Sabre Industries™
INNOVATION DELIVERED

Structural Design Report

190' Monopole
Site: City of Naperville, IL
Site Number: CH95363A

Prepared for: T-MOBILE
by: Sabre Industries ™

Job Number: 556806
Revision C

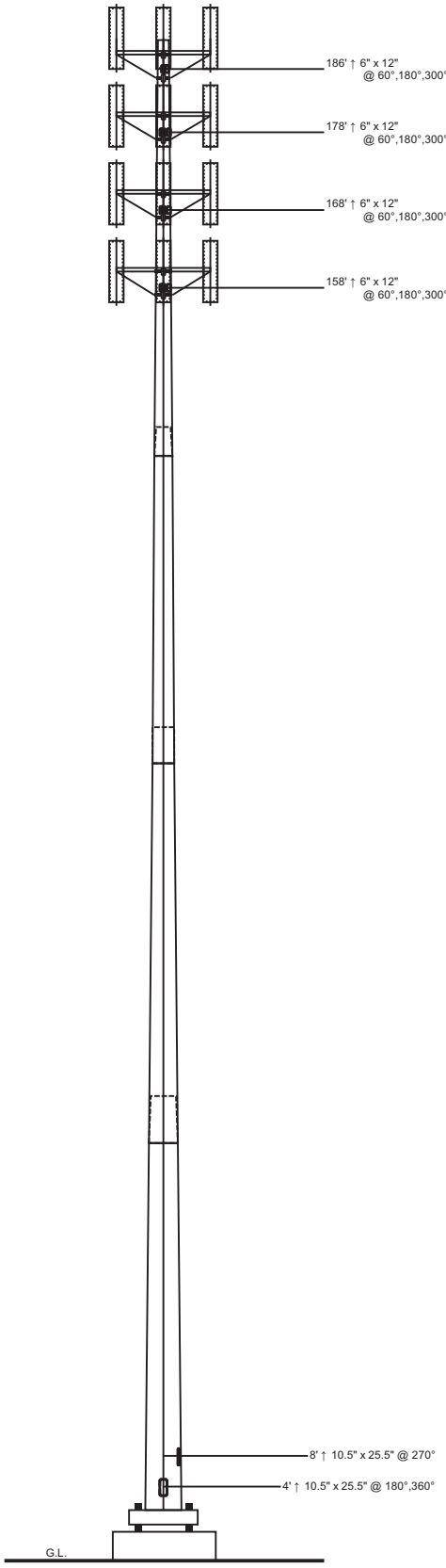
March 5, 2025

LICENSED STRUCTURAL ENGINEER
ROBERT E BEACOM
081-007778
STATE OF ILLINOIS
3/5/25

License Expires: 11-30-26

Digitally Signed By Robert Beacom
DN: C=US,SERIALNUMBER=MAS20250205984402,ST=Texas,L=Alvarado,2.5.4.97=NTRUS\+DE-4349737,O=SABRE INDUSTRIES\, INC.,CN=Robert Beacom Date: 2025.03.05 10:01:30

Length (ft)	53'-3"	53'-6"	43'-3"	53'-6"
Number Of Sides		18		
Thickness (in)	7/16"		3/8"	1/4"
Lap Splice (ft)	6' - 0"	A	B	
Top Diameter (in)	41.71"	32.15"	24.44"	14"
Bottom Diameter (in)	53.42"	43.91"	33.94"	25.76"
Taper (in/ft)	0.2198			
Grade	A572-65			
Weight (lbs)	14172	10080	5364	3353
Overall Steel Height (ft)	189			



Design Criteria - ANSI/TIA-222-H

Wind Speed (No Ice)	107 mph
Wind Speed (Ice)	40 mph
Design Ice Thickness	1.50 in
Risk Category	II
Exposure Category	C
Topographic Factor Procedure	Method 1 (Simplified)
Topographic Category	1
Ground Elevation	686 ft
Seismic Importance Factor, Ie	1.00
0.2-sec Spectral Response, Ss	0.135 g
1-sec Spectral Response, S1	0.067 g
Site Class	D (DEFAULT)
Seismic Design Category	B
Basic Seismic Force-Resisting System	Telecommunication Tower (Pole: Steel)

Limit State Load Combination Reactions

Load Combination	Axial (kips)	Shear (kips)	Moment (ft-k)	Deflection (ft)	Sway (deg)
1.2 D + 1.0 Wo	53.82	26.9	3952.16	19.04	12.87
0.9 D + 1.0 Wo	40.44	26.76	3831.32	18.28	12.29
1.2 D + 1.0 Di + 1.0 Wi	78.03	7.29	1145.96	5.9	3.97
1.2 D + 1.0 Ev + 1.0 Eh	55.09	1.34	239.73	1.28	0.86
0.9 D - 1.0 Ev + 1.0 Eh	39.06	1.36	232.53	1.21	0.81
1.0 D + 1.0 Wo (Service @ 60 mph)	44.92	7.54	1104.27	5.5	3.65

Base Plate Dimensions

Shape	Diameter	Thickness	Bolt Circle	Bolt Qty	Bolt Diameter
Round	66"	2.25"	60.25"	16	2.25"

Anchor Bolt Dimensions

Length	Diameter	Hole Diameter	Weight	Type	Finish
84"	2.25"	2.625"	1937.6	A615-75	Galv

Material List

Display	Value
A	4' - 9"
B	3' - 9"

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) Full Height Step Bolts
5) This tower design and, if applicable, the foundation design(s) shown on the following page(s) also meet or exceed the requirements of the 2021 International Building Code.
6) Tower Rating: 93.1%

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

Job:	**556806C**
Customer:	T-MOBILE
Site Name:	City of Naperville, IL CH95363A
Description:	190' Monopole
Date:	3/5/2025 By: REB

Designed Appurtenance Loading

Elev	Description	Tx-Line
190	(3) Airscale RRH 4T4R B25/66 480W (AHFII)	(2) 4 AWG
190	(3) AHLOB AirScale RRH 4T4R B71/85 320W	
190	(3) 840590966	
190	(3) AEHC Band 41 M-MIMO	
188	(1) PV-LPPGS-12M-HR25-AP3 Platform Mount	
180	(1) PV-LPPGS-12M-HR25-AP3 Platform Mount	
180	(3) 840590966	
180	(3) AEHC Band 41 M-MIMO	
180	(3) Airscale RRH 4T4R B25/66 480W (AHFII)	(2) 4 AWG
180	(3) AHLOB AirScale RRH 4T4R B71/85 320W	

Elev	Description	Tx-Line
170	(1) PV-LPPGS-12M-HR25-AP3 Platform Mount	
170	(3) Airscale RRH 4T4R B25/66 480W (AHFII)	(2) 4 AWG
170	(3) AHLOB AirScale RRH 4T4R B71/85 320W	
170	(3) 840590966	
170	(3) AEHC Band 41 M-MIMO	
160	(1) PV-LPPGS-12M-HR25-AP3 Platform Mount	
160	(3) 840590966	
160	(3) Airscale RRH 4T4R B25/66 480W (AHFII)	(2) 4 AWG
160	(3) AHLOB AirScale RRH 4T4R B71/85 320W	
160	(3) AEHC Band 41 M-MIMO	

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No.: 556806
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Revision C

Customer: T-MOBILE
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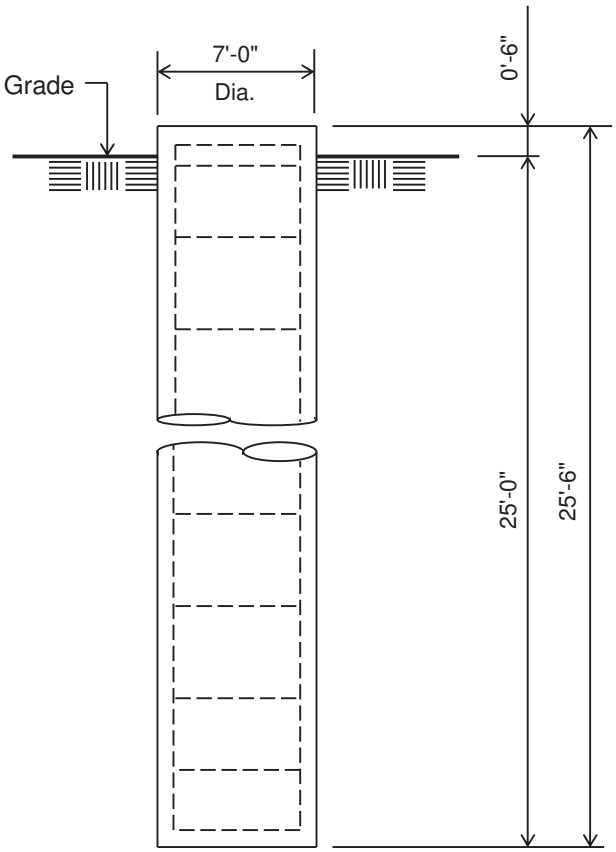
190’ Monopole



ELEVATION VIEW
(36.35 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 318-14.
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 Consulting Group project no. 242018, dated: 7/11/24.
6) See the geotechnical report for drilled pier installation requirements, if specified.
7) The bottom anchor bolt template shall be positioned as closely as possible to the bottom of the anchor bolts.

Rebar Schedule for Pier	
Pier	(36) #8 vertical rebar w/ #5 ties, (2) within top 5” of pier, then 8” C/C

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

190' Monopole / City of Naperville, 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 **Pn kip	RESISTANCES **Mn ft-kip	SPLICE TYPE	OVERLAP LENGTH ft	OVERLAP RATIO	w/t
189.0										
			14.22	0.250	810.6	227.0				
	A	18								8.6
			25.31	0.250	1448.2	733.4				
139.2										
			25.31	0.250	1448.2	733.4				
	A/B	18					SLIP	3.75	1.78	
			25.66	0.375	2201.2	1119.2				
135.5										
			25.66	0.375	2201.2	1119.2				
	B	18								10.9
			33.39	0.375	2874.9	1915.6				
100.7										
			33.39	0.375	2874.9	1915.6				
	B/C	18					SLIP	4.75	1.72	
			33.72	0.438	3380.3	2266.1				
96.0										
			33.72	0.438	3380.3	2266.1				
	C	18								12.5
			43.23	0.438	4330.0	3743.7				
53.2										
			43.23	0.438	4330.0	3743.7				
	C/D	18					SLIP	6.00	1.67	
			43.71	0.438	4366.5	3817.9				
47.2										
			43.71	0.438	4366.5	3817.9				
	D	18								16.5
			54.24	0.438	5103.9	5559.8				
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	135.500	0	A325	0.00	92.0	0	135.500
B	96.000	0	A325	0.00	92.0	0	96.000
C	47.250	0	A325	0.00	92.0	0	47.250
D	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	53.50	26.16	14.22	0.625	1	0	0	0	0
B	18	43.25	34.47	24.81	0.625	2	0	0	0	0
C	18	53.50	44.58	32.64	0.625	3	0	0	0	0
D	18	53.25	54.24	42.36	0.625	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	FLANGE in	IRREGULARITY .PROJECTION. % OF AREA	ORIENT deg
PL	1	1	0.0	26.16	0.25	0.250	0.250	0.00	0.0
PL	2	1	0.0	34.47	0.38	0.375	0.375	0.00	0.0
PL	3	1	0.0	44.58	0.44	0.438	0.438	0.00	0.0
PL	4	1	0.0	54.24	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 5 condition(s) shown in full
* RRUs/TMAs were assumed to be behind antennas

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

LOADING CONDITION A

107 mph wind with no ice. Wind Azimuth: 0• (1.2 D + 1.0 Wo)

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	189.000	0.00	0.0	0.0	3.0849	1.9750	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.0000	0.0673	0.0000	0.0000
C	187.000	0.00	0.0	0.0	1.0235	2.5836	0.0000	0.0000
C	184.500	0.00	0.0	0.0	0.0283	0.0151	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.0000	0.0644	0.0000	0.0000
C	179.000	0.00	0.0	0.0	3.4542	4.5586	0.0000	0.0000
C	175.000	0.00	0.0	0.0	0.0311	0.0168	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.0000	0.0608	0.0000	0.0000
C	169.000	0.00	0.0	0.0	3.4129	4.5586	0.0000	0.0000
C	165.000	0.00	0.0	0.0	0.0307	0.0168	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.0000	0.0572	0.0000	0.0000
C	159.000	0.00	0.0	0.0	3.3696	4.5586	0.0000	0.0000
C	155.000	0.00	0.0	0.0	0.0303	0.0168	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0298	0.0168	0.0000	0.0000
C	135.000	0.00	0.0	0.0	0.0294	0.0168	0.0000	0.0000
C	125.000	0.00	0.0	0.0	0.0289	0.0168	0.0000	0.0000
C	115.000	0.00	0.0	0.0	0.0284	0.0168	0.0000	0.0000
C	105.000	0.00	0.0	0.0	0.0279	0.0168	0.0000	0.0000
C	95.000	0.00	0.0	0.0	0.0273	0.0168	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.0267	0.0168	0.0000	0.0000
C	75.000	0.00	0.0	0.0	0.0260	0.0168	0.0000	0.0000
C	65.000	0.00	0.0	0.0	0.0252	0.0168	0.0000	0.0000
C	55.000	0.00	0.0	0.0	0.0243	0.0168	0.0000	0.0000
C	45.000	0.00	0.0	0.0	0.0233	0.0168	0.0000	0.0000
C	35.000	0.00	0.0	0.0	0.0221	0.0168	0.0000	0.0000
C	25.000	0.00	0.0	0.0	0.0206	0.0168	0.0000	0.0000
C	15.000	0.00	0.0	0.0	0.0185	0.0168	0.0000	0.0000

D	189.000	0.00	180.0	0.0	0.0341	0.0473	0.0000	0.0000
D	139.250	0.00	180.0	0.0	0.0528	0.0773	0.0000	0.0000
D	139.250	0.00	180.0	0.0	0.0547	0.2003	0.0000	0.0000
D	135.500	0.00	180.0	0.0	0.0547	0.2003	0.0000	0.0000
D	135.500	0.00	180.0	0.0	0.0555	0.1238	0.0000	0.0000
D	100.750	0.00	180.0	0.0	0.0659	0.1552	0.0000	0.0000
D	100.750	0.00	180.0	0.0	0.0673	0.3435	0.0000	0.0000
D	96.000	0.00	180.0	0.0	0.0673	0.3435	0.0000	0.0000
D	96.000	0.00	180.0	0.0	0.0678	0.1898	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0756	0.2350	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0757	0.4805	0.0000	0.0000
D	47.250	0.00	180.0	0.0	0.0757	0.4805	0.0000	0.0000
D	47.250	0.00	180.0	0.0	0.0757	0.2454	0.0000	0.0000
D	11.812	0.00	180.0	0.0	0.0697	0.2819	0.0000	0.0000
D	11.812	0.00	180.0	0.0	0.0697	0.2892	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0714	0.2965	0.0000	0.0000

LOADING CONDITION M

107 mph wind with no ice. Wind Azimuth: 0• (0.9 D + 1.0 Wo)

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	189.000	0.00	0.0	0.0	3.0849	1.4812	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.0000	0.0505	0.0000	0.0000
C	187.000	0.00	0.0	0.0	1.0235	1.9377	0.0000	0.0000
C	184.500	0.00	0.0	0.0	0.0283	0.0113	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.0000	0.0483	0.0000	0.0000
C	179.000	0.00	0.0	0.0	3.4542	3.4189	0.0000	0.0000
C	175.000	0.00	0.0	0.0	0.0311	0.0126	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.0000	0.0456	0.0000	0.0000
C	169.000	0.00	0.0	0.0	3.4129	3.4189	0.0000	0.0000
C	165.000	0.00	0.0	0.0	0.0307	0.0126	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.0000	0.0429	0.0000	0.0000
C	159.000	0.00	0.0	0.0	3.3696	3.4189	0.0000	0.0000
C	155.000	0.00	0.0	0.0	0.0303	0.0126	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0298	0.0126	0.0000	0.0000
C	135.000	0.00	0.0	0.0	0.0294	0.0126	0.0000	0.0000
C	125.000	0.00	0.0	0.0	0.0289	0.0126	0.0000	0.0000
C	115.000	0.00	0.0	0.0	0.0284	0.0126	0.0000	0.0000
C	105.000	0.00	0.0	0.0	0.0279	0.0126	0.0000	0.0000
C	95.000	0.00	0.0	0.0	0.0273	0.0126	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.0267	0.0126	0.0000	0.0000
C	75.000	0.00	0.0	0.0	0.0260	0.0126	0.0000	0.0000
C	65.000	0.00	0.0	0.0	0.0252	0.0126	0.0000	0.0000
C	55.000	0.00	0.0	0.0	0.0243	0.0126	0.0000	0.0000
C	45.000	0.00	0.0	0.0	0.0233	0.0126	0.0000	0.0000
C	35.000	0.00	0.0	0.0	0.0221	0.0126	0.0000	0.0000
C	25.000	0.00	0.0	0.0	0.0206	0.0126	0.0000	0.0000
C	15.000	0.00	0.0	0.0	0.0185	0.0126	0.0000	0.0000
D	189.000	0.00	180.0	0.0	0.0341	0.0355	0.0000	0.0000
D	139.250	0.00	180.0	0.0	0.0528	0.0580	0.0000	0.0000
D	139.250	0.00	180.0	0.0	0.0547	0.1503	0.0000	0.0000
D	135.500	0.00	180.0	0.0	0.0547	0.1503	0.0000	0.0000
D	135.500	0.00	180.0	0.0	0.0555	0.0929	0.0000	0.0000
D	100.750	0.00	180.0	0.0	0.0659	0.1164	0.0000	0.0000
D	100.750	0.00	180.0	0.0	0.0673	0.2576	0.0000	0.0000
D	96.000	0.00	180.0	0.0	0.0673	0.2576	0.0000	0.0000
D	96.000	0.00	180.0	0.0	0.0678	0.1424	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0756	0.1762	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0757	0.3604	0.0000	0.0000
D	47.250	0.00	180.0	0.0	0.0757	0.3604	0.0000	0.0000
D	47.250	0.00	180.0	0.0	0.0757	0.1841	0.0000	0.0000
D	11.812	0.00	180.0	0.0	0.0697	0.2114	0.0000	0.0000
D	11.812	0.00	180.0	0.0	0.0697	0.2169	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0714	0.2224	0.0000	0.0000

LOADING CONDITION Y

40 mph wind with 1.5 ice. Wind Azimuth: 0• (1.2 D + 1.0 Di + 1.0 Wi)

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	189.000	0.00	0.0	0.0	0.7207	3.9864	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.0000	0.0673	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.2882	3.2805	0.0000	0.0000
C	184.500	0.00	0.0	0.0	0.0317	0.0271	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.0000	0.0644	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.8530	7.2523	0.0000	0.0000
C	175.000	0.00	0.0	0.0	0.0347	0.0288	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.0000	0.0608	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.8407	7.2369	0.0000	0.0000
C	165.000	0.00	0.0	0.0	0.0341	0.0288	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.0000	0.0572	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.8279	7.2207	0.0000	0.0000
C	155.000	0.00	0.0	0.0	0.0335	0.0288	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0328	0.0288	0.0000	0.0000
C	135.000	0.00	0.0	0.0	0.0321	0.0288	0.0000	0.0000
C	125.000	0.00	0.0	0.0	0.0314	0.0288	0.0000	0.0000
C	115.000	0.00	0.0	0.0	0.0306	0.0288	0.0000	0.0000
C	105.000	0.00	0.0	0.0	0.0298	0.0288	0.0000	0.0000
C	95.000	0.00	0.0	0.0	0.0289	0.0288	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.0280	0.0288	0.0000	0.0000
C	75.000	0.00	0.0	0.0	0.0270	0.0288	0.0000	0.0000
C	65.000	0.00	0.0	0.0	0.0258	0.0288	0.0000	0.0000
C	55.000	0.00	0.0	0.0	0.0246	0.0288	0.0000	0.0000
C	45.000	0.00	0.0	0.0	0.0232	0.0288	0.0000	0.0000
C	35.000	0.00	0.0	0.0	0.0215	0.0288	0.0000	0.0000
C	25.000	0.00	0.0	0.0	0.0195	0.0288	0.0000	0.0000
C	15.000	0.00	0.0	0.0	0.0168	0.0288	0.0000	0.0000
D	189.000	0.00	180.0	0.0	0.0103	0.0840	0.0000	0.0000
D	139.250	0.00	180.0	0.0	0.0147	0.1332	0.0000	0.0000
D	139.250	0.00	180.0	0.0	0.0151	0.2584	0.0000	0.0000
D	135.500	0.00	180.0	0.0	0.0151	0.2584	0.0000	0.0000
D	135.500	0.00	180.0	0.0	0.0153	0.1828	0.0000	0.0000
D	100.750	0.00	180.0	0.0	0.0177	0.2263	0.0000	0.0000
D	100.750	0.00	180.0	0.0	0.0180	0.4164	0.0000	0.0000
D	96.000	0.00	180.0	0.0	0.0180	0.4164	0.0000	0.0000
D	96.000	0.00	180.0	0.0	0.0181	0.2634	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0198	0.3207	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0198	0.5676	0.0000	0.0000
D	47.250	0.00	180.0	0.0	0.0198	0.5676	0.0000	0.0000
D	47.250	0.00	180.0	0.0	0.0198	0.3330	0.0000	0.0000
D	11.812	0.00	180.0	0.0	0.0179	0.3718	0.0000	0.0000
D	11.812	0.00	180.0	0.0	0.0179	0.3762	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0182	0.3777	0.0000	0.0000

LOADING CONDITION AK

Seismic – Azimuth: 0• (1.2 D + 1.0 Ev + 1.0 Eh)

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	189.000	0.00	0.0	0.0	0.1173	2.0224	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.1502	2.6456	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.0039	0.0689	0.0000	0.0000
C	184.500	0.00	0.0	0.0	0.0009	0.0155	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.2428	4.6680	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.0034	0.0659	0.0000	0.0000
C	175.000	0.00	0.0	0.0	0.0009	0.0172	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.2164	4.6680	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.0029	0.0623	0.0000	0.0000

C	165.000	0.00	0.0	0.0	0.0008	0.0172	0.0000	0.0000
C	162.250	0.00	0.0	0.0	0.1486	3.4770	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.1915	4.6680	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.0024	0.0586	0.0000	0.0000
C	155.000	0.00	0.0	0.0	0.0007	0.0172	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0006	0.0172	0.0000	0.0000
C	135.000	0.00	0.0	0.0	0.0005	0.0172	0.0000	0.0000
C	125.000	0.00	0.0	0.0	0.0004	0.0172	0.0000	0.0000
C	117.620	0.00	0.0	0.0	0.1390	6.1880	0.0000	0.0000
C	115.000	0.00	0.0	0.0	0.0004	0.0172	0.0000	0.0000
C	105.000	0.00	0.0	0.0	0.0003	0.0172	0.0000	0.0000
C	95.000	0.00	0.0	0.0	0.0003	0.0172	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.0002	0.0172	0.0000	0.0000
C	75.000	0.00	0.0	0.0	0.0002	0.0172	0.0000	0.0000
C	74.000	0.00	0.0	0.0	0.1036	11.6507	0.0000	0.0000
C	65.000	0.00	0.0	0.0	0.0001	0.0172	0.0000	0.0000
C	55.000	0.00	0.0	0.0	0.0001	0.0172	0.0000	0.0000
C	45.000	0.00	0.0	0.0	0.0001	0.0172	0.0000	0.0000
C	35.000	0.00	0.0	0.0	0.0000	0.0172	0.0000	0.0000
C	26.620	0.00	0.0	0.0	0.0167	14.5341	0.0000	0.0000
C	25.000	0.00	0.0	0.0	0.0000	0.0172	0.0000	0.0000
C	15.000	0.00	0.0	0.0	0.0000	0.0172	0.0000	0.0000
D	189.000	0.00	180.0	180.0	0.0000	0.0000	0.0000	0.0000
D	0.000	0.00	180.0	180.0	0.0000	0.0000	0.0000	0.0000

LOADING CONDITION AL

Seismic - Azimuth: 0• (0.9 D - 1.0 Ev + 1.0 Eh)

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	189.000	0.00	0.0	0.0	0.1173	1.4338	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.1502	1.8757	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.0039	0.0489	0.0000	0.0000
C	184.500	0.00	0.0	0.0	0.0009	0.0109	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.2428	3.3095	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.0034	0.0468	0.0000	0.0000
C	175.000	0.00	0.0	0.0	0.0009	0.0122	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.2164	3.3095	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.0029	0.0441	0.0000	0.0000
C	165.000	0.00	0.0	0.0	0.0008	0.0122	0.0000	0.0000
C	162.250	0.00	0.0	0.0	0.1486	2.4651	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.1915	3.3095	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.0024	0.0415	0.0000	0.0000
C	155.000	0.00	0.0	0.0	0.0007	0.0122	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0006	0.0122	0.0000	0.0000
C	135.000	0.00	0.0	0.0	0.0005	0.0122	0.0000	0.0000
C	125.000	0.00	0.0	0.0	0.0004	0.0122	0.0000	0.0000
C	117.620	0.00	0.0	0.0	0.1390	4.3872	0.0000	0.0000
C	115.000	0.00	0.0	0.0	0.0004	0.0122	0.0000	0.0000
C	105.000	0.00	0.0	0.0	0.0003	0.0122	0.0000	0.0000
C	95.000	0.00	0.0	0.0	0.0003	0.0122	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.0002	0.0122	0.0000	0.0000
C	75.000	0.00	0.0	0.0	0.0002	0.0122	0.0000	0.0000
C	74.000	0.00	0.0	0.0	0.1036	8.2601	0.0000	0.0000
C	65.000	0.00	0.0	0.0	0.0001	0.0122	0.0000	0.0000
C	55.000	0.00	0.0	0.0	0.0001	0.0122	0.0000	0.0000
C	45.000	0.00	0.0	0.0	0.0001	0.0122	0.0000	0.0000
C	35.000	0.00	0.0	0.0	0.0000	0.0122	0.0000	0.0000
C	26.620	0.00	0.0	0.0	0.0167	10.3045	0.0000	0.0000
C	25.000	0.00	0.0	0.0	0.0000	0.0122	0.0000	0.0000
C	15.000	0.00	0.0	0.0	0.0000	0.0122	0.0000	0.0000
D	189.000	0.00	180.0	180.0	0.0000	0.0000	0.0000	0.0000
D	0.000	0.00	180.0	180.0	0.0000	0.0000	0.0000	0.0000

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190' Monopole / City of Naperville, IL

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
189.0	19.04I	-0.11C	2.88I	12.87I	-0.05C	0.01E
181.9	17.52I	-0.11C	2.54I	12.78I	-0.05C	0.01E
174.8	16.02I	-0.10C	2.21I	12.52I	-0.05C	0.01E
167.7	14.57I	-0.09C	1.89I	12.07I	-0.05C	0.01E
160.6	13.16I	-0.09C	1.60I	11.47I	-0.05C	0.01E
153.5	11.83I	-0.08C	1.34I	10.75I	-0.05C	0.01E
146.4	10.59I	-0.08C	1.12I	9.92I	-0.05C	0.01E
139.2	9.45I	-0.07C	0.93I	9.04I	-0.05C	0.01E
135.5	8.88I	-0.07C	0.84I	8.72I	-0.05C	0.01E
130.5	8.16I	-0.06C	0.73I	8.28I	-0.05C	0.01E
125.6	7.47I	-0.06C	0.64I	7.83I	-0.05C	0.01E
120.6	6.83I	-0.05C	0.55I	7.39I	-0.05C	0.01E
115.6	6.21I	-0.05C	0.47I	6.96I	-0.05C	0.01E
110.7	5.64I	-0.04C	0.41I	6.53I	-0.05C	0.00E
105.7	5.10I	-0.04C	0.35I	6.12I	-0.04C	0.00E
100.7	4.59I	-0.04C	0.29I	5.72I	-0.04C	0.00E
96.0	4.13I	-0.03C	0.25I	5.39I	-0.04C	0.00E
89.9	3.59I	-0.03C	0.20I	4.96I	-0.04C	0.00E
83.8	3.08I	-0.03C	0.16I	4.54I	-0.04C	0.00E
77.7	2.62I	-0.02C	0.12I	4.14I	-0.03C	0.00E
71.6	2.20I	-0.02C	0.09I	3.75I	-0.03C	0.00E
65.5	1.83I	-0.02C	0.07I	3.38I	-0.03C	0.00E
59.4	1.49I	-0.01C	0.05I	3.02I	-0.03C	0.00E
53.2	1.18I	-0.01C	0.04I	2.67I	-0.02C	0.00E
47.2	0.92I	-0.01C	0.03I	2.35I	-0.02C	0.00E
41.3	0.70I	-0.01C	0.02I	2.01I	-0.02C	0.00E
35.4	0.51I	0.00C	0.01I	1.70I	-0.02C	0.00E
29.5	0.35I	0.00C	0.01I	1.39I	-0.01C	0.00E
23.6	0.22I	0.00C	0.00I	1.09I	-0.01C	0.00E
17.7	0.12I	0.00C	0.00I	0.80I	-0.01C	0.00E
11.8	0.05I	0.00C	0.00I	0.53I	0.00C	0.00E

5.9	0.01I	0.00C	0.00Y	0.26I	0.00C	0.00E
0.0	0.00A	0.00A	0.00A	0.00A	0.00A	0.00A

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

MAST ELEV ft	TOTAL AXIAL kip	SHEAR.w.r.t.WIND.DIR ALONG kip	ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	ACROSS ft-kip	TORSION ft-kip
189.0						
	3.99 AA	3.09 C	0.00 I	0.02 C	-0.01 I	0.00 I
	7.98 AA	4.39 C	0.00 I	-32.91 I	0.03 C	0.02 E
181.9						
	7.99 AC	4.39 T	0.01 B	-32.92 I	0.04 C	0.02 E
	16.00 AC	8.14 T	0.01 B	-89.27 K	-0.11 B	0.07 E
174.8						
	16.00 AC	8.16 P	0.02 U	-89.27 L	0.09 E	0.07 E
	24.02 AC	11.86 P	0.02 U	-166.04 K	-0.22 U	0.12 E
167.7						
	24.02 AC	11.85 N	-0.02 X	-166.03 K	-0.20 U	0.12 E
	24.82 AC	12.19 N	-0.02 X	-269.20 I	-0.30 U	0.19 E
160.6						
	24.82 AB	12.20 T	0.04 U	-269.22 I	-0.28 U	0.19 E
	32.95 AB	15.93 T	0.04 U	-397.42 I	-0.55 U	0.30 E
153.5						
	32.95 AC	15.92 Q	-0.04 W	-397.39 I	-0.56 U	0.30 E
	33.82 AC	16.26 Q	-0.04 W	-533.79 K	-0.86 U	0.42 E
146.4						
	33.82 AB	16.27 P	-0.03 K	-533.76 K	-0.89 U	0.42 E
	34.77 AB	16.66 P	-0.03 K	-671.88 K	-1.03 U	0.56 E
139.2						
	34.77 Y	16.77 M	0.12 T	-672.06 K	-1.12 U	0.54 E
	35.74 Y	16.97 M	0.12 T	-745.70 K	-1.05 U	0.65 E
135.5						
	35.75 AB	17.05 F	0.19 U	-745.74 K	-0.97 U	0.65 E
	36.70 AB	17.35 F	0.19 U	-844.02 F	-1.90 U	0.75 E
130.5						
	36.70 AB	17.29 C	0.18 U	-844.04 F	-2.01 U	0.76 E
	37.65 AB	17.58 C	0.18 U	-944.76 C	-2.91 U	0.87 E
125.6						
	37.65 AB	17.61 C	-0.20 C	-944.72 C	-2.88 U	0.87 E
	38.67 AB	17.93 C	-0.20 C	-1046.78 C	-3.83 U	0.97 E
120.6						
	38.67 Y	17.96 F	0.15 K	-1046.91 C	-3.83 U	0.98 E
	39.68 Y	18.26 F	0.15 K	-1150.06 C	-4.53 U	1.06 E
115.6						
	39.68 AA	18.32 C	-0.22 C	-1149.99 C	-4.42 U	1.05 E
	40.76 AA	18.66 C	-0.22 C	-1255.00 C	-5.09 U	1.14 E
110.7						
	40.76 AB	18.56 C	-0.25 C	-1255.09 C	-5.06 U	1.14 E
	41.84 AB	18.88 C	-0.25 C	-1360.90 C	6.11 C	1.18 E
105.7						
	41.84 Y	18.91 L	0.26 B	-1360.86 C	6.03 C	1.20 E
	42.97 Y	19.26 L	0.26 B	-1467.62 C	7.40 C	1.21 E
100.7						
	42.97 Y	19.29 O	0.24 B	-1467.76 C	7.41 C	1.21 E
	44.95 Y	19.61 O	0.24 B	-1571.01 F	8.40 C	1.25 E
96.0						
	44.95 AB	19.70 I	0.40 B	-1570.85 F	8.34 C	1.26 E

	46.61 AB	20.14 I	0.40 B	-1707.46 I	9.65 C	1.32 E
89.9	.....					
	46.61 AB	20.10 I	0.32 B	-1707.50 I	9.65 C	1.32 E
	48.32 AB	20.55 I	0.32 B	-1846.04 I	10.91 C	1.39 E
83.8	.....					
	48.32 AB	20.50 I	0.32 B	-1846.02 I	10.97 C	1.39 E
	50.05 AB	20.93 I	0.32 B	-1986.50 I	12.28 C	1.47 E
77.7	.....					
	50.06 AB	20.99 O	-0.27 C	-1986.54 I	-12.30 B	1.47 E
	51.87 AB	21.45 O	-0.27 C	-2128.88 I	14.02 C	1.51 E
71.6	.....					
	51.87 AB	21.58 I	-0.29 C	-2128.95 I	14.01 C	1.52 E
	53.70 AB	22.02 I	-0.29 C	-2274.53 I	15.88 C	1.55 E
65.5	.....					
	53.70 AB	22.05 I	-0.26 C	-2274.58 I	15.88 C	1.55 E
	55.61 AB	22.53 I	-0.26 C	-2422.51 I	17.55 C	1.59 E
59.4	.....					
	55.61 AB	22.46 I	-0.32 C	-2422.53 I	17.55 C	1.59 E
	57.57 AB	22.94 I	-0.32 C	-2572.09 I	19.57 C	1.61 E
53.2	.....					
	57.57 AB	22.94 I	-0.31 C	-2572.13 I	19.59 C	1.61 E
	60.98 AB	23.39 I	-0.31 C	-2721.19 I	21.54 C	1.63 E
47.2	.....					
	60.98 AB	23.43 I	-0.28 C	-2721.21 I	21.57 C	1.63 E
	62.99 AB	23.89 I	-0.28 C	-2870.05 I	23.31 C	1.64 E
41.3	.....					
	62.99 AB	23.89 I	-0.31 C	-2870.03 I	23.34 C	1.64 E
	65.02 AB	24.33 I	-0.31 C	-3020.54 I	25.27 C	1.65 E
35.4	.....					
	65.02 AB	24.31 I	-0.33 C	-3020.55 I	25.26 C	1.65 E
	67.11 AB	24.76 I	-0.33 C	-3172.50 I	27.27 C	1.66 E
29.5	.....					
	67.11 AB	24.76 I	-0.31 C	-3172.48 I	27.27 C	1.66 E
	69.24 AB	25.21 I	-0.31 C	-3325.84 I	29.12 C	1.66 E
23.6	.....					
	69.24 AB	25.22 I	-0.30 C	-3325.85 I	29.12 C	1.66 E
	71.37 AB	25.64 I	-0.30 C	-3480.69 I	30.95 C	1.67 E
17.7	.....					
	71.37 AB	25.63 I	-0.31 C	-3480.68 I	30.95 C	1.67 E
	73.58 AB	26.06 I	-0.31 C	-3636.72 I	32.82 C	1.67 E
11.8	.....					
	73.58 AB	26.05 I	-0.33 C	-3636.73 I	32.82 C	1.67 E
	75.80 AB	26.47 I	-0.33 C	-3793.86 I	34.77 C	1.68 E
5.9	.....					
	75.80 AB	26.48 I	-0.33 C	-3793.86 I	34.77 C	1.68 E
	78.03 AB	26.90 I	-0.33 C	-3952.16 I	36.72 C	1.68 E
base reaction	78.03 AB	-26.90 I	0.33 C	3952.16 I	-36.72 C	-1.68 E

COMPLIANCE WITH 4.8.2 & 4.5.4

ELEV ft	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t(w/t)	MAX ALLOWED
189.00	.....						
	0.00AA	0.00C	0.01C	0.00AC	YES	8.64A	45.2
	0.01AA	0.12I	0.01C	0.12I	YES	9.74A	45.2
181.89	.....						
	0.01AC	0.12I	0.01T	0.12I	YES	9.74A	45.2

	0.02AC	0.26K	0.02T	0.27K	YES	10.84A	45.2
174.79							
	0.02AC	0.26L	0.02P	0.27K	YES	10.84A	45.2
	0.02AC	0.41K	0.02P	0.42K	YES	11.95A	45.2
167.68							
	0.02AC	0.41K	0.02N	0.42K	YES	11.95A	45.2
	0.02AC	0.56I	0.02N	0.57I	YES	13.05A	45.2
160.57							
	0.02AB	0.56I	0.02T	0.57I	YES	13.05A	45.2
	0.03AB	0.71I	0.03T	0.72I	YES	14.15A	45.2
153.46							
	0.03AC	0.71I	0.03Q	0.72I	YES	14.15A	45.2
	0.02AC	0.83K	0.02Q	0.84K	YES	15.25A	45.2
146.36							
	0.02AB	0.83K	0.02P	0.84K	YES	15.25A	45.2
	0.02AB	0.92K	0.02P	0.93K	YES	16.35A	45.2
139.25							
	0.02Y	0.62K	0.02M	0.63K	YES	10.78A	45.2
	0.02Y	0.64K	0.02M	0.65K	YES	11.17A	45.2
135.50							
	0.02AB	0.67K	0.02F	0.68K	YES	10.94A	45.2
	0.02AB	0.69F	0.02F	0.70F	YES	11.45A	45.2
130.54							
	0.02AB	0.69F	0.02C	0.70F	YES	11.45A	45.2
	0.02AB	0.71C	0.01C	0.72C	YES	11.96A	45.2
125.57							
	0.02AB	0.71C	0.01C	0.72C	YES	11.96A	45.2
	0.02AB	0.73C	0.01C	0.74C	YES	12.48A	45.2
120.61							
	0.02Y	0.73C	0.01F	0.74C	YES	12.48A	45.2
	0.02Y	0.74C	0.01F	0.75C	YES	12.99A	45.2
115.64							
	0.02AA	0.74C	0.01C	0.75C	YES	12.99A	45.2
	0.02AA	0.75C	0.01C	0.76C	YES	13.50A	45.2
110.68							
	0.02AB	0.75C	0.01C	0.76C	YES	13.50A	45.2
	0.02AB	0.76C	0.01C	0.77C	YES	14.02A	45.2
105.71							
	0.02Y	0.76C	0.01L	0.77C	YES	14.02A	45.2
	0.01Y	0.77C	0.01L	0.78C	YES	14.53A	45.2
100.75							
	0.01Y	0.66C	0.01O	0.67C	YES	12.40A	45.2
	0.01Y	0.66F	0.01O	0.67F	YES	12.82A	45.2
96.00							
	0.01AB	0.69F	0.01I	0.70F	YES	12.52A	45.2
	0.01AB	0.70I	0.01I	0.70I	YES	13.06A	45.2
89.89							
	0.01AB	0.70I	0.01I	0.70I	YES	13.06A	45.2
	0.01AB	0.70I	0.01I	0.70I	YES	13.60A	45.2
83.79							
	0.01AB	0.70I	0.01I	0.70I	YES	13.60A	45.2
	0.01AB	0.69I	0.01O	0.70I	YES	14.14A	45.2
77.68							
	0.01AB	0.69I	0.01O	0.70I	YES	14.14A	45.2
	0.01AB	0.69I	0.01O	0.70I	YES	14.69A	45.2
71.57							
	0.01AB	0.69I	0.01I	0.70I	YES	14.69A	45.2
	0.01AB	0.69I	0.01I	0.70I	YES	15.23A	45.2
65.46							
	0.01AB	0.69I	0.01I	0.70I	YES	15.23A	45.2
	0.01AB	0.69I	0.01I	0.70I	YES	15.77A	45.2

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 59.36  ..........................................................................
          0.01AB    0.69I     0.01I     0.70I     YES      15.77A       45.2

          0.01AB    0.69I     0.01I     0.70I     YES      16.31A       45.2
 53.25  ..........................................................................
          0.01AB    0.69I     0.01I     0.70I     YES      16.31A       45.2

          0.01AB    0.69I     0.01I     0.70I     YES      16.84A       45.2
 47.25  ..........................................................................
          0.01AB    0.71I     0.01I     0.72I     YES      16.49A       45.2

          0.01AB    0.71I     0.01I     0.72I     YES      17.01A       45.2
 41.34  ..........................................................................
          0.01AB    0.71I     0.01I     0.72I     YES      17.01A       45.2

          0.01AB    0.71I     0.01I     0.72I     YES      17.53A       45.2
 35.44  ..........................................................................
          0.01AB    0.71I     0.01I     0.72I     YES      17.53A       45.2

          0.01AB    0.71I     0.01I     0.72I     YES      18.06A       45.2
 29.53  ..........................................................................
          0.01AB    0.71I     0.01I     0.72I     YES      18.06A       45.2

          0.01AB    0.71I     0.01I     0.72I     YES      18.58A       45.2
 23.62  ..........................................................................
          0.01AB    0.71I     0.01I     0.72I     YES      18.58A       45.2

          0.01AB    0.71I     0.01I     0.72I     YES      19.10A       45.2
 17.72  ..........................................................................
          0.01AB    0.71I     0.01I     0.72I     YES      19.10A       45.2

          0.01AB    0.71I     0.01I     0.72I     YES      19.63A       45.2
 11.81  ..........................................................................
          0.01AB    0.71I     0.01I     0.72I     YES      19.63A       45.2

          0.02AB    0.71I     0.01I     0.72I     YES      20.15A       45.2
  5.91  ..........................................................................
          0.02AB    0.71I     0.01I     0.72I     YES      20.15A       45.2

          0.02AB    0.71I     0.01I     0.72I     YES      20.67A       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

   78.03       26.90       -0.33    -3952.16       36.72        1.68
      AB          I           C           I           C           E


================================================================================


================================================================================
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Sabre Towers and Poles                              on:  5 mar 2025  at:  9:44:52
================================================================================

190' Monopole / City of Naperville, IL


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

* Only 1 condition(s) shown in full
* RRUs/TMAs were assumed to be behind antennas

* 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• (1.0 D + 1.0 Wo)

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	189.000	0.00	0.0	0.0	0.8679	1.6458	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.0000	0.0561	0.0000	0.0000
C	187.000	0.00	0.0	0.0	0.2880	2.1530	0.0000	0.0000
C	184.500	0.00	0.0	0.0	0.0080	0.0126	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.0000	0.0537	0.0000	0.0000
C	179.000	0.00	0.0	0.0	0.9718	3.7988	0.0000	0.0000
C	175.000	0.00	0.0	0.0	0.0087	0.0140	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.0000	0.0507	0.0000	0.0000
C	169.000	0.00	0.0	0.0	0.9602	3.7988	0.0000	0.0000
C	165.000	0.00	0.0	0.0	0.0086	0.0140	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.0000	0.0477	0.0000	0.0000
C	159.000	0.00	0.0	0.0	0.9480	3.7988	0.0000	0.0000
C	155.000	0.00	0.0	0.0	0.0085	0.0140	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0084	0.0140	0.0000	0.0000
C	135.000	0.00	0.0	0.0	0.0083	0.0140	0.0000	0.0000
C	125.000	0.00	0.0	0.0	0.0081	0.0140	0.0000	0.0000
C	115.000	0.00	0.0	0.0	0.0080	0.0140	0.0000	0.0000
C	105.000	0.00	0.0	0.0	0.0078	0.0140	0.0000	0.0000
C	95.000	0.00	0.0	0.0	0.0077	0.0140	0.0000	0.0000
C	85.000	0.00	0.0	0.0	0.0075	0.0140	0.0000	0.0000
C	75.000	0.00	0.0	0.0	0.0073	0.0140	0.0000	0.0000
C	65.000	0.00	0.0	0.0	0.0071	0.0140	0.0000	0.0000
C	55.000	0.00	0.0	0.0	0.0068	0.0140	0.0000	0.0000
C	45.000	0.00	0.0	0.0	0.0066	0.0140	0.0000	0.0000
C	35.000	0.00	0.0	0.0	0.0062	0.0140	0.0000	0.0000
C	25.000	0.00	0.0	0.0	0.0058	0.0140	0.0000	0.0000
C	15.000	0.00	0.0	0.0	0.0052	0.0140	0.0000	0.0000
D	189.000	0.00	180.0	0.0	0.0096	0.0394	0.0000	0.0000
D	139.250	0.00	180.0	0.0	0.0149	0.0644	0.0000	0.0000
D	139.250	0.00	180.0	0.0	0.0154	0.1669	0.0000	0.0000
D	135.500	0.00	180.0	0.0	0.0154	0.1669	0.0000	0.0000
D	135.500	0.00	180.0	0.0	0.0156	0.1032	0.0000	0.0000
D	100.750	0.00	180.0	0.0	0.0186	0.1294	0.0000	0.0000
D	100.750	0.00	180.0	0.0	0.0189	0.2863	0.0000	0.0000
D	96.000	0.00	180.0	0.0	0.0189	0.2863	0.0000	0.0000
D	96.000	0.00	180.0	0.0	0.0191	0.1582	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0213	0.1958	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0213	0.4004	0.0000	0.0000
D	47.250	0.00	180.0	0.0	0.0213	0.4004	0.0000	0.0000
D	47.250	0.00	180.0	0.0	0.0213	0.2045	0.0000	0.0000
D	11.812	0.00	180.0	0.0	0.0196	0.2349	0.0000	0.0000
D	11.812	0.00	180.0	0.0	0.0196	0.2410	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0201	0.2471	0.0000	0.0000

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

MAST ELEV ft	.....DEFLECTIONS (ft)..... HORIZONTAL ..... ALONG	ACROSS	DOWN	.....ROTATIONS (deg)..... TILT ..... ALONG	ACROSS	TWIST
189.0	5.50B	0.02K	0.24B	3.65B	0.01K	0.00C
181.9	5.05B	0.02K	0.21B	3.62B	0.01K	0.00C
174.8	4.60B	0.02K	0.18B	3.55B	0.01K	0.00C
167.7	4.17B	0.02K	0.16B	3.42B	0.01K	0.00C
160.6	3.76B	0.02K	0.13B	3.25B	0.01K	0.00C
153.5	3.37B	0.02K	0.11B	3.04B	0.01K	0.00C
146.4	3.01B	0.02K	0.09B	2.80B	0.01K	0.00C

139.2	2.68B	0.01K	0.08B	2.55B	0.01K	0.00C
135.5	2.51B	0.01K	0.07B	2.46B	0.01K	0.00C
130.5	2.31B	0.01K	0.06B	2.33B	0.01K	0.00C
125.6	2.11B	0.01K	0.05B	2.20B	0.01K	0.00C
120.6	1.93B	0.01K	0.05B	2.08B	0.01K	0.00C
115.6	1.75B	0.01K	0.04B	1.96B	0.01K	0.00C
110.7	1.59B	0.01K	0.03K	1.84B	0.01K	0.00C
105.7	1.43B	0.01K	0.03K	1.72B	0.01K	0.00C
100.7	1.29B	0.01K	0.02K	1.60B	0.01K	0.00C
96.0	1.16B	0.01K	0.02K	1.51B	0.01K	0.00C
89.9	1.01B	0.01K	0.02K	1.39B	0.01K	0.00C
83.8	0.86B	0.01K	0.01K	1.27B	0.01K	0.00C
77.7	0.74B	0.01K	0.01K	1.16B	0.01K	0.00C
71.6	0.62B	0.00K	0.01K	1.05B	0.01K	0.00C
65.5	0.51B	0.00K	0.01K	0.95B	0.01K	0.00C
59.4	0.42B	0.00K	0.01K	0.84B	0.01K	0.00C
53.2	0.33B	0.00K	0.00K	0.75B	0.01K	0.00C
47.2	0.26B	0.00K	0.00K	0.66B	0.00K	0.00C
41.3	0.19B	0.00K	0.00K	0.56B	0.00K	0.00C
35.4	0.14B	0.00K	0.00K	0.47B	0.00K	0.00C
29.5	0.10B	0.00K	0.00K	0.39B	0.00K	0.00C
23.6	0.06B	0.00K	0.00K	0.30B	0.00K	0.00C
17.7	0.03B	0.00K	0.00K	0.22B	0.00K	0.00C
11.8	0.01B	0.00K	0.00D	0.15B	0.00K	0.00C
5.9	0.00B	0.00K	0.00D	0.07B	0.00K	0.00C
0.0	0.00A	0.00A	0.00A	0.00A	0.00A	0.00A

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

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
189.0	1.65 K	0.87 L	0.00 K	-0.01 K	0.00 K	0.00 K
	4.16 K	1.24 L	0.00 K	-9.40 B	0.01 C	0.00 K
181.9	4.16 D	1.24 K	0.00 K	-9.40 I	0.01 C	0.00 K
	8.35 D	2.30 K	0.00 K	-25.43 K	-0.03 K	0.00 C
174.8	8.35 C	2.30 I	0.00 E	-25.43 K	-0.03 K	0.00 C
	12.54 C	3.34 I	0.00 E	-47.20 K	0.04 B	0.01 C
167.7	12.54 K	3.34 I	-0.01 B	-47.19 I	0.05 B	0.01 C
	12.92 K	3.44 I	-0.01 B	-76.43 K	0.10 B	0.01 C
160.6	12.92 K	3.44 I	-0.01 B	-76.44 K	0.09 B	0.01 C

	17.18 K	4.48 I	−0.01 B	−112.58 K	0.18 B	0.02 C
153.5						
	17.18 K	4.49 E	−0.01 B	−112.57 K	0.19 B	0.02 C
	17.60 K	4.58 E	−0.01 B	−150.97 K	0.26 B	0.02 C
146.4						
	17.60 K	4.58 K	−0.01 B	−150.97 K	0.26 B	0.03 C
	18.06 K	4.69 K	−0.01 B	−189.78 K	0.37 B	0.03 C
139.2						
	18.06 F	4.74 E	−0.02 E	−189.77 K	0.36 B	0.03 C
	18.69 F	4.80 E	−0.02 E	−210.48 K	0.37 B	0.04 C
135.5						
	18.69 L	4.78 B	−0.05 B	−210.45 K	0.32 B	0.04 C
	19.22 L	4.87 B	−0.05 B	−238.23 K	0.56 B	0.05 C
130.5						
	19.23 D	4.91 B	0.05 C	−238.25 K	0.56 B	0.05 C
	19.77 D	4.99 B	0.05 C	−266.31 I	0.72 B	0.06 C
125.6						
	19.77 D	4.98 B	−0.04 I	−266.32 I	0.71 B	0.06 C
	20.34 D	5.07 B	−0.04 I	−294.92 B	0.88 B	0.07 C
120.6						
	20.34 D	5.08 B	0.03 C	−294.90 B	0.90 B	0.07 C
	20.92 D	5.16 B	0.03 C	−323.85 B	1.00 B	0.08 C
115.6						
	20.92 D	5.20 B	−0.03 F	−323.86 B	1.01 B	0.08 C
	21.53 D	5.29 B	−0.03 F	−353.34 B	1.11 B	0.09 C
110.7						
	21.54 D	5.26 B	−0.05 B	−353.31 B	1.10 B	0.08 C
	22.15 D	5.35 B	−0.05 B	−382.95 B	1.37 B	0.09 C
105.7						
	22.15 D	5.35 B	0.07 K	−382.95 B	1.33 B	0.09 C
	22.80 D	5.45 B	0.07 K	−412.96 B	1.47 B	0.09 C
100.7						
	22.80 D	5.45 B	0.07 K	−412.91 B	1.49 B	0.09 C
	24.16 D	5.54 B	0.07 K	−442.04 B	1.46 B	0.09 C
96.0						
	24.16 D	5.53 E	0.05 K	−442.04 B	1.42 B	0.09 C
	25.16 D	5.65 E	0.05 K	−479.89 B	−1.56 K	0.09 C
89.9						
	25.15 D	5.66 B	0.06 K	−479.90 B	−1.55 K	0.09 C
	26.18 D	5.78 B	0.06 K	−518.44 B	−1.95 K	0.09 C
83.8						
	26.18 D	5.79 E	−0.06 F	−518.44 B	−1.96 K	0.09 C
	27.23 D	5.91 E	−0.06 F	−557.51 B	−2.33 K	0.09 C
77.7						
	27.23 D	5.92 B	0.08 K	−557.52 B	−2.33 K	0.09 C
	28.33 D	6.05 B	0.08 K	−597.29 B	−2.81 K	0.09 C
71.6						
	28.33 D	6.03 B	0.09 K	−597.30 B	−2.80 K	0.09 C
	29.44 D	6.15 B	0.09 K	−637.51 B	−3.36 K	0.09 C
65.5						
	29.44 D	6.16 B	0.07 K	−637.50 B	−3.38 K	0.09 C
	30.60 D	6.29 B	0.07 K	−678.38 B	−3.81 K	0.09 C
59.4						
	30.60 D	6.28 B	0.08 K	−678.37 B	−3.80 K	0.09 C
	31.79 D	6.42 B	0.08 K	−719.76 B	−4.31 K	0.10 C
53.2						
	31.79 D	6.43 B	0.08 K	−719.75 B	−4.31 K	0.10 C
	34.20 D	6.56 B	0.08 K	−761.11 B	−4.78 K	0.10 C
47.2						
	34.20 D	6.56 B	0.08 K	−761.11 B	−4.77 K	0.10 C
	35.43 D	6.69 B	0.08 K	−802.42 B	−5.25 K	0.10 C

41.3						
	35.43 D	6.70 B	0.08 K	−802.41 B	−5.25 K	0.10 C
	36.69 D	6.82 B	0.08 K	−844.24 B	−5.73 K	0.10 C
35.4						
	36.69 D	6.81 B	0.08 K	−844.25 B	−5.73 K	0.10 C
	37.98 D	6.94 B	0.08 K	−886.54 B	−6.23 K	0.10 C
29.5						
	37.98 D	6.94 B	0.08 K	−886.53 B	−6.23 K	0.10 C
	39.31 D	7.07 B	0.08 K	−929.27 B	−6.72 K	0.10 C
23.6						
	39.31 D	7.07 B	0.08 K	−929.26 B	−6.72 K	0.10 C
	40.65 D	7.19 B	0.08 K	−972.45 B	−7.20 K	0.10 C
17.7						
	40.65 D	7.18 B	0.08 K	−972.44 B	−7.21 K	0.10 C
	42.04 D	7.30 B	0.08 K	−1016.01 B	−7.70 K	0.10 C
11.8						
	42.04 D	7.30 B	0.08 K	−1016.01 B	−7.70 K	0.10 C
	43.47 D	7.42 B	0.08 K	−1059.95 B	−8.20 K	0.10 C
5.9						
	43.47 D	7.42 B	0.08 K	−1059.95 B	−8.20 K	0.10 C
	44.92 D	7.54 B	0.08 K	−1104.27 B	−8.68 K	0.10 C
base reaction	44.92 D	−7.54 B	−0.08 K	1104.27 B	8.68 K	−0.10 C

COMPLIANCE WITH 4.8.2 & 4.5.4

ELEV ft	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t(w/t)	MAX ALLOWED
189.00							
	0.00K	0.00K	0.00L	0.00K	YES	8.64A	45.2
	0.00K	0.03B	0.00L	0.04B	YES	9.74A	45.2
181.89							
	0.00D	0.03I	0.00K	0.04I	YES	9.74A	45.2
	0.01D	0.07K	0.00K	0.08K	YES	10.84A	45.2
174.79							
	0.01C	0.07K	0.00I	0.08K	YES	10.84A	45.2
	0.01C	0.12K	0.01I	0.13K	YES	11.95A	45.2
167.68							
	0.01K	0.12I	0.01I	0.13K	YES	11.95A	45.2
	0.01K	0.16K	0.01I	0.17K	YES	13.05A	45.2
160.57							
	0.01K	0.16K	0.01I	0.17K	YES	13.05A	45.2
	0.01K	0.20K	0.01I	0.21K	YES	14.15A	45.2
153.46							
	0.01K	0.20K	0.01E	0.21K	YES	14.15A	45.2
	0.01K	0.23K	0.01E	0.25K	YES	15.25A	45.2
146.36							
	0.01K	0.23K	0.01K	0.25K	YES	15.25A	45.2
	0.01K	0.26K	0.01K	0.27K	YES	16.35A	45.2
139.25							
	0.01F	0.17K	0.00E	0.18K	YES	10.78A	45.2
	0.01F	0.18K	0.00E	0.19K	YES	11.17A	45.2
135.50							
	0.01L	0.19K	0.00B	0.20K	YES	10.94A	45.2
	0.01L	0.20K	0.00B	0.20K	YES	11.45A	45.2
130.54							
	0.01D	0.20K	0.00B	0.20K	YES	11.45A	45.2
	0.01D	0.20I	0.00B	0.21I	YES	11.96A	45.2

125.57							
	0.01D	0.20I	0.00B	0.21I	YES	11.96A	45.2
	0.01D	0.21B	0.00B	0.21B	YES	12.48A	45.2
120.61							
	0.01D	0.21B	0.00B	0.21B	YES	12.48A	45.2
	0.01D	0.21B	0.00B	0.22B	YES	12.99A	45.2
115.64							
	0.01D	0.21B	0.00B	0.22B	YES	12.99A	45.2
	0.01D	0.21B	0.00B	0.22B	YES	13.50A	45.2
110.68							
	0.01D	0.21B	0.00B	0.22B	YES	13.50A	45.2
	0.01D	0.21B	0.00B	0.22B	YES	14.02A	45.2
105.71							
	0.01D	0.21B	0.00B	0.22B	YES	14.02A	45.2
	0.01D	0.22B	0.00B	0.22B	YES	14.53A	45.2
100.75							
	0.01D	0.19B	0.00B	0.19B	YES	12.40A	45.2
	0.01D	0.19B	0.00B	0.19B	YES	12.82A	45.2
96.00							
	0.01D	0.20B	0.00E	0.20B	YES	12.52A	45.2
	0.01D	0.20B	0.00E	0.20B	YES	13.06A	45.2
89.89							
	0.01D	0.20B	0.00B	0.20B	YES	13.06A	45.2
	0.01D	0.20B	0.00B	0.20B	YES	13.60A	45.2
83.79							
	0.01D	0.20B	0.00E	0.20B	YES	13.60A	45.2
	0.01D	0.19B	0.00E	0.20B	YES	14.14A	45.2
77.68							
	0.01D	0.19B	0.00B	0.20B	YES	14.14A	45.2
	0.01D	0.19B	0.00B	0.20B	YES	14.69A	45.2
71.57							
	0.01D	0.19B	0.00B	0.20B	YES	14.69A	45.2
	0.01D	0.19B	0.00B	0.20B	YES	15.23A	45.2
65.46							
	0.01D	0.19B	0.00B	0.20B	YES	15.23A	45.2
	0.01D	0.19B	0.00B	0.20B	YES	15.77A	45.2
59.36							
	0.01D	0.19B	0.00B	0.20B	YES	15.77A	45.2
	0.01D	0.19B	0.00B	0.20B	YES	16.31A	45.2
53.25							
	0.01D	0.19B	0.00B	0.20B	YES	16.31A	45.2
	0.01D	0.19B	0.00B	0.20B	YES	16.84A	45.2
47.25							
	0.01D	0.20B	0.00B	0.21B	YES	16.49A	45.2
	0.01D	0.20B	0.00B	0.21B	YES	17.01A	45.2
41.34							
	0.01D	0.20B	0.00B	0.21B	YES	17.01A	45.2
	0.01D	0.20B	0.00B	0.21B	YES	17.53A	45.2
35.44							
	0.01D	0.20B	0.00B	0.21B	YES	17.53A	45.2
	0.01D	0.20B	0.00B	0.21B	YES	18.06A	45.2
29.53							
	0.01D	0.20B	0.00B	0.21B	YES	18.06A	45.2
	0.01D	0.20B	0.00B	0.21B	YES	18.58A	45.2
23.62							
	0.01D	0.20B	0.00B	0.21B	YES	18.58A	45.2
	0.01D	0.20B	0.00B	0.21B	YES	19.10A	45.2
17.72							
	0.01D	0.20B	0.00B	0.21B	YES	19.10A	45.2
	0.01D	0.20B	0.00B	0.21B	YES	19.63A	45.2
11.81							

```
            0.01D     0.20B     0.00B     0.21B     YES       19.63A       45.2

            0.01D     0.20B     0.00B     0.21B     YES       20.15A       45.2
  5.91  ..........................................................................
            0.01D     0.20B     0.00B     0.21B     YES       20.15A       45.2

            0.01D     0.20B     0.00B     0.21B     YES       20.67A       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
44.92	7.54	0.08	-1104.27	-8.68	0.10
D	B	K	B	K	C

Seismic Load Effects
Equivalent Lateral Force Procedure
ANSI/TIA-222-H

Parameters	
Risk Category	II
R	1.500
S_S	0.135
S_1	0.067
Site Class	D (default)
T_L (sec)	12.000
F_a	1.600
F_v	2.400
S_{MS}	0.216
S_{M1}	0.161
S_{DS}	0.144
S_{D1}	0.107
T_s	0.743
I_e	1.000
Ω	1.500
C_S	0.030
E (ksi)	29,000
I_{top} (in^4)	261
I_{bot} (in^4)	26,155
I_{avg} (in^4)	13,208
g (in/s^2)	386.4
W_t (kips)	44.829
W_u (kips)	15.195
W_L (kips)	29.633
L_p (in)	2268
f_1 (Hertz)	0.208
T (sec)	4.797
k_e	2.0000
V_s (kips)	1.345
Seismic Design Category	B

Vertical Distribution of Seismic Forces

Description	h_i (ft.)	w_i (kips)	W_u (kips)	$w_i h_i^{ke}$	F_{sz} or E_h (kips)	E_V (kips)	1.2 D + 1.0 E_V (kips)	0.9 D - 1.0 E_V (kips)
Antenna Load	189.00	1.6458	1.6458	58,789.6218	0.1173	0.0474	2.0224	1.4338
Line Deadload	187.00	0.0561	0.0000	1,961.7609	0.0039	0.0016	0.0689	0.0489
Mount Load	187.00	2.1530	2.1530	75,288.2570	0.1502	0.0620	2.6456	1.8757
Step Bolts/Safety Climb Load	184.50	0.0126	0.0000	428.9072	0.0009	0.0004	0.0155	0.0109
Line Deadload	179.00	0.0537	0.0000	1,720.6017	0.0034	0.0015	0.0659	0.0468
Mount/Antenna Load	179.00	3.7988	3.7988	121,717.3508	0.2428	0.1094	4.6680	3.3095
Step Bolts/Safety Climb Load	175.00	0.0140	0.0000	428.7500	0.0009	0.0004	0.0172	0.0122
Line Deadload	169.00	0.0507	0.0000	1,448.0427	0.0029	0.0015	0.0623	0.0441
Mount/Antenna Load	169.00	3.7988	3.7988	108,497.5268	0.2164	0.1094	4.6680	3.3095
Step Bolts/Safety Climb Load	165.00	0.0140	0.0000	381.1500	0.0008	0.0004	0.0172	0.0122
Structure - Section 1	162.25	2.8296	0.0000	74,489.3968	0.1486	0.0815	3.4770	2.4651
Line Deadload	159.00	0.0477	0.0000	1,205.9037	0.0024	0.0014	0.0586	0.0415
Mount/Antenna Load	159.00	3.7988	3.7988	96,037.4628	0.1915	0.1094	4.6680	3.3095
Step Bolts/Safety Climb Load	155.00	0.0140	0.0000	336.3500	0.0007	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	145.00	0.0140	0.0000	294.3500	0.0006	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	135.00	0.0140	0.0000	255.1500	0.0005	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	125.00	0.0140	0.0000	218.7500	0.0004	0.0004	0.0172	0.0122
Structure - Section 2	117.62	5.0358	0.0000	69,667.5958	0.1390	0.1450	6.1880	4.3872
Step Bolts/Safety Climb Load	115.00	0.0140	0.0000	185.1500	0.0004	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	105.00	0.0140	0.0000	154.3500	0.0003	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	95.00	0.0140	0.0000	126.3500	0.0003	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	85.00	0.0140	0.0000	101.1500	0.0002	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	75.00	0.0140	0.0000	78.7500	0.0002	0.0004	0.0172	0.0122
Structure - Section 3	74.00	9.4813	0.0000	51,919.5988	0.1036	0.2731	11.6507	8.2601
Step Bolts/Safety Climb Load	65.00	0.0140	0.0000	59.1500	0.0001	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	55.00	0.0140	0.0000	42.3500	0.0001	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	45.00	0.0140	0.0000	28.3500	0.0001	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	35.00	0.0140	0.0000	17.1500	0.0000	0.0004	0.0172	0.0122
Structure - Section 4	26.62	11.8279	0.0000	8,381.5385	0.0167	0.3406	14.5341	10.3045
Step Bolts/Safety Climb Load	25.00	0.0140	0.0000	8.7500	0.0000	0.0004	0.0172	0.0122
Step Bolts/Safety Climb Load	15.00	0.0140	0.0000	3.1500	0.0000	0.0004	0.0172	0.0122
	Σ	44.83	15.1952	674,272.72	1.35	1.29	55.09	39.05

Sabre Industries™
INNOVATION DELIVERED

SO#: 556806C
Site Name: City of Naperville, IL
Date: 3/5/2025

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

Pole Data

Diameter:	53.420	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:	3952.16	ft-kips
Axial, Pu:	53.82	kips
Shear, Vu:	26.9	kips

Anchor Rod Data

Quantity:	16		
Diameter:	2.25	in	
Rod Material:	A615		
Strength (Fu):	100	ksi	
Yield (Fy):	75	ksi	
BC Diam. (in):	60.25	BC Override:	

Anchor Rod Results (per 4.9.9)

Maximum Put:	194.27	Kips
Φt*Rnt:	243.75	Kips
Vu:	1.68	Kips
Φv*Rnv:	149.10	Kips
Tension Interaction Ratio:	0.64	
Maximum Puc:	200.15	Kips
Φc*Rnc:	268.39	Kips
Vu:	1.68	Kips
Φc*Rnvc:	120.77	Kips
Compression Interaction Ratio:	0.75	
Maximum Interaction Ratio:	**74.6%**	**Pass**

Plate Data

Diameter (in):	66	Dia. Override:	
Thickness:	2.25	in	
Yield (Fy):	50	ksi	
Eff Width/Rod:	10.60	in	
Drain Hole:	2.625	in. diameter	
Drain Location:	24.5	in. center of pole to center of drain hole	
Center Hole:	41	in. diameter	

Base Plate Results

Base Plate (Mu/Z):	31.6	ksi
Allowable Φ*Fy:	45.0	ksi (per AISC)
Base Plate Interaction Ratio:	**70.2%**	**Pass**

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

                    LPile for Windows, Version 2019-11.009

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

This copy of LPile is being used by:

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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\Program Files (x86)\Ensoft\Lpile2019\files\

Name of input data file:
556806C.lp11d

Name of output report file:
556806C.lp11o

Name of plot output file:
556806C.lp11p

Name of runtime message file:
556806C.lp11r


--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 5, 2025              Time:   9:43:33


--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Site         : City of Naperville, IL


Tower        : 190' Monopole


Prepared for : T-MOBILE


Job Number   : 556806 Revision C


Engineer     : REB


--------------------------------------------------------------------------------
                        Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

```
 - 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
 - Input of moment resistance at the pile tip not selected
 - Input of side resistance moment along pile 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                                  =      25.500 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.

            Depth Below          Pile
Point        Pile Head         Diameter
 No.            feet            inches
-----      -------------     -------------
  1             0.000          84.0000
  2            25.500          84.0000


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                                  =    25.500000 ft
   Shaft Diameter                                     =    84.000000 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	=	125.000000 pcf
Effective unit weight at bottom of layer	=	125.000000 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 2 is stiff clay without free water

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	15.000000 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	=	3500. psf
Undrained cohesion at bottom of layer	=	3500. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	15.000000 ft
Distance from top of pile to bottom of layer	=	22.500000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Friction angle at top of layer	=	38.000000 deg.
Friction angle at bottom of layer	=	38.000000 deg.
Subgrade k at top of layer	=	225.000000 pci
Subgrade k at bottom of layer	=	225.000000 pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	22.500000 ft
Distance from top of pile to bottom of layer	=	27.500000 ft
Effective unit weight at top of layer	=	47.600000 pcf
Effective unit weight at bottom of layer	=	47.600000 pcf
Friction angle at top of layer	=	33.000000 deg.
Friction angle at bottom of layer	=	33.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	27.500000 ft
Distance from top of pile to bottom of layer	=	30.500000 ft
Effective unit weight at top of layer	=	52.600000 pcf
Effective unit weight at bottom of layer	=	52.600000 pcf
Friction angle at top of layer	=	40.000000 deg.
Friction angle at bottom of layer	=	40.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 6 is stiff clay without free water

Distance from top of pile to top of layer	=	30.500000 ft
Distance from top of pile to bottom of layer	=	35.500000 ft
Effective unit weight at top of layer	=	77.600000 pcf
Effective unit weight at bottom of layer	=	77.600000 pcf
Undrained cohesion at top of layer	=	7000. psf
Undrained cohesion at bottom of layer	=	7000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

(Depth of the lowest soil layer extends 10.000 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	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay	0.5000	125.0000	1500.	--	0.00700	--
	w/o Free Water	3.5000	125.0000	1500.	--	0.00700	--
2	Stiff Clay	3.5000	130.0000	3500.	--	0.00500	--
	w/o Free Water	15.0000	130.0000	3500.	--	0.00500	--
3	Sand	15.0000	115.0000	--	38.0000	--	225.0000
	(Reese, et al.)	22.5000	115.0000	--	38.0000	--	225.0000
4	Sand	22.5000	47.6000	--	33.0000	--	60.0000
	(Reese, et al.)	27.5000	47.6000	--	33.0000	--	60.0000
5	Sand	27.5000	52.6000	--	40.0000	--	125.0000
	(Reese, et al.)	30.5000	52.6000	--	40.0000	--	125.0000
6	Stiff Clay	30.5000	77.6000	7000.	--	0.00400	--
	w/o Free Water	35.5000	77.6000	7000.	--	0.00400	--

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	Run Analysis
1	1	V = 35867. lbs	M = 63234560. in-lbs	71760.	No	Yes
2	1	V = 7540. lbs	M = 13251240. in-lbs	44920.	No	Yes

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	=	25.500000 ft
Shaft Diameter	=	84.000000 in
Concrete Cover Thickness (to edge of long. rebar)	=	3.625000 in
Number of Reinforcing Bars	=	36 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	5542. sq. in.
Total Area of Reinforcing Steel	=	28.274334 sq. in.
Area Ratio of Steel Reinforcement	=	0.51 percent
Edge-to-Edge Bar Spacing	=	5.602048 in
Maximum Concrete Aggregate Size	=	0.750000 in
Ratio of Bar Spacing to Aggregate Size	=	7.47
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	=	22785.579 kips
Tensile Load for Cracking of Concrete	=	-2522.125 kips
Nominal Axial Tensile Capacity	=	-1696.460 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.000000	0.785398	37.875000	0.00000
2	1.000000	0.785398	37.299594	6.576925
3	1.000000	0.785398	35.590858	12.954013
4	1.000000	0.785398	32.800712	18.937500
5	1.000000	0.785398	29.013933	24.345581
6	1.000000	0.785398	24.345581	29.013933
7	1.000000	0.785398	18.937500	32.800712
8	1.000000	0.785398	12.954013	35.590858
9	1.000000	0.785398	6.576925	37.299594
10	1.000000	0.785398	0.00000	37.875000
11	1.000000	0.785398	-6.576925	37.299594
12	1.000000	0.785398	-12.954013	35.590858
13	1.000000	0.785398	-18.937500	32.800712
14	1.000000	0.785398	-24.345581	29.013933
15	1.000000	0.785398	-29.013933	24.345581
16	1.000000	0.785398	-32.800712	18.937500
17	1.000000	0.785398	-35.590858	12.954013
18	1.000000	0.785398	-37.299594	6.576925
19	1.000000	0.785398	-37.875000	0.00000
20	1.000000	0.785398	-37.299594	-6.576925
21	1.000000	0.785398	-35.590858	-12.954013
22	1.000000	0.785398	-32.800712	-18.937500
23	1.000000	0.785398	-29.013933	-24.345581
24	1.000000	0.785398	-24.345581	-29.013933
25	1.000000	0.785398	-18.937500	-32.800712
26	1.000000	0.785398	-12.954013	-35.590858
27	1.000000	0.785398	-6.576925	-37.299594
28	1.000000	0.785398	0.00000	-37.875000
29	1.000000	0.785398	6.576925	-37.299594
30	1.000000	0.785398	12.954013	-35.590858
31	1.000000	0.785398	18.937500	-32.800712
32	1.000000	0.785398	24.345581	-29.013933
33	1.000000	0.785398	29.013933	-24.345581
34	1.000000	0.785398	32.800712	-18.937500
35	1.000000	0.785398	35.590858	-12.954013
36	1.000000	0.785398	37.299594	-6.576925

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

Minimum spacing between any two bars not equal to zero = 5.602 inches
between bars 30 and 31.

Ratio of bar spacing to maximum aggregate size = 7.47

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	44.920
2	71.760

Summary of Results for Nominal 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	44.920	63434.081	0.00300000
2	71.760	64325.743	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 (0.75).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318,
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	Nominal Ax. Thrust kips	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	44.920000	63434.	29.198000	41232.	1.3595E+09
2	0.65	71.760000	64326.	46.644000	41812.	1.3819E+09
1	0.75	44.920000	63434.	33.690000	47576.	1.3100E+09
2	0.75	71.760000	64326.	53.820000	48244.	1.3322E+09
1	0.90	44.920000	63434.	40.428000	57091.	833339159.
2	0.90	71.760000	64326.	64.584000	57893.	848222874.

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	102038.
2	3.5000	1.3555	Yes	No	102038.	1060839.
3	15.0000	12.5638	No	No	1162877.	1816919.
4	22.5000	24.5323	Yes	No	2979795.	727618.
5	27.5000	27.0000	No	No	3707414.	0.00
6	30.5000	30.0000	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	35867.	M, in-lb	6.32E+07	71760.	1.7027	-0.02298	-424691.	6.39E+07
2	V, lb	7540.	M, in-lb	1.33E+07	44920.	0.02722	-2.78E-04	-99214.	1.33E+07

Maximum pile-head deflection = 1.7026878845 inches
Maximum pile-head rotation = -0.0229752537 radians = -1.316385 deg.

The analysis ended normally.

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Moment (ft·k)	3,952.16	
Shear (k)	26.90	
Caisson diameter (ft)	7	
Caisson height above ground (ft)	0.5	
Caisson height below ground (ft)	25	
Lateral soil pressure (lb/ft^2)	**363.00**	
Ground to application of force, h (ft)	147.42	
Applied lateral force, P (lb)	26,900	
Lateral soil bearing pressure, S_1 (lb/ft)	3,025.00	
Diameter, b (ft)	7	
A	2.97	$= (2.34P)/(S_1 b)$
Minimum depth of embedment, d (ft)	23.39	$= 0.5A[\ 1 + (\ 1 + (\ 4.36h\ /\ A\ )\ )^{1/2}\ ]$

190' Monopole / City of Naperville, IL
Maximum