Sabre Industries™
Towers and Poles

Structural Design Report

75' Extendible to 85' Monopole
Site: W 151st & S 80th, IL
Site Number: 311466

Prepared for: DOLAN REALTY ADVISORS LLC
by: Sabre Towers & Poles ™

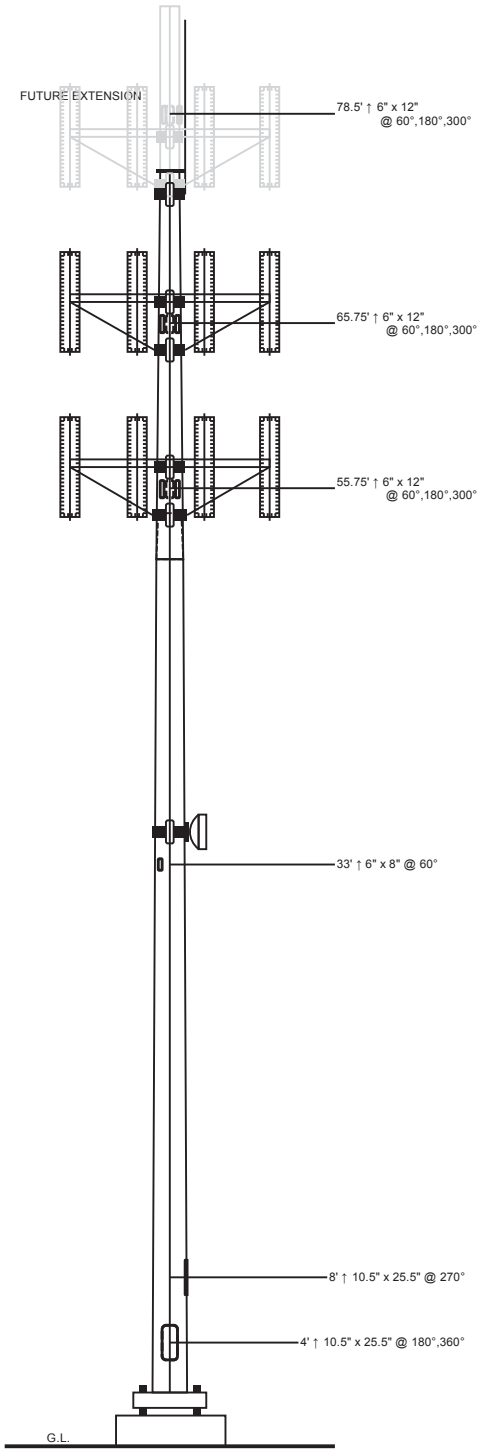
Job Number: 404472

March 16, 2018

LICENSED STRUCTURAL ENGINEER
ROBERT E. BEACOM
081-007778
STATE OF ILLINOIS

3/16/18

License Expires: 11-30-18



Length (ft)	53'-3"	23'-6"	10'-0"
Number Of Sides	18		
Thickness (in)	1/4"		
Lap Splice (ft)		2' - 9"	
Top Diameter (in)	17.86"	15.25"	13.75"
Bottom Diameter (in)	25.85"	18.77"	15.25"
Taper (in/ft)	0.15		
Grade	A572-65		
Weight (lbs)	4033	1393	590
Overall Steel Height (ft)	74		10 (Extension)

Designed Appurtenance Loading

Elev	Description	Tx-Line
84.12/84.12**	(1) DB224	(1) 7/8"
77***	Platform - 12' w/ Enhanced Support Rail	
77***	(9) SBNHH-1D65B	(9) 1 5/8"
73.5	Flush Mount (Monopole Only)	
67	Platform - 12' w/ Enhanced Support Rail	
67	(9) SBNHH-1D65B	(9) 1 5/8"
57	Platform - 12' w/ Enhanced Support Rail	
57	(9) SBNHH-1D65B	(9) 1 5/8"
35	(1) Dish Mount (Monopole Only) - Pipe Mount (up to 6' Dish)	
35	(1) 2' H.P. Dish	(1) Cat 5

Load Case Reactions

Description	Axial (kips)	Shear (kips)	Moment (ft-k)	Deflection (ft)	Sway (deg)
3s Gusted Wind	18.03	10.93	705.52	6.27	6.61
3s Gusted Wind 0.9 Dead	13.53	10.93	688.07	6.08	6.39
3s Gusted Wind&Ice	25.28	2.56	172.34	1.58	1.66
Service Loads	15.04	2.78	177.31	1.59	1.66

Base Plate Dimensions

Shape	Diameter	Thickness	Bolt Circle	Bolt Qty	Bolt Diameter
Round	37.25"	1.75"	31.5"	6	2.25"

Anchor Bolt Dimensions

Length	Diameter	Hole Diameter	Weight	Type	Finish
84"	2.25"	2.625"	726.6	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) The Monopole was designed for a basic wind speed of 89 mph with 0" of radial ice, and 40 mph with 3/4" of radial ice, in accordance with ANSI/TIA-222-G, Structure Class II, Exposure Category C, Topographic Category 1.
5) The tower design meets the requirements for an Ultimate Wind Speed of 115 mph (Risk Category II), in accordance with the 2015 International Building Code.
6) Full Height Step Bolts
7) Tower Rating: 90.7%

** These Appurtenances cannot be installed at the higher elevation until the Monopole has been extended.

*** These Appurtenances cannot be installed until the Monopole has been extended.

Sabre Industries™ Towers and Poles

Sabre Communications Corporation
7101 Southbridge Drive
P.O. Box 658
Sioux City, IA 51102-0658
Phone: (712) 258-6690
Fax: (712) 279-0814

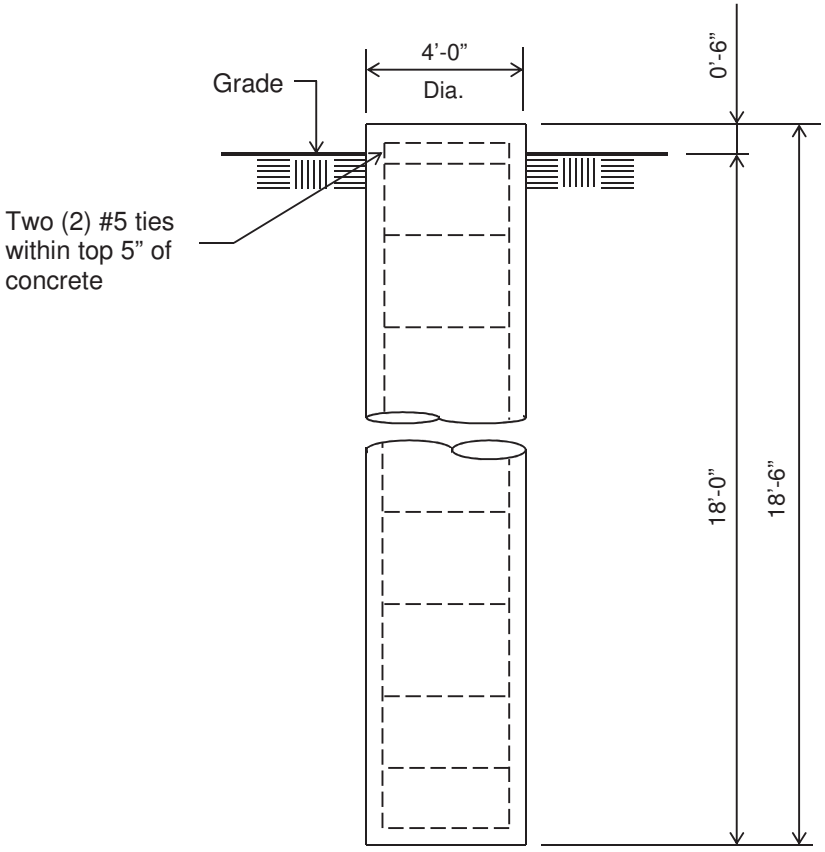
Job:	**404472**
Customer:	DOLAN REALTY ADVISORS LLC
Site Name:	W 151st & S 80th, IL 311466
Description:	75' ext. 85' Monopole
Date:	3/16/2018 By: REB

Sabre Industries™
Towers and Poles

No.: 404472

Date: 03/16/18
By: MH

Customer: DOLAN REALTY ADVISORS LLC
Site: W 151st & S 80th, IL 311466
75’ Monopole Extendible to 85’ at
89 mph Wind with no ice and 40 mph Wind with 0.75 in. Ice per ANSI/TIA-222-G.



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

Notes:

1) Concrete shall have a minimum 28-day compressive strength of 4,500 psi, in accordance with ACI 318-11.

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 G2 Project No. 162457, dated: 12/21/2016.

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

7) The foundation is based on the following factored loads:
   Moment = 705.52 k-ft
   Axial = 18.03 k
   Shear = 10.93 k

Rebar Schedule for Pier	
Pier	(16) #7 vertical rebar w/ #5 ties, two within top 5” of pier, then 12” C/C

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

(USA 222-G) - 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: 15 mar 2018 at: 15:19:38

75' ext. 85' Monopole / W 151st & S 80th, IL

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

POLE GEOMETRY

ELEV ft	SECTION NAME	No. SIDE	OUTSIDE DIAM in	THICK -NESS in	RESISTANCES ϕ*Pn kip	RESISTANCES ϕ*Mn ft-kip	SPLICE TYPE	...OVERLAP... LENGTH ft	...OVERLAP... RATIO	w/t
84.0										
			13.96	0.250	795.9	218.7				
	A	18								7.9
			15.48	0.250	884.3	270.5				
74.0										
			15.48	0.250	884.3	270.5				
	B	18								9.0
			18.64	0.250	1067.3	395.2				
53.2										
			18.64	0.250	1067.3	395.2				
	B/C	18					SLIP	2.75	1.80	
			18.57	0.250	1063.1	392.0				
50.5										
			18.57	0.250	1063.1	392.0				
	C	18								11.1
			26.25	0.250	1499.7	788.2				
0.0										

POLE ASSEMBLY

SECTION NAME	BASE ELEV ft	.....BOLTS AT BASE OF SECTION..... NUMBER	TYPE	DIAM in	STRENGTH ksi	THREADS IN SHEAR PLANE	CALC BASE ELEV ft
A	74.000	0	A325	0.00	92.0	0	74.000
B	50.500	0	A325	0.00	92.0	0	50.500
C	0.000	0	A325	0.00	92.0	0	0.000

POLE SECTIONS

SECTION NAME	No.of SIDES	LENGTH ft	OUTSIDE.DIAMETER BOT * in	OUTSIDE.DIAMETER TOP * in	BEND RAD in	MAT-ERIAL ID	FLANGE.ID BOT	FLANGE.ID TOP	FLANGE.WELD ..GROUP.ID.. BOT	FLANGE.WELD ..GROUP.ID.. TOP
A	18	10.00	15.48	13.96	0.000	1	0	0	0	0
B	18	23.50	19.07	15.48	0.000	2	0	0	0	0
C	18	53.25	26.25	18.14	0.000	3	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	15.49	0.25	0.250	0.250	0.00	0.0

PL		2	1	0.0	19.06	0.25	0.250	0.250	0.00	0.0
PL		3	1	0.0	26.25	0.25	0.250	0.250	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

* Only 3 condition(s) shown in full
* Some concentrated wind loads may have been derived from full-scale wind tunnel testing

LOADING CONDITION A

89 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	83.120	0.00	0.0	0.0	0.0000	0.0539	0.0000	0.0000
C	83.120	0.00	0.0	0.0	0.2527	0.0794	0.0000	0.0000
C	76.000	0.00	0.0	0.0	0.0000	0.8536	0.0000	0.0000
C	76.000	0.00	0.0	0.0	2.5379	3.3040	0.0000	0.0000
C	72.500	0.00	0.0	0.0	0.0161	0.2496	0.0000	0.0000
C	66.000	0.00	0.0	0.0	0.0000	0.7413	0.0000	0.0000
C	66.000	0.00	0.0	0.0	2.4646	3.3040	0.0000	0.0000
C	56.000	0.00	0.0	0.0	0.0000	0.6290	0.0000	0.0000
C	56.000	0.00	0.0	0.0	2.3822	3.3040	0.0000	0.0000
C	34.000	0.00	0.0	0.0	0.0000	0.0041	0.0000	0.0000
D	84.000	0.00	180.0	0.0	0.0322	0.0452	0.0000	0.0000
D	60.167	0.00	180.0	0.0	0.0364	0.0539	0.0000	0.0000
D	60.167	0.00	180.0	0.0	0.0378	0.0741	0.0000	0.0000
D	50.500	0.00	180.0	0.0	0.0378	0.0741	0.0000	0.0000
D	50.500	0.00	180.0	0.0	0.0384	0.0616	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0395	0.0798	0.0000	0.0000

ANTENNA LOADING

.....ANTENNA..... TYPE	ELEV ft	AZI	ATTACHMENT RAD ft	AZI	.....ANTENNA FORCES..... AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
HP	34.0	0.0	1.6	0.0	0.14	0.00	0.05	0.00

LOADING CONDITION M

89 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	83.120	0.00	0.0	0.0	0.0000	0.0404	0.0000	0.0000

C	83.120	0.00	0.0	0.0	0.2527	0.0596	0.0000	0.0000
C	76.000	0.00	0.0	0.0	0.0000	0.6402	0.0000	0.0000
C	76.000	0.00	0.0	0.0	2.5379	2.4780	0.0000	0.0000
C	72.500	0.00	0.0	0.0	0.0161	0.1872	0.0000	0.0000
C	66.000	0.00	0.0	0.0	0.0000	0.5560	0.0000	0.0000
C	66.000	0.00	0.0	0.0	2.4646	2.4780	0.0000	0.0000
C	56.000	0.00	0.0	0.0	0.0000	0.4717	0.0000	0.0000
C	56.000	0.00	0.0	0.0	2.3822	2.4780	0.0000	0.0000
C	34.000	0.00	0.0	0.0	0.0000	0.0031	0.0000	0.0000
D	84.000	0.00	180.0	0.0	0.0322	0.0339	0.0000	0.0000
D	60.167	0.00	180.0	0.0	0.0364	0.0404	0.0000	0.0000
D	60.167	0.00	180.0	0.0	0.0378	0.0527	0.0000	0.0000
D	25.250	0.00	180.0	0.0	0.0394	0.0481	0.0000	0.0000
D	25.250	0.00	180.0	0.0	0.0387	0.0553	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0395	0.0598	0.0000	0.0000

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

.....ANTENNA.....			ATTACHMENT		.....ANTENNA FORCES.....			
TYPE	ELEV	AZI	RAD	AZI	AXIAL	SHEAR	GRAVITY	TORSION
	ft		ft		kip	kip	kip	ft-kip
HP	34.0	0.0	1.6	0.0	0.14	0.00	0.04	0.00

==========

LOADING CONDITION Y ==========

40 mph wind with 0.75 ice. Wind Azimuth: 0◆

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

LOAD	ELEV	APPLY..LOAD..AT		LOAD	.....FORCES.....		....MOMENTS.....	
TYPE		RADIUS	AZI	AZI	HORIZ	DOWN	VERTICAL	TORSNAL
	ft	ft			kip	kip	ft-kip	ft-kip
C	83.120	0.00	0.0	0.0	0.0000	0.0539	0.0000	0.0000
C	83.120	0.00	0.0	0.0	0.1205	0.2474	0.0000	0.0000
C	76.000	0.00	0.0	0.0	0.0000	0.8536	0.0000	0.0000
C	76.000	0.00	0.0	0.0	0.5400	4.5373	0.0000	0.0000
C	72.500	0.00	0.0	0.0	0.0086	0.2496	0.0000	0.0000
C	66.000	0.00	0.0	0.0	0.0000	0.7413	0.0000	0.0000
C	66.000	0.00	0.0	0.0	0.5215	4.5202	0.0000	0.0000
C	56.000	0.00	0.0	0.0	0.0000	0.6290	0.0000	0.0000
C	56.000	0.00	0.0	0.0	0.5008	4.5007	0.0000	0.0000
C	34.000	0.00	0.0	0.0	0.0000	0.0041	0.0000	0.0000
D	84.000	0.00	180.0	0.0	0.0092	0.0774	0.0000	0.0000
D	60.167	0.00	180.0	0.0	0.0101	0.0907	0.0000	0.0000
D	60.167	0.00	180.0	0.0	0.0103	0.1126	0.0000	0.0000
D	50.500	0.00	180.0	0.0	0.0103	0.1126	0.0000	0.0000
D	50.500	0.00	180.0	0.0	0.0104	0.1022	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0102	0.1226	0.0000	0.0000

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

.....ANTENNA.....			ATTACHMENT		.....ANTENNA FORCES.....			
TYPE	ELEV	AZI	RAD	AZI	AXIAL	SHEAR	GRAVITY	TORSION
	ft		ft		kip	kip	kip	ft-kip
HP	34.0	0.0	1.6	0.0	0.02	0.00	0.17	0.00

==========

==========

==========

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

MAST ELEV ft	DEFLECTIONS (ft) HORIZONTAL ALONG	HORIZONTAL ACROSS	DOWN	ROTATIONS (deg) TILT ALONG	TILT ACROSS	TWIST
84.0	6.27A	0.01C	0.59A	6.61A	0.01C	0.00Q
79.0	5.70A	0.01C	0.52A	6.61A	0.01C	0.00Q
74.0	5.14A	0.01C	0.45A	6.59A	0.01C	0.00Q
67.1	4.36A	0.01C	0.37A	6.47A	0.01C	0.00Q
60.2	3.60A	0.01C	0.28A	6.23A	0.01C	0.00Q
50.5	2.60A	0.01C	0.18A	5.65A	0.01C	0.00Q
37.9	1.49A	0.00C	0.08A	4.45A	0.01C	0.00Q
25.2	0.67A	0.00C	0.02A	3.03A	0.01C	0.00Q
12.6	0.17A	0.00W	0.00A	1.52A	0.00W	0.00Q
0.0	0.00A	0.00A	0.00A	0.00A	0.00A	0.00A

MAXIMUM ANTENNA AND REFLECTOR ROTATIONS

ELEV ft	ANT AZI deg	ANT TYPE	BEAM DEFLECTIONS (deg) ROLL	YAW	PITCH	TOTAL
34.0	0.0	HP	4.006 D	0.122 C	4.018 A	4.018 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	SHEAR.w.r.t.WIND.DIR ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	MOMENT.w.r.t.WIND.DIR ACROSS ft-kip	TORSION ft-kip
84.0	0.00 D	0.00 X	0.00 U	-0.01 U	0.01 U	0.00 U
	0.70 AC	0.42 C	0.00 U	-1.56 C	-0.01 U	0.00 C
79.0	0.70 AC	0.42 O	-0.01 B	-1.56 D	-0.02 U	0.00 U
	6.50 AC	3.13 O	-0.01 B	-10.26 L	0.03 B	0.00 B
74.0	6.49 AI	3.13 O	0.01 Q	-10.26 A	-0.02 N	0.00 B
	7.33 AI	3.38 O	0.01 Q	-36.48 A	0.06 H	-0.01 O
67.1	7.33 AI	3.38 S	0.01 Q	-36.48 A	0.06 H	0.01 Q
	13.21 AI	6.09 S	0.01 Q	-81.39 A	-0.12 Q	-0.03 O
60.2	13.21 AI	6.10 N	0.01 Q	-81.40 A	-0.12 Q	-0.03 O
	19.42 AI	8.85 N	0.01 Q	-166.65 A	-0.18 Q	-0.05 O
50.5	19.42 AI	8.84 N	-0.01 T	-166.66 A	-0.18 Q	-0.05 O
	20.75 AI	9.33 N	-0.01 T	-296.78 A	-0.22 Q	-0.09 O
37.9	20.75 AI	9.33 O	-0.01 O	-296.79 A	-0.22 Q	-0.09 O

	22.31 AI	9.95 N	-0.07 W	-431.01 A	-0.74 C	0.16 Q
25.2						
	22.31 AI	9.94 N	-0.07 W	-431.01 A	-0.74 C	0.16 Q
	23.76 AI	10.44 N	-0.07 W	-567.75 A	-1.64 C	0.15 Q
12.6						
	23.76 AI	10.44 N	-0.07 W	-567.75 A	-1.64 C	0.15 Q
	25.28 AI	10.93 N	-0.07 W	-705.52 A	2.53 W	0.15 Q
base reaction	25.28 AI	-10.93 N	0.07 W	705.52 A	-2.53 W	-0.15 Q

COMPLIANCE WITH 4.8.2 & 4.5.4

ELEV ft	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t(w/t)	MAX ALLOWED
84.00	0.00D	0.00U	0.00U	0.00U	YES	7.93A	45.2
	0.00AC	0.01C	0.00C	0.01I	YES	8.46A	45.2
79.00	0.00AC	0.01D	0.00O	0.01D	YES	8.46A	45.2
	0.01AC	0.04L	0.01O	0.04L	YES	8.99A	45.2
74.00	0.01AI	0.04A	0.01O	0.04G	YES	8.99A	45.2
	0.01AI	0.12A	0.01O	0.12A	YES	9.72A	45.2
67.08	0.01AI	0.12A	0.01S	0.12A	YES	9.72A	45.2
	0.01AI	0.23A	0.01S	0.24A	YES	10.46A	45.2
60.17	0.01AI	0.23A	0.01N	0.24A	YES	10.46A	45.2
	0.02AI	0.40A	0.02N	0.42A	YES	11.48A	45.2
50.50	0.02AI	0.43A	0.02N	0.44A	YES	11.13A	45.2
	0.02AI	0.62A	0.02N	0.63A	YES	12.46A	45.2
37.87	0.02AI	0.62A	0.02O	0.63A	YES	12.46A	45.2
	0.02AI	0.75A	0.02N	0.76A	YES	13.80A	45.2
25.25	0.02AI	0.75A	0.02N	0.76A	YES	13.80A	45.2
	0.02AI	0.84A	0.01N	0.85A	YES	15.13A	45.2
12.62	0.02AI	0.84A	0.01N	0.85A	YES	15.13A	45.2
	0.02AI	0.90A	0.01N	0.91A	YES	16.47A	45.2
0.00							

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

DOWN	SHEAR.w.r.t.WIND.DIR ALONG	ACROSS	MOMENT.w.r.t.WIND.DIR ALONG	ACROSS	TORSION
kip	kip	kip	ft-kip	ft-kip	ft-kip
25.28 AI	10.93 N	-0.07 W	-705.52 A	2.53 W	0.15 Q

Processed under license at:

Sabre Towers and Poles on: 15 mar 2018 at: 15:19:44

75' ext. 85' Monopole / W 151st & S 80th, IL

****
********** 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	83.120	0.00	0.0	0.0	0.0000	0.0449	0.0000	0.0000
C	83.120	0.00	0.0	0.0	0.0642	0.0662	0.0000	0.0000
C	76.000	0.00	0.0	0.0	0.0000	0.7114	0.0000	0.0000
C	76.000	0.00	0.0	0.0	0.6450	2.7533	0.0000	0.0000
C	72.500	0.00	0.0	0.0	0.0041	0.2080	0.0000	0.0000
C	66.000	0.00	0.0	0.0	0.0000	0.6178	0.0000	0.0000
C	66.000	0.00	0.0	0.0	0.6264	2.7533	0.0000	0.0000
C	56.000	0.00	0.0	0.0	0.0000	0.5242	0.0000	0.0000
C	56.000	0.00	0.0	0.0	0.6054	2.7533	0.0000	0.0000
C	34.000	0.00	0.0	0.0	0.0000	0.0034	0.0000	0.0000
D	84.000	0.00	180.0	0.0	0.0082	0.0377	0.0000	0.0000
D	60.167	0.00	180.0	0.0	0.0092	0.0449	0.0000	0.0000
D	60.167	0.00	180.0	0.0	0.0096	0.0618	0.0000	0.0000
D	50.500	0.00	180.0	0.0	0.0096	0.0618	0.0000	0.0000
D	50.500	0.00	180.0	0.0	0.0098	0.0513	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0100	0.0665	0.0000	0.0000

ANTENNA LOADING

.....ANTENNA..... TYPE	ELEV ft	AZI	ATTACHMENT RAD ft	AZI	.....ANTENNA FORCES..... AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
HP	34.0	0.0	1.6	0.0	0.04	0.00	0.04	0.00

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

MAST ELEV ft	.....DEFLECTIONS (ft)..... HORIZONTAL ..... ALONG	ACROSS	DOWN	.....ROTATIONS (deg)..... TILT ..... ALONG	ACROSS	TWIST
84.0	1.59B	0.00E	0.04A	1.66B	0.00E	0.00D
79.0	1.44B	0.00E	0.03A	1.66B	0.00E	0.00D
74.0	1.30B	0.00E	0.03A	1.66B	0.00E	0.00D
67.1	1.10B	0.00E	0.02A	1.63B	0.00E	0.00D
60.2	0.91B	0.00E	0.02A	1.56B	0.00E	0.00D
50.5	0.66B	0.00K	0.01A	1.42B	0.00E	0.00D
37.9	0.38B	0.00K	0.01A	1.12B	0.00E	0.00D

25.2	0.17B	0.00K	0.00A	0.76B	0.00K	0.00D
12.6	0.04B	0.00K	0.00A	0.38B	0.00K	0.00D
0.0	0.00A	0.00A	0.00A	0.00A	0.00A	0.00A

MAXIMUM ANTENNA AND REFLECTOR ROTATIONS

ELEV ft	ANT AZI deg	ANT TYPE	.... BEAM DEFLECTIONS (deg) .... ROLL	YAW	PITCH	TOTAL
34.0	0.0	HP	1.007 D	0.008 K	1.008 A	1.008 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
84.0	0.00 B	0.00 I	0.00 K	0.00 I	0.00 L	0.00 H
	0.30 F	0.11 I	0.00 K	-0.40 I	0.00 K	0.00 I
79.0	0.31 L	0.11 L	0.00 L	-0.40 F	0.00 F	0.00 L
	3.97 L	0.80 L	0.00 L	-2.58 D	0.01 L	0.00 L
74.0	3.97 L	0.80 B	0.00 L	-2.59 D	0.01 L	0.00 L
	4.47 L	0.86 B	0.00 L	-9.15 B	0.02 L	0.00 H
67.1	4.47 L	0.86 B	0.00 B	-9.15 B	0.02 L	0.00 H
	8.14 L	1.55 B	0.00 B	-20.40 B	0.02 L	0.00 H
60.2	8.14 L	1.55 B	0.00 B	-20.39 B	0.02 L	0.00 H
	12.02 L	2.25 B	0.00 B	-41.74 B	0.04 L	0.00 H
50.5	12.02 L	2.25 D	0.00 C	-41.74 B	0.04 L	0.00 H
	12.69 L	2.37 D	0.00 C	-74.34 B	0.06 L	0.00 H
37.9	12.69 L	2.37 D	0.00 L	-74.34 B	0.06 L	0.00 H
	13.45 L	2.53 A	-0.02 K	-107.98 B	0.20 E	0.03 D
25.2	13.45 L	2.53 A	-0.02 K	-107.98 B	0.20 E	0.03 D
	14.22 L	2.65 A	-0.02 K	-142.41 B	0.38 K	0.03 D
12.6	14.22 L	2.65 A	-0.02 K	-142.41 B	0.38 K	0.03 D
	15.04 L	2.78 A	-0.02 K	-177.31 B	0.61 K	0.03 D
base reaction	15.04 L	-2.78 A	0.02 K	177.31 B	-0.61 K	-0.03 D

COMPLIANCE WITH 4.8.2 & 4.5.4

ELEV ft	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t(w/t)	MAX ALLOWED
84.00	0.00B	0.00I	0.00I	0.00I	YES	7.93A	45.2

	0.00F	0.00I	0.00I	0.00I	YES	8.46A	45.2
79.00							
	0.00L	0.00F	0.00L	0.00F	YES	8.46A	45.2
	0.00L	0.01D	0.00L	0.01L	YES	8.99A	45.2
74.00							
	0.00L	0.01D	0.00B	0.01D	YES	8.99A	45.2
	0.00L	0.03B	0.00B	0.03B	YES	9.72A	45.2
67.08							
	0.00L	0.03B	0.00B	0.03B	YES	9.72A	45.2
	0.01L	0.06B	0.00B	0.07B	YES	10.46A	45.2
60.17							
	0.01L	0.06B	0.00B	0.07B	YES	10.46A	45.2
	0.01L	0.10B	0.00B	0.11B	YES	11.48A	45.2
50.50							
	0.01L	0.11B	0.00D	0.12B	YES	11.13A	45.2
	0.01L	0.16B	0.00D	0.17B	YES	12.46A	45.2
37.87							
	0.01L	0.16B	0.00D	0.17B	YES	12.46A	45.2
	0.01L	0.19B	0.00A	0.20B	YES	13.80A	45.2
25.25							
	0.01L	0.19B	0.00A	0.20B	YES	13.80A	45.2
	0.01L	0.21B	0.00A	0.22B	YES	15.13A	45.2
12.62							
	0.01L	0.21B	0.00A	0.22B	YES	15.13A	45.2
	0.01L	0.22B	0.00A	0.23B	YES	16.47A	45.2
0.00							

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

DOWN	SHEAR.w.r.t.WIND.DIR ALONG	ACROSS	MOMENT.w.r.t.WIND.DIR ALONG	ACROSS	TORSION
kip	kip	kip	ft-kip	ft-kip	ft-kip
15.04	2.78	-0.02	-177.31	0.61	0.03
L	A	K	B	K	D

Sabre Industries™
Towers and Poles

SO#: 404472
Site Name: W 151st & S 80th, IL
Date: 3/16/2018

Round Flange Plate and Bolts per ANSI/TIA 222-G
Elevation = 74 feet

Pole Data

Diameter:	15.25	in
Thickness:	0.25	in
Yield (Fy):	65	ksi
# of Sides:	18	"0" IF Round
Strength (Fu):	80	ksi

Reactions

Moment, Mu:	10.26	ft-kips
Axial, Pu:	4.77	kips
Shear, Vu:	3.13	kips

Bolt Data

Quantity:	4		
Diameter:	0.5	in	
Bolt Material:	A325		
Strength (Fu):	120	ksi	
Yield (Fy):	92	ksi	
BC Diam. (in):	17.75	BC Override:	

Flange Bolt Results

Allowable Φ*Rnt:	12.78	kips
Adjusted Φ*Rnt (due to shear):	12.74	kips
Maximum Bolt Tension:	5.74	kips
Bolt Interaction Ratio:	**45.1%**	**Pass**

Plate Data

Diameter (in):	19.25	Dia. Override:	
Thickness:	1.5	in	
Center Hole Diam.:	10	in	
Yield (Fy):	50	ksi	
Single-Rod B-eff:	5.50	in	
Drain Hole:	1	in. diameter	
Drain Location:	6.5	in. center of pole to center of drain hole	

Flange Plate Results

Compression Side Plate (Mu/Z):	2.0	ksi
Allowable Φ*Fy:	45.0	ksi
Compr. Plate Interaction Ratio:	**4.4%**	**Pass**

Sabre Industries™
Towers and Poles

SO#: 404472
Site Name: W 151st & S 80th, IL
Date: 3/16/2018

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

Pole Data

Diameter:	25.850	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:	705.52	ft-kips
Axial, Pu:	18.03	kips
Shear, Vu:	10.93	kips

Anchor Rod Data

Quantity:	6		
Diameter:	2.25	in	
Rod Material:	A615		
Strength (Fu):	100	ksi	
Yield (Fy):	75	ksi	
BC Diam. (in):	31.5	BC Override:	

Anchor Rod Results

Maximum Rod (Pu+ Vu/η):	185.8 Kips	
Allowable Φ*Rnt:	260.0 Kips	(per 4.9.9)
Anchor Rod Interaction Ratio:	**71.5%** **Pass**	

Plate Data

Diameter (in):	37.25	Dia. Override:	
Thickness:	1.75	in	
Yield (Fy):	50	ksi	
Eff Width/Rod:	13.55	in	
Drain Hole:	2.625	in. diameter	
Drain Location:	10.75	in. center of pole to center of drain hole	
Center Hole:	13.5	in. diameter	

Base Plate Results

Base Plate (Mu/Z):	38.4 ksi	
Allowable Φ*Fy:	45.0 ksi	(per AISC)
Base Plate Interaction Ratio:	**85.4%** **Pass**	

LPile for Windows, Version 2018-10.003

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

This copy of LPile is being used by:

Matt Higgins
Sabre Industries

Serial Number of Security Device: 227886552

This copy of LPile is licensed for exclusive use by:

Sabre Communications Corporation

Use of this program by any entity other than Sabre Communications Corporation
is a violation of the software license agreement.

Files Used for Analysis

Path to file locations:
\Program Files (x86)\Ensoft\Lpile2018\files\

Name of input data file:
404472.lp10

Name of output report file:
404472.lp10

Name of plot output file:
404472.lp10

Name of runtime message file:
404472.lp10

Date and Time of Analysis

Date: March 15, 2018 Time: 15:26:56

Problem Title

Site : W 151st & S 80th, IL

Tower : 85' Monopole

Prepared for : DOLAN REALTY ADVISORS LLC

Job Number : 404472

Engineer : MH

Program Options and Settings

Computational Options:
 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 999
 - 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

 - Use of p-y modification factors for p-y curves not selected
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - 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:
 - Output files use decimal points to denote decimal symbols.
 - Report only summary tables of pile-head deflection, maximum bending moment,
   and maximum shear force in output report file.
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 18.500 ft
Depth of ground surface below top of pile = 0.5000 ft

Pile diameters 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. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	48.0000
2	18.500	48.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a round drilled shaft, bored pile, or CIDH pile
   Length of section = 18.500000 ft
   Shaft Diameter = 48.000000 in
   Shear capacity of section = 0.0000 lbs

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 6 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.500000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1000.000000 psf
Undrained cohesion at bottom of layer	=	1000.000000 psf
Epsilon-50 at top of layer	=	0.010000
Epsilon-50 at bottom of layer	=	0.010000

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	6.000000 ft
Effective unit weight at top of layer	=	125.000000 pcf
Effective unit weight at bottom of layer	=	125.000000 pcf
Undrained cohesion at top of layer	=	250.000000 psf
Undrained cohesion at bottom of layer	=	250.000000 psf
Epsilon-50 at top of layer	=	0.020000
Epsilon-50 at bottom of layer	=	0.020000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	6.000000 ft
Distance from top of pile to bottom of layer	=	8.500000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	1500. psf
Undrained cohesion at bottom of layer	=	1500. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	8.500000 ft
Distance from top of pile to bottom of layer	=	27.500000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	2500. psf
Undrained cohesion at bottom of layer	=	2500. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer	=	27.500000 ft
Distance from top of pile to bottom of layer	=	32.500000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	4000. psf
Undrained cohesion at bottom of layer	=	4000. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

Layer 6 is stiff clay without free water

Distance from top of pile to top of layer	=	32.500000 ft
Distance from top of pile to bottom of layer	=	45.500000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	2250. psf
Undrained cohesion at bottom of layer	=	2250. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

(Depth of the lowest soil layer extends 27.000 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	E50 or krm
1	Stiff Clay w/o Free Water	0.5000 3.5000	120.0000 120.0000	1000.0000 1000.0000	0.01000 0.01000
2	Soft Clay	3.5000 6.0000	125.0000 125.0000	250.0000 250.0000	0.02000 0.02000
3	Stiff Clay w/o Free Water	6.0000 8.5000	130.0000 130.0000	1500. 1500.	0.00700 0.00700
4	Stiff Clay w/o Free Water	8.5000 27.5000	130.0000 130.0000	2500. 2500.	0.00500 0.00500
5	Stiff Clay w/o Free Water	27.5000 32.5000	130.0000 130.0000	4000. 4000.	0.00500 0.00500
6	Stiff Clay w/o Free Water	32.5000 45.5000	130.0000 130.0000	2250. 2250.	0.00500 0.00500

Static 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 = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	1	V = 14573. lbs	M = 11288320. in-lbs	24040.	No
2	1	V = 2780. lbs	M = 2127720. in-lbs	15040.	No

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force 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	=	18.500000 ft
Shaft Diameter	=	48.000000 in
Concrete Cover Thickness	=	3.625000 in
Number of Reinforcing Bars	=	16 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	1810. sq. in.
Total Area of Reinforcing Steel	=	9.621128 sq. in.
Area Ratio of Steel Reinforcement	=	0.53 percent
Edge-to-Edge Bar Spacing	=	6.904227 in
Maximum Concrete Aggregate Size	=	0.750000 in
Ratio of Bar Spacing to Aggregate Size	=	9.21
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 = 7462.024 kips
Tensile Load for Cracking of Concrete = -824.678 kips
Nominal Axial Tensile Capacity = -577.268 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	0.875000	0.601320	19.937500	0.00000
2	0.875000	0.601320	18.419848	7.629751
3	0.875000	0.601320	14.097941	14.097941
4	0.875000	0.601320	7.629751	18.419848
5	0.875000	0.601320	0.00000	19.937500
6	0.875000	0.601320	-7.629751	18.419848
7	0.875000	0.601320	-14.097941	14.097941
8	0.875000	0.601320	-18.419848	7.629751
9	0.875000	0.601320	-19.937500	0.00000
10	0.875000	0.601320	-18.419848	-7.629751
11	0.875000	0.601320	-14.097941	-14.097941
12	0.875000	0.601320	-7.629751	-18.419848
13	0.875000	0.601320	0.00000	-19.937500
14	0.875000	0.601320	7.629751	-18.419848
15	0.875000	0.601320	14.097941	-14.097941
16	0.875000	0.601320	18.419848	-7.629751

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

Minimum spacing between any two bars not equal to zero = 6.904 inches
between bars 11 and 12.

Ratio of bar spacing to maximum aggregate size = 9.21

Concrete Properties:

Compressive Strength of Concrete = 4500. psi
Modulus of Elasticity of Concrete = 3823676. psi
Modulus of Rupture of Concrete = -503.115295 psi
Compression Strain at Peak Stress = 0.002001
Tensile Strain at Fracture of Concrete = -0.0001152
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 2

Number	Axial Thrust Force kips
1	15.040
2	24.040

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	15.040	12021.535	0.00300000
2	24.040	12182.938	0.00300000

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

In ACI 318, 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, 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.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	12022.	9.776000	7814.	139904194.
2	0.65	12183.	15.626000	7919.	142222183.
1	0.70	12022.	10.528000	8415.	139341478.
2	0.70	12183.	16.828000	8528.	141515425.
1	0.75	12022.	11.280000	9016.	134591574.
2	0.75	12183.	18.030000	9137.	136921642.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.5000	0.00	N.A.	No	0.00	40359.
2	3.5000	7.6114	No	No	40359.	21134.
3	6.0000	3.0881	No	No	61493.	58493.
4	8.5000	3.6180	Yes	No	119986.	451213.
5	27.5000	27.0000	No	No	571199.	0.00
6	32.5000	32.0000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	14573.	M, in-lb	1.13E+07	24040.	3.6549	-0.03482	-129837.	1.15E+07
2	V, lb	2780.	M, in-lb	2127720.	15040.	0.01794	-2.46E-04	-20765.	2165520.

Maximum pile-head deflection = 3.6549435150 inches
Maximum pile-head rotation = -0.0348155668 radians = -1.994785 deg.

The analysis ended normally.

1807.3.2.1 (2009 IBC, 2012 IBC, & 2015 IBC)

Moment (ft·k)	705.52	
Shear (k)	10.93	
Caisson diameter (ft)	4	
Caisson height above ground (ft)	0.5	
Caisson height below ground (ft)	18	
Lateral soil pressure (lb/ft^2)	**300.00**	
Ground to application of force, h (ft)	65.05	
Applied lateral force, P (lb)	10,930	
Lateral soil bearing pressure, S_1 (lb/ft)	1,800.00	
Diameter, b (ft)	4	
A	3.55	$= (2.34P)/(S_1 b)$
Minimum depth of embedment, d (ft)	17.75	$= 0.5A[\,1 + (\,1 + (\,4.36h / A\,)\,)^{1/2}\,]$