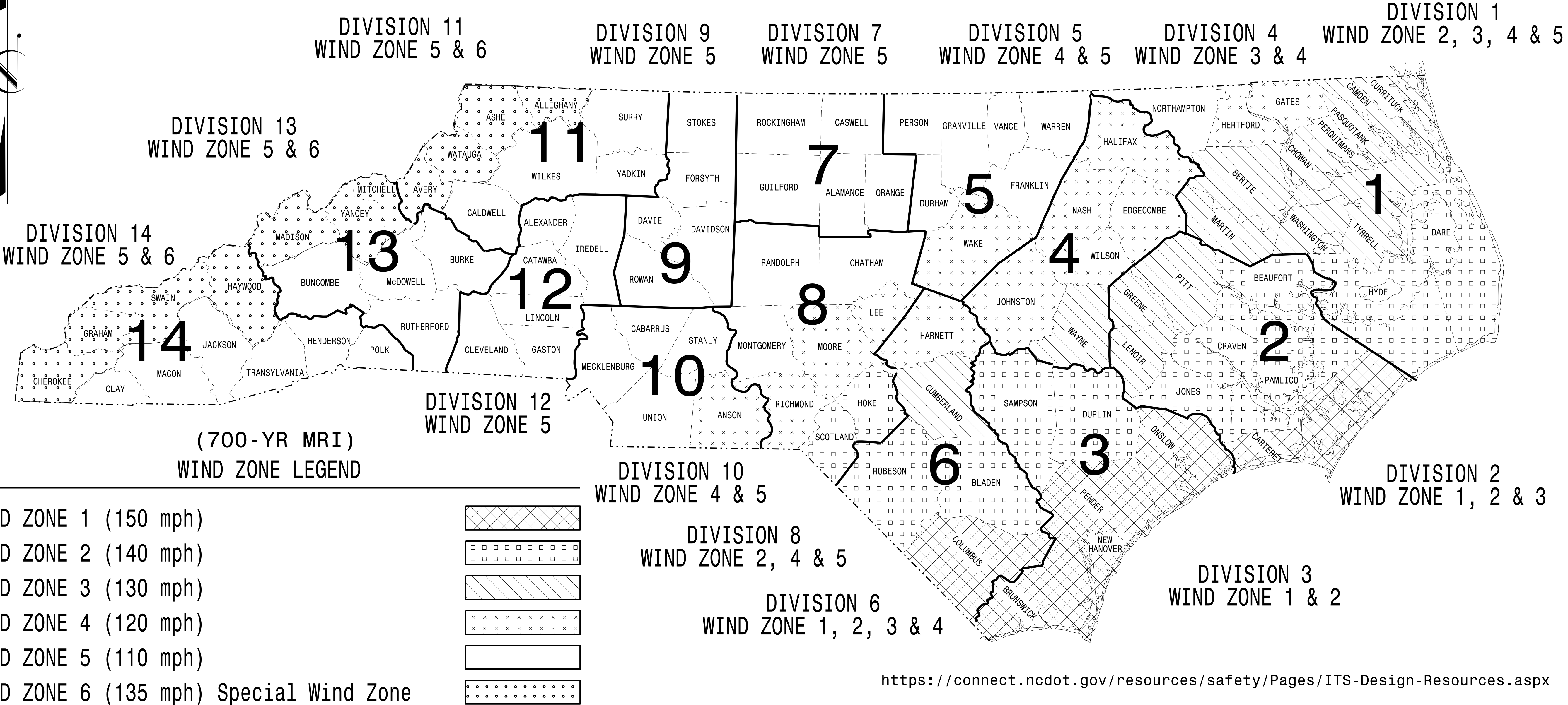


STATE OF NORTH CAROLINA

DIVISION OF HIGHWAYS

STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)



<https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx>

Prepared In the Offices of:



Designed in conformance
with the latest
2020 Interim to the
1st Edition 2015

AASHTO
LRFD

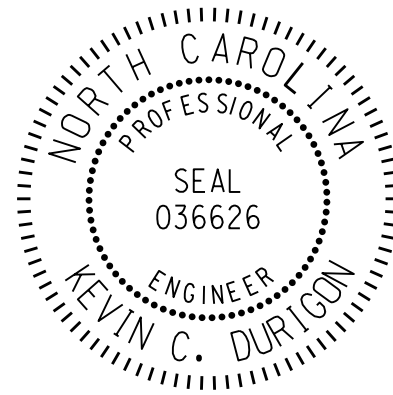
Standard Specifications for
Highway Signs, Luminaires,
and Traffic Signals

DRAWING NUMBER	INDEX OF PLANS DESCRIPTION
Sig. M 1A	Statewide Wind Zone Map (700-yr MRI)
Sig. M 1B	Statewide Wind Zone Map (10-yr MRI)
Sig. M 2	Typical Fabrication Details-All Metal Poles
Sig. M 3	Typical Fabrication Details-Strain Poles
Sig. M 4	Typical Fabrication Details-Mast Arm Poles
Sig. M 5	Typical Fabrication Details-Mast Arm Connection
Sig. M 6	Typical Fabrication Details-Strain Pole Attachments
Sig. M 7	Construction Details-Foundations
Sig. M 8	Standard Strain Pole Foundation-All Soil Conditions
Sig. M 9	Typical Fabrication Details-CCTV Camera Poles

MOBILITY AND SAFETY DIVISION -
TRANSPORTATION SYSTEMS MANAGEMENT
AND OPERATIONS UNIT

D.Y. ISHAK - STATE SIGNALS ENGINEER
K. DURIGON, P.E. - ITS AND SIGNALS STRUCTURAL ENGINEER
B. WALKER, P.E. - ITS AND SIGNALS STRUCTURAL ENGINEER

SEAL



DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3764DA

09/21/2023
DATE

09-01-2023 12:21 S:\ITS\SSM\115\Signal\Structures\Drawings\2024 Metal Pole (10-yr MRI).dgn kdurigon

NCDOT METAL POLE STANDARDS

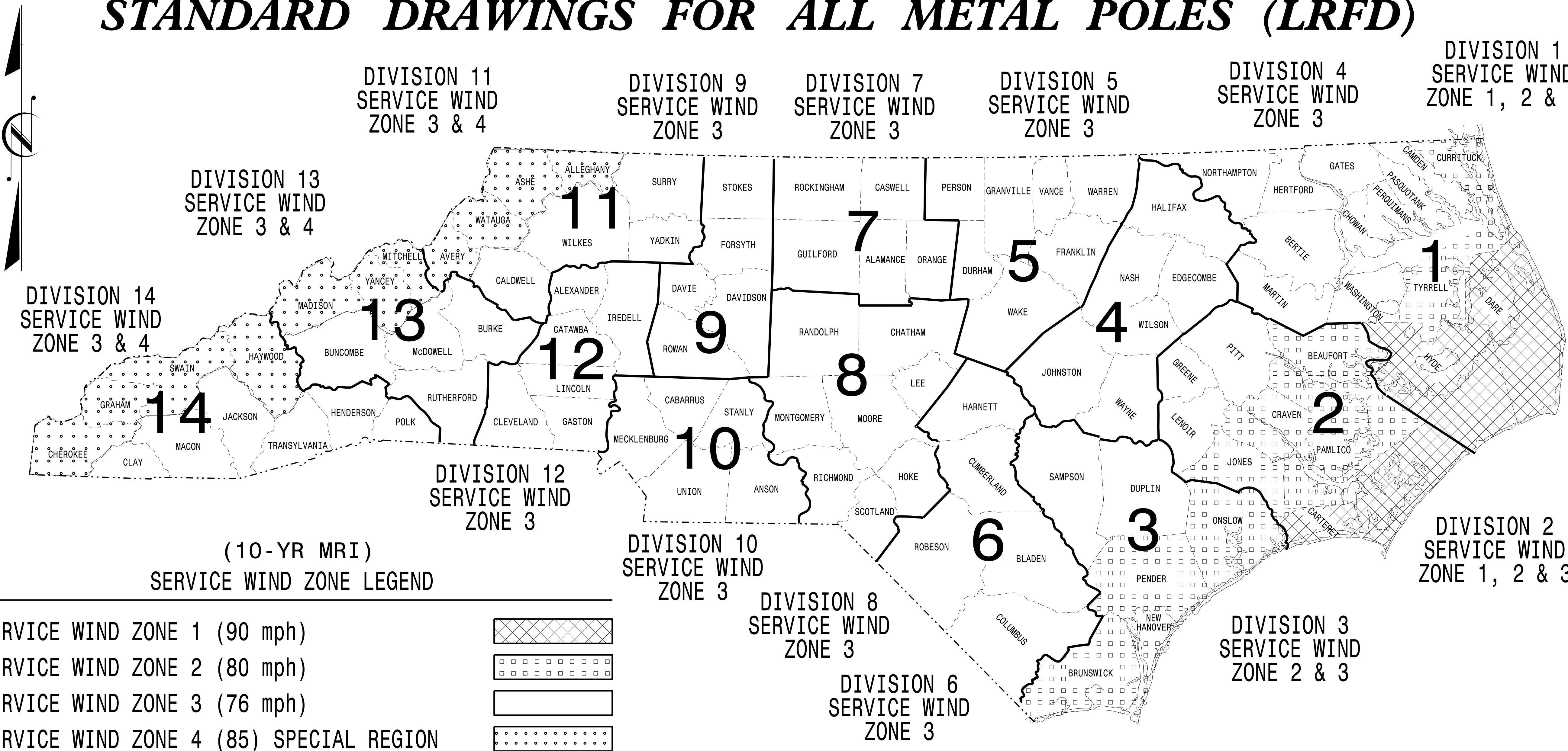
STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

PROJECT I.D.NO.

SHEET NO.

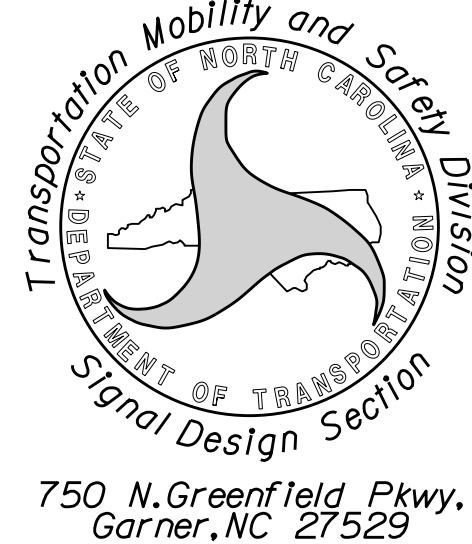
Sig.M1B

STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)



<https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx>

Prepared in the Offices of:



Designed in conformance
with the latest
2020 Interim to the
1st Edition 2015

**AASHTO
LRFD**

Standard Specifications for
Highway Signs, Luminaires,
and Traffic Signals

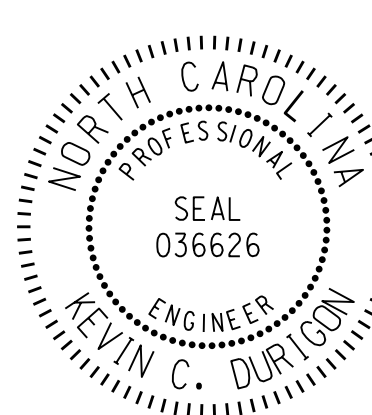
**DRAWING
NUMBER**

INDEX OF PLANS	
DESCRIPTION	
Sig. M 1A	Statewide Wind Zone Map (700-yr MRI)
Sig. M 1B	Statewide Wind Zone Map (10-yr MRI)
Sig. M 2	Typical Fabrication Details-All Metal Poles
Sig. M 3	Typical Fabrication Details-Strain Poles
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Sig. M 5	Typical Fabrication Details-Mast Arm Connection
Sig. M 6	Typical Fabrication Details-Strain Pole Attachments
Sig. M 7	Construction Details-Foundations
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Sig. M 9	Typical Fabrication Details-CCTV Camera Poles

NCDOT CONTACTS:
MOBILITY AND SAFETY DIVISION -
TRANSPORTATION SYSTEMS MANAGEMENT
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D.Y. ISHAK - STATE SIGNALS ENGINEER
K. DURIGON, P.E. - ITS AND SIGNALS STRUCTURAL ENGINEER
B. WALKER, P.E. - ITS AND SIGNALS STRUCTURAL ENGINEER

SEAL

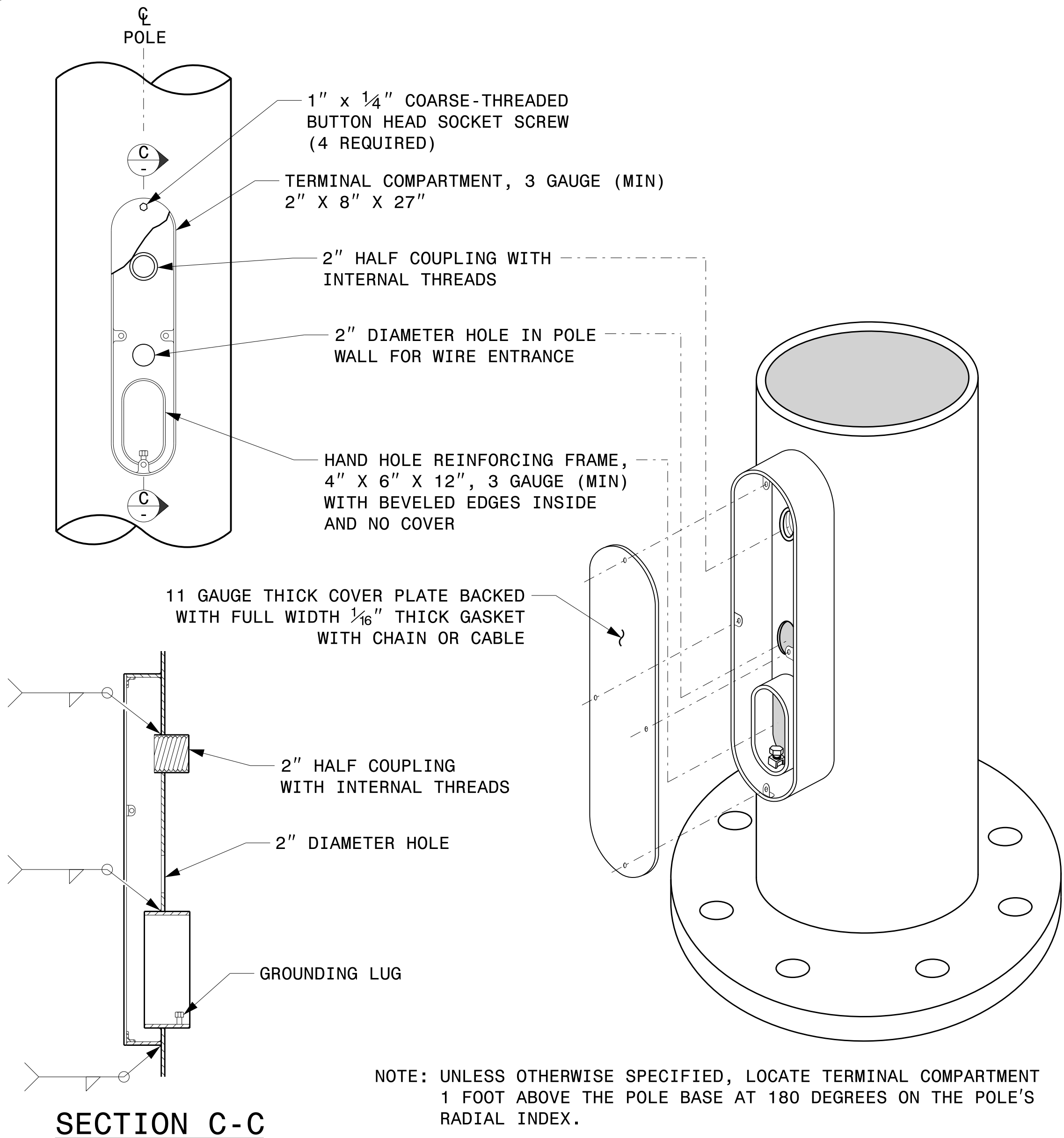


DocuSigned by:

Kevin Durigon
SIGNATURE
4B23DC79B3784DA

09/21/2023

DATE



TERMINAL COMPARTMENT DETAIL

MFG _____	MFG. DATE: MM/YY _____
SHAFT D/T/L/Y _____	_____
ARM-A D/T/L/Y _____	_____
ARM-B D/T/L/Y _____	_____
A.B. DIA./B.C./L/Y _____	_____
NCDOT SIG. INV. NO. _____	_____
NCDOT POLE NO. _____	_____

SHAFT I.D. TAG
(PROVIDE ON SHAFT OF STRAIN POLES
AND MAST ARM POLE SHAFT)

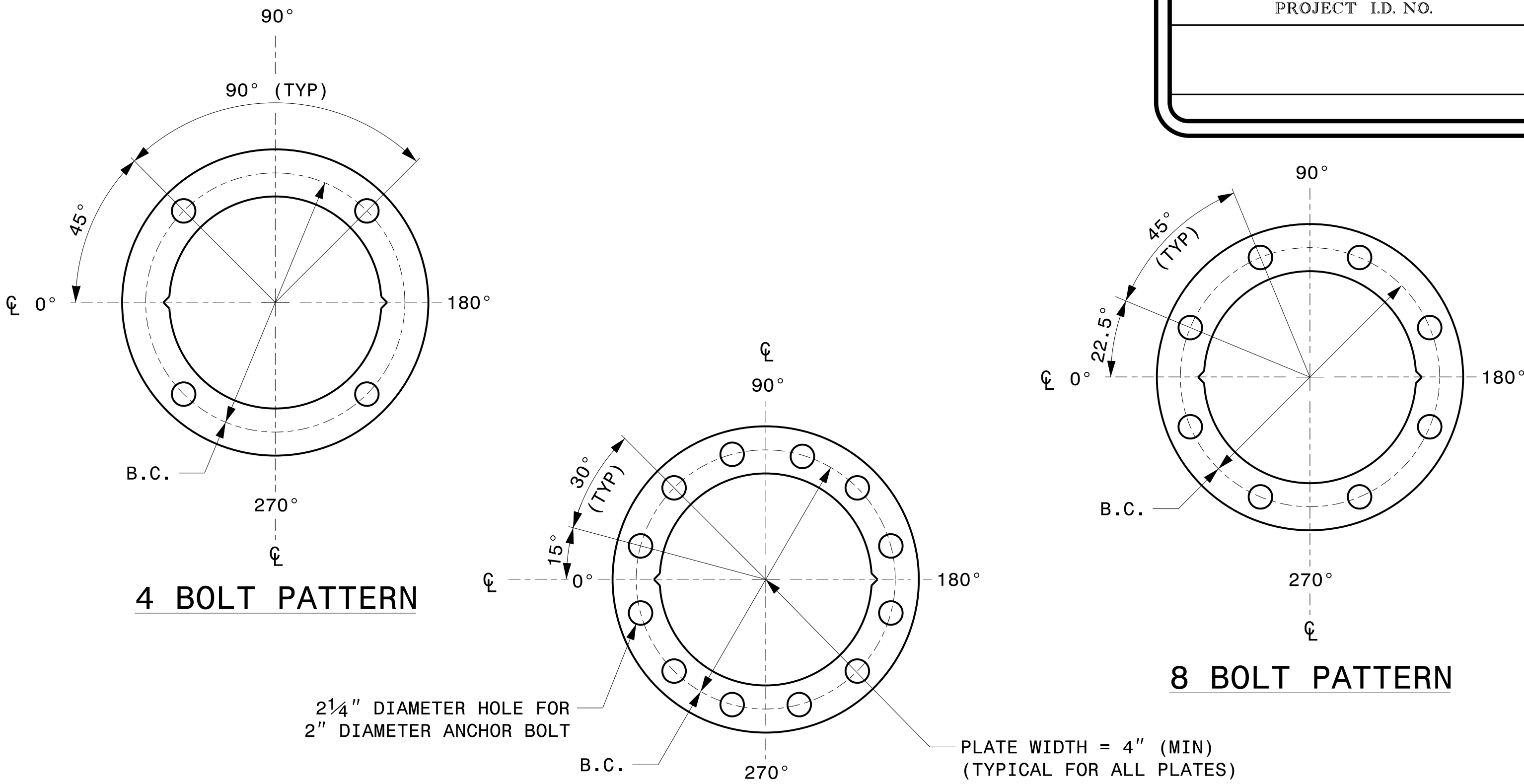
MFG _____	MFG. DATE: MM/YY _____
SECTION D/T/L/Y _____	_____
NCDOT SIG. INV. NO. _____	_____
NCDOT POLE NO. _____	_____

ARM I.D. TAG
(PROVIDE ON EACH SECTION OF
A MULTI-SECTION MAST ARM)

NOTES:

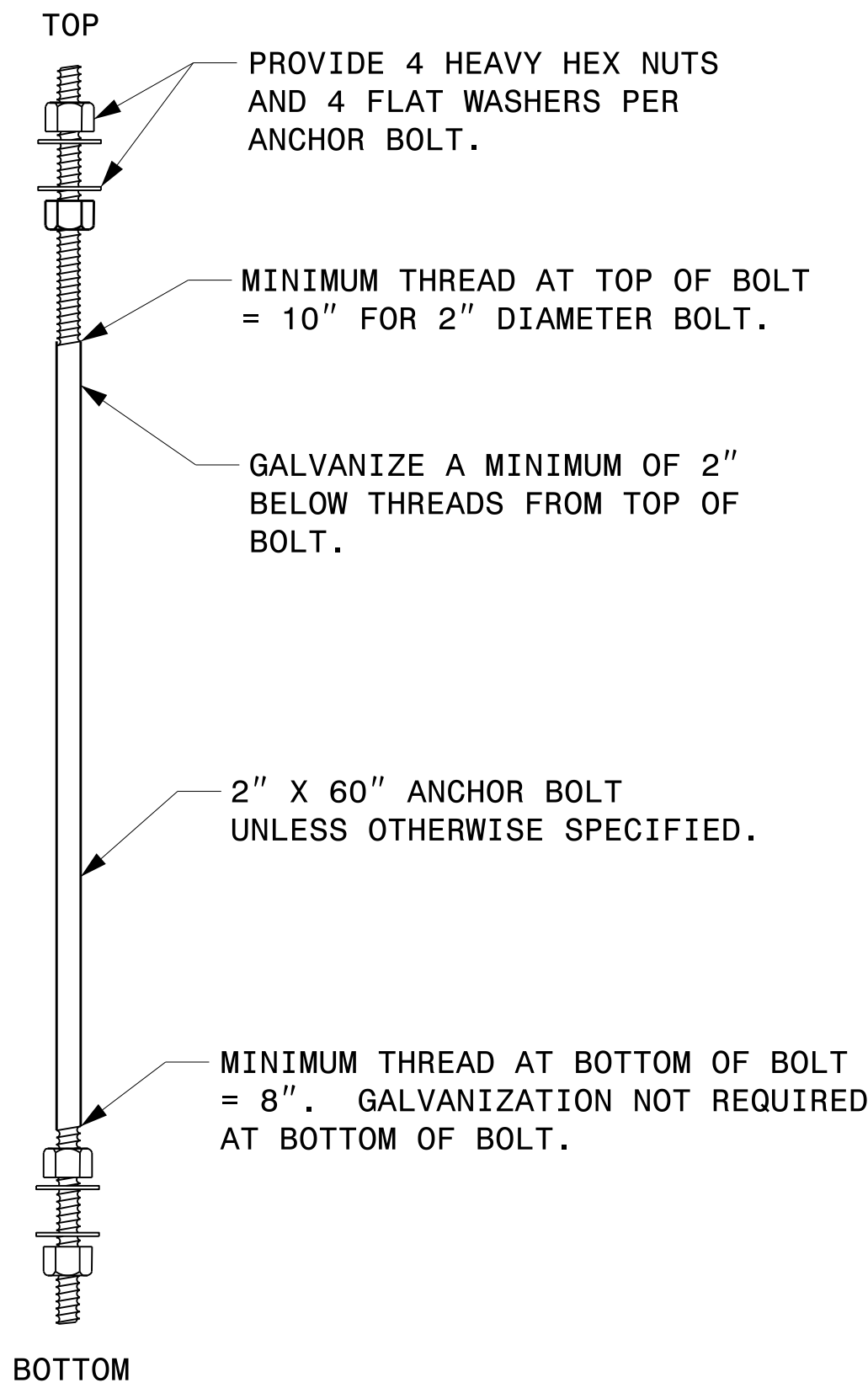
- D = DIAMETER, T = THICKNESS, L = LENGTH, Y = YIELD STRENGTH
- A.B. = ANCHOR BOLT
- B.C. = BOLT CIRCLE OF ANCHOR BOLTS
- IF STANDARD DESIGN, INCLUDE CASE NUMBER IN ADDITION TO POLE NUMBER ON "NCDOT POLE NO." LINE.
- SIGNAL INV. NUMBER AND POLE I.D. NUMBER.
SEE DRAWING M3 AND M4 FOR MOUNTING POSITIONS OF I.D. TAGS.

IDENTIFICATION TAG DETAILS

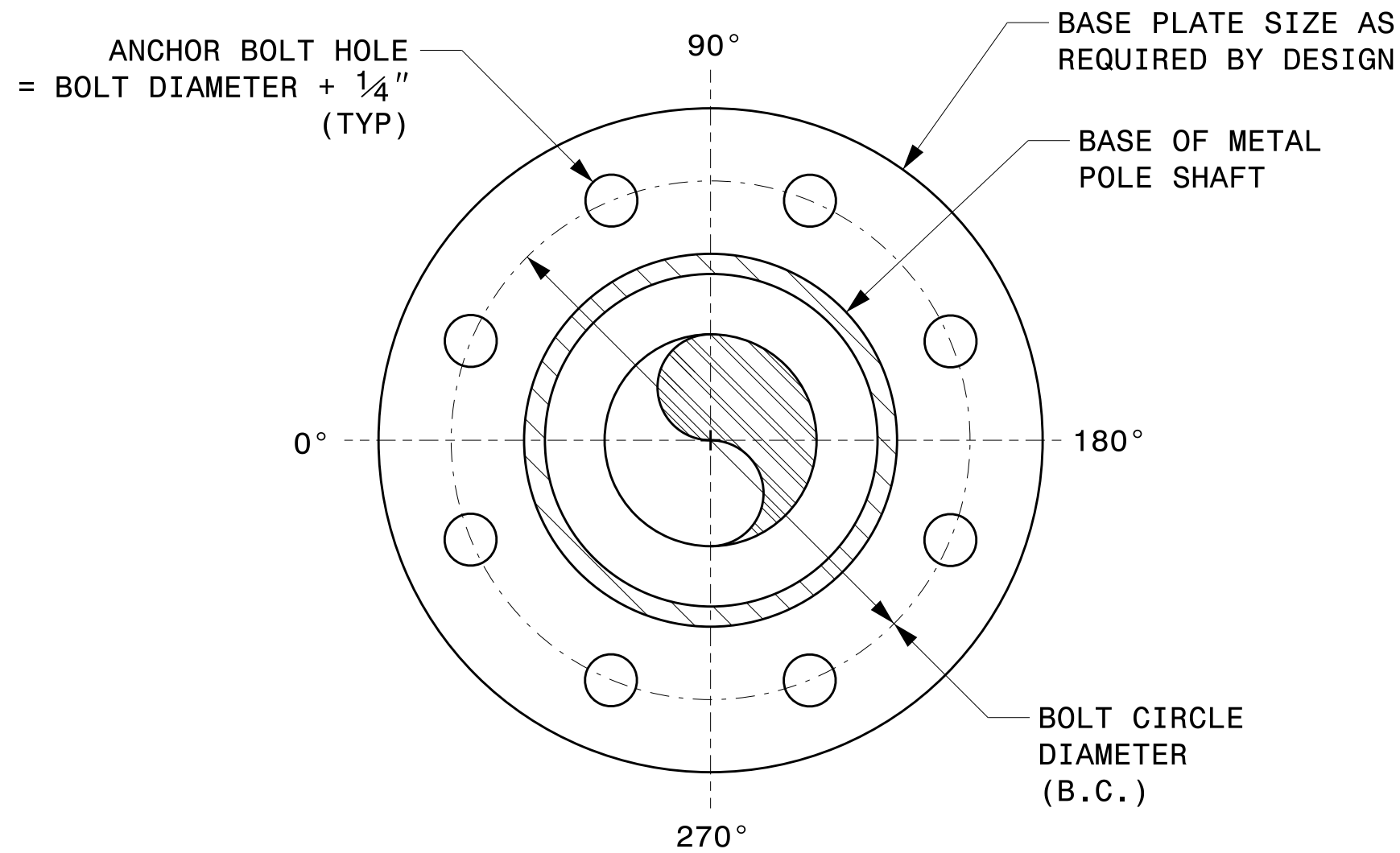


CONSTRUCT TEMPLATES AND PLATES FROM 1/4" (MIN) THICK STEEL. GALVANIZING IS NOT REQUIRED.

BASE PLATE TEMPLATE AND ANCHOR BOLT LOCK PLATE DETAILS



ANCHOR BOLT DETAIL



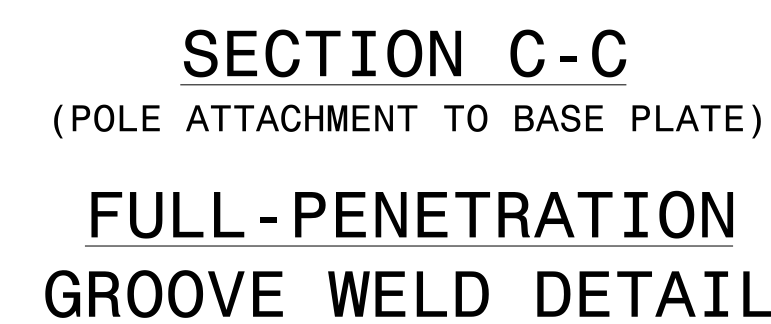
NOTE: BASE PLATE MAY BE CIRCULAR, OCTAGONAL, SQUARE OR RECTANGULAR IN SHAPE.

TYPICAL BASE PLATE DETAIL

Prepared In the Offices of: 750 N. Greenfield Pkwy, Garner, NC 27529	Typical Fabrication Details For All Metal Poles		SEAL DocuSigned by: 4B23DC79B3784DA	
	PLAN DATE: SEPTEMBER 2023	DESIGNED BY: C.F. ANDREWS		
	PREPARED BY: K.C. DURIGON	REVIEWED BY: D.C. SARKAR		
SCALE: 0 NA NONE	REVISIONS	INIT.	DATE	

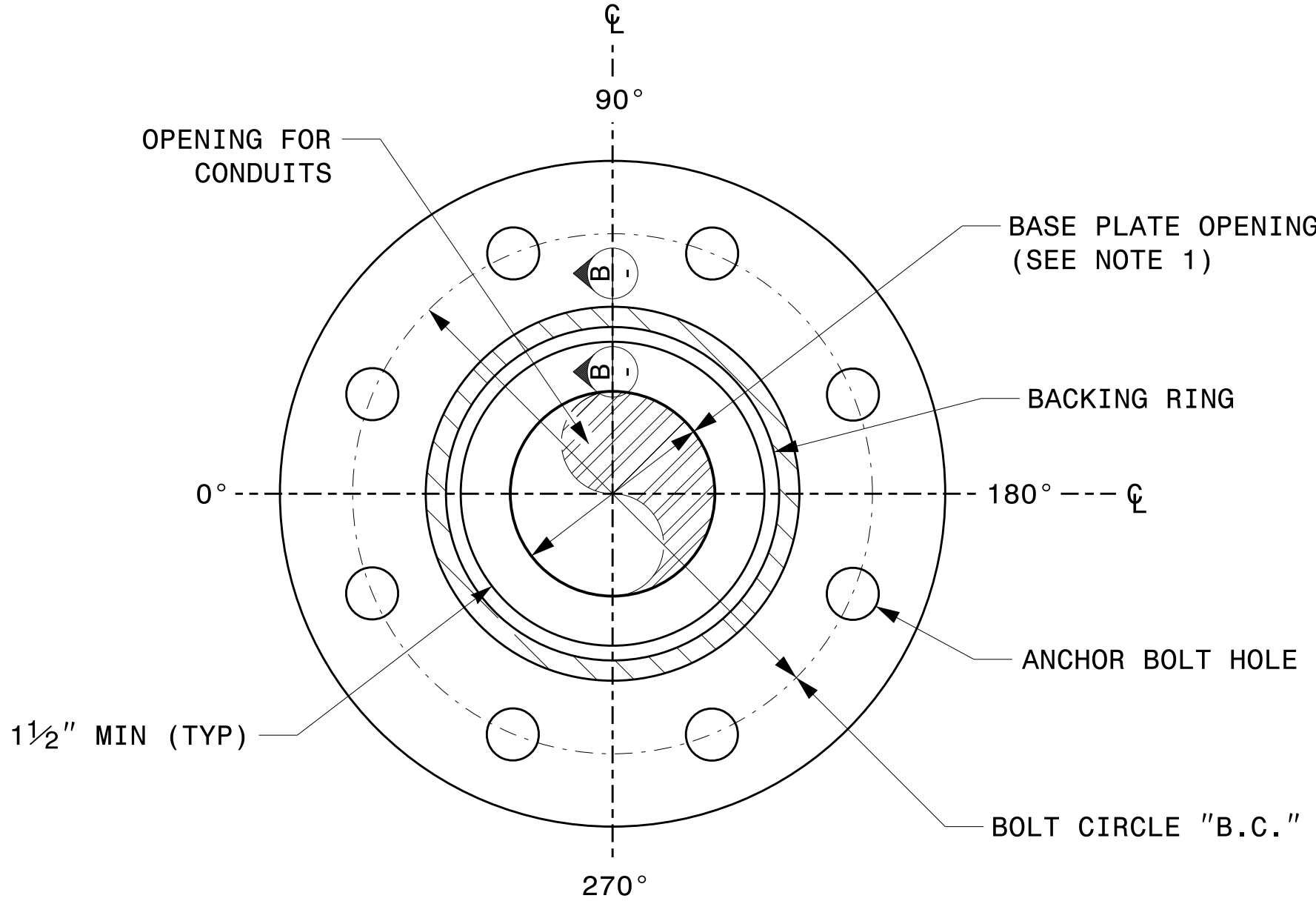


RADIAL ORIENTATION OF FACTORY INSTALLED ACCESSORIES AT TOP OF POLE

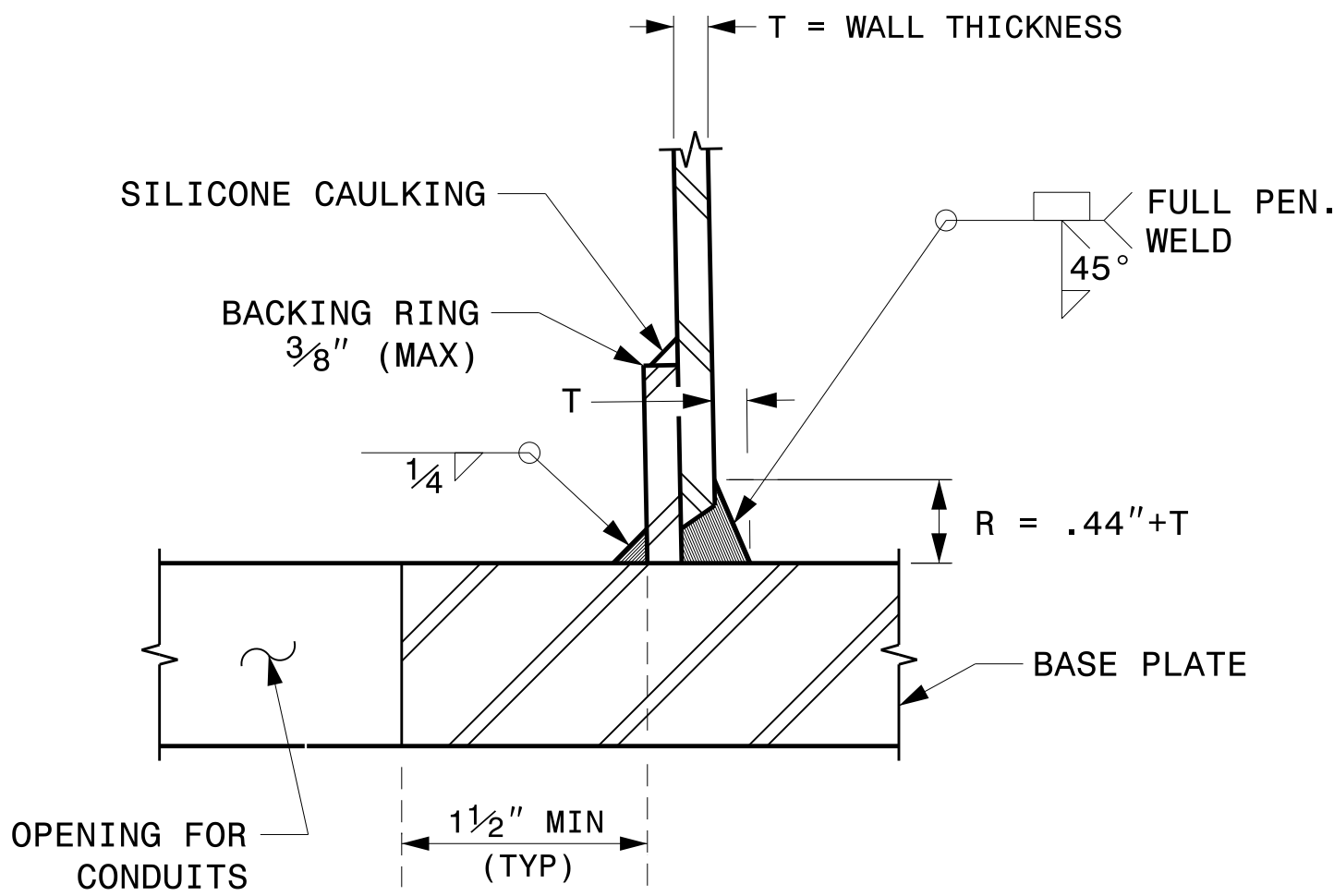


NOTE:

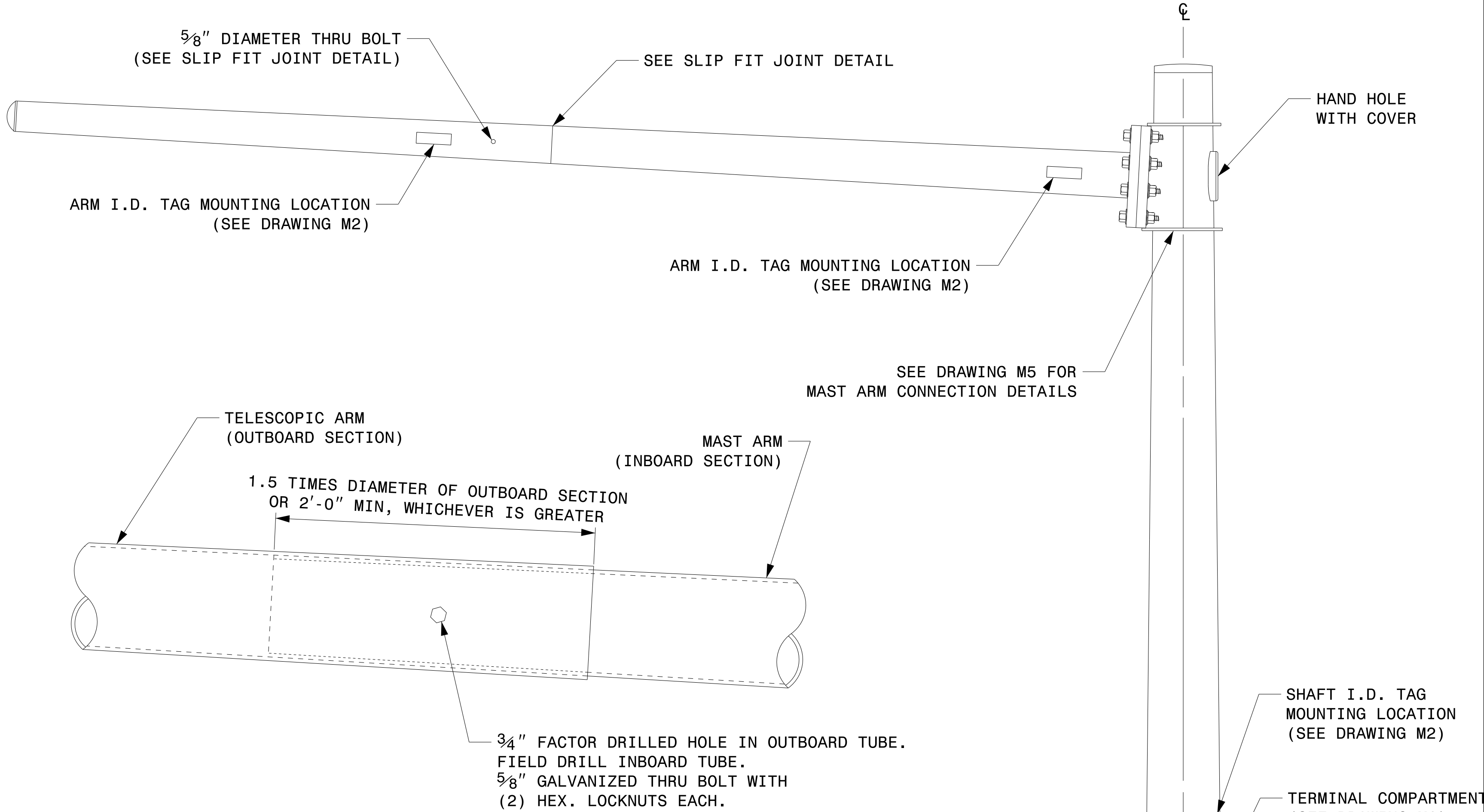
1. OPENING IN POLE BASE PLATE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS 3 1/2" BUT SHALL NOT BE LESS THAN 8 1/2".



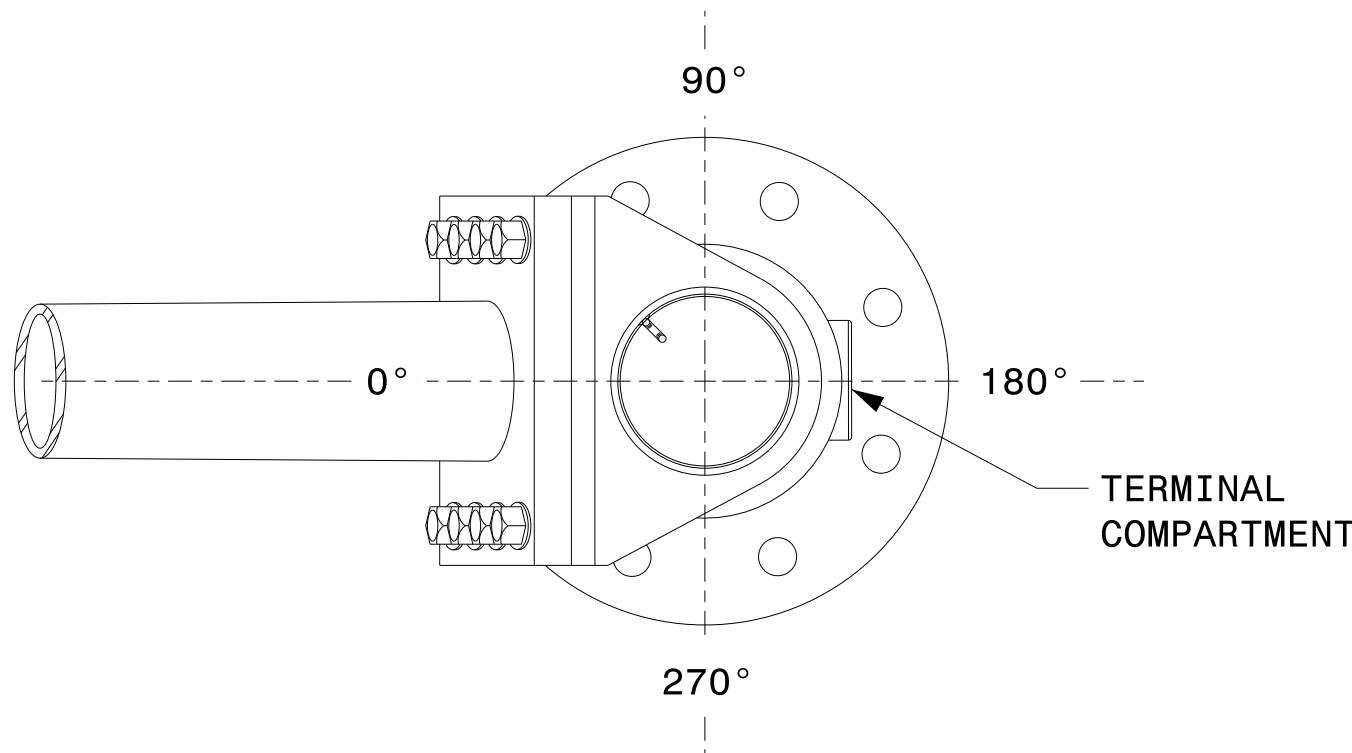
SECTION A-A
POLE BASE PLATE DETAILS



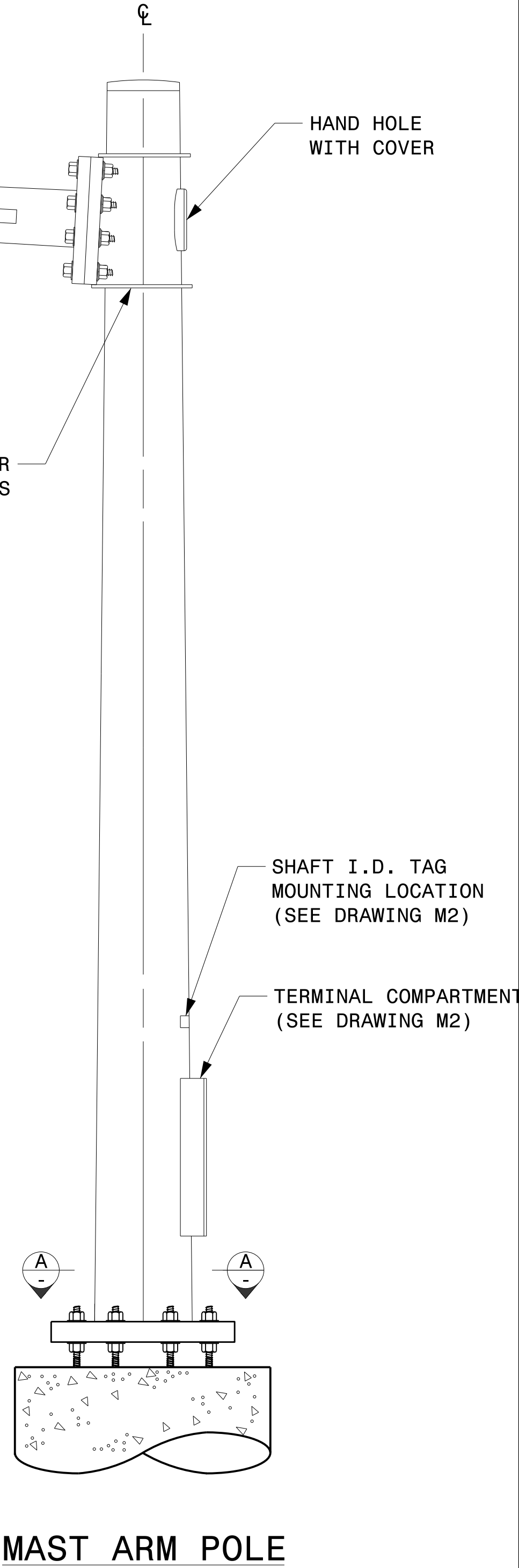
SECTION B-B
(POLE ATTACHMENT TO BASE PLATE)
FULL-PENETRATION
GROOVE WELD DETAIL



SLIP FIT JOINT DETAIL FOR MAST ARM



MAST ARM RADIAL ORIENTATION



MAST ARM POLE

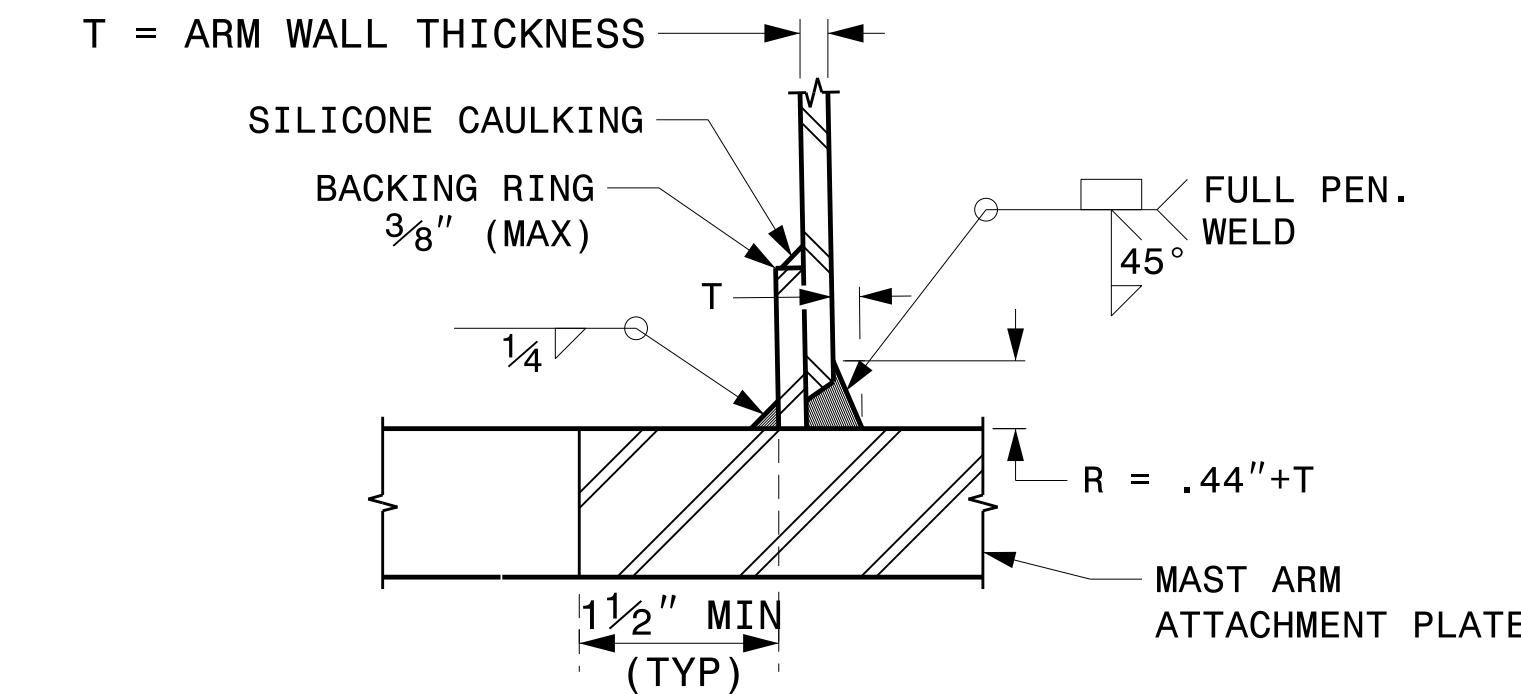
Prepared In the Offices of: 750 N. Greenfield Pkwy, Garner, NC 27529	Typical Fabrication Details For Mast Arm Poles		SEAL DocuSigned by: <i>Kevin Durigon</i> 1B23DC70B378ADA							
	PLAN DATE: SEPTEMBER 2023 DESIGNED BY: K.C. DURIGON PREPARED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR	REVISIONS <table><tr><th>INIT.</th><th>DATE</th></tr><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table>		INIT.	DATE					
INIT.	DATE									

WELDED RING STIFFENED MAST ARM CONNECTION

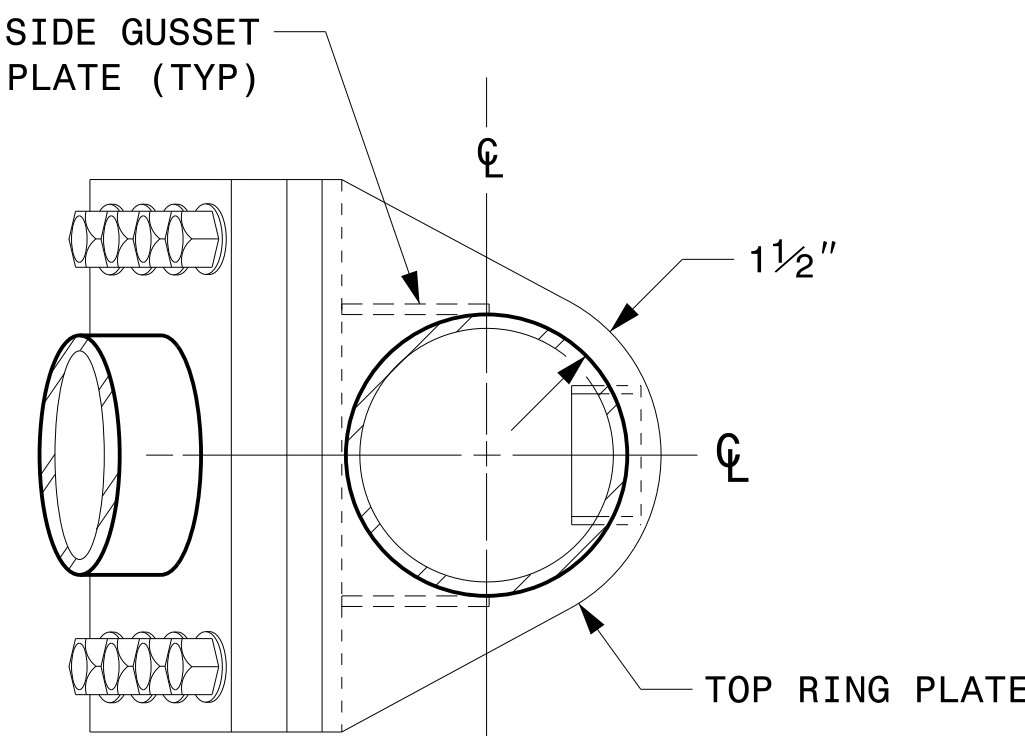
PROJECT I.D. NO.

SHEET NO.

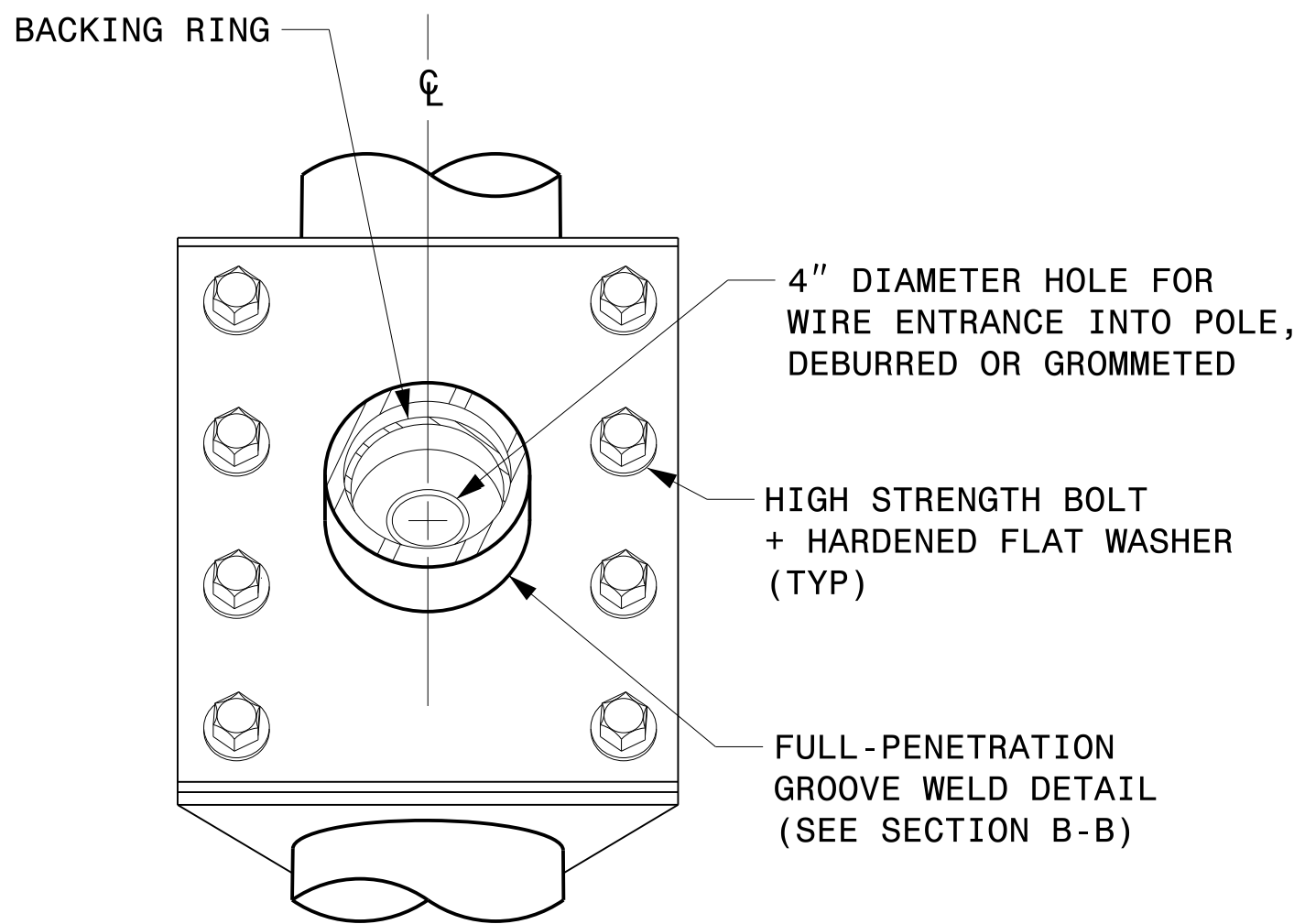
Sig.M5



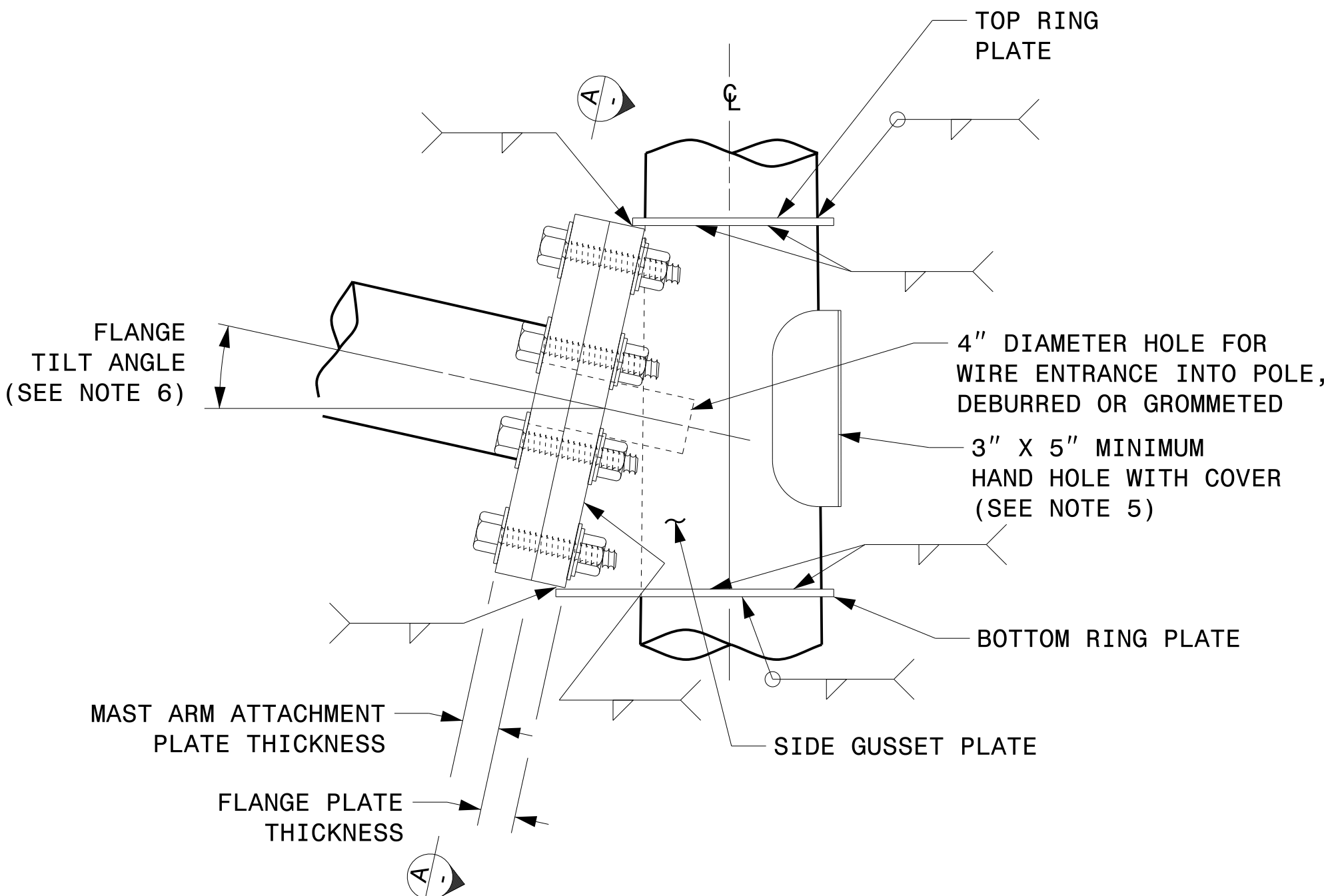
SECTION B-B
FULL-PENETRATION GROOVE WELD DETAIL



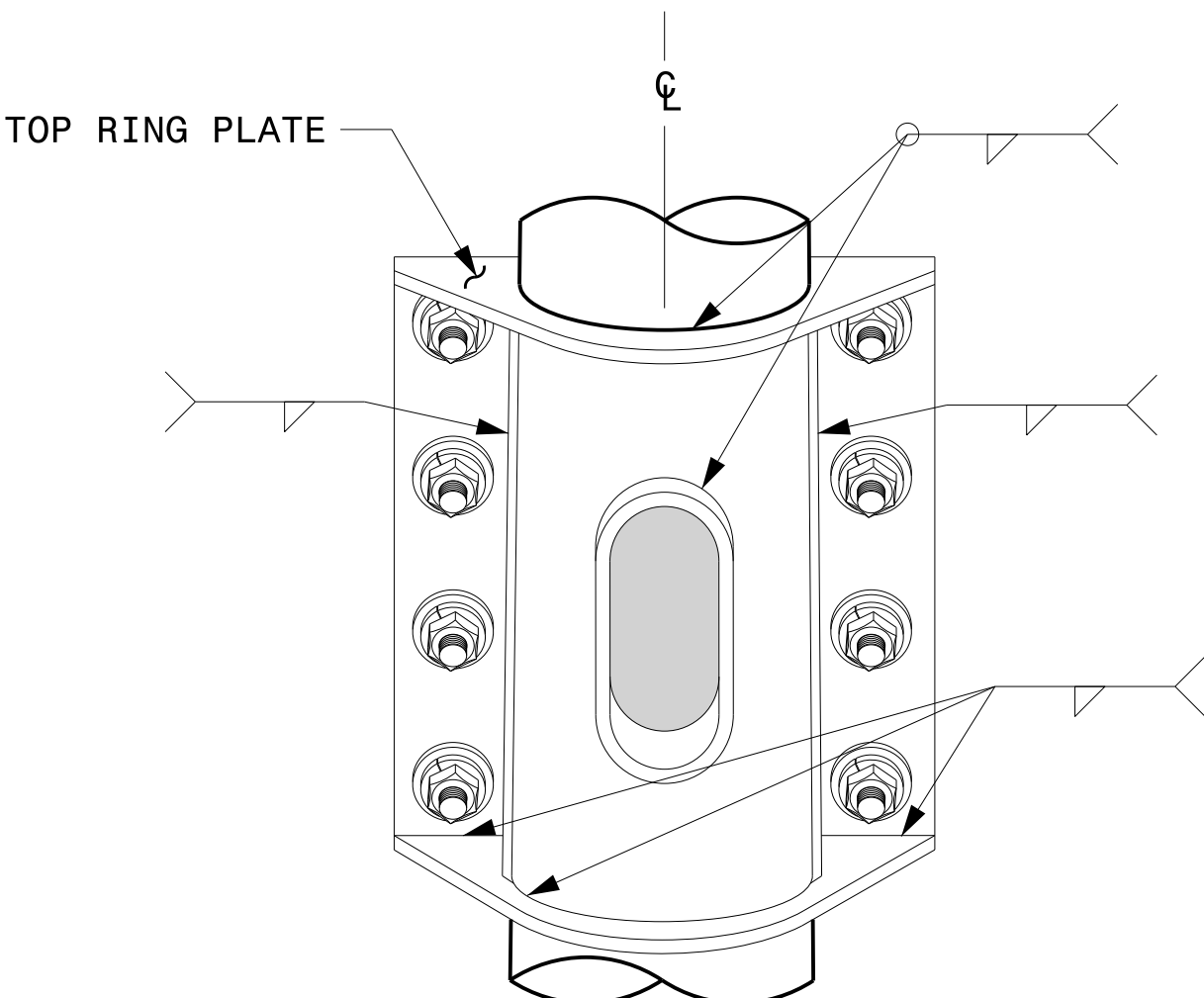
PLAN VIEW



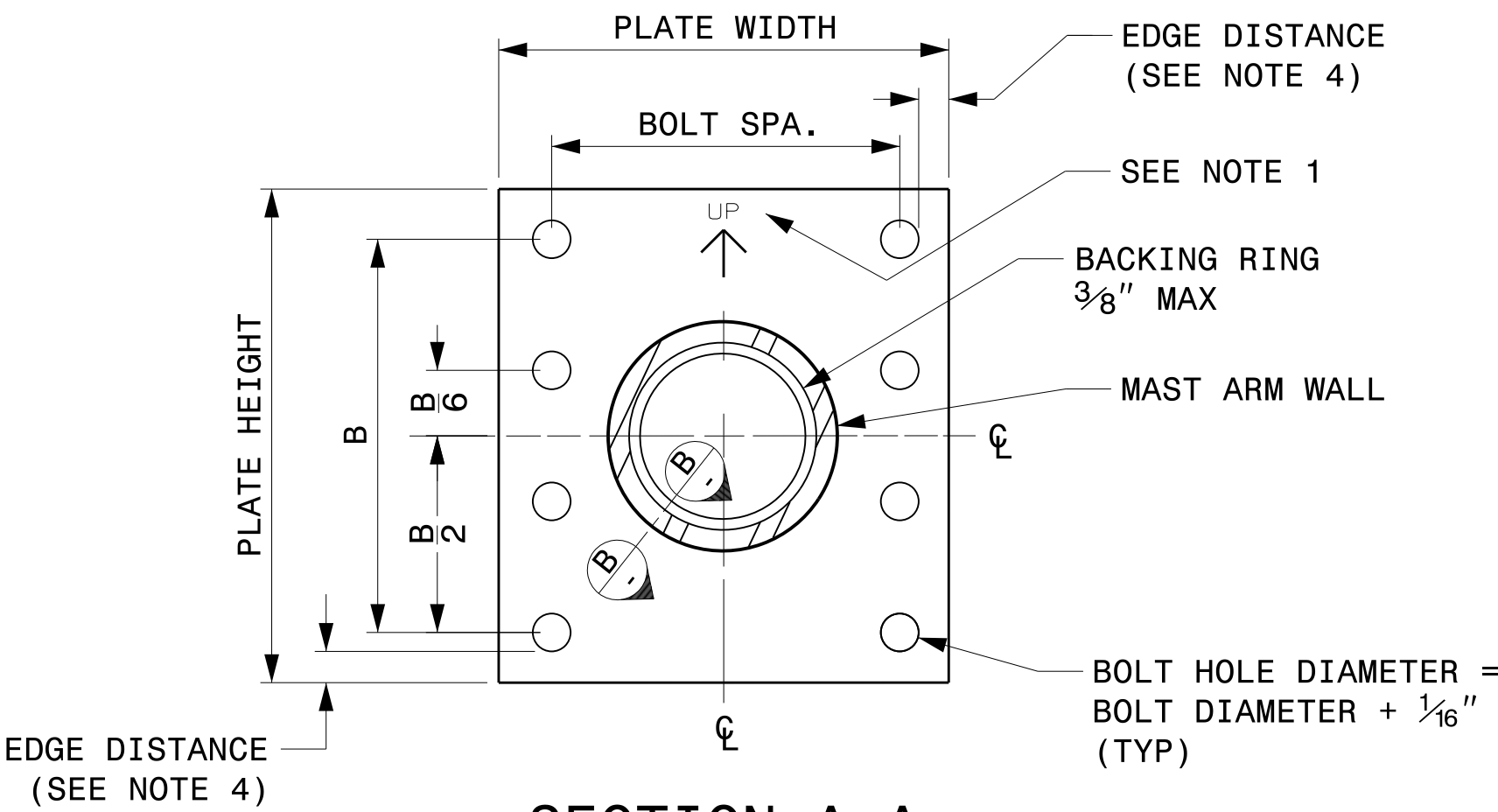
FRONT ELEVATION VIEW



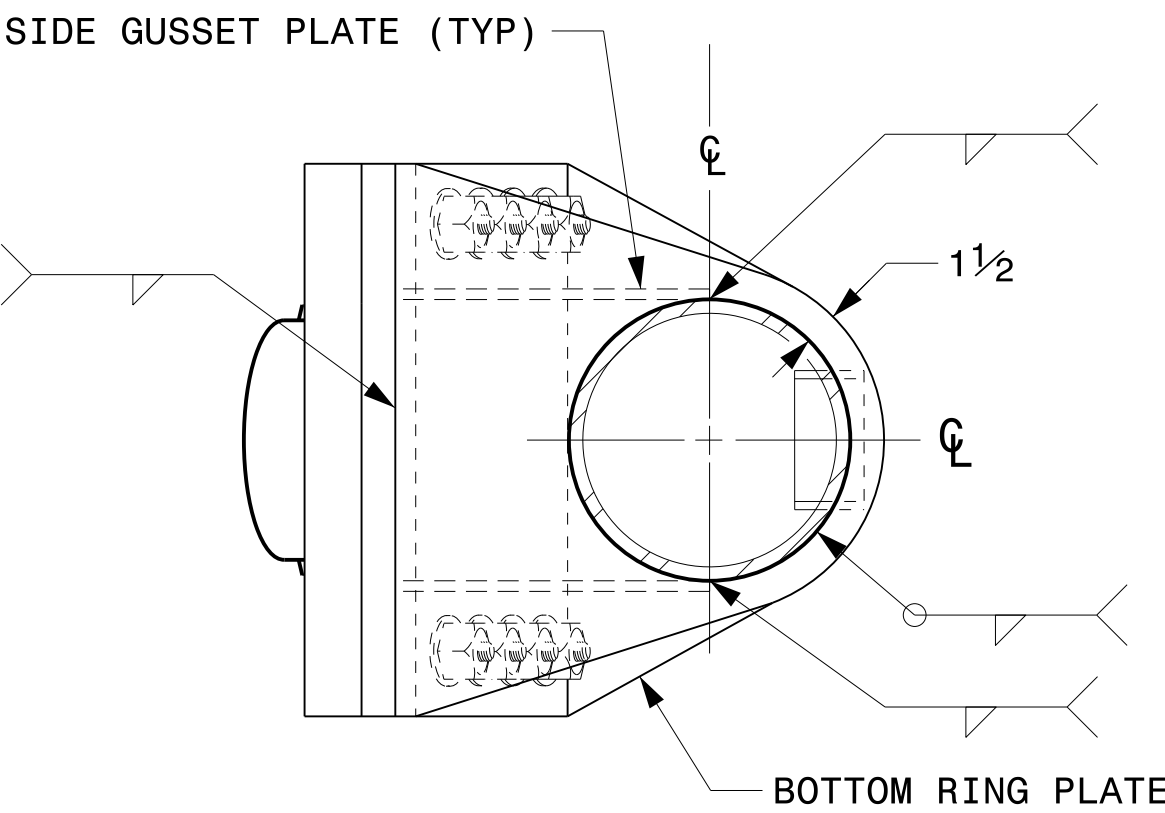
SIDE ELEVATION VIEW



BACK ELEVATION VIEW



SECTION A-A
MAST ARM ATTACHMENT PLATE

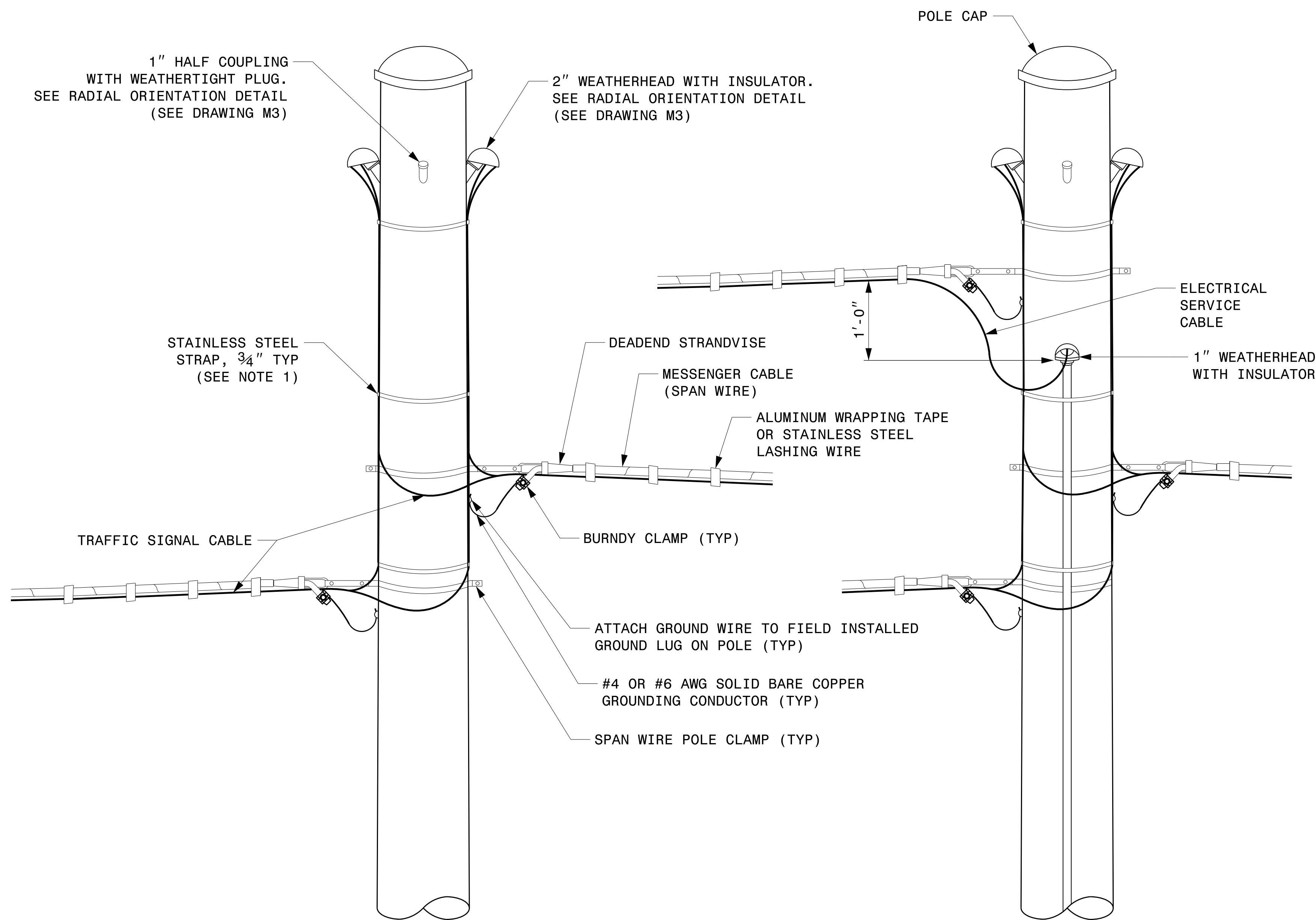


BOTTOM VIEW

NOTES:

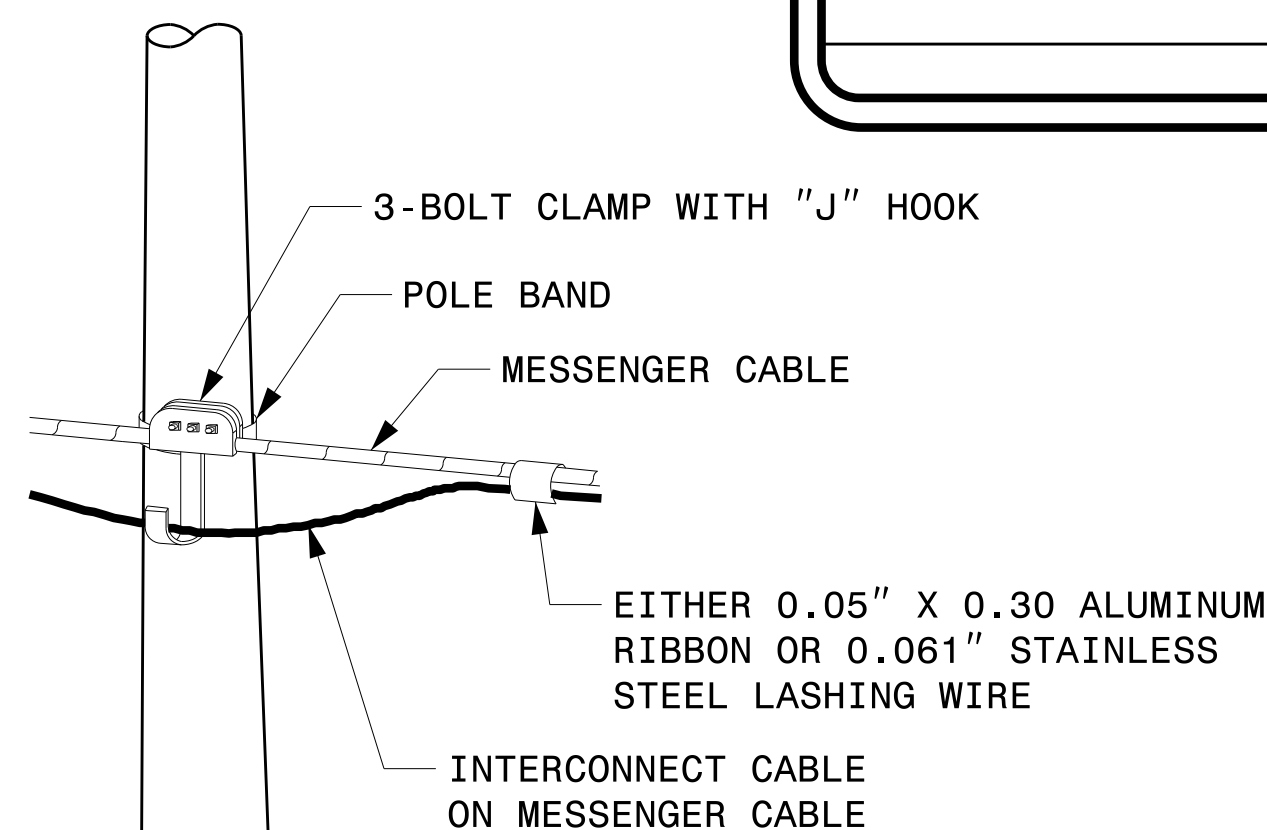
1. PROVIDE A PERMANENT MEANS OF IDENTIFICATION ABOVE THE MAST ARM TO INDICATE PROPER ATTACHMENT ORIENTATION OF THE MAST ARM.
2. DESIGNER WILL DETERMINE THE SIZE OF ALL STRUCTURAL COMPONENTS, PLATES, FASTENERS, AND WELDS SHOWN UNLESS THEY ARE ALREADY SPECIFIED.
3. FABRICATOR IS RESPONSIBLE FOR PROVIDING APPROPRIATE HOLES AT DRAINAGE POINTS TO DRAIN GALVANIZING MATERIALS.
4. FOR MINIMUM EDGE DISTANCE AND NOMINAL BOLT HOLE SIZE, FOLLOW THE LATEST AISC STEEL CONSTRUCTION MANUAL.
5. PROVIDE UPPER HANDHOLE AS NECESSARY WHEN SHAFT EXTENSIONS ARE REQUIRED FOR LUMINAIRE ARMS OR CAMERA. FOR POLES WITHOUT LUMINAIRES/CAMERA, WIRING CAN BE DONE THROUGH THE TOP OF POLE.
6. ALLOWABLE RANGE OF FLANGE TILT ANGLE WILL VARY FROM 0° TO AS REQUIRED.

	Typical Fabrication Details For Mast Arm Connection To Pole		
	PLAN DATE: SEPTEMBER 2023	DESIGNED BY: C.F. ANDREWS	
750 N. Greenfield Pkwy, Garner, NC 27529	PREPARED BY: K.C. DURIGON	REVIEWED BY: D.C. SARKAR	
SCALE: 0 = NA	REVISIONS	INIT.	DATE
NONE			
DocuSigned by: 			09/21/2023 DATE

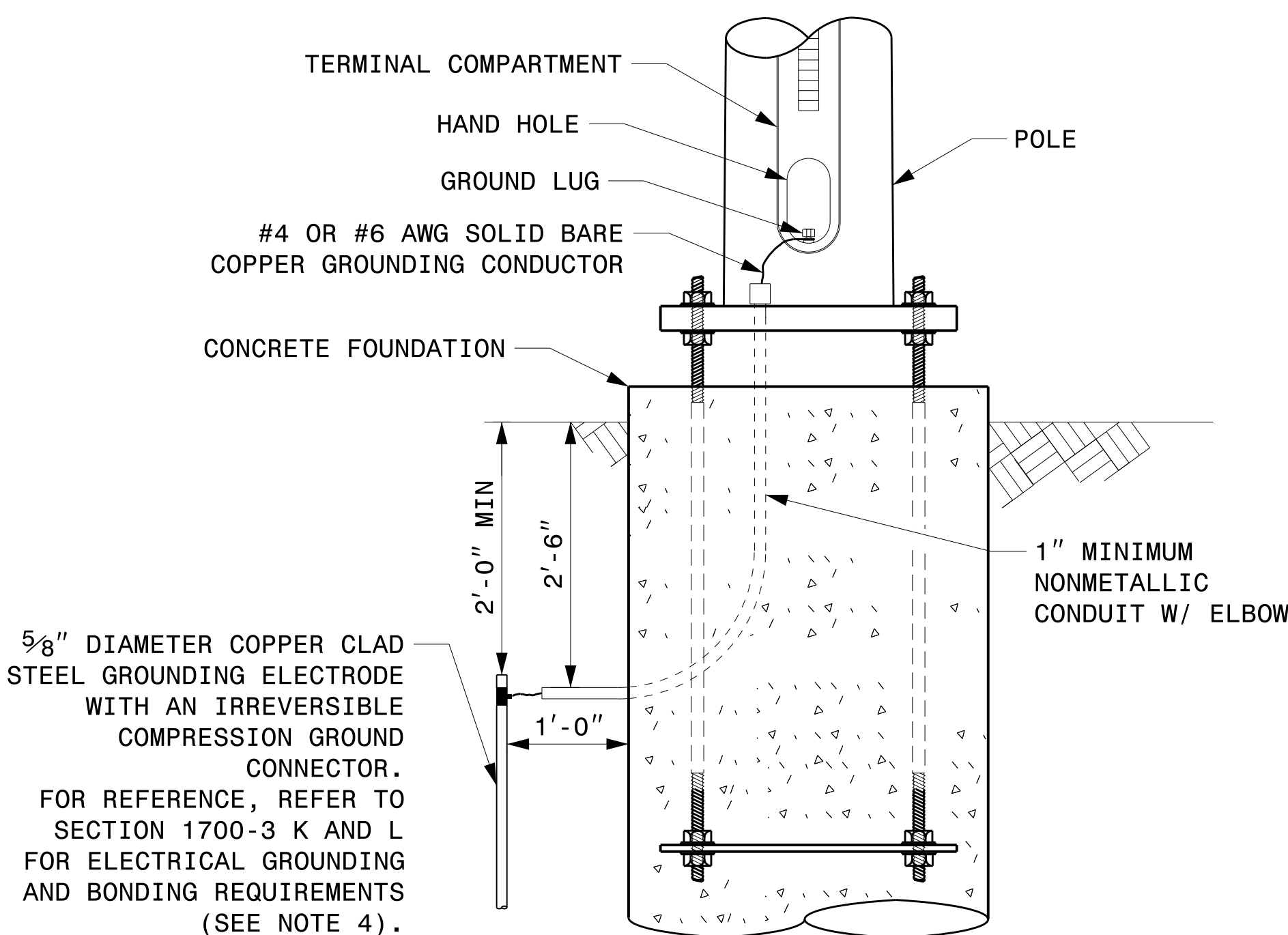


STRAIN POLE ATTACHMENTS

- NOTES:
- STRAP ALL SIGNAL CABLES TO THE SIDE OF THE POLE WITH 3/4" STAINLESS STEEL STRAPS WHEN THE DISTANCE BETWEEN SPAN WIRE ATTACHMENT CLAMP AND WEATHERHEADS EXCEEDS 3'-0".
 - PROVIDE MINIMUM TWO SPAN WIRE POLE CLAMPS PER POLE.
 - IT IS PROHIBITED TO ATTACH TWO SPAN WIRES AT ONE POLE CLAMP.
 - FOR GENERAL REQUIREMENTS, REFER TO NCDOT STANDARD SPECIFICATIONS FOR ROADWAY AND STRUCTURES, JANUARY 2024.



ATTACHMENT OF CABLE TO INTERMEDIATE METAL POLE



METAL POLE GROUNDING DETAIL FOR STRAIN POLE AND MAST ARM

Prepared In the Offices of:

750 N.Greenfield Pkwy,Garner,NC 27529

Typical Fabrication Details For Strain Pole Attachments

PLAN DATE: SEPTEMBER 2023 DESIGNED BY: C.F. ANDREWS
PREPARED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR

REVISIONS
INIT. DATE

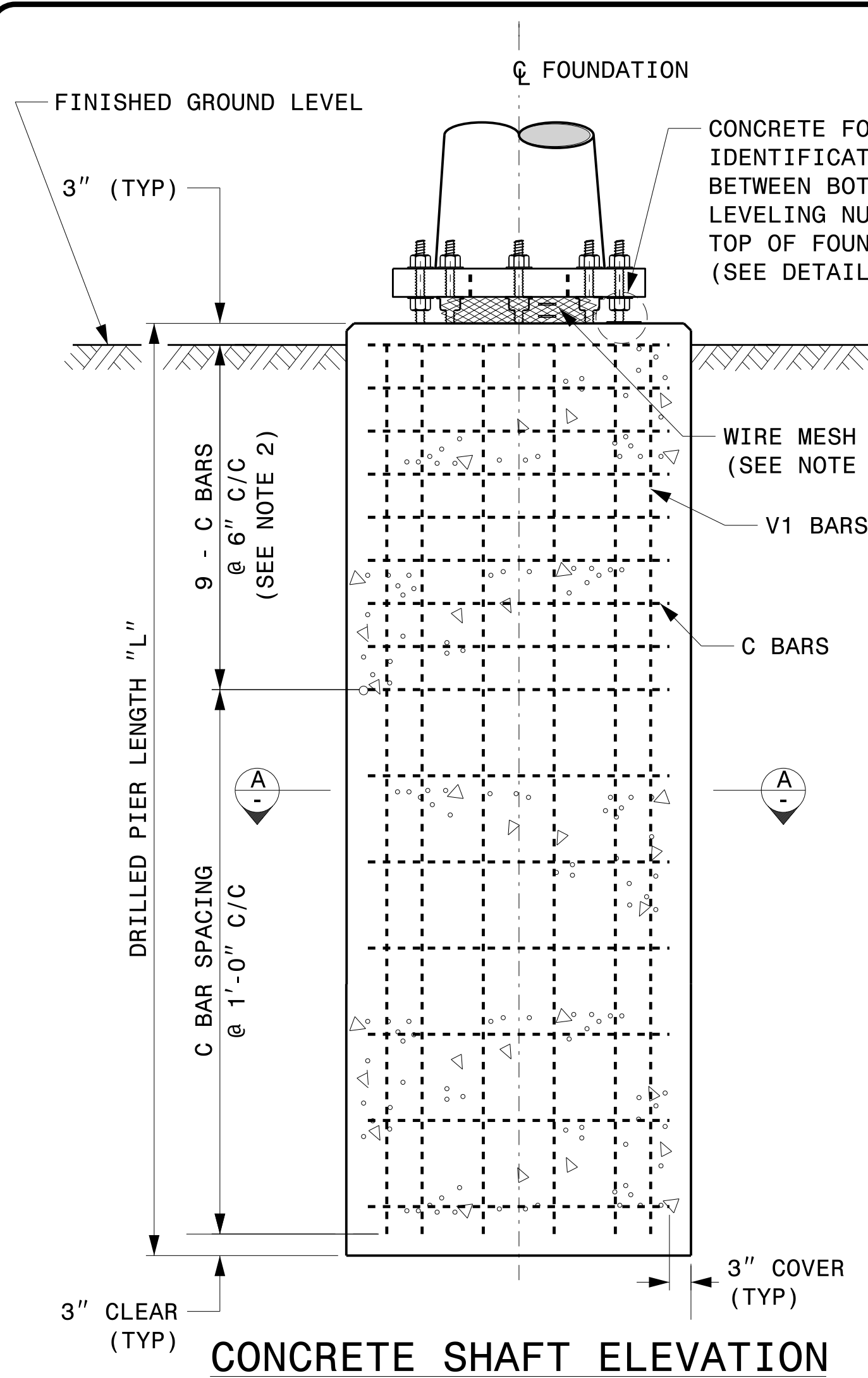
SEAL
NORTH CAROLINA
PROFESSIONAL ENGINEER
SEAL 036626
KEYVIN C. DURIGON

DocuSigned by:
Kevin Durigon
4B23DC79B3784DA...

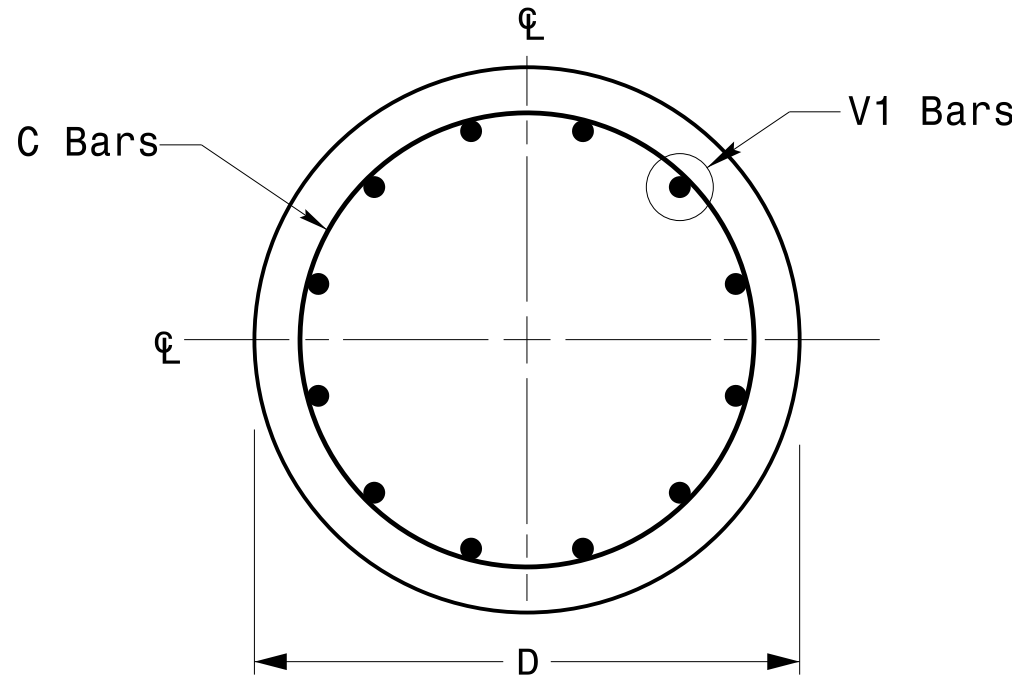
09/21/2023
DATE

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Kedar Igon

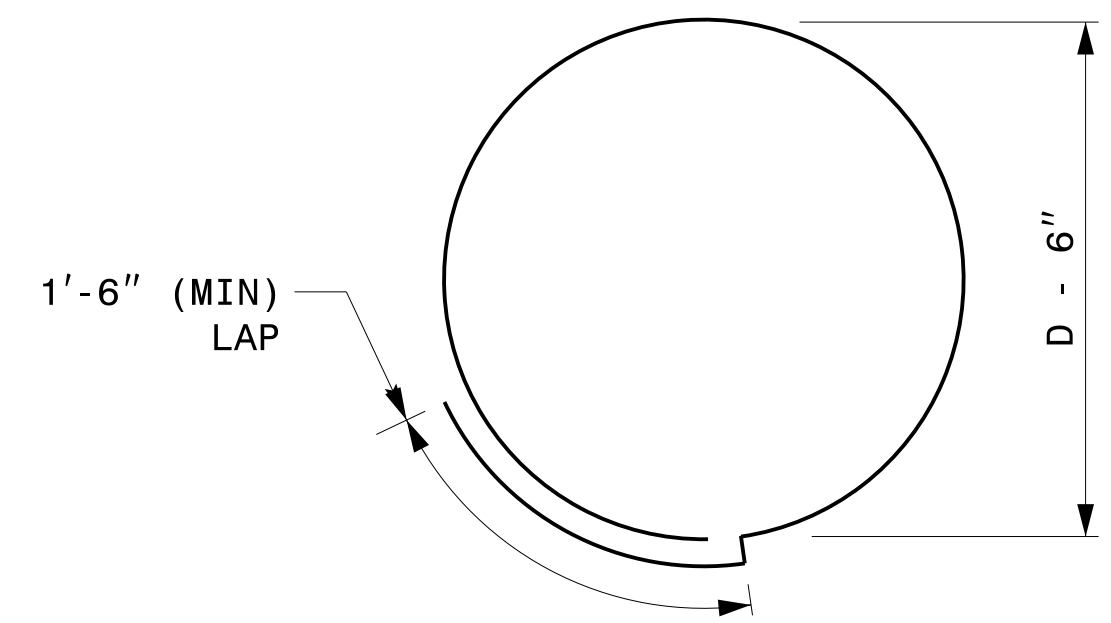
Fabrication Details – Strain Pole Attachments



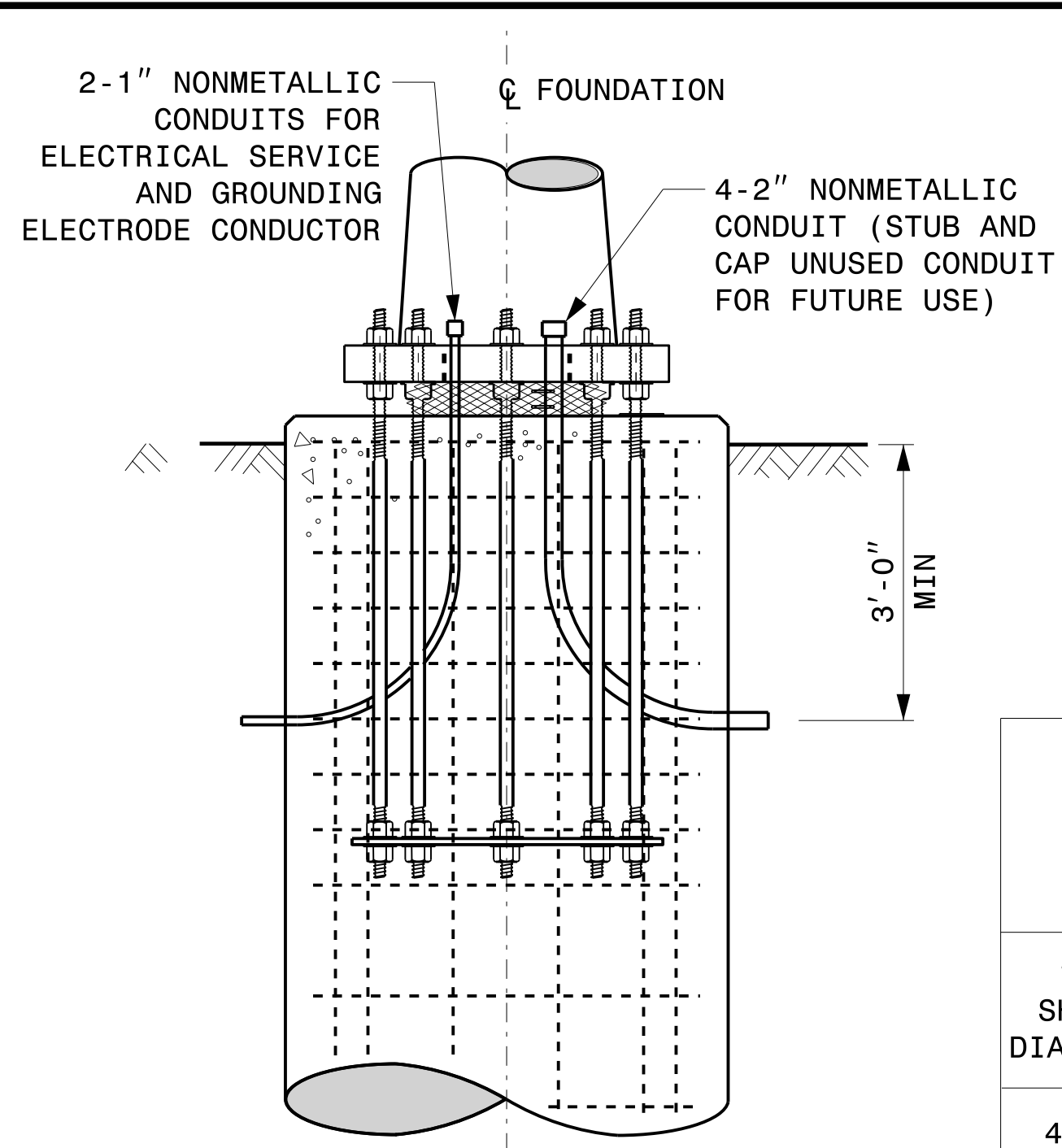
CONCRETE SHAFT ELEVATION



SECTION A-A



TYPICAL "C" BAR DETAIL



TYPICAL FOUNDATION CONDUIT DETAILS

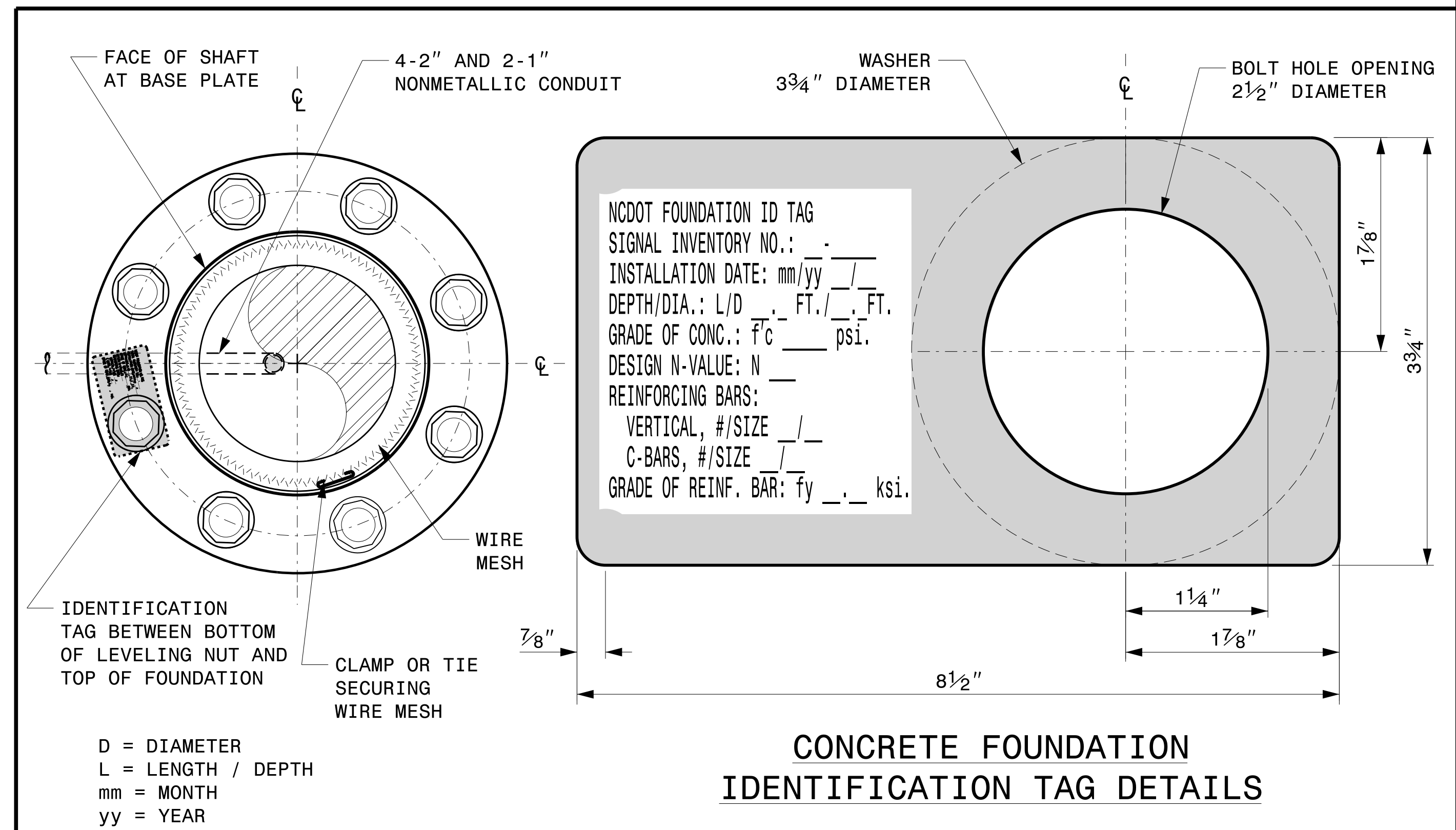
GENERAL NOTES:

- IF ACTUAL SUBSURFACE CONDITIONS DIFFER SIGNIFICANTLY FROM BORING DATA, CONTACT THE ENGINEER BEFORE EXCAVATING OR PLACING CONCRETE.
- CIRCULAR TIE REINFORCING RINGS MAY BE VERTICALLY ADJUSTED BY +/-3" AT A DEPTH BETWEEN 2'-0" AND 3'-0" TO FACILITATE THE INSTALLATION OF ELECTRICAL CONDUIT ENTERING IN THE CAGE.
- FOR STANDARD FOUNDATIONS, SEE SHEET SIG. M8 FOR DETAILS. VERTICAL REINFORCING BARS (V1) MAY BE HORIZONTALLY ADJUSTED BY +/-3" TO FACILITATE THE INSTALLATION OF ELECTRICAL CONDUIT ENTERING INTO THE CAGE.
- PROVIDE 2" TO 5" FOUNDATION PROJECTION ABOVE GROUND LEVEL, DEPENDING ON THE GROUND SLOPE.
- UNLESS OTHERWISE SHOWN, FOUNDATION DESIGNS ARE BASED ON NON-SLOPING LEVEL GROUND SURFACES WITH SLOPE RATIOS OF 8:1 (H:V) OR FLATTER. IF ACTUAL GROUND LINE SLOPES ARE STEEPER, CONTACT THE ENGINEER BEFORE EXCAVATING OR PLACING CONCRETE.
- CONSTRUCT FOUNDATIONS IN ACCORDANCE WITH NCDOT STANDARD PROVISIONS SP09 R005- FOUNDATIONS AND ANCHOR ROD ASSEMBLIES FOR METAL POLES. ALL APPLICABLE 2024 NCDOT STANDARD SPECIFICATIONS ARE REFERENCED IN THIS PROVISION. REFER TO THE NCDOT RESOURCES/SPECIFICATIONS PAGE LOCATED ON THE CONNECT NCDOT WEBSITE.

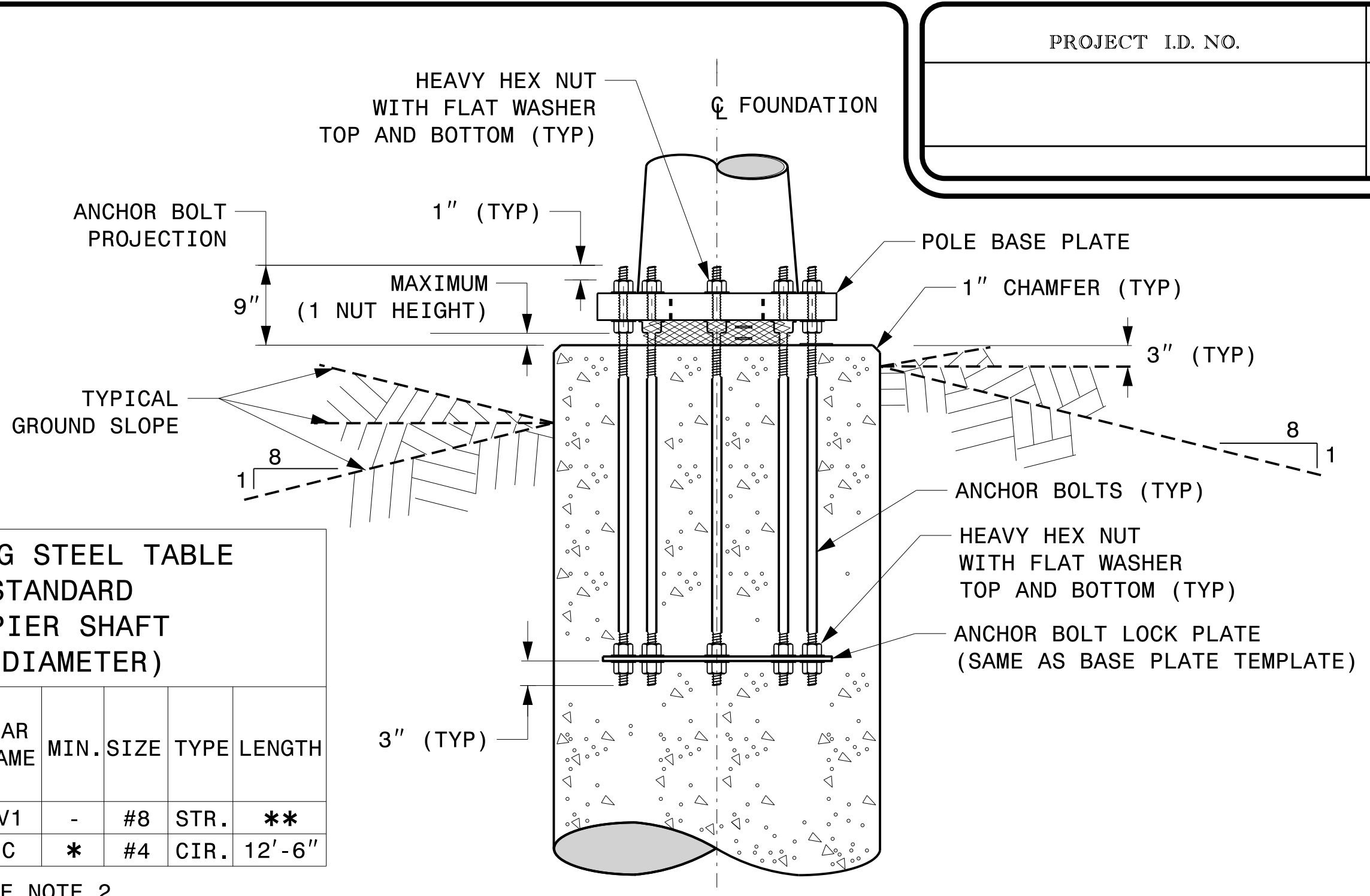
[https://connect.ncdot.gov/resources/Specifications and Special Provisions.aspx](https://connect.ncdot.gov/resources/Specifications%20and%20Special%20Provisions.aspx)
- USE AIR ENTRAINED AA CONCRETE MIX WITH A COMPRESSION STRENGTH OF f'c=4500 psi (MIN) AFTER 28 DAYS.
- USE ASTM A615 GRADE 60 DEFORMED BARS FOR ALL REINFORCING STEEL. MAINTAIN AT LEAST 3" COVER ON ALL REINFORCEMENT.
- LOCATE IDENTIFICATION TAG ON TOP OF THE FOUNDATION, DIRECTLY ABOVE THE CONDUIT'S ENTRY POINT.
- PROVIDE TWO LAYERS OF 4 MESH GALVANIZED WELDED 23 GAUGE (0.025) 6" WIDE AROUND PIPES UNDER THE BASE PLATE AND SECURE IT WITH TIES IF NECESSARY.
- PREFERRED LOCATION FOR THE I.D. TAG IS AS SHOWN IN DETAIL-A: DIRECTLY ABOVE THE CONDUIT ENTERING THE FOUNDATION.

REINFORCING STEEL TABLE FOR STANDARD DRILL PIER SHAFT (4'-0" DIAMETER)						
"D" SHAFT DIAMETER	CONCRETE VOLUME (CU. YDS)	BAR NAME	MIN. SIZE	TYPE	LENGTH	
4'-0"	.465 X L	V1	-	#8 STR.	**	
		C	*	#4 CIR.	12'-6"	

* SEE NOTE 2
** SEE NOTE 3



DETAIL-A



TYPICAL FOUNDATION ANCHOR BOLT DETAILS

(REINFORCING CAGE NOT SHOWN FOR CLARITY)

Prepared In the Offices of:

750 N.Greenfield Pkwy,Garner,NC 27529

SCALE
0 NA
NONE

Construction Details
For
Foundations

PLAN DATE: SEPTEMBER 2023 DESIGNED BY: K.C. DURIGON
PREPARED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR

REVISIONS
INIT. DATE

SEAL
NORTH CAROLINA
PROFESSIONAL ENGINEER
SEAL 036626
KEVIN C. DURIGON

DocuSigned by:
Kevin Durigon
4B23DC79B3784DA

09/23/2023
DATE

03-dpt-2023 19x46
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Kedur.fgm

SOIL CONDITION

STANDARD STRAIN POLES						STANDARD FOUNDATIONS 48" Diameter Drilled Pier Length (L) – Feet							Reinforcement			
Case No.	Pole Height (Ft.)	Base Plate BC (In.)	Reactions at the Pole Base			Clay				Sand			Longitudinal		Stirrups	
			Axial (kip)	Shear (kip)	Moment (ft–kip)	Medium N–Value 4–8	Stiff N–Value 9–15	Very Stiff N–Value 16–30	Hard N–Value > 30	Loose N–Value 4–10	Medium N–Value 11–30	Dense N–Value > 30	Bar Size (#)	Quantity (ea.)	Bar Size (#)	Spacing (in.)
S26L1	26	22	2	9	210	19.5	12.5	9	6.5	15.5	14.5	13	8	12	4	12
S26L2	26	23	2	10	240	19.5	12	9	6.5	15.5	14.5	13	8	12	4	12
S26L3	26	25	2	11	260	20.5	12	10	8	16	15	13	8	12	4	12
S30L1	30	22	2	9	230	19	11	9	7	15.5	14	12.5	8	12	4	12
S30L2	30	23	2	10	270	20	12	10	8	16	14.5	13	8	12	4	12
S30L3	30	25	2	11	290	21	12	10	8	17	15	13.5	8	12	4	12
S30H1	30	25	3	13	355	23	13	11	9	18	16.5	14.5	8	12	4	12
S30H2	30	29	3	15	405	25	14	11	9	19	17.5	15.5	8	14	4	12
S30H3	30	29	3	16	430	26	15	12	9	20	18	16	8	14	4	6
S35L1	35	22	3	8	260	19.5	12	10	8	15.5	14.5	13	8	12	4	12
S35L2	35	23	3	10	300	21	12	10	8	16.5	15	13.5	8	12	4	12
S35L3	35	25	3	10	320	21.5	13	10	8	17	15.5	14	8	12	4	12
S35H1	35	25	3	12	390	23.5	14	11	9	18	17	15	8	14	4	12
S35H2	35	29	4	14	460	26	15	12	9	20	18	16	8	14	4	6
S35H3	35	29	4	16	495	28.5	15	13.5	10	21.5	19	17	8	14	4	6

48" DIAMETER FOUNDATION CONCRETE VOLUME (CUBIC YARDS) = (0.465) x DRILLED PIER LENGTH

GENERAL NOTES:

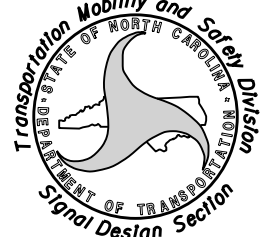
1. VALUES SHOWN IN THE "REACTIONS AT THE POLE BASE" COLUMN REPRESENT THE MINIMUM ACCEPTABLE CAPACITY ALLOWED FOR DESIGN USING A COMBINED FORCE RATIO (CFR) OF 1.00.
2. USE CHAIRS AND SPACERS TO MAINTAIN PROPER CLEARANCE.
3. FOR FOUNDATION, ALWAYS USE AIR-ENTRAINED CONCRETE MIX.

FOUNDATION SELECTION:

1. PERFORM A STANDARD PENETRATION TEST AT EACH PROPOSED FOUNDATION SITE TO DETERMINE "N" VALUE.
2. SELECT THE APPROPRIATE WIND ZONE FROM M1 DRAWING.
3. SELECT THE SOIL TYPE (CLAY OR SAND) THAT BEST DESCRIBES THE SOIL CHARACTERISTICS.
4. GET THE APPROPRIATE STANDARD POLE CASE NUMBER FROM THE PLANS OR FROM THE ENGINEER.
5. SELECT THE APPROPRIATE COLUMN UNDER "STANDARD FOUNDATIONS" BASED ON SOIL TYPE AND "N" VALUE. SELECT THE APPROPRIATE ROW BASED ON THE POLE LOAD CASE.
6. THE FOUNDATION DEPTH IS THE VALUE SHOWN IN THE "STANDARD FOUNDATIONS" CATEGORY WHERE THE COLUMN AND THE ROW INTERSECT.
7. USE CONSTRUCTION PROCEDURES AND DESIGN METHODS PRESCRIBED BY FHWA-NHI-10-016 MANUAL FOR DRILLED SHAFTS.

09-001-2023 19x48
S:\1\SSM1415 Signal\Signal Design Section\Structures\Drawings\2024 Metal Pole Str Drawing for LBF02024 Sig.M8 Str. Strain Pole Found.-Saturated Soil Condition.dgn
Kedur.fgm

Prepared In the Offices of:



750 N.Greenfield Pkwy,Garner,NC 27529

0

SCALE

NA

NONE

Standard Strain Pole Foundation for All Soil Conditions

PLAN DATE: SEPTEMBER 2023

DESIGNED BY: K.C. DURIGON

PREPARED BY: K.C. DURIGON

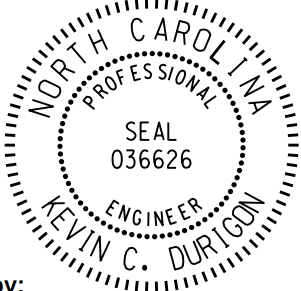
REVIEWED BY: D.C. SARKAR

REVISIONS

INIT.

DATE

SEAL



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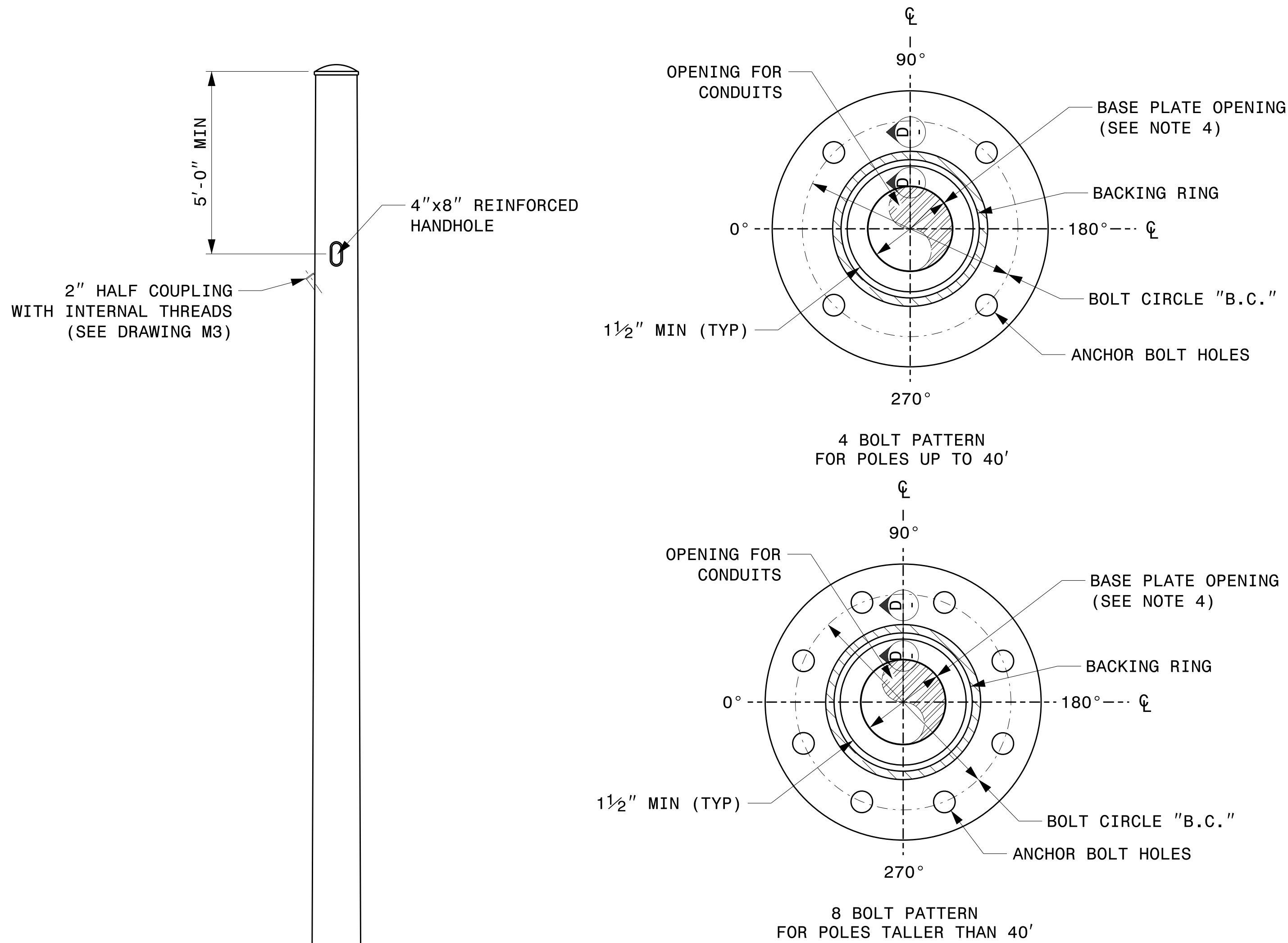
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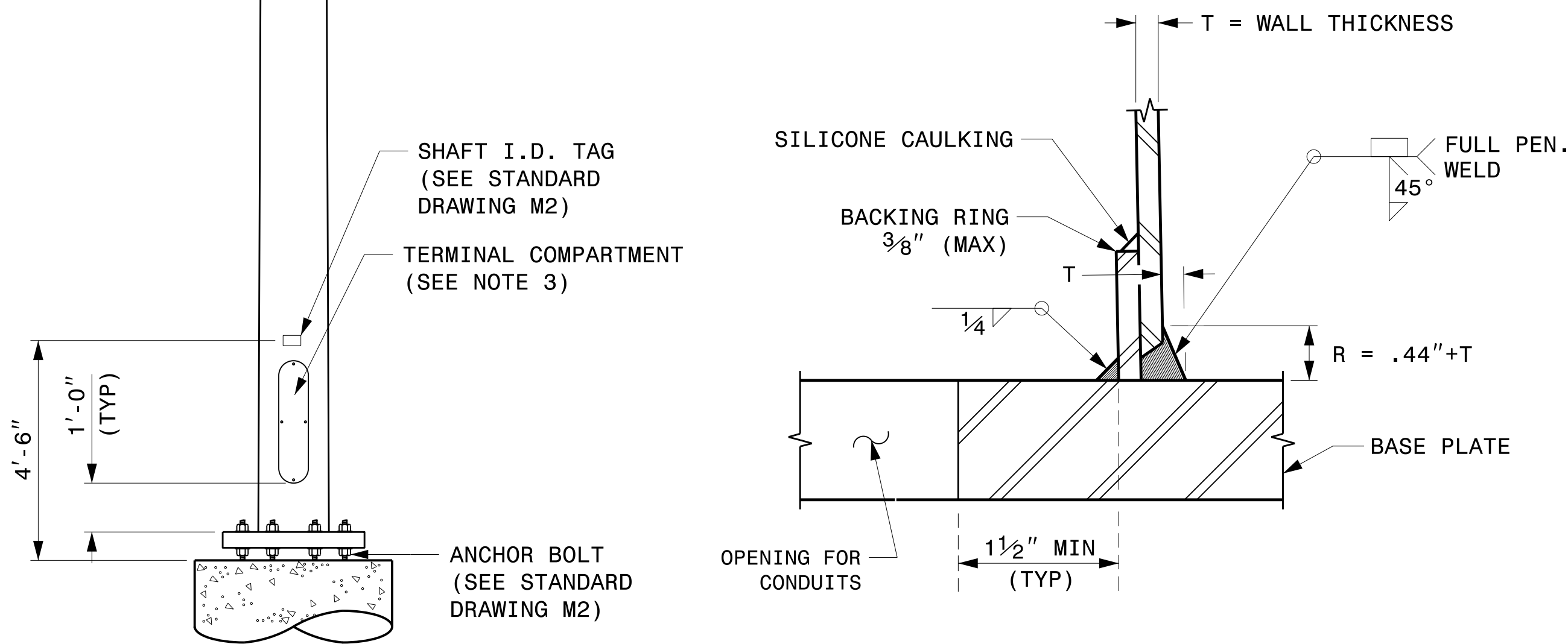
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BASE PLATE DETAILS



SECTION D-D
(POLE ATTACHMENT TO BASE PLATE)
FULL-PENETRATION
GROOVE WELD DETAIL

CCTV CAMERA POLE
(NOT TO SCALE)

- NOTES:
1. THIS DRAWING PROVIDES BASIC DETAILS FOR CCTV POLES. PROJECT REQUIREMENTS MAY REQUIRE SPECIAL FACTORY PREPS THAT ARE NOT SHOWN ON THESE DETAILS.
 2. DETAILS FOR INTERNAL CAMERA LOWERING SYSTEMS ARE NOT SHOWN.
 3. POLE MOUNTED CABINETS MAY REQUIRE MODIFICATIONS TO THE LOWER HANDHOLE OPENING TO MOUNT CABINETS. 4" X 8" REINFORCED HANDHOLES ARE ACCEPTABLE OPTIONS, AND MAY BE PREFERRED.
 4. OPENING IN POLE BASE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS 3 1/2" BUT SHALL NOT BE LESS THAN 8 1/2".
 5. USE COMPACT SECTION CRITERIA D/T RATIO PER AASHTO LTS-LRFD 1ST EDITION SECTION 5.7.2.

	Typical Fabrication Details For CCTV Poles		
	PLAN DATE: SEPTEMBER 2023	DESIGNED BY: K.C. DURIGON	
	PREPARED BY: K.C. DURIGON	REVIEWED BY: C.F. ANDREWS	
SCALE: 0 = NA	REVISIONS	INIT.	DATE
NONE			

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