

09\_08/2019

10/30/2023  
R:\Traffic\Design\Signals\R5861\_sig\_.tsh.dgn  
dsedr

**TIP PROJECT: R-5861**

**CONTRACT: C204887**

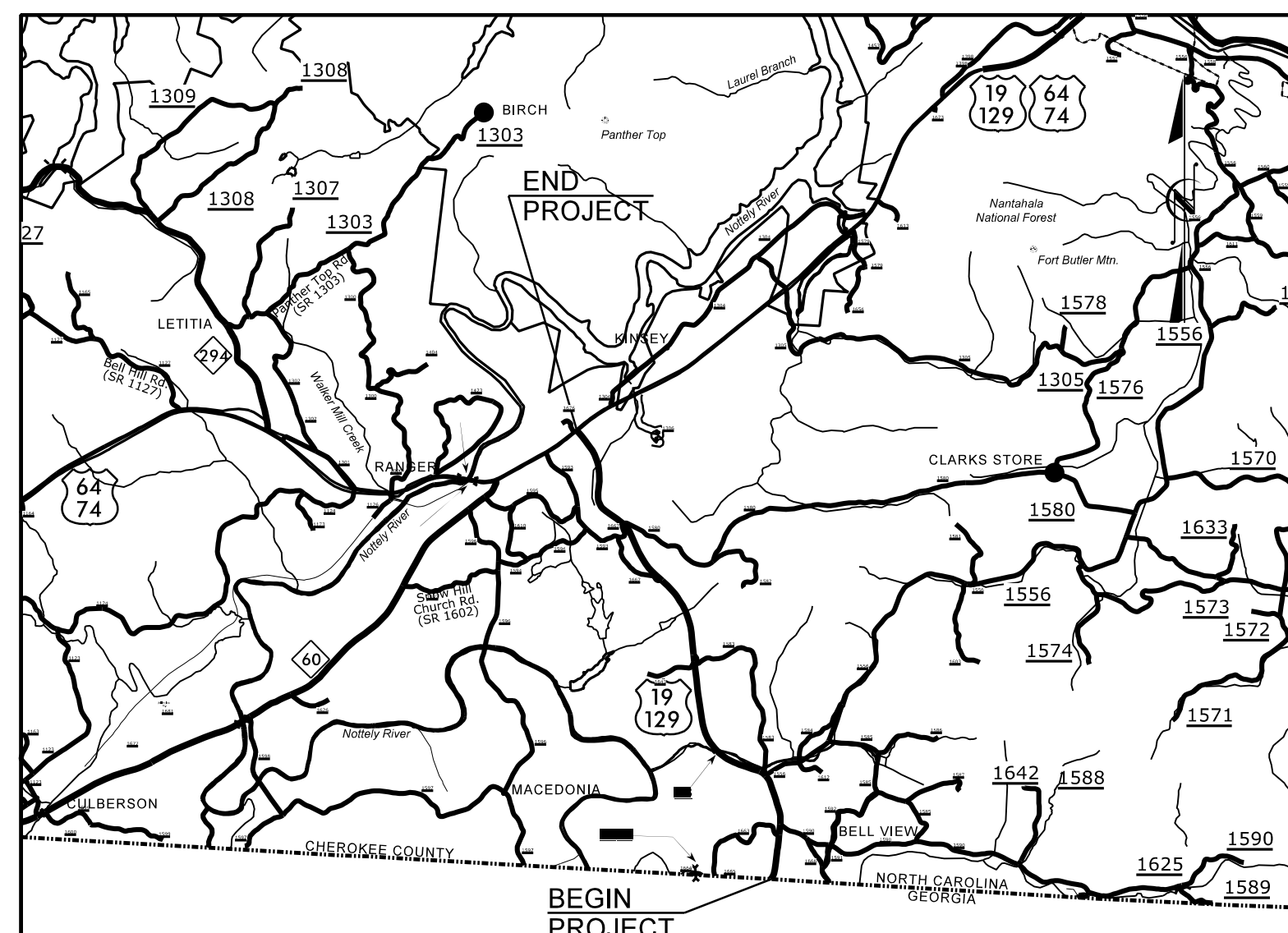
Project No.	Sheet No.
R-5861	Sig. 1.0

STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

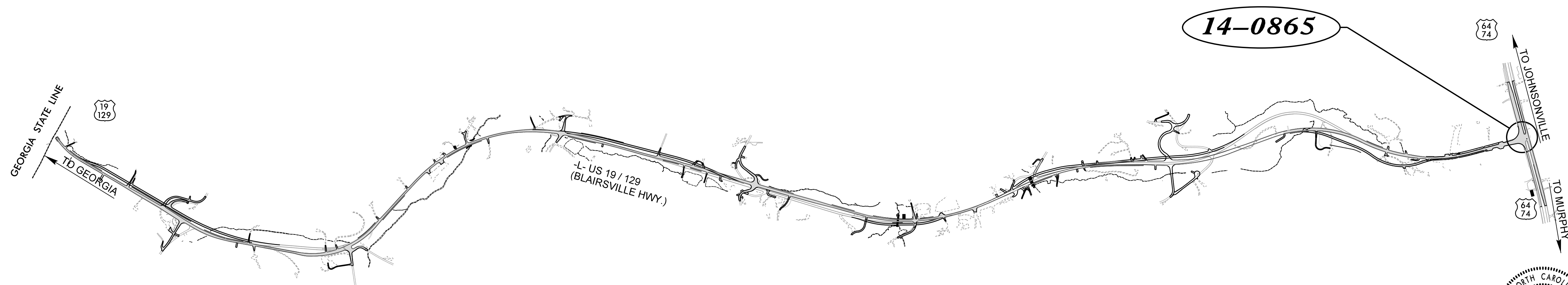
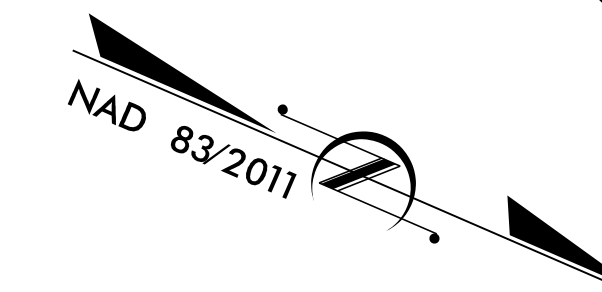
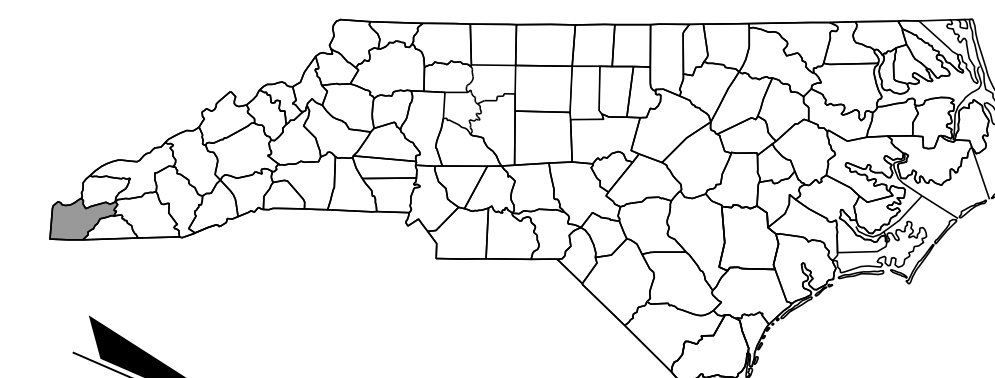
**CHEROKEE COUNTY**

**LOCATION: WIDENING US 19 /129 FROM THE GEORGIA STATE LINE TO US 64 /74.**

**TYPE OF WORK: TRAFFIC SIGNALS**



VICINITY MAP (NTS)



DocuSigned by:  
David T. Sears  
10/30/2023  
009183F28E5741E

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED

Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.

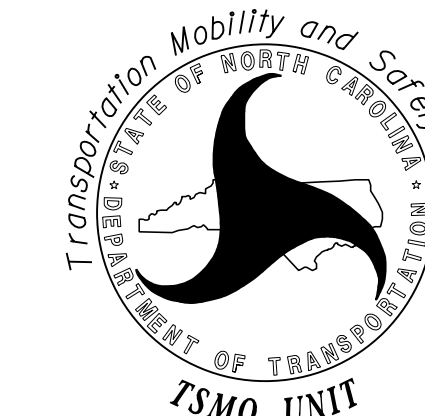
Sheet #	Reference #	Index of Plans	Location/Description
Sig. 1.0	-----	Title Sheet	
Sig. 1.1	-----	Standard Plate Sheets	
Sig. 2.0-3.1	14-0865	US 64 Business at US 19-129 and Commercial Drive	
Sig. M1-M8	N/A	Standard Drawings for Metal Poles	

**TRANSPORTATION SYSTEMS  
MANAGEMENT & OPERATIONS**

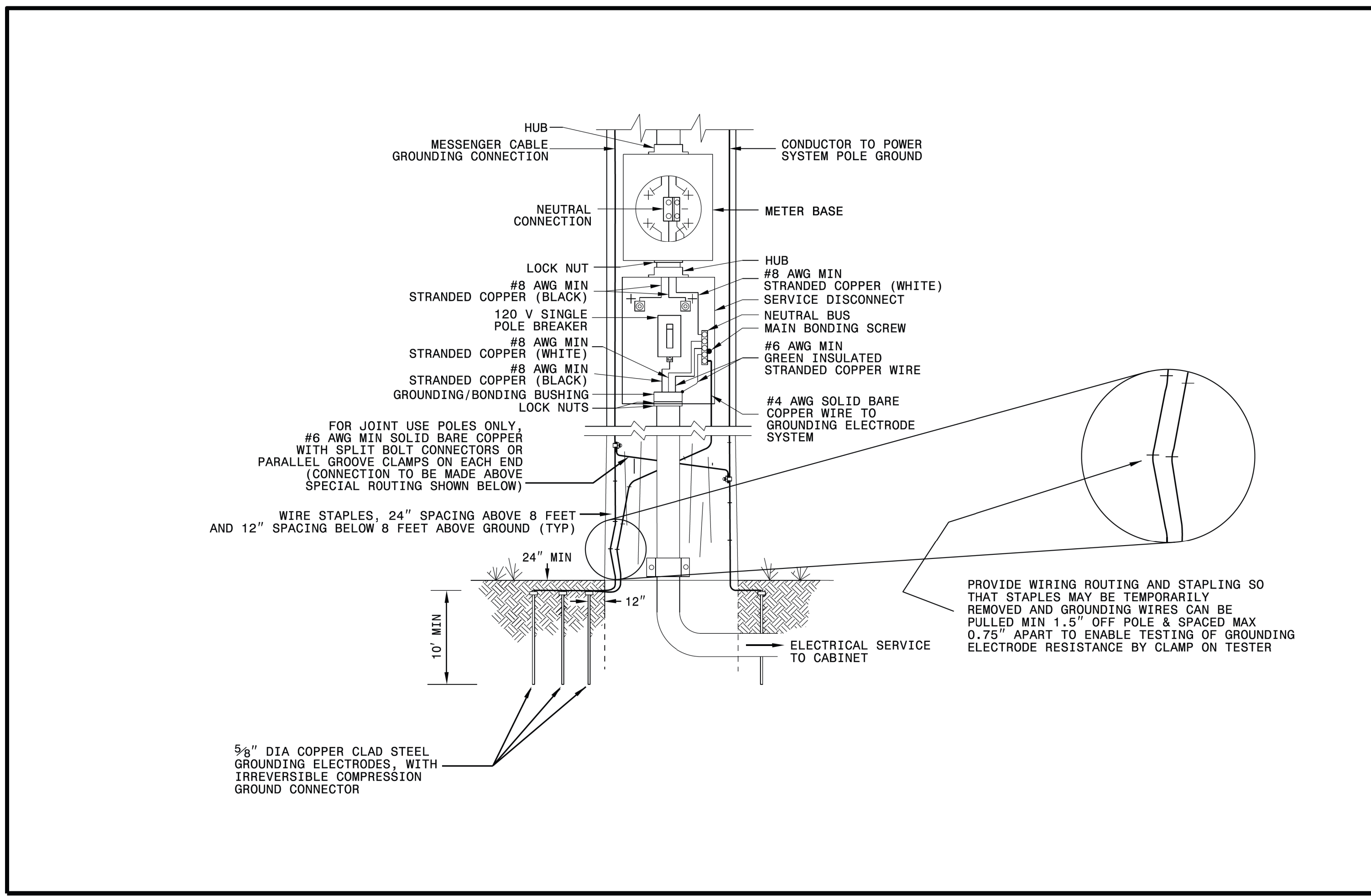
Contacts:

**R. Nicholas Zinser, P.E. – Western Region Signals Engineer**  
**D. Todd Joyce, P.E. – Signal Equipment Design Review Engineer**

Prepared for the Office of:  
DIVISION OF HIGHWAYS  
TRANSPORTATION MOBILITY & SAFETY DIVISION



750 N. Greenfield Parkway, Garner, NC 27529



1-18 STATE OF NORTH CAROLINA DEPT. OF TRANSPORTATION DIVISION OF HIGHWAYS RALEIGH, N.C.

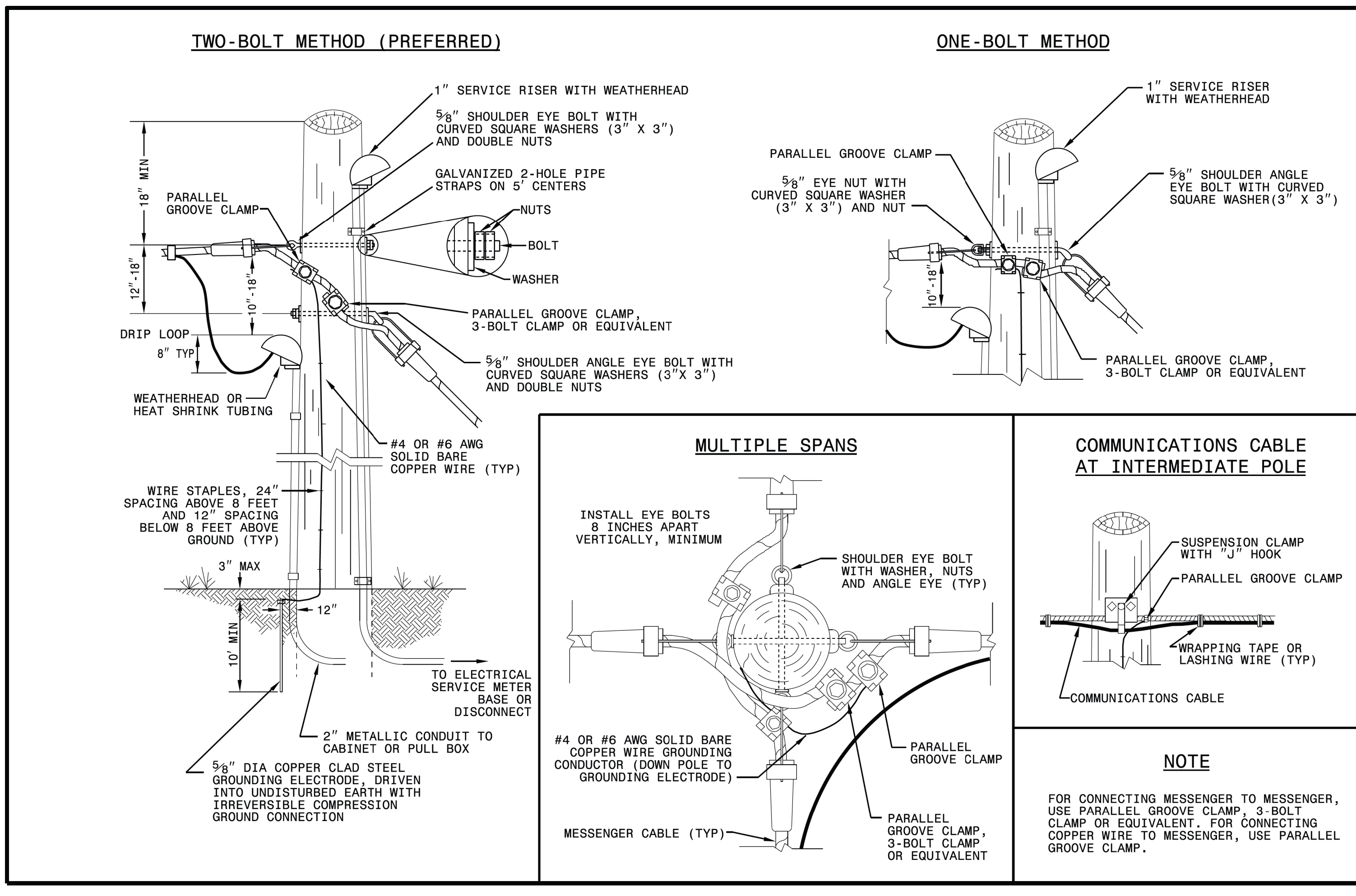
ENGLISH STANDARD DRAWING FOR

**ELECTRICAL SERVICE GROUNDING**

GROUNDING AND BONDING

SHEET 1 OF 1

**1700D01**



1-18 STATE OF NORTH CAROLINA DEPT. OF TRANSPORTATION DIVISION OF HIGHWAYS RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR

**WOOD POLES**

METHODS OF ATTACHMENT AND GROUNDING

SHEET 1 OF 1

**1720D01**

11-0CT-2017 09:55  
 U:\2018 STD Drawings\Plate Sheets\2018\_Plate Sheet -dgn  
 r:\rough

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

See Plate for Title

Prepared in the Offices of:

SEAL

SEAL 032108

ENGINEER

Mohd A. Aslami

10/11/2017

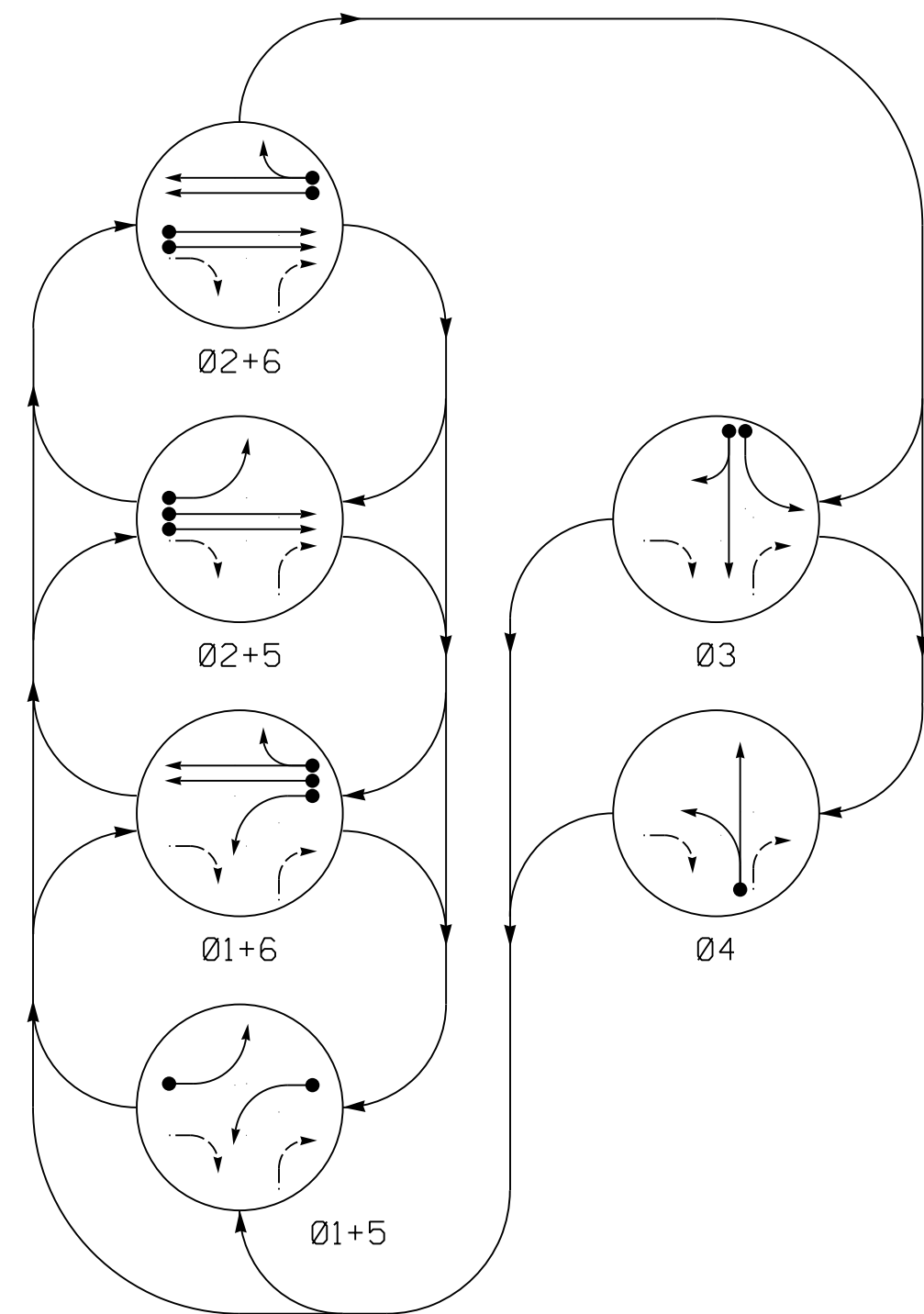
DATE

750 N. Greenfield Parkway  
 Garner, NC 27529





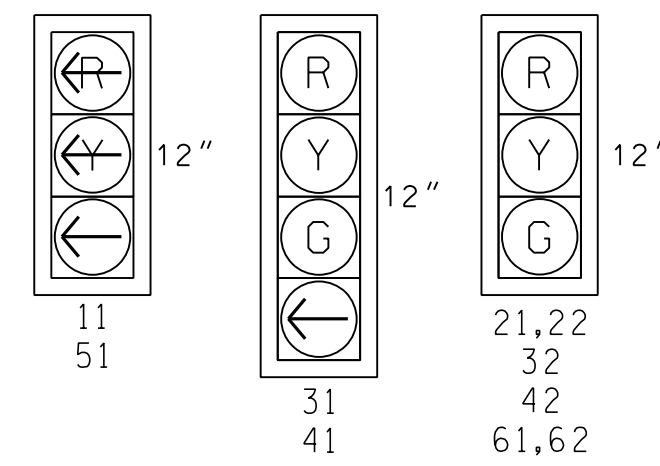
PHASING DIAGRAM



SIGNAL FACE	PHASE					
	Ø1+5	Ø1+6	Ø2+5	Ø2+6	Ø3	Ø4
11	←	←	→	→	→	→
21,22	R	R	G	G	R	R
31	R	R	R	R	G	R
32	R	R	R	R	G	R
41	R	R	R	R	G	R
42	R	R	R	R	G	R
51	←	←	→	→	→	→
61,62	R	G	R	G	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART											
DETECTOR						PROGRAMMING					
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	2-4-2	X	1	-	-	X	-	X	X
2A	6X6	420	5	X	2	-	-	X	X	X	X
2B	6X6	420	5	X	2	-	-	X	X	X	X
3A	6X20	0	2-4-2	-	3	3.0	-	X	-	X	-
3B	6X20	0	2-4-2	-	3	10.0	-	X	-	X	-
4A	6X40	0	2-4-2	X	4	-	-	X	-	X	X
5A	6X40	0	2-4-2	X	5	-	-	X	-	X	X
6A	6X6	420	6	X	6	-	-	X	X	X	X
6B	6X6	420	6	X	6	-	-	X	X	X	X

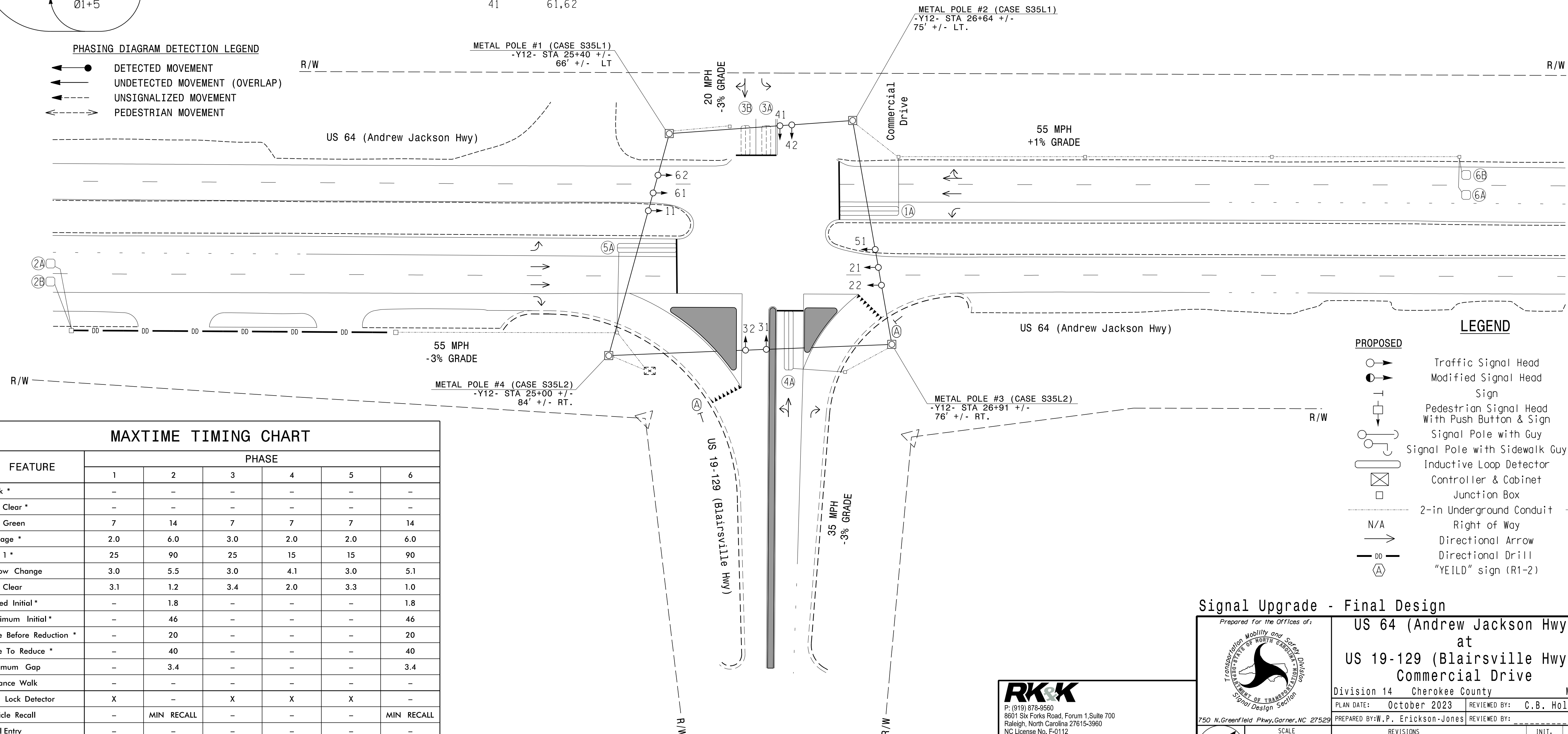
6 Phase Fully Actuated Isolated

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the engineer.
3. Phase 1 and/or phase 5 may be lagged.
4. The order of phase 3 and phase 4 may be reversed.
5. Install backplates with retro-reflective sheeting for all proposed signal heads.
6. Set all detector units to presence mode.

PHASING DIAGRAM DETECTION LEGEND

- ←● DETECTED MOVEMENT
- ← UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- ←--- PEDESTRIAN MOVEMENT



FEATURE	PHASE					
	1	2	3	4	5	6
Walk *	-	-	-	-	-	-
Ped Clear *	-	-	-	-	-	-
Min Green	7	14	7	7	7	14
Passage *	2.0	6.0	3.0	2.0	2.0	6.0
Max I *	25	90	25	15	15	90
Yellow Change	3.0	5.5	3.0	4.1	3.0	5.1
Red Clear	3.1	1.2	3.4	2.0	3.3	1.0
Added Initial *	-	1.8	-	-	-	1.8
Maximum Initial *	-	46	-	-	-	46
Time Before Reduction *	-	20	-	-	-	20
Time To Reduce *	-	40	-	-	-	40
Minimum Gap	-	3.4	-	-	-	3.4
Advance Walk	-	-	-	-	-	-
Non Lock Detector	X	-	X	X	X	-
Vehicle Recall	-	MIN RECALL	-	-	-	MIN RECALL
Dual Entry	-	-	-	-	-	-

\* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

PROPOSED	EXISTING
○ → Traffic Signal Head	● → N/A
○ → Modified Signal Head	○ → N/A
○ → Pedestrian Signal Head	○ → N/A
○ → Signal Pole with Guy	○ → N/A
○ → Signal Pole with Sidewalk Guy	○ → N/A
⊠ Inductive Loop Detector	⊠ Inductive Loop Detector
⊠ Controller & Cabinet	⊠ Junction Box
□ Junction Box	□ Junction Box
--- 2-in Underground Conduit	--- 2-in Underground Conduit
N/A Right of Way	N/A Right of Way
→ Directional Arrow	→ Directional Arrow
--- Directional Drill	--- Directional Drill
⊠ "YIELD" sign (R1-2)	⊠ "YIELD" sign (R1-2)

Signal Upgrade - Final Design

**RK&K**  
 P: (919) 878-9560  
 8801 Six Forks Road, Forum 1, Suite 700  
 Raleigh, North Carolina 27615-3960  
 NC License No. F-0112  
 Engineers | Construction Managers | Planners | Scientists  
 www.rkk.com  
 Responsive People | Creative Solutions

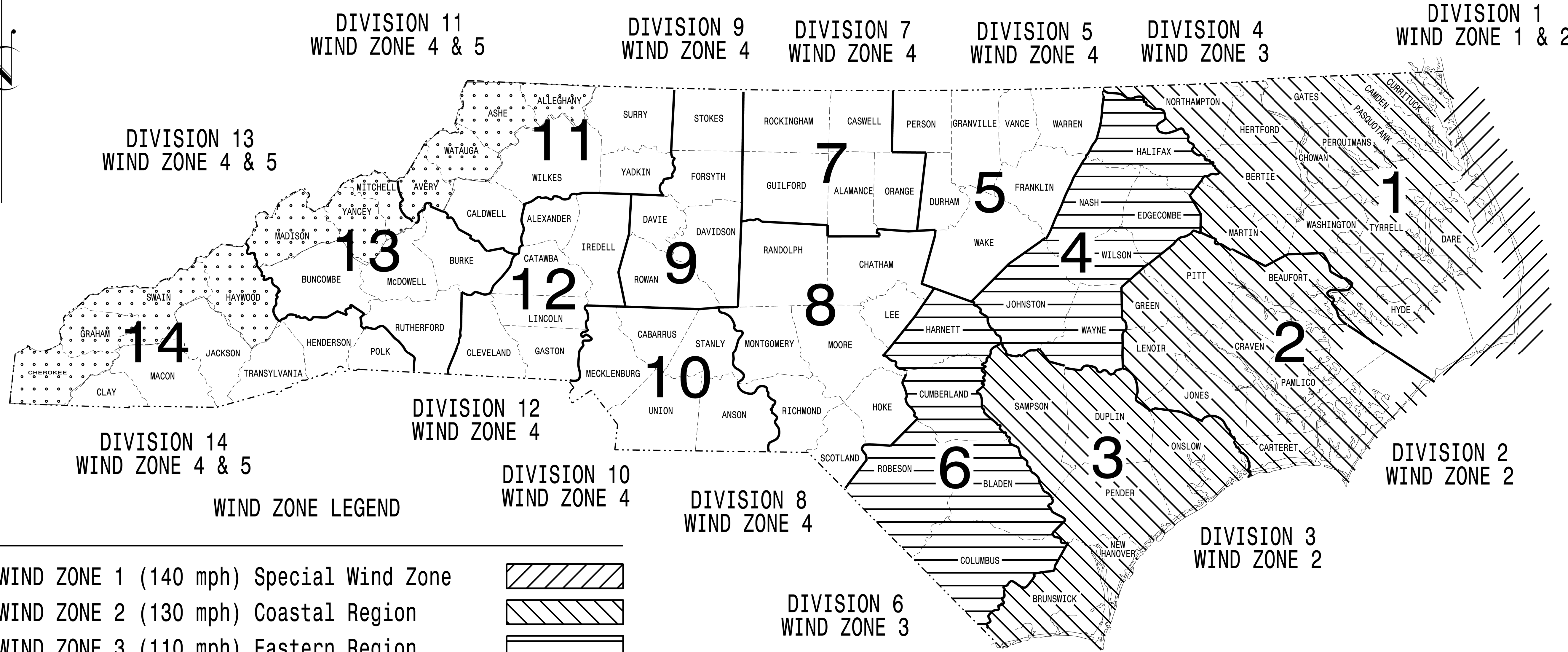
Prepared for the Offices of:  
**US 64 (Andrew Jackson Hwy) at US 19-129 (Blairsville Hwy) / Commercial Drive**  
 Division 14 Cherokee County Murphree  
 PLAN DATE: October 2023 REVIEWED BY: C.B. Holden  
 PREPARED BY: W.P. Erickson-Jones REVIEWED BY:  
 SCALE: 1" = 40'  
 REVISIONS: \_\_\_\_\_ INIT. DATE  
 DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED  
 SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 044558 DAVID T. SEARS  
 DocuSigned by: David T. Sears 10/30/2023  
 SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_  
 SIG. INVENTORY NO. 14-0865



# STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

PROJECT I.D. NO. R-5861	SHEET NO. Sig.M1
----------------------------	---------------------

## STANDARD DRAWINGS FOR ALL METAL POLES



<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 NUMBER	DESCRIPTION
Sig. M 1	Statewide Wind Zone Map
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

### NCDOT CONTACTS:

**MOBILITY AND SAFETY DIVISION - ITS AND SIGNALS UNIT**

---

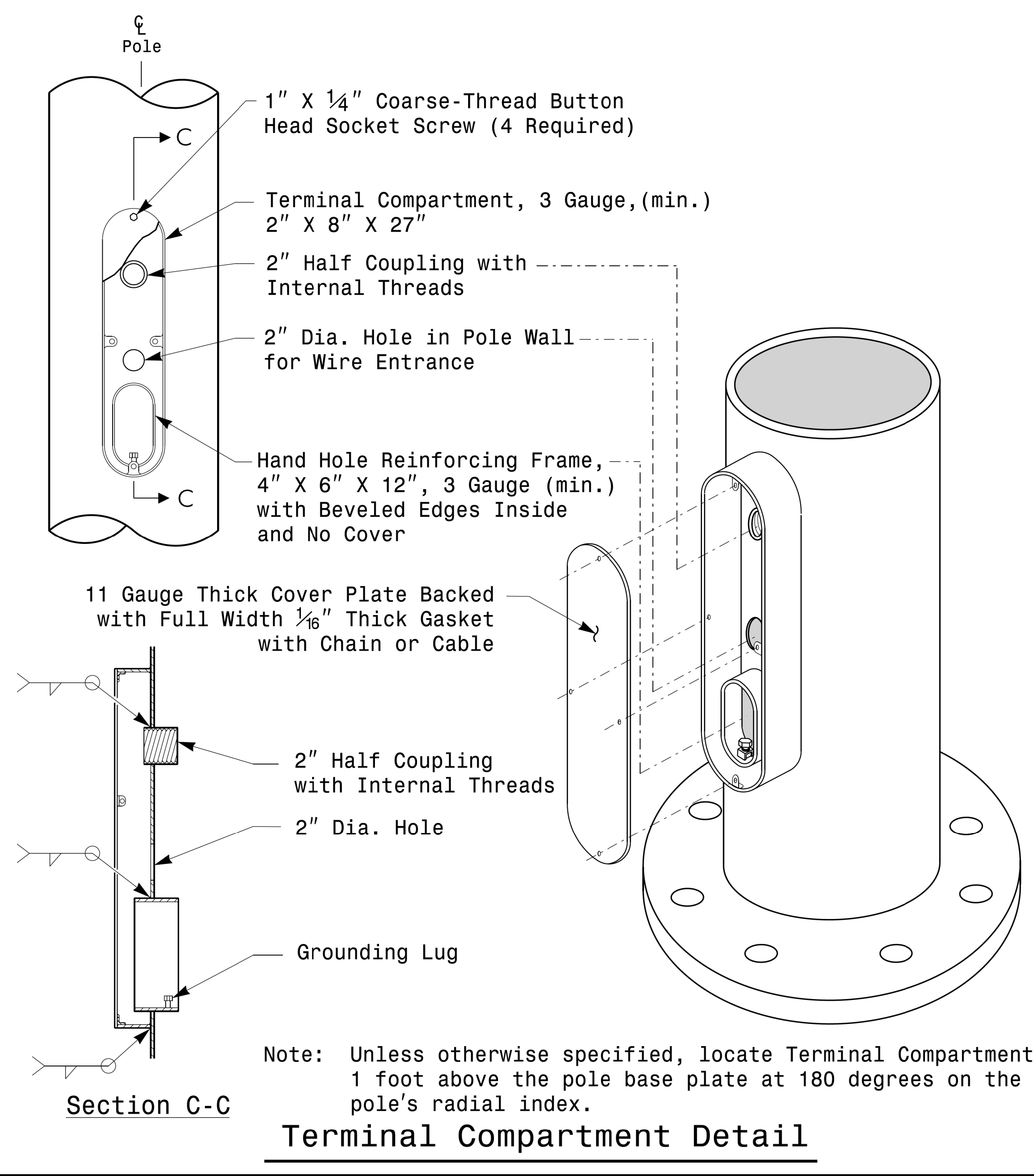
**M.M. MCDIARMID, P.E. - STATE ITS AND SIGNALS ENGINEER**

**J. P. GALLOWAY, P.E. - STATE SIGNALS ENGINEER**

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

SEAL

DocuSigned by:  
*Debesh C. Sarkar*  
10/11/2017  
DATE

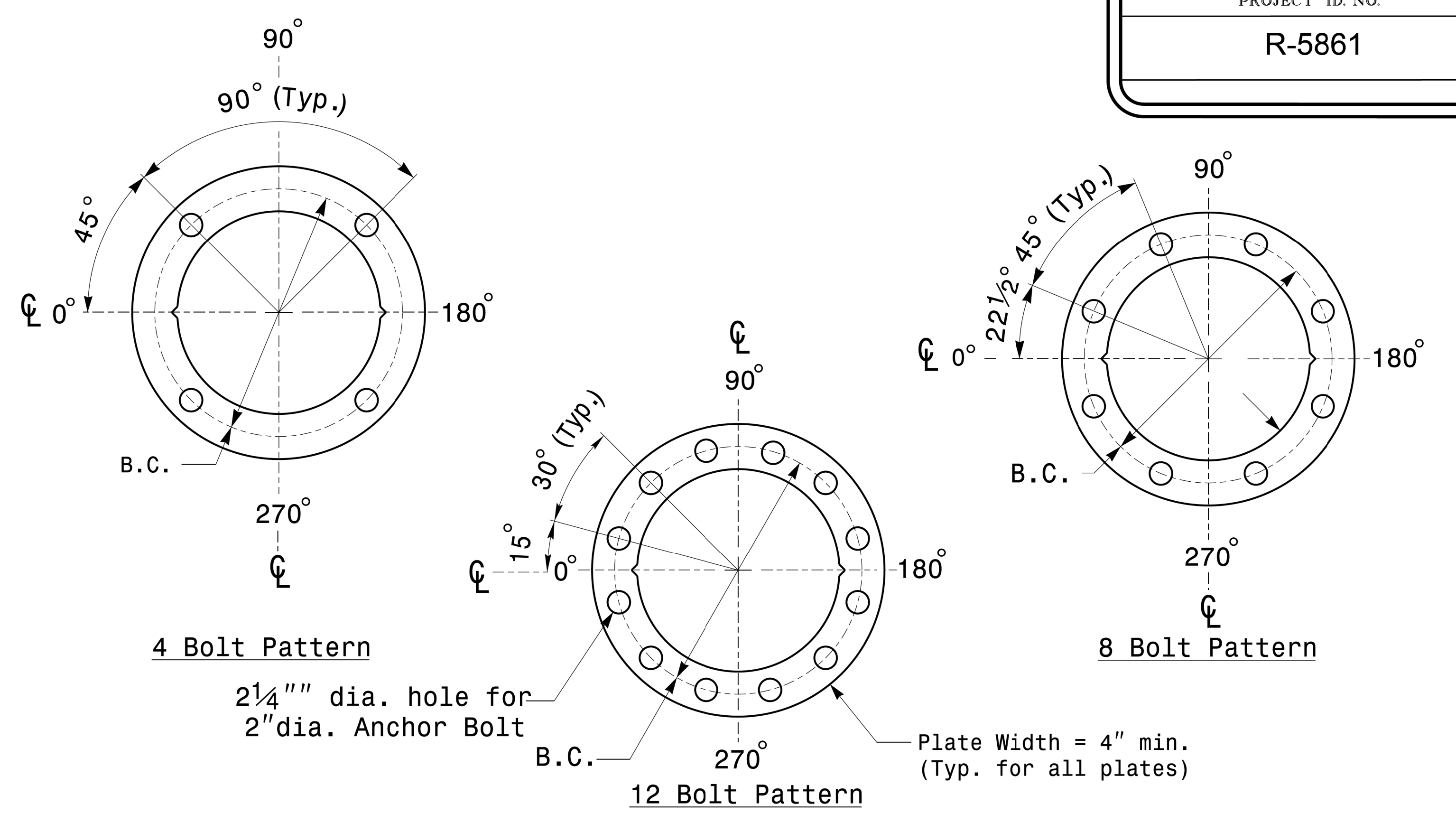


MFG _____	MFG. DATE: MM/YY _____
SHAFT D/T/L/Y _____	_____
ARM-A D/T/L/Y _____	_____
ARM-B D/T/L/Y _____	_____
A.B. DIA./B.C./L/Y _____	_____
NCDOT SIG. INV. NO. _____	_____
NCDOT POLE NO. _____	_____

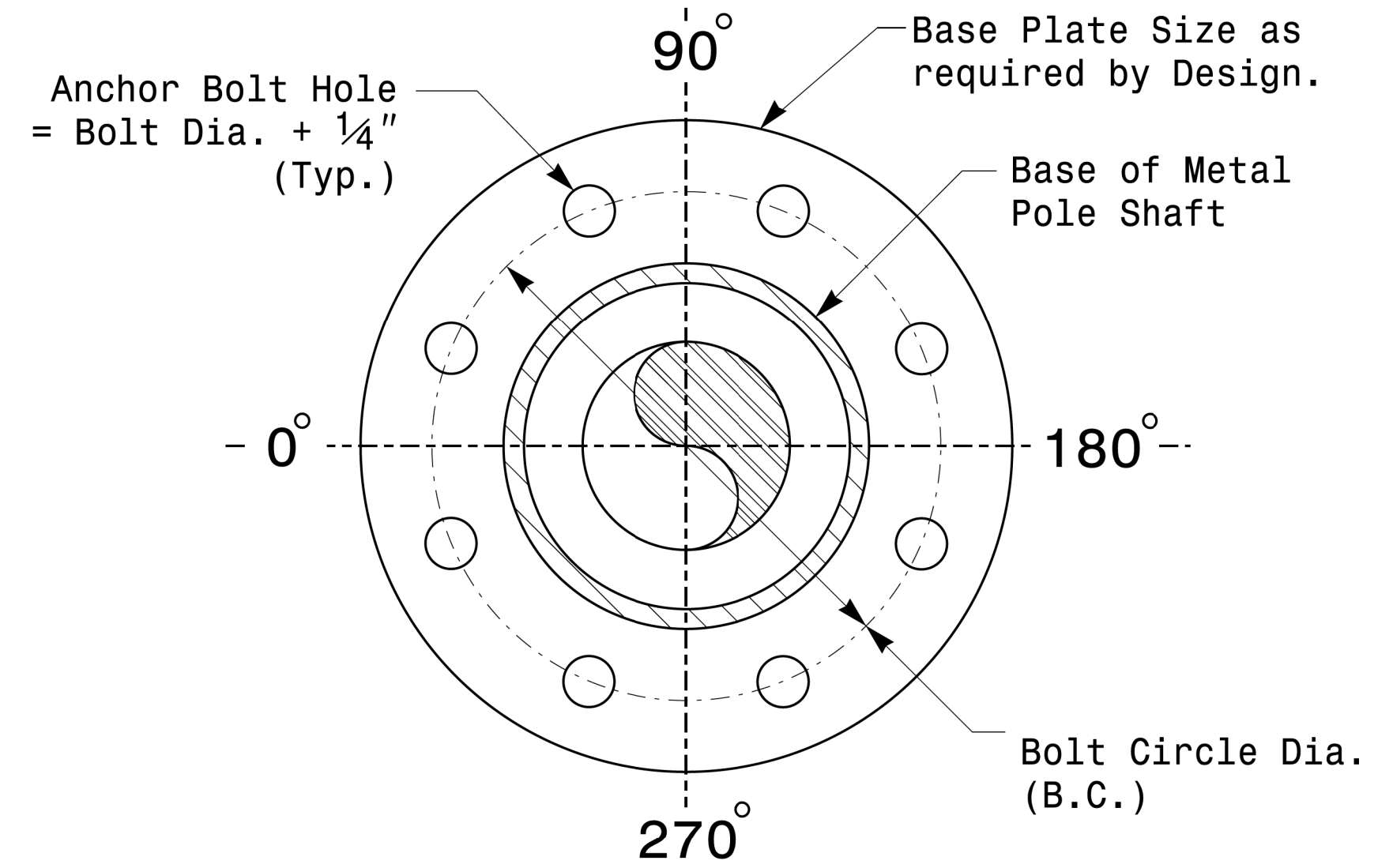
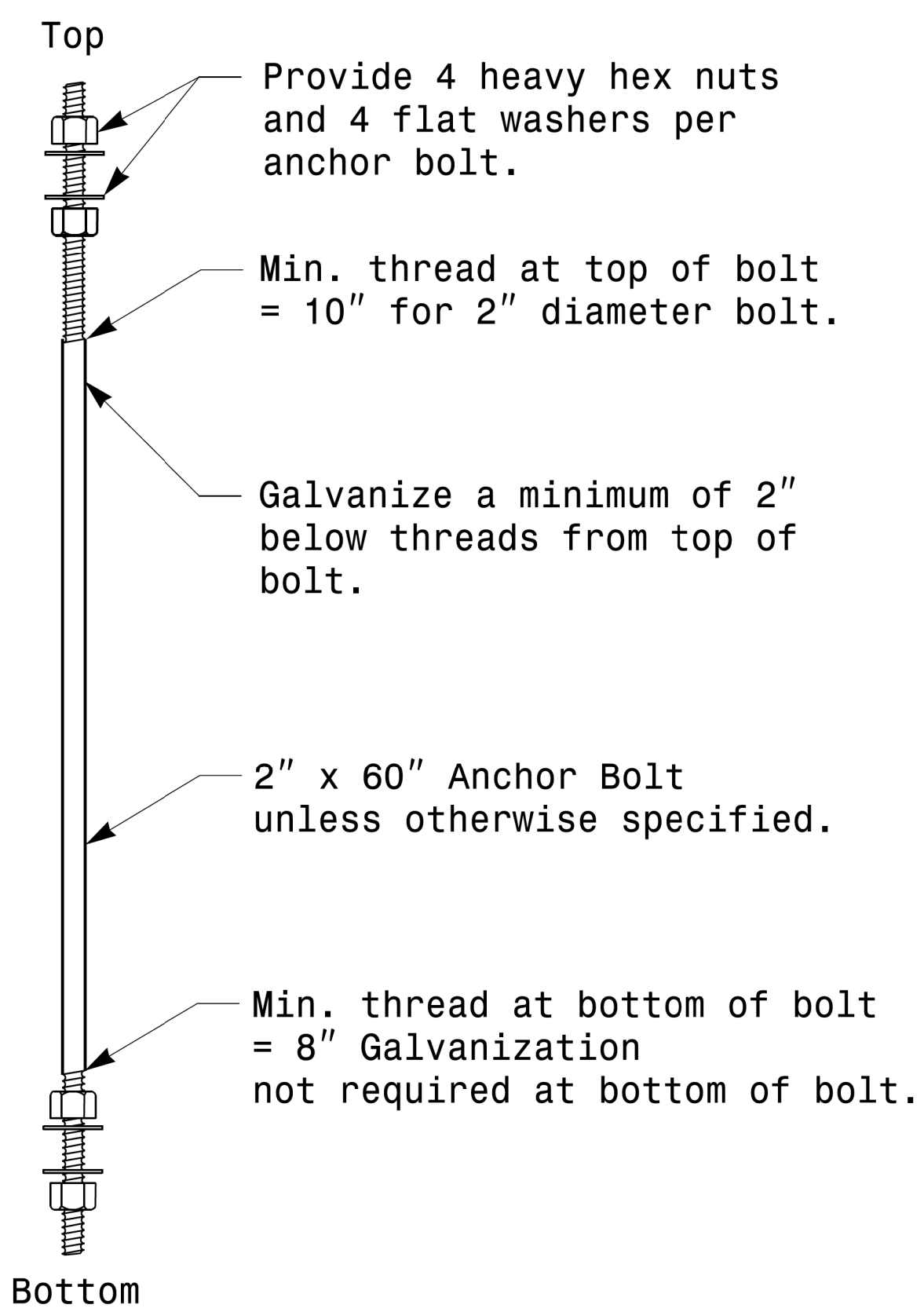
Shaft I.D. Tag  
(Provide on Shaft of Strain Poles and Mast Arm Poles Shaft)

- Notes:
- 1) D= Diameter, T= Thickness, L= Length, Y= Yield Strength
  - 2) A.B. = Anchor Bolt
  - 3) B.C. = Bolt Circle of Anchor Bolts
  - 4) If Custom Design, use "NCDOT STANDARD" line for Signal Inv. Number and pole I.D. number
  - 5) 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.



Note: Base plate may be circular, octagonal, square or rectangular in shape.

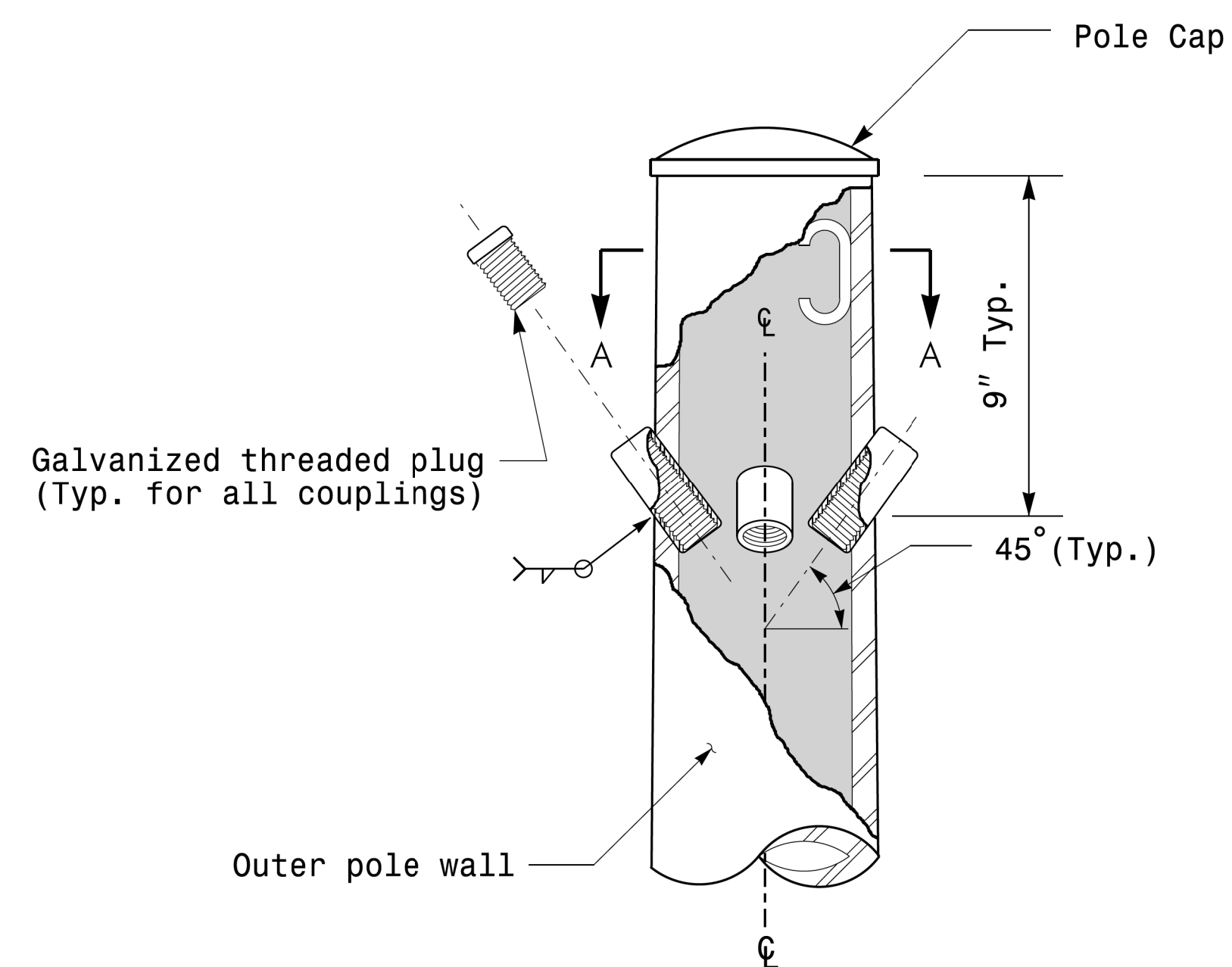
**Typical Base Plate Detail**

	<p>Typical Fabrication Details For All Metal Poles</p>		
	<p>PLAN DATE: OCTOBER 2017</p>	<p>DESIGNED BY: C.F. ANDREWS</p>	
<p>750 N. Greenfield Pkwy, Garner, NC 27529</p>	<p>PREPARED BY: N. BITTING</p>	<p>REVISIONS</p>	<p>INIT. DATE</p>
<p>SCALE: 0 NA NONE</p>	<p>DocuSign by: <i>Debash C. Sarkar</i></p>		<p>10/11/2017 DATE</p>

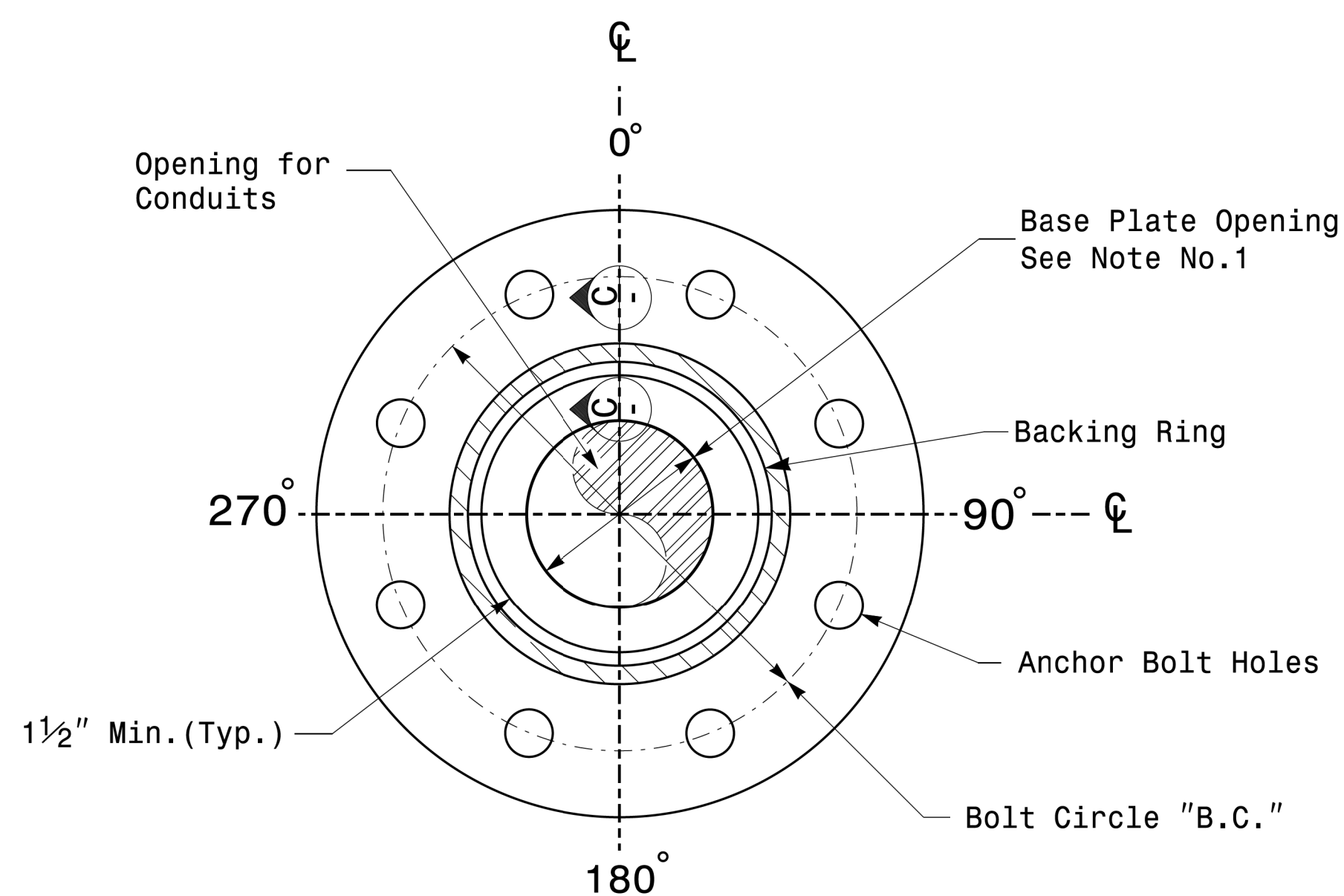
11-OCT-2017 08:30 514135204115 Signal.sds:gnal Design Section\Facsimile Sheets\2016\2014 Sig. M2 Std. Fabrication Detail Is-All Poles.dgn



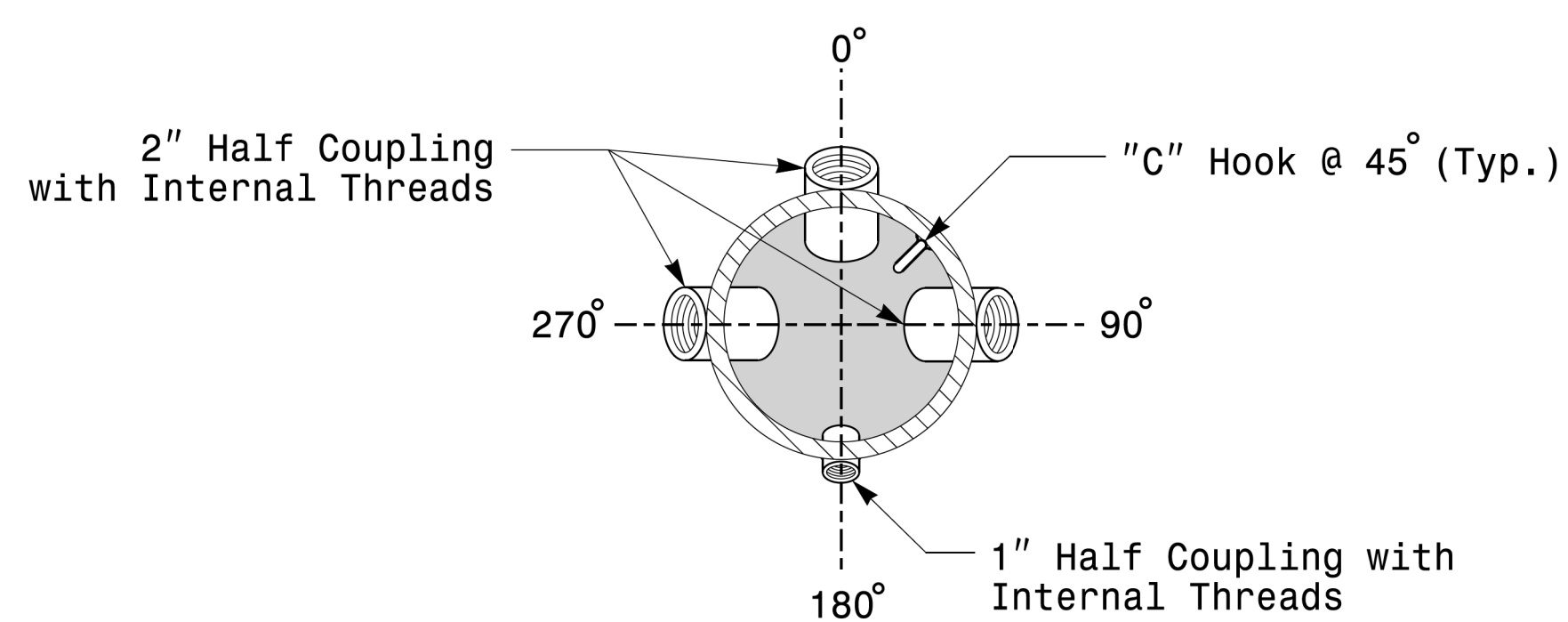
Note:  
 1. Opening in pole base plate shall be equal to pole base inside diameter minus 3 1/2" but shall not be less than 8 1/2".



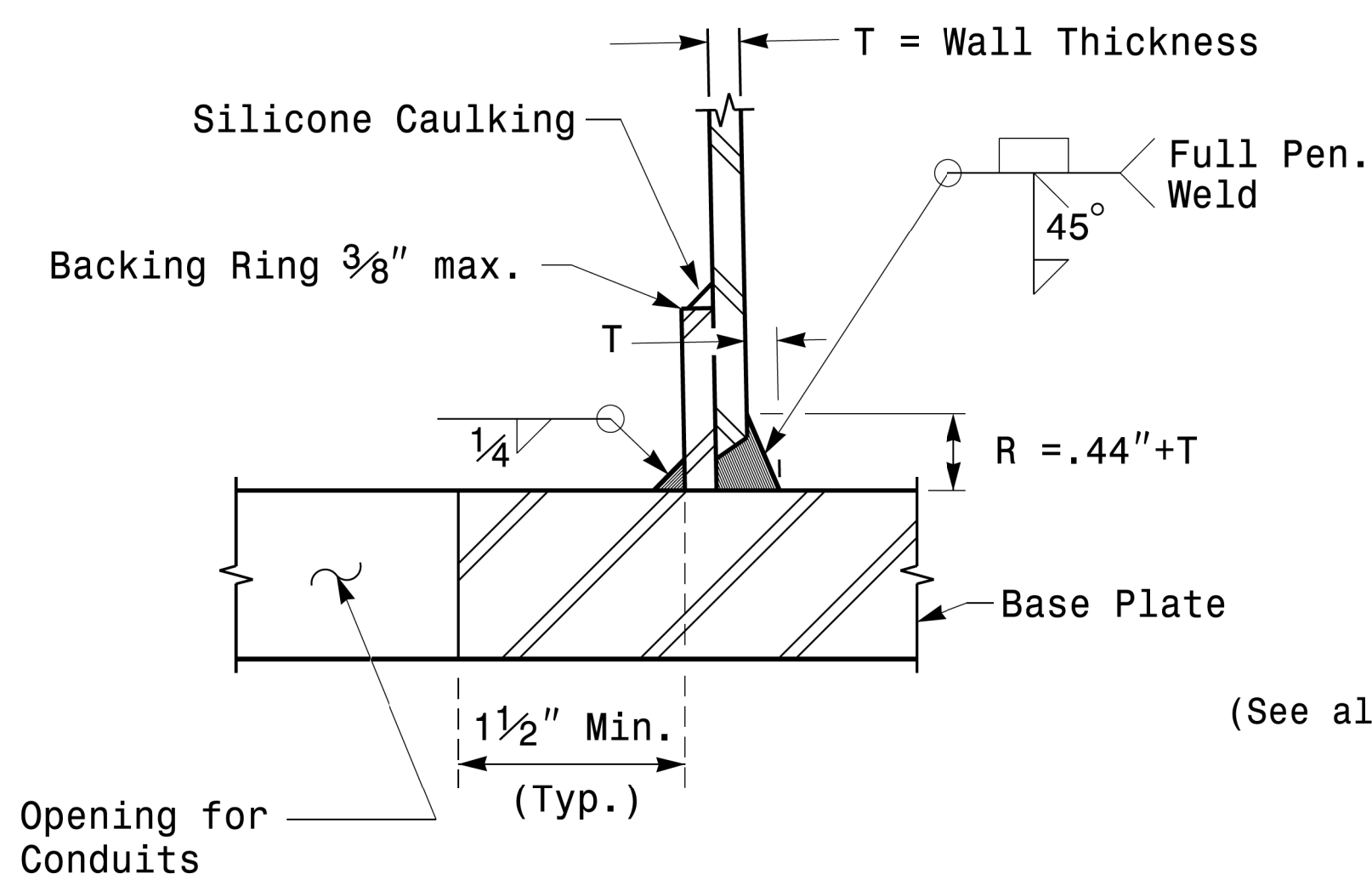
Cable Entrances at Top of Pole



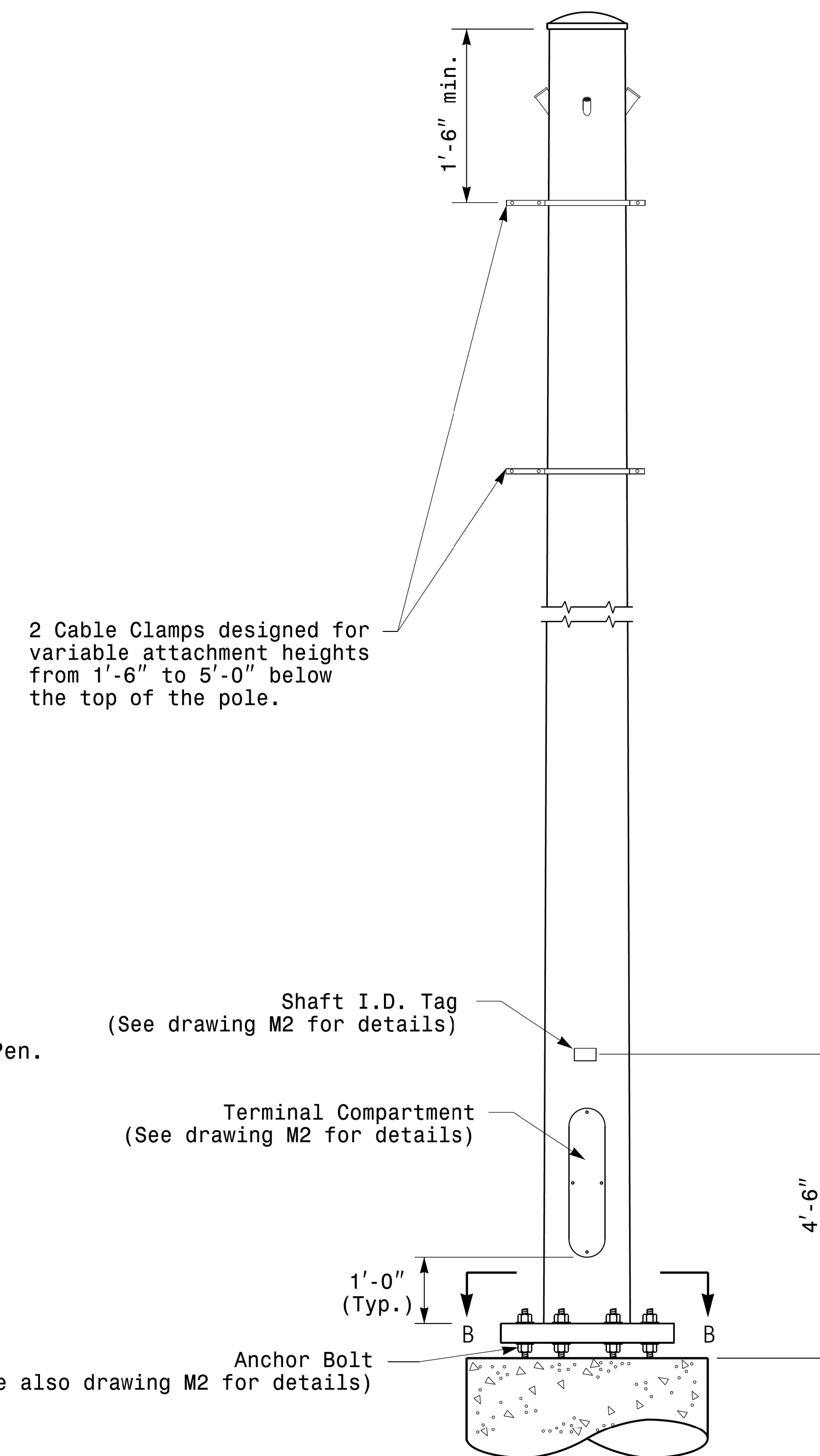
Section B-B Pole Base Plate Details (8 and 12 Bolt Pattern)



Section A-A Radial Orientation for Factory Installed Accessories at Top of Pole



Section C-C Full-Penetration Groove Weld Detail (Pole Attachment to Base Plate)



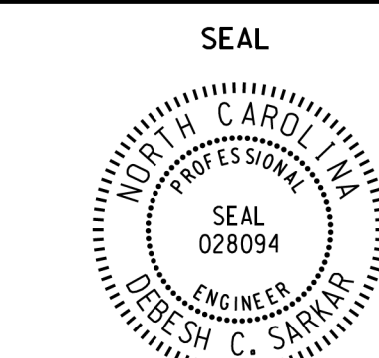
Monotube Strain Pole

11-001-2017\_08:25 S:\136304\13 Signal\sig1 Design Section\Eastern Region\Sheet\2016\2014 Sig.M3 Std. Fabrication Details-Strain Poles.dgn

Prepared in the Offices of:  
 Transportation Mobility and Safety Division  
 NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 Signal Design Section  
 750 N. Greenfield Play, Garner, NC 27529

Typical Fabrication Details For Strain Poles

PLAN DATE: OCTOBER 2017	DESIGNED BY: K.C. DURIGON
PREPARED BY: N. BITTING	REVIEWED BY: D.C. SARKAR
REVISIONS	INIT. DATE

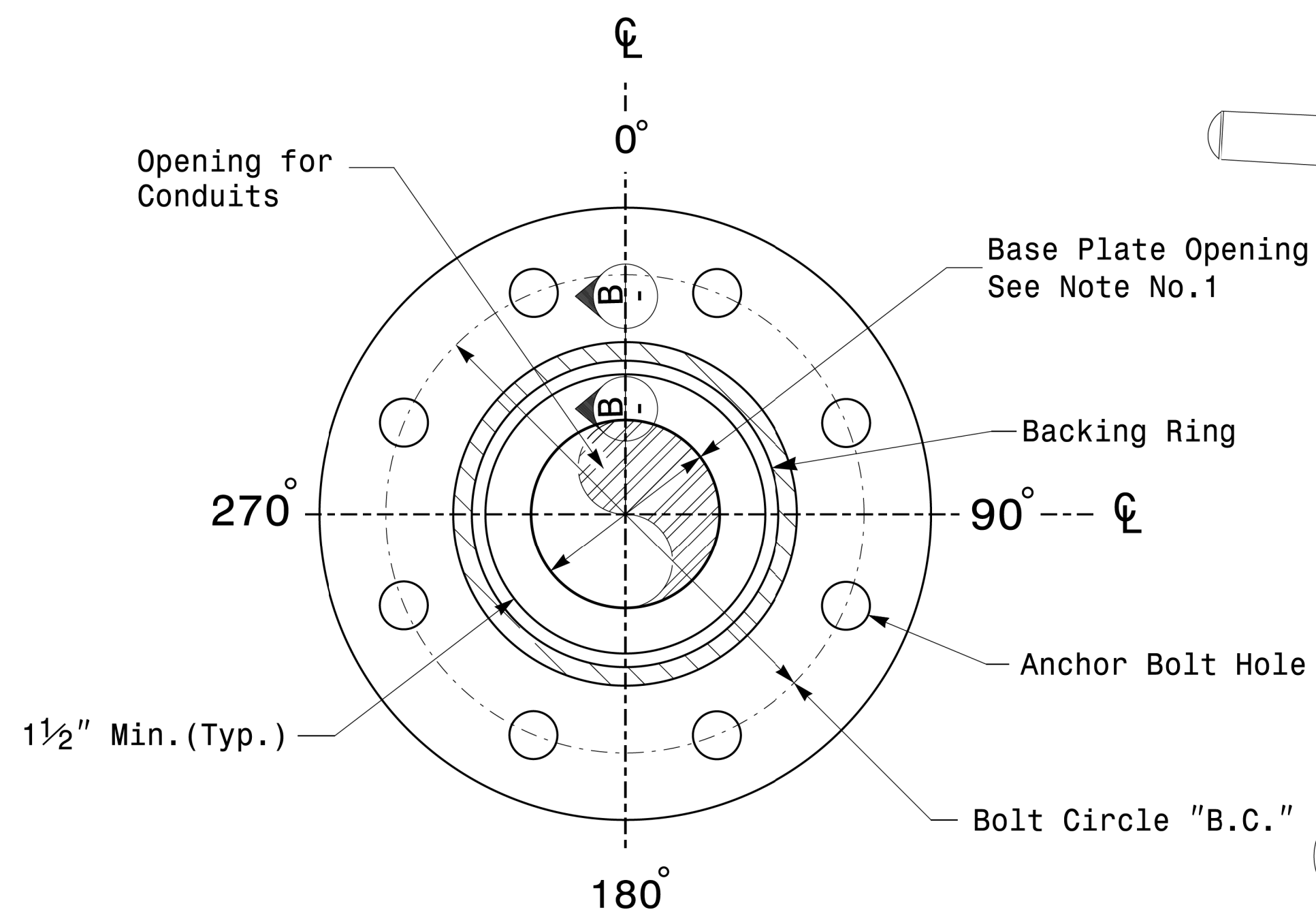


DocuSigned by: Debesh C. Sarkar

10/11/2017 DATE

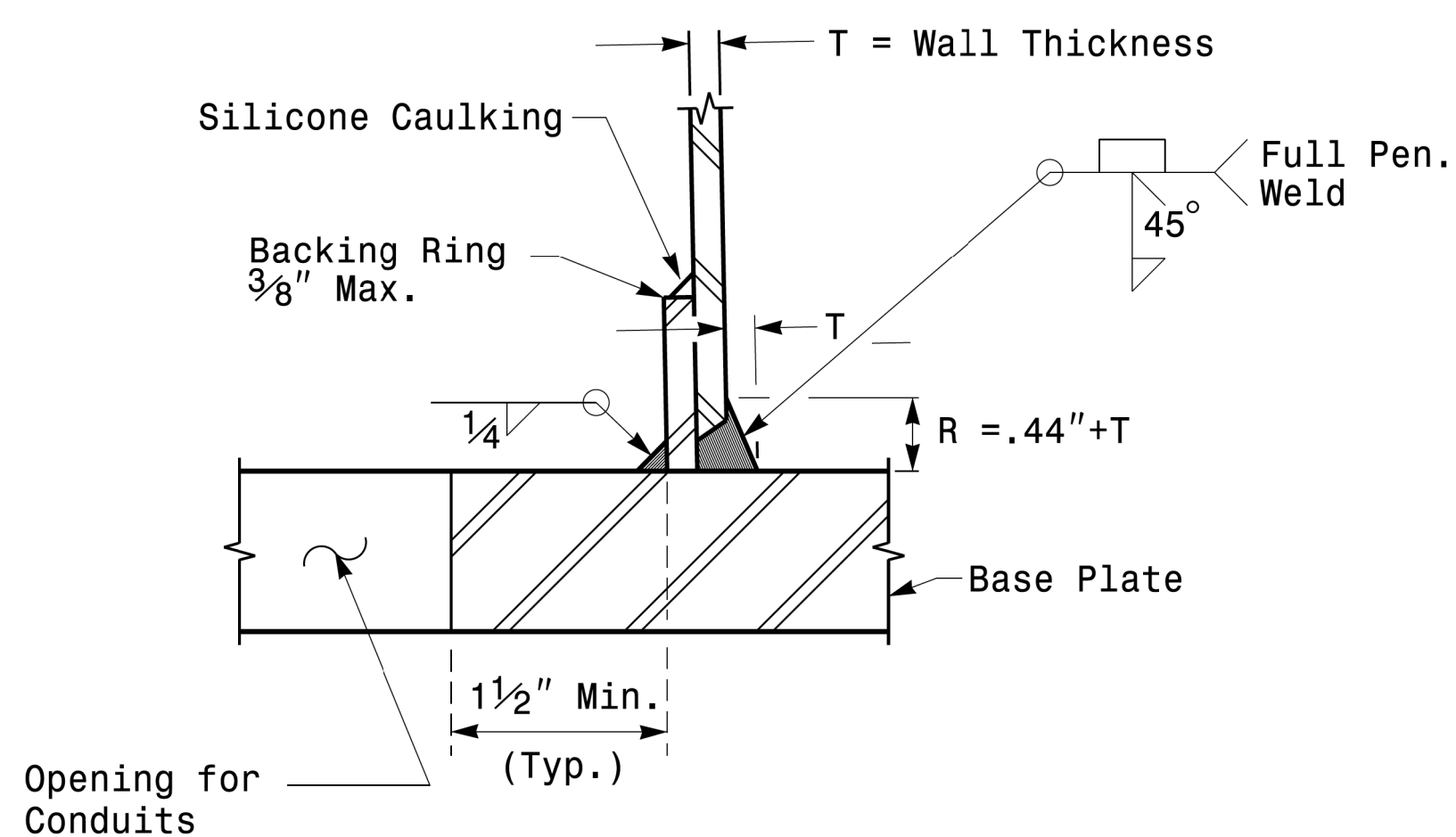
Fabrication Details - Strain Poles

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

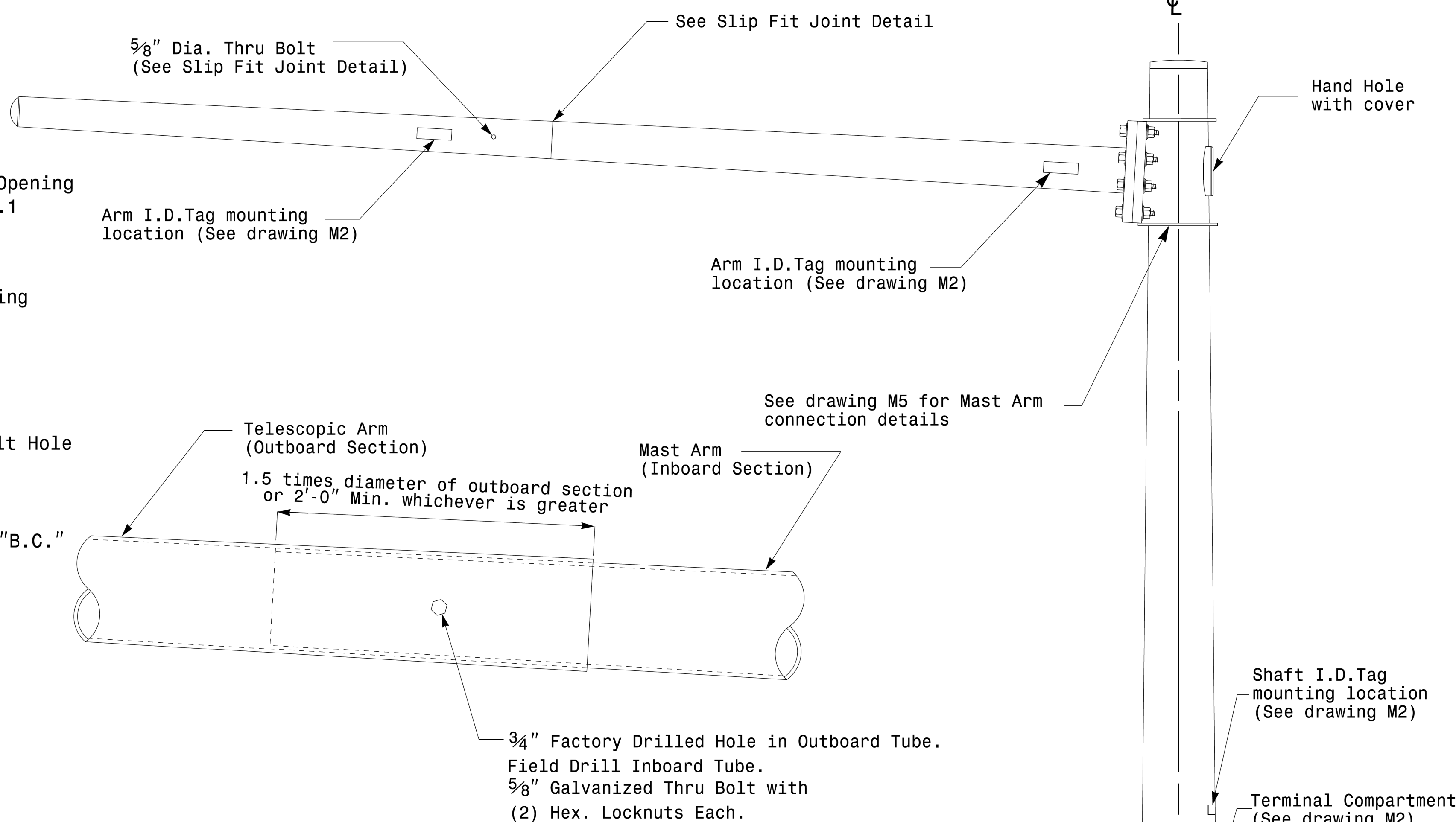
Pole Base Plate Details



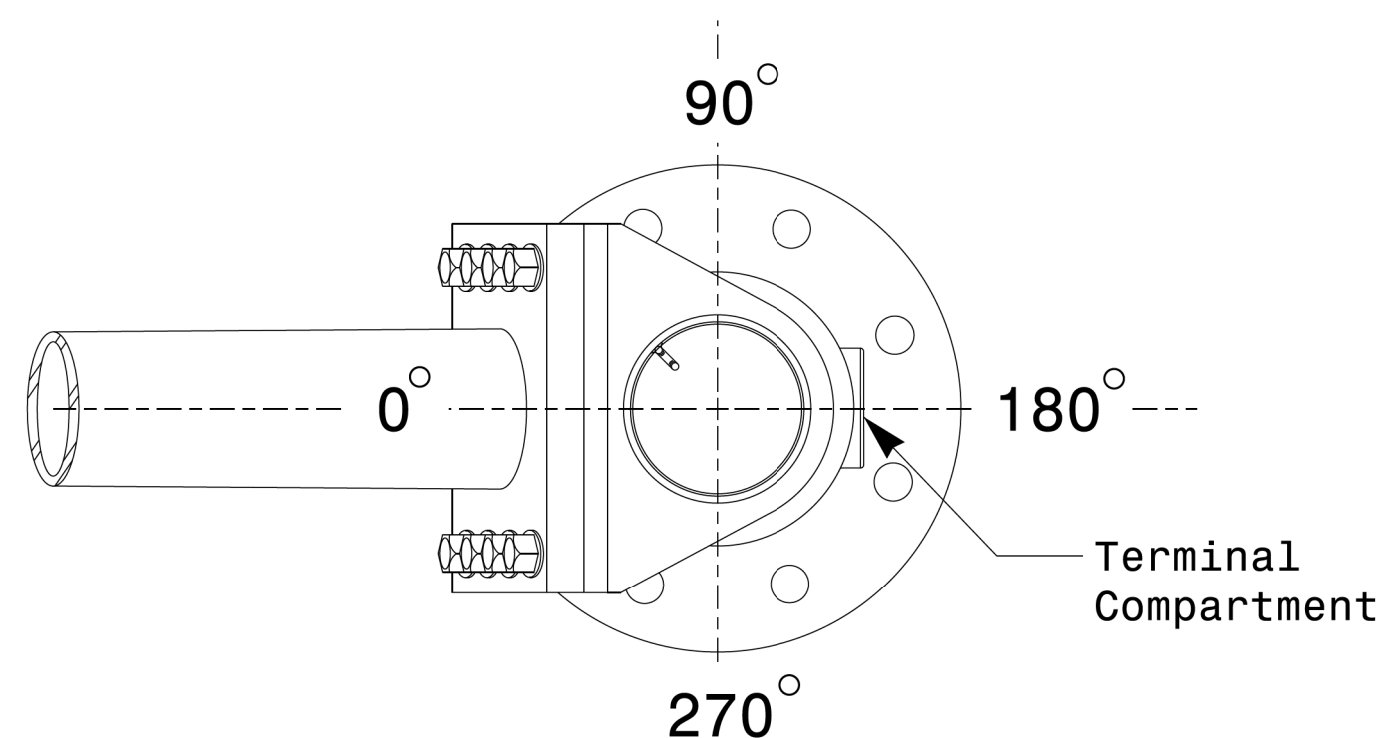
Section B-B

(Pole Attachment to Base Plate)

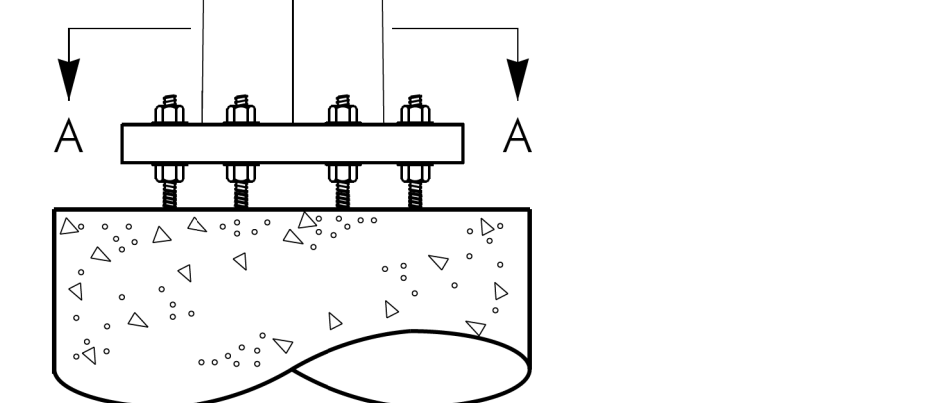
Full-Penetration Groove Weld Detail



Slip Fit Joint Detail for Mast Arm



Mast Arm Radial Orientation



Mast Arm Pole

<p>Prepared in the Offices of:</p> <p>750 N. Greenfield Pkwy, Garner, NC 27529</p>	<p>Typical Fabrication Details For Mast Arm Poles</p>		<p>SEAL</p> <p>Dinesh C. Sarkar</p>
	<p>PLAN DATE: OCTOBER 2017</p> <p>DESIGNED BY: K.C. DURIGON</p>	<p>REVIEWED BY: D.C. SARKAR</p>	
<p>SCALE: 0 NA NONE</p>	<p>PREPARED BY: N. BITTING</p>	<p>REVISIONS</p>	<p>INIT. DATE</p>
<p>DocuSigned by: Dinesh C. Sarkar</p>			<p>10/11/2017</p>

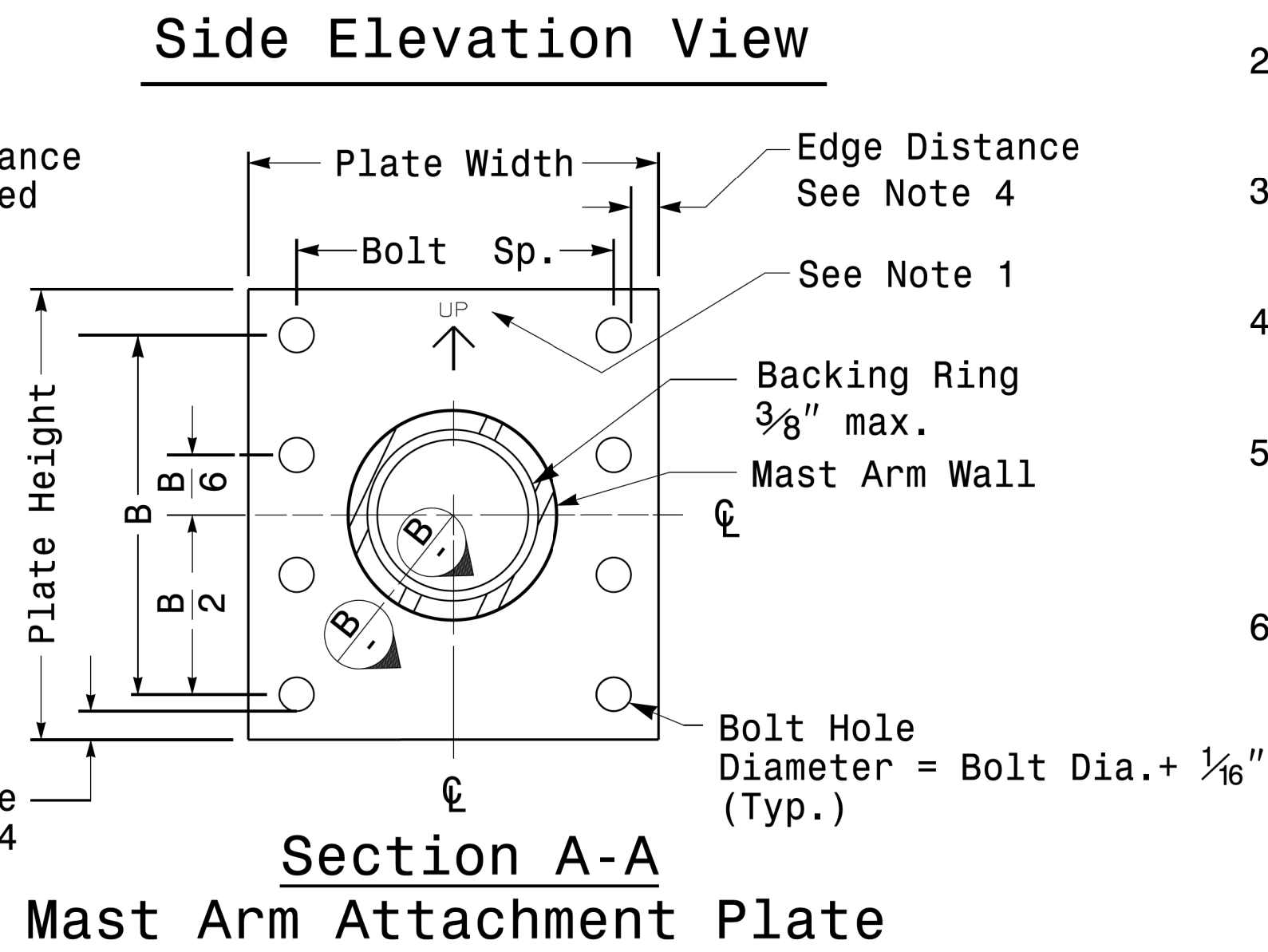
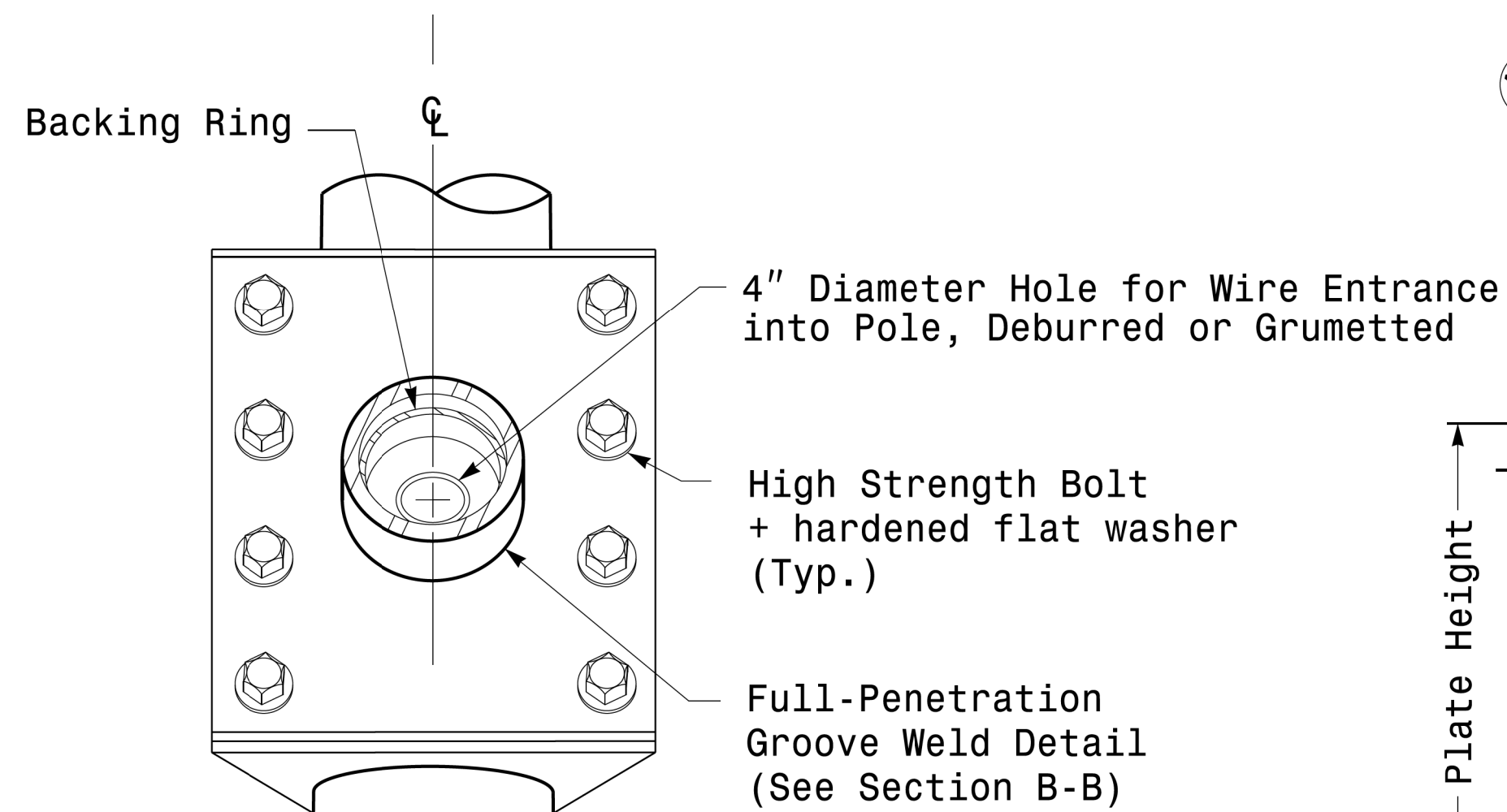
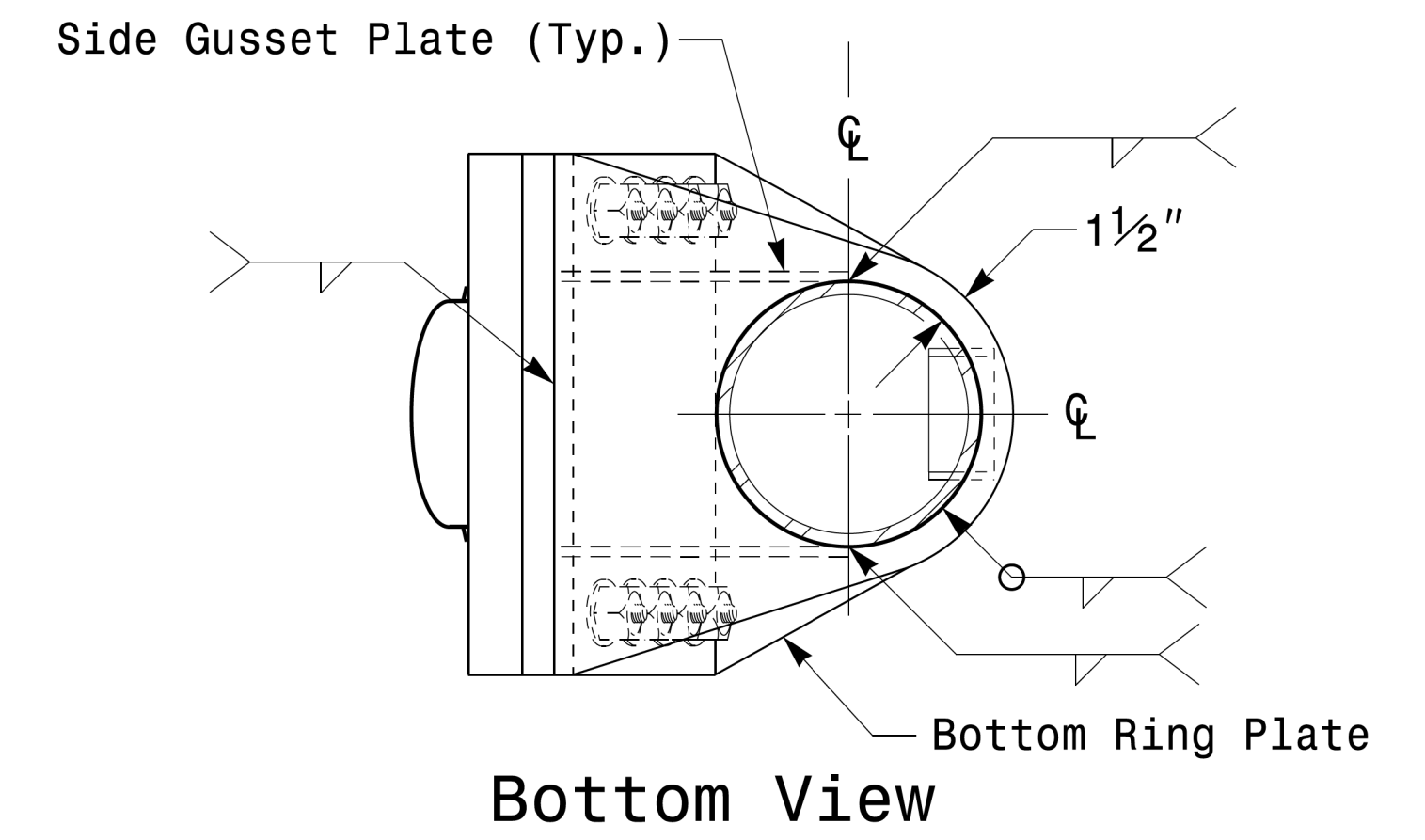
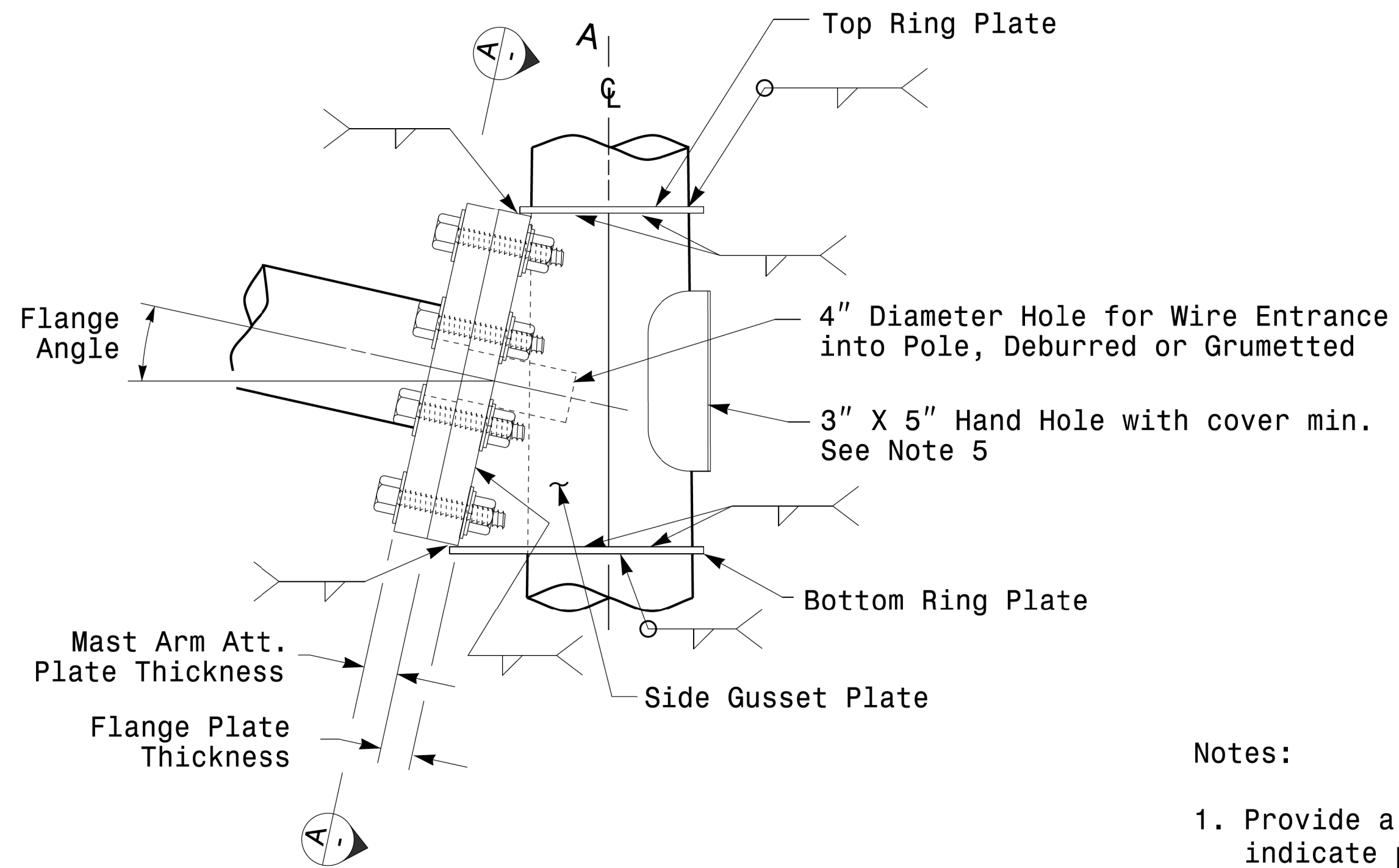
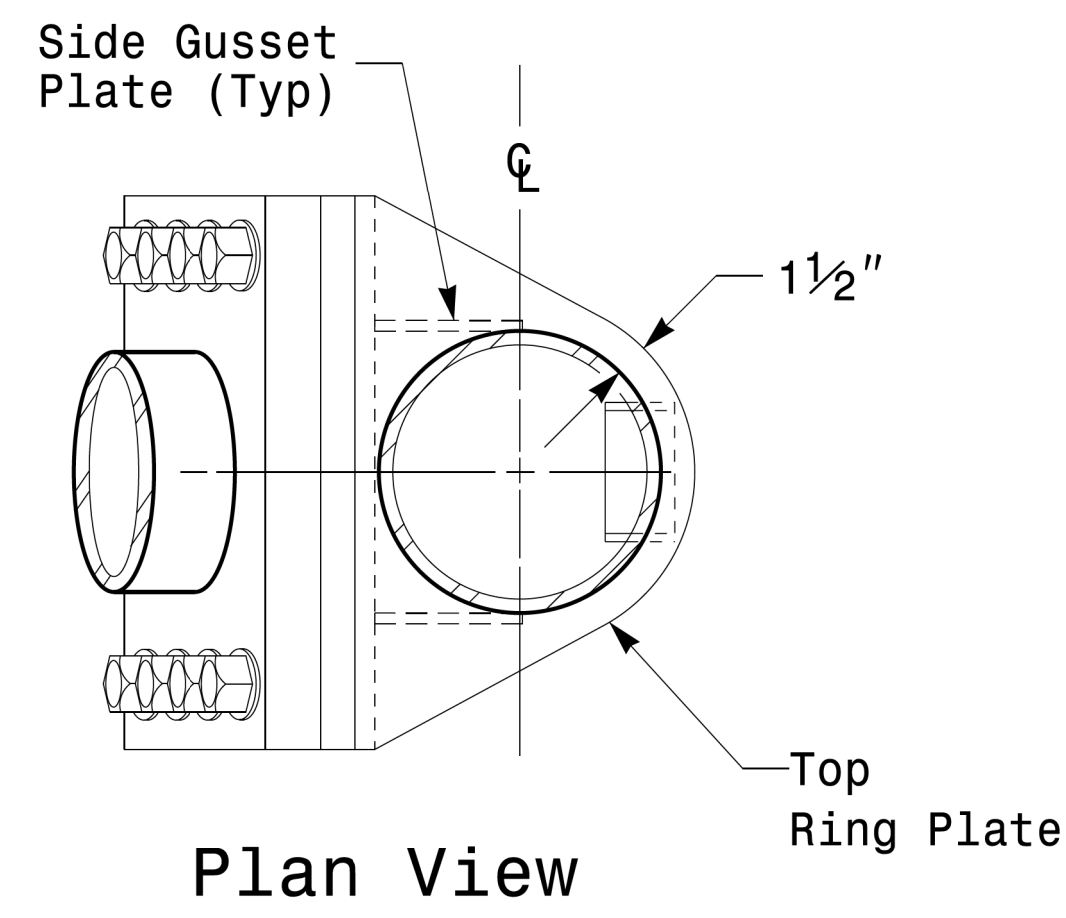
Fabrication Details - Mast Arm Poles

11-OCT-2017 08:33 51413625M415 Signal.s4s:gnr1 Design Section\FacStruct\Regional\Sheets\2016\2014 Sig.M4 Std. Fabrication Detail\Mast Arm Poles.dgn

# Welded Ring Stiffened Mast Arm Connection

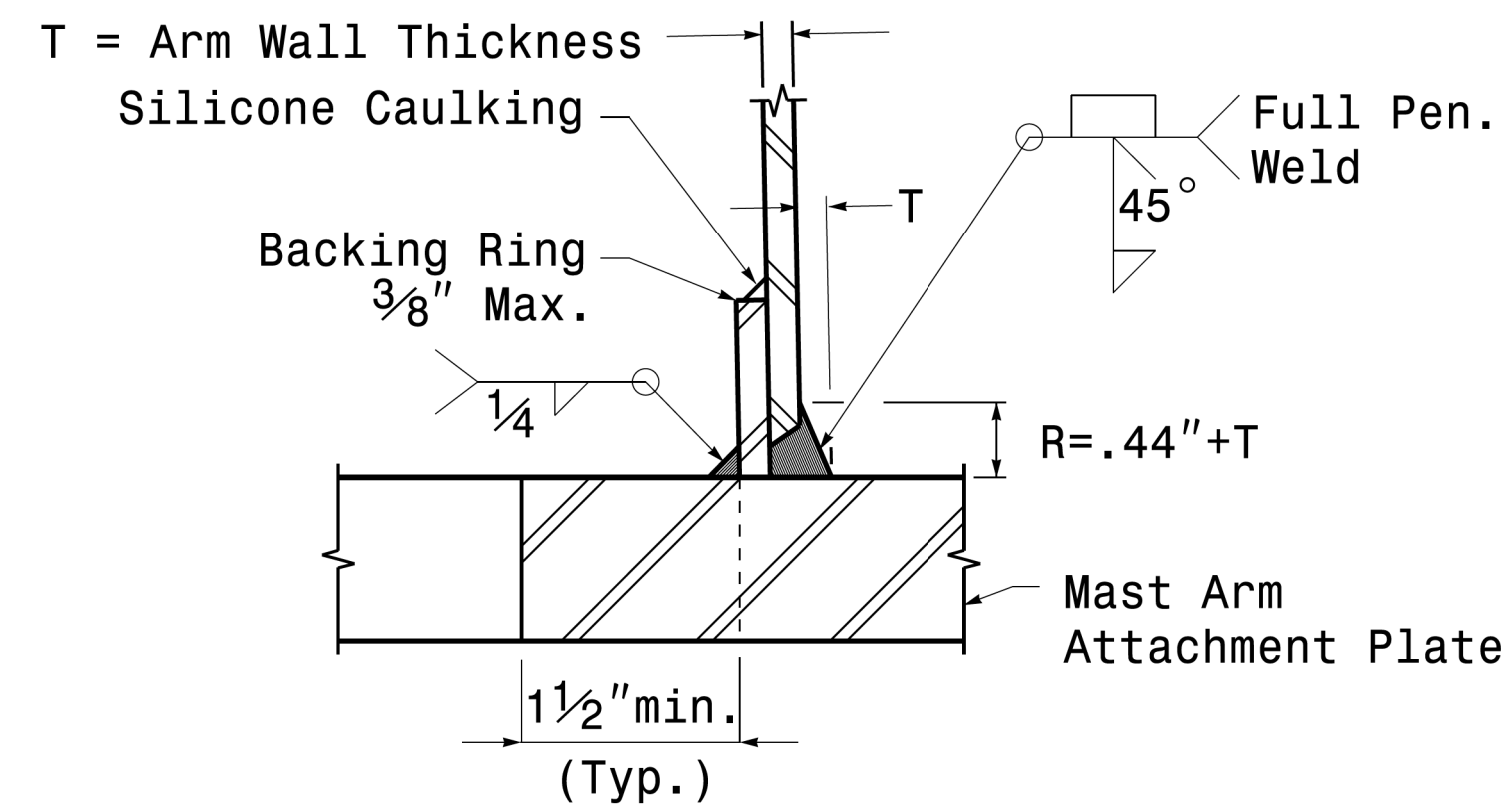
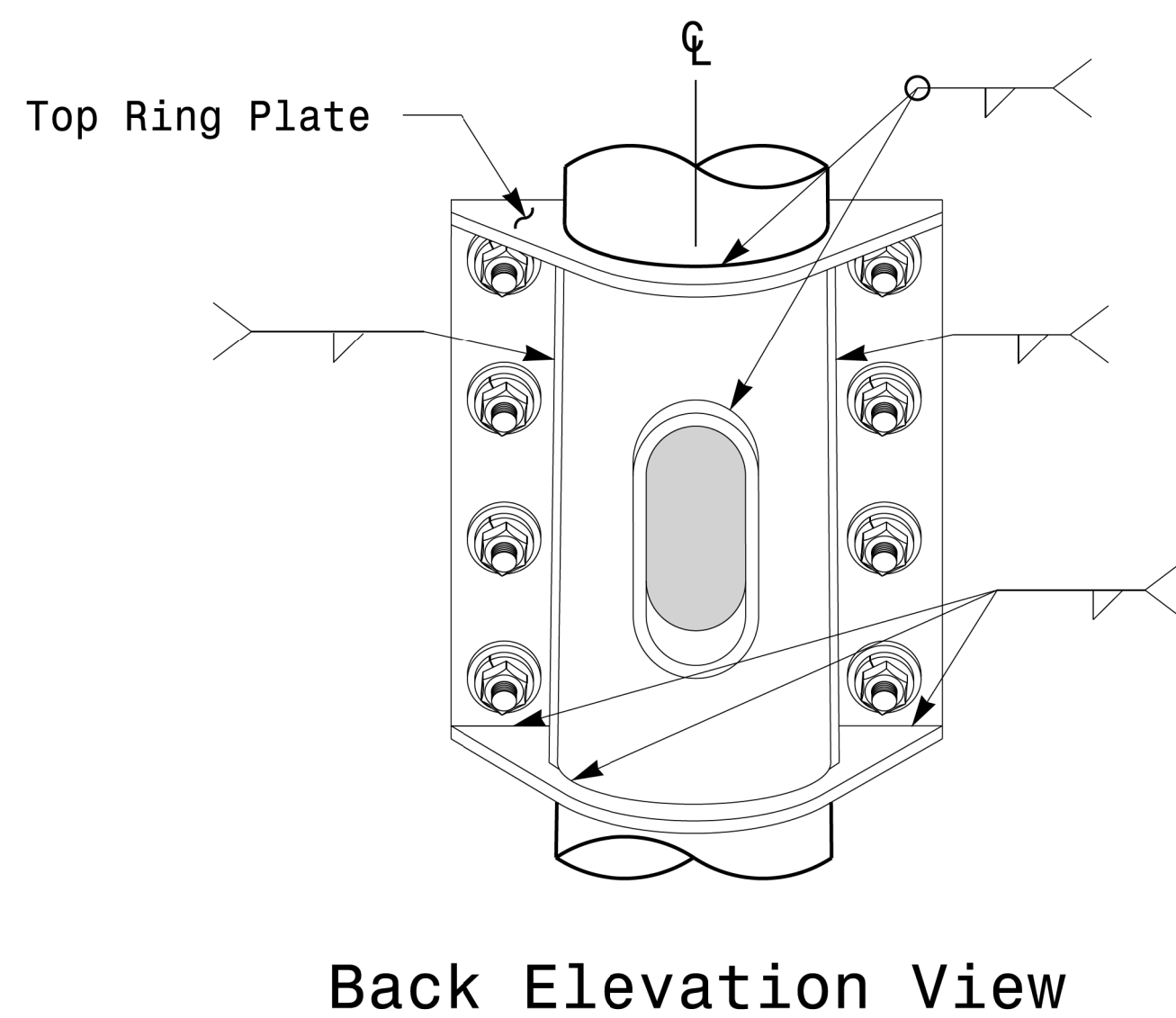
PROJECT ID. NO. SHEET NO.

R-5861 Sig.M5



**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 follow AISC Table J3.4 and J3.5. For nominal bolt hole size use Table J3.3.
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.



Prepared in the Offices of:  
  
 750 N. Greenfield Pkwy, Garner, NC 27529

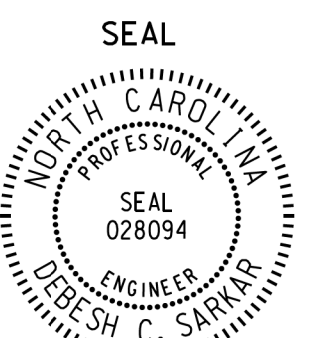
**Typical Fabrication Details  
For  
Mast Arm Connection To Pole**

PLAN DATE: OCTOBER 2017 DESIGNED BY: C.F. ANDREWS  
 PREPARED BY: N. BITTING REVIEWED BY: D.C. SARKAR

750 N. Greenfield Pkwy, Garner, NC 27529

REVISIONS INIT. DATE

SCALE 0 NA NONE

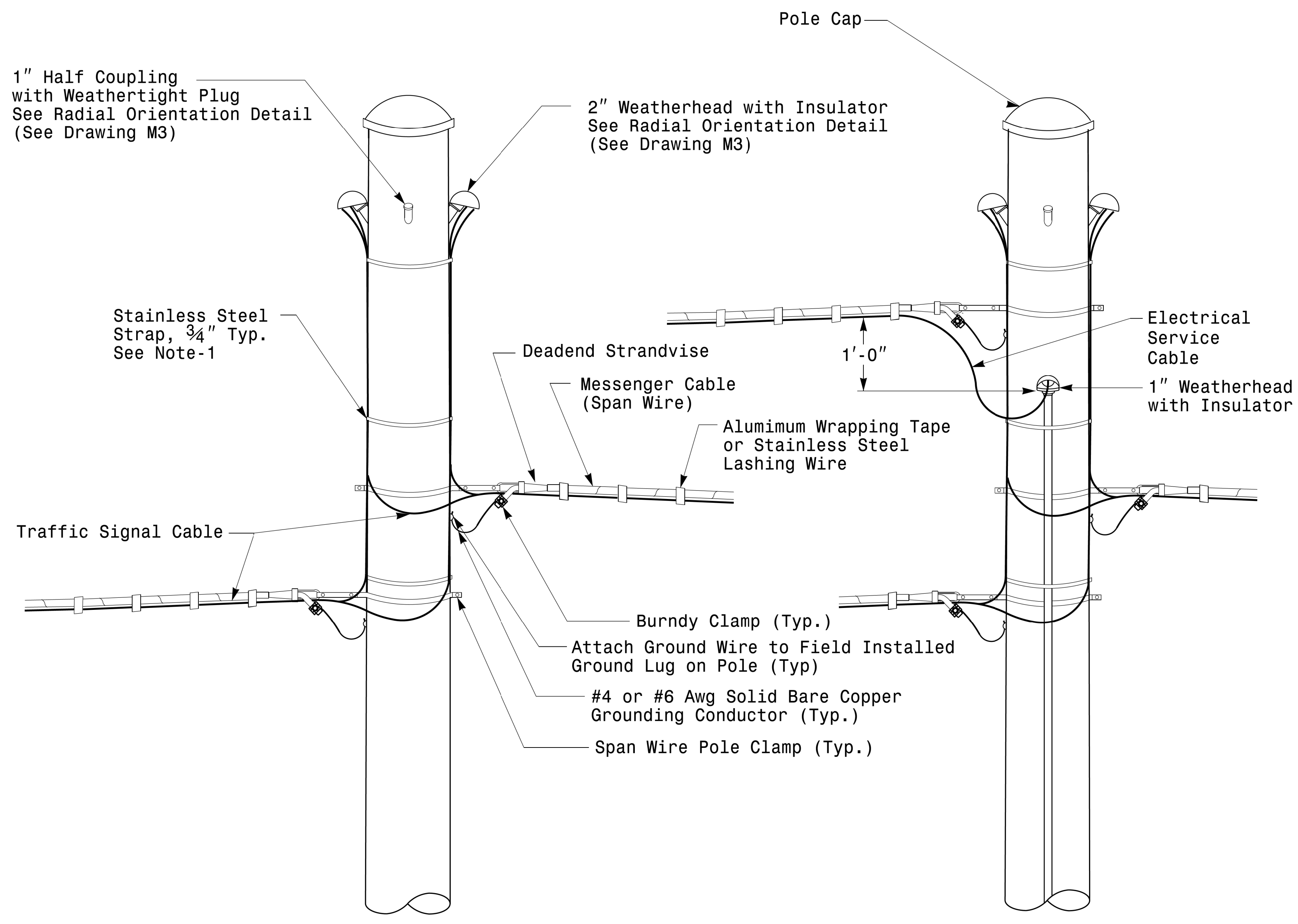


DocuSigned by:  
  
 D. C. SARKAR

10/11/2017  
 DATE

**Fabrication Details – Mast Arm Connection**

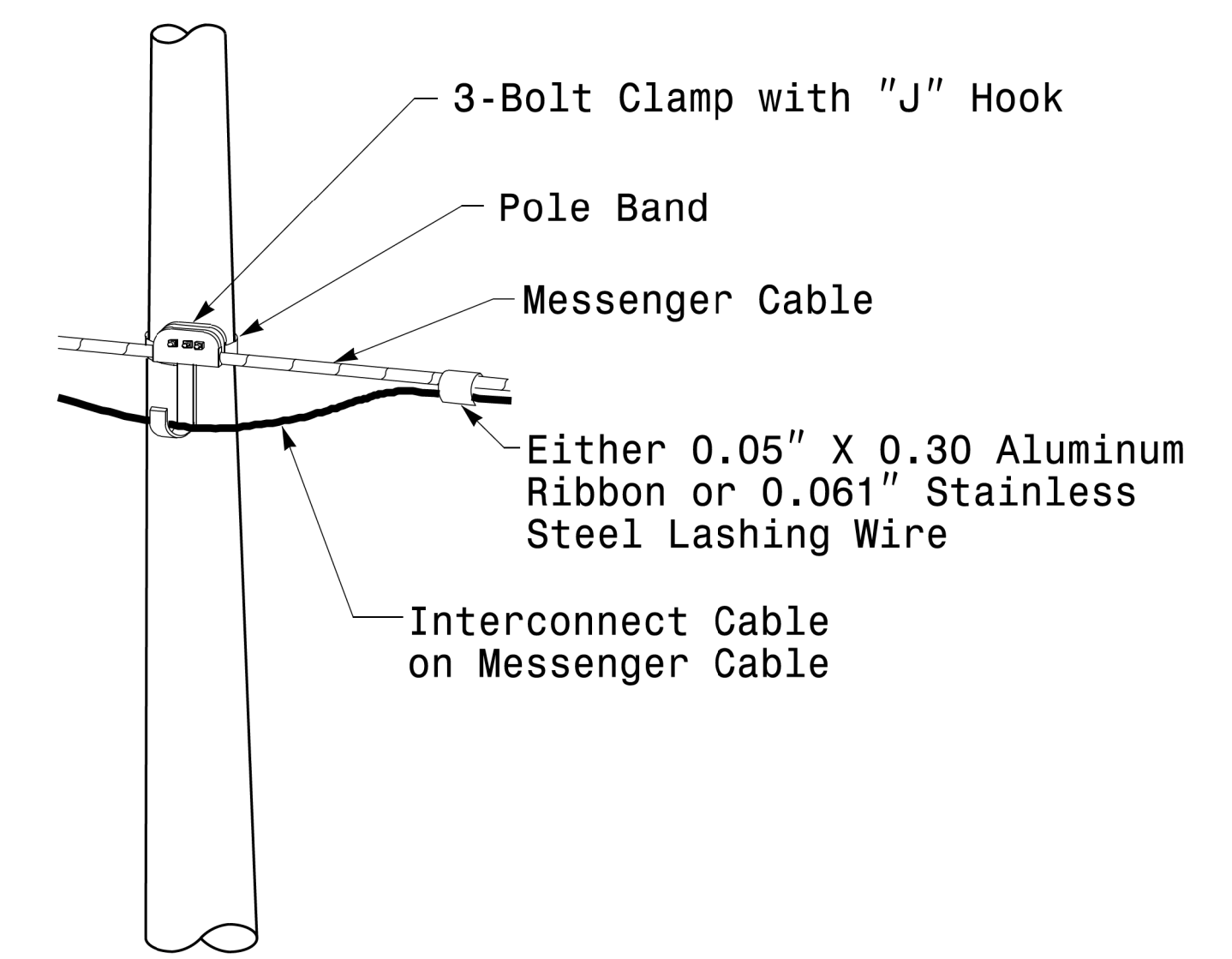
11-001-2017\_08:35  
 S:\Projects\1715\SigM5.dgn Design Section\Eastern Region\Sheet\Sheets\2016\2014\_Sig\_M5\_Std\_Connection\_Fabrication\_Detail\15-Mast\_Arm\_Pole.dgn  
 User: dca



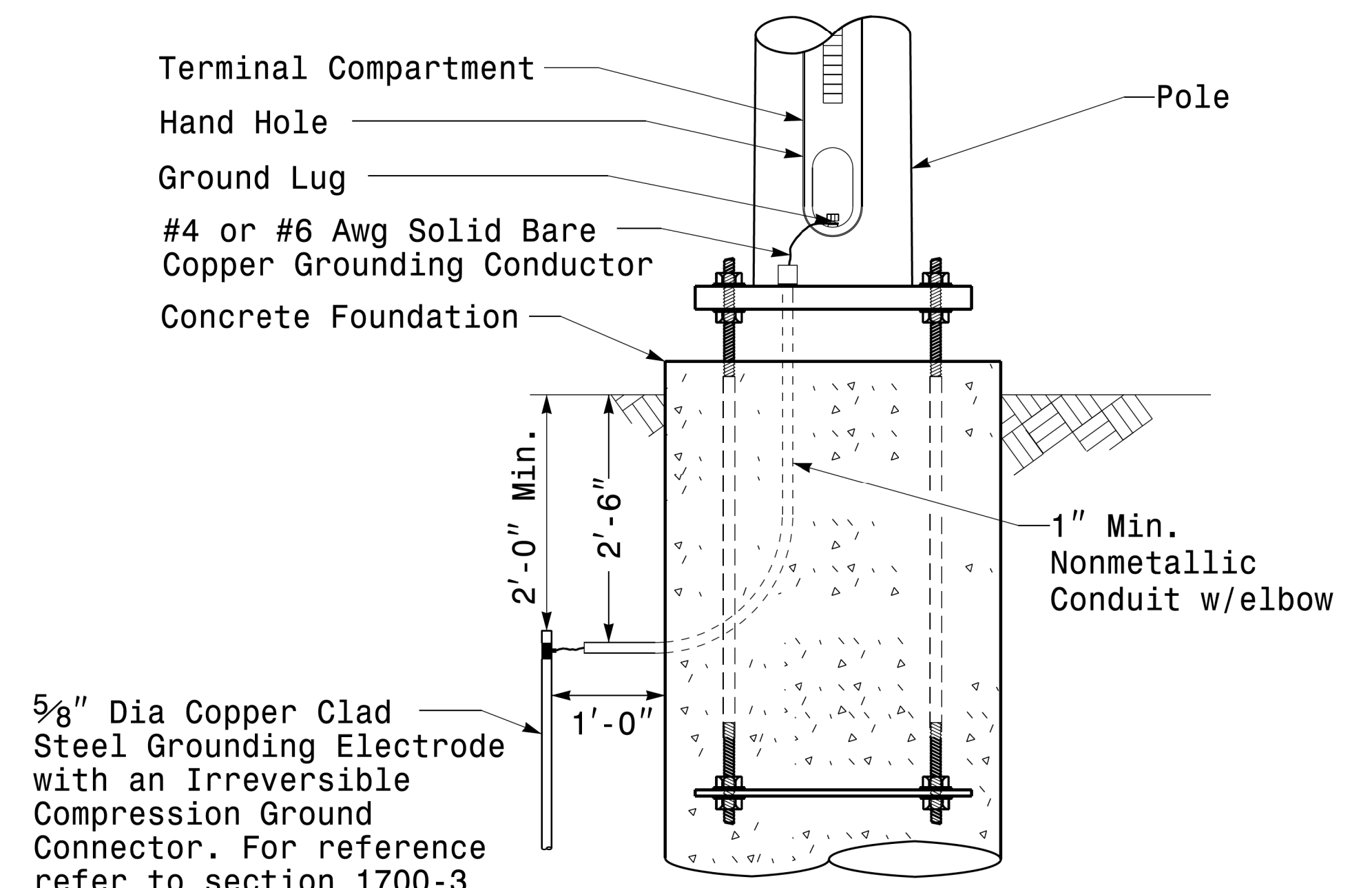
**Strain Pole Attachments**

**NOTE:**

1. Strap all signal cables to the side of the pole with 3/4" stainless steel straps when the distance between the spanwire attachment clamp and the weatherheads exceeds 3'-0".
2. Provide minimum two spanwire pole clamps per pole.
3. It is prohibited to attach two span wires at one pole clamp.
4. For general requirements refer to NCDOT Standard Specifications for Roadway and Structures, January 2018.



**Attachment of Cable to Intermediate Metal Pole**



5/8" Dia Copper Clad Steel Grounding Electrode with an Irreversible Compression Ground Connector. For reference refer to section 1700-3 K and L for electrical grounding and bonding requirements, See Note 4.

**Metal Pole Grounding Detail For Strain Pole and Mast Arm**

	<p>Typical Fabrication Details For Strain Pole Attachments</p>		<p>SEAL</p>	
	<p>PLAN DATE: OCTOBER 2017</p>	<p>DESIGNED BY: C.F. ANDREWS</p>		<p>REVISIONS</p>
	<p>PREPARED BY: N. BITTING</p>	<p>REVIEWED BY: D.C. SARKAR</p>		<p>INIT. DATE</p>
<p>750 N. Greenfield Pkwy, Garner, NC 27529</p> <p>SCALE: 0 NA NONE</p>	<p>DocuSigned by: D. Sarkar</p>	<p>10/11/2017</p>	<p>DATE</p>	

11-OCT-2017 08:36 S:\13563\MTS Signal\sig Design Section\Facsimile Sheets\2016\2014 Sig.M6 Std. Fabrication Details-Strain Poles.dgn



# 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.)
WIND ZONE 1	LIGHT	S26L3	26	25	2	11	270	19	13	10	8	17	14.5	12.5	8	12	4	12
		S30L3	30	25	2	11	300	19.5	13.5	10	8	17.5	15	13	8	14	4	12
		S35L3	35	25	3	11	320	20	13.5	10.5	8	17.5	15	13	8	14	4	12
	HEAVY	S30H3	30	29	3	16	450	24.5	16	12	9	21	17.5	15	8	16	4	6
		S35H3	35	29	4	16	515	26	17	12.5	9.5	22	18.5	16	8	16	4	6
WIND ZONE 2	LIGHT	S26L2	26	23	2	10	245	18	12.5	9.5	8	16.5	14	12	8	12	4	12
		S30L2	30	23	2	10	270	18.5	12.5	10	8	16.5	14	12.5	8	12	4	12
		S35L2	35	23	3	10	300	19.5	13	10	8	17	14.5	13	8	12	4	12
	HEAVY	S30H2	30	29	3	15	415	23	15.5	11.5	9	20	17	14.5	8	16	4	6
		S35H2	35	29	4	15	475	25	16.5	12	9.5	21	17.5	15.5	8	16	4	6
WIND ZONE 3	LIGHT	S26L2	26	23	2	10	245	18	12.5	9.5	8	16.5	14	12	8	12	4	12
		S30L2	30	23	2	10	270	18.5	12.5	10	8	16.5	14	12.5	8	12	4	12
		S35L2	35	23	3	10	300	19.5	13	10	8	17	14.5	13	8	12	4	12
	HEAVY	S30H2	30	29	3	15	415	23	15.5	11.5	9	20	17	14.5	8	16	4	6
		S35H2	35	29	4	15	475	25	16.5	12	9.5	21	17.5	15.5	8	16	4	6
WIND ZONE 4	LIGHT	S26L1	26	22	2	8	190	16	11.5	8.5	8	15	12.5	11	8	12	4	12
		S30L1	30	22	2	8	205	16.5	11.5	9	8	15	13	11.5	8	12	4	12
		S35L1	35	22	3	8	230	17	12	9	8	15.5	13.5	11.5	8	12	4	12
	HEAVY	S30H1	30	25	3	12	320	20.5	13.5	10.5	8	18	15	13.5	8	16	4	6
		S35H1	35	25	4	12	350	21	14	10.5	8.5	18.5	15.5	13.5	8	16	4	6
WIND ZONE 5	LIGHT	S26L2	26	23	2	10	245	18	12.5	9.5	8	16.5	14	12	8	12	4	12
		S30L2	30	23	2	10	270	18.5	12.5	10	8	16.5	14	12.5	8	12	4	12
		S35L2	35	23	3	10	300	19.5	13	10	8	17	14.5	13	8	12	4	12
	HEAVY	S30H2	30	29	3	15	415	23	15.5	11.5	9	20	17	14.5	8	16	4	6
		S35H2	35	29	4	15	475	25	16.5	12	9.5	21	17.5	15.5	8	16	4	6

**General Notes:**

1. Values shown in the "Reactions at the Pole Base" column represent the minimum acceptable capacity allowed for design using a design CSR of 1.00.
2. Use chairs and spacers to maintain proper clearance.
3. For foundation, always use air-entrain concrete mix.



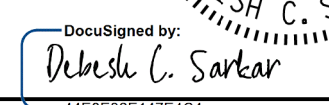
**Foundation Selection:**

1. Perform a standard penetration test at each proposed foundation site to determine "N" value.
2. Select the appropriate wind zone from M 1 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 for Reference Drilled Shafts.

**Standard Strain Pole Foundation-All Soil Condition**

11-05-2017 08:40 S:\IT\AS\15 Signal\Design\Design Section\Eastern Region\MM Sheets\2016\2014 Sig.M8 Std. Strain Pole Found.-Structured Soil Condition.dgn rnz/insr

48" Dia. Foundations Concrete Volume (cubic yards) = (0.465) x Drilled Pier Length

	<p><b>Standard Strain Pole Foundation for All Soil Conditions</b></p> <p>PLAN DATE: OCTOBER 2017    DESIGNED BY: C.B. COGDELL                  PREPARED BY: N. BITTING    REVIEWED BY: D.C. SARKAR</p>													
SCALE: 0 NA NONE	REVISIONS: <table border="1" style="font-size: small;"> <tr> <th>NO.</th> <th>DATE</th> <th>INIT.</th> <th>DATE</th> </tr> <tr> <td>1</td> <td>7/12/2015</td> <td>N.B.</td> <td></td> </tr> <tr> <td colspan="4">Changed "Foundation Depth" to "Drilled Pier Length" in Conc. Egn.</td> </tr> </table>	NO.	DATE	INIT.	DATE	1	7/12/2015	N.B.		Changed "Foundation Depth" to "Drilled Pier Length" in Conc. Egn.				Digitally Signed by:  DATE: 10/11/2017
NO.	DATE	INIT.	DATE											
1	7/12/2015	N.B.												
Changed "Foundation Depth" to "Drilled Pier Length" in Conc. Egn.														