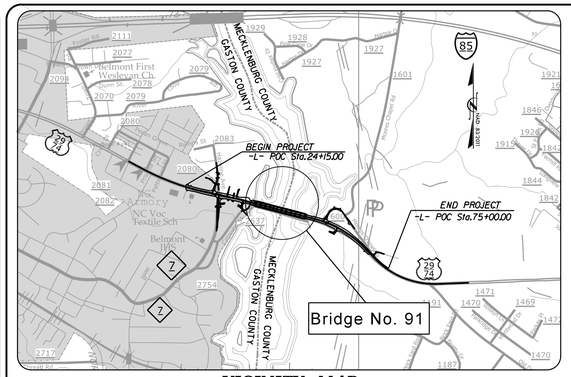
Project No.	Sheet No.
B-6051/U-6143	Sig. 1.0

CONTRACT NO: C204773 TIP PROJECT: B-6051 /U-6143

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

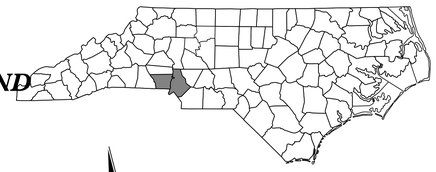
GASTON / MECKLENBURG COUNTIES



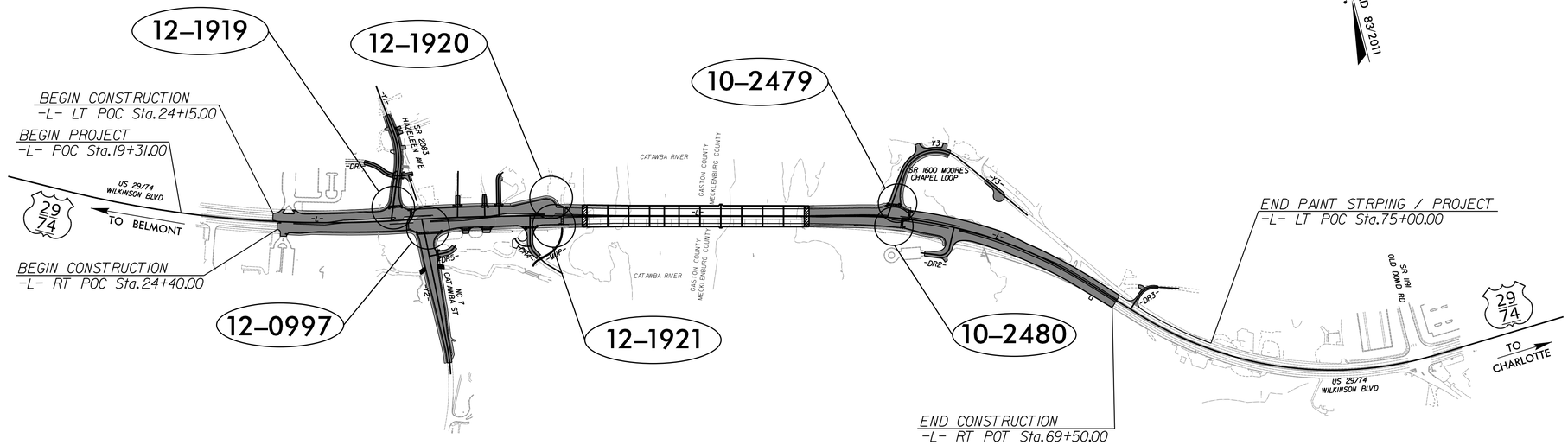
VICINITY MAP
(NOT TO SCALE)

LOCATION: *US 29/US74 REPLACE BRIDGE 350091 OVER CATAWBA RIVER & NC 7 (EAST CATAWBA STREET) AT US 74 (WILKINSON BOULEVARD) INTERSECTION. CONSTRUCT NORTHBOUND RIGHT-TURN LANE ON NC 7 (EAST CATAWABA STREET) AND EXTEND EXISTING WESTBOUND LEFT-TURN LANE ON US 74 (WILKINSON BOULEVARD)*

TYPE OF WORK: *TRAFFIC SIGNALS AND SIGNAL CABLE*



NAD 83/2011



NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS
DocuSigned by: David T Sears 8/1/2025
-069183F28E5741E...

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

Index of Plans

Sheet #	Reference #	Location/Description
Sig. 1.0	--------	Title Sheet
Sig. 2.0-8.2	12-0997	US 29-74 (Wilkinson Blvd) at NC 7 (Catawba St)
Sig. 9.0-10.2	12-1919	US 29-74 (Wilkinson Blvd) at SR 2083 (Hazeleen Ave)
Sig. 11.0-13.3	12-1920	US 29-74 (Wilkinson Blvd) at Eastbound U-Turn Bulb West of Catawba River Bridge
Sig. 14.0-14.2	12-1921	Pedestrian Hybrid Beacon: US 29-74 (Wilkinson Blvd) at Eastbound U-Turn Bulb West of Catawba River Bridge
Sig. 15.0-17.2	10-2479	US 29-74 (Wilkinson Blvd) at SR 1600 (Moores Chapel Loop)
Sig. 18.0-18.2	10-2480	Pedestrian Hybrid Beacon: US 29-74 (Wilkinson Blvd) at SR 1600 (Moores Chapel Loop)
Sig. M1A-M9	--------	Metal Pole Standard Drawings
SCP 1-8	--------	Signal Communication Plans

TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

Contacts:

R. Nicholas Zinser, P.E. – Western Region Signals Engineer
D. Todd Joyce, P.E. – Signal Equipment Design Engineer
Gregory A. Green – Signal Communications Project Engineer
Heidi T. Berggren, EI – Signal Communications Project Design Engineer

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

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

750 N. Greenfield Parkway, Garner, NC 27529

8/1/2025
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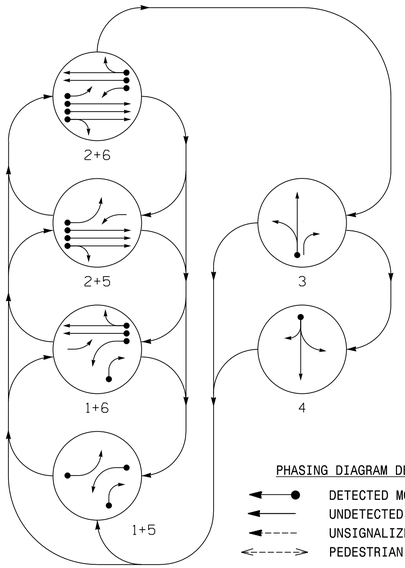
PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 2.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

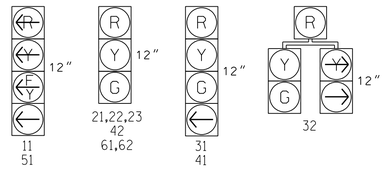
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 1+5	1+6	2+5	2+6	3	4	FLASH
11	←	←	F Y	F Y	R	R	R
21,22,23	R	R	G	G	R	R	R
31	R	R	R	R	G ←	R	R
32	R / R →		R	G	R	R	
41	R	R	R	R	R	G ←	R
42	R	R	R	R	R	G	R
51	←	F Y	←	F Y	R	R	R
61,62	R	G	R	G	R	R	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

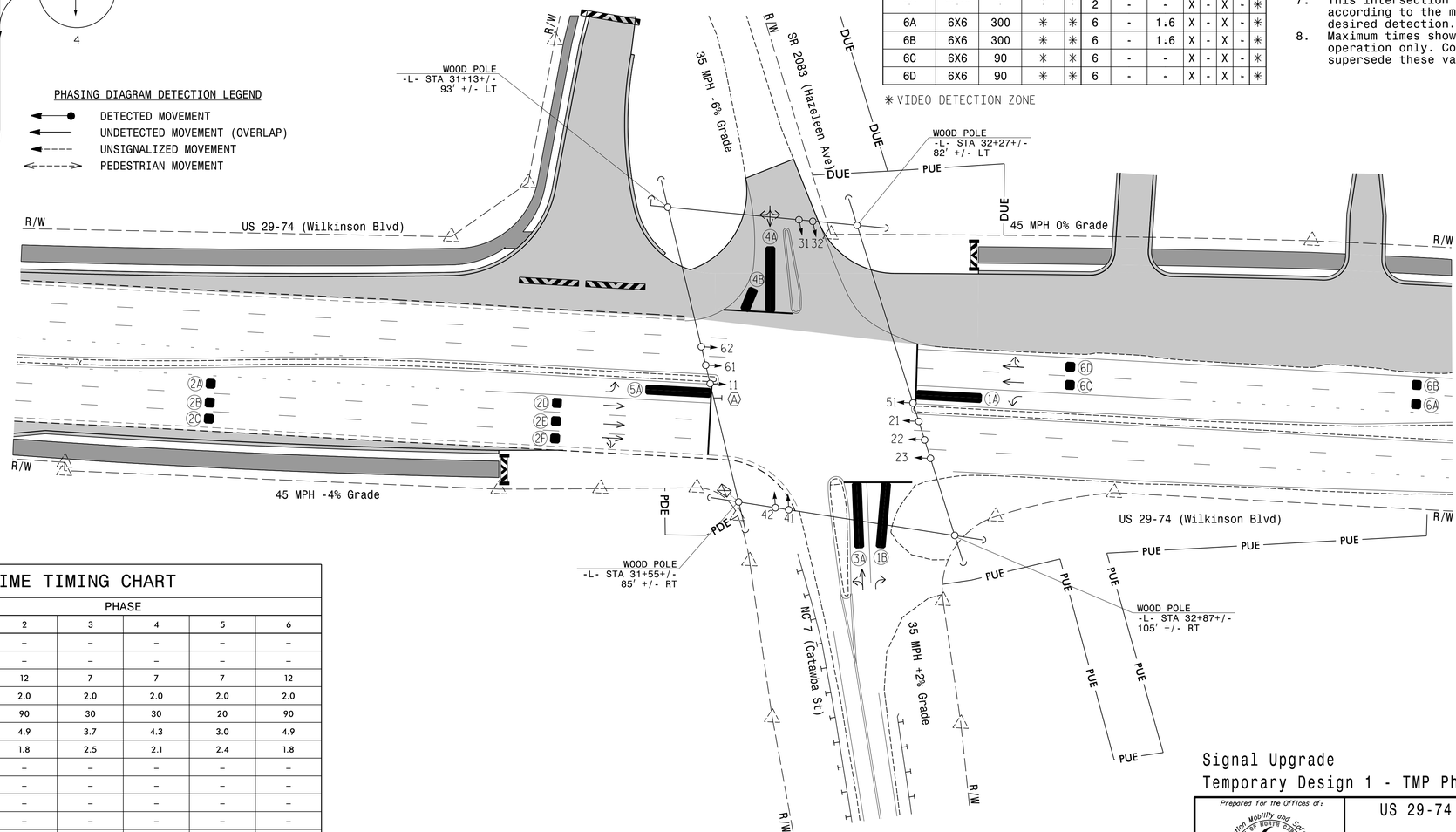
DETECTOR ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	PROGRAMMING CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	✳	✳	1	15.0	-	X	-	X	-	✳
					6	-	-	X	-	X	-	✳
1B	6X40	0	✳	✳	1	15.0	-	X	-	X	-	✳
2A	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2B	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2C	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2D	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
2E	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
2F	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
3A	6X40	0	✳	✳	3	-	-	X	-	X	-	✳
4A	6X40	0	✳	✳	4	10.0	-	X	-	X	-	✳
4B	6X15	0	✳	✳	4	10.0	-	X	-	X	-	✳
5A	6X40	0	✳	✳	5	15.0	-	X	-	X	-	✳
					2	-	-	X	-	X	-	✳
6A	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6B	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6C	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
6D	6X6	90	✳	✳	6	-	-	X	-	X	-	✳

✳ VIDEO DETECTION ZONE

6 Phase
Fully Actuated
(Belmont Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification 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. The order of phase 3 and phase 4 may be reversed.
5. Set all detector units to presence mode.
6. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
7. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	→
— PUE —	Utility Easment	— PUE —
— PDE —	Drainage Easment	— PDE —
N/A	Guardrail	
	Construction Zone	
	Non-Intrusive Detection Zone	
	Pedestrian Barricade	
	Barricade	
Ⓐ	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	Ⓐ

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	–	–	–	–	–
Ped Clear	–	–	–	–	–	–
Min Green *	7	12	7	7	7	12
Passage *	2.0	2.0	2.0	2.0	2.0	2.0
Max 1 *	20	90	30	30	20	90
Yellow Change	3.0	4.9	3.7	4.3	3.0	4.9
Red Clear	2.6	1.8	2.5	2.1	2.4	1.8
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

* 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.

Signal Upgrade
Temporary Design 1 - TMP Phase I Step 2

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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

SCALE 0 40 1"=40'

US 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)/
SR 2083 (Hazeleen Avenue)
Division 12 Gaston County Belmont
PLAN DATE: August 2025 REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS
DocuSigned by: David T Sears 069183F28E5741E...
8/1/2025
SIGNATURE DATE
SIG. INVENTORY NO. 12-0997TI

8/1/2025
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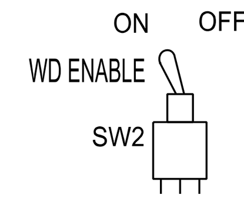
dsears

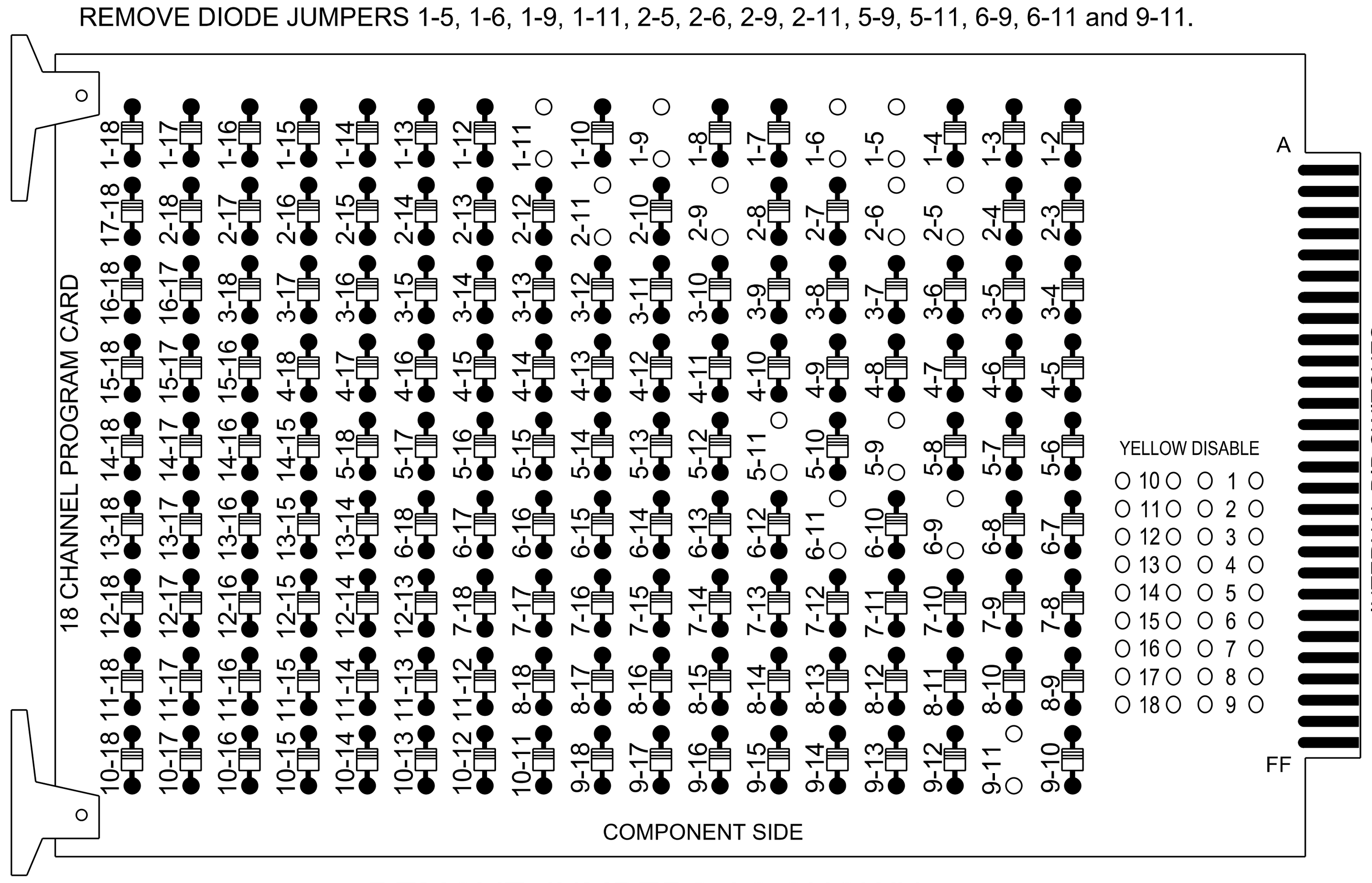
PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 2.1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

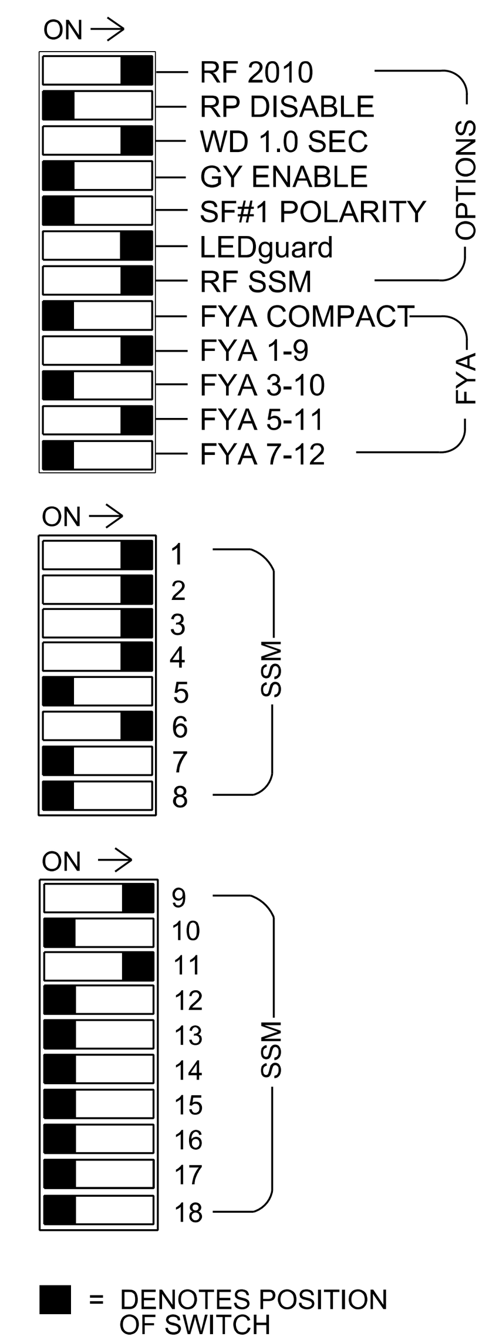
(remove jumpers and set switches as shown)



REMOVE DIODE JUMPERS 1-5, 1-6, 1-9, 1-11, 2-5, 2-6, 2-9, 2-11, 5-9, 5-11, 6-9, 6-11 and 9-11.



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.
4. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

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

*See overlap programming detail on 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.	11★	32	21,22, 23	NU	31	32	41	42	NU	51★	61,62	NU	NU	NU	NU	11★	NU	NU	51★	NU	NU
RED		*	128		116	116	101	101			134										
YELLOW			129		117	117	102	102		*	135										
GREEN			130		118	118	103	103			136										
RED ARROW																A121			A114		
YELLOW ARROW		126														A122			A115		
FLASHING YELLOW ARROW																A123			A116		
GREEN ARROW	127	127			118		103			133											

NU = Not Used

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

★ See pictorial of head wiring in detail this sheet.

INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	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

OVERLAP PROGRAMMING

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

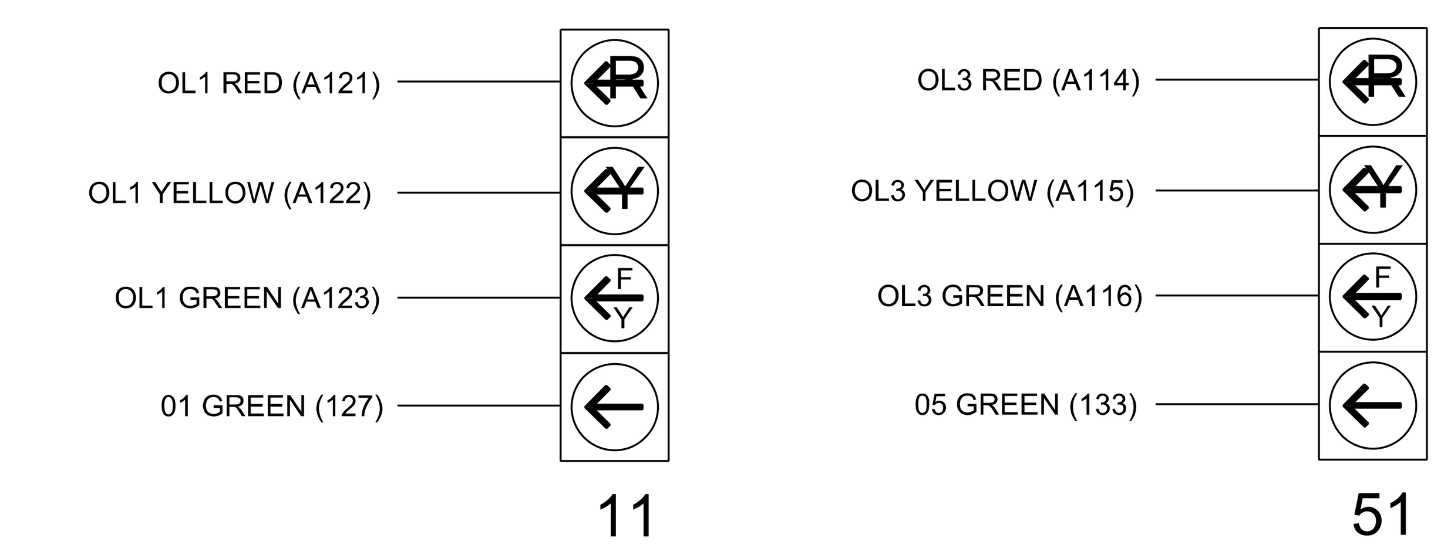
Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

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

FYA SIGNAL WIRING DETAIL

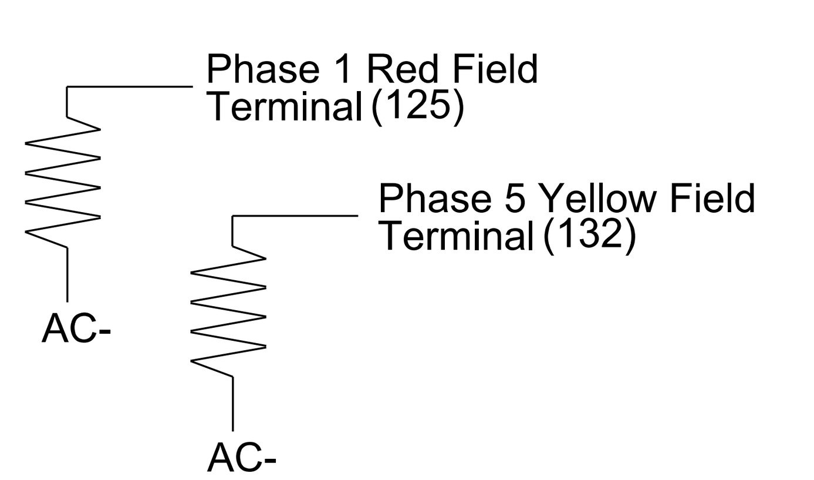
(wire signal heads as shown)



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 video detection system for vehicle detection for zones 1A, 1B, 2A, 2B, 2C, 2D, 2E, 2F, 3A, 4A, 4B, 5A, 6A, 6B, 6C, and 6D. Perform installation according to manufacturer's directions and NCDOT engineer -approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-0997T1
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Temporary Design 1 - TMP Phase I Step 2
Electrical Detail

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Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)/
SR 2083 (Hazeleen Avenue)

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 044558 DAVID T. SEARS

DocuSigned by: David T Sears
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 12-0997T1

8/1/2025
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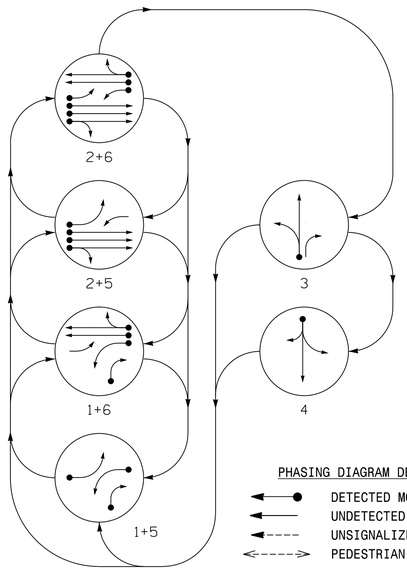
PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 3.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

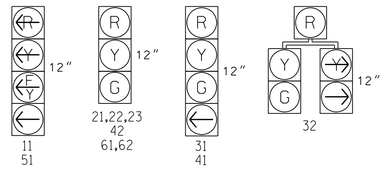
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 1+5	1+6	2+5	2+6	3	4	FLASH
11	←	←	~~F Y~~	~~F Y~~	~~R~~	~~R~~	~~R~~
21,22,23	R	R	G	G	R	R	R
31	R	R	R	R	G ←	R	R
32	R ↗	R ↗	R	R	G	R	R
41	R	R	R	R	R	G ←	R
42	R	R	R	R	R	G	R
51	←	~~F Y~~	←	~~F Y~~	~~R~~	~~R~~	~~R~~
61,62	R	G	R	G	R	R	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

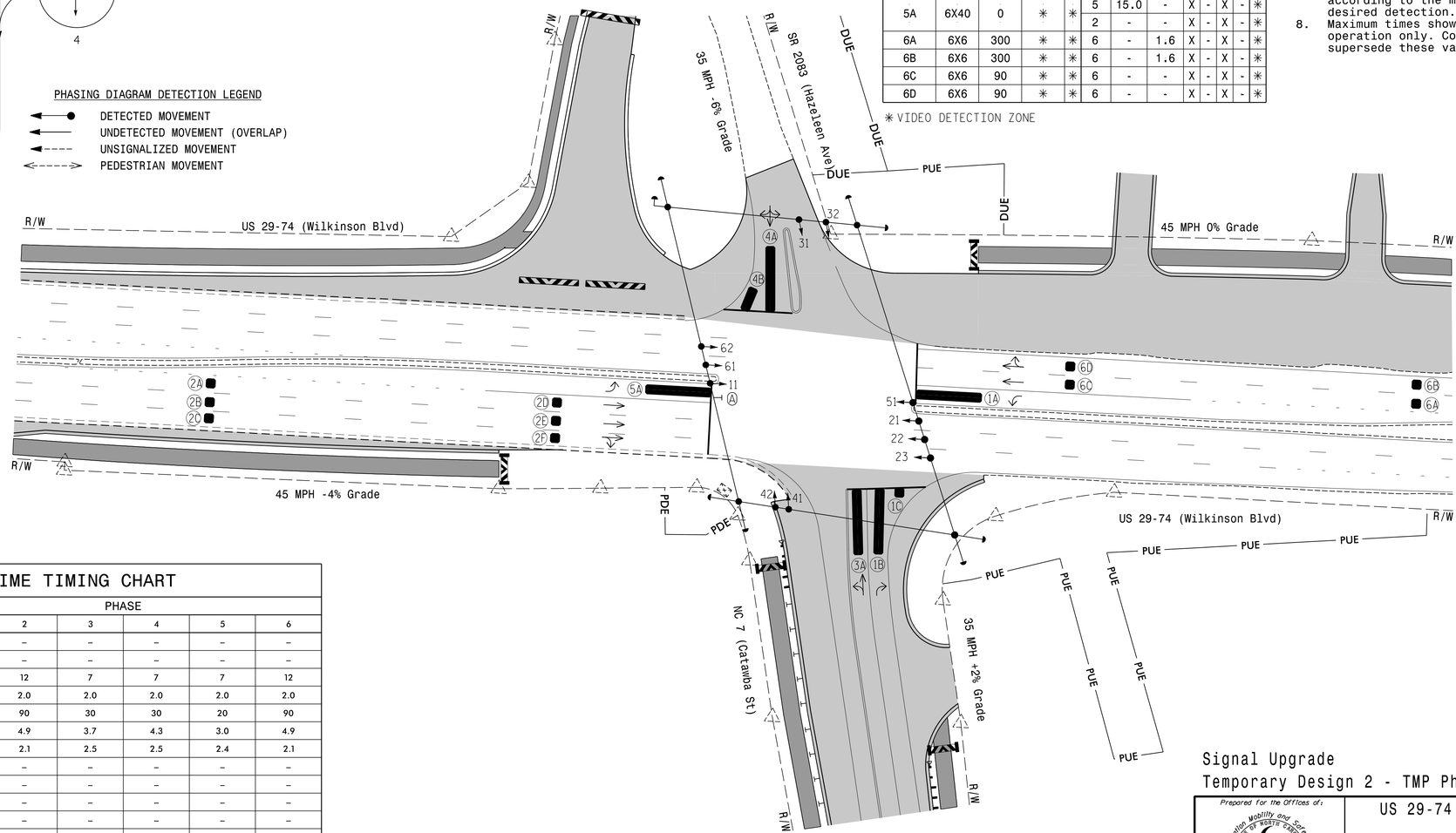
DETECTOR ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	PROGRAMMING CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	✳	✳	1	15.0	-	X	-	X	-	✳
					6	-	-	X	-	X	-	✳
1B	6X40	0	✳	✳	1	15.0	-	X	-	X	-	✳
1C	6X6	0	✳	✳	1	15.0	-	X	-	X	-	✳
2A	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2B	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2C	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2D	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
2E	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
2F	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
3A	6X40	0	✳	✳	3	3.0	-	X	-	X	-	✳
4A	6X40	0	✳	✳	4	10.0	-	X	-	X	-	✳
4B	6X15	0	✳	✳	4	10.0	-	X	-	X	-	✳
5A	6X40	0	✳	✳	5	15.0	-	X	-	X	-	✳
					2	-	-	X	-	X	-	✳
6A	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6B	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6C	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
6D	6X6	90	✳	✳	6	-	-	X	-	X	-	✳

✳ VIDEO DETECTION ZONE

6 Phase
Fully Actuated
(Belmont Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification 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. The order of phase 3 and phase 4 may be reversed.
5. Set all detector units to presence mode.
6. Reposition existing signal head numbered 32.
7. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	→
— PUE —	Utility Easment	— PUE —
— PDE —	Drainage Easment	— PDE —
N/A	Guardrail	
	Construction Zone	
	Non-Intrusive Detection Zone	
	Pedestrian Barricade	
	Barricade	
Ⓐ	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	Ⓐ

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	–	–	–	–	–
Ped Clear	–	–	–	–	–	–
Min Green *	7	12	7	7	7	12
Passage *	2.0	2.0	2.0	2.0	2.0	2.0
Max 1 *	20	90	30	30	20	90
Yellow Change	3.0	4.9	3.7	4.3	3.0	4.9
Red Clear	2.3	2.1	2.5	2.5	2.4	2.1
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

* 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.

Signal Upgrade
Temporary Design 2 - TMP Phase I Step 3

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

SCALE 0 40 1"=40'

US 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)/
SR 2083 (Hazeleen Avenue)
Division 12 Gaston County Belmont

PLAN DATE: August 2025 REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones REVIEWED BY:

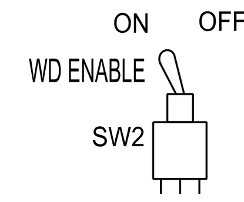
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS
DocuSigned by: David T Sears 0691B3F28E5741E...
8/1/2025
SIGNATURE DATE
SIG. INVENTORY NO. 12-099T12

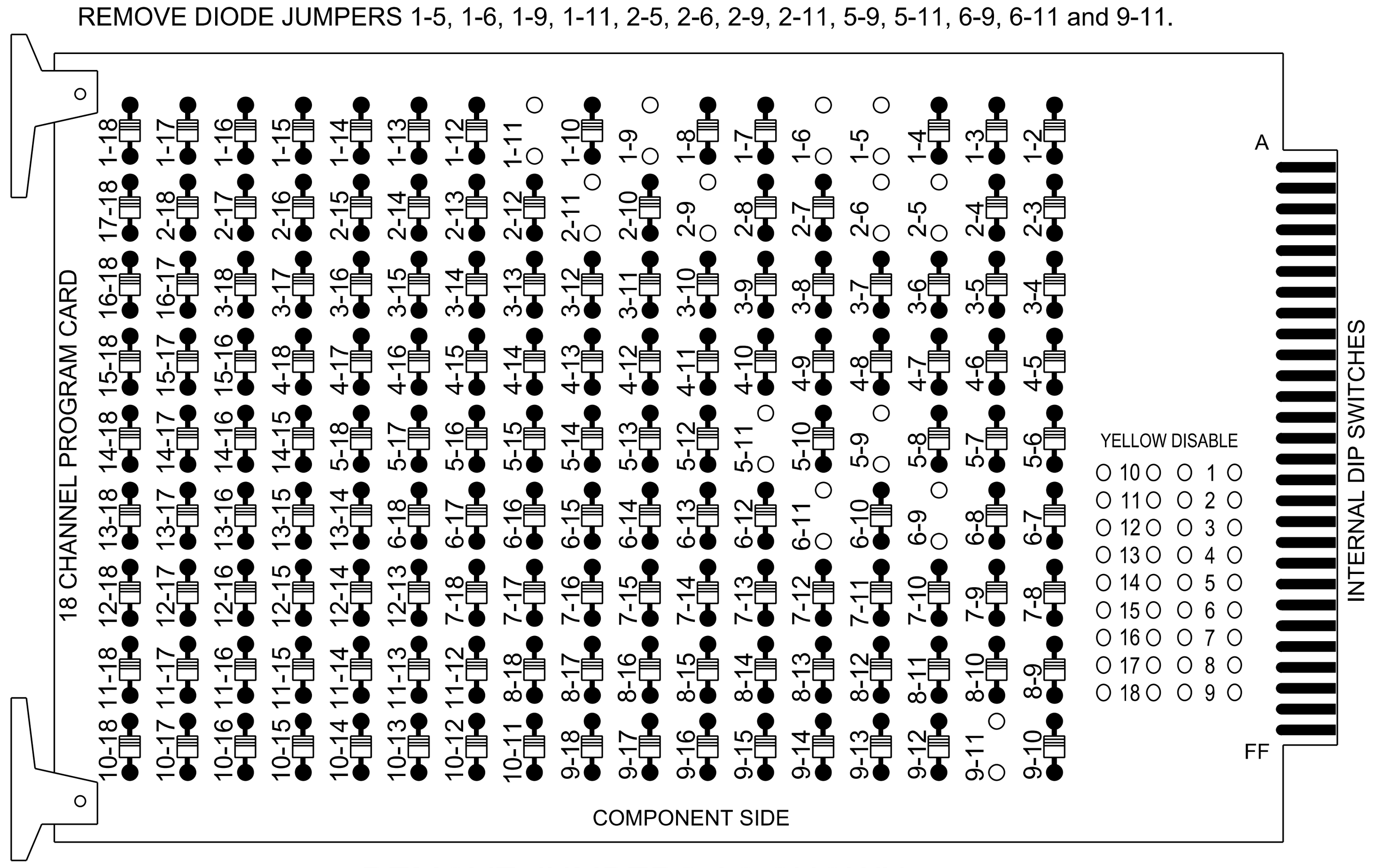
8/1/2025
R:\Traffic\Signals\Designs\B-6051_Signal_12-099T12_dsn.dgn
dsears

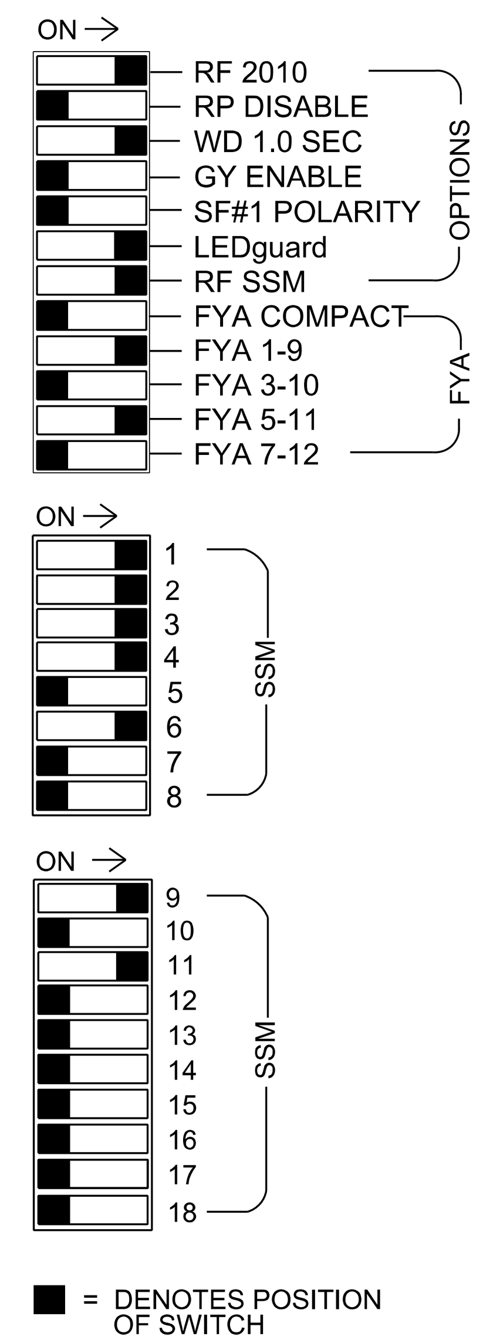
18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE DIODE JUMPERS 1-5, 1-6, 1-9, 1-11, 2-5, 2-6, 2-9, 2-11, 5-9, 5-11, 6-9, 6-11 and 9-11.





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.
4. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

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

*See overlap programming detail on 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.	11★	32	21,22, 23	NU	31	32	41	42	NU	51★	61,62	NU	NU	NU	NU	11★	NU	NU	51★	NU	NU
RED	·	*	128	·	116	116	101	101	·	·	134	·	·	·	·	·	·	·	·	·	·
YELLOW	·		129	·	117	117	102	102	·	*	135	·	·	·	·	·	·	·	·	·	·
GREEN	·		130	·	118	118	103	103	·	·	136	·	·	·	·	·	·	·	·	·	·
RED ARROW	·		·	·	·		·		·	·	·	·	·	·	·	A121	·	·	A114	·	·
YELLOW ARROW	·	126	·	·	·		·		·	·	·	·	·	·	·	A122	·	·	A115	·	·
FLASHING YELLOW ARROW	·		·	·	·		·		·	·	·	·	·	·	·	A123	·	·	A116	·	·
GREEN ARROW	127	127	·	·	118		103		·	133	·	·	·	·	·	·	·	·	·	·	·

NU = Not Used

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

★ See pictorial of head wiring in detail this sheet.

INPUT FILE POSITION LAYOUT

(front view)

FILE		1	2	3	4	5	6	7	8	9	1O	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

OVERLAP PROGRAMMING

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

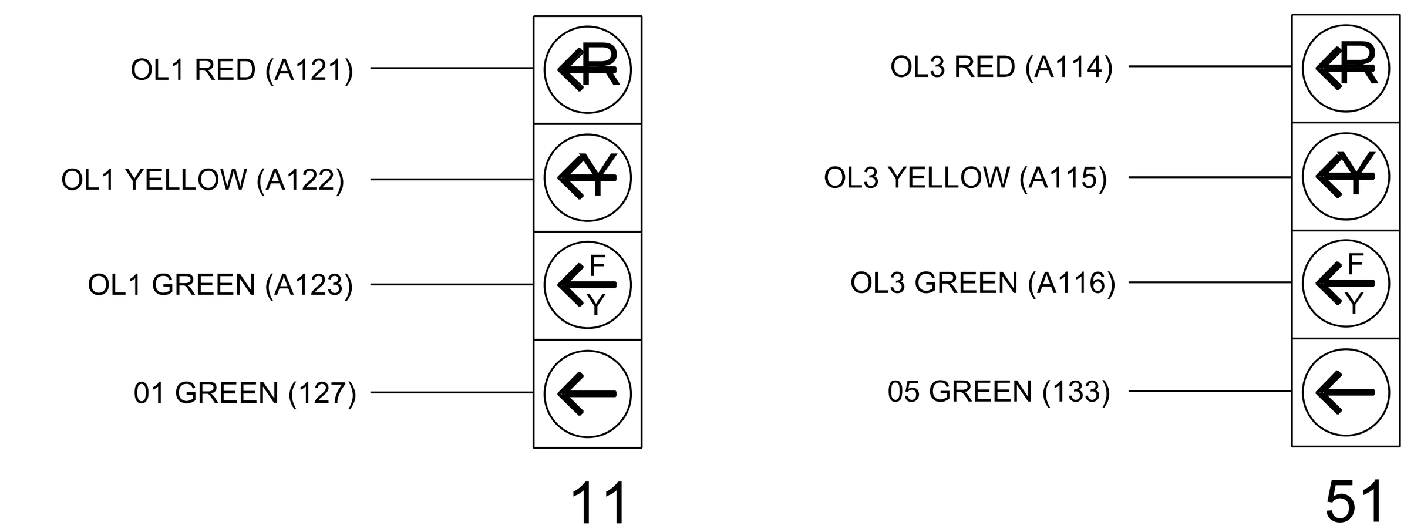
Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

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

FYA SIGNAL WIRING DETAIL

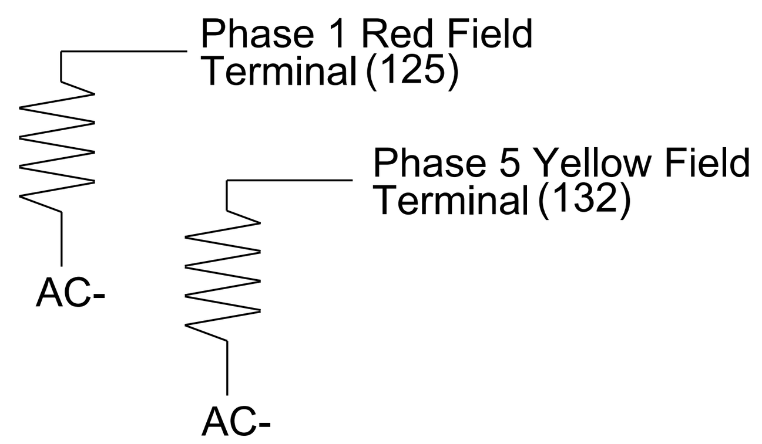
(wire signal heads as shown)



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 video detection system for vehicle detection for zones 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 2F, 3A, 4A, 4B, 5A, 6A, 6B, 6C, and 6D. Perform installation according to manufacturer's directions and NCDOT engineer -approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-0997T2
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Temporary Design 2 - TMP Phase I Step 3
Electrical Detail

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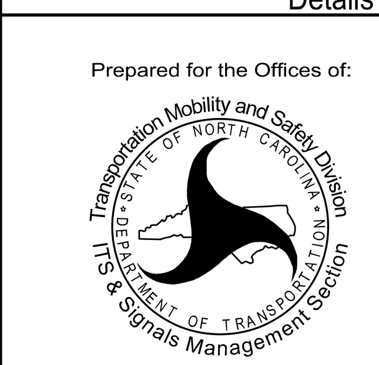

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US 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)/
SR 2083 (Hazeleen Avenue)

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

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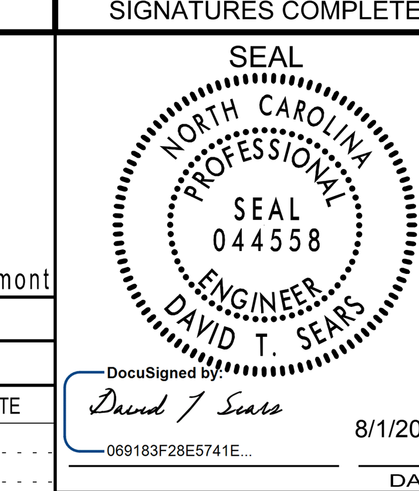
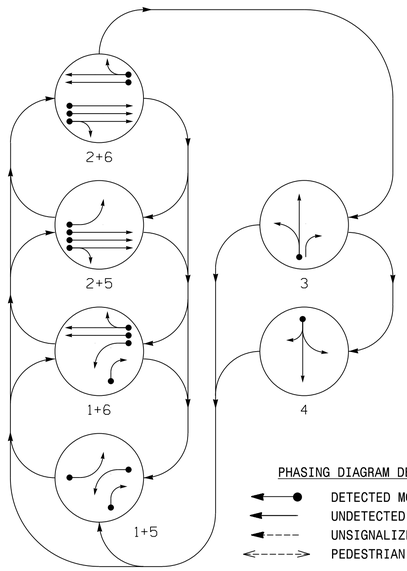


8/1/2025
DATE

SIG. INVENTORY NO. 12-0997T2

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 4.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

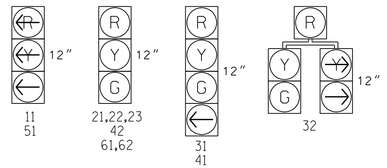
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 1+5	1+6	2+5	2+6	3	4	FLASH
11	←	←	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~
21,22,23	R	R	G	G	R	R	R
31	R	R	R	R	G ←	R	R
32	R ↗	R ↗	R	R	G	R	R
41	R	R	R	R	R	G ←	R
42	R	R	R	R	R	G	R
51	←	~~R~~	←	~~R~~	~~R~~	~~R~~	~~R~~
61,62	R	G	R	G	R	R	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

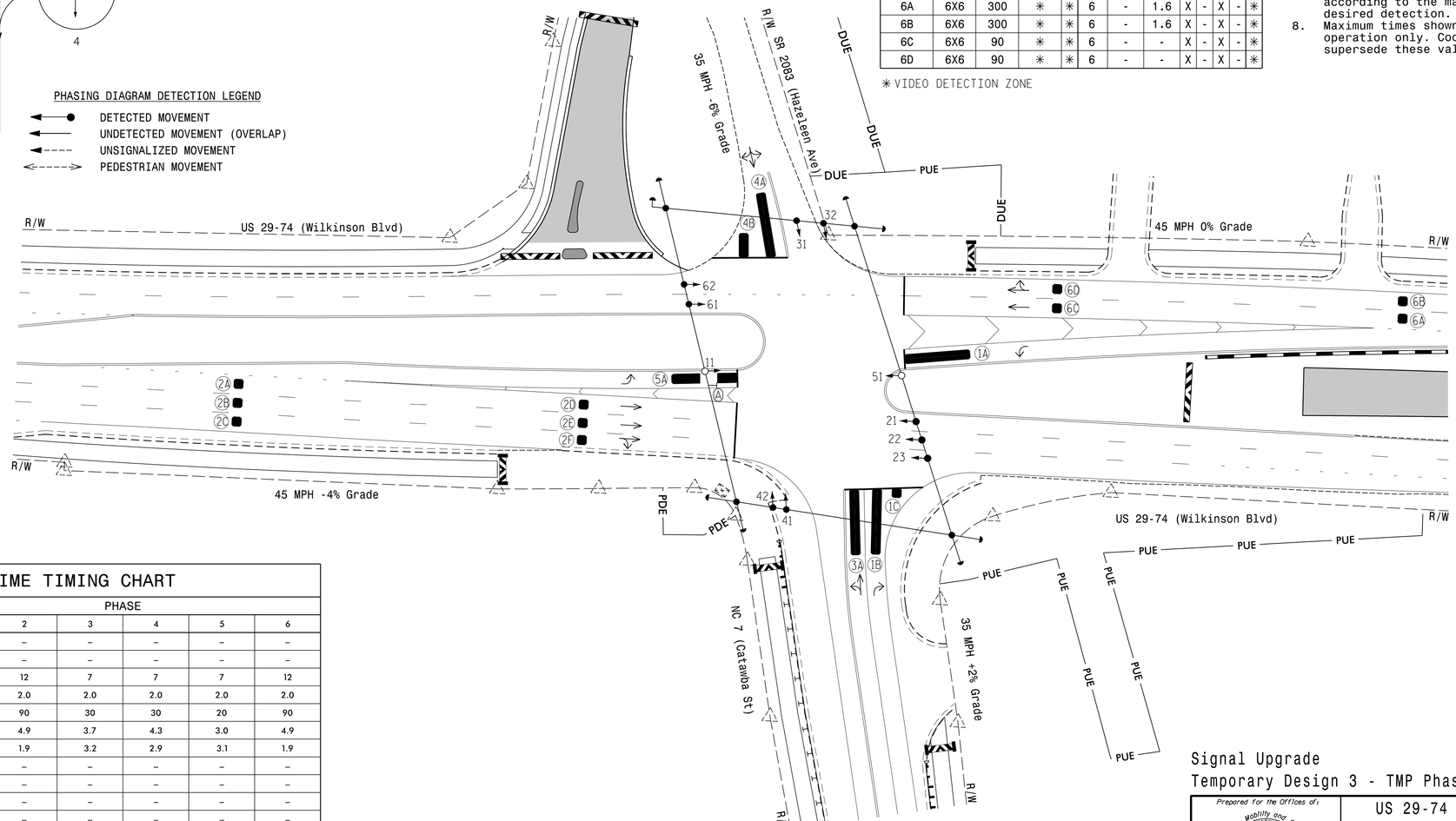
DETECTOR					PROGRAMMING							
ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	✳	✳	1	-	-	X	-	X	-	✳
1B	6X40	0	✳	✳	1	15.0	-	X	-	X	-	✳
1C	6X6	0	✳	✳	1	15.0	-	X	-	X	-	✳
2A	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2B	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2C	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2D	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
2E	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
2F	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
3A	6X40	0	✳	✳	3	3.0	-	X	-	X	-	✳
4A	6X40	0	✳	✳	4	10.0	-	X	-	X	-	✳
4B	6X15	0	✳	✳	4	10.0	-	X	-	X	-	✳
5A	6X40	0	✳	✳	5	-	-	X	-	X	-	✳
6A	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6B	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6C	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
6D	6X6	90	✳	✳	6	-	-	X	-	X	-	✳

✳ VIDEO DETECTION ZONE

6 Phase
Fully Actuated
(Belmont Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification 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. The order of phase 3 and phase 4 may be reversed.
5. Set all detector units to presence mode.
6. Reposition existing signal heads numbered 61 and 62.
7. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	
— PUE —	Utility Easment	— PUE —
— PDE —	Drainage Easment	— PDE —
N/A	Guardrail	
	Construction Zone	
	Non-Intrusive Detection Zone	
	Pedestrian Barricade	
	Barricade	
	Portable Concrete Barrier	
Ⓐ	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	Ⓐ

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	–	–	–	–	–
Ped Clear	–	–	–	–	–	–
Min Green *	7	12	7	7	7	12
Passage *	2.0	2.0	2.0	2.0	2.0	2.0
Max 1 *	20	90	30	30	20	90
Yellow Change	3.0	4.9	3.7	4.3	3.0	4.9
Red Clear	2.9	1.9	3.2	2.9	3.1	1.9
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

* 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.

Signal Upgrade
Temporary Design 3 - TMP Phase II Steps 1-2

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PLAN DATE: August 2025 REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

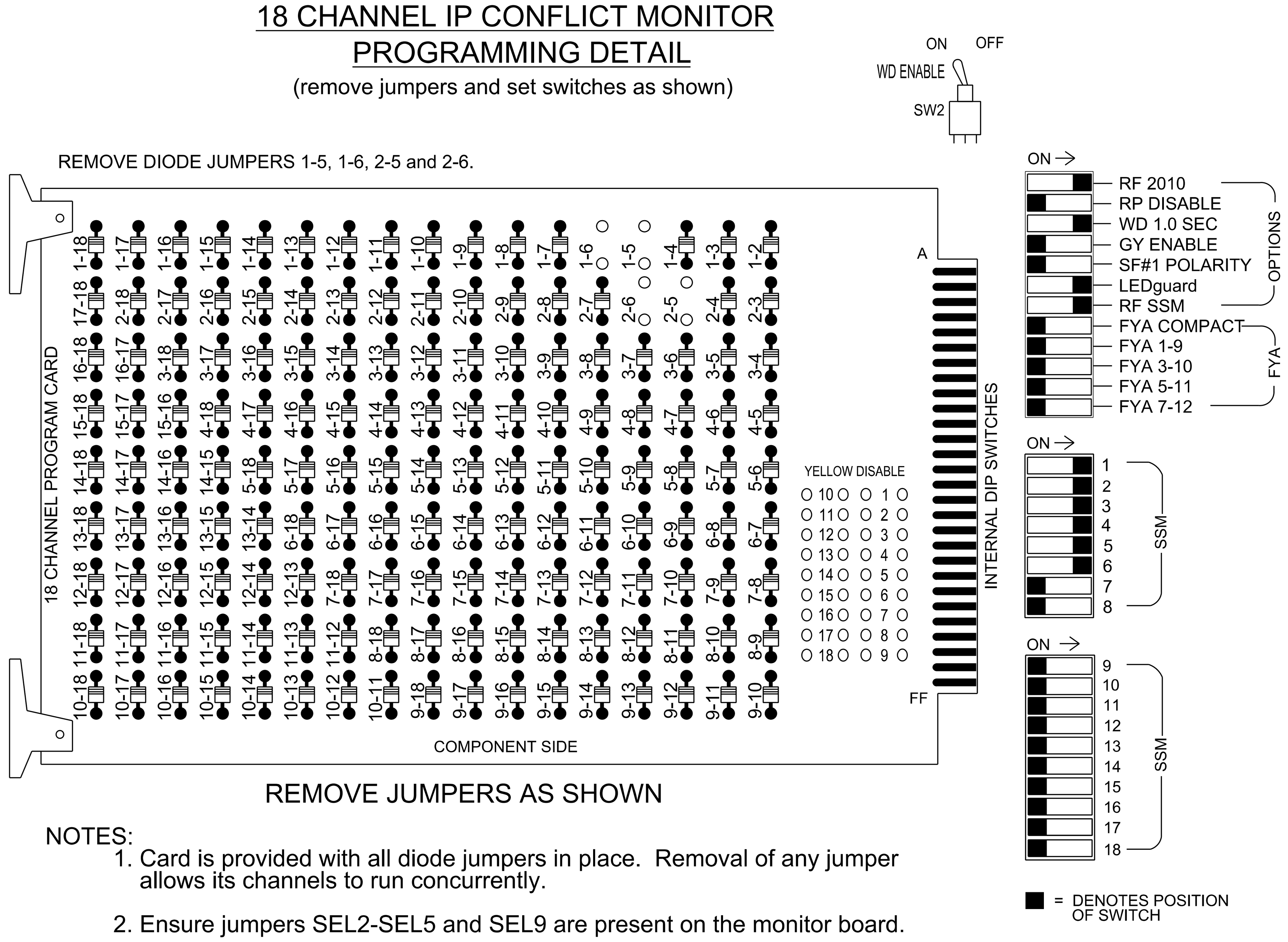
DocuSigned by: David T Sears
069183F28E5741E...
SIGNATURE 8/1/2025 DATE

SIG. INVENTORY NO. 12-0997T3

8/1/2025
R:\Traffic\Signals\Design\Signals\B-6051_Signal_12-0997T3_dsn.dgn
dsears

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE JUMPERS AS SHOWN

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. 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.
4. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

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

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	32	21,22, 23	NU	31	32	41	42	NU	51	61,62	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED	·		128	·	116	116	101	101	·	·	134	·	·	·	·	·	·	·	·	·	·
YELLOW	·		129	·	117	117	102	102	·	·	135	·	·	·	·	·	·	·	·	·	·
GREEN	·		130	·	118	118	103	103	·	·	136	·	·	·	·	·	·	·	·	·	·
RED ARROW	125		·	·	·		·		·	131	·	·	·	·	·	·	·	·	·	·	·
YELLOW ARROW	126	126	·	·	·		·		·	132	·	·	·	·	·	·	·	·	·	·	·
GREEN ARROW	127	127	·	·	118		103		·	133	·	·	·	·	·	·	·	·	·	·	·

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

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

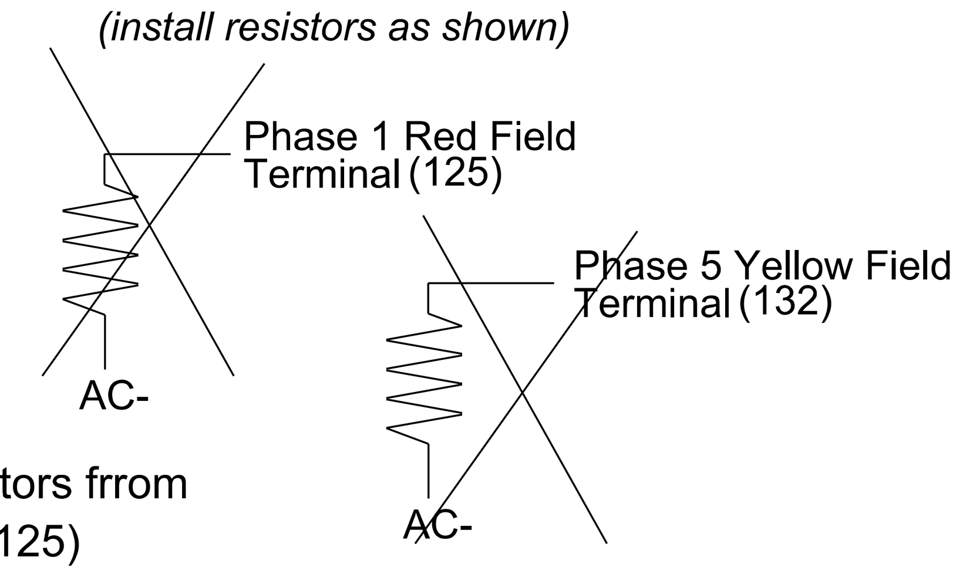
EX. : 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE
ST = STOP TIME

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)



! If present, remove load resistors frrom
Phase 1 Red Field Terminal (125)
and from Phase 5 Yellow Field Terminal (132)

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection for zones 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 2F, 3A, 4A, 4B, 5A, 6A, 6B, 6C, and 6D. Perform installation according to manufacturer's directions and NCDOT engineer -approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-0997T3
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Temporary Design 3 - TMP Phase II Steps 1-2
Electrical Detail

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ITS & Signals Management Section
750 N. Greenfield Pkwy, Garner, NC 27529

US 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)/
SR 2083 (Hazeleen Avenue)

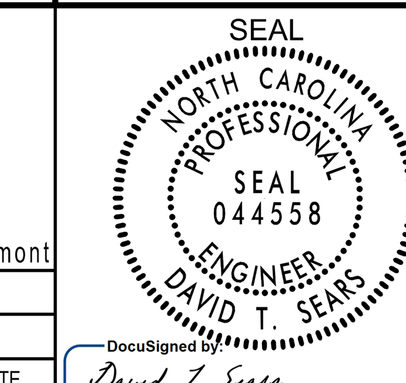
Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL



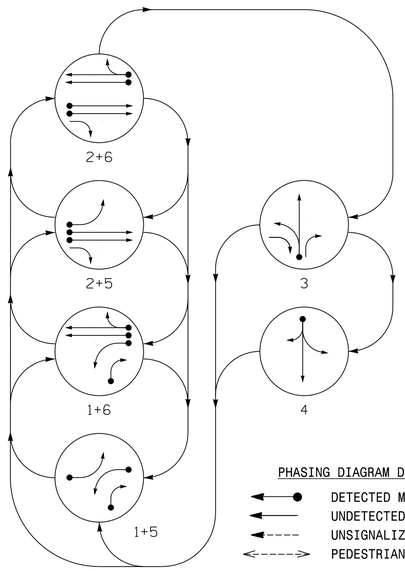
DocuSigned by:
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 12-0997T3

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 5.0

6 Phase
Fully Actuated
(Belmont Signal System)

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

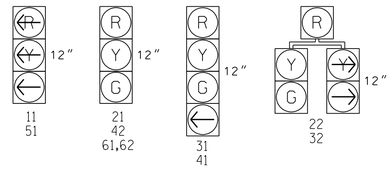
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 1+5	1+6	2+5	2+6	3	4	FLASH
11	←	←	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~
21	R	R	G	G	R	R	R
22	R	R	G	G	R/	R	R
31	R	R	R	R	G ←	R	R
32	R/	R/	R	R	G	R	R
41	R	R	R	R	R	G ←	R
42	R	R	R	R	R	G	R
51	←	~~R~~	←	~~R~~	~~R~~	~~R~~	~~R~~
61,62	R	G	R	G	R	R	R

SIGNAL FACE I.D.

All Heads L.E.D.



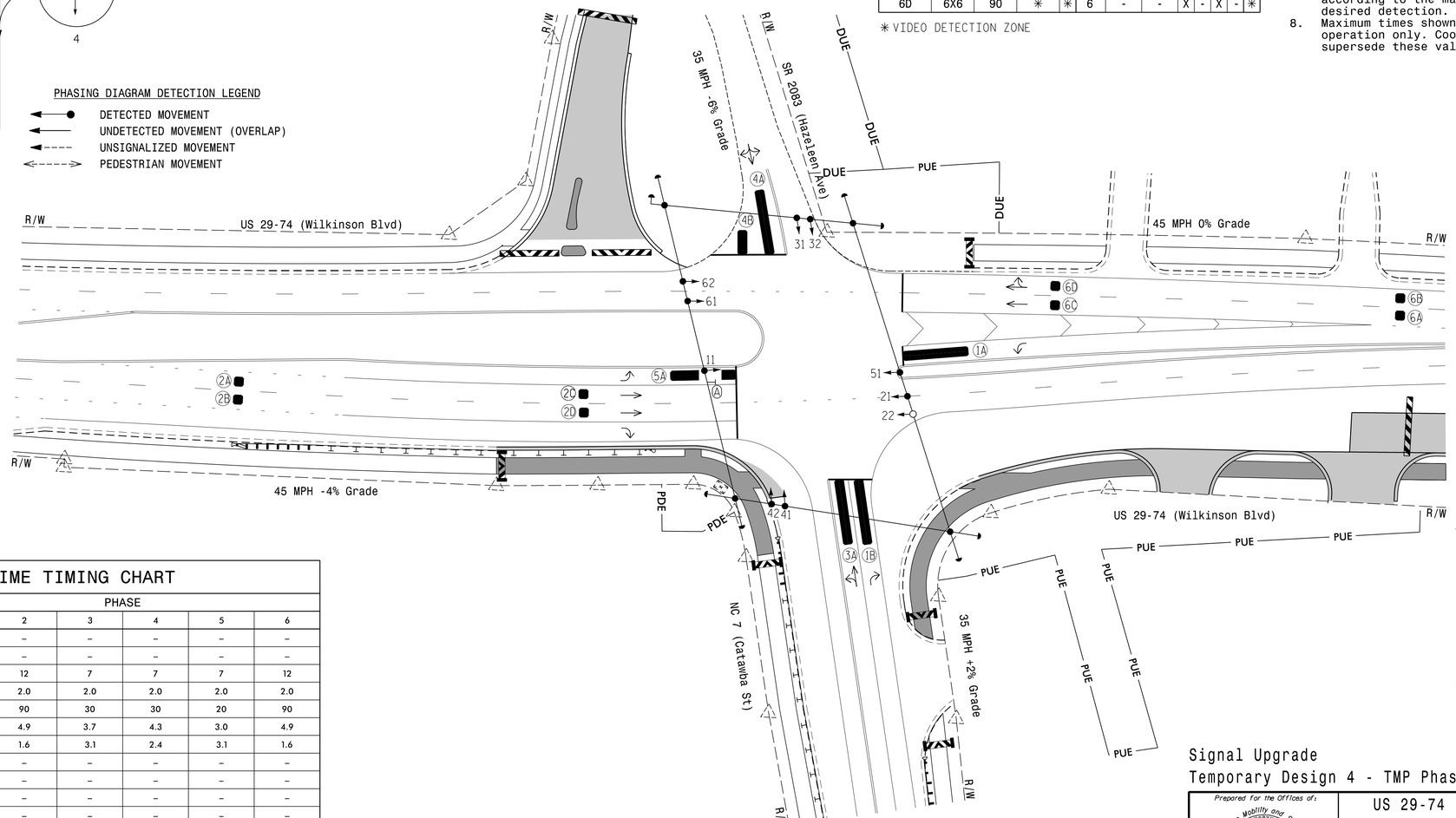
MAXTIME DETECTOR INSTALLATION CHART

DETECTOR					PROGRAMMING							
ZONE	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	6X40	0	*	*	1	-	-	X	-	X	-	*
1B	6X40	0	*	*	1	15.0	-	X	-	X	-	*
2A	6X6	300	*	*	2	-	1.6	X	-	X	-	*
2B	6X6	300	*	*	2	-	1.6	X	-	X	-	*
2C	6X6	90	*	*	2	-	-	X	-	X	-	*
2D	6X6	90	*	*	2	-	-	X	-	X	-	*
3A	6X40	0	*	*	3	3.0	-	X	-	X	-	*
4A	6X40	0	*	*	4	10.0	-	X	-	X	-	*
4B	6X15	0	*	*	4	10.0	-	X	-	X	-	*
5A	6X40	0	*	*	5	-	-	X	-	X	-	*
6A	6X6	300	*	*	6	-	1.6	X	-	X	-	*
6B	6X6	300	*	*	6	-	1.6	X	-	X	-	*
6C	6X6	90	*	*	6	-	-	X	-	X	-	*
6D	6X6	90	*	*	6	-	-	X	-	X	-	*

*VIDEO DETECTION ZONE

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification 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. The order of phase 3 and phase 4 may be reversed.
5. Set all detector units to presence mode.
6. Reposition existing signal heads numbered 21 and 32.
7. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	
— PUE —	Utility Easment	— PUE —
— PDE —	Drainage Easment	— PDE —
N/A	Guardrail	
	Construction Zone	
	Non-Intrusive Detection Zone	
	Pedestrian Barricade	
	Barricade	
A	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	A

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	–	–	–	–	–
Ped Clear	–	–	–	–	–	–
Min Green *	7	12	7	7	7	12
Passage *	2.0	2.0	2.0	2.0	2.0	2.0
Max 1 *	20	90	30	30	20	90
Yellow Change	3.0	4.9	3.7	4.3	3.0	4.9
Red Clear	2.6	1.6	3.1	2.4	3.1	1.6
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

* 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.

Signal Upgrade
Temporary Design 4 - TMP Phase II Steps 3-4

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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 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)/
SR 2083 (Hazeleen Avenue)

Division 12 Gaston County Belmont

PLAN DATE:	August 2025	REVIEWED BY:	DT Sears
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	

REVISIONS	INIT.	DATE

SCALE 0 40 1"=40'

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

DocuSigned by: David T Sears 0691B3F2E5741E...
8/1/2025
SIGNATURE DATE

SIG. INVENTORY NO. I2-0997T4

8/1/2025
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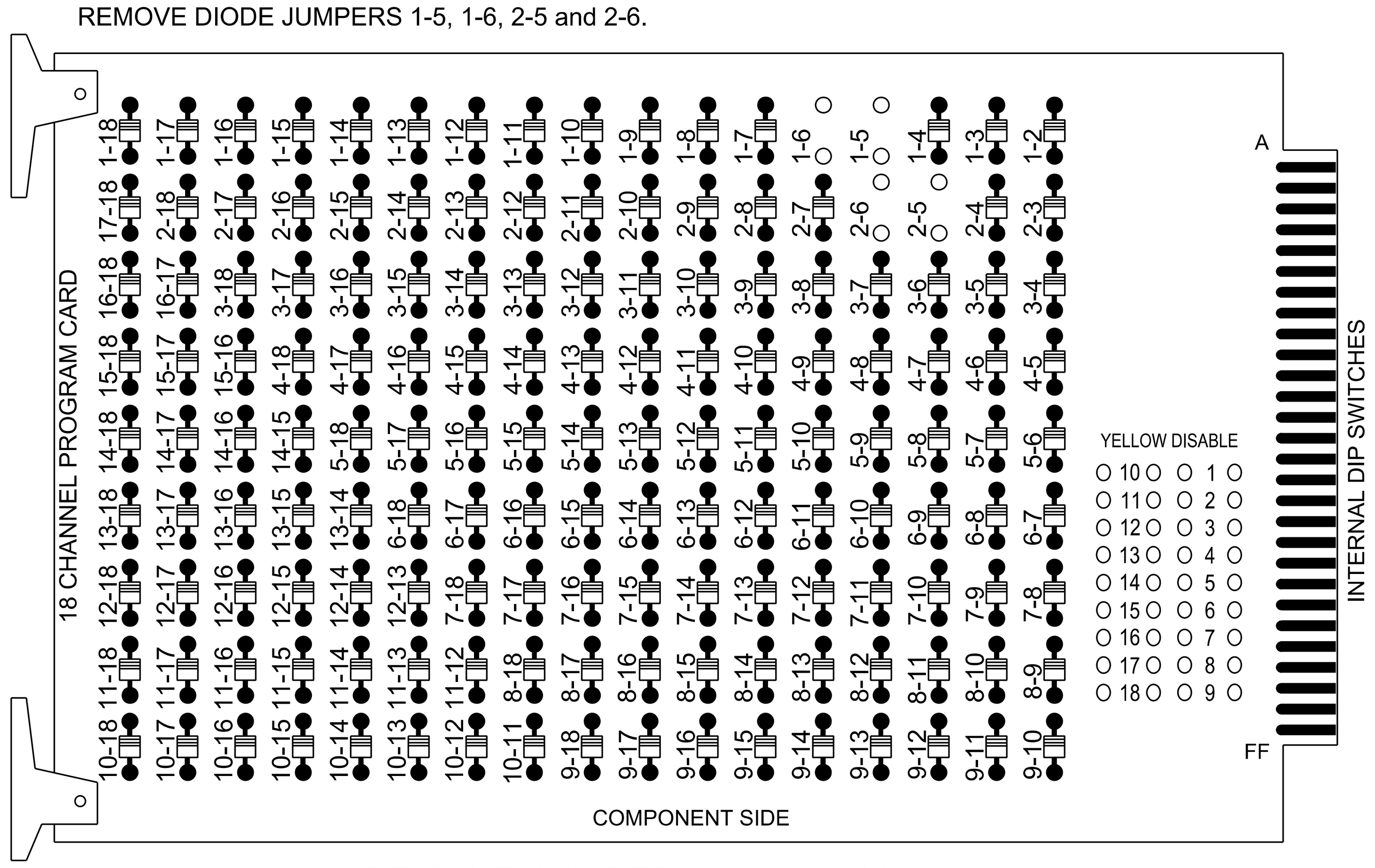
dsears

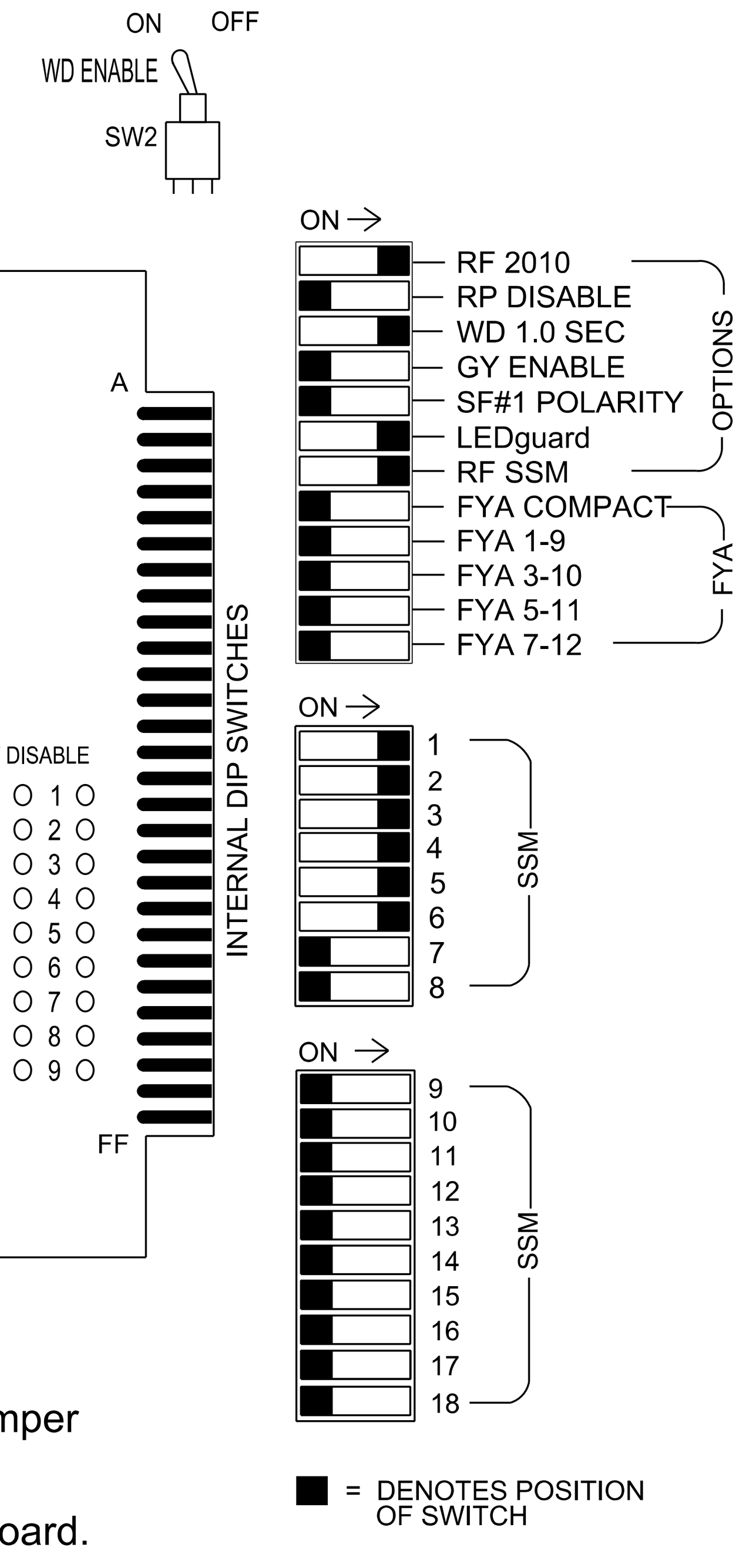
PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 5.1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 1-5, 1-6, 2-5 and 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. 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.
4. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

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

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	32	21,22	NU	31	32	22	41	42	NU	51	61,62	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED			128		116	116		101	101			134										
YELLOW			129		117	117		102	102			135										
GREEN			130		118	118		103	103			136										
RED ARROW	125										131											
YELLOW ARROW	126	126					117				132											
GREEN ARROW	127	127			118		118	103			133											

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

FILE		1	2	3	4	5	6	7	8	9	1O	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 video detection system for vehicle detection for zones 1A, 1B, 2A, 2B, 2C, 2D, 3A, 4A, 4B, 5A, 6A, 6B, 6C, and 6D. Perform installation according to manufacturer's directions and NCDOT engineer -approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-0997T4
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Temporary Design 4 - TMP Phase II Steps 3-4
Electrical Detail

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Electrical and Programming Details For:

Prepared for the Offices of:
Transportation Mobility and Safety Division
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PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

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SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

DocuSigned by: David T Sears
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 12-0997T4

8/1/2025
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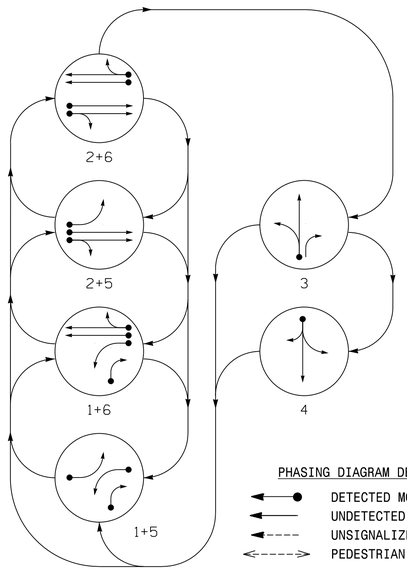
dsears

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 6.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

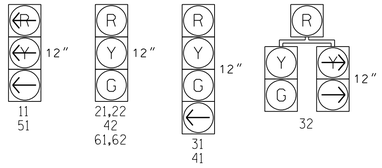
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 1+5	1+6	2+5	2+6	3	4	FLASH
11	←	←	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~
21,22	R	R	G	G	R	R	R
31	R	R	R	R	G ←	R	R
32	R ↗	R ↗	R	R	G	R	R
41	R	R	R	R	R	G ←	R
42	R	R	R	R	R	G	R
51	←	~~R~~	←	~~R~~	~~R~~	~~R~~	~~R~~
61,62	R	G	R	G	R	R	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

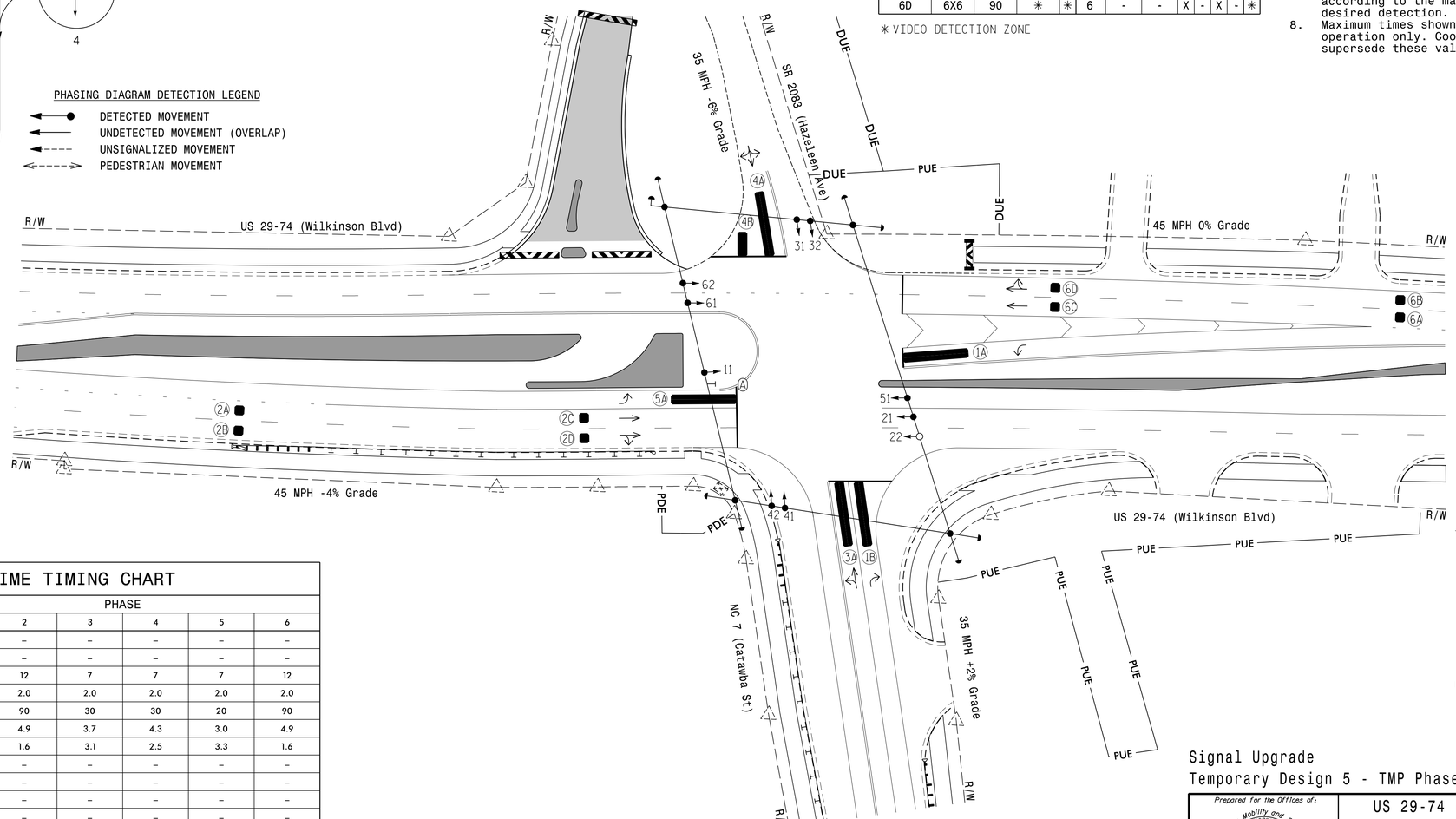
DETECTOR					PROGRAMMING							
ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	✳	✳	1	-	-	X	-	X	-	✳
1B	6X40	0	✳	✳	1	15.0	-	X	-	X	-	✳
2A	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2B	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2C	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
2D	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
3A	6X40	0	✳	✳	3	3.0	-	X	-	X	-	✳
4A	6X40	0	✳	✳	4	10.0	-	X	-	X	-	✳
4B	6X15	0	✳	✳	4	10.0	-	X	-	X	-	✳
5A	6X40	0	✳	✳	5	-	-	X	-	X	-	✳
6A	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6B	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6C	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
6D	6X6	90	✳	✳	6	-	-	X	-	X	-	✳

✳ VIDEO DETECTION ZONE

6 Phase
Fully Actuated
(Belmont Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification 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. The order of phase 3 and phase 4 may be reversed.
5. Set all detector units to presence mode.
6. Reposition existing signal heads numbered 21 and 51.
7. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	
— PUE —	Utility Easment	— PUE —
— PDE —	Drainage Easment	— PDE —
N/A	Guardrail	
	Construction Zone	
	Non-Intrusive Detection Zone	
	Pedestrian Barricade	
	Barricade	
Ⓐ	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	Ⓐ

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	–	–	–	–	–
Ped Clear	–	–	–	–	–	–
Min Green *	7	12	7	7	7	12
Passage *	2.0	2.0	2.0	2.0	2.0	2.0
Max 1 *	20	90	30	30	20	90
Yellow Change	3.0	4.9	3.7	4.3	3.0	4.9
Red Clear	2.8	1.6	3.1	2.5	3.3	1.6
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

* 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.

Signal Upgrade
Temporary Design 5 - TMP Phase III Steps 1-2

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SR 2083 (Hazeleen Avenue)

Division 12 Gaston County Belmont

PLAN DATE:	August 2025	REVIEWED BY:	DT Sears
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	

REVISIONS	INIT.	DATE

SCALE 0 40 1"=40'

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

DocuSigned by: David T Sears
069183F2E5741E...
8/1/2025
SIGNATURE DATE

SIG. INVENTORY NO. 12-0997T5

8/1/2025
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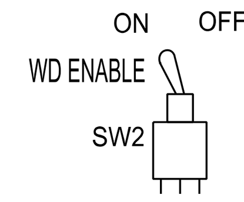
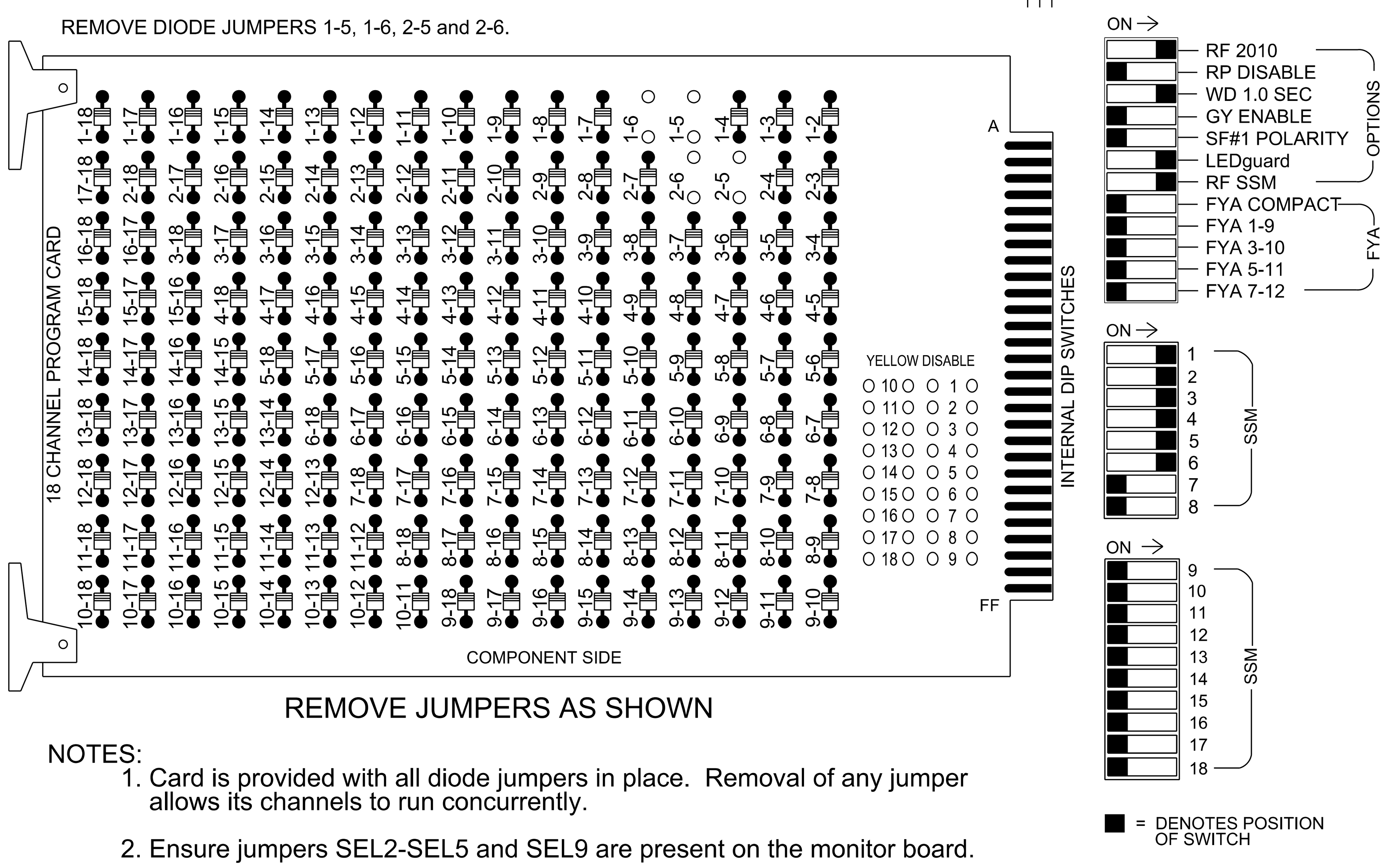
dsears

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE DIODE JUMPERS 1-5, 1-6, 2-5 and 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. 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.
4. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

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

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	32	21,22	NU	31	32	41	42	NU	51	61,62	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED			128		116	116	101	101			134										
YELLOW			129		117	117	102	102			135										
GREEN			130		118	118	103	103			136										
RED ARROW	125									131											
YELLOW ARROW	126	126								132											
GREEN ARROW	127	127			118		103			133											

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

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

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

FS = FLASH SENSE
ST = STOP TIME

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection for zones 1A, 1B, 2A, 2B, 2C, 2D, 3A, 4A, 4B, 5A, 6A, 6B, 6C, and 6D. Perform installation according to manufacturer's directions and NCDOT engineer -approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-0997T5
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Temporary Design 5 - TMP Phase III Steps 1-2
Electrical Detail

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Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)/
SR 2083 (Hazeleen Avenue)

Division 12 Gaston County Belmont

PLAN DATE:	August 2025	REVIEWED BY:	CB Holden
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	DT Sears

REVISIONS	INIT.	DATE

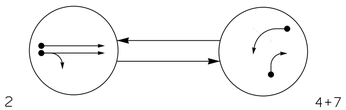
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

DocuSigned by:
David T Sears
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 12-0997T5

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 7.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

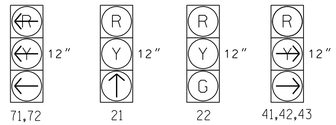
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 2	PHASE 4+7	FLASH
21	↑	R	R
22	G	R	R
41,42,43	R	→	R
71,72	~~R~~	←	~~R~~

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

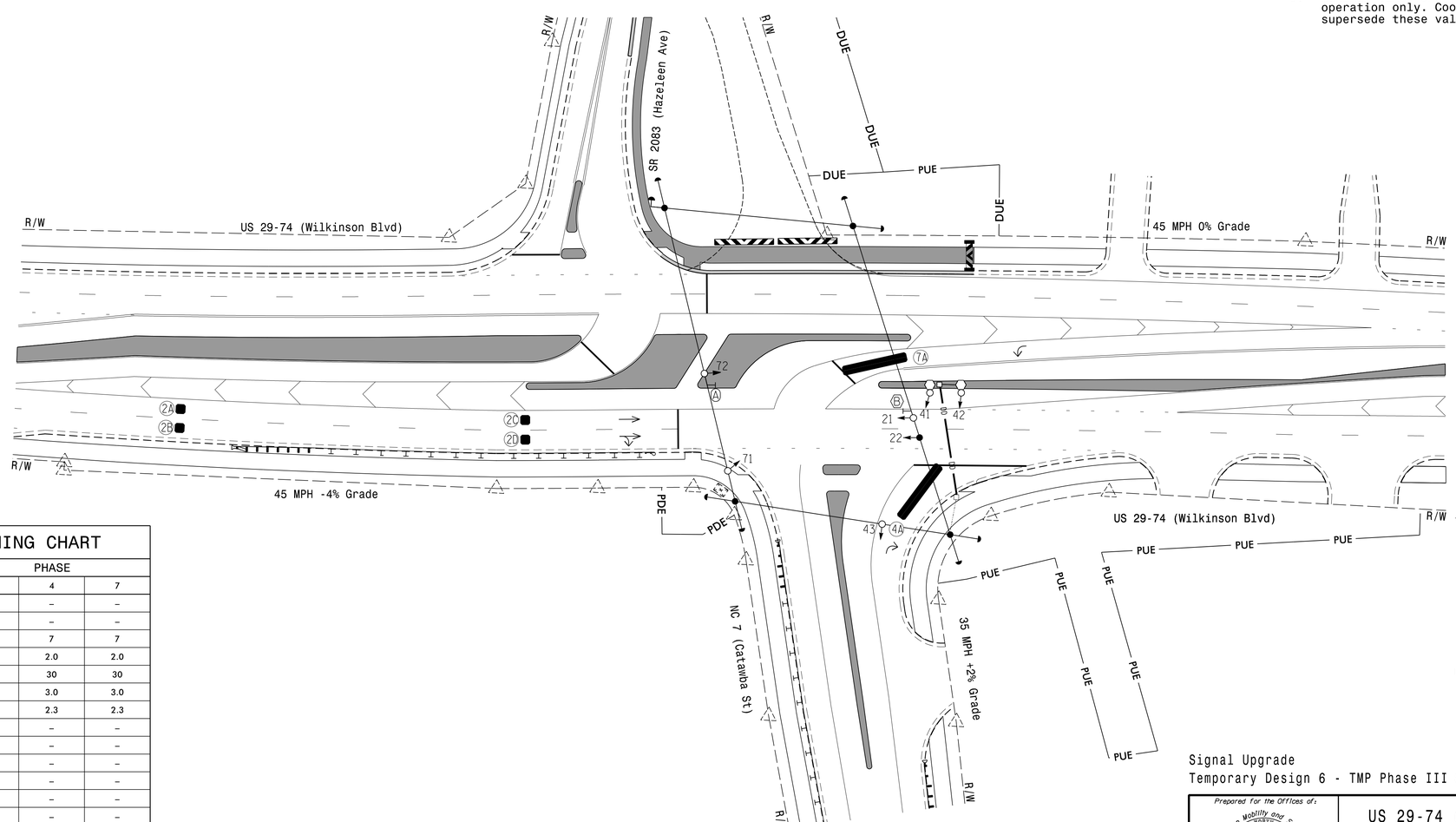
DETECTOR					PROGRAMMING							
ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
2A	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2B	6X6	300	✳	✳	2	-	1.6	X	-	X	-	✳
2C	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
2D	6X6	90	✳	✳	2	-	-	X	-	X	-	✳
4A	6X40	0	✳	✳	4	15.0	-	X	-	X	-	✳
7A	6X40	0	✳	✳	7	-	-	X	-	X	-	✳

✳ VIDEO DETECTION ZONE

2 Phase
Fully Actuated
(Belmont Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Set all detector units to presence mode.
4. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
5. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	→
— PUE —	Utility Easment	— PUE —
— PDE —	Drainage Easment	— PDE —
N/A	Guardrail	⊥⊥
▒	Construction Zone	▒
▬	Non-Intrusive Detection Zone	▬
▓	Pedestrian Barricade	▓
▨	Barricade	▨
Ⓐ	"U-TURN YIELD TO RIGHT TURN" Sign (R10-16)	Ⓐ
Ⓑ	No Left Turn Sign (R3-2)	Ⓑ

MAXTIME TIMING CHART

FEATURE	PHASE 2	PHASE 4	PHASE 7
Walk *	–	–	–
Ped Clear	–	–	–
Min Green *	12	7	7
Passage *	2.0	2.0	2.0
Max 1 *	90	30	30
Yellow Change	4.9	3.0	3.0
Red Clear	3.2	2.3	2.3
Added Initial *	–	–	–
Maximum Initial *	–	–	–
Time Before Reduction *	–	–	–
Time To Reduce *	–	–	–
Minimum Gap	–	–	–
Advance Walk	–	–	–
Non Lock Detector	–	X	X
Vehicle Recall	MIN RECALL	–	–
Dual Entry	–	X	X

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

Signal Upgrade
Temporary Design 6 - TMP Phase III Step 3 - Phase IV

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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

SCALE
0 40
1"=40'

US 29-74 (Wilkinson Blvd) at NC 7 (Catawba St)

Division 12 Gaston County Belmont

PLAN DATE: August 2025 REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

DocuSigned by: David T Sears
069183F2E5741E...
SIGNATURE 8/1/2025 DATE

SIG. INVENTORY NO. 12-0997T6

8/1/2025
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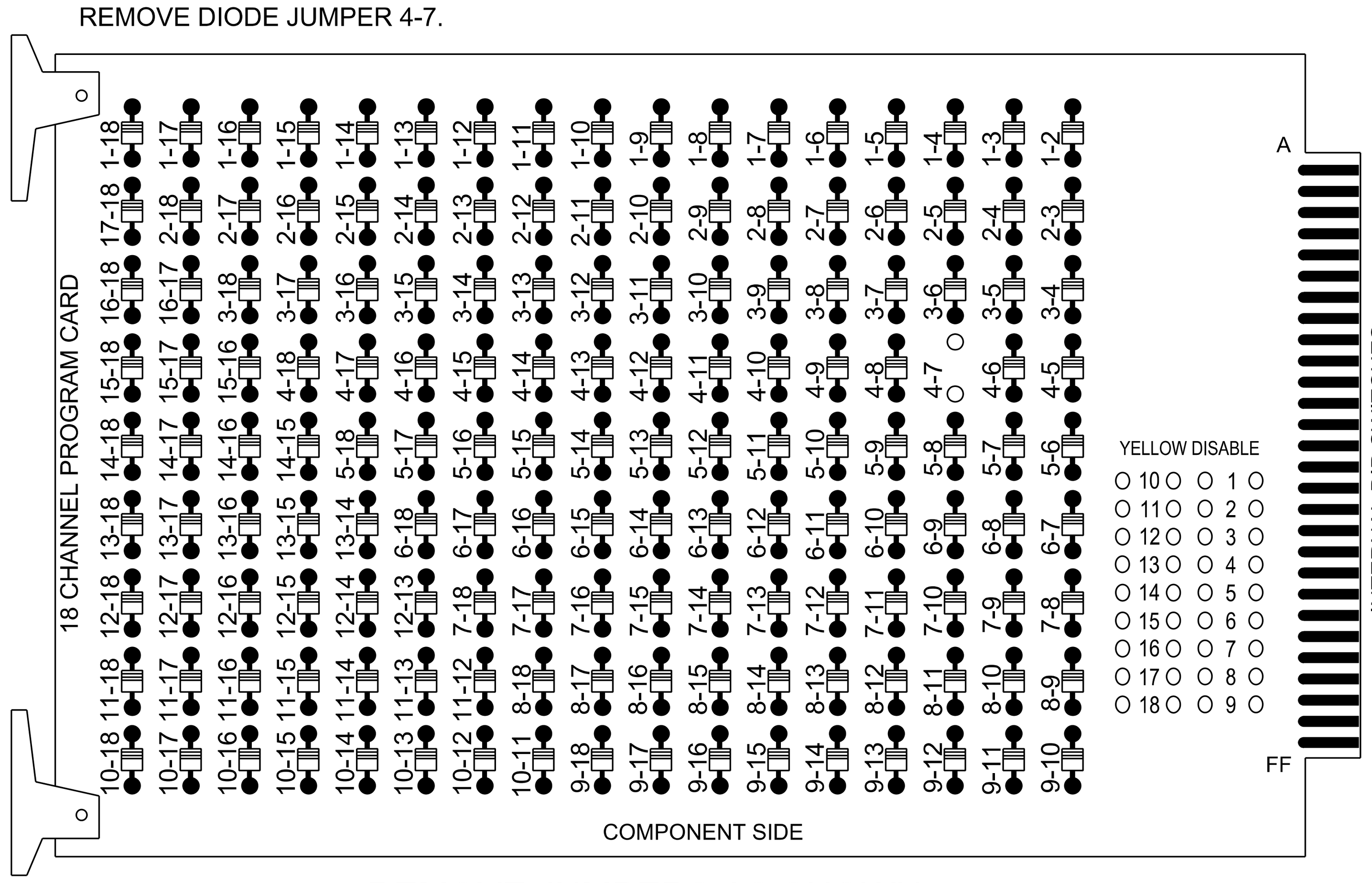
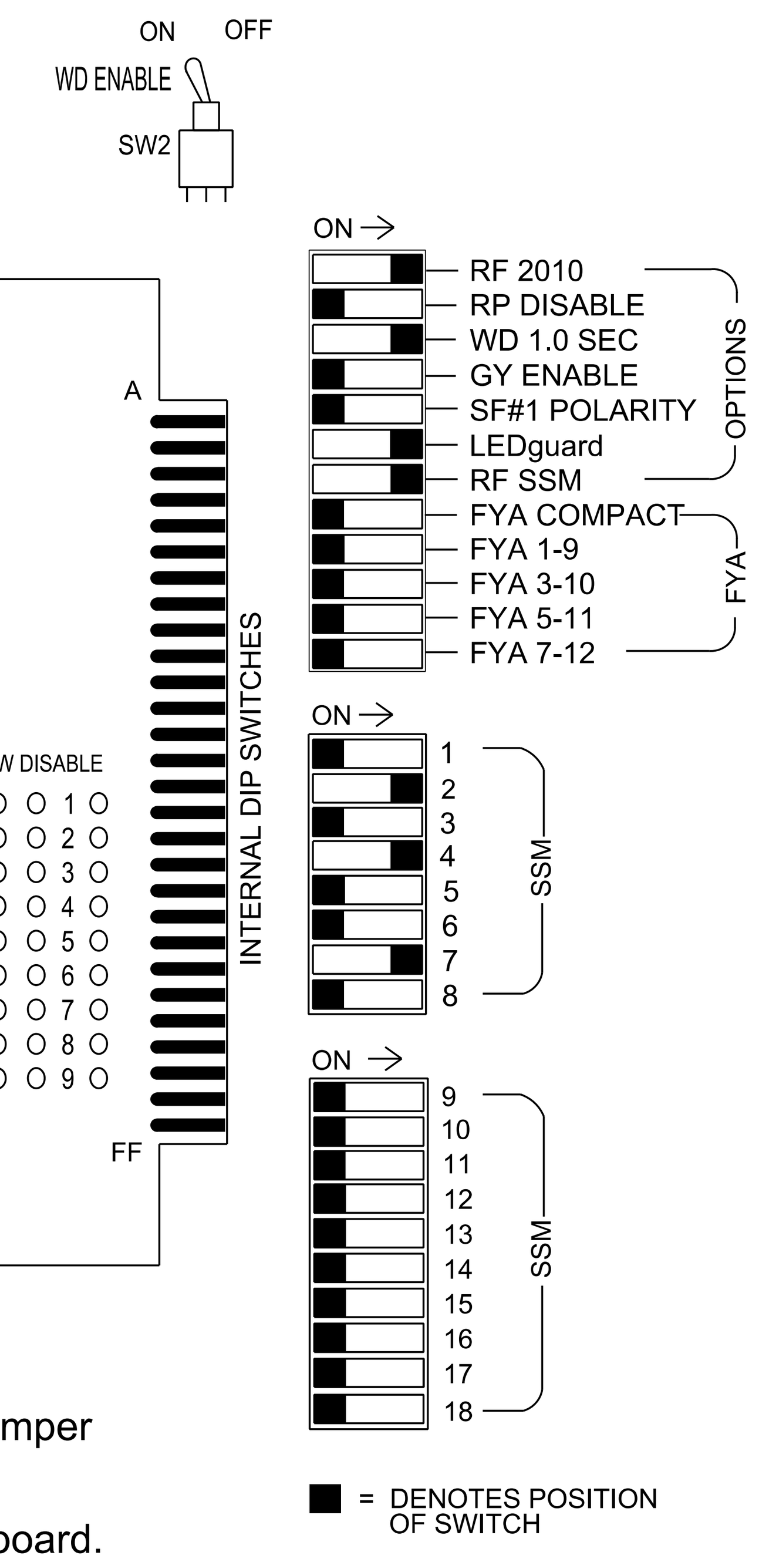
dsears

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPER 4-7.





■ = 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 7 for Dual Entry.
3. Program controller to start up in phase 2 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
5. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

Controller..2070LX
Cabinet...332 w/ Aux
Software...Q-Free MAXTIME
Cabinet Mount....................................Base
Output File Positions..........................18 With Aux. Output File
Load Switches Used...........................S2, S5, S10
Phases Used.......................................2, 4, 7
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..NOT USED
Overlap "4"..NOT USED

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2		S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2		13	3	4	14	5	6	15	7	8	16	9	10	17	11	12	18
PHASE	1	2		2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	21	22	NU	NU	41,42, 43	NU	NU	NU	NU	71,72	NU	NU	NU	NU	NU	NU	NU	NU
RED		128	128			101													
YELLOW		129	129																
GREEN			130																
RED ARROW											122								
YELLOW ARROW						102					123								
GREEN ARROW		130				103					124								

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

FILE		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 video detection system for vehicle detection for zones 2A, 2B, 2C, 2D, 4A, and 7A. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-0997T6
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Temporary Design 6 - TMP Phase III Step 3-Phase IV
Electrical Detail

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Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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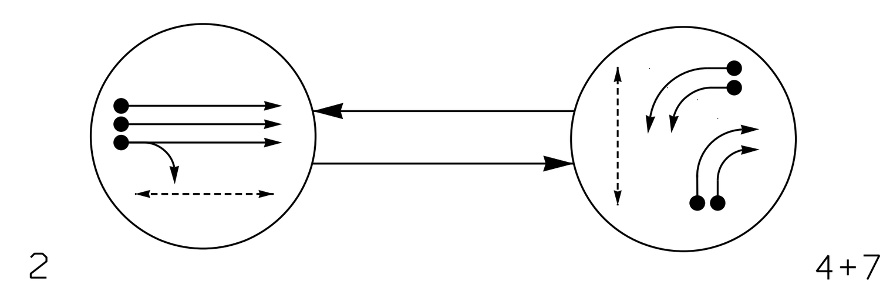
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS
DocuSigned by: David T. Sears
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 12-0997T6

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

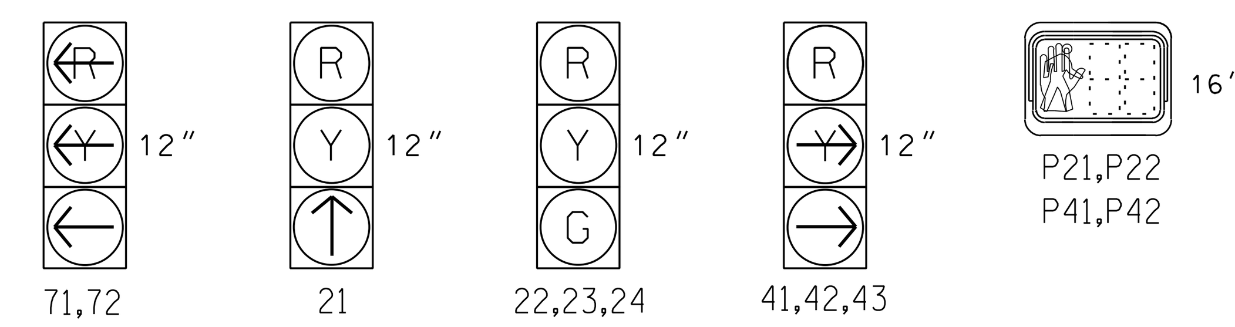
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 2	PHASE 4+7	PHASE FLASH
21	↑	R	R
22,23,24	G	R	R
41,42,43	R	→	R
71,72	←R	←	←R
P21,P22	W	DW	DRK
P41,P42	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



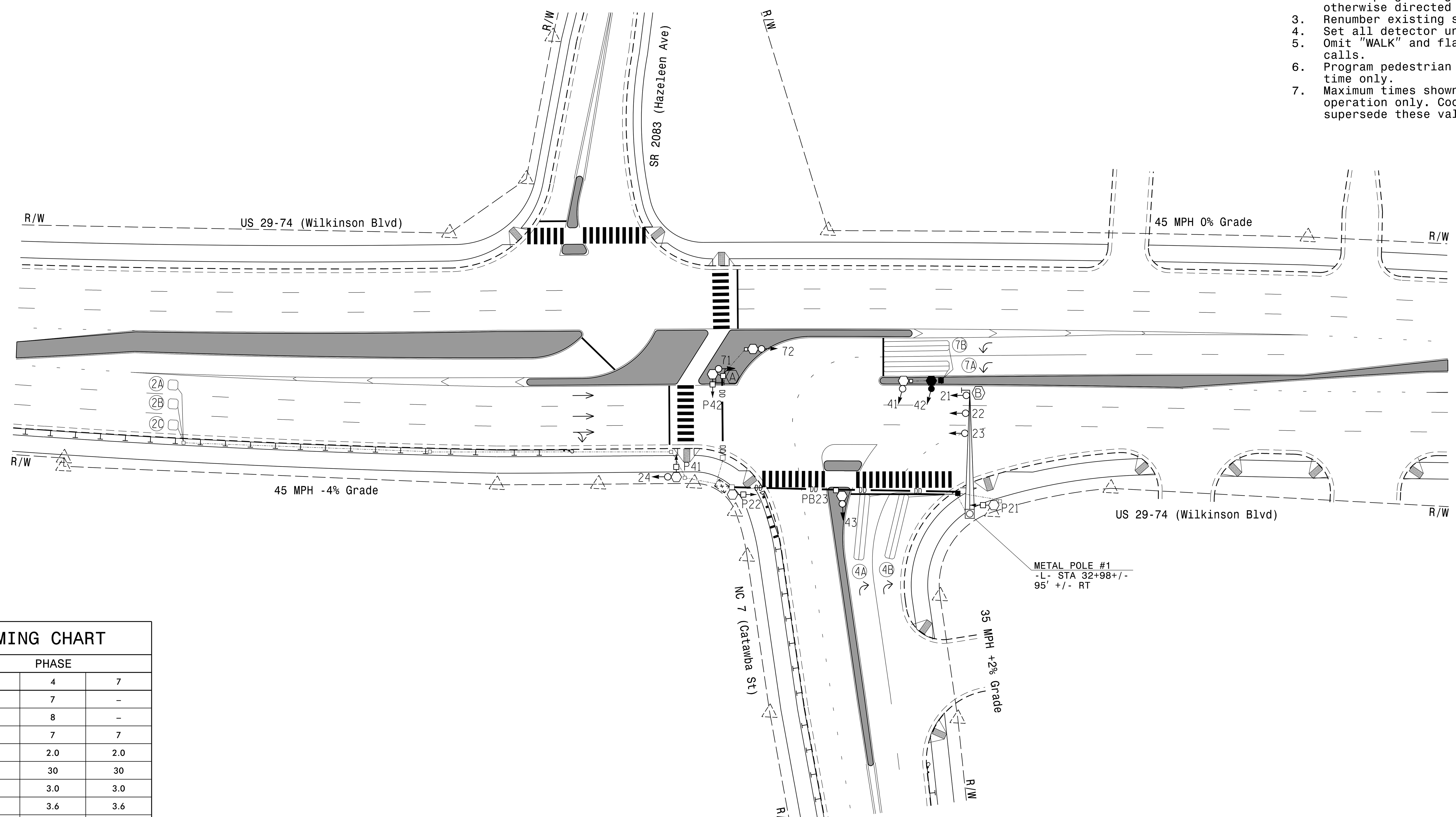
MAXTIME DETECTOR INSTALLATION CHART

DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
2A	6X6	300	4	X	2	-	-	X	X	X	-	X
2B	6X6	300	4	X	2	-	-	X	X	X	-	X
2C	6X6	300	4	X	2	-	-	X	X	X	-	X
4A	6X40	0	2-4-2	X	4	15.0	-	X	-	X	-	X
4B	6X40	0	2-4-2	X	4	15.0	-	X	-	X	-	X
7A	6X40	0	2-4-2	X	7	-	-	X	-	X	-	X
7B	6X40	0	2-4-2	X	7	-	-	X	-	X	-	X

2 Phase
Fully Actuated
(Belmont Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Renumber existing signal head 41 to 42.
4. Set all detector units to presence mode.
5. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
6. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
7. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	
N/A	Guardrail	
	Metal Pole with Mastarm	
	Type II Signal Pedestal	
(A)	No U-Turn Sign (R3-4)	(A)
(B)	No Left Turn Sign (R3-2)	(B)
N/A	Curb Ramp	

MAXTIME TIMING CHART

FEATURE	PHASE 2	PHASE 4	PHASE 7
Walk *	7	7	–
Ped Clear	41	8	–
Min Green *	12	7	7
Passage *	6.0	2.0	2.0
Max 1 *	90	30	30
Yellow Change	4.9	3.0	3.0
Red Clear	2.6	3.6	3.6
Added Initial *	1.0	–	–
Maximum Initial *	34	–	–
Time Before Reduction *	15	–	–
Time To Reduce *	30	–	–
Minimum Gap	3.0	–	–
Advance Walk	7	–	–
Non Lock Detector	–	X	X
Vehicle Recall	MIN RECALL	–	–
Dual Entry	–	X	X

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

Signal Upgrade - Final Design

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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 29-74 (Wilkinson Blvd) at NC 7 (Catawba St)

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

DocuSigned by: David T. Sears
069183F28E5741E...
SIGNATURE 8/1/2025 DATE

SIG. INVENTORY NO. 12-0997

8/1/2025
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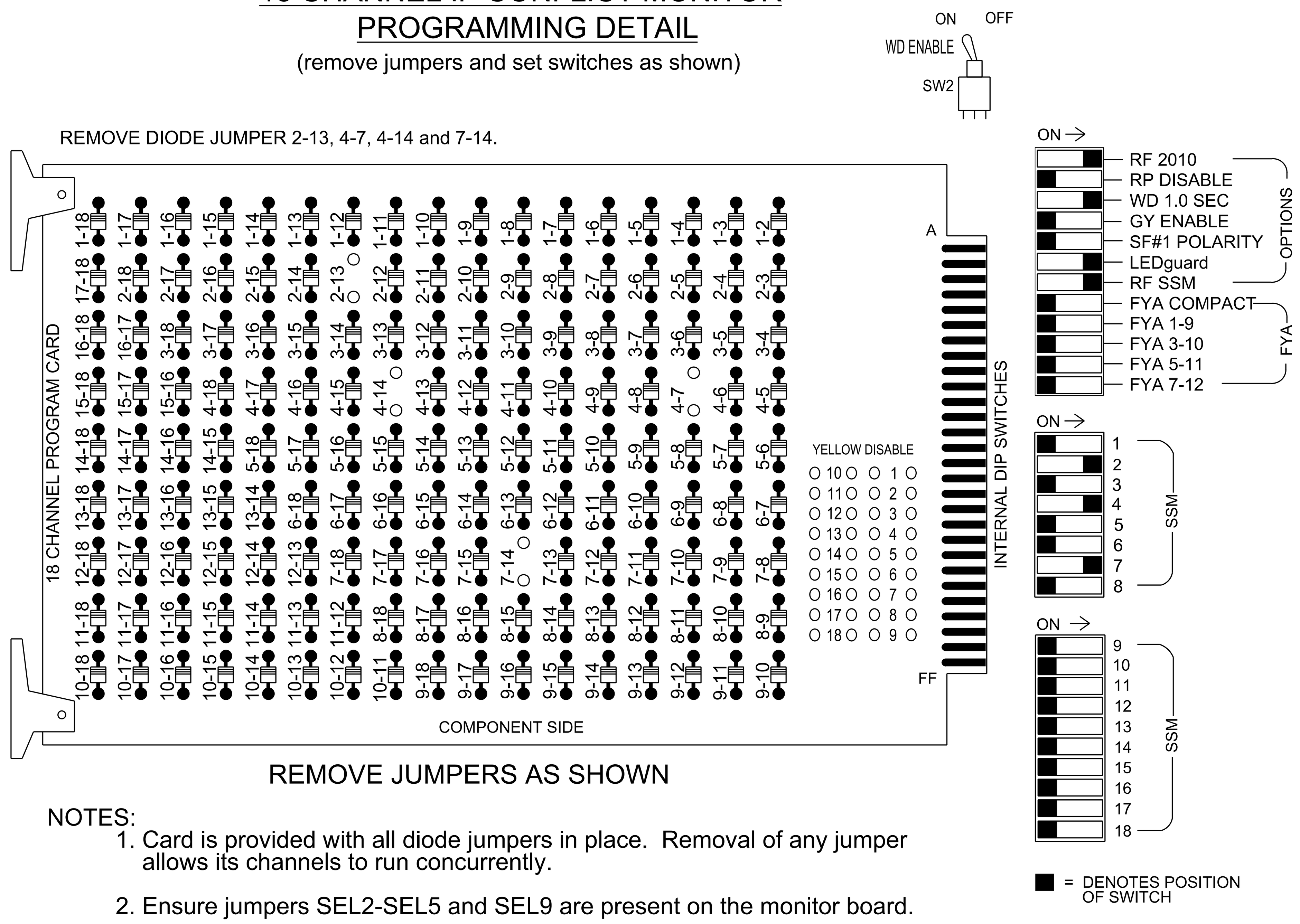
dsears

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPER 2-13, 4-7, 4-14 and 7-14.



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 7 for Dual Entry.
3. Program controller to start up in phase 2 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
5. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

Controller..2070LX
Cabinet...332 w/ Aux
Software...Q-Free MAXTIME
Cabinet Mount.....................................Base
Output File Positions...........................18 With Aux. Output File
Load Switches Used............................S2, S3, S5, S6, S10
Phases Used..2, 2 PED, 4, 4 PED, 7
Overlap "1"...NOT USED
Overlap "2"...NOT USED
Overlap "3"...NOT USED
Overlap "4"...NOT USED

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	22,23, 24	P21, P22	NU	41,42, 43	P41, P42	NU	NU	NU	71,72	NU	NU	NU	NU	NU	NU	NU	NU
RED		128	128			101													
YELLOW		129	129																
GREEN			130																
RED ARROW											122								
YELLOW ARROW						102					123								
GREEN ARROW		130				103					124								
(Don't Walk hand)				113			104												
(Walk person)				115			106												

NU = Not Used

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	Ø 2 2A	Ø 2 2C	SLOT EMPTY	SLOT EMPTY	Ø 4 4A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Ø 2 PED DC ISOLATOR	SLOT EMPTY	FS DC ISOLATOR
	L		Ø 2 2B	NOT USED			Ø 4 4B						Ø 4 PED DC ISOLATOR		ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Ø 7 7A	Ø 7 7B	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L					NOT USED	NOT USED								

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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
2A	TB2-5,6	I2U	39	1	2	2			X	X	X	
2B	TB2-7,8	I2L	43	5	3	2			X	X	X	
2C	TB2-9,10	I3U	63	29	4	2			X	X	X	
4A	TB4-9,10	I6U	41	3	8	4	15.0		X		X	
4B	TB4-11,12	I6L	45	7	9	4	15.0		X		X	
7A	TB5-5,6	J5U	57	19	21	7			X		X	
7B	TB5-9,10	J6U	42	4	22	7			X		X	
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						

NOTE:
INSTALL DC ISOLATORS IN INPUT FILE SLOT I12.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-0997
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

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.

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Signal Upgrade - Final Design - Electrical Detail

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Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

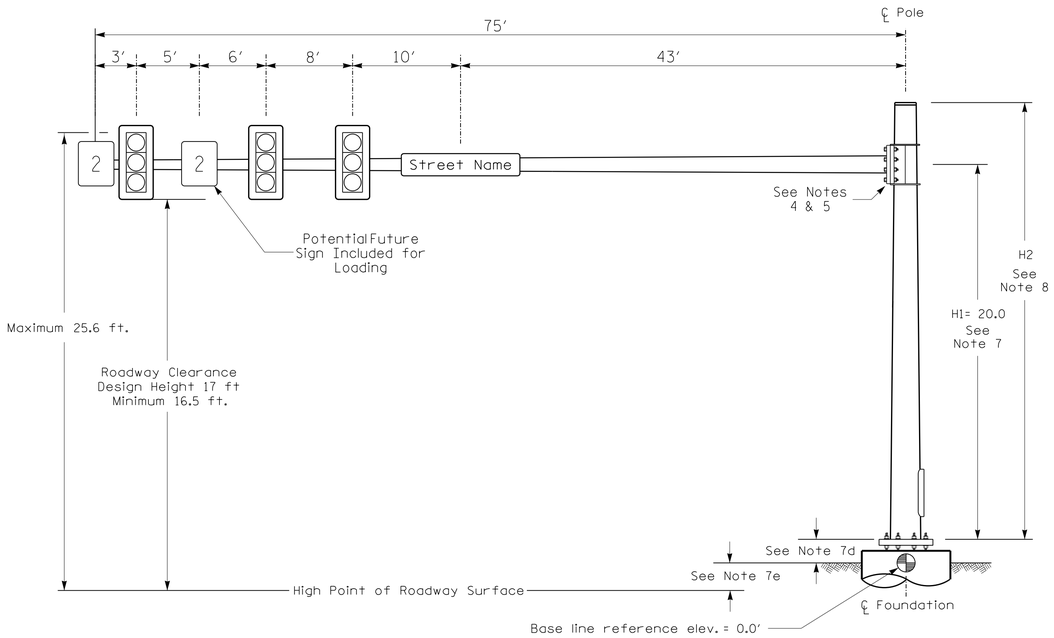
DocuSigned by: David T. Sears
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 12-0997

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 8.2

Design Loading for METAL POLE NO. 1



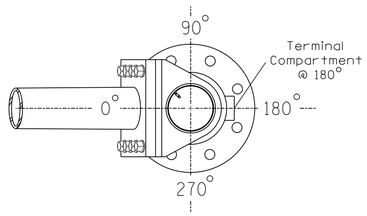
Elevation View

SPECIAL NOTE

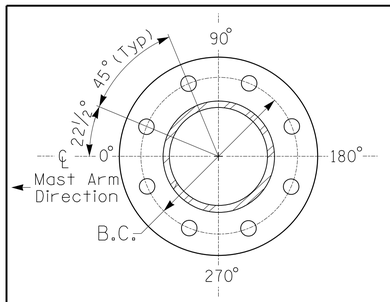
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	N/A
Baseline reference point at ⊕ Foundation @ ground level	0.0 ft.	
Elevation difference at High point of roadway surface	+0.8 ft.	
Elevation difference at Edge of travelway or face of curb	-0.5 ft.	

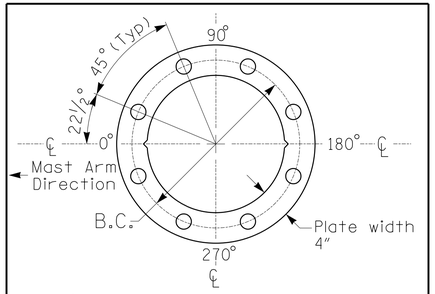


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
▯	RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5"W X 52.5"L	60 LBS
2	SIGN RIGID MOUNTED	7.5 S.F.	30.0"W X 36.0"L	14 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	16.0 S.F.	24.0"W X 96.0"L	36 LBS

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 1st Edition 2015 AASHTO LRFD "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 2024 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
   - The 2024 NCDOT Roadway Standard Drawings.
   - The traffic signal project plans and special provisions.
   - The NCDOT "Metal Pole Standards" located at the following NCDOT website: https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

DESIGN REQUIREMENTS

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

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

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NCDOT Wind Zone 5 (110 mph)

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

US 29-74 (Wilkinson Blvd)
at
NC 7 (Catawba St)

Division 12 Gaston County Belmont

PLAN DATE:	August 2025	REVIEWED BY:	DT Sears
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	

SCALE 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

DocuSigned by: David T Sears 0691B3F28E5741E... 8/1/2025
SIGNATURE DATE

SIG. INVENTORY NO. 12-0997

8/1/2025
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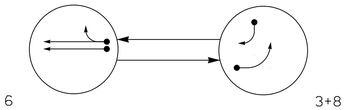
dsears

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig. 9.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

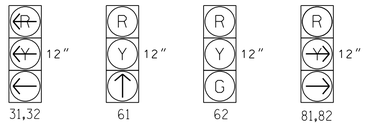
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 6	PHASE 3+8	PHASE FLASH
31,32	R	←	R
61	↑	R	R
62	G	R	R
81,82	R	→	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

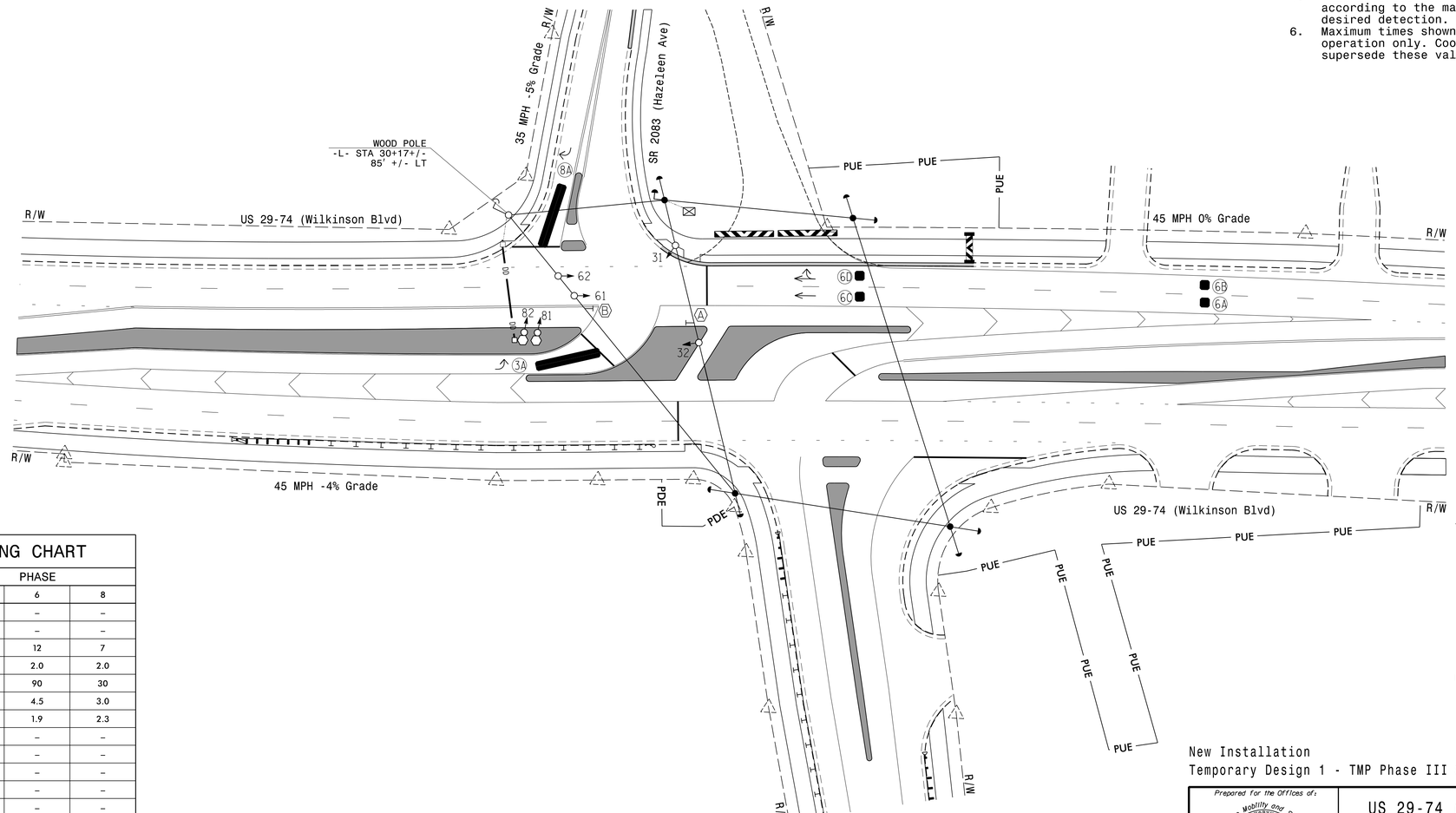
DETECTOR					PROGRAMMING							
ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
3A	6X40	0	✳	✳	3	-	-	X	-	X	-	✳
6A	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6B	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6C	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
6D	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
8A	6X40	0	✳	✳	8	15.0	-	X	-	X	-	✳

✳ VIDEO DETECTION ZONE

2 Phase
Fully Actuated
(Isolated)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Set all detector units to presence mode.
4. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
5. The cabinet should be designed to include an Auxiliary Output File for future use.
4. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
6. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	→
— PUE —	Utility Easment	— PUE —
— PDE —	Drainage Easment	— PDE —
▒	Construction Zone	▒
▬	Non-Intrusive Detection Zone	▬
N/A	Guardrail	⊥⊥
⋈	Pedestrian Barricade	⋈
▨	Barricade	▨
Ⓐ	No U-Turn Sign (R3-4)	Ⓐ
Ⓑ	No Left Turn Sign (R3-2)	Ⓑ

MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6	PHASE 8
Walk *	–	–	–
Ped Clear	–	–	–
Min Green *	7	12	7
Passage *	2.0	2.0	2.0
Max 1 *	30	90	30
Yellow Change	3.0	4.5	3.0
Red Clear	2.3	1.9	2.3
Added Initial *	–	–	–
Maximum Initial *	–	–	–
Time Before Reduction *	–	–	–
Time To Reduce *	–	–	–
Minimum Gap	–	–	–
Advance Walk	–	–	–
Non Lock Detector	X	–	X
Vehicle Recall	–	MIN RECALL	–
Dual Entry	X	–	X

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

New Installation
Temporary Design 1 - TMP Phase III Step 3 - Phase IV

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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

SCALE
0 40
1"=40'

US 29-74 (Wilkinson Blvd) at SR 2083 (Hazeleen Ave)

Division 12 Gaston County Belmont

PLAN DATE: August 2025 REVIEWED BY: DT Sears

PREPARED BY: WP Erickson-Jones REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

DocuSigned by: David T Sears
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8/1/2025
SIGNATURE DATE

SIG. INVENTORY NO. 12-1919TI

8/1/2025
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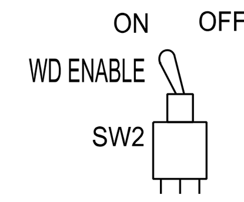
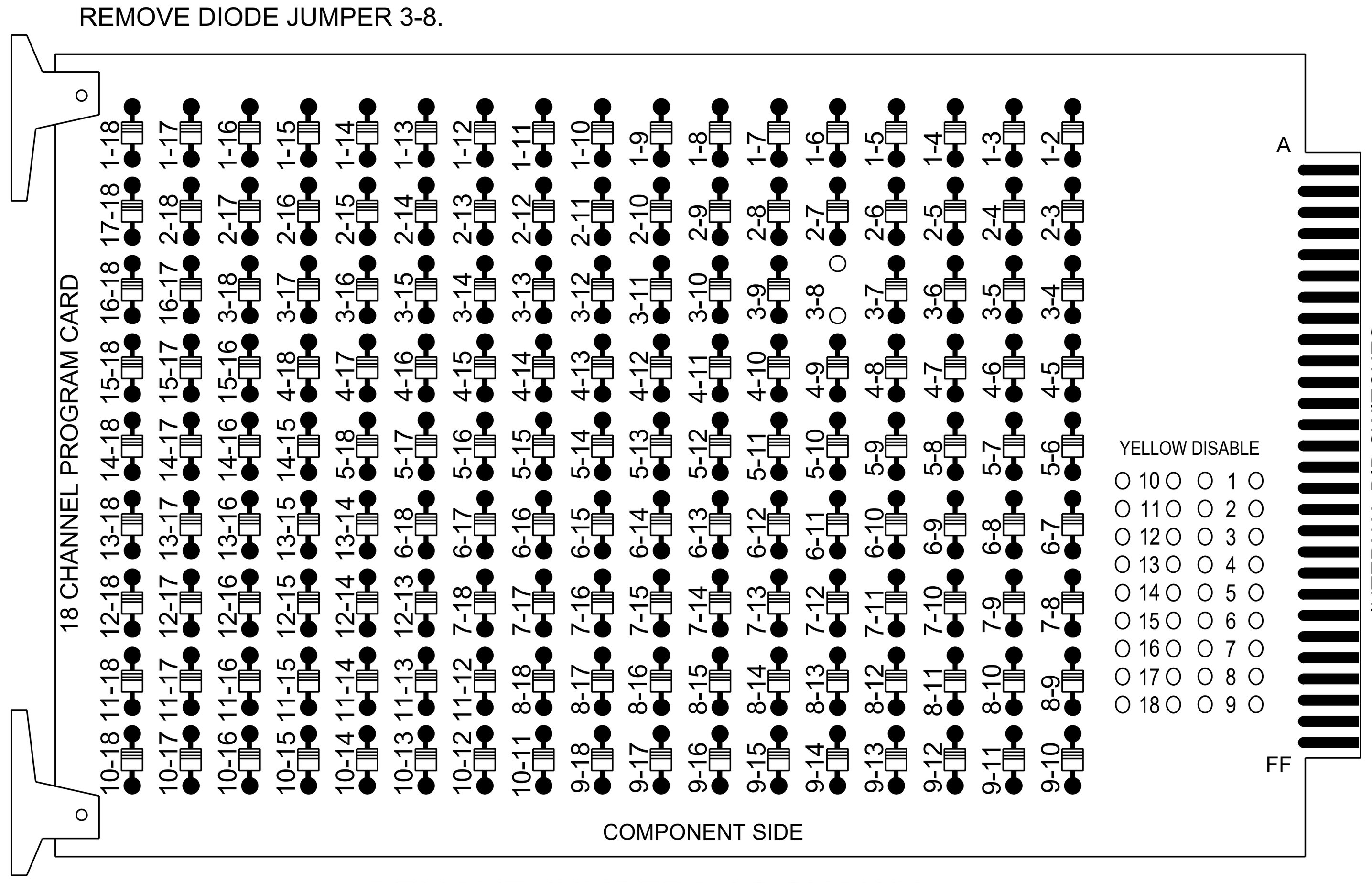
dsears

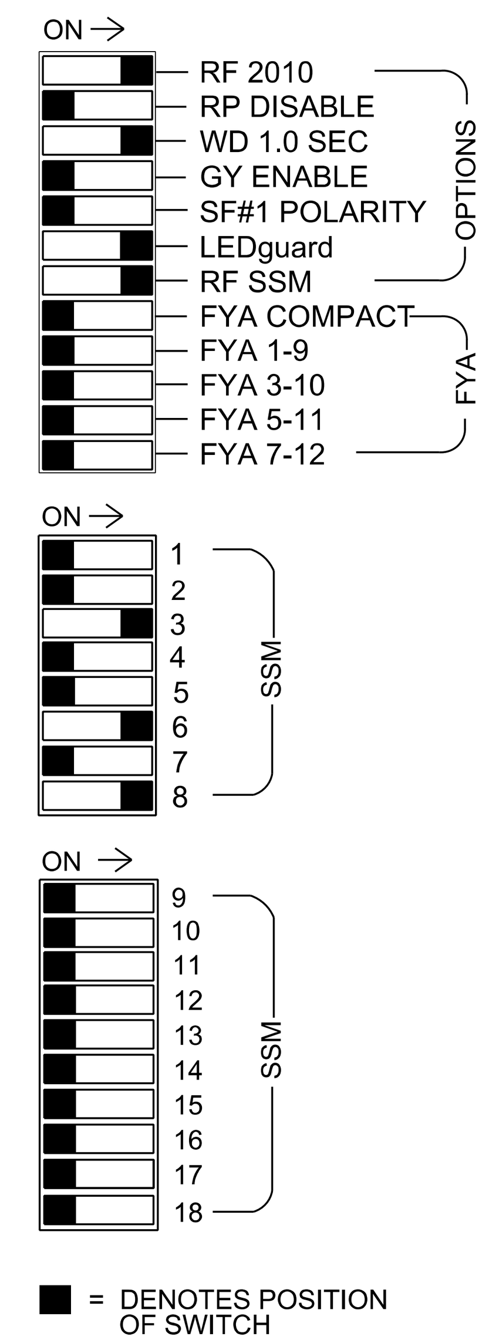
18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE DIODE JUMPER 3-8.





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

EQUIPMENT INFORMATION

Controller..2070LX
Cabinet...332 w/ Aux
Software...Q-Free MAXTIME
Cabinet Mount....................................Base
Output File Positions...........................18 With Aux. Output File
Load Switches Used...........................S4, S8, S11
Phases Used.......................................3, 6, 8
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..NOT USED
Overlap "4"..NOT USED

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8		S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6		15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6		6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	NU	NU	31,32	NU	NU	NU	61	62	NU	NU	81,82	NU	NU	NU	NU	NU	NU	NU
RED								134	134			107							
YELLOW								135	135										
GREEN									136										
RED ARROW				116															
YELLOW ARROW				117								108							
GREEN ARROW				118				136				109							

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

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

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

FS = FLASH SENSE
ST = STOP TIME

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection for zones 3A, 6A, 6B, 6C, 6D, and 8A. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-1919T1
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

New Installation - Temporary Design 1 - TMP Phase III Step 3-Phase IV
Electrical Detail

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Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd)
at
SR 2083 (Hazeleen Avenue)

Division 12 Gaston County Belmont

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REVISIONS	INIT.	DATE

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NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

DocuSigned by: David T Sears
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8/1/2025
DATE

SIG. INVENTORY NO. 12-1919T1

8/1/2025
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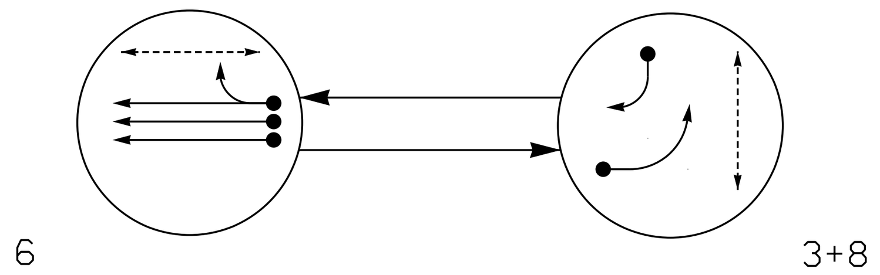
dsears

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

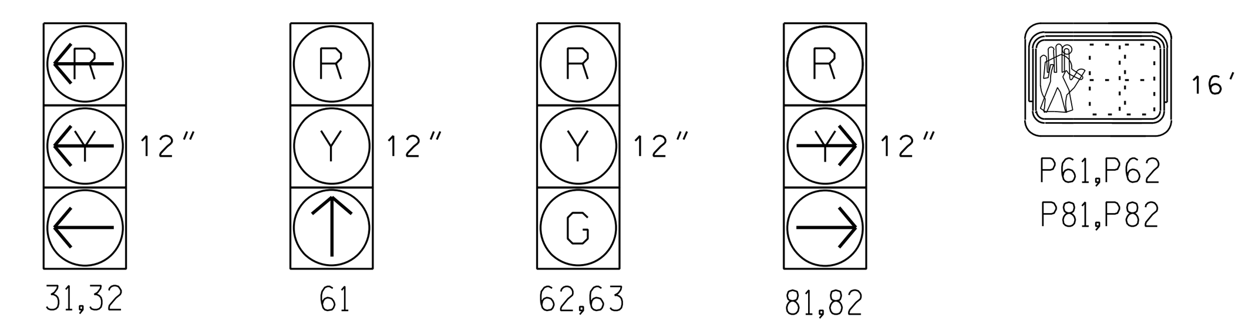
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 6	PHASE 3+8	FLASH
31,32	-R	←	-R
61	↑	R	R
62,63	G	R	R
81,82	R	→	R
P61,P62	W	DW	DRK
P81,P82	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



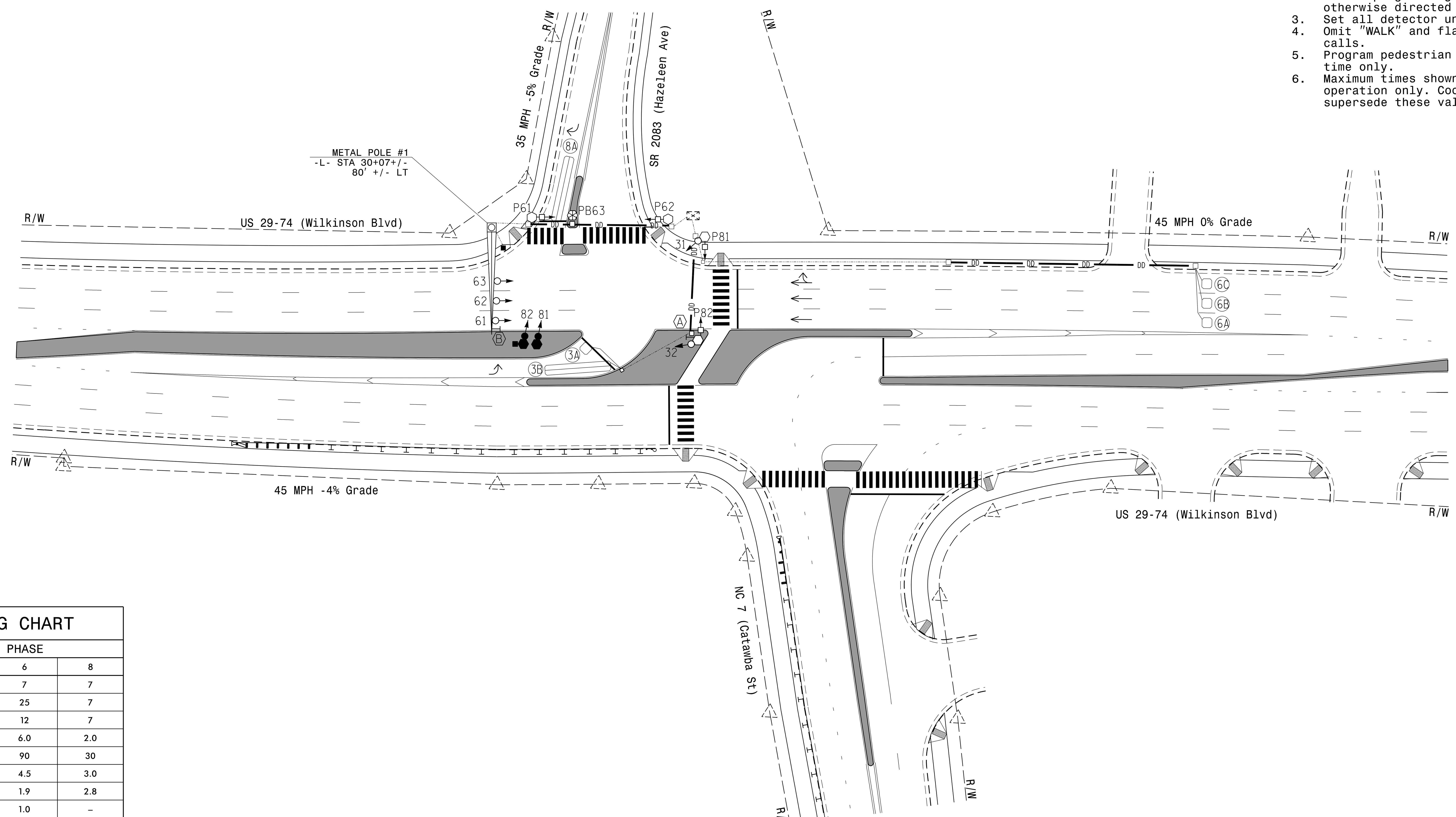
MAXTIME DETECTOR INSTALLATION CHART

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	6X6	0	3	X	3	-	-	X	-	X	-	X
3B	6X40	0	2-4-2	X	3	-	-	X	-	X	-	X
6A	6X6	300	4	X	6	-	-	X	X	X	-	X
6B	6X6	300	4	X	6	-	-	X	X	X	-	X
6C	6X6	300	4	X	6	-	-	X	X	X	-	X
8A	6X40	0	2-4-2	X	8	15.0	-	X	-	X	-	X

2 Phase
Fully Actuated
(Belmont Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification 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. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
5. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
6. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	
	Metal Pole with Mastarm	
N/A	Guardrail	
	Type I Pushbutton Post	
	Type II Signal Pedestal	
N/A	Curb Ramp	
Ⓐ	No U-Turn Sign (R3-4)	Ⓐ
Ⓑ	No Left Turn Sign (R3-2)	Ⓑ

MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6	PHASE 8
Walk *	–	7	7
Ped Clear	–	25	7
Min Green *	7	12	7
Passage *	2.0	6.0	2.0
Max 1 *	30	90	30
Yellow Change	3.0	4.5	3.0
Red Clear	2.8	1.9	2.8
Added Initial *	–	1.0	–
Maximum Initial *	–	34	–
Time Before Reduction *	–	15	–
Time To Reduce *	–	30	–
Minimum Gap	–	3.0	–
Advance Walk	–	7	–
Non Lock Detector	X	–	X
Vehicle Recall	–	MIN RECALL	–
Dual Entry	X	–	X

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

New Installation - Final Design

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SCALE 0 40
1"=40'

US 29-74 (Wilkinson Blvd)
at
SR 2083 (Hazeleen Ave)

Division 12 Gaston County Belmont

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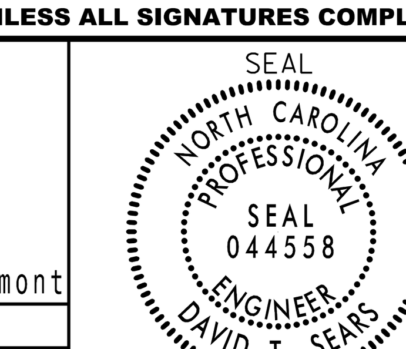
REVISIONS INIT. DATE



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SIGNATURE DATE

SIG. INVENTORY NO. 12-1919

8/1/2025
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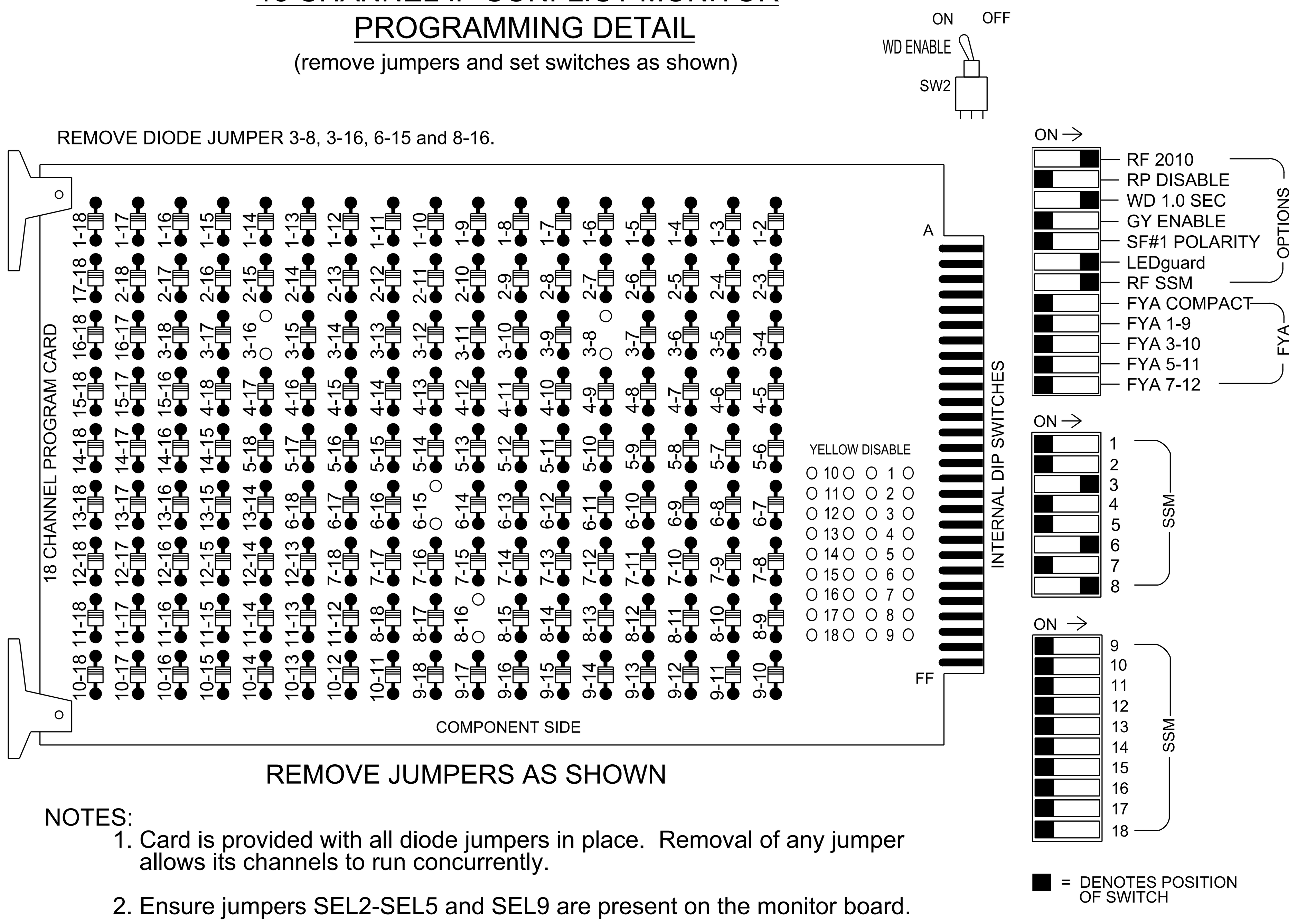
dsears

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPER 3-8, 3-16, 6-15 and 8-16.



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 3 and 8 for Dual Entry.
3. Program controller to start up in phase 6 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
5. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

Controller..2070LX
Cabinet..332 w/ Aux
Software...Q-Free MAXTIME
Cabinet Mount....................................Base
Output File Positions..........................18 With Aux. Output File
Load Switches Used...........................S4, S8, S9, S11, S12
Phases Used.......................................3, 6, 6 PED, 8, 8 PED
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..NOT USED
Overlap "4"..NOT USED

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8		S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6		15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6		6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	NU	NU	31,32	NU	NU	NU	61	62,63	P61, P62	NU	81,82	P81, P82	NU	NU	NU	NU	NU	NU
RED								134	134			107							
YELLOW								135	135										
GREEN									136										
RED ARROW				116															
YELLOW ARROW				117								108							
GREEN ARROW				118				136				109							
(Don't Walk hand)										119			110						
(Walk person)										121			112						

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

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

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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
3A	TB4-5,6	I5U	58	20	7	3			X		X	
3B	TB4-9,10	I6U	41	3	8	3			X		X	
6A	TB3-5,6	J2U	40	2	16	6			X	X	X	
6B	TB3-7,8	J2L	44	6	17	6			X	X	X	
6C	TB3-9,10	J3U	64	30	18	6			X	X	X	
8A	TB5-9,10	J6U	42	4	22	8	15.0		X		X	
PED PUSH BUTTONS												
P61,P62	TB8-7,9	I13U	68	34	6	PED 6						
P81,P82	TB8-8,9	I13L	70	36	8	PED 8						

NOTE:
INSTALL DC ISOLATORS IN INPUT FILE SLOT I13.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

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: 12-1919
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

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www.rkk.com
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New Installation - Final Design - Electrical Detail

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd)
at
SR 2083 (Hazeleen Avenue)

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS
DocuSigned by: David T. Sears
069183F28E5741E...
8/1/2025
DATE

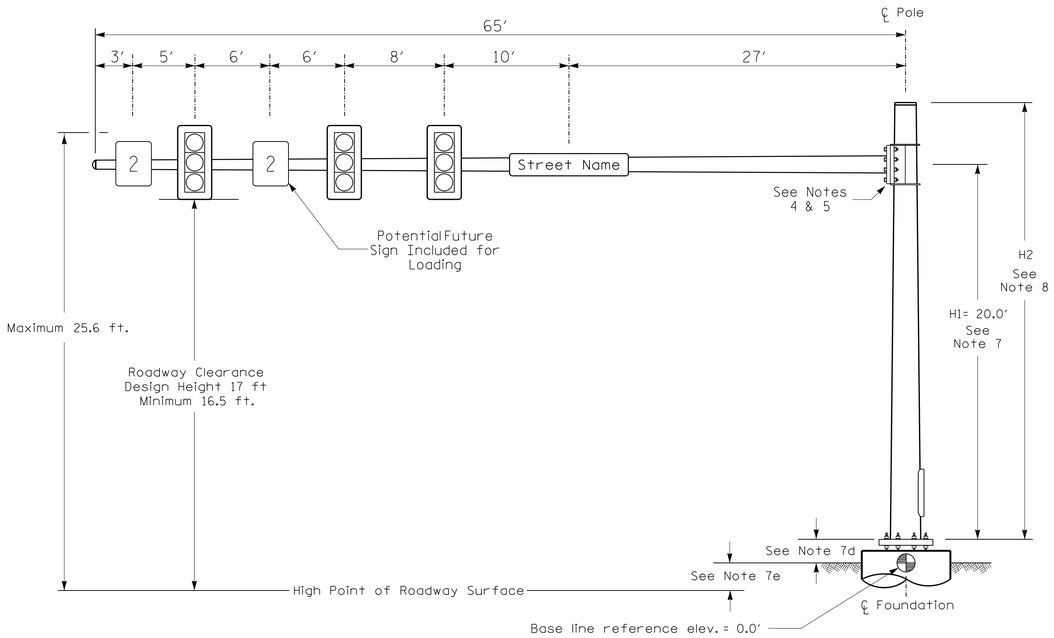
SIG. INVENTORY NO. 12-1919

8/1/2025
R:*Traffic*Signals*Design*Signals*B-6051_Signal_121919e_dsn.dgn
dsears

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.10.2

Design Loading for METAL POLE NO. 1



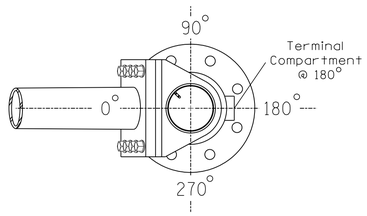
Elevation View

SPECIAL NOTE

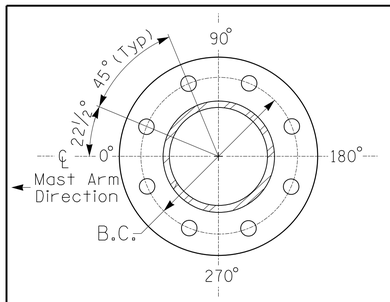
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	N/A
Baseline reference point at ⊕ Foundation @ ground level	0.0 ft.	
Elevation difference at High point of roadway surface	+1.3 ft.	
Elevation difference at Edge of travelway or face of curb	+0.1 ft.	

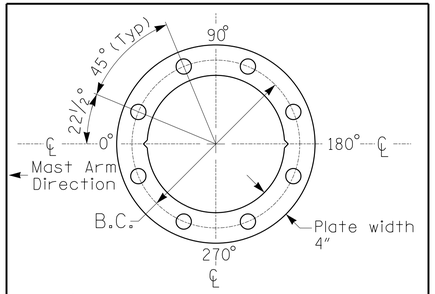


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
[signal]	RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5"W X 52.5"L	60 LBS
2	SIGN RIGID MOUNTED	7.5 S.F.	30.0"W X 36.0"L	14 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	16.0 S.F.	24.0"W X 96.0"L	36 LBS

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 1st Edition 2015 AASHTO LRFD "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 2024 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
   - The 2024 NCDOT Roadway Standard Drawings.
   - The traffic signal project plans and special provisions.
   - The NCDOT "Metal Pole Standards" located at the following NCDOT website: https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

DESIGN REQUIREMENTS

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

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

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NCDOT Wind Zone 5 (110 mph)

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

US 29-74 (Wilkinson Blvd)
at
SR 2083 (Hazeleen Ave)

Division 12 Gaston County Belmont

PLAN DATE: August 2025 REVIEWED BY: DT Sears

PREPARED BY: WP Erickson-Jones REVIEWED BY:

SCALE 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL
SEAL 044558
ENGINEER
DAVID T SEARS

DocuSigned by: David T Sears 0691837F28E5741E...
8/1/2025
SIGNATURE DATE

SIG. INVENTORY NO. 12-1919

8/1/2025
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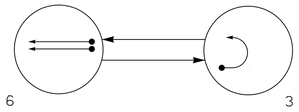
dsears

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.11.0

PHASING DIAGRAM



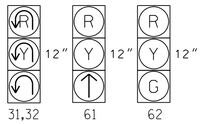
PHASING DIAGRAM DETECTION LEGEND

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

TABLE OF OPERATION			
SIGNAL FACE	PHASE 6	PHASE 3	FLASH
31,32	R		R
61	↑	R	R
62	G	R	R

SIGNAL FACE I.D.

All Heads L.E.D.



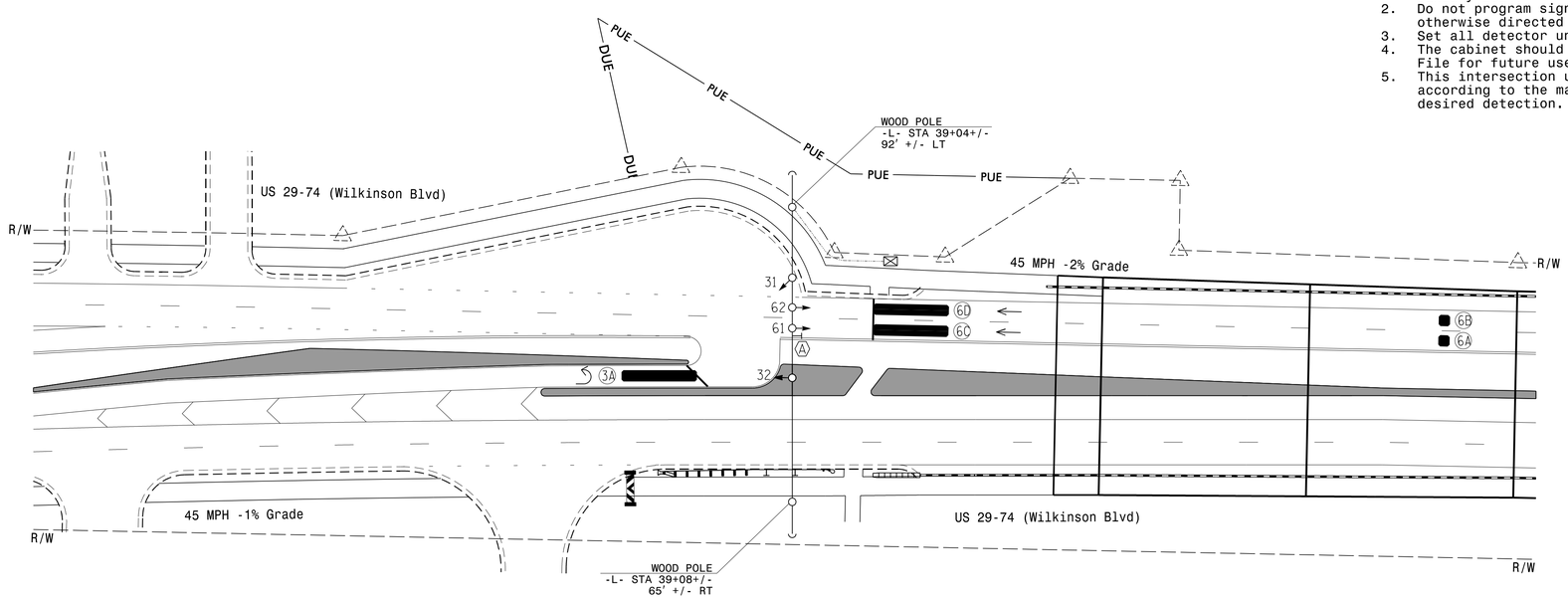
MAXTIME DETECTOR INSTALLATION CHART											
DETECTOR					PROGRAMMING						
ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
3A	6X40	0	✳	✳	3	-	-	X	-	X	-	✳
6A	6X6	300	✳	✳	6	-	-	X	X	X	-	✳
6B	6X6	300	✳	✳	6	-	-	X	X	X	-	✳
6C	6X40	0	✳	✳	6	5.0	2.0	X	-	X	X	✳
6D	6X40	0	✳	✳	6	5.0	2.0	X	-	X	X	✳

✳ VIDEO DETECTION ZONE

2 Phase
Fully Actuated
(Isolated)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Set all detector units to presence mode.
4. The cabinet should be designed to include an Auxiliary Output File for future use.
5. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.



MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6
Walk *	–	–
Ped Clear	–	–
Min Green *	7	12
Passage *	2.0	6.0
Max 1 *	30	90
Yellow Change	3.0	4.7
Red Clear	4.2	1.6
Added Initial *	–	–
Maximum Initial *	–	–
Time Before Reduction *	–	15
Time To Reduce *	–	30
Minimum Gap	–	3.0
Advance Walk	–	–
Non Lock Detector	X	X
Vehicle Recall	–	MIN RECALL
Dual Entry	–	–

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

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	→
▬	Non-Intrusive Detection Zone	▬
N/A	Guardrail	
	Pedestrian Barricade	
Ⓐ	No Left Turn Sign (R3-2)	Ⓐ

New Installation
Temporary Design 1 - TMP Phase III Step 3

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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

SCALE
0 40
1"=40'

US 29-74 (Wilkinson Blvd) at Eastbound U-Turn Bulb West of Catawba River Bridge

Division 12 Gaston County Belmont

PLAN DATE: August 2025 REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS
DocuSigned by: David T Sears 0691B3F28E5741E...
8/1/2025
SIGNATURE DATE
SIG. INVENTORY NO. 12-19201I

8/1/2025
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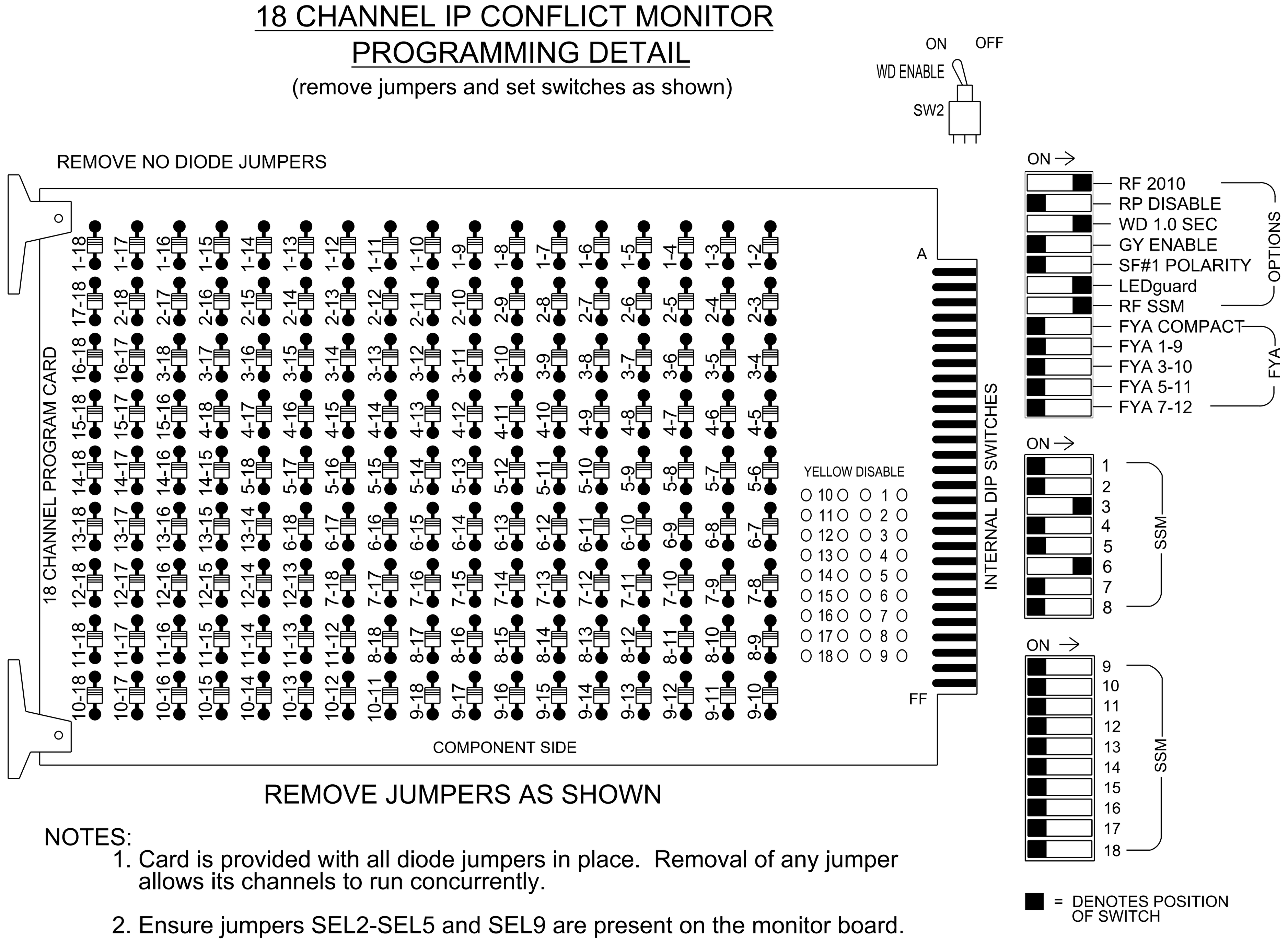
dsears

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.11.1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE JUMPERS AS SHOWN

NOTES:
1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. 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 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...........................S4, S8
Phases Used.......................................3, 6
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..NOT USED
Overlap "4"..NOT USED

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8		S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6		15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6		6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	NU	NU	31,32	NU	NU	NU	61	62	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED								134	134										
YELLOW								135	135										
GREEN									136										
RED ARROW				116															
YELLOW ARROW				117															
GREEN ARROW				118				136											

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

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

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

FS = FLASH SENSE
ST = STOP TIME

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection for zones 3A, 6A, 6B, 6C and 6D. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-1920T1
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

New Installation - Temporary Design 1 - TMP Phase III Step 3
Electrical Detail

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Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd) at Eastbound U-Turn Bulb West of Catawba River Bridge

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY:

REVISIONS	INIT.	DATE

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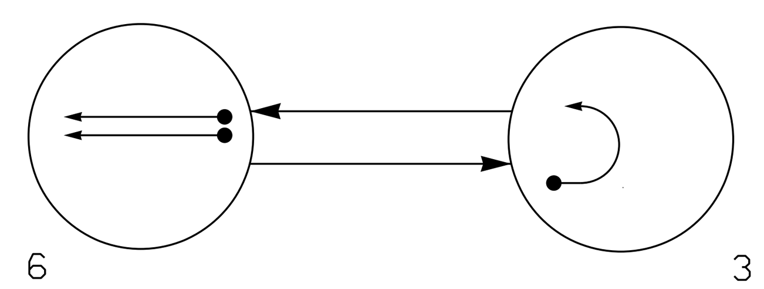
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS
DocuSigned by: David T. Sears 069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 12-1920T1

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.12.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

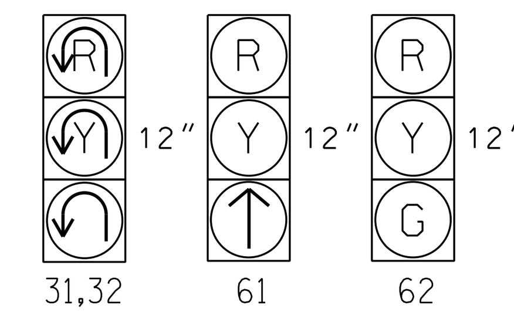
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 6	PHASE 3	FLASH
31,32	↶R	↶	↶R
61	↑	R	R
62	G	R	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

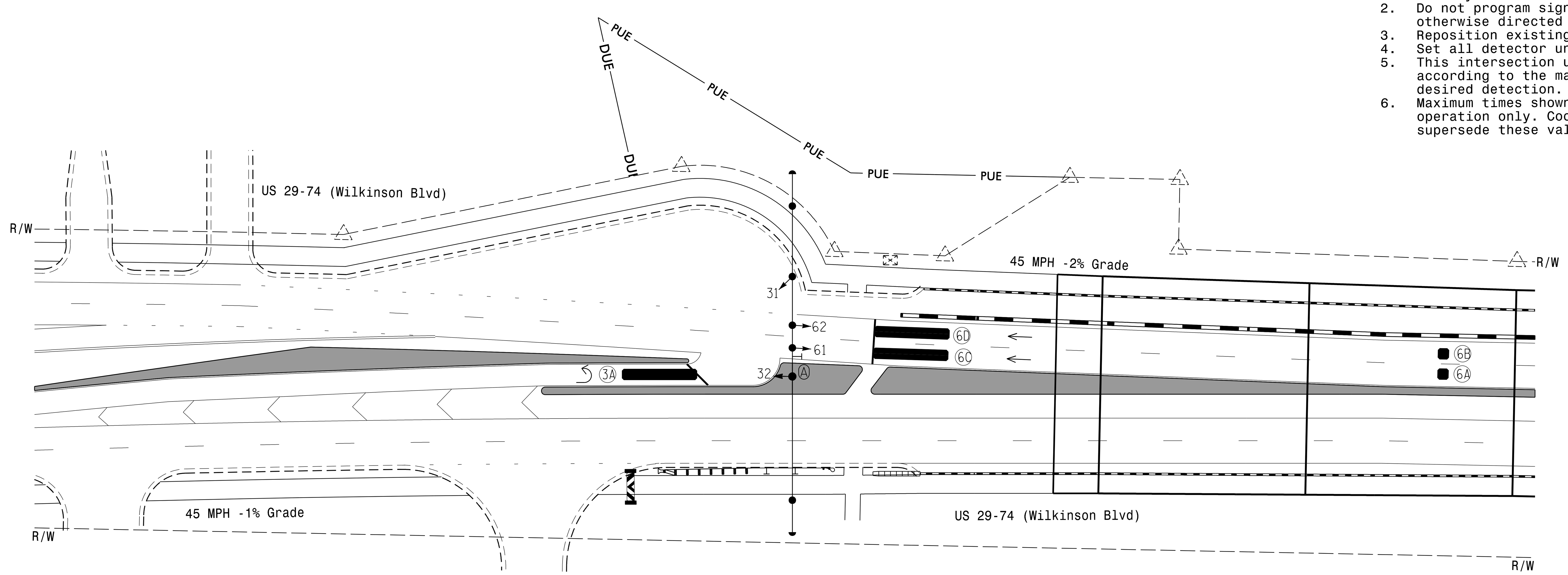
DETECTOR					PROGRAMMING							
ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
3A	6X40	0	✳	✳	3	-	-	X	-	X	-	✳
6A	6X6	300	✳	✳	6	-	-	X	X	X	-	✳
6B	6X6	300	✳	✳	6	-	-	X	X	X	-	✳
6C	6X40	0	✳	✳	6	5.0	2.0	X	-	X	X	✳
6D	6X40	0	✳	✳	6	5.0	2.0	X	-	X	X	✳

✳ VIDEO DETECTION ZONE

2 Phase
Fully Actuated
(Isolated)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Reposition existing signal heads numbered 61 and 62.
4. Set all detector units to presence mode.
5. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
6. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



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	
N/A	Guardrail	
	Non-Intrusive Detection Zone	
	Pedestrian Barricade	
A	No Left Turn Sign (R3-2)	A

MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6
Walk *	–	–
Ped Clear	–	–
Min Green *	7	12
Passage *	2.0	6.0
Max 1 *	30	90
Yellow Change	3.0	4.7
Red Clear	4.2	1.6
Added Initial *	–	–
Maximum Initial *	–	–
Time Before Reduction *	–	15
Time To Reduce *	–	30
Minimum Gap	–	3.0
Advance Walk	–	–
Non Lock Detector	X	X
Vehicle Recall	–	MIN RECALL
Dual Entry	–	–

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

8/1/2025
R:*Traffic*Signals*Design*Signals*B-6051_Signal_12-1920T2_dsn.dgn
dsears

Signal Upgrade
Temporary Design 2 - TMP Phase IV Step 1

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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 29-74 (Wilkinson Blvd) at Eastbound U-Turn Bulb West of Catawba River Bridge

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones	REVIEWED BY:

REVISIONS	INIT.	DATE

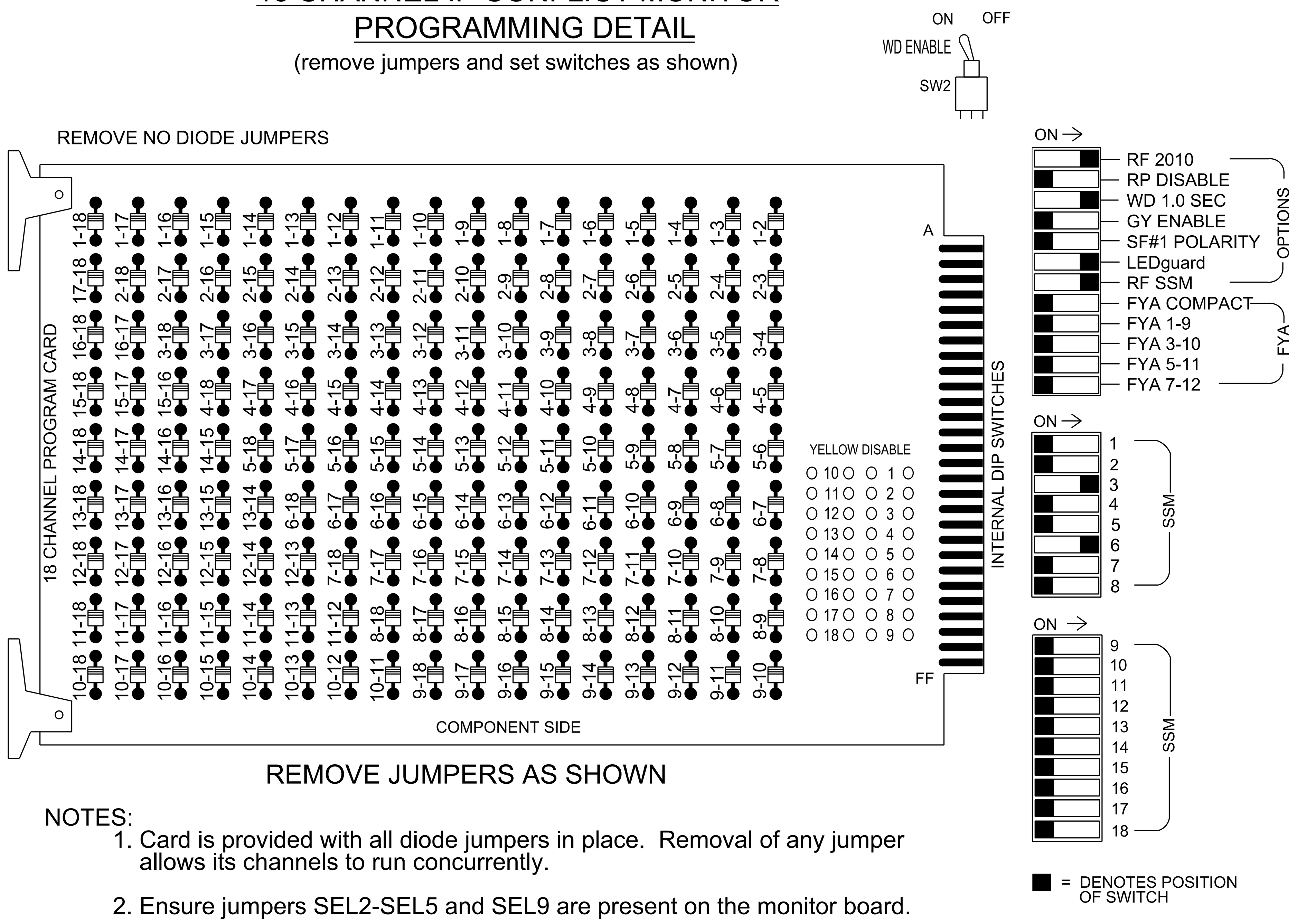
SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 044558 DAVID T. SEARS

DocuSigned by: David T Sears 069183F28E5741E... 8/1/2025
SIGNATURE DATE

SIG. INVENTORY NO. 12-1920T2

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE JUMPERS AS SHOWN

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. 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 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............................S4, S8
Phases Used..3, 6
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..NOT USED
Overlap "4"..NOT USED

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8		S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6		15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6		6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	NU	NU	31,32	NU	NU	NU	61	62	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED								134	134										
YELLOW								135	135										
GREEN									136										
RED ARROW				116															
YELLOW ARROW				117															
GREEN ARROW				118				136											

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

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

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

FS = FLASH SENSE
ST = STOP TIME

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection for zones 3A, 6A, 6B, 6C and 6D. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-1920T2
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Temporary Design 2 - TMP Phase IV Step 1
Electrical Detail

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Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd)
at
Eastbound U-Turn Bulb
West of Catawba River Bridge

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

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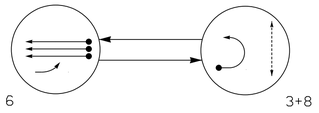
SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 044558 DAVID T. SEARS
DocuSigned by: David T. Sears
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 12-1920T2

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.13.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

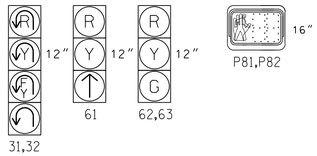
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 6	PHASE 3+8	PHASE FLASH
31,32	FY	↑	R
61	↑	R	R
62,63	G	R	R
P81,P82	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

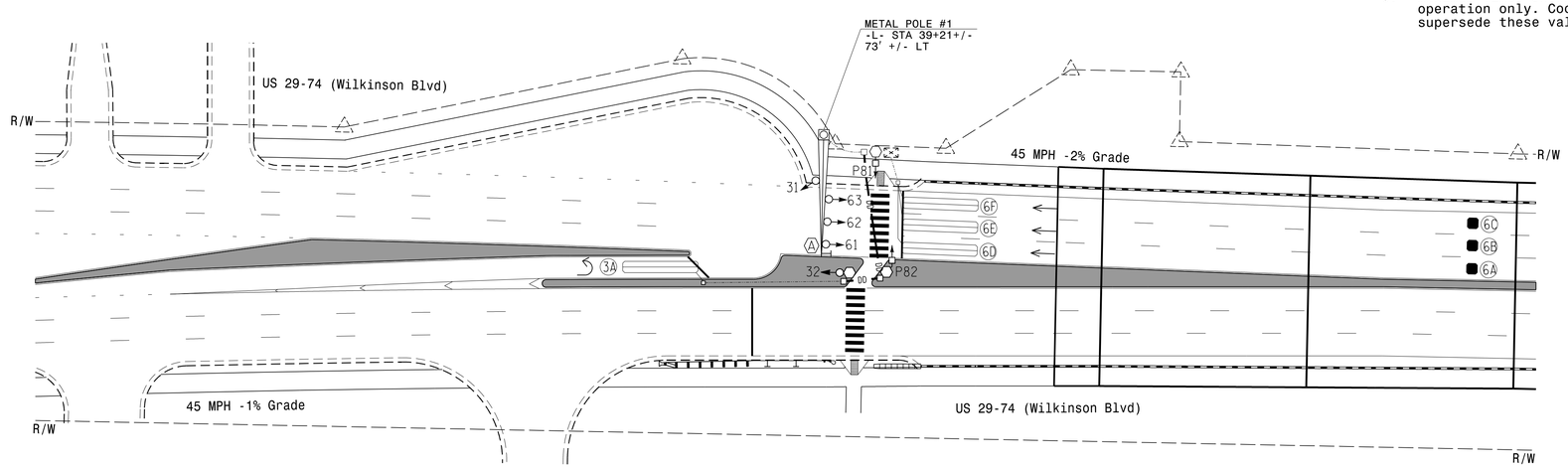
DETECTOR					PROGRAMMING							
LOOP/ ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
3A	6X40	0	2-4-2	X	3	15.0	-	X	-	X	-	X
6A	6X6	300	✳	✳	6	-	-	X	X	X	-	✳
6B	6X6	300	✳	✳	6	-	-	X	X	X	-	✳
6C	6X6	300	✳	✳	6	-	-	X	X	X	-	✳
6D	6X40	0	2-4-2	X	6	5.0	2.0	X	-	X	X	X
6E	6X40	0	2-4-2	X	6	5.0	2.0	X	-	X	X	X
6F	6X40	0	2-4-2	X	6	5.0	2.0	X	-	X	X	X

✳ VIDEO DETECTION ZONE

2 Phase
Fully Actuated
(Belmont Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification 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. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
5. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
6. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6	PHASE 8
Walk *	–	–	7
Ped Clear	–	–	8
Min Green *	7	12	7
Passage *	2.0	6.0	2.0
Max 1 *	30	90	30
Yellow Change	3.0	4.7	3.0
Red Clear	4.2	1.8	4.2
Added Initial *	–	–	–
Maximum Initial *	–	–	–
Time Before Reduction *	–	15	–
Time To Reduce *	–	30	–
Minimum Gap	–	3.0	–
Advance Walk	–	–	–
Non Lock Detector	X	X	X
Vehicle Recall	–	MIN RECALL	–
Dual Entry	X	–	X

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

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	
DD	Directional Drill	N/A
	Metal Pole with Mastarm	
N/A	Guardrail	
	Type II Signal Pedestal	
N/A	Curb Ramp	
A	No Left Turn Sign (R3-2)	A

Signal Upgrade - Final Design

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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 29-74 (Wilkinson Blvd) at Eastbound U-Turn Bulb West of Catawba River Bridge

Division 12 Gaston County Belmont

PLAN DATE: August 2025 REVIEWED BY: DT Sears

PREPARED BY: WP Erickson-Jones REVIEWED BY:

REVISIONS	INIT.	DATE

SCALE 0 40 1"=40'

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

DocuSigned by: David T Sears 069183F28E5741E...

8/1/2025

SIGNATURE DATE

SIG. INVENTORY NO. 12-1920

8/1/2025
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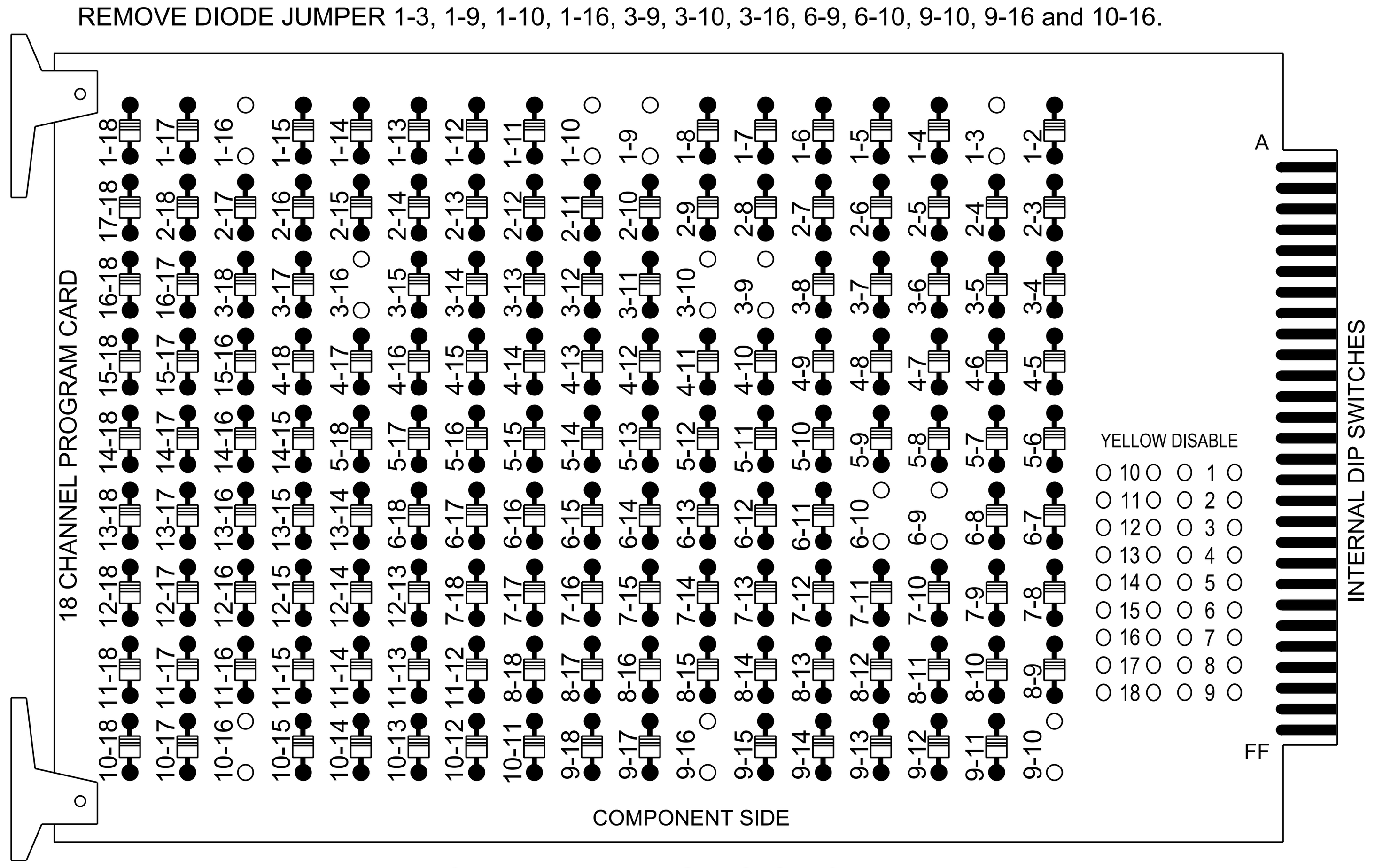
dsears

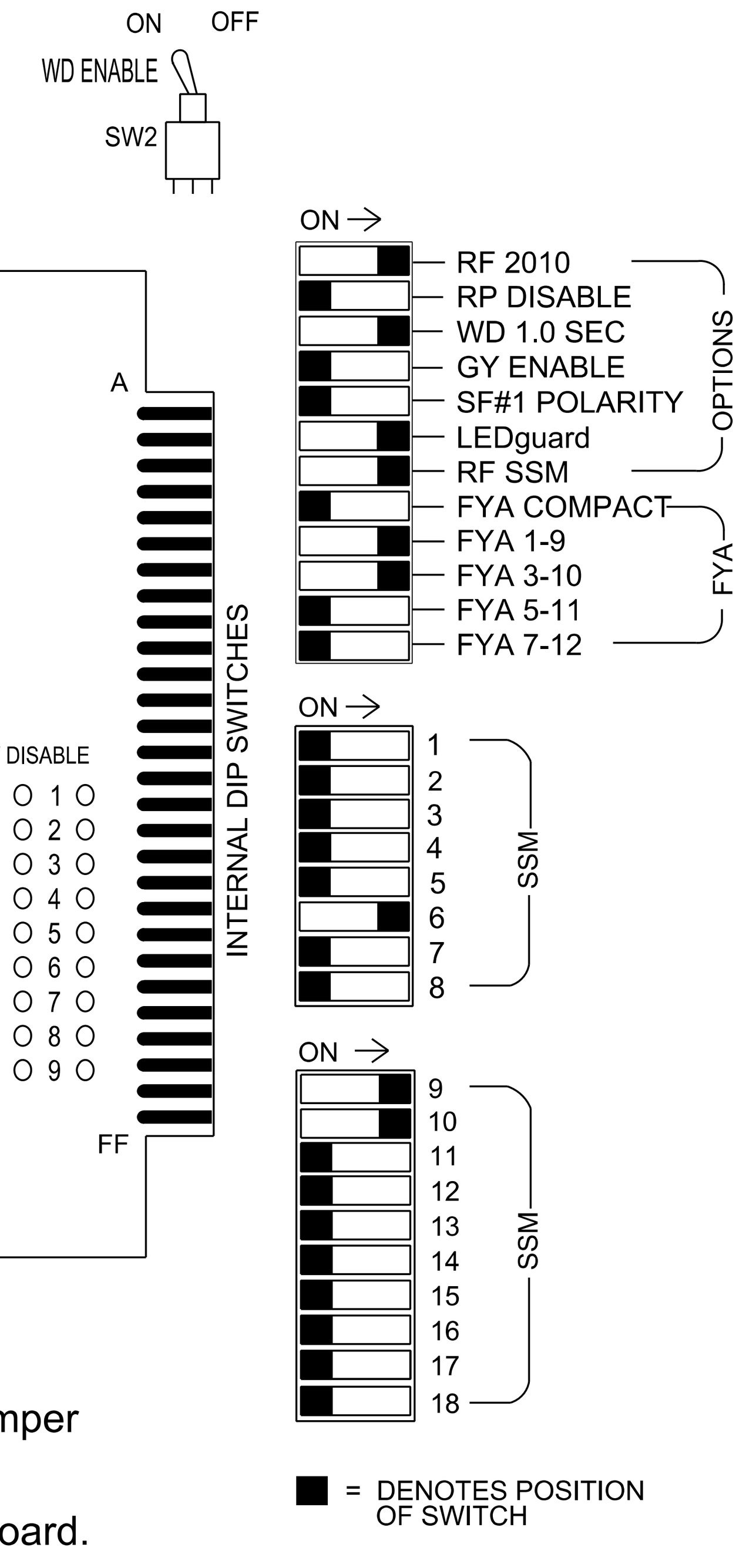
PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.13.1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPER 1-3, 1-9, 1-10, 1-16, 3-9, 3-10, 3-16, 6-9, 6-10, 9-10, 9-16 and 10-16.





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 3 and 8 for Dual Entry.
3. Program controller to start up in phase 6 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
5. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

Controller..2070LX
Cabinet...332 w/ Aux
Software...Q-Free MAXTIME
Cabinet Mount....................................Base
Output File Positions..........................18 With Aux. Output File
Load Switches Used...........................S1, S4, S8, S12, AUX S1, AUX S2
Phases Used.......................................3, 6, **8, 8 PED
Overlap "1"..*
Overlap "2"..*
Overlap "3"..NOT USED
Overlap "4"..NOT USED
Overlap "7"..*

* See overlap programming details on this sheet.
** Phase used for timing purposes only.

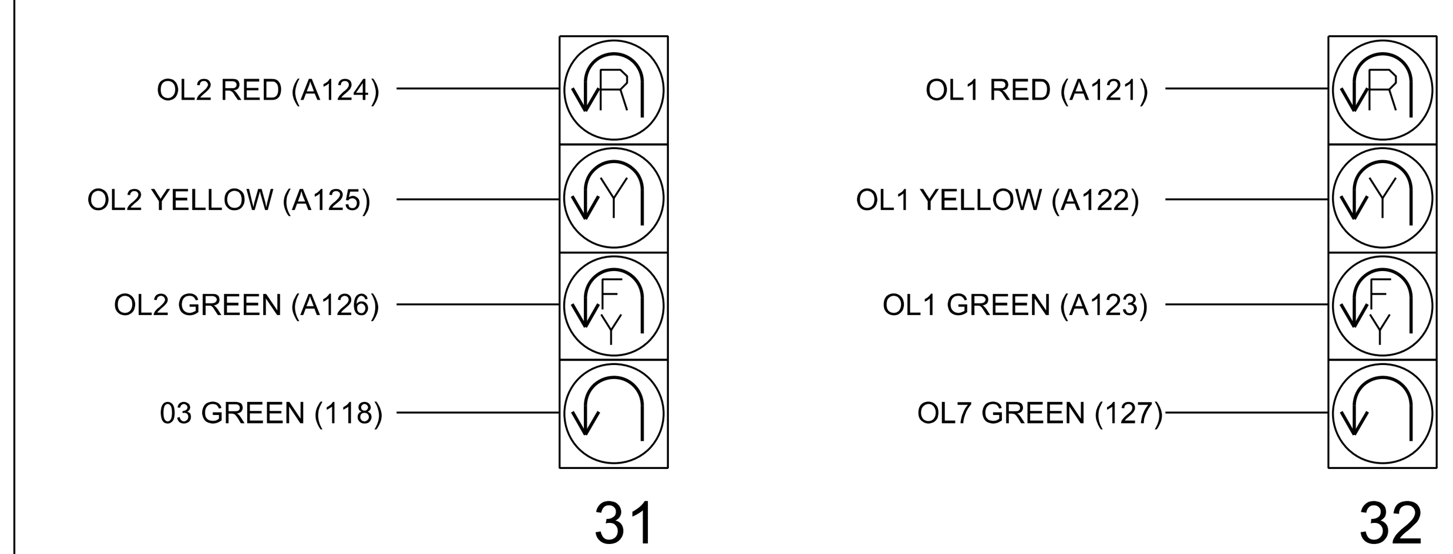
SIGNAL HEAD HOOK-UP CHART

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	OL7	2	2 PED	3	4	4 PED	5	6		6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	32★	NU	NU	31★	NU	NU	NU	61	62,63	NU	NU	NC	P81, P82	32★	31★	NU	NU	NU	NU
RED								134	134										
YELLOW	*			*				135	135										
GREEN									136										
RED ARROW														A121	A124				
YELLOW ARROW														A122	A125				
FLASHING YELLOW ARROW														A123	A126				
GREEN ARROW	127			118				136											
(hand)													110						
(walk)													112						

NU = Not Used
NC = No Connection
* 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)

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	∅ 3 3A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	NOT USED	FS DC ISOLATOR
"I"	L	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	NOT USED	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	∅ 8 PED DC ISOLATOR	ST DC ISOLATOR
"J"	U	SLOT EMPTY	∅ 6 6D	∅ 6 6F	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
"J"	L	SLOT EMPTY	∅ 6 6E	NOT USED	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY

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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
3A	TB4-5,6	I5U	58	20	7	3	15.0		X		X	
6D	TB3-5,6	J2U	40	2	16	6	5.0	2.0	X		X	X
6E	TB3-7,8	J2L	44	6	17	6	5.0	2.0	X		X	X
6F	TB3-9,10	J3U	64	30	18	6	5.0	2.0	X		X	X
PED PUSH BUTTONS												
P81,P82	TB8-8,9	I13L	70	36	8	PED 8						

NOTE: INSTALL DC ISOLATOR IN INPUT FILE SLOT I13.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection for zones 6A, 6B and 6C. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

OVERLAP PROGRAMMING

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

Web Interface
Home >Controller >Overlap Configuration >Overlaps

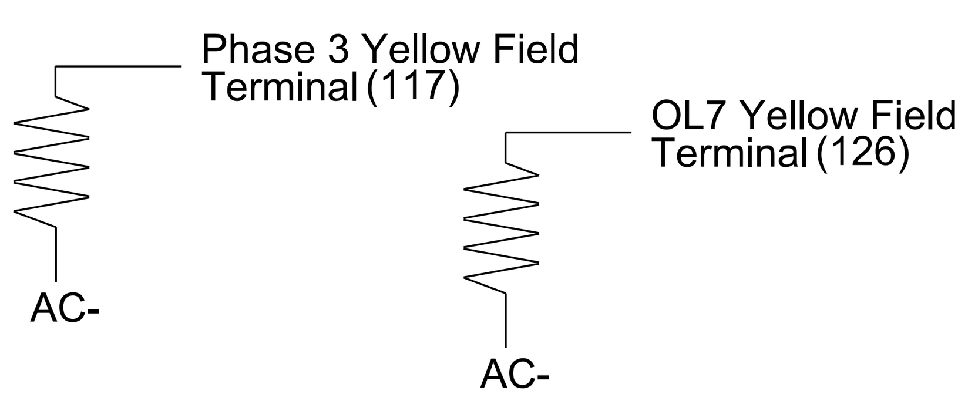
Overlap Plan 1

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

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)



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.

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THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-1920
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Final Design - Electrical Detail-Sheet 1 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

US 29-74 (Wilkinson Blvd)
at
Eastbound U-Turn Bulb
West of Catawba River Bridge

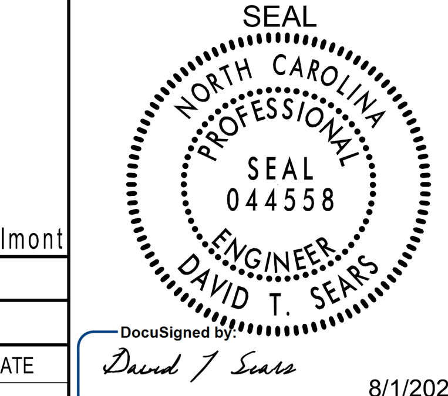
Division 12 Gaston County Belmont

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

PLAN DATE:	August 2025	REVIEWED BY:	CB Holden
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	DT Sears

REVISIONS	INIT.	DATE

SEAL



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8/1/2025
DATE

SIG. INVENTORY NO. 12-1920

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.13.2

OUTPUT CHANNEL CONFIGURATION

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

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

Channel Configuration

NOTICE OVERLAP 7 ASSIGNED TO CHANNEL 1 →

Channel	Control Type	Control Source	Flash Yellow	Flash Red	Flash Alt	MMU Channel
1	Overlap	7	·	X	X	1
2	Phase Vehicle	2	·	X		2
3	Phase Vehicle	3	·	X	X	3
4	Phase Vehicle	4	·	X	·	4
5	Phase Vehicle	5	·	X		5
6	Phase Vehicle	8	·	X	X	6
7	Phase Vehicle	7	·	X	·	7
8	Phase Vehicle	8	·	X	X	8
9	Overlap	1	·	X	X	9
10	Overlap	2	·	X	X	10
11	Overlap	3	·	X	·	11
12	Overlap	4	·	X	·	12
13	Phase Ped	2	·	·	·	13
14	Phase Ped	4	·	·	·	14
15	Phase Ped	6	·	·	·	15
16	Phase Ped	8	·	·	·	16
17	Overlap	5	·	X	X	17
18	Overlap	6	·	X	·	18

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-1920
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Final Design - Electrical Detail-Sheet 2 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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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 29-74 (Wilkinson Blvd)
at
Eastbound U-Turn Bulb
West of Catawba River Bridge

Division 12 | Gaston County | Belmont

PLAN DATE:	August 2025	REVIEWED BY:	CB Holden
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	DT Sears

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL
SEAL 044558
ENGINEER
DAVID T. SEARS

DocuSigned by:
David T Sears
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 12-1920

8/1/2025
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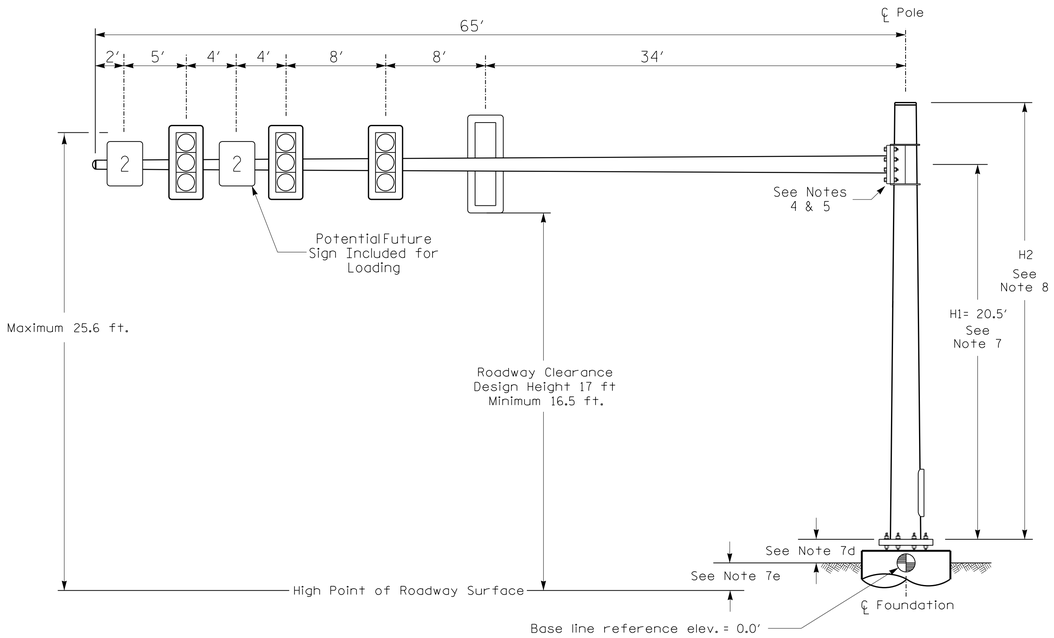
dsears

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.13.3

Design Loading for METAL POLE NO. 1



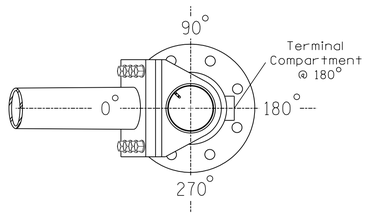
Elevation View

SPECIAL NOTE

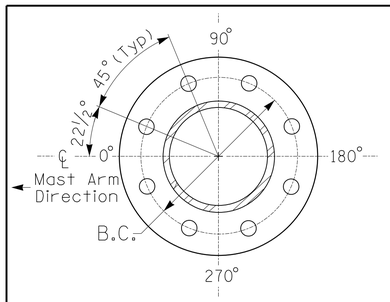
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	N/A
Baseline reference point at ⊕ Foundation @ ground level	0.0 ft.	
Elevation difference at High point of roadway surface	+1.4 ft.	
Elevation difference at Edge of travelway or face of curb	+0.7 ft.	

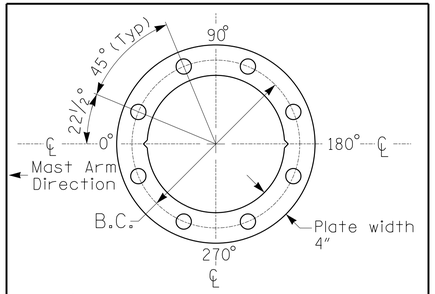


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12″-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5″W X 66.0″L	74 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5″W X 52.5″L	60 LBS
2	SIGN RIGID MOUNTED	7.5 S.F.	30.0″W X 36.0″L	14 LBS

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 1st Edition 2015 AASHTO LRFD "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 2024 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
   - The 2024 NCDOT Roadway Standard Drawings.
   - The traffic signal project plans and special provisions.
   - The NCDOT "Metal Pole Standards" located at the following NCDOT website: https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

DESIGN REQUIREMENTS

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

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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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NCDOT Wind Zone 5 (110 mph)

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 29-74 (Wilkinson Blvd) at Eastbound U-Turn Bulb West of Catawba River Bridge

Division 12 Gaston County Belmont

PLAN DATE: August 2025 REVIEWED BY: DT Sears

PREPARED BY: WP Erickson-Jones REVIEWED BY:

SCALE 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

DocuSigned by: David T Sears 0691B3F28E5741E...

8/1/2025

SIGNATURE DATE

SIG. INVENTORY NO. 12-1920

8/1/2025
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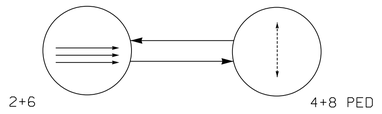
dsears

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.14.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

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

TABLE OF OPERATION

SIGNAL FACE	PHASE 2+6 DARK	2+6 ACTIVATION	2+6 STEADY YELLOW	ALL RED	4+8 PED WALK	4+8 PED CLEAR	FLASH
21,22,23	DRK	FY	Y	R	R	FR*	Y
P41	DW	DW	DW	DW	W	FDW	DRK
P81	DW	DW	DW	DW	W	FDW	DRK

✳ ALTERNATING FLASH

Y- Steady Yellow
FY - Flashing Yellow
R - Steady Red
FR - Flashing Red
W - Walk
DW - Don't Walk
FDW - Flashing Don't Walk
DRK - Dark

SIGNAL FACE I.D.

All Heads L.E.D.

Figure 1

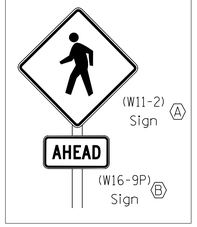
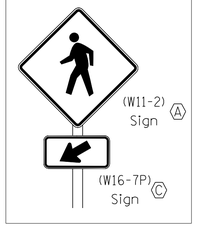


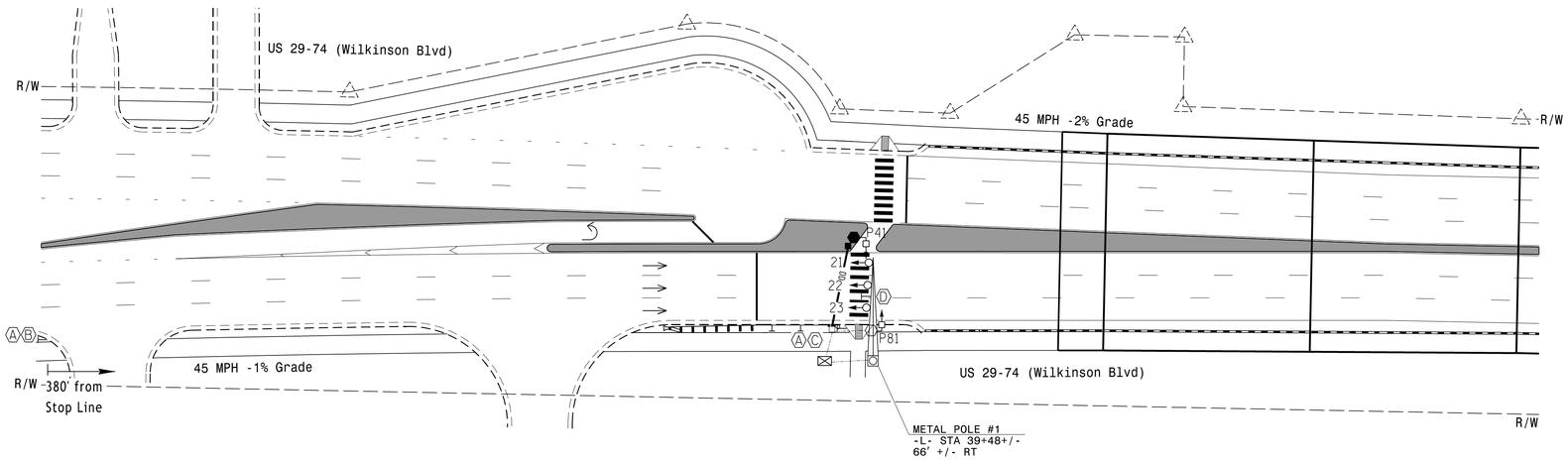
Figure 2



2 Phase
Semi-Actuated
Pedestrian Hybrid Beacon
(Belmont Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification for Roads and Structures" dated January 2024.
2. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
3. Enable Ped Clear During Red Clear for phases 4+8.
4. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
5. Locate Pedestrian and Crosswalk advance signs in accordance with Table 2C-3 in Section 2C.04 of the 2023 MUTCD or as otherwise directed by the Engineer.



MAXTIME TIMING CHART

FEATURE	PHASE 2	4 PED	6	8 PED
Walk *	–	7	–	7
Ped Clear	–	8	–	8
Min Green *	12	7	12	7
Passage *	0.0	0.0	0.0	0.0
Max 1 *	90	7	90	7
Yellow Change	4.6	3.0	4.6	3.0
Red Clear	5.0	0.0	5.0	0.0
Added Initial *	–	–	–	–
Maximum Initial *	–	–	–	–
Time Before Reduction *	–	–	–	–
Time To Reduce *	–	–	–	–
Minimum Gap	–	–	–	–
Pre Clearance	5.0	–	5.0	–
Advance Walk	–	–	–	–
Non Lock Detector	–	X	–	X
Vehicle Recall	MIN RECALL	–	MIN RECALL	–
Dual Entry	–	–	–	–

Serves as Steady Yellow Clearance Time
Serves as All Red Clearance Time
Serves as Flashing Yellow Time

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

LEGEND

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	→
N/A	Guardrail	⊥⊥
⬡	Type II Signal Pedestal	⬢
N/A	Curb Ramp	◢
Ⓐ	Pedestrian Warning Sign (W11-2)	Ⓐ
Ⓑ	"AHEAD" Sign (W16-9P)	Ⓑ
Ⓒ	Left Downward Arrow Sign (W16-7P)	Ⓒ
Ⓓ	"STOP ON RED - YIELD ON FLASHING RED AFTER STOP" Sign (R10-23a)	Ⓓ

New Installation

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

SCALE 0 40 1"=40'

Pedestrian Hybrid Beacon: US 29-74 (Wilkinson Blvd) at Eastbound U-Turn Bulb West of Catawba River Bridge

Division 12 Gaston County Belmont

PLAN DATE: August 2025 REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

DocuSigned by: David T Sears
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SIGNATURE 8/1/2025 DATE

SIG. INVENTORY NO. 12-1921

8/1/2025
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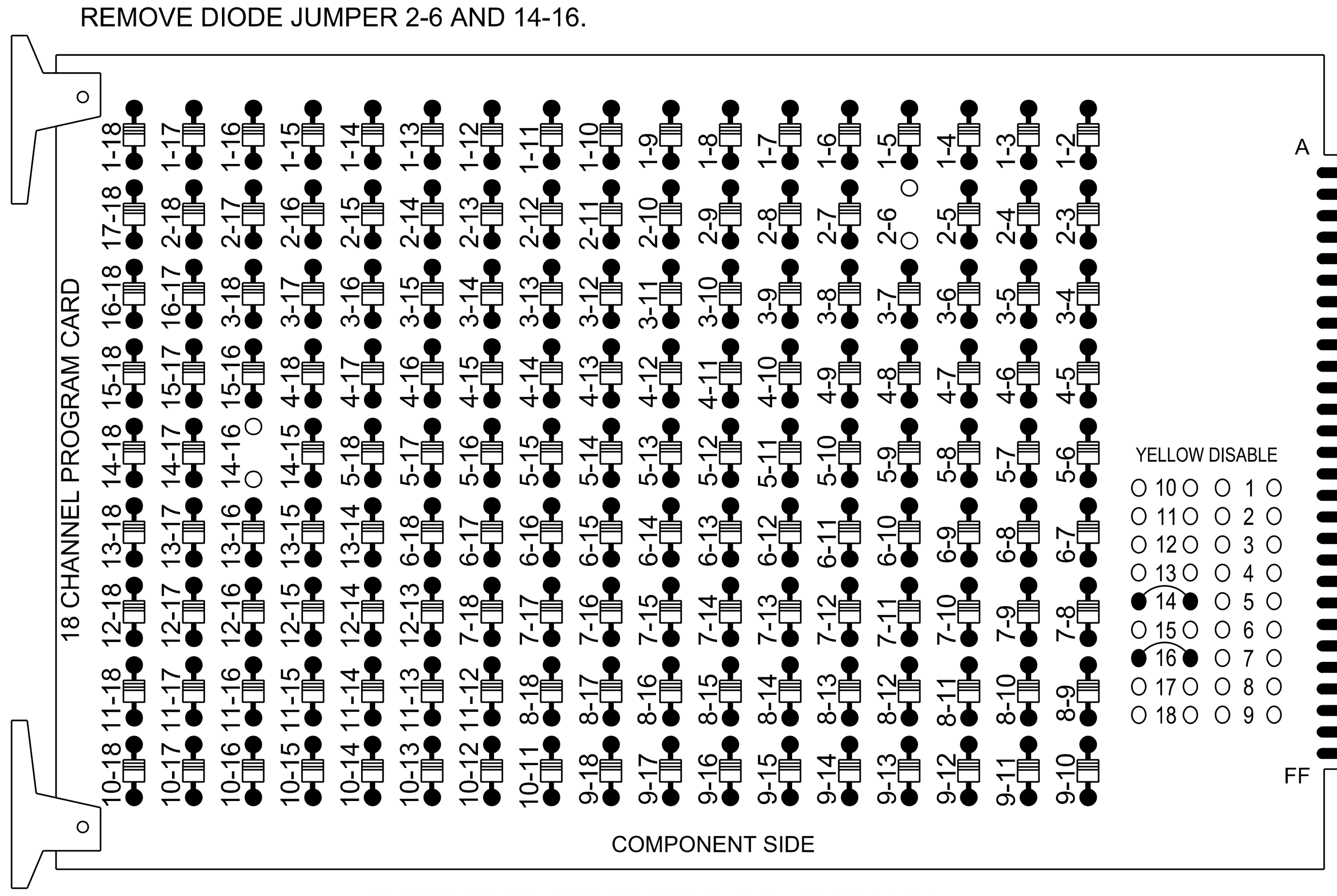
dsears

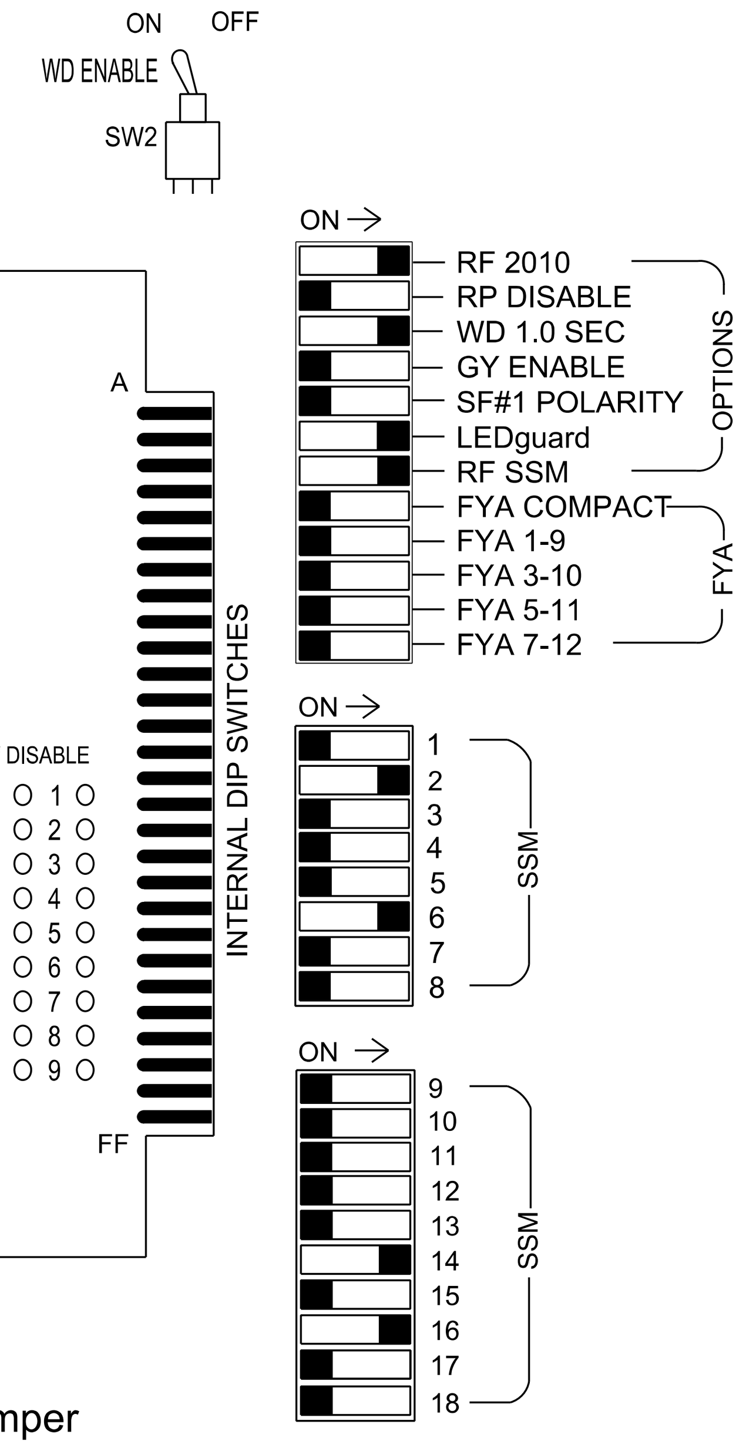
PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.14.1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPER 2-6 AND 14-16.





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. Install the latest 332_NCDOT_HAWK_Default database onto controller.
4. Program phases 4 and 8 No Startup Veh Call and No Startup Ped Call.
5. Program phases 4 and 8 for Ped Clear during Red Clear.
6. The cabinet and controller are part of the Belmont Signal System.

EQUIPMENT INFORMATION

Controller..2070LX
Cabinet...332
Software...Q-Free MAXTIME
Cabinet Mount....................................Base
Output File Positions...........................12
Load Switches Used...........................S2, S6, S8, S12
Phases Used.......................................2, 4*, 4 PED, 6, 8*, 8 PED
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..NOT USED
Overlap "4"..NOT USED

*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
CMU CHANNEL NO.	1	2	13	3	4	14	5	6	15	7	8	16
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED
SIGNAL HEAD NO.	NU	21,22, 23	NU	NU	NC	P41	NU	21,22, 23	NU	NU	NC	P81
RED		128						134				
YELLOW		129						*				
GREEN		*						*				
RED ARROW												
YELLOW ARROW												
FLASHING YELLOW ARROW												
GREEN ARROW												
(hand)						104						110
(walking person)						106						112

NU = Not Used
NC = Not Connected
*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	1O	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	NOT USED	NOT USED	FS DC ISOLATOR
"I"	L												Ø4 PED DC ISOLATOR	Ø8 PED DC ISOLATOR	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
"J"	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												
P41	TB8-5,6	I12L	69	35	4	PED 4 / 8 *						
P81	TB8-8,9	I13L	70	36	8	PED 8 / 4 *						

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

* FOR THE ABOVE DETECTORS TO CALL ANOTHER PHASE SCROLL OVER AND ENTER SECOND PHASE IN "ADDITIONAL CALL PHASES" COLUMN.

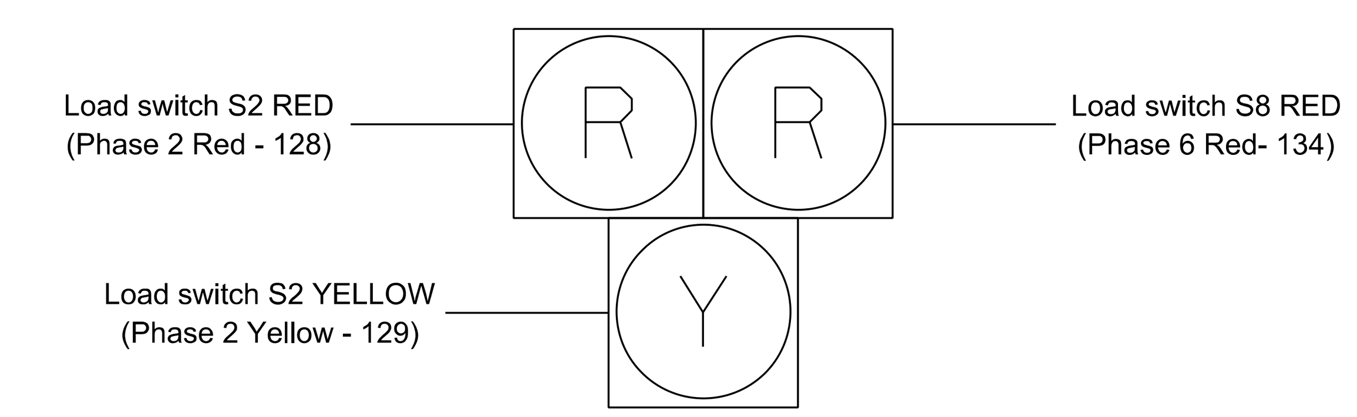
INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

OPERATIONAL NOTES

1. In order for the controller to perform the Pedestrian Hybrid Beacon (HAWK signal) sequence, the 332_NCDOT_HAWK_v1_3 database must be installed on the controller.
2. The only Phase 6 load switch output that is being used drives one of the red signal faces of each signal head.
3. 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.
4. The Phase 2 and Phase 6 Red outputs drives the solid Red displays during the Phase 2 and 6 Red Clear and Ped 4 and 8 Walk Interval. The Logic Processor flashes Phase 2 and Phase 6 Red Outputs in a wig-wag pattern during 4+8 Ped Clear Interval.
5. The controller must be programmed for Ped Clear During Red Clear for Pedestrian Phases 4 and 8 so that Red displays continue to flash during Phases 4 and 8 Yellow Change and Red Clear.
6. Make sure that all Phase 2 and Phase 6 timings match each other and that all Phase 4 and Phase 8 timings match each other.
7. The Ped 4 push button is programmed to call Ped 4 and Ped 8. The Ped 8 push button is programmed to call Ped 8 and Ped 4.

SIGNAL HEAD WIRING DETAIL

(wire signal heads as shown)



21,22,
23

TIMING INTERVAL

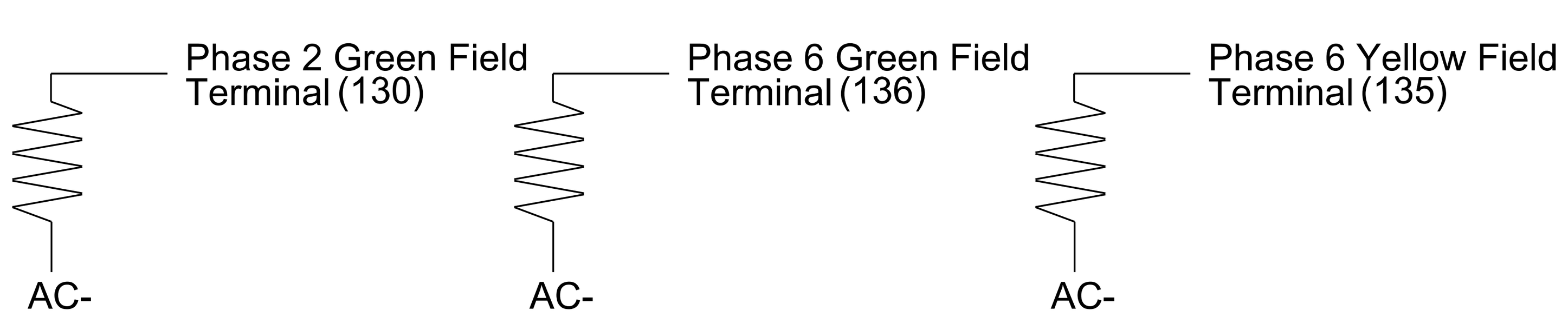
PHASE 2+6 = DARK DISPLAY
PHASE 2+6 PRE CLEARANCE = FLASHING YELLOW DISPLAY
PHASE 2+6 YELLOW CHANGE = STEADY YELLOW DISPLAY
PHASE 2+6 RED CLEAR THROUGH 4+8 WALK = STEADY RED DISPLAY
PED 4+8 DON'T WALK = ALTERNATING FLASHING RED DISPLAY

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 12-1921
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

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)



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.

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New Installation - Electrical Detail

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

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

Pedestrian Hybrid Beacon:
US 29-74 (Wilkinson Blvd) at
Eastbound U-Turn Bulb
West of Catawba River Bridge

Division 12 Gaston County Belmont

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 044558 DAVID T. SEARS

DocuSigned by: David T Sears 069183F28E5741E... 8/1/2025
DATE

SIG. INVENTORY NO. 12-1921

8/1/2025
R:*Traffic*Signals*Design*Signals*B-6051_Signal_121921e_dsn.dgn
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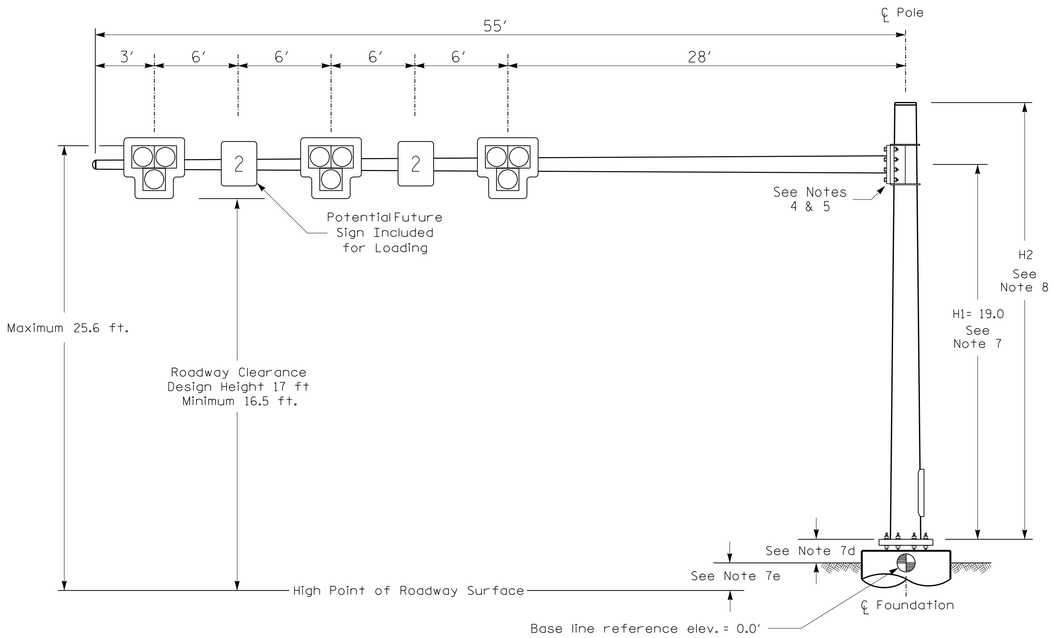
METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.14.2

Design Loading for METAL POLE NO. 1



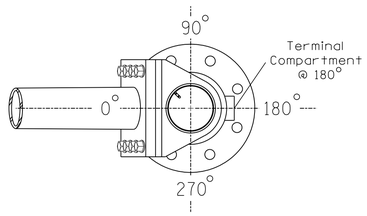
Elevation View

SPECIAL NOTE

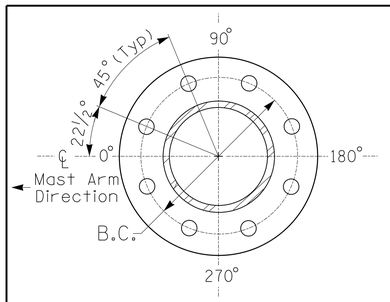
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	N/A
Baseline reference point at ⊕ Foundation @ ground level	0.0 ft.	
Elevation difference at High point of roadway surface	+0.5 ft.	
Elevation difference at Edge of travelway or face of curb	-0.3 ft.	

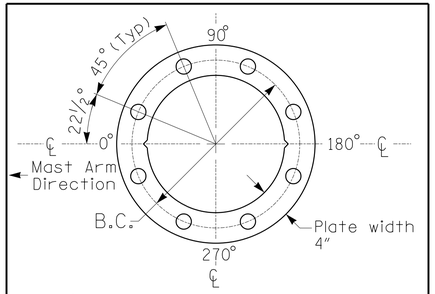


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
⊕	RIGID MOUNTED 12"-3 SECTION T-TYPE HYBRID BEACON - WITH BACKPLATE	10.5 S.F.	39.0"W X 39.0"L	62 LBS
2	SIGN RIGID MOUNTED	7.5 S.F.	30.0"W X 36.0"L	14 LBS

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 1st Edition 2015 AASHTO LRFD "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
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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.
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5. A clamp-type bolted mast arm-to-pole connection may be used instead of the welded ring stiffened box connection shown as long as the connection meets all of the design requirements.
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   a. Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
8. The pole manufacturer will determine the total height (H2) of each pole using the greater of the following:
   - Mast arm attachment height (H1) plus 2 feet, or
   - H1 plus 1/2 of the total height of the mast arm attachment assembly plus 1 foot.
9. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
10. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
11. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

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

NCDOT Wind Zone 5 (110 mph)

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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

Pedestrian Hybrid Beacon: US 29-74 (Wilkinson Blvd) at Eastbound U-Turn Bulb West of Catawba River Bridge

Division 12 Gaston County Belmont

PLAN DATE:	August 2025	REVIEWED BY:	DT Sears
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	

SCALE 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

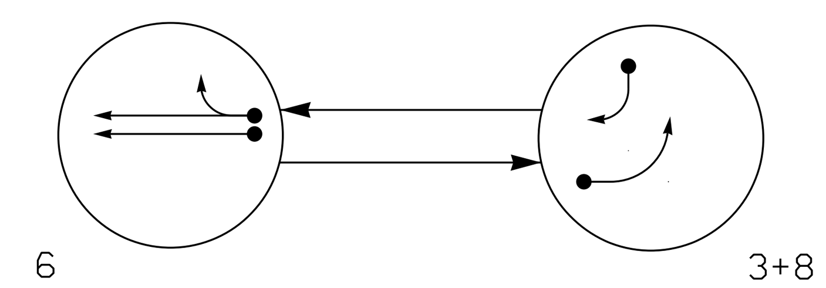
DocuSigned by: David T Sears 0691837281E5741E...

8/1/2025
SIGNATURE DATE

SIG. INVENTORY NO. 12-1921

8/1/2025
R:\Traffic\Signals\Designs\Signals\B-6051_Signal_12-1921_Mastarm_dsn.dgn
dsears

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

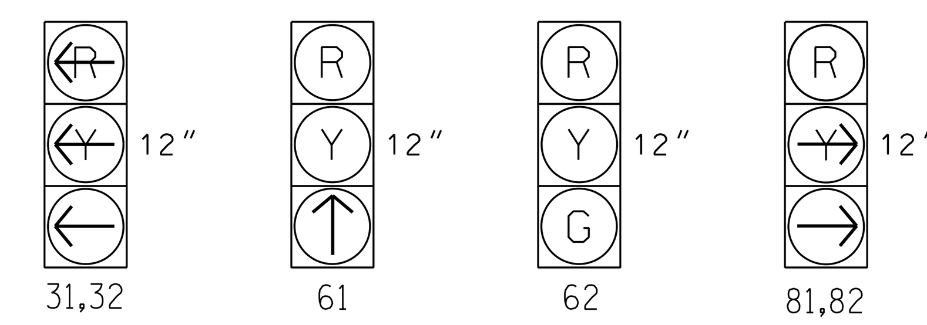
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 6	PHASE 3+8	PHASE FLASH
31,32	←R	←	←R
61	↑	R	R
62	G	R	R
81,82	R	→	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

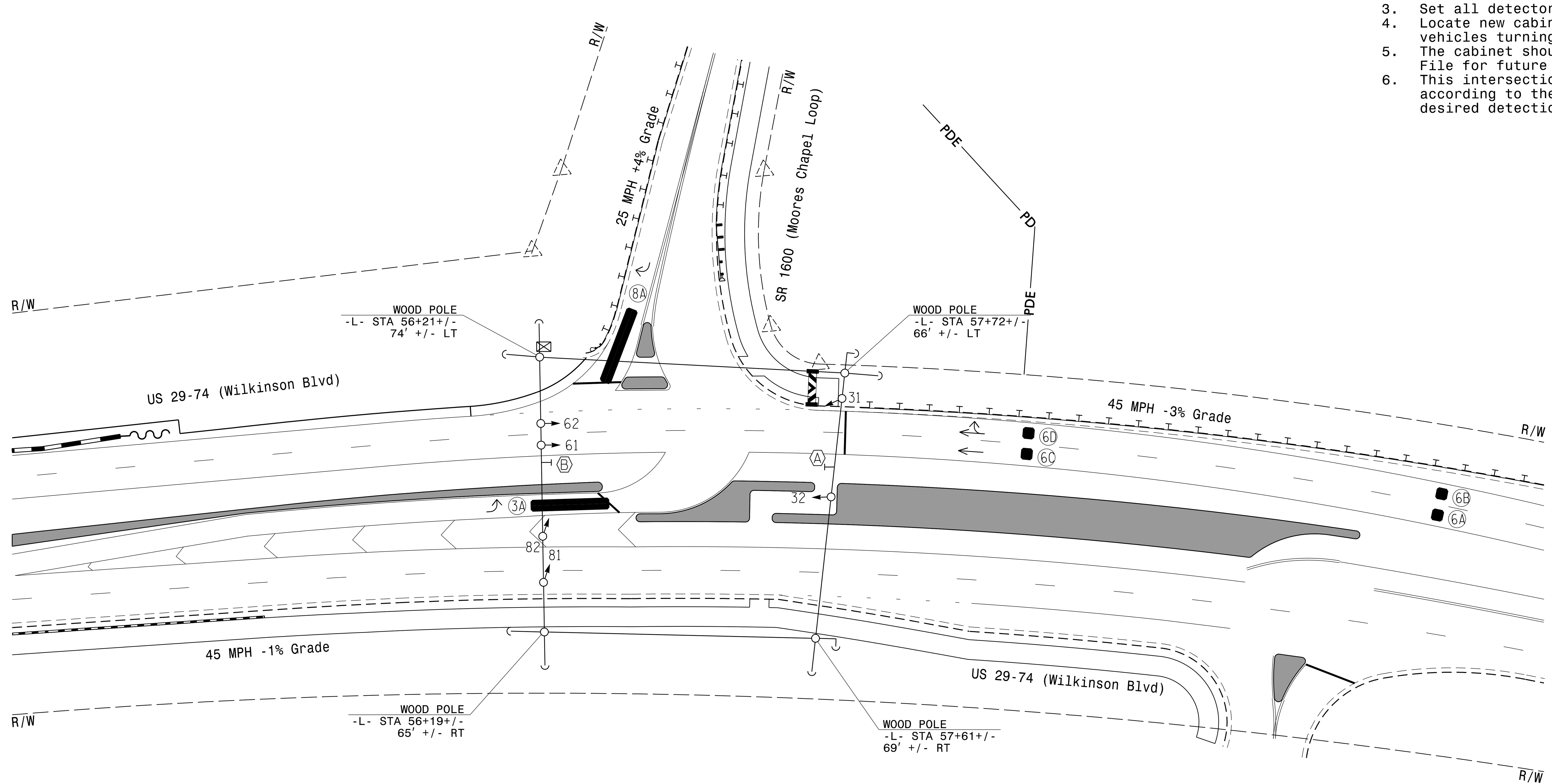
DETECTOR					PROGRAMMING							
ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
3A	6X40	0	✳	✳	3	-	-	X	-	X	-	✳
6A	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6B	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6C	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
6D	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
8A	6X40	0	✳	✳	8	15.0	-	X	-	X	-	✳

✳ VIDEO DETECTION ZONE

2 Phase
Fully Actuated
(Isolated)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Set all detector units to presence mode.
4. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
5. The cabinet should be designed to include an Auxiliary Output File for future use.
6. This intersection uses video 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	
	Non-Intrusive Detection Zone	
N/A	Guardrail	
	Pedestrian Barricade	
	Portable Concrete Barrier	
— PDE —	Drainage Easment	— PDE —
Ⓐ	No U-Turn Sign (R3-4)	Ⓐ
Ⓑ	No Left Turn Sign (R3-2)	Ⓑ

MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6	PHASE 8
Walk *	–	–	–
Ped Clear	–	–	–
Min Green *	7	12	7
Passage *	2.0	2.0	2.0
Max 1 *	30	90	30
Yellow Change	3.0	4.8	3.0
Red Clear	2.6	2.2	2.6
Added Initial *	–	–	–
Maximum Initial *	–	–	–
Time Before Reduction *	–	–	–
Time To Reduce *	–	–	–
Minimum Gap	–	–	–
Advance Walk	–	–	–
Non Lock Detector	X	–	X
Vehicle Recall	–	MIN RECALL	–
Dual Entry	X	–	X

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

8/1/2025
R:*Traffic*Signals*Design*Signals*B-6051_Signal_10-2479T1_dsn.dgn
dsears

New Installation
Temporary Design 1 - TMP Phase III Step 4

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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 29-74 (Wilkinson Blvd) at SR 1600 (Moores Chapel Loop)

Division 10 Mecklenburg County Charlotte

PLAN DATE: August 2025	REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones	REVIEWED BY:

REVISIONS	INIT.	DATE

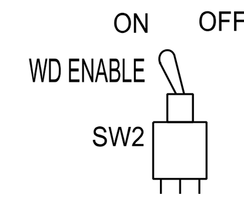
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

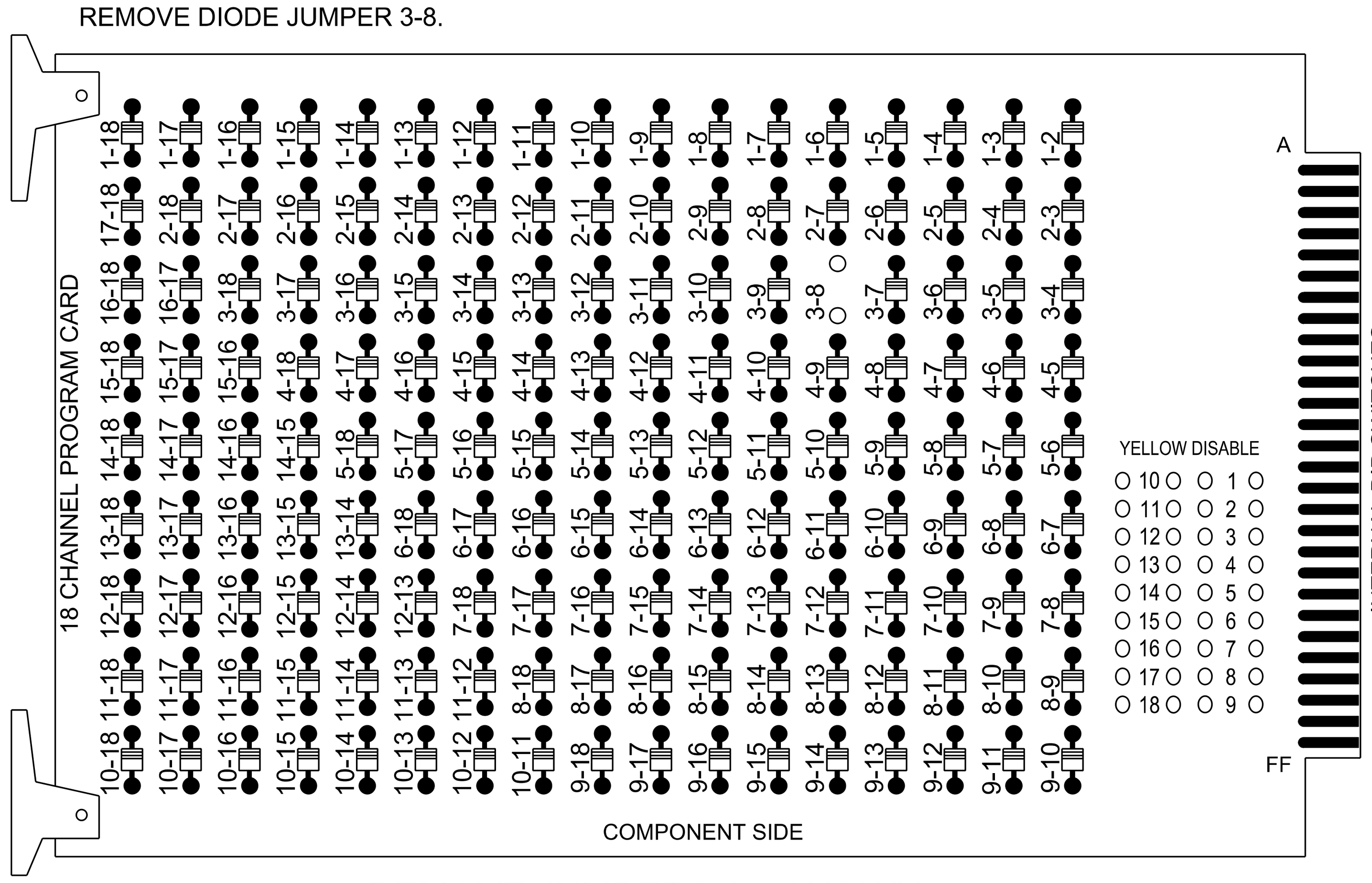
DocuSigned by: David T Sears 069183F28E5741E...
SIGNATURE 8/1/2025 DATE

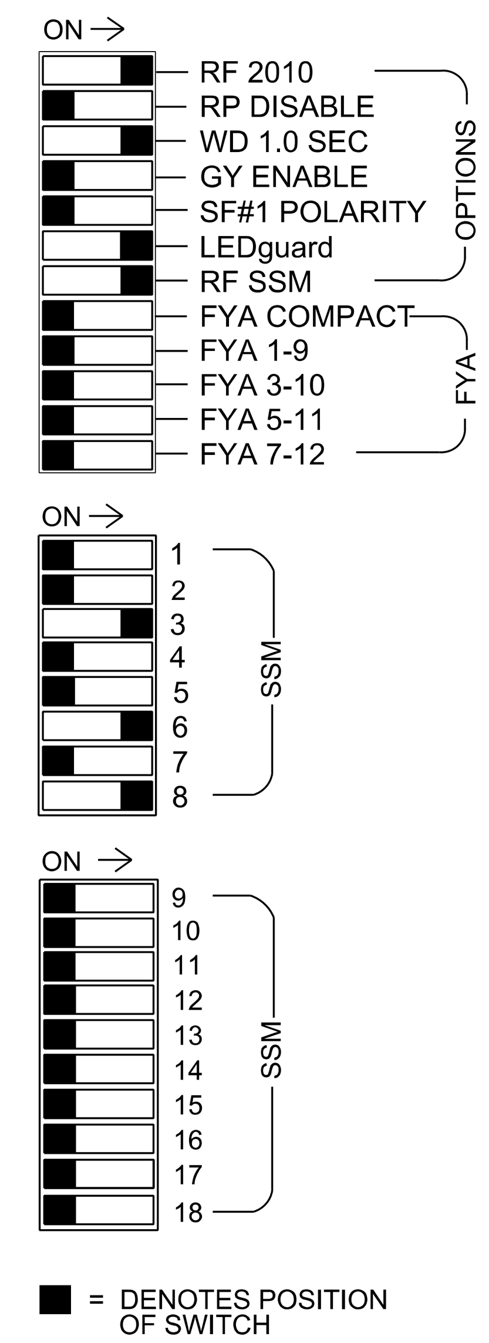
SIG. INVENTORY NO. 10-2479TI

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)







REMOVE JUMPERS AS SHOWN

NOTES:
1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. 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 3 and 8 for Dual Entry.
3. Program controller to start up in phase 6 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.

EQUIPMENT INFORMATION

Controller..2070LX
Cabinet...332 w/ Aux
Software...Q-Free MAXTIME
Cabinet Mount....................................Base
Output File Positions..........................18 With Aux. Output File
Load Switches Used...........................S4, S8, S11
Phases Used.......................................3, 6, 8
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..NOT USED
Overlap "4"..NOT USED

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8		S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6		15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6		6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	NU	NU	31,32	NU	NU	NU	61	62	NU	NU	81,82	NU	NU	NU	NU	NU	NU	NU
RED								134	134			107							
YELLOW								135	135										
GREEN									136										
RED ARROW				116															
YELLOW ARROW				117								108							
GREEN ARROW				118				136				109							

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

FILE		1	2	3	4	5	6	7	8	9	1O	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 video detection system for vehicle detection for zones 3A, 6A, 6B, 6C, 6D, and 8A. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 10-2479T1
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

New Installation - Temporary Design 1 - TMP Phase III Step 4
Electrical Detail

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Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd)
at
SR 1600 (Moores Chapel Loop)

Division 10 Mecklenburg County Charlotte

PLAN DATE:	August 2025	REVIEWED BY:	CB Holden
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	DT Sears

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS
DocuSigned by: David T. Sears
069183F28E5741E...
8/1/2025
DATE

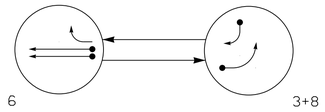
PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.15.1

SIG. INVENTORY NO. 10-2479T1

8/1/2025
R:*Traffic*Signals*Design*Signals*B-6051_Signal_102479eT1_dsn.dgn
dsears

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.16.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

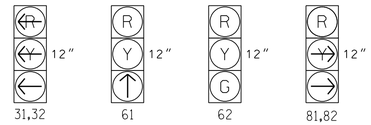
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 6	PHASE 3+8	PHASE FLASH
31,32	~~R~~	←	~~R~~
61	↑	R	R
62	G	R	R
81,82	R	→	R

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

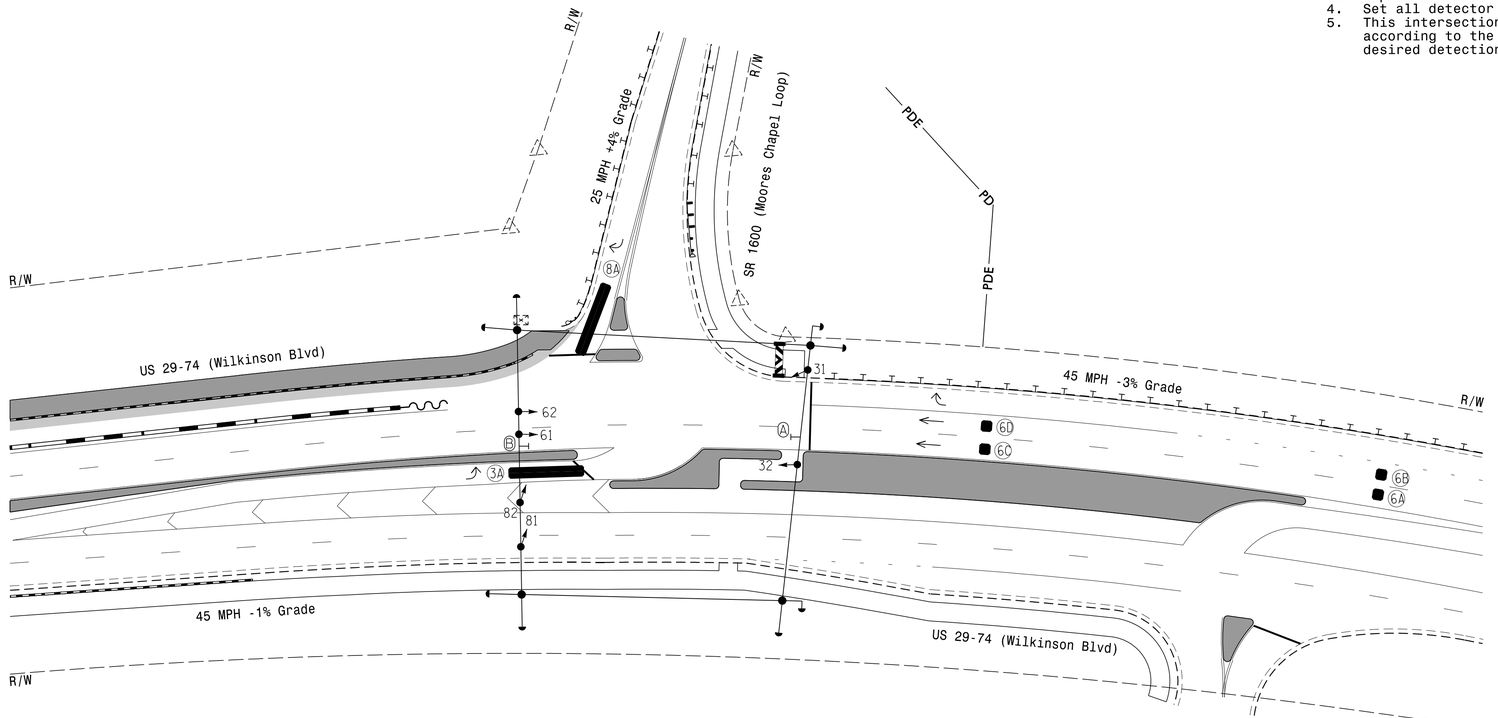
DETECTOR					PROGRAMMING							
ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
3A	6X40	0	✳	✳	3	-	-	X	-	X	-	✳
6A	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6B	6X6	300	✳	✳	6	-	1.6	X	-	X	-	✳
6C	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
6D	6X6	90	✳	✳	6	-	-	X	-	X	-	✳
8A	6X40	0	✳	✳	8	15.0	-	X	-	X	-	✳

✳ VIDEO DETECTION ZONE

2 Phase
Fully Actuated
(Isolated)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Reposition existing signal heads numbered 61 and 62.
4. Set all detector units to presence mode.
5. This intersection uses video detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.



MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6	PHASE 8
Walk *	–	–	–
Ped Clear	–	–	–
Min Green *	7	12	7
Passage *	2.0	2.0	2.0
Max 1 *	30	90	30
Yellow Change	3.0	4.8	3.0
Red Clear	2.6	2.2	2.6
Added Initial *	–	–	–
Maximum Initial *	–	–	–
Time Before Reduction *	–	–	–
Time To Reduce *	–	–	–
Minimum Gap	–	–	–
Advance Walk	–	–	–
Non Lock Detector	X	–	X
Vehicle Recall	–	MIN RECALL	–
Dual Entry	X	–	X

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

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	▒
▬	Non-Intrusive Detection Zone	▬
N/A	Guardrail	⊥⊥
⋈	Pedestrian Barricade	⋈
▬	Portable Concrete Barrier	▬
— PDE —	Drainage Easment	— PDE —
Ⓐ	No U-Turn Sign (R3-4)	Ⓐ
Ⓑ	No Left Turn Sign (R3-2)	Ⓑ

Signal Upgrade
Temporary Design 2 - TMP Phase IV Step 1

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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

SCALE
0 40
1"=40'

US 29-74 (Wilkinson Blvd)
at
SR 1600 (Moores Chapel Loop)

Division 10 Mecklenburg County Charlotte

PLAN DATE: August 2025 REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA
PROFESSIONAL
SEAL
044558
ENGINEER
DAVID T. SEARS

DocuSigned by:
David T Sears
0691B3F2BE5741E...
SIGNATURE 8/1/2025
DATE

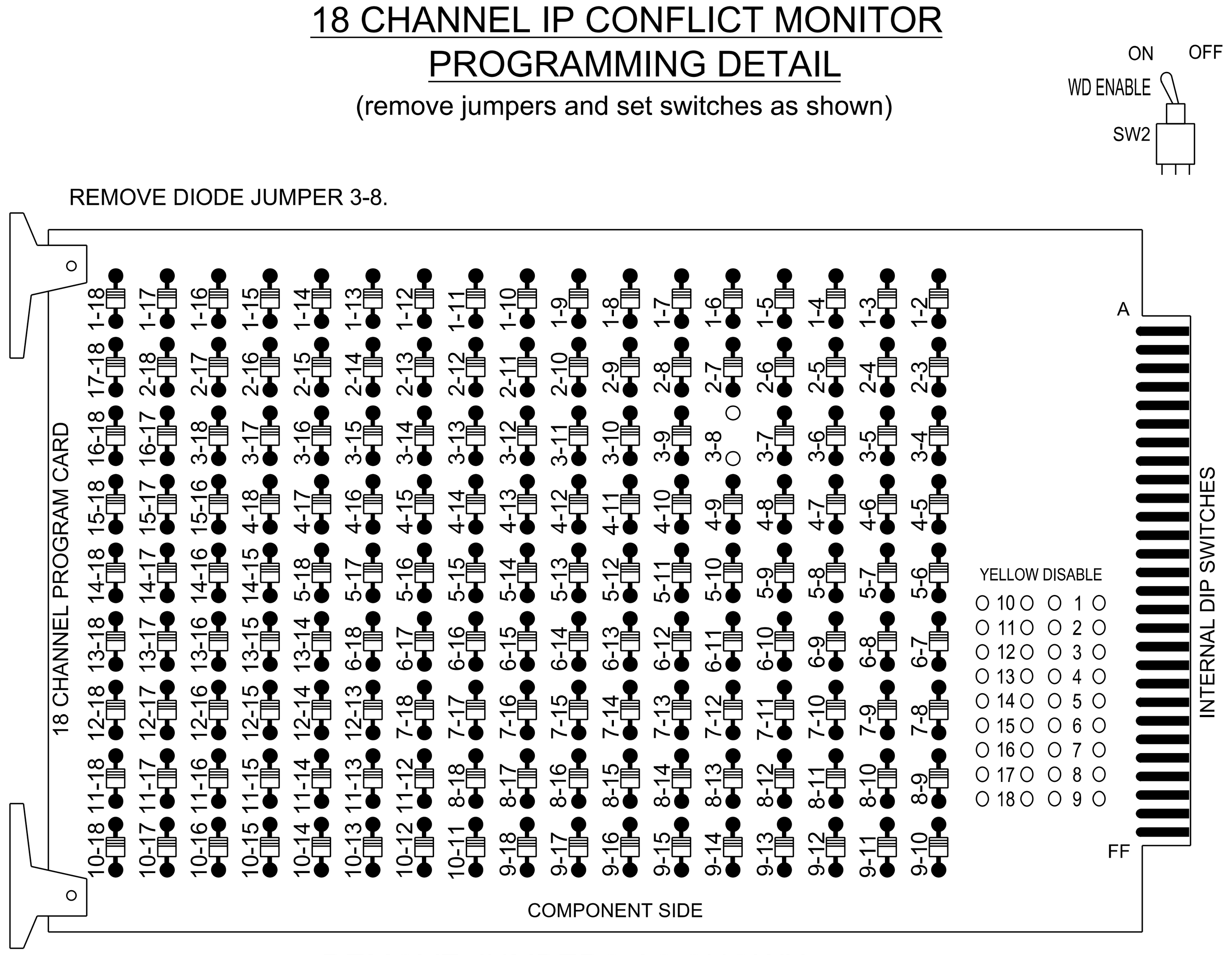
SIG. INVENTORY NO. I0-247912

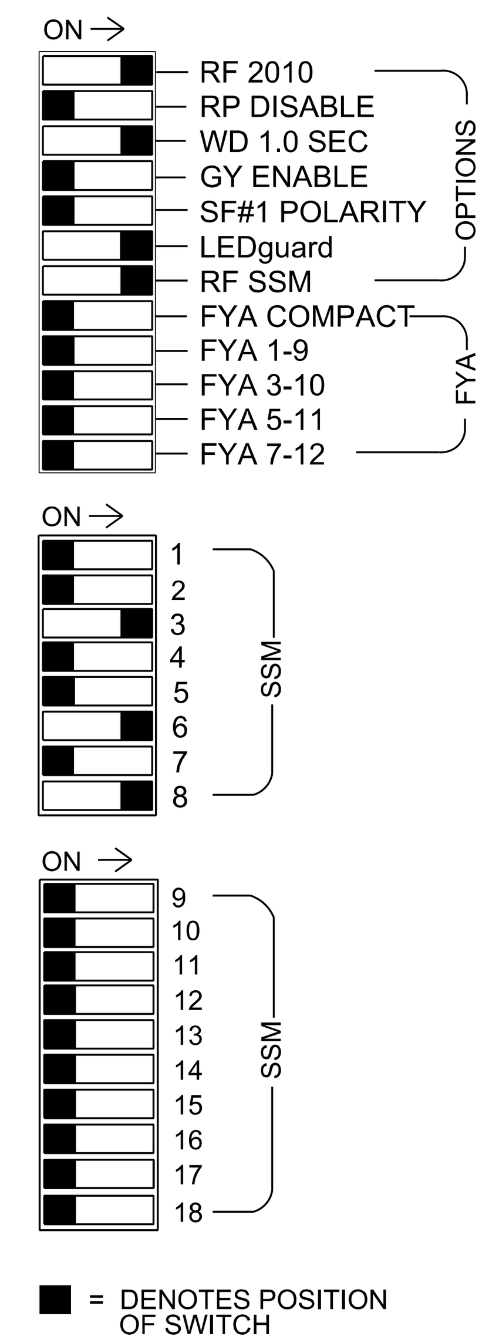
8/1/2025
B-6051/Ficheiros/Signals/Design/Signals/B-6051_Signal_I0-247912_dsn.dgn
dsears

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.16.1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)





REMOVE JUMPERS AS SHOWN

NOTES:
1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. 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 3 and 8 for Dual Entry.
3. Program controller to start up in phase 6 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.

EQUIPMENT INFORMATION

Controller...2070LX
Cabinet..332 w/ Aux
Software...Q-Free MAXTIME
Cabinet Mount....................................Base
Output File Positions..........................18 With Aux. Output File
Load Switches Used...........................S4, S8, S11
Phases Used.......................................3, 6, 8
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..NOT USED
Overlap "4"..NOT USED

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8		S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6		15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6		6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	NU	NU	31,32	NU	NU	NU	61	62	NU	NU	81,82	NU	NU	NU	NU	NU	NU	NU
RED								134	134			107							
YELLOW								135	135										
GREEN									136										
RED ARROW				116															
YELLOW ARROW				117								108							
GREEN ARROW				118				136				109							

NU = Not Used

INPUT FILE POSITION LAYOUT

(front view)

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

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

FS = FLASH SENSE
ST = STOP TIME

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection for zones 3A, 6A, 6B, 6C, 6D, and 8A. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 10-2479T2
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Temporary Design 2 - TMP Phase IV Step 1
Electrical Detail

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Electrical and Programming Details For:

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

US 29-74 (Wilkinson Blvd)
at
SR 1600 (Moores Chapel Loop)

Division 10 Mecklenburg County Charlotte

PLAN DATE: August 2025 REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

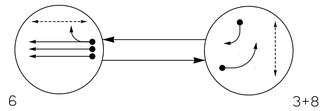
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS
DocuSigned by: David T. Sears
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 10-2479T2

8/1/2025
R:*Traffic*Signals*Design*Signals*B-6051_Signal_102479eT2_dsn.dgn
dsears

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.17.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

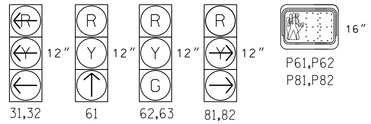
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 6	PHASE 3+8	PHASE FLASH
31,32	~~R~~	←	~~R~~
61	↑	R	R
62,63	G	R	R
81,82	R	→	R
P61,P62	W	DW	DRK
P81,P82	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



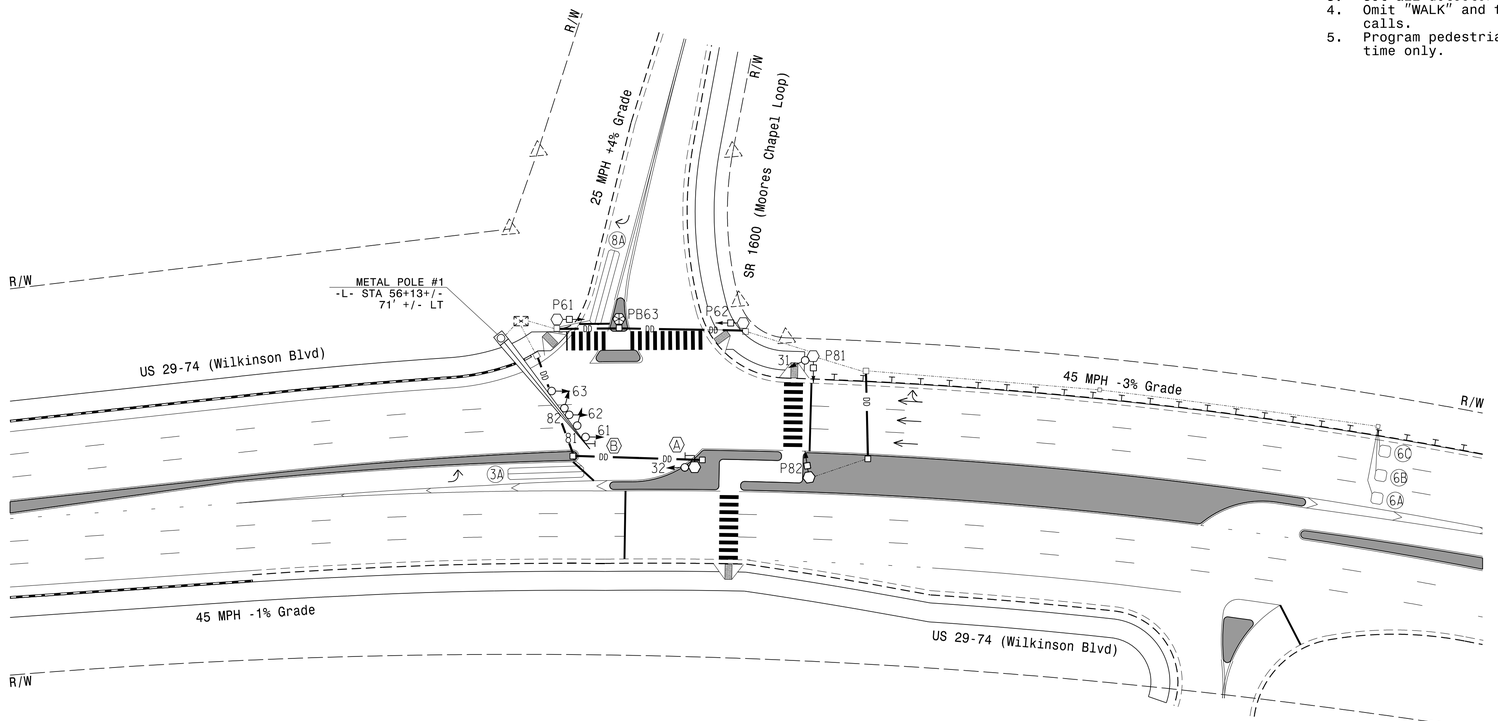
MAXTIME DETECTOR INSTALLATION CHART

DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
3A	6X40	0	2-4-2	X	3	-	-	X	-	X	-	X
6A	6X6	300	5	X	6	-	-	X	X	X	-	X
6B	6X6	300	5	X	6	-	-	X	X	X	-	X
6C	6X6	300	5	X	6	-	-	X	X	X	-	X
8A	6X40	0	2-4-2	X	8	15.0	-	X	-	X	-	X

2 Phase
Fully Actuated
(Isolated)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification 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. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
5. Program pedestrian heads to countdown the flashing "Don't Walk" time only.



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	→
⊛	Type I Pushbutton Post	●
⬡	Type II Signal Pedestal	⬢
N/A	Guardrail	⊥⊥
N/A	Curb Ramp	◢◣
Ⓐ	No U-Turn Sign (R3-4)	Ⓐ
Ⓑ	No Left Turn Sign (R3-2)	Ⓑ

MAXTIME TIMING CHART

FEATURE	PHASE 3	PHASE 6	PHASE 8
Walk *	–	7	7
Ped Clear	–	24	8
Min Green *	7	12	7
Passage *	2.0	6.0	2.0
Max 1 *	30	90	30
Yellow Change	3.0	4.8	3.0
Red Clear	2.8	1.9	2.8
Added Initial *	–	1.0	–
Maximum Initial *	–	34	–
Time Before Reduction *	–	15	–
Time To Reduce *	–	30	–
Minimum Gap	–	3.0	–
Advance Walk	–	7	–
Non Lock Detector	X	–	X
Vehicle Recall	–	MIN RECALL	–
Dual Entry	X	–	X

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

8/1/2025
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dsears

Signal Upgrade - Final Design

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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

SCALE
0 40
1"=40'

US 29-74 (Wilkinson Blvd)
at
SR 1600 (Moores Chapel Loop)

Division 10 Mecklenburg County Charlotte

PLAN DATE: August 2025 REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

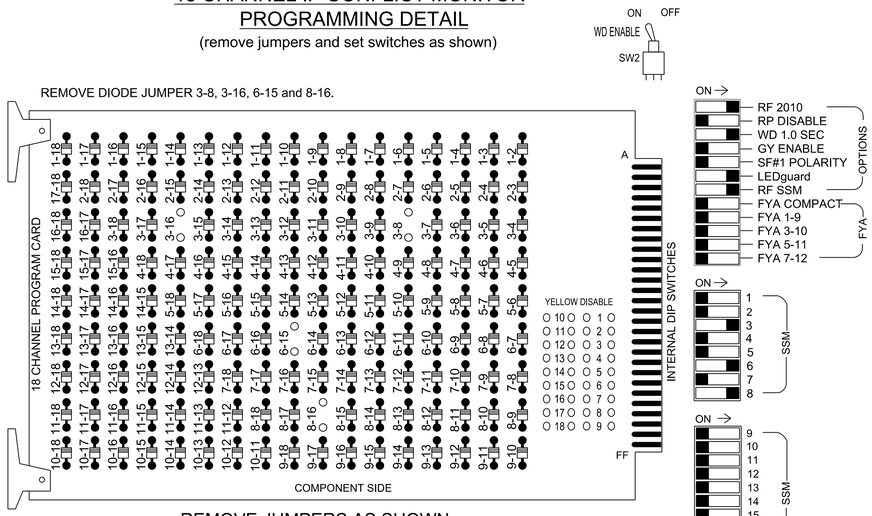
DocuSigned by:
David T Sears
089183F2E5741E...
SIGNATURE 8/1/2025 DATE

SIG. INVENTORY NO. 10-2479

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.17.1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE JUMPERS AS SHOWN

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. 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 3 and 8 for Dual Entry.
3. Program controller to start up in phase 6 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.

EQUIPMENT INFORMATION

Controller.....2070LX
Cabinet.....332 w/ Aux
Software.....Q-Free MAXTIME
Cabinet Mount.....Base
Output File Positions.....18 With Aux. Output File
Load Switches Used.....S4, S8, S9, S11, S12
Phases Used.....3, 6, 6 PED, 8, 8 PED
Overlap "1".....NOT USED
Overlap "2".....NOT USED
Overlap "3".....NOT USED
Overlap "4".....NOT USED

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8		S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6		15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6		6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	NU	NU	31,32	NU	NU	NU	61	62,63	P61, P62	NU	81,82	P81, P82	NU	NU	NU	NU	NU	NU
RED	·	·	·	·	·	·	·	134	134	·	·	107	·	·	·	·	·	·	·
YELLOW	·	·	·	·	·	·	·	135	135	·	·	·	·	·	·	·	·	·	·
GREEN	·	·	·	·	·	·	·	·	136	·	·	·	·	·	·	·	·	·	·
RED ARROW	·	·	·	116	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
YELLOW ARROW	·	·	·	117	·	·	·	·	·	·	·	108	·	·	·	·	·	·	·
GREEN ARROW	·	·	·	118	·	·	·	136	·	·	·	109	·	·	·	·	·	·	·
✋	·	·	·	·	·	·	·	·	·	119	·	·	110	·	·	·	·	·	·
🚶	·	·	·	·	·	·	·	·	·	121	·	·	112	·	·	·	·	·	·

NU = Not Used

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	∅3 3A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	∅6 PED DC ISOLATOR	FS DC ISOLATOR
	L					NOT USED								∅8 PED DC ISOLATOR	ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	∅6 6A	∅6 6C	SLOT EMPTY	SLOT EMPTY	∅8 8A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L		∅6 6B	NOT USED			NOT USED								

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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
3A	TB4-5,6	I5U	58	20	7	3			X		X	
6A	TB3-5,6	J2U	40	2	16	6			X	X	X	
6B	TB3-7,8	J2L	44	6	17	6			X	X	X	
6C	TB3-9,10	J3U	64	30	18	6			X	X	X	
8A	TB5-9,10	J6U	42	4	22	8	15.0		X		X	
PED PUSH BUTTONS												
P61,P62	TB8-7,9	I13U	68	34	6	PED 6						
P81,P82	TB8-8,9	I13L	70	36	8	PED 8						

NOTE:
INSTALL DC ISOLATORS IN INPUT FILE SLOT I13.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

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.

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THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 10-2479
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

Signal Upgrade - Final Design - Electrical Detail

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
Traffic Signals & Signals Management Section

750 N. Greenfield Pkwy, Garner, NC 27529

US 29-74 (Wilkinson Blvd)
at
SR 1600 (Moores Chapel Loop)

Division 10 | Mecklenburg County | Charlotte

PLAN DATE: August 2025 | REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones | REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

DocuSigned by:
David T Sears
069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 10-2479

8/1/2025
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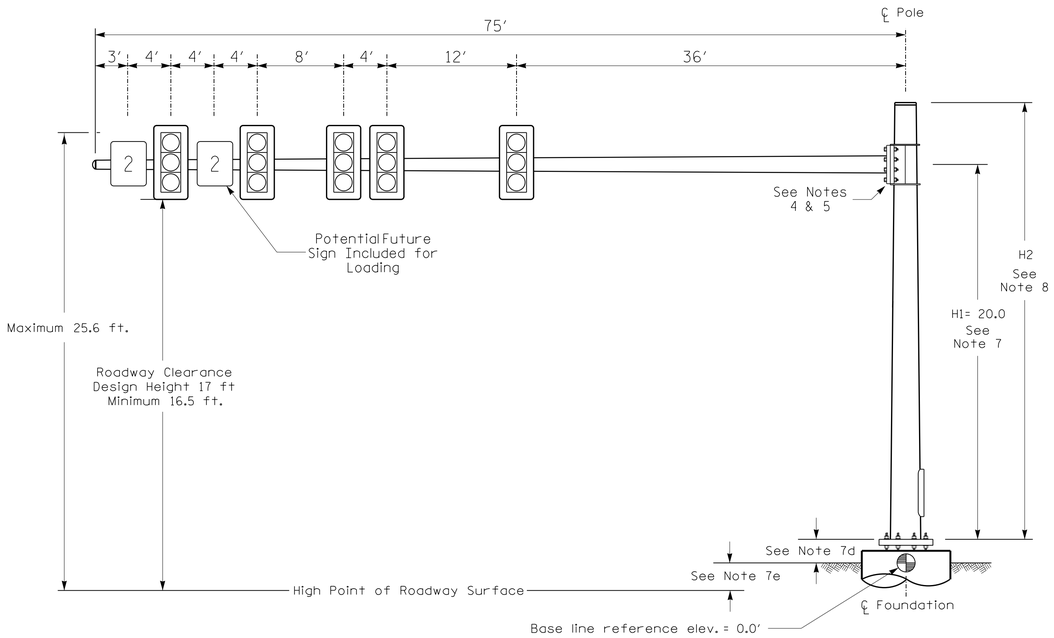
Design Loading for METAL POLE NO. 1



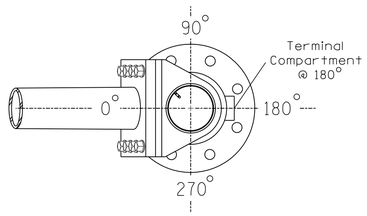
Elevation View

SPECIAL NOTE

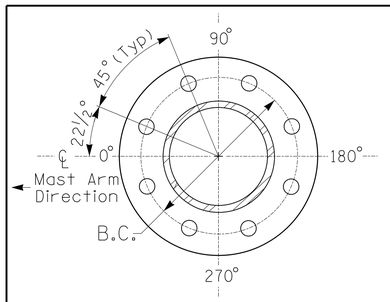
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	N/A
Baseline reference point at ⊕ Foundation @ ground level	0.0 ft.	
Elevation difference at High point of roadway surface	+0.3 ft.	
Elevation difference at Edge of travelway or face of curb	+1.5 ft.	

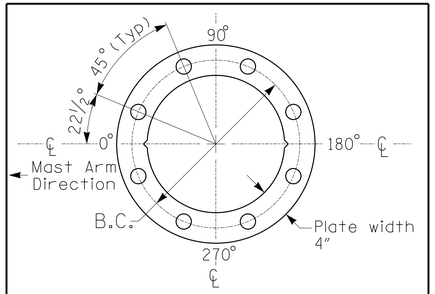


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.17.2

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
[signal]	RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5"W X 52.5"L	60 LBS
2	SIGN RIGID MOUNTED	7.5 S.F.	30.0"W X 36.0"L	14 LBS

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 1st Edition 2015 AASHTO LRFD "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 2024 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
   - The 2024 NCDOT Roadway Standard Drawings.
   - The traffic signal project plans and special provisions.
   - The NCDOT "Metal Pole Standards" located at the following NCDOT website: https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

DESIGN REQUIREMENTS

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

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

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NCDOT Wind Zone 5 (110 mph)

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 29-74 (Wilkinson Blvd)
at
SR 1600 (Moores Chapel Loop)

Division 10 Mecklenburg County Charlotte

PLAN DATE:	August 2025	REVIEWED BY:	DT Sears
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	

SCALE: 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

DocuSigned by: David T Sears 0691837281E5741E...
SIGNATURE 8/1/2025 DATE

SIG. INVENTORY NO. 12-2479

8/1/2025
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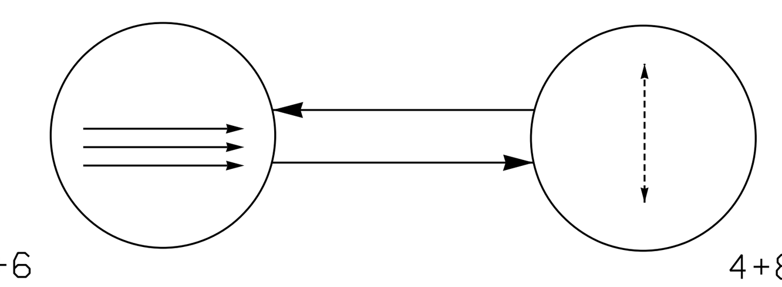
PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.18.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

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

TABLE OF OPERATION

SIGNAL FACE	PHASE: 2+6 DARK	ACTIVATION	STEADY YELLOW	ALL RED	4+8 PED WALK	4+8 PED CLEAR	FLASH
21,22,23	DRK	FY	Y	R	R	FR*	Y
P41	DW	DW	DW	DW	W	FDW	DRK
P81	DW	DW	DW	DW	W	FDW	DRK

* ALTERNATING FLASH

Y- Steady Yellow
FY - Flashing Yellow
R - Steady Red
FR - Flashing Red
W - Walk
DW - Don't Walk
FDW - Flashing Don't Walk
DRK - Dark

SIGNAL FACE I.D.

All Heads L.E.D.

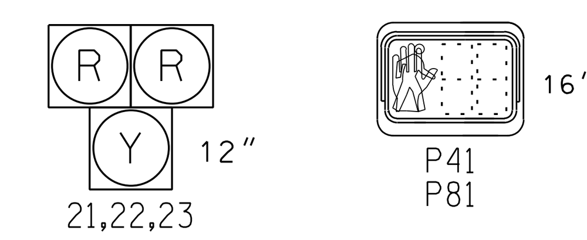


Figure 1

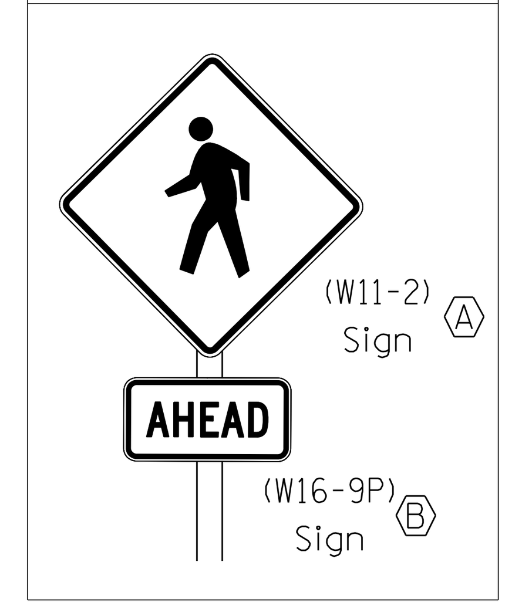
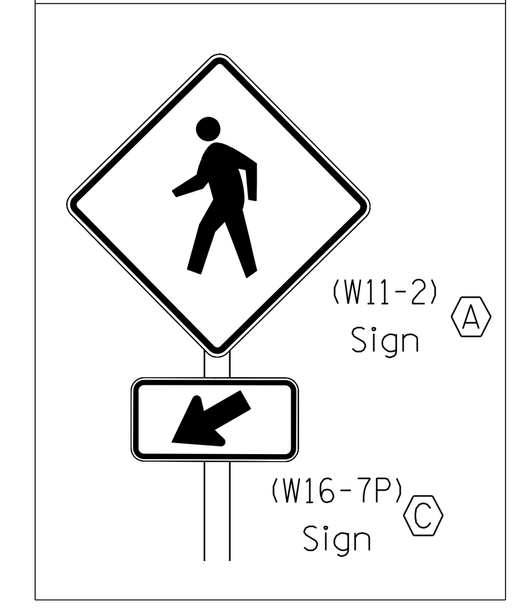


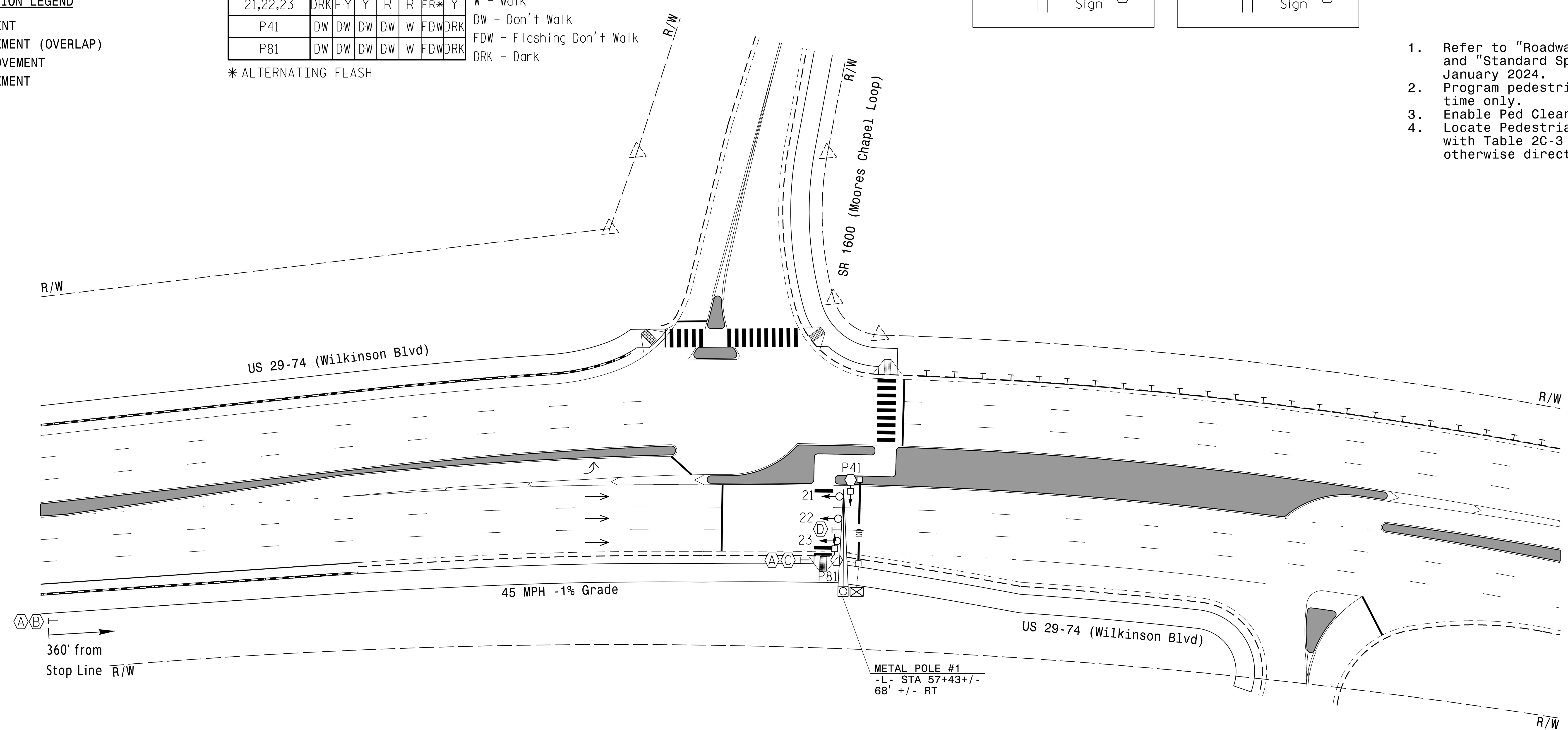
Figure 2



2 Phase
Semi-Actuated
Pedestrian Hybrid Beacon
(Isolated)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specification for Roads and Structures" dated January 2024.
2. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
3. Enable Ped Clear During Red Clear for phases 4+8.
4. Locate Pedestrian and Crosswalk advance signs in accordance with Table 2C-3 in Section 2C.04 of the 2023 MUTCD or as otherwise directed by the Engineer.



MAXTIME TIMING CHART

FEATURE	PHASE 2	4 PED	6	8 PED
Walk *	–	7	–	7
Ped Clear	–	7	–	7
Min Green *	12	7	12	7
Passage *	0.0	0.0	0.0	0.0
Max 1 *	90	7	90	7
Yellow Change	4.6	3.0	4.6	3.0
Red Clear	5.0	0.0	5.0	0.0
Added Initial *	–	–	–	–
Maximum Initial *	–	–	–	–
Time Before Reduction *	–	–	–	–
Time To Reduce *	–	–	–	–
Minimum Gap	–	–	–	–
Pre Clearance	5.0	–	5.0	–
Advance Walk	–	–	–	–
Non Lock Detector	–	X	–	X
Vehicle Recall	MIN RECALL	–	MIN RECALL	–
Dual Entry	–	–	–	–

Serves as Steady Yellow Clearance Time (Yellow Change, phases 2 and 6)
Serves as AllRed Clearance Time (Red Clear, phases 2 and 6)
Serves as Flashing Yellow Time (Pre Clearance, phases 2 and 6)

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

LEGEND

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	⟶
N/A	Guardrail	⊥ ⊥
⬡	Type II Signal Pedestal	⬢
N/A	Curb Ramp	⩓
A	Pedestrian Warning Sign (W11-2)	A
B	"AHEAD" Sign (W16-9P)	B
C	Left Downward Arrow Sign (W16-7P)	C
D	"STOP ON RED - YIELD ON FLASHING RED AFTER STOP" Sign (R10-23a)	D

New Installation

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Transportation Mobility and Safety Division
Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

SCALE 0 40 1"=40'

Pedestrian Hybrid Beacon:
US 29-74 (Wilkinson Blvd)
at
SR 1600 (Moores Chapel Loop)

Division 10 Mecklenburg County Charlotte

PLAN DATE: August 2025	REVIEWED BY: DT Sears
PREPARED BY: WP Erickson-Jones	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T. SEARS

DocuSigned by: David T Sears
069183F28E5741E...
SIGNATURE 8/1/2025 DATE

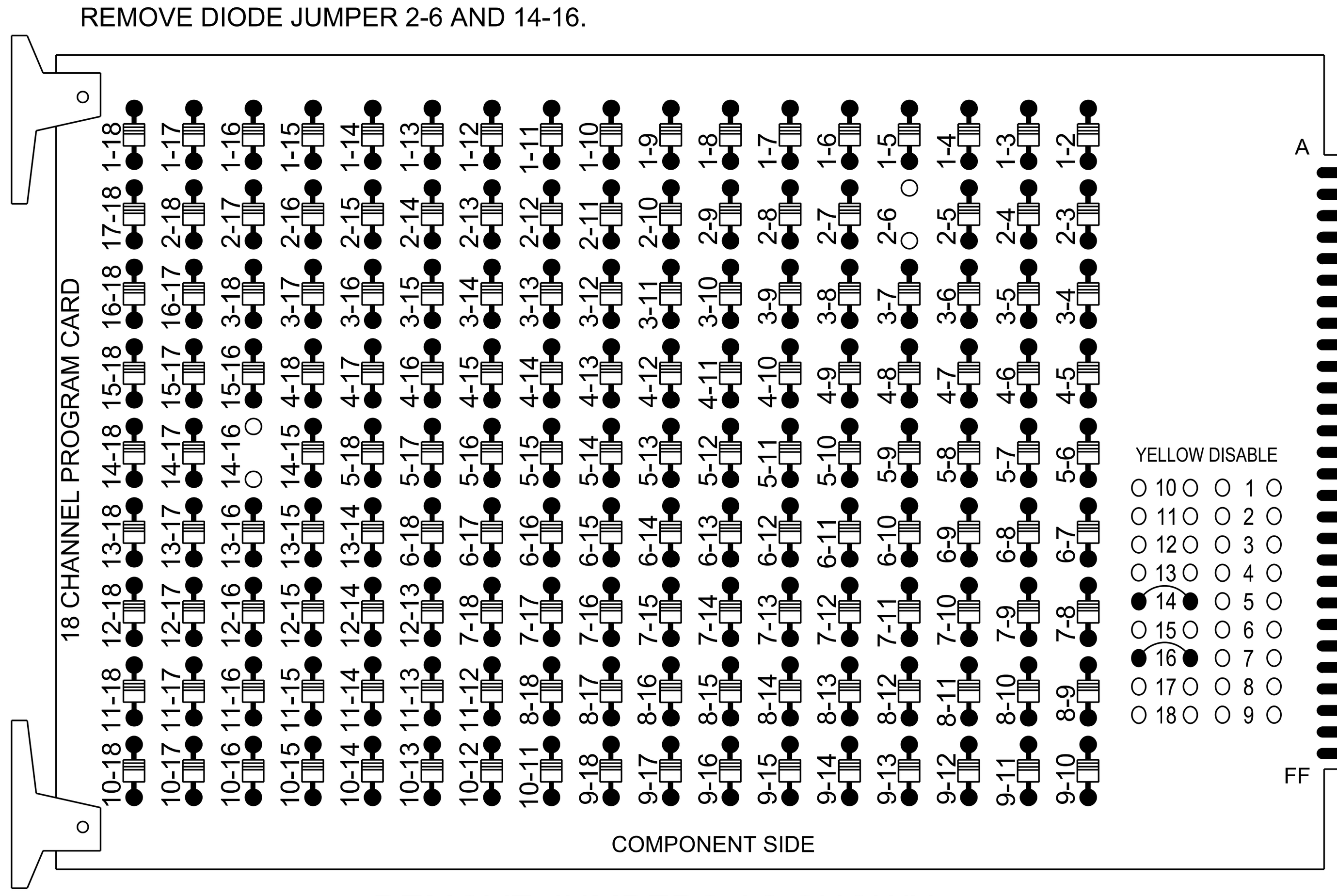
SIG. INVENTORY NO. 10-2480

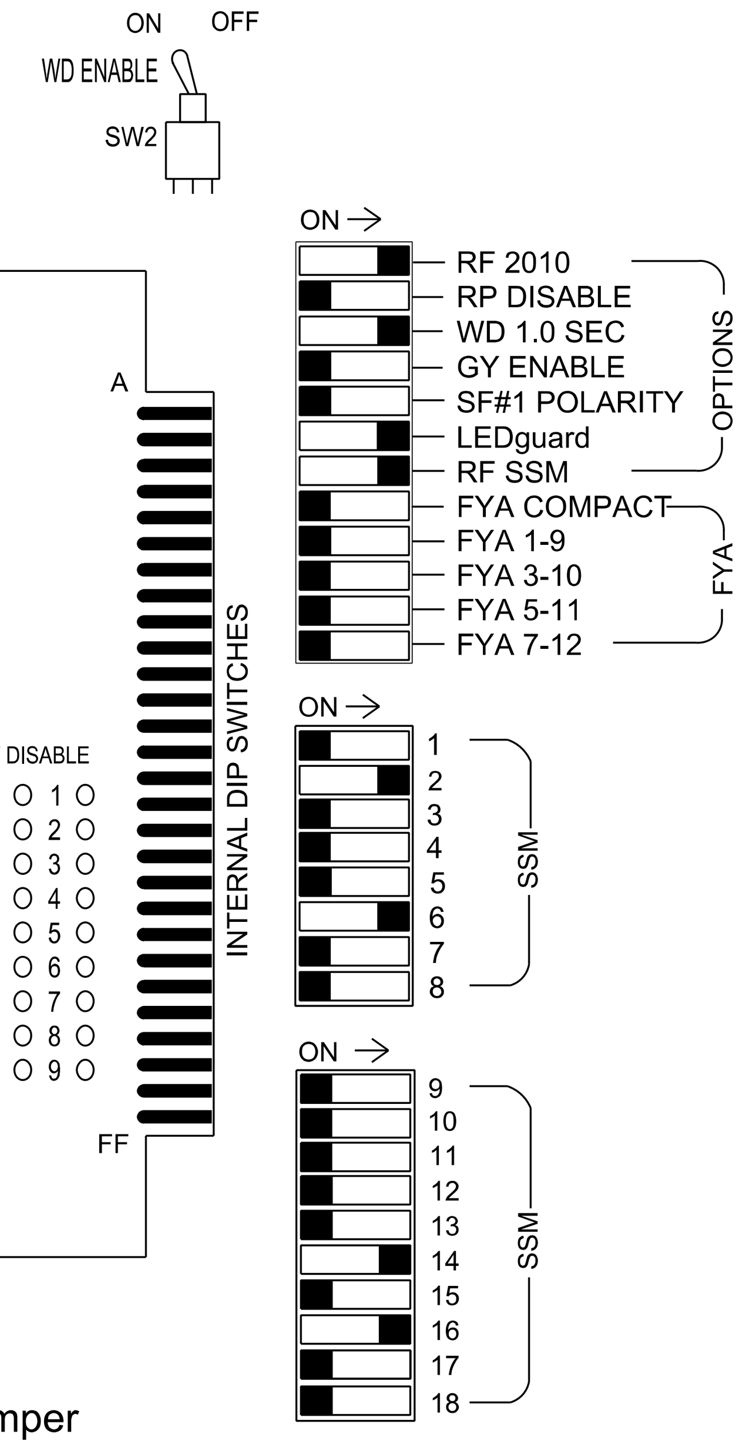
8/1/2025
R:*Traffic*Signals*Design*Signals*B-6051_Signal_10-2480_dsn.dgn
dsears

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPER 2-6 AND 14-16.





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.

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. Install the latest 332_NCDOT_HAWK_Default database onto controller.
4. Program phases 4 and 8 for No Startup Veh Call and No Startup Ped Call.
5. Program phases 4 and 8 for Ped Clear During Red Clear.

EQUIPMENT INFORMATION

Controller..2070LX
Cabinet..332
Software...Q-Free MAXTIME
Cabinet Mount....................................Base
Output File Positions...........................12
Load Switches Used............................S2, S6, S8, S12
Phases Used.......................................2, 4*, 4 PED, 6, 8*, 8 PED
Overlap "1"..NOT USED
Overlap "2"..NOT USED
Overlap "3"..NOT USED
Overlap "4"..NOT USED

*Used for timing purposes only.

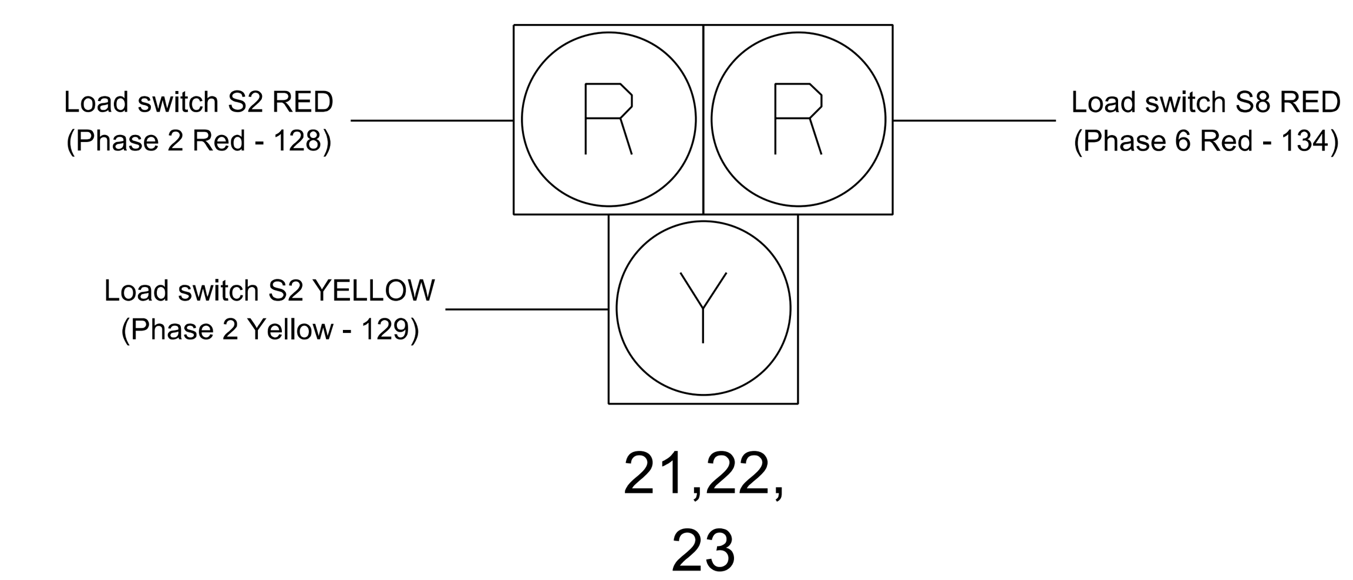
SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
CMU CHANNEL NO.	1	2	13	3	4	14	5	6	15	7	8	16
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED
SIGNAL HEAD NO.	NU	21,22, 23	NU	NU	NC	P41	NU	21,22, 23	NU	NU	NC	P81
RED		128						134				
YELLOW		129						*				
GREEN		*						*				
RED ARROW												
YELLOW ARROW												
FLASHING YELLOW ARROW												
GREEN ARROW												
✋						104						110
🚶						106						112

NU = Not Used
NC = Not Connected
*Denotes install load resistor. See load resistor installation detail this sheet.

SIGNAL HEAD WIRING DETAIL

(wire signal heads as shown)



INPUT FILE POSITION LAYOUT

(front view)

FILE		1	2	3	4	5	6	7	8	9	1O	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	NOT USED	NOT USED	FS DC ISOLATOR
"I"	L												Ø4 PED DC ISOLATOR	Ø8 PED DC ISOLATOR	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
"J"	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												
P41	TB8-5,6	I12L	69	35	4	PED 4 / 8 *						
P81	TB8-8,9	I13L	70	36	8	PED 8 / 4 *						

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

* FOR THE ABOVE DETECTORS TO CALL ANOTHER PHASE SCROLL OVER AND ENTER SECOND PHASE IN "ADDITIONAL CALL PHASES" COLUMN.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

OPERATIONAL NOTES

1. In order for the controller to perform the Pedestrian Hybrid Beacon (HAWK signal) sequence, the 332_NCDOT_HAWK_v1_3 database must be installed on the controller.
2. The only Phase 6 load switch output that is being used drives one of the red signal faces of each signal head.
3. 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.
4. The Phase 2 and Phase 6 Red outputs drives the solid Red displays during the Phase 2 and 6 Red Clear and Ped 4 and 8 Walk Interval. The Logic Processor flashes Phase 2 and Phase 6 Red Outputs in a wig-wag pattern during 4+8 Ped Clear Interval.
5. The controller must be programmed for Ped Clear During Red Clear for Pedestrian Phases 4 and 8 so that Red displays continue to flash during Phases 4 and 8 Yellow Change and Red Clear.
6. Make sure that all Phase 2 and Phase 6 timings match each other and that all Phase 4 and Phase 8 timings match each other.
7. The Ped 4 push button is programmed to call Ped 4 and Ped 8. The Ped 8 push button is programmed to call Ped 8 and Ped 4.

TIMING INTERVAL

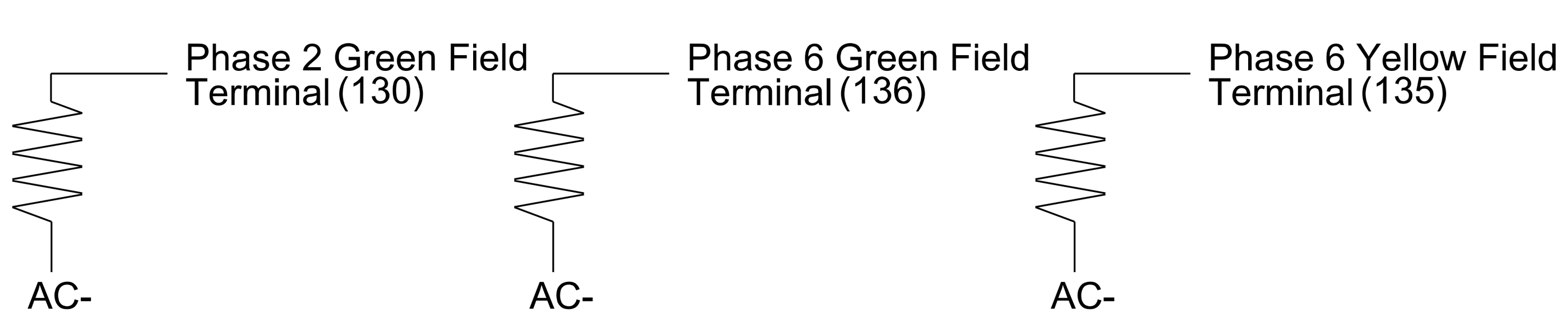
PHASE 2+6 = DARK DISPLAY
PHASE 2+6 PRE CLEARANCE = FLASHING YELLOW DISPLAY
PHASE 2+6 YELLOW CHANGE = STEADY YELLOW DISPLAY
PHASE 2+6 RED CLEAR THROUGH 4+8 WALK = STEADY RED DISPLAY
PED 4+8 DON'T WALK = ALTERNATING FLASHING RED DISPLAY

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 10-2480
DESIGNED: August 2025
SEALED: 8/1/2025
REVISED: N/A

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)



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.

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New Installation - Electrical Detail

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

Pedestrian Hybrid Beacon:
US 29-74 (Wilkinson Blvd)
at
SR 1600 (Moores Chapel Loop)

Division 10 Mecklenburg County Charlotte

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

PLAN DATE: August 2025	REVIEWED BY: CB Holden
PREPARED BY: WP Erickson-Jones	REVIEWED BY: DT Sears

REVISIONS	INIT.	DATE

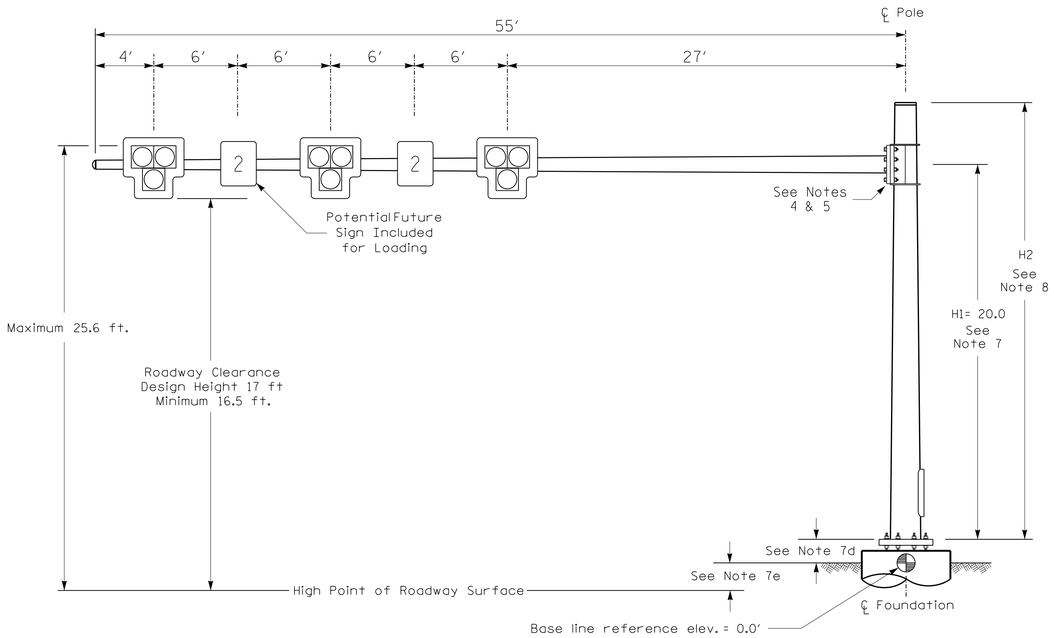
SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 044558 DAVID T. SEARS
DocuSigned by: David T Sears 069183F28E5741E...
8/1/2025
DATE

SIG. INVENTORY NO. 10-2480

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
B-6051/U-6143	Sig.18.2

Design Loading for METAL POLE NO. 1



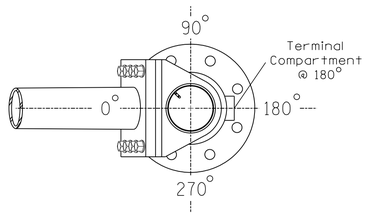
Elevation View

SPECIAL NOTE

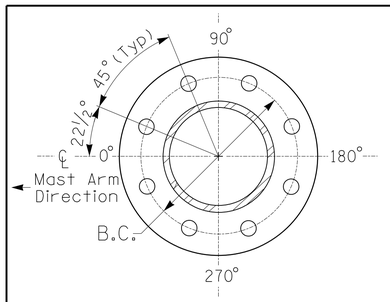
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

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

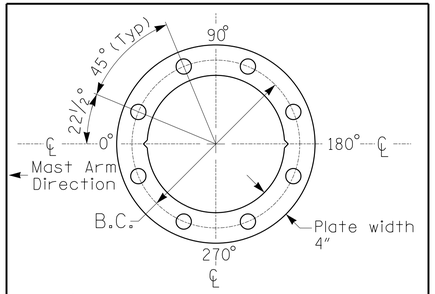


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



BASE PLATE TEMPLATE & ANCHOR BOLT LOCK PLATE DETAIL

For 8 Bolt Base Plate

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
⊕	RIGID MOUNTED 12"-3 SECTION T-TYPE HYBRID BEACON - WITH BACKPLATE	10.5 S.F.	39.0"W X 39.0"L	62 LBS
2	SIGN RIGID MOUNTED	7.5 S.F.	30.0"W X 36.0"L	14 LBS

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 1st Edition 2015 AASHTO LRFD "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 2024 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
   - The 2024 NCDOT Roadway Standard Drawings.
   - The traffic signal project plans and special provisions.
   - The NCDOT "Metal Pole Standards" located at the following NCDOT website: https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

DESIGN REQUIREMENTS

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

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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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Engineers | Construction Managers | Planners | Scientists
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NCDOT Wind Zone 5 (110 mph)

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

Pedestrian Hybrid Beacon: US 29-74 (Wilkinson Blvd) at SR 1600 (Moores Chapel Loop)

Division 10 Mecklenburg County Charlotte

PLAN DATE:	August 2025	REVIEWED BY:	DT Sears
PREPARED BY:	WP Erickson-Jones	REVIEWED BY:	

SCALE: 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 044558 ENGINEER DAVID T SEARS

DocuSigned by: David T Sears 0691837281E5741E...
SIGNATURE 8/1/2025 DATE

SIG. INVENTORY NO. 12-2480

8/1/2025
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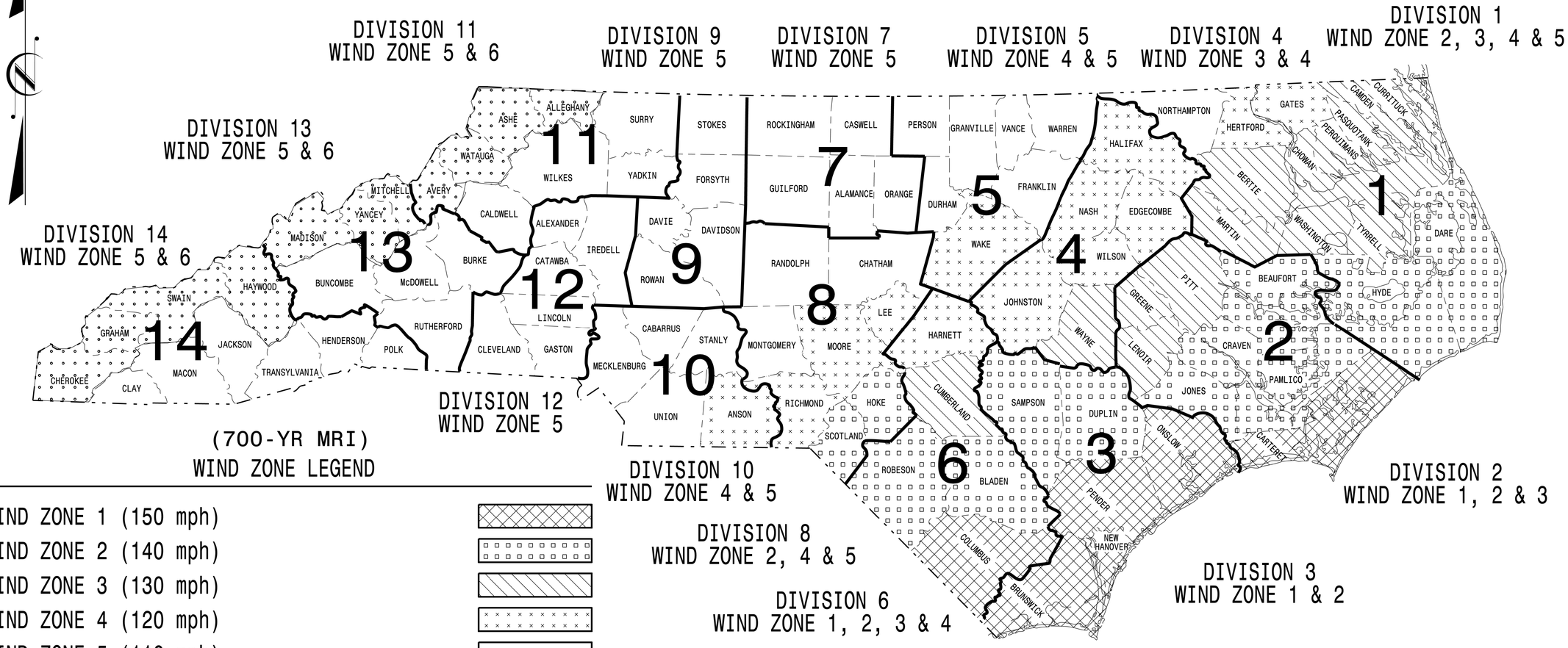
dsears

PROJECT I.D. NO.	SHEET NO.
B-6051/U-6143	Sig.M1A

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

STANDARD DRAWINGS FOR ALL METAL POLES (LRFD)

NCDOT METAL POLE STANDARDS



(700-YR MRI)
WIND ZONE LEGEND

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

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

Prepared in the Offices of:

Transportation Mobility and Safety Division
Signal Design Section
STATE OF 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
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09/21/2023
DATE

21-SEP-2023 08:20
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