Structural Analysis
135-ft Monopole

Prepared For:
Tarpon Towers II, LLC
8916 77th Terrace East, Suite 103
Lakewood Ranch, FL 34202

MFP Project #40921-031

Site Location:
CT1209 Windsor
780 Prospect Hill Road
Windsor, Hartford County, CT
Dish Site# BOHVN00150A
Hartford Co., CT
Lat/Long: 41°52'58.5", -72°42'29.2"

Analysis Type:
ANSI/TIA-222-G
Structure Rating – 39.3% (Foundation) Passing

February 1, 2022

2/2022

Michael F. Plahovinsak, P.E.
18301 State Route 161 W, Plain City, OH 43064
614-398-6250 - mike@mfpenq.com

Project Summary:

I have completed a structural analysis of the existing monopole for the following new configuration:

- 115' – Dish Wireless:
  - (3) JMA MX08FRO665-20_V0F Antennas
  - (3) Fujitsu TA08025-B604 + (3) Fujitsu TA08025-B605 RRH's
  - (1) Raycap RDIDC-9181-PF-48
  - (1) 1.65" Hybrid
  - Valmont SNP8HR-396 Mount

The pole has been analyzed in accordance with the requirements of the International Building Code per IBC section 3108, and the recommendations of the Telecommunications Industry Association *"Structural Standard for Steel Antenna Supporting Structures"* **ANSI/TIA-222-G.**

This analysis may be considered a "Rigorous Structural Analysis" as defined in ANSI/TIA-222-G 15.5.2.

As indicated in the conclusions of this analysis, I have determined that the existing pole and foundation have *sufficient capacity* to support the existing, reserved and proposed antenna loads as detailed herein. Based on the results of my analysis, structural modifications are not required at this time.

Source of Data:

Resource	Source	Job Number	Date
Pole and Foundation Drawings	Michael F. Plahovinsak, PE	23521-150	06/11/21
Geotechnical Report	Welti Geotechnical	N/A	04/13/21
Erection Book	TAPP	TP-19977	06/15/21

Analysis Criteria:

2016 Connecticut Building Code
Structural Standards for Steel Antenna Supporting Structures **ANSI/TIA-222-G**

- TIA-222-G Wind Speed 94 mph (V_{asd} / 3-Second Gust)
- Equivalent ASCE-7-10 Wind 121 mph (V_{ult})
- TIA-222-G Wind w/ 1" Ice 50 mph (3-Sec Gust)
- Operational Wind Speed 60 mph (3-Sec Gust)

Structure Class	Exposure Category	Topographic Category
II (I = 1.0)	C	I

Appurtenance Listing:

Status	Elev.	Antenna / Mounting	Coax	Owner
Existing	130'	(3) Ericsson AIR3246 B66 Antennas (3) RFS APXVAARR24_43-U-NA20 Antennas (3) RFS APX16DWV16DWVSEA20 Antennas (3) Ericsson 4415 B66A + (3) 4449 B71+B12 + (3) 4415 B25 RRH's (1) Commscope VHLP1-23-CR4B Dish Platform Mount	(4) 6x12 HCS	T-Mobile
Proposed*	115'	(3) JMA MX08FRO665-20_V0F Antennas (3) Fujitsu TA08025-B604 + (3) Fujitsu TA08025-B605 RRH's (1) Raycap RDIDC-9181-PF-48 Valmont SNP8HR-396 Mount	(1) 1.65" Hybrid	Dish Wireless

* Analysis is based on a leased wind area of 11,000 in2. The 11,000 in2 is greater than the proposed actual equipment wind area.

All antenna lines assumed internally mounted, not exposed to the wind.

Foundation Analysis:

The existing monopole foundation design was analyzed in conjunction with site specific geotechnical report. The existing foundation has sufficient capacity to support the pole with the proposed antenna configuration.

Conclusion:

I have completed a structural analysis of the existing monopole and foundation in accordance with the project specifics outlined above. My analysis indicates that the existing monopole and foundation are structurally adequate when considering the existing plus proposed loading. Please refer to the attached calculations for an itemized listing of all member stress ratios. The existing pole is safe and adequate to support the proposed loads, and no structural reinforcing is required to support the above loading.

Recommendations:

As a part of routine maintenance, I recommend periodic inspection of the pole and foundation structure for signs of fatigue or corrosion.

If you have any questions about the contents of this structural report or require any additional information, please feel free to contact my office.

Sincerely,

Michael F. Plahovinsak, P.E.

mike@mfpeng.com – 614.398-6250

Standard Conditions for Providing Structural Consulting Services on Existing Structures

1. The following standard conditions are a general overview of key issues regarding the work product supplied.

2. If the existing conditions are not as represented in this structural report or attached sketches, I should be contacted to evaluate the significance of the deviation and revise the structural assessment accordingly.

3. The structural analysis has been performed assuming that the structure is in "like new" condition. No allowance was made for excessive corrosion, damaged or missing structural members, loose bolts, etc. If there are any known deficiencies in the structure that potentially compromise structural integrity, I should be made aware of the deficiencies. If I am aware of a deficiency that exists in a structure at the time of my analysis, a general explanation of the structural concern due to the deficiency will be included in the structural report, but the deficiency will not be reflected in capacity calculations.

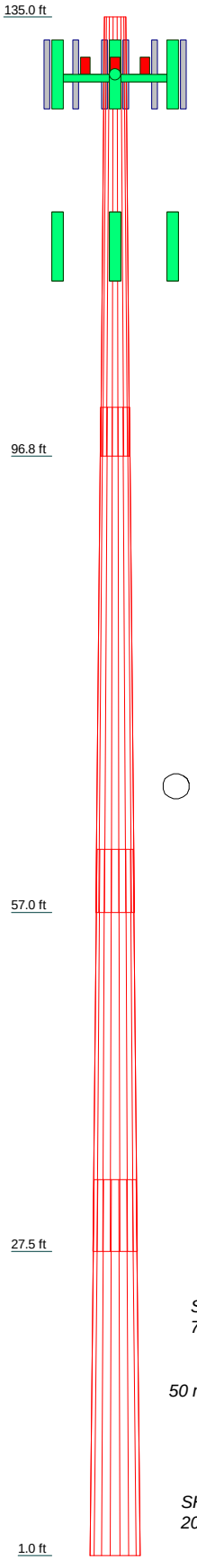
4. The structural analysis provided is an assessment of the primary load carrying capacity of the structure. I provide a limited scope of service in that I have not verified the capacity of every weld, plate, connection detail, etc. In most cases, structural fabrication details are unknown at the time of my analysis, and the detailed field measurement of this information is beyond the scope of my services. In instances where I have not performed connection capacity calculations, it is assumed that existing manufactured connections develop the full capacity of the primary members being connected.

5. The structural integrity of the existing foundation system can only be verified if exact foundation sizes and soils conditions are known. I will not accept any responsibility for the adequacy of the existing foundations unless this site-specific data is supplied.

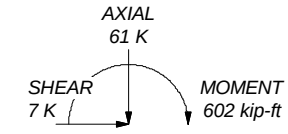
6. Miscellaneous items such as antenna mounts, coax supports, etc. have not been designed, detailed, or specified as part of my work. It is assumed that material of adequate size and strength will be purchased from a reputable component manufacturer. The attached report and sketches are schematic in nature and should not be used to fabricate or purchase hardware and accessories to be attached to the structure. I recommend field measurement of the structure before fabricating or purchasing new hardware and accessories. I am not responsible for proper fit and clearance of hardware and accessory items in the field.

7. The structural analysis has been performed considering minimum code requirements or recommendations. If alternate wind, ice, or deflection criteria are to be considered, then I shall be made aware of the alternate criteria.

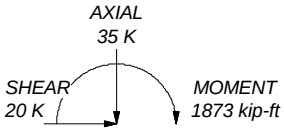
Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	38.25	18	0.1875	4.25	22.0000	30.8489		2.0
2	44.00	18	0.3750	5.50	29.4907	39.6698		6.1
3	35.00	18	0.4375	6.25	37.6474	45.7444		6.8
4	32.75	18	0.5000		43.4235	51.0000		8.3
							A572-65	23.2



ALL REACTIONS ARE FACTORED



TORQUE 0 kip-ft
50 mph WIND - 1.0000 in ICE



TORQUE 0 kip-ft
REACTIONS - 94 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Ericsson AIR 3246 B66 (T-Mobile)	130	RFS - APXVAARR24_43-U-NA20 (T-Mobile)	130
RFS - APXVAARR24_43-U-NA20 (T-Mobile)	130	RFS APX16VDWV-16DWVS (T-Mobile)	130
RFS APX16VDWV-16DWVS (T-Mobile)	130	(3) Ericsson 4415 B66A (T-Mobile)	130
Ericsson AIR 3246 B66 (T-Mobile)	130	(3) Ericsson 4449 B12+B71 (T-Mobile)	130
RFS - APXVAARR24_43-U-NA20 (T-Mobile)	130	(3) Ericsson 4415 B25 (T-Mobile)	130
RFS APX16VDWV-16DWVS (T-Mobile)	130	12' Platform w/ Handrail (T-Mobile)	130
Ericsson AIR 3246 B66 (T-Mobile)	130	Commscope VHLP1-23 (T-Mobile)	130
		Antennas + Equipment (EPA 11,000 in2 / 2,000 lbs) (Dish)	115

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 94 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. TOWER RATING: 38.2%

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18301 State Route 161
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FAX: mike@mfpeng.com

Job: ***135' Monopole - MFP #40921-031 r1***			
Project: ***CT1209 Windsor***			
Client: Tarpon Towers	Drawn by: JC	App'd:	
Code: TIA-222-G	Date: 02/01/22	Scale: NTS	
Path: C:\Users\jorge\Dropbox\MFP Engineering Files\Projects\409-Misc\40921-031\40921-031 r1.eri		Dwg No. E-1	

Tower Input Data

The tower is a monopole.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in Hartford County, Connecticut.
Basic wind speed of 94 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

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	135.00-96.75	38.25	4.25	18	22.0000	30.8489	0.1875	0.7500	A572-65 (65 ksi)
L2	96.75-57.00	44.00	5.50	18	29.4907	39.6698	0.3750	1.5000	A572-65 (65 ksi)
L3	57.00-27.50	35.00	6.25	18	37.6474	45.7444	0.4375	1.7500	A572-65 (65 ksi)
L4	27.50-1.00	32.75		18	43.4235	51.0000	0.5000	2.0000	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	22.3105	12.9812	780.3007	7.7434	11.1760	69.8193	1561.6281	6.4918	3.5420	18.891
	31.2958	18.2474	2167.3087	10.8848	15.6712	138.2986	4337.4693	9.1254	5.0994	27.197
L2	30.8861	34.6549	3711.5567	10.3361	14.9813	247.7466	7427.9971	17.3308	4.5304	12.081
	40.2239	46.7706	9123.8911	13.9496	20.1522	452.7481	18259.7876	23.3897	6.3219	16.858
L3	39.4527	51.6706	9038.5241	13.2095	19.1249	472.6057	18088.9412	25.8402	5.8559	13.385
	46.3826	62.9143	16316.0700	16.0840	23.2382	702.1241	32653.6091	31.4631	7.2810	16.642
L4	45.4845	68.1196	15856.2318	15.2378	22.0591	718.8055	31733.3276	34.0663	6.7625	13.525
	51.7096	80.1435	25821.9188	17.9275	25.9080	996.6774	51677.8148	40.0794	8.0960	16.192

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
L1				1	1	1			

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
135.00-96.75									
L2 96.75-57.00				1	1	1			
L3 57.00-27.50				1	1	1			
L4 27.50-1.00				1	1	1			

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 1/4" (T-Mobile)	C	No	Yes	Inside Pole	130.00 - 1.00	4	No Ice	0.00	0.66
							1/2" Ice	0.00	0.66
							1" Ice	0.00	0.66
1.65" (Dish)	C	No	Yes	Inside Pole	115.00 - 1.00	1	No Ice	0.00	0.92
							1/2" Ice	0.00	0.92
							1" Ice	0.00	0.92

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	135.00-96.75	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.10
L2	96.75-57.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.14
L3	57.00-27.50	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.10
L4	27.50-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.09

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	135.00-96.75	A	2.266	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.10
L2	96.75-57.00	A	2.175	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.14
L3	57.00-27.50	A	2.048	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.10
L4	27.50-1.00	A	1.835	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.09

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Ericsson AIR 3246 B66 (T-Mobile)	A	From Face	3.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	8.04 8.45 8.87	6.41 7.09 7.78	0.24 0.31 0.38
RFS - APXVAARR24_43-U-NA20 (T-Mobile)	A	From Face	3.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	20.24 20.89 21.55	10.79 12.21 13.49	0.16 0.29 0.44
RFS APX16VDWV-16DWVS (T-Mobile)	A	From Face	3.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	6.67 7.06 7.47	3.34 3.99 4.64	0.06 0.11 0.16
Ericsson AIR 3246 B66 (T-Mobile)	B	From Face	3.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	8.04 8.45 8.87	6.41 7.09 7.78	0.24 0.31 0.38
RFS - APXVAARR24_43-U-NA20 (T-Mobile)	B	From Face	3.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	20.24 20.89 21.55	10.79 12.21 13.49	0.16 0.29 0.44
RFS APX16VDWV-16DWVS (T-Mobile)	B	From Face	3.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	6.67 7.06 7.47	3.34 3.99 4.64	0.06 0.11 0.16
Ericsson AIR 3246 B66 (T-Mobile)	C	From Face	3.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	8.04 8.45 8.87	6.41 7.09 7.78	0.24 0.31 0.38
RFS - APXVAARR24_43-U-NA20 (T-Mobile)	C	From Face	3.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	20.24 20.89 21.55	10.79 12.21 13.49	0.16 0.29 0.44
RFS APX16VDWV-16DWVS (T-Mobile)	C	From Face	3.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	6.67 7.06 7.47	3.34 3.99 4.64	0.06 0.11 0.16
(3) Ericsson 4415 B66A (T-Mobile)	A	From Face	2.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	1.64 1.80 1.97	0.68 0.79 0.91	0.05 0.06 0.07
(3) Ericsson 4449 B12+B71 (T-Mobile)	B	From Face	2.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	1.64 1.80 1.97	1.02 1.15 1.29	0.07 0.09 0.11
(3) Ericsson 4415 B25 (T-Mobile)	C	From Face	2.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice 1" Ice	1.64 1.80 1.97	0.68 0.79 0.91	0.05 0.06 0.07
12' Platform w/ Handrail (T-Mobile)	C	None		0.0000	130.00	No Ice 1/2" Ice 1" Ice	30.00 35.00 40.00	30.00 35.00 40.00	1.80 2.60 3.40
**									
Antennas + Equipment (EPA 11,000 in2 / 2,000 lbs) (Dish)	C	None		0.0000	115.00	No Ice 1/2" Ice 1" Ice	76.39 81.39 86.39	76.39 81.39 86.39	2.00 2.50 3.00

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft²	Weight K
Commscope VHLP1-23 (T-Mobile)	C	Paraboloid w/Radome	From Face	1.00 0.00 0.00	0.0000		130.00	1.00	No Ice 1/2" Ice 1" Ice	0.79 0.92 1.06	0.02 0.02 0.03

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	135 - 96.75	Pole	Max Tension	2	0.00	0.00	-0.00
			Max. Compression	8	-22.73	-0.39	0.13
			Max. Mx	4	-8.64	-255.03	-0.32
			Max. My	2	-8.64	0.36	256.07
			Max. Vy	4	11.83	-255.03	-0.32
			Max. Vx	2	-11.87	0.36	256.07
			Max. Torque	6			0.11
L2	96.75 - 57	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-33.67	-0.39	0.13
			Max. Mx	4	-15.51	-773.07	-0.83
			Max. My	2	-15.50	1.07	775.67
			Max. Vy	4	15.13	-773.07	-0.83
			Max. Vx	2	-15.17	1.07	775.67
			Max. Torque	6			0.11
L3	57 - 27.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-45.21	-0.39	0.13
			Max. Mx	4	-23.41	-1244.83	-1.21
			Max. My	2	-23.41	1.61	1248.59
			Max. Vy	4	17.67	-1244.83	-1.21
			Max. Vx	2	-17.71	1.61	1248.59
			Max. Torque	6			0.11
L4	27.5 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-61.24	-0.39	0.13
			Max. Mx	4	-35.24	-1867.63	-1.64

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	2	-35.24	2.21	1872.68
			Max. Vy	4	20.27	-1867.63	-1.64
			Max. Vx	2	-20.31	2.21	1872.68
			Max. Torque	6			0.11

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	135 - 96.75	9.294	12	0.6278	0.0003
L2	101 - 57	5.104	12	0.4957	0.0001
L3	62.5 - 27.5	1.875	12	0.2893	0.0000
L4	33.75 - 1	0.533	12	0.1451	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.00	Commscope VHLP1-23	12	8.640	0.6103	0.0003	59855
115.00	Antennas + Equipment (EPA 11,000 in2 / 2,000 lbs)	12	6.728	0.5552	0.0002	14963

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	135 - 96.75	40.946	2	2.7665	0.0013
L2	101 - 57	22.485	2	2.1846	0.0004
L3	62.5 - 27.5	8.258	2	1.2749	0.0001
L4	33.75 - 1	2.346	2	0.6390	0.0001

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.00	Commscope VHLP1-23	2	38.065	2.6894	0.0011	13636
115.00	Antennas + Equipment (EPA 11,000 in2 / 2,000 lbs)	2	29.642	2.4469	0.0007	3408

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
L1	135 - 96.75 (1)	TP30.8489x22x0.1875	38.25	0.00	0.0	17.6622	-8.64	1120.64	0.008

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
L2	96.75 - 57 (2)	TP39.6698x29.4907x0.375	44.00	0.00	0.0	45.2561	-15.50	3351.08	0.005
L3	57 - 27.5 (3)	TP45.7444x37.6474x0.4375	35.00	0.00	0.0	60.9065	-23.41	4522.87	0.005
L4	27.5 - 1 (4)	TP51x43.4235x0.5	32.75	0.00	0.0	80.1435	-35.24	5940.26	0.006

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	135 - 96.75 (1)	TP30.8489x22x0.1875	256.07	684.95	0.374	0.00	684.95	0.000
L2	96.75 - 57 (2)	TP39.6698x29.4907x0.375	775.67	2614.90	0.297	0.00	2614.90	0.000
L3	57 - 27.5 (3)	TP45.7444x37.6474x0.4375	1248.59	4070.75	0.307	0.00	4070.75	0.000
L4	27.5 - 1 (4)	TP51x43.4235x0.5	1872.68	6156.17	0.304	0.00	6156.17	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	135 - 96.75 (1)	TP30.8489x22x0.1875	11.87	560.32	0.021	0.11	1372.88	0.000
L2	96.75 - 57 (2)	TP39.6698x29.4907x0.375	15.17	1675.54	0.009	0.11	5243.98	0.000
L3	57 - 27.5 (3)	TP45.7444x37.6474x0.4375	17.71	2261.44	0.008	0.11	8163.72	0.000
L4	27.5 - 1 (4)	TP51x43.4235x0.5	20.31	2970.13	0.007	0.11	12345.75	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	135 - 96.75 (1)	0.008	0.374	0.000	0.021	0.000	0.382 ✔	1.000	4.8.2 ✔
L2	96.75 - 57 (2)	0.005	0.297	0.000	0.009	0.000	0.301 ✔	1.000	4.8.2 ✔
L3	57 - 27.5 (3)	0.005	0.307	0.000	0.008	0.000	0.312 ✔	1.000	4.8.2 ✔
L4	27.5 - 1 (4)	0.006	0.304	0.000	0.007	0.000	0.310 ✔	1.000	4.8.2 ✔

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Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
L1	135 - 96.75	Pole	TP30.8489x22x0.1875	1	-8.64	1120.64	38.2	Pass
L2	96.75 - 57	Pole	TP39.6698x29.4907x0.375	2	-15.50	3351.08	30.1	Pass
L3	57 - 27.5	Pole	TP45.7444x37.6474x0.4375	3	-23.41	4522.87	31.2	Pass
L4	27.5 - 1	Pole	TP51x43.4235x0.5	4	-35.24	5940.26	31.0	Pass
							Summary	
						Pole (L1)	38.2	Pass
						RATING =	**38.2**	**Pass**

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Job 135-ft monopole - MFP #40921-031 r1	**Page** BP & AB Calc
Project CT1209 Windsor	**Date** 2/1/2022
Client Tarpon Towers TP-19977	**Designed by** Mike

Anchor Rod and Base Plate Calculation

ANSI/TIA-222-G

Factored Base Reactions:		***Pole Shape:***	***Anchor Rods:***	***Base Plate:***
Moment:	1873 ft-kips	18-Sided	(18) 2.25 in. A615 GR. 75	2.5 in. x 64.5 in. Round
Shear:	20 kips	***Pole Dia. (D_f):***	Anchor Rods Evenly Spaced	fy = 50 ksi
Axial:	35 kips	51.00 in	On a 58.5 in Bolt Circle	

Anchor Rod Calculation According to TIA-222-G section 4.9.9

ϕ_t , ϕ_v =	0.80	TIA 4.9.9
I_{bolts} =	7700.06 in^2	Momet of Inertia
P_u =	87 kips	Compr Force
V_u =	1.1 kips	Shear Force
Rnt =	325.00 kips	Nominal Tensile Strength
n	0.50	for detail type (d)
Stress Rating =	**34.4%**	Satisfies TIA-G 4.9.9

Base Plate Calculation According to TIA-222-G

ϕ =	0.90	TIA 4.7
M_{PL} =	203.1 in-kip	Plate Moment
L =	8.9 in	Section Length
Z =	13.9	Plastic Section Modulus
M_P =	695.4 in-kip	Plastic Moment
ϕM_n=	625.9 in-kip	Factored Resistance

Calculated Moment vs Factored Resistance

203.09 in-kip $\leq$ 626 in-kip

Stress Rating = 32.5%

Anchor Rods Are Adequate	**34.4%**	☑
Base Plate is Adequate	**32.5%**	☑