Sabre Industries™
Towers and Poles

Structural Design Report
170' Monopole
Site: Battle School, MO

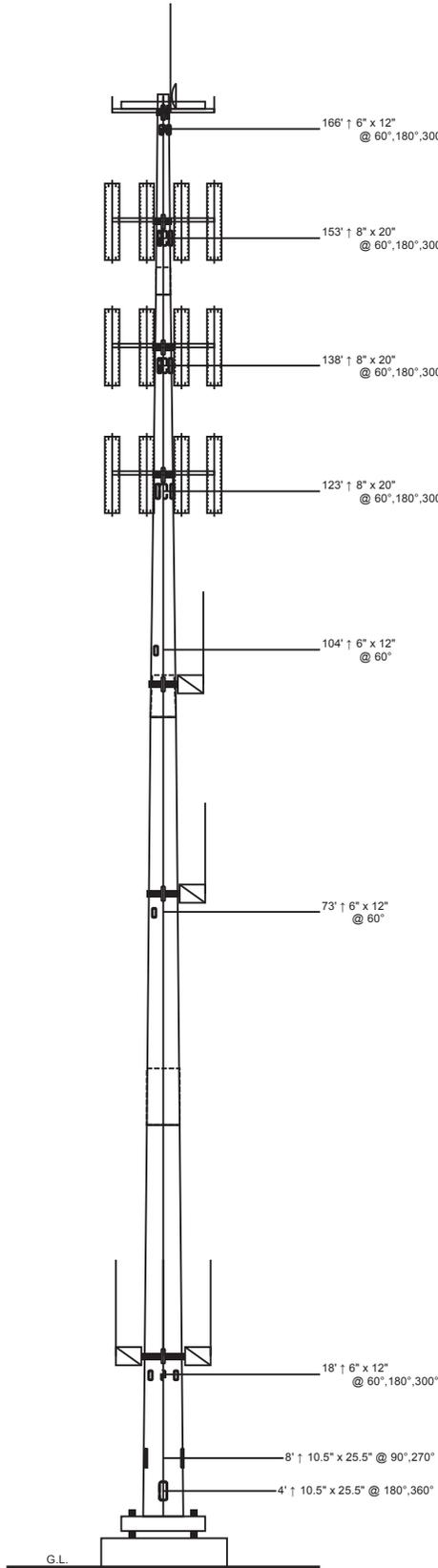Prepared for: BOONE COUNTY
by: Sabre Towers & Poles ™

Job Number: 130727

October 22, 2015

STATE OF MISSOURI
ROBERT E. BEACOM
NUMBER PE-2011019017
PROFESSIONAL ENGINEER

10/26/15

Section	1	2	3	4
Length (ft)	53' - 3"	53' - 6"	53' - 6"	23' - 9"
Number Of Sides	18			
Thickness (in)	7/16"		5/16"	1/4"
Lap Splice (ft)	6' - 9"	5' - 0"	A	
Top Diameter (in)	45.11"	33.42"	21.01"	16"
Bottom Diameter (in)	59.43"	47.8"	35.39"	22.38"
Taper (in/ft)	0.2688			
Grade	A572-65			
Weight (lbs)	15750	10792	5680	1531
Overall Steel Height (ft)	169			

Elevation annotations (top to bottom):
- 166' ↑ 6" x 12" @ 60°,180°,300°
- 153' ↑ 8" x 20" @ 60°,180°,300°
- 138' ↑ 8" x 20" @ 60°,180°,300°
- 123' ↑ 8" x 20" @ 60°,180°,300°
- 104' ↑ 6" x 12" @ 60°
- 73' ↑ 6" x 12" @ 60°
- 18' ↑ 6" x 12" @ 60°,180°,300°
- 8' ↑ 10.5" x 25.5" @ 90°,270°
- 4' ↑ 10.5" x 25.5" @ 180°,360°
- G.L.

Designed Appurtenance Loading

Elev	Description	Tx-Line
181	(1) ATC-GD1V40	(2) 7/8"
170	(3) DB222s	(3) 7/8"
170	(1) SP3-5.2	(1) 5/8"
170	(6) 20" x 20" x 5" Junction Boxs	(6) 1/2"
168	Flush Mount (Monopole Only)	
168	(1) Dish Mount (Monopole Only) - Pipe Mount (up to 6' Dish)	
168	L.P. Platform (Monopole Only) - 12' w/ Handrail	
155	L.P. Platform (Monopole Only) - 12'	
155	(3) Tower Top Amplifiers	(3) 1 5/8"
155	(12) 5960110s	(12) 1 5/8"
140	L.P. Platform (Monopole Only) - 12'	
140	(3) Tower Top Amplifiers	(3) 1 5/8"
140	(12) 5960110s	(12) 1 5/8"
125	L.P. Platform (Monopole Only) - 12'	
125	(3) Tower Top Amplifiers	(3) 1 5/8"
125	(12) 5960110s	(12) 1 5/8"
111	(1) ATC-GD1V40	(2) 7/8"
100	3ft Sidearm	
86	(1) ATC-GD1V40	(2) 7/8"
75	3ft Sidearm	
31.62	(3) DB224s	(3) 1/2"
20	(3) 3ft Sidearms	

Load Case Reactions

Description	Axial (kips)	Shear (kips)	Moment (ft-k)	Deflection (ft)	Sway (deg)
3s Gusted Wind	63.07	48.51	6082.13	15.54	10.68
3s Gusted Wind 0.9 Dead	47.31	48.57	5982.56	15.17	10.39
3s Gusted Wind&Ice	106.02	12.74	1745.25	4.85	3.48
Service Loads	52.48	10.49	1311	3.43	2.32

Base Plate Dimensions

Shape	Diameter	Thickness	Bolt Circle	Bolt Qty	Bolt Diameter
Round	72.25"	2.25"	66.5"	18	2.25"

Anchor Bolt Dimensions

Length	Diameter	Hole Diameter	Weight	Type	Finish
84"	2.25"	2.625"	2179.8	A615-75	Galv-18"

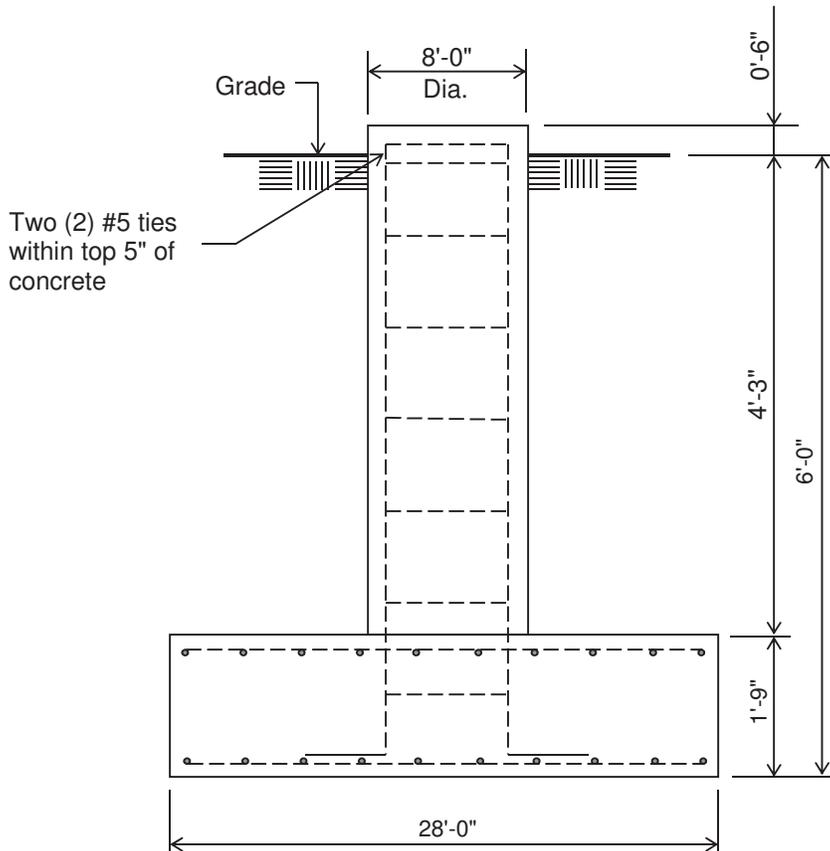## Material List

Display	Value
A	3' - 3"

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) The Monopole was designed for a basic wind speed of 90 mph with 0" of radial ice, and 40 mph with 1" of radial ice, in accordance with ANSI/TIA-222-G, Structure Class III, Exposure Category C, Topographic Category 1.
5) Full Height Step Bolts

Job:	130727
Customer:	BOONE COUNTY
Site Name:	Battle School, MO
Description:	170' Monopole
Date:	10/22/2015 By: BD

Customer: BOONE COUNTY
Site: Battle School, MO

170' Monopole at
90 mph Wind with no ice and 40 mph Wind with 1 in. Ice per ANSI/TIA-222-G.
Antenna Loading per Page 1

Grade

8'-0"
Dia.

0'-6"

Two (2) #5 ties
within top 5" of
concrete

4'-3"

6'-0"

1'-9"

28'-0"

ELEVATION VIEW
(59.66 Cu. Yds.)
(1 REQUIRED; NOT TO SCALE)

Notes:

1). Concrete shall have a minimum 28-day compressive strength of 4500 PSI, in accordance with ACI 318-05

2). Rebar to conform to ASTM specification A615 Grade 60.

3). All rebar to have a minimum of 3" concrete cover.

4). All exposed concrete corners to be chamfered 3/4".

5). The foundation design is based on the geotechnical report by Crockett, Project No. G15046, dated July 20, 2015

6). See the geotechnical report for compaction requirements, if specified.

7). The foundation is based on the following factored loads:
Moment (kip-ft) = 6082.13
Axial (kips) = 63.07
Shear (kips) = 48.51

Rebar Schedule per Pad and Pier	
Pier	(38) #9 vertical rebar w/ hooks at bottom w/ #5 ties, two within top 5" of top of pier then 12" C/C
Pad	(55) #8 horizontal rebar evenly spaced each way top and bottom (220 total)

8). 4.25 ft of soil cover is required over the entire area of the foundation slab.

Customer: BOONE COUNTY
Site: Battle School, MO

170' Monopole at
90 mph Wind with no ice and 40 mph Wind with 1 in. Ice per ANSI/TIA-222-G.
Antenna Loading per Page 1

Notes:

1). Concrete shall have a minimum 28-day compressive strength of 4000 PSI, in accordance with ACI 318-05.

2). Rebars to conform to ASTM specification A615 Grade 60.

3). All rebar to have a minimum of 3" concrete cover.

4). All exposed concrete corners to be chamfered 3/4".

5). The foundation design is based on the geotechnical report by Crockett, Project No. G15046, dated July 20, 2015

6). See the geotechnical report for drilled pier installation requirements, if specified.

7). The foundation is based on the following factored loads:
Moment (kip-ft) = 6082.13
Axial (kips) = 63.07
Shear (kips) = 48.51

ELEVATION VIEW
(69.81 Cu. Yds. each)
(1 REQUIRED; NOT TO SCALE)

Grade

8'-0"
Dia.

0'-6"

37'-0"

37'-6"

Two (2) #5 ties within top 5" of concrete

	Rebar Schedule per Pier
Pier	(38) #10 vertical rebar w/#5 ties, two within top 5" of pier then 7" C/C

7101 Southbridge Drive - P.O. Box 658 - Sioux City, IA 51102-0658 - Phone 712.258.6690 - Fax 712.279.0814

```
================================================================================
(USA) - Monopole Spatial Analysis            (c)2015     Guymast Inc.

Tel:(416)736-7453          Fax:(416)736-4372        Web:www.guymast.com

Processed under license at:

Sabre Towers and Poles                    on: 20 oct 2015  at: 13:27:49
================================================================================
```

170' Monopole / Battle School, MO

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

POLE GEOMETRY
=============

ELEV	SECTION NAME	No.of SIDES	OUTSIDE DIAM	THICK -NESS	RESISTANCES $\phi*Pn$	RESISTANCES $\phi*Mn$	SPLICE TYPE	...OVERLAP... LENGTH	RATIO
ft			in	in	kip	ft-kip		ft	
169.0	....								
			16.25	0.250	928.5	298.5			
	A	18							
			21.83	0.250	1252.9	545.6			
148.5	....								
			21.83	0.250	1252.9	545.6			
	A/B	18					SLIP	3.25	1.78
			22.23	0.312	1590.2	701.3			
145.2	....								
			22.23	0.312	1590.2	701.3			
	B	18							
			34.56	0.312	2435.1	1686.9			
100.0	....								
			34.56	0.312	2435.1	1686.9			
	B/C	18					SLIP	5.00	1.73
			35.31	0.438	3542.6	2490.3			
95.0	....								
			35.31	0.438	3542.6	2490.3			
	C	18							
			46.68	0.438	4648.5	4346.7			
53.2	....								
			46.68	0.438	4648.5	4346.7			
	C/D	18					SLIP	6.75	1.73
			47.67	0.438	4720.5	4508.5			
46.5	....								
			47.67	0.438	4720.5	4508.5			
	D	18							
			60.34	0.438	5551.5	6739.0			
0.0	....								

POLE ASSEMBLY
=============

SECTION NAME	BASE ELEV	............BOLTS AT BASE OF SECTION............ NUMBER	TYPE	DIAM	STRENGTH	THREADS IN SHEAR PLANE	CALC BASE ELEV
	ft			in	ksi		ft
A	145.250	0	A325	0.00	92.0	0	145.250
B	95.000	0	A325	0.00	92.0	0	95.000
C	46.500	0	A325	0.00	92.0	0	46.500
D	0.000	0	A325	0.00	92.0	0	0.000

POLE SECTIONS
=============

SECTION NAME	No.of SIDES	LENGTH	OUTSIDE.DIAMETER BOT *	OUTSIDE.DIAMETER TOP *	THICK- NESS	MAT- ERIAL ID	FLANGE.ID BOT	FLANGE.ID TOP	FLANGE.WELD ..GROUP.ID.. BOT	FLANGE.WELD ..GROUP.ID.. TOP
		ft	in	in	in					
A	18	23.75	22.73	16.25	0.250	1	0	0	0	0
B	18	53.50	35.94	21.33	0.312	2	0	0	0	0
C	18	53.50	48.54	33.94	0.438	3	0	0	0	0
D	18	53.25	60.34	45.81	0.438	4	0	0	0	0

      * - Diameter of circumscribed circle

MATERIAL TYPES
==============

TYPE OF SHAPE	TYPE NO	NO OF ELEM.	ORIENT & deg	HEIGHT in	WIDTH in	.THICKNESS. WEB in	.THICKNESS. FLANGE in	IRREGULARITY .PROJECTION. % OF AREA	IRREGULARITY .PROJECTION. ORIENT deg
PL	1	1	0.0	22.73	0.25	0.250	0.250	0.00	0.0
PL	2	1	0.0	35.94	0.31	0.312	0.312	0.00	0.0
PL	3	1	0.0	48.54	0.44	0.438	0.438	0.00	0.0
PL	4	1	0.0	60.34	0.44	0.438	0.438	0.00	0.0

& - With respect to vertical

MATERIAL PROPERTIES
===================

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
4	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

==

LOADING CONDITION A   ==

90 mph wind with no ice. Wind Azimuth: 0◆

LOADS ON POLE
=============

LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	AZI	LOAD AZI	......FORCES...... HORIZ kip	DOWN kip	......MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	180.000	0.00	0.0	0.0	0.0000	0.2333	0.0000	0.0000
C	180.000	0.00	0.0	0.0	0.6332	0.2966	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.0000	0.1860	0.0000	0.0000
C	169.000	0.00	0.0	0.0	2.4134	0.6512	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0000	0.1303	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0056	0.2904	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0000	0.8056	0.0000	0.0000
C	167.000	0.00	0.0	0.0	1.4465	2.0208	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0225	0.2316	0.0000	0.0000
C	154.000	0.00	0.0	0.0	0.0000	2.8829	0.0000	0.0000
C	154.000	0.00	0.0	0.0	8.5458	3.9504	0.0000	0.0000
C	139.000	0.00	0.0	0.0	0.0000	2.6021	0.0000	0.0000
C	139.000	0.00	0.0	0.0	8.3646	3.9504	0.0000	0.0000
C	124.000	0.00	0.0	0.0	0.0000	2.3213	0.0000	0.0000
C	124.000	0.00	0.0	0.0	8.1674	3.9504	0.0000	0.0000
C	110.000	0.00	0.0	0.0	0.0000	0.1426	0.0000	0.0000
C	110.000	0.00	0.0	0.0	0.5590	0.2966	0.0000	0.0000
C	99.000	0.00	0.0	0.0	0.2718	0.4116	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.0000	0.1102	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.5298	0.2966	0.0000	0.0000
C	74.000	0.00	0.0	0.0	0.2558	0.5760	0.0000	0.0000
C	30.620	0.00	0.0	0.0	0.0000	0.0441	0.0000	0.0000
C	30.620	0.00	0.0	0.0	0.5805	0.2383	0.0000	0.0000
C	19.000	0.00	0.0	0.0	0.3079	0.9360	0.0000	0.0000
D	169.000	0.00	180.0	0.0	0.0523	0.0541	0.0000	0.0000
D	148.500	0.00	180.0	0.0	0.0625	0.0659	0.0000	0.0000
D	148.500	0.00	180.0	0.0	0.0661	0.1561	0.0000	0.0000
D	145.250	0.00	180.0	0.0	0.0661	0.1561	0.0000	0.0000
D	145.250	0.00	180.0	0.0	0.0711	0.0958	0.0000	0.0000
D	130.167	0.00	180.0	0.0	0.0711	0.0958	0.0000	0.0000
D	130.167	0.00	180.0	0.0	0.0812	0.1120	0.0000	0.0000
D	115.083	0.00	180.0	0.0	0.0812	0.1120	0.0000	0.0000
D	115.083	0.00	180.0	0.0	0.0904	0.1283	0.0000	0.0000
D	100.000	0.00	180.0	0.0	0.0904	0.1283	0.0000	0.0000
D	100.000	0.00	180.0	0.0	0.0961	0.3303	0.0000	0.0000
D	95.000	0.00	180.0	0.0	0.0961	0.3303	0.0000	0.0000
D	95.000	0.00	180.0	0.0	0.0992	0.2055	0.0000	0.0000
D	81.083	0.00	180.0	0.0	0.0992	0.2055	0.0000	0.0000
D	81.083	0.00	180.0	0.0	0.1055	0.2265	0.0000	0.0000
D	67.167	0.00	180.0	0.0	0.1055	0.2265	0.0000	0.0000
D	67.167	0.00	180.0	0.0	0.1104	0.2475	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.1104	0.2475	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.1129	0.5219	0.0000	0.0000
D	46.500	0.00	180.0	0.0	0.1129	0.5219	0.0000	0.0000
D	46.500	0.00	180.0	0.0	0.1119	0.2727	0.0000	0.0000
D	34.875	0.00	180.0	0.0	0.1119	0.2727	0.0000	0.0000
D	34.875	0.00	180.0	0.0	0.1112	0.2902	0.0000	0.0000
D	23.250	0.00	180.0	0.0	0.1112	0.2902	0.0000	0.0000
D	23.250	0.00	180.0	0.0	0.1064	0.3078	0.0000	0.0000
D	11.625	0.00	180.0	0.0	0.1064	0.3078	0.0000	0.0000
D	11.625	0.00	180.0	0.0	0.1079	0.3254	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.1079	0.3254	0.0000	0.0000

ANTENNA LOADING
===============

.......ANTENNA.......			ATTACHMENT		..........ANTENNA FORCES..........			
TYPE	ELEV ft	AZI	RAD ft	AZI	AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip

```
STD      169.0    0.0    1.4    0.0     0.62    0.00      0.08      0.00
```

==

LOADING CONDITION M   ===

90 mph wind with no ice. Wind Azimuth: 0◆

LOADS ON POLE
=============

LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	AZI	LOAD AZI	......FORCES...... HORIZ kip	DOWN kip	......MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	180.000	0.00	0.0	0.0	0.0000	0.1750	0.0000	0.0000
C	180.000	0.00	0.0	0.0	0.6332	0.2225	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.0000	0.1395	0.0000	0.0000
C	169.000	0.00	0.0	0.0	2.4134	0.4884	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0000	0.0977	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0056	0.2178	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0000	0.6042	0.0000	0.0000
C	167.000	0.00	0.0	0.0	1.4465	1.5156	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0225	0.1737	0.0000	0.0000
C	154.000	0.00	0.0	0.0	0.0000	2.1622	0.0000	0.0000
C	154.000	0.00	0.0	0.0	8.5458	2.9628	0.0000	0.0000
C	139.000	0.00	0.0	0.0	0.0000	1.9516	0.0000	0.0000
C	139.000	0.00	0.0	0.0	8.3646	2.9628	0.0000	0.0000
C	124.000	0.00	0.0	0.0	0.0000	1.7410	0.0000	0.0000
C	124.000	0.00	0.0	0.0	8.1674	2.9628	0.0000	0.0000
C	110.000	0.00	0.0	0.0	0.0000	0.1069	0.0000	0.0000
C	110.000	0.00	0.0	0.0	0.5590	0.2225	0.0000	0.0000
C	99.000	0.00	0.0	0.0	0.2718	0.3087	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.0000	0.0826	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.5298	0.2225	0.0000	0.0000
C	74.000	0.00	0.0	0.0	0.2558	0.4320	0.0000	0.0000
C	30.620	0.00	0.0	0.0	0.0000	0.0331	0.0000	0.0000
C	30.620	0.00	0.0	0.0	0.5805	0.1787	0.0000	0.0000
C	19.000	0.00	0.0	0.0	0.3079	0.7020	0.0000	0.0000
D	169.000	0.00	180.0	0.0	0.0523	0.0406	0.0000	0.0000
D	148.500	0.00	180.0	0.0	0.0625	0.0494	0.0000	0.0000
D	148.500	0.00	180.0	0.0	0.0661	0.1171	0.0000	0.0000
D	145.250	0.00	180.0	0.0	0.0661	0.1171	0.0000	0.0000
D	145.250	0.00	180.0	0.0	0.0711	0.0718	0.0000	0.0000
D	130.167	0.00	180.0	0.0	0.0711	0.0718	0.0000	0.0000
D	130.167	0.00	180.0	0.0	0.0812	0.0840	0.0000	0.0000
D	115.083	0.00	180.0	0.0	0.0812	0.0840	0.0000	0.0000
D	115.083	0.00	180.0	0.0	0.0904	0.0962	0.0000	0.0000
D	100.000	0.00	180.0	0.0	0.0904	0.0962	0.0000	0.0000
D	100.000	0.00	180.0	0.0	0.0961	0.2478	0.0000	0.0000
D	95.000	0.00	180.0	0.0	0.0961	0.2478	0.0000	0.0000
D	95.000	0.00	180.0	0.0	0.0992	0.1541	0.0000	0.0000
D	81.083	0.00	180.0	0.0	0.0992	0.1541	0.0000	0.0000
D	81.083	0.00	180.0	0.0	0.1055	0.1699	0.0000	0.0000
D	67.167	0.00	180.0	0.0	0.1055	0.1699	0.0000	0.0000
D	67.167	0.00	180.0	0.0	0.1104	0.1856	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.1104	0.1856	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.1129	0.3914	0.0000	0.0000
D	46.500	0.00	180.0	0.0	0.1129	0.3914	0.0000	0.0000
D	46.500	0.00	180.0	0.0	0.1119	0.2045	0.0000	0.0000
D	34.875	0.00	180.0	0.0	0.1119	0.2045	0.0000	0.0000
D	34.875	0.00	180.0	0.0	0.1112	0.2177	0.0000	0.0000
D	23.250	0.00	180.0	0.0	0.1112	0.2177	0.0000	0.0000
D	23.250	0.00	180.0	0.0	0.1064	0.2309	0.0000	0.0000
D	11.625	0.00	180.0	0.0	0.1064	0.2309	0.0000	0.0000
D	11.625	0.00	180.0	0.0	0.1079	0.2440	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.1079	0.2440	0.0000	0.0000

ANTENNA LOADING
===============

TYPE	......ANTENNA....... ELEV ft	AZI	ATTACHMENT RAD ft	AZI	..........ANTENNA FORCES.......... AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
STD	169.0	0.0	1.4	0.0	0.62	0.00	0.06	0.00

==

LOADING CONDITION Y   ===

40 mph wind with 1 ice. Wind Azimuth: 0◆

LOADS ON POLE
=============

LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	AZI	LOAD AZI	......FORCES...... HORIZ kip	DOWN kip	......MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	180.000	0.00	0.0	0.0	0.0000	0.2333	0.0000	0.0000
C	180.000	0.00	0.0	0.0	0.5126	0.8894	0.0000	0.0000

```
C     169.000    0.00    0.0    0.0    0.0000    0.6567    0.0000    0.0000
C     169.000    0.00    0.0    0.0    0.9317    1.5525    0.0000    0.0000
C     167.000    0.00    0.0    0.0    0.0000    0.1303    0.0000    0.0000
C     167.000    0.00    0.0    0.0    0.0006    0.3139    0.0000    0.0000
C     167.000    0.00    0.0    0.0    0.0000    0.8056    0.0000    0.0000
C     167.000    0.00    0.0    0.0    0.6909    2.8985    0.0000    0.0000
C     167.000    0.00    0.0    0.0    0.0167    0.2316    0.0000    0.0000
C     154.000    0.00    0.0    0.0    0.0000    2.8829    0.0000    0.0000
C     154.000    0.00    0.0    0.0    1.8751    8.8764    0.0000    0.0000
C     139.000    0.00    0.0    0.0    0.0000    2.6021    0.0000    0.0000
C     139.000    0.00    0.0    0.0    1.8258    8.8265    0.0000    0.0000
C     124.000    0.00    0.0    0.0    0.0000    2.3213    0.0000    0.0000
C     124.000    0.00    0.0    0.0    1.7726    8.7716    0.0000    0.0000
C     110.000    0.00    0.0    0.0    0.0000    0.1426    0.0000    0.0000
C     110.000    0.00    0.0    0.0    0.4388    0.8611    0.0000    0.0000
C      99.000    0.00    0.0    0.0    0.0721    0.6909    0.0000    0.0000
C      85.000    0.00    0.0    0.0    0.0000    0.1102    0.0000    0.0000
C      85.000    0.00    0.0    0.0    0.4068    0.8469    0.0000    0.0000
C      74.000    0.00    0.0    0.0    0.0663    0.8474    0.0000    0.0000
C      30.620    0.00    0.0    0.0    0.0000    0.0441    0.0000    0.0000
C      30.620    0.00    0.0    0.0    0.3239    1.0001    0.0000    0.0000
C      19.000    0.00    0.0    0.0    0.0716    1.6494    0.0000    0.0000

D     169.000    0.00  180.0    0.0    0.0139    0.1264    0.0000    0.0000
D     162.167    0.00  180.0    0.0    0.0139    0.1264    0.0000    0.0000
D     162.167    0.00  180.0    0.0    0.0149    0.1386    0.0000    0.0000
D     155.333    0.00  180.0    0.0    0.0149    0.1386    0.0000    0.0000
D     155.333    0.00  180.0    0.0    0.0158    0.1507    0.0000    0.0000
D     148.500    0.00  180.0    0.0    0.0158    0.1507    0.0000    0.0000
D     148.500    0.00  180.0    0.0    0.0165    0.2455    0.0000    0.0000
D     145.250    0.00  180.0    0.0    0.0165    0.2455    0.0000    0.0000
D     145.250    0.00  180.0    0.0    0.0174    0.1916    0.0000    0.0000
D     130.167    0.00  180.0    0.0    0.0174    0.1916    0.0000    0.0000
D     130.167    0.00  180.0    0.0    0.0193    0.2209    0.0000    0.0000
D     115.083    0.00  180.0    0.0    0.0193    0.2209    0.0000    0.0000
D     115.083    0.00  180.0    0.0    0.0210    0.2498    0.0000    0.0000
D     100.000    0.00  180.0    0.0    0.0210    0.2498    0.0000    0.0000
D     100.000    0.00  180.0    0.0    0.0220    0.4600    0.0000    0.0000
D      95.000    0.00  180.0    0.0    0.0220    0.4600    0.0000    0.0000
D      95.000    0.00  180.0    0.0    0.0226    0.3403    0.0000    0.0000
D      81.083    0.00  180.0    0.0    0.0226    0.3403    0.0000    0.0000
D      81.083    0.00  180.0    0.0    0.0237    0.3715    0.0000    0.0000
D      67.167    0.00  180.0    0.0    0.0237    0.3715    0.0000    0.0000
D      67.167    0.00  180.0    0.0    0.0245    0.4017    0.0000    0.0000
D      53.250    0.00  180.0    0.0    0.0245    0.4017    0.0000    0.0000
D      53.250    0.00  180.0    0.0    0.0248    0.6821    0.0000    0.0000
D      46.500    0.00  180.0    0.0    0.0248    0.6821    0.0000    0.0000
D      46.500    0.00  180.0    0.0    0.0246    0.4351    0.0000    0.0000
D      11.625    0.00  180.0    0.0    0.0230    0.4754    0.0000    0.0000
D      11.625    0.00  180.0    0.0    0.0229    0.4842    0.0000    0.0000
D       0.000    0.00  180.0    0.0    0.0229    0.4842    0.0000    0.0000
```

ANTENNA LOADING
==============

.......ANTENNA.......			ATTACHMENT		...........ANTENNA FORCES..........			
TYPE	ELEV ft	AZI	RAD ft	AZI	AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
STD	169.0	0.0	1.4	0.0	0.09	0.00	0.31	0.00

```
================================================================================

================================================================================
```
(USA) - Monopole Spatial Analysis   (c)2015   Guymast Inc.

Tel:(416)736-7453   Fax:(416)736-4372   Web:www.guymast.com

Processed under license at:

Sabre Towers and Poles   on: 20 oct 2015 at: 13:27:49
```
================================================================================
```

170' Monopole / Battle School, MO

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

MAST ELEV ft	.......DEFLECTIONS (ft)......... ..... HORIZONTAL ...... ALONG	 ACROSS	 DOWN	.........ROTATIONS (deg)......... .... TILT .... ALONG	 ACROSS	 TWIST	
169.0	15.54A	-0.39W	2.04A	10.68A	-0.33W	-0.02W	
162.2	14.31A	-0.36W	1.81A	10.59A	-0.32W	-0.02W	
155.3	13.10A	-0.32W	1.59A	10.39A	-0.30W	-0.02W	
148.5	11.92A	-0.29W	1.38A	10.10A	-0.28W	-0.01W	
145.2	11.36A	-0.27W	1.28A	9.94A	-0.28W	-0.01W	
130.2	8.94A	-0.20W	0.88A	8.95A	-0.23W	-0.01W	

```
 115.1      6.79A     -0.15W    0.57A           7.65A       -0.18W   -0.01W
         ................................................................
 100.0      5.00A     -0.11W    0.35A           6.19A       -0.14W    0.00W

  95.0      4.48A     -0.10W    0.29A           5.84A       -0.13W    0.00W
         ................................................................
  81.1      3.19A     -0.07W    0.18A           4.83A       -0.11W    0.00W

  67.2      2.14A     -0.04W    0.10A           3.87A       -0.08W    0.00W
         ................................................................
  53.2      1.32A     -0.03W    0.05A           2.98A       -0.06W    0.00W

  46.5      0.99A     -0.02W    0.03A           2.56A       -0.05W    0.00W
         ................................................................
  34.9      0.55A     -0.01W    0.01A           1.86A       -0.04W    0.00K

  23.2      0.24A      0.00W    0.00A           1.20A       -0.02W    0.00K
         ................................................................
  11.6      0.06A      0.00W    0.00A           0.58A       -0.01W    0.00K

   0.0      0.00A      0.00A    0.00A           0.00A        0.00A    0.00A
         ................................................................
```

MAXIMUM ANTENNA ROTATIONS
=========================

ELEV ft	ANT AZI deg	ANT TYPE	.... BEAM DEFLECTIONS (deg)			
			ROLL	YAW	PITCH	TOTAL
169.0	0.0	STD	10.410 D	0.878 C	10.685 A	10.685 A

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

MAST ELEV ft	TOTAL AXIAL kip	SHEAR.w.r.t.WIND.DIR ALONG kip	ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	ACROSS ft-kip	TORSION ft-kip
169.0						
	3.65 c	3.66 A	0.52 O	-7.08 G	-0.43 h	-0.42 U
	8.89 c	5.50 A	0.52 O	-44.17 A	3.50 K	0.51 C
162.2						
	8.89 c	5.52 A	0.52 C	-44.15 A	3.49 K	0.51 C
	9.84 c	5.90 A	0.52 C	-88.47 A	-7.12 C	0.97 C
155.3						
	9.84 c	5.90 A	0.52 O	-88.45 A	7.13 K	0.97 C
	22.63 c	14.86 A	0.52 O	-187.90 A	10.88 K	1.22 C
148.5						
	22.63 Z	14.91 X	-0.56 W	-188.12 A	-10.89 C	1.24 C
	23.43 Z	15.13 X	-0.56 W	-242.27 A	12.68 K	1.31 C
145.2						
	23.43 a	15.19 A	-0.65 W	-242.44 A	12.77 K	1.33 C
	37.75 a	24.61 A	-0.65 W	-588.62 A	22.92 W	-1.64 W
130.2						
	37.75 c	24.57 A	-0.71 W	-588.63 A	22.91 W	-1.64 W
	52.17 c	33.95 A	-0.71 W	-1087.42 A	34.26 W	-1.79 W
115.1						
	52.17 c	33.97 A	-0.72 W	-1087.41 A	34.26 W	-1.79 W
	56.94 c	35.88 A	-0.72 W	-1662.87 A	45.74 W	-1.84 W
100.0						
	56.94 c	35.97 M	-0.67 W	-1662.89 A	45.75 W	-1.84 W
	59.93 c	36.72 M	-0.67 W	-1859.57 A	49.29 W	-1.84 W
95.0						
	59.93 c	36.64 M	-0.74 W	-1859.88 A	49.22 W	-1.82 W
	65.62 c	38.55 M	-0.74 W	-2421.76 A	59.99 W	-1.89 W
81.1						
	65.61 a	38.62 M	-0.74 W	-2421.79 A	59.98 W	-1.88 W
	71.63 a	40.34 M	-0.74 W	-3007.62 A	70.79 W	-1.94 W
67.2						
	71.63 a	40.34 M	-0.73 W	-3007.63 A	70.81 W	-1.94 W
	77.22 a	41.87 M	-0.73 W	-3611.64 A	81.44 W	-1.97 W
53.2						
	77.22 a	41.85 M	-0.74 W	-3611.62 A	81.43 W	-1.97 W
	81.82 a	42.61 M	-0.74 W	-3910.67 A	86.56 W	-1.98 W
46.5						
	81.82 a	42.59 M	-0.72 W	-3910.65 A	86.56 W	-1.98 W
	86.96 a	43.89 M	-0.72 W	-4434.10 A	95.15 W	-1.99 W
34.9						
	86.96 a	43.89 M	-0.71 W	-4434.10 A	95.15 W	-1.99 W

```
        93.29 a    45.77 M    -0.71 W  -4971.19 A    103.63 W    -1.99 W
 23.2   ...................................................................
        93.29 a    45.78 M    -0.73 W  -4971.19 A    103.64 W    -1.99 W

        100.39 a   47.32 M    -0.73 W  -5522.04 A    112.22 W     2.08 K
 11.6   ...................................................................
        100.39 a   47.32 M    -0.72 W  -5522.04 A    112.21 W     2.08 K

        106.02 a   48.57 M    -0.72 W  -6082.13 A    120.67 W     2.11 K
-------------------------------------------------------------------------------
base
reaction 106.02 a  -48.57 M    0.72 W   6082.13 A   -120.67 W    -2.11 K
-------------------------------------------------------------------------------
```

COMPLIANCE WITH 4.8.2 & 4.5.4
=============================

ELEV	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t(w/t)	MAX ALLOWED
ft							
169.00							
	0.00c	0.02G	0.01A	0.03G	YES	9.52A	45.2
	0.01c	0.12A	0.01A	0.12A	YES	10.82A	45.2
162.17							
	0.01c	0.12A	0.01A	0.12A	YES	10.82A	45.2
	0.01c	0.19A	0.01A	0.20A	YES	12.11A	45.2
155.33							
	0.01c	0.19A	0.01A	0.20A	YES	12.11A	45.2
	0.02c	0.34A	0.02A	0.35A	YES	13.41A	45.2
148.50							
	0.01z	0.28A	0.02X	0.29A	YES	10.37A	45.2
	0.01z	0.33A	0.02X	0.34A	YES	10.87A	45.2
145.25							
	0.01a	0.35A	0.02A	0.35A	YES	10.59A	45.2
	0.02a	0.59A	0.03A	0.61A	YES	12.87A	45.2
130.17							
	0.02c	0.59A	0.03A	0.61A	YES	12.87A	45.2
	0.02c	0.82A	0.03A	0.83A	YES	15.16A	45.2
115.08							
	0.02c	0.82A	0.03A	0.83A	YES	15.16A	45.2
	0.02c	0.99A	0.03A	1.00A	YES	17.45A	45.2
100.00							
	0.02c	0.70A	0.02M	0.71A	YES	11.96A	45.2
	0.02c	0.72A	0.02M	0.73A	YES	12.50A	45.2
95.00							
	0.02c	0.75A	0.02M	0.76A	YES	12.25A	45.2
	0.02c	0.79A	0.02M	0.80A	YES	13.76A	45.2
81.08							
	0.02a	0.79A	0.02M	0.80A	YES	13.76A	45.2
	0.02a	0.81A	0.02M	0.82A	YES	15.26A	45.2
67.17							
	0.02a	0.81A	0.02M	0.82A	YES	15.26A	45.2
	0.02a	0.83A	0.02M	0.84A	YES	16.77A	45.2
53.25							
	0.02a	0.83A	0.02M	0.84A	YES	16.77A	45.2
	0.02a	0.84A	0.02M	0.85A	YES	17.50A	45.2
46.50							
	0.02a	0.87A	0.02M	0.88A	YES	17.15A	45.2
	0.02a	0.88A	0.02M	0.89A	YES	18.41A	45.2
34.87							
	0.02a	0.88A	0.02M	0.89A	YES	18.41A	45.2
	0.02a	0.89A	0.02M	0.90A	YES	19.67A	45.2
23.25							
	0.02a	0.89A	0.02M	0.90A	YES	19.67A	45.2
	0.02a	0.90A	0.02M	0.91A	YES	20.93A	45.2
11.62							
	0.02a	0.90A	0.02M	0.91A	YES	20.93A	45.2
	0.02a	0.90A	0.02M	0.91A	YES	22.19A	45.2
0.00							

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

| DOWN | SHEAR.w.r.t.WIND.DIR | | MOMENT.w.r.t.WIND.DIR | | TORSION |
| | ALONG | ACROSS | ALONG | ACROSS | |
kip	kip	kip	ft-kip	ft-kip	ft-kip
106.02	48.57	-0.72	-6082.13	120.67	2.11

==

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

Tel:(416)736-7453   Fax:(416)736-4372   Web:www.guymast.com

Processed under license at:

Sabre Towers and Poles   on: 20 oct 2015 at: 13:27:58
==

170' Monopole / Battle School, MO

****
************************** 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
 =============

LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	AZI	LOAD AZI	......FORCES...... HORIZ kip	DOWN kip	......MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	180.000	0.00	0.0	0.0	0.0000	0.1944	0.0000	0.0000
C	180.000	0.00	0.0	0.0	0.1369	0.2472	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.0000	0.1550	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.5216	0.5427	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0000	0.1085	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0012	0.2420	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0000	0.6713	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.3126	1.6840	0.0000	0.0000
C	167.000	0.00	0.0	0.0	0.0049	0.1930	0.0000	0.0000
C	154.000	0.00	0.0	0.0	0.0000	2.4024	0.0000	0.0000
C	154.000	0.00	0.0	0.0	1.8469	3.2920	0.0000	0.0000
C	139.000	0.00	0.0	0.0	0.0000	2.1684	0.0000	0.0000
C	139.000	0.00	0.0	0.0	1.8078	3.2920	0.0000	0.0000
C	124.000	0.00	0.0	0.0	0.0000	1.9344	0.0000	0.0000
C	124.000	0.00	0.0	0.0	1.7651	3.2920	0.0000	0.0000
C	110.000	0.00	0.0	0.0	0.0000	0.1188	0.0000	0.0000
C	110.000	0.00	0.0	0.0	0.1208	0.2472	0.0000	0.0000
C	99.000	0.00	0.0	0.0	0.0587	0.3430	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.0000	0.0918	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.1145	0.2472	0.0000	0.0000
C	74.000	0.00	0.0	0.0	0.0553	0.4800	0.0000	0.0000
C	30.620	0.00	0.0	0.0	0.0000	0.0367	0.0000	0.0000
C	30.620	0.00	0.0	0.0	0.1254	0.1986	0.0000	0.0000
C	19.000	0.00	0.0	0.0	0.0665	0.7800	0.0000	0.0000
D	169.000	0.00	180.0	0.0	0.0113	0.0451	0.0000	0.0000
D	148.500	0.00	180.0	0.0	0.0135	0.0549	0.0000	0.0000
D	148.500	0.00	180.0	0.0	0.0143	0.1301	0.0000	0.0000
D	145.250	0.00	180.0	0.0	0.0143	0.1301	0.0000	0.0000
D	145.250	0.00	180.0	0.0	0.0154	0.0798	0.0000	0.0000
D	130.167	0.00	180.0	0.0	0.0154	0.0798	0.0000	0.0000
D	130.167	0.00	180.0	0.0	0.0175	0.0934	0.0000	0.0000
D	115.083	0.00	180.0	0.0	0.0175	0.0934	0.0000	0.0000
D	115.083	0.00	180.0	0.0	0.0195	0.1069	0.0000	0.0000
D	100.000	0.00	180.0	0.0	0.0195	0.1069	0.0000	0.0000
D	100.000	0.00	180.0	0.0	0.0208	0.2753	0.0000	0.0000
D	95.000	0.00	180.0	0.0	0.0208	0.2753	0.0000	0.0000
D	95.000	0.00	180.0	0.0	0.0214	0.1713	0.0000	0.0000
D	81.083	0.00	180.0	0.0	0.0214	0.1713	0.0000	0.0000
D	81.083	0.00	180.0	0.0	0.0228	0.1888	0.0000	0.0000
D	67.167	0.00	180.0	0.0	0.0228	0.1888	0.0000	0.0000
D	67.167	0.00	180.0	0.0	0.0239	0.2062	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0239	0.2062	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0244	0.4349	0.0000	0.0000
D	46.500	0.00	180.0	0.0	0.0244	0.4349	0.0000	0.0000
D	46.500	0.00	180.0	0.0	0.0242	0.2272	0.0000	0.0000
D	34.875	0.00	180.0	0.0	0.0242	0.2272	0.0000	0.0000
D	34.875	0.00	180.0	0.0	0.0240	0.2419	0.0000	0.0000
D	23.250	0.00	180.0	0.0	0.0240	0.2419	0.0000	0.0000
D	23.250	0.00	180.0	0.0	0.0230	0.2565	0.0000	0.0000
D	11.625	0.00	180.0	0.0	0.0230	0.2565	0.0000	0.0000
D	11.625	0.00	180.0	0.0	0.0233	0.2712	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0233	0.2712	0.0000	0.0000

ANTENNA LOADING

```
==============
```

.......ANTENNA.......		ATTACHMENT		..........ANTENNA FORCES..........			
TYPE	ELEV ft	AZI	RAD ft	AZI	AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
STD	169.0	0.0	1.4	0.0	0.13	0.00	0.06	0.00

```
===============================================================================
```

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

MAST ELEV ft	.......DEFLECTIONS (ft).........		DOWN	.........ROTATIONS (deg).........		TWIST
	..... HORIZONTAL ...... ALONG	ACROSS		.... TILT .... ALONG	ACROSS	
169.0	3.43A	0.08C	0.10A	2.32A	0.07C	0.00E
162.2	3.15A	0.07C	0.09A	2.30A	0.07C	0.00E
155.3	2.88A	0.06C	0.08A	2.26A	0.06C	0.00E
148.5	2.62A	0.06C	0.07A	2.19A	0.06C	0.00E
145.2	2.49A	0.05C	0.06A	2.16A	0.06C	0.00E
130.2	1.95A	0.04C	0.04A	1.94A	0.05C	0.00E
115.1	1.48A	0.03C	0.03A	1.66A	0.04C	0.00E
100.0	1.08A	0.02C	0.02A	1.34A	0.03C	0.00E
95.0	0.97A	0.02C	0.02A	1.26A	0.03C	0.00E
81.1	0.69A	0.01C	0.01A	1.04A	0.02C	0.00E
67.2	0.46A	0.01C	0.01A	0.83A	0.02C	0.00E
53.2	0.28A	0.01C	0.00A	0.64A	0.01C	0.00E
46.5	0.21A	0.00C	0.00A	0.55A	0.01C	0.00E
34.9	0.12A	0.00C	0.00A	0.40A	0.01C	0.00E
23.2	0.05A	0.00C	0.00A	0.26A	0.00C	0.00E
11.6	0.01A	0.00C	0.00L	0.12A	0.00C	0.00E
0.0	0.00A	0.00A	0.00A	0.00A	0.00A	0.00A

MAXIMUM ANTENNA ROTATIONS
```
=========================
```

ELEV ft	ANT AZI deg	ANT TYPE	.... BEAM DEFLECTIONS (deg) ...... ROLL	YAW	PITCH	TOTAL
169.0	0.0	STD	2.253 D	0.042 C	2.324 A	2.324 A

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

MAST ELEV ft	TOTAL AXIAL kip	SHEAR.w.r.t.WIND.DIR ALONG kip	ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	ACROSS ft-kip	TORSION ft-kip
169.0						
	1.20 C	0.79 A	0.11 C	-1.60 G	0.09 D	-0.09 I
	4.42 C	1.19 A	0.11 C	-9.57 A	-0.72 C	0.09 E
162.2						
	4.42 D	1.19 A	-0.11 K	-9.57 A	-0.73 C	0.09 E
	4.76 D	1.28 A	-0.11 K	-19.25 A	1.52 K	0.09 E
155.3						
	4.77 L	1.27 A	0.11 C	-19.24 A	1.53 K	0.09 E
	10.82 L	3.21 A	0.11 C	-40.91 A	-2.37 C	0.09 E
148.5						
	10.83 L	3.21 L	0.11 C	-40.92 A	-2.37 C	0.09 E
	11.25 L	3.26 L	0.11 C	-52.79 A	-2.76 C	0.09 E
145.2						
	11.25 E	3.26 A	0.13 C	-52.83 A	-2.77 C	0.09 E
	17.92 E	5.30 A	0.13 C	-127.83 A	-5.00 C	0.09 E
130.2						
	17.91 L	5.31 A	0.13 C	-127.83 A	-5.00 C	0.09 E
	24.55 L	7.34 A	0.13 C	-235.90 A	-7.26 C	0.10 E

```
115.1  ...................................................................
        24.55 L    7.34 A    0.13 C   -235.89 A    -7.26 C    0.10 E
        26.53 L    7.76 A    0.13 C   -360.08 A    -9.50 C    0.11 E
100.0  ...................................................................
        26.53 L    7.75 A    0.13 C   -360.08 A    -9.50 C    0.11 E
        28.25 L    7.91 A    0.13 C   -402.40 A   -10.23 C    0.11 E
 95.0  ...................................................................
        28.25 L    7.91 A    0.12 C   -402.41 A   -10.24 C    0.11 E
        30.97 L    8.33 A    0.12 C   -523.27 A   -12.05 C    0.12 E
 81.1  ...................................................................
        30.97 L    8.33 A    0.12 C   -523.27 A   -12.06 C    0.12 E
        34.07 L    8.70 A    0.12 C   -649.08 A   -13.85 C    0.12 E
 67.2  ...................................................................
        34.07 L    8.70 A    0.12 C   -649.08 A   -13.85 C    0.12 E
        36.94 L    9.03 A    0.12 C   -778.78 A   -15.61 C    0.13 E
 53.2  ...................................................................
        36.94 L    9.03 A    0.12 C   -778.78 A   -15.60 C    0.13 E
        39.88 L    9.20 A    0.12 C   -842.98 A   -16.44 C    0.13 E
 46.5  ...................................................................
        39.88 L    9.20 A    0.12 C   -843.00 A   -16.45 C    0.13 E
        42.52 L    9.48 A    0.12 C   -955.52 A   -17.88 C    0.13 E
 34.9  ...................................................................
        42.52 L    9.48 A    0.12 C   -955.52 A   -17.88 C    0.13 E
        45.57 L    9.88 A    0.12 C  -1071.21 A   -19.28 C    0.13 E
 23.2  ...................................................................
        45.57 L    9.89 A    0.12 C  -1071.21 A   -19.28 C    0.13 E
        49.33 L   10.22 A    0.12 C  -1190.00 A   -20.68 C    0.13 E
 11.6  ...................................................................
        49.33 L   10.22 A    0.12 C  -1190.00 A   -20.68 C    0.13 E
        52.48 L   10.49 A    0.12 C  -1311.00 A   -22.05 C    0.13 E
-------------------------------------------------------------------------
base
reaction  52.48 L  -10.49 A   -0.12 C  1311.00 A    22.05 C   -0.13 E
-------------------------------------------------------------------------
```

COMPLIANCE WITH 4.8.2 & 4.5.4
=============================

ELEV	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t(w/t)	MAX ALLOWED
ft							
169.00							
	0.00C	0.01G	0.00A	0.01G	YES	9.52A	45.2
	0.00C	0.03A	0.00A	0.03A	YES	10.82A	45.2
162.17							
	0.00D	0.03A	0.00A	0.03A	YES	10.82A	45.2
	0.00D	0.04A	0.00A	0.05A	YES	12.11A	45.2
155.33							
	0.00L	0.04A	0.00A	0.05A	YES	12.11A	45.2
	0.01L	0.07A	0.01A	0.08A	YES	13.41A	45.2
148.50							
	0.01L	0.06A	0.00L	0.07A	YES	10.37A	45.2
	0.01L	0.07A	0.00L	0.08A	YES	10.87A	45.2
145.25							
	0.01E	0.08A	0.00A	0.08A	YES	10.59A	45.2
	0.01E	0.13A	0.01A	0.14A	YES	12.87A	45.2
130.17							
	0.01L	0.13A	0.01A	0.14A	YES	12.87A	45.2
	0.01L	0.18A	0.01A	0.19A	YES	15.16A	45.2
115.08							
	0.01L	0.18A	0.01A	0.19A	YES	15.16A	45.2
	0.01L	0.21A	0.01A	0.22A	YES	17.45A	45.2
100.00							
	0.01L	0.15A	0.00A	0.16A	YES	11.96A	45.2
	0.01L	0.16A	0.00A	0.16A	YES	12.50A	45.2
95.00							
	0.01L	0.16A	0.00A	0.17A	YES	12.25A	45.2
	0.01L	0.17A	0.00A	0.18A	YES	13.76A	45.2
81.08							
	0.01L	0.17A	0.00A	0.18A	YES	13.76A	45.2
	0.01L	0.18A	0.00A	0.18A	YES	15.26A	45.2
67.17							
	0.01L	0.18A	0.00A	0.18A	YES	15.26A	45.2
	0.01L	0.18A	0.00A	0.19A	YES	16.77A	45.2

```
                                                  130727
53.25  ....................................................................
            0.01L    0.18A    0.00A    0.19A    YES    16.77A    45.2
            0.01L    0.18A    0.00A    0.19A    YES    17.50A    45.2
46.50  ...................................................................:
            0.01L    0.19A    0.00A    0.20A    YES    17.15A    45.2
            0.01L    0.19A    0.00A    0.20A    YES    18.41A    45.2
34.87  ...................................................................:
            0.01L    0.19A    0.00A    0.20A    YES    18.41A    45.2
            0.01L    0.19A    0.00A    0.20A    YES    19.67A    45.2
23.25  ...................................................................:
            0.01L    0.19A    0.00A    0.20A    YES    19.67A    45.2
            0.01L    0.19A    0.00A    0.20A    YES    20.93A    45.2
11.62  ...................................................................:
            0.01L    0.19A    0.00A    0.20A    YES    20.93A    45.2
            0.01L    0.19A    0.00A    0.20A    YES    22.19A    45.2
 0.00  ..................................................................
```

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

```
    DOWN     SHEAR.w.r.t.WIND.DIR    MOMENT.w.r.t.WIND.DIR    TORSION
              ALONG      ACROSS        ALONG      ACROSS
     kip        kip         kip       ft-kip      ft-kip      ft-kip

    52.48     10.49        0.12     -1311.00     -22.05        0.13
      L         A           C           A          C            E
```

==

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

Pole Data

Diameter:	59.430	in (flat to flat)
Thickness:	0.4375	in
Yield (Fy):	65	ksi
# of Sides:	18	"0" IF Round
Strength (Fu):	80	ksi

Reactions

Moment, Mu:	6082.13	ft-kips
Axial, Pu:	63.07	kips
Shear, Vu:	48.51	kips

Anchor Rod Data

Quantity:	18	
Diameter:	2.25	in
Rod Material:	A615	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
BC Diam. (in):	66.5	BC Override:

Anchor Rod Results

Maximum Rod (Pu+ Vu/η):	252.8 Kips	
Allowable Φ*Rnt:	260.0 Kips	(per 4.9.9)
Anchor Rod Interaction Ratio:	**97.2% Pass**	

Plate Data

Diameter (in):	72.25	Dia. Override:
Thickness:	2.25	in
Yield (Fy):	50	ksi
Eff Width/Rod:	10.48	in
Drain Hole:	2.625	in. diameter
Drain Location:	27.5	in. center of pole to center of drain hole
Center Hole:	47	in. diameter

Base Plate Results

Base Plate (Mu/Z):	42.0 ksi	
Allowable Φ*Fy:	45.0 ksi	(per AISC)
Base Plate Interaction Ratio:	**93.4% Pass**	

MAT FOUNDATION DESIGN BY SABRE TOWERS & POLES

170' Monopole BOONE COUNTY Battle School, MO (130727) 10-22-15 BD

Overall Loads:

Factored Moment (ft-kips)	6082.13		
Factored Axial (kips)	63.07		
Factored Shear (kips)	48.51		
Bearing Design Strength (ksf)	4.5	Max. Net Bearing Press. (ksf)	4.22
Water Table Below Grade (ft)	**28**		
Width of Mat (ft)	28	Allowable Bearing Pressure (ksf)	**3.00**
Thickness of Mat (ft)	1.75	Safety Factor	**2.00**
Depth to Bottom of Slab (ft)	6	Ultimate Bearing Pressure (ksf)	6.00
Quantity of Bolts in Bolt Circle	18	Bearing Φs	0.75
Bolt Circle Diameter (in)	66.5		
Top of Concrete to Top of Bottom Threads (in)	60		
Diameter of Pier (ft)	8	Minimum Pier Diameter (ft)	7.04
Ht. of Pier Above Ground (ft)	0.5	Equivalent Square b (ft)	7.09
Ht. of Pier Below Ground (ft)	4.25		
Quantity of Bars in Mat	55		
Bar Diameter in Mat (in)	1		
Area of Bars in Mat (in^2)	43.20		
Spacing of Bars in Mat (in)	6.09	Recommended Spacing (in)	6 to 12
Quantity of Bars Pier	38		
Bar Diameter in Pier (in)	1.128		
Tie Bar Diameter in Pier (in)	0.625		
Spacing of Ties (in)	12		
Area of Bars in Pier (in^2)	37.97	Minimum Pier A_s (in^2)	36.19
Spacing of Bars in Pier (in)	7.24	Recommended Spacing (in)	6 to 12
f'c (ksi)	4.5		
fy (ksi)	60		
Unit Wt. of Soil (kcf)	**0.12**		
Unit Wt. of Concrete (kcf)	0.15		

Volume of Concrete (yd^3)	59.66		

Two-Way Shear Action:

Average d (in)	17		
ϕV_c (kips)	1347.4	V_u (kips)	104.9
$\phi V_c = \phi(2 + 4/\beta_c)f'^{1/2}_c b_o d$	2064.7		
$\phi V_c = \phi(\alpha_s d/b_o + 2)f'^{1/2}_c b_o d$	1347.4		
$\phi V_c = \phi 4 f'^{1/2}_c b_o d$	1376.5		
Shear perimeter, b_o (in)	355.00		
β_c	1		

One-Way Shear:

ϕV_c (kips)	651.4	V_u (kips)	409.7

Stability:

Overturning Design Strength (ft-k)	8421.6	Total Applied M (ft-k)	6397.4

Pier Design:

ϕV_n (kips)	844.5	V_u (kips)	48.5
$\phi V_c = \phi 2(1 + N_u/(2000 A_g)) f'_c{}^{1/2} b_w d$	844.5		
V_s (kips)	0.0	*** V_s max $= 4 f'_c{}^{1/2} b_w d$ (kips)	1978.3
Maximum Spacing (in)	7.62	(Only if Shear Ties are Required)	
Actual Hook Development (in)	16.00	Req'd Hook Development l_{dh} (in)	14.12

*** Ref. To Spacing Requirements ACI 11.5.4.3

Flexure in Slab:

ϕM_n (ft-kips)	3108.6	M_u (ft-kips)	3084.0
a (in)	2.02		
Steel Ratio	0.00756		
β_1	0.825		
Maximum Steel Ratio (ρ_t)	0.0197		
Minimum Steel Ratio	0.0018		
Rebar Development in Pad (in)	122.46	Required Development in Pad (in)	26.57

Condition	1 is OK, 0 Fails
Maximum Soil Bearing Pressure	1
Pier Area of Steel	1
Pier Shear	1
Interaction Diagram Visual Check	1
Two-Way Shear Action	1
One-Way Shear Action	1
Overturning	1
Flexure	1
Steel Ratio	1
Length of Development in Pad	1
Hook Development	1

==

LPile Plus for Windows, Version 2013-07.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

© 1985-2013 by Ensoft, Inc.
All Rights Reserved

==

This copy of LPile is used by:

Ben Daleske
Sabre Towers and Poles

Serial Number of Security Device: 227886555
This copy of LPile is licensed for exclusive use by: Sabre Industries, Sioux City, IA

Use of this program by any entity other than Sabre Industries, Sioux City, IA
is forbidden by the software license agreement.

Files Used for Analysis

Path to file locations: C:\Progra~2\Ensoft\Lpile2013\
Name of input data file: 130727.lp7d
Name of output report file: 130727.lp7o
Name of plot output file: 130727.lp7p
Name of runtime messeage file: 130727.lp7r

Date and Time of Analysis

Date: October 22, 2015   Time: 14:29:47

Problem Title

170' Monopole BOONE COUNTY Battle School, MO (130727) 10-22-15 BD

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Engineering Units of Input Data and Computations:
 - Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed   =   300
 - Deflection tolerance for convergence   =   1.0000E-05 in
 - Maximum allowable deflection   =   100.0000 in
 - Number of pile increments   =   100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

Computational Options:
 - Use unfactored loads in computations (conventional analysis)
 - Compute pile response under loading and nonlinear bending properties of pile
   (only if nonlinear pile properties are input)
 - Use of p-y modification factors for p-y curves not selected
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - No p-y curves to be computed and reported for user-specified depths
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 3

```
-------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
-------------------------------------------------------------------------------

Total number of pile sections                   =           1

Total length of pile                            =       37.50 ft

Depth of ground surface below top of pile       =        0.50 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile.

Point        Depth          Pile
               X          Diameter
               ft            in
-----      ---------     -----------
  1         0.00000      96.0000000
  2        37.500000     96.0000000


Input Structural Properties:
--------------------------

Pile Section No. 1:

    Section Type                               = Drilled Shaft (Bored Pile)
    Section Length                             =       37.50000 ft
    Section Diameter                           =       96.00000 in


-------------------------------------------------------------------------------
                     Ground Slope and Pile Batter Angles
-------------------------------------------------------------------------------

Ground Slope Angle                              =        0.000 degrees
                                                =        0.000 radians

Pile Batter Angle                               =        0.000 degrees
                                                =        0.000 radians


-------------------------------------------------------------------------------
                      Soil and Rock Layering Information
-------------------------------------------------------------------------------

The soil profile is modelled using 5 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

    Distance from top of pile to top of layer     =        0.50000 ft
    Distance from top of pile to bottom of layer  =        3.50000 ft
    Effective unit weight at top of layer         =      124.93440 pcf
    Effective unit weight at bottom of layer      =      124.93440 pcf
    Undrained cohesion at top of layer            =       14.40000 psf
    Undrained cohesion at bottom of layer         =       14.40000 psf
    Epsilon-50 at top of layer                    =        0.10000
    Epsilon-50 at bottom of layer                 =        0.10000


Layer 2 is stiff clay without free water

    Distance from top of pile to top of layer     =        3.50000 ft
    Distance from top of pile to bottom of layer  =       13.50000 ft
    Effective unit weight at top of layer         =      124.93440 pcf
    Effective unit weight at bottom of layer      =      124.93440 pcf
    Undrained cohesion at top of layer            =     1249.92000 psf
    Undrained cohesion at bottom of layer         =     1249.92000 psf
    Epsilon-50 at top of layer                    =        0.00900
    Epsilon-50 at bottom of layer                 =        0.00900


Layer 3 is stiff clay without free water

    Distance from top of pile to top of layer     =       13.50000 ft
    Distance from top of pile to bottom of layer  =       28.50000 ft
    Effective unit weight at top of layer         =      124.93440 pcf
    Effective unit weight at bottom of layer      =      124.93440 pcf
    Undrained cohesion at top of layer            =     2999.52000 psf
    Undrained cohesion at bottom of layer         =     2999.52000 psf
    Epsilon-50 at top of layer                    =        0.00500
    Epsilon-50 at bottom of layer                 =        0.00500


Layer 4 is stiff clay without free water

    Distance from top of pile to top of layer     =       28.50000 ft
    Distance from top of pile to bottom of layer  =       30.50000 ft
    Effective unit weight at top of layer         =       62.55360 pcf
    Effective unit weight at bottom of layer      =       62.55360 pcf
    Undrained cohesion at top of layer            =     2999.52000 psf
    Undrained cohesion at bottom of layer         =     2999.52000 psf
    Epsilon-50 at top of layer                    =        0.00500
    Epsilon-50 at bottom of layer                 =        0.00500
```

Layer 5 is stiff clay without free water

```
    Distance from top of pile to top of layer       =       30.50000 ft
    Distance from top of pile to bottom of layer    =       50.50000 ft
    Effective unit weight at top of layer           =       62.55360 pcf
    Effective unit weight at bottom of layer         =       62.55360 pcf
    Undrained cohesion at top of layer              =     2499.84000 psf
    Undrained cohesion at bottom of layer           =     2499.84000 psf
    Epsilon-50 at top of layer                      =        0.00600
    Epsilon-50 at bottom of layer                   =        0.00600
```

   (Depth of lowest soil layer extends   13.00 ft below pile tip)

                         Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Strain Factor Epsilon 50
1	Soft Clay	0.500	124.934	14.400	0.10000
		3.500	124.934	14.400	0.10000
2	Stiff Clay w/o Free Water	3.500	124.934	1249.920	0.00900
		13.500	124.934	1249.920	0.00900
3	Stiff Clay w/o Free Water	13.500	124.934	2999.520	0.00500
		28.500	124.934	2999.520	0.00500
4	Stiff Clay w/o Free Water	28.500	62.554	2999.520	0.00500
		30.500	62.554	2999.520	0.00500
5	Stiff Clay w/o Free Water	30.500	62.554	2499.840	0.00600
		50.500	62.554	2499.840	0.00600

                                 Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

            Pile-head Loading and Pile-head Fixity Conditions
----

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	1	V = 64680. lbs	M = 97314080. in-lbs	84093.	No

```
V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.
```

    Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
----

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

```
Length of Section                              =       37.50000 ft
Shaft Diameter                                 =       96.00000 in
Concrete Cover Thickness                        =        3.62419 in
Number of Reinforcing Bars                      =             38 bars
Yield Stress of Reinforcing Bars                =       60000. psi
Modulus of Elasticity of Reinforcing Bars       =    29000000. psi
Gross Area of Shaft                             =     7238.22947 sq. in.
Total Area of Reinforcing Steel                 =       48.26000 sq. in.
Area Ratio of Steel Reinforcement               =         0.67 percent
Edge-to-Edge Bar Spacing                        =        5.95417 in
Maximum Concrete Aggregate Size                 =        0.75000 in
Ratio of Bar Spacing to Aggregate Size          =         7.94
Offset of Center of Rebar Cage from Center of Pile =     0.0000 in
```

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As   =   27341.497 kips

```
Tensile Load for Cracking of Concrete                   =    -3151.843 kips
Nominal Axial Tensile Capacity                          =    -2895.600 kips
```

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.27000	1.27000	43.74081	0.00000
2	1.27000	1.27000	43.14424	7.19950
3	1.27000	1.27000	41.37081	14.20262
4	1.27000	1.27000	38.46889	20.81832
5	1.27000	1.27000	34.51764	26.86616
6	1.27000	1.27000	29.62484	32.18116
7	1.27000	1.27000	23.92396	36.61834
8	1.27000	1.27000	17.57048	40.05667
9	1.27000	1.27000	10.73773	42.40235
10	1.27000	1.27000	3.61209	43.59141
11	1.27000	1.27000	-3.61209	43.59141
12	1.27000	1.27000	-10.73773	42.40235
13	1.27000	1.27000	-17.57048	40.05667
14	1.27000	1.27000	-23.92396	36.61834
15	1.27000	1.27000	-29.62484	32.18116
16	1.27000	1.27000	-34.51764	26.86616
17	1.27000	1.27000	-38.46889	20.81832
18	1.27000	1.27000	-41.37081	14.20262
19	1.27000	1.27000	-43.14424	7.19950
20	1.27000	1.27000	-43.74081	0.00000
21	1.27000	1.27000	-43.14424	-7.19950
22	1.27000	1.27000	-41.37081	-14.20262
23	1.27000	1.27000	-38.46889	-20.81832
24	1.27000	1.27000	-34.51764	-26.86616
25	1.27000	1.27000	-29.62484	-32.18116
26	1.27000	1.27000	-23.92396	-36.61834
27	1.27000	1.27000	-17.57048	-40.05667
28	1.27000	1.27000	-10.73773	-42.40235
29	1.27000	1.27000	-3.61209	-43.59141
30	1.27000	1.27000	3.61209	-43.59141
31	1.27000	1.27000	10.73773	-42.40235
32	1.27000	1.27000	17.57048	-40.05667
33	1.27000	1.27000	23.92396	-36.61834
34	1.27000	1.27000	29.62484	-32.18116
35	1.27000	1.27000	34.51764	-26.86616
36	1.27000	1.27000	38.46889	-20.81832
37	1.27000	1.27000	41.37081	-14.20262
38	1.27000	1.27000	43.14424	-7.19950

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero =   5.95417 inches between Bars 26 and 27

Spacing to aggregate size ratio =   7.93890

Concrete Properties:

```
Compressive Strength of Concrete                        =    4000.00000 psi
Modulus of Elasticity of Concrete                       =      3604997. psi
Modulus of Rupture of Concrete                          =     -474.34164 psi
Compression Strain at Peak Stress                       =        0.00189
Tensile Strain at Fracture of Concrete                  =     -0.0001154
Maximum Coarse Aggregate Size                           =        0.75000 in
```

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	84.093

Definitions of Run Messages and Notes:

    C = concrete in section has cracked in tension.
    Y = stress in reinforcing steel has reached yield stress.
    T = ACI 318-08 criteria for tension-controlled section met, tensile strain in
        reinforcement exceeds 0.005 while simultaneously compressive strain in
        concrete more than than 0.003. See ACI 318-08, Section 10.3.4.
    Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force =   84.093 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Concrete Stress ksi	Max Steel Stress ksi	Run Msg

0.000000313	5867.7942909	18776941731.	56.4651367	0.0000176	-0.0000124	0.0738567	0.5073653	
0.000000625	11707.	18731597466.	52.2461914	0.0000327	-0.0000273	0.1360415	0.9382622	
0.000000938	17517.	18685054549.	50.8399826	0.0000477	-0.0000423	0.1977304	1.3691620	
0.000001250	23298.	18638208298.	50.1369322	0.0000627	-0.0000573	0.2589231	1.8000638	
0.000001563	29049.	18591240321.	49.7151409	0.0000777	-0.0000723	0.3196196	2.2309673	
0.000001875	34770.	18544211435.	49.4339789	0.0000927	-0.0000873	0.3798200	2.6618726	
0.000002188	40463.	18497147716.	49.2331760	0.0001077	-0.0001023	0.4395242	3.0927796	
0.000002500	40463.	16185004252.	25.2740319	0.0000632	-0.0001768	0.2585700	-5.0928327	C
0.000002813	40463.	14386670446.	24.7915823	0.0000697	-0.0002003	0.2847397	-5.7687866	C
0.000003125	40463.	12948003401.	24.4032900	0.0000763	-0.0002237	0.3107878	-6.4449518	C
0.000003438	40463.	11770912183.	24.0746360	0.0000828	-0.0002472	0.3365915	-7.1222097	C
0.000003750	40463.	10790002835.	23.8017042	0.0000893	-0.0002707	0.3623189	-7.7993647	C
0.000004063	40463.	9960002617.	23.5716380	0.0000958	-0.0002942	0.3879700	-8.4764164	C
0.000004375	40463.	9248573858.	23.3681732	0.0001022	-0.0003178	0.4134202	-9.1542630	C
0.000004688	40463.	8632002268.	23.1904303	0.0001087	-0.0003413	0.4387541	-9.8323009	C
0.000005000	40463.	8092502126.	23.0356385	0.0001152	-0.0003648	0.4640129	-10.5102324	C
0.000005313	40463.	7616472589.	22.8997496	0.0001217	-0.0003883	0.4891963	-11.1880573	C
0.000005625	40463.	7193335223.	22.7796151	0.0001281	-0.0004119	0.5143043	-11.8657753	C
0.000005938	40463.	6814738632.	22.6727491	0.0001346	-0.0004354	0.5393369	-12.5433860	C
0.000006250	40463.	6474001701.	22.5771631	0.0001411	-0.0004589	0.5642938	-13.2208892	C
0.000006563	40463.	6165715905.	22.4877390	0.0001476	-0.0004824	0.5890847	-13.8989521	C
0.000006875	40463.	5885456092.	22.4062098	0.0001540	-0.0005060	0.6137796	-14.5770619	C
0.000007188	40463.	5629566696.	22.3323079	0.0001605	-0.0005295	0.6383999	-15.2550596	C
0.000007500	40463.	5395001417.	22.2650815	0.0001670	-0.0005530	0.6629453	-15.9329448	C
0.000007813	40463.	5179201361.	22.2037310	0.0001735	-0.0005765	0.6874158	-16.6107172	C
0.000008125	40463.	4980001308.	22.1475801	0.0001799	-0.0006001	0.7118112	-17.2883764	C
0.000008438	40463.	4795556815.	22.0960524	0.0001864	-0.0006236	0.7361315	-17.9659222	C
0.000008750	40463.	4624286929.	22.0486539	0.0001929	-0.0006471	0.7603765	-18.6433540	C
0.000009063	40463.	4464828759.	22.0049589	0.0001994	-0.0006706	0.7845460	-19.3206717	C
0.000009375	40463.	4316001134.	21.9645983	0.0002059	-0.0006941	0.8086401	-19.9978748	C
0.000009688	40463.	4176775291.	21.9272507	0.0002124	-0.0007176	0.8326585	-20.6749630	C
0.0000100	40463.	4046251063.	21.8926349	0.0002189	-0.0007411	0.8566011	-21.3519359	C
0.0000103	40463.	3923637394.	21.8605038	0.0002254	-0.0007646	0.8804678	-22.0287931	C
0.0000106	40463.	3808236295.	21.8306393	0.0002320	-0.0007880	0.9042585	-22.7055342	C
0.0000109	40463.	3699429543.	21.8028483	0.0002385	-0.0008115	0.9279730	-23.3821590	C
0.0000113	40463.	3596667612.	21.7769592	0.0002450	-0.0008350	0.9516113	-24.0586670	C
0.0000116	40463.	3499460379.	21.7528188	0.0002515	-0.0008585	0.9751732	-24.7350579	C
0.0000119	40463.	3407369316.	21.7302903	0.0002580	-0.0008820	0.9986585	-25.4113313	C
0.0000122	40463.	3320000832.	21.7092506	0.0002646	-0.0009054	1.0220672	-26.0874867	C
0.0000128	40463.	3158049610.	21.6712062	0.0002777	-0.0009523	1.0686542	-27.4394424	C
0.0000134	40476.	3012153313.	21.6379228	0.0002908	-0.0009992	1.1149329	-28.7909219	C
0.0000141	42235.	3003343016.	21.6087732	0.0003039	-0.0010461	1.1609026	-30.1419221	C
0.0000147	43992.	2995178129.	21.5823402	0.0003170	-0.0010930	1.2065153	-31.4928219	C
0.0000153	45747.	2987581207.	21.5587811	0.0003301	-0.0011399	1.2517972	-32.8434037	C
0.0000159	47502.	2980486451.	21.5381784	0.0003433	-0.0011867	1.2967706	-34.1934731	C
0.0000166	49254.	2973836468.	21.5202050	0.0003564	-0.0012336	1.3414346	-35.5430265	C
0.0000172	51005.	2967582059.	21.5045815	0.0003696	-0.0012804	1.3857879	-36.8920606	C
0.0000178	52755.	2961681378.	21.4910675	0.0003828	-0.0013272	1.4298296	-38.2405707	C
0.0000184	54503.	2956097778.	21.4794557	0.0003960	-0.0013740	1.4735583	-39.5885538	C
0.0000191	56250.	2950799575.	21.4695657	0.0004093	-0.0014207	1.5169731	-40.9360059	C
0.0000197	57995.	2945759102.	21.4612403	0.0004225	-0.0014675	1.5600726	-42.2829232	C
0.0000203	59738.	2940952091.	21.4543417	0.0004358	-0.0015142	1.6028558	-43.6293019	C
0.0000209	61480.	2936357169.	21.4487486	0.0004491	-0.0015609	1.6453215	-44.9751380	C
0.0000216	63220.	2931955431.	21.4443539	0.0004624	-0.0016076	1.6874685	-46.3204274	C
0.0000222	64959.	2927730100.	21.4410627	0.0004757	-0.0016543	1.7292955	-47.6651662	C
0.0000228	66696.	2923666230.	21.4387903	0.0004891	-0.0017009	1.7708013	-49.0093502	C
0.0000234	68432.	2919750466.	21.4374615	0.0005024	-0.0017476	1.8119848	-50.3529753	C
0.0000241	70166.	2915970833.	21.4370088	0.0005158	-0.0017942	1.8528446	-51.6960372	C
0.0000247	71898.	2912316564.	21.4373716	0.0005292	-0.0018408	1.8933795	-53.0385317	C
0.0000253	73628.	2908777950.	21.4384954	0.0005427	-0.0018873	1.9335883	-54.3804544	C
0.0000259	75357.	2905346214.	21.4403310	0.0005561	-0.0019339	1.9734696	-55.7218010	C
0.0000266	77085.	2902013397.	21.4428339	0.0005696	-0.0019804	2.0130222	-57.0625670	C
0.0000272	78810.	2898772269.	21.4459640	0.0005831	-0.0020269	2.0522446	-58.4027478	C
0.0000278	80534.	2895616244.	21.4496845	0.0005966	-0.0020734	2.0911357	-59.7423389	C
0.0000284	82257.	2892539309.	21.4539621	0.0006101	-0.0021199	2.1296940	-60.0000000	CY
0.0000291	83977.	2889535964.	21.4587667	0.0006236	-0.0021664	2.1679181	-60.0000000	CY
0.0000297	85623.	2884128197.	21.4578200	0.0006370	-0.0022130	2.2052797	-60.0000000	CY
0.0000303	87011.	2870472224.	21.4360661	0.0006498	-0.0022602	2.2404794	-60.0000000	CY
0.0000309	88254.	2852650788.	21.4035680	0.0006622	-0.0023078	2.2743289	-60.0000000	CY
0.0000316	89351.	2830916915.	21.3605559	0.0006742	-0.0023558	2.3068219	-60.0000000	CY
0.0000322	90395.	2808380713.	21.3153014	0.0006861	-0.0024039	2.3386620	-60.0000000	CY
0.0000328	91373.	2784693632.	21.2666046	0.0006978	-0.0024522	2.3697409	-60.0000000	CY
0.0000334	92233.	2758363712.	21.2101533	0.0007092	-0.0025008	2.3996675	-60.0000000	CY
0.0000341	93074.	2732434914.	21.1545772	0.0007206	-0.0025494	2.4292086	-60.0000000	CY
0.0000347	93908.	2707271080.	21.1009138	0.0007319	-0.0025981	2.4584663	-60.0000000	CY
0.0000353	94659.	2680611856.	21.0422577	0.0007431	-0.0026469	2.4868142	-60.0000000	CY
0.0000359	95322.	2652446487.	20.9785355	0.0007539	-0.0026961	2.5142389	-60.0000000	CY
0.0000366	95981.	2625119970.	20.9169535	0.0007648	-0.0027452	2.5414092	-60.0000000	CY
0.0000372	96639.	2598694888.	20.8577322	0.0007756	-0.0027944	2.5683562	-60.0000000	CY
0.0000397	98906.	2492119435.	20.6098967	0.0008180	-0.0029920	2.6707610	-60.0000000	CY
0.0000422	100887.	2391396547.	20.3596487	0.0008589	-0.0031911	2.7662096	-60.0000000	CY
0.0000447	102453.	2292656096.	20.1038489	0.0008984	-0.0033916	2.8547024	-60.0000000	CY
0.0000472	103914.	2202143733.	19.8695674	0.0009376	-0.0035924	2.9393267	-60.0000000	CY
0.0000497	105207.	2117369226.	19.6442611	0.0009761	-0.0037939	3.0191806	-60.0000000	CY
0.0000522	106233.	2035606576.	19.4063380	0.0010128	-0.0039972	3.0923071	-60.0000000	CY
0.0000547	107255.	1961232827.	19.1924544	0.0010496	-0.0042004	3.1628436	-60.0000000	CY
0.0000572	108256.	1893006959.	18.9978960	0.0010864	-0.0044036	3.2305940	-60.0000000	CY
0.0000597	108974.	1825741951.	18.7936265	0.0011217	-0.0046083	3.2927200	-60.0000000	CY
0.0000622	109666.	1763471226.	18.5970920	0.0011565	-0.0048135	3.3513087	-60.0000000	CY
0.0000647	110347.	1705854471.	18.4118720	0.0011910	-0.0050190	3.4069552	-60.0000000	CY
0.0000672	111025.	1652472150.	18.2421448	0.0012256	-0.0052244	3.4602857	-60.0000000	CY
0.0000697	111637.	1601960340.	18.0791107	0.0012599	-0.0054301	3.5105371	-60.0000000	CY
0.0000722	112111.	1553056541.	17.9140822	0.0012932	-0.0056368	3.5569807	-60.0000000	CY
0.0000747	112561.	1507094389.	17.7590922	0.0013264	-0.0058436	3.6010086	-60.0000000	CY
0.0000772	112992.	1463861797.	17.6021916	0.0013587	-0.0060513	3.6415627	-60.0000000	CY
0.0000797	113420.	1423308656.	17.4564516	0.0013911	-0.0062589	3.6800696	-60.0000000	CY
0.0000822	113845.	1385189925.	17.3208694	0.0014236	-0.0064664	3.7165089	-60.0000000	CY

0.0000847	114266.	1349269236.	17.1943415	0.0014561	-0.0066739	3.7508397	-60.0000000	CY
0.0000872	114675.	1315273071.	17.0751858	0.0014887	-0.0068813	3.7829655	-60.0000000	CY
0.0000897	114959.	1281767540.	16.9483073	0.0015201	-0.0070899	3.8116911	-60.0000000	CY
0.0000922	115231.	1249966875.	16.8283798	0.0015514	-0.0072986	3.8383839	-60.0000000	CY
0.0000947	115489.	1219681154.	16.7066216	0.0015819	-0.0075081	3.8624302	-60.0000000	CY
0.0000972	115740.	1190895649.	16.5892980	0.0016123	-0.0077177	3.8844126	-60.0000000	CY
0.0000997	115990.	1163533805.	16.4788557	0.0016427	-0.0079273	3.9045477	-60.0000000	CY
0.0001022	116237.	1137490804.	16.3748016	0.0016733	-0.0081367	3.9228166	-60.0000000	CY
0.0001047	116483.	1112671839.	16.2766900	0.0017040	-0.0083460	3.9392001	-60.0000000	CY
0.0001072	116726.	1088990938.	16.1841172	0.0017347	-0.0085553	3.9536784	-60.0000000	CY
0.0001097	116967.	1066369960.	16.0967167	0.0017656	-0.0087644	3.9662316	-60.0000000	CY
0.0001122	117207.	1044737725.	16.0141550	0.0017966	-0.0089734	3.9768391	-60.0000000	CY
0.0001147	117430.	1023912042.	15.9341230	0.0018274	-0.0091826	3.9854213	-60.0000000	CY
0.0001172	117604.	1003551449.	15.8514499	0.0018576	-0.0093924	3.9918910	-60.0000000	CY
0.0001197	117762.	983913458.	15.7644129	0.0018868	-0.0096032	3.9963579	-60.0000000	CY
0.0001222	117895.	964872241.	15.6768497	0.0019155	-0.0098145	3.9990279	-60.0000000	CY
0.0001247	118027.	946582017.	15.5935843	0.0019443	-0.0100257	3.9999964	-60.0000000	CY
0.0001272	118156.	928990396.	15.5146824	0.0019733	-0.0102367	3.9918632	-60.0000000	CY
0.0001297	118284.	912065654.	15.4395538	0.0020023	-0.0104477	3.9943800	-60.0000000	CY
0.0001322	118410.	895770360.	15.3679704	0.0020315	-0.0106585	3.9977065	-60.0000000	CY
0.0001347	118534.	880069284.	15.2997436	0.0020607	-0.0108693	3.9995709	-60.0000000	CY
0.0001372	118657.	864926573.	15.2348358	0.0020900	-0.0110800	3.9980536	-60.0000000	CY
0.0001522	119358.	784284249.	14.9048037	0.0022683	-0.0123417	3.9947316	60.0000000	CY
0.0001672	119919.	717274041.	14.6075504	0.0024422	-0.0136078	3.9999619	60.0000000	CY
0.0001822	120253.	660049527.	14.3353960	0.0026117	-0.0148783	3.9957353	60.0000000	CY
0.0001972	120544.	611314909.	14.1118341	0.0027827	-0.0161473	3.9860306	60.0000000	CY
0.0002122	120817.	569387806.	13.9297284	0.0029557	-0.0174143	3.9970866	60.0000000	CY
0.0002272	121019.	532682783.	13.7669720	0.0031277	-0.0186823	3.9868749	60.0000000	CYT
0.0002422	121194.	500414822.	13.6363417	0.0033026	-0.0199474	3.9898604	60.0000000	CYT
0.0002572	121339.	471793455.	13.5359216	0.0034813	-0.0212087	3.9998909	60.0000000	CYT
0.0002722	121402.	446024847.	13.4468361	0.0036601	-0.0224699	3.9763792	60.0000000	CYT
0.0002872	121454.	422908081.	13.3693898	0.0038395	-0.0237305	3.9852614	60.0000000	CYT

    Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	84.093	120868.967	0.00300000

Note note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318-08, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318-08, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resistance Factor for Moment	Nominal Moment Capacity in-kip	Ultimate (Factored) Axial Thrust kips	Ultimate (Factored) Moment Capacity in-kip	Bending Stiffness at Ult. Mom. Cap. kip-in^2
1	0.65	120868.967	54.661	78564.826	2899233457.034
1	0.70	120868.967	58.865	84608.276	2887461693.667
1	0.75	120868.967	63.070	90651.725	2802156928.171

              Computed Values of Pile Loading and Deflection
                 for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head	=	64680.0 lbs
Applied moment at pile head	=	97314080.0 in-lbs
Axial thrust load on pile head	=	84093.3 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	3.4998	97314080.	64680.	-0.0175	0.000	2.565E+12	0.000	0.000	0.000
1.125	3.2668	98206585.	64575.	-0.0170	0.000	2.524E+12	-20.8928	28.7794	0.000
2.250	3.0410	99095365.	64281.	-0.0165	0.000	2.482E+12	-21.6980	32.1079	0.000
3.375	2.8225	99979580.	63992.	-0.0159	0.000	2.436E+12	-21.1653	33.7446	0.000
4.500	2.6114	1.008E+08	48572.	-0.0154	0.000	2.397E+12	-1387.8033	2391.4573	0.000
5.625	2.4080	1.013E+08	29492.	-0.0148	0.000	2.363E+12	-1438.1960	2687.6266	0.000
6.750	2.2124	1.016E+08	9759.1670	-0.0142	0.000	2.345E+12	-1484.6616	3019.7313	0.000
7.875	2.0247	1.016E+08	-10574.	-0.0130	0.000	2.344E+12	-1527.0431	3393.8567	0.000
9.000	1.8449	1.013E+08	-31451.	-0.0130	0.000	2.361E+12	-1565.1533	3817.5636	0.000

10.125	1.6730	1.008E+08	-52812.	-0.0125	0.000	2.396E+12	-1598.7619	4300.4207	0.000
11.250	1.5086	99949213.	-74595.	-0.0119	0.000	2.438E+12	-1627.5802	4854.7737	0.000
12.375	1.3518	98806388.	-96732.	-0.0113	0.000	2.497E+12	-1651.2454	5496.8594	0.000
13.500	1.2022	97362093.	-120955.	-0.0108	0.000	2.563E+12	-2470.8616	9249.1336	0.000
14.625	1.0594	95442401.	-167945.	-0.0103	0.000	2.647E+12	-3681.1594	15636.	0.000
15.750	0.9233	92851450.	-217556.	-0.009853	0.000	2.739E+12	-3666.4373	17870.	0.000
16.875	0.7933	89591989.	-266862.	-0.009410	0.000	2.826E+12	-3635.5987	20623.	0.000
18.000	0.6691	85669716.	-315625.	-0.008996	0.000	2.884E+12	-3585.3217	24113.	0.000
19.125	0.5503	81093887.	-363551.	-0.008606	0.000	2.895E+12	-3510.7643	28708.	0.000
20.250	0.4366	75878218.	-410265.	-0.008240	0.000	2.904E+12	-3404.4285	35086.	0.000
21.375	0.3277	70042287.	-455260.	-0.007902	0.000	2.916E+12	-3253.4495	44674.	0.000
22.500	0.2232	63613968.	-497779.	-0.007593	0.000	2.931E+12	-3032.4272	61144.	0.000
23.625	0.1226	56634377.	-536513.	-0.007317	0.000	2.950E+12	-2676.8139	98264.	0.000
24.750	0.0255	49171575.	-568074.	-0.007075	0.000	2.974E+12	-1852.3259	327002.	0.000
25.875	-0.0686	41549275.	-551549.	-0.006870	0.000	3.007E+12	2429.7068	159403.	0.000
27.000	-0.1608	34352380.	-514035.	-0.006817	0.000	1.855E+13	3077.3364	86121.	0.000
28.125	-0.2527	27713885.	-469361.	-0.006794	0.000	1.860E+13	3524.7709	62777.	0.000
29.250	-0.3443	21711247.	-420282.	-0.006776	0.000	1.865E+13	3792.7822	49578.	0.000
30.375	-0.4356	16399261.	-366973.	-0.006763	0.000	1.869E+13	4100.0337	42352.	0.000
31.500	-0.5269	11801529.	-315815.	-0.006752	0.000	1.873E+13	3821.9325	32644.	0.000
32.625	-0.6180	7900116.	-262690.	-0.006745	0.000	1.875E+13	4046.3059	29465.	0.000
33.750	-0.7090	4735978.	-206620.	-0.006741	0.000	1.878E+13	4258.8563	27031.	0.000
34.875	-0.8000	2347893.	-147743.	-0.006738	0.000	1.878E+13	4462.5114	25102.	0.000
36.000	-0.8909	773006.	-86165.	-0.006737	0.000	1.878E+13	4659.2774	23533.	0.000
37.125	-0.9819	47198.	-21969.	-0.006737	0.000	1.878E+13	4850.5863	22230.	0.000

```
* This analysis computed pile response using nonlinear moment-curvature relationships.
  Values of total stress due to combined axial and bending stresses are computed only
  for elastic sections only and do not equal the actual stresses in concrete and steel.
  Stresses in concrete and steel may be interpolated from the output for nonlinear
  bending properties relative to the magnitude of bending moment developed in the pile.
```

Output Summary for Load Case No. 1:

```
Pile-head deflection           =      3.4997503 inches
Computed slope at pile head    =     -0.0175097 radians
Maximum bending moment         =    101643311. inch-lbs
Maximum shear force            =      -569294. lbs
Depth of maximum bending moment =     7.5000000 feet below pile head
Depth of maximum shear force   =     25.1250000 feet below pile head
Number of iterations           =             74
Number of zero deflection points =            1
```

```
                    Summary of Pile Response(s)
```

Definitions of Pile-head Loading Conditions:

```
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians
```

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	1	V = 64680.	M = 97314080.	84093.	3.49975031	101643311.	-569294.	-0.01750968

The analysis ended normally.

1805.7.2.1 (2006 IBC) & 1807.3.2.1 (2009 IBC & 2012 IBC)

$$d = A/2*(1+(1+(4.36*h/A))^{0.5})$$

Monopole

Moment (ft-k)	6082.13
Shear (k)	48.5
Caisson Diameter, b (ft)	8
Caisson Height Above Ground (ft)	0.5
Caisson Height Below Ground (ft)	30
Lateral soil pressure per foot (lb/ft^3)	270
Applied lateral force, P (lbs)	48510
Dist. from ground to application of P, h (ft)	125.88
$A = 2.34*P/(S1*b)$	5.26
Min. Depth of Embedment Required, d (ft)	29.61