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1) INTRODUCTION

This tower is a 174.0-ft monopole tower. The original design standard and wind speed were unavailable for review. TEP visited the site in October of 2023 to gather tower steel and appurtenance information. All information provided to TEP was assumed to be accurate and complete.

2) ANALYSIS CRITERIA

TIA-222 Revision: ANSI/TIA-222-G-2-2009
Type of Analysis: Feasibility
Risk Category: II
Wind Speed: 104 mph (Nominal)
Exposure Category: D
Topographic Procedure: Method 1 (Kzt = 1.0)
Ice Thickness: 0.25 in
Wind Speed with Ice: 30 mph
Seismic Design Category: B
Seismic Ss: 0.076
Seismic S1: 0.044
Service Wind Speed: 60 mph

Table 1 - Existing, Proposed, and Reserved Antenna and Cable Information

Existing/ Proposed/ Reserved	Mount Level (ft)	Ant CL (ft)	Qty	Antenna Model	Mount Type	Qty Coax	Coax Size	Coax Location	Owner/ Tenant
Existing	170.0	170.0	6	Commscope NNH4-65C-R6-V3	Square Platform Mount	12	1-5/8 3/4 3/8 5/16 2" Conduit	Inside	AT&T
			3	72" X 12" X 7" Panel Antenna					
			3	Ericsson RADIO 4449					
			3	Ericsson RADIO 4426					
			3	Ericsson RADIO 4478					
			6	Ericsson RRUS 32					
			4	ANDREW E15S09P94					
			3	Raycap DC6-48-60-18-8F					
Proposed	161.0	161.0	3	Commscope NHH-65C-R2B	(3)T-Arm Mount	-	-	-	Verizon
			3	Samsung MT6413-77A					
			3	Samsung B2/B66A RRH ORAN (RF4439d-25A)					
			3	Samsung RF4461d-13A					
			2	RVZDC-6627-PF-48 OVP					
Existing	161.0	161.0	3	Commscope NHH-65C-R2B		2	1-5/8 Hybrid	Inside	Verizon
To Be Removed	161.0	161.0	3	Andrew HBXX-6517DS A2M	-	12	1-5/8	Inside	Verizon
			6	CSS X7C-FRO-860-VR0					
			3	Nokia B66A RRH 4x45					
			3	Alcatel Lucent B13 RRH4x30					
			3	Alcatel Lucent B25 RRH 4x30					
			3	Nokia 13.75" X 12.5" X7.5"					
			6	Commscope CBC78T-DS-43					
			2	Raycap RHSDC-3315-PF-48					

Existing/ Proposed/ Reserved	Mount Level (ft)	Ant CL (ft)	Qty	Antenna Model	Mount Type	Qty Coax	Coax Size	Coax Location	Owner/ Tenant
Existing	148.0	148.0	3	Cellmax CMA-BDHH/6521/E0-6/RET	Circular Platform Mount	3	1-3/4 Hybrid	Inside	T-Mobile
			3	96" X 24" X 8" Panel Antenna					
			3	Ericsson AIR 6449 B41					
			3	ERICSSON RADIO 4415					
			3	ERICSSON RADIO 4449					
			3	ERICSSON RADIO 2212					
Existing	120.0	129.0	1	Amphenol 4220.09-445Txx	Standoff Mount	1	7/8	Inside	Nags Head
Existing	114.5	117.0	1	5-FT OMNI	Sidearm Mount	1 1	1-5/8 1/2	Inside	County

3) ANALYSIS PROCEDURE

Table 2 - Documents Provided

Document	Remarks	Source
Tower Mapping Report	Tower Engineering Professionals, Inc., October 23, 2023 TEP No. 73857.860919	TEP
Previous Structural Analysis	Tower Engineering Professionals, Inc., October 31, 2023 TEP No. 73857.860920	TEP
Correspondence	Correspondence in reference to the existing, proposed, and reserved loading.	Dewberry

3.1) Analysis Method

tnxTower (version 8.2.4.3), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Analysis Assumptions

- 1) The tower and foundation were built and maintained in accordance with the manufacturer's specification.
- 2) The configuration of existing antennas, transmission cables, mounts and other appurtenances are as specified in the tower mapping report by TEP.
- 3) Unless specified by the client or tower mapping, the location of the existing and proposed coax is assumed by TEP and listed in Table 1.
- 4) All tower components are in sufficient condition to carry their full design capacity.
- 5) Serviceability with respect to antenna twist, tilt, roll, or lateral translation, is not checked and is left to the carrier or tower owner to ensure conformance.
- 6) All antenna mounts and mounting hardware are structurally sufficient to carry the full design capacity requirements of appurtenance wind area and weight as provided by the original manufacturer specifications. It is the carrier's responsibility to ensure compliance to the structural limitations of the existing and/or proposed antenna mounts. TEP did not analyze antenna supporting mounts as part of this structural analysis report.
- 7) The following material grade were assumed:
 - a) Tower shaft grade: ASTM A572-65
 - b) Anchor bolts: ASTM A615-75
 - c) Base plate: ASTM A572-50

This analysis may be affected if any assumptions are not valid or have been made in error. Tower Engineering Professionals should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 3 - Section Capacity (Summary)¹

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (lb)	øP _{allow} (lb)	% Capacity	Pass / Fail
L1	174 - 144.17	Pole	TP27.89x19.125x0.1875	1	-11032.50	1055210.00	67.8	Pass
L2	144.17 - 94.4	Pole	TP42.14x26.513x0.3125	2	-20750.00	2755060.00	86.9	Pass
L3	94.4 - 46.05	Pole	TP55.72x39.9987x0.375	3	-35140.10	4217740.00	83.8	Pass
L4	46.05 - 0	Pole	TP68.5x52.9604x0.4375	4	-58297.30	6044450.00	76.4	Pass
							Summary	
						Pole (L2)	86.9	Pass
						RATING =	86.9	Pass

Table 4 - Tower Component Stresses vs. Capacity

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	-	80.7	Pass
1	Base Plate	-	58.0	Pass

Structure Rating (max from all components)¹ =	86.9%
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Notes:

- 1) See additional documentation in "Appendix B - Additional Calculations" for calculations supporting the % capacity listed.

Table 5 - Dish Twist/Sway Results for 60 mph Service Wind Speed

Elevation (ft)	Dish Model	Beam Deflection		
		Deflection (in)	Tilt (deg)	Twist (deg)
-	-	-	-	-

4.1) Recommendations

- 1) If the load differs from that described in Table 1 of this report or the provisions of this analysis are found to be invalid, another structural analysis should be performed.
- 2) The tower has sufficient capacity to carry the existing, proposed, and reserved loading. No modifications are required at this time.
- 3) TEP did not have sufficient information to perform a foundation analysis. Provide TEP with foundation drawings and/or a geotechnical report for this site in order to determine the substructure capacity. If this information is not available, TEP recommends a foundation mapping and/or geotechnical investigation.
- 4) Prior to acceptance of changed configuration a rigorous structural analysis shall be performed in order to determine the overall stability and the adequacy of the structural members, foundations and connections.

APPENDIX A
TNX TOWER OUTPUT

Section	1	2	3	4
Length (ft)	29.83	53.18	53.51	52.89
Number of Sties	18	18	18	18
Thickness (in)	0.1875	0.3125	0.3750	0.4375
Socket Length (ft)	3.41	5.16	6.84	52.8604
Top Dia (in)	18.1250	26.5130	38.9987	68.5000
Bot Dia (in)	27.8900	42.1400	55.7200	150.081
Grade		A572-65		
Weight (lb)	1408.7	6105.2	10291.0	32873.0

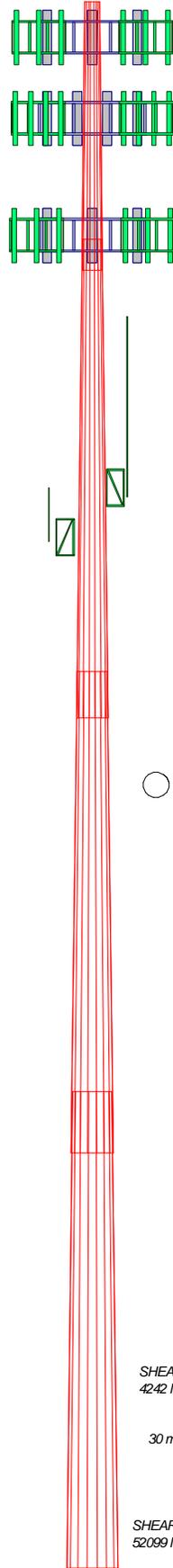
174.0 ft

144.2 ft

94.4 ft

46.0 ft

0.0 ft



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) NNH-65C-R6-V3 w/ Mount Pipe	170	RF4461d-13A	161
(2) NNH-65C-R6-V3 w/ Mount Pipe	170	RF4461d-13A	161
(2) NNH-65C-R6-V3 w/ Mount Pipe	170	B2/B66A RRH-BR049	161
72" x 12" x 7" Panel w/ Mount Pipe	170	B2/B66A RRH-BR049	161
72" x 12" x 7" Panel w/ Mount Pipe	170	(2) RVZDC-6627-PF-48	161
RADIO 4449	170	T-Arm Mount [TA 701-3]	161
RADIO 4449	170	CMA-BDHH6521/E0-6 w/ mount pipe	148
RADIO 4449	170	CMA-BDHH6521/E0-6 w/ mount pipe	148
RADIO 4426	170	CMA-BDHH6521/E0-6 w/ mount pipe	148
RADIO 4426	170	96"x24"x5" w/ Mount Pipe	148
RADIO 4426	170	96"x24"x5" w/ Mount Pipe	148
RADIO 4478	170	96"x24"x5" w/ Mount Pipe	148
RADIO 4478	170	AIR 6449 B41 w/ Mount Pipe	148
RADIO 4478	170	AIR 6449 B41 w/ Mount Pipe	148
(2) RRLUS 32	170	AIR 6449 B41 w/ Mount Pipe	148
(2) RRLUS 32	170	RADIO 4415	148
(2) RRLUS 32	170	RADIO 4415	148
(2) E15S09P94	170	RADIO 4415	148
E15S09P94	170	RADIO 4449	148
E15S09P94	170	RADIO 4449	148
DC6-48-60-18-8F	170	RADIO 2212	148
DC6-48-60-18-8F	170	RADIO 2212	148
DC6-48-60-18-8F	170	RADIO 2212	148
(3) 2.4" Dia. x 9-ft Pipe	170	RADIO 2212	148
Platform Mount [LP 1304-1_HR-1]	170	2L3x3x16 x 13ft	148
MTB413-77A w/ Mount Pipe	161	2L3x3x16 x 13ft	148
MTB413-77A w/ Mount Pipe	161	2L3x3x16 x 13ft	148
MTB413-77A w/ Mount Pipe	161	Miscellaneous [NA 506-1]	148
(2) NNH-65C-R2B w/ Mount Pipe	161	4220.09-445-TXX	120
(2) NNH-65C-R2B w/ Mount Pipe	161	Side Arm Mount [SO 203-1]	120
(2) NNH-65C-R2B w/ Mount Pipe	161	5' x 12" dia Omni	114.5
RF4461d-13A	161	Side Arm Mount [SO 302-1]	114.5

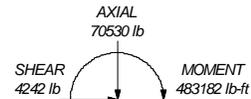
MATERIAL STRENGTH

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

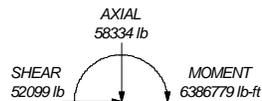
TOWER DESIGN NOTES

1. Tower is located in Dare County, North Carolina.
2. Tower designed for Exposure D to the TIA-222-G Standard.
3. Tower designed for a 104 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 30 mph basic wind with 0.25 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: 86.9%

ALL REACTIONS ARE FACTORED



TORQUE 201 lb-ft
30 mph WIND - 0.2500 in ICE



TORQUE 755 lb-ft
REACTIONS - 104 mph WIND

 Tower Engineering Professionals, Inc.	Tower Engineering Professionals, Inc. 326 Tryon Road Raleigh, NC 27603 Phone: (919) 661-6351 FAX: (919) 661-6350		Job: Nags Head Project: TEP No. 73857.976701 Client: Dewberry Drawn by: Ethan L. Gardner App'd: Code: TIA-222-G Date: 07/18/24 Scale: NTS Path:
			Dwg No: E-1

tnxTower Tower Engineering Professionals, Inc. 326 Tryon Road Raleigh, NC 27603 Phone: (919) 661-6351 FAX: (919) 661-6350	Job	Nags Head	Page	3 of 12
	Project	TEP No. 73857.976701	Date	12:16:41 07/18/24
	Client	Dewberry	Designed by	Ethan L. Gardner

tnxTower Tower Engineering Professionals, Inc. 326 Tryon Road Raleigh, NC 27603 Phone: (919) 661-6351 FAX: (919) 661-6350	Job	Nags Head	Page	4 of 12
	Project	TEP No. 73857.976701	Date	12:16:41 07/18/24
	Client	Dewberry	Designed by	Ethan L. Gardner

Description	Face or Shield Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	C _A A _A ft ² /ft	Weight plf
								Ice		
** LDF7-50A(1-5/8)	A	No	No	Inside Pole	170.00 - 3.00	0.0000	0	12	No Ice 0.00 Ice 1/2" 0.00	0.82 0.82
3/4" Coax	A	No	No	Inside Pole	170.00 - 3.00	0.0000	0	4	No Ice 0.00 Ice 1/2" 0.00	3.00 3.00
3/8" Coax	A	No	No	Inside Pole	170.00 - 3.00	0.0000	0	2	No Ice 0.00 Ice 1/2" 0.00	0.07 0.07
2" Flexible Conduit	A	No	No	Inside Pole	170.00 - 3.00	0.0000	0	2	No Ice 0.00 Ice 1/2" 0.00	0.34 0.34
5/16" Coax	A	No	No	Inside Pole	170.00 - 3.00	0.0000	0	1	No Ice 0.00 Ice 1/2" 0.00	0.09 0.09
								Ice		
** 1 5/8" Hybrid	C	No	No	Inside Pole	161.00 - 6.96	0.0000	0	2	No Ice 0.00 Ice 1/2" 0.00	0.75 0.75
								Ice		
** 1-3/4" Feedline	B	No	No	Inside Pole	148.00 - 3.00	0.0000	0	3	No Ice 0.00 Ice 1/2" 0.00	1.68 1.68
								Ice		
** 7/8" Coax	C	No	No	Inside Pole	120.00 - 3.00	0.0000	0	1	No Ice 0.00 Ice 1/2" 0.00	0.26 0.26
								Ice		
**** LDF7-50A(1-5/8)	B	No	No	Inside Pole	114.50 - 3.00	0.0000	0	1	No Ice 0.00 Ice 1/2" 0.00	0.82 0.82
LDF4-75A(1/2)	B	No	No	Inside Pole	114.50 - 3.00	0.0000	0	1	No Ice 0.00 Ice 1/2" 0.00	0.16 0.16
								Ice		

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R	A _F	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight lb
L1	174.00-144.17	A	0.000	0.000	0.000	1.933	608.03
		B	0.000	0.000	0.000	0.000	19.29
		C	0.000	0.000	0.000	0.000	25.25
L2	144.17-94.40	A	0.000	0.000	0.000	3.225	1166.35

Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight lb
L3	94.40-46.05	B	0.000	0.000	0.000	0.000	270.39
		C	0.000	0.000	0.000	0.000	81.44
		A	0.000	0.000	0.000	3.133	1133.08
L4	46.05-0.00	B	0.000	0.000	0.000	0.000	290.92
		C	0.000	0.000	0.000	0.000	85.33
		A	0.000	0.000	0.000	2.984	1010.90
		B	0.000	0.000	0.000	0.000	259.03
		C	0.000	0.000	0.000	0.000	70.04

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 _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight lb
L1	174.00-144.17	A	0.585	0.000	0.000	0.000	8.911	646.09
		B	0.000	0.000	0.000	0.000	19.29	
		C	0.000	0.000	0.000	0.000	25.25	
L2	144.17-94.40	A	0.568	0.000	0.000	0.000	14.868	1229.85
		B	0.000	0.000	0.000	0.000	270.39	
		C	0.000	0.000	0.000	0.000	81.44	
L3	94.40-46.05	A	0.539	0.000	0.000	0.000	14.115	1192.11
		B	0.000	0.000	0.000	0.000	290.92	
		C	0.000	0.000	0.000	0.000	85.33	
L4	46.05-0.00	A	0.482	0.000	0.000	0.000	12.905	1062.79
		B	0.000	0.000	0.000	0.000	259.03	
		C	0.000	0.000	0.000	0.000	70.04	

Feed Line Center of Pressure

Section	Elevation ft	CP _X Ice in	CP _Z Ice in	CP _X Ice in	CP _Z Ice in
L1	174.00-144.17	0.0000	-0.5616	0.0000	-1.2541
L2	144.17-94.40	0.0000	-0.5705	0.0000	-1.3190
L3	94.40-46.05	0.0000	-0.5758	0.0000	-1.3313
L4	46.05-0.00	0.0000	-0.5786	0.0000	-1.3030

Note: For pole sections, center of pressure calculations do not consider feed line shielding.

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Azimuth Adjustment °	Placement ft	C _A A _A Front ft ²	C _A A _A Side ft ²	Weight lb
			ft		ft	ft ²	ft ²	lb

tnxTower Tower Engineering Professionals, Inc. 326 Tryon Road Raleigh, NC 27603 Phone: (919) 661-6351 FAX: (919) 661-6350	Job Nags Head						Page 5 of 12		
	Project TEP No. 73857.976701						Date 12:16:41 07/18/24		
	Client Dewberry						Designed by Ethan L. Gardner		

Description	Face or Leg	Offset Type	Offsets: Horz Lateral	Vertical	Adjustment	Placement	C _N A _A Front	C _S A _A Side	Weight
			ft	ft	°	ft	ft ²	ft ²	lb
170									
(2) NNH4-65C-R6-V3 w/ Mount Pipe	A	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 17.31 1/2" Ice 18.04	10.34 11.86	134.95 252.88
(2) NNH4-65C-R6-V3 w/ Mount Pipe	B	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 17.31 1/2" Ice 18.04	10.34 11.86	134.95 252.88
(2) NNH4-65C-R6-V3 w/ Mount Pipe	C	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 17.31 1/2" Ice 18.04	10.34 11.86	134.95 252.88
72" x 12" x 7" Panel w/ Mount Pipe	A	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 8.71 1/2" Ice 9.37	7.58 8.87	96.32 171.23
72" x 12" x 7" Panel w/ Mount Pipe	B	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 8.71 1/2" Ice 9.37	7.58 8.87	96.32 171.23
72" x 12" x 7" Panel w/ Mount Pipe	C	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 8.71 1/2" Ice 9.37	7.58 8.87	96.32 171.23
RADIO 4449	A	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 1.98 1/2" Ice 2.16	1.41 1.57	85.00 103.55
RADIO 4449	B	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 1.98 1/2" Ice 2.16	1.41 1.57	85.00 103.55
RADIO 4449	C	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 1.98 1/2" Ice 2.16	1.41 1.57	85.00 103.55
RADIO 4426	A	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 1.64 1/2" Ice 1.80	0.73 0.84	48.50 61.32
RADIO 4426	B	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 1.64 1/2" Ice 1.80	0.73 0.84	48.50 61.32
RADIO 4426	C	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 1.64 1/2" Ice 1.80	0.73 0.84	48.50 61.32
RADIO 4478	A	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 1.62 1/2" Ice 1.78	1.00 1.13	60.00 74.78
RADIO 4478	B	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 1.62 1/2" Ice 1.78	1.00 1.13	60.00 74.78
RADIO 4478	C	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 1.62 1/2" Ice 1.78	1.00 1.13	60.00 74.78
(2) RRUS 32	A	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 2.86 1/2" Ice 3.08	1.78 1.97	55.12 77.39
(2) RRUS 32	B	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 2.86 1/2" Ice 3.08	1.78 1.97	55.12 77.39
(2) RRUS 32	C	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 2.86 1/2" Ice 3.08	1.78 1.97	55.12 77.39
(2) E15S09P94	A	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 0.57 1/2" Ice 0.67	0.32 0.40	14.80 19.74

tnxTower Tower Engineering Professionals, Inc. 326 Tryon Road Raleigh, NC 27603 Phone: (919) 661-6351 FAX: (919) 661-6350	Job Nags Head						Page 6 of 12		
	Project TEP No. 73857.976701						Date 12:16:41 07/18/24		
	Client Dewberry						Designed by Ethan L. Gardner		

Description	Face or Leg	Offset Type	Offsets: Horz Lateral	Vertical	Adjustment	Placement	C _N A _A Front	C _S A _A Side	Weight
			ft	ft	°	ft	ft ²	ft ²	lb
E15S09P94	B	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 4.00 1/2" Ice 0.67	0.32 0.40	14.80 19.74
E15S09P94	C	From Centroid-Le	4.00	0.00	0.0000	170.00	No Ice 4.00 1/2" Ice 0.67	0.32 0.40	14.80 19.74
DC6-48-60-18-8F	A	From Centroid-Le	2.00	0.00	0.0000	170.00	No Ice 2.00 1/2" Ice 1.36	0.85 1.36	18.90 35.59
DC6-48-60-18-8F	B	From Centroid-Le	2.00	0.00	0.0000	170.00	No Ice 2.00 1/2" Ice 1.36	0.85 1.36	18.90 35.59
DC6-48-60-18-8F	C	From Centroid-Le	2.00	0.00	0.0000	170.00	No Ice 2.00 1/2" Ice 1.36	0.85 1.36	18.90 35.59
(3) 2.4" Dia. x 9-ft Pipe	B	From Centroid-Fa	4.00	0.00	0.0000	170.00	No Ice 4.00 1/2" Ice 3.09	2.16 3.09	32.94 49.18
Platform Mount [LP 1304-1_HR-1]	C	None	0.00	0.00	0.0000	170.00	No Ice 26.70 1/2" Ice 32.69	26.70 32.69	2626.77 3571.43
MT6413-77A w/ Mount Pipe	A	From Leg	4.00	0.00	0.0000	161.00	No Ice 4.00 1/2" Ice 4.31	2.15 2.55	69.74 103.26
MT6413-77A w/ Mount Pipe	B	From Leg	4.00	0.00	0.0000	161.00	No Ice 4.00 1/2" Ice 4.31	2.15 2.55	69.74 103.26
MT6413-77A w/ Mount Pipe	C	From Leg	4.00	0.00	0.0000	161.00	No Ice 4.00 1/2" Ice 4.31	2.15 2.55	69.74 103.26
(2) NHH-65C-R2B w/ Mount Pipe	A	From Leg	4.00	0.00	0.0000	161.00	No Ice 11.63 1/2" Ice 12.35	9.79 11.31	84.45 173.76
(2) NHH-65C-R2B w/ Mount Pipe	B	From Leg	4.00	0.00	0.0000	161.00	No Ice 11.63 1/2" Ice 12.35	9.79 11.31	84.45 173.76
(2) NHH-65C-R2B w/ Mount Pipe	C	From Leg	4.00	0.00	0.0000	161.00	No Ice 11.63 1/2" Ice 12.35	9.79 11.31	84.45 173.76
RF4461d-13A	A	From Leg	4.00	0.00	0.0000	161.00	No Ice 1.87 1/2" Ice 2.03	1.28 1.42	79.10 97.61
RF4461d-13A	B	From Leg	4.00	0.00	0.0000	161.00	No Ice 1.87 1/2" Ice 2.03	1.28 1.42	79.10 97.61
RF4461d-13A	C	From Leg	4.00	0.00	0.0000	161.00	No Ice 1.87 1/2" Ice 2.03	1.28 1.42	79.10 97.61
B2/B66A RRH-BR049	A	From Leg	4.00	0.00	0.0000	161.00	No Ice 1.88 1/2" Ice 2.05	1.25 1.39	84.40 102.74
B2/B66A RRH-BR049	B	From Leg	4.00	0.00	0.0000	161.00	No Ice 1.88 1/2" Ice 2.05	1.25 1.39	84.40 102.74
B2/B66A RRH-BR049	C	From Leg	4.00	0.00	0.0000	161.00	No Ice 1.88 1/2" Ice 2.05	1.25 1.39	84.40 102.74

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	Client Dewberry					Designed by Ethan L. Gardner			

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{NAA} Front ft ²	C _{SAA} Side ft ²	Weight lb	
(2) RVZDC-6627-PF-48	C	From Leg	0.00 2.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	3.79 4.04	2.51 2.73	32.00 63.48
T-Arm Mount [TA 701-3]	C	None	0.00	0.0000	161.00	No Ice 1/2" Ice	23.94 30.04	23.94 30.04	1092.00 1475.58
148 CMA-BDHH/6521/E0-6 w/ mount pipe	A	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	11.78 12.31	6.23 7.23	96.90 173.63
CMA-BDHH/6521/E0-6 w/ mount pipe	B	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	11.78 12.31	6.23 7.23	96.90 173.63
CMA-BDHH/6521/E0-6 w/ mount pipe	C	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	11.78 12.31	6.23 7.23	96.90 173.63
96"x24"x5" w/ Mount Pipe	A	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	20.27 20.91	7.92 9.33	69.20 188.49
96"x24"x5" w/ Mount Pipe	B	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	20.27 20.91	7.92 9.33	69.20 188.49
96"x24"x5" w/ Mount Pipe	C	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	20.27 20.91	7.92 9.33	69.20 188.49
AIR 6449 B41 w/ Mount Pipe	A	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	5.87 6.23	3.27 3.73	128.35 177.30
AIR 6449 B41 w/ Mount Pipe	B	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	5.87 6.23	3.27 3.73	128.35 177.30
AIR 6449 B41 w/ Mount Pipe	C	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	5.87 6.23	3.27 3.73	128.35 177.30
RADIO 4415	A	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	1.86 2.03	0.87 1.00	49.60 64.16
RADIO 4415	B	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	1.86 2.03	0.87 1.00	49.60 64.16
RADIO 4415	C	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	1.86 2.03	0.87 1.00	49.60 64.16
RADIO 4449	A	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	1.98 2.16	1.41 1.57	85.00 103.55
RADIO 4449	B	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	1.98 2.16	1.41 1.57	85.00 103.55
RADIO 4449	C	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	1.98 2.16	1.41 1.57	85.00 103.55
RADIO 2212	A	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	1.64 1.80	0.64 0.75	35.27 47.41
RADIO 2212	B	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	1.64 1.80	0.64 0.75	35.27 47.41

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Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{NAA} Front ft ²	C _{SAA} Side ft ²	Weight lb	
RADIO 2212	C	From Centroid-Le	0.00 4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	1.64 1.80	0.64 0.75	35.27 47.41
2L3x3x3/16 x 13ft	A	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	3.90 4.83	3.90 4.83	97.00 171.00
2L3x3x3/16 x 13ft	B	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	3.90 4.83	3.90 4.83	97.00 171.00
2L3x3x3/16 x 13ft	C	From Centroid-Le	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	3.90 4.83	3.90 4.83	97.00 171.00
Miscellaneous [NA 506-1]	C	None	0.00	0.0000	148.00	No Ice 1/2" Ice	27.49 33.96	27.49 33.96	1587.00 2297.42
120 4220.09-445-TXX	B	From Leg	3.00 0.00 9.00	0.0000	120.00	No Ice 1/2" Ice	3.66 5.44	3.66 5.44	28.66 56.62
Side Arm Mount [SO 203-1]	B	From Leg	1.50 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	1.78 2.24	3.79 4.47	125.00 152.76
117 5' x 12" dia Omni	C	From Leg	4.00 0.00 2.50	0.0000	114.50	No Ice 1/2" Ice	2.78 4.12	2.78 4.12	25.00 67.48
Side Arm Mount [SO 302-1]	C	From Leg	2.00 0.00 0.00	0.0000	114.50	No Ice 1/2" Ice	0.81 1.30	3.31 5.00	55.00 82.94

**									
*									

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
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

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Comb. No.	Description
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
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice
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

Elevation	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
161.00	MT6413-77A w/ Mount Pipe	41	22.472	1.4637	0.0018	9332
148.00	CMA-BDHH/6521/E0-6 w/ mount pipe	41	18.527	1.3643	0.0009	4790
120.00	4220.09-445-TXX	40	11.427	1.0424	0.0004	4898
114.50	5' x 12" dia Omni	40	10.262	0.9709	0.0004	4965

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	174 - 144.17	143.214	4	8.3073	0.0162
L2	147.58 - 94.4	99.114	4	7.3374	0.0046
L3	99.56 - 46.05	40.255	4	4.2236	0.0015
L4	52.89 - 0	10.425	4	1.8518	0.0004

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
170.00	(2) NNH4-65C-R6-V3 w/ Mount Pipe	4	136.299	8.1839	0.0141	4699
161.00	MT6413-77A w/ Mount Pipe	4	120.914	7.8893	0.0097	1805
148.00	CMA-BDHH/6521/E0-6 w/ mount pipe	4	99.765	7.3577	0.0050	923
120.00	4220.09-445-TXX	4	61.604	5.6257	0.0022	928
114.50	5' x 12" dia Omni	4	55.332	5.2401	0.0020	938

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	174 - 144.17	26.635	41	1.5422	0.0030
L2	147.58 - 94.4	18.406	41	1.3605	0.0009
L3	99.56 - 46.05	7.464	40	0.7825	0.0003
L4	52.89 - 0	1.932	40	0.3431	0.0001

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L _w ft	K/U _r	A in ²	P _a lb	φP _a lb	Ratio P _a /φP _a
L1	174 - 144.17 (1)	TP27.89x19.125x0.1875	29.83	0.00	0.0	15.8902	-11032.50	1055210.00	0.010
L2	144.17 - 94.4 (2)	TP42.14x26.513x0.3125	53.18	0.00	0.0	39.9837	-20750.00	2755060.00	0.008
L3	94.4 - 46.05 (3)	TP55.72x39.9987x0.375	53.51	0.00	0.0	63.4825	-35140.10	4217740.00	0.008
L4	46.05 - 0 (4)	TP68.5x52.9604x0.4375	52.89	0.00	0.0	94.5133	-58297.30	6044450.00	0.010

Critical Deflections and Radius of Curvature - Service Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
170.00	(2) NNH4-65C-R6-V3 w/ Mount Pipe	41	25.344	1.5190	0.0026	24265

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Pole Bending Design Data

Section No.	Elevation ft	Size	M_{ax}		Ratio $\frac{M_{ax}}{\phi M_{ax}}$	M_{xy}		Ratio $\frac{M_{xy}}{\phi M_{xy}}$
			lb-ft	lb-ft		lb-ft	lb-ft	
L1	174 - 144.17 (1)	TP27.89x19.125x0.1875	385275.83	579848.33	0.664	0.00	579848.33	0.000
L2	144.17 - 94.4 (2)	TP42.14x26.513x0.3125	1965200.00	2284000.00	0.860	0.00	2284000.00	0.000
L3	94.4 - 46.05 (3)	TP55.72x39.9987x0.375	3840816.67	4629616.67	0.830	0.00	4629616.67	0.000
L4	46.05 - 0 (4)	TP68.5x52.9604x0.4375	6386774.67	8471750.00	0.754	0.00	8471750.00	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V_n		Ratio $\frac{V_n}{\phi V_n}$	Actual T_n		Ratio $\frac{T_n}{\phi T_n}$
			lb	lb		lb-ft	lb-ft	
L1	174 - 144.17 (1)	TP27.89x19.125x0.1875	29539.00	527607.00	0.056	167.45	1162341.67	0.000
L2	144.17 - 94.4 (2)	TP42.14x26.513x0.3125	36547.40	1377530.00	0.027	1207.63	4578933.33	0.000
L3	94.4 - 46.05 (3)	TP55.72x39.9987x0.375	43884.30	2108870.00	0.021	945.85	9280416.67	0.000
L4	46.05 - 0 (4)	TP68.5x52.9604x0.4375	52139.90	3022230.00	0.017	718.52	16980749.33	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P_n	Ratio M_{ax}	Ratio M_{xy}	Ratio V_n	Ratio T_n	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
		$\frac{P_n}{\phi P_n}$	$\frac{M_{ax}}{\phi M_{ax}}$	$\frac{M_{xy}}{\phi M_{xy}}$	$\frac{V_n}{\phi V_n}$	$\frac{T_n}{\phi T_n}$			
L1	174 - 144.17 (1)	0.010	0.664	0.000	0.056	0.000	0.678	1.000	
L2	144.17 - 94.4 (2)	0.008	0.860	0.000	0.027	0.000	0.869	1.000	
L3	94.4 - 46.05 (3)	0.008	0.830	0.000	0.021	0.000	0.838	1.000	
L4	46.05 - 0 (4)	0.010	0.754	0.000	0.017	0.000	0.764	1.000	

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
L1	174 - 144.17	Pole	TP27.89x19.125x0.1875	1	-11032.50	1055210.00	67.8	Pass
L2	144.17 - 94.4	Pole	TP42.14x26.513x0.3125	2	-20750.00	2755060.00	86.9	Pass
L3	94.4 - 46.05	Pole	TP55.72x39.9987x0.375	3	-35140.10	4217740.00	83.8	Pass
L4	46.05 - 0	Pole	TP68.5x52.9604x0.4375	4	-58297.30	6044450.00	76.4	Pass
Summary								
Pole (L2)							86.9	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
RATING = 86.9								Pass

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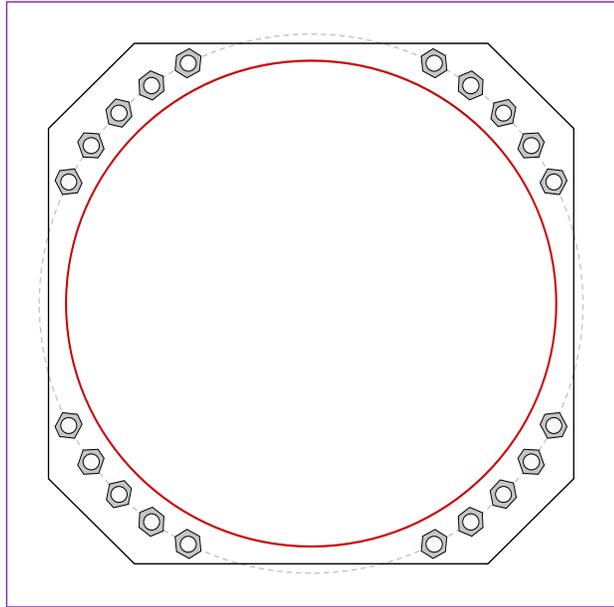
APPENDIX B
ADDITIONAL CALCULATIONS

Monopole Base Plate Connection

Site Info	
Site #	N/A
Site Name	Nags Head Town Hall
TEP #	73857.976701

Analysis Considerations	
TIA-222 Revision	G
Grout Considered:	No
l_{ar} (in)	2.25
Eta Factor, η	0.5

Applied Loads	
Moment (kip-ft)	6386.78
Axial Force (kips)	58.30
Shear Force (kips)	52.14



Connection Properties		Analysis Results	
Anchor Rod Data		Anchor Rod Summary <i>(units of kips, kip-in)</i>	
(20) 2-1/4" ϕ bolts (A615-75 N; $F_y=75$ ksi, $F_u=100$ ksi) on 76" BC <i>Anchor Spacing: 6 in</i>		$Pu_c = 204.53$	$\phi Pn_t = 260$
Base Plate Data		$Vu = 2.61$	$\phi Vn = n/a$
73.375" W x 3.5" Plate (A572-50; $F_y=50$ ksi, $F_u=65$ ksi); Clip: 12 in		$Mu = n/a$	$\phi Mn = n/a$
Stiffener Data		Base Plate Summary	
N/A		Max Stress (ksi):	26.08 (Flexural)
Pole Data		Allowable Stress (ksi):	45
68.5" x 0.4375" 18-sided pole (A572-65; $F_y=65$ ksi, $F_u=80$ ksi)		Stress Rating:	58.0% Pass
			80.7% Pass