

Report Date: November 5, 2021

Client: ARE Telecom Incorporated
1043 Grand Ave #213
St Paul, MN 55105
Attn: Flaubert Zinkia
(240) 584-9714
fzinkia@aretelecom.com

Structure: Existing 120-ft Monopole
Site Name: Elyria Water Tank
City, County, State: Elyria, Lorain County, OH
Latitude, Longitude: 41.368075°, -82.079244°

ARE Project: TMB-00003
PJF Project: A21221-0042.002.7205

Paul J. Ford and Company is pleased to submit this “**Structural Analysis Report**” to determine the tower stress level.

Analysis Criteria:

This analysis utilizes an ultimate 3-second gust wind speed of 115 mph (converted to an equivalent 89 mph nominal 3-second gust wind speed per Section 1609.3.1 for use with TIA-222 G) as required by the 2015 International Building Code. Applicable Standard references and design criteria are listed in Section 2 - Analysis Criteria.

Proposed Appurtenance Loads:

The structure was analyzed with the proposed loading configuration shown in Table 1 of this report.

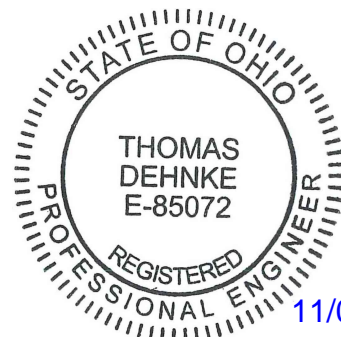
Summary of Analysis Results:

Proposed Structure: Pass – 47.5%
Proposed Foundation: Pass – 77.7%

We at Paul J. Ford and Company appreciate the opportunity of providing our continuing professional services to you and ARE Telecom Incorporated. If you have any questions or need further assistance on this or any other projects, please give us a call.

Respectfully Submitted by:
Paul J. Ford and Company


Jake Gold
Structural Designer 
jgold@pauljford.com



11/05/2021

TABLE OF CONTENTS

1) INTRODUCTION

2) ANALYSIS CRITERIA

Table 1 - Proposed Equipment Configuration

3) ANALYSIS PROCEDURE

Table 2 - Documents Provided

3.1) Analysis Method

3.2) Assumptions

4) ANALYSIS RESULTS

Table 3 - Section Capacity (Summary)

Table 4 – Tower Component Stresses vs. Capacity

4.1) Recommendations

5) APPENDIX A

tnxTower Output

6) APPENDIX B

Additional Calculations

7) APPENDIX C

Proposed Pole and Foundation Drawings

1) INTRODUCTION

This tower is a 120 ft Monopole tower designed by ARE Telecom.

2) ANALYSIS CRITERIA

TIA-222 Revision: TIA-222-G
Risk Category: II
Ultimate/Nominal Wind Speed: 115/89 mph
Exposure Category: C
Topographic Factor: 1
Ice Thickness: 0.75 in
Wind Speed with Ice: 40 mph
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)
120.0	120.0	1	are mounts	T-Arm Platform 36"	1	1-3/8
		3	commscope	FFVV-65C-R3-V1 w/ Mount Pipe		
		3	nokia	AEHC w/ Mount Pipe		
		3	nokia	AHFIG		
		3	nokia	AHLOA		

3) ANALYSIS PROCEDURE

Table 2 - Documents Provided

Document	Remarks	Source
POLE AND FOUNDATION DRAWING	34.2m Hyd Pole AFS1500/1700 rev B, 08/13/2019	ARE TELECOM

3.1) Analysis Method

tnxTower (version 8.1.1.0), 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) 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.
- 3) All coaxial cables are assumed to run internal to the monopole shaft.

This analysis may be affected if any assumptions are not valid or have been made in error. Paul J. Ford and Company should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 3 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	119.881 - 109.766	Pole	TP12.8x9.843x0.1969	1	-2.74	588.99	32.9	Pass
L2	109.766 - 99.569	Pole	TP15.781x12.8x0.1969	2	-3.27	728.30	44.8	Pass
L3	99.569 - 68.27	Pole	TP24.932x15.781x0.2362	3	-5.72	1298.00	47.5	Pass
L4	68.27 - 37.102	Pole	TP34.044x24.932x0.315	4	-9.97	2341.52	37.2	Pass
L5	37.102 - 13.546	Pole	TP40.931x34.044x0.3937	5	-14.87	3572.84	29.9	Pass
L6	13.546 - 7.575	Pole	TP42.677x40.931x0.3937	6	-16.25	3664.19	30.5	Pass
							Summary	
						Pole (L3)	47.5	Pass
						RATING =	47.5	Pass

Table 4 - Tower Component Stresses vs. Capacity

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Flange Bolts	109.475	19.1%	Pass
1	Flange Plate		27.2%	Pass
1	Flange Bolts	99.275	22.5%	Pass
1	Flange Plate		39.8%	Pass
1	Flange Bolts	68.275	27.0%	Pass
1	Flange Plate		37.1%	Pass
1	Flange Bolts	37.105	28.8%	Pass
1	Flange Plate		40.9%	Pass
1	Flange Bolts	13.545	27.7%	Pass
1	Flange Plate		29.2%	Pass
1	Anchor Rods	7.575	46.9%	Pass
1	Base Plate		28.2%	Pass
1	Kingpost Flange	7.575	46.9%	Pass
1	Base Foundation (Structure)	0	34.2%	Pass
1	Base Foundation (Soil Interaction)	0	77.7%	Pass

Structure Rating (max from all components) =	77.7%
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Notes:

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

4.1) Recommendations

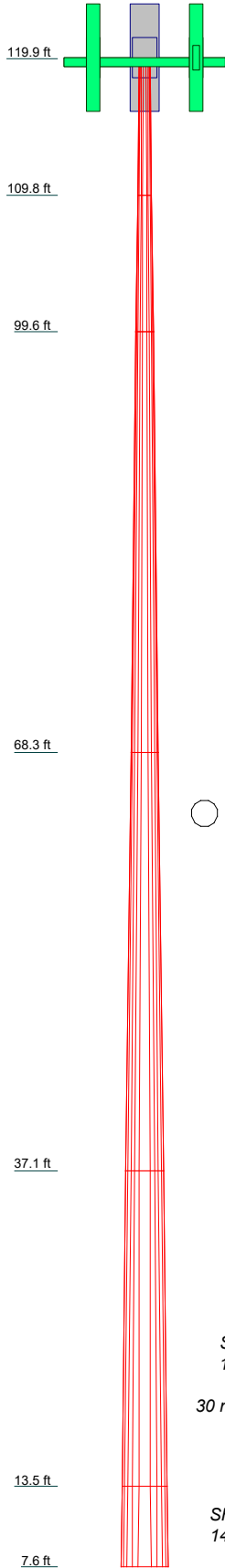
The tower and its foundation have sufficient capacity to carry the proposed load configuration. Install the pole and foundation as directed by ARE Telecom.

STANDARD CONDITIONS FOR FURNISHING OF PROFESSIONAL ENGINEERING SERVICES ON
EXISTING STRUCTURES BY PAUL J. FORD AND COMPANY

- 1) Paul J. Ford and Company has not made a field inspection to verify the monopole dimensions or the antenna/coax loading. If the existing conditions are not as represented on these sketches, we should be contacted immediately to reevaluate any conclusions stated in this report.
- 2) No allowance was made for any damaged, missing, or rusted material. The analysis of this monopole assumes that no physical deterioration has occurred in any of the structural components of the monopole and that all the structural members have the same load carrying capacity as the day the monopole was erected.
- 3) It is not possible to have all the detailed information to perform a thorough analysis of every structural sub-component of an existing monopole. The structural analysis provided by Paul J. Ford and Company verifies the adequacy of the main structural members of the monopole. Paul J. Ford and Company provides a limited scope of service in that we cannot verify the adequacy of every weld, plate, connection detail, etc.

APPENDIX A
TNXTOWER OUTPUT

Section	1	2	3	4	5	6
Length (ft)	10.12	10.20	31.30	31.17	23.56	5.97
Number of Sides	12	12	12	12	12	12
Thickness (in)	0.1969	0.1969	0.2362	0.3150	0.3937	0.3937
Top Dia (in)	9.8430	12.8000	15.7810	24.9320	34.0440	40.9310
Bot Dia (in)	12.8000	15.7810	24.9320	34.0440	40.9310	42.6770
Grade	A572-65					
Weight (K)	0.2	0.3	1.6	3.1	3.8	1.1



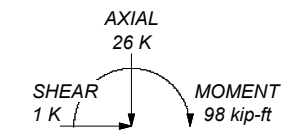
MATERIAL STRENGTH

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

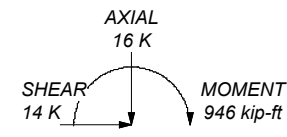
TOWER DESIGN NOTES

1. Tower designed for Exposure C to the TIA-222-G Standard.
2. Tower designed for a 89 mph basic wind in accordance with the TIA-222-G Standard.
3. Tower is also designed for a 30 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 60 mph wind.
5. Tower Structure Class II.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 47.5%

ALL REACTIONS ARE FACTORED



30 mph WIND - 0.7500 in ICE



REACTIONS - 89 mph WIND

PJF Paul J. Ford and Company
 250 E Broad St., Ste 600
 Columbus, OH 43215
 Phone: 614-221-6679
 FAX:

Job: **Elyria Water Tank, Elyria, Ohio**
 Project: **PJF 21221-0042.002.7205**
 Client: ARE Telecom
 Code: TIA-222-G
 Path: G:\TOWER\212 ARE\2021\21221-0042 Elyria_OH\21221-0042.002.7205_Final\Trx\21221-0042.002.en

Drawn by: Jake Gold	App'd:
Date: 11/01/21	Scale: NTS
Dwg No. E-1	

Tower Input Data

The tower is a monopole.

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

The following design criteria apply:

- ASCE 7-10 Wind Data is used (wind speeds converted to nominal values).
- Basic wind speed of 89 mph.
- Structure Class II.
- Exposure Category C.
- Topographic Category 1.
- Crest Height 0.00 ft.
- Nominal ice thickness of 0.7500 in.
- Ice thickness is considered to increase with height.
- Ice density of 56 pcf.
- A wind speed of 30 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 60 mph.
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in pole design is 1.
- Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs Consider Moments - Horizontals Consider Moments - Diagonals Use Moment Magnification ✓ Use Code Stress Ratios ✓ Use Code Safety Factors - Guys Escalate Ice Always Use Max Kz Use Special Wind Profile Include Bolts In Member Capacity Leg Bolts Are At Top Of Section Secondary Horizontal Braces Leg Use Diamond Inner Bracing (4 Sided) SR Members Have Cut Ends SR Members Are Concentric	Distribute Leg Loads As Uniform Assume Legs Pinned ✓ Assume Rigid Index Plate ✓ Use Clear Spans For Wind Area Use Clear Spans For KL/r Retension Guys To Initial Tension ✓ Bypass Mast Stability Checks ✓ Use Azimuth Dish Coefficients ✓ Project Wind Area of Appurt. Autocalc Torque Arm Areas Add IBC .6D+W Combination Sort Capacity Reports By Component Triangulate Diamond Inner Bracing Treat Feed Line Bundles As Cylinder Ignore KL/ry For 60 Deg. Angle Legs	Use ASCE 10 X-Brace Ly Rules Calculate Redundant Bracing Forces Ignore Redundant Members in FEA SR Leg Bolts Resist Compression All Leg Panels Have Same Allowable Offset Girt At Foundation ✓ Consider Feed Line Torque Include Angle Block Shear Check Use TIA-222-G Bracing Resist. Exemption Use TIA-222-G Tension Splice Exemption <div style="text-align: center; background-color: #e0e0e0; padding: 2px;">Poles</div> ✓ Include Shear-Torsion Interaction Always Use Sub-Critical Flow Use Top Mounted Sockets Pole Without Linear Attachments Pole With Shroud Or No Appurtenances Outside and Inside Corner Radii Are Known
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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	119.88-109.77	10.12	0.00	12	9.8430	12.8000	0.1969	0.7876	A572-65 (65 ksi)
L2	109.77-99.57	10.20	0.00	12	12.8000	15.7810	0.1969	0.7876	A572-65 (65 ksi)
L3	99.57-68.27	31.30	0.00	12	15.7810	24.9320	0.2362	0.9448	A572-65 (65 ksi)
L4	68.27-37.10	31.17	0.00	12	24.9320	34.0440	0.3150	1.2600	A572-65 (65 ksi)
L5	37.10-13.55	23.56	0.00	12	34.0440	40.9310	0.3937	1.5748	A572-65 (65 ksi)
L6	13.55-7.58	5.97		12	40.9310	42.6770	0.3937	1.5748	A572-65

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
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(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	10.1208	6.1158	72.6345	3.4533	5.0987	14.2458	147.1771	3.0100	2.1102	10.717
	13.1821	7.9906	162.0017	4.5119	6.6304	24.4332	328.2595	3.9327	2.9027	14.742
L2	13.1821	7.9906	162.0017	4.5119	6.6304	24.4332	328.2595	3.9327	2.9027	14.742
	16.2682	9.8806	306.2899	5.5791	8.1746	37.4687	620.6264	4.8629	3.7016	18.799
L3	16.2544	11.8228	364.6508	5.5650	8.1746	44.6080	738.8813	5.8188	3.5963	15.226
	25.7282	18.7827	1462.1469	8.8411	12.9148	113.2150	2962.7061	9.2443	6.0488	25.609
L4	25.7004	24.9690	1931.3356	8.8129	12.9148	149.5446	3913.4096	12.2890	5.8376	18.532
	35.1338	34.2113	4967.7848	12.0750	17.6348	281.7036	10066.078	16.8378	8.2796	26.284
L5	35.1061	42.6590	6165.5817	12.0468	17.6348	349.6260	12493.140	20.9954	8.0687	20.494
	42.2360	51.3897	10778.831	14.5124	21.2023	508.3813	21840.835	25.2924	9.9144	25.183
L6	42.2360	51.3897	10778.831	14.5124	21.2023	508.3813	21840.835	25.2924	9.9144	25.183
	44.0436	53.6031	12232.461	15.1374	22.1067	553.3376	24786.283	26.3818	10.3823	26.371

Tower Elevation ft	Gusset Area (per face) ft ²	Gusset Thickness in	Gusset Grade	Adjust. Factor A _r	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 119.88- 109.77				1	1	1			
L2 109.77- 99.57				1	1	1			
L3 99.57- 68.27				1	1	1			
L4 68.27- 37.10				1	1	1			
L5 37.10- 13.55				1	1	1			
L6 13.55-7.58				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} ft ² /ft	Weight plf	
HCS 2.0 NWS(1- 3/8)	C	No	No	Inside Pole	119.88 - 7.58	6	No Ice	0.00	1.61
							1/2" Ice	0.00	1.61
							1" Ice	0.00	1.61

Feed Line/Linear Appurtenances Section Areas

Tower Section n	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _{AA} In Face ft ²	C _{AA} Out Face ft ²	Weight K
L1	119.88-109.77	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.10
L2	109.77-99.57	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.10
L3	99.57-68.27	A	0.000	0.000	0.000	0.000	0.00

Tower Section <i>n</i>	Tower Elevation <i>ft</i>	Face	A_R <i>ft²</i>	A_F <i>ft²</i>	C_{AA} <i>In Face</i> <i>ft²</i>	C_{AA} <i>Out Face</i> <i>ft²</i>	Weight <i>K</i>
L4	68.27-37.10	B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.30
		A	0.000	0.000	0.000	0.000	0.00
L5	37.10-13.55	B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.30
		A	0.000	0.000	0.000	0.000	0.00
L6	13.55-7.58	B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.23
		A	0.000	0.000	0.000	0.000	0.00

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section <i>n</i>	Tower Elevation <i>ft</i>	Face or Leg	Ice Thickness <i>in</i>	A_R <i>ft²</i>	A_F <i>ft²</i>	C_{AA} <i>In Face</i> <i>ft²</i>	C_{AA} <i>Out Face</i> <i>ft²</i>	Weight <i>K</i>
L1	119.88-109.77	A	1.699	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.10
L2	109.77-99.57	A	1.683	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.10
L3	99.57-68.27	A	1.645	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	0.30
L4	68.27-37.10	A	1.570	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	0.30
L5	37.10-13.55	A	1.459	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	0.23
L6	13.55-7.58	A	1.338	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	0.06

Feed Line Center of Pressure

Section	Elevation <i>ft</i>	CP_x <i>in</i>	CP_z <i>in</i>	CP_x <i>Ice</i> <i>in</i>	CP_z <i>Ice</i> <i>in</i>
L1	119.88-109.77	0.0000	0.0000	0.0000	0.0000
L2	109.77-99.57	0.0000	0.0000	0.0000	0.0000
L3	99.57-68.27	0.0000	0.0000	0.0000	0.0000
L4	68.27-37.10	0.0000	0.0000	0.0000	0.0000
L5	37.10-13.55	0.0000	0.0000	0.0000	0.0000
L6	13.55-7.58	0.0000	0.0000	0.0000	0.0000

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 Vert <i>ft</i> <i>ft</i> <i>ft</i>	Azimuth Adjustmen <i>t</i> <i>°</i>	Placement <i>ft</i>	C_{AA} Front <i>ft²</i>	C_{AA} Side <i>ft²</i>	Weight <i>K</i>	
FFVV-65C-R3-V1_TIA w/ Mount Pipe	A	From Leg	4.00	0.0000	120.00	No Ice	21.36	11.46	0.18
			0.00			1/2"	22.12	12.99	0.33
			0.00			Ice	22.88	14.54	0.48
FFVV-65C-R3-V1_TIA w/ Mount Pipe	B	From Leg	4.00	0.0000	120.00	No Ice	21.36	11.46	0.18
			0.00			1" Ice	22.12	12.99	0.33

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K	
			0.00			1/2" Ice	22.88	14.54	0.48
FFVV-65C-R3-V1_TIA w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	21.36 22.12	11.46 12.99	0.18 0.33
AEHC_TIA w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	6.94 7.33	3.45 3.93	0.11 0.17
AEHC_TIA w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	6.94 7.33	3.45 3.93	0.11 0.17
AEHC_TIA w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	6.94 7.33	3.45 3.93	0.11 0.17
AHLOA	A	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.23 2.42	1.39 1.55	0.08 0.10
AHLOA	B	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.23 2.42	1.39 1.55	0.08 0.10
AHLOA	C	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.23 2.42	1.39 1.55	0.08 0.10
AHFIG	A	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	3.08 3.31	1.40 1.59	0.08 0.10
AHFIG	B	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	3.08 3.31	1.40 1.59	0.08 0.10
AHFIG	C	From Leg	4.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	3.08 3.31	1.40 1.59	0.08 0.10
T-Arm Platform 36"	C	None		0.0000	120.00	No Ice 1/2" Ice Ice	26.90 34.50 43.48	26.90 34.50 43.48	0.95 1.29 1.64

Tower Pressures - No Ice

$G_H = 1.100$

Section Elevation ft	z ft	K _Z	q _z psf	A _G ft ²	F a c e	A _F ft ²	A _R ft ²	A _{leg} ft ²	Leg %	C _{AA} In Face ft ²	C _{AA} Out Face ft ²
L1 119.88-109.77	114.60	1.302	25	9.821	A	0.000	9.821	9.821	100.00	0.000	0.000
					B	0.000	9.821		100.00	0.000	0.000
					C	0.000	9.821		100.00	0.000	0.000
L2 109.77-99.57	104.49	1.277	25	12.513	A	0.000	12.513	12.513	100.00	0.000	0.000
					B	0.000	12.513		100.00	0.000	0.000
					C	0.000	12.513		100.00	0.000	0.000
L3 99.57-68.27	82.89	1.217	23	54.750	A	0.000	54.750	54.750	100.00	0.000	0.000
					B	0.000	54.750		100.00	0.000	0.000

Section Elevation ft	z ft	K _z	q _z psf	A _G ft ²	F a c e	A _F ft ²	A _R ft ²	A _{leg} ft ²	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
L4 68.27-37.10	52.12	1.103	21	79.003	C	0.000	54.750	79.003	100.00	0.000	0.000
					A	0.000	79.003		100.00	0.000	0.000
					B	0.000	79.003		100.00	0.000	0.000
L5 37.10-13.55	24.96	0.945	18	75.911	C	0.000	79.003	75.911	100.00	0.000	0.000
					A	0.000	75.911		100.00	0.000	0.000
					B	0.000	75.911		100.00	0.000	0.000
L6 13.55-7.58	10.54	0.85	16	21.466	C	0.000	21.466	21.466	100.00	0.000	0.000
					A	0.000	21.466		100.00	0.000	0.000
					B	0.000	21.466		100.00	0.000	0.000

Tower Pressure - With Ice

G_H = 1.100

Section Elevation ft	z ft	K _z	q _z psf	t _z in	A _G ft ²	F a c e	A _F ft ²	A _R ft ²	A _{leg} ft ²	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
L1 119.88-109.77	114.60	1.302	3	1.6989	12.685	A	0.000	12.685	12.685	100.00	0.000	0.000
						B	0.000	12.685		100.00	0.000	0.000
						C	0.000	12.685		100.00	0.000	0.000
L2 109.77-99.57	104.49	1.277	3	1.6832	15.373	A	0.000	15.373	15.373	100.00	0.000	0.000
						B	0.000	15.373		100.00	0.000	0.000
						C	0.000	15.373		100.00	0.000	0.000
L3 99.57-68.27	82.89	1.217	3	1.6447	63.330	A	0.000	63.330	63.330	100.00	0.000	0.000
						B	0.000	63.330		100.00	0.000	0.000
						C	0.000	63.330		100.00	0.000	0.000
L4 68.27-37.10	52.12	1.103	2	1.5702	87.160	A	0.000	87.160	87.160	100.00	0.000	0.000
						B	0.000	87.160		100.00	0.000	0.000
						C	0.000	87.160		100.00	0.000	0.000
L5 37.10-13.55	24.96	0.945	2	1.4587	81.638	A	0.000	81.638	81.638	100.00	0.000	0.000
						B	0.000	81.638		100.00	0.000	0.000
						C	0.000	81.638		100.00	0.000	0.000
L6 13.55-7.58	10.54	0.85	2	1.3382	22.797	A	0.000	22.797	22.797	100.00	0.000	0.000
						B	0.000	22.797		100.00	0.000	0.000
						C	0.000	22.797		100.00	0.000	0.000

Tower Pressure - Service

G_H = 1.100

Section Elevation ft	z ft	K _z	q _z psf	A _G ft ²	F a c e	A _F ft ²	A _R ft ²	A _{leg} ft ²	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
L1 119.88-109.77	114.60	1.302	10	9.821	A	0.000	9.821	9.821	100.00	0.000	0.000
					B	0.000	9.821		100.00	0.000	0.000
					C	0.000	9.821		100.00	0.000	0.000
L2 109.77-99.57	104.49	1.277	10	12.513	A	0.000	12.513	12.513	100.00	0.000	0.000
					B	0.000	12.513		100.00	0.000	0.000
					C	0.000	12.513		100.00	0.000	0.000
L3 99.57-68.27	82.89	1.217	10	54.750	A	0.000	54.750	54.750	100.00	0.000	0.000
					B	0.000	54.750		100.00	0.000	0.000
					C	0.000	54.750		100.00	0.000	0.000
L4 68.27-37.10	52.12	1.103	9	79.003	A	0.000	79.003	79.003	100.00	0.000	0.000
					B	0.000	79.003		100.00	0.000	0.000
					C	0.000	79.003		100.00	0.000	0.000
L5 37.10-13.55	24.96	0.945	7	75.911	A	0.000	75.911	75.911	100.00	0.000	0.000
					B	0.000	75.911		100.00	0.000	0.000
					C	0.000	75.911		100.00	0.000	0.000
L6 13.55-7.58	10.54	0.85	7	21.466	A	0.000	21.466	21.466	100.00	0.000	0.000
					B	0.000	21.466		100.00	0.000	0.000
					C	0.000	21.466		100.00	0.000	0.000

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
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+1.0 Temp
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
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

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	119.881 - 109.766	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-7.39	0.00	0.00
			Max. Mx	8	-2.74	-48.61	0.00
			Max. My	2	-2.74	0.00	48.61
			Max. Vy	8	4.99	-48.61	0.00
			Max. Vx	2	-4.99	0.00	48.61
			Max. Torque	4			-0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L2	109.766 - 99.569	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-8.22	0.00	0.00
			Max. Mx	8	-3.27	-102.05	0.00
			Max. My	2	-3.27	0.00	102.05
			Max. Vy	8	5.52	-102.05	0.00
			Max. Vx	2	-5.52	0.00	102.05
			Max. Torque	4			-0.00
L3	99.569 - 68.27	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-11.96	0.00	0.00
			Max. Mx	8	-5.72	-307.00	0.00
			Max. My	2	-5.72	0.00	307.00
			Max. Vy	8	7.72	-307.00	0.00
			Max. Vx	2	-7.72	0.00	307.00
			Max. Torque	4			-0.00
L4	68.27 - 37.102	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-17.99	0.00	0.00
			Max. Mx	8	-9.97	-590.94	0.00
			Max. My	2	-9.97	0.00	590.94
			Max. Vy	8	10.60	-590.94	0.00
			Max. Vx	2	-10.60	0.00	590.94
			Max. Torque	4			-0.00
L5	37.102 - 13.546	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-24.46	0.00	0.00
			Max. Mx	8	-14.87	-867.28	0.00
			Max. My	2	-14.87	0.00	867.28
			Max. Vy	8	12.94	-867.28	0.00
			Max. Vx	2	-12.94	0.00	867.28
			Max. Torque	4			-0.00
L6	13.546 - 7.575	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-26.24	0.00	0.00
			Max. Mx	8	-16.25	-946.24	0.00
			Max. My	2	-16.25	0.00	946.24
			Max. Vy	8	13.52	-946.24	0.00
			Max. Vx	2	-13.52	0.00	946.24
			Max. Torque	4			-0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	26	26.24	0.00	0.00
	Max. H _x	20	16.25	13.52	0.00
	Max. H _z	2	16.25	0.00	13.52
	Max. M _x	2	946.24	0.00	13.52
	Max. M _z	8	946.24	-13.52	0.00
	Max. Torsion	24	0.00	6.76	11.71
	Min. Vert	3	12.19	0.00	13.52
	Min. H _x	8	16.25	-13.52	0.00
	Min. H _z	14	16.25	0.00	-13.52
	Min. M _x	14	-946.24	0.00	-13.52
	Min. M _z	20	-946.24	13.52	0.00
	Min. Torsion	4	-0.00	-6.76	11.71

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	13.54	0.00	0.00	0.00	0.00	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	16.25	0.00	-13.52	-946.24	0.00	0.00
0.9 Dead+1.6 Wind 0 deg - No Ice	12.19	0.00	-13.52	-940.89	0.00	0.00
1.2 Dead+1.6 Wind 30 deg - No Ice	16.25	6.76	-11.71	-819.53	-473.16	0.00
0.9 Dead+1.6 Wind 30 deg - No Ice	12.19	6.76	-11.71	-814.95	-470.51	0.00
1.2 Dead+1.6 Wind 60 deg - No Ice	16.25	11.71	-6.76	-473.16	-819.53	-0.00
0.9 Dead+1.6 Wind 60 deg - No Ice	12.19	11.71	-6.76	-470.51	-814.95	-0.00
1.2 Dead+1.6 Wind 90 deg - No Ice	16.25	13.52	0.00	0.00	-946.24	0.00
0.9 Dead+1.6 Wind 90 deg - No Ice	12.19	13.52	0.00	0.00	-940.89	0.00
1.2 Dead+1.6 Wind 120 deg - No Ice	16.25	11.71	6.76	473.16	-819.53	0.00
0.9 Dead+1.6 Wind 120 deg - No Ice	12.19	11.71	6.76	470.51	-814.95	0.00
1.2 Dead+1.6 Wind 150 deg - No Ice	16.25	6.76	11.71	819.53	-473.16	-0.00
0.9 Dead+1.6 Wind 150 deg - No Ice	12.19	6.76	11.71	814.95	-470.51	-0.00
1.2 Dead+1.6 Wind 180 deg - No Ice	16.25	0.00	13.52	946.24	0.00	0.00
0.9 Dead+1.6 Wind 180 deg - No Ice	12.19	0.00	13.52	940.89	0.00	0.00
1.2 Dead+1.6 Wind 210 deg - No Ice	16.25	-6.76	11.71	819.53	473.16	0.00
0.9 Dead+1.6 Wind 210 deg - No Ice	12.19	-6.76	11.71	814.95	470.51	0.00
1.2 Dead+1.6 Wind 240 deg - No Ice	16.25	-11.71	6.76	473.16	819.53	-0.00
0.9 Dead+1.6 Wind 240 deg - No Ice	12.19	-11.71	6.76	470.51	814.95	-0.00
1.2 Dead+1.6 Wind 270 deg - No Ice	16.25	-13.52	0.00	0.00	946.24	0.00
0.9 Dead+1.6 Wind 270 deg - No Ice	12.19	-13.52	0.00	0.00	940.89	0.00
1.2 Dead+1.6 Wind 300 deg - No Ice	16.25	-11.71	-6.76	-473.16	819.53	0.00
0.9 Dead+1.6 Wind 300 deg - No Ice	12.19	-11.71	-6.76	-470.51	814.95	0.00
1.2 Dead+1.6 Wind 330 deg - No Ice	16.25	-6.76	-11.71	-819.53	473.16	-0.00
0.9 Dead+1.6 Wind 330 deg - No Ice	12.19	-6.76	-11.71	-814.95	470.51	-0.00
1.2 Dead+1.0 Ice+1.0 Temp	26.24	0.00	0.00	0.00	0.00	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	26.24	0.00	-1.33	-98.24	0.00	0.00
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	26.24	0.66	-1.15	-85.08	-49.12	0.00
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	26.24	1.15	-0.66	-49.12	-85.08	-0.00
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	26.24	1.33	0.00	0.00	-98.24	0.00
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	26.24	1.15	0.66	49.12	-85.08	0.00
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	26.24	0.66	1.15	85.08	-49.12	-0.00
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	26.24	0.00	1.33	98.24	0.00	0.00
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	26.24	-0.66	1.15	85.08	49.12	0.00
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	26.24	-1.15	0.66	49.12	85.08	-0.00

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
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	26.24	-1.33	0.00	0.00	98.24	0.00
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	26.24	-1.15	-0.66	-49.12	85.08	0.00
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	26.24	-0.66	-1.15	-85.08	49.12	-0.00
Dead+Wind 0 deg - Service	13.54	0.00	-3.44	-239.75	0.00	0.00
Dead+Wind 30 deg - Service	13.54	1.72	-2.97	-207.63	-119.87	0.00
Dead+Wind 60 deg - Service	13.54	2.97	-1.72	-119.87	-207.63	-0.00
Dead+Wind 90 deg - Service	13.54	3.44	0.00	0.00	-239.75	0.00
Dead+Wind 120 deg - Service	13.54	2.97	1.72	119.87	-207.63	0.00
Dead+Wind 150 deg - Service	13.54	1.72	2.97	207.63	-119.87	-0.00
Dead+Wind 180 deg - Service	13.54	0.00	3.44	239.75	0.00	0.00
Dead+Wind 210 deg - Service	13.54	-1.72	2.97	207.63	119.87	0.00
Dead+Wind 240 deg - Service	13.54	-2.97	1.72	119.87	207.63	-0.00
Dead+Wind 270 deg - Service	13.54	-3.44	0.00	0.00	239.75	0.00
Dead+Wind 300 deg - Service	13.54	-2.97	-1.72	-119.87	207.63	0.00
Dead+Wind 330 deg - Service	13.54	-1.72	-2.97	-207.63	119.87	-0.00

Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.00	-13.54	0.00	0.00	13.54	0.00	0.000%
2	0.00	-16.25	-13.52	0.00	16.25	13.52	0.005%
3	0.00	-12.19	-13.52	0.00	12.19	13.52	0.009%
4	6.76	-16.25	-11.71	-6.76	16.25	11.71	0.001%
5	6.76	-12.19	-11.71	-6.76	12.19	11.71	0.001%
6	11.71	-16.25	-6.76	-11.71	16.25	6.76	0.001%
7	11.71	-12.19	-6.76	-11.71	12.19	6.76	0.001%
8	13.52	-16.25	0.00	-13.52	16.25	0.00	0.005%
9	13.52	-12.19	0.00	-13.52	12.19	0.00	0.009%
10	11.71	-16.25	6.76	-11.71	16.25	-6.76	0.001%
11	11.71	-12.19	6.76	-11.71	12.19	-6.76	0.001%
12	6.76	-16.25	11.71	-6.76	16.25	-11.71	0.001%
13	6.76	-12.19	11.71	-6.76	12.19	-11.71	0.001%
14	0.00	-16.25	13.52	0.00	16.25	-13.52	0.005%
15	0.00	-12.19	13.52	0.00	12.19	-13.52	0.009%
16	-6.76	-16.25	11.71	6.76	16.25	-11.71	0.001%
17	-6.76	-12.19	11.71	6.76	12.19	-11.71	0.001%
18	-11.71	-16.25	6.76	11.71	16.25	-6.76	0.001%
19	-11.71	-12.19	6.76	11.71	12.19	-6.76	0.001%
20	-13.52	-16.25	0.00	13.52	16.25	0.00	0.005%
21	-13.52	-12.19	0.00	13.52	12.19	0.00	0.009%
22	-11.71	-16.25	-6.76	11.71	16.25	6.76	0.001%
23	-11.71	-12.19	-6.76	11.71	12.19	6.76	0.001%
24	-6.76	-16.25	-11.71	6.76	16.25	11.71	0.001%
25	-6.76	-12.19	-11.71	6.76	12.19	11.71	0.001%
26	0.00	-26.24	0.00	0.00	26.24	0.00	0.000%
27	0.00	-26.24	-1.33	0.00	26.24	1.33	0.002%
28	0.66	-26.24	-1.15	-0.66	26.24	1.15	0.002%
29	1.15	-26.24	-0.66	-1.15	26.24	0.66	0.002%
30	1.33	-26.24	0.00	-1.33	26.24	0.00	0.002%
31	1.15	-26.24	0.66	-1.15	26.24	-0.66	0.002%
32	0.66	-26.24	1.15	-0.66	26.24	-1.15	0.002%
33	0.00	-26.24	1.33	0.00	26.24	-1.33	0.002%
34	-0.66	-26.24	1.15	0.66	26.24	-1.15	0.002%
35	-1.15	-26.24	0.66	1.15	26.24	-0.66	0.002%

<i>Load Comb.</i>	<i>Sum of Applied Forces</i>			<i>Sum of Reactions</i>			<i>% Error</i>
	<i>PX K</i>	<i>PY K</i>	<i>PZ K</i>	<i>PX K</i>	<i>PY K</i>	<i>PZ K</i>	
36	-1.33	-26.24	0.00	1.33	26.24	0.00	0.002%
37	-1.15	-26.24	-0.66	1.15	26.24	0.66	0.002%
38	-0.66	-26.24	-1.15	0.66	26.24	1.15	0.002%
39	0.00	-13.54	-3.44	0.00	13.54	3.44	0.003%
40	1.72	-13.54	-2.98	-1.72	13.54	2.97	0.003%
41	2.98	-13.54	-1.72	-2.97	13.54	1.72	0.003%
42	3.44	-13.54	0.00	-3.44	13.54	0.00	0.003%
43	2.98	-13.54	1.72	-2.97	13.54	-1.72	0.003%
44	1.72	-13.54	2.98	-1.72	13.54	-2.97	0.003%
45	0.00	-13.54	3.44	0.00	13.54	-3.44	0.003%
46	-1.72	-13.54	2.98	1.72	13.54	-2.97	0.003%
47	-2.98	-13.54	1.72	2.97	13.54	-1.72	0.003%
48	-3.44	-13.54	0.00	3.44	13.54	0.00	0.003%
49	-2.98	-13.54	-1.72	2.97	13.54	1.72	0.003%
50	-1.72	-13.54	-2.98	1.72	13.54	2.97	0.003%

Non-Linear Convergence Results

<i>Load Combination</i>	<i>Converged?</i>	<i>Number of Cycles</i>	<i>Displacement Tolerance</i>	<i>Force Tolerance</i>
1	Yes	6	0.00000001	0.00000001
2	Yes	15	0.00005894	0.00007727
3	Yes	14	0.00008783	0.00013091
4	Yes	17	0.00000001	0.00013154
5	Yes	17	0.00000001	0.00010039
6	Yes	17	0.00000001	0.00013154
7	Yes	17	0.00000001	0.00010039
8	Yes	15	0.00005894	0.00007727
9	Yes	14	0.00008783	0.00013091
10	Yes	17	0.00000001	0.00013154
11	Yes	17	0.00000001	0.00010039
12	Yes	17	0.00000001	0.00013154
13	Yes	17	0.00000001	0.00010039
14	Yes	15	0.00005894	0.00007727
15	Yes	14	0.00008783	0.00013091
16	Yes	17	0.00000001	0.00013154
17	Yes	17	0.00000001	0.00010039
18	Yes	17	0.00000001	0.00013154
19	Yes	17	0.00000001	0.00010039
20	Yes	15	0.00005894	0.00007727
21	Yes	14	0.00008783	0.00013091
22	Yes	17	0.00000001	0.00013154
23	Yes	17	0.00000001	0.00010039
24	Yes	17	0.00000001	0.00013154
25	Yes	17	0.00000001	0.00010039
26	Yes	6	0.00000001	0.00000001
27	Yes	14	0.00000001	0.00006509
28	Yes	14	0.00000001	0.00006612
29	Yes	14	0.00000001	0.00006612
30	Yes	14	0.00000001	0.00006509
31	Yes	14	0.00000001	0.00006612
32	Yes	14	0.00000001	0.00006612
33	Yes	14	0.00000001	0.00006509
34	Yes	14	0.00000001	0.00006612
35	Yes	14	0.00000001	0.00006612
36	Yes	14	0.00000001	0.00006509
37	Yes	14	0.00000001	0.00006612
38	Yes	14	0.00000001	0.00006612
39	Yes	14	0.00000001	0.00005645
40	Yes	14	0.00000001	0.00005116
41	Yes	14	0.00000001	0.00005116
42	Yes	14	0.00000001	0.00005645
43	Yes	14	0.00000001	0.00005116
44	Yes	14	0.00000001	0.00005116
45	Yes	14	0.00000001	0.00005645
46	Yes	14	0.00000001	0.00005116
47	Yes	14	0.00000001	0.00005116
48	Yes	14	0.00000001	0.00005645
49	Yes	14	0.00000001	0.00005116
50	Yes	14	0.00000001	0.00005116

Maximum Tower Deflections - Service Wind

<i>Section No.</i>	<i>Elevation ft</i>	<i>Horz. Deflection in</i>	<i>Gov. Load Comb.</i>	<i>Tilt °</i>	<i>Twist °</i>
L1	119.881 - 109.766	13.040	39	1.4267	0.0000
L2	109.766 - 99.569	10.132	39	1.2846	0.0000
L3	99.569 - 68.27	7.639	39	1.0462	0.0000
L4	68.27 - 37.102	2.694	39	0.4902	0.0000
L5	37.102 - 13.546	0.545	39	0.1827	0.0000
L6	13.546 - 7.575	0.021	41	0.0340	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
120.00	FFVV-65C-R3-V1_TIA w/ Mount Pipe	39	13.040	1.4267	0.0000	4673

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	119.881 - 109.766	51.519	8	5.6439	0.0000
L2	109.766 - 99.569	40.034	8	5.0815	0.0000
L3	99.569 - 68.27	30.184	8	4.1379	0.0000
L4	68.27 - 37.102	10.639	2	1.9374	0.0000
L5	37.102 - 13.546	2.152	4	0.7217	0.0000
L6	13.546 - 7.575	0.083	4	0.1340	0.0000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
120.00	FFVV-65C-R3-V1_TIA w/ Mount Pipe	8	51.519	5.6439	0.0000	1200

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	119.881 - 109.766 (1)	TP12.8x9.843x0.1969	10.11	0.00	0.0	7.9906	-2.74	588.99	0.005
L2	109.766 - 99.569 (2)	TP15.781x12.8x0.1969	10.20	0.00	0.0	9.8806	-3.27	728.30	0.004
L3	99.569 - 68.27 (3)	TP24.932x15.781x0.2362	31.30	0.00	0.0	18.782 7	-5.72	1298.00	0.004
L4	68.27 - 37.102 (4)	TP34.044x24.932x0.315	31.17	0.00	0.0	34.211 3	-9.97	2341.52	0.004
L5	37.102 - 13.546 (5)	TP40.931x34.044x0.3937	23.56	0.00	0.0	51.389 7	-14.87	3572.84	0.004
L6	13.546 - 7.575 (6)	TP42.677x40.931x0.3937	5.97	0.00	0.0	53.603 1	-16.25	3664.19	0.004

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	119.881 - 109.766 (1)	TP12.8x9.843x0.1969	48.61	150.08	0.324	0.00	150.08	0.000
L2	109.766 - 99.569 (2)	TP15.781x12.8x0.1969	102.06	230.15	0.443	0.00	230.15	0.000
L3	99.569 - 68.27 (3)	TP24.932x15.781x0.2362	307.03	651.99	0.471	0.00	651.99	0.000
L4	68.27 - 37.102 (4)	TP34.044x24.932x0.315	590.99	1606.72	0.368	0.00	1606.72	0.000
L5	37.102 - 13.546 (5)	TP40.931x34.044x0.3937	867.36	2945.41	0.294	0.00	2945.41	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 $\frac{M_{uy}}{\phi M_{ny}}$
L6	13.546 - 7.575 (6)	TP42.677x40.931x0.3937	946.32	3152.07	0.300	0.00	3152.07	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	119.881 - 109.766 (1)	TP12.8x9.843x0.1969	4.99	294.49	0.017	0.00	305.92	0.000
L2	109.766 - 99.569 (2)	TP15.781x12.8x0.1969	5.52	364.15	0.015	0.00	468.67	0.000
L3	99.569 - 68.27 (3)	TP24.932x15.781x0.2362	7.72	649.00	0.012	0.00	1326.31	0.000
L4	68.27 - 37.102 (4)	TP34.044x24.932x0.315	10.60	1170.76	0.009	0.00	3268.22	0.000
L5	37.102 - 13.546 (5)	TP40.931x34.044x0.3937	12.94	1786.42	0.007	0.00	5992.01	0.000
L6	13.546 - 7.575 (6)	TP42.677x40.931x0.3937	13.52	1832.09	0.007	0.00	6411.58	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P_u	Ratio M_{ux}	Ratio M_{uy}	Ratio V_u	Ratio T_u	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
		ϕP_n	ϕM_{nx}	ϕM_{ny}	ϕV_n	ϕT_n			
L1	119.881 - 109.766 (1)	0.005	0.324	0.000	0.017	0.000	0.329	1.000	4.8.2
L2	109.766 - 99.569 (2)	0.004	0.443	0.000	0.015	0.000	0.448	1.000	4.8.2
L3	99.569 - 68.27 (3)	0.004	0.471	0.000	0.012	0.000	0.475	1.000	4.8.2
L4	68.27 - 37.102 (4)	0.004	0.368	0.000	0.009	0.000	0.372	1.000	4.8.2
L5	37.102 - 13.546 (5)	0.004	0.294	0.000	0.007	0.000	0.299	1.000	4.8.2
L6	13.546 - 7.575 (6)	0.004	0.300	0.000	0.007	0.000	0.305	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	119.881 - 109.766	Pole	TP12.8x9.843x0.1969	1	-2.74	588.99	32.9	Pass	
L2	109.766 - 99.569	Pole	TP15.781x12.8x0.1969	2	-3.27	728.30	44.8	Pass	
L3	99.569 - 68.27	Pole	TP24.932x15.781x0.2362	3	-5.72	1298.00	47.5	Pass	
L4	68.27 - 37.102	Pole	TP34.044x24.932x0.315	4	-9.97	2341.52	37.2	Pass	
L5	37.102 - 13.546	Pole	TP40.931x34.044x0.3937	5	-14.87	3572.84	29.9	Pass	
L6	13.546 - 7.575	Pole	TP42.677x40.931x0.3937	6	-16.25	3664.19	30.5	Pass	
							Summary		
							Pole (L3)	47.5	Pass
							RATING =	47.5	Pass

APPENDIX B
ADDITIONAL CALCULATIONS

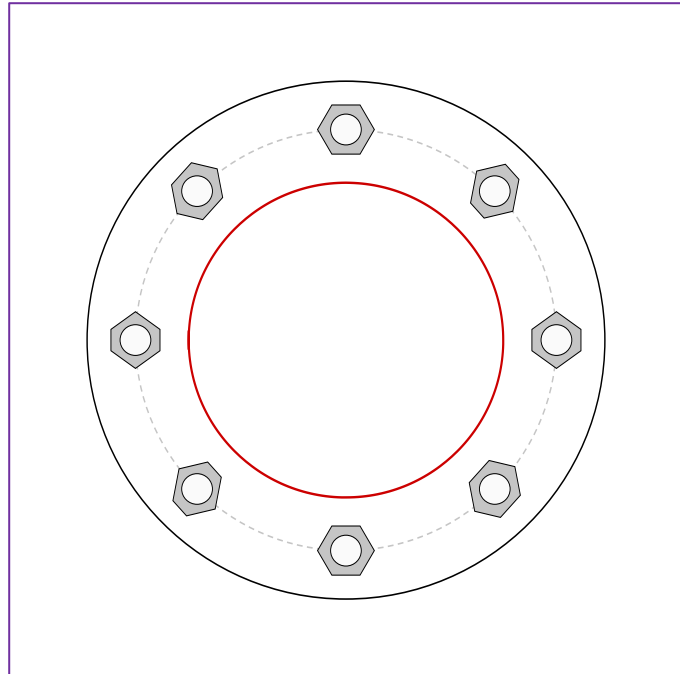
Monopole Flange Plate Connection

Elevation = 109.475 ft.

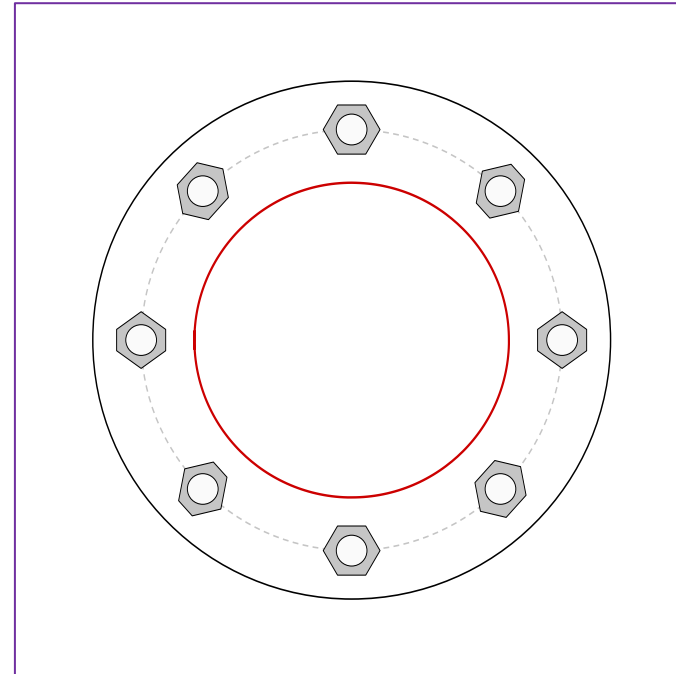
Applied Loads	
Moment (kip-ft)	48.61
Axial Force (kips)	2.74
Shear Force (kips)	4.99

TIA-222 Revision	G
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Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(8) 1-1/4" ϕ bolts (A325 N; Fy=81 ksi, Fu=120 ksi) on 17.126" BC

Top Plate Data

21.063" OD x 1.181" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Top Stiffener Data

N/A

Top Pole Data

12.8" x 0.1969" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Bottom Plate Data

21.063" OD x 1.181" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

12.8" x 0.1969" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	16.65
Allowable (kips)	87.20
Stress Rating:	19.1% Pass

Top Plate Capacity

Max Stress (ksi):	12.22	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	27.2%	Pass
Tension Side Stress Rating:	14.3%	Pass

Bottom Plate Capacity

Max Stress (ksi):	12.22	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	27.2%	Pass
Tension Side Stress Rating:	14.3%	Pass

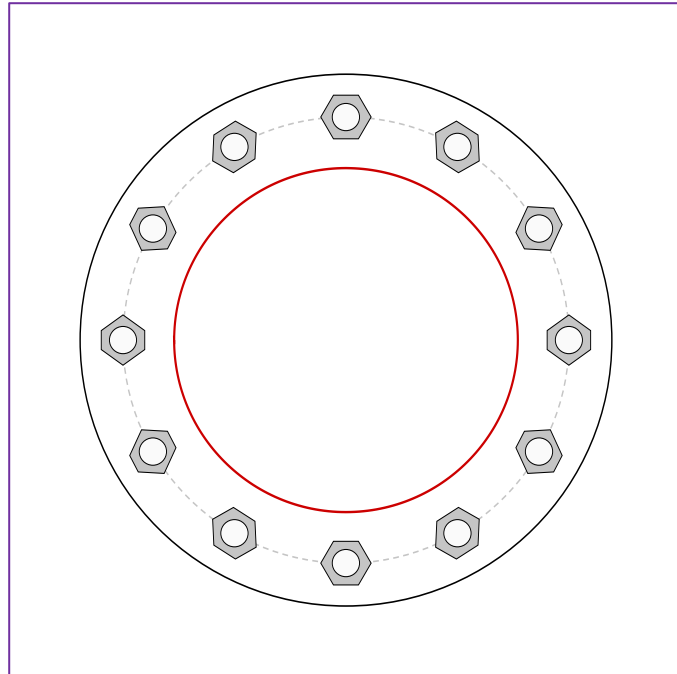
Monopole Flange Plate Connection

Elevation = 99.275 ft.

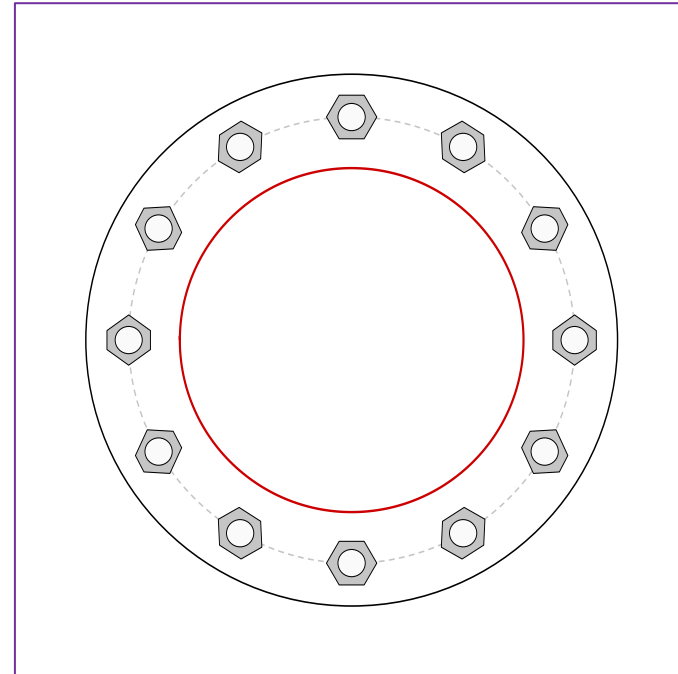
Applied Loads	
Moment (kip-ft)	102.06
Axial Force (kips)	3.27
Shear Force (kips)	5.52

TIA-222 Revision	G
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Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(12) 1-1/4" ϕ bolts (A325 N; Fy=81 ksi, Fu=120 ksi) on 20.472" BC

Top Plate Data

24.409" OD x 1.181" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Top Stiffener Data

N/A

Top Pole Data

15.781" x 0.1969" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Bottom Plate Data

24.409" OD x 1.575" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

15.781" x 0.1969" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	19.64
Allowable (kips)	87.21
Stress Rating:	22.5% Pass

Top Plate Capacity

Max Stress (ksi):	17.92	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	39.8%	Pass
Tension Side Stress Rating:	23.8%	Pass

Bottom Plate Capacity

Max Stress (ksi):	10.07	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	22.4%	Pass
Tension Side Stress Rating:	13.4%	Pass

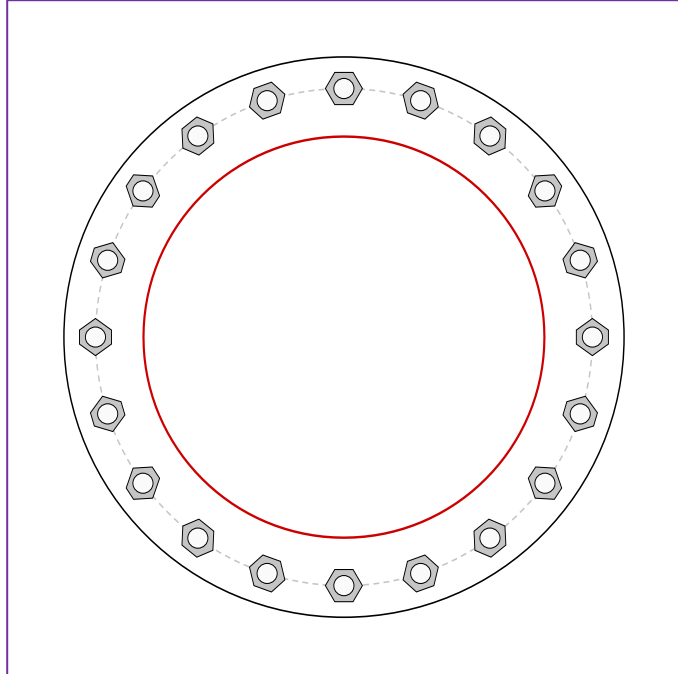
Monopole Flange Plate Connection

Elevation = 68.275 ft.

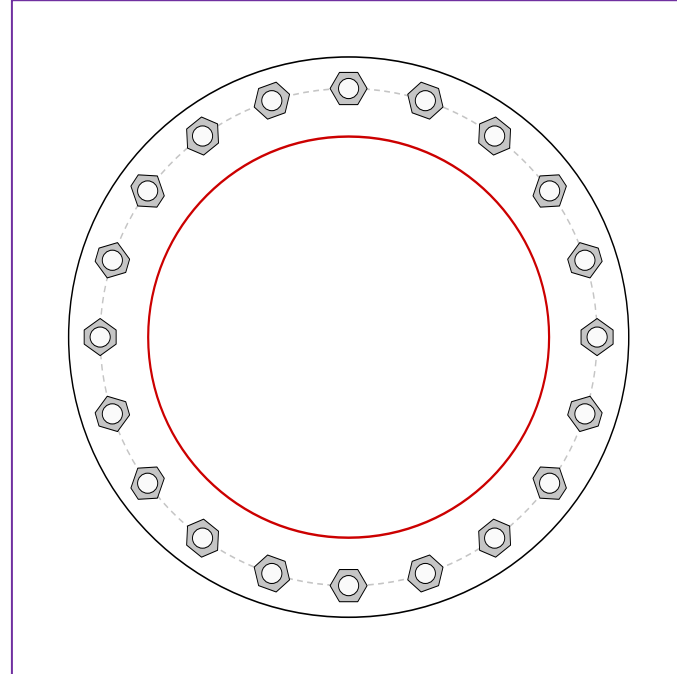
Applied Loads	
Moment (kip-ft)	307.03
Axial Force (kips)	5.72
Shear Force (kips)	7.72

TIA-222 Revision	G
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Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(20) 1-1/4" ϕ bolts (A325 N; Fy=81 ksi, Fu=120 ksi) on 30.906" BC

Top Plate Data

34.843" OD x 1.575" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Top Stiffener Data

N/A

Top Pole Data

24.932" x 0.2362" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Bottom Plate Data

34.843" OD x 1.575" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

24.932" x 0.2362" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	23.54
Allowable (kips)	87.21
Stress Rating:	27.0% Pass

Top Plate Capacity

Max Stress (ksi):	16.71	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	37.1%	Pass
Tension Side Stress Rating:	23.5%	Pass

Bottom Plate Capacity

Max Stress (ksi):	16.71	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	37.1%	Pass
Tension Side Stress Rating:	23.5%	Pass

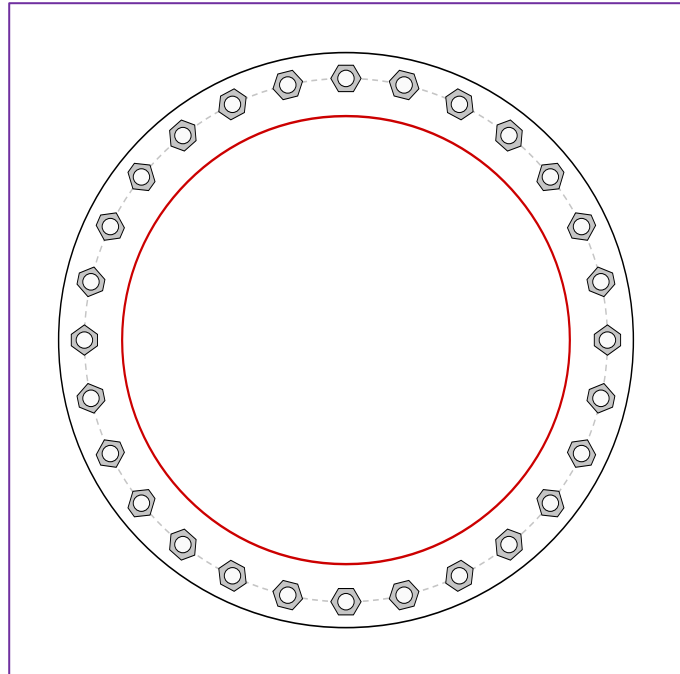
Monopole Flange Plate Connection

Elevation = 37.105 ft.

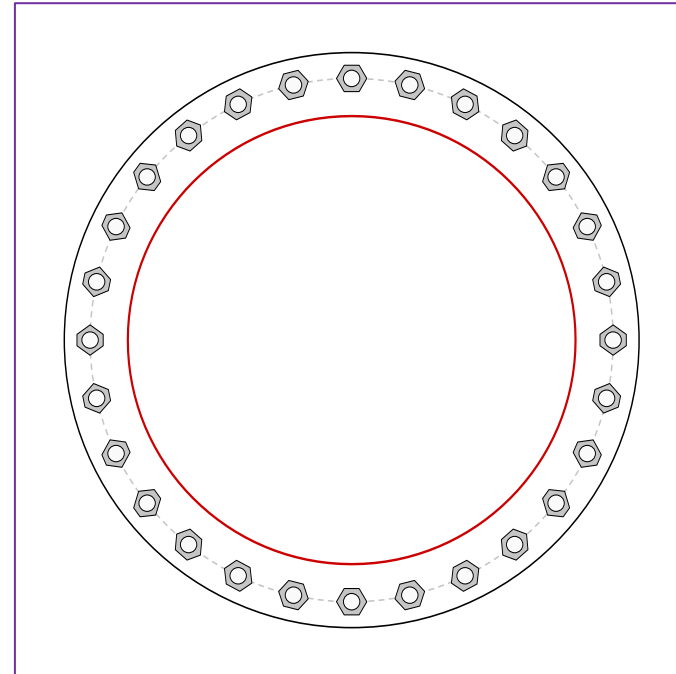
Applied Loads	
Moment (kip-ft)	590.99
Axial Force (kips)	9.97
Shear Force (kips)	10.60

TIA-222 Revision	G
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Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(28) 1-1/4" ϕ bolts (A325 N; Fy=81 ksi, Fu=120 ksi) on 39.764" BC

Top Plate Data

43.701" OD x 1.575" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Top Stiffener Data

N/A

Top Pole Data

34.044" x 0.315" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Bottom Plate Data

43.701" OD x 1.575" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

34.044" x 0.315" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	25.11
Allowable (kips)	87.21
Stress Rating:	28.8% Pass

Top Plate Capacity

Max Stress (ksi):	18.39	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	40.9%	Pass
Tension Side Stress Rating:	24.4%	Pass

Bottom Plate Capacity

Max Stress (ksi):	18.39	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	40.9%	Pass
Tension Side Stress Rating:	24.4%	Pass

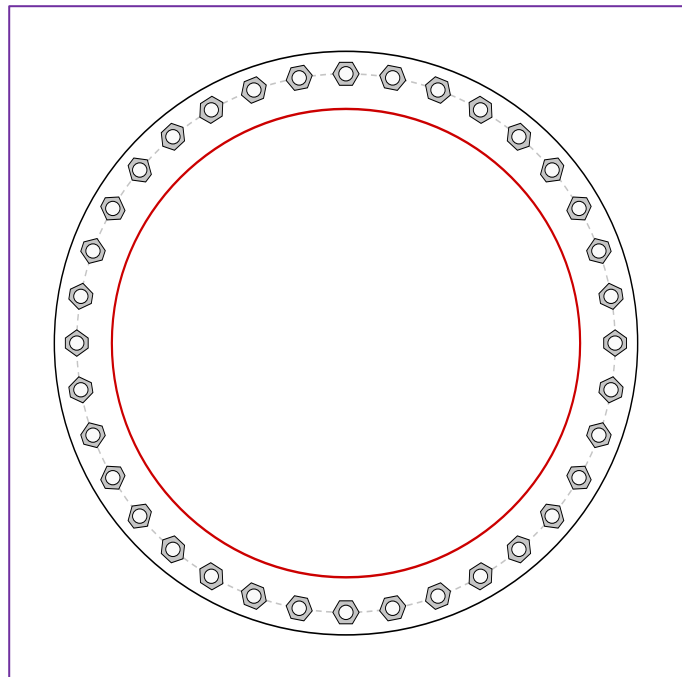
Monopole Flange Plate Connection

Elevation = 13.545 ft.

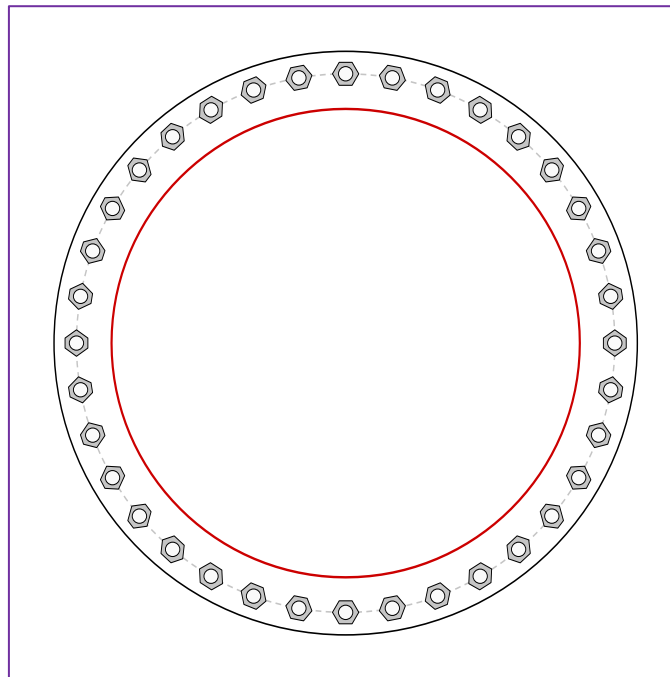
Applied Loads	
Moment (kip-ft)	867.36
Axial Force (kips)	14.87
Shear Force (kips)	12.94

TIA-222 Revision	G
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Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(36) 1-1/4" ϕ bolts (A325 N; Fy=81 ksi, Fu=120 ksi) on 47.047" BC

Top Plate Data

50.984" OD x 1.969" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Top Stiffener Data

N/A

Top Pole Data

40.931" x 0.3937" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Bottom Plate Data

50.984" OD x 1.969" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

40.931" x 0.3937" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	24.16
Allowable (kips)	87.21
Stress Rating:	27.7% Pass

Top Plate Capacity

Max Stress (ksi):	13.14	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	29.2%	Pass
Tension Side Stress Rating:	17.8%	Pass

Bottom Plate Capacity

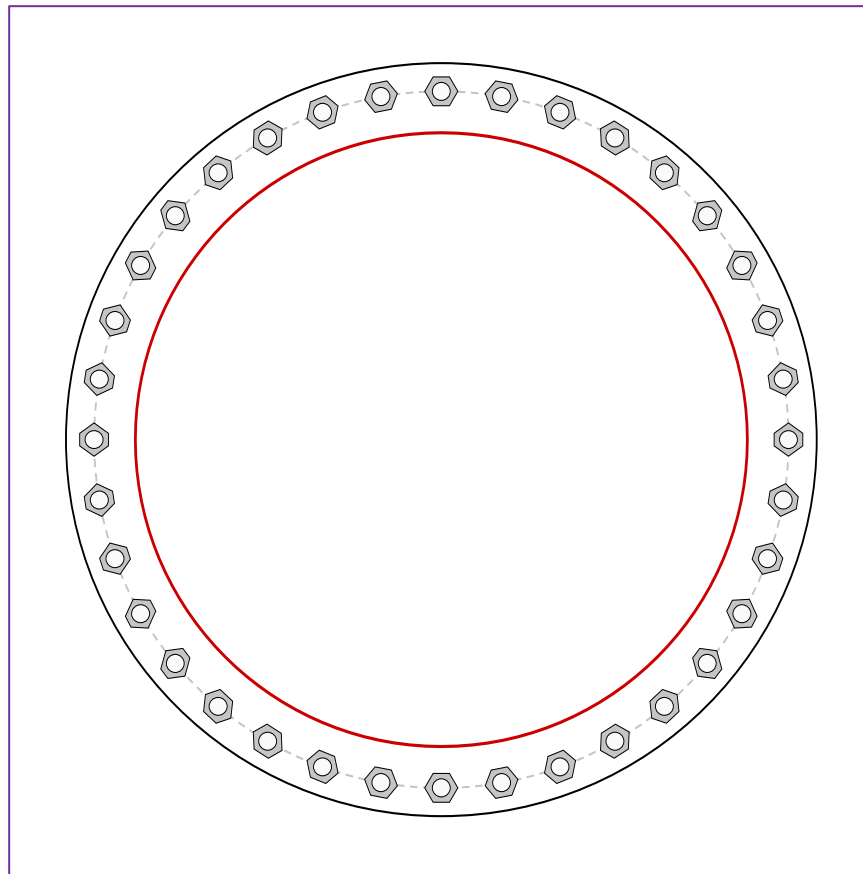
Max Stress (ksi):	13.14	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	29.2%	Pass
Tension Side Stress Rating:	17.8%	Pass

Monopole Base Plate Connection

Baseplate @ 7.575 ft

Analysis Considerations	
TIA-222 Revision	G
Grout Considered:	No
l_{ar} (in)	0
Eta Factor, η	0.5

Applied Loads	
Moment (kip-ft)	946.32
Axial Force (kips)	16.25
Shear Force (kips)	13.52



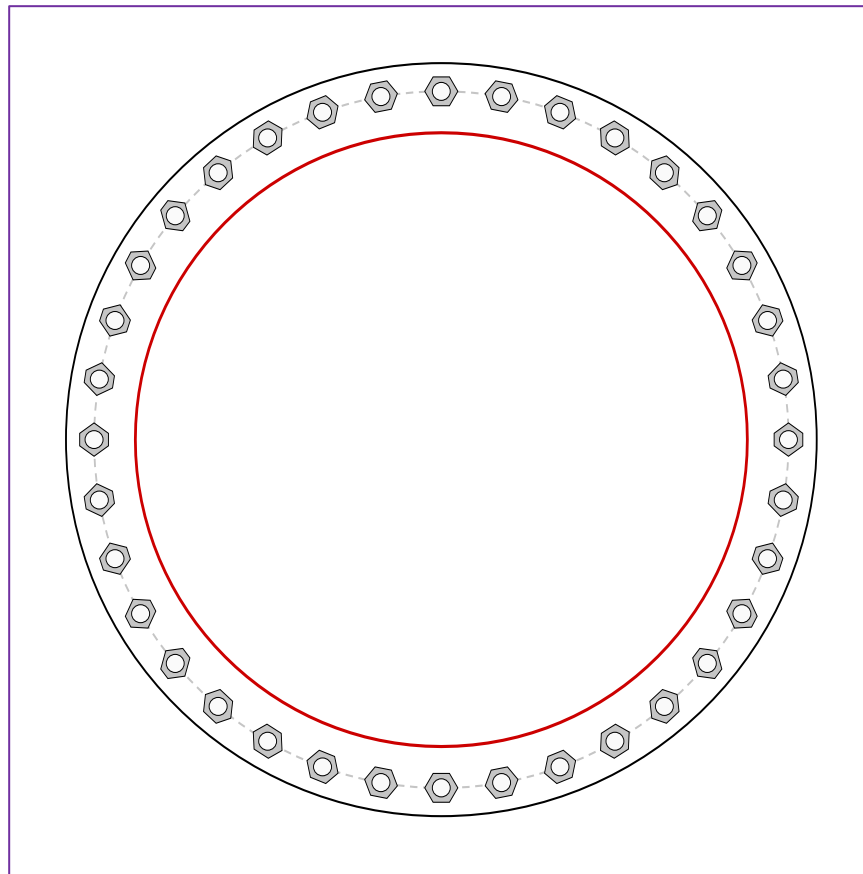
Connection Properties		Analysis Results		
Anchor Rod Data		Anchor Rod Summary <i>(units of kips, kip-in)</i>		
(36) 1-1/4" ϕ bolts (F1554-55 N; $F_y=55$ ksi, $F_u=75$ ksi) on 48.425" BC		$Pu_c = 26.5$	$\phi Pn_t = 58.14$	Stress Rating
Base Plate Data		$Vu = 0.38$	$\phi Vn = n/a$	46.9%
52.362" OD x 1.969" Plate (A572-50; $F_y=50$ ksi, $F_u=65$ ksi)		$Mu = n/a$	$\phi Mn = n/a$	Pass
Stiffener Data		Base Plate Summary		
N/A		Max Stress (ksi):	12.67	(Flexural)
Pole Data		Allowable Stress (ksi):	45	
42.677" x 0.3937" 12-sided pole (A572-65; $F_y=65$ ksi, $F_u=80$ ksi)		Stress Rating:	28.2%	Pass

Monopole Base Plate Connection

Kingpost flange @ 7.575 ft

Analysis Considerations	
TIA-222 Revision	G
Grout Considered:	No
l_{ar} (in)	0
Eta Factor, η	0.5

Applied Loads	
Moment (kip-ft)	946.32
Axial Force (kips)	16.25
Shear Force (kips)	13.52



Connection Properties		Analysis Results		
Anchor Rod Data		Anchor Rod Summary <i>(units of kips, kip-in)</i>		
(36) 1-1/4" ϕ bolts (F1554-55 N; $F_y=55$ ksi, $F_u=75$ ksi) on 48.43" BC		$Pu_c = 26.5$	$\phi Pn_t = 58.14$	Stress Rating
Base Plate Data		$Vu = 0.38$	$\phi Vn = n/a$	46.9%
52.362" OD x 1.575" Plate (A572-50; $F_y=50$ ksi, $F_u=65$ ksi)		$Mu = n/a$	$\phi Mn = n/a$	Pass
Stiffener Data		Base Plate Summary		
N/A		Max Stress (ksi):	19.81	(Flexural)
Pole Data		Allowable Stress (ksi):	45	
42.6772" x 0.397" 18-sided pole (A572-65; $F_y=65$ ksi, $F_u=80$ ksi)		Stress Rating:	44.0%	Pass

Moment Capacity of Round Ballast Foundation

PJF job no. 00019-0623.002.7205

AFS-1500

Assumption: Foundation is bearing at or near the ground surface

Uniform bearing stress distribution assumed under foundation when ultimate bearing capacity reached

Foundation Load Check Summary

Pole overturning moment = 946.32 ft-kips (at pole base plate)
Pole base shear load = 13.52 kips
Pole axial load = 16.25 kips (Load assumed to be centered on cross-section and to have 1.2 load factor)
Foundation kingpost diameter = 43 inches
Use kingpost diameter in ballast volume calculation? N
Base plate to bottom of foundation = 7.75 feet
Overturning moment at base of foundation, M_u = 1051.1 ft-kips (at pole base plate)

Foundation axial load reduction factor = 0.9 (Use 1.0 if F-Standard / Working Load analysis)
Foundation steel weight = 12.5 kips (3250 kg per email from Mike Clifton /ARE dated 9-30-2015)
Foundation diameter = 20.1 feet
Foundation ID = 8.15 ft (Shaft OD plus portion of foundation base without bottom plate)
Ballast unit weight = 100 pcf
Ballast depth = 6.75 ft
Foundation ballast total weight = 179.0 kips

Foundation bottom plate thickness = 0.197 inches
Foundation bottom plate yield strength = 50 ksi
Max plate width, a = 36.3 inches (Larger of two plate dims)
Max plate height, b = 11.8 inches (Smaller of two plate dims)
Bottom plate support condition = SS Fixed or Simply Supported (SS)
Width / Height Ratio = 3.08
 β = 0.7155 From Roark and Young, Table 26.1, 1a (SS) or 8a (Fixed)

Bearing Check

Reduction factor, ϕ = 0.75
Ult gross soil bearing cap = 3000 psf
Factored Nominal Bearing Capacity, ϕB_n = 2250 psf
Ultimate Gross Soil bearing, B_u = 1748 psf (Axial load resisting overturning / Area of Annulus)
% Capacity = 77.7% **OK** ($B_u / \phi B_n$)

Overturning / Stability Check

Reduction factor = 1.00 (Use 0.67 if F-Standard / Working Load analysis; use 1.0 if G-Standard / LRFD)
Axial load resisting overturning = 205.0 kips (Unfactored)
Overturning moment at base of foundation = 1051.1 ft-kips (at pole base plate)
Moment resisting overturning at foundation toe = 2060.4 ft-kips
% Capacity = 51.0% **OK**

Bottom Plate Bending Check

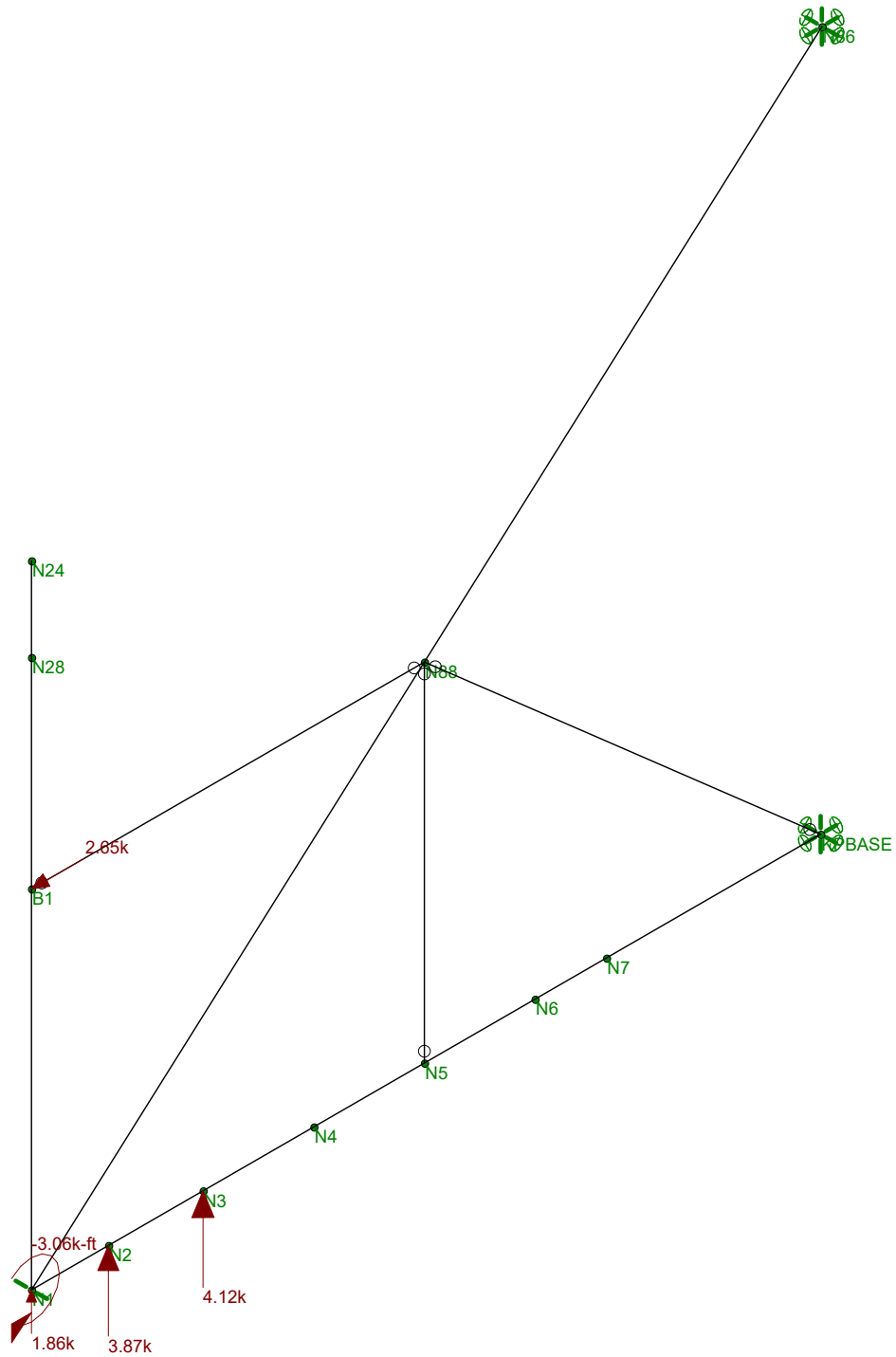
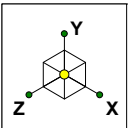
Shape factor adjustment = 1.5 (Use 1 if F-Standard / Working Load analysis; use 1.5 if G-Standard / LRFD)
Adjust for ballast overburden pressure? N (Y or N)
Max foundation bearing stress = 12.1 psi (Adjusted using bearing % Capacity)
Max plate bending stress = 20.8 ksi (Adjusted using bearing % Capacity)
Maximum plate bending capacity = 45.0 ksi
% Capacity = 46.2% **OK**

Shape factor adjustment is based on assumption that Roark & Young work uses plate section modulus

Determination of soil compression area

Load eccentricity = 5.70 feet
Difference = 0.00 (A_o Centroid location - Load eccentricity)
Outside Diameter = 20.10 ft Outside radius of found, r_o = 10.05 ft
Inside Diameter = 8.15 in Inside radius of pole, r_i = 4.08 in
Neutral axis location = 7.84 ft (Measured from max. compression fiber)
Therefore $c =$ 7.84 feet and $a = \beta_1 \times c =$ 7.84 feet
 $\alpha_{A_o} =$ 1.349 radians
 $A_o =$ 114.6 square feet Centroid of $A_o =$ 5.48 feet above center of section
 $\alpha_{A_i} =$ 0.997 radians
 $A_i =$ 9.0 square inches Centroid of $A_i =$ 2.97 inches above center of section

Area of Annulus = $A_o - A_i =$ 105.6 square feet Net area of annulus = 105.6 square feet
Centroid of annulus located 15.75 feet from maximum tension side of foundation



Loads: BLC 1, BLC1
Envelope Only Solution

Paul J. Ford and Company	Elyria Water Tank, Elyria, OH	SK - 1
JAG		Nov 1, 2021 at 12:08 PM
21221-0042.002.7205		21221-0042.002.7205.r3d



(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (mm^2)	92903.412
Merge Tolerance (mm)	3.048
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (in/sec^2)	386.4
Wall Mesh Size (mm)	304.801
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 15th(360-16): LRFD
Adjust Stiffness?	Yes(Iterative)
RISACONNECTION CODE	None
Cold Formed Steel Code	None
Wood Code	None
Wood Temperature	< 100F
Concrete Code	None
Masonry Code	None
Aluminum Code	None - Building
Stainless Steel Code	None

Number of Shear Regions	4
Region Spacing Increment (mm)	101.6
Biaxial Column Method	Exact Integration
Parame Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR SET ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

(Global) Model Settings, Continued

Seismic Code	ASCE 7-16
Seismic Base Elevation (in)	Not Entered
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Drift Cat	Other
Om Z	1
Om X	1
Cd Z	4
Cd X	4
Rho Z	1
Rho X	1

Joint Loads and Enforced Displacements (BLC 1 : BLC1)

	Joint Label	L,D,M	Direction	Magnitude[(k.k-ft), (in.rad), (k*s^2/i...
1	N1	L	Mx	-3.06
2	B1	L	Z	2.65
3	N1	L	Y	1.86
4	N2	L	Y	3.87
5	N3	L	Y	4.12
6	N4	L	Y	0
7	N5	L	Y	0
8	N6	L	Y	0
9	N7	L	Y	0

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	P14	N1	N86			CH_PIPE114X5	None	None	A53 Gr. B	Typical
2	LL14	KPBASE	N1		180	LL_100X100X...	None	None	Q345-B	Typical
3	M55	N5	N88			L 63X5	None	None	Q345-B	Typical
4	M56	KPBASE	N88			L 63X5	None	None	Q345-B	Typical
5	M17	N1	N24		180	L 63X5	None	None	Q345-B	Typical
6	M6	B1	N88			PL 6x60	None	None	Q345-B	Typical

Hot Rolled Steel Design Parameters

	Label	Shape	Length[in]	Lbyy[in]	Lbzz[in]	Lcomp top[in]	Lcomp bot[in]	L-torg...	Kyy	Kzz	Cb	Function
1	P14	CH_PIPE11...	131.58									Lateral
2	LL14	LL_100X10...	98.425									Lateral
3	M55	L 63X5	43.307									Lateral
4	M56	L 63X5	65.714									Lateral
5	M17	L 63X5	78.74									Lateral
6	M6	PL 6x60	49									Lateral



Envelope Member Section Forces

Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-...	LC	y-y Mome...	LC	z-z Mom...	LC	
1	P14	1	max	11.711	1	.172	1	.008	1	-.012	1	-.017	1	.692	1
2			min	11.711	1	.172	1	.008	1	-.012	1	-.017	1	.692	1
3		2	max	11.711	1	.172	1	.008	1	-.012	1	.004	1	.222	1
4			min	11.711	1	.172	1	.008	1	-.012	1	.004	1	.222	1
5		3	max	11.765	1	-.038	1	-.003	1	.012	1	.006	1	-.211	1
6			min	11.765	1	-.038	1	-.003	1	.012	1	.006	1	-.211	1
7		4	max	11.765	1	-.038	1	-.003	1	.012	1	-.002	1	-.105	1
8			min	11.765	1	-.038	1	-.003	1	.012	1	-.002	1	-.105	1
9		5	max	11.765	1	-.038	1	-.003	1	.012	1	-.01	1	0	1
10			min	11.765	1	-.038	1	-.003	1	.012	1	-.01	1	0	1
11	LL14	1	max	-8.667	1	-.388	1	-.003	1	.005	1	0	1	-.263	1
12			min	-8.667	1	-.388	1	-.003	1	.005	1	0	1	-.263	1
13		2	max	-8.667	1	-.388	1	-.003	1	.005	1	-.005	1	.532	1
14			min	-8.667	1	-.388	1	-.003	1	.005	1	-.005	1	.532	1
15		3	max	-8.667	1	-.399	1	-.003	1	.005	1	-.011	1	1.343	1
16			min	-8.667	1	-.399	1	-.003	1	.005	1	-.011	1	1.343	1
17		4	max	-8.656	1	1.955	1	.008	1	-.005	1	.004	1	-2.606	1
18			min	-8.656	1	1.955	1	.008	1	-.005	1	.004	1	-2.606	1
19		5	max	-8.656	1	-6.006	1	.008	1	-.005	1	.02	1	3.784	1
20			min	-8.656	1	-6.006	1	.008	1	-.005	1	.02	1	3.784	1
21	M55	1	max	2.356	1	.011	1	-.011	1	0	1	0	1	.015	1
22			min	2.356	1	.011	1	-.011	1	0	1	0	1	.015	1
23		2	max	2.356	1	.011	1	-.011	1	0	1	0	1	.001	1
24			min	2.356	1	.011	1	-.011	1	0	1	0	1	.001	1
25		3	max	2.356	1	.011	1	-.011	1	0	1	0	1	-.013	1
26			min	2.356	1	.011	1	-.011	1	0	1	0	1	-.013	1
27		4	max	2.356	1	.011	1	-.011	1	0	1	0	1	-.026	1
28			min	2.356	1	.011	1	-.011	1	0	1	0	1	-.026	1
29		5	max	2.356	1	.011	1	-.011	1	0	1	0	1	-.04	1
30			min	2.356	1	.011	1	-.011	1	0	1	0	1	-.04	1
31	M56	1	max	-3.758	1	0	1	0	1	0	1	.002	1	0	1
32			min	-3.758	1	0	1	0	1	0	1	.002	1	0	1
33		2	max	-3.758	1	0	1	0	1	0	1	.002	1	0	1
34			min	-3.758	1	0	1	0	1	0	1	.002	1	0	1
35		3	max	-3.758	1	0	1	0	1	0	1	.003	1	0	1
36			min	-3.758	1	0	1	0	1	0	1	.003	1	0	1
37		4	max	-3.758	1	0	1	0	1	0	1	.003	1	0	1
38			min	-3.758	1	0	1	0	1	0	1	.003	1	0	1
39		5	max	-3.758	1	0	1	0	1	0	1	.003	1	0	1
40			min	-3.758	1	0	1	0	1	0	1	.003	1	0	1
41	M17	1	max	.002	1	0	1	-.009	1	0	1	.02	1	.025	1
42			min	.002	1	0	1	-.009	1	0	1	.02	1	.025	1
43		2	max	.002	1	0	1	-.009	1	0	1	.011	1	.014	1
44			min	.002	1	0	1	-.009	1	0	1	.011	1	.014	1
45		3	max	.002	1	0	1	-.009	1	0	1	.002	1	.002	1
46			min	.002	1	0	1	-.009	1	0	1	.002	1	.002	1
47		4	max	0	1	0	1	0	1	0	1	0	1	0	1
48			min	0	1	0	1	0	1	0	1	0	1	0	1
49		5	max	0	1	0	1	0	1	0	1	0	1	0	1
50			min	0	1	0	1	0	1	0	1	0	1	0	1
51	M6	1	max	-2.659	1	0	1	0	1	0	1	0	1	0	1
52			min	-2.659	1	0	1	0	1	0	1	0	1	0	1
53		2	max	-2.659	1	0	1	0	1	0	1	0	1	0	1
54			min	-2.659	1	0	1	0	1	0	1	0	1	0	1
55		3	max	-2.659	1	0	1	0	1	0	1	0	1	0	1
56			min	-2.659	1	0	1	0	1	0	1	0	1	0	1



Envelope Member Section Forces (Continued)

Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-...	LC	y-y Mome...	LC	z-z Mom...	LC
57	4	max	-2.659	1	0	1	0	1	0	1	0	1	0	1
58		min	-2.659	1	0	1	0	1	0	1	0	1	0	1
59	5	max	-2.659	1	0	1	0	1	0	1	0	1	0	1
60		min	-2.659	1	0	1	0	1	0	1	0	1	0	1

Envelope AISC 15th(360-16): LRFD Steel Code Checks

Member	Shape	Code C...	Loc[in]	LC Shear ...	Loc[in]	Dir	LC	phi*Pnc [k]	phi*Pnt [k]	phi*Mn y-...	phi*Mn z-...	Cb	Eqn	
1	LL14	LL_100X100...	.342	98.425	1	.094	89.197	y	1	134.719	218.178	23.425	11.769	2... H1-1b
2	P14	CH_PIPE114...	.270	0	1	.008	0		1	56.928	83.588	9.523	9.523	2... H1-1a
3	M55	L 63X5	.121	43.307	1	.001	0	z	1	24.323	42.847	.58	1.645	2... H2-1
4	M56	L 63X5	.072	0	1	.000	0	y	1	12.064	42.847	.58	1.381	1 H2-1
5	M6	PL 6x60	.054	49	1	.001	0	y	1	.244	25.11	.124	.438	1 H1-1b
6	M17	L 63X5	.000	43.471	1	.001	0	z	1	8.403	42.847	.58	1.629	2... H1-1a

APPENDIX C
PROPOSED POLE AND FOUNDATION DRAWINGS