PROJECT: U–4700CC

CONTRACT:

Project No.	Sheet No.
U–4700CC	Sig. 1.0

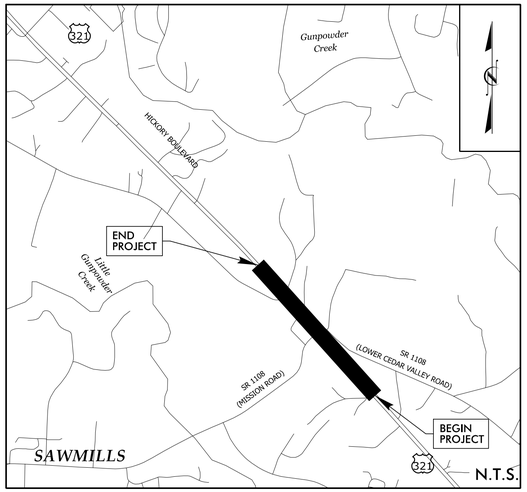
STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CALDWELL COUNTY

LOCATION: INTERSECTION OF US 321 (HICKORY BOULEVARD) AND SR 1108 (MISSION ROAD) /(LOWER CEDAR VALLEY ROAD)

TYPE OF WORK: TRAFFIC SIGNALS AND TRAFFIC SIGNAL COMMUNICATIONS

Vicinity Map



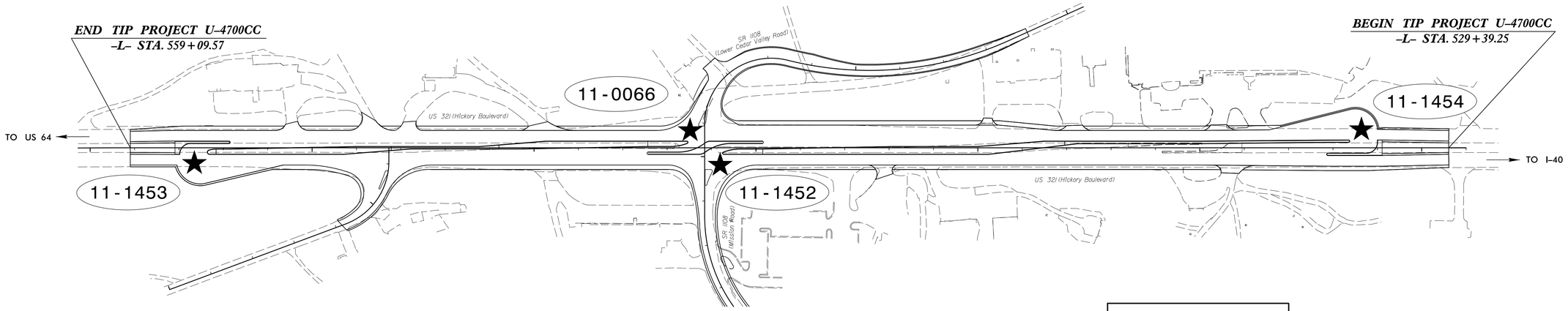
★ PROPOSED SIGNAL

XX-XXXX SIGNAL ID NUMBER

NAD 83/ NSRS 2011

END TIP PROJECT U–4700CC
–L– STA. 559+09.57

BEGIN TIP PROJECT U–4700CC
–L– STA. 529+39.25



Index of Plans

Sheet #	Reference #	Location/Description
Sig. 1.0	--------	Project Title Sheet
Sig. 2.0–2.4	11–1453	US 321 (Hickory Boulevard) SB at U–Turn North of SR 1108 (Mission–Lower Cedar Valley Road)
Sig. 3.0–5.4	11–0066	US 321 (Hickory Boulevard) NB at SR 1108 (Mission–Lower Cedar Valley Road)
Sig. 6.0–7.4	11–1452	US 321 (Hickory Boulevard) SB at SR 1108 (Mission–Lower Cedar Valley Road)
Sig. 8.0–8.2	11–1454	US 321 (Hickory Boulevard) NB at U–Turn South of SR 1108 (Mission–Lower Cedar Valley Road)
Sig. M1–M9	N/A	2024 Standard Metal Pole Sheets
SCP–1	Sig. Comm.	Signal Communication Plans

stv
STV Engineers, Inc.
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(704) 372–1885
NC License Number F–0991

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

NCDOT TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS UNIT

Contacts:

R. Nicholas Zinser, P.E. – Western Region Signals Engineer
Keith M. Mims, P.E. – State Signal Equipment Engineer
Gregory A. Green – Signal Communications Project Engineer

STV, Inc.

Contacts:

Trent M. Moody, P.E. – Senior Associate Engineering Director
Donald J. Darity, P.E. – Senior Traffic Signal Manager

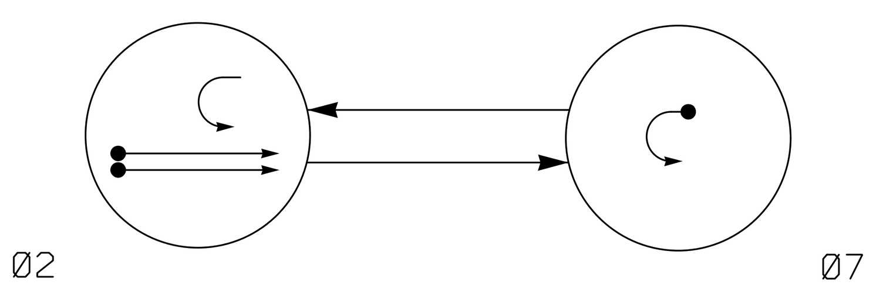
Prepared for the Offices of:
DIVISION OF HIGHWAYS
TRANSPORTATION MOBILITY AND SAFETY DIVISION

Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
TSMO UNIT

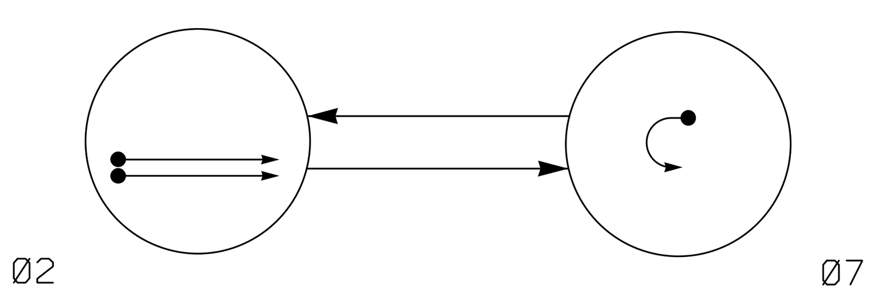
750 N. Greenfield Parkway, Garner, NC 27529

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 2.0

DEFAULT PHASING DIAGRAM



ALTERNATE PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

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

DEFAULT PHASING TABLE OF OPERATION

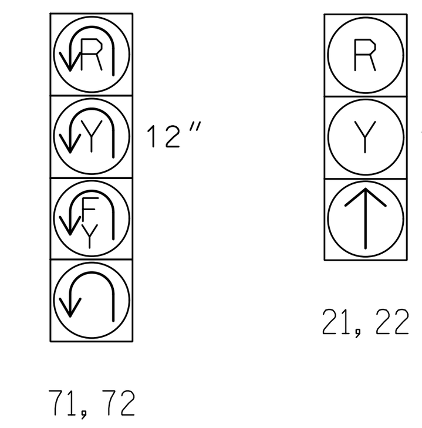
SIGNAL FACE	PHASE Ø2	Ø7	FLASH
21, 22	↑	R	Y
71, 72	F↶	↶	Y↶

ALTERNATE PHASING TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2	Ø7	FLASH
21, 22	↑	R	Y
71, 72	R↶	↶	Y↶

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

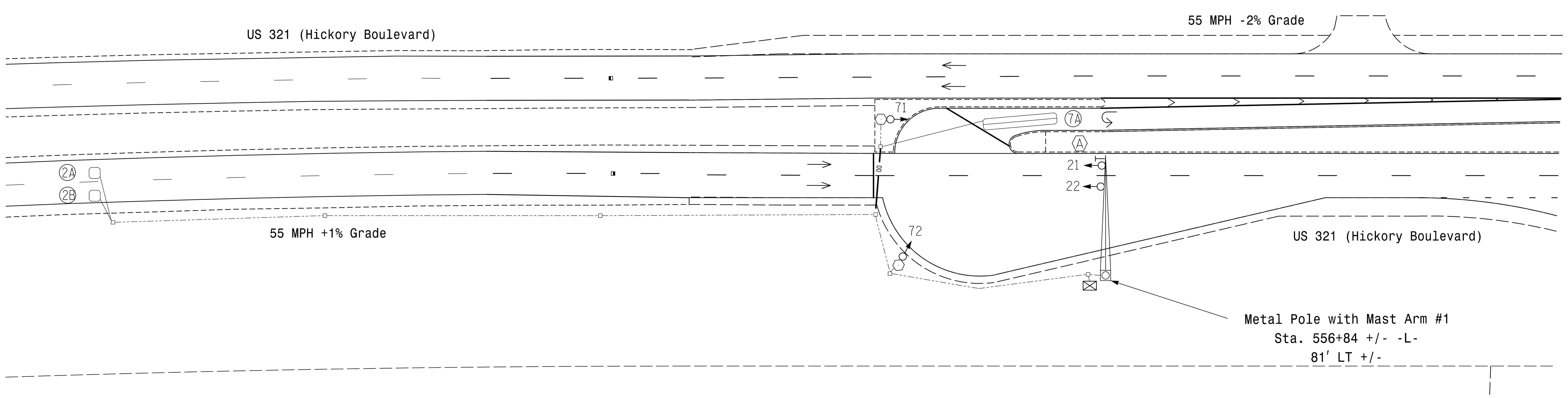
DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
2A	6X6	420	5	X	2	–	–	X	X	X	–	X
2B	6X6	420	5	X	2	–	–	X	X	X	–	X
7A	6X40	0	2-4-2	X	7	✳15.0	–	X	–	X	–	X

✳Disable Delay during Alternate Phasing operation.

2 Phase
Fully Actuated with Alternate Phasing Operation
US 321 Closed Loop 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. 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. The Division Traffic Engineer will determine the hours of use for each phasing plan.
6. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
7. Pedestal mounted signal heads shall be mounted a minimum of 8' above the high point of the roadway surface elevation.
8. Refer to Roadway and/or Pavement Marking plans for stop bar locations.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Metal Pole with Mastarm	
DD	Directional Drill	N/A
	Type II Signal Pedestal	
A	No Left Turn Sign (R3-2)	A

MAXTIME TIMING CHART

FEATURE	PHASE 2	7
Walk *	–	–
Ped Clear *	–	–
Min Green	14	7
Passage *	6.0	2.0
Max 1 *	90	20
Yellow Change	5.1	3.0
Red Clear	1.0	4.4
Added Initial *	1.5	–
Maximum Initial *	46	–
Time Before Reduction *	15	–
Time To Reduce *	30	–
Minimum Gap	3.4	–
Advance Walk	–	–
Non Lock Detector	–	X
Vehicle Recall	MIN RECALL	–
Dual Entry	–	–

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

New Installation

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Prepared for the Offices of:
Transportation Mobility and Safety Division, Signal Design Section — State of North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

SCALE 0 40 1"=40'

US 321 (Hickory Boulevard) SB at U-Turn North of SR 1108 (Mission Road)/ SR 1108 (Lower Cedar Valley Road)

Division 11	Caldwell County	Hudson	
PLAN DATE: Sept 2023		REVIEWED BY: D.J. Darity	
PREPARED BY: J.T. Grimm		REVIEWED BY: T.M. Moody	

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

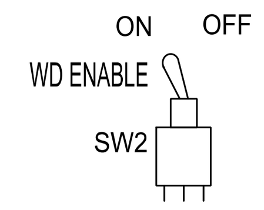
DocuSigned by: Donald J. Darity 10/18/2023
589F69087E72485
SIGNATURE DATE

SIG. INVENTORY NO. 11-1453

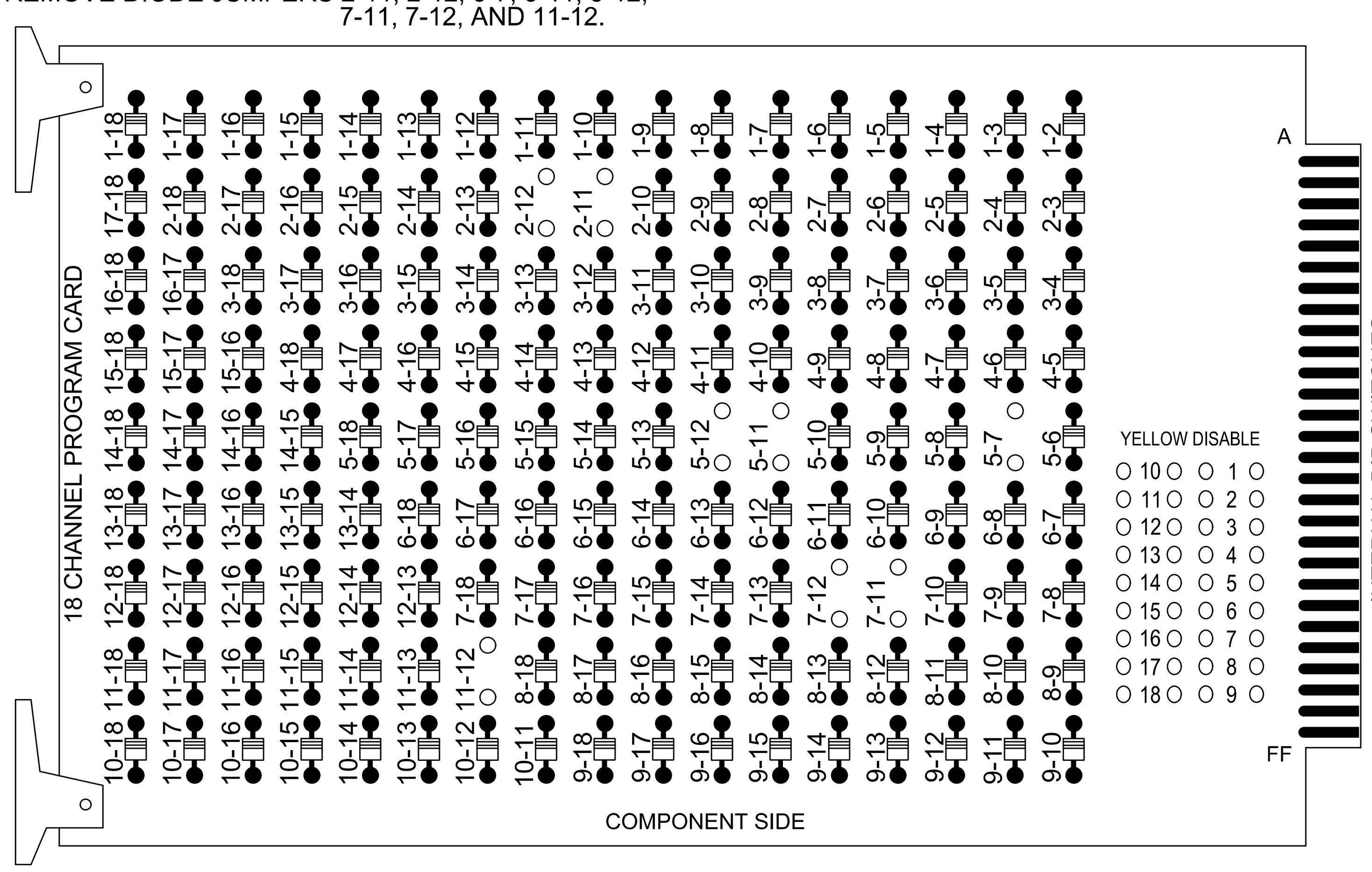
PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 2.1

18 CHANNEL CONFLICT MONITOR PROGRAMMING DETAIL

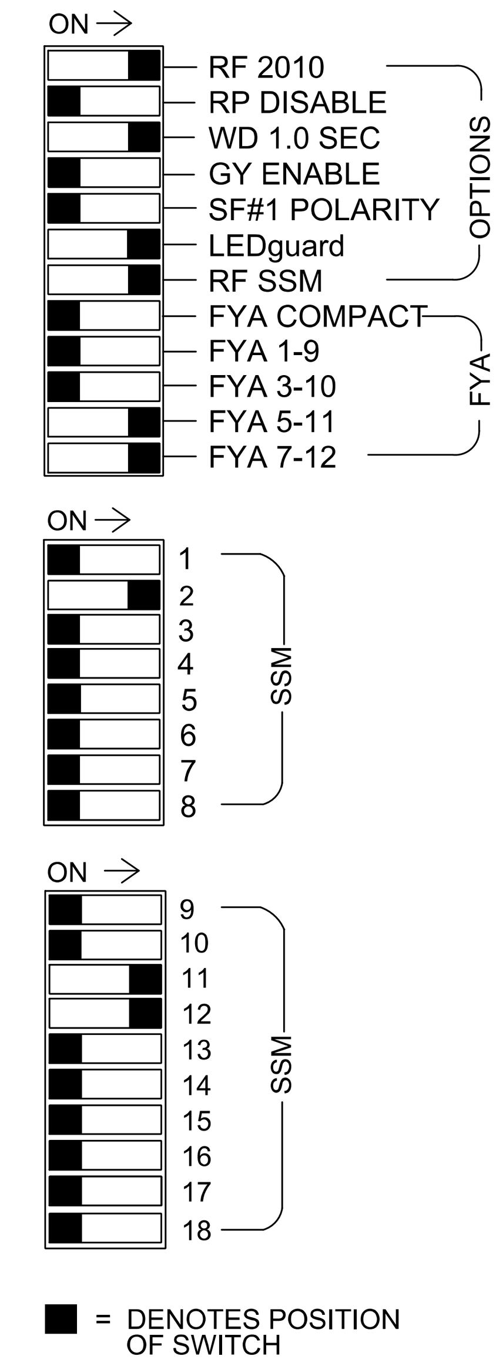
(remove jumpers and set switches as shown)



REMOVE DIODE JUMPERS 2-11, 2-12, 5-7, 5-11, 5-12, 7-11, 7-12, AND 11-12.



REMOVE JUMPERS AS SHOWN



NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

NOTES

1. 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.
2. Program controller to start up in phase 2 Green No Walk.
3. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
4. The cabinet and controller are part of the US 321 Closed Loop 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, S7, S10, AUX S4, AUX S5
Phases Used.......................................2, 7
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..*
Overlap "4"..*
Overlap "7"..*

*See overlap programming detail on sheet 2

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	7 PED	OL7	6	6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	21,22	NU	NU	NU	NU	72★	NU	NU	71★	NU	NU	NU	NU	NU	72★	71★	NU
RED		128																
YELLOW		129					*			*								
GREEN																		
RED ARROW																A114	A101	
YELLOW ARROW																A115	A102	
FLASHING YELLOW ARROW																A116	A103	
GREEN ARROW		130					133			124								
(Don't Walk)																		
(Walk)																		

NU = Not Used

* Denotes install load resistor. See load resistor installation detail this sheet.
★ See pictorial of head wiring in detail this sheet.

INPUT FILE POSITION LAYOUT

(front view)

FILE		1	2	3	4	5	6	7	8	9	10	11	12	13	14
"I"	U	SLOT EMPTY	Ø 2 2A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	FS DC ISOLATOR
	L		Ø 2 2B												ST DC ISOLATOR
"J"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Ø 7 7A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L					NOT USED									

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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

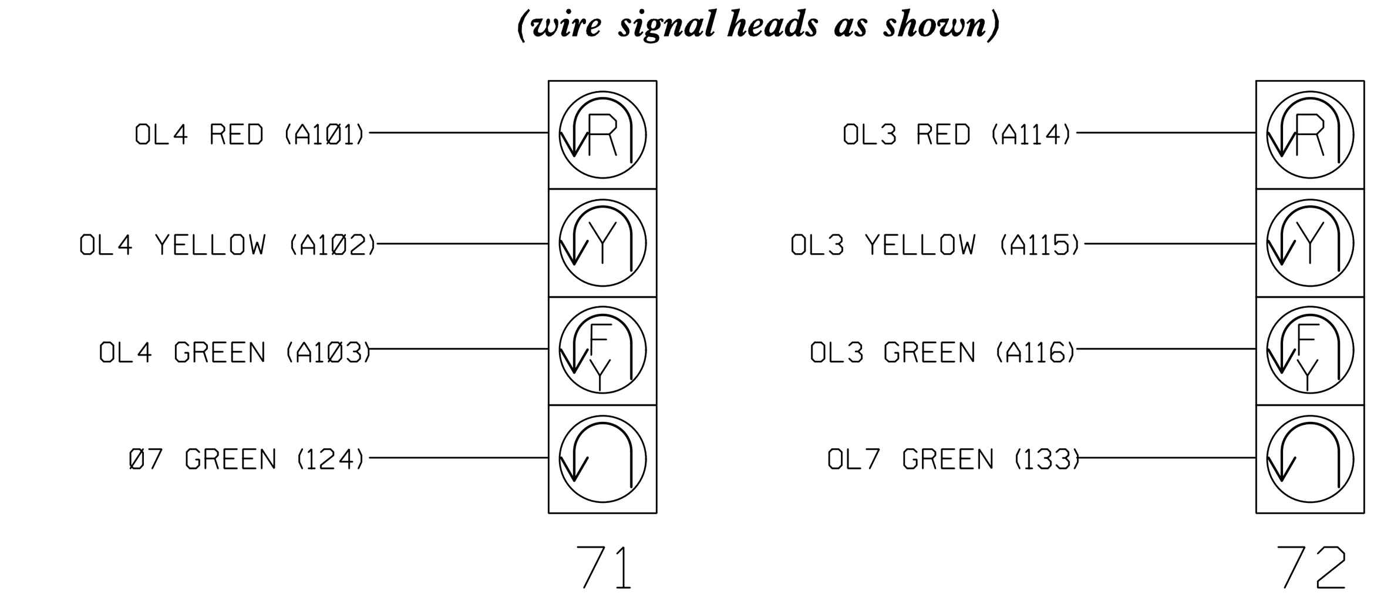
LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
2A	TB2-5,6	I2U	39	1	2	2			X	X	X	
2B	TB2-7,8	I2L	43	5	3	2			X	X	X	
7A	TB5-5,6	J5U	57	19	21 *	7	15.0		X		X	

* For the detectors to work as shown on the signal plan, see the Vehicle Detector Setup Programming Detail for Alternate Phasing on sheet 3.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

4 SECTION FYA SIGNAL WIRING DETAIL

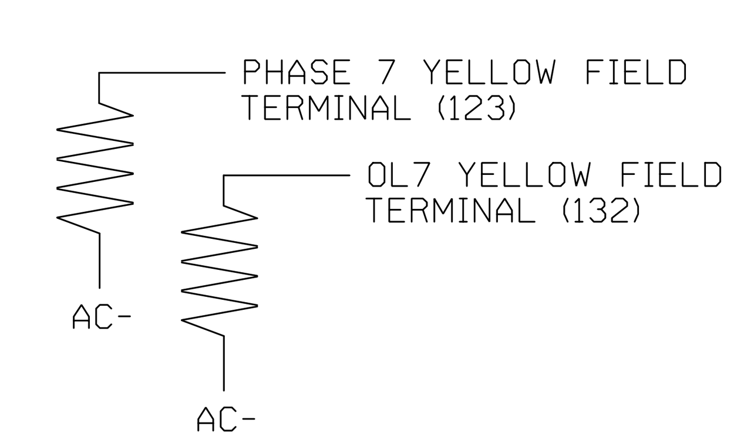
(wire signal heads as shown)



LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

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



THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 11-1453
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL DETAIL SHEET 1 OF 3

STV Engineers, Inc.
900 West Trade St., Suite 715
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(704) 372-1885
NC License Number F-0991

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for the Offices of:
Transportation Mobility and Safety Division, ITS & Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) SB at U-Turn North of SR 1108 (Mission Road)/ SR 1108 (Lower Cedar Valley Road)

Division 11	Caldwell County	Hudson
PLAN DATE: Sept 2023	REVIEWED BY: D.J. Darity	
PREPARED BY: R.L. Aristondo	REVIEWED BY: T.M. Moody	

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

SIG. INVENTORY NO. 11-1453

10/17/2023
LeonR

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 2.2

OUTPUT CHANNEL CONFIGURATION

Front Panel
Main Menu >Controller >More>Channels>Channels Config

Web Interface
Home >Controller >Advanced IO>Channels>Channels Configuration

Channel Configuration

NOTE OL7 ASSIGNED TO CHANNEL 5 →

Channel	Control Type	Control Source	Flash Yellow	Flash Red	Flash Alt	MMU Channel
1	None	1		X	X	1
2	Phase Vehicle	2	X			2
3	None	3		X	X	3
4	Phase Vehicle	4		X		4
5	Overlap	7		X		5
6	None	6	X		X	6
7	Phase Vehicle	7		X		7
8	None	8		X	X	8
9	None	1	X		X	9
10	None	2		X	X	10
11	Overlap	3	X			11
12	Overlap	4	X			12
13	None	2				13
14	None	4				14
15	None	6				15
16	None	8				16
17	None	5		X	X	17
18	None	6		X		18

MAXTIME OVERLAP PROGRAMMING DETAIL FOR DEFAULT PHASING

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

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

Overlap	3	4	7
Type	FYA 4 - Section	FYA 4 - Section	Normal
Included Phases	2	2	7
Modifier Phases	-	7	-
Modifier Overlaps	7	-	-
Trail Green	0	0	0
Trail Yellow	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0

MAXTIME OVERLAP PROGRAMMING DETAIL FOR ALTERNATE PHASING

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

Web Interface
Home >Controller >Overlap Configuration >Overlaps

In the table view of the web interface, right click on "Overlap" in the top left corner of the table. Copy the entire contents of Overlap Plan 1. Paste Overlap Plan 1 into Overlap Plan 2. Modify Overlap Plan 2 as shown below and save changes.

Overlap Plan 2

Overlap	3	4	7
Type	FYA 4 - Section	FYA 4 - Section	Normal
Included Phases	-	-	7
Modifier Phases	-	7	-
Modifier Overlaps	7	-	-
Trail Green	0	0	0
Trail Yellow	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0

← NOTICE INCLUDED PHASES ON OL3 AND OL4

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 11-1453
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED:

ELECTRICAL DETAIL SHEET 2 OF 3

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NC License Number F-0991

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for the Offices of:
Transportation Mobility and Safety Division
ITS & Signals Management Section
State of North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) SB
at U-Turn North of
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Road)

Division 11 Caldwell County Hudson

PLAN DATE: Sept 2023	REVIEWED BY: D.J. Darity
PREPARED BY: R.L. Aristondo	REVIEWED BY: T.M. Moody

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

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SIG. INVENTORY NO. 11-1453

MAXTIME DETECTOR PROGRAMMING DETAIL FOR ALTERNATE PHASING LOOP 7A

Front Panel
Main Menu >Controller >Detector >Veh Det Plans

Web Interface
Home >Controller >Detector Configuration >Vehicle Detectors

In the table view of web interface right click on "Detector" in the top left corner of the table. Copy the entire contents of Detector Plan 1. Paste Detector Plan 1 into Detector Plan 2. Modify Detector Plan 2 as shown below and save changes.

PLAN 2

	Detector	Call Phase	Delay
7A	21	7	0

MAXTIME ALTERNATE PHASING ACTIVATION DETAIL

To run alternate phasing, select a Pattern that is programmed to run Overlap Plan 2 and Detector Plan 2.
A Pattern can be selected through the scheduler or manually by changing the Operational Mode.

PHASING	OVERLAP PLAN	VEH DET PLAN
ACTIVE PLAN REQUIRED TO RUN DEFAULT PHASING	1	1
ACTIVE PLAN REQUIRED TO RUN ALTERNATE PHASING	2	2

ALTERNATE PHASING CHANGE SUMMARY

THE FOLLOWING IS A SUMMARY OF WHAT TAKES PLACE WHEN OVERLAPS 3 AND 4, AND VEHICLE DETECTOR PLAN 2 ACTIVATE TO CALL THE "ALTERNATE PHASING":

OVERLAP PLAN 2: Modifies overlap included phases for heads 71 and 72 to run protected turns only.

VEH DET PLAN 2: Reduces delay time for phase 7 call on loop 7A to 0 seconds.

MAXTIME ALTERNATE PHASING PATTERN PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >Coordination >Patterns

Web Interface
Home >Controller >Coordination >Patterns

Pattern Parameters

Pattern	Veh Det Plan	Overlap Plan
*	2	2

* The Pattern number(s) are to be determined by the Division and/or City Traffic Engineer.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 11-1453
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED:

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ELECTRICAL DETAIL SHEET 3 OF 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 321 (Hickory Boulevard) SB
at U-Turn North of
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Road)

Division 11 | Caldwell County | Hudson

PLAN DATE: Sept 2023 | REVIEWED BY: D.J. Darity
PREPARED BY: R.L. Aristondo | REVIEWED BY: T.M. Moody

REVISIONS	INIT.	DATE

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Prepared for the Offices of:
Transportation Mobility and Safety Division
ITS & Signals Management Section
STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
750 N.Greenfield Pkwy,Garner,NC 27529

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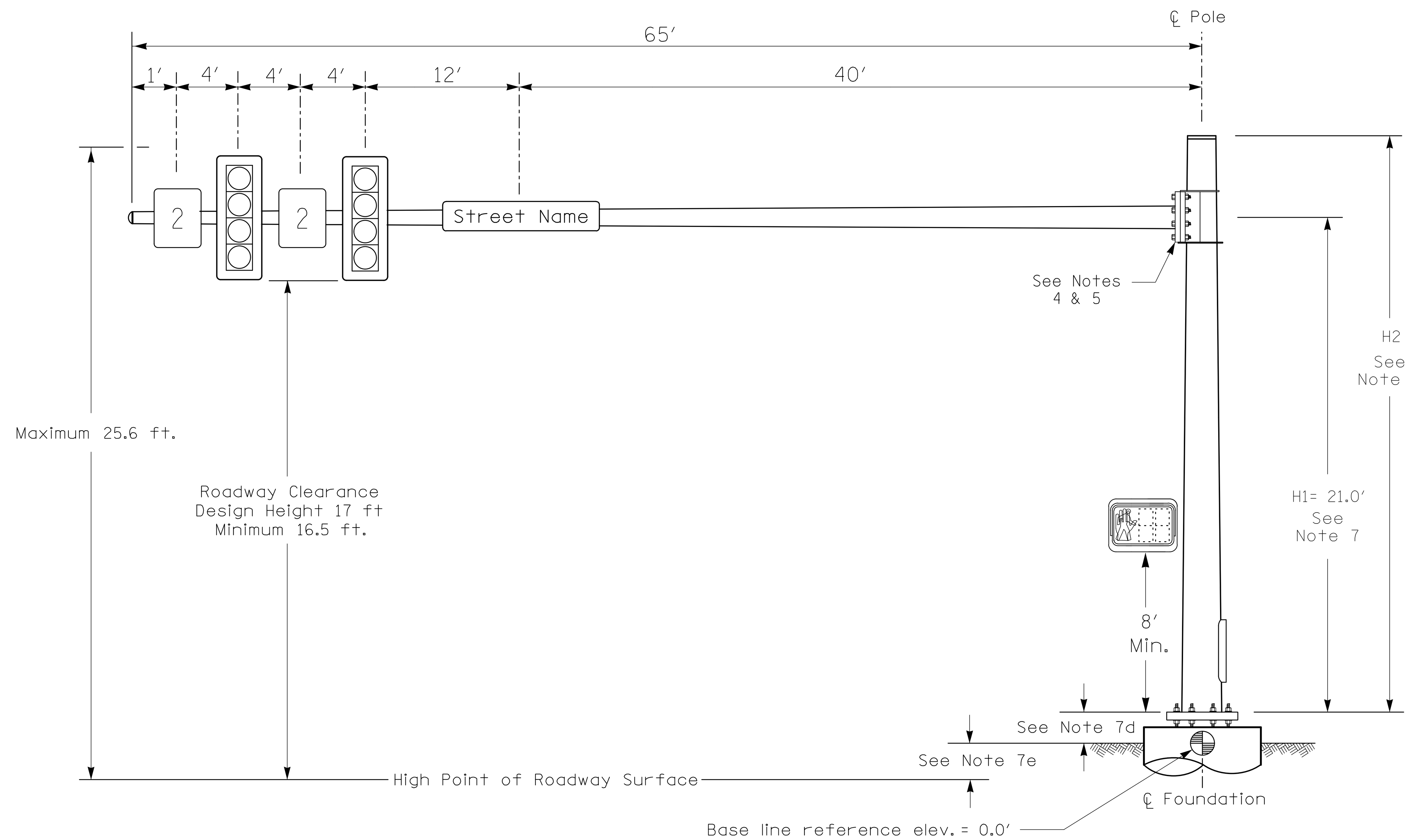
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by:
Donald J. Darity 10/18/2023
589F69087E72485...
SIGNATURE DATE

SIG. INVENTORY NO. 11-1453

Design Loading for METAL POLE NO. 1

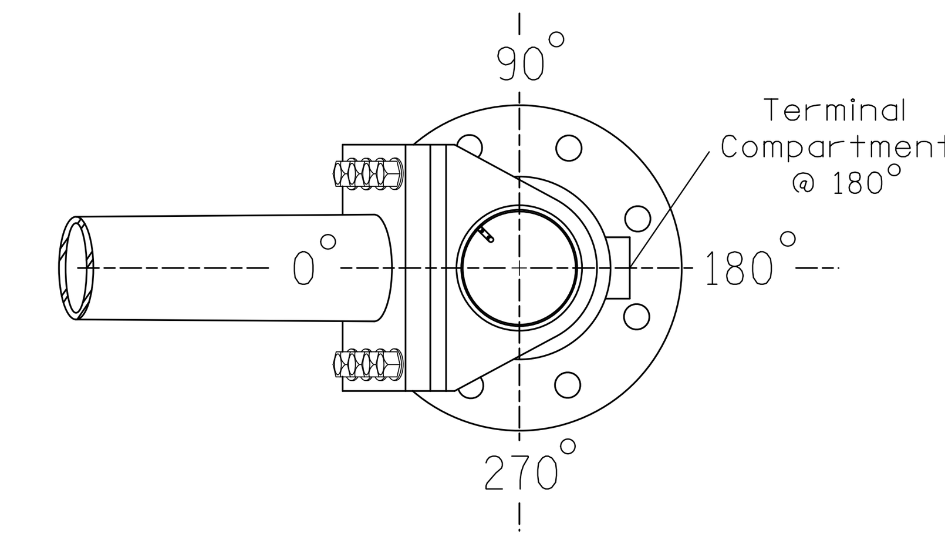


Elevation View @ 270°

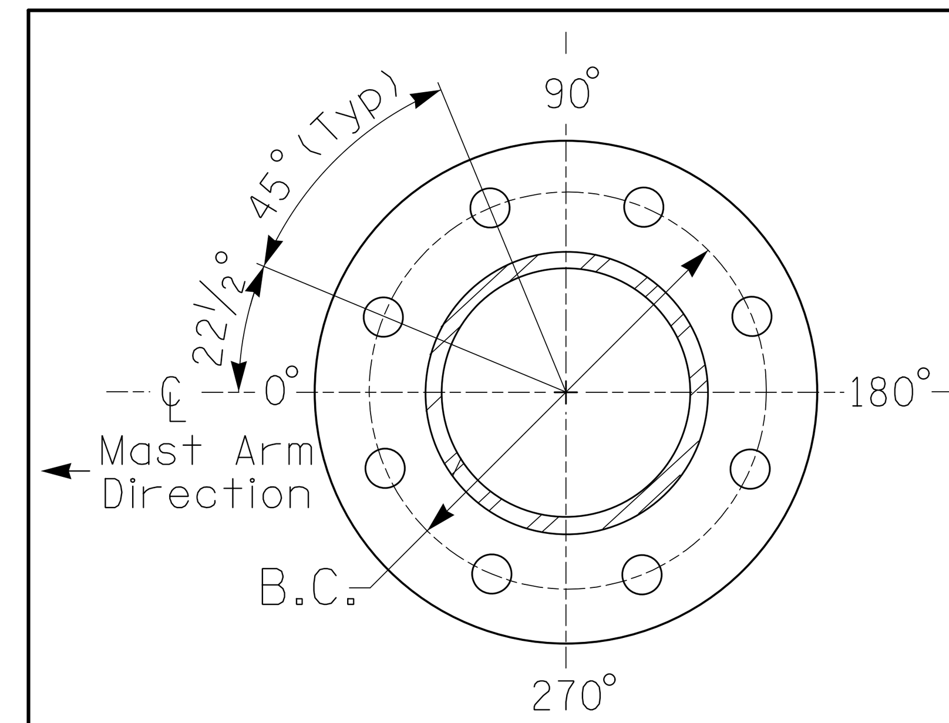
SPECIAL NOTE

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

Elevation Data for Mast Arm Attachment (H1)		
Elevation Differences for:	Pole 1	N/A
Baseline reference point at ℄ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	+1.6 ft.	0.0 ft.
Elevation difference at Edge of travelway or face of curb	N/A	0.0 ft.

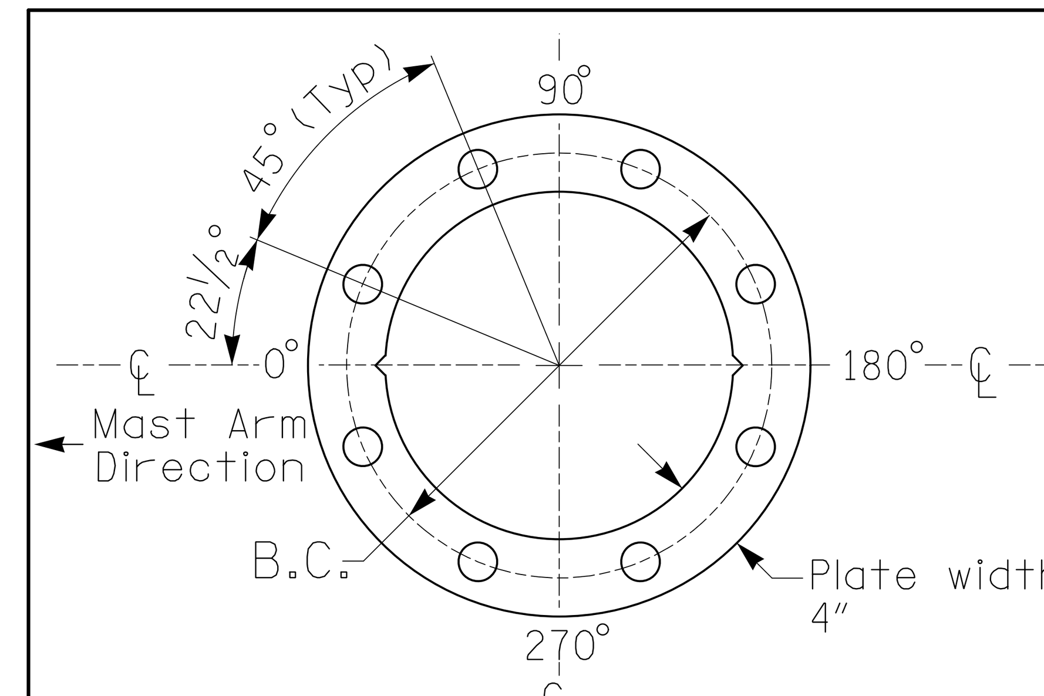


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



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

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 2.4

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12"-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5"W X 66.0"L	74 LBS
	PEDESTRIAN SIGNAL HEAD WITH MOUNTING HARDWARE	2.2 S.F.	18.5"W X 17.0"L	21 LBS
2	SIGN RIGID MOUNTED	9.0 S.F.	36.0"W X 36.0"L	17 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	16.0 S.F.	24.0"W X 96.0"L	36 LBS

NOTES

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 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

2. 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.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. 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.
6. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
7. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
8. 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.
9. 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.
10. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
11. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

STV Engineers, Inc.
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NC License Number F-0991

NCDOT Wind Zone 4 (90 mph)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared for the Offices of: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) SB at U-Turn North of SR 1108 (Mission Road)/ SR 1108 (Lower Cedar Valley Rd)

Division 11 | Caldwell County | Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	J.T. Grimm	REVIEWED BY:	T.M. Moody

SCALE 0 N/A — N/A

REVISIONS | INIT. | DATE

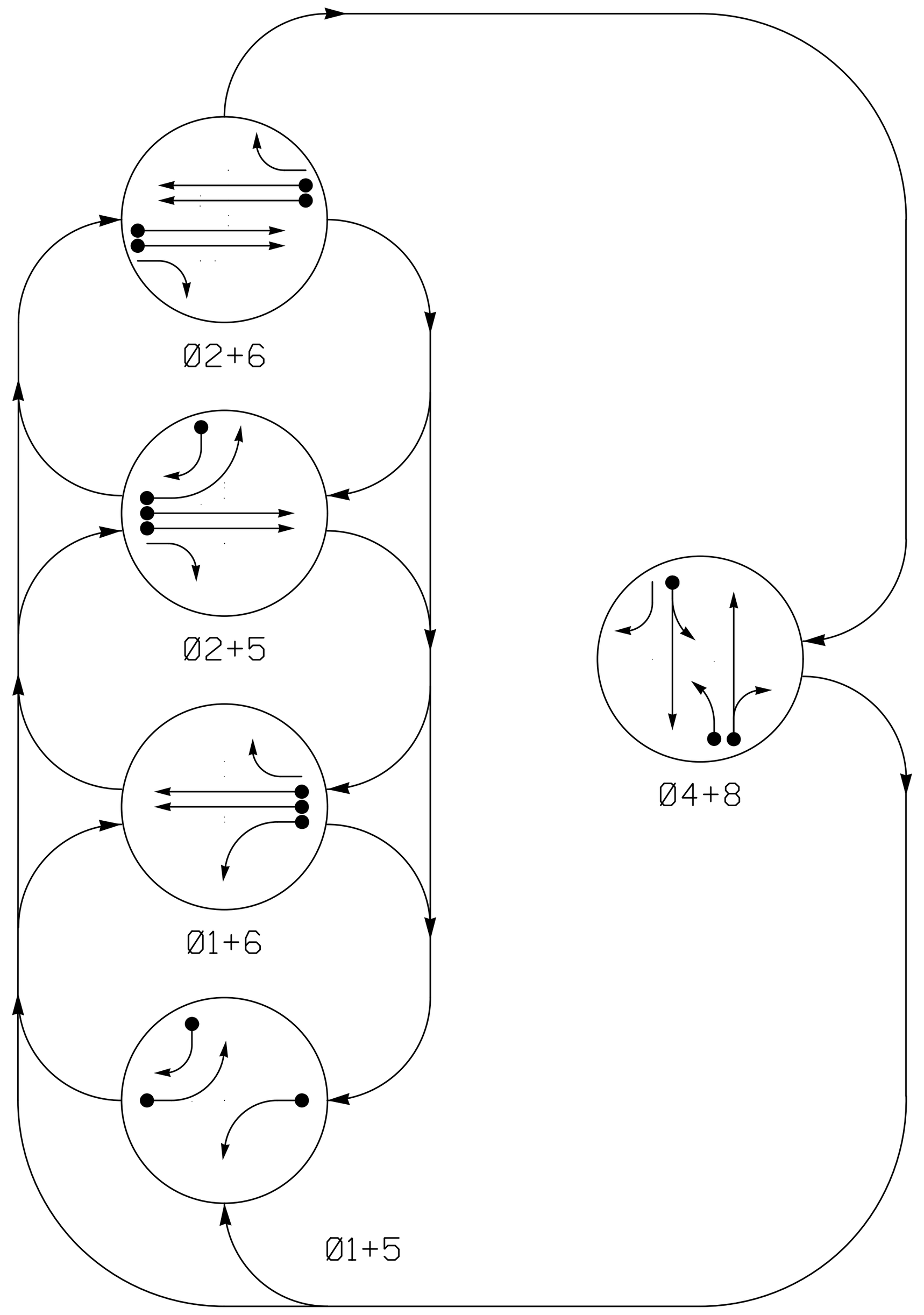
SEAL — NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 19713 DONALD J. DARITY

DocuSigned by: Donald J. Darity — SIGNATURE 10/18/2023 DATE

SIG. INVENTORY NO. 11-1453

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 3.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

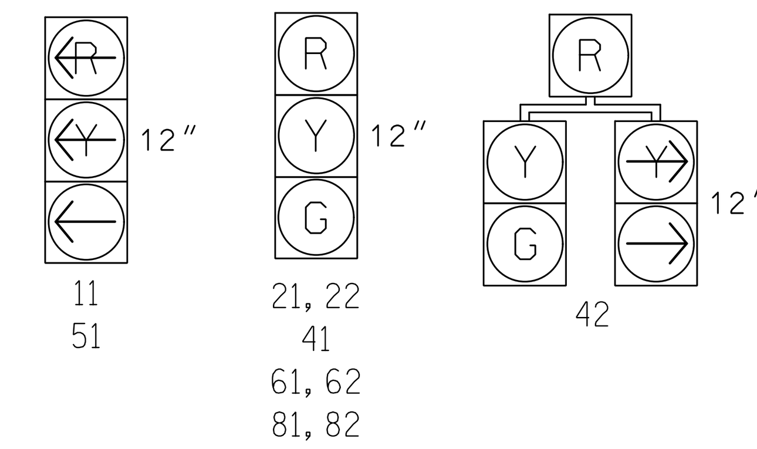
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø1+5	Ø1+6	Ø2+5	Ø2+6	Ø4+8	FLASH
11	←	←	←R	←R	←R	←R
21, 22	R	R	G	G	R	Y
41	R	R	R	R	G	R
42	R / →	R	R / →	R	G	R
51	←	←R	←	←R	←R	←R
61, 62	R	G	R	G	R	Y
81, 82	R	R	R	R	G	R

SIGNAL FACE I.D.

All Heads L.E.D.



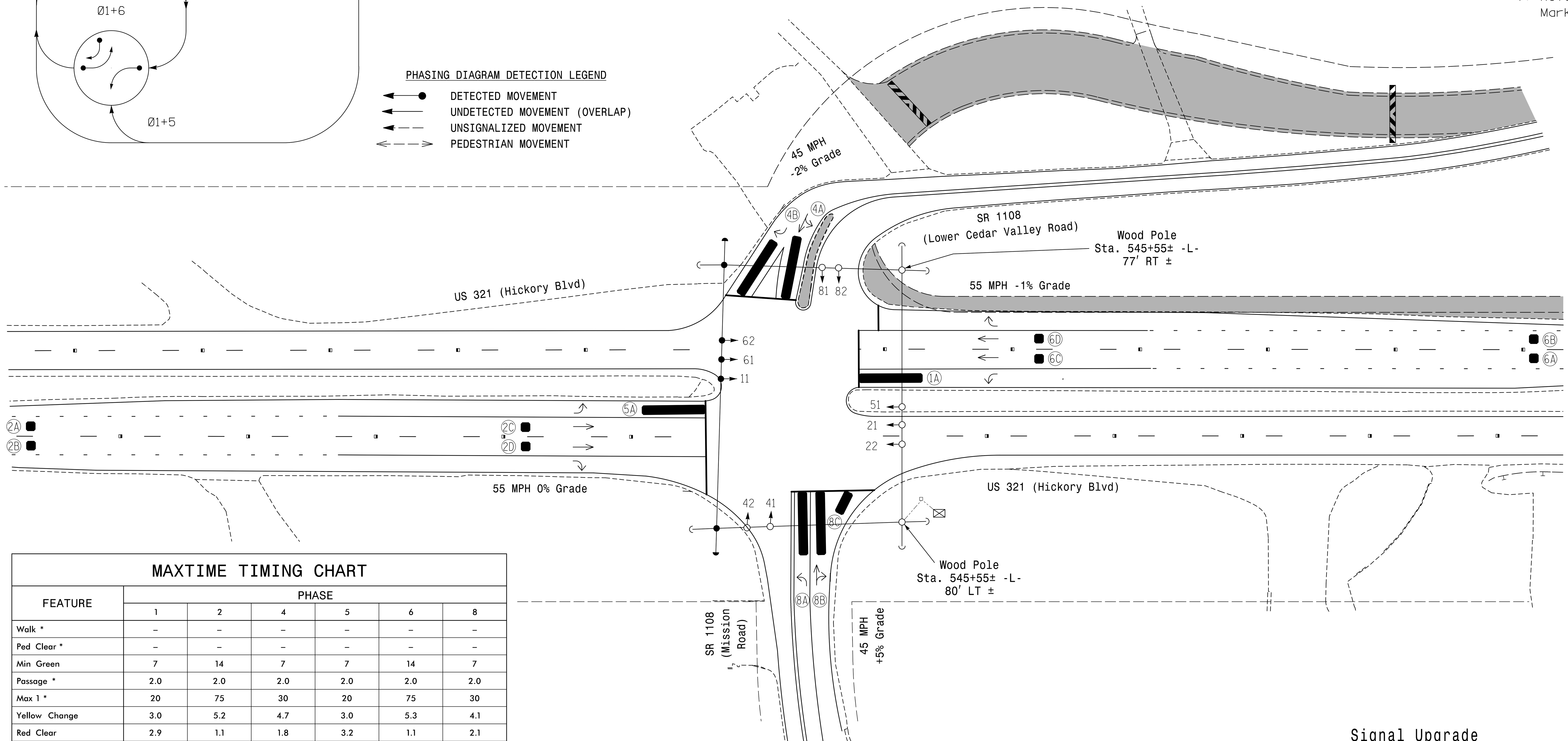
MAXTIME DETECTOR INSTALLATION CHART

DETECTOR: LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	PROGRAMMING: CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	*	*	1	-	-	X	-	X	-	*
2A,2B	6X6	420	*	*	2	-	2.2	X	-	X	-	*
2C,2D	6X6	110	*	*	2	-	-	X	-	X	-	*
4A	6X40	0	*	*	4	-	-	X	-	X	-	*
4B	6X40	0	*	*	4	15.0	-	X	-	X	-	*
5A	6X40	0	*	*	5	-	-	X	-	X	-	*
6A,6B	6X6	420	*	*	6	-	2.2	X	-	X	-	*
6C,6D	6X6	110	*	*	6	-	-	X	-	X	-	*
8A	6X40	0	*	*	8	3.0	-	X	-	X	-	*
8B	6X40	0	*	*	8	10.0	-	X	-	X	-	*
8C	6X15	0	*	*	8	15	-	X	-	X	-	*

* Video Detection Zone

5 Phase Fully Actuated Isolated

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. Reposition existing signal heads numbered 11, 61, and 62.
4. Set all detector units to presence mode.
5. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
6. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
7. Refer to Roadway and/or Pavement Marking plans for stop bar locations.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Video Detection Zone	
	Construction Zone	N/A
	Guardrail	
	Type III Barricade	N/A

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	4	5	6	8
Walk *	–	–	–	–	–	–
Ped Clear *	–	–	–	–	–	–
Min Green	7	14	7	7	14	7
Passage *	2.0	2.0	2.0	2.0	2.0	2.0
Max 1 *	20	75	30	20	75	30
Yellow Change	3.0	5.2	4.7	3.0	5.3	4.1
Red Clear	2.9	1.1	1.8	3.2	1.1	2.1
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	–	X
Vehicle Recall	–	MIN RECALL	–	–	MIN RECALL	–
Dual Entry	–	–	X	–	–	X

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

Signal Upgrade
Temporary Design 1 - TMP Phase I

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(704) 372-1885
NC License Number F-0991

Prepared for the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) NB at SR 1108 (Mission Road)/ SR 1108 (Lower Cedar Valley Rd)

Division 11 Caldwell County Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	R. Leon	REVIEWED BY:	T.M. Moody

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

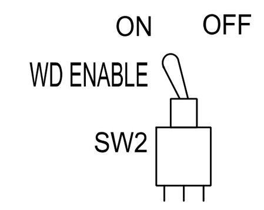
DocuSigned by: Donald J. Darity 589F69087E72485...
SIGNATURE 10/18/2023 DATE

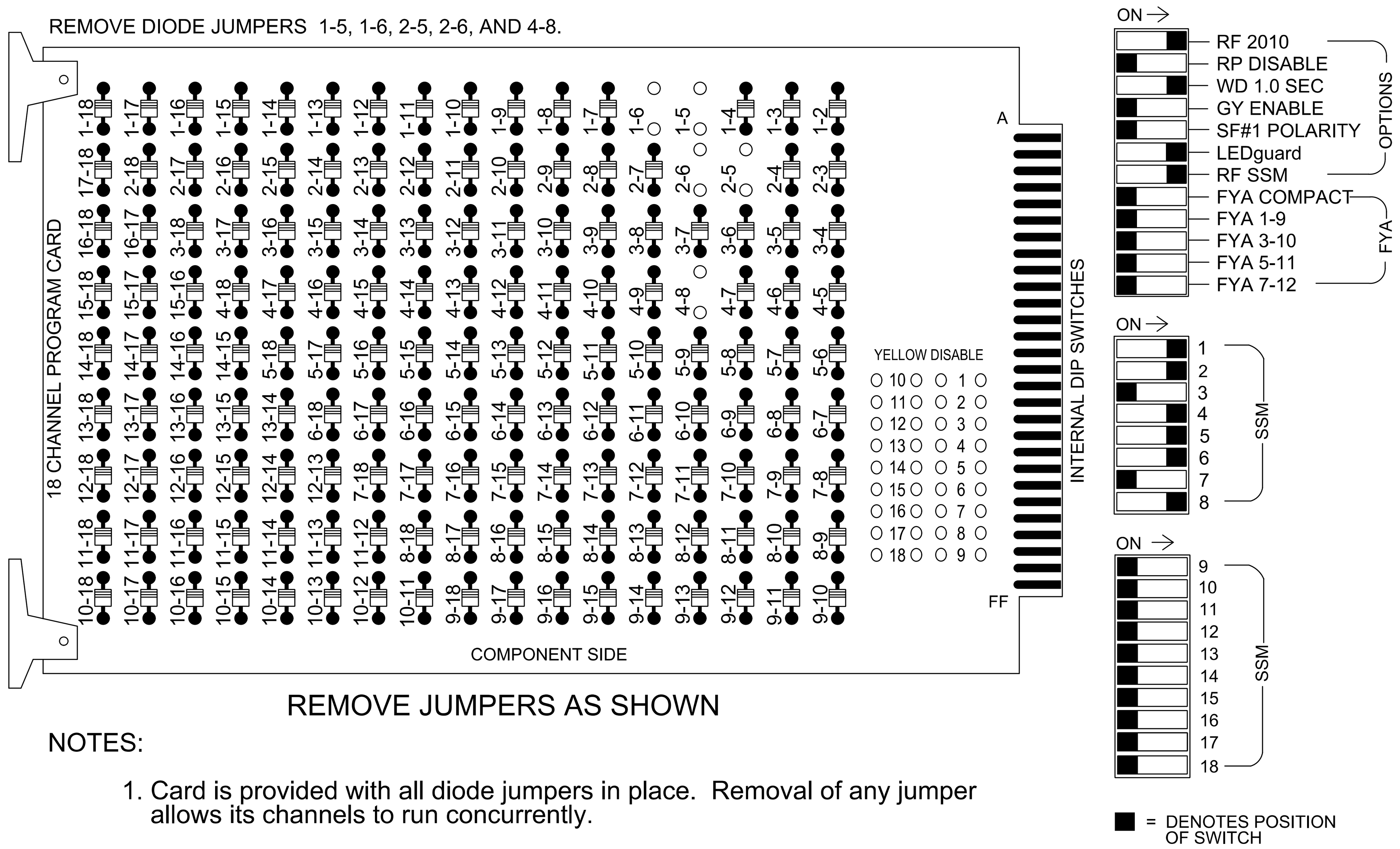
SIG. INVENTORY NO. 11-0066T1

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 3.1

18 CHANNEL CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)





REMOVE JUMPERS AS SHOWN

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

NOTES

1. 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.
2. Program phases 4 and 8 for Dual Entry.
3. Program controller to start up in phase 2 Green No Walk and 6 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.

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............................S1, S2, S5, S7, S8, S11
Phases Used..1, 2, 4, 5, 6, 8
Overlaps..NONE

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.	11	21,22	NU	NU	41,42	NU	42	51	61,62	NU	NU	81,82	NU	NU	NU	NU	NU	NU	NU
RED		128			101				134			107							
YELLOW		129			102				135			108							
GREEN		130			103				136			109							
RED ARROW	125							131											
YELLOW ARROW	126						132	132											
GREEN ARROW	127						133	133											
(Don't Walk hand)																			
(Walk person)																			

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	1O	11	12	13	14
FILE "I"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	FS DC ISOLATOR
	L														ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L														

VIDEO DETECTION

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

FS = FLASH SENSE
ST = STOP TIME

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: 11-0066T1
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED: N/A

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL DETAIL

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 321 (Hickory Boulevard) NB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11 | Caldwell County | Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	R. Leon	REVIEWED BY:	H.M. Surti

REVISIONS | INIT. | DATE

Prepared for the Offices of: Transportation Mobility and Safety Division, ITS & Signals Management Section, North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

stv
STV Engineers, Inc.
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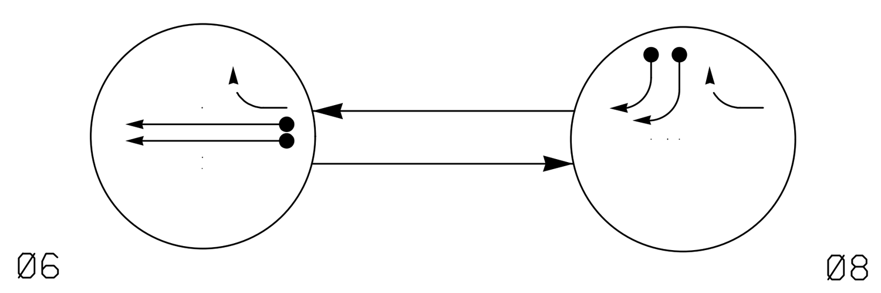
(704) 372-1885
NC License Number F-0991

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 19713 DONALD J. DARITY

DocuSigned by: Donald J. Darity
SIGNATURE 10/18/2023 DATE

SIG. INVENTORY NO. 11-0066T1

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

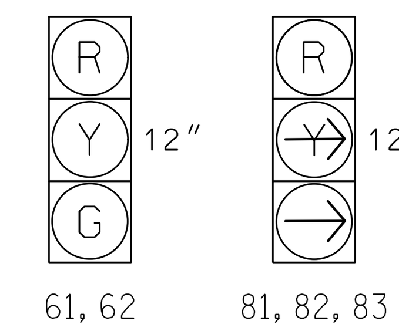
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø6	PHASE Ø8	FLASH
61, 62	G	R	Y
81, 82, 83	R	→	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

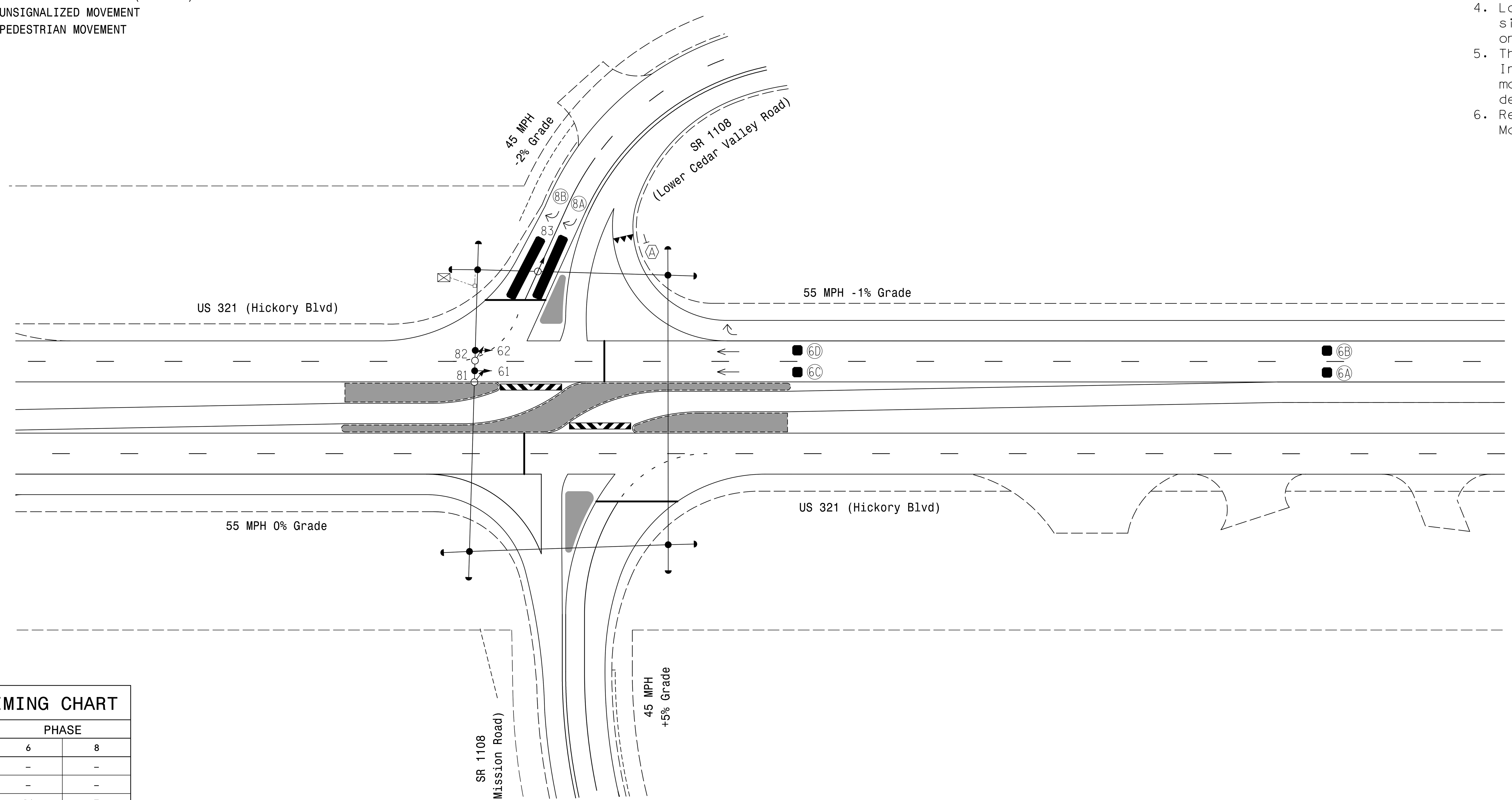
DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
6A,6B	6X6	420	*	*	6	-	2.2	X	-	X	-	*
6C,6D	6X6	110	*	*	6	-	-	X	-	X	-	*
8A	6X40	0	*	*	8	15.0	-	X	-	X	-	*
8B	6X40	0	*	*	8	15.0	-	X	-	X	-	*

* Video Detection Zone

2 Phase
Fully Actuated
Isolated

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. 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. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
6. Refer to Roadway and/or Pavement Marking plans for stop bar locations.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Video Detection Zone	
	Construction Zone	N/A
	Type III Barricade	N/A
	Yield Bars	
(A)	"YIELD" Sign R1-2	(A)

MAXTIME TIMING CHART

FEATURE	PHASE 6	PHASE 8
Walk *	-	-
Ped Clear *	-	-
Min Green	14	7
Passage *	2.0	2.0
Max 1 *	90	20
Yellow Change	5.3	3.0
Red Clear	1.3	2.8
Added Initial *	-	-
Maximum Initial *	-	-
Time Before Reduction *	-	-
Time To Reduce *	-	-
Minimum Gap	-	-
Advance Walk	-	-
Non Lock Detector	-	X
Vehicle Recall	MIN RECALL	-
Dual Entry	-	-

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

Signal Upgrade
Temporary Design 2 - TMP Phase III

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NC License Number F-0991

Prepared for the Offices of: Transportation Mobility and Safety Division, Signal Design Section, State of North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) NB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11 Caldwell County Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	R. Leon	REVIEWED BY:	T.M. Moody

SCALE 0 40, 1"=40'

REVISIONS	INIT.	DATE

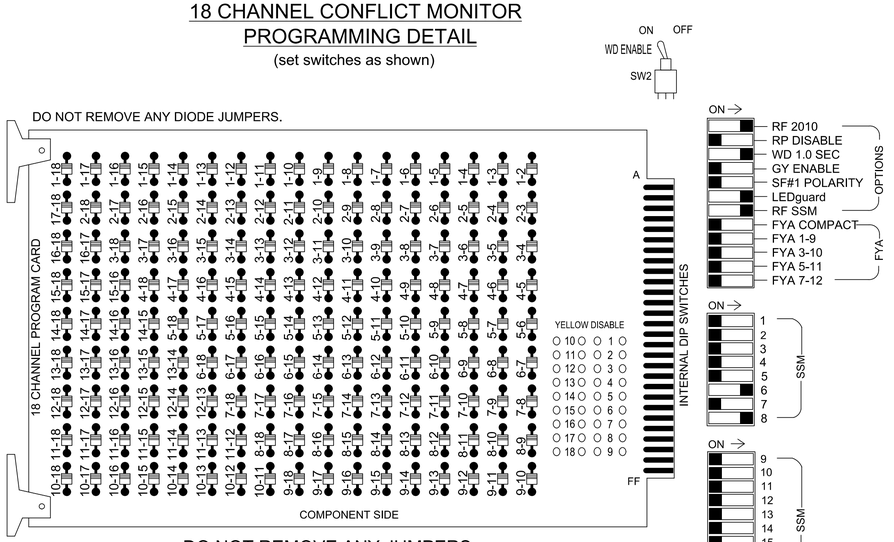
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY
DocuSigned by: Donald J. Darity 589F69087E72485...
SIGNATURE
10/18/2023
DATE

SIG. INVENTORY NO. 11-0066T2

18 CHANNEL CONFLICT MONITOR PROGRAMMING DETAIL

(set switches as shown)



DO NOT REMOVE ANY JUMPERS

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

NOTES

1. 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.
2. Program controller to start up in phase 6 Green No Walk.
3. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.

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.....S8, S11
Phases Used.....6, 8
Overlaps.....NONE

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 4.1

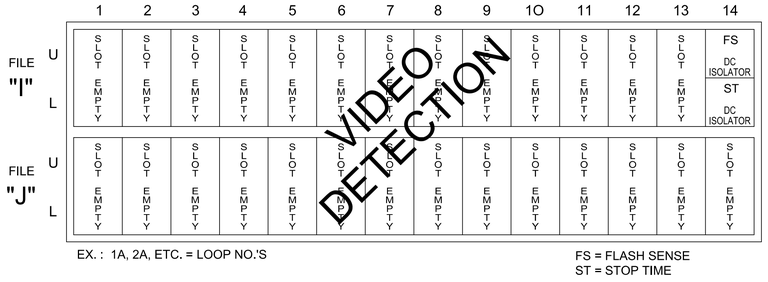
SIGNAL HEAD HOOK-UP CHART

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	NU	NU	NU	NU	NU	NU	61,62	NU	NU	81,82 83	NU	NU	NU	NU	NU	NU	NU
RED								134			107							
YELLOW								135										
GREEN								136										
RED ARROW																		
YELLOW ARROW											108							
FLASHING YELLOW ARROW																		
GREEN ARROW											109							
✋																		
🚶																		

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)



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

FS = FLASH SENSE
ST = STOP TIME

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: 11-0066T2
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED: N/A

ELECTRICAL DETAIL

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 321 (Hickory Boulevard) NB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)
Division 11 Caldwell County Hudson

PLAN DATE: Sept 2023 REVIEWED BY: D.J. Darity
PREPARED BY: R. Leon REVIEWED BY: H.W. Surti

REVISIONS	INIT.	DATE

SEAL NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

SIG. INVENTORY NO. 11-0066T2

Prepared for the Offices of: NC Department of Transportation, Mobility and Safety Division, Traffic Engineering Branch, Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

STV Engineers, Inc.
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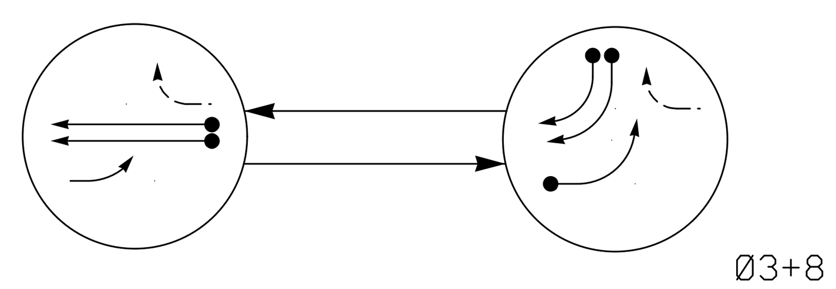
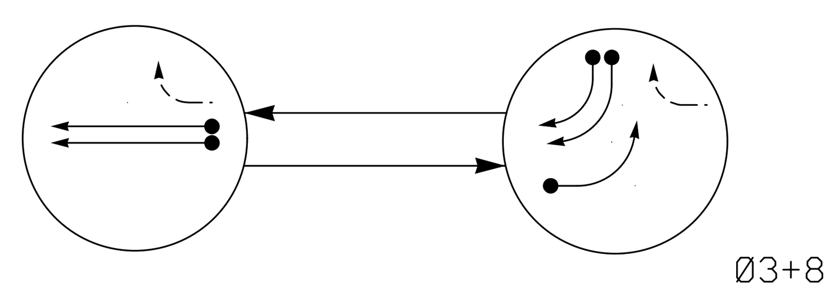
Charlotte, NC 28202
(704) 372-1885
NC License Number F-0991

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 5.0

DEFAULT PHASING DIAGRAM



ALTERNATE PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

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

DEFAULT PHASING TABLE OF OPERATION

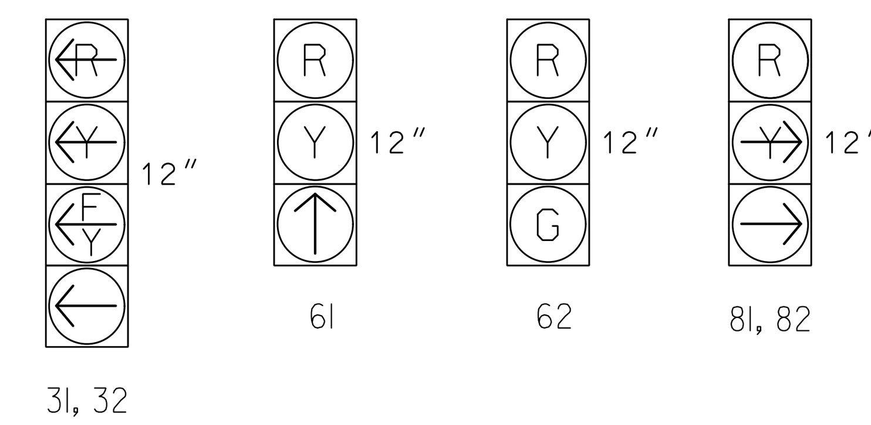
SIGNAL FACE	PHASE Ø6	PHASE Ø3+8	PHASE FLASH
31, 32	← F/Y	←	← Y
61	↑	R	Y
62	G	R	Y
81, 82	R	→	R

ALTERNATE PHASING TABLE OF OPERATION

SIGNAL FACE	PHASE Ø6	PHASE Ø3+8	PHASE FLASH
31, 32	← R	←	← Y
61	↑	R	Y
62	G	R	Y
81, 82	R	→	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

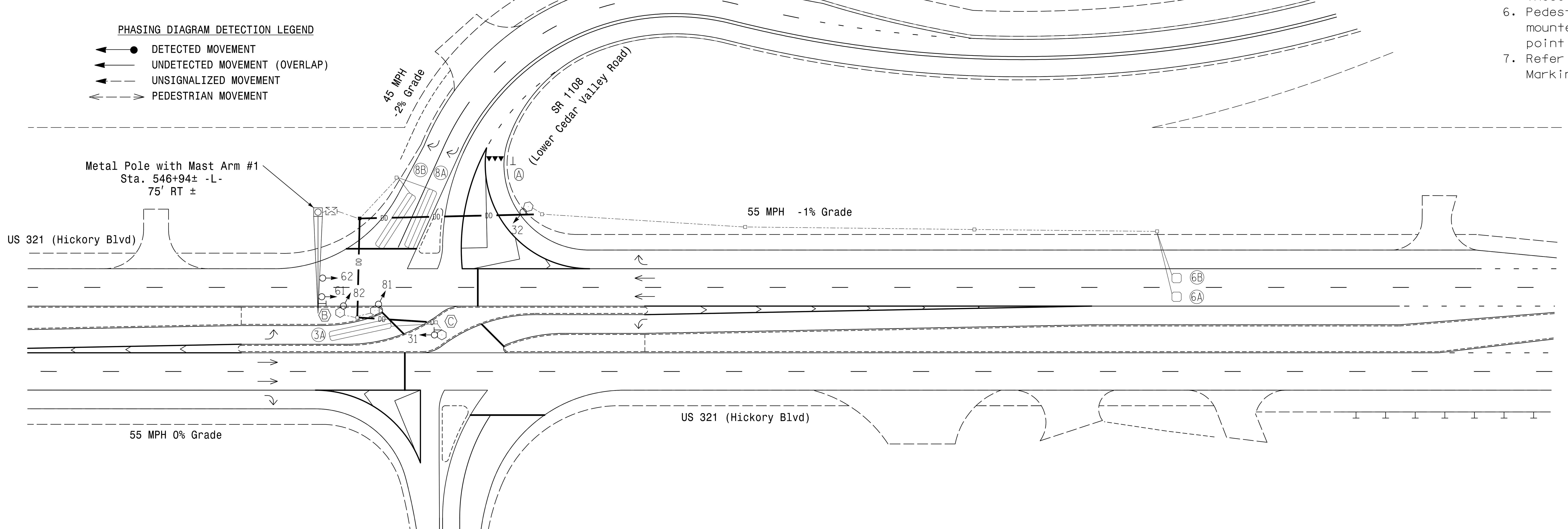
DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
3A	6X40	0	2-4-2	X	3	✳15.0	-	X	-	X	-	X
6A	6X6	420	5	X	6	-	-	X	X	X	-	X
6B	6X6	420	5	X	6	-	-	X	X	X	-	X
8A	6X40	0	2-4-2	X	8	15.0	-	X	-	X	-	X
8B	6X40	0	2-4-2	X	8	15.0	-	X	-	X	-	X

✳ Disable Delay During Alternate Phasing Operation.

2 Phase
Fully Actuated with Alternate Phasing Operation
US 321 Closed Loop 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. Set all detector units to presence mode.
4. The Division Traffic Engineer will determine the hours of use for each phasing plan.
5. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
6. Pedestal mounted signal heads shall be mounted a minimum of 8' above the high point of the roadway surface elevation.
7. Refer to Roadway and/or Pavement Marking plans for stop bar locations.



SR 1108 (Mission Road)

45 MPH +5% Grade

LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Metal Pole with Mastarm	
	Directional Drill	N/A
	Type II Signal Pedestal	
	Yield Bars	
(A)	"YIELD" Sign (R1-2)	(A)
(B)	No Left Turn Sign (R3-2)	(B)
(C)	No U-Turn Sign (R3-4)	(C)

MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6	PHASE 8
Walk *	–	–	–
Ped Clear *	–	–	–
Min Green	7	14	7
Passage *	2.0	6.0	2.0
Max 1 *	30	90	20
Yellow Change	3.0	5.3	3.0
Red Clear	1.8	1.3	2.4
Added Initial *	–	1.5	–
Maximum Initial *	–	46	–
Time Before Reduction *	–	15	–
Time To Reduce *	–	30	–
Minimum Gap	–	3.4	–
Advance Walk	–	–	–
Non Lock Detector	X	–	X
Vehicle Recall	–	MIN RECALL	–
Dual Entry	X	–	X

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

Signal Upgrade - Final Design

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(704) 372-1885
NC License Number F-0991

Prepared for the Offices of: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

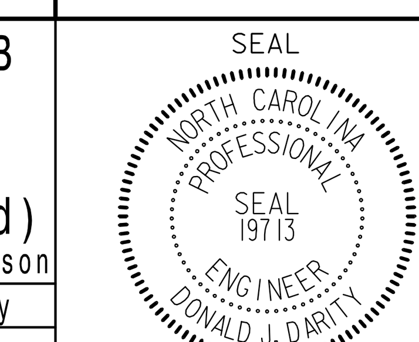
SCALE 0 40 1"=40'

US 321 (Hickory Boulevard) NB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11	Caldwell County	Hudson
PLAN DATE: Sept 2023	REVIEWED BY: D.J. Darity	
PREPARED BY: J.T. Grimm	REVIEWED BY: T.M. Moody	

REVISIONS	INIT.	DATE

SEAL



DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

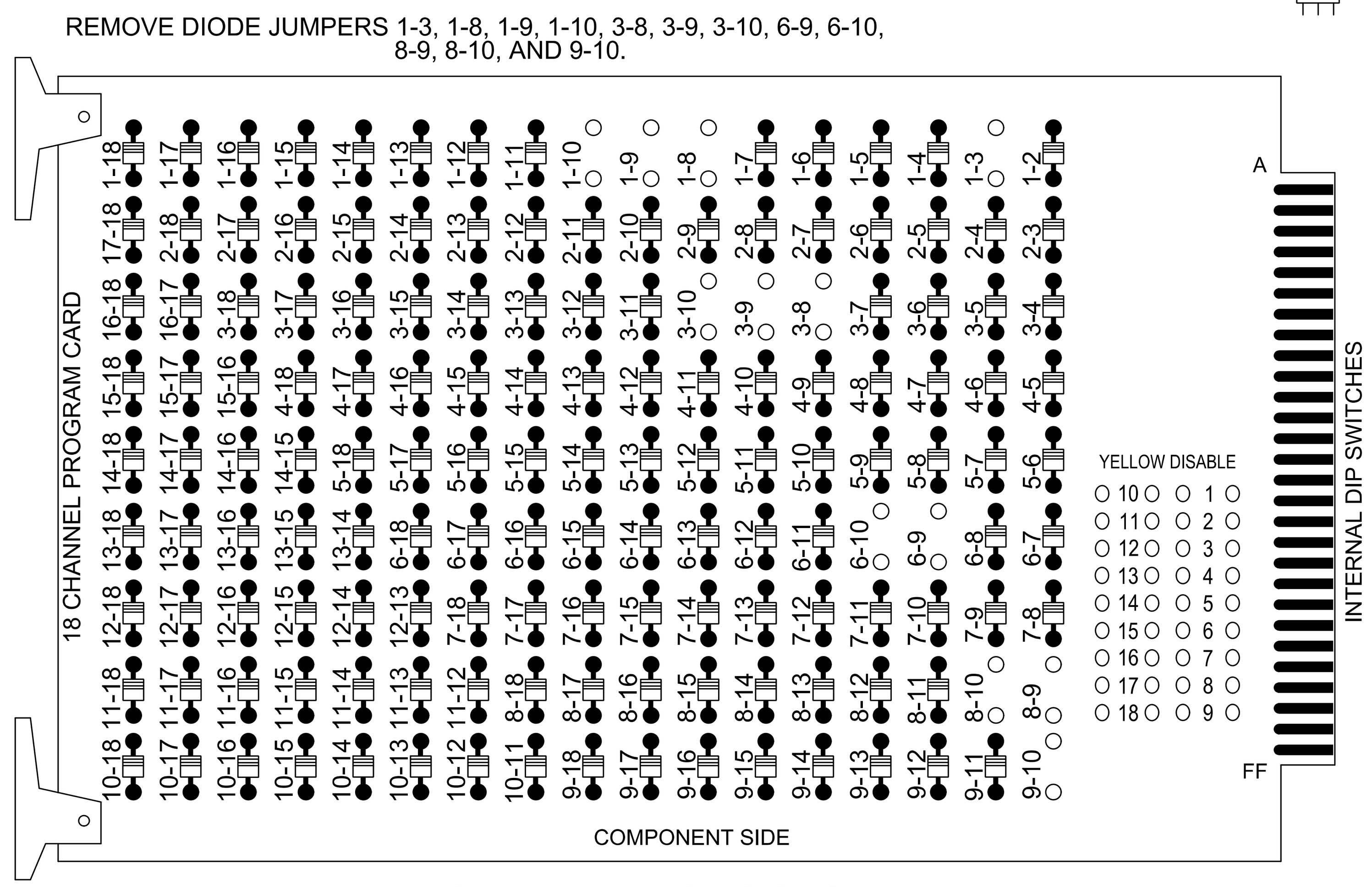
SIG. INVENTORY NO. 11-0066

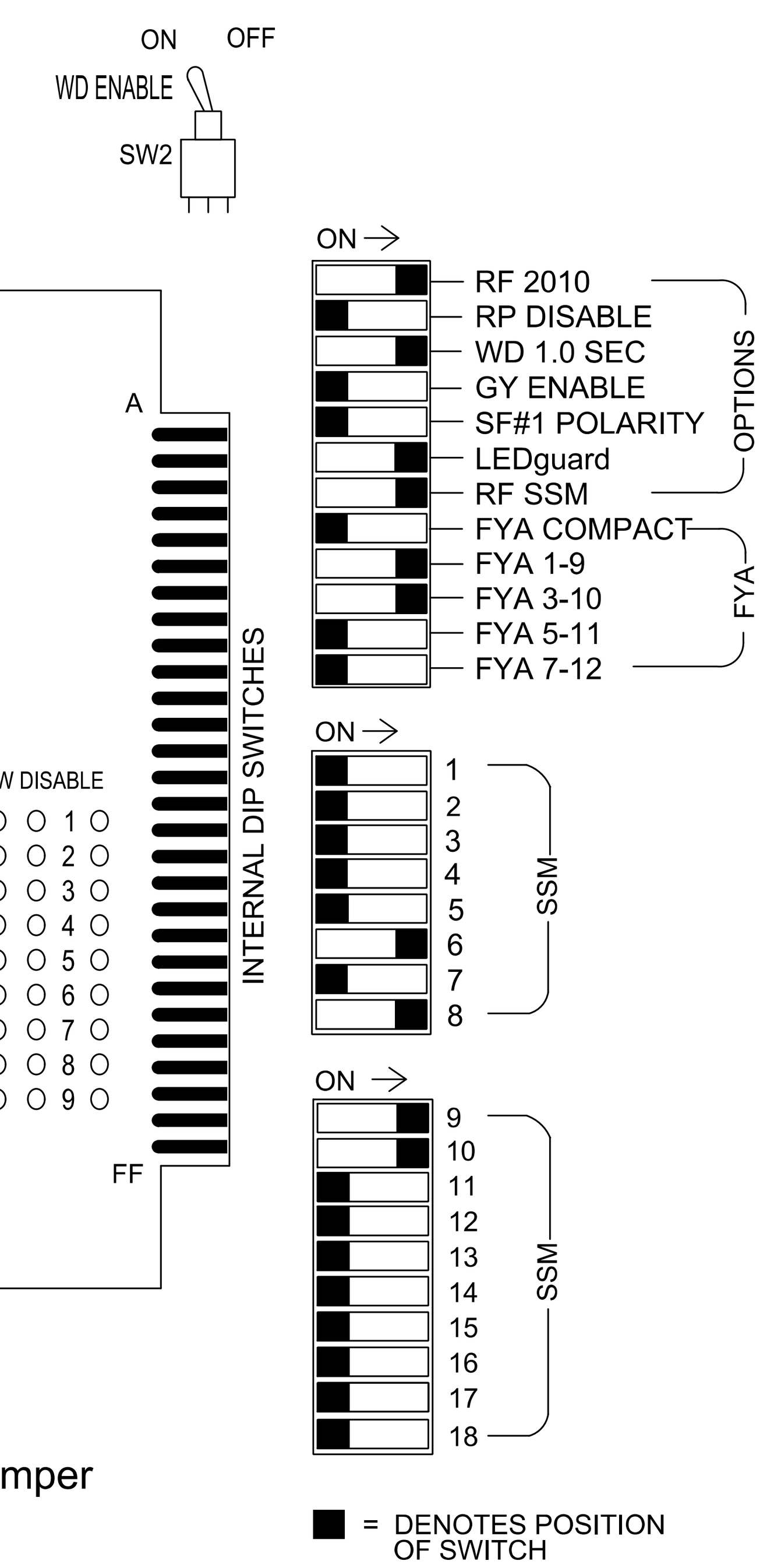
PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 5.1

18 CHANNEL CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 1-3, 1-8, 1-9, 1-10, 3-8, 3-9, 3-10, 6-9, 6-10, 8-9, 8-10, AND 9-10.





REMOVE JUMPERS AS SHOWN

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

NOTES

1. 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.
2. Program phases 3 and 8 for Dual Entry.
3. Program controller to start up in phase 6 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
5. The cabinet and controller are part of the US 321 Closed Loop 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...........................S1, S4, S8, S11, AUX S1, AUX S2
Phases Used.......................................3, 6, 8
Overlap "1"..*
Overlap "2"..*
Overlap "3"..NOT USED
Overlap "4"..NOT USED
Overlap "7"..*

*See overlap programming detail on sheet 2

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	OL7	2	2 PED	3	4	4 PED	5	6		6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	32★	NU	NU	31★	NU	NU	NU	61	62	NU	NU	81,82	NU	32★	31★	NU	NU	NU	NU
RED								134	134			107							
YELLOW	*			*				135	135										
GREEN									136										
RED ARROW														A121	A124				
YELLOW ARROW												108		A122	A125				
FLASHING YELLOW ARROW														A123	A126				
GREEN ARROW	127			118				136				109							
(hand symbol)																			
(pedestrian symbol)																			

NU = Not Used

* Denotes install load resistor. See load resistor installation detail this sheet.

★ See pictorial of head wiring in detail this sheet.

INPUT FILE POSITION LAYOUT

(front view)

FILE		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Ø 3 3A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	FS DC ISOLATOR
	L					NOT USED									ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	Ø 6 6A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Ø 8 8A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L		Ø 6 6B				Ø 8 8B								

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
3A	TB4-5,6	I5U	58	20	7 *	3	15		X		X	
6A	TB3-5,6	J2U	40	2	16	6			X	X	X	
6B	TB3-7,8	J2L	44	6	17	6			X	X	X	
8A	TB5-9,10	J6U	42	4	22	8	15		X		X	
8B	TB5-11,12	J6L	46	8	23	8	15		X		X	

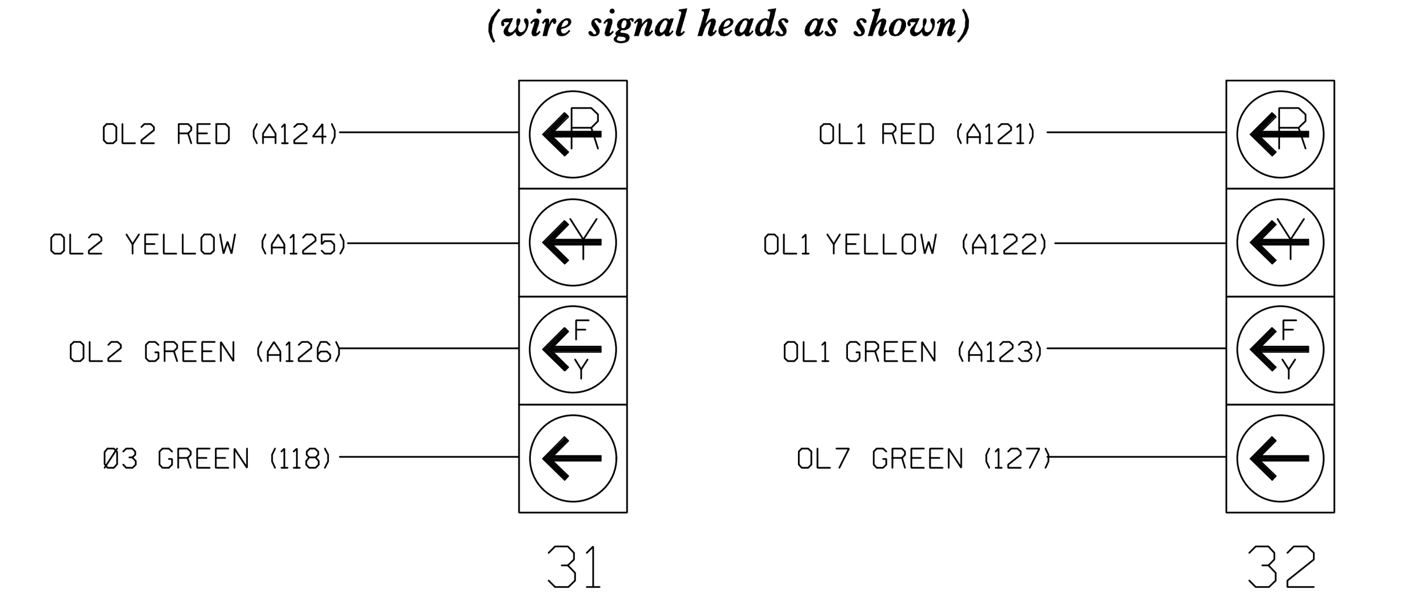
* For the detectors to work as shown on the signal plan, see the Vehicle Detector Setup Programming Detail for Alternate Phasing on sheet 3.

INPUT FILE POSITION LEGEND: J2L

FILE J
SLOT 2
LOWER

4 SECTION FYA PPLT SIGNAL WIRING DETAIL

(wire signal heads as shown)

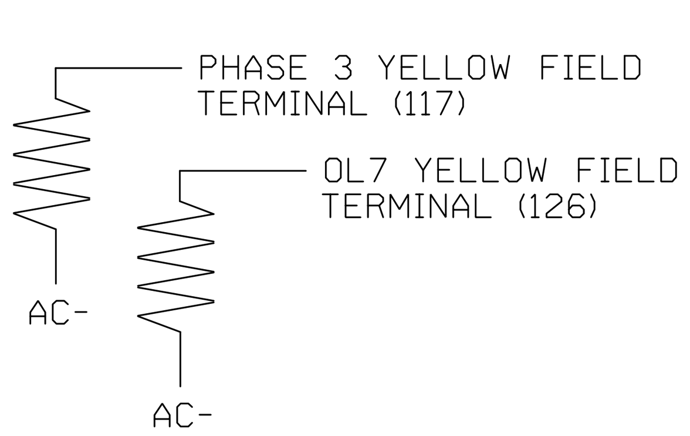


LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

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



THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 11-0066
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED:

ELECTRICAL DETAIL SHEET 1 OF 3

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stv
STV Engineers, Inc.
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Charlotte, NC 28202
(704) 372-1885
NC License Number F-0991

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for the Offices of:
ITS & Signals Management Section, Transportation Mobility and Safety Division, State of North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) NB at SR 1108 (Mission Road)/ SR 1108 (Lower Cedar Valley Rd)

Division 11 | Caldwell County | Hudson

PLAN DATE: Sept 2023	REVIEWED BY: D.J. Darity
PREPARED BY: R.L. Aristondo	REVIEWED BY: T.M. Moody

REVISIONS	INIT.	DATE

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NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

SIG. INVENTORY NO. 11-0066

CHANNEL CONFIGURATION PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >More>Channels>Channels Config

Web Interface
Home >Controller >Advanced IO>Channels>Channels Configuration

Channel Configuration

NOTE OL7 ASSIGNED TO CHANNEL 1 → (Channel 1)

Channel	Control Type	Control Source	Flash Yellow	Flash Red	Flash Alt	MMU Channel
1	Overlap	7		X	X	1
2	None	2	X			2
3	Phase Vehicle	3		X	X	3
4	None	4		X		4
5	None	5		X		5
6	Phase Vehicle	6	X		X	6
7	None	7		X		7
8	Phase Vehicle	8		X	X	8
9	Overlap	1	X		X	9
10	Overlap	2	X		X	10
11	None	3	X			11
12	None	4		X		12
13	None	2				13
14	None	4				14
15	None	6				15
16	None	8				16
17	None	5		X	X	17
18	None	6		X		18

MAXTIME OVERLAP PROGRAMMING DETAIL FOR DEFAULT PHASING

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

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

NOTICE OL7 → (Modifier Overlaps)

Overlap	1	2	7
Type	FYA 4 - Section	FYA 4 - Section	Normal
Included Phases	6	6	3
Modifier Phases	-	3	-
Modifier Overlaps	7	-	-
Trail Green	0	0	0
Trail Yellow	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0

MAXTIME OVERLAP PROGRAMMING DETAIL FOR ALTERNATE PHASING

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

Web Interface
Home >Controller >Overlap Configuration >Overlaps

In the table view of the web interface, right click on "Overlap" in the top left corner of the table. Copy the entire contents of Overlap Plan 1. Paste Overlap Plan 1 into Overlap Plan 2. Modify Overlap Plan 2 as shown below and save changes.

Overlap Plan 2

Overlap	1	2	7
Type	FYA 4 - Section	FYA 4 - Section	Normal
Included Phases	-	-	3
Modifier Phases	-	3	-
Modifier Overlaps	7	-	-
Trail Green	0	0	0
Trail Yellow	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0

← NOTICE INCLUDED PHASES ON OL1 AND OL2

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 11-0066
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ELECTRICAL DETAIL SHEET 2 OF 3

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Prepared for the Offices of:
Transportation Mobility and Safety Division — ITS & Signals Management Section — State of North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) NB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11 | Caldwell County | Hudson

PLAN DATE: Sept 2023	REVIEWED BY: D.J. Darity
PREPARED BY: R.L. Aristondo	REVIEWED BY: T.M. Moody

REVISIONS	INIT.	DATE

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SIGNATURE | DATE 10/18/2023

SIG. INVENTORY NO. 11-0066

MAXTIME DETECTOR PROGRAMMING DETAIL FOR ALTERNATE PHASING LOOP 3A

Front Panel
Main Menu >Controller >Detector >Veh Det Plans

Web Interface
Home >Controller >Detector Configuration >Vehicle Detectors

In the table view of web interface right click on "Detector" in the top left corner of the table. Copy the entire contents of Detector Plan 1. Paste Detector Plan 1 into Detector Plan 2. Modify Detector Plan 2 as shown below and save changes.

PLAN 2

	Detector	Call Phase	Delay
3A	7	3	0

MAXTIME ALTERNATE PHASING ACTIVATION DETAIL

To run alternate phasing, select a Pattern that is programmed to run Overlap Plan 2 and Detector Plan 2.
A Pattern can be selected through the scheduler or manually by changing the Operational Mode.

PHASING	OVERLAP PLAN	VEH DET PLAN
ACTIVE PLAN REQUIRED TO RUN DEFAULT PHASING	1	1
ACTIVE PLAN REQUIRED TO RUN ALTERNATE PHASING	2	2

ALTERNATE PHASING CHANGE SUMMARY

THE FOLLOWING IS A SUMMARY OF WHAT TAKES PLACE WHEN OVERLAPS 1 AND 2, AND VEHICLE DETECTOR PLAN 2 ACTIVATE TO CALL THE "ALTERNATE PHASING":

OVERLAP PLAN 2: Modifies overlap included phases for heads 31 and 32 to run protected turns only.

VEH DET PLAN 2: Reduces delay time for phase 3 call on loop 3A to 0 seconds.

MAXTIME ALTERNATE PHASING PATTERN PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >Coordination >Patterns

Web Interface
Home >Controller >Coordination >Patterns

Pattern Parameters

Pattern	Veh Det Plan	Overlap Plan
*	2	2

* The Pattern number(s) are to be determined by the Division and/or City Traffic Engineer.

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THE SIGNAL DESIGN: 11-0066
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ELECTRICAL DETAIL SHEET 3 OF 3

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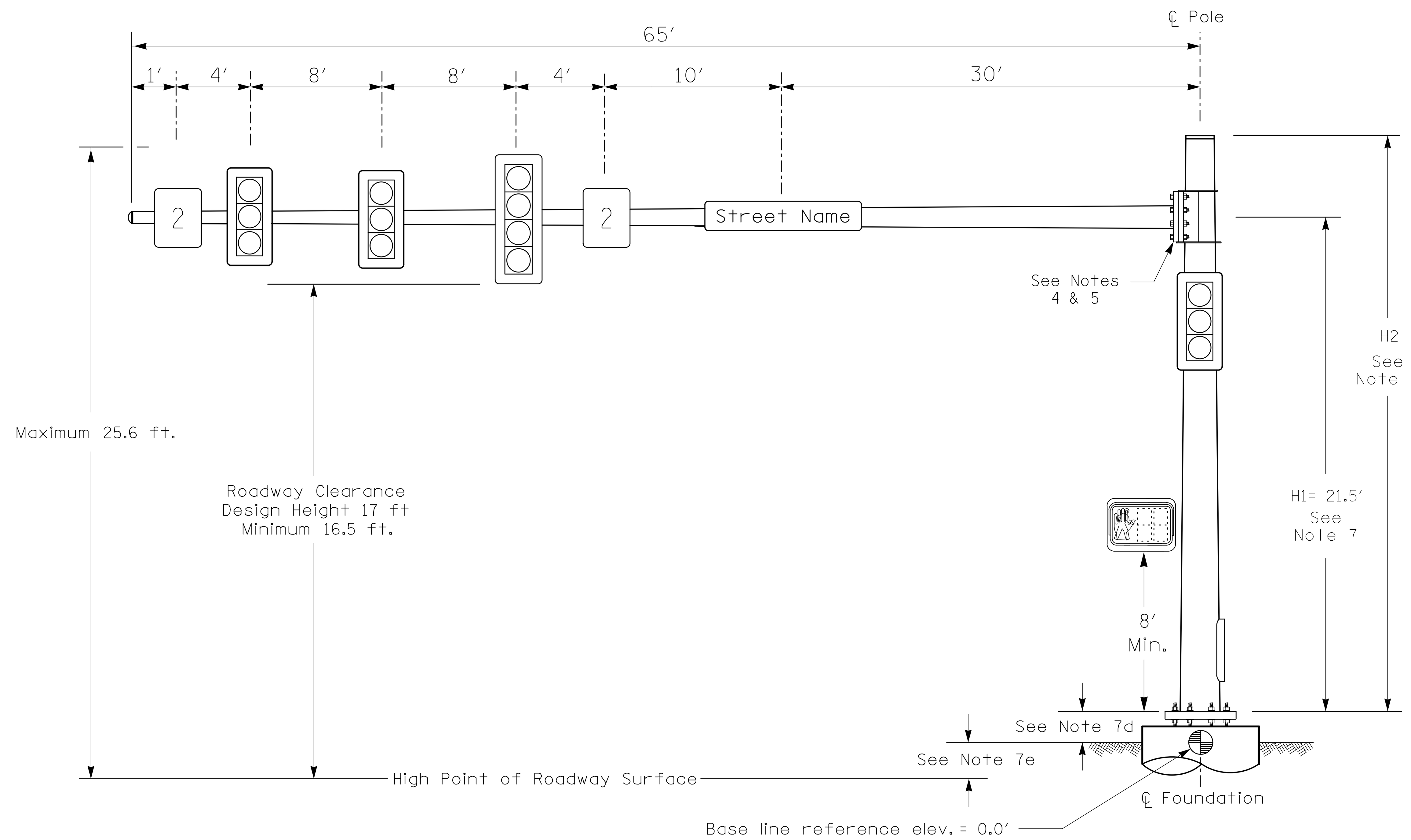
SIG. INVENTORY NO. 11-0066

Design Loading for METAL POLE NO. 1



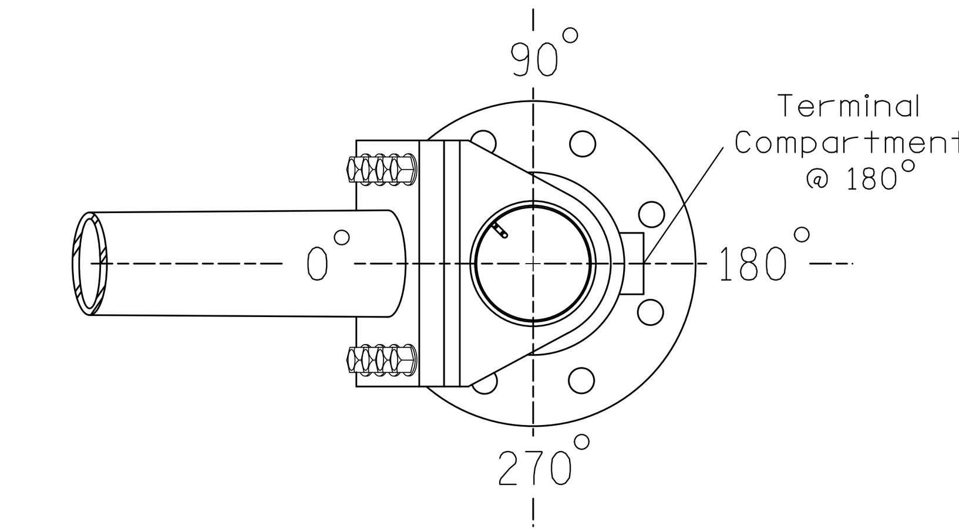
Elevation View @ 270°

SPECIAL NOTE

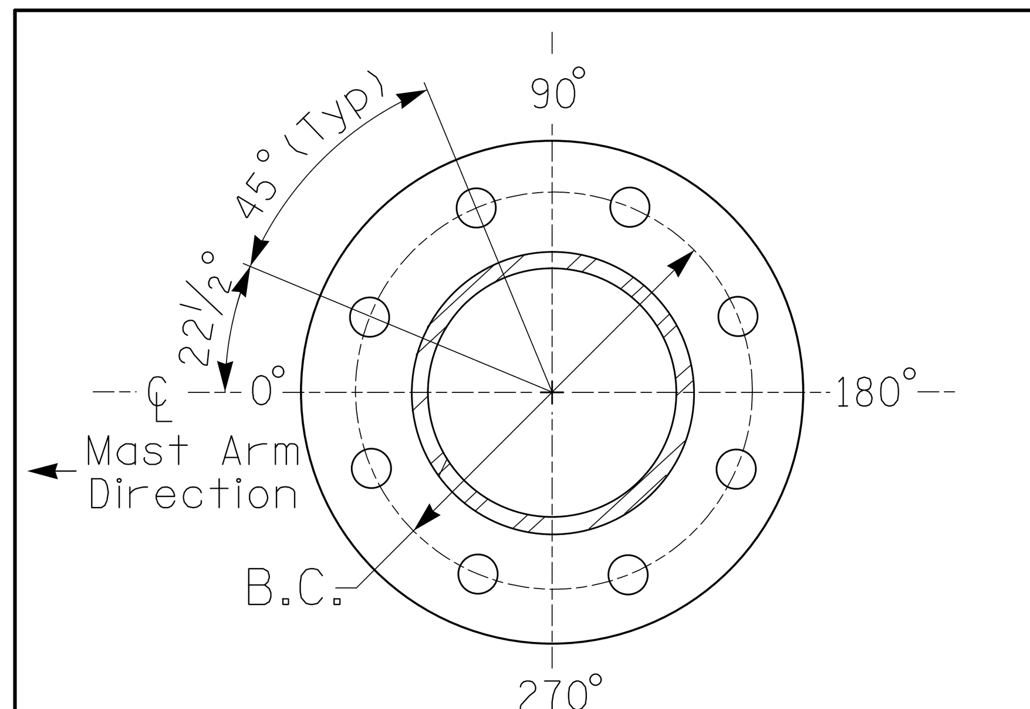
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	N/A
Baseline reference point at ℄ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	+2.5 ft.	0.0 ft.
Elevation difference at Edge of travelway or face of curb	N/A	0.0 ft.

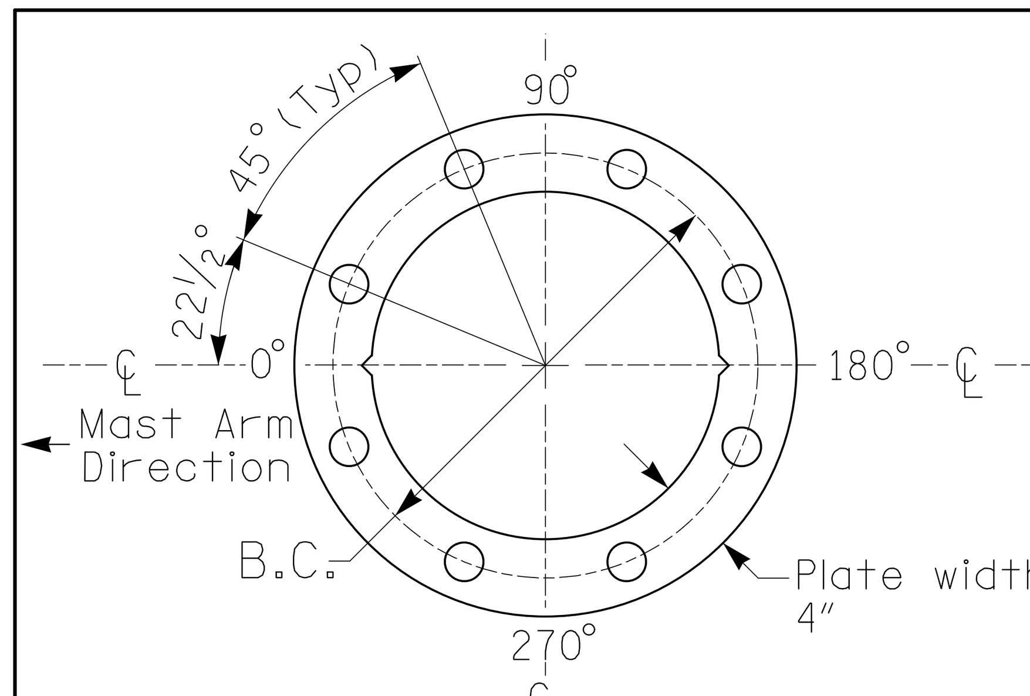


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



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

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 5.4

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12"-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5"W X 66.0"L	74 LBS
	RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5"W X 52.5"L	60 LBS
	PEDESTRIAN SIGNAL HEAD WITH MOUNTING HARDWARE	2.2 S.F.	18.5"W X 17.0"L	21 LBS
2	SIGN RIGID MOUNTED	9.0 S.F.	36.0"W X 36.0"L	17 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	16.0 S.F.	24.0"W X 96.0"L	36 LBS

NOTES

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 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

2. 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.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. 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.
6. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
7. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
8. 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.
9. 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.
10. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
11. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

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NCDOT Wind Zone 4 (90 mph)

Prepared for the Offices of: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) NB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11 Caldwell County Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	J.T. Grimm	REVIEWED BY:	T.M. Moody

SCALE 0 N/A
N/A

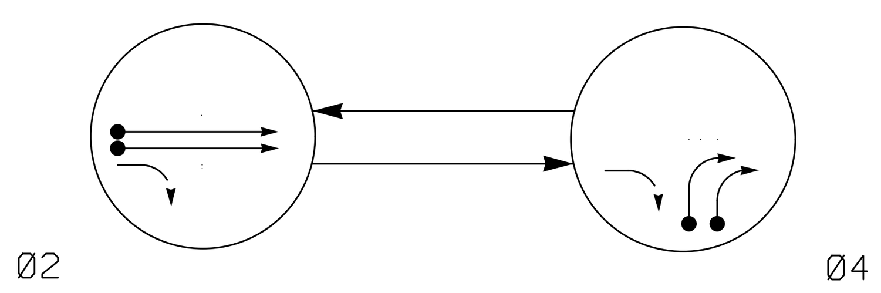
REVISIONS | INIT. | DATE

SEAL — North Carolina Professional Engineer SEAL 19713 Donald J. Darity

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

SIG. INVENTORY NO. 11-0066

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

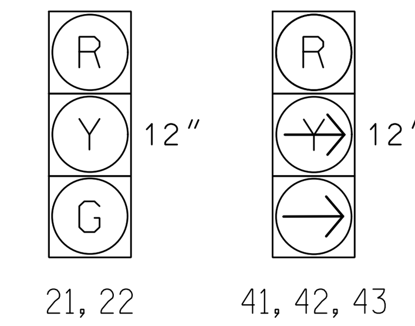
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø6	PHASE Ø8	PHASE FLASH
21, 22	G	R	Y
41, 42, 43	R	→	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

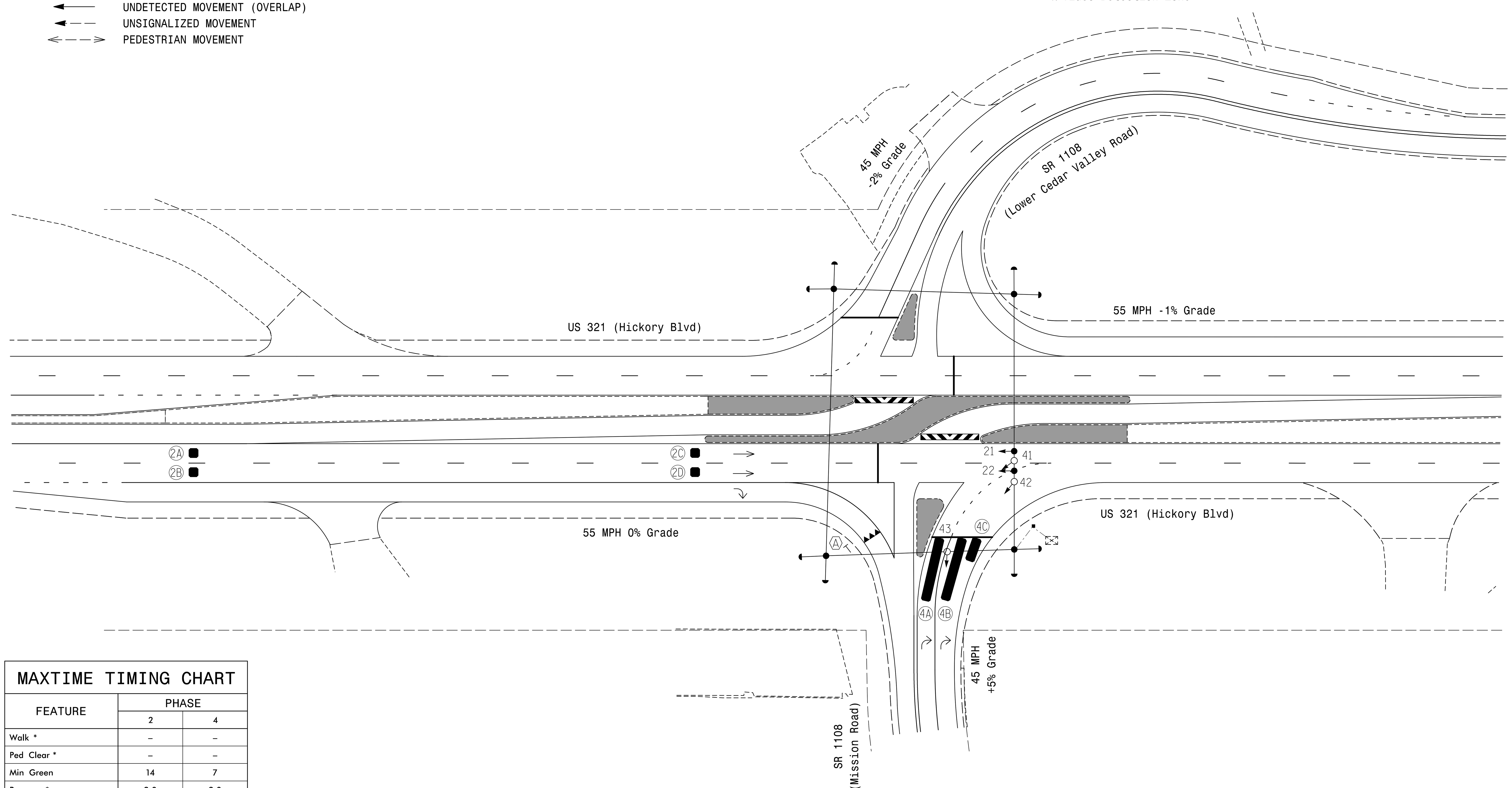
DETECTOR: LOOP	DETECTOR: SIZE (FT)	DETECTOR: DISTANCE FROM STOPBAR (FT)	DETECTOR: TURNS	DETECTOR: NEW LOOP	PROGRAMMING: CALL PHASE	PROGRAMMING: DELAY TIME	PROGRAMMING: EXTEND TIME	PROGRAMMING: EXTEND	PROGRAMMING: ADDED INITIAL	PROGRAMMING: CALL	PROGRAMMING: DELAY DURING GREEN	NEW CARD
2A,2B	6X6	420	*	*	2	-	2.2	X	-	X	-	*
2C,2D	6X6	110	*	*	2	-	-	X	-	X	-	*
4A	6X40	0	*	*	4	15.0	-	X	-	X	-	*
4B	6X40	0	*	*	4	15.0	-	X	-	X	-	*
4C	6X30	0	*	*	4	15.0	-	X	-	X	-	*

* Video Detection Zone

2 Phase
Fully Actuated
Isolated

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. Set all detector units to presence mode.
4. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
5. Refer to Roadway and/or Pavement Marking plans for stop bar locations.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Video Detection Zone	
	Construction Zone	N/A
	Type III Barricade	N/A
(A)	"YIELD" Sign R1-2	(A)

MAXTIME TIMING CHART

FEATURE	PHASE 2	PHASE 4
Walk *	–	–
Ped Clear *	–	–
Min Green	14	7
Passage *	2.0	2.0
Max 1 *	90	20
Yellow Change	5.2	3.0
Red Clear	1.4	3.1
Added Initial *	–	–
Maximum Initial *	–	–
Time Before Reduction *	–	–
Time To Reduce *	–	–
Minimum Gap	–	–
Advance Walk	–	–
Non Lock Detector	–	X
Vehicle Recall	MIN RECALL	–
Dual Entry	–	–

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

Signal Upgrade
Temporary Design - TMP Phase III

stv
STV Engineers, Inc.
900 West Trade St., Suite 715
Charlotte, NC 28202
(704) 372-1885
NC License Number F-0991

Prepared for the Offices of: Transportation Mobility and Safety Division — Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SCALE 0 40 1"=40'

US 321 (Hickory Boulevard) NB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11 Caldwell County Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	R. Leon	REVIEWED BY:	T.M. Moody

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

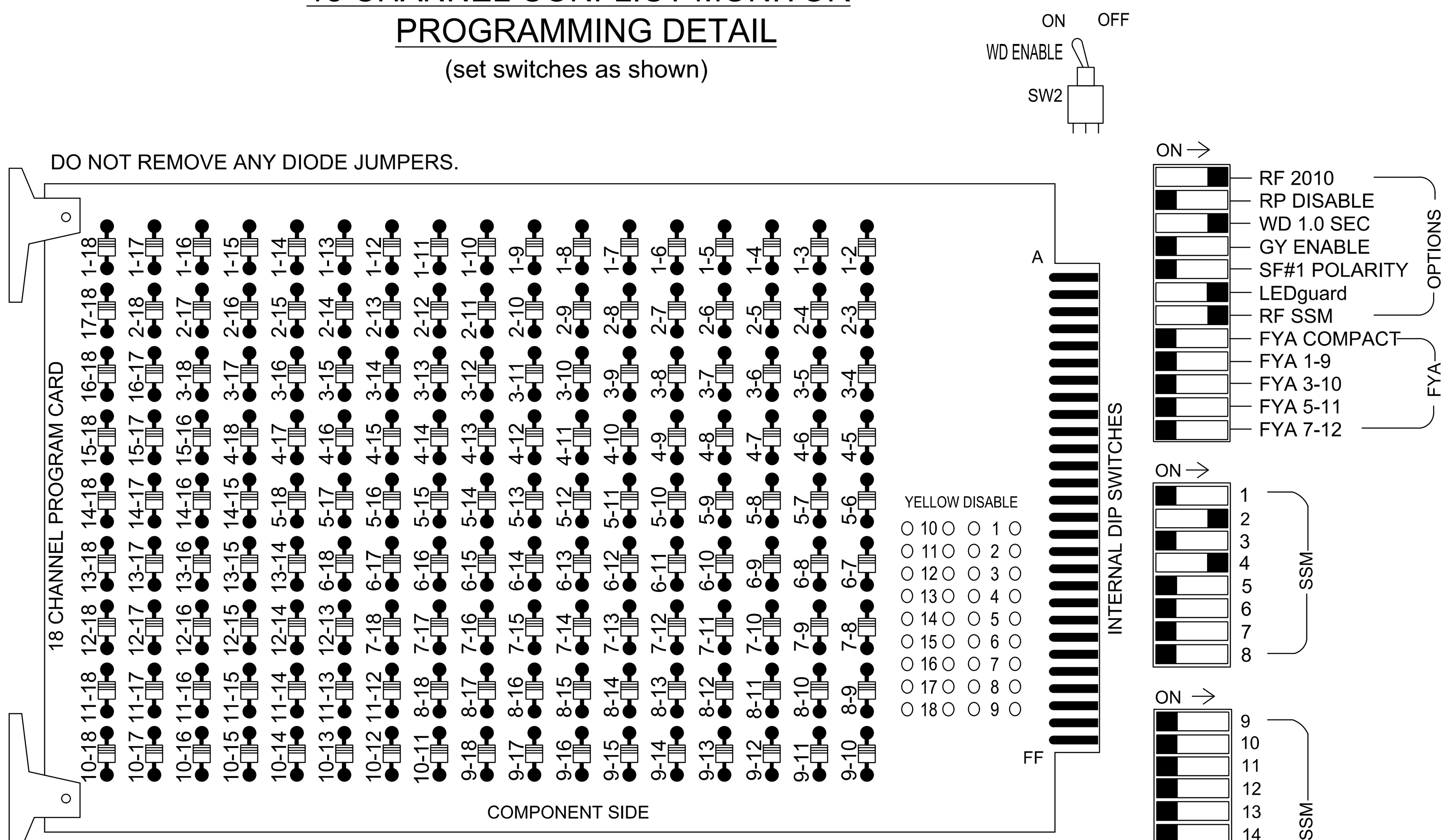
DocuSigned by:
Donald J. Darity 10/18/2023
SIGNATURE DATE
SIG. INVENTORY NO. 11-1452T

10/17/2023
LeonR

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 6.1

18 CHANNEL CONFLICT MONITOR PROGRAMMING DETAIL

(set switches as shown)



DO NOT REMOVE ANY JUMPERS

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

■ = DENOTES POSITION OF SWITCH

NOTES

1. 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.
2. Program controller to start up in phase 2 Green No Walk.
3. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.

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, S5
Phases Used..2, 4
Overlaps...NONE

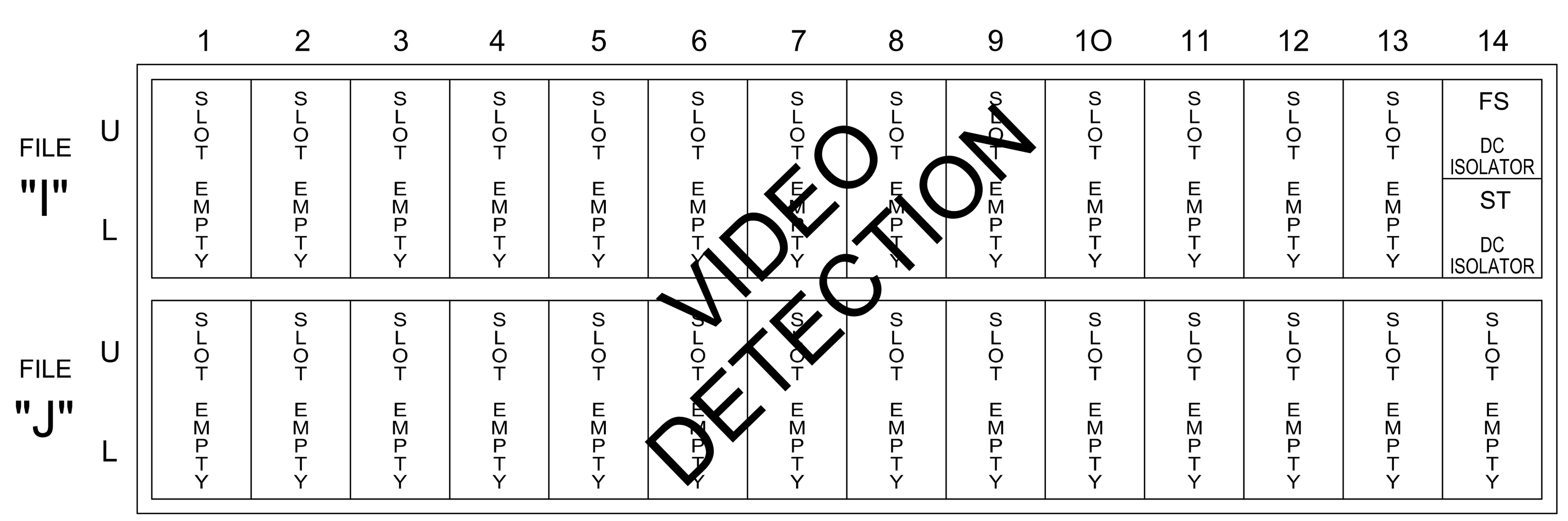
SIGNAL HEAD HOOK-UP CHART

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	41, 42,43	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED		128			101													
YELLOW		129																
GREEN		130																
RED ARROW																		
YELLOW ARROW					102													
FLASHING YELLOW ARROW																		
GREEN ARROW					103													
✋																		
🚶																		

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)



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

FS = FLASH SENSE
ST = STOP TIME

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: 11-1452T
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED: N/A

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL DETAIL

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for the Offices of:
Transportation Mobility and Safety Division
STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
ITS & Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) NB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11 Caldwell County Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	R. Leon	REVIEWED BY:	H.M. Surti

REVISIONS	INIT.	DATE

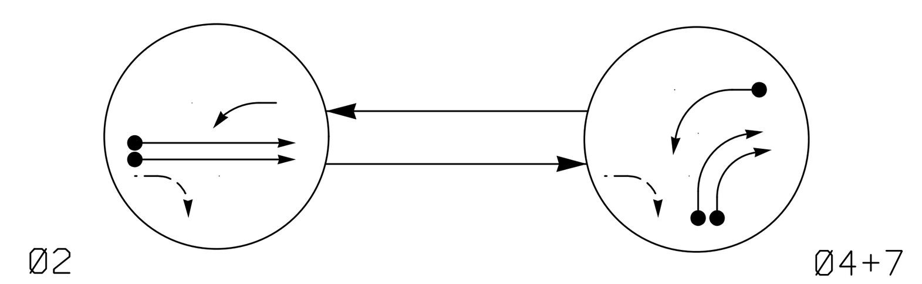
STV Engineers, Inc.
900 West Trade St., Suite 715
Charlotte, NC 28202
(704) 372-1885
NC License Number F-0991

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 19713 DONALD J. DARITY

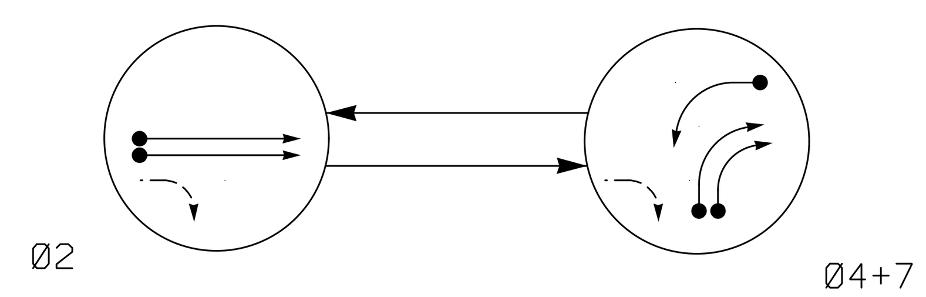
DocuSigned by: Donald J. Darity 589F69087E72485...
SIGNATURE 10/18/2023 DATE

SIG. INVENTORY NO. 11-1452T

DEFAULT PHASING DIAGRAM



ALTERNATE PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

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

DEFAULT PHASING TABLE OF OPERATION

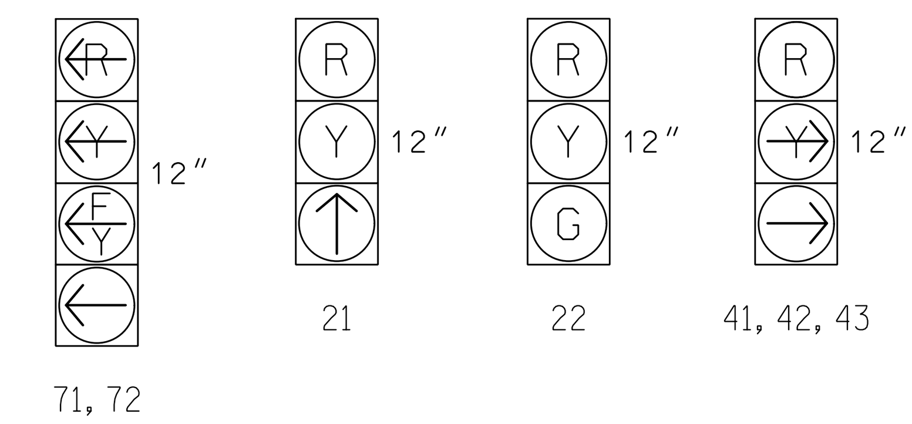
SIGNAL FACE	PHASE Ø2	PHASE Ø4+7	FLASH
21	↑	R	Y
22	G	R	Y
41, 42, 43	R	→	R
71, 72	F/Y	←	Y

ALTERNATE PHASING TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2	PHASE Ø4+7	FLASH
21	↑	R	Y
22	G	R	Y
41, 42, 43	R	→	R
71, 72	R	←	Y

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

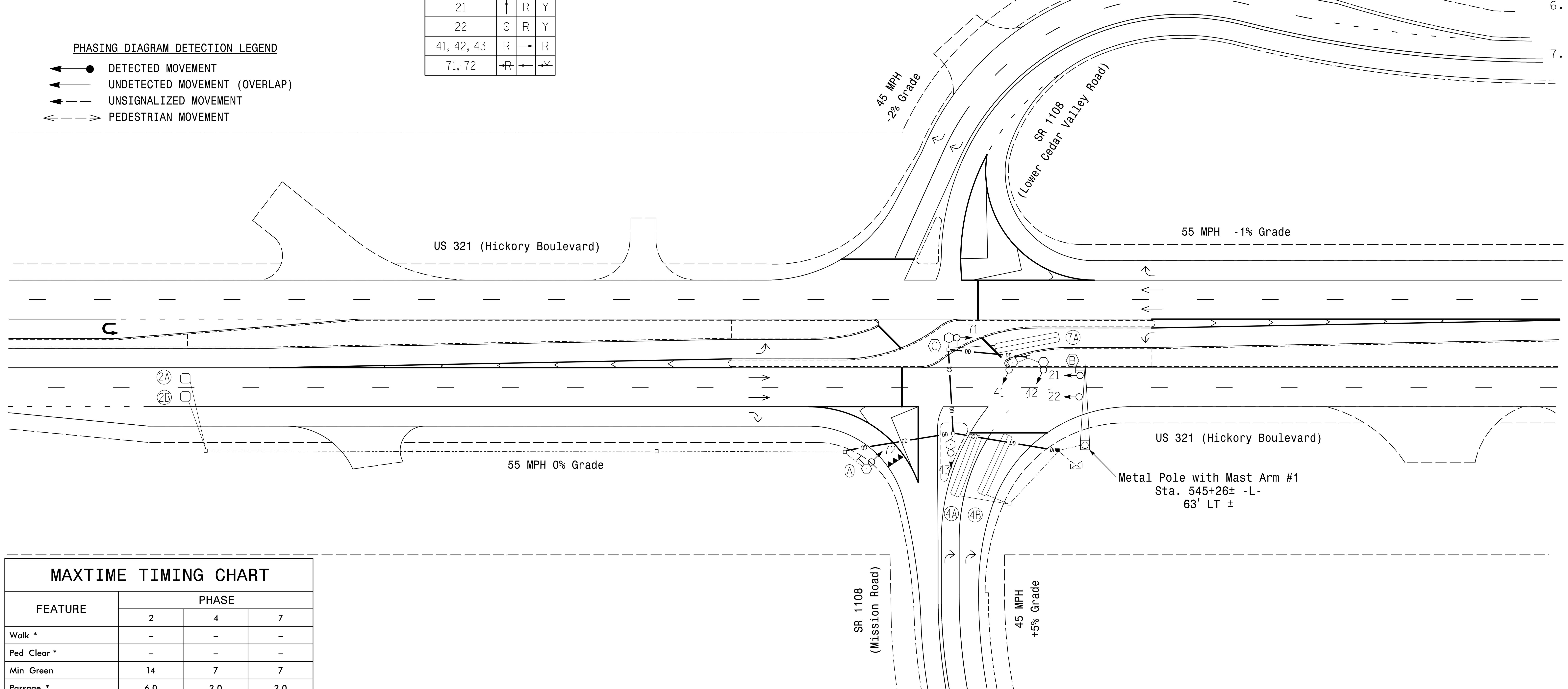
DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
2A	6X6	420	5	X	2	-	-	X	X	X	-	X
2B	6X6	420	5	X	2	-	-	X	X	X	-	X
4A	6X40	0	2-4-2	X	4	15.0	-	X	-	X	-	X
4B	6X40	0	2-4-2	X	4	15.0	-	X	-	X	-	X
7A	6X40	0	2-4-2	X	7	✳15.0	-	X	-	X	-	X

✳ Disable Delay During Alternate Phasing Operation.

2 Phase
Fully Actuated w/ Alternate Phasing Operation
US 321 Closed Loop 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. Set all detector units to presence mode.
4. The Division Traffic Engineer will determine the hours of use for each phasing plan.
5. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
6. Pedestal mounted signal heads shall be mounted a minimum of 8' above the high point of the roadway surface elevation.
7. Refer to Roadway and/or Pavement Marking plans for stop bar locations.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Metal Pole with Mastarm	
	Directional Drill	N/A
	Type II Signal Pedestal	
	Yield Bars	
Ⓐ	"YIELD" Sign (R1-2)	Ⓐ
Ⓑ	No Left Turn Sign (R3-2)	Ⓑ
Ⓒ	No U-Turn Sign (R3-4)	Ⓒ

MAXTIME TIMING CHART

FEATURE	PHASE 2	PHASE 4	PHASE 7
Walk *	–	–	–
Ped Clear *	–	–	–
Min Green	14	7	7
Passage *	6.0	2.0	2.0
Max 1 *	90	20	30
Yellow Change	5.2	3.0	3.0
Red Clear	1.4	2.6	1.8
Added Initial *	1.5	–	–
Maximum Initial *	46	–	–
Time Before Reduction *	15	–	–
Time To Reduce *	30	–	–
Minimum Gap	3.4	–	–
Advance Walk	–	–	–
Non Lock Detector	–	X	X
Vehicle Recall	MIN RECALL	–	–
Dual Entry	–	X	X

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

Signal Upgrade - Final Design

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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(704) 372-1885
NC License Number F-0991

Prepared for the Offices of: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SCALE 0 40
1"=40'

US 321 (Hickory Boulevard) SB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11 | Caldwell County | Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	J.T. Grimm	REVIEWED BY:	T.M. Moody

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

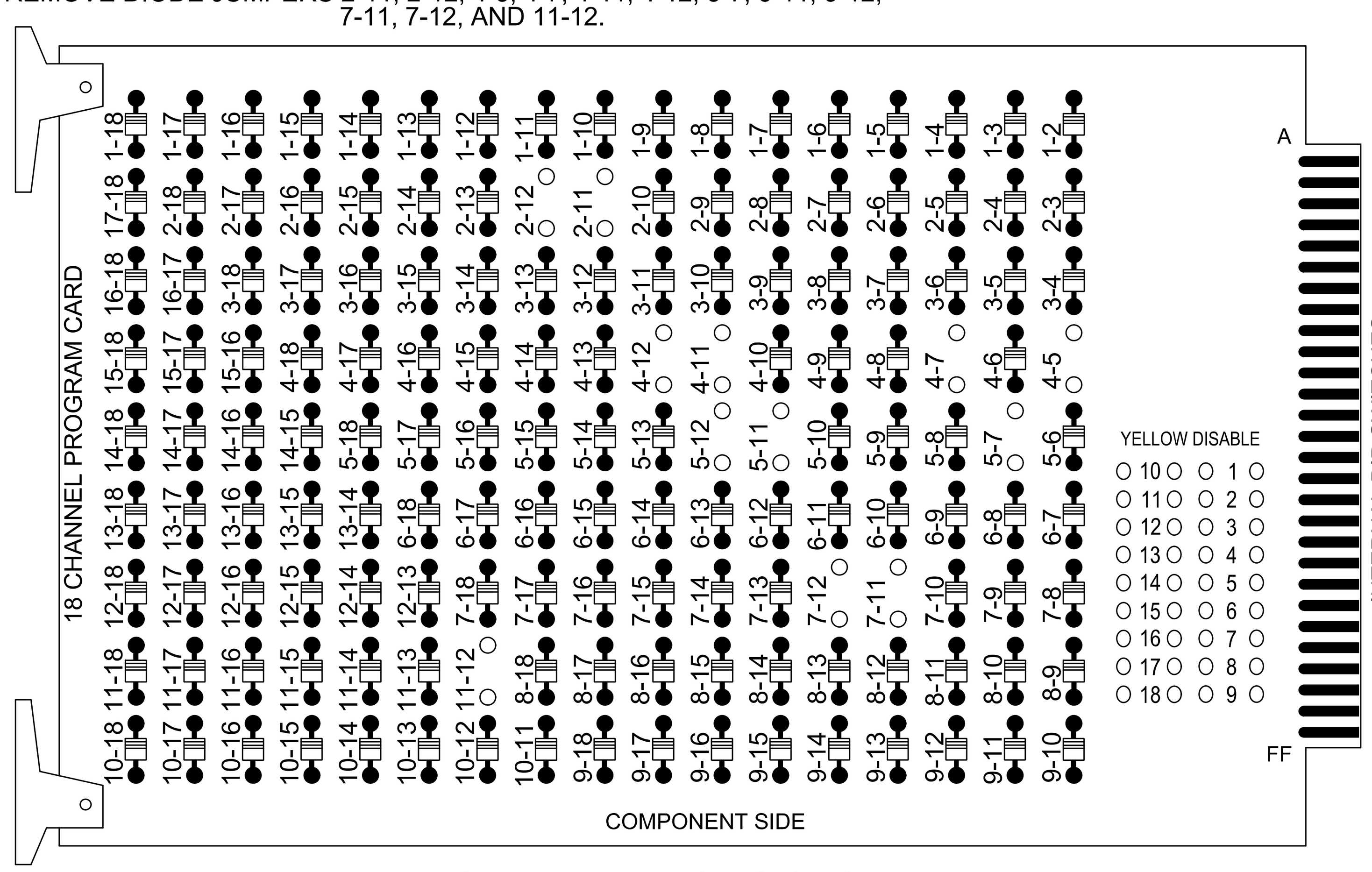
SIG. INVENTORY NO. 11-1452

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 7.1

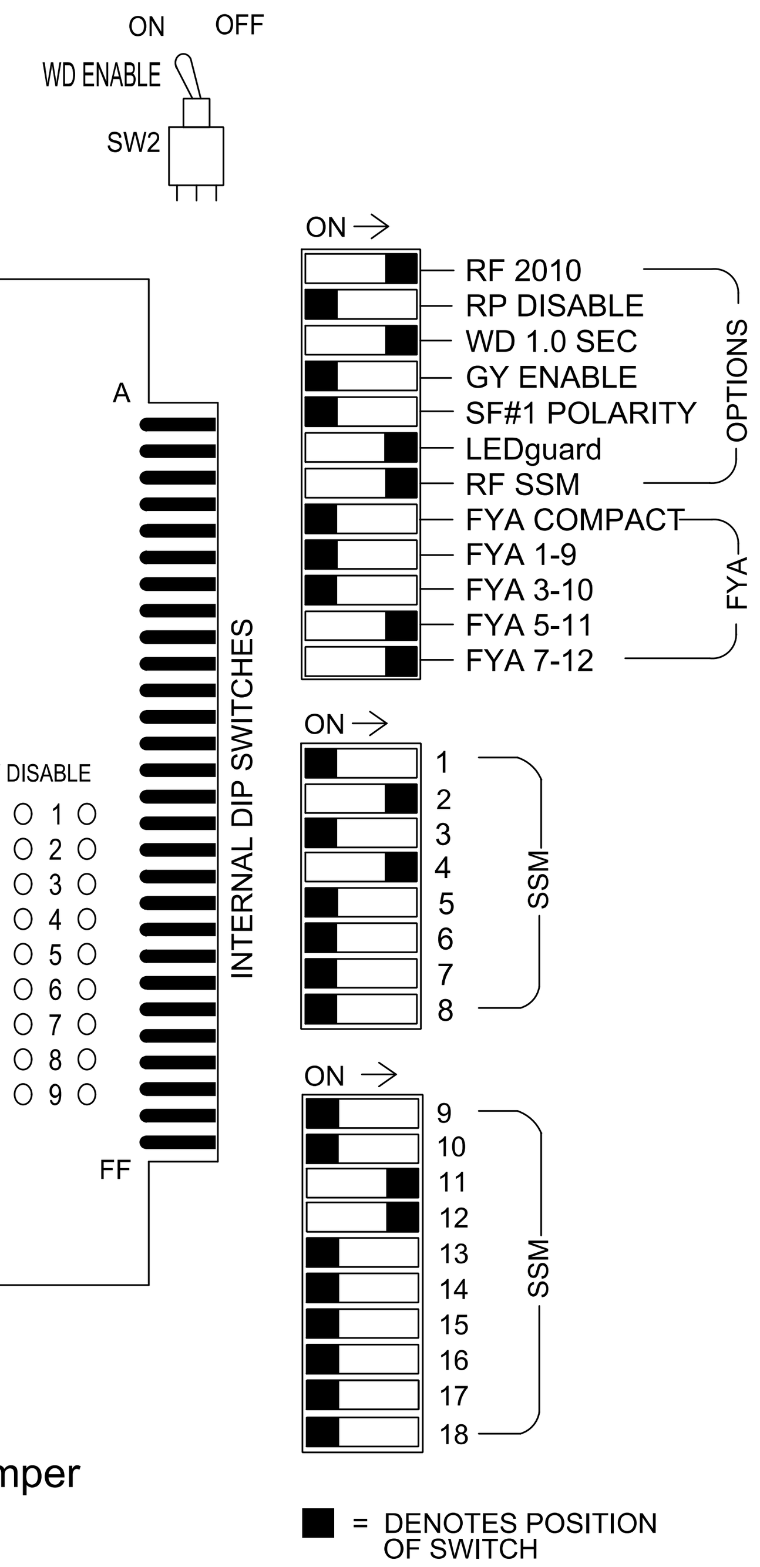
18 CHANNEL CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 2-11, 2-12, 4-5, 4-7, 4-11, 4-12, 5-7, 5-11, 5-12, 7-11, 7-12, AND 11-12.



REMOVE JUMPERS AS SHOWN



■ = DENOTES POSITION OF SWITCH

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

NOTES

1. 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.
2. Program phases 4 and 7 for Dual Entry.
3. Program controller to start up in phase 2 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
5. The cabinet and controller are part of the US 321 Closed Loop 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, S5, S7, S10, AUX S4, AUX S5
Phases Used...2, 4, 7
Overlap "1"...NOT USED
Overlap "2"...NOT USED
Overlap "3"...*
Overlap "4"...*
Overlap "7"...*

*See overlap programming detail on sheet 2

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	7 PED	OL7	6	6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	21	22	NU	NU	41,42 43	NU	72★	NU	NU	71★	NU	NU	NU	NU	NU	72★	71★	NU
RED		128	128			101													
YELLOW		129	129					*			*								
GREEN			130																
RED ARROW																	A114	A101	
YELLOW ARROW						102											A115	A102	
FLASHING YELLOW ARROW																	A116	A103	
GREEN ARROW		130				103		133			124								
(hand)																			
(pedestrian)																			

NU = Not Used

* Denotes install load resistor. See load resistor installation detail this sheet.

★ See pictorial of head wiring in detail this sheet.

INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I"	U	SLOT EMPTY	ø 2 2A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	ø 4 4A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	FS DC ISOLATOR
	L		ø 2 2B				ø 4 4B								ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	ø 7 7A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L					NOT USED									

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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

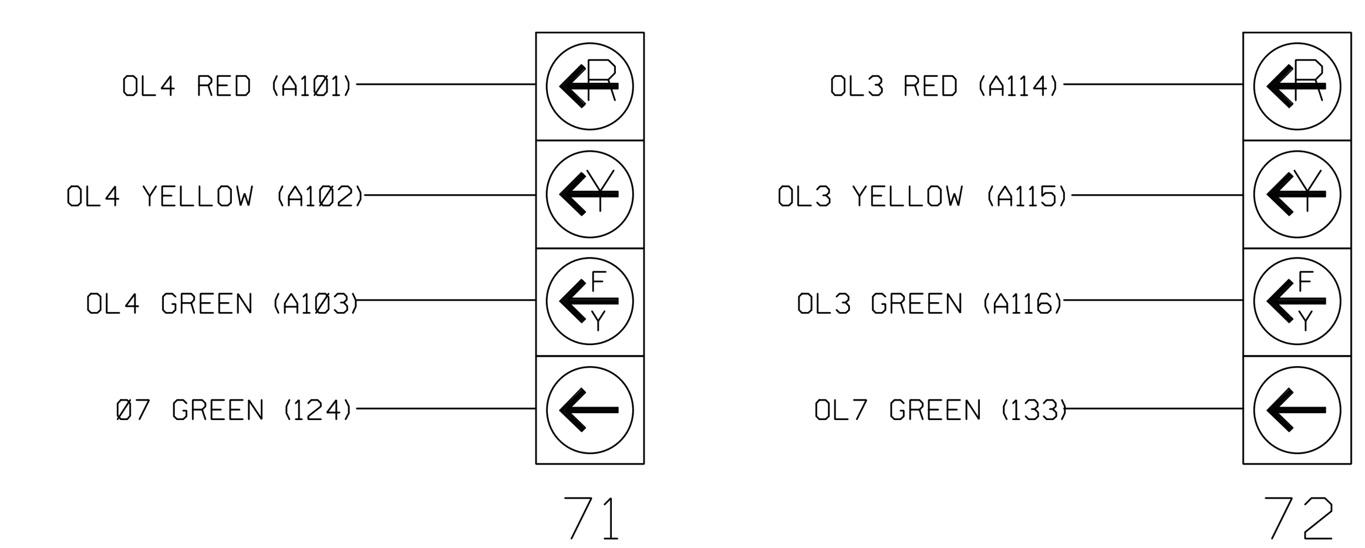
LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
2A	TB2-5,6	I2U	39	1	2	2			X	X	X	
2B	TB2-7,8	I2L	43	5	3	2			X	X	X	
4A	TB4-9,10	I6U	41	3	8	4	15.0		X		X	
4B	TB4-11,12	I6L	45	7	9	4	15.0		X		X	
7A	TB5-5,6	J5U	57	19	21 *	7	15.0		X		X	

* For the detectors to work as shown on the signal plan, see the Vehicle Detector Setup Programming Detail for Alternate Phasing on sheet 3.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

4 SECTION FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)

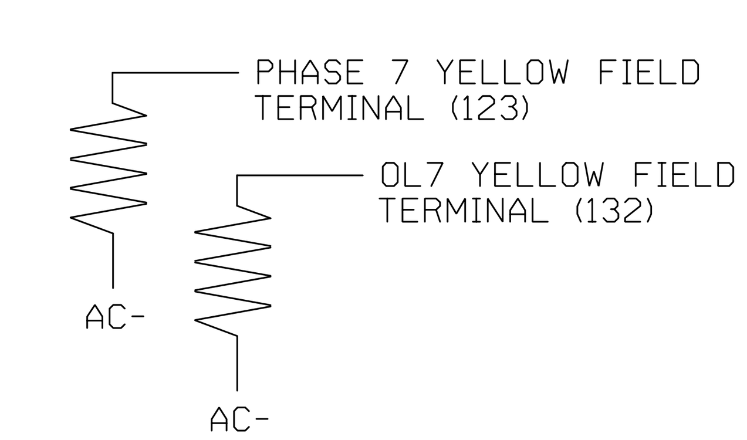


LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

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



THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 11-1452
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED: N/A

ELECTRICAL DETAIL SHEET 1 OF 3

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STV Engineers, Inc.
900 West Trade St., Suite 715
Charlotte, NC 28202
(704) 372-1885
NC License Number F-0991

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for the Offices of: Transportation Mobility and Safety Division, ITS & Signals Management Section, North Carolina Department of Transportation

750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) SB at SR 1108 (Mission Road)/ SR 1108 (Lower Cedar Valley Rd)

Division 11 Caldwell County Hudson

PLAN DATE: Sept 2023 REVIEWED BY: D.J. Darity
PREPARED BY: R.L. Aristondo REVIEWED BY: T.M. Moody

REVISIONS INIT. DATE

SEAL — NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 19713 DONALD J. DARITY

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

SIG. INVENTORY NO. 11-1452

OUTPUT CHANNEL CONFIGURATION

Front Panel
Main Menu >Controller >More>Channels>Channels Config

Web Interface
Home >Controller >Advanced IO>Channels>Channels Configuration

Channel Configuration

NOTE OL7 ASSIGNED TO CHANNEL 5

Channel	Control Type	Control Source	Flash Yellow	Flash Red	Flash Alt	MMU Channel
1	None	1		X	X	1
2	Phase Vehicle	2	X			2
3	None	3		X	X	3
4	Phase Vehicle	4		X		4
5	Overlap	7		X		5
6	None	6	X		X	6
7	Phase Vehicle	7		X		7
8	None	8		X	X	8
9	None	1	X		X	9
10	None	2		X	X	10
11	Overlap	3	X			11
12	Overlap	4	X			12
13	None	2				13
14	None	4				14
15	None	6				15
16	None	8				16
17	None	5		X	X	17
18	None	6		X		18

MAXTIME OVERLAP PROGRAMMING DETAIL FOR DEFAULT PHASING

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

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

Overlap	3	4	7
Type	FYA 4 - Section	FYA 4 - Section	Normal
Included Phases	2	2	7
Modifier Phases	-	7	-
Modifier Overlaps	7	-	-
Trail Green	0	0	0
Trail Yellow	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0

MAXTIME OVERLAP PROGRAMMING DETAIL FOR ALTERNATE PHASING

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

Web Interface
Home >Controller >Overlap Configuration >Overlaps

In the table view of the web interface, right click on "Overlap" in the top left corner of the table. Copy the entire contents of Overlap Plan 1. Paste Overlap Plan 1 into Overlap Plan 2. Modify Overlap Plan 2 as shown below and save changes.

Overlap Plan 2

Overlap	3	4	7
Type	FYA 4 - Section	FYA 4 - Section	Normal
Included Phases	-	-	7
Modifier Phases	-	7	-
Modifier Overlaps	7	-	-
Trail Green	0	0	0
Trail Yellow	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0

NOTICE INCLUDED PHASES ON OL3 AND OL4

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 11-1452
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED: N/A

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL DETAIL SHEET 2 OF 3

STV Engineers, Inc.
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(704) 372-1885
NC License Number F-0991

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for the Offices of:
Transportation Mobility and Safety Division
ITS & Signals Management Section
State of North Carolina Department of Transportation
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) SB
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SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)
Division 11 Caldwell County Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	R.L. Aristondo	REVIEWED BY:	T.M. Moody

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

SIG. INVENTORY NO. 11-1452

MAXTIME DETECTOR PROGRAMMING DETAIL FOR ALTERNATE PHASING LOOP 7A

Front Panel
Main Menu >Controller >Detector >Veh Det Plans

Web Interface
Home >Controller >Detector Configuration >Vehicle Detectors

In the table view of web interface right click on "Detector" in the top left corner of the table. Copy the entire contents of Detector Plan 1. Paste Detector Plan 1 into Detector Plan 2. Modify Detector Plan 2 as shown below and save changes.

PLAN 2

	Detector	Call Phase	Delay
7A	21	7	0

MAXTIME ALTERNATE PHASING ACTIVATION DETAIL

To run alternate phasing, select a Pattern that is programmed to run Overlap Plan 2 and Detector Plan 2.
A Pattern can be selected through the scheduler or manually by changing the Operational Mode.

PHASING	OVERLAP PLAN	VEH DET PLAN
ACTIVE PLAN REQUIRED TO RUN DEFAULT PHASING	1	1
ACTIVE PLAN REQUIRED TO RUN ALTERNATE PHASING	2	2

ALTERNATE PHASING CHANGE SUMMARY

THE FOLLOWING IS A SUMMARY OF WHAT TAKES PLACE WHEN OVERLAPS 3 AND 4, AND VEHICLE DETECTOR PLAN 2 ACTIVATE TO CALL THE "ALTERNATE PHASING":

OVERLAP PLAN 2: Modifies overlap included phases for heads 71 and 72 to run protected turns only.

VEH DET PLAN 2: Reduces delay time for phase 7 call on loop 7A to 0 seconds.

MAXTIME ALTERNATE PHASING PATTERN PROGRAMMING DETAIL

Front Panel
Main Menu >Controller >Coordination >Patterns

Web Interface
Home >Controller >Coordination >Patterns

Pattern Parameters

Pattern	Veh Det Plan	Overlap Plan
*	2	2

* The Pattern number(s) are to be determined by the Division and/or City Traffic Engineer.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 11-1452
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED: N/A

ELECTRICAL DETAIL SHEET 3 OF 3

STV Engineers, Inc.
900 West Trade St., Suite 715
Charlotte, NC 28202
(704) 372-1885
NC License Number F-0991

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for the Offices of:
Transportation Mobility and Safety Division
ITS & Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) SB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11 Caldwell County Hudson

PLAN DATE: Sept 2023	REVIEWED BY: D.J. Darity
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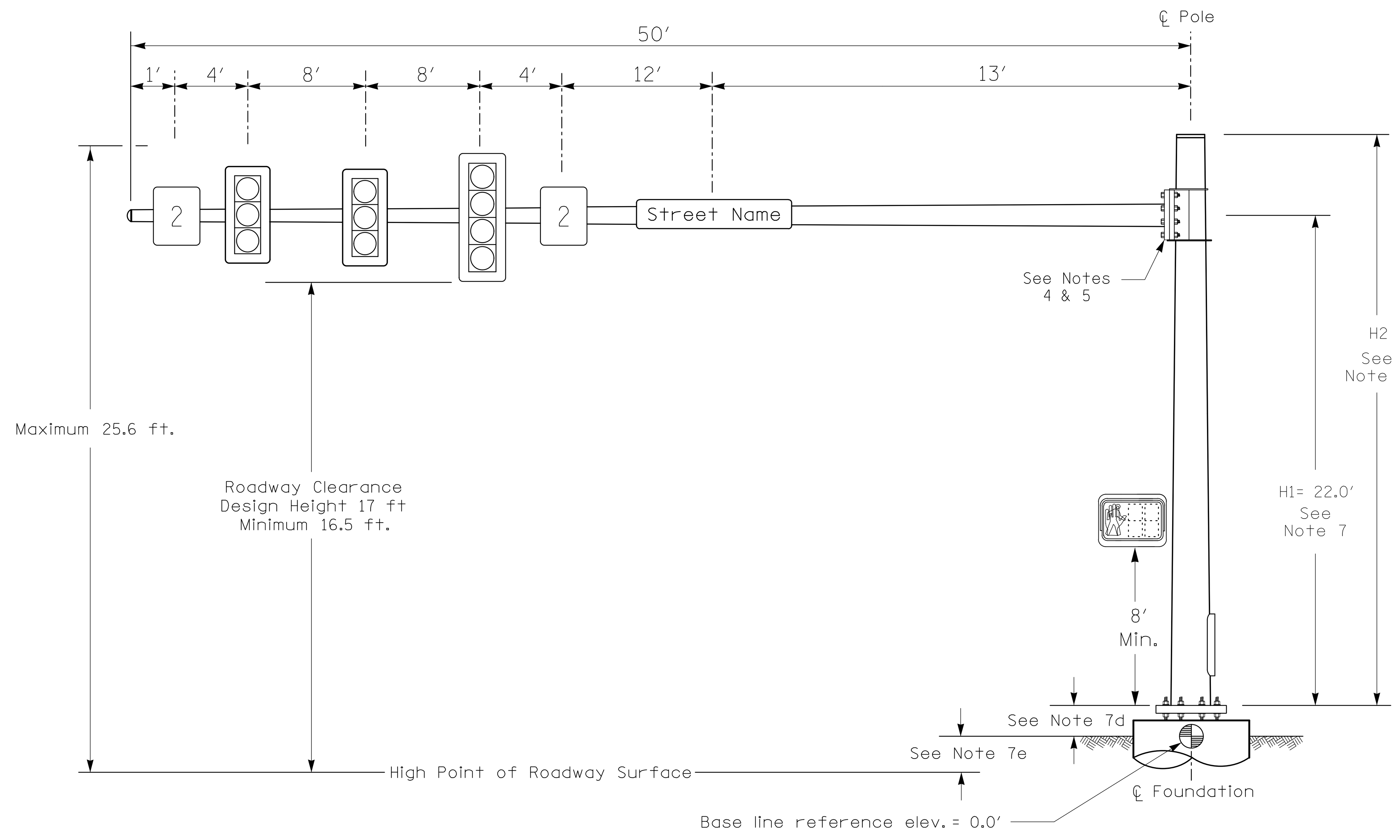
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by: Donald J. Darity 589F69087E72485...
SIGNATURE 10/18/2023 DATE

SIG. INVENTORY NO. 11-1452

Design Loading for METAL POLE NO. 1



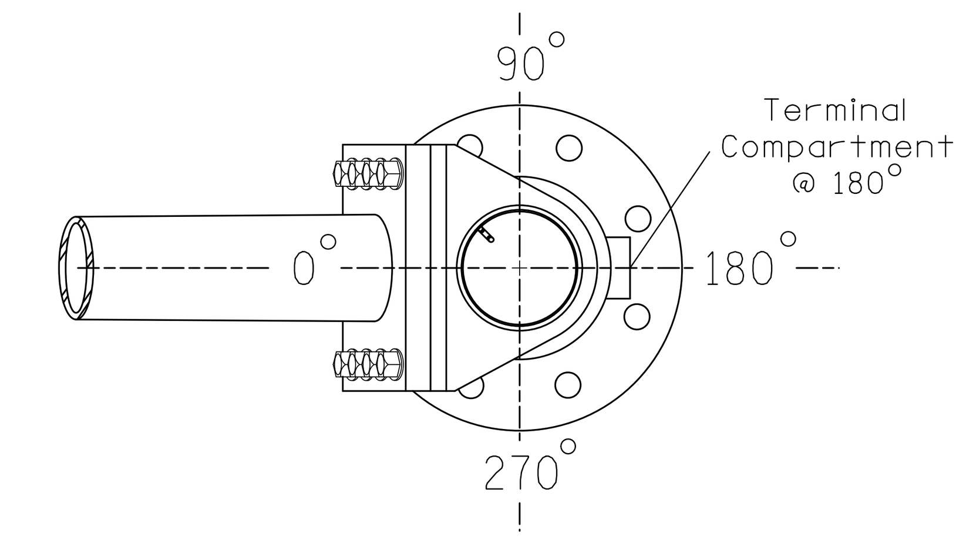
Elevation View @ 270°

SPECIAL NOTE

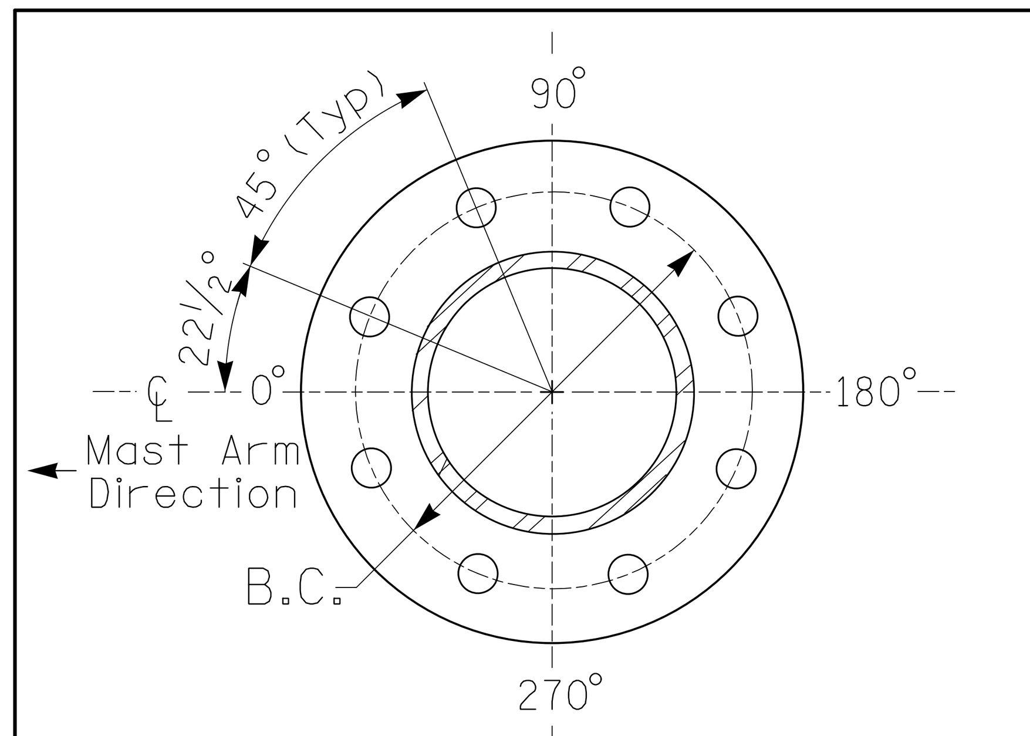
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	N/A
Baseline reference point at ℄ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	+2.6 ft.	0.0 ft.
Elevation difference at Edge of travelway or face of curb	N/A	0.0 ft.

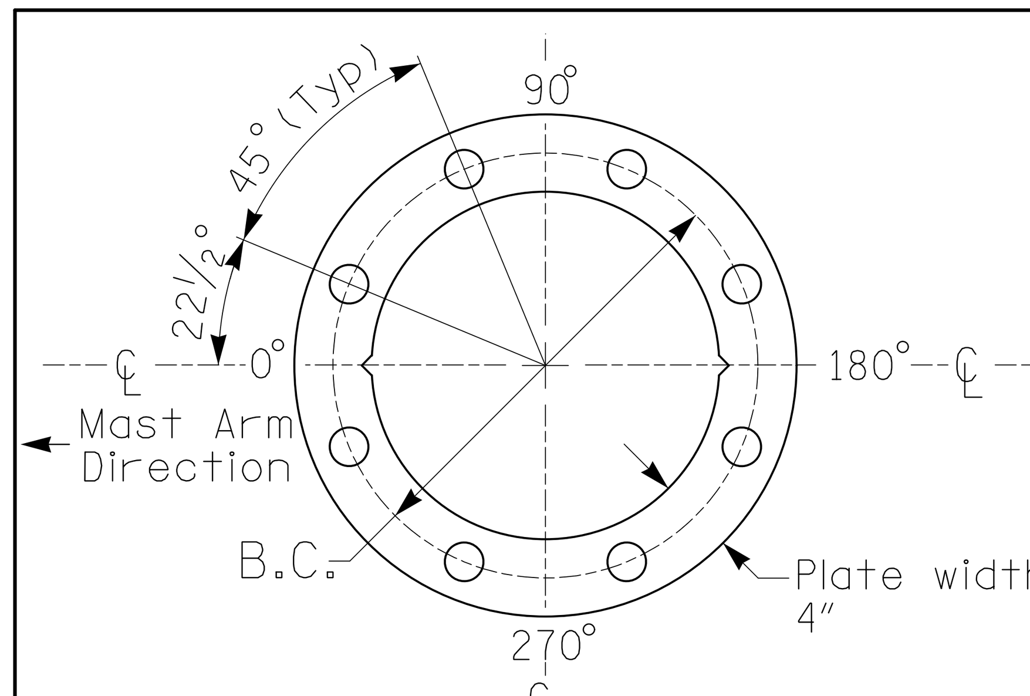


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



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

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 7.4

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12″-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5″W X 66.0″L	74 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5″W X 52.5″L	60 LBS
	PEDESTRIAN SIGNAL HEAD WITH MOUNTING HARDWARE	2.2 S.F.	18.5″W X 17.0″L	21 LBS
2	SIGN RIGID MOUNTED	9.0 S.F.	36.0″W X 36.0″L	17 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	16.0 S.F.	24.0″W X 96.0″L	36 LBS

NOTES

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 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

2. 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.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. 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.
6. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
7. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
8. 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.
9. 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.
10. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
11. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

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NCDOT Wind Zone 4 (90 mph)

Prepared for the Offices of: Transportation Mobility and Safety Division — Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) SB
at
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Rd)

Division 11 | Caldwell County | Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	J.T. Grimm	REVIEWED BY:	T.M. Moody

SCALE: 0 N/A — N/A

REVISIONS	INIT.	DATE

SEAL — NORTH CAROLINA PROFESSIONAL ENGINEER — SEAL 19713 — DONALD J. DARITY

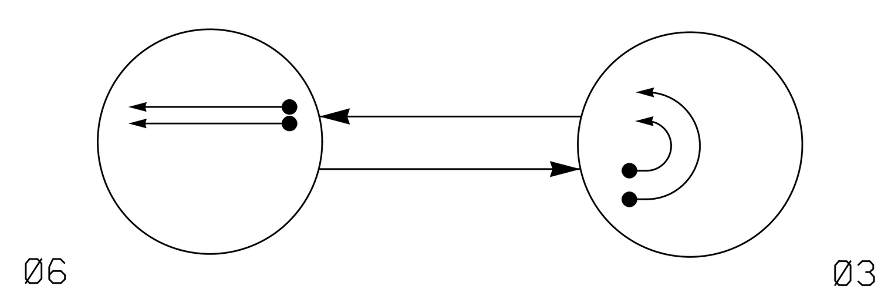
DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

SIG. INVENTORY NO. 11-1452

10/11/2023
ww\stvgroup.stvinc.com\v3\DGPA\Vol3\Projects\4019919\4019919_0001\60_Discipline Info\Traffic\Signal Design\U-4700CC(Mission)\Merge Files\11452_sig_m_2023xxxx.dgn
LeonArR

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 8.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

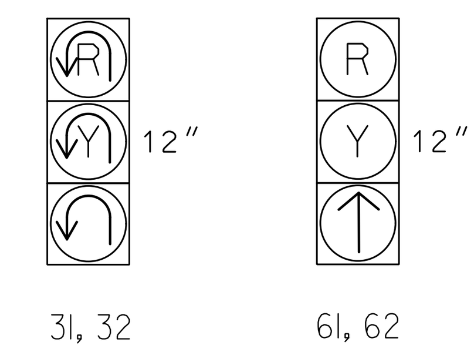
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø6	PHASE Ø3	PHASE FLASH
31, 32	R		Y
61, 62	↑	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



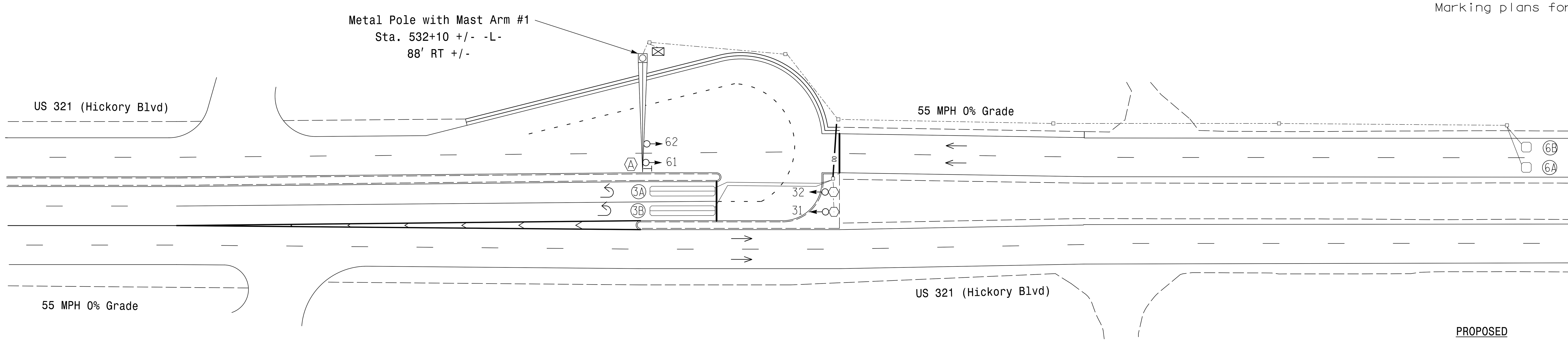
MAXTIME DETECTOR INSTALLATION CHART

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

2 Phase
Fully Actuated
US 321 Closed Loop 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. 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 supersede these values.
6. Pedestal mounted signal heads shall be mounted a minimum of 8' above the high point of the roadway surface elevation.
7. Refer to Roadway and/or Pavement Marking plans for stop bar locations.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Metal Pole with Mastarm	
DD	Directional Drill	N/A
	Type II Signal Pedestal	
A	No Left Turn Sign (R3-2)	A

MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6
Walk *	–	–
Ped Clear *	–	–
Min Green	7	14
Passage *	2.0	6.0
Max 1 *	20	90
Yellow Change	3.0	5.2
Red Clear	5.3	1.0
Added Initial *	–	1.5
Maximum Initial *	–	46
Time Before Reduction *	–	15
Time To Reduce *	–	30
Minimum Gap	–	3.4
Advance Walk	–	–
Non Lock Detector	X	–
Vehicle Recall	–	MIN RECALL
Dual Entry	–	–

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

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Charlotte, NC 28202
(704) 372-1885
NC License Number F-0991

New Installation

Prepared for the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SCALE 0 40 1"=40'

US 321 (Hickory Boulevard) NB
at U-Turn South of
SR 1108 (Mission Road)/
SR 1108 (Lower Cedar Valley Road)

Division 11 Caldwell County Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	J.T. Grimm	REVIEWED BY:	T.M. Moody

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

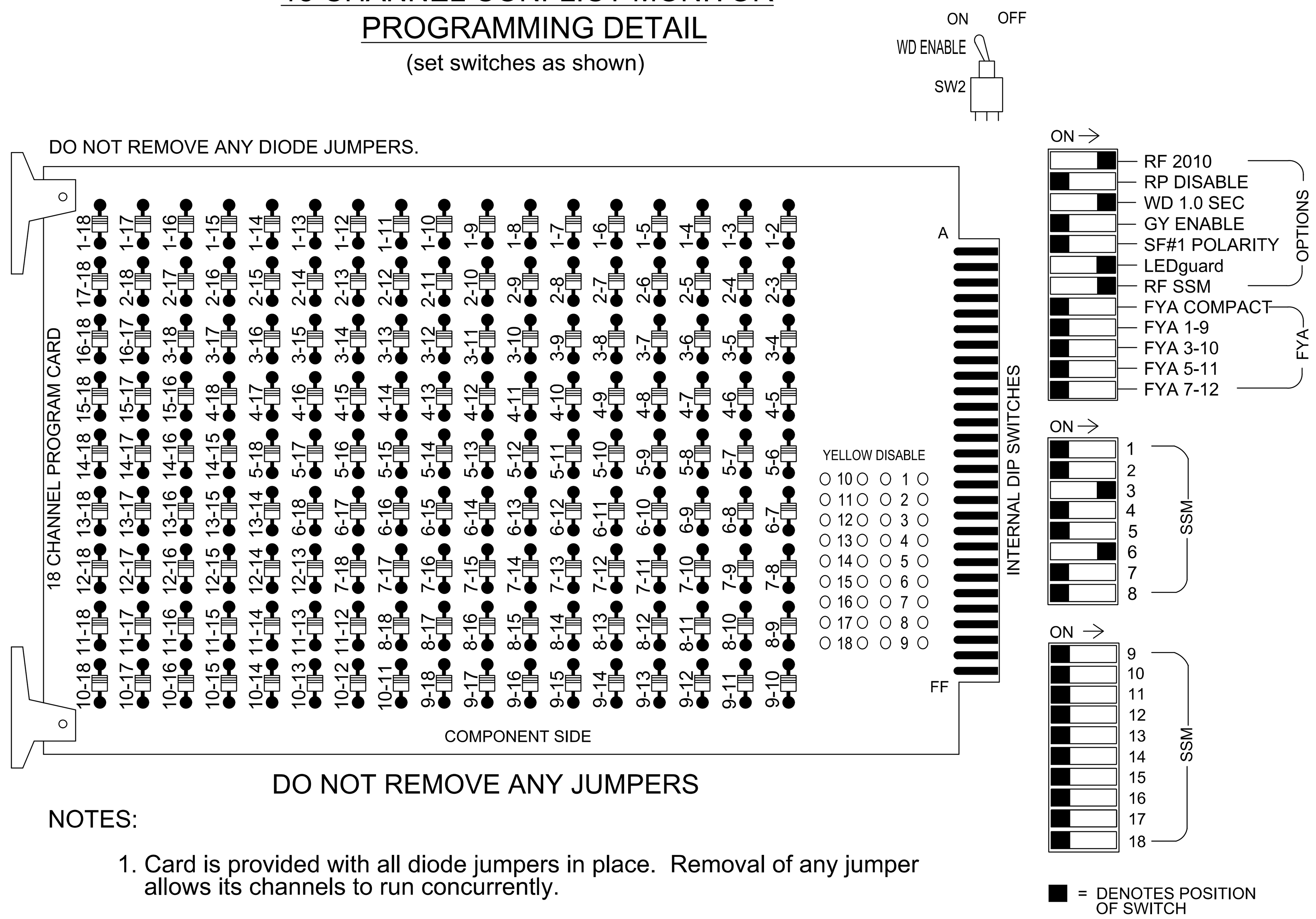
DocuSigned by: Donald J. Darity 589F69087E72485...
SIGNATURE 10/18/2023 DATE

SIG. INVENTORY NO. 11-1454

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 8.1

18 CHANNEL CONFLICT MONITOR PROGRAMMING DETAIL

(set switches as shown)



DO NOT REMOVE ANY JUMPERS

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

NOTES

1. 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.
2. Program controller to start up in phase 6 Green No Walk.
3. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
4. The cabinet and controller are part of the US 321 Closed Loop 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...........................S4, S8
Phases Used.......................................3, 6
Overlaps..NONE

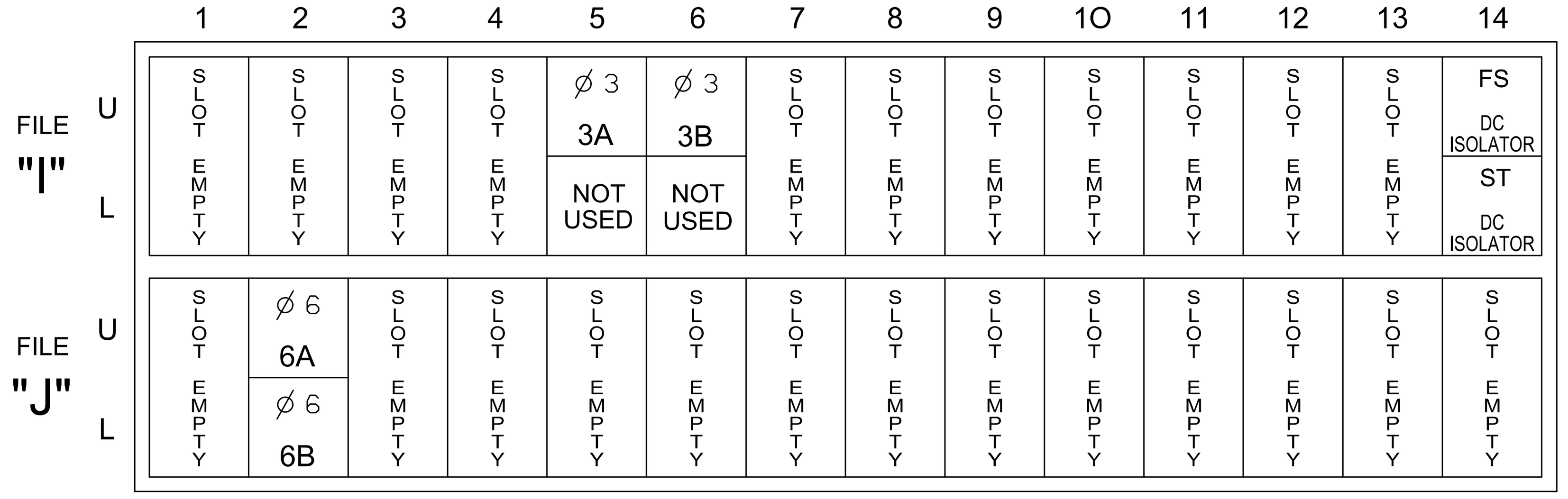
SIGNAL HEAD HOOK-UP CHART

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	NU	NU	31,32	NU	NU	NU	61,62	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED								134										
YELLOW								135										
GREEN																		
RED ARROW				116														
YELLOW ARROW				117														
GREEN ARROW				118				136										
(hand)																		
(walk)																		

NU = Not Used

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
3A	TB4-5,6	I5U	58	20	7	3			X		X	
3B	TB4-9,10	I6U	41	3	8	3			X		X	
6A	TB3-5,6	J2U	40	2	16	6			X	X	X	
6B	TB3-7,8	J2L	44	6	17	6			X	X	X	

INPUT FILE POSITION LEGEND: J2L

FILE J
SLOT 2
LOWER

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 11-1454
DESIGNED: Sept 2023
SEALED: 10/18/2023
REVISED: N/A

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL DETAIL

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 321 (Hickory Boulevard) NB at U-Turn South of SR 1108 (Mission Road)/ SR 1108 (Lower Cedar Valley Rd)

Division 11 Caldwell County Hudson

PLAN DATE: Sept 2023 REVIEWED BY: D.J. Darity
PREPARED BY: R.L. Aristondo REVIEWED BY: T.M. Moody

REVISIONS INIT. DATE

Prepared for the Offices of: Transportation Mobility and Safety Division, ITS & Signals Management Section, North Carolina Department of Transportation

750 N.Greenfield Pkwy,Garner,NC 27529

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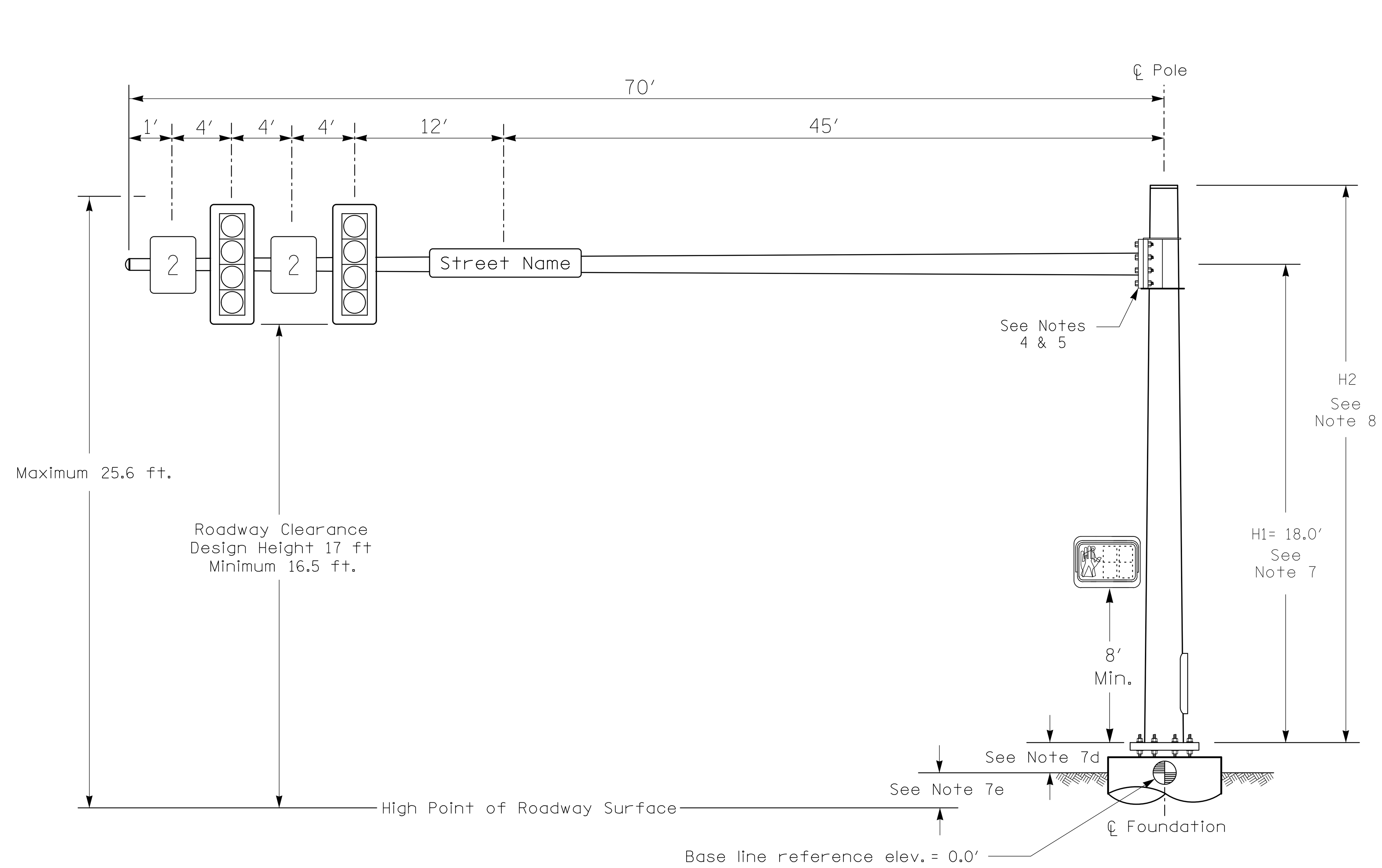
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

SIG. INVENTORY NO. 11-1454

Design Loading for METAL POLE NO. 1



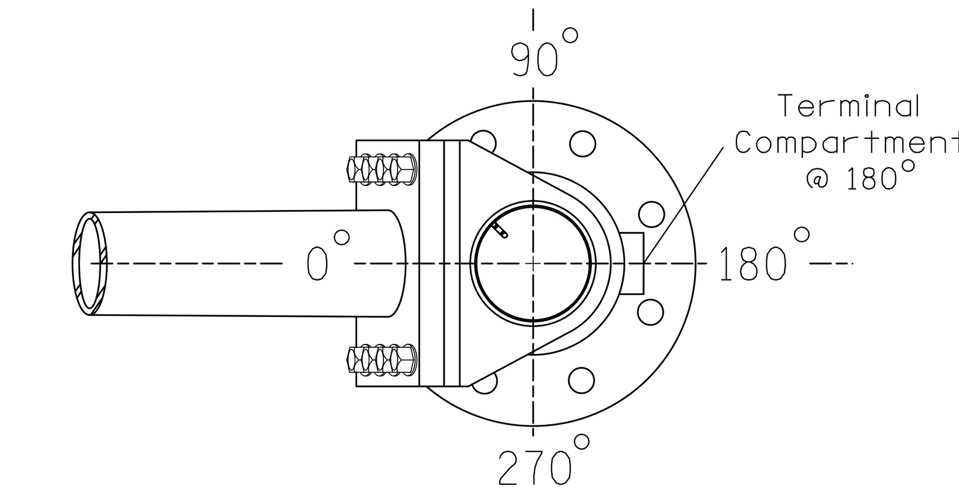
Elevation View @ 270°

SPECIAL NOTE

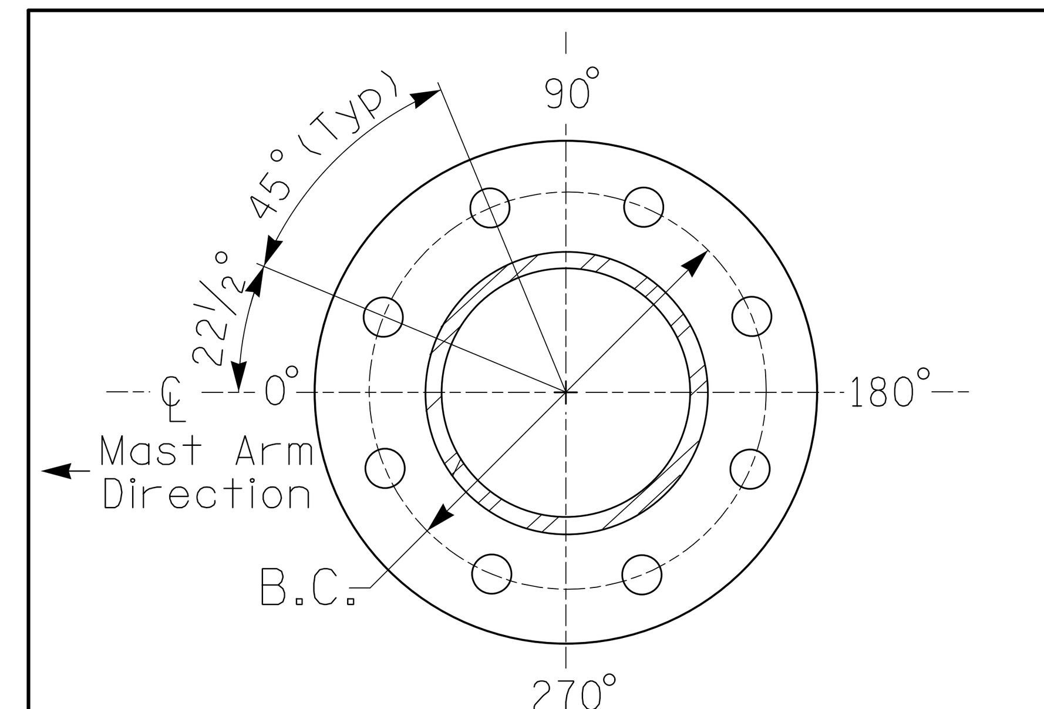
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	N/A
Baseline reference point at ℄ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	-1.1 ft.	0.0 ft.
Elevation difference at Edge of travelway or face of curb	N/A	0.0 ft.

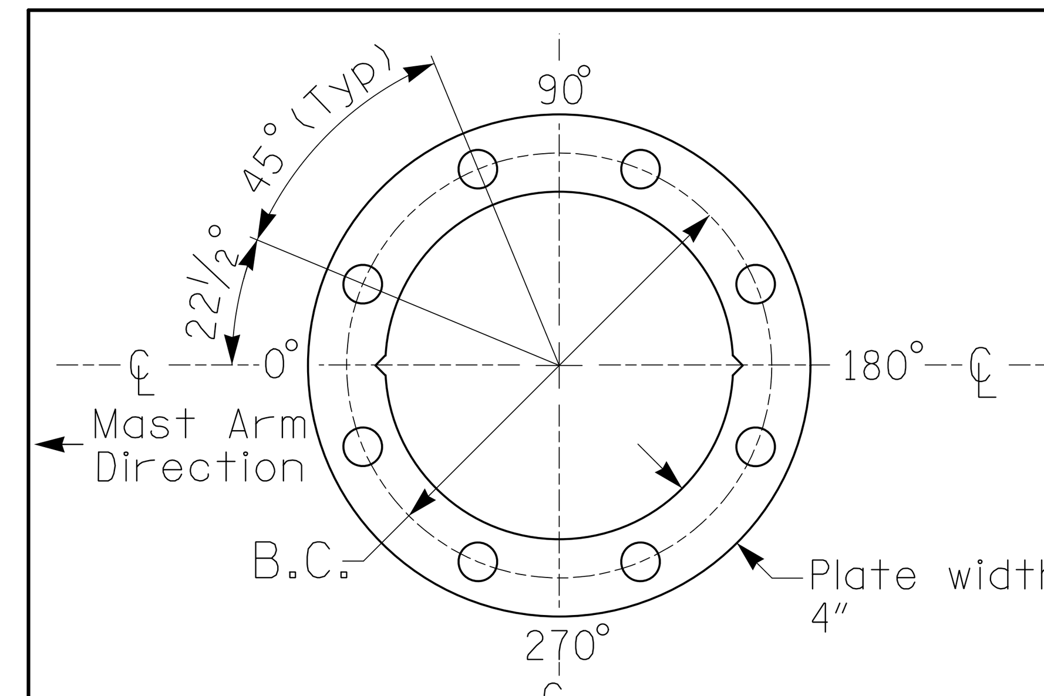


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	Sig. 8.2

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12"-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5"W X 66.0"L	74 LBS
	PEDESTRIAN SIGNAL HEAD WITH MOUNTING HARDWARE	2.2 S.F.	18.5"W X 17.0"L	21 LBS
2	SIGN RIGID MOUNTED	9.0 S.F.	36.0"W X 36.0"L	17 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	16.0 S.F.	24.0"W X 96.0"L	36 LBS

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DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
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DESIGN REQUIREMENTS

2. 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.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. 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.
6. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
7. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
8. 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.
9. 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.
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NCDOT Wind Zone 4 (90 mph)

Prepared for the Offices of: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 321 (Hickory Boulevard) NB at U-Turn South of SR 1108 (Mission Road)/ SR 1108 (Lower Cedar Valley Rd)

Division 11 Caldwell County Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	J.T. Grimm	REVIEWED BY:	T.M. Moody

SCALE 0 N/A
N/A

REVISIONS | INIT. | DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

SIG. INVENTORY NO. 11-1454

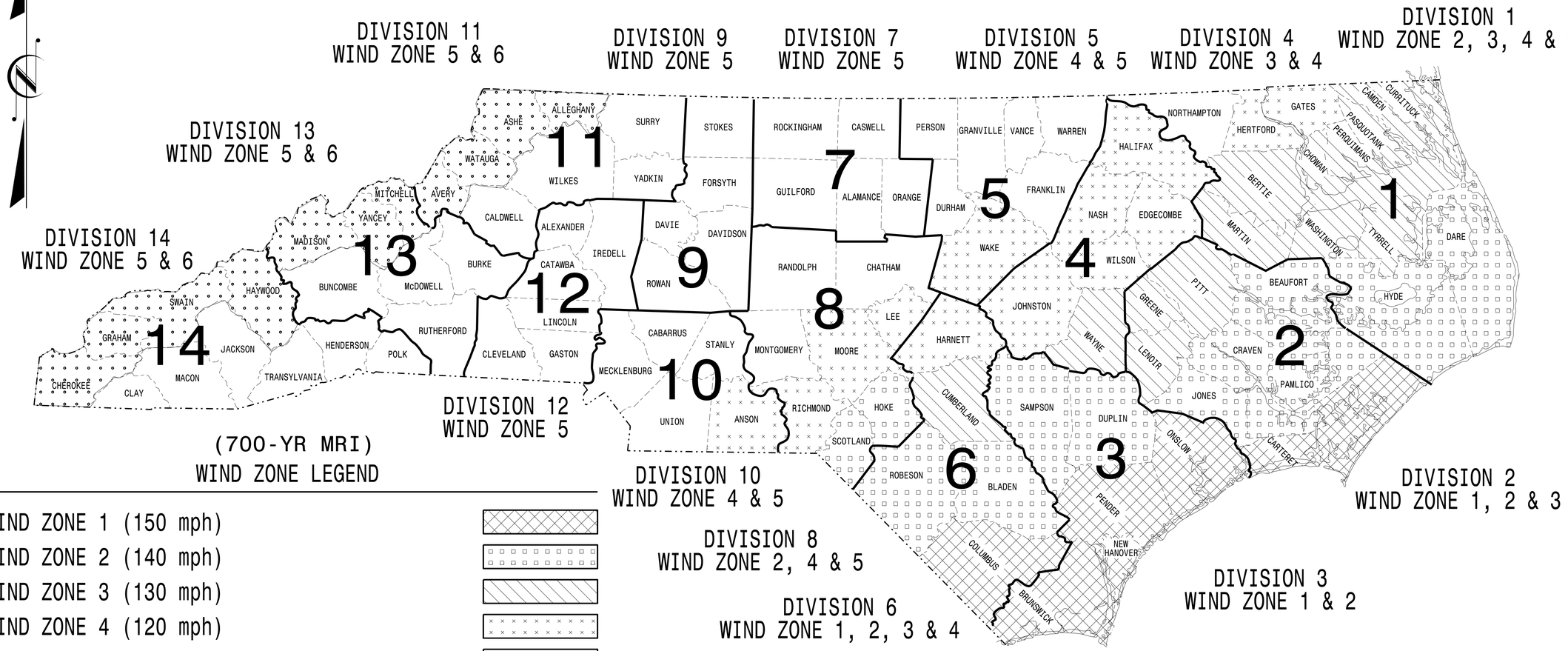
10/17/2023
\\stvgroup.stvinc.com\v3\DGPA\Vol3\Projects\4019919\4019919_0001\60_Discipline Info\Traffic\Signal Design\U-4700CC(Mission)\Merge Files\11454_sig_m_2023xxxx.dgn
LeonArR

PROJECT I.D.NO.	SHEET NO.
U-4700CC	Sig.M1A

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)

NCDOT METAL POLE STANDARDS



(700-YR MRI)
WIND ZONE LEGEND

WIND ZONE 1 (150 mph)	
WIND ZONE 2 (140 mph)	
WIND ZONE 3 (130 mph)	
WIND ZONE 4 (120 mph)	
WIND ZONE 5 (110 mph)	
WIND ZONE 6 (135 mph) Special Wind Zone	

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

Prepared in the Offices of:

Transportation Mobility and Safety Division
Signal Design Section
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

INDEX OF PLANS

DRAWING NUMBER	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

NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

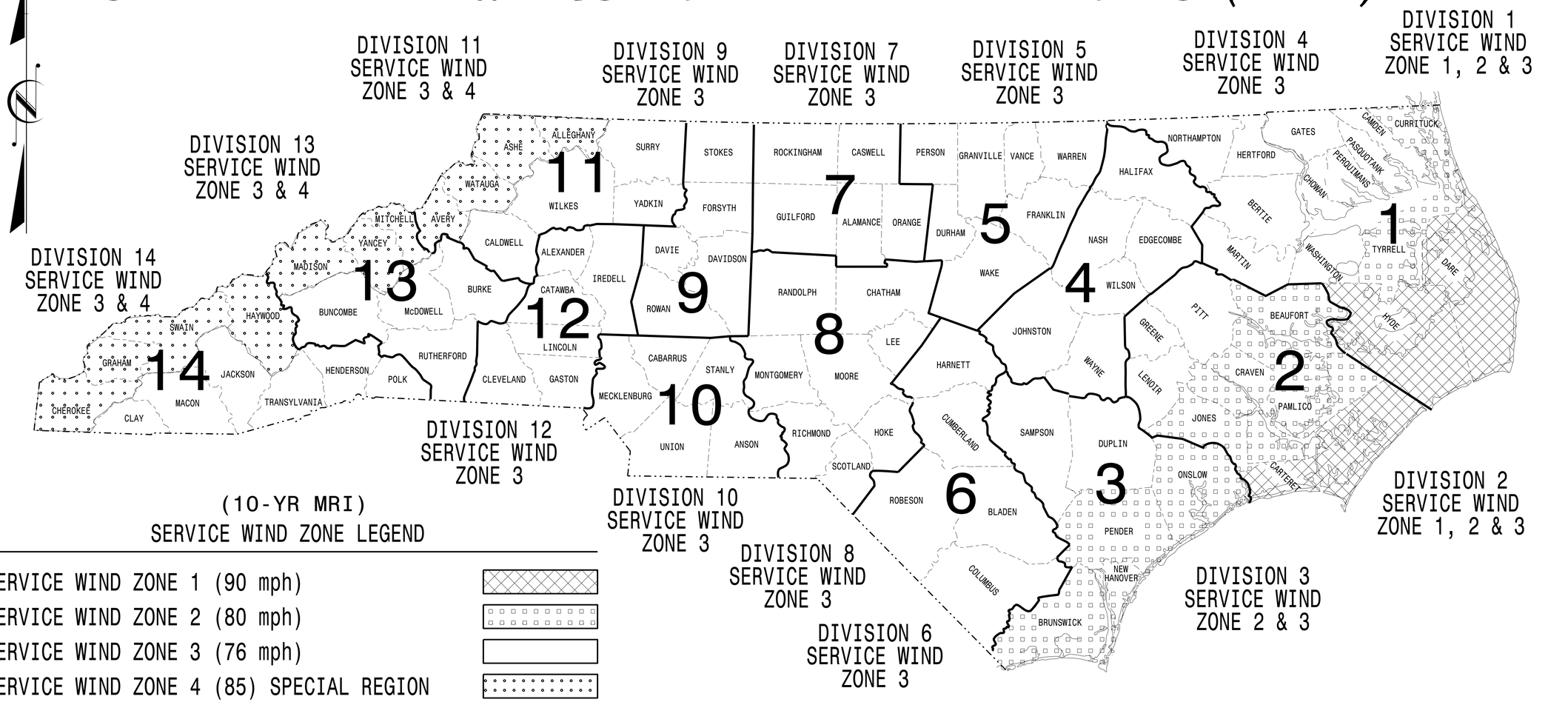
DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3784DA...
09/21/2023
DATE

PROJECT I.D.NO.	SHEET NO.
U-4700CC	Sig.M1B

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)

NCDOT METAL POLE STANDARDS



(10-YR MRI)
SERVICE WIND ZONE LEGEND

SERVICE WIND ZONE 1 (90 mph)	
SERVICE WIND ZONE 2 (80 mph)	
SERVICE WIND ZONE 3 (76 mph)	
SERVICE WIND ZONE 4 (85) SPECIAL REGION	

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

Prepared in the Offices of:

Transportation Mobility and Safety Division
Signal Design Section
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

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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

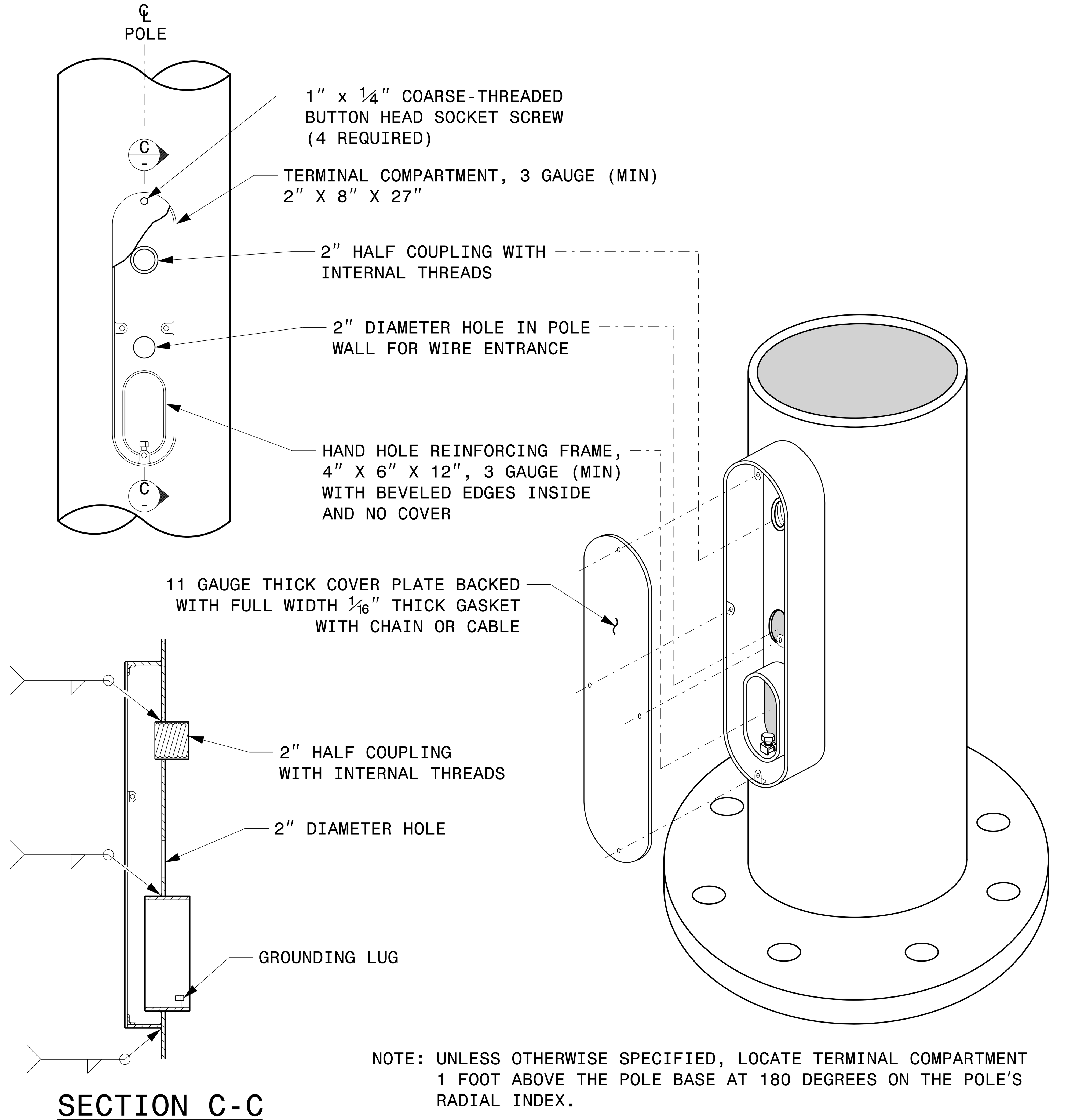
SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3784DA...
09/21/2023
DATE

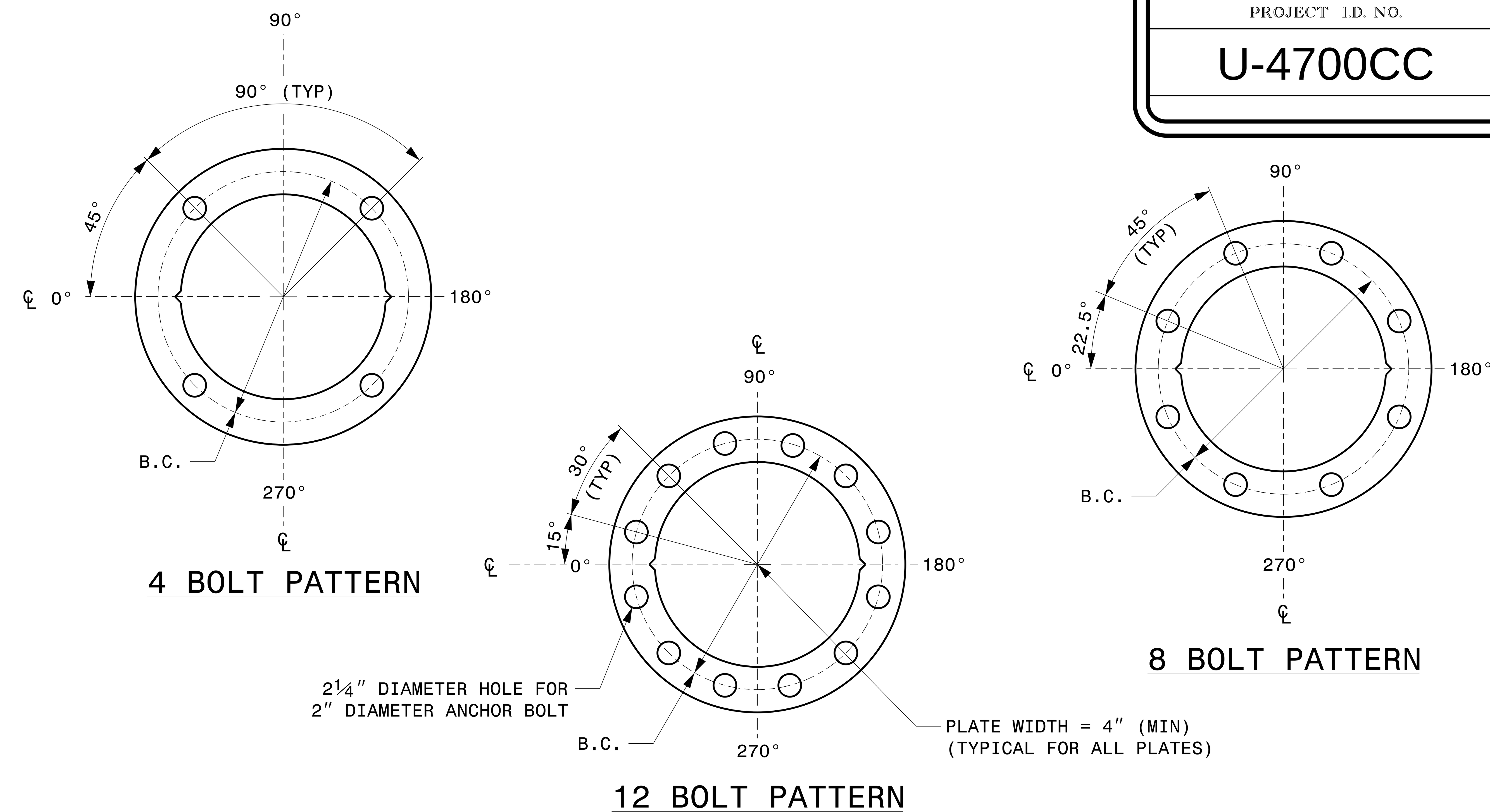
03-OCT-2023 12:21
S:\TSSGU\ITS Signals\Signal Design Section\Structures\Drawings\2024 Metal Pole Std Drawings for LRFD\2024 Sig. M1B Standard All Metal Pole (10-yr MRI).dgn
kcdurigon

Fabrication Details – All Metal Poles



NOTE: UNLESS OTHERWISE SPECIFIED, LOCATE TERMINAL COMPARTMENT 1 FOOT ABOVE THE POLE BASE AT 180 DEGREES ON THE POLE'S RADIAL INDEX.

TERMINAL COMPARTMENT DETAIL



CONSTRUCT TEMPLATES AND PLATES FROM ¼" (MIN) THICK STEEL. GALVANIZING IS NOT REQUIRED.

BASE PLATE TEMPLATE AND ANCHOR BOLT LOCK PLATE DETAILS

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

SHAFT I.D. TAG
(PROVIDE ON SHAFT OF STRAIN POLES AND MAST ARM POLE SHAFT)

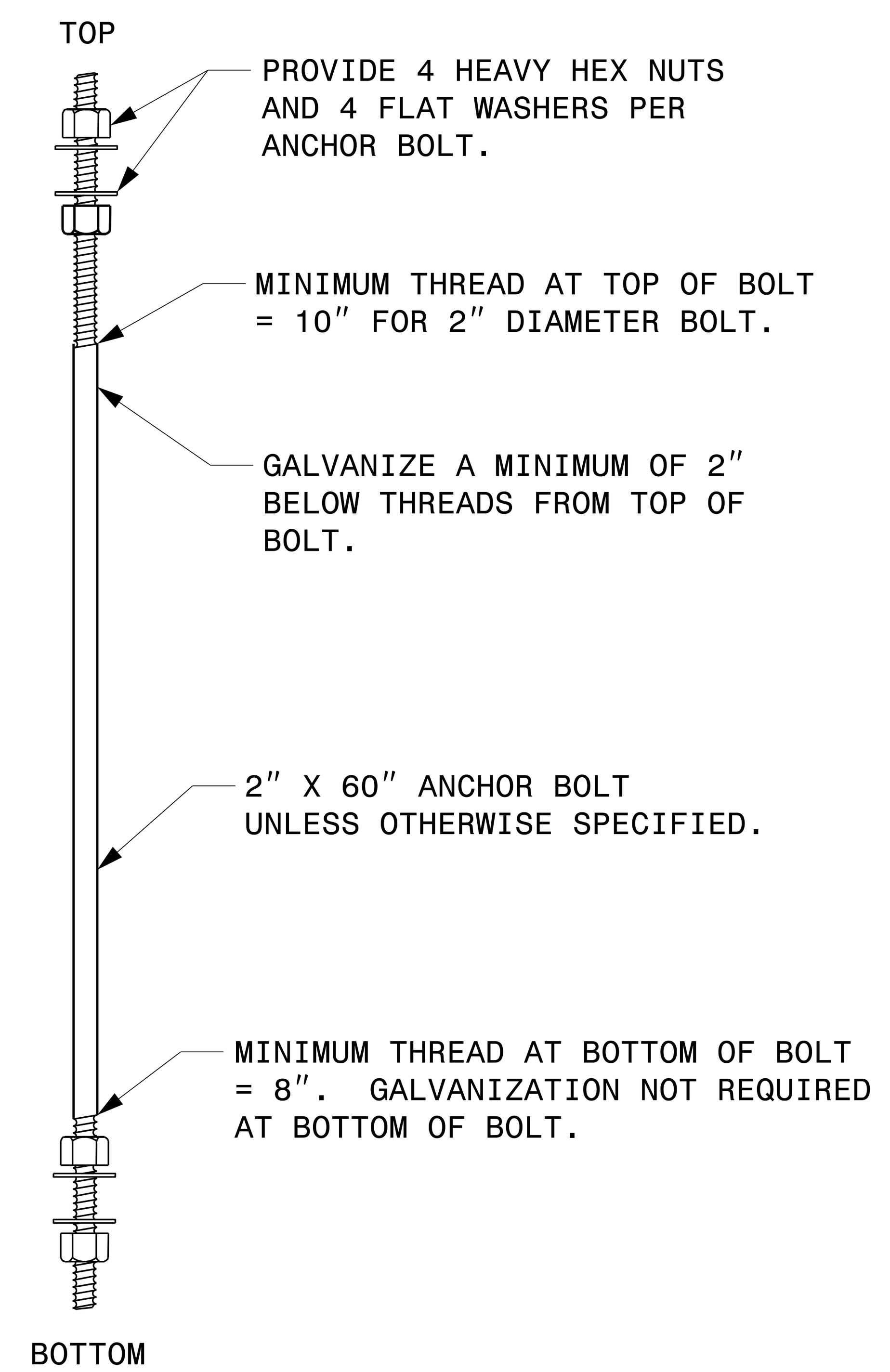
MFG ________ MFG. DATE: MM/YY
SECTION D/T/L/Y ----/----/----/----
NCDOT SIG. INV. NO. ________
NCDOT POLE NO. ________

ARM I.D. TAG
(PROVIDE ON EACH SECTION OF A MULTI-SECTION MAST ARM)

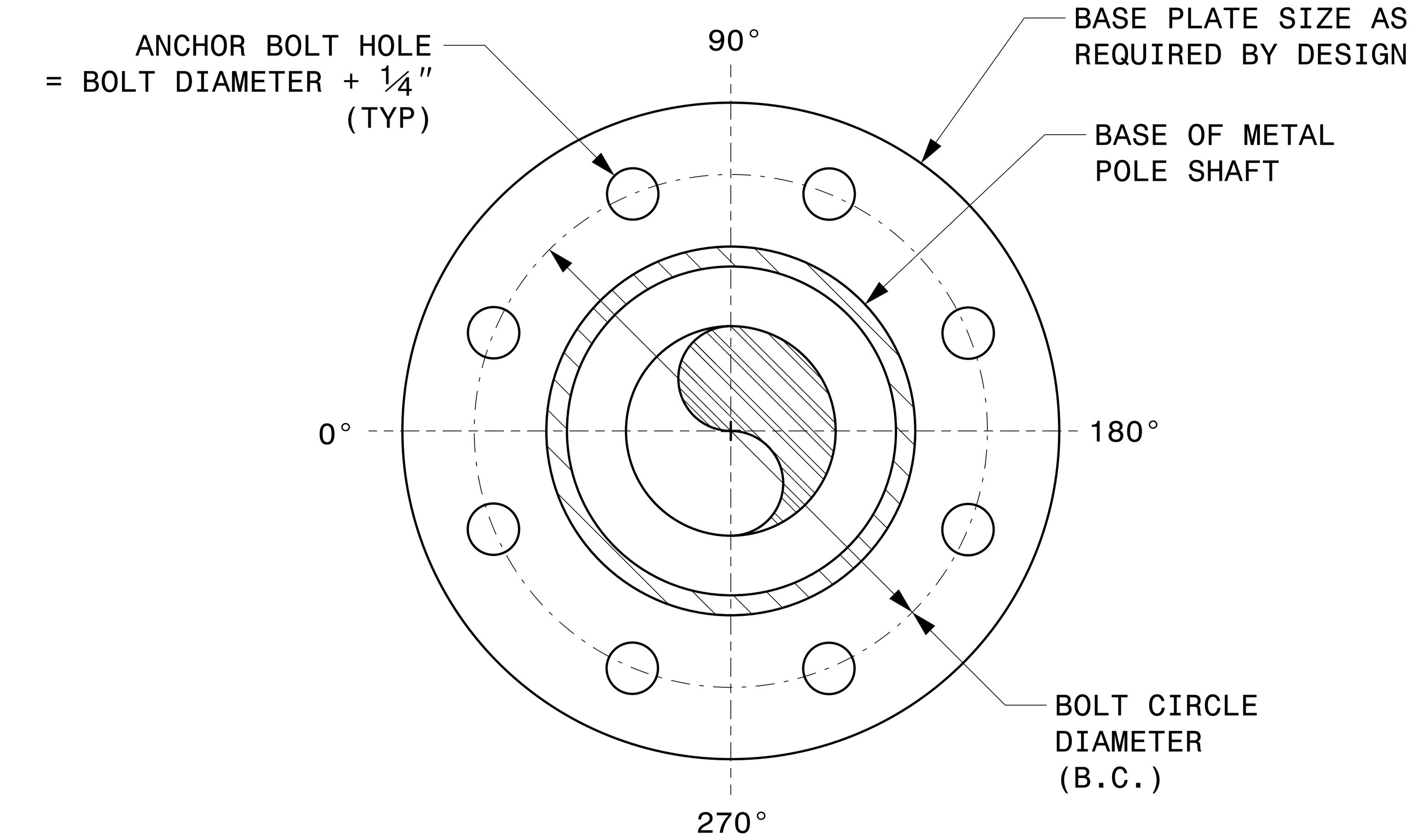
NOTES:

1. D = DIAMETER, T = THICKNESS, L = LENGTH, Y = YIELD STRENGTH
2. A.B. = ANCHOR BOLT
3. B.C. = BOLT CIRCLE OF ANCHOR BOLTS
4. IF STANDARD DESIGN, INCLUDE CASE NUMBER IN ADDITION TO POLE NUMBER ON "NCDOT POLE NO." LINE.
5. SIGNAL INV. NUMBER AND POLE I.D. NUMBER. SEE DRAWING M3 AND M4 FOR MOUNTING POSITIONS OF I.D. TAGS.

IDENTIFICATION TAG DETAILS



ANCHOR BOLT DETAIL



NOTE: BASE PLATE MAY BE CIRCULAR, OCTAGONAL, SQUARE OR RECTANGULAR IN SHAPE.

TYPICAL BASE PLATE DETAIL

Prepared in the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

Typical Fabrication Details
For
All Metal Poles

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

SCALE
0 NA
NONE

REVISIONS | INIT. | DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

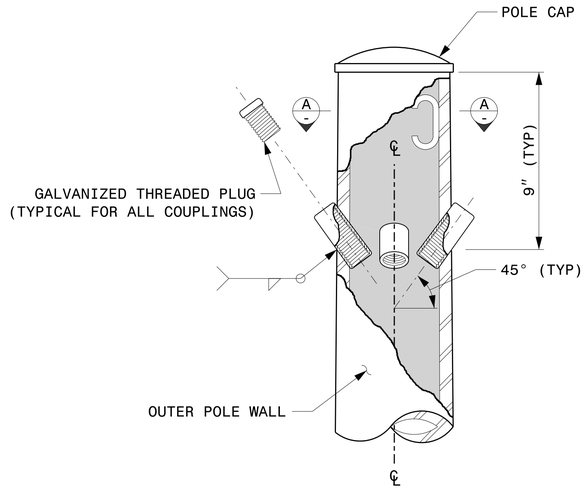
DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3784DA...
09/21/2023
DATE

PROJECT I.D. NO.	SHEET NO.
U-4700CC	Sig.M3

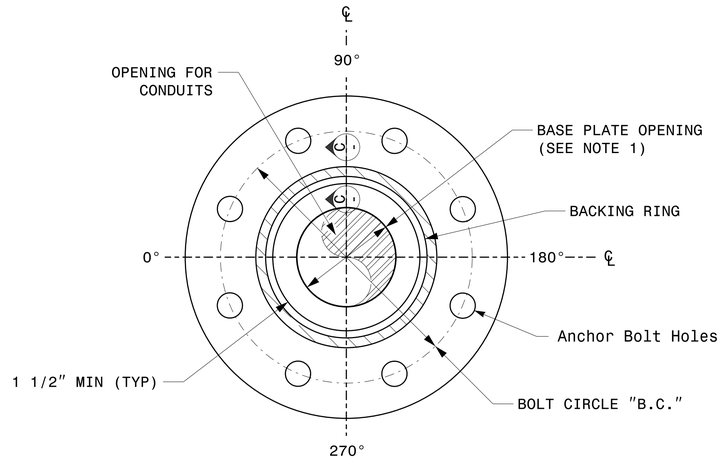
Fabrication Details – Strain Poles

NOTE:

1. OPENING IN POLE BASE PLATE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS 3½" BUT SHALL NOT BE LESS THAN 8½".

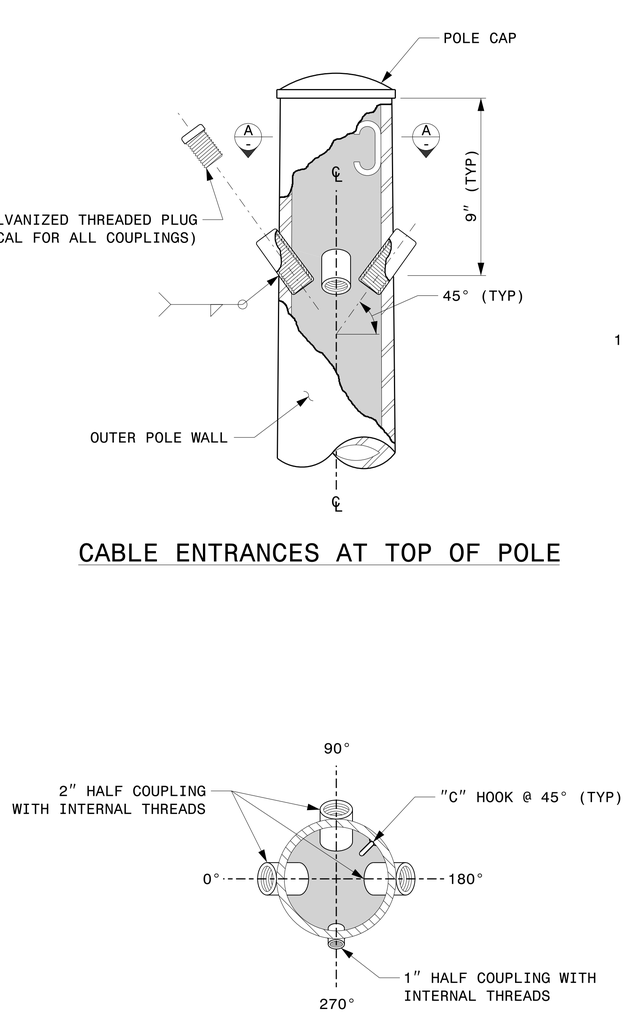


CABLE ENTRANCES AT TOP OF POLE



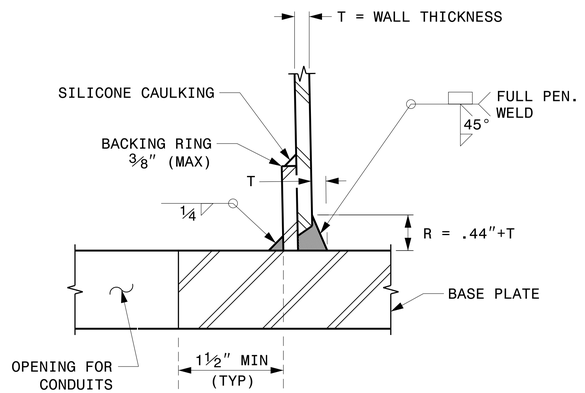
SECTION B-B

POLE BASE PLATE DETAILS
(8 AND 12 BOLT PATTERN)



SECTION A-A

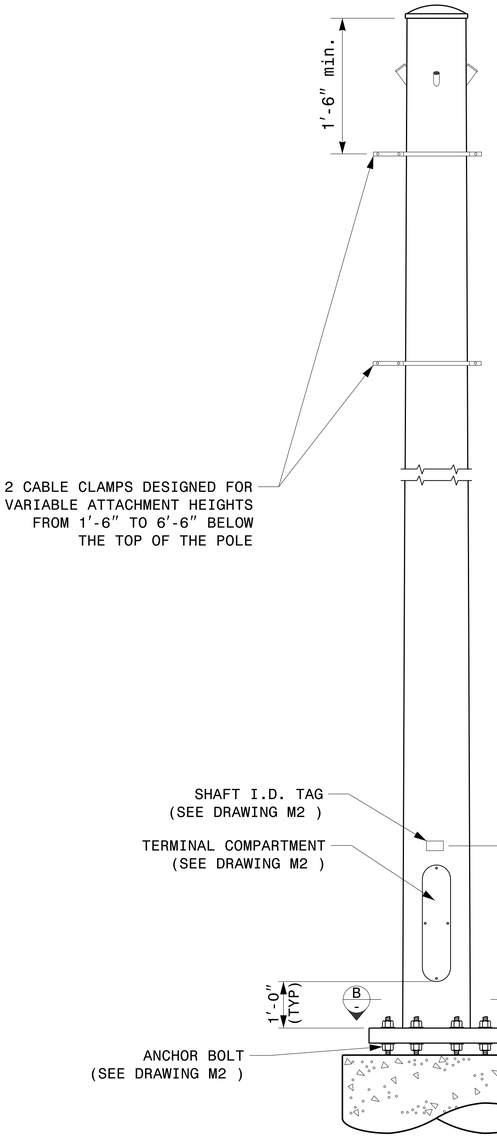
RADIAL ORIENTATION OF FACTORY INSTALLED ACCESSORIES AT TOP OF POLE



SECTION C-C

(POLE ATTACHMENT TO BASE PLATE)

FULL-PENETRATION GROOVE WELD DETAIL



MONOTUBE STRAIN POLE

Prepared In the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

Typical Fabrication Details
For
Strain Poles

PLAN DATE:	SEPTEMBER 2023	DESIGNED BY:	K.C. DURIGON
PREPARED BY:	K.C. DURIGON	REVIEWED BY:	D.C. SARKAR

REVISIONS	INIT.	DATE

SCALE
0 NA
NONE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

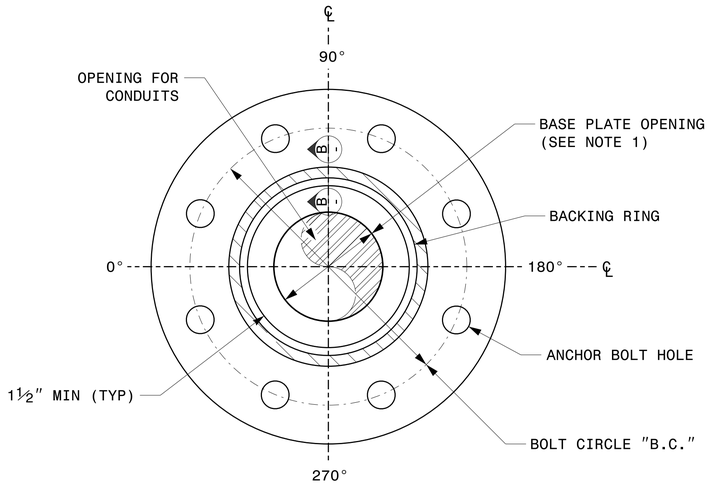
DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3784DA...
09/21/2023
DATE

PROJECT I.D. NO.	SHEET NO.
U-4700CC	Sig.M4

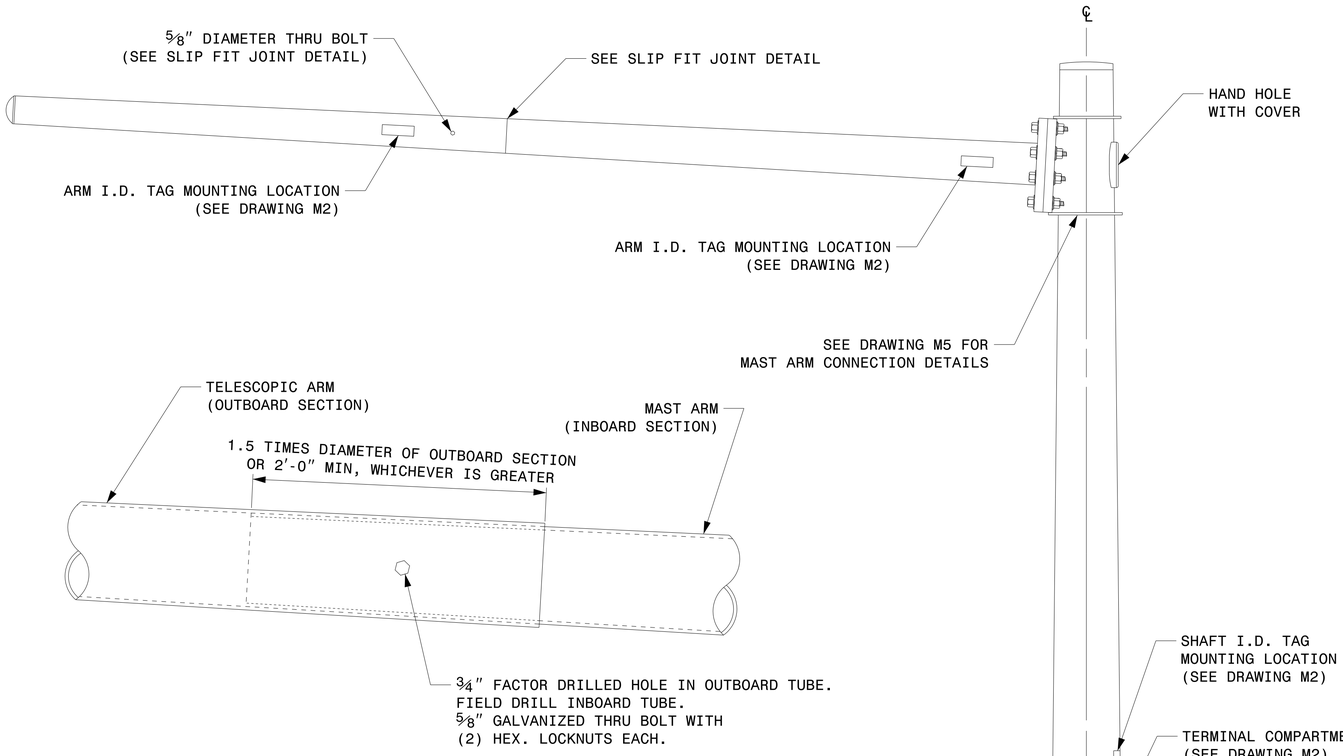
Fabrication Details – Mast Arm Poles

NOTE:

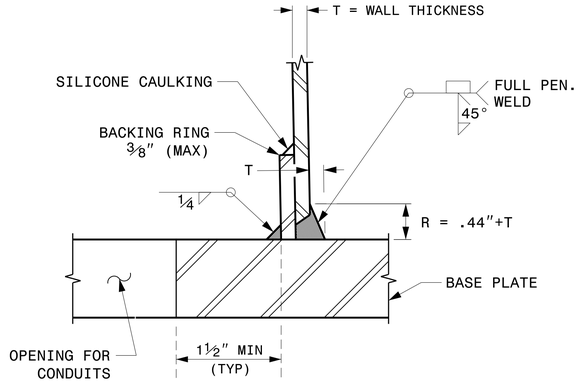
1. OPENING IN POLE BASE PLATE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS 3½" BUT SHALL NOT BE LESS THAN 8½".



SECTION A-A
POLE BASE PLATE DETAILS

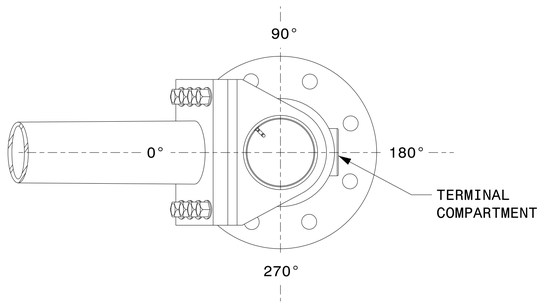


SLIP FIT JOINT DETAIL FOR MAST ARM

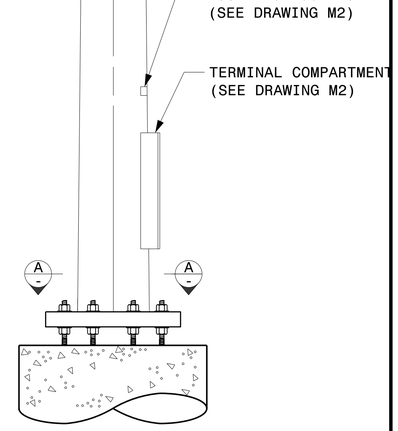


SECTION B-B
(POLE ATTACHMENT TO BASE PLATE)

FULL-PENETRATION GROOVE WELD DETAIL



MAST ARM RADIAL ORIENTATION



MAST ARM POLE

Prepared in the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy.,Garner,NC 27529

SCALE
0 NA
NONE

Typical Fabrication Details For Mast Arm Poles

PLAN DATE: SEPTEMBER 2023 DESIGNED BY: K.C. DURIGON
PREPARED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR

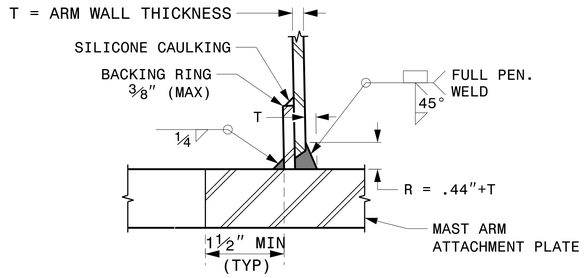
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

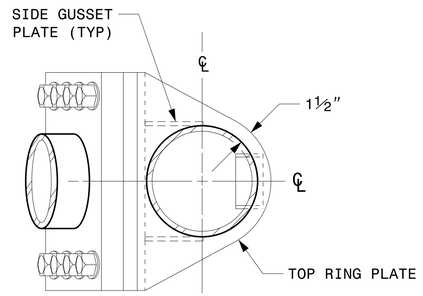
DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3784DA...
09/21/2023
DATE

WELDED RING STIFFENED MAST ARM CONNECTION

PROJECT I.D. NO.	SHEET NO.
U-4700CC	Sig.M5



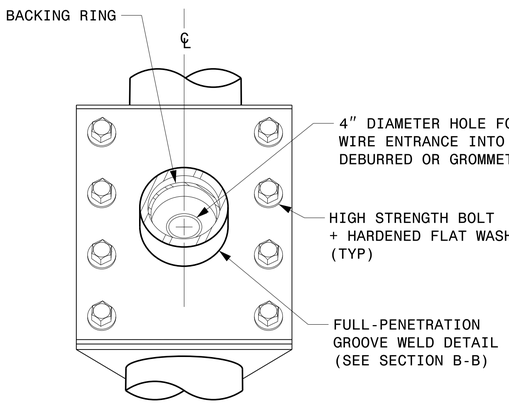
SECTION B-B
FULL-PENETRATION GROOVE WELD DETAIL



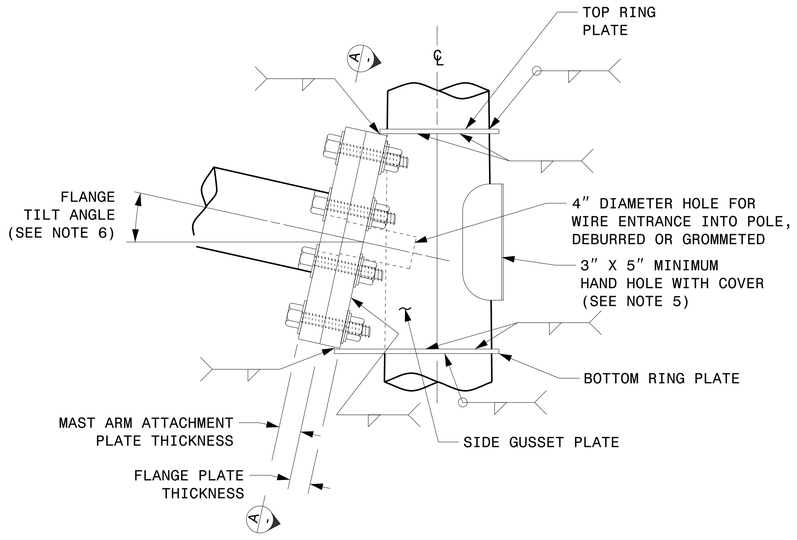
PLAN VIEW

NOTES:

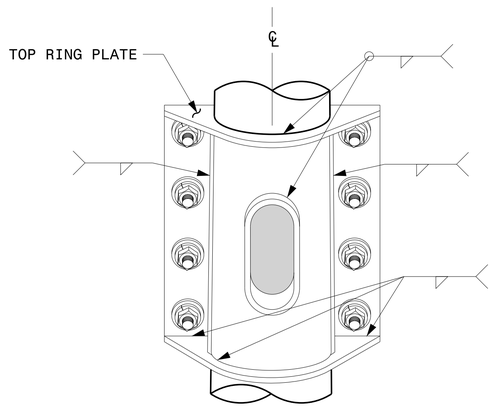
1. PROVIDE A PERMANENT MEANS OF IDENTIFICATION ABOVE THE MAST ARM TO INDICATE PROPER ATTACHMENT ORIENTATION OF THE MAST ARM.
2. DESIGNER WILL DETERMINE THE SIZE OF ALL STRUCTURAL COMPONENTS, PLATES, FASTENERS, AND WELDS SHOWN UNLESS THEY ARE ALREADY SPECIFIED.
3. FABRICATOR IS RESPONSIBLE FOR PROVIDING 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.



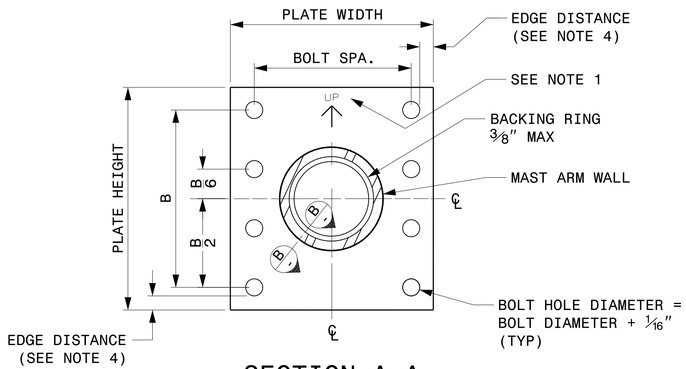
FRONT ELEVATION VIEW



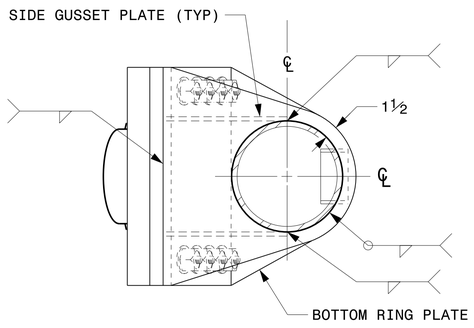
SIDE ELEVATION VIEW



BACK ELEVATION VIEW



SECTION A-A
MAST ARM ATTACHMENT PLATE



BOTTOM VIEW

Prepared in the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

SCALE
0 NA
NONE

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

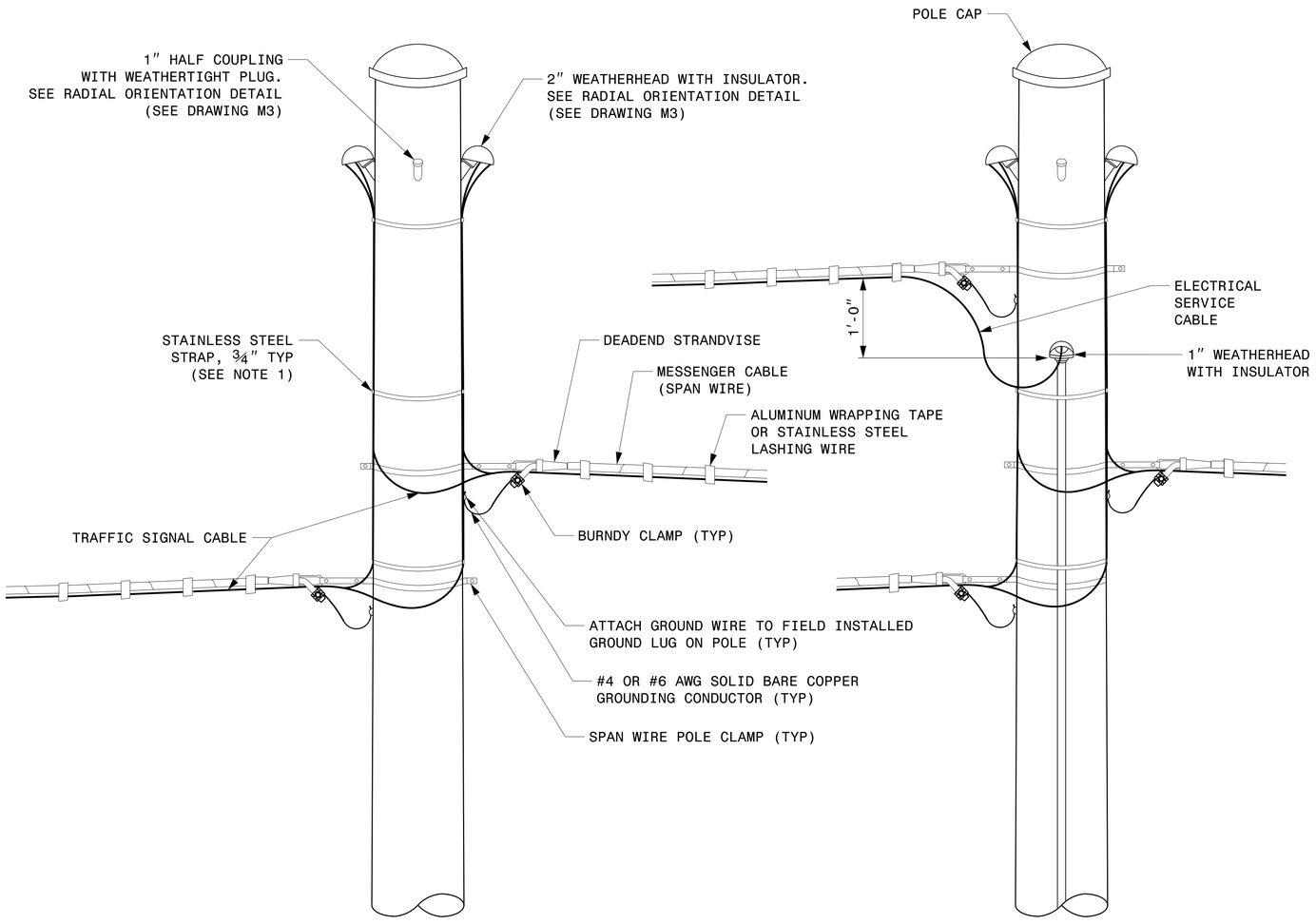
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3784DA...
09/21/2023
DATE

Fabrication Details – Mast Arm Connection

PROJECT I.D. NO.	SHEET NO.
U-4700CC	Sig.M6

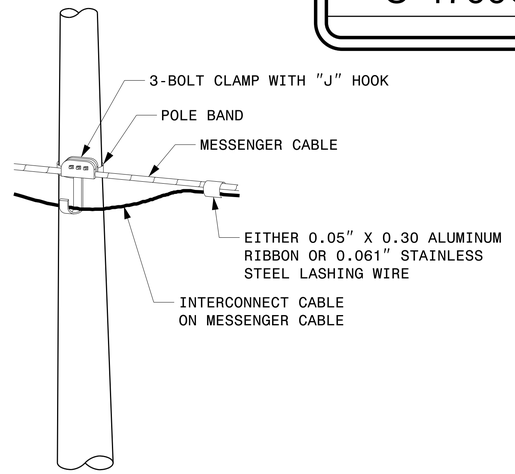
Fabrication Details – Strain Pole Attachments



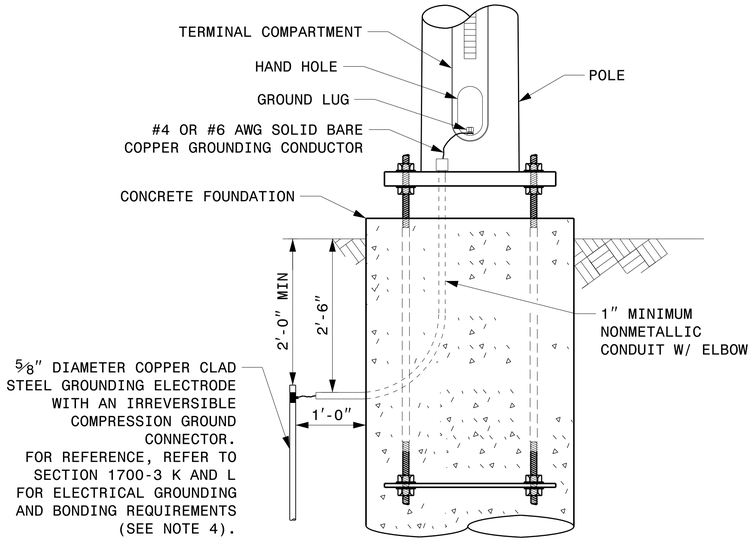
STRAIN POLE ATTACHMENTS

NOTES:

1. STRAP ALL SIGNAL CABLES TO THE SIDE OF THE POLE WITH ¾″ STAINLESS STEEL STRAPS WHEN THE DISTANCE BETWEEN SPAN WIRE ATTACHMENT CLAMP AND WEATHERHEADS EXCEEDS 3′-0″.
2. PROVIDE MINIMUM TWO SPAN WIRE 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 2024.



ATTACHMENT OF CABLE TO INTERMEDIATE METAL POLE



METAL POLE GROUNDING DETAIL FOR STRAIN POLE AND MAST ARM

Prepared In the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SCALE
0 NA
NONE

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

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3784DA...
09/21/2023
DATE

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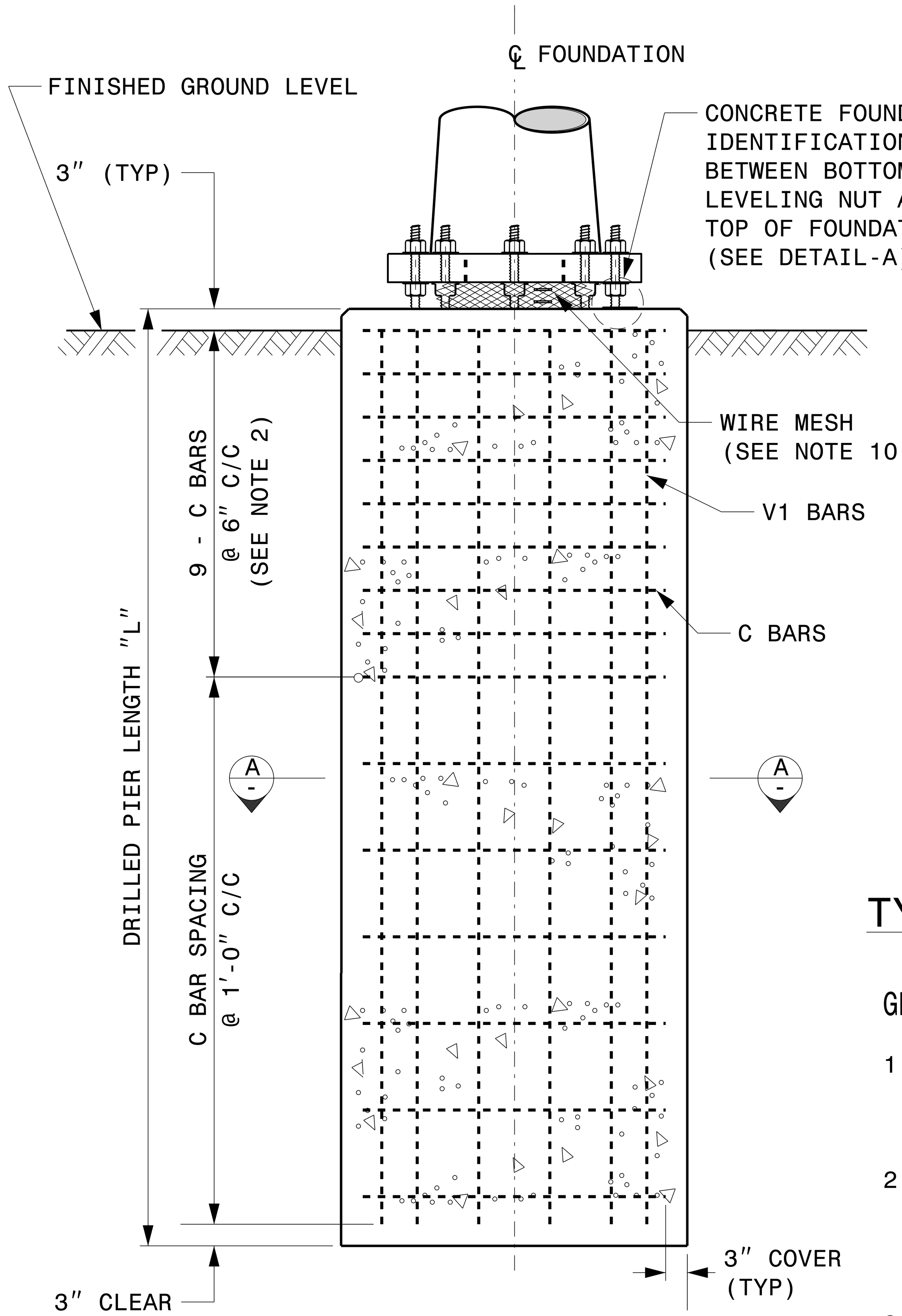
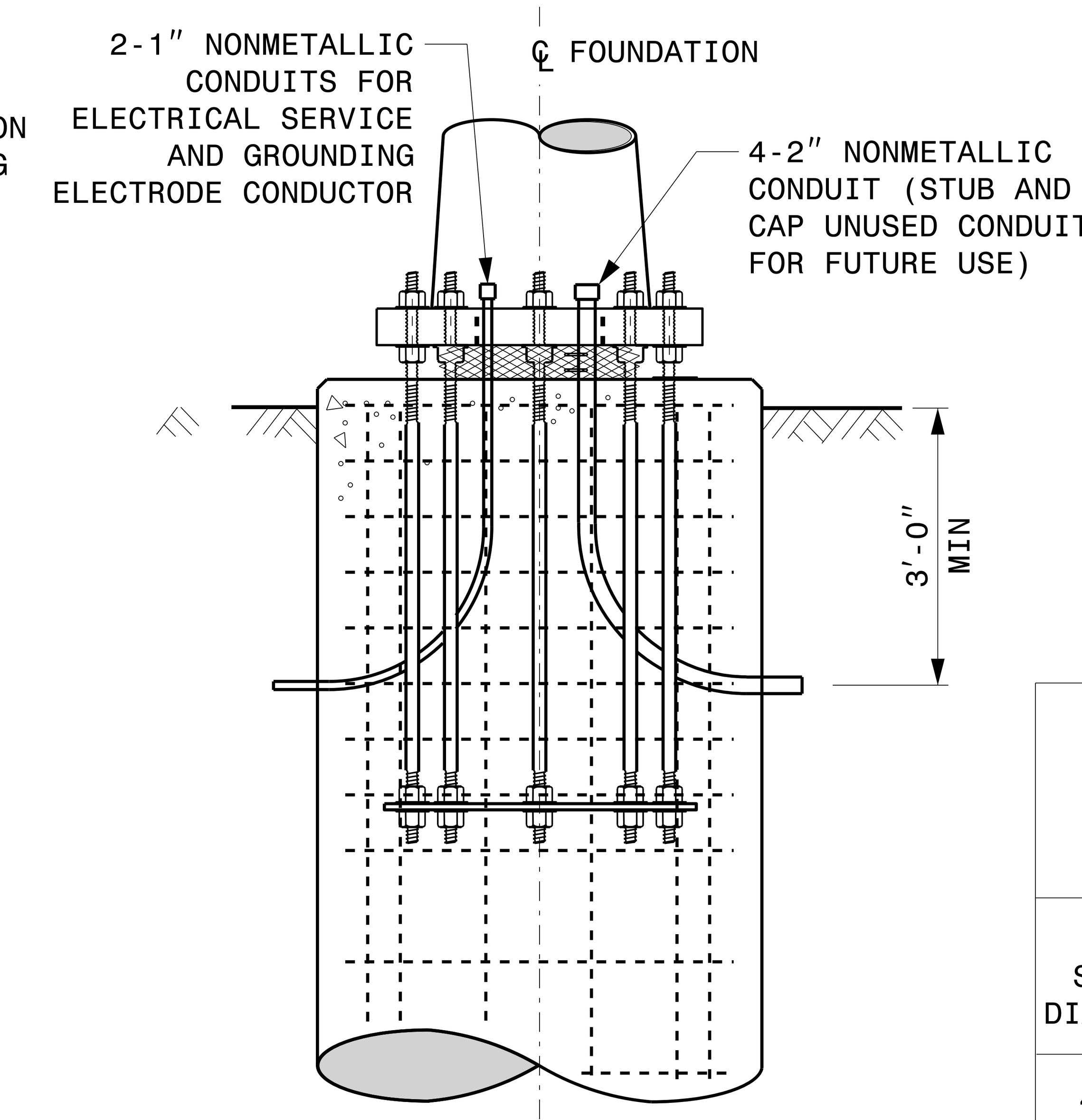
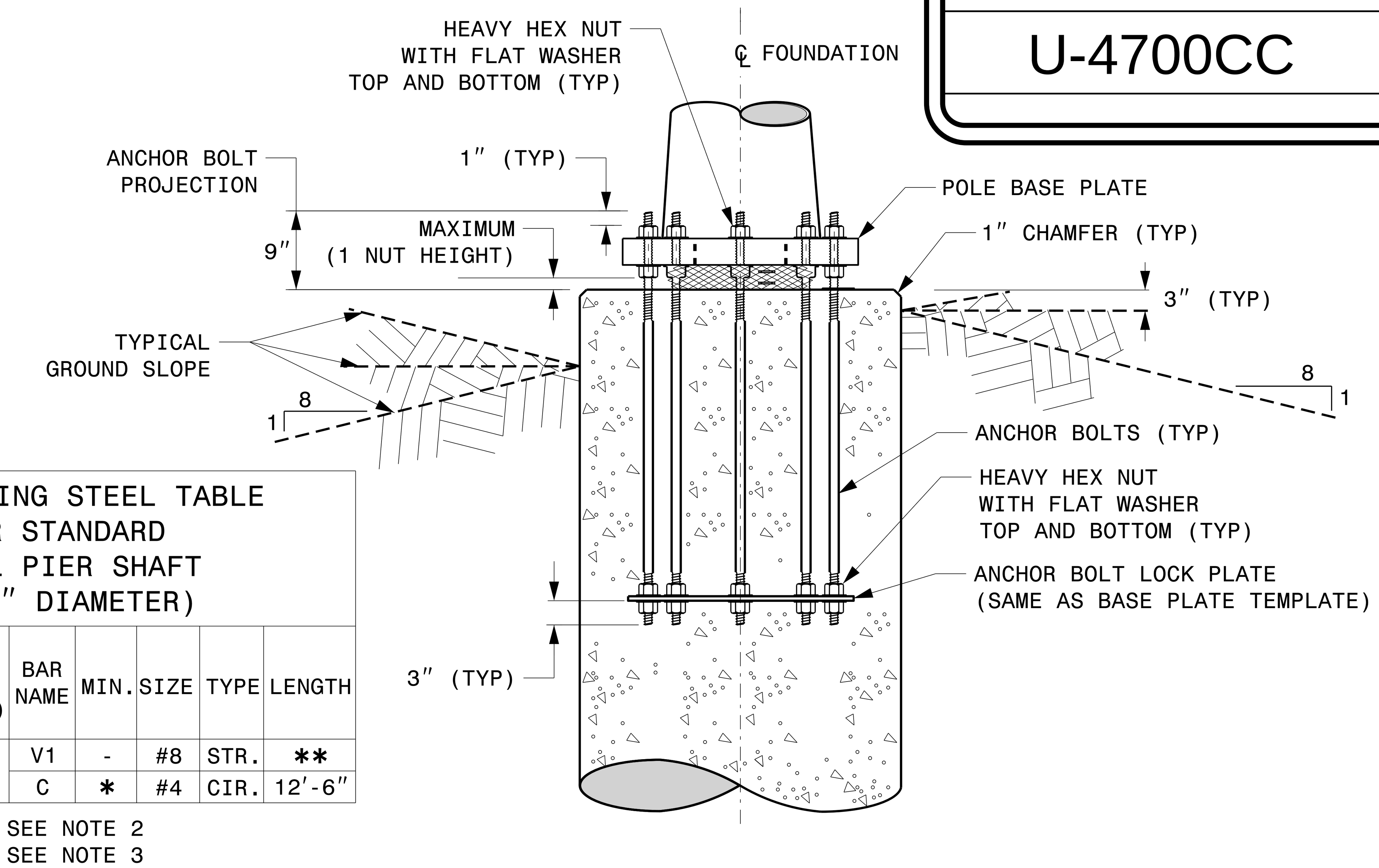
kcdurigon



CONCRETE SHAFT ELEVATION



TYPICAL FOUNDATION CONDUIT DETAILS



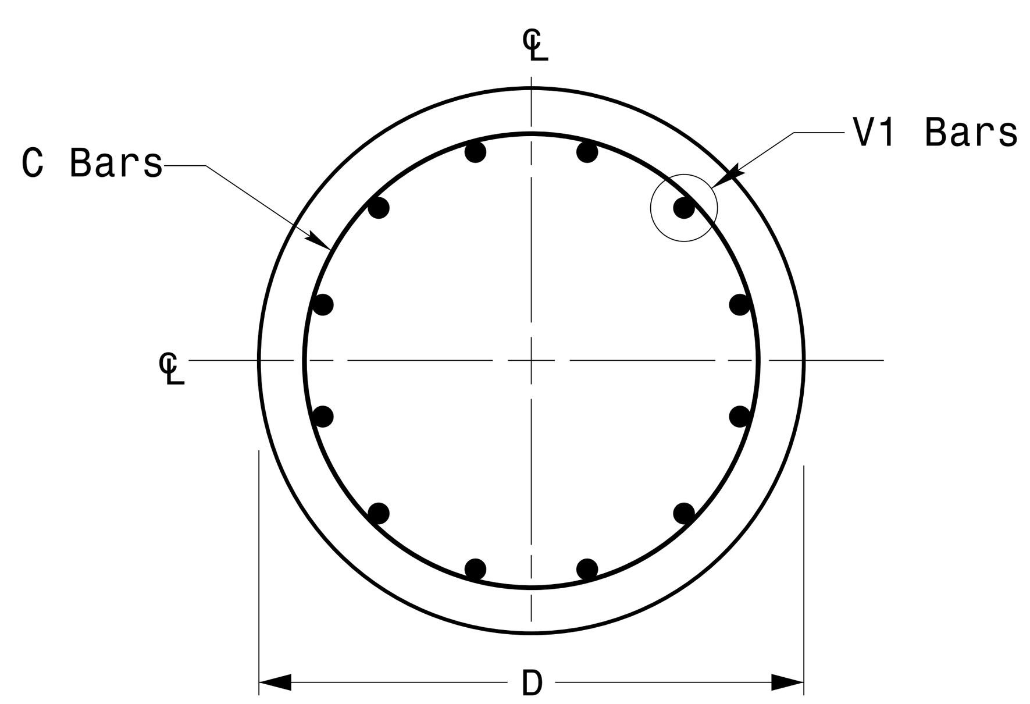
TYPICAL FOUNDATION ANCHOR BOLT DETAILS

(REINFORCING CAGE NOT SHOWN FOR CLARITY)

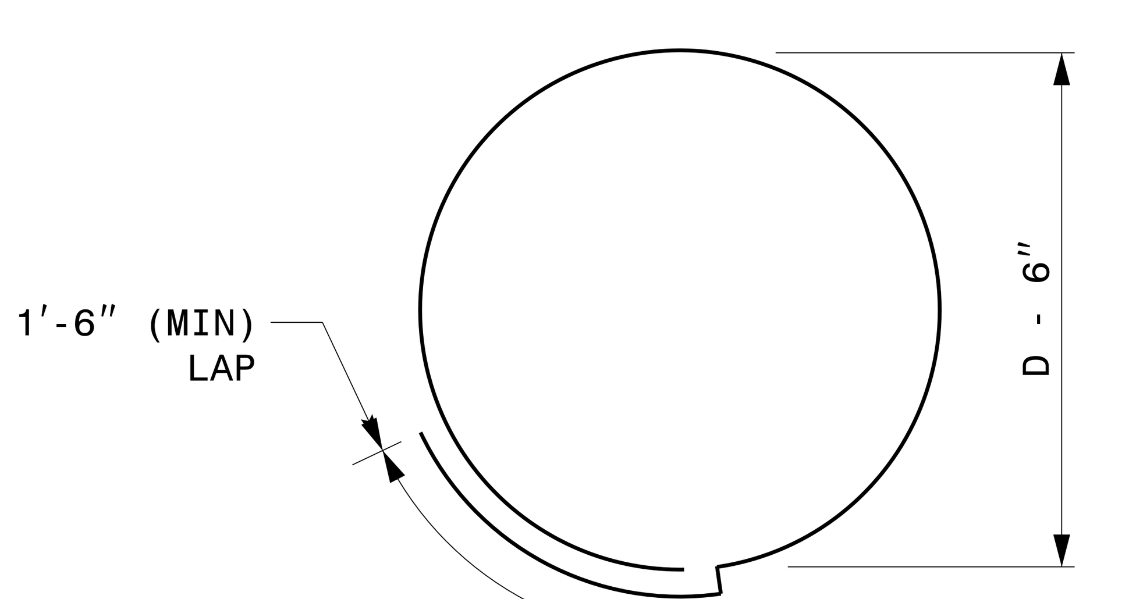
REINFORCING STEEL TABLE FOR STANDARD DRILL PIER SHAFT (4′-0″ DIAMETER)

"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



SECTION A-A



TYPICAL "C" BAR DETAIL

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 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

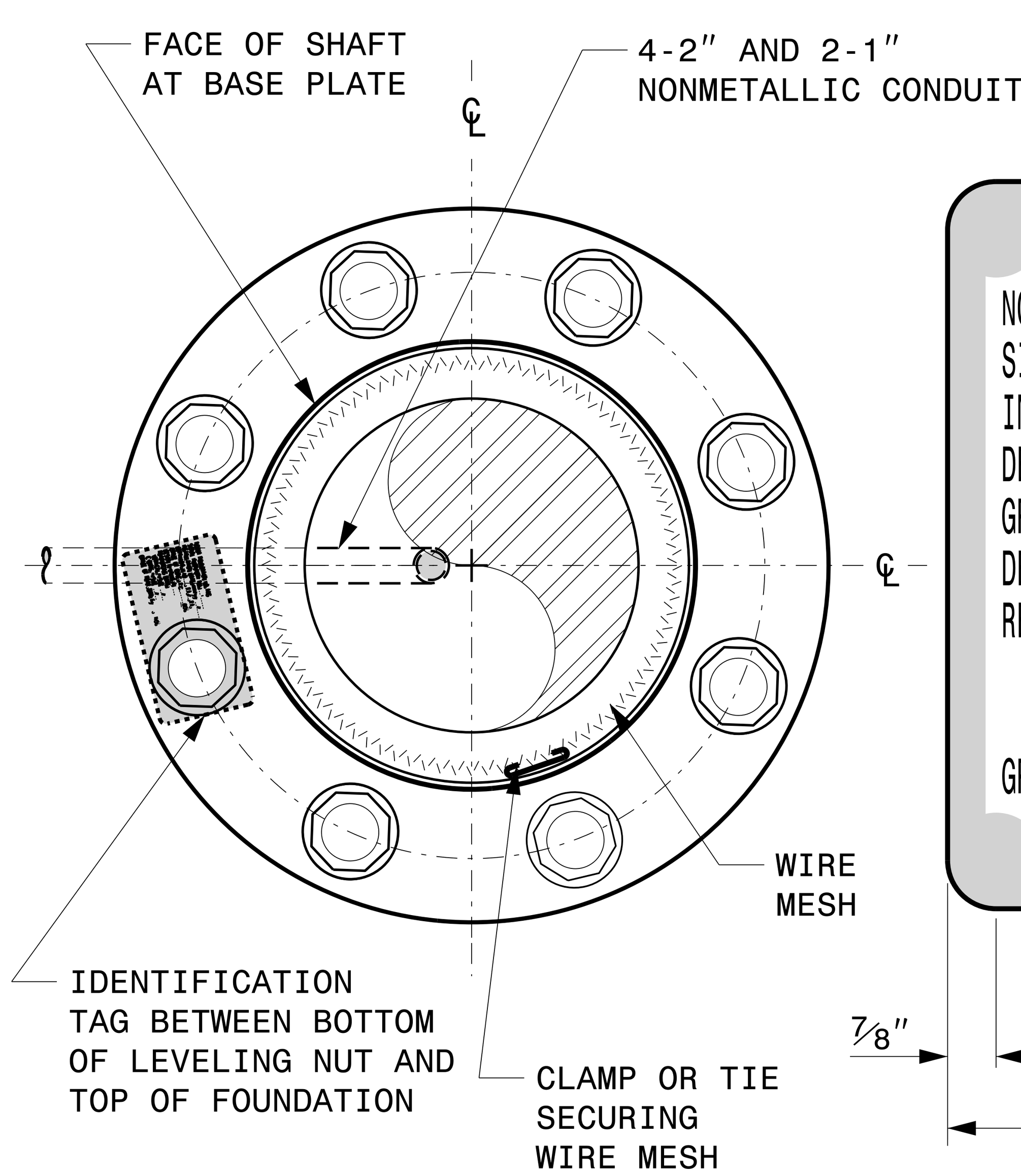
7. USE AIR ENTRAINED AA CONCRETE MIX WITH A COMPRESSION STRENGTH OF f′c=4500 psi (MIN) AFTER 28 DAYS.

8. USE ASTM A615 GRADE 60 DEFORMED BARS FOR ALL REINFORCING STEEL. MAINTAIN AT LEAST 3″ COVER ON ALL REINFORCEMENT.

9. LOCATE IDENTIFICATION TAG ON TOP OF THE FOUNDATION, DIRECTLY ABOVE THE CONDUIT'S ENTRY POINT.

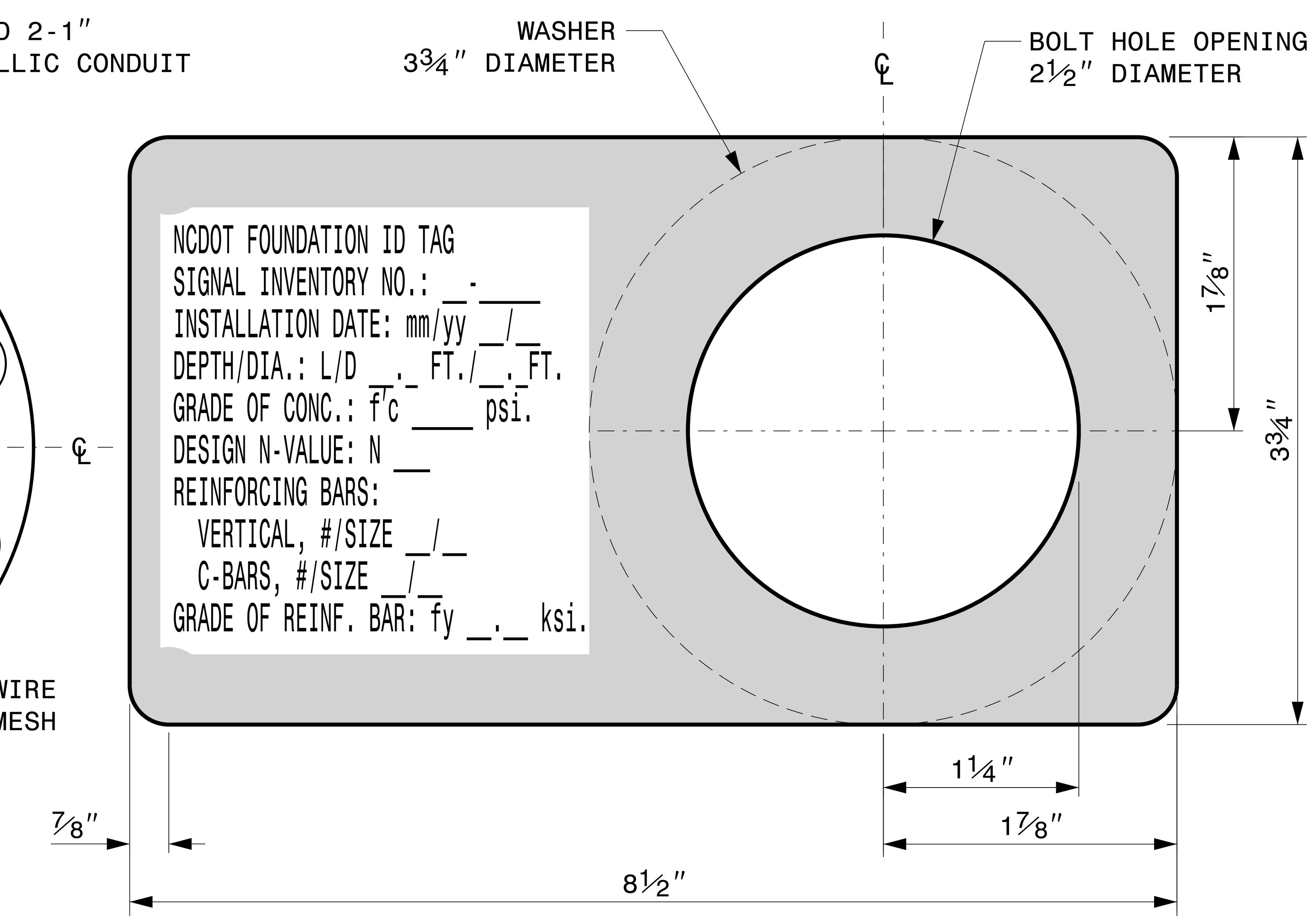
10. PROVIDE TWO LAYERS OF 4 MESH GALVANIZED WELDED 23 GAUGE (0.025) 6″ WIDE AROUND PIPES UNDER THE BASE PLATE AND SECURE IT WITH TIES IF NECESSARY.

11. PREFERRED LOCATION FOR THE I.D. TAG IS AS SHOWN IN DETAIL-A: DIRECTLY ABOVE THE CONDUIT ENTERING THE FOUNDATION.



D = DIAMETER
L = LENGTH / DEPTH
mm = MONTH
yy = YEAR

DETAIL-A



CONCRETE FOUNDATION IDENTIFICATION TAG DETAILS

Construction Details – Foundations

Prepared in the Offices of: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SCALE 0 NA
NONE

Construction Details For Foundations

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

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

DocuSigned by: Kevin Durigon
SIGNATURE 4B23DC79B3784DA
09/21/2023 DATE

SOIL CONDITION

STANDARD STRAIN POLES						STANDARD FOUNDATIONS 48" Diameter Drilled Pier Length (L) – Feet							Reinforcement			
			Reactions at the Pole Base			Clay				Sand			Longitudinal		Stirrups	
Case No.	Pole Height (Ft.)	Base Plate BC (In.)	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.)
S26L1	26	22	2	9	210	19.5	12.5	9	6.5	15.5	14.5	13	8	12	4	12
S26L2	26	23	2	10	240	19.5	12	9	6.5	15.5	14.5	13	8	12	4	12
S26L3	26	25	2	11	260	20.5	12	10	8	16	15	13	8	12	4	12
S30L1	30	22	2	9	230	19	11	9	7	15.5	14	12.5	8	12	4	12
S30L2	30	23	2	10	270	20	12	10	8	16	14.5	13	8	12	4	12
S30L3	30	25	2	11	290	21	12	10	8	17	15	13.5	8	12	4	12
S30H1	30	25	3	13	355	23	13	11	9	18	16.5	14.5	8	12	4	12
S30H2	30	29	3	15	405	25	14	11	9	19	17.5	15.5	8	14	4	12
S30H3	30	29	3	16	430	26	15	12	9	20	18	16	8	14	4	6
S35L1	35	22	3	8	260	19.5	12	10	8	15.5	14.5	13	8	12	4	12
S35L2	35	23	3	10	300	21	12	10	8	16.5	15	13.5	8	12	4	12
S35L3	35	25	3	10	320	21.5	13	10	8	17	15.5	14	8	12	4	12
S35H1	35	25	3	12	390	23.5	14	11	9	18	17	15	8	14	4	12
S35H2	35	29	4	14	460	26	15	12	9	20	18	16	8	14	4	6
S35H3	35	29	4	16	495	28.5	15	13.5	10	21.5	19	17	8	14	4	6

48" DIAMETER FOUNDATION CONCRETE VOLUME (CUBIC YARDS) = (0.465) x DRILLED PIER LENGTH

GENERAL NOTES:

1. VALUES SHOWN IN THE "REACTIONS AT THE POLE BASE" COLUMN REPRESENT THE MINIMUM ACCEPTABLE CAPACITY ALLOWED FOR DESIGN USING A COMBINED FORCE RATIO (CFR) OF 1.00.
2. USE CHAIRS AND SPACERS TO MAINTAIN PROPER CLEARANCE.
3. FOR FOUNDATION, ALWAYS USE AIR-ENTRAINED 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 M1 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 MANUAL FOR DRILLED SHAFTS.

Standard Strain Pole Foundation – All Soil Conditions

Prepared in the Offices of: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529
SCALE 0 NA
NONE

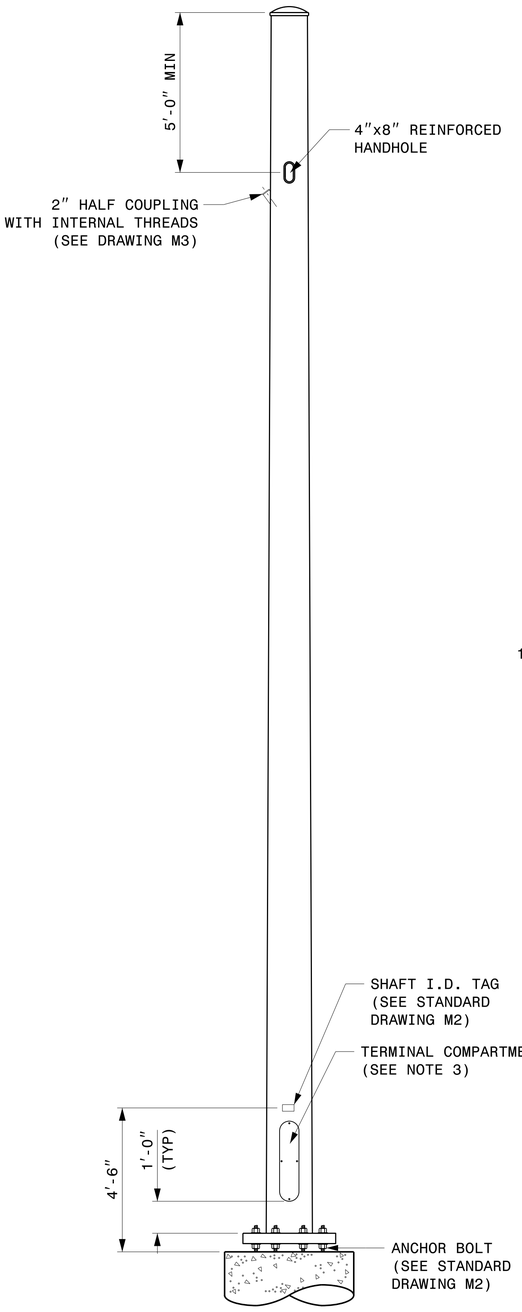
Standard Strain Pole Foundation for All Soil Conditions

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

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036626 KEVIN C. DURIGON
DocuSigned by: Kevin Durigon
4B23DC79B3784DA
SIGNATURE
09/21/2023
DATE

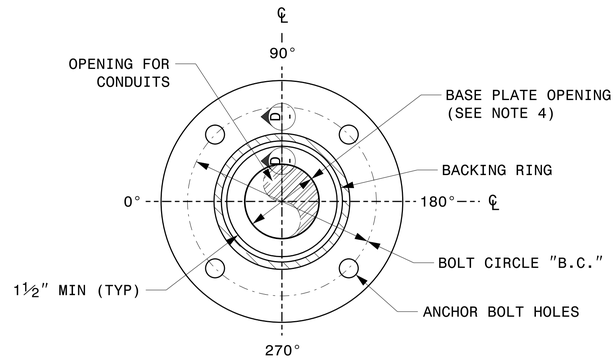
PROJECT I.D. NO.	SHEET NO.
U-4700CC	Sig.M9

Fabrication Details – CCTV Camera Poles

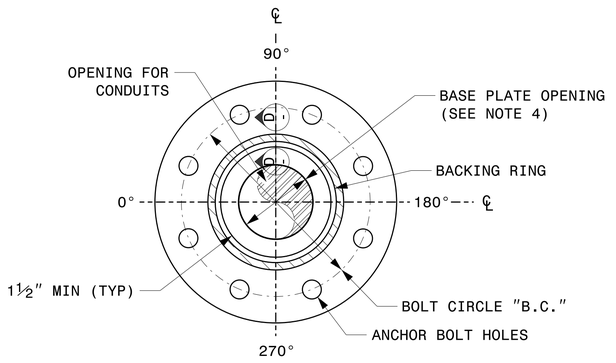


CCTV CAMERA POLE

(NOT TO SCALE)

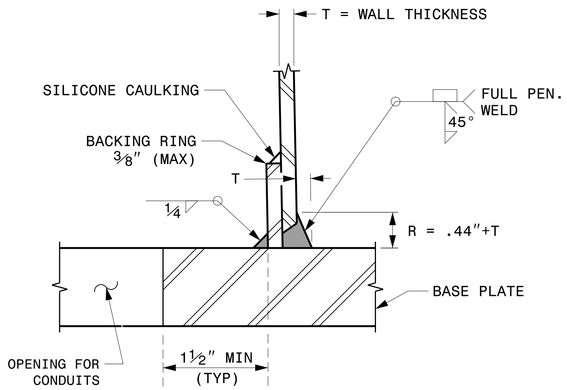


4 BOLT PATTERN
FOR POLES UP TO 40'



8 BOLT PATTERN
FOR POLES TALLER THAN 40'

BASE PLATE DETAILS



SECTION D-D

(POLE ATTACHMENT TO BASE PLATE)

FULL-PENETRATION GROOVE WELD DETAIL

NOTES:

1. THIS DRAWING PROVIDES BASIC DETAILS FOR CCTV POLES. PROJECT REQUIREMENTS MAY REQUIRE SPECIAL FACTORY PREPS THAT ARE NOT SHOWN ON THESE DETAILS.
2. DETAILS FOR INTERNAL CAMERA LOWERING SYSTEMS ARE NOT SHOWN.
3. POLE MOUNTED CABINETS MAY REQUIRE MODIFICATIONS TO THE LOWER HANDHOLE OPENING TO MOUNT CABINETS. 4" X 8" REINFORCED HANDHOLES ARE ACCEPTABLE OPTIONS, AND MAY BE PREFERRED.
4. OPENING IN POLE BASE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS 3½" BUT SHALL NOT BE LESS THAN 8½".
5. USE COMPACT SECTION CRITERIA D/T RATIO PER AASHTO LTS-LRFD 1ST EDITION SECTION 5.7.2.

Prepared in the Offices of:
Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

SCALE
0 NA
NONE

Typical Fabrication Details
For
CCTV Poles

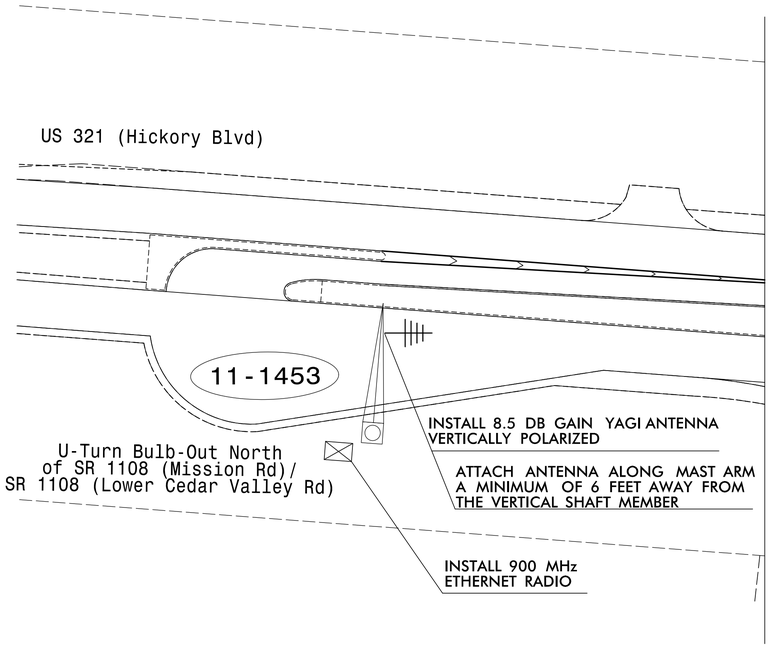
PLAN DATE:	SEPTEMBER 2023	DESIGNED BY:	K.C. DURIGON
PREPARED BY:	K.C. DURIGON	REVIEWED BY:	C.F. ANDREWS

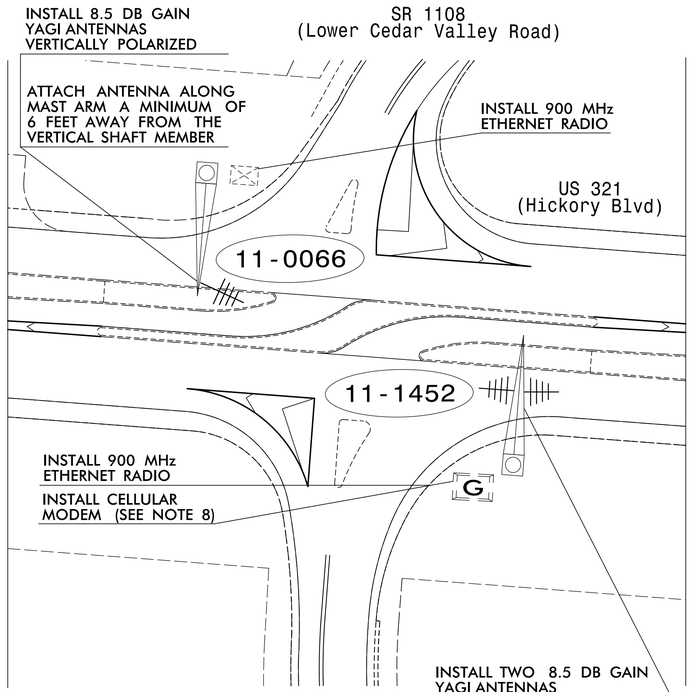
REVISIONS	INIT.	DATE

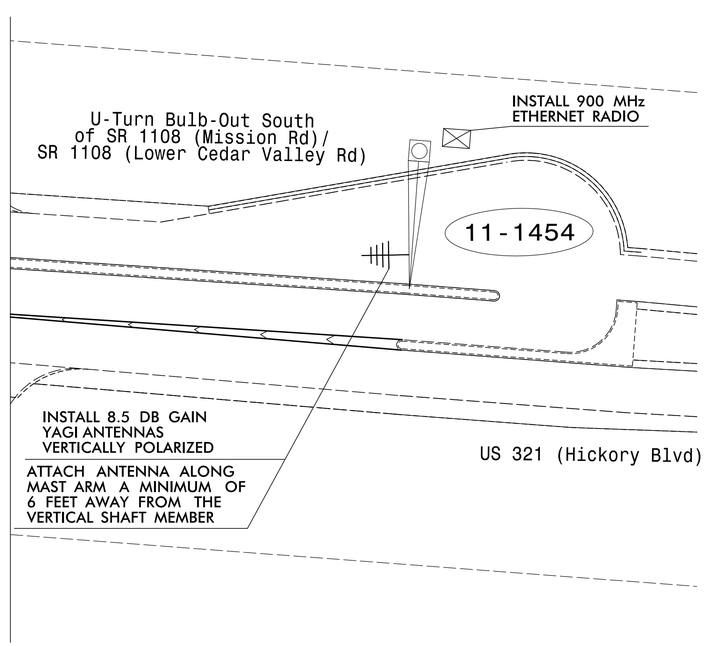
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3784DA...
09/21/2023
DATE

PROJECT REFERENCE NO.	SHEET NO.
U-4700 CC	SCP-1







NOTES FOR WIRELESS COMMUNICATIONS:

1. FIVE (5) DAYS PRIOR TO BEGINNING WORK ON THE SIGNAL SYSTEM, CONTACT THE DIVISION 11 TRAFFIC ENGINEER AT (336) 903–9122. NOTIFY THE DIVISION TRAFFIC ENGINEER AFTER ALL WORK IS PERFORMED TO ENSURE THAT ALL WIRELESS CIRCUITS ARE FUNCTIONING PROPERLY. WORK IS NOT COMPLETE UNTIL THE SIGNAL SYSTEM IS BACK UP AND OPERATIONAL.
2. INSTALL COAXIAL CABLE:
   A. ON WOOD POLES, REQUIRING A NEW RIGID GALVANIZED STEEL RISER, INSTALL A 2" RISER WITH WEATHERHEAD AND ROUTE THE COAXIAL CABLE TO THE ANTENNA.
   B. ON METAL POLES WITH MAST ARMS, RUN COAXIAL CABLE UP THROUGH THE POLE AND OUT THE MAST ARM; FIELD DRILL A 1⁄2"HOLE UP THROUGH THE BOTTOM OF MAST ARM FOR INSTALLATION OF THE COAXIAL CABLE TO THE ANTENNA.
   C. ON METAL STRAIN POLES, RUN COAXIAL CABLE UP THROUGH THE POLE AND OUT THE WEATHERHEAD AND ROUTE THE COAXIAL CABLE TO THE ANTENNA.
   D. BETWEEN THE POINT OF EXITING THE RISER, METAL POLE, OR MAST ARM AND THE ANTENNA, SECURE THE COAXIAL CABLE TO THE STRUCTURE USING 3⁄4" STAINLESS STEEL STRAPS EVERY 12".
3. IF AN EXISTING 2" SPARE RIGID GALVANIZED STEEL RISER IS AVAILABLE, INSTALL THE COAXIAL CABLE IN THE SPARE RISER WITH 2" WEATHERHEAD.
4. INSTALL WIRELESS ANTENNA ON POLE WITH RF WARNING SIGN. (NOTE: RF WARNING SIGN NOT REQUIRED WHEN ANTENNA IS INSTALLED ON AN NCDOT–OWNED POLE.)
5. INSTALL WIRELESS RADIO WITH EXTERIOR DISCONNECT SWITCH LOCATED ON CABINET. (NOTE: RF ANTENNA DISCONNECT SWITCH AND DECAL ARE NOT REQUIRED WHEN THE ANTENNA IS INSTALLED ON AN NCDOT–OWNED POLE).
6. MAINTAIN PROPER CLEARANCE FROM ALL UTILITIES PER THE NATIONAL ELECTRICAL SAFETY CODE.
7. REFERENCE "WIRELESS RADIO ANTENNA TYPICAL DETAILS" IN THE 2018 NCDOT ROADWAY STANDARD DRAWINGS.
8. CELL MODEMS TO BE SUPPLIED BY THE DEPARTMENT. CONTACT THE DIVISION 11 TRAFFIC ENGINEER AT (336) 903–9122 AND ALLOW EIGHT (8) WEEKS LEAD TIME BEFORE ANTICIPATED DEPLOYMENT.

LEGEND

- YAGI ANTENNA (DOUBLE) FOR REPEATER OPERATION
- YAGI ANTENNA (SINGLE)
- OMNI ANTENNA
- EXISTING CONTROLLER AND CABINET
- GATEWAY RADIO LOCATION
- XX-XXXX — SIGNAL INVENTORY NUMBER
- NEW METAL POLE W/MAST ARM
- EXISTING METAL POLE W/MAST ARM
- EXISTING WOOD POLE
- NEW METAL POLE
- SP — SIGNAL POLE
- EXISTING METAL POLE
- NEW OVERSIZED JUNCTION BOX
- EXISTING OVERSIZED JUNCTION BOX
- EXISTING CONDUIT
- NEW CONDUIT
- EXISTING COMMUNICATIONS CABLE

stv
STV Engineers, Inc.
900 West Trade St., Suite 715
Charlotte, NC 28202
(704) 372-1885
NC License Number F-0991

FINAL COMMUNICATIONS PLAN

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared for the Offices of:
North Carolina Department of Transportation Mobility and Safety Division Traffic Engineering Branch Signal Section

750 N.Greenfield Pkwy.Garner,NC 27529

Signal System D11-16 Hudson
Wireless Communication Plans

Division 11 Caldwell County Hudson

PLAN DATE:	Sept 2023	REVIEWED BY:	D.J. Darity
PREPARED BY:	R.L. Aristondo	REVIEWED BY:	T.M. Moody

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 19713 ENGINEER DONALD J. DARITY

DocuSigned by: Donald J. Darity 10/18/2023
SIGNATURE DATE

CADD FILE NAME: U-4700CC SCP