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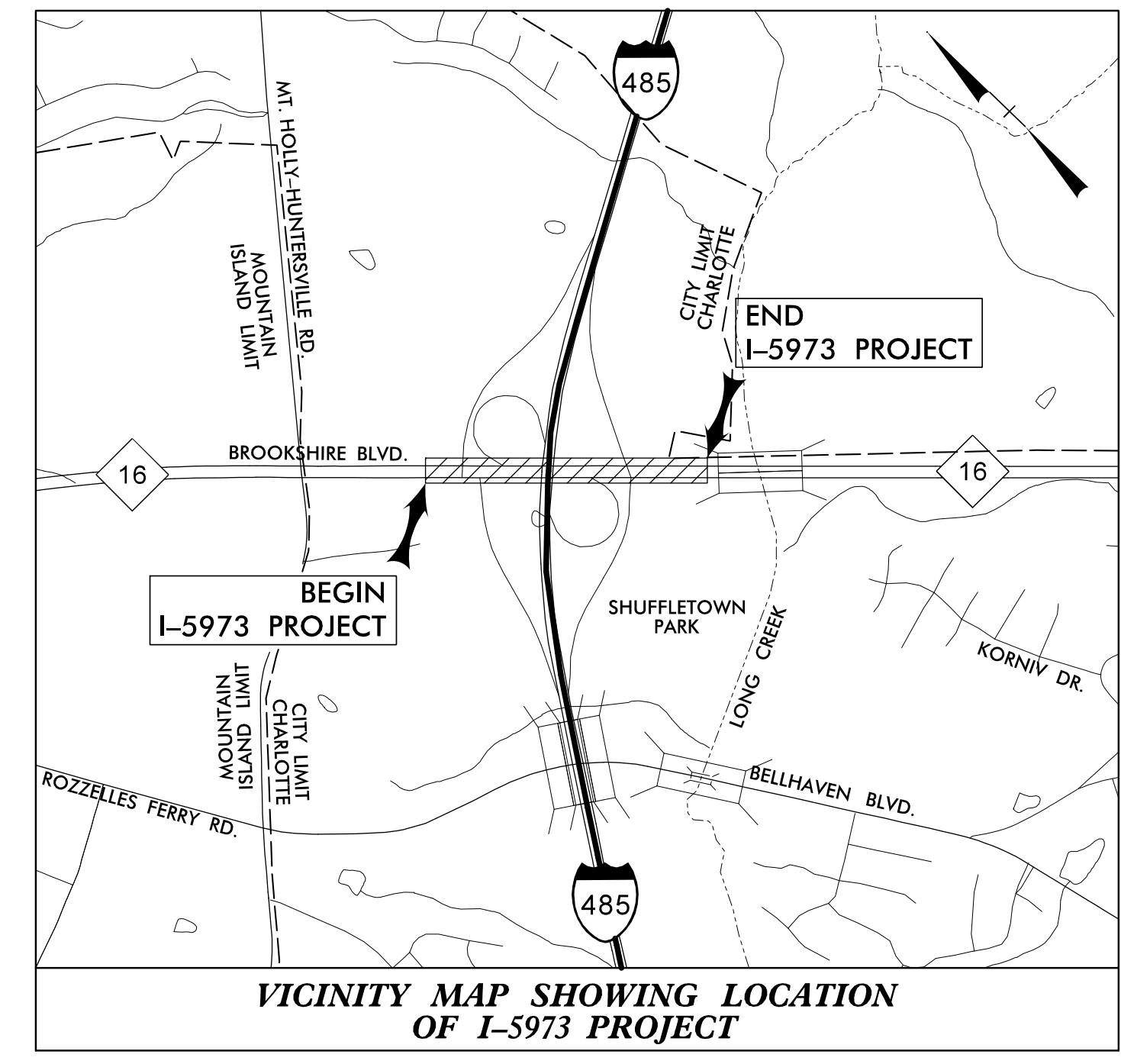
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STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

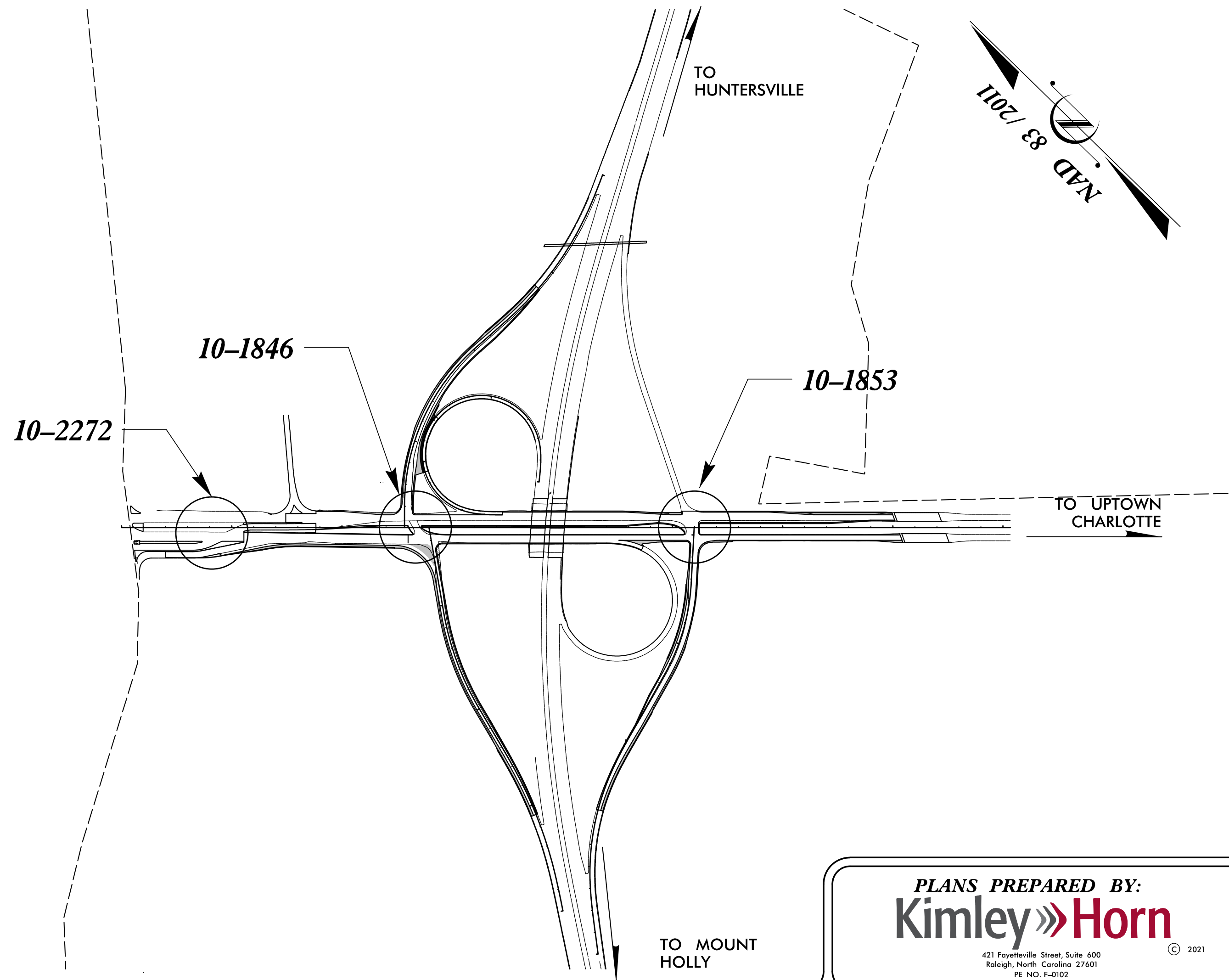
MECKLENBURG COUNTY

LOCATION: NC 16 (BROOKSHIRE BLVD) AND NORTHERN I-485 INTERCHANGE

TYPE OF WORK: TRAFFIC SIGNALS AND SIGNAL COMMUNICATIONS



VICINITY MAP SHOWING LOCATION OF I-5973 PROJECT



TIP PROJECT: I-5973

CONTRACT: C204805

\\kimley-horn.com\SE_RAL\RAL_TPT0\SIGNALS\01036453_I-5973\I-485_Brookshire\SA - Signal Design\NCDDT_plans\I-5973_sig_tsh.dgn

PLANS PREPARED BY:
Kimley»Horn
421 Fayetteville Street, Suite 600
Raleigh, North Carolina 27601
PE NO. F-0102 © 2021

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. 0.0	-----	Title Sheet	
Sig. 1.0-1.3	10-2272	NC 16 (Brookshire Blvd.) at East Cross-over	
Sig. 2.0-2.8	10-1846	NC 16 (Brookshire Blvd.) at I-485 SB Ramp	
Sig. 3.0-3.6	10-1853	NC 16 (Brookshire Blvd.) at I-485 NB Ramp	
Sig. 4.0	-----	Standard Wood Pole Sheet	
M1 - M8	-----	Standard Metal Pole Details	
Cable Routing Plans	-----		
SCP1	-----	Cover Sheet	
SCP2A-SCP2E	-----	General Notes and Details	
SCP3A-SCP3D	-----	Splice Details	
SCP3E	-----	Quantities Tabulations	
SCP4-SCP9	-----	Cable Routing	

NCDOT SIGNAL CONTACT:

Tim Williams, P.E.
CENTRAL REGION SIGNALS ENGINEER

Keith M. Mims, P.E.
ITS & SIGNALS MANAGEMENT ENGINEER

Stacie L. Phillips, P.E.
TRAFFIC SIGNAL ENGINEER

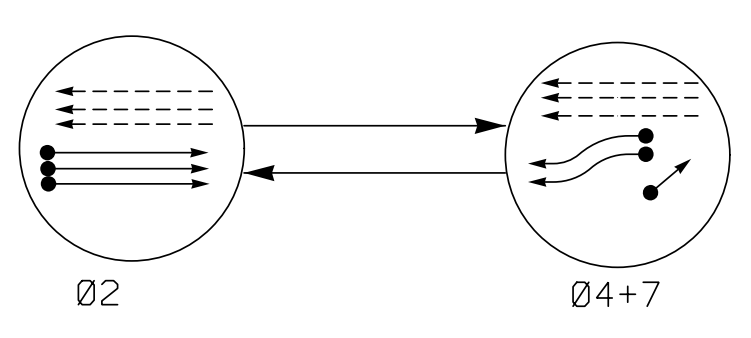
Inger Z. VanOsdell
SIGNAL COMMUNICATION ENGINEER

DocuSigned by:
Stacie L. Phillips
2/16/2022
SIGNATURE: P.E.

Prepared for:

750 N. Greenfield Pkwy, Garner, NC 27529

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

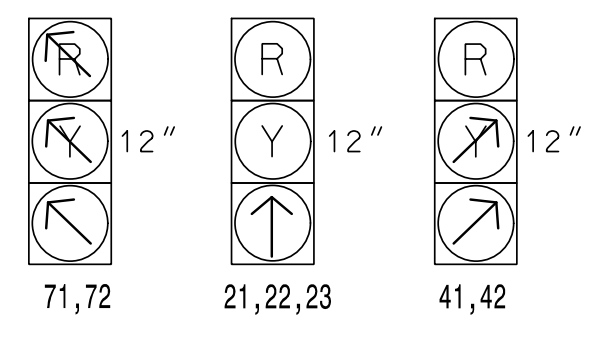
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- ⋯ PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE		
	02	04+7	FLASH
21,22,23	↑	R	Y
41,42,43	R	↘	R
71,72	↘	↘	R

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART
EOS-2070LX CONTROLLER w/ TS-2 CABINET

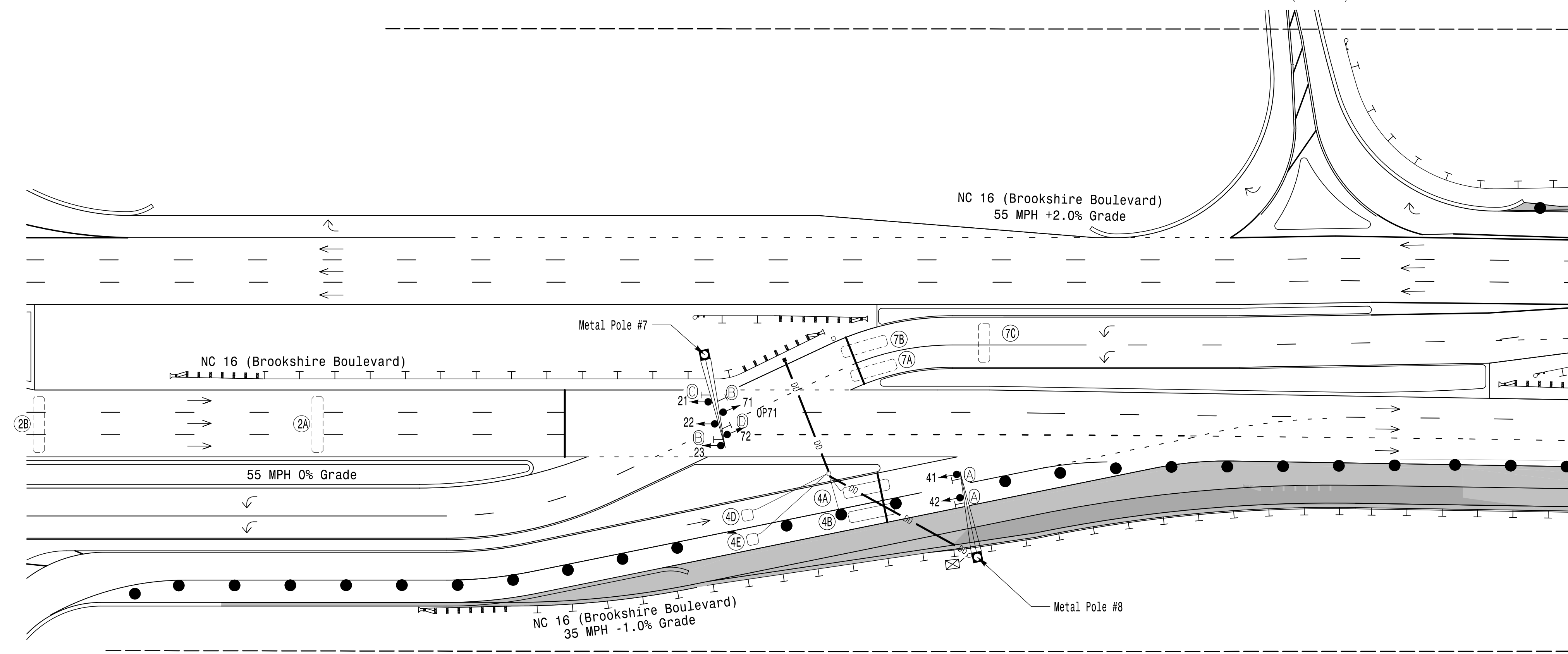
LOOP NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW EXISTING	DETECTOR UNITS			DET. TYPE	
					NEMA PHASE	TIMING			
						FEATURE	TIME		
2A	6X30	130	3	-	Y	2	-	-	N
2B	6X30	280	3	-	Y	2	-	-	N
4A	6X25	+5	3	Y	-	4	-	-	N
* 4B	6X25	+5	3	Y	-	4	-	-	N
4D	6X6	70	3	Y	-	4	-	-	N
* 4E	6X6	70	3	Y	-	4	-	-	N
7A	6X25	+5	3	-	Y	7	-	-	N
7B	6X25	+5	3	-	Y	7	-	-	N
7C	6X21	70	3	-	Y	7	-	-	N

* INSTALL LOOPS FOR FUTURE USE. THESE LOOPS WILL BE DISABLED IN CONSTRUCTION PHASE 2A AND ENABLED FOR CONSTRUCTION PHASE 2B(SEE INSET).

3 Phase Fully Actuated (Charlotte Signal System)

NOTES

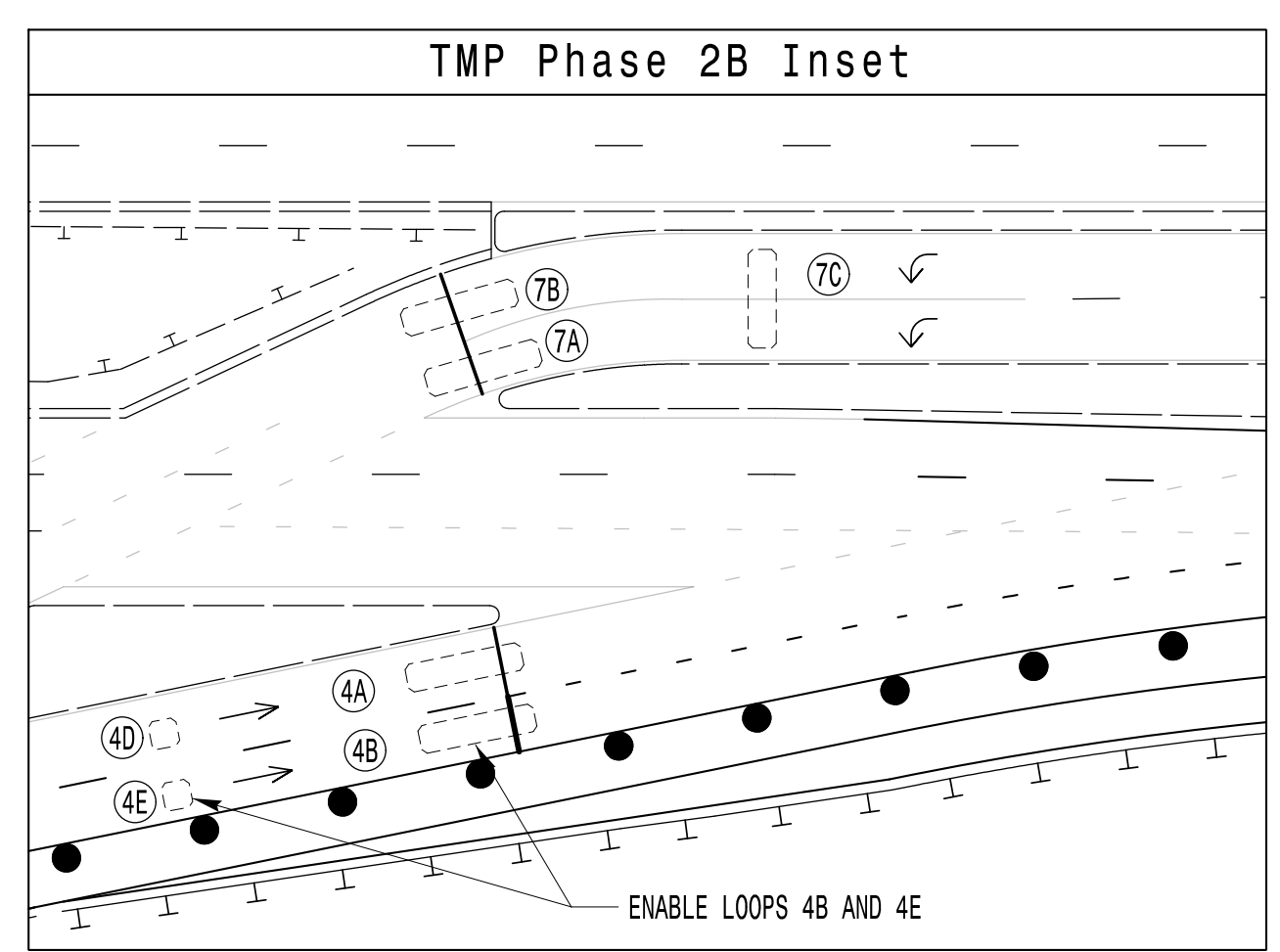
1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Set all detector units to presence mode.
4. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
5. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values shall supersede these values.
6. Charlotte Signal System Data: Controller Asset #2272



TIMING CHART
EOS-2070LX CONTROLLER

PHASE	02	04	07
MINIMUM GREEN *	14 SEC.	7 SEC.	7 SEC.
VEHICLE EXT. *	2.0 SEC.	3.0 SEC.	3.0 SEC.
YELLOW CHANGE INT.	5.2 SEC.	3.9 SEC.	3.4 SEC.
RED CLEARANCE	2.9 SEC.	1.0 SEC.	3.0 SEC.
MAX. I *	45 SEC.	45 SEC.	45 SEC.
RECALL POSITION	MIN. RECALL	NONE	NONE
LOCK DET.	ON	OFF	OFF
WALK *	- SEC.	- SEC.	- SEC.
PED. CLEAR	- SEC.	- SEC.	- SEC.
VOLUME DENSITY	OFF	OFF	OFF
ACTUATION B4 ADD *	- VEH.	- VEH.	- VEH.
SEC. PER ACTUATION *	- SEC.	- SEC.	- SEC.
MAX. INITIAL *	- SEC.	- SEC.	- SEC.
TIME B4 REDUCTION *	- SEC.	- SEC.	- SEC.
TIME TO REDUCE *	- SEC.	- SEC.	- SEC.
MINIMUM GAP	- SEC.	- SEC.	- SEC.
DUAL ENTRY	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON

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



LEGEND

PROPOSED	EXISTING
○ Traffic Signal Head	● Traffic Signal Head
○ Modified Signal Head	N/A
⊥ Sign	⊥ Sign
⊥ Pedestrian Signal Head With Push Button & Sign	⊥ Pedestrian Signal Head With Push Button & Sign
⊥ Metal Pole with Mastarm	⊥ Metal Pole with Mastarm
⊥ Inductive Loop Detector	⊥ Inductive Loop Detector
⊥ Controller & Cabinet	⊥ Controller & Cabinet
⊥ Junction Box	⊥ Junction Box
⊥ 2-in Underground Conduit	⊥ 2-in Underground Conduit
N/A Right of Way	--- Right of Way
→ Directional Arrow	→ Directional Arrow
--- Directional Drill	N/A
N/A Guardrail	--- Guardrail
(A) "NO TURN ON RED" Sign (R10-11)	(A) "NO TURN ON RED" Sign (R10-11)
(B) NO RIGHT SYMBOL SIGN (R3-2)	(B) NO RIGHT SYMBOL SIGN (R3-2)
(C) No Left Turn Sign (R3-2)	(C) No Left Turn Sign (R3-2)
(D) No U-Turn Sign (R3-4)	(D) No U-Turn Sign (R3-4)
Construction Zone	Construction Zone
Construction Zone Drums	Construction Zone Drums

Signal Upgrade - Temporary Design 1
TMP Phase 2A

Prepared For the Offices of:

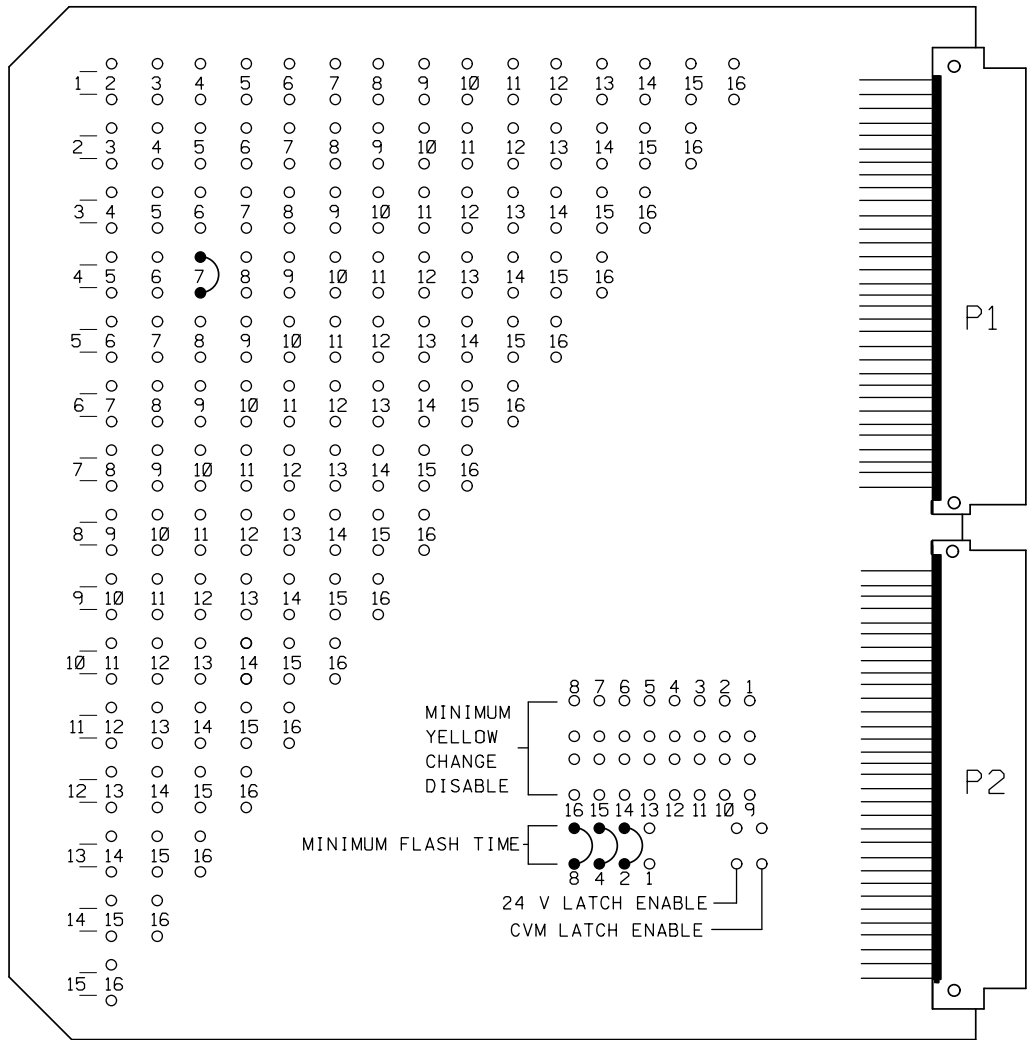
NC 16 (Brookshire Boulevard) at East Cross-over
 Division 10 Mecklenburg County Charlotte
 PLAN DATE: September 2021 REVIEWED BY: SL Phillips
 PREPARED BY: SP Pennington REVIEWED BY:
 REVISIONS: INIT. DATE
 SCALE: 1" = 40'
 DocuSigned by: 2/16/2022
 SIGNATURE DATE
 SIG. INVENTORY NO. 10-2272T

PLANS PREPARED IN THE OFFICE OF:
Kimley»Horn
 NC License #F-0102
 421 Fayetteville Street, Suite 600
 Raleigh, NC 27601
 (919) 677-2000

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown)



MMU PROGRAMMING CARD

Table for FIELD CHECK ENABLE, DUAL IND ENABLE, RED FAIL ENABLE. Columns: CHANNEL NUMBER (1-16), ENABLE/DISABLE.

Table for UNIT OPTIONS. Columns: OPTION, SETTING. Options include RECURRENT PULSE, WALK DISABLE, LOG CVM FAULTS, etc.

Table for FLASHING YELLOW ARROW. Columns: CONFIG MODE, ENABLE CHANNEL PAIR, FYA, CH 1-13, etc.

MMU PROGRAMMING NOTE: ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1

Table showing detector card placement in a rack. Columns: CH1-CH6, Slot, Slot Type (SLOT, EMP TTY).

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

Table for LOOP NO. and LOOP PANEL TERMINALS (e.g., 2A, L1A, L1B).

NOTE: BE SURE TO PROGRAM DETECTOR TYPES AND TIMERS (EXTEND AND DELAY) AS SHOWN ON THE SIGNAL PLANS.

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

Table for CONTROLLER DETECTOR NO., FUNCTION, TIMING (FEATURE, TIME(SEC)).

UNUSED LOAD SWITCH CHANNELS SHALL BE DISABLED IN CONTROLLER PROGRAMMING

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

Table for LOAD SWITCH NUMBER and FUNCTION.

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 10-2272T DESIGNED: September 2021 SEALED: 2/16/2022 REVISED:

PLANS PREPARED IN THE OFFICE OF: Kimley-Horn NC License #F-0102 421 Fayetteville Street, Suite 600 Raleigh, NC 27601 (919) 677-2000

NOTES

- 1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,5,6,8,9,10,11,12,13,14,15 & 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out)...

FIELD CONNECTION HOOK-UP CHART

Table for FIELD CONNECTION HOOK-UP CHART showing PHASE, SIGNAL HEAD NO., RED, YELLOW, GREEN, RED ARROW, YELLOW ARROW, GREEN ARROW, and pedestrian symbols across columns 1-16.

NU = NOT USED

ECONOLITE EOS SPECIAL MMU PROGRAMMING

(program controller as shown)

- 1. From Main Menu select 1. CONFIGURATION
2. From CONFIGURATION Submenu select 1. CABINET
3. From Cabinet Submenu select 4. MONITOR PROGRAMMING

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data. This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

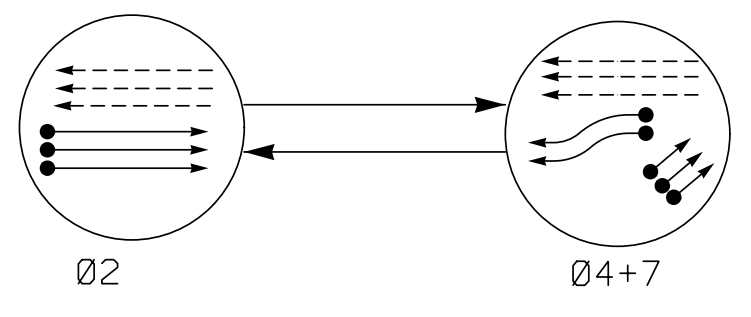
Table for MMU PROGRAM [MANUAL] showing CH 6-15 and their corresponding phases (e.g., CH 6 to 1, CH 7 to 2, etc.).

END PROGRAMMING

Temporary Design Electrical Detail

Form for Temporary Design Electrical Detail including project info: NC 16 (Brookshire Boulevard) at East Cross-Over, Division 10, Mecklenburg County, Charlotte. Includes signature and seal for SL Phillips.

PHASING DIAGRAM

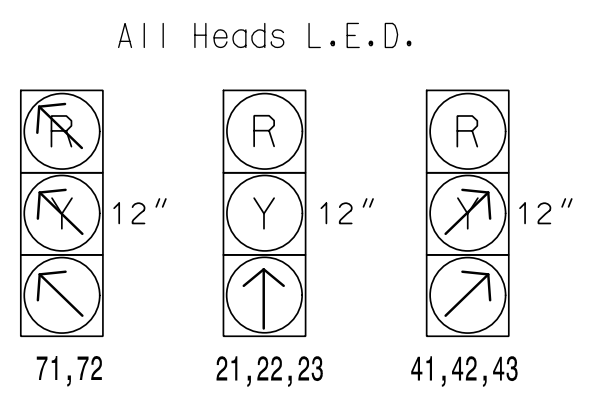


PHASING DIAGRAM DETECTION LEGEND

- → DETECTED MOVEMENT
- → UNDETECTED MOVEMENT (OVERLAP)
- → UNSIGNALIZED MOVEMENT
- ⋯ → PEDESTRIAN MOVEMENT

SIGNAL FACE	PHASE		
	02	04+7	FLASH
21,22,23	↑	R	Y
41,42,43	R	↘	R
71,72	↘	↘	↘

SIGNAL FACE I.D.



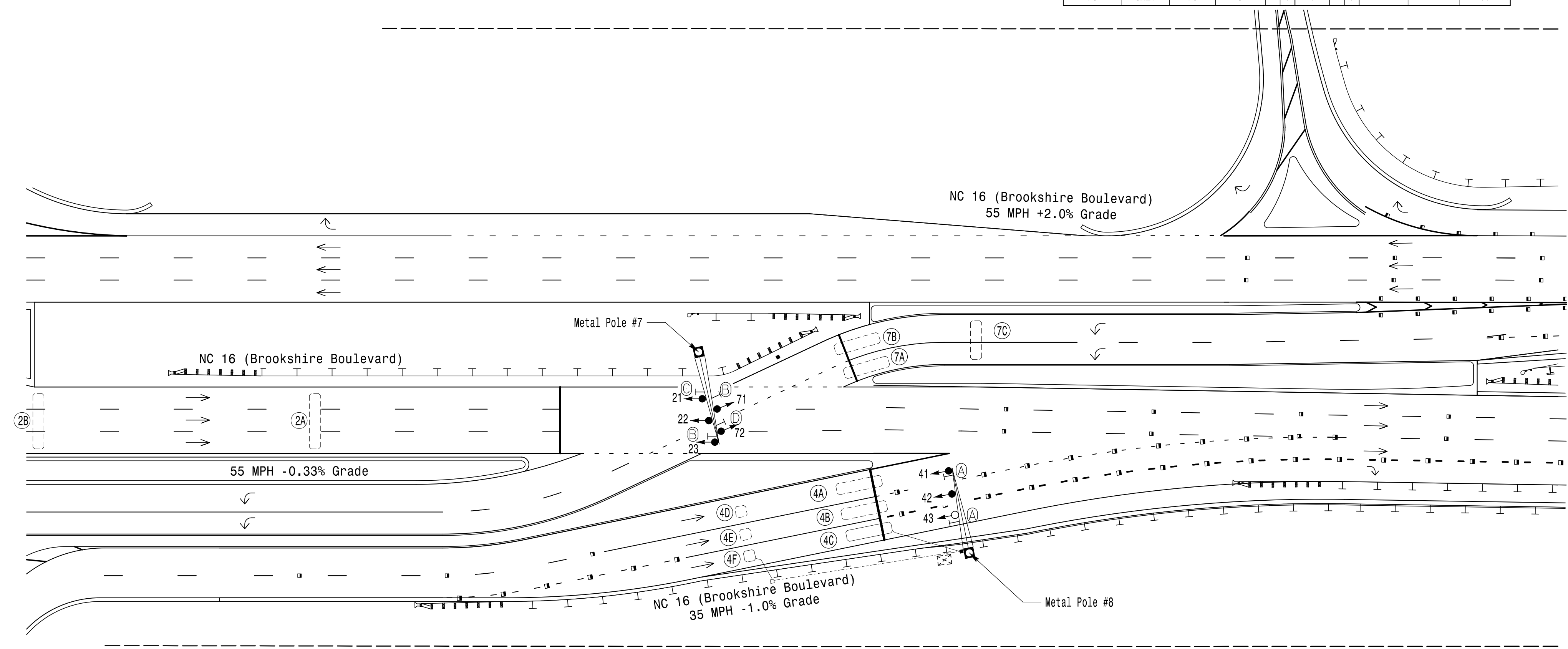
LOOP & DETECTOR INSTALLATION CHART
EOS-2070LX CONTROLLER w/ TS-2 CABINET

LOOP NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW EXISTING	DETECTOR UNITS			DET. TYPE	
					NEMA PHASE	TIMING			
						NEW EXISTING	FEATURE		TIME
2A	6X30	130	3	- Y	2	- Y	-	-	N
2B	6X30	280	3	- Y	2	- Y	-	-	N
4A	6X25	+5	3	- Y	4	- Y	-	-	N
4B	6X25	+5	3	- Y	4	- Y	-	-	N
4C	6X25	+5	3	Y	- 4	Y	-	-	N
4D	6X6	70	3	- Y	4	- Y	-	-	N
4E	6X6	70	3	- Y	4	- Y	-	-	N
4F	6X6	70	3	Y	- 4	Y	-	-	N
7A	6X25	+5	3	- Y	7	- Y	-	-	N
7B	6X25	+5	3	- Y	7	- Y	-	-	N
7C	6X21	70	3	- Y	7	- Y	-	-	N

3 Phase Fully Actuated (Charlotte Signal System)

NOTES

- Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
- Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
- Set all detector units to presence mode.
- Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values shall supersede these values.
- Charlotte Signal System Data: Controller Asset #2272



TIMING CHART EOS-2070LX CONTROLLER			
PHASE	02	04	07
MINIMUM GREEN *	14 SEC.	7 SEC.	7 SEC.
VEHICLE EXT. *	2.0 SEC.	3.0 SEC.	3.0 SEC.
YELLOW CHANGE INT.	5.2 SEC.	3.9 SEC.	3.4 SEC.
RED CLEARANCE	2.9 SEC.	1.0 SEC.	3.0 SEC.
MAX. I *	45 SEC.	45 SEC.	45 SEC.
RECALL POSITION	MIN. RECALL	NONE	NONE
LOCK DET.	ON	OFF	OFF
WALK *	- SEC.	- SEC.	- SEC.
PED. CLEAR	- SEC.	- SEC.	- SEC.
VOLUME DENSITY	OFF	OFF	OFF
ACTUATION B4 ADD *	- VEH.	- VEH.	- VEH.
SEC. PER ACTUATION *	- SEC.	- SEC.	- SEC.
MAX. INITIAL *	- SEC.	- SEC.	- SEC.
TIME B4 REDUCTION *	- SEC.	- SEC.	- SEC.
TIME TO REDUCE *	- SEC.	- SEC.	- SEC.
MINIMUM GAP	- SEC.	- SEC.	- SEC.
DUAL ENTRY	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON

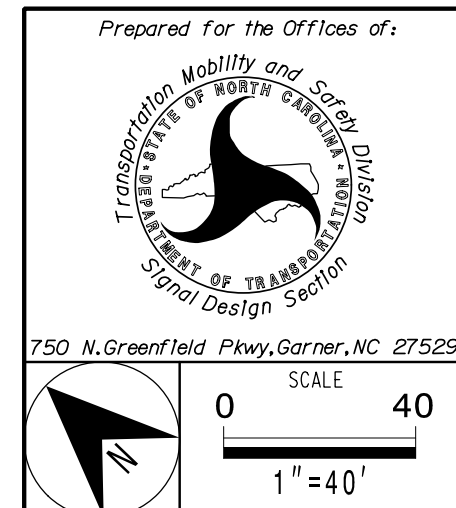
* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than that is shown. Min Green for all other phases should not be lower than 4 seconds.

LEGEND			
PROPOSED	EXISTING		
○ →	Traffic Signal Head	● →	Traffic Signal Head
○ →	Modified Signal Head	N/A	Modified Signal Head
⊥	Sign	⊥	Sign
⊥	Pedestrian Signal Head With Push Button & Sign	⊥	Pedestrian Signal Head With Push Button & Sign
⊥	Metal Pole with Mastarm	⊥	Metal Pole with Mastarm
⊥	Inductive Loop Detector	⊥	Inductive Loop Detector
⊥	Controller & Cabinet	⊥	Controller & Cabinet
⊥	Junction Box	⊥	Junction Box
⊥	2-in Underground Conduit	⊥	2-in Underground Conduit
N/A	Right of Way	---	Right of Way
→	Directional Arrow	→	Directional Arrow
—	Directional Drill	N/A	Directional Drill
N/A	Guardrail	---	Guardrail
(A)	"NO TURN ON RED" Sign (R10-11)	(A)	"NO TURN ON RED" Sign (R10-11)
(B)	NO RIGHT SYMBOL SIGN (R3-2)	(B)	NO RIGHT SYMBOL SIGN (R3-2)
(C)	No Left Turn Sign (R3-2)	(C)	No Left Turn Sign (R3-2)
(D)	No U-Turn Sign (R3-4)	(D)	No U-Turn Sign (R3-4)

Signal Upgrade - Final Design

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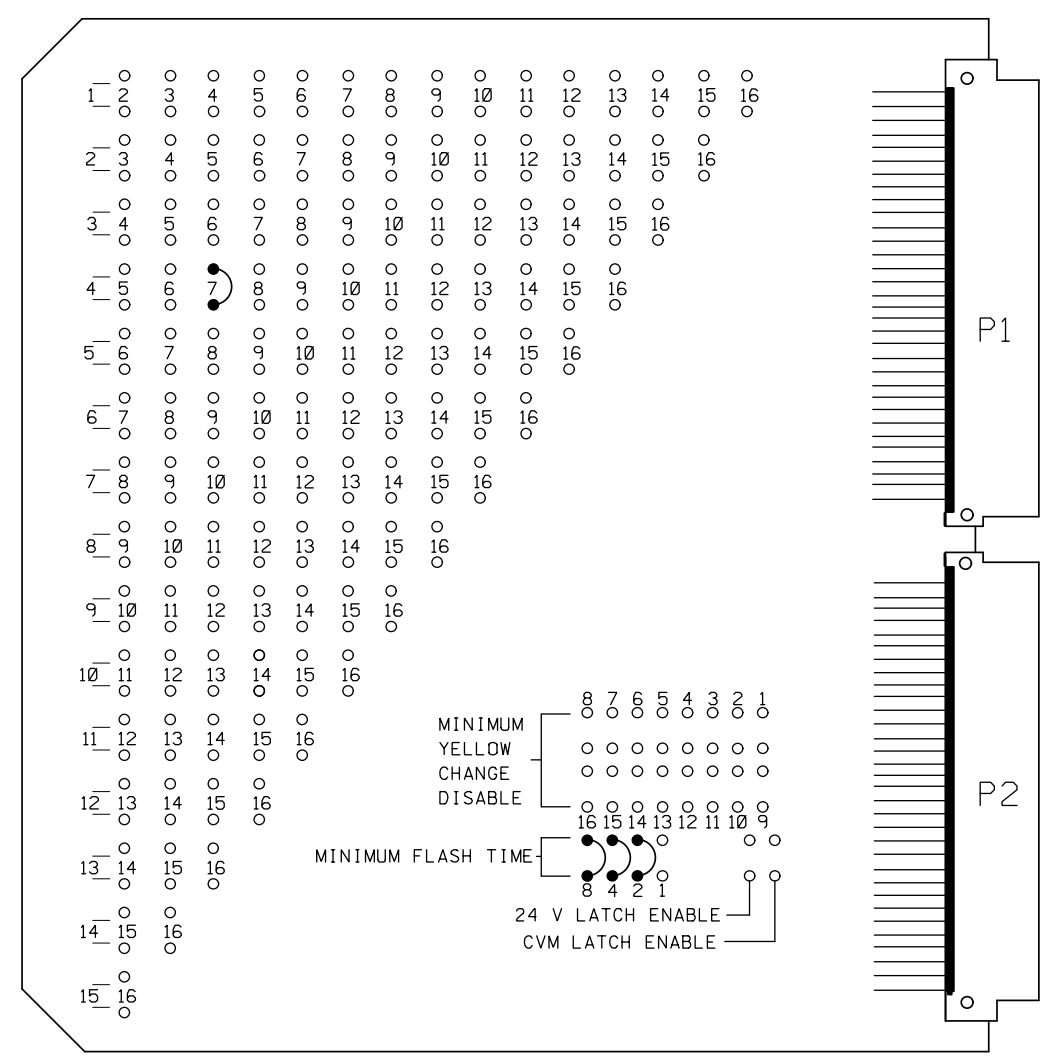
PLANS PREPARED IN THE OFFICE OF:
Kimley-Horn
NC License #F-0102
421 Fayetteville Street, Suite 600
Raleigh, NC 27601
(919) 677-2000



Prepared For the Offices of:		NC 16 (Brookshire Boulevard) at East Cross-over	
Division 10 Mecklenburg County Charlotte		Division 10 Mecklenburg County Charlotte	
PLAN DATE: September 2021	REVIEWED BY: SL Phillips	PREPARED BY: SP Pennington	REVIEWED BY:
REVISIONS		INIT.	DATE

DocuSigned by:
Stage L Phillips
SIGNATURE
DATE: 2/16/2022
SIG. INVENTORY NO. 10-2272

**EDI MODEL MMU2-16LEip
MALFUNCTION MANAGEMENT UNIT
PROGRAMMING DETAIL**
(program card and tables as shown)



CHANNEL NUMBER	ENABLE/DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	DISABLE
7	ENABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	OFF
FYA TRAP DETECT	OFF

MMU PROGRAMMING CARD

MMU PROGRAMMING NOTE
ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

- To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
- To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,5,6,8,9,10,11,12,13,14,15 & 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
- Program controller to start up in Phase 2 Green.
- Set power-up flash time to 12 seconds and implement on the malfunction management unit. Set controller power-up flash time to 22 seconds.
- Enable simultaneous gap-out feature, on controller unit, for all phases.
- Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
- Program detector call delay and extension timing on the controller, unless otherwise specified.
- Set all detector card unit channels to "presence" mode.
- The cabinet and controller are a part of the Charlotte Signal System.

FIELD CONNECTION HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22,23	NU	41,42,43	NU	NU	71,72	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED		2R		4R												
YELLOW		2Y														
GREEN																
RED ARROW							7R									
YELLOW ARROW				4Y			7Y									
GREEN ARROW		2G		4G			7G									
⚠																
🚶																

NU = NOT USED

ECONOLITE EOS SPECIAL MMU PROGRAMMING

(program controller as shown)

- From Main Menu select
- From CONFIGURATION Submenu select
- From Cabinet Submenu select

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.
This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1

BIU	CH1	CH1	CH1	CH1	CH1	CH1	SLOT	SLOT	SLOT	SLOT	SLOT
	L3 ø4	L1 ø2	L7 ø7	L5 ø4	L11 ø4	L9 ø4					
	4A	2A	7B	4C	4F	4D	EMPTY	EMPTY	EMPTY	EMPTY	EMPTY
CH2	CH2	CH2	CH2	CH2	CH2	CH2	EMPTY	EMPTY	EMPTY	EMPTY	EMPTY
L4 ø4	L2 ø2	L8 ø7	L6 ø7	L12 ø4 NOT USED	L10 ø4	4E					
	4B	2B	7C	7A							

EQUIPMENT INFORMATION

CONTROLLER.....2070LX
 CABINETTS-2
 SOFTWAREECONOLITE EOS
 CABINET MOUNT.....BASE W/ RISER
 LOADBAY POSITIONS.....16
 LOAD SWITCHES USED.....2,4,7
 PHASES USED.....2,4,7
 OLA.....NOT USED
 OLB.....NOT USED
 OLC.....NOT USED
 OLD.....NOT USED

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	-
2	ø2
3	-
4	ø4
5	-
6	-
7	ø7
8	-
9	-
10	-
11	-
12	-
13	-
14	-
15	-
16	-

UNUSED LOAD SWITCH CHANNELS SHALL BE DISABLED IN CONTROLLER PROGRAMMING

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
2A	L1A,L1B
2B	L2A,L2B
4A	L3A,L3B
4B	L4A,L4B
4C	L5A,L5B
7A	L6A,L6B
7B	L7A,L7B
7C	L8A,L8B
4D	L9A,L9B
4E	L10A,L10B
4F	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

NOTE
BE SURE TO PROGRAM DETECTOR TYPES AND TIMERS (EXTEND AND DELAY) AS SHOWN ON THE SIGNAL PLANS.

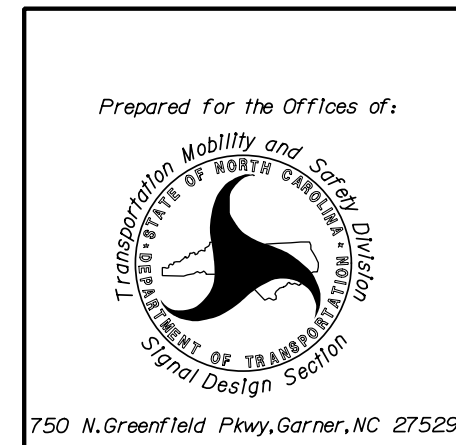
PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1	ø2	-	-
2	ø2	-	-
3	ø4	-	-
4	ø4	-	-
5	ø4	-	-
6	ø7	-	-
7	ø7	-	-
8	ø7	-	-
9	ø4	-	-
10	ø4	-	-
11	ø4	-	-
12	-	-	-
13	-	-	-
14	-	-	-
15	-	-	-
16	-	-	-

Final Design
Electrical Detail

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 10-2272
 DESIGNED: September 2021
 SEALED: 2/16/2022
 REVISED:

PLANS PREPARED IN THE OFFICE OF:
Kimley-Horn
 NC License #F-0102
 421 Fayetteville Street, Suite 600
 Raleigh, NC 27601
 (919) 677-2000



NC 16 (Brookshire Boulevard)
at
East Cross-Over
Division 10 Mecklenburg County Charlotte
 PLAN DATE: September 2021 REVIEWED BY: SL Phillips
 PREPARED BY: SP Pennington REVIEWED BY:

REVISIONS	INIT.	DATE

DocuSigned by:
SL Phillips
SIGNATURE
DATE: 2/16/2022

SIG. INVENTORY NO. 10-2272

*****ACT TIME*****
 *****CON*****
 *****USER*****

TIP PROJECT: I-5973

CONTRACT: C204658

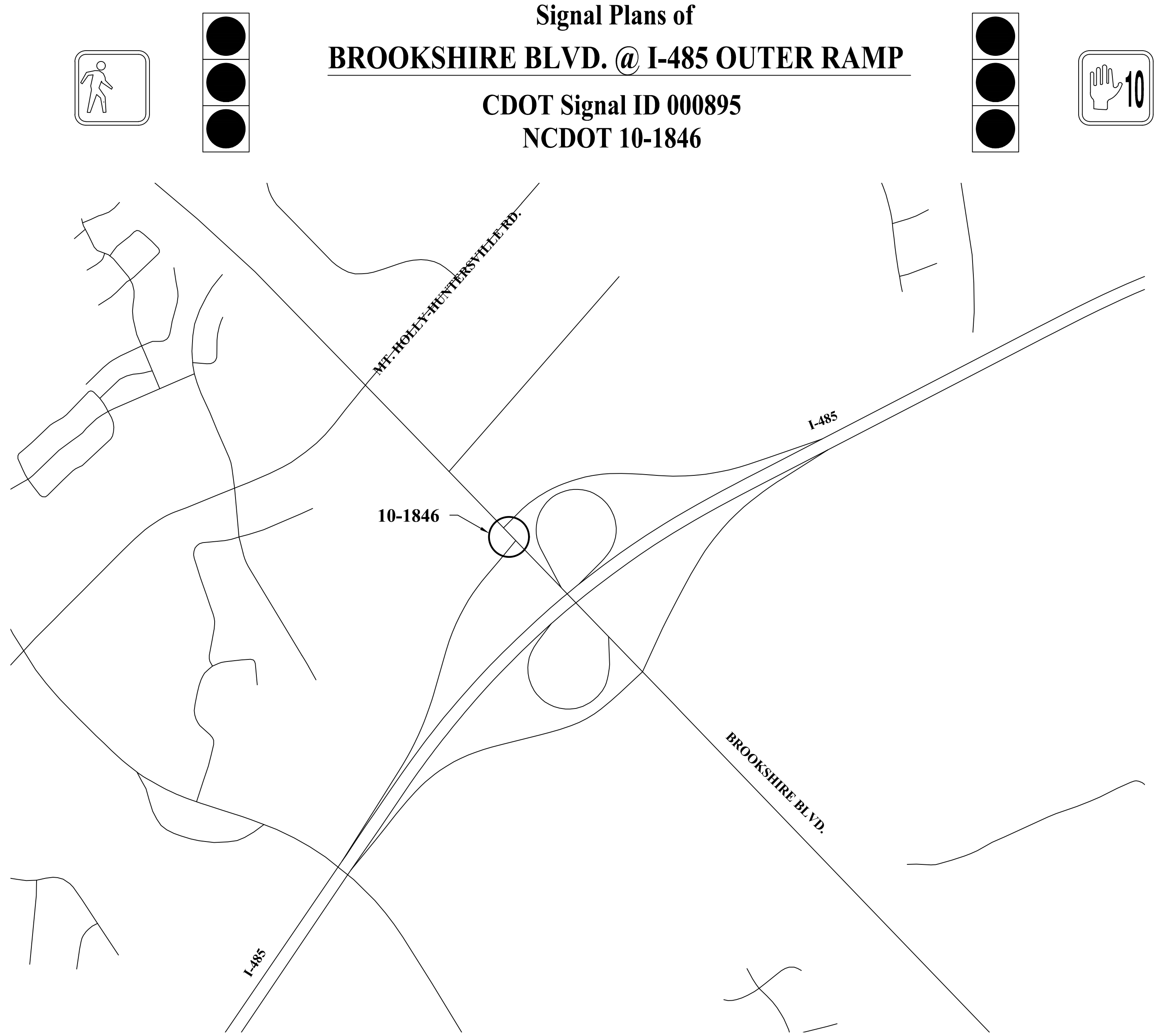
INDEX OF SHEETS

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TOTAL SHEETS 9



Signal Plans of
BROOKSHIRE BLVD. @ I-485 OUTER RAMP
 CDOT Signal ID 000895
 NCDOT 10-1846



VICINITY MAP (NTS)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	I-5973
SHEET NO.	SIG. 2.0

LEGEND

PROPOSED	DESCRIPTION	EXISTING
	CONTROL BOX	
	METER PEDESTAL	
	PULL BOX	
	STEEL POLE	
	MAST ARM	
	PED PEDESTAL	
	UTILITY POLE	
	ANCHOR	
	SIGNAL HEAD	
	VIDEO CAMERA	
	OPTICOM	
	OBSERVATION CAM	
	DETECTOR	
	CONDUIT	
	INTERCONNECT	
	EDGE OF PVMT.	
	CURB & GUTTER	
	TUBULAR MARKER	
	GROUND SIGN	
	OVERHEAD SIGN	
	DOUBLE YELLOW	
	STOP BAR	
	WHITE SKIP	
	WHITE MINI	
	PAVEMENT ARROW	
	PROPERTY LINE	
	ROW	

PULLBOX ID

	SIZE	PULLBOX TYPE
①	13"x24"x12"	LOOP
②	17"x30"x24"	FIBER OPTIC
③	24"x36"x24"	CONTROLLER / FIBER
④	30"x48"x36"	CONTROLLER
⑤	24"x24"x12"	CONTROLLER
⑥	36"x36"x12"	CONTROLLER

NOTE: PULLBOX MATERIAL MUST MEET OR EXCEED THE 1998 CDOT TRAFFIC SIGNAL SPECIFICATIONS.

PLANS PREPARED BY:



PLAN NOTES

- ALL PAVEMENT MARKING DIMENSIONS ARE APPROXIMATE.
- SIGNAL SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST NCDOT STANDARD SPECIFICATIONS AND CDOT TRAFFIC SIGNAL SPECIAL PROVISIONS.
- PED SIGNALS WITH PUSHBUTTONS WILL BE LABELED "PB" (FOR EXAMPLE PB21, PB22)
- COUNTDOWN PEDESTRIAN SIGNALS SHALL COUNT DOWN FLASHING DON'T WALK ONLY.

PE SEAL



DocuSigned by: SL Phillips 2/16/2022

PROJECT TEAM

DESIGNER:	SP PENNINGTON
PROJECT MANAGER:	SL PHILLIPS, P.E.

SHEET 2.0



Signal ID 00895 / NCDOT 10-1846

BROOKSHIRE BLVD. @ I-485 OUTER RAMP

NO.	DATE	BY	REVISION DESCRIPTION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

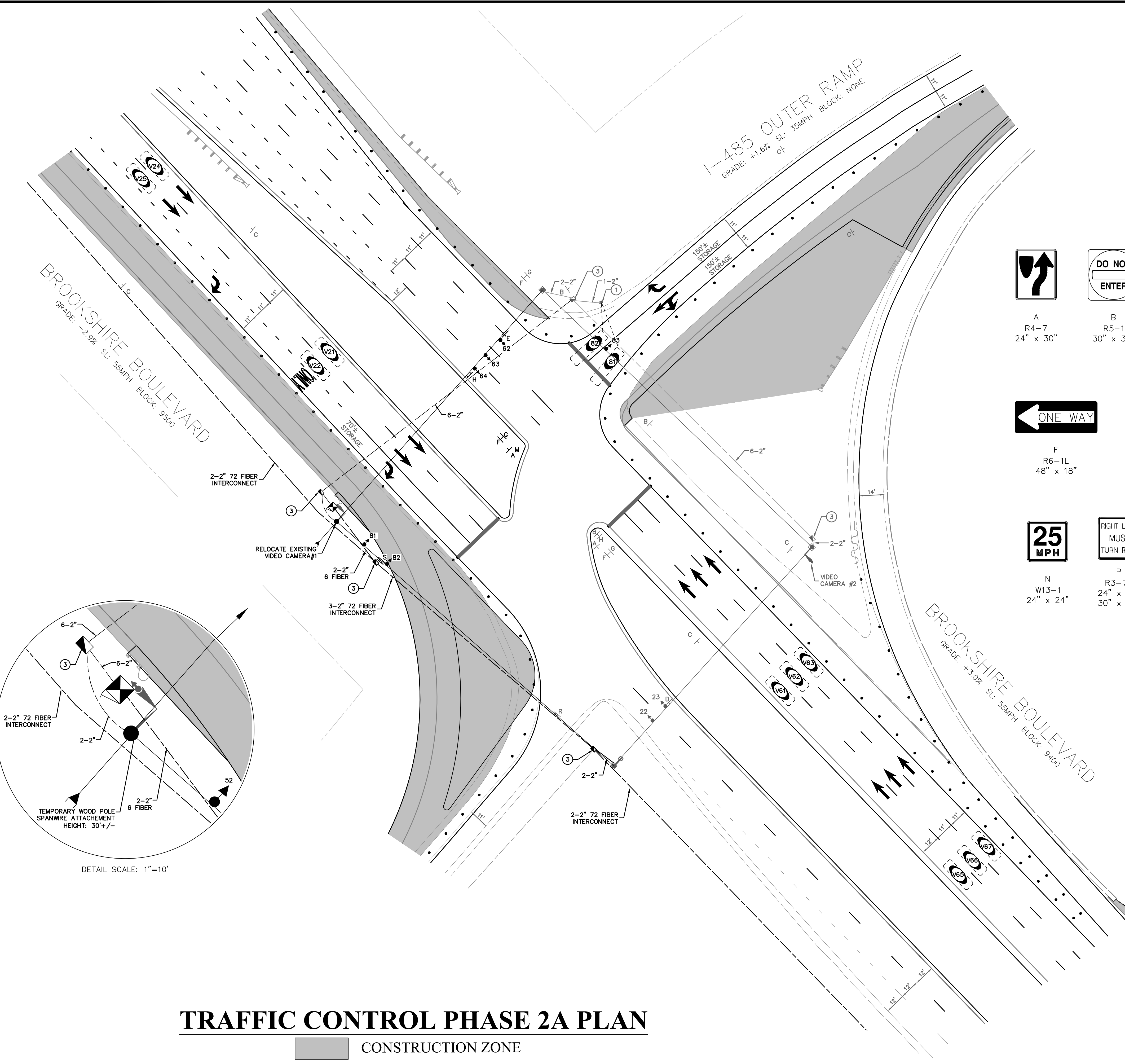
DocuSigned by:
SAL P. 2/16/2022
032607

00895	SIGNAL NO.	10-1846	SLP PREPARED BY	9/2021	DATE
	NCDOT ID NO.				

SHEET **SIG2.1** OF **SIG2.8**

BROOKSHIRE BLVD. @ I-485 OUTER RAMP

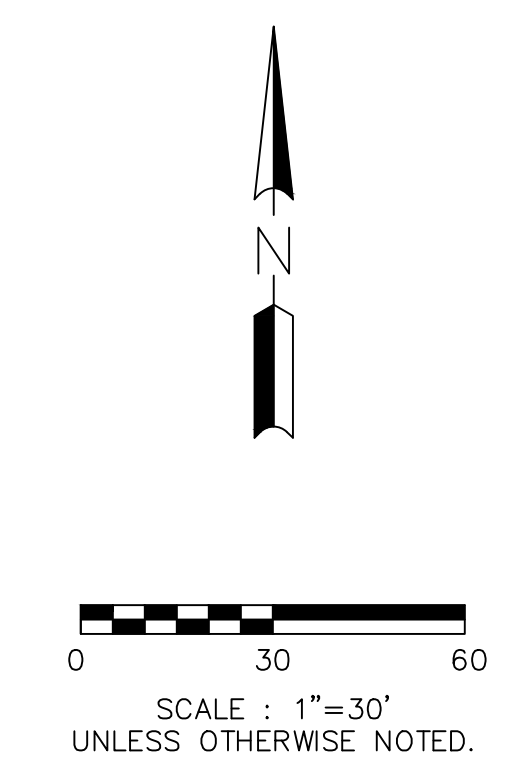
TEMPORARY 1 SIGNAL PLAN



- SIGNAL HEAD ID**
- 82
 - 22, 23
81, 83
 - 62, 63, 64
- SIGN ID**
- A R4-7 24" x 30"
 - B R5-1 30" x 30"
 - C R5-1a 36" x 24"
 - D R3-2 24" x 24" 30" x 30"
 - E R3-1 24" x 24" 30" x 30"
 - F R6-1L 48" x 18"
 - G R6-1R 48" x 18"
 - H R3-18 24" x 24" 30" x 30"
 - M R3-7L 24" x 24" 30" x 30"
 - N W13-1 24" x 24"
 - P R3-7R 24" x 24" 30" x 30"
- Legend:**
- WRONG WAY**
 - ONE WAY** (Left and Right)
 - 25 MPH**
 - RIGHT LANE MUST TURN RIGHT**
 - BROOKSHIRE BLVD. 9400** (R and S)
 - LEFT LANE MUST TURN LEFT**

TRAFFIC CONTROL PHASE 2A PLAN

CONSTRUCTION ZONE



SIGNAL PHASING

Ring Configuration 1,2,3,4b
5,6,7,8b

1 NOT USED	5 NOT USED
2	6
3 NOT USED	7 NOT USED
4 NOT USED	8

MIN RECALL MIN RECALL

SIGNAL SEQUENCE

RING 1	PHASE 1	PHASE 2	PHASE 3	PHASE 4	FLASH
SIGNAL ID NUMBER	R/W OTH	R/W OTH	R/W OTH	R/W OTH	Y
22,23		G Y			

RING 2	PHASE 5	PHASE 6	PHASE 7	PHASE 8	FLASH
SIGNAL ID NUMBER	R/W OTH	R/W OTH	R/W OTH	R/W OTH	Y
62,63,64		▲ Y			
81,83				G Y R	
82				◀ Y R	

OVERLAP PHASE

OVERLAP PHASE	OL-A/-++	OL-B/-++	OL-C/-++	OL-D/-++	FLASH
SIGNAL ID NUMBER	R/W OTH	R/W OTH	R/W OTH	R/W OTH	Y

RED ARROW ◀ YELLOW ARROW
GREEN ARROW ▲ FLASHING YELLOW ARROW

TURNING MOVEMENT COUNT

Phase	1	2	3	4	5	6	7	8
% Grade	0.0%	-2.9%	0.0%	0.0%	0.0%	3.0%	0.0%	1.6%
Distance		35				95		110
Approach Speed (mph)		55				55		20
Yellow		5.5				4.9		3.0
All Red		1.0				1.2		3.4
Total Clearance		6.5				6.1		6.4

SIGN ID

CLEARANCE INTERVALS

Phase	1	2	3	4	5	6	7	8
% Grade	0.0%	-2.9%	0.0%	0.0%	0.0%	3.0%	0.0%	1.6%
Distance		35				95		110
Approach Speed (mph)		55				55		20
Yellow		5.5				4.9		3.0
All Red		1.0				1.2		3.4
Total Clearance		6.5				6.1		6.4

SIGNAL HEAD ID

--	--	--

PROJECT REFERENCE NO. **I-5973**

SHEET NO. **SIG. 2.2**

Plans Prepared By: **Kimley»Horn**

421 FAYETTEVILLE STREET, SUITE 600
RALEIGH, NORTH CAROLINA, 27601
PHONE: 919-677-2600

NO.	DATE	BY	REVISION DESCRIPTION

MALFUNCTION MANAGEMENT UNIT / CONFLICT MONITOR

PROGRAMMING DETAIL

(program card and tables as shown)

CHANNEL NUMBER	ENABLE/DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	DISABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	ENABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

ECONOLITE EOS-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

- From Main Menu select **1. CONFIGURATION**
- From CONFIGURATION Submenu select **1. CABINET**
- From PORT 1 (SDLC) Submenu select **4. MONITOR PROGRAMMING**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

```

MMU PROGRAM [ MANUAL ]

CH 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2
1 . . . . .
2 . . . . . X . . .
3 . . . . .
4 . . . . .
5 . . . . .
6 . . . . .
7 . . . . .
8 . . . . .
9 . . . . .
10 . . . . .
11 . . . . .
12 . . . . .
13 . . . . .
14 . . . . .
15 . . . . .
    
```

END PROGRAMMING

DETECTOR RACK SETUP

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

DET BIU #1	COMMUNICATIONS	DETECTOR CHANNELS	DETECTOR CHANNELS	DETECTOR CHANNELS	DETECTOR CHANNELS	DETECTOR CHANNELS	DETECTOR CHANNELS	DET BIU #2
NOT USED	NOT USED	CH3 L7	CH1 L5	CH4 L8	CH2 L6			
		NOT USED	Ø 8	NOT USED	Ø 8			

DETECTOR INFORMATION

DETECTOR NUMBER	AMP. NO.	SIZE / ZONE	Ø	AMP TYPE	DELAY DISABLE	COMMENTS:
V21,V22	1	AD-130'	2	N		(THRU) (CAMERA #1)
V23,V24	2	AD-280'	2	N		(THRU) (CAMERA #1)
V61,V62,V63	3	AD-130'	6	N		(THRU) (CAMERA #2)
V64,V64,V65	4	AD-280'	6	N		(THRU) (CAMERA #2)
81	5	6'x25'	8	N		STOPBAR
82	5	6'x25'	8	N		STOPBAR

NOTE:
ALL STOPBAR LOOPS EXTEND 5' BEYOND THE STOPBAR UNLESS OTHERWISE NOTED.
ALL LOOPS RECEIVE THREE TURNS.

DocuSigned by: **SALPH** 2/16/2022

00895 SIGNAL NO. 10-1846 NCDOT ID NO.

PREPARED BY: SLP DATE: 9/2021


BROOKSHIRE BLVD. @ I-485 OUTER RAMP

TEMPORARY 1 SIGNAL DETAILS

SHEET **SIG2.2** OF **SIG2.8**

NO.	DATE	BY	REVISION DESCRIPTION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

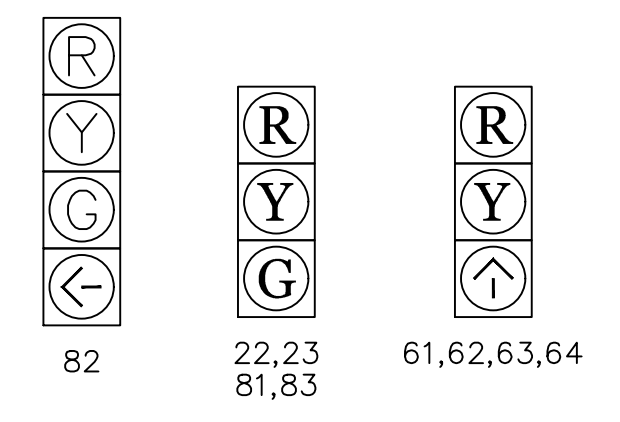


Designed by: *SALP* 2/16/2022
0327ASBP00847

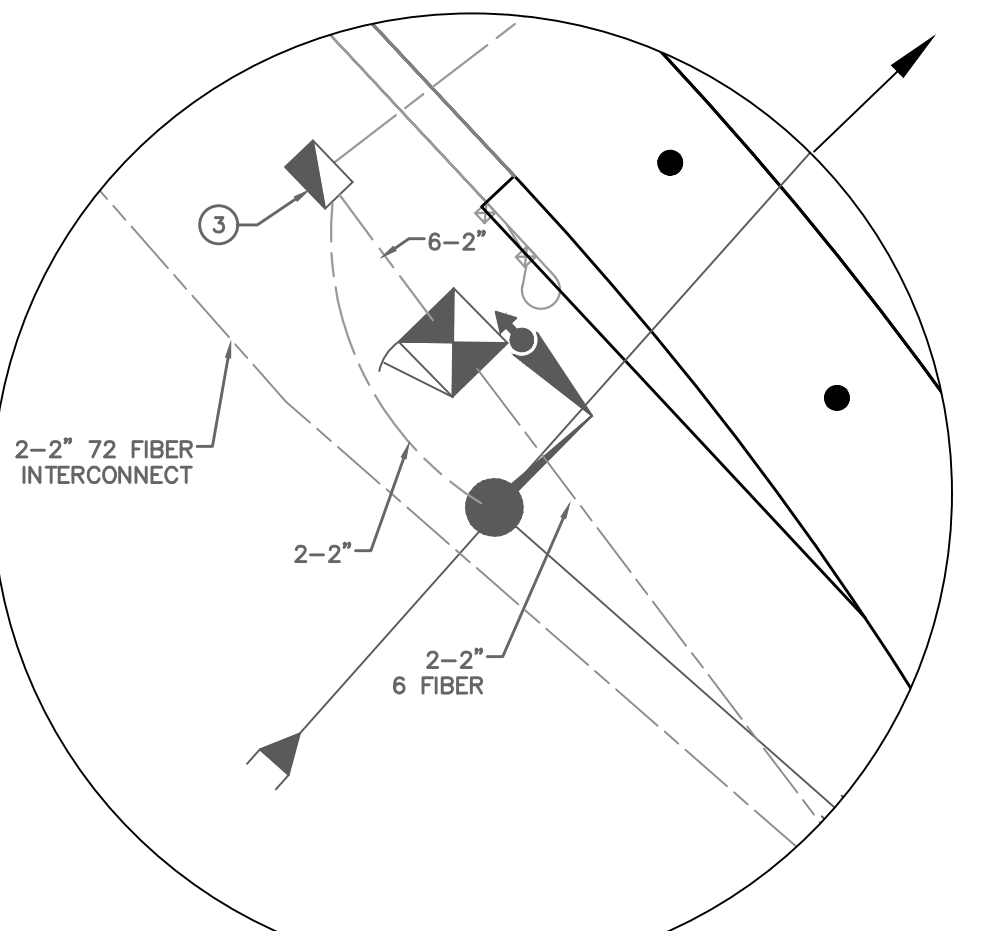
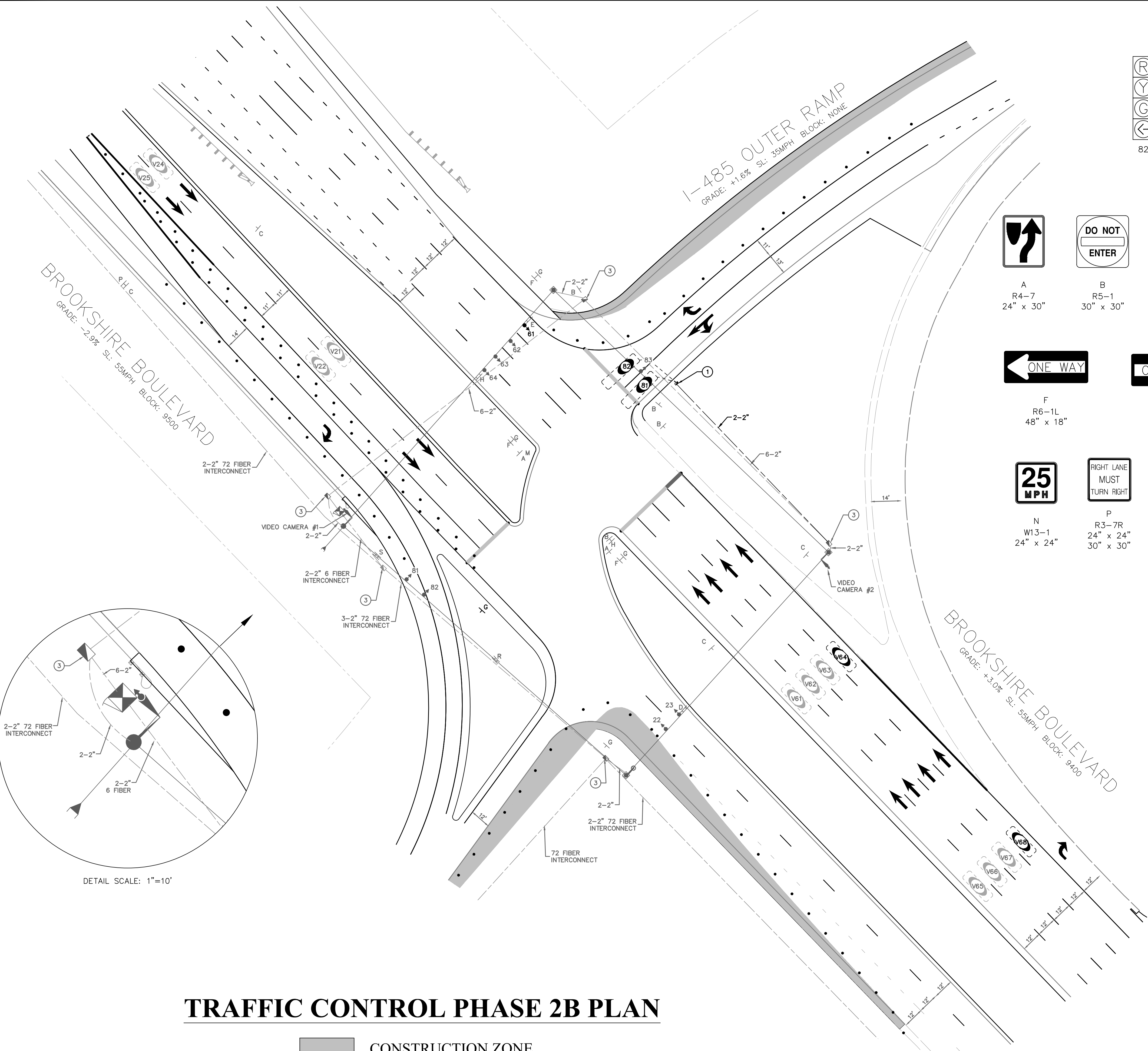
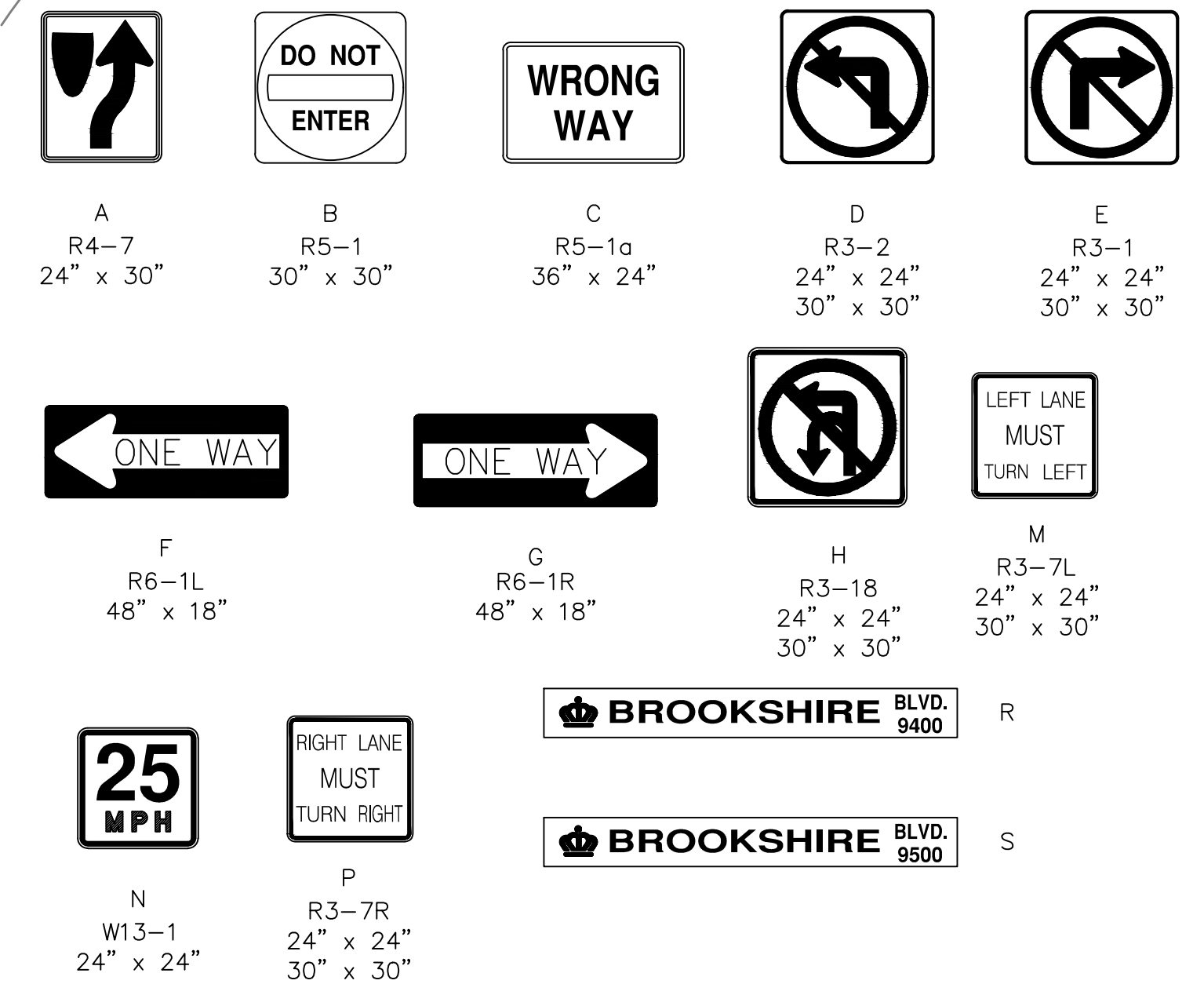
00895 SIGNAL NO.	SLP PREPARED BY	9/2021 DATE
10-1846 NCDOT ID NO.		

BROOKSHIRE BLVD. @ I-485 OUTER RAMP	TEMPORARY 2 SIGNAL PLAN
SHEET SIG2.3	OF SIG2.8

SIGNAL HEAD ID

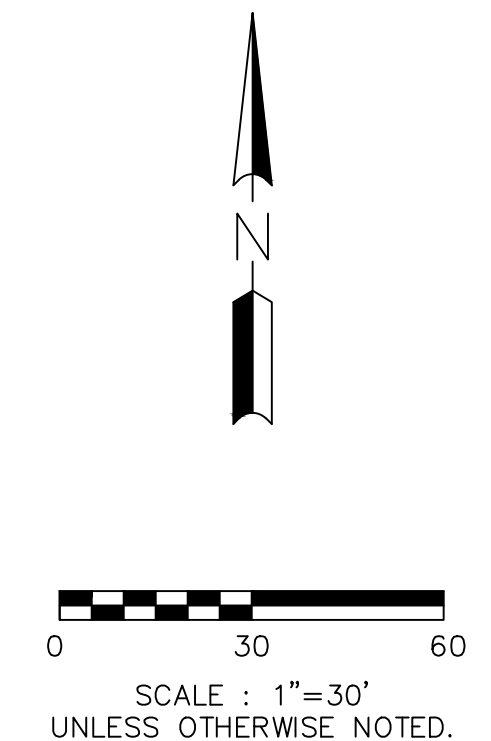


SIGN ID



TRAFFIC CONTROL PHASE 2B PLAN

CONSTRUCTION ZONE



SIGNAL PHASING

Ring Configuration 1,2,3,4,5,6,7,8

1 NOT USED 5 NOT USED
 2 6
 3 NOT USED 7 NOT USED
 4 NOT USED 8

SIGNAL SEQUENCE

RING 1	PHASE 1	PHASE 2	PHASE 3	PHASE 4	FLASH				
SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W	OTH	FLASH
22,23			G	Y					

RING 2	PHASE 5	PHASE 6	PHASE 7	PHASE 8	FLASH				
SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W	OTH	FLASH
61,62,63,64			▲	Y					
81,83							G	Y	R
82								Y	R

OVERLAP PHASE

OL-A/-+ OL-B/-+ OL-C/-+ OL-D/-+ FLASH

RED ARROW < YELLOW ARROW
 GREEN ARROW * FLASHING YELLOW ARROW

TURNING MOVEMENT COUNT

Phase	1	2	3	4	5	6	7	8
% Grade		-2.9%				3.0%		1.6%
Distance		35				80		100
Approach Speed (mph)		55				55		20
Yellow		5.5				4.9		3.0
All Red		1.0				1.0		3.3
Total Clearance		6.5				5.9		6.3

SIGN ID

25 MPH
 BROOKSHIRE BLVD. 9400
 BROOKSHIRE BLVD. 9500

CLEARANCE INTERVALS

Phase	1	2	3	4	5	6	7	8
% Grade		-2.9%				3.0%		1.6%
Distance		35				80		100
Approach Speed (mph)		55				55		20
Yellow		5.5				4.9		3.0
All Red		1.0				1.0		3.3
Total Clearance		6.5				5.9		6.3

SIGNAL HEAD ID

MALFUNCTION MANAGEMENT UNIT / CONFLICT MONITOR

DETECTOR RACK SETUP

PROGRAMMING DETAIL

(program card and tables as shown)

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE

CHANNEL NUMBER	ENABLE/DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	DISABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	ENABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

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

END PROGRAMMING

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

DET BIU #1	DETECTION	CH3 L7 NOT USED	CH1 L5 Ø 8	COMMUNICATIONS	SLOT	SLOT	SLOT	SLOT	DET BIU #2
		CH4 L8 NOT USED	CH2 L6 Ø 8		EMPTY	EMPTY	EMPTY	EMPTY	

DETECTOR INFORMATION

DETECTOR NUMBER	AMP. NO.	SIZE / ZONE	Ø	AMP. TYPE	DELAY DISABLE #	COMMENTS:
V21,V22	1	AD-130'	2	N		(THRU) (CAMERA #1)
V23,V24	2	AD-280'	2	N		(THRU) (CAMERA #1)
V61,V62,V63,V64	3	AD-130'	6	N		(THRU) (CAMERA #2)
V65,V66,V67,V68	4	AD-280'	6	N		(THRU) (CAMERA #2)
81	5	6'x25'	8	N		STOPBAR
82	5	6'x25'	8	N		STOPBAR

NOTE: ALL STOPBAR LOOPS EXTEND 5' BEYOND THE STOPBAR UNLESS OTHERWISE NOTED. ALL LOOPS RECEIVE THREE TURNS.

PROJECT REFERENCE NO. **I-5973**
 SHEET NO. **SIG. 2.4**

Plans Prepared By: **Kimley-Horn**
 421 FAYETTEVILLE STREET, SUITE 600
 RALEIGH, NORTH CAROLINA, 27601
 PHONE 919-977-2000

NO.	DATE	BY	REVISION DESCRIPTION

DocuSigned by: **J.P. 2/16/2022**
 0087A562D0B437

00895 SIGNAL NO. **BROOKSHIRE BLVD. @ I-485 OUTER RAMP**
 10-1846 NCDOT ID NO. **TEMPORARY 2 SIGNAL DETAILS**

SHEET **SIG2.4** OF **SIG2.8**

Plans Prepared By:
Kimley»Horn
 421 FAYETTEVILLE STREET, SUITE 600
 RALEIGH, NORTH CAROLINA, 27601
 PHONE: 919-677-2000

NO.	DATE	BY	REVISION DESCRIPTION

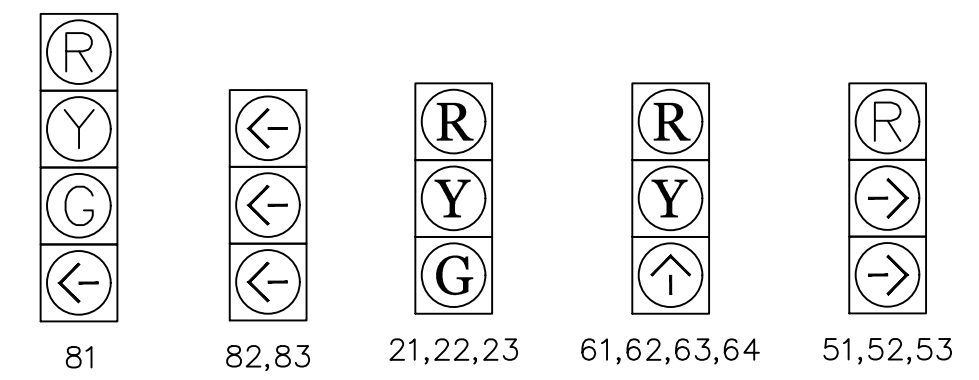


DocuSigned by:
 J.W. Phillips
 0087A56E90B437

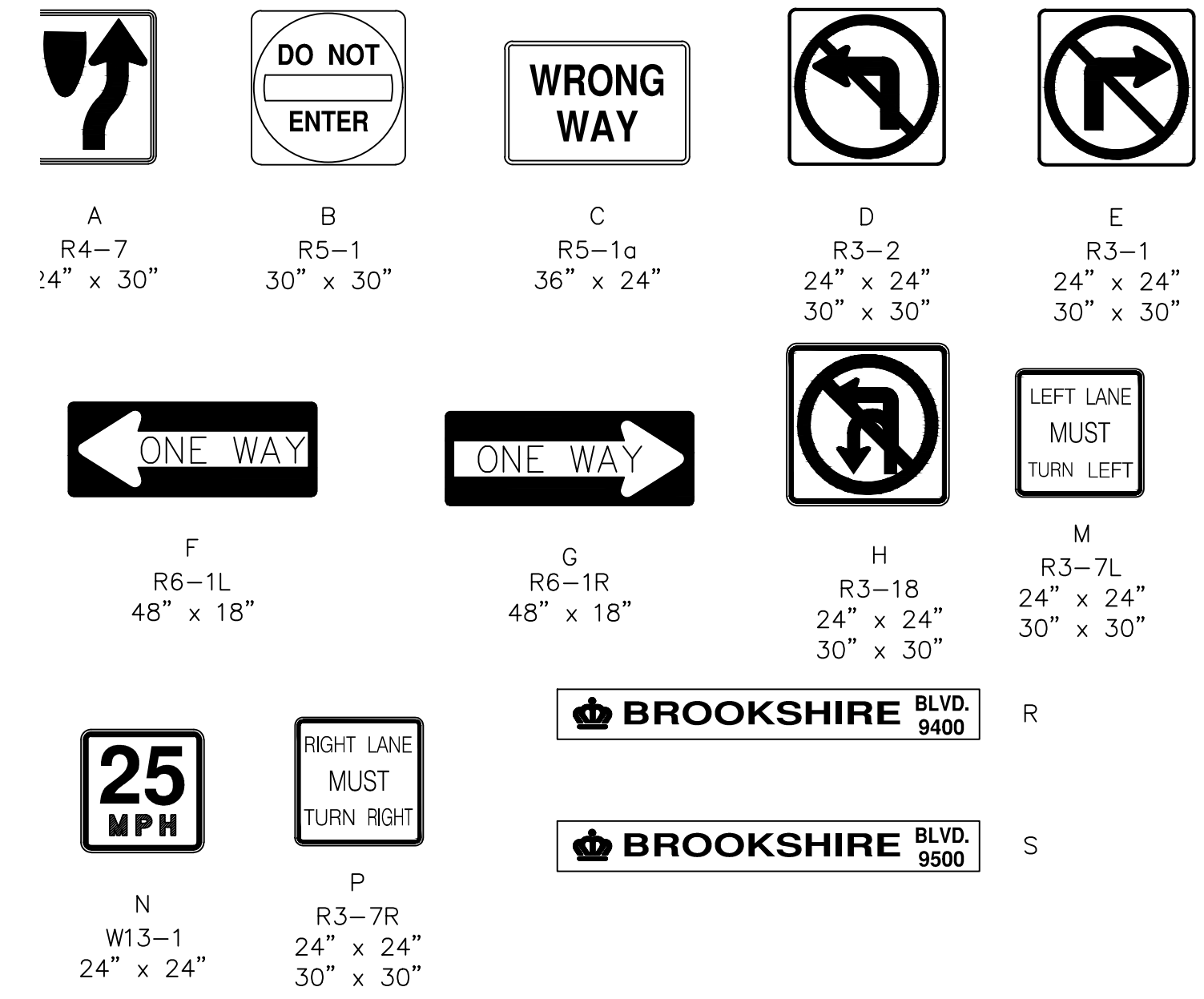
00895	SIGNAL NO.	SLP	PREPARED BY	9/2021	DATE
10-1846	NCDOT ID NO.				

BROOKSHIRE BLVD. @ I-485 OUTER RAMP
 FINAL DESIGN SIGNAL PLAN
 SHEET SIG2.5 OF SIG2.8

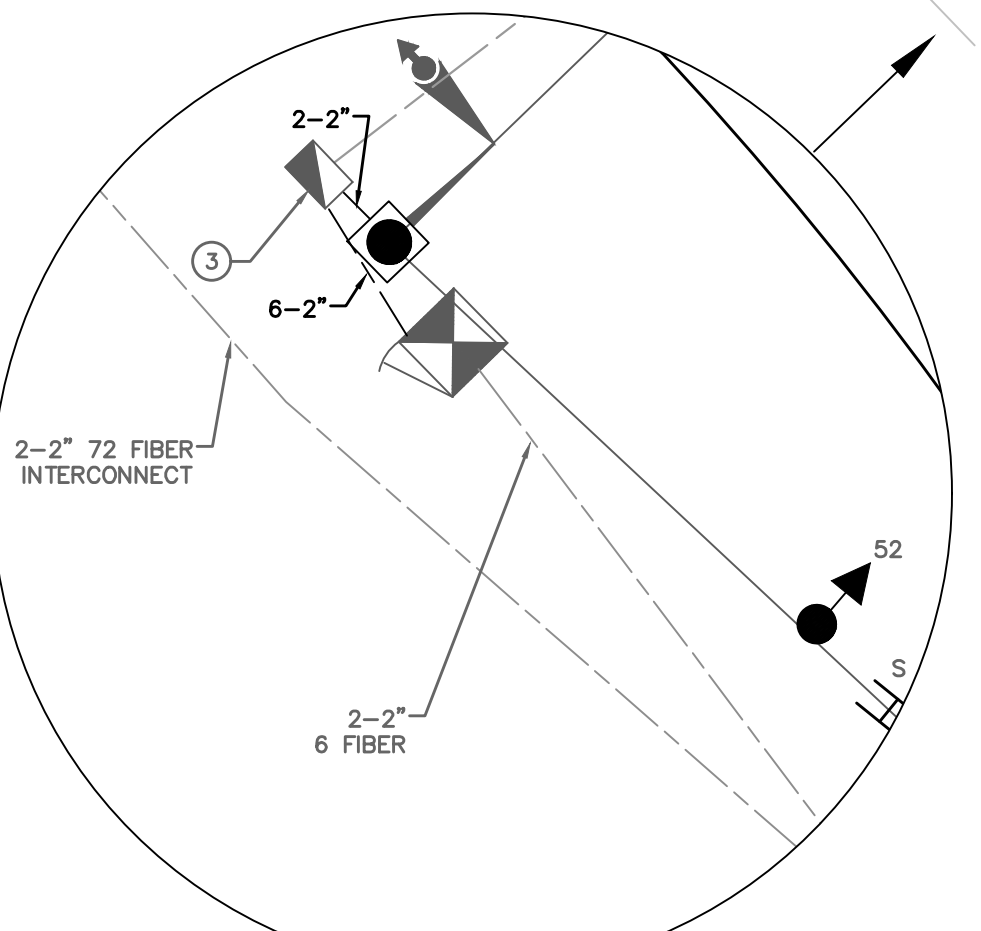
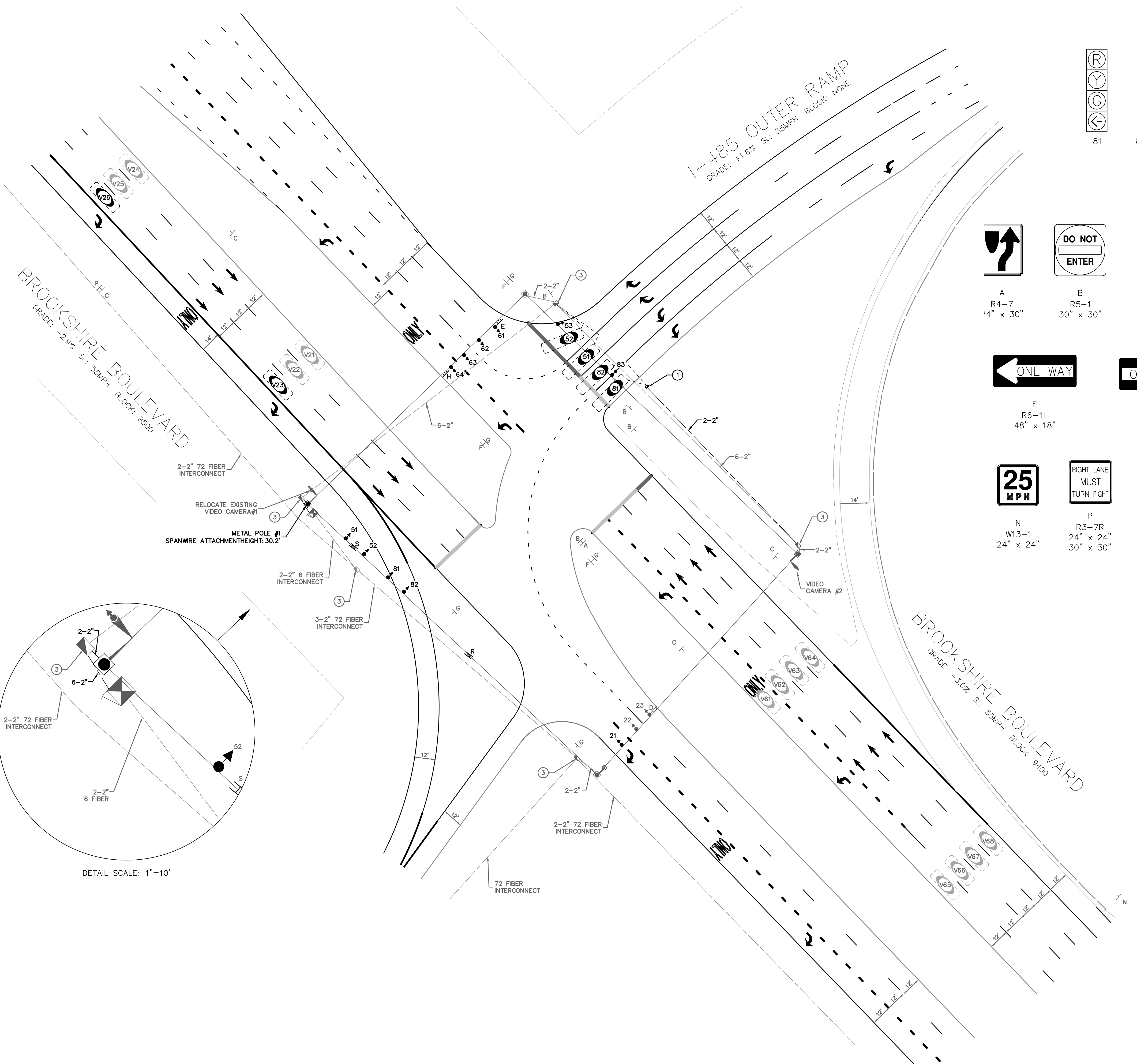
SIGNAL HEAD ID



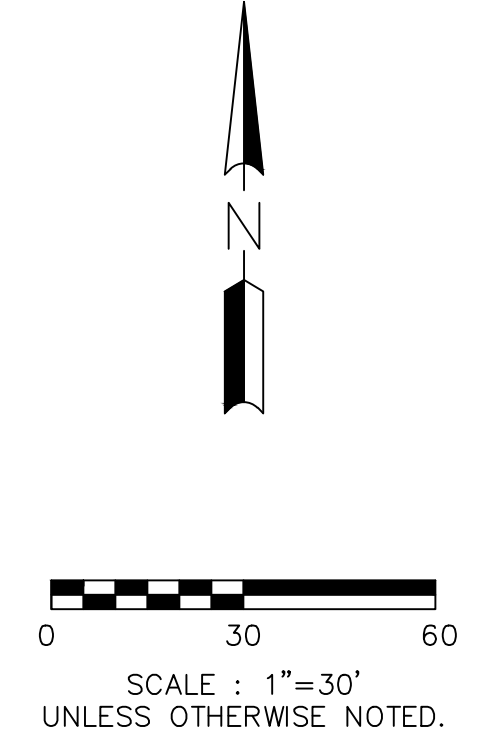
SIGN ID



BROOKSHIRE BLVD. 9400 R
BROOKSHIRE BLVD. 9500 S



DETAIL SCALE: 1"=10'



SIGNAL PHASING

Ring Configuration 1,2,3,4,5,6,7,8

1 NOT USED	5 OL-A
2	6
3 NOT USED	7 NOT USED
4 NOT USED	8 OL-A

SIGNAL SEQUENCE

RING 1	PHASE 1	PHASE 2	PHASE 3	PHASE 4	FLASH				
SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W	OTH	FLASH
21,22,23		G	Y						Y

RING 2	PHASE 5	PHASE 6	PHASE 7	PHASE 8	FLASH				
SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W	OTH	FLASH
61,62,63,64			▲	Y					Y
81									Y
82,83									Y

OVERLAP PHASE

OL-A/5+8	OL-B/-+--	OL-C/-+--	OL-D/-+--	FLASH					
SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W	OTH	FLASH
51,52,53									R

RED ARROW < YELLOW ARROW
GREEN ARROW * FLASHING YELLOW ARROW

TURNING MOVEMENT COUNT

Phase	1	2	3	4	5	6	7	8
% Grade	0.0%	-2.9%	0.0%	0.0%	1.6%	3.0%	0.0%	1.6%
Distance		35			50	80		120
Approach Speed (mph)		55			35	55		20
Yellow		5.5			3.7	4.9		3.0
All Red		1.0			1.0	1.0		3.6
Total Clearance		6.5			4.7	5.9		6.6

SIGN ID

A R4-7 24" x 30"	B R5-1 30" x 30"	C R5-1a 36" x 24"	D R3-2 24" x 24" 30" x 30"	E R3-1 24" x 24" 30" x 30"
F R6-1L 48" x 18"	G R6-1R 48" x 18"	H R3-18 24" x 24" 30" x 30"	M R3-7L 24" x 24" 30" x 30"	
N W13-1 24" x 24"	P R3-7R 24" x 24" 30" x 30"			

DO NOT ENTER, WRONG WAY, ONE WAY, LEFT LANE MUST TURN LEFT, BROOKSHIRE BLVD. 9400, BROOKSHIRE BLVD. 9500, 25 MPH, RIGHT LANE MUST TURN RIGHT

CLEARANCE INTERVALS

Phase	1	2	3	4	5	6	7	8
% Grade	0.0%	-2.9%	0.0%	0.0%	1.6%	3.0%	0.0%	1.6%
Distance		35			50	80		120
Approach Speed (mph)		55			35	55		20
Yellow		5.5			3.7	4.9		3.0
All Red		1.0			1.0	1.0		3.6
Total Clearance		6.5			4.7	5.9		6.6

SIGNAL HEAD ID

81	82,83	21,22,23	61,62,63,64	51,52,53
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MALFUNCTION MANAGEMENT UNIT / CONFLICT MONITOR

DETECTOR RACK SETUP

PROGRAMMING DETAIL

(program card and tables as shown)

FIELD CHECK ENABLE
DUAL IND ENABLE
RED FAIL ENABLE

CHANNEL NUMBER	ENABLE/DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	DISABLE
5	ENABLE
6	DISABLE
7	DISABLE
8	ENABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	ENABLE
14	DISABLE
15	DISABLE
16	DISABLE

ECONOLITE EOS-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

- From Main Menu select **1. CONFIGURATION**
- From CONFIGURATION Submenu select **1. CABINET**
- From PORT 1 (SDLC) Submenu select **4. MONITOR PROGRAMMING**

CAUTION!
Set intersection to Flash before attempting to enter or change any MMU programming data.
This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

```

MMU PROGRAM [ MANUAL ]

CH 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2
1 . . . . .
2 . . . X . . . . . X X . .
3 . . . . .
4 . . . . .
5 . . . X . . . . .
6 . . . . .
7 . . . . .
8 . . . X . . . . .
9 . . . . .
10 . . . . .
11 . . . . .
12 . . . . .
13 . . . . .
14 . . . . .
15 . . . . .
    
```

END PROGRAMMING

OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3xDay Latch	ON

CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	ON
FYA TRAP DETECT	ON

MMU PROGRAMMING NOTE
ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

DET BIU #1	DETECTION	CH3 L7 Ø 5	CH1 L5 Ø 8	COMMUNICATIVE REMOTE IONS	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	DET BIU #2
		CH4 L8 Ø 5	CH2 L6 Ø 8						

DETECTOR INFORMATION

DETECTOR NUMBER	AMP. NO.	SIZE / ZONE	Ø	AMP. DELAY TYPE	DISABLE #	COMMENTS:
V21,V22,V23	1	AD-130'	2	N		(THRU) (CAMERA #1)
V24,V25,V26	2	AD-280'	2	N		(THRU) (CAMERA #1)
V61,V62,V63,V64	3	AD-130'	6	N		(THRU) (CAMERA #2)
V65,V66,V67,V68	4	AD-280'	6	N		(THRU) (CAMERA #2)
81	5	6'x25'	8	N		STOPBAR
82	5	6'x25'	8	N		STOPBAR
51	6	6'x25'	5	D	5,8	STOPBAR
52	6	6'x25'	5	D	5,8	STOPBAR

NOTE:
ALL STOPBAR LOOPS EXTEND 5' BEYOND THE STOPBAR UNLESS OTHERWISE NOTED.
ALL LOOPS RECEIVE THREE TURNS.

00895 SIGNAL NO. 10-1846 NCDOT ID NO. 9/2021 DATE

BROOKSHIRE BLVD. @ I-485 OUTER RAMP
SHEET SIG2.6 OF SIG2.8
FINAL DESIGN SIGNAL DETAILS

PROJECT REFERENCE NO. **I-5973**
SHEET NO. **SIG. 2.6**

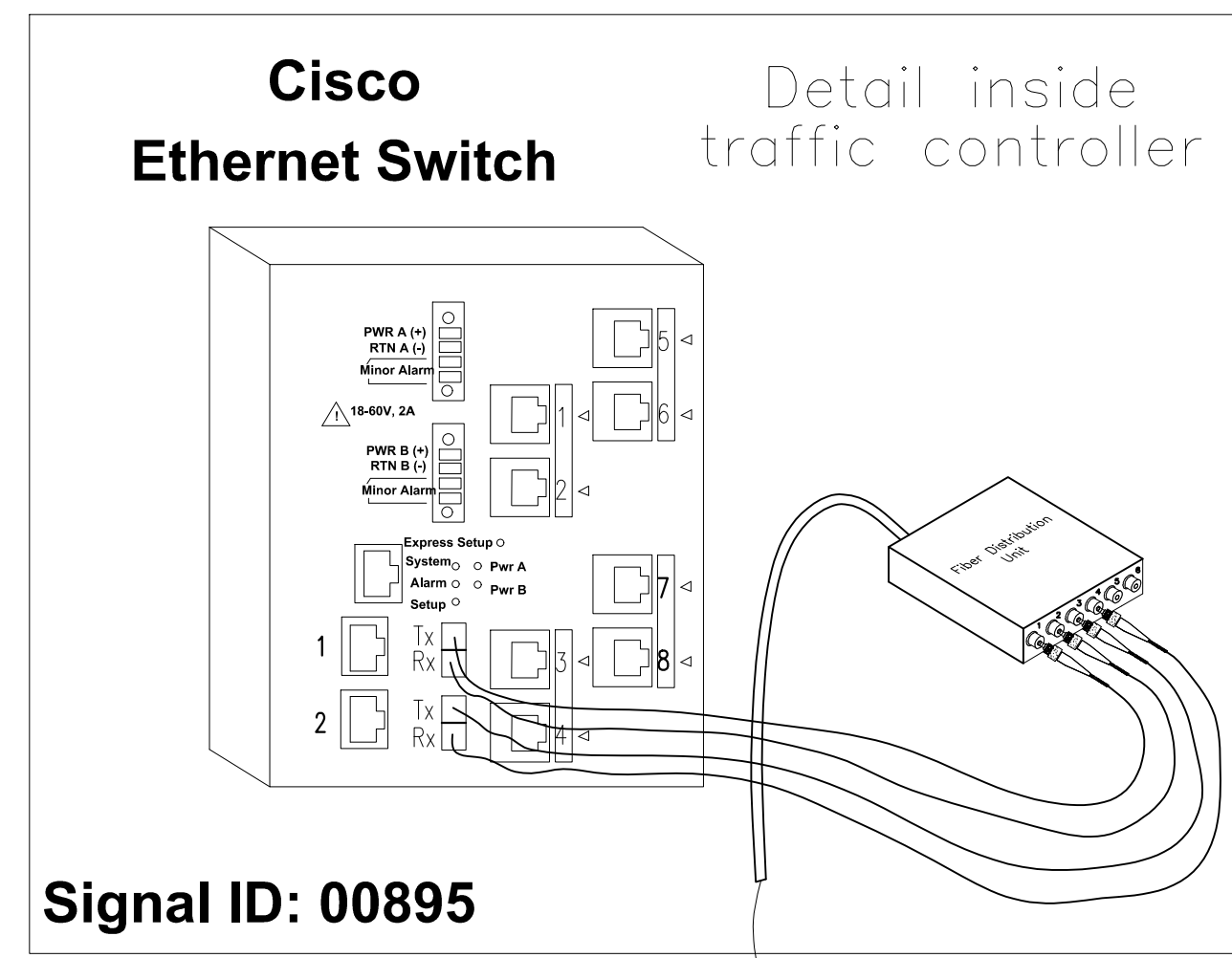
Plans Prepared By: **Kimley»Horn**
421 FAYETTEVILLE STREET, SUITE 600
RALEIGH, NORTH CAROLINA, 27601
PHONE: 919-977-2000

REVISION DESCRIPTION
NO. DATE BY

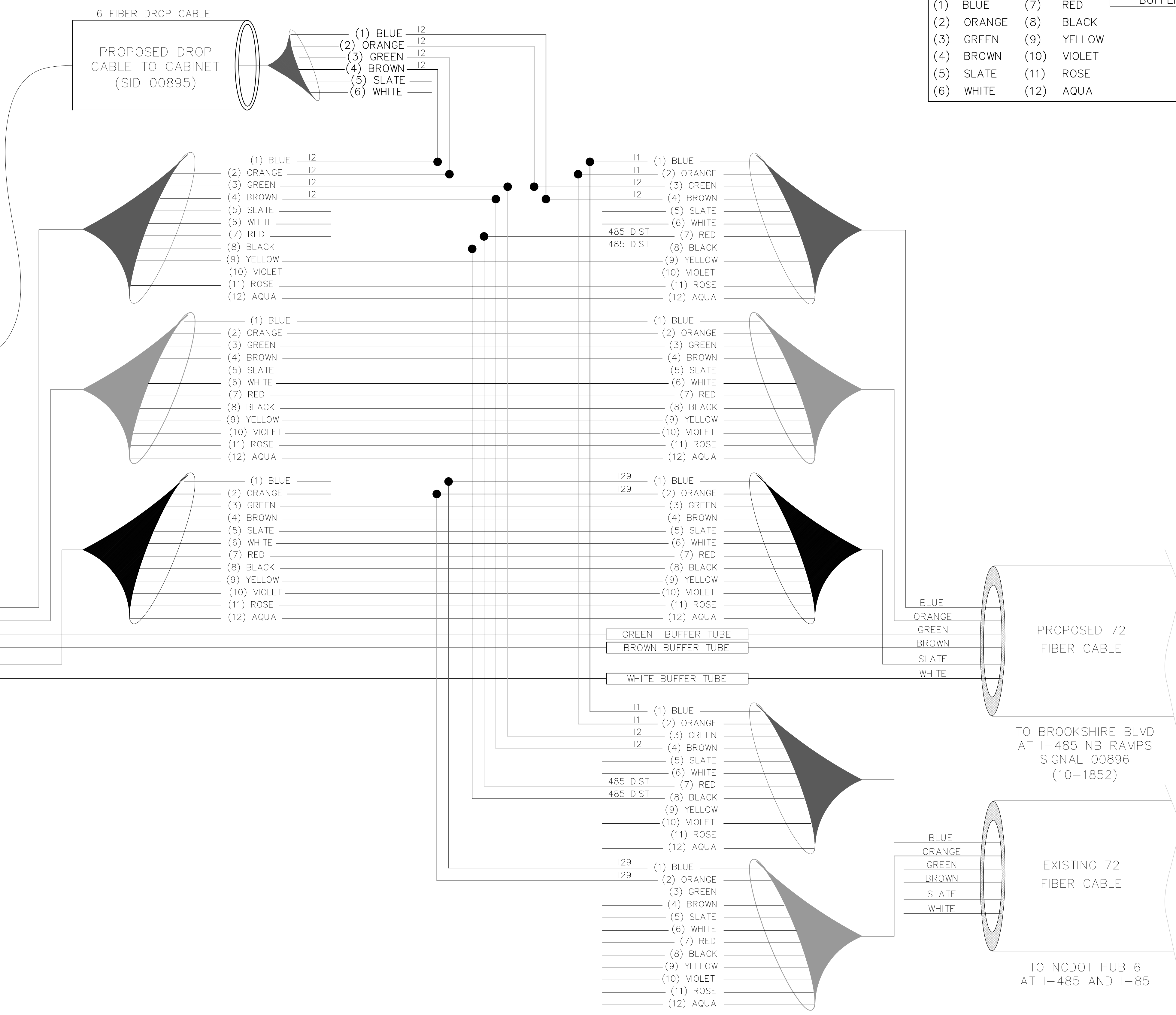
DocuSigned by: **SAW** 2/16/2022
00787A59E068497

DocuSign Envelope ID: 03901C2B-53C7-4179-8A35-E508A32BD93F

**NEW SPLICE ENCLOSURE IN NEW HANDHOLE (HH5) AT
BROOKSHIRE BLVD AT I-485 SB OUTER RAMP
SIG. INV# 00895 (10-1846)**



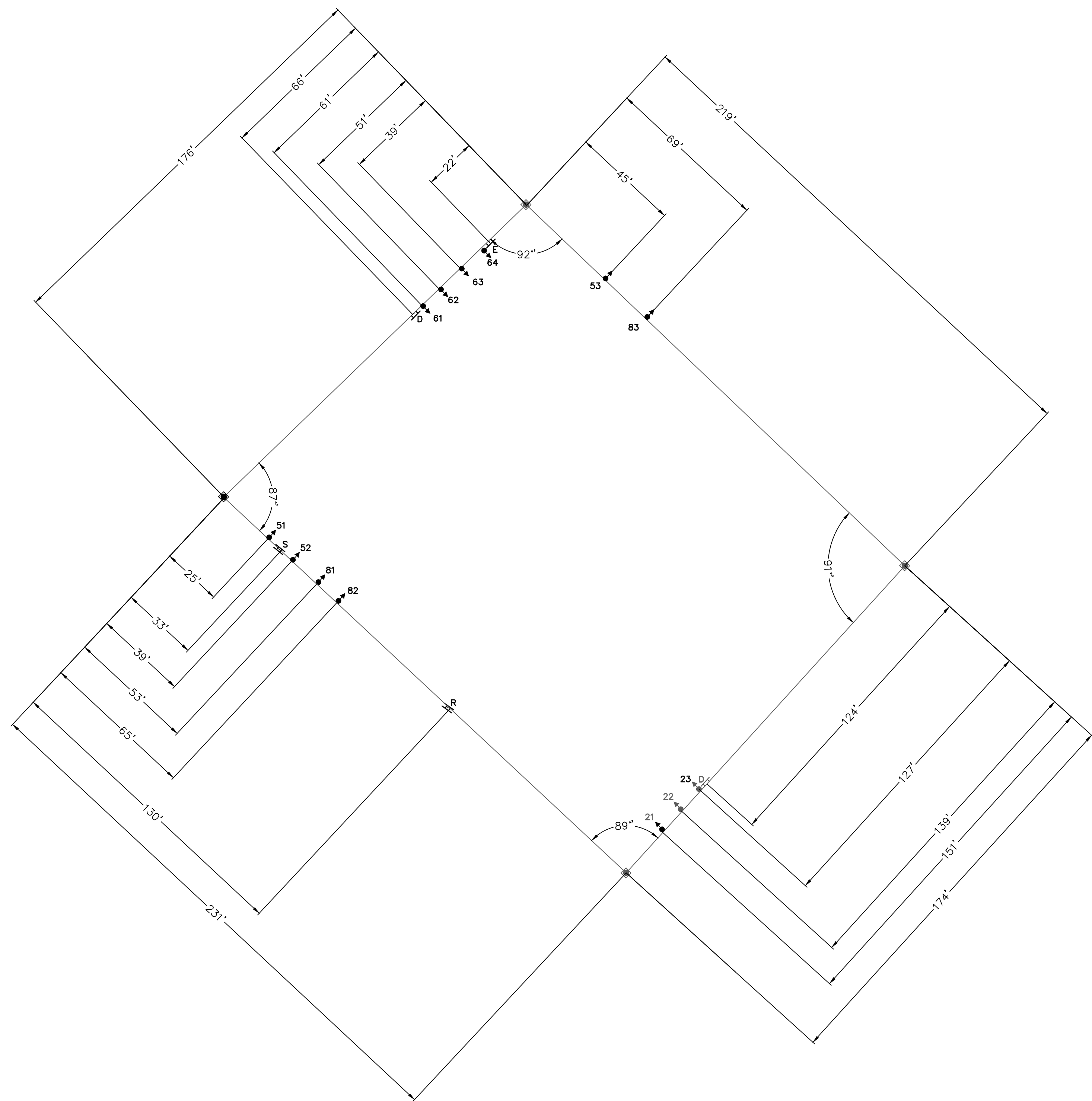
COLOR CODE TIA/EIA 598-A		LEGEND	
(1) BLUE	(7) RED	○ EXISTING SPLICE	□ BUFFER TUBE
(2) ORANGE	(8) BLACK	● NEW SPLICE	
(3) GREEN	(9) YELLOW		
(4) BROWN	(10) VIOLET		
(5) SLATE	(11) ROSE		
(6) WHITE	(12) AQUA		



DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

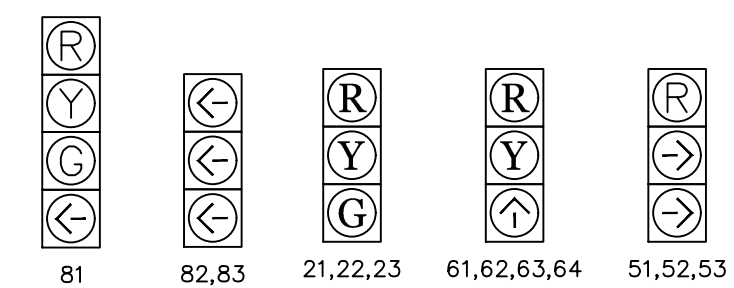
PROJECT REFERENCE NO. I-5973	
SHEET NO. SIG. 2.7	
Plans Prepared By: Kimley»Horn 421 FAYETTEVILLE STREET, SUITE 600 RALEIGH, NORTH CAROLINA, 27601 PHONE: 919-971-6200	
NO.	DESCRIPTION
BY	
DATE	
Digitized by: <i>SLP</i> 2/16/2022 00895 (10-1846)	
00895 SIGNAL NO.	10-1846 NCDOT ID NO.
BROOKSHIRE BLVD. @ I-485 OUTER RAMP SPLICE DETAIL	
SHEET SIG. 2.7	OF SIG. 2.8

SPLICE CASE IN FIBER HH# 5 (SEE SHEET CR7) AT BROOKSHIRE BLVD

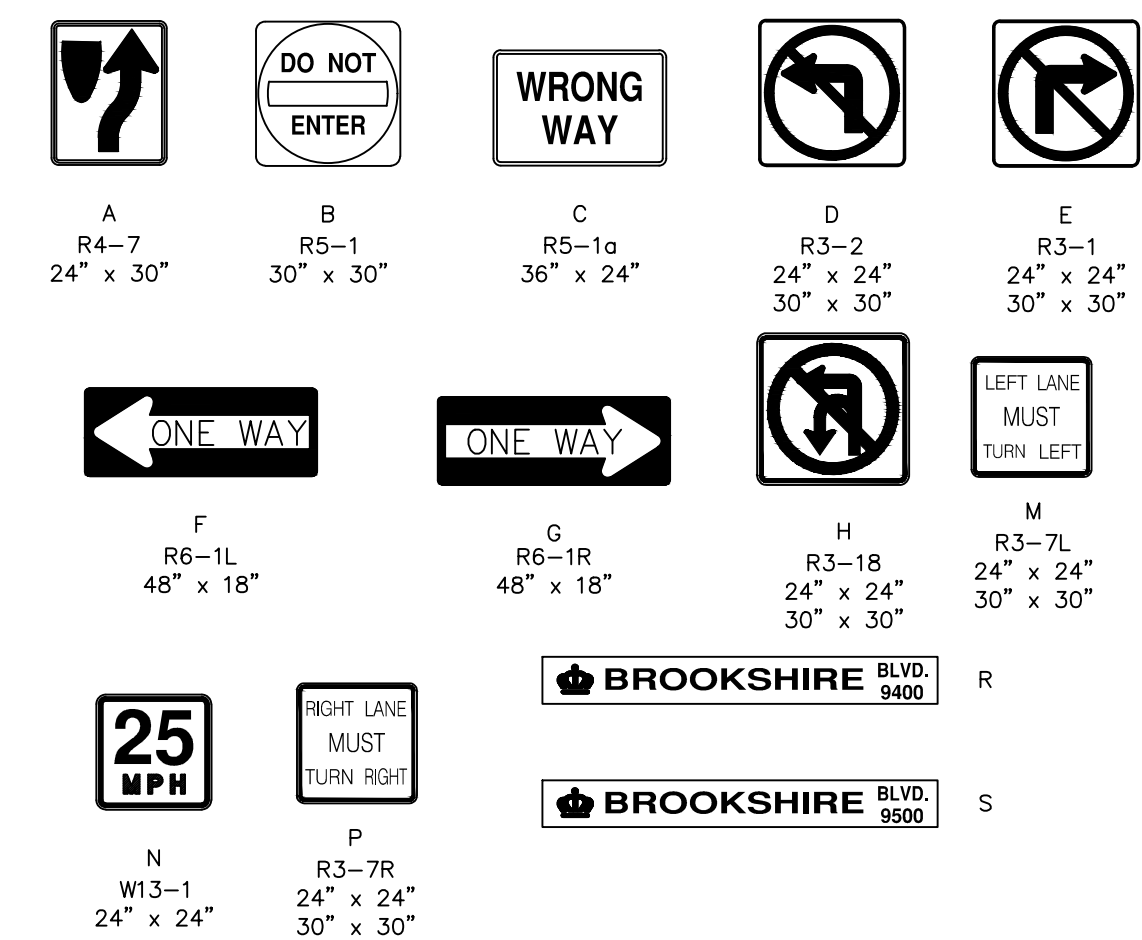


METAL STRAIN POLE LOADING SCHEDULE				
LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	SIGNAL HEAD 12"-4 SECTION-WITH HANGER AND BALANCE ADJUSTER	16.3 S.F.	25.5" W X 66.0" L	69 LBS
	SIGNAL HEAD 12"-3 SECTION-WITH HANGER AND BALANCE ADJUSTER	9.3 S.F.	25.5" W X 52.5" L	56 LBS
	SIGN WITH HANGER AND BALANCE ADJUSTER	5.0 S.F.	24.0" W X 30.0" L	11 LBS
	STREET NAME SIGN WITH HANGER AND BALANCE ADJUSTER	12.0 S.F.	18.0" W X 96.0" L	27 LBS

SIGNAL HEAD ID



SIGN ID



PROJECT REFERENCE NO.

I-5973

SHEET NO.

SIG. 2.8

Plans Prepared By:

Kimley»Horn
421 FAVETTEVALE STREET, SUITE 600
RALEIGH, NORTH CAROLINA, 27601
PHONE: 919-877-2000

DESCRIPTION

BY

DATE

NO.

DOCUMENT NOT CONSIDERED
FINAL UNTIL SIGNATURES
COMPLETED



DocuSigned by:
SAJPH 2/16/2022
1C37A58ED816A37...

00895 SIGNAL NO.
10-1846 NCDOT ID NO.
SLP PREPARED BY
9/2021 DATE

00895 SIGNAL NO.
10-1846 NCDOT ID NO.

**BROOKSHIRE BLVD. @
I-485 OUTER RAMP**

**METAL POLE
DETAILS**

SHEET
SIG2.8

OF
SIG2.8

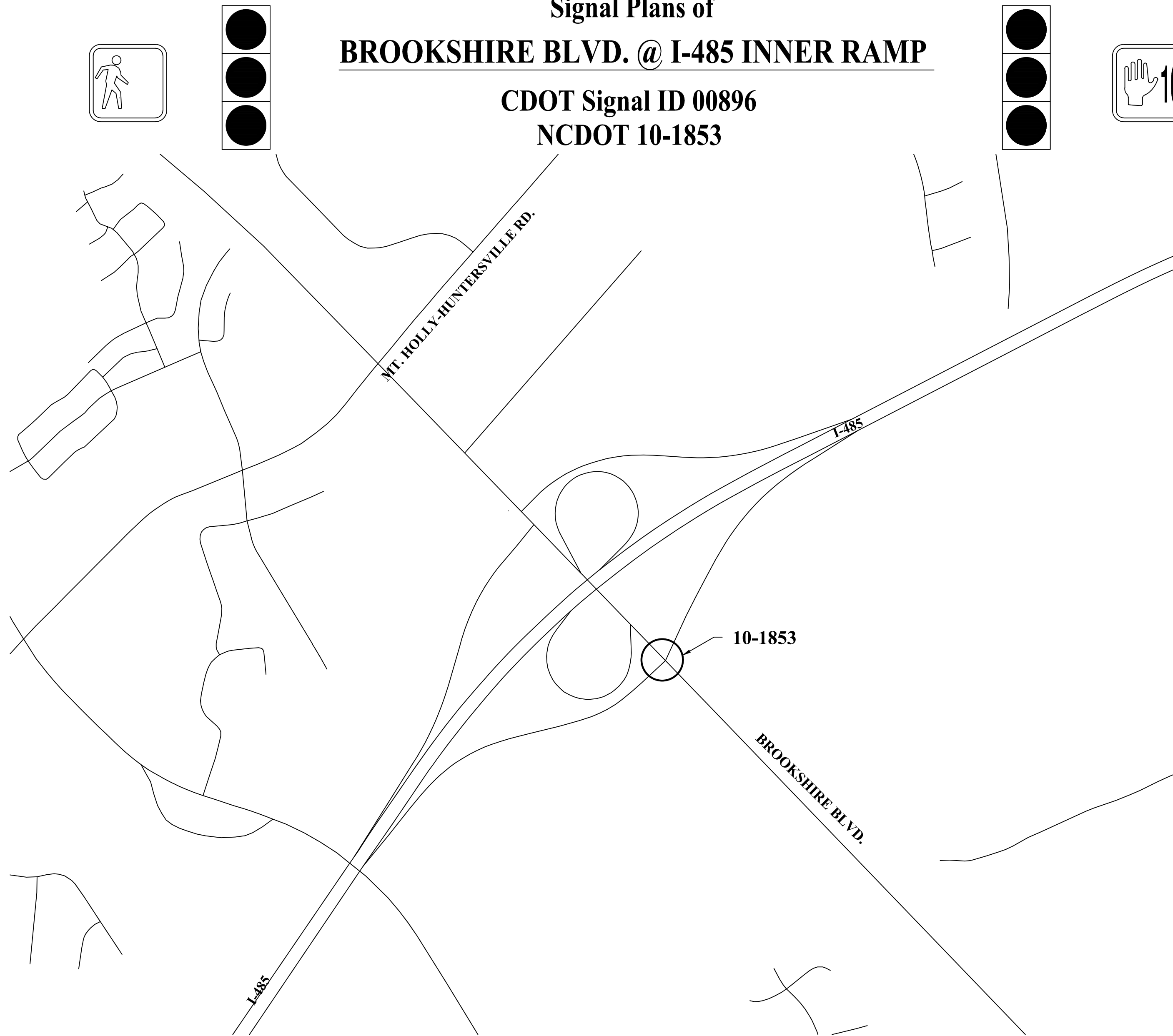
TIP PROJECT: I-5973

CONTRACT: C204658

INDEX OF SHEETS	
Cover Sheet.....	SIG3.0
Temp Signal Plans	SIG3.1-SIG3.2
Temp Signal Details	SIG3.3
Final Signal Plans	SIG3.4
Final Signal Details	SIG3.5
Final Splice Detail	SIG3.6
TOTAL SHEETS 7	



Signal Plans of
BROOKSHIRE BLVD. @ I-485 INNER RAMP
 CDOT Signal ID 00896
 NCDOT 10-1853



PROJECT REFERENCE NO.	I-5973
SHEET NO.	SIG. 3.0

LEGEND		
PROPOSED	DESCRIPTION	EXISTING
	CONTROL BOX	
	METER PEDESTAL	
	PULL BOX	
	STEEL POLE	
	MAST ARM	
	PED PEDESTAL	
	UTILITY POLE	
	ANCHOR	
	SIGNAL HEAD	
	VIDEO CAMERA	
	OPTICOM	
	OBSERVATION CAM	
	DETECTOR	
	CONDUIT	
	INTERCONNECT	
	EDGE OF PVMT.	
	CURB & GUTTER	
	TUBULAR MARKER	
	GROUND SIGN	
	OVERHEAD SIGN	
	DOUBLE YELLOW	
	STOP BAR	
	WHITE SKIP	
	WHITE MINI	
	PAVEMENT ARROW	
	PROPERTY LINE	
	ROW	

PULLBOX ID		
	SIZE	PULLBOX TYPE
①	13"x24"x12"	LOOP
②	17"x30"x24"	FIBER OPTIC
③	24"x36"x24"	CONTROLLER / FIBER
④	30"x48"x36"	CONTROLLER
⑤	24"x24"x12"	CONTROLLER
⑥	36"x36"x12"	CONTROLLER

NOTE:
 PULLBOX MATERIAL MUST MEET OR EXCEED THE 1998
 CDOT TRAFFIC SIGNAL SPECIFICATIONS.

VICINITY MAP (NTS)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PLANS PREPARED BY:

421 FAYETTEVILLE STREET, SUITE 600
 RALEIGH, NORTH CAROLINA, 27601
 PHONE: 919-677-2000

PLAN NOTES

- ALL PAVEMENT MARKING DIMENSIONS ARE APPROXIMATE.
- SIGNAL SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST NCDOT STANDARD SPECIFICATIONS AND CDOT TRAFFIC SIGNAL SPECIAL PROVISIONS.
- PED SIGNALS WITH PUSHBUTTONS WILL BE LABELED "PB" (FOR EXAMPLE PB21, PB22)
- COUNTDOWN PEDESTRIAN SIGNALS SHALL COUNT DOWN FLASHING DON'T WALK ONLY.

PE SEAL

DocuSigned by:
S. Phillips
 2/16/2022

PROJECT TEAM	
DESIGNER:	SP PENNINGTON
PROJECT MANAGER:	SL PHILLIPS, P.E.

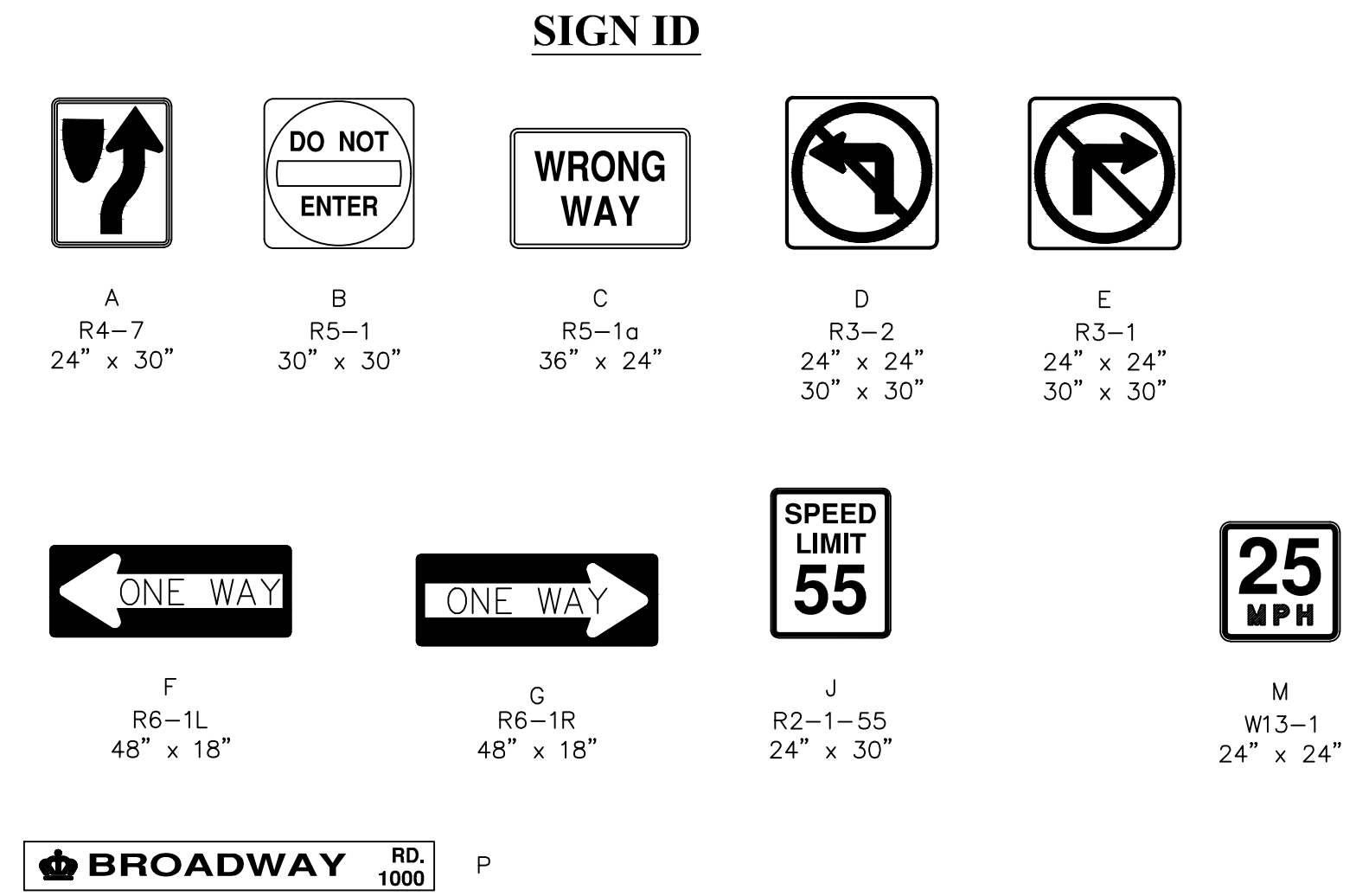
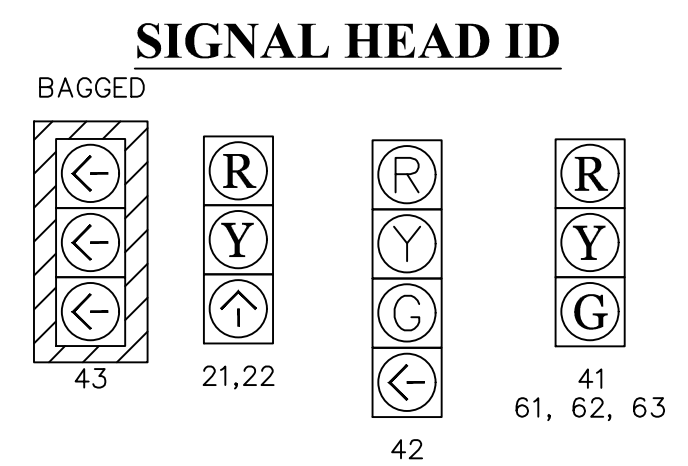
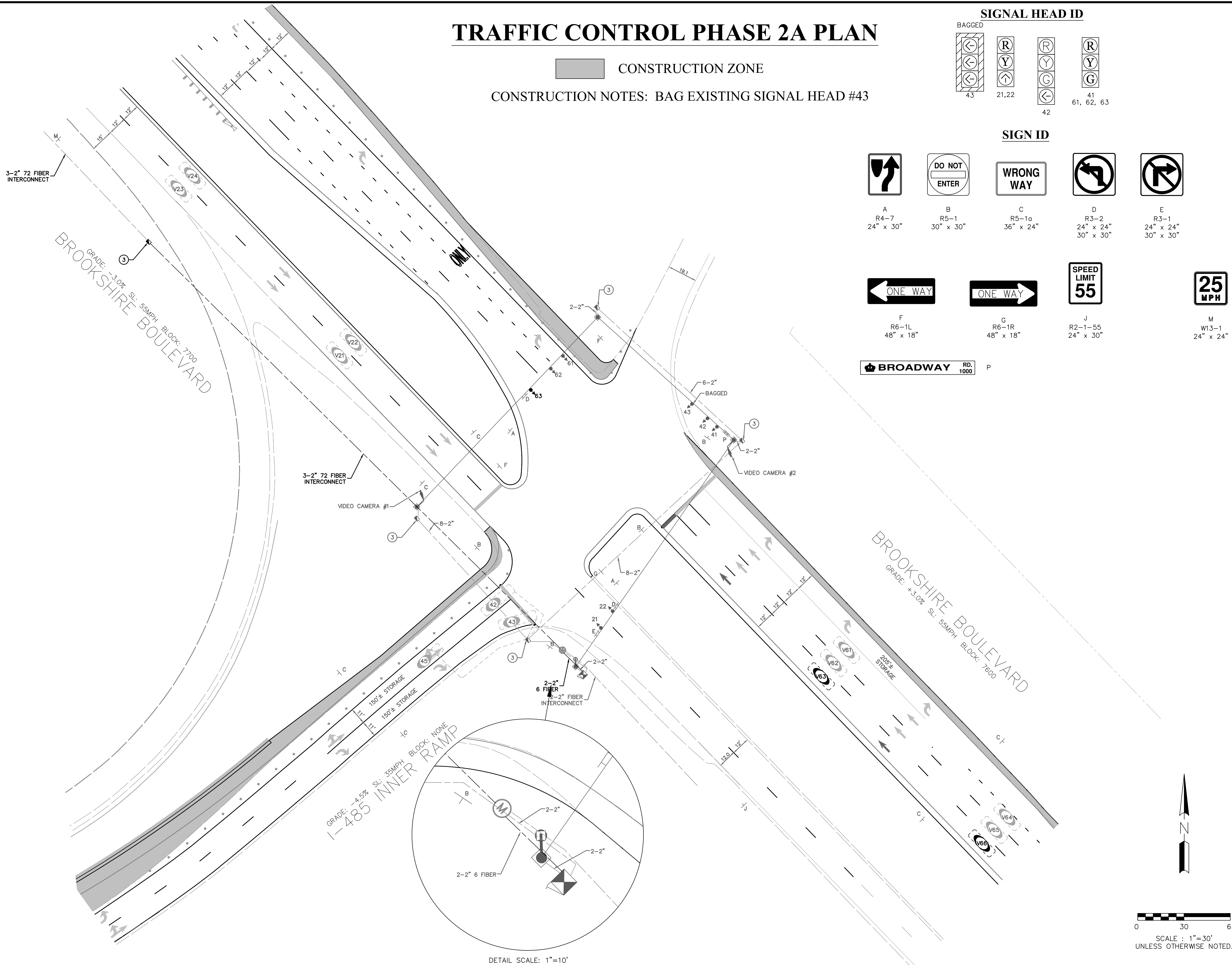
SHEET 3.0

BROOKSHIRE BLVD. @ I-485 INNER RAMP Signal ID 00896 / NCDOT 10-1853

TRAFFIC CONTROL PHASE 2A PLAN

CONSTRUCTION ZONE

CONSTRUCTION NOTES: BAG EXISTING SIGNAL HEAD #43



PROJECT REFERENCE NO.
I-5973
 SHEET NO.
SIG. 3.1

Plans Prepared By:
Kimley-Horn
 421 FAYETTEVILLE STREET, SUITE 600
 RICHMOND, VA 23220
 PHONE 819-677-2200

NO.	DATE	BY	REVISION DESCRIPTION

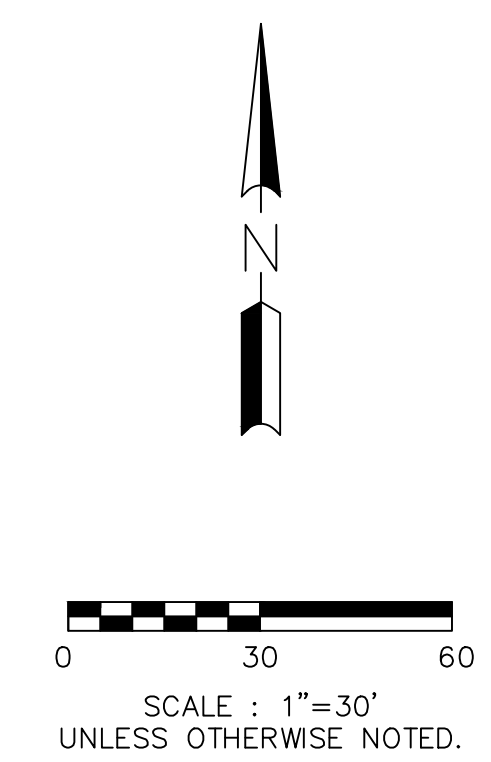


DocuSigned by:
 SALPH 2/16/2022
 (007A98E908457)

00896 SIGNAL NO.	10-1853 NCDOT ID NO.	SLP PREPARED BY	9/2021 DATE
---------------------	-------------------------	--------------------	----------------

SHEET
SIG3.1
 OF
SIG3.6

**BROOKSHIRE BLVD. @
 I-485 INNER RAMP
 TEMPORARY 1
 SIGNAL PLAN**

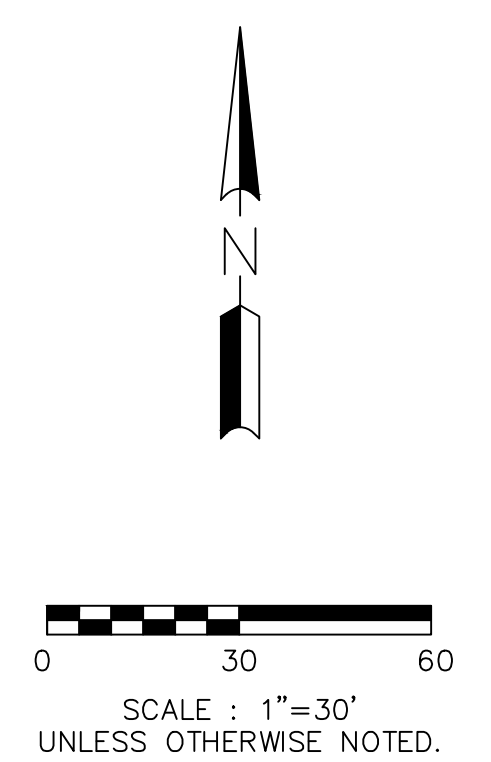
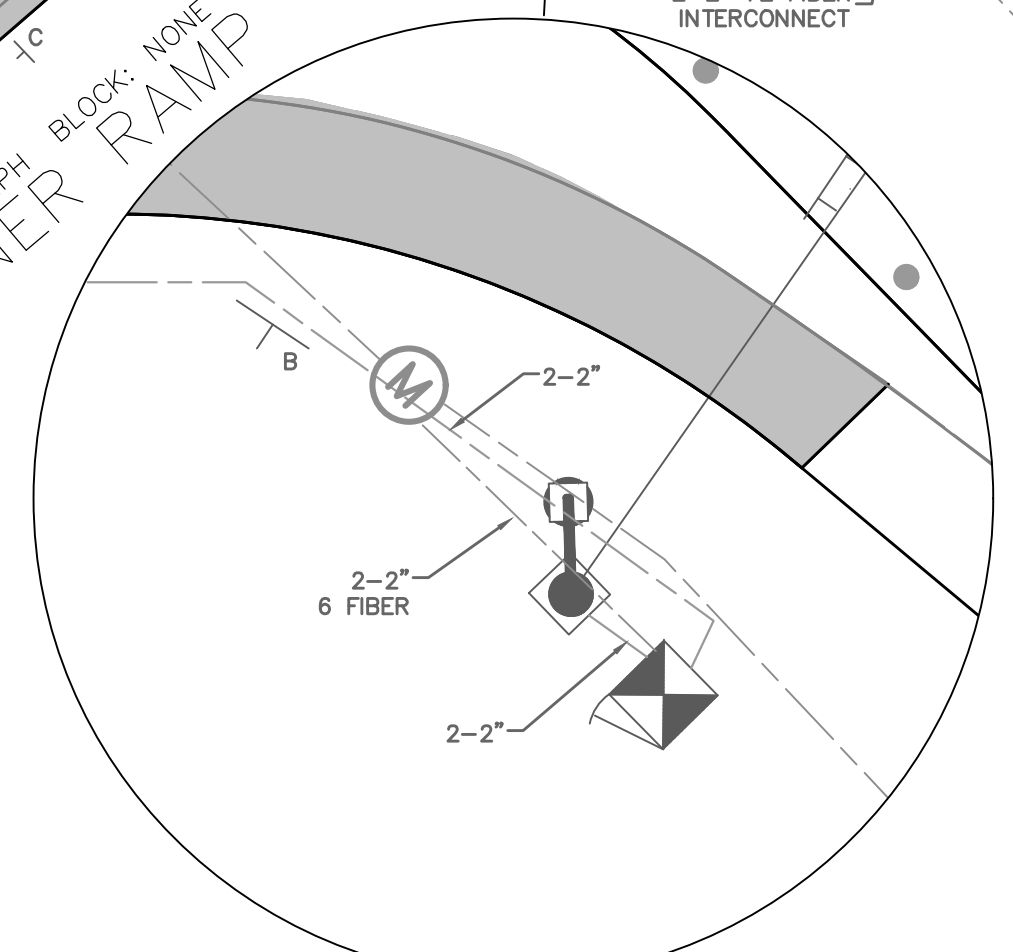
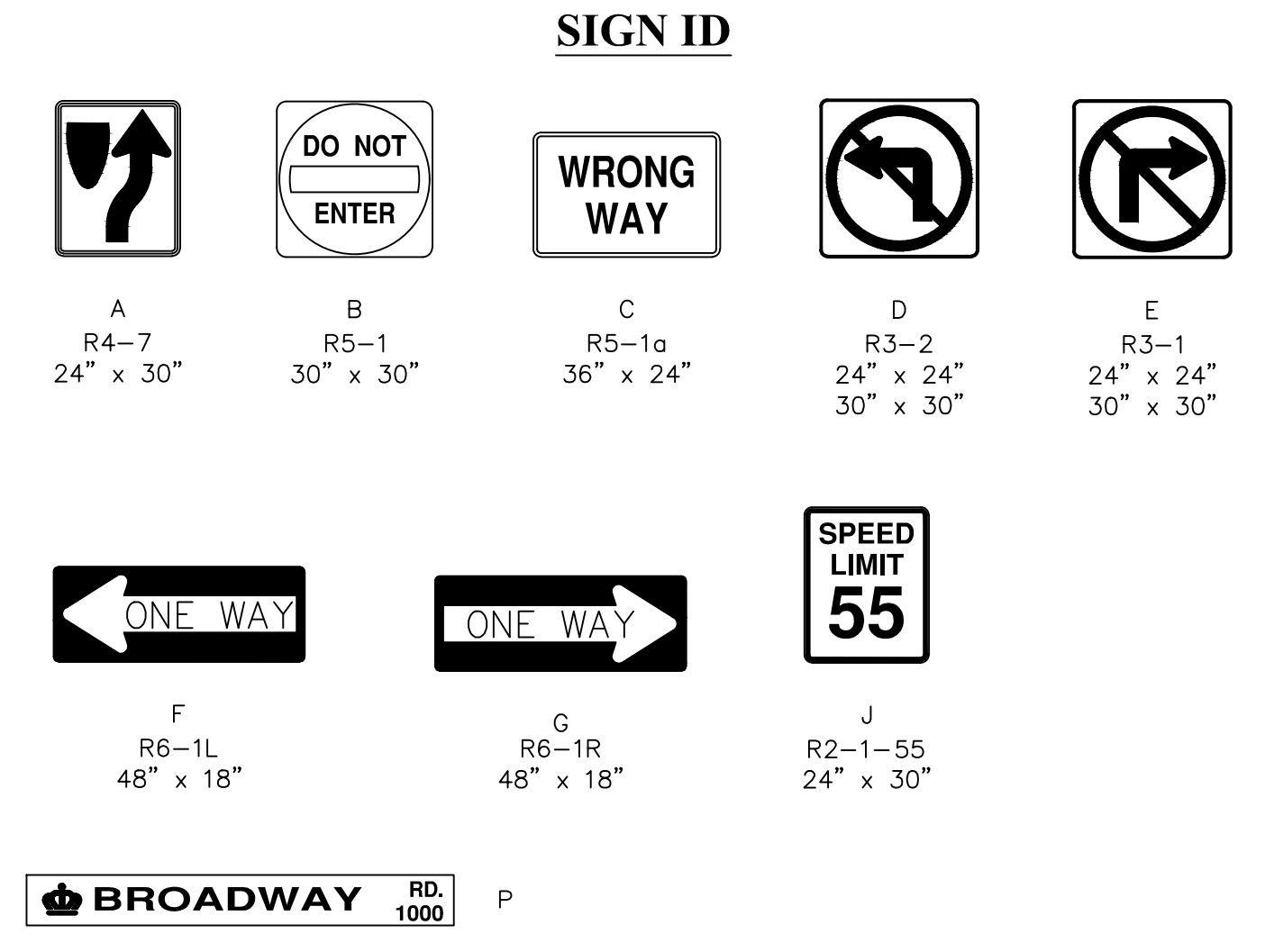
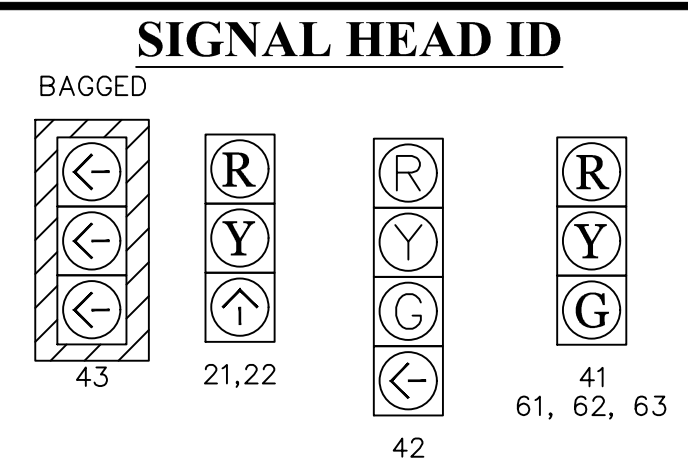
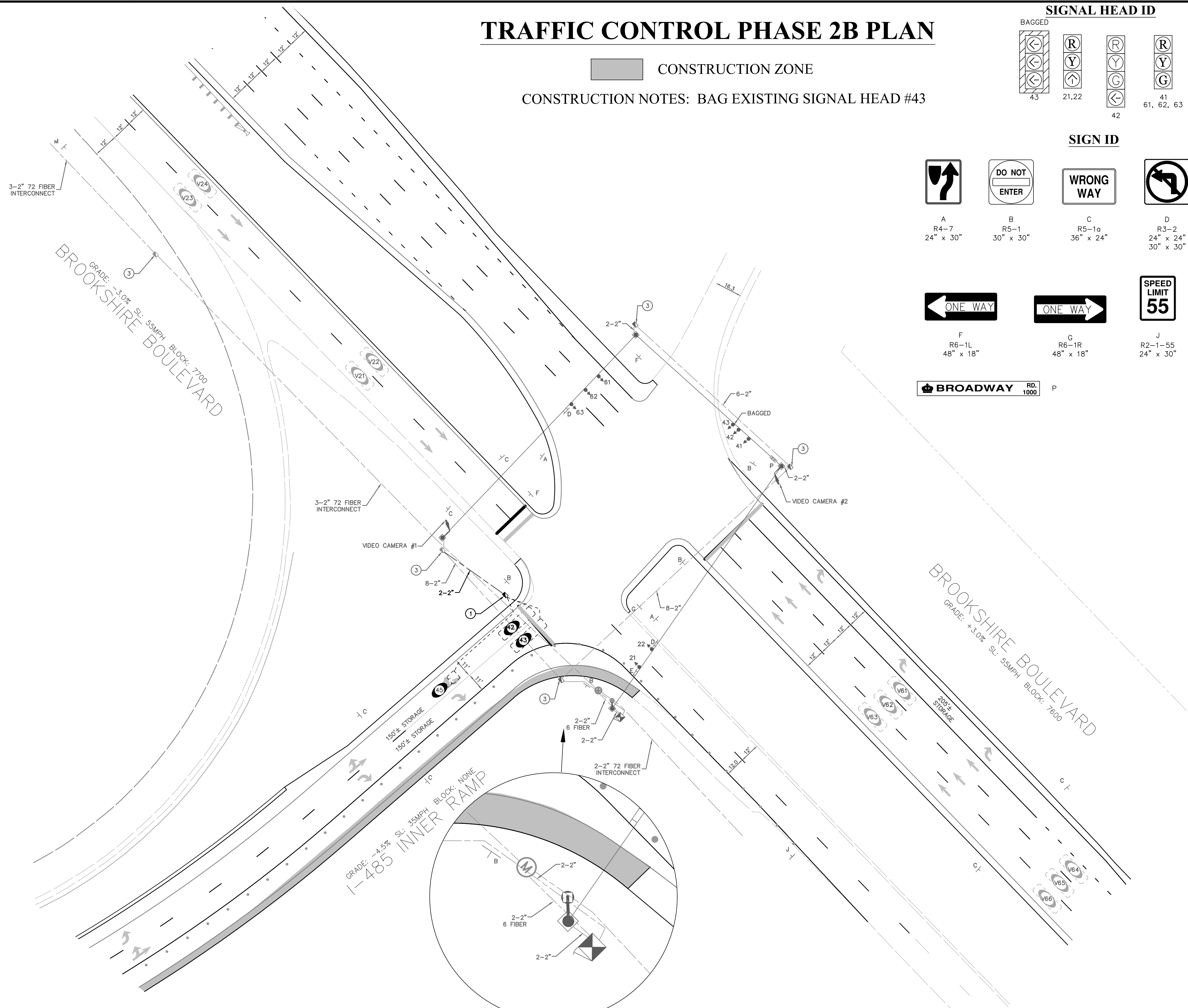


DETAIL SCALE: 1"=10'

TRAFFIC CONTROL PHASE 2B PLAN

CONSTRUCTION ZONE

CONSTRUCTION NOTES: BAG EXISTING SIGNAL HEAD #43



PROJECT REFERENCE NO. **I-5973**

SHEET NO. **SIG. 3.2**

Plans Prepared By: **Kimley»Horn**
421 FAYETTEVILLE STREET, SUITE 600
RALEIGH, NORTH CAROLINA, 27601
PHONE: 919-677-6000

NO.	DATE	BY	REVISION DESCRIPTION

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DocuSigned by: *SAL P.* 2/16/2022
DCR7ASRE0006437

00896 SIGNAL NO.	SLP PREPARED BY	9/2021 DATE
10-1853 NCDOT ID NO.		

BROOKSHIRE BLVD. @ I-485 INNER RAMP

TEMPORARY 2 SIGNAL PLAN

SHEET **SIG3.2** OF **SIG3.6**

SIGNAL PHASING

Ring Configuration **1,2,3,4,5,6,7,8**

1 NOT USED	5 NOT USED
2	6
MIN RECALL	MIN RECALL
3 NOT USED	7 NOT USED
4	8 NOT USED

SIGNAL SEQUENCE

RING 1	PHASE 1		PHASE 2		PHASE 3		PHASE 4		FLASH
SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W	OTH	
21,22				▲	Y				Y
41							G	Y	R
42							G	Y	R

RING 2	PHASE 5		PHASE 6		PHASE 7		PHASE 8		FLASH
SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W	OTH	
61,62,63					G	Y			Y

OVERLAP PHASE

OVERLAP PHASE

SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W	OTH	FLASH
---	---	---	---	---	---	---	---	---	---

RED ARROW ◀ YELLOW ARROW
 GREEN ARROW ▶ FLASHING YELLOW ARROW

TURNING MOVEMENT COUNT

Phase	1	2	3	4	5	6	7	8
% Grade	0.0%	-3.0%	0.0%	-4.5%	0.0%	3.0%	0.0%	0.0%
Distance		60		115		65		
Approach Speed (mph)		55		35		55		
Yellow		5.5		4.2		4.9		
All Red		1.0		2.5		1.0		
Total Clearance		6.5		6.7		5.9		

SIGN ID

A R4-7 24" x 30"	B R5-1 30" x 30"	C R5-1a 36" x 24"	D R3-2 24" x 24" 30" x 30"	E R3-1 24" x 24" 30" x 30"
F R6-1L 48" x 18"	G R6-1R 48" x 18"	J R2-1-55 24" x 30"	M W13-1 24" x 24"	

CLEARANCE INTERVALS

Phase	1	2	3	4	5	6	7	8
% Grade	0.0%	-3.0%	0.0%	-4.5%	0.0%	3.0%	0.0%	0.0%
Distance		60		115		65		
Approach Speed (mph)		55		35		55		
Yellow		5.5		4.2		4.9		
All Red		1.0		2.5		1.0		
Total Clearance		6.5		6.7		5.9		

SIGNAL HEAD ID

43	21,22	42	61, 62, 63

PROJECT REFERENCE NO. **I-5973**

SHEET NO. **SIG. 3.3**

Plans Prepared By: **Kimley-Horn**

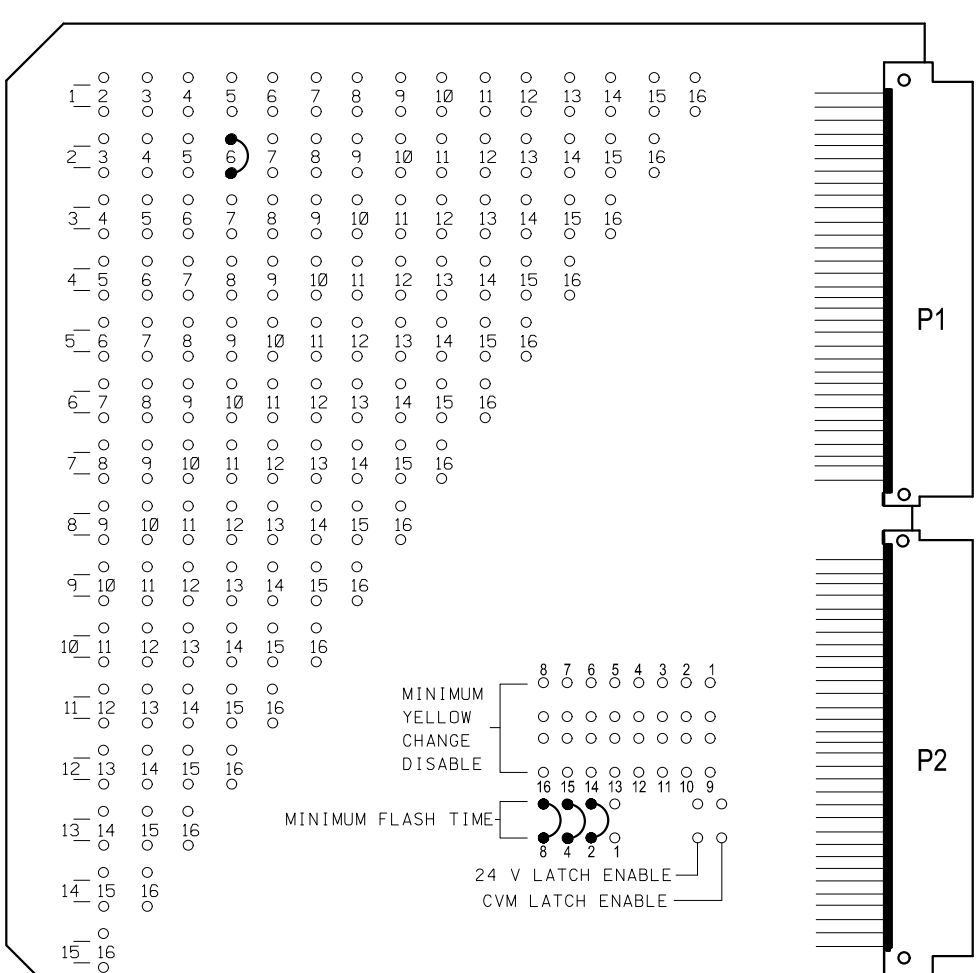
421 FAIRVIEW STREET, SUITE 600
 RANALPH, CA 94588
 PHONE: 916-477-2800

NO.	DATE	BY	REVISION DESCRIPTION

MALFUNCTION MANAGEMENT UNIT / CONFLICT MONITOR

PROGRAMMING DETAIL

(program card and tables as shown)



CHANNEL NUMBER	ENABLE/DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

ECONOLITE EOS-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

- From Main Menu select **1. CONFIGURATION**
- From CONFIGURATION Submenu select **1. CABINET**
- From PORT 1 (SDLC) Submenu select **4. MONITOR PROGRAMMING**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

```

MMU PROGRAM [  MANUAL ]

CH  6  5  4  3  2  1  0  9  8  7  6  5  4  3  2
1  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
3  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
4  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
5  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
6  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
7  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
8  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
9  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
10 .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
11 .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
12 .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
13 .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
14 .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
15 .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
    
```

END PROGRAMMING

DETECTOR RACK SETUP

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

DET BIU #1	DETECTION	CH3	CH1	COMMUNICATIONS	SLOT	SLOT	SLOT	SLOT	DET BIU #2
		L7	L5	COMMUNICATIONS	EMPTY	EMPTY	EMPTY	EMPTY	
		Ø 4	Ø 4	REMODULATE					
		L8	L6	REMODULATE					
		NOT USED	Ø 4	REMODULATE					

DETECTOR NUMBER	AMP. NO.	SIZE / ZONE	Ø	AMP. TYPE	DELAY / DISABLE	COMMENTS:
V21,V22	1	6'X20'	2	N		130' FROM STOPLINE (THRU) (CAMERA #1)
V23,V24	2	6'X20'	2	N		280' FROM STOPLINE (THRU) (CAMERA #1)
42	3	6'X25'	4	N		STOPBAR
43	8	6'X25'	4	D 4		STOPBAR
45	4	6'x6'	4	S		55' FROM STOPBAR
V61,V62,63	5	6'X20'	6	N		130' FROM STOPLINE (THRU) (CAMERA #2)
V64,V65,V66	6	6'X20'	6	N		280' FROM STOPLINE (THRU) (CAMERA #2)

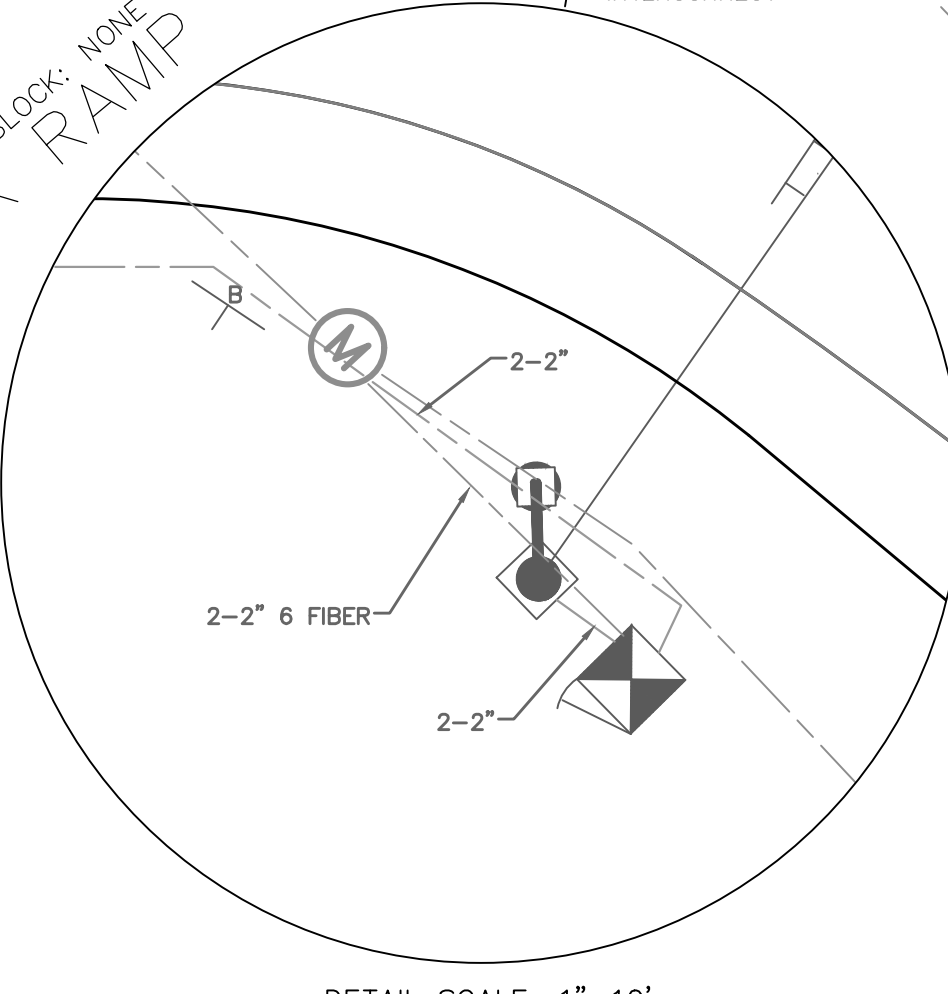
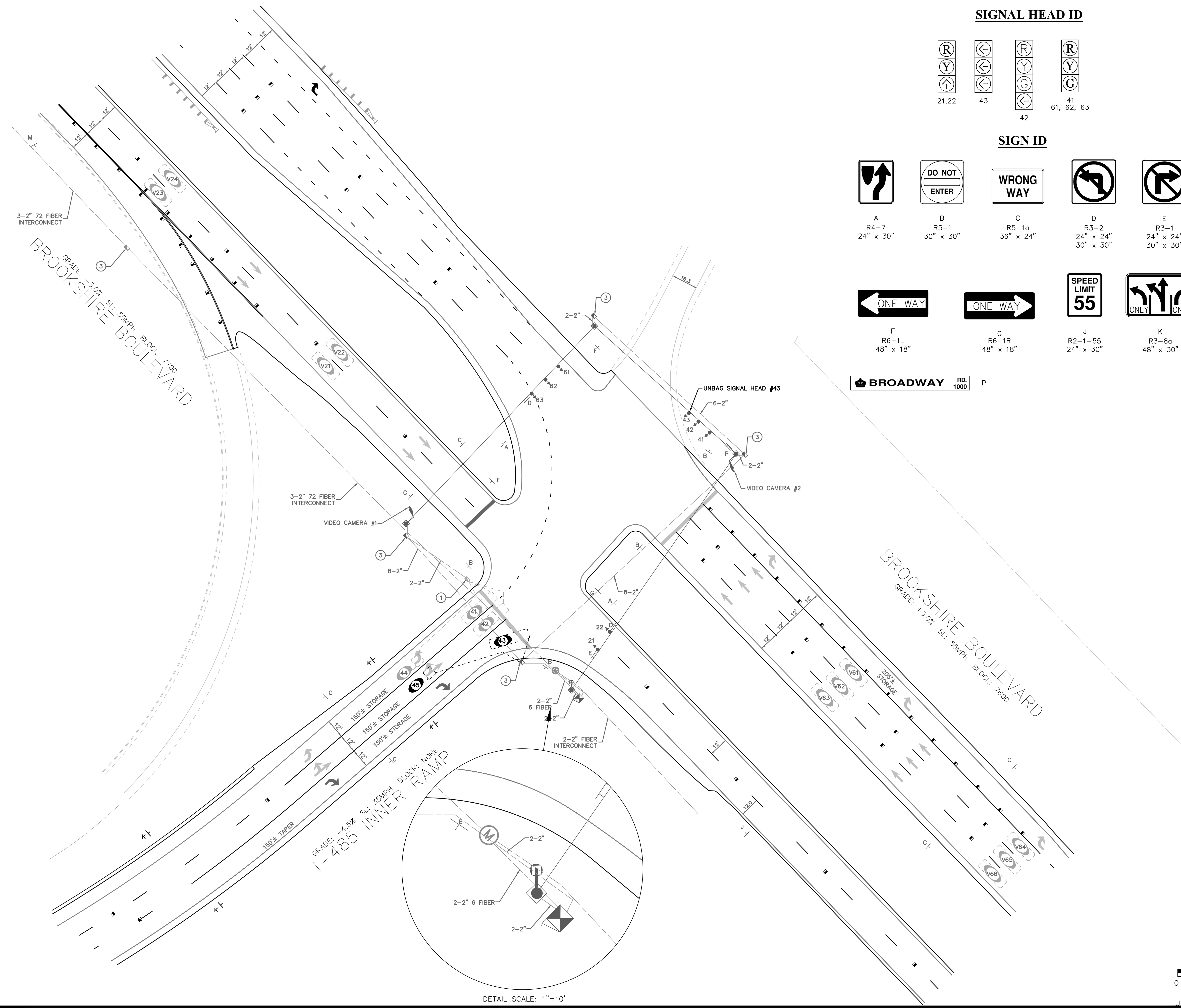
NOTE: ALL STOPBAR LOOPS EXTEND TO THE PROJECT CURB LINE UNLESS OTHERWISE NOTED. ALL LOOPS RECEIVE THREE TURNS.

00896 SIGNAL NO. 10-1853 NCDOT ID NO.

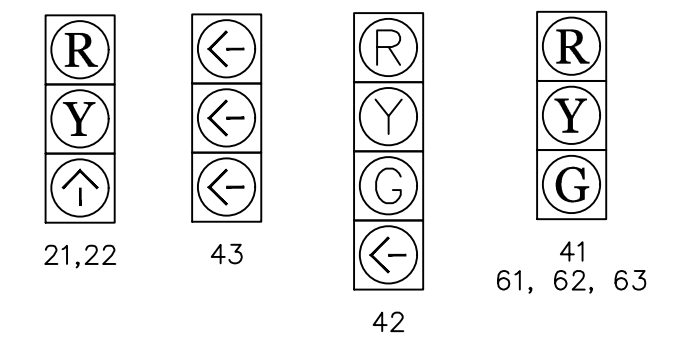
SIP PREPARED BY: 9/2021 DATE

BROOKSHIRE BLVD. @ I-485 INNER RAMP TEMPORARY SIGNAL DETAILS

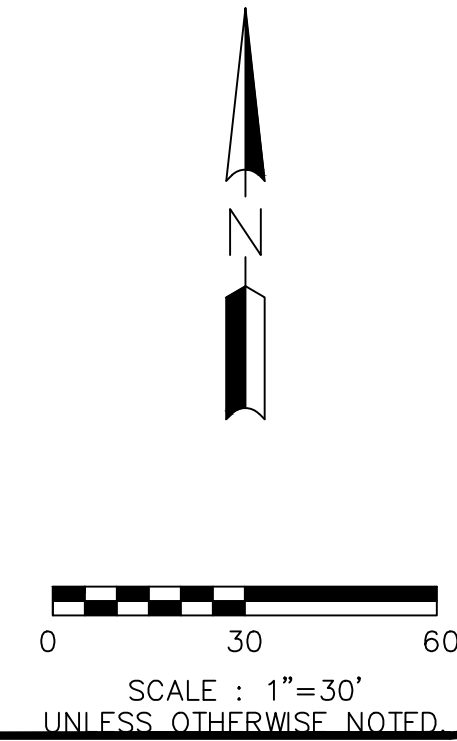
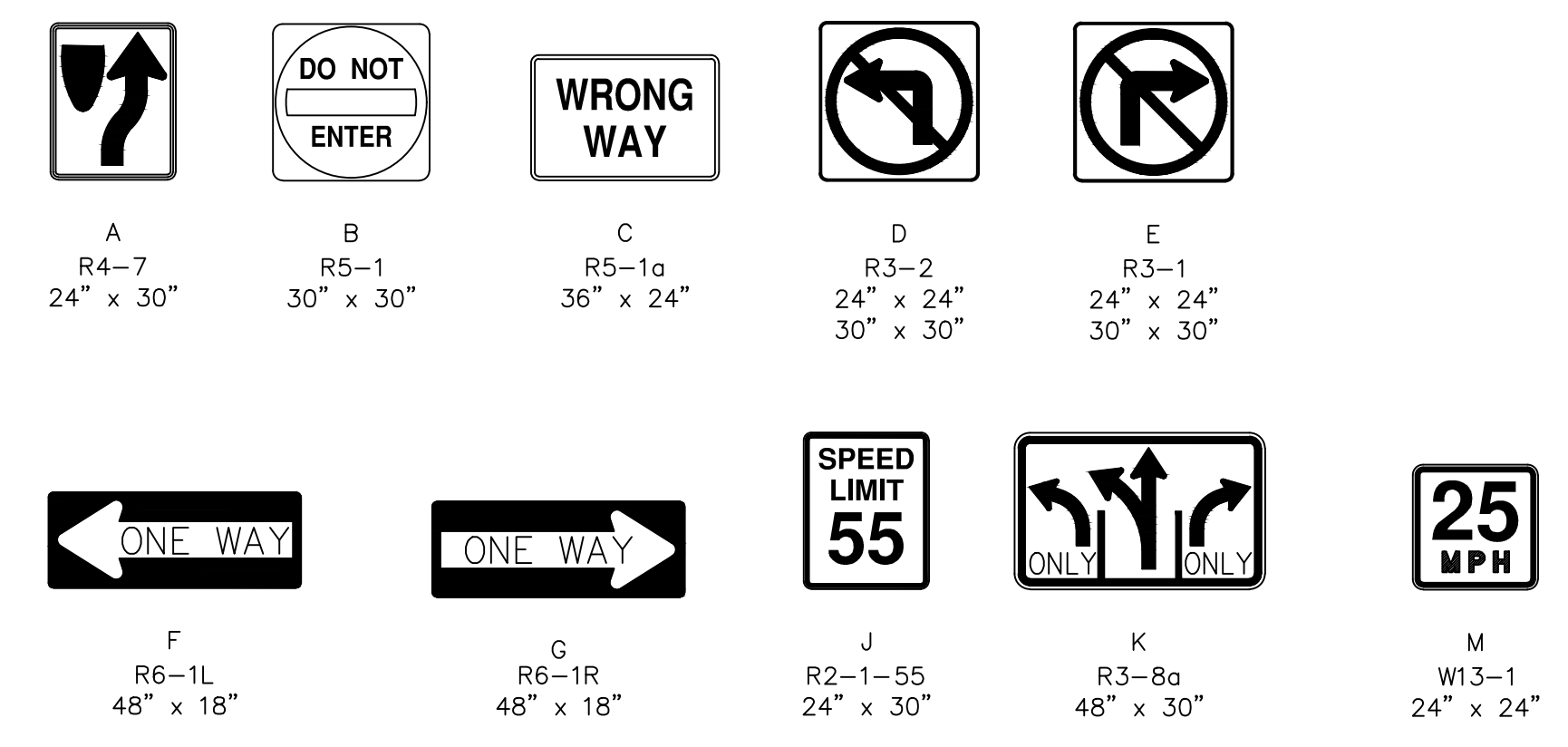
SHEET SIG3.3 OF SIG3.6



SIGNAL HEAD ID



SIGN ID



PROJECT REFERENCE NO. **I-5973**

SHEET NO. **SIG. 3.4**

Plans Prepared By: **Kimley-Horn**
421 FAYETTEVILLE STREET, SUITE 600
RICHMOND, VA 23220
PHONE 919-977-2200

NO.	DATE	BY	REVISION DESCRIPTION

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Seal: NORTH CAROLINA PROFESSIONAL SEAL 032607 CIVIL ENGINEER PHILIP

DocuSigned by: *SALPH* 2/16/2022
0CB7A56ED06B437

00896 SIGNAL NO.	10-1853 NDOT ID NO.	SUP PREPARED BY	9/2021 DATE
---------------------	------------------------	--------------------	----------------

BROOKSHIRE BLVD. @ I-485 INNER RAMP

FINAL SIGNAL PLAN

SHEET **SIG3.4** OF **SIG3.6**

SIGNAL PHASING	
Ring Configuration	1,2,3,4,5,6
1 NOT USED	5 NOT USED
2	6
3 NOT USED	7 NOT USED
4	8 NOT USED

SIGNAL SEQUENCE							
RING 1	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7
SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W
21,22			▲	Y			
41					G	Y	R
42							◀
43							◀

OVERLAP PHASE							
OVERLAP PHASE	OL-A/-/+	OL-B/-/+	OL-C/-/+	OL-D/-/+	FLASH	FLASH	FLASH
SIGNAL ID NUMBER	R/W	OTH	R/W	OTH	R/W	OTH	R/W
21,22							
41							
42							
43							

TURNING MOVEMENT COUNT								
Phase	1	2	3	4	5	6	7	8
% Grade	0.0%	-3.0%	0.0%	-4.5%	0.0%	3.0%	0.0%	0.0%
Distance		60		115		65		
Approach Speed (mph)		55		35		55		
Yellow		5.5		4.2		4.9		
All Red		1.0		2.5		1.0		
Total Clearance		6.5		6.7		5.9		

SIGN ID				

PROJECT REFERENCE NO. **I-5973**

SHEET NO. **SIG. 3.5**

Plans Prepared By: **Kimley-Horn**

421 FAYETTEVILLE STREET, SUITE 600
RALEIGH, NORTH CAROLINA, 27601
PHONE 919-977-2000

MALFUNCTION MANAGEMENT UNIT / CONFLICT MONITOR

PROGRAMMING DETAIL

(program card and tables as shown)

CHANNEL NUMBER	ENABLE/DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

ECONOLITE EOS-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

- From Main Menu select **1. CONFIGURATION**
- From CONFIGURATION Submenu select **1. CABINET**
- From PORT 1 (SDLC) Submenu select **4. MONITOR PROGRAMMING**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

```
MMU PROGRAM [ MANUAL ]

CH 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2
1 . . . . .
2 . . . . . X . . .
3 . . . . .
4 . . . . .
5 . . . . .
6 . . . . .
7 . . . . .
8 . . . . .
9 . . . . .
10 . . . . .
11 . . . . .
12 . . . . .
13 . . . . .
14 . . . . .
15 . . . . .

END PROGRAMMING
```

DETECTOR RACK SETUP

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

DET BIU #1	DEFINITION	CH3	CH1	COMMUNICATIONS	SLOT	SLOT	SLOT	SLOT	DET BIU #2
		L7 ø 4	L5 ø 4	COMMUNICATIONS	EMPTY	EMPTY	EMPTY	EMPTY	
		L8 ø 4	L6 ø 4	COMMUNICATIONS	EMPTY	EMPTY	EMPTY	EMPTY	

DETECTOR NUMBER	AMP. NO.	SIZE / ZONE	ø	AMP TYPE	DELAY DISABLE ø	COMMENTS:
V21,V22	1	6'X20'	2	N		130' FROM STOPLINE (THRU) (CAMERA #1)
V23,V24	2	6'X20'	2	N		280' FROM STOPLINE (THRU) (CAMERA #1)
41,42	3	6'x25'	4	N		STOPBAR
43	8	6'x25'	4	D	4	STOPBAR
44,45	4	6'x6'	4	S		56' FROM STOPBAR
V61,V62,63	5	6'X20'	6	N		130' FROM STOPLINE (THRU) (CAMERA #2)
V64,V65,V66	6	6'X20'	6	N		280' FROM STOPLINE (THRU) (CAMERA #2)

NOTE:
ALL STOPBAR LOOPS EXTEND TO THE PROJECT CURB LINE UNLESS OTHERWISE NOTED.
ALL LOOPS RECEIVE THREE TURNS.

REVISION DESCRIPTION

NO.	DATE	BY

DocuSigned by: **SAP/2/16/2022**

00896 SIGNAL NO. 10-1853 NCDOT ID NO.

PREPARED BY: SLP DATE: 9/2021

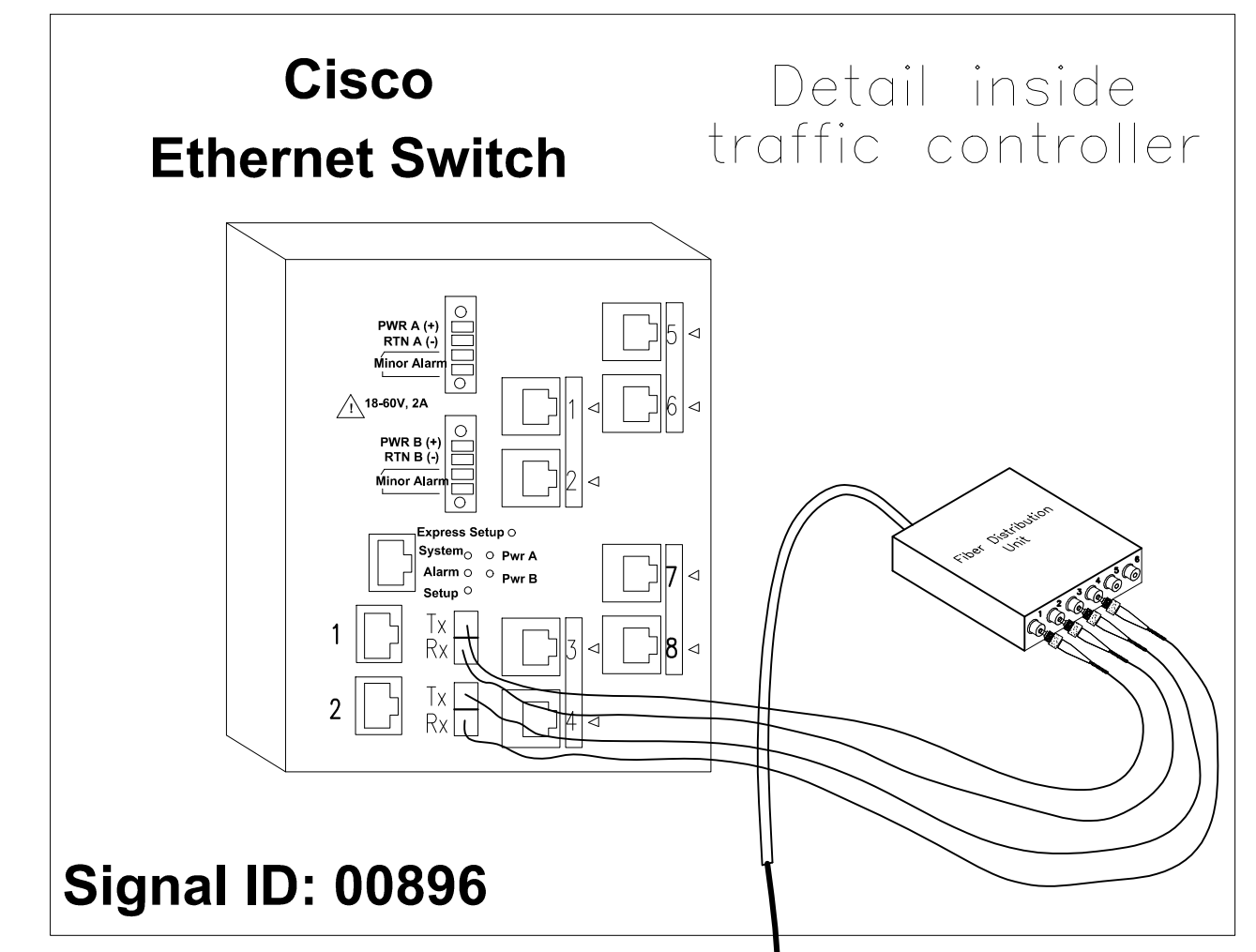
BROOKSHIRE BLVD. @ I-485 INNER RAMP

SIG3.5 OF **SIG3.6**

FINAL SIGNAL DETAILS

**MODIFY EXISTING SPLICE ENCLOSURE IN EXISTING MANHOLE (MH2) AT BROOKSHIRE BLVD. AT I-485 NB INNER RAMP
SIG. INV# 00896 (10-1853)**

COLOR CODE TIA/EIA 598-A		LEGEND	
(1) BLUE	(7) RED	○ EXISTING SPLICE	▭ BUFFER TUBE
(2) ORANGE	(8) BLACK	● NEW SPLICE	
(3) GREEN	(9) YELLOW		
(4) BROWN	(10) VIOLET		
(5) SLATE	(11) ROSE		
(6) WHITE	(12) AQUA		



PROJECT REFERENCE NO. **I-5973**

SHEET NO. **SIG. 3.6**

Plans Prepared By: **Kimley-Horn**
481 FAYETTEVILLE STREET, SUITE 400
SALUDA, NORTH CAROLINA, 27060
PHONE: 919-477-2000

NO.	DATE	BY	REVISION DESCRIPTION

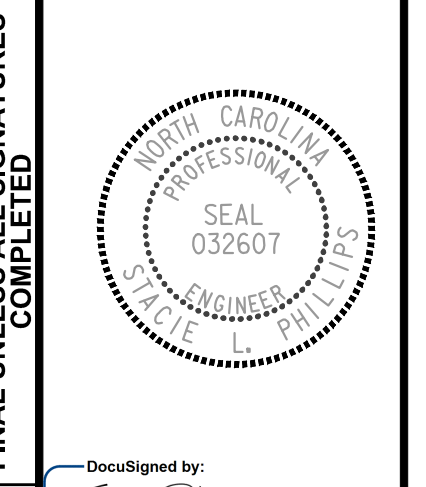
DocuSigned by: *SAI PL* 2/16/2022
0071A5ED9B431

00896 SIGNAL NO.
10-1853 NCDOT ID NO.9/2021 DATESLP PREPARED BY

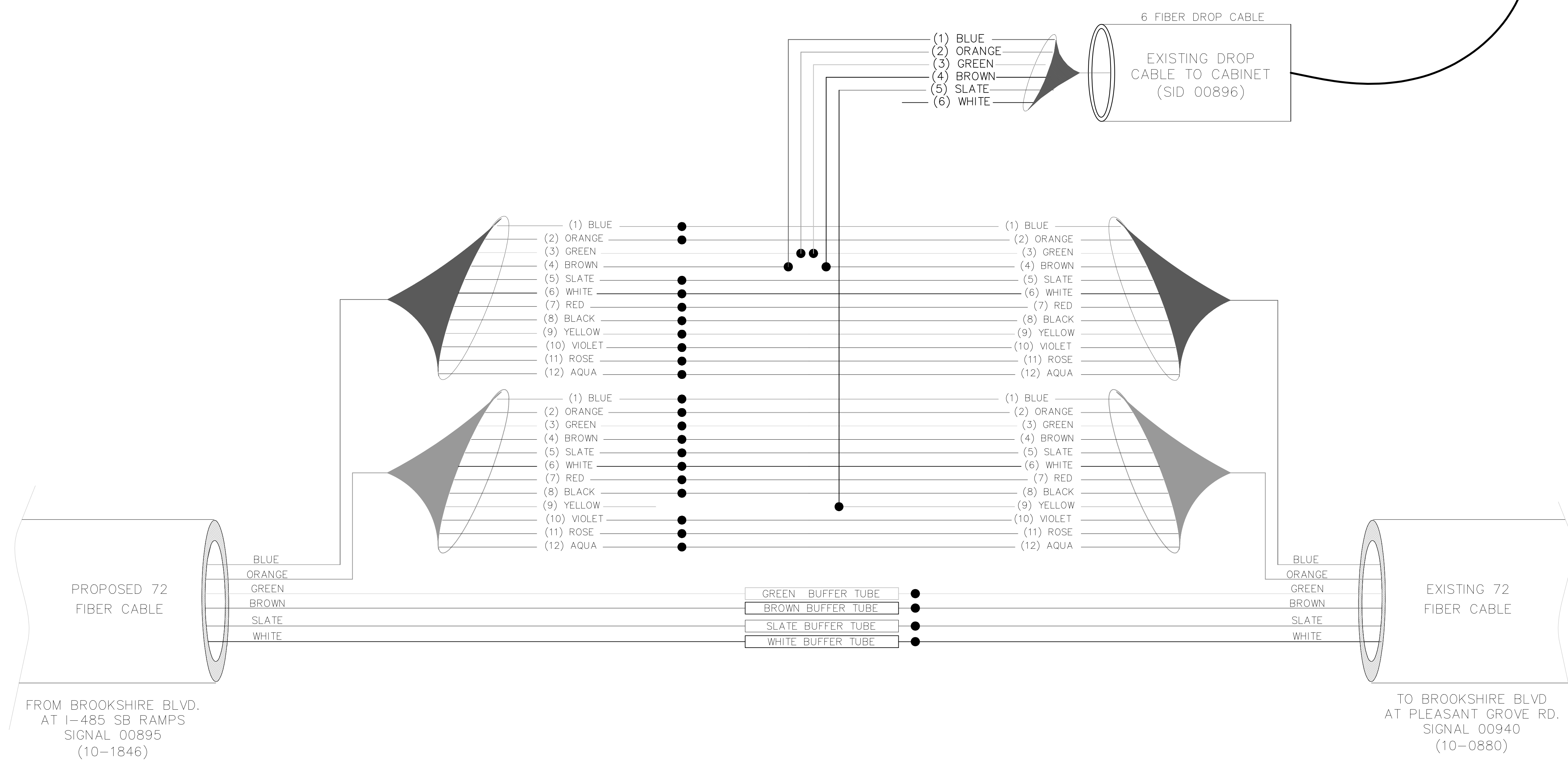
BROOKSHIRE BLVD. @ I-485 INNER RAMP

SPLICE DETAIL

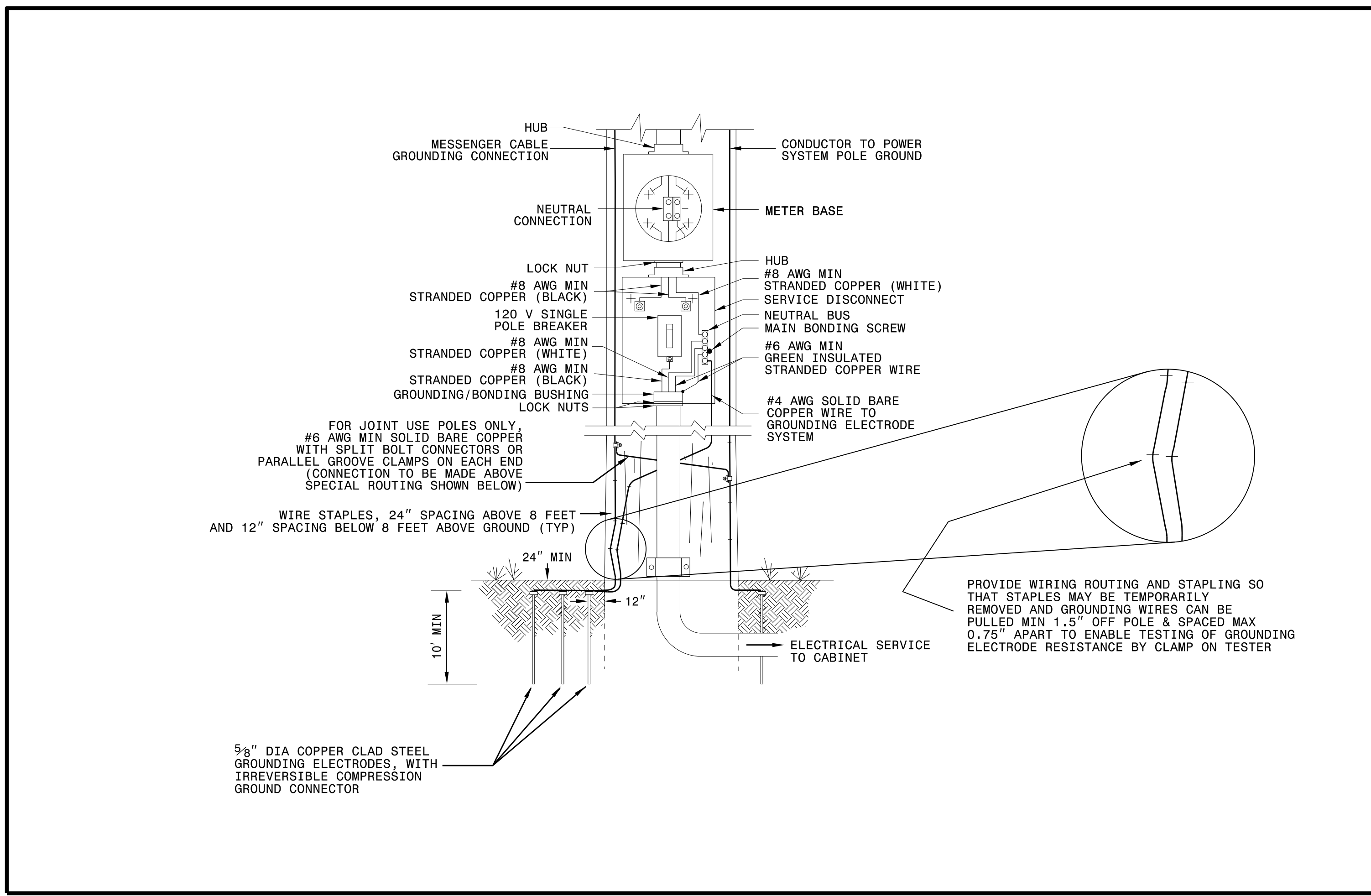
SHEET **SIG3.6** OF **SIG3.6**



DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



EXISTING SPLICE CASE IN MH# 2 (SEE SHEET CR9) AT BROOKSHIRE BLVD



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

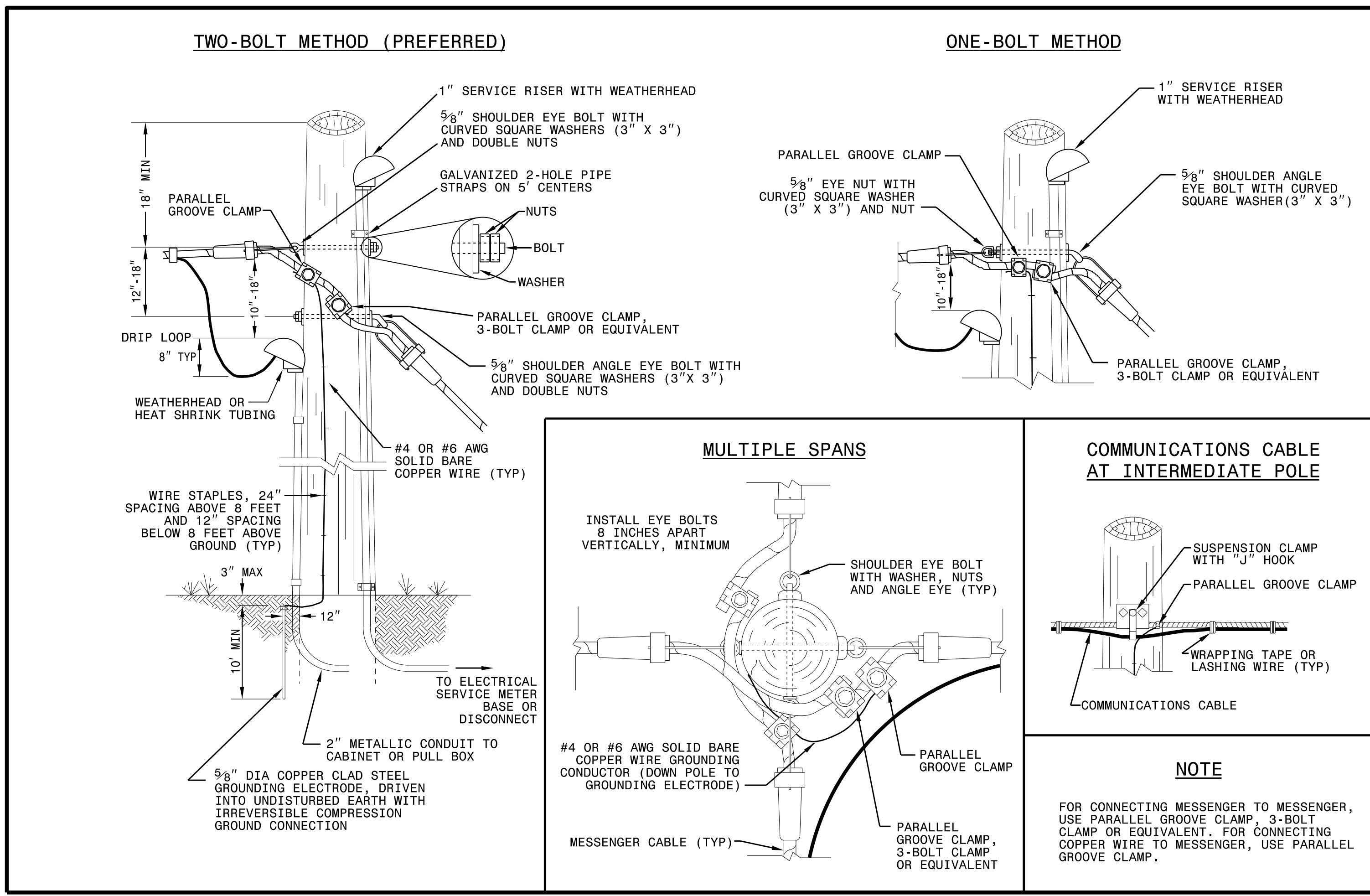
ENGLISH STANDARD DRAWING FOR

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

DOCUMENT NOT CONSIDERED
FINAL UNLESS ALL
SIGNATURES COMPLETED

See Plate for Title

Prepared in the Offices of:

SEAL

DocuSigned by:
Mohd Aslami

10/11/2017

DATE

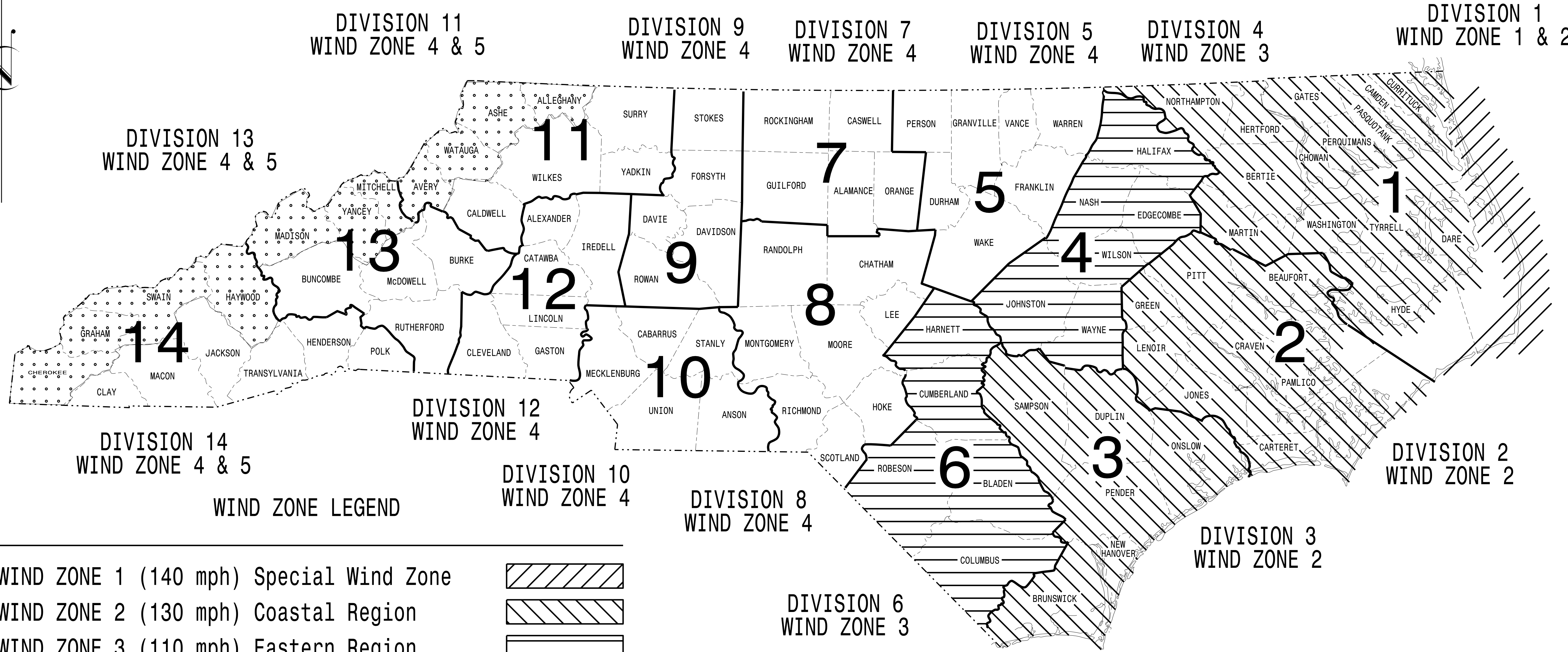
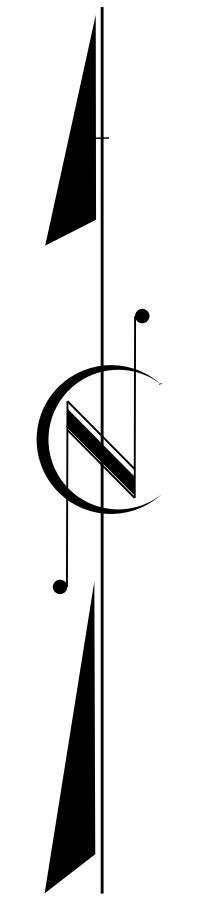
750 N. Greenfield Parkway
Garner, NC 27529

11-0CT-2017_08:56
U:\2018_S14_Drawing\Plate_Sheets\2018_Plate_Sheet.dgn
r:\rough

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:

 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

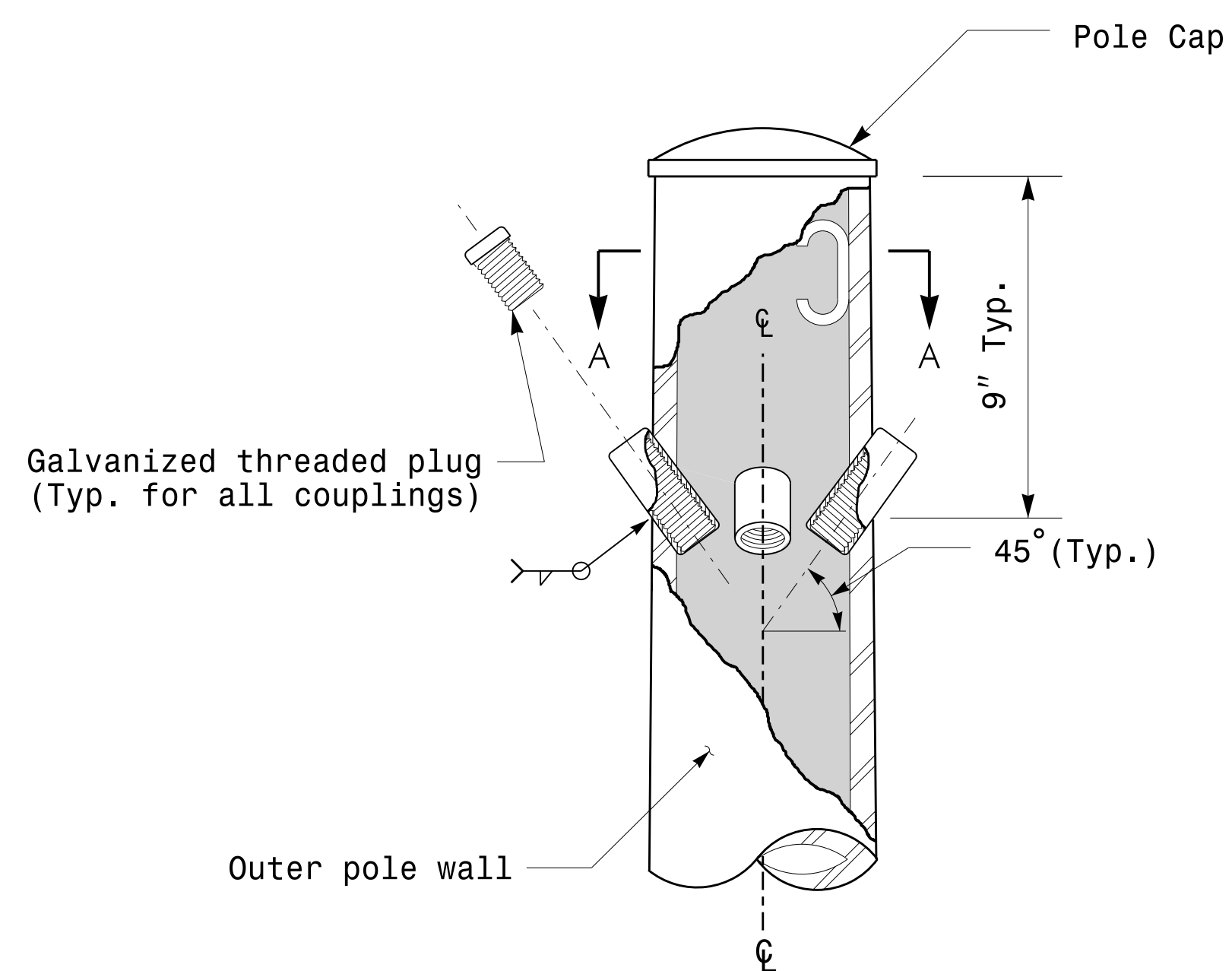
M.M. MCDIARMID, P.E. - STATE ITS AND SIGNALS ENGINEER
J.P. GALLOWAY, P.E. - STATE SIGNALS ENGINEER
D.C. SARKAR, P.E. - ITS AND SIGNALS SENIOR STRUCTURAL ENGINEER

SEAL

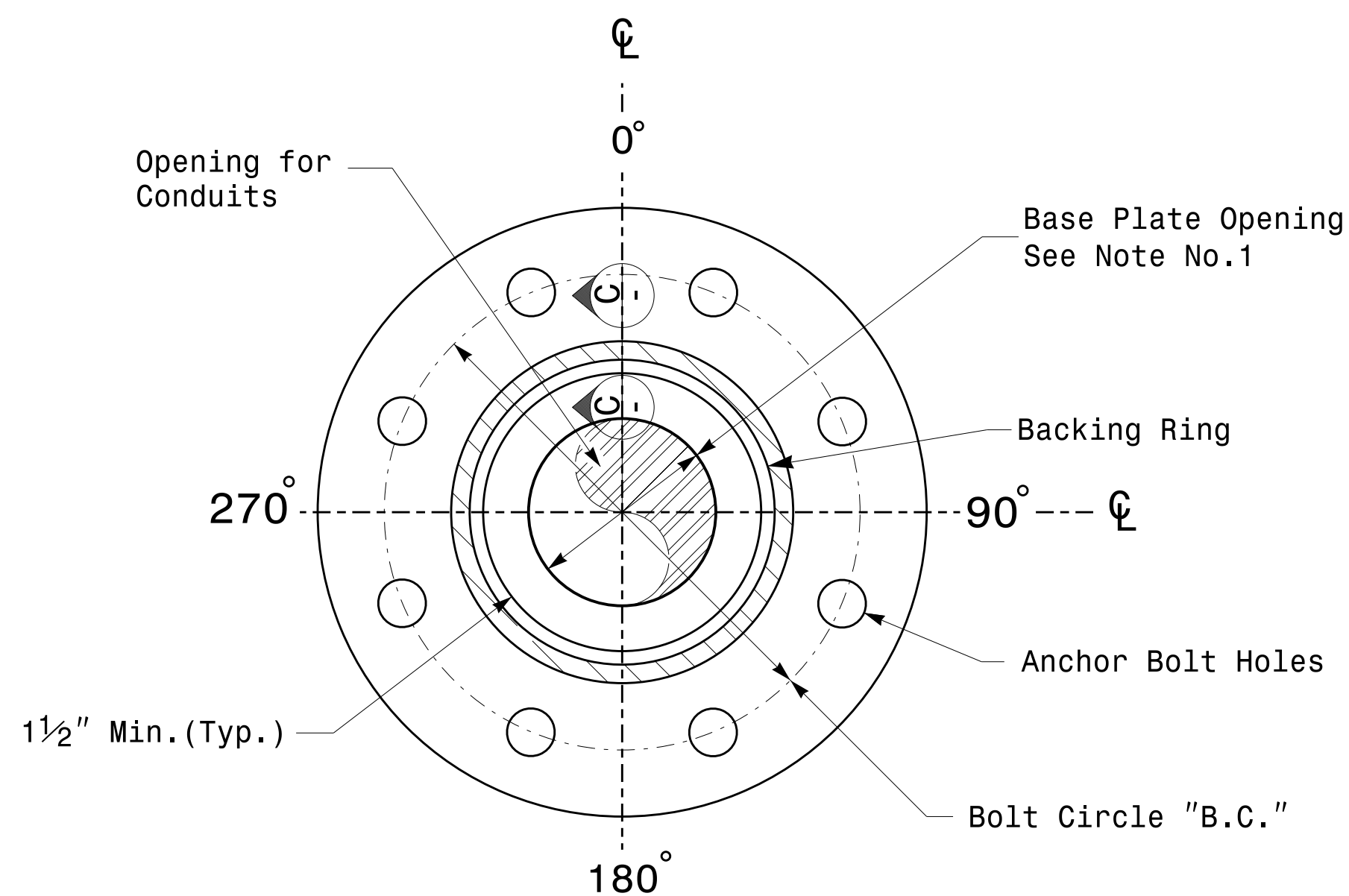
DocuSigned by:

 DATE 10/11/2017

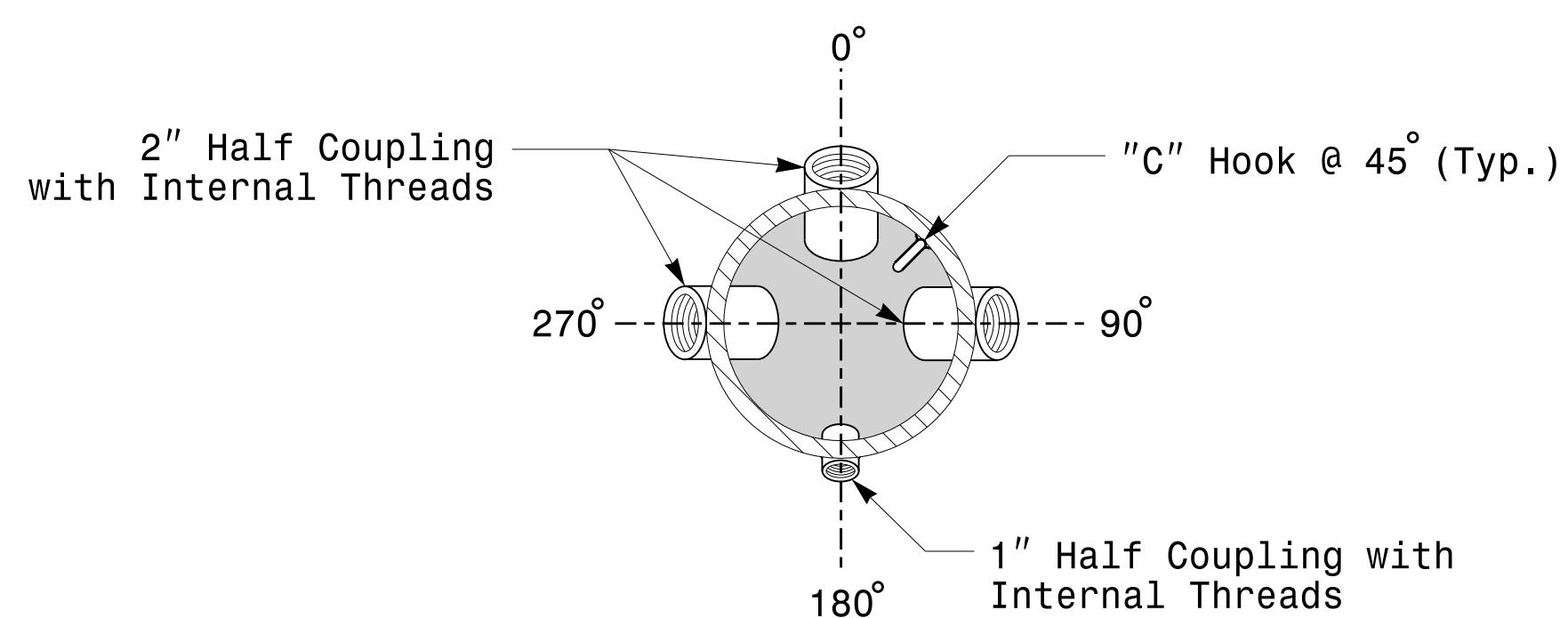
Note:
 1. Opening in pole base plate shall be equal to pole base inside diameter minus 3 1/2" but shall not be less than 8 1/2".



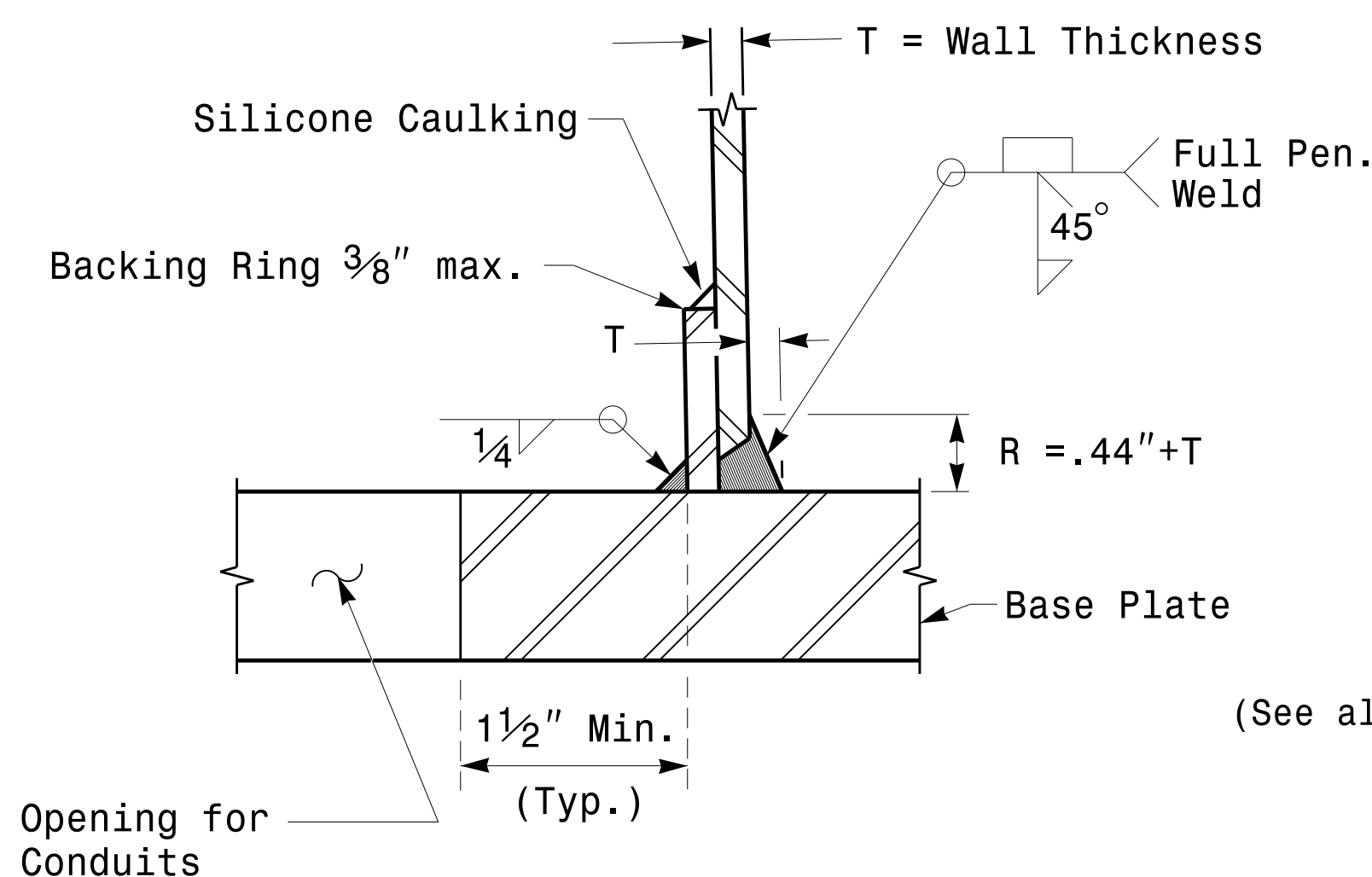
Cable Entrances at Top of Pole



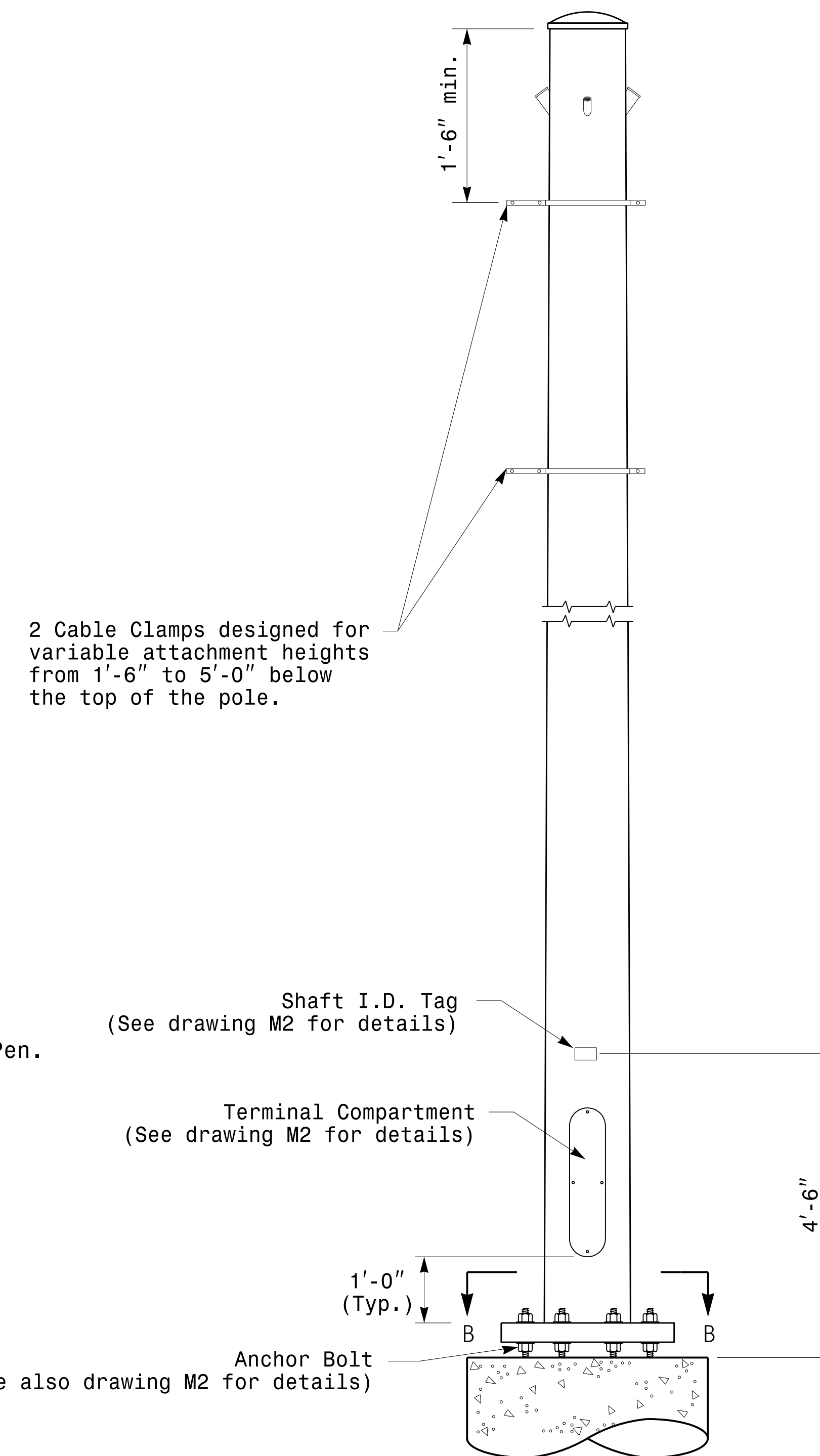
Section B-B
Pole Base Plate Details
(8 and 12 Bolt Pattern)



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

Prepared in the Offices of:

 750 N. Greenleaf Pkwy, 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

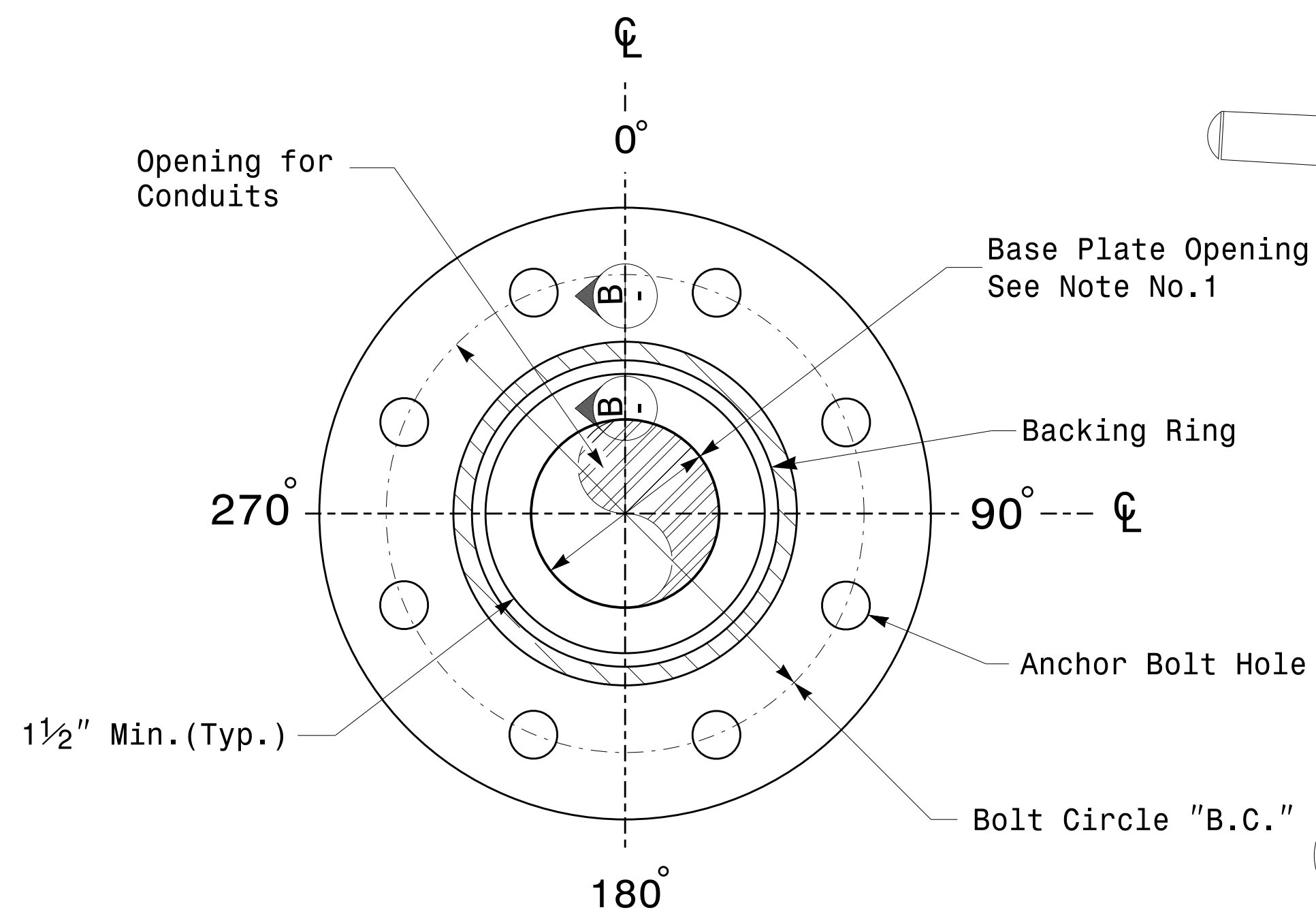
SEAL

 DocuSigned by: Debesh C. Sarkar
 44E8E7816FA4F49E

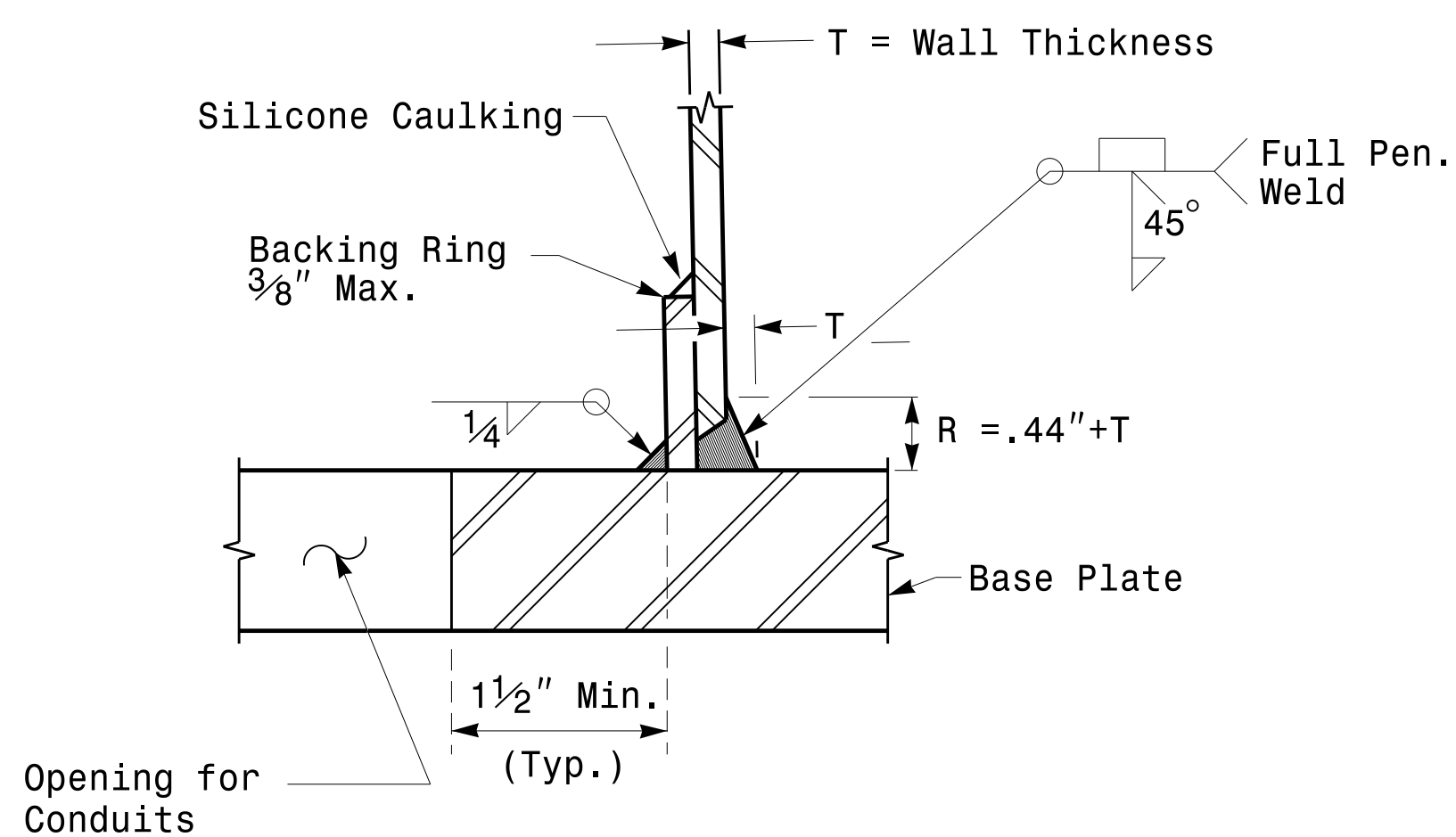
10/11/2017
 DATE

Fabrication Details – Strain Poles

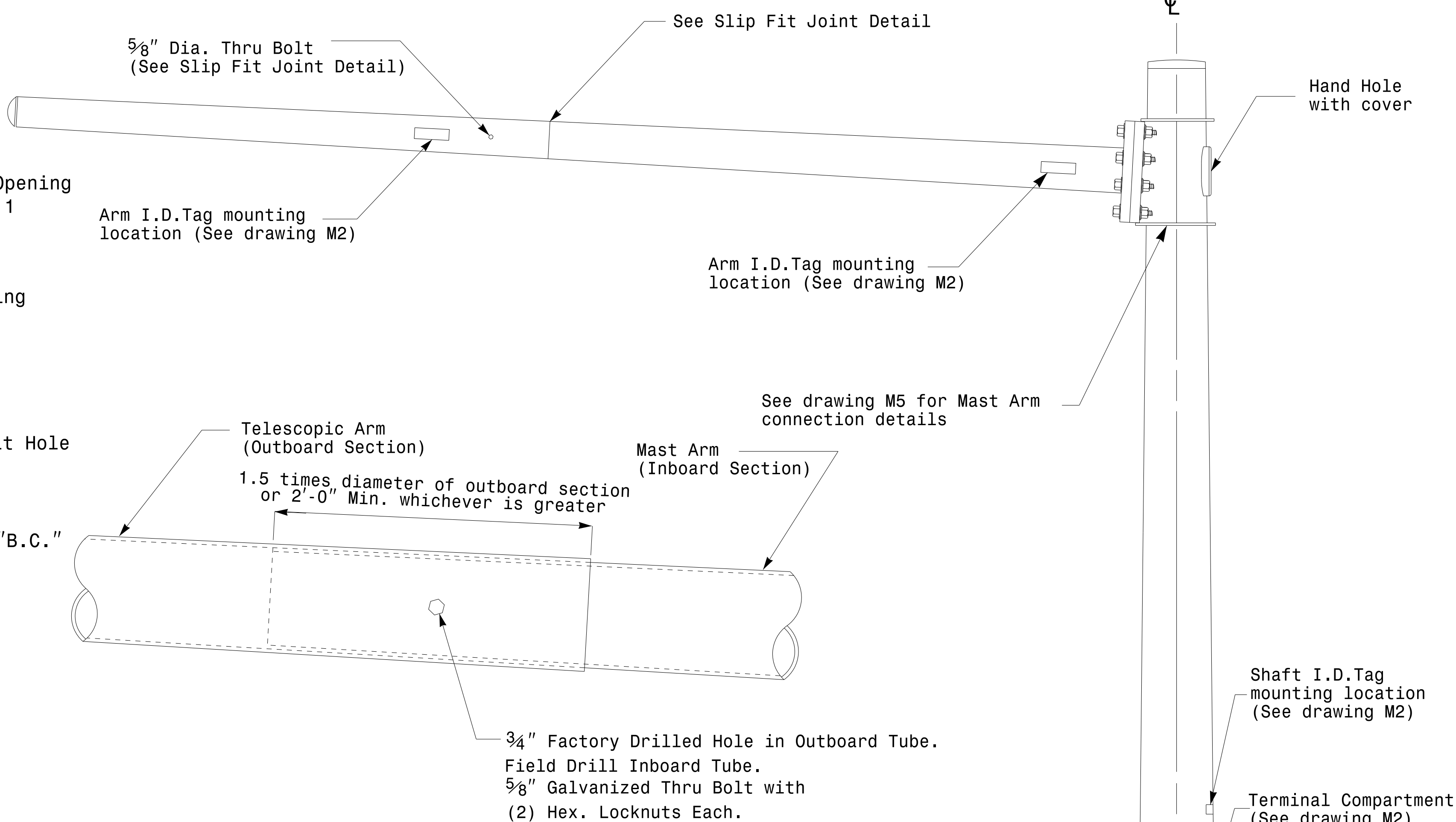
Note:
 1. Opening in pole base plate shall be equal to pole base inside diameter minus 3 1/2" but shall not be less than 8 1/2".



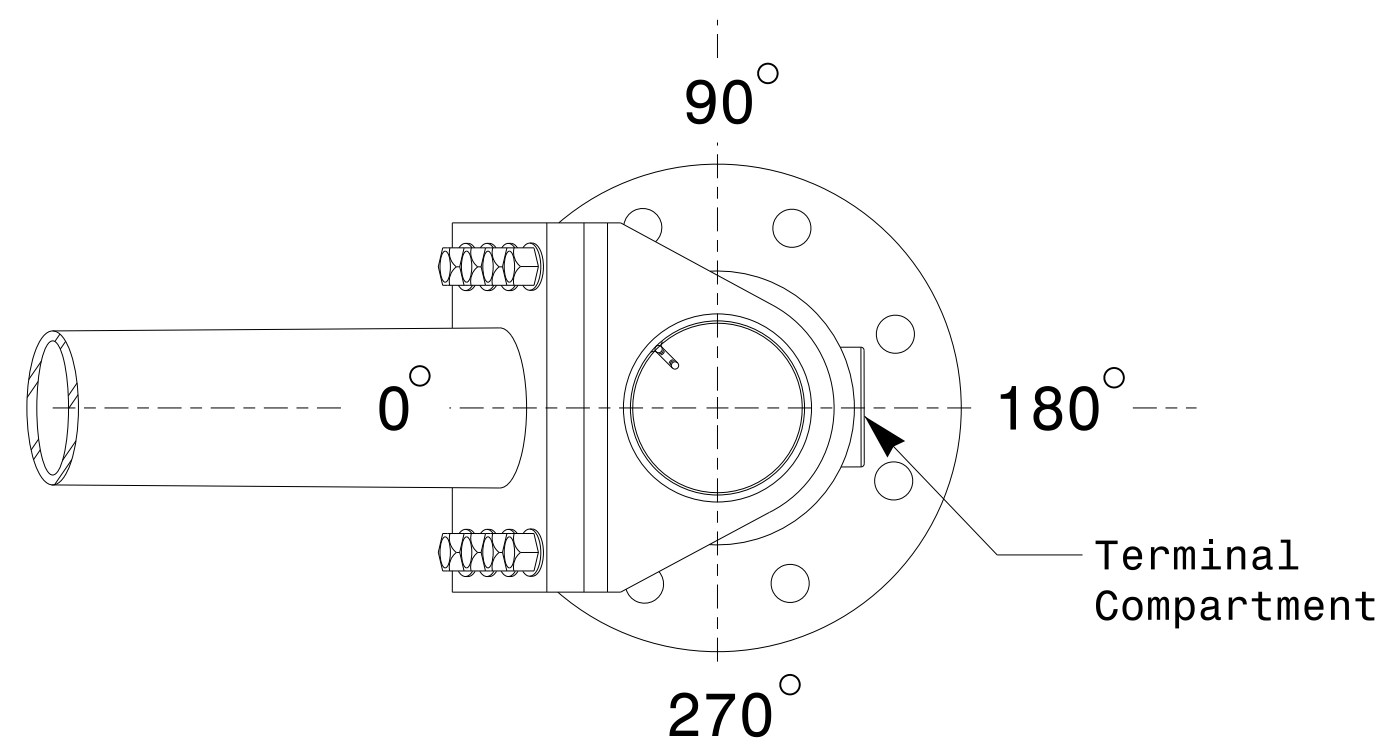
Section A-A
 Pole Base Plate Details



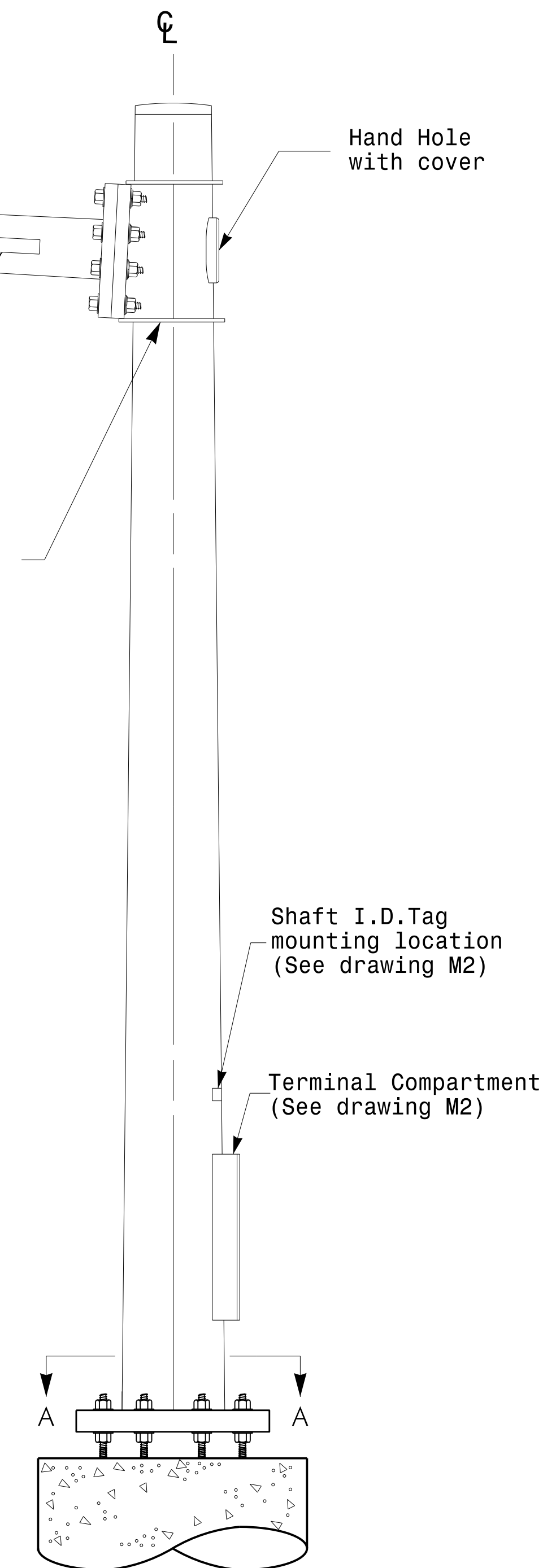
Section B-B
 (Pole Attachment to Base Plate)
 Full-Penetration Groove Weld Detail



Slip Fit Joint Detail for Mast Arm



Mast Arm Radial Orientation



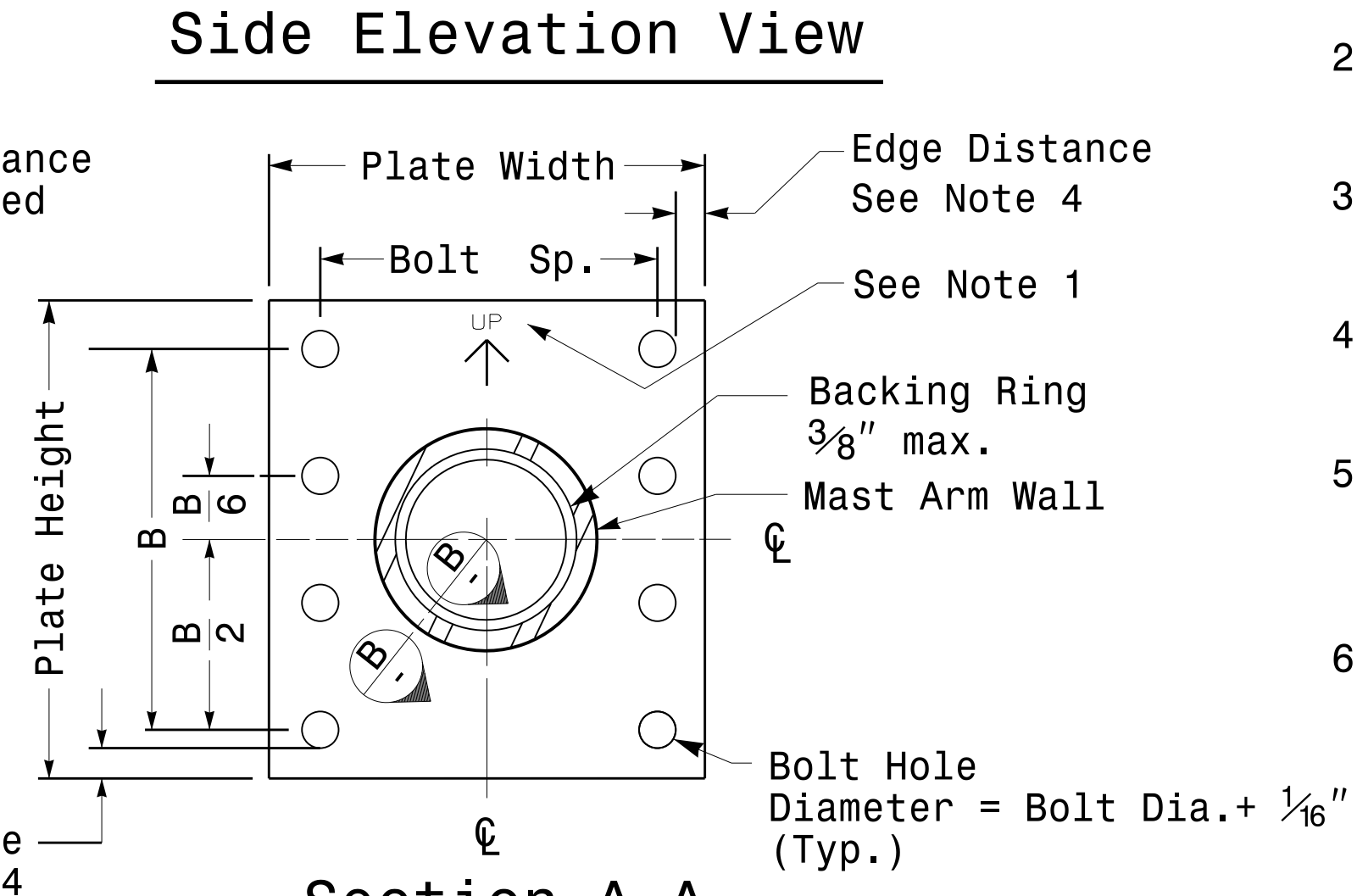
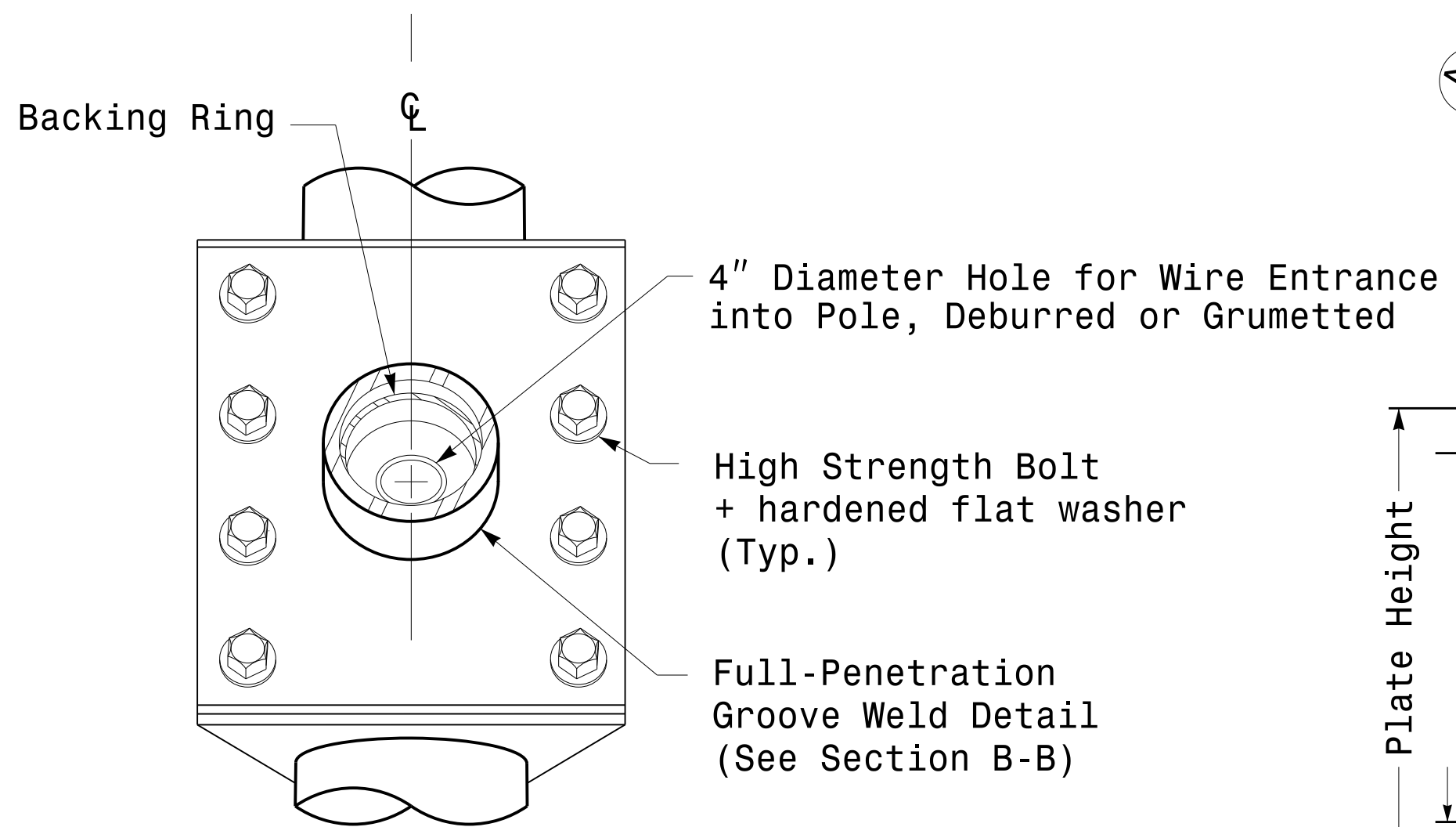
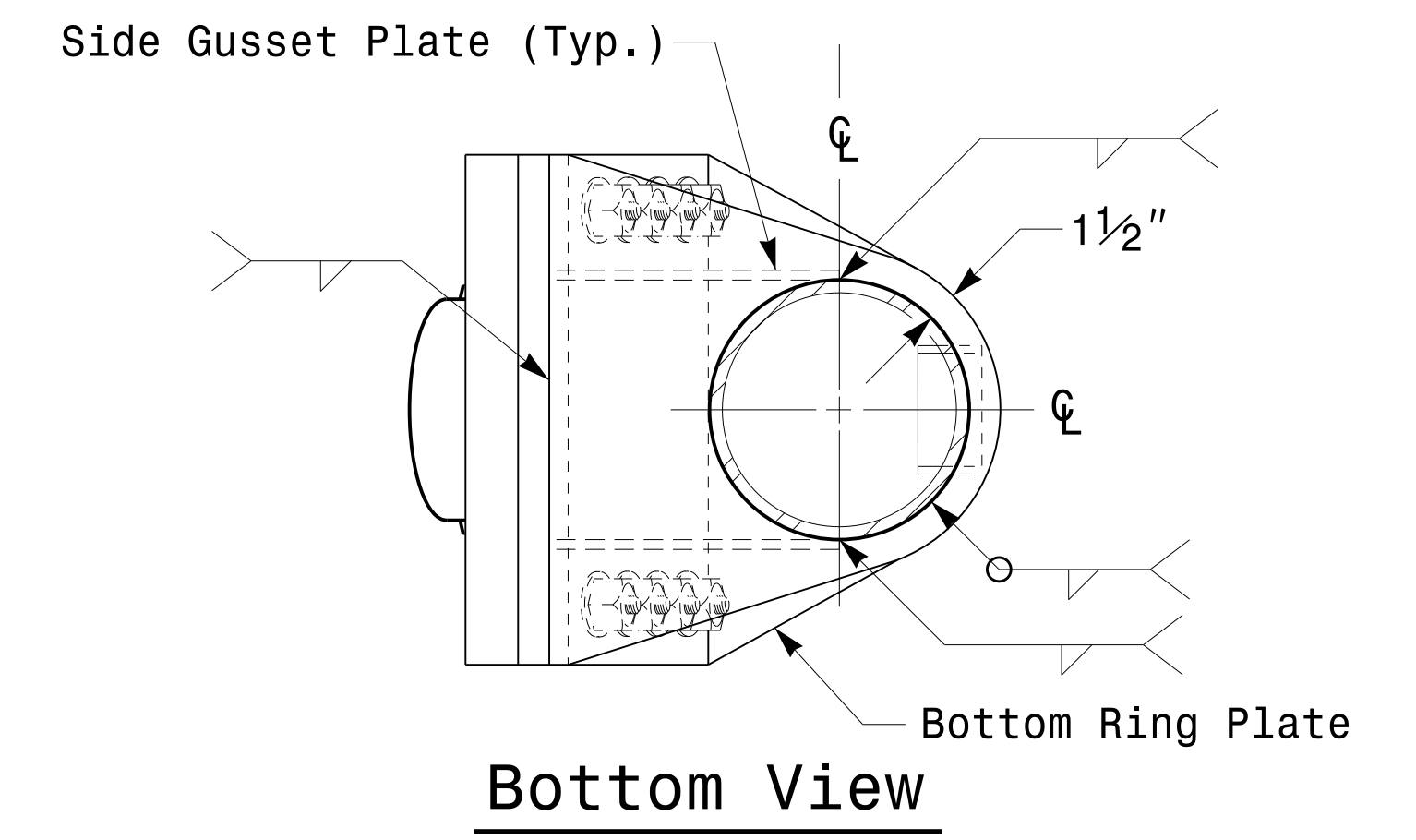
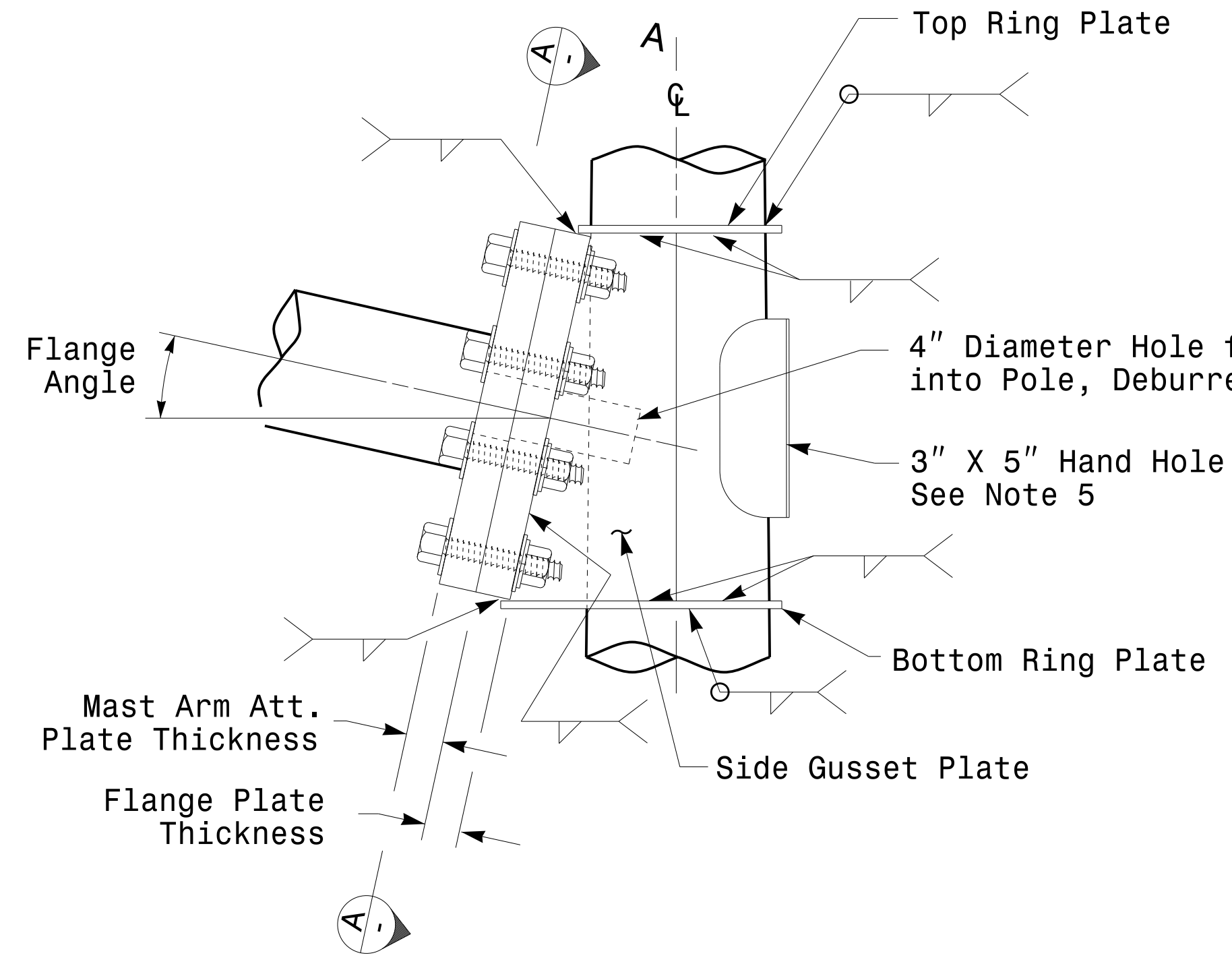
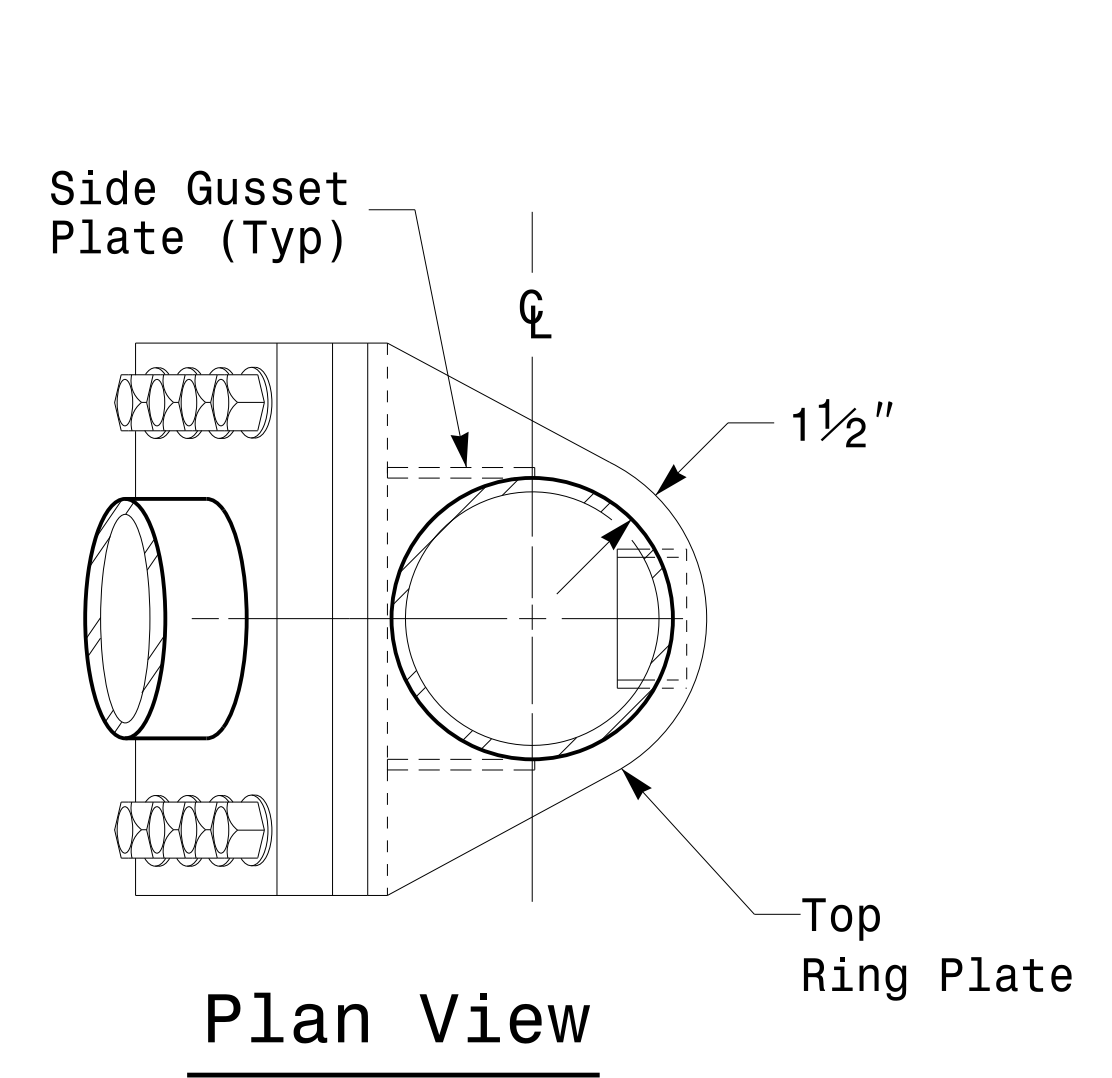
Mast Arm Pole

Fabrication Details – Mast Arm Poles

<p>Prepared in the Offices of: Transportation Mobility and Safety Division UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE Signal Design Section 750 N. Greenfield Pkwy, Garner, NC 27529</p>	Typical Fabrication Details For Mast Arm Poles		SEAL D. C. SARKAR ENGINEER
	PLAN DATE: OCTOBER 2017 PREPARED BY: N. BITTING	DESIGNED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR	
SCALE: 0 NA NONE	DocuSigned by: Dinesh C. Sarkar 10/11/2017		DATE

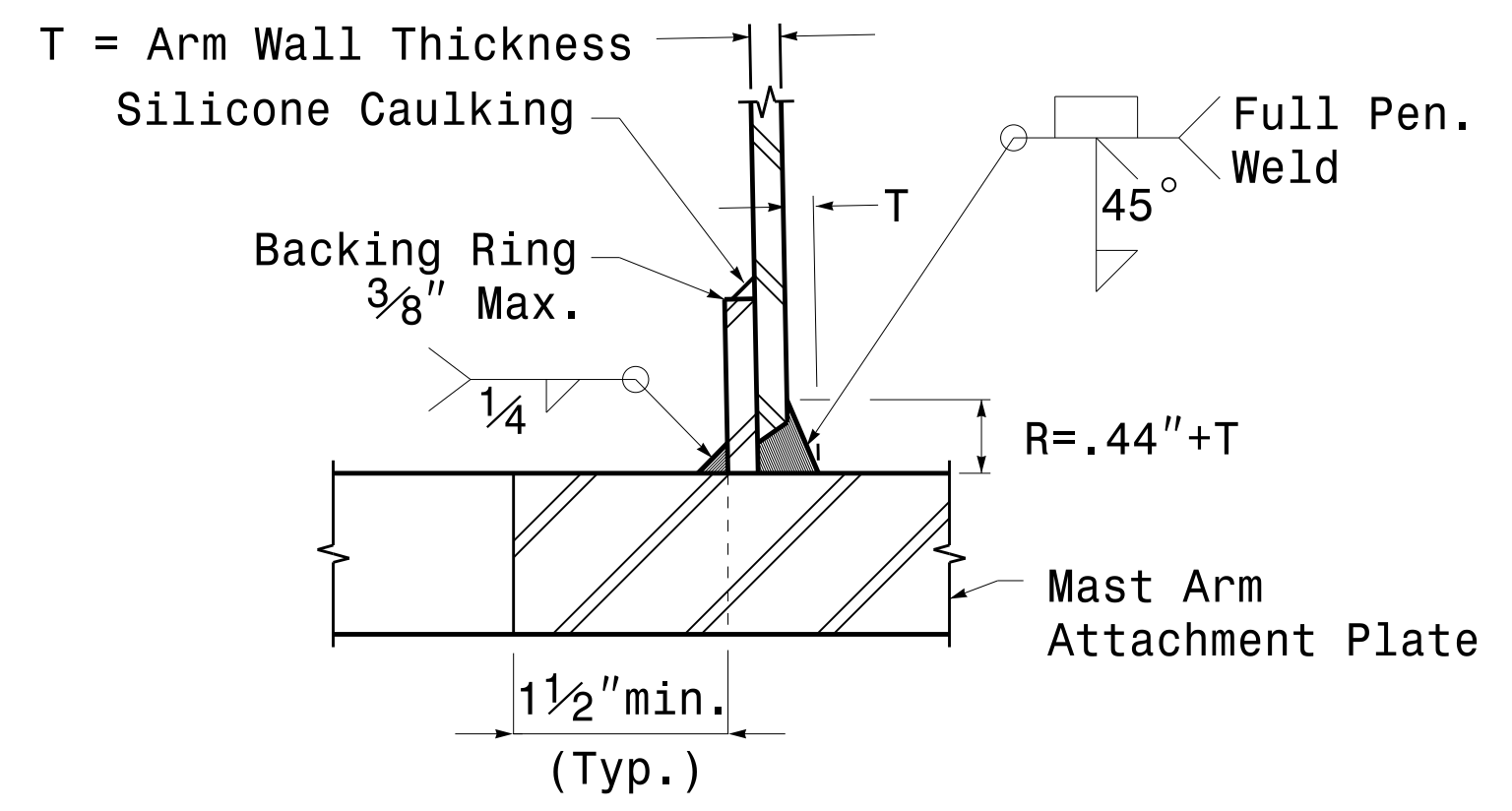
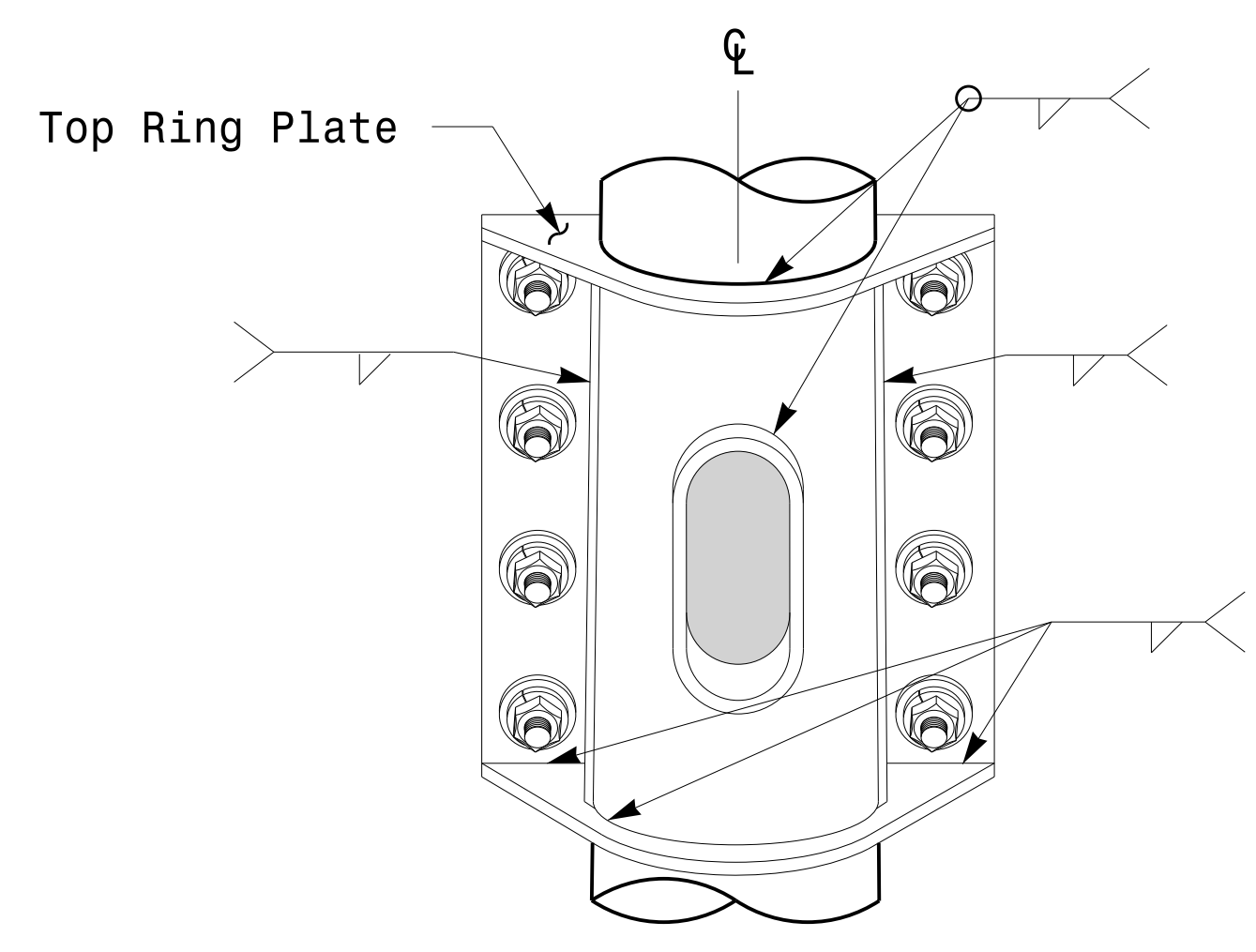
11-OCT-2017 08:33 136560115 Signal Design Section Eastern Region\m4 Sheets\2016\2014 Sig.M4 Std. Fabrication Detail - Mast Arm Poles.dgn

Welded Ring Stiffened Mast Arm Connection



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	
REVISIONS	INIT.	DATE

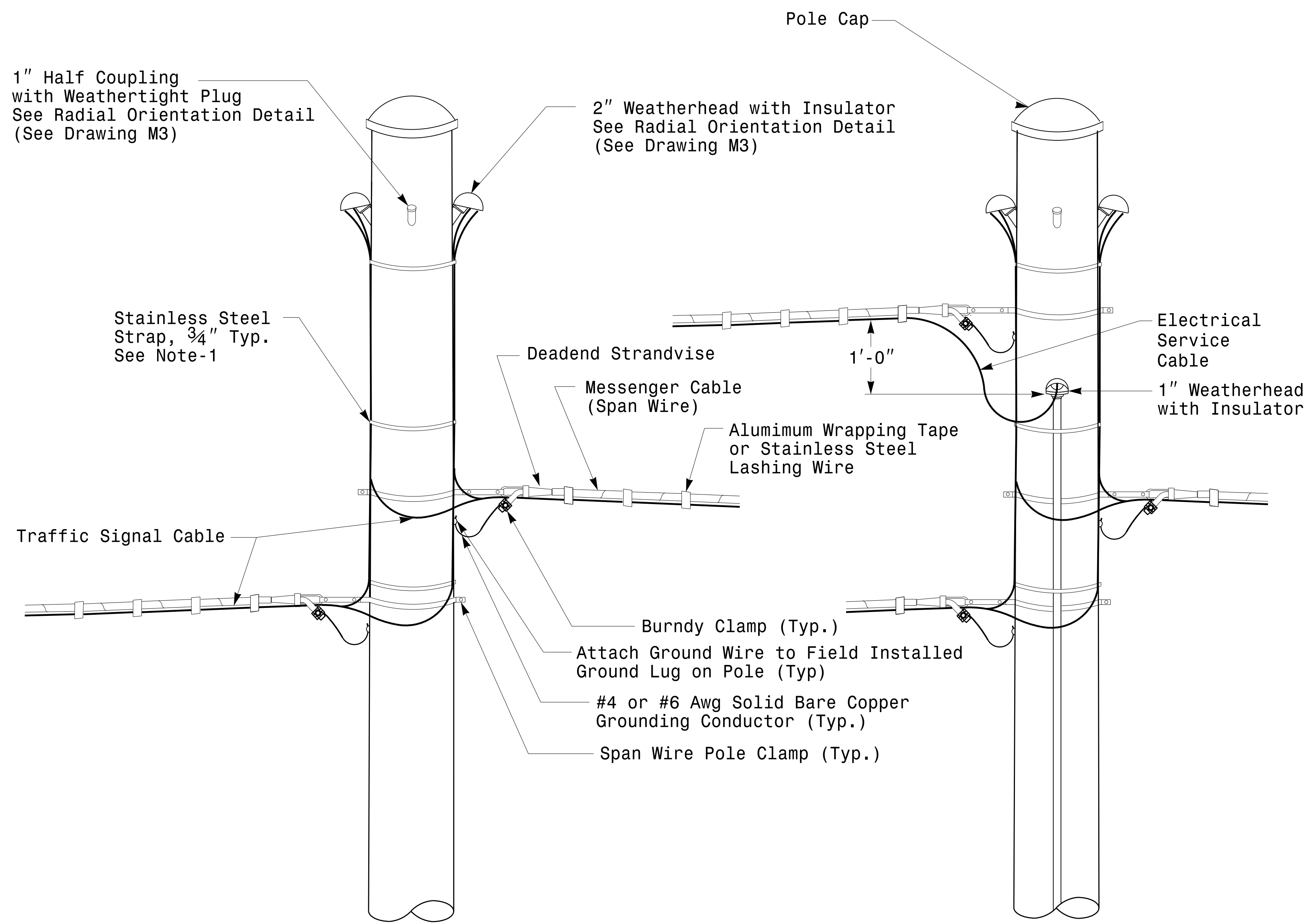
SEAL

Debesh C. Sarkar
SEAL 028094
ENGINEER

10/11/2017
DATE

11-001-2017-08135
155604115 5104156101 Design Section Eastern Region 44 Sheets 2016-2014 Sig.M5 Std. Connection Fabrication Detail Mast Arm Poles.dgn
2016

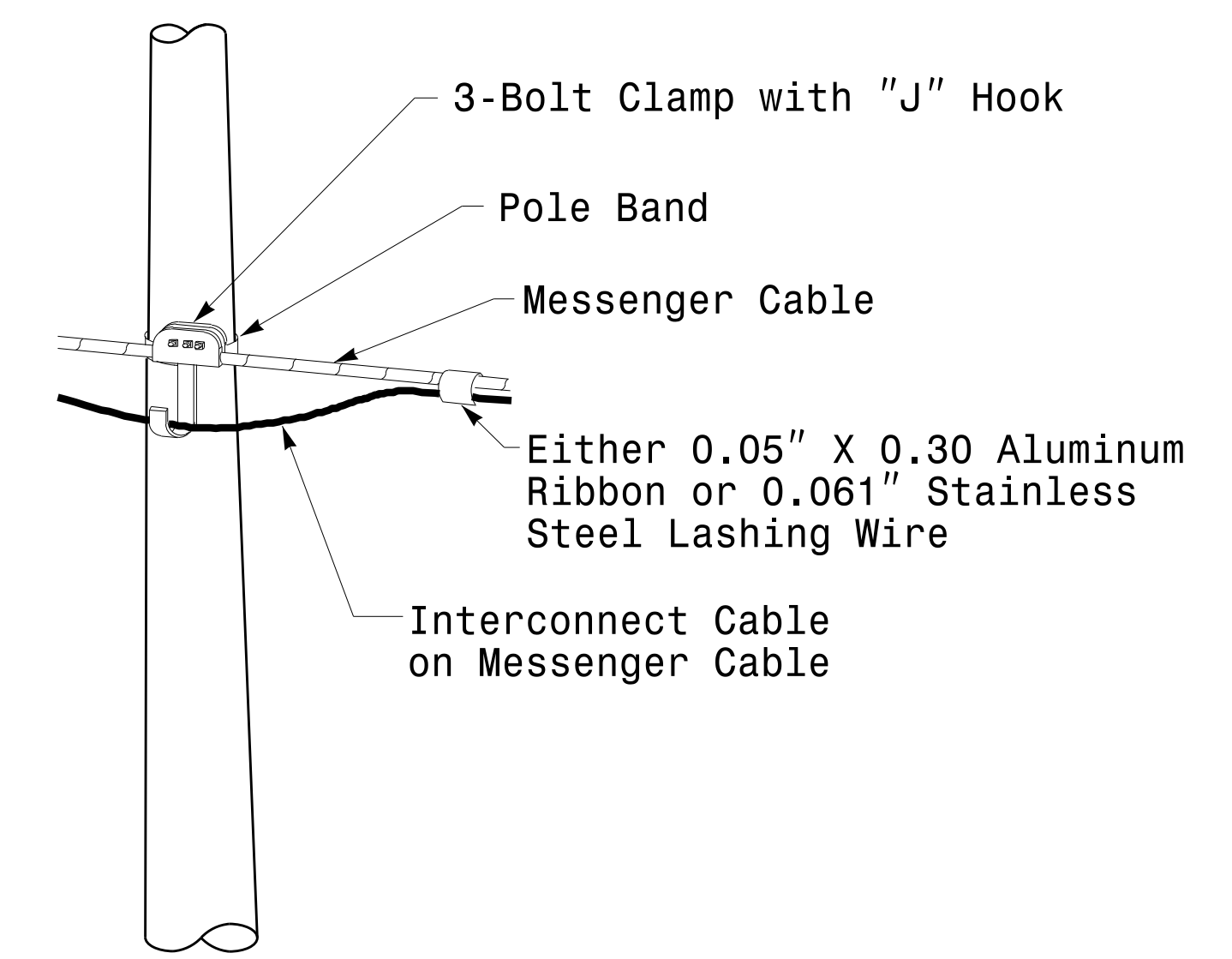
Fabrication Details – Mast Arm Connection



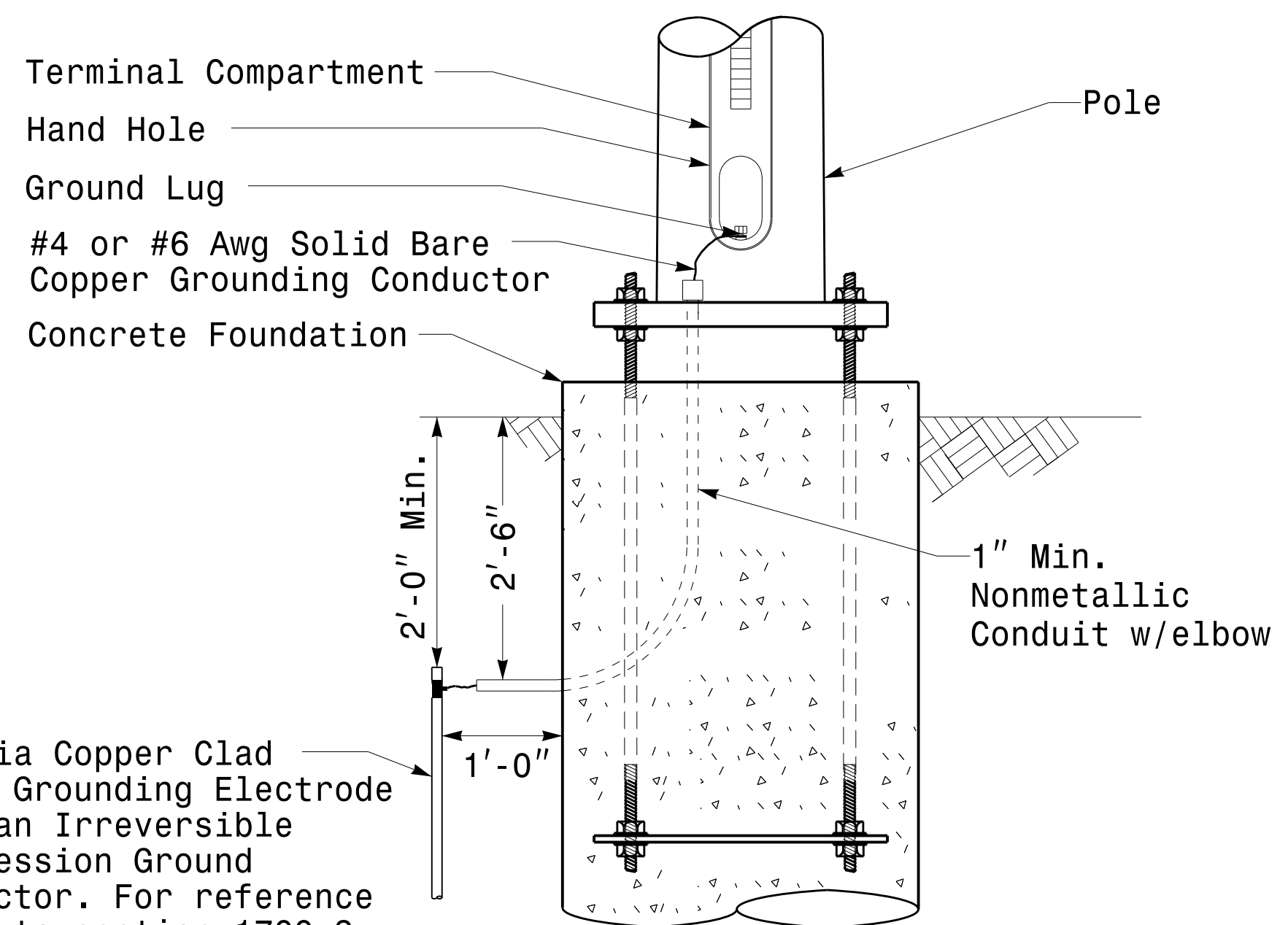
Strain Pole Attachments

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

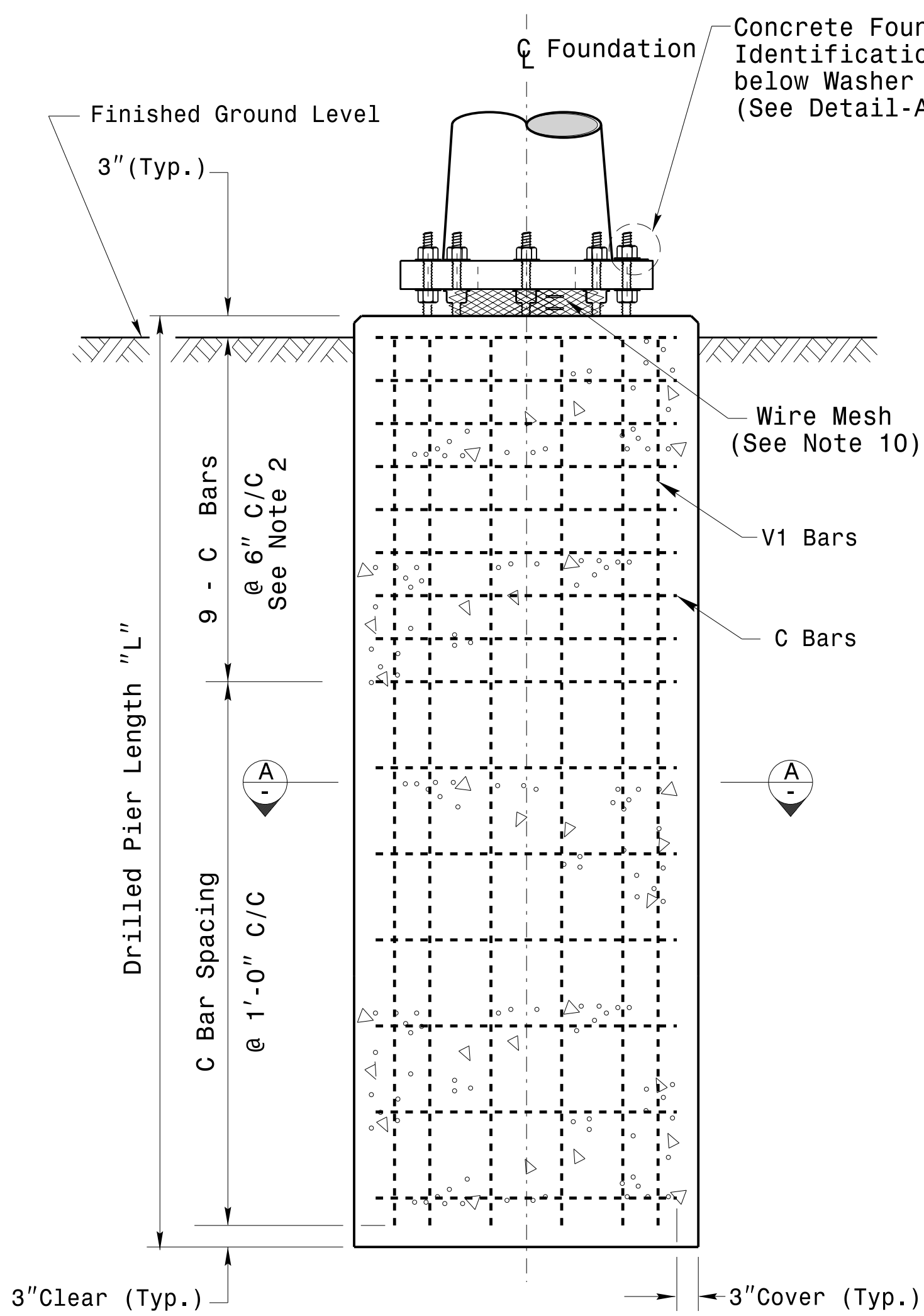


5/8" Dia Copper Clad Steel Grounding Electrode with an Irreversible Compression Ground Connector. For reference refer to section 1700-3 K and L for electrical grounding and bonding requirements, See Note 4.

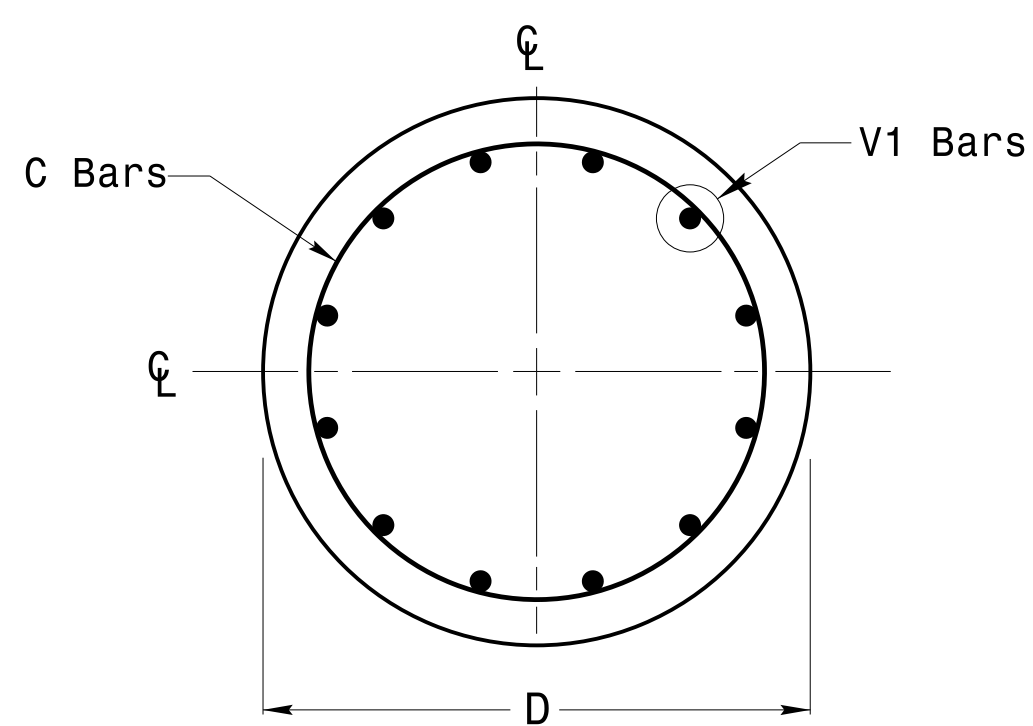
Metal Pole Grounding Detail For Strain Pole and Mast Arm

11-0CT-2017-08:36 136504115 StrainPole.dgn Design Section Eastern Region 0162014 Sig.M6 Std. Fabrication Detail: Strain Poles.dgn

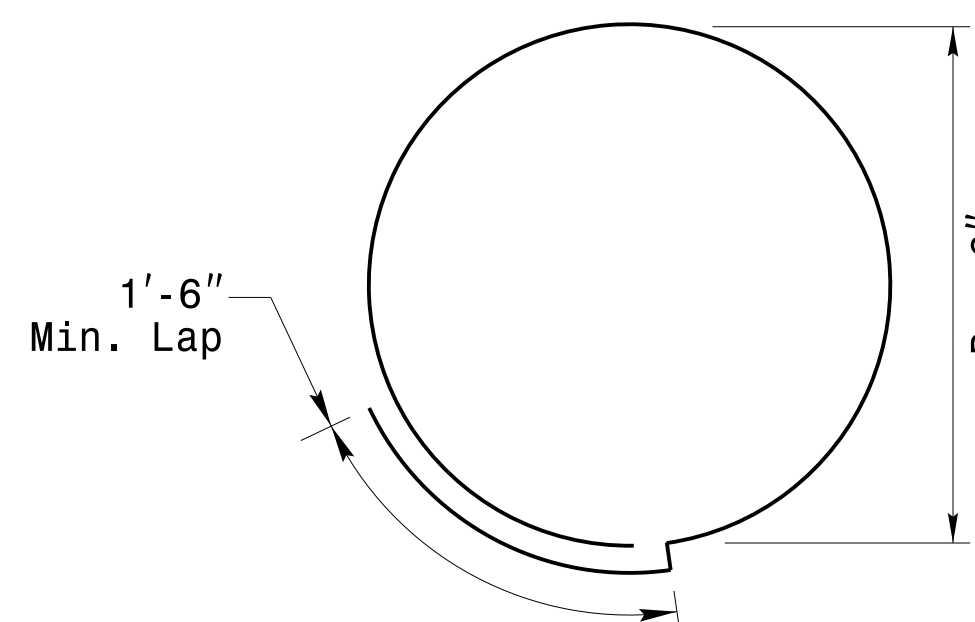
	Typical Fabrication Details For Strain Pole Attachments		
	PLAN DATE: OCTOBER 2017 PREPARED BY: N. BITTING	DESIGNED BY: C.F. ANDREWS REVIEWED BY: D.C. SARKAR	
REVISIONS: _____ INIT. DATE		DocuSigned by: <i>Deshi C. Sarkar</i> 10/11/2017 DATE	



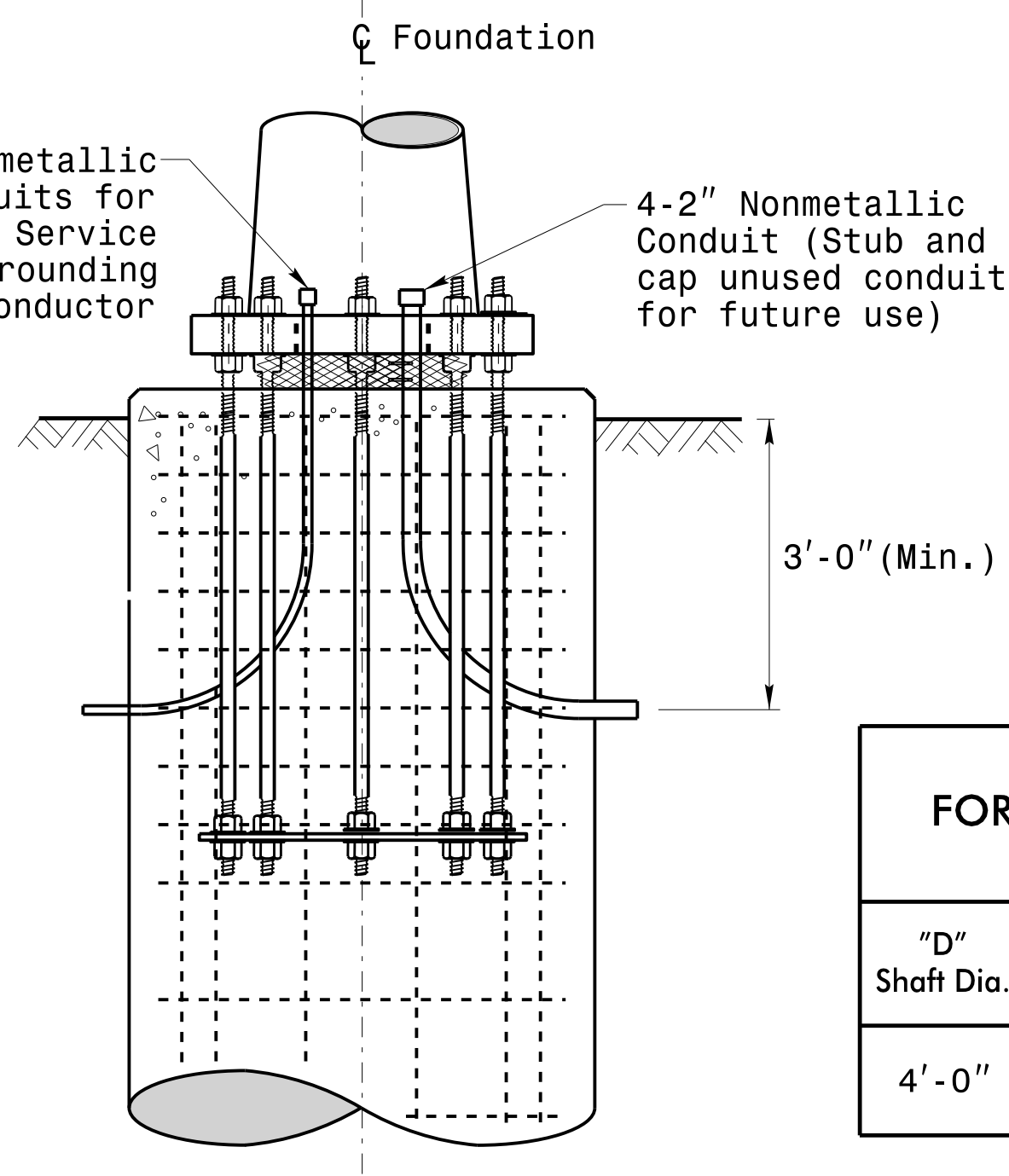
Concrete Shaft Elevation



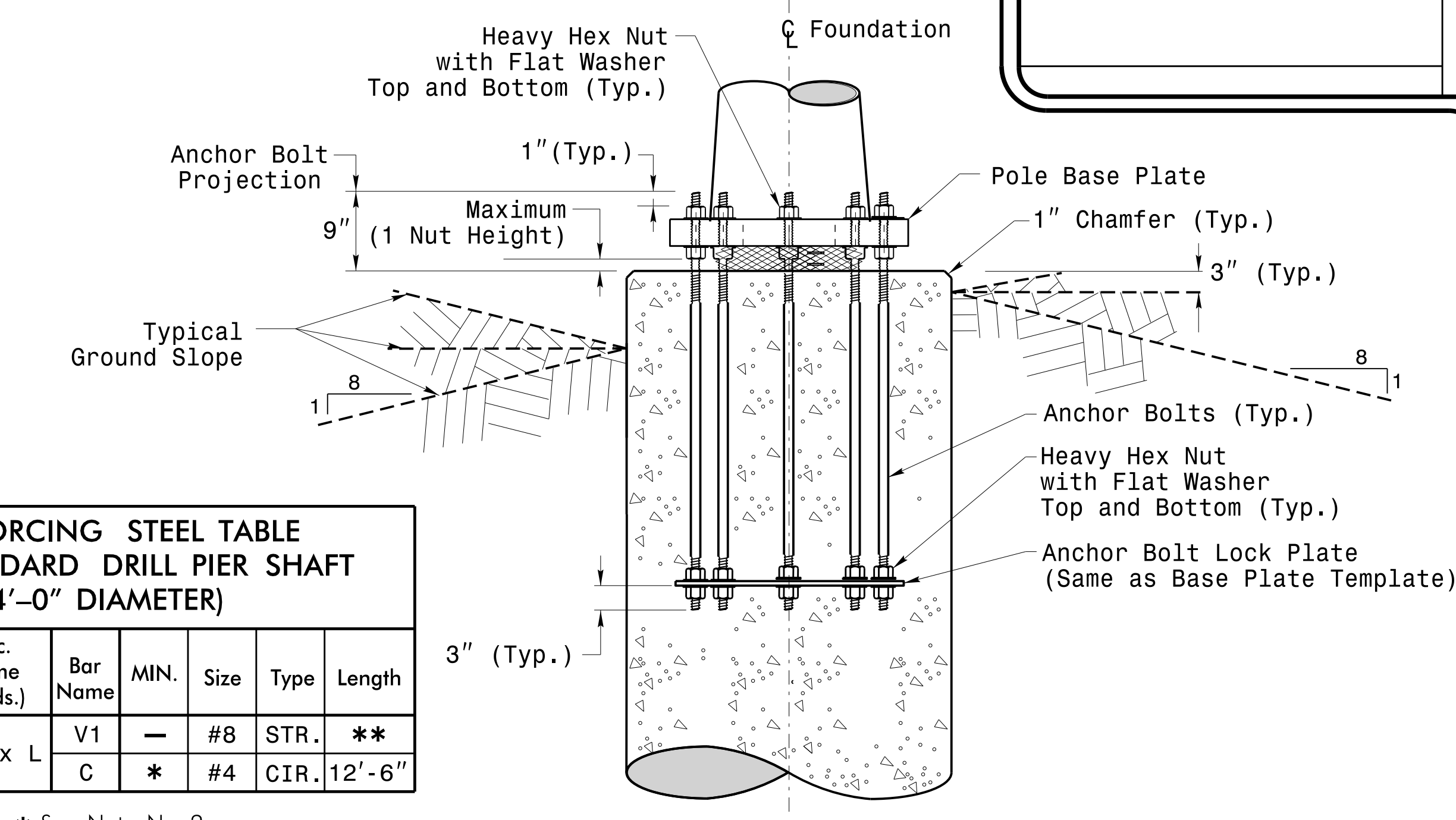
Section A-A



Typical "C" Bar Detail



Typical Foundation Conduit Details



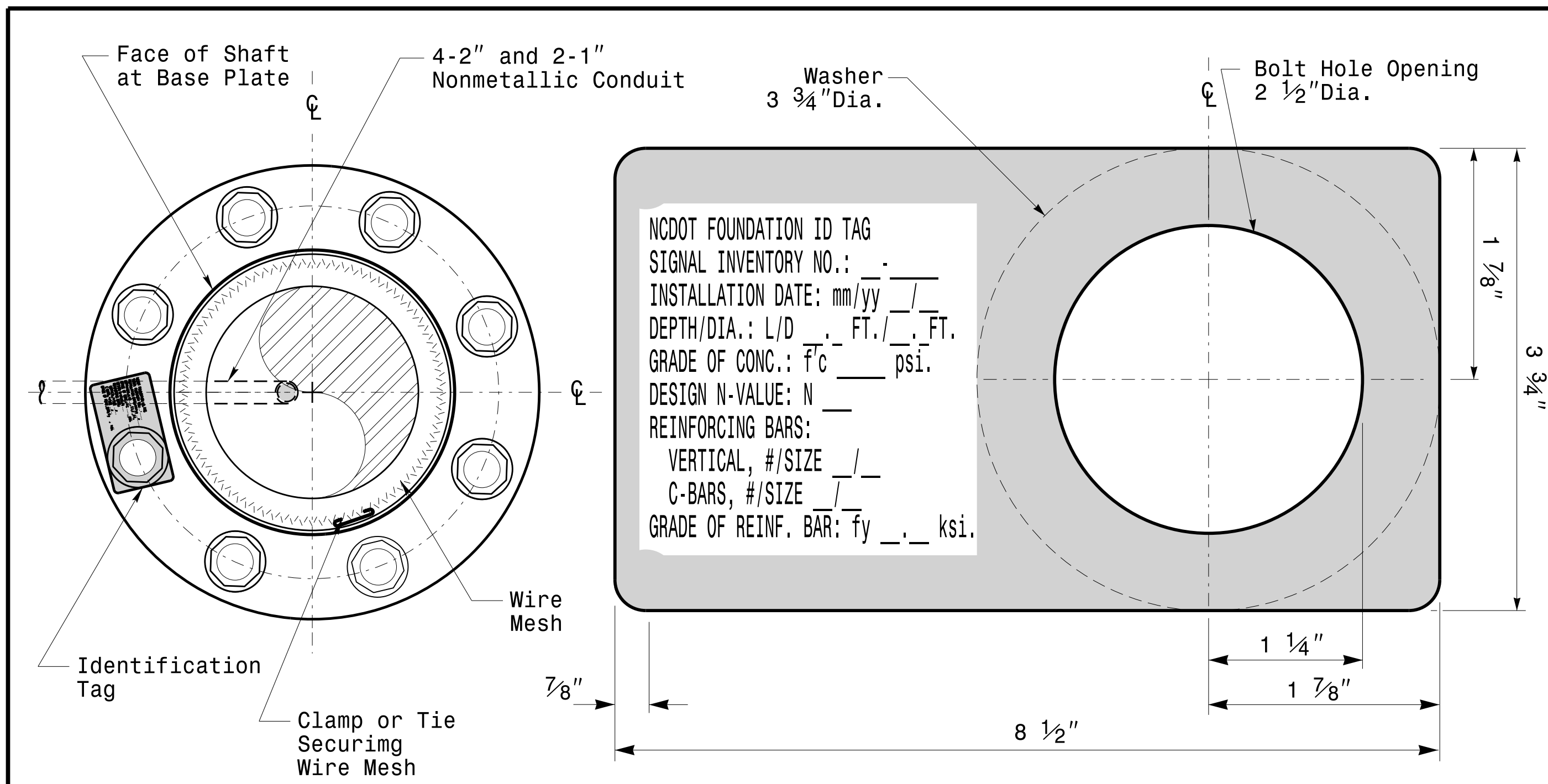
Typical Foundation Anchor Bolt Details
(Reinforcing Cage Not Shown for Clarity)

"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

General Notes:

1. If actual subsurface conditions differ significantly from boring data contact the Engineer before excavating or placing concrete.
2. 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.
3. 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.
4. Provide 2" to 5" foundation projection above ground level depending on the ground slope.
5. 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.
6. 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](https://connect.ncdot.gov/resources/Specifications%20and%20Special%20Provisions.aspx)
7. Use air entrained AA concrete mix with a compression strength of f'c=4500 psi.(min.) after 28 days.
8. Use ASTM A615 grade 60 deformed bars for all reinforcing steel. Maintain at least 3" cover on all reinforcement.
9. Locate the Identification Tag on the top of the base plate, directly above the conduit's entry point.
10. 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.
11. Preferred location for the I.D. Tag is as shown in Detail-A; directly above the conduit entering the foundation.



Concrete Foundation Identification Tag Details

Detail-A

	Construction Details For Foundations			
	PLAN DATE: OCTOBER 2018	DESIGNED BY: C.B. COGDILL		
	PREPARED BY: N. BITTING	REVIEWED BY: D.C. SARKAR		
SCALE: NONE	REV. NO. 1	COMMENTS: Revised Foundation Tag Details	INIT. DATE: N.B. 5/11/2015	
			DATE: 10/11/2017	

11-OCT-2017 08:37
I:\S60\W115\Signal\sig\Design\Section\Eastern_Reg\onM\Sheets\2016\2014_Sig_M7_Shd_Construction_Detail\Is-Strain_Poles.dgn
PLOT

Construction Details – Foundations

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.


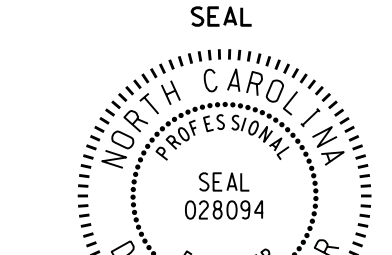
Foundation Selection:

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

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

	<p>Standard Strain Pole Foundation for All Soil Conditions</p> <p>PLAN DATE: OCTOBER 2017 DESIGNED BY: C.B. COGDILL PREPARED BY: N. BITTING REVIEWED BY: D.C. SARKAR</p>	
SCALE: 0 NA NONE	REVISIONS: Changed "Foundation Depth" to "Drilled Pier Length" in Conc. Egn. N.B. 7/12/2015	DATE: 10/11/2017