



August 17, 2011
Revised: November 9, 2011

Mr. Douglas Fetkowitz
OVERLAND CONTRACTING (BLACK & VEATCH)
45 Eisenhower Drive, Suite 240
Paramus, New Jersey 07652

Re: **Kendall Park – 062D4331**
3960 Route 1
South Brunswick, NJ 08901
FPA No. 1771.038R1

Dear Mr. Fetkowitz:

French & Parrello Associates, P.A. has analyzed the following 185' monopole in accordance with Electronics Industry Association Standard EIA/TIA-222G.

Tower:	Valmont Tower, Inc. 185' Monopole
Location:	South Brunswick, NJ
Site:	062U4331
County:	Middlesex
State:	New Jersey
Code:	EIA/TIA-222G
Design Windspeed:	95 mph
	50 mph w/ 1" radial ice
Exposure Category:	B

Discrete Attachments:

Existing 1	- Lightning Rod	@ 185'
Existing 1	- 4' whip w/ Mount	@ 185'
Existing 1	- 15' Low Profile Platform	@ 180'
Existing 3	- Kathrein 800 10504	@ 180'
Existing 3	- 10' Face T- Arm Mount	@ 165' (AT&T)
Existing 12	- 4' Panel Antenna	@ 165' (AT&T)
Remove 12	- 4' Panel Antenna	@ 165' (AT&T)
Proposed 12	- P65-15-XLH-RR LTE Antenna	@ 165' (AT&T)
Proposed 6	- RRH Units	@ 165' (AT&T)
Existing 3	- 4' Panel Antenna Flush Mount	@ 150' (T-Mobile)
Existing 3	- TMA	@ 150' (T-Mobile)
Existing 3	- 5' Face T- Arm Mount	@ 130' (ClearWire)
Existing 3	- 4' Panel Antenna	@ 130' (ClearWire)

Existing 4	- 1' Diameter Dish	@ 130' (ClearWire)
Existing 1	- RFS BMR10-A-B1 w/ Mount	@ 100'
Existing 1	- DB810KE-XT w/ Mount	@ 100'
Existing 1	- GPS	@ 50'

Linear Attachments:

Existing 1	- 1 $\frac{5}{8}$ " Cable	10' to 185'
Existing 6	- 1 $\frac{5}{8}$ " Cable	10' to 180'
Existing 12	- 1 $\frac{5}{8}$ " Cable	10' to 165'
Proposed 3	- 2" Innerduct	10' to 165'
Existing 12	- 1 $\frac{1}{4}$ " Cable	10' to 150'
Existing 3	- 1 $\frac{5}{8}$ " Cable	10' to 130'
Existing 1	- $\frac{7}{8}$ " Cable	10' to 100'
Existing 1	- 1 $\frac{5}{8}$ " Cable	10' to 100'
Existing 1	- $\frac{7}{8}$ " Cable	10' to 50'

The monopole dimensions were obtained from tower report by Valmont dated November 8, 1999, and a tower analysis and reinforcement design report by KMB dated March 10, 2010. The existing antenna types obtained from a KMB tower analysis and reinforcement design report dated March 10, 2010 and observed in the field on August 11, 2011 by French & Parrello Associates, P.A. The antenna types are as assumed and if different, FPA should be notified immediately. The monopole was assumed to be made of steel with a minimum yield stress of 65,000 psi. The 185' existing monopole consists of four 12 sided sections that are 57"φ at the base of the pole and tapered to a 13.6"φ at the top of the pole. The four monopole sections have thicknesses of 0.4375", 0.3750", 0.3125", and 0.2188" respectively from base to top of the pole. The monopole is reinforced with four 0.25" x 4" plates from elevation 132.8' to 147.8' above the base. The base of the monopole was observed to have a 2-1/4" thick round base plate with (16) 2-1/4" anchor bolts and (16) 1/2" x 7" stiffener plates. For additional information on the geometry of the monopole, refer to the attached analysis. No allowance has been assumed for damaged, rusted, or missing members. All members have been assumed to have no deficiencies. If the existing conditions differ, FPA should be immediately notified to reevaluate the structure.

The analysis was performed with the future arrangement of equipment (@±165') in place as shown above. The proposed configuration calls for (12) existing antennas (@±165') to be removed and replaced with (12) new LTE antennas and RRH units (@±165'). The new cables will be routed on the outside face of the monopole. The analysis was performed under the code requirements set by ANSI/TIA/EIA-222G. This analysis assumes the wind blowing from three different directions (i.e., normal, 60°, and 90° to the face). Based on our analysis, the tower was calculated to be at 83.3% of its allowable structural capacity, and is structurally adequate to support the proposed loads.

The foundation was observed in the field to be a 7'-0" diameter caisson foundation having an unknown depth. The maximum factored foundation loads at the base of the tower with the current configuration is 42.4 kips of compression, 29.7 kips of shear, and 3,296 kip-ft of moment. The original nominal design reactions with an applied factor of safety of 2 and corresponding reduction factors is 59.1 kips of compression, 60.6 kips of shear, and 6,619 kip-ft of moment. Based on our analysis, the foundation was calculated to be at 72% of its allowable structural capacity and the foundation is structurally adequate to support the proposed loads.

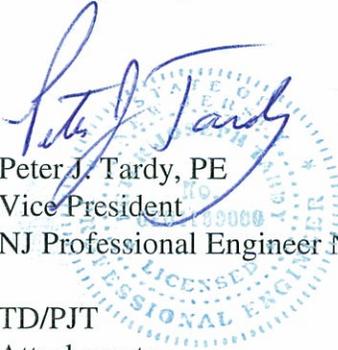
Should you have any questions or comments, please do not hesitate to contact us.

Very truly yours,

FRENCH & PARRELLO ASSOCIATES, P.A.



Timothy R. Donahue
Staff Engineer
Building Design Services



Peter J. Tardy, PE
Vice President
NJ Professional Engineer No. 41990

TD/PJT
Attachments

CHECK FOUNDATION:

ORIGINAL DESIGN REACTIONS (PER VALMONT REPORT DATED 11/12/99)

$$M = 4413 \text{ k-ft}$$

$$V = 40.4 \text{ kip}$$

$$P = 39.4 \text{ kip}$$

PER TIA-6 9.4

ASSUME F.S. = 2

$$M_u = 8826 \text{ k-ft} \times 0.75 = 6619 \text{ k-ft}$$

$$V_u = 80.8 \text{ kip} \times 0.75 = 60.6 \text{ kip}$$

$$P_u = 78.8 \text{ kip} \times 0.75 = 59.1 \text{ kip}$$

FROM REVISED TOWER REPORT

$$M_u = 3,296 \text{ k-ft} / 6619 \text{ k-ft} = 0.50$$

$$V_u = 29.7 \text{ kip} / 60.6 \text{ kip} = 0.49$$

$$P_u = 42.4 \text{ kip} / 59.1 = 0.72$$

∴ FOUNDATION IS AT 72% CAPACITY

OK

$$P_{\text{MAX}} = \text{ICE} + \text{SERVICE} \quad P = 78.9 \text{ kip}$$

$$M = 989 \text{ k-ft}$$

$$V = 7.9 \text{ kip}$$

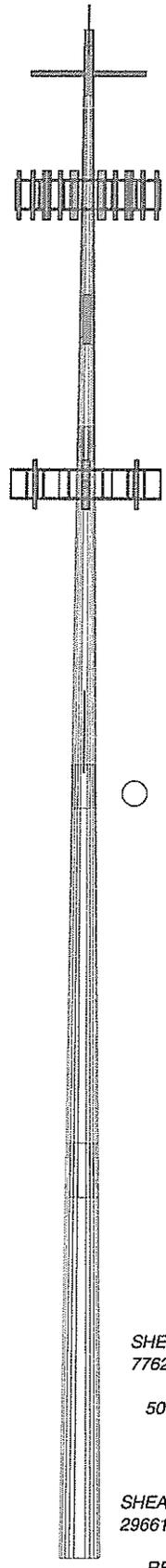
⇒ FPA'S EXPERIENCE $P_u \gg$ DUE TO
REQUIRED MOMENT CAPACITY.

∴ 78.9 kip w/ SERVICE LOADS

OK

Length (ft)	50.08	52.50	46.33	15.00	37.17
Number of Sides	12	12	12	12	12
Thickness (in)	0.4375	0.3750	0.3125	0.2675	0.2188
Socket Length (ft)		6.58	5.33	4.17	
Top Dia (in)	45.3627	34.6396	25.0208	22.8499	13.5630
Bot Dia (in)	57.8751	47.7667	36.5963	26.5976	22.8499
Grade		A572-65			
Weight (lb)	28609.1	8806.2	4837.8	1075.2	1602.9

185.0 ft
147.8 ft
132.8 ft
90.7 ft
43.5 ft
0.0 ft



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Generic Lightning Rod 4' copper	185	(3) RRH AWS 2X40 (80W) (ATI)	165
4' Whip	185	(3) APXV18-206517-C (T-Mobile)	150
PiROD 15' Low Profile Platform (Monopole) (Metro)	180	(3) TMA (T-Mobile)	150
(3) 800 10504 (Metro)	180	(3) 2' Standoff T-Arm (5' face width) (ClearWire)	130
(3) 742 351 (Metro)	180	(3) Flat Panel 48"x8" (ClearWire)	130
(3) 2' Standoff T-Arm (10' face width) (ATI)	165	(4) 1' Dia Dish (ClearWire)	130
(12) P65-15-XLH-RR (ATI)	165	BMR10-A-81	100
(3) RRH 700 MHz 2X40 (80W) (ATI)	165	DB810KE-XT	100
		(2) GPS (Metro)	50

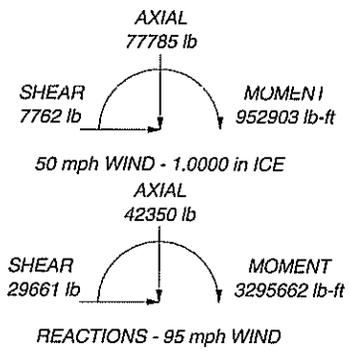
MATERIAL STRENGTH

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

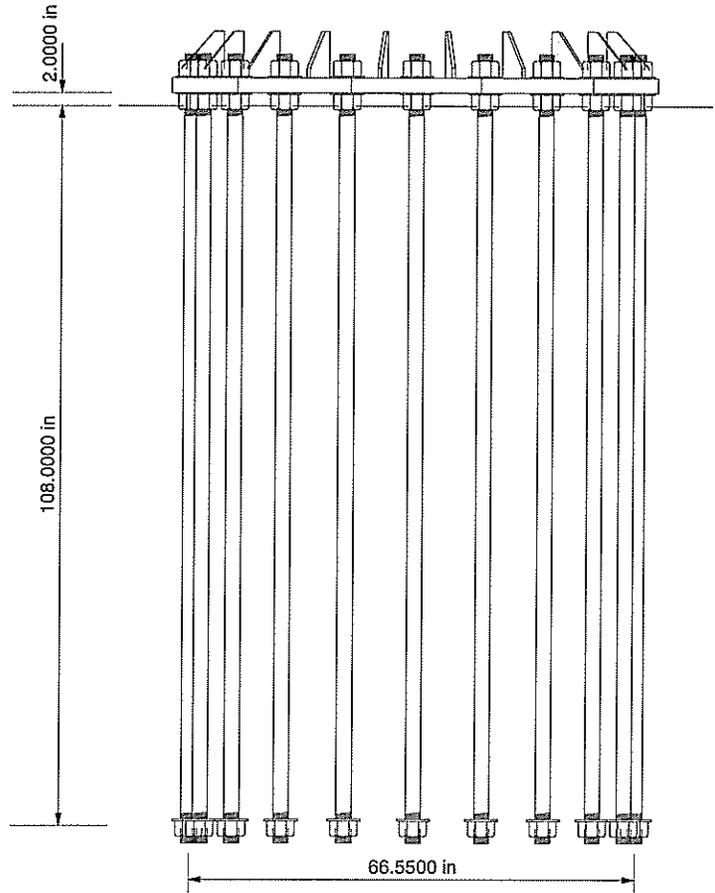
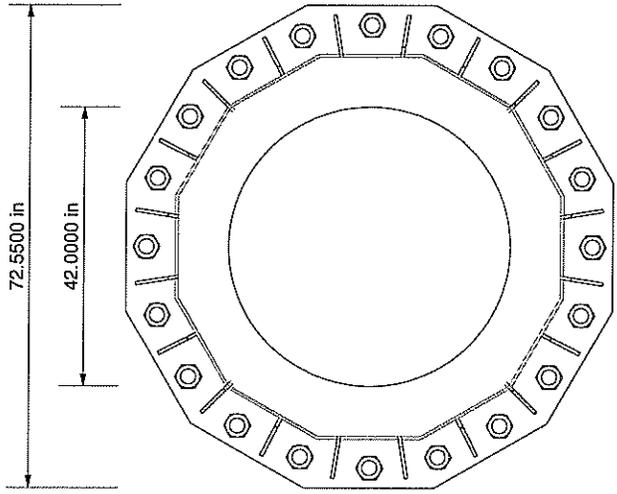
TOWER DESIGN NOTES

1. Tower is located in Middlesex County, New Jersey.
2. Tower designed for Exposure B to the TIA-222-G Standard.
3. Tower designed for a 95 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. TOWER RATING: 83.3%

ALL REACTIONS ARE FACTORED



French and Parrello 1800 Route 34, Suite 101 Wall, NJ 07719 Phone: 732.312.9688 FAX: 732.312.9801	Job: 1771.038 - 062U4331 Route 1 Monmouth Junct
	Project: 185' Monopole
	Client: AT&T (Black & Veatch) Drawn by: Timothy Donahue App'd:
	Code: TIA-222-G Date: 11/09/11 Scale: NT:
	Path: _____ Dwg No. E-



FOUNDATION NOTES

1. Plate thickness is 2.2500 in.
2. Plate grade is A633-60.
3. Anchor bolt grade is A615-75.
4. f'c is 4 ksi.

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	Project: 185' Monopole		
	Client: AT&T (Black & Veatch)	Drawn by: Timothy Donahue	App'd:
	Code: TIA-222-G	Date: 11/09/11	Scale: NT
	Path:	Dwg No. 2-	

RISATower French and Parrello 1800 Route 34, Suite 101 Wall, NJ 07719 Phone: 732.312.9688 FAX: 732.312.9801	Job 1771.038 - 062U4331 Route 1 Monmouth Junction	Page 1 of 18
	Project 185' Monopole	Date 15:50:28 11/09/11
	Client AT&T (Black & Veatch)	Designed by Timothy.Donahue

Tower Input Data

There is a pole section.

This tower is designed using the TIA-222-G standard.

The following design criteria apply:

- Tower is located in Middlesex County, New Jersey.
- Basic wind speed of 95 mph.
- Structure Class II.
- Exposure Category B.
- Topographic Category 1.
- Crest Height 0.00 ft.
- Nominal ice thickness of 1.0000 in.
- Ice thickness is considered to increase with height.
- Ice density of 56 pcf.
- A wind speed of 50 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 60 mph.
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in pole design is 1.
- 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	185.00-147.83	37.17	0.00	12	13.5630	22.8499	0.2188	0.8752	A572-65 (65 ksi)
L2	147.83-132.83	15.00	4.17	12	22.8499	26.5976	0.2675	1.0700	A572-65 (65 ksi)
L3	132.83-90.67	46.33	5.33	12	25.0208	36.5963	0.3125	1.2500	A572-65

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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
L4	90.67-43.50	52.50	6.58	12	34.6396	47.7567	0.3750	1.5000	(65 ksi) A572-65 (65 ksi)
L5	43.50-0.00	50.08		12	45.3627	57.8751	0.4375	1.7500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in ²	I in ⁴	r in	C in	I/C in ³	J in ⁴	I/Q in ²	w in	w/t
L1	14.0415	9.4015	213.6814	4.7772	7.0256	30.4145	432.9765	4.6271	3.0485	13.933
	23.6560	15.9444	1042.3321	8.1019	11.8362	88.0627	2112.0475	7.8474	5.5374	25.308
L2	23.6560	19.4514	1266.1230	8.0845	11.8362	106.9700	2565.5084	9.5734	5.4069	20.213
	27.5359	22.6795	2006.8971	9.4262	13.7776	145.6640	4066.5177	11.1621	6.4113	23.967
L3	26.9820	24.8627	1937.3976	8.8456	12.9608	149.4818	3925.6928	12.2367	5.8681	18.778
	37.8873	36.5106	6135.2139	12.9896	18.9569	323.6405	12431.6066	17.9694	8.9703	28.705
L4	37.2402	41.3745	6200.2578	12.2667	17.9433	345.5471	12563.4032	20.3633	8.2784	22.076
	49.4414	57.2134	16394.7391	16.9626	24.7380	662.7361	33220.1863	28.1587	11.7938	31.45
L5	48.6649	63.2883	16303.8118	16.0832	23.4979	693.8423	33035.9429	31.1486	10.9847	25.108
	59.9167	80.9153	34072.9212	20.5627	29.9793	1136.5476	69040.9760	39.8240	14.3380	32.773

Tower Elevation ft	Gusset Area ft ² (per face)	Gusset Thickness in	Gusset Grade	Adjust. Factor A _f	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontal in
L1 185.00-147.83				1	1	1		
L2 147.83-132.83				1	1	1		
L3 132.83-90.67				1	1	1		
L4 90.67-43.50				1	1	1		
L5 43.50-0.00				1	1	1		

Monopole Base Plate Data

Base Plate Data

Base plate is square	
Base plate is grouted	
Anchor bolt grade	A615-75
Anchor bolt size	2.2500 in
Number of bolts	20
Embedment length	108.0000 in
f _c	4.0 ksi
Grout space	2.0000 in
Base plate grade	A633-60
Base plate thickness	2.2500 in
Bolt circle diameter	66.5500 in
Outer diameter	72.5500 in
Inner diameter	42.0000 in
Base plate type	Stiffened Plate

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Base Plate Data	
Bolts per stiffener	1
Stiffener thickness	0.5000 in
Stiffener height	7.0000 in

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight plf
LDF12-50A (2-1/4 FOAM) (AT&T)	C	Surface Ar (CaAa)	165.00 - 10.00	2	2	0.000 0.000	2.3500		1.22
LDF7-50A (1-5/8 FOAM) (Metro)	C	Surface Ar (CaAa)	180.00 - 10.00	2	2	0.000 0.000	1.9800		0.82

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C _{AA} ft ² /ft	Weight plf
LDF5-50A (7/8 FOAM)	C	No	Inside Pole	185.00 - 10.00	1	No Ice 1/2" Ice 1" Ice 0.00 0.00 0.00	0.33 0.33 0.33
LDF7-50A (1-5/8 FOAM) (AT&T)	C	No	Inside Pole	165.00 - 10.00	12	No Ice 1/2" Ice 1" Ice 0.00 0.00 0.00	0.82 0.82 0.82
LDF7-50A (1-5/8 FOAM) (T-Mobile)	C	No	Inside Pole	150.00 - 10.00	6	No Ice 1/2" Ice 1" Ice 0.00 0.00 0.00	0.82 0.82 0.82
LDF7-50A (1-5/8 FOAM) (ClearWire)	C	No	Inside Pole	130.00 - 10.00	3	No Ice 1/2" Ice 1" Ice 0.00 0.00 0.00	0.82 0.82 0.82

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 lb
L1	185.00-147.83	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	20.809	0.000	286.55
L2	147.83-132.83	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	12.990	0.000	287.55
L3	132.83-90.67	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	36.511	0.000	904.96
L4	90.67-43.50	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	40.849	0.000	1020.29
L5	43.50-0.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	29.011	0.000	724.61

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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 lb
L1	185.00-147.83	A	2.349	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	54.989	0.000	1126.39
L2	147.83-132.83	A	2.311	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	33.571	0.000	795.30
L3	132.83-90.67	A	2.258	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	94.358	0.000	2332.07
L4	90.67-43.50	A	2.145	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	104.308	0.000	2566.92
L5	43.50-0.00	A	1.913	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	72.199	0.000	1750.02

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K _a No Ice	K _a Ice
L1	5	LDF12-50A (2-1/4 FOAM)	147.83 - 165.00	1.0000	1.0000
L1	6	LDF7-50A (1-5/8 FOAM)	147.83 - 180.00	1.0000	1.0000
L2	5	LDF12-50A (2-1/4 FOAM)	132.83 - 147.83	1.0000	1.0000
L2	6	LDF7-50A (1-5/8 FOAM)	132.83 - 147.83	1.0000	1.0000
L3	5	LDF12-50A (2-1/4 FOAM)	90.67 - 132.83	1.0000	1.0000
L3	6	LDF7-50A (1-5/8 FOAM)	90.67 - 132.83	1.0000	1.0000
L4	5	LDF12-50A (2-1/4 FOAM)	43.50 - 90.67	1.0000	1.0000
L4	6	LDF7-50A (1-5/8 FOAM)	43.50 - 90.67	1.0000	1.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment °	Placement ft	C _{AA} Front ft ²	C _{AA} Side ft ²	Weight lb
Generic Lightning Rod 4' copper	C	None			185.00	No Ice	0.50	0.00
						1/2" Ice	1.00	0.00
						1" Ice	1.50	0.00
4' Whip	C	None			185.00	No Ice	0.40	8.00

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	Project 185' Monopole	Date 15:50:28 11/09/11
	Client AT&T (Black & Veatch)	Designed by Timothy.Donahue

Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C _{AA} Front	C _{AA} Side	Weight
			Horz	Lateral					
			ft	ft	°	ft	ft ²	ft ²	lb
						1/2" Ice	0.81	0.81	11.77
						1" Ice	1.06	1.06	18.23
PiROD 15' Low Profile Platform (Monopole) (Metro)	C	None			0.0000	No Ice	17.30	17.30	1500.00
(3) 800 10504 (Metro)	C	None			0.0000	1/2" Ice	22.10	22.10	2030.00
						1" Ice	26.90	26.90	2560.00
(3) 742 351 (Metro)	C	None			0.0000	No Ice	3.35	1.86	17.60
						1/2" Ice	3.70	2.19	35.63
						1" Ice	4.05	2.52	57.94
(3) 2' Standoff T-Arm (10' face width) (AT&T)	C	None			0.0000	No Ice	5.89	1.73	13.50
(12) P65-15-XLH-RR (AT&T)	C	None			0.0000	1/2" Ice	6.30	2.04	40.80
						1" Ice	6.72	2.36	72.57
(3) RRH 700 MHz 2X40 (80W) (AT&T)	C	None			0.0000	No Ice	5.50	5.50	129.00
(3) RRH AWS 2X40 (80W) (AT&T)	C	None			0.0000	1/2" Ice	6.90	6.90	170.00
						1" Ice	8.30	8.30	211.00
(3) APXV18-206517-C (T-Mobile)	C	None			0.0000	No Ice	5.95	3.08	41.00
(3) TMA (T-Mobile)	C	None			0.0000	1/2" Ice	6.36	3.41	75.35
						1" Ice	6.78	3.74	114.37
(3) 2' Standoff T-Arm (5' face width) (ClearWire)	C	None			0.0000	No Ice	2.49	2.21	51.00
(3) Flat Panel 48"x8" (ClearWire)	C	None			0.0000	1/2" Ice	2.71	2.42	72.38
						1" Ice	2.94	2.63	96.81
DB810KE-XT	C	None			0.0000	No Ice	2.92	2.19	43.00
						1/2" Ice	3.16	2.41	65.04
						1" Ice	3.41	2.65	90.25
BMR10-A-B1	C	None			0.0000	No Ice	5.05	3.07	26.40
						1/2" Ice	5.50	3.50	52.63
(2) GPS (Metro)	C	None			0.0000	1" Ice	5.96	3.94	84.37
						No Ice	0.97	0.29	8.00
						1/2" Ice	1.11	0.38	13.96
						1" Ice	1.25	0.48	21.61
						No Ice	3.50	3.50	91.00
						1/2" Ice	4.20	4.20	120.00
						1" Ice	4.90	4.90	149.00
						No Ice	3.73	1.31	24.00
						1/2" Ice	4.10	1.60	41.99
						1" Ice	4.48	1.90	63.93
						No Ice	3.63	3.63	35.00
						1/2" Ice	5.10	5.10	61.88
						1" Ice	6.60	6.60	98.03
						No Ice	8.38	8.38	83.00
						1/2" Ice	9.16	9.16	141.06
						1" Ice	9.95	9.95	207.89
						No Ice	0.67	0.67	25.00
						1/2" Ice	0.83	0.83	32.64
						1" Ice	1.01	1.01	42.16

Dishes

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Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft	Aperture Area ft ²	Weight lb
(4) 1' Dia Dish (ClearWire)		Paraboloid w/o Radome	None		0.0000		130.00	1.00	No Ice 1/2" Ice 1" Ice	20.00 24.73 29.46

Tower Pressures - No Ice

$G_H = 1.100$

Section Elevation ft	z ft	K _Z	q _z psf	A _G ft ²	F a c e ft ²	A _F ft ²	A _R ft ²	A _{leg} ft ²	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
L1 185.00-147.83	164.98	1.14	25.0	58.384	A	0.000	58.384	58.384	100.00	0.000	0.000
					B	0.000	58.384	100.00	0.000	0.000	
					C	0.000	58.384	100.00	20.809	0.000	
L2 147.83-132.83	140.14	1.088	23.9	31.995	A	0.000	31.995	31.995	100.00	0.000	0.000
					B	0.000	31.995	100.00	0.000	0.000	
					C	0.000	31.995	100.00	12.990	0.000	
L3 132.83-90.67	110.85	1.018	22.3	113.954	A	0.000	113.954	113.954	100.00	0.000	0.000
					B	0.000	113.954	100.00	0.000	0.000	
					C	0.000	113.954	100.00	36.511	0.000	
L4 90.67-43.50	66.58	0.88	19.2	170.365	A	0.000	170.365	170.365	100.00	0.000	0.000
					B	0.000	170.365	100.00	0.000	0.000	
					C	0.000	170.365	100.00	40.849	0.000	
L5 43.50-0.00	21.12	0.7	15.5	196.804	A	0.000	196.804	196.804	100.00	0.000	0.000
					B	0.000	196.804	100.00	0.000	0.000	
					C	0.000	196.804	100.00	29.011	0.000	

Tower Pressure - With Ice

$G_H = 1.100$

Section Elevation ft	z ft	K _Z	q _z psf	t _z in	A _G ft ²	F a c e ft ²	A _F ft ²	A _R ft ²	A _{leg} ft ²	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
L1 185.00-147.83	164.98	1.14	6.9	2.3492	72.937	A	0.000	72.937	72.937	100.00	0.000	0.000
						B	0.000	72.937	100.00	0.000	0.000	
						C	0.000	72.937	100.00	54.989	0.000	
L2 147.83-132.83	140.14	1.088	6.6	2.3112	37.773	A	0.000	37.773	37.773	100.00	0.000	0.000
						B	0.000	37.773	100.00	0.000	0.000	
						C	0.000	37.773	100.00	33.571	0.000	
L3 132.83-90.67	110.85	1.018	6.2	2.2576	130.194	A	0.000	130.194	130.194	100.00	0.000	0.000
						B	0.000	130.194	100.00	0.000	0.000	
						C	0.000	130.194	100.00	94.358	0.000	
L4 90.67-43.50	66.58	0.88	5.3	2.1454	188.114	A	0.000	188.114	188.114	100.00	0.000	0.000
						B	0.000	188.114	100.00	0.000	0.000	
						C	0.000	188.114	100.00	104.308	0.000	
L5 43.50-0.00	21.12	0.7	4.3	1.9127	212.358	A	0.000	212.358	212.358	100.00	0.000	0.000
						B	0.000	212.358	100.00	0.000	0.000	
						C	0.000	212.358	100.00	72.199	0.000	

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	Client AT&T (Black & Veatch)	Designed by Timothy.Donahue

Tower Pressure - Service

$G_H = 1.100$

Section Elevation ft	z ft	K_z	q_z psf	A_G ft ²	Face A B C	A_F ft ²	A_R ft ²	A_{leg} ft ²	Leg %	C_{AA} In Face ft ²	C_{AA} Out Face ft ²
L1 185.00-147.83	164.98	1.14	8.9	58.384	A	0.000	58.384	58.384	100.00	0.000	0.000
					B	0.000	58.384	100.00	0.000	0.000	
					C	0.000	58.384	100.00	20.809	0.000	
L2 147.83-132.83	140.14	1.088	8.5	31.995	A	0.000	31.995	31.995	100.00	0.000	0.000
					B	0.000	31.995	100.00	0.000	0.000	
					C	0.000	31.995	100.00	12.990	0.000	
L3 132.83-90.67	110.85	1.018	8.0	113.954	A	0.000	113.954	113.954	100.00	0.000	0.000
					B	0.000	113.954	100.00	0.000	0.000	
					C	0.000	113.954	100.00	36.511	0.000	
L4 90.67-43.50	66.58	0.88	6.9	170.365	A	0.000	170.365	170.365	100.00	0.000	0.000
					B	0.000	170.365	100.00	0.000	0.000	
					C	0.000	170.365	100.00	40.849	0.000	
L5 43.50-0.00	21.12	0.7	5.5	196.804	A	0.000	196.804	196.804	100.00	0.000	0.000
					B	0.000	196.804	100.00	0.000	0.000	
					C	0.000	196.804	100.00	29.011	0.000	

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face A B C	e	C_F	q_z psf	D_F	D_R	A_E ft ²	F lb	w plf	Ctrl. Face
L1 185.00-147.83	286.55	1602.90	A	1	1	25.0	1	1	58.384	1606.32	43.22	C
			B	1	1	1	1	58.384				
			C	1	1	1	1	58.384				
L2 147.83-132.83	287.55	1075.22	A	1	1	23.9	1	1	31.995	840.66	56.04	C
			B	1	1	1	1	31.995				
			C	1	1	1	1	31.995				
L3 132.83-90.67	904.96	4837.79	A	1	1	22.3	1	1	113.954	2795.51	66.31	C
			B	1	1	1	1	113.954				
			C	1	1	1	1	113.954				
L4 90.67-43.50	1020.29	8806.19	A	1	1	19.2	1	1	170.365	3597.83	76.27	C
			B	1	1	1	1	170.365				
			C	1	1	1	1	170.365				
L5 43.50-0.00	724.61	12287.00	A	1	1	15.5	1	1	196.804	3362.91	77.31	C
			B	1	1	1	1	196.804				
			C	1	1	1	1	196.804				
Sum Weight:	3223.95	28609.10						OTM	1003274.5 7 lb-ft	12203.23		

Tower Forces - No Ice - Wind 60 To Face

RISATower French and Parrello 1800 Route 34, Suite 101 Wall, NJ 07719 Phone: 732.312.9688 FAX: 732.312.9801	Job 1771.038 - 062U4331 Route 1 Monmouth Junction	Page 8 of 18
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Section Elevation ft	Add Weight lb	Self Weight lb	F a c e	e	C _F	q _z psf	D _F	D _R	A _E ft ²	F lb	w plf	Ctrl. Face
L1 185.00-147.83	286.55	1602.90	A	1	1	25.0	1	1	58.384	1606.32	43.22	C
			B	1	1		1	1	58.384			
			C	1	1		1	1	58.384			
L2 147.83-132.83	287.55	1075.22	A	1	1	23.9	1	1	31.995	840.66	56.04	C
			B	1	1		1	1	31.995			
			C	1	1		1	1	31.995			
L3 132.83-90.67	904.96	4837.79	A	1	1	22.3	1	1	113.954	2795.51	66.31	C
			B	1	1		1	1	113.954			
			C	1	1		1	1	113.954			
L4 90.67-43.50	1020.29	8806.19	A	1	1	19.2	1	1	170.365	3597.83	76.27	C
			B	1	1		1	1	170.365			
			C	1	1		1	1	170.365			
L5 43.50-0.00	724.61	12287.00	A	1	1	15.5	1	1	196.804	3362.91	77.31	C
			B	1	1		1	1	196.804			
			C	1	1		1	1	196.804			
Sum Weight:	3223.95	28609.10						OTM	1003274.5 7 lb-ft	12203.23		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	F a c e	e	C _F	q _z psf	D _F	D _R	A _E ft ²	F lb	w plf	Ctrl. Face
L1 185.00-147.83	286.55	1602.90	A	1	1	25.0	1	1	58.384	1840.08	49.50	C
			B	1	1		1	1	58.384			
			C	1	1.146		1	1	58.384			
L2 147.83-132.83	287.55	1075.22	A	1	1	23.9	1	1	31.995	1008.79	67.25	C
			B	1	1		1	1	31.995			
			C	1	1.2		1	1	31.995			
L3 132.83-90.67	904.96	4837.79	A	1	1	22.3	1	1	113.954	3076.45	72.97	C
			B	1	1		1	1	113.954			
			C	1	1.1		1	1	113.954			
L4 90.67-43.50	1020.29	8806.19	A	1	1	19.2	1	1	170.365	3597.83	76.27	C
			B	1	1		1	1	170.365			
			C	1	1		1	1	170.365			
L5 43.50-0.00	724.61	12287.00	A	1	1	15.5	1	1	196.804	3362.91	77.31	C
			B	1	1		1	1	196.804			
			C	1	1		1	1	196.804			
Sum Weight:	3223.95	28609.10						OTM	1096545.4 5 lb-ft	12886.06		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	F a c e	e	C _F	q _z psf	D _F	D _R	A _E ft ²	F lb	w plf	Ctrl. Face
L1	1126.39	3850.54	A	1	1.2	6.9	1	1	72.937	667.06	17.95	C

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	Project 185' Monopole	Date 15:50:28 11/09/11
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Section Elevation ft	Add Weight lb	Self Weight lb	F a c e	e	C _F	q _z psf	D _F	D _R	A _E ft ²	F lb	w plf	Ctrl. Face
185.00-147.83			B	1	1.2		1	1	72.937			
L2	795.30	2248.85	C	1	1.2		1	1	72.937			
147.83-132.83			A	1	1.2	6.6	1	1	37.773	329.91	21.99	C
			B	1	1.2		1	1	37.773			
L3	2332.07	8840.99	C	1	1.2		1	1	37.773			
132.83-90.67			A	1	1.2	6.2	1	1	130.194	1061.69	25.18	C
			B	1	1.2		1	1	130.194			
L4	2566.92	14383.22	C	1	1.2		1	1	130.194			
90.67-43.50			A	1	1.2	5.3	1	1	188.114	1320.55	28.00	C
			B	1	1.2		1	1	188.114			
L5 43.50-0.00	1750.02	17950.11	C	1	1.2		1	1	188.114			
			A	1	1.2	4.3	1	1	212.358	1206.21	27.73	C
			B	1	1.2		1	1	212.358			
			C	1	1.2		1	1	212.358			
Sum Weight:	8570.71	47273.72						OTM	387370.94 lb-ft	4585.41		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	F a c e	e	C _F	q _z psf	D _F	D _R	A _E ft ²	F lb	w plf	Ctrl. Face
L1	1126.39	3850.54	A	1	1.2	6.9	1	1	72.937	667.06	17.95	C
185.00-147.83			B	1	1.2		1	1	72.937			
			C	1	1.2		1	1	72.937			
L2	795.30	2248.85	A	1	1.2	6.6	1	1	37.773	329.91	21.99	C
147.83-132.83			B	1	1.2		1	1	37.773			
			C	1	1.2		1	1	37.773			
L3	2332.07	8840.99	A	1	1.2	6.2	1	1	130.194	1061.69	25.18	C
132.83-90.67			B	1	1.2		1	1	130.194			
			C	1	1.2		1	1	130.194			
L4	2566.92	14383.22	A	1	1.2	5.3	1	1	188.114	1320.55	28.00	C
90.67-43.50			B	1	1.2		1	1	188.114			
			C	1	1.2		1	1	188.114			
L5 43.50-0.00	1750.02	17950.11	A	1	1.2	4.3	1	1	212.358	1206.21	27.73	C
			B	1	1.2		1	1	212.358			
			C	1	1.2		1	1	212.358			
Sum Weight:	8570.71	47273.72						OTM	387370.94 lb-ft	4585.41		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	F a c e	e	C _F	q _z psf	D _F	D _R	A _E ft ²	F lb	w plf	Ctrl. Face
L1	1126.39	3850.54	A	1	1.2	6.9	1	1	72.937	876.60	23.58	C
185.00-147.83			B	1	1.2		1	1	72.937			

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	Client AT&T (Black & Veatch)	Designed by Timothy.Donahue

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z	D _F	D _R	A _E	F	w	Ctrl. Face
ft	lb	lb	e			psf			ft ²	lb	plf	
L2 147.83-132.83	795.30	2248.85	C	1	1.2	6.6	1	1	72.937	452.08	30.14	C
			A	1	1.2				37.773			
			B	1	1.2				37.773			
L3 132.83-90.67	2332.07	8840.99	C	1	1.2	6.2	1	1	37.773	1382.29	32.79	C
			A	1	1.2				130.194			
			B	1	1.2				130.194			
L4 90.67-43.50	2566.92	14383.22	C	1	1.2	5.3	1	1	130.194	1320.55	28.00	C
			A	1	1.2				188.114			
			B	1	1.2				188.114			
L5 43.50-0.00	1750.02	17950.11	C	1	1.2	4.3	1	1	188.114	1206.21	27.73	C
			A	1	1.2				212.358			
			B	1	1.2				212.358			
Sum Weight:	8570.71	47273.72	C	1	1.2			1	212.358			
								OTM	474602.85	5237.74		
									lb-ft			

Tower Forces - Service - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z	D _F	D _R	A _E	F	w	Ctrl. Face
ft	lb	lb	e			psf			ft ²	lb	plf	
L1 185.00-147.83	286.55	1602.90	A	1	1	8.9	1	1	58.384	573.30	15.42	C
			B	1	1				58.384			
			C	1	1				58.384			
L2 147.83-132.83	287.55	1075.22	A	1	1	8.5	1	1	31.995	300.03	20.00	C
			B	1	1				31.995			
			C	1	1				31.995			
L3 132.83-90.67	904.96	4837.79	A	1	1	8.0	1	1	113.954	997.73	23.67	C
			B	1	1				113.954			
			C	1	1				113.954			
L4 90.67-43.50	1020.29	8806.19	A	1	1	6.9	1	1	170.365	1284.08	27.22	C
			B	1	1				170.365			
			C	1	1				170.365			
L5 43.50-0.00	724.61	12287.00	A	1	1	5.5	1	1	196.804	1200.23	27.59	C
			B	1	1				196.804			
			C	1	1				196.804			
Sum Weight:	3223.95	28609.10										
								OTM	358072.04	4355.37		
									lb-ft			

Tower Forces - Service - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z	D _F	D _R	A _E	F	w	Ctrl. Face
ft	lb	lb	e			psf			ft ²	lb	plf	
L1 185.00-147.83	286.55	1602.90	A	1	1	8.9	1	1	58.384	573.30	15.42	C
			B	1	1		1	1	58.384			
			C	1	1		1	1	58.384			

RISATower

French and Parrello
 1800 Route 34, Suite 101
 Wall, NJ 07719
 Phone: 732.312.9688
 FAX: 732.312.9801

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Project	185' Monopole	Date	15:50:28 11/09/11
Client	AT&T (Black & Veatch)	Designed by	Timothy.Donahue

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z	D _F	D _R	A _E	F	w	Ctrl. Face
ft	lb	lb				psf			ft ²	lb	plf	
L2 147.83-132.83	287.55	1075.22	A	1	1	8.5	1	1	31.995	300.03	20.00	C
			B	1	1		1	1	31.995			
			C	1	1		1	1	31.995			
L3 132.83-90.67	904.96	4837.79	A	1	1	8.0	1	1	113.954	997.73	23.67	C
			B	1	1		1	1	113.954			
			C	1	1		1	1	113.954			
L4 90.67-43.50	1020.29	8806.19	A	1	1	6.9	1	1	170.365	1284.08	27.22	C
			B	1	1		1	1	170.365			
			C	1	1		1	1	170.365			
L5 43.50-0.00	724.61	12287.00	A	1	1	5.5	1	1	196.804	1200.23	27.59	C
			B	1	1		1	1	196.804			
			C	1	1		1	1	196.804			
Sum Weight:	3223.95	28609.10						OTM	358072.04 lb-ft	4355.37		

Tower Forces - Service - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z	D _F	D _R	A _E	F	w	Ctrl. Face
ft	lb	lb				psf			ft ²	lb	plf	
L1 185.00-147.83	286.55	1602.90	A	1	1	8.9	1	1	58.384	656.73	17.67	C
			B	1	1		1	1	58.384			
			C	1	1.146		1	1	58.384			
L2 147.83-132.83	287.55	1075.22	A	1	1	8.5	1	1	31.995	360.04	24.00	C
			B	1	1		1	1	31.995			
			C	1	1.2		1	1	31.995			
L3 132.83-90.67	904.96	4837.79	A	1	1	8.0	1	1	113.954	1098.00	26.04	C
			B	1	1		1	1	113.954			
			C	1	1.1		1	1	113.954			
L4 90.67-43.50	1020.29	8806.19	A	1	1	6.9	1	1	170.365	1284.08	27.22	C
			B	1	1		1	1	170.365			
			C	1	1		1	1	170.365			
L5 43.50-0.00	724.61	12287.00	A	1	1	5.5	1	1	196.804	1200.23	27.59	C
			B	1	1		1	1	196.804			
			C	1	1		1	1	196.804			
Sum Weight:	3223.95	28609.10						OTM	391360.73 lb-ft	4599.08		

Force Totals

Load Case	Vertical Forces	Sum of Forces X	Sum of Forces Z	Sum of Overturning Moments, M _x	Sum of Overturning Moments, M _z	Sum of Torques
	lb	lb	lb	lb-ft	lb-ft	lb-ft
Leg Weight	28609.10					
Bracing Weight	0.00					
Total Member Self-Weight	28609.10			0.00	0.00	
Total Weight	35291.55			0.00	0.00	

RISATower

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Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M _x lb-ft	Sum of Overturning Moments, M _z lb-ft	Sum of Torques lb-ft
Wind 0 deg - No Ice		0.00	-17855.40	-1902304.11	0.00	0.00
Wind 90 deg - No Ice		18538.24	0.00	0.00	-1995575.00	0.00
Wind 180 deg - No Ice		0.00	17855.40	1902304.11	0.00	0.00
Member Ice	18664.62					
Total Weight Ice	68843.54			0.00	0.00	
Wind 0 deg - Ice		0.00	-7109.97	-788298.55	0.00	0.00
Wind 90 deg - Ice		7762.29	0.00	0.00	-875530.46	0.00
Wind 180 deg - Ice		0.00	7109.97	788298.55	0.00	0.00
Total Weight	35291.55			0.00	0.00	
Wind 0 deg - Service		0.00	-6372.65	-678938.69	0.00	0.00
Wind 90 deg - Service		6616.36	0.00	0.00	-712227.38	0.00
Wind 180 deg - Service		0.00	6372.65	678938.69	0.00	0.00

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 90 deg - No Ice
5	0.9 Dead+1.6 Wind 90 deg - No Ice
6	1.2 Dead+1.6 Wind 180 deg - No Ice
7	0.9 Dead+1.6 Wind 180 deg - No Ice
8	1.2 Dead+1.0 Ice+1.0 Temp
9	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
10	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
11	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
12	Dead+Wind 0 deg - Service
13	Dead+Wind 90 deg - Service
14	Dead+Wind 180 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
L1	185 - 147.83	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-16855.14	0.00	0.00
			Max. Mx	4	-4626.04	-210423.07	0.00
			Max. My	2	-4712.77	0.00	203533.12
			Max. Vy	4	10902.63	-210423.07	0.00
			Max. Vx	2	-10508.75	0.00	203533.12
L2	147.83 - 132.83	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-19229.96	0.00	0.00
			Max. Mx	4	-5787.24	-334830.76	0.00
			Max. My	2	-5888.29	0.00	322648.69
			Max. Vy	4	12097.75	-334830.76	0.00
			Max. Vx	2	-11510.72	0.00	322648.69
L3	132.83 - 90.67	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-33324.37	0.00	0.00
			Max. Mx	4	-12932.82	-969635.08	0.00

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Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft			
L4	90.67 - 43.5	Pole	Max. My	2	-13040.61	0.00	923131.44			
			Max. Vy	4	18555.86	-969635.08	0.00			
			Max. Vx	2	-17491.54	0.00	923131.44			
			Max Tension	1	0.00	0.00	0.00			
			Max. Compression	8	-51798.76	0.00	0.00			
			Max. Mx	4	-24385.86	-1948912.2	0.00			
						2				
						Max. My	2	-24442.55	0.00	1850777.06
			Max. Vy	4	24025.13	-1948912.2	0.00			
							2			
L5	43.5 - 0	Pole	Max. Vx	2	-22902.42	0.00	1850777.06			
			Max Tension	1	0.00	0.00	0.00			
			Max. Compression	8	-77784.61	0.00	0.00			
			Max. Mx	4	-42333.41	-3295662.2	0.00			
						7				
						Max. My	2	-42334.76	0.00	3141868.11
						Max. Vy	4	29684.65	-3295662.2	0.00
										7
			Max. Vx	2	-28591.02	0.00	3141868.11			

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Pole	Max. Vert	10	77784.61	-7762.40	0.00
	Max. H _x	14	35291.55	0.00	-6372.65
	Max. H _z	2	42349.86	0.00	28568.65
	Max. M _x	2	3141868.11	0.00	28568.65
	Max. M _z	4	3295662.27	-29661.18	0.00
	Max. Torsion	1	0.00	0.00	0.00
	Min. Vert	3	31762.39	0.00	28568.64
	Min. H _x	4	42349.86	-29661.18	0.00
	Min. H _z	6	42349.86	0.00	-28568.65
	Min. M _x	6	-3141868.11	0.00	-28568.65
	Min. M _z	1	0.00	0.00	0.00
	Min. Torsion	1	0.00	0.00	0.00

Tower Mast Reaction Summary

Load Combination	Vertical lb	Shear _x lb	Shear _z lb	Overturning Moment, M _x lb-ft	Overturning Moment, M _z lb-ft	Torque lb-ft
Dead Only	35291.55	0.00	0.00	0.00	0.00	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	42349.86	0.00	-28568.65	-3141868.11	0.00	0.00
0.9 Dead+1.6 Wind 0 deg - No Ice	31762.39	0.00	-28568.64	-3115612.14	0.00	0.00
1.2 Dead+1.6 Wind 90 deg - No Ice	42349.86	29661.18	0.00	0.00	-3295662.27	0.00
0.9 Dead+1.6 Wind 90 deg - No Ice	31762.39	29661.18	0.00	0.00	-3268092.36	0.00
1.2 Dead+1.6 Wind 180 deg -	42349.86	0.00	28568.65	3141868.11	0.00	0.00

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Load Combination	Vertical lb	Shear _x lb	Shear _z lb	Overturing Moment, M _x lb-ft	Overturing Moment, M _z lb-ft	Torque lb-ft
No Ice						
0.9 Dead+1.6 Wind 180 deg - No Ice	31762.39	0.00	28568.64	3115612.14	0.00	0.00
1.2 Dead+1.0 Ice+1.0 Temp	77784.61	0.00	0.00	0.00	0.00	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	77784.61	0.00	-7110.07	-858078.39	0.00	0.00
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	77784.61	7762.40	0.00	0.00	-952903.44	0.00
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	77784.61	0.00	7110.07	858078.39	0.00	0.00
Dead+Wind 0 deg - Service	35291.55	0.00	-6372.65	-697749.49	0.00	0.00
Dead+Wind 90 deg - Service	35291.55	6616.36	0.00	0.00	-731988.15	0.00
Dead+Wind 180 deg - Service	35291.55	0.00	6372.65	697749.49	0.00	0.00

Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX lb	PY lb	PZ lb	PX lb	PY lb	PZ lb	
1	0.00	-35291.55	0.00	0.00	35291.55	0.00	0.000%
2	0.00	-42349.85	-28568.64	0.00	42349.86	28568.65	0.000%
3	0.00	-31762.39	-28568.64	0.00	31762.39	28568.64	0.000%
4	29661.18	-42349.85	0.00	-29661.18	42349.86	0.00	0.000%
5	29661.18	-31762.39	0.00	-29661.18	31762.39	0.00	0.000%
6	0.00	-42349.85	28568.64	0.00	42349.86	-28568.65	0.000%
7	0.00	-31762.39	28568.64	0.00	31762.39	-28568.64	0.000%
8	0.00	-77784.61	0.00	0.00	77784.61	0.00	0.000%
9	0.00	-77784.61	-7109.97	0.00	77784.61	7110.07	0.000%
10	7762.29	-77784.61	0.00	-7762.40	77784.61	0.00	0.000%
11	0.00	-77784.61	7109.97	0.00	77784.61	-7110.07	0.000%
12	0.00	-35291.55	-6372.65	0.00	35291.55	6372.65	0.000%
13	6616.36	-35291.55	0.00	-6616.36	35291.55	0.00	0.000%
14	0.00	-35291.55	6372.65	0.00	35291.55	-6372.65	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	0.00023508
3	Yes	4	0.00000001	0.00007202
4	Yes	4	0.00000001	0.00024530
5	Yes	4	0.00000001	0.00007328
6	Yes	4	0.00000001	0.00023508
7	Yes	4	0.00000001	0.00007202
8	Yes	4	0.00000001	0.00000001
9	Yes	5	0.00000001	0.00052422
10	Yes	5	0.00000001	0.00057811
11	Yes	5	0.00000001	0.00052422
12	Yes	4	0.00000001	0.00002243
13	Yes	4	0.00000001	0.00002371
14	Yes	4	0.00000001	0.00002243

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Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	185 - 147.83	28.709	13	1.4974	0.0000
L2	147.83 - 132.83	17.565	13	1.2772	0.0000
L3	137 - 90.67	14.804	13	1.1549	0.0000
L4	96 - 43.5	6.700	13	0.7116	0.0000
L5	50.08 - 0	1.706	13	0.3170	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
185.00	Generic Lightning Rod 4' copper	13	28.709	1.4974	0.0000	34975
180.00	PIROD 15' Low Profile Platform (Monopole)	13	27.132	1.4781	0.0000	34975
165.00	(3) 2' Standoff T-Arm (10' face width)	13	22.488	1.4088	0.0000	8743
150.00	(3) APXV18-206517-C	13	18.153	1.2984	0.0000	5026
130.00	(4) 1' Dia Dish	13	13.163	1.0737	0.0000	5445
100.00	DB810KE-XT	13	7.334	0.7513	0.0000	5793
50.00	(2) GPS	13	1.701	0.3164	0.0000	6616

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	185 - 147.83	129.251	4	6.7519	0.0000
L2	147.83 - 132.83	79.109	4	5.7571	0.0000
L3	137 - 90.67	66.682	4	5.2058	0.0000
L4	96 - 43.5	30.187	4	3.2074	0.0000
L5	50.08 - 0	7.687	4	1.4283	0.0000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
185.00	Generic Lightning Rod 4' copper	4	129.251	6.7519	0.0000	7945
180.00	PIROD 15' Low Profile Platform (Monopole)	4	122.158	6.6646	0.0000	7945
165.00	(3) 2' Standoff T-Arm (10' face width)	4	101.262	6.3514	0.0000	1983
150.00	(3) APXV18-206517-C	4	81.755	5.8528	0.0000	1136

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Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
130.00	(4) 1' Dia Dish	4	59.293	4.8399	0.0000	1225
100.00	DB810KE-XT	4	33.041	3.3863	0.0000	1294
50.00	(2) GPS	4	7.663	1.4257	0.0000	1469

Base Plate Design Data

Plate Thickness	Number of Anchor Bolts	Anchor Bolt Size	Actual Allowable Ratio Bolt Tension	Actual Allowable Ratio Bolt Compression	Actual Allowable Ratio Plate Stress	Actual Allowable Ratio Stiffener Stress	Controlling Condition	Ratio
in		in	lb	lb	ksi	ksi		
2.2500	20	2.2500	116735.16	120968.50	15.38	45.00	Stiff	0.83
			268385.28	445519.56	54.00	54.00		✓
			0.43	0.27	0.28	0.83		

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L _u	Kl/r	A	P _u	φP _n	Ratio P _u /φP _n
	ft		ft	ft		in ²	lb	lb	
L1	185 - 147.83 (1)	TP22.8499x13.563x0.2188	37.17	185.00	274.0	15.9444	-4626.04	47975.60	0.096
L2	147.83 - 132.83 (2)	TP26.5976x22.8499x0.2675	15.00	185.00	245.2	21.7820	-5787.24	81834.60	0.071
L3	132.83 - 90.67 (3)	TP36.5963x25.0208x0.3125	46.33	185.00	177.4	35.1705	-12932.80	252421.00	0.051
L4	90.67 - 43.5 (4)	TP47.7567x34.6396x0.375	52.50	185.00	139.0	53.8676	-23244.30	629809.00	0.037
L5	43.5 - 0 (5)	TP57.8751x45.3627x0.4375	50.08	185.00	108.0	80.9153	-42333.40	4520780.00	0.009

Pole Bending Design Data

Section No.	Elevation	Size	M _{ux}	φM _{ux}	Ratio M _{ux} /φM _{ux}	M _{uy}	φM _{uy}	Ratio M _{uy} /φM _{uy}
	ft		lb-ft	lb-ft		lb-ft	lb-ft	
L1	185 - 147.83 (1)	TP22.8499x13.563x0.2188	210423.33	429305.83	0.490	0.00	429305.83	0.000
L2	147.83 - 132.83 (2)	TP26.5976x22.8499x0.2675	334830.83	654755.00	0.511	0.00	654755.00	0.000
L3	132.83 - 90.67 (3)	TP36.5963x25.0208x0.3125	969633.33	1463583.33	0.663	0.00	1463583.33	0.000
L4	90.67 - 43.5 (4)	TP47.7567x34.6396x0.375	1841841.67	2862616.67	0.643	0.00	2862616.67	0.000
L5	43.5 - 0 (5)	TP57.8751x45.3627x0.4375	3295658.33	5291625.00	0.623	0.00	5291625.00	0.000

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Section No.	Elevation ft	Size	M_{ix} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ix}}{\phi M_{nx}}$	M_{iy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{iy}}{\phi M_{ny}}$
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Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V_u lb	ϕV_n lb	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u lb-ft	ϕT_n lb-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	185 - 147.83 (1)	TP22.8499x13.563x0.2188	10902.60	466374.00	0.023	0.00	870500.00	0.000
L2	147.83 - 132.83 (2)	TP26.5976x22.8499x0.2675	12097.80	637125.00	0.019	0.00	1327641.67	0.000
L3	132.83 - 90.67 (3)	TP36.5963x25.0208x0.3125	18555.90	1028740.00	0.018	0.00	2967691.67	0.000
L4	90.67 - 43.5 (4)	TP47.7567x34.6396x0.375	23759.10	1593690.00	0.015	0.00	5804500.00	0.000
L5	43.5 - 0 (5)	TP57.8751x45.3627x0.4375	29684.70	2260390.00	0.013	0.00	10729750.00	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P_u ϕP_n	Ratio M_{ux} ϕM_{nx}	Ratio M_{uy} ϕM_{ny}	Ratio V_u ϕV_n	Ratio T_u ϕT_n	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	185 - 147.83 (1)	0.096	0.490	0.000	0.023	0.000	0.587	1.000	4.8.2 ✓
L2	147.83 - 132.83 (2)	0.071	0.511	0.000	0.019	0.000	0.582	1.000	4.8.2 ✓
L3	132.83 - 90.67 (3)	0.051	0.663	0.000	0.018	0.000	0.714	1.000	4.8.2 ✓
L4	90.67 - 43.5 (4)	0.037	0.643	0.000	0.015	0.000	0.681	1.000	4.8.2 ✓
L5	43.5 - 0 (5)	0.009	0.623	0.000	0.013	0.000	0.632	1.000	4.8.2 ✓

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
L1	185 - 147.83	Pole	TP22.8499x13.563x0.2188	1	-4626.04	47975.60	58.7	Pass
L2	147.83 - 132.83	Pole	TP26.5976x22.8499x0.2675	2	-5787.24	81834.60	58.2	Pass
L3	132.83 - 90.67	Pole	TP36.5963x25.0208x0.3125	3	-12932.80	252421.00	71.4	Pass
L4	90.67 - 43.5	Pole	TP47.7567x34.6396x0.375	4	-23244.30	629809.00	68.1	Pass
L5	43.5 - 0	Pole	TP57.8751x45.3627x0.4375	5	-42333.40	4520780.00	63.2	Pass
Summary								
Pole (L3)							71.4	Pass

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Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
						Base Plate	83.3	Pass
						RATING =	83.3	Pass

Element Map

Section No.	Section Elevation ft	Component Type	Element List
L1	185.00-147.83	Pole	1
L2	147.83-132.83	Pole	2
L3	132.83-90.67	Pole	3
L4	90.67-43.50	Pole	4
L5	43.50-0.00	Pole	5
			Total number of elements: 5