Project: HL–0003

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

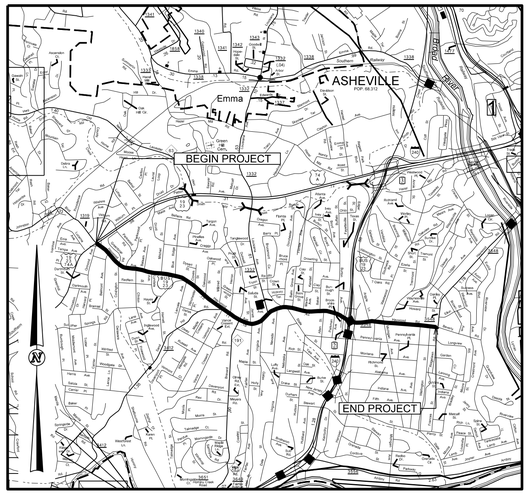
Project No.	Sheet No.
HL–0003	Sig. 1.0

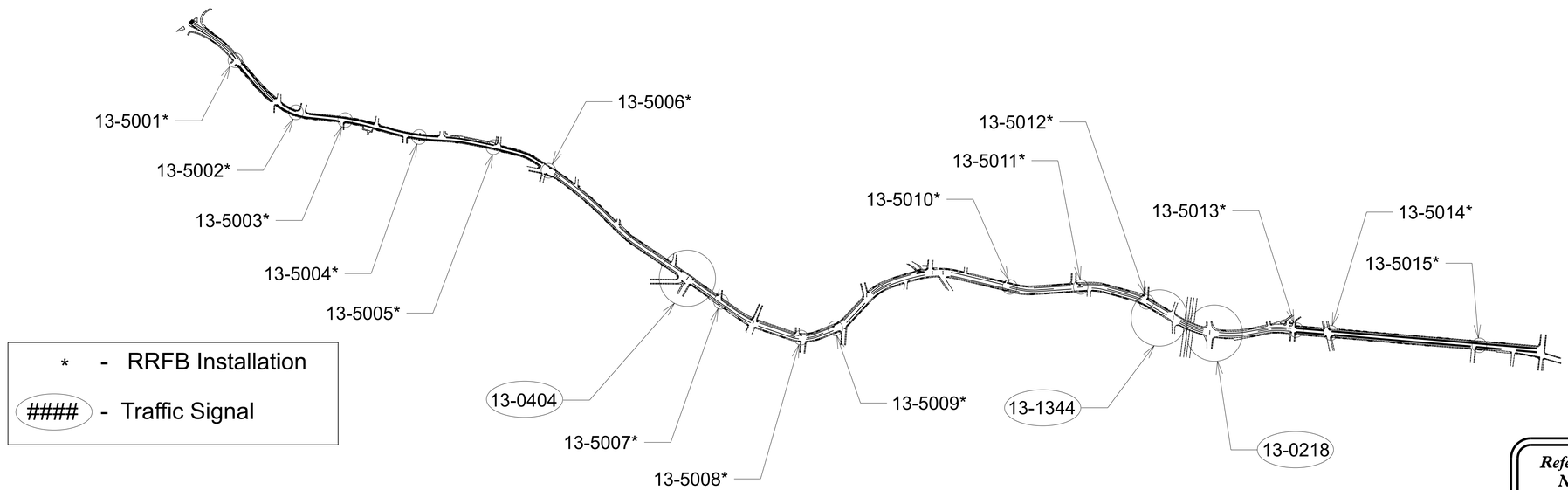
BUNCOMBE COUNTY

LOCATION: ALONG SR 3548 (HAYWOOD ROAD) FROM US 19/23/74 (PATTON AVENUE) TO RIDGELAWN ROAD IN ASHEVILLE

TYPE OF WORK: TRAFFIC SIGNALS, RRFB INSTALLATION

Vicinity





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 – 2.1	13–0218	US 19–23 Business /SR 3548 (Haywood Road) at I–240 EB Ramp /Hanover Street
Sig. 3.0 – 3.1	13–1344	US 19–23 Bus. (Haywood Rd) at I–240 WB Off–Ramp
Sig. 4.0 – 4.2	13–0404	US 19–23 Bus. (Haywood Road) at SR 3412 (Sand Hill Road) and Vermont Avenue
Sig. 5.0	RRFB	Standard Drawing for RRFB

TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

Contacts:

R. Nicholas Zinser P.E. – Western Region Signals Engineer
Keith M. Mims, P.E. – Signal Equipment Design Engineer
Alex D. Stewart, P.E. – Intelligent Transportation Systems Engineer

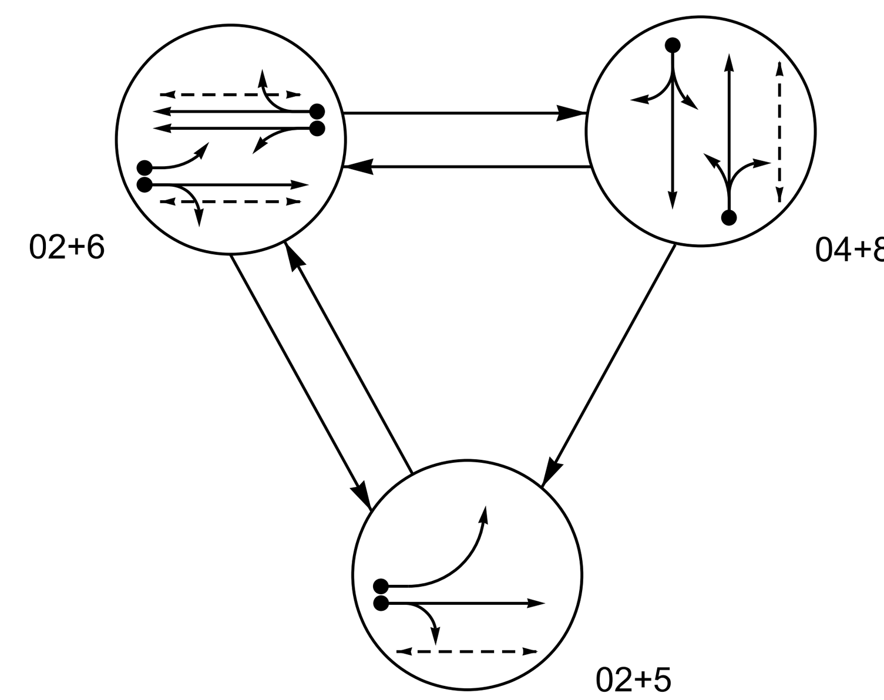
Prepared in the Office of:
DIVISION OF HIGHWAYS
TRANSPORTATION MOBILITY & SAFETY DIVISION

TSMO UNIT

750 N. Greenfield Parkway, Garner, NC 27529

PROJECT REFERENCE NO.	SHEET NO.
HL-0003	Sig. 2.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

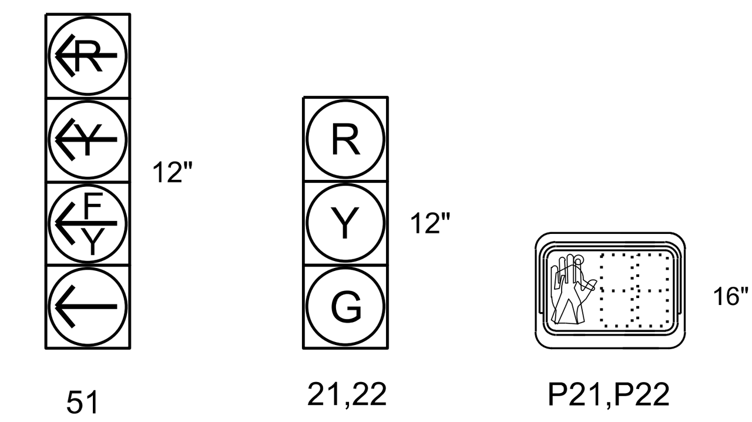
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 02+5	PHASE 02+6	PHASE 04+8	FLASH
21,22	G	G	R	Y
41,42	R	R	G	R
51	←	← F Y	← R	← Y
61,62	R	G	R	Y
81,82	R	R	G	R
P21,P22	W	W	DW	DRK
P61,P62	DW	W	DW	DRK
P81,P82	DW	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

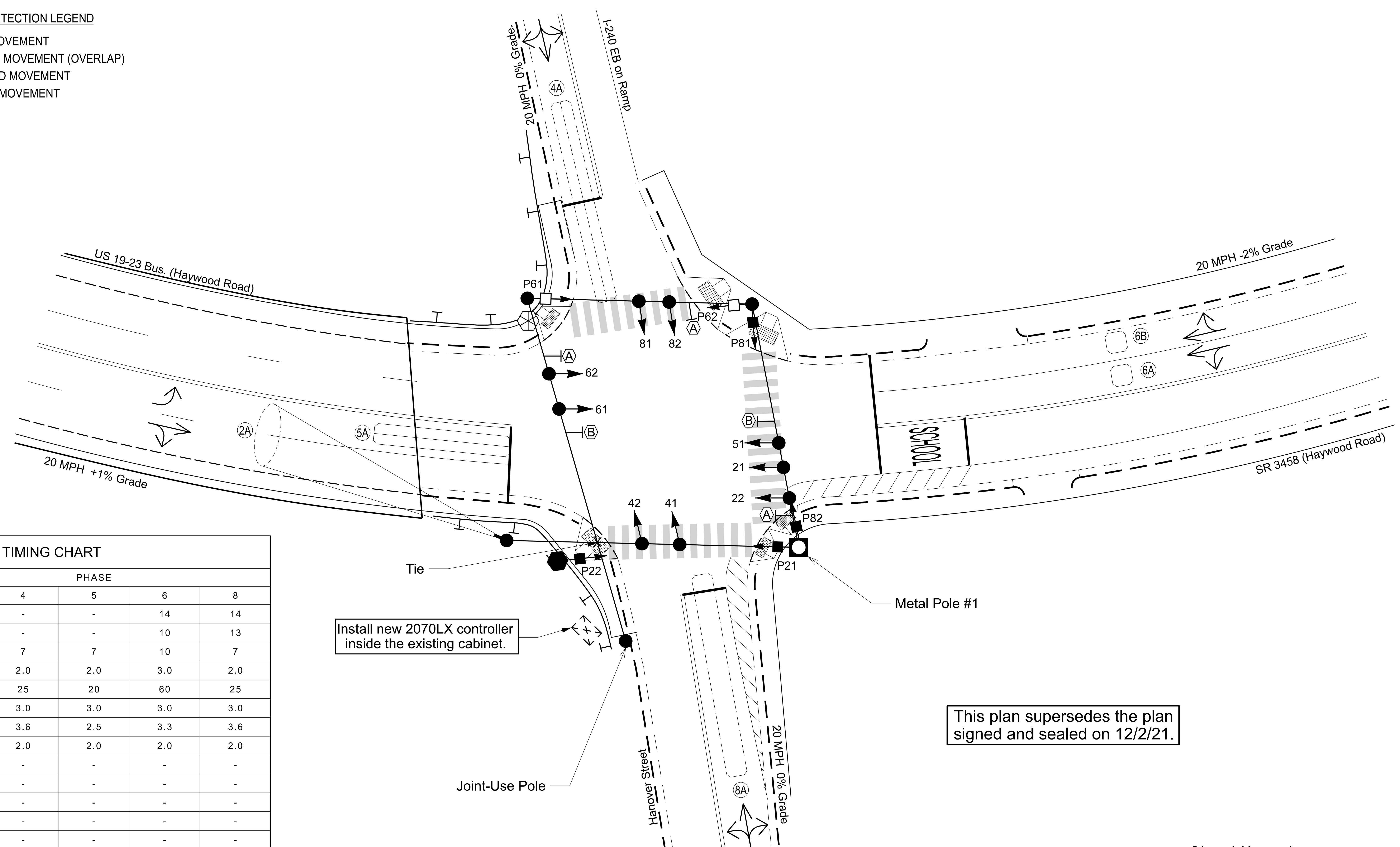
LOOP	SIZE (FT)	DISTANCE FROM STOP LINE (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
DETECTOR					PROGRAMMING							
2A *	EXIST	70	EXIST	-	2	-	-	X	-	X	-	-
4A	6X60	+30	2-4-2	-	4	10.0	-	X	-	X	-	-
5A	6X40	0	2-4-2	X	5	15.0	-	X	-	X	-	-
					2	-	-	X	-	X	-	-
6A	6X6	70	4	X	6	-	-	X	-	X	-	-
6B	6X6	70	4	X	6	-	-	X	-	X	-	-
8A	6X60	+5	3	-	8	10.0	-	X	-	X	-	-

* Microwave Detection Zone

3 Phase
Fully Actuated
D13-22_Asheville

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specifications for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Enable Backup Prevention programming for phase 2 to allow the controller to clear from phase 02+6 to phase 02+5 by progressing through an all red display.
4. Set all detector units to presence mode.
5. In the event of loop replacement, refer to the current ITS and Signals Design Manual and submit a Plan of Record to the Signal Design Section.
6. Disconnect existing pushbuttons for pedestrian signal heads P21 and P22.
7. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls for phase 8.
8. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
9. See Pavement Marking Plans for proposed crosswalk locations.
10. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



This plan supersedes the plan signed and sealed on 12/2/21.

LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
X-UC	2-in Underground Conduit	UC
N/A	Right of Way	
	Directional Arrow	
N/A	Curb Ramp	
	Metal Strain Pole	
	Type II Signal Pedestal	
	Type I Pushbutton Post	
A	Right "TURNING VEHICLES" Yield "TO" Pedestrians Sign (R10-14L)	A
B	Left "TURNING VEHICLES" Yield "TO" Pedestrians Sign (R10-15L)	B
	Detection Zone	

MAXTIME TIMING CHART

FEATURE	PHASE 2	PHASE 4	PHASE 5	PHASE 6	PHASE 8
Walk *	14	-	-	14	14
Ped Clear	11	-	-	10	13
Min Green *	10	7	7	10	7
Passage *	3.0	2.0	2.0	3.0	2.0
Max 1 *	60	25	20	60	25
Yellow Change	3.0	3.0	3.0	3.0	3.0
Red Clear	3.3	3.6	2.5	3.3	3.6
Red Revert	5.0	2.0	2.0	2.0	2.0
Added Initial *	-	-	-	-	-
Maximum Initial *	-	-	-	-	-
Time Before Reduction *	-	-	-	-	-
Time To Reduce *	-	-	-	-	-
Minimum Gap	-	-	-	-	-
Advance Walk	7	-	-	7	7
Non Lock Detector	-	X	X	-	X
Vehicle Recall	PED RECALL	-	-	PED RECALL	-
Dual Entry	-	X	-	-	X
Actuated Rest in Walk	X	-	-	X	-
Simultaneous Start	-	X	-	-	X
Ped Recycle	X	-	-	X	-

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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Signal Upgrade

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

US 19-23 Business / SR 3548 (Haywood Road) at I-240 EB Ramp / Hanover Street

Division 13 | Buncombe County | Asheville

PLAN DATE:	December 2023	REVIEWED BY:	R.N. Zinser
PREPARED BY:	T.A. Kenion	REVIEWED BY:	

SCALE 0 20 — 1"=20'

REVISIONS	INIT.	DATE

SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 043914 RICHARD N. ZINSER

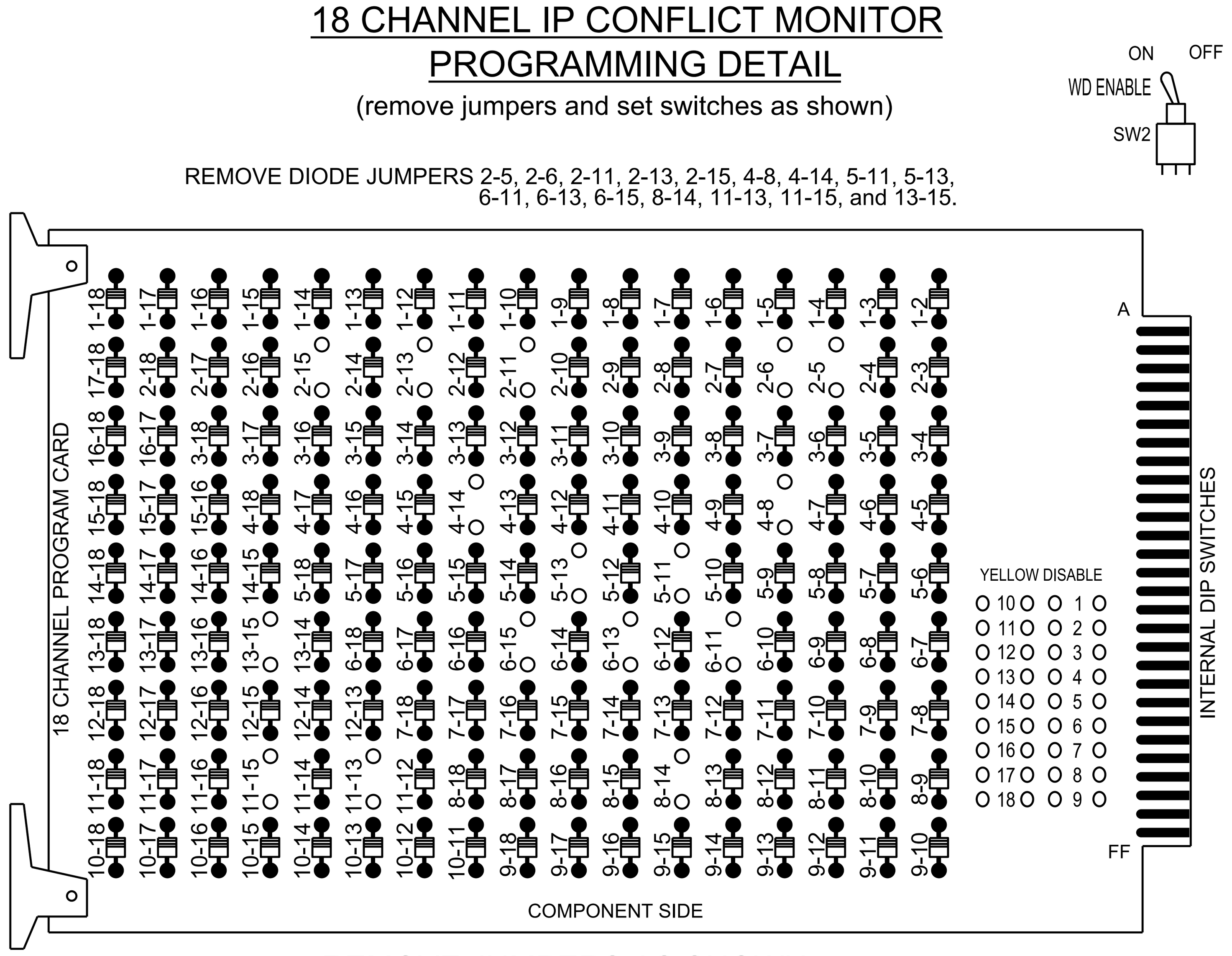
DocuSigned by: R. Nicholas Zinser 02/09/2024
F1388973472248F...
DATE

SIG. INVENTORY NO. 13-0218

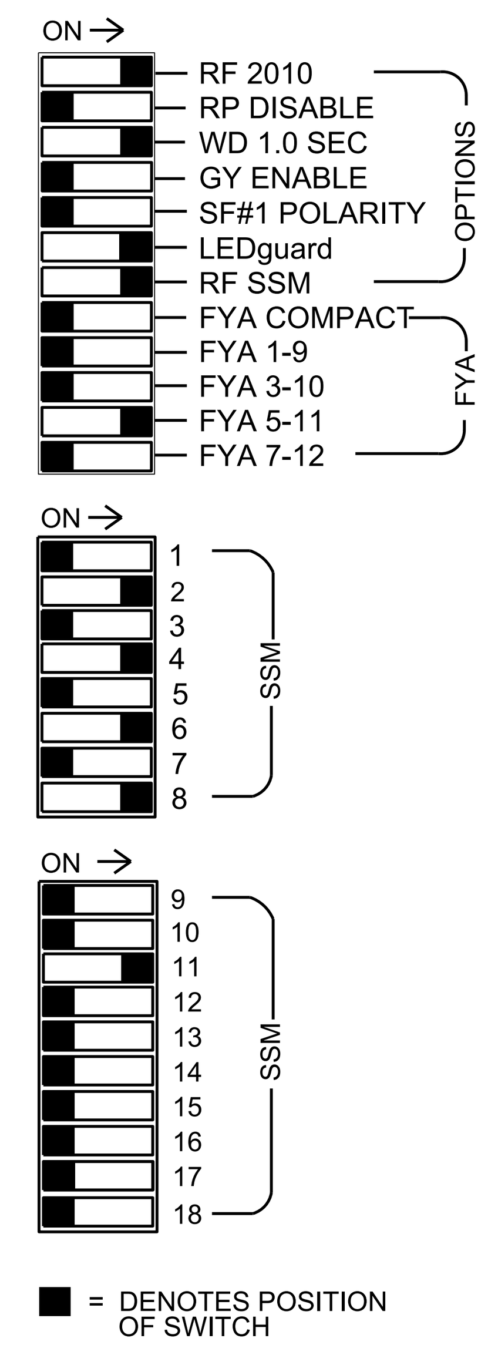
18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 2-5, 2-6, 2-11, 2-13, 2-15, 4-8, 4-14, 5-11, 5-13, 6-11, 6-13, 6-15, 8-14, 11-13, 11-15, and 13-15.



REMOVE JUMPERS AS SHOWN



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

NOTES

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the signal plan.
2. Program phases 4 and 8 for Dual Entry and Simultaneous Start.
3. Program controller to start up in phase 2 Green No Walk and 6 Green No Walk.
4. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
5. The cabinet and controller are part of the D13-22_Asheville 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, S7, S8, S9, S11, S12, AUX S4
Phases Used..2, 2PED, 4, 5, 6, 6PED,8, 8PED
Overlap "1"...NOT USED
Overlap "2"...NOT USED
Overlap "3"...*
Overlap "4"...NOT USED

*See overlap programming detail on Sheet 2.

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6	15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	NU	21,22	P21, P22	NU	41,42	NU	51★	61,62	P61, P62	NU	81,82	P81, P82	NU	NU	NU	51★	NU	NU
RED		128			101			134			107							
YELLOW		129			102		*	135			108							
GREEN		130			103			136			109							
RED ARROW																A114		
YELLOW ARROW																A115		
FLASHING YELLOW ARROW																A116		
GREEN ARROW							133											
(Don't Walk hand symbol)			113						119			110						
(Walk pedestrian symbol)			115						121			112						

* Denotes install load resistor. See load resistor installation detail this sheet.
★ See pictorial of head wiring in detail this sheet.
NU = Not Used

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.

INPUT FILE POSITION LAYOUT

(front view)

FILE		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	WIRED INPUT (crossed out)	Ø 4 4A	SLOT EMPTY	WIRED INPUT (crossed out)	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Ø6 PED DC ISOLATOR	FS DC ISOLATOR
	L						NOT USED							Ø8 PED DC ISOLATOR	ST DC ISOLATOR
FILE "J"	U	Ø 5 5A	Ø 6 6A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Ø 8 8A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L	NOT USED	Ø 6 6B				NOT USED								

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

FS = FLASH SENSE
ST = STOP TIME

NOTE: REMOVE EXISTING JUMPERS ASSOCIATED W/ DETECTOR SLOTS I5 AND I8 FROM REAR OF INPUT FILE.

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
4A	TB4-9,10	I6U	41	3	8	4	10		X		X	
5A	TB3-1,2	J1U	55	17	15	5	15		X		X	
				-	31	2			X		X	
6A	TB3-5,6	J2U	40	2	16	6			X		X	
6B	TB3-7,8	J2L	44	6	17	6			X		X	
8A	TB5-9,10	J6U	42	4	22	8	10		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 ISOLATOR IN INPUT FILE SLOT I13.

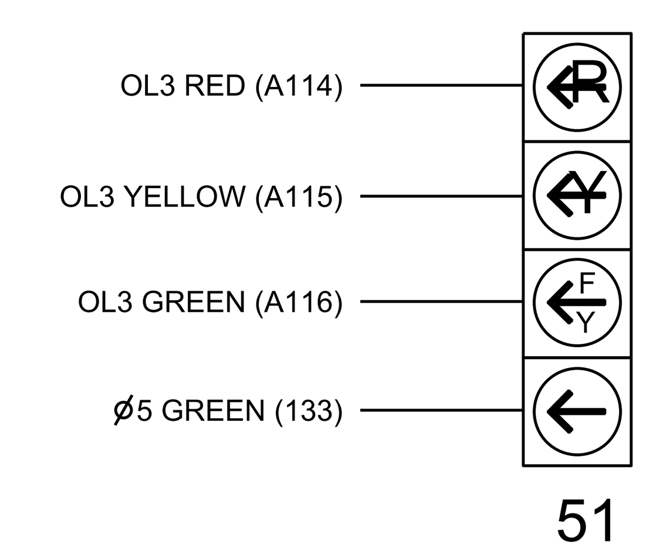
INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

SPECIAL DETECTOR NOTE

For Zone 2A install a multizone microwave detection system for vehicle detection. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

FYA SIGNAL WIRING DETAIL

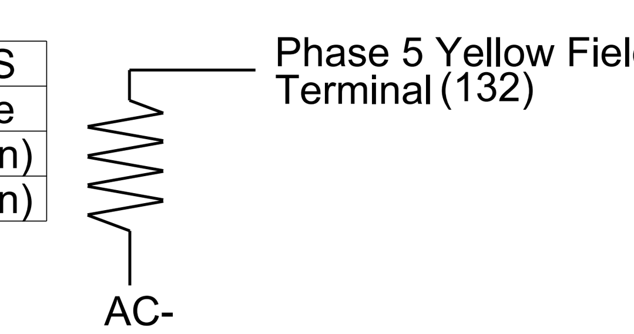
(wire signal heads as shown)



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)



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

BACKUP PREVENTION PROGRAMMING

Front Panel
Main Menu >Controller >Sequence & Phs Config >Backup Prevention >Backup Protection Plan

Web Interface
Home >Controller> Backup Prevention >Backup Protection Plan

Sequence 1

No Backup Phase	1	2	3	4	5	6	7	8
Serve Phase 1	-	-	-	-	-	-	-	-
Serve Phase 2	-	-	-	-	-	-	-	-
Serve Phase 3	-	-	-	-	-	-	-	-
Serve Phase 4	-	-	-	-	-	-	-	-
Serve Phase 5	-	-	-	-	-	-	-	-
Serve Phase 6	-	-	-	-	X	-	-	-
Serve Phase 7	-	-	-	-	-	-	-	-
Serve Phase 8	-	-	-	-	-	-	-	-

ALL RED BACKUP PROGRAMMING

Front Panel
Main Menu >Controller >Sequence & Phs Config>Backup Prevention >Backup Through Red

Web Interface
Home >Controller >Backup Prevention >Backup Calls Phase Plans >(scroll down) to Backup Through Red

Backup Through All Red

Sequence	Backup Through All Red
1	YES

THIS PLAN SUPERSEDES THE PLAN SIGNED AND SEALED ON 12/7/2024.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 13-0218
DESIGNED: December 2023
SEALED: 2/9/2024
REVISED:

Electrical Detail

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

US 19-23 Business / SR 3548 (Haywood Road) at I-240 EB Ramp / Hanover Street

Division 13 Buncombe County Asheville

PLAN DATE: January 2024	REVIEWED BY: D.T.J.
PREPARED BY: D.J. Craddock	REVIEWED BY:

REVISIONS	INIT.	DATE

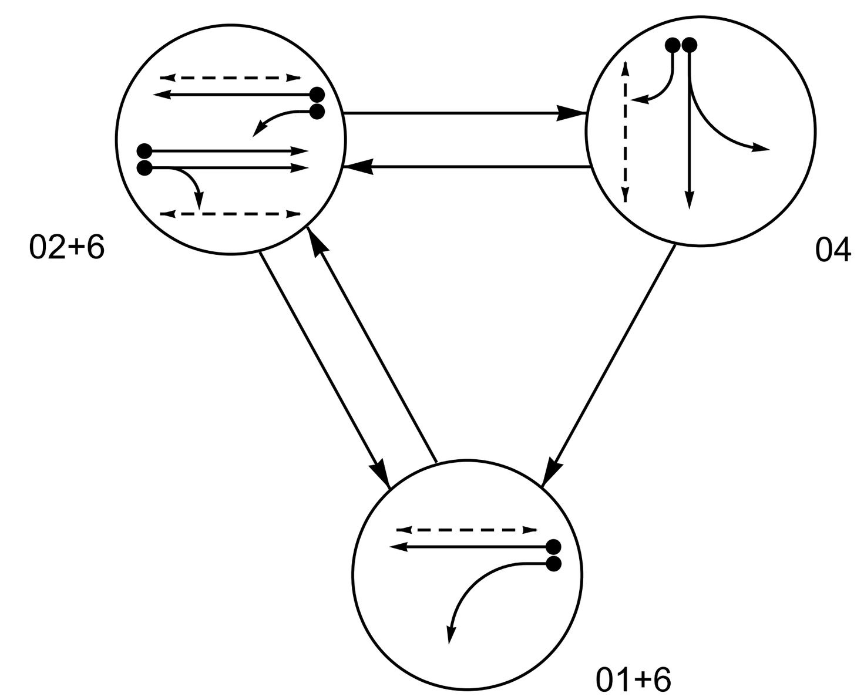
Prepared in the Offices of:
Transportation Mobility and Safety Division
ITS & Signals Management Section
State of North Carolina Department of Transportation
750 N. Greenfield Pkwy, Garner, NC 27529

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 031001 ENGINEER D. TODD JOYCE

DocuSigned by: D. Todd Joyce 02/09/2024
DATE

SIG. INVENTORY NO. 13-0218

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

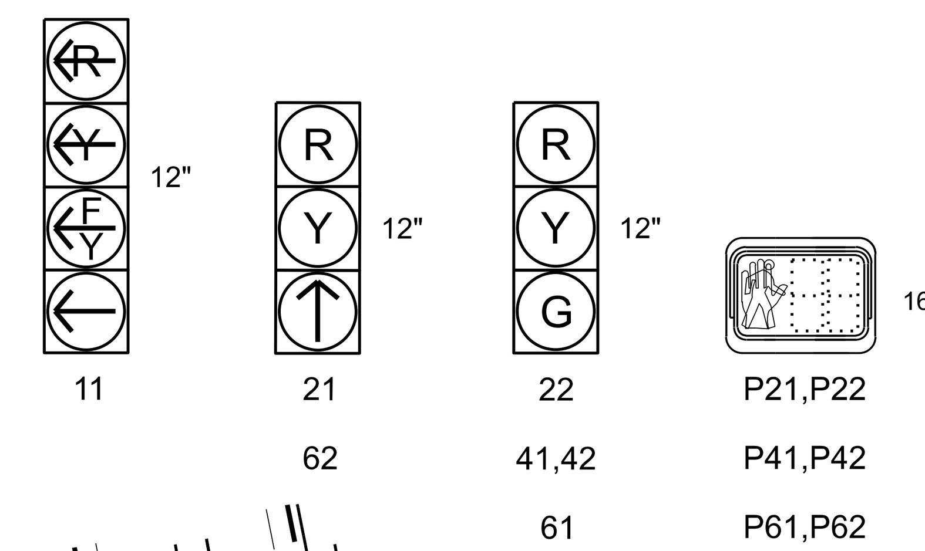
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 01+6	PHASE 02+6	PHASE 04	PHASE FLASH
11	←	←FY	←R	←Y
21	R	↑	R	Y
22	R	G	R	Y
41,42	R	R	G	R
61	G	G	R	Y
62	↑	↑	R	Y
P21,P22	DW	W	DW	DRK
P41,P42	DW	DW	W	DRK
P61,P62	W	W	DW	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

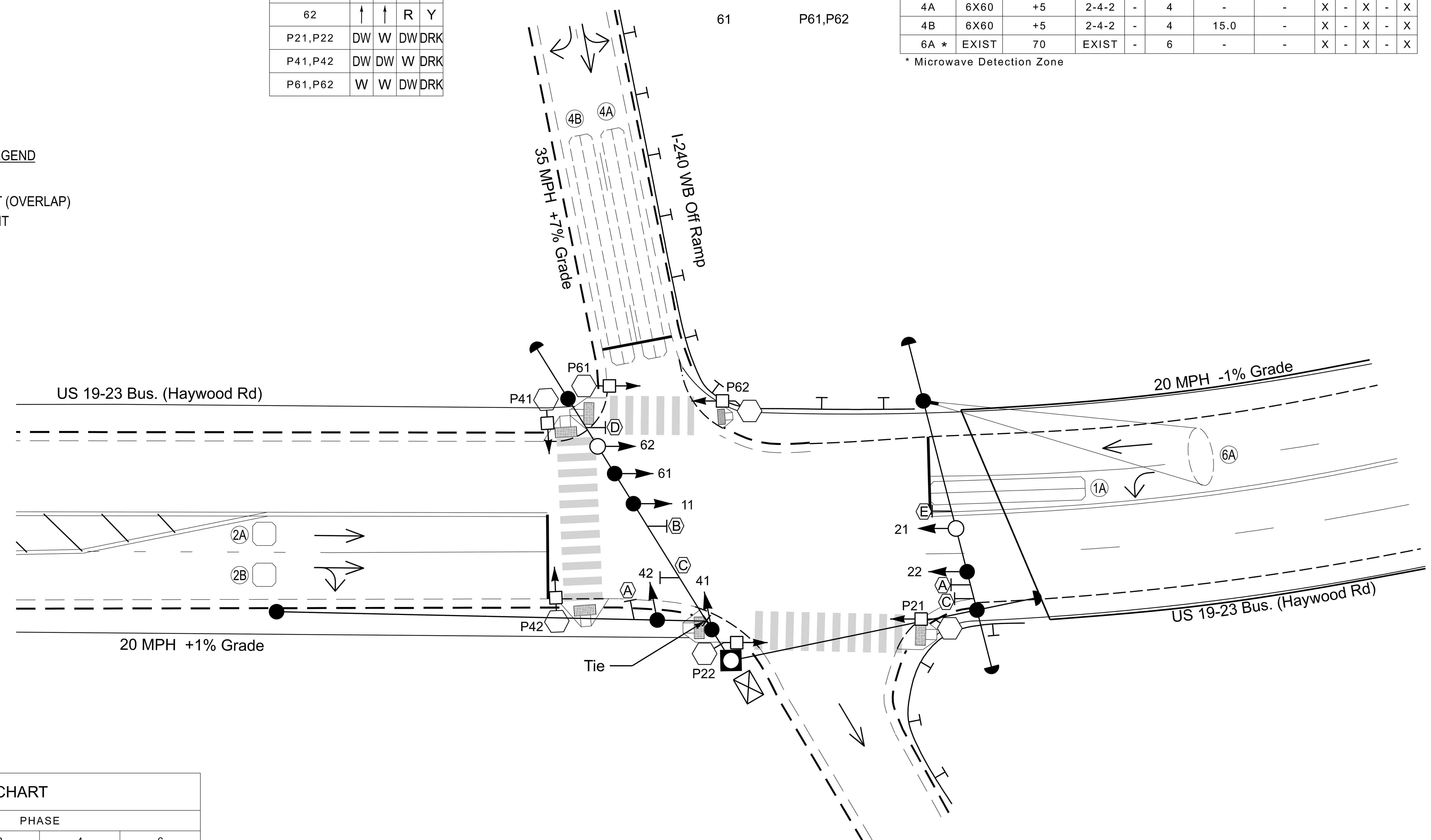
LOOP	SIZE (FT)	DISTANCE FROM STOP LINE (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
DETECTOR					PROGRAMMING							
1A	6X40	0	2-4-2	X	1	15.0	-	X	-	X	-	X
					6	-	-	X	-	X	-	X
2A	6X6	70	EXIST	X	2	-	-	X	-	X	-	X
2B	6X6	70	EXIST	X	2	-	-	X	-	X	-	X
4A	6X60	+5	2-4-2	-	4	-	-	X	-	X	-	X
4B	6X60	+5	2-4-2	-	4	15.0	-	X	-	X	-	X
6A *	EXIST	70	EXIST	-	6	-	-	X	-	X	-	X

* Microwave Detection Zone

3 Phase
Full Actuated
D13-22_Asheville

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specifications for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 1 may be lagged.
4. Set all detector units to presence mode.
5. In the event of loop replacement, refer to the current ITS and Signals Design Manual and submit a Plan of Record to the Signal Design Section.
6. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
7. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls for Phase 4.
8. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
9. Pavement markings are existing.
10. 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	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
X-UC	2-in Underground Conduit	UC
N/A	Right of Way	
	Directional Arrow	
	Metal Strain Pole	
N/A	Curb Ramp	
	Type II Signal Pedestal	
Ⓐ	Right "TURNING VEHICLES" Yield "TO" Pedestrians Sign (R10-15R)	Ⓐ
Ⓑ	Left "TURNING VEHICLES" Yield "TO" Pedestrians Sign (R10-15L)	Ⓑ
Ⓒ	"NO TURN ON RED" Sign (R10-11)	Ⓒ
Ⓓ	No Right Turn Sign (R3-1)	Ⓓ
Ⓔ	No Left Turn Sign (R3-2)	Ⓔ
	Detection Zone	

MAXTIME TIMING CHART

FEATURE	PHASE 1	PHASE 2	PHASE 4	PHASE 6
Walk *	-	14	13	7
Ped Clear	-	13	10	7
Min Green *	7	10	7	10
Passage *	2.0	3.0	2.0	3.0
Max 1 *	20	60	25	60
Yellow Change	3.0	3.0	3.5	3.0
Red Clear	2.1	3.1	1.7	3.1
Added Initial *	-	-	-	-
Maximum Initial *	-	-	-	-
Time Before Reduction *	-	-	-	-
Time To Reduce *	-	-	-	-
Minimum Gap	-	-	-	-
Advance Walk	-	7	6	-
Non Lock Detector	X	-	X	-
Vehicle Recall	-	PED RECALL	-	PED RECALL
Dual Entry	-	-	-	-
Actuated Rest in Walk	-	X	-	X
Ped Recycle	-	X	-	X

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

New Installation

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

US 19-23 Bus. (Haywood Rd)
at
I-240 WB Off-Ramp

Division 13 | Buncombe County | Asheville

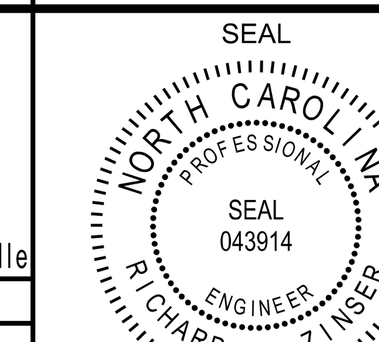
PLAN DATE: January 2024 | REVIEWED BY: R.N. Zinser

PREPARED BY: T.A. Kenion | REVIEWED BY:

SCALE 0 20 1"=20'

REVISIONS | INIT. | DATE

SEAL



DocuSigned by: R. Nicholas Zinser 02/09/2024

DATE

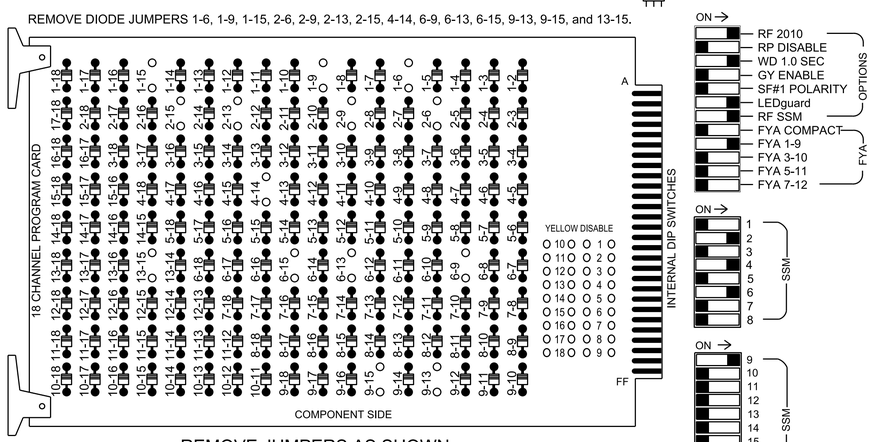
SIG. INVENTORY NO. 13-1344

PROJECT REFERENCE NO.	SHEET NO.
HL-0003	Sig. 3.1

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 1-6, 1-9, 1-15, 2-6, 2-9, 2-13, 2-15, 4-14, 6-9, 6-13, 6-15, 9-13, 9-15, and 13-15.



■ = 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 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 D13-22_Asheville 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, S3, S5, S6, S8, S9, AUX S1
Phases Used.....1, 2, 2PED, 4, 4PED, 6, 6PED
Overlap "1".....*
Overlap "2".....NOT USED
Overlap "3".....NOT USED
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★	21	22	P21, P22	NU	41,42	P41, P42	NU	61	62	P61, P62	NU	NU	NU	11★	NU	NU	NU	NU	NU
RED		128	128			101			134	134										
YELLOW	*	129	129			102			135	135										
GREEN			130			103			136											
RED ARROW															A121					
YELLOW ARROW															A122					
FLASHING YELLOW ARROW															A123					
GREEN ARROW	127	130							136											
✋				113			104				119									
🚶				115			106				121									

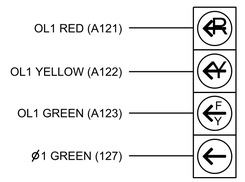
*Denotes install load resistor. See load resistor installation detail this sheet.
★See pictorial of head wiring in detail this sheet.
NU = Not Used

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.

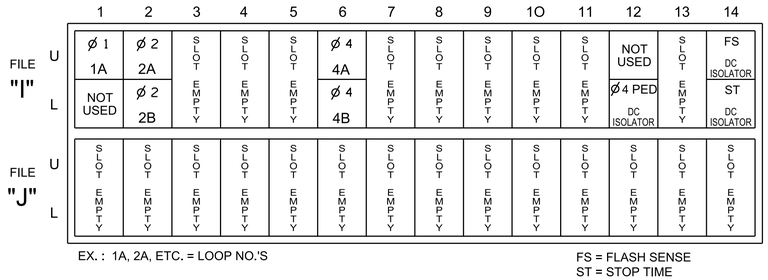
FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)



INPUT FILE POSITION LAYOUT

(front view)



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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
1A	TB2-1,2	I1U	56	18	1	1	15		X		X	
				-	29	6			X		X	
2A	TB2-5,6	I2U	39	1	2	2			X		X	
2B	TB2-7,8	I2L	43	5	3	2			X		X	
4A	TB4-9,10	I6U	41	3	8	4			X		X	
4B	TB4-11,12	I6L	45	7	9	4	15		X		X	
PED PUSH BUTTONS												
P41,P42	TB8-5,6	I12L	69	35	4	PED 4						

NOTE:
INSTALL DC ISOLATOR IN INPUT FILE SLOT I12.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

SPECIAL DETECTOR NOTE

For Zone 6A, install a multizone microwave detection system for vehicle detection. Perform installation according to manufacturer's directions and NCDOT engineer-approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans.

OVERLAP PROGRAMMING

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

Web Interface
Home >Controller >Overlap Configuration >Overlaps

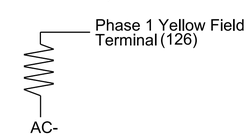
Overlap Plan 1

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

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)



THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 13-1344
DESIGNED: January 2024
SEALED: 2/9/2024
REVISED:

Electrical Detail

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

US 19-23 Bus. (Haywood Rd)
at
I-240 WB Off-Ramp

Division 13 | Buncombe County | Asheville

PLAN DATE: February 2024 | REVIEWED BY: D.T.J.
PREPARED BY: D.J. Craddock | REVIEWED BY:

REVISIONS	INIT.	DATE

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

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 031001 ENGINEER D. TODD JOYCE

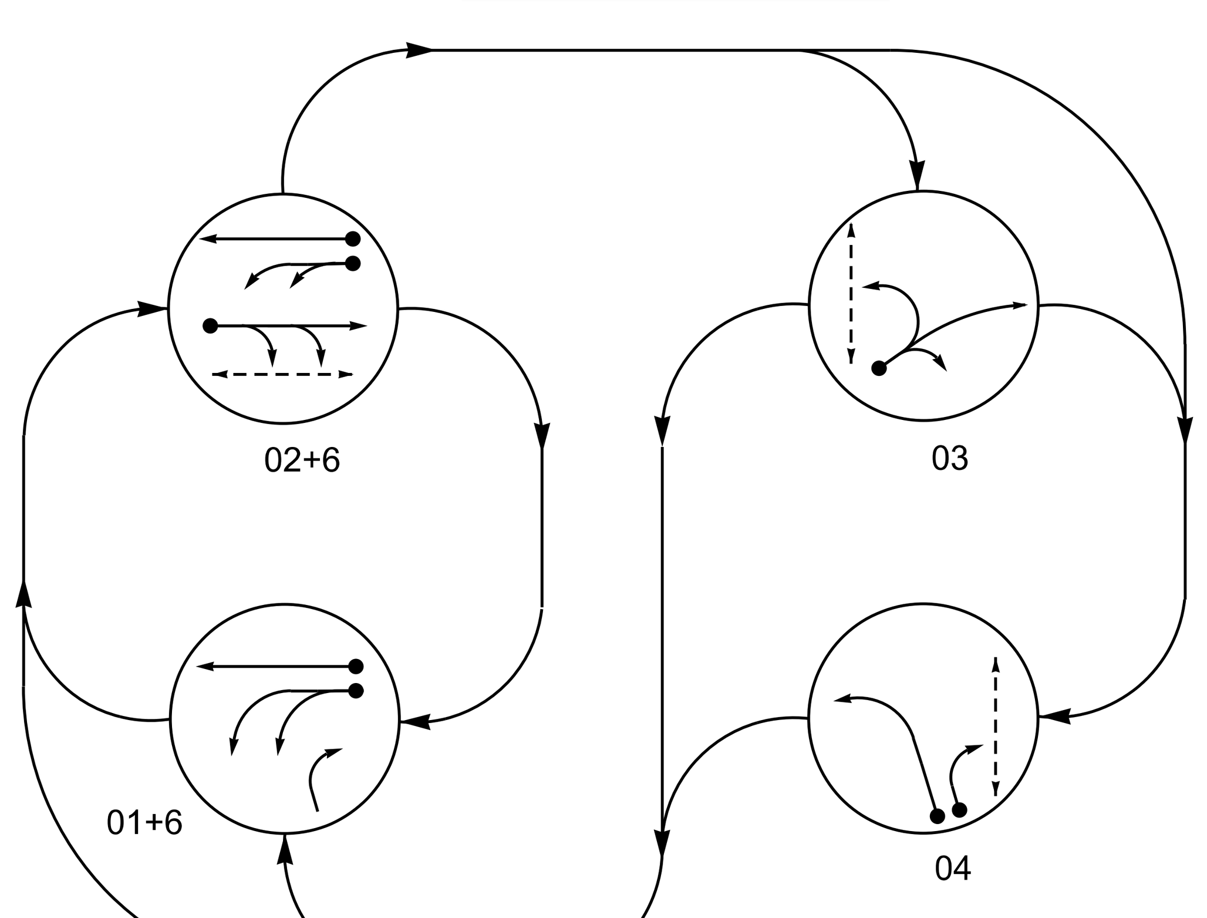
DocuSigned by: D. Todd Joyce 02/09/2024
SIGNATURE DATE

SIG. INVENTORY NO. 13-1344

09-FEB-2024 11:48
C:\Work\Projects\13344_sm_ele_20240208\dgn\
djcraddock1

PROJECT REFERENCE NO.	SHEET NO.
HL-0003	Sig. 4.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

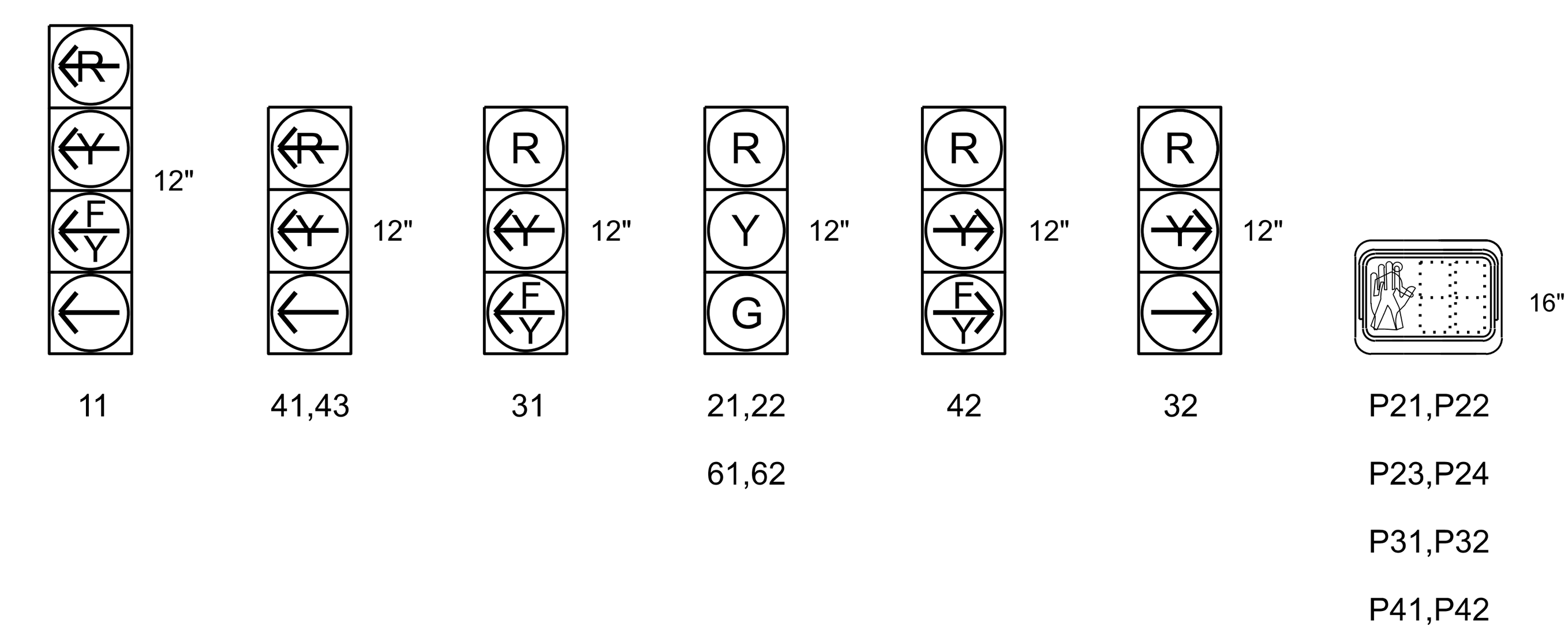
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 01+6	PHASE 02+6	PHASE 03	PHASE 04	FLASH
11	←	←F/Y	←R	←R	←Y
21,22	R	G	R	R	Y
31	R	R	←F/Y	R	R
32	R	R	→	R	R
41,43	←R	←R	←R	←	←R
42	F/Y→	R	R	F/Y→	R
61,62	G	G	R	R	Y
P21,P22	DW	W	DW	DW	DRK
P23,P24	DW	W	DW	DW	DRK
P31,P32	DW	DW	W	DW	DRK
P41,P42	DW	DW	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



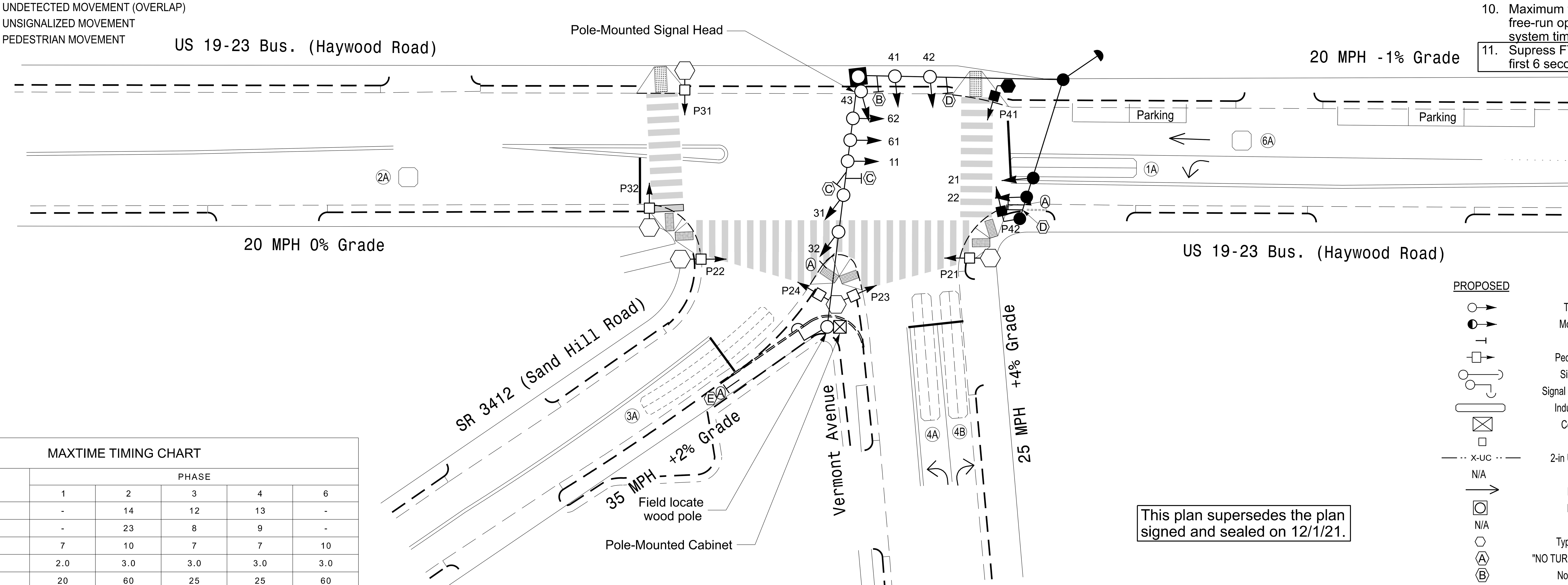
MAXTIME DETECTOR INSTALLATION CHART

DETECTOR					PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOP LINE (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	2-4-2	X	1	15.0	-	X	-	X	-	X
					6	-	-	X	-	X	-	X
2A	6X6	70	4	X	2	-	-	X	-	X	-	X
3A	6X50	+20	2-4-2	-	3	-	-	X	-	X	-	X
4A	6X40	+10	2-4-2	-	4	3.0	-	X	-	X	-	X
4B	6X40	+10	2-4-2	-	4	15.0	-	X	-	X	-	X
6A	6X6	70	4	X	6	-	-	X	-	X	-	X

4 Phase
Fully Actuated
D13-22_Asheville

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2024 and "Standard Specifications for Roads and Structures" dated January 2024.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Set all detector units to presence mode.
4. In the event of loop replacement, refer to the current ITS and Signals Design Manual and submit a Plan of Record to the Signal Design Section.
5. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
6. Program controller to operate using FYA compact mode.
7. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls for Phases 3 and 4.
8. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
9. See Pavement Marking Plans for proposed crosswalk locations.
10. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
11. Supress FYA for signal head 42 during the first 6 seconds of the phase 4 green interval.



This plan supersedes the plan signed and sealed on 12/1/21.

LEGEND

Description	PROPOSED	EXISTING
Traffic Signal Head		
Modified Signal Head		N/A
Sign		
Pedestrian Signal Head		
Signal Pole with Guy		
Signal Pole with Sidewalk Guy		
Inductive Loop Detector		
Controller & Cabinet		
Junction Box		
2-in Underground Conduit	X-UC	UC
Right of Way	N/A	
Directional Arrow		
Metal Strain Pole		
Curb Ramp	N/A	
Type II Signal Pedestal		
"NO TURN ON RED" Sign (R10-11)	A	A
No U Turn Sign (R3-4)	B	B
Left "TURNING VEHICLES" Yield "TO" Pedestrians Sign (R10-15L)	C	C
Right "TURNING VEHICLES" Yield "TO" Pedestrians Sign (R10-15R)	D	D
"STOP HERE ON RED" Sign (R10-6)	E	E

MAXTIME TIMING CHART

FEATURE	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 6
Walk *	-	14	12	13	-
Ped Clear	-	23	8	9	-
Min Green *	7	10	7	7	10
Passage *	2.0	3.0	3.0	3.0	3.0
Max 1 *	20	60	25	25	60
Yellow Change	3.0	3.0	3.0	3.0	3.0
Red Clear	3.3	3.3	3.3	3.5	3.3
Added Initial *	-	-	-	-	-
Maximum Initial *	-	-	-	-	-
Time Before Reduction *	-	-	-	-	-
Time To Reduce *	-	-	-	-	-
Minimum Gap	-	-	-	-	-
Advance Walk	-	7	5	-	-
Non Lock Detector	X	-	X	X	-
Vehicle Recall	-	PED RECALL	-	-	MIN RECALL
Dual Entry	-	-	-	-	-
Actuated Rest in Walk	-	X	-	-	-
Ped Recycle	-	X	-	-	-

* These values may be field adjusted. Do not adjust Min Green and Passage 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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

US 19-23 Bus. (Haywood Road)
at
SR 3412 (Sand Hill Road) and
Vermont Avenue

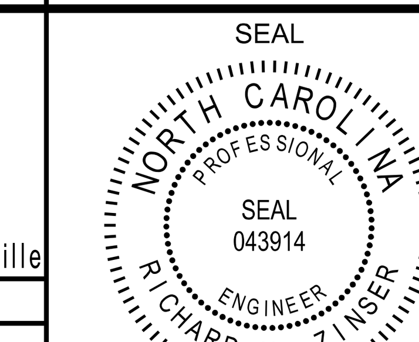
Division 13 | Buncombe County | Asheville

PLAN DATE:	January 2024	REVIEWED BY:	R.N. Zinser
PREPARED BY:	T.A. Kenion	REVIEWED BY:	

SCALE 0 20
1"=20'

REVISIONS | INIT. | DATE

SEAL



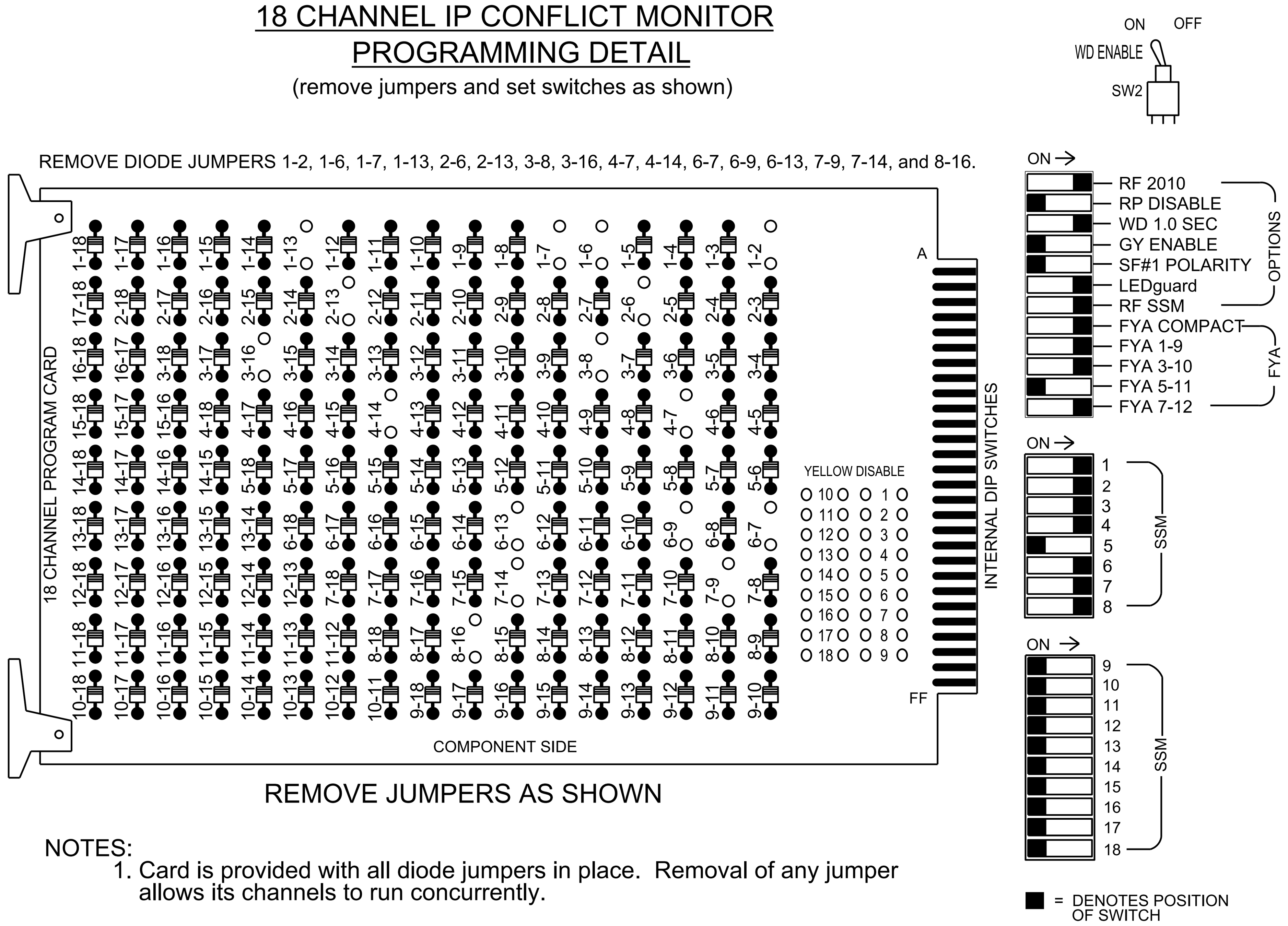
DocuSigned by: R. Nicholas Zinser 02/09/2024
DATE

SIG. INVENTORY NO. 13-0404

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 1-2, 1-6, 1-7, 1-13, 2-6, 2-13, 3-8, 3-16, 4-7, 4-14, 6-7, 6-9, 6-13, 7-9, 7-14, 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 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 D13-22_Asheville System.

EQUIPMENT INFORMATION

Controller..2070LX
Cabinet..336
Software..Q-Free MAXTIME
Cabinet Mount.....................................Pole
Output File Positions...........................12
Load Switches Used.............................S1, S2, S3, S4, S5, S6, S8, S10, S11, S12
Phases Used.......................................1, 2, 2PED, 3, 3 PED, 4, 4PED, 6
Overlap "1"...*
Overlap "2"...*
Overlap "3"...NOT USED
Overlap "4"...*

*See overlap programming detail on Sheet 2.

PROJECT REFERENCE NO.	SHEET NO.
HL-0003	Sig. 4.1

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	9	13	3	4	14	5	6	15	7	8	16
PHASE	OL1	2	1 GRN	2 PED	OL2	4	4 PED	5	6	6 PED	OL4	3	3 PED
SIGNAL HEAD NO.	11★	21,22	11★	P21,P22 P23,P24	31★	41,43	P41, P42	NU	61,62	NU	42★	32	P31, P32
RED		128			116				134		122	107	
YELLOW		129							135				
GREEN		130							136				
RED ARROW	125					101							
YELLOW ARROW	126				117	102					123	108	
FLASHING YELLOW ARROW	127				118						124		
GREEN ARROW						103						109	
(DON'T WALK hand)				113			104						110
PED YELLOW			114				*						*
(WALK person)				115			106						112

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

★ See pictorial of head wiring in detail this sheet.

NOTE: Loadswitches S1, S4, S10, S11, and S12 have been reassigned. See Sheet 2 for programming details.

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.

INPUT FILE POSITION LAYOUT

(front view)

FILE "I"

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

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
1A	TB21-1,2	I1U	56	18	1	1	15		X		X	
				-	29	6			X		X	
2A	TB21-3,4	I2U	39	1	2	2			X		X	
3A	TB21-5,6	I3U	58	20	7	3			X		X	
4A	TB21-7,8	I4U	41	3	8	4	3		X		X	
4B	TB23-7,8	I4L	45	7	9	4	15		X		X	
6A	TB21-11,12	I6U	40	2	16	6			X		X	
PED PUSH BUTTONS												
P31,P32	TB24-11,12	I13L	70	36	8	PED 3						
P41,P42	TB24-9,10	I12L	69	35	4	PED 4						

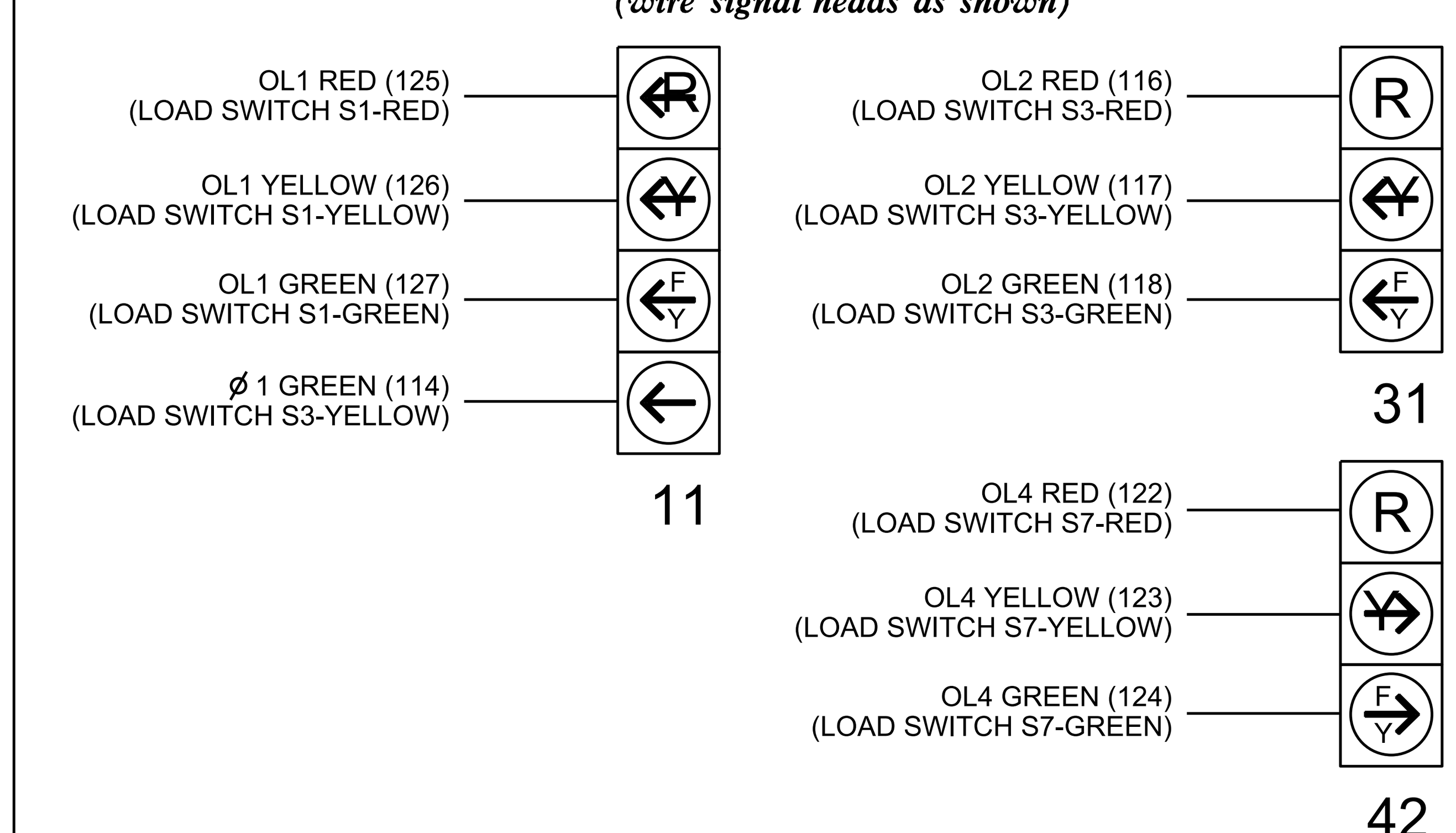
NOTE:
INSTALL DC ISOLATORS IN INPUT FILE SLOTS I12 AND I13.

INPUT FILE POSITION LEGEND: J2L

FILE J
SLOT 2
LOWER

FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)



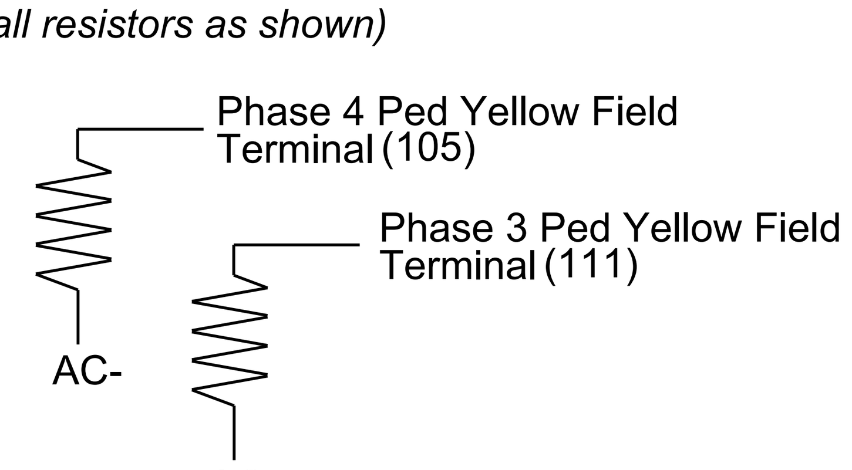
THIS PLAN SUPERSEDES THE PLAN SIGNED AND SEALED ON 12/1/2021.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 13-0404
DESIGNED: January 2024
SEALED: 2/9/2024
REVISED:

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)



Electrical Detail - Sheet 1 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Electrical and Programming Details For:

US 19-23 Bus. (Haywood Road)
at
SR 3412 (Sand Hill Road) and Vermont Avenue

Division 13 | Buncombe County | Asheville

PLAN DATE: February 2024 | REVIEWED BY: D.T.J.
PREPARED BY: D.J. Craddock | REVIEWED BY:

REVISIONS | INIT. | DATE

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

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER
SEAL 031001
D. TODD JOYCE

DocuSigned by:
D. Todd Joyce 02/09/2024
DATE

SIG. INVENTORY NO. 13-0404

09-FEB-2024 11:55
djcraddock1

PED DETECTOR PROGRAMMING DETAIL

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

Web Interface
Home >Controller >Detector Configuration >Pedestrian Detector

Plan 1

Detector	Descripton	Call Phase	Call Overlap
2		2	0
4		4	0
6		6	0
8		3	0

NOTICE PHASE 3 PED ASSIGNED TO PED 8 DETECTOR →

OUTPUT CHANNEL CONFIGURATION

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

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

Channel Configuration

Channel	Control Type	Control Source	Flash Yellow	Flash Red	Flash Alt	MMU Channel
1	Overlap	1	X		X	1
2	Phase Vehicle	2	X			2
3	Overlap	2		X	X	3
4	Phase Vehicle	4		X		4
5	Phase Vehicle	5		X		5
6	Phase Vehicle	6	X		X	6
7	Overlap	4		X		7
8	Phase Vehicle	3		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	3				16
17	Overlap	5		X	X	17
18	Overlap	6		X		18

NOTICE CONTROL TYPE & FLASH → (Channel 1)
NOTICE CONTROL TYPE & SOURCE → (Channel 3)
NOTICE CONTROL TYPE & SOURCE → (Channel 7)
NOTICE PHASE 3 ASSIGNED TO CHANNEL 8 → (Channel 8)
NOTICE PHASE 3 PED ASSIGNED TO CHANNEL 16 → (Channel 16)

OUTPUT POINTS CONFIGURATION

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

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

IO Module 1

Output Point	Descripton	Output Control Type	Index
33	C1-35	Phase Green	1
34	C1-36	Not Active	15
35	C1-37	Not Active	14
36	C1-38	Not Active	16

NOTICE OUTPUT CONTROL TYPE & INDEX → (Output Point 33)

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	3	4
Type	FYA 4 - Section	FYA 4 - Section	Off	FYA 4 - Section
Included Phases	2	3	-	1,4
Modifier Phases	1	-	-	-
Modifier Overlaps	-	-	-	-
Trail Green	0	0	0	0
Trail Yellow	0.0	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0	0.0
FYA Ped Delay	0.0	0.0	0.0	6.0

PED YELLOW CONFLICT MONITOR WIRING DETAIL

(make cabinet wiring changes as shown below)

In order to use FYA COMPACT mode with the 16 or 18 Channel Monitor, the cabinet must be wired such that the (unused) Ped Yellow load switch outputs are wired to the conflict monitor as follows: From 2 PY (field term. 114) to chan. 9 green (monitor pin 13).

Follow the instructions below to make appropriate connections:

STEP 1: Fold down rear panel of output file.

STEP 2: Find unused wiring harness fom conflict monitor card edge connector (which should be tied and bundled together).

STEP 3: Find the connector that correspond to the following conflict monitor card edge pins and solder wire the the appropiate terminal on the rear of the output file shown below:

CMU-13 ----------------------------2PY (term. 114)

NOTE: Some cabinet manufacturers use keyed connectors to accomlplish this wiring configuration. If connectors are used, fold down the rear panel of the output file and find the set of 3 keyed connectors and connect them as shown below:

1 - 2PY ------------ 1- CMU-13
2 - 4PY ------------ 2- CMU-16
3 - 6PY ------------ 3- CMU-R
4 - 8PY ------------ 4- CMU-U

THIS PLAN SUPERSEDES THE PLAN SIGNED AND SEALED ON 12/1/2021.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 13-0404
DESIGNED: January 2024
SEALED: 2/9/2024
REVISED:

Electrical Detail - Sheet 2 of 2

Electrical and Programming Details For:

US 19-23 Bus. (Haywood Road)
at
SR 3412 (Sand Hill Road) and
Vermont Avenue

Division 13 Buncombe County Asheville

PLAN DATE: February 2024 REVIEWED BY: D.T.J.
PREPARED BY: D.J. Craddock REVIEWED BY:

REVISIONS	INIT.	DATE

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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 031001 ENGINEER D. TODD JOYCE

DocuSigned by: D. Todd Joyce 02/09/2024
A90CADFDBD4241D...
DATE

SIG. INVENTORY NO. 13-0404

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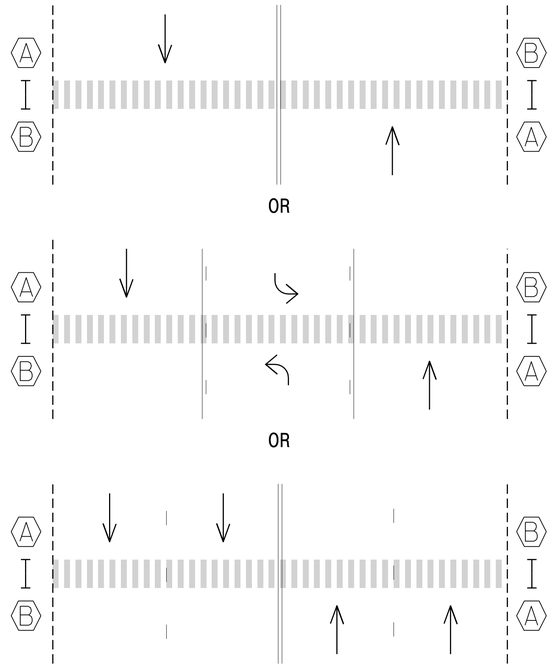
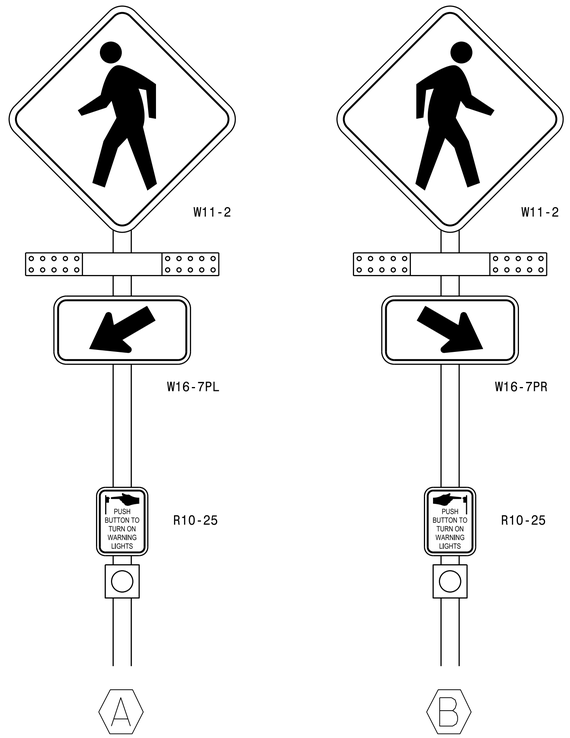
C:*Work_for_home*130404_sm_ele_20240204d.dgn
djcraddock1

PROJECT REFERENCE NO.	SHEET NO.

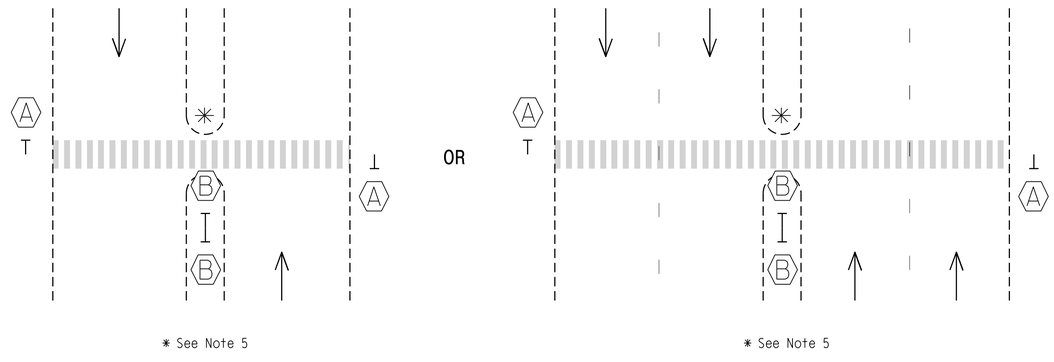
Two to Four Lanes, Undivided



RRFB Sign Detail



Two or Multi-Lanes, Divided



✳ See Note 5

✳ See Note 5

Notes

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

Timing of RRFBs

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

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

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

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

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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Standard Drawing for Rectangular Rapid Flashing Beacon

Prepared in the Offices of:

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

750 N. Greenfield Parkway
Garner, NC 27529

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by:

SIGNATURE — 12/19/2022 DATE

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