



Structural Design Report

150' Monopole

Site: MRK Trail, WI

Site Number: WI047

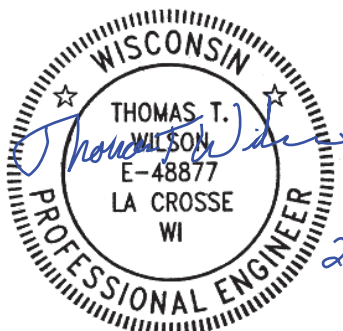
Prepared for: DIAMOND COMMUNICATIONS LLC

by: Sabre IndustriesTM

Job Number: 538652

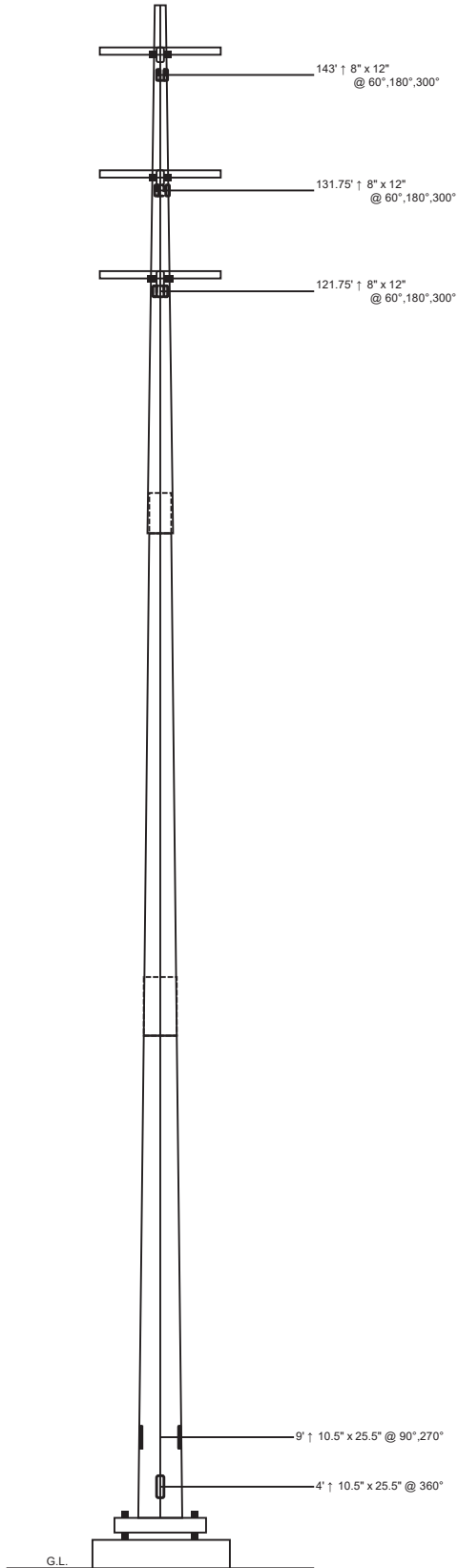
February 21, 2024

Monopole Profile.....	1
Foundation Design Summary (Preliminary) (Option 1).....	2
Foundation Design Summary (Preliminary) (Option 2).....	3
Pole Calculations.....	4-15
Foundation Calculations.....	16-23



2/21/2024

Length (ft)	53'-3"	53'-6"	52'-0"
Number Of Sides	18		
Thickness (in)	5/16"	1/4"	
Lap Splice (ft)	5'-9"	4'-0"	
Top Diameter (in)	38.87"	26.58"	14.1"
Bottom Diameter (in)	53.26"	41.05"	28.16"
Taper (in/ft)		0.2704	
Grade		A572-65	
Weight (lbs)	10152	6427	3515
Overall Steel Height (ft)			149



Designed Appurtenance Loading

Elev	Description	Tx-Line
145	H.D. MOVE Platform (Monopole Only) - 12' w/ Support Rail (AT&T approved)	
145	(1) 30,000 Sq. Inches 8,000# (below top)	(12) 1 5/8"
133	Platform - 12'	
133	(1) 25,000 sq. in. (8000 lbs) (below top)	(12) 1 5/8"
123	Platform - 12'	
123	(1) 15,000 sq. in. (3000 lbs) (below top)	(12) 1 5/8"

Design Criteria - ANSI/TIA-222-G

ASCE 7-16 Ultimate Wind Speed (No Ice)	107 mph
Wind Speed (Ice)	40 mph
Design Ice Thickness	1.50 in
Structure Class	II
Risk Category	II
Exposure Category	C
Topographic Category	1
Seismic Importance Factor, Ie	1.00
0.2-sec Spectral Response, Ss	0.081 g
1-sec Spectral Response, S1	0.05 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	55.16	26.74	3415.27	14.23	11.35
0.9 D + 1.0 Wo	41.38	26.66	3278.77	13.48	10.67
1.2 D + 1.0 Di + 1.0 Wi	100.28	7.07	1097.48	5.13	4.16
1.2 D + 1.0 Ev + 1.0 Eh	55.95	1.38	211.69	0.97	0.77
0.9 D - 1.0 Ev + 1.0 Eh	40.58	1.38	200.88	0.9	0.72
1.0 D + 1.0 Wo (Service @ 60 mph)	46.01	7.79	982.65	4.18	3.28

Base Plate Dimensions

Shape	Diameter	Thickness	Bolt Circle	Bolt Qty	Bolt Diameter
Round	65.5"	2"	59.75"	12	2.25"

Anchor Bolt Dimensions

Length	Diameter	Hole Diameter	Weight	Type	Finish
84"	2.25"	2.625"	1453.2	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) This tower design and, if applicable, the foundation design(s) shown on the following page(s) also meet or exceed the requirements of the 2015 International Building Code.
- 5) Full Height Step Bolts
- 6) Tower Rating: 99.8%



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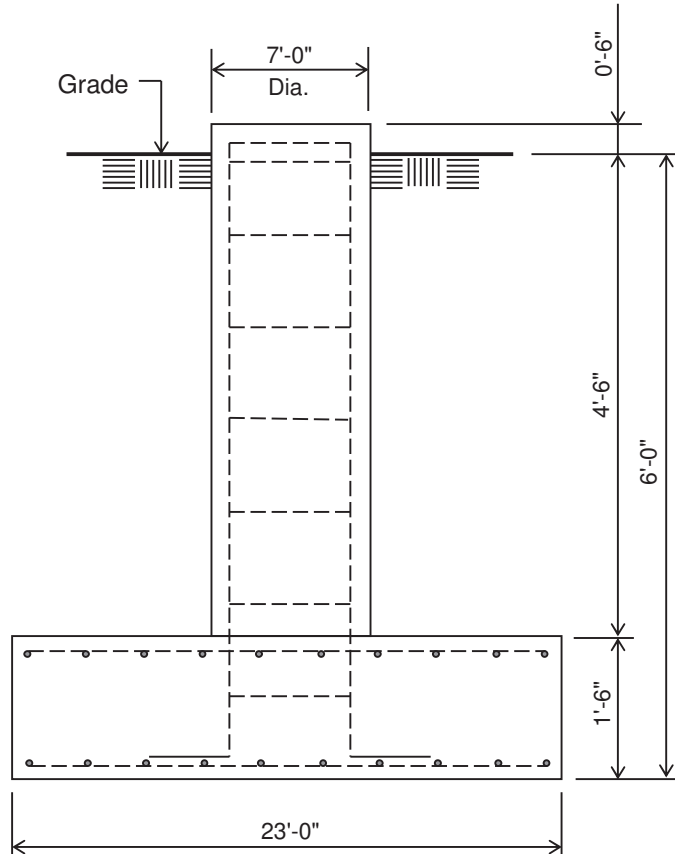
Job:	538652
Customer:	DIAMOND COMMUNICATIONS LLC
Site Name:	MRK Trail, WI WI047
Description:	150' Monopole
Date:	2/21/2024
By:	TTW

Customer: DIAMOND COMMUNICATIONS LLC

Site: MRK Trail, WI W1047

150' Monopole

PRELIMINARY -NOT FOR CONSTRUCTION-



ELEVATION VIEW

(36.52 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 presumptive clay soil as defined in ANSI/TIA-222-G-2005. It is recommended that a soil analysis of the site be performed to verify the soil parameters used in the design.
- 6) 4.5 ft of soil cover is required over the entire area of the foundation slab.
- 7) The foundation is based on the following factored loads:
Moment = 3,415.27 k-ft
Axial = 55.16 k
Shear = 26.74 k

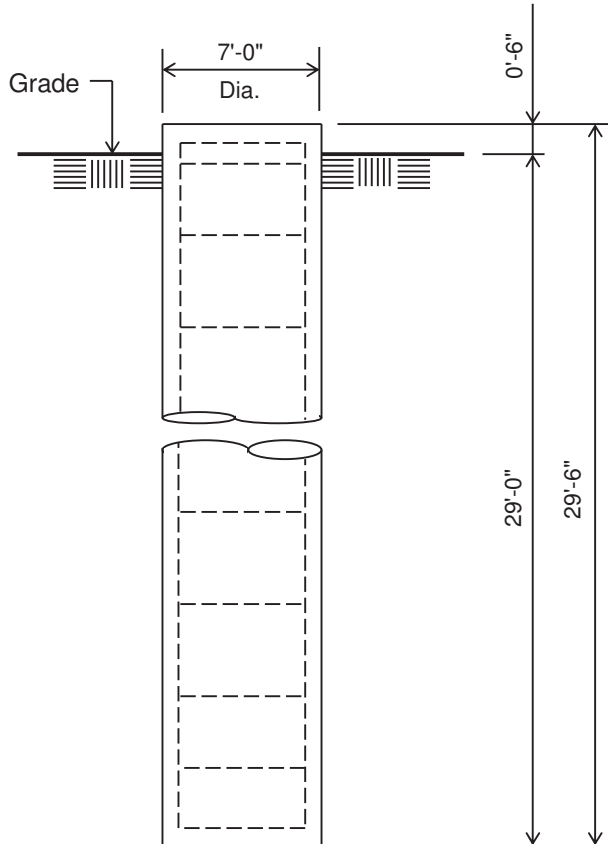
Rebar Schedule for Pad and Pier	
Pier	(36) #8 vertical rebar w/ hooks at bottom w/ #5 ties, (2) within top 5" of pier, then 12" C/C
Pad	(47) #8 horizontal rebar evenly spaced each way top and bottom (188 total)

Customer: DIAMOND COMMUNICATIONS LLC

Site: MRK Trail, WI WI047

150' Monopole

PRELIMINARY -NOT FOR CONSTRUCTION-



ELEVATION VIEW

(42.05 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 presumptive clay soil as defined in ANSI/TIA-222-G-2005. It is recommended that a soil analysis of the site be performed to verify the soil parameters used in the design.
- 6) The foundation is based on the following factored loads:
Moment = 3,415.27 k-ft
Axial = 55.16 k
Shear = 26.74 k

Rebar Schedule for Pier

Pier	(36) #8 vertical rebar w/ #5 ties, (2) within top 5" of pier, then 12" C/C
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150' Monopole / MRK Trail, WI

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

POLE GEOMETRY =====

ELEV	SECTION	No.	OUTSIDE	THICK	RESISTANCES	SPLICE	...OVERLAP...	w/t
ft	NAME	SIDE	DIAM	-NESS	*Pn *Mn	TYPE	LENGTH	RATIO
			in	in	kip ft-kip		ft	
149.0								
	A	18	14.32	0.250	816.5 230.4			8.2
			27.49	0.250	1551.8 854.9			
101.0								
	A/B	18	27.49	0.250	1551.8 854.9	SLIP	4.00	1.73
			28.09	0.312	2015.9 1130.4			
97.0								
	B	18	28.09	0.312	2015.9 1130.4			13.8
			40.09	0.312	2701.8 2176.5			
53.2								
	B/C	18	40.09	0.312	2701.8 2176.5	SLIP	5.75	1.71
			41.05	0.312	2744.7 2265.1			
47.5								
	C	18	41.05	0.312	2744.7 2265.1			21.1
			54.09	0.312	3220.2 3514.1			
0.0								

POLE ASSEMBLY =====

SECTION	BASE	BOLTS	AT	BASE	OF	SECTION	CALC
NAME	ELEV	NUMBER	TYPE	DIAM	STRENGTH	THREADS IN	BASE
	ft			in	ksi	SHEAR PLANE	ELEV
							ft
A	97.000	0	A325	0.00	92.0	0	97.000
B	47.500	0	A325	0.00	92.0	0	47.500
C	0.000	0	A325	0.00	92.0	0	0.000

POLE SECTIONS =====

SECTION	No. of	LENGTH	OUTSIDE	DIAMETER	BEND	MAT-	FLANGE	ID	FLANGE	WELD
NAME	SIDES		BOT	TOP	RAD	ERIAL	BOT	TOP	..GROUP	ID..
		ft	* in	* in	in	ID			BOT	TOP
A	18	52.00	28.59	14.32	0.000	1	0	0	0	0
B	18	53.50	41.68	26.99	0.000	2	0	0	0	0
C	18	53.25	54.09	39.47	0.000	3	0	0	0	0

* - Diameter of circumscribed circle

MATERIAL TYPES =====

TYPE OF	TYPE	NO OF	ORIENT	HEIGHT	WIDTH	.THICKNESS.	IRREGULARITY
SHAPE	NO	ELEM.				WEB FLANGE	.PROJECTION.
							% OF ORIENT
							AREA

			& deg	in	in	in	in		deg
PL	1	1	0.0	28.60	0.25	0.250	0.250	0.00	0.0
PL	2	1	0.0	41.68	0.31	0.312	0.312	0.00	0.0
PL	3	1	0.0	54.09	0.31	0.312	0.312	0.00	0.0

& - With respect to vertical

MATERIAL PROPERTIES

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

* Only 5 condition(s) shown in full

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

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LOADING CONDITION A

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

LOADS ON POLE

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LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	..AT AZI	LOAD AZI	FORCES..... HORIZ kip	DOWN kip	MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	144.000	0.00	0.0	0.0	0.0000	2.1565	0.0000	0.0000
C	144.000	0.00	0.0	0.0	7.7213	12.0252	0.0000	0.0000
C	132.000	0.00	0.0	0.0	0.0000	1.9768	0.0000	0.0000
C	132.000	0.00	0.0	0.0	6.0866	11.2920	0.0000	0.0000
C	122.000	0.00	0.0	0.0	0.0000	1.8271	0.0000	0.0000
C	122.000	0.00	0.0	0.0	3.8214	5.2920	0.0000	0.0000
D	149.000	0.00	180.0	0.0	0.0359	0.0521	0.0000	0.0000
D	133.000	0.00	180.0	0.0	0.0359	0.0521	0.0000	0.0000
D	133.000	0.00	180.0	0.0	0.0444	0.0659	0.0000	0.0000
D	117.000	0.00	180.0	0.0	0.0444	0.0659	0.0000	0.0000
D	117.000	0.00	180.0	0.0	0.0522	0.0798	0.0000	0.0000
D	101.000	0.00	180.0	0.0	0.0522	0.0798	0.0000	0.0000
D	101.000	0.00	180.0	0.0	0.0567	0.1973	0.0000	0.0000
D	97.000	0.00	180.0	0.0	0.0567	0.1973	0.0000	0.0000
D	97.000	0.00	180.0	0.0	0.0596	0.1189	0.0000	0.0000
D	82.417	0.00	180.0	0.0	0.0596	0.1189	0.0000	0.0000
D	82.417	0.00	180.0	0.0	0.0651	0.1347	0.0000	0.0000
D	67.833	0.00	180.0	0.0	0.0651	0.1347	0.0000	0.0000
D	67.833	0.00	180.0	0.0	0.0695	0.1506	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0695	0.1506	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0718	0.3211	0.0000	0.0000
D	47.500	0.00	180.0	0.0	0.0718	0.3211	0.0000	0.0000
D	47.500	0.00	180.0	0.0	0.0721	0.1691	0.0000	0.0000
D	35.625	0.00	180.0	0.0	0.0721	0.1691	0.0000	0.0000
D	35.625	0.00	180.0	0.0	0.0724	0.1820	0.0000	0.0000
D	23.750	0.00	180.0	0.0	0.0724	0.1820	0.0000	0.0000
D	23.750	0.00	180.0	0.0	0.0700	0.1949	0.0000	0.0000
D	11.875	0.00	180.0	0.0	0.0700	0.1949	0.0000	0.0000
D	11.875	0.00	180.0	0.0	0.0712	0.2078	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0712	0.2078	0.0000	0.0000

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LOADING CONDITION M

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

LOADS ON POLE

=====

LOAD TYPE	ELEV ft	APPLY. RADIUS ft	LOAD. AT AZI	LOAD AZI	FORCES.....		MOMENTS.....	
					HORIZ kip	DOWN kip	VERTICAL ft-kip	TORSNAL ft-kip
C	144.000	0.00	0.0	0.0	0.0000	1.6174	0.0000	0.0000
C	144.000	0.00	0.0	0.0	7.7213	9.0189	0.0000	0.0000
C	132.000	0.00	0.0	0.0	0.0000	1.4826	0.0000	0.0000
C	132.000	0.00	0.0	0.0	6.0866	8.4690	0.0000	0.0000
C	122.000	0.00	0.0	0.0	0.0000	1.3703	0.0000	0.0000
C	122.000	0.00	0.0	0.0	3.8214	3.9690	0.0000	0.0000
D	149.000	0.00	180.0	0.0	0.0359	0.0391	0.0000	0.0000
D	133.000	0.00	180.0	0.0	0.0359	0.0391	0.0000	0.0000
D	133.000	0.00	180.0	0.0	0.0444	0.0494	0.0000	0.0000
D	117.000	0.00	180.0	0.0	0.0444	0.0494	0.0000	0.0000
D	117.000	0.00	180.0	0.0	0.0522	0.0598	0.0000	0.0000
D	101.000	0.00	180.0	0.0	0.0522	0.0598	0.0000	0.0000
D	101.000	0.00	180.0	0.0	0.0567	0.1480	0.0000	0.0000
D	97.000	0.00	180.0	0.0	0.0567	0.1480	0.0000	0.0000
D	97.000	0.00	180.0	0.0	0.0596	0.0892	0.0000	0.0000
D	82.417	0.00	180.0	0.0	0.0596	0.0892	0.0000	0.0000
D	82.417	0.00	180.0	0.0	0.0651	0.1011	0.0000	0.0000
D	67.833	0.00	180.0	0.0	0.0651	0.1011	0.0000	0.0000
D	67.833	0.00	180.0	0.0	0.0695	0.1129	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0695	0.1129	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0718	0.2408	0.0000	0.0000
D	47.500	0.00	180.0	0.0	0.0718	0.2408	0.0000	0.0000
D	47.500	0.00	180.0	0.0	0.0718	0.1268	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0710	0.1559	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. RADIUS ft	LOAD. AT AZI	LOAD AZI	FORCES.....		MOMENTS.....	
					HORIZ kip	DOWN kip	VERTICAL ft-kip	TORSNAL ft-kip
C	144.000	0.00	0.0	0.0	0.0000	2.1565	0.0000	0.0000
C	144.000	0.00	0.0	0.0	1.9615	27.2010	0.0000	0.0000
C	132.000	0.00	0.0	0.0	0.0000	1.9768	0.0000	0.0000
C	132.000	0.00	0.0	0.0	1.5080	25.5041	0.0000	0.0000
C	122.000	0.00	0.0	0.0	0.0000	1.8271	0.0000	0.0000
C	122.000	0.00	0.0	0.0	0.9489	10.8388	0.0000	0.0000
D	149.000	0.00	180.0	0.0	0.0117	0.0908	0.0000	0.0000
D	133.000	0.00	180.0	0.0	0.0117	0.0908	0.0000	0.0000
D	133.000	0.00	180.0	0.0	0.0138	0.1133	0.0000	0.0000
D	117.000	0.00	180.0	0.0	0.0138	0.1133	0.0000	0.0000
D	117.000	0.00	180.0	0.0	0.0159	0.1356	0.0000	0.0000
D	101.000	0.00	180.0	0.0	0.0159	0.1356	0.0000	0.0000
D	101.000	0.00	180.0	0.0	0.0170	0.2581	0.0000	0.0000
D	97.000	0.00	180.0	0.0	0.0170	0.2581	0.0000	0.0000
D	97.000	0.00	180.0	0.0	0.0177	0.1833	0.0000	0.0000
D	82.417	0.00	180.0	0.0	0.0177	0.1833	0.0000	0.0000
D	82.417	0.00	180.0	0.0	0.0191	0.2059	0.0000	0.0000
D	67.833	0.00	180.0	0.0	0.0191	0.2059	0.0000	0.0000
D	67.833	0.00	180.0	0.0	0.0202	0.2280	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0202	0.2280	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0207	0.4024	0.0000	0.0000
D	47.500	0.00	180.0	0.0	0.0207	0.4024	0.0000	0.0000
D	47.500	0.00	180.0	0.0	0.0207	0.2522	0.0000	0.0000
D	35.625	0.00	180.0	0.0	0.0207	0.2522	0.0000	0.0000
D	35.625	0.00	180.0	0.0	0.0207	0.2683	0.0000	0.0000
D	23.750	0.00	180.0	0.0	0.0207	0.2683	0.0000	0.0000
D	23.750	0.00	180.0	0.0	0.0198	0.2826	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0200	0.2921	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.. RADIUS ft	LOAD.. AZI	AT AZI	FORCES.....		MOMENTS.....	
					HORIZ kip	DOWN kip	VERTICAL ft-kip	TORSNAL ft-kip
C	144.000	0.00	0.0	0.0	0.4703	12.1976	0.0000	0.0000
C	144.000	0.00	0.0	0.0	0.0843	2.1874	0.0000	0.0000
C	132.000	0.00	0.0	0.0	0.3711	11.4539	0.0000	0.0000
C	132.000	0.00	0.0	0.0	0.0650	2.0052	0.0000	0.0000
C	123.000	0.00	0.0	0.0	0.1002	3.5608	0.0000	0.0000
C	122.000	0.00	0.0	0.0	0.1485	5.3679	0.0000	0.0000
C	122.000	0.00	0.0	0.0	0.0513	1.8533	0.0000	0.0000
C	74.250	0.00	0.0	0.0	0.0753	7.3438	0.0000	0.0000
C	26.620	0.00	0.0	0.0	0.0132	9.9836	0.0000	0.0000
D	149.000	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.. RADIUS ft	LOAD.. AZI	AT AZI	FORCES.....		MOMENTS.....	
					HORIZ kip	DOWN kip	VERTICAL ft-kip	TORSNAL ft-kip
C	144.000	0.00	0.0	0.0	0.4703	8.8465	0.0000	0.0000
C	144.000	0.00	0.0	0.0	0.0843	1.5865	0.0000	0.0000
C	132.000	0.00	0.0	0.0	0.3711	8.3071	0.0000	0.0000
C	132.000	0.00	0.0	0.0	0.0650	1.4544	0.0000	0.0000
C	123.000	0.00	0.0	0.0	0.1002	2.5826	0.0000	0.0000
C	122.000	0.00	0.0	0.0	0.1485	3.8931	0.0000	0.0000
C	122.000	0.00	0.0	0.0	0.0513	1.3441	0.0000	0.0000
C	74.250	0.00	0.0	0.0	0.0753	5.3262	0.0000	0.0000
C	26.620	0.00	0.0	0.0	0.0132	7.2408	0.0000	0.0000
D	149.000	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

(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: 21 feb 2024 at: 13:16:40

150' Monopole / MRK Trail, WI

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

MAST ELEV ft	DEFLECTIONS (ft).....			ROTATIONS (deg).....		
	HORIZONTAL ALONG	ACROSS	DOWN	TILT ALONG	ACROSS	TWIST
149.0	14.23F	0.01K	1.98A	11.35F	0.01K	0.00F
133.0	11.21F	-0.01O	1.39A	10.99F	0.01K	0.00F

117.0	8.40F	-0.01O	0.88A	9.64F	0.01K	0.00F
101.0	6.02F	-0.01O	0.51A	7.76F	0.01K	0.00F
97.0	5.50F	-0.01O	0.45A	7.37F	-0.01O	0.00F
82.4	3.83F	-0.01O	0.25A	5.93F	-0.01O	0.00F
67.8	2.50F	0.00O	0.13A	4.61F	-0.01O	0.00F
53.2	1.49F	0.00O	0.06A	3.43F	-0.01O	0.00F
47.5	1.17F	0.00O	0.04A	3.01F	0.00O	0.00F
35.6	0.63F	0.00O	0.02A	2.14F	0.00O	0.00F
23.7	0.27F	0.00O	0.00A	1.36F	0.00O	0.00F
11.9	0.07F	0.00O	0.00AG	0.65F	0.00O	0.00F
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	WIND.DIR ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	WIND.DIR ACROSS ft-kip	TORSION ft-kip
149.0	0.00 F	0.00 Q	0.00 L	0.00 N	0.00 L	0.00 L
133.0	30.81 Z	8.29 N	0.00 L	-116.84 A	0.03 AA	-0.01 U
117.0	30.81 AG	8.29 X	0.00 F	-116.84 A	0.03 AA	-0.01 U
101.0	72.76 AG	18.90 X	0.00 F	-442.17 A	0.12 AA	-0.03 U
97.0	72.76 AJ	18.90 N	0.00 E	-442.17 A	0.12 AA	-0.03 U
82.4	74.93 AJ	19.72 N	0.00 E	-832.14 A	0.23 AA	-0.06 U
67.8	74.93 AG	19.83 A	0.05 T	-832.07 A	0.23 AA	-0.06 U
53.2	75.96 AG	20.06 A	0.05 T	-930.09 A	0.29 AA	-0.08 U
47.5	75.97 AG	20.06 F	-0.06 O	-930.08 A	0.28 AA	-0.09 U
35.6	78.64 AG	20.92 F	-0.06 O	-1290.02 F	0.95 O	-0.10 F
23.7	78.64 AG	20.92 F	-0.05 O	-1290.03 F	0.94 O	-0.11 F
11.9	81.64 AG	21.87 F	-0.05 O	-1653.93 F	-1.71 K	-0.15 F
0.0	81.64 AG	21.87 F	0.05 K	-1653.92 F	-1.72 K	-0.15 F
	84.96 AG	22.88 F	0.05 K	-2022.40 F	-2.47 K	-0.19 F
	84.96 AG	22.88 F	0.06 K	-2022.46 F	-2.46 K	-0.19 F
	87.28 AG	23.29 F	0.06 K	-2169.36 F	-2.81 K	-0.21 F
	87.28 AG	23.35 F	-0.07 F	-2169.35 F	-2.81 K	-0.21 F
	90.27 AG	24.21 F	-0.07 F	-2476.12 F	-3.51 K	-0.25 F
	90.27 AG	24.20 F	-0.07 O	-2476.12 F	-3.52 K	-0.25 F
	93.46 AG	25.06 F	-0.07 O	-2786.08 F	4.26 O	-0.27 F
	93.46 AG	25.07 F	-0.07 O	-2786.09 F	4.26 O	-0.27 F
	96.84 AG	25.90 F	-0.07 O	-3099.20 F	5.12 O	-0.28 F
	96.84 AG	25.90 F	-0.07 O	-3099.19 F	5.11 O	-0.28 F
	100.28 AG	26.74 F	-0.07 O	-3415.27 F	6.00 O	-0.29 F

base

reaction 100.28 AG -26.74 F 0.07 O 3415.27 F -6.00 O 0.29 F

COMPLIANCE WITH 4.8.2 & 4.5.4

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ELEV ft	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t (w/t)	MAX ALLOWED
149.00	0.00F	0.00N	0.00Q	0.00N	YES	8.18A	45.2
133.00	0.03Z	0.29A	0.02N	0.31A	YES	11.23A	45.2
	0.03AG	0.29A	0.02X	0.31K	YES	11.23A	45.2
117.00	0.05AG	0.72A	0.03X	0.75A	YES	14.29A	45.2
	0.05AJ	0.72A	0.03R	0.75A	YES	14.29A	45.2
101.00	0.05AJ	0.97A	0.03R	1.00A	YES	17.34A	45.2
	0.04AG	0.77A	0.02A	0.79A	YES	13.52A	45.2
97.00	0.04AG	0.79A	0.02A	0.81A	YES	14.13A	45.2
	0.04AG	0.82A	0.02F	0.84A	YES	13.84A	45.2
82.42	0.03AG	0.87F	0.02F	0.89F	YES	16.07A	45.2
	0.03AG	0.87F	0.02F	0.89F	YES	16.07A	45.2
67.83	0.03AG	0.91F	0.02F	0.93F	YES	18.29A	45.2
	0.03AG	0.91F	0.02F	0.93F	YES	18.29A	45.2
53.25	0.03AG	0.93F	0.02F	0.95F	YES	20.52A	45.2
	0.03AG	0.93F	0.02F	0.95F	YES	20.52A	45.2
47.50	0.03AG	0.93F	0.02F	0.95F	YES	21.40A	45.2
	0.03AG	0.96F	0.02F	0.98F	YES	21.04A	45.2
35.62	0.03AG	0.96F	0.02F	0.98F	YES	22.86A	45.2
	0.03AG	0.96F	0.02F	0.98F	YES	22.86A	45.2
23.75	0.03AG	0.97F	0.02F	0.98F	YES	24.67A	45.2
	0.03AG	0.97F	0.02F	0.98F	YES	24.67A	45.2
11.87	0.03AG	0.97F	0.02F	0.99F	YES	26.48A	45.2
	0.03AG	0.97F	0.02F	0.99F	YES	26.48A	45.2
0.00	0.03AG	0.97F	0.02F	0.99F	YES	28.29A	45.2

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

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DOWN kip	SHEAR.w.r.t.WIND.DIR ALONG kip	WIND.DIR ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	WIND.DIR ACROSS ft-kip	TORSION ft-kip
100.28 AG	26.74 F	-0.07 O	-3415.27 F	6.00 O	-0.29 F

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

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150' Monopole / MRK Trail, WI

***** 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° (1.0 D + 1.0 Wo)

LOADS ON POLE
=====

LOAD TYPE	ELEV ft	APPLY.. RADIUS ft	LOAD.. AZI	AT AZI	FORCES.....		MOMENTS.....	
					HORIZ kip	DOWN kip	VERTICAL ft-kip	TORSNAL ft-kip
C	144.000	0.00	0.0	0.0	0.0000	1.7971	0.0000	0.0000
C	144.000	0.00	0.0	0.0	2.2564	10.0210	0.0000	0.0000
C	132.000	0.00	0.0	0.0	0.0000	1.6474	0.0000	0.0000
C	132.000	0.00	0.0	0.0	1.7787	9.4100	0.0000	0.0000
C	122.000	0.00	0.0	0.0	0.0000	1.5226	0.0000	0.0000
C	122.000	0.00	0.0	0.0	1.1167	4.4100	0.0000	0.0000
D	149.000	0.00	180.0	0.0	0.0105	0.0434	0.0000	0.0000
D	133.000	0.00	180.0	0.0	0.0105	0.0434	0.0000	0.0000
D	133.000	0.00	180.0	0.0	0.0130	0.0549	0.0000	0.0000
D	117.000	0.00	180.0	0.0	0.0130	0.0549	0.0000	0.0000
D	117.000	0.00	180.0	0.0	0.0152	0.0665	0.0000	0.0000
D	101.000	0.00	180.0	0.0	0.0152	0.0665	0.0000	0.0000
D	101.000	0.00	180.0	0.0	0.0166	0.1644	0.0000	0.0000
D	97.000	0.00	180.0	0.0	0.0166	0.1644	0.0000	0.0000
D	97.000	0.00	180.0	0.0	0.0174	0.0991	0.0000	0.0000
D	82.417	0.00	180.0	0.0	0.0174	0.0991	0.0000	0.0000
D	82.417	0.00	180.0	0.0	0.0190	0.1123	0.0000	0.0000
D	67.833	0.00	180.0	0.0	0.0190	0.1123	0.0000	0.0000
D	67.833	0.00	180.0	0.0	0.0203	0.1255	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0203	0.1255	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0210	0.2676	0.0000	0.0000
D	47.500	0.00	180.0	0.0	0.0210	0.2676	0.0000	0.0000
D	47.500	0.00	180.0	0.0	0.0211	0.1409	0.0000	0.0000
D	35.625	0.00	180.0	0.0	0.0211	0.1409	0.0000	0.0000
D	35.625	0.00	180.0	0.0	0.0212	0.1517	0.0000	0.0000
D	23.750	0.00	180.0	0.0	0.0212	0.1517	0.0000	0.0000
D	23.750	0.00	180.0	0.0	0.0204	0.1624	0.0000	0.0000
D	11.875	0.00	180.0	0.0	0.0204	0.1624	0.0000	0.0000
D	11.875	0.00	180.0	0.0	0.0208	0.1732	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0208	0.1732	0.0000	0.0000

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

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MAST ELEV ft	DEFLECTIONS (ft).....			ROTATIONS (deg).....		
	 HORIZONTAL ALONG	 ACROSS	DOWN	 TILT ALONG	 ACROSS	TWIST
149.0	4.18A	0.00B	0.17A	3.28A	0.00L	0.00K
133.0	3.28A	0.00B	0.12A	3.18A	0.00L	0.00K
117.0	2.44A	0.00B	0.08A	2.78A	0.00L	0.00K
101.0	1.74A	0.00B	0.05A	2.23A	0.00L	0.00F
97.0	1.59A	0.00B	0.04A	2.12A	0.00L	0.00F

82.4	1.11A	0.00B	0.02A	1.70A	0.00B	0.00F
67.8	0.72A	0.00B	0.01A	1.33A	0.00B	0.00F
53.2	0.43A	0.00B	0.01A	0.99A	0.00B	0.00F
47.5	0.34A	0.00B	0.00A	0.86A	0.00B	0.00F
35.6	0.18A	0.00B	0.00A	0.62A	0.00B	0.00F
23.7	0.08A	0.00B	0.00A	0.39A	0.00B	0.00F
11.9	0.02A	0.00B	0.00A	0.19A	0.00B	0.00F
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
149.0	0.00 C	0.00 D	0.00 E	0.00 E	0.00 L	0.00 L
133.0	12.51 E	2.42 E	0.00 E	-33.75 I	0.01 K	0.00 K
117.0	12.51 E	2.42 B	0.00 H	-33.75 I	0.01 K	0.00 K
101.0	30.38 E	5.53 B	0.00 H	-127.26 I	0.02 K	0.00 K
97.0	30.38 E	5.53 C	0.00 C	-127.26 I	0.02 K	0.00 K
82.4	31.44 E	5.77 C	0.00 C	-239.09 I	0.04 K	0.01 K
67.8	31.44 A	5.78 A	0.02 F	-239.10 I	0.06 K	0.01 K
53.2	32.10 A	5.85 A	0.02 F	-267.08 I	-0.08 F	0.01 K
47.5	32.10 C	5.85 A	-0.02 L	-267.12 I	-0.08 F	0.01 K
35.6	33.55 C	6.11 A	-0.02 L	-370.08 A	0.20 L	-0.01 F
23.7	33.55 E	6.11 A	0.01 B	-370.08 A	0.20 L	-0.01 F
11.9	35.18 E	6.38 A	0.01 B	-474.29 A	0.32 L	-0.01 F
base	35.18 E	6.39 A	0.01 B	-474.29 A	0.32 L	-0.01 F
reaction	37.01 E	6.68 A	0.01 B	-580.09 A	-0.48 B	-0.01 F
	37.01 E	6.68 A	-0.01 L	-580.08 A	-0.47 B	-0.01 F
	38.55 E	6.80 A	-0.01 L	-622.32 A	-0.53 B	-0.02 F
	38.55 E	6.80 A	0.01 B	-622.32 A	-0.52 B	-0.02 F
	40.22 E	7.05 A	0.01 B	-710.53 A	-0.68 B	-0.02 F
	40.22 E	7.05 A	0.01 B	-710.53 A	-0.68 B	-0.02 F
	42.03 E	7.30 A	0.01 B	-800.03 A	-0.82 B	-0.02 F
	42.03 E	7.30 A	0.01 B	-800.03 A	-0.82 B	-0.02 F
	43.95 E	7.54 A	0.01 B	-890.73 A	-0.97 B	-0.02 F
	43.95 E	7.55 A	-0.01 L	-890.73 A	-0.97 B	-0.02 F
	46.01 E	7.79 A	-0.01 L	-982.65 A	-1.10 B	-0.02 F
base	46.01 E	-7.79 A	0.01 L	982.65 A	1.10 B	0.02 F
reaction						

COMPLIANCE WITH 4.8.2 & 4.5.4

=====

ELEV	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL SATISFIED	D/t (w/t)	MAX ALLOWED	
ft							
149.00	0.00C	0.00E	0.00E	0.00E	YES	8.18A	45.2
133.00	0.01E	0.08I	0.00E	0.10I	YES	11.23A	45.2
	0.01E	0.08I	0.00B	0.10I	YES	11.23A	45.2
117.00	0.02E	0.21I	0.01B	0.23I	YES	14.29A	45.2
	0.02E	0.21I	0.01C	0.23I	YES	14.29A	45.2
101.00	0.02E	0.28I	0.01C	0.30I	YES	17.34A	45.2
	0.02A	0.22I	0.01A	0.24I	YES	13.52A	45.2
97.00	0.02A	0.23I	0.01A	0.24I	YES	14.13A	45.2
	0.02C	0.24I	0.01A	0.25I	YES	13.84A	45.2
82.42	0.01C	0.25A	0.01A	0.26A	YES	16.07A	45.2
	0.01E	0.25A	0.01A	0.26A	YES	16.07A	45.2
67.83	0.01E	0.26A	0.01A	0.27A	YES	18.29A	45.2
	0.01E	0.26A	0.01A	0.27A	YES	18.29A	45.2
53.25	0.01E	0.27A	0.00A	0.28A	YES	20.52A	45.2
	0.01E	0.27A	0.00A	0.28A	YES	20.52A	45.2
47.50	0.01E	0.27A	0.00A	0.28A	YES	21.40A	45.2
	0.01E	0.27A	0.00A	0.29A	YES	21.04A	45.2
35.62	0.01E	0.28A	0.00A	0.29A	YES	22.86A	45.2
	0.01E	0.28A	0.00A	0.29A	YES	22.86A	45.2
23.75	0.01E	0.28A	0.00A	0.29A	YES	24.67A	45.2
	0.01E	0.28A	0.00A	0.29A	YES	24.67A	45.2
11.87	0.01E	0.28A	0.00A	0.29A	YES	26.48A	45.2
	0.01E	0.28A	0.00A	0.29A	YES	26.48A	45.2
0.00	0.01E	0.28A	0.00A	0.29A	YES	28.29A	45.2

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

=====

DOWN 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
46.01 E	7.79 A	-0.01 L	-982.65 A	-1.10 B	-0.02 F

=====

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

		<u>Vertical Distribution of Seismic Forces</u>								
		<u>Description</u>	<u>h_i (ft.)</u>	<u>w_i (kips)</u>	<u>W_u (kips)</u>	<u>w_ih_i^{ke}</u>	<u>F_{sz} or E_h</u>	<u>E_V (kips)</u>	<u>1.2 D + 1.0 E_V</u>	<u>0.9 D - 1.0 E_V</u>
<u>Parameters</u>							<u>(kips)</u>		<u>(kips)</u>	<u>(kips)</u>
Risk Category	II	Line Deadload	144.00	1.7971	0.0000	37,264.6656	0.0843	0.0309	2.1874	1.5865
		Mount/Antenna Load	144.00	10.0210	10.0210	207,795.4560	0.4703	0.1724	12.1976	8.8465
R	1.500	Line Deadload	132.00	1.6474	0.0000	28,704.2976	0.0650	0.0283	2.0052	1.4544
S _S	0.081	Mount/Antenna Load	132.00	9.4100	9.4100	163,959.8400	0.3711	0.1619	11.4539	8.3071
S ₁	0.050	Structure - Section 1	123.00	2.9254	0.0000	44,258.3766	0.1002	0.0503	3.5608	2.5826
Site Class	D (default)	Line Deadload	122.00	1.5226	0.0000	22,662.3784	0.0513	0.0262	1.8533	1.3441
T _L (sec)	12.000	Mount/Antenna Load	122.00	4.4100	4.4100	65,638.4400	0.1485	0.0759	5.3679	3.8931
F _a	1.600	Structure - Section 2	74.25	6.0333	0.0000	33,261.9600	0.0753	0.1038	7.3438	5.3262
F _v	2.400	Structure - Section 3	26.62	8.2021	0.0000	5,812.2082	0.0132	0.1411	9.9836	7.2408
S _{MS}	0.130		Σ	45.97	23.8410	609,357.62	1.38	0.79	55.95	40.58
S _{M1}	0.120									
S _{DS}	0.086									
S _{D1}	0.080									
T _s	0.930									
I _e	1.000									
Ω	1.500									
C _S	0.030									
E (ksi)	29,000									
I _{top} (in ⁴)	267									
I _{bot} (in ⁴)	18,644									
I _{avg} (in ⁴)	9,455									
g (in/s ²)	386.4									
W _t (kips)	45.969									
W _u (kips)	23.841									
W _L (kips)	22.128									
L _p (in)	1788									
f ₁ (Hertz)	0.220									
T (sec)	4.542									
k _e	2.0000									
V _s (kips)	1.379									
Seismic Design Category	B									

Round Flange Plate and Bolts per ANSI/TIA 222-G

Elevation = 149 feet

Pole Data

Diameter:	14.1	in
Thickness:	0.25	in
Yield (Fy):	65	ksi
# of Sides:	18	"0" IF Round
Strength (Fu):	80	ksi

Reactions

Moment, Mu:	230	ft-kips
Axial, Pu:	0	kips
Shear, Vu:	0	kips

Bolt Data

Quantity:	12	
Diameter:	1	in
Bolt Material:	A325	
Strength (Fu):	120	ksi
Yield (Fy):	92	ksi
BC Diam. (in):	17.25	BC Override:

Flange Bolt Results

Allowable Φ *Rnt:	54.54 kips
Adjusted Φ *Rnt (due to shear):	54.54 kips
Maximum Bolt Tension:	53.33 kips
Bolt Interaction Ratio:	97.8% Pass

Plate Data

Diameter (in):	19.75	Dia. Override:	
Thickness:	1.5	in	
Center Hole Diam.:	8	in	
Yield (Fy):	50	ksi	
Single-Rod B-eff:	3.73	in	
Drain Hole:	1	in. diameter	
Drain Location:	6	in. center of pole to center of drain hole	

Flange Plate Results

Compression Side Plate (Mu/Z):	23.6 ksi
Allowable Φ *Fy:	45.0 ksi
Compr. Plate Interaction Ratio:	52.5% Pass

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

Pole Data

Diameter: 53.260 in (flat to flat)
Thickness: 0.3125 in
Yield (Fy): 65 ksi
of Sides: 18 "0" IF Round
Strength (Fu): 80 ksi

Reactions

Moment, Mu: 3415.27 ft-kips
Axial, Pu: 55.16 kips
Shear, Vu: 26.74 kips

Anchor Rod Data

Quantity: 12
Diameter: 2.25 in
Rod Material: A615
Strength (Fu): 100 ksi
Yield (Fy): 75 ksi
BC Diam. (in): 59.75 BC Override:

Anchor Rod Results

Maximum Rod (Pu+ Vu/η): 237.7 Kips
Allowable $\Phi \cdot R_{nt}$: 260.0 Kips (per 4.9.9)
Anchor Rod Interaction Ratio: **91.4% Pass**

Plate Data

Diameter (in): 65.5 Dia. Override:
Thickness: 2 in
Yield (Fy): 50 ksi
Eff Width/Rod: 14.09 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): 37.1 ksi
Allowable $\Phi \cdot F_y$: 45.0 ksi (per AISC)
Base Plate Interaction Ratio: **82.4% Pass**

MAT FOUNDATION DESIGN BY SABRE INDUSTRIES

150' Monopole DIAMOND COMMUNICATIONS LLC MRK Trail, WI (538652) 02/21/24 TTW

Overall Loads:

Factored Moment (ft-kips)	3415.27
Factored Axial (kips)	55.16
Factored Shear (kips)	26.74
Bearing Design Strength (ksf)	3.75
Water Table Below Grade (ft)	999
Width of Mat (ft)	23
Thickness of Mat (ft)	1.5
Depth to Bottom of Slab (ft)	6
Quantity of Bolts in Bolt Circle	12
Bolt Circle Diameter (in)	59.75
Top of Concrete to Top of Bottom Threads (in)	60
Diameter of Pier (ft)	7
Ht. of Pier Above Ground (ft)	0.5
Ht. of Pier Below Ground (ft)	4.5
Quantity of Bars in Mat	47
Bar Diameter in Mat (in)	1
Area of Bars in Mat (in ²)	36.91
Spacing of Bars in Mat (in)	5.85
Quantity of Bars Pier	36
Bar Diameter in Pier (in)	1
Tie Bar Diameter in Pier (in)	0.625
Spacing of Ties (in)	12
Area of Bars in Pier (in ²)	28.27
Spacing of Bars in Pier (in)	6.61
f'c (ksi)	4.5
fy (ksi)	60
Unit Wt. of Soil (kcf)	0.11
Unit Wt. of Concrete (kcf)	0.15

Volume of Concrete (yd³) 36.52**Two-Way Shear Action:**

Average d (in)	14
ϕv_c (ksi)	0.218
$\phi v_c = \phi(2 + 4/\beta_c)f'_c{}^{1/2}$	0.342
$\phi v_c = \phi(\alpha_s d/b_o + 2)f'_c{}^{1/2}$	0.218
$\phi v_c = \phi 4f'_c{}^{1/2}$	0.228
Shear perimeter, b_o (in)	307.88
β_c	1

One-Way Shear:

ϕV_c (kips)	440.6
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Stability:

Overturning Design Strength (ft-k)	4519.4
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Pier-Slab Transfer by Flexure:

b_{slab} (ft)	11.50
ϕM_n (ft-kips)	2151.3

Max. Net Bearing Press. (ksf)	3.60
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Allowable Bearing Pressure (ksf)	2.50
Safety Factor	2.00
Ultimate Bearing Pressure (ksf)	5.00
Bearing Φ s	0.75

Minimum Pier Diameter (ft)	6.31
Equivalent Square b (ft)	6.20
Square Pier? (Y/N)	N

Recommended Spacing (in)	5 to 12
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Minimum Pier A_s (in ²)	27.71
Recommended Spacing (in)	5 to 12

v_u (ksi)	0.173
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V_u (kips)	278.3
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Total Applied M (ft-k)	3589.1
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$0.60M_{sc}$ (ft-kips)	2129.4
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Pier Design:

ϕV_n (kips)	646.9	V_u (kips)	26.7
$\phi V_c = \phi 2(1 + N_u / (2000 A_g)) f'_c{}^{1/2} b_w d$	646.9		
V_s (kips)	0.0	*** $V_s \text{ max} = 4 f'_c{}^{1/2} b_w d$ (kips)	1514.7
Maximum Spacing (in)	8.71	(Only if Shear Ties are Required)	
Actual Hook Development (in)	13.00	Req'd Hook Development l_{dh} (in)	12.52

*** Ref. To Spacing Requirements ACI 11.5.4.3

Flexure in Slab:

ϕM_n (ft-kips)	2151.3	M_u (ft-kips)	1587.3
a (in)	2.10		
Steel Ratio	0.00955		
β_1	0.825		
Maximum Steel Ratio (ρ_t)	0.0197		
Minimum Steel Ratio	0.0018		
Rebar Development in Pad (in)	97.78	Required Development in Pad (in)	26.83

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

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LFile for Windows, Version 2019-11.009

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

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

Name of input data file:
538652.lp11d

Name of output report file:
538652.lp11o

Name of plot output file:
538652.lp11p

Name of runtime message file:
538652.lp11r

Date and Time of Analysis

Date: February 21, 2024

Time: 13:21:10

Problem Title

Site : MRK Trail, WI

Tower : 150' Monopole

Prepared for : DIAMOND COMMUNICATIONS LLC

Job Number : 538652

Engineer : TTW

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 = 29.500 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	84.0000
2	29.500	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 = 29.500000 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 1 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	=	60.500000	ft
Effective unit weight at top of layer	=	110.000000	pcf
Effective unit weight at bottom of layer	=	110.000000	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	

(Depth of the lowest soil layer extends 31.000 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	E50 or krm
1	Stiff Clay w/o Free Water	0.5000 60.5000	110.0000 110.0000	1000.0000 1000.0000	0.010000 0.010000

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 Analysis No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run
1	1	V = 35653. lbs	M = 54644320. in-lbs	73547.	No	
Yes						
2	1	V = 7790. lbs	M = 11791800. in-lbs	46010.	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

File Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	29.500000 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 = $0.85 F_c A_c + F_y A_s$	=	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	0.000000
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	0.000000	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	0.000000
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	0.000000	-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 LFile

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	46.010
2	73.547

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	46.010	63470.349	0.00300000
2	73.547	64384.994	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	46.010000	63470.	29.906500	41256.	1.3604E+09
2	0.65	73.546667	64385.	47.805333	41850.	1.3834E+09
1	0.75	46.010000	63470.	34.507500	47603.	1.3109E+09
2	0.75	73.546667	64385.	55.160000	48289.	1.3336E+09
1	0.90	46.010000	63470.	41.409000	57123.	833943885.
2	0.90	73.546667	64385.	66.192000	57946.	849200109.

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	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	35653.	M, in-lb	5.46E+07	73547.	15.4589	-0.07501	-326135.	5.54E+07
2	V, lb	7790.	M, in-lb	1.18E+07	46010.	0.04261	-3.02E-04	-66275.	1.19E+07

Maximum pile-head deflection = 15.4589467518 inches
Maximum pile-head rotation = -0.0750072368 radians = -4.297598 deg.

The analysis ended normally.

IBC 1807.3.2.1

Moment (ft·k)	3,415.27	
Shear (k)	26.74	
Caisson diameter (ft)	7	
Caisson height above ground (ft)	0.5	
Caisson height below ground (ft)	25	
Lateral soil pressure (lb/ft ²)	300.00	
Ground to application of force, h (ft)	128.22	
Applied lateral force, P (lb)	26,740	
Lateral soil bearing pressure, S ₁ (lb/ft)	2,500.00	
Diameter, b (ft)	7	
A	3.58	$= (2.34P)/(S_1 b)$
Minimum depth of embedment, d (ft)	24.21	$= 0.5A[1 + (1 + (4.36h / A))^{1/2}]$