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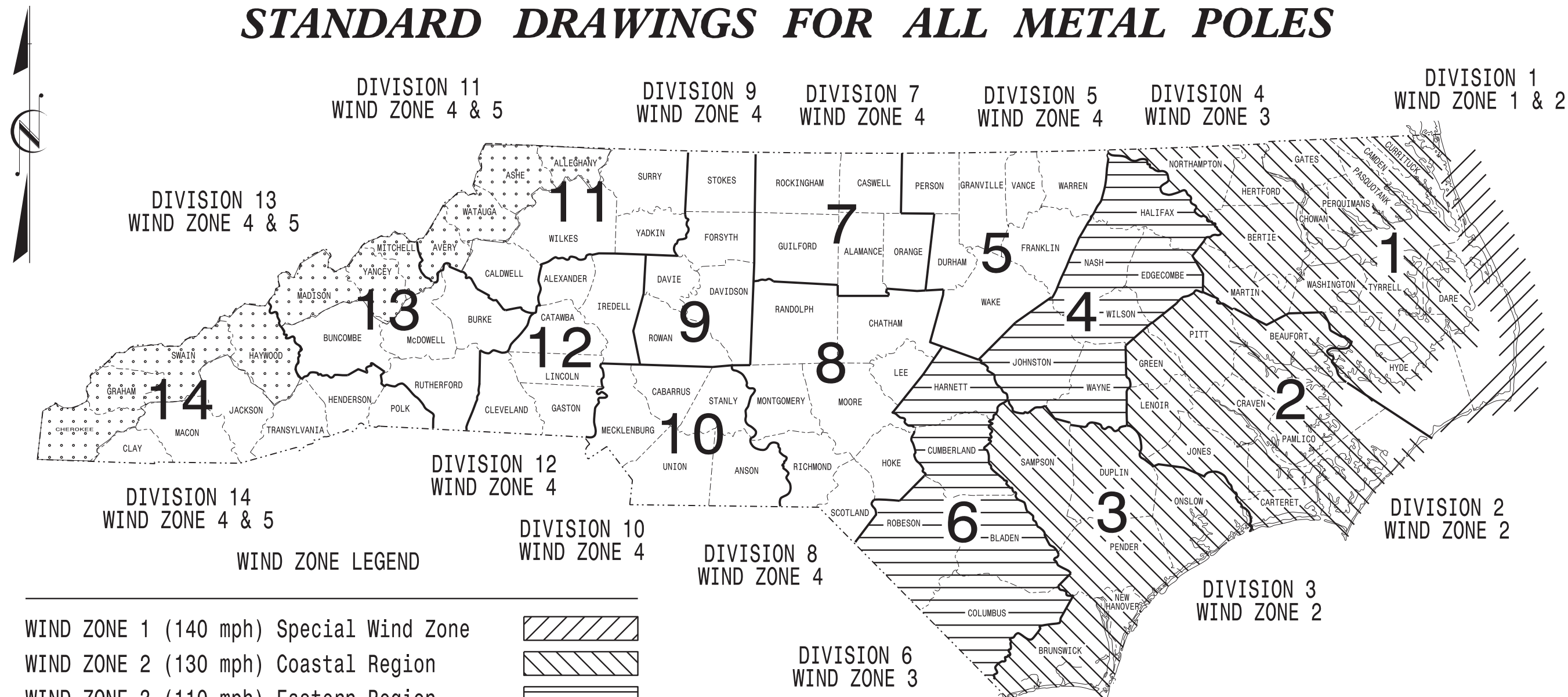
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STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

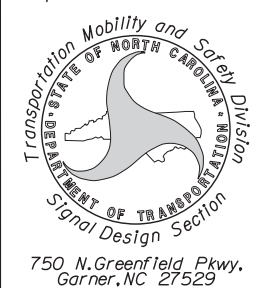
PROJECT I.D. NO. U-5169	SHEET NO. Sig.M1
----------------------------	---------------------

STANDARD DRAWINGS FOR ALL METAL POLES



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

Prepared in the Offices of:



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:

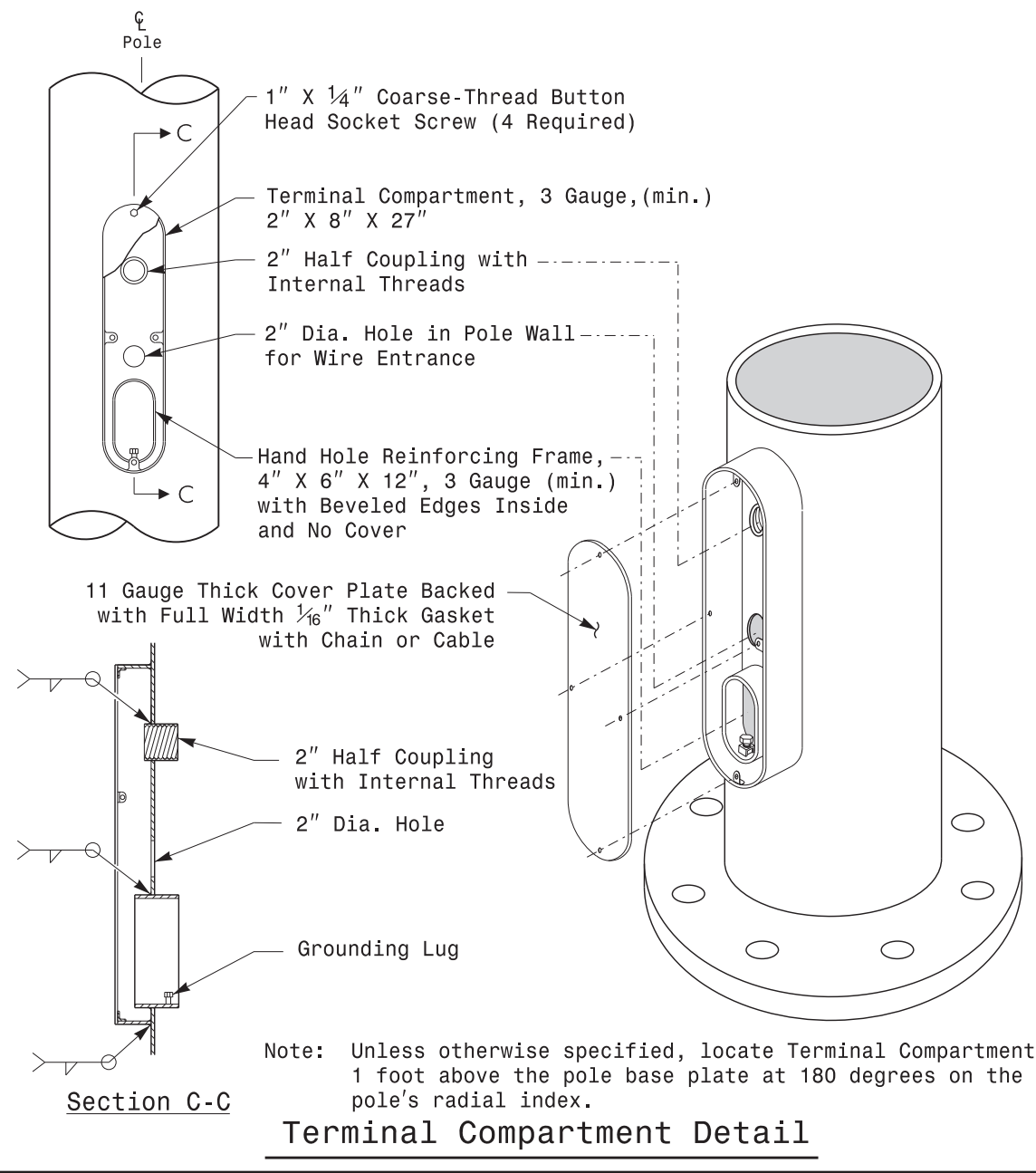
MOBILITY AND SAFETY DIVISION - ITS AND SIGNALS UNIT

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





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. _____

MFG _____ MFG. DATE:MM/YY

SECTION D/T/L/Y _____

NCDOT SIG. INV. NO. _____

NCDOT POLE NO. _____

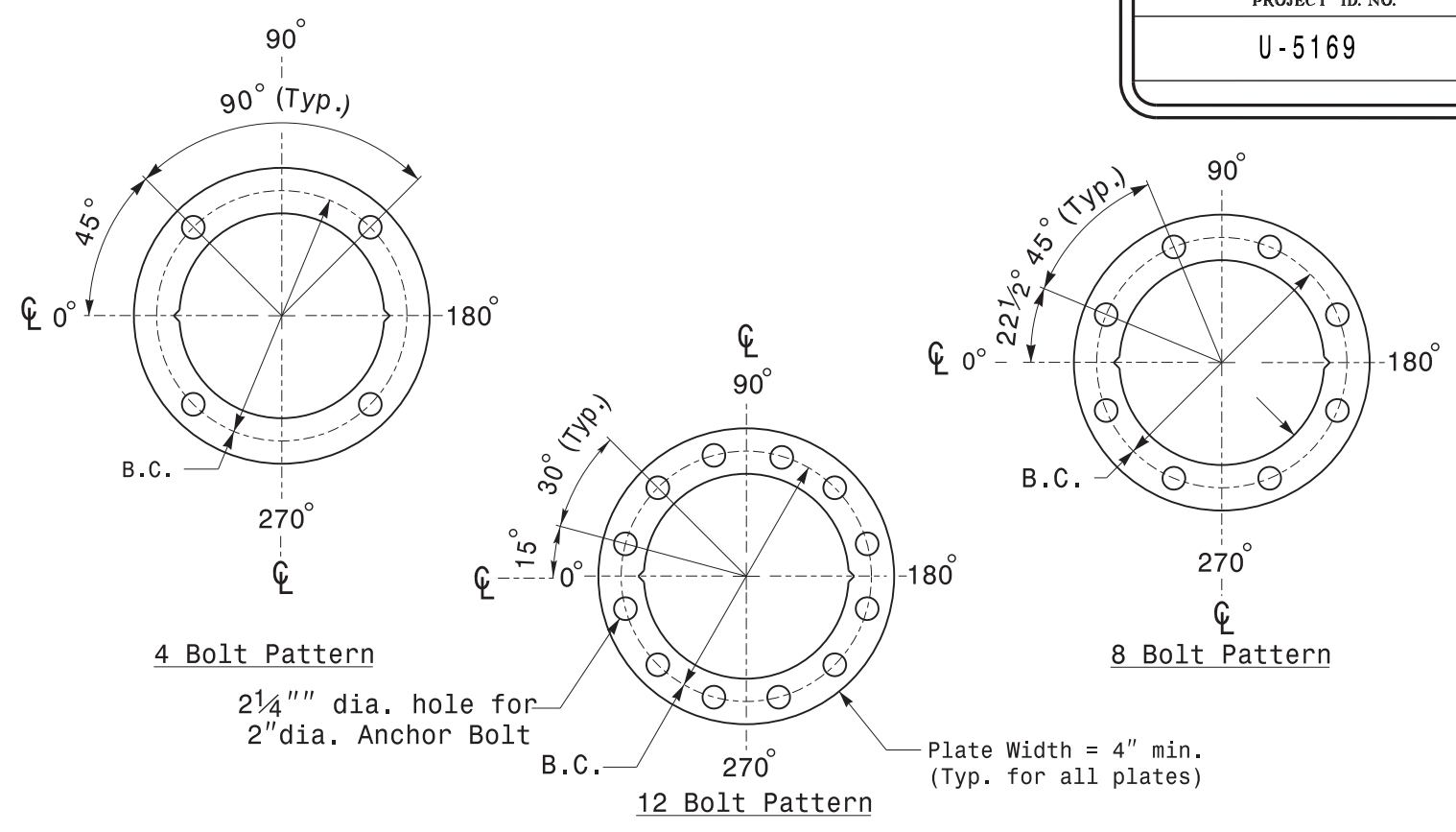
Arm I.D. Tag
(Provide on each section of a multi-section mast arm.)

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

Notes:

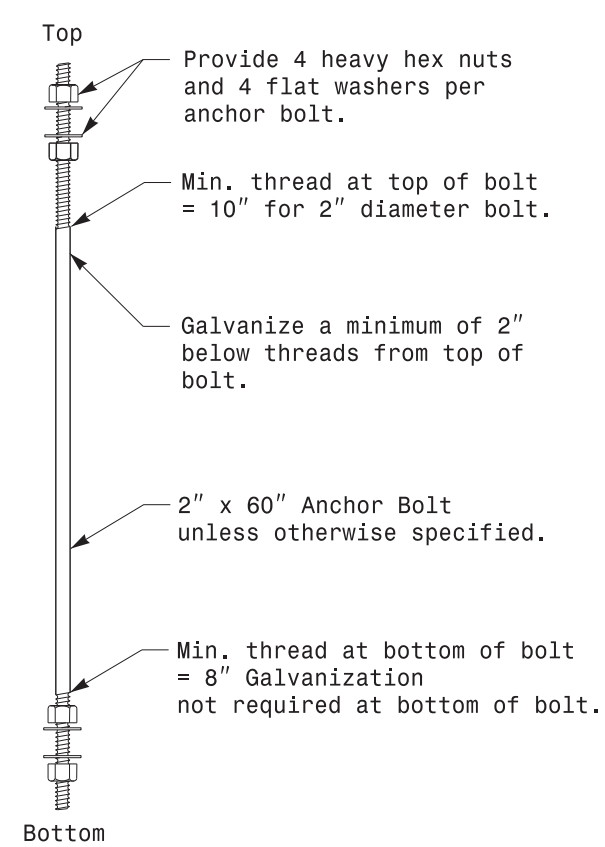
- 1) D= Diameter, T= Thickness, L= Length, Y= Yield Strength
- 2) A.B. = Anchor Bolt
- 3) B.C. = Bolt Circle of Anchor Bolts
- 4) If Custom Design, use "NCDOT STANDARD" line for Signal Inv. Number and pole I.D. number
- 5) See drawing M3 and M4 for mounting positions of I.D. tags.

Identification Tag Details

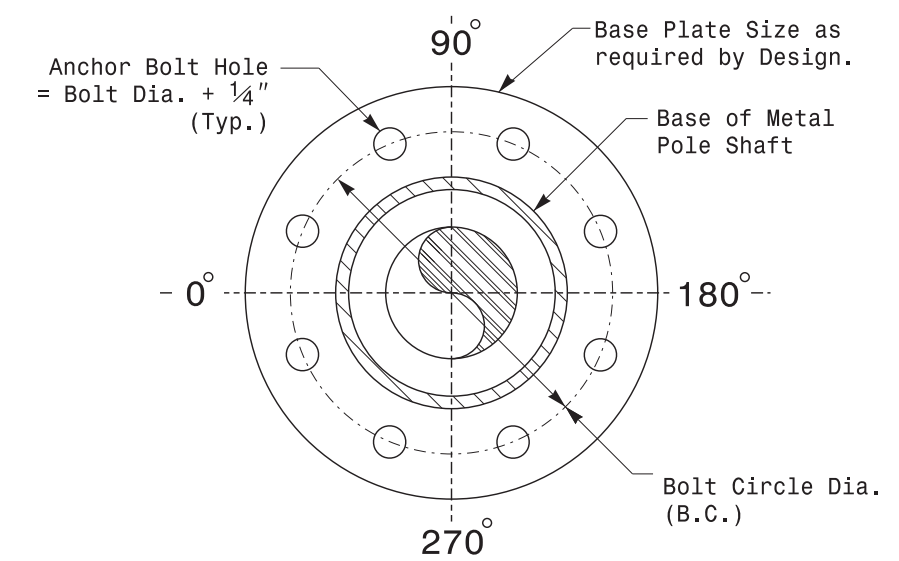


Construct Templates and Plates from 1/4" min. thick Steel. Galvanizing is not required.

Base Plate Template and Anchor Bolt Lock Plate Details

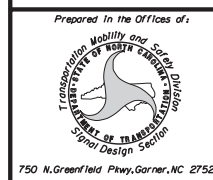


Anchor Bolt Detail



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

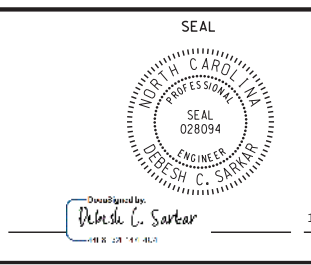
Typical Base Plate Detail



750 N. Greenfield Pkwy, Garner, NC 27529

Typical Fabrication Details For All Metal Poles

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



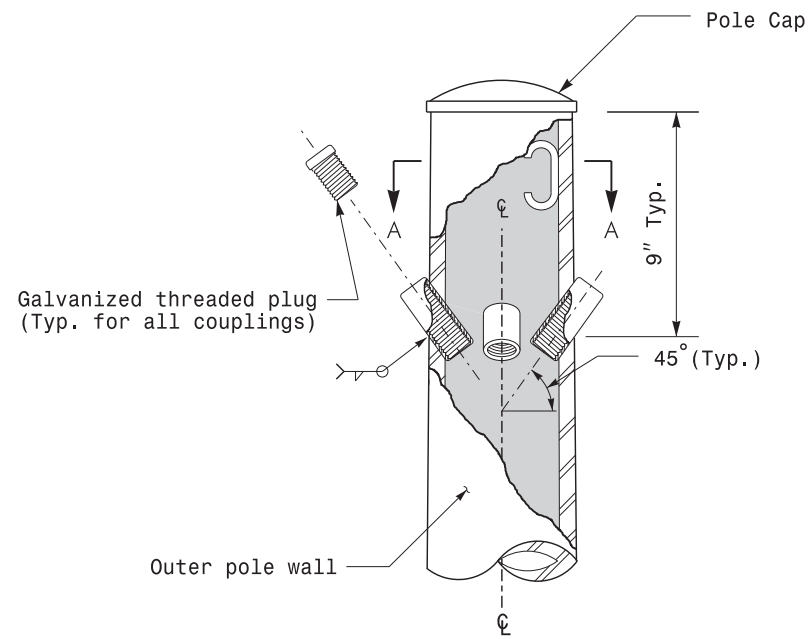
Designed by: *Debesh C. Sarkar*

10/11/2017 DATE

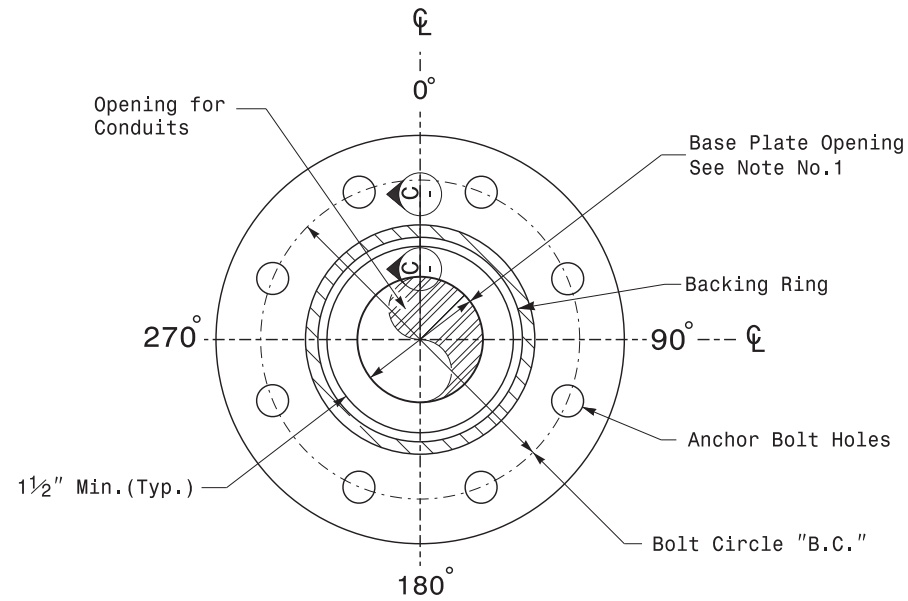
11-DEC-2017 08:30 11850MM15 Signal&Design Section Eastern RegionM Sheets#016#2014 Sig.M2 Std. Fabrication Detail-All Poles.dgn

Fabrication Details - All Metal Poles

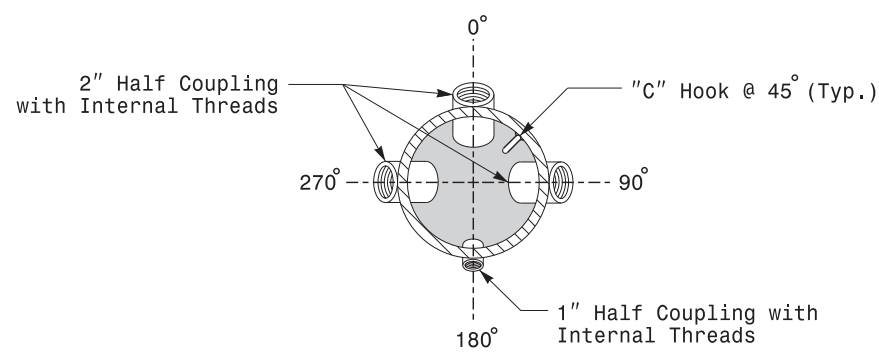
Note:
1. Opening in pole base plate shall be equal to pole base inside diameter minus 3 1/2" but shall not be less than 8 1/2".



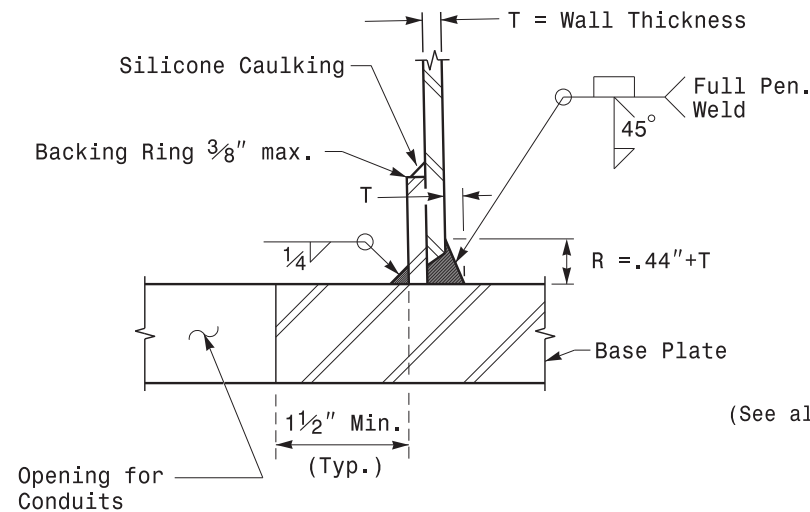
Cable Entrances at Top of Pole



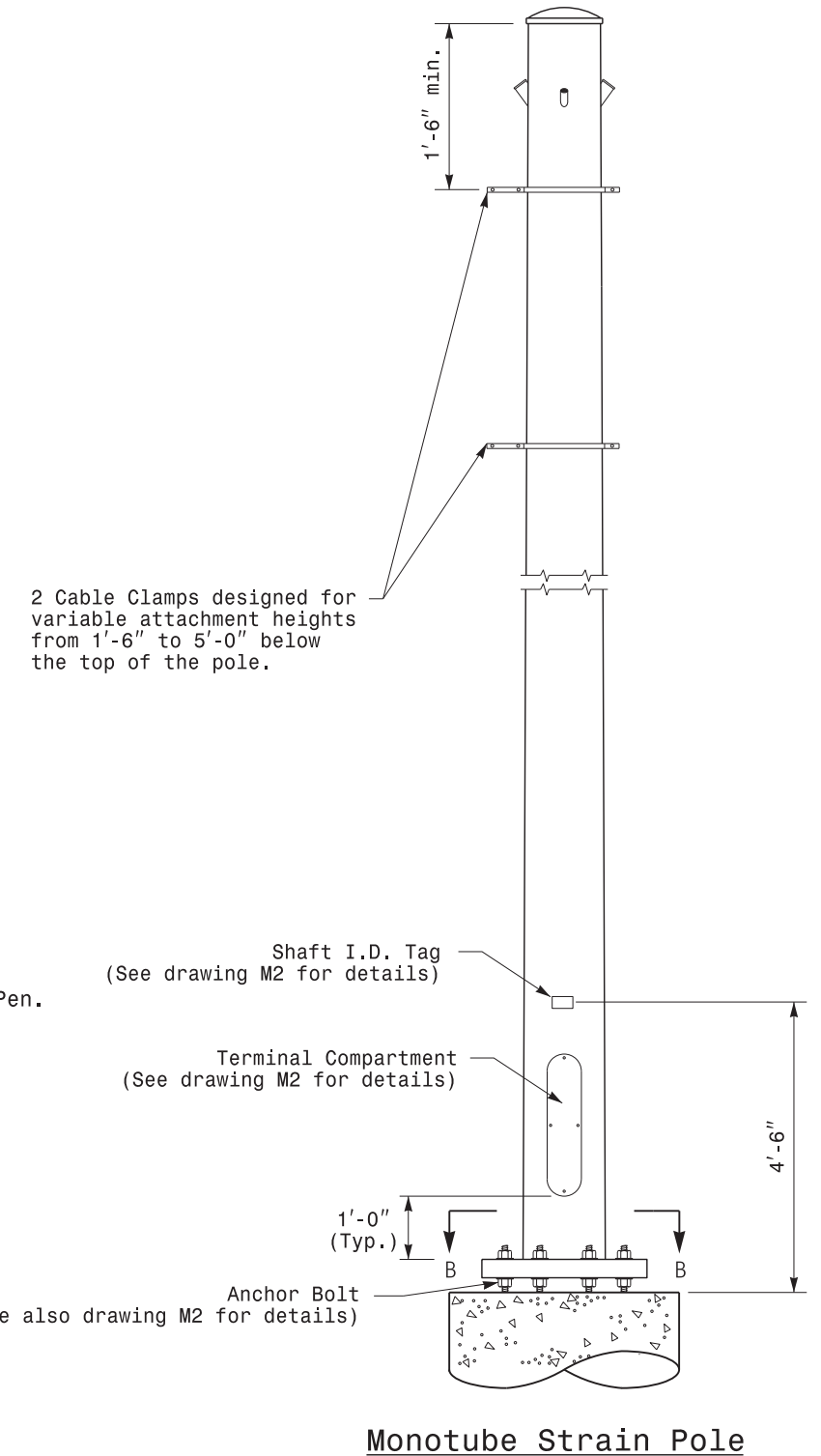
Section B-B
Pole Base Plate Details
(8 and 12 Bolt Pattern)



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



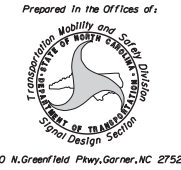
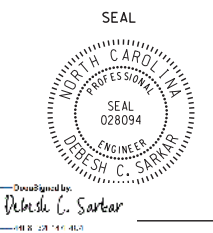
Section C-C
(Pole Attachment to Base Plate)
Full-Penetration
Groove Weld Detail



Monotube Strain Pole

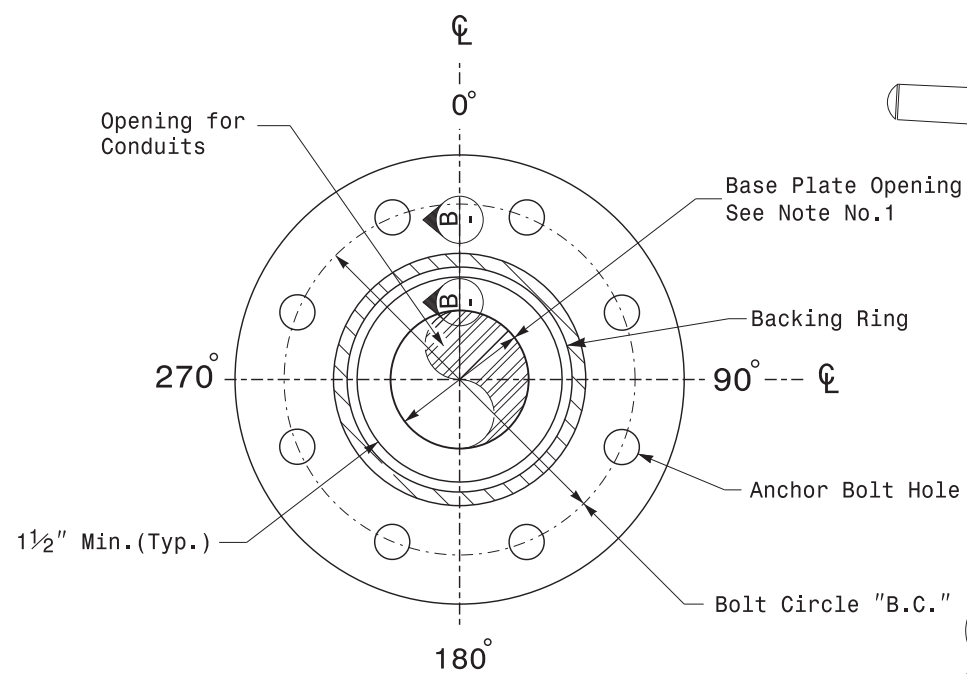
2 Cable Clamps designed for variable attachment heights from 1'-6" to 5'-0" below the top of the pole.

11-OCT-2017 08:25 136350115 Signal&Sign Design Section\Eastern Region\11-016-2014 Sig.M3 Std. Fabrication Details-Strain Poles.dgn PZ:lsar

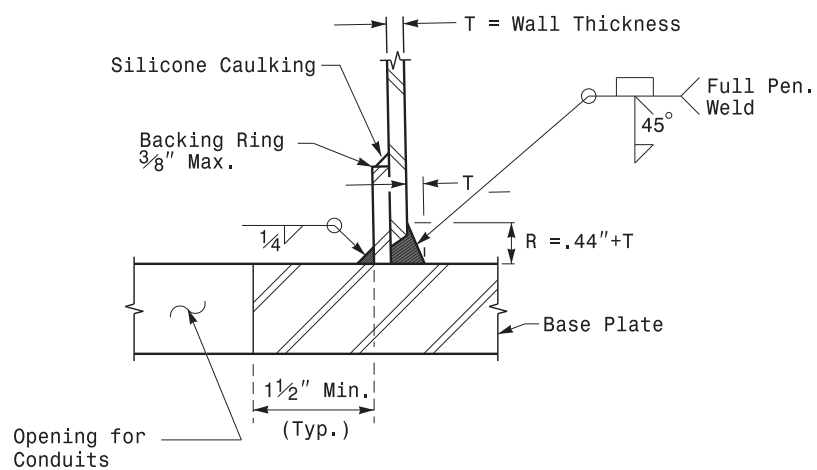
	Typical Fabrication Details For Strain Poles		
	PLAN DATE: OCTOBER 2017 DESIGNED BY: K.C. DURIGON PREPARED BY: N. BITTING REVIEWED BY: D.C. SARKAR	SCALE: 0 NONE REVISIONS:	

Fabrication Details – Strain Poles

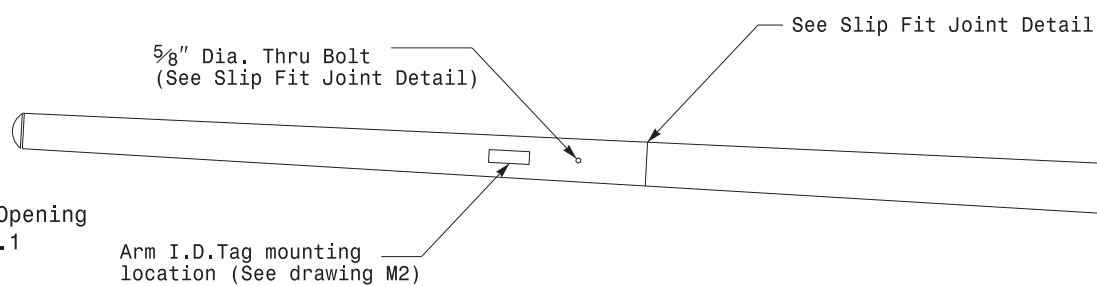
Note:
 1. Opening in pole base plate shall be equal to pole base inside diameter minus 3 1/2" but shall not be less than 8 1/2".



Section A-A
 Pole Base Plate Details



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



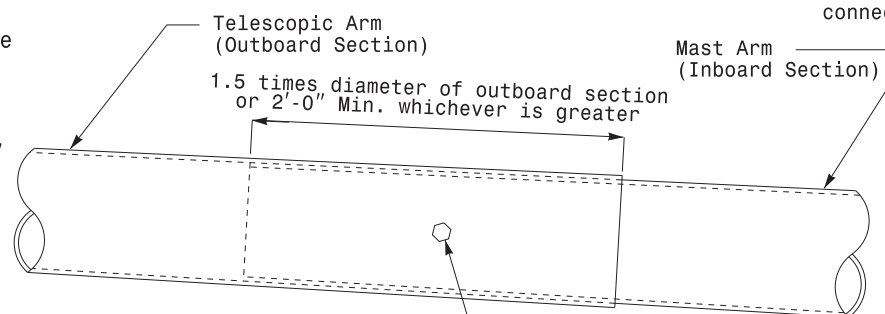
5/8" Dia. Thru Bolt
 (See Slip Fit Joint Detail)

See Slip Fit Joint Detail

Hand Hole with cover

Arm I.D. Tag mounting location (See drawing M2)

Arm I.D. Tag mounting location (See drawing M2)



Telescopic Arm (Outboard Section)

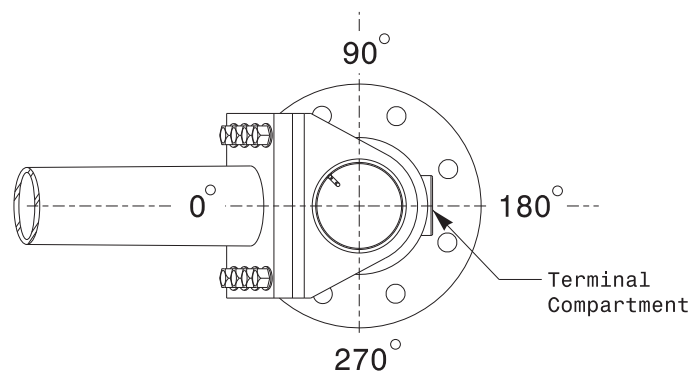
Mast Arm (Inboard Section)

1.5 times diameter of outboard section or 2'-0" Min. whichever is greater

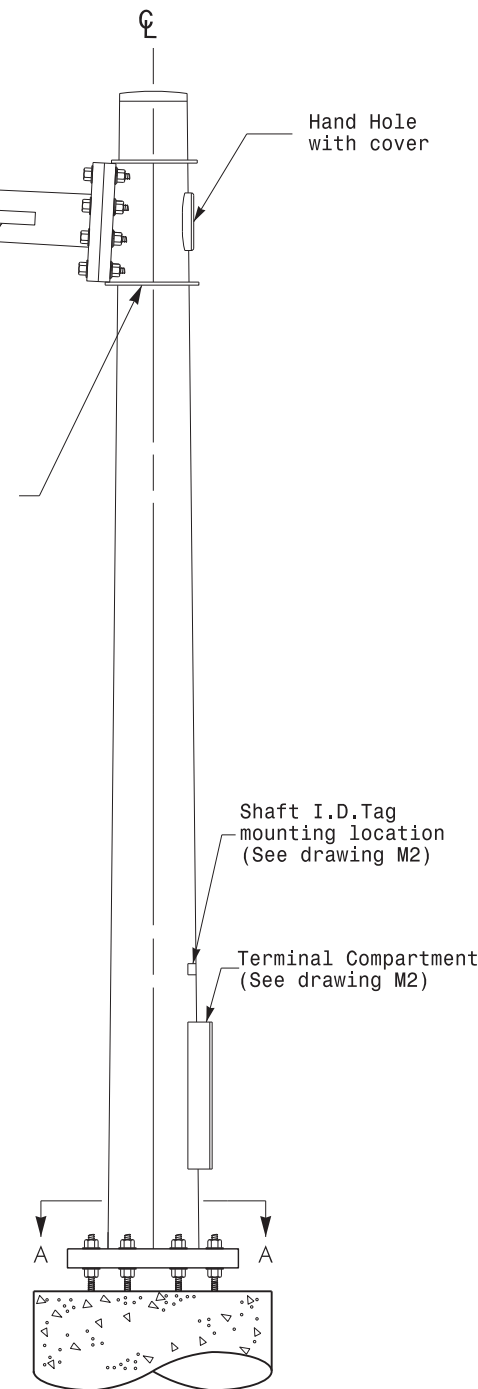
See drawing M5 for Mast Arm connection details

3/4" Factory Drilled Hole in Outboard Tube. Field Drill Inboard Tube. 5/8" Galvanized Thru Bolt with (2) Hex. Locknuts Each.

Slip Fit Joint Detail for Mast Arm



Mast Arm Radial Orientation



Mast Arm Pole

11-0CT-2017 08:33 11850M115 Signal&Sign Design Section Eastern RegionM Sheeta20162014 Sig.M4 Std. Fabrication Detail-Mast Arm Poles.dgn

	Typical Fabrication Details For Mast Arm Poles		SEAL D.C. SARKAR ENGINEER	
	PLAN DATE: OCTOBER 2017	DESIGNED BY: K.C. DURIGON		10/11/2017 DATE
	PREPARED BY: N. BITTING	REVIEWED BY: D.C. SARKAR		
SCALE 0 NA NONE	REVISIONS INIT. DATE	REVISIONS INIT. DATE	DATE	

Fabrication Details - Mast Arm Poles

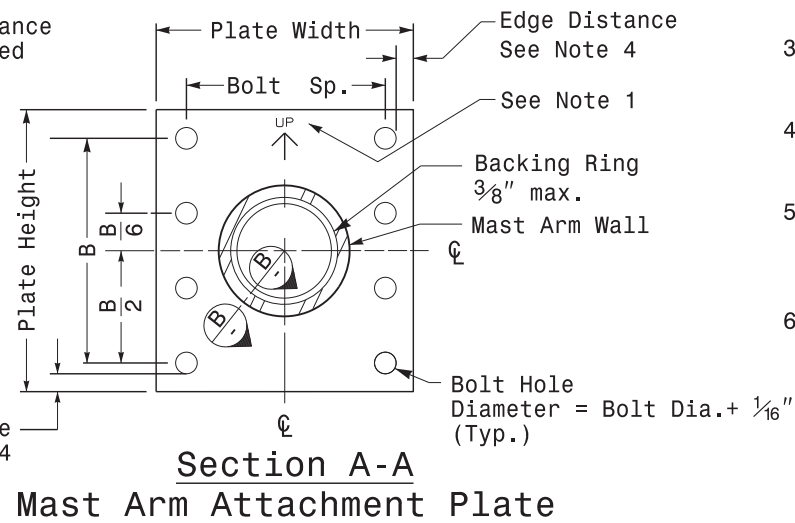
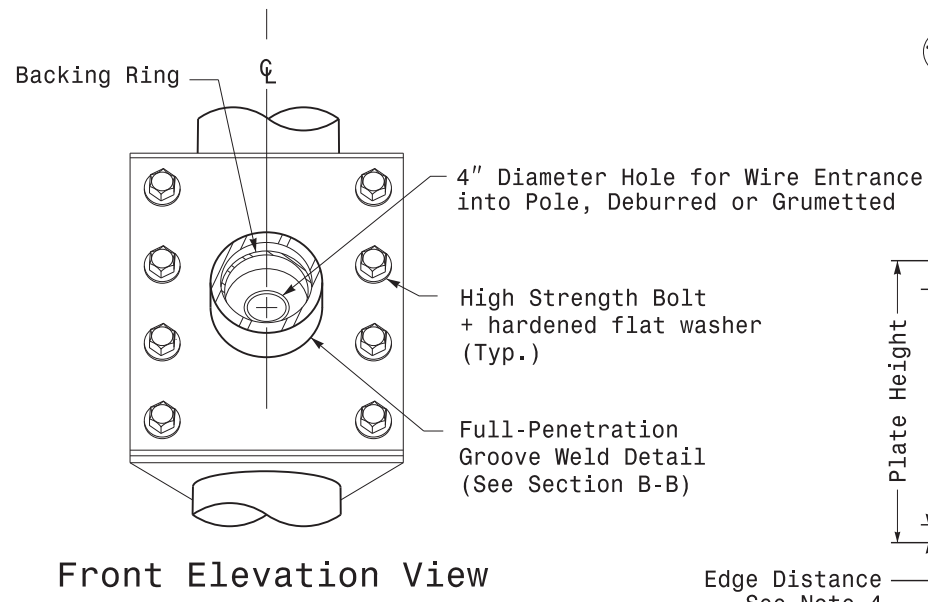
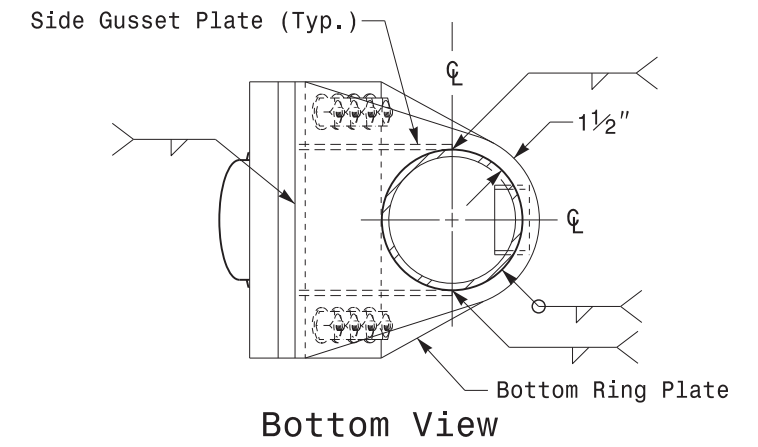
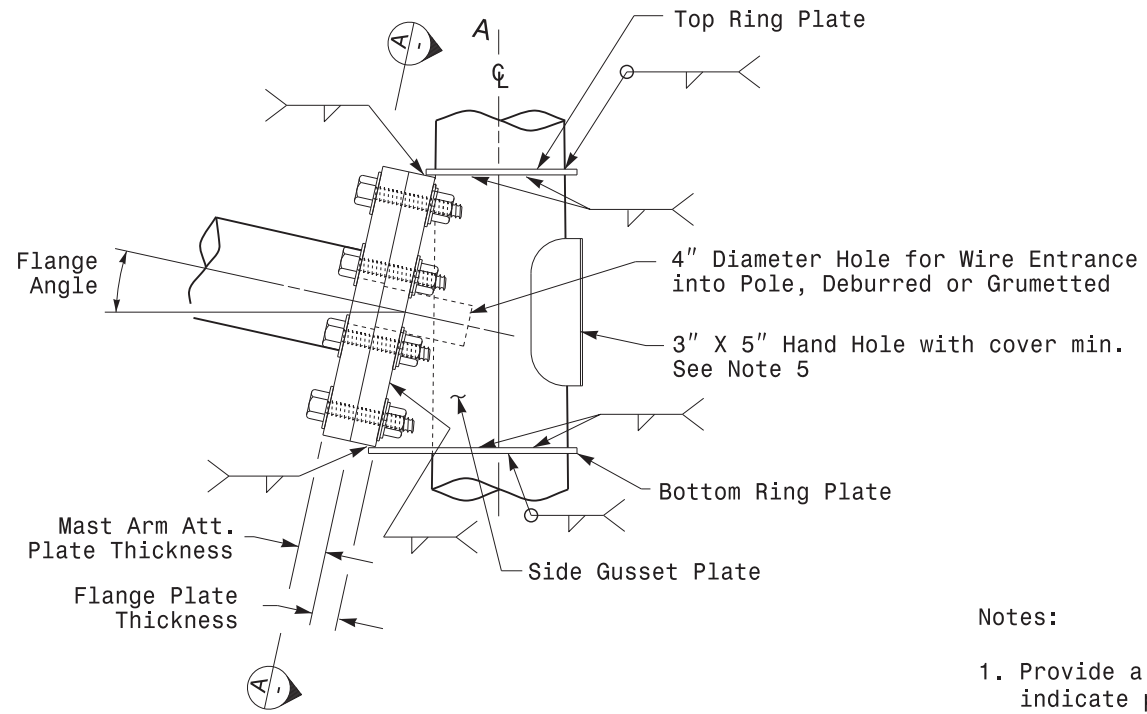
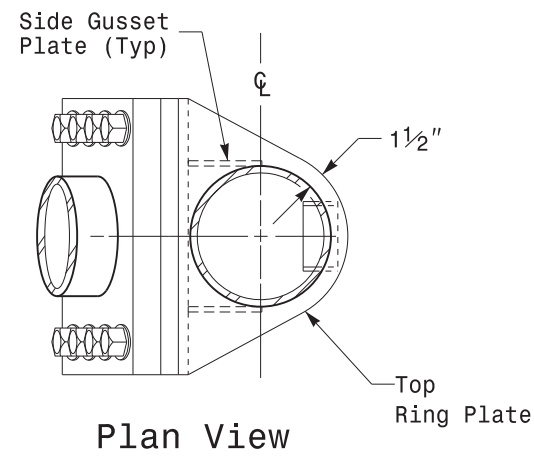
Welded Ring Stiffened Mast Arm Connection

PROJECT ID. NO.

SHEET NO.

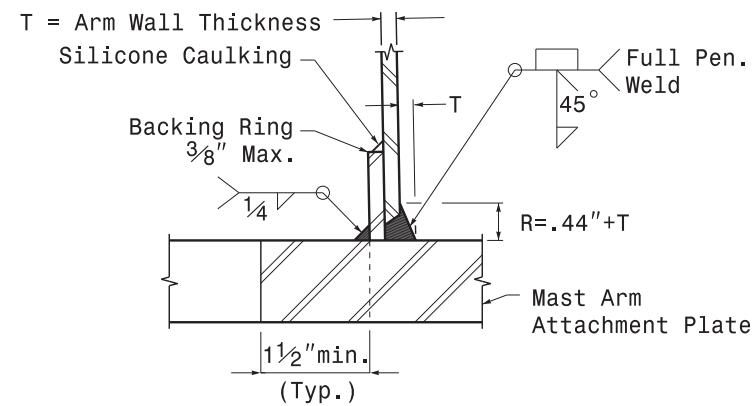
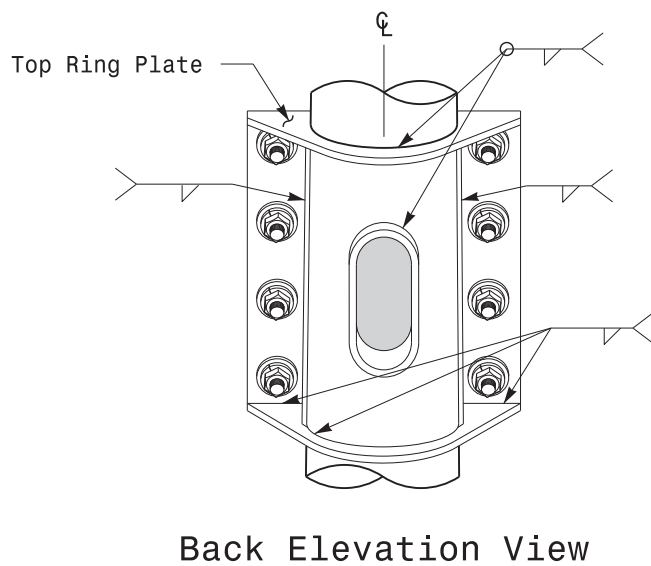
U-5169

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

SCALE: 0 NA NONE

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		
REVISIONS	INIT.	DATE	

SEAL

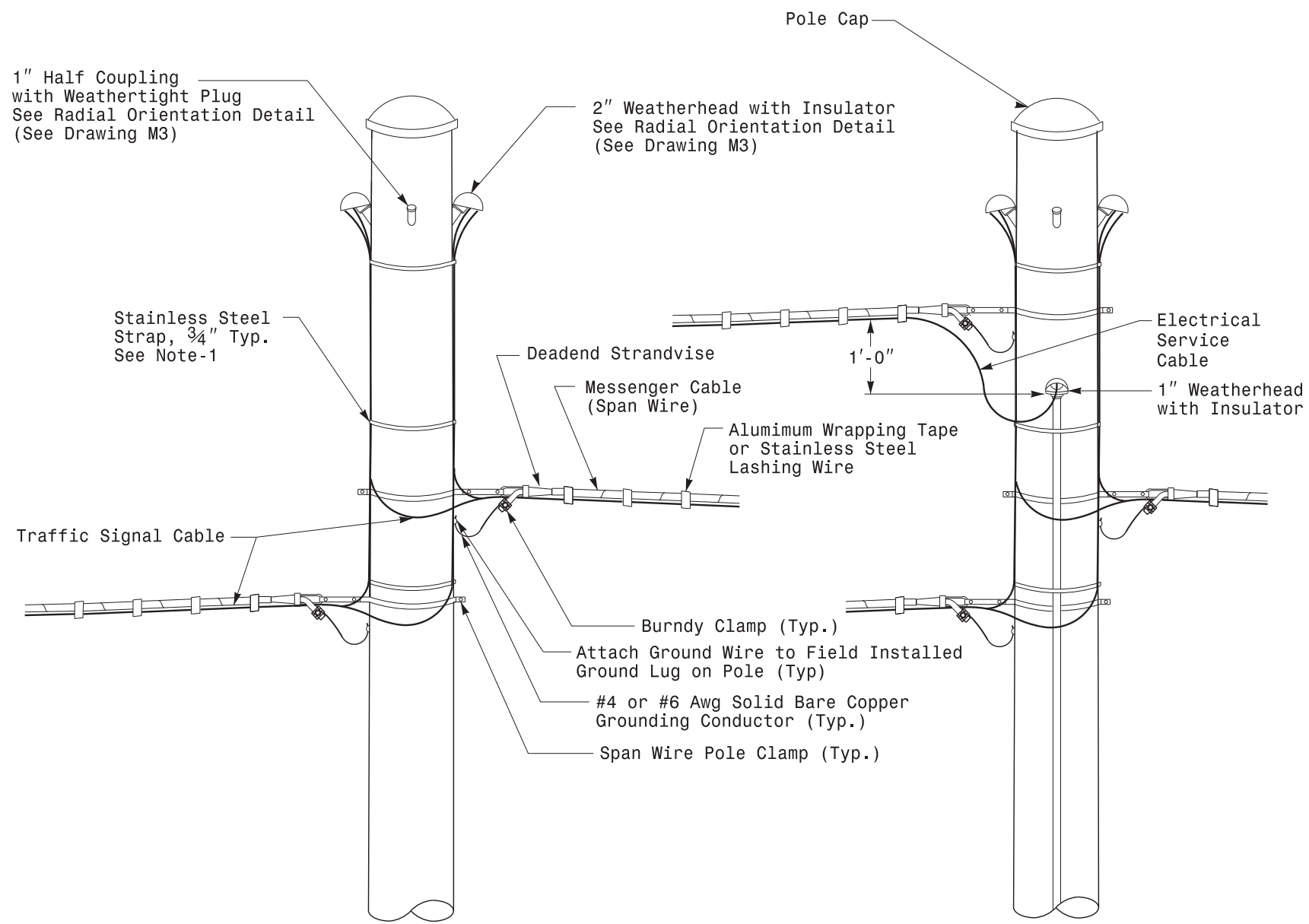
Debesh C. Sarkar

10/11/2017

DATE

11-0CT-2017-08:35 1:50:11:15 Signal:Sig:Design Section:Eastern Region:Sheet:016:2014 Sig.M5 Std. Connection Fabrication Detail:is-mast-arm-poles.dgn PZ:1/2/17

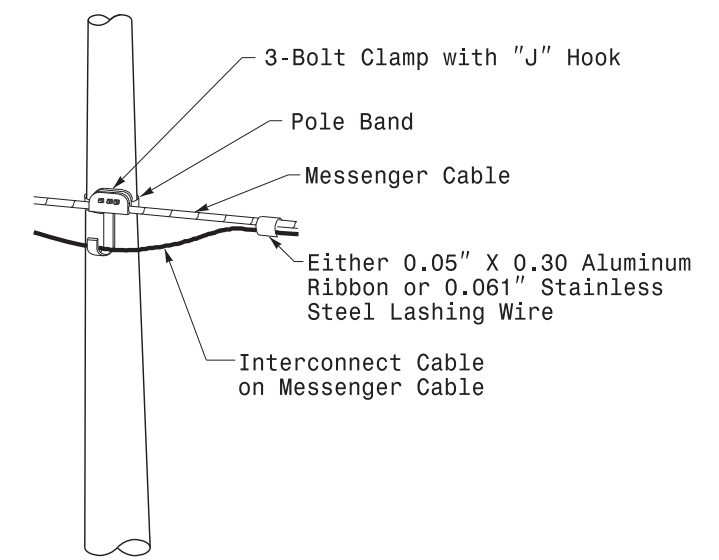
Fabrication Details - Mast Arm Connection



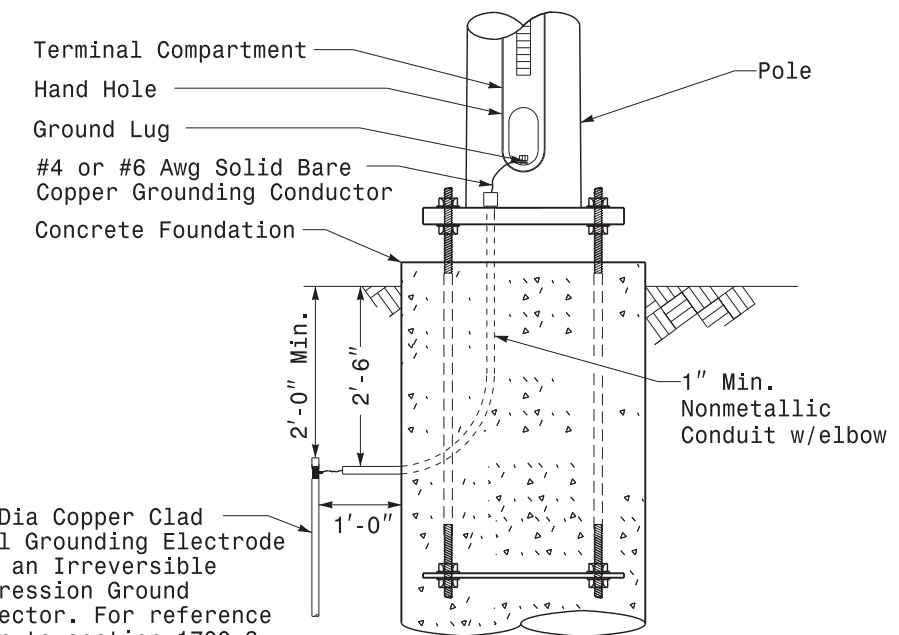
Strain Pole Attachments

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

11-DEC-2017 08:36 P:\SIGNALS\Signal Design Section\Eastern Region\MS Sheets\2016\2014 Sig.M6 Strain Pole.dgn

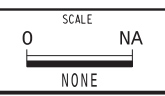
Prepared in the Offices of:

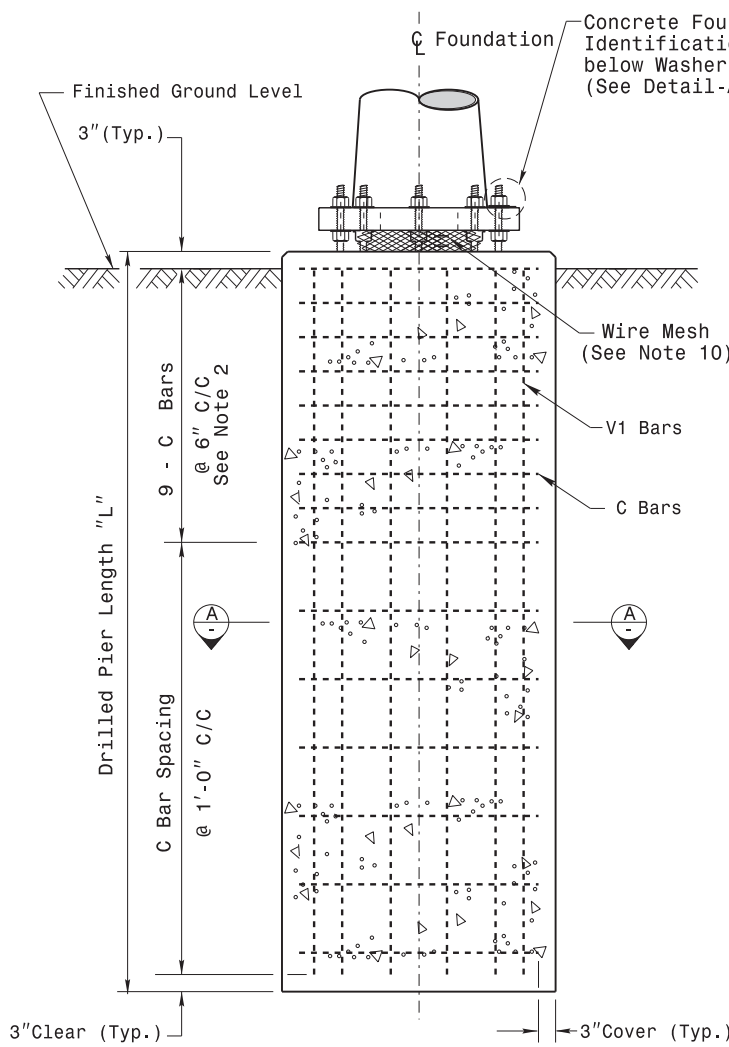
750 N. Greenfield Pkwy, Garner, NC 27529

Typical Fabrication Details For Strain Pole Attachments			
PLAN DATE:	OCTOBER 2017	DESIGNED BY:	C.F. ANDREWS
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR
REVISIONS	INIT.	DATE	

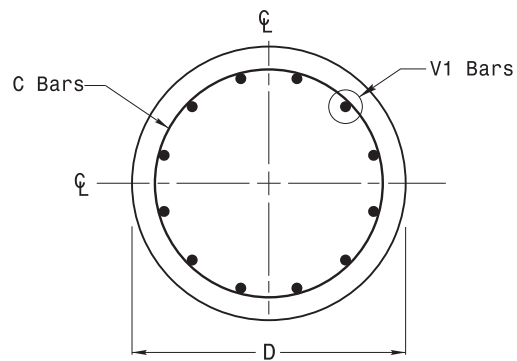
SEAL

Checked/Signaled by: *D.C. Sarkar* 10/11/2017

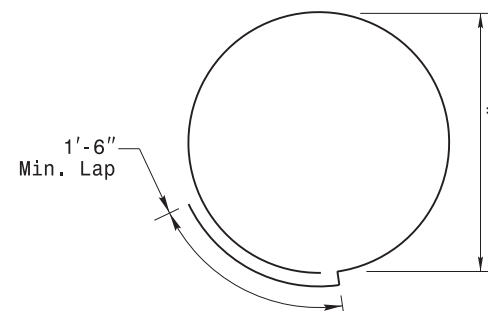




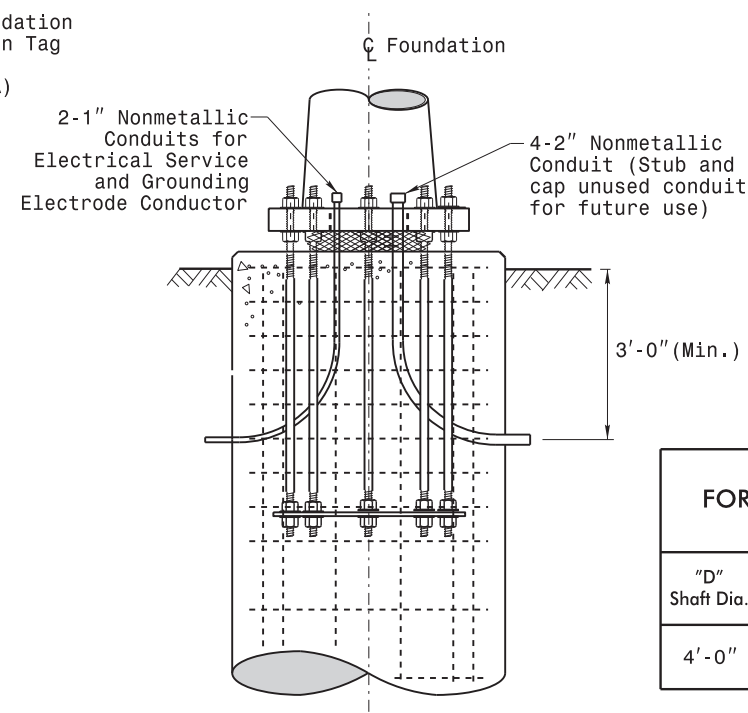
Concrete Shaft Elevation



Section A-A



Typical "C" Bar Detail



Typical Foundation Conduit Details

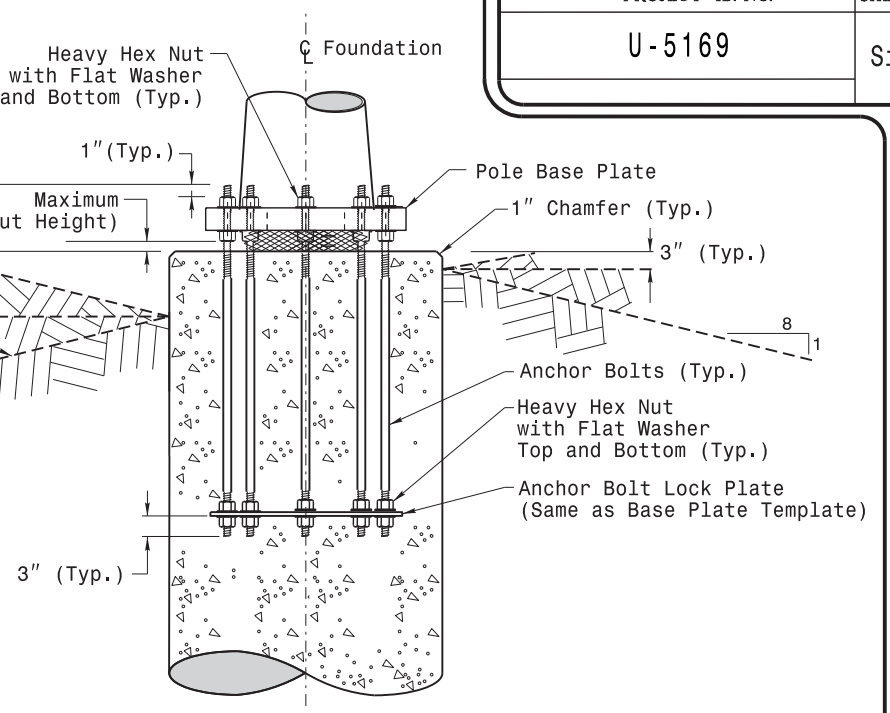
General Notes:

- 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 2018 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>
- 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 the Identification Tag on the top of the base plate, directly above the conduit's entry point.
- Provide two layers of galvanized welded 23 gauge (0.25) 6" wide 4 mesh wire 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)

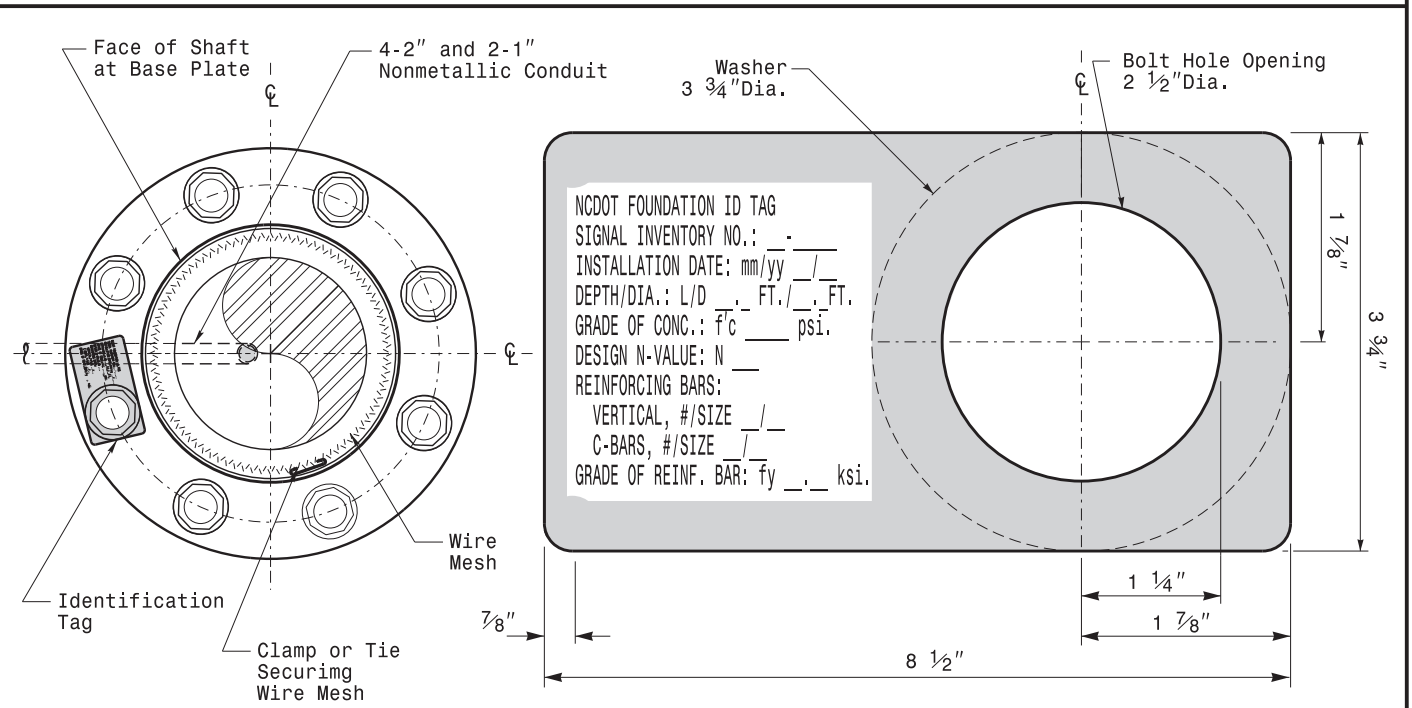
"D" Shaft Dia.	Conc. Volume (cu. yds.)	Bar Name	MIN.	Size	Type	Length
4'-0"	.465 x L	V1	-	#8	STR.	**
		C	*	#4	CIR.	12'-6"

* See Note No. 2
** See Note No. 3



Typical Foundation Anchor Bolt Details

(Reinforcing Cage Not Shown for Clarity)



Concrete Foundation Identification Tag Details

D = Diameter
L = Length/Depth
mm = Month
yy = Year

Detail-A

Prepared in the Offices of:
TRANSPORENT MOBILITY AND SOUTH DIVISION
DIVISION OF TRANSPORTATION
SIGNAL DESIGN SECTION
750 N. Greenfield Pkwy, Garner, NC 27529

Construction Details For Foundations

PLAN DATE: OCTOBER 2018 DESIGNED BY: C.B. COGDILL
PREPARED BY: N. BITTING REVIEWED BY: D.C. SARKAR

REV. NO.	COMMENTS	INIT.	DATE
1	Revised Foundation Tag Details	N.B.	5/11/2015

SCALE: 0 NA NONE

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER
SEAL 028094
DIPESH C. SARKAR
DESIGNED BY:
Dipesh C. Sarkar
DATE: 10/11/2017

SOIL CONDITION

PROJECT ID. NO.	SHEET NO.
U-5169	Sig.M8

		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.

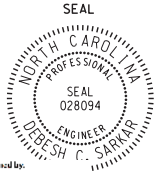
Foundation Selection:

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.

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

Standard Strain Pole Foundation-All Soil Condition

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SEAL
NORTH CAROLINA
PROFESSIONAL ENGINEER
028094
D. C. SARKAR

Standard Strain Pole Foundation for All Soil Conditions

PLAN DATE: OCTOBER 2017 DESIGNED BY: C.B. COGDILL
 PREPARED BY: N. BITTING REVIEWED BY: D.C. SARKAR

REVISIONS: _____ DATE: _____
 Changed Foundation Depth to "Drilled Pier Length" in Conc. Eqn. N.B. 7/12/2015

Drawn by: D. C. Sarkar DATE: 10/11/2017



SCALE: 0 NA
NONE