Project No.	Sheet No.
R-5164F	Sig. 1

Project: R-5164F

Contract: C202436

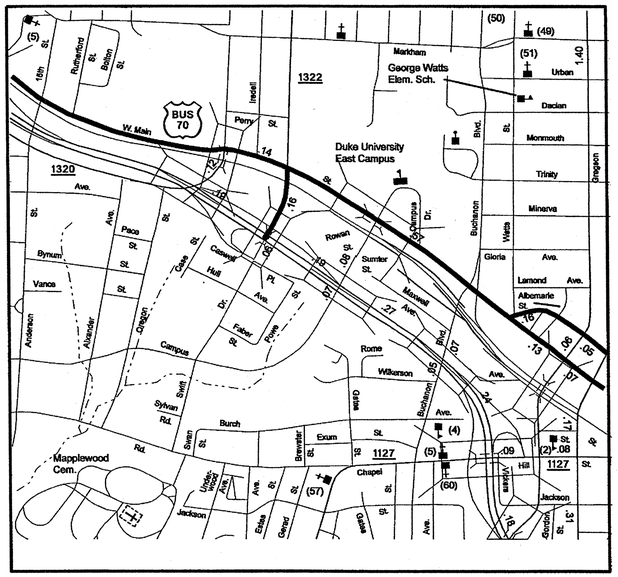
STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

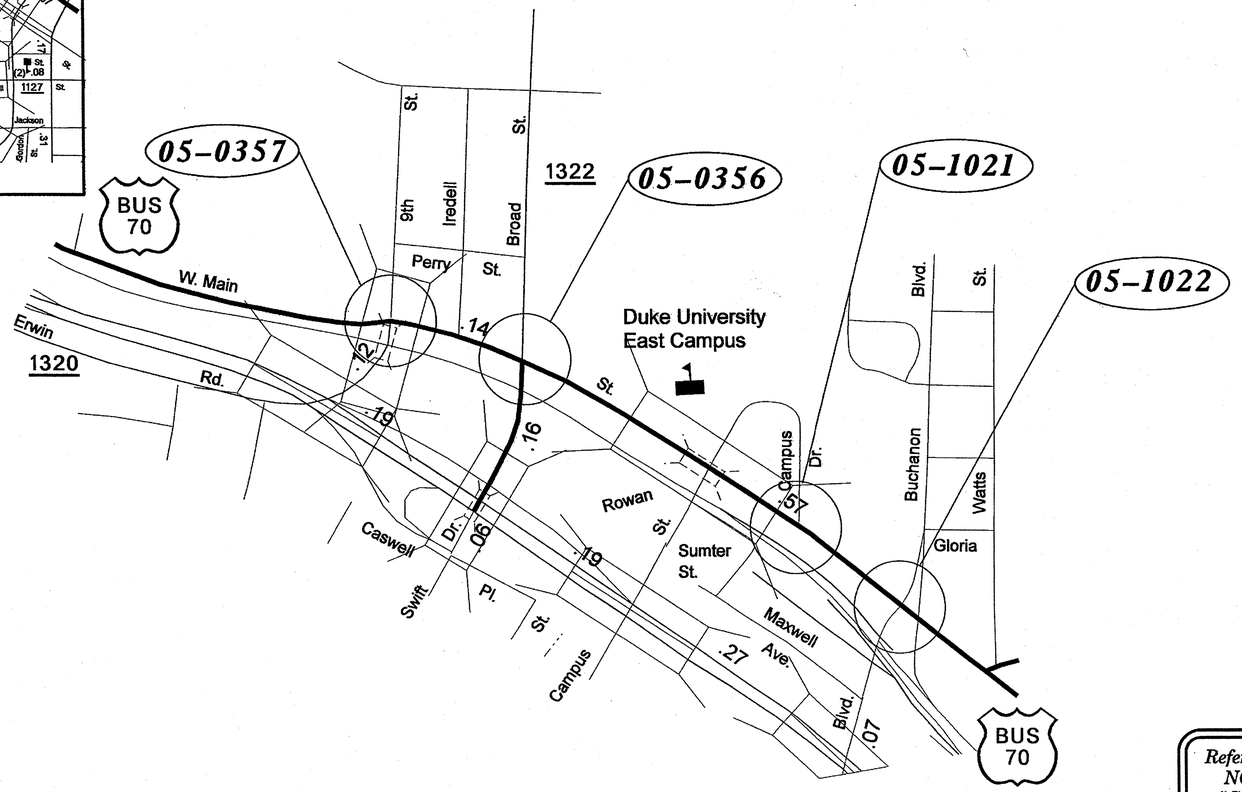
DURHAM COUNTY

LOCATION: *US 70 Business (W. Main St.) From SR 1320 (Erwin Rd.) To Buchanan Boulevard in Durham*

TYPE OF WORK: *Traffic Signals and Communication Cable*

Vicinity





Refer to "Roadway Standard Drawings NCDOT" dated January 2012 and "Standard Specifications for Roads and Structures" dated January 2012.

Index of Plans

Sheet #	Reference #	Location/Description
Sig. 1	N/A	Title Sheet
Sig. 2–3	05–0357	US 70 Business (West Main Street) at US 70 Business (Ninth Street)/SR 1320 (Erwin Road)
Sig. 4–6	05–0356	US 70 Business (West Main Street) at SR 1322 (Broad Street)/Swift Avenue
Sig. 7–8	05–1021	US 70 Business (West Main Street) at Campus Drive
Sig. 9–11	05–1022	US 70 Business (West Main Street) at Buchanan Boulevard

INTELLIGENT TRANSPORTATION AND SIGNALS UNIT

Contacts:

Robert J. Ziemba, PE – Central Region Signals Project Engineer
George C. Brown, PE – Signal Equipment Design Engineer

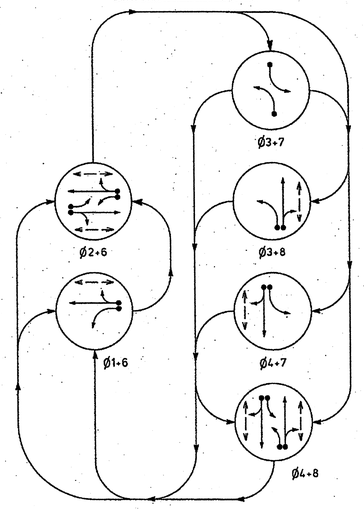
Prepared in the Office of:
DIVISION OF HIGHWAYS
TRANSPORTATION MOBILITY AND SAFETY DIVISION

Intelligent Transportation Systems & Signals Unit

750 N. Greenfield Parkway, Garner, NC 27529

PROJECT REFERENCE NO.	SHEET NO.
R-5164F	SIG. 2

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

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

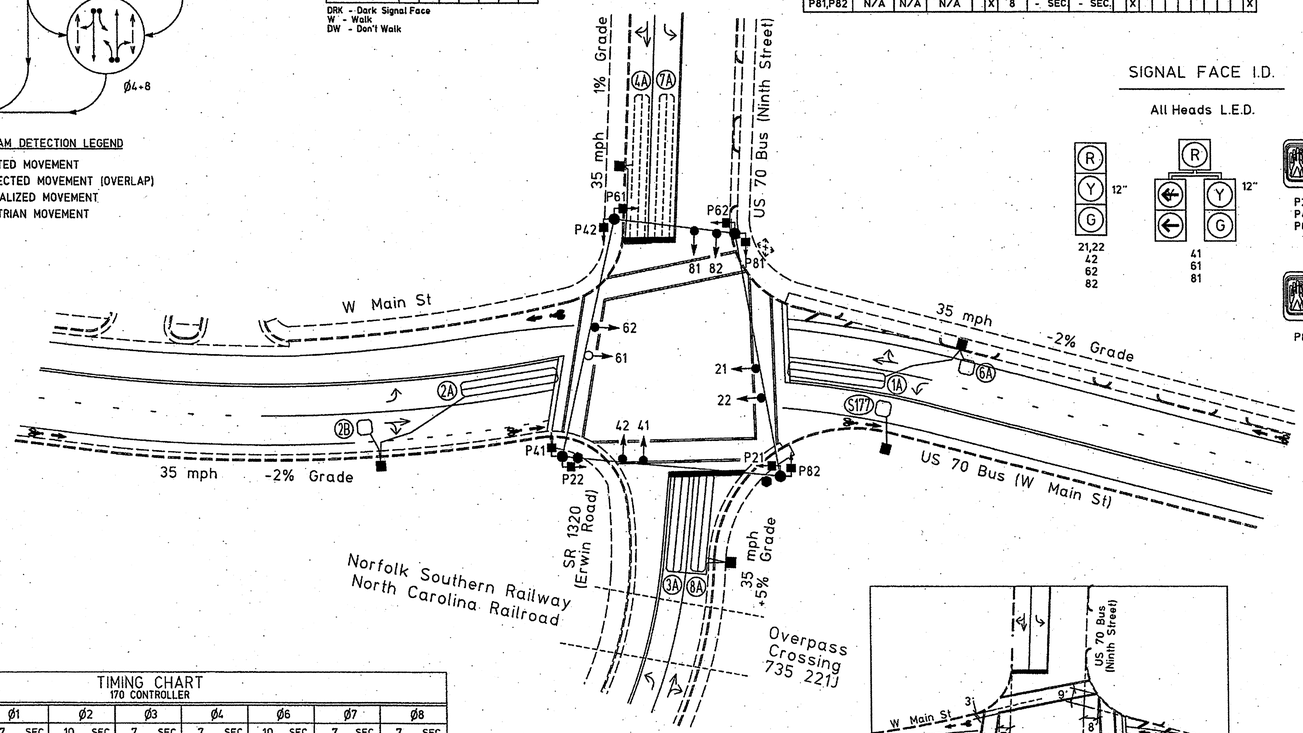
TABLE OF OPERATION

SIGNAL FACE	PHASE Ø1+6	Ø2+6	Ø3+7	Ø3+8	Ø4+7	Ø4+8	FLASH
21, 22	R	G	R	R	R	R	Y
41	R	R	R	R	G	R	Y
42	R	R	R	R	G	G	R
61	G	G	R	R	R	R	Y
62	G	G	R	R	R	R	Y
81	R	R	R	G	R	G	R
82	R	R	R	G	R	G	R
P21, P22	DW	W	DW	DW	DW	DW	DRK
P41, P42	DW	DW	DW	DW	W	W	DRK
P61, P62	W	W	DW	DW	DW	DW	DRK
P81, P82	DW	DW	DW	W	DW	W	DRK

DRK - Dark Signal Face
W - Walk
DW - Don't Walk

170 LOOP & DETECTOR UNIT INSTALLATION CHART

INDUCTIVE LOOPS: LOOP NO.	SIZE (ft)	TURNS	DIST. FROM STOPBAR (ft)	NEW	EXISTING	DETECTOR PROGRAMMING: NEMA PHASE	TIMING: DELAY	TIMING: CARRY (STRETCH)	ATTRIBUTES 1	2	3	4	5	6-7	8	SYSTEM LOOPS: NEW	STATUS: EXISTING
1A	6x40	2-4-2	0		X	1	10 SEC.	- SEC.				X	X				X
						6	- SEC.	- SEC.				X	X				X
						4	10 SEC.	- SEC.					X				X
2A	6x40	2-4-2	0		X	2	- SEC.	- SEC.				X	X				X
2B	6x6	4	70		X	2	- SEC.	- SEC.				X	X				X
3A	6x40	2-4-2	0		X	3	10 SEC.	- SEC.				X	X				X
						8	3 SEC.	- SEC.				X	X				X
4A	6x60	2-4-2	0		X	4	5 SEC.	- SEC.				X	X				X
6A	6x6	4	70		X	6	- SEC.	- SEC.				X	X				X
7A	6x60	2-4-2	0		X	7	10 SEC.	- SEC.				X	X				X
						4	3 SEC.	- SEC.				X	X				X
8A	6x40	2-4-2	0	X		8	- SEC.	- SEC.				X	X				X
S177	6x6	4	+130	X		N/A	- SEC.	- SEC.			X				X	X	X
PEDESTRIAN DETECTION																	
P21,P22	N/A	N/A	N/A	X		2	- SEC.	- SEC.	X								X
P41,P42	N/A	N/A	N/A	X		4	- SEC.	- SEC.	X								X
P61,P62	N/A	N/A	N/A	X		6	- SEC.	- SEC.	X								X
P81,P82	N/A	N/A	N/A	X		8	- SEC.	- SEC.	X								X



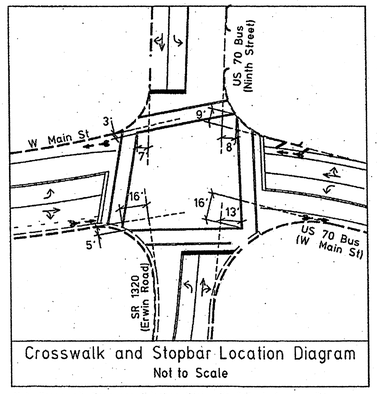
SIGNAL FACE I.D.

All Heads L.E.D.

TIMING CHART
170 CONTROLLER

PHASE	Ø1	Ø2	Ø3	Ø4	Ø6	Ø7	Ø8
MINIMUM INITIAL*	7 SEC.	10 SEC.	7 SEC.	7 SEC.	10 SEC.	7 SEC.	7 SEC.
VEHICLE EXTENSION*	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.
YELLOW CHANGE INT.	3.3 SEC.	4.0 SEC.	3.0 SEC.	3.8 SEC.	4.0 SEC.	3.1 SEC.	3.6 SEC.
RED CLEARANCE	1.7 SEC.	1.7 SEC.	1.8 SEC.	1.7 SEC.	1.5 SEC.	2.0 SEC.	1.6 SEC.
MAXIMUM LIMIT*	20 SEC.	45 SEC.	20 SEC.	30 SEC.	45 SEC.	20 SEC.	30 SEC.
RECALL POSITION	NONE	VEH RECALL	NONE	NONE	VEH RECALL	NONE	NONE
VEHICLE CALL MEMORY	NONE	YELLOW LOCK	NONE	NONE	YELLOW LOCK	NONE	NONE
DOUBLE ENTRY	OFF	OFF	OFF	ON	OFF	OFF	ON
WALK*	- SEC.	7 SEC.	- SEC.	7 SEC.	7 SEC.	- SEC.	7 SEC.
FLASHING DON'T WALK	- SEC.	17 SEC.	- SEC.	14 SEC.	14 SEC.	- SEC.	16 SEC.
TYPE 3 LIMIT	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.
ALTERNATE EXTENSION	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.
ADD PER VEHICLE*	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.
MAXIMUM INITIAL*	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.
MAXIMUM GAP*	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.
REDUCE 0.1 SEC EVERY*	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.
MINIMUM GAP	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.	2.0 SEC.

* 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.



Crosswalk and Stopbar Location Diagram
Not to Scale

Note: Crosswalk lines are 8 inches thick with 8 feet of separation. Locate stopbars 4 feet behind and parallel to crosswalks.

6 Phase
Fully Actuated
(Durham Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2012, "Standard Specifications for Roads and Structures" dated January 2012, and all applicable sections of the latest version of the generic Project Special Provisions.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Program phase 1 as protected/permissive.
4. Program phase 3 as protected/permissive.
5. Program phase 7 as protected/permissive.
6. Program controller to clear from phase 2+6 to phase 1+6 by progressing through phase 4+8 (see Electrical Details).
7. Set all detector units to presence mode.
8. Reposition existing signal heads numbered 21, 22 and 62.
9. Program all timing information into phase banks 1, 2 and 3 unless otherwise noted.
10. Set phase bank 3 maximum limit to 250 seconds for phases used.
11. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
12. Program pedestrian heads to count down the flashing "Don't Walk" time only.
13. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
14. This intersection features audible pedestrian signals with a "cuckoo" beacon. These audible signals must comply with all guidelines set in the Americans with Disabilities Act.

LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Pull Box	
	2 in. Underground Conduit	
	Right of Way with Marker	
	Directional Arrow	
	Pedestrian Pushbutton Pedestal	
	Stop Bar	
	Wheelchair Ramp	

DURHAM
1869
CITY OF INVENTION

City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

SIGNAL UPGRADE

Transportation Mobility and Safety Division
THE STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
Signal Design Section
750 Greenfield Pkwy, Garner, NC 27529

US 70 Business (West Main Street) at US 70 Business (Ninth Street)/ SR 1320 (Erwin Road)

DIVISION 5 DURHAM COUNTY DURHAM

PLAN DATE: JANUARY 2011 REVIEWED BY: P NICHOLAS
PREPARED BY: L TRACEY REVIEWED BY:

REVISIONS	INIT.	DATE

SCALE 0 30 1" = 30'

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS
SIGNATURE 12-5-11 DATE
SIG. INVENTORY NO. 05-0357

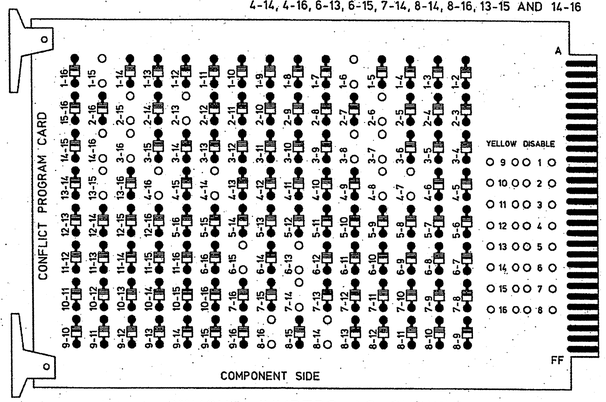
PROJECT REFERENCE NO.	SHEET NO.
R-5164F	SIG. 3

EDI MODEL 2010ECL CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

WD ENABLE
OFF / ON
SW2

REMOVE DIODE JUMPERS 1-6, 1-15, 2-6, 2-13, 2-15, 3-7, 3-8, 3-16, 4-7, 4-8, 4-14, 4-16, 6-13, 6-15, 7-14, 8-14, 8-16, 13-15 AND 14-16



INTERNAL DIP SWITCHES

OPTIONS

SW3 (ON →)
- RF 2010
- RP DISABLE
- WD 1.0 SEC
- GY ENABLE
- POLARITY
- YEL TIME-1
- YEL TIME-2
- YEL TIME-3

SW4 (ENABLE →) SSM
1 2 3 4 5 6 7 8

SW5 (ENABLE →) SSM
9 10 11 12 13 14 15 16

■ = DENOTES POSITION OF SWITCH

REMOVE JUMPERS AS SHOWN

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Make sure jumpers SEL2-SEL5 are present on the monitor board.

NOTES

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.
2. To prevent red failures on unused monitor channels, see Red Monitor Board Programming this sheet.
3. Program controller to start up in phases 2 and 6 green.
4. Set power-up flash time to 7 seconds and implement within the controller programming.
5. Enable simultaneous gap-out feature, on the controller unit, for all phases.
6. Program phases 4 and 8, on the controller unit, for Double Entry.
7. Ensure start up flash phases are coordinated with flash program block assignments.
8. This controller and cabinet are part of the Durham City System.

EQUIPMENT INFORMATION

CONTROLLER.....McCAIN TRAFFIC TYPE 170E
CABINET .....McCAIN TRAFFIC MODEL 336
(Dwg No.: M30898/REV. F)
SOFTWARE .....BI TRANS 233NC2×
CABINET MOUNT.....BASE
OUTPUT FILE POSITIONS.....12
LOAD SWITCHES USED.....S1,S2,S2P,S3,S4,S4P,S6,S6P,S7,S8,S8P
PHASES USED.....1,2,2PED,3,4,4PED,6,6PED,7,8,8PED
OVERLAPS.....NONE

×Software to be supplied by City of Durham.

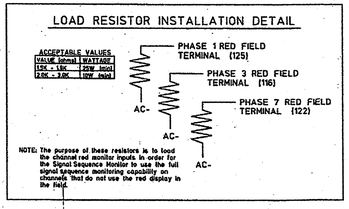
SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S2P	S3	S4	S4P	S5	S6	S6P	S7	S8	S8P
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED
SIGNAL HEAD NO.	61	21,22	P21, P22	81	41,42	P41, P42	NU	61,62	P61, P62	41	81,82	P81, P82
RED	×	128		×	101			134		×	107	
YELLOW		129			102			135			108	
GREEN		130			103			136			109	
RED ARROW												
YELLOW ARROW	126			117						123		
GREEN ARROW	127			118						124		
✋			113			104			119			110
🚶			115			106			121			112

NU = Not Used

× Denotes Install Load Resistor. See Load Resistor Installation Detail this page.

LOAD RESISTOR INSTALLATION DETAIL



NOTE: The purpose of these resistors is to load the channel red monitor inputs in order for the Signal Sequence Monitor to use the full signal sequence monitoring capability on channels that do not use the red display in the field.

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-0357
DESIGNED: January 2011
SEALED: Dec. 5, 2011
REVISED:

INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "J"	U	∅1,6,4 1A	∅ 2 2A	∅3,8 3A	∅ 4 4A	SYS. DET. S177	∅ 6 6A	∅7,4 7A	∅ 8 8A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	∅2 PED DC ISOLATOR	∅6 PED DC ISOLATOR	FS DC ISOLATOR
	L	NOT USED	∅ 2 2B	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED				∅4 PED DC ISOLATOR	∅8 PED DC ISOLATOR	ST DC ISOLATOR

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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	DETECTOR NO.	PIN NO.	ATTRIBUTES	NEMA PHASE
1A	TB21-1,2	I1U	1	56	5, 7	1
			2	56	5, 7	6
			3	56	7	4
2A	TB21-3,4	I2U	4	39	5, 7	2
2B	TB23-3,4	I2L	5	43	5, 7	2
3A	TB21-5,6	I3U	6	58	5, 7	3
			7	58	5, 7	8
4A	TB21-7,8	I4U	8	41	5, 7	4
6A	TB21-11,12	I6U	9	40	5, 7	6
7A	TB21-13,14	I7U	10	57	5, 7	7
			11	57	5, 7	4
8A	TB22-1,2	I8U	12	42	5, 7	8
×S177	TB21-9,10	I5U	13	55	4	SYS.
PEDESTRIAN PUSHBUTTONS						
P21,P22	TB22-9,10	I12U	14	67	2	2PED
P41,P42	TB24-9,10	I12L	15	69	2	4PED
P61,P62	TB22-11,12	I13U	16	68	2	6PED
P81,P82	TB24-11,12	I13L	17	70	2	8PED

NOTE: Program detector delay and carryover times as specified on signal design plans.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

DETECTOR ATTRIBUTES LEGEND:
1-FULL TIME DELAY
2-PED CALL
3-RESERVED
4-COUNTING
5-EXTENSION
6-TYPE 3
7-CALLING
8-ALTERNATE

PEDESTRIAN PHASE PROGRAMMING

PROGRAM PEDESTRIAN OUTPUTS 2P,4P,6P AND 8P
AT KEYPAD INPUT E/125+F+5=∅2,
AT KEYPAD INPUT E/125+F+6=∅6,
AT KEYPAD INPUT E/125+F+7=∅4,
AT KEYPAD INPUT E/125+F+8=∅8.

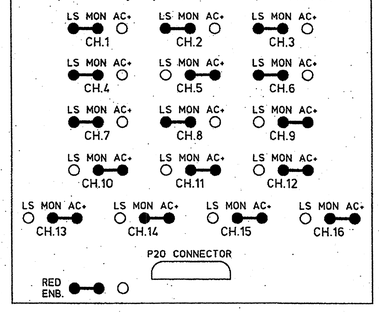
BACK-UP PROTECTION NOTE

To insure that the controller will not sequence from phase 2+6 directly to phase 1 or from phase 4+8 directly to phase 3 and/or 7, special programming has to be enabled in the BI TRANS 233 NC software. Program 170E Controller as follows:

1. Program phases 1, 3 and 7 as protected/permitted.
   At keypad input E/125+E+4=∅1,3,7.
2. Loop 1A will have to be programmed to call phase 4 (with appropriate delay time) to allow controller to sequence thru phase 4 before proceeding to phase 1. See input file programming on this sheet.

RED MONITOR BOARD PROGRAMMING

(position jumpers as shown below)



×SYSTEM DETECTOR PROGRAMMING NOTES

In order for system loops to operate properly, their pin assignments will have to be re-assigned on 170E controller as described below.

A. To assure that this pin is cleared from its default function, program as follows:
   Keypad input E/126+0+C = 0
B. Program pin for system detector as follows:
   Keypad input E/126+B+1 = 55

SIGNAL SYSTEM DATA:	
Drop	4
Area	2
Area Address	121
Comm Channel	FT-5

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.

SIGNAL UPGRADE

DURHAM
DEPARTMENT OF TRANSPORTATION

City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

Transportation Mobility and Safety Division
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
Signals Management Section
750 Greenfield Pkwy, Garner, NC 27529

US 70 Business (West Main Street)
at US 70 Business
(Ninth Street)/
SR 1320 (Erwin Road)

DIVISION 5 DURHAM COUNTY DURHAM

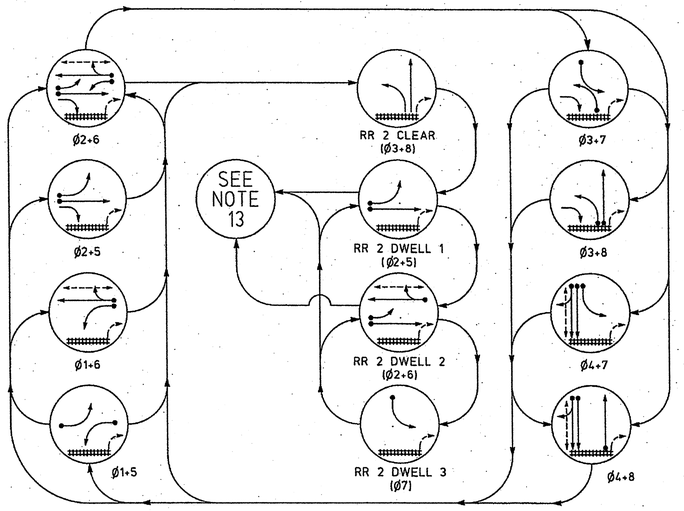
PLAN DATE: JANUARY 2011	REVIEWED BY: P NICHOLAS
PREPARED BY: L TRACEY	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS IV
SIGNATURE 12-5-11 DATE
SIG. INVENTORY NO. 05-0357

PROJECT REFERENCE NO.	SHEET NO.
R-5164F	SIG. 4

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

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

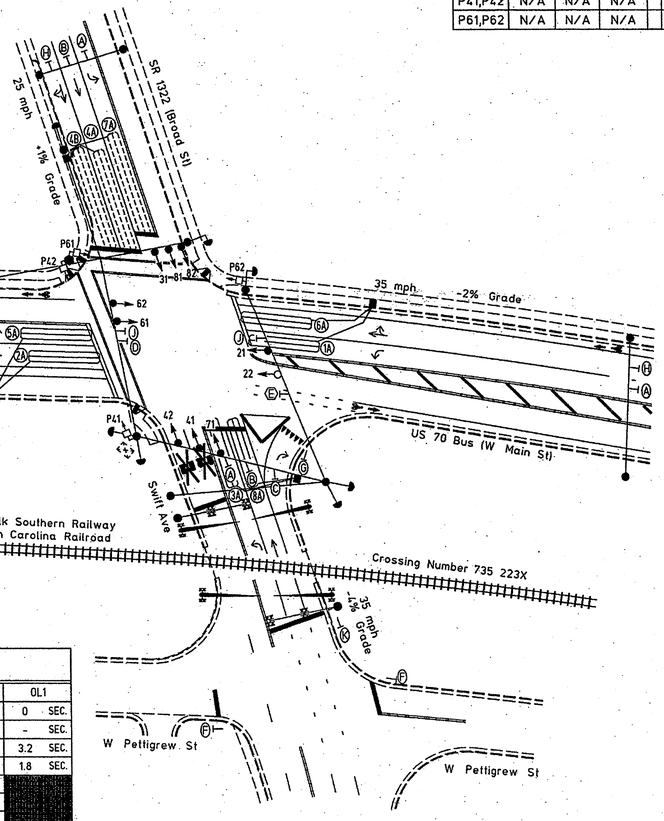
TABLE OF OPERATION

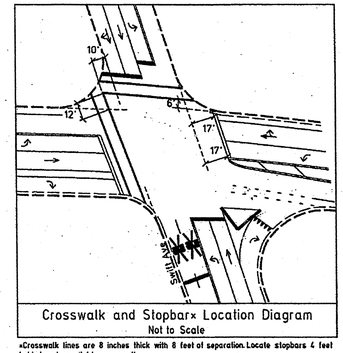
SIGNAL FACE	PHASE															
	Ø1+5	Ø1+6	Ø2+5	Ø2+6	Ø3+7	Ø3+8	Ø4+7	Ø4+8	RR 2 PREEMPT 1	RR 2 TRACK CLEARED 1	RR 2 PREEMPT 2	RR 2 TRACK CLEARED 2	FLASH
21	R/G	R	R/G	G	R	R	R	R	R/G	G	R	Y	
22	R	R	G	G	R/R	R	R	R	R	G	R	Y	
31	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	
41, 42	R	R	R	R	R	R	G	G	R	R	R	R	
61	R/G	R	G	R	R	R	R	R	R	R	G	R	Y
62	R	G	R	G	R	R	R	R	R	R	G	R	Y
71	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	⊣	
81, 82	R	R	R	R	R	G	R	G	G	R	R	R	
P41,P42	DW	DW	DW	DW	DW	DW	W	W	DW	DW	DW	DW	DRK
P61,P62	DW	W	DW	W	DW	DW	DW	DW	DW	DW	W	DW	DRK
SIGN D	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	*
SIGN E	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	*

* See Note 16
DRK - Dark Signal Face
W - Walk
DW - Don't Walk

LOOP & DETECTOR UNIT INSTALLATION CHART
170 CONTROLLER AND CABINET

INDUCTIVE LOOPS						DETECTOR PROGRAMMING															
							TIMING		ATTRIBUTES									LOOPS	STATUS	
LOOP NO.	SIZE (ft)	TURNS	DIST. FROM STOPBAR (ft)	NEW	EXISTING	NEMA PHASE	DELAY	CARRY (STRETCH)	1 FULL TIME DELAY	2 PEDESTRIAN CALL	3 RESERVED	4 RESERVED	5 QUIET	6 EXTENSION	7 TYPE 3	8 CALLING	ALTERNATE	SYSTEM LOOPS	NEW	EXISTING
1A	6X40	2-4-2	0		X	1	10 SEC.	- SEC.						X		X				X
						6	3 SEC.	- SEC.						X		X				X
						4	10 SEC.	- SEC.								X				X
2A	6X40	2-4-2	0	X		2	- SEC.	- SEC.						X		X				X
3A	6X40	2-4-2	+5	X		3	3 SEC.	- SEC.						X		X				X
4A	6X60	2-4-2	0		X	4	- SEC.	- SEC.						X		X				X
4B	6X60	2-4-2	0		X	4	5 SEC.	- SEC.						X		X				X
						5	10 SEC.	- SEC.						X		X				X
5A	6X40	2-4-2	0	X		2	3 SEC.	- SEC.						X		X				X
						4	10 SEC.	- SEC.								X				X
6A	6X40	2-4-2	0	X		6	- SEC.	- SEC.						X		X				X
7A	6X60	2-4-2	0		X	7	3 SEC.	- SEC.						X		X				X
8A	6X40	2-4-2	+5	X		8	- SEC.	- SEC.						X		X				X
PEDESTRIAN DETECTION																				
P41,P42	N/A	N/A	N/A		X	4	- SEC.	- SEC.		X										X
P61,P62	N/A	N/A	N/A		X	6	- SEC.	- SEC.		X										X





Crosswalk and Stopbar* Location Diagram
Not to Scale

*Crosswalk lines are 8 inches thick with 8 feet of separation. Locate stopbars 4 feet behind and parallel to crosswalks.

170 RAILROAD PREEMPTION

FUNCTION	RR 2 (SEC)
DELAY BEFORE PREEMPT	0
TRACK CLEARANCE GREEN	20

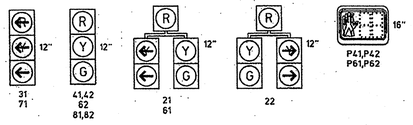
TIMING CHART
170 CONTROLLER

PHASE	Ø1	Ø2	Ø3	Ø4	Ø5	Ø6	Ø7	Ø8	OL1
MINIMUM INITIAL *	7 SEC.	10 SEC.	7 SEC.	7 SEC.	7 SEC.	10 SEC.	7 SEC.	7 SEC.	0 SEC.
VEHICLE EXTENSION *	2.0 SEC.	3.0 SEC.	4.0 SEC.	1.0 SEC.	2.0 SEC.	3.0 SEC.	1.0 SEC.	4.0 SEC.	- SEC.
YELLOW CHANGE INT.	3.3 SEC.	3.9 SEC.	3.4 SEC.	3.1 SEC.	3.2 SEC.	4.0 SEC.	3.1 SEC.	4.1 SEC.	3.2 SEC.
RED CLEARANCE	1.3 SEC.	1.4 SEC.	2.4 SEC.	2.5 SEC.	1.7 SEC.	1.5 SEC.	2.2 SEC.	1.8 SEC.	1.8 SEC.
MAXIMUM LIMIT *	15 SEC.	50 SEC.	25 SEC.	30 SEC.	15 SEC.	50 SEC.	20 SEC.	30 SEC.	
RECALL POSITION	NONE	VEH. RECALL	NONE	NONE	NONE	VEH. RECALL	NONE	NONE	
VEHICLE CALL MEMORY	NONE	YELLOW LOCK	NONE	NONE	NONE	YELLOW LOCK	NONE	NONE	
DOUBLE ENTRY	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
WALK *	- SEC.	- SEC.	- SEC.	7 SEC.	- SEC.	7 SEC.	- SEC.	- SEC.	
FLASHING DON'T WALK	- SEC.	- SEC.	- SEC.	22 SEC.	- SEC.	15 SEC.	- SEC.	- SEC.	
TYPE 3 LIMIT	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
ALTERNATE EXTENSION	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
ADD PER VEHICLE *	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
MAXIMUM INITIAL *	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
MAXIMUM GAP *	2.0 SEC.	3.0 SEC.	4.0 SEC.	1.0 SEC.	2.0 SEC.	3.0 SEC.	1.0 SEC.	4.0 SEC.	
REDUCE 0.1 SEC EVERY *	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
MINIMUM GAP *	2.0 SEC.	3.0 SEC.	4.0 SEC.	1.0 SEC.	2.0 SEC.	3.0 SEC.	1.0 SEC.	4.0 SEC.	

* 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 FACE I.D.

All Heads L.E.D.



8 Phase
Fully Actuated
with Railroad Preemption
(Durham Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2012, "Standard Specifications for Roads and Structures" dated January 2012, and all applicable sections of the latest version of the generic Project Special Provisions.
2. This location contains railroad preemption phasing. Do not program signal for late night flashing operation.
3. Program phase 1 as protected/permissive.
4. Program phase 5 as protected/permissive.
5. Program controller to clear from phase 2+6 to phases 1 and/or 5 by progressing through phase 4+8 (see Electrical Details).
6. Set all detector units to presence mode.
7. Reposition existing signal heads numbered 21, 22, 61 and 62.
8. Program all timing information into phase banks 1, 2 and 3 unless otherwise noted.
9. Set phase bank 3 maximum limit to 250 seconds for phases used.
10. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
11. Program pedestrian heads to count down the flashing "Don't Walk" time only.
12. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
13. Upon completion of railroad preemption, controller returns to normal operation based on vehicle demand.
14. Call Phase Bank 1 during Railroad Preemption.
15. Set Red Revert time to 1 second.
16. Ensure flashing operation does not alter operation of blankout signs.
17. Existing "LEFT TURN YIELD ON GREEN" ball sign (R10-12) and lane control signs on US 70 Business may be removed at the discretion of the Regional Traffic Engineer.

SIGNS

PROPOSED		EXISTING
Ⓐ	Left Arrow "ONLY" Sign (R3-5L)	Ⓐ
Ⓑ	Through Arrow "ONLY" Sign (R3-5A)	Ⓑ
Ⓒ	Right Arrow "ONLY" Sign (R3-5R)	Ⓒ
Ⓓ	"NO LEFT TURN - TRAIN" LED Blankout Sign	Ⓓ
Ⓔ	"NO RIGHT TURN - TRAIN" LED Blankout Sign	Ⓔ
Ⓕ	"STOP" Sign (R1-1)	Ⓕ
Ⓖ	"YIELD" Sign (R1-2)	Ⓖ
Ⓗ	Combined Through and Right Arrow Sign (R3-6R)	Ⓗ
Ⓙ	"LEFT TURN YIELD ON GREEN" Ball Sign (R10-12)	Ⓙ
Ⓚ	"DO NOT STOP ON TRACKS" Sign (R8-8)	Ⓚ

LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Pull Box	
	2 in. Underground Conduit	
	Right of Way with Marker	
	Directional Arrow	
	Signal Pedestal	
	Stop Bar	
	Wheelchair Ramp	
N/A	Railroad Tracks	
N/A	Railroad Cantilever	
N/A	Railroad Gate and Flasher	

SIGNAL UPGRADE - FINAL DESIGN

DURHAM
CITY OF MEDICINE

City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

Transportation Mobility and Safety Division
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
Signal Design Section
750 Greenfield Pkwy, Garner, NC 27529

SCALE
0 40
1" = 40'

US 70 Business (West Main Street) at SR 1322 (Broad Street)/ Swift Avenue

DIVISION 5 | DURHAM COUNTY | DURHAM

PLAN DATE: JANUARY 2011 | REVIEWED BY: P NICHOLAS

PREPARED BY: L TRACEY | REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS

SIGNATURE 12-5-11 DATE

SIG. INVENTORY NO. 05-0356

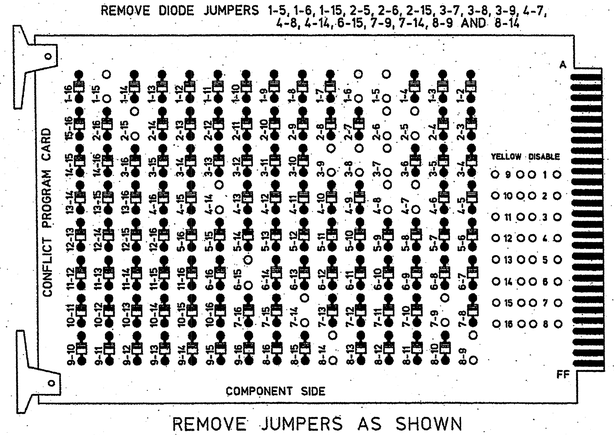
PROJECT REFERENCE NO:	SHEET NO.
R-5164F	SIG. 5

EDI MODEL 2010ECL CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

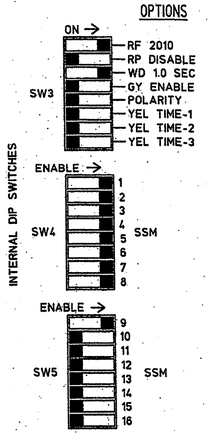
WD ENABLE
SW2
OFF ON

REMOVE DIODE JUMPERS 1-5, 1-6, 1-15, 2-5, 2-6, 2-15, 3-7, 3-8, 3-9, 4-7, 4-8, 4-14, 6-15, 7-9, 7-14, 8-9 AND 8-14



REMOVE JUMPERS AS SHOWN

OPTIONS



■ = DENOTES POSITION OF SWITCH

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Make sure jumpers SEL2-SEL5 are present on the monitor board.

NOTES

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.
2. To prevent red failures on unused monitor channels, see Red Monitor Board Programming this sheet.
3. Program controller to start up in phases 2 and 6 green.
4. Set power-up flash time to 7 seconds and implement within the controller programming.
5. Enable simultaneous gap-out feature, on the controller unit, for all phases.
6. Ensure start up flash phases are coordinated with flash program block assignments.
7. This controller and cabinet are part of the Durham City System.

EQUIPMENT INFORMATION

CONTROLLER.....McCAIN TRAFFIC TYPE 170E
CABINET .....McCAIN TRAFFIC MODEL 332 (Dwg No.: M30117/REV. C)
SOFTWARE .....BI TRANS 233NC2×
CABINET MOUNT.....BASE
OUTPUT FILE POSITIONS.....18 (12 STD, 6 AUX)
LOAD SWITCHES USED.....S1,S2,S3,S4,S4P,S5,S6,S6P,S7,S8,S9
PHASES USED.....1,2,3,4,4PED,5,6,6PED,7,8
OVERLAPS.....OL1 = Ø3

×Software to be supplied by City of Durham.

SIGNAL HEAD HOOK-UP CHART

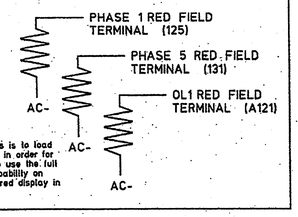
LOAD SWITCH NO.	S1	S2	S2P	S3	S4	S4P	S5	S6	S6P	S7	S8	S8P	S9	S10	S11	S12	S13	S14
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	61	21,22	NU	31	41,42	P41, P42	21	61,62	P61, P62	71	81,82	NU	22	NU	NU	NU	NU	NU
RED	×	128			101		×	134			107		×					
YELLOW		129			102			135			108							
GREEN		130			103			136			109							
RED ARROW				116						122								
YELLOW ARROW	126			117			132			123			A122					
GREEN ARROW	127			118			133			124			A123					
✋						104			119									
🚶						106			121									

NU = Not Used

× Denotes Install Load Resistor. See Load Resistor Installation Detail this page.

LOAD RESISTOR INSTALLATION DETAIL

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



NOTE: The purpose of these resistors is to load the channel red monitor inputs in order for the Signal Sequence Monitor to use the full signal sequence monitoring capability on channels that do not use the red display in the field.

INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I"	U	Ø1,6,4 1A	Ø 2 2A	SLOT EMPTY	SLOT EMPTY	Ø 3 3A	Ø 4 4A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Advance DC ISOLATOR	NOT USED	Ø6 PED DC ISOLATOR	FS DC ISOLATOR
	L	NOT USED	NOT USED			NOT USED	Ø 4 4B					Advance Enable DC ISOLATOR	Ø4 PED DC ISOLATOR	NOT USED	ST DC ISOLATOR
FILE "J"	U	Ø5,2,4 5A	Ø 6 6A	SLOT EMPTY	SLOT EMPTY	Ø 7 7A	Ø 8 8A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	NOT USED	SLOT EMPTY	SLOT EMPTY	NOT USED
	L	NOT USED	NOT USED			NOT USED	NOT USED					Door Ajar DC ISOLATOR			RR2 AC ISOLATOR

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

FS = FLASH SENSE
ST = STOP TIME
RR = RAILROAD PREEMPTION

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	DETECTOR NO.	PIN NO.	ATTRIBUTES	NEMA PHASE
1A	TB2-1,2	I1U	1	56	5, 7	1
			2	56	5, 7	6
			3	56	7	4
2A	TB2-5,6	I2U	4	39	5, 7	2
3A	TB4-5,6	I5U	5	58	5, 7	3
4A	TB4-9,10	I6U	6	41	5, 7	4
4B	TB4-11,12	I6L	7	45	5, 7	4
5A	TB3-1,2	J1U	8	55	5, 7	5
			9	55	5, 7	2
			10	55	7	4
6A	TB3-5,6	J2U	11	40	5, 7	6
7A	TB5-5,6	J5U	12	57	5, 7	7
8A	TB5-9,10	J6U	13	42	5, 7	8
PEDESTRIAN PUSHBUTTONS						
P41,P42	TB8-5,6	I12L	14	69	2	4PED
P61,P62	TB8-7,9	I13U	15	68	2	6PED

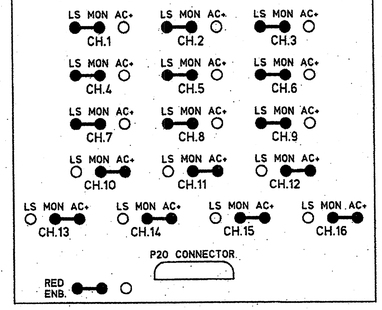
NOTE: Program detector delay and carryover times as specified on signal design plans.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

DETECTOR ATTRIBUTES LEGEND:
1-FULL TIME DELAY
2-PED CALL
3-RESERVED
4-COUNTING
5-EXTENSION
6-TYPE 3
7-CALLING
8-ALTERNATE

RED MONITOR BOARD PROGRAMMING

(position jumpers as shown below)



BACK-UP PROTECTION NOTE

To insure that the controller will not sequence from phase 2+6 directly to phase 1 and/or 5, special programming has to be enabled in the BI TRANS 233 NC software. Program 170E Controller as follows:

1. Program phase 1 and 5 as protected/permitted:
   At keypad input E/125+E+4= Ø1,5.
2. Loops 1A and 5A will have to be programmed to call phase 4 (with appropriate delay time) to allow controller to sequence thru phase 4 before proceeding to phase 1 and/or 5. See input file programming on this sheet.

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN:	05-0356
DESIGNED:	January 2011
SEALED:	Dec. 5, 2011
REVISED:	

SIGNAL SYSTEM DATA:	
Drop	7
Area	2
Area Address	112
Comm Channel	FT-5

PEDESTRIAN PHASE PROGRAMMING

PROGRAM PEDESTRIAN OUTPUTS 4P AND 6P
AT KEYPAD INPUT E/125+F+7=Ø4,
AT KEYPAD INPUT E/125+F+6=Ø6.

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.

HEAD 22 ARROWS (OL1) OPERATION DURING RR PREEMPTION

IN ORDER FOR THE RAILROAD PREEMPTION CLEAR PHASE TO OPERATE AS PHASES 3 AND 8 WITHOUT SIGNAL HEAD 22 RIGHT-TURN ARROWS (OL1), THE FOLLOWING PROGRAMMING MUST BE IN PLACE:

ASSIGN O/L VEH. SET 2 INPUT AT E/126+D+C= 225
ASSIGN RR PREEMPT OUTPUT AT E/127+D+D= 225

225 = ASSIGNABLE PSEUDO-PIN (SOFTWARE)

SEE SHEET 2 FOR OVERLAP PROGRAMMING/ RAILROAD PREEMPTION WIRING AND CONTROLLER PROGRAMMING

FINAL DESIGN SHEET 1 OF 2

DURHAM
CITY OF INNOVATION
City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

Transportation Mobility and Safety Division
STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signals Management Section
750 Greenfield Pkwy, Garner, NC 27529

US 70 Business (West Main Street) at SR 1322 (Broad Street)/ Swift Avenue

DIVISION 5 DURHAM COUNTY DURHAM

PLAN DATE: JANUARY 2011	REVIEWED BY: P NICHOLAS
PREPARED BY: L TRACEY	REVIEWED BY:

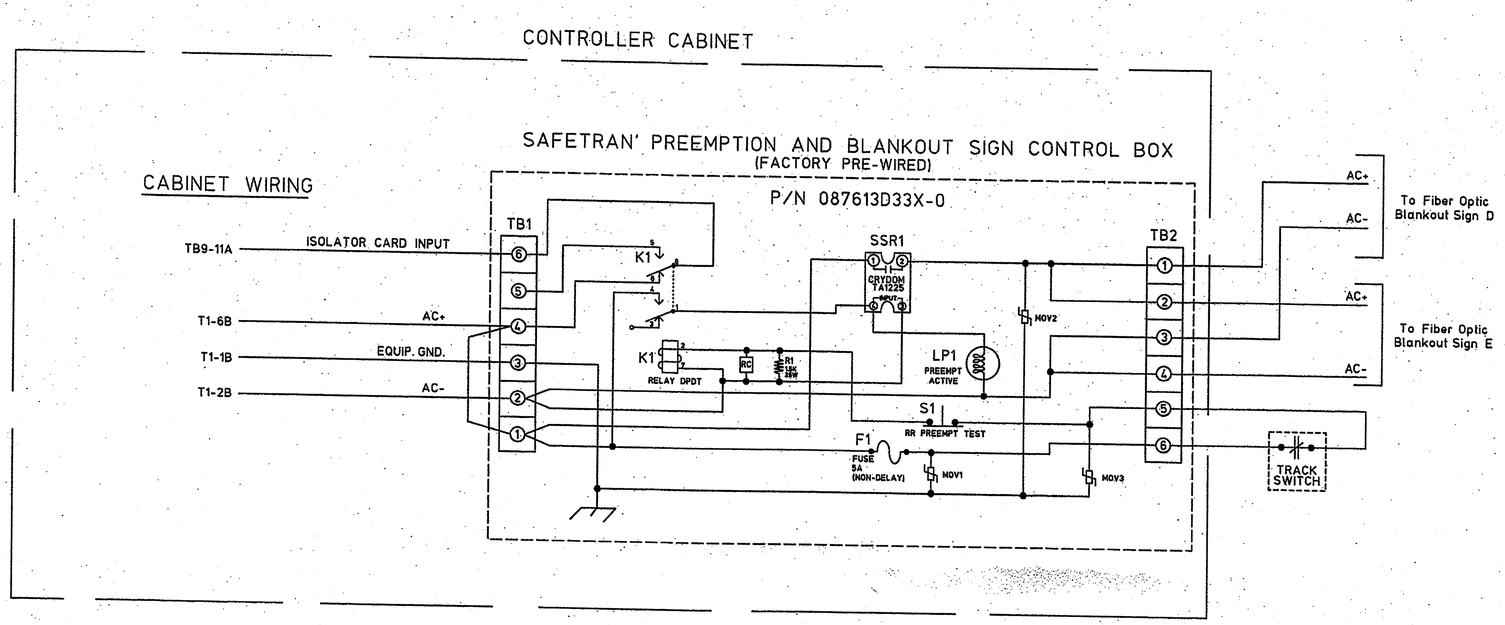
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS IV
SIGNATURE 12-5-11 DATE
SIG. INVENTORY NO. 05-0356

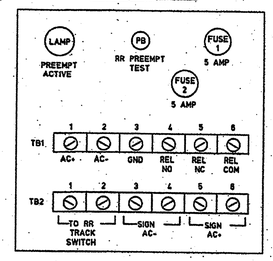
PROJECT REFERENCE NO.	SHEET NO.
R-5164F	SIG. 6

RAILROAD PREEMPTION WIRING DETAIL

(WIRE AS SHOWN)



FRONT VIEW



NOTES

1. RELAY K1 IS SHOWN IN THE ENERGIZED (PREEMPT NOT ACTIVE) NORMAL OPERATING STATE.
2. RELAY K1 IS A DPDT WITH 120VAC COIL (OMRON MK2P-3 OR EQUAL) WITH OCTAL BASE.
3. RELAY SSR1 IS A SPST (NORMALLY OPEN) SOLID STATE RELAY WITH AC INPUT AND AC 25 AMP OUTPUT, CRYDOM TA1225 (OR APPROVED EQUAL).
4. AC ISOLATOR CARD SHALL ACTIVATE PREEMPTION UPON REMOVAL OF AC+ FROM THE INPUT (AS SHOWN ABOVE). TO ACCOMPLISH THIS SET INVERT DIP SWITCH ON AC ISOLATOR CARD.
5. RESISTOR IS VALUED AT 2K OHM, 12 WATT, CLAROSTAT VPR10F-2K (OR APPROVED EQUAL).
6. RC NETWORK IS VALUED AT .1 MIRCOFARAD, 100 OHM.
7. THIS SCHEMATIC IS BASED ON PLANS GENERATED BY SAFETRAN TRAFFIC SYSTEMS DATED 10/19/00.
8. IMPORTANT! ENSURE TERMINAL TB9-12 (ON INPUT PANEL) IS CONNECTED TO AC NEUTRAL (JUMPER MAY HAVE TO BE ADDED).

SPECIAL NOTES: USING PHASE BANK 1 DURING RAILROAD PREEMPTION

In order for Controller to switch to Phase Bank 1 for Railroad Preemption while running coordinated timing, program 170E Controller as follows:

Assign Railroad Preempt 2 (RR2) at E/127+D+D = 225
Assign Free (7-Wire) Input at E/126+E+5 = 225

225 = ASSIGNABLE PSEUDO-PIN

170E CONTROLLER RAILROAD PREEMPTION PROGRAMMING

1. PROGRAM RR2 INPUT PIN NO. AT E/126+F+6=52 (THIS IS DEFAULT PARAMETER)
2. PROGRAM TRACK CLEARANCE PHASES AT E/125+E+2=Ø3,8
3. PROGRAM LIMITED SERVICE PHASES AT E/125+E+3=Ø2,5,6,7
4. PROGRAM RR PREEMPT DELAY TIME AT F/1+E+A= 0 (SEC.)
5. PROGRAM TRACK CLEARANCE TIME AT F/1+E+B= 20 (SEC.)
6. PROGRAM MINIMUM GREEN BEFORE PREEMPT AT F/1+0+8= 1 (SEC.)
7. ENABLE NON-LOCK FEATURE AT E/125+F+4=6 (RR2)

OVERLAP PROGRAMMING NOTES

TO ASSURE THAT LOADSWITCH S9 IS ASSIGNED AS OVERLAP 1, PROGRAM CONTROLLER AT KEYPAD INPUT E/29+1+0=9

TO SET THE PARENT PHASE FOR OVERLAP 1 (VEH SET 1) AS PHASE 3, PROGRAM CONTROLLER AT KEYPAD INPUT E/29+1+1=Ø3

TO SET THE PARENT PHASE FOR OVERLAP 1 (VEH SET 2) AS NONE, NO PROGRAMMING IS REQUIRED.

PROGRAM TIMING FOR OVERLAP 1 AS FOLLOWS:

GREEN CLEAR - E/29+1+D=0.0 (SEC.)
YELLOW CHANGE INTERVAL - E/29+1+E=3.2 (SEC.)
RED CLEARANCE - E/29+1+F=1.8 (SEC.)

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-0356
DESIGNED: January 2011
SEALED: Dec. 5, 2012
REVISED:

FINAL DESIGN SHEET 2 OF 2

DURHAM

City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

Transportation Mobility and Safety Division
DEPARTMENT OF TRANSPORTATION · STATE OF NORTH CAROLINA
Signals Management Section
750 Greenfield Pkwy, Garner, NC 27529

US 70 Business (West Main Street) at
SR 1322 (Broad Street)/
Swift Avenue

DIVISION 5 DURHAM COUNTY DURHAM

PLAN DATE: JANUARY 2011	REVIEWED BY: P NICHOLAS
PREPARED BY: L TRACEY	REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL

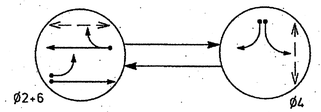
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS

SIGNATURE 12-5-11 DATE

SIG. INVENTORY NO. 05-0356

PROJECT REFERENCE NO.	SHEET NO.
R-5164F	SIG. 7

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	G	R	Y
41, 42	R	G	R
61, 62	G	R	Y
P41, P42	DW	W	DRK
P61, P62	W	DW	DRK

DRK - Dark Signal Face
W - Walk
DW - Don't Walk

170 LOOP & DETECTOR UNIT INSTALLATION CHART

INDUCTIVE LOOPS						DETECTOR PROGRAMMING														
							TIMING		ATTRIBUTES										STATUS	
LOOP NO.	SIZE (ft)	TURNS	DIST. FROM STOPBAR (ft)	NEW	EXISTING	NEMA PHASE	DELAY	CARRY (STRETCH)	1 FAIL TIME RECALL	2 PEDESTRIAN CALL	3 RESERVED	4 COUNT	5 EXTENSION	6 TYPE 3	7 CALLING	8 ALTERNATE	SYSTEM LOOPS	NEW	EXISTING
2A	6x40	2-4-2	0	X		2	- SEC.	- SEC.					X		X			X	
2B	6x6	4	70	X		2	- SEC.	- SEC.					X		X			X	
4A	6x30	2-4-2	0	X		4	2 SEC.	- SEC.					X		X				X
4B	6x30	2-4-2	0	X		4	5 SEC.	- SEC.					X		X				X
6A	6x6	4	70	X		6	- SEC.	- SEC.					X		X			X	
S183	6x6	4	265	X		N/A	- SEC.	- SEC.				X					X		X
S184	6x6	4	+385	X		N/A	- SEC.	- SEC.				X					X		X
PEDESTRIAN DETECTION																			
P41,P42	N/A	N/A	N/A	X		4	- SEC.	- SEC.		X								X	
P61,P62	N/A	N/A	N/A	X		6	- SEC.	- SEC.		X								X	

2 Phase
Fully Actuated
(Durham Signal System)

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2012, "Standard Specifications for Roads and Structures" dated January 2012, and all applicable sections of the latest version of the generic Project Special Provisions.
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 heads numbered 21, 22, 61 and 62.
5. Program all timing information into phase banks 1, 2 and 3 unless otherwise noted.
6. Set phase bank 3 maximum limit to 250 seconds for phases used.
7. Omit "WALK" and flashinig "DON'T WALK" with no pedestrian calls.
8. Program pedestrian heads to count down the flashing "Don't Walk" time only.
9. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.

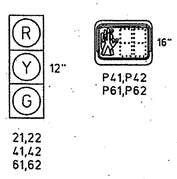
TIMING CHART

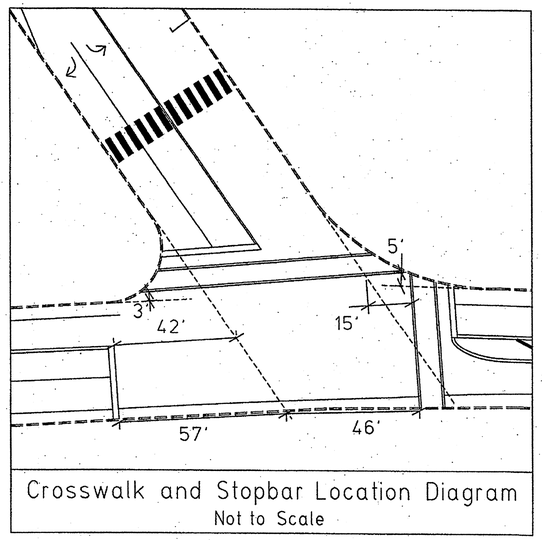
PHASE	ø2	ø4	ø6
MINIMUM INITIAL×	10 SEC	7 SEC	10 SEC
VEHICLE EXTENSION×	2.0 SEC	2.0 SEC	2.0 SEC
YELLOW CHANGE INTERVAL	3.7 SEC	3.2 SEC	3.8 SEC
RED CLEARANCE	2.1 SEC	2.1 SEC	1.6 SEC
MAXIMUM LIMIT×	30 SEC	15 SEC	30 SEC
RECALL POSITION	VEH RECALL	NONE	VEH RECALL
VEHICLE CALL MEMORY	YELLOW LOCK	NONE	YELLOW LOCK
DOUBLE ENTRY	OFF	OFF	OFF
WALK×	- SEC	7 SEC	7 SEC
FLASHING DON'T WALK	- SEC	10 SEC	20 SEC
TYPE 3 LIMIT	- SEC	- SEC	- SEC
ADD PER VEHICLE×	- SEC	- SEC	- SEC
MAXIMUM INITIAL×	- SEC	- SEC	- SEC
MAXIMUM GAP×	2.0 SEC	2.0 SEC	2.0 SEC
REDUCE 0.1 SEC EVERY×	- SEC	- SEC	- SEC
MINIMUM GAP×	2.0 SEC	2.0 SEC	2.0 SEC

× 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 FACE I.D.

All Heads L.E.D.





Crosswalk and Stopbar Location Diagram
Not to Scale

Note: Crosswalk lines are 8 inches thick with 8 feet of separation. Locate stopbars 4 feet behind and parallel to crosswalks.

LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Pull Box	
	2 in. Underground Conduit	
	Right of Way with Marker	
	Directional Arrow	
	Pedestrian Signal Pedestal	
	Stop Bar	
	Wheelchair Ramp	

SIGNAL UPGRADE

DURHAM
1869
CITY OF MEDICINE

City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

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

750 Greenfield Pkwy, Garner, NC 27529

SCALE
0 30
1" = 30'

US 70 Business (West Main Street) at Campus Drive

DIVISION 5 DURHAM COUNTY DURHAM

PLAN DATE: JANUARY 2011 REVIEWED BY: P NICHOLAS

PREPARED BY: L TRACEY REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS IV

SIGNATURE 12-7-11 DATE

CIG INVENTORY NO. 05-1021

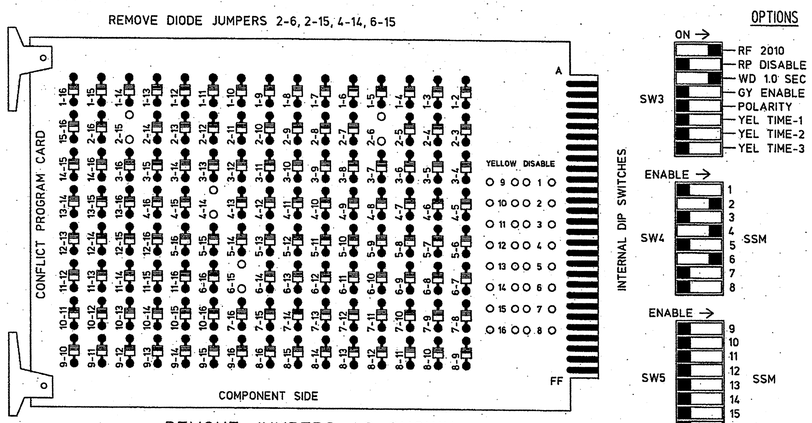
PROJECT REFERENCE NO.	SHEET NO.
R-5164F	SIG. 8

EDI MODEL 2010ECL CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

WD ENABLE
OFF ON
SW2

REMOVE DIODE JUMPERS 2-6, 2-15, 4-14, 6-15



REMOVE JUMPERS AS SHOWN

■ = DENOTES POSITION OF SWITCH

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Make sure jumpers SEL2-SEL5 are present on the monitor board.

NOTES

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.
2. To prevent red failures on unused monitor channels, see Red Monitor Board Programming this sheet.
3. Program controller to start up in phases 2 and 6 green.
4. Set power-up flash time to 7 seconds and implement within the controller programming.
5. Enable simultaneous gap-out feature, on the controller unit, for all phases.
6. Ensure start up flash phases are coordinated with flash program block assignments.
7. This controller and cabinet are part of the Durham City System.

EQUIPMENT INFORMATION

CONTROLLER.....McCAIN TRAFFIC TYPE 170E
CABINET .....McCAIN TRAFFIC MODEL 336
(Dwg No.: M30898/REV. F)
SOFTWARE .....BI TRANS 233NC2×
CABINET MOUNT.....POLE
OUTPUT FILE POSITIONS.....12
LOAD SWITCHES USED.....S2,S4,S4P,S6,S6P
PHASES USED.....2,4,4PED,6,6PED
OVERLAPS.....NONE

×Software to be supplied by City of Durham.

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S2P	S3	S4	S4P	S5	S6	S6P	S7	S8	S8P
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED
SIGNAL HEAD NO.	NU	21,22	NU	NU	41,42	P41, P42	NU	61,62	P61, P62	NU	NU	NU
RED		128			101			134				
YELLOW		129			102			135				
GREEN		130			103			136				
RED ARROW												
YELLOW ARROW												
GREEN ARROW												
✋						104			119			
🚶						106			121			

NU = Not Used

PEDESTRIAN PHASE PROGRAMMING

PROGRAM PEDESTRIAN OUTPUTS 4P AND 6P
AT KEYPAD INPUT E/125+F+7=Ø4,
AT KEYPAD INPUT E/125+F+6=Ø6.

COUNTDOWN PEDESTRIAN SIGNAL OPERATION

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

INPUT FILE POSITION LAYOUT

(front view)

FILE		1	2	3	4	5	6	7	8	9	10	11	12	13	14
"I"	U	SLOT EMPTY	Ø2 2A	SLOT EMPTY	Ø4 4A	SLOT EMPTY	Ø6 6A	SYS DET. S183	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	NOT USED	Ø6 PED DC ISOLATOR	FS DC ISOLATOR
	L	SLOT EMPTY	Ø2 2B	SLOT EMPTY	Ø4 4B	SLOT EMPTY	NOT USED	SYS DET. S184	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	Ø4 PED DC ISOLATOR	NOT USED	ST DC ISOLATOR

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

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	DETECTOR NO.	PIN NO.	ATTRIBUTES	NEMA PHASE
2A	TB21-3,4	12U	1	39	5, 7	2
2B	TB23-3,4	12L	2	43	5, 7	2
4A	TB21-7,8	14U	3	41	5, 7	4
4B	TB23-7,8	14L	4	45	5, 7	4
6A	TB21-11,12	16U	5	40	5, 7	6
×S183	TB21-13,14	17U	6	57	4	SYS.
×S184	TB23-13,14	17L	7	50	4	SYS.
PEDESTRIAN PUSHBUTTONS						
P41,P42	TB24-9,10	12L	8	69	2	4PED
P61,P62	TB22-11,12	13U	9	68	2	6PED

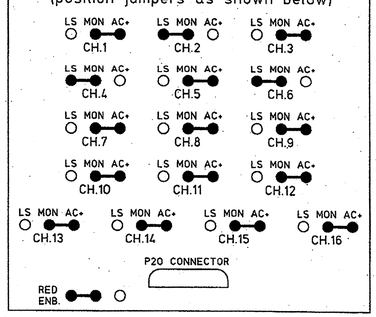
NOTE: Program detector delay and carryover times as specified on signal design plans.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

DETECTOR ATTRIBUTES LEGEND:
1-FULL TIME DELAY
2-PED CALL
3-RESERVED
4-COUNTING
5-EXTENSION
6-TYPE 3
7-CALLING
8-ALTERNATE

RED MONITOR BOARD PROGRAMMING

(position jumpers as shown below)



×SYSTEM DETECTOR PROGRAMMING NOTES

In order for system loops to operate properly, their pin assignments will have to be re-assigned on 170E controller as described below.

A. To assure that these pins are cleared from their default function, program as follows:

Keypad input E/126+0+B = 0
Keypad input E/126+0+E = 0

B. Program pins for system detectors as follows:

Keypad input E/126+B+1 = 57
Keypad input E/126+B+2 = 50

THIS ELECTRICAL DETAIL IS FOR	
THE SIGNAL DESIGN:	05-1021
DESIGNED:	January 2011
SEALED:	Dec. 7, 2011
REVISED:	

SIGNAL SYSTEM DATA:	
Drop	12
Area	2
Area Address	124
Comm Channel	FT-5

DURHAM
1 8 6 9
Est. 1869
City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

SIGNAL UPGRADE

Transportation Mobility and Safety Division
STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION
Signals Management Section
750 Greenfield Pkwy, Garner, NC 27529

US 70 Business (West Main Street) at Campus Drive

DIVISION 5 DURHAM COUNTY DURHAM

PLAN DATE: JANUARY 2011	REVIEWED BY: P NICHOLAS
PREPARED BY: L TRACEY	REVIEWED BY:

REVISIONS	INT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS IV
12-7-11
SIGNATURE DATE
SIG. INVENTORY NO. 05-1021

PROJECT REFERENCE NO.	SHEET NO.
R-5164F	SIG. 9

8 Phase Fully Actuated with EV Preemption and Railroad Preemption (Durham Signal System)

PHASING DIAGRAM

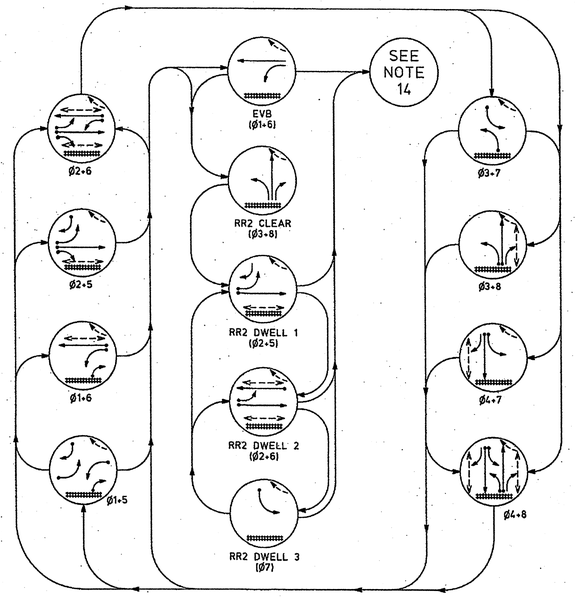


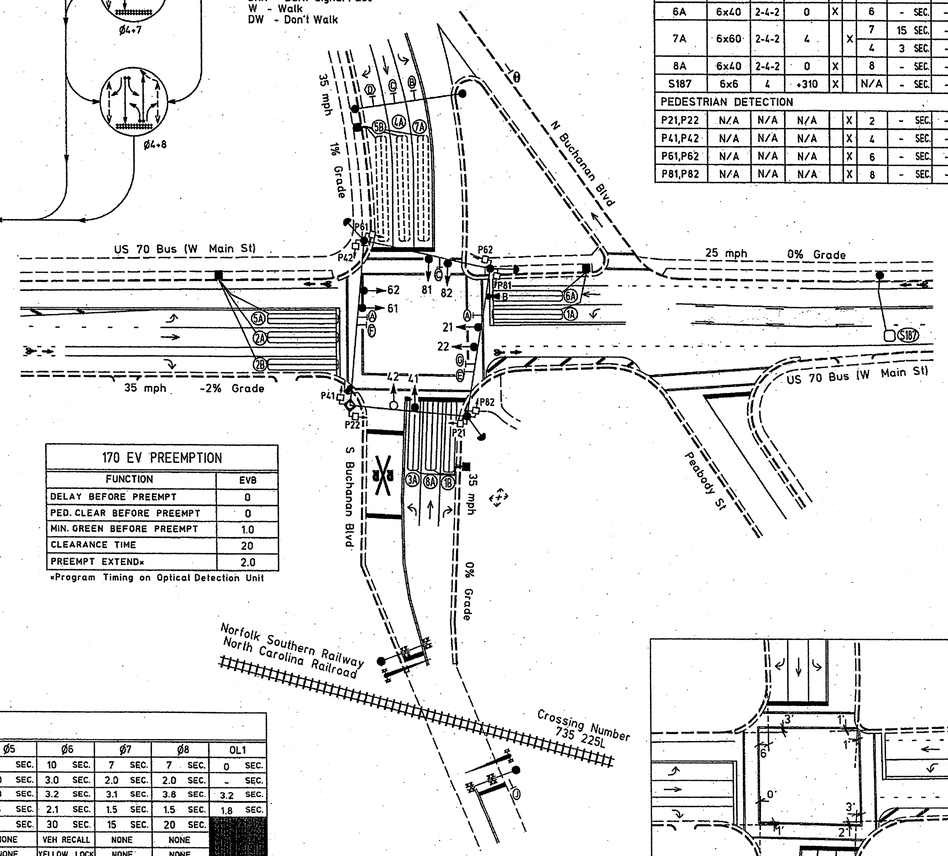
TABLE OF OPERATION

SIGNAL FACE	PHASE Ø1+5	Ø1+6	Ø2+5	Ø2+6	Ø3+7	Ø3+8	Ø4+7	Ø4+8	RR2 CLR 2	RR2 CLR 3	RR2 DWL 1	RR2 DWL 2	RR2 DWL 3	EVB	FLASH
21	R	R	G	G	R	R	R	R	R	G	G	R	R	R	Y
22	R	R	G	G	R	R	R	R	R	G	G	R	R	R	Y
41	R	R	R	R	R	R	G	G	R	R	R	R	R	R	R
42	R	R	R	R	R	R	G	G	R	R	R	R	R	R	R
61	R	G	R	G	R	R	R	R	R	G	R	R	G	R	Y
62	R	G	R	G	R	R	R	R	R	G	R	R	G	R	Y
81	R	R	R	R	R	G	R	G	R	R	R	R	R	R	R
82	R	R	R	R	R	G	R	G	R	R	R	R	R	R	R
P21,P22	DW	DW	W	W	DW	DW	DW	DW	DW	W	W	DW	DW	DW	DRK
P41,P42	DW	DW	DW	DW	DW	DW	W	W	DW	DW	DW	DW	DW	DW	DRK
P61,P62	DW	W	DW	W	DW	DW	DW	DW	DW	DW	W	DW	DW	DW	DRK
P81,P82	DW	DW	DW	DW	DW	W	DW	W	DW	DW	DW	DW	DW	DW	DRK
SIGN F	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	××
SIGN G	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	××

×× See Note 13
DRK - Dark Signal Face
W - Walk
DW - Don't Walk

170 LOOP & DETECTOR UNIT INSTALLATION CHART

INDUCTIVE LOOPS LOOP NO.	SIZE (ft)	TURNS	DIST. FROM STOPBAR (ft)	NEW	EXISTING	DETECTOR PROGRAMMING NEMA PHASE	TIMING DELAY	TIMING CARRY (STRETCH)	ATTRIBUTES 1 LANE DELAY	2 PEDESTRIAN CALL	3 RESERVED	4 COUNT	5 EXTENSION	6 TYPE 3	7 CALLING	8 ALTERNATE	SYSTEM LOOPS	STATUS NEW	STATUS EXISTING
1A	6x40	2-4-2	0	X		1	15 SEC.	- SEC.					X		X				X
						6	- SEC.	- SEC.					X		X				X
						4	15 SEC.	- SEC.							X				X
1B	6x40	2-4-2	0	X		1	10 SEC.	- SEC.					X		X				X
						4	10 SEC.	- SEC.							X				X
2A	6x40	2-4-2	0	X		2	- SEC.	- SEC.					X		X				X
2B	6x40	2-4-2	0	X		2	- SEC.	- SEC.											
3A	6x40	2-4-2	0	X		3	15 SEC.	- SEC.					X		X			X	
						8	3 SEC.	- SEC.					X		X			X	
4A	6x60	2-4-2	4		X	4	- SEC.	- SEC.					X		X				X
5A	6x40	2-4-2	4	X		5	15 SEC.	- SEC.					X		X				X
						2	- SEC.	- SEC.					X		X				X
						4	15 SEC.	- SEC.							X				X
5B	6x60	2-4-2	0		X	5	10 SEC.	- SEC.					X		X				X
						4	10 SEC.	- SEC.							X				X
6A	6x40	2-4-2	0	X		6	- SEC.	- SEC.					X		X				X
7A	6x60	2-4-2	4		X	7	15 SEC.	- SEC.					X		X			X	
						4	3 SEC.	- SEC.					X		X			X	
8A	6x40	2-4-2	0	X		8	- SEC.	- SEC.					X		X				X
S187	6x6	4	+310	X		N/A	- SEC.	- SEC.				X					X		X
PEDESTRIAN DETECTION																			
P21,P22	N/A	N/A	N/A		X	2	- SEC.	- SEC.		X									X
P41,P42	N/A	N/A	N/A		X	4	- SEC.	- SEC.		X									X
P61,P62	N/A	N/A	N/A		X	6	- SEC.	- SEC.		X									X
P81,P82	N/A	N/A	N/A		X	8	- SEC.	- SEC.		X									X



PHASING DIAGRAM DETECTION LEGEND

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

170 EV PREEMPTION

FUNCTION	EVB
DELAY BEFORE PREEMPT	0
PED. CLEAR BEFORE PREEMPT	0
MIN. GREEN BEFORE PREEMPT	1.0
CLEARANCE TIME	20
PREEMPT EXTEND×	2.0

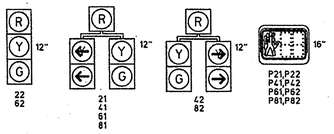
×Program Timing on Optical Detection Unit

170 RAILROAD PREEMPTION TIMING CHART

FUNCTION	RR2 (SEC)
DELAY BEFORE PREEMPT	0
TRACK CLEARANCE GREEN	27

SIGNAL FACE I.D.

All Heads L.E.D.



TIMING CHART
170 CONTROLLER

PHASE	Ø1	Ø2	Ø3	Ø4	Ø5	Ø6	Ø7	Ø8	OL1
MINIMUM INITIAL×	7 SEC.	10 SEC.	7 SEC.	7 SEC.	7 SEC.	10 SEC.	7 SEC.	7 SEC.	0 SEC.
VEHICLE EXTENSION×	2.0 SEC.	3.0 SEC.	2.0 SEC.	1.0 SEC.	2.0 SEC.	3.0 SEC.	2.0 SEC.	2.0 SEC.	- SEC.
YELLOW CHANGE INT.	3.2 SEC.	4.0 SEC.	3.2 SEC.	3.8 SEC.	3.3 SEC.	3.2 SEC.	3.1 SEC.	3.8 SEC.	3.2 SEC.
RED CLEARANCE	1.8 SEC.	1.5 SEC.	1.8 SEC.	1.5 SEC.	1.8 SEC.	2.1 SEC.	1.5 SEC.	1.5 SEC.	1.8 SEC.
MAXIMUM LIMIT×	15 SEC.	30 SEC.	20 SEC.	20 SEC.	15 SEC.	30 SEC.	15 SEC.	20 SEC.	
RECALL POSITION	NONE	VEH RECALL	NONE	NONE	NONE	VEH RECALL	NONE	NONE	
VEHICLE CALL MEMORY	NONE	YELLOW LOCK	NONE	NONE	NONE	YELLOW LOCK	NONE	NONE	
DOUBLE ENTRY	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	
WALK×	- SEC.	7 SEC.	- SEC.	7 SEC.	- SEC.	7 SEC.	- SEC.	7 SEC.	
FLASHING DON'T WALK	- SEC.	19 SEC.	- SEC.	17 SEC.	- SEC.	15 SEC.	- SEC.	15 SEC.	
TYPE 3 LIMIT	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
ALTERNATE EXTENSION	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
ADD PER VEHICLE×	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
MAXIMUM INITIAL×	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
MAXIMUM GAP×	2.0 SEC.	3.0 SEC.	2.0 SEC.	1.0 SEC.	2.0 SEC.	3.0 SEC.	2.0 SEC.	2.0 SEC.	
REDUCE 0.1 SEC EVERY×	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	- SEC.	
MINIMUM GAP	2.0 SEC.	3.0 SEC.	2.0 SEC.	1.0 SEC.	2.0 SEC.	3.0 SEC.	2.0 SEC.	2.0 SEC.	

× 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.

Crosswalk and Stopbar Location Diagram
Not to Scale

Note: Crosswalk lines are 8 inches thick with 8 feet of separation.
Locate stopbars 4 feet behind and parallel to crosswalks.

SIGNS

PROPOSED		EXISTING
Ⓐ	"LEFT TURN YIELD ON GREEN" Ball Sign (R10-12)	Ⓐ
Ⓑ	Left Arrow "ONLY" Sign (R3-5L)	Ⓑ
Ⓒ	Through Arrow "ONLY" Sign (R3-5A)	Ⓒ
Ⓓ	Right Arrow "ONLY" Sign (R3-5R)	Ⓓ
Ⓔ	"NO TURN ON RED" Sign (R10-11)	Ⓔ
Ⓕ	Fiber Optic Blankout Sign "NO LEFT TURN TRAIN"	Ⓕ
Ⓖ	Fiber Optic Blankout Sign "NO RIGHT TURN TRAIN"	Ⓖ
Ⓗ	"YIELD" Sign (R1-2)	Ⓗ
Ⓙ	"DO NOT STOP ON TRACKS" Sign (R8-8)	Ⓙ

LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Metal Pole	
	Inductive Loop Detector	
	Controller & Cabinet	
	Pull Box	
	2 in. Underground Conduit	
	Right of Way with Marker	
	Directional Arrow	
	Signal Pedestal	
	Optical Detector	
	Stop Bar	
	Wheelchair Ramp	
N/A	Railroad Tracks	
N/A	Railroad Cantilever	
N/A	Railroad Gate and Flasher	

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2012, "Standard Specifications for Roads and Structures" dated January 2012, and all applicable sections of the latest version of the generic Project Special Provisions.
2. This location contains railroad preemption phasing. Do not program signal for late night flashing operation.
3. Program phase 1, phase 3, phase 5 and phase 7 as protected/permissive.
4. Program controller to clear from phase 2+6 to phases 1 and/or 5 by progressing through phase 4+8 (see Electrical Details).
5. Set all detector units to presence mode.
6. Reposition existing signal heads numbered 21, 22, 61 and 62.
7. Program all timing information into phase banks 1, 2 and 3 unless otherwise noted.
8. Set phase bank 3 maximum limit to 250 seconds for phases used.
9. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
10. Program pedestrian heads to count down the flashing "Don't Walk" time only.
11. Existing "LEFT TURN YIELD ON GREEN" ball signs (R10-12) and lane control signs may be removed at the discretion of the Regional Traffic Engineer.
12. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
13. Ensure flashing operation does not alter operation of blankout signs.
14. Upon completion of preemption, controller returns to normal operation based on vehicle demand.
15. Call Phase Bank 1 during Railroad Preemption.
16. Set Red Revert time to 1 second.
17. This intersection features an optical preemption system. Shown locations of optical detectors are conceptual only.
18. Program signal heads numbered 61 and 62 to clear to all red before going into emergency vehicle preempt.
19. Install loop 2B now for future use. Do not wire to loop terminal (see Electrical Details).

SIGNAL UPGRADE - FINAL DESIGN

DURHAM
1 8 6 9
Local Landmark

City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signal Design Section
750 Greenfield Pkwy, Garner, NC 27529

SCALE 0 40 1" = 40'

US 70 Business (West Main Street) at Buchanan Boulevard

DIVISION 5 DURHAM COUNTY DURHAM

PLAN DATE: JANUARY 2011 REVIEWED BY: P NICHOLAS

PREPARED BY: L TRACEY REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS IV

SIGNATURE 12-21-11 DATE

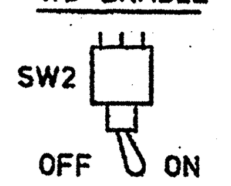
SIG. INVENTORY NO. 05-1022

PROJECT REFERENCE NO.	SHEET NO.
R-5164F	SIG. 10

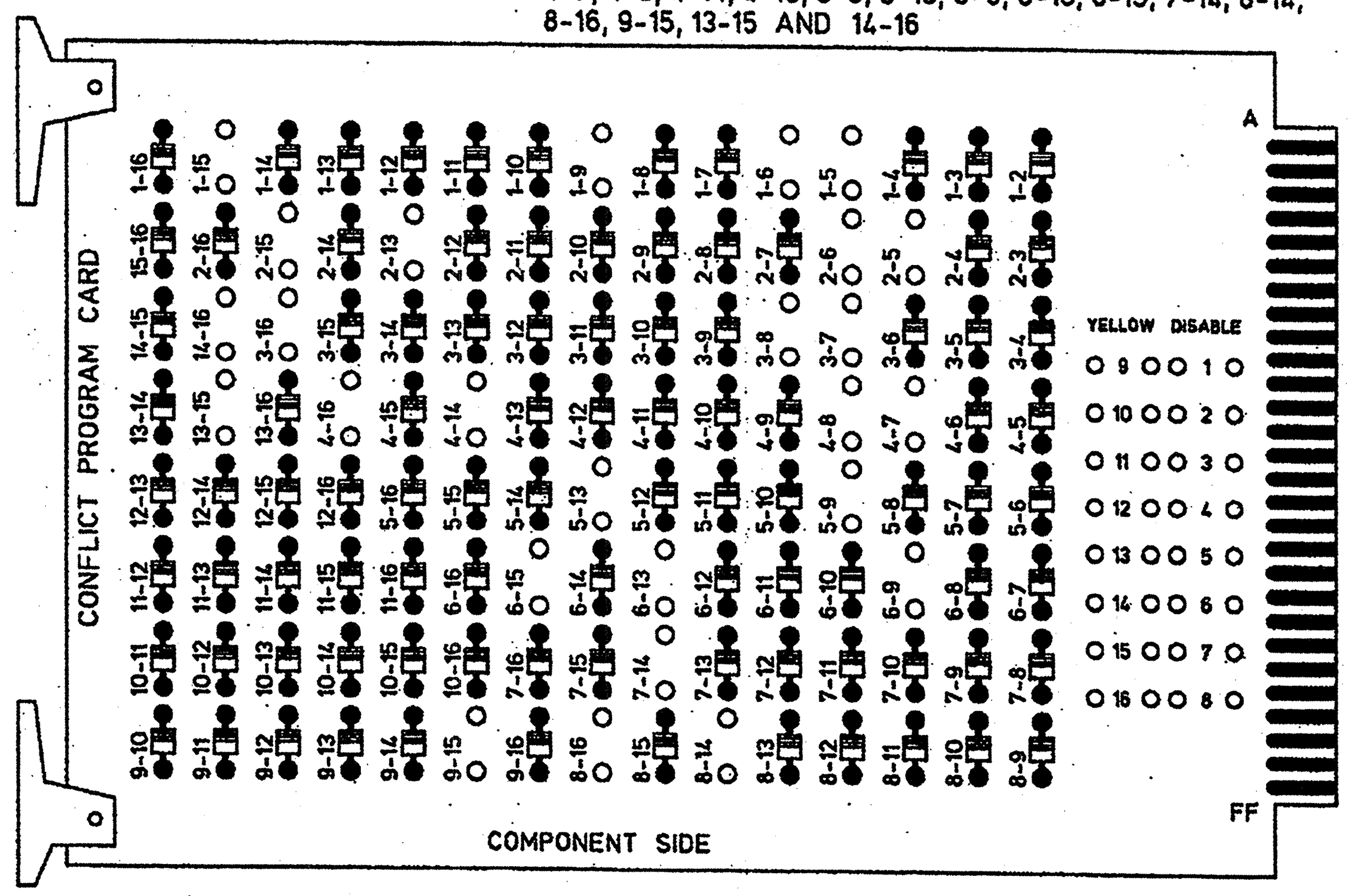
EDI MODEL 2010ECL CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

WD ENABLE

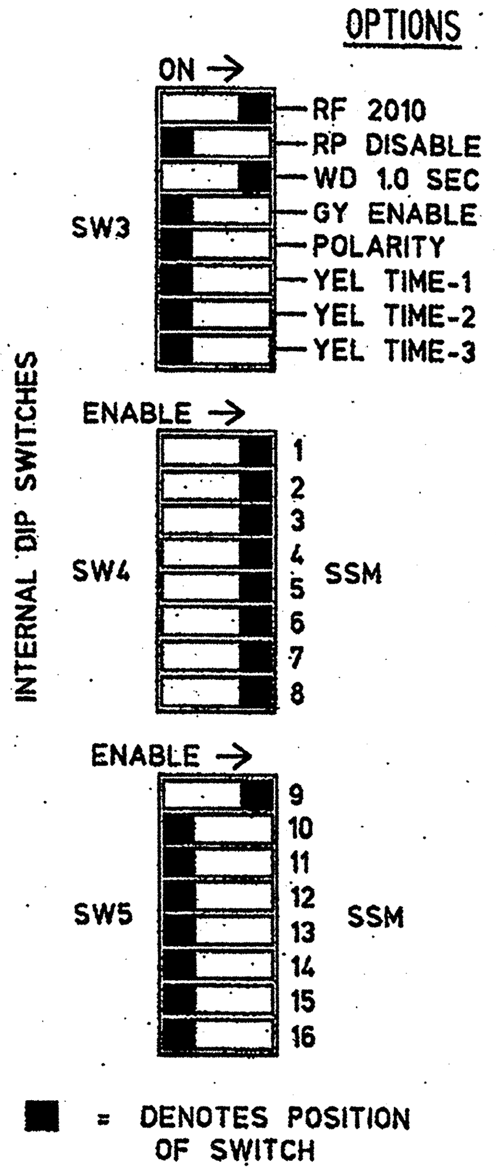


REMOVE DIODE JUMPERS 1-5, 1-6, 1-9, 1-15, 2-5, 2-6, 2-13, 2-15, 3-7, 3-8, 3-16, 4-7, 4-8, 4-14, 4-16, 5-9, 5-13, 6-9, 6-13, 6-15, 7-14, 8-14, 8-16, 9-15, 13-15 AND 14-16



REMOVE JUMPERS AS SHOWN

OPTIONS



■ = DENOTES POSITION OF SWITCH

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.

2. Make sure jumpers SEL2-SEL5 are present on the monitor board.

NOTES

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.
2. To prevent red failures on unused monitor channels 10,11,12,13,14,15 and 16, tie unused load switch red outputs to load switch AC+ per cabinet manufacturer's instructions.
3. Program controller to start up in phases 2 and 6 green.
4. Set power-up flash time to 7 seconds and implement within the controller programming.
5. Enable simultaneous gap-out feature, on the controller unit, for all phases.
6. Program phases 4 and 8, on the controller unit, for Double Entry.
7. Ensure start up flash phases are coordinated with flash program block assignments.
8. This controller and cabinet are part of the Durham City System.

EQUIPMENT INFORMATION

CONTROLLER.............................McCAIN TRAFFIC TYPE 170E
CABINET ....McCAIN TRAFFIC MODEL 332 (Dwg No.: M30117/REV. C)
SOFTWARE ....BI TRANS 233NC2×
CABINET MOUNT.....................BASE
OUTPUT FILE POSITIONS......18 (12 STD, 6 AUX)
LOAD SWITCHES USED.........S1,S2,S2P,S3,S4,S4P,S5,S6,S6P,S7,S8,S8P,S9
PHASES USED.........................1,2,2PED,3,4,4PED,5,6,6PED,7,8,8PED
OVERLAPS.................................OL1 = Ø1

×Software to be supplied by City of Durham.

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.

SIGNAL HEAD HOOK-UP CHART

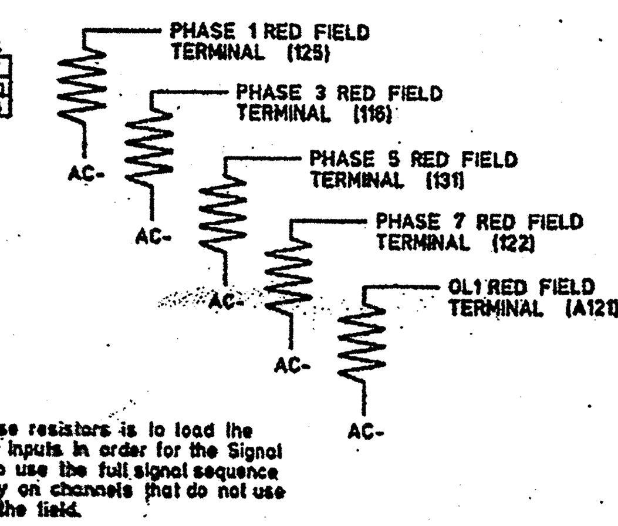
LOAD SWITCH NO.	S1	S2	S2P	S3	S4	S4P	S5	S6	S6P	S7	S8	S8P	S9	S10	S11	S12	S13	S14
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	61	21,22	P21, P22	81	41,42	P41, P42	21,42	61,62	P61, P62	41	81,82	P81, P82	82	NU	NU	NU	NU	NU
RED	×	128		×	101		×	134		×	107		×					
YELLOW		129			102			135			108							
GREEN		130			103			136			109							
RED ARROW																		
YELLOW ARROW	126			117			132			123			A122					
GREEN ARROW	127			118			133			124			A123					
(Don't Walk)			113			104			119			110						
(Walk)			115			106			121			112						

NU = Not Used

× Denotes Install Load Resistor. See Load Resistor Installation Detail this page.

LOAD RESISTOR INSTALLATION DETAIL

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



NOTE: The purpose of these resistors is to load the channel red monitor inputs in order for the Signal Sequence Monitor to use the full signal sequence monitoring capability on channels that do not use the red display in the field.

SIGNAL SYSTEM DATA:	
Drop	6
Area	2
Area Address	125
Comm Channel	FT-5

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 05-1022
DESIGNED: January 2011
SEALED: Dec. 21, 2011
REVISED:

INPUT FILE POSITION LAYOUT

(front view)

FILE		1	2	3	4	5	6	7	8	9	10	11	12	13	14
"I"	U	Ø1,6,4 1A	Ø2 2A	SLOT EMPTY	SLOT EMPTY	Ø3,8 3A	Ø4 4A	SLOT EMPTY	SLOT EMPTY	Ø1,4 1B	SLOT EMPTY	Advance DC ISOLATOR	Ø2 PED DC ISOLATOR	Ø6 PED DC ISOLATOR	FS DC ISOLATOR
"I"	L	NOT USED	NOT USED			NOT USED	NOT USED			SYS. DET. S187		Advance Enable DC ISOLATOR	Ø4 PED DC ISOLATOR	Ø8 PED DC ISOLATOR	ST DC ISOLATOR
"J"	U	Ø5,2,4 5A	Ø6 6A	SLOT EMPTY	SLOT EMPTY	Ø7,4 7A	Ø8 8A	SLOT EMPTY	SLOT EMPTY	Ø5,4 5B	SLOT EMPTY	NOT USED	SLOT EMPTY	● EVB SEE NOTE BELOW ×	NOT USED
"J"	L	NOT USED	NOT USED			NOT USED	NOT USED			NOT USED		Door Ajar DC ISOLATOR		NOT USED	RR2 AC ISOLATOR

● "TOMAR" INTERFACE CARD (4-CHANNEL)

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

× NOTE: OPTICAL DETECTORS SHALL BE WIRED TO INPUT FILE PER MANUFACTURER'S INSTRUCTIONS.

FS = FLASH SENSE
ST = STOP TIME
RR = RAILROAD PREEMPT

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	DETECTOR NO.	PIN NO.	ATTRIBUTES	NEMA PHASE
1A	TB2-1,2	I1U	1	56	5, 7	1
			2	56	5, 7	6
			3	56	7	4
1B	TB6-9,10	I9U	4	60	5, 7	1
			5	60	7	4
2A	TB2-5,6	I2U	6	39	5, 7	2
3A	TB4-5,6	I5U	7	58	5, 7	3
			8	59	5, 7	8
4A	TB4-9,10	I6U	9	41	5, 7	4
5A	TB3-1,2	J1U	10	55	5, 7	5
			11	55	5, 7	2
			12	55	7	4
5B	TB7-9,10	J9U	13	59	5, 7	5
			14	59	7	4
6A	TB3-5,6	J2U	15	40	5, 7	6
7A	TB5-5,6	J5U	16	57	5, 7	7
			17	57	5, 7	4
8A	TB5-9,10	J6U	18	42	5, 7	8
×S187	TB6-11,12	I9L	19	62	4	SYS
PEDESTRIAN PUSHBUTTONS						
P21,P22	TB8-4,6	I12U	20	67	2	2
P41,P42	TB8-5,6	I12L	21	69	2	4
P61,P62	TB8-7,9	I13U	22	68	2	6
P81,P82	TB8-8,9	I13L	23	70	2	8

NOTE: Program detector delay and carryover times as specified on signal design plans.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

DETECTOR ATTRIBUTES LEGEND:
1-FULL TIME DELAY
2-PED CALL
3-RESERVED
4-COUNTING
5-EXTENSION
6-TYPE 3
7-CALLING
8-ALTERNATE

EMERGENCY VEHICLE PREEMPTION PROGRAMMING

E.V. PREEMPT	OPTICAL DETECTOR	TERMINAL	INPUT PIN	CLEARANCE PHASES LOCATION	DELAY TIME LOCATION	CLEAR TIME LOCATION
EVB	B	TB9-7,9	E/126+F+2=72	E/125+E+B=Ø1,6	F/1+E+4=0 (SEC.)	F/1+E+5=20 (SEC.)

1. PROGRAM MINIMUM GREEN BEFORE PREEMPT AT: F/1+0+8= 1 (SEC.)
2. PROGRAM PHASE 2 PED. CLEAR BEFORE PREEMPT AT: F/1+2+B= 0 (SEC.)
   PROGRAM PHASE 4 PED. CLEAR BEFORE PREEMPT AT: F/1+4+B= 0 (SEC.)
   PROGRAM PHASE 6 PED. CLEAR BEFORE PREEMPT AT: F/1+6+B= 0 (SEC.)
   PROGRAM PHASE 8 PED. CLEAR BEFORE PREEMPT AT: F/1+8+B= 0 (SEC.)
3. FOR PREEMPTION IMMEDIATE RESPONSE, DISABLE MIN. WALK AT: E/125+F+F= 3
4. PROGRAM EXTEND TIME ON OPTICAL DETECTOR UNIT FOR 2.0 SEC.

HEAD 82 ARROWS (OL1) OPERATION DURING PREEMPTION

IN ORDER FOR E.V. PREEMPTION TO OPERATE AS PHASES 1 AND 6 WITHOUT SIGNAL HEAD 82 RIGHT-TURN ARROWS (OL1), THE FOLLOWING PROGRAMMING MUST BE IN PLACE:

ASSIGN O/L VEH. SET 2 INPUT AT E/126+D+C= 200
ASSIGN E.V. PREEMPT OUTPUT AT E/127+D+9= 200

200 = ASSIGNABLE PSEUDO-PIN (SOFTWARE)

BACK-UP PROTECTION NOTE

To insure that the controller will not sequence from phase 2+6 directly to phase 1 and/or 5 or from phase 4+8 directly to phase 3 and/or 7, special programming has to be enabled in the BI TRANS 233 NC software. Program 170E Controller as follows:

1. Program phases 1, 3, 5 and 7 as protected/permitted. At keypad input E/125+E+4= Ø1,3,5,7.
2. Loops 1A, 1B, 5A and 5B will have to be programmed to call phase 4 (with appropriate delay time) to allow controller to sequence thru phase 4 before proceeding to phase 1 and/or 5. See input file programming on this sheet.

PEDESTRIAN PHASE PROGRAMMING

PROGRAM PEDESTRIAN OUTPUTS 2P,4P,6P AND 8P
AT KEYPAD INPUT E/125+F+5=Ø2,
AT KEYPAD INPUT E/125+F+6=Ø6,
AT KEYPAD INPUT E/125+F+7=Ø4,
AT KEYPAD INPUT E/125+F+8=Ø8.

×SYSTEM DETECTOR PROGRAMMING NOTES

In order for system loops to operate properly, their pin assignments will have to be re-assigned on 170E controller as described below.

A. To assure that this pin is cleared from its default function, program as follows:
   Keypad input E/126+4+3 = 0
B. Program pin for system detector as follows:
   Keypad input E/126+B+1 = 62

SEE SHEET 2 FOR OVERLAP PROGRAMMING/ RAILROAD PREEMPTION WIRING AND CONTROLLER PROGRAMMING

FINAL DESIGN   SHEET 1 OF 2

DURHAM 1869 CITY OF MEDICINE
City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

Transportation Mobility and Safety Division
STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signals Management Section
750 Greenfield Pkwy, Garner, NC 27529

US 70 Business (West Main Street) at Buchanan Boulevard

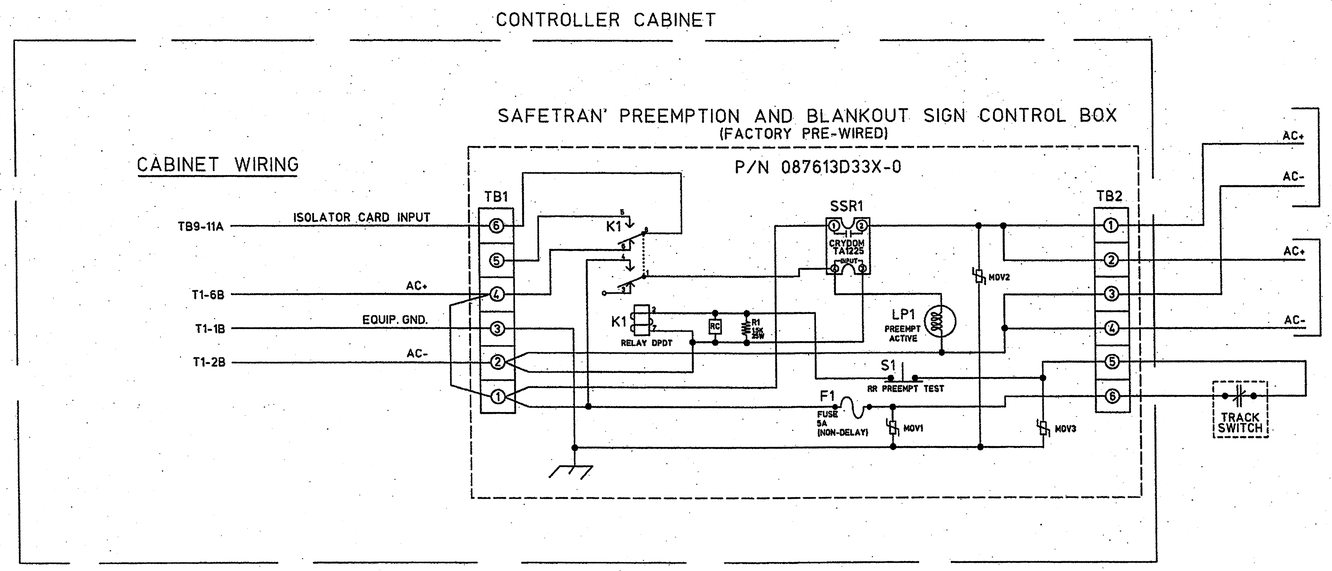
DIVISION 5	DURHAM COUNTY	DURHAM
PLAN DATE: JANUARY 2011	REVIEWED BY: P NICHOLAS	
PREPARED BY: L TRACEY	REVIEWED BY:	
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS IV
SIGNATURE   DATE 12-21-11
SIG. INVENTORY NO. 05-1022

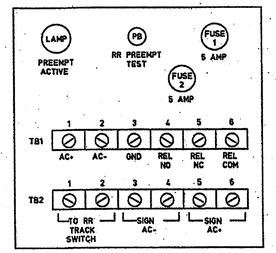
PROJECT REFERENCE NO.	SHEET NO.
R-5164F	SIG. 1/

RAILROAD PREEMPTION WIRING DETAIL

(WIRE AS SHOWN)



FRONT VIEW



OVERLAP PROGRAMMING NOTES

TO ASSURE THAT LOADSWITCH S9 IS ASSIGNED AS OVERLAP 1, PROGRAM CONTROLLER AT KEYPAD INPUT E/29+1+0=9

TO SET THE PARENT PHASE FOR OVERLAP 1 (VEH SET 1) AS PHASE 1, PROGRAM CONTROLLER AT KEYPAD INPUT E/29+1+1=Ø1

TO SET THE PARENT PHASE FOR OVERLAP 1 (VEH SET 2) AS NONE, NO PROGRAMMING IS REQUIRED.

PROGRAM TIMING FOR OVERLAP 1 AS FOLLOWS:

GREEN CLEAR - E/29+1+D=0.0 (SEC.)
YELLOW CHANGE INTERVAL - E/29+1+E=3.2 (SEC.)
RED CLEARANCE - E/29+1+F=1.8 (SEC.)

170E CONTROLLER RAILROAD PREEMPTION PROGRAMMING

1. PROGRAM RR2 INPUT PIN NO. AT E/126+F+6=52 (THIS IS DEFAULT PARAMETER)
2. PROGRAM TRACK CLEARANCE PHASES AT E/125+E+2=Ø3,8
3. PROGRAM LIMITED SERVICE PHASES AT E/125+E+3=Ø2,5,6,7
4. PROGRAM RR PREEMPT DELAY TIME AT F/1+E+A= 0 (SEC.)
5. PROGRAM TRACK CLEARANCE TIME AT F/1+E+B= 27 (SEC.)
6. PROGRAM MINIMUM GREEN BEFORE PREEMPT AT F/1+0+8= 1 (SEC.)
7. ENABLE NON-LOCK' FEATURE AT E/125+F+4=6 (RR2)

NOTES

1. RELAY K1 IS SHOWN IN THE ENERGIZED (PREEMPT NOT ACTIVE) NORMAL OPERATING STATE.
2. RELAY K1 IS A DPDT WITH 120VAC COIL (OMRON MK2P-3 OR EQUAL) WITH OCTAL BASE.
3. RELAY SSR1 IS A SPST (NORMALLY OPEN) SOLID STATE RELAY WITH AC INPUT AND AC 25 AMP OUTPUT, CRYDOM TA1225 (OR APPROVED EQUAL).
4. AC ISOLATOR CARD SHALL ACTIVATE PREEMPTION UPON REMOVAL OF AC+ FROM THE INPUT (AS SHOWN ABOVE). TO ACCOMPLISH THIS SET INVERT DIP SWITCH ON AC ISOLATOR CARD.
5. RESISTOR IS VALUED AT 2K OHM, 12 WATT, CLAROSTAT VPR10F-2K (OR APPROVED EQUAL).
6. RC NETWORK IS VALUED AT .1 MIRCOFARAD, 100 OHM.
7. THIS SCHEMATIC IS BASED ON PLANS GENERATED BY SAFETRAN TRAFFIC SYSTEMS DATED 10/19/00.
8. IMPORTANT! ENSURE TERMINAL TB9-12 (ON INPUT PANEL) IS CONNECTED TO AC NEUTRAL (JUMPER MAY HAVE TO BE ADDED).

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-1022
DESIGNED: January 2011
SEALED: Dec. 21, 2011
REVISED:

SPECIAL NOTES: USING PHASE BANK 1 DURING RAILROAD PREEMPTION

In order for Controller to switch to Phase Bank 1 for Railroad Preemption while running coordinated timing, program 170E Controller as follows:

Assign Railroad Preempt 2 (RR2) at E/127+D+D = 225
Assign Free (7-Wire) Input at E/126+E+5 = 225

225 = ASSIGNABLE PSEUDO-PIN

DURHAM

City of Durham
101 City Hall Plaza
Durham, NC 27701
(919) 560-4366

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

750 Greenfield Pkwy, Garner, NC 27529

FINAL DESIGN SHEET 2 OF 2

US 70 Business (West Main Street) at Buchanan Boulevard

DIVISION 5 DURHAM COUNTY DURHAM
PLAN DATE: JANUARY 2011 REVIEWED BY: P NICHOLAS
PREPARED BY: L TRACEY REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 032040 ENGINEER PETER JOSEPH NICHOLAS
SIGNATURE 12-21-11 DATE
SIG. INVENTORY NO. 05-1022