) LGP21901 Diplexer (ATTI - Existing)	120
53"x7"x3" Panel (T-Mobile - Existing)	140	(2) LGP21901 Diplexer (ATTI - Existing)	120
(2) TMA 10"x8"x3" (T-Mobile - Existing)	140	EEl 10' Universal T-Arm (ATTI - Existing)	120
(2) TMA 10"x8"x3" (T-Mobile - Existing)	140		
(2) TMA 10"x8"x3" (T-Mobile - Existing)	140	EEl 10' Universal T-Arm (ATTI - Existing)	120
EEl 10' Universal T-Arm (T-Mobile - Existing)	140		
EEl 10' Universal T-Arm (T-Mobile - Existing)	140	AM-X-CD-16-65-00T-RET(72") (ATTI - Proposed)	120
EEl 10' Universal T-Arm (T-Mobile - Existing)	140	AM-X-CD-16-65-00T-RET(72") (ATTI - Proposed)	120
EEl Pine Branches	130	P65-17-XLH-RR (ATTI - Proposed)	120
LPA-80080-4CF (Verizon - Existing)	130	(2) RRUS-11 (ATTI - Proposed)	120
BXA-171085-8BF (Verizon - Existing)	130	(2) RRUS-11 (ATTI - Proposed)	120
BXA-70063/6CF (Verizon - Existing)	130	(2) RRUS-11 (ATTI - Proposed)	120
LPA-80080-4CF (Verizon - Existing)	130	DC6-48-60-18-8F Surge Arrestor (ATTI - Proposed)	120
LPA-80080-4CF (Verizon - Existing)	130		
BXA-171085-8BF (Verizon - Existing)	130	EEl Pine Branches	110
BXA-70063/6CF (Verizon - Existing)	130	EEl Pine Branches	100
LPA-80080-4CF (Verizon - Existing)	130	EEl Pine Branches	90
LPA-80080-4CF (Verizon - Existing)	130	EEl Pine Branches	80
BXA-171085-8BF (Verizon - Existing)	130		

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

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 92.1%

Dwg No. E-1

J:\h\105300\WCD-44-CT2016\STRUCTURAL\overlaid\Filed\57 FEB Monocline - New Millred CT.c

Stability of Footing:

Adjusted Concrete Unit Weight =

$$\gamma_c := \text{if}(\text{Bouyancy} = 1, \gamma_{\text{conc}} - 62.4 \text{pcf}, \gamma_{\text{conc}}) = 150 \text{pcf}$$

Adjusted Soil Unit Weight =

$$\gamma_s := \text{if}(\text{Bouyancy} = 1, \gamma_{\text{soil}} - 62.4 \text{pcf}, \gamma_{\text{soil}}) = 100 \text{pcf}$$

Passive Pressure =

$$P_{pn} := K_p \cdot \gamma_s \cdot n + c \cdot 2 \cdot \sqrt{K_p} = 0.142 \text{ksf}$$

$$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = 0.355 \text{ksf}$$

$$P_{top} := \text{if}(n < (D_f - T_f), P_{pt}, P_{pn}) = 0.355 \text{ksf}$$

$$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 0.923 \text{ksf}$$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 0.639 \text{ksf}$$

$$T_p := \text{if}(n < (D_f - T_f), T_f, (D_f - n)) = 4$$

$$A_p := W_f \cdot T_p = 128$$

Ultimate Shear =

$$S_u := P_{ave} \cdot A_p = 81.808 \text{kip}$$

Weight of Concrete Pad =

$$WT_c := \left[\left(W_f^2 \cdot T_f \right) + \frac{d_p^2 \cdot \pi}{4} \cdot L_p \right] \cdot \gamma_c = 637.594 \text{kip}$$

Weight of Soil Above Footing =

$$WT_{s1} := \left[\left(W_f^2 - \frac{d_p^2 \cdot \pi}{4} \right) \cdot (L_p - L_{pag} - n) \right] \cdot \gamma_s = 146.97 \text{kip}$$

Weight of Soil Wedge at Back Face =

$$WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Phi_s)}{2} \cdot W_f \right) \cdot \gamma_s = 11.92 \text{kip}$$

Weight of Soil Wedge at back face Corners =

$$WT_{s3} := 2 \cdot \left[\left(D_f \right)^3 \cdot \frac{\tan(\Phi_s)}{3} \right] \cdot \gamma_s = 3.228 \text{kips}$$

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 845.567 \text{kip}$$

Resisting Moment =

$$M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[(WT_{s2} + WT_{s3}) \cdot \left(W_f + \frac{D_f \tan(\Phi_s)}{3} \right) \right] = 14129 \text{kip-ft}$$

Overturning Moment =

$$M_{ot} := OM + \text{Shear} \cdot (L_p + T_f) = 6754 \text{kip-ft}$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.09$$

Factor of Safety Required =

$$FS_{req} := 2$$

$$\text{OverTurning_Moment_Check} := \text{if}(FS \geq FS_{req}, \text{"Okay"}, \text{"No Good"})$$

$$\text{OverTurning_Moment_Check} = \text{"Okay"}$$

Shear Capacity in Pier:

Shear Resistance of Pier =

$$S_p := \frac{P_{ave} \cdot A_p + \mu \cdot W_{T_{tot}}}{FS_{req}} = 231.157 \cdot \text{kips}$$

$$\text{Shear_Check} := \text{if}(S_p > \text{Shear}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Shear_Check} = \text{"Okay"}$$

Bearing Pressure Caused by Footing:

Area of the Mat =

$$A_{mat} := W_f^2 = 1.024 \times 10^3$$

Section Modulus of Mat =

$$S := \frac{W_f^3}{6} = 5461.33 \cdot \text{ft}^3$$

Maximum Pressure in Mat =

$$P_{max} := \frac{W_{T_{tot}}}{A_{mat}} + \frac{M_{ot}}{S} = 2.062 \cdot \text{ksf}$$

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

$$\text{Max_Pressure_Check} = \text{"Okay"}$$

Minimum Pressure in Mat =

$$P_{min} := \frac{W_{T_{tot}}}{A_{mat}} - \frac{M_{ot}}{S} = -0.411 \cdot \text{ksf}$$

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

$$\text{Min_Pressure_Check} = \text{"No Good"}$$

Distance to Resultant of Pressure Distribution =

$$X_p := \frac{P_{max}}{P_{max} - P_{min}} \cdot \frac{1}{3} = 8.894$$

Distance to Kern =

$$X_k := \frac{W_f}{6} = 5.333$$

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

Eccentricity =

$$e := \frac{M_{ot}}{W_{T_{tot}}} = 7.988$$

Adjusted Soil Pressure =

$$P_a := \frac{2 \cdot W_{T_{tot}}}{3 \cdot W_f \left(\frac{W_f}{2} - e \right)} = 2.199 \cdot \text{ksf}$$

$$q_{adj} := \text{if}(P_{min} < 0, P_a, P_{max}) = 2.199 \cdot \text{ksf}$$

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

$$\text{Pressure_Check} = \text{"Okay"}$$

Concrete Bearing Capacity:

Strength Reduction Factor =

$$\Phi_c := 0.65 \quad (\text{ACI-2008 9.3.2.2})$$

Bearing Strength Between Pier and Pad =

$$P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.054 \times 10^4 \cdot \text{kips} \quad (\text{ACI-2008 10.14})$$

$$\text{Bearing_Check} := \text{if}(P_b > \text{LF} \cdot \text{Axial}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Bearing_Check} = \text{"Okay"}$$

Shear Strength of Concrete:

Beam Shear:

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

$$\Phi_c := 0.85 \quad (\text{ACI 9.3.2.5})$$

$$d := T_f - \text{Cvr}_{\text{pad}} - d_{\text{bbot}}$$

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

$$d_2 := d_1 - d$$

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

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

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

$$V_{\text{Avail}} := \Phi_c \cdot 2 \cdot \sqrt{f_c \cdot \text{psi}} \cdot W_f \cdot d \quad (\text{ACI-2008 11.2.1.1})$$

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

$$\text{Beam_Shear_Check} = \text{"Okay"}$$

Punching Shear:

(Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.11.1.2)

Critical Perimeter of Punching Shear =

$$b_o := (d_p + d) \cdot \pi = 35$$

Area Included Inside Perimeter =

$$A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4} = 97.3$$

Area Outside of Perimeter =

$$A_{\text{out}} := A_{\text{mat}} - A_{bo} = 926.7$$

Guess Value =

$$v_u := 1 \text{ ksf}$$

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

Given

$$d^2 + d_p d = \frac{W_{T_{tot}}}{\pi \cdot v_u}$$

$$v_u := \text{Find}(v_u) = 6.7 \cdot \text{ksf}$$

$$V_u := v_u \cdot d \cdot W_f = 773.7 \cdot \text{kips}$$

Required Shear Strength =

$$V_{req} := LF \cdot V_u = 1 \times 10^3 \cdot \text{kips}$$

Available Shear Strength =

$$V_{avail} := \phi_c \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o \cdot d = 3406.8 \cdot \text{kip} \quad (\text{ACI-2008 11.11.2.1})$$

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

$$\text{Punching_Shear_Check} = \text{"Okay"}$$

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor =

$$\phi_m := .90 \quad (\text{ACI-2008 9.3.2.1})$$

$$q_b := q_{adj} - d_1 \cdot \text{Slope} = 1.078 \cdot \text{ksf}$$

Maximum Bending at Face of Pier =

$$M_n := \frac{1}{\phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 4868.9 \cdot \text{kip-ft}$$

$$\beta := \begin{cases} 0.85 & \text{if } 2500 \cdot \text{psi} \leq f_c \leq 4000 \cdot \text{psi} \\ 0.65 & \text{if } f_c > 8000 \cdot \text{psi} \\ \left[0.85 - \left[\frac{\left(\frac{f_c}{\text{psi}} - 4000 \right)}{1000} \right] \cdot 0.5 \right] & \text{otherwise} \end{cases} = 0.85 \quad (\text{ACI-2008 10.2.7.3})$$

$$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2} = 89 \cdot \text{psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f_c}} \right) = 0.0015$$

$$\rho_{min} := 1.333 \cdot \rho = 0.00201$$

Required Reinforcement for Temperature and Shrinkage:

$$\rho_{sh} := \begin{cases} .0018 & \text{if } f_y \geq 60000 \text{ psi} \\ .0020 & \text{otherwise} \end{cases} \quad (\text{ACI-2008 7.12.2.1})$$

Check Bottom Bars:

$$A_s := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \frac{d}{2} & \text{otherwise} \end{cases} = 33.686 \cdot \text{in}^2$$

$$A_{s_{prov}} := A_{bbot} \cdot NB_{bot} = 65.6 \cdot \text{in}^2$$

$$\text{Pad_Reinforcement_Bot} := \text{if}(A_{s_{prov}} > A_s, \text{"Okay"}, \text{"No Good"})$$

$$\text{Pad_Reinforcement_Bot} = \text{"Okay"}$$

Check top Bars:

$$A_s := \rho_{sh} \cdot \left(W_f \cdot \frac{d}{2} \right) = 15.1 \cdot \text{in}^2$$

$$A_{s_{prov}} := A_{btop} \cdot NB_{top} = 65.6 \cdot \text{in}^2$$

$$\text{Pad_Reinforcement_Top} := \text{if}(A_{s_{prov}} > A_s, \text{"Okay"}, \text{"No Good"})$$

$$\text{Pad_Reinforcement_Top} = \text{"Okay"}$$

Development Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot C_{vr_{pad}} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 7.78 \cdot \text{in}$$

Spacing or Cover Dimension =

$$c := \text{if} \left(C_{vr_{pad}} < \frac{B_{sPad}}{2}, C_{vr_{pad}}, \frac{B_{sPad}}{2} \right) = 3 \cdot \text{in}$$

Transverse Reinforcement Index =

$$k_{tr} := 0 \quad (\text{ACI-2008 12.2.3})$$

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot \text{psi}} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 54.4 \cdot \text{in}$$

Minimum Development Length =

$$L_{dbmin} := 12 \cdot \text{in} \quad (\text{ACI-2008 12.2.1})$$

$$L_{dbtCheck} := \text{if}(L_{dbt} \geq L_{dbmin}, \text{"Use L.dbt"}, \text{"Use L.dbmin"})$$

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - C_{vr_{pad}} = 144 \cdot \text{in}$$

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

$$L_{pad_Check} = \text{"Okay"}$$

Steel Reinforcement in Pier:

Area of Pier =

$$A_p := \frac{\pi \cdot d_p^2}{4} = 6361.73 \cdot \text{in}^2$$

$$A_{smin} := 0.01 \cdot 0.05 \cdot A_p = 3.18 \cdot \text{in}^2 \quad (\text{ACI-2008 10.8.4 \& 10.9.1})$$

$$A_{sprov} := N_{B_{pier}} \cdot A_{b_{pier}} = 56.21 \cdot \text{in}^2$$

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

$$\text{Steel_Area_Check} = \text{"Okay"}$$

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{N_{B_{pier}}} - d_{b_{pier}} = 6.444 \cdot \text{in}$$

Diameter of Reinforcement Cage =

$$\text{Diam}_{cage} := d_p - 2 \cdot C_{vr_{pier}} = 84 \cdot \text{in}$$

Maximum Moment in Pier =

$$M_p := \left[OM + \text{Shear} \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 1 \times 10^5 \cdot \text{in} \cdot \text{kips}$$

Pier Check evaluated from outside program and results are listed below;

$$(D \ N \ n \ P_u \ M_{xu}) := \left(d_p \cdot 12 \ N_{B_{pier}} \ B_{s_{pier}} \ \frac{\text{Axial} \cdot 1.333}{\text{kips}} \ \frac{M_p}{\text{in} \cdot \text{kips}} \right)$$

$$(D \ N \ n \ P_u \ M_{xu}) = (90 \ 36 \ 11 \ 81.3 \ 1 \times 10^5)$$

$$(\phi P_n \ \phi M_{xn} \ f_{sp} \ \rho) := (0 \ 0 \ 0 \ 0)$$

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

$$(\phi P_n \ \phi M_{xn} \ f_{sp} \ \rho) = (86.6 \ 1.1 \times 10^5 \ -60 \ 0)$$

$$\text{Axial_Load_Check} := \text{if}(\phi P_n \geq P_u, \text{"Okay"}, \text{"No Good"})$$

$$\text{Axial_Load_Check} = \text{"Okay"}$$

$$\text{Bending_Check} := \text{if}(\phi M_{xn} \geq M_{xu}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Bending_Check} = \text{"Okay"}$$

Development Length Pier Reinforcement:
Available Length in Foundation:

$$L_{\text{pier}} := L_p - C_{\text{vr}}_{\text{pier}} = 39 \cdot \text{in}$$

$$L_{\text{pad}} := T_f - C_{\text{vr}}_{\text{pad}} = 45 \cdot \text{in}$$

Tension:

(ACI-2008 12.2.3)

Spacing or Cover Dimension =

$$c := \text{if} \left(C_{\text{vr}}_{\text{pier}} < \frac{B_{\text{SPier}}}{2}, C_{\text{vr}}_{\text{pier}}, \frac{B_{\text{SPier}}}{2} \right) = 3 \cdot \text{in}$$

Transverse Reinforcement =

$$k_{\text{tr}} := 0 \quad (\text{ACI-2008 12.2.3})$$

$$L_{\text{dbt}} := \frac{3 \cdot f_y \cdot \alpha_{\text{pier}} \cdot \beta_{\text{pier}} \cdot \gamma_{\text{pier}} \cdot \lambda_{\text{pier}}}{40 \cdot \sqrt{f_c \cdot \text{psi}} \cdot \left(\frac{c + k_{\text{tr}}}{d_{\text{bpier}}} \right)} \cdot d_{\text{bpier}} = 54.45 \cdot \text{in}$$

Minimum Development Length =

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

$$L_{\text{dh}} := \frac{1200 \cdot d_{\text{bpier}}}{\sqrt{\frac{f_c}{\text{psi}}}} \cdot .7 = 21.624 \cdot \text{in} \quad (\text{ACI 12.2.1})$$

$$L_{\text{db}} := \max(L_{\text{dbt}}, L_{\text{dbmin}})$$

$$L_{\text{tension_Check}} := \text{if}(L_{\text{pier}} + L_{\text{pad}} > L_{\text{db}}, \text{"Okay"}, \text{"No Good"})$$

$$L_{\text{tension_Check}} = \text{"Okay"}$$

Compression:

(ACI-2008 12.3.2)

$$L_{\text{dbc1}} := \frac{.02 \cdot d_{\text{bpier}} \cdot f_y}{\sqrt{f_c \cdot \text{psi}}} = 30.892 \cdot \text{in}$$

$$L_{\text{dbmin}} := 0.0003 \cdot \frac{\text{in}^2}{\text{lb}} \cdot (d_{\text{bpier}} \cdot f_y) = 25.38 \cdot \text{in}$$

$$L_{\text{dbc}} := \text{if}(L_{\text{dbc1}} \geq L_{\text{dbmin}}, L_{\text{dbc1}}, L_{\text{dbmin}}) = 30.892 \cdot \text{in}$$

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

$$L_{\text{compression_Check}} = \text{"Okay"}$$

Tie Size and Spacing in Column:

Minimum Tie Size =

$$Tie_{min} := \text{if}(BS_{pier} \leq 10, 3, 4) = 4$$

Used #3 Ties

Seismic Factor =

$$z := \text{if}(Z \leq 2, 1, 0.5) = 1$$

(ACI-2008 21.10.5)

$$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 22.56 \cdot \text{in}$$

$$s_{lim2} := \frac{48 \cdot d_{Tie}}{8} \cdot z = 18 \cdot \text{in}$$

$$s_{lim3} := D_f \cdot z = 78 \cdot \text{in}$$

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

Maximum Spacing =

$$s_{tie} := \min \begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix} = 18 \cdot \text{in}$$

Number of Ties Required =

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

Check Anchor Steel Embedment:

Depth Available =

$$D_{ab} := L_{st} - A_{BP} = 7 \cdot \text{ft}$$

Length of Anchor Bolt =

$$L_{anchor} := \frac{(0.11 \cdot f_{ya}) \cdot \text{in}}{\sqrt{f_c \cdot \text{psi}}} = 12.552 \cdot \text{ft}$$

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

Depth_Check = "No Good"

Note: Anchor plate is provided

AM-X-CD-16-65-00T-RET(6' 65° Dual Broadband Antenna)

Dual Band Electrical DownTilt Antenna

698 ~ 894MHz, X-pol., H65° / V12°**1710 ~ 2170MHz, X-pol., H65° / V6.0°****Electrical Specification**

Frequency Range	698~894MHz	1710~2170MHz
Impedance	50Ω	
Polarization	Dual, Slant ±45°	
Gain	15.5dBi / 13.35dBd @ 698-806MHz 16.0dBi / 13.85dBd @ 824-894MHz	17.3dBi / 15.15dBd @ 1710-1755MHz 17.4dBi / 15.25dBd @ 1850-1900MHz 17.1dBi / 14.95dBd @ 2110-2155MHz
Beamwidth	Horizontal	65° @ 698-806MHz 63° @ 824-894MHz
	Vertical	65° @ 1710-1755MHz 67° @ 1850-1900MHz 69° @ 2110-2155MHz
		12.3° @ 698-806MHz 11.5° @ 824-894MHz
		6.5° @ 1710-1755MHz 6.0° @ 1850-1900MHz 5.7° @ 2110-2155MHz
VSWR	≤1.5:1	
Front-to-Back Ratio	≥27 dB	
Electrical Downtilt Range	2° ~ 16°	0° ~ 10°
Isolation Between Ports	≥30 dB	
Isolation Between Ports of Different Frequency Elements	≥35 dB	
Cross Pole Discrimination	10.0 dB @ ±60° 15.0 dBi @ 0°	
First Upper Side Lobe Suppression	16dB	
Side Lobe Suppression	> 16 dB @ 0-6° Tilt > 18 dB @ 7-12° Tilt (Up to 10° from Boresight)	> 16 dB @ 0-6° Tilt > 18 dB @ 7-10° Tilt (Up to 10° from Boresight)
Passive Intermodulation	≤ -150 dBc @ 2x20w	
Input Maximum CW Power	500 W	300 W
Environmental Compliance	IP65 for Radome IP67 for Connectors	
RET Motor Configuration	Field Replaceable RET Electronic Control Module / RET Motor is internal to antenna & not field replaceable	
Compliant with AISG 1.1 and 2.0	AISG 1.1 and 2.0	

Mechanical Specification

Dimension (W×D×H)	11.8×5.9×72 inches (300×150×1829mm)
Weight (Without clamp)	48.5 lbs (22.0 kg)
Connector	4 x 7/16 DIN(F), Long Neck
Max Wind Speed	150 mph
Wind Load (@150 mph)	1891 N

P65-17-XLH-RR**Dual Broadband Antennas**

POLARIZATION: Dual linear $\pm 45^\circ$
FREQUENCY (MHz): 698-894, 1710-2170
HORIZONTAL BEAM WIDTH ($^\circ$): 65, 65
GAIN (dBi dBd): 17.2/15.1 17.5/15.4
TILT: 0-7, 0-8
LENGTH: 96"

	698-894		1710-2170		
	698-806	806-894	1710-1880	1850-1990	1900-2170
Frequency range (MHz)	698-806	806-894	1710-1880	1850-1990	1900-2170
Frequency band (MHz)	698-806	806-894	1710-1880	1850-1990	1900-2170
Gain (dBi/dBd)	16.4/14.3	17.2/15.1	16.9/14.8	17.2/15.1	17.5/15.4
Polarization	Dual Linear $\pm 45^\circ$		Dual Linear $\pm 45^\circ$		
Nominal Impedance (Ω)	50		50		
VSWR	< 1.5:1		< 1.5:1		
Horizontal beam width, -3 dB ($^\circ$)	70	63	60	63	60
Vertical beam width, -3 dB ($^\circ$)	8.4		6.5		
Electrical down tilt ($^\circ$)	0 to 7		0 to 8		
Side lobe suppression, vertical 1st upper (dB)	> 16		> 16		
Isolation between inputs (dB)	> 30		> 30		
Inter band Isolation (dB)	> 40		> 30		
Tracking, horizontal plane $\pm 60^\circ$ (dB)	< 2		< 2		
Vertical beam squint ($^\circ$)	< 0.5		< 0.5		
Front to back ratio (dB) $180^\circ \pm 30^\circ$ copolar	> 25		> 30		
Front to back ratio (dB) $180^\circ \pm 30^\circ$ total power	> 22		> 25		
Cross polar discrimination (XPD) 0° (dB)	> 15		> 15		
Cross polar discrimination (XPD) $\pm 60^\circ$ (dB)	10		10		
IM3, 2xTx&43dBm (dBc)	<-153		<-153		
Power handling, average per input (W)	500		300		
Power handling, average total (W)	1000		600		

Connector	4 x 7/16 DIN Female, IP67, 4 x AISG [2 x i-RET 8510.40]
Connector position	Bottom
Dimensions, HxWxD, mm(ft)	2445x312x148(96"x12"x6")
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, kg (lbs)	28.2 (62)
Weight, without brackets, kg (lbs)	22.7 (50)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.6 (N)	1006 / 147 / 1273
Maximum operational wind speed, m/s (mph)	45 (100)
Survival wind speed, m/s (mph)	67 (150)
Lightning protection	DC Ground
Operating Temperature	-40°C to +60°C
Radome Material	PVC, IP55
Radome colour	Light Grey
Packing size, HxWxD, mm (ft)	2610 x 427 x 275 (102.8" x 17" x 11")
Shipping weight, kg (lbs)	37 (81)
RET	iRET AISGv1.1, MET and AISGv2.0 Available
Brackets	7256.00, 7454.00A



*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

For detailed patterns visit <http://www.powerwave.com/rpa/>.

RRUS11

Frequency (AT&T)

- ✓ Band 12 (Lower 700 MHz)
- ✓ Band 4 (AWS, 17/2100 MHz) — 2Q2011

RF Characteristics

- ✓ Output power: 2x30 Watts
- ✓ 2x2 MIMO Capable
- ✓ IBW of 20 MHz
- ✓ Rx Sens.: Better than -105 dBm (5 MHz)

RET/TMA Support

- ✓ AISG 2.0 Compatible
- ✓ Via RET Port and Centre Conductor
- ✓ Cascading
- ✓ 30 VDC Bias

Environmental

- ✓ Self Convection
- ✓ Temperature -40 to 131 F

Power

- ✓ Input voltage: -48 VDC or AC (exemption)
- ✓ Fuse size: 13 – 32 A
 - Recommended: 25 A
- ✓ Power Consumption:
 - Typical 200 Watts
 - Max 310 Watts
 - Excl. RET and TMA load



RRUS 11 Mechanics

Wall and pole mounting brackets

- Reused from RRUW and RRU22
- Vertical Mount Only

Clearing distances:

- Above ≥ 16 in.
- Below ≥ 12 in.
- Side ≥ 0 mm

DC connector

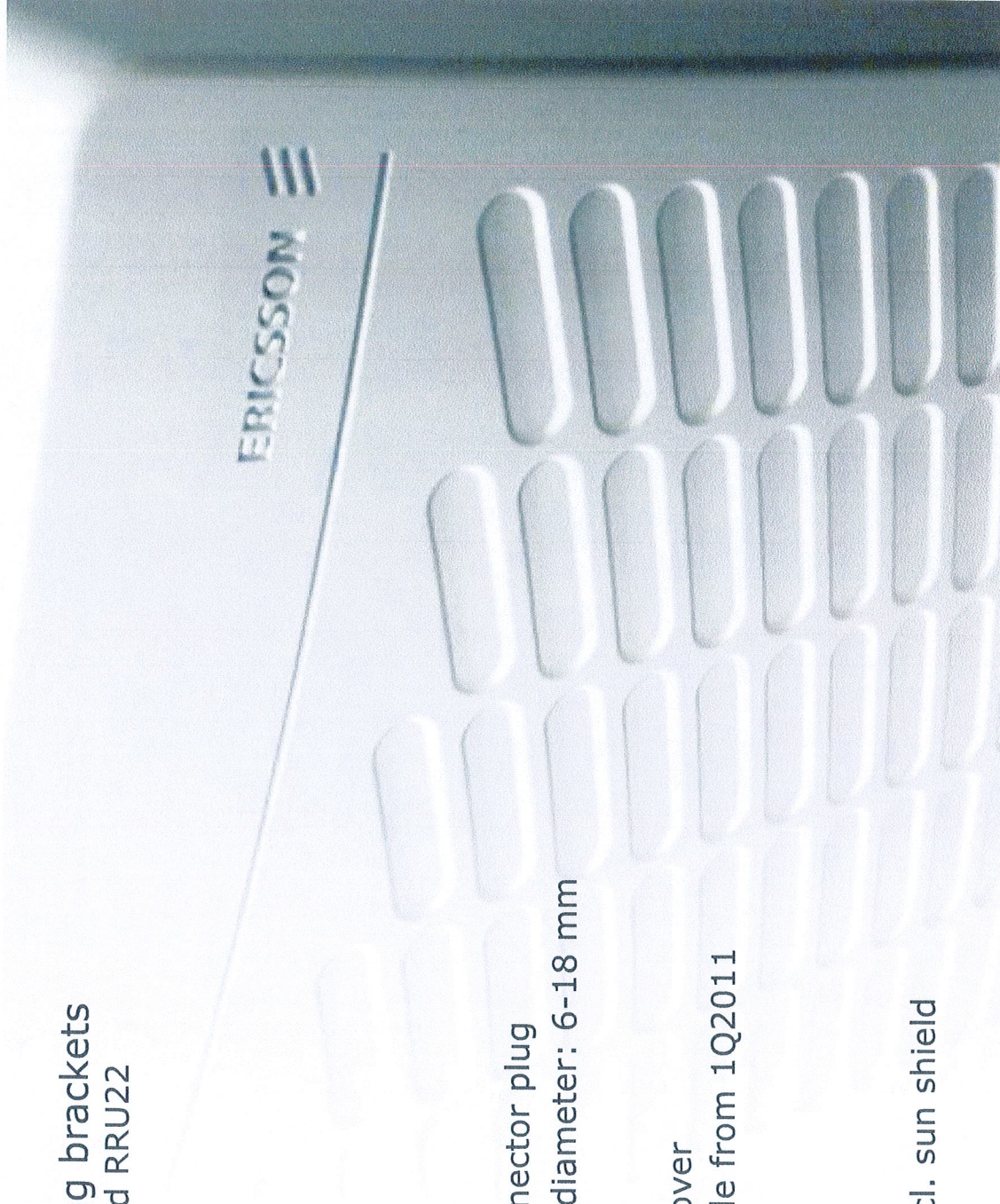
- Bayonet
- Screw terminals in connector plug
- Supported outer cable diameter: 6-18 mm

CPRI connector

- LCD with proprietary cover
- Separate cover available from 1Q2011

Size & Weight

- Band 4: 44 lbs
- Band 12: 50 lbs
- 17.8" x 17.3" x 7.2" incl. sun shield



POWER

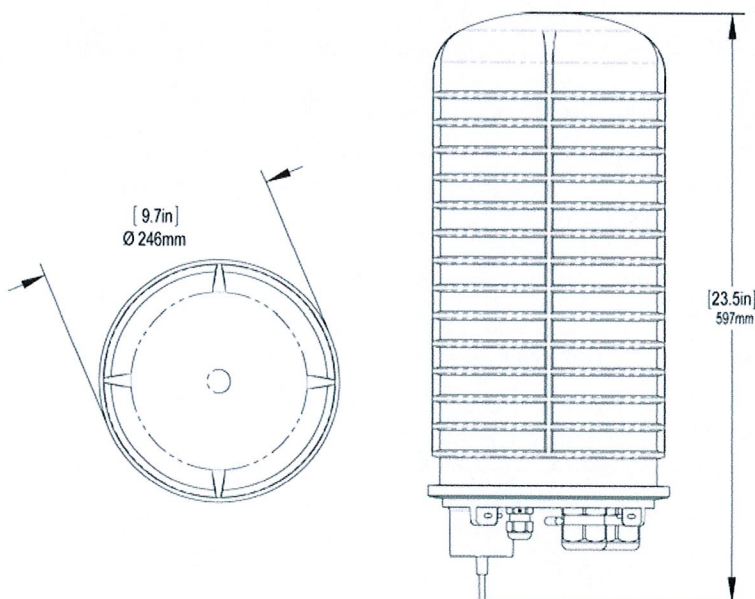
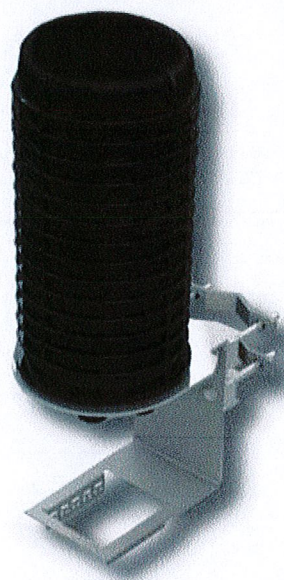
DC6-48-60-18-8F

DC Surge Suppression Solution

The DC6-48-60-18 is a dual chambered, DC surge suppression system for use in multi-circuit, Distributed Antenna Systems. The system will protect up to 6 Remote Radio Heads from voltage surges and lightning, and connect up to 18 fiber pairs. The system is enclosed in a NEMA 4 rated, waterproof enclosure.

FEATURES

- Protects up to 6 Remote Radio Heads, each with its own protection circuit.
- Flexible design allows for installation at the top of a tower for Remote Radio Head protection.
- Includes fiber connections for up to 18 pairs of fiber.
- LED indicators on individual circuits provide visual indication of suppressor status.
- Form 'C' relays allow for remote monitoring of the suppressor status.
- Patented Strikesorb technology provides over 60 kA of surge current capacity per circuit.
- Strikesorb suppression modules are fully recognized to UL 1449-3rd Edition Safety Standard, meeting all intermediate and high current fault requirements to facilitate use in OEM applications.
- Raycap recommends that DC protection system be installed within 2 meters or 6 feet of the radio.
- Dome design is lightweight and aerodynamic providing maximum flexibility for installation on top of towers.



Raycap

DC6-48-60-18-8F

DC Power Surge Protection

Electrical Specifications	
Model Number	DC6-48-60-18-8F
Nominal Operating Voltage	48 VDC
Nominal Discharge Current (I_n)	20 kA 8/20 μ s
Maximum Discharge Current (I_{max}) per NEMA LS-1	60 kA 8/20 μ s
Maximum Continuous Operating Voltage (U_c)	75 VDC
Voltage Protection Rating	400 V

Mechanical Specifications	
Suppression Connection Method	Compression lug, #2-#14 AWG Copper, #2-#12 Aluminum
Fiber Connection Method	LC-LC Single mode duplex
Environmental Rating	IP 68, 7m 72hrs
Operating Temperature	-40° C to + 80° C
Storage Temperature	-70° C to + 80° C
Cold Temperature Cycling	IEC 61300-2-22e -30° C to + 60° C 200 hrs @ 5 psi
Resistance to Aggressive Materials	CEI IEC 61073-2 including acids and bases
UV Protection	ISO 4892-2 Method A Xenon-Arc 2160 hrs
Weight	20 lbs without Mounting Bracket

STANDARDS

Strikesorb modules are compliant to the following Surge Protection Device (SPD) Standards:

- ANSI/UL 1449 - 3rd Edition
- IEEE C62.41
- NEMA LS-1, IEC 61643-1:2005 2nd Edition:2005
- IEC 61643-12
- EN 61643-11:2002 (including A11:2007)



Raycap

G02-00-068 REV 050610



GS-07F-0435V



Certified to
ISO 9001:2000



TUV Rheinland
of North America

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RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12063.CO44 - CT2001	Page	9 of 21
	Project	153-ft EEI Monopine - 86 Boardman Rd., New Milford, CT	Date	16:08:32 10/16/12
	Client	AT&T Mobility	Designed by	TJL

Tower Forces - No Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.262	1.066	A	1	0.65	1	1	1	44.155	1.211	0.063	C
154.000-134.8			B	1	0.65	1	1	1	44.155			
30			C	1	0.65	1	1	1	44.155			
L2	1.870	5.810	A	1	0.65	1	1	1	134.257	3.412	0.075	C
134.830-89.16			B	1	0.65	1	1	1	134.257			
0			C	1	0.65	1	1	1	134.257			
L3	2.057	12.108	A	1	0.65	1	1	1	170.232	3.723	0.083	C
89.160-44.540			B	1	0.65	1	1	1	170.232			
			C	1	0.65	1	1	1	170.232			
L4	1.869	16.623	A	1	0.65	1	1	1	201.878	3.640	0.084	C
44.540-1.000			B	1	0.65	1	1	1	201.878			
			C	1	0.65	1	1	1	201.878			
Sum Weight:	6.057	35.607						OTM	869.635 kip-ft	11.986		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.262	1.066	A	1	0.65	1	1	1	44.155	1.211	0.063	C
154.000-134.8			B	1	0.65	1	1	1	44.155			
30			C	1	0.65	1	1	1	44.155			
L2	1.870	5.810	A	1	0.65	1	1	1	134.257	3.412	0.075	C
134.830-89.16			B	1	0.65	1	1	1	134.257			
0			C	1	0.65	1	1	1	134.257			
L3	2.057	12.108	A	1	0.65	1	1	1	170.232	3.723	0.083	C
89.160-44.540			B	1	0.65	1	1	1	170.232			
			C	1	0.65	1	1	1	170.232			
L4	1.869	16.623	A	1	0.65	1	1	1	201.878	3.640	0.084	C
44.540-1.000			B	1	0.65	1	1	1	201.878			
			C	1	0.65	1	1	1	201.878			
Sum Weight:	6.057	35.607						OTM	869.635 kip-ft	11.986		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.262	1.066	A	1	0.65	1	1	1	44.155	1.211	0.063	C
154.000-134.8			B	1	0.65	1	1	1	44.155			
30			C	1	0.65	1	1	1	44.155			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L2 134.830-89.160	1.870	5.810	A	1	0.65	1	1	1	134.257	3.412	0.075	C
			B	1	0.65	1	1	1	134.257			
			C	1	0.65	1	1	1	134.257			
L3 89.160-44.540	2.057	12.108	A	1	0.65	1	1	1	170.232	3.723	0.083	C
			B	1	0.65	1	1	1	170.232			
			C	1	0.65	1	1	1	170.232			
L4 44.540-1.000	1.869	16.623	A	1	0.65	1	1	1	201.878	3.640	0.084	C
			B	1	0.65	1	1	1	201.878			
			C	1	0.65	1	1	1	201.878			
Sum Weight:	6.057	35.607						OTM	869.635 kip-ft	11.986		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1 154.000-134.830	0.262	1.399	A	1	0.65	1	1	1	45.752	0.941	0.049	C
			B	1	0.65	1	1	1	45.752			
			C	1	0.65	1	1	1	45.752			
L2 134.830-89.160	1.870	6.819	A	1	0.65	1	1	1	138.063	2.631	0.058	C
			B	1	0.65	1	1	1	138.063			
			C	1	0.65	1	1	1	138.063			
L3 89.160-44.540	2.057	13.382	A	1	0.65	1	1	1	173.950	2.853	0.064	C
			B	1	0.65	1	1	1	173.950			
			C	1	0.65	1	1	1	173.950			
L4 44.540-1.000	1.869	18.132	A	1	0.65	1	1	1	205.506	2.779	0.064	C
			B	1	0.65	1	1	1	205.506			
			C	1	0.65	1	1	1	205.506			
Sum Weight:	6.057	39.731						OTM	669.946 kip-ft	9.205		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1 154.000-134.830	0.262	1.399	A	1	0.65	1	1	1	45.752	0.941	0.049	C
			B	1	0.65	1	1	1	45.752			
			C	1	0.65	1	1	1	45.752			
L2 134.830-89.160	1.870	6.819	A	1	0.65	1	1	1	138.063	2.631	0.058	C
			B	1	0.65	1	1	1	138.063			
			C	1	0.65	1	1	1	138.063			
L3 89.160-44.540	2.057	13.382	A	1	0.65	1	1	1	173.950	2.853	0.064	C
			B	1	0.65	1	1	1	173.950			
			C	1	0.65	1	1	1	173.950			
L4 44.540-1.000	1.869	18.132	A	1	0.65	1	1	1	205.506	2.779	0.064	C
			B	1	0.65	1	1	1	205.506			
			C	1	0.65	1	1	1	205.506			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
Sum Weight:	6.057	39.731						OTM	669.946 kip-ft	9.205		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.262	1.399	A	1	0.65	1	1	1	45.752	0.941	0.049	C
154.000-134.8			B	1	0.65	1	1	1	45.752			
30			C	1	0.65	1	1	1	45.752			
L2	1.870	6.819	A	1	0.65	1	1	1	138.063	2.631	0.058	C
134.830-89.16			B	1	0.65	1	1	1	138.063			
0			C	1	0.65	1	1	1	138.063			
L3	2.057	13.382	A	1	0.65	1	1	1	173.950	2.853	0.064	C
89.160-44.540			B	1	0.65	1	1	1	173.950			
			C	1	0.65	1	1	1	173.950			
L4	1.869	18.132	A	1	0.65	1	1	1	205.506	2.779	0.064	C
44.540-1.000			B	1	0.65	1	1	1	205.506			
			C	1	0.65	1	1	1	205.506			
Sum Weight:	6.057	39.731						OTM	669.946 kip-ft	9.205		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.262	1.399	A	1	0.65	1	1	1	45.752	0.941	0.049	C
154.000-134.8			B	1	0.65	1	1	1	45.752			
30			C	1	0.65	1	1	1	45.752			
L2	1.870	6.819	A	1	0.65	1	1	1	138.063	2.631	0.058	C
134.830-89.16			B	1	0.65	1	1	1	138.063			
0			C	1	0.65	1	1	1	138.063			
L3	2.057	13.382	A	1	0.65	1	1	1	173.950	2.853	0.064	C
89.160-44.540			B	1	0.65	1	1	1	173.950			
			C	1	0.65	1	1	1	173.950			
L4	1.869	18.132	A	1	0.65	1	1	1	205.506	2.779	0.064	C
44.540-1.000			B	1	0.65	1	1	1	205.506			
			C	1	0.65	1	1	1	205.506			
Sum Weight:	6.057	39.731						OTM	669.946 kip-ft	9.205		

Tower Forces - Service - Wind Normal To Face

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.262	1.066	A	1	0.65	1	1	1	44.155	0.473	0.025	C
154.000-134.8			B	1	0.65	1	1	1	44.155			
30			C	1	0.65	1	1	1	44.155			
L2	1.870	5.810	A	1	0.65	1	1	1	134.257	1.333	0.029	C
134.830-89.16			B	1	0.65	1	1	1	134.257			
0			C	1	0.65	1	1	1	134.257			
L3	2.057	12.108	A	1	0.65	1	1	1	170.232	1.454	0.033	C
89.160-44.540			B	1	0.65	1	1	1	170.232			
			C	1	0.65	1	1	1	170.232			
L4	1.869	16.623	A	1	0.65	1	1	1	201.878	1.422	0.033	C
44.540-1.000			B	1	0.65	1	1	1	201.878			
			C	1	0.65	1	1	1	201.878			
Sum Weight:	6.057	35.607						OTM	339.701 kip-ft	4.682		

Tower Forces - Service - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.262	1.066	A	1	0.65	1	1	1	44.155	0.473	0.025	C
154.000-134.8			B	1	0.65	1	1	1	44.155			
30			C	1	0.65	1	1	1	44.155			
L2	1.870	5.810	A	1	0.65	1	1	1	134.257	1.333	0.029	C
134.830-89.16			B	1	0.65	1	1	1	134.257			
0			C	1	0.65	1	1	1	134.257			
L3	2.057	12.108	A	1	0.65	1	1	1	170.232	1.454	0.033	C
89.160-44.540			B	1	0.65	1	1	1	170.232			
			C	1	0.65	1	1	1	170.232			
L4	1.869	16.623	A	1	0.65	1	1	1	201.878	1.422	0.033	C
44.540-1.000			B	1	0.65	1	1	1	201.878			
			C	1	0.65	1	1	1	201.878			
Sum Weight:	6.057	35.607						OTM	339.701 kip-ft	4.682		

Tower Forces - Service - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.262	1.066	A	1	0.65	1	1	1	44.155	0.473	0.025	C
154.000-134.8			B	1	0.65	1	1	1	44.155			
30			C	1	0.65	1	1	1	44.155			
L2	1.870	5.810	A	1	0.65	1	1	1	134.257	1.333	0.029	C
134.830-89.16			B	1	0.65	1	1	1	134.257			
0			C	1	0.65	1	1	1	134.257			
L3	2.057	12.108	A	1	0.65	1	1	1	170.232	1.454	0.033	C
89.160-44.540			B	1	0.65	1	1	1	170.232			
			C	1	0.65	1	1	1	170.232			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L4	1.869	16.623	A	1	0.65	1	1	1	201.878	1.422	0.033	C
44.540-1.000			B	1	0.65	1	1	1	201.878			
			C	1	0.65	1	1	1	201.878			
Sum Weight:	6.057	35.607						OTM	339.701 kip-ft	4.682		

Tower Forces - Service - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.262	1.066	A	1	0.65	1	1	1	44.155	0.473	0.025	C
154.000-134.8			B	1	0.65	1	1	1	44.155			
30			C	1	0.65	1	1	1	44.155			
L2	1.870	5.810	A	1	0.65	1	1	1	134.257	1.333	0.029	C
134.830-89.16			B	1	0.65	1	1	1	134.257			
0			C	1	0.65	1	1	1	134.257			
L3	2.057	12.108	A	1	0.65	1	1	1	170.232	1.454	0.033	C
89.160-44.540			B	1	0.65	1	1	1	170.232			
			C	1	0.65	1	1	1	170.232			
L4	1.869	16.623	A	1	0.65	1	1	1	201.878	1.422	0.033	C
44.540-1.000			B	1	0.65	1	1	1	201.878			
			C	1	0.65	1	1	1	201.878			
Sum Weight:	6.057	35.607						OTM	339.701 kip-ft	4.682		

Force Totals

Load Case	Vertical Forces	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M _x kip-ft	Sum of Overturning Moments, M _y kip-ft	Sum of Torques kip-ft
Leg Weight	35.607					
Bracing Weight	0.000					
Total Member Self-Weight	35.607					
Total Weight	60.823			-0.176	0.485	
Wind 0 deg - No Ice		-0.053	-55.468	-6166.175	7.831	-0.985
Wind 30 deg - No Ice		27.698	-48.010	-5336.415	-3077.897	-0.789
Wind 45 deg - No Ice		39.198	-39.184	-4355.002	-4356.806	-0.606
Wind 60 deg - No Ice		48.026	-27.688	-3076.814	-5338.774	-0.382
Wind 90 deg - No Ice		55.487	0.053	7.170	-6169.001	0.127
Wind 120 deg - No Ice		48.079	27.780	3089.185	-5346.120	0.603
Wind 135 deg - No Ice		39.272	39.259	4365.038	-4367.195	0.786
Wind 150 deg - No Ice		27.789	48.063	5343.409	-3090.620	0.916
Wind 180 deg - No Ice		0.053	55.468	6165.824	-6.860	0.985
Wind 210 deg - No Ice		-27.698	48.010	5336.064	3078.867	0.789
Wind 225 deg - No Ice		-39.198	39.184	4354.650	4357.777	0.606
Wind 240 deg - No Ice		-48.026	27.688	3076.463	5339.744	0.382
Wind 270 deg - No Ice		-55.487	-0.053	-7.521	6169.972	-0.127
Wind 300 deg - No Ice		-48.079	-27.780	-3089.537	5347.090	-0.603

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Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 315 deg - No Ice		-39.272	-39.259	-4365.390	4368.165	-0.786
Wind 330 deg - No Ice		-27.789	-48.063	-5343.761	3091.590	-0.916
Member Ice	4.124					
Total Weight Ice	71.510					
Wind 0 deg - Ice		-0.042	-53.195	-5991.554	6.561	-0.976
Wind 30 deg - Ice		26.571	-46.047	-5185.922	-2991.560	-0.850
Wind 45 deg - Ice		37.598	-37.585	-4232.562	-4234.031	-0.697
Wind 60 deg - Ice		46.064	-26.561	-2990.772	-5187.912	-0.496
Wind 90 deg - Ice		53.214	0.042	5.708	-5993.984	-0.009
Wind 120 deg - Ice		46.106	26.634	3000.613	-5193.789	0.481
Wind 135 deg - Ice		37.658	37.644	4240.536	-4242.341	0.684
Wind 150 deg - Ice		26.644	46.089	5191.462	-3001.739	0.841
Wind 180 deg - Ice		0.042	53.195	5991.217	-5.192	0.976
Wind 210 deg - Ice		-26.571	46.047	5185.585	2992.930	0.850
Wind 225 deg - Ice		-37.598	37.585	4232.226	4235.401	0.697
Wind 240 deg - Ice		-46.064	26.561	2990.435	5189.282	0.496
Wind 270 deg - Ice		-53.214	-0.042	-6.045	5995.354	0.009
Wind 300 deg - Ice		-46.106	-26.634	-3000.950	5195.159	-0.481
Wind 315 deg - Ice		-37.658	-37.644	-4240.873	4243.711	-0.684
Wind 330 deg - Ice		-26.644	-46.089	-5191.799	3003.109	-0.841
Total Weight	60.823					
Wind 0 deg - Service		-0.021	-21.667	-2408.769	3.354	-0.385
Wind 30 deg - Service		10.819	-18.754	-2084.644	-1202.008	-0.308
Wind 45 deg - Service		15.312	-15.306	-1701.280	-1701.582	-0.237
Wind 60 deg - Service		18.760	-10.816	-1201.988	-2085.163	-0.149
Wind 90 deg - Service		21.674	0.021	2.694	-2409.471	0.050
Wind 120 deg - Service		18.781	10.851	1206.606	-2088.032	0.235
Wind 135 deg - Service		15.341	15.335	1704.986	-1705.640	0.307
Wind 150 deg - Service		10.855	18.774	2087.162	-1206.978	0.358
Wind 180 deg - Service		0.021	21.667	2408.418	-2.384	0.385
Wind 210 deg - Service		-10.819	18.754	2084.293	1202.978	0.308
Wind 225 deg - Service		-15.312	15.306	1700.928	1702.552	0.237
Wind 240 deg - Service		-18.760	10.816	1201.636	2086.133	0.149
Wind 270 deg - Service		-21.674	-0.021	-3.045	2410.441	-0.050
Wind 300 deg - Service		-18.781	-10.851	-1206.958	2089.003	-0.235
Wind 315 deg - Service		-15.341	-15.335	-1705.338	1706.610	-0.307
Wind 330 deg - Service		-10.855	-18.774	-2087.514	1207.948	-0.358

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice

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Comb. No.	Description
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 K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	154 - 134.83	Pole	Max Tension	6	0.000	0.000	-0.000
			Max. Compression	18	-10.048	0.630	0.364
			Max. Mx	14	-6.057	110.746	0.281
			Max. My	2	-6.064	0.456	110.497
			Max. Vy	14	-16.137	110.746	0.281
			Max. Vx	2	-16.076	0.456	110.497
			Max. Torque	28			
L2	134.83 - 89.16	Pole	Max Tension	1	0.000	0.000	-0.896
			Max. Compression	18	-31.132	0.685	0.168
			Max. Mx	14	-21.547	1452.711	2.649
			Max. My	2	-21.550	2.933	1450.657
			Max. Vy	14	-42.561	1452.711	2.649
			Max. Vx	2	-42.541	2.933	1450.657
			Max. Torque	10			
L3	89.16 - 44.54	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-49.107	0.685	0.168
			Max. Mx	14	-38.450	3597.397	5.025

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Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L4	44.54 - 1	Pole	Max. My	2	-38.452	5.340	3594.470
			Max. Vy	14	-52.530	3597.397	5.025
			Max. Vx	2	-52.510	5.340	3594.470
			Max. Torque	10			-0.978
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-71.510	0.685	0.168
			Max. Mx	14	-60.783	6327.794	7.742
			Max. My	2	-60.783	8.061	6323.880
			Max. Vy	14	-55.531	6327.794	7.742
			Max. Vx	2	-55.512	8.061	6323.880
			Max. Torque	10			-0.975

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	71.510	53.214	0.042
	Max. H _x	14	60.823	55.487	0.053
	Max. H _z	2	60.823	0.053	55.468
	Max. M _x	2	6323.880	0.053	55.468
	Max. M _z	6	6326.781	-55.487	-0.053
	Max. Torsion	2	0.974	0.053	55.468
	Min. Vert	1	60.823	0.000	0.000
	Min. H _x	6	60.823	-55.487	-0.053
	Min. H _z	10	60.823	-0.053	-55.468
	Min. M _x	10	-6323.512	-0.053	-55.468
	Min. M _z	14	-6327.794	55.487	0.053
	Min. Torsion	10	-0.975	-0.053	-55.468

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	60.823	0.000	0.000	-0.176	0.485	0.000
Dead+ Wind 0 deg - No Ice	60.823	-0.053	-55.468	-6323.880	8.060	-0.974
Dead+ Wind 30 deg - No Ice	60.823	27.698	-48.010	-5472.903	-3156.610	-0.782
Dead+ Wind 45 deg - No Ice	60.823	39.198	-39.184	-4466.382	-4468.241	-0.601
Dead+ Wind 60 deg - No Ice	60.823	48.026	-27.688	-3155.494	-5475.329	-0.380
Dead+ Wind 90 deg - No Ice	60.823	55.487	0.053	7.371	-6326.781	0.124
Dead+ Wind 120 deg - No Ice	60.823	48.079	27.780	3168.195	-5482.856	0.595
Dead+ Wind 135 deg - No Ice	60.823	39.272	39.259	4476.670	-4478.900	0.777
Dead+ Wind 150 deg - No Ice	60.823	27.789	48.063	5480.060	-3169.682	0.906
Dead+ Wind 180 deg - No Ice	60.823	0.053	55.468	6323.512	-7.053	0.975
Dead+ Wind 210 deg - No Ice	60.823	-27.698	48.010	5472.537	3157.621	0.781
Dead+ Wind 225 deg - No Ice	60.823	-39.198	39.184	4466.015	4469.253	0.600
Dead+ Wind 240 deg - No Ice	60.823	-48.026	27.688	3155.126	5476.342	0.379
Dead+ Wind 270 deg - No Ice	60.823	-55.487	-0.053	-7.742	6327.794	-0.125
Dead+ Wind 300 deg - No Ice	60.823	-48.079	-27.780	-3168.567	5483.866	-0.595
Dead+ Wind 315 deg - No Ice	60.823	-39.272	-39.259	-4477.042	4479.908	-0.776
Dead+ Wind 330 deg - No Ice	60.823	-27.789	-48.063	-5480.431	3170.690	-0.905
Dead+Ice+Temp	71.510	0.000	0.000	-0.168	0.685	0.000

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Load Combination	Vertical K	Shear _x K	Shear _y K	Overturning Moment, M _x kip-ft	Overturning Moment, M _y kip-ft	Torque kip-ft
Dead+Wind 0 deg+Ice+Temp	71.510	-0.042	-53.195	-6189.078	6.818	-0.965
Dead+Wind 30 deg+Ice+Temp	71.510	26.571	-46.047	-5356.884	-3090.164	-0.843
Dead+Wind 45 deg+Ice+Temp	71.510	37.598	-37.585	-4372.089	-4373.605	-0.692
Dead+Wind 60 deg+Ice+Temp	71.510	46.064	-26.561	-3089.353	-5358.939	-0.495
Dead+Wind 90 deg+Ice+Temp	71.510	53.214	0.042	5.915	-6191.584	-0.013
Dead+Wind 120 deg+Ice+Temp	71.510	46.106	26.634	3099.535	-5365.010	0.471
Dead+Wind 135 deg+Ice+Temp	71.510	37.658	37.644	4380.325	-4382.202	0.674
Dead+Wind 150 deg+Ice+Temp	71.510	26.644	46.089	5362.595	-3100.707	0.830
Dead+Wind 180 deg+Ice+Temp	71.510	0.042	53.195	6188.719	-5.372	0.966
Dead+Wind 210 deg+Ice+Temp	71.510	-26.571	46.047	5356.528	3091.612	0.842
Dead+Wind 225 deg+Ice+Temp	71.510	-37.598	37.585	4371.732	4375.055	0.692
Dead+Wind 240 deg+Ice+Temp	71.510	-46.064	26.561	3088.996	5360.390	0.494
Dead+Wind 270 deg+Ice+Temp	71.510	-53.214	-0.042	-6.275	6193.035	0.013
Dead+Wind 300 deg+Ice+Temp	71.510	-46.106	-26.634	-3099.898	5366.460	-0.471
Dead+Wind 315 deg+Ice+Temp	71.510	-37.658	-37.644	-4380.688	4383.650	-0.673
Dead+Wind 330 deg+Ice+Temp	71.510	-26.644	-46.089	-5362.957	3102.153	-0.829
Dead+Wind 0 deg - Service	60.823	-0.021	-21.667	-2472.840	3.466	-0.384
Dead+Wind 30 deg - Service	60.823	10.819	-18.754	-2140.090	-1233.963	-0.308
Dead+Wind 45 deg - Service	60.823	15.312	-15.306	-1746.529	-1746.830	-0.237
Dead+Wind 60 deg - Service	60.823	18.760	-10.816	-1233.954	-2140.615	-0.150
Dead+Wind 90 deg - Service	60.823	21.674	0.021	2.770	-2473.554	0.049
Dead+Wind 120 deg - Service	60.823	18.781	10.851	1238.700	-2143.569	0.234
Dead+Wind 135 deg - Service	60.823	15.341	15.335	1750.336	-1751.008	0.306
Dead+Wind 150 deg - Service	60.823	10.855	18.774	2142.673	-1239.081	0.357
Dead+Wind 180 deg - Service	60.823	0.021	21.667	2472.470	-2.445	0.384
Dead+Wind 210 deg - Service	60.823	-10.819	18.754	2139.722	1234.985	0.308
Dead+Wind 225 deg - Service	60.823	-15.312	15.306	1746.158	1747.851	0.237
Dead+Wind 240 deg - Service	60.823	-18.760	10.816	1233.583	2141.637	0.149
Dead+Wind 270 deg - Service	60.823	-21.674	-0.021	-3.141	2474.575	-0.049
Dead+Wind 300 deg - Service	60.823	-18.781	-10.851	-1239.072	2144.590	-0.234
Dead+Wind 315 deg - Service	60.823	-15.341	-15.335	-1750.707	1752.029	-0.306
Dead+Wind 330 deg - Service	60.823	-10.855	-18.774	-2143.046	1240.103	-0.357

Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.000	-60.823	0.000	0.000	60.823	0.000	0.000%
2	-0.053	-60.823	-55.468	0.053	60.823	55.468	0.000%
3	27.698	-60.823	-48.010	-27.698	60.823	48.010	0.000%
4	39.198	-60.823	-39.184	-39.198	60.823	39.184	0.000%
5	48.026	-60.823	-27.688	-48.026	60.823	27.688	0.000%
6	55.487	-60.823	0.053	-55.487	60.823	-0.053	0.000%
7	48.079	-60.823	27.780	-48.079	60.823	-27.780	0.000%
8	39.272	-60.823	39.259	-39.272	60.823	-39.259	0.000%
9	27.789	-60.823	48.063	-27.789	60.823	-48.063	0.000%
10	0.053	-60.823	55.468	-0.053	60.823	-55.468	0.000%
11	-27.698	-60.823	48.010	27.698	60.823	-48.010	0.000%
12	-39.198	-60.823	39.184	39.198	60.823	-39.184	0.000%
13	-48.026	-60.823	27.688	48.026	60.823	-27.688	0.000%
14	-55.487	-60.823	-0.053	55.487	60.823	0.053	0.000%
15	-48.079	-60.823	-27.780	48.079	60.823	27.780	0.000%
16	-39.272	-60.823	-39.259	39.272	60.823	39.259	0.000%
17	-27.789	-60.823	-48.063	27.789	60.823	48.063	0.000%
18	0.000	-71.510	0.000	0.000	71.510	0.000	0.000%
19	-0.042	-71.510	-53.195	0.042	71.510	53.195	0.000%
20	26.571	-71.510	-46.047	-26.571	71.510	46.047	0.000%

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Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
21	37.598	-71.510	-37.585	-37.598	71.510	37.585	0.000%
22	46.064	-71.510	-26.561	-46.064	71.510	26.561	0.000%
23	53.214	-71.510	0.042	-53.214	71.510	-0.042	0.000%
24	46.106	-71.510	26.634	-46.106	71.510	-26.634	0.000%
25	37.658	-71.510	37.644	-37.658	71.510	-37.644	0.000%
26	26.644	-71.510	46.089	-26.644	71.510	-46.089	0.000%
27	0.042	-71.510	53.195	-0.042	71.510	-53.195	0.000%
28	-26.571	-71.510	46.047	26.571	71.510	-46.047	0.000%
29	-37.598	-71.510	37.585	37.598	71.510	-37.585	0.000%
30	-46.064	-71.510	26.561	46.064	71.510	-26.561	0.000%
31	-53.214	-71.510	-0.042	53.214	71.510	0.042	0.000%
32	-46.106	-71.510	-26.634	46.106	71.510	26.634	0.000%
33	-37.658	-71.510	-37.644	37.658	71.510	37.644	0.000%
34	-26.644	-71.510	-46.089	26.644	71.510	46.089	0.000%
35	-0.021	-60.823	-21.667	0.021	60.823	21.667	0.000%
36	10.819	-60.823	-18.754	-10.819	60.823	18.754	0.000%
37	15.312	-60.823	-15.306	-15.312	60.823	15.306	0.000%
38	18.760	-60.823	-10.816	-18.760	60.823	10.816	0.000%
39	21.674	-60.823	0.021	-21.674	60.823	-0.021	0.000%
40	18.781	-60.823	10.851	-18.781	60.823	-10.851	0.000%
41	15.341	-60.823	15.335	-15.341	60.823	-15.335	0.000%
42	10.855	-60.823	18.774	-10.855	60.823	-18.774	0.000%
43	0.021	-60.823	21.667	-0.021	60.823	-21.667	0.000%
44	-10.819	-60.823	18.754	10.819	60.823	-18.754	0.000%
45	-15.312	-60.823	15.306	15.312	60.823	-15.306	0.000%
46	-18.760	-60.823	10.816	18.760	60.823	-10.816	0.000%
47	-21.674	-60.823	-0.021	21.674	60.823	0.021	0.000%
48	-18.781	-60.823	-10.851	18.781	60.823	10.851	0.000%
49	-15.341	-60.823	-15.335	15.341	60.823	15.335	0.000%
50	-10.855	-60.823	-18.774	10.855	60.823	18.774	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	0.00026912
3	Yes	5	0.00000001	0.00025874
4	Yes	5	0.00000001	0.00028494
5	Yes	5	0.00000001	0.00026462
6	Yes	4	0.00000001	0.00006686
7	Yes	5	0.00000001	0.00026520
8	Yes	5	0.00000001	0.00028601
9	Yes	5	0.00000001	0.00026029
10	Yes	4	0.00000001	0.00020889
11	Yes	5	0.00000001	0.00026595
12	Yes	5	0.00000001	0.00028503
13	Yes	5	0.00000001	0.00026022
14	Yes	4	0.00000001	0.00008609
15	Yes	5	0.00000001	0.00026218
16	Yes	5	0.00000001	0.00028626
17	Yes	5	0.00000001	0.00026696
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00010517
20	Yes	5	0.00000001	0.00059207
21	Yes	5	0.00000001	0.00066631

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22	Yes	5	0.00000001	0.00060320
23	Yes	5	0.00000001	0.00010399
24	Yes	5	0.00000001	0.00060320
25	Yes	5	0.00000001	0.00066854
26	Yes	5	0.00000001	0.00059583
27	Yes	5	0.00000001	0.00010476
28	Yes	5	0.00000001	0.00060552
29	Yes	5	0.00000001	0.00066672
30	Yes	5	0.00000001	0.00059451
31	Yes	5	0.00000001	0.00010409
32	Yes	5	0.00000001	0.00059972
33	Yes	5	0.00000001	0.00066942
34	Yes	5	0.00000001	0.00060698
35	Yes	4	0.00000001	0.00007107
36	Yes	4	0.00000001	0.00095349
37	Yes	5	0.00000001	0.00003721
38	Yes	4	0.00000001	0.00099411
39	Yes	4	0.00000001	0.00003881
40	Yes	4	0.00000001	0.00099642
41	Yes	5	0.00000001	0.00003744
42	Yes	4	0.00000001	0.00096286
43	Yes	4	0.00000001	0.00006607
44	Yes	5	0.00000001	0.00003334
45	Yes	5	0.00000001	0.00003726
46	Yes	4	0.00000001	0.00096409
47	Yes	4	0.00000001	0.00003974
48	Yes	4	0.00000001	0.00097781
49	Yes	5	0.00000001	0.00003759
50	Yes	5	0.00000001	0.00003355

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	154 - 134.83	36.226	48	2.025	0.002
L2	139.16 - 89.16	29.966	48	1.985	0.002
L3	94.83 - 44.54	13.688	48	1.383	0.001
L4	51.46 - 1	3.940	48	0.715	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.000	EEI Pine Branches	48	34.526	2.020	0.002	24750
140.000	EEI Pine Branches	48	30.315	1.990	0.002	8996
130.000	EEI Pine Branches	48	26.233	1.912	0.001	6402
120.000	EEI Pine Branches	48	22.340	1.789	0.001	5106
110.000	EEI Pine Branches	48	18.682	1.637	0.001	4247
100.000	EEI Pine Branches	48	15.307	1.470	0.001	3635
90.000	EEI Pine Branches	48	12.261	1.303	0.000	3349
80.000	EEI Pine Branches	48	9.573	1.144	0.000	3281

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Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	154 - 134.83	92.432	15	5.170	0.006
L2	139.16 - 89.16	76.480	15	5.069	0.004
L3	94.83 - 44.54	34.969	15	3.534	0.001
L4	51.46 - 1	10.072	15	1.829	0.000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.000	EEI Pine Branches	15	88.099	5.157	0.005	9884
140.000	EEI Pine Branches	15	77.369	5.081	0.004	3591
130.000	EEI Pine Branches	15	66.967	4.882	0.003	2548
120.000	EEI Pine Branches	15	57.040	4.570	0.003	2028
110.000	EEI Pine Branches	15	47.710	4.182	0.002	1683
100.000	EEI Pine Branches	15	39.099	3.757	0.002	1437
90.000	EEI Pine Branches	15	31.326	3.331	0.001	1322
80.000	EEI Pine Branches	15	24.464	2.923	0.001	1293

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L _n ft	Kl/r	F _a ksi	A in ²	Actual P K	Allow. P _a K	Ratio P P _a
L1	154 - 134.83 (1)	TP30.03x25.25x0.188	19.170	0.000	0.0	38.627	17.118	-6.053	661.204	0.009
L2	134.83 - 89.16 (2)	TP40.91x28.575x0.313	50.000	0.000	0.0	39.000	38.880	-21.542	1516.330	0.014
L3	89.16 - 44.54 (3)	TP51.28x38.886x0.5	50.290	0.000	0.0	39.000	77.881	-38.447	3037.370	0.013
L4	44.54 - 1 (4)	TP61x48.575x0.563	50.460	0.000	0.0	39.000	107.904	-60.783	4208.240	0.014

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	154 - 134.83 (1)	TP30.03x25.25x0.188	110.847	10.934	38.627	0.283	0.000	0.000	38.627	0.000
L2	134.83 - 89.16 (2)	TP40.91x28.575x0.313	1454.42 5	46.414	39.000	1.190	0.000	0.000	39.000	0.000
L3	89.16 - 44.54	TP51.28x38.886x0.5	3600.95	45.924	39.000	1.178	0.000	0.000	39.000	0.000

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	Client	AT&T Mobility	Designed by	TJL

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 $\frac{f_{by}}{F_{by}}$
L4	44.54 - 1 (4)	TP61x48.575x0.563	0 6333.51 7	47.297	39.000	1.213	0.000	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	154 - 134.83 (1)	TP30.03x25.25x0.188	16.169	0.945	26.000	0.073	0.000	0.000	26.000	0.000
L2	134.83 - 89.16 (2)	TP40.91x28.575x0.313	42.603	1.096	26.000	0.084	0.597	0.009	26.000	0.000
L3	89.16 - 44.54 (3)	TP51.28x38.886x0.5	52.572	0.675	26.000	0.052	0.595	0.004	26.000	0.000
L4	44.54 - 1 (4)	TP61x48.575x0.563	55.574	0.515	26.000	0.040	0.776	0.003	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P P_a	Ratio f_{bx} F_{bx}	Ratio f_{by} F_{by}	Ratio f_v F_v	Ratio f_{vt} F_{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	154 - 134.83 (1)	0.009	0.283	0.000	0.073	0.000	0.294	1.333	H1-3+VT ✓
L2	134.83 - 89.16 (2)	0.014	1.190	0.000	0.084	0.000	1.206	1.333	H1-3+VT ✓
L3	89.16 - 44.54 (3)	0.013	1.178	0.000	0.052	0.000	1.191	1.333	H1-3+VT ✓
L4	44.54 - 1 (4)	0.014	1.213	0.000	0.040	0.000	1.228	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	154 - 134.83	Pole	TP30.03x25.25x0.188	1	-6.053	881.385	22.0	Pass
L2	134.83 - 89.16	Pole	TP40.91x28.575x0.313	2	-21.542	2021.268	90.5	Pass
L3	89.16 - 44.54	Pole	TP51.28x38.886x0.5	3	-38.447	4048.814	89.3	Pass
L4	44.54 - 1	Pole	TP61x48.575x0.563	4	-60.783	5609.584	92.1	Pass
							Summary	
							Pole (L4)	Pass
							RATING = 92.1	Pass

Anchor Bolt and Base Plate Analysis:**Input Data:**Tower Reactions:

Overturning Moment =	OM := 6334-ft-kips	(Input From RisaTower)
Shear Force =	Shear := 56-kips	(Input From RisaTower)
Axial Force =	Axial := 61-kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 28	(User Input)
Diameter of Bolt Circle =	D _{bc} := 68.0-in	(User Input)
Bolt "Column" Distance =	l := 3.0-in	(User Input)
Bolt Ultimate Strength =	F _u := 100-ksi	(User Input)
Bolt Yield Strength =	F _y := 75-ksi	(User Input)
Bolt Modulus =	E := 29000-ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25-in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 Mod 60

Plate Yield Strength =	F _{ybp} := 60-ksi	(User Input)
Base Plate Thickness =	t _{bp} := 3.0-in	(User Input)
Base Plate Diameter =	D _{bp} := 74.0-in	(User Input)
Outer Pole Diameter =	D _{pole} := 61.0-in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 34\text{-in}$$

Distance to Bolts =

$$i := 1..N$$

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

$$d_1 = 7.57\text{-in}$$

$$d_7 = 34.00\text{-in}$$

$$d_2 = 14.75\text{-in}$$

$$d_8 = 33.15\text{-in}$$

$$d_3 = 21.20\text{-in}$$

$$d_9 = 30.63\text{-in}$$

$$d_4 = 26.58\text{-in}$$

$$d_{10} = 26.58\text{-in}$$

$$d_5 = 30.63\text{-in}$$

$$d_{11} = 21.20\text{-in}$$

$$d_6 = 33.15\text{-in}$$

etc.

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 30.5\text{-in}$$

Moment Arms of Bolts about Neutral Axis =

$$MA_i := \text{if}(d_i \geq R_{pole}, d_i - R_{pole}, 0\text{in})$$

$$MA_1 = 0.00\text{-in}$$

$$MA_7 = 3.50\text{-in}$$

$$MA_2 = 0.00\text{-in}$$

$$MA_8 = 2.65\text{-in}$$

$$MA_3 = 0.00\text{-in}$$

$$MA_9 = 0.13\text{-in}$$

$$MA_4 = 0.00\text{-in}$$

$$MA_{10} = 0.00\text{-in}$$

$$MA_5 = 0.13\text{-in}$$

$$MA_{11} = 0.00\text{-in}$$

$$MA_6 = 2.65\text{-in}$$

etc

Effective Width of Baseplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 33.5\text{-in}$$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i (d_i)^2 = 1.618 \times 10^4 \cdot \text{in}^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot \text{in}^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot \text{in}}{n} \right)^2 = 3.248 \cdot \text{in}^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 2.033 \cdot \text{in}$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.508 \cdot \text{in}$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.826 \cdot \text{in}^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{\text{Max}} := OM \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 157.5 \cdot \text{kips}$

Allowable Tensile Force = $T_{\text{ALL.Gross}} := 1.333 \cdot (0.33 \cdot A_g \cdot F_u) = 174.9 \cdot \text{kips}$ (1.333 increase allowed per TIA/EIA)

$T_{\text{ALL.Net}} := 1.333 \cdot (0.60 \cdot A_n \cdot F_y) = 194.812 \cdot \text{kips}$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} = 80.8\%$ Bolts are "upset bolts". Use net area per AISC

Condition1 = $\text{Condition1} := \text{if} \left(\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} \leq 1.00, \text{"OK"}, \text{"Overstressed"} \right)$

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{\text{Shear}}{N} \right) \cdot l = 0.5 \cdot \text{ft} \cdot \text{kips}$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 7.3 \cdot \text{ksi}$

Allowable Bending Stress = $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 60 \cdot \text{ksi}$ (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

Per ASCE Manual 72: "If the clearance between the base plate and concrete does not exceed two times the bolt diameter a bending stress analysis of the bolts is NOT normally required."

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 161.9 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 49.8 \text{ ksi}$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{F_y}} = 87.364$$

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

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 60 \text{ ksi} \quad (1.333 \text{ increase allowed per TIA/EIA})$$

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = 83.1\%$$

Condition 2 =

$$\text{Condition2} := \text{if } \left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \leq 1.00, \text{"OK"}, \text{"Overstressed"} \right)$$

Condition2 = "OK"

Base Plate Analysis:

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

$C_1 = 37.7 \text{ kips}$

$C_7 = 161.9 \text{ kips}$

$C_2 = 71.5 \text{ kips}$

$C_8 = 157.9 \text{ kips}$

$C_3 = 101.7 \text{ kips}$

$C_9 = 146.0 \text{ kips}$

$C_4 = 127.0 \text{ kips}$

$C_{10} = 127.0 \text{ kips}$

$C_5 = 146.0 \text{ kips}$

$C_{11} = 101.7 \text{ kips}$

$C_6 = 157.9 \text{ kips}$

etc.

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{(B_{eff} t_{bp})^2} = 28.7 \text{ ksi}$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot F_{ybp} = 59.9 \text{ ksi}$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 47.9\%$$

Condition3 =

$$\text{Condition3} := \text{if} \left(\frac{f_{bp}}{F_{bp}} < 1.00, \text{"Ok"}, \text{"Overstressed"} \right)$$

Condition3 = "Ok"

Standard Monopole Foundation:**Input Data:**Tower Data

Overturning Moment =	OM := 6334-ft-kips	(User Input from RISATower)
Shear Force =	Shear := 56-kip	(User Input from RISATower)
Axial Force =	Axial := 61-kip	(User Input from RISATower)
Tower Height =	H _t := 153-ft	(User Input)

Footing Data:

Overall Depth of Footing =	D _f := 6.5-ft	(User Input)
Length of Pier =	L _p := 3.5-ft	(User Input)
Extension of Pier Above Grade =	L _{pag} := 1-ft	(User Input)
Diameter of Pier =	d _p := 7.5-ft	(User Input)
Thickness of Footing =	T _f := 4-ft	(User Input)
Width of Footing =	W _f := 32-ft	(User Input)

Anchor Bolt Data:

Length of Anchor Bolts =	L _{st} := 96-in	(User Input)
Projection of Anchor Bolts Above Pier =	A _{BP} := 12-in	(User Input)
Anchor Bolt Diameter =	d _{anchor} := 2.25-in	(User Input)
Base Plate Bolt Circle =	MP := 68.0-in	(User Input)

Material Properties:

Concrete Compressive Strength =	f _c := 3000-psi	(User Input)
Steel Reinforcement Yield Strength =	f _y := 60000-psi	(User Input)
Anchor Bolt Yield Strength =	f _{ya} := 75000-psi	(User Input)
Internal Friction Angle of Soil =	Φ _s := 10-deg	(User Input)
Allowable Soil Bearing Capacity =	q _s := 6000-psf	(User Input)
Unit Weight of Soil =	γ _{soil} := 100-pcf	(User Input)
Unit Weight of Concrete =	γ _{conc} := 150-pcf	(User Input)
Foundation Bouyancy =	Bouyancy := 0	(User Input) (Yes=1 / No=0)
Depth to Neglect =	n := 1-ft	(User Input)
Cohesion of Clay Type Soil =	c := 0-ksf	(User Input) (Use 0 for Sandy Soil)
Seismic Zone Factor =	Z := 2	(User Input) (UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	μ := 0.45	(User Input)

Pier Reinforcement:

Bar Size =	$BS_{\text{pier}} := 11$	(User Input)	
Bar Diameter =	$d_{\text{bpier}} := 1.41\text{-in}$	(User Input)	
Number of Bars =	$NB_{\text{pier}} := 36$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{\text{pier}} := 3\text{-in}$	(User Input)	
Reinforcement Location Factor =	$\alpha_{\text{pier}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{\text{pier}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{\text{pier}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{\text{pier}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{\text{Tie}} := 3\text{-in}$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{\text{top}} := 11$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{\text{btop}} := 1.41\text{-in}$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{\text{top}} := 42$	(User Input)	(Top of Pad)
Bar Size =	$BS_{\text{bot}} := 11$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{\text{bbot}} := 1.41\text{-in}$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{\text{bot}} := 42$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{\text{pad}} := 3.0\text{-in}$	(User Input)	
Reinforcement Location Factor =	$\alpha_{\text{pad}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{\text{pad}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{\text{pad}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{\text{pad}} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =	$A_{\text{bpier}} := \frac{\pi \cdot d_{\text{bpier}}^2}{4} = 1.561\text{-in}^2$	
Pad Top Reinforcement Bar Area =	$A_{\text{btop}} := \frac{\pi \cdot d_{\text{btop}}^2}{4} = 1.561\text{-in}^2$	
Pad Bottom Reinforcement Bar Area =	$A_{\text{bbot}} := \frac{\pi \cdot d_{\text{bbot}}^2}{4} = 1.561\text{-in}^2$	
Coefficient of Lateral Soil Pressure =	$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 1.42$	
Load Factor =	$LF := \begin{cases} 1.333 & \text{if } H_t \leq 700\text{-ft} \\ 1.7 & \text{if } H_t \geq 1200\text{-ft} \\ 1.333 + \left(\frac{H_t - 700\text{ft}}{1200\text{ft} - 700\text{ft}} \right) \cdot 0.4 & \text{otherwise} \end{cases}$	= 1.333