FRED A. NUDD CORPORATION
1743 ROUTE 104, BOX 577
ONTARIO, NY 14519
(315) 524-2531 FAX (315) 524-4249

Page 1 of 2		Job Number:	24316-011
Eng: MFP		Customer Ref:	4600021635
		Date:	10/18/2017
Structure:	100-FT MONOPOLE		
Site:	CAYUGA HEIGHTS		
Location:	TOMPKINS CO., NY / 42°28'46", -76°28'51"		
Owner:	IUSA		
Revision No.:	Revision Date:		

DESIGN

Building Code: 2010 BUIDING CODE OF NEW YORK STATE			
Design Standard: ANSI/TIA-222-G-2			
Wind Speed Load Cases: 3-SEC. GUSTED WIND SPEED			
Load Case #1: 115 MPH Design Wind Speed - V_{ASD} (V_{ULT} = 148 MPH)			
Load Case #2: 50 MPH Wind with 2" Ice Accumulation			
Load Case #3 60 MPH Service Wind Speed			
Structure Class	Exposure Cat.	Topography Cat.	Crest Height
III (I=1.15)	C	1	

EQUIPMENT LIST

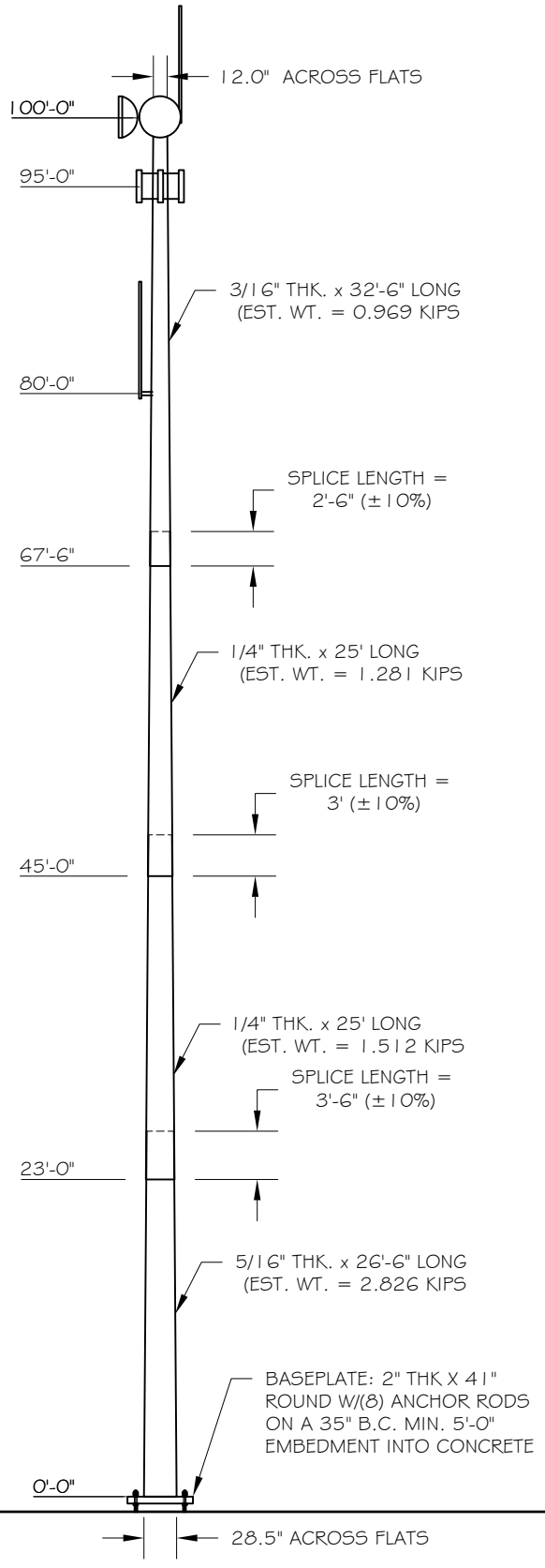
Elev.	Description
TOP	20' OMNI ANTENNA + (2) 3' MICROWAVE DISHES
100	FLUSH MOUNTS
95	(3) WIMAX ANTENNAS
95	STAND OFF MOUNTS
90	20' OMNI ANTENNA
80	FLUSH MOUNT

ANTENNA FEED LINES ROUTED ON THE INSIDE OF THE POLE

STRUCTURE PROPERTIES

Cross-Section: 18-SIDED	Taper: 0.17875 in/ft
Shaft Steel: ASTM A572 GR 65	Baseplate Steel: ASTM A572 GR 50
Anchor Rods: 2 in. F1554 GR. 105 X 6'-0" LONG	

Sect.	Length (ft)	Thickness (in)	Splice (ft)	Top Dia. (in)	Bot Dia. (in)
1	32.50	0.1875	2.50	12.00	17.81
2	25.00	0.2500	3.00	16.99	21.46
3	25.00	0.2500	3.50	20.42	24.89
4	26.50	0.3125	0.00	23.76	28.50



STATE OF NEW YORK
MICHAEL FARRELL PLAHOVINSAK
LICENSED PROFESSIONAL ENGINEER

10.18.2017

MICHAEL F. PLAHOVINSAK, P.E. #85261
Sole Proprietor - Independent Engineer
18301 S.R. 161, Plain City, OH 43064
614-398-6250 / mike@mfpeng.com

BASE REACTIONS FOR FOUNDATION DESIGN

Moment: 1084 ft-kip
Shear: 16 kip
Axial: 10 kip

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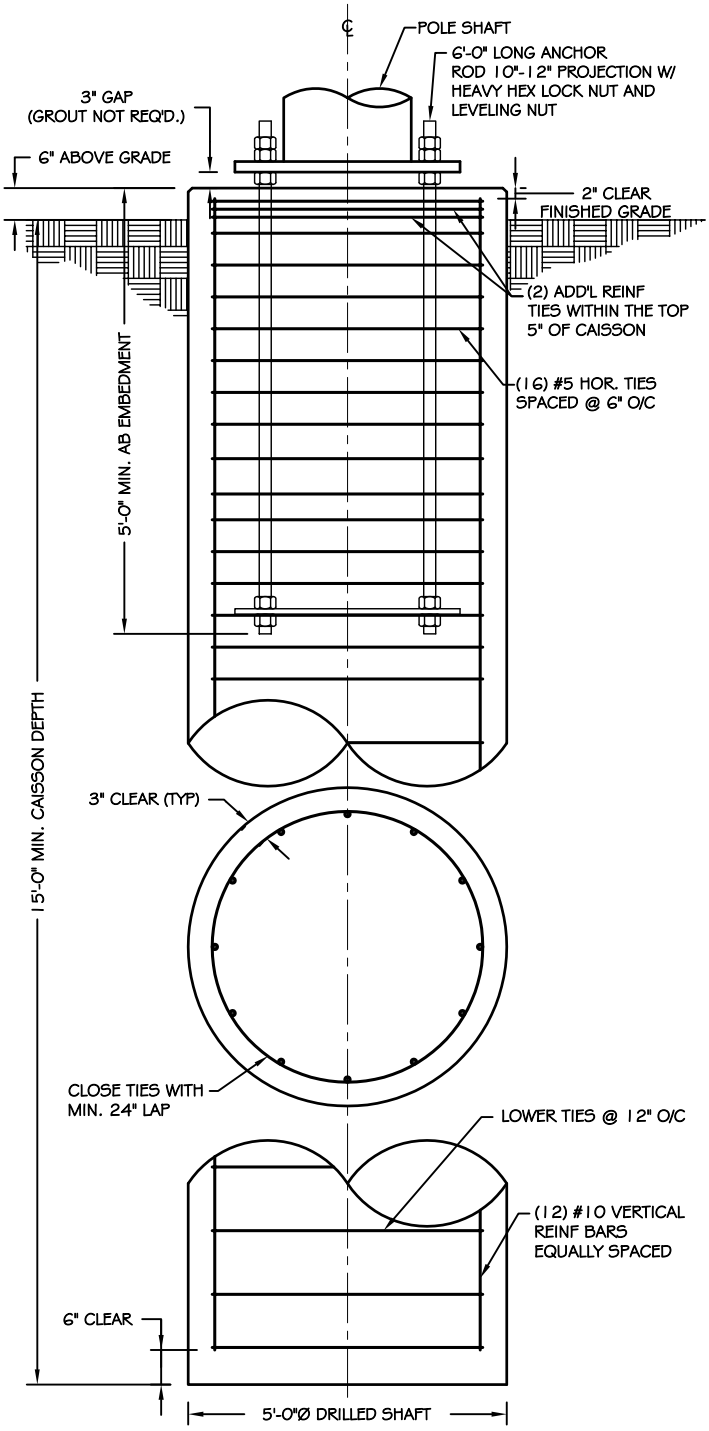

CAISSON FOUNDATION

NOT TO SCALE

FOUNDATION NOTES:

1. ALL FOUNDATION CONCRETE SHALL USE TYPE II CEMENT AND ATTAIN A MINIMUM COMPRESSIVE STRENGTH OF 4500 PSI AT 28 DAYS. CONCRETE SHALL HAVE A MAXIMUM WATER/CEMENT RATIO OF 0.46 AND SHALL BE AIR ENTRAINED 6% (±1.5%). ALL CONCRETE CONSTRUCTION SHALL BE IN ACCORDANCE WITH ACI 318, "THE BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", LATEST EDITION.

2. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615 VERTICAL BARS SHALL BE GRADE 60, AND TIES OR STIRRUPS SHALL BE A MINIMUM OF GRADE 40. THE PLACEMENT OF ALL REINFORCEMENT SHALL CONFORM TO ACI 315, "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES", LATEST EDITION.

3. CAISSON FOUNDATION INSTALLATION SHALL BE IN ACCORDANCE WITH ACI 336, "STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF DRILLED PIERS", LATEST EDITION.

4. THE CONTRACTOR SHALL DETERMINE THE MEANS AND METHODS TO SUPPORT THE EXCAVATION DURING CONSTRUCTION. THE CONTRACTOR SHALL READ THE GEOTECHNICAL REPORT AND SHALL CONSULT THE GEOTECHNICAL ENGINEER AS NECESSARY PRIOR TO CONSTRUCTION.

5. FOUNDATION DESIGN IS BASED ON GEOTECHNICAL REPORT BY:
ENGINEER: RAY M. TEETER, P.E.
REPORT NO.: RMT-12802 (DATED 8/25/16)

6. ESTIMATED CONCRETE VOLUME = 11 CUBIC YARDS.

7. THE FOUNDATION HAS BEEN DESIGNED TO RESIST THE FOLLOWING FACTORED LOADS:
MOMENT: 1084 FT*KIPS
SHEAR: 16 KIPS
AXIAL: 10 KIPS

MICHAEL F. PLAHOVINSAK, P.E. #85261
Sole Proprietor - Independent Engineer
18301 S.R. 161, Plain City, OH 43064
614-398-6250 / mike@mfpeng.com

Tower Input Data

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

Tower is located in Tompkins County, New York.
Basic wind speed of 115 mph.
Structure Class III.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 2.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

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	100.00-67.50	32.50	2.50	18	12.0000	17.8100	0.1875	0.7500	A572-65 (65 ksi)
L2	67.50-45.00	25.00	3.00	18	16.9881	21.4600	0.2500	1.0000	A572-65 (65 ksi)
L3	45.00-23.00	25.00	3.50	18	20.4234	24.8900	0.2500	1.0000	A572-65 (65 ksi)
L4	23.00-0.00	26.50		18	23.7647	28.5000	0.3125	1.2500	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	12.1851	7.0299	123.9285	4.1934	6.0960	20.3295	248.0200	3.5156	1.7820	9.504
	18.0847	10.4876	411.4795	6.2560	9.0475	45.4800	823.5004	5.2448	2.8046	14.958
L2	17.7042	13.2817	470.1117	5.9420	8.6299	54.4745	940.8420	6.6421	2.5499	10.2
	21.7911	16.8301	956.5472	7.5295	10.9017	87.7431	1914.3530	8.4167	3.3370	13.348
L3	21.2827	16.0076	823.0376	7.1615	10.3751	79.3284	1647.1582	8.0053	3.1545	12.618
	25.2740	19.5518	1499.7073	8.7472	12.6441	118.6091	3001.3879	9.7778	3.9406	15.763
L4	24.7663	23.2616	1616.3805	8.3255	12.0725	133.8900	3234.8879	11.6330	3.6326	11.624
	28.9397	27.9585	2806.4937	10.0066	14.4780	193.8454	5616.6803	13.9819	4.4660	14.291

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
3/8" Safety Climb	C	No	CaAa (Out Of Face)	100.00 - 0.00	1	No Ice	0.04	0.08
						1/2" Ice	0.14	0.65
						1" Ice	0.24	1.84
						2" Ice	0.44	6.04
**								
7/8"	C	No	Inside Pole	100.00 - 0.00	6	No Ice	0.00	0.35
						1/2" Ice	0.00	0.35
						1" Ice	0.00	0.35
						2" Ice	0.00	0.35
7/8"	C	No	Inside Pole	70.00 - 0.00	2	No Ice	0.00	0.35
						1/2" Ice	0.00	0.35
						1" Ice	0.00	0.35
						2" Ice	0.00	0.35
7/8"	C	No	Inside Pole	60.00 - 0.00	2	No Ice	0.00	0.35
						1/2" Ice	0.00	0.35
						1" Ice	0.00	0.35
						2" Ice	0.00	0.35
7/8"	C	No	Inside Pole	35.00 - 0.00	2	No Ice	0.00	0.35
						1/2" Ice	0.00	0.35
						1" Ice	0.00	0.35
						2" Ice	0.00	0.35

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
5/8" X 4' Lightning Rod	C	None		0.0000	102.00	No Ice	0.31	0.31	0.01
						1/2" Ice	0.83	0.83	0.01
						1" Ice	1.32	1.32	0.02
						2" Ice	1.96	1.96	0.04
***									
20 ft x 3" dia whip	A	From Face	3.00 0.00 0.00	0.0000	110.00	No Ice	6.00	6.00	0.06
						1/2" Ice	8.03	8.03	0.10
						1" Ice	10.08	10.08	0.16
						2" Ice	14.23	14.23	0.31
Flush Mounts	A	None		0.0000	100.00	No Ice	2.09	2.09	0.06
						1/2" Ice	2.39	2.39	0.07
						1" Ice	2.70	2.70	0.09
						2" Ice	3.33	3.33	0.14
*									
MARS MA-WD36-MIMO3 Flat Panel	A	From Face	6.00 0.00 0.00	0.0000	95.00	No Ice	7.23	0.64	0.02
						1/2" Ice	7.59	0.83	0.05
						1" Ice	7.96	1.03	0.08
						2" Ice	8.73	1.45	0.16
MARS MA-WD36-MIMO3 Flat Panel	B	From Face	6.00 0.00 0.00	0.0000	95.00	No Ice	7.23	0.64	0.02
						1/2" Ice	7.59	0.83	0.05
						1" Ice	7.96	1.03	0.08
						2" Ice	8.73	1.45	0.16
MARS MA-WD36-MIMO3 Flat Panel	C	From Face	6.00 0.00 0.00	0.0000	95.00	No Ice	7.23	0.64	0.02
						1/2" Ice	7.59	0.83	0.05
						1" Ice	7.96	1.03	0.08

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
						2" Ice	8.73	1.45	0.16
**									
Mecury Base Station	A	From Face	2.00 0.00 0.00	0.0000	95.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.60 5.92 6.24 6.91	0.93 1.12 1.31 1.73	0.01 0.04 0.07 0.14
**									
6-ft Stand Off Mounts	C	None		0.0000	95.00	No Ice 1/2" Ice 1" Ice 2" Ice	12.00 18.00 24.00 36.00	12.00 18.00 24.00 36.00	1.14 1.27 0.47 0.56
**									
20 ft x 3" dia whip	A	From Face	3.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice 2" Ice	6.00 8.03 10.08 14.23	6.00 8.03 10.08 14.23	0.06 0.10 0.16 0.31
(3) Flush Mounts	A	None		0.0000	80.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.09 2.39 2.70 3.33	2.09 2.39 2.70 3.33	0.06 0.07 0.09 0.14

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 ft^2	Weight K
3 ft standard	A	Paraboloid w/o Radome	From Face	1.00 0.00 0.00	0.0000		100.00	3.00	No Ice 1/2" Ice 1" Ice 2" Ice	7.06 7.47 7.88 8.73	0.10 0.18 0.25 0.39
3 ft standard	B	Paraboloid w/o Radome	From Face	1.00 0.00 0.00	0.0000		100.00	3.00	No Ice 1/2" Ice 1" Ice 2" Ice	7.06 7.47 7.88 8.73	0.10 0.18 0.25 0.39

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

Comb. No.	Description
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	100 - 67.5	Pole	Max Tension	5	0.00	-8.15	-0.66
			Max. Compression	8	-15.19	9.66	6.94
			Max. Mx	4	-2.41	-163.18	-17.70
			Max. My	6	-2.47	-4.01	-156.06
			Max. Vy	4	7.24	-163.18	-17.70
			Max. Vx	6	6.96	-4.01	-156.06
			Max. Torque	6			-3.20
L2	67.5 - 45	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-21.33	10.62	7.63
			Max. Mx	4	-4.07	-341.67	-31.59
			Max. My	6	-4.12	-7.69	-328.52
			Max. Vy	4	9.01	-341.67	-31.59
			Max. Vx	6	8.74	-7.69	-328.52
			Max. Torque	6			-3.18
L3	45 - 23	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-28.05	11.22	8.05
			Max. Mx	4	-6.20	-554.14	-45.11
			Max. My	6	-6.22	-11.33	-535.10
			Max. Vy	4	10.74	-554.14	-45.11
			Max. Vx	6	10.47	-11.33	-535.10
			Max. Torque	6			-3.16
L4	23 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-37.17	11.47	8.23
			Max. Mx	4	-9.80	-865.25	-61.44
			Max. My	6	-9.80	-15.78	-839.09
			Max. Vy	4	12.71	-865.25	-61.44
			Max. Vx	6	12.45	-15.78	-839.09
			Max. Torque	6			-3.15

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	100 - 67.5	13.305	13	1.1894	0.0265
L2	70 - 45	6.491	13	0.9011	0.0097
L3	48 - 23	2.971	13	0.6086	0.0047
L4	26.5 - 0	0.876	13	0.3033	0.0018

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
110.00	20 ft x 3" dia whip	13	13.305	1.1894	0.0265	21721
102.00	5/8" X 4' Lightning Rod	13	13.305	1.1894	0.0265	21721
100.00	3 ft standard	13	13.305	1.1894	0.0265	21721
95.00	MARS MA-WD36-MIMO3 Flat Panel	13	12.089	1.1462	0.0232	21721
90.00	20 ft x 3" dia whip	13	10.886	1.1022	0.0200	10860
80.00	(3) Flush Mounts	13	8.578	1.0083	0.0142	5430

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	100 - 67.5	101.325	4	9.1329	0.1990
L2	70 - 45	49.375	4	6.8726	0.0726
L3	48 - 23	22.596	4	4.6344	0.0349
L4	26.5 - 0	6.659	4	2.3070	0.0134

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
110.00	20 ft x 3" dia whip	4	101.325	9.1329	0.1990	2928
102.00	5/8" X 4' Lightning Rod	4	101.325	9.1329	0.1990	2928
100.00	3 ft standard	4	101.325	9.1329	0.1990	2928
95.00	MARS MA-WD36-MIMO3 Flat Panel	4	92.048	8.7909	0.1745	2928
90.00	20 ft x 3" dia whip	4	82.877	8.4430	0.1505	1462
80.00	(3) Flush Mounts	4	65.277	7.7054	0.1068	728

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	100 - 67.5 (1)	TP17.81x12x0.1875	32.50	0.00	0.0	10.2216	-2.41	759.41	0.003
L2	67.5 - 45 (2)	TP21.46x16.9881x0.25	25.00	0.00	0.0	16.4043	-4.07	1218.76	0.003
L3	45 - 23 (3)	TP24.89x20.4234x0.25	25.00	0.00	0.0	19.0556	-6.20	1415.74	0.004
L4	23 - 0 (4)	TP28.5x23.7647x0.3125	26.50	0.00	0.0	27.9585	-9.80	2077.18	0.005

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	100 - 67.5 (1)	TP17.81x12x0.1875	164.14	267.40	0.614	0.00	267.40	0.000
L2	67.5 - 45 (2)	TP21.46x16.9881x0.25	343.13	515.94	0.665	0.00	515.94	0.000
L3	45 - 23 (3)	TP24.89x20.4234x0.25	555.97	697.36	0.797	0.00	697.36	0.000

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 $\frac{M_{uy}}{\phi M_{ny}}$
L4	23 - 0 (4)	TP28.5x23.7647x0.3125	867.43	1200.14	0.723	0.00	1200.14	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	100 - 67.5 (1)	TP17.81x12x0.1875	7.26	379.71	0.019	2.35	535.46	0.004
L2	67.5 - 45 (2)	TP21.46x16.9881x0.25	9.03	609.38	0.015	2.33	1033.15	0.002
L3	45 - 23 (3)	TP24.89x20.4234x0.25	10.76	707.87	0.015	2.32	1396.42	0.002
L4	23 - 0 (4)	TP28.5x23.7647x0.3125	12.73	1038.59	0.012	2.31	2403.22	0.001

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	100 - 67.5 (1)	0.003	0.614	0.000	0.019	0.004	0.618 ✔	1.000	4.8.2 ✔
L2	67.5 - 45 (2)	0.003	0.665	0.000	0.015	0.002	0.669 ✔	1.000	4.8.2 ✔
L3	45 - 23 (3)	0.004	0.797	0.000	0.015	0.002	0.802 ✔	1.000	4.8.2 ✔
L4	23 - 0 (4)	0.005	0.723	0.000	0.012	0.001	0.728 ✔	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	100 - 67.5	Pole	TP17.81x12x0.1875	1	-2.41	759.41	61.8	Pass
L2	67.5 - 45	Pole	TP21.46x16.9881x0.25	2	-4.07	1218.76	66.9	Pass
L3	45 - 23	Pole	TP24.89x20.4234x0.25	3	-6.20	1415.74	80.2	Pass
L4	23 - 0	Pole	TP28.5x23.7647x0.3125	4	-9.80	2077.18	72.8	Pass
							Summary	
						Pole (L3)	80.2	Pass
						RATING =	**80.2**	**Pass**

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

Job	Page
100-ft monopole - MFP #24316-011	BP-G
Project	**Date**
Cayuga Heights	09/22/2016
Client	**Designed by**
FRED NUDD 4600021635	Mike

Anchor Rod and Base Plate Calculation

ANSI/TIA-222-G-2

Factored Base Reactions:		***Pole Shape:***	***Anchor Rods:***	***Base Plate:***
Moment:	867 ft-kips	18-Sided	(8) 2 in. F1554 GR. 105	2 in. x 41 in. Round
Shear:	13 kips	***Pole Dia. (D_f):***	Anchor Rods Evenly Spaced	fy = 50 ksi
Axial:	10 kips	28.50 in	On a 35 in Bolt Circle	

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

ϕ =	0.80	TIA 4.9.9	
I_{bolts} =	1225.00	in^2	Momet of Inertia
P_u =	149	kips	Tension Force
V_u =	2	kips	Shear Force
R_{nt} =	312.50	kips	Nominal Tensile Strength
η =	0.50	for detail type (d)	

The following Interation Equation Shall Be Satisfied:

$$\left(\frac{P_u + \frac{V_u}{\eta}}{\phi R_{nt}} \right) \leq 1.0$$

$$0.608 \leq 1$$

Base Plate Calculation According to TIA-222-G

ϕ =	0.90	TIA 4.7	
M_{PL} =	337.2	in-kip	Plate Moment
L =	11.2	in	Section Length
Z =	11.2		Plastic Section Modulus
M_P =	559.6	in-kip	Plastic Moment
ϕM_n =	503.6	in-kip	Factored Resistance

Calculated Moment vs Factored Resistance

337.23 in-kip $\leq$ 504 in-kip

Anchor Rods Are Adequate	**60.8%** ☑
Base Plate is Adequate	**67.0%** ☑

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

Job	Page
100-ft monopole - MFP #24316-011	FND
Project	**Date**
Cayuga Heights	09/22/2016
Client	**Designed by**
FRED NUDD 4600021635	Mike

Caisson Calculation

According to ANSI/TIA-222-G-2

1. Foundation overturning resistance calculated with PLS Caisson, for Brom's method for rigid piles. Soil layers modeled after recommendations from the geotechnical report.
2. Cohesion strength for the upper 15 ft has been reduced by 50%
3. In lieu of a soil resistance factor fs = 0.75 (TIA-9.4.1) an additional safey fator against soil failure of 1.33 has been applied.
4. Foundation is designed with a minimum safety factor resisting overturning of 2.0
5. Foundation has been designed with factored loads per TIA-222-G.
6. Geotechnical report indicates groundwater was not encountered within the depth of the foundation.

*** PIER PROPERTIES CONCRETE STRENGTH (ksi) = 4.50 STEEL STRENGTH (ksi) = 60.00

DIAMETER (ft) = 5.000 DISTANCE FROM TOP OF PIER TO GROUND LEVEL (ft) = 0.50

*** SOIL PROPERTIES

LAYER	TYPE	THICKNESS (ft)	DEPTH AT TOP OF LAYER (ft)	DENSITY (pcf)	CU (psf)	KP	PHI (degrees)
1	S	3.00	0.00	100.0		1.000	-0.00
2	S	13.00	3.00	120.0		3.690	35.00
3	C	10.00	16.00	140.0	10000.0		

*** DESIGN (FACTORED) LOADS AT TOP OF PIER MOMENT (ft-k) = 1084.0 VERTICAL (k) = 10.0 SHEAR (k) = 16.0
ADDITIONAL SAFETY FACTOR AGAINST SOIL FAILURE = 1.33

*** CALCULATED PIER LENGTH (ft) = 15.500

*** CHECK OF SOILS PROPERTIES AND ULTIMATE RESISTING FORCES ALONG PIER

TYPE	TOP OF LAYER BELOW TOP OF PIER (ft)	THICKNESS (ft)	DENSITY (pcf)	CU (psf)	KP	FORCE (k)	ARM (ft)
S	0.50	3.00	100.0		1.000	6.75	2.50
S	3.50	8.02	120.0		3.690	346.50	8.33
S	11.52	3.98	120.0		3.690	-330.98	13.61

*** SHEAR AND MOMENTS ALONG PIER

DISTANCE BELOW TOP OF PIER (ft)	WITH THE ADDITIONAL SAFETY FACTOR SHEAR (k)	WITH THE ADDITIONAL SAFETY FACTOR MOMENT (ft-k)	WITHOUT ADDITIONAL SAFETY FACTOR SHEAR (k)	WITHOUT ADDITIONAL SAFETY FACTOR MOMENT (ft-k)
0.00	22.3	1602.4	16.7	1201.8
1.55	21.4	1636.6	16.1	1227.5
3.10	17.2	1667.0	12.9	1250.3
4.65	-8.0	1678.8	-6.0	1259.1
6.20	-53.5	1633.2	-40.1	1224.9
7.75	-115.0	1504.6	-86.3	1128.5
9.30	-192.5	1268.3	-144.4	951.2
10.85	-285.9	899.6	-214.5	674.7
12.40	-266.6	429.8	-200.0	322.3
13.95	-141.3	111.6	-106.0	83.7
15.50	0.0	0.0	0.0	0.0

*** TOTAL REINFORCEMENT PCT = 0.42 REINFORCEMENT AREA (in^2) = 11.88
*** USABLE AXIAL CAP. (k) = 10.0 USABLE MOMENT CAP. (ft-k) = 1322.3

For Design:

5-ft Diameter caisson x 15.5-ft long (15-ft Embeded with 0.5-ft above grade)
Concrete strength =4500 PSI @ 28 days. Estimated Concrete Volume = 11 CY3.
(12) #10 Vertical Rebar. Steel Cross-Section = 15.24 in2

FRED A. NUDD CORPORATION
1743 ROUTE 104, P.O. BOX 577
ONTARIO,NY 14519
(315)524-2531

TOWER INSPECTION PROCEEDURES

Owners of towers should perform initial and periodic tower inspections and maintenance to assure safety and to extend the service life. It is recommended that major inspections be performed when:

A.) After every severe wind and/or ice storm or any other extreme conditions.
B.) One-year maximum interval for Class III structures. Refer to Table 2-1 of TIA/EIA RS 222-G for a definition of each class. Most guyed broadcast towers will be Class III.
C.) At the completion of any major installation/maintenance performed on the tower. Have the work inspected to insure the installation was performed in accordance with the design. Also, damage to tower members can occur from the rigging required for installation. The tow most common damages are bent members due to improper rigging connections to the tower and burning grooves in tower members due to the load line being to close to the tower face.
D.) Use the maintenance and condition assessment guidelines from Annex J of TIA/EIA RS 222-G.
E.) Include an inventory of existing equipment with the inspection.

Some of the items listed below apply to new and existing tower infrastructures.

I. **Tower Conditions** (guyed and self-supporting)
   A. Members
      1. Bent members (legs and lacing)
      2. Loose members
      3. Missing members
      4. Climbing facilities, platforms, catwalks-all secure
      5. Loose and/or missing bolts

   B. Finish
      1. Paint and/or galvanizing condition
      2. Rust and/or corrosion conditions
      3. FAA or ICAO color marking conditions
      4. Water collection in members (to be remedied, e.g., unplug drain holes, etc)

   C. Lighting
      1. Conduit, junction boxes and fasteners weather tight and secure
      2. Drains and vents open
      3. Wiring condition
      4. Controllers functioning
         a. Flashers
         b. Photo control
         c. Alarms
      5. Light lenses
      6. Bulb condition (Option: change all bulbs at one time)

D. Grounding
    1. Connections checked and secure
    2. Corrosion observed and remedied
    3. Lightning protection secure (as required)

E. Tower Base Foundation
    1. Ground Conditions
        a. Settlements or movements
        b. Erosion
        c. Site condition (standing water, drainage, trees, etc)
    2. Base Condition
        a. Nuts and lock nuts tight
        b. Grout condition
    3. Concrete Condition
        a. Crackling, spalling or splitting
        b. Chipped or broken concrete
        c. Honeycombing
        d. Low spots to collect moisture

Guy wires must be kept clean and clear of dirt and debris.

F. Tower Base Foundation
    1. Ground Conditions
        a. Settlements or movements
        b. Erosion
        c. Site condition (standing water, drainage, trees, etc)
    2. Base Condition
        a. Nuts and lock nuts tight
        b. Grout condition
    3. Concrete Condition
        a. Crackling, spalling or splitting
        b. Chipped or broken concrete
        c. Honeycombing
        d. Low spots to collect moisture

II. Guyed Towers

A. Anchors
    1. Settlement, movement or earth cracks
    2. Backfill heaped over concrete for water shedding
    3. Anchor rod condition below earth (12” minimum)
    4. Corrosion
    5. Grounding
    6. Anchor head clear of earth

B. Tower Guys
    1. Strand
        a. Type (1x7 EHS, 1x19 bridge strand, etc)
        b. Size
        c. Breaking Strength

d. Elevation
e. Condition (corrosion, breaks, nicks, kinks, etc)

2. Guy Hardware
   a. Turnbuckles (or equivalent) secure and safety properly applied
   b. Cable Thimbles properly in place (if required)
   c. Service sleeves properly in place (if required)
   d. Cable connectors (end fittings)
      1. Cable clamps applied properly and bolts tight
      2. Preformed wraps properly applied, fully wrapped and sleeve in place
      3. Wire serving properly applied
      4. Strandvices secure
      5. Poured sockets secure and showing no signs of separation. (Note: Connectors should show no sign of damaged cable or slippage)
   e. Shackles, bolts, pins and cotter pins secure and in good condition

3. Guy Tensions
   a. Tension should be checked by manufacturer's recommendations

Notes:

1.) Variations in guy tensions are to be expected due to temperature and wind. These are minor variations. Should there be significant tension changes, the cause should be determined immediately and proper remedial action taken. Possible causes may be initial construction loosening, extreme wind or ice, anchor movements, base settlement or connection slippage.

2.) Tension variations at a single level are to be expected because of anchor elevation differences, construction deviations, and wind effects.

Caution: Do not check or adjust guy tensions during times of excessive winds.

III. Antennas and Feedlines

A. Antenna Mounts and Antennas

1. Members
   a. Bent, broken or cracked
   b. Loose
   c. Missing
   d. Loose and/or missing bolts
2. Adjustments secure and locked
3. Elements
   a. Bent, broken, cracked or bullet damaged
   b. Loose
   c. Missing
   d. Loose or missing fasteners
4. Corrosion condition
5. Radomes or cover conditions

B. Feed lines (waveguide, coax, etc)
    1. Hangers and supports
        a. Condition
        b. Quality
        c. Corrosion condition

    2. Flanges and seals (check integrity)
    3. Line Condition
        a. Dents
        b. Abrasions
        c. Holes
        d. Leaks
        e. Jacket condition

    4. Grounds
        a. Top ground strap bonded both ends
        b. Bottom ground strap bonded both ends

    5. Feedline support (ice shields)
        a. Properly attached
        b. Loose and missing bolts
        c. Members straight and undamaged

Physical changes in the antenna system can affect a directional array, but it is equally important to inspect tower fences and clear ground vegetation

Stainless steel cotter pins are best. This anchor plate is cold galvanized for protection from rust.

Guy anchor showing the turnbuckle safety in figure-eight formation as required by TIA/EIA 222.