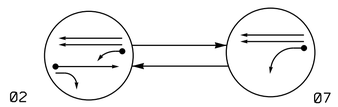
PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 14.0

PHASING DIAGRAM



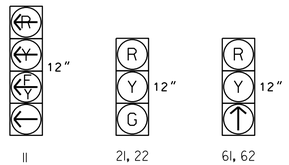
PHASING DIAGRAM DETECTION LEGEND

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

TABLE OF OPERATION			
SIGNAL FACE	PHASE 02	PHASE 07	FLASH
11	F/Y	←	Y
21, 22	G	R	Y
61, 62	↑	↑	Y

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

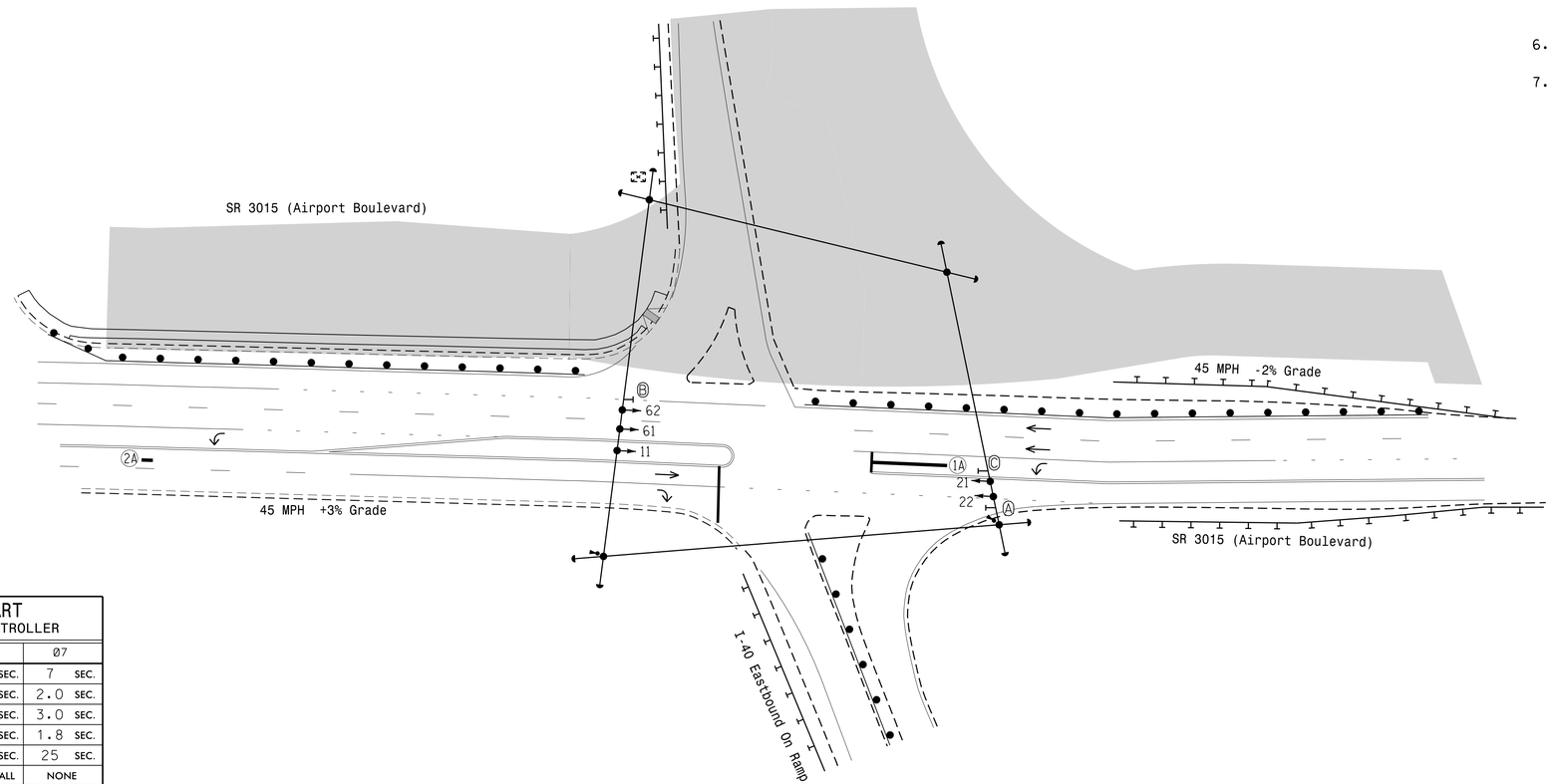
INDUCTIVE LOOPS						DETECTOR UNITS						
ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME (sec)	ADDED INITIAL	DET. TYPE
1A*	6X40	0	*	-	X	7	-	*	DELAY	15	-	S
2A*	6X6	300	*	-	X	2	-	*	-	-	X	N

* Video detection zone.

2 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
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. Pavement markings are existing.
5. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
6. Cary signal system data:
   Fiber channel #: 26.
7. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



LEGEND

PROPOSED		EXISTING
○→	Traffic Signal Head	●→
◐→	Modified Signal Head	N/A
⊣	Sign	⊣
□↓	Pedestrian Signal Head	■↓
○	Signal Pole with Guy	●
○	Signal Pole with Sidewalk Guy	●
▭	Inductive Loop Detector	▭
⊠	Controller & Cabinet	⊠
□	Junction Box	■
----------	2-in Underground Conduit	----------
N/A	Right of Way	----------
→	Directional Arrow	→
N/A	Curb Ramp	N/A
N/A	Guardrail	N/A
●---●	Construction Zone Drums	●---●
▒	Construction Zone	▒
○⊲	Out of Pavement Detector	●⊲
▬	Video Detection Area	▬
Ⓐ	Right Arrow "ONLY" Sign (R3-5R)	Ⓐ
Ⓑ	No Right Turn Sign (R3-2)	Ⓑ
Ⓒ	No U-Turn/No Left Turn Sign (R3-18)	Ⓒ

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	02	07
MINIMUM GREEN *	12 SEC.	7 SEC.
VEHICLE EXT. *	6.0 SEC.	2.0 SEC.
YELLOW CHANGE INT.	4.3 SEC.	3.0 SEC.
RED CLEARANCE	1.0 SEC.	1.8 SEC.
MAX. 1 *	120 SEC.	25 SEC.
RECALL POSITION	MIN. RECALL	NONE
LOCK DET.	ON	OFF
WALK *	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.
VOLUME DENSITY	ON	OFF
ACTUATION B4 ADD *	– VEH.	– VEH.
SEC. PER ACTUATION *	2.5 SEC.	– SEC.
MAX. INITIAL *	34 SEC.	– SEC.
TIME B4 REDUCTION *	15 SEC.	– SEC.
TIME TO REDUCE *	45 SEC.	– SEC.
MINIMUM GAP	3.0 SEC.	– SEC.
DUAL ENTRY	OFF	OFF
SIMULTANEOUS GAP	ON	ON

* These values may be field adjusted. Do not adjust in 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.

02-AUG-2019 13:42
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jolorr

Signal Upgrade - Temporary Design 2 (TMP Phase II)

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

SR 3015 (Airport Boulevard) at I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: March 2019 REVIEWED BY:

PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

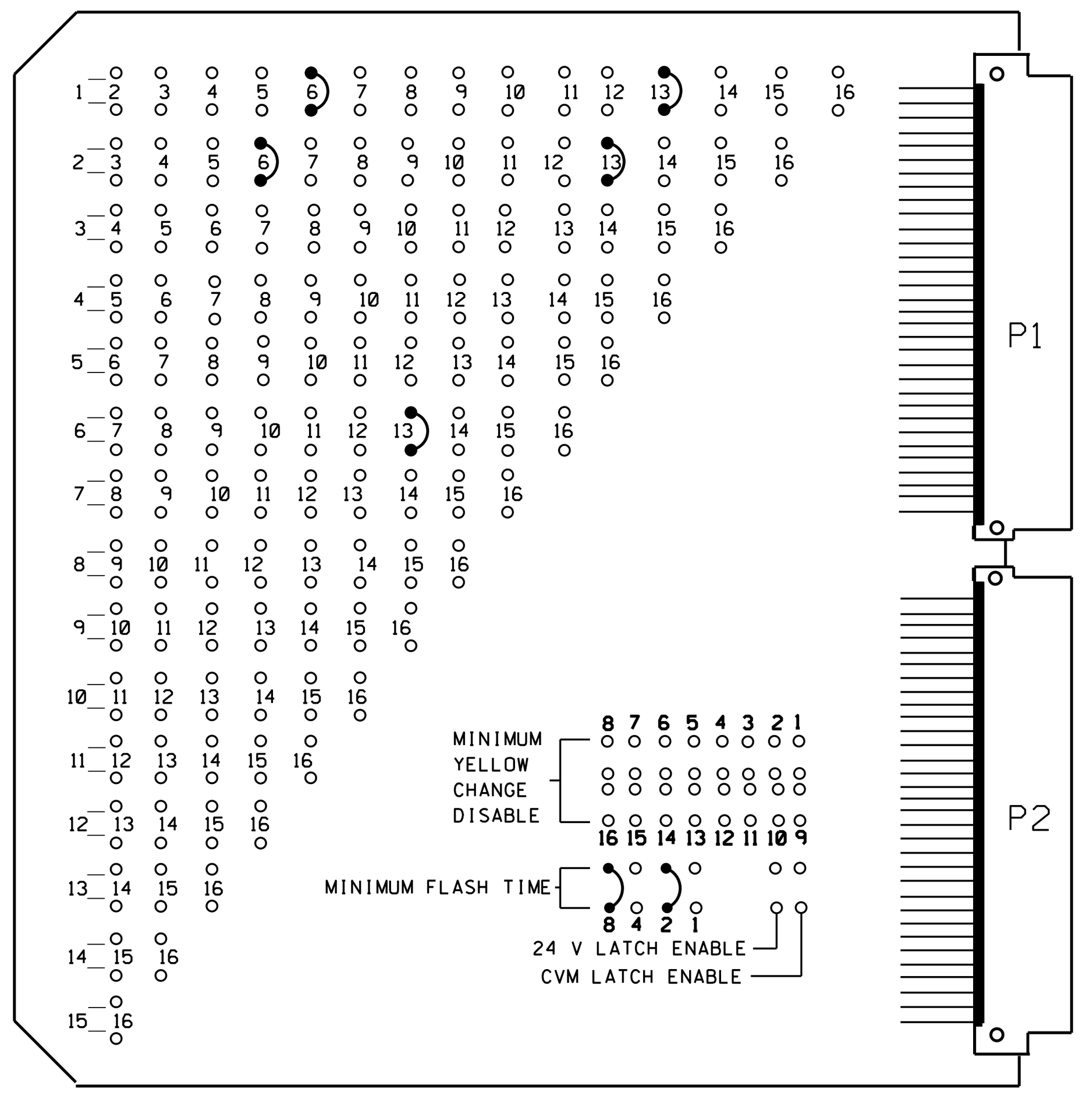
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA
DocuSigned by: 7/24/2019
DATE

SIG. INVENTORY NO. 05-094TI2

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 14.1

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	DISABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	ENABLE
14	DISABLE
15	DISABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	ON
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	ON
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	ON
FYA TRAP DETECT	ON

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 3,4,5,7,8,9,10,11,12,14,15, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 2 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phase 2 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	OLE	2	3	4	5	OLF	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	11★	21,22	NU	NU	NU	61,62	NU	NU	NU	NU	NU	NU	11★	NU	NU	NU
RED	✳	2R				6R										
YELLOW	✳	2Y				6Y										
GREEN		2G														
RED ARROW													13R			
YELLOW ARROW													13Y			
FLASHING YELLOW ARROW													13G			
GREEN ARROW	1G					6G										
(Don't Walk)																
(Walk)																

NU = Not Used

✳ Denotes install load resistor. See Load Resistor Installation Detail on sheet 2.

★ See pictorial of head wiring detail this sheet.

NOTE: Load switches 1 and 6 have been reassigned as overlaps. See sheet 3 for programming details.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
NU	L1A,L1B
NU	L2A,L2B
NU	L3A,L3B
NU	L4A,L4B
NU	L5A,L5B
NU	L6A,L6B
NU	L7A,L7B
NU	L8A,L8B
NU	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

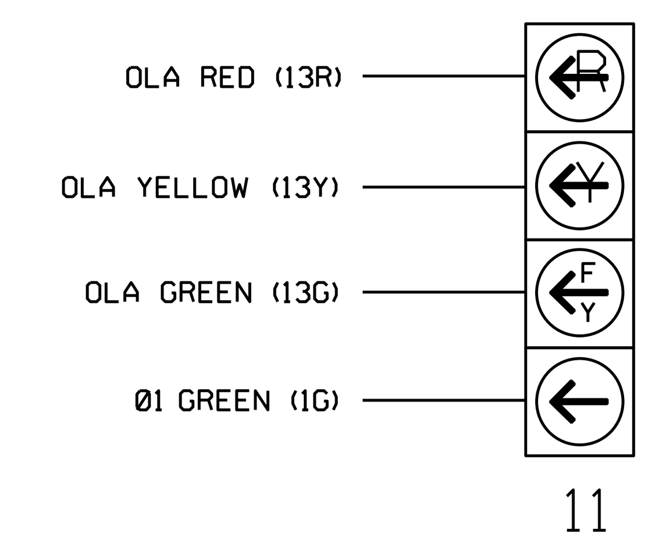
EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......1,2,6,13
PHASES USED.............2,7
OLA.....................✳
OLB.....................NOT USED
OLC.....................NOT USED
OLD.....................NOT USED
OLE.....................7
OLF.....................2+7

✳ SEE OVERLAP PROGRAMMING DETAIL ON SHEET 2

FYA SIGNAL WIRING DETAIL

(wire signal head as shown)



SPECIAL DETECTOR NOTE

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

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-0947T2
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp Design 2 (TMP Phase II)
Sheet 1 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard) at I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: May 2019 REVIEWED BY:
PREPARED BY: S. Armstrong 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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 8/1/2019
430320FAA2654C3...
DATE

SIG. INVENTORY NO. 05-0947T2

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sarmstrong

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

1. From Main Menu select [2. CONTROLLER]
2. From CONTROLLER Submenu select [2. VEHICLE OVERLAPS]

Toggle to advance to Overlap E

OVERLAP E

Select TMG VEH OVLP [E] and 'NORMAL'

```
TMG VEH OVLP...[E] TYPE: .......NORMAL
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . . . . . X . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

Toggle to advance to Overlap A

OVERLAP A

Select TMG VEH OVLP [A] and 'PPLT FYA'

```
TMG VEH OVLP...[A] TYPE: .....PPLT FYA

PROTECTED LEFT TURN....   OVERLAP  E
OPPOSING THROUGH.......   PHASE    2

FLASHING ARROW OUTPUT.....CH13 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

Toggle to advance to Overlap F

OVERLAP F

Select TMG VEH OVLP [F] and 'NORMAL'

```
TMG VEH OVLP...[F] TYPE: .......NORMAL
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . X . . . . X . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

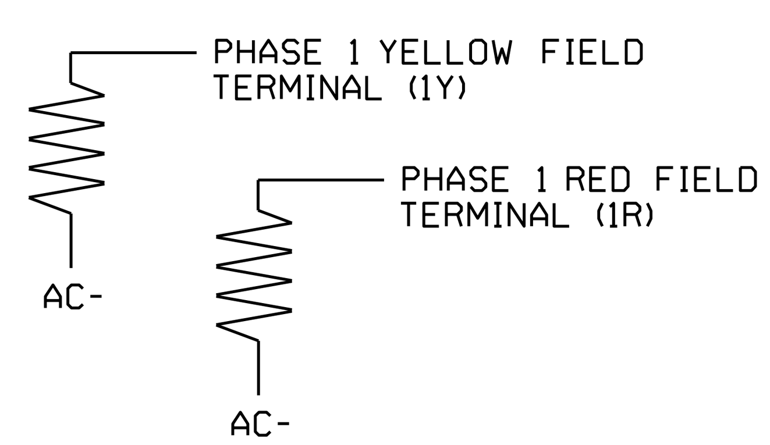
END PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

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



PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 14.2

ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select [1. CONFIGURATION]
2. From CONFIGURATION Submenu select [4. PORT 1 (SDLC)]
3. From PORT 1 (SDLC) Submenu select [2. MMU PROGRAM]

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

```
CH  6 5 4 3 2 1 0 9 8 7 6 5 4 3 2
 1  . . . X . . . . . . X . . . .
 2  . . . X . . . . . . X . . .
 3  . . . . . . . . . . . . .
 4  . . . . . . . . . . . .
 5  . . . . . . . . . . .
 6  . . . X . . . . . .
 7  . . . . . . . . .
 8  . . . . . . . .
 9  . . . . . . .
10  . . . . . .
11  . . . . .
12  . . . .
13  . . .
14  . .
15  .
```

END PROGRAMMING

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947T2
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp Design 2 (TMP Phase II)
Sheet 2 of 3

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Prepared In the Offices of:
750 N.Greenfield Pkwy,Garner,NC 27529

Division 5 Wake County Morrisville

PLAN DATE: May 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... 8/1/2019
DATE

SIG. INVENTORY NO. 05-0947T2

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sarmstrong

ECONOLITE ASC/3-2070
LOAD SWITCH ASSIGNMENT DETAIL

(program controller as shown)

To assign load switches 1 and 6 as OLE and OLF, program LD SWITCH 1 as OVLP '5' TYPE 'O' and LD SWITCH 6 as OVLP '6' TYPE 'O' as shown below.

1. From Main Menu select **1. CONFIGURATION**
2. From CONFIGURATION Submenu select **3. LOAD SW ASSIGN**

LD SWITCH ASSIGN

	PHASE /OVLP	TYPE	DIMMING R	Y	G	D	FLASH PWR	AUT	TGR
→ 1	5	O	.	.	.	+	A	Y	X
2	2	V	.	.	.	+	A	Y	.
3	3	V	.	.	.	+	A	R	X
4	4	V	.	.	.	+	A	R	.
5	5	V	.	.	.	−	A	R	.
→ 6	6	O	.	.	.	−	A	Y	X
7	7	V	.	.	.	−	A	R	.
8	8	V	.	.	.	−	A	R	X
9	2	P	.	.	.	+	A	R	X
10	4	P	.	.	.	+	A	R	X
11	6	P	.	.	.	−	A	R	.
12	8	P	.	.	.	−	A	R	.
13	1	O	.	.	.	+	A	.	.
14	2	O	.	.	.	−	A	.	.
15	3	O	.	.	.	+	A	.	.
16	4	O	.	.	.	−	A	.	.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947T2
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

26-JUL-2019 07:31
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sarmstrong

Electrical Detail - Temp Design 2 (TMP Phase II)
Sheet 3 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 | Wake County | Morrisville

PLAN DATE: May 2019 | REVIEWED BY:
PREPARED BY: S. Armstrong | 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

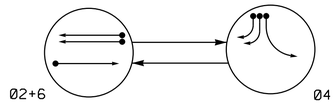
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough
430320FAA2654C3
8/1/2019
DATE

SIG. INVENTORY NO. 05-0947T2

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 15.0

PHASING DIAGRAM



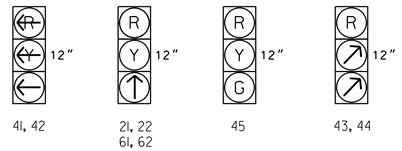
PHASING DIAGRAM DETECTION LEGEND

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

TABLE OF OPERATION			
SIGNAL FACE	PHASE Ø2+6	PHASE Ø4	FLASH
21, 22	↑	R	Y
41, 42	~~R~~	←	~~R~~
43, 44	R	↗	R
45	R	G	R
61, 62	↑	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

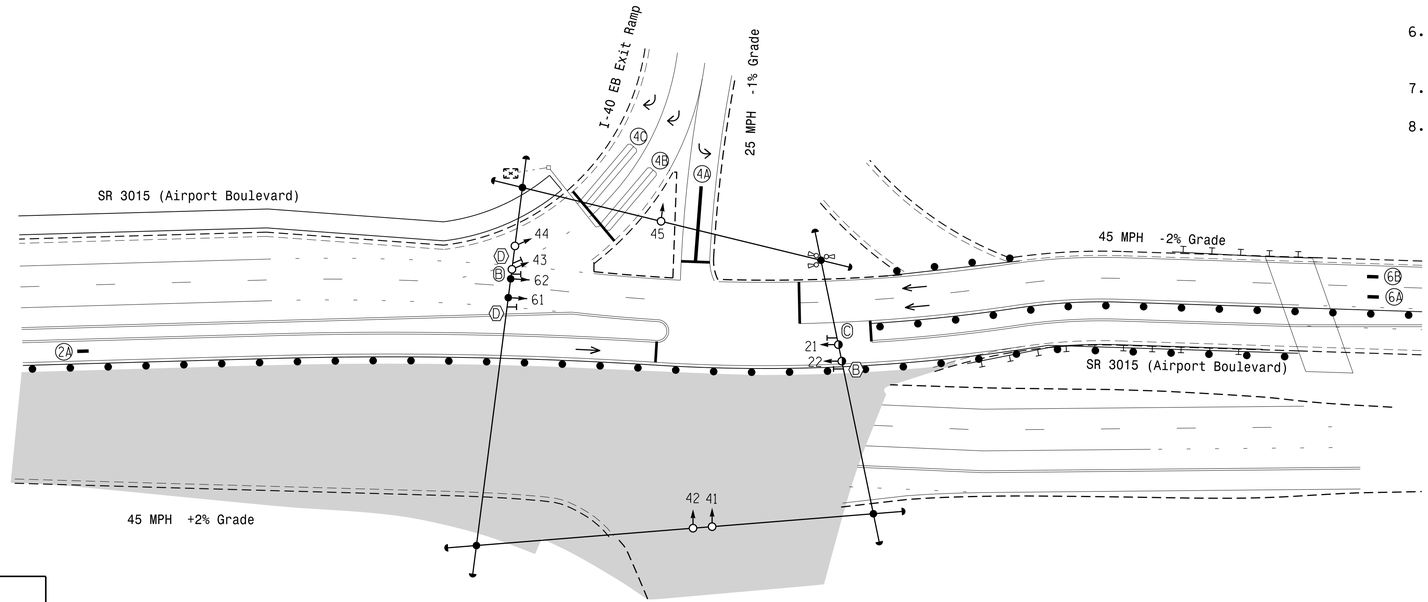
INDUCTIVE LOOPS						DETECTOR UNITS						
LOOP / ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME (sec)	ADDED INITIAL	DET. TYPE
2A*	6X6	300	*	X	-	2	-	*	-	-	X	N
4A*	6X40	0	*	X	-	4	*	-	-	-	-	S
4B	6X40	0	2-4-2	X	-	4	-	X	DELAY	15	-	S
4C	6X40	0	2-4-2	X	-	4	-	X	DELAY	15	-	S
6A*	6X6	300	*	X	-	6	-	*	-	-	X	N
6B*	6X6	300	*	X	-	6	-	*	-	-	X	N

* Video detection zone.

2 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Reposition existing signal heads numbered 21, 22, 61, and 62.
4. Set all detector units to presence mode.
5. Pavement markings are existing unless otherwise shown.
6. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
7. Cary signal system data:
   Fiber channel #: 26.
8. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	02	04	06
MINIMUM GREEN *	12 SEC.	7 SEC.	12 SEC.
VEHICLE EXT. *	6.0 SEC.	2.0 SEC.	6.0 SEC.
YELLOW CHANGE INT.	4.7 SEC.	3.0 SEC.	4.7 SEC.
RED CLEARANCE	2.6 SEC.	2.1 SEC.	2.6 SEC.
MAX. 1 *	120 SEC.	25 SEC.	120 SEC.
RECALL POSITION	MIN. RECALL	NONE	MIN. RECALL
LOCK DET.	ON	OFF	ON
WALK *	– SEC.	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.	– SEC.
VOLUME DENSITY	ON	OFF	ON
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	2.5 SEC.	– SEC.	1.5 SEC.
MAX. INITIAL *	34 SEC.	– SEC.	34 SEC.
TIME B4 REDUCTION *	15 SEC.	– SEC.	15 SEC.
TIME TO REDUCE *	45 SEC.	– SEC.	45 SEC.
MINIMUM GAP	3.0 SEC.	– SEC.	3.0 SEC.
DUAL ENTRY	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON

* These values may be field adjusted. Do not adjust in 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	■↓
○	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	Curb Ramp	
N/A	Guardrail	
●	Construction Zone Drums	●
▨	Construction Zone	▨
○◁	Out of Pavement Detector	●▬
▬	Video Detection Area	▬
Ⓑ	No Right Turn Sign (R3-1)	Ⓑ
Ⓒ	No U-Turn/No Left Turn Sign (R3-18)	Ⓒ
Ⓓ	No Left Turn Sign (R3-2)	Ⓓ

This plan supersedes the plan signed and sealed on 7/24/19.

Signal Upgrade - Temporary Design 3 (TMP Phase III, Step A)

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

SR 3015 (Airport Boulevard) at I-40 EB Ramp

Division 5 Wake County Morrisville

PLAN DATE: September 2019 REVIEWED BY:

PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by: 10/2/2019
DATE

SIG. INVENTORY NO. 05-0947T3

02-OCT-2019 12:20
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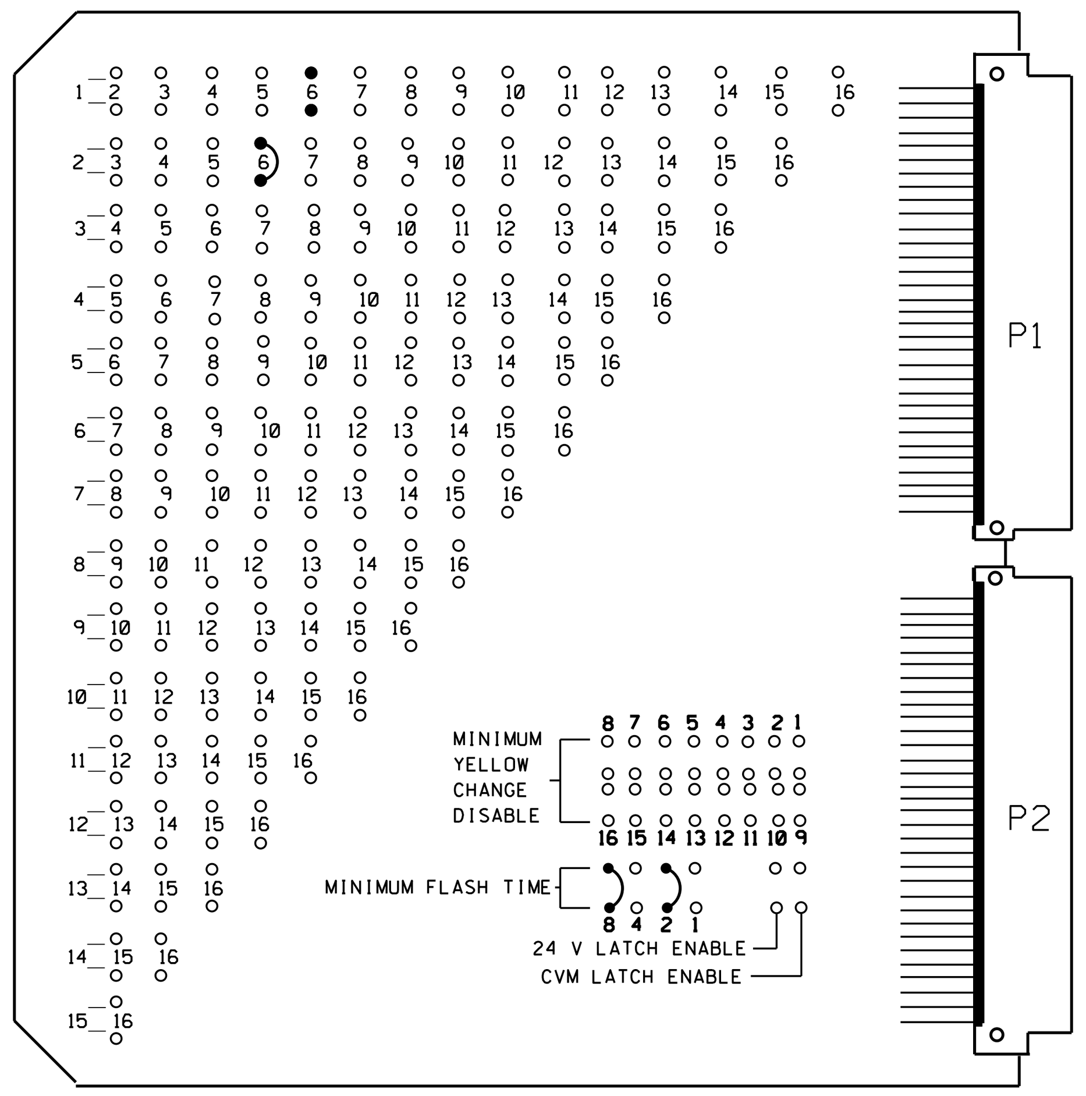
rziemba

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	OFF
FYA TRAP DETECT	OFF

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,5,7,8,9,10,11,12,13,14,15, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 2 Green and 6 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 2 and 6 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	4	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22	NU	41,42	43,44	45	NU	61,62	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
RED		2R			4R	4R		6R										
YELLOW		2Y				4Y		6Y										
GREEN						4G												
RED ARROW				4R														
YELLOW ARROW				4Y	4Y													
FLASHING YELLOW ARROW																		
GREEN ARROW		2G		4G	4G			6G										
(hand symbol)																		
(pedestrian symbol)																		

NU = Not Used

NOTE: Load switches 1 and 6 have been reassigned as vehicle load switches. See sheet 3 for programming details.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU	SLOT EMPTY	SLOT EMPTY	CH1 L7 Ø 4 / CH2 L8 Ø 4	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
NU	L1A,L1B
NU	L2A,L2B
NU	L3A,L3B
NU	L4A,L4B
NU	L5A,L5B
NU	L6A,L6B
4B	L7A,L7B
4C	L8A,L8B
NU	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1			
2			
3			
4			
5			
6			
7	Ø 4	DELAY	15
8	Ø 4	DELAY	15
9			
10			
11			
12			
13			
14			
15			
16			

EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,4,6
PHASES USED.............2,4,6
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................NOT USED
OLD.....................NOT USED

SPECIAL DETECTOR NOTE

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

THIS ELECTRICAL DETAIL SUPERSEDES THE DETAIL SEALED ON 8/1/2019.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947T3
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

Electrical Detail - Temp Design 3 (TMP Phase III, Step A)
Sheet 1 of 3

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard) at I-40 EB Ramps

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

Division 5   Wake County   Morrisville

PLAN DATE: October 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 10/8/2019
430320FAA2654C3...
DATE

SIG. INVENTORY NO. 05-0947T3

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 15.2

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

1. From Main Menu select **2. CONTROLLER**
2. From CONTROLLER Submenu select **2. VEHICLE OVERLAPS**

Toggle to advance to Overlap E

OVERLAP E

Select TMG VEH OVLP [E] and 'NORMAL'

```
TMG VEH OVLP...[E] TYPE: .......NORMAL
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . . . . . X . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

Toggle to advance to Overlap A

OVERLAP A

Select TMG VEH OVLP [A] and 'PPLT FYA'

```
TMG VEH OVLP...[A] TYPE: .....PPLT FYA

PROTECTED LEFT TURN....   OVERLAP  E
OPPOSING THROUGH.......   PHASE    2

FLASHING ARROW OUTPUT.....CH13 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

Toggle to advance to Overlap F

OVERLAP F

Select TMG VEH OVLP [F] and 'NORMAL'

```
TMG VEH OVLP...[F] TYPE: .......NORMAL
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . X . . . . X . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

END PROGRAMMING

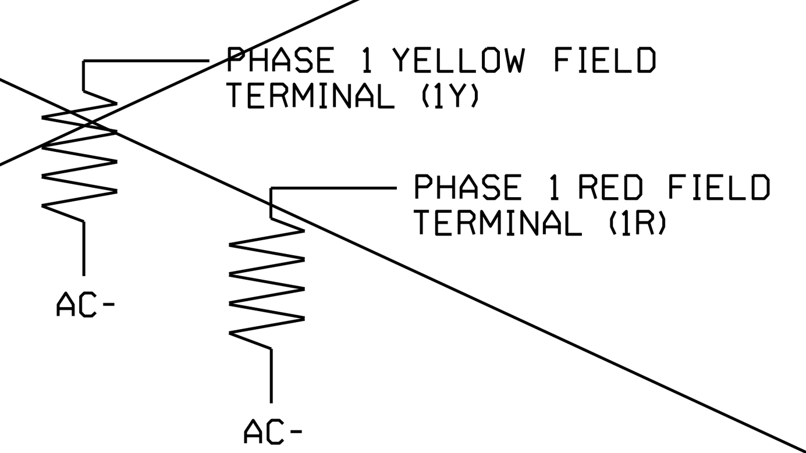
DELETE OVERLAP PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

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



REMOVE LOAD RESISTORS

ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select **1. CONFIGURATION**
2. From CONFIGURATION Submenu select **4. PORT 1 (SDLC)**
3. From PORT 1 (SDLC) Submenu select **2. MMU PROGRAM**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

CH	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	X	.	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	.	.	.	.	.	.	.	.	.	.	.	.			
5	.	.	.	.	.	.	.	.	.	.	.				
6	.	.	.	.	.	.	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	.	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	.														

END PROGRAMMING

THIS ELECTRICAL DETAIL SUPERSEDES THE DETAIL SEALED ON 8/1/2019.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947T3
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

Electrical Detail - Temp Design 3 (TMP Phase III, Step A)
Sheet 2 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 | Wake County | Morrisville

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

PLAN DATE: October 2019 | REVIEWED BY:
PREPARED BY: S. Armstrong | REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 10/8/2019
430320FAA2654C3...
DATE

SIG. INVENTORY NO. 05-0947T3

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sarmstrong

ECONOLITE ASC/3-2070
LOAD SWITCH ASSIGNMENT DETAIL

(program controller as shown)

To assign load switches 1 and 6 as vehicle load switches, program LD SWITCH 1 as PHASE '1' TYPE 'V' and LD SWITCH 6 as PHASE '6' TYPE 'V' as shown below.

1. From Main Menu select **[1. CONFIGURATION]**
2. From CONFIGURATION Submenu select **[3. LOAD SW ASSIGN]**

LD SWITCH ASSIGN

	PHASE /OVLP	TYPE	DIMMING R	Y	G	D	---FLASH--- PWR	AUT	TGR
→ 1	1	V	.	.	.	+	A	R	X
2	2	V	.	.	.	+	A	Y	.
3	3	V	.	.	.	+	A	R	X
4	4	V	.	.	.	+	A	R	.
5	5	V	.	.	.	−	A	R	.
→ 6	6	V	.	.	.	−	A	Y	X
7	7	V	.	.	.	−	A	R	.
8	8	V	.	.	.	−	A	R	X
9	2	P	.	.	.	+	A	R	X
10	4	P	.	.	.	+	A	R	X
11	6	P	.	.	.	−	A	R	.
12	8	P	.	.	.	−	A	R	.
13	1	O	.	.	.	+	A	.	.
14	2	O	.	.	.	−	A	.	.
15	3	O	.	.	.	+	A	.	.
16	4	O	.	.	.	−	A	.	.

THIS ELECTRICAL DETAIL SUPERSEDES
THE DETAIL SEALED ON 8/1/2019.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947T3
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

Electrical Detail - Temp Design 3 (TMP Phase III, Step A)
Sheet 3 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

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

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 | Wake County | Morrisville

PLAN DATE: October 2019	REVIEWED BY:
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REVISIONS	INIT.	DATE

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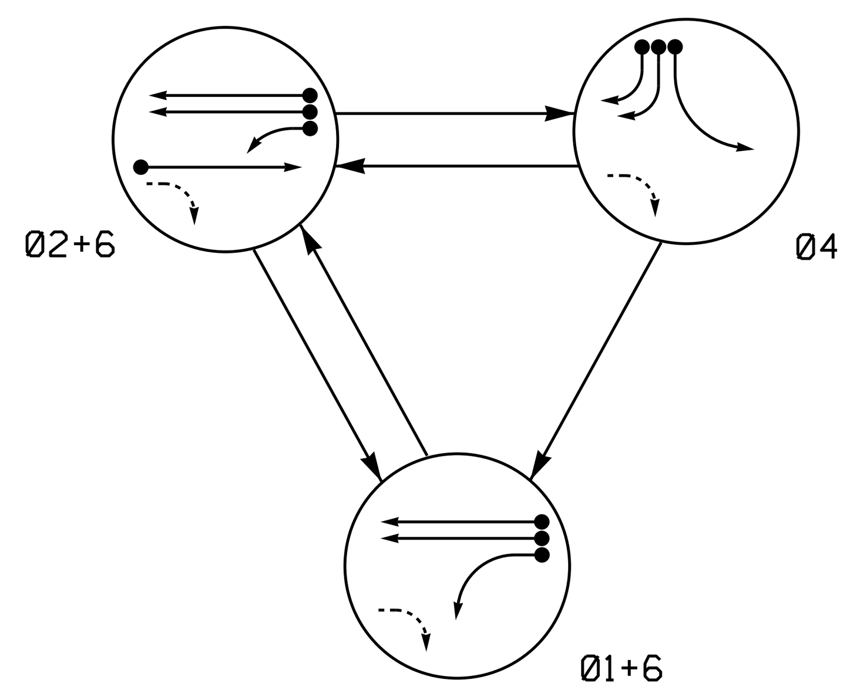
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by:
Ryan W. Hough
430320FAA2654C3...
10/8/2019
DATE

SIG. INVENTORY NO. 05-0947T3

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

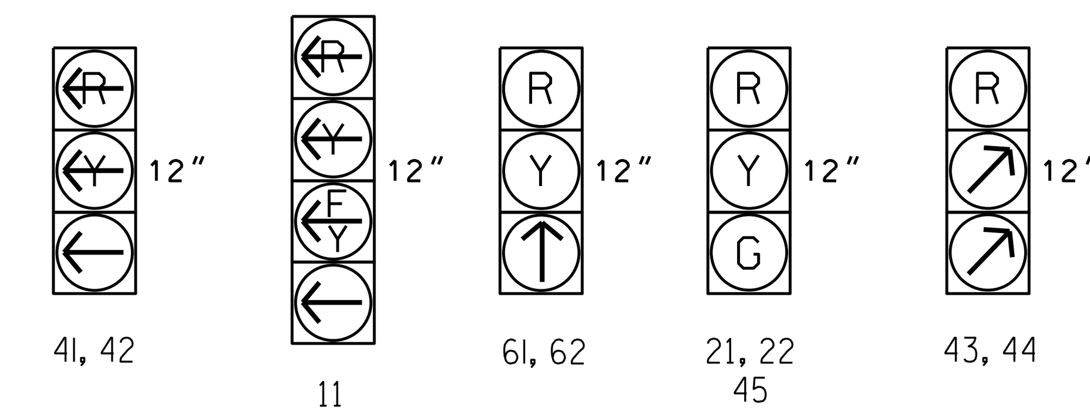
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø1+6	Ø2+6	Ø4	FLASH
11	←	← F/Y	← R	← Y
21, 22	R	G	R	Y
41, 42	← R	← R	←	← R
43, 44	R	R	↗	R
45	R	R	G	R
61, 62	↑	↑	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

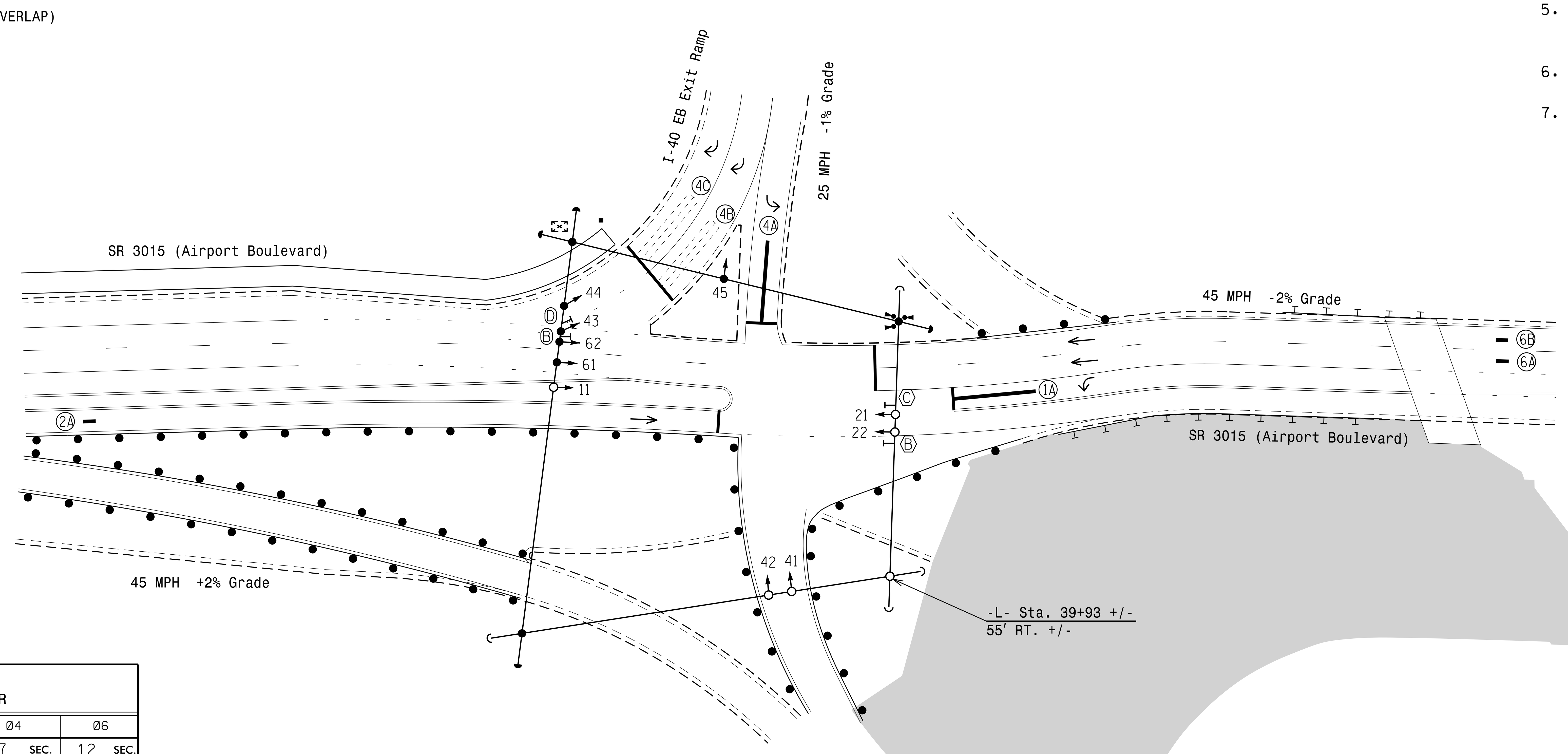
INDUCTIVE LOOPS						DETECTOR UNITS						
LOOP / ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME (sec)	ADDED INITIAL	DET. TYPE
1A*	6X40	0	*	*	-	1	-	X	DELAY	15	-	S
						6	-	X	DELAY	3	-	G
2A*	6X6	300	*	-	*	2	-	X	-	-	X	N
4A*	6X40	0	*	-	*	4	X	-	-	-	-	S
4B	6X40	0	2-4-2	-	X	4	-	X	DELAY	15	-	S
4C	6X40	0	2-4-2	-	X	4	-	X	DELAY	15	-	S
6A*	6X6	300	*	-	*	6	-	X	-	-	X	N
6B*	6X6	300	*	-	*	6	-	X	-	-	X	N

* Video detection zone.

3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
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. Pavement markings are existing.
5. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
6. Cary signal system data:
   Fiber channel #: 26.
7. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
N/A	Curb Ramp	
N/A	Guardrail	
	Construction Zone Drums	
	Construction Zone	
	Out of Pavement Detector	
	Video Detection Area	
B	No Right Turn Sign (R3-1)	B
C	No U-Turn/No Left Turn Sign (R3-18)	C
D	No Left Turn Sign (R3-2)	D

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	Ø1	Ø2	Ø4	Ø6
MINIMUM GREEN *	7 SEC.	12 SEC.	7 SEC.	12 SEC.
VEHICLE EXT. *	2.0 SEC.	6.0 SEC.	2.0 SEC.	6.0 SEC.
YELLOW CHANGE INT.	3.0 SEC.	4.7 SEC.	3.0 SEC.	4.7 SEC.
RED CLEARANCE	2.6 SEC.	2.6 SEC.	1.9 SEC.	2.6 SEC.
MAX. 1 *	25 SEC.	120 SEC.	25 SEC.	120 SEC.
RECALL POSITION	NONE	MIN. RECALL	NONE	MIN. RECALL
LOCK DET.	OFF	ON	OFF	ON
WALK *	– SEC.	– SEC.	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.	– SEC.	– SEC.
VOLUME DENSITY	OFF	ON	OFF	ON
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	– SEC.	2.5 SEC.	– SEC.	1.5 SEC.
MAX. INITIAL *	– SEC.	34 SEC.	– SEC.	34 SEC.
TIME B4 REDUCTION *	– SEC.	15 SEC.	– SEC.	15 SEC.
TIME TO REDUCE *	– SEC.	45 SEC.	– SEC.	45 SEC.
MINIMUM GAP	– SEC.	3.0 SEC.	– SEC.	3.0 SEC.
DUAL ENTRY	OFF	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust in 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.

This plan supersedes the plan signed and sealed on 7/24/19.

Signal Upgrade - Temporary Design 4 (TMP Phase III, Step B)

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

SR 3015 (Airport Boulevard) at I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: September 2019	REVIEWED BY:
PREPARED BY: J.A. Lohr	REVIEWED BY:

REVISIONS	INIT.	DATE

SCALE 0 40
1"=40'

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by:
10/2/2019
DATE

SIG. INVENTORY NO. 05-0947T4

02-OCT-2019 12:26
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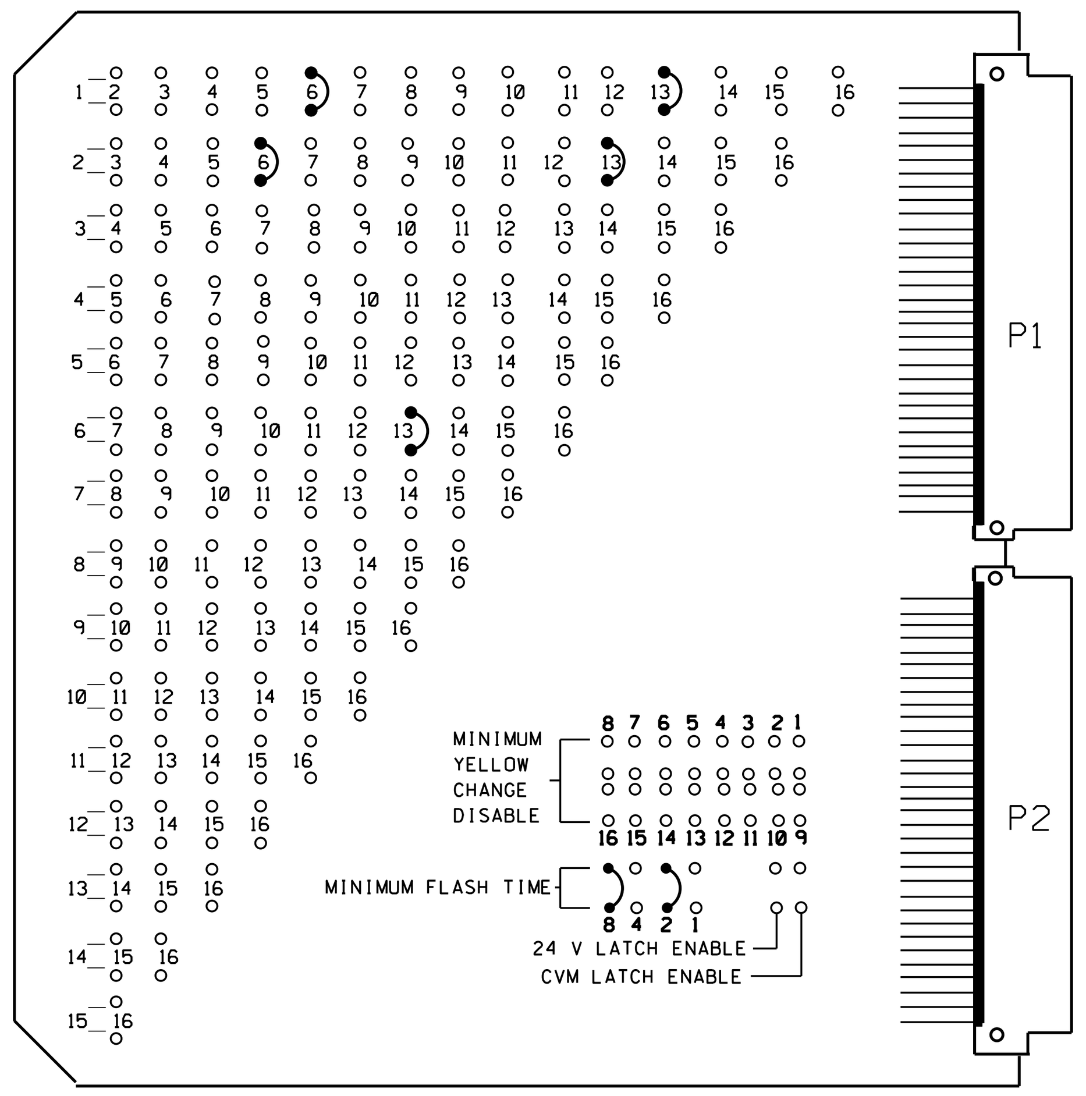
rziemba

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	ENABLE
14	DISABLE
15	DISABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	ON
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	ON
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	ON
FYA TRAP DETECT	ON

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 3,5,7,8,9,10,11,12,14,15, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 2 Green and 6 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 2 and 6 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	4	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	11★	21,22	NU	41,42	43,44	45	NU	61,62	NU	NU	NU	NU	NU	NU	11★	NU	NU	NU
RED	✳	2R			4R	4R		6R										
YELLOW	✳	2Y				4Y		6Y										
GREEN		2G				4G												
RED ARROW				4R											13R			
YELLOW ARROW				4Y	4Y										13Y			
FLASHING YELLOW ARROW															13G			
GREEN ARROW	1G			4G	4G			6G										
(hand symbol)																		
(pedestrian symbol)																		

NU = Not Used

✳ Denotes install load resistor. See Load Resistor Installation Detail on sheet 2.

★ See pictorial of head wiring detail this sheet.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU	SLOT EMPTY	CH1 L1 ø 1 / CH2 L2 ø 6 ✳	CH1 L7 ø 4 / CH2 L8 ø 4	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY

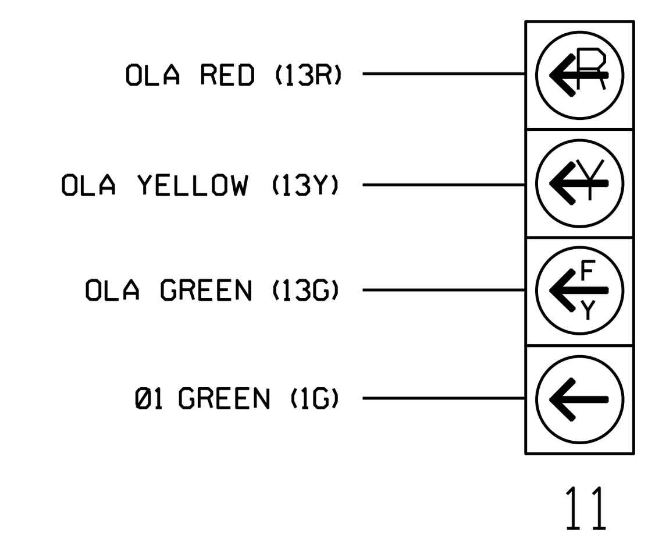
EQUIPMENT INFORMATION

CONTROLLER.............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT..........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......1,2,4,6,13
PHASES USED............1,2,4,6
OLA....................✳
OLB....................NOT USED
OLC....................NOT USED
OLD....................NOT USED

✳ SEE OVERLAP PROGRAMMING DETAIL ON SHEET 2

FYA SIGNAL WIRING DETAIL

(wire signal head as shown)



WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

	LOOP NO.	LOOP PANEL TERMINALS
ADD JUMPERS FROM: L1A TO L2A, AND L1B TO L2B	1A	L1A,L1B
		L2A,L2B
	NU	L3A,L3B
	NU	L4A,L4B
	NU	L5A,L5B
	NU	L6A,L6B
	4B	L7A,L7B
	4C	L8A,L8B
	NU	L9A,L9B
	NU	L10A,L10B
	NU	L11A,L11B
	NU	L12A,L12B
	NU	L13A,L13B
	NU	L14A,L14B
	NU	L15A,L15B
	NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING FEATURE	TIMING TIME (SEC)
1	ø 1	DELAY	15
✳2	ø 6	DELAY	3
3			
4			
5			
6			
7	ø 4	DELAY	15
8	ø 4	DELAY	15
9			
10			
11			
12			
13			
14			
15			
16			

✳ Detector Type - G

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	ø 1
2	ø 2
3	ø 3
4	ø 4
5	ø 5
6	ø 6
7	ø 7
8	ø 8
9	ø 2 PED
10	ø 4 PED
11	ø 6 PED
12	ø 8 PED
13	OLA
14	OLB
15	OLC
16	OLD

SPECIAL DETECTOR NOTE

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

For Detection Zones 1A the equipment placement and slots reserved for wired inputs are typical for a NCDOT installation.

THIS ELECTRICAL DETAIL SUPERSEDES THE DETAIL SEALED ON 8/1/2019.

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-0947T4
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

Electrical Detail - Temp Design 4 (TMP Phase III, Step B)
Sheet 1 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

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

SR 3015 (Airport Boulevard) at I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: October 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... 10/8/2019 DATE

SIG. INVENTORY NO. 05-0947T4

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sarmstrong

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

1. From Main Menu select **2. CONTROLLER**
2. From CONTROLLER Submenu select **2. VEHICLE OVERLAPS**

OVERLAP A

Select TMG VEH OVLP [A] and 'PPLT FYA'

```
TMG VEH OVLP...[A] TYPE: .....PPLT FYA

PROTECTED LEFT TURN....   PHASE    1
OPPOSING THROUGH.......   PHASE    2

FLASHING ARROW OUTPUT.....CH13 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

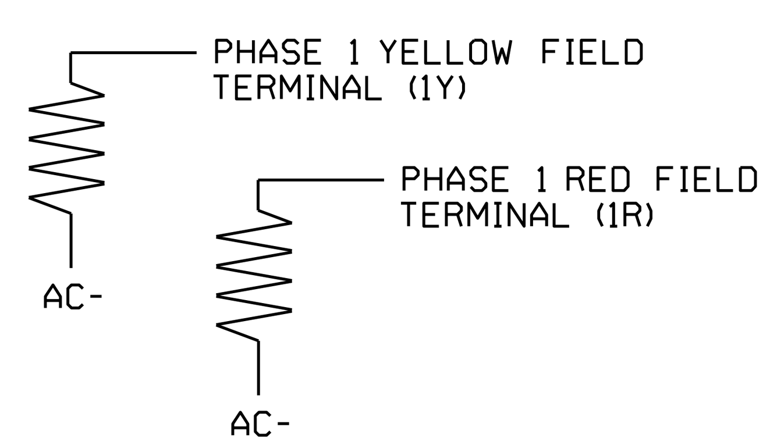
END PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

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



ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select **1. CONFIGURATION**
2. From CONFIGURATION Submenu select **4. PORT 1 (SDLC)**
3. From PORT 1 (SDLC) Submenu select **2. MMU PROGRAM**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

CH	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2
1	.	.	.	X	.	.	.	.	.	.	X	.	.	.	.
2	.	.	.	X	.	.	.	.	.	.	X	.	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	.	.	.	.	.	.	.	.	.	.	.	.			
5	.	.	.	.	.	.	.	.	.	.	.				
6	.	.	.	X	.	.	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	.	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	.														

END PROGRAMMING

THIS ELECTRICAL DETAIL SUPERSEDES THE DETAIL SEALED ON 8/1/2019.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947T4
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

Electrical Detail - Temp Design 4 (TMP Phase III, Step B)
Sheet 2 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: October 2019 REVIEWED BY:
PREPARED BY: S. Armstrong REVIEWED BY:

REVISIONS	INIT.	DATE

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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough
10/8/2019
DATE

SIG. INVENTORY NO. 05-0947T4

03-OCT-2019 08:09
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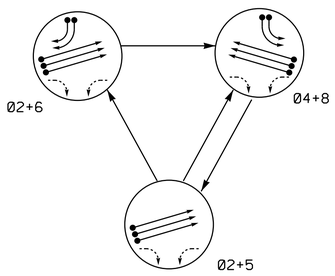
sarmstrong

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 17.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

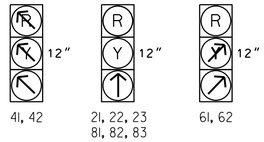
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2+5	PHASE Ø2+6	PHASE Ø4+8	FLASH
21, 22, 23	↑	↑	R	R
41, 42	↖	↖	↘	↖
61, 62	R	↗	R	R
81, 82, 83	R	R	↑	R

SIGNAL FACE I.D.

All Heads L.E.D.



41, 42 — 21, 22, 23 — 81, 82, 83 — 61, 62

LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

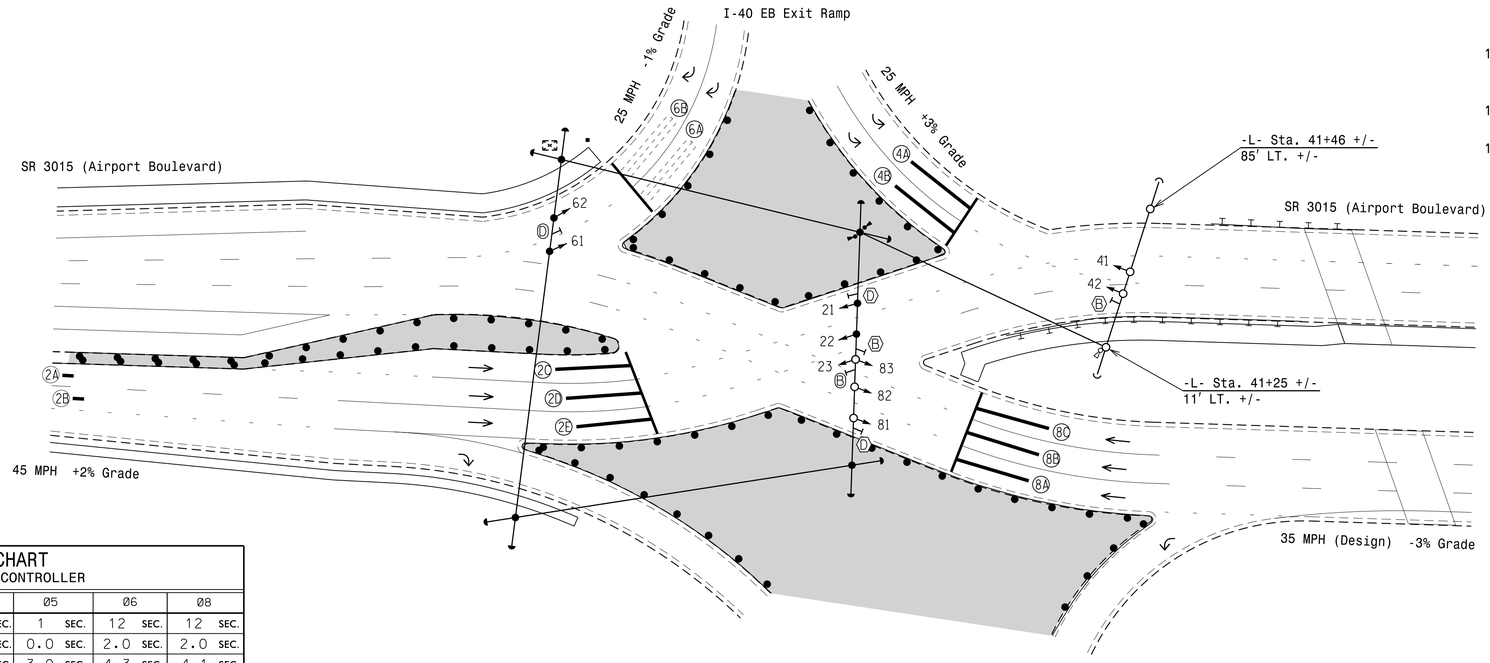
INDUCTIVE LOOPS						DETECTOR UNITS						
LOOP / ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME	ADDED INITIAL	DET. TYPE
2A*	6X6	0	*	X		2	-	*	-	-	X	N
2B*	6X6	0	*	X		2	-	*	-	-	X	N
2C*	6X40	0	*	X		2	*	-	-	-	-	S
2D*	6X40	0	*	X		2	*	-	-	-	-	S
2E*	6X40	0	*	X		2	*	-	-	-	-	S
4A*	6X40	0	*	X	-	4	-	*	-	-	-	S
4B*	6X40	0	*	X	-	4	-	*	-	-	-	S
6A	6X40	0	2-4-2	-	X	6	-	X	DELAY	15	-	S
6B	6X40	0	2-4-2	-	X	6	-	X	DELAY	15	-	S
8A*	6X40	0	*	X	-	8	*	-	-	-	-	S
8B*	6X40	0	*	X	-	8	*	-	-	-	-	S
8C*	6X40	0	*	X	-	8	*	-	-	-	-	S

* Video detection zone.

3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Omit phase 6 during phase 4+8 on.
4. Program controller to clear from phase 4+8 to phase 6 by progressing through phase 5 (see Electrical Details).
5. Renumber existing signal heads numbered 43 and 44 to 61 and 62, respectively.
6. Reposition existing signal heads numbered 21, 22, and 61.
7. Renumber existing loops numbered 4B and 4C, to 6A and 6B, respectively.
8. Set all detector units to presence mode.
9. Program controller to start up in all red.
10. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
11. Cary signal system data:
    Fiber channel #: 26.
12. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	02	04	05	06	08
MINIMUM GREEN *	12 SEC.	12 SEC.	1 SEC.	12 SEC.	12 SEC.
VEHICLE EXT. *	6.0 SEC.	2.0 SEC.	0.0 SEC.	2.0 SEC.	2.0 SEC.
YELLOW CHANGE INT.	4.3 SEC.	4.1 SEC.	3.0 SEC.	4.3 SEC.	4.1 SEC.
RED CLEARANCE	3.3 SEC.	3.2 SEC.	1.0 SEC.	3.3 SEC.	3.2 SEC.
MAX. 1 *	60 SEC.	60 SEC.	1 SEC.	60 SEC.	60 SEC.
RECALL POSITION	SOFT RECALL	NONE	NONE	SOFT RECALL	NONE
LOCK DET.	OFF	OFF	OFF	OFF	OFF
WALK *	– SEC.	– SEC.	– SEC.	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.	– SEC.	– SEC.	– SEC.
VOLUME DENSITY	ON	OFF	OFF	OFF	OFF
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	1.5 SEC.	– SEC.	– SEC.	– SEC.	– SEC.
MAX. INITIAL *	34 SEC.	– SEC.	– SEC.	– SEC.	– SEC.
TIME B4 REDUCTION *	15 SEC.	– SEC.	– SEC.	– SEC.	– SEC.
TIME TO REDUCE *	30 SEC.	– SEC.	– SEC.	– SEC.	– SEC.
MINIMUM GAP	3.0 SEC.	– SEC.	– SEC.	– SEC.	– SEC.
DUAL ENTRY	ON	ON	ON	ON	ON
SIMULTANEOUS GAP	ON	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust in 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	■↓
○→	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	Curb Ramp	
N/A	Guardrail	
•–•	Construction Zone Drums	•–•
	Construction Zone	
○◁	Out of Pavement Detector	●◀
	Video Detection Area	
Ⓑ	No Right Turn Sign (R3-1)	Ⓑ
Ⓓ	No Left Turn Sign (R3-2)	Ⓓ

Signal Upgrade - Temporary Design 5 (TMP Phase IV)

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

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: March 2019 REVIEWED BY:

PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

DocuSigned by: 7/24/2019 DATE

SIG. INVENTORY NO. 05-0947T5

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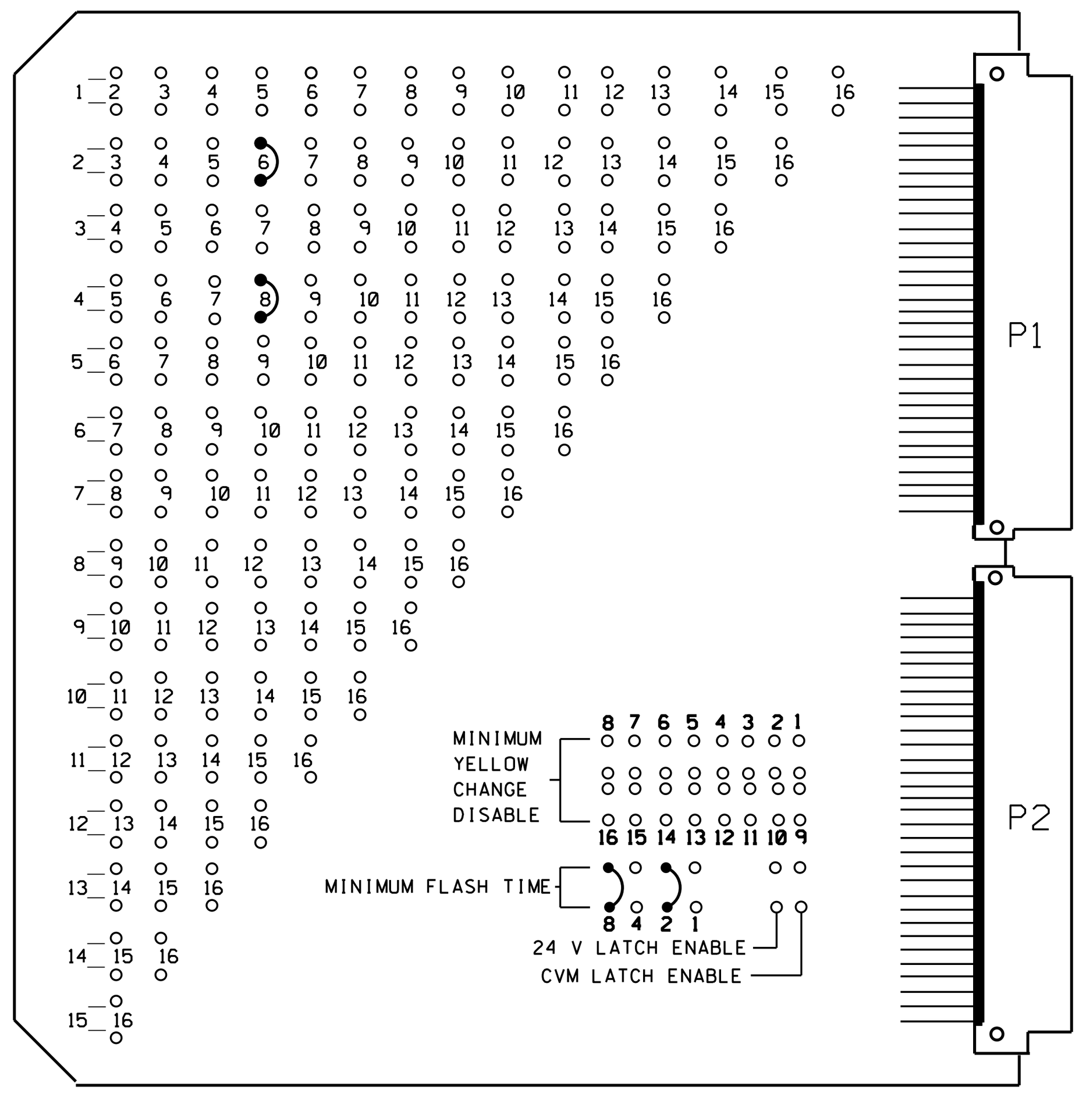
PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 17.1

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	ENABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	OFF
FYA TRAP DETECT	OFF

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,5,7,9,10,11,12,13,14,15, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up as follows: Main Menu 2-5 MUTCD-> YES, ALL RED...6, Phase 2 Green, Phase 6 Green
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phase 2 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22 23	NU	41,42	NC	61,62	NU	81,82 83	NU	NU	NU	NU	NU	NU	NU	NU
RED		2R				6R		8R								
YELLOW		2Y						8Y								
GREEN																
RED ARROW				4R												
YELLOW ARROW				4Y		6Y										
GREEN ARROW		2G		4G		6G		8G								
(hand symbol)																
(walking person symbol)																

NU = Not Used

NC = Not Connected

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU	SLOT EMPTY	SLOT EMPTY	CH1 L7 Ø6 / CH2 L8 Ø6	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
NU	L1A,L1B
NU	L2A,L2B
NU	L3A,L3B
NU	L4A,L4B
NU	L5A,L5B
NU	L6A,L6B
6B	L7A,L7B
6A	L8A,L8B
NU	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

~~ADD JUMPERS FROM: L1A TO L2A, AND L1B TO L2B~~

REMOVE THESE JUMPERS!

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1			
2			
3			
4			
5			
6			
7	Ø6	DELAY	15
8	Ø6	DELAY	15
9			
10			
11			
12			
13			
14			
15			
16			

SPECIAL DETECTOR NOTE

Install a video detection system for vehicle detection. Perform installation according to manufacturer's directions and NCDOT engineer approved mounting locations to accomplish the detection schemes shown on the Signal Design Plans for zones 2A, 2B, 2C, 2D, 2E, 4A, 4B, 8A, 8B, and 8C.

EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,4,6,8
PHASES USED.............2,4,5*,6,8
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................NOT USED
OLD.....................NOT USED

* Phase used for timing purposes only

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	Ø1
2	Ø2
3	Ø3
4	Ø4
5	Ø5
6	Ø6
7	Ø7
8	Ø8
9	Ø2 PED
10	Ø4 PED
11	Ø6 PED
12	Ø8 PED
13	OLA
14	OLB
15	OLC
16	OLD

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-0947T5
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp Design 5 (TMP Phase IV)
Sheet 1 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

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

SR 3015 (Airport Boulevard) at I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: May 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough
430320FAA2654C3...
8/1/2019
DATE

SIG. INVENTORY NO. 05-0947T5

29-JUL-2019 09:33
sarmstrong

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

1. From Main Menu select [2. CONTROLLER]
2. From CONTROLLER Submenu select [2. VEHICLE OVERLAPS]

OVERLAP A

Select TMG VEH OVLP [A] and 'PPLT FYA'

```
TMG VEH OVLP...[A] TYPE: .....[PPLT FYA]

PROTECTED LEFT TURN....   PHASE    1
OPPOSING THROUGH.......   PHASE    2

FLASHING ARROW OUTPUT.....CH13 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

END PROGRAMMING

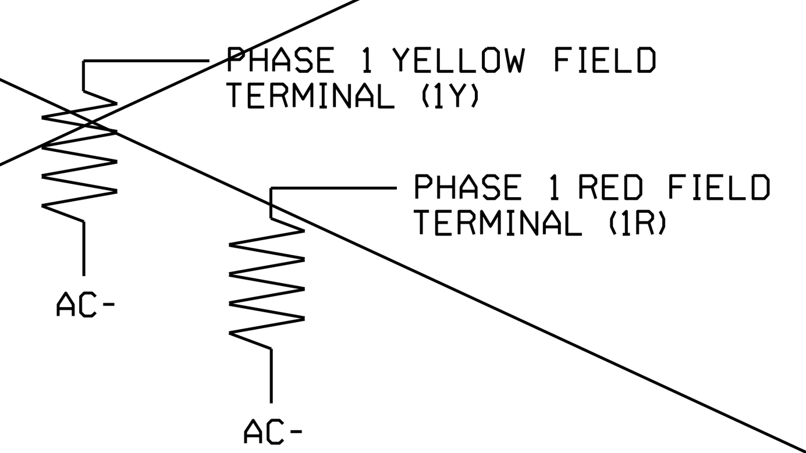
DELETE OVERLAP PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

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



REMOVE LOAD RESISTORS

ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select [1. CONFIGURATION]
2. From CONFIGURATION Submenu select [4. PORT 1 (SDLC)]
3. From PORT 1 (SDLC) Submenu select [2. MMU PROGRAM]

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

CH	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	X	.	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	.	.	.	.	.	.	.	.	X	.	.	.			
5	.	.	.	.	.	.	.	.	.	.	.				
6	.	.	.	.	.	.	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	.	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	.														

END PROGRAMMING

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947T5
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp Design 5 (TMP Phase IV)
Sheet 2 of 3

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: May 2019 REVIEWED BY:
PREPARED BY: S. Armstrong REVIEWED BY:

REVISIONS	INIT.	DATE

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

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3...
8/1/2019
DATE

SIG. INVENTORY NO. 05-0947T5

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PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 17.3

ECONOLITE ASC/3-2070 BACKUP PROTECTION ENABLE PROGRAMMING

(program controller as shown)

1. From Main Menu select [1. CONFIGURATION]
2. From CONFIGURATION Submenu select [1. CONTROLLER SEQ]
3. From CONTROLLER SEQUENCE Submenu select [3. BACKUP PREVENT PHASES]

This programming ensures the controller clears from 4+8 to phase 6 by progressing through phase 5 and also ensures the controller will not back up from 2+6 to phase 5.

Follow programming as shown below. On the 'ENABLE BACKUP PREVENT' screen move cursor to the appropriate field and press 'YES/NO' on the controller keypad to toggle field value between 'X' ,'B', 'C' and 'OFF'.

ENABLE BACKUP PREVENT

TMG/BKUP	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6
1		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.
4	.	.	.		C	X	.	.	.	.	.	.	.	.	.	.
5	.	.	.	.		.	.	.	.	.	.	.	.	.	.	.
6	.	.	.	.	X		.	.	.	.	.	.	.	.	.	.
7	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.
8	.	.	.	.	C	X	.		.	.	.	.	.	.	.	.
9	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.
10	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.
11	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.
12	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.
13	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.
14	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

END PROGRAMMING

NOTE

1. 'B' with a 'C' programmed for the 'TIMING' (row) phase places a demand on that 'BACKUP' (column) phase. The controller will then service the called phase and proceed normally.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947T5
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp Design 5 (TMP Phase IV)
Sheet 3 of 3

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared In the Offices of:

Transportation Mobility and Safety Division
ITS & Signals Management Section

750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: May 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3...

8/1/2019 DATE

SIG. INVENTORY NO. 05-0947T5

26-JUL-2019 07:34
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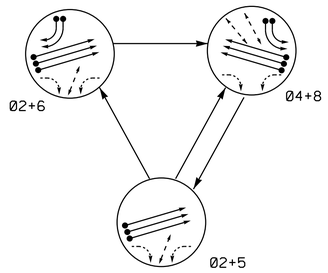
sarmstrong

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 18.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

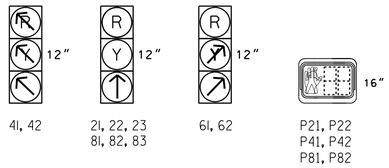
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2+5	Ø2+6	Ø4+8	FLASH
21, 22, 23	↑	↑	R	R
41, 42	↖	↖	↘	↖
61, 62	R	↗	R	R
81, 82, 83	R	R	↑	R
P21, P22	W	W	DW	DRK
P41, P42	DW	DW	W	DRK
P81, P82	DW	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



41, 42 — 21, 22, 23, 81, 82, 83 — 61, 62 — P21, P22, P41, P42, P81, P82

LOOP & DETECTOR INSTALLATION CHART

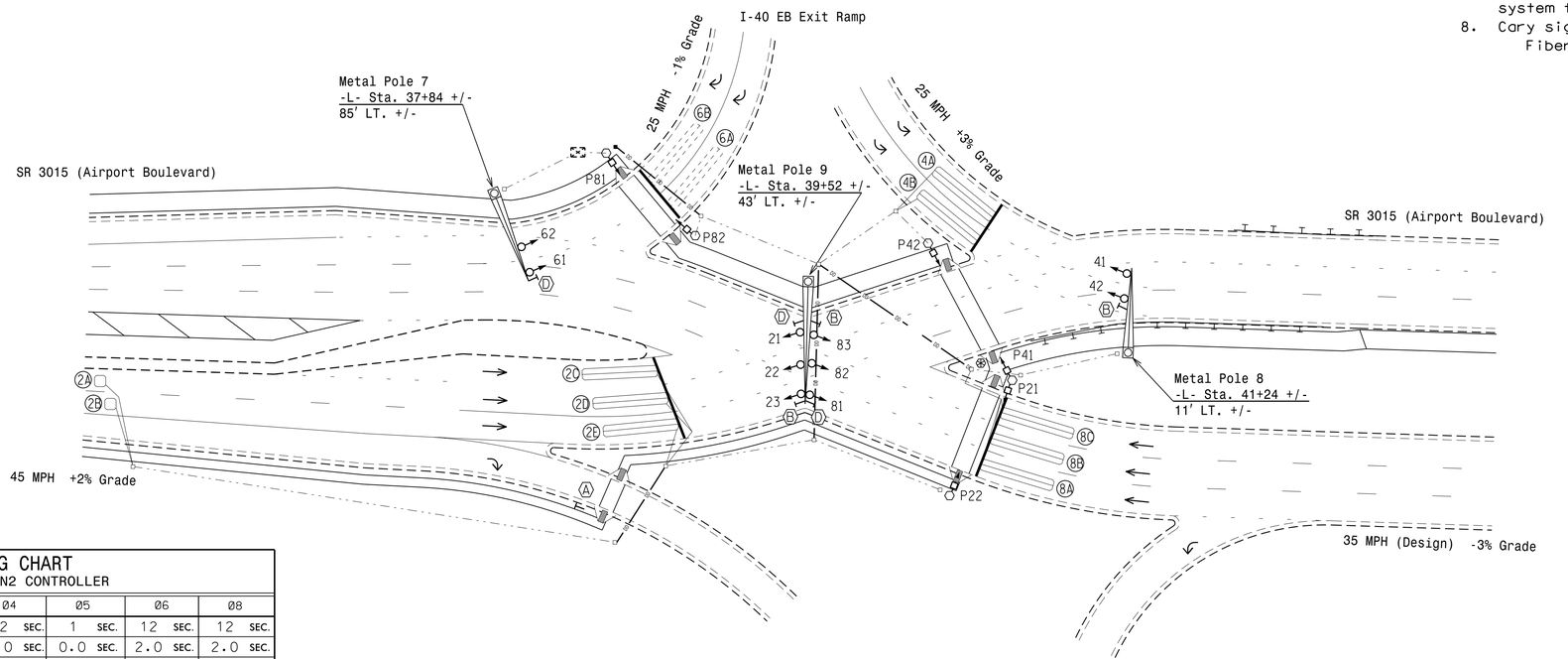
ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

INDUCTIVE LOOPS						DETECTOR UNITS					
LOOP NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME	ADDED INITIAL	DET. TYPE
2A	6X6	300	5	X	-	2	X	-	-	-	X	N
2B	6X6	300	5	X	-	2	X	-	-	-	X	N
2C	6X40	0	2-4-2	X	-	2	X	-	-	-	-	S
2D	6X40	0	2-4-2	X	-	2	X	-	-	-	-	S
2E	6X40	0	2-4-2	X	-	2	X	-	-	-	-	S
4A	6X40	0	2-4-2	X	-	4	-	X	-	-	-	S
4B	6X40	0	2-4-2	X	-	4	-	X	-	-	-	S
6A	6X40	0	2-4-2	-	X	6	-	X	DELAY	15	-	S
6B	6X40	0	2-4-2	-	X	6	-	X	DELAY	15	-	S
8A	6X40	0	2-4-2	X	-	8	-	X	-	-	-	S
8B	6X40	0	2-4-2	X	-	8	-	X	-	-	-	S
8C	6X40	0	2-4-2	X	-	8	-	X	-	-	-	S

3 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Omit phase 6 during phase 4+8 on.
4. Program controller to clear from phase 4+8 to phase 6 by progressing through phase 5 (see Electrical Details).
5. Set all detector units to presence mode.
6. Program controller to start up in all red.
7. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
8. Cary signal system data:
   Fiber channel #: 26.



LEGEND

PROPOSED		EXISTING
○→	Traffic Signal Head	●→
◐→	Modified Signal Head	N/A
⊣	Sign	⊣
□↓	Pedestrian Signal Head	■↓
○→	Signal Pole with Guy	●→
○→	Signal Pole with Sidewalk Guy	●→
▭	Inductive Loop Detector	▭
⊠	Controller & Cabinet	⊠
□	Junction Box	■
----	2-in Underground Conduit	----
N/A	Right of Way	----
→	Directional Arrow	→
▱	Metal Pole with Mastarm	▱
N/A	Curb Ramp	⩚
N/A	Guardrail	⊥⊥
—DD—	Directional Drill	N/A
⊛	Type I Pushbutton Post	⊛
⬡	Type II Signal Pedestal	⬢
Ⓐ	Pedestrian Crossing Sign (W11-2) with Diagonal Arrow Plaque (W16-7pL)	Ⓐ
Ⓑ	No Right Turn Sign (R3-1)	Ⓑ
Ⓓ	No Left Turn Sign (R3-2)	Ⓓ

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	Ø2	Ø4	Ø5	Ø6	Ø8
MINIMUM GREEN *	12 SEC.	12 SEC.	1 SEC.	12 SEC.	12 SEC.
VEHICLE EXT. *	6.0 SEC.	2.0 SEC.	0.0 SEC.	2.0 SEC.	2.0 SEC.
YELLOW CHANGE INT.	4.3 SEC.	4.1 SEC.	3.0 SEC.	4.3 SEC.	4.1 SEC.
RED CLEARANCE	3.3 SEC.	3.2 SEC.	1.0 SEC.	3.2 SEC.	3.2 SEC.
MAX. 1 *	60 SEC.	60 SEC.	1 SEC.	60 SEC.	60 SEC.
RECALL POSITION	SOFT RECALL	NONE	NONE	SOFT RECALL	NONE
LOCK DET.	OFF	OFF	OFF	OFF	OFF
WALK *	7 SEC.	7 SEC.	– SEC.	– SEC.	7 SEC.
PED. CLEAR	9 SEC.	11 SEC.	– SEC.	– SEC.	6 SEC.
VOLUME DENSITY	ON	OFF	OFF	ON	OFF
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	– SEC.	– SEC.	– SEC.	– SEC.	– SEC.
MAX. INITIAL *	– SEC.	– SEC.	– SEC.	– SEC.	– SEC.
TIME B4 REDUCTION *	15 SEC.	– SEC.	– SEC.	– SEC.	– SEC.
TIME TO REDUCE *	50 SEC.	– SEC.	– SEC.	– SEC.	– SEC.
MINIMUM GAP	3.0 SEC.	– SEC.	– SEC.	– SEC.	– SEC.
DUAL ENTRY	ON	ON	ON	ON	ON
SIMULTANEOUS GAP	ON	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust in 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 - Final Design

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

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 Wake County Morrisville

PLAN DATE: March 2019 REVIEWED BY:
PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZYEMBA
DocuSigned by: 7/24/2019
DATE
SIG. INVENTORY NO. 05-0947

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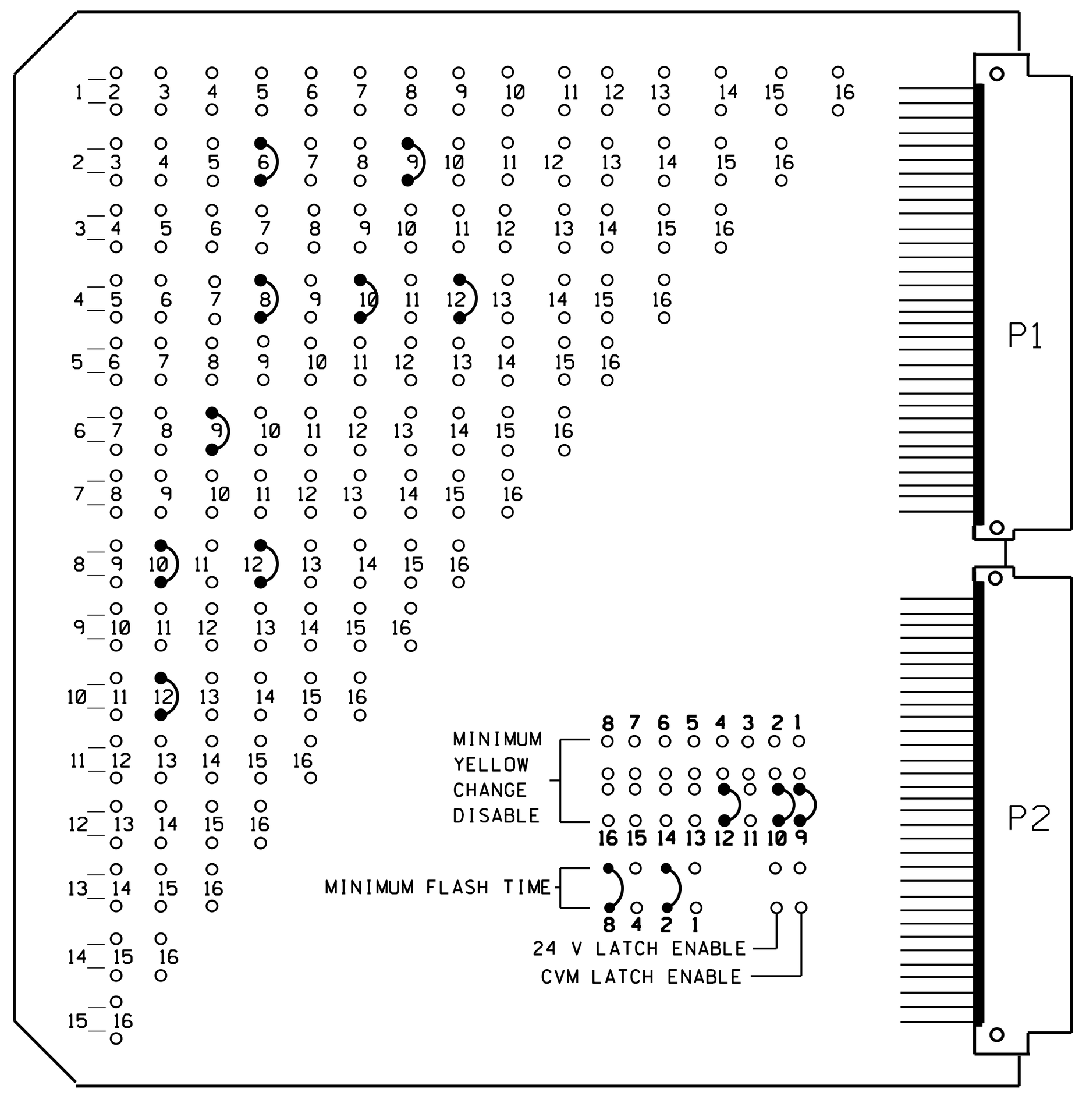
EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	ENABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	ENABLE
9	ENABLE
10	ENABLE
11	DISABLE
12	ENABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	OFF
FYA TRAP DETECT	OFF

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,5,7,11,13,14,15, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up as follows: Main Menu 2-5 MUTCD->YES, ALL RED...6, Phase 2 Walk, Phase 6 Green
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phase 2 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22 23	NU	41,42	NC	61,62	NU	81,82 83	P21, P22	P41, P42	NU	P81, P82	NU	NU	NU	NU
RED		2R				6R		8R								
YELLOW		2Y						8Y								
GREEN																
RED ARROW				4R												
YELLOW ARROW				4Y		6Y										
GREEN ARROW		2G		4G		6G		8G								
(Don't Walk symbol)									9R	10R		12R				
(Walk symbol)									9G	10G		12G				

NU = Not Used

NC = Not Connected

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU										
		CH1 L3 Ø2	CH1 L1 Ø2 **	CH1 L7 Ø4	CH1 L5 Ø2	CH1 L11 Ø8	CH1 L9 Ø6	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
		CH2 L4 Ø2	CH2 L2 Ø2 **	CH2 L8 Ø6	CH2 L6 Ø4	CH2 L12 Ø8	CH2 L10 Ø8					

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
2A	L1A,L1B
2B	L2A,L2B
2C	L3A,L3B
2D	L4A,L4B
2E	L5A,L5B
4A	L6A,L6B
4B	L7A,L7B
6A	L8A,L8B
6B	L9A,L9B
8A	L10A,L10B
8B	L11A,L11B
8C	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING FEATURE	TIMING TIME(SEC)
**1	Ø2		
**2	Ø2		
3	Ø2		
4	Ø2		
5	Ø2		
6	Ø4		
7	Ø4		
8	Ø6	DELAY	15
9	Ø6	DELAY	15
10	Ø8		
11	Ø8		
12	Ø8		
13			
14			
15			
16			

** Detector Type - N

EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,4,6,8,9,10,11,12
PHASES USED.............2,2PED,4,4PED,5*,6,8,8PED
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................NOT USED
OLD.....................NOT USED

* Phase used for timing purposes only

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	Ø1
2	Ø2
3	Ø3
4	Ø4
5	Ø5
6	Ø6
7	Ø7
8	Ø8
9	Ø2 PED
10	Ø4 PED
11	Ø6 PED
12	Ø8 PED
13	OLA
14	OLB
15	OLC
16	OLD

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-0947
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Final Design - Sheet 1 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of:

ITS & Signals Management Section, Mobility and Safety Division

750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard) at I-40 EB Ramps

Division 5 | Wake County | Morrisville

PLAN DATE: May 2019 | REVIEWED BY:

PREPARED BY: S. Armstrong | REVIEWED BY:

REVISIONS | INIT. | DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 8/1/2019

DATE

SIG. INVENTORY NO. 05-0947

29-JUL-2019 09:33
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sarmstrong

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 18.2

ECONOLITE ASC/3-2070 BACKUP PROTECTION ENABLE PROGRAMMING

(program controller as shown)

1. From Main Menu select [1. CONFIGURATION]
2. From CONFIGURATION Submenu select [1. CONTROLLER SEQ]
3. From CONTROLLER SEQUENCE Submenu select [3. BACKUP PREVENT PHASES]

This programming ensures the controller clears from 4+8 to phase 6 by progressing through phase 5 and also ensures the controller will not back up from 2+6 to phase 5.

Follow programming as shown below. On the 'ENABLE BACKUP PREVENT' screen move cursor to the appropriate field and press 'YES/NO' on the controller keypad to toggle field value between 'X' ,'B', 'C' and 'OFF'.

ENABLE BACKUP PREVENT

TMG/BKUP	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6
1		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.
4	.	.	.		C	X	.	.	.	.	.	.	.	.	.	.
5	.	.	.	.		.	.	.	.	.	.	.	.	.	.	.
6	.	.	.	.	X		.	.	.	.	.	.	.	.	.	.
7	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.
8	.	.	.	.	C	X	.		.	.	.	.	.	.	.	.
9	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.
10	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.
11	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.
12	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.
13	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.
14	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

END PROGRAMMING

NOTE

1. 'B' with a 'C' programmed for the 'TIMING' (row) phase places a demand on that 'BACKUP' (column) phase. The controller will then service the called phase and proceed normally.

ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select [1. CONFIGURATION]
2. From CONFIGURATION Submenu select [4. PORT 1 (SDLC)]
3. From PORT 1 (SDLC) Submenu select [2. MMU PROGRAM]

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

MMU PROGRAM [MANUAL]

CH	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	X	.	.	X	.	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	.	.	.	.	X	.	X	.	X	.	.	.			
5	.	.	.	.	.	.	.	.	.	.	.				
6	.	.	.	.	.	.	.	X	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	X	.	X	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	X	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	.														

END PROGRAMMING

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Final Design - Sheet 2 of 3

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

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

750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 | Wake County | Morrisville

PLAN DATE: May 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3...

8/1/2019
DATE

SIG. INVENTORY NO. 05-0947

26-JUL-2019 07:35
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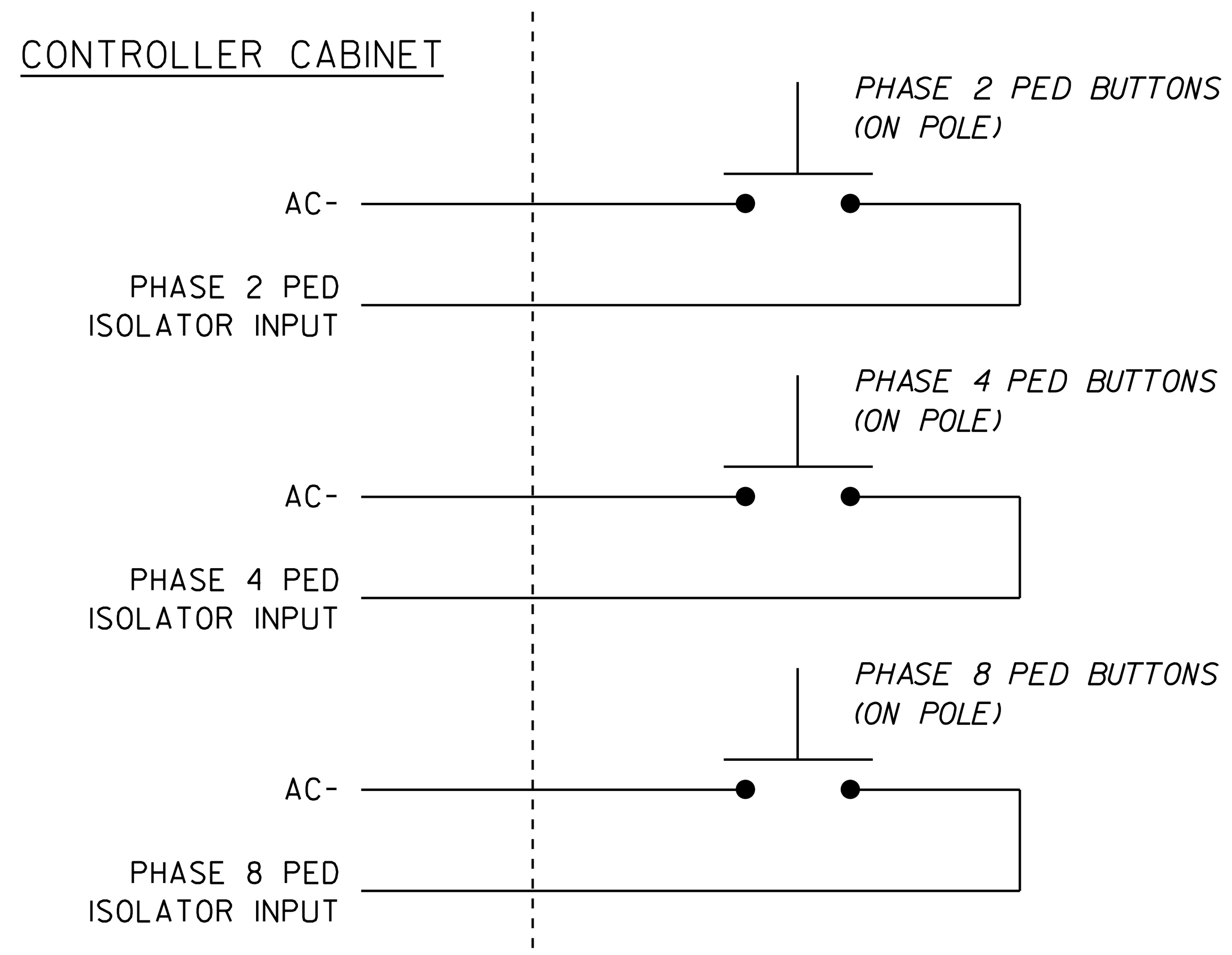
sarmstrong

PEDESTRIAN PUSH BUTTON WIRING DETAIL

(wire push buttons as shown)



COUNTDOWN PEDESTRIAN SIGNAL OPERATION

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

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-0947
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Final Design - Sheet 3 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of:

ITS & Signals Management Section, Transportation Mobility and Safety Division, Department of Transportation, State of North Carolina

750 N.Greenfield Pkwy,Garner,NC 27529

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 | Wake County | Morrisville

PLAN DATE: May 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

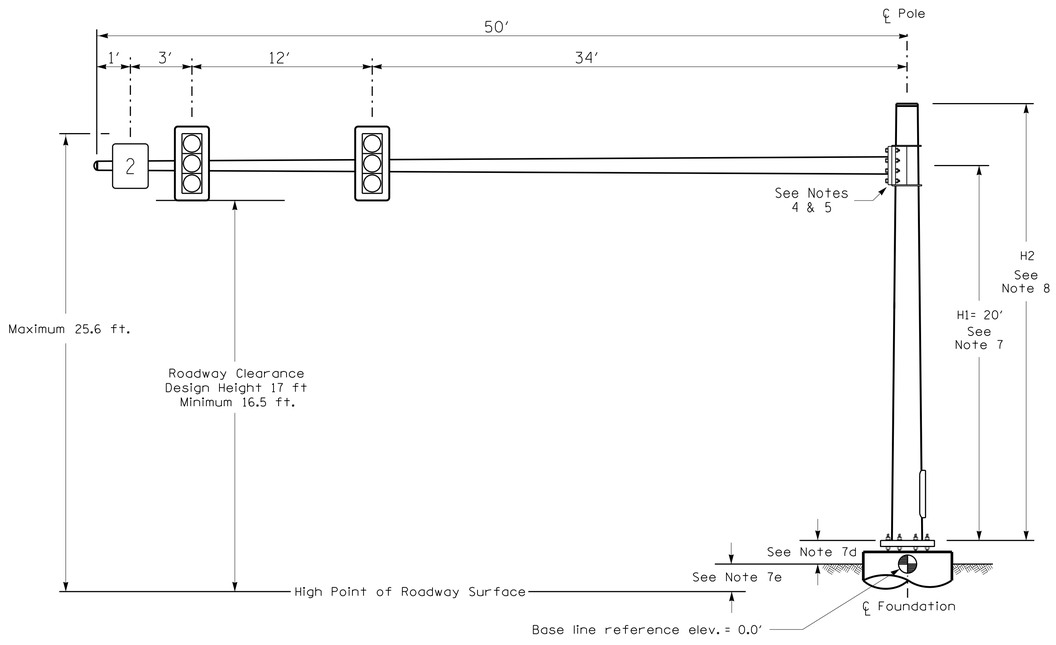
DocuSigned by: Ryan W. Hough
430320EAA2654C3

8/1/2019
DATE

SIG. INVENTORY NO. 05-0947

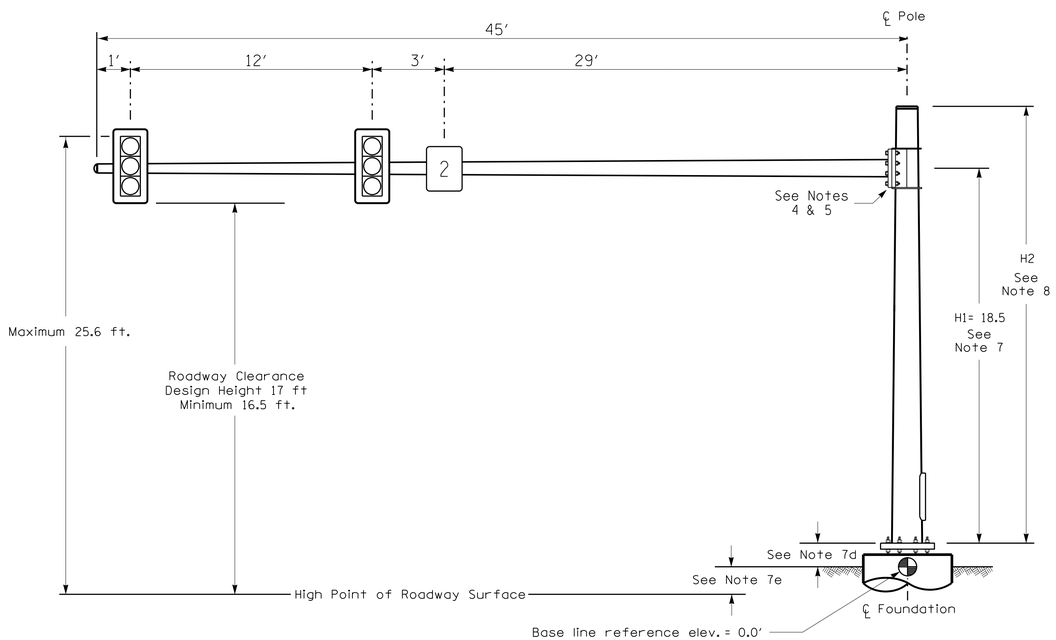
26-JUL-2019 07:35
.*050947_sm_ele_xxx.dgn
sarmstrong

Design Loading for METAL POLE NO. 7



Elevation View

Design Loading for METAL POLE NO. 8



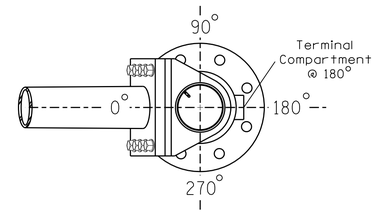
Elevation View

SPECIAL NOTE

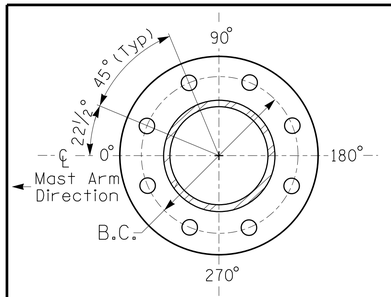
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 7	Pole 8
Baseline reference point at ℄ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	+1.5 ft.	-0.3 ft.
Elevation difference at Edge of travelway or face of curb	+0.4 ft.	-0.3 ft.

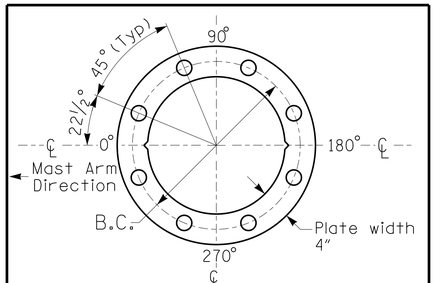


POLE RADIAL ORIENTATION



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 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

NOTES

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
   - The 2018 NCDOT "Standard Specifications for Roads and Structures." The latest addenda to the specifications can be found in the traffic signal project special provisions.
   - The 2018 NCDOT Roadway Standard Drawings.
   - The traffic signal project plans and special provisions.
   - The NCDOT "Metal Pole Standards" located at the following NCDOT website: https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. The camber design for the mast arm deflection should provide an appearance of a low pitched arch where the tip or the free end of the mast arm does not deflect below horizontal when fully loaded.
5. A clamp-type bolted mast arm-to-pole connection may be used instead of the welded ring stiffened box connection shown as long as the connection meets all of the design requirements.
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.

NCDOT Wind Zone 4 (90 mph)

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

SR 3015 (Airport Boulevard)
at
I-40 EB Ramps

Division 5 Wake County Cary

PLAN DATE: March 2019 REVIEWED BY:
PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

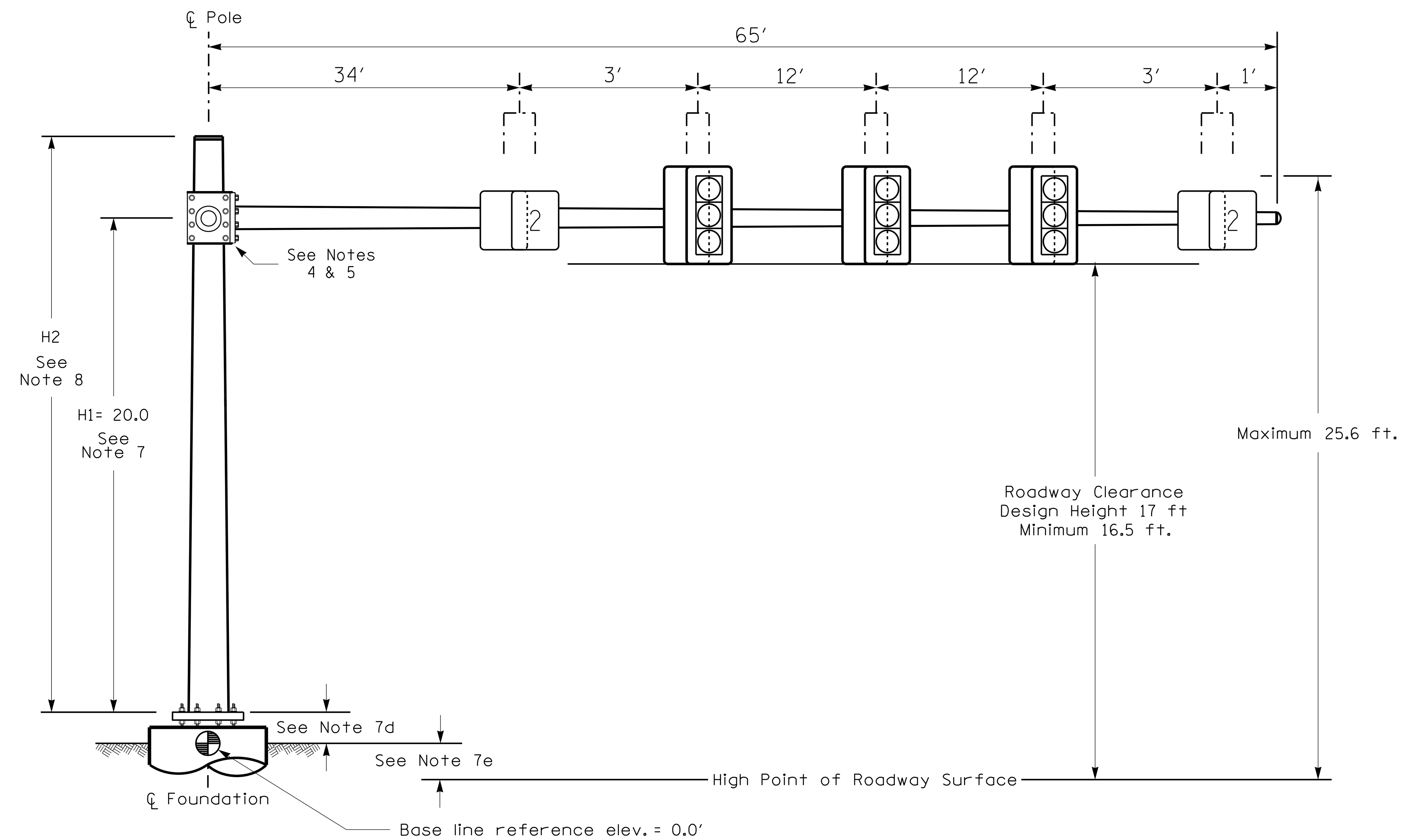
DocuSigned by: 8/5/2019
DATE

SIG. INVENTORY NO. 05-0947

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 18.5

METAL POLE No. 9

Design Loading for METAL POLE NO. 9



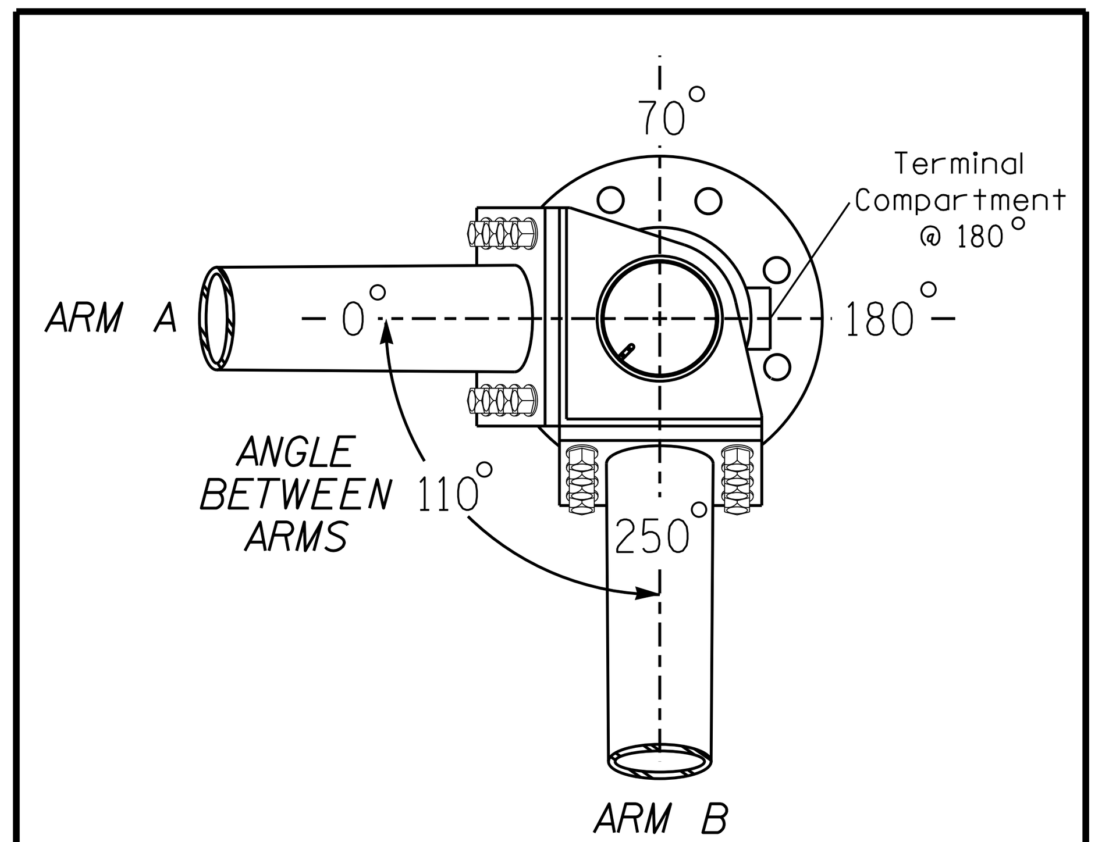
Elevation View @ 0°

SPECIAL NOTE

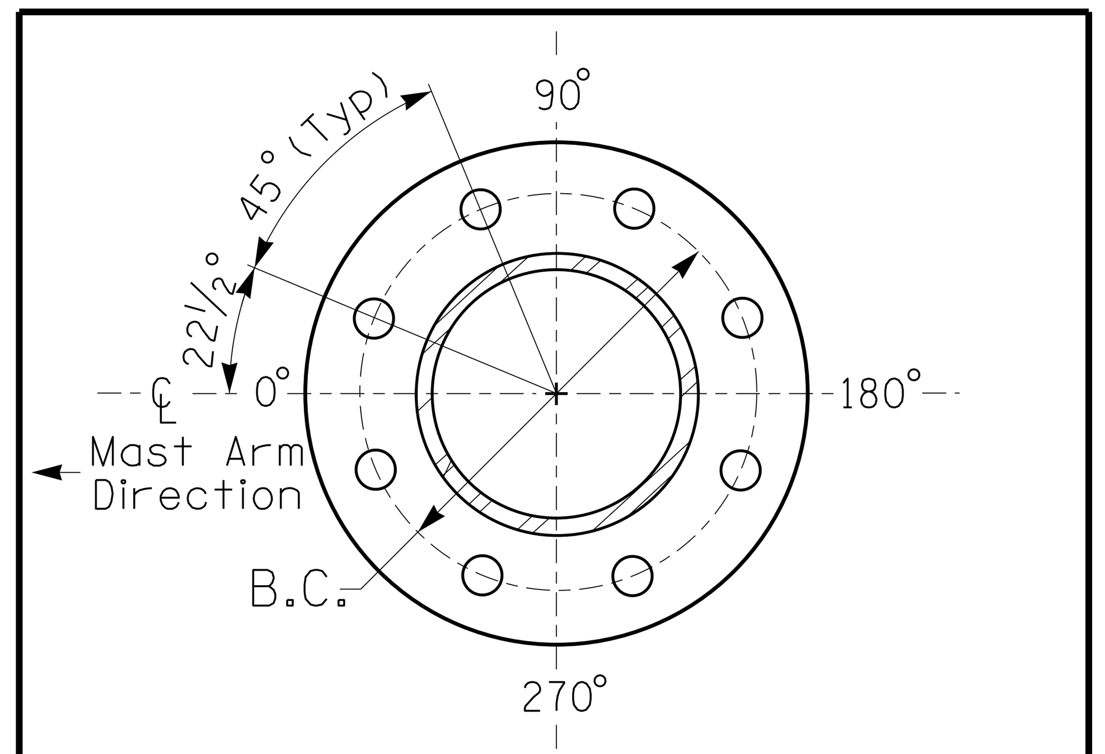
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 9	
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	+0.8 ft.	

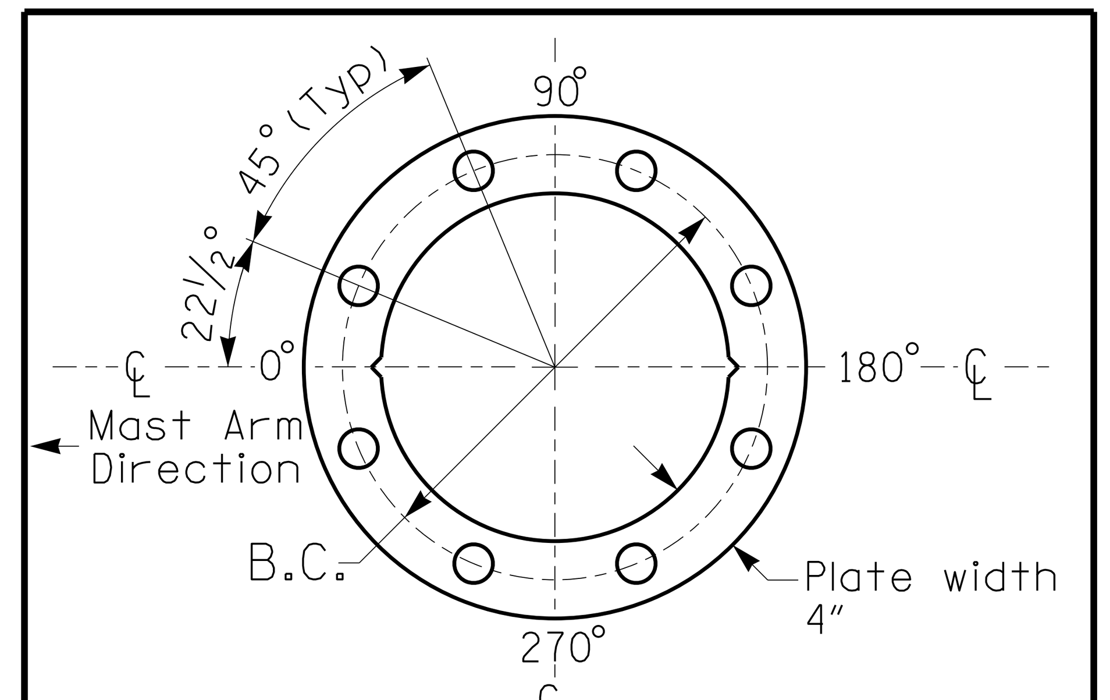


POLE RADIAL ORIENTATION



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 head)	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

NOTES

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1. Design the traffic signal structure and foundation in accordance with:
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   - The traffic signal project plans and special provisions.
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DESIGN REQUIREMENTS

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3. Design all signal supports using stress ratios that do not exceed 0.9.
4. The camber design for the mast arm deflection should provide an appearance of a low pitched arch where the tip or the free end of the mast arm does not deflect below horizontal when fully loaded.
5. A clamp-type bolted mast arm-to-pole connection may be used instead of the welded ring stiffened box connection shown as long as the connection meets all of the design requirements. This requires staggering the connections. Use elevation data for each arm to determine appropriate arm connection points.
6. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
7. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
8. The pole manufacturer will determine the total height (H2) of each pole using the greater of the following:
   - Mast arm attachment height (H1) plus 2 feet, or
   - H1 plus 1/2 of the total height of the mast arm attachment assembly plus 1 foot.
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NCDOT Wind Zone 4 (90 mph)

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

SCALE 0 N/A
N/A

SR 3015 (Airport Boulevard)
at
I-40 Eastbound Ramp

Division 5 | Wake County | Cary

PLAN DATE:	March 2019	REVIEWED BY:
PREPARED BY:	J.A. Lohr	REVIEWED BY:

REVISIONS	INIT.	DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA

8/5/2019
DATE

SIG. INVENTORY NO. 05-0947

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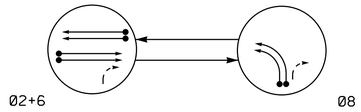
PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 19.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

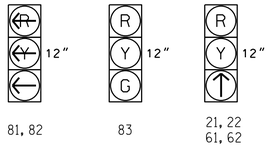
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 02+6	PHASE 08	PHASE FLASH
21, 22	↑	R	Y
61, 62	↑	R	Y
81, 82	~~R~~	←	~~R~~
83	R	G	R

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

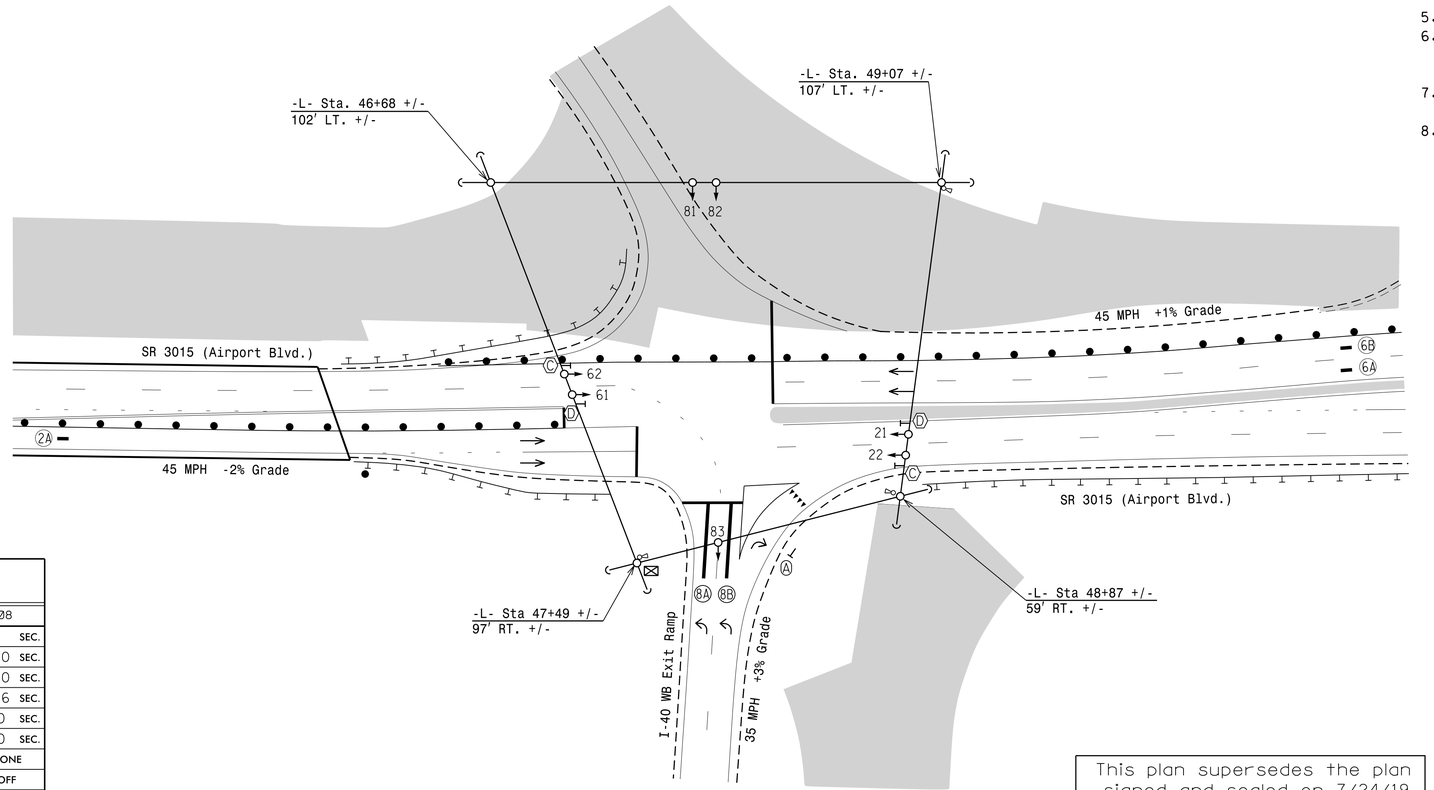
INDUCTIVE LOOPS						DETECTOR UNITS						
ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME (sec)	ADDED INITIAL	DET. TYPE
2A*	6X6	300	*	X	-	2	*	-	-	-	X	N
6A*	6X6	300	*	X	-	6	*	-	-	-	X	N
6B*	6X6	300	*	X	-	6	*	-	-	-	X	N
8A*	6X40	0	*	X	-	4	*	-	-	-	-	S
8B*	6X40	0	*	X	-	4	*	-	DELAY	3	-	S

*Video detection zone.

2 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
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. Pavement markings are existing.
6. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
7. Cary signal system data:
   Fiber Chabnnel #: 26.
8. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



This plan supersedes the plan signed and sealed on 7/24/19.

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	I I
⋈	Video Detector	●◤
▬	Video Detection Area	▬
•-•	Construction Zone Drums	•-•
▒	Construction Zone	▒
Ⓐ	"YIELD" Sign (R1-2)	Ⓐ
Ⓒ	No Right Turn Sign (R3-1)	Ⓒ
Ⓓ	No U-Turn / No Left Turn Sign (R3-18)	Ⓓ

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	02	06	08
MINIMUM GREEN *	12 SEC.	12 SEC.	7 SEC.
VEHICLE EXT. *	6.0 SEC.	6.0 SEC.	2.0 SEC.
YELLOW CHANGE INT.	4.7 SEC.	4.7 SEC.	3.0 SEC.
RED CLEARANCE	1.0 SEC.	1.0 SEC.	2.6 SEC.
MAX. 1 *	120 SEC.	120 SEC.	50 SEC.
MAX. 2 *	35 SEC.	35 SEC.	90 SEC.
RECALL POSITION	MIN. RECALL	MIN. RECALL	NONE
LOCK DET.	ON	ON	OFF
WALK *	– SEC.	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.	– SEC.
VOLUME DENSITY	ON	ON	OFF
ACTUATION B4 ADD *	– VEH.	– VEH.	– VEH.
SEC. PER ACTUATION *	2.5 SEC.	1.5 SEC.	– SEC.
MAX. INITIAL *	34 SEC.	34 SEC.	– SEC.
TIME B4 REDUCTION *	15 SEC.	15 SEC.	– SEC.
TIME TO REDUCE *	45 SEC.	45 SEC.	– SEC.
MINIMUM GAP	3.0 SEC.	3.0 SEC.	– SEC.
DUAL ENTRY	OFF	OFF	OFF
SIMULTANEOUS GAP	ON	ON	ON

* 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 II)

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

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 Wake County Morrisville

PLAN DATE: September 2019 REVIEWED BY:

PREPARED BY: J.A. Lohr REVIEWED BY:

REVISIONS	INIT.	DATE

SCALE 0 40 1"=40'

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIEMBA
DocuSigned by: 10/2/2019 DATE

SIG. INVENTORY NO. 05-1168T1

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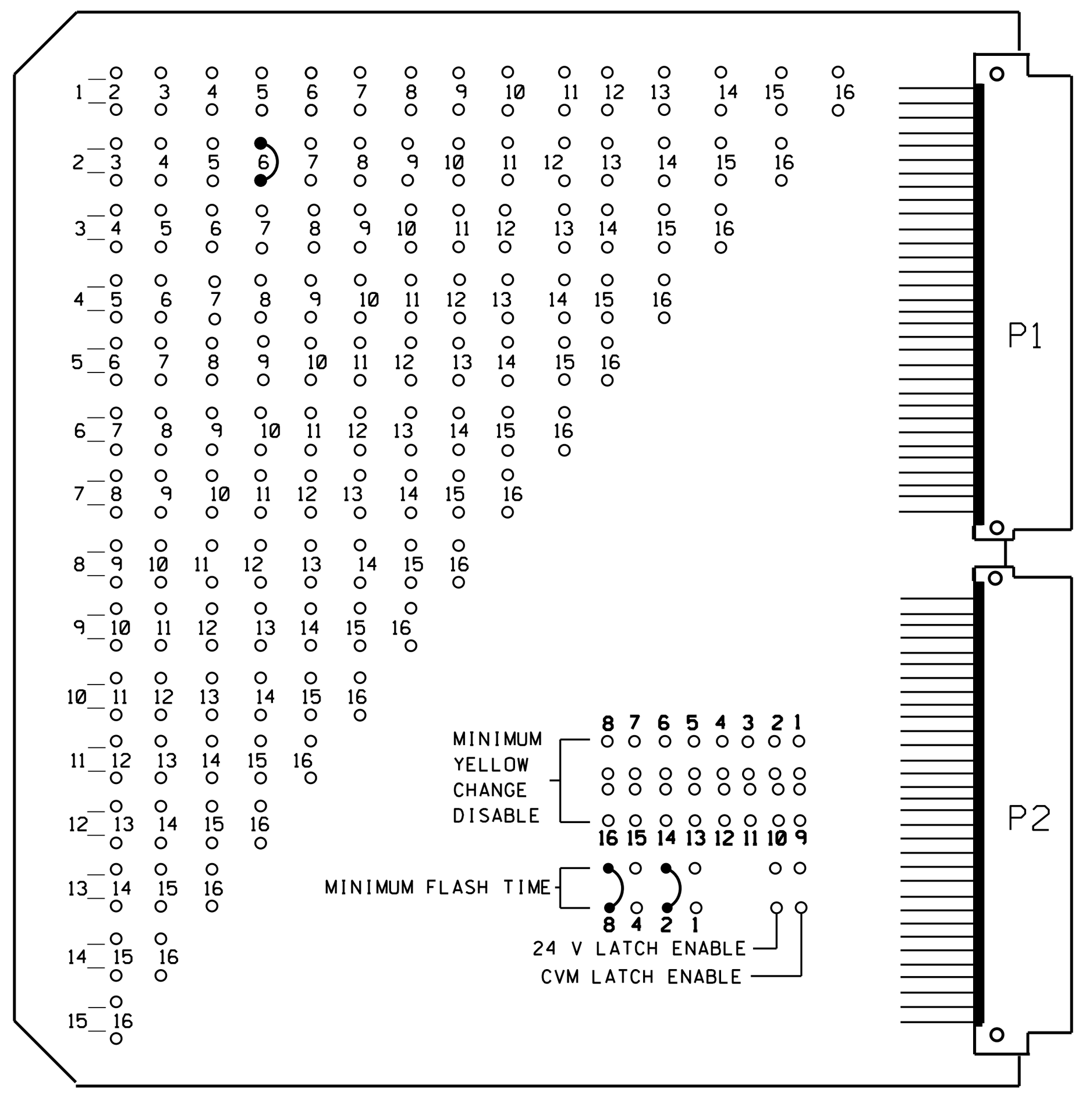
rziemba

EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	DISABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	ENABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	DISABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	OFF
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	OFF
CH 7	OFF
FLASH RATE FAULT	OFF
FYA TRAP DETECT	OFF

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,4,5,7,9,10,11,12,13,14,15, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 2 Green and 6 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 2 and 6 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

SIGNAL HEAD HOOK-UP CHART

PHASE	1	2	3	4	5	6	7	8		2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22	NU	NU	NU	61,62	NU	81,82	83	NU	NU	NU	NU	NU	NU	NU	NU
RED		2R				6R			8R								
YELLOW		2Y				6Y			8Y								
GREEN									8G								
RED ARROW																	
YELLOW ARROW								8R									
FLASHING YELLOW ARROW								8Y									
GREEN ARROW		2G				6G		8G									
✋																	
🚶																	

NU = Not Used

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW. PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY

EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,6,8
PHASES USED.............2,6,8
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................NOT USED
OLD.....................NOT USED

THIS ELECTRICAL DETAIL SUPERSEDES THE DETAIL SEALED ON 8/1/2019.

WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
NU	L1A,L1B
NU	L2A,L2B
NU	L3A,L3B
NU	L4A,L4B
NU	L5A,L5B
NU	L6A,L6B
NU	L7A,L7B
NU	L8A,L8B
NU	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168T1
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

LOAD SWITCH ASSIGNMENT DETAIL

(program controller according to schedule in chart below)

LOAD SWITCH NUMBER	FUNCTION
1	ø1
2	ø2
3	ø3
4	ø4
5	ø5
6	ø6
7	ø7
8	ø8
9	ø2 PED
10	ø4 PED
11	ø6 PED
12	ø8 PED
13	OLA
14	OLB
15	OLC
16	OLD

SPECIAL DETECTOR NOTE

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

Electrical Detail - Temp Design 1 (TMP Phase II)
Sheet 1 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard) at I-40 WB Ramps

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

750 N.Greenfield Pkwy,Garner,NC 27529

Division 5 Wake County Morrisville

PLAN DATE: October 2019	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... DATE 10/8/2019

SIG. INVENTORY NO. 05-1168T1

03-OCT-2019 07:43
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sarmstrong

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 19.2

ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select **1. CONFIGURATION**
2. From CONFIGURATION Submenu select **4. PORT 1 (SDLC)**
3. From PORT 1 (SDLC) Submenu select **2. MMU PROGRAM**

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

```
MMU PROGRAM [     MANUAL]

       CH  6 5 4 3 2 1 0 9 8 7 6 5 4 3 2
        1  . . . . . . . . . . . . . . .
        2  . . . . . . . . . . X . . .
        3  . . . . . . . . . . . . . .
        4  . . . . . . . . . . . .
        5  . . . . . . . . . . . .
        6  . . . . . . . . . .
        7  . . . . . . . . .
        8  . . . . . . . . .
        9  . . . . . . . .
       10  . . . . . .
       11  . . . . .
       12  . . . .
       13  . . .
       14  . .
       15  .
```

END PROGRAMMING

THIS ELECTRICAL DETAIL SUPERSEDES THE DETAIL SEALED ON 8/1/2019.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168T1
DESIGNED: September 2019
SEALED: 10/2/2019
REVISED: N/A

Electrical Detail - Temp Design 1 (TMP Phase II)
Sheet 2 of 2

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 | Wake County | Morrisville

PLAN DATE: October 2019 | REVIEWED BY:

PREPARED BY: S. Armstrong | REVIEWED BY:

REVISIONS	INIT.	DATE

Prepared in the Offices of:
Transportation Mobility and Safety Division
NC DEPARTMENT OF TRANSPORTATION
Traffic Engineering & Signal Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 10/8/2019
430320FAA2654C3... DATE

SIG. INVENTORY NO. 05-1168T1

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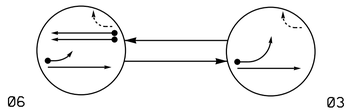
PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig 20.0

PHASING DIAGRAM



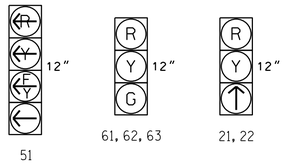
PHASING DIAGRAM DETECTION LEGEND

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

TABLE OF OPERATION			
SIGNAL FACE	PHASE Ø6	PHASE Ø3	PHASE FLASH
21, 22	↑	↑	Y
51	←/Y	←	Y
61, 62, 63	G	R	Y

SIGNAL FACE I.D.

All Heads L.E.D.



LOOP & DETECTOR INSTALLATION CHART

ASC/3-2070EN2 CONTROLLER w/ TS-2 CABINET

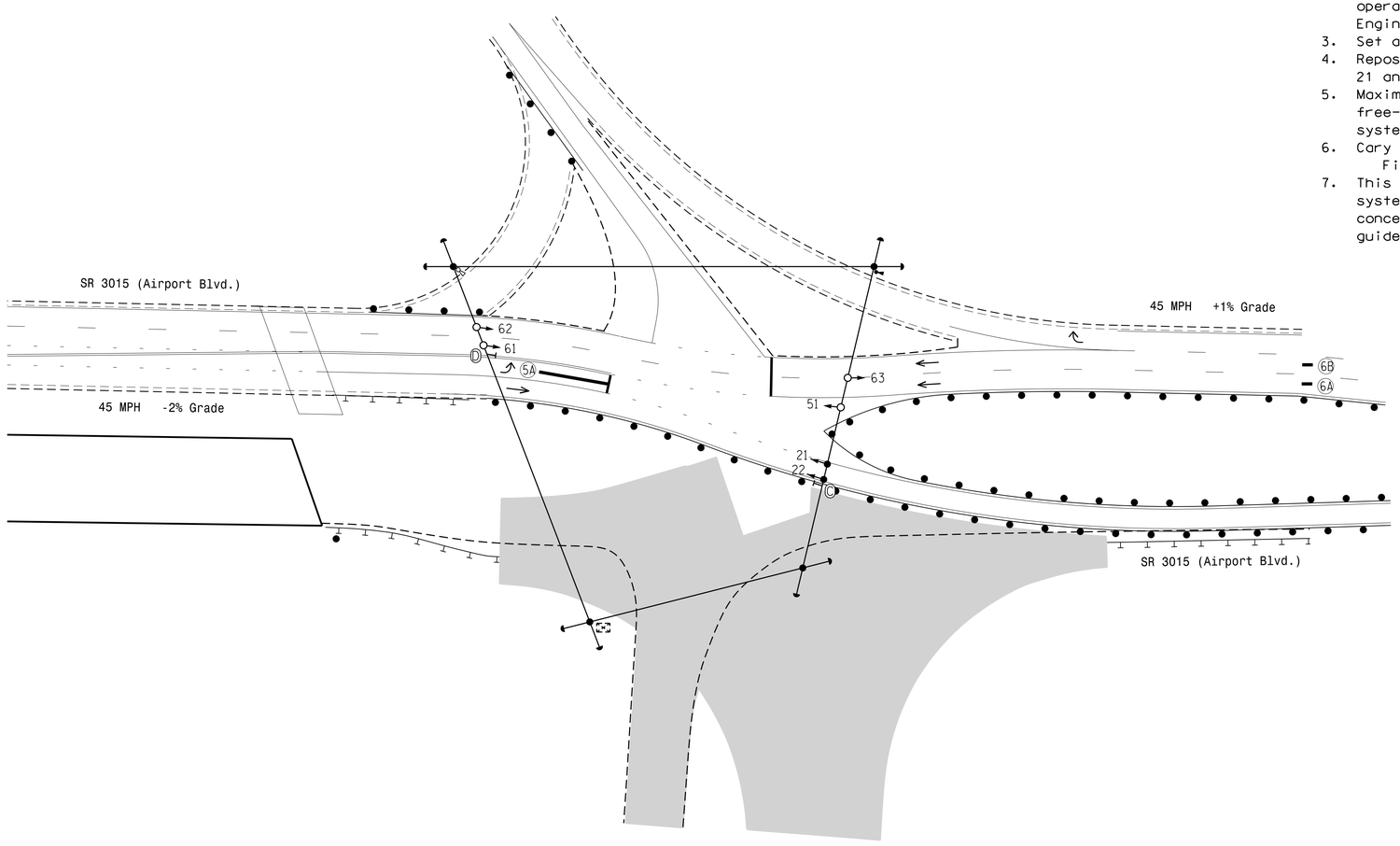
INDUCTIVE LOOPS						DETECTOR UNITS						
ZONE NO.	SIZE (ft)	DIST. FROM STOPBAR (ft)	TURNS	NEW	EXISTING	NEMA PHASE	NEW	EXISTING	TIMING FEATURE	TIMING TIME (sec)	ADDED INITIAL	DET. TYPE
5A*	6X40	0	*	X	-	3	-	*	DELAY	15	-	S
6A*	6X6	300	*	X	-	6	-	*	-	-	X	N
6B*	6X6	300	*	X	-	6	-	*	-	-	X	N

* Video detection zone.

2 Phase
Fully Actuated
(Cary Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
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. Reposition existing signal heads numbered 21 and 22.
5. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
6. Cary signal system data:
   Fiber Chabnnel #: 26.
7. This intersection features a video detection system. Shown locations of detectors are conceptual only. Refer to the manufacturer's guidelines for optimal detector placement.



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	⊣⊣
⋈	Video Detector	⋈
▬	Video Detection Area	▬
●●	Construction Zone Drums	●●
▒	Construction Zone	▒
Ⓒ	No Right Turn Sign (R3-1)	Ⓒ
Ⓓ	No U-Turn / No Left Turn Sign (R3-18)	Ⓓ

TIMING CHART

ASC/3-2070EN2 CONTROLLER

PHASE	03	06
MINIMUM GREEN *	7 SEC.	12 SEC.
VEHICLE EXT. *	2.0 SEC.	6.0 SEC.
YELLOW CHANGE INT.	3.0 SEC.	4.4 SEC.
RED CLEARANCE	1.9 SEC.	1.2 SEC.
MAX. 1 *	35 SEC.	120 SEC.
MAX. 2 *	15 SEC.	35 SEC.
RECALL POSITION	NONE	MIN. RECALL
LOCK DET.	OFF	ON
WALK *	– SEC.	– SEC.
PED. CLEAR	– SEC.	– SEC.
VOLUME DENSITY	OFF	ON
ACTUATION B4 ADD *	– VEH.	– VEH.
SEC. PER ACTUATION *	– SEC.	1.5 SEC.
MAX. INITIAL *	– SEC.	34 SEC.
TIME B4 REDUCTION *	– SEC.	15 SEC.
TIME TO REDUCE *	– SEC.	45 SEC.
MINIMUM GAP	– SEC.	3.0 SEC.
DUAL ENTRY	OFF	OFF
SIMULTANEOUS GAP	ON	ON

* 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 III, Step A)

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

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

Division 5 Wake County Morrisville

PLAN DATE: March 2018 REVIEWED BY:
PREPARED BY: J.A. Lohr REVIEWED BY:

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 026486 ENGINEER ROBERT J. ZIMBA

DocuSigned by: 7/24/2019
DATE

SIG. INVENTORY NO. 05-1168T2

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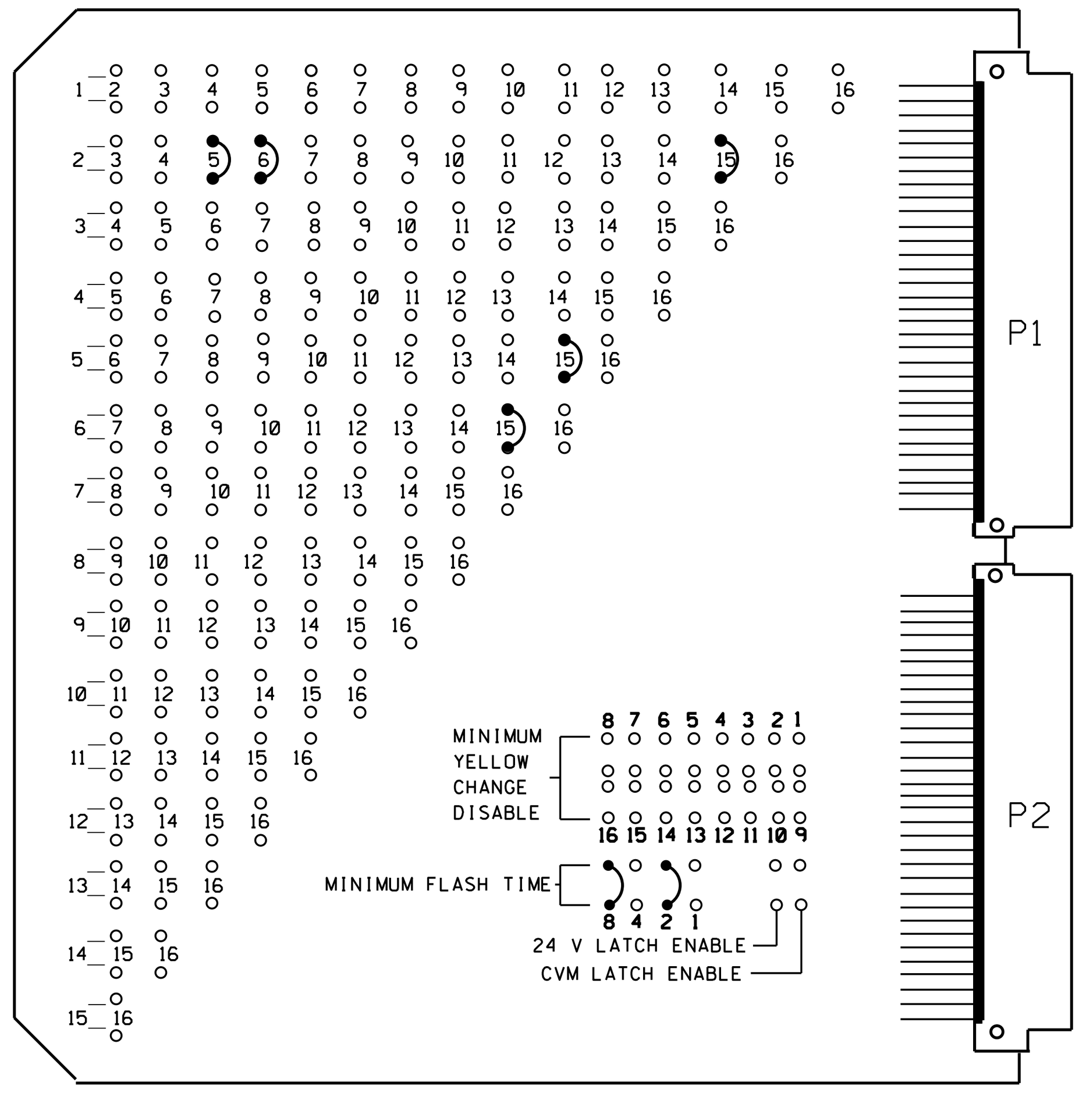
EDI MODEL MMU2-16LEip MALFUNCTION MANAGEMENT UNIT PROGRAMMING DETAIL

(program card and tables as shown below)



MMU PROGRAMMING CARD

FIELD CHECK ENABLE DUAL IND ENABLE RED FAIL ENABLE	
CHANNEL NUMBER	ENABLE/ DISABLE
1	DISABLE
2	ENABLE
3	DISABLE
4	DISABLE
5	DISABLE
6	ENABLE
7	DISABLE
8	DISABLE
9	DISABLE
10	DISABLE
11	DISABLE
12	DISABLE
13	DISABLE
14	DISABLE
15	ENABLE
16	DISABLE

UNIT OPTIONS	
OPTION	SETTING
RECURRENT PULSE	ON
WALK DISABLE	OFF
LOG CVM FAULTS	ON
EXTERN WATCHDOG	OFF
24V-2=12VDC	OFF
PGM CARD MEMORY	ON
LEDguard	ON
FORCE TYPE 16	OFF
TYPE12-SDLC	OFF
VM 3x/Day Latch	ON

FLASHING YELLOW ARROW	
CONFIG MODE	B
ENABLE CHANNEL PAIR, FYA	
CH 1-13	OFF
CH 3-14	OFF
CH 5-15	ON
CH 7-16	OFF
RED/YEL INPUT ENABLE	
CH 1	OFF
CH 3	OFF
CH 5	ON
CH 7	OFF
FLASH RATE FAULT	ON
FYA TRAP DETECT	ON

MMU PROGRAMMING NOTE

ENSURE YELLOW CHANGE PLUS RED CLEARANCE MONITORING IS ENABLED FOR ALL CHANNELS.

NOTES

1. To prevent "flash-conflict" problems, wire all unused load switches to flash red. Verify that signal heads flash in accordance with the signal plans.
2. To prevent red failures on unused monitor channels, tie unused load switch red outputs 1,3,4,7,8,9,10,11,12,13,14, and 16 to load switch AC+ by inserting a jumper plug in the unused load switch socket from pin 1 (LS AC+) to pin 3 (RED out). Make sure all flash transfer relays are in place.
3. Program controller to start up in phase 6 Green.
4. Set power-up flash time to 10 seconds and implement on the Malfunction Management Unit. Set controller power-up flash time to 0 seconds.
5. Enable simultaneous gap-out feature for all phases.
6. Program detectors in accordance with the manufacturer's instructions to accomplish the detection schemes shown on the signal design plans.
7. Program detector call delay and extension timing on the controller, unless otherwise specified.
8. Set all detector card unit channels to "presence" mode.
9. Program phases 2 and 6 for volume density operation.
10. The cabinet and controller are a part of the Cary Signal System.

PROJECT REFERENCE NO.	SHEET NO.
I-5700	Sig. 20.1

SIGNAL HEAD HOOK-UP CHART

PHASE	1	OLE	3	4	OLF	6	7	8	2 PED	4 PED	6 PED	8 PED	OLA	OLB	OLC	OLD
SIGNAL HEAD NO.	NU	21,22	NU	NU	51★	61,62 63	NU	NU	NU	NU	NU	NU	NU	NU	51★	NU
RED		2R			✳	6R										
YELLOW		2Y			✳	6Y										
GREEN						6G										
RED ARROW															15R	
YELLOW ARROW															15Y	
FLASHING YELLOW ARROW															15G	
GREEN ARROW		2G			5G											
(hand symbol)																
(pedestrian symbol)																

NU = Not Used

✳ Denotes install load resistor. See Load Resistor Installation Detail on sheet 2.

★ See pictorial of head wiring detail this sheet.

NOTE: Load switches 1 and 6 have been reassigned as overlaps. See sheet 3 for programming details.

DETECTOR RACK SET-UP DETAIL

INSERT DETECTOR CARDS IN RACK ACCORDING TO THE DETAIL SHOWN BELOW.
PARTICULAR DETECTOR CHANNELS WILL CALL PHASES INDICATED.

RACK #1	BIU	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY

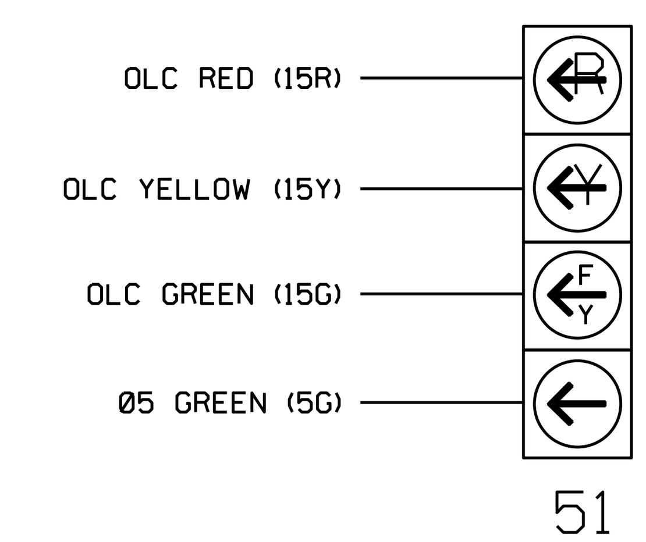
EQUIPMENT INFORMATION

CONTROLLER..............2070EN2
CABINET NC-8 TS-2
SOFTWARE ....ECONOLITE ASC/3-2070
CABINET MOUNT...........BASE
LOADBAY POSITIONS.......16
LOAD SWITCHES USED......2,5,6,15
PHASES USED.............3,6
OLA.....................NOT USED
OLB.....................NOT USED
OLC.....................✳
OLD.....................NOT USED
OLE.....................3+6
OLF.....................3

✳ SEE OVERLAP PROGRAMMING DETAIL ON SHEET 2

FYA SIGNAL WIRING DETAIL

(wire signal head as shown)



WIRE LOOPS TO TERMINALS ON LOOP PANEL AS SHOWN IN THE CHART BELOW

LOOP NO.	LOOP PANEL TERMINALS
NU	L1A,L1B
NU	L2A,L2B
NU	L3A,L3B
NU	L4A,L4B
NU	L5A,L5B
NU	L6A,L6B
NU	L7A,L7B
NU	L8A,L8B
NU	L9A,L9B
NU	L10A,L10B
NU	L11A,L11B
NU	L12A,L12B
NU	L13A,L13B
NU	L14A,L14B
NU	L15A,L15B
NU	L16A,L16B

PROGRAM CONTROLLER DETECTORS ACCORDING TO THE SCHEDULE SHOWN IN THE CHART BELOW

CONTROLLER DETECTOR NO.	FUNCTION	TIMING	
		FEATURE	TIME(SEC)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168T2
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

SPECIAL DETECTOR NOTE

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

Electrical Detail - Temp Design 2 (TMP Phase III, Step A)
Sheet 1 of 3

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ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 3015 (Airport Boulevard)
at
I-40 WB Ramps

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

Division 5 Wake County Morrisville

PLAN DATE: May 2015	REVIEWED BY:
PREPARED BY: S. Armstrong	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 036833 ENGINEER RYAN W. HOUGH

DocuSigned by: Ryan W. Hough 430320FAA2654C3... DATE 8/1/2019

SIG. INVENTORY NO. 05-1168T2

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sarmstrong

ECONOLITE ASC/3-2070 OVERLAP PROGRAMMING DETAIL

(program controller as shown)

1. From Main Menu select [2. CONTROLLER]
2. From CONTROLLER Submenu select [2. VEHICLE OVERLAPS]

Toggle to reach Overlap F

OVERLAP F

Select TMG VEH OVLP [F] and 'NORMAL'

```
TMG VEH OVLP...[F] TYPE: .......NORMAL
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . X . . . . . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

Toggle to reach Overlap C

OVERLAP C

Select TMG VEH OVLP [C] and 'PPLT FYA'

```
TMG VEH OVLP...[C] TYPE: .....PPLT FYA

PROTECTED LEFT TURN....   OVERLAP  F
OPPOSING THROUGH.......   PHASE    6

FLASHING ARROW OUTPUT.....CH15 ISOLATE

DELAY START OF: FYA..0.0 CLEARANCE..0.0
ACTION PLAN SF BIT DISABLE........... 0
```

Toggle Twice

OVERLAP E

Select TMG VEH OVLP [E] and 'NORMAL'

```
TMG VEH OVLP...[E] TYPE: .......NORMAL
  PHASES 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
INCLUDED . . X . . X . . . . . . . . . .

LAG GRN 0.0 YEL 0.0 RED 0.0
```

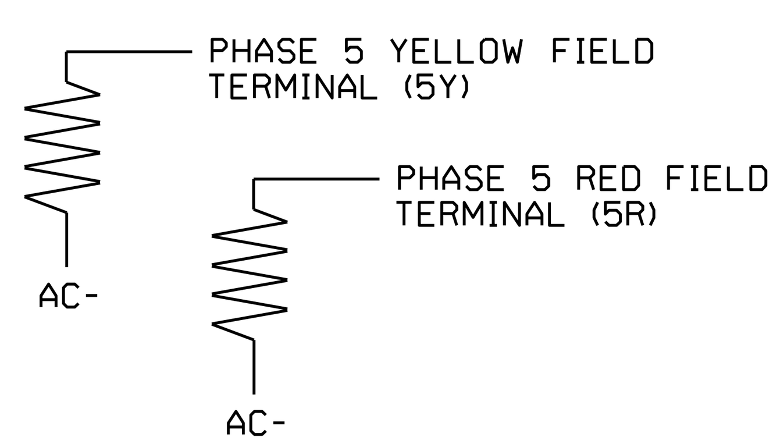
END PROGRAMMING

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES

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



ECONOLITE ASC/3-2070 SPECIAL MMU PROGRAMMING

(program controller as shown)

1. From Main Menu select [1. CONFIGURATION]
2. From CONFIGURATION Submenu select [4. PORT 1 (SDLC)]
3. From PORT 1 (SDLC) Submenu select [2. MMU PROGRAM]

CAUTION!

Set intersection to Flash before attempting to enter or change any MMU programming data.

This programming and that of the MMU programming card must match exactly. If they do not, the intersection will be placed into Flash.

```
MMU PROGRAM [     MANUAL]

      CH  6 5 4 3 2 1 0 9 8 7 6 5 4 3 2
       1  . . . . . . . . . . . . . . .
       2  . X . . . . . . . . X X . .
       3  . . . . . . . . . . . . .
       4  . . . . . . . . . . . .
       5  . X . . . . . . . . .
       6  . X . . . . . . . .
       7  . . . . . . . . .
       8  . . . . . . . .
       9  . . . . . . .
      10  . . . . . .
      11  . . . . .
      12  . . . .
      13  . . .
      14  . .
      15  .
```

END PROGRAMMING

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1168T2
DESIGNED: March 2019
SEALED: 7/24/2019
REVISED: N/A

Electrical Detail - Temp Design 2 (TMP Phase III, Step A)
Sheet 2 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

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

SR 3015 (Airport Boulevard)
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I-40 WB Ramps

Division 5	Wake County	Morrisville
PLAN DATE: May 2015	REVIEWED BY:	
PREPARED BY: S. Armstrong	REVIEWED BY:	

REVISIONS	INIT.	DATE

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SEAL

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Ryan W. Hough
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SIG. INVENTORY NO. 05-1168T2

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