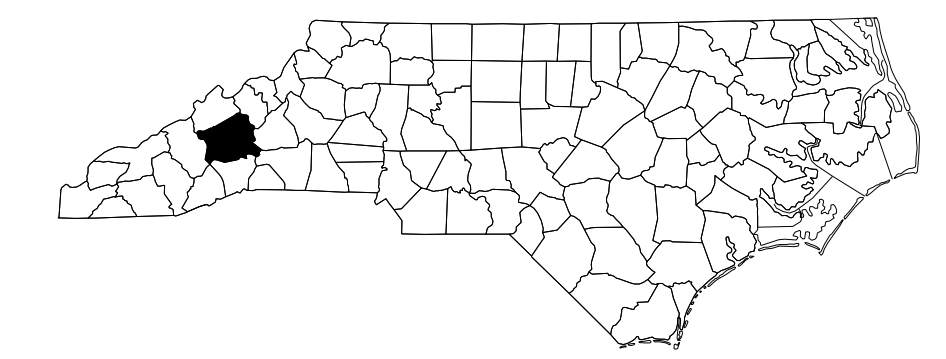


STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

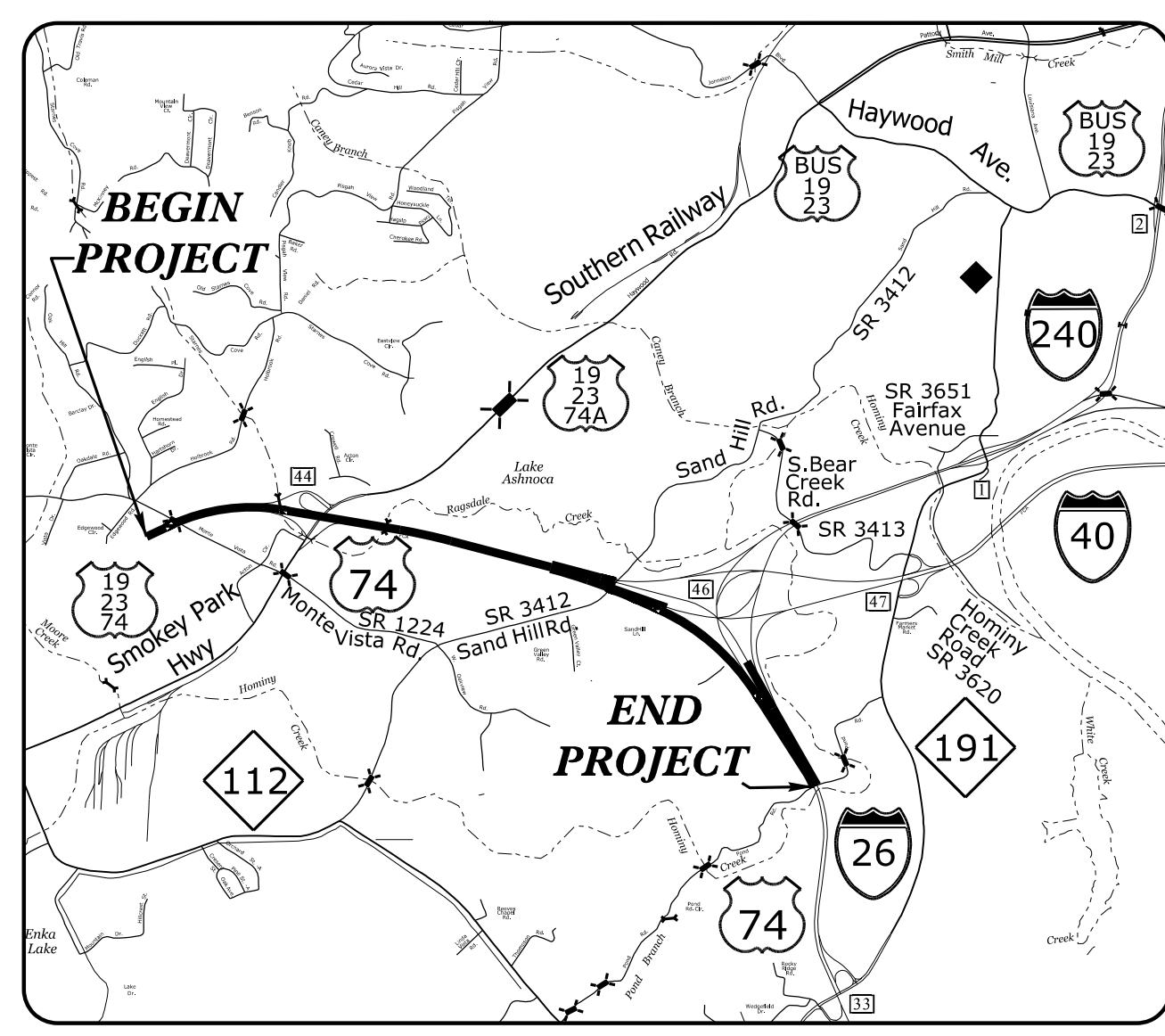
BUNCOMBE COUNTY

LOCATION: I-40 FROM EAST OF SR 1224 (MONTE VISTA RD) TO WEST OF SR 3412 (SAND HILL RD) AND I-40 AT I-26 AND US 19/23 (SMOKEY PARK HIGHWAY)

TYPE OF WORK: TRAFFIC SIGNALS AND SIGNAL COMMUNICATIONS

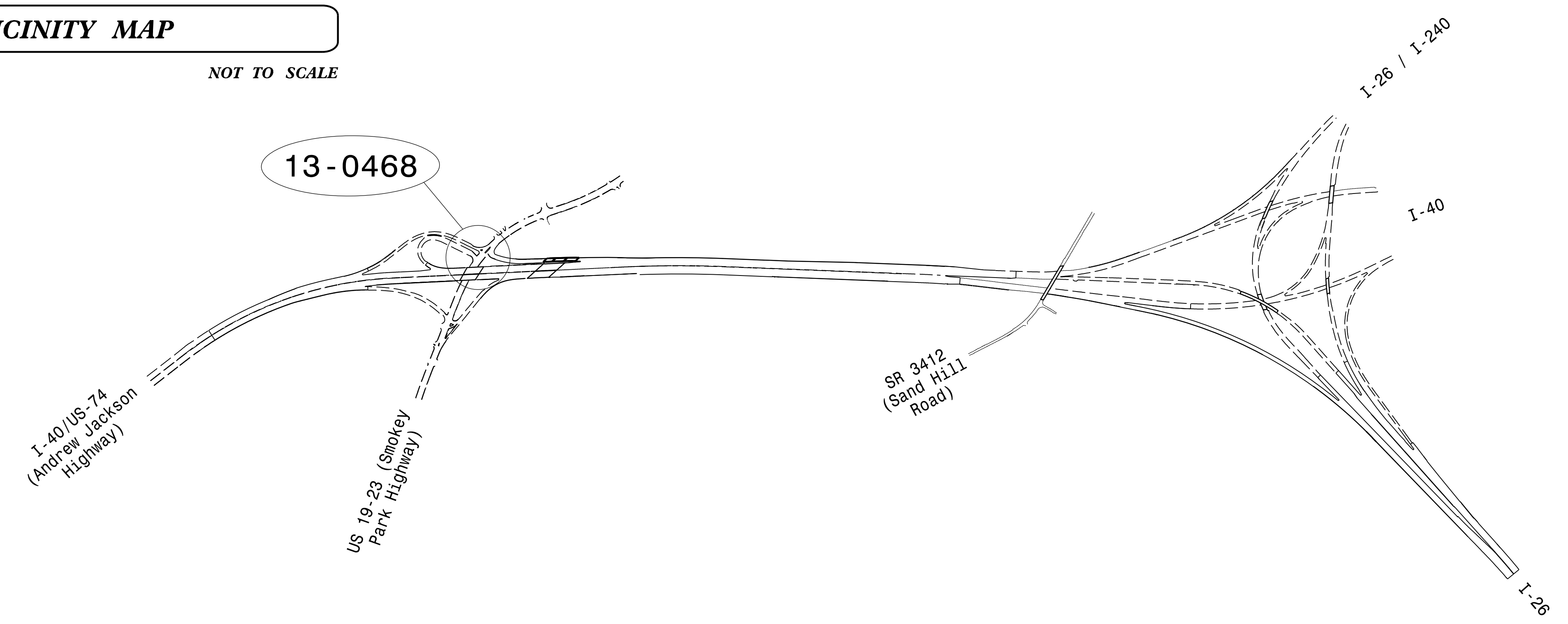


DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED



VICINITY MAP

NOT TO SCALE



Project: I-2513AA/AB

CONTRACT: C204878

I:\9\2024\pwt\aeocom-ne-pw-bentley.com\AECOM_DS21_NA_2020\Documents\60646756-I-2513AA\900-CAD_GIS\910_CAD\70_NCDOT_TIP\Signals\Design\AA_AB\I-2513AA_AB_sig_tsh.dgn

AECOM
NC Firm License No.: F-0342
5438 Wade Park Boulevard
Suite 200 Raleigh, NC 27607
Phone: 919-461-1100

Refer to "Roadway Standard Drawings
NCDOT" dated January 2024 and
"Standard Specifications for Roads
and Structures" dated January 2024.

| Index of Plans | | |
|----------------|-------------|--|
| Sheet # | Reference # | Location/Description |
| Sig. 1.0 | --- | Project Titlesheet |
| Sig. 2.1 - 4.5 | 13-0468 | US 19-23 (Smokey Park Highway) at I-40 EB/WB Ramps |
| Sig. M1A - M8 | N/A | Standard Metal Pole Sheets |
| SCP 1 - 4 | N/A | Signal Communication Plans and Splice Details |

**NCDOT TRANSPORTATION SYSTEMS
MANAGEMENT & OPERATIONS UNIT**

Contacts:
R. Nicholas Zinser, PE - Western Region Signals Engineer
Keith M. Mims, PE - Signal Equipment Design Engineer
Gregory A. Green - Signal Communications Project Engineer
Heidi T. Berggren, EI - Signal Communications Project Design Engineer

AECOM
 Contacts:
John Sloan - Project Engineer
Rochelle Garrett - NC Signals Engineer

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

750 N. Greenfield Parkway, Garner, NC 27529

PHASING DIAGRAM

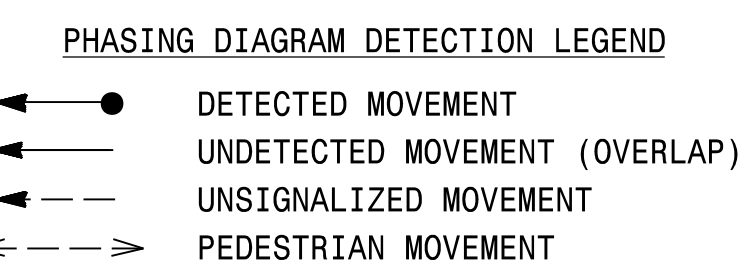
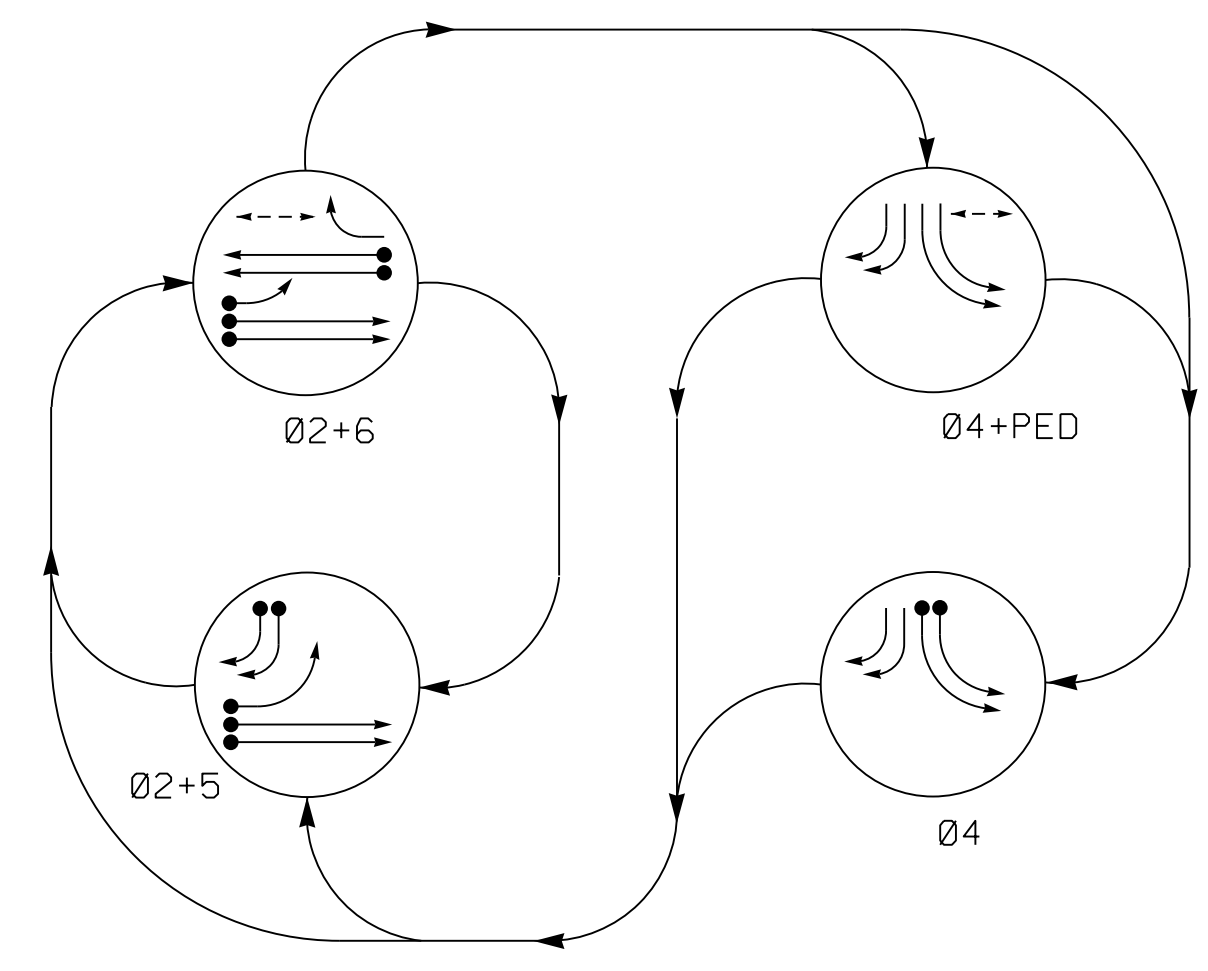
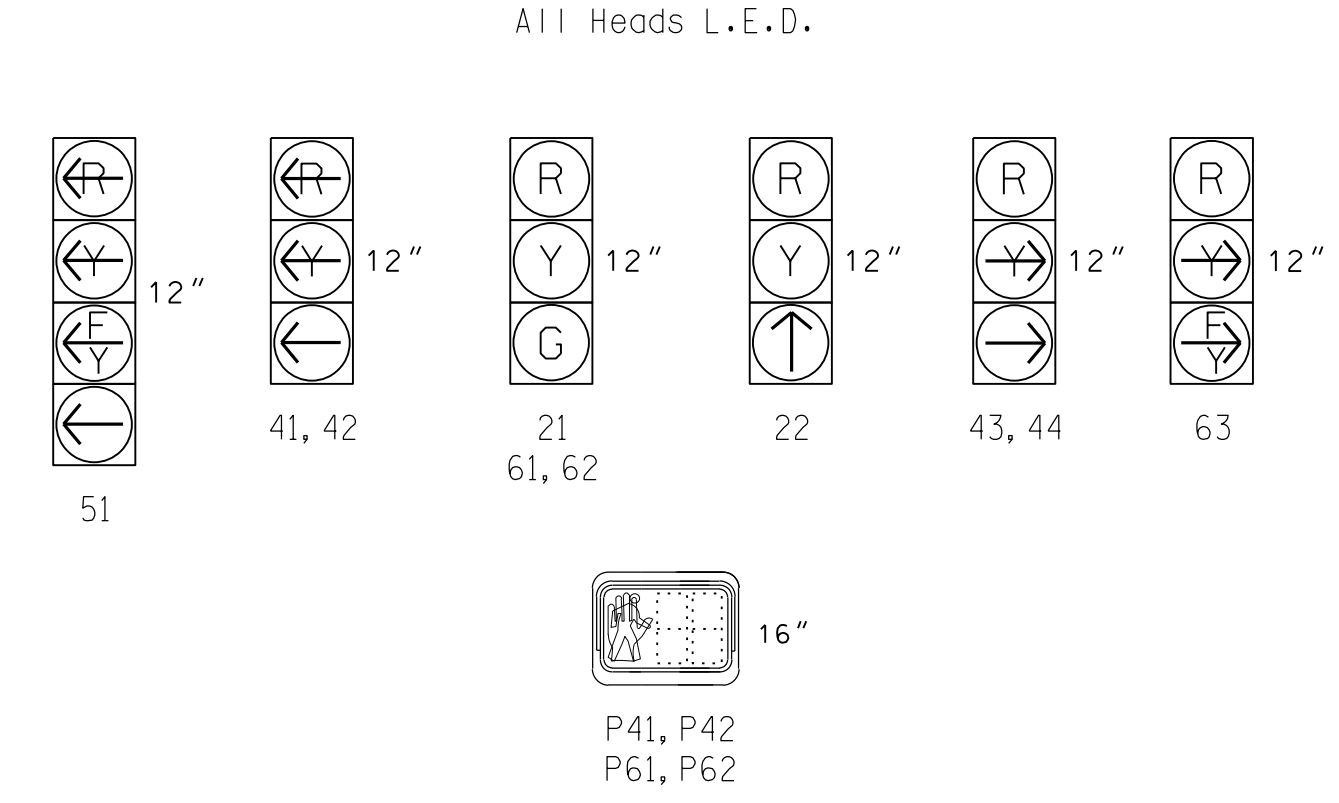


TABLE OF OPERATION table with columns for SIGNAL FACE and PHASE (02+5, 02+6, 04+PED, 04, FLASH).

SIGNAL FACE I.D.

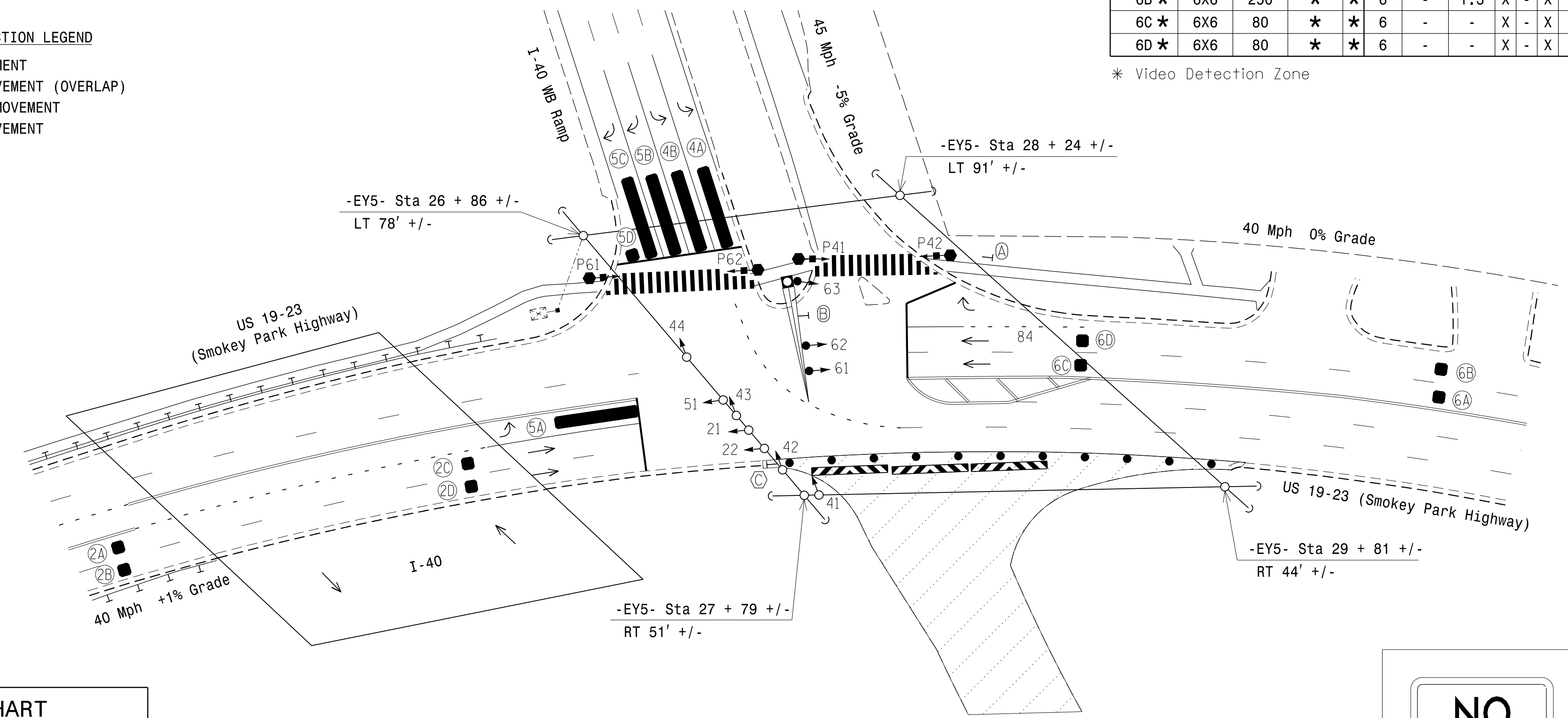


MAXTIME DETECTOR INSTALLATION CHART table with columns for ZONE, SIZE (FT), DISTANCE FROM STOPBAR (FT), TURNS, NEW LOOP, CALL PHASE, DELAY TIME, EXTEND TIME, EXTEND INITIAL, ADDED INITIAL, CALL, DELAY DURING GREEN, and NEW CARD.

4 Phase Fully Actuated (Asheville Signal System)

NOTES

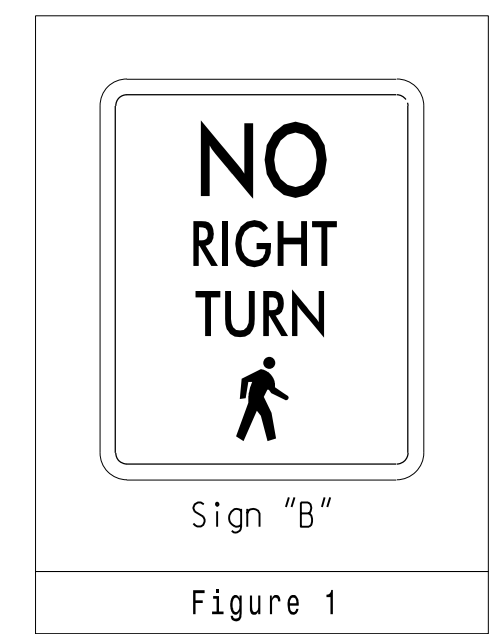
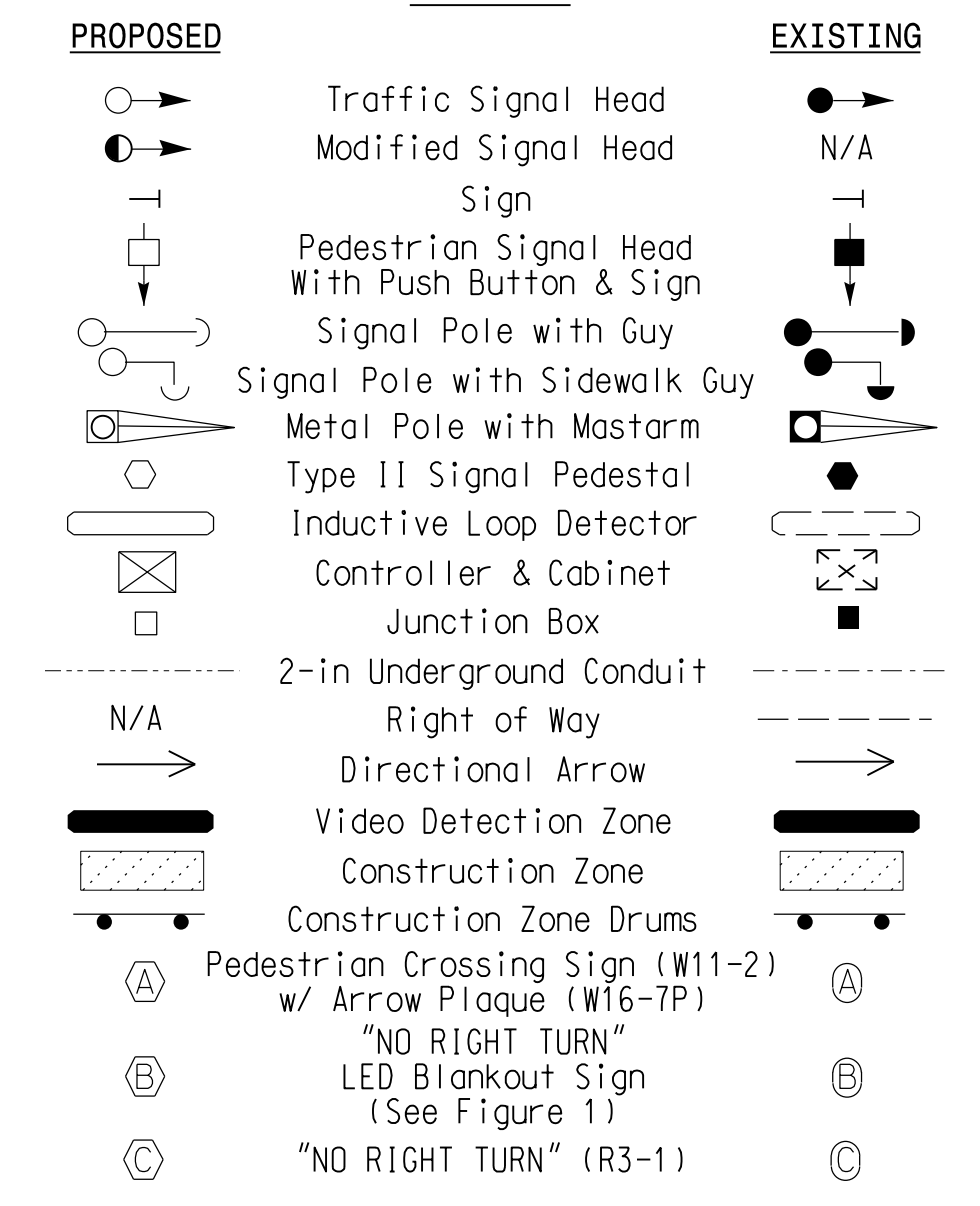
- 1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specifications for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 5 may be lagged.
4. Set all detector units to presence mode.
5. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
6. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
7. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



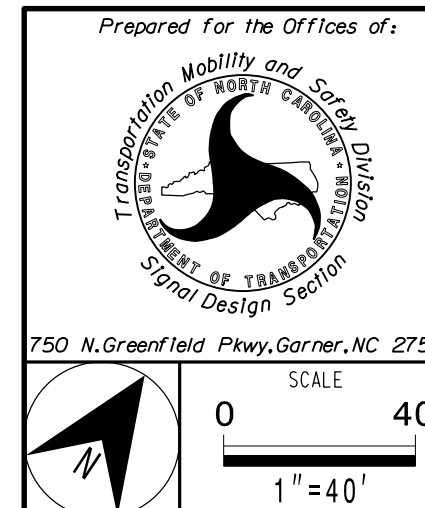
MAXTIME TIMING CHART table with columns for FEATURE and PHASE (2, 4, 5, 6). Rows include Walk, Ped Clear, Min Green, Passage, Max I, Yellow Change, Red Clear, Added Initial, Maximum Initial, Time Before Reduction, Time To Reduce, Minimum Gap, Advance Walk, Non Lock Detector, Vehicle Recall, and Dual Entry.

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

LEGEND



Signal Upgrade Temporary Design 1 (TMP Phases I - II)



Project information form including: US 19-23 (Smokey Park Highway) at I-40 WB Ramps, Division 13, Buncombe County, Asheville, PLAN DATE: December 2023, REVIEWED BY: R. Garrett, PREPARED BY: M. Tindal, REVISIONS table, and SIGNATURE/DATE fields.

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Seal area with text: SEAL, PROFESSIONAL ENGINEER, RACHELE GARRET, ENGINEER, 026679, and SIGNATURE/DATE fields.

12/5/2023 10:44:00 AM C:\Users\paw.bentl\ey-com\AECOM\2521_NA_2020\Documents\60646756-1-2513\AA\100-CAD_6154910-CAD\70_NCDOT_TIP\45_ignal\450951_gh\AA_AB\4_3046871_sfi.g_dsn_20231205.dgn T:\na\im

OVERLAP PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >Overlap >Overlap Parameters/Overlap Timings

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

| Overlap | 1 | 2 | 3 | 4 |
|-------------------|-----------------|-----|-----------------|--------|
| Type | FYA 4 - Section | Off | FYA 4 - Section | Normal |
| Included Phases | 6 | - | 6 | 4,5 |
| Modifier Phases | - | - | 5 | - |
| Modifier Overlaps | - | - | - | - |
| Trail Green | 0 | 0 | 0 | 0 |
| Trail Yellow | 0.0 | 0.0 | 0.0 | 0.0 |
| Trail Red | 0.0 | 0.0 | 0.0 | 0.0 |

FLASHER CIRCUIT MODIFICATION DETAIL

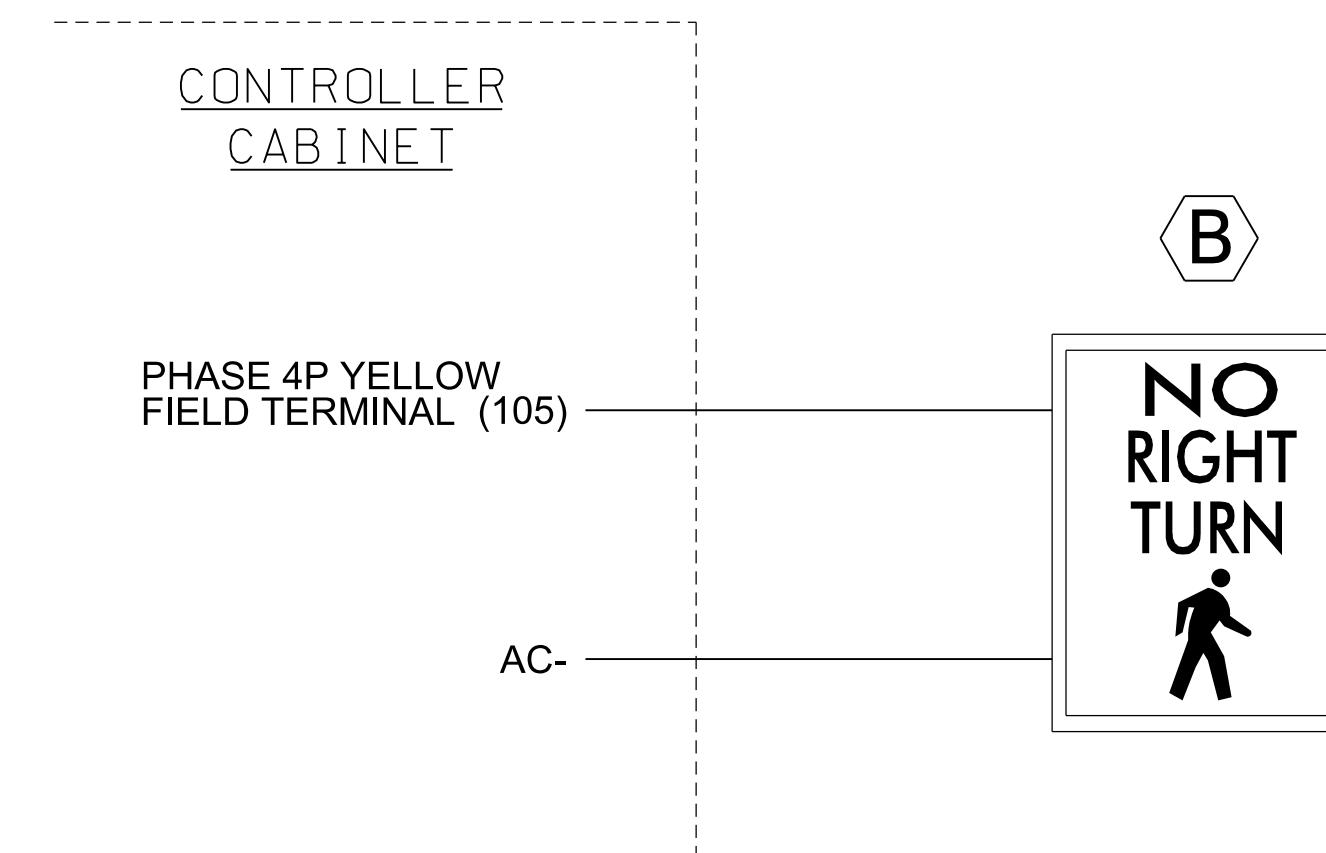
IN ORDER TO ENSURE THAT SIGNALS FLASH CONCURRENTLY ON THE SAME APPROACH, MAKE THE FOLLOWING FLASHER CIRCUIT CHANGES:

1. ON REAR OF PDA - REMOVE WIRE FROM TERM. T2-4 AND TERMINATE ON T2-2.
2. ON REAR OF PDA - REMOVE WIRE FROM TERM. T2-5 AND TERMINATE ON T2-3.
3. REMOVE FLASHER UNIT 2.

THE CHANGES LISTED ABOVE TIES ALL PHASES AND OVERLAPS TO FLASHER UNIT 1.

BLANKOUT SIGN (B) WIRING DETAIL

(wire sign as shown)



NOTE: IF FIELD TERMINAL 105 HAS A CONFLICT MONITOR WIRE CONNECTED, REMOVE, TAPE, AND LABEL WIRE.

OUTPUT POINTS PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >More >Advanced IO >Output Points

Web Interface
Home >Controller >Advanced IO >Cabinet Configuration >Output Points

IO Module 1

| Output Point | Description | Output Control Type | Index |
|--------------|-------------|---------------------|-------|
| 35 | C1-37 | Global Variable | 35 |

LOGIC PROCESSOR PROGRAMMING

Front Panel
Main Menu >Controller >More >User Programs >Definition

Web Interface
Home >Controller >User Programs Configuration >User Programs Definition

Program 1

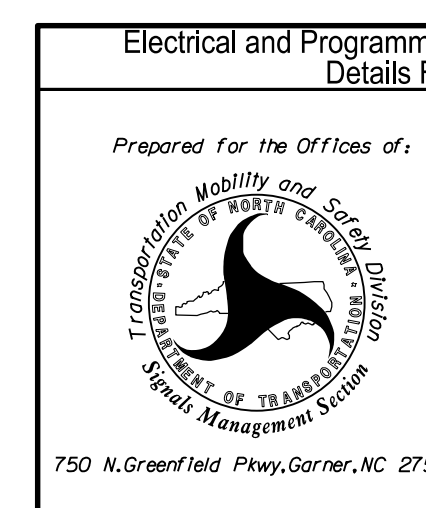
| Statement | Result | Index | Operation | Parameter A | Index | Parameter B | Index | Delay | Ext |
|-----------|-----------------|-------|---------------|-------------|-------|---------------------|-------|-------|-----|
| 1 | Global Variable | 35 | Result=(AorB) | Phase Walk | 4 | Phase Ped Clearance | 4 | 0.0 | 0.0 |

LOGIC STATEMENT DESCRIPTION

Statement 1 Description: Illuminate Blankout Sign (B) at beginning of Phase 4 WALK to the end of Phase 4 DON'T WALK.

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 13-0468T1
DESIGNED: December 2023
SEALED: 12/5/2023
REVISED:

Temporary Design 1 (TMP Phases I - II)
Electrical Detail - Sheet 2 of 2



| | | |
|---|-------------------------|-----------|
| Electrical and Programming Details For: Prepared for the Offices of: US 19-23 (Smokey Park Highway) at I-40 WB Ramps | | |
| Division 13 | Buncombe County | Asheville |
| PLAN DATE: December 2023 | REVIEWED BY: J O Deaton | |
| PREPARED BY: M W Yalch | REVIEWED BY: | |
| REVISIONS | INIT. | DATE |
| | | |

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

| |
|--|
| SEAL |
| |
| DocuSigned by: James O. Deaton SIGNATURE DATE 12/5/2023 |
| SIG. INVENTORY NO. 13-0468T1 |

12/5/2023 10:58:41 AM C:\Users\jwalch\OneDrive\Documents\13-0468T1\13-0468T1-12-5-2023.dgn

PHASING DIAGRAM

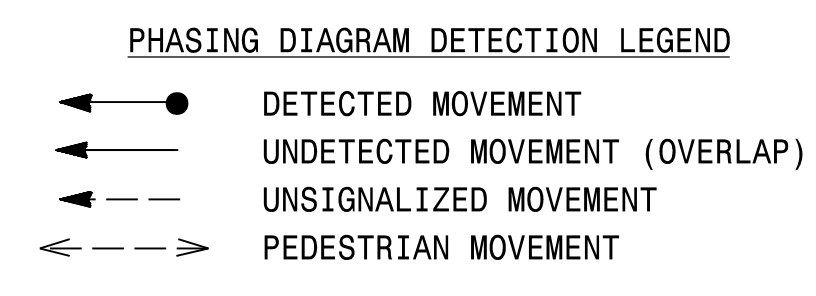
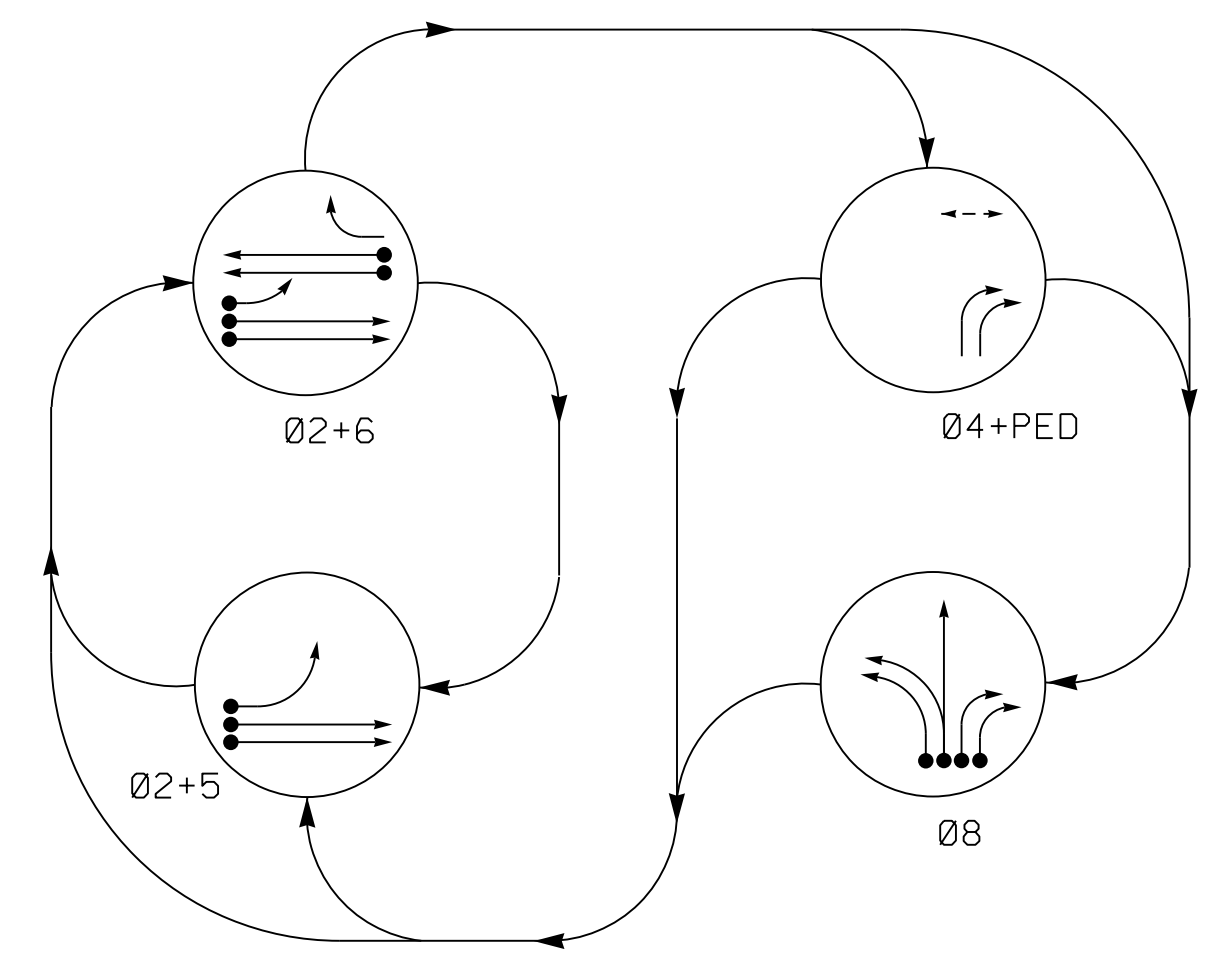
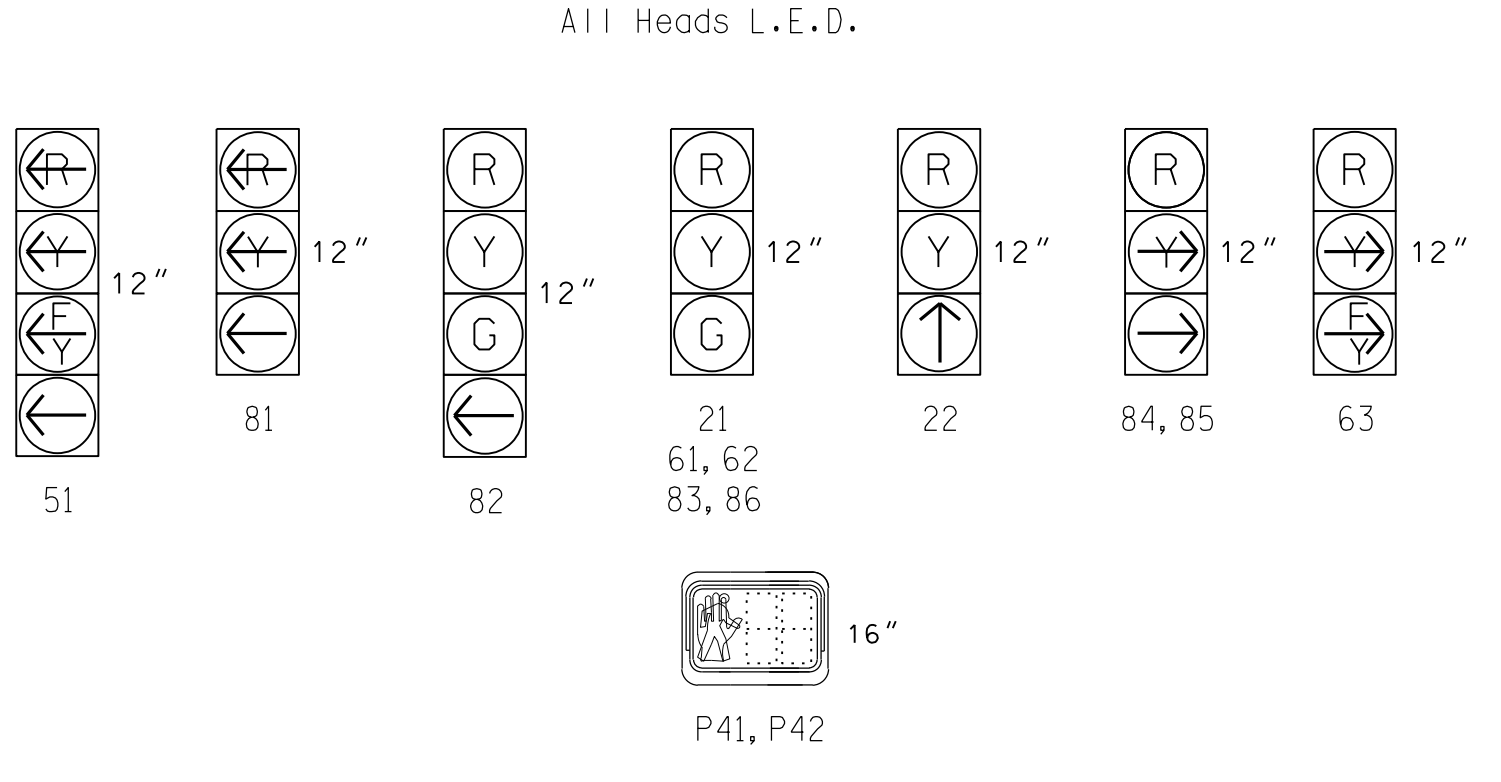


TABLE OF OPERATION

Table with columns for Signal Face and Phase (02+5, 02+6, 04+PED, 08, H, S, L, F, T, H, S, L, F, T, H, S, L, F, T). Rows include signal faces 21, 22, 51, 61, 62, 63, 81, 82, 83, 86, 84, 85, P41, P42, and Sign 'B'.

SIGNAL FACE I.D.



MAXTIME DETECTOR INSTALLATION CHART

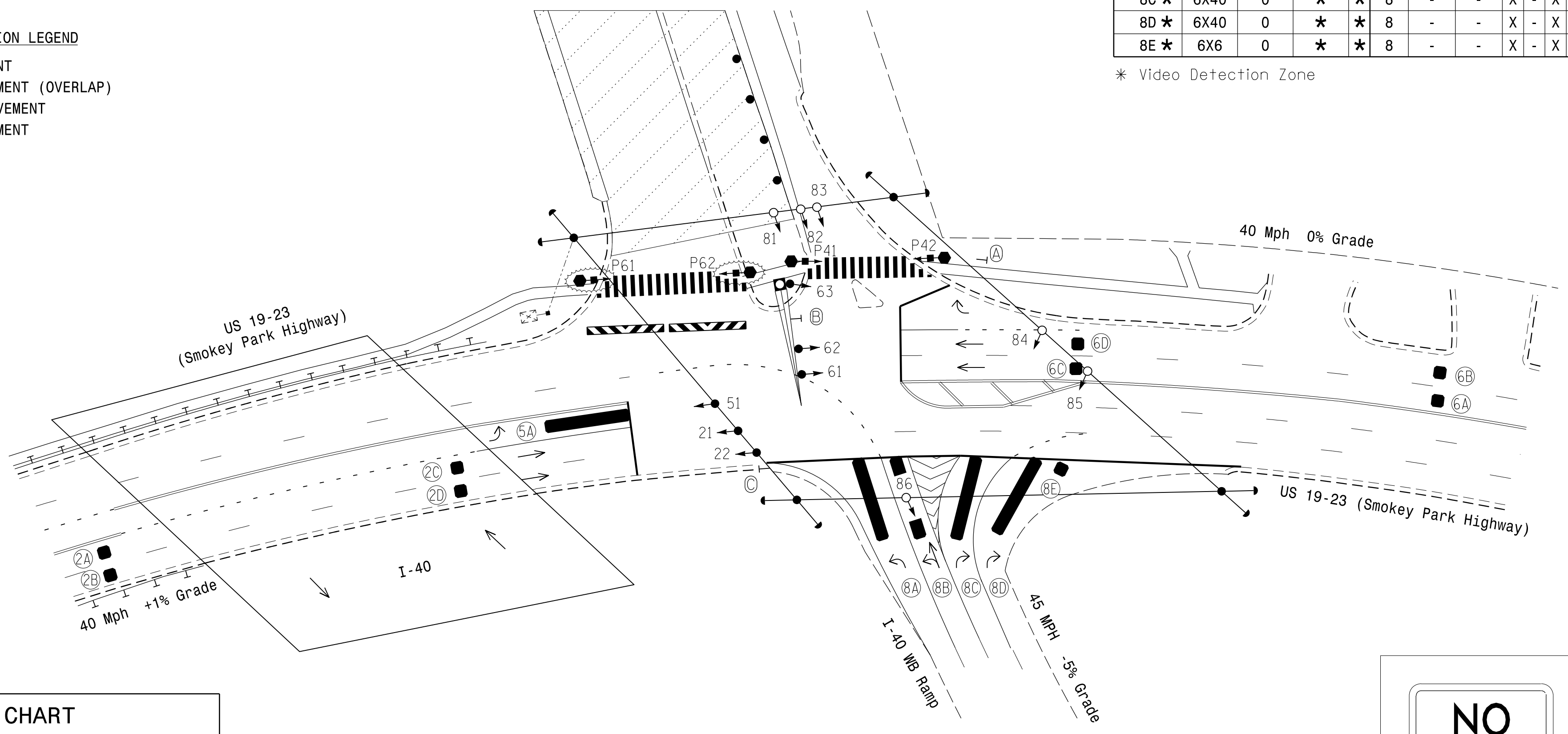
Table with columns for Zone, Size (FT), Distance from Stopbar (FT), Turns, New Loop, Call Phase, Delay Time, Extend Time, Extend Initial, Call, Delay During Green, and New Card. Rows include detector zones 2A through 8E.

* Video Detection Zone

4 Phase Fully Actuated (Asheville Signal System)

NOTES

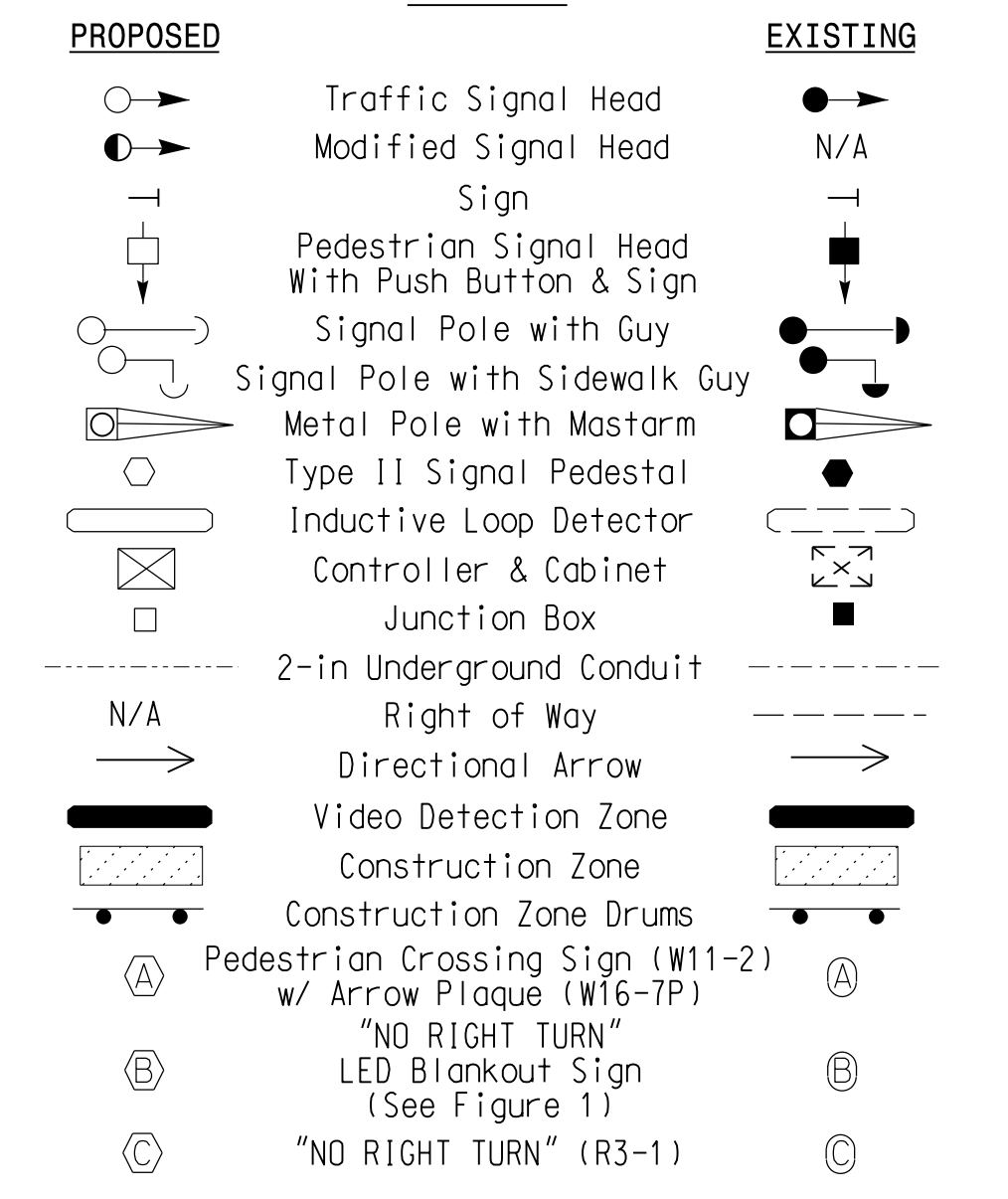
- 1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specifications for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Disconnect and bag signals P61 and P62.
4. Phase 5 may be lagged.
5. Remove existing signal heads numbered 41, 42, 43, and 44.
6. Set all detector units to presence mode.
7. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
8. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
9. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
10. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



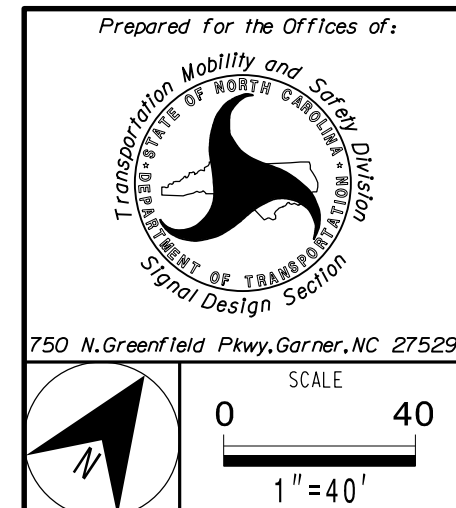
MAXTIME TIMING CHART table with columns for Feature and Phase (2, 4, 5, 6, 8). Rows include Walk, Ped Clear, Min Green, Passage, Max I, Yellow Change, Red Clear, Added Initial, Maximum Initial, Time Before Reduction, Time To Reduce, Minimum Gap, Advance Walk, Non Lock Detector, Vehicle Recall, and Dual Entry.

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

LEGEND

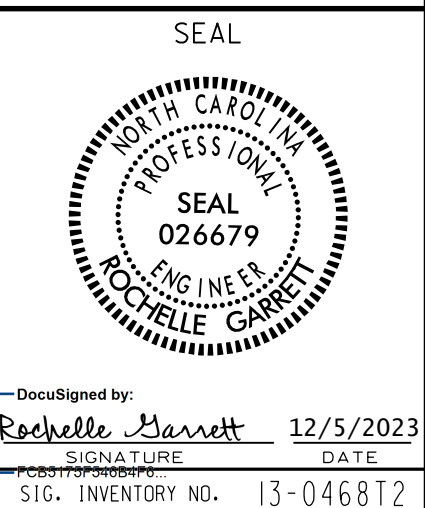


Signal Upgrade Temporary Design 2 (TMP Phases III - V)



Project information table including Division 13, Buncombe County, Asheville, Plan Date (December 2023), and Prepared By (M. Tindal).

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

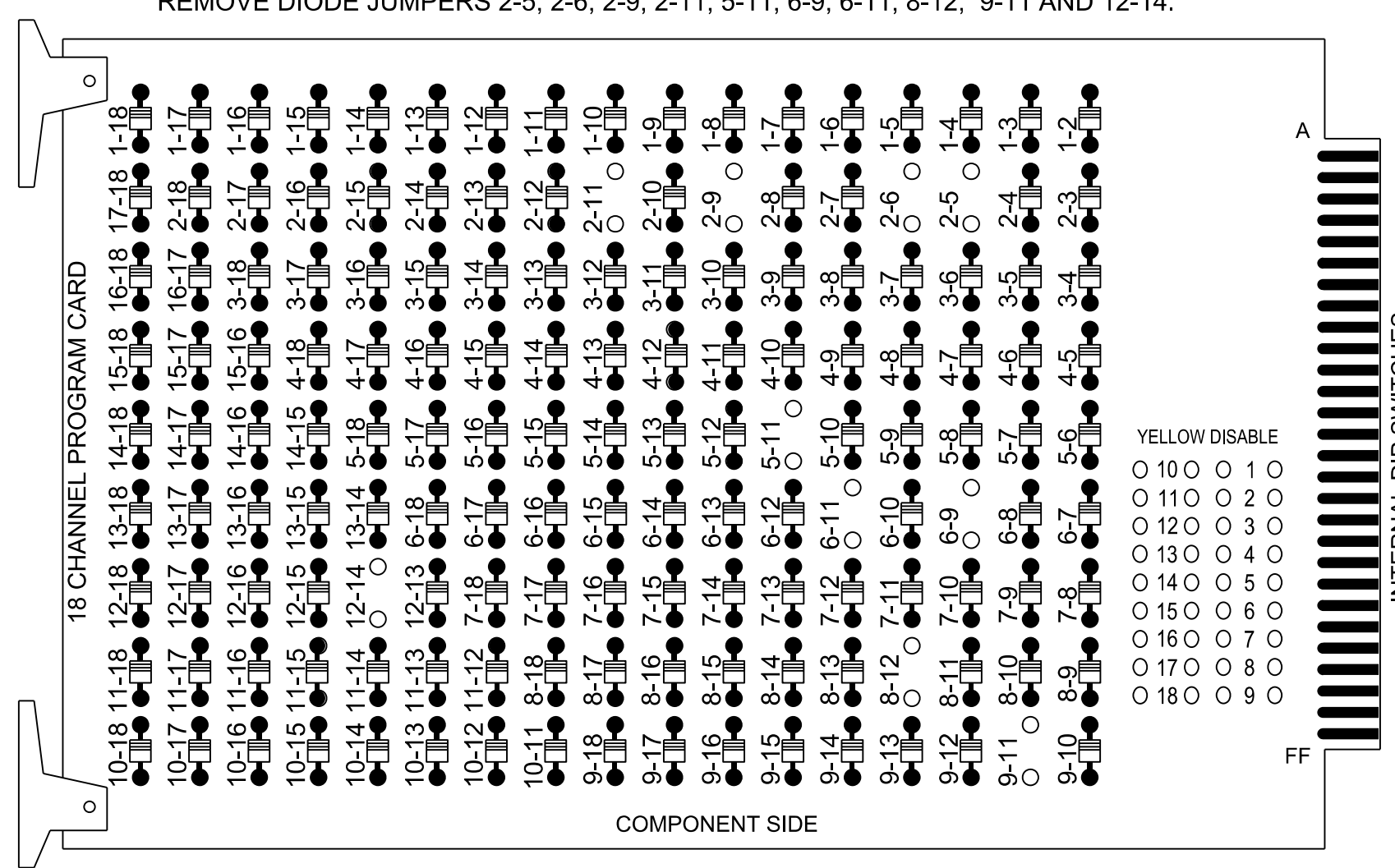


12/5/2023 10:54:00 AM \\pww-bentl\ey-com\AECOM\DS21_NA_2020\Documents\60646756-1-2513\AA\100-CAD_6154910-CAD\70_NCDOT_TIP\45_ignals\00sig_ign\AA_AB\13046872.sig_dgn-20231205.dgn T:\dms1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

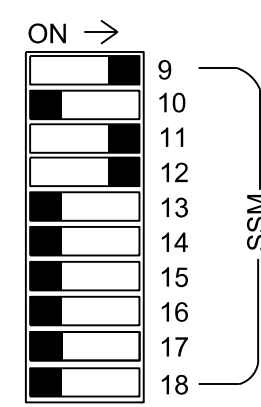
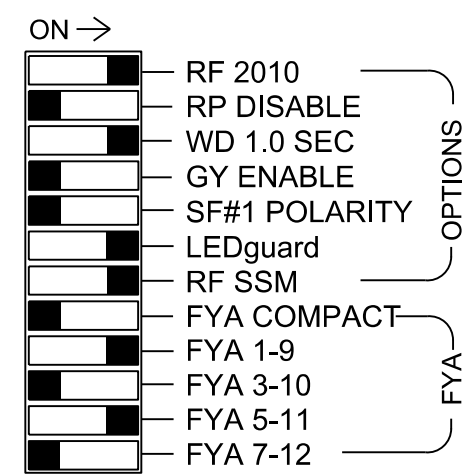
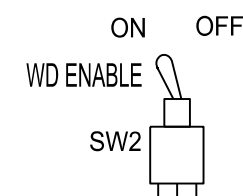
REMOVE DIODE JUMPERS 2-5, 2-6, 2-9, 2-11, 5-11, 6-9, 6-11, 8-12, 9-11 AND 12-14.



REMOVE JUMPERS AS SHOWN

NOTES:

- Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
- Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
- Ensure that the Red Enable is active at all times during normal operation.
- Integrate monitor with Ethernet network in cabinet.



■ = DENOTES POSITION OF SWITCH

NOTES

- To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the signal plan.
- Program phases 4 and 8 for Dual Entry.
- Program controller to start up in phase 2 Green No Walk and 6 Green No Walk.
- The cabinet and controller are part of the Asheville Signal System.

EQUIPMENT INFORMATION

Controller.....2070LX
 Cabinet.....332 w/ Aux
 Software.....Q-Free MAXTIME
 Cabinet Mount.....Base
 Output File Positions.....18 With Aux. Output File
 Load Switches Used.....S2, S6, S7, S8, S11, AUX S1, AUX S4, AUX S5
 Phases Used.....2, 4#, 4PED, 5, 6, 8
 Overlap "1".....*
 Overlap "2".....NOT USED
 Overlap "3".....*
 Overlap "4".....*

* See overlap programming detail on sheet 2
 # Phase used for timing purposes only.

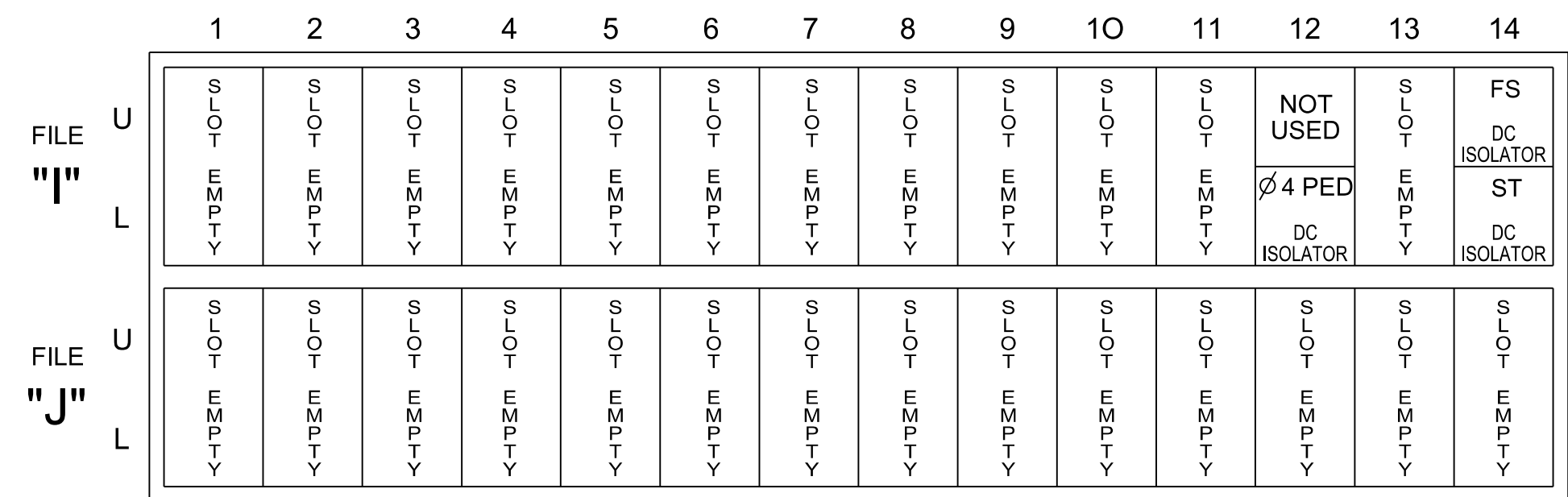
SIGNAL HEAD HOOK-UP CHART

| LOAD SWITCH NO. | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 | S12 | AUX S1 | AUX S2 | AUX S3 | AUX S4 | AUX S5 | AUX S6 | |
|-----------------------|----|-----|-------|----|----|----------|-----|----|-------|-----|-----|-------|--------|--------|--------|--------|--------|--------|-----------|
| CMU CHANNEL NO. | 1 | 2 | 13 | 3 | 4 | 14 | 5 | 6 | 15 | 7 | 8 | 16 | 9 | 10 | 17 | 11 | 12 | 18 | |
| 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. | NU | 21 | 22 | NU | NU | P41, P42 | *** | 51 | 61,62 | NU | 81 | 82 | 83,86 | NU | 63 | NU | 51 | 84,85 | NU |
| RED | | 128 | 128 | | | | | | 134 | | | 107 | 107 | A121 | | | | | A101 |
| YELLOW | | 129 | 129 | | | | | * | 135 | | | 108 | 108 | | | | | | |
| GREEN | | 130 | | | | | | | 136 | | | 109 | 109 | | | | | | |
| RED ARROW | | | | | | | | | | | 107 | | | | | | | | A114 |
| YELLOW ARROW | | | | | | | | | | | 108 | | | A122 | | | | | A115 A102 |
| FLASHING YELLOW ARROW | | | | | | | | | | | | | | A123 | | | | | A116 |
| GREEN ARROW | | 130 | | | | | | | 133 | | | 109 | 109 | | | | | | A103 |
| PED YELLOW | | | | | | | | | 104 | | | | | | | | | | |
| PED | | | | | | | | | 105 | | | | | | | | | | |
| PED | | | | | | | | | 106 | | | | | | | | | | |

NC = Not Connected
 NU = Not Used
 * Denotes install load resistor. See load resistor installation detail this sheet.
 * See pictorial of head wiring in detail this sheet.
 *** See Blankout Sign Notes on Sheet 2.

INPUT FILE POSITION LAYOUT

(front view)



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

FS = FLASH SENSE
 ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

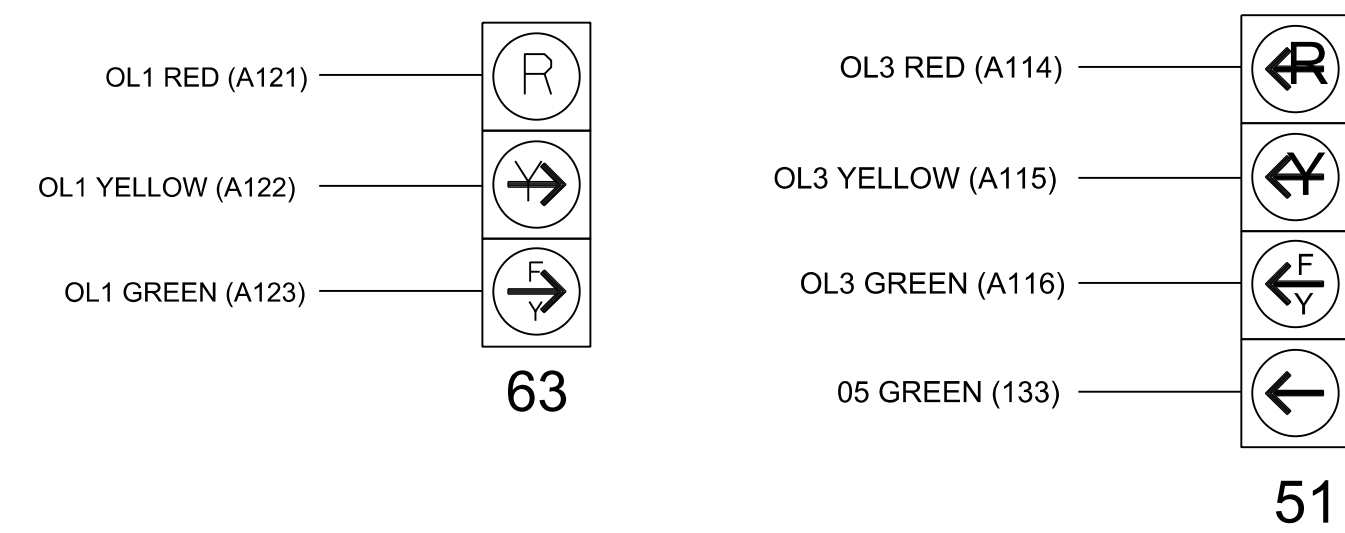
| LOOP NO. | LOOP TERMINAL | INPUT FILE POS. | PIN NO. | INPUT POINT | DETECTOR NO. | CALL PHASE | DELAY TIME | EXTEND TIME | EXTEND | ADDED INITIAL | CALL | DELAY DURING GREEN |
|------------------|---------------|-----------------|---------|-------------|--------------|------------|------------|-------------|--------|---------------|------|--------------------|
| PED PUSH BUTTONS | | | | | | | | | | | | |
| P41,P42 | TB8-5,6 | I12L | 69 | 35 | 4 | PED 4 | | | | | | |

NOTE: INSTALL DC ISOLATORS IN INPUT FILE SLOT I12.

INPUT FILE POSITION LEGEND: J2L
 FILE J
 SLOT 2
 LOWER

FYA SIGNAL WIRING DETAIL

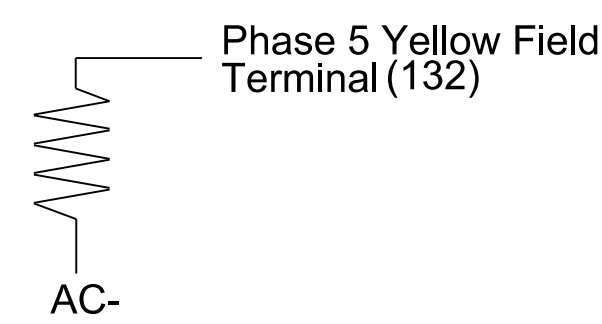
(wire signal heads as shown)



LOAD RESISTOR INSTALLATION DETAIL

(install resistor as shown)

| ACCEPTABLE VALUES | |
|-------------------|-----------|
| Value (ohms) | Wattage |
| 1.5K - 1.9K | 25W (min) |
| 2.0K - 3.0K | 10W (min) |



SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 13-0468T2
 DESIGNED: December 2023
 SEALED: 12/5/2023
 REVISED:



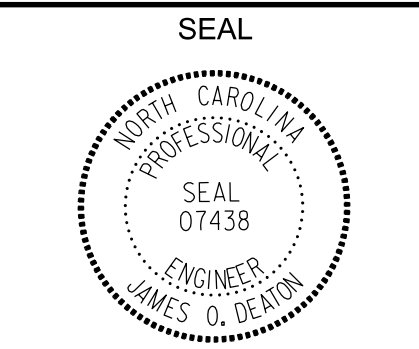
COUNTDOWN PEDESTRIAN SIGNAL OPERATION

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.

Temporary Design 2 (TMP Phases III - V)
 Electrical Detail - Sheet 1 of 2

| | | | |
|---|-------|---|--|
| Electrical and Programming Details For: | | US 19-23 (Smokey Park Highway) at I-40 WB Ramps | |
| Prepared for the Offices of: | | Division 13 Buncombe County Asheville | |
| PLAN DATE: December 2023 | | REVIEWED BY: J O Deaton | |
| PREPARED BY: M W Yalch | | REVIEWED BY: | |
| REVISIONS | INIT. | DATE | |
| DocuSigned by: James O. Deaton | | 12/5/2023 | |
| SIGNATURE | | DATE | |
| SIG. INVENTORY NO. 13-0468T2 | | | |

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



OVERLAP PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >Overlap >Overlap Parameters/Overlap Timings

Web Interface
Home >Controller >Overlap Configuration >Overlaps
Overlap Plan 1

| Overlap | 1 | 2 | 3 | 4 |
|-------------------|-----------------|-----|-----------------|--------|
| Type | FYA 4 - Section | Off | FYA 4 - Section | Normal |
| Included Phases | 6 | - | 6 | 4,8 |
| Modifier Phases | - | - | 5 | - |
| Modifier Overlaps | - | - | - | - |
| Trail Green | 0 | 0 | 0 | 0 |
| Trail Yellow | 0.0 | 0.0 | 0.0 | 0.0 |
| Trail Red | 0.0 | 0.0 | 0.0 | 0.0 |

FLASHER CIRCUIT MODIFICATION DETAIL

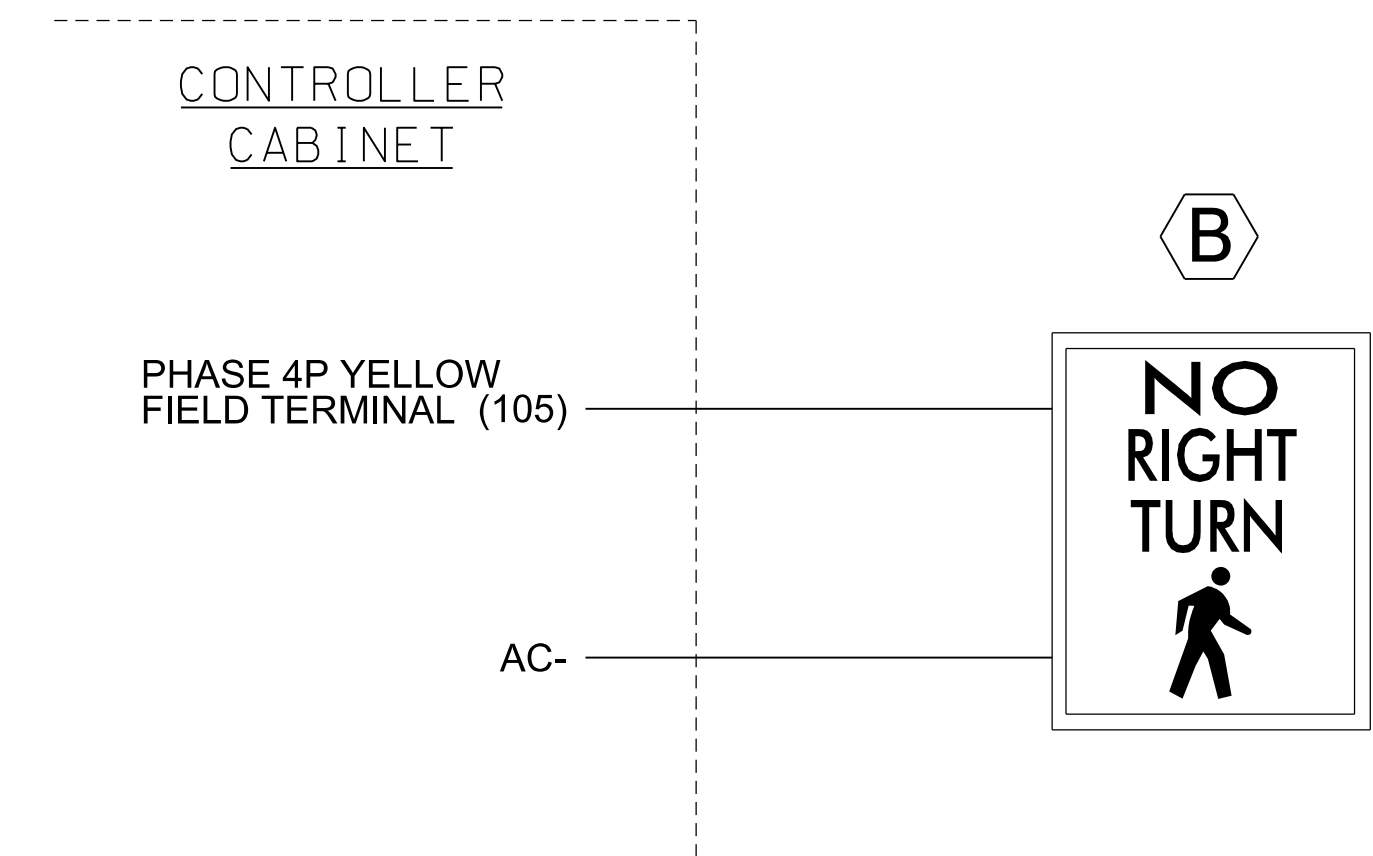
IN ORDER TO ENSURE THAT SIGNALS FLASH CONCURRENTLY ON THE SAME APPROACH, MAKE THE FOLLOWING FLASHER CIRCUIT CHANGES:

1. ON REAR OF PDA - REMOVE WIRE FROM TERM. T2-4 AND TERMINATE ON T2-2.
2. ON REAR OF PDA - REMOVE WIRE FROM TERM. T2-5 AND TERMINATE ON T2-3.
3. REMOVE FLASHER UNIT 2.

THE CHANGES LISTED ABOVE TIES ALL PHASES AND OVERLAPS TO FLASHER UNIT 1.

BLANKOUT SIGN (B) WIRING DETAIL

(wire sign as shown)



NOTE: IF FIELD TERMINAL 105 HAS A CONFLICT MONITOR WIRE CONNECTED, REMOVE, TAPE, AND LABEL WIRE.

OUTPUT POINTS PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >More >Advanced IO >Output Points

Web Interface
Home >Controller >Advanced IO >Cabinet Configuration >Output Points

IO Module 1

| Output Point | Description | Output Control Type | Index |
|--------------|-------------|---------------------|-------|
| 35 | C1-37 | Global Variable | 35 |

LOGIC PROCESSOR PROGRAMMING

Front Panel
Main Menu >Controller >More >User Programs >Definition

Web Interface
Home >Controller >User Programs Configuration >User Programs Definition

Program 1

| Statement | Result | Index | Operation | Parameter A | Index | Parameter B | Index | Delay | Ext |
|-----------|-----------------|-------|---------------|-------------|-------|---------------------|-------|-------|-----|
| 1 | Global Variable | 35 | Result=(AorB) | Phase Walk | 4 | Phase Ped Clearance | 4 | 0.0 | 0.0 |

LOGIC STATEMENT DESCRIPTION

Statement 1 Description: Illuminate Blankout Sign (B) at beginning of Phase 4 WALK to the end of Phase 4 DON'T WALK.

SEQUENCE DETAIL

Front Panel
Main Menu >Controller >Sequence & Phs Config>Sequences

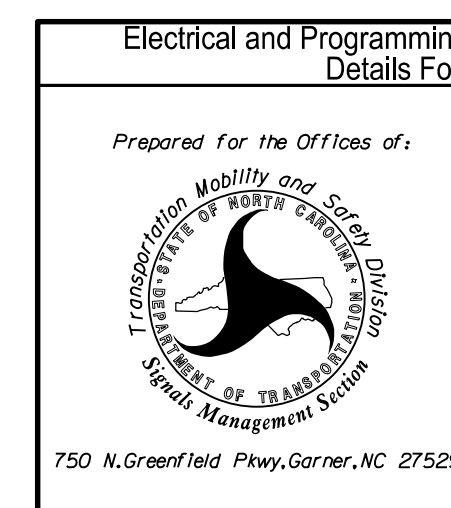
Web Interface
Home >Controller >Sequence

Sequence 1

| Ring | Sequence Data |
|------|---------------|
| 1 | 2,a,4,8,b |
| 2 | 5,6,a,b |

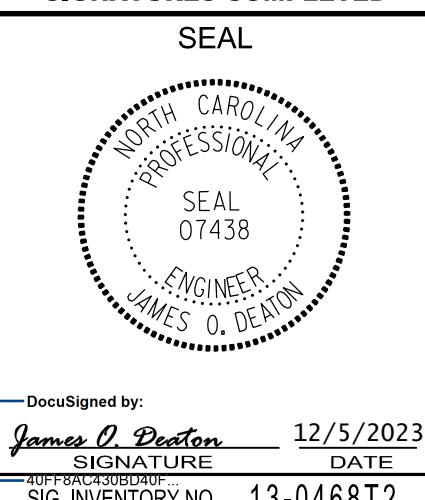
THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 13-0468T2
DESIGNED: December 2023
SEALED: 12/5/2023
REVISED:

Temporary Design 2 (TMP Phases III - V)
Electrical Detail - Sheet 2 of 2



| | | | |
|---|-------------------------|---|--------------|
| Electrical and Programming Details For: | | US 19-23 (Smokey Park Highway) at I-40 WB Ramps | |
| Prepared for the Offices of: | Division 13 | Buncombe County | Asheville |
| PLAN DATE: December 2023 | REVIEWED BY: J O Deaton | PREPARED BY: M W Yalch | REVIEWED BY: |
| REVISIONS | | INIT. | DATE |
| | | | |
| | | | |

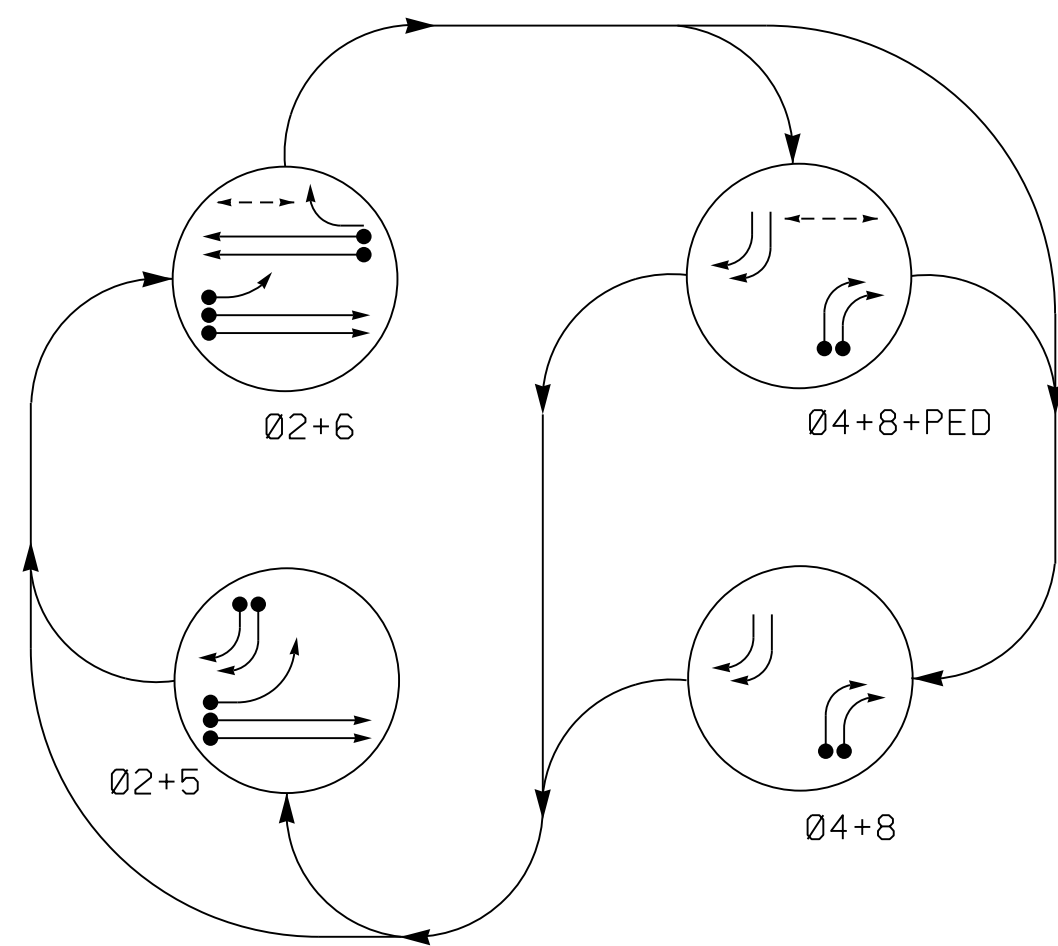
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



DocuSigned by: James O. Deaton
SIGNATURE DATE 12/5/2023
SIG. INVENTORY NO. 13-0468T2

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PHASING DIAGRAM

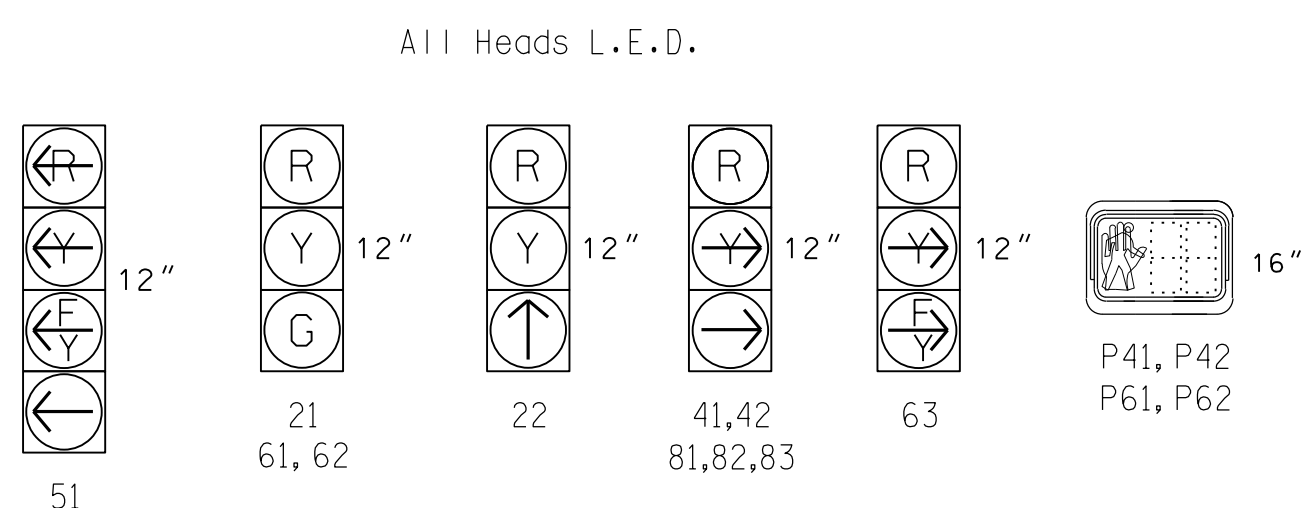


PHASING DIAGRAM DETECTION LEGEND

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

TABLE OF OPERATION table with columns for SIGNAL FACE, PHASE, and signal status (G, R, Y, etc.) for various signal faces (21, 22, 41, 42, 51, 61, 62, 63, etc.).

SIGNAL FACE I.D.

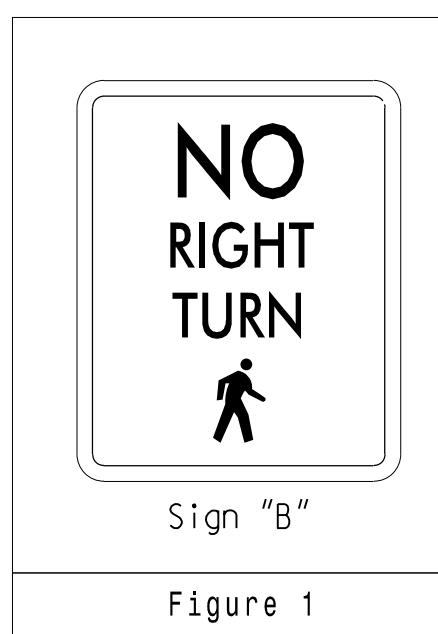
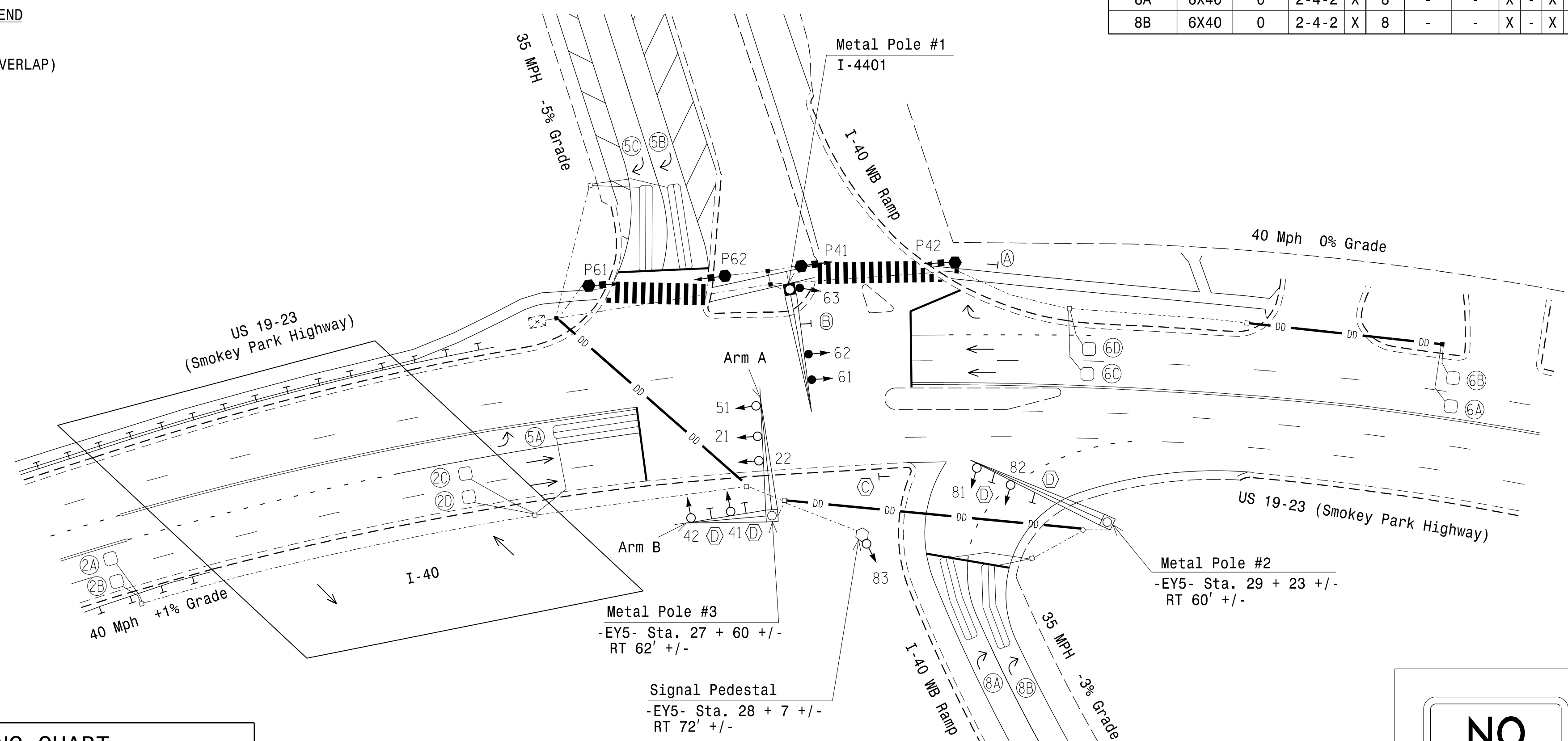


MAXTIME DETECTOR INSTALLATION CHART table with columns for DETECTOR (LOOP, SIZE, DISTANCE) and PROGRAMMING (CALL PHASE, DELAY TIME, EXTEND TIME, etc.).

4 Phase Fully Actuated (Asheville Signal System)

NOTES

- 1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024...
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Reconnect and unbag signal head P61 and P62.
4. Phase 5 may be lagged.
5. Set all detector units to presence mode.
6. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
7. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
8. Pavement markings are existing.
9. Repaint stop lines and crosswalks.
10. Install pavement markings to designate lane separations for WB Off Ramps.
11. Maximum times shown in timing chart are for free-run operation only.



LEGEND

Legend table defining symbols for PROPOSED (Traffic Signal Head, Modified Signal Head, etc.) and EXISTING (Traffic Signal Head, Modified Signal Head, etc.) components.

MAXTIME TIMING CHART table with columns for FEATURE, PHASE, and timing values (Walk, Ped Clear, Min Green, etc.) for phases 2, 4, 5, 6, and 8.

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

Signal Upgrade - Final Design

AECOM logo and contact information: NC Firm License No.: F-0342, 5438 Wade Park Boulevard, Suite 200 Raleigh, NC 27607, Phone: 919-461-1100

Professional Engineer seal for RACHELLE GARRETT, License No. 026679, State of North Carolina. Includes a scale bar (1 inch = 40 feet) and a north arrow.

Project information box: US 19-23 (Smokey Park Highway) at I-40 WB Ramps, Division 13, Buncombe County, Asheville. Includes plan date (December 2023), reviewed by (R. Garrett), prepared by (M. Tindal), and a revision table.

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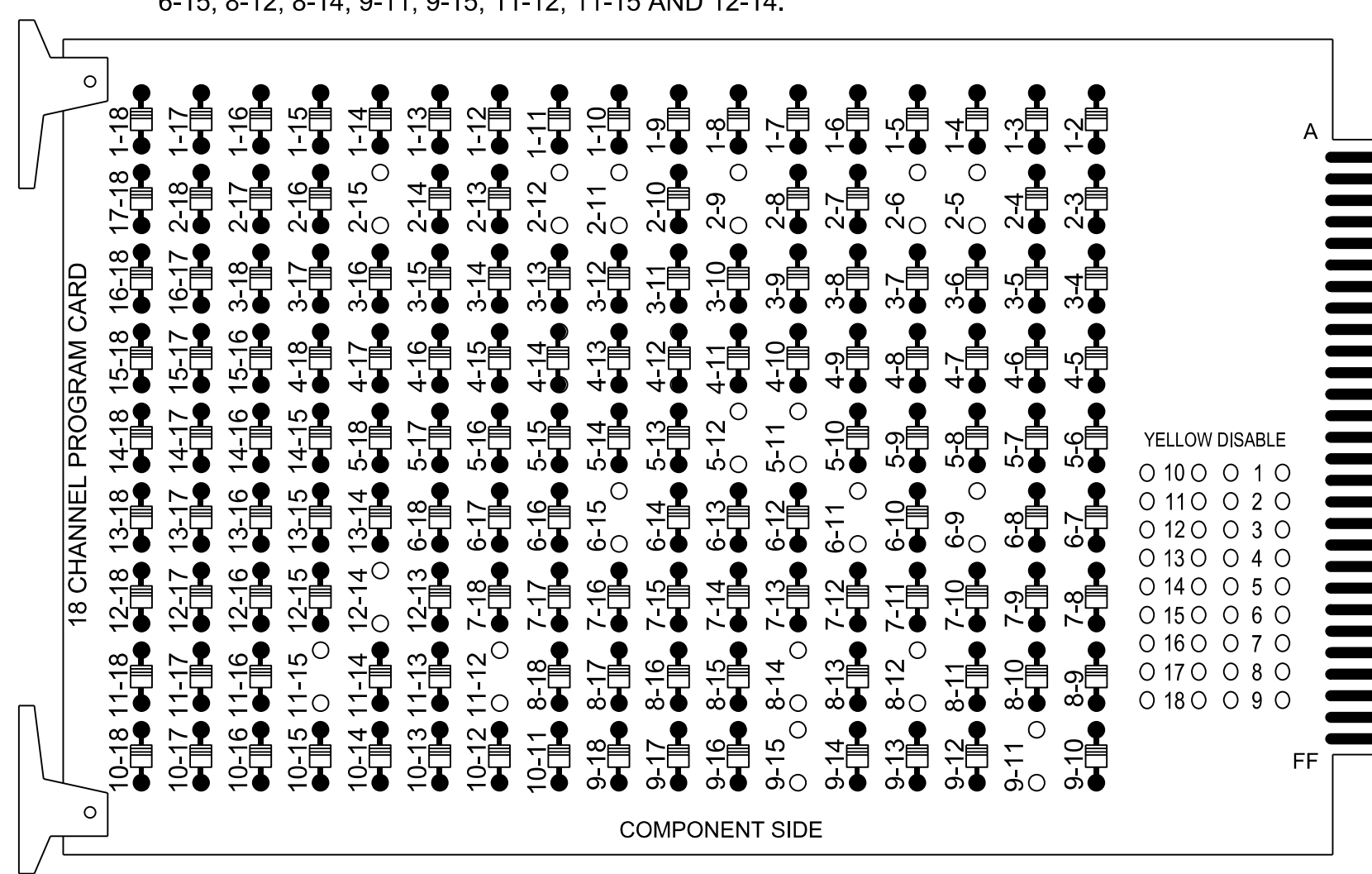
Professional Engineer seal for RACHELLE GARRETT, License No. 026679, State of North Carolina, with a signature line.

Vertical text on the left side of the page: 12/15/2023, DW: aecocom-pw-bentley.com, AECOM, DSD1_NA_20200, documents, 60646756-1-251, 3A400-CAD, 6154910-CAD, 70, NCDOT, TTP, ignal, s, n05, ign, ab, 30468, s, g, defn, 20231205, dgn, Tindal, M.

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

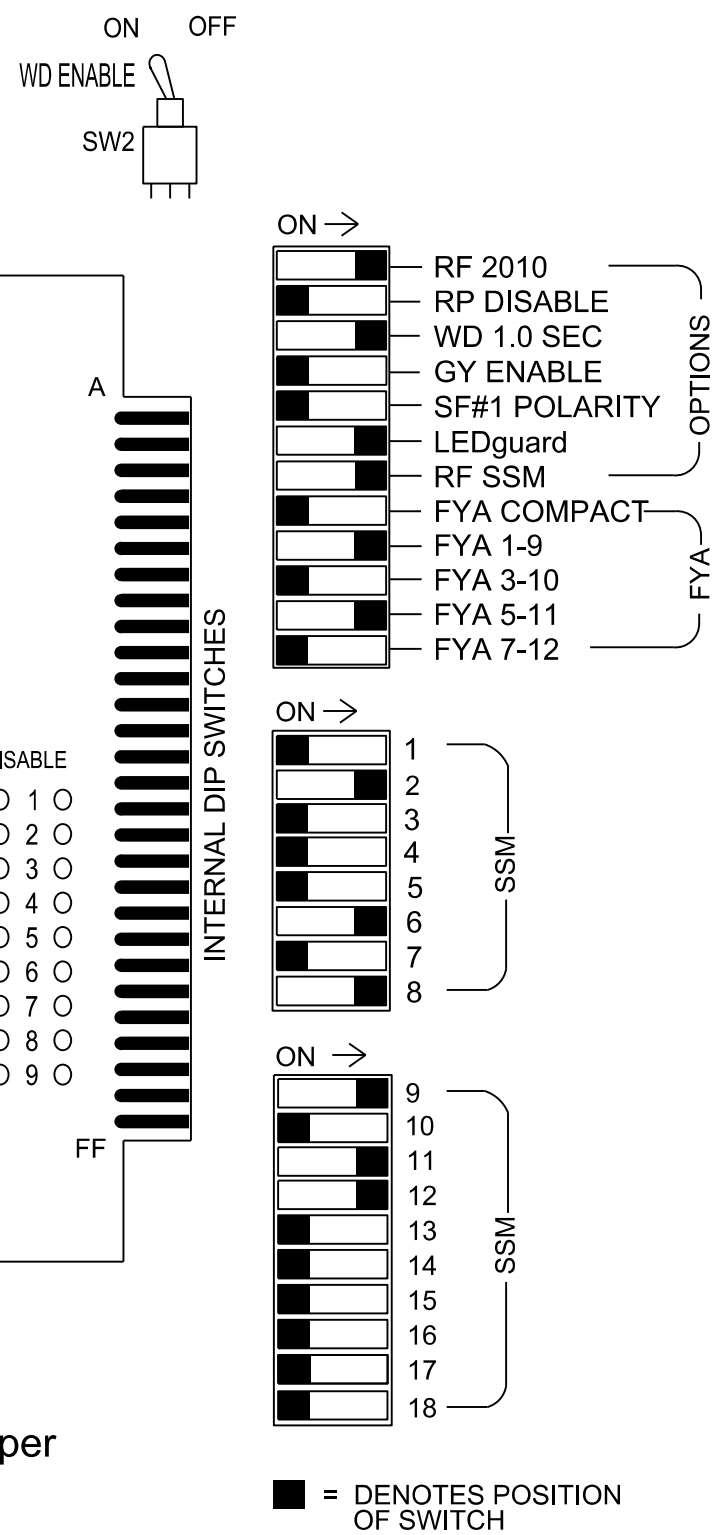
REMOVE DIODE JUMPERS 2-5, 2-6, 2-9, 2-11, 2-12, 2-15, 5-11, 5-12, 6-9, 6-11, 6-15, 8-12, 8-14, 9-11, 9-15, 11-12, 11-15 AND 12-14.



REMOVE JUMPERS AS SHOWN

NOTES:

- Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
- Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
- Ensure that the Red Enable is active at all times during normal operation.
- Integrate monitor with Ethernet network in cabinet.



NOTES

- To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the signal plan.
- Program phases 4 and 8 for Dual Entry.
- Program controller to start up in phase 2 Green No Walk and 6 Green Walk.
- The cabinet and controller are part of the Asheville Signal System.

EQUIPMENT INFORMATION

Controller.....2070LX
 Cabinet.....332 w/ Aux
 Software.....Q-Free MAXTIME
 Cabinet Mount.....Base
 Output File Positions.....18 With Aux. Output File
 Load Switches Used.....S2, S6, S7, S8, S9, S11, AUX S1, AUX S4, AUX S5
 Phases Used.....2, 4#, 4PED, 5, 6, 6PED, 8
 Overlap "1".....*
 Overlap "2".....NOT USED
 Overlap "3".....*
 Overlap "4".....*

*See overlap programming detail on sheet 2
 #Phase used for timing only.

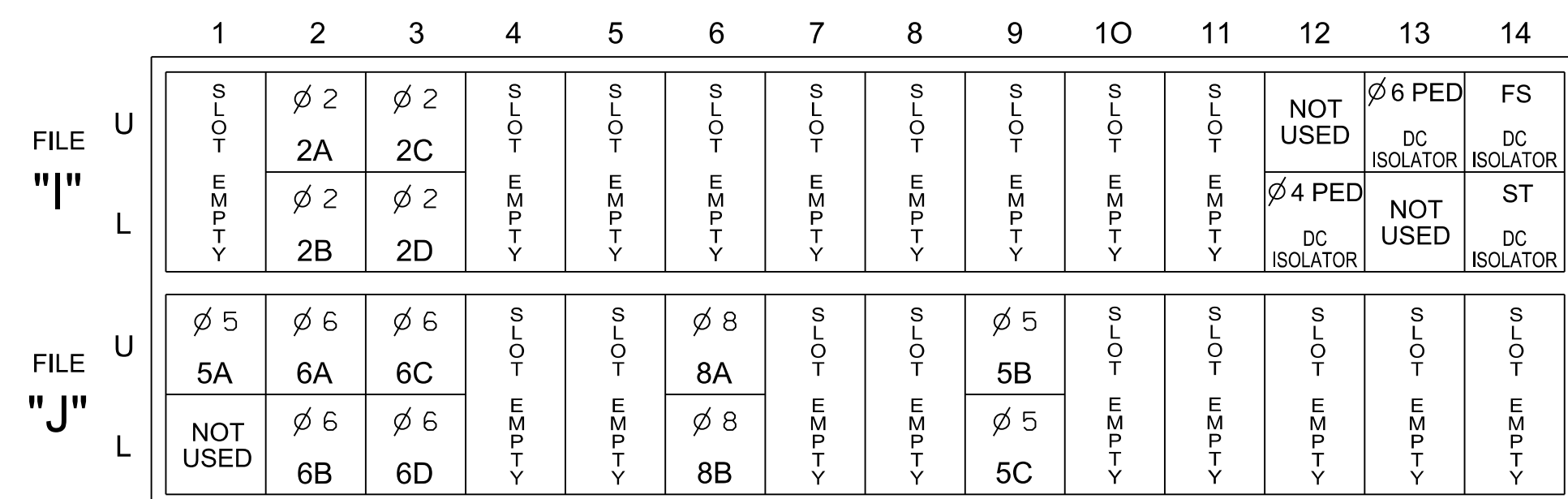
SIGNAL HEAD HOOK-UP CHART

| LOAD SWITCH NO. | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 | S12 | AUX S1 | AUX S2 | AUX S3 | AUX S4 | AUX S5 | AUX S6 |
|-----------------------|----|-----|-------|----|----|-------|----------|-----|-------|-------|----------|-------|----------|--------|--------|--------|--------|------------|
| CMU CHANNEL NO. | 1 | 2 | 13 | 3 | 4 | 14 | 5 | 6 | 15 | 7 | 8 | 16 | 9 | 10 | 17 | 11 | 12 | 18 |
| 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. | NU | 21 | 22 | NU | NU | NC | P41, P42 | *** | 51* | 61,62 | P61, P62 | NU | 81,82,83 | 63* | NU | NU | 51* | 41,42 |
| RED | | 128 | 128 | | | | | | | | | | | | | | | A101 |
| YELLOW | | 129 | 129 | | | | | * | | | | | | | | | | |
| GREEN | | 130 | | | | | | | | | | | | | | | | |
| RED ARROW | | | | | | | | | | | | | | | | | | A114 |
| YELLOW ARROW | | | | | | | | | | | | 108 | A122 | | | | | A115, A102 |
| FLASHING YELLOW ARROW | | | | | | | | | | | | | A123 | | | | | A116 |
| GREEN ARROW | | | 130 | | | | | 133 | | | 109 | | | | | | | A103 |
| PED | | | | | | | | | | | | | | | | | | |
| YELLOW | | | | | | | | | | | | | | | | | | |
| PED YELLOW | | | | | | | | | | | | | | | | | | |
| Hand icon | | | | | | | | | | | | | | | | | | |
| Ped icon | | | | | | | | | | | | | | | | | | |

NC = Not Connected
 NU = Not Used
 * Denotes install load resistor. See load resistor installation detail this sheet.
 * See pictorial of head wiring in detail this sheet.
 *** See Blankout Sign Notes on Sheet 2.

INPUT FILE POSITION LAYOUT

(front view)



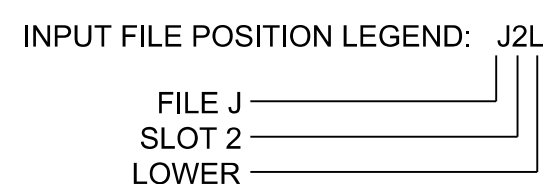
EX : 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE
 ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

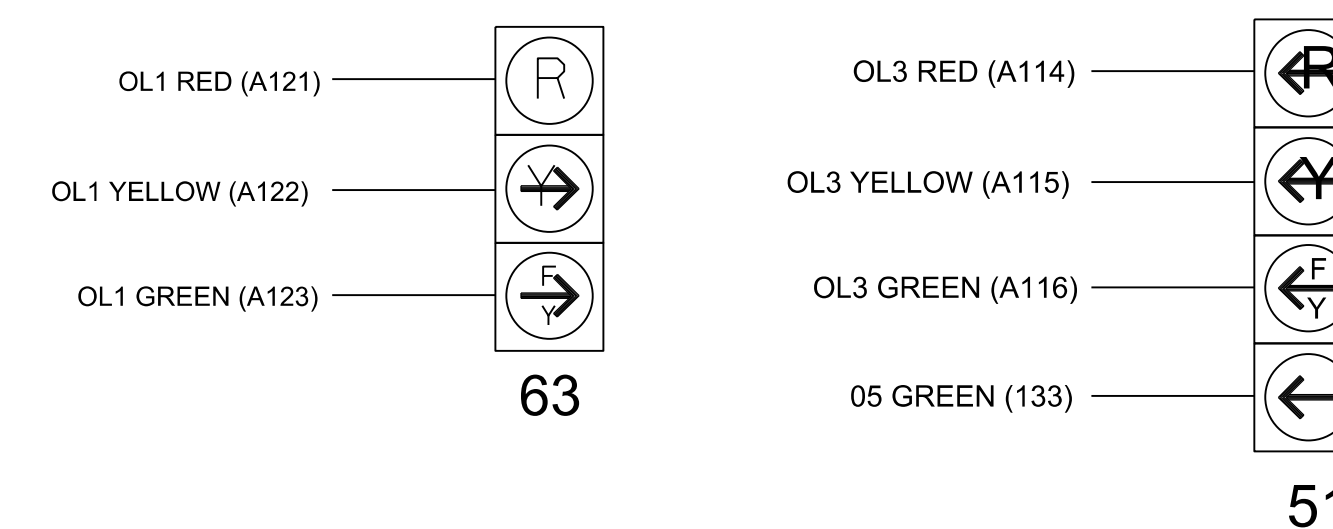
| LOOP NO. | LOOP TERMINAL | INPUT FILE POS. | PIN NO. | INPUT POINT | DETECTOR NO. | CALL PHASE | DELAY TIME | EXTEND TIME | EXTEND | ADDED INITIAL | CALL | DELAY DURING GREEN |
|------------------|---------------|-----------------|---------|-------------|--------------|------------|------------|-------------|--------|---------------|------|--------------------|
| 2A | TB2-5.6 | I2U | 39 | 1 | 2 | 2 | | 1.3 | X | | X | |
| 2B | TB2-7.8 | I2L | 43 | 5 | 3 | 2 | | 1.3 | X | | X | |
| 2C | TB2-9,10 | I3U | 63 | 29 | 4 | 2 | | | X | | X | |
| 2D | TB2-11,12 | I3L | 76 | 42 | 5 | 2 | | | X | | X | |
| 5A | TB3-1,2 | J1U | 55 | 17 | 15 | 5 | 15 | | X | | X | |
| 6A | TB3-5.6 | J2U | 40 | 2 | 16 | 6 | | 1.3 | X | | X | |
| 6B | TB3-7.8 | J2L | 44 | 6 | 17 | 6 | | 1.3 | X | | X | |
| 6C | TB3-9,10 | J3U | 64 | 30 | 18 | 6 | | | X | | X | |
| 6D | TB3-11,12 | J3L | 77 | 43 | 19 | 6 | | | X | | X | |
| 8A | TB5-9,10 | J6U | 42 | 4 | 22 | 8 | | | X | | X | |
| 8B | TB5-11,12 | J6L | 46 | 8 | 23 | 8 | | | X | | X | |
| 5B | TB7-9,10 | J9U | 59 | 21 | 27 | 5 | | | X | | X | |
| 5C | TB7-11,12 | J9L | 61 | 23 | 28 | 5 | | | X | | X | |
| PED PUSH BUTTONS | | | | | | | | | | | | |
| P41,P42 | TB8-5.6 | I12L | 69 | 35 | 4 | PED 4 | | | | | | |
| P61,P62 | TB8-7.9 | I13U | 68 | 34 | 6 | PED 6 | | | | | | |

NOTE:
 INSTALL DC ISOLATORS IN INPUT FILE SLOTS I12 AND I13.



FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)



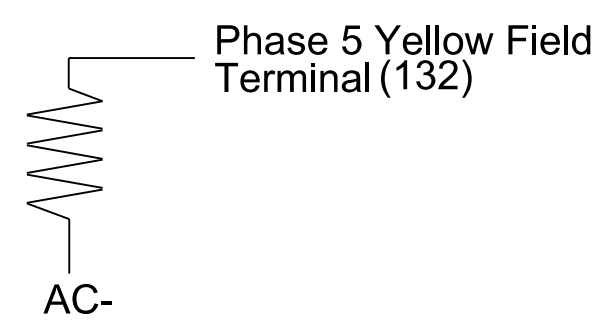
COUNTDOWN PEDESTRIAN SIGNAL OPERATION

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.

LOAD RESISTOR INSTALLATION DETAIL

(install resistor as shown)

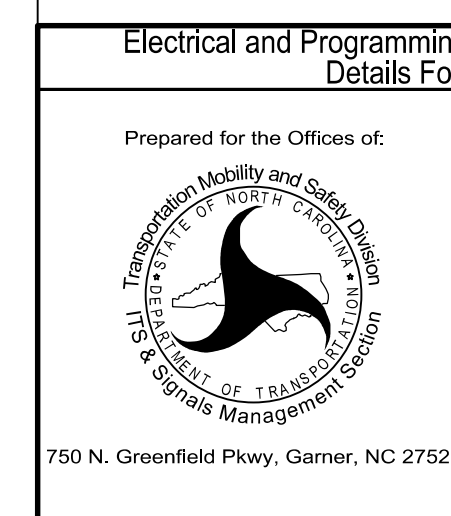
| ACCEPTABLE VALUES | |
|-------------------|-----------|
| Value (ohms) | Wattage |
| 1.5K - 1.9K | 25W (min) |
| 2.0K - 3.0K | 10W (min) |



THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 13-0468
 DESIGNED: December 2023
 SEALED: 12/5/2023
 REVISED:



Final Design
 Electrical Detail - Sheet 1 of 2



US 19-23 (Smokey Park Highway)
 at
 I-40 WB Ramps

| | | |
|--------------------------|-------------------------|-----------|
| Division 13 | Buncombe County | Asheville |
| PLAN DATE: December 2023 | REVIEWED BY: J O Deaton | |
| PREPARED BY: M W Yalch | REVIEWED BY: | |
| REVISIONS | INIT. | DATE |

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

| | |
|---|-----------|
| SEAL | |
| NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 07438 JAMES O. DEATON | |
| DocuSigned by: | 12/5/2023 |
| James O. Deaton | DATE |
| SIGNATURE | DATE |
| SIG. INVENTORY NO. | 13-0468 |

OVERLAP PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >Overlap >Overlap Parameters/Overlap Timings

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

| Overlap | 1 | 2 | 3 | 4 |
|-------------------|-----------------|-----|-----------------|--------|
| Type | FYA 4 - Section | Off | FYA 4 - Section | Normal |
| Included Phases | 6 | - | 6 | 4,5 |
| Modifier Phases | - | - | 5 | - |
| Modifier Overlaps | - | - | - | - |
| Trail Green | 0 | 0 | 0 | 0 |
| Trail Yellow | 0.0 | 0.0 | 0.0 | 0.0 |
| Trail Red | 0.0 | 0.0 | 0.0 | 0.0 |

FLASHER CIRCUIT MODIFICATION DETAIL

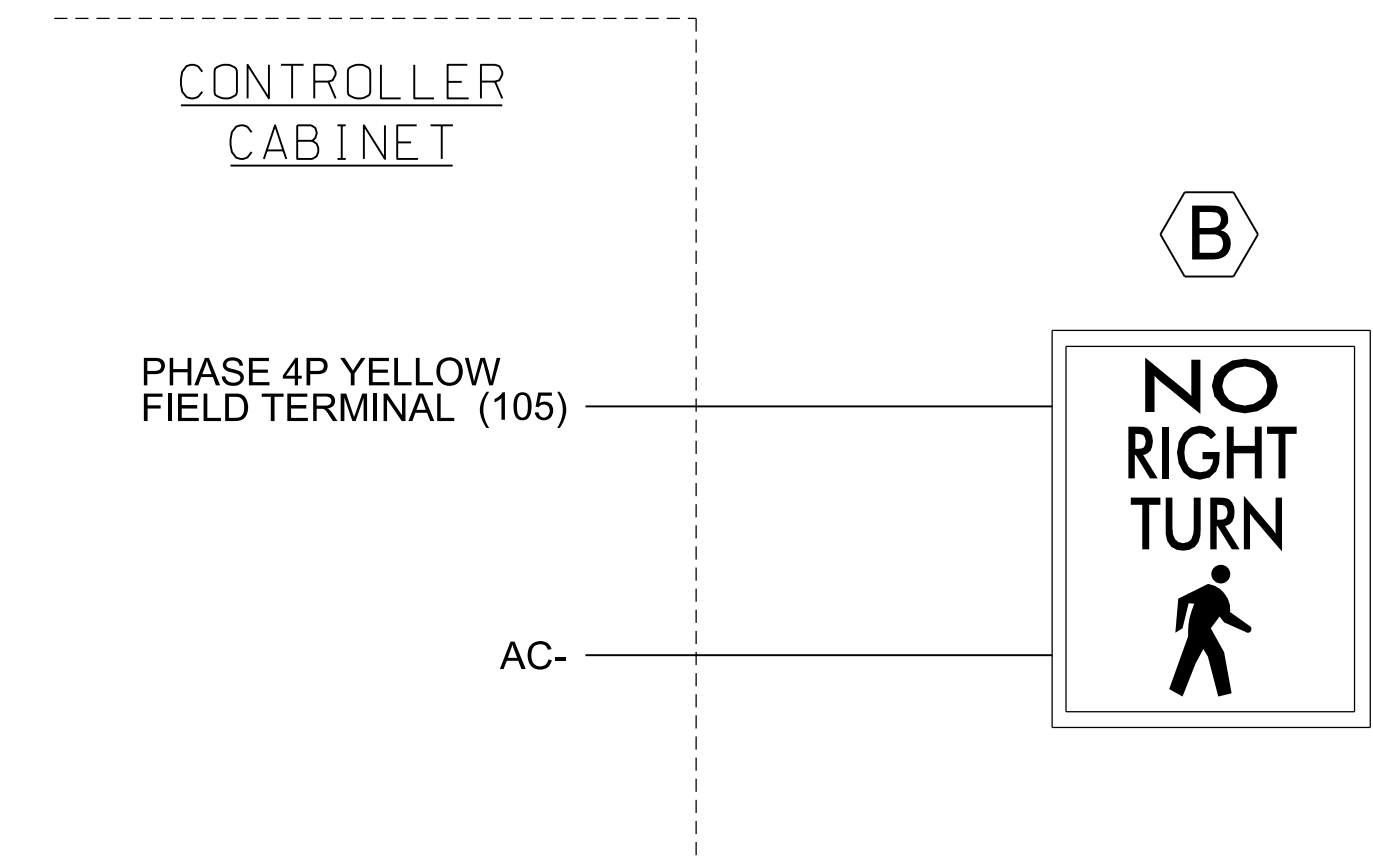
IN ORDER TO ENSURE THAT SIGNALS FLASH CONCURRENTLY ON THE SAME APPROACH, MAKE THE FOLLOWING FLASHER CIRCUIT CHANGES:

- ON REAR OF PDA - REMOVE WIRE FROM TERM. T2-4 AND TERMINATE ON T2-2.
- ON REAR OF PDA - REMOVE WIRE FROM TERM. T2-5 AND TERMINATE ON T2-3.
- REMOVE FLASHER UNIT 2.

THE CHANGES LISTED ABOVE TIES ALL PHASES AND OVERLAPS TO FLASHER UNIT 1.

BLANKOUT SIGN (B) WIRING DETAIL

(wire sign as shown)



NOTE: IF FIELD TERMINAL 105 HAS A CONFLICT MONITOR WIRE CONNECTED, REMOVE, TAPE, AND LABEL WIRE.

OUTPUT POINTS PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >More >Advanced IO >Output Points

Web Interface
Home >Controller >Advanced IO >Cabinet Configuration >Output Points

IO Module 1

| Output Point | Description | Output Control Type | Index |
|--------------|-------------|---------------------|-------|
| 35 | C1-37 | Global Variable | 35 |

LOGIC PROCESSOR PROGRAMMING

Front Panel
Main Menu >Controller >More >User Programs >Definition

Web Interface
Home >Controller >User Programs Configuration >User Programs Definition

Program 1

| Statement | Result | Index | Operation | Parameter A | Index | Parameter B | Index | Delay | Ext |
|-----------|-----------------|-------|---------------|-------------|-------|---------------------|-------|-------|-----|
| 1 | Global Variable | 35 | Result=(AorB) | Phase Walk | 4 | Phase Ped Clearance | 4 | 0.0 | 0.0 |

LOGIC STATEMENT DESCRIPTION

Statement 1 Description: Illuminate Blankout Sign (B) at beginning of Phase 4 WALK to the end of Phase 4 DON'T WALK.

SEQUENCE DETAIL

Front Panel
Main Menu >Controller >Sequence & Phs Config>Sequences

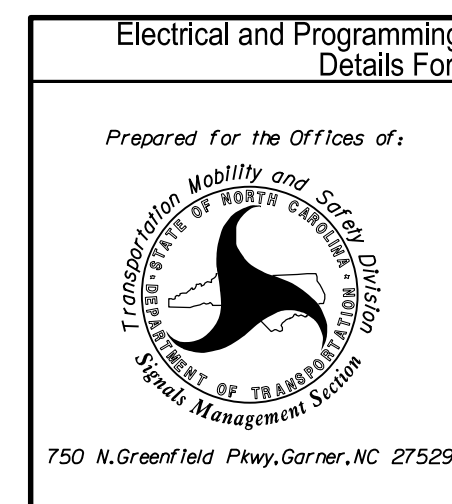
Web Interface
Home >Controller >Sequence

Sequence 1

| Ring | Sequence Data |
|------|---------------|
| 1 | 2,a,4,b |
| 2 | 5,6,a,8,b |

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 13-0468
DESIGNED: December 2023
SEALED: 12/5/2023
REVISED:

Final Design
Electrical Detail - Sheet 2 of 2



| | | |
|---|-------------------------|-----------|
| US 19-23 (Smokey Park Highway) at I-40 WB Ramps | | |
| Division 13 | Buncombe County | Asheville |
| PLAN DATE: December 2023 | REVIEWED BY: J O Deaton | |
| PREPARED BY: M W Yalch | REVIEWED BY: | |
| REVISIONS | INIT. | DATE |
| | | |

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 07438 JAMES O. DEATON

DocuSigned by: James O. Deaton 12/5/2023

SIGNATURE DATE

SIG. INVENTORY NO. 13-0468

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| MAST ARM LOADING SCHEDULE | | | | |
|---------------------------|---|----------|-------------------------|--------|
| LOADING SYMBOL | DESCRIPTION | AREA | SIZE | WEIGHT |
| | RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE | 9.3 S.F. | 25.5" W X 52.5" L | 60 LBS |
| | SIGN RIGID MOUNTED | 9.0 S.F. | 36.0" W X 36.0" L | 17 LBS |

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 2 | |
|--|----------|--|
| Baseline reference point at ☐ Foundation @ ground level | 0.0 ft. | |
| Elevation difference at High point of roadway surface | 0.85 ft. | |
| Elevation difference at Edge of travelway or face of curb | 0.93 ft. | |

NOTES

DESIGN REFERENCE MATERIAL

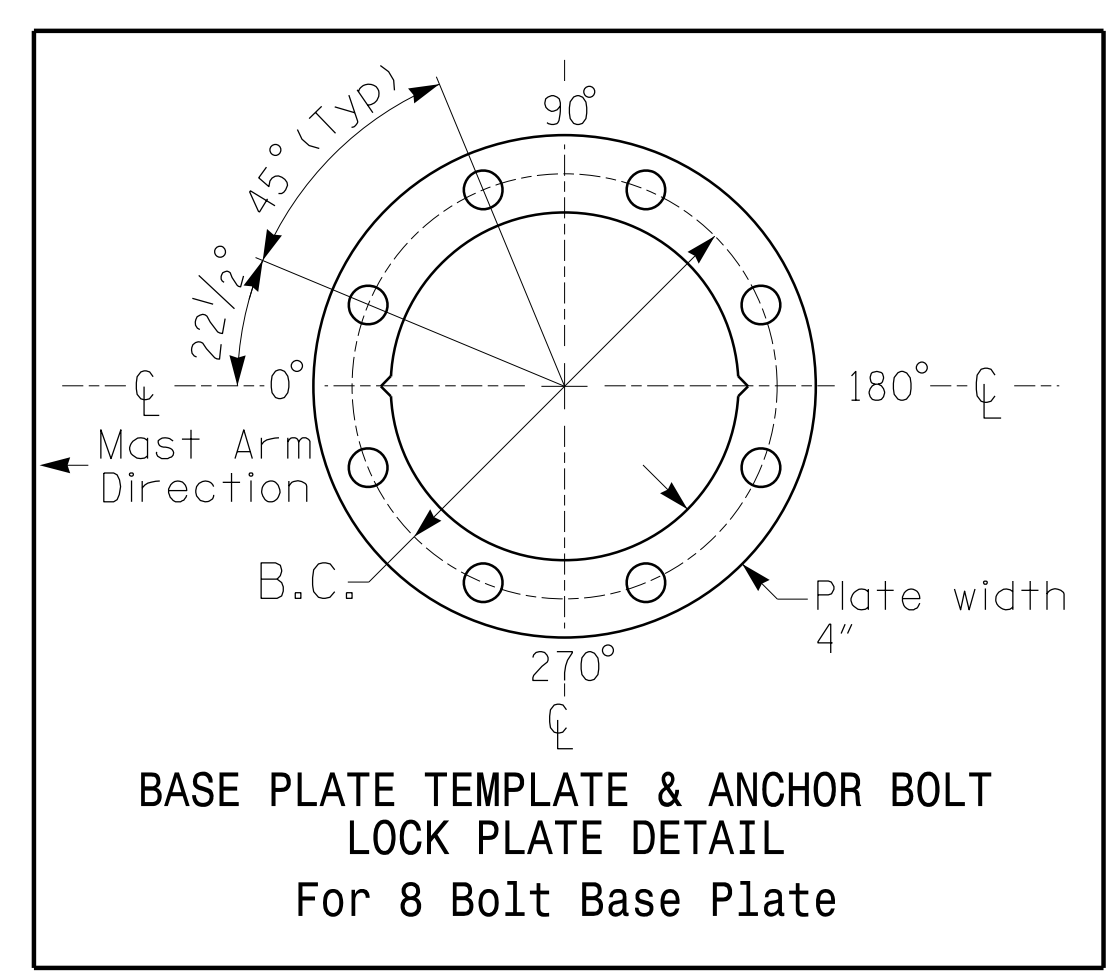
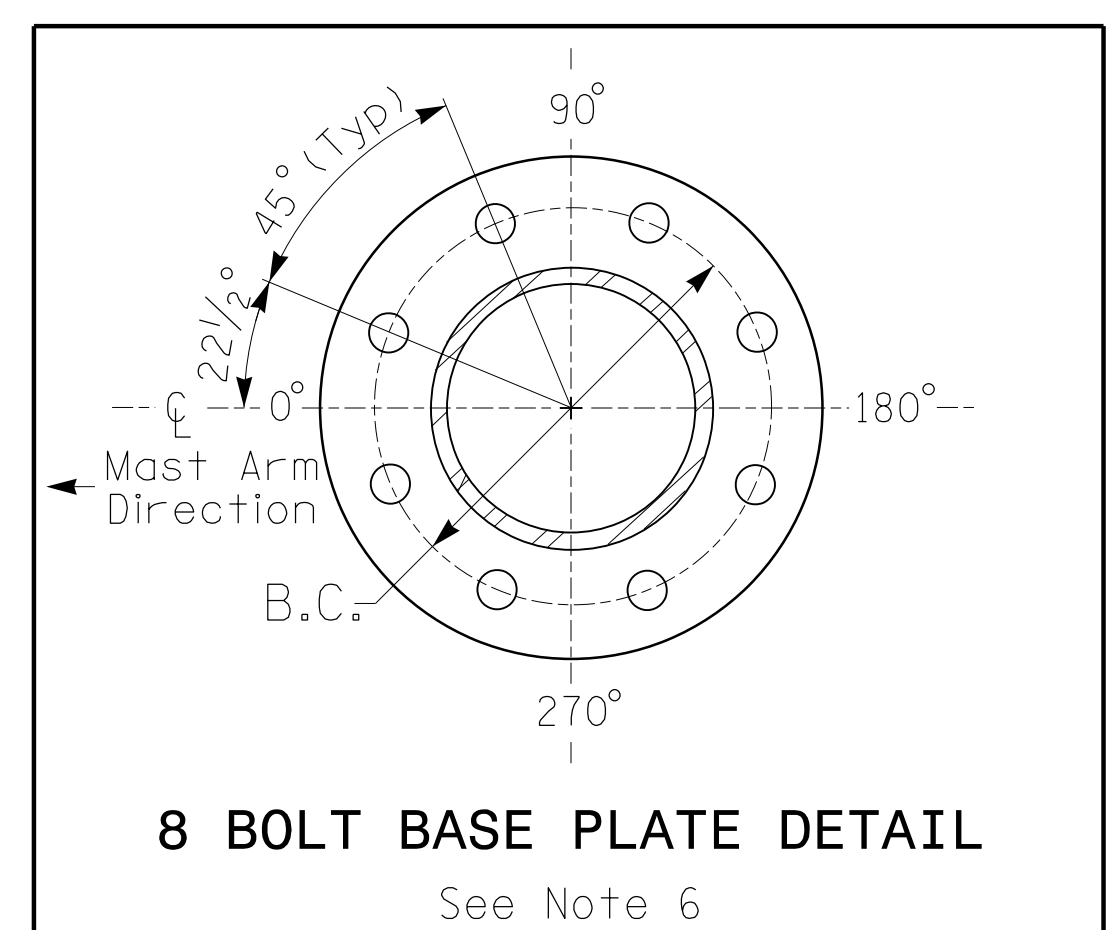
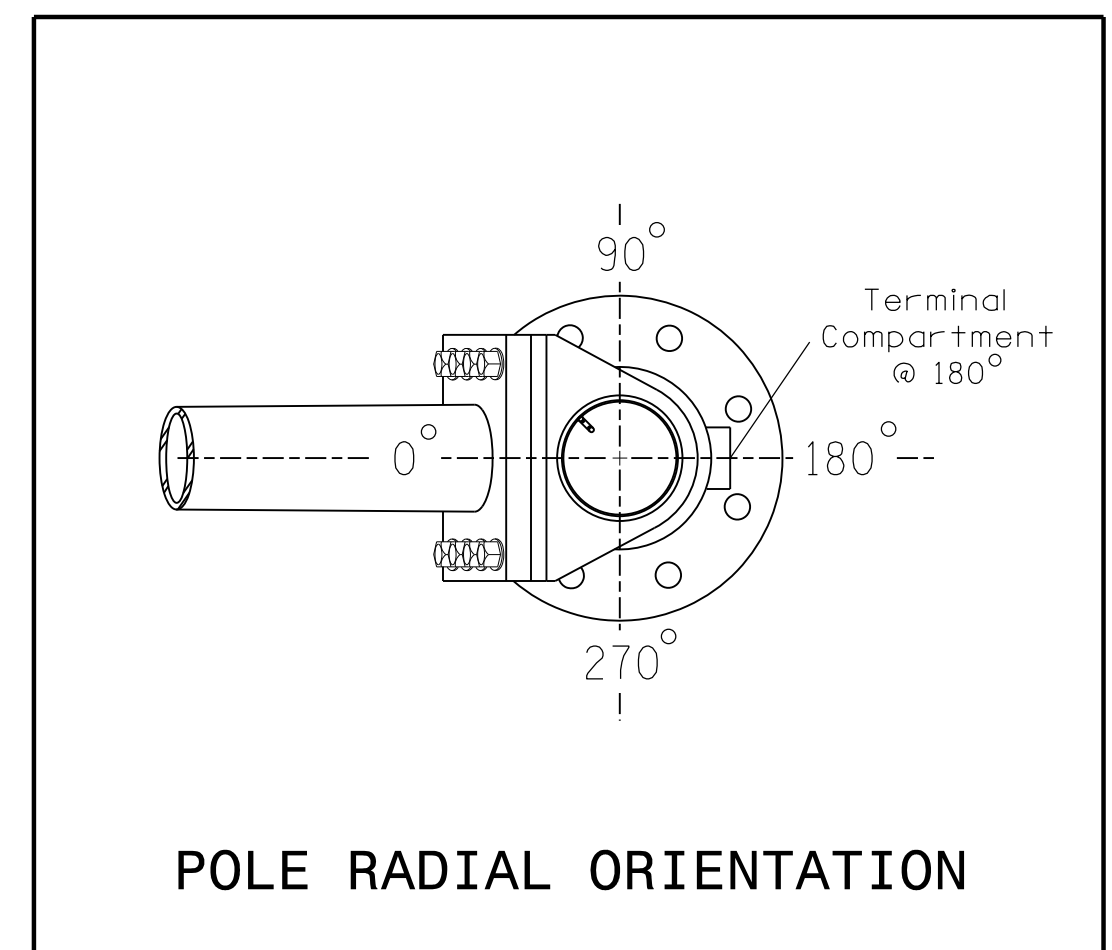
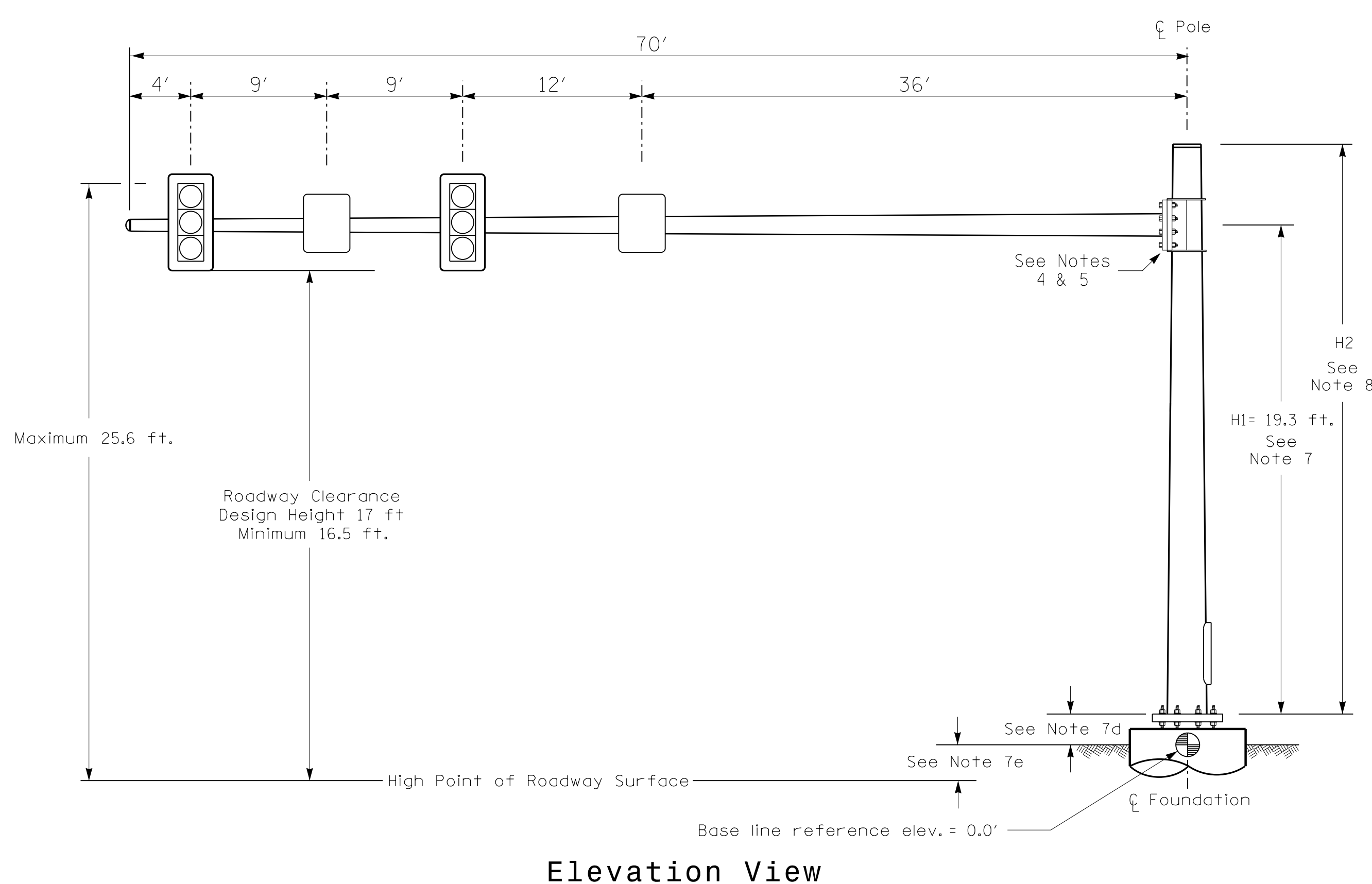
- Design the traffic signal structure and foundation in accordance with:
 - The 1st Edition 2015 AASHTO LRFD "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
 - The 2024 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
 - The 2024 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 force 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.
 - Signalheads 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 signalheads 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.

All metal poles and arms shall be black factory powder coat in color as specified in the project special provisions.

Design Loading for METAL POLE NO. 2



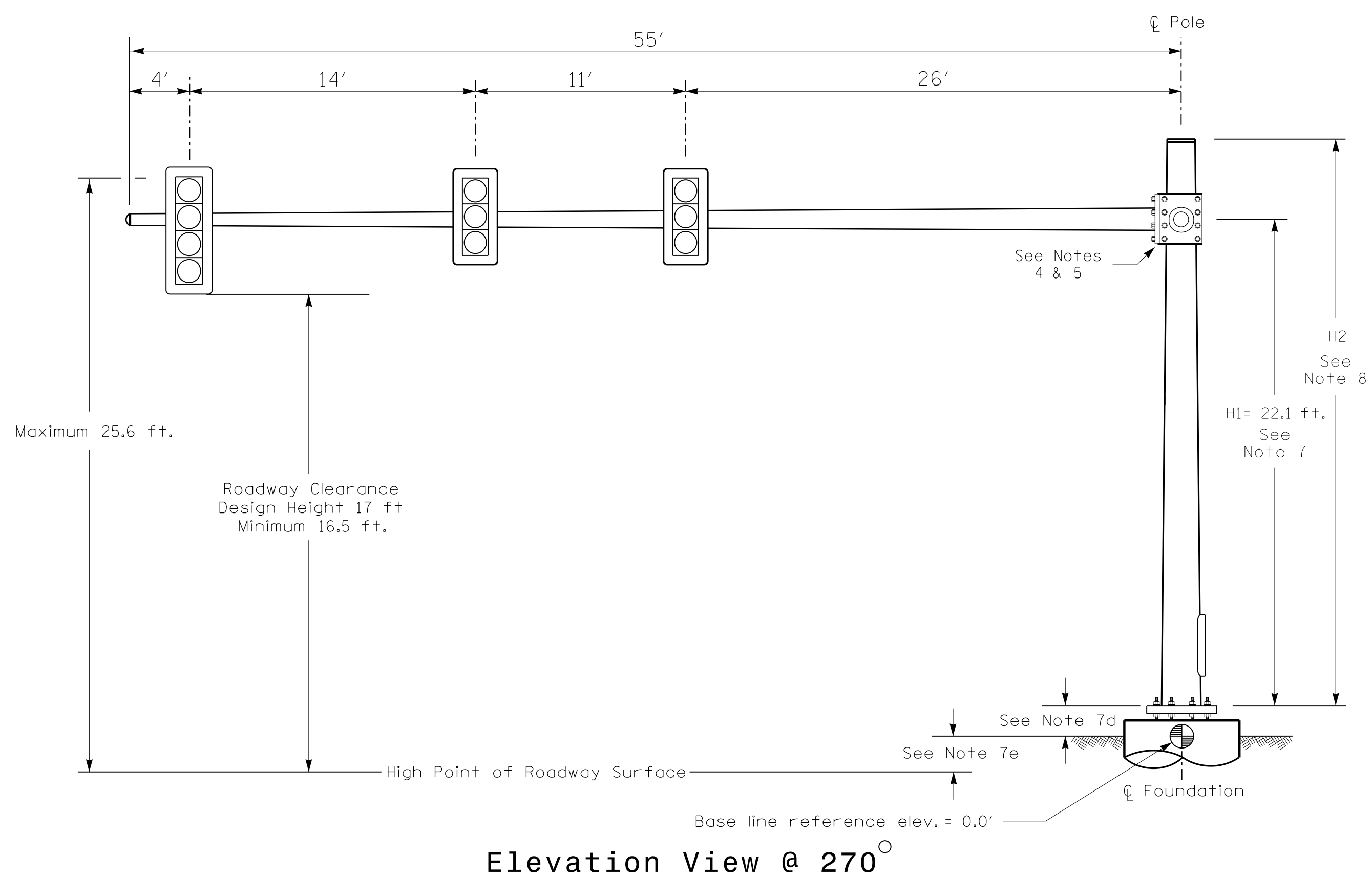
NCDOT Wind Zone 5 (110 mph)

| | | | |
|--|--|---|---|
| Prepared in the Offices of: Transportation Mobility and Safety Division STATE OF NORTH CAROLINA SIGNAL DESIGN SECTION 750 N. Greenfield Pkwy, Garner, NC 27529 | US 19-23 (Smokey Park Highway) at I-40 WB Ramps Division 13 Buncombe County Asheville | | DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED SEAL SEAL 026679 ENGINEER ROCHELLE GARRETT |
| | PLAN DATE: December 2023 PREPARED BY: M. Tindal | REVIEWED BY: R. Garrett REVIEWED BY: | |

DocuSigned by:
 Rochelle Garrett 12/5/2023
 DATE
 SIG. INVENTORY NO. 13-0468

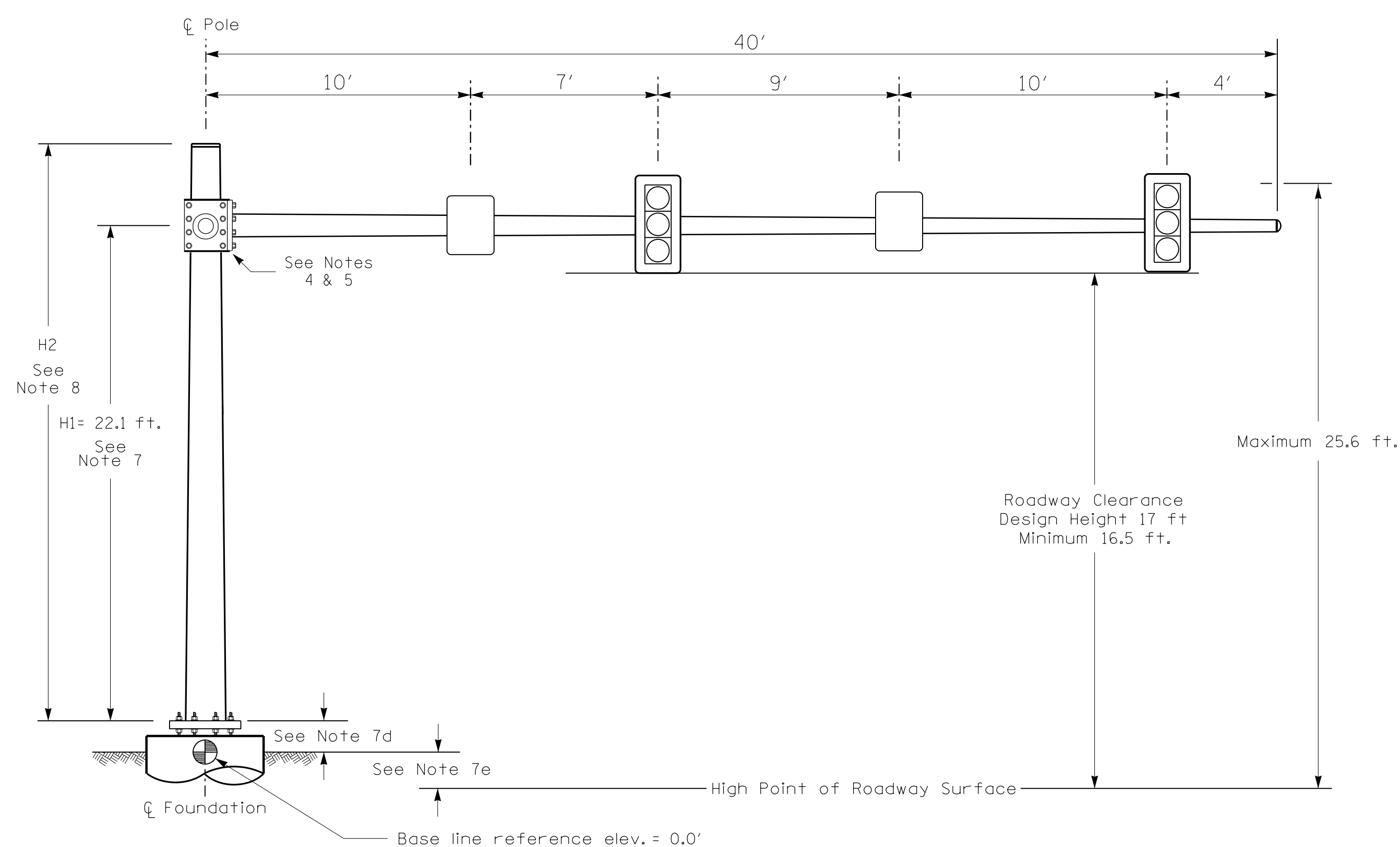
12/5/2023
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Design Loading for METAL POLE NO. 3, MAST ARM A



Elevation View @ 270°

Design Loading for METAL POLE NO. 3, MAST ARM B



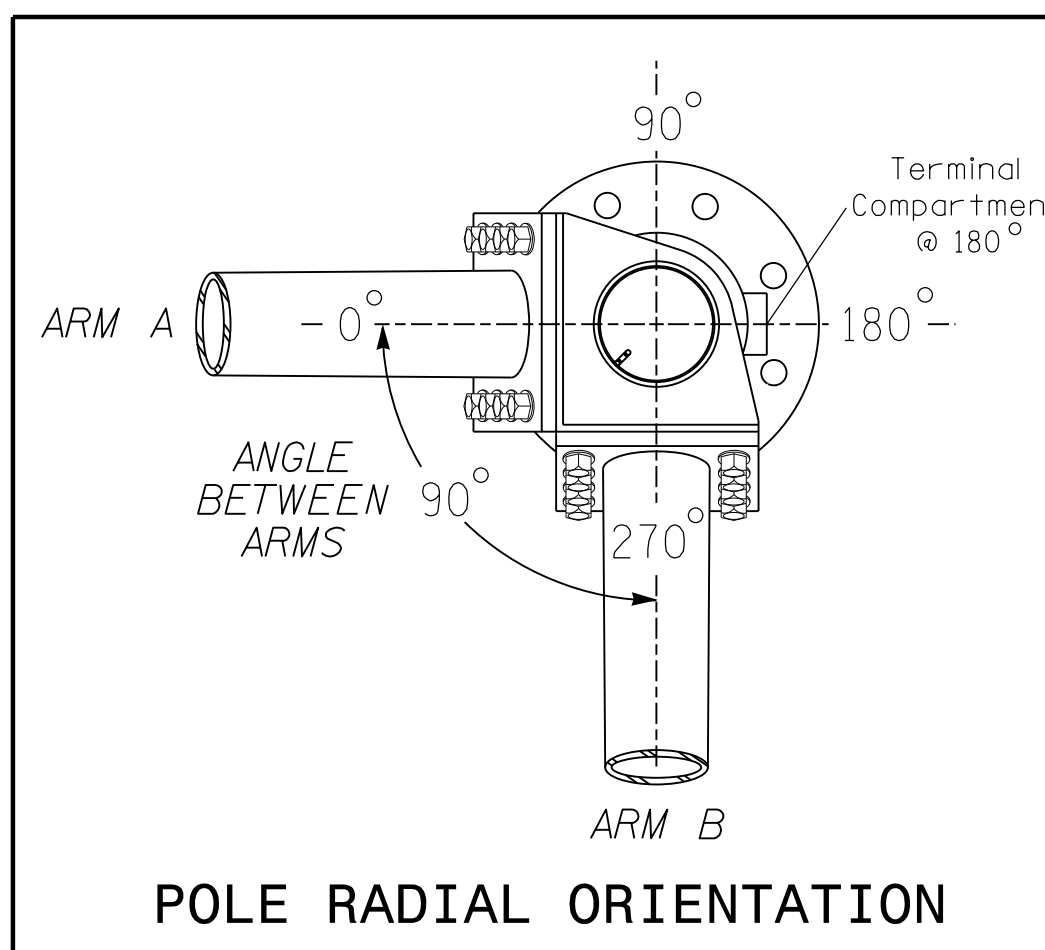
Elevation View @ 0°

SPECIAL NOTE

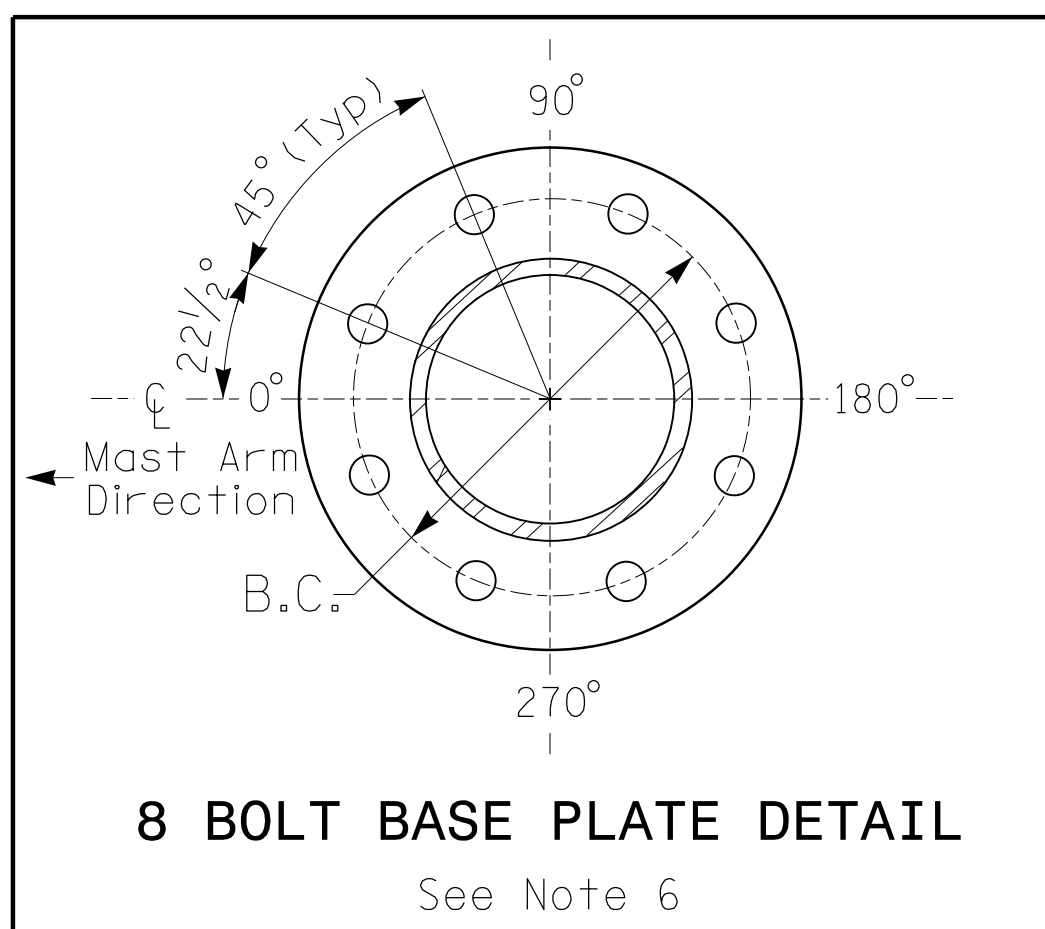
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

| Elevation Differences for: | Pole 3 | |
|--|----------|--|
| Baseline reference point at ϕ Foundation @ ground level | 0.0 ft. | |
| Elevation difference at High point of roadway surface | 3.09 ft. | |
| Elevation difference at Edge of travelway or face of curb | 0.73 ft. | |

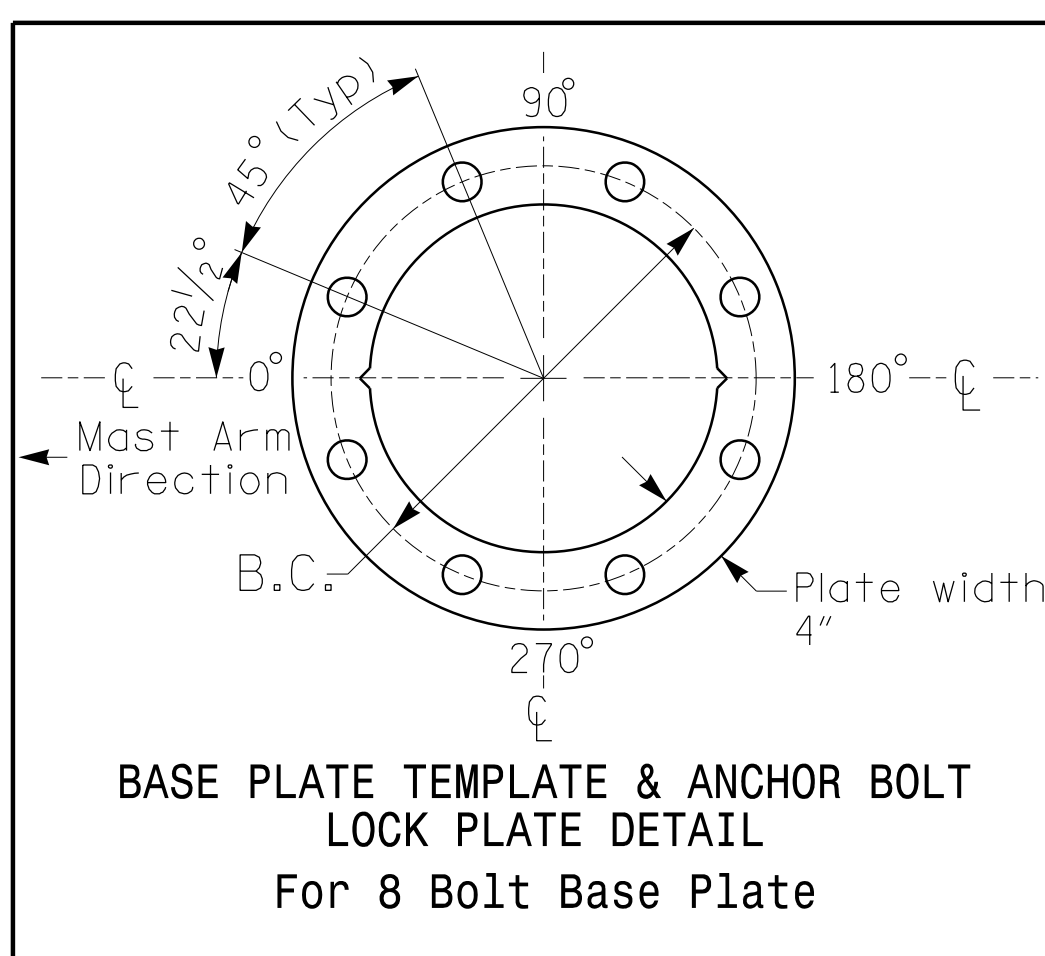


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



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

All metal poles and arms shall be black factory powder coat in color as specified in the project special provisions.

MAST ARM LOADING SCHEDULE

| LOADING SYMBOL | DESCRIPTION | AREA | SIZE | WEIGHT |
|----------------|--|-----------|-------------------|--------|
| | RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE | 9.3 S.F. | 25.5" W X 52.5" L | 60 LBS |
| | RIGID MOUNTED SIGNAL HEAD 12"-4 SECTION-WITH BACKPLATE | 11.5 S.F. | 25.5" W X 66.0" L | 74 LBS |
| | SIGN RIGID MOUNTED | 5.0 S.F. | 36.0" W X 36.0" L | 17 LBS |

NOTES

DESIGN REFERENCE MATERIAL

- Design the traffic signal structure and foundation in accordance with:
 - The 1st Edition 2015 AASHTO LRFD "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
 - The 2024 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
 - The 2024 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 force 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. This requires staggering the connections. Use elevation data for each arm to determine appropriate arm connection points.
- 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 5 (110 mph)

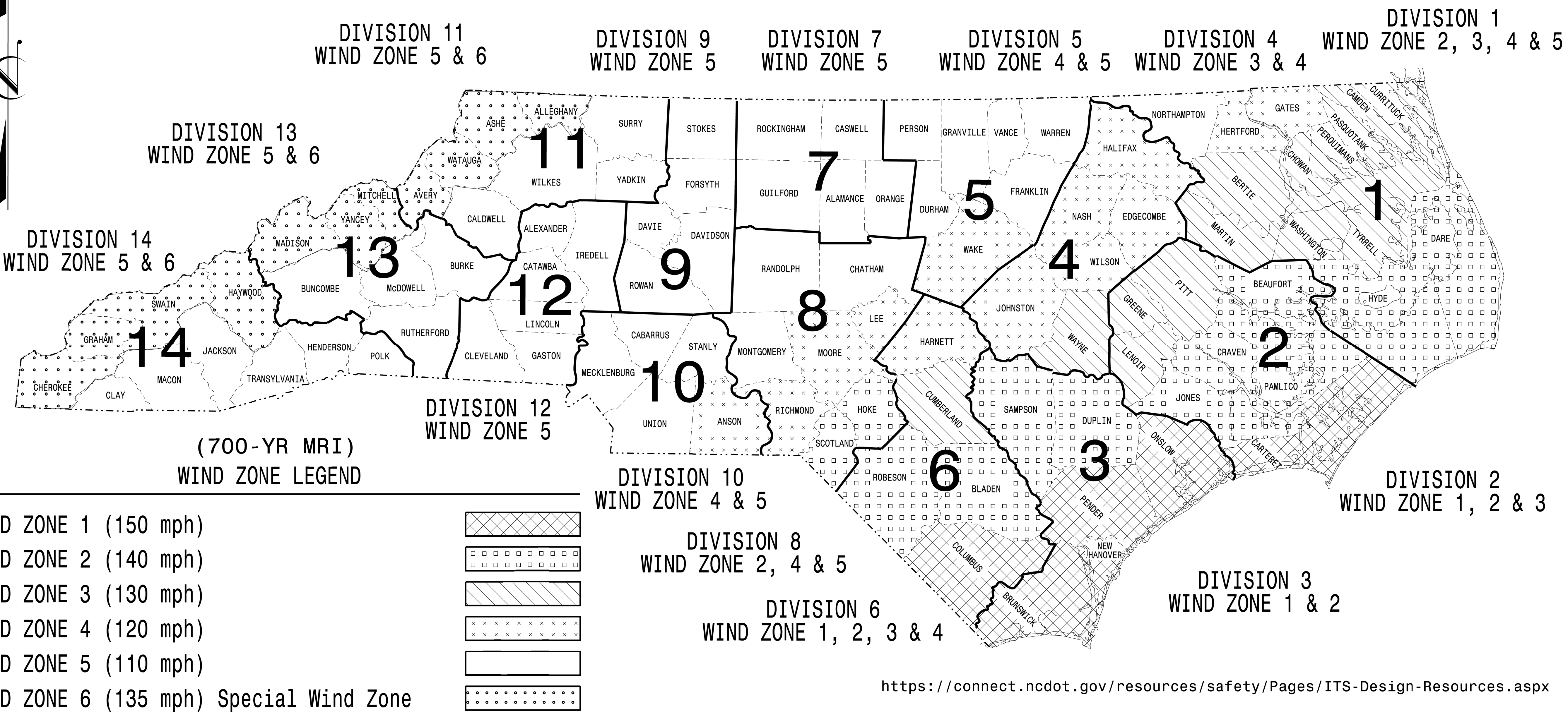
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| | Prepared in the Offices of: US 19-23 (Smokey Park Highway) at I-40 WB Ramps | | DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED SEAL |
| | Division 13 Buncombe County Asheville | | |
| | PLAN DATE: December 2023 PREPARED BY: M. Tindal | REVIEWED BY: R. Garrett | |
| SCALE: 0 N/A N/A | REVISIONS: | INIT. DATE: | DocuSigned by: Rachelle Garrett DATE: 12/5/2023 SIG. INVENTORY NO. 13-0468 |

12/15/2023 09:46:00 AM C:\Users\paw.denti\OneDrive\Documents\60646756-1-2513A\100-CAD 6154910-CAD\10-NC DOT-TIP\Signal\0001-AB\130468-sig.mxd 20231205.dgn
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STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)

NCDOT METAL POLE STANDARDS



09-0CT-2023, 12:07 S:\ITS\AS\KITS\Sig\Standards\Structures\Drawings\2024\Metal Pole Std Drawings For LRFD\2024 Sig. M1A Standard A11 Metal Pole (700-yr MRI).dgn

Prepared in the Offices of:

750 N. Greenfield Pkwy.
Garner, NC 27529

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

AASHTO LRFD

Standard Specifications for Highway Signs, Luminaires, and Traffic Signals

| DRAWING NUMBER | INDEX OF PLANS DESCRIPTION |
|----------------|---|
| Sig. M 1A | Statewide Wind Zone Map (700-yr MRI) |
| Sig. M 1B | Statewide Wind Zone Map (10-yr MRI) |
| Sig. M 2 | Typical Fabrication Details-All Metal Poles |
| Sig. M 3 | Typical Fabrication Details-Strain Poles |
| Sig. M 4 | Typical Fabrication Details-Mast Arm Poles |
| Sig. M 5 | Typical Fabrication Details-Mast Arm Connection |
| Sig. M 6 | Typical Fabrication Details-Strain Pole Attachments |
| Sig. M 7 | Construction Details-Foundations |
| Sig. M 8 | Standard Strain Pole Foundation-All Soil Conditions |
| Sig. M 9 | Typical Fabrication Details-CCTV Camera Poles |

**MOBILITY AND SAFETY DIVISION -
TRANSPORTATION SYSTEMS MANAGEMENT
AND OPERATIONS UNIT**

D.Y. ISHAK - STATE SIGNALS ENGINEER
K. DURIGON, P.E. - ITS AND SIGNALS STRUCTURAL ENGINEER
B. WALKER, P.E. - ITS AND SIGNALS STRUCTURAL ENGINEER

SEAL

DocuSigned by:

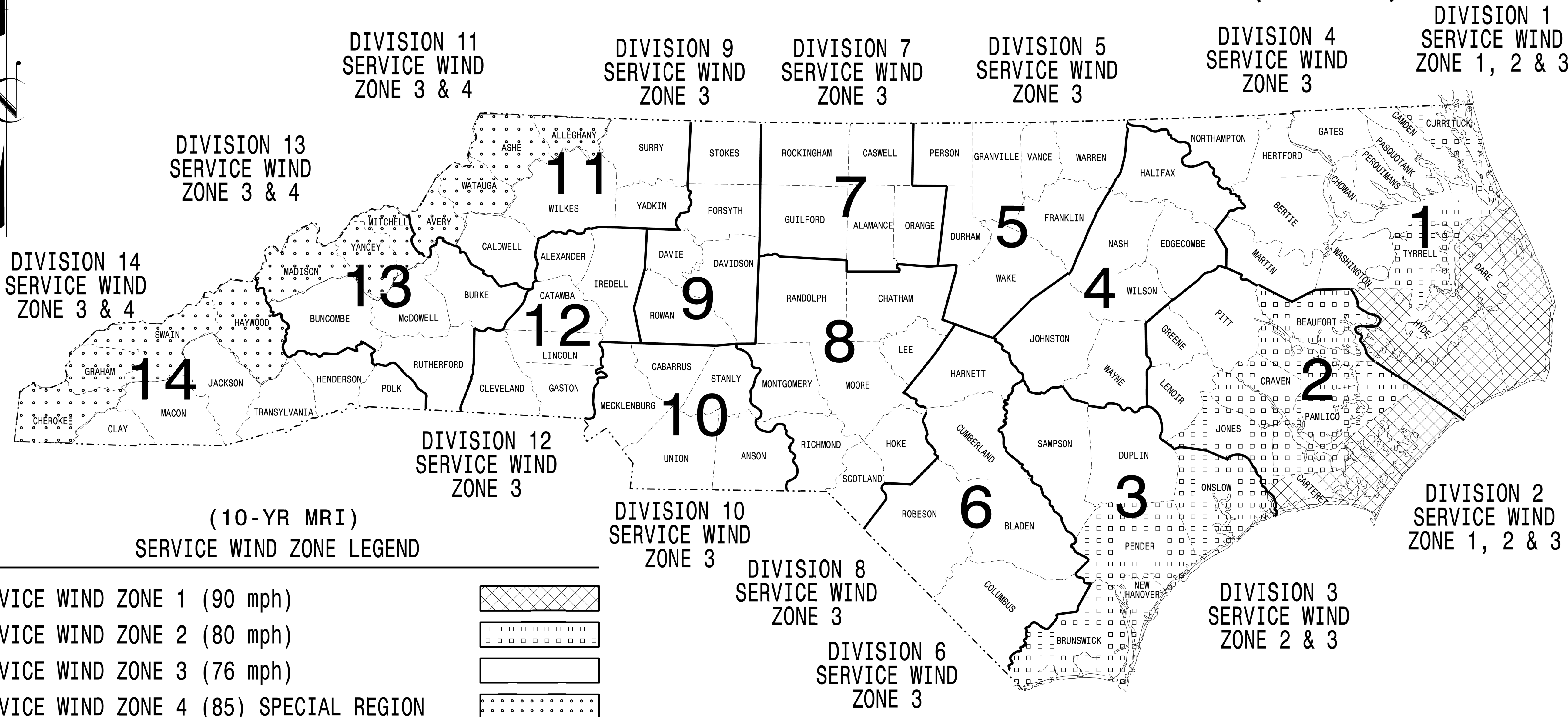
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09/21/2023
DATE

STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)

NCDOT METAL POLE STANDARDS



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



Designed in conformance with the latest 2020 Interim to the 1st Edition 2015
AASHTO LRFD
Standard Specifications for Highway Signs, Luminaires, and Traffic Signals

| DRAWING NUMBER | INDEX OF PLANS DESCRIPTION |
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| Sig. M 1A | Statewide Wind Zone Map (700-yr MRI) |
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| Sig. M 7 | Construction Details--Foundations |
| Sig. M 8 | Standard Strain Pole Foundation--All Soil Conditions |
| Sig. M 9 | Typical Fabrication Details--CCTV Camera Poles |

NCDOT CONTACTS:
MOBILITY AND SAFETY DIVISION - TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS UNIT

D.Y. ISHAK - STATE SIGNALS ENGINEER
K. DURIGON, P.E. - ITS AND SIGNALS STRUCTURAL ENGINEER
B. WALKER, P.E. - ITS AND SIGNALS STRUCTURAL ENGINEER

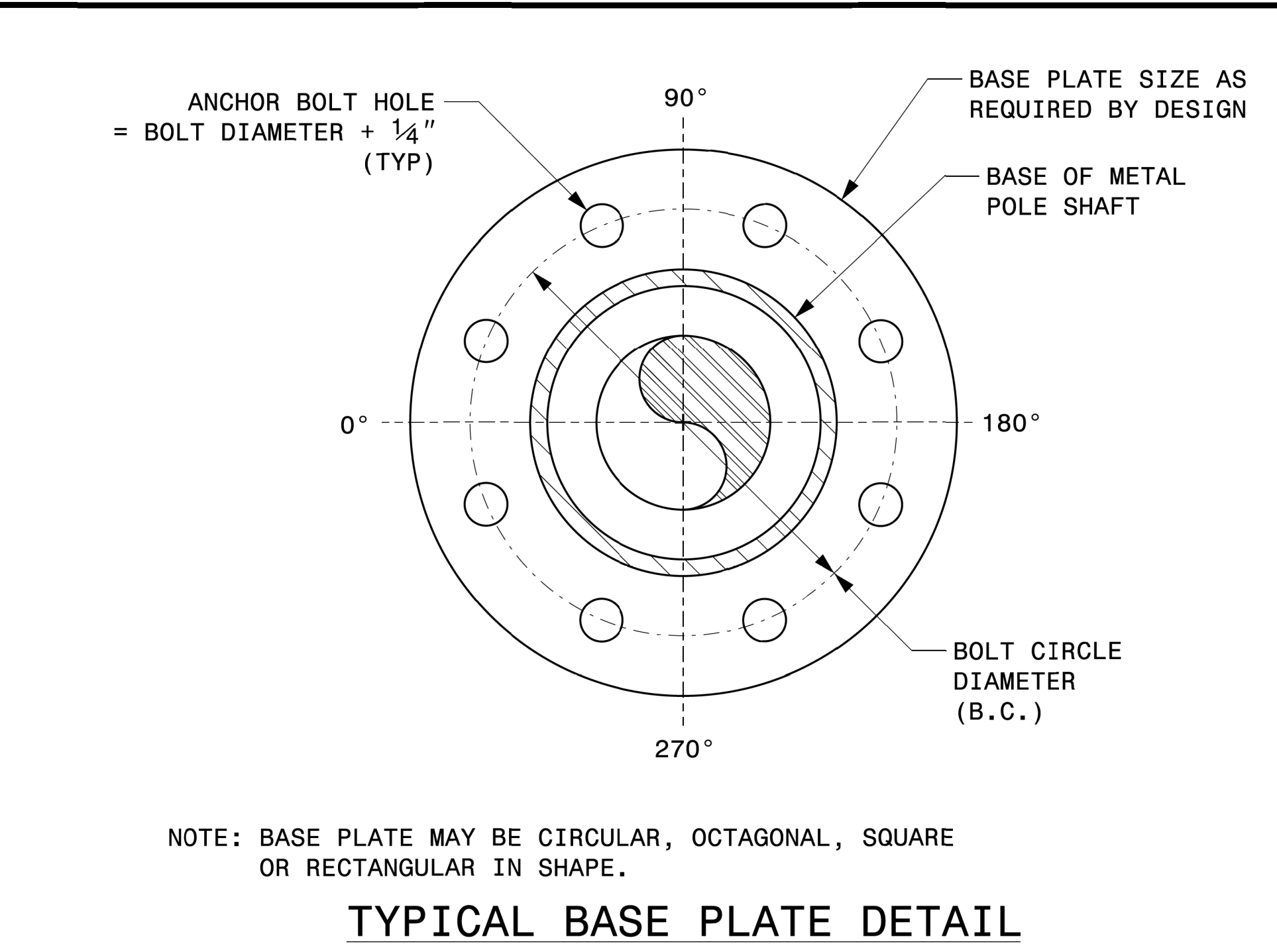
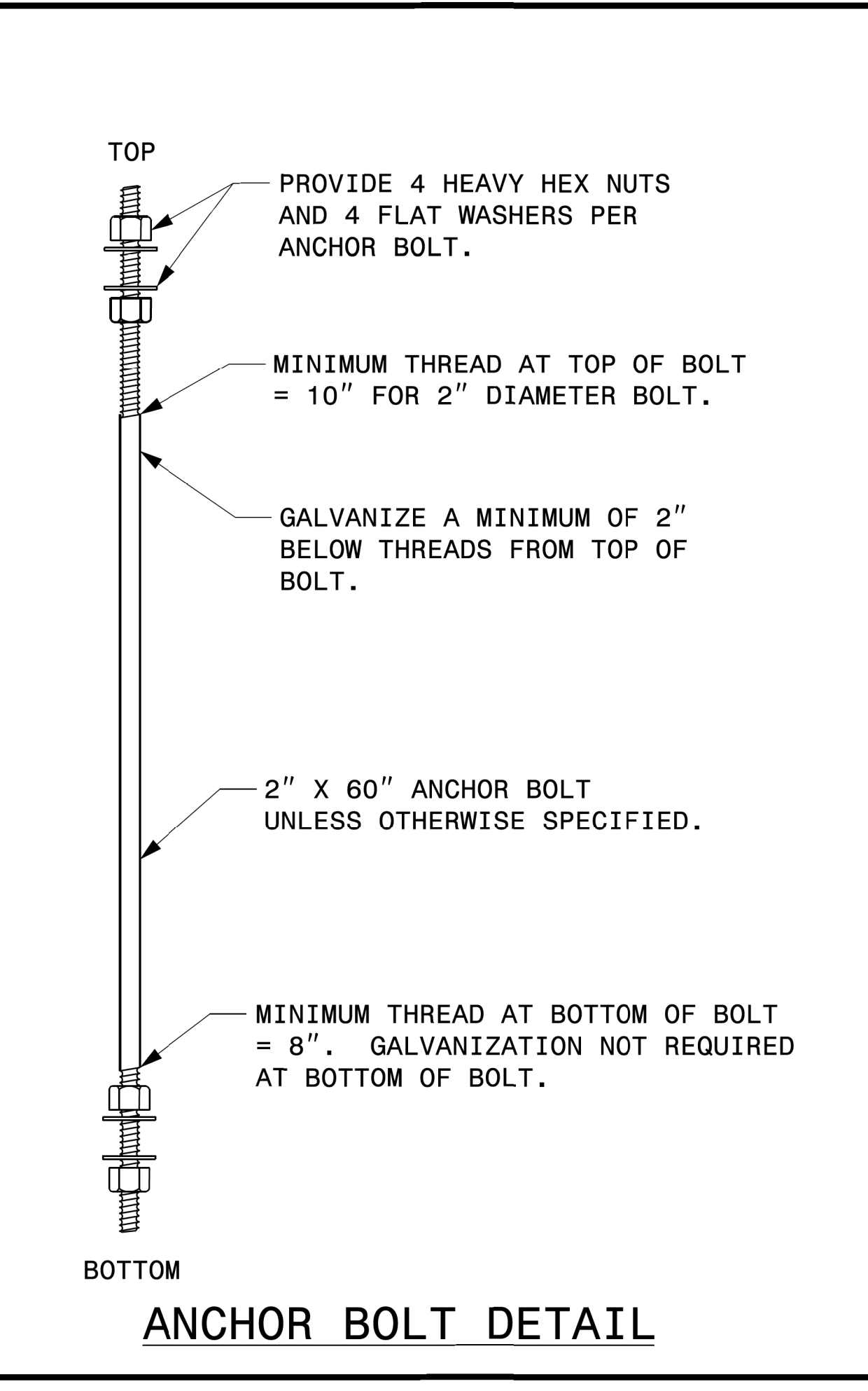
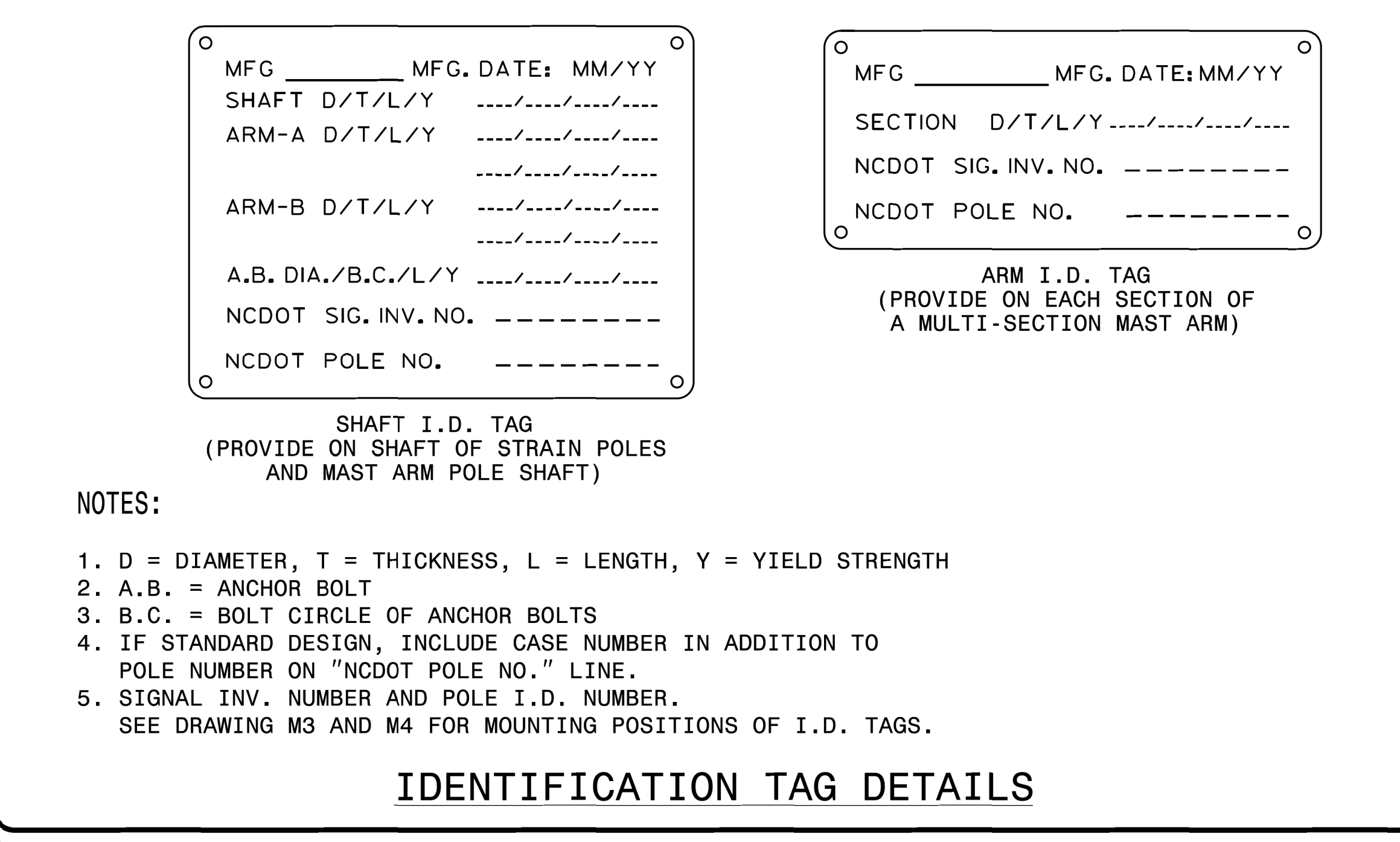
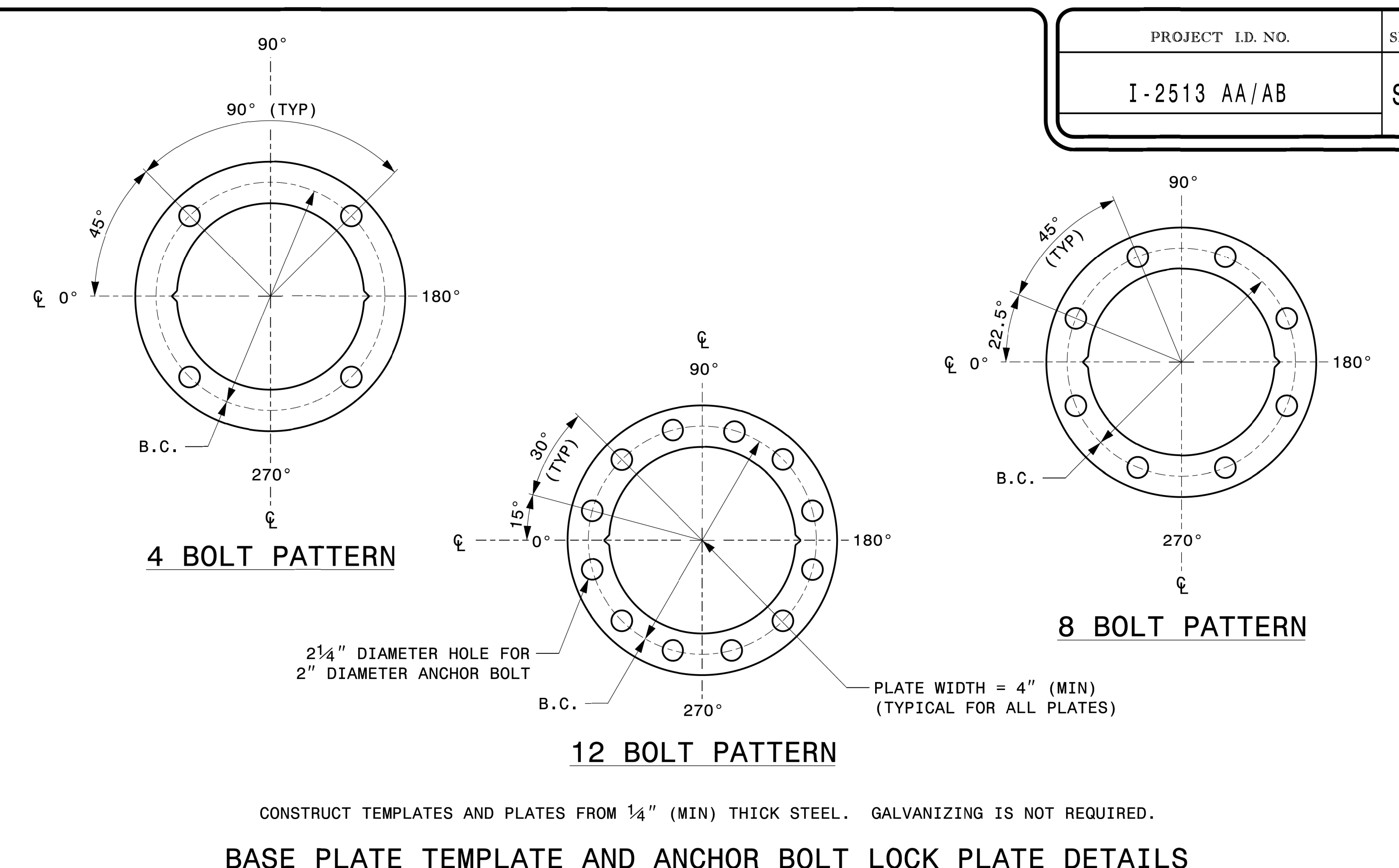
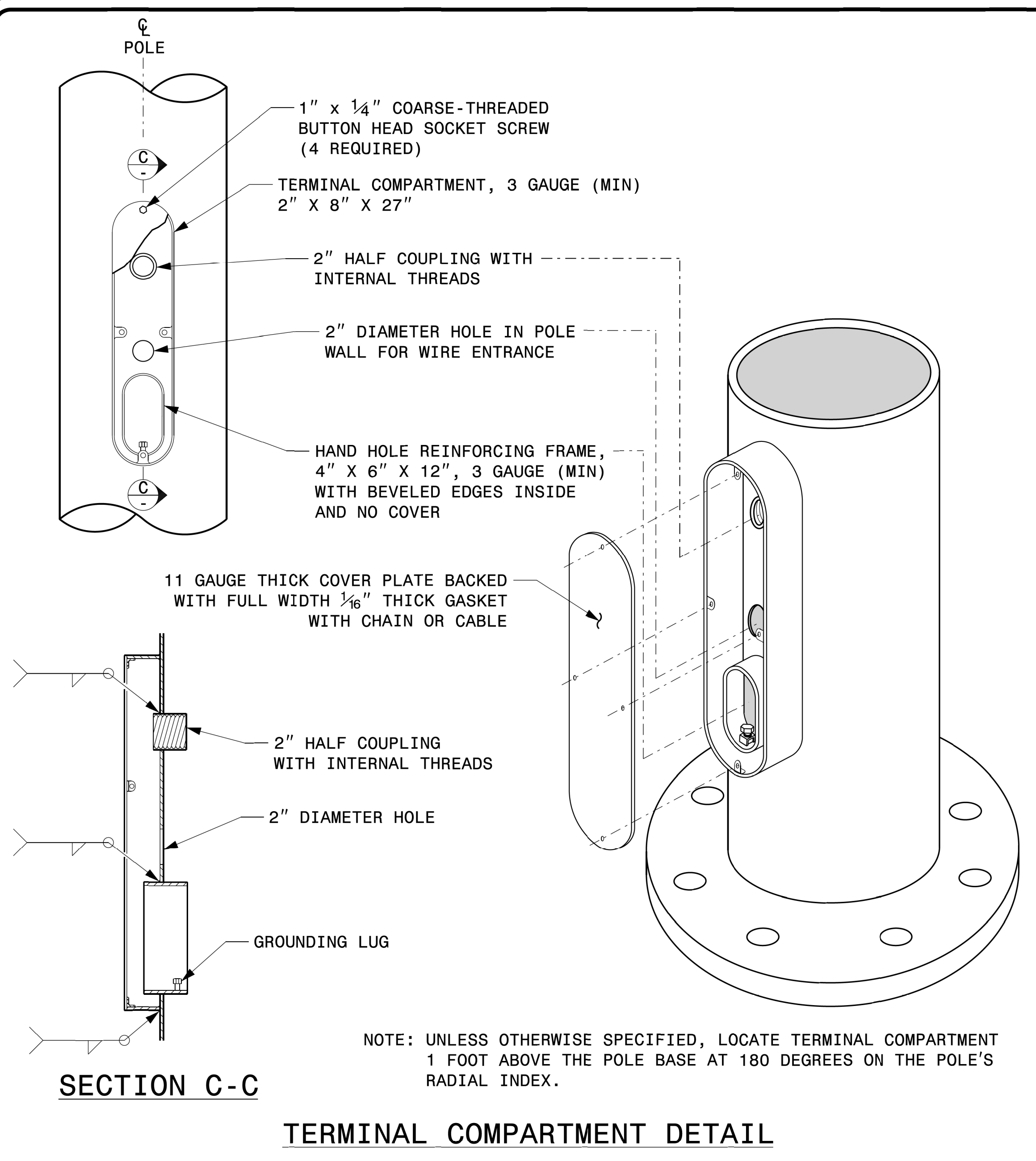
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Kevin Durigon
SIGNATURE
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09/21/2023
DATE

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| | |
|------------------|-----------|
| PROJECT I.D. NO. | SHEET NO. |
| I-2513 AA/AB | Sig.M2 |



Prepared in the Offices of:

750 N. Grandfield Pkwy, Garner, NC 27529

PLAN DATE: SEPTEMBER 2023 DESIGNED BY: C.F. ANDREWS

PREPARED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR

| REVISIONS | INIT. | DATE |
|-----------|-------|------|
| | | |

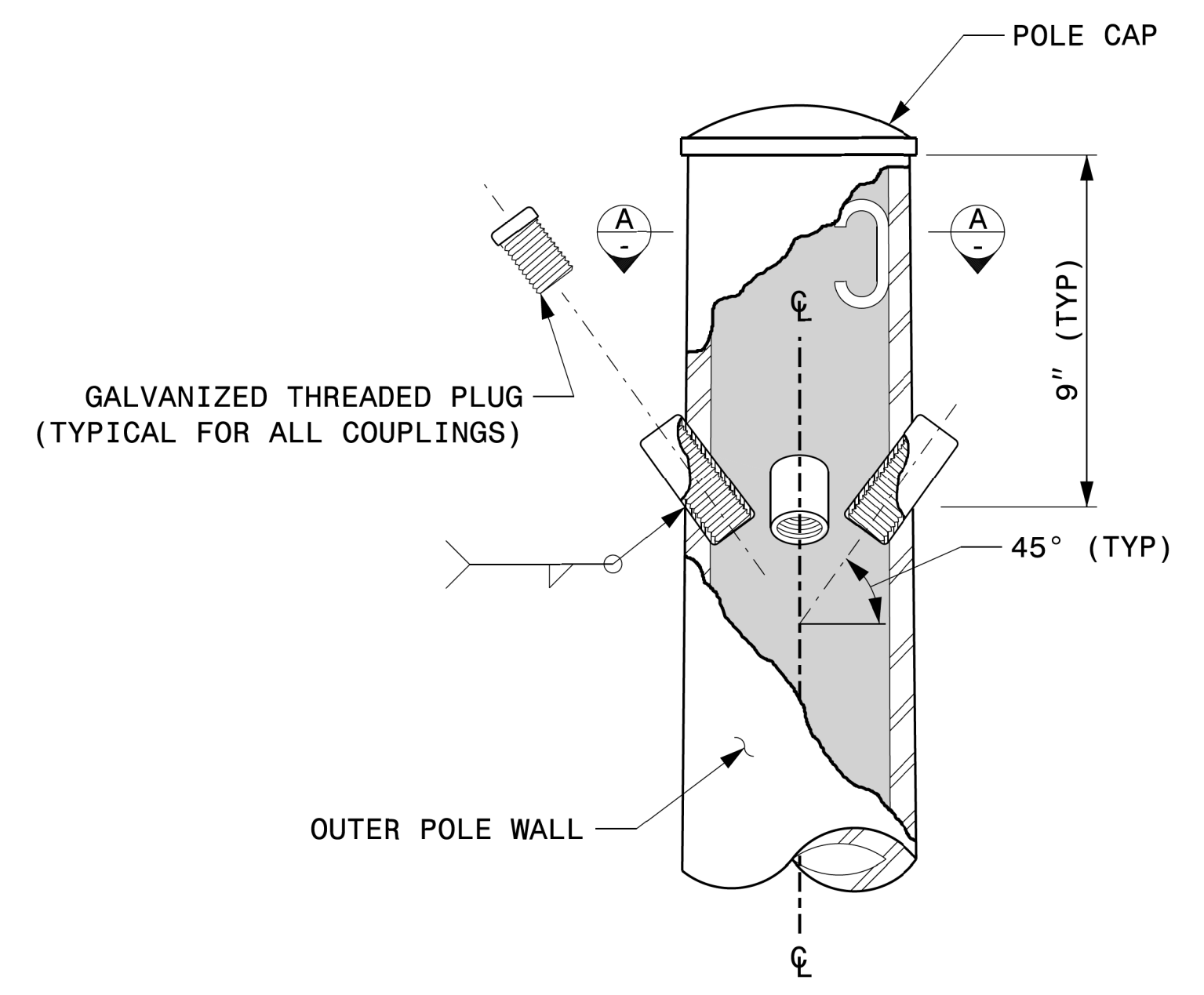
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09/21/2023 DATE

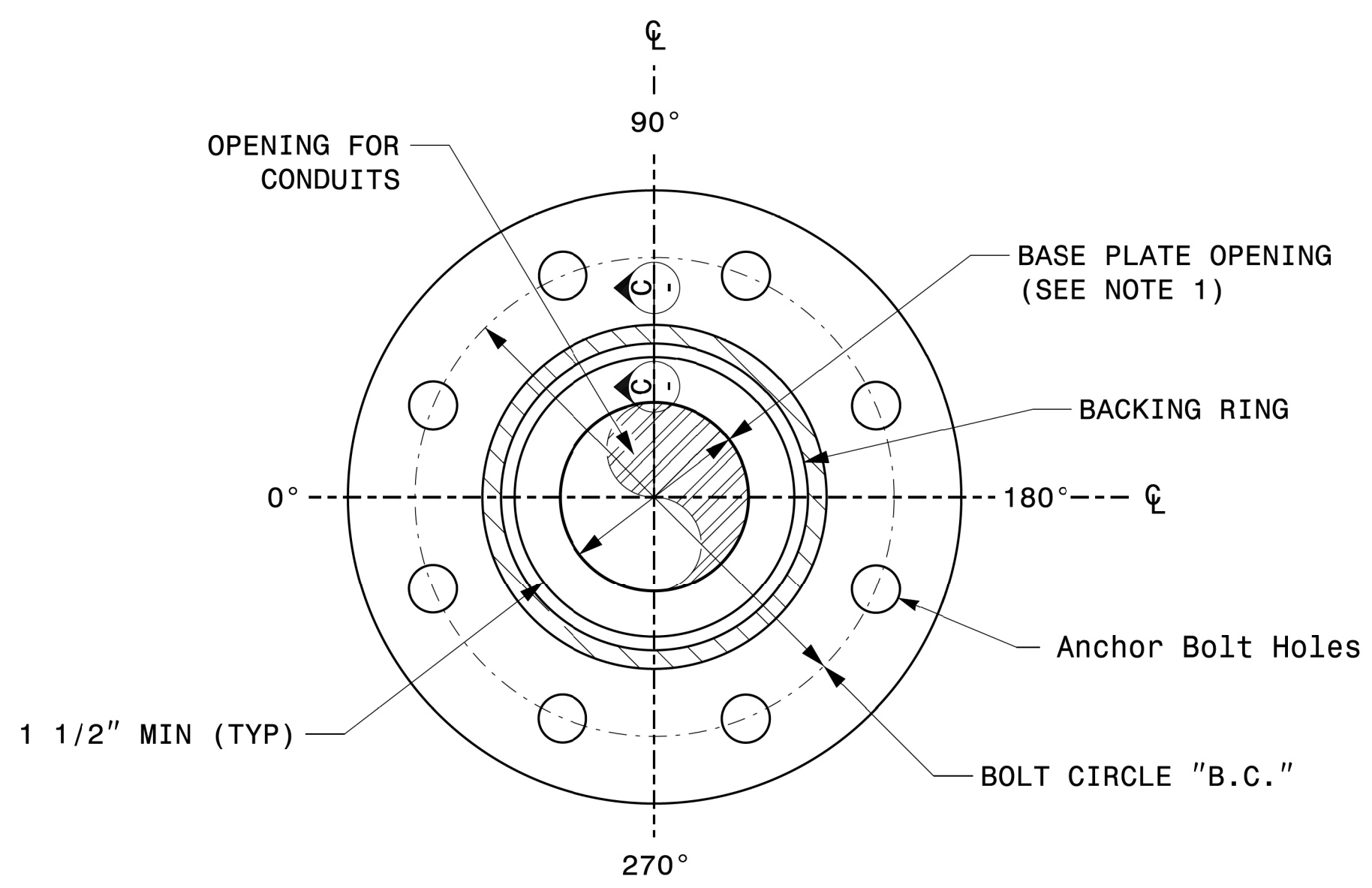
Fabrication Details – All Metal Poles

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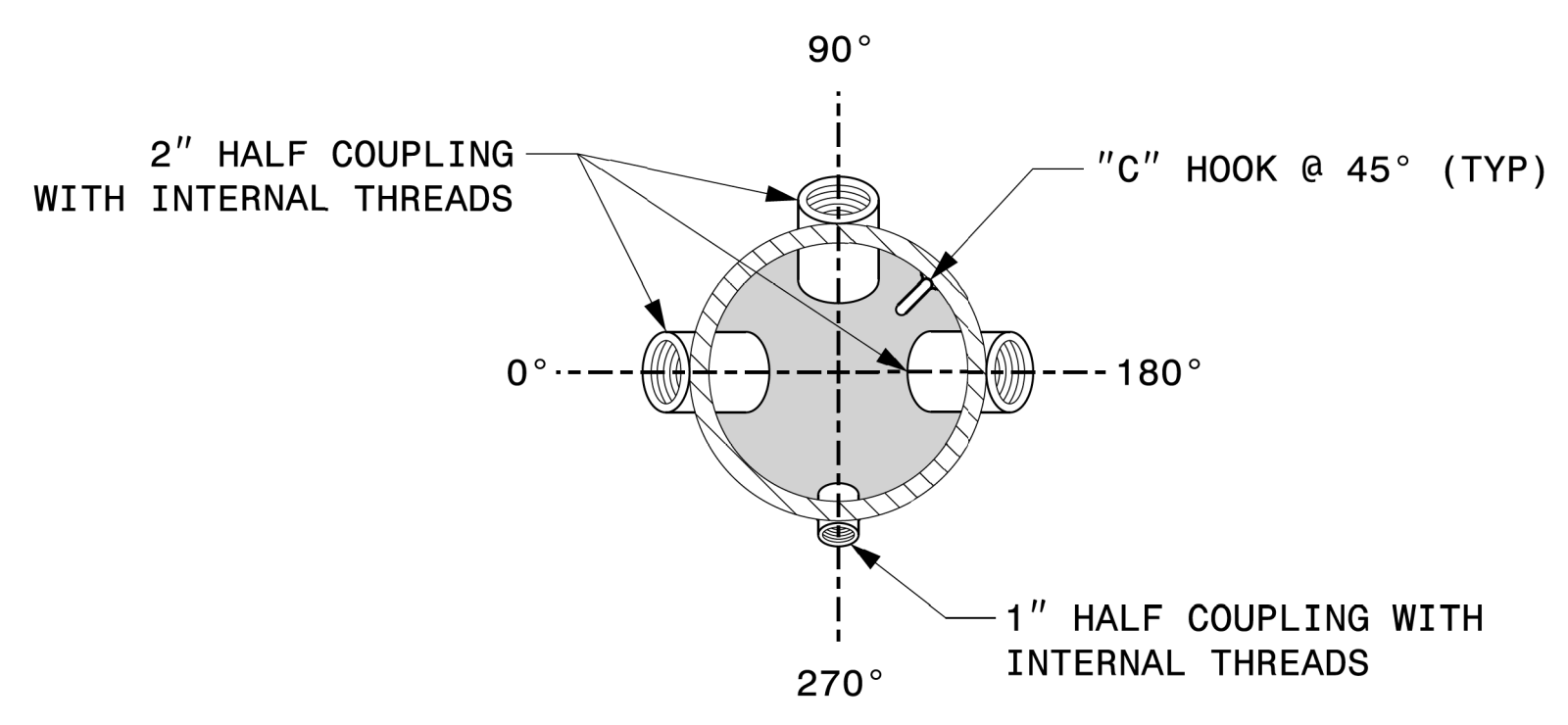
NOTE:
 1. OPENING IN POLE BASE PLATE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS 3 1/2" BUT SHALL NOT BE LESS THAN 8 1/2".



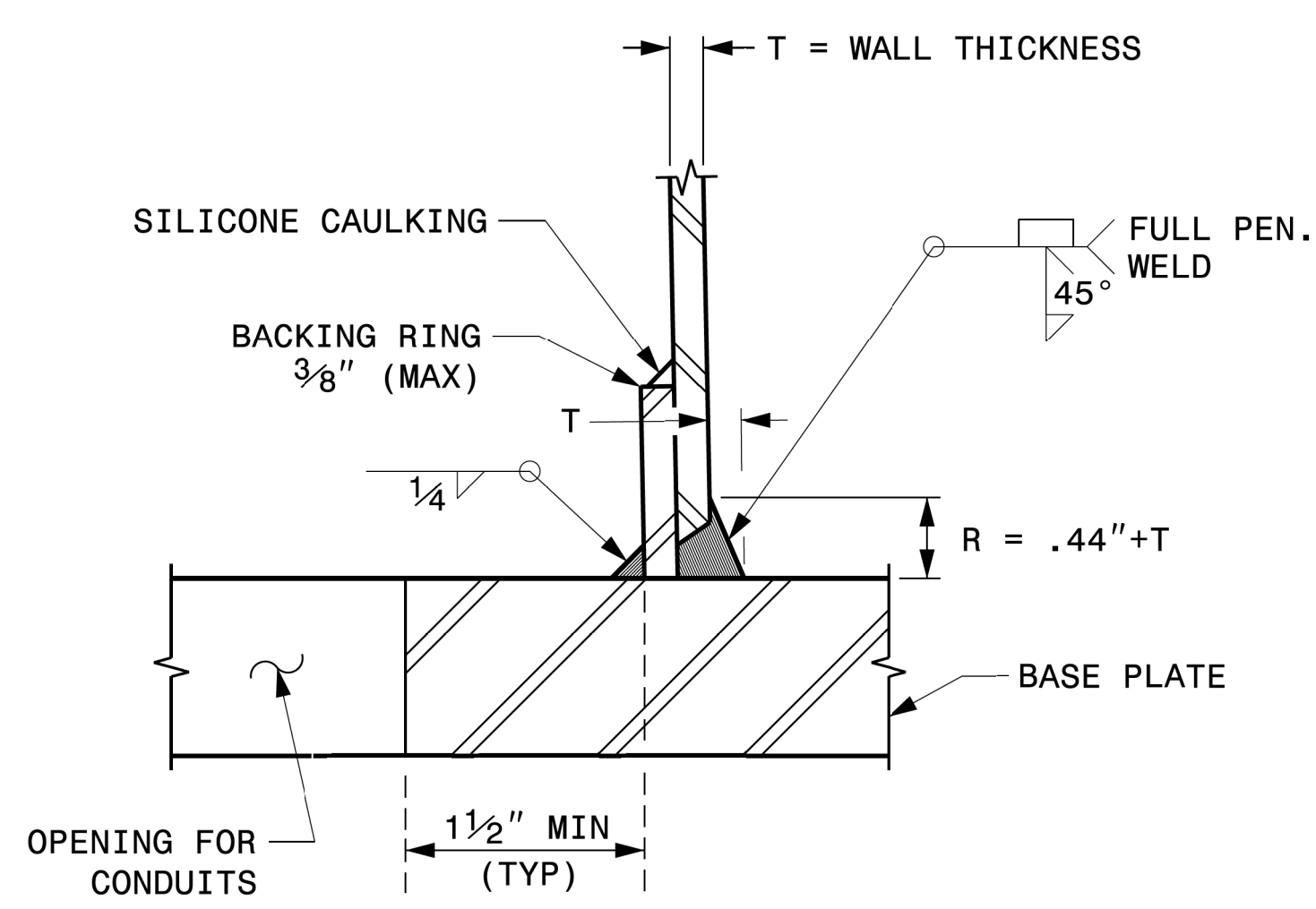
CABLE ENTRANCES AT TOP OF POLE



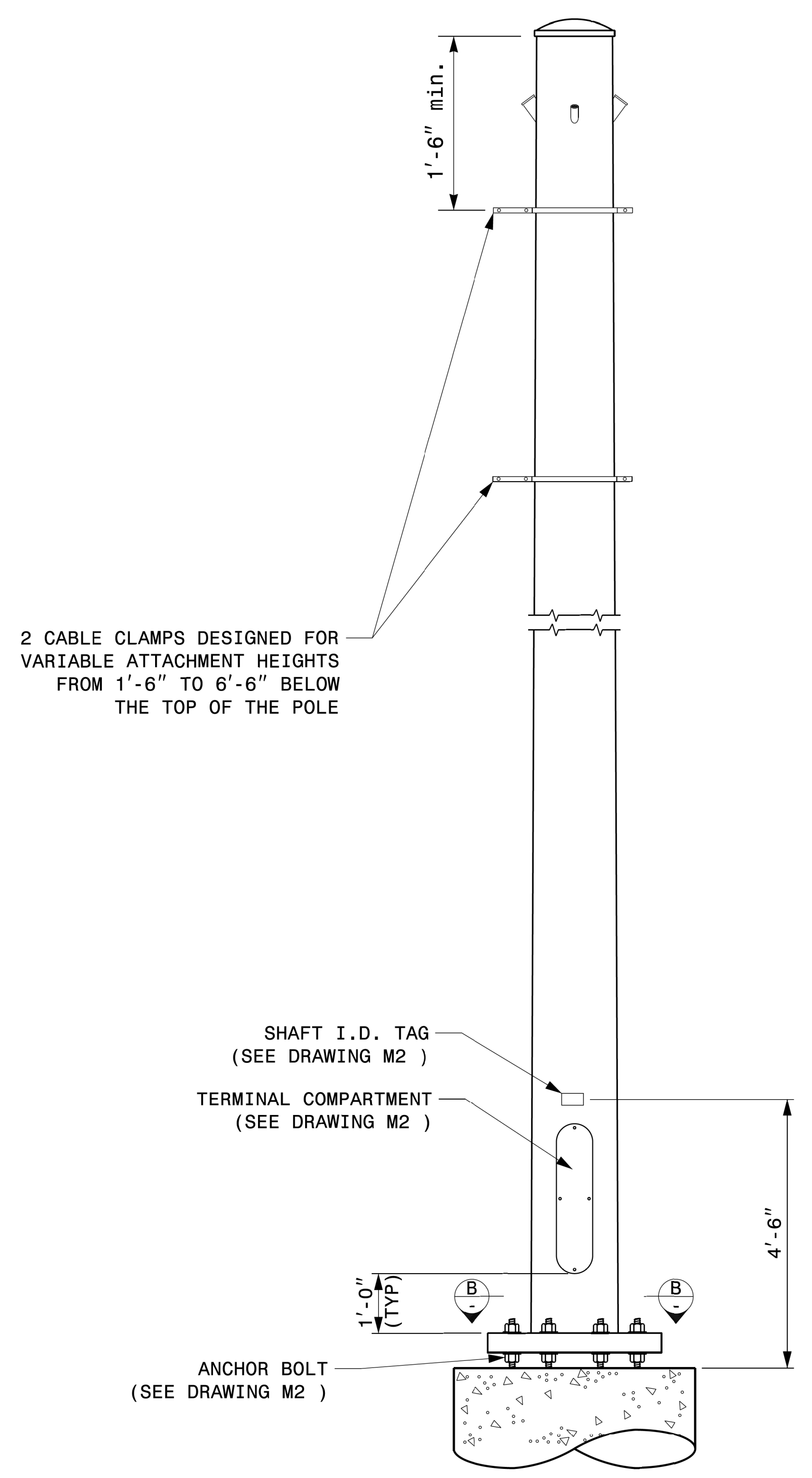
SECTION B-B
 POLE BASE PLATE DETAILS
 (8 AND 12 BOLT PATTERN)



SECTION A-A
 RADIAL ORIENTATION OF FACTORY INSTALLED ACCESSORIES AT TOP OF POLE



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



MONOTUBE STRAIN POLE

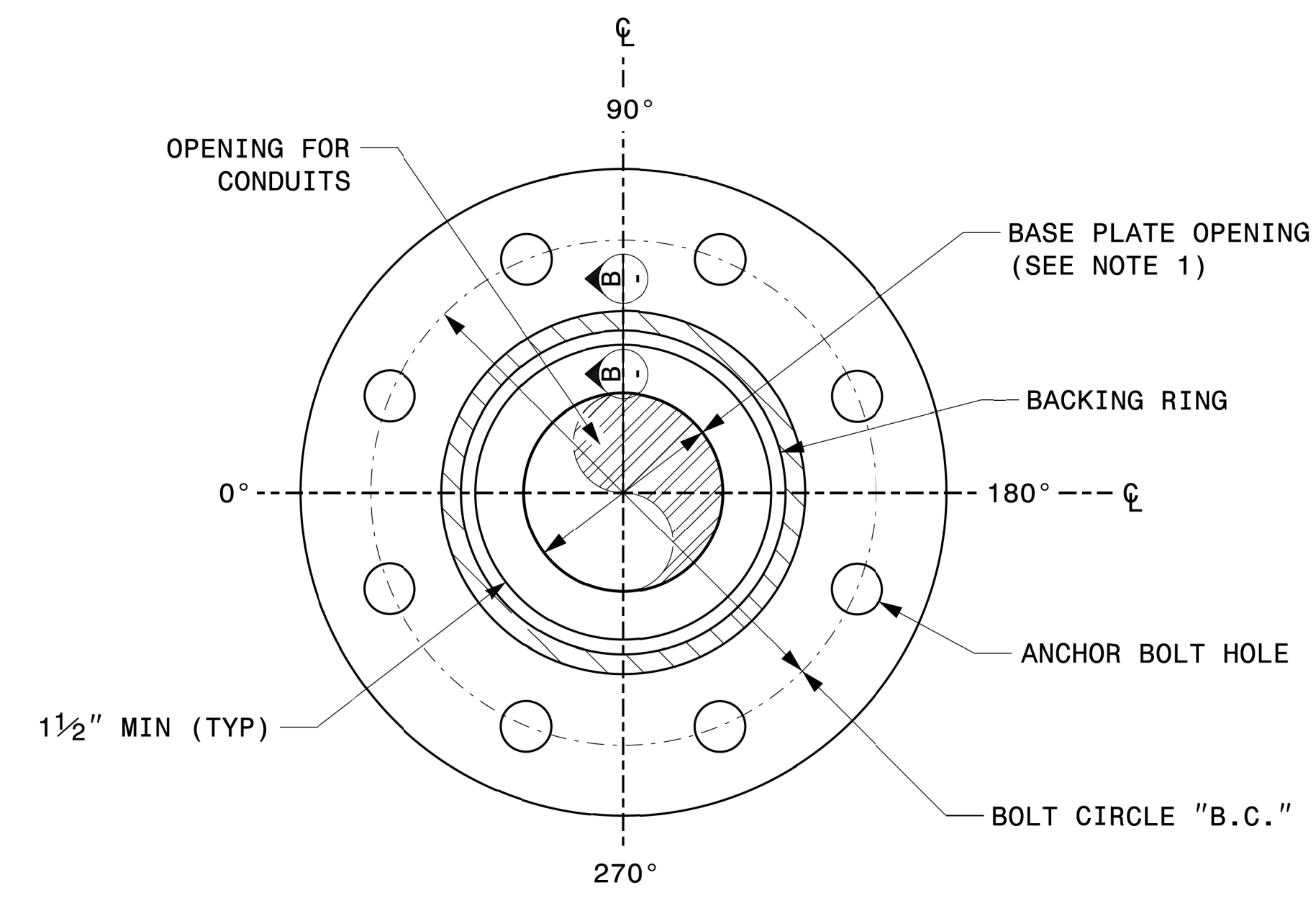
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| <p>750 N. Grandfield Hwy, Garner, NC 27529</p> | Typical Fabrication Details For Strain Poles | | SEAL |
| | PLAN DATE: SEPTEMBER 2023 PREPARED BY: K.C. DURIGON | DESIGNED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR | |
| SCALE: 0 NA NONE | REVISIONS: INIT. DATE | NONE | 4B23DC79B378ADA |

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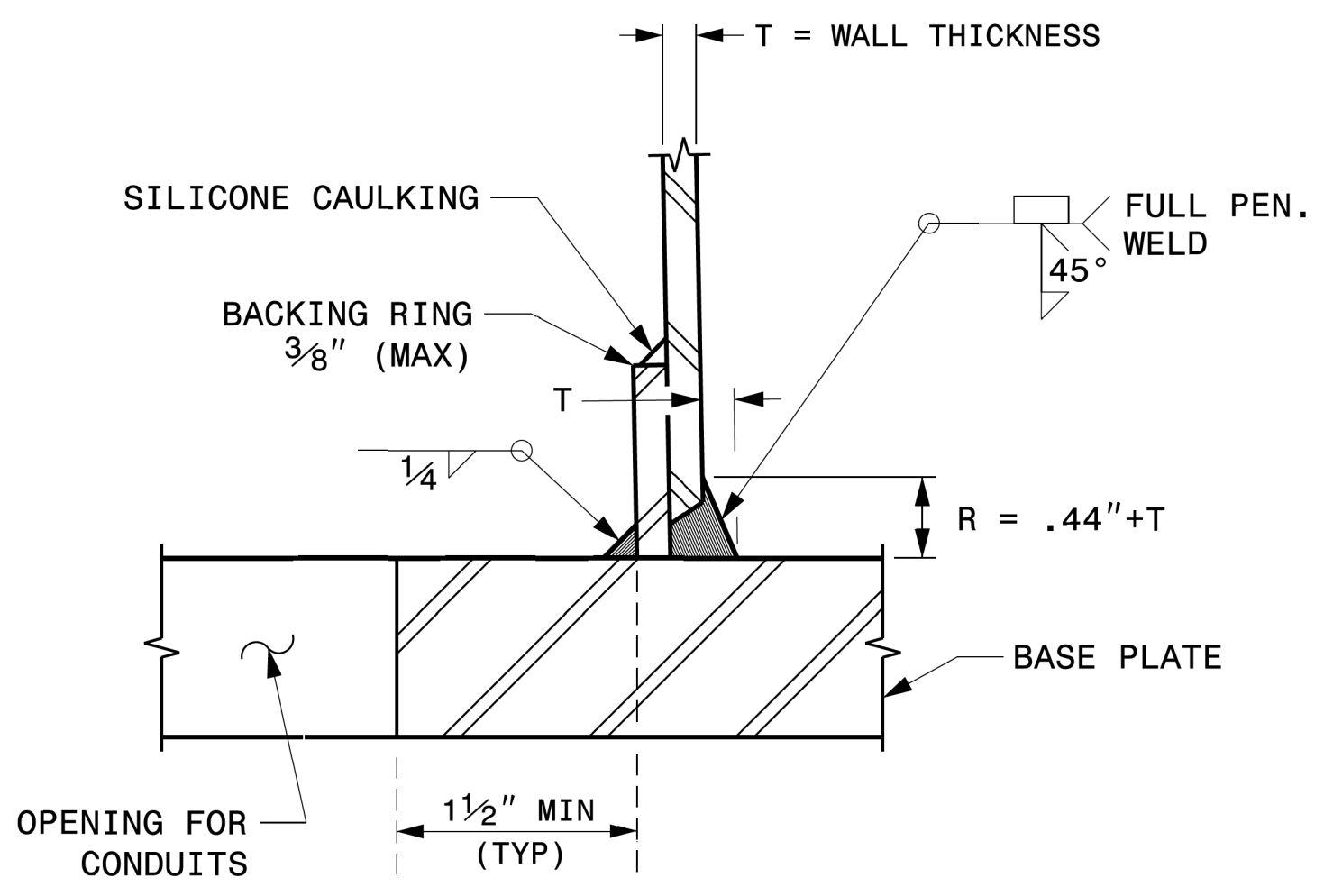
Fabrication Details – Strain Poles

NOTE:

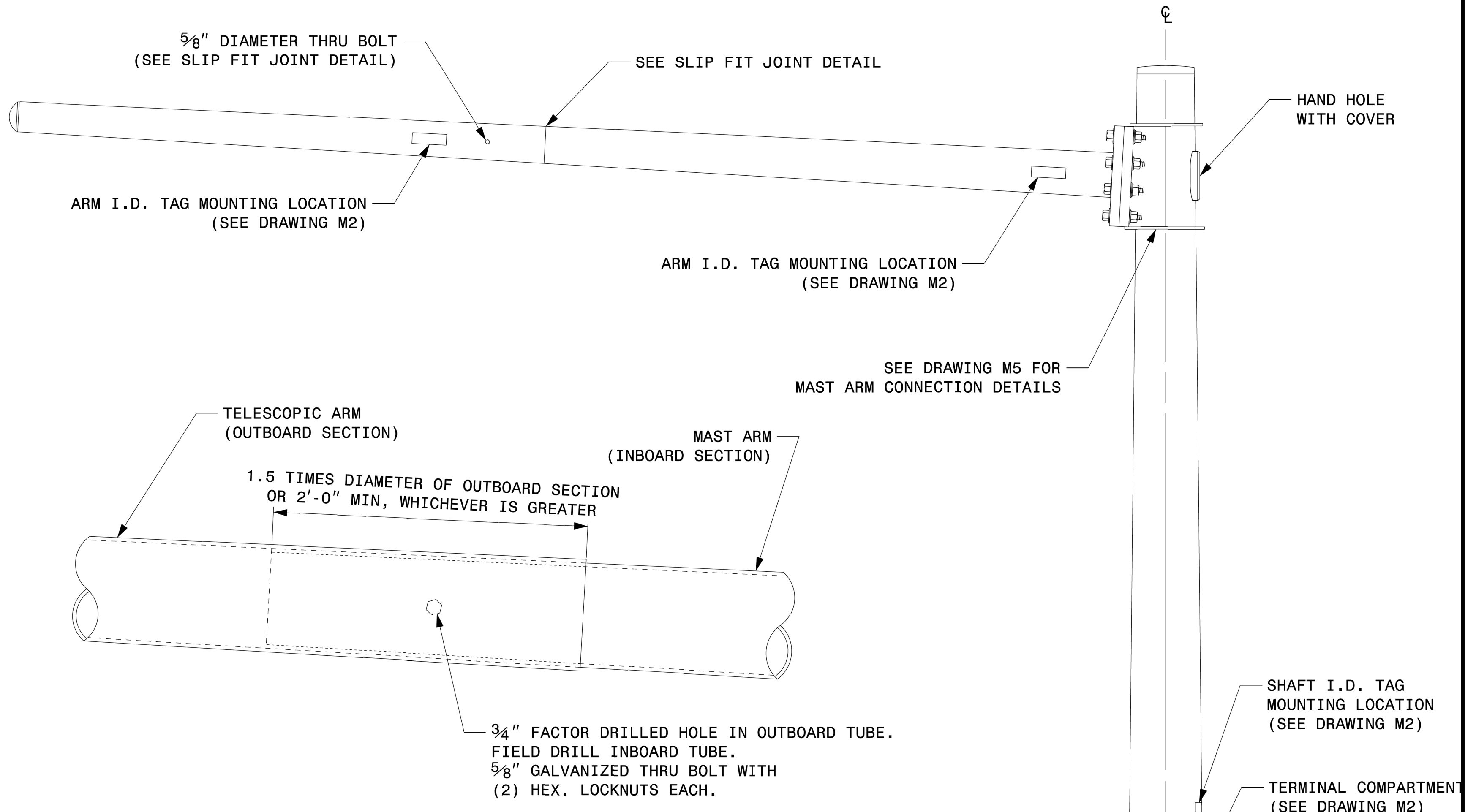
1. OPENING IN POLE BASE PLATE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS 3 1/2" BUT SHALL NOT BE LESS THAN 8 1/2".



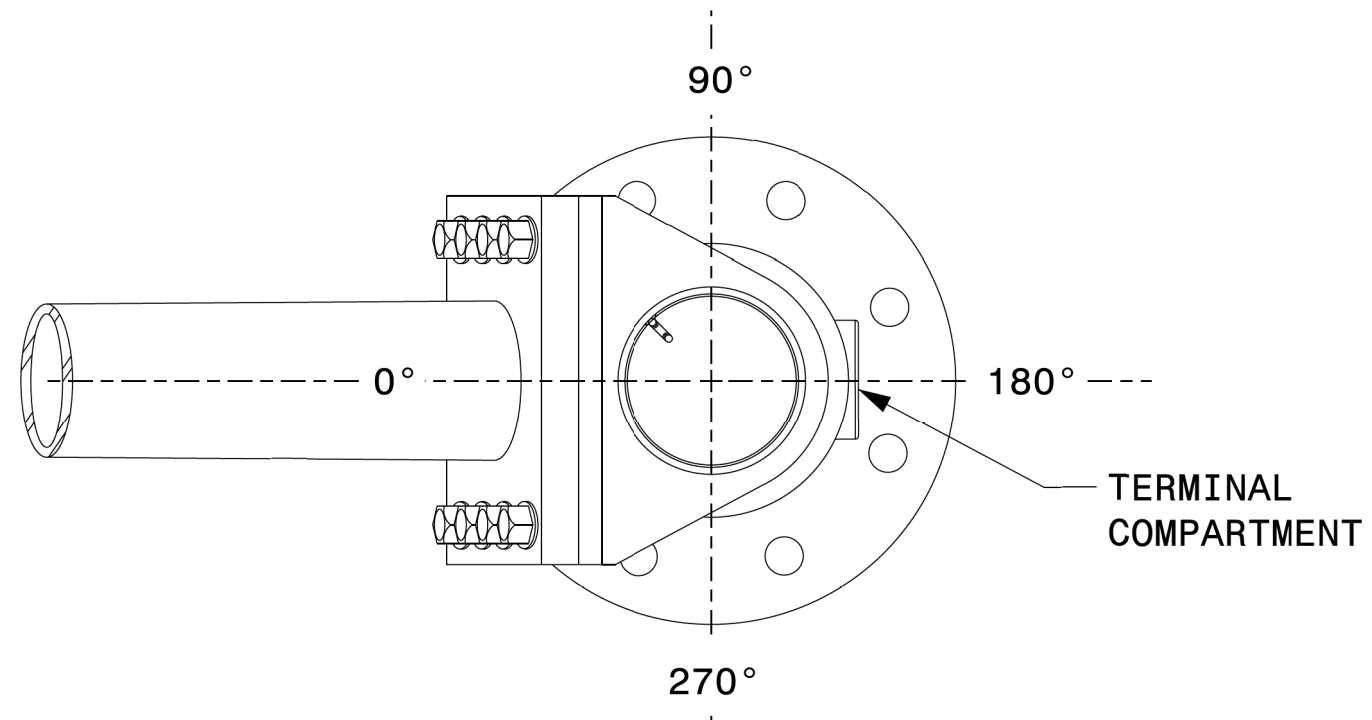
**SECTION A-A
POLE BASE PLATE DETAILS**



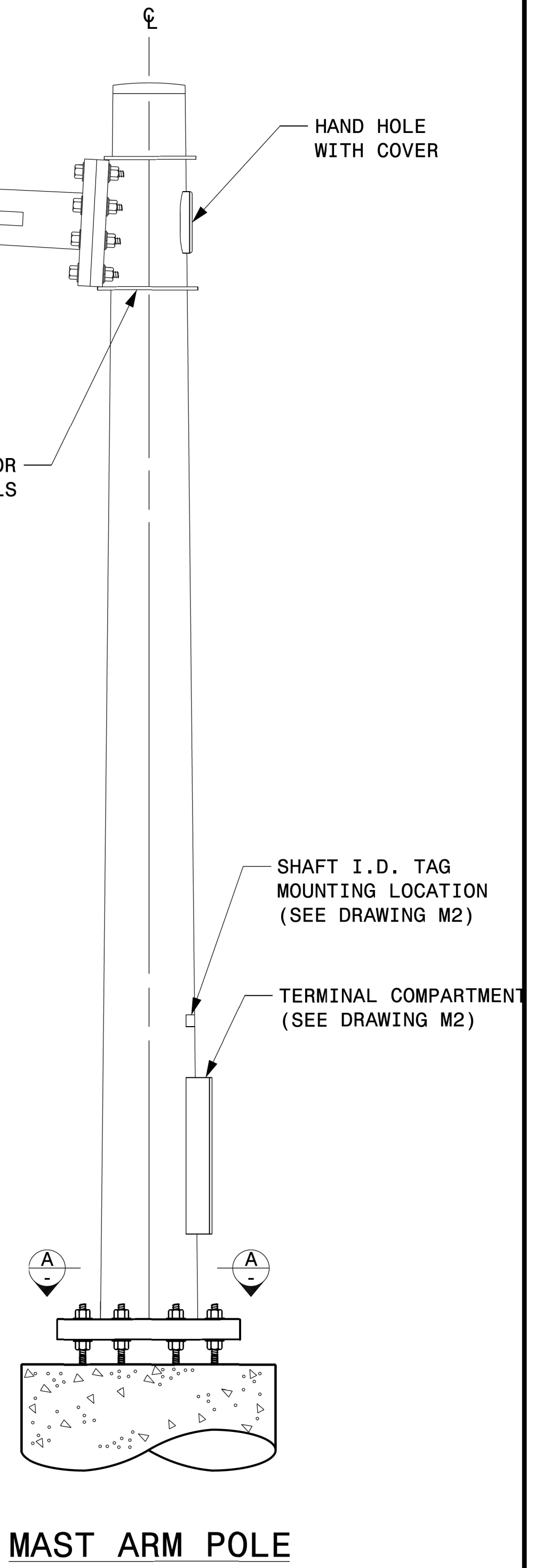
**SECTION B-B
(POLE ATTACHMENT TO BASE PLATE)
FULL-PENETRATION
GROOVE WELD DETAIL**



SLIP FIT JOINT DETAIL FOR MAST ARM



MAST ARM RADIAL ORIENTATION



MAST ARM POLE

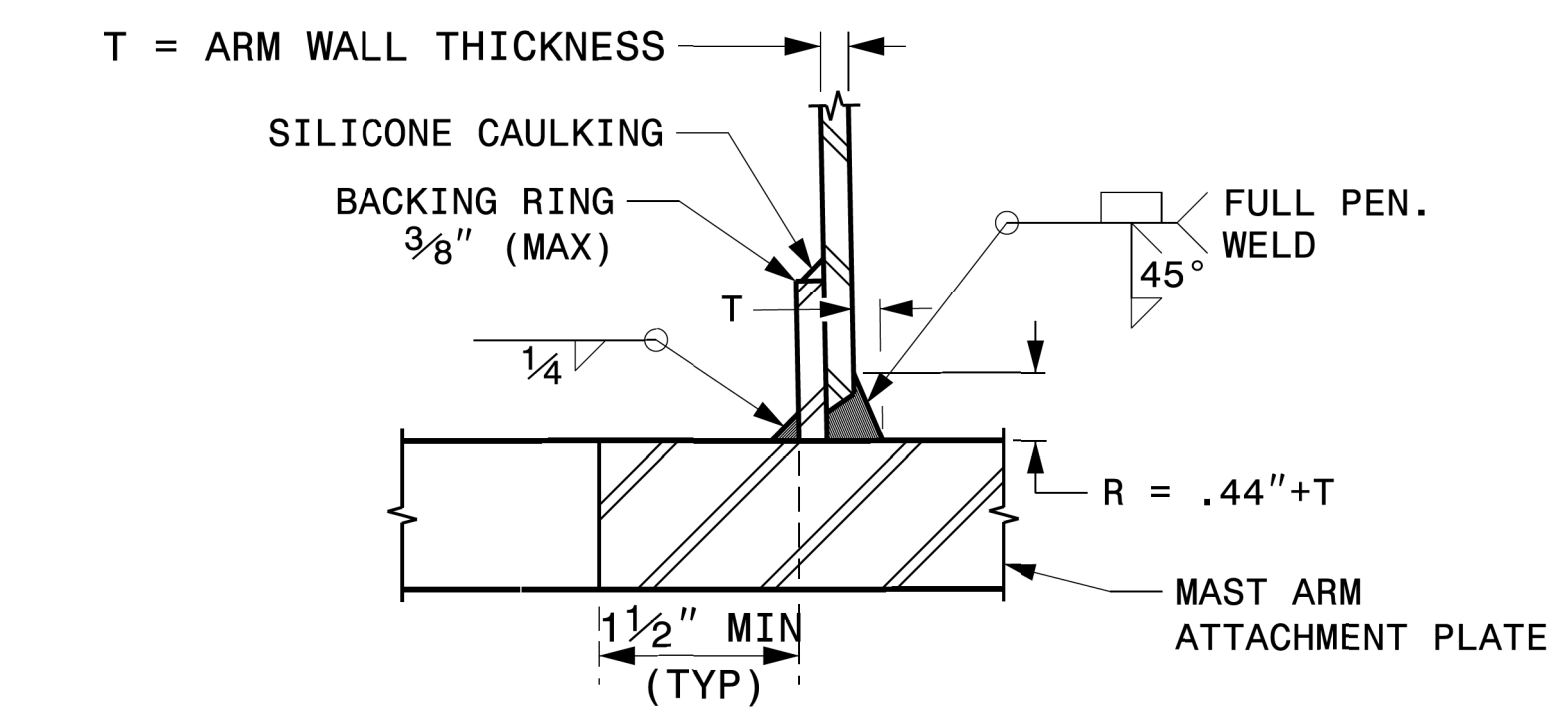
Fabrication Details – Mast Arm Poles

| | <p>Prepared in the Offices of:</p> | | <p>Typical Fabrication Details For Mast Arm Poles</p> | | <p>SEAL</p> | | | |
|-------|--|---|---|------|-------------|--|--|--------------------------------------|
| | <p>PLAN DATE: SEPTEMBER 2023 DESIGNED BY: K.C. DURIGON</p> <p>PREPARED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR</p> | <p>REVISIONS</p> <table border="1"> <tr> <th>INIT.</th> <th>DATE</th> </tr> <tr> <td> </td> <td> </td> </tr> </table> | INIT. | DATE | | | | <p>SCALE</p> <p>0 NA</p> <p>NONE</p> |
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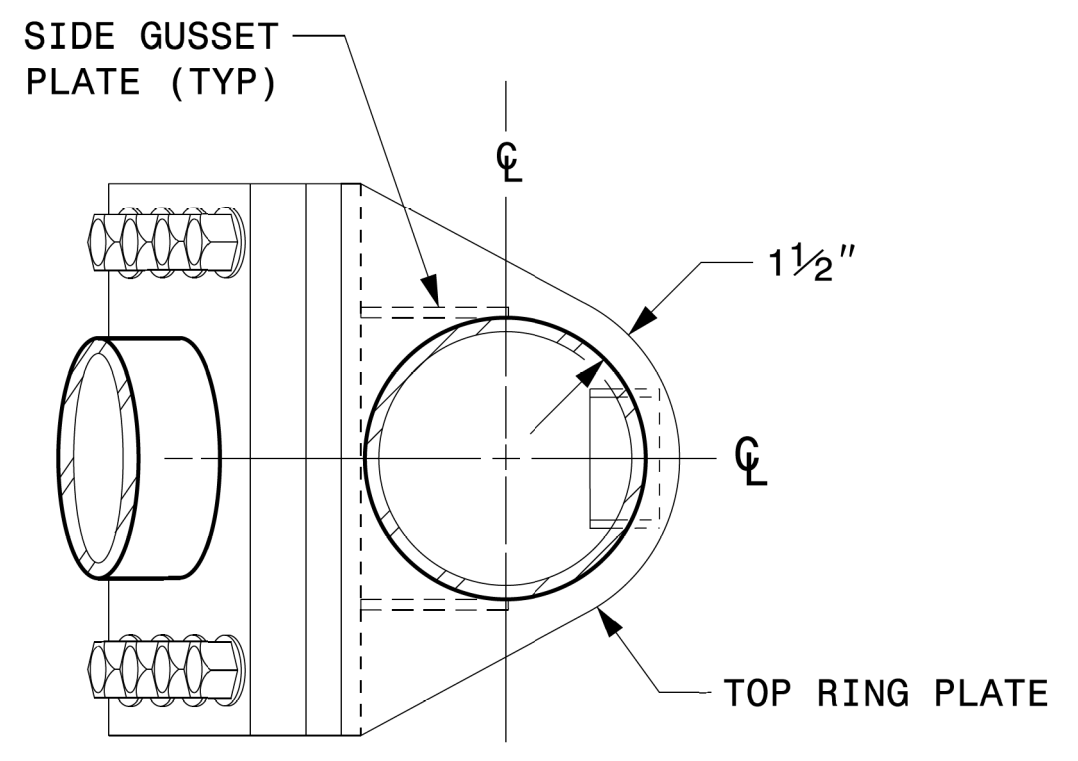
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WELDED RING STIFFENED MAST ARM CONNECTION

| | |
|------------------|-----------|
| PROJECT I.D. NO. | SHEET NO. |
| I-2513 AA/AB | Sig.M5 |



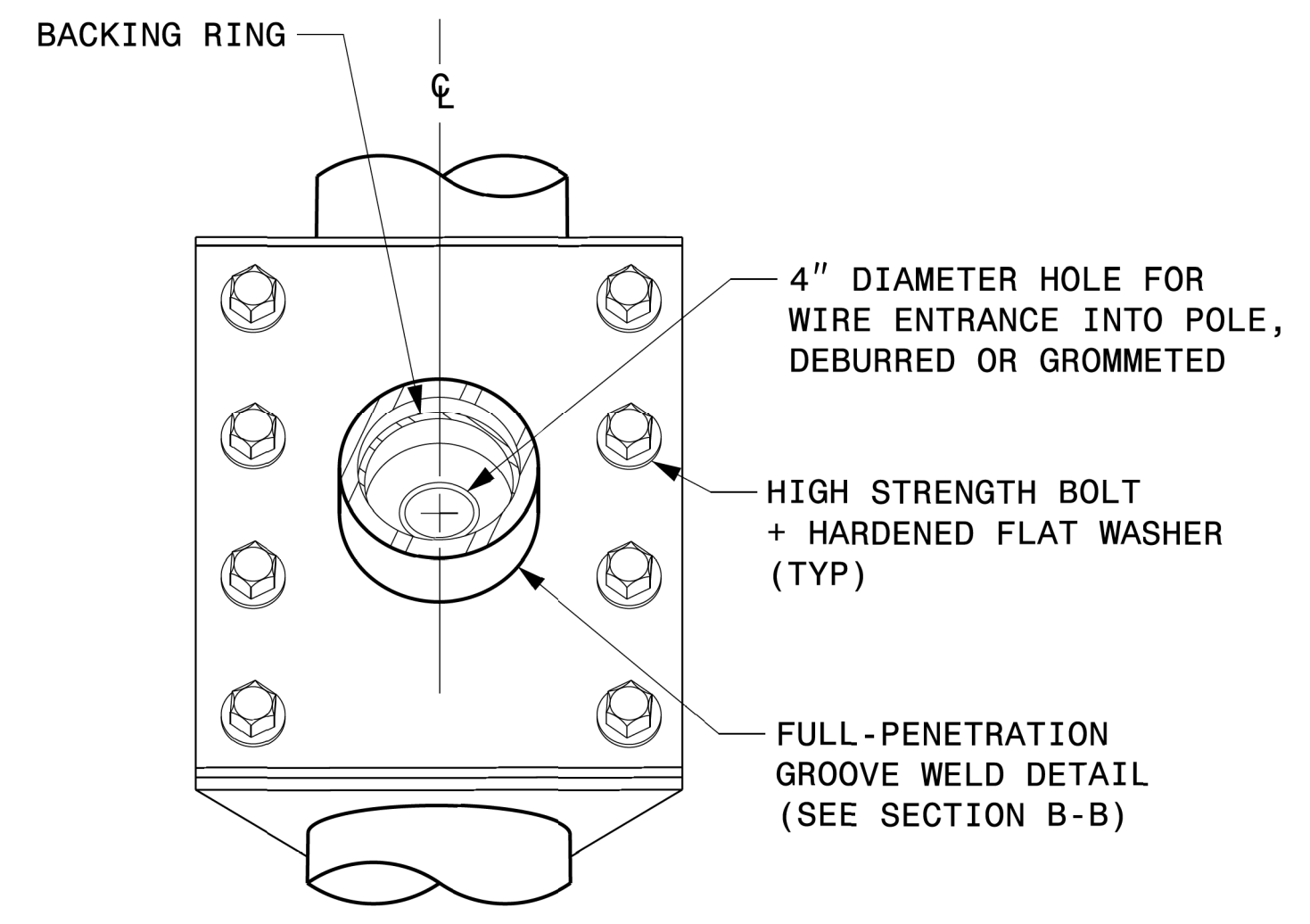
SECTION B-B
FULL-PENETRATION GROOVE WELD DETAIL



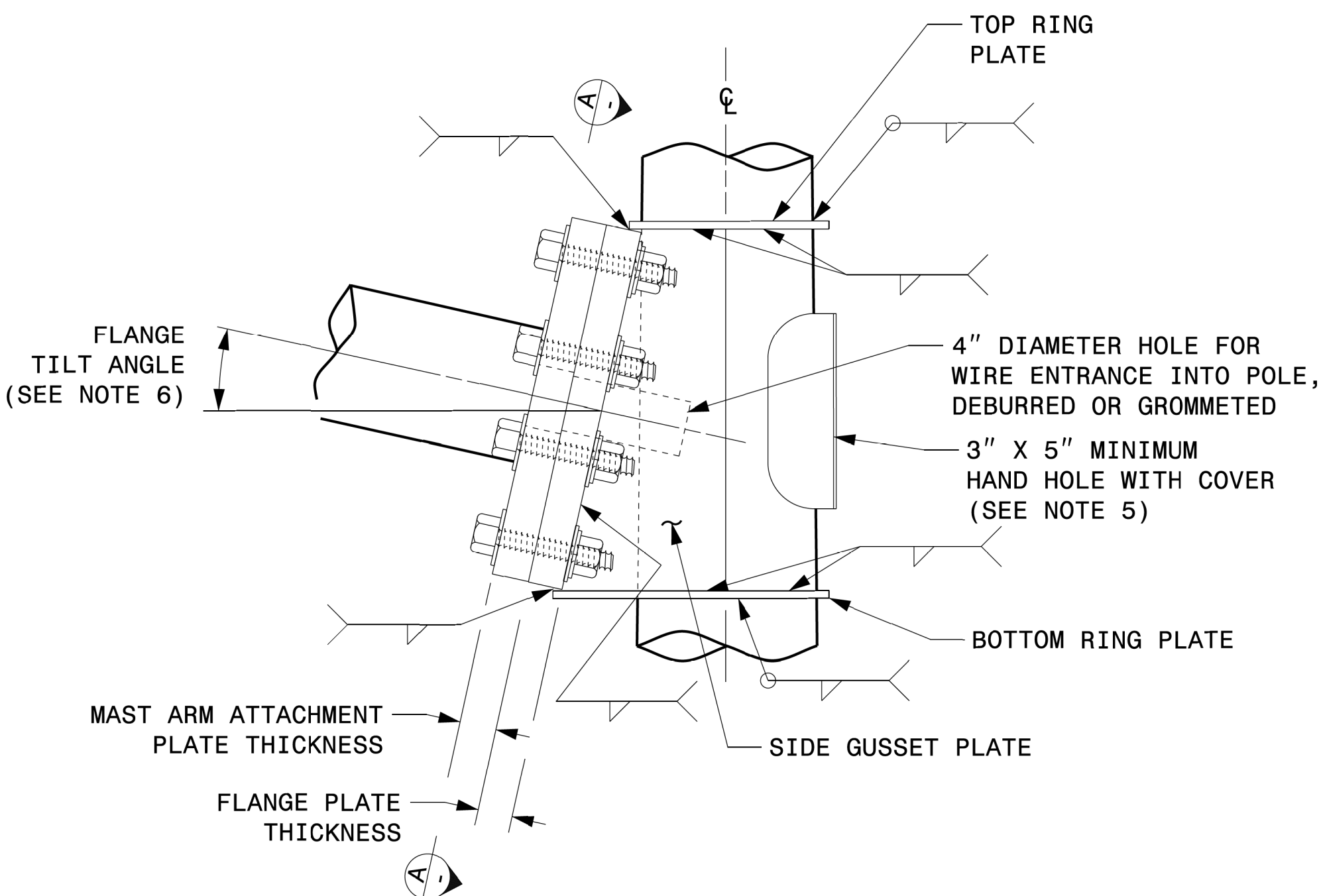
PLAN VIEW

NOTES:

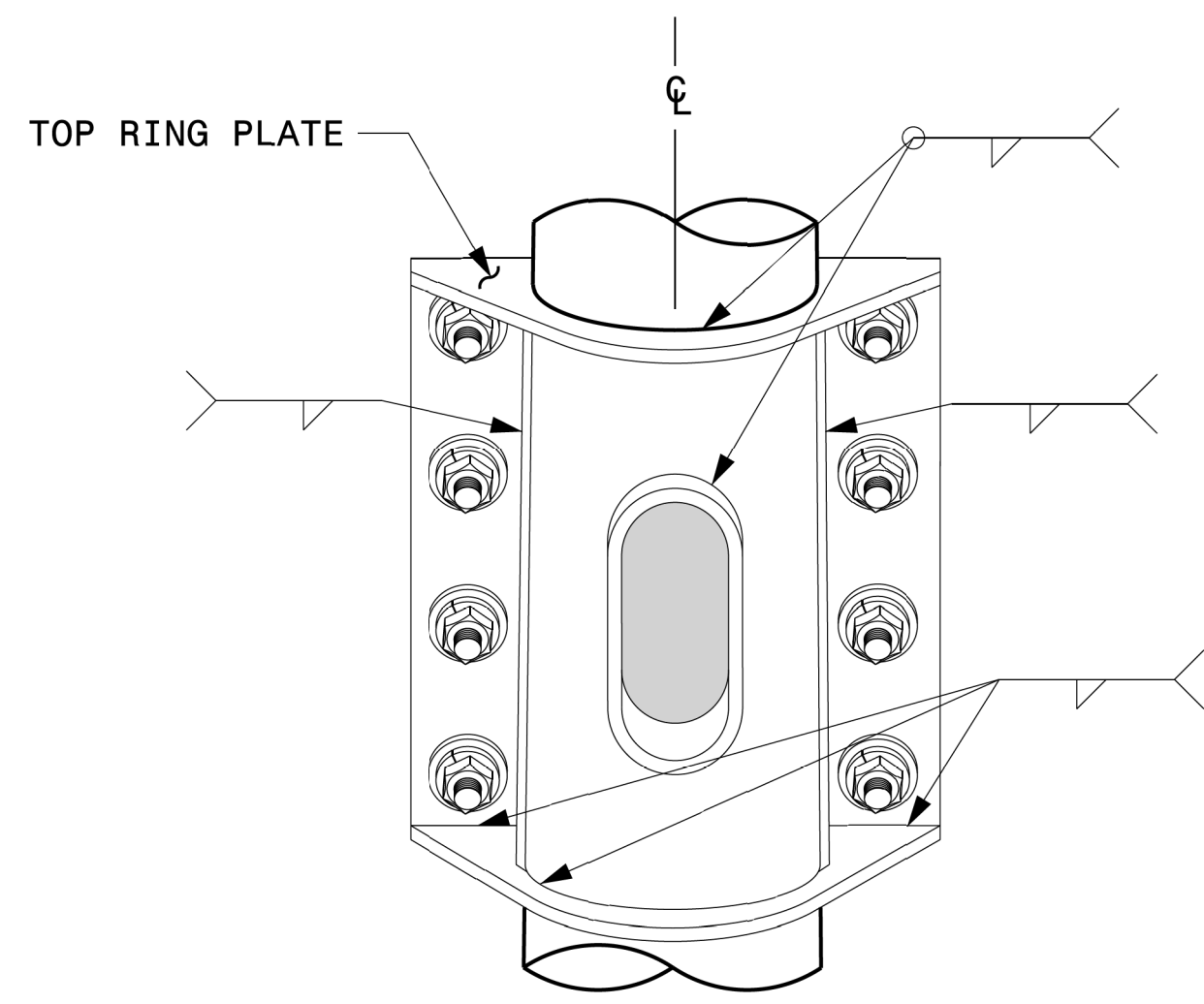
1. PROVIDE A PERMANENT MEANS OF IDENTIFICATION ABOVE THE MAST ARM TO INDICATE PROPER ATTACHMENT ORIENTATION OF THE MAST ARM.
2. DESIGNER WILL DETERMINE THE SIZE OF ALL STRUCTURAL COMPONENTS, PLATES, FASTENERS, AND WELDS SHOWN UNLESS THEY ARE ALREADY SPECIFIED.
3. FABRICATOR IS RESPONSIBLE FOR PROVIDING APPROPRIATE HOLES AT DRAINAGE POINTS TO DRAIN GALVANIZING MATERIALS.
4. FOR MINIMUM EDGE DISTANCE AND NOMINAL BOLT HOLE SIZE, FOLLOW THE LATEST AISC STEEL CONSTRUCTION MANUAL.
5. PROVIDE UPPER HANDHOLE AS NECESSARY WHEN SHAFT EXTENSIONS ARE REQUIRED FOR LUMINAIRE ARMS OR CAMERA. FOR POLES WITHOUT LUMINAIRES/CAMERA, WIRING CAN BE DONE THROUGH THE TOP OF POLE.
6. ALLOWABLE RANGE OF FLANGE TILT ANGLE WILL VARY FROM 0° TO AS REQUIRED.



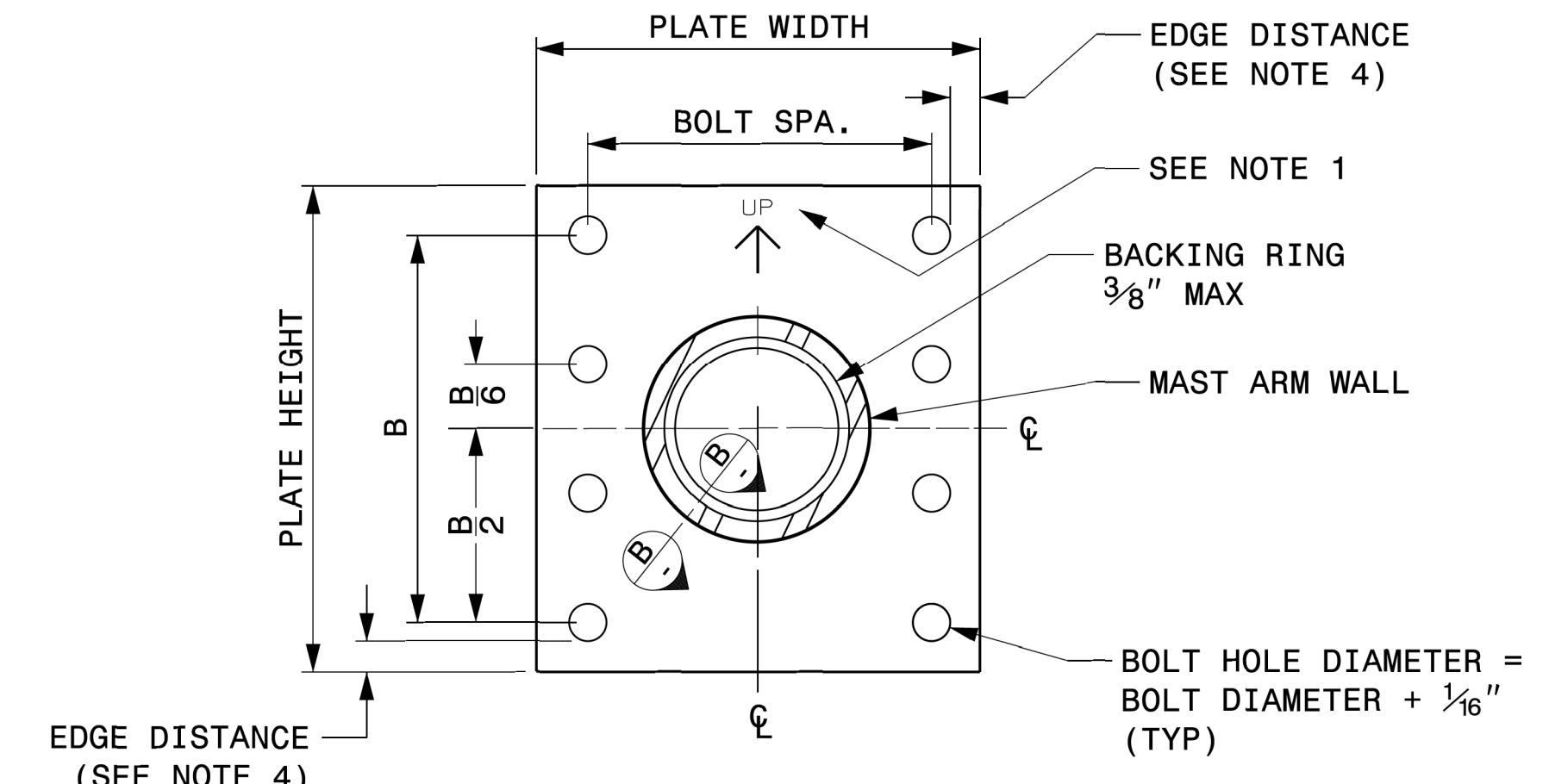
FRONT ELEVATION VIEW



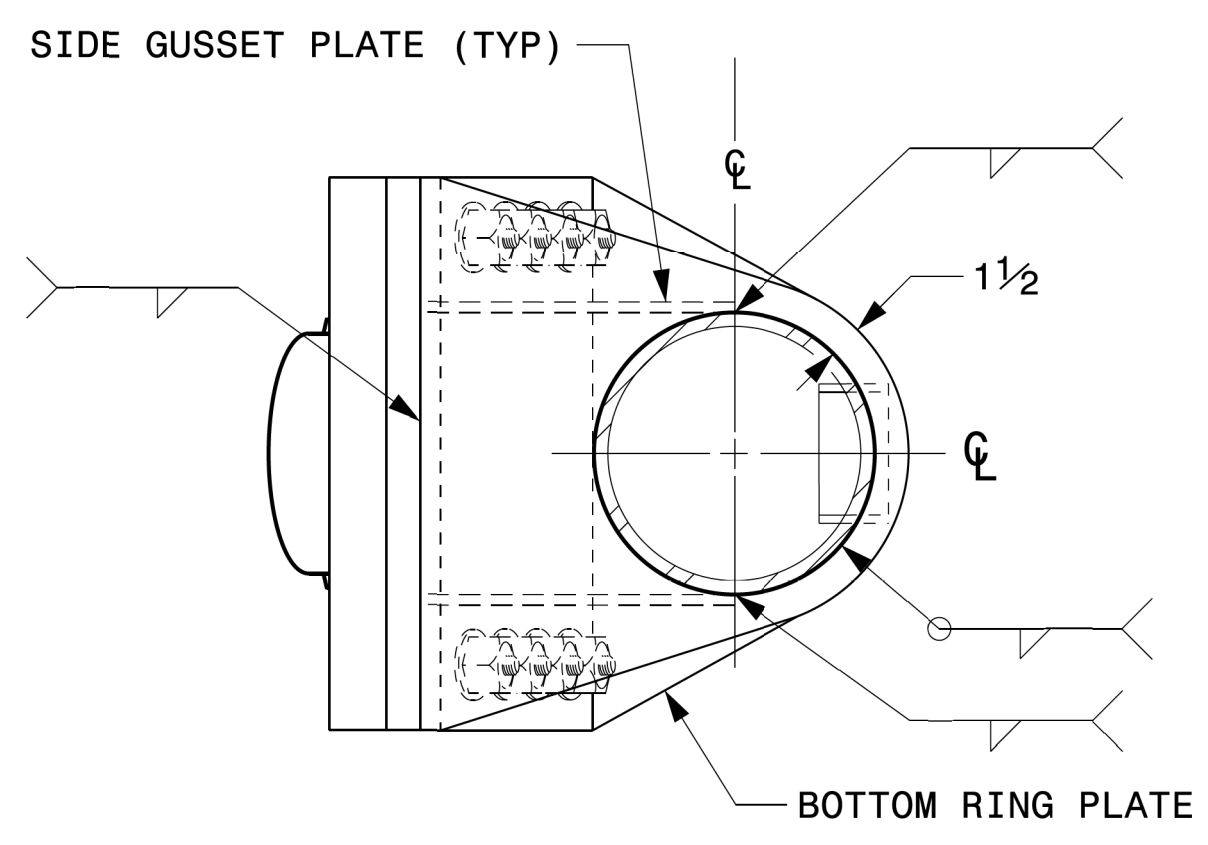
SIDE ELEVATION VIEW



BACK ELEVATION VIEW



SECTION A-A
MAST ARM ATTACHMENT PLATE



BOTTOM VIEW

09-2023-003 12/3/8 S:\TSS\SM\TSS\Sig.M5.dgn Design Section Structures\Drawings\2024 Metal Pole Std Drawings for LRF\2024 Sig.M5 Std. Connection Fabrication Detail\1-Mast Arm Poles.dgn kcdur:qgn

Prepared in the Offices of:

750 N. Grandfield Hwy, Garner, NC 27529

Typical Fabrication Details For Mast Arm Connection To Pole

| | |
|---------------------------|---------------------------|
| PLAN DATE: SEPTEMBER 2023 | DESIGNED BY: C.F. ANDREWS |
| PREPARED BY: K.C. DURIGON | REVIEWED BY: D.C. SARKAR |
| REVISIONS | INIT. DATE |
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SEAL

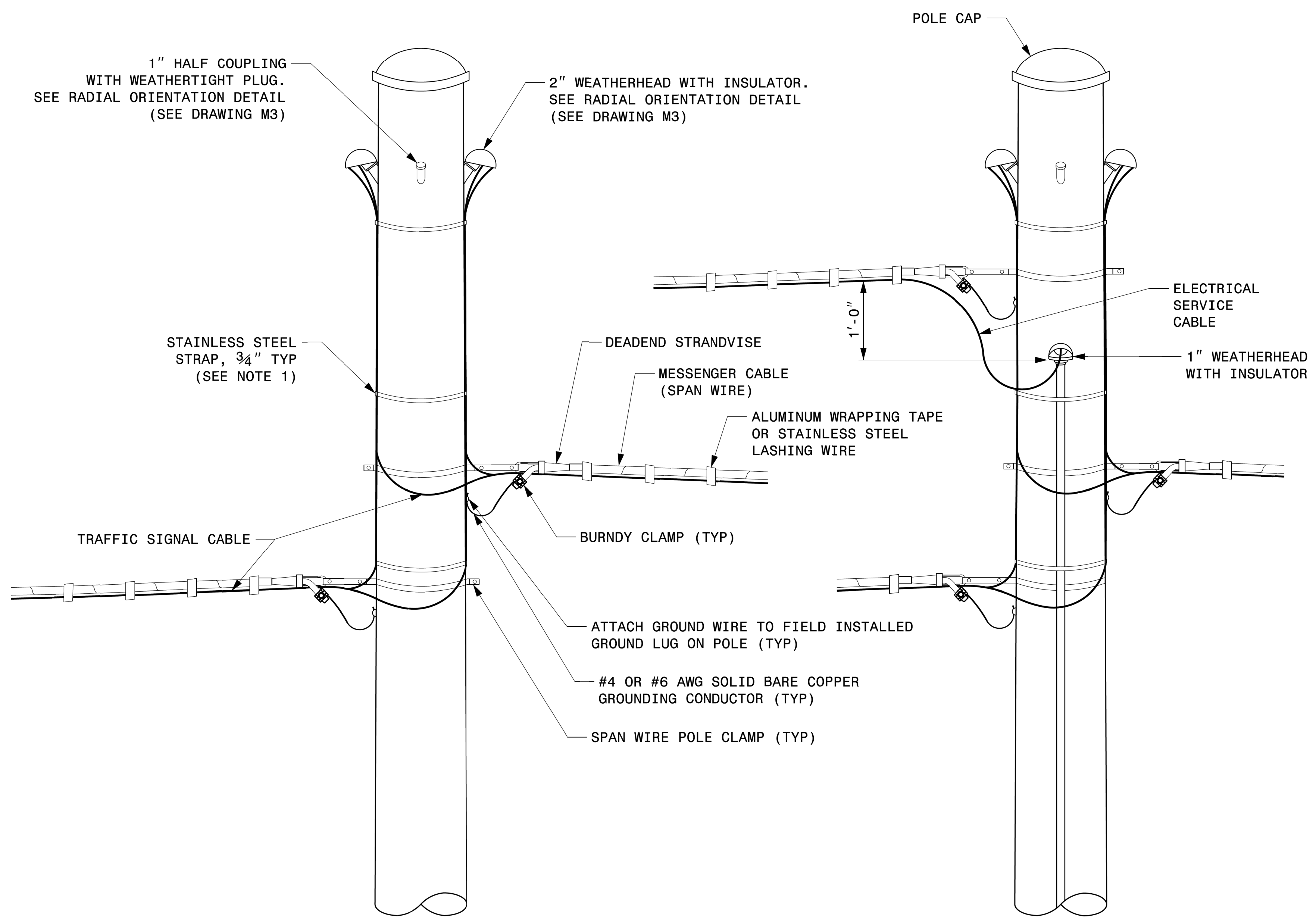
DocuSigned by: **Kevin Durigon**

4B23DC79B3784DA

09/21/2023 DATE

Fabrication Details – Mast Arm Connection

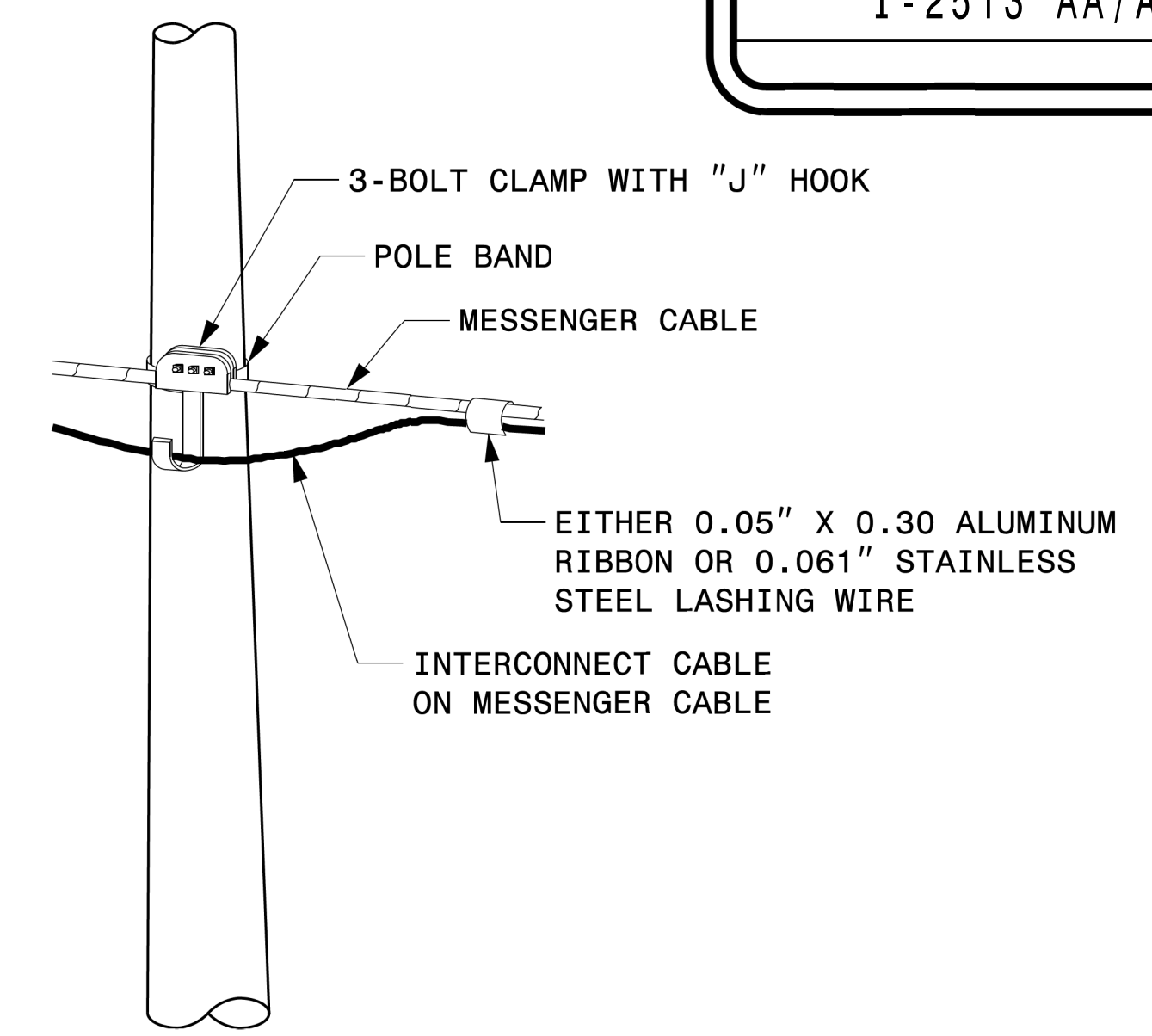
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| PROJECT I.D. NO. | SHEET NO. |
| I-2513 AA/AB | Sig.M6 |



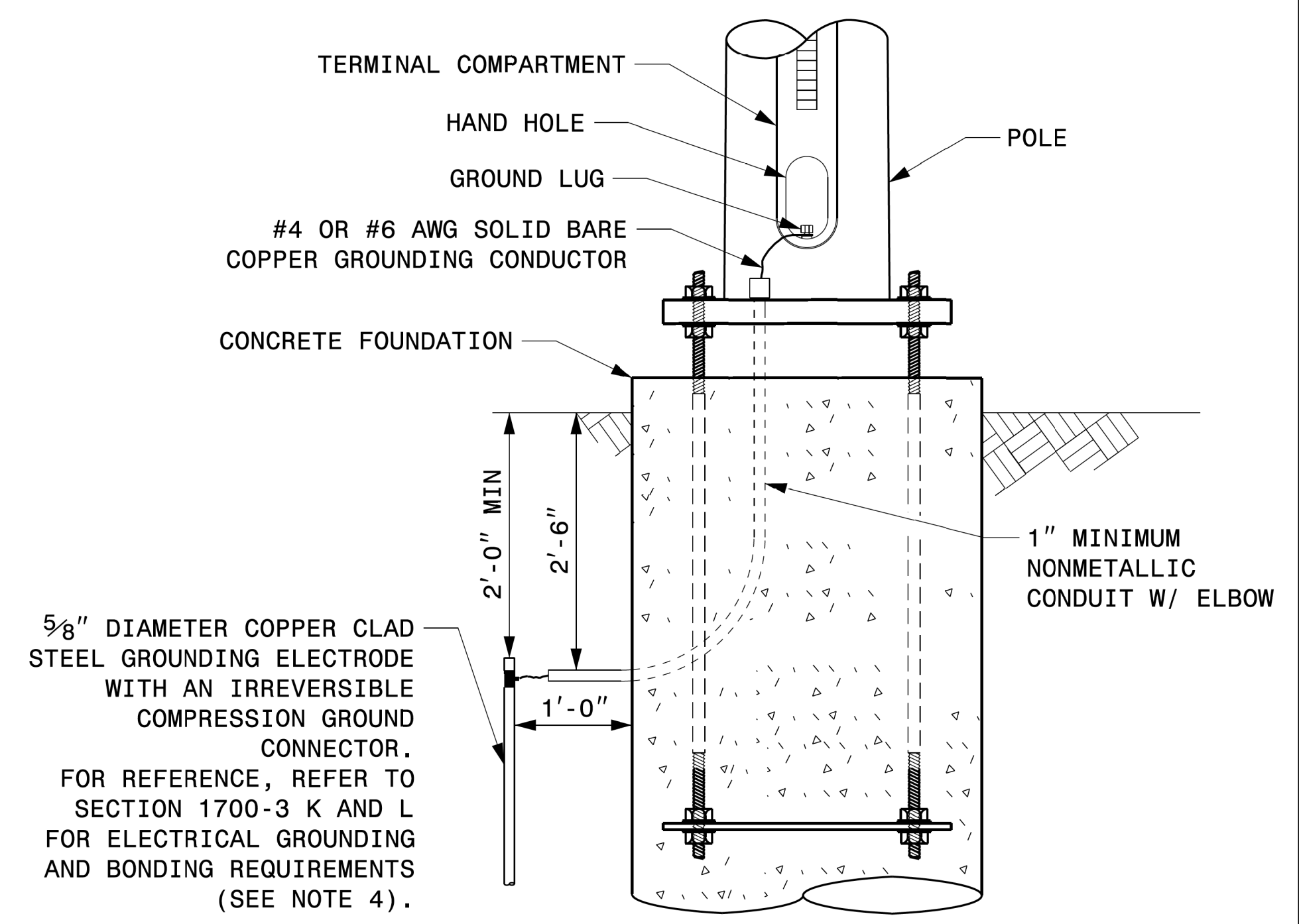
STRAIN POLE ATTACHMENTS

NOTES:

- STRAP ALL SIGNAL CABLES TO THE SIDE OF THE POLE WITH 3/4" STAINLESS STEEL STRAPS WHEN THE DISTANCE BETWEEN SPAN WIRE ATTACHMENT CLAMP AND WEATHERHEADS EXCEEDS 3'-0".
- PROVIDE MINIMUM TWO SPAN WIRE POLE CLAMPS PER POLE.
- IT IS PROHIBITED TO ATTACH TWO SPAN WIRES AT ONE POLE CLAMP.
- FOR GENERAL REQUIREMENTS, REFER TO NCDOT STANDARD SPECIFICATIONS FOR ROADWAY AND STRUCTURES, JANUARY 2024.



ATTACHMENT OF CABLE TO INTERMEDIATE METAL POLE



METAL POLE GROUNDING DETAIL FOR STRAIN POLE AND MAST ARM

Prepared in the Offices of:

 750 N. Grandfield Hwy, Garner, NC 27529

Typical Fabrication Details For Strain Pole Attachments

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

SCALE: 0 NA NONE

SEAL

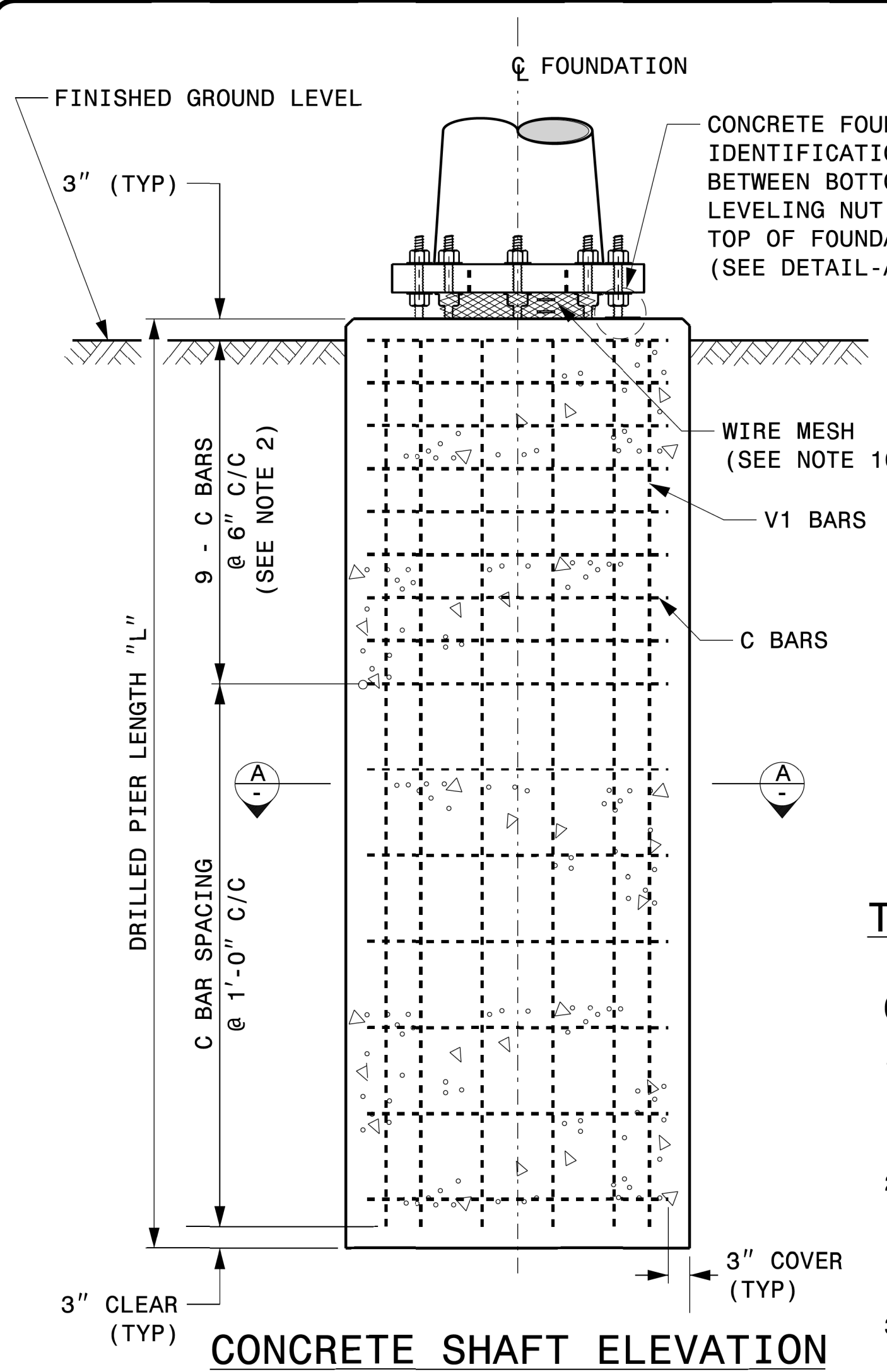
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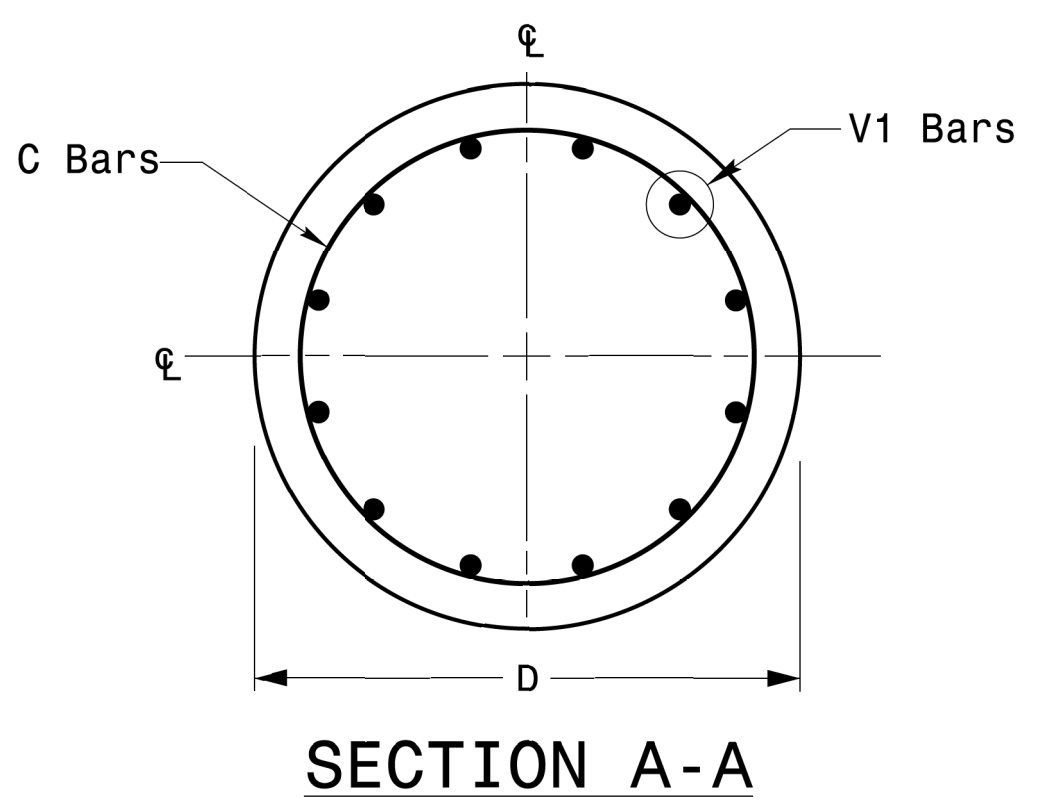
09/21/2023
DATE

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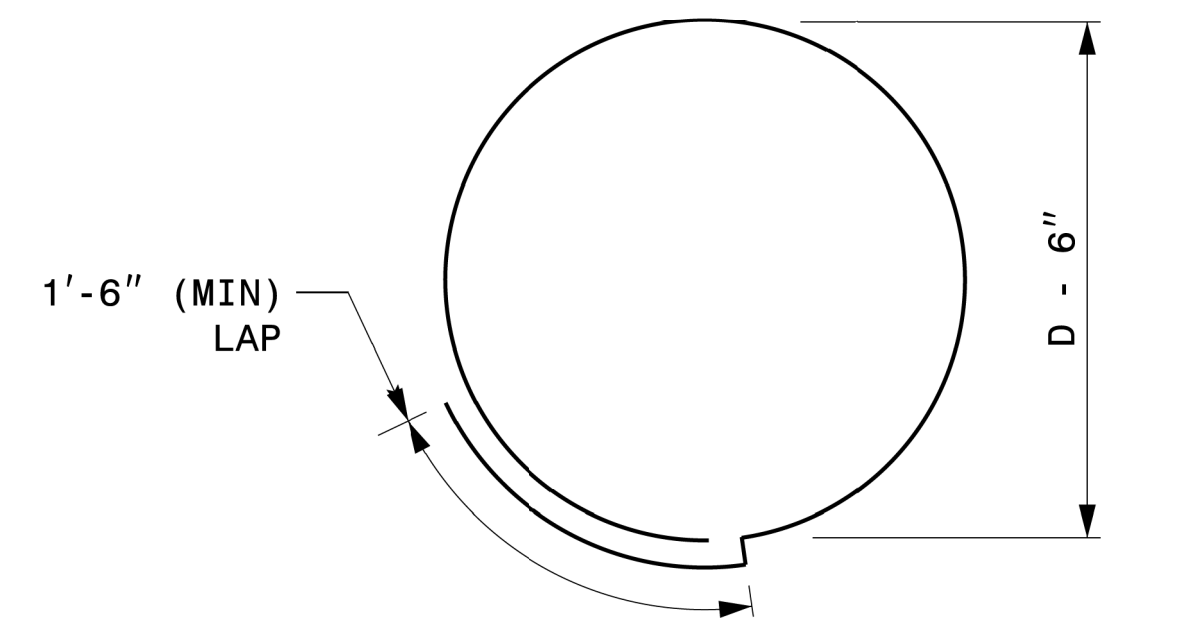
Fabrication Details – Strain Pole Attachments



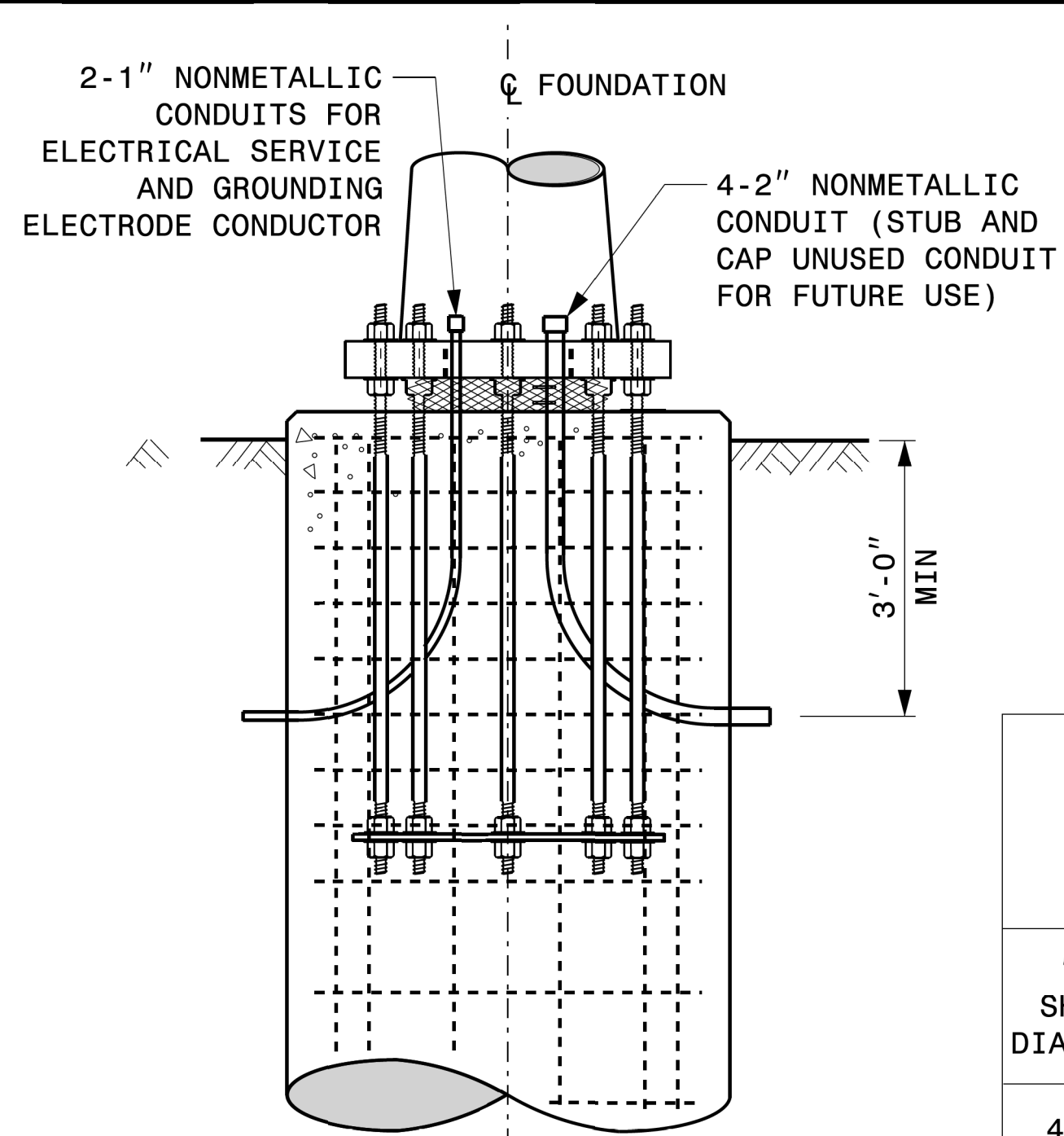
CONCRETE SHAFT ELEVATION



SECTION A-A



TYPICAL "C" BAR DETAIL



TYPICAL FOUNDATION CONDUIT DETAILS

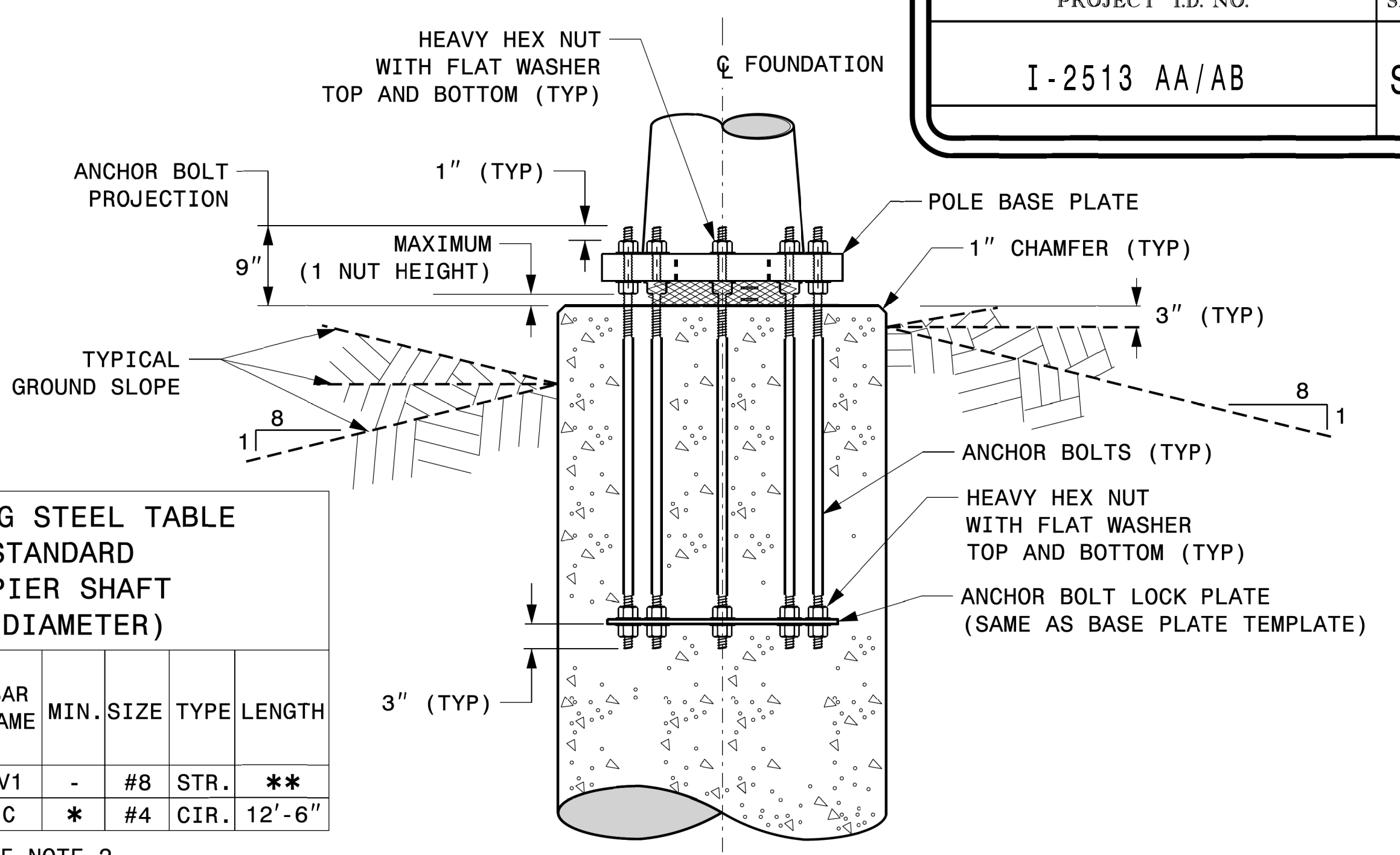
REINFORCING STEEL TABLE FOR STANDARD DRILL PIER SHAFT (4'-0" DIAMETER)

| "D" SHAFT DIAMETER | CONCRETE VOLUME (CU. YDS) | BAR NAME | MIN. SIZE | TYPE | LENGTH |
|--------------------|---------------------------|----------|-----------|---------|--------|
| 4'-0" | .465 X L | V1 | - | #8 STR. | ** |
| | | C | * | #4 CIR. | 12'-6" |

* SEE NOTE 2
** SEE NOTE 3

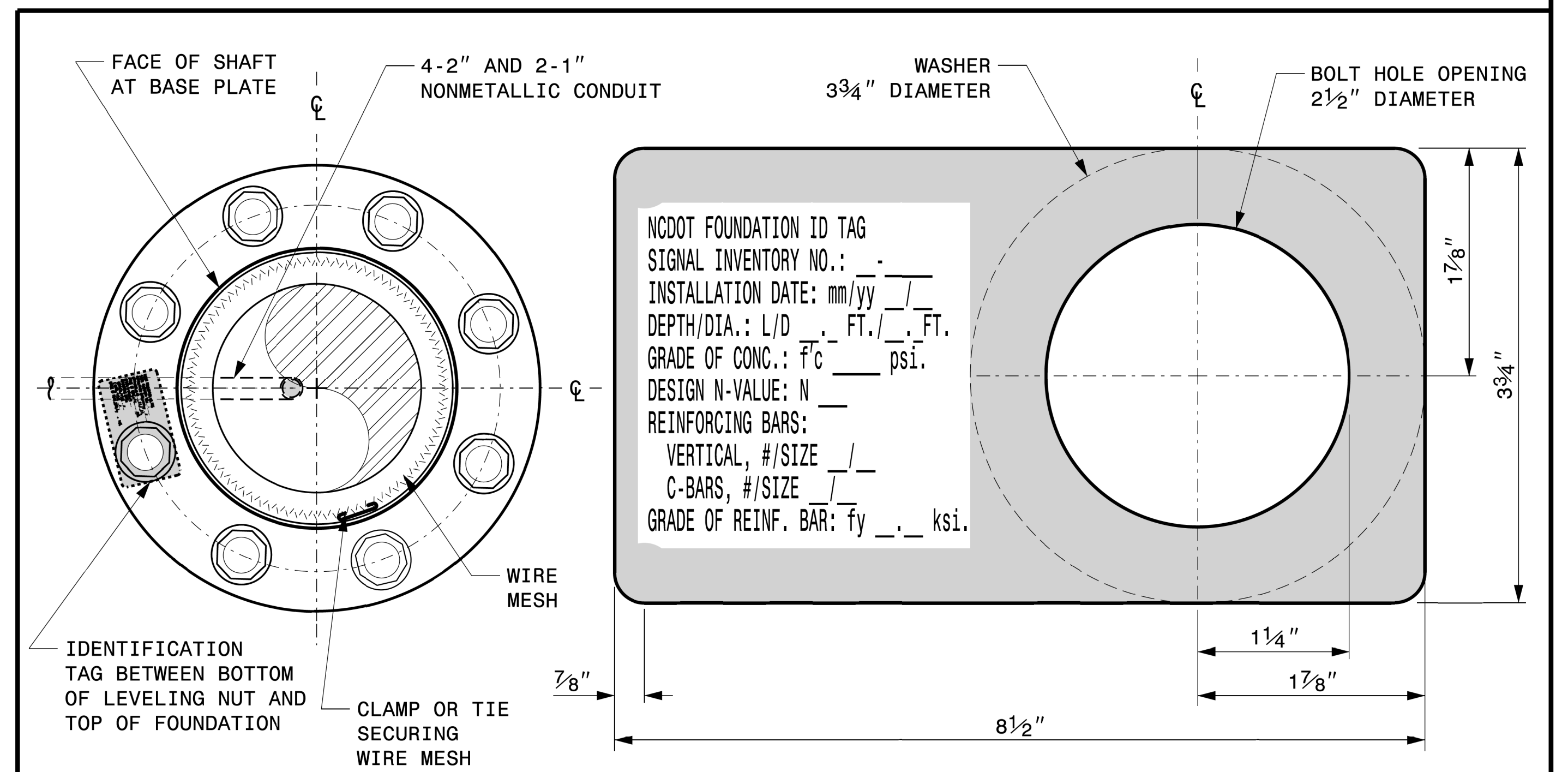
GENERAL NOTES:

- IF ACTUAL SUBSURFACE CONDITIONS DIFFER SIGNIFICANTLY FROM BORING DATA, CONTACT THE ENGINEER BEFORE EXCAVATING OR PLACING CONCRETE.
- CIRCULAR TIE REINFORCING RINGS MAY BE VERTICALLY ADJUSTED BY +/-3" AT A DEPTH BETWEEN 2'-0" AND 3'-0" TO FACILITATE THE INSTALLATION OF ELECTRICAL CONDUIT ENTERING IN THE CAGE.
- FOR STANDARD FOUNDATIONS, SEE SHEET SIG. M8 FOR DETAILS. VERTICAL REINFORCING BARS (V1) MAY BE HORIZONTALLY ADJUSTED BY +/-3" TO FACILITATE THE INSTALLATION OF ELECTRICAL CONDUIT ENTERING INTO THE CAGE.
- PROVIDE 2" TO 5" FOUNDATION PROJECTION ABOVE GROUND LEVEL, DEPENDING ON THE GROUND SLOPE.
- UNLESS OTHERWISE SHOWN, FOUNDATION DESIGNS ARE BASED ON NON-SLOPING LEVEL GROUND SURFACES WITH SLOPE RATIOS OF 8:1 (H:V) OR FLATTER. IF ACTUAL GROUND LINE SLOPES ARE STEEPER, CONTACT THE ENGINEER BEFORE EXCAVATING OR PLACING CONCRETE.
- CONSTRUCT FOUNDATIONS IN ACCORDANCE WITH NCDOT STANDARD PROVISIONS SP09 R005- FOUNDATIONS AND ANCHOR ROD ASSEMBLIES FOR METAL POLES. ALL APPLICABLE 2024 NCDOT STANDARD SPECIFICATIONS ARE REFERENCED IN THIS PROVISION. REFER TO THE NCDOT RESOURCES/SPECIFICATIONS PAGE LOCATED ON THE CONNECT NCDOT WEBSITE.
[https://connect.ncdot.gov/resources/Specifications and Special Provisions.aspx](https://connect.ncdot.gov/resources/Specifications%20and%20Special%20Provisions.aspx)
- USE AIR ENTRAINED AA CONCRETE MIX WITH A COMPRESSION STRENGTH OF $f'_c=4500$ psi (MIN) AFTER 28 DAYS.
- USE ASTM A615 GRADE 60 DEFORMED BARS FOR ALL REINFORCING STEEL. MAINTAIN AT LEAST 3" COVER ON ALL REINFORCEMENT.
- LOCATE IDENTIFICATION TAG ON TOP OF THE FOUNDATION, DIRECTLY ABOVE THE CONDUIT'S ENTRY POINT.
- PROVIDE TWO LAYERS OF 4 MESH GALVANIZED WELDED 23 GAUGE (0.025) 6" WIDE AROUND PIPES UNDER THE BASE PLATE AND SECURE IT WITH TIES IF NECESSARY.
- PREFERRED LOCATION FOR THE I.D. TAG IS AS SHOWN IN DETAIL-A; DIRECTLY ABOVE THE CONDUIT ENTERING THE FOUNDATION.



TYPICAL FOUNDATION ANCHOR BOLT DETAILS

(REINFORCING CAGE NOT SHOWN FOR CLARITY)



DETAIL-A

CONCRETE FOUNDATION IDENTIFICATION TAG DETAILS

| <p>750 N. Grandfield Pkwy, Garner, NC 27529</p> | <p>Construction Details For Foundations</p> | | <p>SEAL</p> | | | |
|---|--|---|-------------|-------|------|--|
| | <p>PLAN DATE: SEPTEMBER 2023 DESIGNED BY: K.C. DURIGON</p> <p>PREPARED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR</p> | <p>REVISIONS</p> <table border="1"> <tr> <th>INIT.</th> <th>DATE</th> </tr> <tr> <td> </td> <td> </td> </tr> </table> | | INIT. | DATE | |
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| <p>SCALE: NA</p> <p>NONE</p> | <p>DATE: 09/21/2023</p> | | <p>DATE</p> | | | |

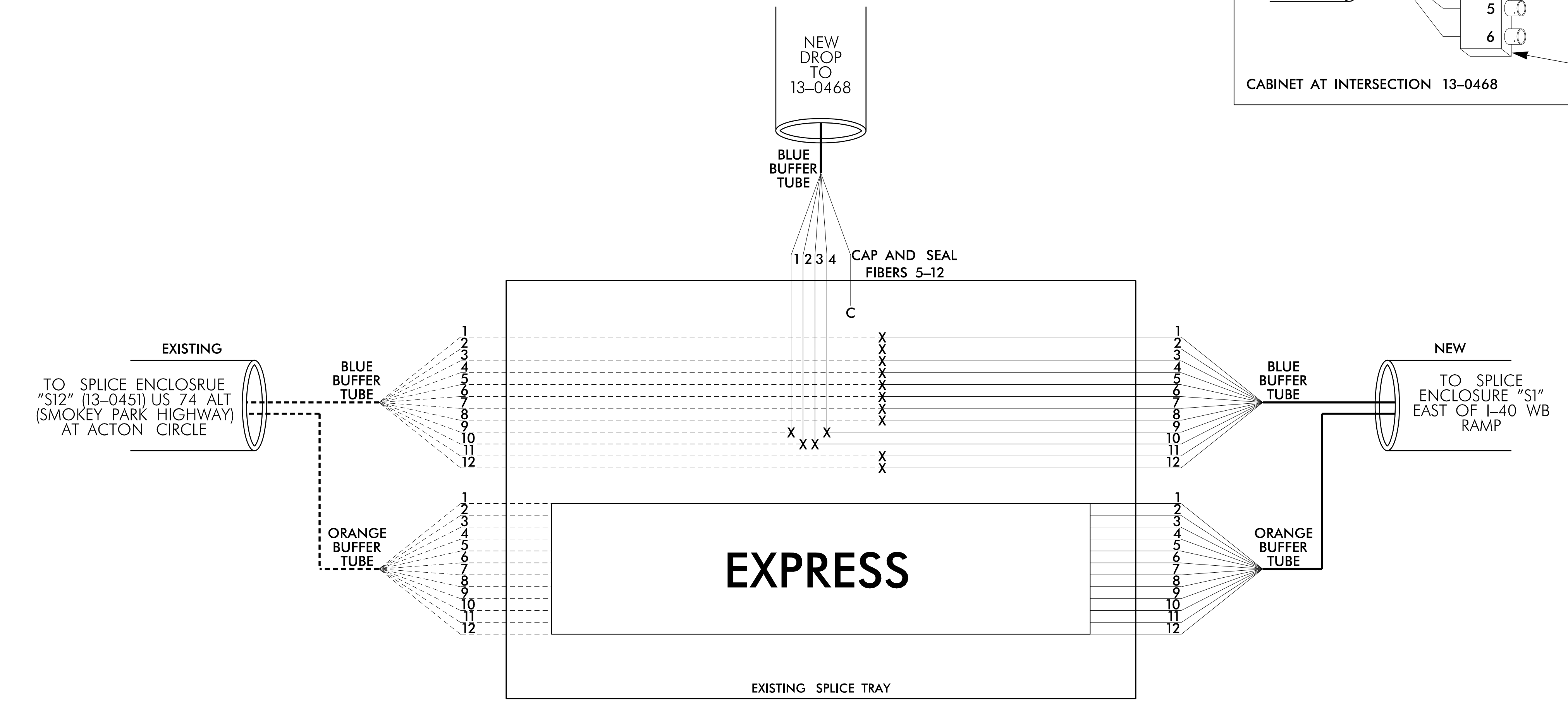
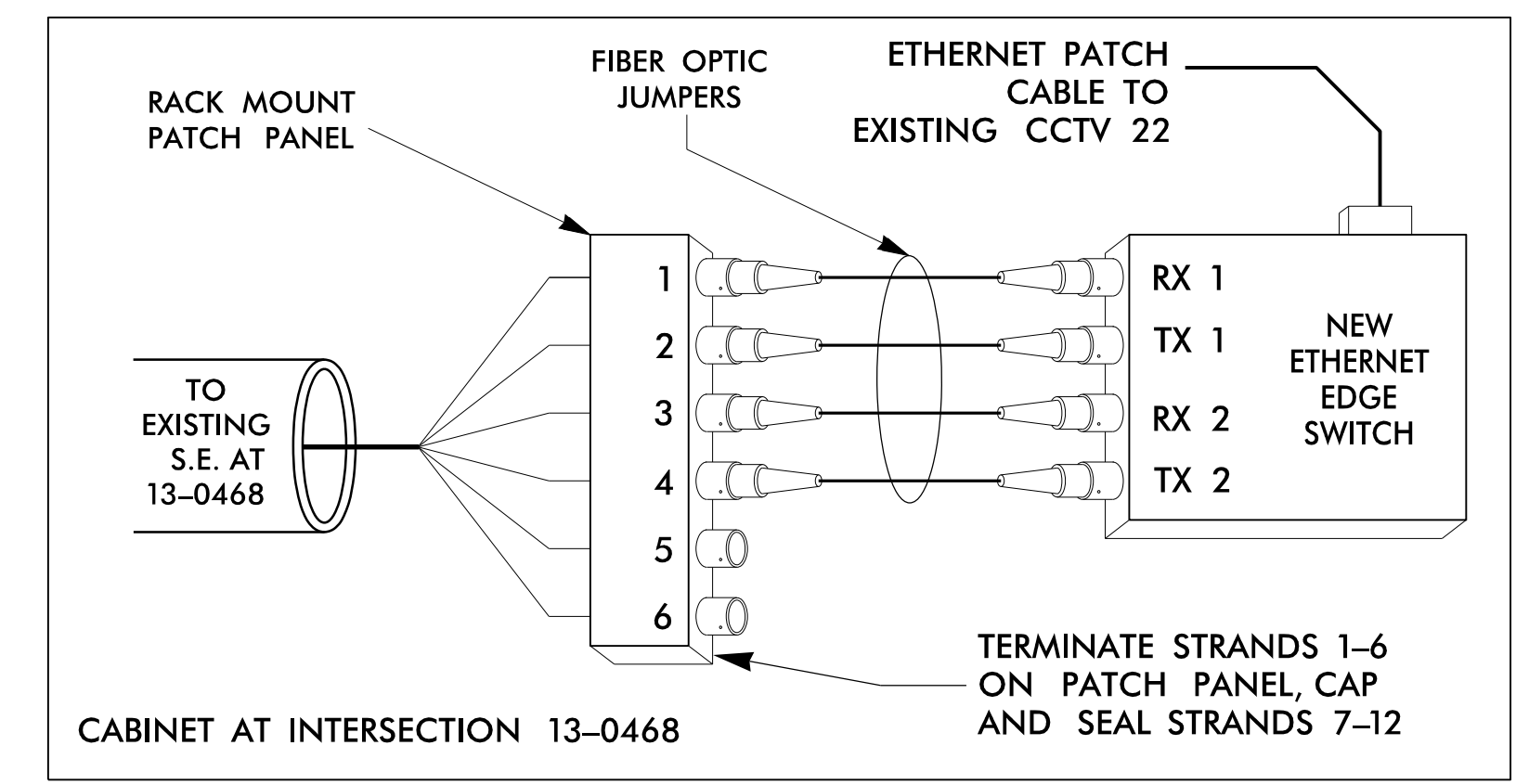
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Construction Details - Foundations

EXISTING UNDERGROUND SPLICE ENCLOSURE
 "S12-1" US 74 ALT (SMOKEY PARK HIGHWAY)
 AT I-40 WB RAMP
 SIG. INV. #13-0468

Notes:
 Unused fibers left coiled and stored in splice tray.
 Unused Buffer Tubes left coiled and stored in splice tray.

- LEGEND**
- X = FUSION SPLICE
 - E = EXISTING SPLICE
 - C = CAP IN TRAY
- EXPRESS** = EXPRESS ALL FIBERS/
BUFFER TUBES
- SPLICE** = SPLICE ALL FIBERS/
BUFFER TUBES
- COLOR CODE**
TIA/EIA 598-A
- | | |
|------------|-------------|
| (1) BLUE | (7) RED |
| (2) ORANGE | (8) BLACK |
| (3) GREEN | (9) YELLOW |
| (4) BROWN | (10) VIOLET |
| (5) SLATE | (11) ROSE |
| (6) WHITE | (12) AQUA |



- FIVE (5) DAYS PRIOR TO BEGINNING WORK ON THE SIGNAL SYSTEM, CONTACT THE ASHEVILLE TRAFFIC ENGINEER, KEVIN SEXTON, AT (828) 298-0094 TO ARRANGE FOR THE CITY OF ASHEVILLE TO PROGRAM THE NEW FIELD ETHERNET SWITCHES WITH THE NECESSARY NETWORK CONFIGURATION DATA, INCLUDING BUT NOT LIMITED TO: THE PROJECT IP ADDRESS, DEFAULT GATEWAY, SUBNET MASK AND VLAN ID INFORMATION. NOTIFY THE TRAFFIC ENGINEER AFTER ALL WORK IS PERFORMED TO ENSURE THAT ALL FIBER CIRCUITS ARE FUNCTIONING PROPERLY. WORK IS NOT COMPLETE UNTIL THE SIGNAL SYSTEM IS BACK UP AND OPERATIONAL.
- CONTRACTOR TO RECORD EXISTING SPLICE ARRANGEMENT FOR COMPARISON TO THE SUPPLIED SPLICE DETAILS. IF DISCREPANCIES EXIST, CONTACT THE ENGINEER TO DETERMINE HOW TO PROCEED WITH RESPLICING. PROVIDE AS-BUILT PLANS TO THE ENGINEER IF FINAL SPLICE ARRANGEMENT DIFFERS FROM THE SUPPLIED SPLICE DETAILS.
- ETHERNET SWITCH TERMINATION CONFIGURATIONS ARE GENERIC. CONTRACTOR IS RESPONSIBLE FOR DETERMINING \ ENSURING PROPER TERMINATIONS.
- INCLUDE ON THE COVER OF EACH SPLICE TRAY THE FOLLOWING:
 REFERENCE SECTION 1731 "FIBER OPTIC SPLICE ENCLOSURE"

- SPLICE LOCATION
- DATE
- COMPANY NAME
- NAME OF INDIVIDUAL PERFORMING THE SPLICING

PRIOR TO INSTALLING THE COVER ON THE SPLICE TRAY TAKE A DIGITAL PHOTOGRAPH SHOWING THE SPLICE TRAY AND INFORMATION SHOWN ABOVE (1-4) AND SUBMIT PHOTOGRAPH ALONG WITH OTDR TEST RESULTS.

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

| | | | |
|--|---|--|--|
| Prepared for the Offices of: 750 N. Greenfield Pkwy, Garner, NC 27529 | Asheville Signal System Splice Details | | SEAL SEAL 026679 ROCHELLE GARRETT |
| | Division 13 Buncombe County Asheville | PLAN DATE: December 2023 REVIEWED BY: M. Cavenaugh | |
| SCALE: 0 NA N.T.S. | REVISIONS: _____ INIT. DATE | DocuSigned by: Rochelle Garrett 12/5/2023 SIGNATURE DATE CADD Filename: | |

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 Suite 200 Raleigh, NC 27607
 Phone: 919-461-1100

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NEW UNDERGROUND SPLICE ENCLOSURE "S1" US 74 ALT (SMOKEY PARK HIGHWAY) EAST OF I-40 WB RAMP

LEGEND

X = FUSION SPLICE
E = EXISTING SPLICE
C = CAP IN TRAY

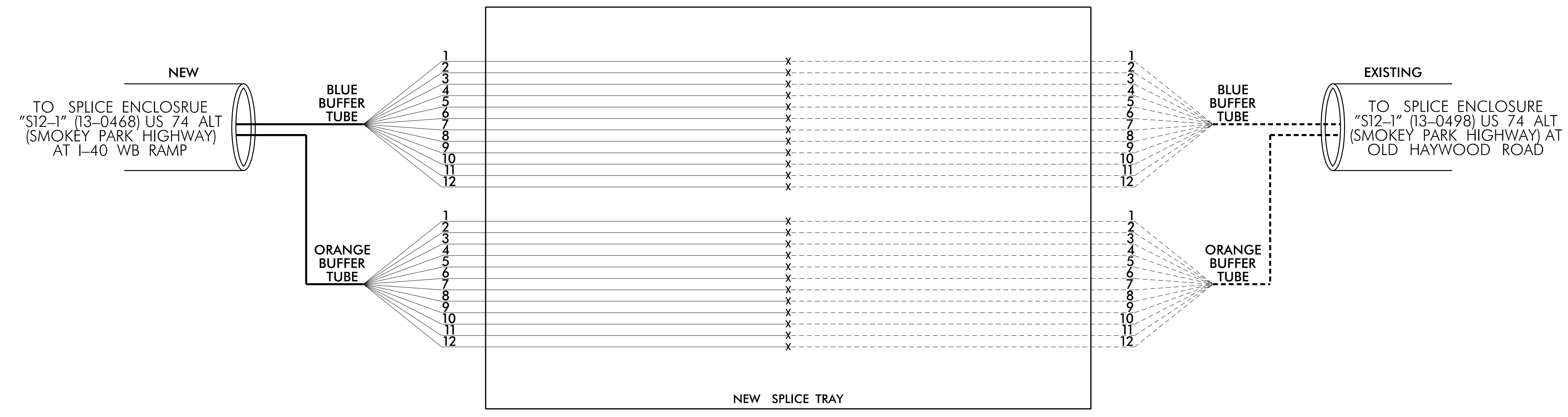
EXPRESS = EXPRESS ALL FIBERS/ BUFFER TUBES

SPLICE = SPLICE ALL FIBERS/ BUFFER TUBES

COLOR CODE TIA/EIA 598-A

| | |
|------------|-------------|
| (1) BLUE | (7) RED |
| (2) ORANGE | (8) BLACK |
| (3) GREEN | (9) YELLOW |
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Notes:
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Unused Buffer Tubes left coiled and stored in splice tray.



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3. ETHERNET SWITCH TERMINATION CONFIGURATIONS ARE GENERIC. CONTRACTOR IS RESPONSIBLE FOR DETERMINING \ ENSURING PROPER TERMINATIONS.
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Prepared for the Offices of:

Asheville Signal System Splice Details

Division 13 Buncombe County Asheville

PLAN DATE: December 2023 REVIEWED BY: M. Cavenaugh

PREPARED BY: M. Tindal REVIEWED BY: R. Garrett

SCALE: 0 NA N.T.S.

REVISIONS: INIT. DATE

DocuSigned by: **Rehelle Garrett** 12/5/2023

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