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09/08/09

See Sheet 1A For Index of Sheets

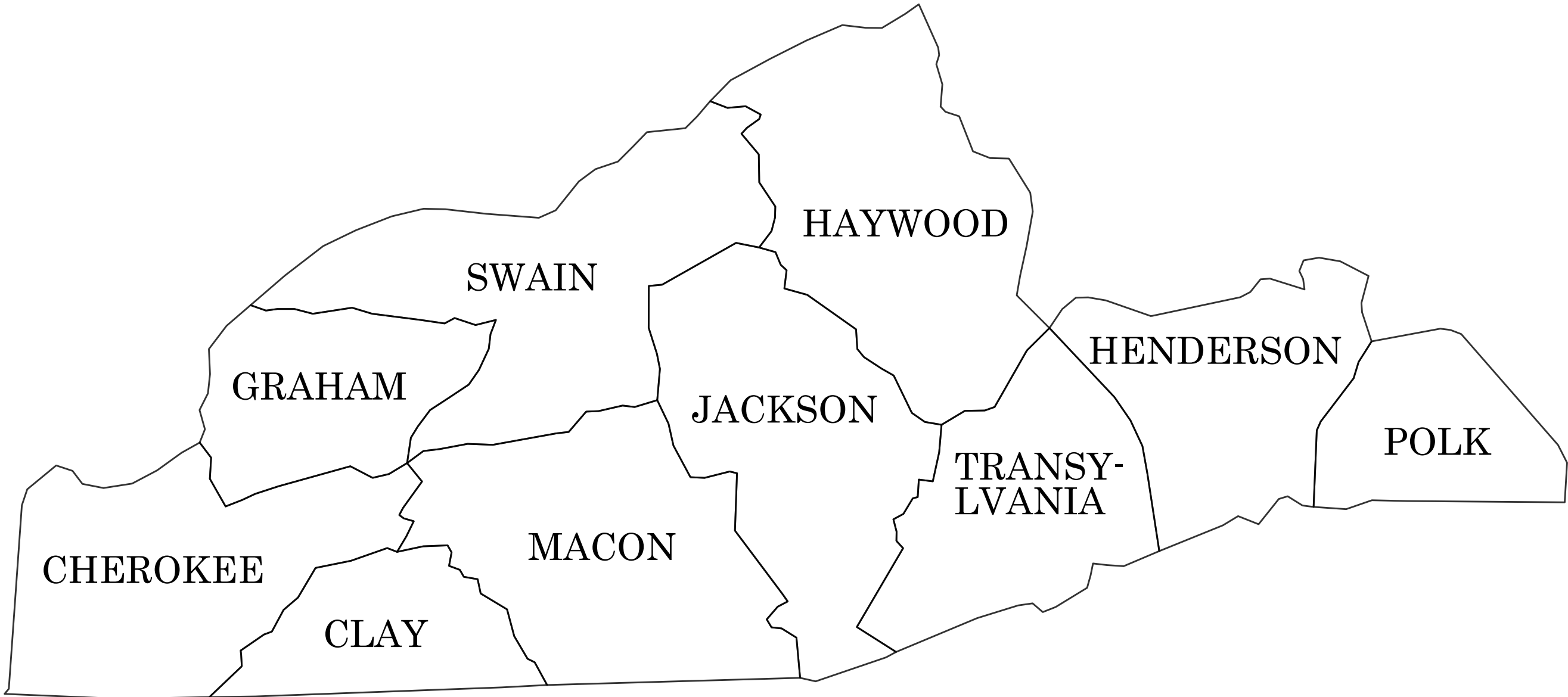
STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

DIVISION 14

LOCATION: *VARIOUS LOCATIONS
ACROSS DIVISION 14*

TYPE OF WORK: *ID/IQ ON-CALL SIGNALS
REPAIR & MAINTENANCE SERVICES*

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	DN12178038	1	18
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	
14.1020SM	TBD		
14.1022SM			
14.1038SM			
14.1044SM			
14.1045SM			
14.1050SM			
14.1056SM			
14.1075SM			
14.1088SM			



CONTRACT: DN12178038

Prepared in the Office of:
DIVISION OF HIGHWAYS
253 WEBSTER RD., SYLVA NC, 28779

2024 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
N/A

LETTING DATE:
NOVEMBER 12, 2025

STEVEN BUCHANAN
PROJECT ENGINEER

JAMES HOLLINGSWORTH P.E.
PROJECT DESIGN ENGINEER



INDEX OF SHEETS

SHEET NUMBER	SHEET
1	TITLE SHEET
1A	INDEX OF SHEETS AND STANDARD DRAWINGS
SIG SP1 THRU SIG SP12	STANDARD NOTES FOR METAL STRAIN POLES
SIG M1A THRU SIG M9	STANDARD DRAWINGS FOR ALL METAL POLES

2024 ROADWAY ENGLISH STANDARD DRAWINGS

The following Roadway Standards as appear in "Roadway Standard Drawings" Highway Design Branch - N. C. Department of Transportation - Raleigh, N. C., Dated January, 2024 are applicable to this project and by reference hereby are considered a part of these plans:

STD.NO.	TITLE
DIVISION 11	WORK ZONE TRAFFIC CONTROL
1101.01	WORK ZONE ADVANCE WARNING SIGNS
1101.02	TEMPORARY LANE CLOSURES
1101.03	TEMPORARY ROAD CLOSURES
1101.04	TEMPORARY SHOULDER CLOSURES
1101.05	WORK ZONE VEHICLE ACCESSES
1101.06	WARNING SIGNS FOR BLASTING ZONES
1101.11	TRAFFIC CONTROL DESIGN TABLES
1110.01	STATIONARY WORK ZONE SIGNS
1110.02	PORTABLE WORK ZONE SIGNS
1115.01	FLASHING ARROW BOARDS
1130.01	DRUMS
1135.01	CONES
1145.01	BARRICADES - TYPE III
1150.01	FLAGGERS
1160.01	TEMPORARY CRASH CUSHION - REFLECTIVE END TREATMENT
1165.01	TRUCK MOUNTED ATTENUATOR
1170.01	PORTABLE CONCRETE BARRIER
1180.01	SKINNY DRUMS
DIVISION 17	SIGNALS AND TRAFFIC MANAGEMENT SYSTEMS
1700.01	ELECTRICAL SERVICE OPTIONS
1700.02	ELECTRICAL SERVICE GROUNDING
1705.01	SIGNAL HEADS - VEHICULAR SIGNAL HEADS
1705.02	SIGNAL HEADS - MOUNTING
1705.03	SIGNAL HEADS - WIRE COLOR CONVENTIONS
1705.04	SIGNAL HEADS - PEDESTRIAN PUSHBUTTON PLACEMENT
1715.01	UNDERGROUND CONDUIT - TRENCHING
1716.01	JUNCTION BOXES
1720.01	WOOD POLES
1721.01	GUY ASSEMBLIES
1725.01	INDUCTIVE DETECTION LOOPS
1730.01	FIBER-OPTIC CABLE - SPARE CABLE STORAGE
1736.01	SPREAD SPECTRUM RADIO
1743.01	PEDESTALS - PEDESTRIAN PUSHBUTTON POST (TYPE I)
1743.02	PEDESTALS - NORMAL DUTY (TYPE II)
1743.03	PEDESTALS - HEAVY DUTY (TYPE III)
1743.04	PEDESTALS - FOUNDATIONS
1751.01	CONTROLLER AND CABINETS - CABINET COMPONENT LAYOUT
1751.02	CONTROLLER AND CABINETS - POWER, GROUND, AND AUXILIARY

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

PROJECT NO.	SHEET NO.
DN12178038	Sig.SP 1

STANDARD NOTES FOR METAL STRAIN POLES

GENERAL

- THESE NOTES PROVIDE INFORMATION AND REQUIREMENTS FOR THE DESIGN, FABRICATION, AND INSTALLATION OF STANDARD METAL STRAIN POLES. THEY ARE TO BE USED BY DESIGN ENGINEERS, CONTRACTORS, AND POLE MANUFACTURERS IN THE SELECTION, FABRICATION, AND INSTALLATION OF METAL TRAFFIC SIGNAL SUPPORTS IN NORTH CAROLINA. THE NOTES ARE CATEGORIZED FOR EASE OF USE, AND ARE NUMBERED CHRONOLOGICALLY. NOTES THAT ARE SPECIFIC TO A PARTICULAR SITUATION, DESIGN DETAIL OR REQUIREMENT ARE SHOWN ON THE APPLICABLE PAGE TO CLARIFY INTENT AND UNDERSTANDING.
- THE FOLLOWING STANDARD DESIGNS ARE BASED ON LIGHT AND HEAVY LOADING CASES. NO VARIATIONS, SUBSTITUTION OR RE-DESIGN OF THE SPECIFIED POLES AND FOUNDATIONS WILL BE PERMITTED UNLESS IT IS APPROVED BY THE ITS AND SIGNALS UNIT.
- THESE METAL POLE STANDARDS MAKE REFERENCE TO THE NCDOT "ROADWAY STANDARD DRAWINGS" DATED JANUARY 2012 HEREINAFTER REFERRED TO AS THE STANDARD DRAWINGS AND TO THE NCDOT "STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES" DATED JANUARY 2012 HEREINAFTER REFERRED TO AS THE STANDARD SPECIFICATIONS. IF THERE IS A DISCREPANCY BETWEEN THE STANDARD DRAWINGS/SPECIFICATIONS AND THESE STANDARDS, THEN THESE DRAWINGS AND PROJECT SPECIAL SPECIFICATIONS SHALL GOVERN.
- POLE CASES PREAPPROVED ON THE ITS & SIGNALS QUALIFIED PRODUCTS LIST (QPL) WILL NOT REQUIRE MANUFACTURER'S CALCULATIONS. HOWEVER, CERTIFICATION OF COMPLIANCE WITH THE MANUFACTURER'S PREAPPROVED SHOP DRAWING ON FILE WITH THE DEPARTMENT SHALL BE FURNISHED TO THE ENGINEER. IF POLE CASES ARE NOT ON THE QPL, OR VARIATIONS TO A CASE STANDARD HAS BEEN APPROVED, MANUFACTURER'S SHOP DRAWINGS SHALL BE REQUIRED.

DESIGN CRITERIA

- THE METAL POLE DESIGN SHALL CONFORM TO THE "2013 AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS" AND LATEST APPROVED INTERIM SPECIFICATIONS. DESIGN WIND PRESSURES AND APPLICATIONS ARE IN ACCORDANCE WITH SECTION 3.8 AND 3.9 OF THE 2013 AASHTO SPECIFICATIONS.
- 2 PLY POLES ARE NOT ACCEPTABLE. EXCEPTIONS TO THIS DESIGN PARAMETER WILL BE DUE TO THE USE OF DECORATIVE POLES.
- THESE STRAIN POLE STANDARDS ALLOW FOR SIGNAL HEADS TO BE PLACED ANYWHERE ALONG THE SPANWIRE. THE MOST CRITICAL LOCATIONS ARE SHOWN IN THE TYPICAL INTERSECTION LOADING CASES SHOWN ON DRAWING SP8-SP12 (LOAD CASE AND DESIGN DETAILS SHEET) OF THESE STANDARDS. FOR DESIGN PURPOSES, USE 4% SAG FOR THE SPANWIRE. ROADWAY DESIGN CLEARANCE RANGE FROM BOTTOM OF SIGNAL HEADS TO PAVEMENT IS 17 FEET.
- PROVISIONS SHALL BE MADE FOR DRAINAGE OF WATER FROM INSIDE THE METAL POLE.

POLE MATERIALS

- PROVIDE MATERIALS FOR STEEL METAL POLES THAT COMPLY WITH SECTION 1072 AND 1098 OF THE STANDARD SPECIFICATIONS AND PER THE LATEST PROJECT SPECIAL PROVISIONS.

POLE MONOTUBE SHALL:
 - GALVANIZE ALL ITEMS OF THE SIGNAL SUPPORT STRUCTURE PER AASHTO M111.
 - USE ASTM A595 MATERIAL (55 KSI) OR EQUIVALENT AS APPROVED BY THE ENGINEER.
 - HAVE A LINEAR TAPER OF 0.14 IN/FT.

- BASE PLATE SHALL:
 - CONFORM TO ASTM A572 GR 50 OR EQUIVALENT.
 - MECHANICALLY GALVANIZED IN ACCORDANCE WITH AASHTO M111.
- ANCHOR BOLTS, NUTS, AND WASHER MATERIAL:
 - ANCHOR BOLTS - USE AASHTO M 314 GRADE 55 MATERIAL OR APPROVED EQUIVALENT.
 - NUTS - USE AASHTO M291 GRADE 2H, DH, OR DH3 MATERIAL OR APPROVED EQUIVALENT.
 - WASHERS - USE AASHTO M293 MATERIAL OR EQUIVALENT.
- ALL ANCHOR BOLTS, NUTS, WASHERS SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M232 OR M298.

POLE FABRICATION

- ALL OTHER STEEL HARDWARE MATERIAL REQUIRED BUT NOT SPECIFIED ABOVE SHALL COMPLY WITH SECTIONS 1072 AND 1098 OF THE STANDARD SPECIFICATIONS.
- POLE ASSEMBLIES SHALL BE PERMANENTLY TAGGED OR ENGRAVED WITH THE FOLLOWING:
 - POLE MANUFACTURERS NAME
 - MANUFACTURE DATE
 - POLE CASE NUMBER
 - THICKNESS AND GRADE OF STEEL
- FOR MANUFACTURING THE METAL POLE THE FOLLOWING CRITERIA MUST BE ADHERED TO:
 - THE METAL POLES SHALL NOT BE SPLICED WITHIN 5 FEET FROM BASE NOR WITHIN 2 FEET FROM ANY CONNECTION.
 - ONLY ONE SPLICE PER UPRIGHT WILL BE PERMITTED.
 - THE QUALITY CONTROL AND WORKMANSHIP OF THE SPLICE WELDS ARE THE SOLE RESPONSIBILITY OF THE POLE MANUFACTURER.
 - CIRCUMFERENTIAL WELDING OF THE POLES IS NOT ALLOWED.
- ALL WELDS SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF THE AWS D1.1 STRUCTURAL WELDING CODE-STEEL.
- PROVIDE 2- 3" FACTORY DRILLED HOLES THROUGH THE POLE WALL FOR WIRE ENTRANCE ACCESS TO THE TERMINAL STRIP INSIDE THE TERMINAL COMPARTMENT. THE HOLES SHALL BE IN THE CENTER OF THE TERMINAL COMPARTMENT (0 DEGREES ON THE POLES RADIAL INDEX) LOCATED AT 26" AND 36" FROM THE BASE OF THE POLE. SEE DRAWING Sig.SP4 (POLE FABRICATION DETAILS) OF THESE METAL POLE STANDARDS FOR GRAPHIC DETAILS.
- THE METAL POLE SHALL BE FABRICATED WITH 3-2" THREADED HALF COUPLINGS AND 1-1" THREADED HALF COUPLING INSTALLED 9" FROM THE TOP OF THE POLE TO RECEIVE THE WEATHERHEADS FOR SIGNAL WIRE ENTRANCES TO THE POLE. THE HALF COUPLINGS SHALL BE WELDED AT NO LESS THAN A 45 DEGREE ANGLE FROM HORIZONTAL TO PROPERLY INSTALL THE WEATHERHEADS. THE 1" HALF COUPLING FOR ELECTRICAL SERVICE ENTRANCE SHALL BE LOCATED AT 0 DEGREES ON THE POLES RADIAL INDEX. ALL OTHER 2" HALF COUPLINGS SHALL BE LOCATED AT 90 DEGREE INCREMENTS. PROVIDE WEATHER TIGHT BUSHING CAPS FOR ALL HALF COUPLINGS. REFER TO DRAWING Sig.SP4 (POLE FABRICATION DETAILS) OF THESE METAL POLE STANDARDS FOR GRAPHIC DETAILS.
- PROVIDE A FACTORY STANDARD "C" HOOK FOR CABLE SUPPORT WELDED INSIDE THE TOP OF THE POLE AT 225 DEGREES ON THE POLES RADIAL INDEX. REFER TO DRAWING M3 (POLE FABRICATION DETAILS) OF THESE METAL POLE STANDARDS FOR DETAILS.
- FOR ALL OTHER NON-STRUCTURAL DETAILS AND REQUIREMENTS, REFER TO APPLICABLE SECTIONS OF THESE STANDARDS, THE TRAFFIC SIGNAL PLANS AND SPECIFICATIONS.
- AT THE TIME OF SHIPMENT FROM THE FACTORY, ENSURE THE POLE IS PACKAGED SO THAT WATER CAN NOT GET INSIDE THE POLE.
- SHIP ALL POLE ACCESSORIES FOR EACH POLE IN A SEPARATE WATERTIGHT CONTAINER WITH A LABEL THAT IDENTIFIES THE SPECIFIC POLE AND DESCRIBES THE CONTENTS.

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

Prepared In the Offices of:



750 N.Greenfield Pkwy.
Garner, NC 27529

Designed in conformance
with the latest
2015 Interim to the
6th Edition 2013
AASHTO
Standard Specifications for
Structural Supports for
Highway Signs, Luminaires,
and Traffic Signals

INDEX OF PLANS			
DRAWING		DESCRIPTION	
No.			
Sig.SP 1-2	Standard	Strain Pole	Notes
Sig.SP 3-7	Statewide	Wind Zones	
Sig.SP 8	ZONE 1	140 MPH	
Sig.SP 9	ZONE 2	130 MPH	
Sig.SP 10	ZONE 3	110 MPH	
Sig.SP 11	ZONE 4	90 MPH	
Sig.SP 12	ZONE 5	120 MPH	

NCDOT CONTACTS:
MOBILITY AND SAFETY DIVISION - ITS AND SIGNALS UNIT

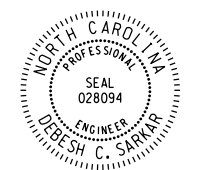
G. A. FULLER, P.E. - STATE ITS AND SIGNALS ENGINEER

G. G. MURR, JR., P.E. - STATE SIGNALS ENGINEER

D.C. SARKAR, P.E. - ITS AND SIGNALS SENIOR STRUCTURAL ENGINEER

C.F. ANDREWS - ITS AND SIGNALS JOURNEY STRUCTURAL ENGINEER

SEAL



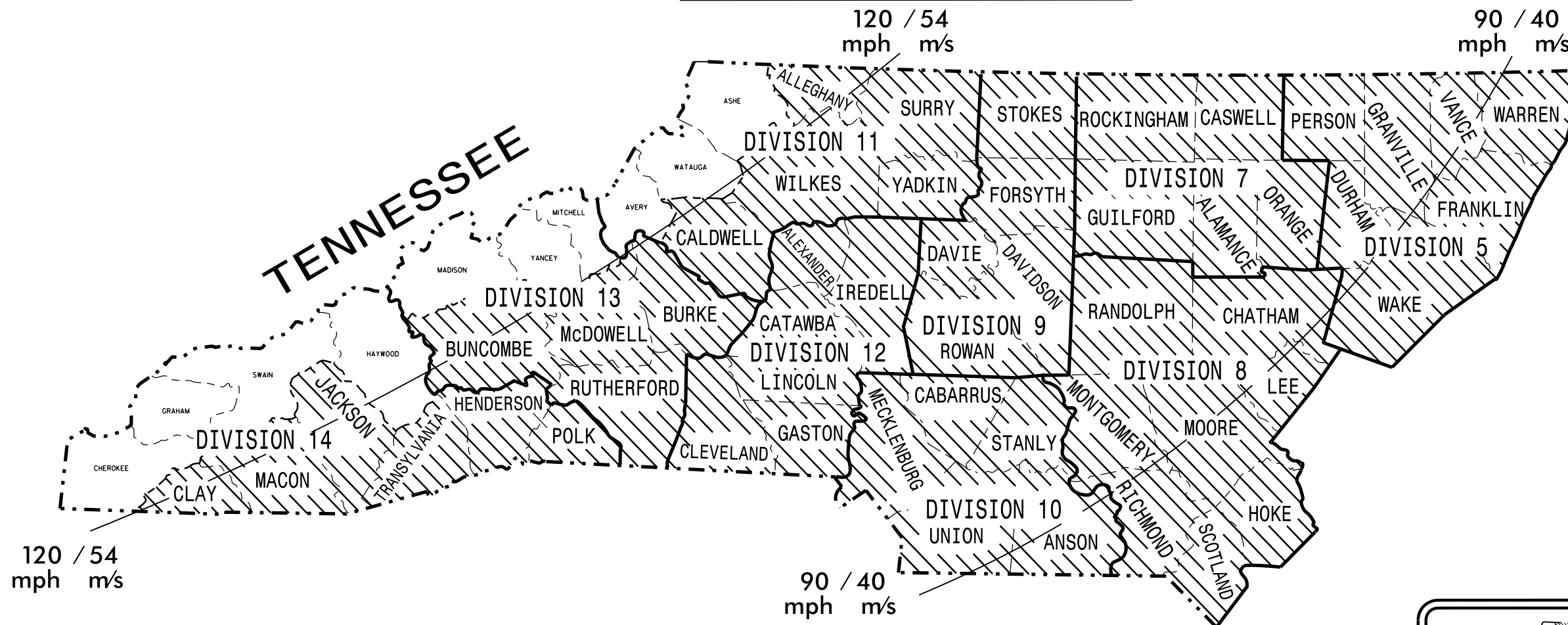
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Debesh C Sarkar
SIGNATURE

8/2/2016
DATE

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

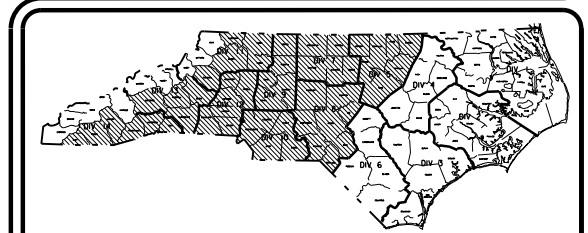
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SHEET NO. Sig.SP6

STANDARD DRAWINGS FOR ALL METAL POLES
ZONE 4 – 90 mph (40 m/s)

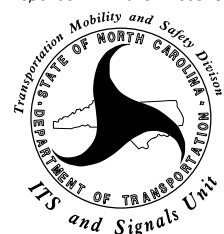


ALL COUNTIES WITHIN DIVISIONS 5, 7, 8, 9, 10, AND 12.
ALLEGHANY, CALDWELL, SURRY, WILKES, AND YADKIN COUNTIES IN DIVISION 11.
BUNCOMBE, BURKE, McDOWELL, AND RUTHERFORD COUNTIES IN DIVISION 13.
CLAY, HENDERSON, JACKSON, MACON, POLK, RUTHERFORD, AND TRANSYLVANIA COUNTIES IN DIVISION 14.

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



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AASHTO

Standard Specifications for
Structural Supports for
Highway Signs, Luminaires,
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INDEX OF PLANS

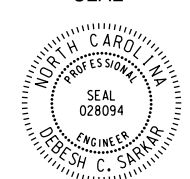
DRAWING NUMBER	DESCRIPTION
Sig.SP 1-2	Standard Strain Pole Notes
Sig.SP 3-7	Statewide Wind Zones
Sig.SP 8	ZONE 1 140 MPH
Sig.SP 9	ZONE 2 130 MPH
Sig.SP 10	ZONE 3 110 MPH
Sig.SP 11	ZONE 4 90 MPH
Sig.SP 12	ZONE 5 120 MPH

NCDOT CONTACTS:

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D. C. SARKAR, P.E. - ITS AND SIGNALS SENIOR STRUCTURAL ENGINEER
C. F. ANDREWS - ITS AND SIGNALS JOURNEY STRUCTURAL ENGINEER

SEAL



DocuSigned by:

Debesh C. Sarkar

8/2/2016

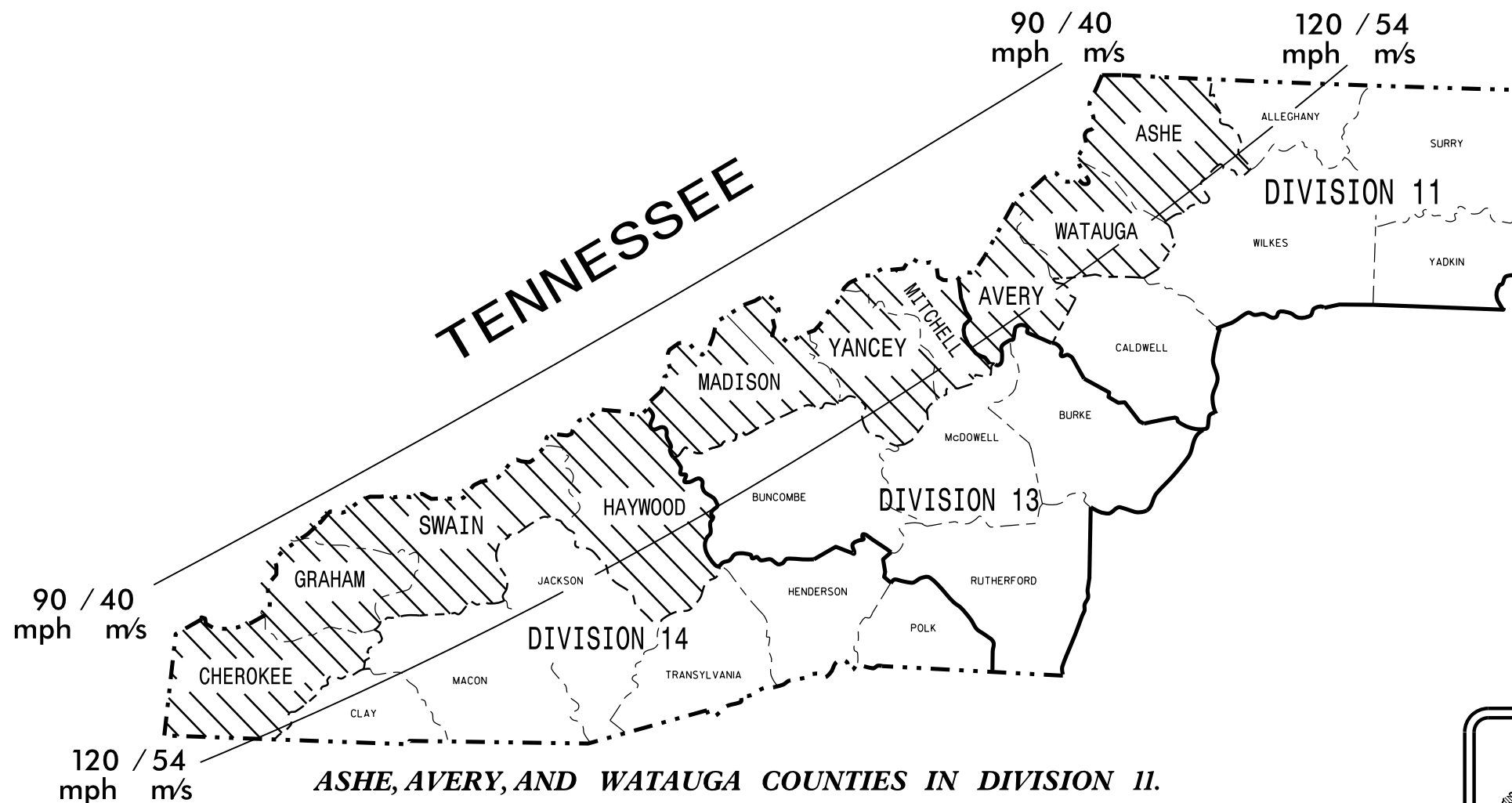
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DATE

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

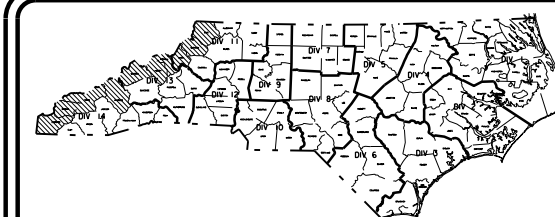
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SHEET NO. Sig.SP7

STANDARD DRAWINGS FOR ALL METAL POLES
ZONE 5 – 120 mph (54 m/s) SPECIAL WIND REGION

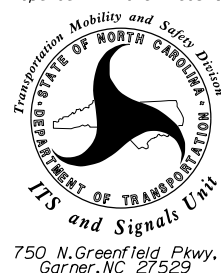


ASHE, AVERY, AND WATAUGA COUNTIES IN DIVISION 11.
MADISON, MITCHELL, AND YANCEY COUNTIES IN DIVISION 13.
CHEROKEE, GRAHAM, HAYWOOD, AND SWAIN COUNTIES IN DIVISION 14.

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



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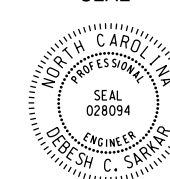
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Debesh C. Sarkar

8/2/2016

SIGNATURE

DATE

ZONE 4 (90 MPH)

PROJECT ID. NO.
DN12178038

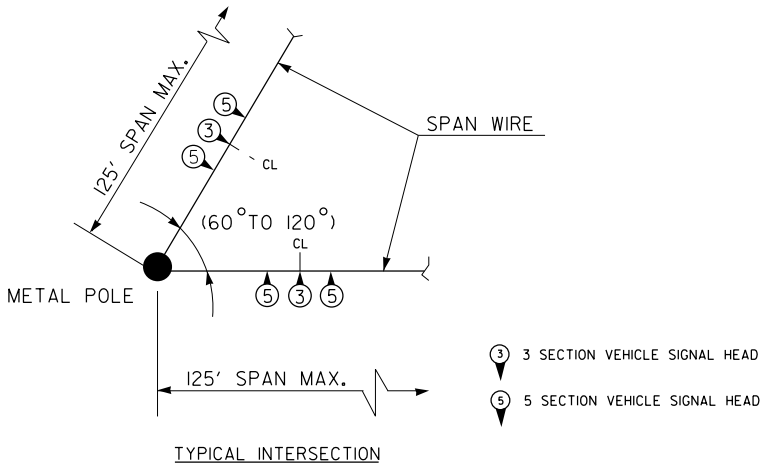
SHEET NO.
Sig.SP 11

LIGHT LOADING

(FOR ONE POLE AND ONE FOUNDATION)

CASE No.	POLE HEIGHT IN (FT.)	METAL POLE		BASE PLATES			ANCHOR BOLTS		CONCRETE FOOTING		
		WALL THICKNESS TH GAGE, (IN.)	BASE DIAMETER (IN.)	D (IN.)	BC (IN.)	T (IN.)	NO. OF BOLTS	DIAMETER X TOTAL LENGTH (IN.)	DIAMETER d (IN.)	DEPTH L (FT.)	VOLUME (CU. YDS.)
S26L1	26	0.3125	15	28	22	2	8	2 X 60	48	*	*
S30L1	30	0.3125	16	28	22	2	8	2 X 60	48	*	*
S35L1	35	0.375	15	28	22	2	8	2 X 60	48	*	*

★SEE NOTE 1 AND 2 "SOIL TESTING AND STANDARD SOIL FOUNDATIONS" ON SHEET Sig.SP2 OF THE STANDARD NOTES.

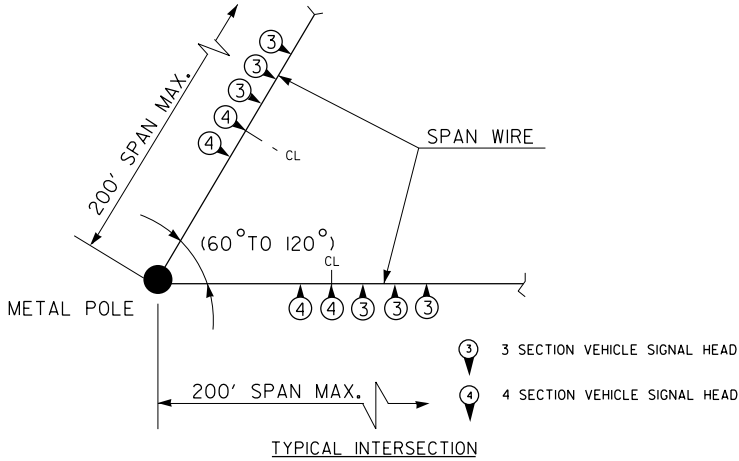


HEAVY LOADING

(FOR ONE POLE AND ONE FOUNDATION)

CASE No.	POLE HEIGHT IN (FT.)	METAL POLE		BASE PLATES			ANCHOR BOLTS		CONCRETE FOOTING		
		WALL THICKNESS TH GAGE, (IN.)	BASE DIAMETER (IN.)	D (IN.)	BC (IN.)	T (IN.)	NO. OF BOLTS	DIAMETER X TOTAL LENGTH (IN.)	DIAMETER d (IN.)	DEPTH L (FT.)	VOLUME (CU. YDS.)
S30H1	30	0.3125	19	31	25	2	12	2 X 60	48	*	*
S35H1	35	0.375	18	31	25	2	12	2 X 60	48	*	*

★SEE NOTE 1 AND 2 "SOIL TESTING AND STANDARD SOIL FOUNDATIONS" ON SHEET Sig.SP2 OF THE STANDARD NOTES.



METAL STRAIN POLES

COUNTY WIND ZONE 4

90 mph / 40 m/s

DURHAM	CHATHAM	CABARRUS	IREDELL
FRANKLIN	HOKE	MECKLENBURG	LINCOLN
GRANVILLE	LEE	STANLY	BUNCOMBE
PERSON	MONTGOMERY	UNION	BURKE
VANCE	MOORE	ALLEGHANY	MCDOWELL
WARREN	RANDOLPH	CALDWELL	RUTHERFORD
WAKE	RICHMOND	SURRY	CLAY
ALAMANCE	DAVIDSON	WILKES	HENDERSON
CASWELL	DAVIE	YADKIN	JACKSON
GUILFORD	FORSYTH	ALEXANDER	MACON
ORANGE	ROWAN	CATAWBA	POLK
ROCKINGHAM	STOKES	CLEVELAND	TRANSYLVANIA
SCOTLAND	ANSON	GASTON	

Prepared In the Offices of:



750 N.Greenfield Pkwy.Garner,NC 27529

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AASHTO

Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals

WIND ZONE 4
LOAD CASE AND DESIGN
DETAILS

PLAN DATE:	JUNE 2016	DESIGNED BY:	K.C.DURIGON
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR
REVISIONS		INIT.	DATE

SEAL



DocuSigned by:

Debesh C Sarkar

8/2/2015

SIGNATURE

DATE

ZONE 5 (120 MPH) SPECIAL WIND ZONE

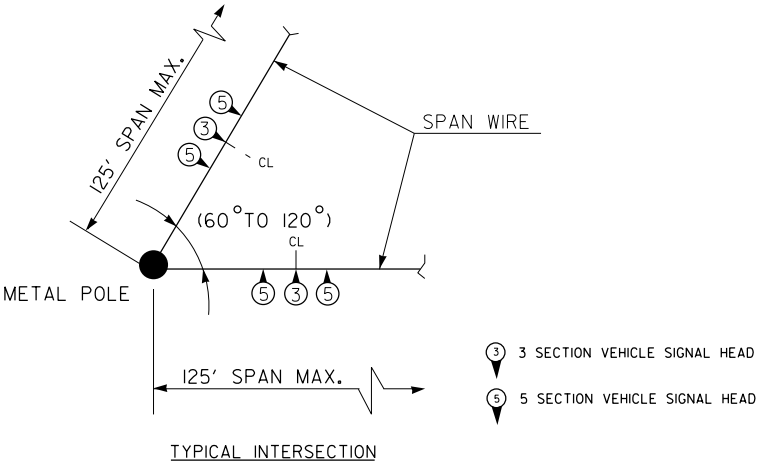
PROJECT ID. NO. DN12178038 SHEET NO. Sig.SP 12

LIGHT LOADING

(FOR ONE POLE AND ONE FOUNDATION)

CASE No.	POLE HEIGHT IN (FT.)	METAL POLE		BASE PLATES			ANCHOR BOLTS		CONCRETE FOOTING		
		WALL THICKNESS TH GAGE, (IN.)	BASE DIAMETER (IN.)	D (IN.)	BC (IN.)	T (IN.)	NO. OF BOLTS	DIAMETER X TOTAL LENGTH (IN.)	DIAMETER d (IN.)	DEPTH L (FT.)	VOLUME (CU. YDS.)
S26L2	26	0.3125	16	29	23	2	8	2 X 60	48	*	*
S30L2	30	0.3125	17	29	23	2	8	2 X 60	48	*	*
S35L2	35	0.375	17	29	23	2	8	2 X 60	48	*	*

★SEE NOTE 1 AND 2 "SOIL TESTING AND STANDARD SOIL FOUNDATIONS" ON SHEET Sig.SP2 OF THE STANDARD NOTES.

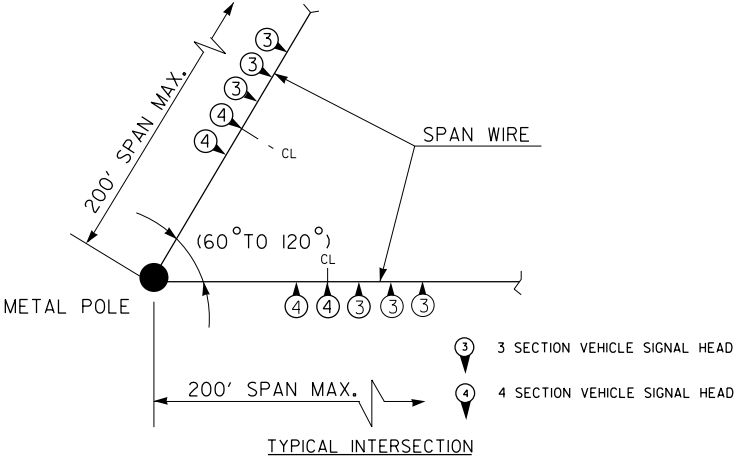


HEAVY LOADING

(FOR ONE POLE AND ONE FOUNDATION)

CASE No.	POLE HEIGHT IN (FT.)	METAL POLE		BASE PLATES			ANCHOR BOLTS		CONCRETE FOOTING		
		WALL THICKNESS TH GAGE, (IN.)	BASE DIAMETER (IN.)	D (IN.)	BC (IN.)	T (IN.)	NO. OF BOLTS	DIAMETER X TOTAL LENGTH (IN.)	DIAMETER d (IN.)	DEPTH L (FT.)	VOLUME (CU. YDS.)
S30H2	30	0.3125	21	35	29	2	12	2 X 60	48	*	*
S35H2	35	0.375	21	35	29	2	12	2 X 60	48	*	*

★SEE NOTE 1 AND 2 "SOIL TESTING AND STANDARD SOIL FOUNDATIONS" ON SHEET Sig.SP2 OF THE STANDARD NOTES.



COUNTY WIND ZONE 5

120 mph / 58 m/s

ASHE
AVERY
WATAUGA
MADISON
MITCHELL
YANCEY
CHEROKEE
GRAHAM
HAYWOOD
SWAIN

METAL STRAIN POLES

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AASHTO

Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals

WIND ZONE 5
LOAD CASE AND DESIGN
DETAILS

PLAN DATE: JUNE 2016	DESIGNED BY: K.C. DURIGON
PREPARED BY: N. BITTING	REVIEWED BY: D.C. SARKAR
REVISIONS	INIT. DATE

SEAL



DocuSigned by:

Debesh C Sarkar

8/2/2016

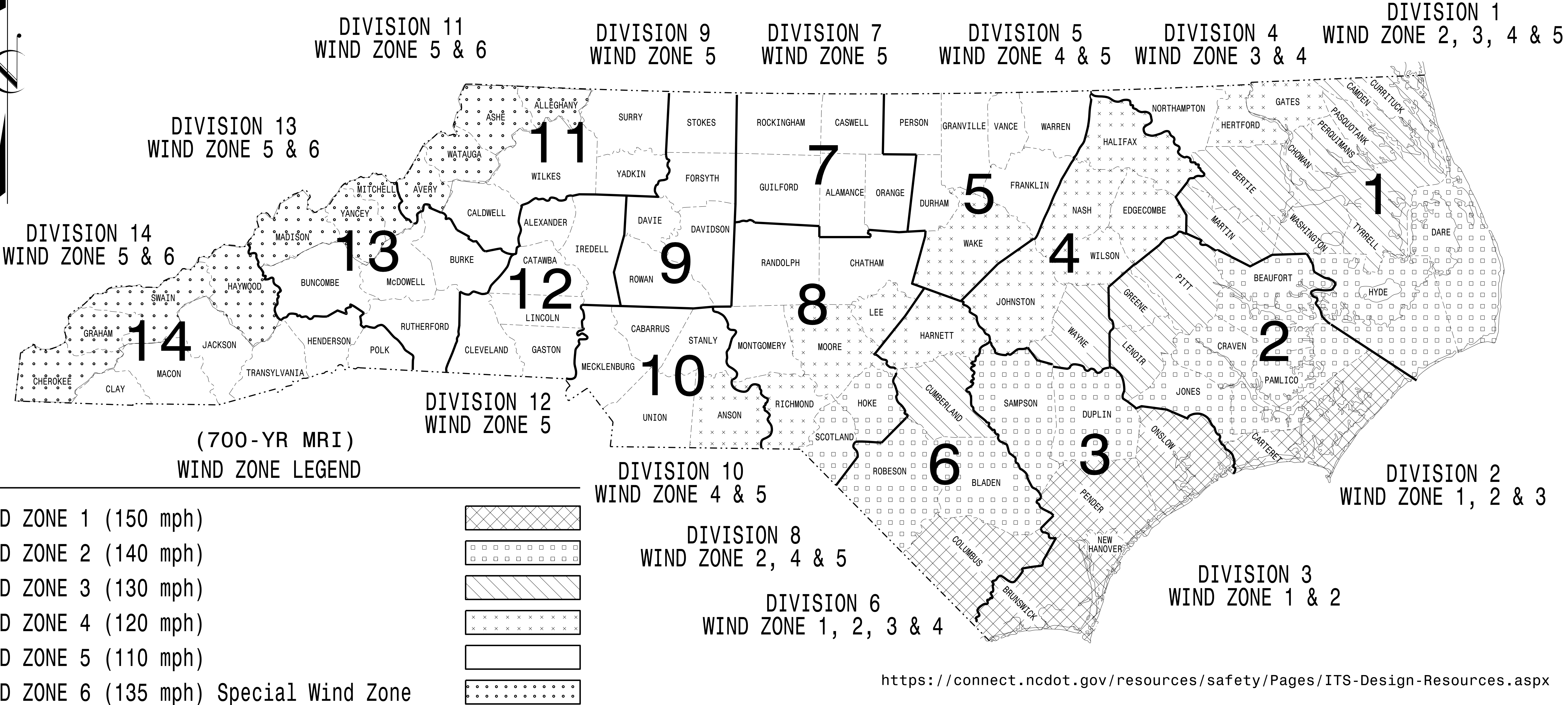
SIGNATURE

DATE

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>

NCDOT METAL POLE STANDARDS

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

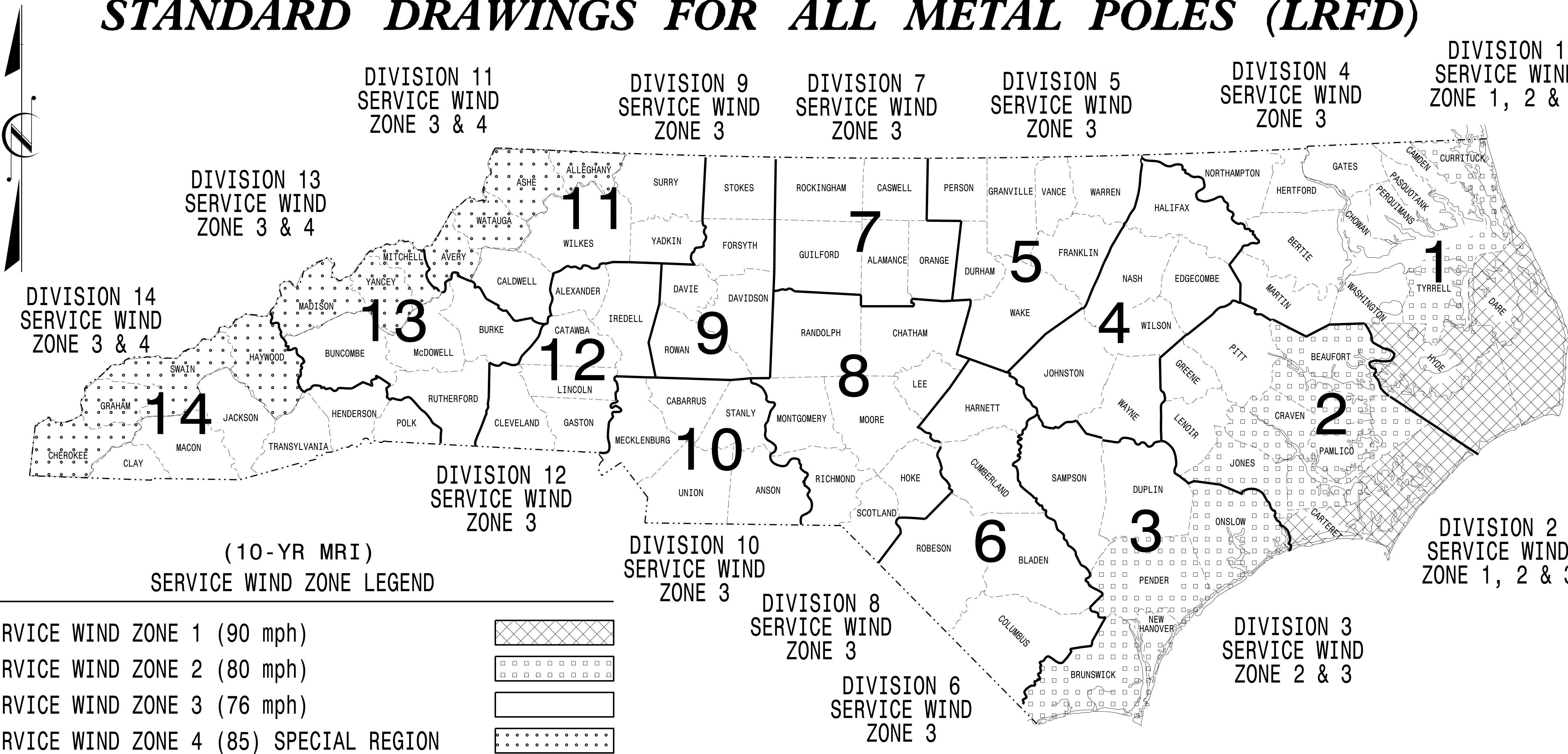
DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3764DA

09/21/2023
DATE

STATE OF NORTH CAROLINA

DIVISION OF HIGHWAYS

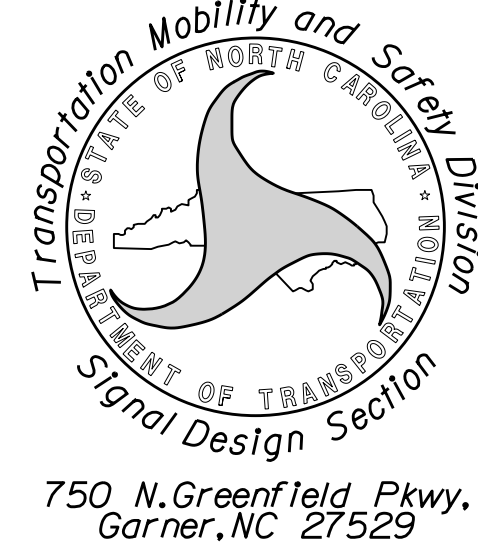
STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)



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

NCDOT METAL POLE STANDARDS

Prepared In the Offices of:



750 N.Greenfield Pkwy.
Garner, NC 27529

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

AASHTO
LRFD

Standard Specifications for
Highway Signs, Luminaires,
and Traffic Signals

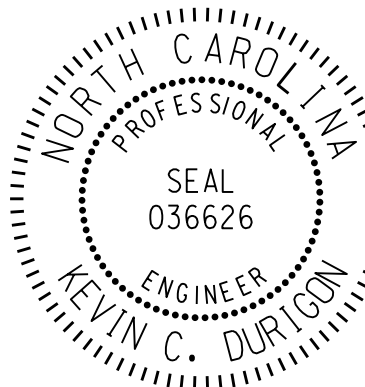
DRAWING
NUMBER

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NCDOT CONTACTS:
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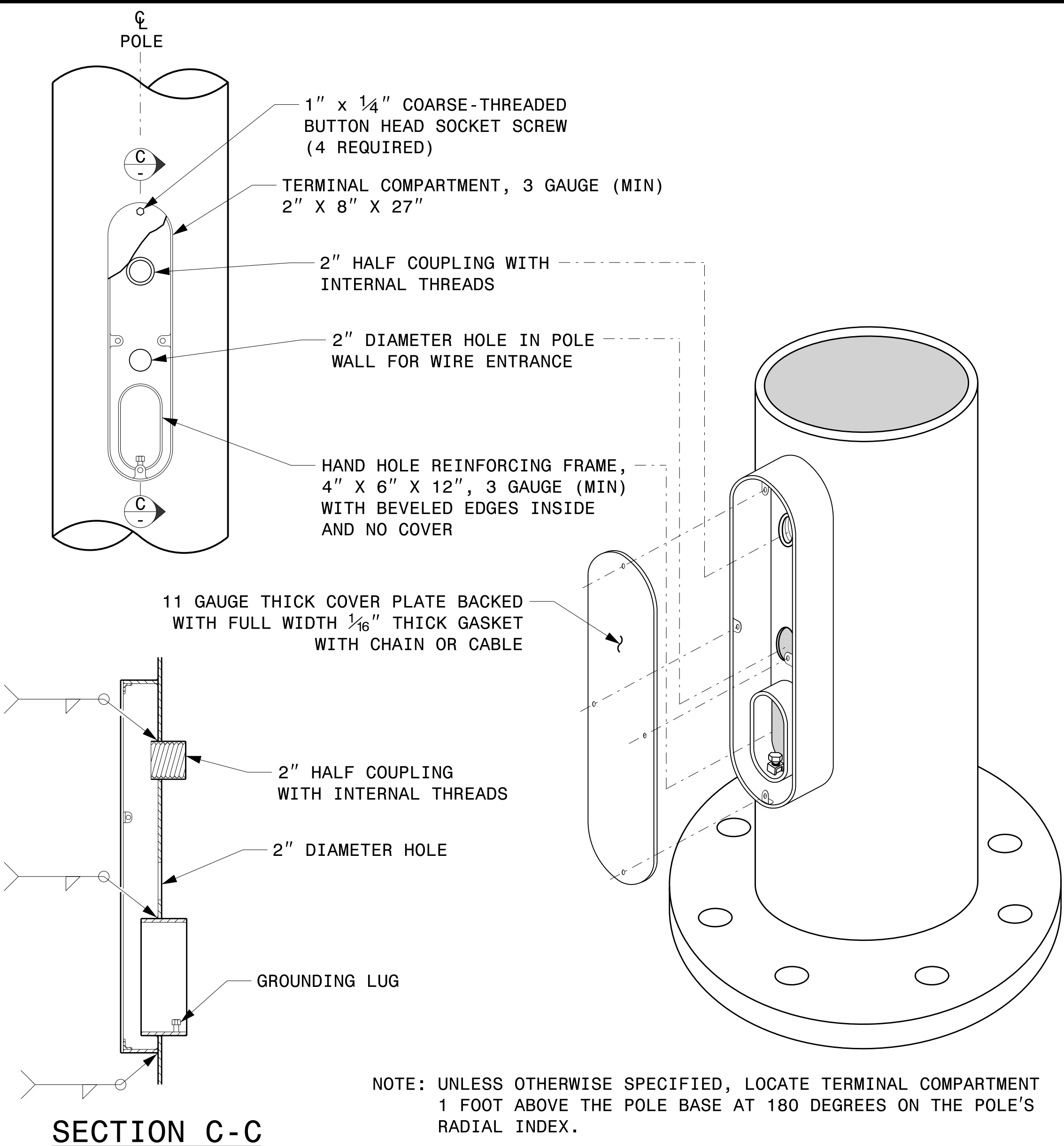
SEAL



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)

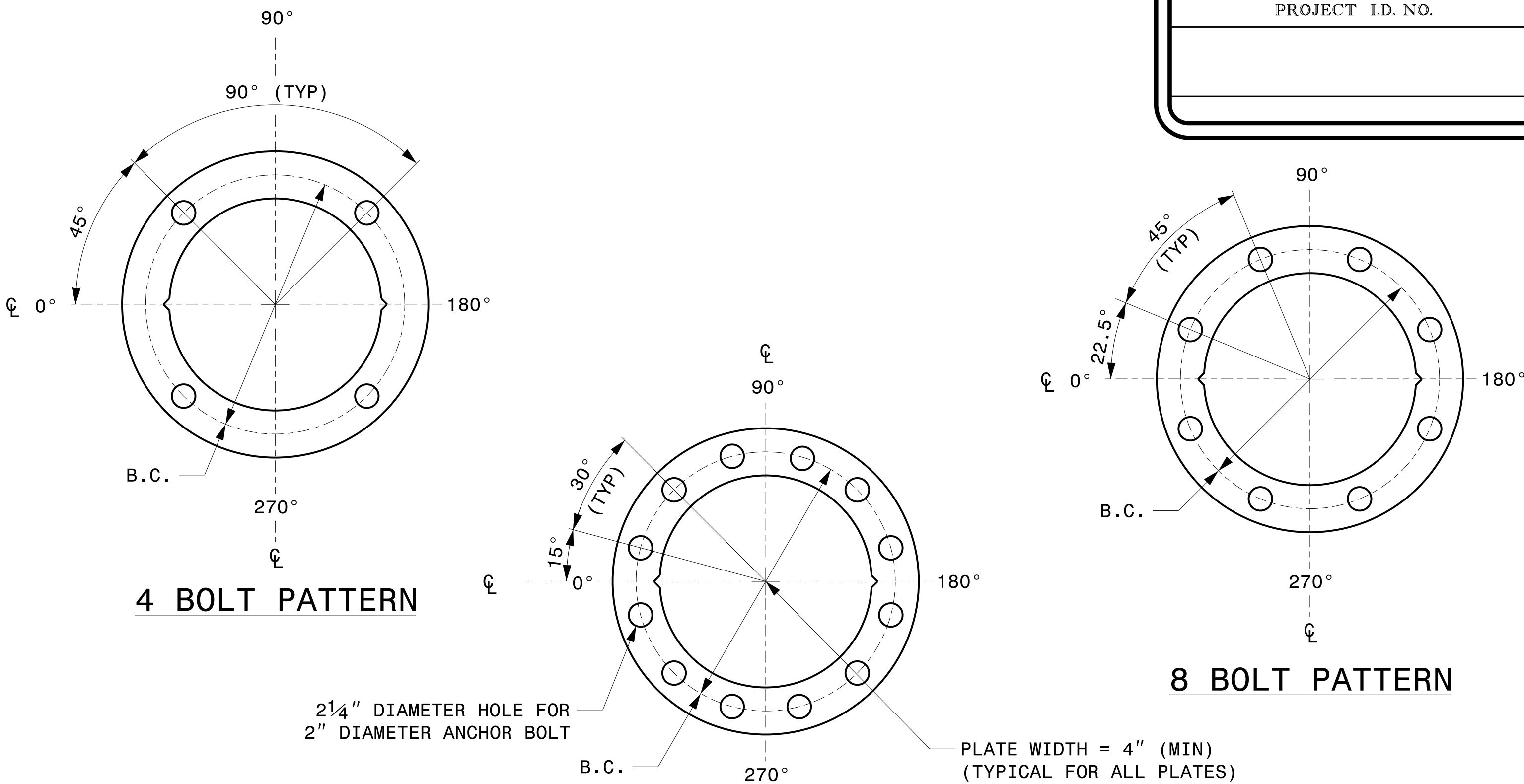
MFG _____	MFG. DATE: MM/YY _____
SECTION D/T/L/Y _____	_____
NCDOT SIG. INV. NO. _____	_____
NCDOT POLE NO. _____	_____

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

NOTES:

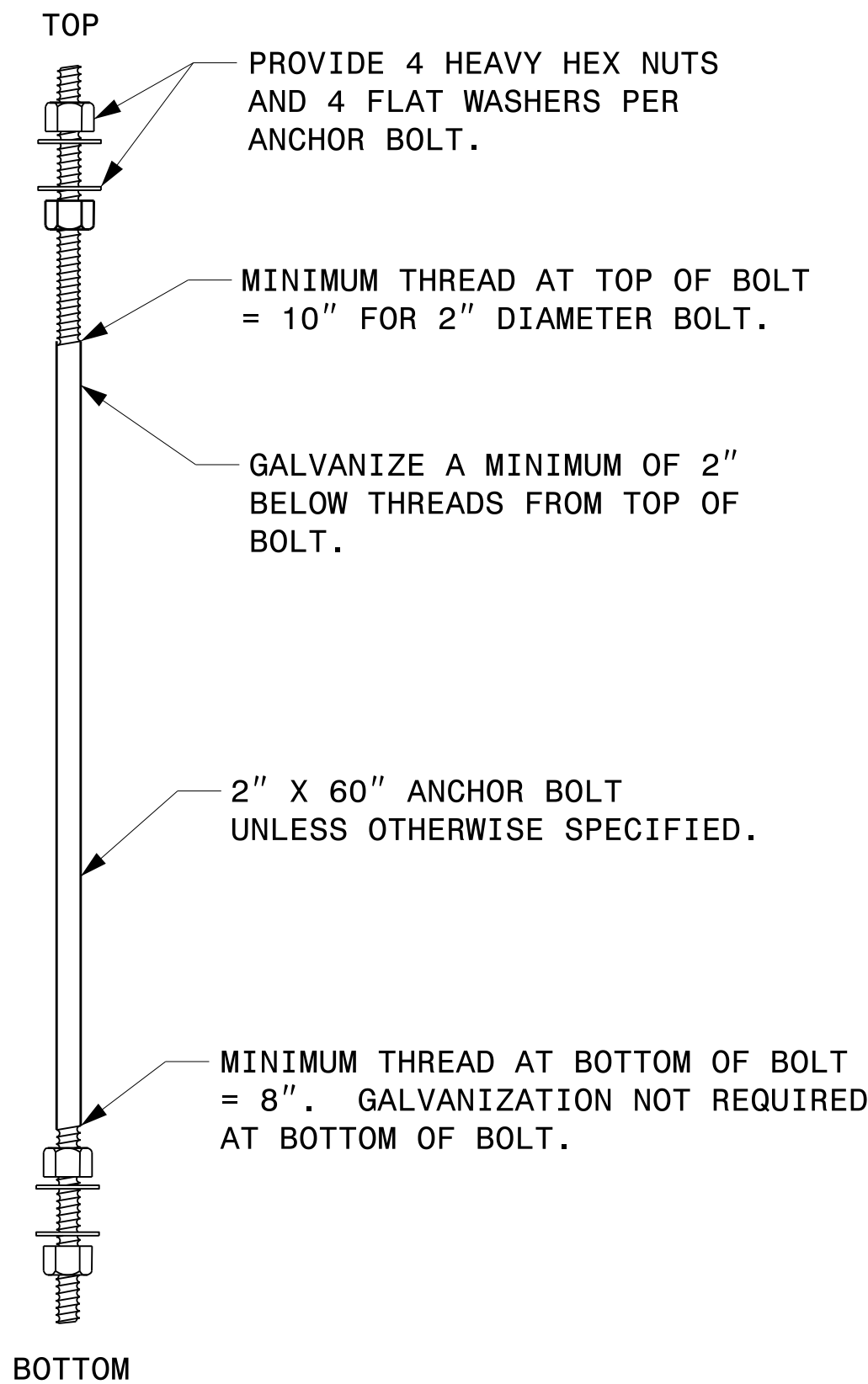
- D = DIAMETER, T = THICKNESS, L = LENGTH, Y = YIELD STRENGTH
- A.B. = ANCHOR BOLT
- B.C. = BOLT CIRCLE OF ANCHOR BOLTS
- IF STANDARD DESIGN, INCLUDE CASE NUMBER IN ADDITION TO POLE NUMBER ON "NCDOT POLE NO." LINE.
- SIGNAL INV. NUMBER AND POLE I.D. NUMBER.
SEE DRAWING M3 AND M4 FOR MOUNTING POSITIONS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

IDENTIFICATION TAG DETAILS

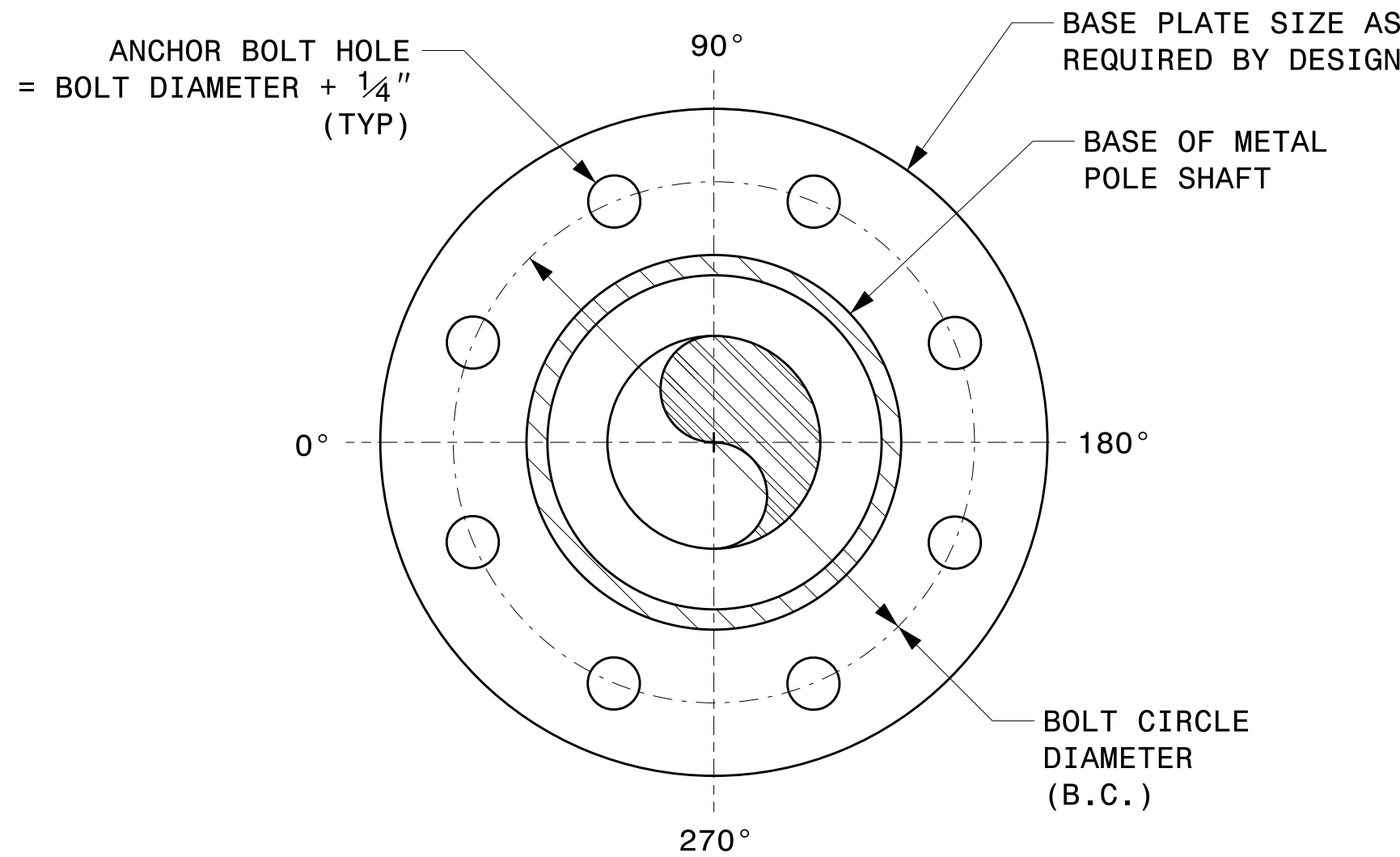


CONSTRUCT TEMPLATES AND PLATES FROM 1/4" (MIN) THICK STEEL. GALVANIZING IS NOT REQUIRED.

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

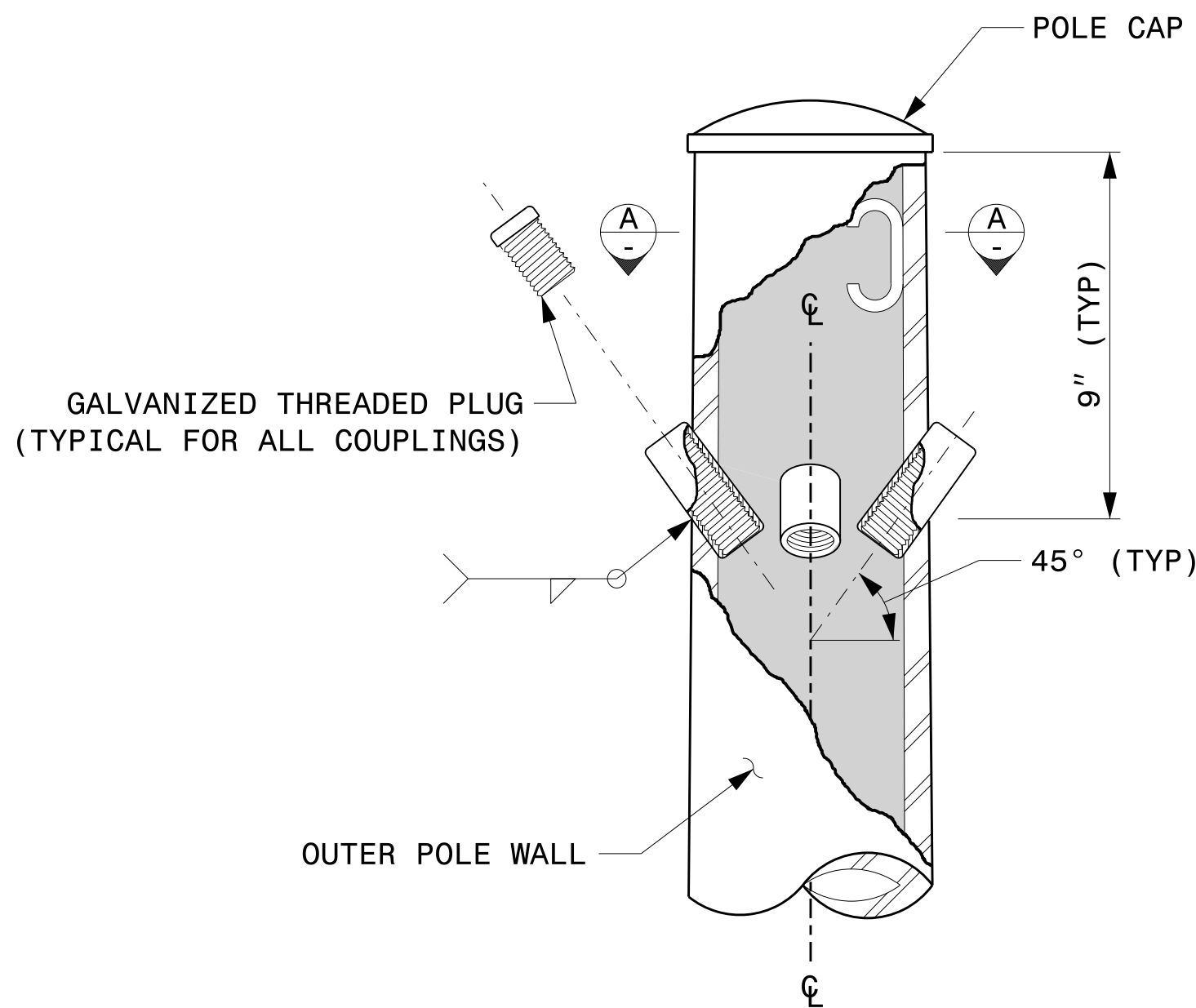
DocuSigned by:

4B23DC79B3784DA

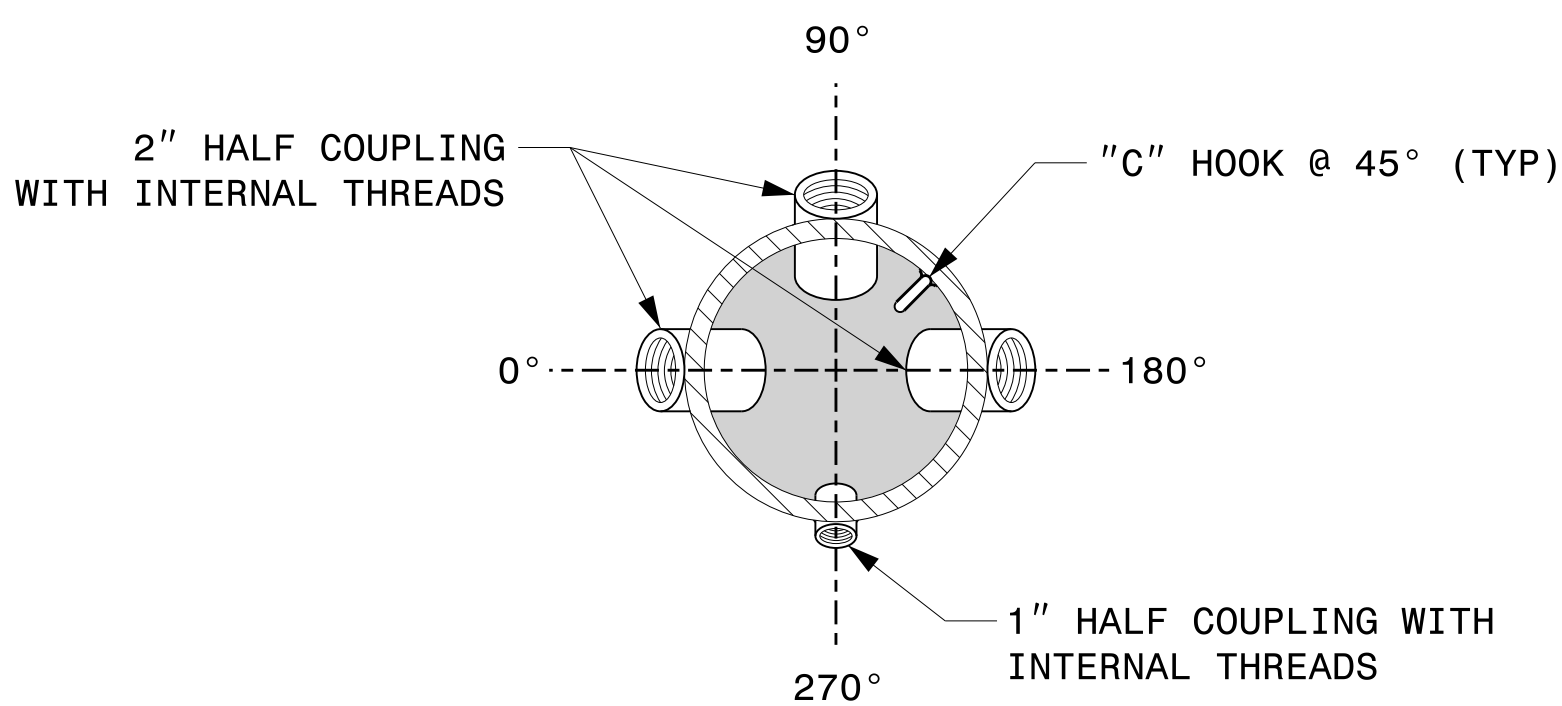
09/21/2023
DATE

NOTE:

1. OPENING IN POLE BASE PLATE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS $3\frac{1}{2}$ " BUT SHALL NOT BE LESS THAN $8\frac{1}{2}$ ".

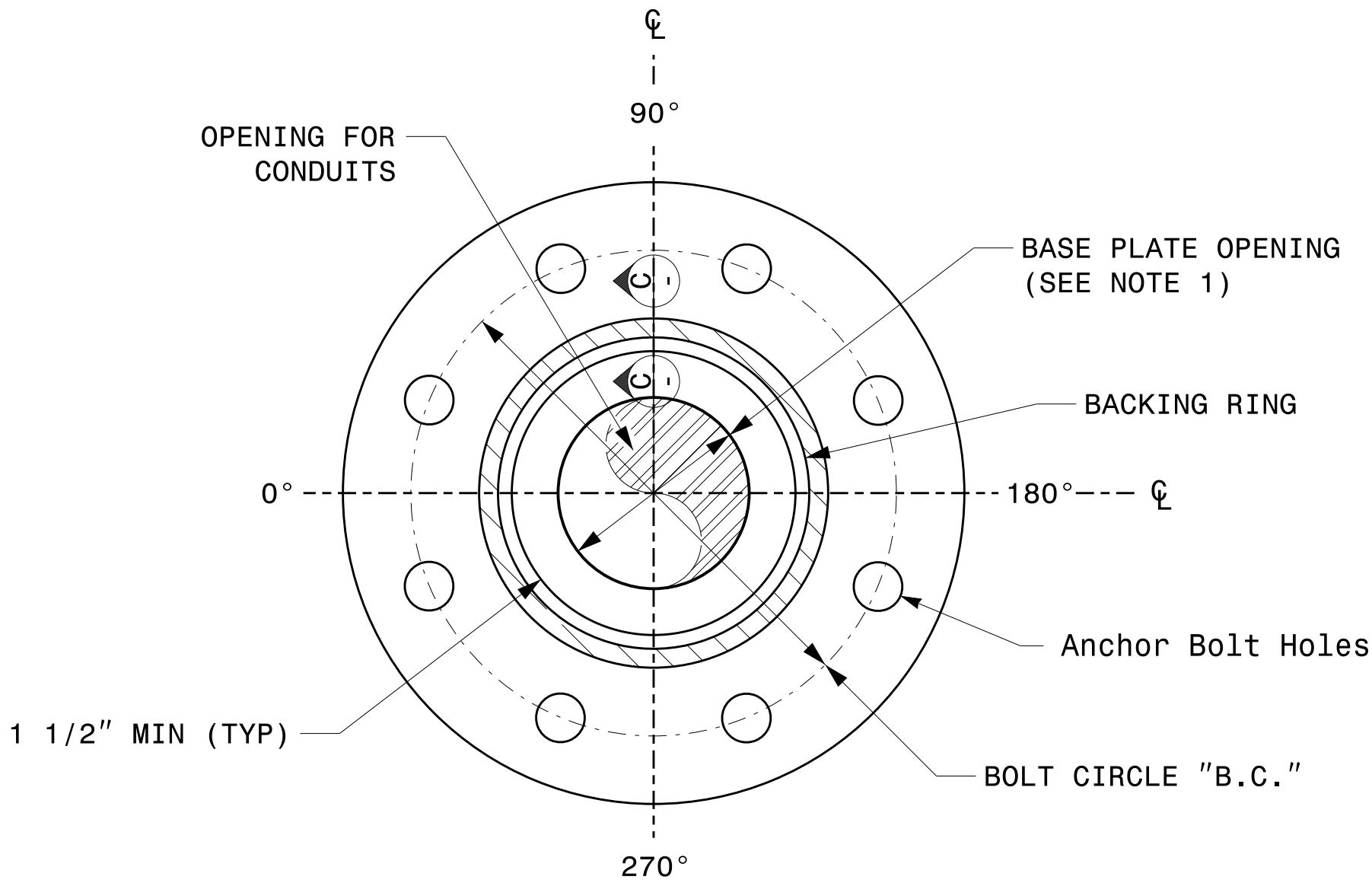


CABLE ENTRANCES AT TOP OF POLE



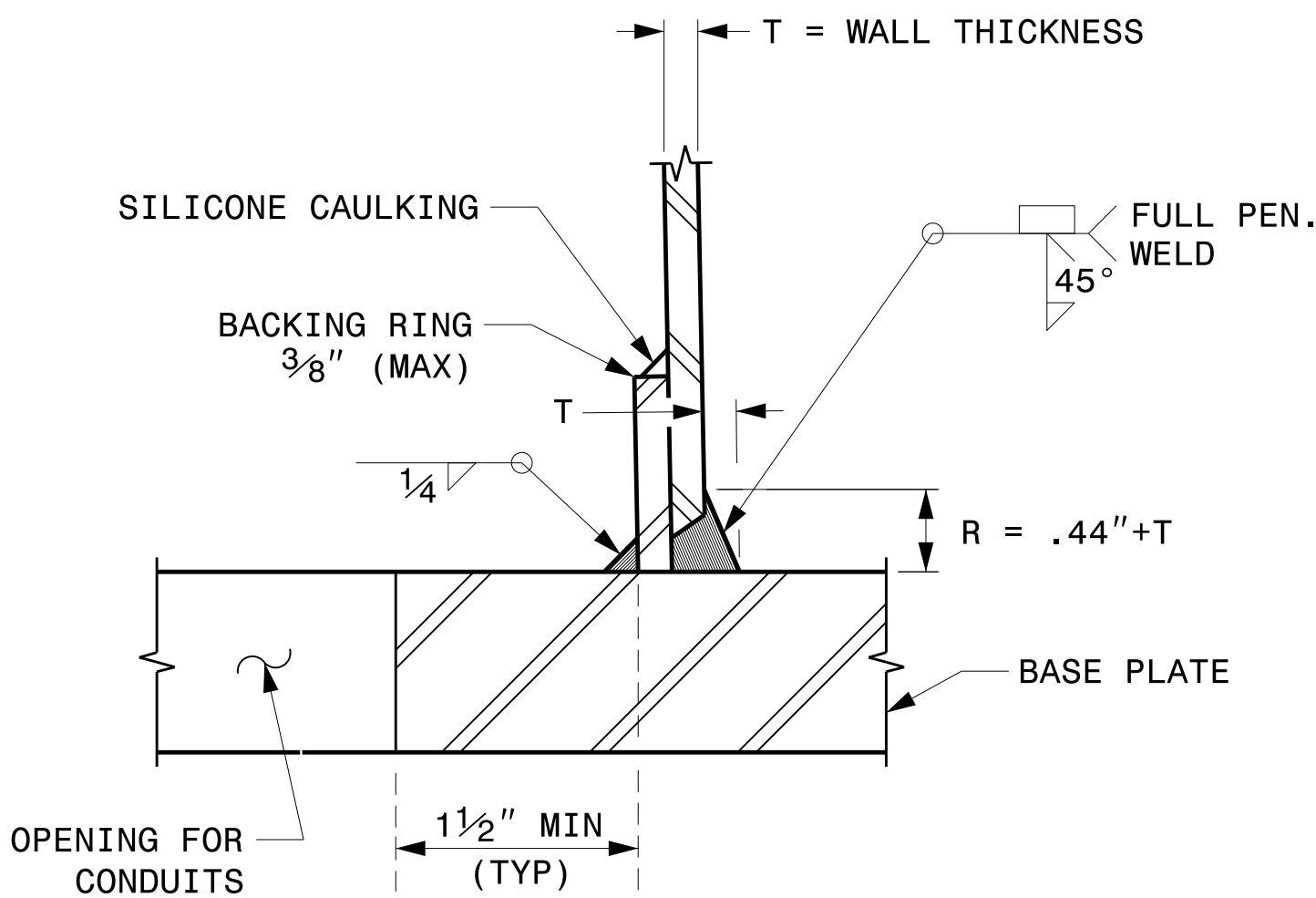
SECTION A-A

RADIAL ORIENTATION OF FACTORY INSTALLED ACCESSORIES AT TOP OF POLE



SECTION B-B

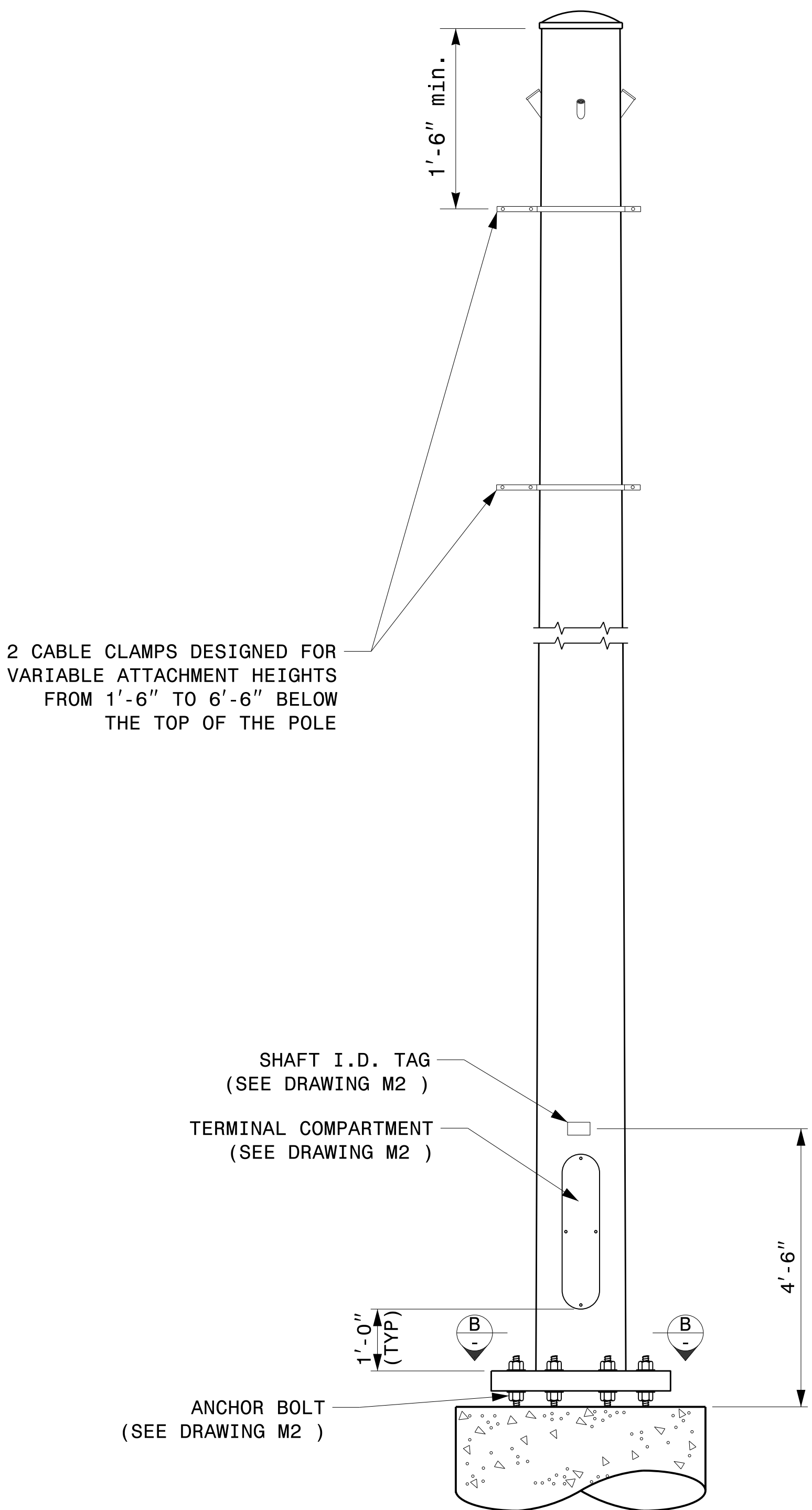
POLE BASE PLATE DETAILS (8 AND 12 BOLT PATTERN)



SECTION C-C

(POLE ATTACHMENT TO BASE PLATE)

FULL-PENETRATION GROOVE WELD DETAIL

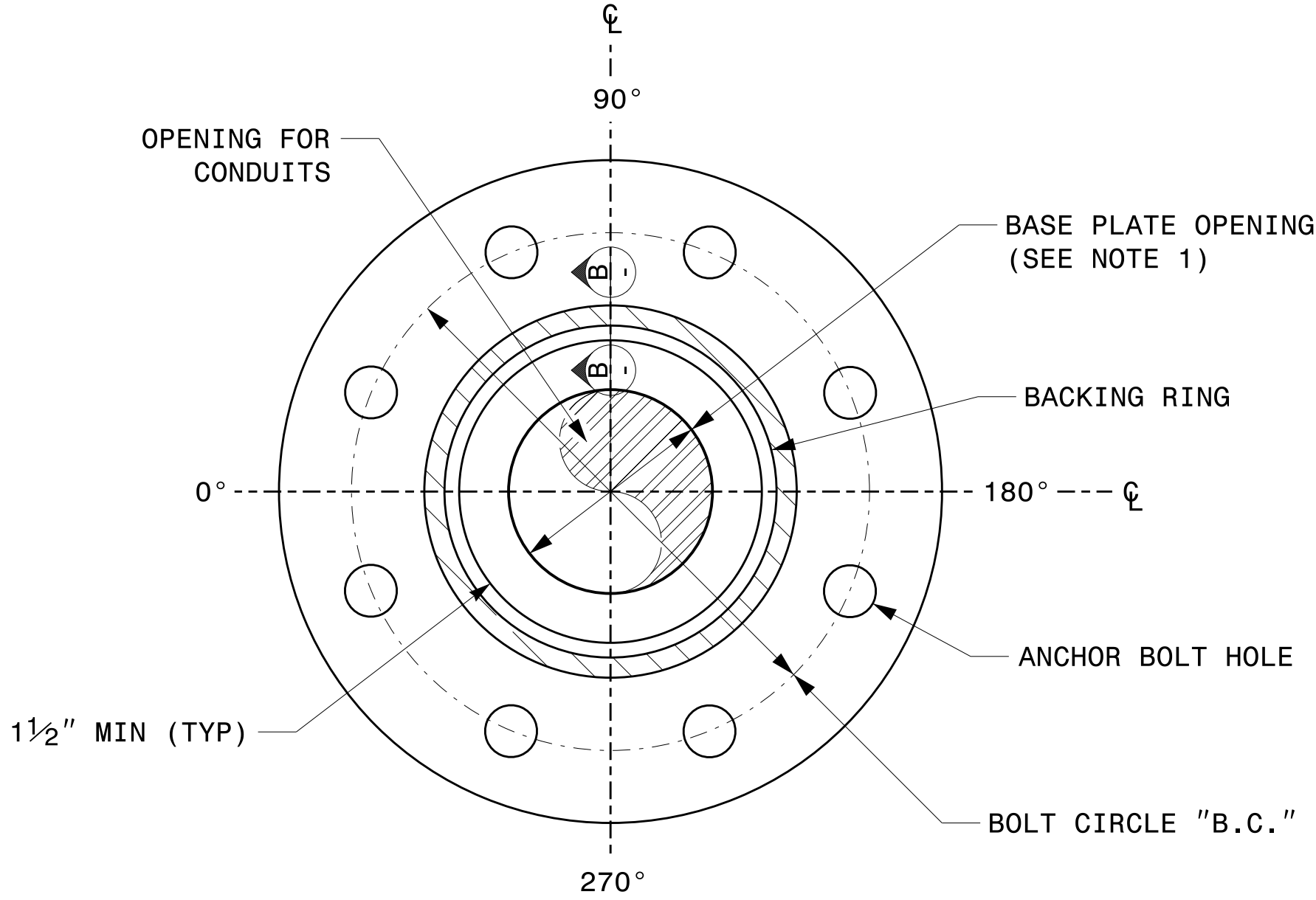


MONOTUBE STRAIN POLE

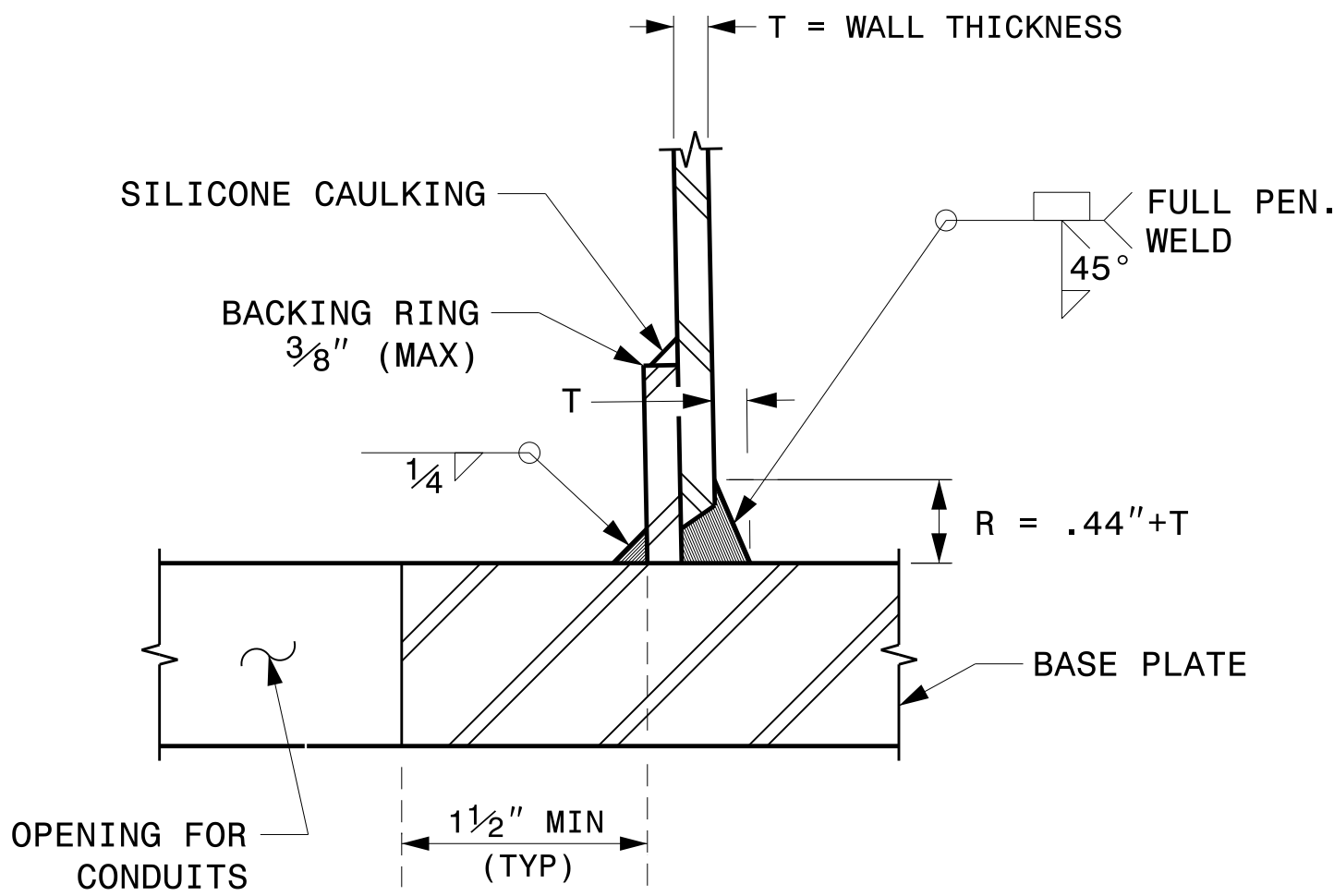
	Typical Fabrication Details For Strain Poles		
	PLAN DATE: SEPTEMBER 2023	DESIGNED BY: K.C. DURIGON	
	PREPARED BY: K.C. DURIGON	REVIEWED BY: D.C. SARKAR	
SCALE: 0 NA NONE	REVISIONS	INIT.	DATE
DocuSigned by: Kevin Durigon		09/21/2023	

NOTE:

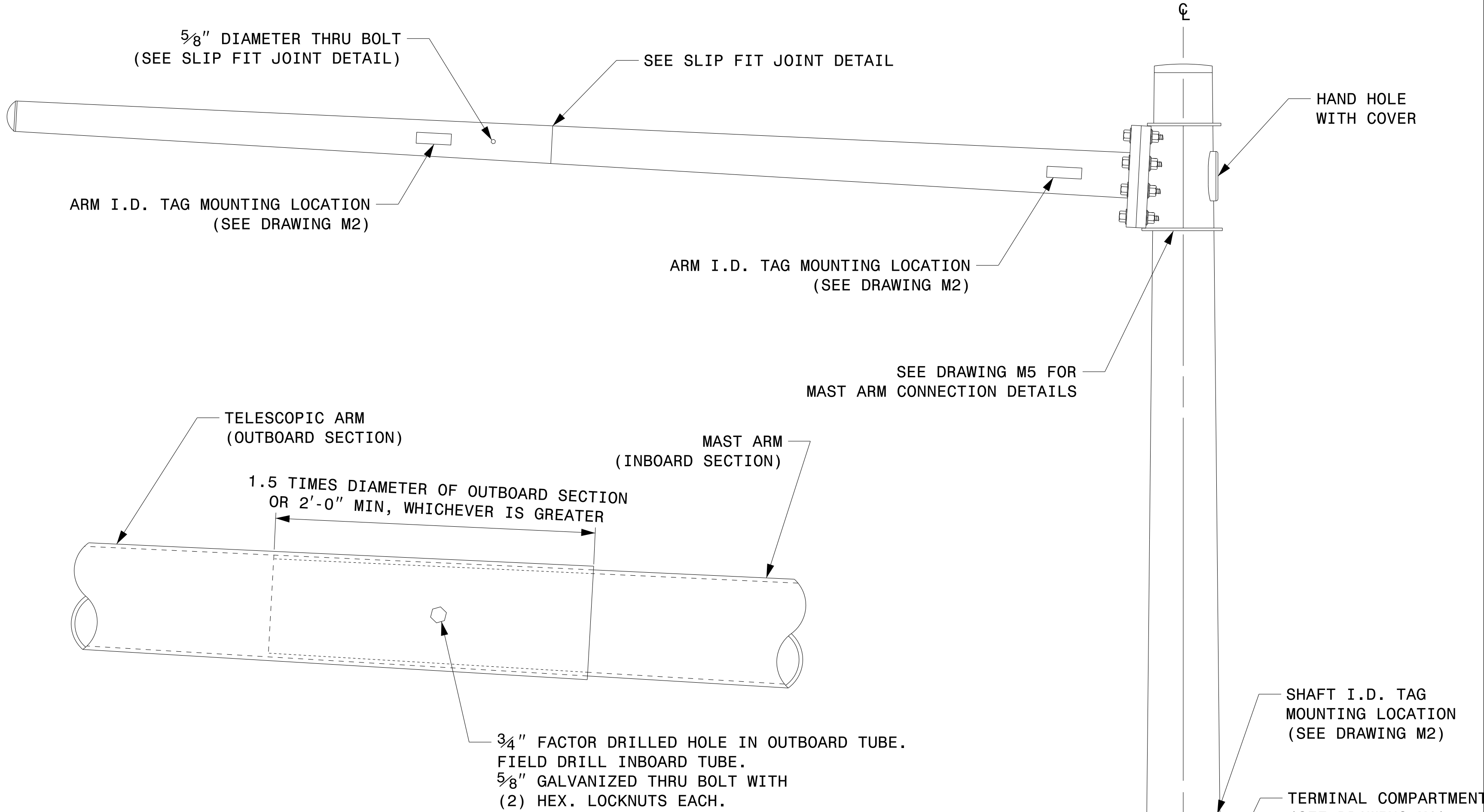
1. OPENING IN POLE BASE PLATE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS 3 1/2" BUT SHALL NOT BE LESS THAN 8 1/2".



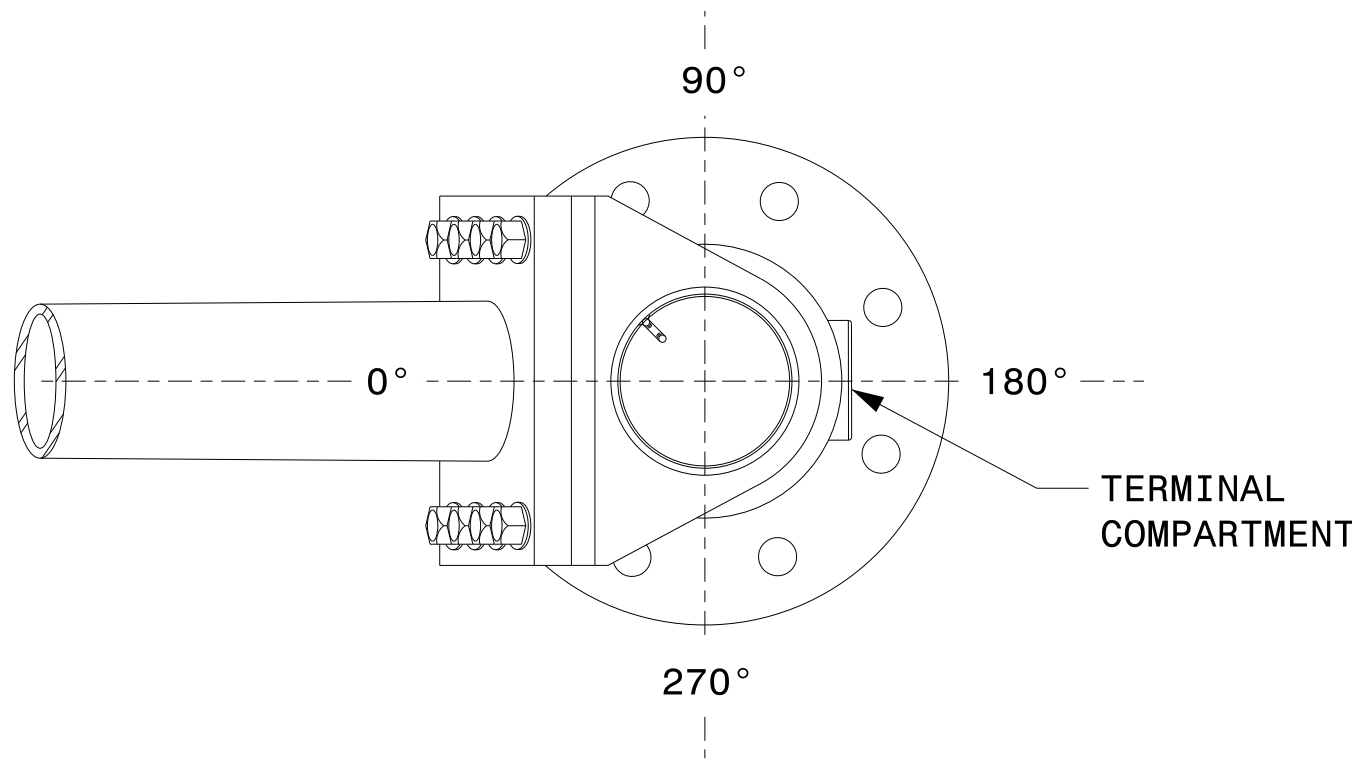
SECTION A-A
POLE BASE PLATE DETAILS



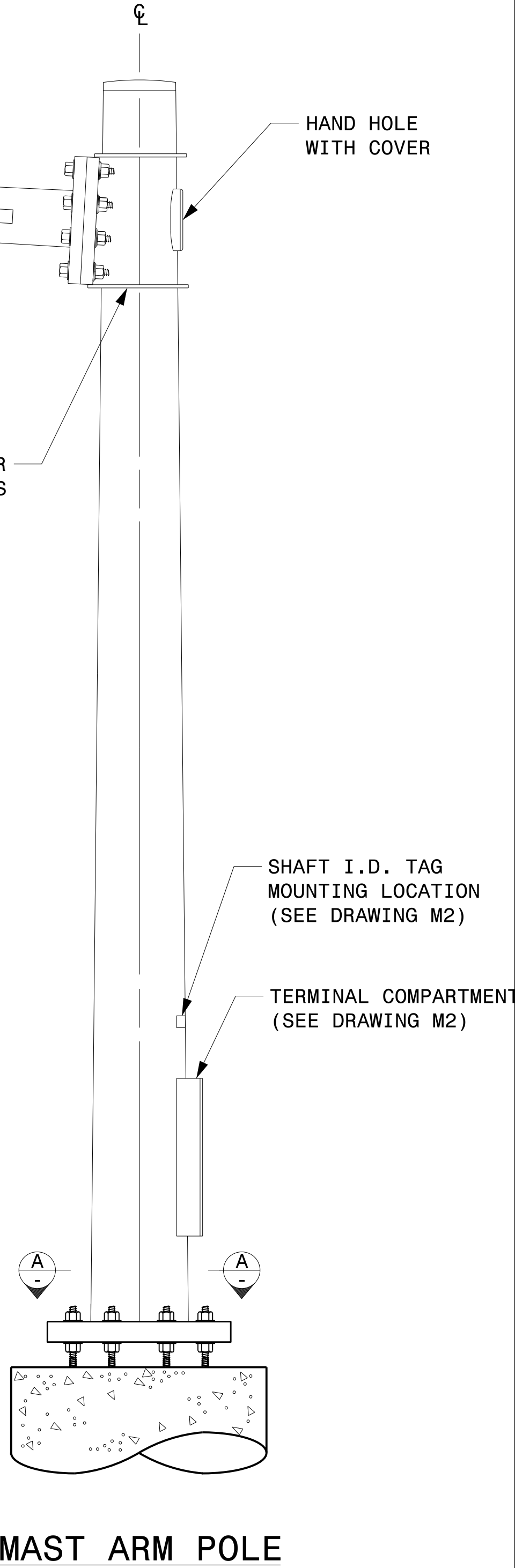
SECTION B-B
(POLE ATTACHMENT TO BASE PLATE)
FULL-PENETRATION
GROOVE WELD DETAIL



SLIP FIT JOINT DETAIL FOR MAST ARM



MAST ARM RADIAL ORIENTATION



MAST ARM POLE

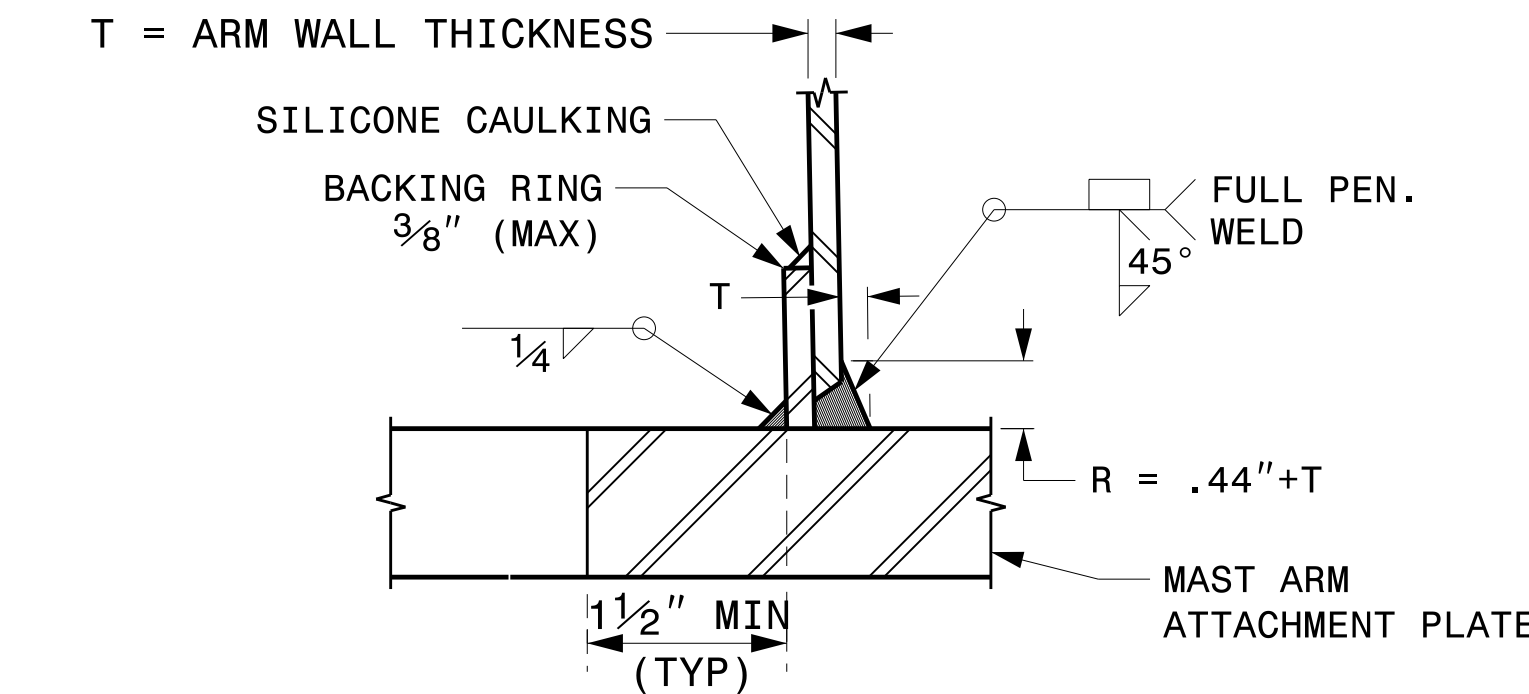
	Typical Fabrication Details For Mast Arm Poles		
	PLAN DATE: SEPTEMBER 2023 DESIGNED BY: K.C. DURIGON PREPARED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR	DESIGNED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR	
0 SCALE NA NONE	REVISIONS	INIT.	DATE
DocuSigned by: 		09/21/2023 DATE	

WELDED RING STIFFENED MAST ARM CONNECTION

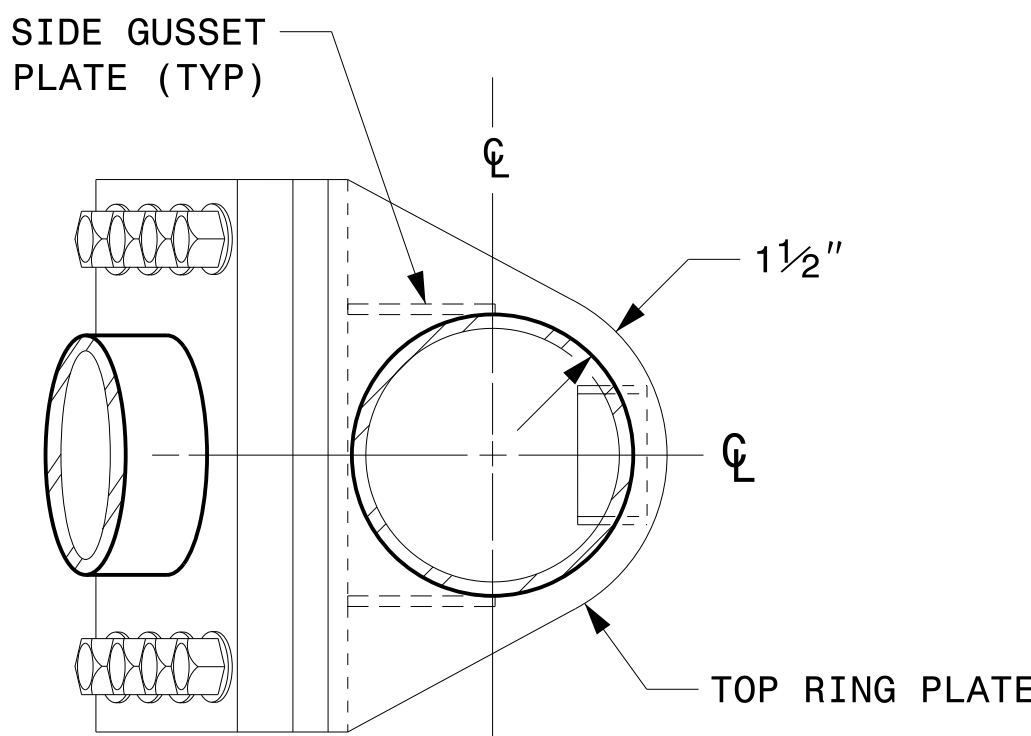
PROJECT I.D. NO.

SHEET NO.

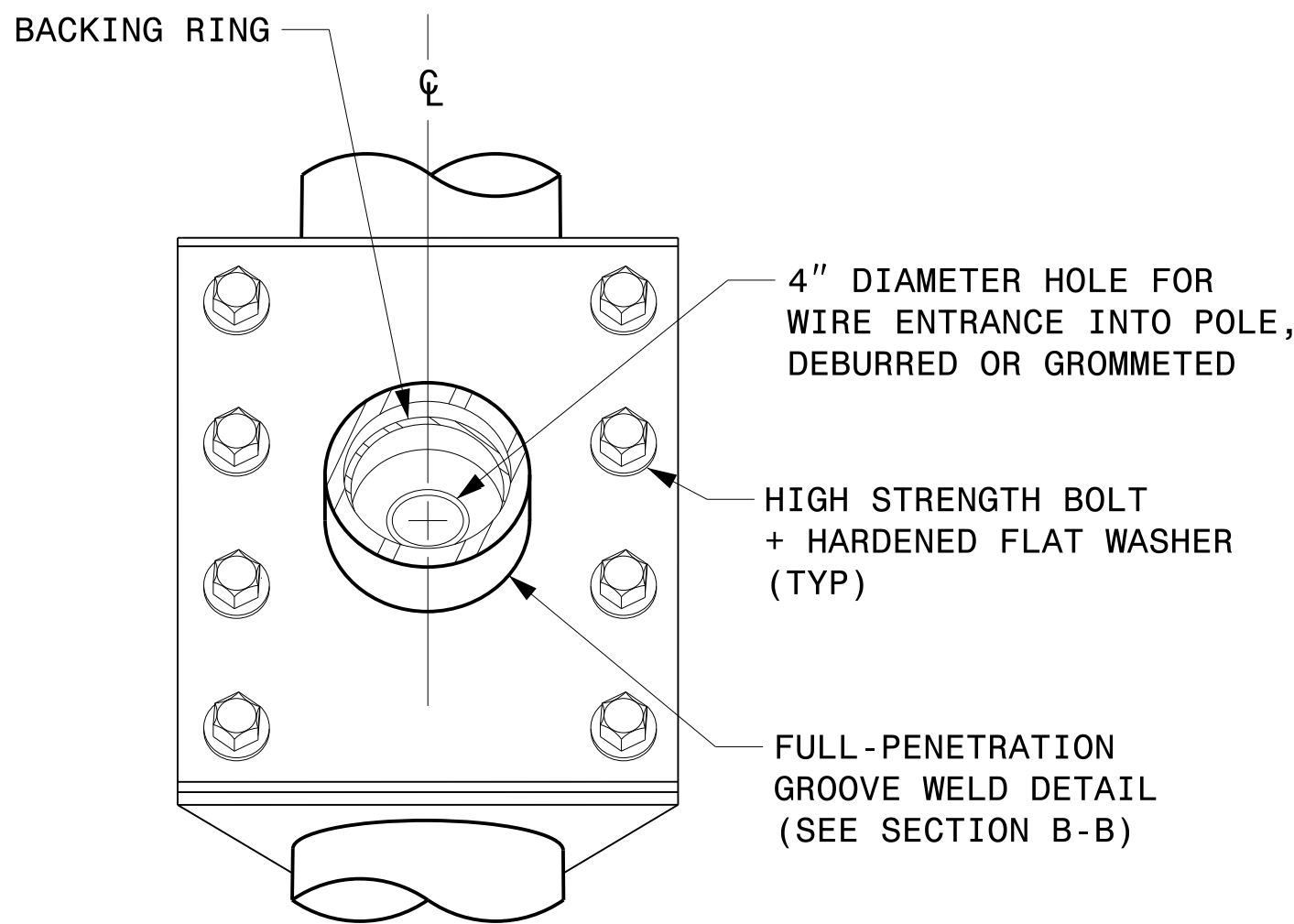
Sig.M5



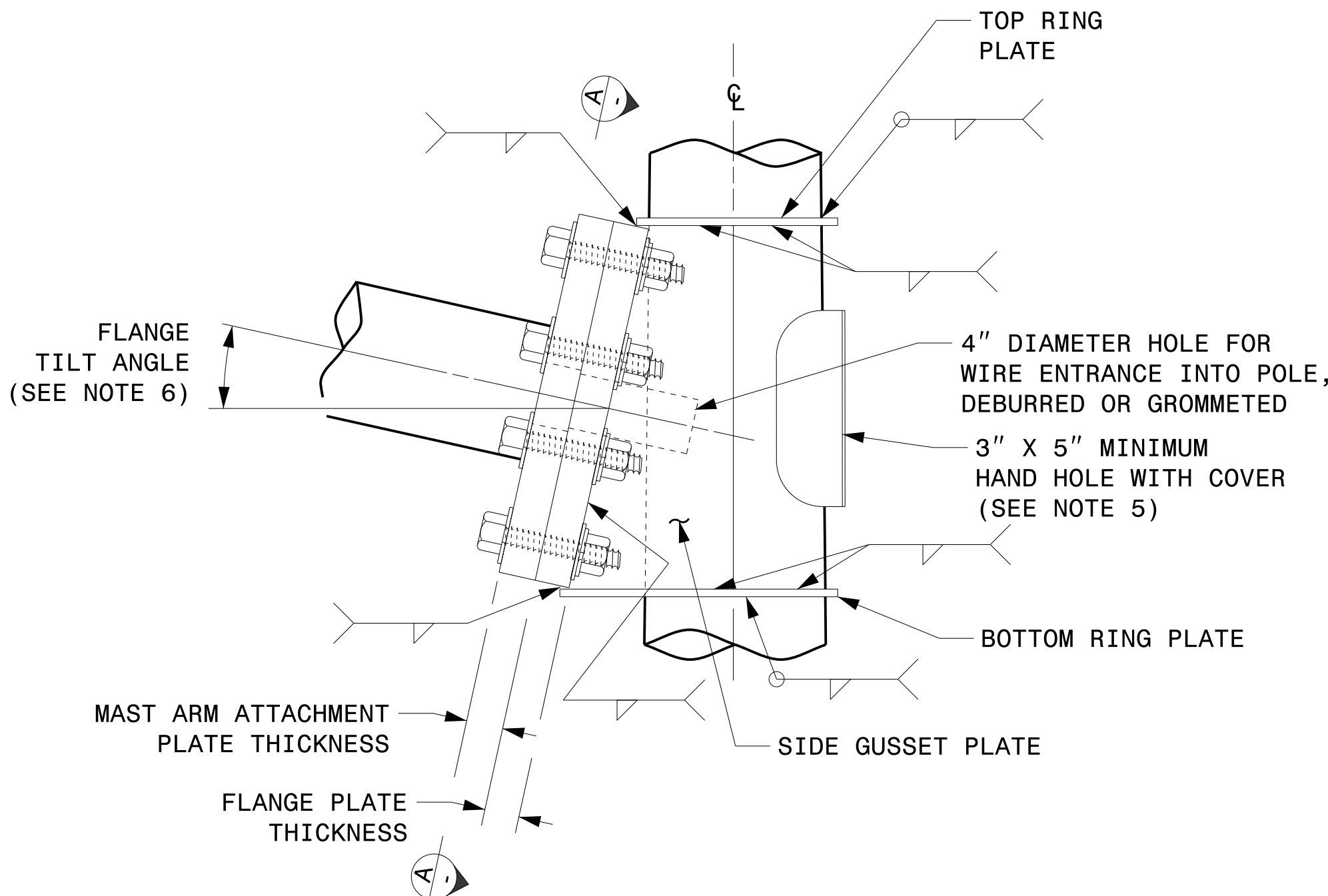
SECTION B-B
FULL-PENETRATION GROOVE WELD DETAIL



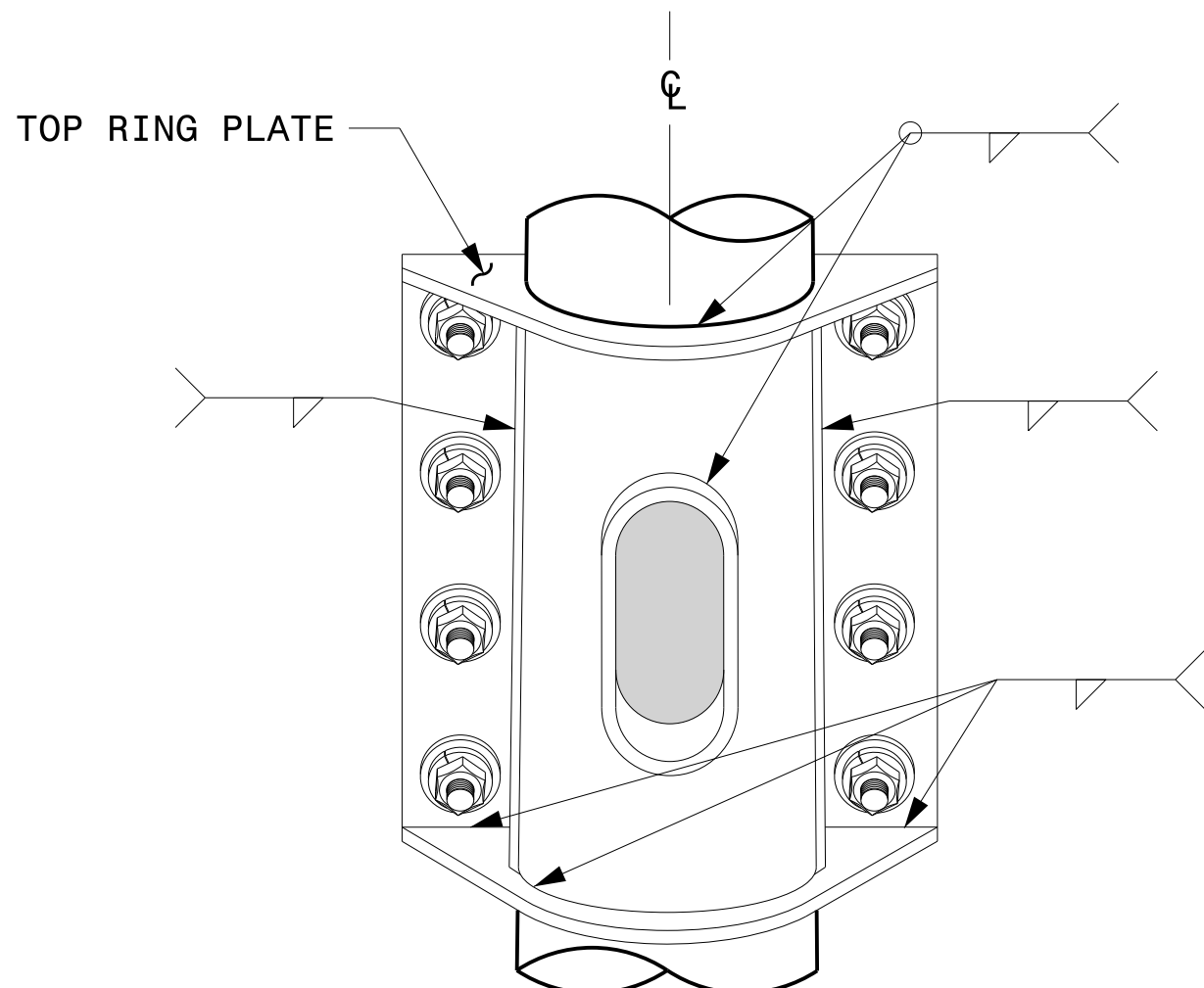
PLAN VIEW



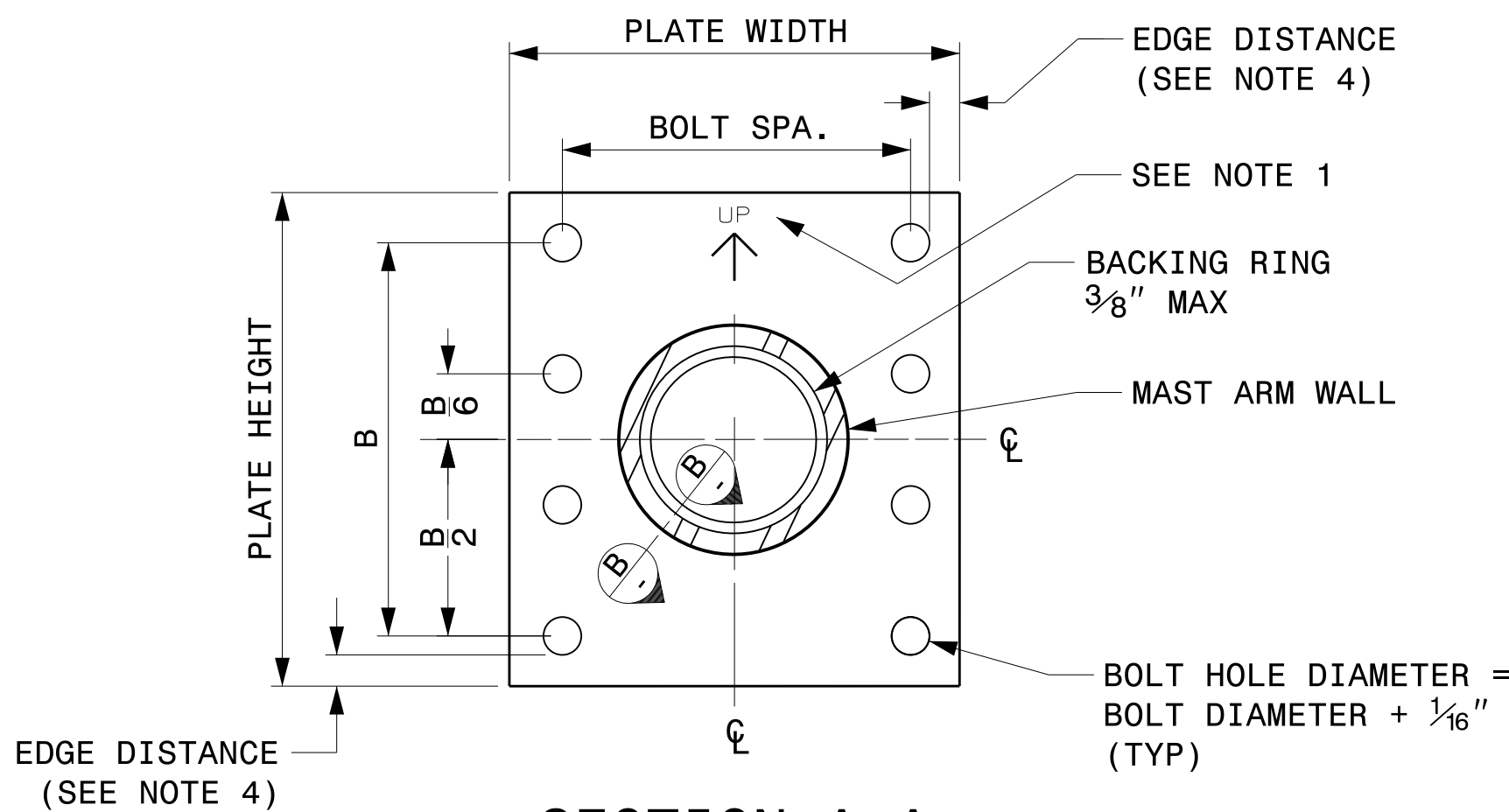
FRONT ELEVATION VIEW



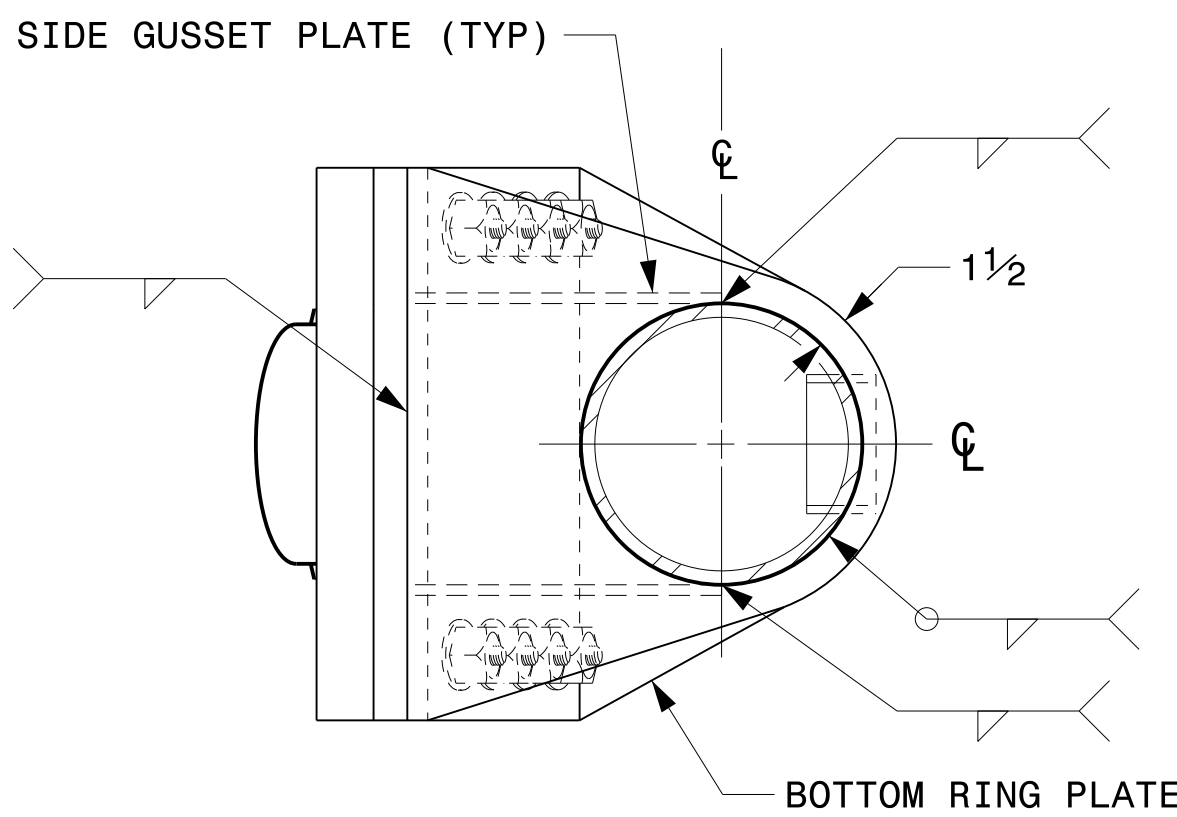
SIDE ELEVATION VIEW



BACK ELEVATION VIEW



SECTION A-A
MAST ARM ATTACHMENT PLATE

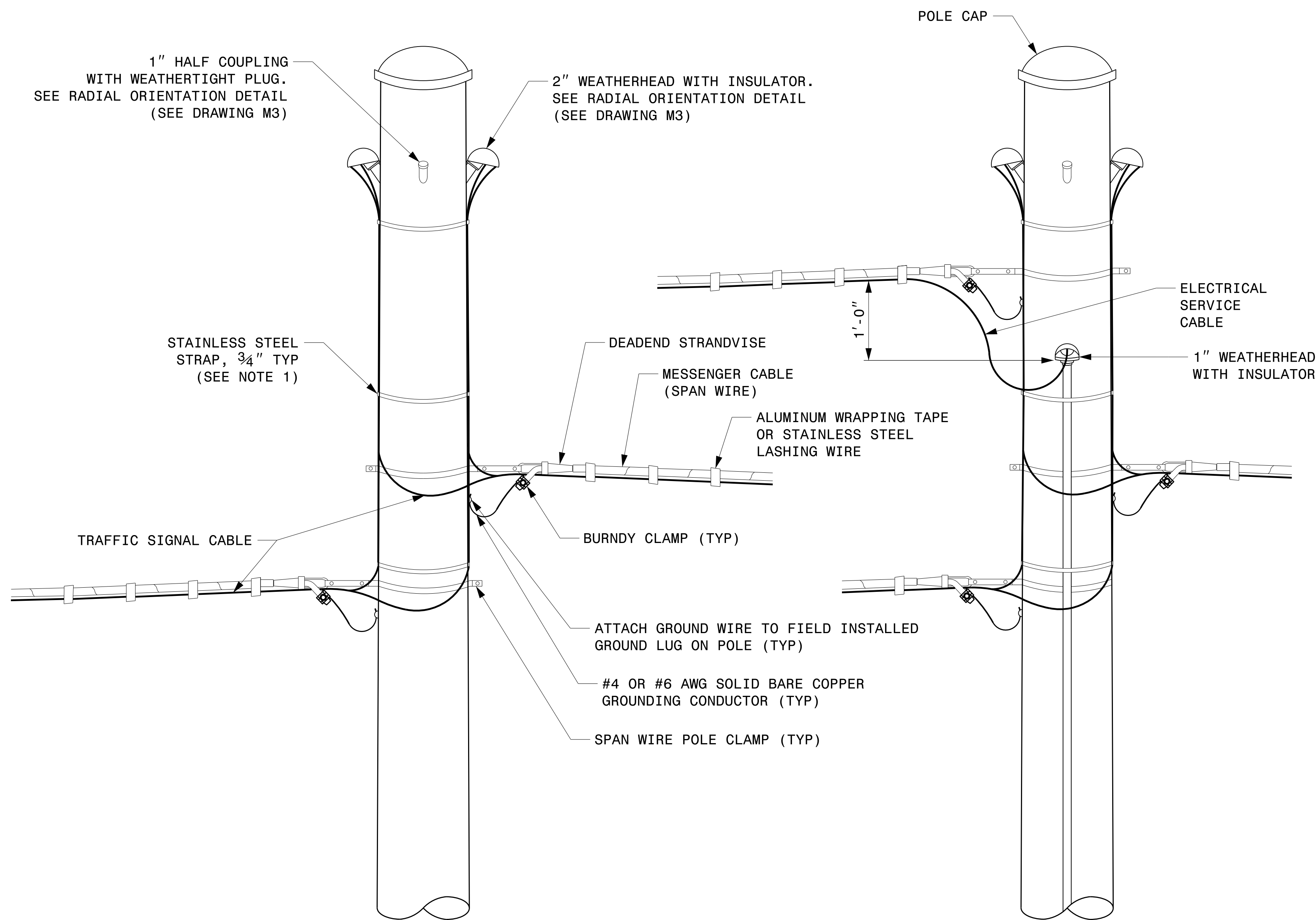


BOTTOM VIEW

NOTES:

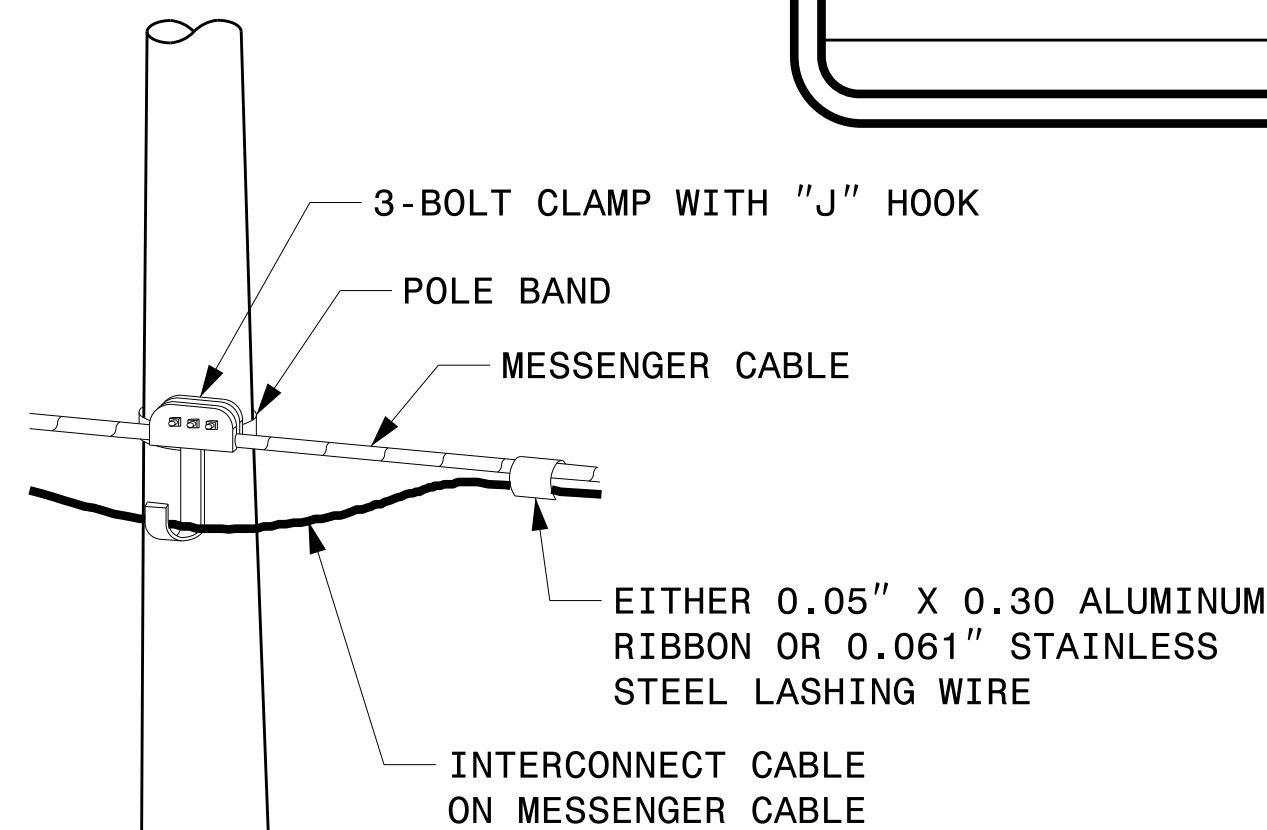
1. PROVIDE A PERMANENT MEANS OF IDENTIFICATION ABOVE THE MAST ARM TO INDICATE PROPER ATTACHMENT ORIENTATION OF THE MAST ARM.
2. DESIGNER WILL DETERMINE THE SIZE OF ALL STRUCTURAL COMPONENTS, PLATES, FASTENERS, AND WELDS SHOWN UNLESS THEY ARE ALREADY SPECIFIED.
3. FABRICATOR IS RESPONSIBLE FOR PROVIDING 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 = 1' NA	REVISIONS	INIT.	DATE
NONE			
DocuSigned by: 			09/21/2023 DATE

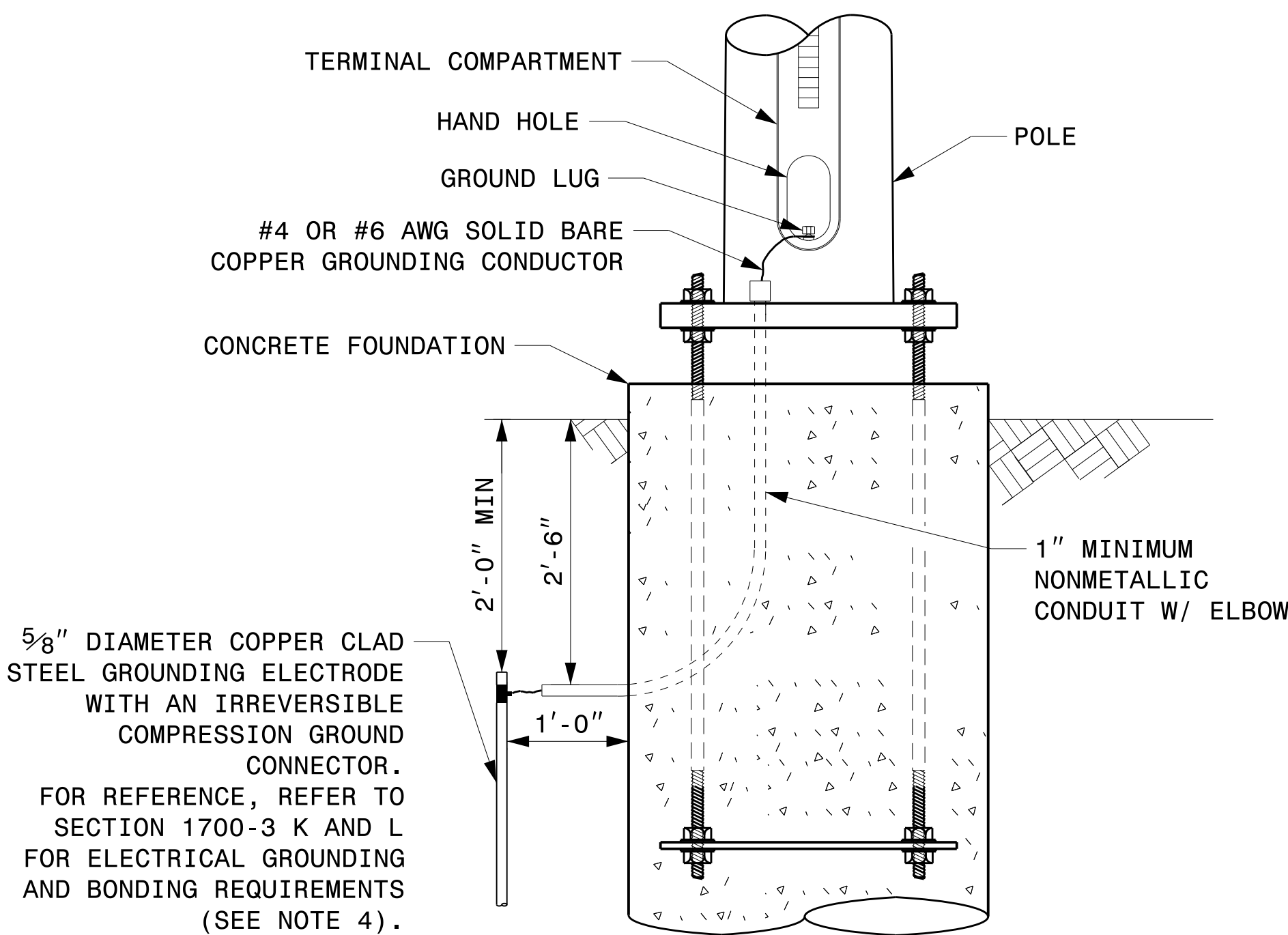


STRAIN POLE ATTACHMENTS

- 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

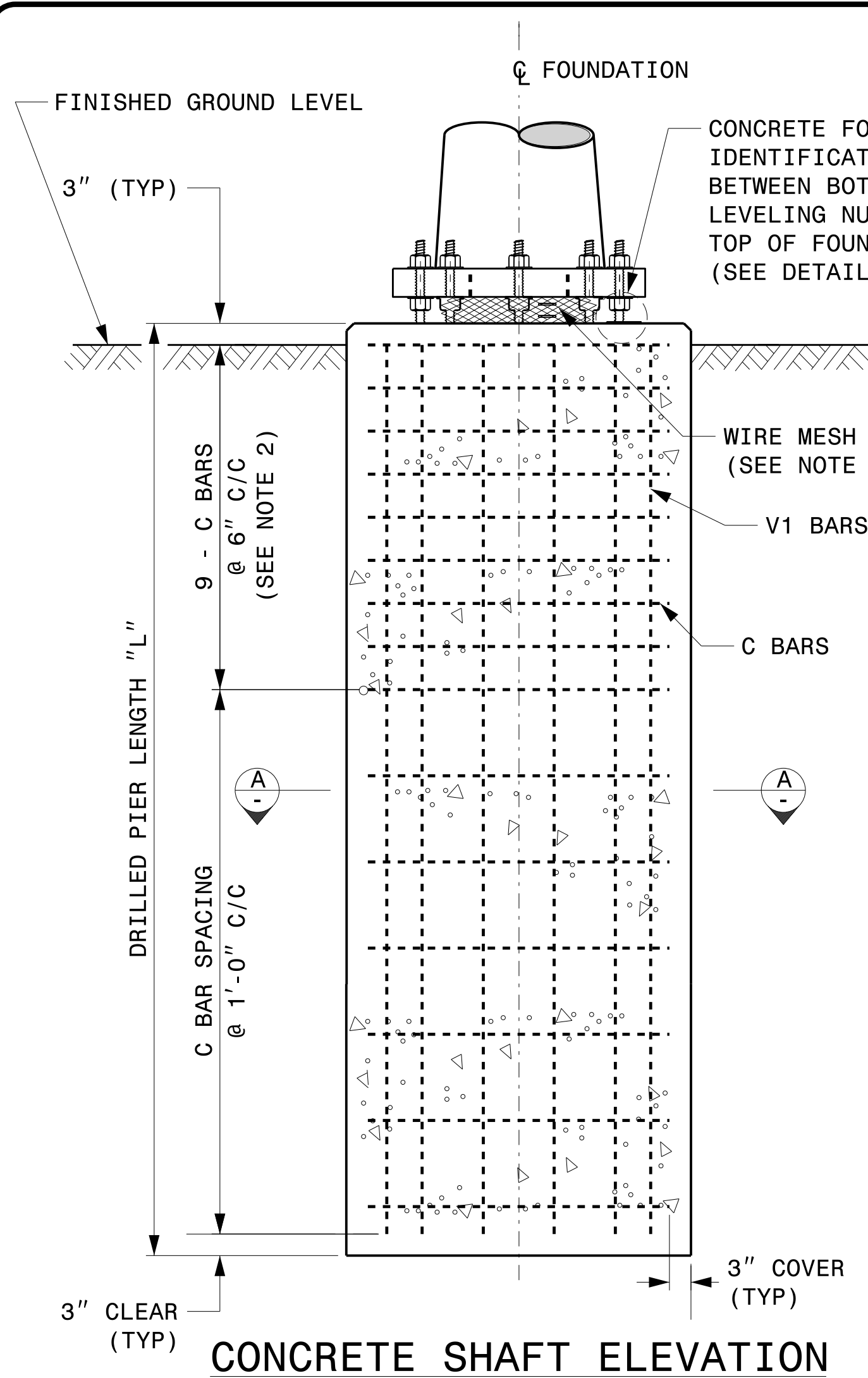
SEAL
NORTH CAROLINA
PROFESSIONAL ENGINEER
SEAL 036626
KEYVIN C. DURIGON

DocuSigned by:
Kevin Durigon
4B23DC79B3784DA...

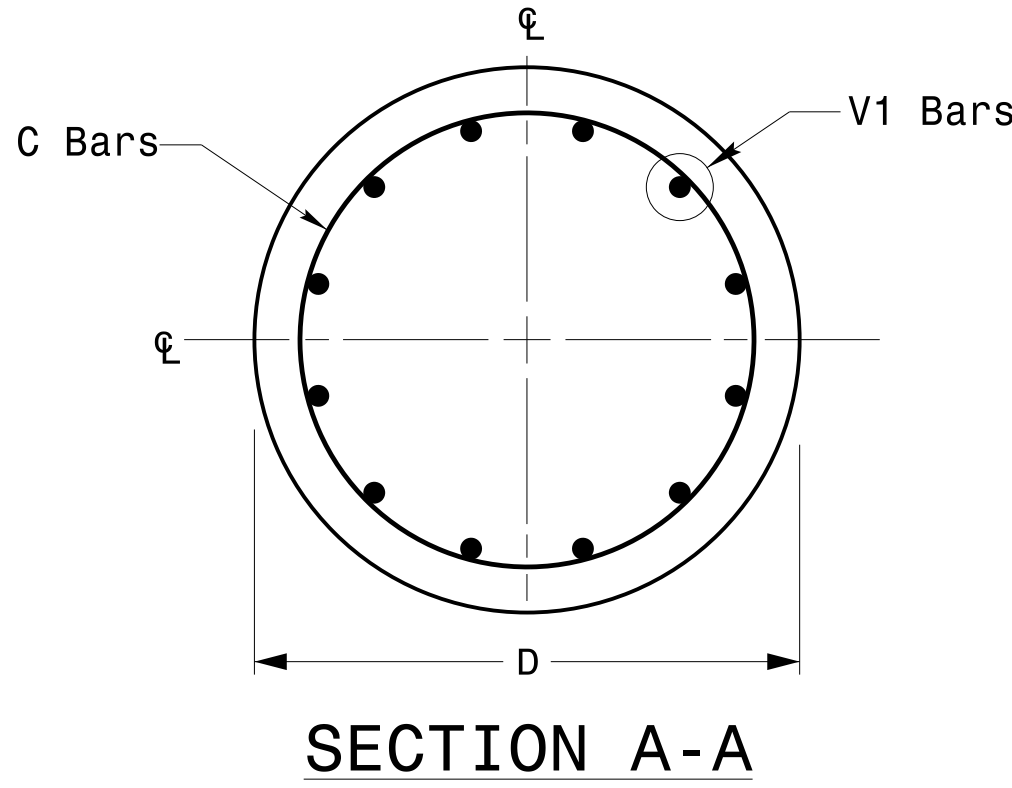
09/21/2023
DATE

03-dgt-2023 10-41
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Kedar Igon

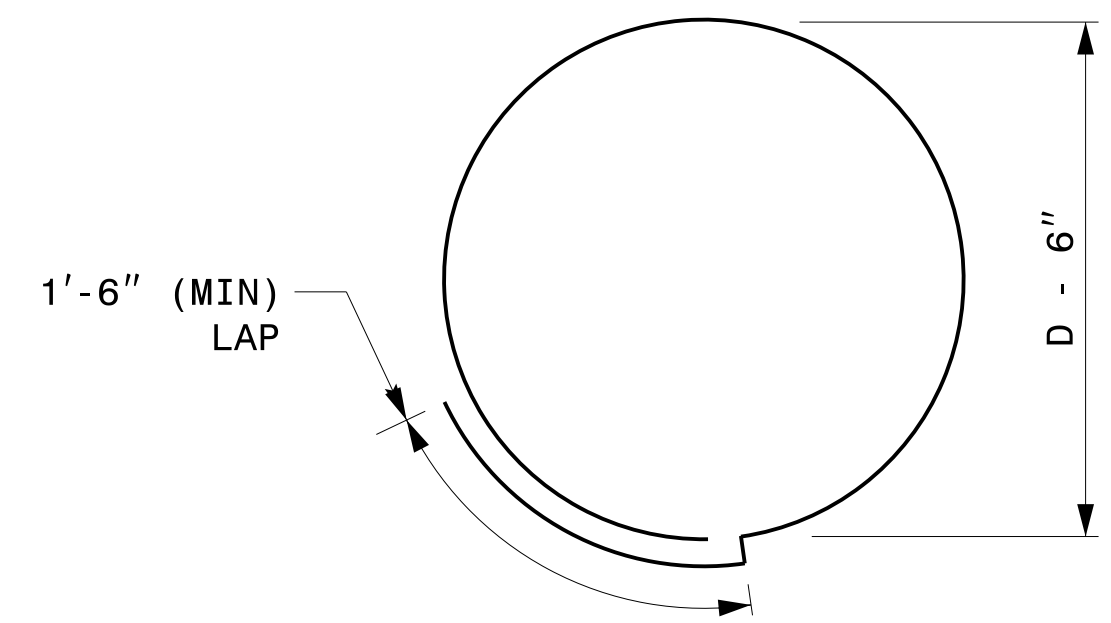
Fabrication Details – Strain Pole Attachments



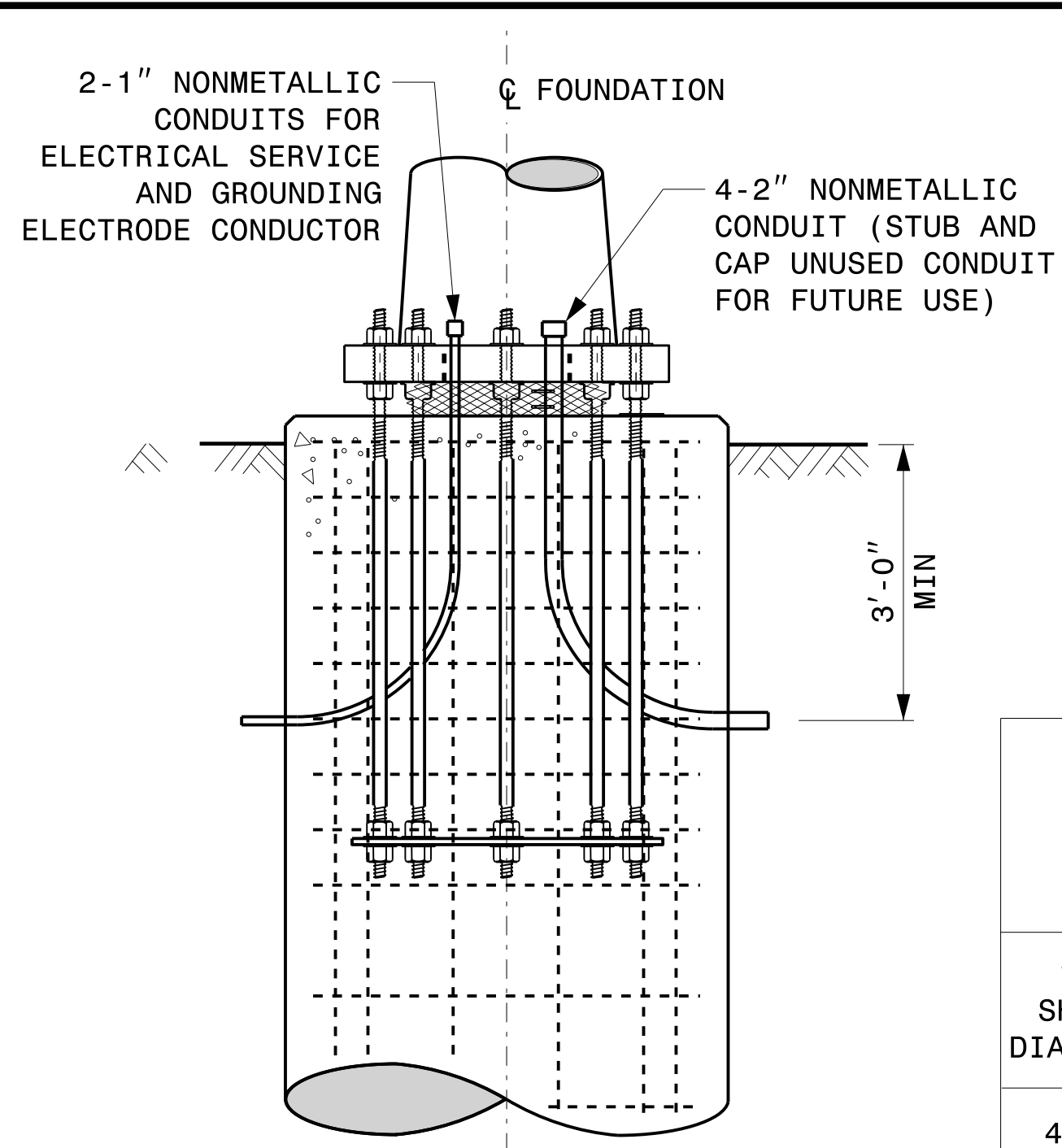
CONCRETE SHAFT ELEVATION



SECTION A-A



TYPICAL "C" BAR DETAIL



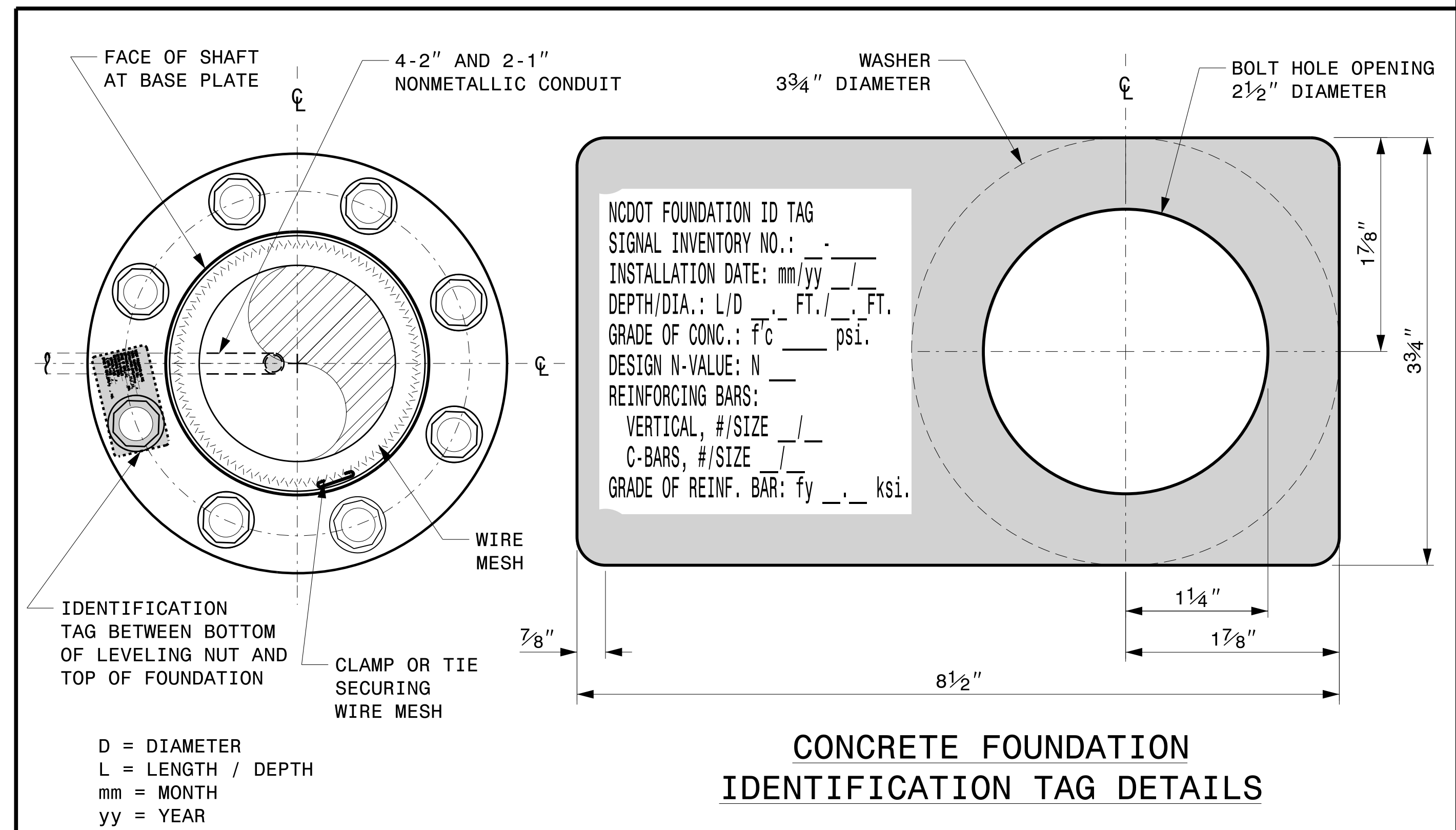
TYPICAL FOUNDATION CONDUIT DETAILS

GENERAL NOTES:

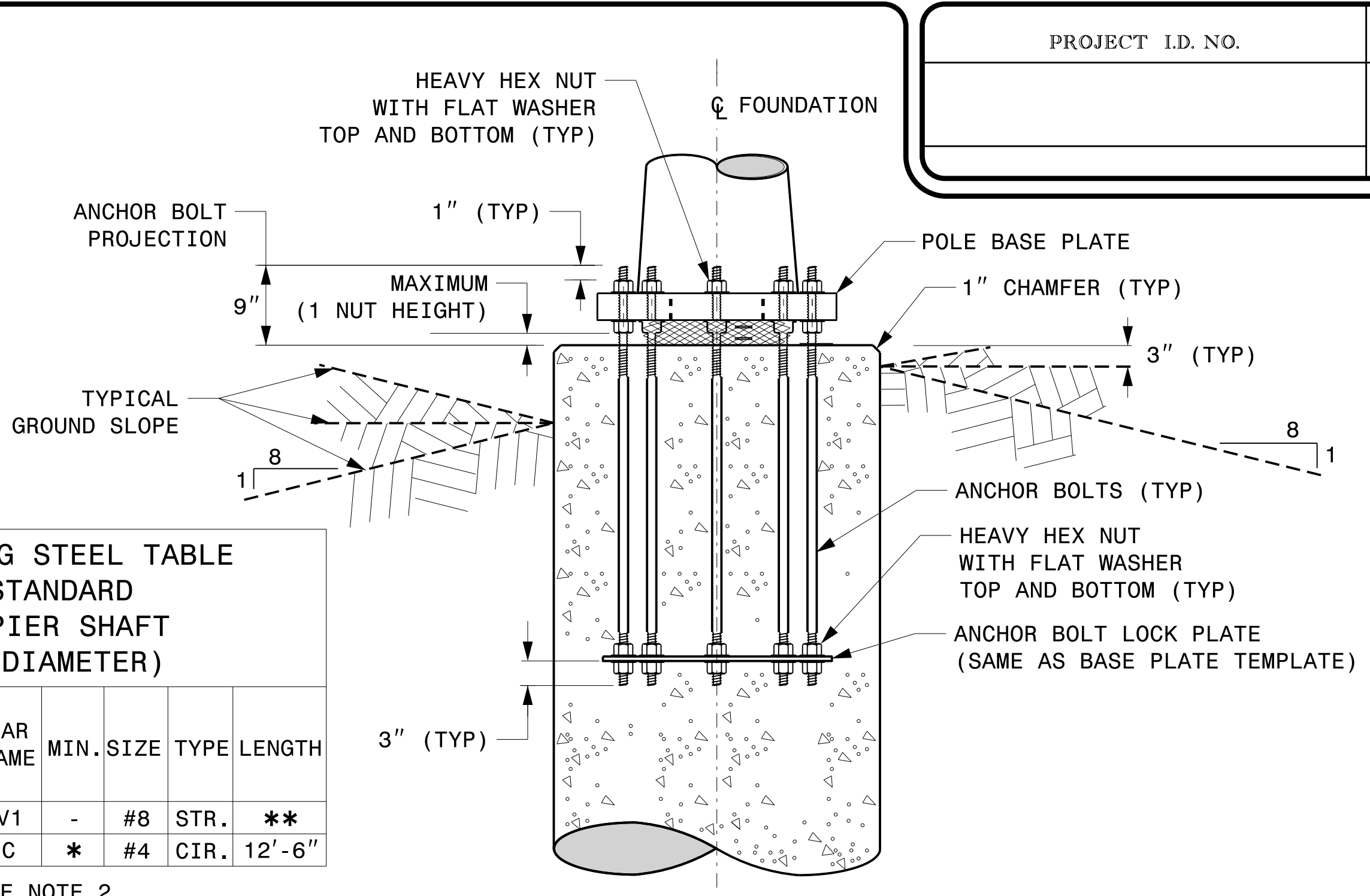
- IF ACTUAL SUBSURFACE CONDITIONS DIFFER SIGNIFICANTLY FROM BORING DATA, CONTACT THE ENGINEER BEFORE EXCAVATING OR PLACING CONCRETE.
- CIRCULAR TIE REINFORCING RINGS MAY BE VERTICALLY ADJUSTED BY +/-3" AT A DEPTH BETWEEN 2'-0" AND 3'-0" TO FACILITATE THE INSTALLATION OF ELECTRICAL CONDUIT ENTERING IN 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

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

PROJECT I.D. NO.	SHEET NO.
	Sig.M8

GENERAL NOTES:

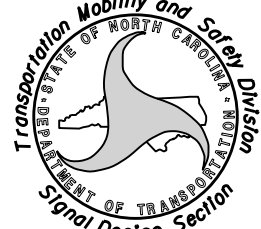
1. VALUES SHOWN IN THE "REACTIONS AT THE POLE BASE" COLUMN REPRESENT THE MINIMUM ACCEPTABLE CAPACITY ALLOWED FOR DESIGN USING A COMBINED FORCE RATIO (CFR) OF 1.00.
2. USE CHAIRS AND SPACERS TO MAINTAIN PROPER CLEARANCE.
3. FOR FOUNDATION, ALWAYS USE AIR-ENTRAINED CONCRETE MIX.

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.fgn

Prepared In the Offices of:



750 N.Greenfield Pkwy,Garner,NC 27529

SCALE

0 1"=10' NA

NONE

Standard Strain Pole Foundation for All Soil Conditions

PLAN DATE: SEPTEMBER 2023

DESIGNED BY: K.C. DURIGON

PREPARED BY: K.C. DURIGON

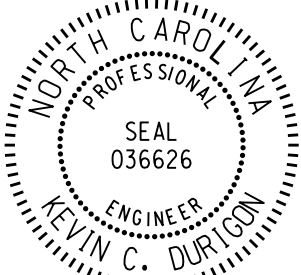
REVIEWED BY: D.C. SARKAR

REVISIONS

INIT.

DATE

SEAL



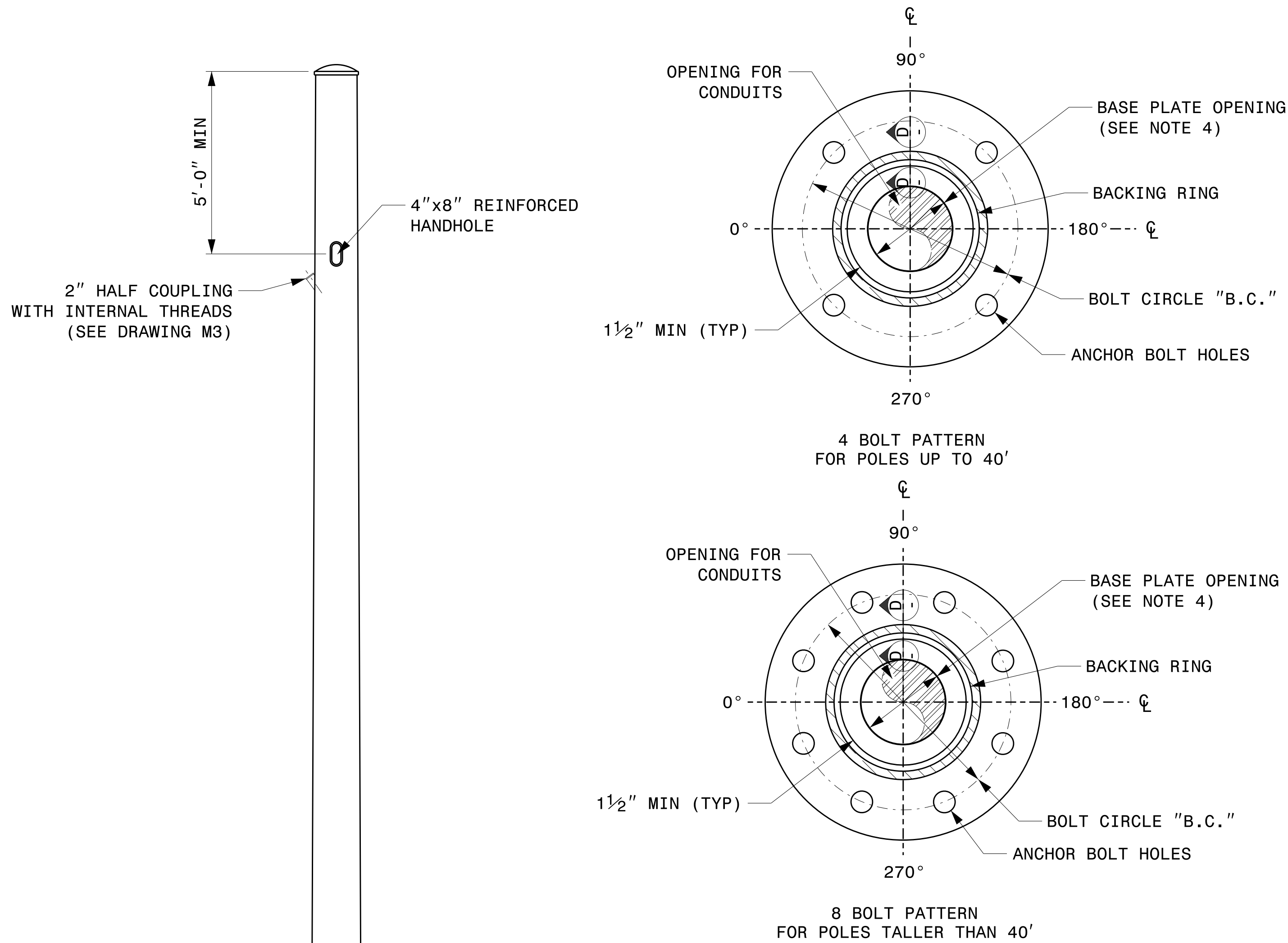
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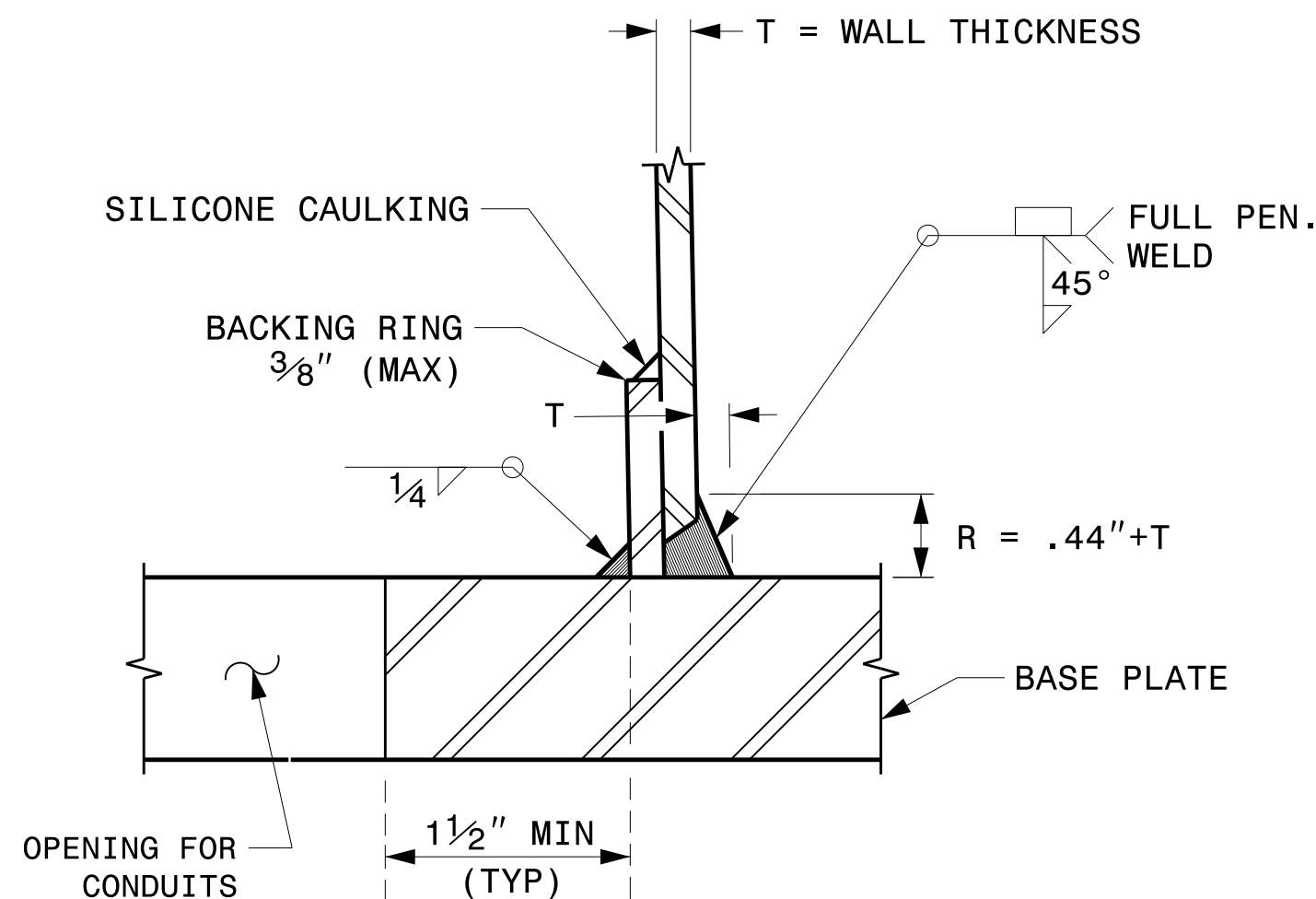
09/21/2023

DATE

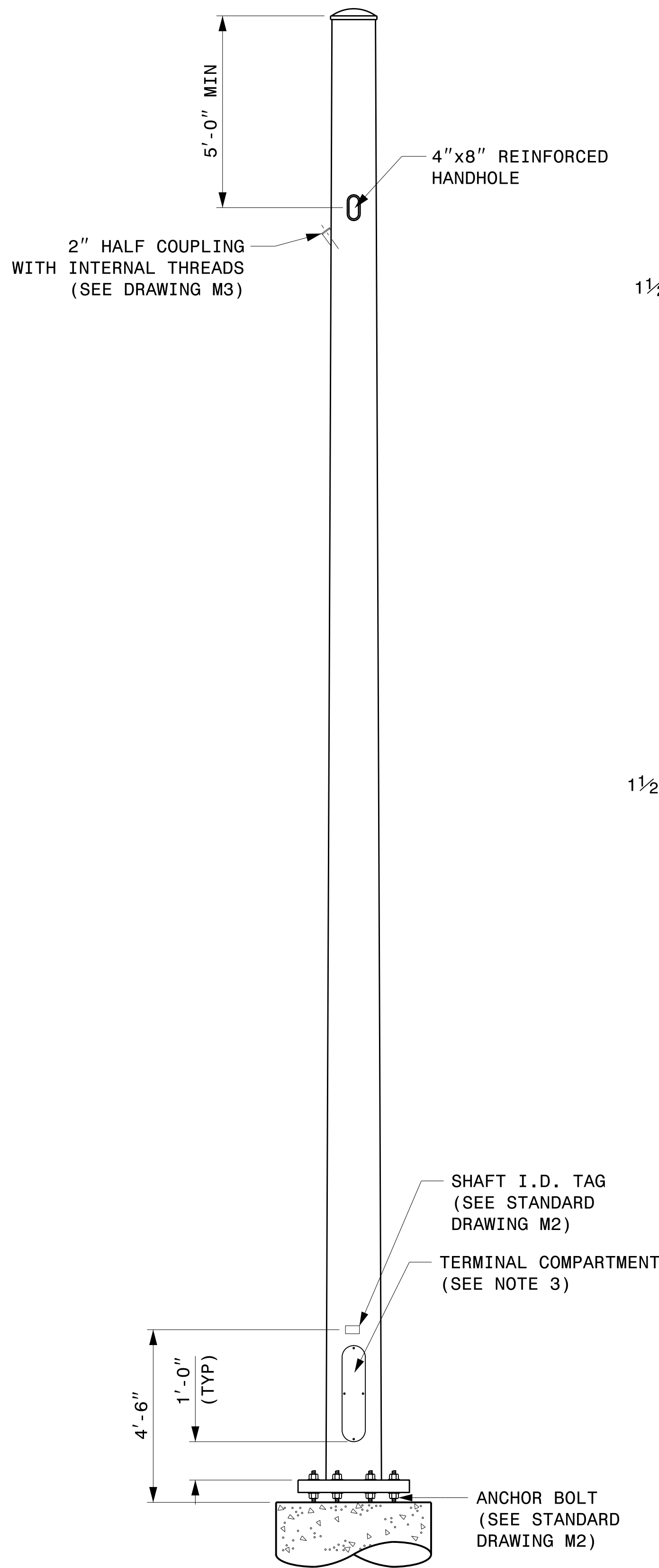
Standard Strain Pole Foundation – All Soil Conditions



BASE PLATE DETAILS



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

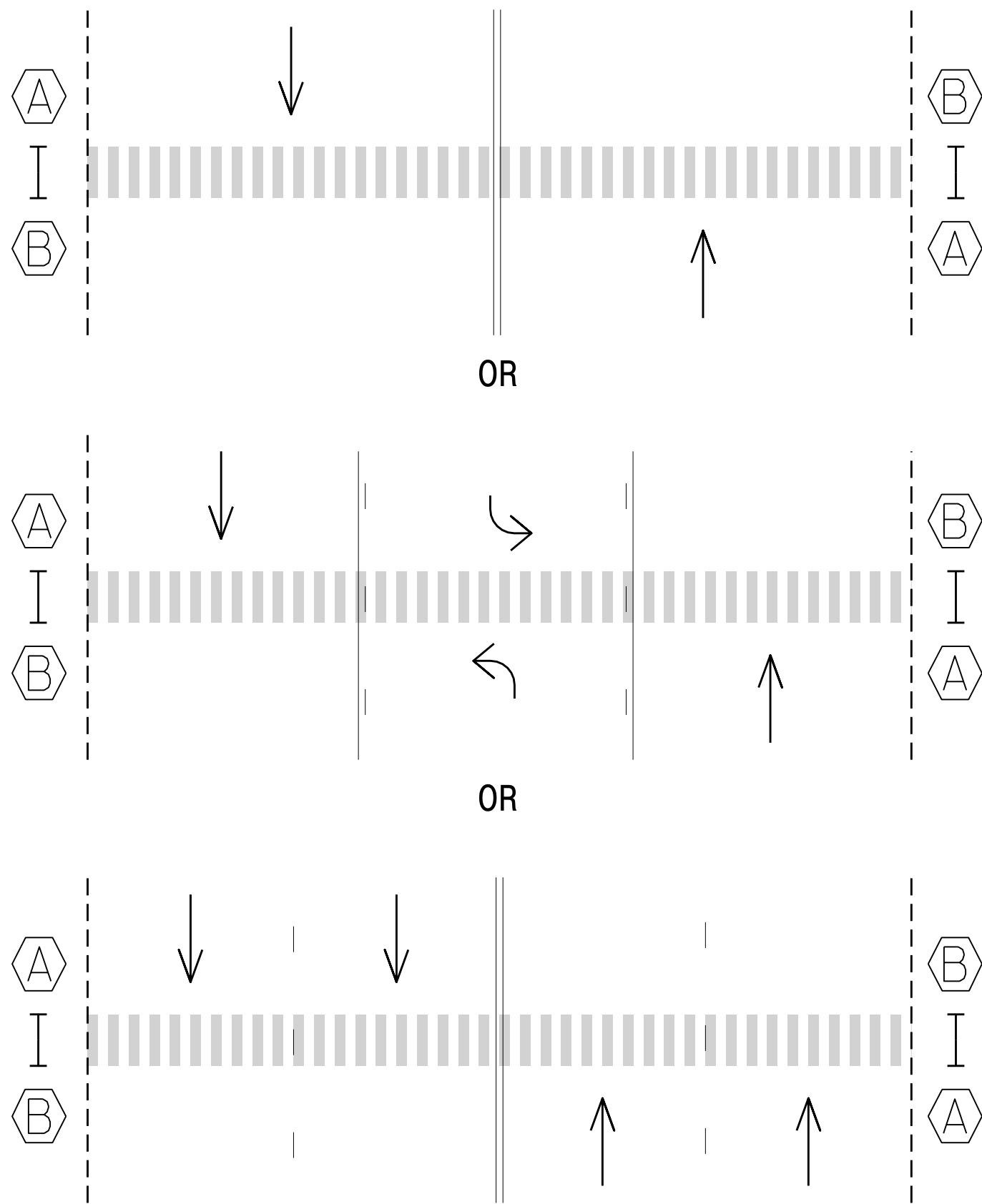


CCTV CAMERA POLE
(NOT TO SCALE)

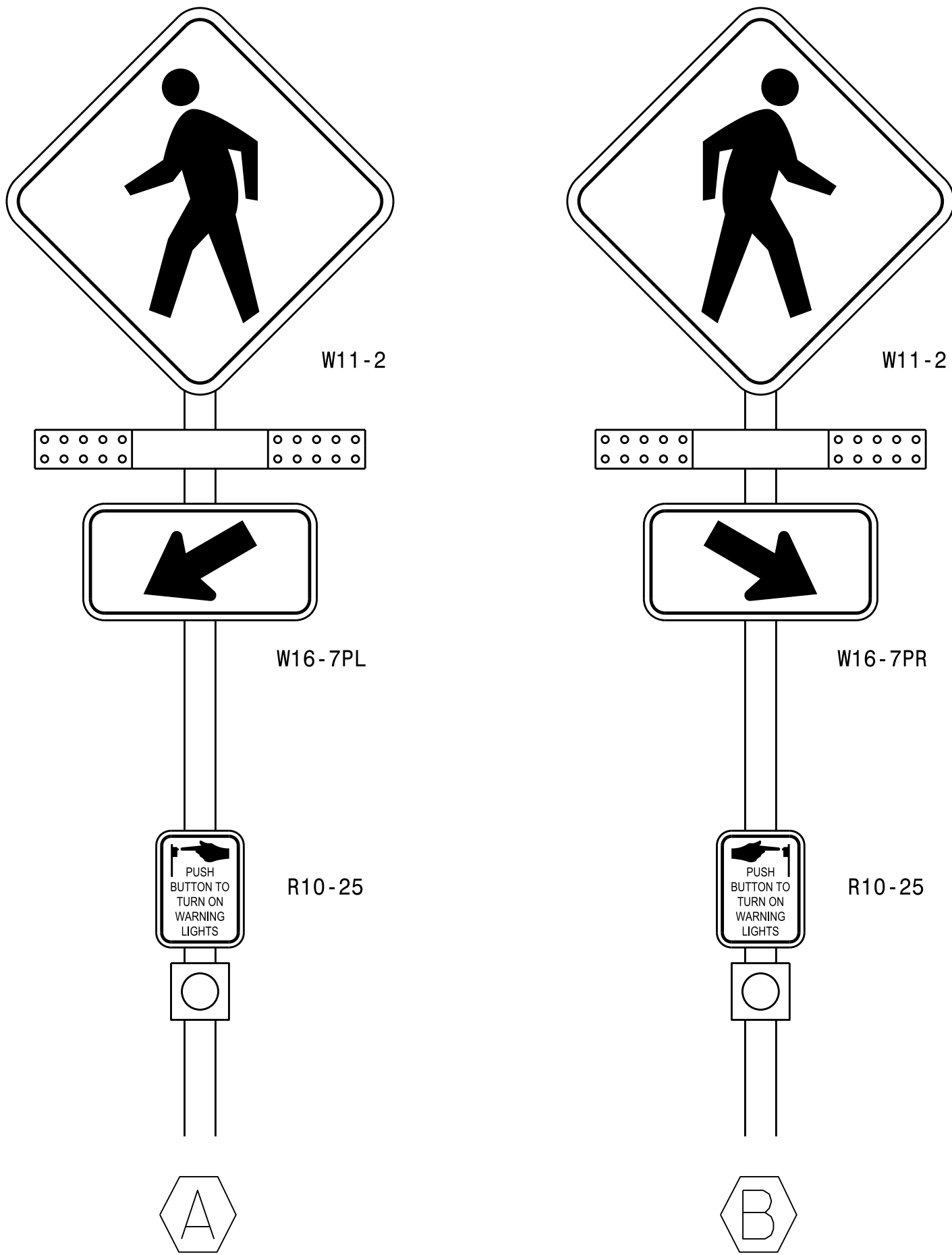
- NOTES:
1. THIS DRAWING PROVIDES BASIC DETAILS FOR CCTV POLES. PROJECT REQUIREMENTS MAY REQUIRE SPECIAL FACTORY PREPS THAT ARE NOT SHOWN ON THESE DETAILS.
 2. DETAILS FOR INTERNAL CAMERA LOWERING SYSTEMS ARE NOT SHOWN.
 3. POLE MOUNTED CABINETS MAY REQUIRE MODIFICATIONS TO THE LOWER HANDHOLE OPENING 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.

 750 N. Greenfield Pkwy, Garner, NC 27529	Typical Fabrication Details For CCTV Poles		 DocuSigned by: Kevin Durigon 4B23DC79B3784DA...
	PLAN DATE: SEPTEMBER 2023	DESIGNED BY: K.C. DURIGON	
	PREPARED BY: K.C. DURIGON	REVIEWED BY: C.F. ANDREWS	
SCALE 0 NA NONE	REVISIONS	INIT.	DATE

Two to Four Lanes, Undivided



RRFB Sign Detail



Notes

1. Design the RRFB in accordance with the 2009 MUTCD Interim Approval 21 -- Rectangular Rapid-Flashing Beacons at Crosswalks. The RRFB unit associated with a post-mounted sign and plaque should be located between the pedestrian crossing warning (W11-2) sign and the supplemental downward diagonal arrow plaque (W16-7p).
2. If sight distance approaching the crosswalk is deemed insufficient, a supplemental RRFB with an "AHEAD" (W16-9P) plaque may be installed on that approach in advance of the crosswalk.
3. When practical, the RRFB and mounting post on the right side of the road shall be mounted on the approach side of the crosswalk closest to approaching traffic.
4. When practical, the RRFB and mounting post on the left side of the road may be mounted on the back of the post for the opposing approach.
5. A RRFB on the left side of the roadway or in the median may be individually mounted on the approach side of the crosswalk closest to approaching traffic, or, when practical, may be mounted back to back on the same post and mounted on either side of the crosswalk in the median.
6. Locate push button sign (R10-25) and push button to face crosswalk, even if it is mounted on the back side of the sign.
7. All RRFB units associated with a given crosswalk (including those with an advance crossing sign) shall, when actuated, simultaneously commence operation of their rapid-flashing indications and shall cease operation simultaneously.

Timing of RRFBs

When actuated, the two yellow indications in each RRFB unit shall flash in a rapidly flashing sequence.

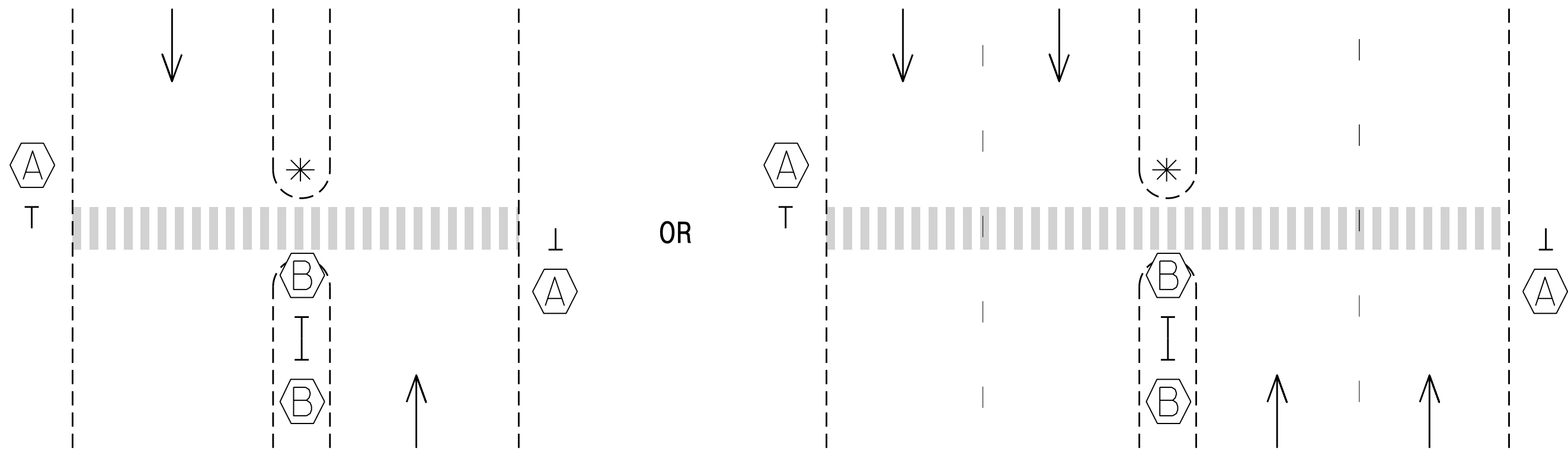
The RRFB shall flashing sequence shall provide enough time for pedestrians to cross from curb to curb. It is recommended to be a minimum of 7 seconds plus the crossing distance (D) divided by 3.5 feet/per sec., rounded up to the next whole second:

$$\text{Flash Time (sec.)} = 7 + D/3.5$$

RRFBs shall provide 75 flashing sequences per minute. During each 800-millisecond flashing sequence, the left and right RRFB indications shall operate using the following sequence:

- The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- Both RRFB indications shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- Both RRFB indications shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 250 milliseconds.

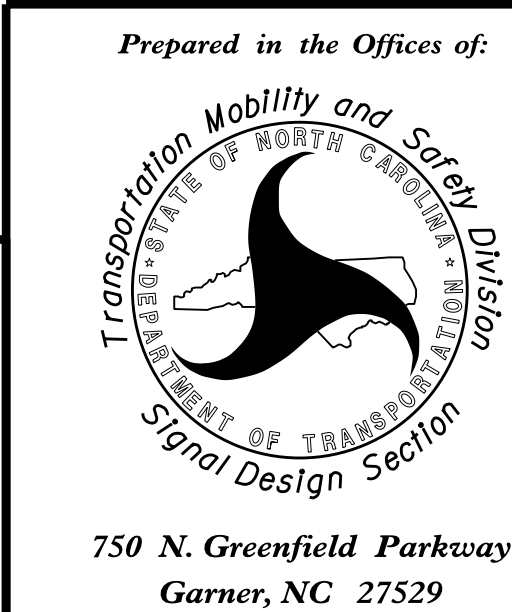
Two or Multi-Lanes, Divided



* See Note 5

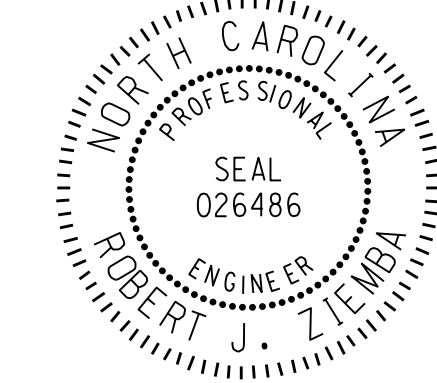
* See Note 5

Standard Drawing for
Rectangular Rapid
Flashing Beacon



DOCUMENT NOT CONSIDERED
FINAL UNLESS ALL
SIGNATURES COMPLETED

SEAL



DocuSigned by:
Robert J. Ziemba
SIGNATURE

12/19/2022
DATE