Project No.	Sheet No.
U–5783	Sig. 1.0

Project: U–5783

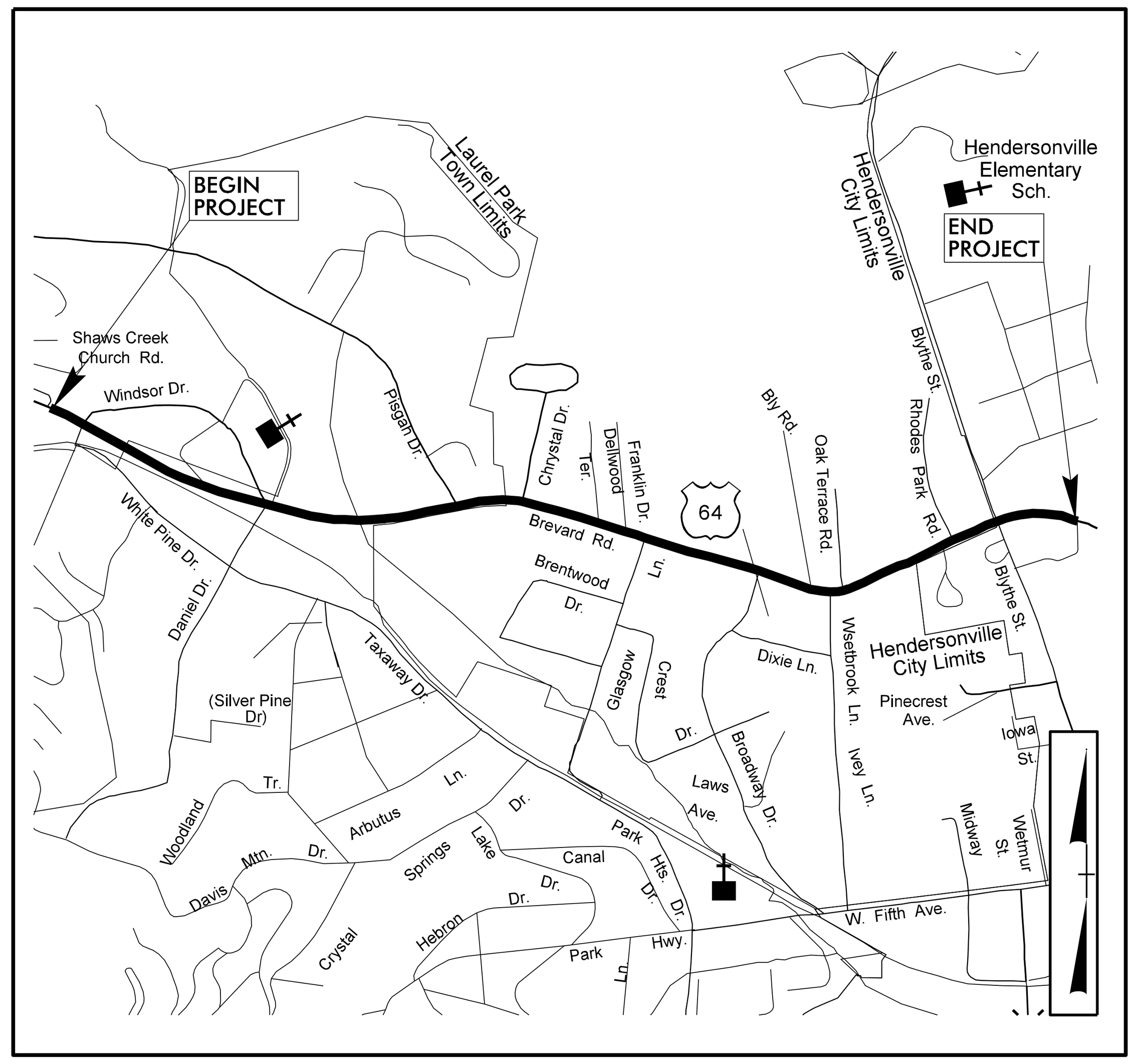
STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

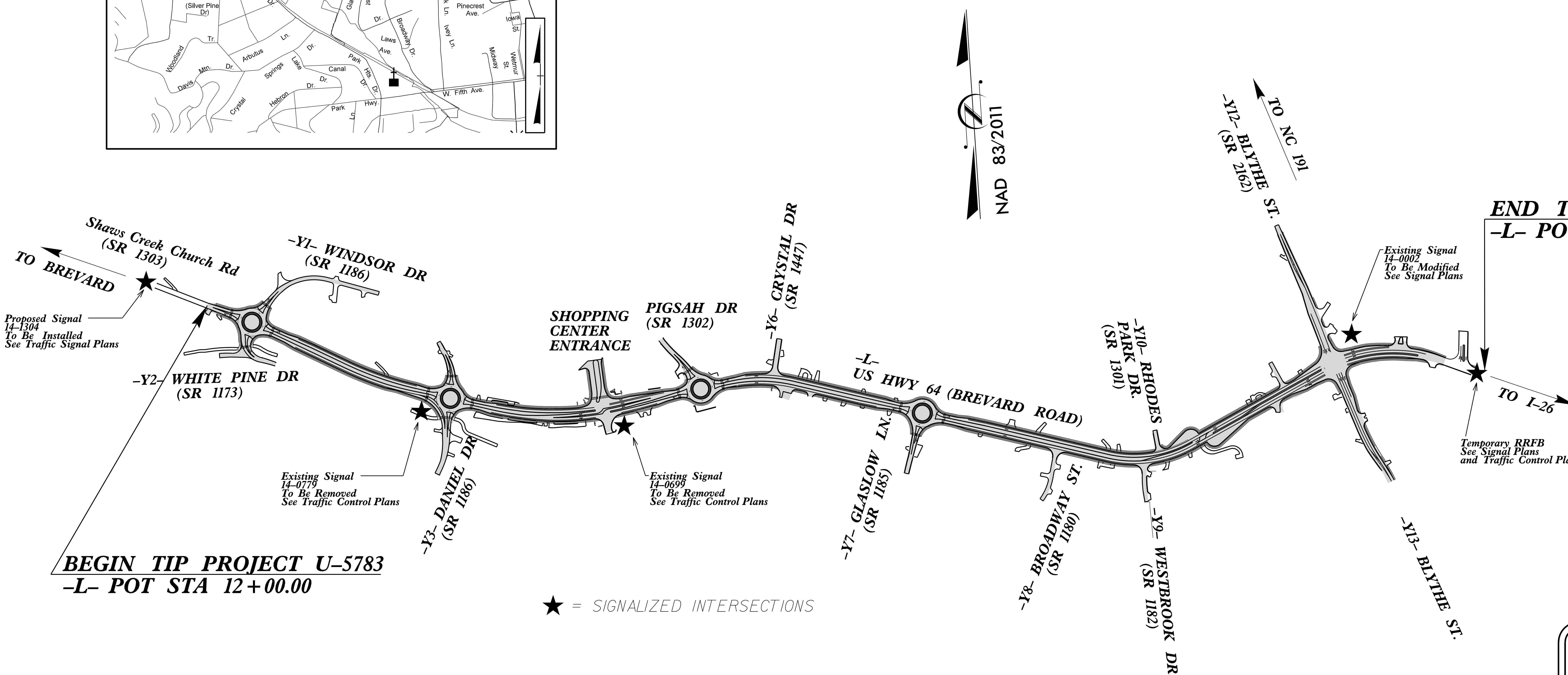
Henderson County

LOCATION: US 64 (BREVARD ROAD) FROM SR 1173 (WHITE PINE DRIVE) TO SR 2162 (BLYTHE STREET)

TYPE OF WORK: TRAFFIC SIGNALS

Vicinity Map





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(828) 254-2201
FAX (828) 254-4562
NC LIC. NO. C-1154

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

Index of Plans

TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

Contacts:

R. N. Zinser, PE – Western Region Signals Engineer
D. T. Joyce, PE – Signal Equipment Design Engineer

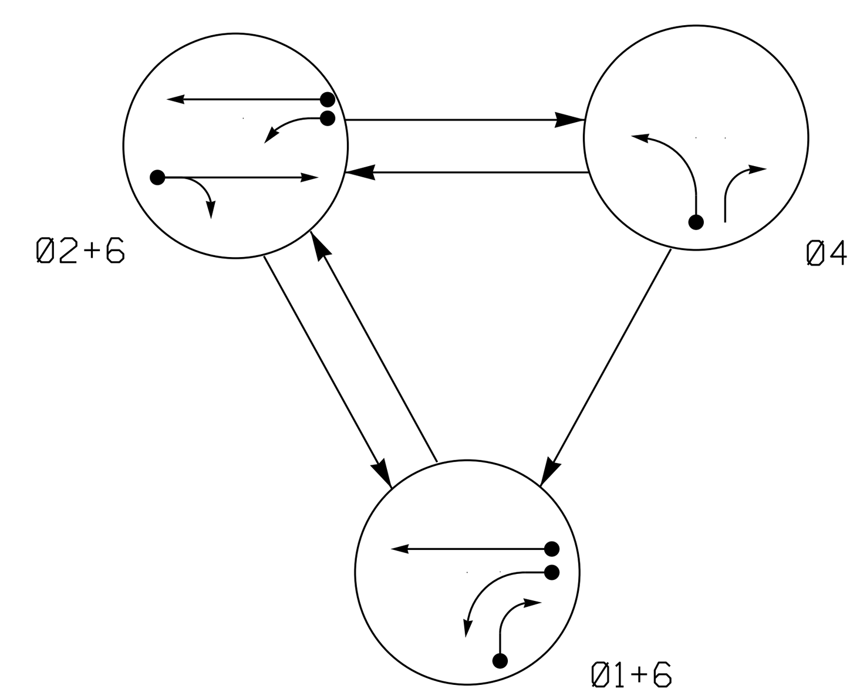
Prepared for the Office of:
DIVISION OF HIGHWAYS
TRANSPORTATION MOBILITY & SAFETY DIVISION

TSMO UNIT

750 N. Greenfield Parkway, Garner, NC 27529

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 2.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

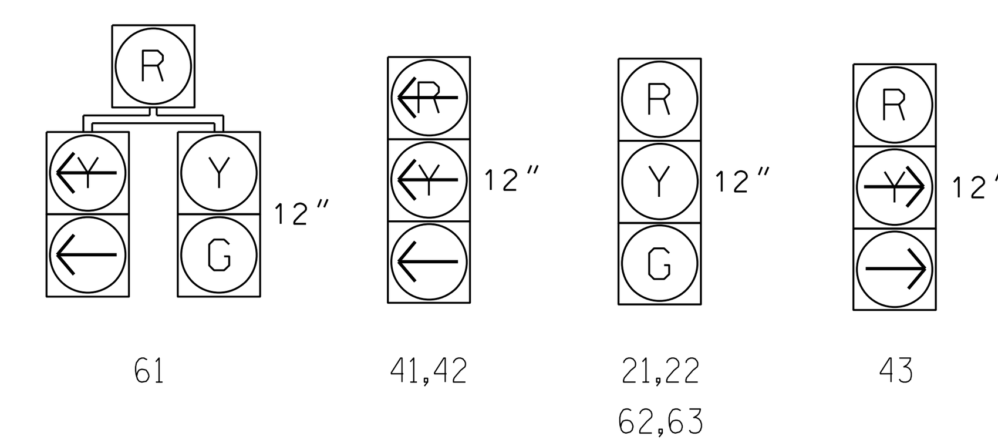
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø1+6	Ø2+6	Ø4	FLASH
21,22	R	G	R	Y
41,42	←R	←R	←	←R
43	→	R	→	R
61	← / G	G	R	Y
62,63	G	G	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

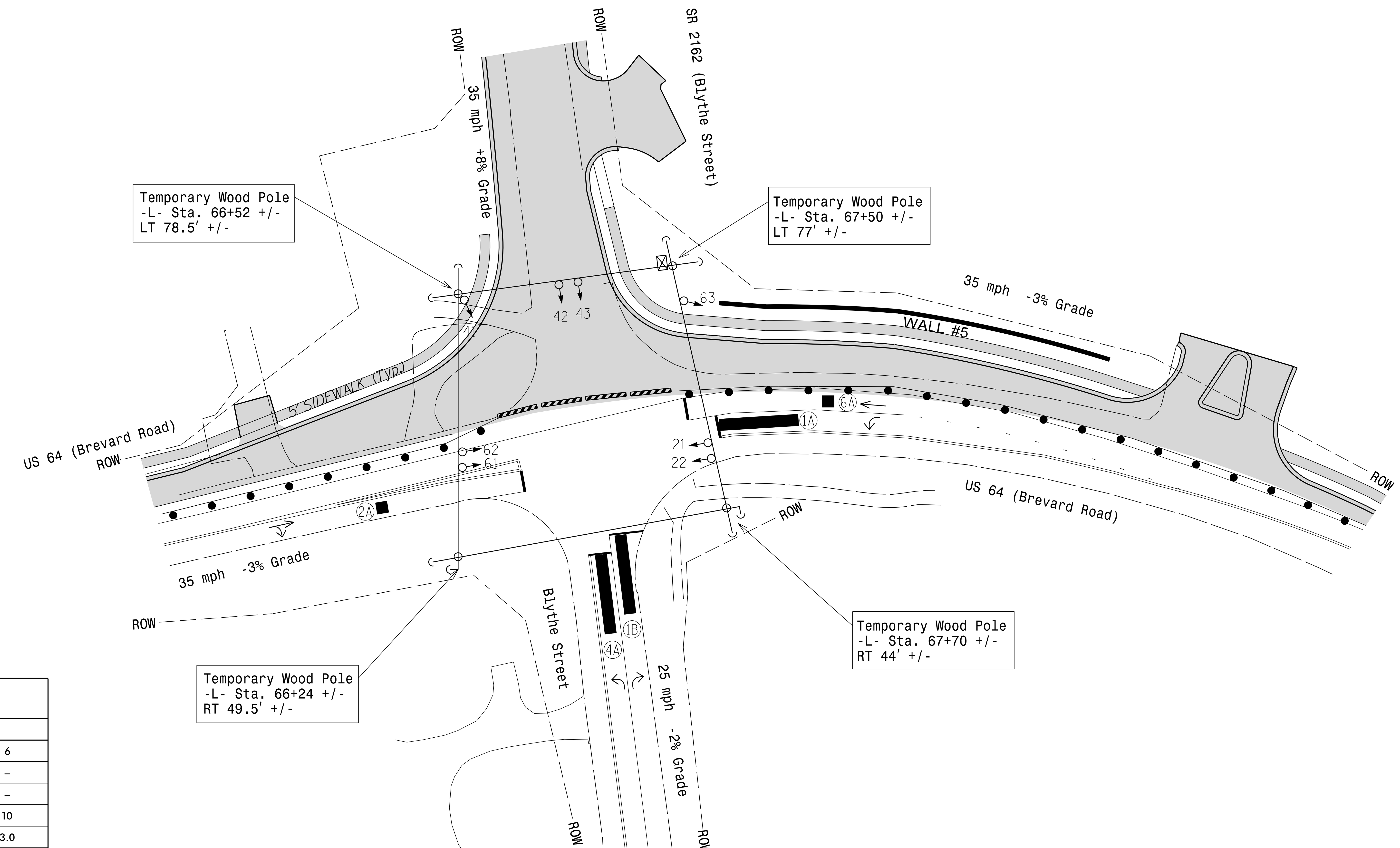
DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	*	0	*	*	1	15.0	-	X	-	X	-	*
					6	-	-	X	-	X	-	*
1B	*	0	*	*	1	15.0	-	X	-	X	-	*
2A	*	70	*	*	2	-	-	X	-	X	-	*
4A	*	0	*	*	4	-	-	X	-	X	-	*
6A	*	70	*	*	6	-	-	X	-	X	-	*

* Multi-Zone Microwave Detection Area

3 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. Phase 1 may be lagged.
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. All proposed permanent signal heads, pedestals, posts and bases shall be hunter green in color.
7. See Roadway Pavement Marking Plans for pavement marking locations.
8. This intersection uses multi-zone microwave detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	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	
	Construction Zone	
	Construction Zone Drums	
	Road Closure Barricades	
	Non-Intrusive Detection Zone	

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	4	6
Walk *	-	-	-	-
Ped Clear	-	-	-	-
Min Green*	7	10	7	10
Passage *	2.0	3.0	2.0	3.0
Max 1 *	20	60	30	60
Yellow Change	3.0	4.1	3.0	4.1
Red Clear	2.8	1.4	2.3	1.7
Added Initial*	-	-	-	-
Maximum Initial*	-	-	-	-
Time Before Reduction *	-	-	-	-
Time To Reduce *	-	-	-	-
Minimum Gap	-	-	-	-
Advance Walk	-	-	-	-
Non Lock Detector	X	-	X	-
Vehicle Recall	-	MIN RECALL	-	MIN RECALL
Dual Entry	-	-	-	-

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

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NC LIC. NO. C-1154

Temporary Signal - TCP Phase 4A

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 64 (Brevard Road)
at
SR 2162 (Blythe Street)

Division 14 Henderson County Hendersonville

PLAN DATE:	September 2023	REVIEWED BY:	JB Voso
PREPARED BY:	KG Eudy	REVIEWED BY:	

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 022599 JAMES B. VOSO

James Voso 4/1/2024
SIGNATURE DATE

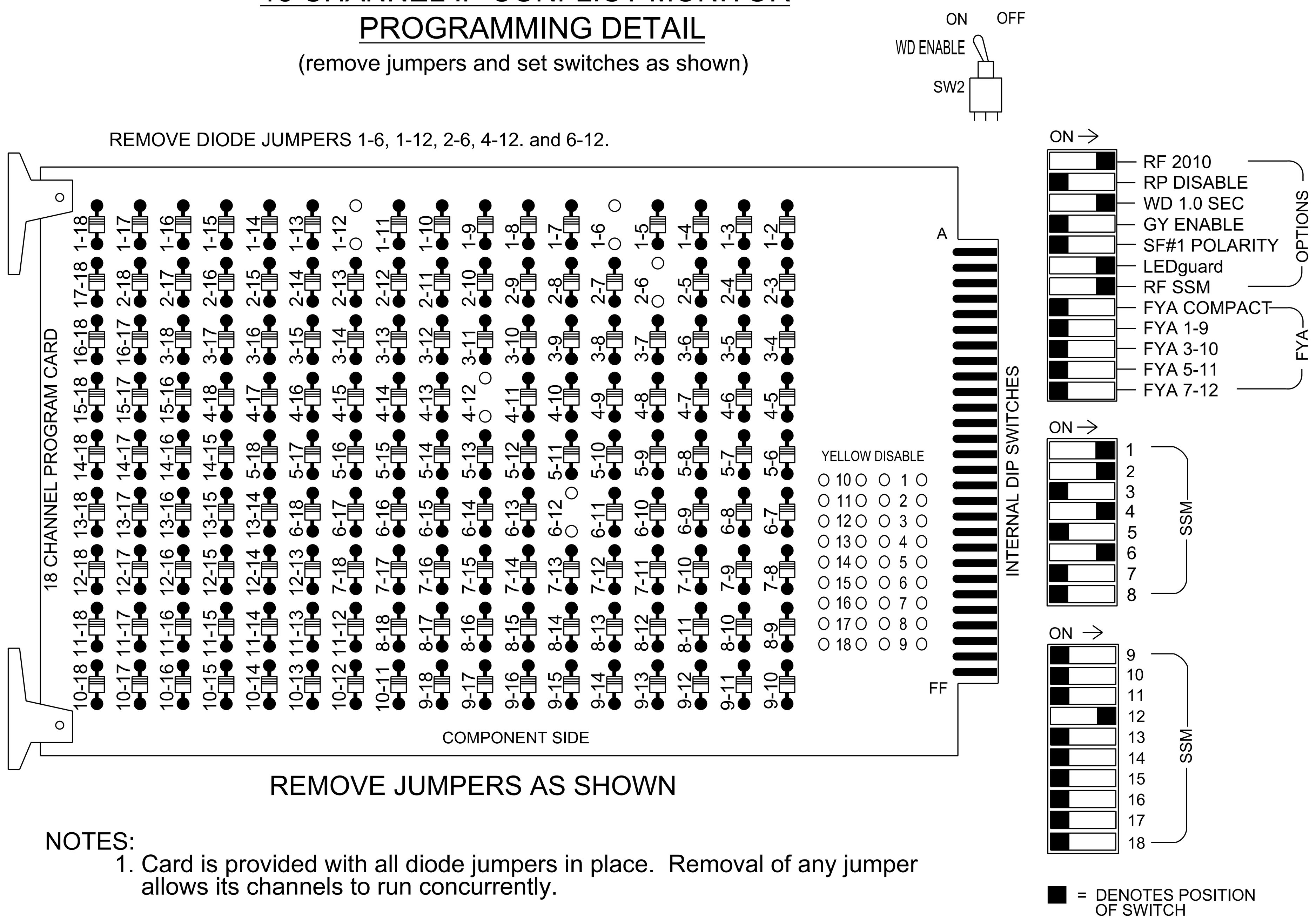
SIG. INVENTORY NO. 14-0002T1

10:08:31 AM
I:*3572 US 64 Widening (U-5783)*06 U-5783*Traffic*Signals*Design*Signals*14-0002*U5783_140002 Microwave detection.dgn
jbvoso

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 1-6, 1-12, 2-6, 4-12. and 6-12.



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. Integrate monitor with Ethernet network in cabinet.

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 and 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............................S1, S2, S5, S8, AUX S5
Phases Used.......................................1, 2, 4, 6
Overlap "1"..Not Used
Overlap "2"..Not Used
Overlap "3"..Not Used
Overlap "4"..*

* See overlap programming detail this sheet.

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.	61	21,22	NU	NU	41,42	NU	NU	61,62 63	NU	NU	NU	NU	NU	NU	NU	NU	43	NU
RED	*	128						134									A101	
YELLOW		129						135										
GREEN		130						136										
RED ARROW					101													
YELLOW ARROW	126				102												A102	
FLASHING YELLOW ARROW																		
GREEN ARROW	127				103												A103	
(hand)																		
(pedestrian)																		

NU = Not Used

* Denotes install load resistor. See load resistor installation 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	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
"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														

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

FS = FLASH SENSE
ST = STOP TIME

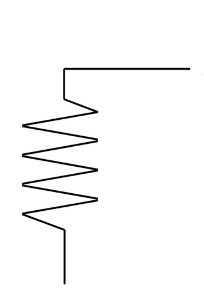
SPECIAL DETECTOR NOTE

Install a multi-zone microwave 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.

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown)

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



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	4
Type	Normal
Included Phases	1,4
Modifier Phases	-
Modifier Overlaps	-
Trail Green	0
Trail Yellow	0.0
Trail Red	0.0

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NC LIC. NO. C-1154

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0002T1
DESIGNED: September 2023
SEALED: 4/1/2024
REVISED: NA

Temporary Signal - TCP Phase 4A
Electrical Detail - Sheet 1 of 1

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

US 64 (Brevard Road)
at
SR 2162 (Blythe Street)

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

Division 14 | Henderson County | Hendersonville

PLAN DATE: September 2023 | REVIEWED BY: JB Voso
PREPARED BY: KG Eudy | REVIEWED BY:

REVISIONS	INIT.	DATE

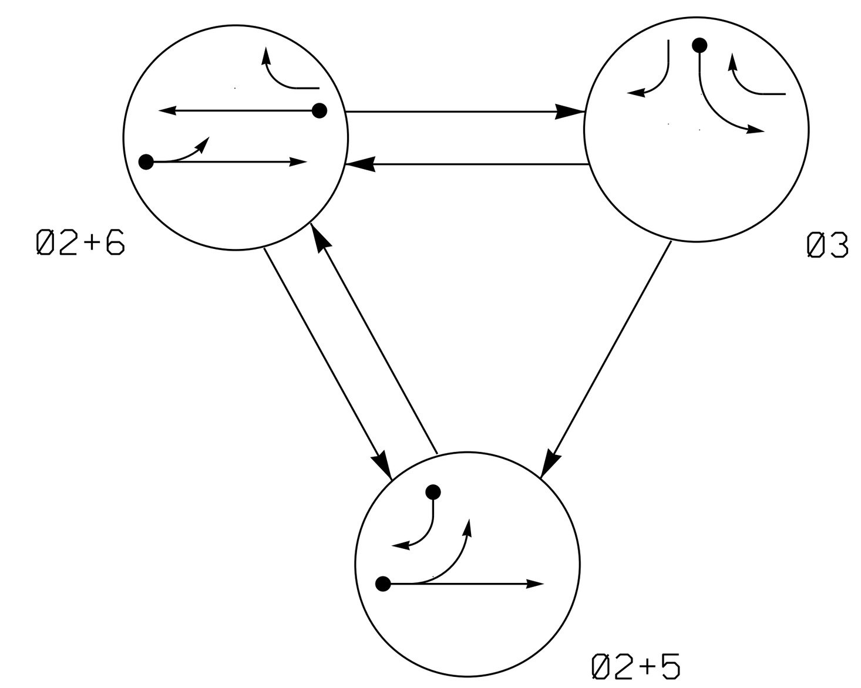
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
DocuSigned by: James Voso 140FD60379E041F...
4/1/2024
DATE

SIG. INVENTORY NO. 14-0002T1

11:02:11 AM
I:*3572 US 64 Widening (U-5783)*06 U-5783*Traffic*Signals*Design*Signals*14-0002*U5783_140002 Microwave detection.dgn
jbvoso

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 3.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

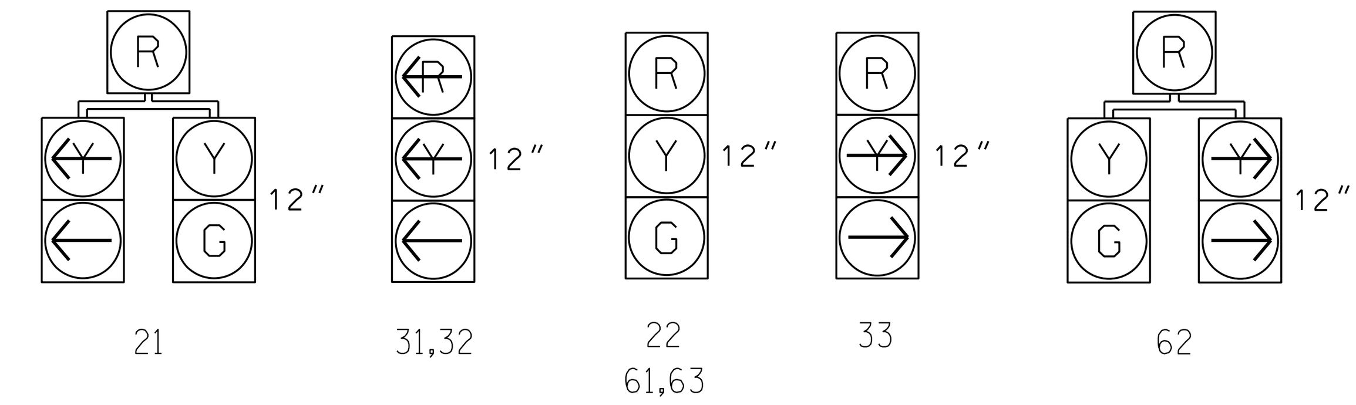
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2+5	Ø2+6	Ø3	FLASH
21	G / ←	G	R	Y
22	G	G	R	Y
31,32	←R (struck)	←R (struck)	←	←R (struck)
33	→	R	→	R
61,63	R	G	R	Y
62	R	G	R / →	Y

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

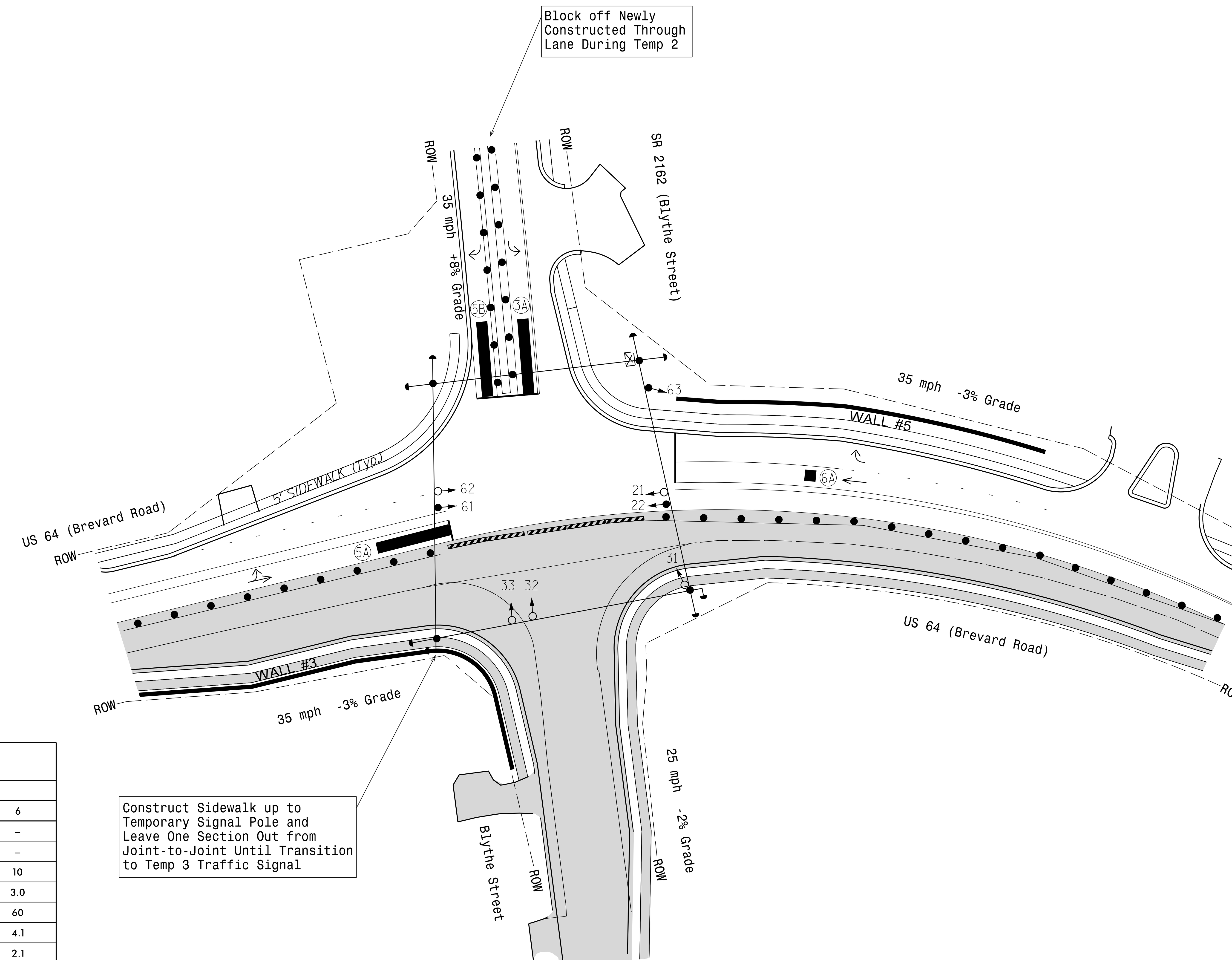
DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
3A	*	0	*	*	3	-	-	X	-	X	-	*
5A	*	0	*	*	5	15.0	-	X	-	X	-	*
					2	-	-	X	-	X	-	*
5B	*	0	*	*	5	15.0	-	X	-	X	-	*
6A	*	70	*	*	6	-	-	X	-	X	-	*

* Multi-Zone Microwave Detection Area

3 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. Phase 5 may be lagged.
4. Reposition existing signal heads numbered 22 and 61.
5. Set all detector units to presence mode.
6. All proposed permanent signal heads, pedestals, posts and bases shall be hunter green in color.
7. See Roadway Pavement Marking Plans for pavement marking locations.
8. This intersection uses multi-zone microwave detection. Install detectors according to the manufacturer's instructions to achieve the desired detection. Relocate/re-position detectors from TCP Phase 4A to achieve detection shown.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	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	
	Construction Zone	
	Construction Zone Drums	
	Road Closure Barricades	
	Non-Intrusive Detection Zone	

MAXTIME TIMING CHART

FEATURE	PHASE 2	3	5	6
Walk *	–	–	–	–
Ped Clear	–	–	–	–
Min Green*	10	7	7	10
Passage *	3.0	2.0	2.0	3.0
Max 1 *	60	30	20	60
Yellow Change	4.1	3.0	3.0	4.1
Red Clear	1.9	2.6	2.4	2.1
Added Initial *	–	–	–	–
Maximum Initial *	–	–	–	–
Time Before Reduction *	–	–	–	–
Time To Reduce *	–	–	–	–
Minimum Gap	–	–	–	–
Advance Walk	–	–	–	–
Non Lock Detector	–	X	X	–
Vehicle Recall	MIN RECALL	–	–	MIN RECALL
Dual Entry	–	–	–	–

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

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NC LIC. NO. C-1154

Temporary Signal - TCP Phase 5A

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

US 64 (Brevard Road) at SR 2162 (Blythe Street)

Division 14 Henderson County Hendersonville

PLAN DATE:	September 2023	REVIEWED BY:	JB Voso
PREPARED BY:	KG Eudy	REVIEWED BY:	

REVISIONS	INIT.	DATE

SCALE 0 40 1"=40'

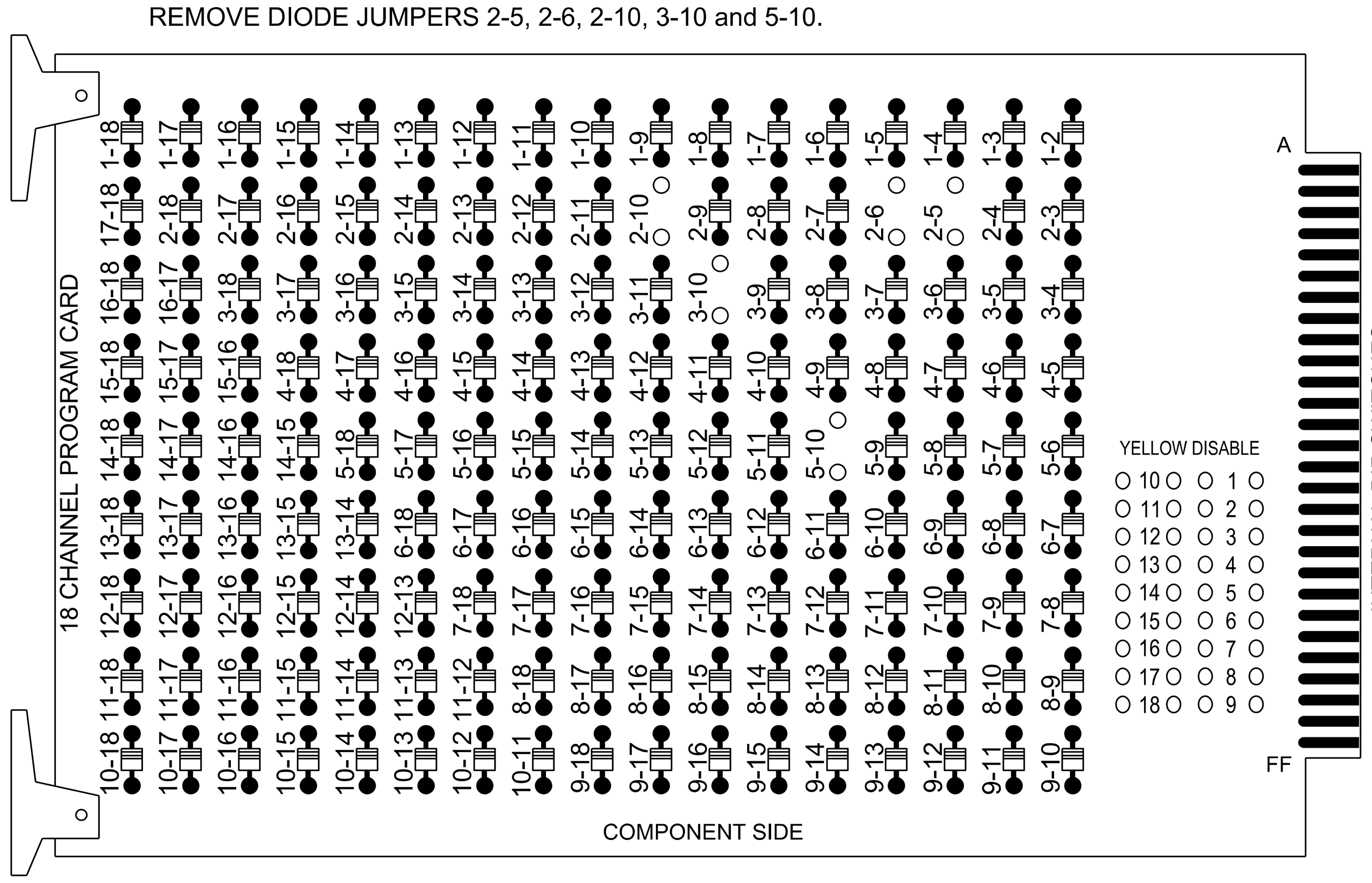
SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 022599 JAMES B. VOSO
DocuSigned by: James Voso 140FD60379E041F...
SIGNATURE DATE 4/1/2024

SIG. INVENTORY NO. I4-0002T2

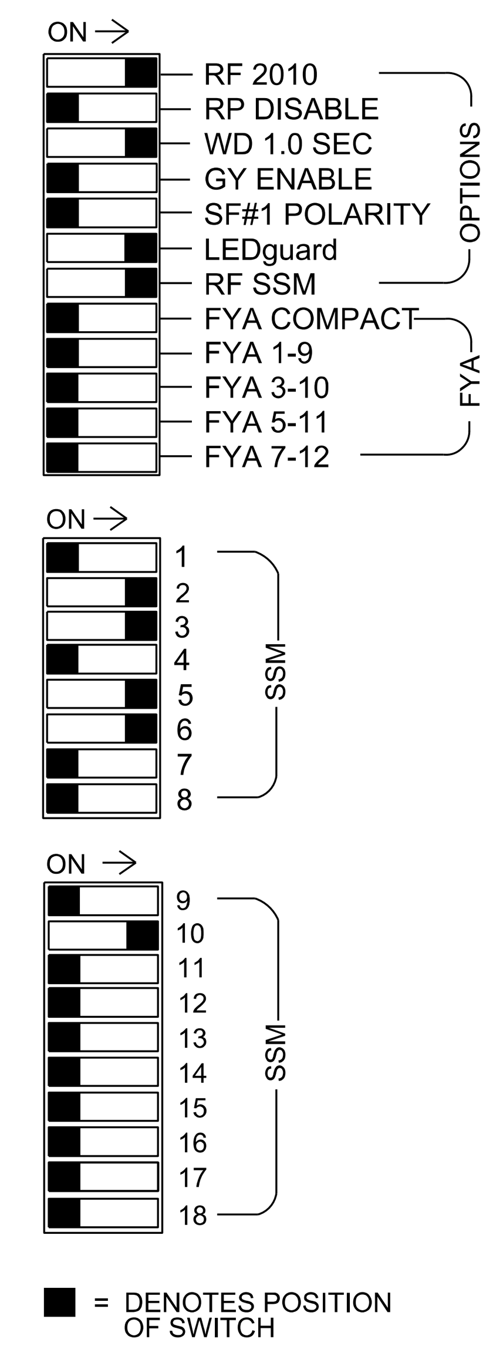
18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 2-5, 2-6, 2-10, 3-10 and 5-10.



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. Integrate monitor with Ethernet network in cabinet.

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 and 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...........................S2, S4, S7, S8, AUX S2
Phases Used.......................................2, 3, 5, 6
Overlap "1"..Not Used
Overlap "2"..*
Overlap "3"..Not Used
Overlap "4"..Not Used

* See overlap programming detail this sheet.

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 3.1

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	21.22	NU	31,32	62	NU	NU	21	61,62 63	NU	NU	NU	NU	NU	33	NU	NU	NU	NU
RED		128						*	134						A124				
YELLOW		129							135										
GREEN		130							136										
RED ARROW				116															
YELLOW ARROW				117	117			132							A125				
FLASHING YELLOW ARROW																			
GREEN ARROW				118	118			133							A126				
(Don't Walk hand)																			
(Walk person)																			

NU = Not Used

* Denotes install load resistor. See load resistor installation 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	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														

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

FS = FLASH SENSE
ST = STOP TIME

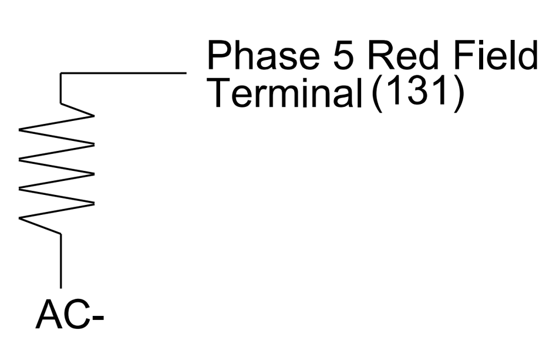
SPECIAL DETECTOR NOTE

Install a multi-zone microwave 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.

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown)

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



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	2
Type	Normal
Included Phases	3,5
Modifier Phases	-
Modifier Overlaps	-
Trail Green	0
Trail Yellow	0.0
Trail Red	0.0

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NC LIC. NO. C-1154

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0002T2
DESIGNED: September 2023
SEALED: 4/1/2024
REVISED: NA

Temporary Signal - TCP Phase 5A
Electrical Detail - Sheet 1 of 1

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

US 64 (Brevard Road)
at
SR 2162 (Blythe Street)

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

Division 14 | Henderson County | Hendersonville

PLAN DATE: September 2023 | REVIEWED BY: JB Voso
PREPARED BY: KG Eudy | REVIEWED BY:

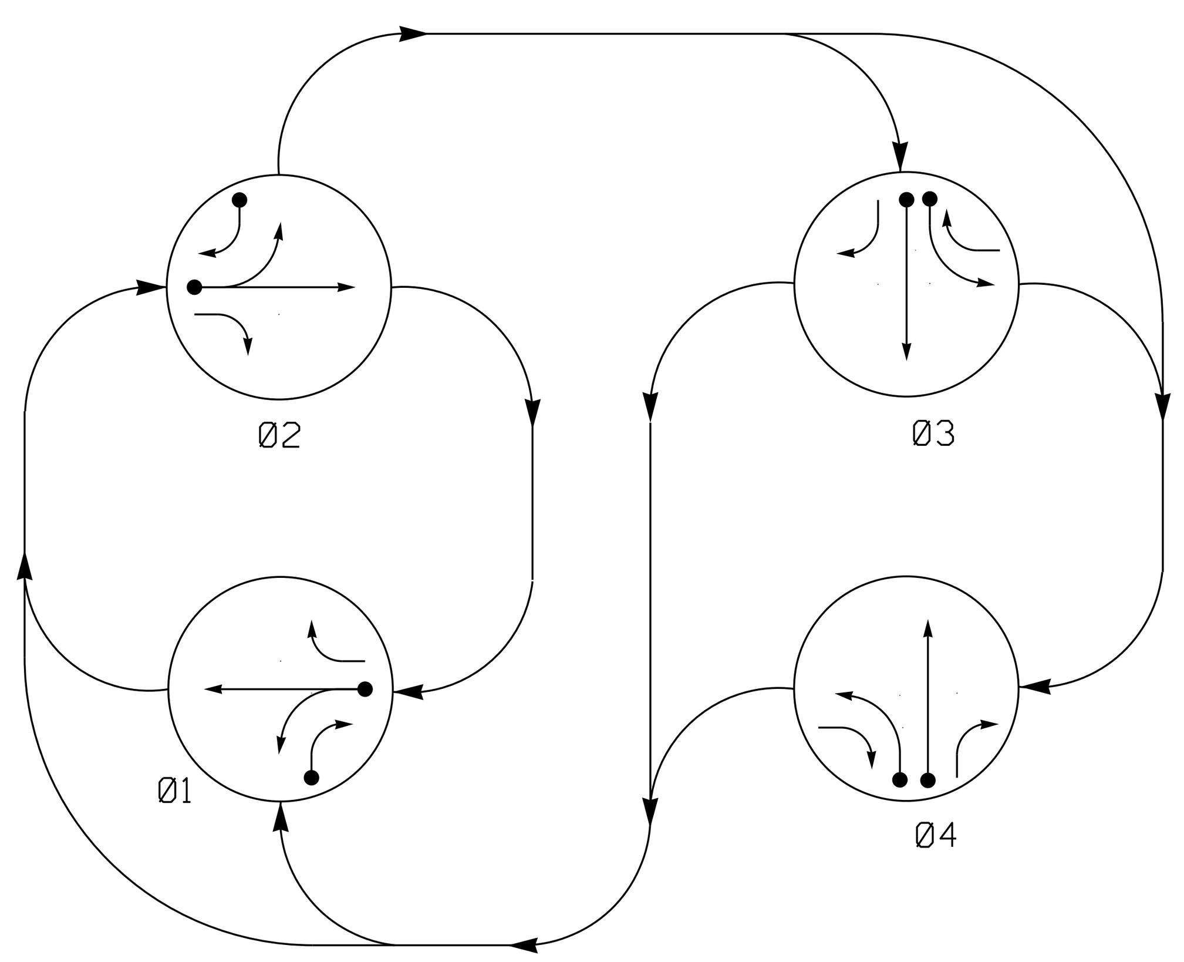
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 022599 JAMES B. VOSO
James Voso
4/1/2024
DATE

SIG. INVENTORY NO. 14-0002T2

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 4.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

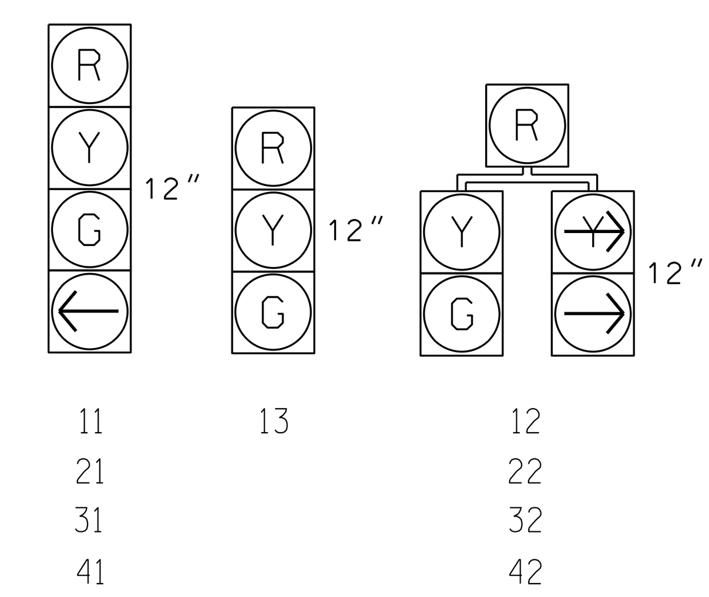
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø1	Ø2	Ø3	Ø4	FLASH
11	G ←	R	R	R	Y
12	G	R	R →	R	Y
13	G	R	R	R	Y
21	R	G ←	R	R	Y
22	R	G	R	R →	Y
31	R	R	G ←	R	R
32	R	R →	G	R	R
41	R	R	R	G ←	R
42	R →	R	R	G	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

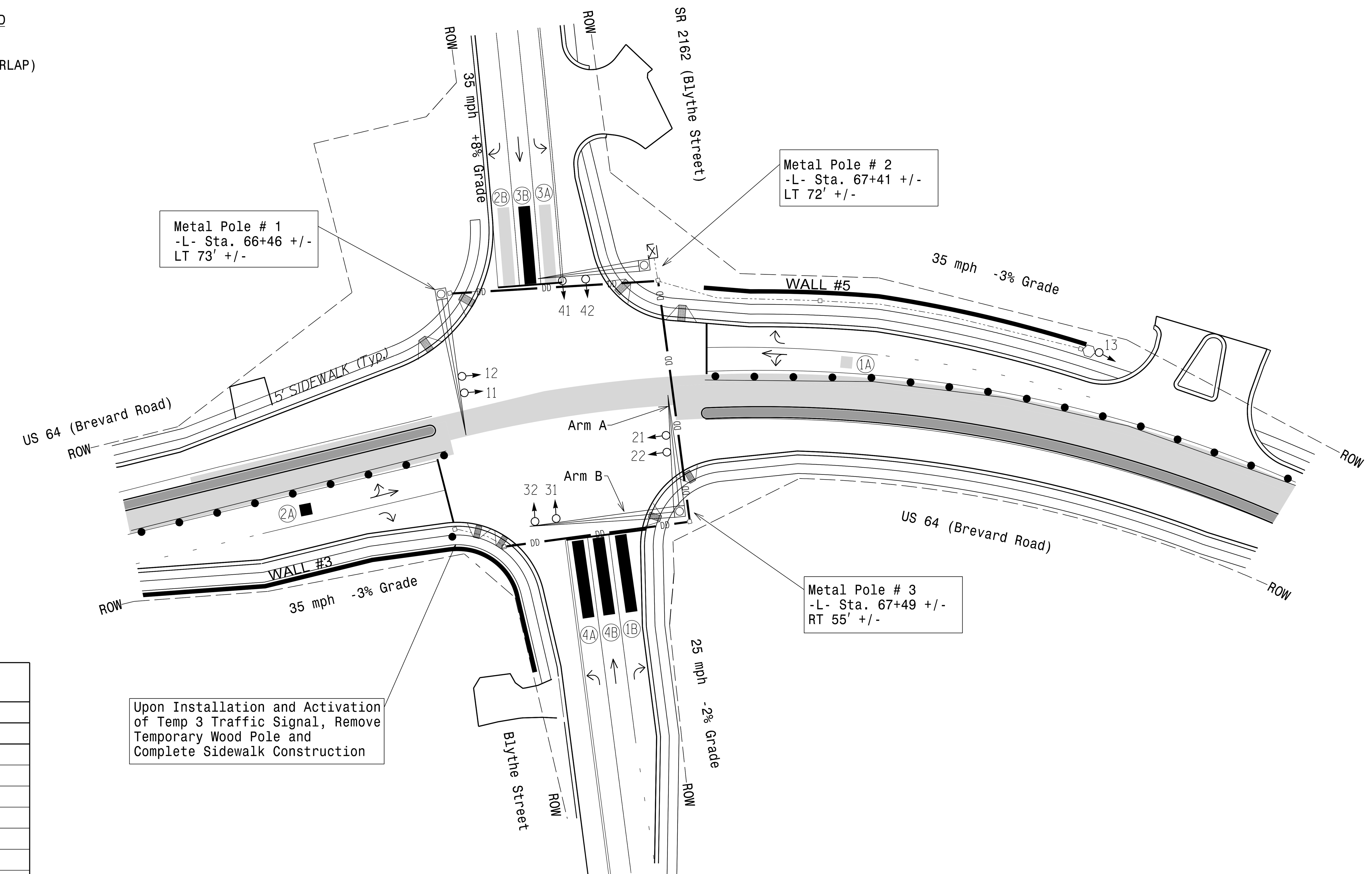
DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	*	70	*	*	1	-	-	X	-	X	-	*
1B	*	0	*	*	1	15.0	-	X	-	X	-	*
2A	*	70	*	*	2	-	-	X	-	X	-	*
2B	*	0	*	*	2	15.0	-	X	-	X	-	*
3A	*	0	*	*	3	-	-	X	-	X	-	*
3B	*	0	*	*	3	-	-	X	-	X	-	*
4A	*	0	*	*	4	-	-	X	-	X	-	*
4B	*	0	*	*	4	-	-	X	-	X	-	*

* Multi-Zone Microwave Detection Area

4 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. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
5. All proposed signal heads, pedestals, posts and bases shall be hunter green in color.
6. See Roadway Pavement Marking Plans for pavement marking locations.
7. This intersection uses multi-zone microwave detection. Install detectors according to the manufacturer's instructions to achieve the desired detection. Relocate/re-position detectors from TCP Phase 5A to achieve detection shown.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Metal Pole with Mastarm	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
	Directional Drill	N/A
N/A	Right of Way	
	Directional Arrow	
N/A	Curb Ramp	
	Type II Signal Pedestal	
	Type I Pushbutton Post	
	Construction Zone	
	Construction Zone Drums	
	Road Closure Barricades	
	Non-Intrusive Detection Zone	

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4
Walk *	–	–	–	–
Ped Clear	–	–	–	–
Min Green*	10	10	7	7
Passage *	3.0	3.0	2.0	2.0
Max 1 *	45	45	30	20
Yellow Change	4.1	4.1	3.0	4.0
Red Clear	2.3	2.2	3.2	2.2
Added Initial *	–	–	–	–
Maximum Initial *	–	–	–	–
Time Before Reduction *	–	–	–	–
Time To Reduce *	–	–	–	–
Minimum Gap	–	–	–	–
Advance Walk	–	–	–	–
Non Lock Detector	–	–	X	X
Vehicle Recall	MIN RECALL	MIN RECALL	–	–
Dual Entry	–	–	–	–

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

Temporary Signal - TCP Phase 5B

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NC LIC. NO. C-1154

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

US 64 (Brevard Road)
at
SR 2162 (Blythe Street)

Division 14 Henderson County Hendersonville

PLAN DATE:	September 2023	REVIEWED BY:	JB Voso
PREPARED BY:	KG Eudy	REVIEWED BY:	

SCALE 0 40
1"=40'

REVISIONS | INIT. | DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

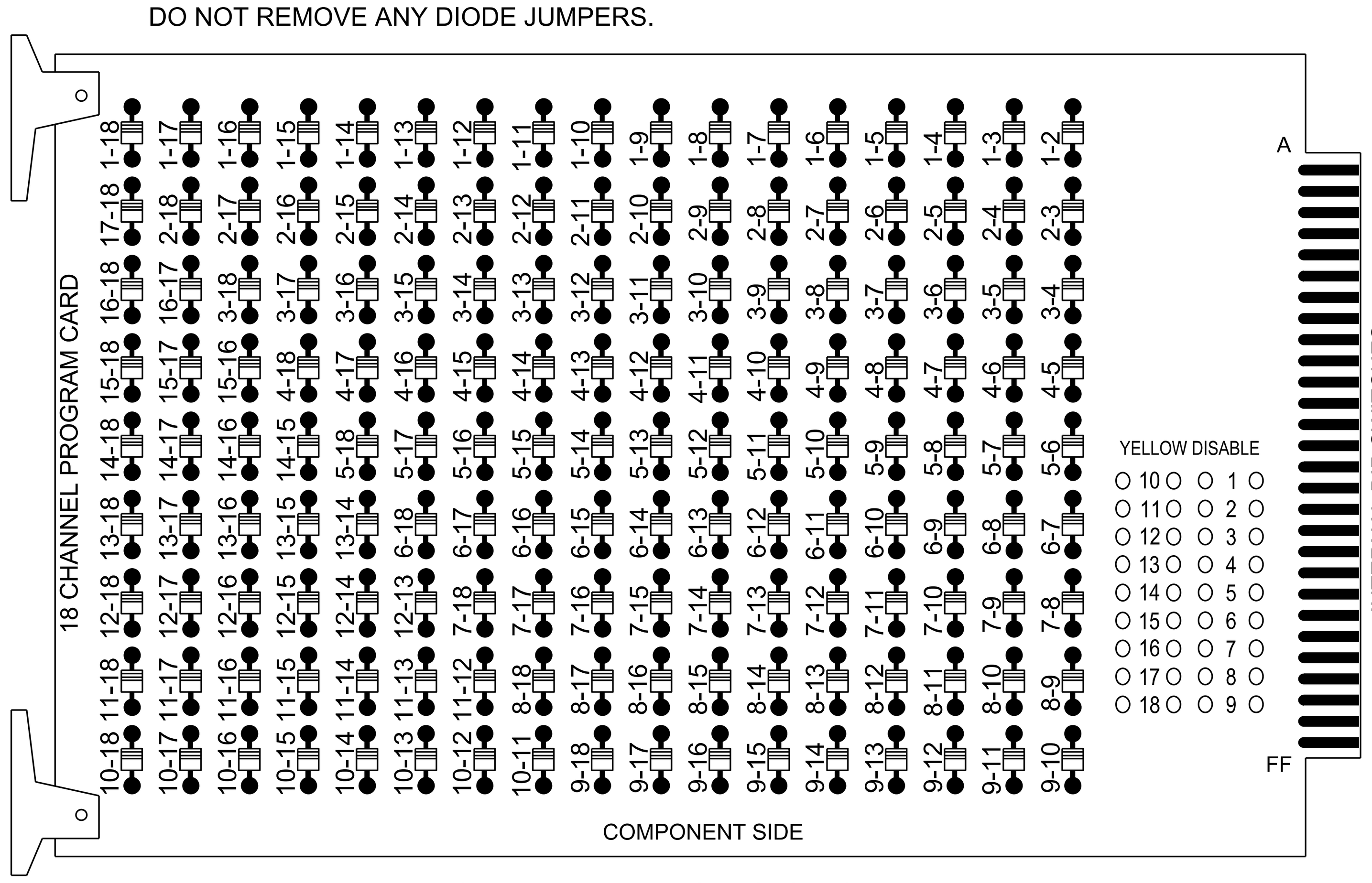
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
DocuSigned by: James Voso
SIGNATURE 4/1/2024 DATE

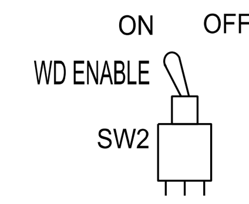
SIG. INVENTORY NO. I4-0002T3

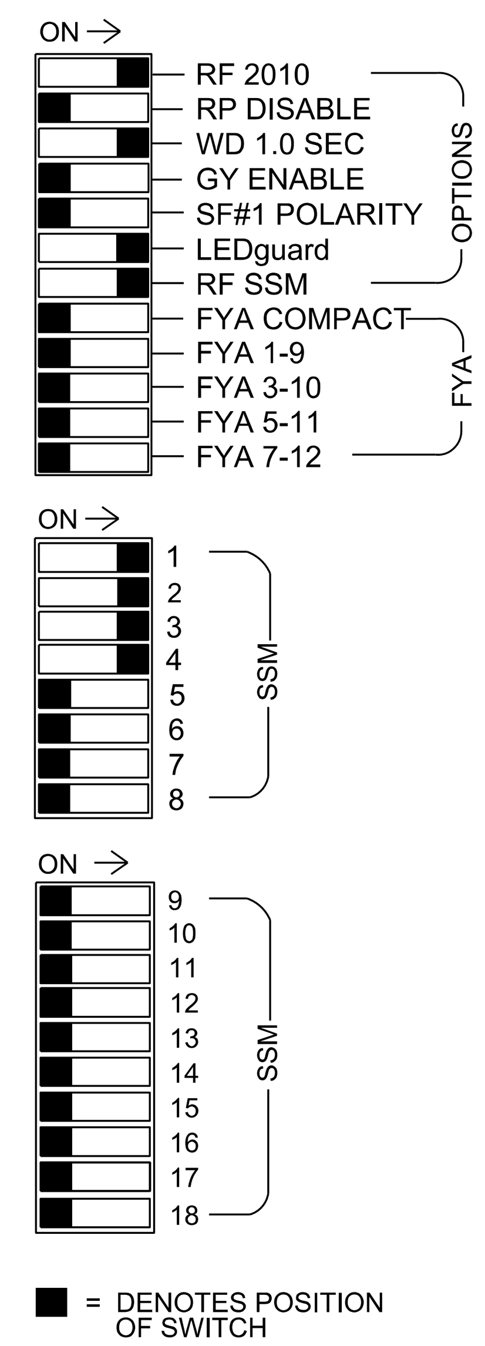
18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

DO NOT REMOVE ANY DIODE JUMPERS.







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. Integrate monitor with Ethernet network in cabinet.

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. Return controller to Factory Defaults before programmimng per this electrical detail.
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.

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	12,13	42	21	22	32	NU	31	32	12	41	42	22	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED	125	125		128	128			116	116		101	101														
YELLOW	126	126		129	129			117	117		102	102														
GREEN	127	127		130	130			118	118		103	103														
RED ARROW																										
YELLOW ARROW			126			129				117			102													
FLASHING YELLOW ARROW																										
GREEN ARROW	127		127	130		130		118		118	103		103													
(don't walk symbol)																										
(walk symbol)																										

NU = Not Used

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, S4, S5
Phases Used.......................................1, 2, 3, 4
Overlap "1"..Not Used
Overlap "2"..Not Used
Overlap "3"..Not Used
Overlap "4"..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														

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

FS = FLASH SENSE
ST = STOP TIME

SPECIAL DETECTOR NOTE

Install a multi-zone microwave 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.

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NC LIC. NO. C-1154

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0002T3
DESIGNED: September 2023
SEALED: 4/1/2024
REVISED: NA

Temporary Signal - TCP Phase 5B
Electrical Detail - Sheet 1 of 1

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

US 64 (Brevard Road)
at
SR 2162 (Blythe Street)

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

Division 14 Henderson County Hendersonville

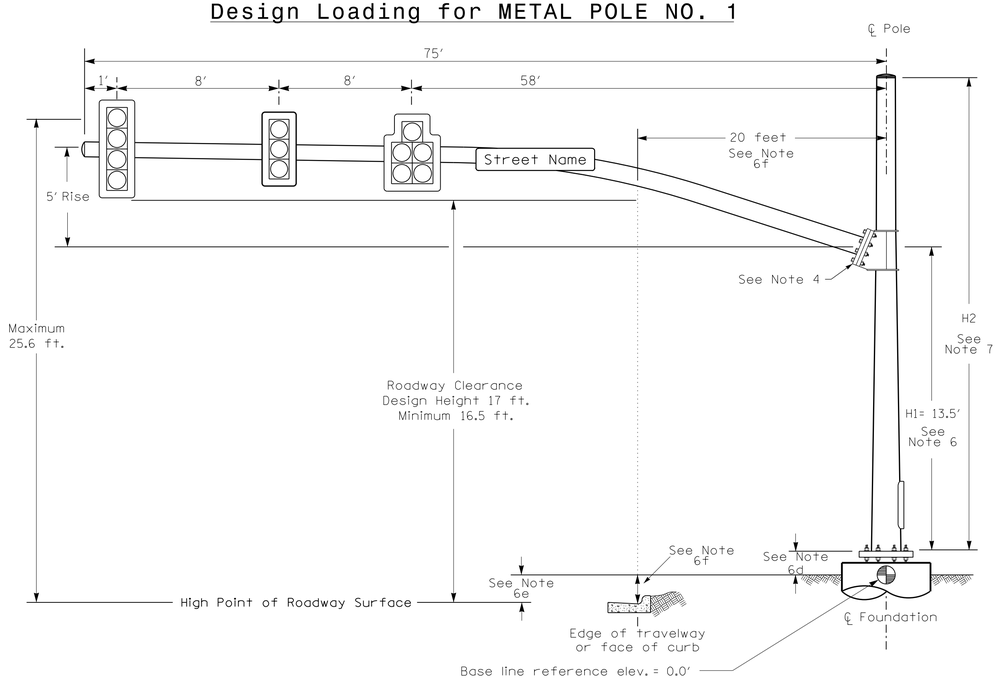
PLAN DATE: September 2023 REVIEWED BY: JB Voso
PREPARED BY: KG Eudy REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
DocuSigned by: James Voso 140FD60379E041F...
4/1/2024
DATE

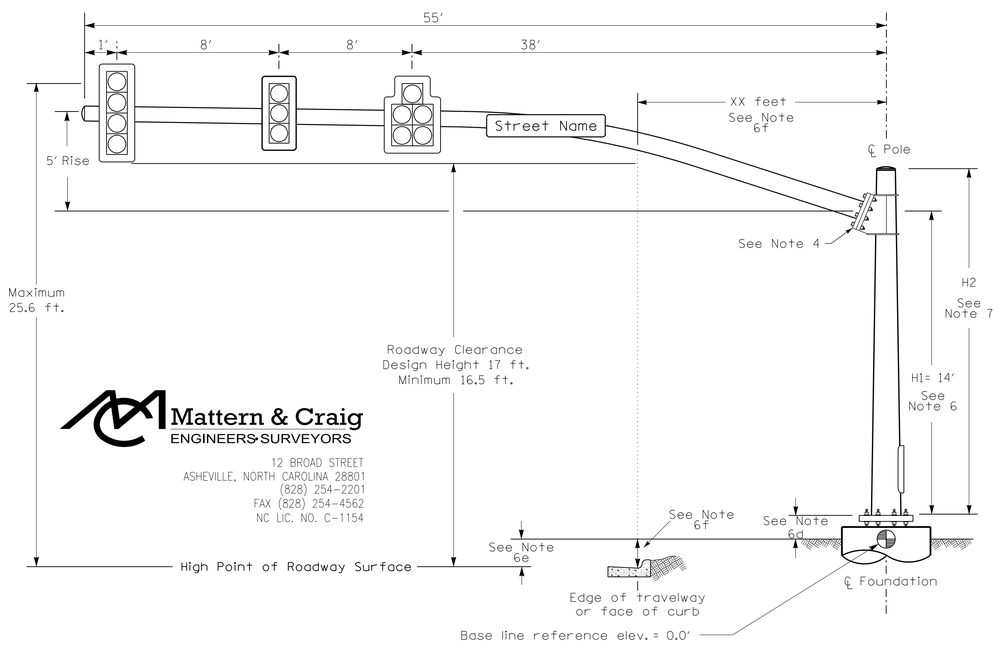
SIG. INVENTORY NO. 14-0002T3

Design Loading for METAL POLE NO. 1



Elevation View

Design Loading for METAL POLE NO. 2



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NC LIC. NO. C-1154

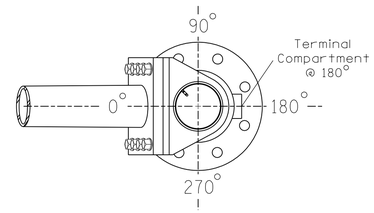
Elevation View

SPECIAL NOTE

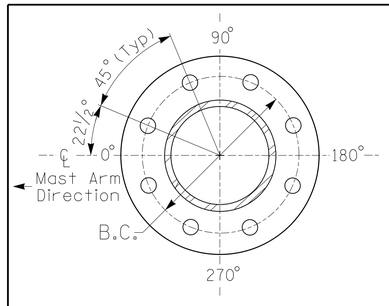
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	Pole 2
Baseline reference point at ℄ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	-0.86 ft.	-0.05 ft.
Elevation difference at Edge of travelway or face of curb	-0.86 ft.	-0.90 ft.

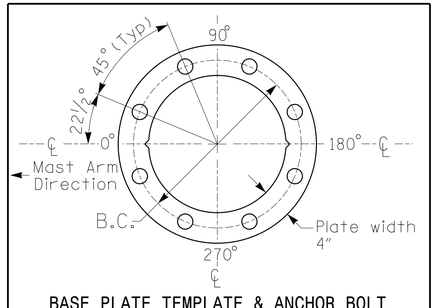


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 5



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

METAL POLE No. 1 and 2

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 4.2

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12″-5 SECTION-WITH BACKPLATE	16.3 S.F.	42.0″W X 56.0″L	103 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5″W X 66.0″L	74 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5″W X 52.5″L	60 LBS
Street Name	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. 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.
5. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
6. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Nominal vertical rise in mast arm is 5 feet as measured from the centerline of the arm base to the centerline of the free end of the arm.
   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.
   f. Provide horizontal distance from the proposed centerline of the foundation to the edge of travelway. Refer to the Elevation Data Chart for elevation difference between the proposed foundation ground level and the edge of travelway. This information is necessary to ensure that the roadway clearance is maintained at the edge of the travelway and to aid in the camber design of the arm.
7. 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.
8. 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.
9. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
10. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

All metal poles and arms should be hunter green in color as specified in the project special provisions.

NCDOT Wind Zone 4 (90 mph)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

US 64 (Brevard Road)
at
SR 2162 (Blythe Street)

Division 14 Henderson County Hendersonville

PLAN DATE: September 2023 REVIEWED BY: JB Voso
PREPARED BY: KG Eudy REVIEWED BY:

SCALE: 0 N/A N/A

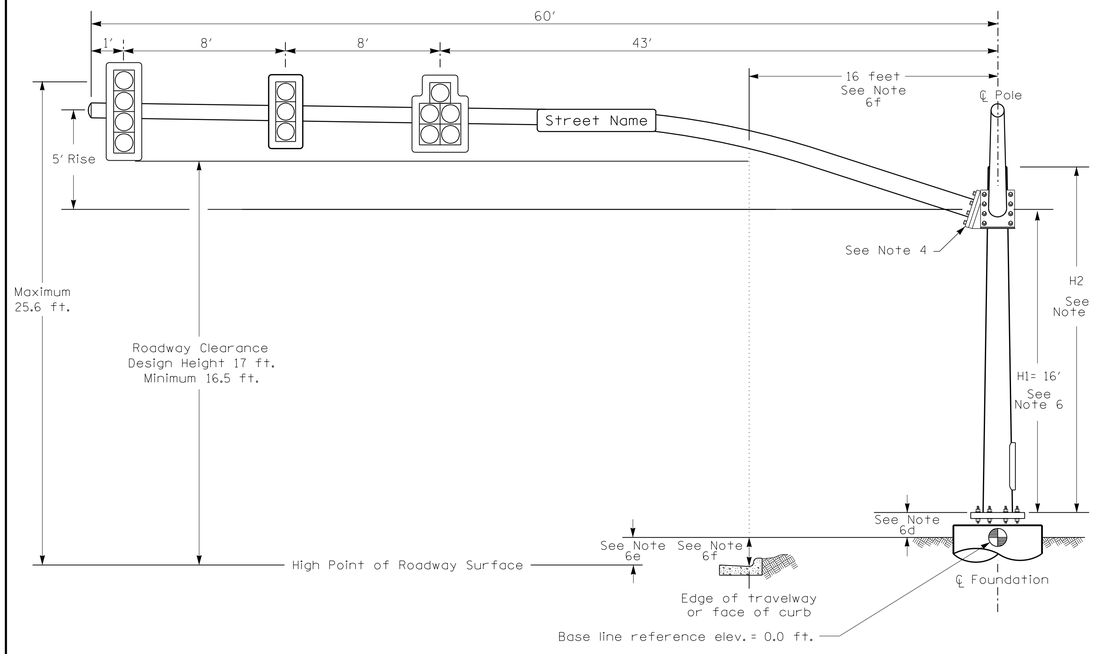
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
Docusigned by: James Voso 140FD6037BE041F
SIGNATURE
4/1/2024
DATE

SIG. INVENTORY NO. 14-0002

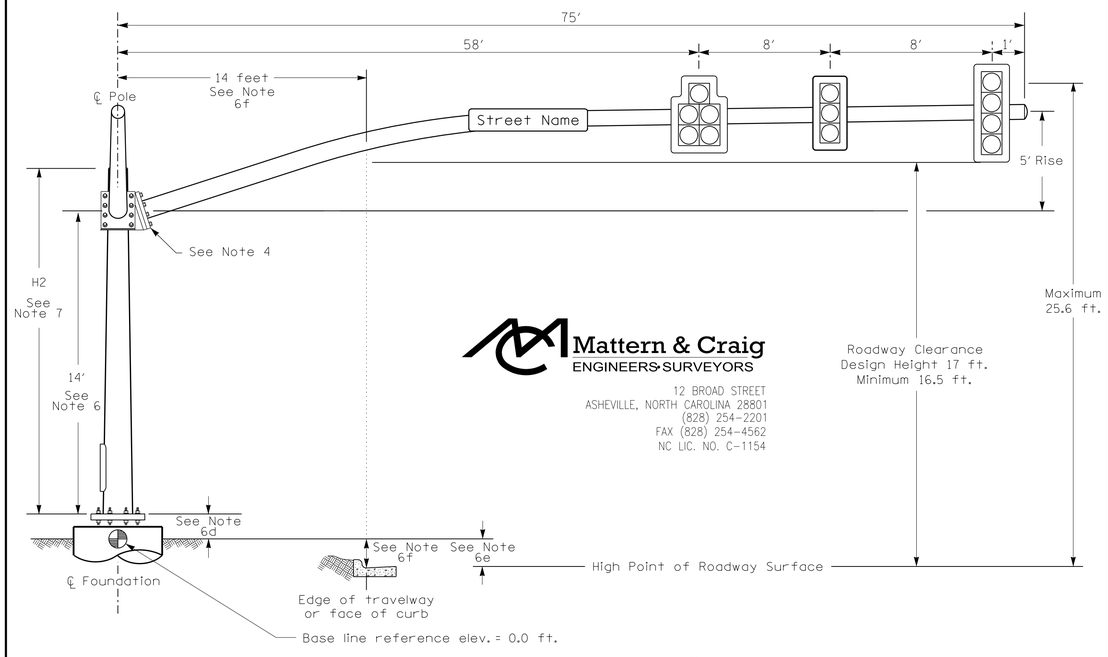
10:20:48 AM
I:\4572\US 64 Widening (U-5783)\06 U-5783\Traffic\Signals\Design\Signals\14-0002\U5783_140002.dgn
jbvoso

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



Elevation View @ 270°

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



Elevation View @ 0°

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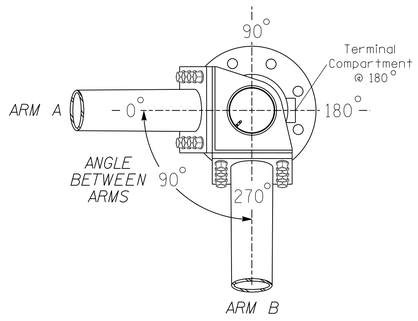
SPECIAL NOTE

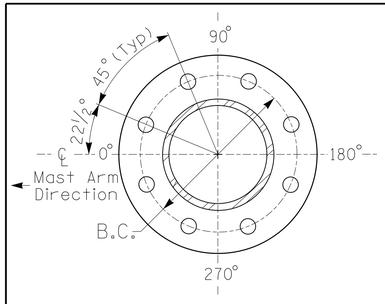
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Arm A	Arm B
Baseline reference point at ℄ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	+1.63 ft.	-0.24 ft.
Elevation difference at Edge of travelway or face of curb	-0.60 ft.	-1.24 ft.

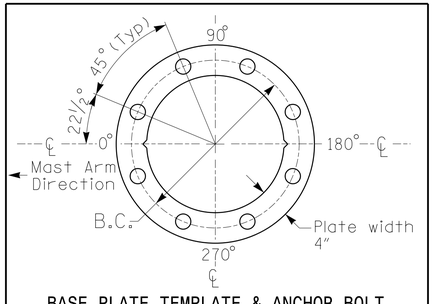


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 5



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

METAL POLE No. 3

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 4.3

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12″-5 SECTION-WITH BACKPLATE	16.3 S.F.	42.0″W X 56.0″L	103 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5″W X 66.0″L	74 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5″W X 52.5″L	60 LBS
Street Name	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:
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   - 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. 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 connection points.
5. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
6. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Nominal vertical rise in mast arm is 5 feet as measured from the centerline of the arm base to the centerline of the free end of the arm.
   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.
   f. Provide horizontal distance from the proposed centerline of the foundation to the edge of travelway. Refer to the Elevation Data Chart for elevation difference between the proposed foundation ground level and the edge of travelway. This information is necessary to ensure that the roadway clearance is maintained at the edge of the travelway and to aid in the camber design of the arm.
7. 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.
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NCDOT Wind Zone 4 (90 mph)

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US 64 (Brevard Road)
at
SR 2162 (Blythe Street)

Division 14 Henderson County Hendersonville

PLAN DATE:	September 2023	REVIEWED BY:	JB Voso
PREPARED BY:	KG Eudy	REVIEWED BY:	

SCALE: 0 N/A N/A

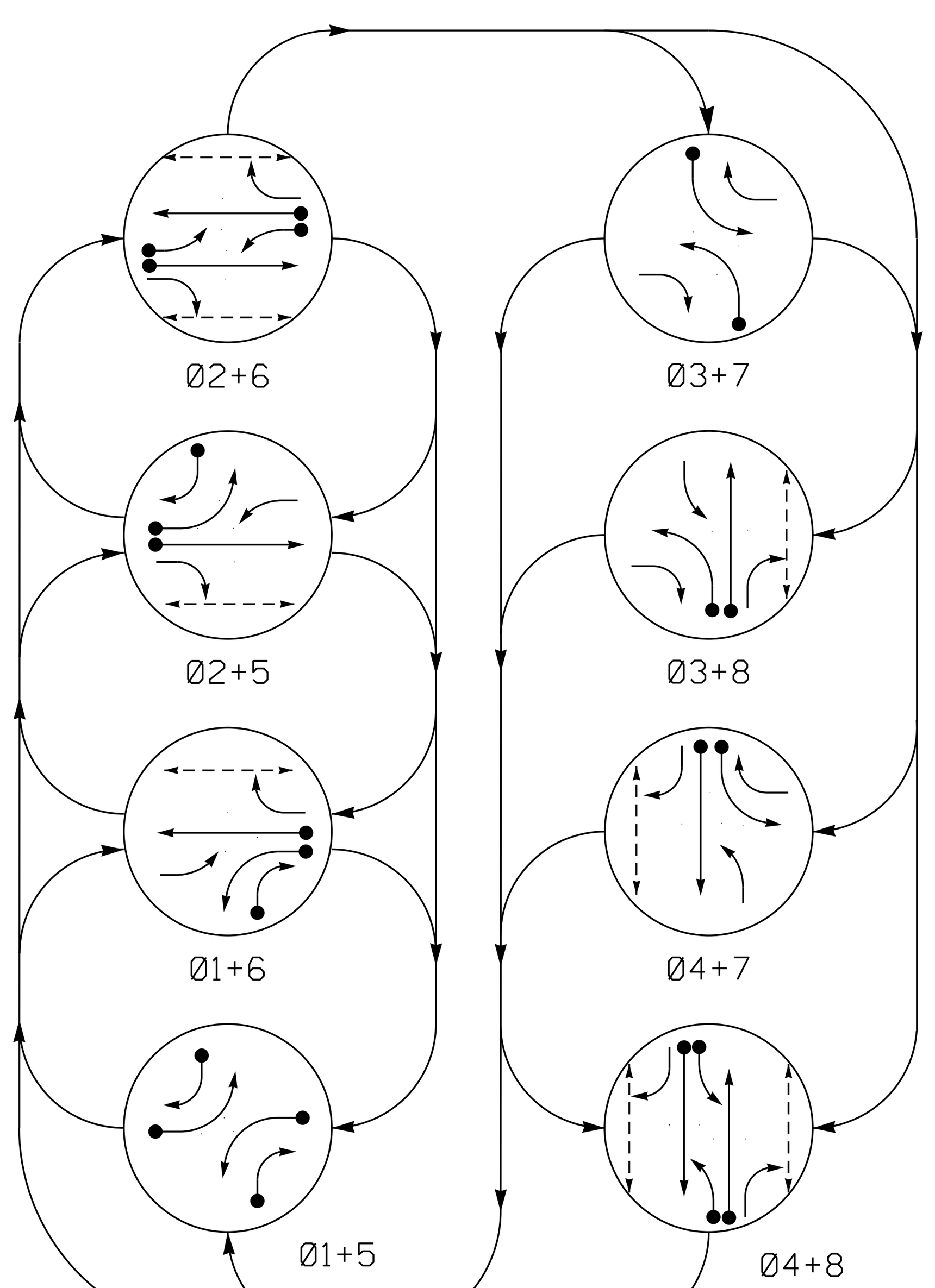
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
Docusigned by: James Voso 190FD6D378ED45F...
4/1/2024
SIGNATURE DATE

SIG. INVENTORY NO. 14-0002

10:27:30 AM
I:\5172_US 64 Widening (U-5783)\06 U-5783\Traffic\Signals\Design\Signals\14-0002\U5783_140002.dgn
jbvoso

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

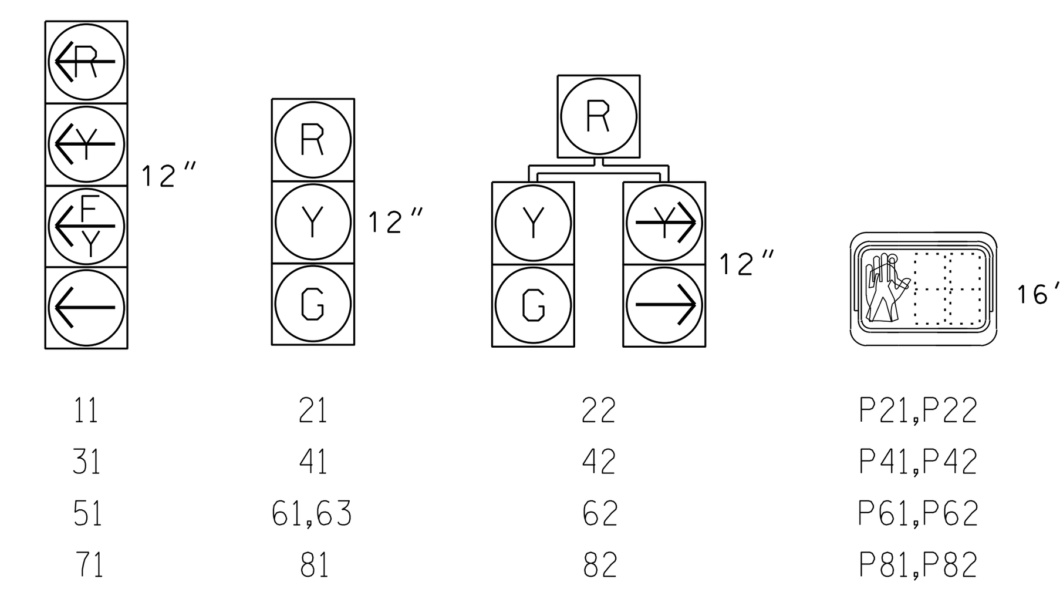
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø1+5	Ø1+6	Ø2+5	Ø2+6	Ø3+7	Ø3+8	Ø4+7	Ø4+8	FLASH
11	←	←	←F/Y	←F/Y	←R	←R	←R	←R	←Y
21	R	R	G	G	R	R	R	R	Y
22	R	R	G	G	R/→	R/→	R	R	Y
31	←R	←R	←R	←R	←	←	←F/Y	←F/Y	←R
41	R	R	R	R	R	R	G	G	R
42	R/→	R	R/→	R	R	R	G	G	R
51	←	←F/Y	←	←F/Y	←R	←R	←R	←R	←Y
61,63	R	G	R	G	R	R	R	R	Y
62	R	G	R	G	R/→	R	R/→	R	Y
71	←R	←R	←R	←R	←	←F/Y	←	←F/Y	←R
81	R	R	R	R	R	G	R	G	R
82	R/→	R/→	R	R	R	G	R	G	R
P21,P22	DW	DW	W	W	DW	DW	DW	DW	DRK
P41,P42	DW	DW	DW	DW	DW	DW	W	W	DRK
P61,P62	DW	W	DW	W	DW	DW	DW	DW	DRK
P81,P82	DW	DW	DW	DW	DW	W	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

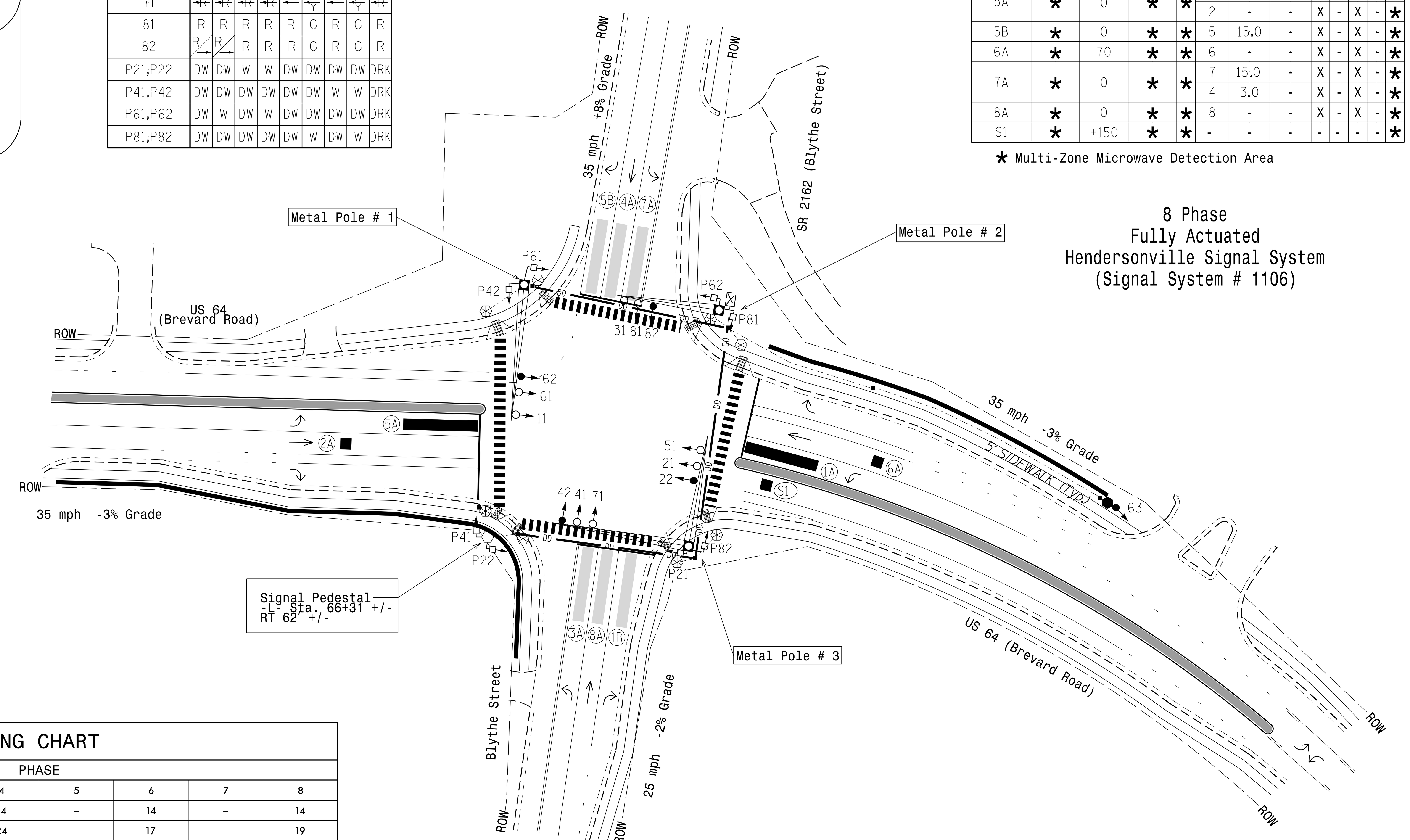
DETECTOR: LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	PROGRAMMING: CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	*	0	*	*	1	15.0	-	X	-	X	-	*
					6	-	-	X	-	X	-	*
1B	*	0	*	*	1	15.0	-	X	-	X	-	*
2A	*	70	*	*	2	-	-	X	-	X	-	*
3A	*	0	*	*	3	15.0	-	X	-	X	-	*
					8	3.0	-	X	-	X	-	*
4A	*	0	*	*	4	-	-	X	-	X	-	*
5A	*	0	*	*	5	15.0	-	X	-	X	-	*
					2	-	-	X	-	X	-	*
5B	*	0	*	*	5	15.0	-	X	-	X	-	*
6A	*	70	*	*	6	-	-	X	-	X	-	*
7A	*	0	*	*	7	15.0	-	X	-	X	-	*
					4	3.0	-	X	-	X	-	*
8A	*	0	*	*	8	-	-	X	-	X	-	*
S1	*	+150	*	*	-	-	-	-	-	-	-	*

* Multi-Zone Microwave Detection Area

8 Phase
Fully Actuated
Hendersonville Signal System
(Signal System # 1106)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specifications for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 1 and/or phase 5 may be lagged.
4. Phase 3 and/or phase 7 may be lagged.
5. Set all detector units to presence mode.
6. Reposition existing signal heads numbered 22, 42, 62, and 82.
7. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
8. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
9. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
10. All proposed signal heads, pedestals, posts and bases shall be hunter green in color.
11. See Roadway Pavement Marking Plans for pavement marking locations.
12. This intersection uses multi-zone microwave detection. Install detectors according to the manufacturer's instructions to achieve the desired detection. Relocate/re-position detectors from TCP Phase 5B to achieve detection shown.
13. Suppress FYA for signal head 11 during the first 7 seconds of the phase 2 ped.
14. Suppress FYA for signal head 31 during the first 7 seconds of the phase 4 ped.
15. Suppress FYA for signal head 51 during the first 7 seconds of the phase 6 ped.
16. Suppress FYA for signal head 71 during the first 7 seconds of the phase 8 ped.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Metal Pole with Mastarm	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
	Directional Drill	N/A
N/A	Right of Way	
	Directional Arrow	
N/A	Curb Ramp	
	Type II Signal Pedestal	
	Type I Pushbutton Post	
	Non-Intrusive Detection Zone	

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6	7	8
Walk *	–	14	–	14	–	14	–	14
Ped Clear	–	18	–	24	–	17	–	19
Min Green*	7	10	7	7	7	10	7	7
Passage *	2.0	3.0	2.0	2.0	2.0	3.0	2.0	2.0
Max 1 *	20	60	15	35	20	60	15	35
Yellow Change	3.0	4.1	3.0	3.4	3.0	4.1	3.0	3.4
Red Clear	3.3	2.6	3.2	3.3	3.3	2.6	3.3	3.3
Added Initial *	–	–	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–	–	–
Non Lock Detector	X	–	X	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 phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

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Signal Upgrade - Final

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

US 64 (Brevard Road) at SR 2162 (Blythe Street)

Division 14 Henderson County Hendersonville

PLAN DATE: September 2023	REVIEWED BY: JB Voso
PREPARED BY: KG Eudy	REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

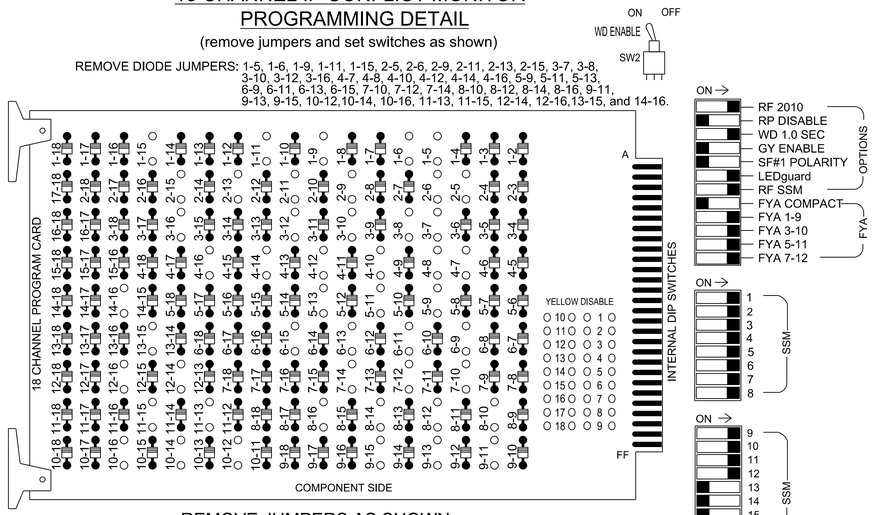
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
DocuSigned by: James Voso 140FD60379E041F...
SIGNATURE 4/1/2024 DATE
SIG. INVENTORY NO. 14-0002

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 5.1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS: 1-5, 1-6, 1-9, 1-11, 1-15, 2-5, 2-6, 2-9, 2-11, 2-13, 2-15, 3-7, 3-8, 3-10, 3-12, 3-16, 4-7, 4-8, 4-10, 4-12, 4-14, 4-16, 5-9, 5-11, 5-13, 6-9, 6-11, 6-13, 6-15, 7-10, 7-12, 7-14, 8-10, 8-12, 8-14, 8-16, 9-11, 9-13, 9-15, 10-12,10-14, 10-16, 11-13, 11-15, 12-14, 12-16,13-15, and 14-16.



■ = DENOTES POSITION OF SWITCH

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. Integrate monitor with Ethernet network in cabinet.

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.
5. The cabinet and controller are part of the Hendersonville Signal System (Signal System # 1106).

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, S3, S4, S5, S6, S7, S8, S9 S10, S11, S12, AUX S1, AUX S2, AUX 4, AUX 5
Phases Used.....1, 2, 2PED, 3, 4, 4PED, 5, 6, 6PED, 7, 8, 8PED
Overlap "1".....*
Overlap "2".....*
Overlap "3".....*
Overlap "4".....*

*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	4 PED	5	6	6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	11★	82	21,22	P21, P22	31★	22	41,42	P41, P42	51★	42	61,62 63	P61, P62	71★	62	81,82	P81, P82	11★	31★	NU	51★	71★	NU
RED		*	128			*	101			*	134			*	107							
YELLOW			129				102				135				108							
GREEN			130				103				136				109							
RED ARROW																	A121	A124		A114	A101	
YELLOW ARROW		126			117			132				123					A122	A125		A115	A102	
FLASHING YELLOW ARROW																	A123	A126		A116	A103	
GREEN ARROW	127	127		118	118		133	133		124	124											
✋			113			104			119			110										
🚶			115			106			121			112										

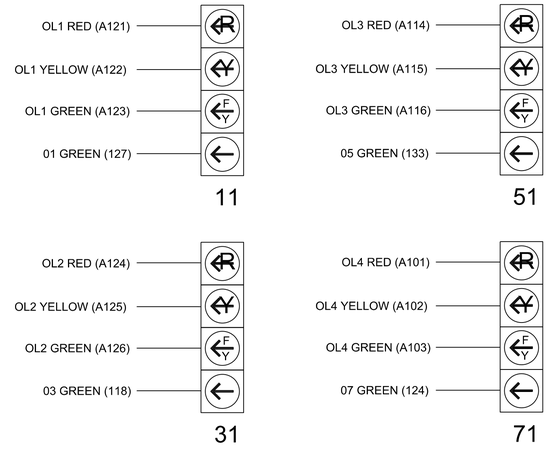
NU = Not Used

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

★See pictorial of head wiring in detail this sheet.

FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)



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	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Ø2 PED DC ISOLATOR	Ø6 PED DC ISOLATOR	FS DC ISOLATOR
	L												Ø4 PED DC ISOLATOR	Ø8 PED DC ISOLATOR	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														

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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
PED PUSH BUTTONS												
P21,P22	TB8-4,6	I12U	67	33	2	PED 2						
P41,P42	TB8-5,6	I12L	69	35	4	PED 4						
P61,P62	TB8-7,9	I13U	68	34	6	PED 6						
P81,P82	TB8-8,9	I13L	70	36	8	PED 8						

*System detector only. Remove any assigned vehicle phase.

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

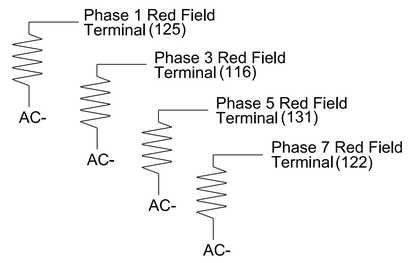
INPUT FILE POSITION LEGEND: J2L

FILE J
SLOT 2
LOWER

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown)

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



SPECIAL DETECTOR NOTE

Install a multi-zone microwave 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.

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THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0002
DESIGNED: September 2023
SEALED: 4/1/2024
REVISED: NA

Signal Upgrade - Final
Electrical Detail - Sheet 1 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

Prepared for the Offices of:

Transportation Mobility and Safety Division
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
Signals Management Section

750 N. Greenfield Pkwy, Garner, NC 27529

US 64 (Brevard Road)
at
SR 2162 (Blythe Street)

Division 14 | Henderson County | Hendersonville

PLAN DATE: September 2023 | REVIEWED BY: JB Voso
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NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO

DocuSigned by: James Voso 140FD6037BE041F...
4/1/2024
DATE

SIG. INVENTORY NO. 14-0002

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	1	2	3	4
Type	FYA 4 - Section	FYA 4 - Section	FYA 4 - Section	FYA 4 - Section
Included Phases	2	4	6	8
Modifier Phases	1	3	5	7
Modifier Overlaps	-	-	-	-
Trail Green	0	0	0	0
Trail Yellow	0.0	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0	0.0
FYA Ped Delay	7.0	7.0	7.0	7.0

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COUNTDOWN PEDESTRIAN SIGNAL OPERATION

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

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0002
DESIGNED: September 2023
SEALED: 4/1/2024
REVISED: NA

FLASHER CIRCUIT MODIFICATION DETAIL

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

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

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

Signal Upgrade - Final
Electrical Detail - Sheet 2 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

US 64 (Brevard Road) at SR 2162 (Blythe Street)

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

Division 14 | Henderson County | Hendersonville

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NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
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140FD60379E041F...
4/1/2024
DATE

SIG. INVENTORY NO. 14-0002

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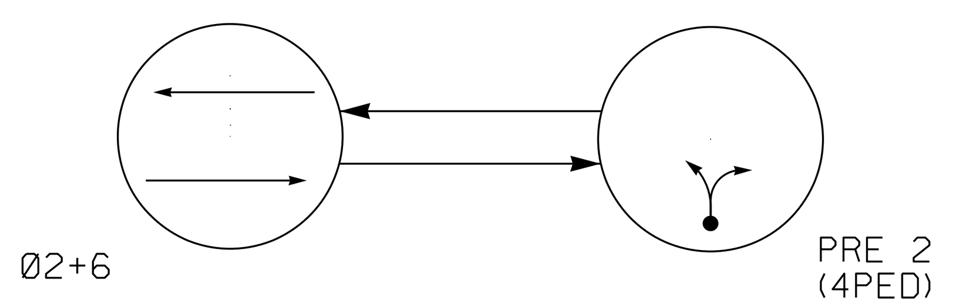
jbvoso

2 Phase
Semi-Actuated
w/ Emergency Vehicle Preemption
(Isolated)

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

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

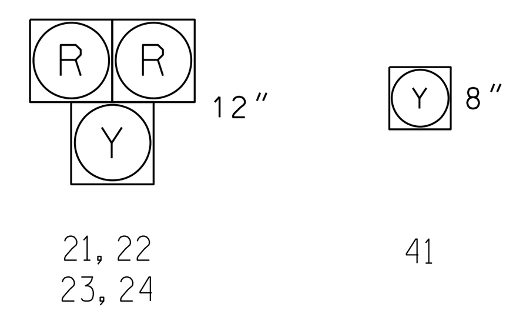
TABLE OF OPERATION

SIGNAL FACE	PHASE					
	Ø2+6 DARK	ACTIVATION	STEADY YELLOW	STEADY RED	Ø4 EVP 2	FLASH
21, 22	DRK	FY	Y	R	FR*	Y
23, 24	DRK	FY	Y	R	FR*	Y
41,42	DRK	DRK	DRK	DRK	FY	DRK

* - Alternating Flash
Y - Steady Yellow
FY - Flashing Yellow
R - Steady Red
FR - Flashing Red
DRK - Dark

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME PREEMPTION CHART

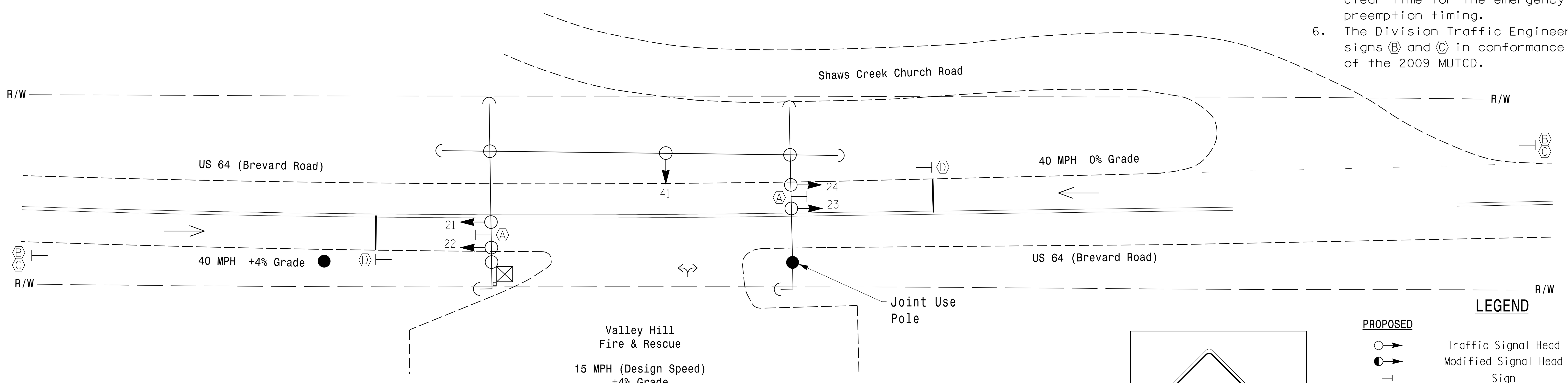
FUNCTION	PRE 2
Type	EMERG VEH
Exit Phases	2
Delay	**
Max Presence	120
Enter Min Green	1
Enter Walk	255 *
Enter Ped Clear	255 *
Enter Yellow Change	25.5 *
Enter Red Clear	25.5 *
Track Green	–
Track Yellow Change	25.5 *
Track Red Clear	25.5 *
Dwell Green	0
Exit Min Green	255 *
Exit Yellow Change	25.5 *
Exit Red Clear	25.5 *
Dwell Extend Time	–
Exit Type	EXIT PHASES
Ped Clear Through Yellow	–
Require All Red Entry	–

* Directs controller to use default phase timing.

** See Note 5.

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. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
4. Locate emergency vehicle preemption switch in Valley Hill Fire & Rescue Station #4. Route necessary cabling from controller cabinet to pushbutton switch via paved trench. Coordinate actual location with fire station personnel.
5. The Division Traffic Engineer will determine the Delay before Preempt and the phase 4 Ped Clear time for the emergency vehicle preemption timing.
6. The Division Traffic Engineer shall locate signs Ⓑ and Ⓒ in conformance with section 2C of the 2009 MUTCD.



MAXTIME TIMING CHART

FEATURE	PHASE 2	PHASE 4	PHASE 6
Walk *	–	0	–
Ped Clear *	–	**	–
Min Green	10	7	10
Passage *	–	–	–
Max 1 *	30	30	30
Yellow Change	4.2	3.0	4.2
Red Clear	3.6	3.6	3.6
Added Initial *	–	–	–
Maximum Initial *	–	–	–
Time Before Reduction *	–	–	–
Time To Reduce *	–	–	–
Minimum Gap	–	–	–
Advance Walk	–	–	–
Pre Clearance	5.0	–	5.0
Non Lock Detector	–	–	–
Vehicle Recall	MIN RECALL	–	MIN RECALL
Dual Entry	–	–	–

Serves as Preempt Dwell Time
Serves as Steady Yellow Clearance Time
Serves as All Red Clearance Time
Serves as Flashing Yellow Interval

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

** See Note 5.

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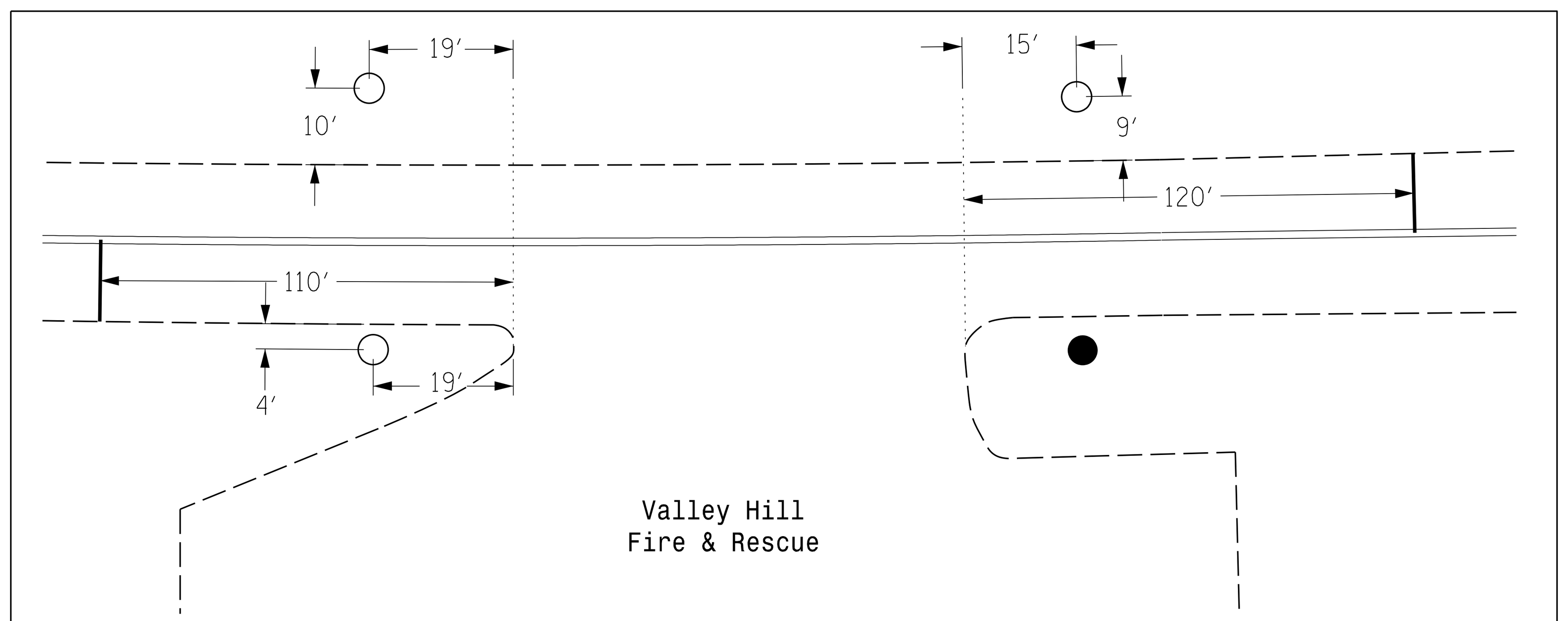

PROPOSED POLE AND STOPBAR LOCATIONS

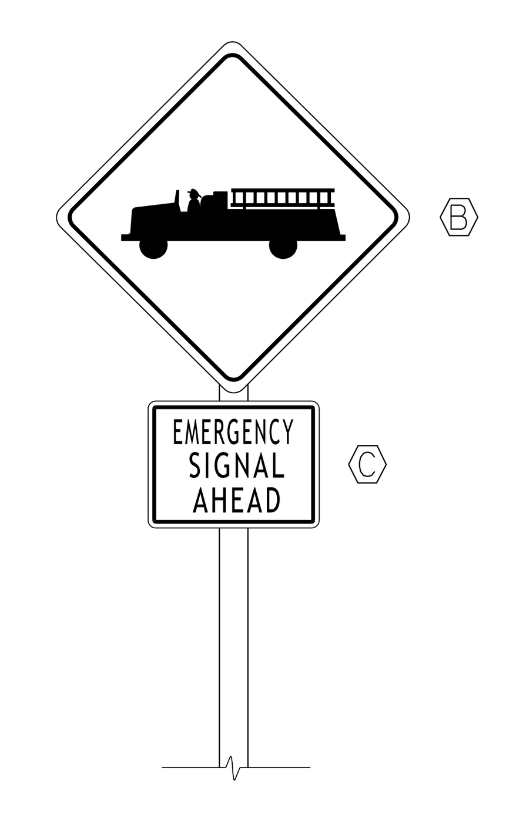

Figure 1

LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	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	
Ⓐ	"EMERGENCY SIGNAL STOP ON FLASHING RED" Sign (R10-14A)	Ⓐ
Ⓑ	Emergency Vehicle Sign (W11-8) (See Figure 1)	Ⓑ
Ⓒ	"EMERGENCY SIGNAL AHEAD" Sign (W11-12P) (See Figure 1)	Ⓒ
Ⓓ	"STOP HERE ON FLASHING RED" Sign (R10-14b)	Ⓓ

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New Installation

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

US 64 (Brevard Road) at Valley Hill Fire & Rescue

Division 14 Henderson County Laurel Park

PLAN DATE:	October 2023	REVIEWED BY:	JB Voso
PREPARED BY:	KG Eudy	REVIEWED BY:	

SCALE 0 20 1"=20'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO

DocuSigned by: James Voso
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4/1/2024
DATE

SIG. INVENTORY NO. 14-1304

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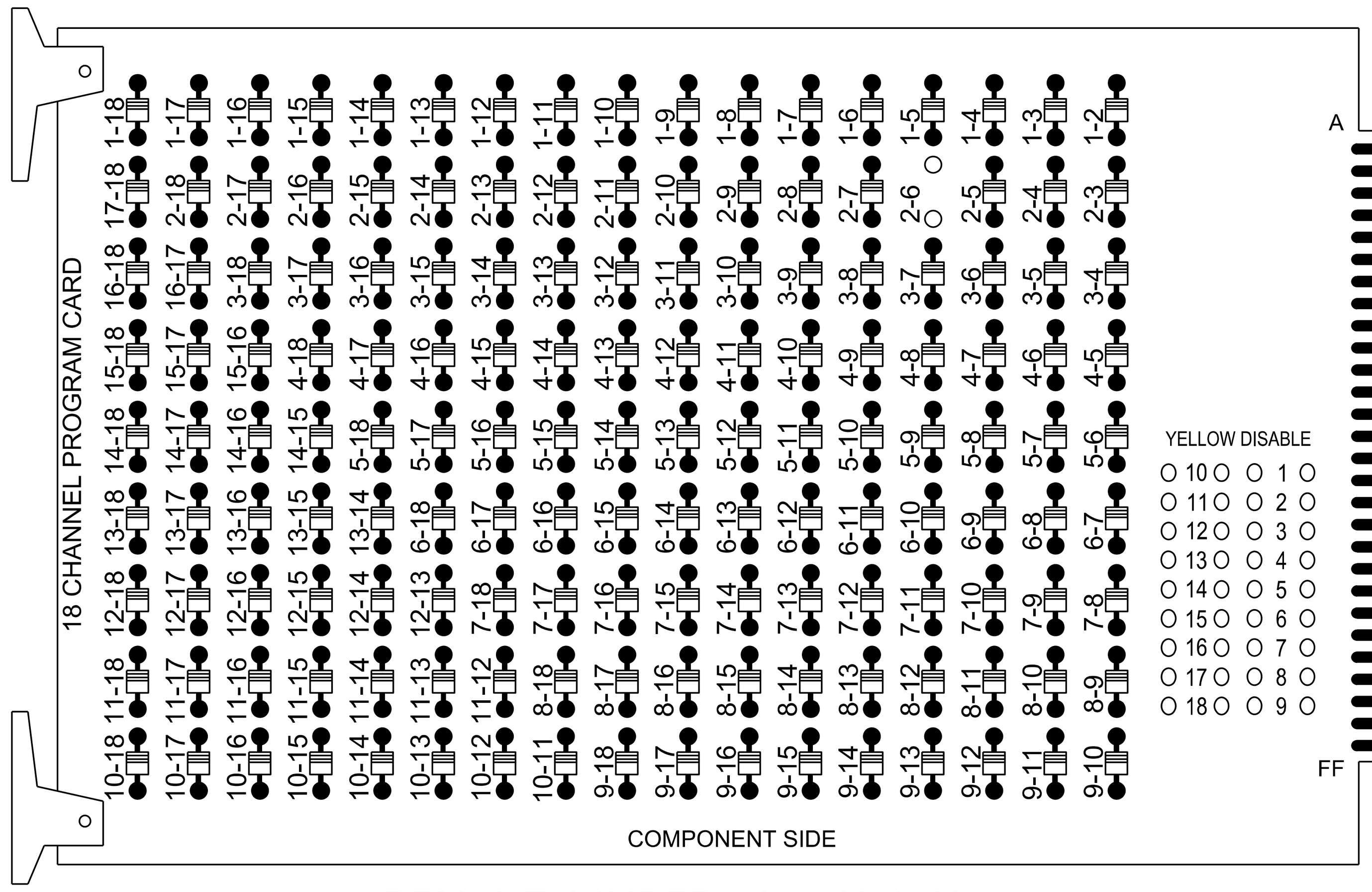
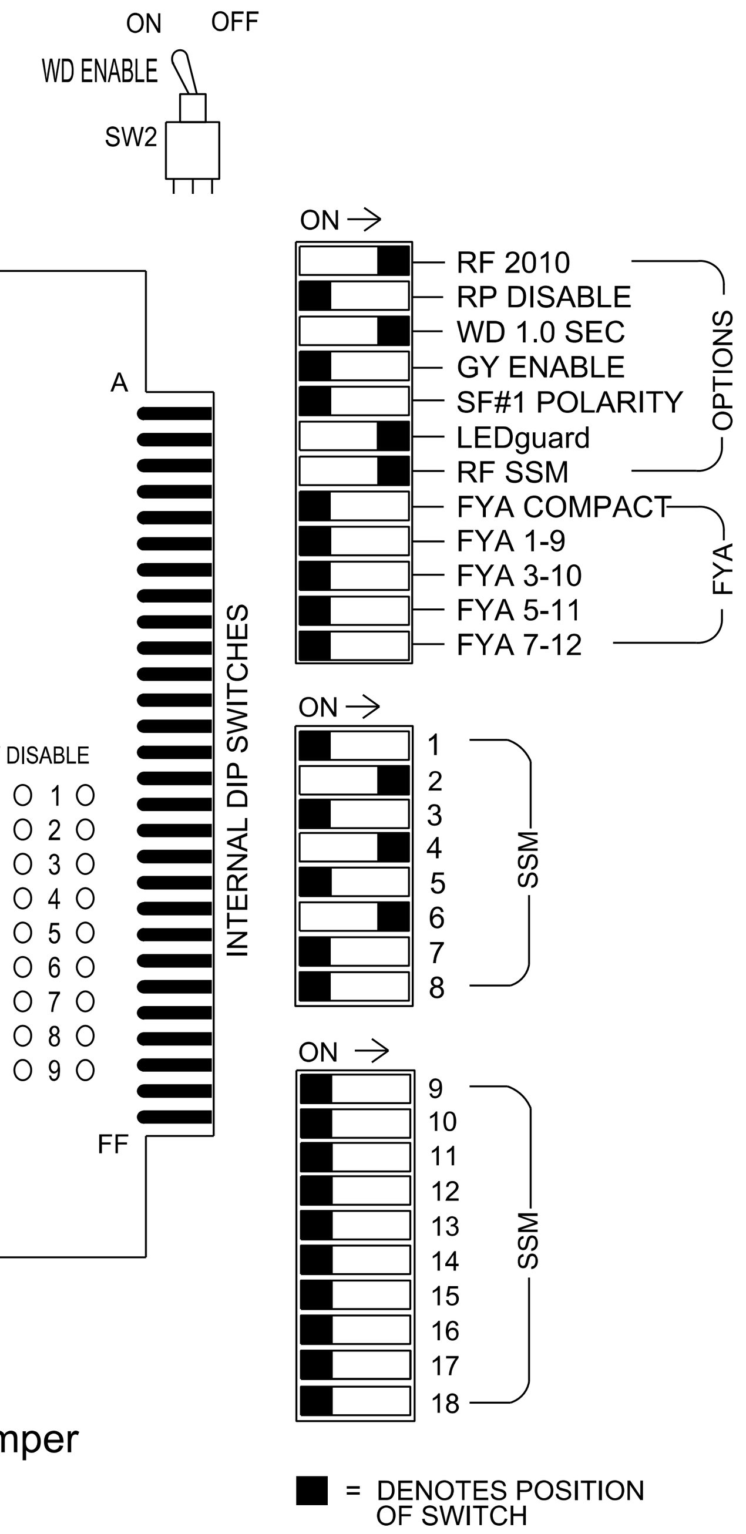
jbvoso

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 2-6.





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. Integrate monitor with Ethernet network in cabinet.

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. Install 332_NCDOT_HAWK_Default database onto controller.
3. Program controller to start up in phase 2 Green No Walk and 6 Green No Walk.
4. Program phase 4 for No Startup Veh Call and No Startup Ped Call.
5. Program phase 4 for Ped Clear During Red Clear.

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, S3, S5, S8
Phases Used.......................................2, 4, 4PED**, 6
Overlap "1"..Not Used
Overlap "2"..Not Used
Overlap "3"..Not Used
Overlap "4"..Not Used

** Phase used for timing purposes only.

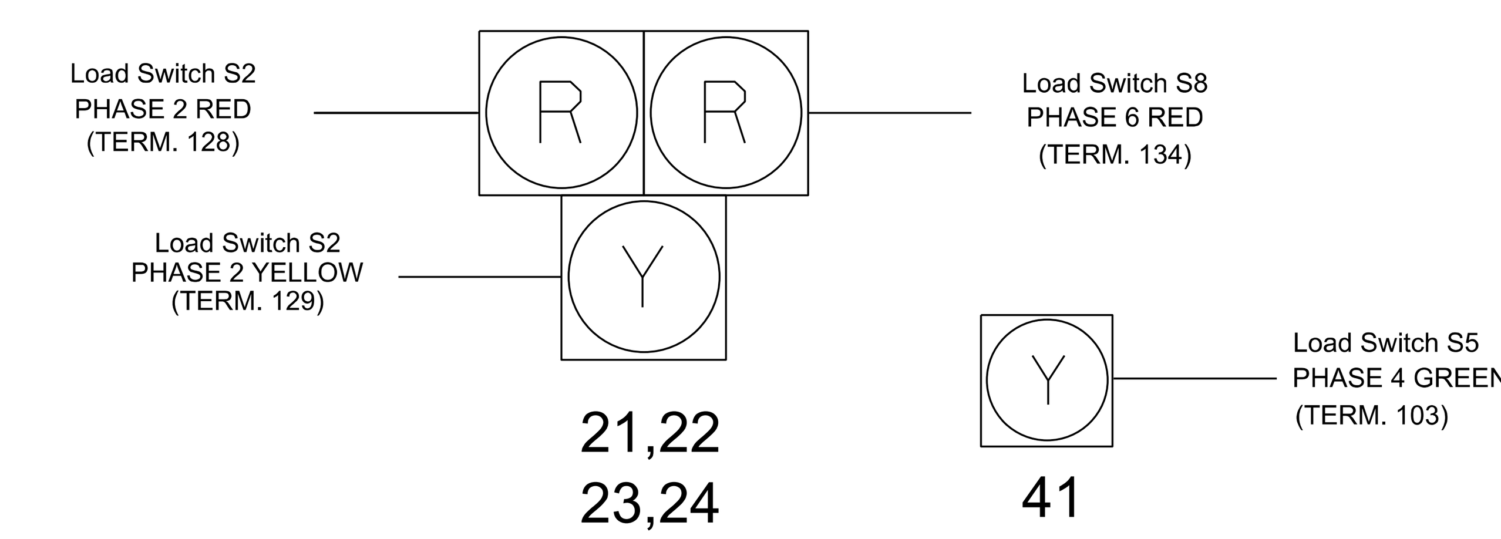
SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3		S4	S5	S6	S7	S8	S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13		3	4	14	5	6	15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	EVP 2	3	4	4 PED	5	6	6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	21,22 23,24	NU	FIRE PILOT LAMP	NU	41	NC	NU	21,22 23,24	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED		128				*			134										
YELLOW		129				*			*										
GREEN		*				103			*										
RED ARROW																			
YELLOW ARROW																			
FLASHING YELLOW ARROW																			
GREEN ARROW																			
(DON'T WALK hand symbol)																			
PED YELLOW				* 114															
(WALK symbol)			*																

NU = Not Used
NC = No Connection
* Denotes install load resistor. See load resistor installation detail this sheet.
Note: Load Switch S3 Yellow is used to drive the fire station pilot lamp. See Sheet 3 for wiring details.

SIGNAL HEAD WIRING DETAIL

(wire signal heads as shown)



INPUT FILE POSITION LAYOUT

(front view)

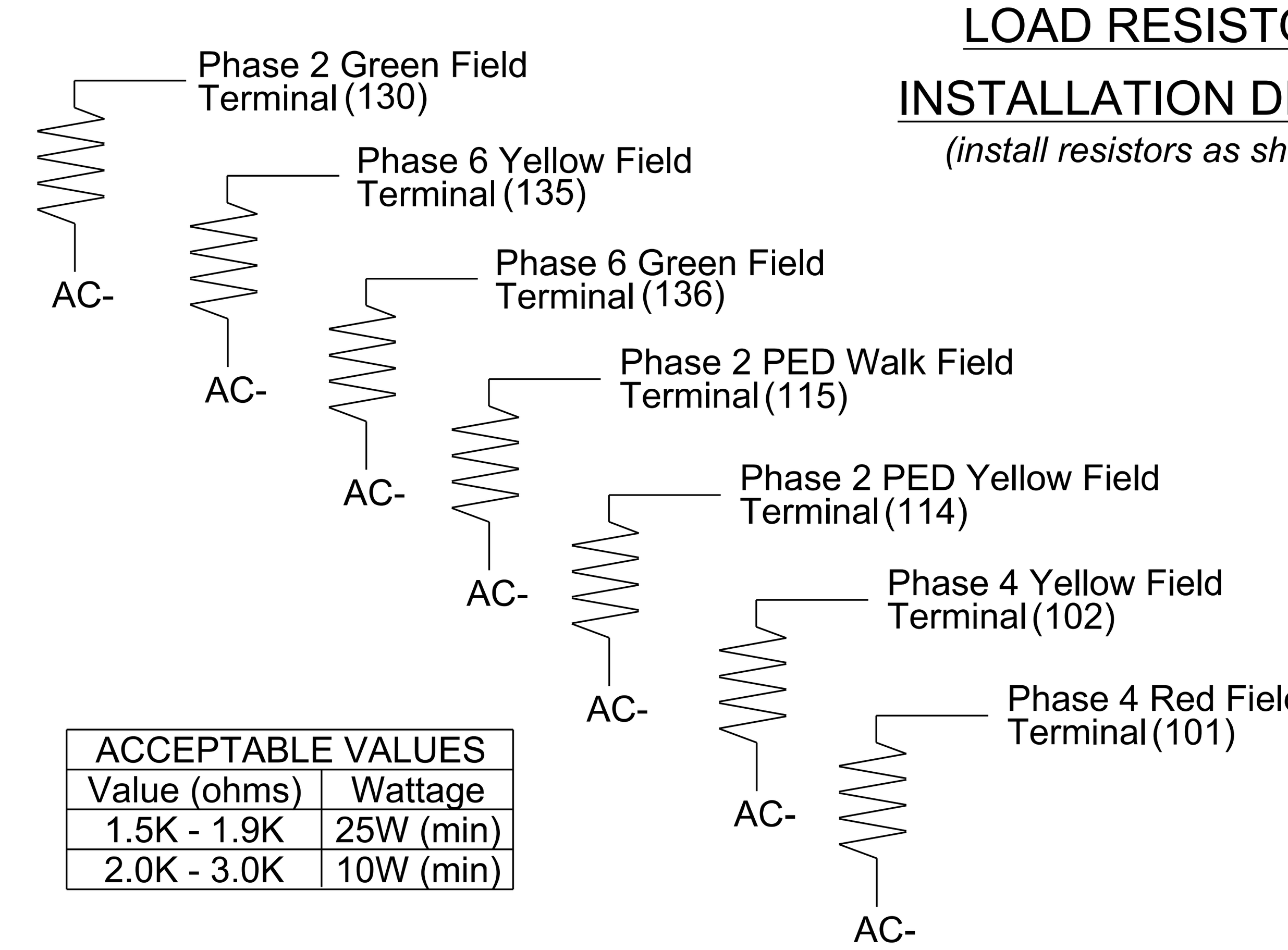
		1	2	3	4	5	6	7	8	9	1O	11	12	13	14
FILE "I"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	FS DC ISOLATOR
	L														ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	NOT USED
	L														PRE2 AC ISOLATOR

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

FS = FLASH SENSE
ST = STOP TIME
PRE = PREEMPT

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown)



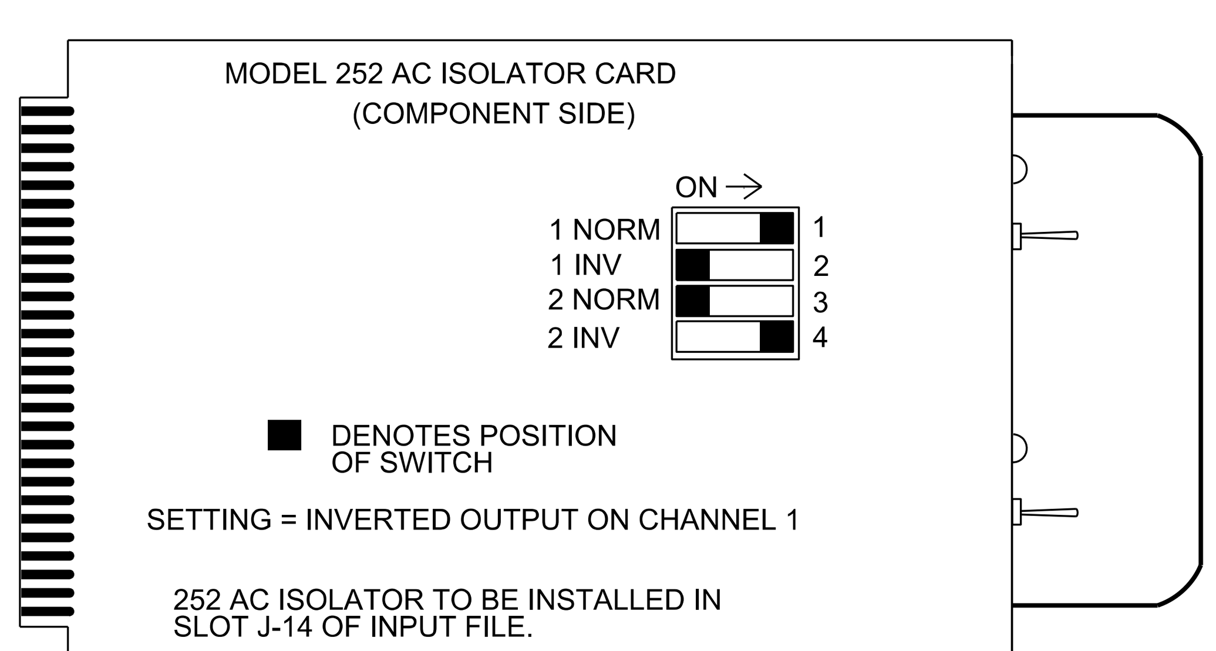
ACCEPTABLE VALUES	
Value (ohms)	Wattage
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)

TIMING INTERVAL

PHASE 2+6 GREEN = Dark Display
PHASE 2+6 PRE CLEARANCE = Flashing Yellow Time
PHASE 2+6 YELLOW CHANGE = Solid Yellow Time
PHASE 2+6 RED CLEAR = Steady Red DIsplay
PHASE 4 PED CLEAR = Alternating Flashing Red Display
PHASE 4 YELLOW CHANGE = Alternating Flashing Red Display
PHASE 4 RED CLEAR = Alternating Flashing Red Display

PREEMPT 2 AC ISOLATOR (MODEL 252) OUTPUT PROGRAMMING DETAIL

(set DIP switches as shown below)



THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-1304
DESIGNED: October 2023
SEALED: 4/1/2024
REVISED: NA

Mattern & Craig
CONSULTING ENGINEERS • SURVEYORS
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FAX (828) 254-4562

Electrical Detail - Sheet 1 of 3

Electrical and Programming Details For:

US 64 (Brevard Road)
at
Valley Hill Fire & Rescue

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

Division 14 | Henderson County | Laurel Park

PLAN DATE:	October 2023	REVIEWED BY:	JB Voso
PREPARED BY:	KG Eudy	REVIEWED BY:	

REVISIONS	INIT.	DATE

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NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
DocuSigned by: James Voso
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4/1/2024
DATE

SIG. INVENTORY NO. 14-1304

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 6.2

LOGIC PROCESSOR PROGRAMMING

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

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

Modify Program 1 as shown below and save changes.

Program 1

Statement	Result	Index	Operation	Parameter A	Index	Parameter B	Index	Delay	Ext
21	Phase Phase Omit	4	Result=!A	Preempt Status	2	None	0	0.0	0.0
22	Global Variable	33	Result=(A OR B)	Preempt Input	2	Preempt Status	2	0.0	0.0

LOGIC STATEMENT DESCRIPTION

Statement 21 Description: Omits phase 4 while not in preemption.

Statement 22 Description: Turns pilot lamp on when button is pushed.

PREEMPTION PROGRAMMING

Front Panel
Main Menu >Controller >Preemption >Preempt Phasing/Preempt Parameters

Web Interface
Home >Controller >Preempt Configuration >Preempts

Preempt Configuration

Preempt	2
Enabled	Enabled
Type	Emergency Veh
Track Phases	-
Track Overlaps	-
Dwell Phases	4
Dwell Peds	4
Dwell Overlaps	-
Cycling Phases	-
Cycling Overlaps	-
Exit Phases	2
Exit Overlaps	-
Delay	*
Max Presence	120
Max Pres Act	Terminate
Enter Min Green	1
Enter Walk	255
Enter Ped Clear	255
Enter Yellow Change	25.5
Enter Red Clear	25.5
Track Green	0
Track Yellow Chane	25.5
Track Red Clear	25.5
Dwell Green	0
Exit Min Green	255
Exit Yellow Change	25.5
Exit Red Clear	25.5
Dwell Ext Time	0.0
Exit Type	Exit Phases
Not Ovrd Flash	X
Not Ovrd Nxt Pre	-
Track Clear Ovrd	X
Ped Clear During Yellow	-
Require All Red Entry	

* The Division Traffic Engineer will determine the Delay before Preempt time.

OPERATIONAL NOTES

1. In order for the controller to perform the Emergency Vehicle Hybrid Beacon (HAWK signal) sequence, the 332_NCDOT_HAWK_Default databasae must be installed on the controller.

2. The Logic Processor flashes Phase 2 Yellow during the Phase 2 Pre-Clearance interval. Phase 2 Yellow drives the solid yellow signal face during the Phase 2 vehicle Yellow Change.

3. The Phase 2 and Phase 6 Red outputs drive the solid Red displays during the Phase 2 and 6 Red Clear. The Logic Processor flashes Phase 2 and 6 Red Outputs in a wig-wag pattern during Phase 4 Ped Clear interval.

4. The controller must be programmed for Ped Clear During Red for Pedestrian Phase 4 so that the Red displays continue to flash during Phases 4 Yellow Change and Red Clear.

5. Make sure all Phase 2 and Phase 6 timings match each other.

OUTPUT POINTS PROGRAMMING

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

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

Modify IO Module 1 as shown below and save changes.

IO Module 1

Output Point	Description	Output Control Type	Index
33	C1-35	Global Variable	33

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-1304
DESIGNED: October 2023
SEALED: 4/1/2024
REVISED: NA

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Electrical Detail - Sheet 2 of 3

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Electrical and Programming Details For:

US 64 (Brevard Road)
at
Valley Hill Fire & Rescue

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

Division 14 | Henderson County | Laurel Park

PLAN DATE: October 2023 | REVIEWED BY: JB Voso
PREPARED BY: KG Eudy | REVIEWED BY:

REVISIONS	INIT.	DATE

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NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
DocuSigned by: James Voso
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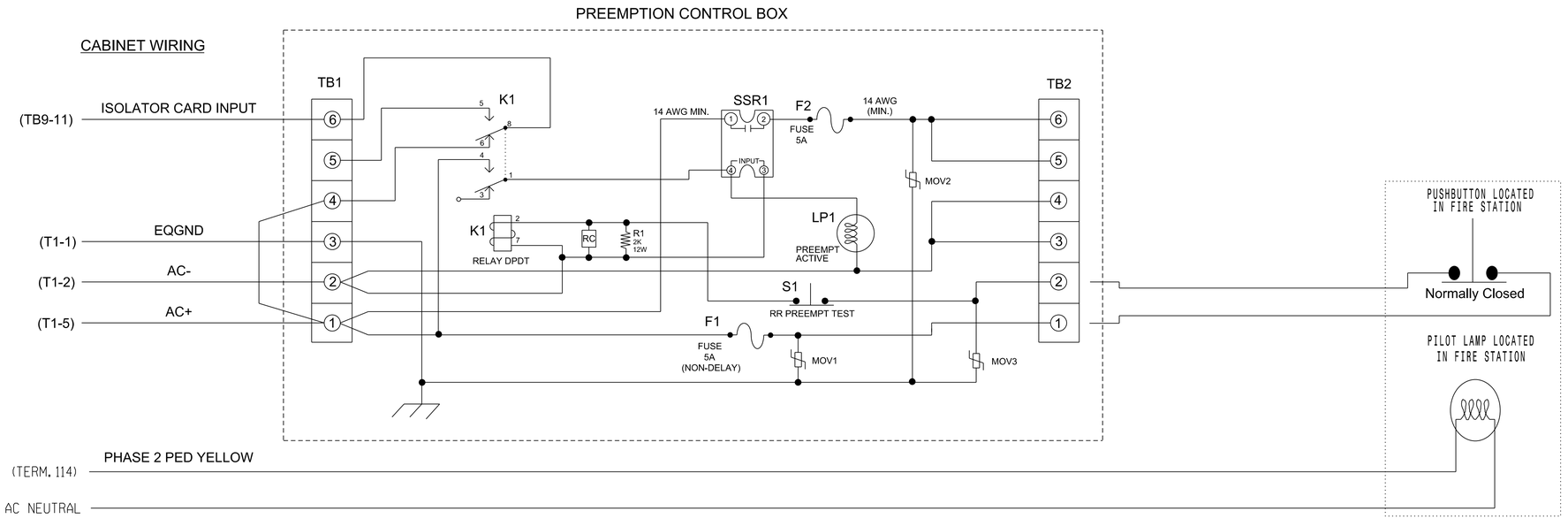
4/1/2024
DATE

SIG. INVENTORY NO. 14-1304

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 6.3

EMERGENCY VEHICLE PREEMPTION WIRING DETAIL

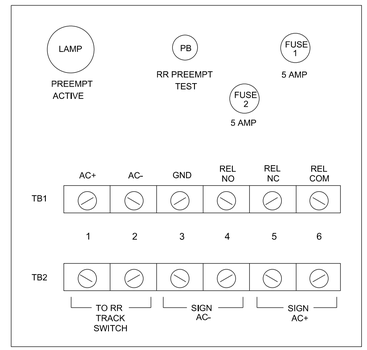
(wire as shown below)



NOTES

1. Relay K1 is shown in the energized (Preempt not active) normal operation state.
2. Relay K1 is a DPDT with 120VAC coil with octal base.
3. Relay SSR1 is a SPST (normally open) Solid State Relay with AC input and AC (25 amp) output.
4. AC Isolator Card shall activate preemption upon removal of AC+ from the input (as shown above). To accomplish this set invert dip switch on AC Isolator Card.
5. IMPORTANT!! A jumper must be added between input file terminals J14-E and J14-K if not already present. Also, terminal TB9-12 (on input panel) shall be connected to AC neutral (jumper may have to be added).

FRONT VIEW



Electrical Detail - Sheet 3 of 3

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THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-1304
DESIGNED: October 2023
SEALED: 4/1/2024
REVISED: NA

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FIRM LICENSE No. C-1154
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FAX (828) 254-4562

Electrical and Programming Details For:

Prepared for the Offices of:

Transportation Mobility and Safety Division
STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Traffic & Signals Management Section

750 N. Greenfield Pkwy, Garner, NC 27529

US 64 (Brevard Road)
at
Valley Hill FIre & Rescue

PLAN DATE: October 2023	REVIEWED BY: JB Voso
PREPARED BY: KG Eudy	REVIEWED BY:

REVISIONS	INIT.	DATE

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NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO

DocuSigned by: James Voso 140FD60376E041F...

4/1/2024
DATE

SIG. INVENTORY NO. 14-1304

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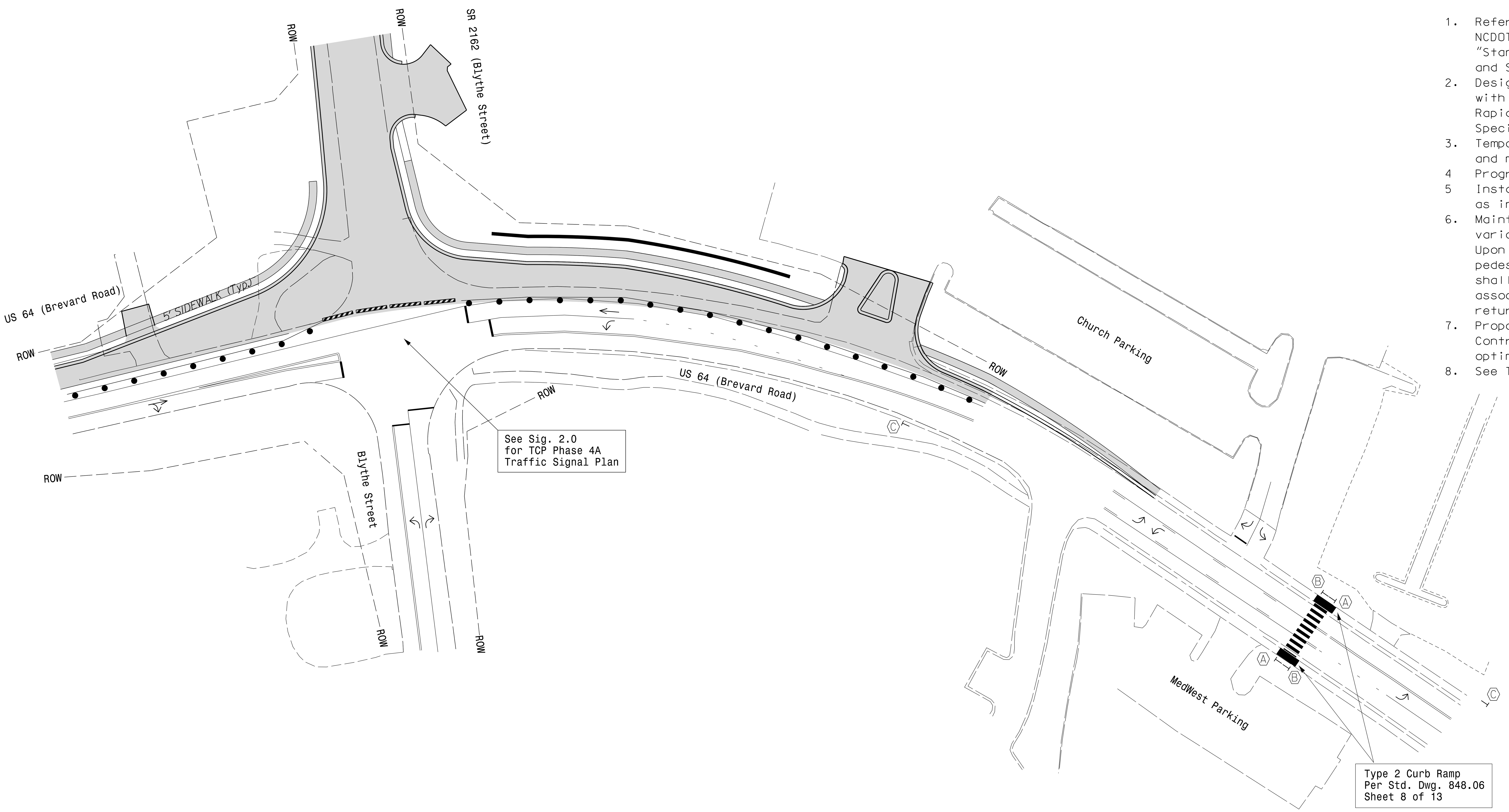
jbvoso

U-5783\Traffic\Signals\Design\Signals\14-1304 (Fire Station)\U5783_140002.dgn

U-5783\MO6 US 64 Widening (U-5783)

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 7.0



NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specifications for Roads and Structures" dated January 2024.
2. Design and install RRFB in accordance with Standard Drawing for "Rectangular Rapid Flashing Beacon" and applicable Special Provisions.
3. Temporary RRFB's shall be solar powered and mounted using 3-lb U-channel posts.
4 Program flashing operation for 18 seconds.
5 Install ADA-compliant wheelchair ramps as indicated on plan.
6. Maintain temporary RRFB crossing during various phases of traffic control for U-5783. Upon installation of final traffic signal and pedestrian crossing at 14-0002, Contractor shall deactivate RRFB's, remove all signs and associated hardware, remove crosswalk and return sidewalk to original condition.
7. Proposed signs Ⓒ are shown for reference. Contractor shall field locate for optimal visibility and proper distance.
8. See Traffic Control Plans for more details.

LEGEND

PROPOSED		EXISTING
	10' Wide Hi-Vis Crosswalk	NA
	Sign	NA
	Type II Signal Pedestal	
Ⓐ	Pedestrian Crossing Sign (W11-2) with Downward Diagonal Arrow (W16-7P L)	Ⓐ
Ⓑ	Pedestrian Crossing Sign (W11-2) with Downward Diagonal Arrow (W16-7P R)	Ⓑ
Ⓒ	Pedestrian Crossing Sign (W11-2) with "AHEAD" Plaque (W16-9P)	Ⓒ
	Directional Arrow	
	Construction Zone	
	Construction Zone Drums	
	Road Closure Barricades	

Temporary RRFB - TCP Phase 4A

Mattern & Craig
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(828) 254-2201
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NC LIC. NO. C-1154

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'

Temporary Rectangular Rapid Flashing Beacon (RRFB) Crossing

Division 14 Henderson County Hendersonville

PLAN DATE:	September 2023	REVIEWED BY:	JB Voso
PREPARED BY:	KG Eudy	REVIEWED BY:	

REVISIONS	INIT.	DATE

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SIGNATURE 4/1/2024 DATE

SIG. INVENTORY NO. RRFB

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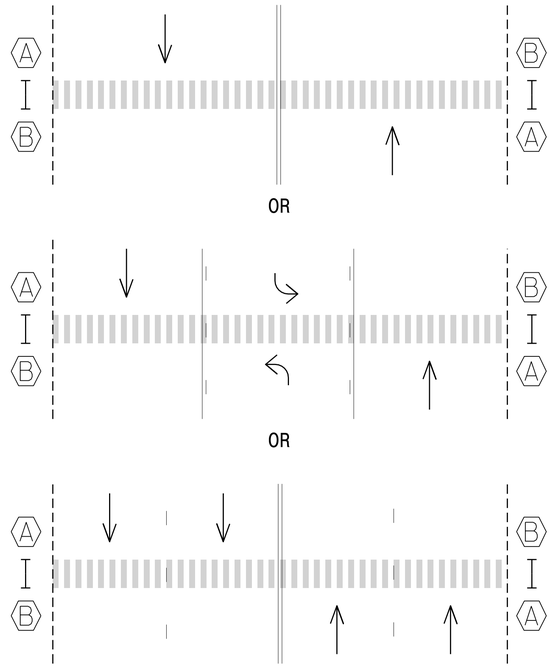
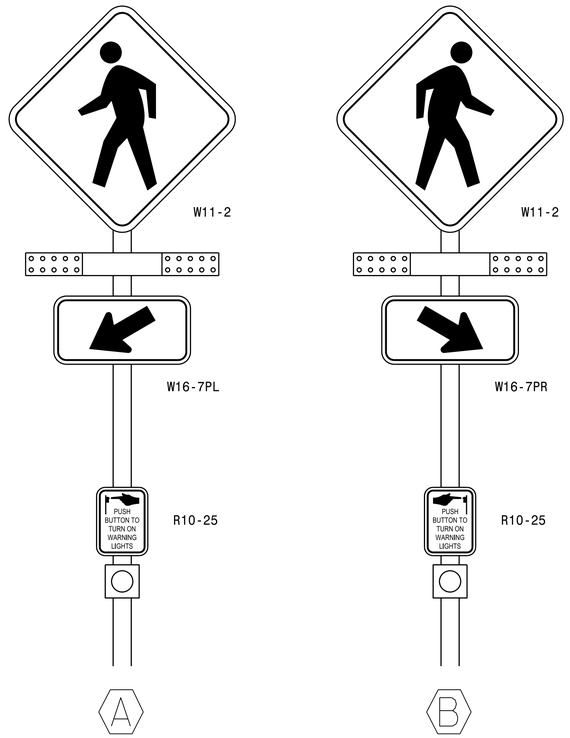
jbvoso

PROJECT REFERENCE NO.	SHEET NO.
U-5783	Sig. 7.1

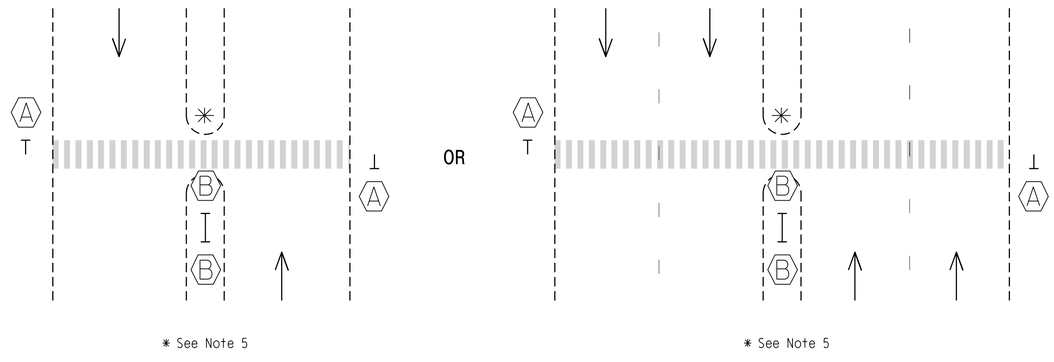
Two to Four Lanes, Undivided



RRFB Sign Detail



Two or Multi-Lanes, Divided



✳ See Note 5

✳ See Note 5

Notes

1. Design the RRFB in accordance with the 2009 MUTCD Interim Approval 21 -- Rectangular Rapid-Flashing Beacons at Crosswalks. The RRFB unit associated with a post-mounted sign and plaque should be located between the pedestrian crossing warning (W11-2) sign and the supplemental downward diagonal arrow plaque (W16-7p).
2. If sight distance approaching the crosswalk is deemed insufficient, a supplemental RRFB with an "AHEAD" (W16-9P) plaque may be installed on that approach in advance of the crosswalk.
3. When practical, the RRFB and mounting post on the right side of the road shall be mounted on the approach side of the crosswalk closest to approaching traffic.
4. When practical, the RRFB and mounting post on the left side of the road may be mounted on the back of the post for the opposing approach.
5. A RRFB on the left side of the roadway or in the median may be individually mounted on the approach side of the crosswalk closest to approaching traffic, or, when practical, may be mounted back to back on the same post and mounted on either side of the crosswalk in the median.
6. Locate push button sign (R10-25) and push button to face crosswalk, even if it is mounted on the back side of the sign.
7. All RRFB units associated with a given crosswalk (including those with an advance crossing sign) shall, when actuated, simultaneously commence operation of their rapid-flashing indications and shall cease operation simultaneously.

Timing of RRFBs

When actuated, the two yellow indications in each RRFB unit shall flash in a rapidly flashing sequence.

The RRFB shall flashing sequence shall provide enough time for pedestrians to cross from curb to curb. It is recommened to be a minimum of 7 seconds plus the crossing distance (D) divided by 3.5 feet/per sec., rounded up to the next whole second:

$$\text{Flash Time (sec.)} = 7 + D/3.5$$

RRFBs shall provide 75 flashing sequences per minute. During each 800-millisecond flashing sequence, the left and right RRFB indications shall operate using the following sequence:

- The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- Both RRFB indications shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 50 milliseconds.
- Both RRFB indications shall be illuminated for approximately 50 milliseconds. Both RRFB indications shall be dark for approximately 250 milliseconds.

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Standard Drawing for Rectangular Rapid Flashing Beacon

Prepared in the Offices of:

Transportation Mobility and Safety Division
STATE OF NORTH CAROLINA · DEPARTMENT OF TRANSPORTATION
Signal Design Section

750 N. Greenfield Parkway
Garner, NC 27529

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by:

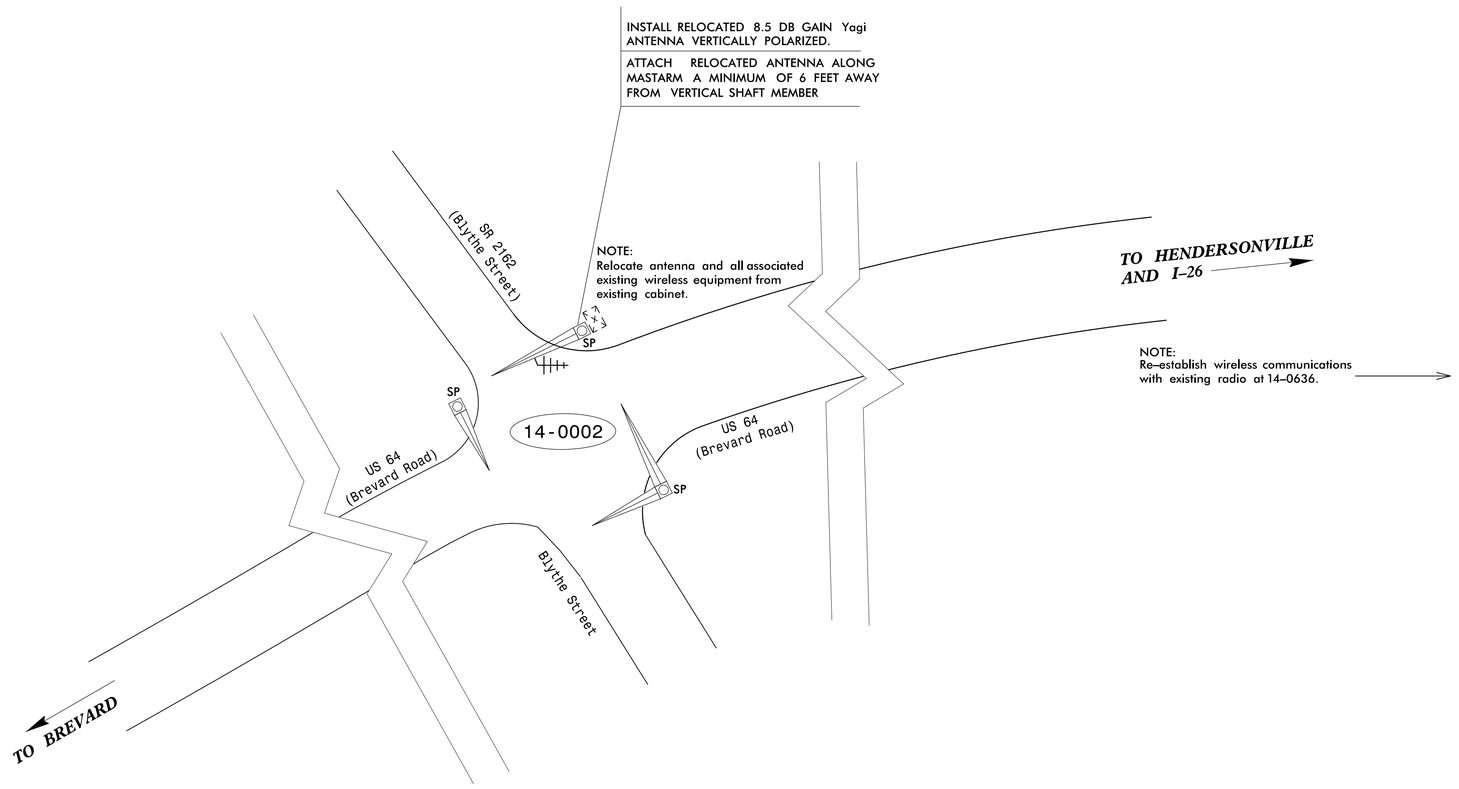
SIGNATURE — 12/19/2022 DATE

19-DEC-2022 15:47
S:\Traffic\Signals\Signal Design Section\Central Region\Rob's Files\RRFB Stds\rrfb.dgn
rziemba

PROJECT REFERENCE NO.	SHEET NO.
U-5783	SCP-01

LEGEND

NEW		EXISTING
	YAGI ANTENNA (DOUBLE) FOR REPEATER OPERATION	
	YAGI ANTENNA (SINGLE)	
	OMNI ANTENNA	
SP	SIGNAL POLE	SP
XX–XXXX	SIGNAL INVENTORY NUMBER	XX–XXXX
	METAL POLE	
	METAL POLE WITH MAST ARM	
	CONTROLLER AND CABINET	
G	GATEWAY AND CABINET	G



NOTES:

1. INSTALL COAXIAL CABLE:
   A. ON WOOD POLES REQUIRING A NEW RIGID GALVANIZED STEEL RISER, INSTALL 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, THE METAL POLE OR MAST ARM AND THE ANTENNA, SECURE THE COAXIAL CABLE TO THE STRUCTURE USING 3/4" STAINLESS STEEL STRAPS EVERY 12".
2. IF AN EXISTING 2" SPARE RIGID GALVANIZED STEEL RISER IS AVAILABLE, INSTALL THE COAXIAL CABLE IN THE SPARE RISER.
3. INSTALL WIRELESS ANTENNA ON POLE WITH RF WARNING SIGN. (NOTE: RF WARNING SIGN NOT REQUIRED WHEN ANTENNA IS INSTALLED ON AN NCDOT–OWNED POLE.)
4. MAINTAIN PROPER CLEARANCE FROM ALL UTILITIES PER THE NATIONAL ELECTRICAL SAFETY CODE (NESC).
5. INSTALL WIRELESS SERIAL RADIO MODEM 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. REFERENCE "WIRELESS RADIO ANTENNA TYPICAL DETAILS."
7. FIVE (5) DAYS PRIOR TO BEGINNING WORK ON SIGNAL SYSTEM, CONTACT THE DIVISION TRAFFIC ENGINEER AT 828–631–1185. NOTIFY THE DIVISION TRAFFIC ENGINEER AFTER ALL WORK IS PERFORMED TO ENSURE THAT ALL WIRELESS CIRCUITS ARE FUNCTIONING PROPERLY. WORK IS NOT COMPLETE UNTIL ALL SIGNALS ARE COMMUNICATING WITH THE CENTRAL SYSTEM.

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FAX (828) 254-4562

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

D14-06 Hendersonville Wireless Communications Plan

Division 14 Henderson County Hendersonville

PLAN DATE:	September 2023	REVIEWED BY:	JBV
PREPARED BY:	BGR	REVIEWED BY:	

SCALE: 0 NTS

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022599 ENGINEER JAMES B. VOSO
Digitally signed by James Voso
140FD60379ED45F...
4/1/2024
SIGNATURE DATE

CADD Filename: 14-0002

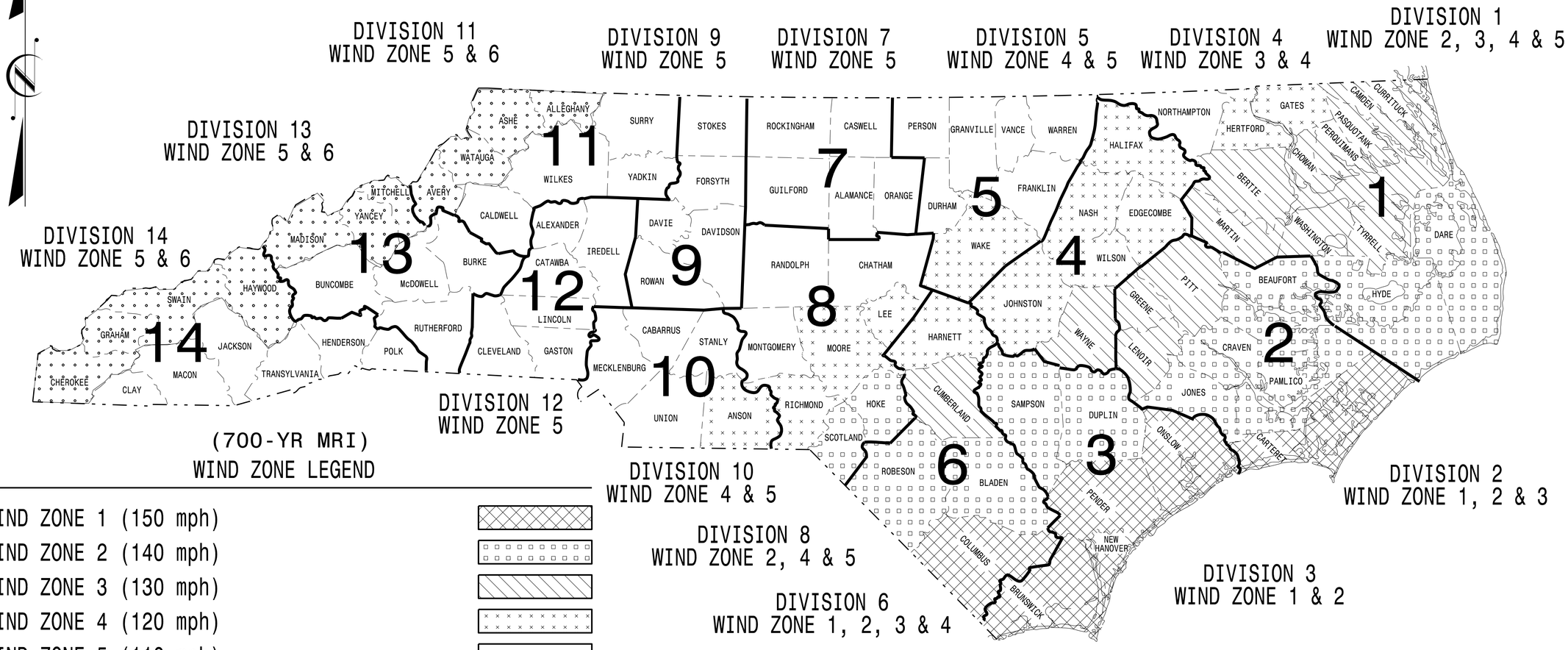
PROJECT I.D. NO.	SHEET NO.
U-5783	Sig.M1A

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)

POLE STANDARDS

NCDOT METAL POLES



(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
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

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
4B23DC79B378ADA...
09/21/2023
DATE

21-SEP-2023 08:20
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kcdurigon

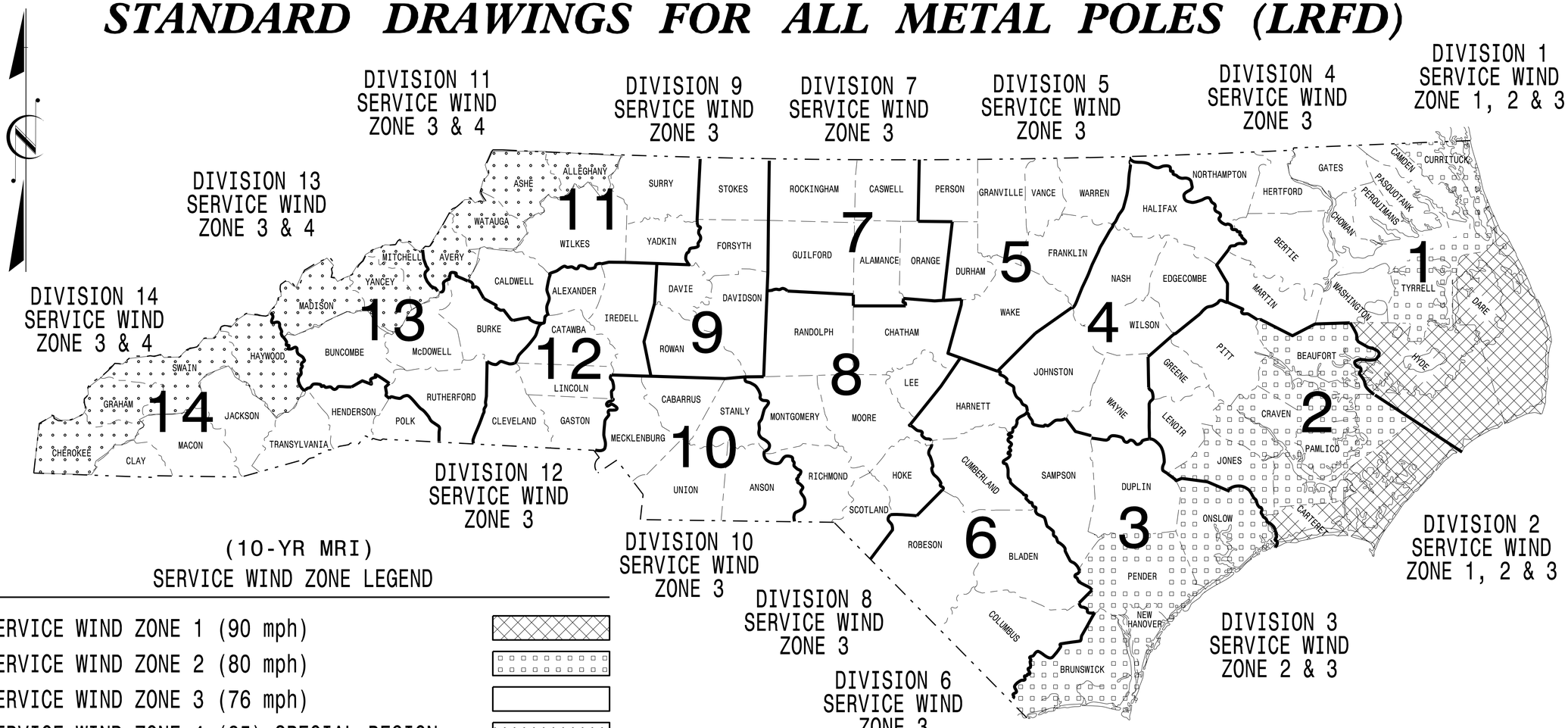
POLE STANDARDS

NCDOT METAL POLES

PROJECT I.D. NO.	SHEET NO.
U-5783	Sig.M1B

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)



(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
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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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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
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09/21/2023
DATE

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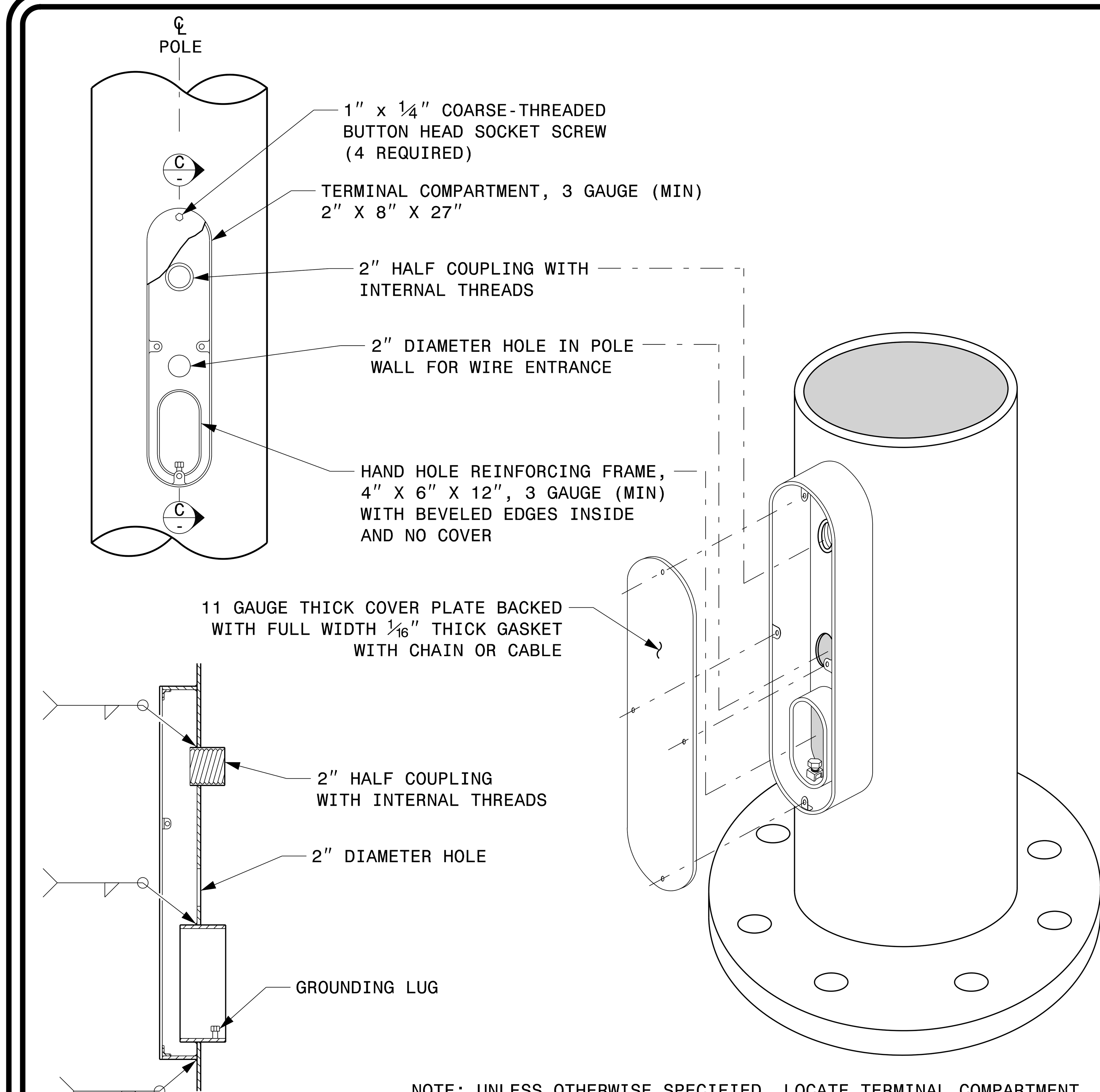
Kcdurigon

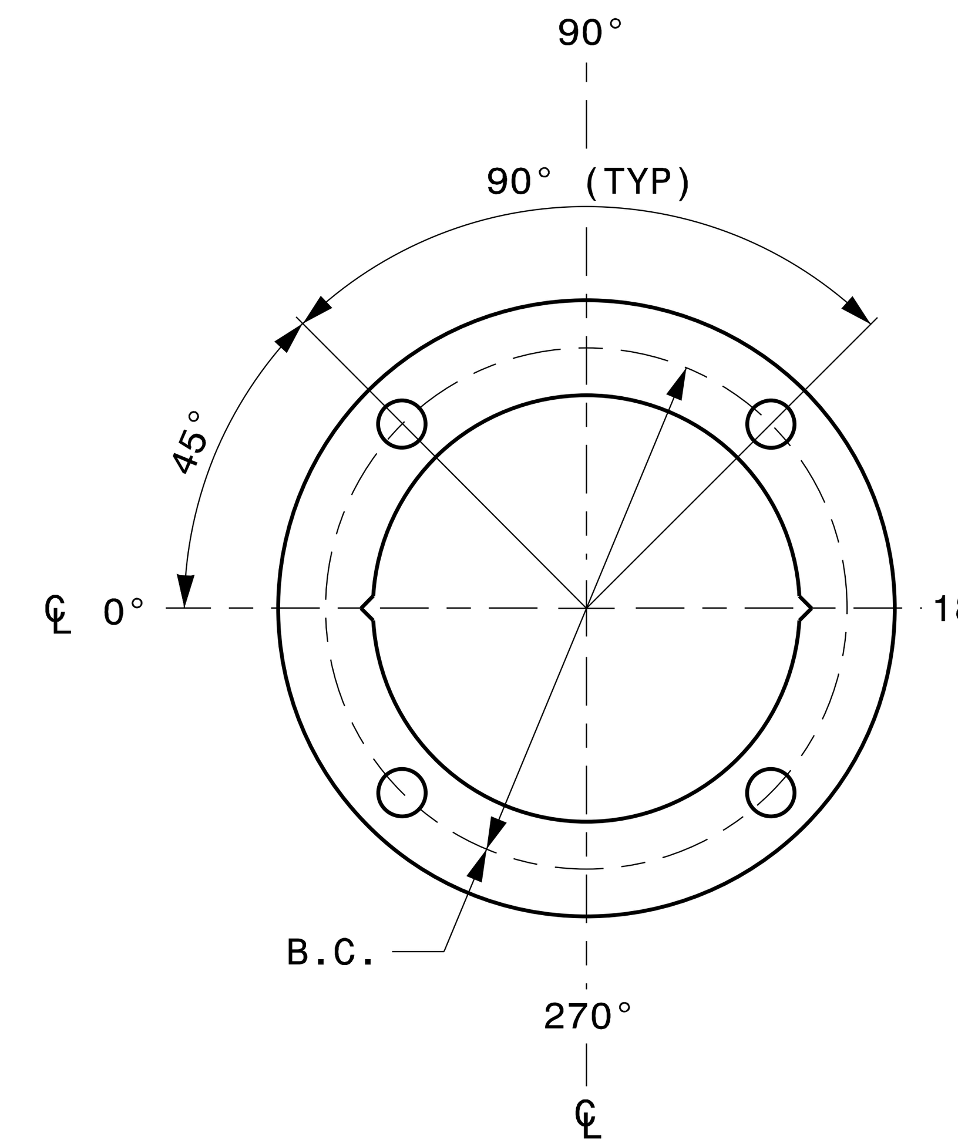
PROJECT I.D. NO.	SHEET NO.
U-5783	Sig.M2

Fabrication Details – All Metal Poles

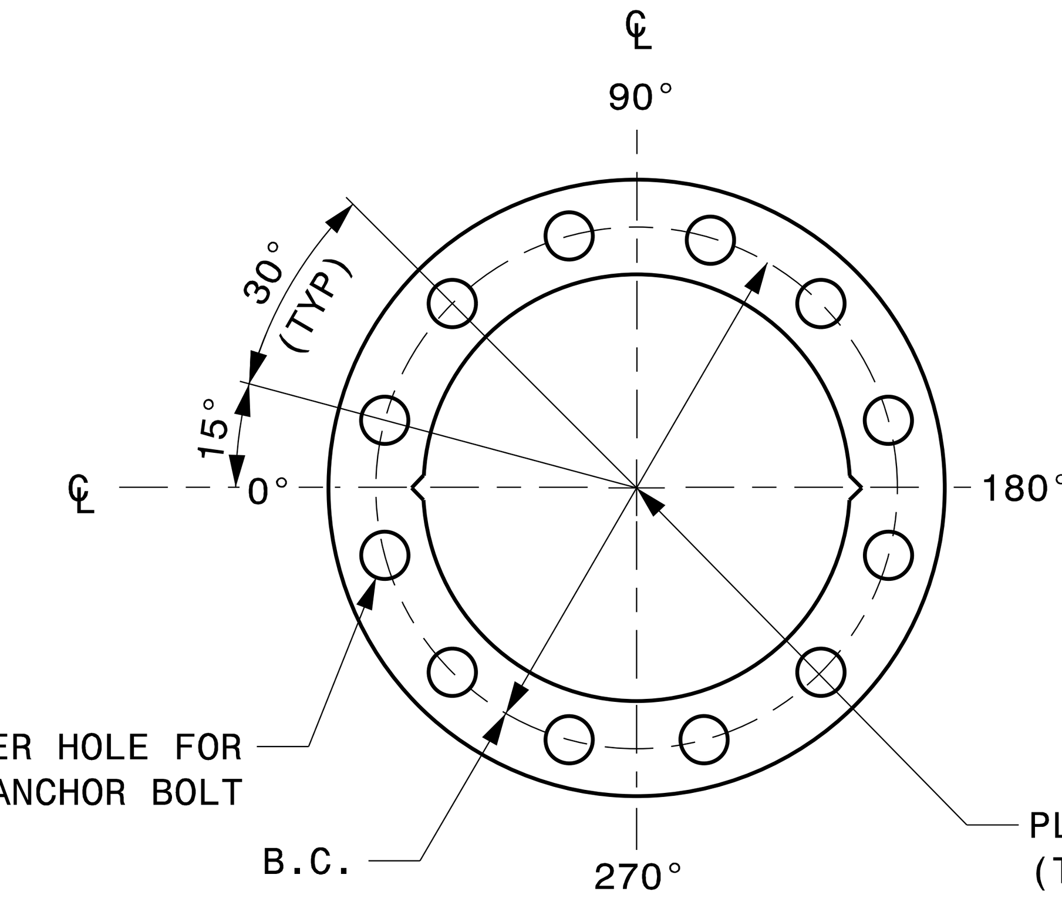


NOTE: UNLESS OTHERWISE SPECIFIED, LOCATE TERMINAL COMPARTMENT 1 FOOT ABOVE THE POLE BASE AT 180 DEGREES ON THE POLE'S RADIAL INDEX.

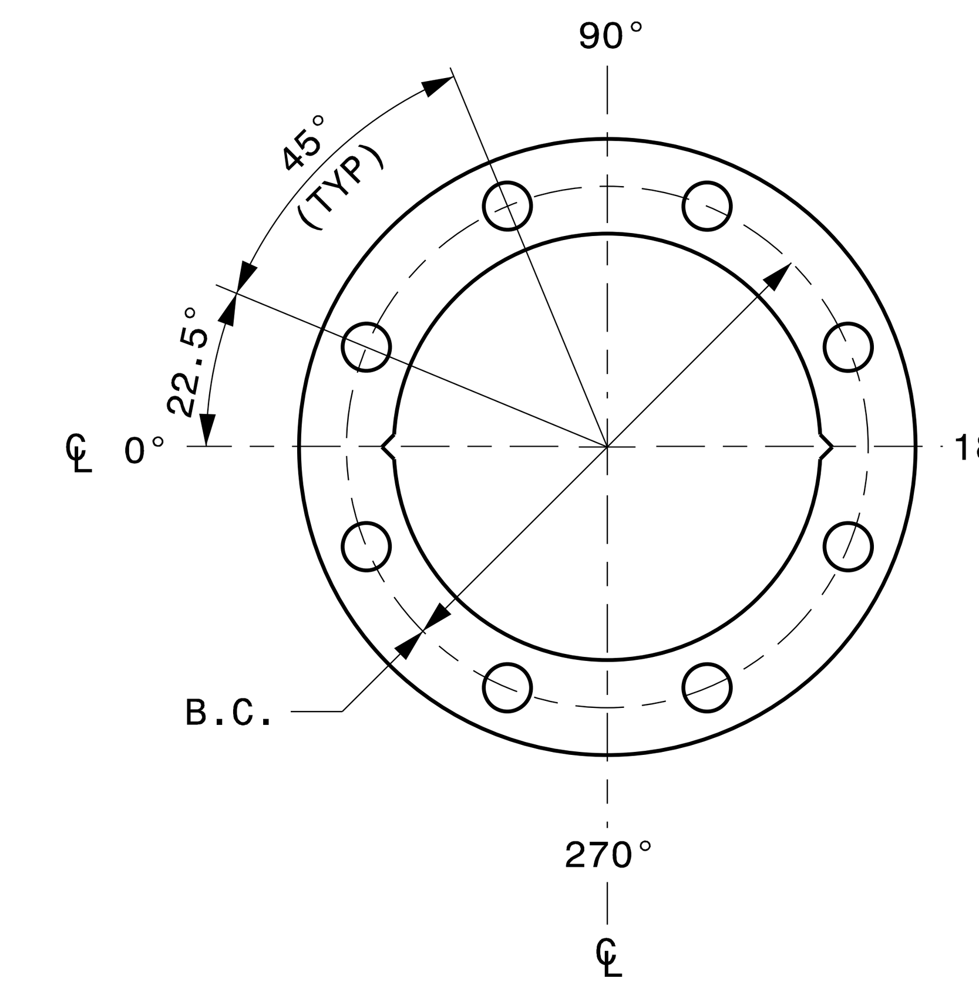
TERMINAL COMPARTMENT DETAIL



4 BOLT PATTERN



12 BOLT PATTERN



8 BOLT PATTERN

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

BASE PLATE TEMPLATE AND ANCHOR BOLT LOCK PLATE DETAILS

SHAFT I.D. TAG

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)

ARM I.D. TAG

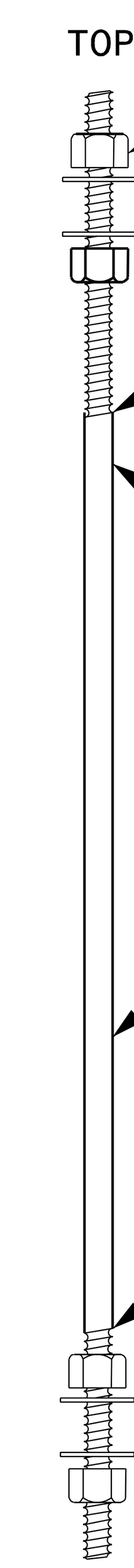
MFG ________ MFG. DATE: MM/YY
SECTION D/T/L/Y ____/____/____/____
NCDOT SIG. INV. NO. __ __ __ __
NCDOT POLE NO. __ __ __ __

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

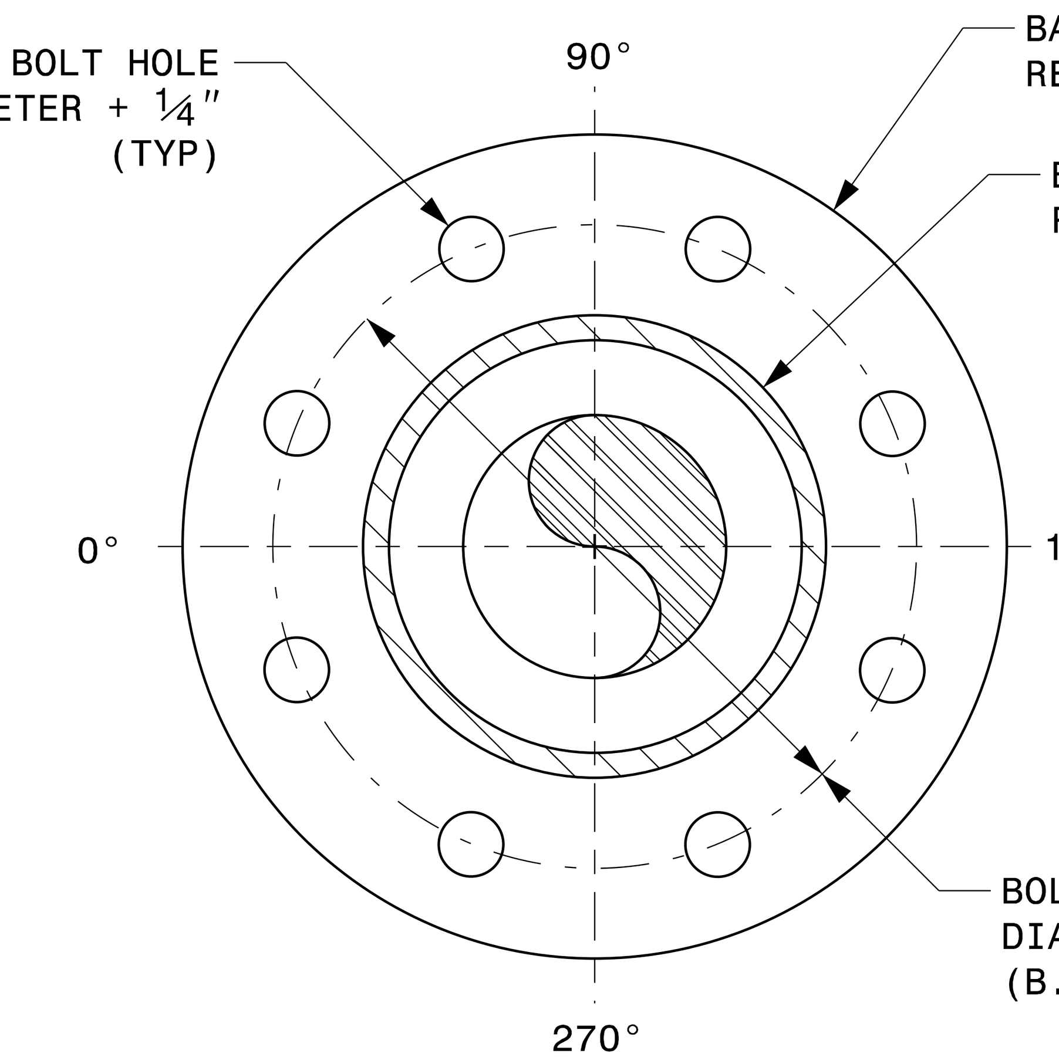
NOTES:

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

SCALE: 0 NA — NONE

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

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036626 ENGINEER KEVIN C. DURIGON

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

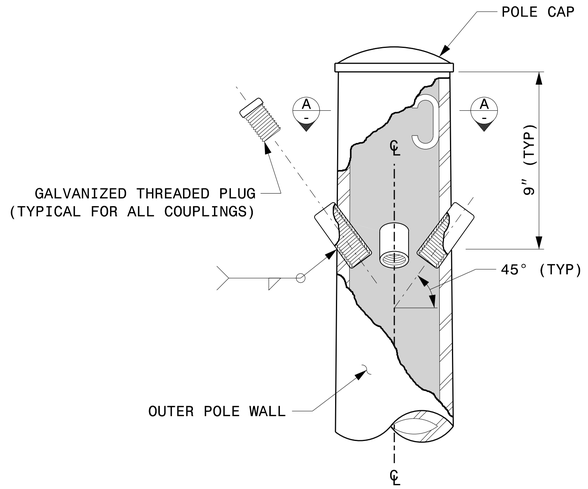
21-SEP-2023 07:56
S:*ITS&SU*ITS Signals*Signal Design Section*Structures*Drawings*2024 Metal Pole Std Drawings for LRFD*2024 Sig-M2 Std. Fabrication Details-All Poles.dgn
kcdurigon

PROJECT I.D. NO.	SHEET NO.
U-5783	Sig.M3

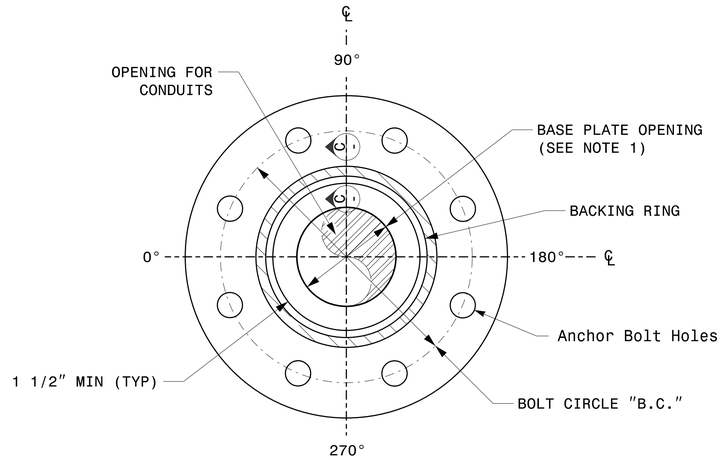
Fabrication Details – Strain Poles

NOTE:

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

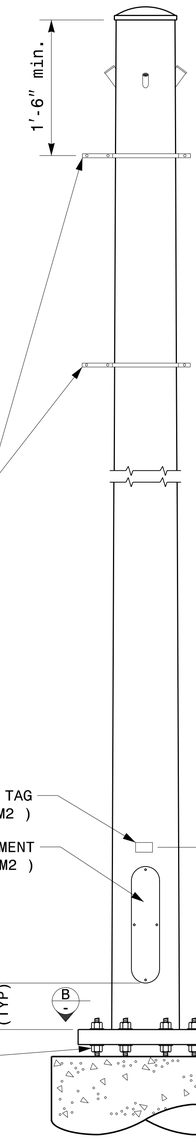


CABLE ENTRANCES AT TOP OF POLE

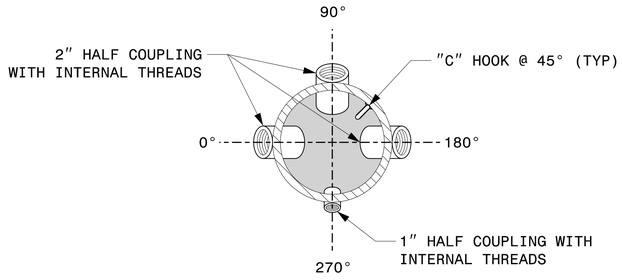


SECTION B-B

POLE BASE PLATE DETAILS
(8 AND 12 BOLT PATTERN)

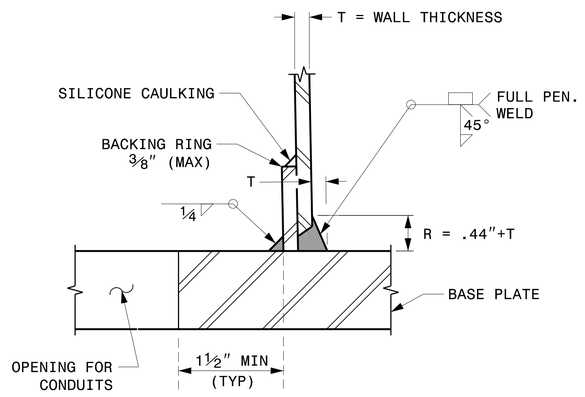


MONOTUBE STRAIN POLE



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

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 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

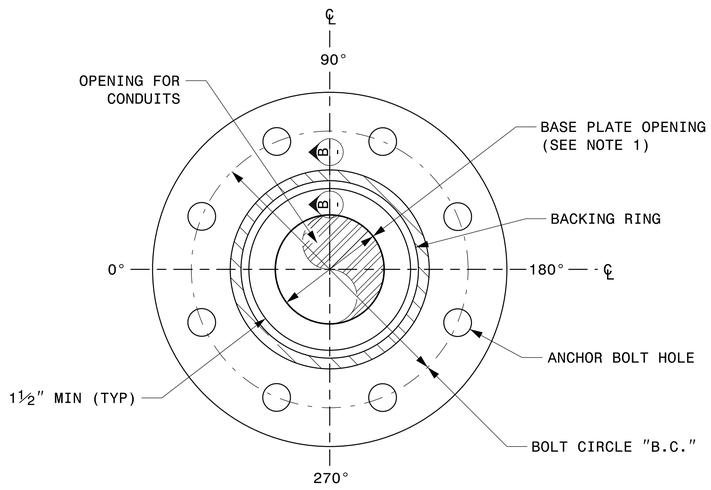
DocuSigned by:
Kevin Durigon
SIGNATURE
4B23DC79B3784DA...
09/21/2023
DATE

03-OCT-2023 12:31
S:\NITSAS\NITS\Signals\Signal Design Sections\Structures\Drawings*2024 Metal Pole Std Drawings for LRFD*2024 Sig.M3 Std. Fabrication Details-Strain Poles.dgn
kcdurigon

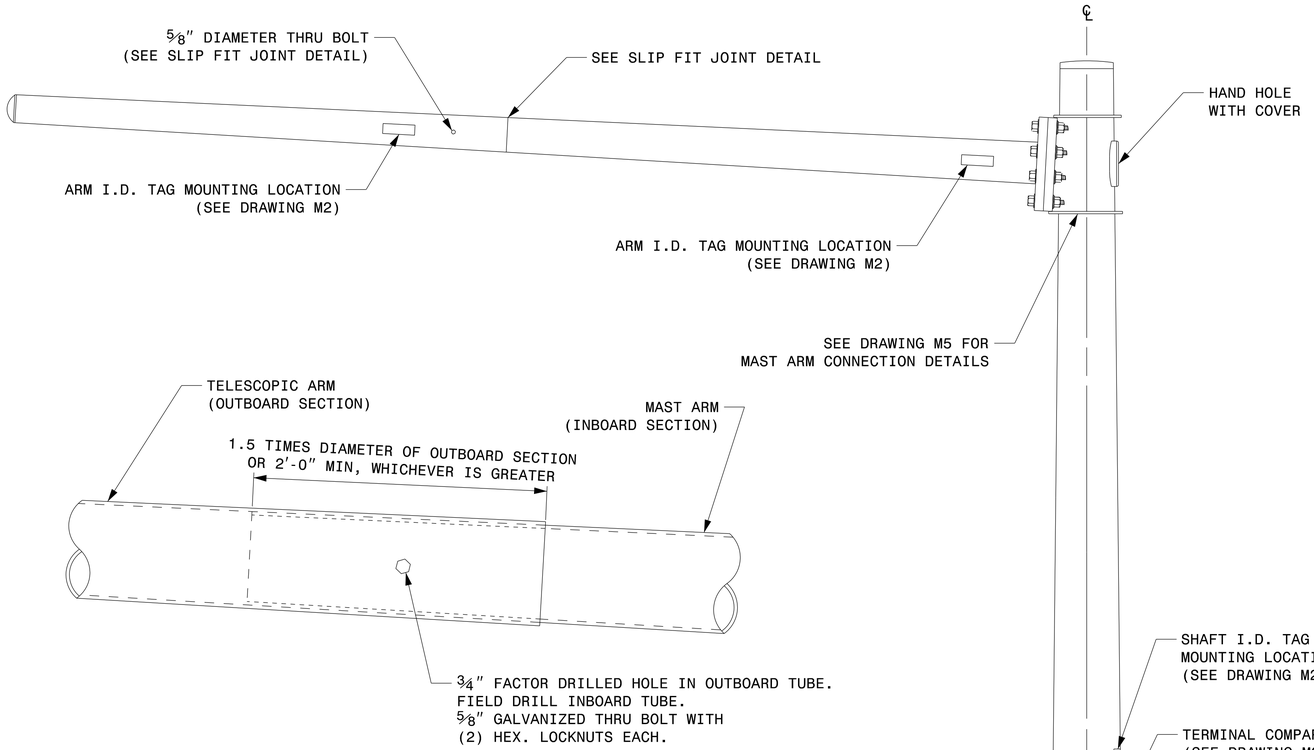
PROJECT I.D. NO.	SHEET NO.
U-5783	Sig.M4

NOTE:

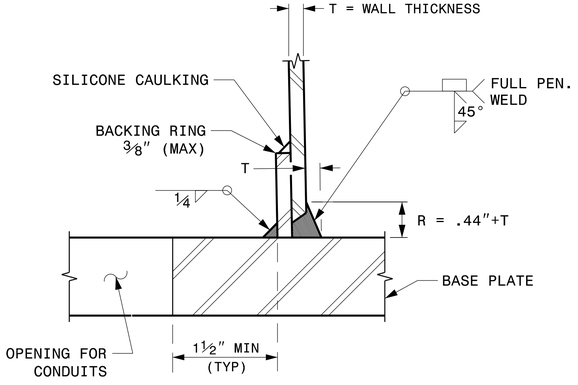
1. OPENING IN POLE BASE PLATE SHALL BE EQUAL TO POLE BASE INSIDE DIAMETER MINUS 3½" BUT SHALL NOT BE LESS THAN 8½".



SECTION A-A
POLE BASE PLATE DETAILS

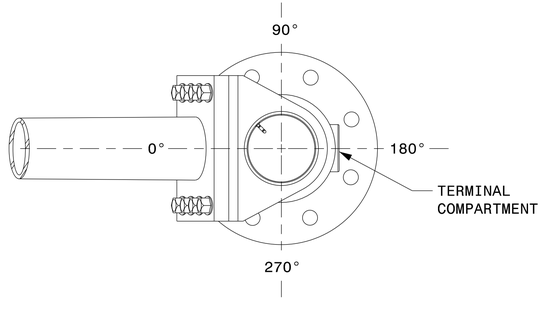


SLIP FIT JOINT DETAIL FOR MAST ARM



SECTION B-B
(POLE ATTACHMENT TO BASE PLATE)

FULL-PENETRATION GROOVE WELD DETAIL



MAST ARM RADIAL ORIENTATION

MAST ARM POLE

Fabrication Details – Mast Arm Poles

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

SCALE
0 NA
NONE

Typical Fabrication Details For Mast Arm Poles

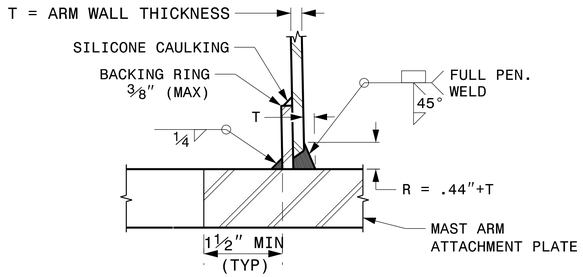
PLAN DATE: SEPTEMBER 2023 DESIGNED BY: K.C. DURIGON
PREPARED BY: K.C. DURIGON REVIEWED BY: D.C. SARKAR

REVISIONS	INIT.	DATE

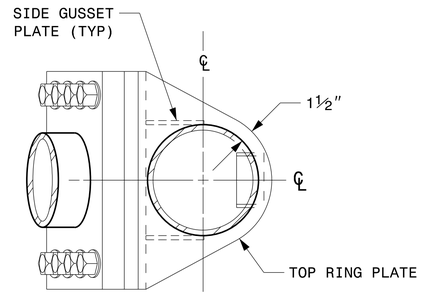
SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036626 KEVIN C. DURIGON
DocuSigned by: Kevin Durigon SIGNATURE 09/21/2023 DATE

WELDED RING STIFFENED MAST ARM CONNECTION

PROJECT I.D. NO.	SHEET NO.
U-5783	Sig.M5



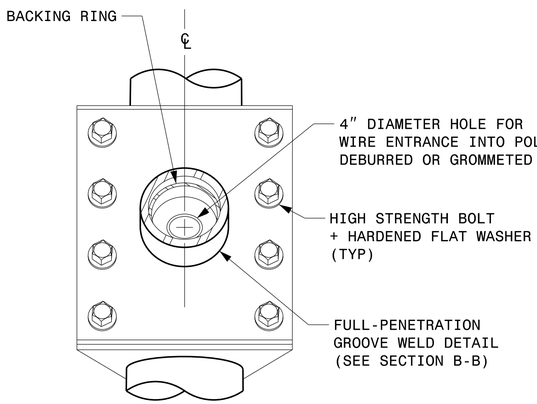
SECTION B-B
FULL-PENETRATION GROOVE WELD DETAIL



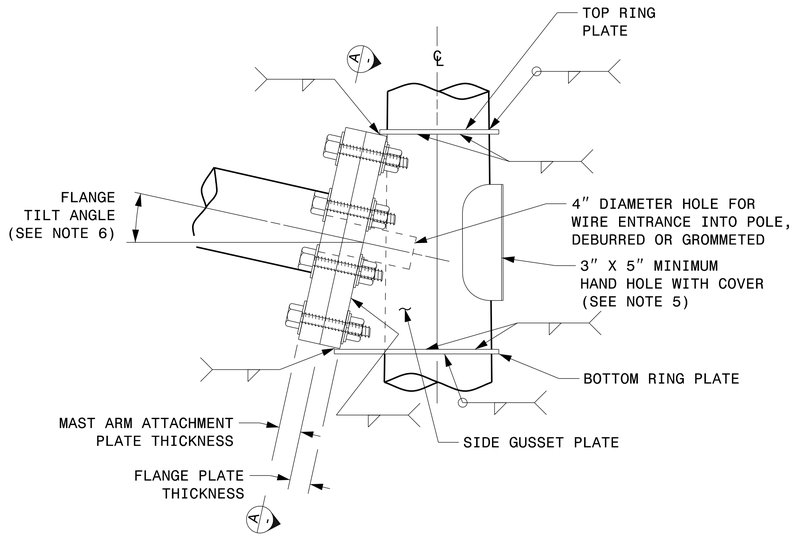
PLAN VIEW

NOTES:

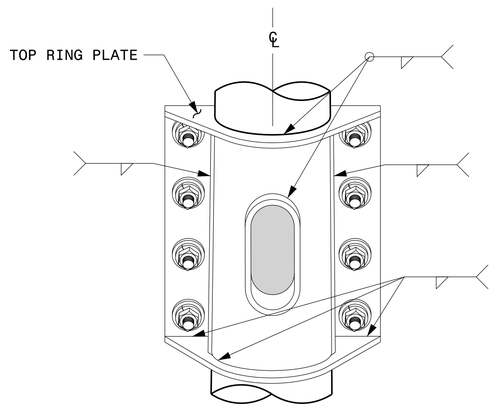
1. PROVIDE A PERMANENT MEANS OF IDENTIFICATION ABOVE THE MAST ARM TO INDICATE PROPER ATTACHMENT ORIENTATION OF THE MAST ARM.
2. DESIGNER WILL DETERMINE THE SIZE OF ALL STRUCTURAL COMPONENTS, PLATES, FASTENERS, AND WELDS SHOWN UNLESS THEY ARE ALREADY SPECIFIED.
3. FABRICATOR IS RESPONSIBLE FOR PROVIDING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



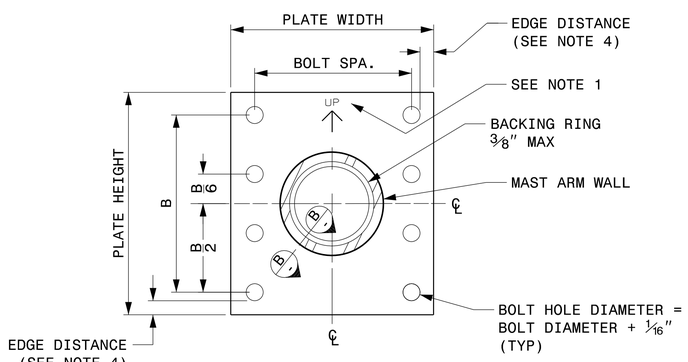
FRONT ELEVATION VIEW



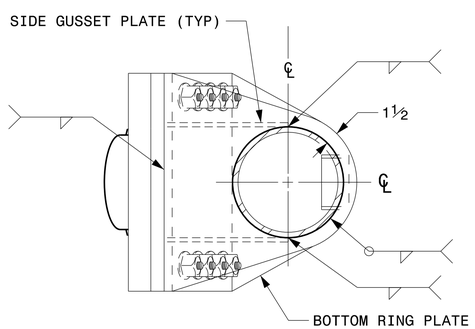
SIDE ELEVATION VIEW



BACK ELEVATION VIEW



SECTION A-A
MAST ARM ATTACHMENT PLATE



BOTTOM VIEW

Typical Fabrication Details – Mast Arm Connection

Prepared in the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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
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09/21/2023
DATE

21-SEP-2023 08:01
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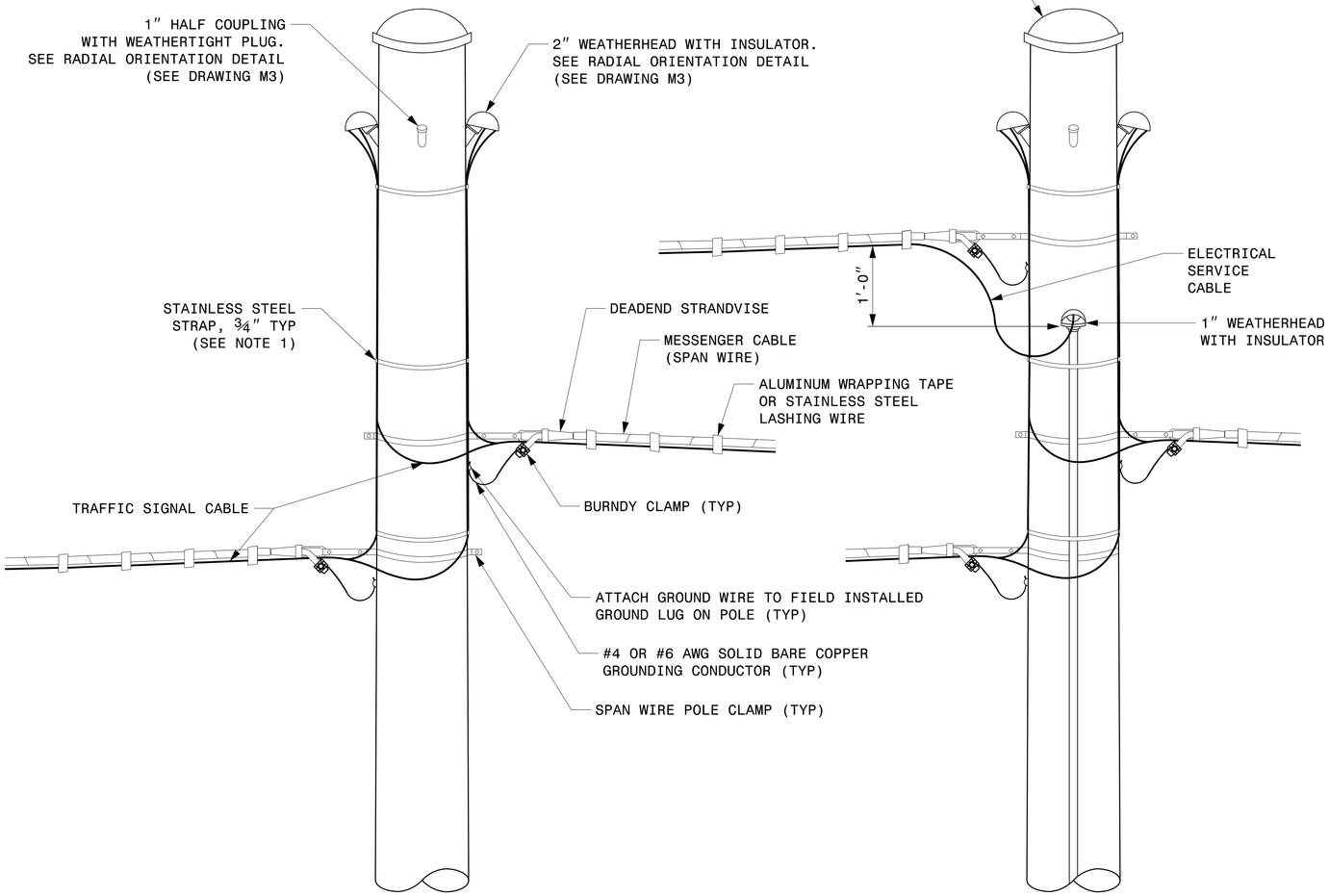
kdurigon

PROJECT I.D. NO.	SHEET NO.
U-5783	Sig.M6

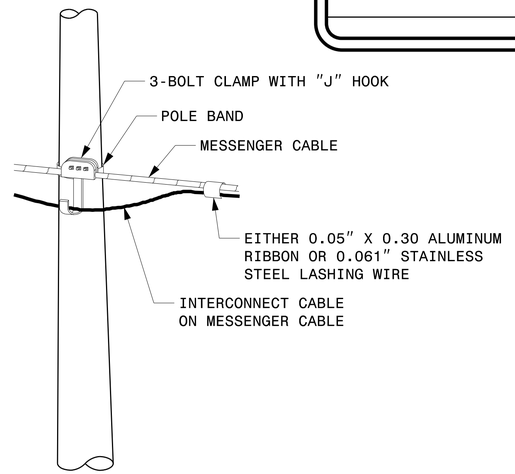
Fabrication Details – Strain Pole Attachments



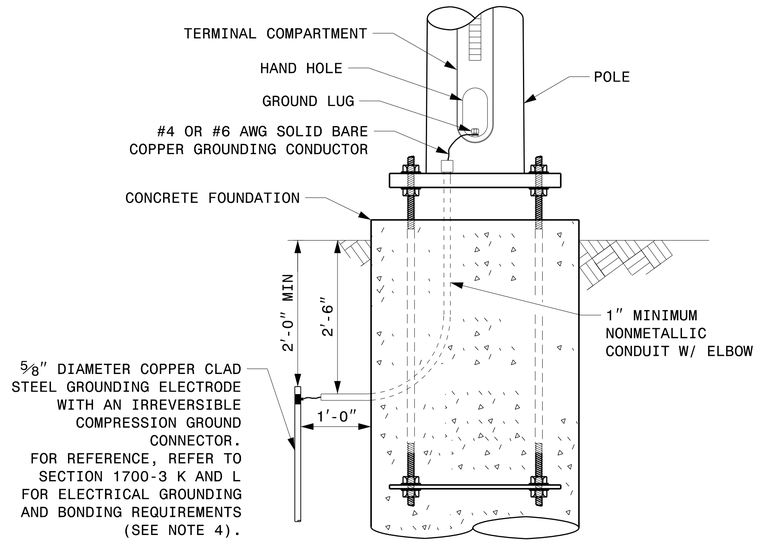
STRAIN POLE ATTACHMENTS

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

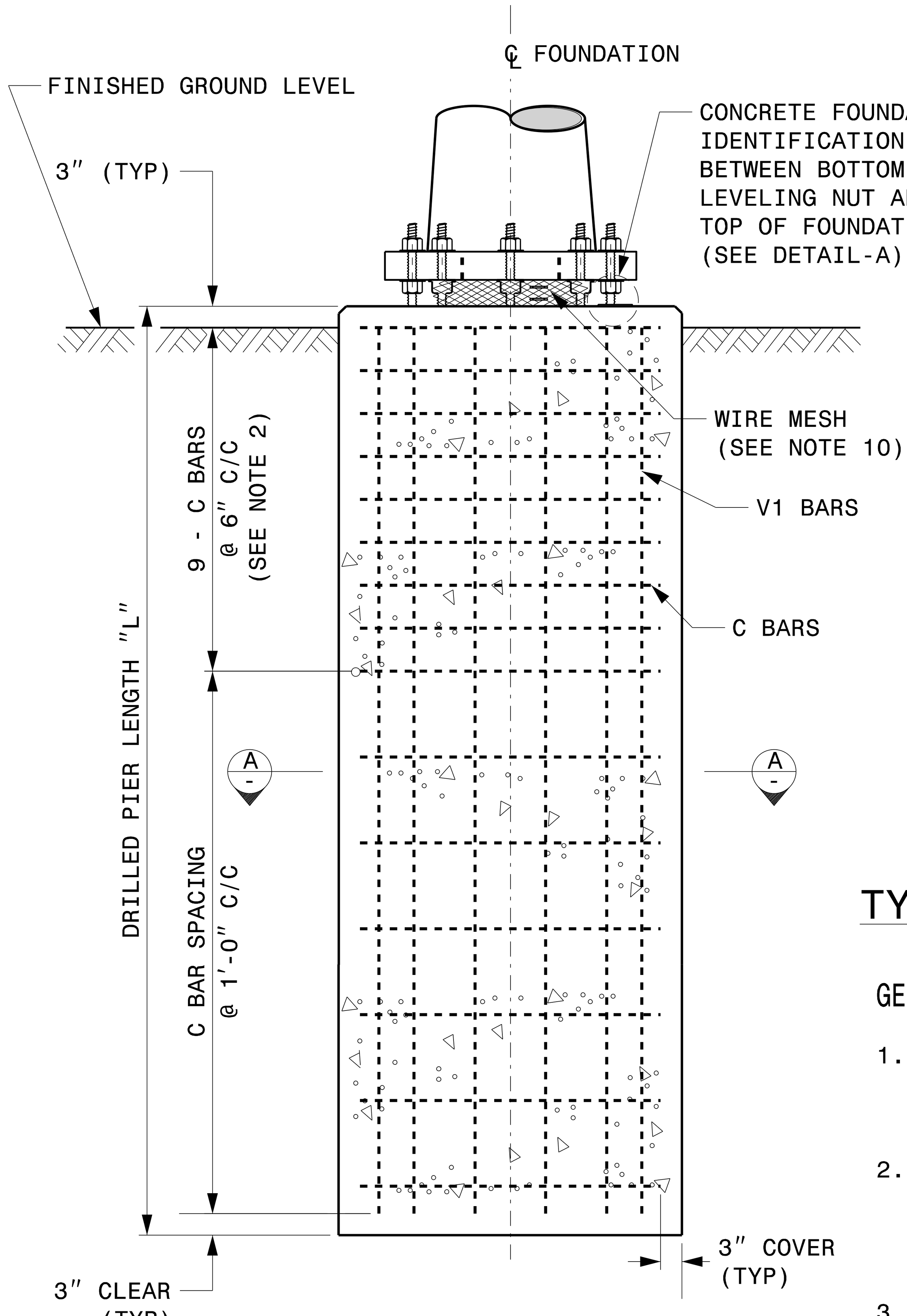
PLAN DATE:	SEPTEMBER 2023	DESIGNED BY:	C.F. ANDREWS
PREPARED BY:	K.C. DURIGON	REVIEWED BY:	D.C. SARKAR

REVISIONS	INIT.	DATE

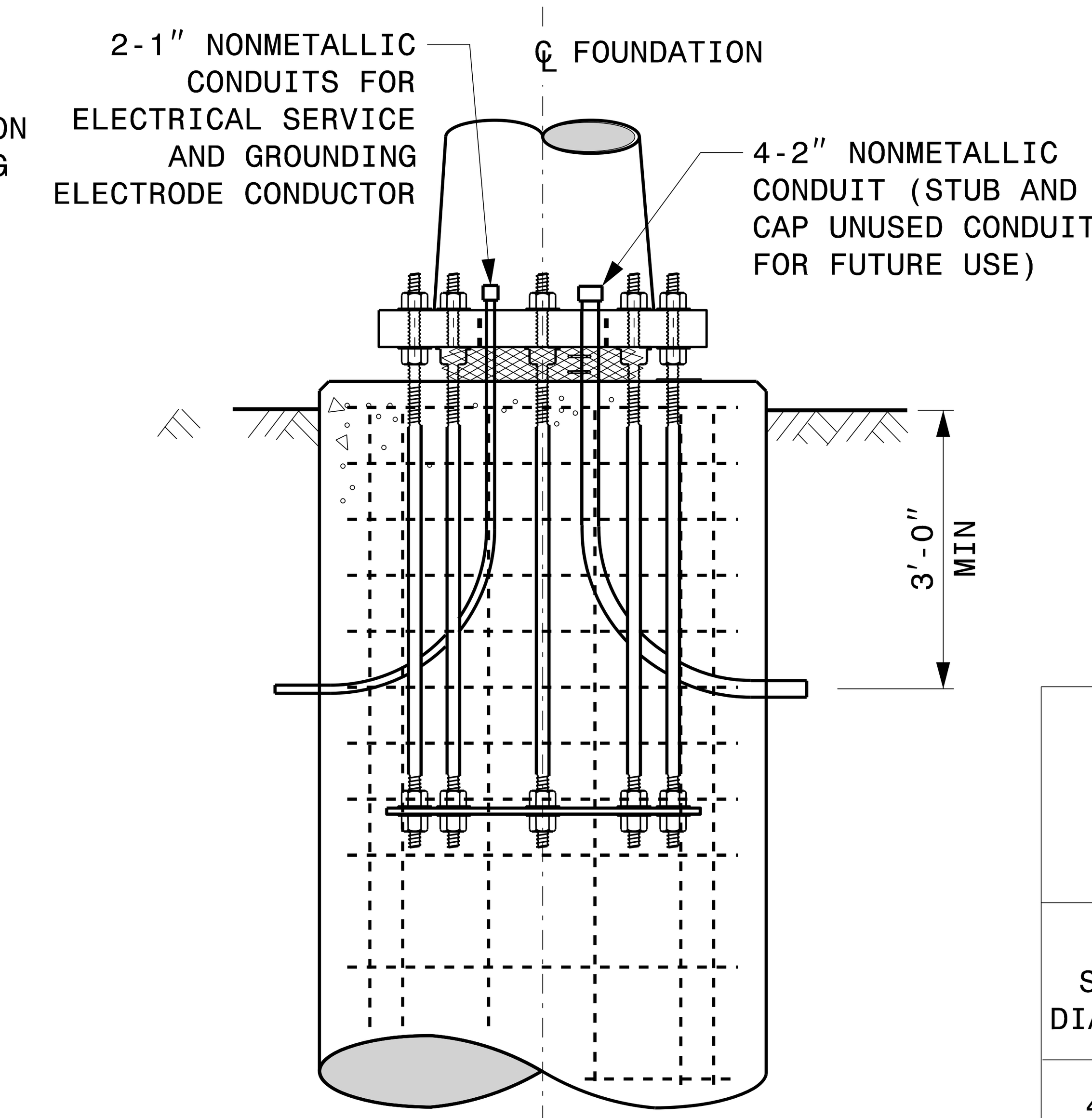
SEAL
NORTH CAROLINA
PROFESSIONAL
SEAL
036626
ENGINEER
KEVIN C. DURIGON

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

PROJECT I.D. NO.	SHEET NO.
U-5783	Sig.M7



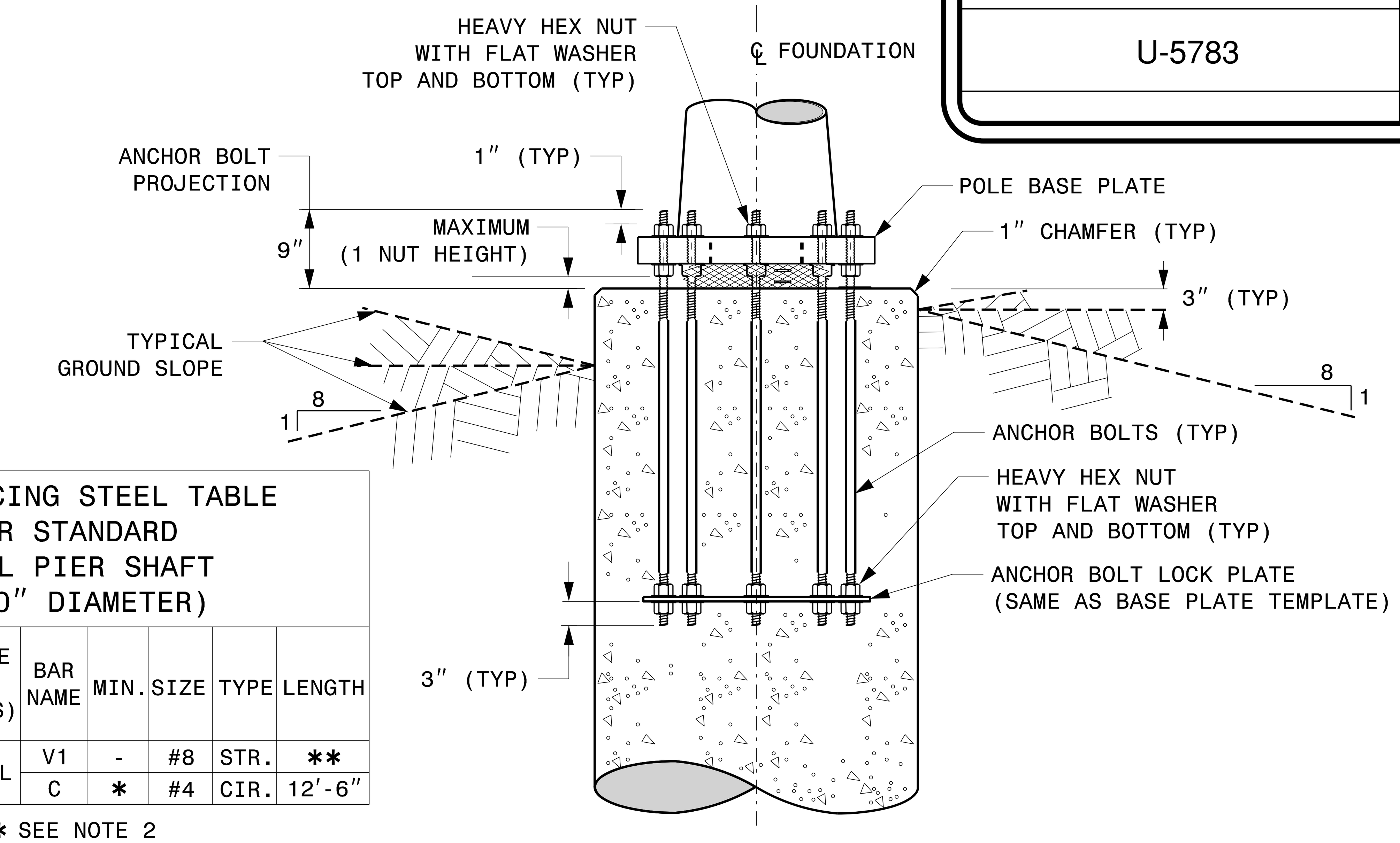
CONCRETE SHAFT ELEVATION



TYPICAL FOUNDATION CONDUIT DETAILS

REINFORCING STEEL TABLE FOR STANDARD DRILL PIER SHAFT (4′-0″ DIAMETER)						
"D" SHAFT DIAMETER	CONCRETE VOLUME (CU. YDS)	BAR NAME	MIN.	SIZE	TYPE	LENGTH
4′-0″	.465 X L	V1	-	#8	STR.	**
		C	*	#4	CIR.	12′-6″

* SEE NOTE 2
** SEE NOTE 3

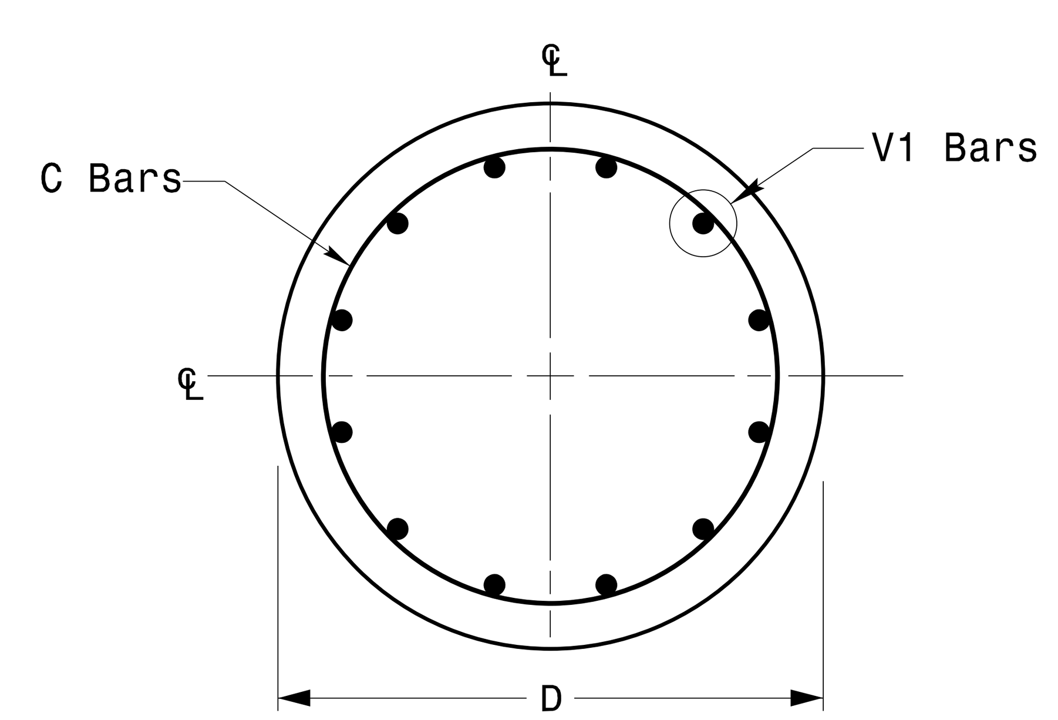


TYPICAL FOUNDATION ANCHOR BOLT DETAILS
(REINFORCING CAGE NOT SHOWN FOR CLARITY)

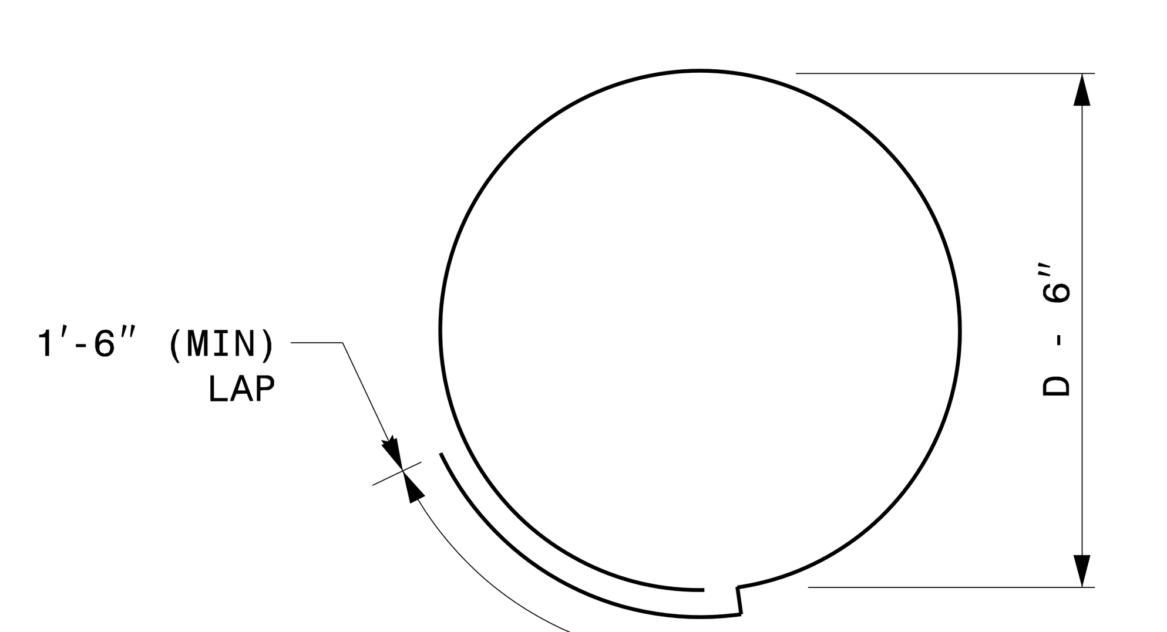
GENERAL NOTES:

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.

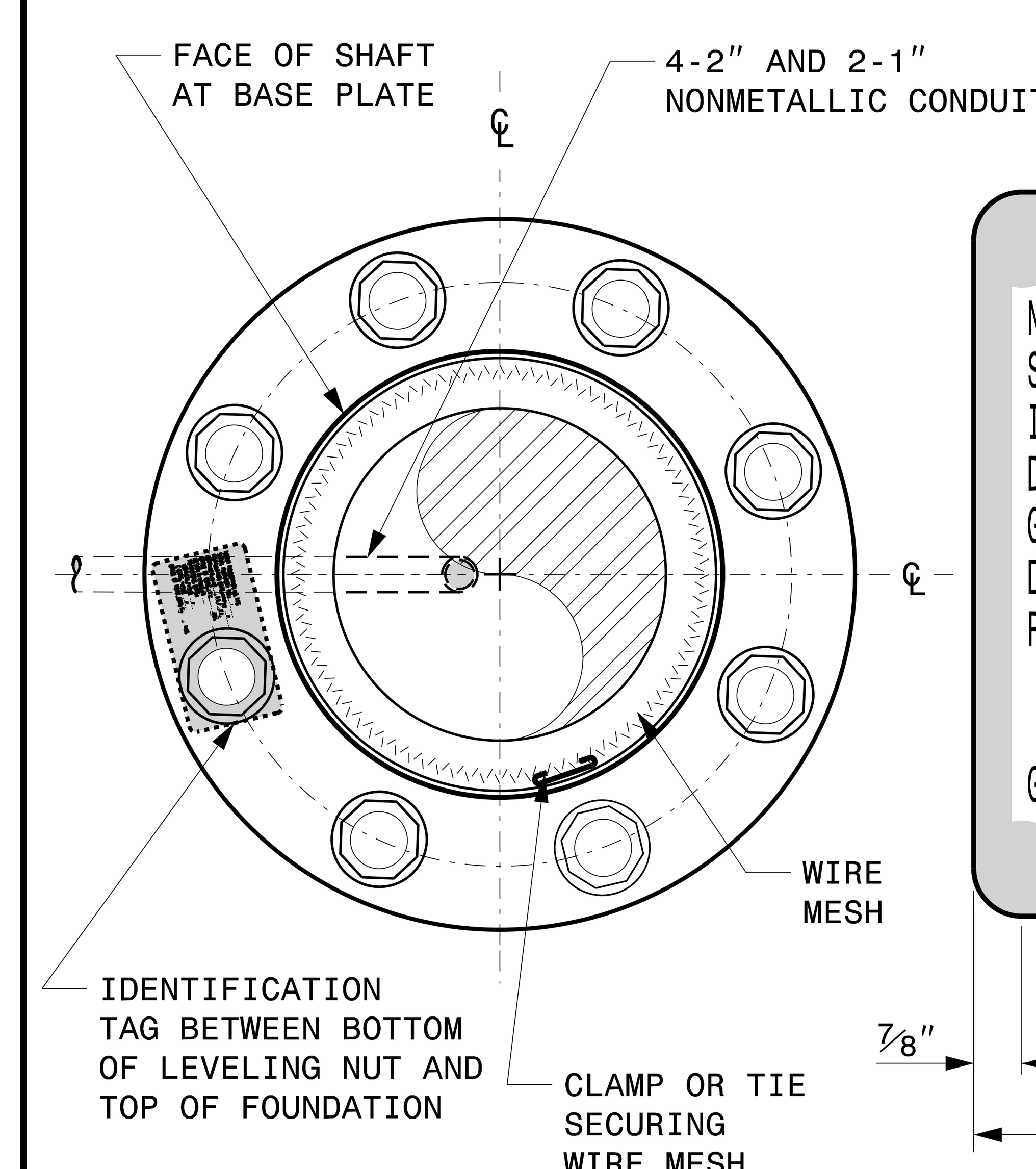
   https://connect.ncdot.gov/resources/Specifications and Special Provisions.aspx
7. USE AIR ENTRAINED AA CONCRETE MIX WITH A COMPRESSION STRENGTH OF f′c=4500 psi (MIN) AFTER 28 DAYS.
8. USE ASTM A615 GRADE 60 DEFORMED BARS FOR ALL REINFORCING STEEL. MAINTAIN AT LEAST 3″ COVER ON ALL REINFORCEMENT.
9. LOCATE 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.



SECTION A-A

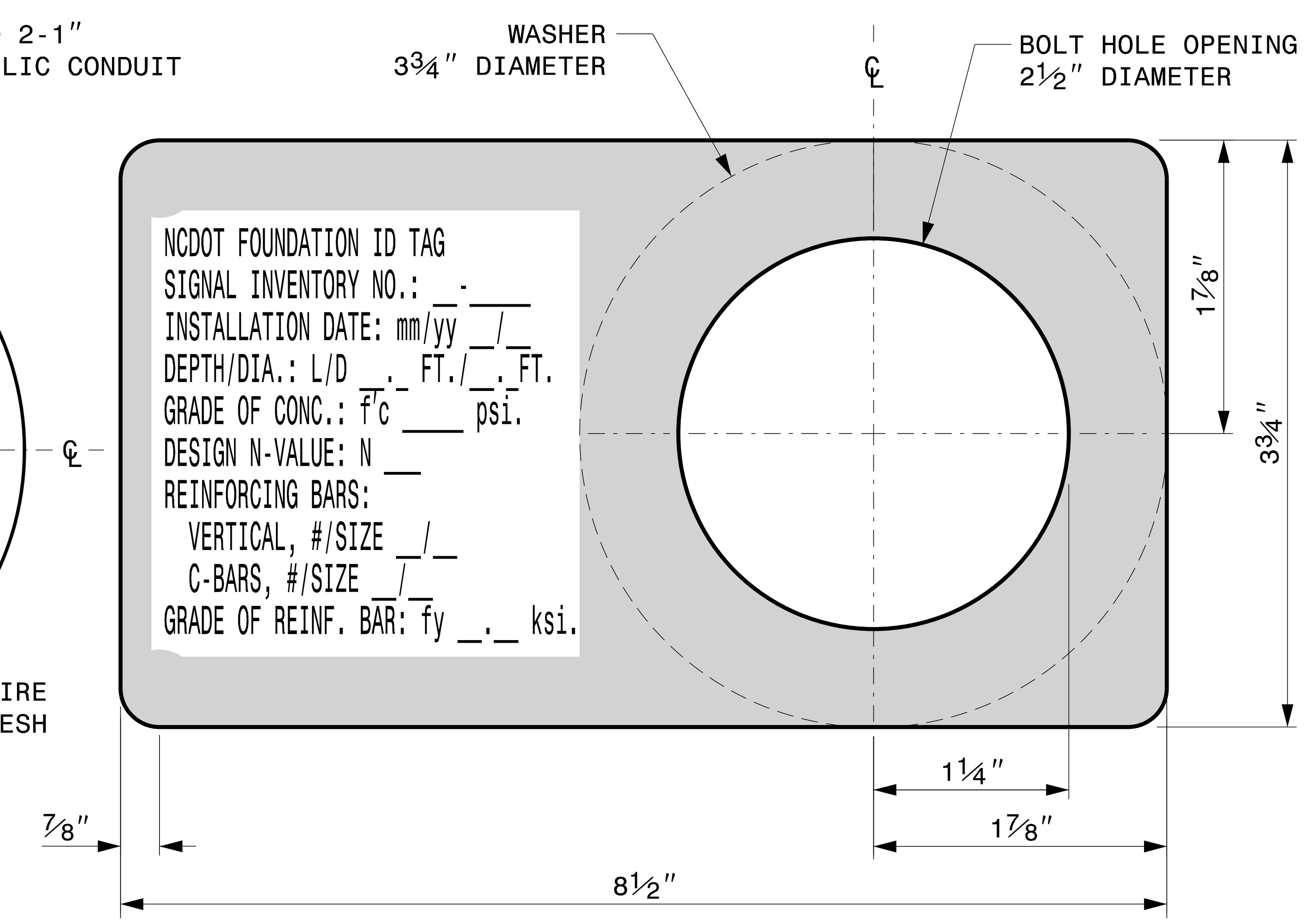


TYPICAL "C" BAR DETAIL



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
4B23DC79B3784DA...
SIGNATURE 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.

PROJECT I.D. NO.	SHEET NO.
U-5783	Sig.M8

Standard Strain Pole Foundation – All Soil Conditions

Prepared in the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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 SEAL 036626 ENGINEER KEVIN C. DURIGON

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