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May 10, 2019

Melanie A. Bachman, Esq.
Executive Director/Staff Attorney
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **TS-VER-077-180405 – Celco Partnership d/b/a Verizon Wireless
Request for an Order to Approve Shared Use of Tower Located at 33 Mitchell
Drive, Manchester, Connecticut**

Dear Ms. Bachman:

Enclosed please find fifteen (15) copies of a January 14, 2019 Structural Analysis Report (“Report”) for the existing tower at 33 Mitchell Drive in Manchester, CT. The Council asked that the Report be submitted as a Condition of its most recent request to revise the TS-VER-077-180405 approval.

Please do not hesitate to contact me if you have any questions or need any additional information.

Sincerely,



Kenneth C. Baldwin

KCB/kmd
Enclosures

19351156-v1



**STRUCTURAL ANALYSIS REPORT
170' SELF-SUPPORTING TOWER
MANCHESTER, CONNECTICUT**

Prepared for
Verizon Wireless

Verizon Site: 469645 Manchester North CT

January 14, 2019



APT Project #CT141NB9161

**STRUCTURAL ANALYSIS REPORT
170' SELF-SUPPORTING TOWER
MANCHESTER, CONNECTICUT**

**prepared for
Verizon Wireless**

EXECUTIVE SUMMARY:

All-Points Technology Corporation, P.C. (APT) performed a structural analysis of this 170-foot self-supporting tower. The analysis was performed for Verizon Wireless's proposed installation of six panel antennas, six remote radio heads (RRHs) and one power/fiber distribution box (D-box) at 100' as detailed below, to be fed by one hybrid power/fiber line. The equipment is to be installed on three 12' sector mounts, assumed to be SitePro1 model VFA12-HD or equivalent. The analysis also included reserved equipment, which is shown below.

APT's analysis indicates the tower and foundation meet the requirements of the Connecticut State Building Code and TIA-222 with Verizon Wireless's proposed equipment changes and the additional reserved loads.

INTRODUCTION:

A structural analysis was performed on the above-mentioned communications tower by APT for Verizon Wireless. The tower is located at 33 Mitchell Drive in Manchester, Connecticut.

APT did not visit the site to conduct this structural analysis. The analysis relied solely on information provided by others, which included design drawings and calculations by Valmont (Eng. File No. A-175553, dated September 20, 2012); a structural analysis by Centek Engineering, Inc. (Project #15117.000, dated November 13, 2015); a previous structural analysis by APT (project #CT141NB9160, dated October 4, 2017); an additional structural analysis by Centek Engineering, Inc. (Project #18034.00, dated March 6, 2018); a listing of proposed equipment changes for Verizon Wireless (dated September 20, 2018); and draft construction drawings prepared by APT (Project #CT141NB9160, dated December 17, 2018).

The analysis was performed in accordance with the Connecticut State Building Code and TIA-222-G using the following equipment inventory (proposed equipment shown in **bold** text, reserved equipment shown in *italic* text):

All-Points Technology Corporation

116 Grandview Road
Conway, NH 03818
(603) 496-5853

3 Saddlebrook Drive
Killingworth, CT 06419
(860) 663-1697

Carrier	Appurtenance	Elev.	Mount	Feed lines
	Lightning rod	180'	15' pipe mount	N.A.
Reserved	(12) 6' x 1' panel antennas	170'	(3) 12' sector mounts (VFA12-HD or equal)	(12) 1-5/8"
Reserved	(3) 6' high performance dishes	165'	(3) Pipes on legs	(3) 1-5/8"
Reserved	Shively 6812	160'	Leg	(1) 1-5/8"
Reserved	Shively 6812	155'	Leg	(1) 1-5/8"
Reserved	(2) 4' dishes, no radome, (1) 2' HP dish	150'	(3) Pipes on legs	(3) 1-5/8"
T-Mobile	(4) AIR21 B2A-B4P, (4) AIR32 B66Aa-B2a, (4) APXVAARR24-43-U-NA20 panels, (4) KRY 112 144/1 TMAs, (12) RRUS B12/B71 4449 RRHs, (1) SC2-W100AB dish with radome	140'	(1) Custom 4-sided sector frame	(8) 1-5/8", (4) 1-5/8" hybrid, 1/2"
Verizon Wireless	(6) NNHH-65B-R4 panels, (3) RFV01U-D2A B5/B13 RRH-BR4C RRHs, (3) RFV01U-D1A B2/B66A RRHs, (1) RVZDC-6627-PF-48 D-box	100'	(3) VFA12-HD sector mounts or equal, (3) 16' x 3.5" pipe horiz.	(1) hybrid

STRUCTURAL ANALYSIS:

Methodology:

The structural analysis was done in accordance with the Connecticut State Building Code and TIA-222, Revision G (TIA), Structural Standard for Antenna Supporting Structures and Antennas.

The analysis was conducted using a 3-second gust wind speed of 125 miles per hour (ultimate) with no ice and 50-mph with 1" radial ice in accordance with the TIA-222-G standard for this location in Hartford County, Connecticut. The following additional design criteria were used:

Structure Class: II
 Topographic Category: 1
 Exposure Category: B

Analysis Results:

Analysis of the tower was conducted in accordance with the criteria outlined herein with equipment loading as previously described. The following table summarizes the results of the analysis based on stresses of individual leg and bracing members:

All-Points Technology Corporation

116 Grandview Road
 Conway, NH 03818
 (603) 496-5853

3 Saddlebrook Drive
 Killingworth, CT 06419
 (860) 663-1697

Elevation	Legs	Bracing
160'-170'	49%	22%
140'-160'	13%	61%
120'-140'	57%	62%
100'-120'	32%	50%
80'-100'	35%	65%
60'-80'	45%	70%
40'-60'	43%	78%
20'-40'	50%	40%
0'-20'	46%	47%

Bracing, Splice and Anchor Bolts:

Connection bolts were evaluated under the proposed loading. All bolts were found to be adequately sized to support the proposed loads.

Base Foundation:

Evaluation of the base foundations was performed from original design drawings. Reactions imposed by the proposed additions were found to be within the design capacity of the foundation.

Factored base reactions imposed with the equipment changes were calculated as follows:

Compression: 271.2 kips
Uplift: 227.9 kips
Shear: 30.8 kips
Overturning Moment: 5189 ft-kips

CONCLUSIONS AND RECOMMENDATIONS:

APT's structural analysis indicates that the 170-foot self-supporting tower and foundation located at 33 Mitchell Drive in Manchester, Connecticut meet the requirements of the Connecticut State Building Code and TIA-222 with Verizon Wireless's proposed equipment as well as the reserved loadings.

All-Points Technology Corporation

LIMITATIONS:

This report is based on the following:

1. Tower is properly installed and maintained.
2. All members are in an undeteriorated condition.
3. All required members are in place.
4. All bolts are in place and are properly tightened.
5. Tower is in plumb condition.
6. All tower members were properly designed, detailed, fabricated, and installed and have been properly maintained since erection.

All-Points Technology Corporation, P.C. (APT) is not responsible for modifications completed prior to or hereafter which APT is not or was not directly involved. Modifications include but are not limited to:

1. Replacing or strengthening bracing members.
2. Reinforcing vertical members in any manner.
3. Adding or relocating torque arms or guys.
4. Installing antenna mounting gates or side arms.

APT hereby states that this document represents the entire report and that it assumes no liability for any factual changes that may occur after the date of this report. All representations, recommendations, and conclusions are based upon the information contained and set forth herein. If you are aware of any information which is contrary to that which is contained herein, or you are aware of any defects arising from the original design, material, fabrication and erection deficiencies, you should disregard this report and immediately contact APT. APT disclaims all liability for any representation, recommendation, or conclusion not expressly stated herein.

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Appendix A

Tower Schematic

Appendix B

Calculations

tnxTower All-Points Technology Corporation 116 Grandview Road Conway, NH 03818 Phone: (603) 496-5853 FAX: (603) 447-2124	Job U24.0 x 170' Valmont	Page 1 of 7
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	Client Verizon Wireless	Designed by Rob Adair

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 170.00 ft above the ground line.

The base of the tower is set at an elevation of 0.00 ft above the ground line.

The face width of the tower is 7.00 ft at the top and 24.00 ft at the base.

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

The following design criteria apply:

ASCE 7-10 Wind Data is used (wind speeds converted to nominal values).

Basic wind speed of 97 mph.

Ultimate wind speed of 125 mph.

Structure Class II.

Exposure Category B.

Topographic Category 1.

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.

Pressures are calculated at each section.

Stress ratio used in tower member design is 1.

Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Feed Line/Linear Appurtenances

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
12x24 Hybrid fiber-power cable	C	No	Ar (CaAa)	100.00 - 8.00	-6.0000	0.5	1	1	0.5000	1.5700		1.50
1 5/8	C	No	Ar (CaAa)	140.00 - 8.00	-7.0000	0.5	8	4	0.5000	1.9800		1.04
1.57" Hybrid fiber-power cable	C	No	Ar (CaAa)	140.00 - 8.00	-8.0000	0.5	4	4	0.5000	1.5700		1.50
1/2	C	No	Ar (CaAa)	140.00 - 8.00	-9.0000	0.5	1	1	0.5000	0.5800		0.25
1 5/8	B	No	Ar (CaAa)	150.00 - 8.00	-6.0000	0.5	3	2	0.5000	1.9800		1.04
1 5/8	B	No	Ar (CaAa)	155.00 - 8.00	-7.0000	0.5	1	1	0.5000	1.9800		1.04
1 5/8	B	No	Ar (CaAa)	160.00 - 8.00	-8.0000	0.5	1	1	0.5000	1.9800		1.04
1 5/8	B	No	Ar (CaAa)	165.00 - 8.00	-9.0000	0.5	3	2	0.5000	1.9800		1.04
1 5/8	A	No	Ar (CaAa)	170.00 - 8.00	-8.0000	0.5	12	6	0.5000	1.9800		1.04

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	CAAA	Weight plf
3/8" safety cable	A	No	CaAa (In Face)	170.00 - 8.00	4.0000	0.5	1	No Ice	0.04
								1/2" Ice	0.14
								1" Ice	0.24

tnxTower All-Points Technology Corporation 116 Grandview Road Conway, NH 03818 Phone: (603) 496-5853 FAX: (603) 447-2124	Job U24.0 x 170' Valmont	Page 2 of 7
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Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C _{AA} Front	C _{AA} Side	Weight
			Horz	Lateral					
Generic Lightning Rod 4' copper	C	From Leg	0.50	0.0000	180.00	No Ice	0.50	0.50	0.00
			0.00	0.0000		1/2" Ice	1.00	1.00	0.00
			0.00	0.0000		1" Ice	1.50	1.50	0.00
15' x 3.5" pipe	C	From Leg	0.50	0.0000	170.00	No Ice	5.25	5.25	115.00
			0.00	0.0000		1/2" Ice	6.79	6.79	152.17
			2.50	0.0000		1" Ice	8.34	8.34	199.01
(4) 6' x 12" x 8" panel	A	From Leg	4.00	0.0000	170.00	No Ice	8.13	5.87	50.00
			0.00	0.0000		1/2" Ice	8.59	6.32	102.79
			0.00	0.0000		1" Ice	9.05	6.79	161.74
(4) 6' x 12" x 8" panel	B	From Leg	4.00	0.0000	170.00	No Ice	8.13	5.87	50.00
			0.00	0.0000		1/2" Ice	8.59	6.32	102.79
			0.00	0.0000		1" Ice	9.05	6.79	161.74
(4) 6' x 12" x 8" panel	C	From Leg	4.00	0.0000	170.00	No Ice	8.13	5.87	50.00
			0.00	0.0000		1/2" Ice	8.59	6.32	102.79
			0.00	0.0000		1" Ice	9.05	6.79	161.74
SitePro1 VFA12-HD	A	None	0.0000	0.0000	170.00	No Ice	13.20	14.60	650.00
			0.0000	0.0000		1/2" Ice	19.50	14.60	845.00
			0.0000	0.0000		1" Ice	25.80	19.50	1040.00
SitePro1 VFA12-HD	B	None	0.0000	0.0000	170.00	No Ice	13.20	14.60	650.00
			0.0000	0.0000		1/2" Ice	19.50	14.60	845.00
			0.0000	0.0000		1" Ice	25.80	19.50	1040.00
SitePro1 VFA12-HD	C	None	0.0000	0.0000	170.00	No Ice	13.20	14.60	650.00
			0.0000	0.0000		1/2" Ice	19.50	14.60	845.00
			0.0000	0.0000		1" Ice	25.80	19.50	1040.00
6812 1-bay w-radome	B	None	0.0000	0.0000	160.00	No Ice	3.00	3.00	38.00
			0.0000	0.0000		1/2" Ice	3.30	3.30	81.00
			0.0000	0.0000		1" Ice	3.60	3.60	130.00
6812 1-bay w-radome	C	None	0.0000	0.0000	155.00	No Ice	3.00	3.00	38.00
			0.0000	0.0000		1/2" Ice	3.30	3.30	81.00
			0.0000	0.0000		1" Ice	3.60	3.60	130.00
AIR 21 B2A B4P panel	A	From Leg	4.00	0.0000	140.00	No Ice	6.09	4.31	95.00
			0.00	0.0000		1/2" Ice	6.46	4.66	136.89
			0.00	0.0000		1" Ice	6.84	5.02	183.90
AIR 21 B2A B4P panel	B	From Leg	4.00	0.0000	140.00	No Ice	6.09	4.31	95.00
			0.00	0.0000		1/2" Ice	6.46	4.66	136.89
			0.00	0.0000		1" Ice	6.84	5.02	183.90
AIR 21 B2A B4P panel	C	From Face	4.00	0.0000	140.00	No Ice	6.09	4.31	95.00
			0.00	0.0000		1/2" Ice	6.46	4.66	136.89
			0.00	0.0000		1" Ice	6.84	5.02	183.90
AIR 21 B2A B4P panel	C	From Leg	4.00	0.0000	140.00	No Ice	6.09	4.31	95.00
			0.00	0.0000		1/2" Ice	6.46	4.66	136.89
			0.00	0.0000		1" Ice	6.84	5.02	183.90
AIR 32 B66Aa B2a	A	From Leg	4.00	0.0000	140.00	No Ice	6.51	4.71	133.00
			0.00	0.0000		1/2" Ice	6.89	5.07	178.82
			0.00	0.0000		1" Ice	7.27	5.43	229.91
AIR 32 B66Aa B2a	B	From Leg	4.00	0.0000	140.00	No Ice	6.51	4.71	133.00
			0.00	0.0000		1/2" Ice	6.89	5.07	178.82
			0.00	0.0000		1" Ice	7.27	5.43	229.91
AIR 32 B66Aa B2a	C	From Face	4.00	0.0000	140.00	No Ice	6.51	4.71	133.00
			0.00	0.0000		1/2" Ice	6.89	5.07	178.82
			0.00	0.0000		1" Ice	7.27	5.43	229.91
AIR 32 B66Aa B2a	C	From Leg	4.00	0.0000	140.00	No Ice	6.51	4.71	133.00
			0.00	0.0000		1/2" Ice	6.89	5.07	178.82
			0.00	0.0000		1" Ice	7.27	5.43	229.91

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	Project	CT141NB9161 Manchester North	Date	18:28:58 01/14/19
	Client	Verizon Wireless	Designed by	Rob Adair

Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C _A A		Weight
			Horz	Vert			Front	Side	
			ft	ft	°	ft	ft ²	ft ²	lb
APXVAARR24-43-U-NA20	A	From Leg	4.00	0.0000	140.00	No Ice	20.24	8.89	90.20
			0.00			1/2" Ice	20.89	9.49	202.79
			0.00			1" Ice	21.54	10.09	323.92
APXVAARR24-43-U-NA20	B	From Leg	4.00	0.0000	140.00	No Ice	20.24	8.89	90.20
			0.00			1/2" Ice	20.89	9.49	202.79
			0.00			1" Ice	21.54	10.09	323.92
APXVAARR24-43-U-NA20	C	From Face	4.00	0.0000	140.00	No Ice	20.24	8.89	90.20
			0.00			1/2" Ice	20.89	9.49	202.79
			0.00			1" Ice	21.54	10.09	323.92
APXVAARR24-43-U-NA20	C	From Leg	4.00	0.0000	140.00	No Ice	20.24	8.89	90.20
			0.00			1/2" Ice	20.89	9.49	202.79
			0.00			1" Ice	21.54	10.09	323.92
KRY 112 144/1	A	From Leg	4.00	0.0000	140.00	No Ice	0.48	0.22	15.00
			0.00			1/2" Ice	0.57	0.28	19.18
			0.00			1" Ice	0.66	0.36	24.76
KRY 112 144/1	B	From Leg	4.00	0.0000	140.00	No Ice	0.48	0.22	15.00
			0.00			1/2" Ice	0.57	0.28	19.18
			0.00			1" Ice	0.66	0.36	24.76
KRY 112 144/1	C	From Face	4.00	0.0000	140.00	No Ice	0.48	0.22	15.00
			0.00			1/2" Ice	0.57	0.28	19.18
			0.00			1" Ice	0.66	0.36	24.76
KRY 112 144/1	C	From Leg	4.00	0.0000	140.00	No Ice	0.48	0.22	15.00
			0.00			1/2" Ice	0.57	0.28	19.18
			0.00			1" Ice	0.66	0.36	24.76
(3) Ericsson RRUS B12/B71 4449	A	From Leg	4.00	0.0000	140.00	No Ice	1.64	1.30	73.00
			0.00			1/2" Ice	1.80	1.45	90.19
			0.00			1" Ice	1.97	1.60	110.08
(3) Ericsson RRUS B12/B71 4449	B	From Leg	4.00	0.0000	140.00	No Ice	1.64	1.30	73.00
			0.00			1/2" Ice	1.80	1.45	90.19
			0.00			1" Ice	1.97	1.60	110.08
(3) Ericsson RRUS B12/B71 4449	C	From Face	4.00	0.0000	140.00	No Ice	1.64	1.30	73.00
			0.00			1/2" Ice	1.80	1.45	90.19
			0.00			1" Ice	1.97	1.60	110.08
(3) Ericsson RRUS B12/B71 4449	C	From Leg	4.00	0.0000	140.00	No Ice	1.64	1.30	73.00
			0.00			1/2" Ice	1.80	1.45	90.19
			0.00			1" Ice	1.97	1.60	110.08
Custom 4-Sided Sector Mount	C	None		0.0000	140.00	No Ice	36.00	36.00	3000.00
						1/2" Ice	42.00	42.00	3300.00
						1" Ice	48.00	48.00	3600.00
(2) NNHH-65B-R4	A	From Face	4.00	0.0000	100.00	No Ice	12.27	5.75	77.40
			0.00			1/2" Ice	12.77	6.21	149.54
			0.00			1" Ice	13.27	6.67	228.32
(2) NNHH-65B-R4	B	From Face	4.00	0.0000	100.00	No Ice	12.27	5.75	77.40
			0.00			1/2" Ice	12.77	6.21	149.54
			0.00			1" Ice	13.27	6.67	228.32
(2) NNHH-65B-R4	C	From Face	4.00	0.0000	100.00	No Ice	12.27	5.75	77.40
			0.00			1/2" Ice	12.77	6.21	149.54
			0.00			1" Ice	13.27	6.67	228.32
B5/B13 RRH-BR04C RRH	A	From Face	3.50	0.0000	100.00	No Ice	1.88	1.01	82.00
			0.00			1/2" Ice	2.05	1.14	98.43
			0.00			1" Ice	2.22	1.28	117.53
B5/B13 RRH-BR04C RRH	B	From Face	3.50	0.0000	100.00	No Ice	1.88	1.01	82.00
			0.00			1/2" Ice	2.05	1.14	98.43
			0.00			1" Ice	2.22	1.28	117.53
B5/B13 RRH-BR04C RRH	C	From Face	3.50	0.0000	100.00	No Ice	1.88	1.01	82.00
			0.00			1/2" Ice	2.05	1.14	98.43
			0.00			1" Ice	2.22	1.28	117.53

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Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C _A A		Weight
			Horz Lateral	Vert			Front	Side	
			ft	ft	°	ft	ft ²	ft ²	lb
B2/B66A RRH-BR049 RRH	A	From Face	3.50	0.0000	100.00	No Ice	1.88	1.25	97.50
			0.00			1/2" Ice	2.05	1.39	115.84
			0.00			1" Ice	2.22	1.54	136.97
B2/B66A RRH-BR049 RRH	B	From Face	3.50	0.0000	100.00	No Ice	1.88	1.25	97.50
			0.00			1/2" Ice	2.05	1.39	115.84
			0.00			1" Ice	2.22	1.54	136.97
B2/B66A RRH-BR049 RRH	C	From Face	3.50	0.0000	100.00	No Ice	1.88	1.25	97.50
			0.00			1/2" Ice	2.05	1.39	115.84
			0.00			1" Ice	2.22	1.54	136.97
Raycap RVZDC-6627-PF-48 D-box	C	From Face	1.00	0.0000	100.00	No Ice	6.13	5.25	43.00
			0.00			1/2" Ice	6.44	5.55	101.92
			0.00			1" Ice	6.76	5.85	165.82
SitePro VFA12-HD	A	From Face	0.00	0.0000	100.00	No Ice	13.20	9.20	650.00
			0.00			1/2" Ice	19.50	14.60	800.00
			0.00			1" Ice	25.80	19.50	950.00
SitePro VFA12-HD	B	From Face	0.00	0.0000	100.00	No Ice	13.20	9.20	650.00
			0.00			1/2" Ice	19.50	14.60	800.00
			0.00			1" Ice	25.80	19.50	950.00
SitePro VFA12-HD	C	From Face	0.00	0.0000	100.00	No Ice	13.20	9.20	650.00
			0.00			1/2" Ice	19.50	14.60	800.00
			0.00			1" Ice	25.80	19.50	950.00
16'x3 1/2" Pipe Mount	A	None		0.0000	100.00	No Ice	5.60	5.60	164.00
						1/2" Ice	7.24	7.24	203.61
						1" Ice	8.89	8.89	253.50
16'x3 1/2" Pipe Mount	B	None		0.0000	100.00	No Ice	5.60	5.60	164.00
						1/2" Ice	7.24	7.24	203.61
						1" Ice	8.89	8.89	253.50
16'x3 1/2" Pipe Mount	C	None		0.0000	100.00	No Ice	5.60	5.60	164.00
						1/2" Ice	7.24	7.24	203.61
						1" Ice	8.89	8.89	253.50

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets:		Azimuth Adjustment	3 dB Beam Width	Elevation	Outside Diameter	Aperture Area	Weight
				Horz Lateral	Vert						
			ft	ft	°	°	ft	ft	ft ²	lb	
2' dish with radome	A	Paraboloid w/Radome	From Leg	4.00	0.0000	140.00	2.00	No Ice	3.14	50.00	
				0.00				1/2" Ice	3.41	67.50	
				0.00				1" Ice	3.68	85.00	
6' HP dish	A	Paraboloid w/Shroud (HP)	From Leg	1.00	0.0000	165.00	6.00	No Ice	28.27	250.00	
				0.00				1/2" Ice	29.07	400.00	
				0.00				1" Ice	29.86	550.00	
6' HP dish	B	Paraboloid w/Shroud (HP)	From Leg	1.00	0.0000	165.00	6.00	No Ice	28.27	250.00	
				0.00				1/2" Ice	29.07	400.00	
				0.00				1" Ice	29.86	550.00	
6' HP dish	C	Paraboloid w/Shroud (HP)	From Leg	1.00	0.0000	165.00	6.00	No Ice	28.27	250.00	
				0.00				1/2" Ice	29.07	400.00	
				0.00				1" Ice	29.86	550.00	
4' dish, no radome	A	Paraboloid w/o Radome	From Leg	1.00	0.0000	150.00	4.00	No Ice	12.57	150.00	
				0.00				1/2" Ice	13.10	217.33	
				0.00				1" Ice	13.62	284.66	
4' dish, no radome	B	Paraboloid w/o Radome	From Leg	1.00	0.0000	150.00	4.00	No Ice	12.57	150.00	
				0.00				1/2" Ice	13.10	217.33	

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	Client Verizon Wireless	Designed by Rob Adair

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft	Aperture Area ft ²	Weight lb
2' HP dish	C	Paraboloid w/Shroud (HP)	From Leg	0.00 1.00 0.00 0.00	0.0000		150.00	2.00	1" Ice 13.62 No Ice 3.14 1/2" Ice 3.41 1" Ice 3.68	284.66 50.00 67.50 85.00

Solution Summary

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	170 - 160	2.039	39	0.0956	0.0087
T2	160 - 140	1.833	39	0.0949	0.0081
T3	140 - 120	1.427	39	0.0891	0.0046
T4	120 - 100	1.051	39	0.0769	0.0032
T5	100 - 80	0.739	39	0.0635	0.0025
T6	80 - 60	0.472	39	0.0511	0.0018
T7	60 - 40	0.268	39	0.0367	0.0012
T8	40 - 20	0.120	39	0.0244	0.0007
T9	20 - 0	0.030	39	0.0110	0.0003

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.00	Generic Lightning Rod 4' copper	39	2.039	0.0956	0.0087	Inf
170.00	15' x 3.5" pipe	39	2.039	0.0956	0.0087	Inf
165.00	6' HP dish	39	1.936	0.0953	0.0085	Inf
160.00	6812 1-bay w-radome	39	1.833	0.0949	0.0081	894141
155.00	6812 1-bay w-radome	39	1.730	0.0941	0.0074	491439
150.00	4' dish, no radome	39	1.628	0.0928	0.0064	322263
140.00	2' dish with radome	39	1.427	0.0891	0.0046	174916
100.00	(2) NNHH-65B-R4	39	0.739	0.0635	0.0025	138589

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load per Bolt lb	Ratio Load Allowable	Allowable Ratio	Criteria
T1	170	Leg	A325N	1.0000	6	445.19	53014.40	0.008	✓	1 Bolt Tension
		Diagonal	A325N	1.0000	1	3596.56	12723.80	0.283	✓	1 Member Bearing
T2	160	Leg	A325N	1.0000	6	3856.62	53014.40	0.073	✓	1 Bolt Tension
		Diagonal	A325N	1.0000	1	4935.93	12723.80	0.388	✓	1 Member Bearing
T3	140	Leg	A325N	1.0000	12	4306.55	53014.40	0.081	✓	1 Bolt Tension

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Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load per Bolt lb	Ratio Load Allowable	Allowable Ratio	Criteria	
T4	120	Diagonal	A325N	1.0000	1	7093.88	12723.80	0.558	✓	1	Member Bearing
		Leg	A325N	1.0000	12	6831.80	53014.40	0.129	✓	1	Bolt Tension
T5	100	Diagonal	A325N	1.2500	1	7475.22	26643.80	0.281	✓	1	Member Bearing
		Leg	A325N	1.0000	12	8711.59	53014.40	0.164	✓	1	Bolt Tension
T6	80	Diagonal	A325N	1.2500	1	12031.40	31972.50	0.376	✓	1	Member Bearing
		Leg	A325N	1.0000	12	11295.60	53014.40	0.213	✓	1	Bolt Tension
T7	60	Diagonal	A325N	1.2500	1	12321.00	31972.50	0.385	✓	1	Member Bearing
		Leg	A325N	1.0000	12	13680.90	53014.40	0.258	✓	1	Bolt Tension
T8	40	Diagonal	A325N	1.2500	1	11960.70	31972.50	0.374	✓	1	Member Bearing
		Leg	A325N	1.0000	12	15960.70	53014.40	0.301	✓	1	Bolt Tension
T9	20	Diagonal	A325N	1.2500	1	12087.30	42630.00	0.284	✓	1	Member Bearing
		Leg	A325N	1.0000	12	17969.40	53014.40	0.339	✓	1	Bolt Tension
		Diagonal	A325N	1.2500	1	12239.10	42630.00	0.287	✓	1	Member Bearing

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail	
T1	170 - 160	Leg	Pirod 105244	1	-5131.74	142493.00	48.7	Pass	
		Diagonal	L3x3x3/16	15	-3831.34	17853.70	21.5	Pass	
							28.3 (b)		
T2	160 - 140	Horizontal	L2 1/2x2 1/2x3/16	10	-831.14	21077.90	3.9	Pass	
		Top Girt	L2 1/2x2 1/2x3/16	4	-825.80	15619.30	5.3	Pass	
T3	140 - 120	Leg	Pirod 105217	24	-28482.00	214859.00	13.3	Pass	
		Diagonal	L2 1/2x2 1/2x3/16	28	-4951.70	8118.15	61.0	Pass	
T4	120 - 100	Leg	Pirod 105217	39	-45117.80	214859.00	57.2	Pass	
		Diagonal	L3x3x3/16	42	-7068.09	11429.60	61.8	Pass	
T5	100 - 80	Leg	Pirod 105218	54	-96610.30	300681.00	32.1	Pass	
		Diagonal	L3x3x5/16	57	-7397.94	14801.00	50.0	Pass	
T6	80 - 60	Leg	Pirod 105219	69	-123111.00	356293.00	34.6	Pass	
		Diagonal	2L3x3x3/16x3/8	74	-12462.60	19287.30	64.6	Pass	
T7	60 - 40	Leg	Pirod 105219	78	-160431.00	356293.00	45.0	Pass	
		Diagonal	2L3x3x3/16x3/8	83	-12218.70	17497.10	69.8	Pass	
T8	40 - 20	Leg	Pirod 105220	87	-193262.00	451148.00	42.8	Pass	
		Diagonal	2L3x3x3/16x3/8	92	-12321.60	15842.70	77.8	Pass	
T9	20 - 0	Leg	Pirod 105220	96	-226382.00	451148.00	50.2	Pass	
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	101	-12100.00	29951.80	40.4	Pass	
		Leg	Valmont #12 x 2.5	105	-255821.00	557267.00	45.9	Pass	
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	110	-12640.30	27115.90	46.6	Pass	
							Summary		
							Leg (T3)	57.2	Pass
							Diagonal (T7)	77.8	Pass
							Horizontal (T1)	3.9	Pass
							Top Girt (T1)	5.3	Pass
							Bolt Checks	55.8	Pass
							RATING =	77.8	Pass

tnxTower

***All-Points Technology
Corporation***

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All-Points Technology Corp., P.C.

116 Grandview Road
Conway, NH 03818
(603) 496-5853

Client: **Verizon Wireless**
Job: **Manchester, CT**
Calculated By: **R. Adair**

Site: **Manchester N**
Job No.: **CT141NB9161**
Date: **14-Jan-19**

Mat Foundation Analysis

Program assumes:

Mat is square in plan view.
Water table is below bottom of mat.
Unit weight of concrete = 150 pcf
Unit weight of soil = 100 pcf
Self-supporting tower with 3 piers

Information to be provided:

Pier is round or square in plan dimension ("R" or "S")	Shape =	R
OTM = Overturning Moment to be resisted	OTM =	5189 ft-kips
H = Height from ground surface to top of mat (if buried)	H =	4.25 ft.
P _M = Projection of pier above mat	P _M =	4.75 ft.
y = Thickness of mat	y =	1.75 ft.
x = Width of mat	x =	32.00 ft.
d = Diameter of round pier	d =	4.5 ft.
S = Size of tension bars	S =	7

Mass of tower and appurtenances (below)

Results:

<u>Component</u>	<u>Mass</u>	<u>Moment Arm</u>	<u>Moment Resist.</u>
Pier	11.3 kips	16 ft.	181.3 ft-kips
Overburden	500.3 kips	16 ft.	8004.1 ft-kips
Mat	268.8 kips	16 ft.	4300.8 ft-kips

Overturning Moment Resistance : 12486.16 ft-kips
 Factor of Safety = 2.41 **SATISFACTORY**
 Concrete Quantity = 74.8 c.y.