

Date: **November 1, 2019**

James Downey
PBMWS

Subject: Structural Analysis Report - Sabre Sales Order #446817

Site Data:

Site Name:	Marshalltown, IA
Latitude	42° 1' 47.14"
Longitude	-92° 54' 16.49"
Tower Type:	Slimline
Tower Height:	125 FT
Tower Manufacturer:	Sabre Industries

Dear James Downey,

Sabre is pleased to submit 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 to support specified equipment. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load cases, to be:

Existing + Proposed Equipment

Sufficient Capacity

Note: See Table 1 for the existing and proposed loading.

Tower Rating: 63%

Foundation Rating: 76%

The analysis has been performed in accordance with the ANSI/TIA-222-G standard, see the tower profile included in this report for the design parameters.

We at Sabre Towers and Poles appreciate the opportunity of providing our continuing professional services to you. If you have any questions or need further assistance on this or any other projects please give us a call.

Respectfully submitted by:

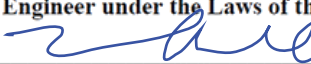
 11/1/19	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the Laws of the State of Iowa.
	 (signature)
	11/1/19 (dated)
	KEITH J. TINDALL
	My license renewal date is <u>December 31, 2020</u> .
	Pages or sheets covered by this seal: <u>1-15</u>

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1) INTRODUCTION

This tower is a 125 FT (Slimline) tower designed by Sabre Industries, Job #09-02097, dated 2/17/2009.

2) ANALYSIS CRITERIA

Table 1 – Existing & Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	E/P/F
119	119	3	Dengyo	OCT6-2LX2HX-BW65			P
113	113	3	Ericsson	RRU 2205			P
109	109	3	Dengyo	OCT6-2LX2HX-BW65	6	7/8	P
100	100	8	OTHER	Stadium Light (EPA = 6.86)	1	1	E
81.5	81.5	1	RAYCAP	RUSDC-6267-PF-48	1	1 1/4	E
81	81	3	ERICSSON	RRU 4449	1	1 1/4	P
81	81	3	ERICSSON	RRU 8843	1	1 1/4	P
81	81	3	ERICSSON	RRU 11 B5			P
81	81	2	RAYCAP	DC6-48-60-18-8F			P

3) ANALYSIS PROCEDURE

Table 2 – Referenced Documents

Document	Reference
Structural Design Report	Sabre Job# 09-02097, Dated 02/17/2009
Geotechnical Report	Edge Consulting Engineers, Inc., Project# 3418, Dated 7/28/2008
Antenna Fit	Stealth, Job# SA19-02019S-00, Dated 10/18/2019

3.1) Analysis Method

POLEMAST™, a commercially available analysis software package developed by Guymast Inc., is utilized by Sabre Towers and Poles to perform the structural analysis and design of monopoles.

The basic criteria for designing a monopole such as wind speed, effective areas of monopole sections, factored resistances, allowable rigidity and foundation requirements are based on ANSI/TIA Standard 222-G.

A monopole is treated as a cantilevered beam with a fixed base support. Wind, ice and weight are the major design loads considered in the static analysis. Effects due to eccentric moments, torques, slopes and deflections are included in the computer program.

After all the necessary input data is entered, the program will compute the effective area of each monopole section, the wind loads at each elevation, and the factored resistance of each section. The total weight, wind shear, overturning moment and torque are calculated at each elevation, in order to determine loads in each section of the monopole. The factored loads are then compared with the factored resistances to determine the adequacy and/or required sizes.

Selected output from the analysis is included in Appendix A.

3.2) Assumptions

- 1) Tower and structures were built in accordance with the manufacturer's specifications.
- 2) The tower and structures have been maintained in accordance with the manufacturer's specification.
- 3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Table 1 and the referenced drawings.
- 4) The existing canister is going to be removed and replaced with a larger diameter and 10' taller canister designed by Stealth, Job# SA19-02019S-00, Dated 10/18/2019.

4) ANALYSIS RESULTS

Table 3 – Existing & Proposed Component Stresses vs. Capacity

Component	Elevation (ft)	% Capacity	Sufficient/Insufficient
Anchor Rods	BASE	52%	Sufficient
Base Plate	BASE	59%	Sufficient
Base Foundation (Pad & Pier)	BASE	50%	Sufficient
Base Foundation Soil Interaction (Pad & Pier)	BASE	76%	Sufficient
Base Foundation (Caisson)	BASE	45%	Sufficient
Pole Shaft	BASE	63%	Sufficient

Structure Rating (max from all components) =	76%
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Notes:

- 1) See additional documentation in "Appendix A" for output supporting the % capacity.
- 2) A structure ratio of 105% or less is within engineering tolerances and considered acceptable.
- 3) A foundation-soil interaction ratio of 110% or less is within engineering tolerances for foundations and is considered acceptable.

4.1) Recommendations

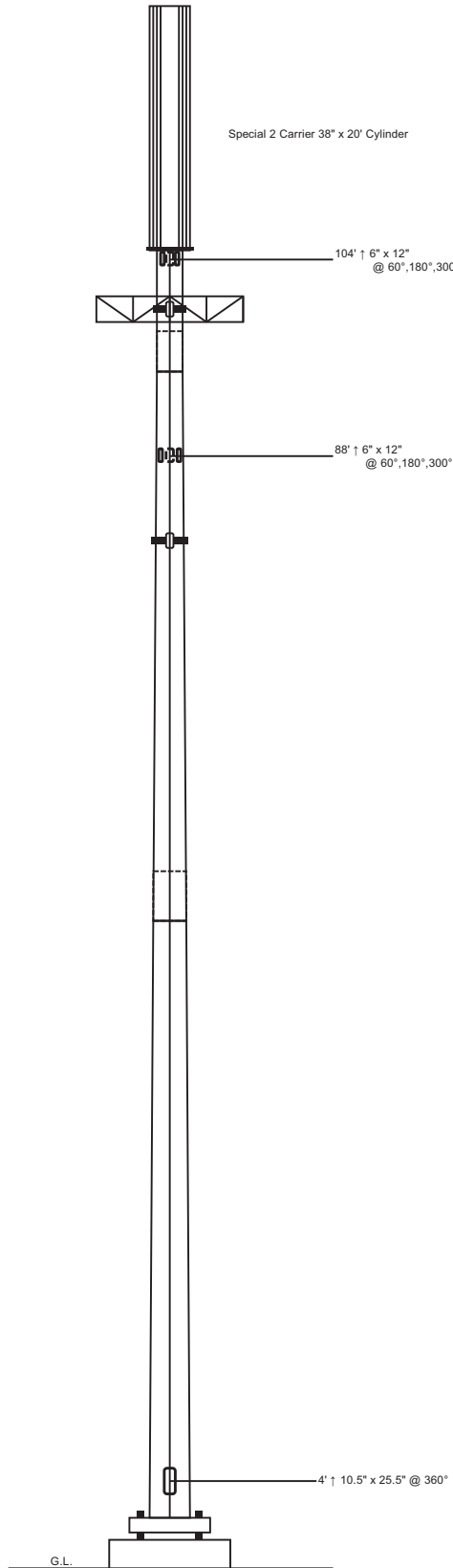
The tower and its base and foundations have sufficient capacity to carry the existing and proposed loads.

- a) Replace the existing canister with a larger diameter and 10' taller canister designed by Stealth.
- b) For proposal please contact our modifications department at modrfq@sabreindustries.com to obtain pricing for the upgrades.

Further engineering and detailing is required to design the new canister.

APPENDIX A
STRUCTURAL ANALYSIS OUTPUT

Length (ft)	53'-0"	48'-3"	10'-0"
Number Of Sides	18		
Thickness (in)	1/4"	3/16"	
Lap Splice (ft)	4'-0"	3'-3"	
Top Diameter (in)	30.9"	24.64"	24"
Bottom Diameter (in)	38.85"	31.88"	25.5"
Taper (in/ft)			
Grade			
Weight (lbs)	6128	2991	982
Overall Steel Height (ft)	104		



Designed Appurtenance Loading

Elev	Description	Tx-Line
119	(3) OCT6-2LX2HX-BW65	
113	(3) RRU 2205s	
109	(3) OCT6-2LX2HX-BW65	(6) 7/8"
105	Special 2 Carrier 38" x 20' Cylinder	
100	Stadium Light Mount (12 Light) - w/ platform	
100	(8) Stadium Light (EPA = 6.86)	(1) 1"
81.5	(1) RUSDC-6267-PF-48	(1) 1 1/4"
81	Flush Mount (Monopole Only)	
81	(3) RRU 4449s	(1) 1 1/4"
81	(3) RRU 8843s	(1) 1 1/4"
81	(3) RRU 11 B5s	
81	(2) DC6-48-60-18-8F	

Design Criteria - ANSI/TIA-222-G

ASCE 7-16 Ultimate Wind Speed (No Ice)	110 mph
Wind Speed (Ice)	40 mph
Design Ice Thickness	1.50 in
Structure Class	II
Risk Category	II
Exposure Category	C
Topographic Category	1

Load Case Reactions

Description	Axial (kips)	Shear (kips)	Moment (ft-k)	Deflection (ft)	Sway (deg)
3s Gusted Wind	16.33	12.18	963.16	4	3.77
3s Gusted Wind 0.9 Dead	12.24	12.17	954.16	3.95	3.72
3s Gusted Wind&Ice	28.66	3.06	245.18	1.03	0.98
Service Loads	13.61	3.4	267.33	1.11	1.04

Base Plate Dimensions

Shape	Width	Thickness	Bolt Circle	Bolt Qty	Bolt Diameter
Square	42.5"	2.25"	44.75"	8	2.25"

Anchor Bolt Dimensions

Length	Diameter	Hole Diameter	Weight	Type	Finish
84"	2.25"	2.625"	968.8	A615-75	Galv

Notes

- 1) Antenna Feed Lines Run Inside Pole
- 2) All dimensions are above ground level, unless otherwise specified.
- 3) Weights shown are estimates. Final weights may vary.
- 4) Tower Rating: 62.5%
- 5) This tower design and, if applicable, the foundation design(s) shown on the following page(s) also meet or exceed the requirements of the 2015 International Building Code.



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Job:	446817
Customer:	PBMWS
Site Name:	Marshalltown, IA
Description:	125' Slimline
Date:	11/1/2019
By:	JLG

446817

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(USA 222-G) - Monopole Spatial Analysis (c)2015 Guymast Inc.

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125' Slimline / Marshalltown, IA

* All pole diameters shown on the following pages are across corners.
See profile drawing for widths across flats.

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POLE GEOMETRY

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ELEV ft	SECTION NAME	NO. SIDE	OUTSIDE DIAM in	THICK -NESS in	RESISTANCES ♦*Pn kip	♦*Mn ft-kip	SPLICE TYPE	...OVERLAP... LENGTH ft	RATIO	w/t
104.0			24.37	0.188	981.1	480.6				
	A	18	25.39	0.188	1007.8	514.7				20.8
97.2			25.39	0.188	1007.8	514.7				
	A/B	18	25.52	0.188	1011.0	518.9	SLIP	3.25	1.55	
94.0			25.52	0.188	1011.0	518.9				
	B	18	31.75	0.188	1146.8	734.5				21.9
53.0			31.75	0.188	1146.8	734.5				
	B/C	18	31.99	0.250	1726.3	1109.7	SLIP	4.00	1.52	
49.0			31.99	0.250	1726.3	1109.7				
	C	18	39.45	0.250	1963.9	1561.4				20.5
0.0										

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POLE ASSEMBLY

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SECTION NAME	BASE ELEV ft	 NUMBER	BOLTS TYPE	AT BASE DIAM in	OF SECTION STRENGTH ksi	 THREADS IN SHEAR PLANE	CALC BASE ELEV ft
A	94.000	0	A325	0.00	92.0	0	94.000
B	49.000	0	A325	0.00	92.0	0	49.000
C	0.000	0	A325	0.00	92.0	0	0.000

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POLE SECTIONS

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SECTION NAME	No.of SIDES	LENGTH ft	OUTSIDE. BOT * in	DIAMETER TOP * in	BEND RAD in	MAT- ERIAL ID	FLANGE.ID BOT	TOP	FLANGE.WELD ..GROUP.ID.. BOT	TOP
A	18	10.00	25.89	24.37	0.000	1	0	0	0	0
B	18	48.25	32.37	25.02	0.000	2	0	0	0	0
C	18	53.00	39.45	31.38	0.000	3	0	0	0	0

* - Diameter of circumscribed circle

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MATERIAL TYPES

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TYPE OF SHAPE	TYPE NO	NO OF ELEM.	ORIENT	HEIGHT	WIDTH	.THICKNESS. WEB FLANGE	IRREGULARITY .PROJECTION.
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		& deg	in	in	in	in	% OF AREA	ORIENT deg
PL	1	1	0.0	25.89	0.19	0.188	0.188	0.00
PL	2	1	0.0	32.37	0.19	0.188	0.188	0.00
PL	3	1	0.0	39.45	0.25	0.250	0.250	0.00

& - with respect to vertical

MATERIAL PROPERTIES

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MATERIAL TYPE NO.	ELASTIC MODULUS ksi	UNIT WEIGHT pcf	.. STRENGTH .. Fu ksi	Fy ksi	THERMAL COEFFICIENT /deg
1	29000.0	490.0	80.0	65.0	0.00001170
2	29000.0	490.0	80.0	65.0	0.00001170
3	29000.0	490.0	80.0	65.0	0.00001170

* Only 3 condition(s) shown in full

* Some concentrated wind loads may have been derived from full-scale wind tunnel testing

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LOADING CONDITION A

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110 mph ultimate wind with no ice. Wind Azimuth: 0

LOADS ON POLE

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LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	..AT AZI	LOAD AZI	FORCES..... HORIZ kip	DOWN kip	MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	118.000	0.00	0.0	0.0	0.0000	0.3010	0.0000	0.0000
C	114.000	0.00	0.0	0.0	1.6594	2.4000	0.0000	0.0000
C	112.000	0.00	0.0	0.0	0.0000	0.0439	0.0000	0.0000
C	108.000	0.00	0.0	0.0	0.0000	0.4199	0.0000	0.0000
C	108.000	0.00	0.0	0.0	0.0000	0.3010	0.0000	0.0000
C	99.000	0.00	0.0	0.0	0.0000	0.0642	0.0000	0.0000
C	99.000	0.00	0.0	0.0	3.4096	1.6272	0.0000	0.0000
C	80.500	0.00	0.0	0.0	0.0000	0.0638	0.0000	0.0000
C	80.500	0.00	0.0	0.0	0.1211	0.0239	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0000	0.0634	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.3931	0.3060	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0000	0.0634	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.2832	0.1980	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0593	0.0600	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.3295	0.5556	0.0000	0.0000
D	104.000	0.00	180.0	0.0	0.0529	0.0591	0.0000	0.0000
D	97.250	0.00	180.0	0.0	0.0529	0.0591	0.0000	0.0000
D	97.250	0.00	180.0	0.0	0.0540	0.1210	0.0000	0.0000
D	94.000	0.00	180.0	0.0	0.0540	0.1210	0.0000	0.0000
D	94.000	0.00	180.0	0.0	0.0549	0.0631	0.0000	0.0000
D	53.000	0.00	180.0	0.0	0.0588	0.0730	0.0000	0.0000
D	53.000	0.00	180.0	0.0	0.0592	0.1766	0.0000	0.0000
D	49.000	0.00	180.0	0.0	0.0592	0.1766	0.0000	0.0000
D	49.000	0.00	180.0	0.0	0.0585	0.1043	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0547	0.1220	0.0000	0.0000

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LOADING CONDITION M

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110 mph ultimate wind with no ice. Wind Azimuth: 0

LOADS ON POLE

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446817

LOAD TYPE	ELEV ft	APPLY.. RADIUS ft	LOAD..AT AZI	LOAD AZI	FORCES..... HORIZ kip	DOWN kip	MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	118.000	0.00	0.0	0.0	0.0000	0.2257	0.0000	0.0000
C	114.000	0.00	0.0	0.0	1.6594	1.8000	0.0000	0.0000
C	112.000	0.00	0.0	0.0	0.0000	0.0329	0.0000	0.0000
C	108.000	0.00	0.0	0.0	0.0000	0.3149	0.0000	0.0000
C	108.000	0.00	0.0	0.0	0.0000	0.2257	0.0000	0.0000
C	99.000	0.00	0.0	0.0	0.0000	0.0481	0.0000	0.0000
C	99.000	0.00	0.0	0.0	3.4096	1.2204	0.0000	0.0000
C	80.500	0.00	0.0	0.0	0.0000	0.0478	0.0000	0.0000
C	80.500	0.00	0.0	0.0	0.1211	0.0180	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0000	0.0475	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.3931	0.2295	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0000	0.0475	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.2832	0.1485	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0593	0.0450	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.3295	0.4167	0.0000	0.0000
D	104.000	0.00	180.0	0.0	0.0529	0.0443	0.0000	0.0000
D	97.250	0.00	180.0	0.0	0.0529	0.0443	0.0000	0.0000
D	97.250	0.00	180.0	0.0	0.0540	0.0907	0.0000	0.0000
D	94.000	0.00	180.0	0.0	0.0540	0.0907	0.0000	0.0000
D	94.000	0.00	180.0	0.0	0.0549	0.0473	0.0000	0.0000
D	53.000	0.00	180.0	0.0	0.0588	0.0548	0.0000	0.0000
D	53.000	0.00	180.0	0.0	0.0592	0.1325	0.0000	0.0000
D	49.000	0.00	180.0	0.0	0.0592	0.1325	0.0000	0.0000
D	49.000	0.00	180.0	0.0	0.0585	0.0782	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0547	0.0915	0.0000	0.0000

LOADING CONDITION Y

40 mph wind with 1.5 ice. wind Azimuth: 0°

LOADS ON POLE

LOAD TYPE	ELEV ft	APPLY.. RADIUS ft	LOAD..AT AZI	LOAD AZI	FORCES..... HORIZ kip	DOWN kip	MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	118.000	0.00	0.0	0.0	0.0000	0.3010	0.0000	0.0000
C	114.000	0.00	0.0	0.0	0.5099	6.3379	0.0000	0.0000
C	112.000	0.00	0.0	0.0	0.0000	0.0439	0.0000	0.0000
C	108.000	0.00	0.0	0.0	0.0000	0.4199	0.0000	0.0000
C	108.000	0.00	0.0	0.0	0.0000	0.3010	0.0000	0.0000
C	99.000	0.00	0.0	0.0	0.0000	0.0642	0.0000	0.0000
C	99.000	0.00	0.0	0.0	0.6495	2.6327	0.0000	0.0000
C	80.500	0.00	0.0	0.0	0.0000	0.0638	0.0000	0.0000
C	80.500	0.00	0.0	0.0	0.0224	0.0566	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0000	0.0634	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0727	0.5817	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0000	0.0634	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0540	0.4688	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0209	0.1420	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0670	0.8313	0.0000	0.0000
D	104.000	0.00	180.0	0.0	0.0154	0.1136	0.0000	0.0000
D	97.250	0.00	180.0	0.0	0.0154	0.1136	0.0000	0.0000
D	97.250	0.00	180.0	0.0	0.0156	0.1767	0.0000	0.0000
D	94.000	0.00	180.0	0.0	0.0156	0.1767	0.0000	0.0000
D	94.000	0.00	180.0	0.0	0.0158	0.1202	0.0000	0.0000
D	53.000	0.00	180.0	0.0	0.0166	0.1360	0.0000	0.0000
D	53.000	0.00	180.0	0.0	0.0166	0.2411	0.0000	0.0000
D	49.000	0.00	180.0	0.0	0.0166	0.2411	0.0000	0.0000
D	49.000	0.00	180.0	0.0	0.0164	0.1704	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0149	0.1859	0.0000	0.0000

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125' Slimline / Marshalltown, IA

MAXIMUM POLE DEFORMATIONS CALCULATED(w.r.t. wind direction)

MAST ELEV ft	DEFLECTIONS (ft)			ROTATIONS (deg)		
	HORIZONTAL ALONG	ACROSS	DOWN	TILT ALONG	ACROSS	TWIST
104.0	4.00L	0.01Q	0.20L	3.77L	0.01Q	0.00Q
97.2	3.56L	0.01Q	0.17L	3.72L	0.01Q	0.00Q
94.0	3.35L	0.01Q	0.16L	3.69L	0.01Q	0.00Q
80.3	2.50L	0.01Q	0.10L	3.40L	0.01Q	0.00Q
66.7	1.75L	0.01Q	0.06L	2.94L	0.01Q	0.00Q
53.0	1.12L	0.00Q	0.03L	2.33L	0.01Q	0.00Q
49.0	0.96L	0.00Q	0.03L	2.18L	0.01Q	0.00Q
36.7	0.55L	0.00Q	0.01L	1.68L	0.00Q	0.00Q
24.5	0.25L	0.00Q	0.00L	1.14L	0.00Q	0.00Q
12.2	0.06L	0.00Q	0.00L	0.58L	0.00Q	0.00Q
0.0	0.00A	0.00A	0.00A	0.00A	0.00A	0.00A

MAXIMUM POLE FORCES CALCULATED(w.r.t. to wind direction)

MAST ELEV ft	TOTAL AXIAL kip		SHEAR.w.r.t.WIND.DIR ALONG kip		MOMENT.w.r.t.WIND.DIR ALONG ft-kip		TORSION ft-kip
104.0	7.40 AJ	1.66 T	0.00 O	-16.60 B	-0.01 X	0.00 X	
97.2	10.87 AJ	5.43 T	0.00 O	-36.70 L	-0.02 O	0.01 L	
	10.87 Z	5.46 P	0.03 K	-36.74 B	0.04 Q	0.01 L	
94.0	11.44 Z	5.64 P	0.03 K	-55.78 K	-0.07 K	0.01 L	
	11.44 AA	5.65 B	0.03 Q	-55.78 K	0.07 I	0.01 L	
80.3	13.24 AA	6.52 B	0.03 Q	-143.10 B	-0.40 Q	0.04 Q	
	13.24 AF	6.52 O	0.03 Q	-143.10 B	-0.40 Q	0.04 Q	
66.7	17.14 AF	8.37 O	0.03 Q	-257.86 B	-0.80 Q	0.08 Q	
	17.14 AF	8.36 O	0.03 Q	-257.86 B	-0.80 Q	0.08 Q	
53.0	18.97 AF	9.16 O	0.03 Q	-383.30 B	-1.21 Q	0.11 Q	
	18.97 AF	9.17 R	0.03 Q	-383.31 B	-1.22 Q	0.11 Q	
49.0	19.93 AF	9.41 R	0.03 Q	-422.01 B	-1.35 Q	0.11 Q	
	19.93 AF	9.41 P	0.03 B	-422.00 B	-1.37 Q	0.11 Q	
36.7	22.04 AF	10.12 P	0.03 B	-545.91 L	-1.67 Q	0.13 Q	

	22.04 AF	10.11 P	0.03 Q	446817 -545.90 L	-1.66 Q	0.13 Q
24.5	24.20 AF	10.81 P	0.03 Q	-677.85 L	-2.03 Q	0.15 Q
	24.20 AF	10.82 L	0.03 Q	-677.85 L	-2.03 Q	0.15 Q
12.2	26.40 AF	11.50 L	0.03 Q	-817.13 L	-2.38 Q	0.16 Q
	26.40 AF	11.50 L	0.03 Q	-817.13 L	-2.38 Q	0.16 Q
	28.66 AF	12.18 L	0.03 Q	-963.16 L	-2.74 Q	0.16 Q
base reaction	28.66 AF	-12.18 L	-0.03 Q	963.16 L	2.74 Q	-0.16 Q

COMPLIANCE WITH 4.8.2 & 4.5.4

ELEV ft	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t(w/t)	MAX ALLOWED
104.00	0.01AJ	0.03B	0.00T	0.04B	YES	20.81A	45.2
97.25	0.01AJ	0.07L	0.01T	0.08L	YES	21.76A	45.2
	0.01Z	0.07B	0.01P	0.08B	YES	21.76A	45.2
94.00	0.01Z	0.10K	0.01P	0.11K	YES	22.22A	45.2
	0.01AA	0.11K	0.01B	0.11K	YES	21.87A	45.2
80.33	0.01AA	0.24B	0.01B	0.25B	YES	23.79A	45.2
	0.01AF	0.24B	0.01O	0.25B	YES	23.79A	45.2
66.67	0.02AF	0.39B	0.02O	0.40B	YES	25.72A	45.2
	0.02AF	0.39B	0.02O	0.40B	YES	25.72A	45.2
53.00	0.02AF	0.52B	0.02O	0.53B	YES	27.65A	45.2
	0.01AF	0.35B	0.01R	0.36B	YES	20.30A	45.2
49.00	0.01AF	0.37B	0.01R	0.38B	YES	20.72A	45.2
	0.01AF	0.38B	0.01P	0.39B	YES	20.45A	45.2
36.75	0.01AF	0.45L	0.01P	0.45L	YES	21.75A	45.2
	0.01AF	0.45L	0.01P	0.45L	YES	21.75A	45.2
24.50	0.01AF	0.51L	0.01P	0.52L	YES	23.05A	45.2
	0.01AF	0.51L	0.01L	0.52L	YES	23.05A	45.2
12.25	0.01AF	0.57L	0.01L	0.57L	YES	24.34A	45.2
	0.01AF	0.57L	0.01L	0.57L	YES	24.34A	45.2
0.00	0.01AF	0.62L	0.01L	0.63L	YES	25.64A	45.2

MAXIMUM LOADS ONTO FOUNDATION(w.r.t. wind direction)

DOWN kip	SHEAR.w.r.t.WIND.DIR ALONG kip	WIND.DIR ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	WIND.DIR ACROSS ft-kip	TORSION ft-kip
28.66 AF	12.18 L	0.03 Q	-963.16 L	-2.74 Q	0.16 Q

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125' Slimline / Marshalltown, IA

***** Service Load Condition *****

* Only 1 condition(s) shown in full

* Some concentrated wind loads may have been derived from full-scale wind tunnel testing

LOADING CONDITION A =====

60 mph wind with no ice. Wind Azimuth: 0°

LOADS ON POLE

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LOAD TYPE	ELEV ft	APPLY.. RADIUS ft	LOAD..AT AZI	LOAD AZI	FORCES.....		MOMENTS.....	
					HORIZ kip	DOWN kip	VERTICAL ft-kip	TORSNAL ft-kip
C	118.000	0.00	0.0	0.0	0.0000	0.2508	0.0000	0.0000
C	114.000	0.00	0.0	0.0	0.4624	2.0000	0.0000	0.0000
C	112.000	0.00	0.0	0.0	0.0000	0.0366	0.0000	0.0000
C	108.000	0.00	0.0	0.0	0.0000	0.3499	0.0000	0.0000
C	108.000	0.00	0.0	0.0	0.0000	0.2508	0.0000	0.0000
C	99.000	0.00	0.0	0.0	0.0000	0.0535	0.0000	0.0000
C	99.000	0.00	0.0	0.0	0.9500	1.3560	0.0000	0.0000
C	80.500	0.00	0.0	0.0	0.0000	0.0531	0.0000	0.0000
C	80.500	0.00	0.0	0.0	0.0338	0.0200	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0000	0.0528	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.1095	0.2550	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0000	0.0528	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0789	0.1650	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0180	0.0500	0.0000	0.0000
C	80.000	0.00	0.0	0.0	0.0918	0.4630	0.0000	0.0000
D	104.000	0.00	180.0	0.0	0.0147	0.0493	0.0000	0.0000
D	97.250	0.00	180.0	0.0	0.0147	0.0493	0.0000	0.0000
D	97.250	0.00	180.0	0.0	0.0150	0.1008	0.0000	0.0000
D	94.000	0.00	180.0	0.0	0.0150	0.1008	0.0000	0.0000
D	94.000	0.00	180.0	0.0	0.0153	0.0526	0.0000	0.0000
D	53.000	0.00	180.0	0.0	0.0164	0.0609	0.0000	0.0000
D	53.000	0.00	180.0	0.0	0.0165	0.1472	0.0000	0.0000
D	49.000	0.00	180.0	0.0	0.0165	0.1472	0.0000	0.0000
D	49.000	0.00	180.0	0.0	0.0163	0.0869	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0152	0.1017	0.0000	0.0000

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MAXIMUM POLE DEFORMATIONS CALCULATED(w.r.t. wind direction)

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MAST ELEV ft	DEFLECTIONS (ft).....			ROTATIONS (deg).....		
	 ALONG	 ACROSS	DOWN	 ALONG	 ACROSS	TWIST
104.0	1.11D	0.00K	0.02D	1.04D	0.00K	0.00C
97.2	0.99D	0.00K	0.01D	1.03D	0.00K	0.00C
94.0	0.93D	0.00K	0.01D	1.02D	0.00K	0.00C

446817

80.3	0.70D	0.00K	0.01D	0.94D	0.00K	0.00C
66.7	0.49D	0.00K	0.01D	0.81D	0.00K	0.00C
53.0	0.31D	0.00K	0.00D	0.65D	0.00K	0.00C
49.0	0.27D	0.00K	0.00D	0.61D	0.00K	0.00C
36.7	0.15D	0.00K	0.00D	0.47D	0.00K	0.00C
24.5	0.07D	0.00K	0.00D	0.32D	0.00K	0.00C
12.2	0.02D	0.00K	0.00D	0.16D	0.00K	0.00C
0.0	0.00A	0.00A	0.00A	0.00A	0.00A	0.00A

MAXIMUM POLE FORCES CALCULATED(w.r.t. to wind direction)

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MAST ELEV ft	TOTAL AXIAL kip	SHEAR.w.r.t.WIND.DIR ALONG kip	WIND.DIR ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	WIND.DIR ACROSS ft-kip	TORSION ft-kip
104.0	2.89 B	0.46 B	0.00 B	-4.63 C	0.00 K	0.00 I
97.2	4.63 B	1.51 B	0.00 B	-10.16 B	0.00 C	0.00 B
	4.63 C	1.52 L	0.00 K	-10.17 D	-0.01 I	0.00 L
94.0	4.96 C	1.57 L	0.00 K	-15.44 D	-0.01 C	0.00 B
	4.96 K	1.58 D	0.00 K	-15.44 C	-0.01 C	0.00 L
80.3	5.77 K	1.82 D	0.00 K	-39.65 D	-0.08 K	0.00 L
	5.77 D	1.82 D	0.00 K	-39.65 D	-0.08 K	0.00 L
66.7	7.58 D	2.33 D	0.00 K	-71.42 D	-0.14 K	0.00 C
	7.58 D	2.33 D	0.00 K	-71.42 D	-0.14 K	0.00 C
53.0	8.40 D	2.55 D	0.00 K	-106.17 D	-0.20 K	-0.01 C
	8.40 D	2.56 D	0.00 K	-106.16 D	-0.20 K	-0.01 C
49.0	8.99 D	2.62 D	0.00 K	-116.91 D	-0.22 K	-0.01 C
	8.99 D	2.62 D	0.01 K	-116.90 D	-0.22 K	-0.01 C
36.7	10.07 D	2.82 D	0.01 K	-151.31 D	-0.30 K	-0.01 C
	10.07 D	2.82 D	0.01 K	-151.30 D	-0.30 K	-0.01 C
24.5	11.21 D	3.01 D	0.01 K	-187.94 D	-0.39 K	-0.01 C
	11.21 D	3.02 D	0.01 K	-187.93 D	-0.39 K	-0.01 C
12.2	12.38 D	3.21 D	0.01 K	-226.66 D	-0.50 K	-0.01 C
	12.38 D	3.21 D	0.01 K	-226.66 D	-0.50 K	-0.01 C
	13.61 D	3.40 D	0.01 K	-267.33 D	-0.60 K	-0.01 C
base reaction	13.61 D	-3.40 D	-0.01 K	267.33 D	0.60 K	0.01 C

COMPLIANCE WITH 4.8.2 & 4.5.4

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ELEV ft	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL SATISFIED	D/t(w/t)	MAX ALLOWED
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446817							
104.00	0.00B	0.01C	0.00B	0.01C	YES	20.81A	45.2
97.25	0.00B	0.02B	0.00B	0.02B	YES	21.76A	45.2
	0.00C	0.02D	0.00L	0.02D	YES	21.76A	45.2
94.00	0.00C	0.03D	0.00L	0.03D	YES	22.22A	45.2
	0.00K	0.03C	0.00D	0.03C	YES	21.87A	45.2
80.33	0.01K	0.07D	0.00D	0.07D	YES	23.79A	45.2
	0.01D	0.07D	0.00D	0.07D	YES	23.79A	45.2
66.67	0.01D	0.11D	0.00D	0.11D	YES	25.72A	45.2
	0.01D	0.11D	0.00D	0.11D	YES	25.72A	45.2
53.00	0.01D	0.14D	0.00D	0.15D	YES	27.65A	45.2
	0.00D	0.10D	0.00D	0.10D	YES	20.30A	45.2
49.00	0.01D	0.10D	0.00D	0.11D	YES	20.72A	45.2
	0.01D	0.11D	0.00D	0.11D	YES	20.45A	45.2
36.75	0.01D	0.12D	0.00D	0.13D	YES	21.75A	45.2
	0.01D	0.12D	0.00D	0.13D	YES	21.75A	45.2
24.50	0.01D	0.14D	0.00D	0.15D	YES	23.05A	45.2
	0.01D	0.14D	0.00D	0.15D	YES	23.05A	45.2
12.25	0.01D	0.16D	0.00D	0.16D	YES	24.34A	45.2
	0.01D	0.16D	0.00D	0.16D	YES	24.34A	45.2
0.00	0.01D	0.17D	0.00D	0.18D	YES	25.64A	45.2

MAXIMUM LOADS ONTO FOUNDATION(w.r.t. wind direction)

DOWN	SHEAR.w.r.t.WIND.DIR	MOMENT.w.r.t.WIND.DIR	TORSION
kip	ALONG kip	ALONG ft-kip	ft-kip
	ACROSS kip	ACROSS ft-kip	
13.61	3.40	-267.33	-0.01
D	D	D	C
	K	K	

Square Base Plate and Anchor Rods per ANSI/TIA 222-G

Pole Data

Diameter: 38.850 in (flat to flat)
Thickness: 0.25 in
Yield (Fy): 65 ksi
of Sides: 18 "0" IF Round
Strength (Fu): 80 ksi

Reactions

Moment, Mu: 963.16 ft-kips
Axial, Pu: 16.33 kips
Shear, Vu: 12.18 kips

Anchor Rod Data

Quantity: 8 (multiple of 4)
Diameter: 2.25 in
Rod Material: A615
Strength (Fu): 100 ksi
Yield (Fy): 75 ksi
BC Diam. (in): 44.75 BC Override: 44.75
Rod Spacing: 6 in

Anchor Rod Results

Maximum Rod (Pu+ Vu/η): 134.2 Kips
Allowable $\Phi \cdot R_{nt}$: 260.0 Kips (per 4.9.9)
Anchor Rod Interaction Ratio: **51.6% Pass**

Plate Data

Width (in): 42.5 Width Override: 42.5
Thickness: 2.25 in
Yield (Fy): 50 ksi
Eff. Width: 21.25 in
Corner Clip: 6.00 in
Drain Hole: 2.625 in. diameter
Drain Location: 17.25 in. center of pole to center of drain hole
Center Hole: 25.5 in. diameter

Base Plate Results

Base Plate (Mu/Z): 26.6 ksi
Allowable $\Phi \cdot F_y$: 45 ksi (per AISC)
Base Plate Interaction Ratio: **59.0% Pass**