Date:

Subject: **Structural Analysis Report**

Carrier Designation:

Site Number:
FA Number:

Crown Castle Designation: **BU Number:**
Site Name:

JDE Job Number:
Work Order Number:
Order Number:

Engineering Firm Designation:

Site Data:

this **"Structural Analysis Report"** to determine the structural integrity of the above-mentioned tower.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

Sufficient Capacity

This analysis has been performed in accordance with the 2018 International Building Code based upon an ultimate 3-second gust wind speed of 99 mph. Applicable Standard references and design criteria are listed in Section 2 - Analysis Criteria.

Structural analysis prepared by

Respectfully submitted by:

Professional Engineer

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1) INTRODUCTION

This tower is a 60.85 ft Monopole tower

2) ANALYSIS CRITERIA

TIA-222 Revision:	TIA-222-H
Risk Category:	II
Wind Speed:	99 mph
Exposure Category:	C
Topographic Factor:	1
Ice Thickness:	0 in
Wind Speed with Ice:	30 mph
Seismic Ss:	0.485
Seismic S1:	0.164
Service Wind Speed:	60 mph

Table 1 - Proposed Equipment Configuration

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
60.0	62.0	3	alcatel lucent	B25 RRH4X30-4R	12 3 2 2	7/8 5/16 3/4 3/8
		3	alcatel lucent	B66A RRH4X45-4R		
		3	alcatel lucent	RRH4X25-WCS-4R		
		3	commscope	NNH4-65C-R6-V3 w/ Mount Pipe		
		3	commscope	NNH4-65D-R6 w/ Mount Pipe		
		1	commscope	WCS-IMFQ-AMT-43		
		3	nokia	AEQK w/ Mount Pipe		
		3	nokia	AHLBBA_CCIV2		
		1	raycap	DC6-48-60-18-8F		
	60.0	1		Sector Mount [10' SM 901-3]		
		3	nokia	AHCA		
	55.5	1	site pro 1	PRK-1245 Tri-Sector Kickers		
57.0	58.0	2	raycap	DC6-48-60-18-8F	1 4	3/8 3/4

3) ANALYSIS PROCEDURE

Table 2 - Documents Provided

Document	Reference	Source
4-TOWER MANUFACTURER DRAWINGS		
4-TOWER STRUCTURAL ANALYSIS REPORTS		

3.1) Analysis Method

tnxTower 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. When applicable, calculated and provided the effective area for panel antennas using approved methods following the intent of the TIA-222 standard.

3.2) Assumptions

1) Tower and structures were maintained in accordance with the TIA-222 Standard.
2) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.

This analysis may be affected if any assumptions are not valid or have been made in error.

4) ANALYSIS RESULTS

Table 3 - Section Capacity

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	60.85 - 29.61	Pole	TP23.927x17x0.1875	1	-7.17	645.79	59.2	Pass
L2	29.61 - 0	Pole	TP30x22.7781x0.25	2	-10.66	1115.41	58.9	Pass
							Summary	
						Pole (L1)	59.2	Pass
						Rating =	59.2	Pass

Table 4 - Tower Component Stresses vs. Capacity

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	39.5	Pass
1	Base Plate	0	49.6	Pass
1, 2	Base Foundation (Compared w/ Design Loads)	0	67.3	Pass

Structure Rating (max from all components) =	67.3%

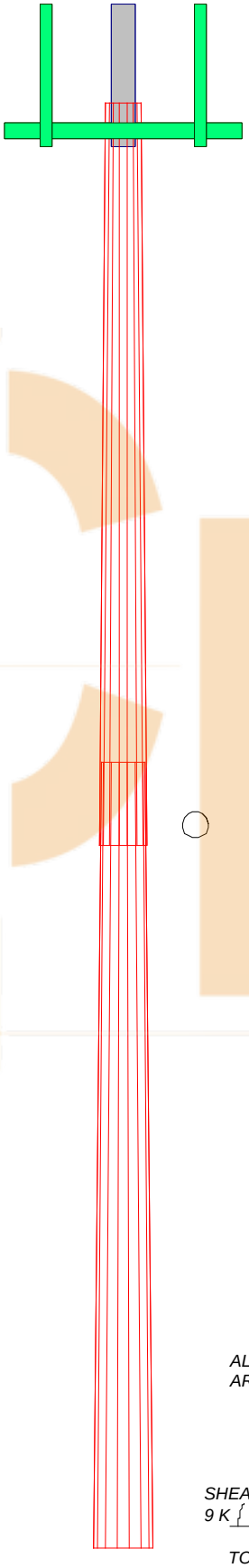
Notes:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity consumed. Rating per TIA-222-H Section 15.5.
2) Foundation capacity determined by comparing analysis reactions to original design reactions.

4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the proposed load configuration. No modifications are required at this time.

APPENDIX A

TNXTOWER OUTPUT



Section	1	2
Length (ft)	31.24	33.10
Number of Sides	18	18
Thickness (in)	0.1875	0.2500
Socket Length (ft)	3.49	
Top Dia (in)	17.0000	22.7781
Bot Dia (in)	23.9270	30.0000
Grade	A572-50	
Weight (K)	1.3	2.3

3.6

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi			

TOWER DESIGN NOTES

1. Tower is located in Clark County, Nevada.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 99 mph basic wind in accordance with the TIA-222-H Standard.
4. Deflections are based upon a 60 mph wind.
5. Tower Risk Category II.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 59.2%

ALL REACTIONS ARE FACTORED

AXIAL 11 K

SHEAR 9 K

MOMENT 489 kip-ft

TORQUE 0 kip-ft

REACTIONS - 99 mph WIND

Tower Input Data

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

- Tower is located in Clark County, Nevada.
- Tower base elevation above sea level: 1827.00 ft.
- Basic wind speed of 99 mph.
- Risk Category II.
- Exposure Category C.
- Simplified Topographic Factor Procedure for wind speed-up calculations is used.
- Topographic Category: 1.
- Crest Height: 0.00 ft.
- Deflections calculated using a wind speed of 60 mph.
- CCISeismic Note: Seismic loads generated by CCISeismic 3.38.
- CCISeismic Note: Seismic calculations are in accordance with TIA-222-H-1.
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in pole design is 1.
- Tower analysis based on target reliabilities in accordance with Annex S.
- Load Modification Factors used: $K_{es}(F_w) = 0.95$, $K_{es}(E_v$ and $E_h) = 1.0$.
- Maximum demand-capacity ratio is: 1.05.
- Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

	Consider Moments - Legs		Distribute Leg Loads As Uniform		Use ASCE 10 X-Brace Ly Rules
	Consider Moments - Horizontals		Assume Legs Pinned		Calculate Redundant Bracing Forces
	Consider Moments - Diagonals	√	Assume Rigid Index Plate		Ignore Redundant Members in FEA
	Use Moment Magnification	√	Use Clear Spans For Wind Area		SR Leg Bolts Resist Compression
√	Use Code Stress Ratios		Use Clear Spans For KL/r		All Leg Panels Have Same Allowable
√	Use Code Safety Factors - Guys		Retension Guys To Initial Tension		Offset Girt At Foundation
	Escalate Ice	√	Bypass Mast Stability Checks	√	Consider Feed Line Torque
	Always Use Max Kz	√	Use Azimuth Dish Coefficients		Include Angle Block Shear Check
	Use Special Wind Profile	√	Project Wind Area of Appurt.		Use TIA-222-H Bracing Resist. Exemption
	Include Bolts In Member Capacity		Autocalc Torque Arm Areas		Use TIA-222-H Tension Splice Exemption
	Leg Bolts Are At Top Of Section		Add IBC .6D+W Combination		Poles
	Secondary Horizontal Braces Leg		Sort Capacity Reports By Component	√	Include Shear-Torsion Interaction
	Use Diamond Inner Bracing (4 Sided)		Triangulate Diamond Inner Bracing		Always Use Sub-Critical Flow
	SR Members Have Cut Ends		Treat Feed Line Bundles As Cylinder		Use Top Mounted Sockets
	SR Members Are Concentric		Ignore KL/ry For 60 Deg. Angle Legs	√	Pole Without Linear Attachments
					Pole With Shroud Or No Appurtenances
					Outside and Inside Corner Radii Are Known

Tapered Pole Section Geometry

Section	*Elevation*	*Section Length*	*Splice Length*	*Number of Sides*	*Top Diameter*	*Bottom Diameter*	*Wall Thickness*	*Bend Radius*	*Pole Grade*
	ft	*ft*	*ft*		*in*	*in*	*in*	*in*	
L1	60.85-29.61	31.24	3.49	18	17.0000	23.9270	0.1875	0.7500	A572-50 (50 ksi)
L2	29.61-0.00	33.10		18	22.7781	30.0000	0.2500	1.0000	A572-50

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
									(50 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	17.2333	10.0055	357.3078	5.9684	8.6360	41.3742	715.0858	5.0037	2.6620	14.197
	24.2672	14.1280	1005.9128	8.4275	12.1549	82.7577	2013.1493	7.0653	3.8812	20.699
L2	23.8642	17.8761	1146.2007	7.9975	11.5713	99.0555	2293.9097	8.9397	3.5690	14.276
	30.4242	23.6066	2639.6436	10.5612	15.2400	173.2050	5282.7605	11.8056	4.8400	19.36

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 60.85-29.61				1	1	1			
L2 29.61-0.00				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
LDF5-50A(7/8)	C	No	No	Inside Pole	60.00 - 8.00	12	No Ice	0.00	0.33
9207(5/16)	C	No	No	Inside Pole	60.00 - 8.00	3	No Ice	0.00	0.06
FB-L98B-034-XXXXXX(3/8)	C	No	No	Inside Pole	60.00 - 8.00	1	No Ice	0.00	0.05
WR-VG86ST-BRD(3/4)	C	No	No	Inside Pole	60.00 - 8.00	2	No Ice	0.00	0.58
FB-L98B-034-XXXXXX(3/8)	C	No	No	Inside Pole	60.00 - 8.00	1	No Ice	0.00	0.05
2" innerduct conduit	C	No	No	Inside Pole	57.00 - 8.00	3	No Ice	0.00	0.20
FB-L98B-034-XXXXXX(3/8)	C	No	No	Inside Pole	57.00 - 8.00	1	No Ice	0.00	0.05
WR-VG86ST-BRD(3/4)	C	No	No	Inside Pole	57.00 - 8.00	4	No Ice	0.00	0.58

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	60.85-29.61	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	0.25
L2	29.61-0.00	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	0.18

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
(85) Palm Fronds ****	C	None		0.0000	62.00	No Ice	141.10	141.10	0.89
Sector Mount [10' SM 901-3]	C	None		0.0000	60.00	No Ice	9.83	9.83	0.97
Site Pro 1 PRK-1245 Tri-Sector Kickers	C	From Leg	3.00 0.00 -4.50	0.0000	60.00	No Ice	3.37	4.77	0.52
AEQK w/ Mount Pipe	A	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	5.68	4.30	0.13
NNH4-65C-R6-V3 w/ Mount Pipe	A	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	9.68	5.17	0.16
NNH4-65D-R6 w/ Mount Pipe	A	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	10.77	5.74	0.12
AEQK w/ Mount Pipe	B	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	5.68	4.30	0.13
NNH4-65C-R6-V3 w/ Mount Pipe	B	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	9.68	5.17	0.16
NNH4-65D-R6 w/ Mount Pipe	B	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	10.77	5.74	0.12
AEQK w/ Mount Pipe	C	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	5.68	4.30	0.13
NNH4-65C-R6-V3 w/ Mount Pipe	C	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	9.68	5.17	0.16
NNH4-65D-R6 w/ Mount Pipe	C	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	10.77	5.74	0.12
B25 RRH4X30-4R	A	From Leg	3.00 0.00 2.00	0.0000	60.00	No Ice	2.14	1.31	0.05
B25 RRH4X30-4R	B	From Leg	3.00 0.00	0.0000	60.00	No Ice	2.14	1.31	0.05

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
B25 RRH4X30-4R	C	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	2.14	1.31	0.05
B66A RRH4X45-4R	A	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	2.54	1.61	0.06
B66A RRH4X45-4R	B	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	2.54	1.61	0.06
B66A RRH4X45-4R	C	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	2.54	1.61	0.06
RRH4X25-WCS-4R	A	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	3.12	2.38	0.07
RRH4X25-WCS-4R	B	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	3.12	2.38	0.07
RRH4X25-WCS-4R	C	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	3.12	2.38	0.07
AHLBBA_CCIV2	A	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	3.06	1.02	0.10
AHLBBA_CCIV2	B	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	3.06	1.02	0.10
AHLBBA_CCIV2	C	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	3.06	1.02	0.10
WCS-IMFQ-AMT-43	B	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	0.38	0.55	0.02
DC6-48-60-18-8F	C	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	0.92	0.92	0.02
AHCA	A	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	1.29	0.72	0.04
AHCA	B	From Leg	0.00 3.00 0.00	0.0000	60.00	No Ice	1.29	0.72	0.04
AHCA	C	From Leg	0.00 3.00 0.00	0.0000	60.00	No Ice	1.29	0.72	0.04
8'x2" Mount Pipe	A	From Leg	0.00 3.00 0.00	0.0000	60.00	No Ice	1.90	1.90	0.03
8'x2" Mount Pipe	B	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	1.90	1.90	0.03
8'x2" Mount Pipe	C	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	1.90	1.90	0.03
8'x2" Mount Pipe	A	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	0.87	1.90	0.03
8'x2" Mount Pipe	B	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	0.87	1.90	0.03
8'x2" Mount Pipe	C	From Leg	2.00 3.00 0.00	0.0000	60.00	No Ice	0.87	1.90	0.03
DC6-48-60-18-8F	A	From Leg	2.00 0.50	0.0000	57.00	No Ice	0.92	0.92	0.02

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
DC6-48-60-18-8F	B	From Leg	0.00 1.00 0.50 0.00 1.00	0.0000	57.00	No Ice	0.92	0.92	0.02

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice
3	0.9 Dead+1.0 Wind 0 deg - No Ice
4	1.2 Dead+1.0 Wind 30 deg - No Ice
5	0.9 Dead+1.0 Wind 30 deg - No Ice
6	1.2 Dead+1.0 Wind 60 deg - No Ice
7	0.9 Dead+1.0 Wind 60 deg - No Ice
8	1.2 Dead+1.0 Wind 90 deg - No Ice
9	0.9 Dead+1.0 Wind 90 deg - No Ice
10	1.2 Dead+1.0 Wind 120 deg - No Ice
11	0.9 Dead+1.0 Wind 120 deg - No Ice
12	1.2 Dead+1.0 Wind 150 deg - No Ice
13	0.9 Dead+1.0 Wind 150 deg - No Ice
14	1.2 Dead+1.0 Wind 180 deg - No Ice
15	0.9 Dead+1.0 Wind 180 deg - No Ice
16	1.2 Dead+1.0 Wind 210 deg - No Ice
17	0.9 Dead+1.0 Wind 210 deg - No Ice
18	1.2 Dead+1.0 Wind 240 deg - No Ice
19	0.9 Dead+1.0 Wind 240 deg - No Ice
20	1.2 Dead+1.0 Wind 270 deg - No Ice
21	0.9 Dead+1.0 Wind 270 deg - No Ice
22	1.2 Dead+1.0 Wind 300 deg - No Ice
23	0.9 Dead+1.0 Wind 300 deg - No Ice
24	1.2 Dead+1.0 Wind 330 deg - No Ice
25	0.9 Dead+1.0 Wind 330 deg - No Ice
26	Dead+Wind 0 deg - Service
27	Dead+Wind 30 deg - Service
28	Dead+Wind 60 deg - Service
29	Dead+Wind 90 deg - Service
30	Dead+Wind 120 deg - Service
31	Dead+Wind 150 deg - Service
32	Dead+Wind 180 deg - Service
33	Dead+Wind 210 deg - Service
34	Dead+Wind 240 deg - Service
35	Dead+Wind 270 deg - Service
36	Dead+Wind 300 deg - Service
37	Dead+Wind 330 deg - Service
38	1.2 Dead+1.0 Ev+1.0 Eh 0 deg
39	0.9 Dead-1.0 Ev+1.0 Eh 0 deg
40	1.2 Dead+1.0 Ev+1.0 Eh 30 deg
41	0.9 Dead-1.0 Ev+1.0 Eh 30 deg
42	1.2 Dead+1.0 Ev+1.0 Eh 60 deg
43	0.9 Dead-1.0 Ev+1.0 Eh 60 deg
44	1.2 Dead+1.0 Ev+1.0 Eh 90 deg
45	0.9 Dead-1.0 Ev+1.0 Eh 90 deg
46	1.2 Dead+1.0 Ev+1.0 Eh 120 deg
47	0.9 Dead-1.0 Ev+1.0 Eh 120 deg
48	1.2 Dead+1.0 Ev+1.0 Eh 150 deg
49	0.9 Dead-1.0 Ev+1.0 Eh 150 deg

Comb. No.	Description
50	1.2 Dead+1.0 Ev+1.0 Eh 180 deg
51	0.9 Dead-1.0 Ev+1.0 Eh 180 deg
52	1.2 Dead+1.0 Ev+1.0 Eh 210 deg
53	0.9 Dead-1.0 Ev+1.0 Eh 210 deg
54	1.2 Dead+1.0 Ev+1.0 Eh 240 deg
55	0.9 Dead-1.0 Ev+1.0 Eh 240 deg
56	1.2 Dead+1.0 Ev+1.0 Eh 270 deg
57	0.9 Dead-1.0 Ev+1.0 Eh 270 deg
58	1.2 Dead+1.0 Ev+1.0 Eh 300 deg
59	0.9 Dead-1.0 Ev+1.0 Eh 300 deg
60	1.2 Dead+1.0 Ev+1.0 Eh 330 deg
61	0.9 Dead-1.0 Ev+1.0 Eh 330 deg

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	60.85 - 29.61	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	42	-7.99	-19.27	11.03
			Max. Mx	20	-7.17	216.84	-0.96
			Max. My	14	-7.17	1.73	-216.56
			Max. Vy	20	-7.85	216.84	-0.96
			Max. Vx	14	7.87	1.73	-216.56
			Max. Torque	25			0.48
L2	29.61 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	42	-11.47	-48.16	27.71
			Max. Mx	20	-10.66	488.68	-0.51
			Max. My	14	-10.66	1.29	-489.08
			Max. Vy	20	-8.57	488.68	-0.51
			Max. Vx	14	8.59	1.29	-489.08
			Max. Torque	25			0.45

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	42	11.47	-0.88	0.51
	Max. H_x	20	10.66	8.56	0.01
	Max. H_z	2	10.66	0.01	8.58
	Max. M_x	2	486.51	0.01	8.58
	Max. M_z	8	484.55	-8.56	-0.01
	Max. Torsion	25	0.45	4.29	7.44
	Min. Vert	55	7.19	0.88	-0.51
	Min. H_x	8	10.66	-8.56	-0.01
	Min. H_z	14	10.66	-0.01	-8.58
	Min. M_x	14	-489.08	-0.01	-8.58
	Min. M_z	20	-488.68	8.56	0.01
	Min. Torsion	13	-0.45	-4.29	-7.44

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	8.88	0.00	0.00	1.06	1.71	-0.00
1.2 Dead+1.0 Wind 0 deg -	10.66	-0.01	-8.58	-486.51	2.84	-0.36

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
No Ice 0.9 Dead+1.0 Wind 0 deg - No Ice	8.00	-0.01	-8.58	-483.74	2.30	-0.37
1.2 Dead+1.0 Wind 30 deg - No Ice	10.66	4.27	-7.43	-420.77	-240.57	-0.18
0.9 Dead+1.0 Wind 30 deg - No Ice	8.00	4.27	-7.43	-418.42	-239.56	-0.19
1.2 Dead+1.0 Wind 60 deg - No Ice	10.66	7.41	-4.28	-241.94	-418.97	0.05
0.9 Dead+1.0 Wind 60 deg - No Ice	8.00	7.41	-4.28	-240.73	-416.83	0.05
1.2 Dead+1.0 Wind 90 deg - No Ice	10.66	8.56	0.01	2.06	-484.55	0.26
0.9 Dead+1.0 Wind 90 deg - No Ice	8.00	8.56	0.01	1.72	-481.99	0.27
1.2 Dead+1.0 Wind 120 deg - No Ice	10.66	7.42	4.30	245.85	-419.74	0.40
0.9 Dead+1.0 Wind 120 deg - No Ice	8.00	7.42	4.30	243.97	-417.60	0.41
1.2 Dead+1.0 Wind 150 deg - No Ice	10.66	4.29	7.44	424.11	-241.91	0.44
0.9 Dead+1.0 Wind 150 deg - No Ice	8.00	4.29	7.44	421.10	-240.89	0.45
1.2 Dead+1.0 Wind 180 deg - No Ice	10.66	0.01	8.58	489.08	1.29	0.35
0.9 Dead+1.0 Wind 180 deg - No Ice	8.00	0.01	8.58	485.65	0.76	0.37
1.2 Dead+1.0 Wind 210 deg - No Ice	10.66	-4.27	7.43	423.34	244.70	0.18
0.9 Dead+1.0 Wind 210 deg - No Ice	8.00	-4.27	7.43	420.33	242.63	0.18
1.2 Dead+1.0 Wind 240 deg - No Ice	10.66	-7.41	4.28	244.51	423.10	-0.05
0.9 Dead+1.0 Wind 240 deg - No Ice	8.00	-7.41	4.28	242.64	419.89	-0.05
1.2 Dead+1.0 Wind 270 deg - No Ice	10.66	-8.56	-0.01	0.51	488.68	-0.26
0.9 Dead+1.0 Wind 270 deg - No Ice	8.00	-8.56	-0.01	0.19	485.06	-0.26
1.2 Dead+1.0 Wind 300 deg - No Ice	10.66	-7.42	-4.30	-243.28	423.87	-0.40
0.9 Dead+1.0 Wind 300 deg - No Ice	8.00	-7.42	-4.30	-242.06	420.66	-0.41
1.2 Dead+1.0 Wind 330 deg - No Ice	10.66	-4.29	-7.44	-421.54	246.04	-0.44
0.9 Dead+1.0 Wind 330 deg - No Ice	8.00	-4.29	-7.44	-419.19	243.96	-0.45
Dead+Wind 0 deg - Service	8.88	-0.00	-2.97	-167.30	1.98	-0.13
Dead+Wind 30 deg - Service	8.88	1.48	-2.57	-144.61	-82.04	-0.07
Dead+Wind 60 deg - Service	8.88	2.57	-1.48	-82.89	-143.61	0.02
Dead+Wind 90 deg - Service	8.88	2.97	0.00	1.33	-166.25	0.09
Dead+Wind 120 deg - Service	8.88	2.57	1.49	85.48	-143.88	0.15
Dead+Wind 150 deg - Service	8.88	1.49	2.58	147.01	-82.50	0.16
Dead+Wind 180 deg - Service	8.88	0.00	2.97	169.43	1.45	0.13
Dead+Wind 210 deg - Service	8.88	-1.48	2.57	146.74	85.46	0.07
Dead+Wind 240 deg - Service	8.88	-2.57	1.48	85.02	147.04	-0.02
Dead+Wind 270 deg - Service	8.88	-2.97	-0.00	0.80	169.67	-0.09
Dead+Wind 300 deg - Service	8.88	-2.57	-1.49	-83.35	147.31	-0.14
Dead+Wind 330 deg - Service	8.88	-1.49	-2.58	-144.88	85.93	-0.16
1.2 Dead+1.0 Ev+1.0 Eh 0 deg	11.47	0.00	-1.01	-56.72	2.08	0.01

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
0.9 Dead-1.0 Ev+1.0 Eh 0 deg	7.19	0.00	-1.01	-56.48	1.53	0.00
1.2 Dead+1.0 Ev+1.0 Eh 30 deg	11.47	0.51	-0.88	-48.95	-26.93	0.00
0.9 Dead-1.0 Ev+1.0 Eh 30 deg	7.19	0.51	-0.88	-48.79	-27.19	0.00
1.2 Dead+1.0 Ev+1.0 Eh 60 deg	11.47	0.88	-0.51	-27.71	-48.16	-0.00
0.9 Dead-1.0 Ev+1.0 Eh 60 deg	7.19	0.88	-0.51	-27.76	-48.21	-0.00
1.2 Dead+1.0 Ev+1.0 Eh 90 deg	11.47	1.01	0.00	1.29	-55.93	-0.00
0.9 Dead-1.0 Ev+1.0 Eh 90 deg	7.19	1.01	0.00	0.95	-55.90	-0.00
1.2 Dead+1.0 Ev+1.0 Eh 120 deg	11.47	0.88	0.51	30.30	-48.16	-0.01
0.9 Dead-1.0 Ev+1.0 Eh 120 deg	7.19	0.88	0.51	29.67	-48.21	-0.00
1.2 Dead+1.0 Ev+1.0 Eh 150 deg	11.47	0.51	0.88	51.54	-26.93	-0.01
0.9 Dead-1.0 Ev+1.0 Eh 150 deg	7.19	0.51	0.88	50.69	-27.19	-0.00
1.2 Dead+1.0 Ev+1.0 Eh 180 deg	11.47	0.00	1.01	59.31	2.08	-0.01
0.9 Dead-1.0 Ev+1.0 Eh 180 deg	7.19	0.00	1.01	58.39	1.53	-0.00
1.2 Dead+1.0 Ev+1.0 Eh 210 deg	11.47	-0.51	0.88	51.54	31.09	-0.00
0.9 Dead-1.0 Ev+1.0 Eh 210 deg	7.19	-0.51	0.88	50.69	30.25	-0.00
1.2 Dead+1.0 Ev+1.0 Eh 240 deg	11.47	-0.88	0.51	30.30	52.32	0.00
0.9 Dead-1.0 Ev+1.0 Eh 240 deg	7.19	-0.88	0.51	29.67	51.27	0.00
1.2 Dead+1.0 Ev+1.0 Eh 270 deg	11.47	-1.01	0.00	1.29	60.09	0.00
0.9 Dead-1.0 Ev+1.0 Eh 270 deg	7.19	-1.01	0.00	0.95	58.97	0.00
1.2 Dead+1.0 Ev+1.0 Eh 300 deg	11.47	-0.88	-0.51	-27.71	52.32	0.01
0.9 Dead-1.0 Ev+1.0 Eh 300 deg	7.19	-0.88	-0.51	-27.76	51.27	0.00
1.2 Dead+1.0 Ev+1.0 Eh 330 deg	11.47	-0.51	-0.88	-48.95	31.09	0.01
0.9 Dead-1.0 Ev+1.0 Eh 330 deg	7.19	-0.51	-0.88	-48.79	30.25	0.00

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-8.88	0.00	0.00	8.88	0.00	0.000%
2	-0.01	-10.66	-8.58	0.01	10.66	8.58	0.000%
3	-0.01	-8.00	-8.58	0.01	8.00	8.58	0.000%
4	4.27	-10.66	-7.43	-4.27	10.66	7.43	0.000%
5	4.27	-8.00	-7.43	-4.27	8.00	7.43	0.000%
6	7.41	-10.66	-4.28	-7.41	10.66	4.28	0.000%
7	7.41	-8.00	-4.28	-7.41	8.00	4.28	0.000%
8	8.56	-10.66	0.01	-8.56	10.66	-0.01	0.000%
9	8.56	-8.00	0.01	-8.56	8.00	-0.01	0.000%
10	7.42	-10.66	4.30	-7.42	10.66	-4.30	0.000%
11	7.42	-8.00	4.30	-7.42	8.00	-4.30	0.000%
12	4.29	-10.66	7.44	-4.29	10.66	-7.44	0.000%
13	4.29	-8.00	7.44	-4.29	8.00	-7.44	0.000%
14	0.01	-10.66	8.58	-0.01	10.66	-8.58	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
15	0.01	-8.00	8.58	-0.01	8.00	-8.58	0.000%
16	-4.27	-10.66	7.43	4.27	10.66	-7.43	0.000%
17	-4.27	-8.00	7.43	4.27	8.00	-7.43	0.000%
18	-7.41	-10.66	4.28	7.41	10.66	-4.28	0.000%
19	-7.41	-8.00	4.28	7.41	8.00	-4.28	0.000%
20	-8.56	-10.66	-0.01	8.56	10.66	0.01	0.000%
21	-8.56	-8.00	-0.01	8.56	8.00	0.01	0.000%
22	-7.42	-10.66	-4.30	7.42	10.66	4.30	0.000%
23	-7.42	-8.00	-4.30	7.42	8.00	4.30	0.000%
24	-4.29	-10.66	-7.44	4.29	10.66	7.44	0.000%
25	-4.29	-8.00	-7.44	4.29	8.00	7.44	0.000%
26	-0.00	-8.88	-2.97	0.00	8.88	2.97	0.000%
27	1.48	-8.88	-2.57	-1.48	8.88	2.57	0.000%
28	2.57	-8.88	-1.48	-2.57	8.88	1.48	0.000%
29	2.97	-8.88	0.00	-2.97	8.88	-0.00	0.000%
30	2.57	-8.88	1.49	-2.57	8.88	-1.49	0.000%
31	1.49	-8.88	2.58	-1.49	8.88	-2.58	0.000%
32	0.00	-8.88	2.97	-0.00	8.88	-2.97	0.000%
33	-1.48	-8.88	2.57	1.48	8.88	-2.57	0.000%
34	-2.57	-8.88	1.48	2.57	8.88	-1.48	0.000%
35	-2.97	-8.88	-0.00	2.97	8.88	0.00	0.000%
36	-2.57	-8.88	-1.49	2.57	8.88	1.49	0.000%
37	-1.49	-8.88	-2.58	1.49	8.88	2.58	0.000%
38	0.00	-11.47	-1.01	0.00	11.47	1.01	0.000%
39	0.00	-7.19	-1.01	0.00	7.19	1.01	0.000%
40	0.51	-11.47	-0.88	-0.51	11.47	0.88	0.000%
41	0.51	-7.19	-0.88	-0.51	7.19	0.88	0.000%
42	0.88	-11.47	-0.51	-0.88	11.47	0.51	0.000%
43	0.88	-7.19	-0.51	-0.88	7.19	0.51	0.000%
44	1.01	-11.47	0.00	-1.01	11.47	0.00	0.000%
45	1.01	-7.19	0.00	-1.01	7.19	0.00	0.000%
46	0.88	-11.47	0.51	-0.88	11.47	-0.51	0.000%
47	0.88	-7.19	0.51	-0.88	7.19	-0.51	0.000%
48	0.51	-11.47	0.88	-0.51	11.47	-0.88	0.000%
49	0.51	-7.19	0.88	-0.51	7.19	-0.88	0.000%
50	0.00	-11.47	1.01	0.00	11.47	-1.01	0.000%
51	0.00	-7.19	1.01	0.00	7.19	-1.01	0.000%
52	-0.51	-11.47	0.88	0.51	11.47	-0.88	0.000%
53	-0.51	-7.19	0.88	0.51	7.19	-0.88	0.000%
54	-0.88	-11.47	0.51	0.88	11.47	-0.51	0.000%
55	-0.88	-7.19	0.51	0.88	7.19	-0.51	0.000%
56	-1.01	-11.47	0.00	1.01	11.47	0.00	0.000%
57	-1.01	-7.19	0.00	1.01	7.19	0.00	0.000%
58	-0.88	-11.47	-0.51	0.88	11.47	0.51	0.000%
59	-0.88	-7.19	-0.51	0.88	7.19	0.51	0.000%
60	-0.51	-11.47	-0.88	0.51	11.47	0.88	0.000%
61	-0.51	-7.19	-0.88	0.51	7.19	0.88	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00018024
3	Yes	4	0.00000001	0.00011392
4	Yes	5	0.00000001	0.00003997
5	Yes	4	0.00000001	0.00083005
6	Yes	5	0.00000001	0.00004085
7	Yes	4	0.00000001	0.00084902
8	Yes	4	0.00000001	0.00013021
9	Yes	4	0.00000001	0.00008236
10	Yes	5	0.00000001	0.00004515
11	Yes	4	0.00000001	0.00093691
12	Yes	5	0.00000001	0.00003952
13	Yes	4	0.00000001	0.00081705

14	Yes	4	0.00000001	0.00017033
15	Yes	4	0.00000001	0.00010737
16	Yes	5	0.00000001	0.00004460
17	Yes	4	0.00000001	0.00091814
18	Yes	5	0.00000001	0.00004366
19	Yes	4	0.00000001	0.00089759
20	Yes	4	0.00000001	0.00012063
21	Yes	4	0.00000001	0.00007597
22	Yes	5	0.00000001	0.00004025
23	Yes	4	0.00000001	0.00083006
24	Yes	5	0.00000001	0.00004595
25	Yes	4	0.00000001	0.00095160
26	Yes	4	0.00000001	0.00002499
27	Yes	4	0.00000001	0.00006210
28	Yes	4	0.00000001	0.00006555
29	Yes	4	0.00000001	0.00001817
30	Yes	4	0.00000001	0.00008441
31	Yes	4	0.00000001	0.00006164
32	Yes	4	0.00000001	0.00002517
33	Yes	4	0.00000001	0.00008285
34	Yes	4	0.00000001	0.00007839
35	Yes	4	0.00000001	0.00001848
36	Yes	4	0.00000001	0.00006448
37	Yes	4	0.00000001	0.00008839
38	Yes	4	0.00000001	0.00000001
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00000001
41	Yes	4	0.00000001	0.00000001
42	Yes	4	0.00000001	0.00000001
43	Yes	4	0.00000001	0.00000001
44	Yes	4	0.00000001	0.00000001
45	Yes	4	0.00000001	0.00000001
46	Yes	4	0.00000001	0.00000001
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00000001
49	Yes	4	0.00000001	0.00000001
50	Yes	4	0.00000001	0.00000001
51	Yes	4	0.00000001	0.00000001
52	Yes	4	0.00000001	0.00000001
53	Yes	4	0.00000001	0.00000001
54	Yes	4	0.00000001	0.00000001
55	Yes	4	0.00000001	0.00000001
56	Yes	4	0.00000001	0.00000001
57	Yes	4	0.00000001	0.00000001
58	Yes	4	0.00000001	0.00000001
59	Yes	4	0.00000001	0.00000001
60	Yes	4	0.00000001	0.00000001
61	Yes	4	0.00000001	0.00000001

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	60.85 - 29.61	7.313	34	1.0772	0.0035
L2	33.1 - 0	2.168	34	0.6032	0.0010

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
62.00	(85) Palm Fronds	34	7.313	1.0772	0.0035	11271
60.23	Tower Section 1 - 1	34	7.181	1.0668	0.0035	11271

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
60.00	Sector Mount [10' SM 901-3]	34	7.132	1.0629	0.0034	11271
57.00	DC6-48-60-18-8F	34	6.496	1.0124	0.0031	11271
55.43	(12) andrew LDF5-50A(7/8) From 8 to 60 (50.85ft to60ft)	34	6.164	0.9859	0.0030	10388
54.61	Tower Section 1 - 2	34	5.994	0.9722	0.0029	9031
53.93	(3) miscl 2" innerduct conduit From 8 to 57 (50.85ft to57ft)	34	5.851	0.9606	0.0028	8138
45.85	(12) andrew LDF5-50A(7/8) From 8 to 60 (40.85ft to50.85ft)	34	4.241	0.8238	0.0020	3757
44.61	Tower Section 1 - 3	34	4.010	0.8026	0.0019	3470
35.85	(12) andrew LDF5-50A(7/8) From 8 to 60 (30.85ft to40.85ft)	34	2.549	0.6514	0.0012	2266
34.61	Tower Section 1 - 4	34	2.372	0.6297	0.0011	2191
31.55	Tower Section 2 - 1	34	1.972	0.5759	0.0009	2171
25.85	(12) andrew LDF5-50A(7/8) From 8 to 60 (20.85ft to30.85ft)	34	1.364	0.4742	0.0006	2599
25.00	Tower Section 2 - 2	34	1.287	0.4589	0.0006	2688
15.85	(12) andrew LDF5-50A(7/8) From 8 to 60 (10.85ft to20.85ft)	32	0.640	0.2927	0.0003	4239
15.00	Tower Section 2 - 3	32	0.594	0.2771	0.0003	4479
9.43	(12) andrew LDF5-50A(7/8) From 8 to 60 (8ft to10.85ft)	32	0.336	0.1745	0.0002	7129
5.00	Tower Section 2 - 4	31	0.169	0.0927	0.0001	13438

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	60.85 - 29.61	20.926	16	3.0620	0.0101
L2	33.1 - 0	6.231	16	1.7323	0.0029

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
62.00	(85) Palm Fronds	16	20.926	3.0620	0.0101	3971
60.23	Tower Section 1 - 1	16	20.549	3.0329	0.0099	3971
60.00	Sector Mount [10' SM 901-3]	16	20.410	3.0221	0.0099	3971
57.00	DC6-48-60-18-8F	16	18.593	2.8812	0.0090	3971
55.43	(12) andrew LDF5-50A(7/8) From 8 to 60 (50.85ft to60ft)	16	17.647	2.8071	0.0085	3660
54.61	Tower Section 1 - 2	16	17.160	2.7687	0.0083	3182
53.93	(3) miscl 2" innerduct conduit From 8 to 57 (50.85ft to57ft)	16	16.753	2.7365	0.0081	2867
45.85	(12) andrew LDF5-50A(7/8) From 8 to 60 (40.85ft to50.85ft)	16	12.156	2.3535	0.0058	1323
44.61	Tower Section 1 - 3	16	11.495	2.2941	0.0055	1222
35.85	(12) andrew LDF5-50A(7/8) From 8 to 60 (30.85ft	16	7.321	1.8687	0.0035	797

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
	to40.85ft)					
34.61	Tower Section 1 - 4	16	6.814	1.8074	0.0032	770
31.55	Tower Section 2 - 1	16	5.671	1.6547	0.0027	763
25.85	(12) andrew LDF5-50A(7/8) From 8 to 60 (20.85ft to30.85ft)	14	3.931	1.3652	0.0018	913
25.00	Tower Section 2 - 2	14	3.711	1.3216	0.0017	944
15.85	(12) andrew LDF5-50A(7/8) From 8 to 60 (10.85ft to20.85ft)	14	1.852	0.8450	0.0008	1489
15.00	Tower Section 2 - 3	14	1.719	0.8001	0.0008	1573
9.43	(12) andrew LDF5-50A(7/8) From 8 to 60 (8ft to10.85ft)	12	0.972	0.5043	0.0004	2504
5.00	Tower Section 2 - 4	12	0.489	0.2679	0.0002	4720

Compression Checks

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	60.85 - 29.61 (1)	TP23.927x17x0.1875	31.24	0.00	0.0	13.6674	-7.17	615.03	0.012
L2	29.61 - 0 (2)	TP30x22.7781x0.25	33.10	0.00	0.0	23.6066	-10.66	1062.30	0.010

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	60.85 - 29.61 (1)	TP23.927x17x0.1875	217.06	356.87	0.608	0.00	356.87	0.000
L2	29.61 - 0 (2)	TP30x22.7781x0.25	489.08	804.62	0.608	0.00	804.62	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	60.85 - 29.61 (1)	TP23.927x17x0.1875	7.84	184.51	0.043	0.05	371.09	0.000
L2	29.61 - 0 (2)	TP30x22.7781x0.25	8.59	315.05	0.027	0.35	830.30	0.000

Pole Interaction Design Data

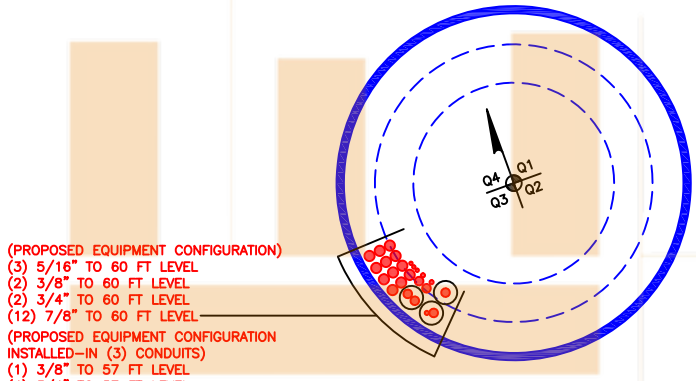
Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	60.85 - 29.61 (1)	0.012	0.608	0.000	0.043	0.000	0.622	1.050	4.8.2
L2	29.61 - 0 (2)	0.010	0.608	0.000	0.027	0.000	0.619	1.050	4.8.2

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
L1	60.85 - 29.61	Pole	TP23.927x17x0.1875	1	-7.17	645.79	59.2	Pass
L2	29.61 - 0	Pole	TP30x22.7781x0.25	2	-10.66	1115.41	58.9	Pass
							Summary	
						Pole (L1)	59.2	Pass
						RATING =	**59.2**	**Pass**

APPENDIX B

BASE LEVEL DRAWING



(PROPOSED EQUIPMENT CONFIGURATION)
(3) 5/16" TO 60 FT LEVEL
(2) 3/8" TO 60 FT LEVEL
(2) 3/4" TO 60 FT LEVEL
(12) 7/8" TO 60 FT LEVEL

(PROPOSED EQUIPMENT CONFIGURATION
INSTALLED-IN (3) CONDUITS)
(1) 3/8" TO 57 FT LEVEL
(4) 3/4" TO 57 FT LEVEL

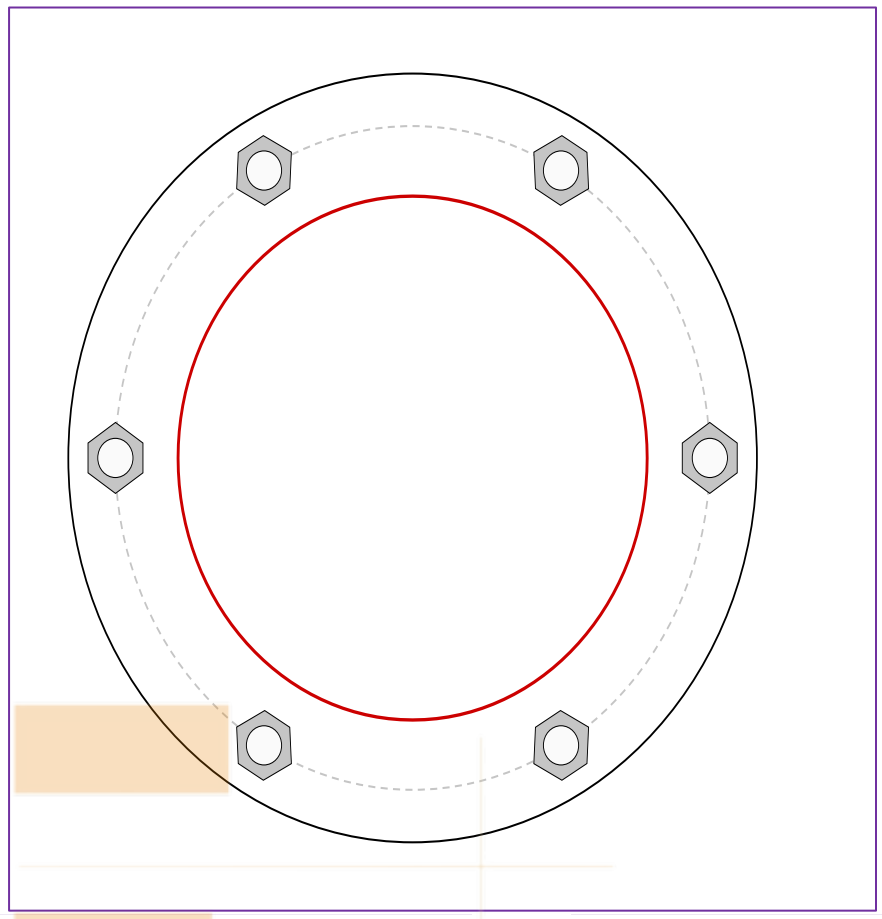
APPENDIX C

ADDITIONAL CALCULATIONS

Monopole Base Plate Connection

Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	No
l_{ar} (in)	2.8125

Applied Loads	
Moment (kip-ft)	489.08
Axial Force (kips)	10.66
Shear Force (kips)	8.59



Anchor Rod Data

(6) 2-1/4" ø bolts (A615-75 N; Fy=75 ksi, Fu=100 ksi) on 38" BC

Base Plate Data

44" OD x 1.75" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Stiffener Data

N/A

Pole Data

30" x 0.25" 18-sided pole (A572-50; Fy=50 ksi, Fu=65 ksi)

Anchor Rod Summary *(units of kips, kip-in)*

Pu_t = 101.04	ϕPn_t = 243.75	**Stress Rating**
Vu = 1.43	ϕVn = 149.1	**39.5%**
Mu = 2.62	ϕMn = 128.14	**Pass**

Base Plate Summary

Max Stress (ksi):	23.43	(Flexural)
Allowable Stress (ksi):	45	
Stress Rating:	**49.6%**	**Pass**

FOUNDATION ANALYSIS:

Original Tower Design Reactions:

Drilled Caisson:

Shear:	12.2	Kip
Overturning moment:	692.5	Kip-ft

Note: Design reactions are multiplied by 1.35 for comparison as allowed by TIA-222-H Section 15.6.2.

TnxTower Reactions:

Drilled Caisson:

Shear:	9.0	Kip
Overturning moment:	489.0	Kip-ft

Stress Ratio:

Drilled Caisson:

Shear:	70.1%
Overturning moment:	67.3%

Note: Ratings per TIA-222-H Section 15.5.

Conclusion:

When the calculated reactions are compared to the original design reactions, the existing foundation is considered to have been designed and constructed with adequate capacity to support the existing and proposed loads.

Controlling Foundation Stress Ratio: **67.3%**

Note: Although the stress ratio for shear is greater than the stress ratio for overturning moment, the moment reaction is the governing criteria for a monopole drilled shaft foundation.