

5 Phase
Fully Actuated
(Durham Signal System)

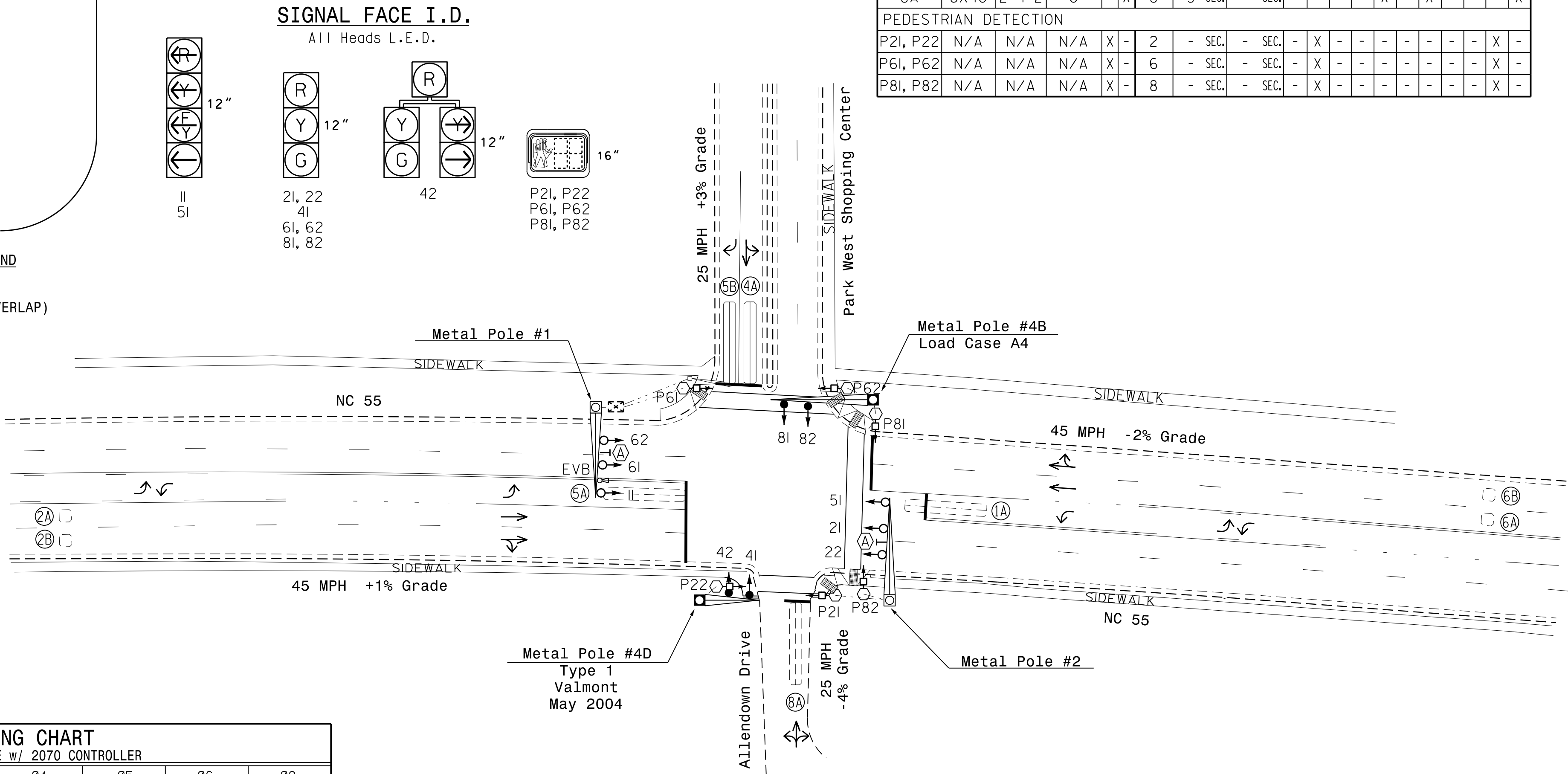
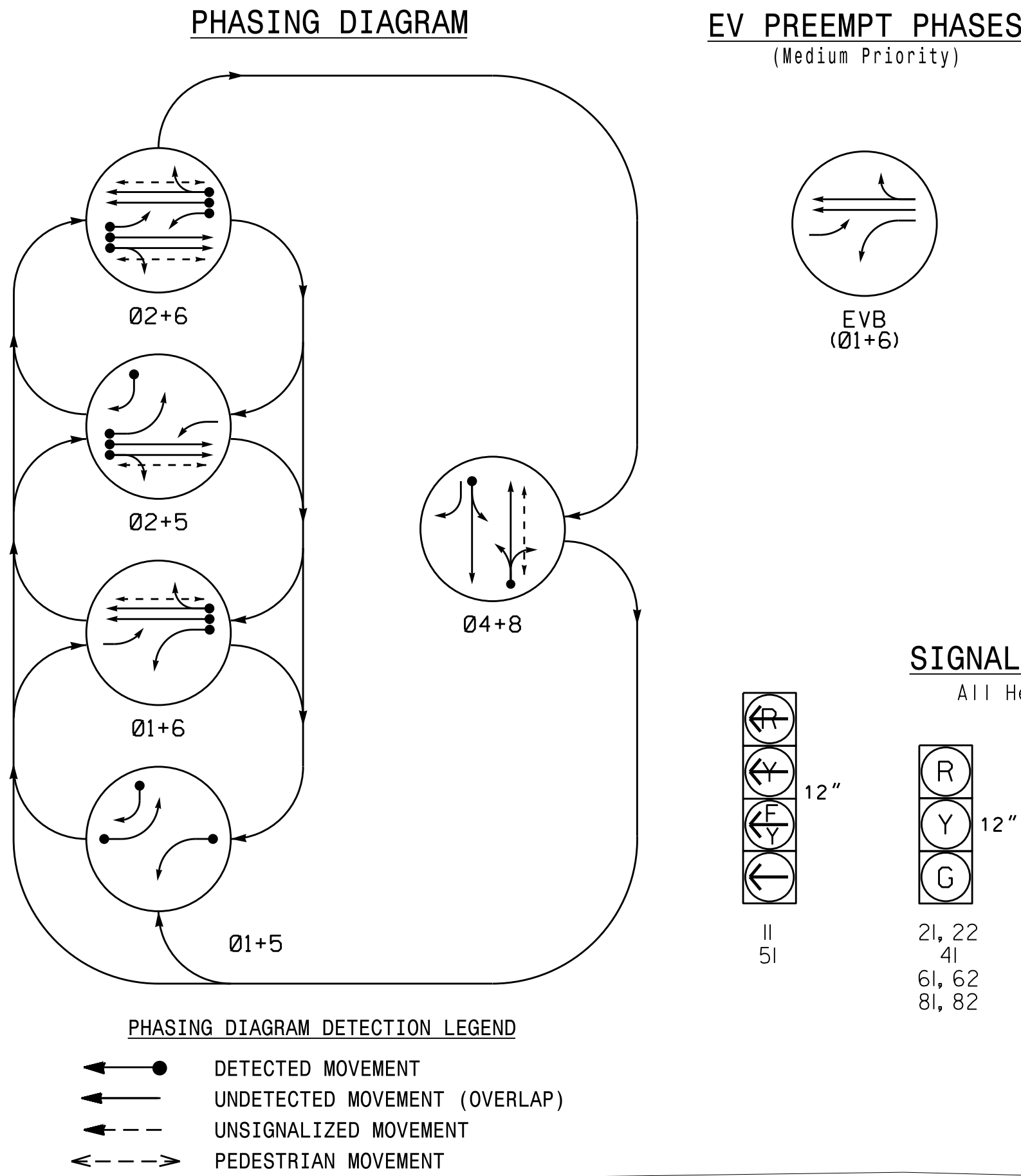
NOTES

- Refer to "Roadway Standard Drawings NCDOT" dated January 2012 and "Standard Specifications for Roads and Structures" dated January 2012.
- Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
- Phase 1 and/or phase 5 may be lagged.
- Disable existing backup protection for Phase 2 and Phase 6.
- Run new lead-in cable and signal cable in existing conduit where possible.
- Set all detector units to presence mode.
- Program all timing information into phase banks 1, 2, and 3 unless otherwise noted.
- Set phase bank 3 maximum limit to 250 seconds for phases used.
- Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
- Program pedestrian heads to countdown the flashing "Don't Walk" time only.
- Pedestrian pedestals are conceptual and shown for reference only. See sheets P1-P3 for pushbutton location details.
- Pavement markings are existing unless otherwise shown.
- This intersection features an optical preemption system. Shown locations of optical detectors are conceptual only.
- Upon completion of Emergency Vehicle Preemption, controller returns to normal operation based on vehicle demand.
- Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
- Install new controller in existing cabinet.

SIGNAL FACE	PHASE							
	Ø1+5	Ø1+6	Ø2+5	Ø2+6	Ø4+8	Ø5+6	Ø6+8	ISOLATED
II	←	←	←	←	←	←	←	←
21, 22	R	R	G	G	R	R	Y	
41	R	R	R	R	G	R	R	
42	←	←	←	←	R	G	R	
51	←	←	←	←	←	←	←	
61, 62	R	G	R	G	R	G	Y	
81, 82	R	R	R	R	G	R	R	
P21, P22	DW	DW	W	W	DW	DRK		
P61, P62	DW	W	DW	W	DW	DRK		
P81, P82	DW	DW	DW	DW	W	DRK		

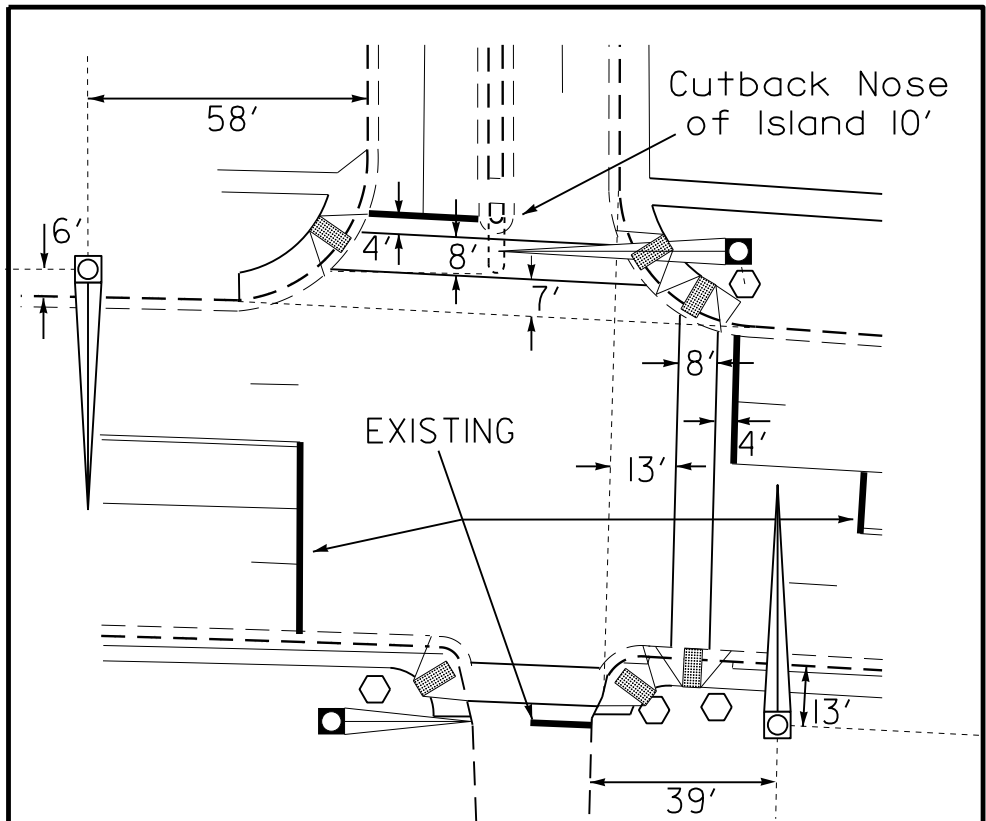
W - Walk
DW - Don't Walk
DRK - Dark

2033 SOFTWARE w/ 2070 CONTROLLER LOOP & DETECTOR UNIT INSTALLATION CHART													
INDUCTIVE LOOPS						DETECTOR PROGRAMMING							
						TIMING		ATTRIBUTES					
LOOP NO.	SIZE (ft)	TURNS	DIST. FROM STOPBAR (ft)	NEW EXISTING	NEMA PHASE	DELAY	CARRY (STRETCH)	FULL TIME DELAY	PEDESTRIAN CALL	RESERVED	COUNT	EXTENSION	TYPE 3 CALLING
1A	6X40	2-4-2	+10	- X	1	15 SEC.	- SEC.	-	-	-	-	X	-
2A	6X6	EXISTING	300	- X	2	3 SEC.	- SEC.	X	-	-	-	X	-
2B	6X6	EXISTING	300	- X	2	- SEC.	- SEC.	-	-	-	X	X	-
4A	6X40	2-4-2	0	X -	4	- SEC.	- SEC.	-	-	-	-	X	-
5A	6X40	2-4-2	0	- X	5	15 SEC.	- SEC.	-	-	-	-	X	-
5B	6X40	2-4-2	0	X -	5	15 SEC.	- SEC.	-	-	-	-	X	-
6A	6X6	EXISTING	300	- X	6	- SEC.	- SEC.	-	-	-	X	X	-
6B	6X6	EXISTING	300	- X	6	- SEC.	- SEC.	-	-	-	X	X	-
8A	6X40	2-4-2	0	- X	8	5 SEC.	- SEC.	-	-	-	-	X	-
PEDESTRIAN DETECTION													
P21, P22	N/A	N/A	N/A	X -	2	- SEC.	- SEC.	-	X	-	-	-	-
P61, P62	N/A	N/A	N/A	X -	6	- SEC.	- SEC.	-	X	-	-	-	-
P81, P82	N/A	N/A	N/A	X -	8	- SEC.	- SEC.	-	X	-	-	-	-



TIMING CHART 2033 SOFTWARE w/ 2070 CONTROLLER						
PHASE	Ø1	Ø2	Ø4	Ø5	Ø6	Ø8
MINIMUM INITIAL *	7 SEC.	12 SEC.	7 SEC.	7 SEC.	12 SEC.	7 SEC.
VEHICLE EXTENSION *	2.0 SEC.	6.0 SEC.	2.0 SEC.	2.0 SEC.	6.0 SEC.	2.0 SEC.
YELLOW CHANGE INT.	3.0 SEC.	4.7 SEC.	3.1 SEC.	3.0 SEC.	4.7 SEC.	3.4 SEC.
RED CLEARANCE	2.8 SEC.	1.3 SEC.	2.8 SEC.	2.4 SEC.	1.3 SEC.	2.4 SEC.
MAXIMUM LIMIT *	15 SEC.	90 SEC.	30 SEC.	15 SEC.	90 SEC.	30 SEC.
RECALL POSITION	NONE	VEH. RECALL	NONE	NONE	VEH. RECALL	NONE
VEHICLE CALL MEMORY	NONLOCK	YELLOW LOCK	NONLOCK	NONLOCK	YELLOW LOCK	NONLOCK
DOUBLE ENTRY	OFF	OFF	ON	OFF	OFF	ON
WALK *	- SEC.	7 SEC.	- SEC.	- SEC.	7 SEC.	7 SEC.
FLASHING DON'T WALK	- SEC.	5 SEC.	- SEC.	- SEC.	13 SEC.	17 SEC.
MINIMUM FDW	- SEC.	5 SEC.	- SEC.	- SEC.	7 SEC.	9 SEC.
TYPE 3 LIMIT	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.
ALTERNATE EXTENSION	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.
ADD PER VEHICLE *	- SEC.	1.5 SEC.	- SEC.	- SEC.	1.5 SEC.	- SEC.
MAXIMUM INITIAL *	- SEC.	34 SEC.	- SEC.	- SEC.	34 SEC.	- SEC.
MAXIMUM GAP*	2.0 SEC.	7.0 SEC.	2.0 SEC.	2.0 SEC.	7.0 SEC.	2.0 SEC.
REDUCE 0.1 SEC EVERY *	- SEC.	1.5 SEC.	- SEC.	- SEC.	1.5 SEC.	- SEC.
MINIMUM GAP	2.0 SEC.	3.0 SEC.	2.0 SEC.	2.0 SEC.	3.0 SEC.	2.0 SEC.

* 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.



2033 EMERGENCY PREEMPTION TIMING CHART	
FUNCTION	EV (1+6) SECONDS
DELAY BEFORE PREEMPT	0
PED. CLEAR BEFORE PREEMPT	*
MIN. GREEN BEFORE PREEMPT	1.0
CLEARANCE TIME	1.0
PREEMPT EXTEND**	2.0

* See Minimum FDW in Timing Chart
** Program Timing on Optical Detector Unit

LEGEND

PROPOSED	EXISTING
Traffic Signal Head	N/A
Modified Signal Head	N/A
Sign	N/A
Pedestrian Signal Head With Push Button & Sign	N/A
Signal Pole with Guy	N/A
Signal Pole with Sidewalk Guy	N/A
Inductive Loop Detector	N/A
Controller & Cabinet	N/A
Junction Box	N/A
2-in Underground Conduit	N/A
Right of Way	N/A
Directional Arrow	N/A
Metal Pole with Mastarm	N/A
Curb Ramp	N/A
Type II Signal Pedestal	N/A
Optical Detector	N/A
Street Name Sign (D3-1)	N/A

Signal Upgrade

Prepared In the Offices of:

750 N. Greenfield Pkwy, Garner, NC 27529

NC 55
at
Allendown Drive and
Park West Shopping Center

Division 5 Durham County Durham

PLAN DATE: November 2016 REVIEWED BY:

PREPARED BY: C.E. Carter REVIEWED BY:

REVISIONS

INIT. DATE

1/12/2017

SIG. INVENTORY NO. 05-2156

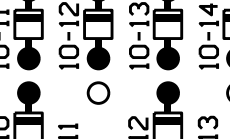
(remove jumpers and set switches as shown)

CONFLICT PROGRAM CARD

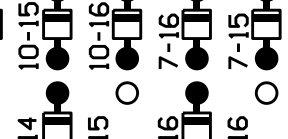
9-10	10-11	11-12	12-13	13-14	14-15	15-16	1-16
9-11	10-12	11-13	12-14	13-15	14-16	2-16	1-15
9-12	10-13	11-14	12-15	13-16	3-16	2-15	1-14
9-13	10-14	11-15	12-16	4-16	3-15	2-14	1-13
9-14	10-15	11-16	5-16	4-15	3-14	2-13	1-12
9-15	10-16	6-16	5-15	4-14	3-13	2-12	1-11
9-16	7-16	6-15	5-14	4-13	3-12	2-11	1-10
8-16	7-15	6-14	5-13	4-12	3-11	2-10	1-9
8-15	7-14	6-13	5-12	4-11	3-10	2-9	1-8
8-14	7-13	6-12	5-11	4-10	3-9	2-8	1-7
8-13	7-12	6-11	5-10	4-9	3-8	2-7	1-6
8-12	7-11	6-10	5-9	4-8	3-7	2-6	1-5
8-11	7-10	6-9	5-8	4-7	3-6	2-5	1-4
8-10	7-9	6-8	5-7	4-6	3-5	2-4	1-3
8-9	7-8	6-7	5-6	4-5	3-4	2-3	1-2

COMPONENT SIDE

FF



INTERNAL DIP SWITCHES



YELLOW DISABLE

☐ 9	☐ 0	☐ 1
☐ 10	☐ 0	☐ 2
☐ 11	☐ 0	☐ 3
☐ 12	☐ 0	☐ 4
☐ 13	☐ 0	☐ 5
☐ 14	☐ 0	☐ 6
☐ 15	☐ 0	☐ 7
☐ 16	☐ 0	☐ 8

FA



1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Make sure jumpers SEL2-SEL5 are present on the monitor board.

ON →

	RF 2010	} OPTIONS
	RP DISABLE	
	WD 1.0 SEC	
	GY ENABLE	
	SF#1 POLARITY	
	LEDguard	} FYA
	RF SSM	
	FYA COMPACT	
	FYA 1-9	
	FYA 3-10	
	FYA 5-11	}
	FYA 7-12	

ON →

	1	} SSM
	2	
	3	
	4	
	5	
	6	
	7	
	8	

ON →

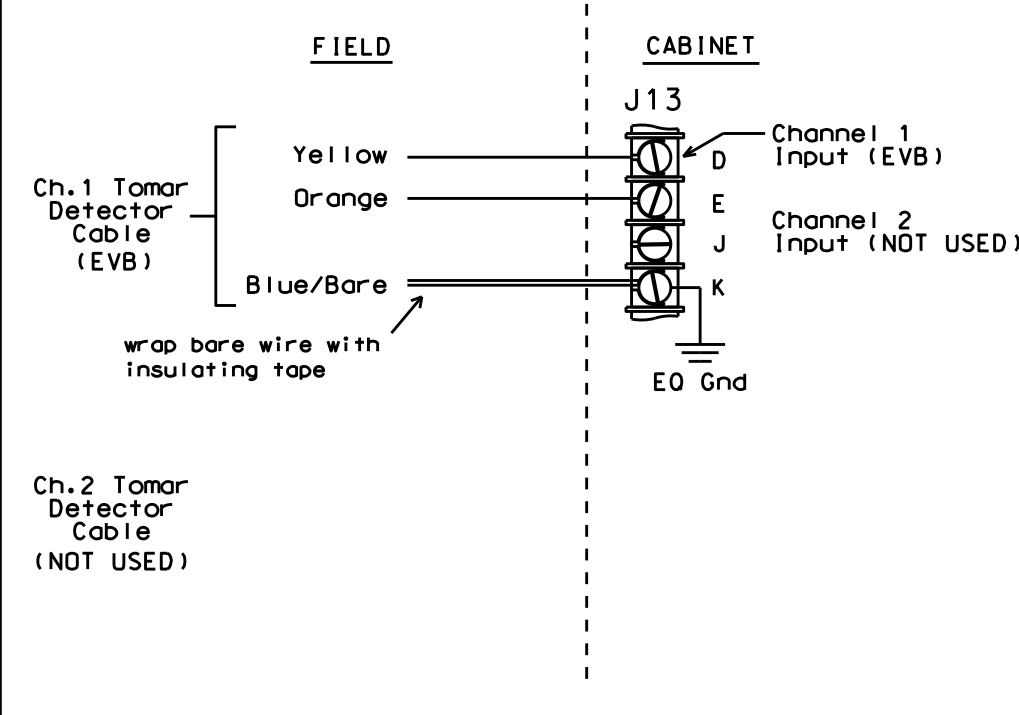
	9	} SSM
	10	
	11	
	12	
	13	
	14	
	15	
	16	

(front view)

EX.: 1A, 2A, ETC. = LOOP NO.'S

TOMAR OSP CARD
INSERT CARD INTO
SLOT J13

(input file, rear view)



1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. Verify that signal heads flash in accordance with the signal plans.
2. Ensure that Red Enable is active at all times during normal operation. To prevent Red Failures on used monitor channels, tie unused red monitor inputs 1,3,5,7, 10,12,13,14,15 & 16 to load switch AC+ per the cabinet manufacturer's instructions.
3. Program controller to Start Up in phases 2 and 6 green.
4. Set power-up flash time to 0 seconds within the controller programming. The conflict monitor will govern startup flash. Ensure STARTUP "RED START" is set to 0 seconds.
5. Enable Simultaneous Gap-Out feature for all phases.
6. Program all timing information into phase banks 1, 2, and 3 unless otherwise noted.
7. Set phase bank 3 maximum limit to 250 seconds for phases used.
8. Program phases 4 and 8 for Double Entry.
9. Ensure start up flash phases are coordinated with flash program block assignments.
10. Program Startup Ped Calls for phases 2, 6, and 8.
11. Set the Red Revert interval on the controller to 1 second.
12. This cabinet and controller are part of the Durham Signal System.

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CONTROLLER.....2070E
CABINET.....332 W/ AUX
SOFTWARE.....McCain 2033
CABINET MOUNT.....BASE
OUTPUT FILE POSITIONS...18 WITH AUX FILE
LOAD SWITCHES USED.....S1,S2,S2P,S4,S5,S6,S6P,S8,
                        S8P,S9,S12
PHASES USED.....1,2,2 PED,4,5,6,6 PED,8,8 PED
OVERLAP 1.....*
OVERLAP 2.....NOT USED
OVERLAP 3.....*
OVERLAP 4.....NOT USED
* See FYA PPLT Programming Detail on Sheet 2.

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LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	DETECTOR NO.	PIN NO.	ATTRIBUTES	NEMA PHASE
1A	TB2-1,2	I1U	14	56	5 7	1
			10	56	1 5 7	6
2A	TB2-5,6	I2U	1	39	4 5 7	2
2B	TB2-7,8	I2L	5	43	4 5 7	2
4A	TB4-9,10	I6U	3	41	5 7	4
5A	TB3-1,2	J1U	13	55	5 7	5
			9	55	1 5 7	2
5B	TB7-9,10	J9U	17	59	5 7	5
6A	TB3-5,6	J2U	2	40	4 5 7	6
6B	TB3-7,8	J2L	6	44	4 5 7	6
8A	TB5-9,10	J6U	4	42	5 7	8
PED PUSH BUTTONS						
P21,P22	TB8-4,6	I12U	25	67	2	2 PED
P61,P62	TB8-7,9	I13U	26	68	2	6 PED
P81,P82	TB8-8,9	I13L	28	70	2	8 PED

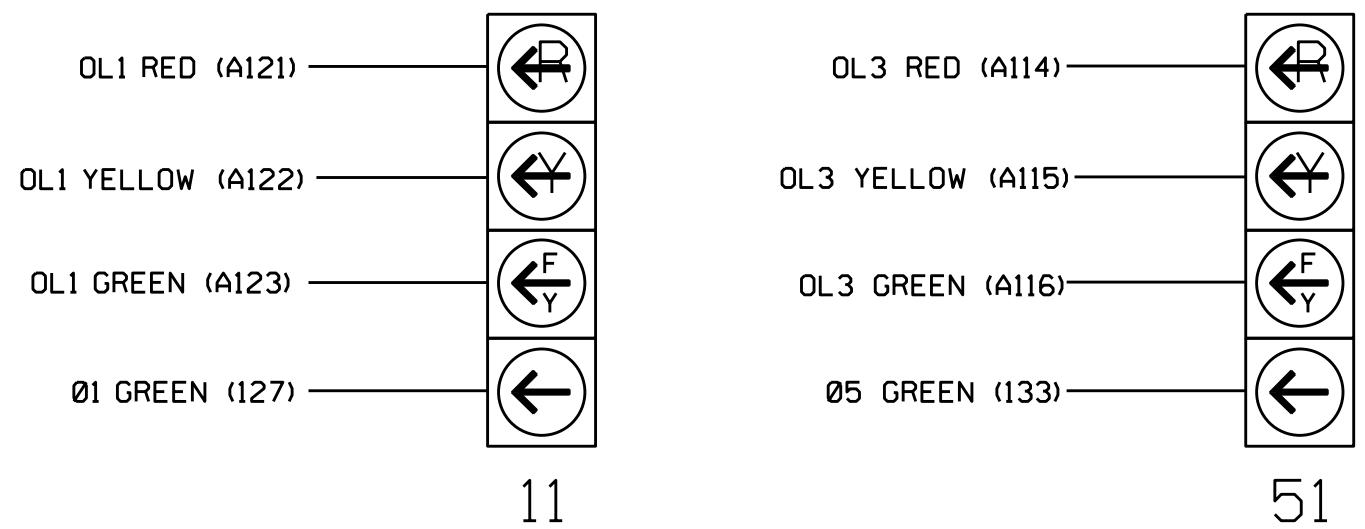
DETECTOR ATTRIBUTES LEGEND: INPUT FILE POSITION LEGEND: J2L

1-FULL TIME DELAY	FILE J	_____
2-PED CALL	SLOT 2	_____
3-RESERVED	LOWER	_____
4-COUNTING		
5-EXTENSION		
6-TYPE 3		
7-CALLING		
8-ALTERNATE		

LOAD SWITCH NO.	S1	S2	S2P	S3	S4	S4P	S5	S6	S6P	S7	S8	S8P	S9	S10	S11	S12	S13	S14	
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE	
SIGNAL HEAD NO.	11★	21,22	P21, P22	NU	41,42	NU	42	51★	61,62	P61, P62	NU	81,82	P81, P82	11★	NU	NU	51★	NU	NU
RED		128			101				134			107							
YELLOW	*	129			102				135			108							
GREEN		130			103				136			109							
RED ARROW													A121			A114			
YELLOW ARROW							132						A122			A115			
FLASHING YELLOW ARROW													A123			A116			
GREEN ARROW	127						133	133											
			113						119			110							
			115						121			112							

★ See pictorial of head wiring in detail below.

(wire signal heads as shown)



THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-2156
DESIGNED: November 2016
SEALED: 1/12/17
REVISED: N/A

Prepared In the Offices of:

Transportation Mobility and Safety Division
DEPARTMENT OF TRANSPORTATION
Signals Management Section

The seal of the North Carolina Department of Transportation is circular. It features a stylized black silhouette of the state of North Carolina in the center. The words "TRANSPORTATION MOBILITY AND SAFETY DIVISION" are written in a circle around the top, and "DEPARTMENT OF TRANSPORTATION" is written around the bottom. Below the seal, the text "Signals Management Section" is visible.

750 N.Greenfield Pkwy.Garner,NC 27529

SEAL

NORTH CAROLINA

PROFESSIONAL

SEAL
030530

ENGINEER

ZACHARY M. LITTLE

-DocuSigned by:

Zachary M. Little 1/31/2017

DATE	INVENTORY NO	DESCRIPTION	QTY	UNIT	PRICE	TOTAL
05/01/00	00000001	00000001	1	EA	1.00	1.00
05/01/00	00000002	00000002	1	EA	1.00	1.00
05/01/00	00000003	00000003	1	EA	1.00	1.00
05/01/00	00000004	00000004	1	EA	1.00	1.00
05/01/00	00000005	00000005	1	EA	1.00	1.00
05/01/00	00000006	00000006	1	EA	1.00	1.00
05/01/00	00000007	00000007	1	EA	1.00	1.00
05/01/00	00000008	00000008	1	EA	1.00	1.00
05/01/00	00000009	00000009	1	EA	1.00	1.00
05/01/00	00000010	00000010	1	EA	1.00	1.00
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05/01/00	00000014	00000014	1	EA	1.00	1.00
05/01/00	00000015	00000015	1	EA	1.00	1.00
05/01/00	00000016	00000016	1	EA	1.00	1.00
05/01/00	00000017	00000017	1	EA	1.00	1.00
05/01/00	00000018	00000018	1	EA	1.00	1.00
05/01/00	00000019	00000019	1	EA	1.00	1.00
05/01/00	00000020	00000020	1	EA	1.00	1.00
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05/01/00	00000022	00000022	1	EA	1.00	1.00
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05/01/00	00000024	00000024	1	EA	1.00	1.00
05/01/00	00000025	00000025	1	EA	1.00	1.00
05/01/00	00000026	00000026	1	EA	1.00	1.00
05/01/00	00000027	00000027	1	EA	1.00	1.00
05/01/00	00000028	00000028	1	EA	1.00	1.00
05/01/00	00000029	00000029	1	EA	1.00	1.00
05/01/00	00000030	00000030	1	EA	1.00	1.00
05/01/00	00000031	00000031	1	EA	1.00	1.00
05/01/00	00000032	00000032	1	EA	1.00	1.00
05/01/00	00000033	00000033	1	EA	1.00	1.00
05/01/00	00000034	00000034	1	EA	1.00	1.00
05/01/00	00000035	00000035	1	EA	1.00	1.00
05/01/00	00000036	00000036	1	EA	1.00	1.00
05/01/00	00000037	00000037	1	EA	1.00	1.00
05/01/00	00000038	00000038	1	EA	1.00	1.00
05/01/00	00000039	00000039	1	EA	1.00	1.00
05/01/00	00000040	00000040	1	EA	1.00	1.00
05/01/00	00000041	00000041	1	EA	1.00	1.00
05/01/00	00000042	00000042	1	EA	1.00	1.00
05/01/00	00000043	00000043	1	EA	1.00	1.00
05/01/00	00000044	00000044	1	EA	1.00	1.00
05/01/00	00000045	00000045	1	EA	1.00	1.00
05/01/00	00000046	00000046	1	EA	1.00	1.00
05/01/00	00000047	00000047	1	EA	1.00	1.00
05/01/00	00000048	00000048	1	EA	1.00	1.00
05/01/00	00000049	0000				

31-JUN-2017 12:53
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bj/simmons

FYA PPLT PROGRAMMING

1. Program Flashing Yellow Arrow phases as follows:
Main Menu - 1) PHASE - 2) PHASE FUNCTIONS PAGE TWO
PPLT FYA = PHASE 1.5
2. Assign output pin for Flashing Yellow Arrow as follows:
Main Menu - 6) OUTPUTS - F) FYA PPLT
Phase 1 = 99
Phase 5 = 90
3. Redirect RED and YELLOW outputs for the left turn phases as follows:
Main Menu - 6) OUTPUTS - 8) REDIRECT PHASE
Phase 1 RED = 97, Phase 1 YELLOW = 98
Phase 5 RED = 88, Phase 5 YELLOW = 89

SPECIAL NOTES EV PREEMPT PROGRAMMING

Setting 'FYA DURING PREEMPT' to 'Y' eliminates yellow trap when transitioning to preempt from adjacent through phase.
Main Menu - 9) UTILITIES - 9) MISC
FYA DURING PREEMPT (Y/N) = Y

EMERGENCY VEHICLE PREEMPTION PROGRAMMING

1. Program EVB preempt as follows:
Main Menu - 2) PREEMPT - 4) EMERGENCY VEHICLE
EVB Clear = 1
EVB Clearance Phases = 1.6
2. Program general preemption parameters as follows:
Main Menu - 2) PREEMPT - 6) MISC PREEMPTION PARAMETERS
Min Time Before PE ForceOff = 1
3. Ped Clear Before Preempt is a pedestrian timing parameter, and is programmed as follows:
Main Menu - 1) PHASE - 5) PEDESTRIAN TIMING
PHASE 2 MIN FDW = 5
PHASE 6 MIN FDW = 7
PHASE 8 MIN FDW = 9

Program Preempt Extend time on optical detector unit for 2.0 sec.

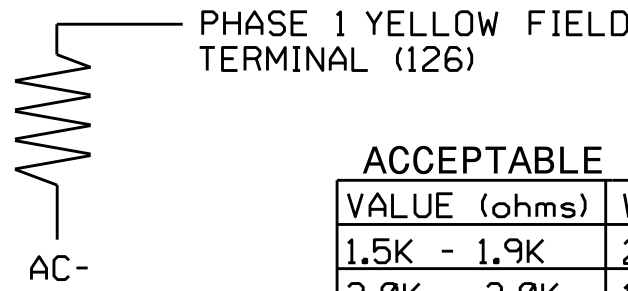
MIN WALK DURING PREEMPTION PROGRAMMING

To disable MIN WALK pedestrian timing during preemption, program the controller as follows:
Main Menu - 9) UTILITIES - 5) CONFIGURATION
EXTRA TWO = 3

PROJECT REFERENCE NO.	SHEET NO.
W-5601HX	Sig. 3

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)



ACCEPTABLE VALUES	
VALUE (ohms)	WATTAGE
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)

COUNTDOWN PEDESTRIAN SIGNAL OPERATION

Countdown Ped Signals are required to display timing only during Ped Clearance Interval. Consult Ped Signal Module user's manual for instructions on selecting this feature.

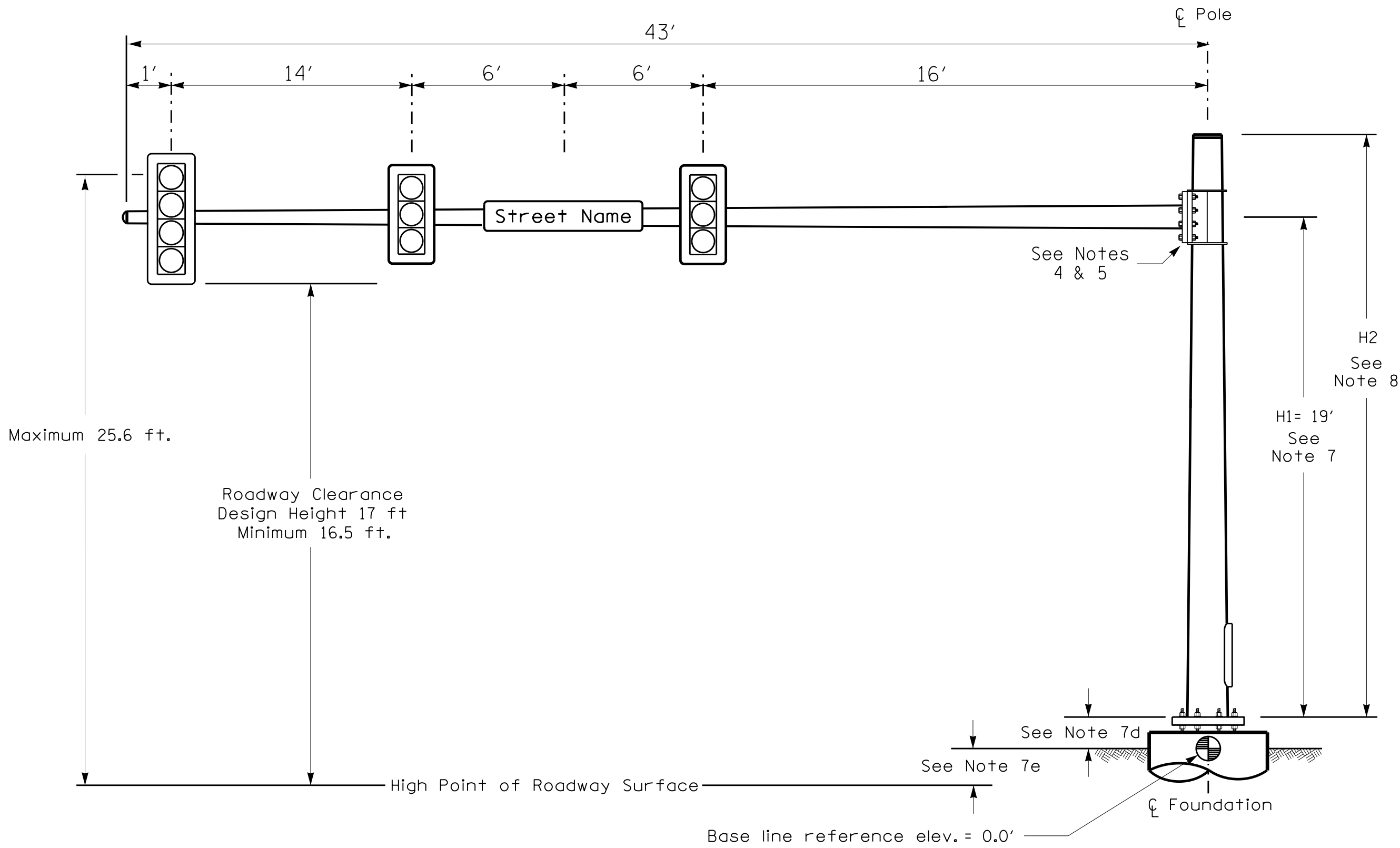
THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-2156
DESIGNED: November 2016
SEALED: 1/12/17
REVISED: N/A

Electrical Detail - Sheet 2 of 2

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

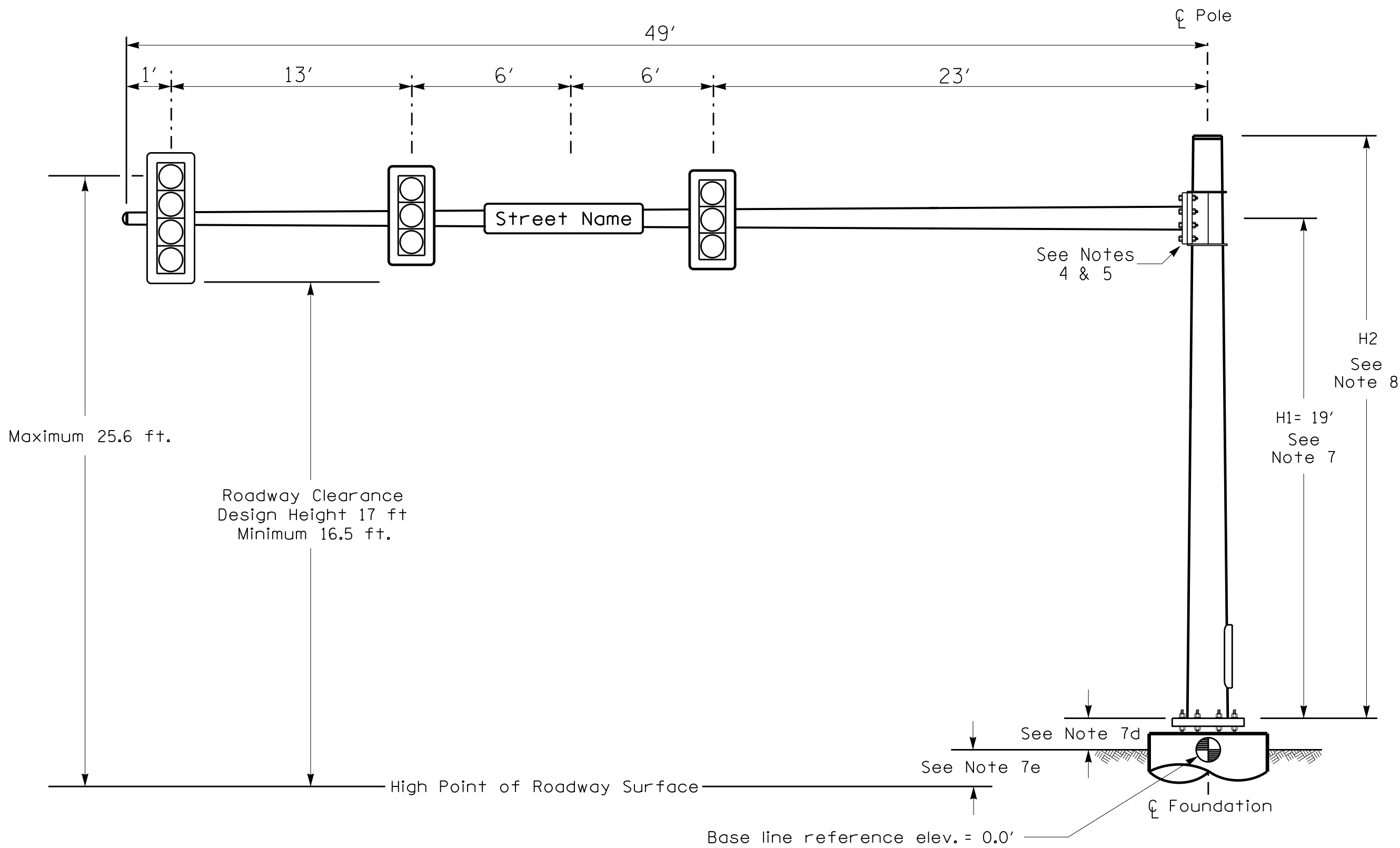
Electrical and Programming Details for: Prepared in the Offices of: 750 N. Greenfield Pkwy, Garner, NC 27529	NC 55 at Allendown Drive and Park West Shopping Center		SEAL 	
	Division 5	Durham County	Durham	
	PLAN DATE: December 2016	REVIEWED BY: BAS		
	PREPARED BY: B. SIMMONS	REVIEWED BY:		
	REVISIONS	INIT.	DATE	
		DocuSigned by 0021EFD94F5341F		1/31/2017 DATE
		SIG. INVENTORY NO.		05-2156

Design Loading for METAL POLE NO. 1



Elevation View

Design Loading for METAL POLE NO. 2



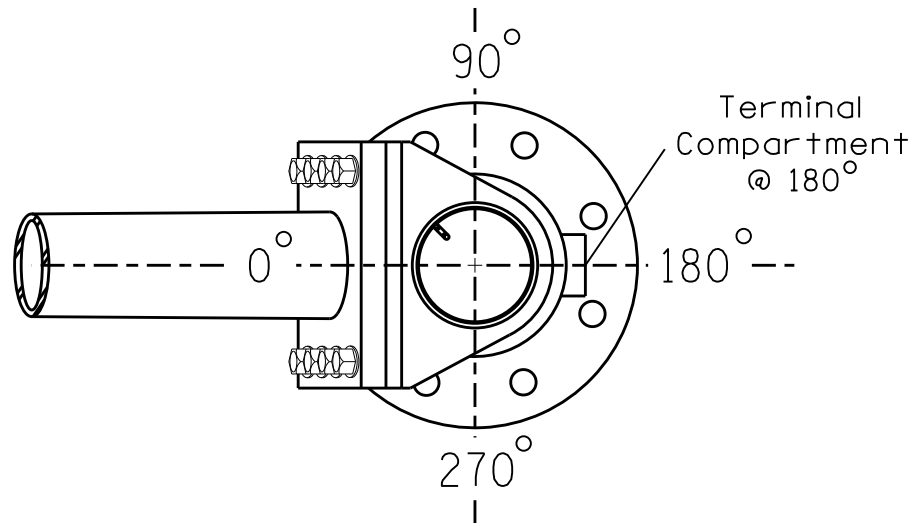
Elevation View

SPECIAL NOTE

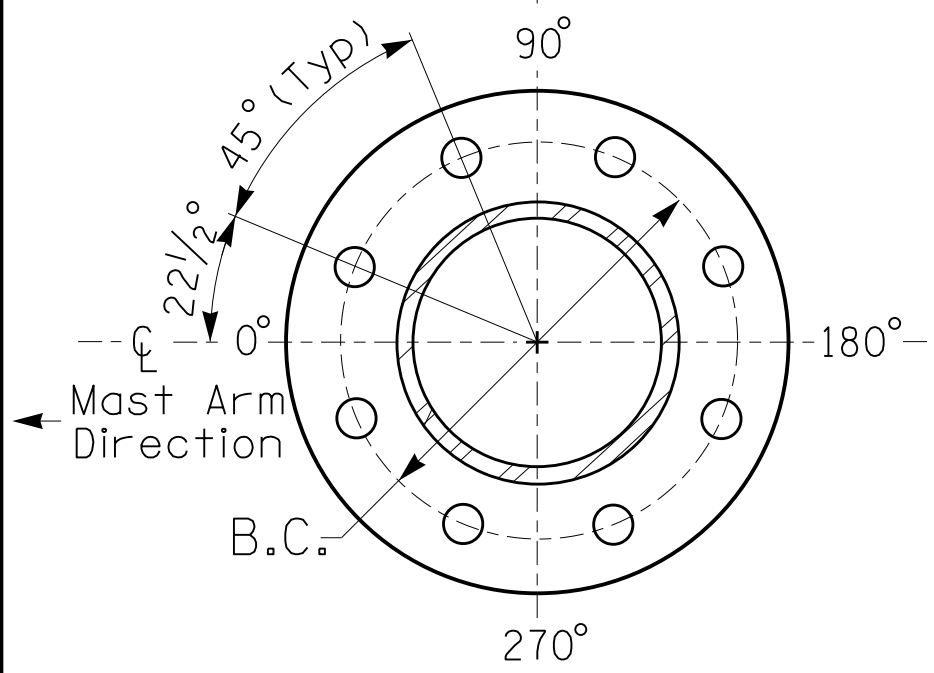
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	Pole 2
Baseline reference point at ϕ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	-0.1 ft.	-0.2 ft.
Elevation difference at Edge of travelway or face of curb	N/A	N/A

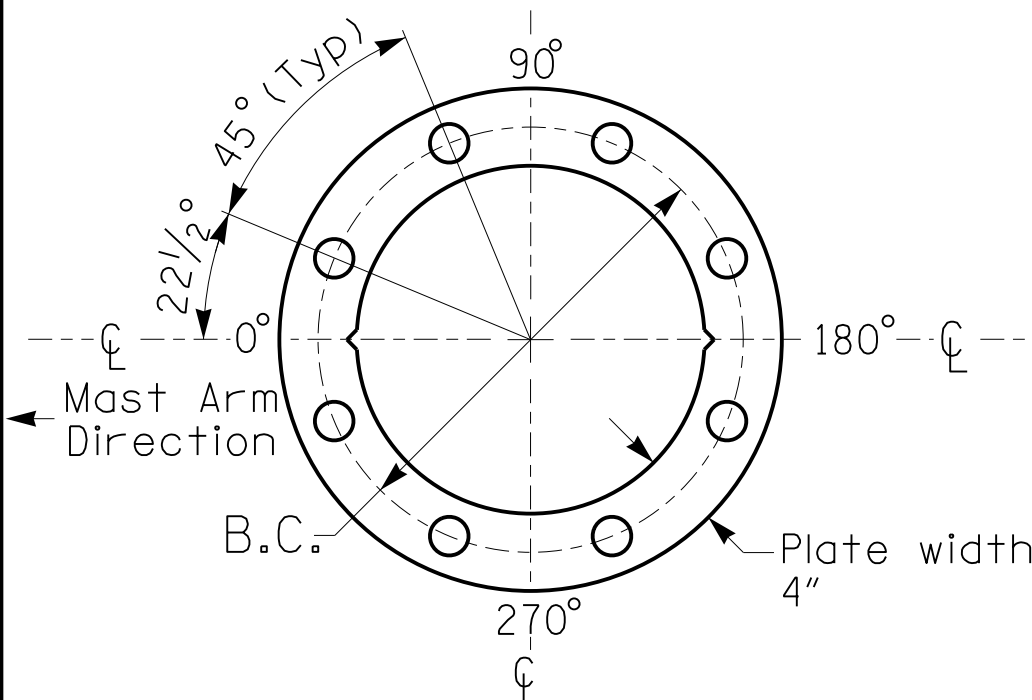


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL
For 8 Bolt Base Plate

METAL POLE No. 1 and 2

PROJECT REFERENCE NO.	SHEET NO.
W-5601HX	Sig. 4

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12"-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5"W X 66.0"L	74 LBS
	RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5"W X 52.5"L	60 LBS
	STREET NAME SIGN RIGID MOUNTED	16.0 S.F.	24.0"W X 96.0"L	36 LBS

NOTES

DESIGN REFERENCE MATERIAL

- Design the traffic signal structure and foundation in accordance with:
 - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
 - The 2012 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
 - The 2012 NCDOT Roadway Standard Drawings.
 - The traffic signal project plans and special provisions.
 - The NCDOT "Metal Pole Standards" located at the following NCDOT website:
<https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx>

DESIGN REQUIREMENTS

- Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
- Design all signal supports using stress ratios that do not exceed 0.9.
- The camber design for the mast arm deflection should provide an appearance of a low pitched arch where the tip or the free end of the mast arm does not deflect below horizontal when fully loaded.
- A clamp-type bolted mast arm-to-pole connection may be used instead of the welded ring stiffened box connection shown as long as the connection meets all of the design requirements.
- Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
- The mast arm attachment height (H1) shown is based on the following design assumptions:
 - Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
 - Signal heads are rigidly mounted and vertically centered on the mast arm.
 - The roadway clearance height for design is as shown in the elevation views.
 - The top of the pole base plate is 0.75 feet above the ground elevation.
 - Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
- The pole manufacturer will determine the total height (H2) of each pole using the greater of the following:
 - Mast arm attachment height (H1) plus 2 feet, or
 - H1 plus 1/2 of the total height of the mast arm attachment assembly plus 1 foot.
- If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
- The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
- The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

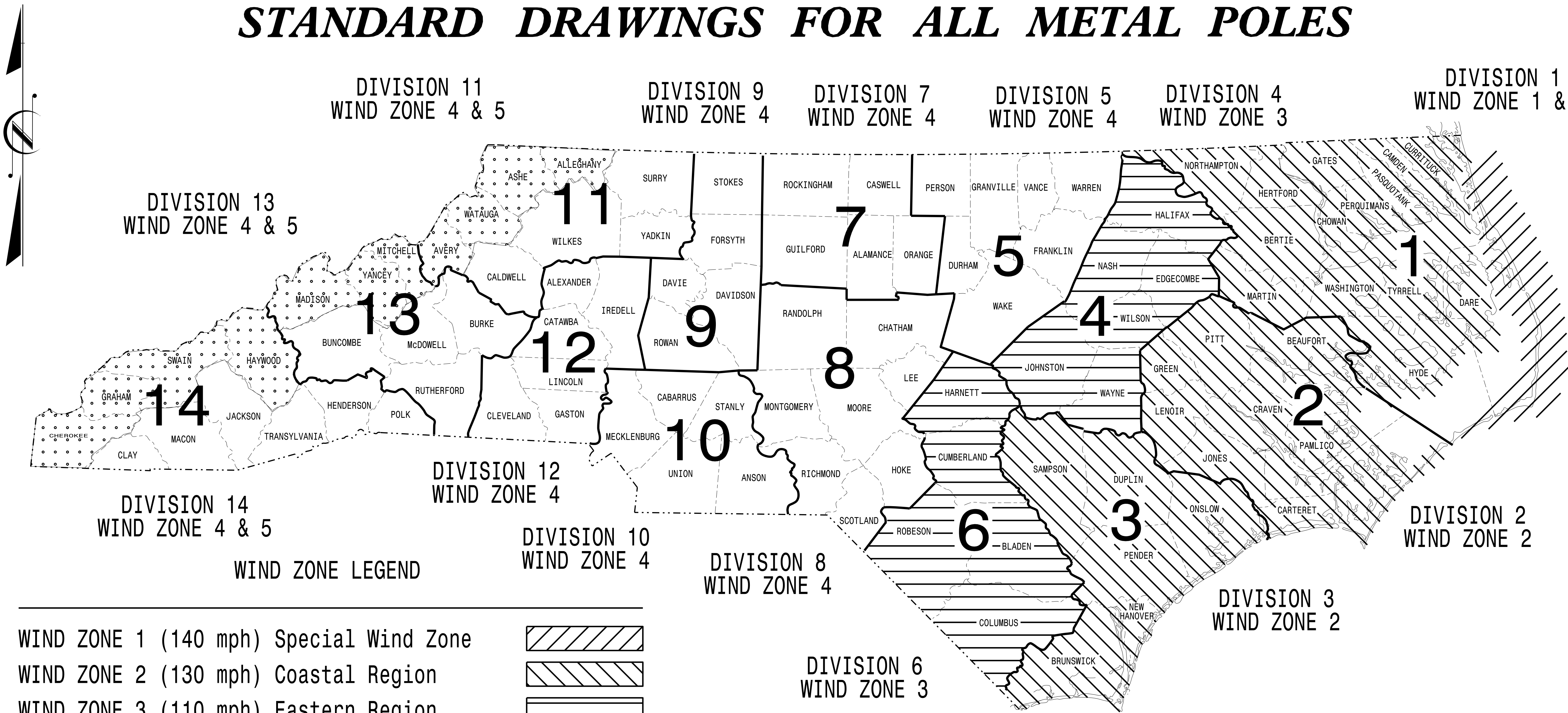
NCDOT Wind Zone 4 (90 mph)

 Prepared In the Offices of: TRANSPORTATION MOBILITY AND SAFETY DIVISION SIGNAL DESIGN SECTION 750 N. Greenfield Pkwy, Garner, NC 27529	NC 55 at Allendown Drive and Park West Shopping Center Division 5 Durham County Durham		DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED
	PLAN DATE: December 2016 PREPARED BY: C.E. Carter REVISIONS INIT. DATE	REVIEWED BY: REVIEWED BY: INIT. DATE	SEAL NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 026486 ROBERT J. LITEMA 2/1/2017 DATE SIG. INVENTORY NO. 05-2156

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

PROJECT I.D. NO.	SHEET NO.
	Sig.M1

STANDARD DRAWINGS FOR ALL METAL POLES

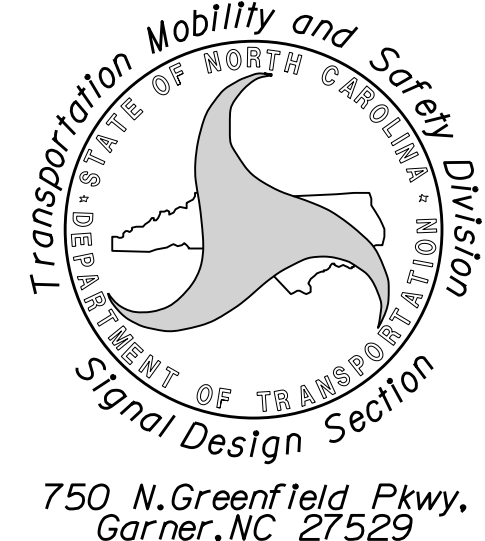


WIND ZONE LEGEND

WIND ZONE 1 (140 mph) Special Wind Zone	
WIND ZONE 2 (130 mph) Coastal Region	
WIND ZONE 3 (110 mph) Eastern Region	
WIND ZONE 4 (90 mph) Central & Mtn. Region	
WIND ZONE 5 (120 mph) Special Wind Zone	

<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

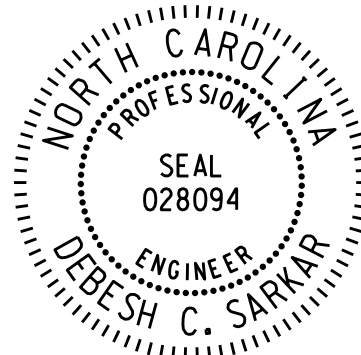
DRAWING NUMBER	DESCRIPTION
Sig. M 1	Statewide Wind Zone Map
Sig. M 2	Typical Fabrication Details-All Metal Poles
Sig. M 3	Typical Fabrication Details-Strain Poles
Sig. M 4	Typical Fabrication Details-Mast Arm Poles
Sig. M 5	Typical Fabrication Details-Mast Arm Connection
Sig. M 6	Typical Fabrication Details-Strain Pole Attachments
Sig. M 7	Construction Details-Foundations
Sig. M 8	Standard Strain Pole Foundation-All Soil Conditions

NCDOT CONTACTS:

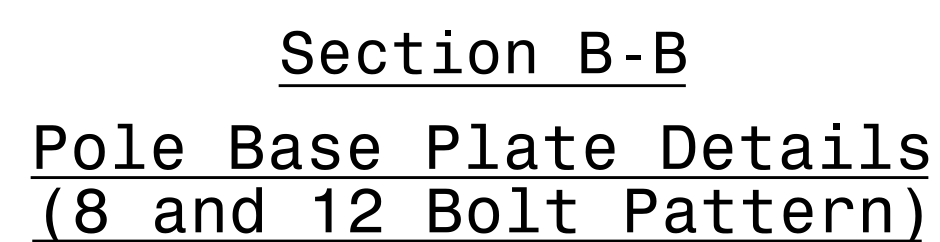
MOBILITY AND SAFETY DIVISION - ITS AND SIGNALS UNIT

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

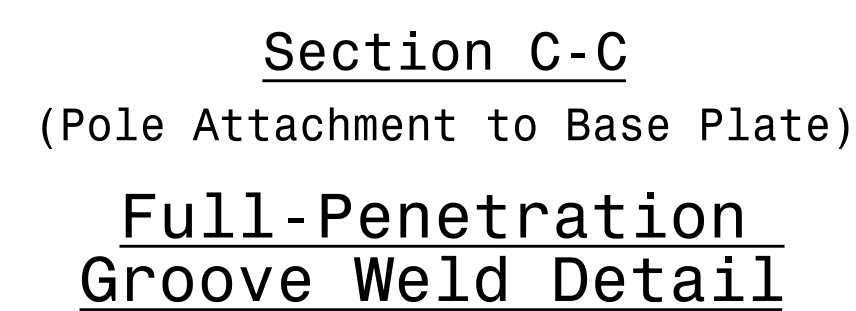
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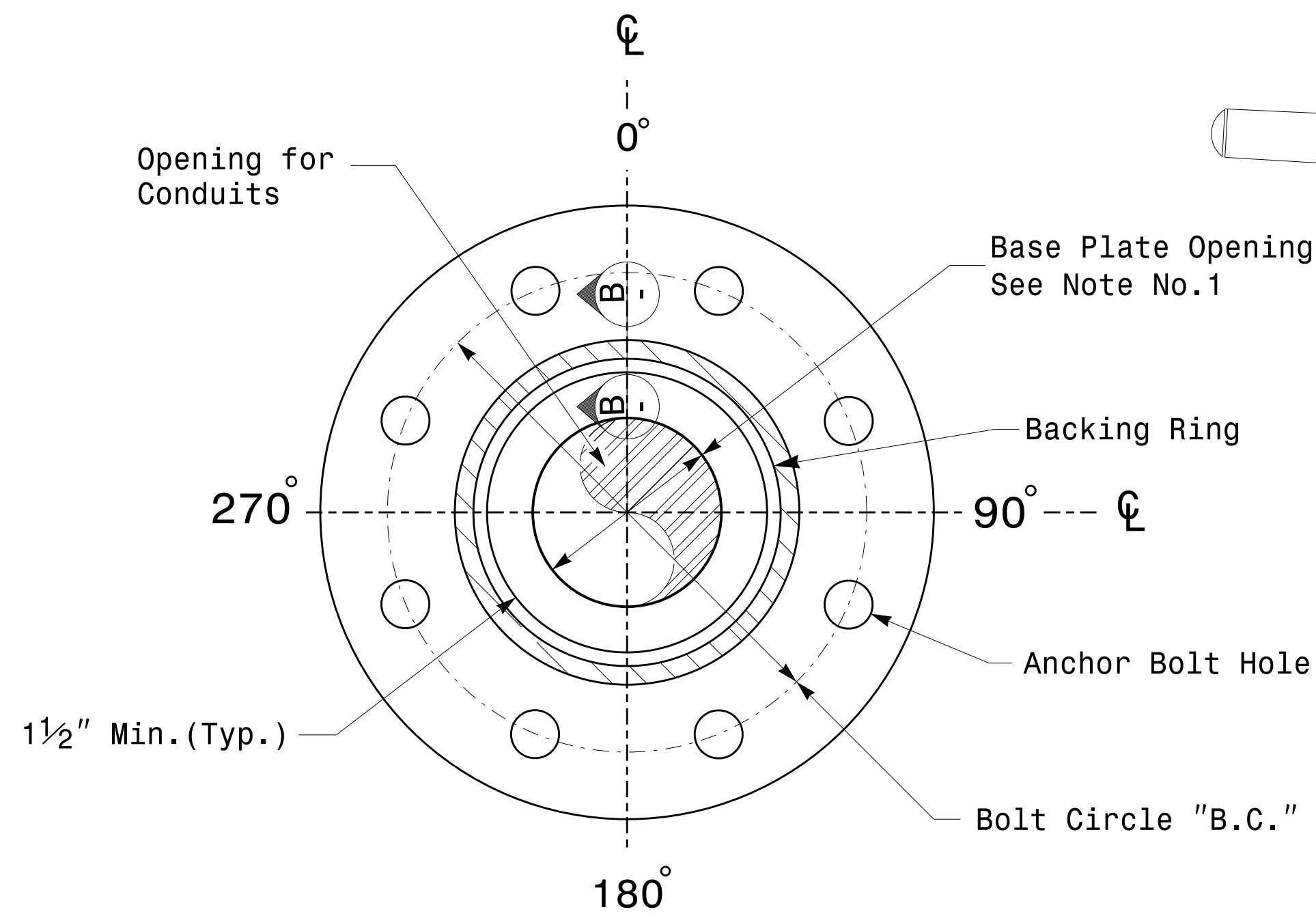
DocuSigned by:
Debesh C. Sarkar
44E8E325
2/17/2016
DATE



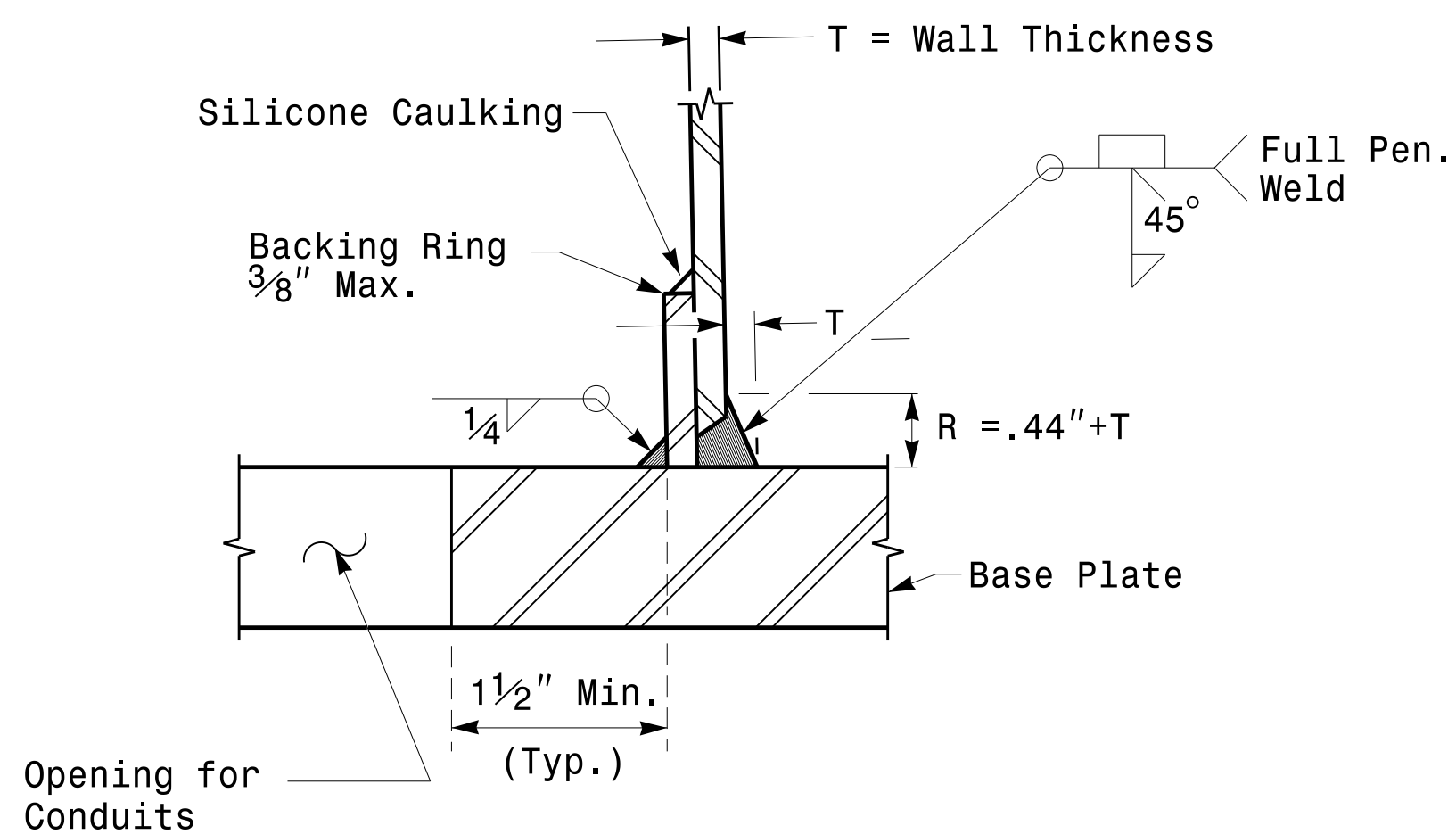
Radial Orientation for Factory Installed Accessories at Top of Pole



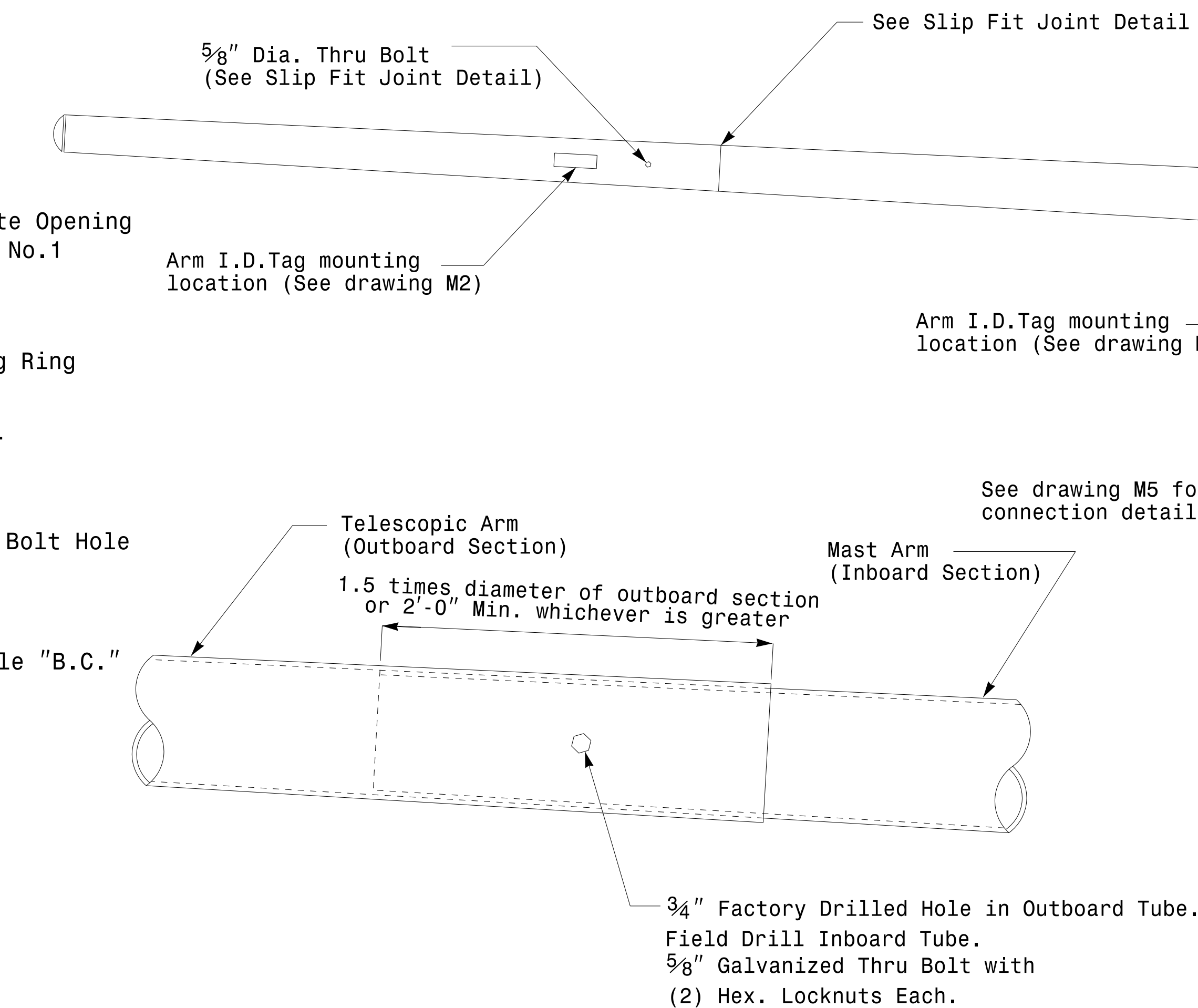
Note:
1. Opening in pole base plate shall be equal to pole base inside diameter minus 3½" but shall not be less than 8½".



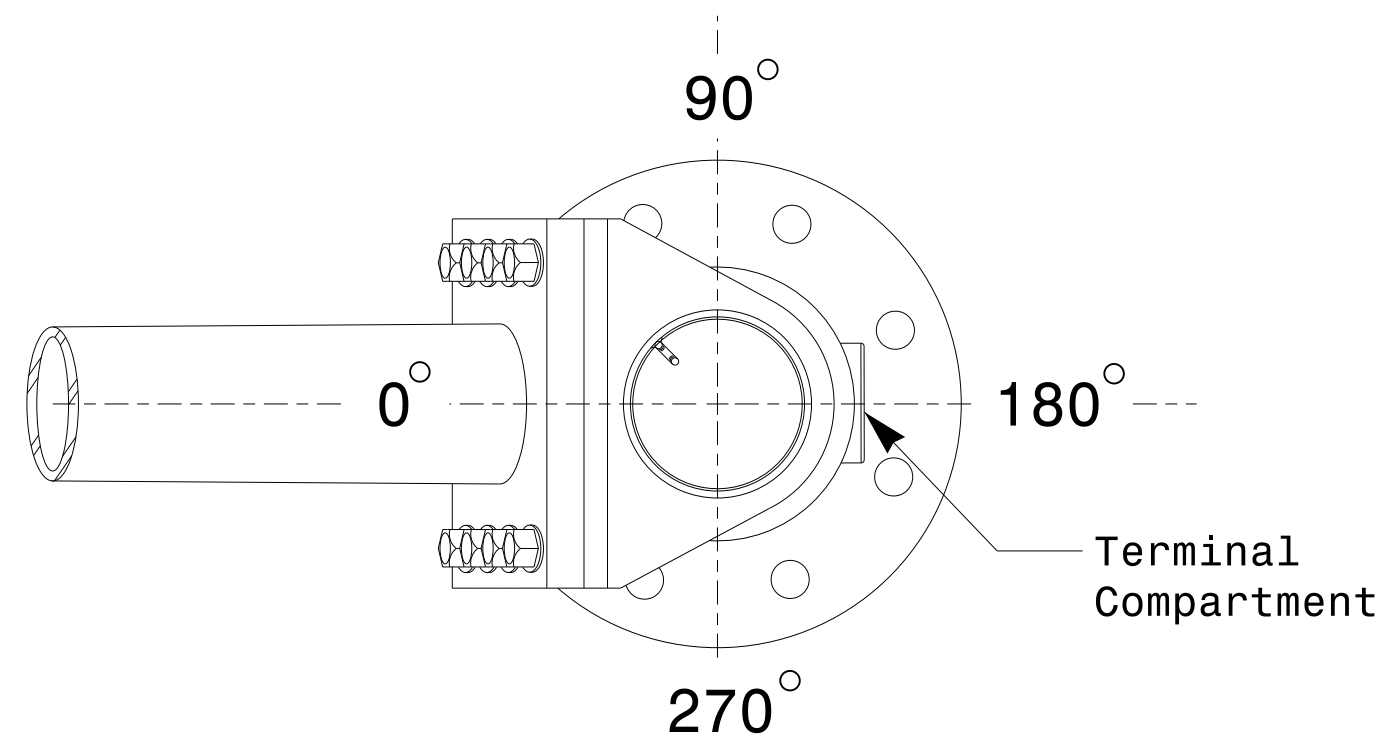
Section A-A
Pole Base Plate Details



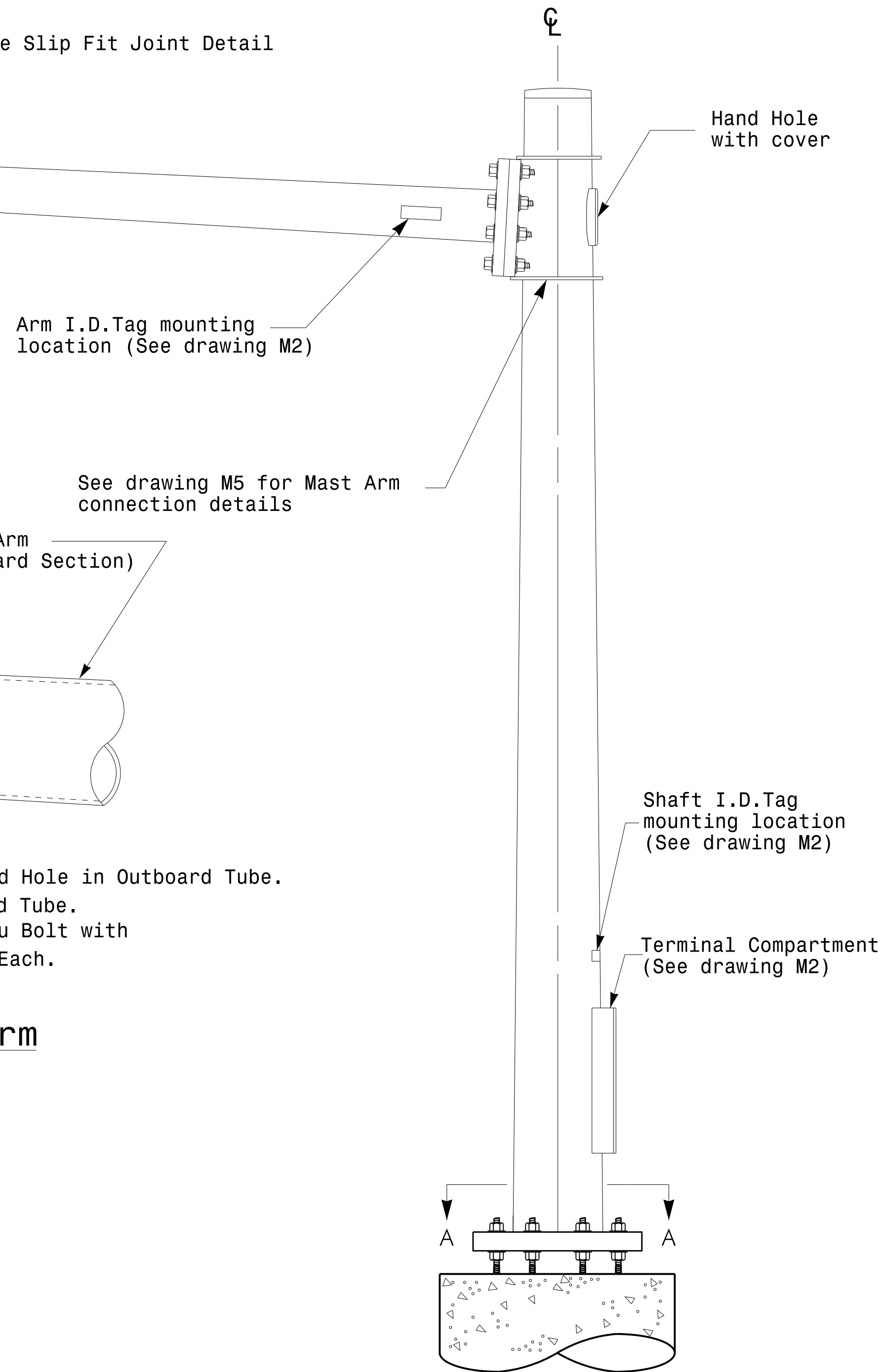
Section B-B
(Pole Attachment to Base Plate)
Full-Penetration
Groove Weld Detail



Slip Fit Joint Detail for Mast Arm



Mast Arm Radial Orientation

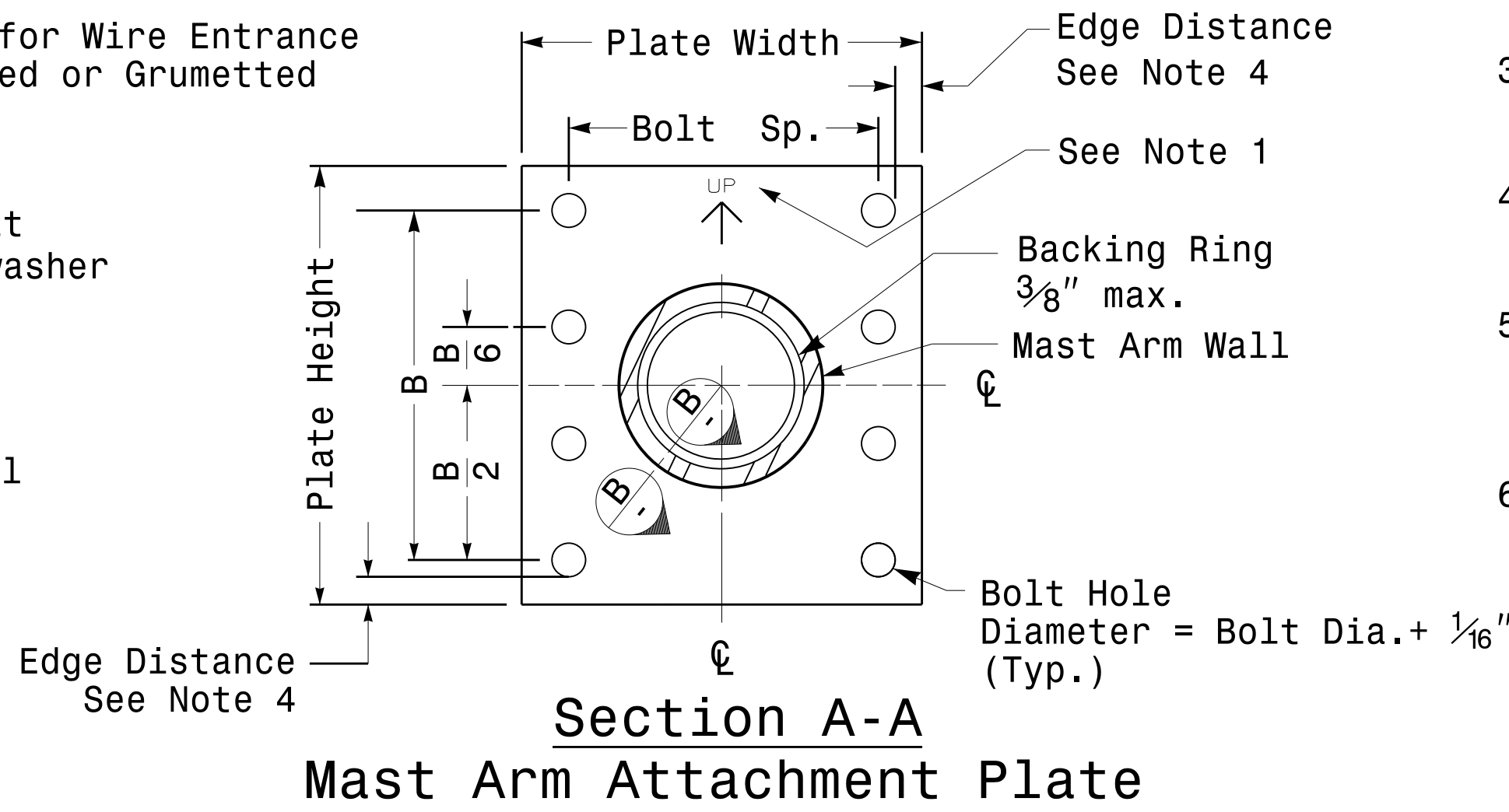
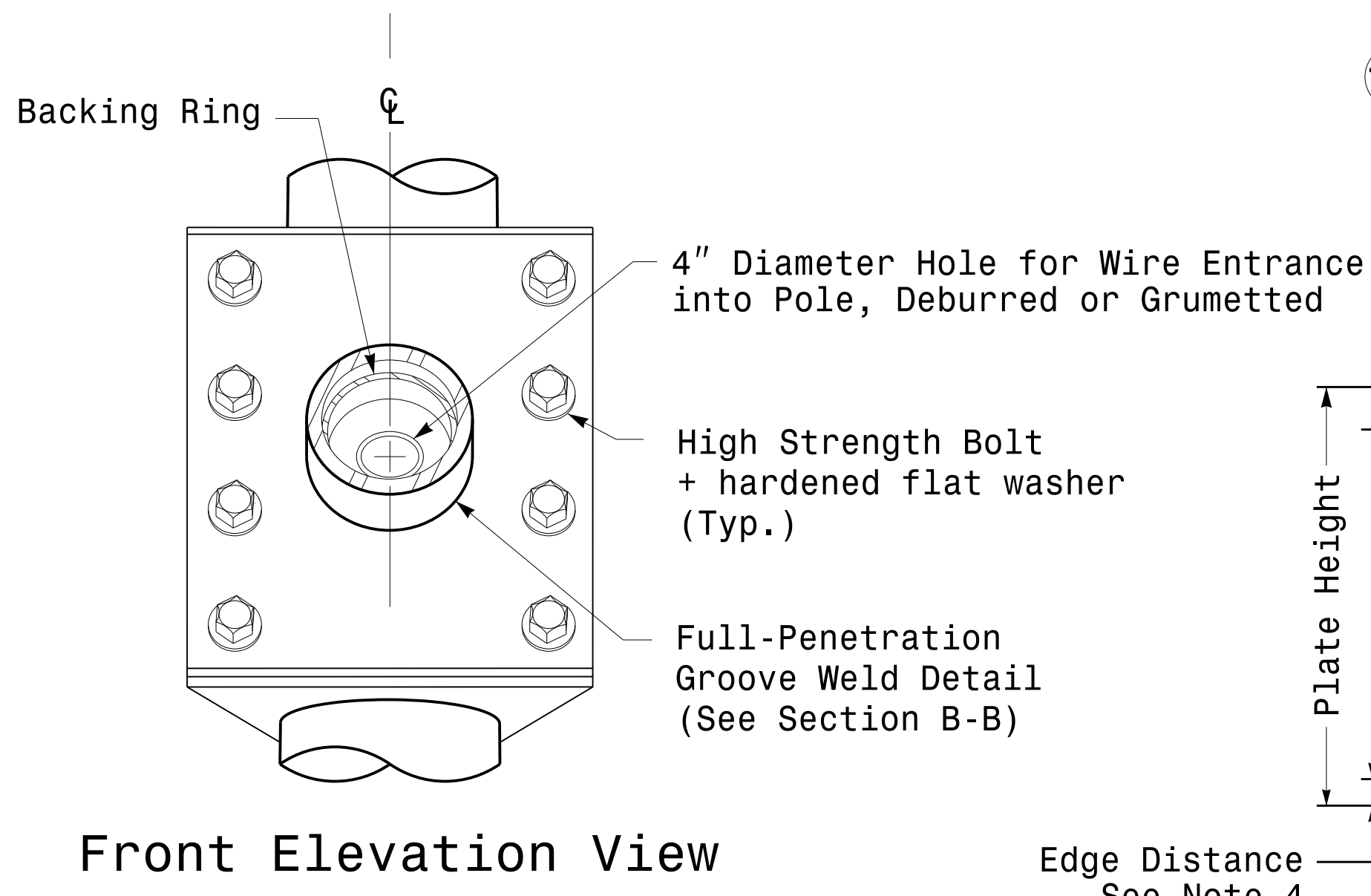
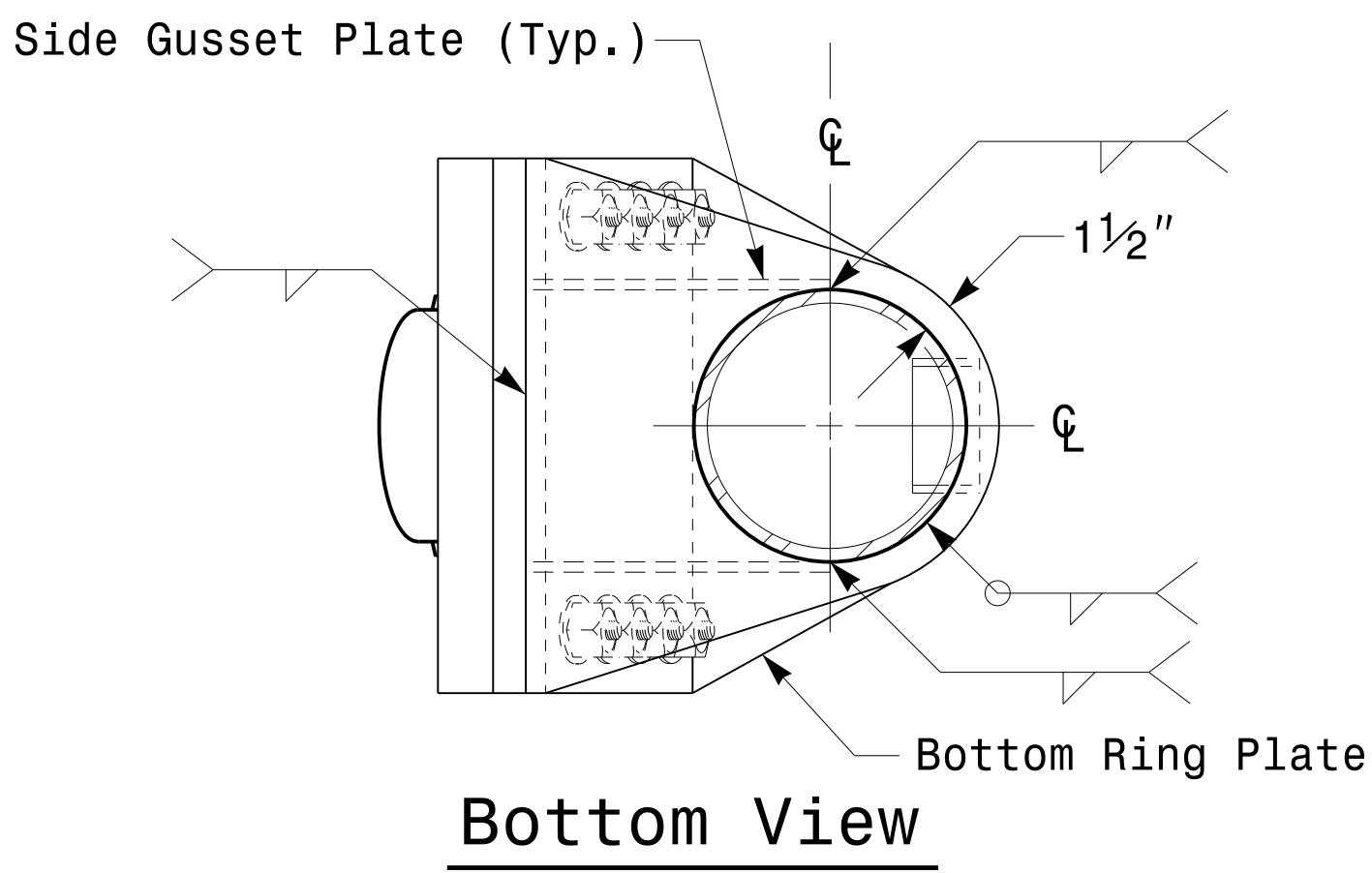
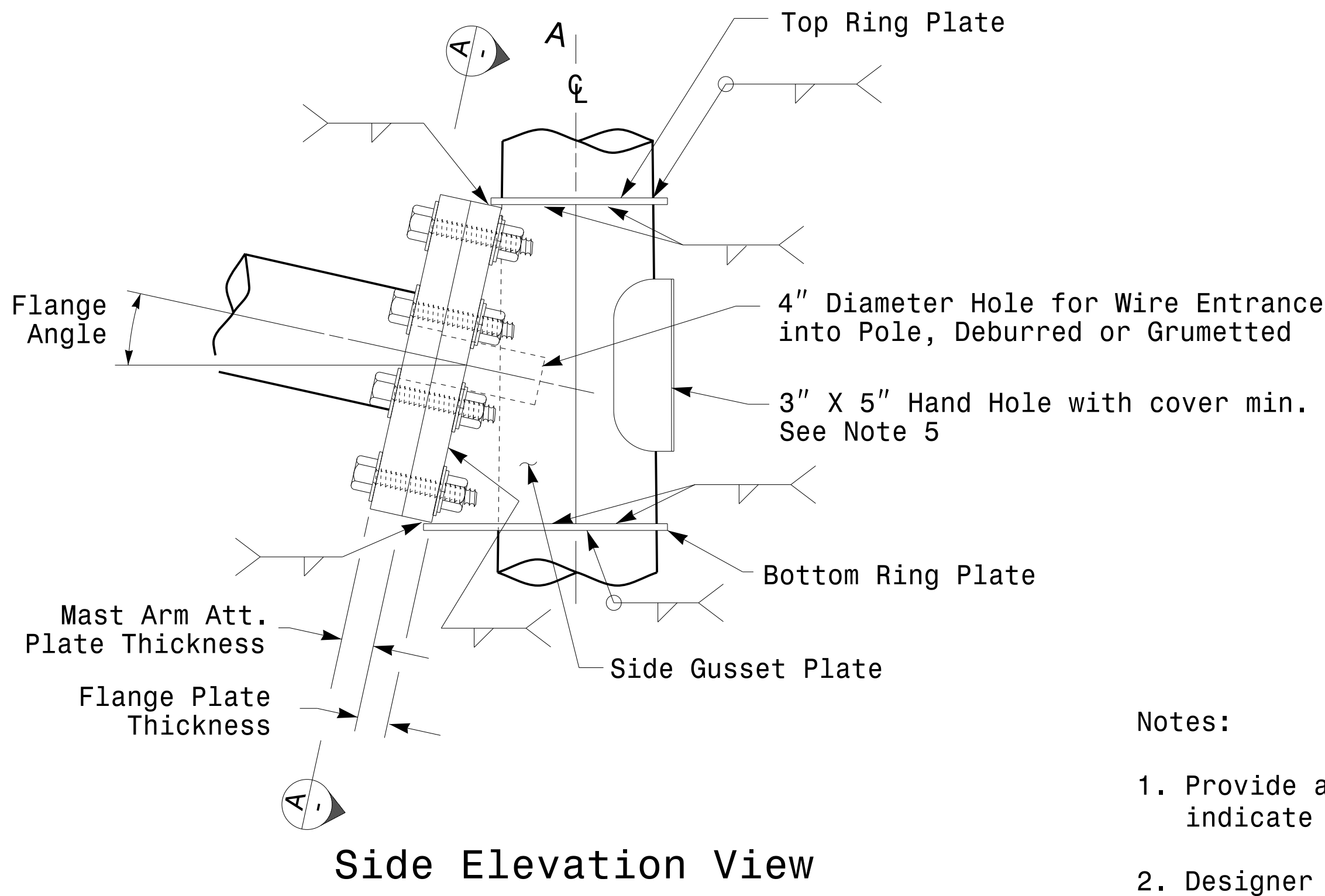
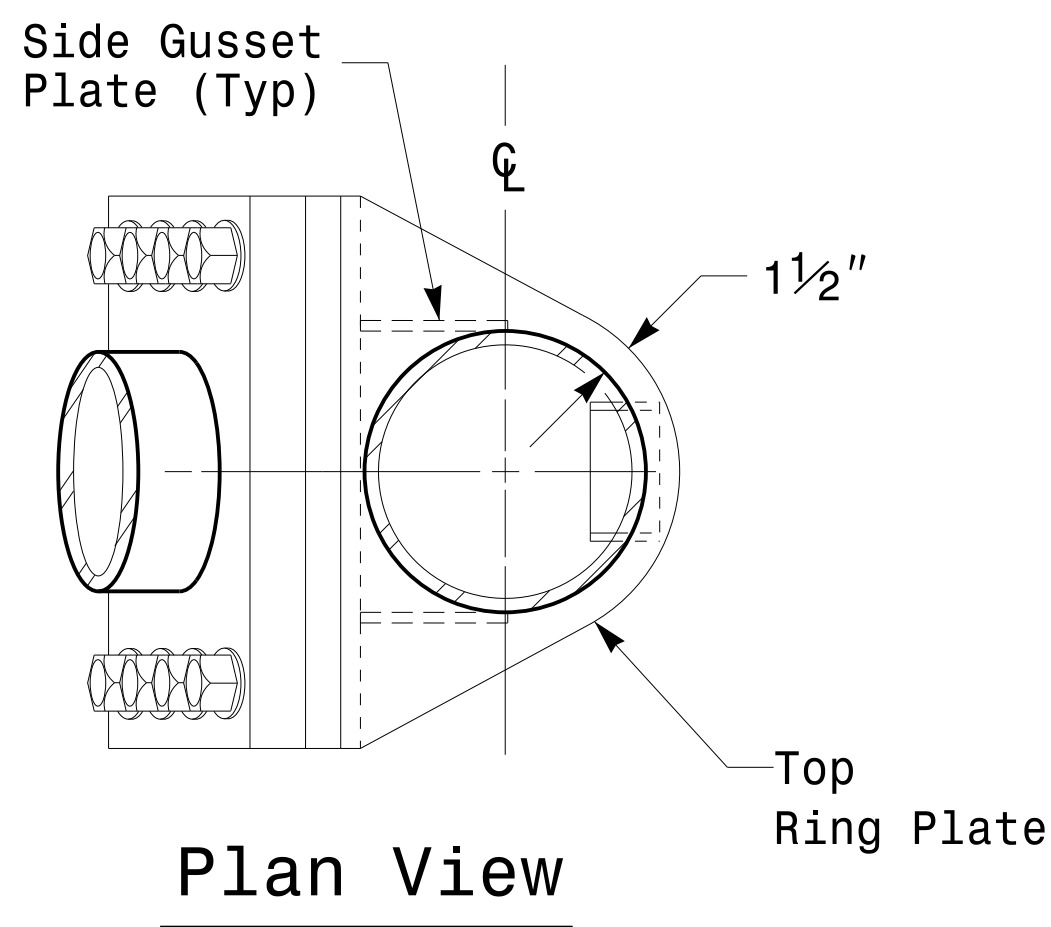


Mast Arm Pole

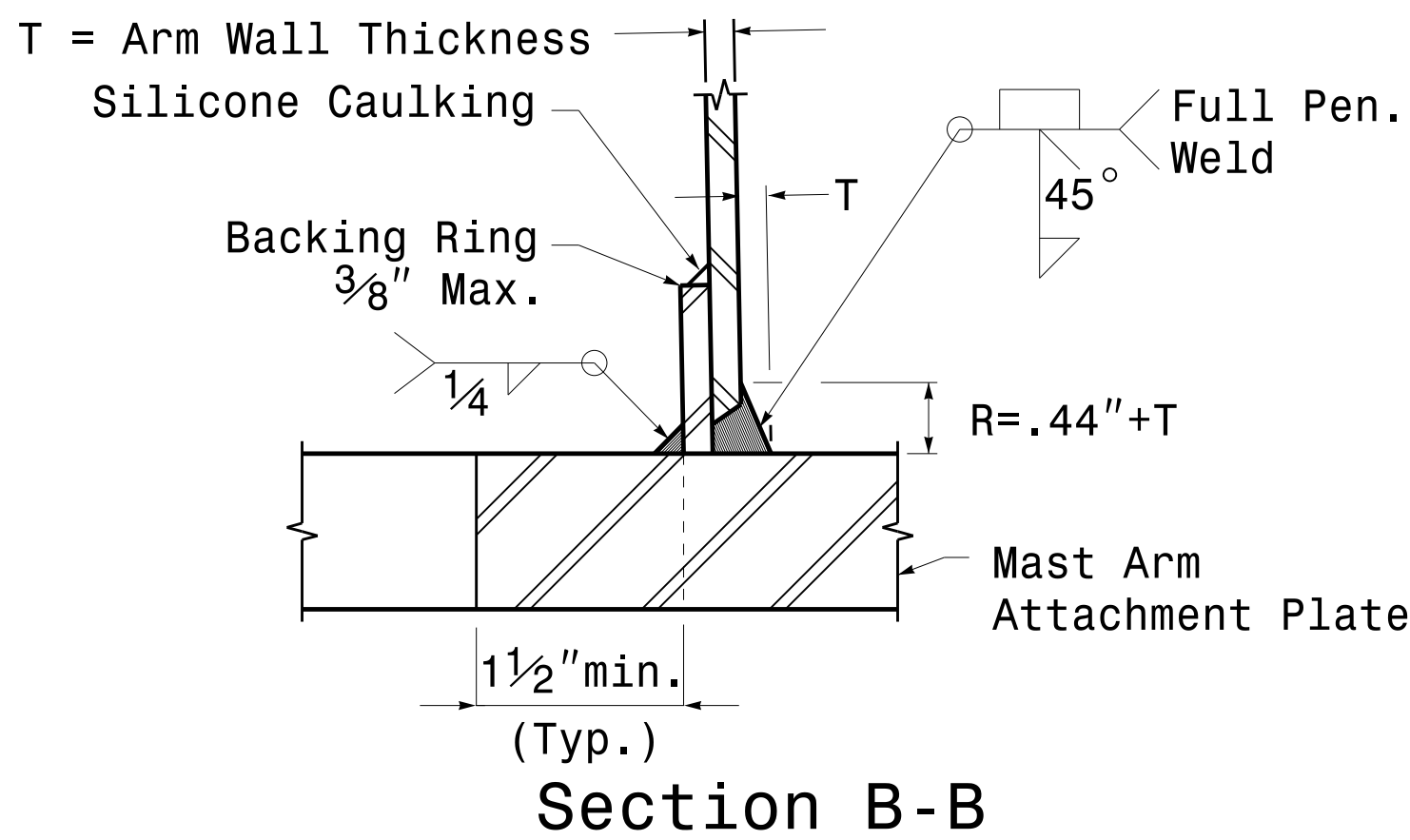
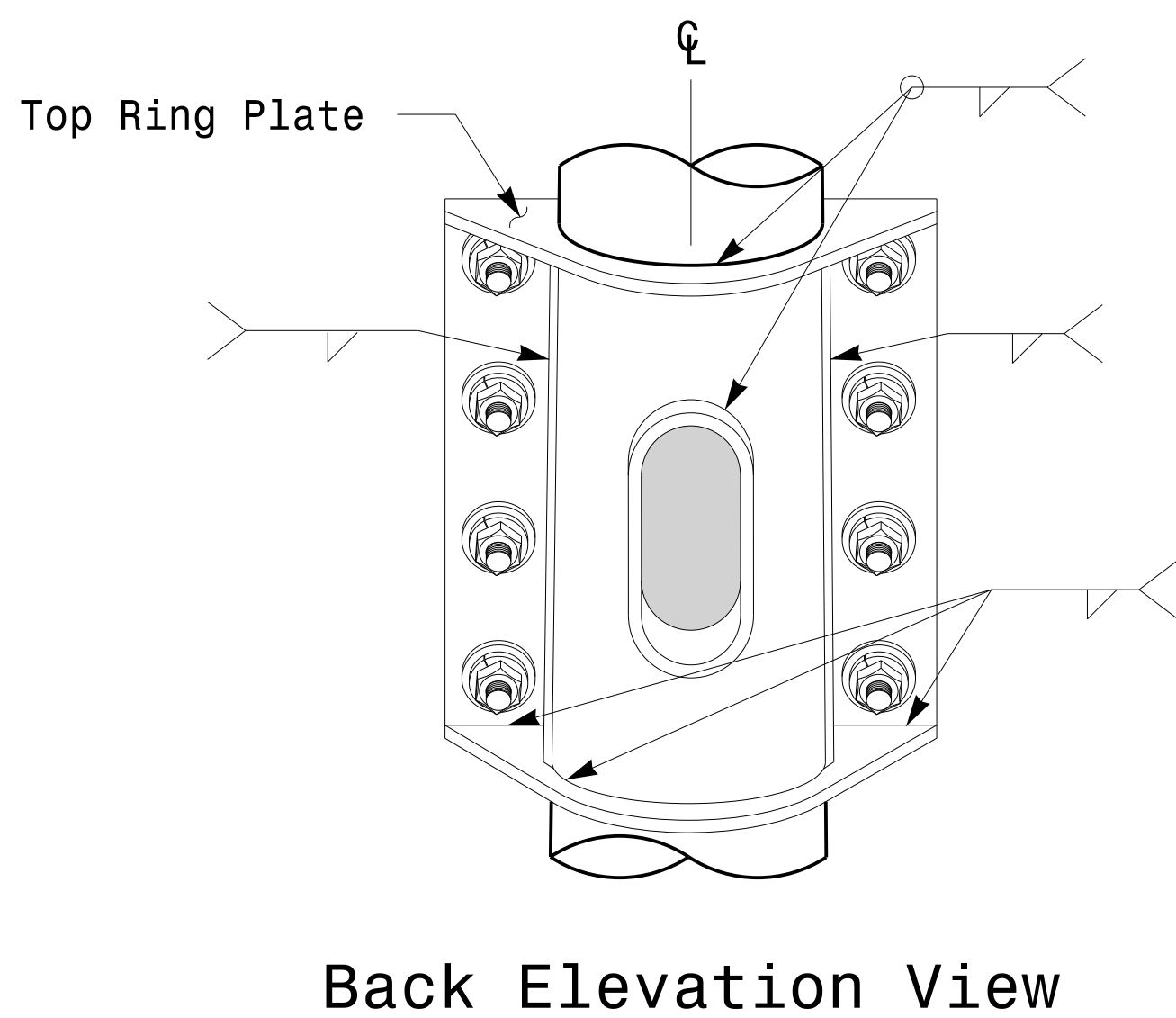
Prepared In the Offices of: TRANSPORTATION MOBILITY AND SAFETY DIVISION U.S. DEPARTMENT OF TRANSPORTATION Signal Design Section 750 N. Greenfield Pkwy, Garner, NC 27529 SCALE 0 NA NONE	Typical Fabrication Details For Mast Arm Poles				SEAL NORTH CAROLINA PROFESSIONAL SEAL 028094 ENGINEER DEBESH C. SARKAR DocuSigned by Debesh C. Sarkar 44E8E32E147E4C4... 2/17/2016 DATE
	PLAN DATE: FEBRUARY 2016	DESIGNED BY: K.C. DURIGON			
	PREPARED BY: N. BITTING	REVIEWED BY: D.C. SARKAR	INIT.	DATE	
	REVISIONS				

Welded Ring Stiffened Mast Arm Connection

PROJECT ID. NO.	SHEET NO.
	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:	FEBRUARY 2016	DESIGNED BY:	C.F. ANDREWS
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR
REVISIONS	INIT.	DATE	

SCALE
0 NA
NONE

SEAL

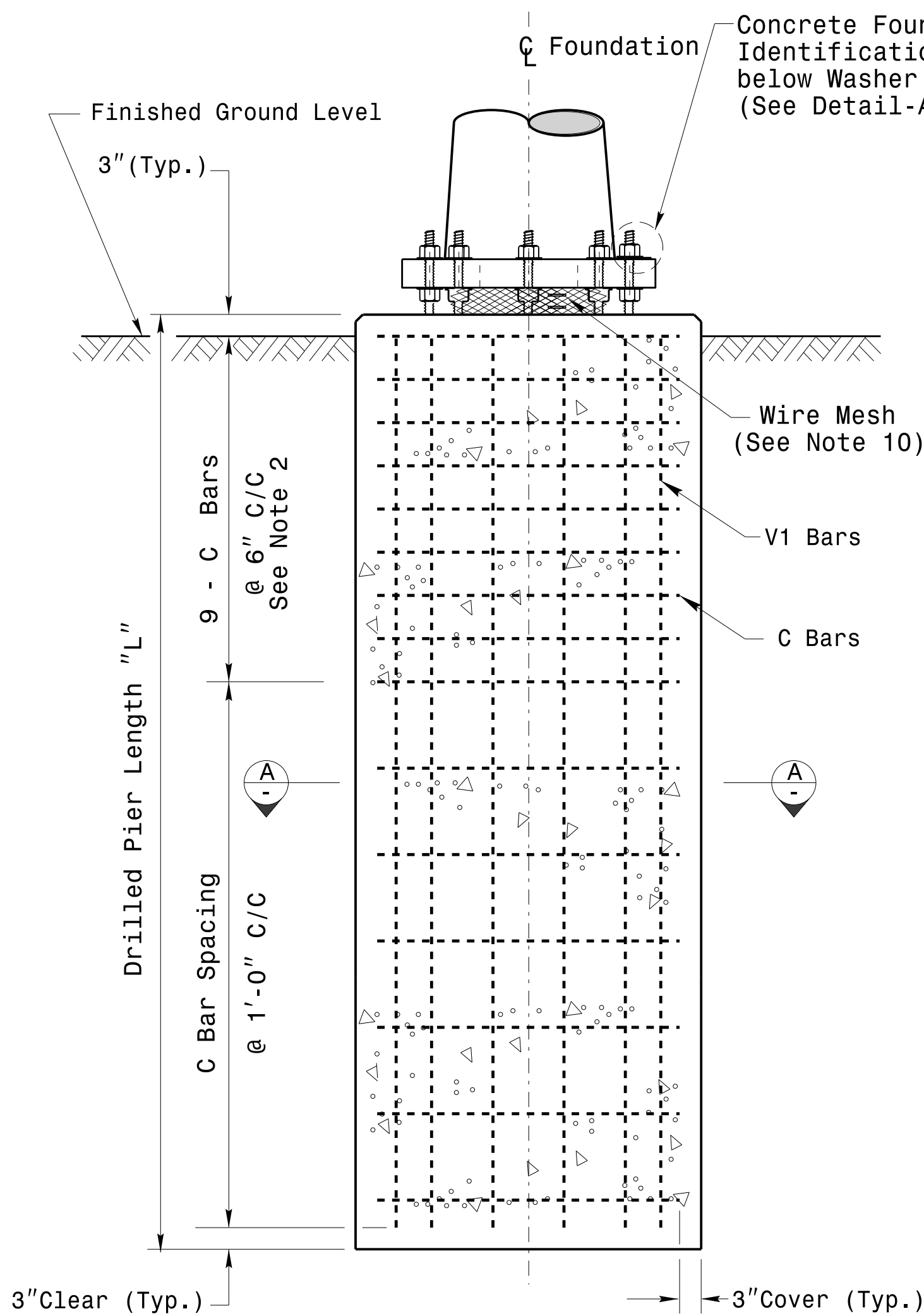
DocuSigned by:
Debesh C. Sarkar

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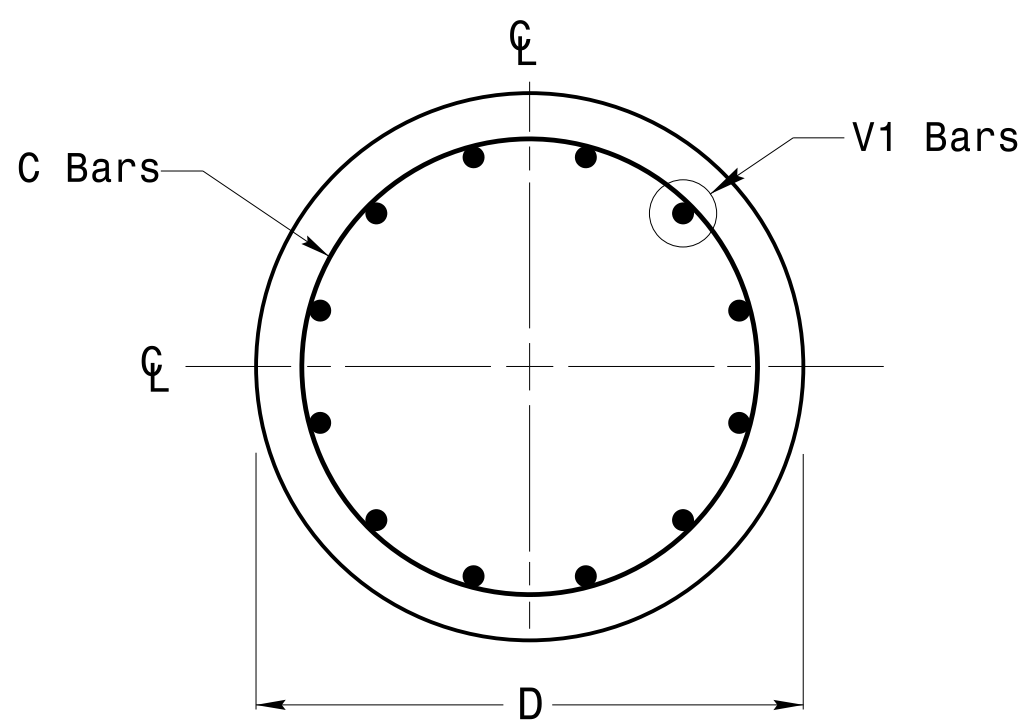
2/17/2016
DATE

17-FEB-2016 16:06
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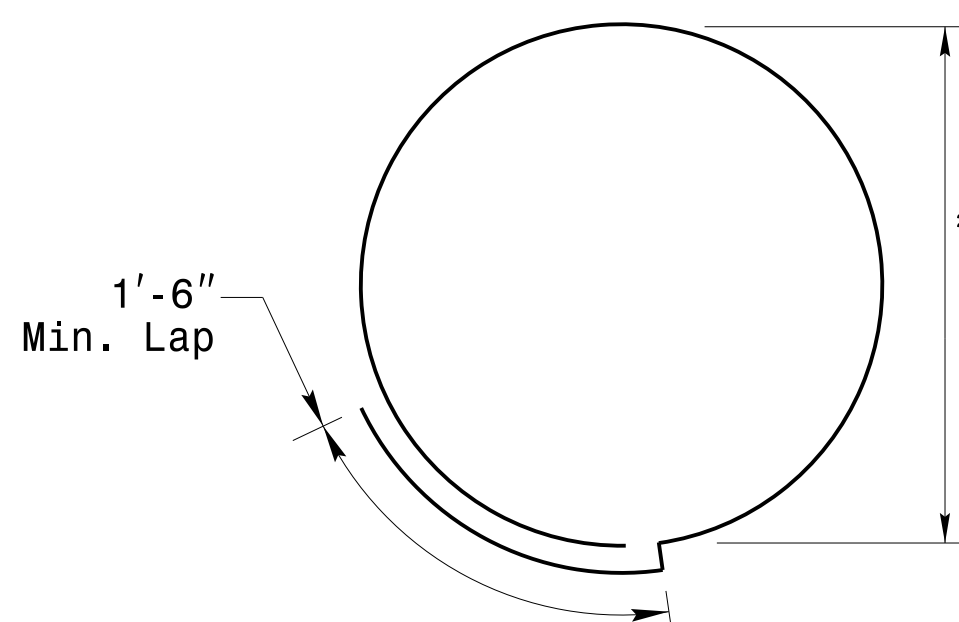
Fabrication Details – Mast Arm Connection



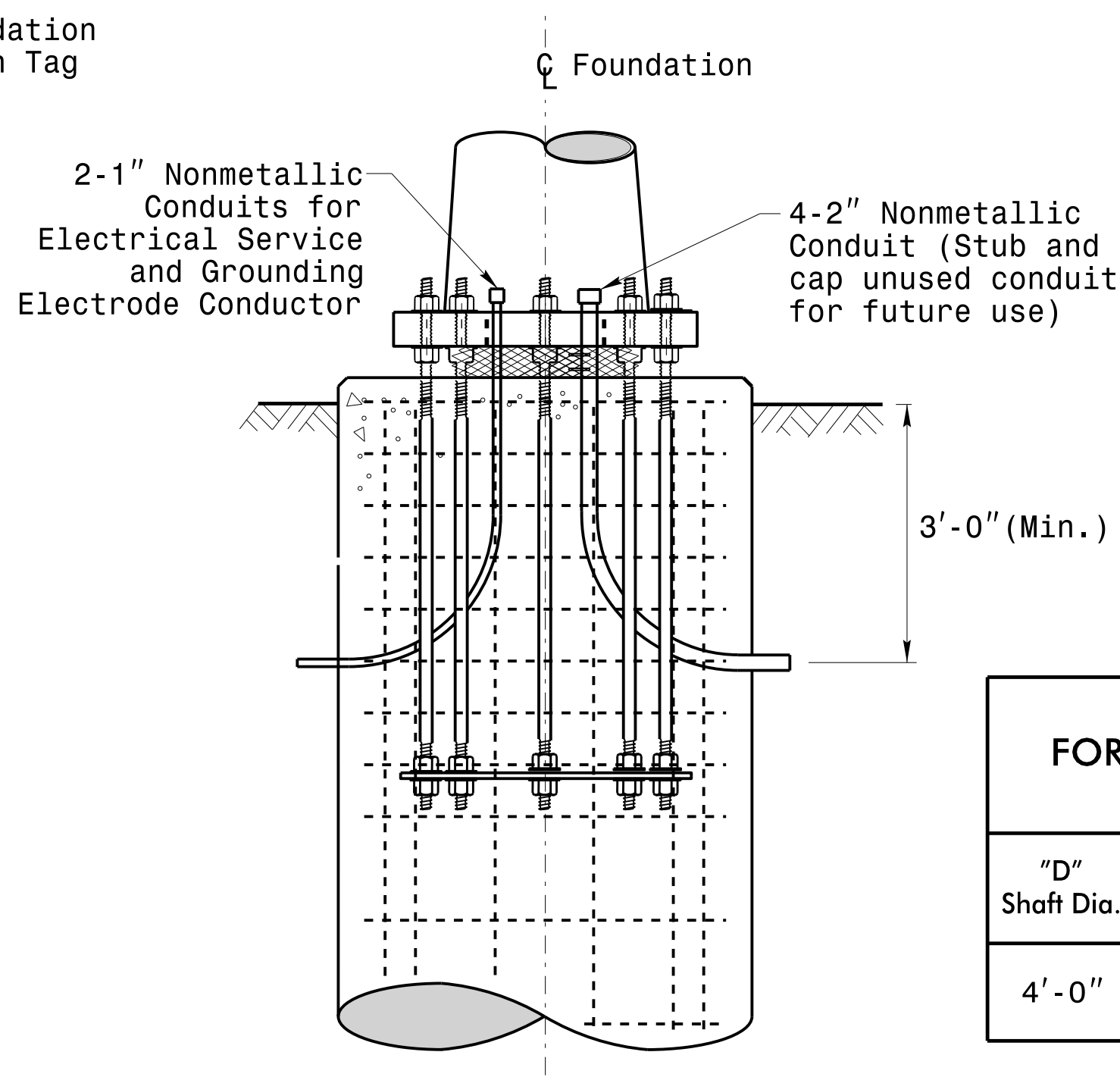
Concrete Shaft Elevation



Section A-A



Typical "C" Bar Detail



Typical Foundation Conduit Details

General Notes:

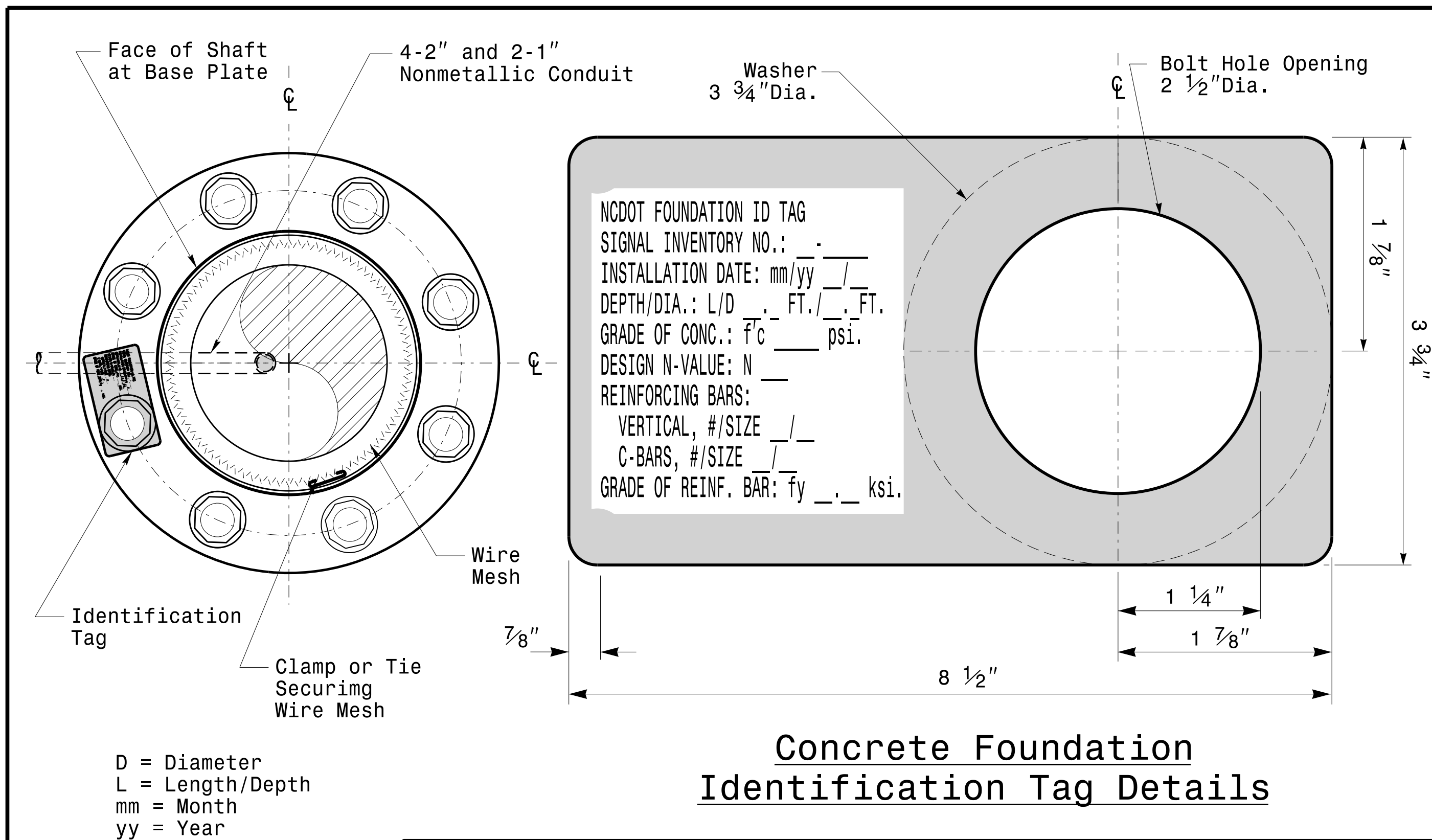
- If actual subsurface conditions differ significantly from boring data contact the Engineer before excavating or placing concrete.
- Circular tie reinforcing rings may be vertically adjusted by +/-3" at a depth between 2'-0" and 3'-0" to facilitate the installation of electrical conduit entering in 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 2012 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 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)



Detail-A

Prepared In the Offices of:

Transportation Mobility and Safety Division

Division of Transportation Planning and Design

750 N. Greenfield Pkwy, Garner, NC 27529

Construction Details For Foundations

PLAN DATE: FEBRUARY 2016 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

SEAL

NORTH CAROLINA PROFESSIONAL ENGINEER

SEAL 028094

D. C. SARKAR

DocuSigned by

Debash C. Sarkar

44E8E32E147E4C4...

2/17/2016

DATE

SOIL CONDITION

PROJECT ID. NO.

SHEET NO.

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.

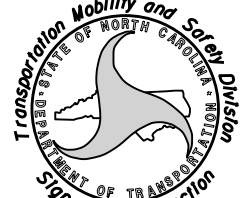
Foundation Selection:

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

Prepared In the Office of:



750 N. Greenfield Pkwy, Garner, NC 27529

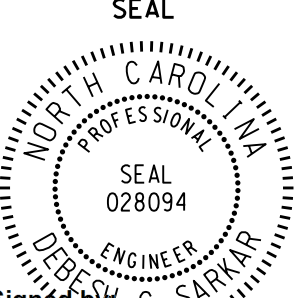
Standard Strain Pole Foundation for All Soil Conditions

PLAN DATE: FEBRUARY 2016DESIGNED BY: C.B. COGDELL
PREPARED BY: N. BITTINGREVIEWED BY: D.C. SARKAR

REVISIONS
Changed "Foundation Depth" to "Drilled Pier Length" in Conc. Exp.
INITIALS
DATE
7/12/2015

SCALE
0 NA
NONE

SEAL



DocuSigned by
Debesh C. Sarkar
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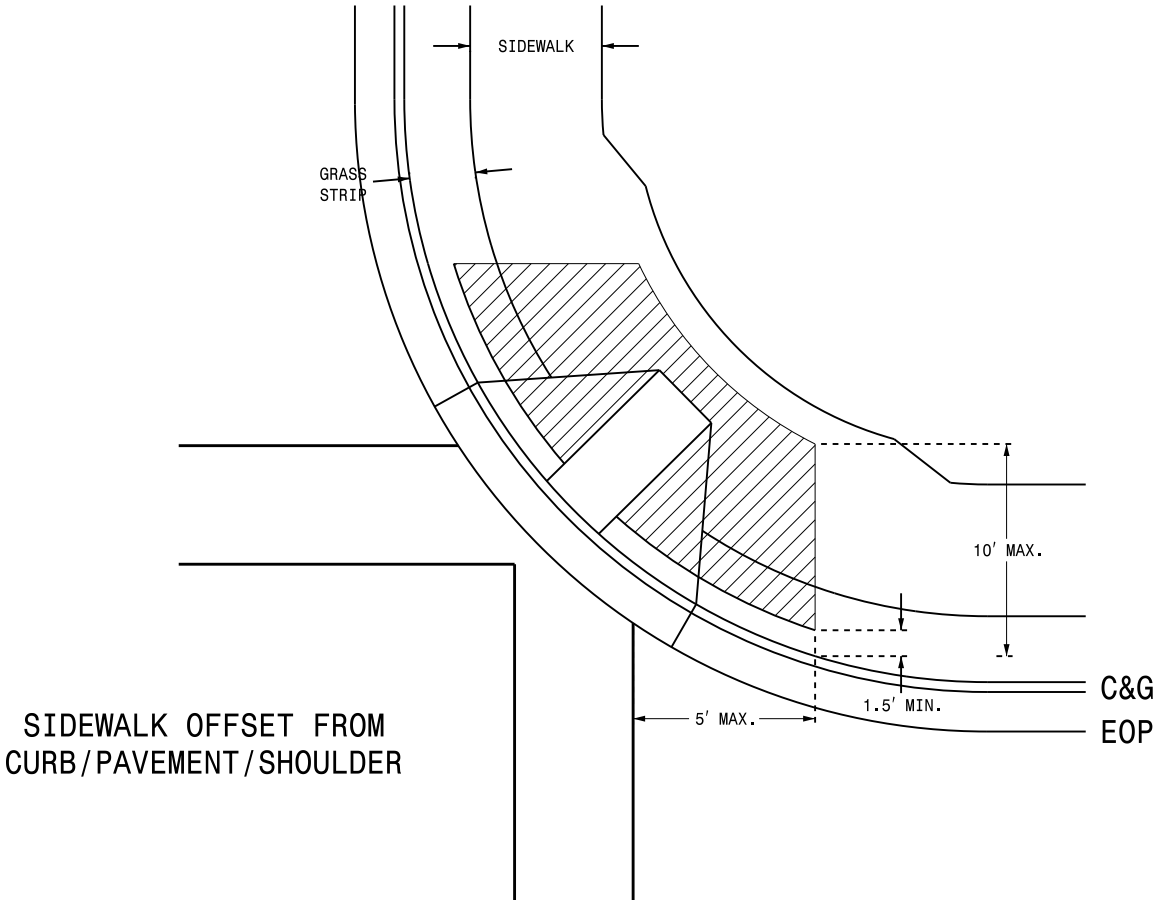
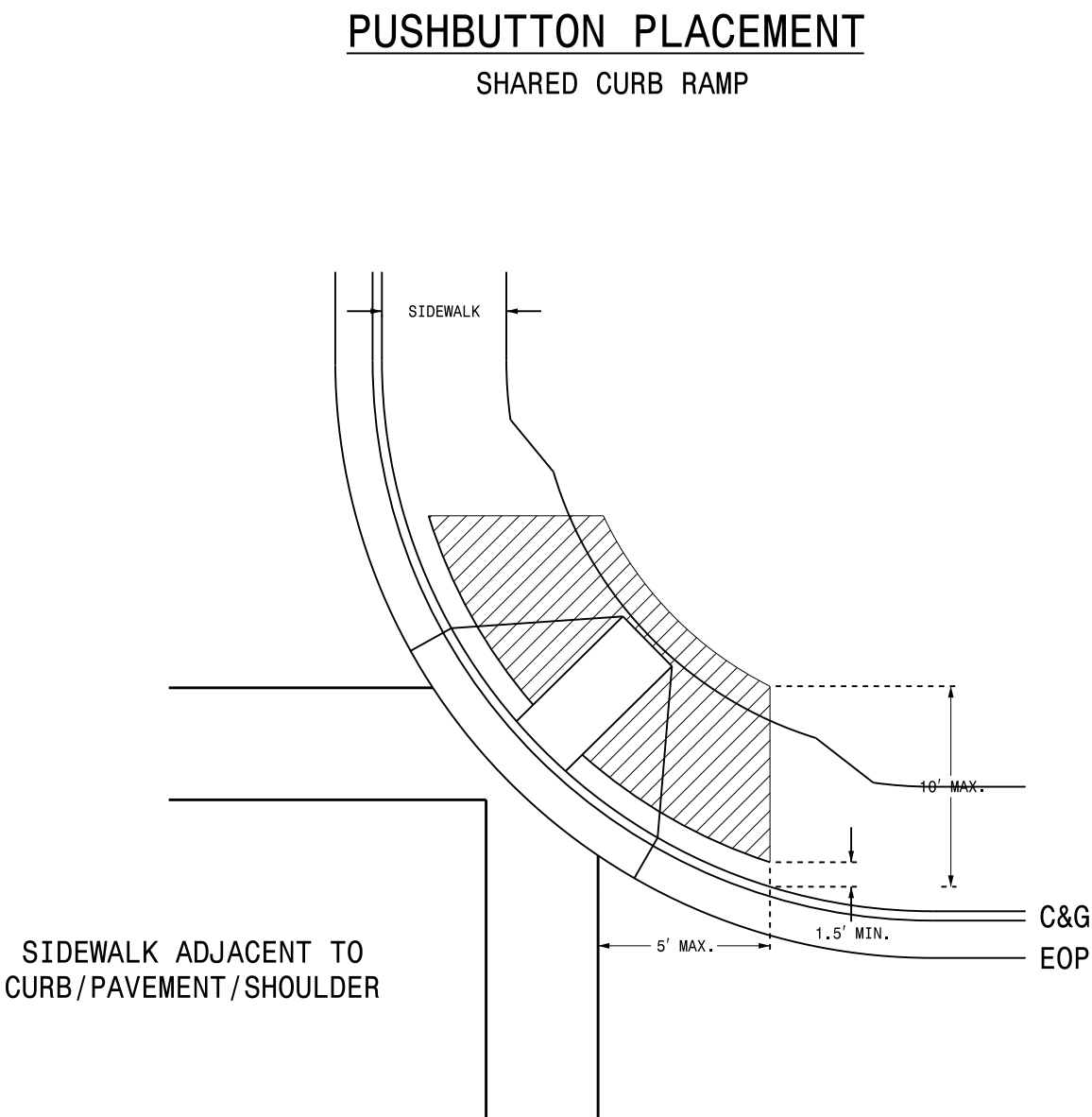
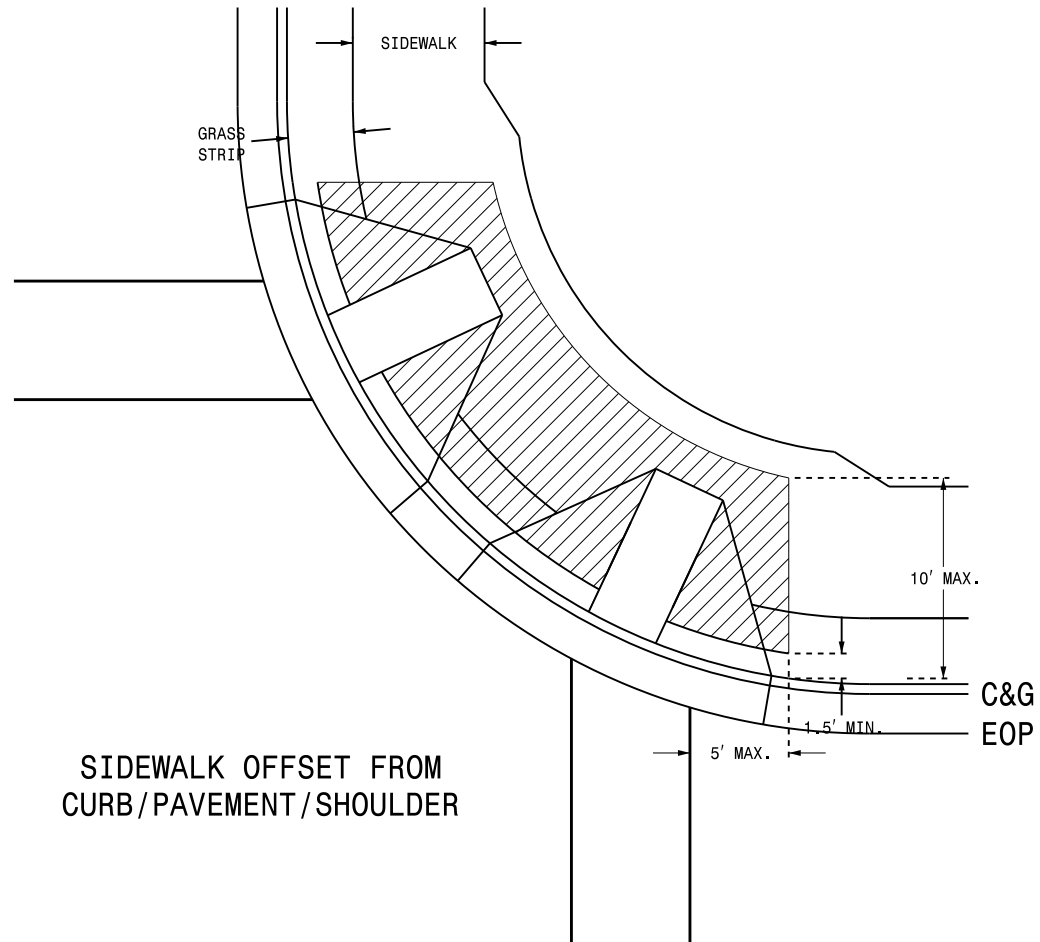
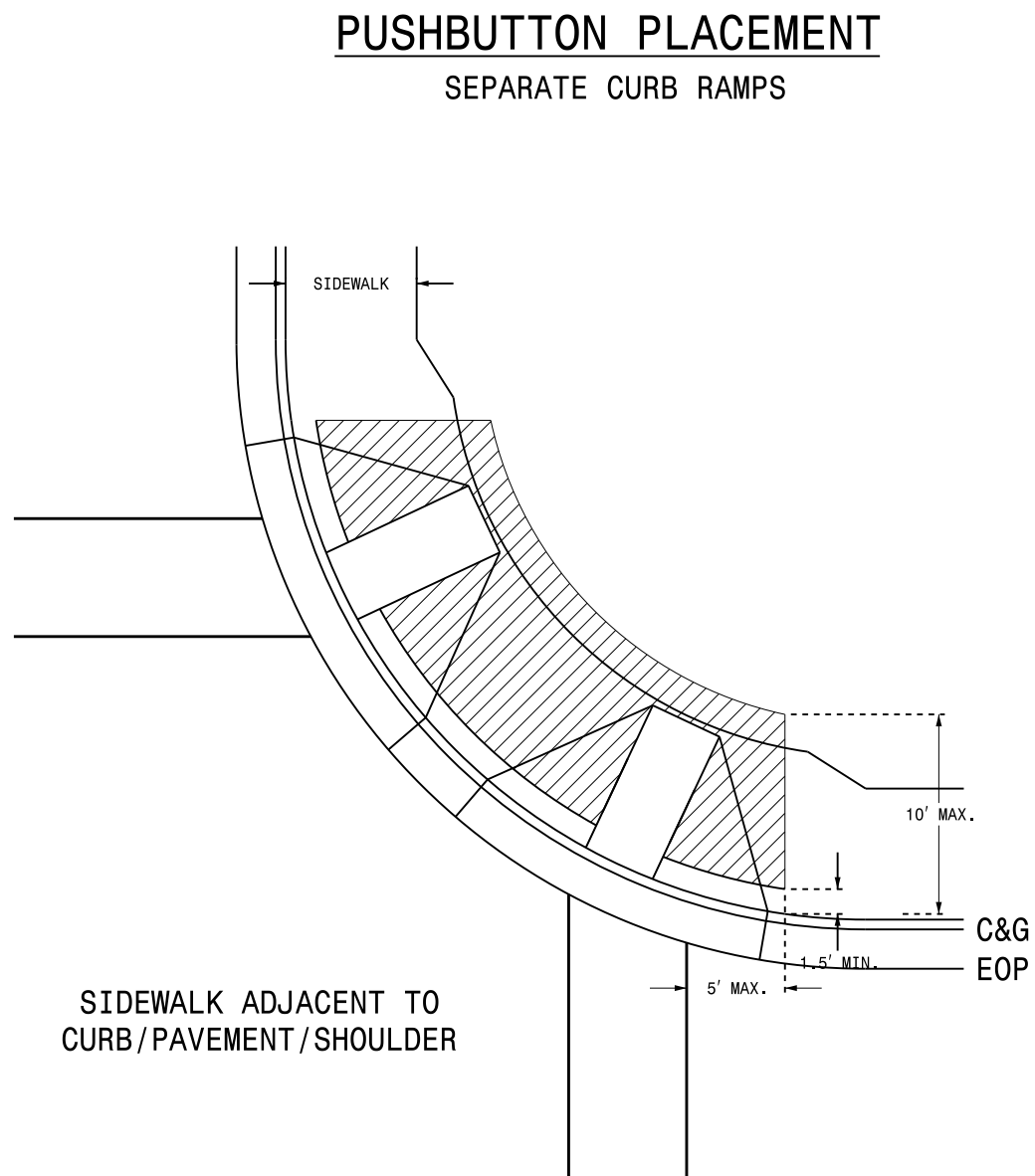
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jgallaway

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

ENGLISH DETAIL DRAWING FOR
PEDESTRIAN PUSHBUTTON LOCATIONS
PLACEMENT DETAIL

SHEET 1 OF 3
1705D01



- NOTES**
1. Pushbutton pedestals should not be located further than 10 feet from the edge of curb, shoulder, or pavement.
 2. The face of the pushbutton should be parallel to the applicable crosswalk.
 3. Separate pushbuttons used on the same corner should be separated by a distance of at least 10 feet.
 4. Pushbuttons shall be installed adjacent to a level surface with a maximum reach distance of 10 inches.
 5. Maintain 4 feet of clearance around pedestal if located in sidewalk.
 6. Refer to section 1705 of the 2012 NCDOT Roadway Standard Drawings for Pushbutton Assembly details.
 7. Refer to section 1743 of the 2012 NCDOT Roadway Standard Drawings for Pedestal details.
 8. Contact Division Traffic Engineer for pushbutton location approval prior to installation.
 9. Curb ramps are for symbolic use only and may not reflect actual design or field conditions.

PROPOSED

LEGEND

	Signal Pole
	Type I Pushbutton Post
	Type II Signal Pedestal
	Pushbutton & Sign
	Pedestrian Signal Head
	Curb Ramp
	Pushbutton Location Area

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

ENGLISH DETAIL DRAWING FOR
PEDESTRIAN PUSHBUTTON LOCATIONS
PLACEMENT DETAIL

SHEET 1 OF 3
1705D01

See Plate for Title

Prepared in the Offices of: 750 N. Greenfield Parkway Garner, NC 27529	SEAL DocuSigned by: 186648292744604 SIGNATURE
	6/17/2014 DATE

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

ENGLISH DETAIL DRAWING FOR
PEDESTRIAN PUSHBUTTON LOCATIONS
PLACEMENT DETAIL

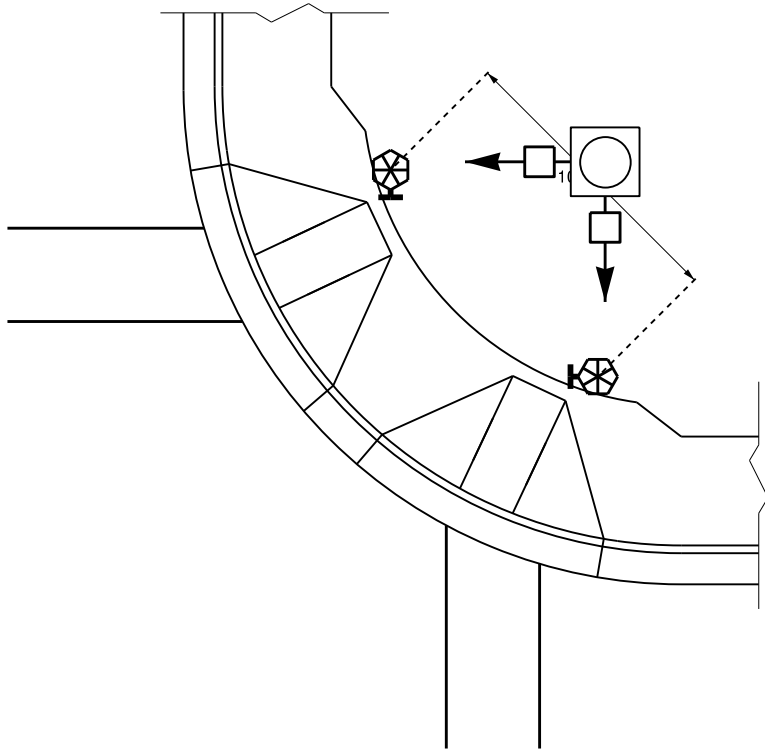
SHEET 2 OF 3
1705D01

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

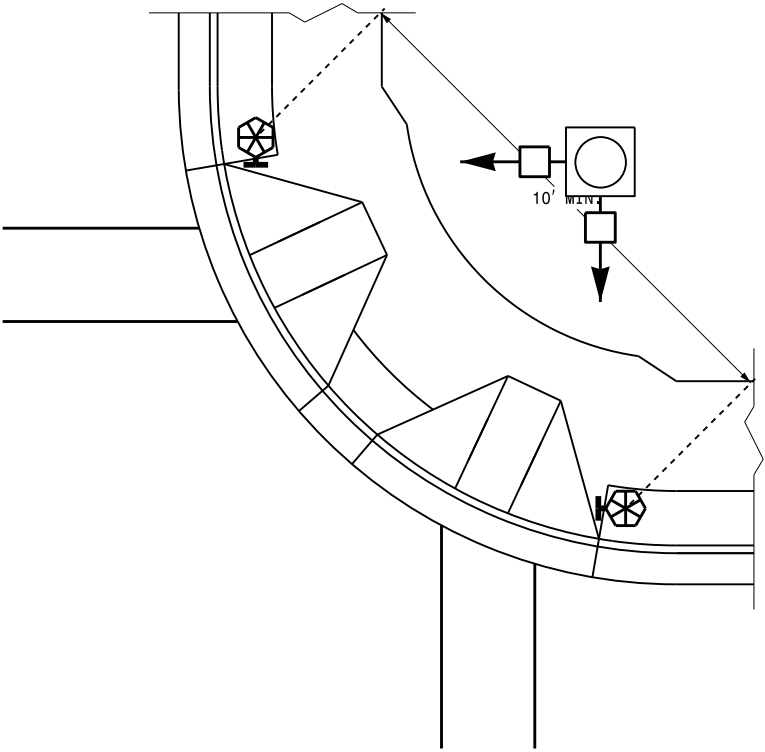
ENGLISH DETAIL DRAWING FOR
PEDESTRIAN PUSHBUTTON LOCATIONS
PLACEMENT DETAIL

SHEET 2 OF 3
1705D01

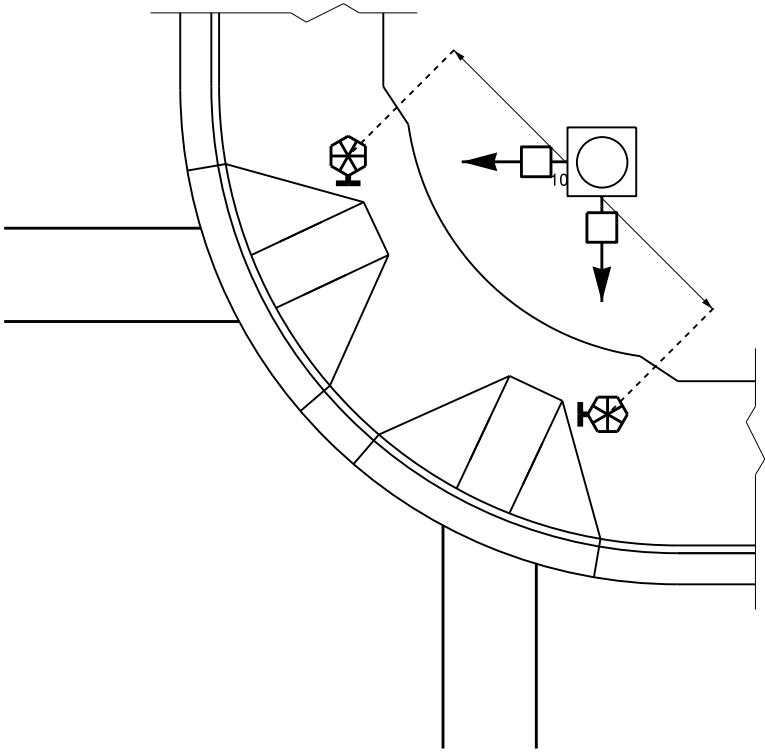
TYPICAL PUSHBUTTON LOCATIONS (CASE I)
SEPARATE CURB RAMPs W/ TYPE I PEDESTALS



BACK OF SIDEWALK IS WITHIN 10'
OF CURB OR PAVEMENT/SHOULDER



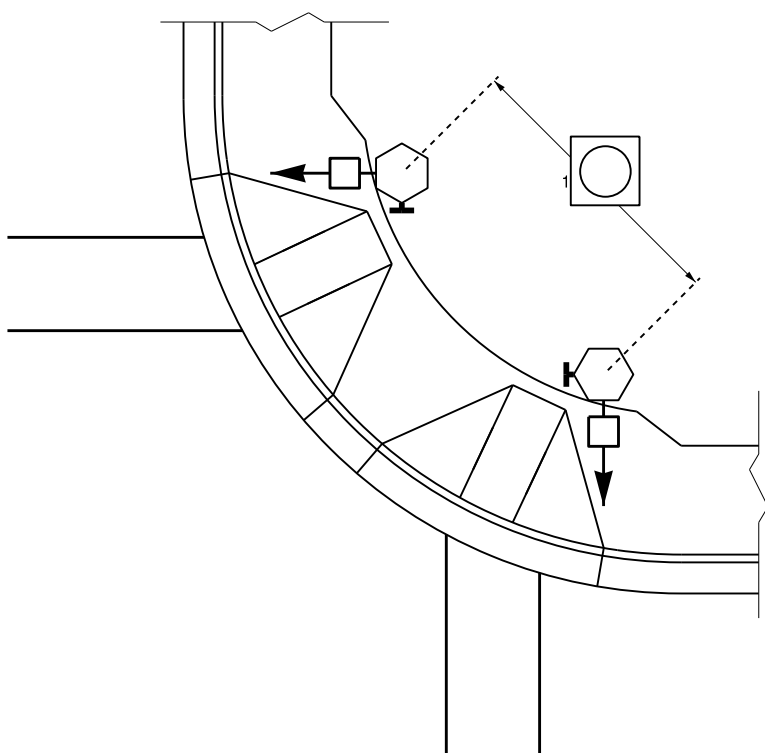
GRASS STRIP PLACEMENT IF BACK
OF SIDEWALK EXCEEDS 10' FROM
CURB OR PAVEMENT/SHOULDER



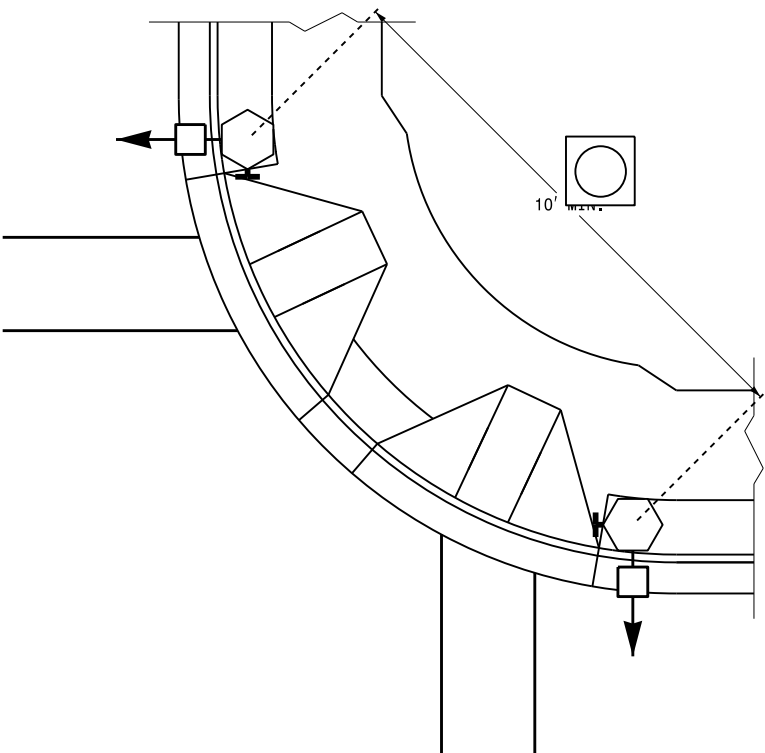
PUSHBUTTON PLACEMENT
IN WIDE SIDEWALK

- PROPOSED**
- Signal Pole
 - Type I Pushbutton Post
 - Type II Signal Pedestal
 - Pushbutton & Sign
 - Pedestrian Signal Head
 - Curb Ramp
 - Pushbutton Location Area

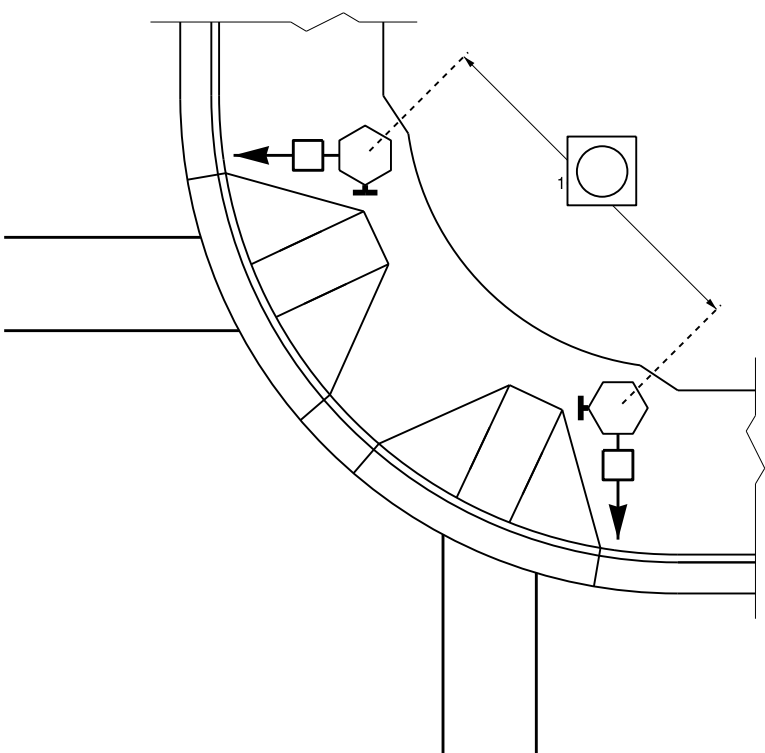
TYPICAL PUSHBUTTON LOCATIONS (CASE II)
SEPARATE CURB RAMPs W/ TYPE II PEDESTALS



BACK OF SIDEWALK IS WITHIN 10'
OF CURB OR PAVEMENT/SHOULDER

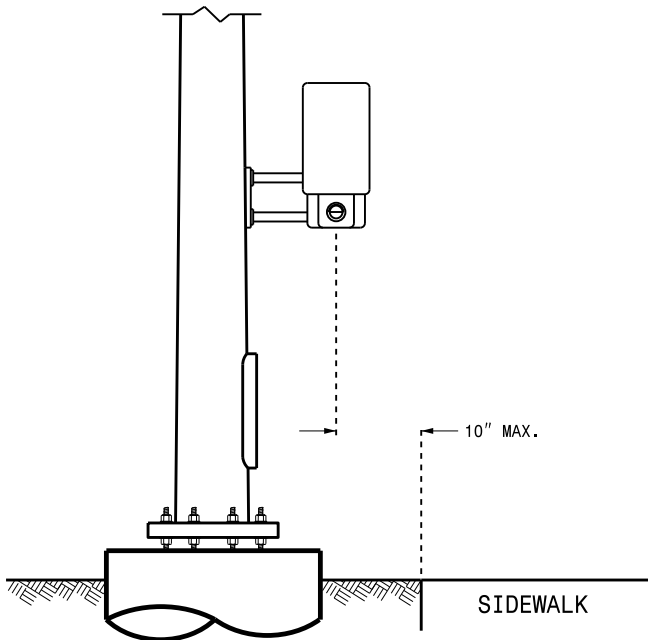


GRASS STRIP PLACEMENT IF BACK
OF SIDEWALK EXCEEDS 10' FROM
CURB OR PAVEMENT/SHOULDER



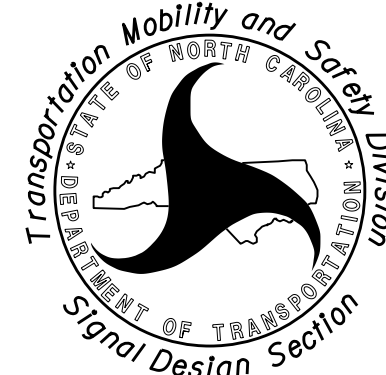
PUSHBUTTON PLACEMENT
IN WIDE SIDEWALK

OPTIONAL PUSHBUTTON EXTENSION
FACE OF PUSHBUTTON PARALLEL TO
APPLICABLE CROSSWALK



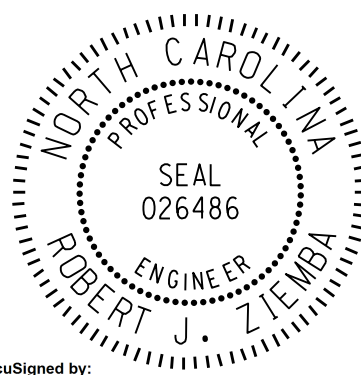
See Plate for Title

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750 N. Greenfield Parkway
Garner, NC 27529

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Robert J. Ziemba
18BB4B0274A494

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6/17/2014

DATE

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

ENGLISH DETAIL DRAWING FOR
PEDESTRIAN PUSHBUTTON LOCATIONS
PLACEMENT DETAIL

SHEET 3 OF 3
1705D01

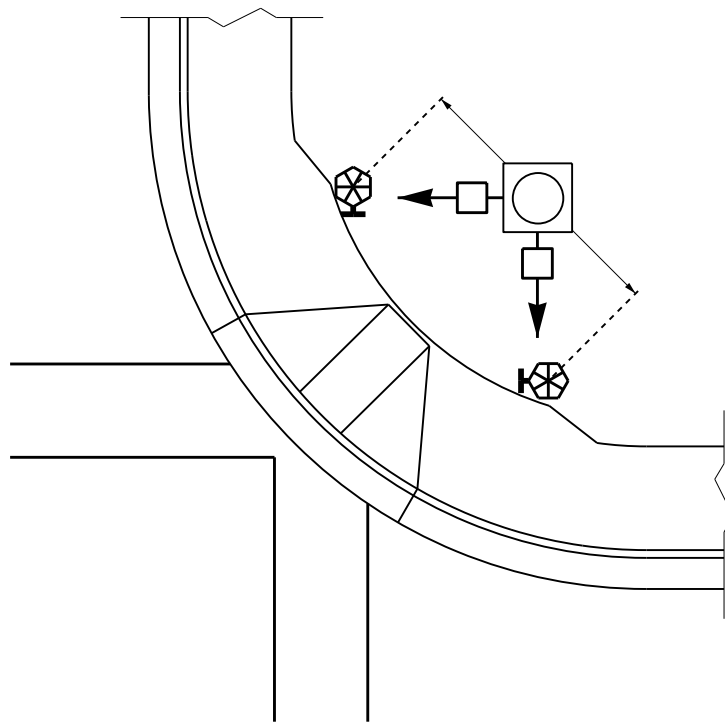
STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH DETAIL DRAWING FOR
PEDESTRIAN PUSHBUTTON LOCATIONS
PLACEMENT DETAIL

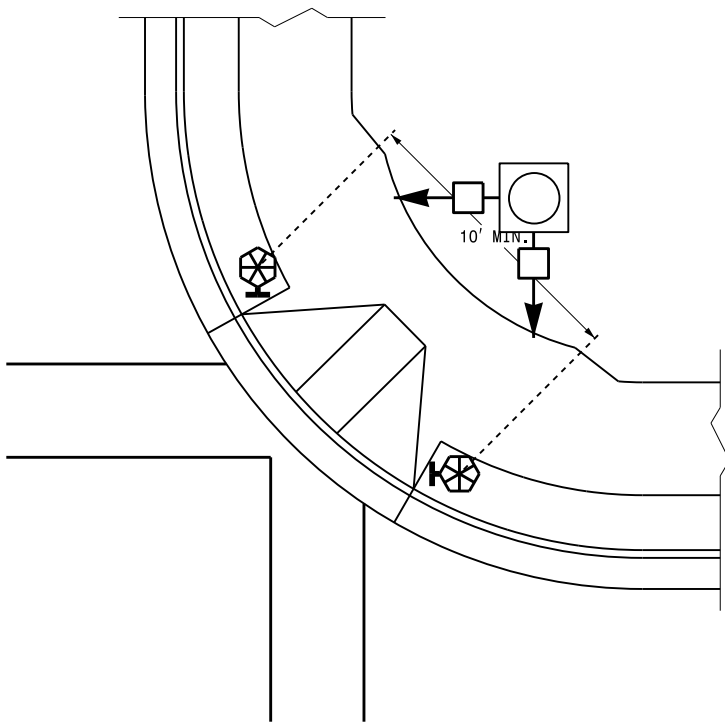
SHEET 3 OF 3
1705D01

TYPICAL PUSHBUTTON LOCATIONS (CASE III)

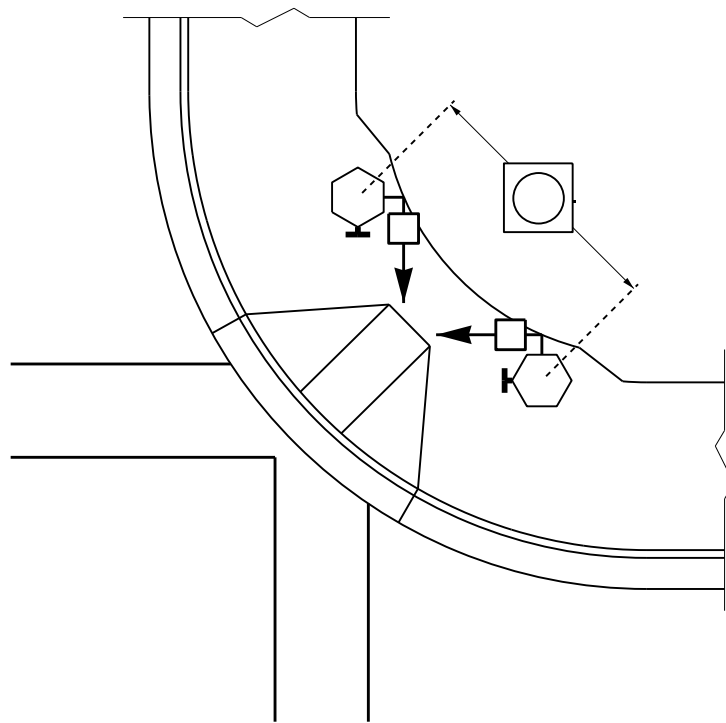
SHARED CURB RAMPS



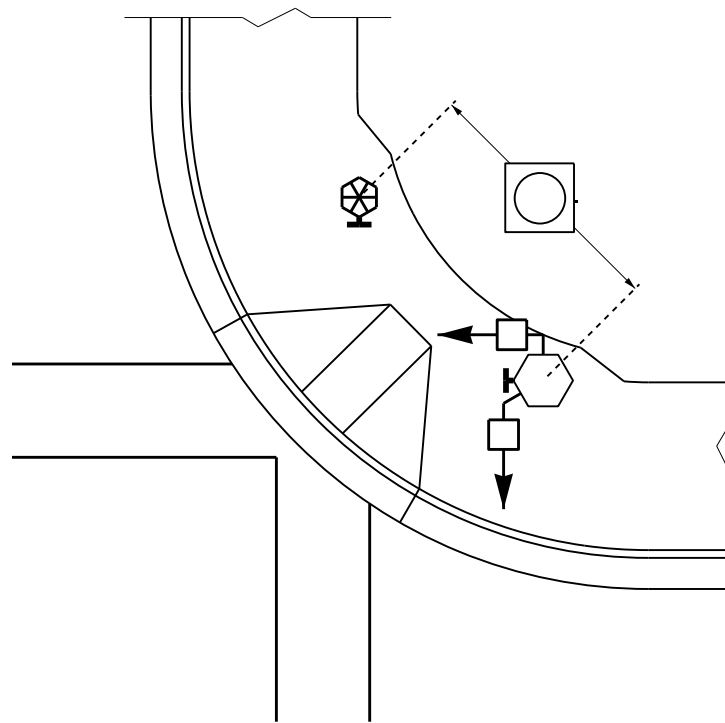
BACK OF SIDEWALK IS WITHIN 10'
OF CURB OR PAVEMENT/SHOULDER



GRASS STRIP PLACEMENT IF BACK
OF SIDEWALK EXCEEDS 10' FROM
CURB OR PAVEMENT/SHOULDER

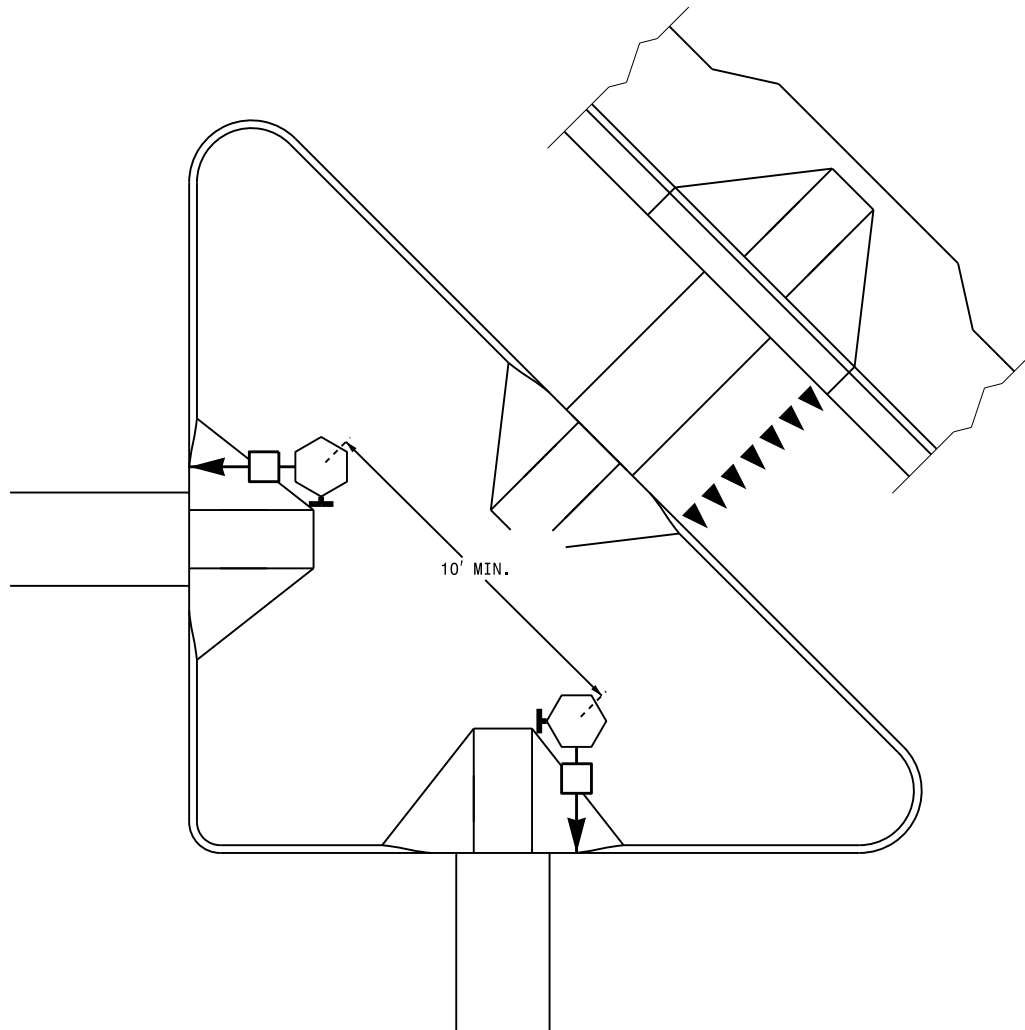


PUSHBUTTON PLACEMENT IN WIDE SIDEWALK
(CORRESPONDING PUSHBUTTONS AND SIGNAL
HEADS ON DIFFERENT PEDESTALS)

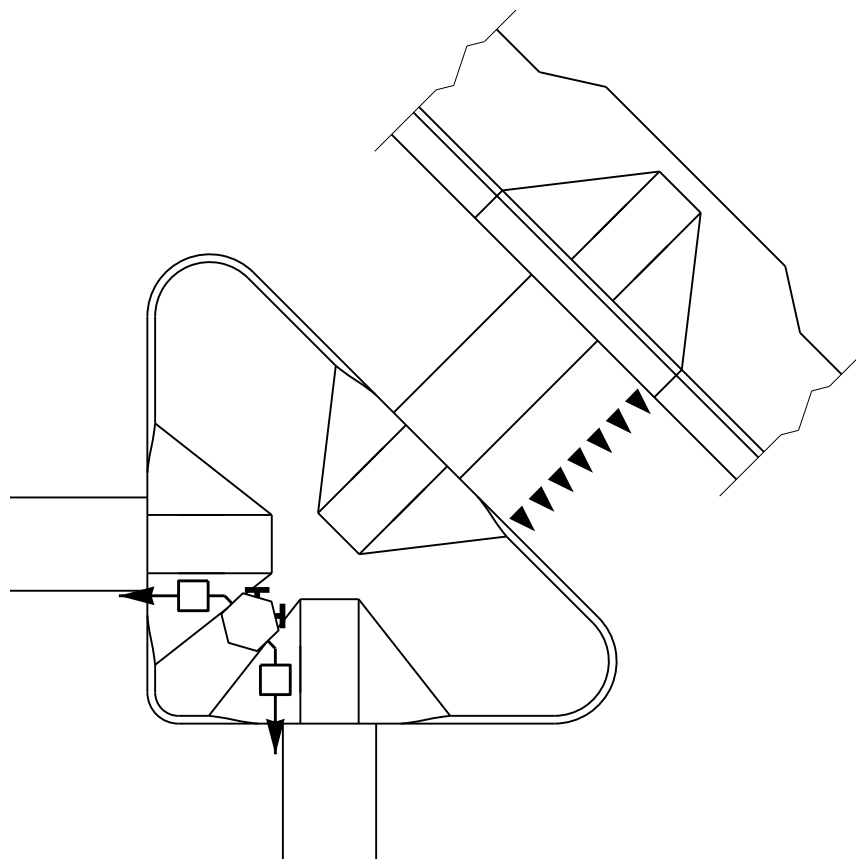


PUSHBUTTON PLACEMENT WITH SHARED
TYPE II SIGNAL PEDESTAL AND TYPE I
PUSHBUTTON POST

TRAFFIC ISLAND PUSHBUTTON LOCATIONS



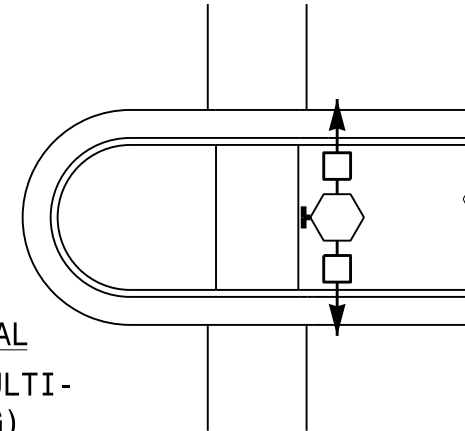
PUSHBUTTON PLACEMENT IN LARGE "PORK
CHOP ISLAND" WITH SEPARATE PEDESTALS



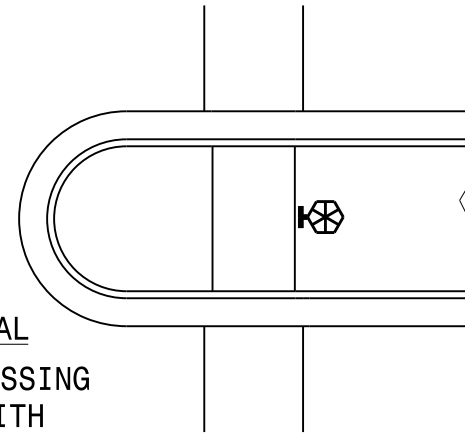
PUSHBUTTON PLACEMENT IN SMALL "PORK
CHOP ISLAND" WITH SHARED PEDESTAL

PUSHBUTTON PLACEMENT IN MEDIAN

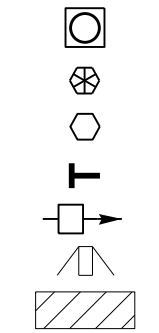
TYPE II PEDESTAL
(FOR STAGED OR MULTI-
PHASE CROSSING)



TYPE I PEDESTAL
(FOR COMPLETE CROSSING
CURB TO CURB WITH
OPTIONAL REFUGE)



PROPOSED



LEGEND

Signal Pole
Type I Pushbutton Post
Type II Signal Pedestal
Pushbutton & Sign
Pedestrian Signal Head
Curb Ramp
Pushbutton Location Area

See Plate for Title

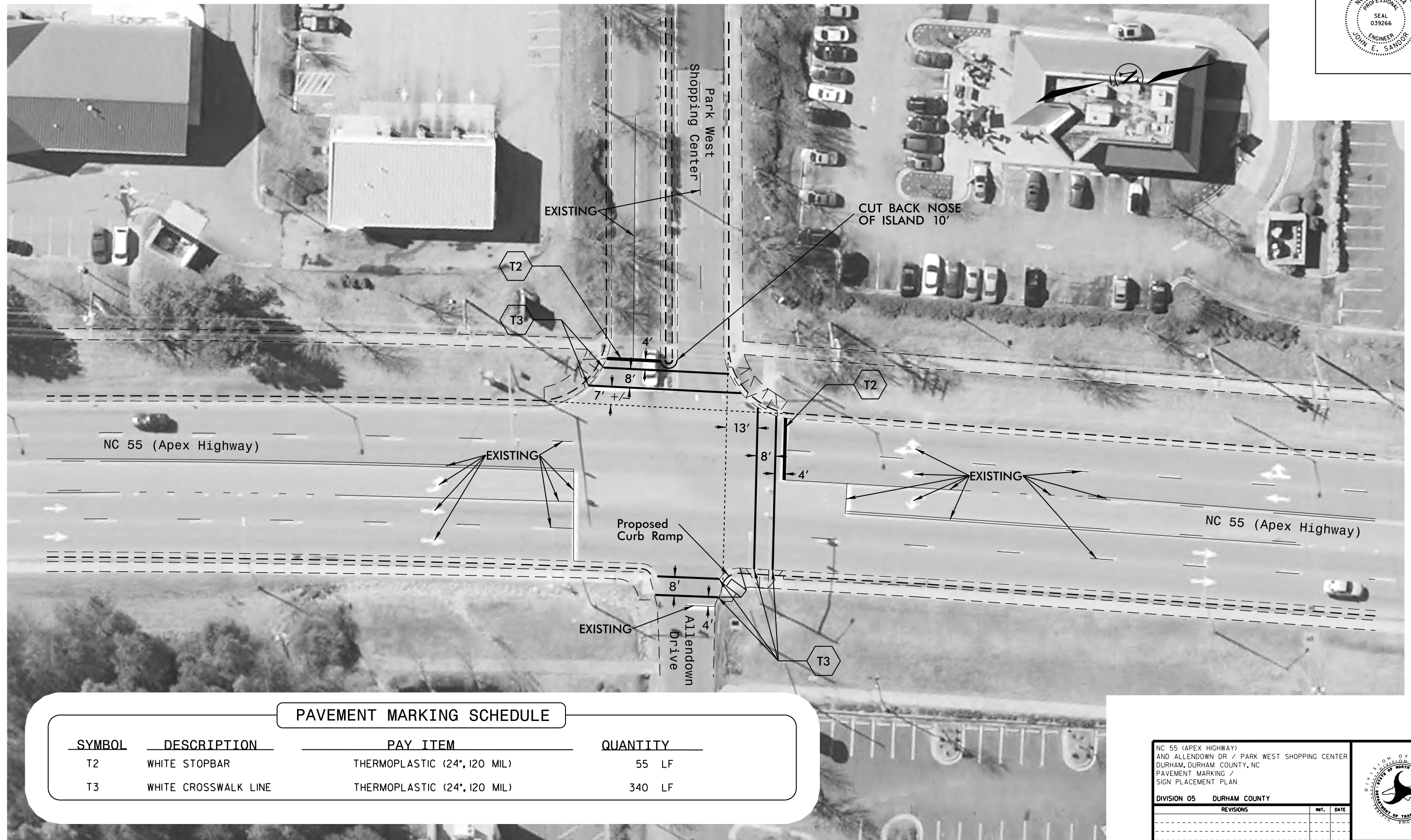
Prepared in the Offices of:

750 N. Greenfield Parkway
Garner, NC 27529

SEAL

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188649602744454
SIGNATURE
6/17/2014
DATE



PAVEMENT MARKING SCHEDULE

SYMBOL	DESCRIPTION	PAY ITEM	QUANTITY
T2	WHITE STOPBAR	THERMOPLASTIC (24", 120 MIL)	55 LF
T3	WHITE CROSSWALK LINE	THERMOPLASTIC (24", 120 MIL)	340 LF

NC 55 (APEX HIGHWAY)
AND ALLENDOWN DR / PARK WEST SHOPPING CENTER
DURHAM, DURHAM COUNTY, NC
PAVEMENT MARKING /
SIGN PLACEMENT PLAN

DIVISION 05 DURHAM COUNTY

REVISIONS	REV.	DATE

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
DIVISION FIVE TRAFFIC ENGINEERING



SCALE: 40' = 1" DATE: 7 APR 2017

PREPARED BY: SJL
REVIEWED BY: JES