Apex Engineers, Inc.

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Phone: (630) 627-1800
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October 7, 2015

Mr. Kenneth Stockero
Mastec Network Solutions
1351 E. Irving Park Road
Itasca, IL 60143

Subject: AT&T Site # WI1206 - AWE - MILWAUKEE FIRE DEPARTMENT
Project: LTE 2C
8814 W Lisbon Avenue
Milwaukee, WI 53222
Apex File # GM09-080

Dear Mr. Stockero,

Further to your request, we are pleased to submit our report regarding the structural analysis of the existing 195 ft. monopole in Milwaukee, Wisconsin for the proposed replacement of (3) existing AT&T with (3) new LTE antennas and (3) RRUS w/ A2 boxes mounted to existing platform at 157 feet elevation. Below is the revised configuration of AT&T antennas:

AT&T low-profile platform at 157' elevation:

- Existing (3) CSS XDUO4-80-R antennas, (3) Andrew SBNH-1D6565A antennas w/ (12) TMAs, and (1) RAYCAP
- Proposed (3) Commscope SBNHH-1D65B antennas, (3) RRUS and (3) A2 boxes fed by existing (12) 1-5/8" coax & DC/fiber bundle

In our analysis, we also included existing antennas as listed in section 6.0 of attached report.

With the proposed antenna arrangement, we are pleased to inform that the monopole and monopole foundation satisfy the structural strength requirements of TIA-222-G Code. All new access holes, if required shall be reinforced with welded rims that are compatible with the pole.

We trust the above information satisfies your needs at this time. If you have questions, please do not hesitate to call.

Very truly yours,
Apex Engineers, Inc.

10/7/15

WISCONSIN
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E-25581
DOWNERS GROVE, IL
PROFESSIONAL ENGINEER

Satishkumar C. Patel, P.E.
Principal

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Structural Analysis of 195 ft. Monopole In Milwaukee, Wisconsin

AT&T Site: WI1206

Apex Project No. GM09-080 LTE 2C

Performed for:

Mastec Network Solutions

By

Apex Engineers, Inc.

October 7, 2015

Table of Contents

1.0 INTRODUCTION

AT&T currently has (3) CSS XDUO4-80-R, (3) Andrew SBNH-1D6565A, (3) Andrew SBNH-1D6565B antennas with (12) TMAs, (3) RRUS and (1) RAYCAP unit mounted to low-profile platform at 157 feet elevation. The existing antennas are fed by (12) 1-5/8" coax transmission lines and (1) DC/fiber bundle. It was proposed by AT&T to replace (3) existing Andrew SBNH-1D6565B antennas with (3) new Commscope SBNHH-1D65B antennas, (3) RRUS and (3) A2 boxes to existing configuration at approximate same elevation.

At the request of Mastec Network Solutions, we have analyzed the 195 ft. monopole in Milwaukee, Wisconsin to determine whether it satisfies the structural strength requirements of TIA-222-G for the proposed antennas configuration. We also included existing antennas as listed in section 6.0 of this report. In our analysis, we considered twelve wind directions at 30° increments for both the bare and iced conditions.

The 16-sided monopole considered in the analysis is 195 ft. in height with five sections. The pole has a constant slope with 52.2 inches diameter at the base and 12.6 inches at the top. The monopole sections are 7/16", 7/16", 5/16", 1/4" and 3/16" thick from bottom to top.

2.0 SUMMARY

With the proposed antenna arrangement, the monopole and monopole foundation satisfy the structural strength requirements of TIA-222-G Code.

3.0 INFORMATION USED IN THE ANALYSIS

- Structural Analysis by Ramaker & Associates, Inc., Job # 20865, dated 4/23/2012
- Construction drawings for LTE 2C upgrade by Apex Engineers, Inc., dated 8/28/2015

4.0 ASSUMPTIONS

For our analysis we assumed that the tower has been maintained in good condition and no structural member has been damaged or deteriorated to such an extent as to reduce its original load carrying capacity. If this is not the case we must be notified so that we can make the appropriate changes to our analysis and conclusions.

5.0 DESIGN STANDARD, WIND AND ICE LOADING USED IN ANALYSIS

- Standard: TIA-222-G
- Basic Wind Speed (bare): 90 mph (TIA-222-G)
- Basic Wind Speed (with ice): 40 mph (TIA-222-G)
- Radial Ice Thickness: 0.75 inch

6.0 APPURTENANCES CONSIDERED IN THE ANALYSIS

Except as otherwise noted in Section 7.0, the following existing appurtenances were considered in our analysis:

Elevation (ft.)	Appurtenance	Coax
195	(9) 20' & (1) 10' Omni antennas (1) 4' Grid dish & (1) Junction box mounted to T-arms	(10) 1 5/8" and (1) 1 5/8"
*157 (AT&T)	Existing: (3) CSS XDUO4-80-R w/ (6) TMAs, (3) Andrew SBNH-1D6565A antennas w/ (6) TMAs, (3) Andrew SBNH-1D6565B antennas w/ (3) RRUSs and (1) RAYCAP mounted to low-profile platform	(12) 1-5/8" and (1) DC/fiber bundle
140	(3) 6' Panel antennas on standoff arms	**(6) 1 5/8"
120	(9) 6' Panel antennas mounted to low-profile platform w/ handrails	(6) 1 5/8"
100	(9) 6' Panel antennas w/ (3) RRUs mounted to low-profile platform	(9) 1 5/8"
80	(1) 4' Dish w/ radome	(1) 1 5/8"

* See Section 7.0 for updated AT&T antenna loadings.
** (6) 1 5/8" coax run outside the monopole between 120'-140' elevations. All other coax run inside the pole.

7.0 PROPOSED ANTENNA ARRANGEMENT

7.1 Proposed Antennas

The antennas listed in Section 6.0 were considered, with the revised AT&T antenna loadings:

Elevation (ft.)	Appurtenance	Coax
171	Existing: (3) CSS XDUO4-80-R antennas w/ (6) TMAs, (6) Andrew SBNH-1D6565A antennas w/ (6) TMAs, (3) RRUS and (1) RAYCAP Proposed: **(3) Commscope SBNHH-1D65B, (3) RRUS w/ A2 boxes** mounted to low-profile platform	(12) 1-5/8" and (1) DC/fiber bundle

7.2 Analysis Results

With the proposed AT&T antenna arrangement, the monopole is still adequate and satisfies the structural strength requirements of TIA-222-G Code.

Per TIA-222-G section 15.5.1, the original reactions which are based upon an Allowable Stress Design procedure shall be multiplied by a 1.35 factor for comparison to the reactions determined in accordance with TIA-222-G Code. The following results indicate the maximum total foundation loads at the base:

	Maximum base reactions w/ proposed antenna (TIA-222-G)	Maximum design base reactions per Ehresmann w/ 1.35 multiplier (TIA/EIA-222-F)	Remarks
Axial Load	54.4 Kips	49.0 Kips	5.4 Kips increase
Total Shear	30.6 Kips	34.5 Kips	OK
Overturning Moment	3988 Kip-ft	4145 Kip-ft	OK

The total shear and overturning moment at the base with proposed antennas are less than design reactions. There is a 5.4 kip increase in axial load which is small compared to foundation axial load capacity. Also, foundation is usually designed to the capacity of the monopole and the stress ratio with proposed antennas is only 75.4%. Therefore, bye engineering judgment, existing foundation is adequate for proposed antenna arrangement.

8.0 CONCLUSIONS

With the proposed antenna arrangement, the monopole and monopole foundation satisfy the structural strength requirements of TIA-222-G Code. All new access holes, if required shall be reinforced with welded rims that are compatible with the pole.

9.0 RECOMMENDATIONS

We recommend our assumptions be checked to ensure that our analysis is based on accurate information. Any discrepancies between our assumptions and the existing conditions should be brought to our attention so that we can make the necessary changes to our analysis and conclusions.

Very truly yours,
Apex Engineers, Inc.

Satishkumar C. Patel, P.E.
Principal

10/7/15

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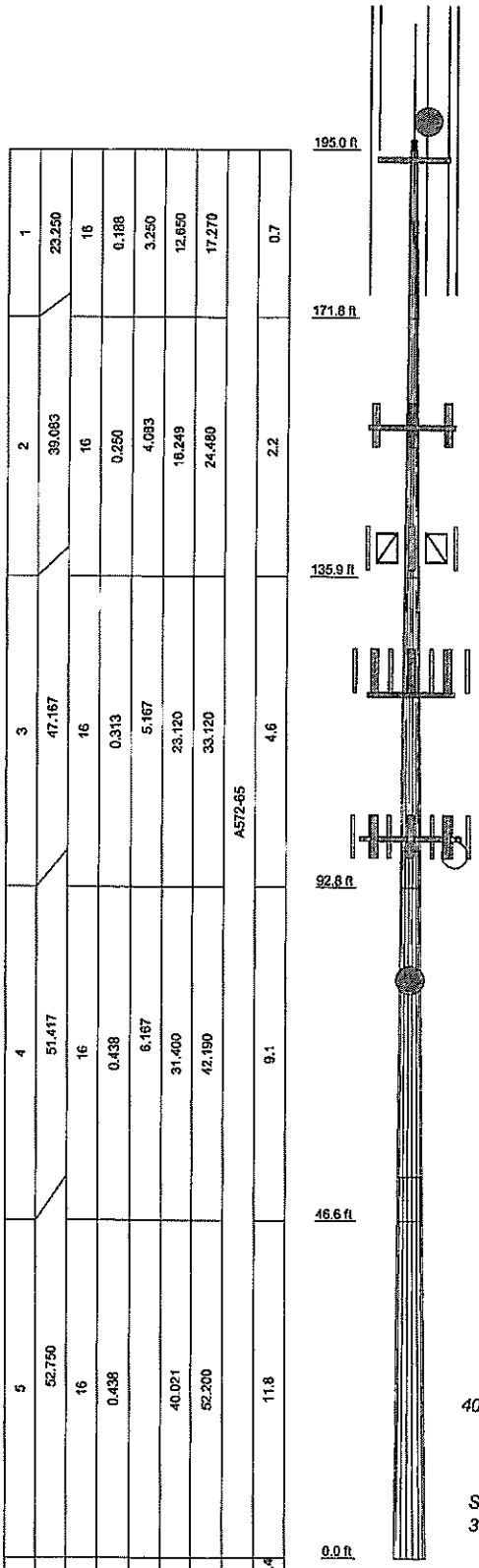
Appendix A

Monopole Analysis



Section	1	2	3	4	5
Length (ft)	23.250	39.083	47.167	51.417	52.750
Number of Sides	16	16	16	16	16
Thickness (in)	0.188	0.250	0.313	0.438	0.438
Socket Length (ft)	3.250	4.083	5.167	6.167	
Top Dia (in)	12.650	16.249	23.120	31.400	40.021
Bot Dia (in)	17.270	24.460	33.120	42.190	52.200
Grade	A572-65				
Weight (K) 28.4	0.7	2.2	4.6	9.1	11.8

ALL REACTIONS ARE FACTORED

AXIAL 88 K

SHEAR 7 K — *MOMENT 981 kip-ft*

TORQUE 2 kip-ft
40 mph WIND - 0.750 in ICE

AXIAL 54 K

SHEAR 31 K — *MOMENT 3988 kip-ft*

TORQUE 5 kip-ft
REACTIONS - 90 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod 2"x21'	195	PIROD 13' Platform w/handrail (ATI)	157
Flash Beacon Lighting	195	Pirod 6' Side Mount Standoff (1)	140
20' Omni	195	Pirod 6' Side Mount Standoff (1)	140
20' Omni	195	6'x8" panel antenna w/ mount pipe	140
20' Omni	195	6'x8" panel antenna w/ mount pipe	140
20' Omni	195	6'x8" panel antenna w/ mount pipe	140
20' Omni	195	Pirod 6' Side Mount Standoff (1)	140
20' Omni	195	(3) 6'x1' panel antenna	120
20' Omni	195	(3) 6'x1' panel antenna	120
20' Omni	195	(3) 6'x1' panel antenna	120
20' Omni	195	PIROD 13' Platform w/handrail	120
10' Omni	195	(3) RRU	102
Junction Box	195	(3) Stand-off Arm w/ mount pipe	102
KP4F-23	195	(2) 6'x6" panel antenna w/ mount pipe	100
(3) Valmont T-Arm (1)	194	6'x1' panel antenna w/ mount pipe	100
(3) SBNHH-1D65B (ATI)	157	6'x1' panel antenna w/ mount pipe	100
(3) RRUS W/ A2 (ATI)	157	6'x1' panel antenna w/ mount pipe	100
(3) SBNH-1D6565A (ATI)	157	(2) 6'x6" panel antenna w/ mount pipe	100
(3) CSS XDUO4 (ATI)	157	(2) 6'x6" panel antenna w/ mount pipe	100
(12) TMA ETD819H-12UB (ATI)	157	PIROD 15' Low Profile Platform	100
(3) RRUS (ATI)	157	Andrew 4' w/Radome	80
RAYCAP 10" DIA x 18" (ATI)	157		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Milwaukee County, Wisconsin.
2. Tower designed for Exposure B to the TIA-222-G Standard.
3. Tower designed for a 90 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 40 mph basic wind with 0.75 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 0.000 ft
8. TOWER RATING: 81.9%

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Consulting Engineers

Job: GM09-080			
Project: WI1206 - AWE - MILWAUKEE FIRE DEPARTMENT			
Client: MASTEC / ATT	Drawn by: Sudhar C.	App'd.	
Code: TIA-222-G	Date: 10/07/15	Scale: NTS	
Path:		Dwg No. E-1	

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 Milwaukee County, Wisconsin.
Basic wind speed of 90 mph.
Structure Class II.
Exposure Category B.
Topographic Category 1.
Crest Height 0.000 ft.
Nominal ice thickness of 0.750 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 40 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

Consider Moments - Legs	Distribute Leg Loads As Uniform	Treat Feedline Bundles As Cylinder
Consider Moments - Horizontals	Assume Legs Pinned	Use ASCE 10 X-Brace Ly Rules
Consider Moments - Diagonals	Assume Rigid Index Plate	√ Calculate Redundant Bracing Forces
Use Moment Magnification	Use Clear Spans For Wind Area	Ignore Redundant Members in FEA
√ Use Code Stress Ratios	Use Clear Spans For KL/r	√ SR Leg Bolts Resist Compression
√ Use Code Safety Factors - Guys	Retension Guys To Initial Tension	√ All Leg Panels Have Same Allowable
Escalate Ice	√ Bypass Mast Stability Checks	Offset Girt At Foundation
Always Use Max Kz	Use Azimuth Dish Coefficients	√ Consider Feedline Torque
Use Special Wind Profile	Project Wind Area of Appurt.	√ Include Angle Block Shear Check
√ Include Bolts In Member Capacity	Autocalc Torque Arm Areas	Poles
√ Leg Bolts Are At Top Of Section	√ SR Members Have Cut Ends	Include Shear-Torsion Interaction
√ Secondary Horizontal Braces Leg	Sort Capacity Reports By Component	Always Use Sub-Critical Flow
Use Diamond Inner Bracing (4 Sided)	√ Triangulate Diamond Inner Bracing	Use Top Mounted Sockets
Add IBC .6D+W Combination		

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	195.000-171.750	23.250	3.250	16	12.650	17.270	0.188	0.750	A572-65 (65 ksi)
L2	171.750-135.917	39.083	4.083	16	16.249	24.480	0.250	1.000	A572-65 (65 ksi)
L3	135.917-92.833	47.167	5.167	16	23.120	33.120	0.313	1.250	A572-65 (65 ksi)
L4	92.833-46.583	51.417	6.167	16	31.400	42.190	0.438	1.750	A572-65 (65 ksi)
L5	46.583-0.000	52.750		16	40.021	52.200	0.438	1.750	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in²	I in⁴	r in	C in	I/C in³	J in⁴	I/Q in²	w in	wt klf
L1	12.898	7.454	146.259	4.437	6.452	22.671	294.732	3.686	2.144	11.436
	17.608	10.217	376.670	6.081	8.808	42.766	759.042	5.052	3.064	16.339
L2	17.265	12.759	412.610	5.696	8.287	49.789	831.467	6.309	2.736	10.944
	24.960	19.323	1433.195	8.626	12.485	114.795	2888.090	9.554	4.374	17.496
L3	24.456	22.736	1494.143	8.119	11.791	126.716	3010.909	11.242	3.979	12.733
	33.769	32.705	4447.075	11.679	16.891	263.278	8961.485	16.171	5.969	19.101
L4	33.120	43.211	5233.282	11.023	16.014	326.798	10545.802	21.366	5.378	12.292
	43.017	58.271	12833.070	14.864	21.517	596.418	25860.448	28.812	7.525	17.2
L5	42.257	55.244	10935.045	14.092	20.411	535.752	22035.660	27.315	7.094	16.214
	53.223	72.241	24452.813	18.427	26.622	918.519	49275.872	35.719	9.517	21.754

Tower Elevation ft	Gusset Area (per face) ft²	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 195.000-171.750				1	1.03	1.03		
L2 171.750-135.917				1	1.03	1.03		
L3 135.917-92.833				1	1.03	1.03		
L4 92.833-46.583				1	1.03	1.03		
L5 46.583-0.000				1	1.03	1.03		

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 klf
Step Bolts	A	Surface Ar (CaAa)	195.000 - 0.000	1	1	0.000 0.000	0.400		0.001
Safety Line 5/8	A	Surface Ar (CaAa)	195.000 - 0.000	1	1	0.500 0.500	0.880		0.000
1 5/8	A	Surface Ar (CaAa)	140.000 - 120.000	2	2	0.250 0.250	1.980		0.001
1 5/8	B	Surface Ar (CaAa)	140.000 - 120.000	2	2	0.250 0.250	1.980		0.001
1 5/8	C	Surface Ar (CaAa)	140.000 - 120.000	2	2	0.250 0.250	1.980		0.001

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft²/ft	Weight klf
1 5/8	A	No	Inside Pole	195.000 - 0.000	11	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
						1" Ice	0.000	0.001
1 5/8 (AT&T)	A	No	Inside Pole	152.000 - 0.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
						1" Ice	0.000	0.001
Fiber Cable 1/2" (AT&T)	A	No	Inside Pole	152.000 - 0.000	1	No Ice	0.000	0.000
						1/2" Ice	0.000	0.000
						1" Ice	0.000	0.000
Power Cable 7/8" (AT&T)	A	No	Inside Pole	152.000 - 0.000	2	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
						1" Ice	0.000	0.001
1 5/8	A	No	Inside Pole	120.000 - 0.000	6	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
						1" Ice	0.000	0.001
1 5/8	A	No	Inside Pole	120.000 - 0.000	6	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
						1" Ice	0.000	0.001
1 5/8	A	No	Inside Pole	100.000 - 0.000	9	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
						1" Ice	0.000	0.001
1 5/8	A	No	Inside Pole	80.000 - 0.000	1	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
						1" Ice	0.000	0.001

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L1	195.000-171.750	A	0.000	0.000	2.976	0.000	0.299
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.000
L2	171.750-135.917	A	0.000	0.000	6.204	0.000	0.691
		B	0.000	0.000	1.617	0.000	0.008
		C	0.000	0.000	1.617	0.000	0.008
L3	135.917-92.833	A	0.000	0.000	11.818	0.000	1.587
		B	0.000	0.000	6.303	0.000	0.033
		C	0.000	0.000	6.303	0.000	0.033
L4	92.833-46.583	A	0.000	0.000	5.920	0.000	2.277
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.000
L5	46.583-0.000	A	0.000	0.000	5.963	0.000	2.307
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.000

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L1	195.000-171.750	A	1.780	0.000	0.000	19.530	0.000	0.543
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.000
L2	171.750-135.917	A	1.749	0.000	0.000	33.939	0.000	1.114
		B		0.000	0.000	3.838	0.000	0.054
		C		0.000	0.000	3.838	0.000	0.054
L3	135.917-92.833	A	1.697	0.000	0.000	50.485	0.000	2.202
		B		0.000	0.000	14.837	0.000	0.208
		C		0.000	0.000	14.837	0.000	0.208
L4	92.833-46.583	A	1.615	0.000	0.000	37.319	0.000	2.726
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.000
L5	46.583-0.000	A	1.445	0.000	0.000	36.063	0.000	2.722
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.000

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	195.000-171.750	-0.046	-0.148	-0.268	-0.513
L2	171.750-135.917	-0.044	-0.140	-0.257	-0.489
L3	135.917-92.833	-0.041	-0.129	-0.225	-0.427
L4	92.833-46.583	-0.048	-0.152	-0.355	-0.673
L5	46.583-0.000	-0.048	-0.152	-0.360	-0.684

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L1	1	Step Bolts	171.75 - 195.00	1.0000	1.0000
L1	2	Safety Line 5/8	171.75 - 195.00	1.0000	1.0000
L1	3	1 5/8	171.75 - 140.00	1.0000	1.0000
L1	4	1 5/8	171.75 - 140.00	1.0000	1.0000
L1	5	1 5/8	171.75 - 140.00	1.0000	1.0000
L2	1	Step Bolts	135.92 - 171.75	1.0000	1.0000
L2	2	Safety Line 5/8	135.92 - 171.75	1.0000	1.0000
L2	3	1 5/8	135.92 - 140.00	1.0000	1.0000
L2	4	1 5/8	135.92 - 140.00	1.0000	1.0000
L2	5	1 5/8	135.92 - 140.00	1.0000	1.0000
L3	1	Step Bolts	92.83 - 135.92	1.0000	1.0000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L3	2	Safety Line 5/8	92.83 - 135.92	1.0000	1.0000
L4	1	Step Bolts	46.58 - 92.83	1.0000	1.0000
L4	2	Safety Line 5/8	46.58 - 92.83	1.0000	1.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert (ft, ft, ft)	Azimuth Adjustment (°)	Placement (ft)		C_AA_A Front (ft^2)	C_AA_A Side (ft^2)	Weight (K)
Lightning Rod 2"x21'	C	From Face	0.000 0.000 10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	4.200 6.325 8.467	4.200 6.325 8.467	0.080 0.112 0.158
Flash Beacon Lighting	C	None		0.000	195.000	No Ice 1/2" Ice 1" Ice	2.700 3.100 3.500	2.700 3.100 3.500	0.050 0.070 0.090
(3) Valmont T-Arm (1)	C	None		0.000	194.000	No Ice 1/2" Ice 1" Ice	10.540 14.450 18.360	10.540 14.450 18.360	0.336 0.412 0.488
20' Omni	A	From Face	5.000 0.000 10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	6.000 8.030 10.060	6.000 8.030 10.060	0.055 0.100 0.145
20' Omni	B	From Face	5.000 -6.000 10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	6.000 8.030 10.060	6.000 8.030 10.060	0.055 0.100 0.145
20' Omni	B	From Face	5.000 -6.000 -10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	6.000 8.030 10.060	6.000 8.030 10.060	0.055 0.100 0.145
20' Omni	B	From Face	5.000 0.000 10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	6.000 8.030 10.060	6.000 8.030 10.060	0.055 0.100 0.145
20' Omni	B	From Face	5.000 0.000 -10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	6.000 8.030 10.060	6.000 8.030 10.060	0.055 0.100 0.145
20' Omni	C	From Face	5.000 -6.000 10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	6.000 8.030 10.060	6.000 8.030 10.060	0.055 0.100 0.145
20' Omni	C	From Face	5.000 -6.000 -10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	6.000 8.030 10.060	6.000 8.030 10.060	0.055 0.100 0.145
20' Omni	C	From Face	5.000 6.000 10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	6.000 8.030 10.060	6.000 8.030 10.060	0.055 0.100 0.145
20' Omni	C	From Face	5.000 6.000 -10.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	6.000 8.030 10.060	6.000 8.030 10.060	0.055 0.100 0.145
10' Omni	C	From Face	5.000 0.000 5.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	2.500 3.530 4.560	2.500 3.530 4.560	0.030 0.050 0.070
Junction Box	C	From Face	5.000 0.000 5.000	0.000	195.000	No Ice 1/2" Ice 1" Ice	2.994 3.226 3.466	1.211 1.374 1.546	0.055 0.075 0.097
PiROD 13' Platform w/handrail (AT&T)	C	None		0.000	157.000	No Ice 1/2" Ice 1" Ice	31.300 40.200 49.100	31.300 40.200 49.100	1.822 2.452 3.082
(3) SBNHH-1D65B (AT&T)	A	None		0.000	157.000	No Ice 1/2" Ice	8.330 8.878	5.342 5.795	0.051 0.101

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert (ft, ft, ft)	Azimuth Adjustment (°)	Placement (ft)		C_AA_A Front (ft^2)	C_AA_A Side (ft^2)	Weight (K)
						1" Ice	9.435	6.255	0.157
(3) RRUS W/ A2 (AT&T)	C	None		0.000	157.000	No Ice 1/2" Ice 1" Ice	2.994 3.226 3.466	1.800 1.985 2.180	0.070 0.094 0.120
(3) SBNH-1D6565A (AT&T)	B	None		0.000	157.000	No Ice 1/2" Ice 1" Ice	5.876 6.287 6.708	3.536 3.901 4.291	0.032 0.068 0.109
(3) CSS XDUO4 (AT&T)	C	None		0.000	157.000	No Ice 1/2" Ice 1" Ice	6.137 6.550 6.971	3.495 3.864 4.250	0.034 0.071 0.113
(12) TMA ETD819H-12UB (AT&T)	C	None		0.000	157.000	No Ice 1/2" Ice 1" Ice	1.530 1.697 1.873	0.388 0.489 0.598	0.019 0.027 0.038
(3) RRUS (AT&T)	C	None		0.000	157.000	No Ice 1/2" Ice 1" Ice	2.994 3.226 3.466	1.211 1.374 1.546	0.055 0.075 0.097
RAYCAP 10" DIA x 18" (AT&T)	C	None		0.000	157.000	No Ice 1/2" Ice 1" Ice	1.000 1.161 1.333	1.000 1.161 1.333	0.020 0.033 0.047
Pirod 6' Side Mount Standoff (1)	A	From Face	3.000 0.000 0.000	0.000	140.000	No Ice 1/2" Ice 1" Ice	4.970 6.120 7.270	4.970 6.120 7.270	0.070 0.130 0.190
Pirod 6' Side Mount Standoff (1)	B	From Leg	3.000 0.000 0.000	0.000	140.000	No Ice 1/2" Ice 1" Ice	4.970 6.120 7.270	4.970 6.120 7.270	0.070 0.130 0.190
Pirod 6' Side Mount Standoff (1)	C	From Face	3.000 0.000 0.000	0.000	140.000	No Ice 1/2" Ice 1" Ice	4.970 6.120 7.270	4.970 6.120 7.270	0.070 0.130 0.190
6'x8" panel antenna w/ mount pipe	A	From Face	6.000 0.000 0.000	0.000	140.000	No Ice 1/2" Ice 1" Ice	6.100 6.670 7.240	6.360 7.540 8.720	0.066 0.120 0.174
6'x8" panel antenna w/ mount pipe	B	From Face	6.000 0.000 0.000	0.000	140.000	No Ice 1/2" Ice 1" Ice	6.100 6.670 7.240	6.360 7.540 8.720	0.066 0.120 0.174
6'x8" panel antenna w/ mount pipe	C	From Face	6.000 0.000 0.000	0.000	140.000	No Ice 1/2" Ice 1" Ice	6.100 6.670 7.240	6.360 7.540 8.720	0.066 0.120 0.174
PiROD 13' Platform w/handrail	C	None		0.000	120.000	No Ice 1/2" Ice 1" Ice	31.300 40.200 49.100	31.300 40.200 49.100	1.822 2.452 3.082
(3) 6'x1' panel antenna	A	From Face	5.000 0.000 3.000	0.000	120.000	No Ice 1/2" Ice 1" Ice	8.378 8.930 9.492	5.407 5.864 6.329	0.048 0.098 0.155
(3) 6'x1' panel antenna	B	From Face	5.000 0.000 3.000	0.000	120.000	No Ice 1/2" Ice 1" Ice	8.378 8.930 9.492	5.407 5.864 6.329	0.048 0.098 0.155
(3) 6'x1' panel antenna	C	From Face	5.000 0.000 3.000	0.000	120.000	No Ice 1/2" Ice 1" Ice	8.378 8.930 9.492	5.407 5.864 6.329	0.048 0.098 0.155
PiROD 15' Low Profile Platform	C	None		0.000	100.000	No Ice 1/2" Ice 1" Ice	17.300 22.100 26.900	17.300 22.100 26.900	1.500 2.030 2.560
(2) 6'x6" panel antenna w/ mount pipe	A	From Face	5.000 0.000 0.000	0.000	100.000	No Ice 1/2" Ice 1" Ice	4.940 5.490 6.040	5.200 6.360 7.520	0.066 0.110 0.154
(2) 6'x6" panel antenna w/ mount pipe	B	From Face	5.000 0.000	0.000	100.000	No Ice 1/2" Ice	4.940 5.490	5.200 6.360	0.066 0.110

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	Placement		C_AA_A Front	C_AA_A Side	Weight
			ft ft ft	°	ft		ft^2	ft^2	K
			0.000			1" Ice	6.040	7.520	0.154
(2) 6'x6" panel antenna w/ mount pipe	C	From Face	5.000 0.000 0.000	0.000	100.000	No Ice 1/2" Ice 1" Ice	4.940 5.490 6.040	5.200 6.360 7.520	0.066 0.110 0.154
6'x1' panel antenna w/ mount pipe	A	From Face	5.000 0.000 0.000	0.000	100.000	No Ice 1/2" Ice 1" Ice	8.640 9.290 9.940	6.360 7.540 8.720	0.066 0.130 0.194
6'x1' panel antenna w/ mount pipe	B	From Face	5.000 0.000 0.000	0.000	100.000	No Ice 1/2" Ice 1" Ice	8.640 9.290 9.940	6.360 7.540 8.720	0.066 0.130 0.194
6'x1' panel antenna w/ mount pipe	C	From Face	5.000 0.000 0.000	0.000	100.000	No Ice 1/2" Ice 1" Ice	8.640 9.290 9.940	6.360 7.540 8.720	0.066 0.130 0.194
(3) RRU	C	None		0.000	102.000	No Ice 1/2" Ice 1" Ice	3.150 3.393 3.646	2.516 2.740 2.974	0.030 0.056 0.085
(3) Stand-off Arm w/ mount pipe	C	None		0.000	102.000	No Ice 1/2" Ice 1" Ice	1.663 2.391 2.825	1.663 2.391 2.825	0.026 0.039 0.056

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	3 dB Beam Width	Elevation	Outside Diameter		Aperture Area	Weight
				ft	°	°	ft	ft		ft^2	K
Andrew 4' w/Radome	C	Paraboloid w/Radome	From Face	2.000 0.000 0.000	Worst		30.000	4.000	No Ice 1/2" Ice 1" Ice	12.566 13.095 13.624	0.140 0.282 0.424
KP4F-23	C	Grid	From Face	6.000 -2.000 4.000	Worst		195.000	4.000	No Ice 1/2" Ice 1" Ice	10.050 13.089 16.128	0.051 0.118 0.185

Tower Pressures - No Ice

$G_H = 1.100$

Section Elevation	z	K_z	q_z	A_G	Face	A_F	A_R	A_{LG}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		ksf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
L1	182.777	1.174	0.023	29.553	A	0.000	30.439	30.439	100.00	2.976	0.000
195.000-171.7					B	0.000	30.439		100.00	0.000	0.000
50					C	0.000	30.439		100.00	0.000	0.000
L2	152.893	1.116	0.022	63.044	A	0.000	64.935	64.935	100.00	6.204	0.000
171.750-135.9					B	0.000	64.935		100.00	1.617	0.000
17					C	0.000	64.935		100.00	1.617	0.000
L3	113.515	1.025	0.020	104.521	A	0.000	107.657	107.657	100.00	11.818	0.000
135.917-92.83					B	0.000	107.657		100.00	6.303	0.000
3					C	0.000	107.657		100.00	6.303	0.000
L4	69.259	0.89	0.017	146.722	A	0.000	151.124	151.124	100.00	5.920	0.000
92.833-46.583					B	0.000	151.124		100.00	0.000	0.000

Section Elevation	z	K_z	q_z	A_G	Face	A_F	A_R	A_{LG}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		ksf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
					C	0.000	151.124		100.00	0.000	0.000
L5	22.646	0.7	0.014	185.322	A	0.000	190.882	190.882	100.00	5.963	0.000
46.583-0.000					B	0.000	190.882		100.00	0.000	0.000
					C	0.000	190.882		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.100$

Section Elevation	z	K_z	q_z	t_z	A_G	Face	A_F	A_R	A_{LG}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		ksf	in	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
L1	182.777	1.174	0.005	1.780	36.451	A	0.000	37.544	37.544	100.00	19.530	0.000
195.000-171.750						B	0.000	37.544		100.00	0.000	0.000
						C	0.000	37.544		100.00	0.000	0.000
L2	152.893	1.116	0.004	1.749	73.675	A	0.000	75.885	75.885	100.00	33.939	0.000
171.750-135.917						B	0.000	75.885		100.00	3.838	0.000
						C	0.000	75.885		100.00	3.838	0.000
L3	113.515	1.025	0.004	1.697	117.077	A	0.000	120.589	120.589	100.00	50.485	0.000
135.917-92.833						B	0.000	120.589		100.00	14.837	0.000
						C	0.000	120.589		100.00	14.837	0.000
L4	69.259	0.89	0.003	1.615	159.805	A	0.000	164.599	164.599	100.00	37.319	0.000
92.833-46.583						B	0.000	164.599		100.00	0.000	0.000
						C	0.000	164.599		100.00	0.000	0.000
L5 46.583-0.000	22.646	0.7	0.003	1.445	197.864	A	0.000	203.800	203.800	100.00	36.063	0.000
						B	0.000	203.800		100.00	0.000	0.000
						C	0.000	203.800		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.100$

Section Elevation	z	K_z	q_z	A_G	Face	A_F	A_R	A_{LG}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		ksf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
L1	182.777	1.174	0.009	29.553	A	0.000	30.439	30.439	100.00	2.976	0.000
195.000-171.7					B	0.000	30.439		100.00	0.000	0.000
50					C	0.000	30.439		100.00	0.000	0.000
L2	152.893	1.116	0.009	63.044	A	0.000	64.935	64.935	100.00	6.204	0.000
171.750-135.9					B	0.000	64.935		100.00	1.617	0.000
17					C	0.000	64.935		100.00	1.617	0.000
L3	113.515	1.025	0.008	104.521	A	0.000	107.657	107.657	100.00	11.818	0.000
135.917-92.83					B	0.000	107.657		100.00	6.303	0.000
3					C	0.000	107.657		100.00	6.303	0.000
L4	69.259	0.89	0.007	146.722	A	0.000	151.124	151.124	100.00	5.920	0.000
92.833-46.583					B	0.000	151.124		100.00	0.000	0.000
					C	0.000	151.124		100.00	0.000	0.000
L5	22.646	0.7	0.006	185.322	A	0.000	190.882	190.882	100.00	5.963	0.000
46.583-0.000					B	0.000	190.882		100.00	0.000	0.000
					C	0.000	190.882		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.299	0.720	A	1	0.75	0.023	1	1	30.439	0.581	0.025	C
195.000-171.7			B	1	0.75		1	1	30.439			
50			C	1	0.75		1	1	30.439			
L2	0.708	2.197	A	1	0.75	0.022	1	1	64.935	1.177	0.033	C
171.750-135.9			B	1	0.75		1	1	64.935			
17			C	1	0.75		1	1	64.935			
L3	1.654	4.583	A	1	0.75	0.020	1	1	107.657	1.790	0.042	C
135.917-92.83			B	1	0.75		1	1	107.657			
3			C	1	0.75		1	1	107.657			
L4	2.277	9.144	A	1	0.75	0.017	1	1	151.124	2.174	0.047	C
92.833-46.583			B	1	0.75		1	1	151.124			
			C	1	0.75		1	1	151.124			
L5	2.307	11.785	A	1	0.75	0.014	1	1	190.882	2.216	0.048	C
46.583-0.000			B	1	0.75		1	1	190.882			
			C	1	0.75		1	1	190.882			
Sum Weight:	7.245	28.429						OTM	689.996 kip-ft	7.937		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.299	0.720	A	1	0.75	0.023	1	1	30.439	0.581	0.025	C
195.000-171.7			B	1	0.75		1	1	30.439			
50			C	1	0.75		1	1	30.439			
L2	0.708	2.197	A	1	0.75	0.022	1	1	64.935	1.177	0.033	C
171.750-135.9			B	1	0.75		1	1	64.935			
17			C	1	0.75		1	1	64.935			
L3	1.654	4.583	A	1	0.75	0.020	1	1	107.657	1.790	0.042	C
135.917-92.83			B	1	0.75		1	1	107.657			
3			C	1	0.75		1	1	107.657			
L4	2.277	9.144	A	1	0.75	0.017	1	1	151.124	2.174	0.047	C
92.833-46.583			B	1	0.75		1	1	151.124			
			C	1	0.75		1	1	151.124			
L5	2.307	11.785	A	1	0.75	0.014	1	1	190.882	2.216	0.048	C
46.583-0.000			B	1	0.75		1	1	190.882			
			C	1	0.75		1	1	190.882			
Sum Weight:	7.245	28.429						OTM	689.996 kip-ft	7.937		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.299	0.720	A	1	0.75	0.023	1	1	30.439	0.581	0.025	C
195.000-171.7			B	1	0.75		1	1	30.439			
50			C	1	0.75		1	1	30.439			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.708	2.197	A	1	0.75	0.022	1	1	64.935	1.177	0.033	C
171.750-135.9			B	1	0.75		1	1	64.935			
17			C	1	0.75		1	1	64.935			
L3	1.654	4.583	A	1	0.75	0.020	1	1	107.657	1.790	0.042	C
135.917-92.83			B	1	0.75		1	1	107.657			
3			C	1	0.75		1	1	107.657			
L4	2.277	9.144	A	1	0.75	0.017	1	1	151.124	2.174	0.047	C
92.833-46.583			B	1	0.75		1	1	151.124			
			C	1	0.75		1	1	151.124			
L5	2.307	11.785	A	1	0.75	0.014	1	1	190.882	2.216	0.048	C
46.583-0.000			B	1	0.75		1	1	190.882			
			C	1	0.75		1	1	190.882			
Sum Weight:	7.245	28.429						OTM	689.996 kip-ft	7.937		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.543	1.579	A	1	1.2	0.005	1	1	37.544	0.226	0.010	C
195.000-171.7			B	1	1.2		1	1	37.544			
50			C	1	1.2		1	1	37.544			
L2	1.223	3.943	A	1	1.2	0.004	1	1	75.885	0.435	0.012	C
171.750-135.9			B	1	1.2		1	1	75.885			
17			C	1	1.2		1	1	75.885			
L3	2.618	7.327	A	1	1.2	0.004	1	1	120.589	0.634	0.015	C
135.917-92.83			B	1	1.2		1	1	120.589			
3			C	1	1.2		1	1	120.589			
L4	2.726	12.754	A	1	1.2	0.003	1	1	164.599	0.748	0.016	C
92.833-46.583			B	1	1.2		1	1	164.599			
			C	1	1.2		1	1	164.599			
L5	2.722	15.814	A	1	1.2	0.003	1	1	203.800	0.748	0.016	C
46.583-0.000			B	1	1.2		1	1	203.800			
			C	1	1.2		1	1	203.800			
Sum Weight:	9.831	41.418						OTM	248.522 kip-ft	2.791		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.543	1.579	A	1	1.2	0.005	1	1	37.544	0.226	0.010	C
195.000-171.7			B	1	1.2		1	1	37.544			
50			C	1	1.2		1	1	37.544			
L2	1.223	3.943	A	1	1.2	0.004	1	1	75.885	0.435	0.012	C
171.750-135.9			B	1	1.2		1	1	75.885			
17			C	1	1.2		1	1	75.885			
L3	2.618	7.327	A	1	1.2	0.004	1	1	120.589	0.634	0.015	C
135.917-92.83			B	1	1.2		1	1	120.589			
3			C	1	1.2		1	1	120.589			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L4	2.726	12.754	A	1	1.2	0.003	1	1	164.599	0.748	0.016	C
92.833-46.583			B	1	1.2		1	1	164.599			
			C	1	1.2		1	1	164.599			
L5	2.722	15.814	A	1	1.2	0.003	1	1	203.800	0.748	0.016	C
46.583-0.000			B	1	1.2		1	1	203.800			
			C	1	1.2		1	1	203.800			
Sum Weight:	9.831	41.418						OTM	248.522 kip-ft	2.791		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.543	1.579	A	1	1.2	0.005	1	1	37.544	0.226	0.010	C
195.000-171.7			B	1	1.2		1	1	37.544			
50			C	1	1.2		1	1	37.544			
L2	1.223	3.943	A	1	1.2	0.004	1	1	75.885	0.435	0.012	C
171.750-135.9			B	1	1.2		1	1	75.885			
17			C	1	1.2		1	1	75.885			
L3	2.618	7.327	A	1	1.2	0.004	1	1	120.589	0.634	0.015	C
135.917-92.83			B	1	1.2		1	1	120.589			
3			C	1	1.2		1	1	120.589			
L4	2.726	12.754	A	1	1.2	0.003	1	1	164.599	0.748	0.016	C
92.833-46.583			B	1	1.2		1	1	164.599			
			C	1	1.2		1	1	164.599			
L5	2.722	15.814	A	1	1.2	0.003	1	1	203.800	0.748	0.016	C
46.583-0.000			B	1	1.2		1	1	203.800			
			C	1	1.2		1	1	203.800			
Sum Weight:	9.831	41.418						OTM	248.522 kip-ft	2.791		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.299	0.720	A	1	0.75	0.009	1	1	30.439	0.231	0.010	C
195.000-171.7			B	1	0.75		1	1	30.439			
50			C	1	0.75		1	1	30.439			
L2	0.708	2.197	A	1	0.75	0.009	1	1	64.935	0.468	0.013	C
171.750-135.9			B	1	0.75		1	1	64.935			
17			C	1	0.75		1	1	64.935			
L3	1.654	4.583	A	1	0.75	0.008	1	1	107.657	0.712	0.017	C
135.917-92.83			B	1	0.75		1	1	107.657			
3			C	1	0.75		1	1	107.657			
L4	2.277	9.144	A	1	0.75	0.007	1	1	151.124	0.865	0.019	C
92.833-46.583			B	1	0.75		1	1	151.124			
			C	1	0.75		1	1	151.124			
L5	2.307	11.785	A	1	0.75	0.006	1	1	190.882	0.881	0.019	C
46.583-0.000			B	1	0.75		1	1	190.882			
			C	1	0.75		1	1	190.882			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
Sum Weight:	7.245	28.429						OTM	274.385 kip-ft	3.156		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.299	0.720	A	1	0.75	0.009	1	1	30.439	0.231	0.010	C
195.000-171.7			B	1	0.75		1	1	30.439			
50			C	1	0.75		1	1	30.439			
L2	0.708	2.197	A	1	0.75	0.009	1	1	64.935	0.468	0.013	C
171.750-135.9			B	1	0.75		1	1	64.935			
17			C	1	0.75		1	1	64.935			
L3	1.654	4.583	A	1	0.75	0.008	1	1	107.657	0.712	0.017	C
135.917-92.83			B	1	0.75		1	1	107.657			
3			C	1	0.75		1	1	107.657			
L4	2.277	9.144	A	1	0.75	0.007	1	1	151.124	0.865	0.019	C
92.833-46.583			B	1	0.75		1	1	151.124			
			C	1	0.75		1	1	151.124			
L5	2.307	11.785	A	1	0.75	0.006	1	1	190.882	0.881	0.019	C
46.583-0.000			B	1	0.75		1	1	190.882			
			C	1	0.75		1	1	190.882			
Sum Weight:	7.245	28.429						OTM	274.385 kip-ft	3.156		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.299	0.720	A	1	0.75	0.009	1	1	30.439	0.231	0.010	C
195.000-171.7			B	1	0.75		1	1	30.439			
50			C	1	0.75		1	1	30.439			
L2	0.708	2.197	A	1	0.75	0.009	1	1	64.935	0.468	0.013	C
171.750-135.9			B	1	0.75		1	1	64.935			
17			C	1	0.75		1	1	64.935			
L3	1.654	4.583	A	1	0.75	0.008	1	1	107.657	0.712	0.017	C
135.917-92.83			B	1	0.75		1	1	107.657			
3			C	1	0.75		1	1	107.657			
L4	2.277	9.144	A	1	0.75	0.007	1	1	151.124	0.865	0.019	C
92.833-46.583			B	1	0.75		1	1	151.124			
			C	1	0.75		1	1	151.124			
L5	2.307	11.785	A	1	0.75	0.006	1	1	190.882	0.881	0.019	C
46.583-0.000			B	1	0.75		1	1	190.882			
			C	1	0.75		1	1	190.882			
Sum Weight:	7.245	28.429						OTM	274.385 kip-ft	3.156		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, Mx kip-ft	Sum of Overturning Moments, Mz kip-ft	Sum of Torques kip-ft
Leg Weight	28.429					
Bracing Weight	0.000					
Total Member Self-Weight	28.429			1.255	-0.334	
Total Weight	45.302			1.255	-0.334	
Wind 0 deg - No Ice		0.000	-19.137	-2330.383	-0.334	1.600
Wind 30 deg - No Ice		9.569	-16.573	-2018.003	-1166.153	2.763
Wind 60 deg - No Ice		16.573	-9.569	-1164.564	-2019.592	3.186
Wind 90 deg - No Ice		19.137	0.000	1.255	-2331.972	2.755
Wind 120 deg - No Ice		16.573	9.569	1167.074	-2019.592	1.586
Wind 150 deg - No Ice		9.569	16.573	2020.513	-1166.153	-0.008
Wind 180 deg - No Ice		0.000	19.137	2332.893	-0.334	-1.600
Wind 210 deg - No Ice		-9.569	16.573	2020.513	1165.485	-2.763
Wind 240 deg - No Ice		-16.573	9.569	1167.074	2018.924	-3.186
Wind 270 deg - No Ice		-19.137	0.000	1.255	2331.304	-2.755
Wind 300 deg - No Ice		-16.573	-9.569	-1164.564	2018.924	-1.586
Wind 330 deg - No Ice		-9.569	-16.573	-2018.003	1165.485	0.008
Member Ice	12.989					
Total Weight Ice	78.034			3.906	-1.178	
Wind 0 deg - Ice		0.000	-6.618	-830.094	-1.178	0.922
Wind 30 deg - Ice		3.309	-5.732	-718.359	-418.178	1.640
Wind 60 deg - Ice		5.732	-3.309	-413.094	-723.443	1.918
Wind 90 deg - Ice		6.618	0.000	3.906	-835.178	1.682
Wind 120 deg - Ice		5.732	3.309	420.906	-723.443	0.995
Wind 150 deg - Ice		3.309	5.732	726.171	-418.178	0.042
Wind 180 deg - Ice		0.000	6.618	837.906	-1.178	-0.922
Wind 210 deg - Ice		-3.309	5.732	726.171	415.822	-1.640
Wind 240 deg - Ice		-5.732	3.309	420.906	721.087	-1.918
Wind 270 deg - Ice		-6.618	0.000	3.906	832.822	-1.682
Wind 300 deg - Ice		-5.732	-3.309	-413.094	721.087	-0.995
Wind 330 deg - Ice		-3.309	-5.732	-718.359	415.822	-0.042
Total Weight	45.302			1.255	-0.334	
Wind 0 deg - Service		0.000	-7.610	-925.708	-0.562	0.636
Wind 30 deg - Service		3.805	-6.591	-801.486	-464.162	1.099
Wind 60 deg - Service		6.591	-3.805	-462.107	-803.542	1.267
Wind 90 deg - Service		7.610	0.000	1.493	-927.763	1.096
Wind 120 deg - Service		6.591	3.805	465.094	-803.542	0.631
Wind 150 deg - Service		3.805	6.591	804.473	-464.162	-0.003
Wind 180 deg - Service		0.000	7.610	928.694	-0.562	-0.636
Wind 210 deg - Service		-3.805	6.591	804.473	463.039	-1.099
Wind 240 deg - Service		-6.591	3.805	465.094	802.418	-1.267
Wind 270 deg - Service		-7.610	0.000	1.493	926.639	-1.096
Wind 300 deg - Service		-6.591	-3.805	-462.107	802.418	-0.631
Wind 330 deg - Service		-3.805	-6.591	-801.486	463.039	0.003

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 30 deg - No Ice
5	0.9 Dead+1.6 Wind 30 deg - No Ice
6	1.2 Dead+1.6 Wind 60 deg - No Ice

Comb. No.	Description
7	0.9 Dead+1.6 Wind 60 deg - No Ice
8	1.2 Dead+1.6 Wind 90 deg - No Ice
9	0.9 Dead+1.6 Wind 90 deg - No Ice
10	1.2 Dead+1.6 Wind 120 deg - No Ice
11	0.9 Dead+1.6 Wind 120 deg - No Ice
12	1.2 Dead+1.6 Wind 150 deg - No Ice
13	0.9 Dead+1.6 Wind 150 deg - No Ice
14	1.2 Dead+1.6 Wind 180 deg - No Ice
15	0.9 Dead+1.6 Wind 180 deg - No Ice
16	1.2 Dead+1.6 Wind 210 deg - No Ice
17	0.9 Dead+1.6 Wind 210 deg - No Ice
18	1.2 Dead+1.6 Wind 240 deg - No Ice
19	0.9 Dead+1.6 Wind 240 deg - No Ice
20	1.2 Dead+1.6 Wind 270 deg - No Ice
21	0.9 Dead+1.6 Wind 270 deg - No Ice
22	1.2 Dead+1.6 Wind 300 deg - No Ice
23	0.9 Dead+1.6 Wind 300 deg - No Ice
24	1.2 Dead+1.6 Wind 330 deg - No Ice
25	0.9 Dead+1.6 Wind 330 deg - No Ice
26	1.2 Dead+1.0 Ice+1.0 Temp
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
39	Dead+Wind 0 deg - Service
40	Dead+Wind 30 deg - Service
41	Dead+Wind 60 deg - Service
42	Dead+Wind 90 deg - Service
43	Dead+Wind 120 deg - Service
44	Dead+Wind 150 deg - Service
45	Dead+Wind 180 deg - Service
46	Dead+Wind 210 deg - Service
47	Dead+Wind 240 deg - Service
48	Dead+Wind 270 deg - Service
49	Dead+Wind 300 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	195 - 171.75	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-7.027	-2.602	-3.178
			Max. Mx	8	-2.053	-108.754	-0.484
			Max. My	14	-2.052	-0.247	-108.959
			Max. Vy	8	5.637	-108.754	-0.484
			Max. Vx	14	5.637	-0.247	-108.959
			Max. Torque	16			3.586
L2	171.75 - 135.917	Pole	Max Tension	1	0.000	0.000	0.000

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	26	-20.780	-2.697	-3.303
			Max. Mx	8	-7.790	-437.365	-0.689
			Max. My	14	-7.789	-0.390	-437.586
			Max. Vy	8	13.311	-437.365	-0.689
			Max. Vx	14	13.311	-0.390	-437.586
			Max. Torque	16			3.569
L3	135.917 - 92.8333	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-46.379	-2.699	-4.523
			Max. Mx	8	-20.351	-1220.644	-1.101
			Max. My	14	-20.350	-0.487	-1221.230
			Max. Vy	8	24.928	-1220.644	-1.101
			Max. Vx	14	24.929	-0.487	-1221.230
			Max. Torque	18			4.191
L4	92.8333 - 46.5833	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-64.168	-2.521	-6.510
			Max. Mx	8	-34.291	-2428.523	-1.680
			Max. My	14	-34.291	-0.493	-2429.724
			Max. Vy	8	28.255	-2428.523	-1.680
			Max. Vx	14	28.256	-0.493	-2429.724
			Max. Torque	18			5.174
L5	46.5833 - 0	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-88.450	-2.063	-5.686
			Max. Mx	8	-54.332	-3987.261	-1.593
			Max. My	14	-54.332	-0.393	-3988.476
			Max. Vy	8	30.674	-3987.261	-1.593
			Max. Vx	14	30.674	-0.393	-3988.476
			Max. Torque	18			5.152

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	33	88.450	-0.000	-6.618
	Max. H$_x$	21	40.772	30.620	-0.000
	Max. H$_z$	3	40.772	-0.000	30.620
	Max. M$_x$	2	3985.079	-0.000	30.620
	Max. M$_z$	8	3987.261	-30.620	-0.000
	Max. Torsion	18	5.142	26.518	-15.310
	Min. Vert	17	40.772	15.310	-26.518
	Min. H$_x$	9	40.772	-30.620	-0.000
	Min. H$_z$	15	40.772	-0.000	-30.620
	Min. M$_x$	14	-3988.476	-0.000	-30.620
	Min. M$_z$	20	-3986.294	30.620	-0.000
	Min. Torsion	6	-5.141	-26.518	15.310

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	45.302	0.000	0.000	1.330	-0.376	-0.000
1.2 Dead+1.6 Wind 0 deg - No Ice	54.363	0.000	-30.620	-3985.079	-0.393	2.559
0.9 Dead+1.6 Wind 0 deg - No Ice	40.772	0.000	-30.620	-3913.604	-0.279	2.527
1.2 Dead+1.6 Wind 30 deg - No Ice	54.363	15.310	-26.518	-3451.019	-1993.759	4.446
0.9 Dead+1.6 Wind 30 deg - No Ice	40.772	15.310	-26.518	-3389.164	-1957.679	4.392
1.2 Dead+1.6 Wind 60 deg - No Ice	54.363	26.518	-15.310	-1991.810	-3453.066	5.141
0.9 Dead+1.6 Wind 60 deg - No Ice	40.772	26.518	-15.310	-1956.272	-3390.640	5.080
1.2 Dead+1.6 Wind 90 deg - No Ice	54.363	30.620	0.000	1.592	-3987.261	4.460
0.9 Dead+1.6 Wind 90 deg - No Ice	40.772	30.620	0.000	1.154	-3915.175	4.406
1.2 Dead+1.6 Wind 120 deg - No Ice	54.363	26.518	15.310	1995.047	-3453.158	2.583
0.9 Dead+1.6 Wind 120 deg - No Ice	40.772	26.518	15.310	1958.617	-3390.705	2.553
1.2 Dead+1.6 Wind 150 deg - No Ice	54.363	15.310	26.518	3454.362	-1993.850	0.014
0.9 Dead+1.6 Wind 150 deg - No Ice	40.772	15.310	26.518	3391.584	-1957.744	0.015
1.2 Dead+1.6 Wind 180 deg - No Ice	54.363	0.000	30.620	3988.476	-0.392	-2.558
0.9 Dead+1.6 Wind 180 deg - No Ice	40.772	0.000	30.620	3916.061	-0.279	-2.527
1.2 Dead+1.6 Wind 210 deg - No Ice	54.363	-15.310	26.518	3454.283	1993.020	-4.445
0.9 Dead+1.6 Wind 210 deg - No Ice	40.772	-15.310	26.518	3391.528	1957.155	-4.392
1.2 Dead+1.6 Wind 240 deg - No Ice	54.363	-26.518	15.310	1994.968	3452.236	-5.142
0.9 Dead+1.6 Wind 240 deg - No Ice	40.772	-26.518	15.310	1958.562	3390.051	-5.080
1.2 Dead+1.6 Wind 270 deg - No Ice	54.363	-30.620	0.000	1.592	3986.294	-4.460
0.9 Dead+1.6 Wind 270 deg - No Ice	40.772	-30.620	0.000	1.154	3914.490	-4.407
1.2 Dead+1.6 Wind 300 deg - No Ice	54.363	-26.518	-15.310	-1991.731	3452.144	-2.583
0.9 Dead+1.6 Wind 300 deg - No Ice	40.772	-26.518	-15.310	-1956.217	3389.987	-2.553
1.2 Dead+1.6 Wind 330 deg - No Ice	54.363	-15.310	-26.518	-3450.940	1992.928	-0.014
0.9 Dead+1.6 Wind 330 deg - No Ice	40.772	-15.310	-26.518	-3389.108	1957.090	-0.015
1.2 Dead+1.0 Ice+1.0 Temp	88.450	0.000	0.000	5.686	-2.063	-0.000
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	88.450	0.000	-6.618	-969.067	-2.108	1.078
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	88.450	3.309	-5.732	-838.496	-489.582	1.891
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	88.450	5.732	-3.309	-481.637	-846.430	2.197
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	88.450	6.618	0.000	5.832	-977.068	1.915

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
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	88.450	5.732	3.309	493.321	-846.462	1.119
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	88.450	3.309	5.732	850.191	-489.598	0.024
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	88.450	0.000	6.618	980.807	-2.107	-1.078
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	88.450	-3.309	5.732	850.171	485.373	-1.891
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	88.450	-5.732	3.309	493.317	842.239	-2.197
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	88.450	-6.618	0.000	5.833	972.807	-1.915
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	88.450	-5.732	-3.309	-481.516	842.180	-1.120
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	88.450	-3.309	-5.732	-838.449	485.339	-0.024
Dead+Wind 0 deg - Service	45.302	0.000	-7.610	-981.477	-0.400	0.664
Dead+Wind 30 deg - Service	45.302	3.805	-6.591	-849.798	-491.844	1.147
Dead+Wind 60 deg - Service	45.302	6.591	-3.805	-490.037	-851.609	1.321
Dead+Wind 90 deg - Service	45.302	7.610	0.000	1.409	-983.295	1.142
Dead+Wind 120 deg - Service	45.302	6.591	3.805	492.858	-851.614	0.657
Dead+Wind 150 deg - Service	45.302	3.805	6.591	852.624	-491.849	-0.004
Dead+Wind 180 deg - Service	45.302	0.000	7.610	984.305	-0.400	-0.664
Dead+Wind 210 deg - Service	45.302	-3.805	6.591	852.620	491.047	-1.147
Dead+Wind 240 deg - Service	45.302	-6.591	3.805	492.854	850.808	-1.321
Dead+Wind 270 deg - Service	45.302	-7.610	0.000	1.409	982.487	-1.142
Dead+Wind 300 deg - Service	45.302	-6.591	-3.805	-490.033	850.803	-0.657
Dead+Wind 330 deg - Service	45.302	-3.805	-6.591	-849.793	491.042	0.004

Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.000	-45.302	0.000	0.000	45.302	-0.000	0.000%
2	0.000	-54.363	-30.620	-0.000	54.363	30.620	0.000%
3	0.000	-40.772	-30.620	-0.000	40.772	30.620	0.000%
4	15.310	-54.363	-26.518	-15.310	54.363	26.518	0.000%
5	15.310	-40.772	-26.518	-15.310	40.772	26.518	0.000%
6	26.518	-54.363	-15.310	-26.518	54.363	15.310	0.000%
7	26.518	-40.772	-15.310	-26.518	40.772	15.310	0.000%
8	30.620	-54.363	0.000	-30.620	54.363	-0.000	0.000%
9	30.620	-40.772	0.000	-30.620	40.772	-0.000	0.000%
10	26.518	-54.363	15.310	-26.518	54.363	-15.310	0.000%
11	26.518	-40.772	15.310	-26.518	40.772	-15.310	0.000%
12	15.310	-54.363	26.518	-15.310	54.363	-26.518	0.000%
13	15.310	-40.772	26.518	-15.310	40.772	-26.518	0.000%
14	0.000	-54.363	30.620	-0.000	54.363	-30.620	0.000%
15	0.000	-40.772	30.620	-0.000	40.772	-30.620	0.000%
16	-15.310	-54.363	26.518	15.310	54.363	-26.518	0.000%
17	-15.310	-40.772	26.518	15.310	40.772	-26.518	0.000%
18	-26.518	-54.363	15.310	26.518	54.363	-15.310	0.000%
19	-26.518	-40.772	15.310	26.518	40.772	-15.310	0.000%
20	-30.620	-54.363	0.000	30.620	54.363	-0.000	0.000%
21	-30.620	-40.772	0.000	30.620	40.772	-0.000	0.000%
22	-26.518	-54.363	-15.310	26.518	54.363	15.310	0.000%
23	-26.518	-40.772	-15.310	26.518	40.772	15.310	0.000%
24	-15.310	-54.363	-26.518	15.310	54.363	26.518	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
25	-15.310	-40.772	-26.518	15.310	40.772	26.518	0.000%
26	0.000	-88.450	0.000	-0.000	88.450	-0.000	0.000%
27	0.000	-88.450	-6.618	-0.000	88.450	6.618	0.000%
28	3.309	-88.450	-5.732	-3.309	88.450	5.732	0.000%
29	5.732	-88.450	-3.309	-5.732	88.450	3.309	0.000%
30	6.618	-88.450	0.000	-6.618	88.450	-0.000	0.000%
31	5.732	-88.450	3.309	-5.732	88.450	-3.309	0.000%
32	3.309	-88.450	5.732	-3.309	88.450	-5.732	0.000%
33	0.000	-88.450	6.618	-0.000	88.450	-6.618	0.000%
34	-3.309	-88.450	5.732	3.309	88.450	-5.732	0.000%
35	-5.732	-88.450	3.309	5.732	88.450	-3.309	0.000%
36	-6.618	-88.450	0.000	6.618	88.450	-0.000	0.000%
37	-5.732	-88.450	-3.309	5.732	88.450	3.309	0.000%
38	-3.309	-88.450	-5.732	3.309	88.450	5.732	0.000%
39	0.000	-45.302	-7.610	-0.000	45.302	7.610	0.000%
40	3.805	-45.302	-6.591	-3.805	45.302	6.591	0.000%
41	6.591	-45.302	-3.805	-6.591	45.302	3.805	0.000%
42	7.610	-45.302	0.000	-7.610	45.302	-0.000	0.000%
43	6.591	-45.302	3.805	-6.591	45.302	-3.805	0.000%
44	3.805	-45.302	6.591	-3.805	45.302	-6.591	0.000%
45	0.000	-45.302	7.610	-0.000	45.302	-7.610	0.000%
46	-3.805	-45.302	6.591	3.805	45.302	-6.591	0.000%
47	-6.591	-45.302	3.805	6.591	45.302	-3.805	0.000%
48	-7.610	-45.302	0.000	7.610	45.302	-0.000	0.000%
49	-6.591	-45.302	-3.805	6.591	45.302	3.805	0.000%
50	-3.805	-45.302	-6.591	3.805	45.302	6.591	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	6	0.00000001	0.00010210
3	Yes	5	0.00000001	0.00056899
4	Yes	7	0.00000001	0.00008802
5	Yes	6	0.00000001	0.00033633
6	Yes	6	0.00000001	0.00097226
7	Yes	6	0.00000001	0.00025929
8	Yes	6	0.00000001	0.00011554
9	Yes	5	0.00000001	0.00864063
10	Yes	7	0.00000001	0.00008211
11	Yes	6	0.00000001	0.00031055
12	Yes	7	0.00000001	0.00008074
13	Yes	6	0.00000001	0.00030479
14	Yes	6	0.00000001	0.00010207
15	Yes	5	0.00000001	0.00056890
16	Yes	6	0.00000001	0.00097732
17	Yes	6	0.00000001	0.00026086
18	Yes	7	0.00000001	0.00008854
19	Yes	6	0.00000001	0.00033835
20	Yes	6	0.00000001	0.00011556
21	Yes	5	0.00000001	0.00064073
22	Yes	7	0.00000001	0.00007538
23	Yes	6	0.00000001	0.00028249
24	Yes	7	0.00000001	0.00007666
25	Yes	6	0.00000001	0.00028789
26	Yes	4	0.00000001	0.00013605
27	Yes	6	0.00004439	0.00037875

28	Yes	7	0.00000001	0.00020128
29	Yes	6	0.00004387	0.00076602
30	Yes	6	0.00004444	0.00048591
31	Yes	6	0.00004384	0.00098428
32	Yes	6	0.00004384	0.00090358
33	Yes	6	0.00004444	0.00039140
34	Yes	6	0.00004386	0.00078116
35	Yes	7	0.00000001	0.00021142
36	Yes	6	0.00004439	0.00047627
37	Yes	6	0.00004384	0.00074057
38	Yes	6	0.00004385	0.00078410
39	Yes	5	0.00000001	0.00011677
40	Yes	5	0.00000001	0.00047947
41	Yes	5	0.00000001	0.00033101
42	Yes	5	0.00000001	0.00013148
43	Yes	5	0.00000001	0.00041729
44	Yes	5	0.00000001	0.00040591
45	Yes	5	0.00000001	0.00011768
46	Yes	5	0.00000001	0.00033520
47	Yes	5	0.00000001	0.00048677
48	Yes	5	0.00000001	0.00013094
49	Yes	5	0.00000001	0.00035024
50	Yes	5	0.00000001	0.00035915

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	195 - 171.75	60.707	44	3.241	0.053
L2	175 - 135.917	47.714	44	2.907	0.025
L3	140 - 92.8333	28.844	44	2.189	0.010
L4	98 - 46.5833	13.190	44	1.332	0.004
L5	52.75 - 0	3.673	44	0.658	0.001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
199.000	KP4F-23	44	60.707	3.241	0.053	10456
195.000	Lightning Rod 2"x21'	44	60.707	3.241	0.053	10456
194.000	(3) Valmont T-Arm (1)	44	60.042	3.225	0.052	10456
157.000	PiROD 13' Platform w/handrail	44	37.317	2.553	0.013	2658
140.000	Pirod 6' Side Mount Standoff (1)	44	28.844	2.189	0.010	2711
120.000	PiROD 13' Platform w/handrail	44	20.501	1.761	0.007	2966
102.000	(3) RRU	44	14.383	1.405	0.004	3252
100.000	PiROD 15' Low Profile Platform	44	13.779	1.368	0.004	3285
80.000	Andrew 4' w/Radome	44	8.534	1.056	0.002	3375

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	195 - 171.75	244.332	14	12.991	0.210
L2	175 - 135.917	192.494	14	11.716	0.096
L3	140 - 92.8333	116.682	14	8.857	0.039
L4	98 - 46.5833	53.443	14	5.399	0.015
L5	52.75 - 0	14.892	14	2.669	0.006

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
199.000	KP4F-23	14	244.332	12.991	0.210	2931
195.000	Lightning Rod 2"x21'	14	244.332	12.991	0.210	2931
194.000	(3) Valmont T-Arm (1)	14	241.682	12.930	0.203	2931
157.000	PiROD 13' Platform w/handrail	14	150.801	10.320	0.051	712
140.000	Pirod 6' Side Mount Standoff (1)	14	116.682	8.857	0.039	703
120.000	PiROD 13' Platform w/handrail	14	83.008	7.132	0.027	757
102.000	(3) RRU	14	58.271	5.693	0.017	821
100.000	PiROD 15' Low Profile Platform	14	55.828	5.545	0.016	828
80.000	Andrew 4' w/Radome	14	34.593	4.203	0.009	843

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	K/r	A in²	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
L1	195 - 171.75 (1)	TP17.27x12.65x0.188	23.250	0.000	0.0	9.831	-2.052	730.409	0.003
L2	171.75 - 135.917 (2)	TP24.48x16.249x0.25	39.083	0.000	0.0	18.638	-7.789	1384.680	0.006
L3	135.917 - 92.8333 (3)	TP33.12x23.12x0.313	47.167	0.000	0.0	31.613	-20.350	2325.860	0.009
L4	92.8333 - 46.5833 (4)	TP42.19x31.4x0.438	51.417	0.000	0.0	56.465	-34.291	4195.040	0.008
L5	46.5833 - 0 (5)	TP52.2x40.021x0.438	52.750	0.000	0.0	72.241	-54.332	5068.530	0.011

Pole Bending Design Data

Section No.	Elevation ft	Size	M_{ux} kip-ft	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{ny} kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L1	195 - 171.75 (1)	TP17.27x12.65x0.188	109.178	245.029	0.446	0.000	245.029	0.000
L2	171.75 - 135.917 (2)	TP24.48x16.249x0.25	437.799	660.925	0.662	0.000	660.925	0.000
L3	135.917 - 92.8333 (3)	TP33.12x23.12x0.313	1221.383	1507.692	0.810	0.000	1507.692	0.000
L4	92.8333 - 46.5833 (4)	TP42.19x31.4x0.438	2429.775	3466.067	0.701	0.000	3466.067	0.000
L5	46.5833 - 0 (5)	TP52.2x40.021x0.438	3988.475	5370.375	0.743	0.000	5370.375	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V_u K	ϕV_n K	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u kip-ft	ϕT_n kip-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	195 - 171.75 (1)	TP17.27x12.65x0.188	5.637	365.204	0.015	0.995	493.966	0.002
L2	171.75 - 135.917 (2)	TP24.48x16.249x0.25	13.312	692.341	0.019	0.987	1332.392	0.001
L3	135.917 - 92.8333 (3)	TP33.12x23.12x0.313	24.929	1162.930	0.021	0.587	3039.433	0.000
L4	92.8333 - 46.5833 (4)	TP42.19x31.4x0.438	28.256	2097.520	0.013	0.014	6987.408	0.000
L5	46.5833 - 0 (5)	TP52.2x40.021x0.438	30.674	2534.260	0.012	2.558	10826.417	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	195 - 171.75 (1)	0.003	0.446	0.000	0.015	0.002	0.449 ✓	1.000	4.8.2 ✓
L2	171.75 - 135.917 (2)	0.006	0.662	0.000	0.019	0.001	0.668 ✓	1.000	4.8.2 ✓
L3	135.917 - 92.8333 (3)	0.009	0.810	0.000	0.021	0.000	0.819 ✓	1.000	4.8.2 ✓
L4	92.8333 - 46.5833 (4)	0.008	0.701	0.000	0.013	0.000	0.709 ✓	1.000	4.8.2 ✓
L5	46.5833 - 0 (5)	0.011	0.743	0.000	0.012	0.000	0.754 ✓	1.000	4.8.2 ✓

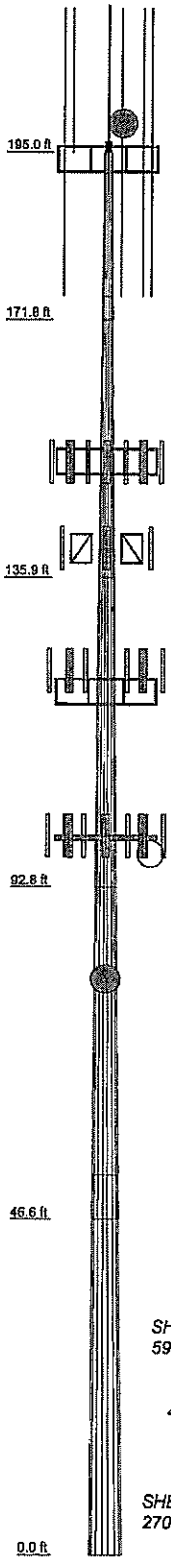
Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
L1	195 - 171.75	Pole	TP17.27x12.65x0.188	1	-2.052	730.409	44.9	Pass
L2	171.75 - 135.917	Pole	TP24.48x16.249x0.25	2	-7.789	1384.680	66.8	Pass
L3	135.917 - 92.8333	Pole	TP33.12x23.12x0.313	3	-20.350	2325.860	81.9	Pass
L4	92.8333 - 46.5833	Pole	TP42.19x31.4x0.438	4	-34.291	4195.040	70.9	Pass
L5	46.5833 - 0	Pole	TP52.2x40.021x0.438	5	-54.332	5868.530	75.4	Pass
							Summary	
							Pole (L3) 81.9	Pass
							RATING = 81.9	Pass

Appendix B

Reference Documents

Section	1	2	3	4	5
Length (ft)	23.25	39.08	47.17	51.42	52.75
Number of Sides	16	16	16	16	16
Thickness (in)	0.1875	0.2500	0.3125	0.4375	0.4375
Socket Length (ft)	3.25	4.08	5.17	6.17	
Top Dia (in)	12.5500	16.2462	23.1207	31.3690	40.0202
Bot Dia (in)	17.2700	24.4800	33.1200	42.1900	52.2000
Grade	A572-65				
Weight (lb) 27601.4	699.0	2133.2	4449.5	8878.2	11441.5



ALL REACTIONS ARE FACTORED

AXIAL 89126 lb

SHEAR 5945 lb — *MOMENT 873185 lb-ft*

TORQUE 1280 lb-ft
40 mph WIND - 0.7500 in ICE

AXIAL 53386 lb

SHEAR 27091 lb — *MOMENT 3489786 lb-ft*

TORQUE 3379 lb-ft
REACTIONS - 90 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod 2"x21'	195	6' Standoff	140
Large Beacon	195	6' Standoff	140
20' Omni	195	6' x 8" Panel Antenna w/Mount Pipe	140
20' Omni	195	6' x 8" Panel Antenna w/Mount Pipe	140
20' Omni	195	6' x 8" Panel Antenna w/Mount Pipe	140
20' Omni	195	6' Standoff	140
20' Omni	195	(2) 6' x 8" Panel Antenna w/Mount Pipe	120
20' Omni	195		
20' Omni	195	(2) 6' x 8" Panel Antenna w/Mount Pipe	120
10' Omni	195		
20' Omni	195	(2) 6' x 8" Panel Antenna w/Mount Pipe	120
20' Omni	195		
KP4F-23	195	PiROD 13' Platform w/handrail	120
PiROD 13' Platform w/handrail	194	(2) 6' x 6" Panel Antenna w/Mount Pipe	100
(3) SBNH-1D6565B w/Mount Pipe	152		
(3) SBNH-1D6565B w/Mount Pipe	152	(2) 6' x 6" Panel Antenna w/Mount Pipe	100
(3) SBNH-1D6565B w/Mount Pipe	152		
(4) ETD819H-12UB	152	(2) 6' x 6" Panel Antenna w/Mount Pipe	100
(4) ETD819H-12UB	152		
(4) ETD819H-12UB	152	6' x 1' Panel Antenna w/Mount Pipe	100
RRUS-11	152	6' x 1' Panel Antenna w/Mount Pipe	100
RRUS-11	152	6' x 1' Panel Antenna w/Mount Pipe	100
RRUS-11	152	PiROD 15' Low Profile Platform	100
DC6-48-60-18-8F	152	Andrew 4' w/Radome	80
PiROD 13' Low Profile Platform	152		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Milwaukee County, Wisconsin.
2. Tower designed for Exposure B to the TIA-222-G Standard.
3. Tower designed for a 90 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 40 mph basic wind with 0.75 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: 102.2%

RAMAKER & ASSOCIATES, INC

Ramaker & Associates, Inc.
1120 Dallas Street
Sauk City, WI 53583
Phone: (608) 643-4100
FAX: (608) 643-7999

Job: *Milwaukee Fire Department (WI1206*			
Project: *20865*			
Client: Goodman/AT&T	Drawn by: tmoore	App'd:	
Code: TIA-222-G	Date: 04/23/12	Scale: NTS	
Path: I:\20800\20865\Structural\Risa\20865 check.eri		Dwg No. E-1	

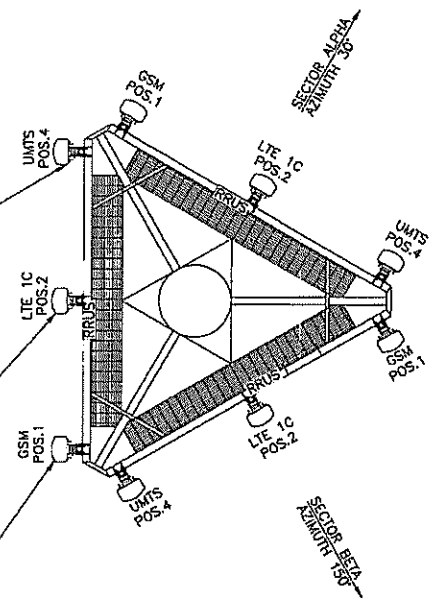
EXISTING ANTENNA MODELS, POSITIONS & AZIMUTHS ARE ASSUMED BASED ON RFDS. CONTRACTOR TO VERIFY PRIOR TO CONSTRUCTION & COORDINATE WITH AT&T RF ENGINEER FOR ANY DISCREPANCY.

POSITION 4 ALL SECTORS:
(3) EXISTING UMTS ANTENNAS ANDREW SBNH-1D6565A (50.9"x11.9"x7.1") (TYP.1 PER SECTOR).

SECTOR GAMMA AZIMUTH 270°

POSITION 2 ALL SECTORS:
(3) EXISTING LTE 1C ANTENNAS ANDREW SBNH-1D6565B (72.4"X11.9"X7.1") W/ (3) EXISTING RRUS 700 (TYP.1 PER SECTOR)

POSITION 1 ALL SECTORS:
(3) EXISTING GSM ANTENNAS CSS XDUO4-80-R (50.5"x12.5"x7.1") (TYP.1 PER SECTOR)



1 LTE 1C/EXISTING ANTENNA LAYOUT
SCALE: N.T.S.

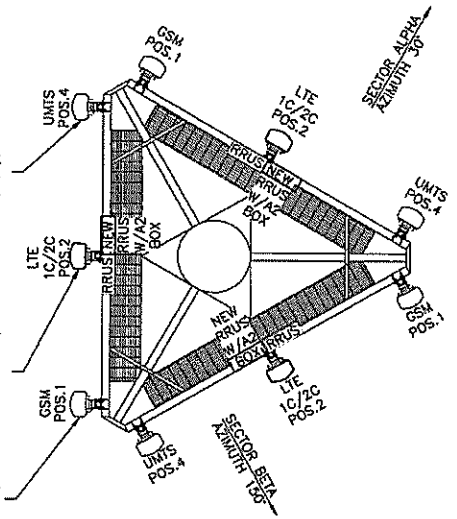
RELOCATE/ ADD/ REPLACE MOUNTING PIPES AS REQUIRED TO ACCOMMODATE NEW ANTENNAS

POSITION 4 ALL SECTORS:
(3) EXISTING UMTS ANTENNAS ANDREW SBNH-1D6565A (50.9"x11.9"x7.1") (TYP.1 PER SECTOR) TO REMAIN.

SECTOR GAMMA AZIMUTH 270°

POSITION 2 ALL SECTORS:
REMOVE (3) EXISTING ANTENNAS AND REPLACE W/ (3) NEW LTE 1C/2C ANTENNAS COMMSCOPE SBNHH-1D65B (72"x11.9"x7.1")
(3) EXISTING RRUS 700 TO REMAIN.
INSTALL (3) NEW RRUS AWS W/A2 BOX (TYP.1 PER SECTOR)

POSITION 1 ALL SECTORS:
(3) EXISTING GSM ANTENNAS CSS XDUO4-80-R (50.5"x12.5"x7.1") (TYP.1 PER SECTOR) TO REMAIN.



2 PROPOSED 2C (AWS) ANTENNA LAYOUT
SCALE: N.T.S.

REFER TO RF DESIGN SHEET FOR ADDITIONAL INFORMATION ON TMA'S/DIPLEXERS/DC&FIBER BOX/SQUID

MasTec Network Solutions
1351 E. Irving Park Rd
Itasca, IL 60143

Apex Engineers, Inc.
Structural & Civil Engineers
500 East 22nd Street, Suite B
Lombard, Illinois 60148
Ph. (630) 627-1800
Fax. (630) 627-1165
APEX JOB No. GM09-080

AWE - MILWAUKEE FIRE DEPARTMENT
SITE NO.WI1206
SITERRA NO. 38489-A
8514 WEST LISBON
MILWAUKEE WI, 53222

at&t

NO.	DATE	REVISIONS	BY	CHK	APP'D
A	06/29/15	ISSUED FOR REVIEW	GR	RD	SP

SCALE: AS SHOWN | DESIGNED BY: XX | DRAWN BY: XX

AT&T MOBILITY

ANTENNA LAYOUT

DRAWING NUMBER: WI1206-04 | REV: A

11 x 17 'B' SIZE

6 5 4 3 2

SECTOR	ANTENNA NUMBER	POLARITY/PORT	TOP AND BOTTOM JUMPER COLOR	COAX ID	ANTENNA MODEL NUMBER	ANTENNA VENDOR	TMA/ DIPL./RRU MODEL NUMBER	AZIMUTH	MECHANICAL DOWNTILT	ELECTRICAL DOWNTILT	ANTENNA CENTERLINE FROM GROUND	ANTENNA TIP HEIGHT	COAXIAL FEEDER		ANTENNA TYPE
													SIZE	LENGTH	
A	A1	850	R W Sl	A1-1	XDU04-80-R	CSS	(2) TMA	30°	-	-	157'-0"	159'-0"	1-5/8"	TBD	GSM
		1900	R W Br	A1-2									1-5/8"		
	A2	700	R O Sl	A2-1	SBNHH-1D65B	COMMSCOPE	RRUS RRUS W/A2 BOX	30°	-	-	157'-0"	160'-0"	FIBER	TBD	LTE 1C/2C
		AWS	R O Br	A2-2											
	A3	-	R Br Sl	A3-1											
		-	R Br Br	A3-2											
	A4	850	R V Sl	A4-1	DBXNH-6565A-R2M	ANDREW	(2) TMA	30°	-	-	157'-0"	159'-0"	1-5/8"	TBD	UMTS
		1900	R V Br	A4-2									1-5/8"		
B	B1	850	Bl W Sl	B1-1	XDU04-80-R	CSS	(2) TMA	150°	-	-	157'-0"	159'-0"	1-5/8"	TBD	GSM
		1900	Bl W Br	B1-2									1-5/8"		
	B2	700	Bl O Sl	B2-1	SBNHH-1D65B	COMMSCOPE	RRUS RRUS W/A2 BOX	150°	-	-	157'-0"	160'-0"	FIBER	TBD	LTE 1C/2C
		AWS	Bl O Br	B2-2											
	B3	-	Bl Br Sl	B3-1											
		-	Bl Br Br	B3-2											
	B4	850	Bl V Sl	B4-1	DBXNH-6565A-R2M	ANDREW	(2) TMA	150°	-	-	157'-0"	159'-0"	1-5/8"	TBD	UMTS
		1900	Bl V Br	B4-2									1-5/8"		
C	C1	850	G W Sl	C1-1	XDU04-80-R	CSS	(2) TMA	270°	-	-	157'-0"	159'-0"	1-5/8"	TBD	GSM
		1900	G W Br	C1-2									1-5/8"		
	C2	700	G O Sl	C2-1	SBNHH-1D65B	COMMSCOPE	RRUS RRUS W/A2 BOX	270°	-	-	157'-0"	160'-0"	FIBER	TBD	LTE 1C/2C
		AWS	G O Br	C2-2											
	C3	-	G Br Sl	C3-1											
		-	G Br Br	C3-2											
	C4	850	G V Sl	C4-1	DBXNH-6565A-R2M	ANDREW	(2) TMA	270°	-	-	157'-0"	159'-0"	1-5/8"	TBD	UMTS
		1900	G V Br	C4-2									1-5/8"		

ANTENNA MATRIX IS PREPARED BASED ON INFORMATION PROVIDED BY MASTEC NETWORK SOLUTION. GENERAL CONTRACTOR TO VERIFY AND INCORPORATE MOST RECENT VERSION OF RFDS PRIOR TO CONSTRUCTION.

1 ANTENNA MATRIX
NTS

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APEX JOB No. GM09-080

AWE - MILWAUKEE FIRE DEPARTMENT
SITE NO.WI1206
SITERRA NO. 38489-A
8814 WEST LISBON
MILWAUKEE WI, 53222

at&t

NO.	DATE	REVISIONS	BY	CHK	APP'D
A	08/28/13	ISSUED FOR REVIEW	GR	RG	SP

SCALE: AS SHOWN | DESIGNED BY: XX | DRAWN BY: XX

AT&T MOBILITY

ANTENNA MATRIX

DRAWING NUMBER: M1205-07 | REV: A

11 x 17 "B" SIZE

6 5 4 3 2

PROJECT INFORMATION

APPLICANT:	AT&T 930 NATIONAL PARKWAY SCHAUMBURG, IL 60173
FA CODE:	10080329
PROPOSED USE:	TELECOMMUNICATIONS FACILITY
STRUCTURE TYPE:	MONOPOLE
SITE ADDRESS:	8814 WEST LISBON MILWAUKEE, WI 53222
PROPERTY OWNER:	CITY OF MILWAUKEE 200 E. WELLS ST. ROOM 800 MILWAUKEE WI 53202
CONTACT PERSON:	CITY ATTORNEY
PARCEL NUMBER:	TBD
JURISDICTION:	MILWAUKEE COUNTY
LATITUDE:	43° 5' 0.283" N
LONGITUDE:	88° 1' 20.942" W
LAT/ LONG TYPE:	NAD 83
GROUND ELEVATION:	758 FT MSL
POWER COMPANY:	WE ENERGIES
PHONE:	(800) 662-4797
TELEPHONE COMPANY:	AT&T
PHONE:	(800)-257-0902

SITE NUMBER: WI1206
SITE NAME: AWE - MILWAUKEE FIRE DEPARTMENT

PROJECT:

LTE 2C (AWS)

PROJECT DESCRIPTION:

REPLACE EXISTING ANTENNAS ON POS. 2.
INSTALL NEW AWS RRUS W/A2 BOX IN EACH SECTOR.
UPGRADE EXISTING LTE RBS 6601 FOR AWS EQUIPMENT.

AT&T APPROVAL

SITE ACQUISITION MANAGER: _____ Date _____
MASTEC CONSTRUCTION MANAGER: _____ Date _____
MASTEC SA PROJECT MANAGER: _____ Date _____
MASTEC SA SPECIALIST: _____ Date _____
MASTEC COMPLIANCE MANAGER: _____ Date _____
AT&T RF PROJECT MANAGER: _____ Date _____
AT&T PROJECT MANAGER: _____ Date _____

AT&T MOBILITY APPROVAL

Real Estate _____ Date _____
RF _____ Date _____
Operation _____ Date _____

LTE PROJECT

☒ 700 ☒ AWS ☐ 1900 ☐ 850 ☐ WCS

DRAWING INDEX

TO OBTAIN LOCATION OF PARTICIPANTS' UNDERGROUND FACILITIES BEFORE YOU DIG IN WISCONSIN.
MEMBER
ONE CALL SYSTEMS INTERNATIONAL
CALL DIGGERS HOT LINE
1-800-242-8511
TOLL FREE
FAX A LOCATE 1-800-338-3860
TDD (FOR HEARING IMPAIRED)
1-800-542-2289

THESE DRAWINGS ARE PREPARED BASED ON INFORMATION PROVIDED BY MASTEC NETWORK SOLUTION. GENERAL CONTRACTOR TO VERIFY AND INCORPORATE MOST RECENT VERSION OF RFDS PRIOR TO CONSTRUCTION.

VICINITY MAP

DIRECTION: (FROM O'HARE INTERNATIONAL AIRPORT)

DEPART CHICAGO O'HARE INTERNATIONAL AIRPORT TAKE RAMP ONTO I-190/CHICAGO AT EXIT 1C, TURN RIGHT ONTO RAMP I-294/I-90 W/MILWAUKEE/ROCKFORD MERGE ONTO I-294 MERGE ONTO I-94 STAY ON I-94 [US-41] AT EXIT 316, TAKE RAMP ONTO I-43 [I-894] I-43/I-894-BYP/MADISON/FOND DU LAC KEEP RIGHT ONTO I-894 [ZOO FWY] I-894/US-45 AT EXIT 1A, ROAD NAME CHANGES TO US-45 [ZOO FWY] AT EXIT 44, KEEP RIGHT TAKE RAMP ONTO W CAPITOL DR WI-190/CAPITAL DRIVE EAST MERGE ONTO SR-190 [W CAPITOL DR] KEEP RIGHT ONTO W LISBON AVE TURN LEFT ONTO N 88TH ST, THEN IMMEDIATELY TURN LEFT ONTO W LISBON AVE TURN RIGHT ONTO LOCAL ROAD(S) ARRIVE WI1206

SITE QUALIFICATION PARTICIPANTS

	NAME	COMPANY	NUMBER
A/E	SATISHKUMAR C. PATEL	APEX ENGINEERS, INC.	(630) 627-1800
SA			
RF			
PM	KEN STOCKERO	MASTEC	(847) 463-5921
CM		MASTEC	

APPLICABLE BUILDING CODES AND STANDARDS

CONTRACTOR'S WORK SHALL COMPLY WITH ALL APPLICABLE NATIONAL, STATE, AND LOCAL CODES AS ADOPTED BY THE LOCAL AUTHORITY HAVING JURISDICTION (AHJ) FOR THE LOCATION. THE EDITION OF THE AHJ ADOPTED CODES AND STANDARDS IN EFFECT ON THE DATE OF CONTRACT AWARD SHALL GOVERN THE DESIGN.

BUILDING CODE:
[INTERNATIONAL BUILDING CODE (IBC), 2012 AS ADOPTED BY LOCAL BUILDING AUTHORITY]

ELECTRICAL CODE:
[NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 70-2002;
2008 NATIONAL ELECTRICAL CODE, AS
ADOPTED BY LOCAL BUILDING AUTHORITY]
LIGHTNING PROTECTION CODE:
[NFPA 780 - 2000, LIGHTNING PROTECTION CODE]
CONTRACTOR'S WORK SHALL COMPLY WITH THE LATEST EDITION OF THE FOLLOWING STANDARDS.
AMERICAN CONCRETE INSTITUTE (ACI) 318, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC), MANUAL OF STEEL CONSTRUCTION, ASD, NINTH EDITION
TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA) 222-G, STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWER AND ANTENNA SUPPORTING STRUCTURES:
TIA 607, COMMERCIAL BUILDING GROUNDING AND BONDING REQUIREMENTS FOR TELECOMMUNICATIONS
INSTITUTE FOR ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE) 81, GUIDE FOR MEASURING EARTH RESISTIVITY, GROUND IMPEDANCE, AND EARTH SURFACE POTENTIALS OF A GROUND SYSTEM
IEEE 1100 (1999) RECOMMENDED PRACTICE FOR POWERING AND GROUNDING OF ELECTRONIC EQUIPMENT
IEEE C62.41, RECOMMENDED PRACTICES ON SURGE VOLTAGES IN LOW VOLTAGE AC POWER CIRCUITS (FOR LOCATION CATEGORY "C3" AND "HIGH SYSTEM EXPOSURE")

TELCORDIA GR-1275, GENERAL INSTALLATION REQUIREMENTS
TELCORDIA GR-1503, COAXIAL CABLE CONNECTIONS

ANSI T1.311, FOR TELECOM - DC POWER SYSTEMS - TELECOM, ENVIRONMENTAL PROTECTION
FOR ANY CONFLICTS BETWEEN SECTIONS OF LISTED CODES AND STANDARDS REGARDING MATERIAL, METHODS OF CONSTRUCTION, OR OTHER REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENT SHALL GOVERN. WHERE THERE IS CONFLICT BETWEEN A GENERAL REQUIREMENT AND A SPECIFIC REQUIREMENT, THE SPECIFIC REQUIREMENT SHALL GOVERN.

I HEREBY CERTIFY THAT THESE PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION AND TO THE BEST OF MY PROFESSIONAL KNOWLEDGE THEY COMPLY WITH THE REQUIREMENT OF ALL APPLICABLE CODES AND ORDINANCES.

DATE: 08/28/15

SATISHKUMAR C. PATEL, S.E.
WISCONSIN P.E. LICENSE #E-25581
EXPIRES 07-31-2016

SATISHKUMAR C. PATEL E-25581 DOWNERS GROVE, IL PROFESSIONAL ENGINEER

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APEX JOB No. GM09-080

AWE - MILWAUKEE FIRE DEPARTMENT
SITE NO.WI1206
SITERRA NO. 38489-A
8814 WEST LISBON
MILWAUKEE WI, 53222

NO.	DATE	REVISIONS	BY	CHK	APP'D
A	08/28/15	ISSUED FOR REVIEW	GR	RD	SP

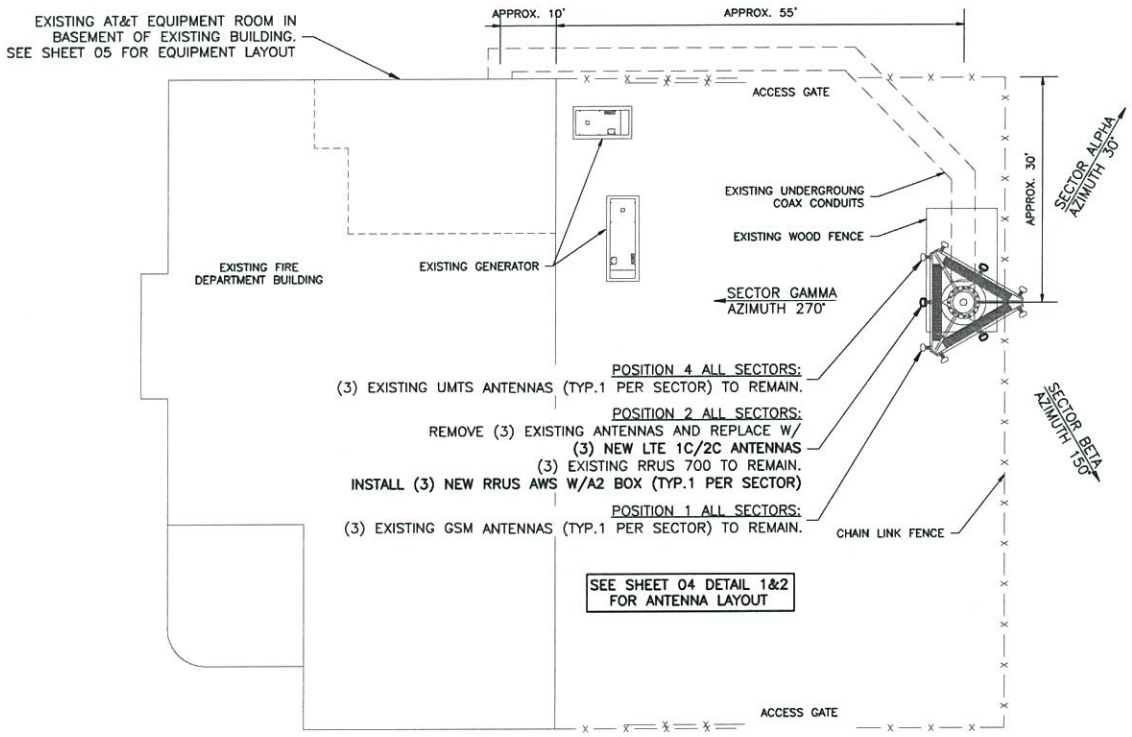
SCALE: AS SHOWN | DESIGNED BY: XX | DRAWN BY: XX

AT&T MOBILITY

TITLE SHEET

DRAWING NUMBER: WI1206-01 | REV: A

11 x 17 "B" SIZE

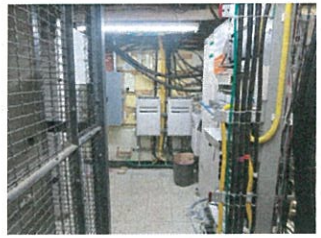


1 SITE PLAN
SCALE: 1/16"=1'-0"

PICTURES TAKEN ON 08/25/2015

EXISTING TOWER

EXISTING ANTENNAS



EXISTING EQUIPMENT

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SCALE: AS SHOWN | DESIGNED BY: XX | DRAWN BY: XX

AT&T MOBILITY

SITE PLAN

DRAWING NUMBER	REV
W11206-02	A

11 x 17 'B' SIZE

6 5 4 3 2

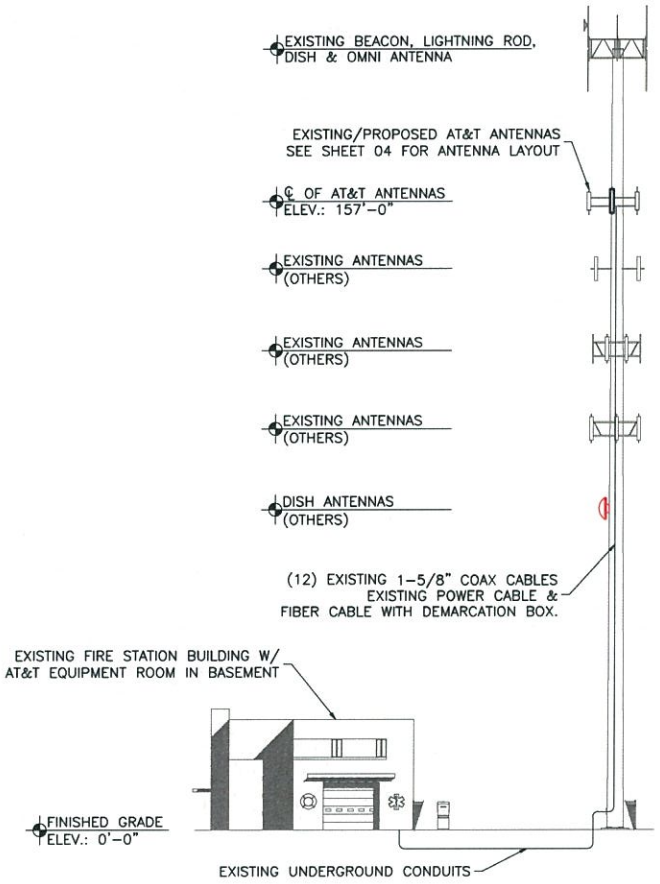
STRUCTURAL ANALYSIS BY OTHERS

NOTE:
1. REFER TO RF DESIGN SHEET/ ANTENNA CONFIGURATION DRAWING/ RET CONTROL DIAGRAM & INSTALL AS REQUIRED UPPER TMA'S, LOWER DIPLEXERS, BIAS-T, PDUs, RET CONTROLLER & HR CABLE, MCU, BOTTOM JUMPERS, GSM 850 RADIOs, LMU CABLES, 500HM LOADs OR TERMINATION CAPS

2. ALL ANTENNA AZIMUTH TO BE FROM TRUE NORTH

ANTENNA MOUNTING FRAME REINFORCEMENT:

SEE DRAWING S01 FOR FRAME REINFORCEMENT



1 ELEVATION
SCALE: 1"=30'-0"

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AT&T MOBILITY

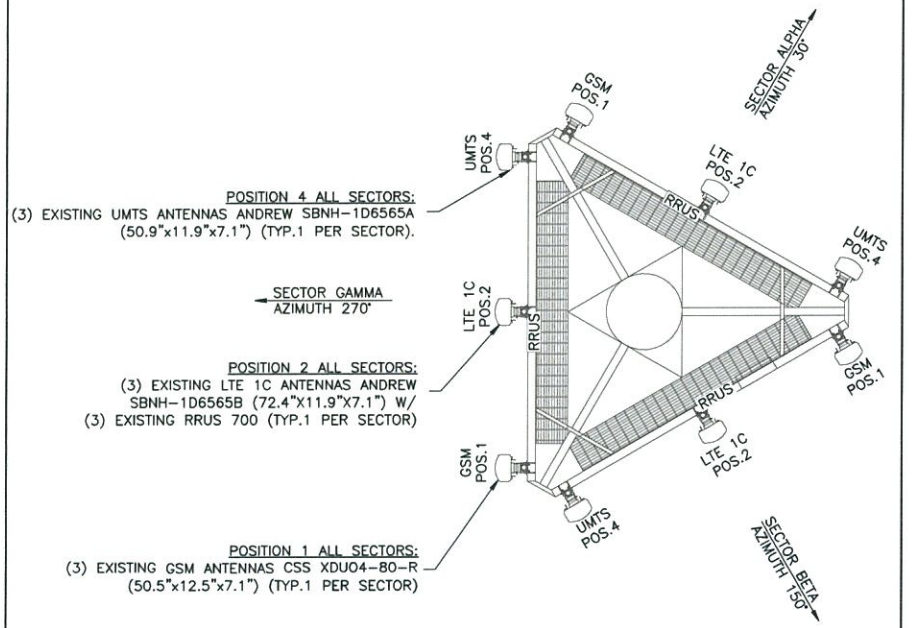
ELEVATION

DRAWING NUMBER	REV
W1206-03	A

11 x 17 'B' SIZE

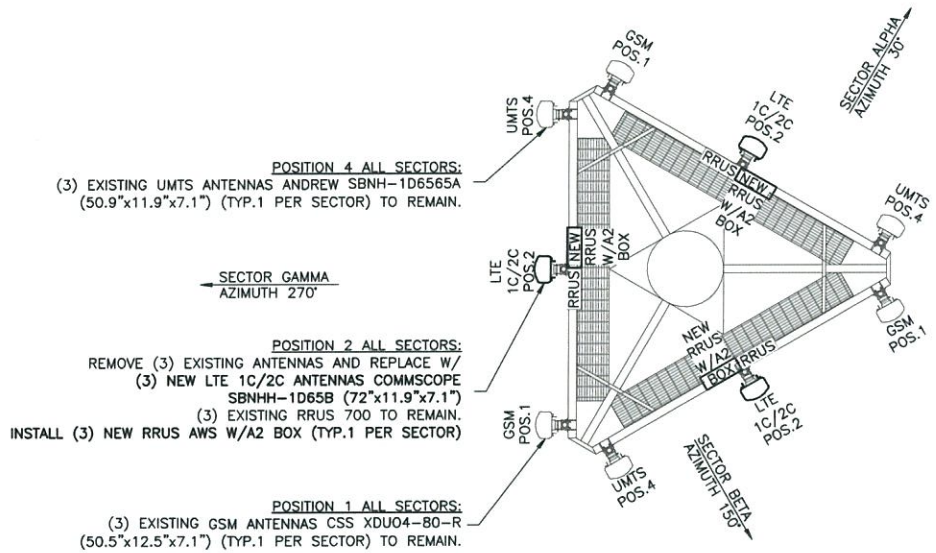
6 5 4 3 2

EXISTING ANTENNA MODELS, POSITIONS & AZIMUTHS ARE ASSUMED BASED ON RFDS. CONTRACTOR TO VERIFY PRIOR TO CONSTRUCTION & COORDINATE WITH AT&T RF ENGINEER FOR ANY DISCREPANCY.



1 LTE 1C/EXISTING ANTENNA LAYOUT
SCALE: N.T.S.

RELOCATE/ ADD/ REPLACE MOUNTING PIPES AS REQUIRED TO ACCOMMODATE NEW ANTENNAS



2 PROPOSED 2C (AWS) ANTENNA LAYOUT
SCALE: N.T.S.

REFER TO RF DESIGN SHEET FOR ADDITIONAL INFORMATION ON TMA'S/DIPLEXERS/DC&FIBER BOX/SQUID

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A	08/28/15	ISSUED FOR REVIEW	GR	RD	SP

SCALE: AS SHOWN | DESIGNED BY: XX | DRAWN BY: XX

AT&T MOBILITY

ANTENNA LAYOUT

DRAWING NUMBER	REV
W1206-04	A

11 x 17 "B" SIZE

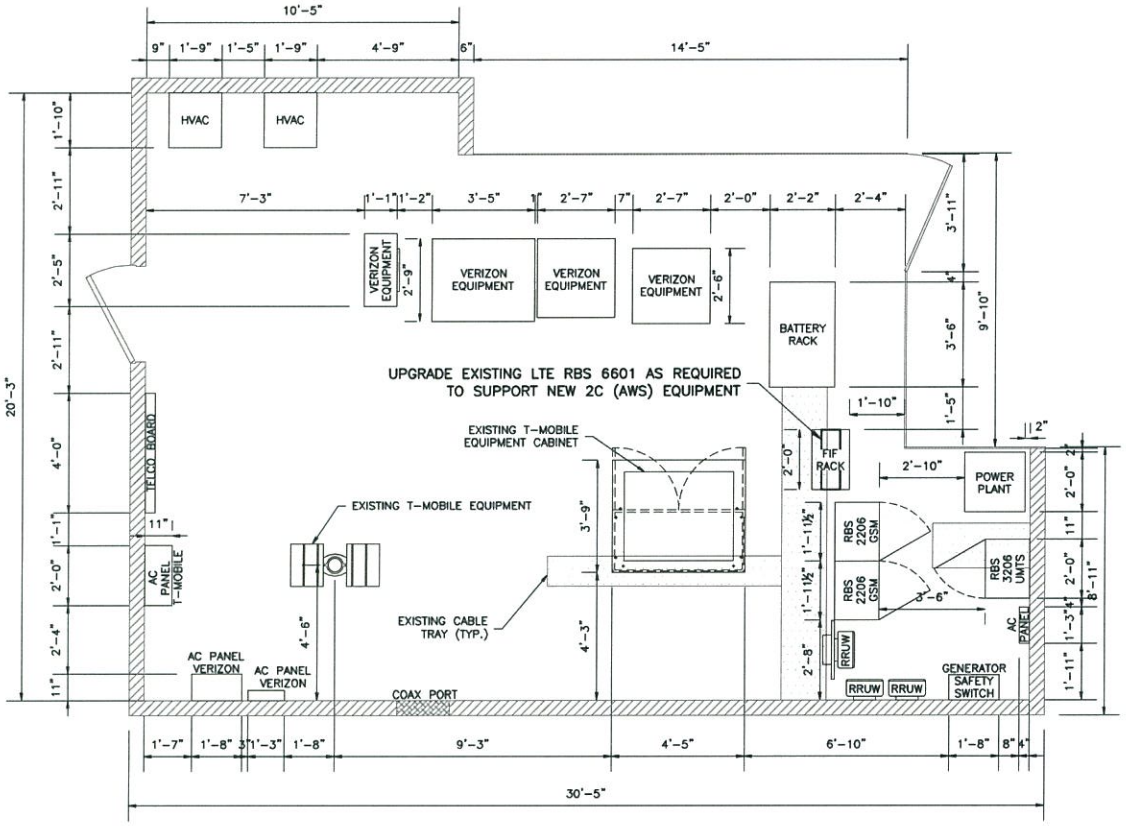
6 5 4 3 2

NOTES:

1. EXISTING SPACE FOR PROPOSED EQUIPMENT ASSUMED TO BE ADEQUATE, PRIOR TO INSTALLATION, COORDINATE FINAL LOCATION WITH CONSTRUCTION MANAGER.

2. COORDINATE WITH CONSTRUCTION MANAGER FOR THE PROVISION OF DC CIRCUIT BREAKERS AND OTHER ANCILLARY ITEMS TO SUPPORT THE NEW EQUIPMENT.

3. PROPERLY BOND ALL EQUIPMENT AND CONDUCTIVE SURFACES TO EXISTING GROUND PER NEC AND AT&T STANDARDS.



1 EQUIPMENT LAYOUT
SCALE: 1/4"=1'-0"

CONTRACTOR TO INSTALL CIRCUIT BREAKERS (PROVIDED BY AT&T) AS REQUIRED.

LTE EQUIPMENT LOCATION

RBS 6601-INDOOR BASEBAND UNIT:

- FOOTPRINT (HxWxD)
  - 66 x 483 x 350 MM (2.6 x 19 x 14 IN)
  - 1.5 U HEIGHT & 19" RACK MOUNTABLE
- WEIGHT
  - 10 KG (22 LBS)
- CLIMATE CONTROL
  - FANS (+41 TO +122F AMBIENT)
- BREAKERS/ POWER CABLE
  - -48 VDC (1x15 AMP BREAKER)
    DC CABLE SIZE #12 AWG (4 MM²)
- POWER CONSUMTION
  - ≈100 WATTS (TYPICAL, WITH ONE DUL-20, AND ONE SAU)
- EXTERNAL ALARMS
  - 8 INTERNAL
  - 32 VIA SEPARATE UNIT SAU UNIT
- POWER & BATTERY BACKUP
  - FROM AT&T POWER CABINET

2 RBS 6601
SCALE: NTS

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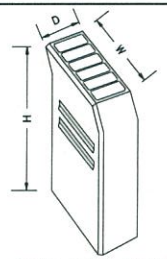
SCALE: AS SHOWN | DESIGNED BY: XX | DRAWN BY: XX

AT&T MOBILITY

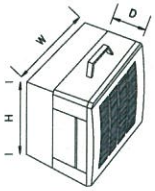
EQUIPMENT LAYOUT

DRAWING NUMBER	REV
WI1206-05	A

11 x 17 'B' SIZE



RRUs-01 & RRUW

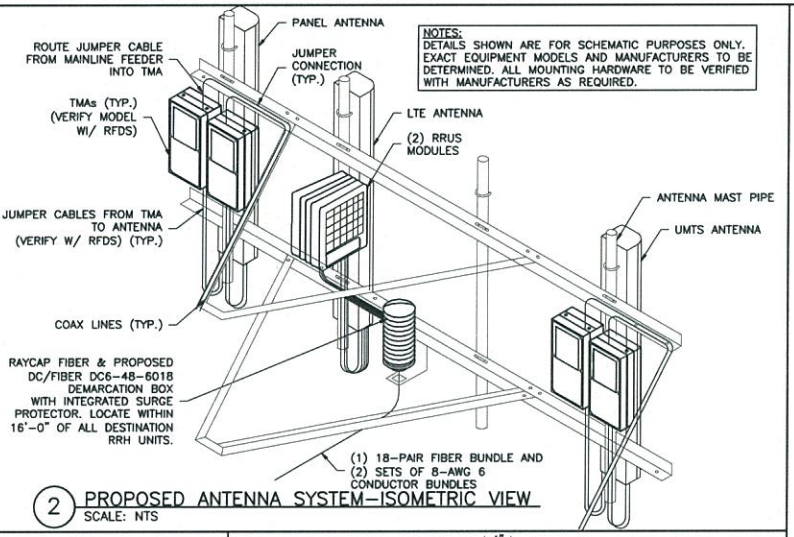


RRUs-11

SIZE AND WEIGHT TABLE

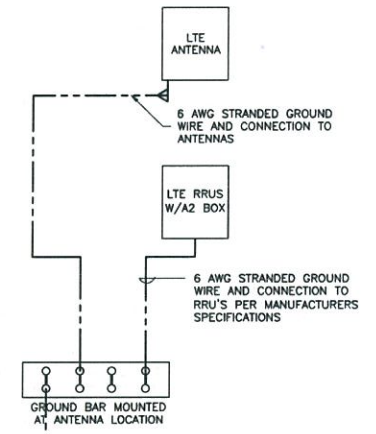
RRU	WIDTH	DEPTH	HEIGHT	WEIGHT W/O BRACKET
RRUS-01/RRUW WITHOUT SOLAR SHIELD	13.8"	4.4"	23.6"	39 LBS
RRUS-01/RRUW WITH SOLAR SHIELD	15.1"	6.7"	25.0"	44 LBS
RRUS11(700 MHz) WITHOUT SOLAR SHIELD	16.3"	5.8"	16.3"	44 LBS
RRUS11 (700 MHz) WITH SOLAR SHIELD	17.8"	7.2"	17.3"	49 LBS
RRUS11 (AWS 1700/2100 MHz) WITHOUT SOLAR SHIELD	16.3"	5.8"	16.3"	50 LBS
RRUS11 (AWS 1700/2100 MHz) WITH SOLAR SHIELD	17.8"	7.2"	17.3"	55 LBS

1 RRU SPECIFICATIONS
SCALE: N.T.S.



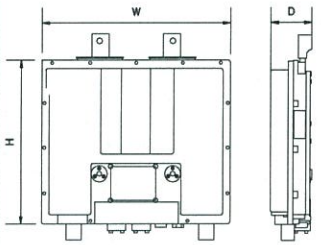
NOTES:
DETAILS SHOWN ARE FOR SCHEMATIC PURPOSES ONLY. EXACT EQUIPMENT MODELS AND MANUFACTURERS TO BE DETERMINED. ALL MOUNTING HARDWARE TO BE VERIFIED WITH MANUFACTURERS AS REQUIRED.

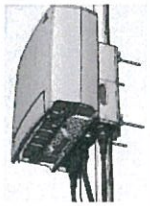
2 PROPOSED ANTENNA SYSTEM-ISOMETRIC VIEW
SCALE: NTS



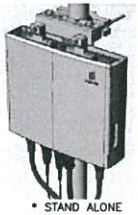
6 GROUNDING DIAGRAM
SCALE: N.T.S.

INSTALLATION CONCEPT





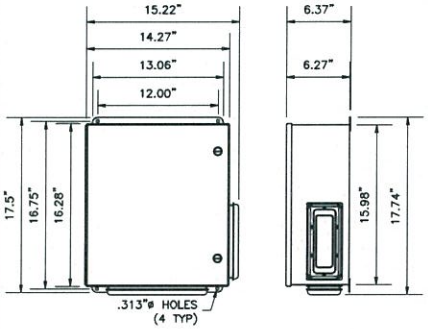
* BACK TO BACK W/RRUS



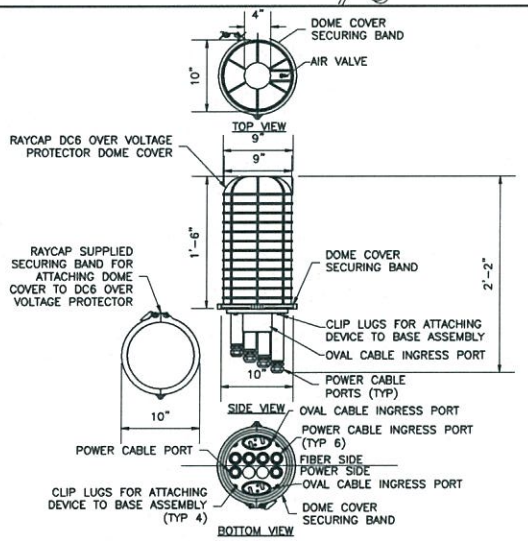
* STAND ALONE

	NO SOLAR SHIELD	WITH SOLAR SHIELD
HEIGHT (H)	12.8" (325.5MM)	12.8" (325.5MM)
WIDTH (W)	14.7" (374MM)	15.0" (380MM)
DEPTH (D)	3.2" (81MM)	3.5" (88MM)
WEIGHT		15 LBS

3 RRUS A2 SPECIFICATIONS
SCALE: N.T.S.



4 DC6 POWER BOX
SCALE: NTS



5 RAYCAP DC6-48-60-18-8F
DC POWER OVER VOLTAGE PROTECTOR (OVP)

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APEX JOB No. GM09-080

AWE - MILWAUKEE FIRE DEPARTMENT
SITE NO.WI1206
SITERRA NO. 38489-A
8814 WEST LISBON
MILWAUKEE WI, 53222

at&t

NO.	DATE	REVISIONS	BY	CHK	APP'D
A	08/28/15	ISSUED FOR REVIEW	GR	RD	SP

SCALE: AS SHOWN | DESIGNED BY: XX | DRAWN BY: XX

AT&T MOBILITY
CONSTRUCTION DETAILS

DRAWING NUMBER	REV
W1206-06	A

11 x 17 'B' SIZE

6 5 4 3 2

SECTOR	ANTENNA NUMBER	POLARITY/PORT	TOP AND BOTTOM JUMPER COLOR	COAX ID	ANTENNA MODEL NUMBER	ANTENNA VENDOR	TMA/ DIPL./RRU MODEL NUMBER	AZIMUTH	MECHANICAL DOWNTILT	ELECTRICAL DOWNTILT	ANTENNA CENTERLINE FROM GROUND	ANTENNA TIP HEIGHT	COAXIAL FEEDER SIZE	COAXIAL FEEDER LENGTH	ANTENNA TYPE
A	A1	850	R W Sl	A1-1	XDU04-80-R	CSS	(2) TMA	30°	–	–	157'-0"	159'-0"	1-5/8"	TBD	GSM
		1900	R W Br	A1-2									1-5/8"		
	A2	700	R O Sl	A2-1	SBNHH-1D65B	COMMSCOPE	RRUS RRUS W/A2 BOX	30°	–	–	157'-0"	160'-0"	FIBER	TBD	LTE 1C/2C
		AWS	R O Br	A2-2											
	A3	–	R Br Sl	A3-1											
		–	R Br Br	A3-2											
	A4	850	R V Sl	A4-1	DBXNH-6565A-R2M	ANDREW	(2) TMA	30°	–	–	157'-0"	159'-0"	1-5/8"	TBD	UMTS
		1900	R V Br	A4-2									1-5/8"		
B	B1	850	Bl W Sl	B1-1	XDU04-80-R	CSS	(2) TMA	150°	–	–	157'-0"	159'-0"	1-5/8"	TBD	GSM
		1900	Bl W Br	B1-2									1-5/8"		
	B2	700	Bl O Sl	B2-1	SBNHH-1D65B	COMMSCOPE	RRUS RRUS W/A2 BOX	150°	–	–	157'-0"	160'-0"	FIBER	TBD	LTE 1C/2C
		AWS	Bl O Br	B2-2											
	B3	–	Bl Br Sl	B3-1											
		–	Bl Br Br	B3-2											
	B4	850	Bl V Sl	B4-1	DBXNH-6565A-R2M	ANDREW	(2) TMA	150°	–	–	157'-0"	159'-0"	1-5/8"	TBD	UMTS
		1900	Bl V Br	B4-2									1-5/8"		
C	C1	850	G W Sl	C1-1	XDU04-80-R	CSS	(2) TMA	270°	–	–	157'-0"	159'-0"	1-5/8"	TBD	GSM
		1900	G W Br	C1-2									1-5/8"		
	C2	700	G O Sl	C2-1	SBNHH-1D65B	COMMSCOPE	RRUS RRUS W/A2 BOX	270°	–	–	157'-0"	160'-0"	FIBER	TBD	LTE 1C/2C
		AWS	G O Br	C2-2											
	C3	–	G Br Sl	C3-1											
		–	G Br Br	C3-2											
	C4	850	G V Sl	C4-1	DBXNH-6565A-R2M	ANDREW	(2) TMA	270°	–	–	157'-0"	159'-0"	1-5/8"	TBD	UMTS
		1900	G V Br	C4-2									1-5/8"		

ANTENNA MATRIX IS PREPARED BASED ON INFORMATION PROVIDED BY MASTEC NETWORK SOLUTION. GENERAL CONTRACTOR TO VERIFY AND INCORPORATE MOST RECENT VERSION OF RFDS PRIOR TO CONSTRUCTION.

1 ANTENNA MATRIX
NTS

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ANTENNA MATRIX

DRAWING NUMBER	REV
W11206-07	A

11 x 17 'B' SIZE

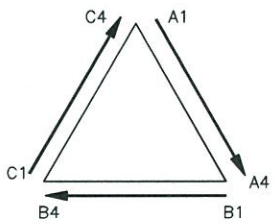
6 5 4 3 2

CABLE MARKING COLOR CONVENTION TABLE

ALPHA, A, X, #1	A1-1	A1-2	A2-1	A2-2	A3-1	A3-2	A4-1	A4-2
	+45	-45	+45	-45	+45	-45	+45	-45
SECTOR ANTENNA PORT (+/-)	RED	RED	RED	RED	RED	RED	RED	RED
	WHITE	WHITE	ORANGE	ORANGE	BROWN	BROWN	VIOLET	VIOLET
	SLATE	BROWN	SLATE	BROWN	SLATE	BROWN	SLATE	BROWN
BAND (LOW/HI) *SEE NOTES 13 AND 15	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET
BEAM (LEFT/RIGHT) *SEE NOTE 14 BELOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW
BETA, B, Y, #2	B1-1	B1-2	B2-1	B2-2	B3-1	B3-2	B4-1	B4-2
	+45	-45	+45	-45	+45	-45	+45	-45
SECTOR ANTENNA PORT	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
	WHITE	WHITE	ORANGE	ORANGE	BROWN	BROWN	VIOLET	VIOLET
	SLATE	BROWN	SLATE	BROWN	SLATE	BROWN	SLATE	BROWN
BAND (LOW/HI) *SEE NOTES 13 AND 15	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET
BEAM (LEFT/RIGHT) *SEE NOTE 14 BELOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW
GAMMA, C, Z, #3	C1-1	C1-2	C2-1	C2-2	C3-1	C3-2	C4-1	C4-2
	+45	-45	+45	-45	+45	-45	+45	-45
SECTOR ANTENNA PORT	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
	WHITE	WHITE	ORANGE	ORANGE	BROWN	BROWN	VIOLET	VIOLET
	SLATE	BROWN	SLATE	BROWN	SLATE	BROWN	SLATE	BROWN
BAND (LOW/HI) *SEE NOTES 13 AND 15	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET
BEAM (LEFT/RIGHT) *SEE NOTE 14 BELOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW
DELTA, D, #4	D1-1	D1-2	D2-1	D2-2	D3-1	D3-2	D4-1	D4-2
	+45	-45	+45	-45	+45	-45	+45	-45
SECTOR ANTENNA PORT	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW
	WHITE	WHITE	ORANGE	ORANGE	BROWN	BROWN	VIOLET	VIOLET
	SLATE	BROWN	SLATE	BROWN	SLATE	BROWN	SLATE	BROWN
BAND (LOW/HI) *SEE NOTES 13 AND 15	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET	ORANGE / VIOLET
BEAM (LEFT/RIGHT) *SEE NOTE 14 BELOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW	SLATE / YELLOW

NOTE 1*: ALL COLOR CODE TAPE SHALL BE 3M-35 AND SHALL BE INSTALLED USING A MINIMUM OF (3) WRAPS OF TAPE.
NOTE 2*: ALL COLOR BANDS INSTALLED AT THE TOWER TOP SHALL BE A MINIMUM OF 3" WIDE AND SHALL HAVE A MINIMUM OF ¾" OF SPACING BETWEEN EACH COLOR.
NOTE 3*: ALL COLOR BANDS INSTALLED AT OR NEAR THE GROUND MAY BE ONLY ¾" WIDE. EACH TOP-JUMPER SHALL BE COLOR CODED WITH (1) SET OF 3" WIDE BANDS.
NOTE 4*: EACH MAIN COAX SHALL BE COLOR CODED WITH (1) SET OF 3" BANDS NEAR THE TOP-JUMPER CONNECTION AND WITH ¾" COLOR BANDS JUST PRIOR TO ENTERING THE BTS OR TRANSMITTER BUILDING.
NOTE 5*: ALL BOTTOM JUMPERS SHALL BE COLOR CODED WITH (1) SET OF ¾" BANDS ON EACH END OF THE BOTTOM JUMPER. NOTE 6*: ALL COLOR CODES SHALL BE INSTALLED SO AS TO ALIGN NEATLY WITH ONE ANOTHER FROM SIDE-TO-SIDE.
NOTE 7*: EACH COLOR BAND SHALL HAVE A MINIMUM OF (3) WRAPS AND SHALL BE NEATLY TRIMMED AND SMOOTHED OUT SO AS TO AVOID UNRAVELING.
NOTE 8*: X-POLE ANTENNAS SHOULD USE "XX-1" FOR THE "+45" PORT, "XX-2" FOR THE "-45" PORT.
NOTE 9*: COLORBAND #4 REFERS TO THE FREQUENCY BAND: ORANGE=850, VIOLET=1900. USED ON JUMPERS ONLY.
NOTE 10*: RF FEEDLINE SHALL BE IDENTIFIED WITH A METAL TAG (STAINLESS OR BRASS) AND STAMPED WITH THE SECTOR, ANTENNA POSITION, AND CABLE NUMBER.
NOTE 11*: ANTENNAS MUST BE IDENTIFIED, USING THE SECTOR LETTER AND ANTENNA NUMBER, WITH A BLACK MARKER PRIOR TO INSTALLATION.
NOTE 12*: ONLY "SECTOR-SPLIT" ANTENNA COAX SHALL CONTAIN A 5TH COLORBAND TO INDICATE "LEFT" OR "RIGHT" BEAM.
NOTE 13*: "SECTOR-SPLIT" ANTENNA COAX SHALL USE BLACK TAPE AS A PLACEHOLDER ON MAINLINE FOR COLORBAND #4 (FREQ BAND)
NOTE 14*: "SECTOR-SPLIT" ANTENNAS SLATE FOR THE LEFT BEAM, AND YELLOW FOR THE RIGHT BEAM
NOTE 15*: "LOW" BAND REFERS TO 700MHZ OR 850MHZ, "HI" BAND REFERS TO 1900MHZ OR 2100MHZ

FIGURE 1: ANTENNA ORIENTATION



NOTE: ALPHA STARTS AT 0 (NORTH) OR FIRST AZIMUTH AFTER 0
NOTE: BETA IS FIRST AZIMUTH AFTER ALPHA IN CLOCK-WISE DIRECTION
NOTE: GAMMA IS FIRST AZIMUTH AFTER BETA IN CLOCK-WISE DIRECTION
NOTE: DELTA IS FIRST AZIMUTH AFTER GAMMA IN CLOCK-WISE DIRECTION
NOTE: AZIMUTH IS IDENTIFIED BY THE PANEL, NOT THE ELEMENTS INSIDE

CABLE MARKING TAGS

TO PROVIDE ADDITIONAL IDENTIFICATION RF CABLES SHALL BE IDENTIFIED WITH A METAL TAG MADE OF STAINLESS STEEL OR BRASS AND STAMPED WITH THE SECTOR, ANTENNA POSITION, AND CABLE NUMBER. THE ID MARKING LOCATIONS SHOULD BE AS PER "CABLE MARKING LOCATIONS TABLE". THE TAG SHOULD BE ATTACHED WITH CORROSIVE PROOF WIRE OR WAX STRING AROUND THE CABLE. THE TAG SHOULD BE LABLED AS SHOWN BELOW IN FIGURE 2.

FIGURE 2: TAG DETAIL EXAMPLE

CABLE MARKING LOCATIONS TABLE

TAPE	TAG	LOCATIONS
X		EACH TOP JUMPER SHALL BE COLOR CODED WITH (1) SET OF 3" WIDE BANDS.
X		EACH MAIN COAX SHALL BE COLOR CODED WITH (1) SET OF 3" WIDE BANDS NEAR THE TOP-JUMPER CONNECTION AND WITH (1) SET OF 3/4" WIDE COLOR BANDS JAST PRIOR TO ENTERING THE BTS OR TRANSMITTER BUILDING.
	X	MARKING TAGS SHALL BE ATTACHED AT CABLE ENTRY PORT ON THE INTERIOR OF THE SHELTER
X		ALL BOTTOM JUMPERS SHALL BE COLOR CODED WITH (1) SET OF 3/4 " WIDE BANDS ON EACH END OF BOTTOM JUMPER.

SITE FIBER COLOR CODE CHART

SECTOR A		
FIBER CABLE PAIR #	TAPE BAND COLOR: RED	FUNCTION
1		LTE-700-A-RRU-A1
2		LTE-AWS-A-RRU-A2
3		LTE/UMTS-850/1900-A-RRU-A3
4		SECTOR A SPARE
SECTOR B		
FIBER CABLE PAIR #	TAPE BAND COLOR: BLUE	FUNCTION
5		LTE-700-B-RRU-B1
6		LTE-AWS-B-RRU-B2
7		LTE/UMTS-850/1900-B-RRU-B3
8		SECTOR B SPARE
SECTOR C		
FIBER CABLE PAIR #	TAPE BAND COLOR: GREEN	FUNCTION
9		LTE-700-C-RRU-C1
10		LTE-AWS-C-RRU-C2
11		LTE/UMTS-850/1900-C-RRU-C3
12		SECTOR C SPARE

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Version 2.06 March 6TH, 2012
Version 2.07 August 10TH, 2012

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AT&T MOBILITY

COAX / FIBER COLOR CODING

DRAWING NUMBER: WI1206-08 | REV: A

11 x 17 "B" SIZE

GENERAL NOTES

1. FOR THE PURPOSE OF CONSTRUCTION DRAWING, THE FOLLOWING DEFINITIONS SHALL APPLY:
   CONTRACTOR – GENERAL CONTRACTOR (CONSTRUCTION)
   OWNER – AT&T
   OEM – ORIGINAL EQUIPMENT MANUFACTURE
2. PRIOR TO THE SUBMISSION OF BIDS, THE BIDDING CONTRACTOR SHALL VISIT THE CELL SITE TO FAMILIARIZE WITH THE EXISTING CONDITIONS AND TO CONFIRM THAT THE WORK CAN BE ACCOMPLISHED AS SHOWN ON THE CONSTRUCTION DRAWINGS. ANY DISCREPANCY FOUND SHALL BE BROUGHT TO THE ATTENTION OF OWNER.
3. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES. CONTRACTOR SHALL ISSUE ALL APPROPRIATE NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS, AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK.

   ALL WORK CARRIED OUT SHALL COMPLY WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.
4. DRAWINGS PROVIDED HERE ARE NOT TO SCALE AND ARE INTENDED TO SHOW OUTLINE ONLY.
5. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
6. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
7. IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION FOR APPROVAL BY THE OWNER.
8. CONTRACTOR SHALL DETERMINE ACTUAL ROUTING OF CONDUIT, POWER AND T1 CABLES, GROUNDING CABLES AS SHOWN ON THE POWER, GROUNDING AND TELCO PLAN DRAWING.
9. THE CONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, LANDSCAPING AND STRUCTURES. ANY DAMAGED PART SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE TO THE SATISFACTION OF OWNER.
10. CONTRACTOR SHALL LEGALLY AND PROPERLY DISPOSE OF ALL SCRAP MATERIALS SUCH AS COAXIAL CABLES AND OTHER ITEMS REMOVED FROM THE EXISTING FACILITY. ANTENNAS REMOVED SHALL BE RETURNED TO THE OWNER'S DESIGNATED LOCATION.
11. CONTRACTOR SHALL LEAVE PREMISES IN CLEAN CONDITION.
12. ALL WORK SHALL BE IN COMPLIANCE WITH CURRENT VERSION OF AT&T CONSTRUCTION SPECIFICATIONS INCLUDING UPDATES. IF CONTRACTOR DOES NOT HAVE A COPY OF SPECS, NOTIFY AT&T IMEDIATELY.

GENERAL NOTES (USE WHERE APPLICABLE)

GROUNDING NOTES

1. COAX CABLE SHALL BE GROUNDED AT ANTENNA LEVEL WITHIN 5' OF ANTENNA, COAX WILL ADDITIONALLY BE GROUNDED AT THE BASE OF THE TOWER 18" BEFORE THE CABLE REACHES A HORIZONTAL PLANE. IF EQUIPMENT CABINET IS MORE THAN 15' FROM THE TOWER AN ADDITIONAL GROUND KIT WILL BE ADDED 24" BEFORE CABLE ENTERS CABINET.
2. ALL COAX GROUND KITS WILL BE ANDREW "COMPACT SURE GROUND" OR APPROVED EQUAL.
3. VERIFY THE GROUNDING CONTINUITY BETWEEN THE TOWER BASE AND THE NEW AT&T CABINET GROUND BAR. CONTRACTOR SHALL ENSURE THAT ALL METALLIC OBJECTS WITHIN 6' FROM CABINET HAVE GROUNDING CONTINUITY. THE CONTRACTOR SHALL CORRECT ANY DEFECTS BY ADDING GROUNDING CONDUCTOR TO ENSURE CONTINUITY.
4. CONTRACTOR SHALL PERFORM A GROUND IMPEDANCE TEST PRIOR TO CONSTRUCTION TO ENSURE SITE IS LOWER THAN 5–OHM. IF SITE HAS A RESISTANCE HIGHER THAN 5 OHM REPORT TO AT&T FOR FURTHER DIRECTION.
5. GROUNDING CONDUCTORS SHALL BE COPPER ONLY. EITHER SOLID OR STRANDED CONDUCTORS ARE PERMITTED. ALL EXTERNAL BURIED CONDUCTORS MUST BE BARE. EQUIPMENT GROUND LEADS IN CABLE TRAYS MUST BE GREEN INSULATED.
6. CONTRACTOR TO PROVIDE GROUND WIRES, BARS AND CONNECTIONS AS SHOWN ON GROUNDING RISER DIAGRAM.
7. ROUTE GROUNDING CONDUCTORS ALONG THE SHORTEST AND STRAIGHTEST PATH POSSIBLE, EXCEPT AS OTHERWISE INDICATED. RADIUS BENDS OF GROUNDING LEADS TO BE A MINIMUM OF 12". #6 WIRE MAY BE BENT WITH 6" RADIUS BEND WHERE FIELD CONDITIONS PROHIBIT WIDER SWEEPS.
8. GROUNDING CONNECTIONS SHALL BE EXOTHERMIC TYPE ("CADWELD") TO ANTENNA MASTS, FENCE POSTS, AND GROUND RODS. REMAINING GROUNDING CONNECTIONS SHALL BE COMPRESSION/ MECHANICAL FITTINGS.

ELECTRICAL NOTES

1. ALL ELECTRICAL WORK SHALL CONFIRM TO THE 2008 NATIONAL ELECTRIC CODE.
2. ALL ELECTRICAL ITEMS SHALL BE U.L. APPROVED OR LISTED.
3. POWER WIRES AND CABLES SHALL BE COPPER WITH TYPE XHHW, THWN, OR THHN INSULATION. SOLID CONDUCTORS FOR #10 AWG AND SMALLER, STRANDED FOR LARGER THAN #10 AWG. MINIMUM SIZE #12 AWG.
4. POWER WIRES OUTSIDE CABINET AND CABLES SHALL BE INSTALLED IN CODE COMPLIANT RIGID CONDUIT OR FLEXIBLE LIQUID TIGHT CONDUIT AS INDICATED ON DRAWING.
5. CONTRACTOR TO OBTAIN ALL PERMITS, PAY PERMIT FEES, AND BE RESPONSIBLE FOR SCHEDULING INSPECTIONS.
6. CONTRACTOR TO OBTAIN LOCAL POWER AND TELEPHONE COMPANY APPROVAL AND COORDINATE WITH UTILITY COMPANIES SERVICE ENTRANCE REQUIREMENTS.

COAX NOTES

1. MINIMUM SEPARATION BETWEEN ANTENNAS IS 36" IF CONTRACTOR CAN NOT MAINTAIN MINIMUM DISTANCE CONTACT ENGINEER FOR SOLUTION / ALTERNATE DESIGN.
2. COAX CABLE LENGTH SHOWN IS APPROXIMATE. CONTRACTOR IS REQUIRED TO MAKE ACTUAL FIELD MEASUREMENT PRIOR TO PURCHASE AND BE RESPONSIBLE FOR SAME.
3. COAX CABLE SHALL BE RAISED / SUPPORTED WITH HOISTING GRIP AT APPROPRIATE POINTS PER MANUFACTURER REQUIREMENTS.
4. CONTRACTOR WILL PROVIDE COAX CABLE, RF CONNECTORS AND RF GROUNDING KITS.
5. CONTRACTOR SHALL SUPPORT COAX CABLE PER MANUFACTURER REQUIREMENTS. SUPPORT SHALL BE STAINLESS STEEL SNAP IN OR NON–COMPRESSING BUTTERFLY CLAMP. NO NYLON OR PLASTIC "ZIP–TIES" WILL BE ALLOWED. COAX MAY BE UNSUPPORTED INSIDE MONOPOLE INSTALLATIONS.
6. NO COAX SHALL BE OUTSIDE THE POLE MORE THAN 20'–0" (UNLESS OTHERWISE DIRECTED). TO GET FROM AN EXISTING PORTHOLE TO ANTENNA HEIGHT IF DISTANCE IS GREATER THAN 20'–0" A NEW 6"X9" PORTHOLE SHALL BE INSTALLED. PORTHOLE SHALL BE INSTALLED PER TOWER MANUFACTURER REQUIREMENTS. NO HOLES WILL BE CUT WITH A TORCH. ALL HOLES WILL BE CUT WITH DIAMOND WHEEL. NO NEW PORTHOLES SHALL BE INSTALLED UNLESS PRIOR WRITTEN APPROVAL IS GIVEN BY "AT&T".

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GENERAL NOTES

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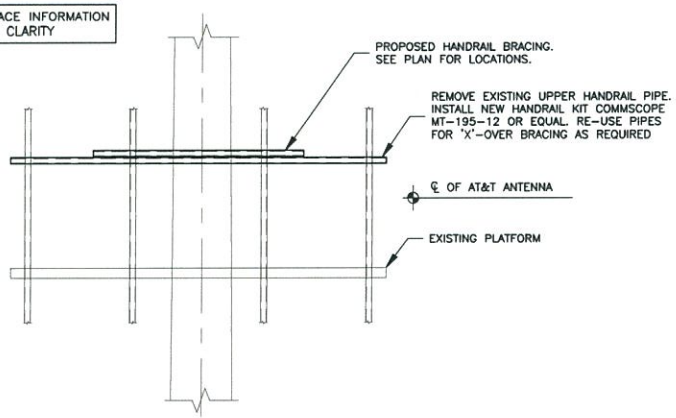
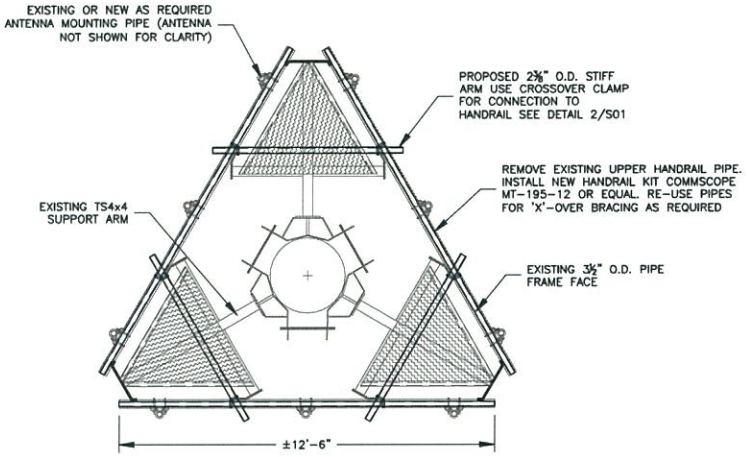
6 5 4 3 2

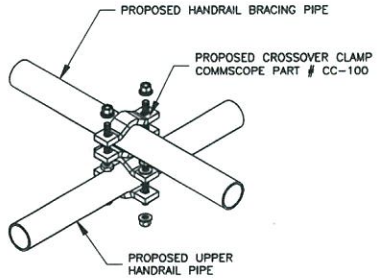
ONLY FRONT FACE INFORMATION IS SHOWN FOR CLARITY



PARTIAL TOWER ELEVATION
SCALE: NONE



PLAN VIEW PLATFORM
SCALE: NONE



2/S01 DETAIL

NOTES:

-CONTRACTOR TO REVIEW MOUNT MAPPING REPORT PREPARED BY APEX ENGINEERS, INC. DATED 08-25-2015

-ALL MATERIALS ARE GALVANIZED

-CONTRACTOR TO FIELD VERIFY ALL EXISTING SIZES AND DIMENSIONS IN FIELD. NOTIFY ENGINEERS FOR ANY DISCREPANCY PRIOR TO CONSTRUCTION

-RELOCATE EXISTING COAX/JUMPERS/MISC. ITEMS AS REQUIRED

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MOUNT MODIFICATION

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