

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

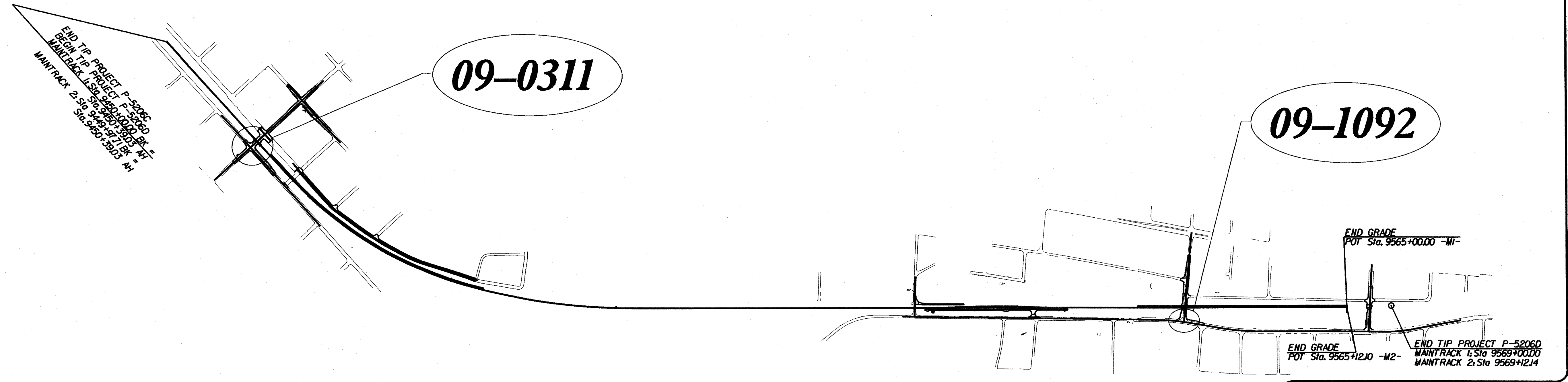
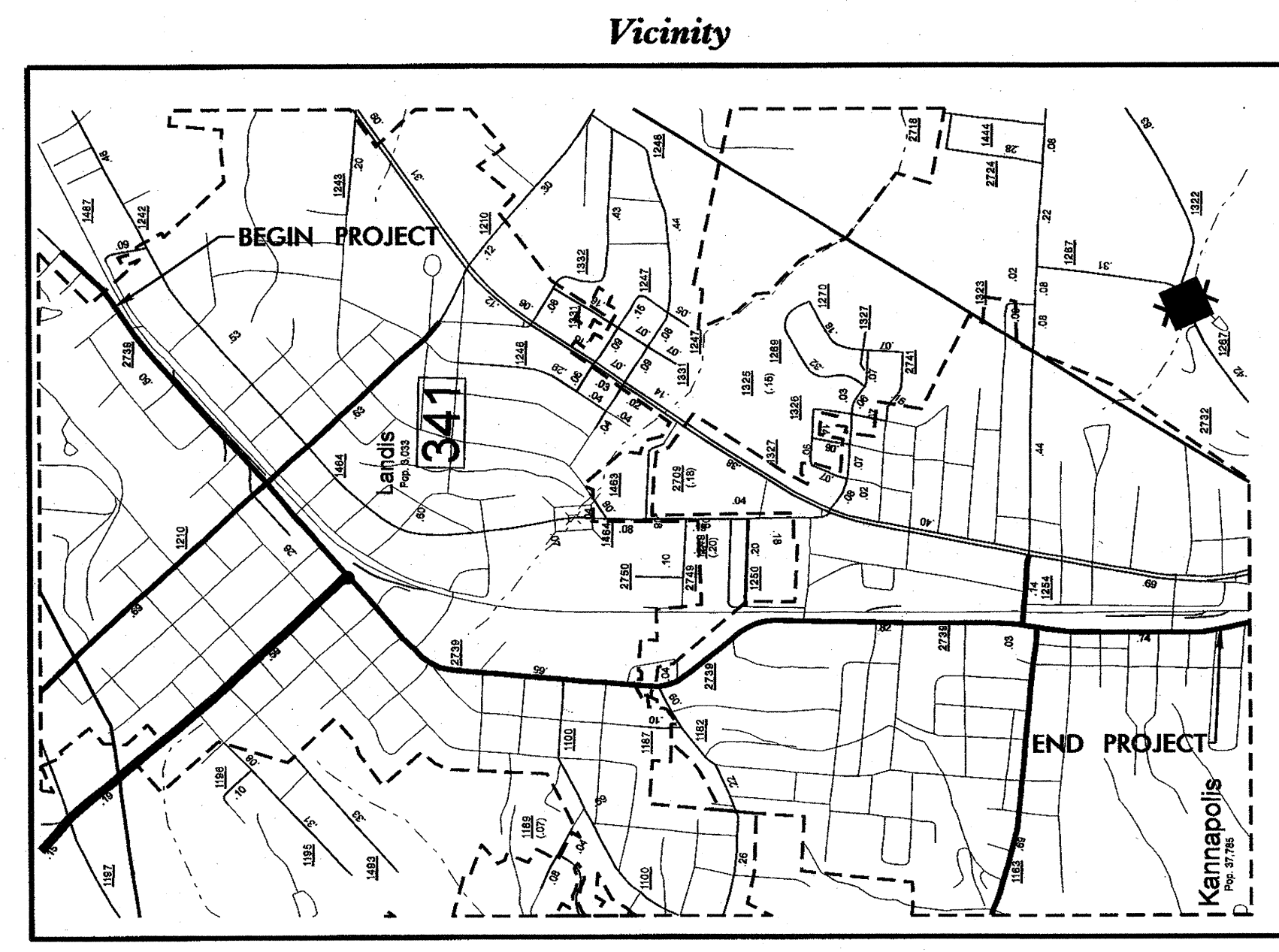
Rowan County

**LOCATION: NCRR/NS MAINLINE REID TO NORTH
KANNAPOLIS RAILROAD ROADBED**

TYPE OF WORK: TRAFFIC SIGNALS

Project: P-5206D

Contract: C-203207



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

Sheet #	Reference #	Index of Plans Location/Description
Sig. 1		Title Sheet
Sig. 2-5	09-0311	SR 2739 (N. Main Street) at SR 1210 (Ryder Avenue)
Sig. 6-9	09-1092	SR 2739 (N. Main Street) at SR 1254 (E. 22nd Street)
Sig. 10-17	N/A	Metal Pole Detail Sheets

INTELLIGENT TRANSPORTATION AND SIGNALS UNIT
Contacts:
Robert J. Ziemba, PE -Central Region Signals Engineer
George C. Brown, PE - Signal Equipment Design Engineer

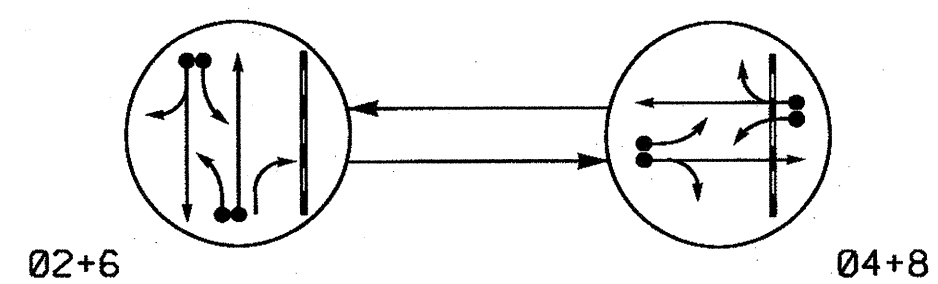
Prepared In the Office of:
DIVISION OF HIGHWAYS
TRANSPORTATION MOBILITY AND SAFETY
DIVISION

750 N. Greenfield Parkway, Garner, NC 27529

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RAIL PREEMPT PHASES
(High Priority)

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND
 ● DETECTED MOVEMENT
 ◐ UNDETECTED MOVEMENT (OVERLAP)
 - - UN SIGNALIZED MOVEMENT
 - - PEDESTRIAN MOVEMENT

SIGNAL FACE	PHASE							
	G+NS	G+8	R	R	D	D	F	F
21	Y	Y	Y	Y	Y	Y	Y	Y
22, 23	G	R	R	G	R	Y		
31	Y	Y	Y	Y	Y	Y	Y	Y
41, 42	R	G	R	R	R	R	R	R
61	Y	Y	Y	Y	Y	Y	Y	Y
62, 63	G	R	R	G	R	Y		
71	Y	Y	Y	Y	Y	Y	Y	Y
81, 82	R	G	G	R	R	R	R	R
Sign B	OFF	OFF	ON	ON	ON	*		

LOOP	INDUCTIVE LOOPS				DETECTOR PROGRAMMING							
	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	PHASE	CALLING	EXTENSION	FULL TIME DELAY	STRETCH TIME	DELAY TIME	SYSTEM LOOP	NEW CARD
2A	6X6	70	4	Y	2	Y	Y	-	-	-	-	Y
2B	6X40	0	2-4-2	Y	2	Y	Y	-	-	-	-	Y
4A	6X40	0	2-4-2	Y	4/7	Y	Y	-	-	3	-	Y
4B	6X40	0	2-4-2	Y	4	Y	Y	-	-	10	-	Y
6A	6X6	70	4	Y	6	Y	Y	-	-	-	-	Y
6B	6X40	0	2-4-2	Y	6	Y	Y	-	-	-	-	Y
8A	6X40	0	2-4-2	Y	8	Y	Y	-	-	-	-	Y
8B	6X40	0	2-4-2	Y	8	Y	Y	-	-	10	-	Y
8C	6X40	0*	2-4-2	Y	8	Y	Y	-	-	5	-	Y
8D	6X40	0*	2-4-2	Y	8	Y	Y	-	-	5	-	Y

2 Phase w/ RR Preemption Fully Actuated (Isolated)

NOTES

- Refer to "Roadway Standard Drawings NCDOT" dated January 2012 and "Standard Specifications for Roads and Structures" dated January 2012.
- This location contains railroad preemption phasing. Do not program signal for late night flashing operation.
- Set all detector units to presence mode.
- Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
- Ensure flashing operation does not alter operation of blankout signs.
- Program parent phases for Overlap "P" for all phases used in normal operation.

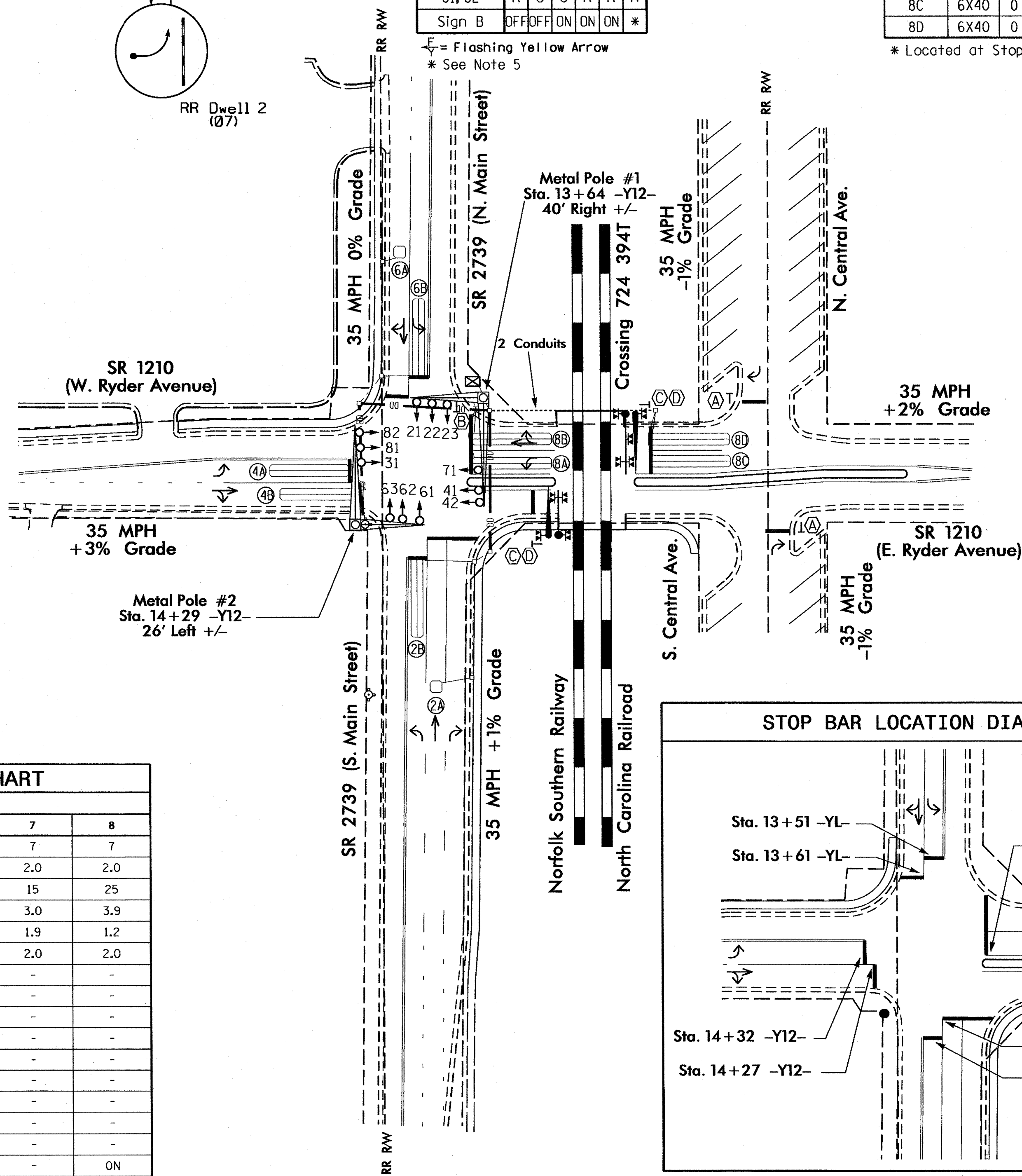
FUNCTION	PRE 1
Interval 1 - Track Clearance Green	20
Interval 1 - Track Clearance Yellow	3.9
Interval 1 - Track Clearance Red	1.2
Interval 2 - Dwell Green	255
Interval 2 - Dwell Yellow	0.0*
Interval 2 - Dwell Red	0.0*
Interval 5 - Exit Green	1
Interval 5 - Yellow	0.0
Interval 5 - Red	0.0
Exit Phase(s)	4+8
Priority	HIGH
Delay Time	0
Min Green Before Pre	1
Ped Clear Before Pre	0
Yellow Clear Before Pre	3.8
Red Clear Before Pre	1.6
Dwell Min Time	10
Enable Backup Protection	N
Ped Clear Through Yellow	N
Omit Overlaps	A, P

* Time defaults to time used for phase during normal operation

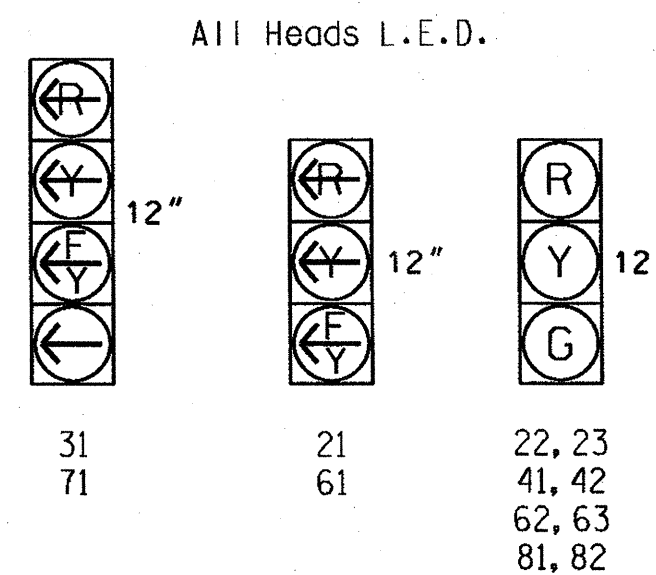
This signal was designed for advanced preemption.

FEATURE	PHASE				
	2	4	6	7	8
Min Green 1 *	10	7	10	7	7
Extension 1 *	3.0	2.0	3.0	2.0	2.0
Max Green 1 *	30	25	30	15	25
Yellow Clearance	3.8	3.9	3.8	3.0	3.9
Red Clearance	1.6	1.2	1.6	1.9	1.2
Red Revert	2.0	2.0	2.0	2.0	2.0
Walk 1 *	-	-	-	-	-
Don't Walk 1	-	-	-	-	-
Seconds Per Actuation *	-	-	-	-	-
Max Variable Initial *	-	-	-	-	-
Time Before Reduction *	-	-	-	-	-
Time To Reduce *	-	-	-	-	-
Minimum Gap	-	-	-	-	-
Recall Mode	MIN RECALL	-	MIN RECALL	-	-
Vehicle Call Memory	YELLOW	-	YELLOW	-	-
Dual Entry	-	ON	-	-	ON
Simultaneous Gap	ON	ON	ON	ON	ON

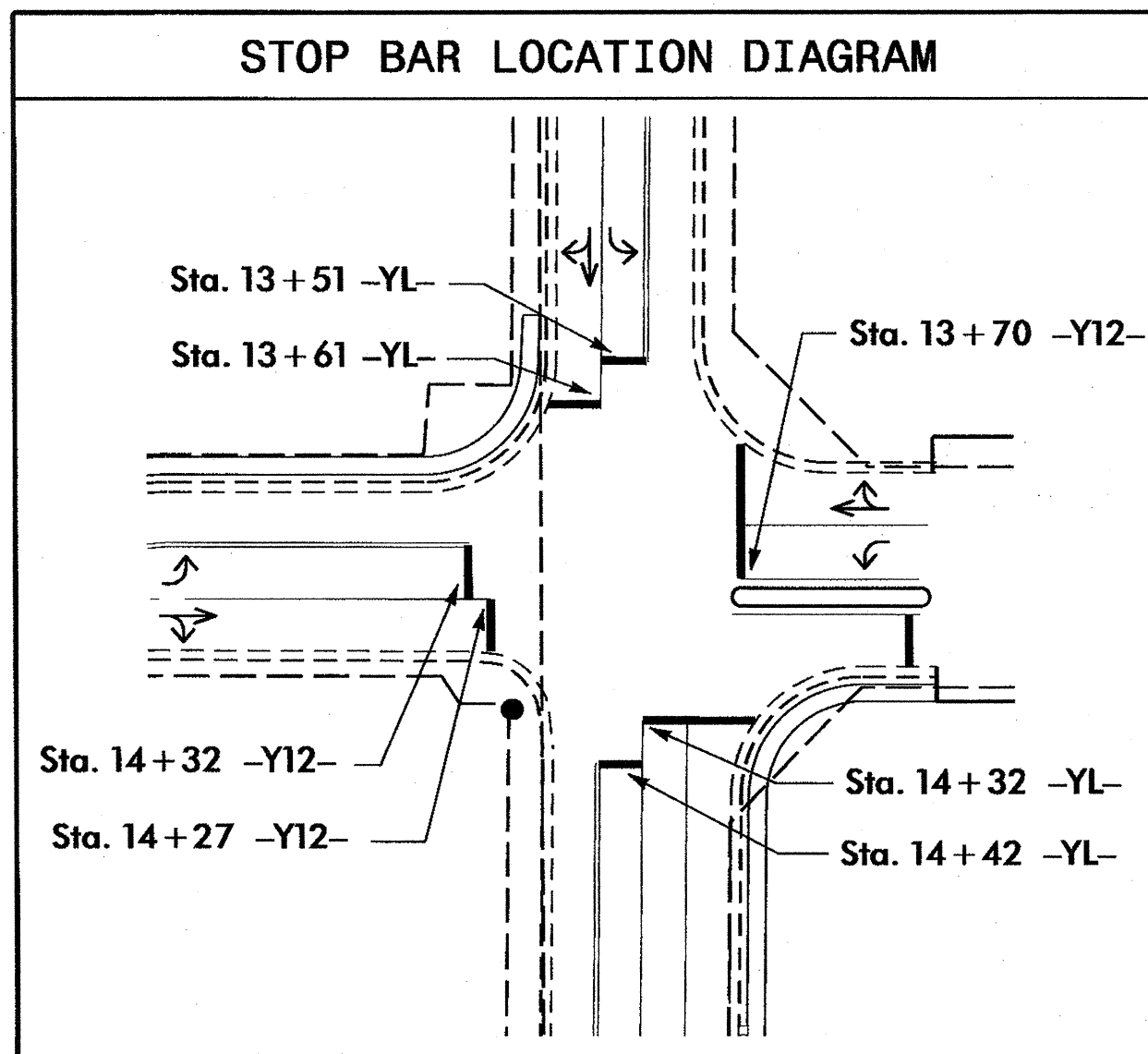
* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.



SIGNAL FACE I.D.



STOP BAR LOCATION DIAGRAM



LEGEND

- | PROPOSED | EXISTING |
|--|--|
| ○ → Traffic Signal Head | ● → Traffic Signal Head |
| ○ → Modified Signal Head | N/A |
| ○ → Sign | - \| Sign |
| ○ → Pedestrian Signal Head With Push Button & Sign | ○ → Pedestrian Signal Head |
| ○ → Signal Pole with Guy | ○ → Signal Pole with Guy |
| ○ → Signal Pole with Sidewalk Guy | ○ → Signal Pole with Sidewalk Guy |
| ⊗ → Inductive Loop Detector | ⊗ → Inductive Loop Detector |
| ⊗ → Controller & Cabinet | ⊗ → Controller & Cabinet |
| □ → Junction Box | □ → Junction Box |
| - - - 2-in Underground Conduit | - - - 2-in Underground Conduit |
| N/A → Right of Way | → Right of Way |
| → Directional Arrow | → Directional Arrow |
| ○ → Metal Pole with Mastarm | ○ → Metal Pole with Mastarm |
| - - - 2-in Rigid Metal Conduit | N/A |
| - - - Directional Drill | N/A |
| N/A → Railroad Tracks | ▬ → Railroad Tracks |
| N/A → Railroad Cantilever | ▬ → Railroad Cantilever |
| N/A → Railroad Gate and Flasher | ▬ → Railroad Gate and Flasher |
| ⊙ → "STOP" Sign (R1-1) | ⊙ → "STOP" Sign (R1-1) |
| ⊙ → "NO RIGHT TURN - TRAIN" L.E.D. Blankout Sign | ⊙ → "NO RIGHT TURN - TRAIN" L.E.D. Blankout Sign |
| ⊙ → "DO NOT STOP ON TRACKS" Sign (R8-8) | ⊙ → "DO NOT STOP ON TRACKS" Sign (R8-8) |
| ⊙ → "STOP HERE WHEN FLASHING" Sign (R8-10) | ⊙ → "STOP HERE WHEN FLASHING" Sign (R8-10) |

Signal Upgrade

Prepared in the Offices of:
TRANSPORTATION MOBILITY AND SAFETY DIVISION
 NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 Signal Design Section

SR 2739 (N. Main Street) at SR 1210 (Ryder Ave.)

Division 9 Rowan County Landis

PLAN DATE: August 2013 REVIEWED BY:

PREPARED BY: C. E. Carter REVIEWED BY:

REVISIONS: INIT. DATE

SCALE: 1"=40'

8/29/13

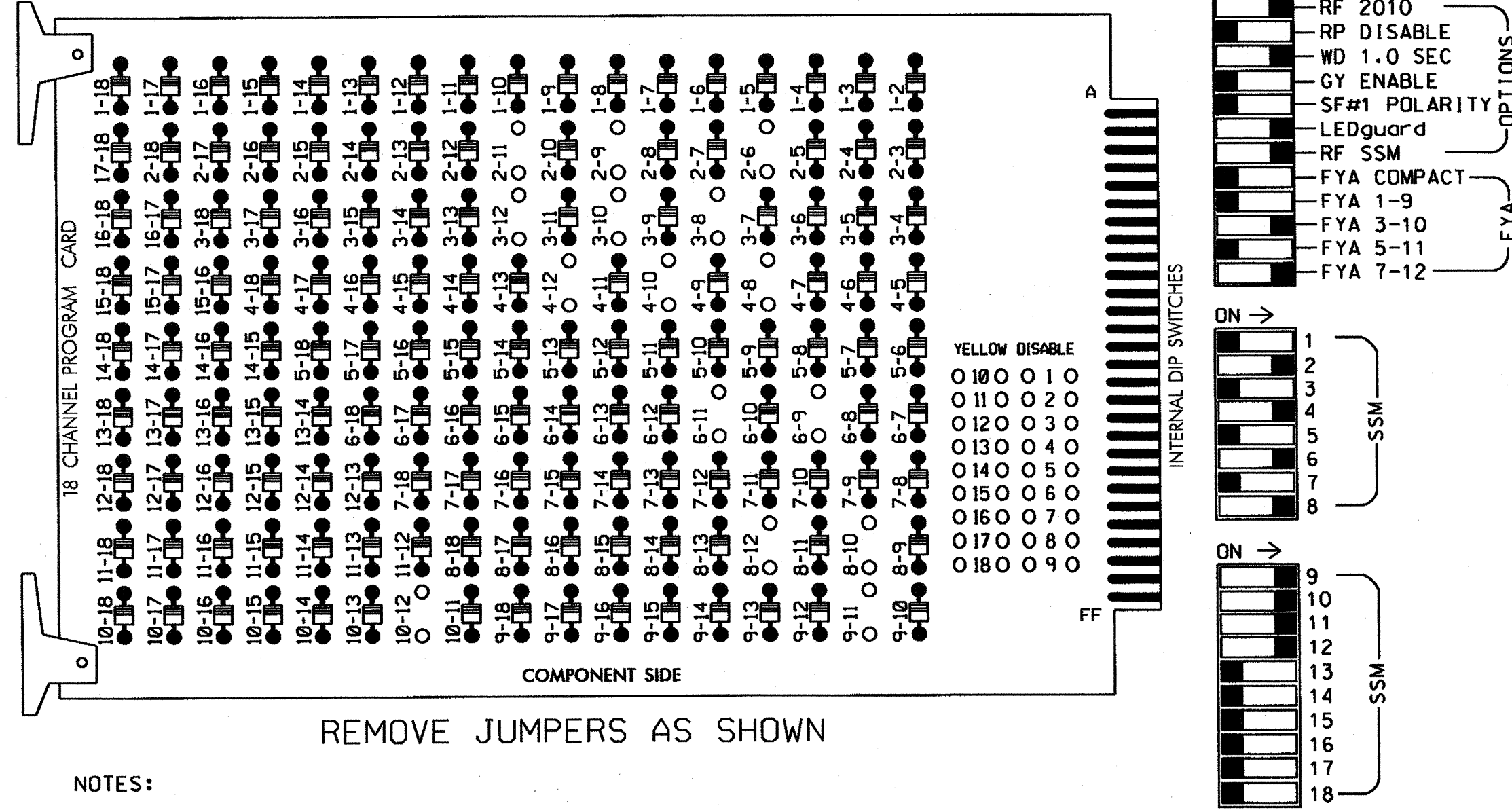
SIG. INVENTORY NO. 09-0311

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EDI MODEL 2018ECL-NC CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 2-6, 2-9, 2-11, 3-8, 3-10, 3-12, 4-8, 4-10, 4-12, 6-9, 6-11, 8-10, 8-12, 9-11 and 10-12.



REMOVE JUMPERS AS SHOWN

NOTES:

- Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
- Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
- Ensure that Red Enable is active at all times during normal operation.
- Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

NOTES

- 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.
- Program phases 4 and 8 for Dual Entry.
- Enable Simultaneous Gap-Out for all phases.
- Program phases 2 and 6 for Start Up In Green.
- Program phases 2 and 6 for Yellow Flash and overlaps 1 and 2 as Wag Overlaps.

EQUIPMENT INFORMATION

CONTROLLER.....2070L
 CABINET.....332 /W/ AUX
 SOFTWARE.....ECONOLITE OASIS 3.03.26E
 OR LATEST APPROVED VERSION
 CABINET MOUNT.....BASE
 OUTPUT FILE POSITIONS...18 WITH AUX. OUTPUT FILE
 LOAD SWITCHES USED.....S2,S4,S5,S8,S10,S11,AUX S1,
 AUX S2,AUX S4,AUX S5
 PHASES USED.....2,*3,4,6,*7,8
 OVERLAP "A".....6
 OVERLAP "B".....3+4
 OVERLAP "C".....2
 OVERLAP "D".....7+8
 OVERLAP "P".....2+4+6+8
 * Denotes phases 3 and 7 used in preemption sequence only.

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6	15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED	OLA	OLB	SPARE	OLC	OLD	SPARE
SIGNAL HEAD NO.	NU	22,23	NU	31*	41,42	NU	NU	62,63	NU	71*	81,82	NU	61*	31*	NU	21*	71*	NU
RED		128			101			134			107							
YELLOW		129		*	102			135		*	108							
GREEN		130			103			136			109							
RED ARROW													A121	A124		A114	A101	
YELLOW ARROW													A122	A125		A115	A102	
FLASHING YELLOW ARROW													A123	A126		A116	A103	
GREEN ARROW						118					124							

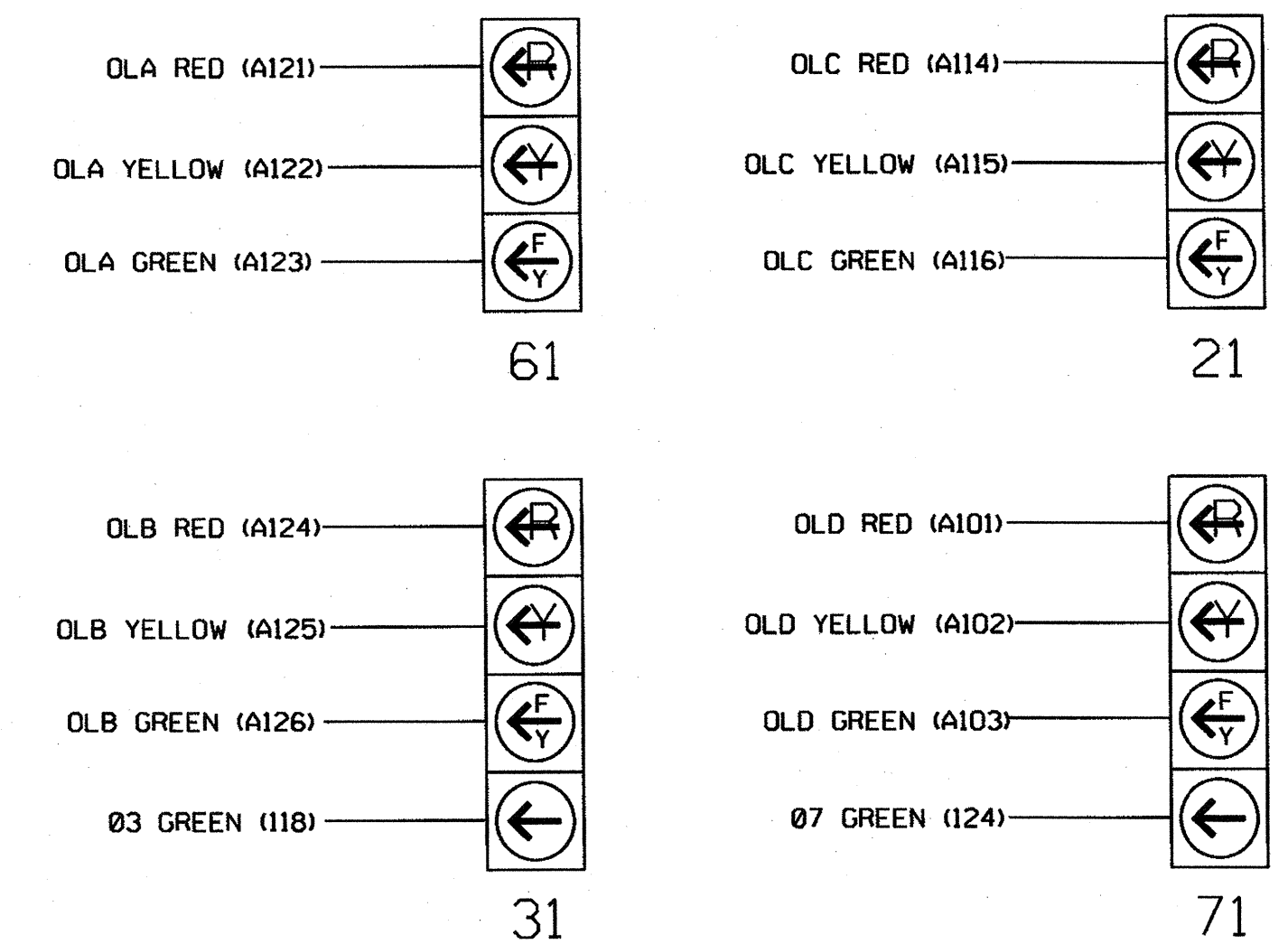
NU = Not Used

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

* See pictorial of head wiring in detail below.

FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)



NOTE

- The sequence display for signal heads 31 and 71 requires special logic programming. See sheet 2 for programming instructions.

INPUT FILE POSITION LAYOUT

(front view)

FILE "I"	1	2	3	4	5	6	7	8	9	10	11	12	13	14
U	S	∅ 2	S	S	S	∅ 4	S	S	S	S	S	S	S	FS
L	U	2A	U	U	U	4A	U	U	U	U	U	U	U	DC ISOLATOR
L	U	2B	U	U	U	4B	U	U	U	U	U	U	U	DC ISOLATOR
U	S	∅ 6	S	S	S	∅ 8	∅ 8	S	S	S	S	S	S	PRE I
L	U	6A	U	U	U	8A	8C	U	U	U	U	U	U	AC ISOLATOR
L	U	6B	U	U	U	8B	8D	U	U	U	U	U	U	NOT USED

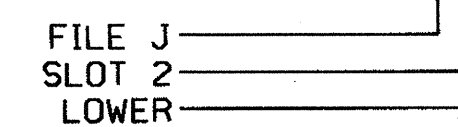
EX.: 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE
 ST = STOP TIME
 PRE = PREEMPT

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT ASSIGNMENT NO.	DETECTOR NO.	NEMA PHASE	CALL	EXTEND	FULL TIME DELAY	STRETCH TIME	DELAY TIME
2A	TB2-5,6	I2U	39	1	2	2	Y	Y			
2B	TB2-7,8	I2L	43	5	12	2	Y	Y			
4A	TB4-9,10	I6U	41	3	4	4/7	Y	Y			3
4B	TB4-11,12	I6L	45	7	14	4	Y	Y			10
6A	TB3-5,6	J2U	40	2	6	6	Y	Y			
6B	TB3-7,8	J2L	44	6	16	6	Y	Y			
8A	TB5-9,10	J6U	42	4	8	8	Y	Y			
8B	TB5-11,12	J6L	46	8	18	8	Y	Y			10
8C	TB7-1,2	J7U	66	28	38	8	Y	Y			5
8D	TB7-3,4	J7L	79	41	48	8	Y	Y			5

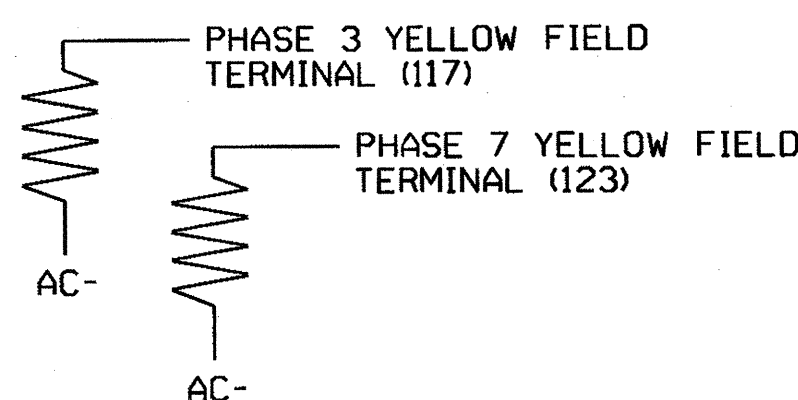
INPUT FILE POSITION LEGEND: J2L



LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

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



PREEMPT ONLY PHASE OMIT NOTE

(program controller as shown below)

From Main Menu press '2' (Phase Control). Then '1' (Phase Control Functions). Program Phases 3 and 7 for 'Omit Phase' and Phases 2, 4, 6 and 8 for 'Startup Calls'. This is to prevent Phases 3 and 7 from being served when not in Preempt.

Electrical Detail - Sheet 1 of 3

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 09-0311
 DESIGNED: August 2013
 SEALED: 8/29/13
 REVISED: N/A

Electrical and Programming Details For:
SR 2739 (N. Main Street) at SR 1210 (Ryder Ave.)
 Division 9 Rowan County Landis

Prepared In the Office of:

 750 N. Greenfield Pkwy, Garner, NC 27529

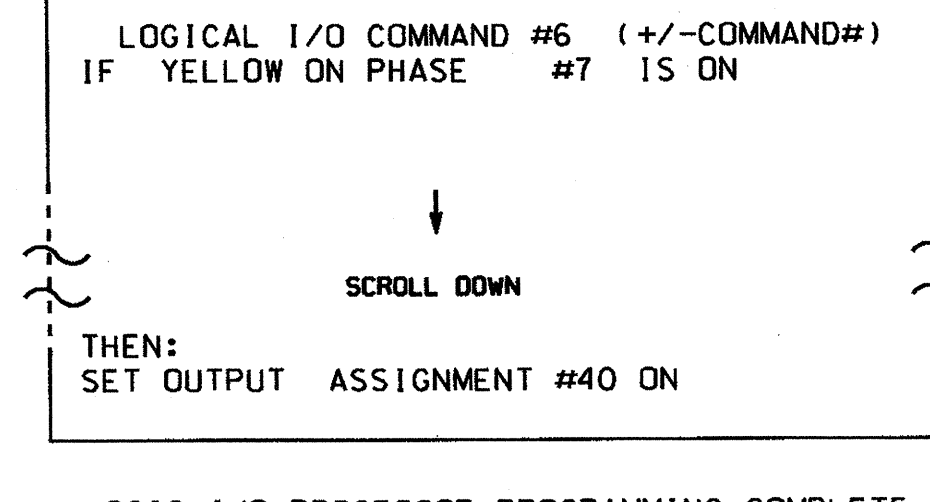
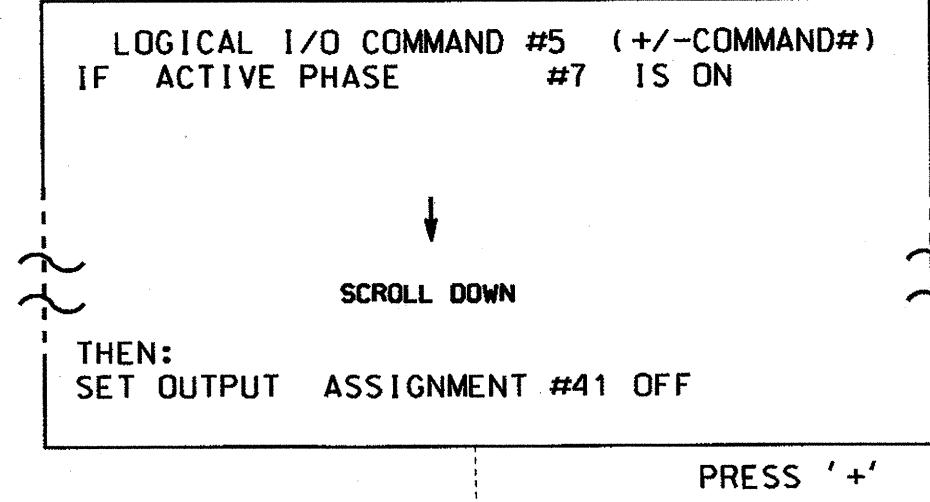
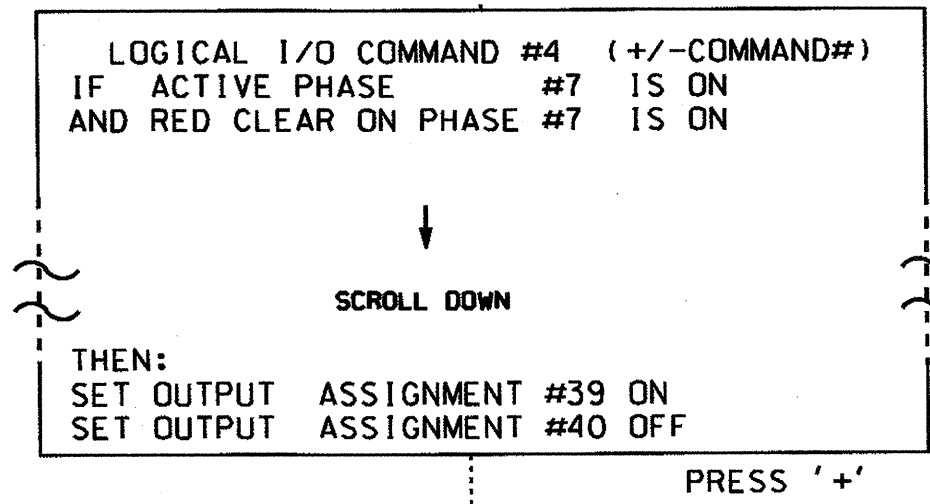
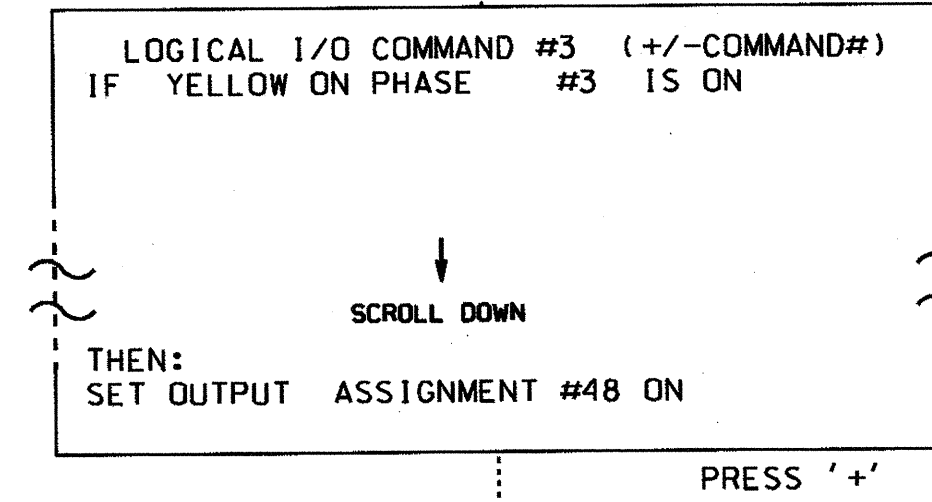
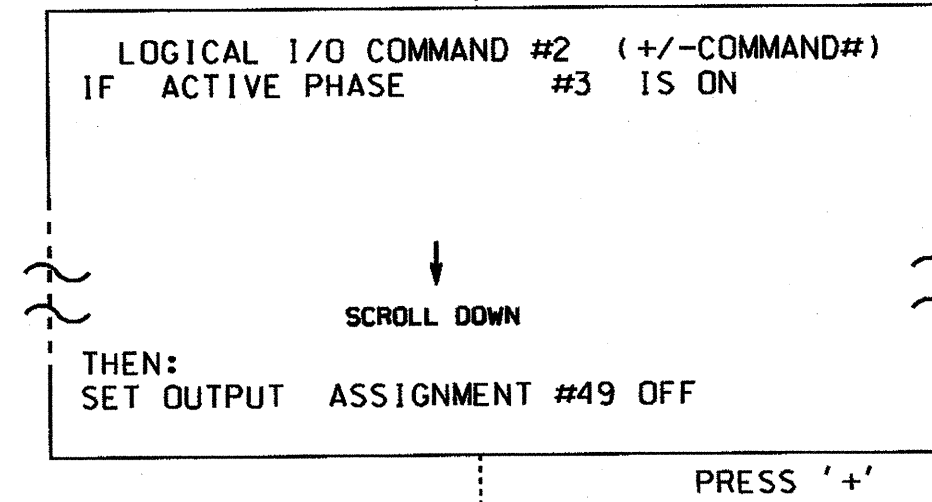
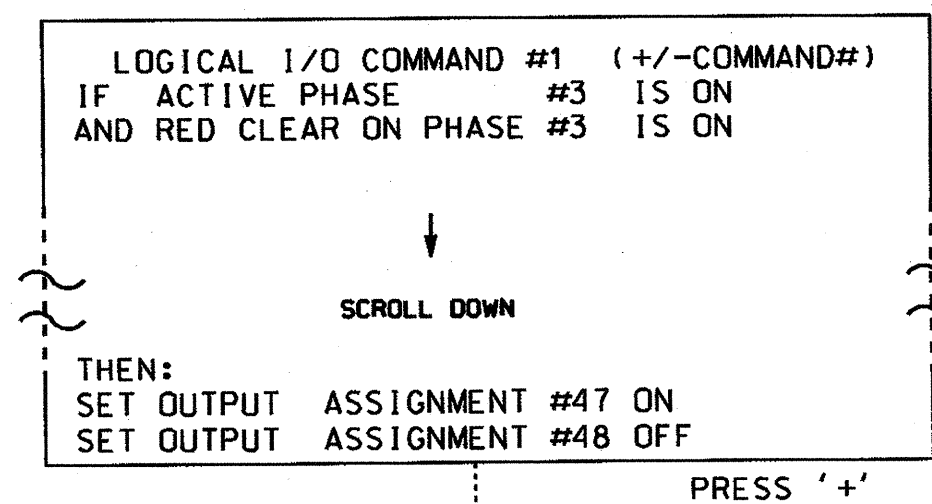
SEAL
 NORTH CAROLINA PROFESSIONAL ENGINEER
 SEAL 022013
 GEORGE C. BROWN

PLAN DATE: August 2013 REVIEWED BY: T. J. J...
 PREPARED BY: C. Strickland REVIEWED BY:
 REVISIONS INIT. DATE
 SIGNATURE: [Signature] DATE: 9/4/13
 SIG. INVENTORY NO. 09-0311

LOGICAL I/O PROCESSOR PROGRAMMING DETAIL TO PRODUCE SPECIAL FYA-PPLT SIGNAL SEQUENCE

(program controller as shown below)

- FROM MAIN MENU PRESS '2' (PHASE CONTROL), THEN '1' (PHASE CONTROL FUNCTIONS). SCROLL TO THE BOTTOM OF THE MENU AND ENABLE ACT LOGIC COMMANDS 1, 2, 3, 4, 5 AND 6.
- FROM MAIN MENU PRESS '6' (OUTPUTS), THEN '3' (LOGICAL I/O PROCESSOR).



LOGIC I/O PROCESSOR PROGRAMMING COMPLETE

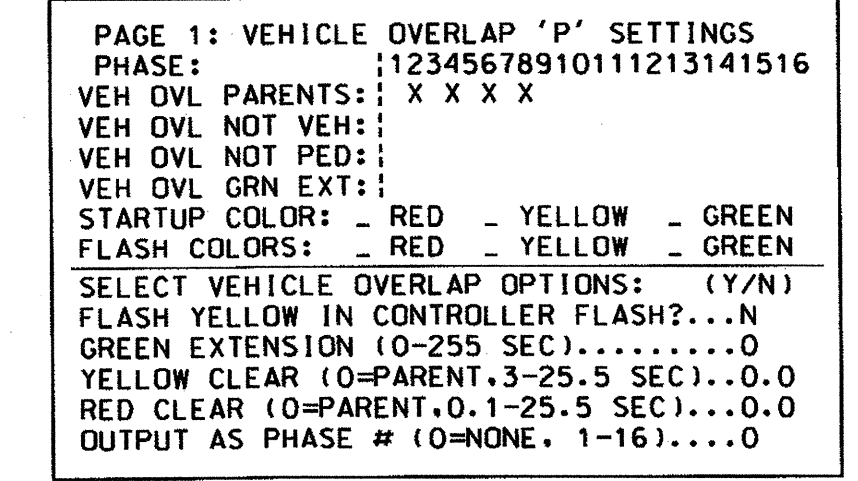
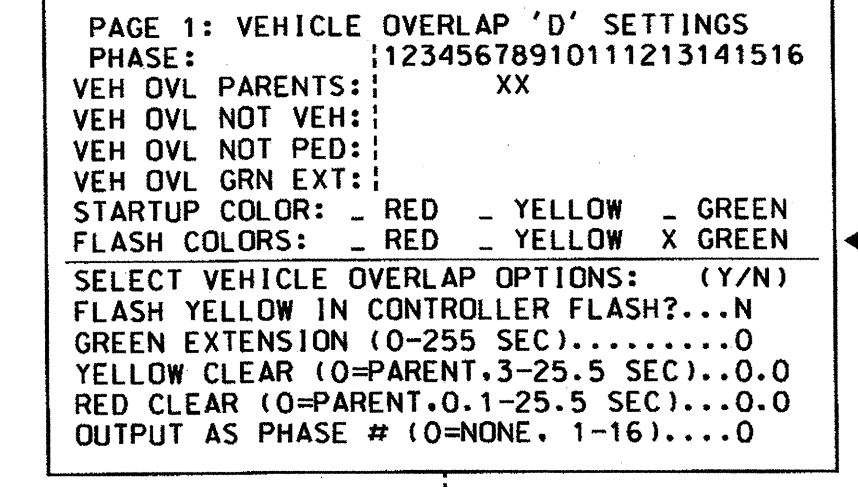
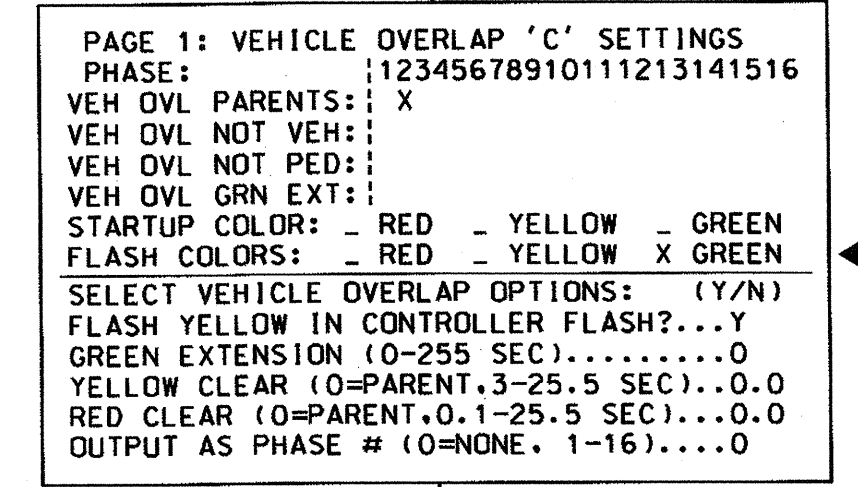
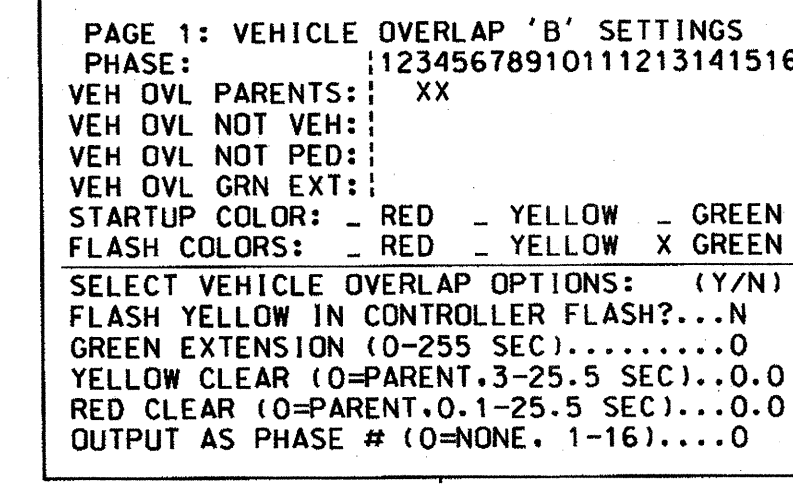
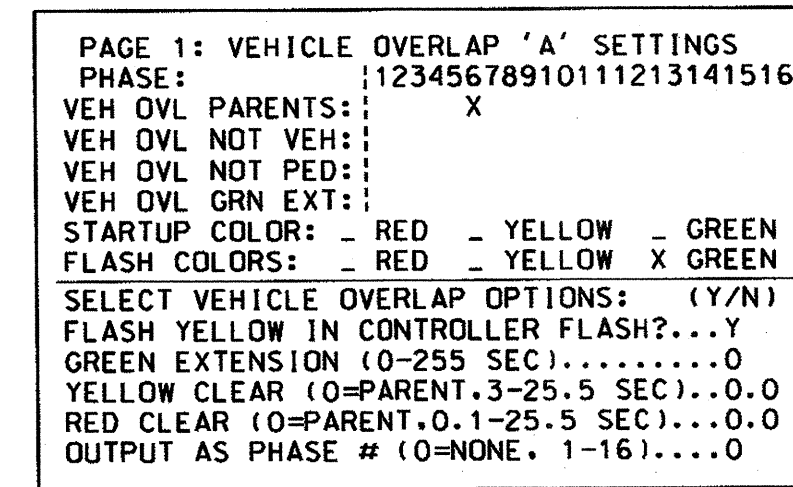
OUTPUT REFERENCE SCHEDULE

- OUTPUT 39 = Overlap D Red
- OUTPUT 40 = Overlap D Yellow
- OUTPUT 41 = Overlap D Green
- OUTPUT 47 = Overlap B Red
- OUTPUT 48 = Overlap B Yellow
- OUTPUT 49 = Overlap B Green

OVERLAP PROGRAMMING DETAIL

(program controller as shown below)

FROM MAIN MENU PRESS '8' (OVERLAPS), THEN '1' (VEHICLE OVERLAP SETTINGS).



OVERLAP PROGRAMMING COMPLETE

The utilization of overlap P ensures consistent clearance timing during transition to preemption

FLASHER CIRCUIT MODIFICATION DETAIL

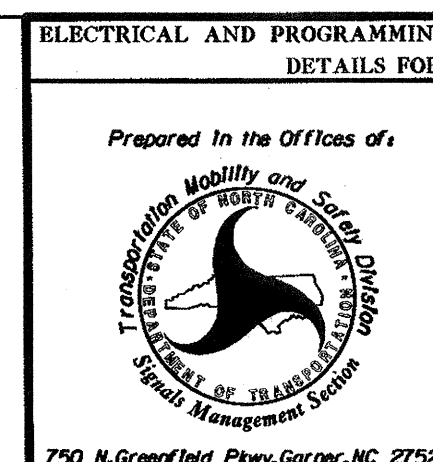
IN ORDER TO INSURE THAT SIGNALS FLASH CONCURRENTLY ON THE SAME APPROACH, MAKE THE FOLLOWING FLASHER CIRCUIT CHANGES:

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

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

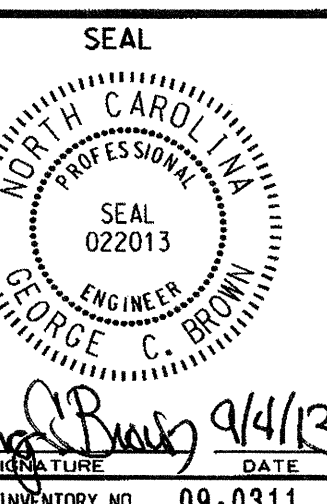
Electrical Detail - Sheet 2 of 3

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 09-0311
DESIGNED: August 2013
SEALED: 8/29/13
REVISED: N/A



SR 2739 (N. Main Street)
at
SR 1210 (Ryder Ave.)

Division 9	Rowan County	Landis
PLAN DATE: August 2013	REVIEWED BY: T. V. J.	
PREPARED BY: C. Strickland	REVIEWED BY:	
REVISIONS	INIT.	DATE



SIG. INVENTORY NO. 09-0311

RAILROAD PREEMPTION PROGRAMMING DETAIL

(program controller as shown below)

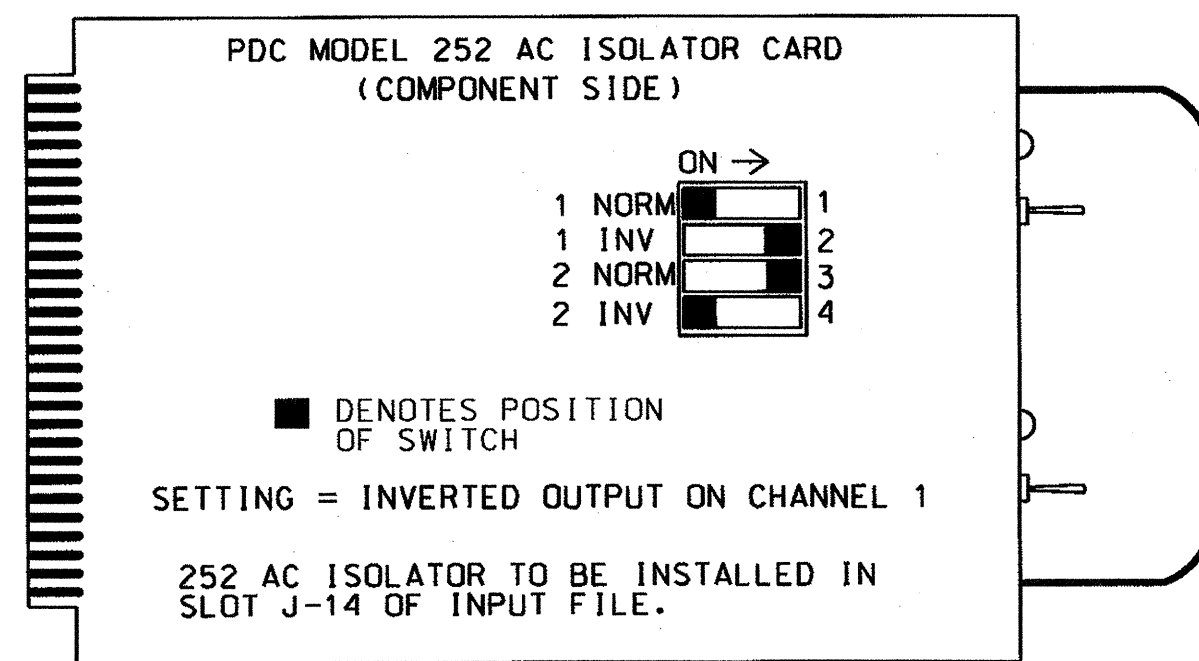
From Main Menu press 'A' (Preemption), then '1' (Standard Preemptions).

PREEMPTION #1	SETTINGS (NEXT:1-10)	CLEAR/DWELL PHASES
INTERVAL/TIMING	GRN YEL RED	12345678910111213141516
1	20 3.9 1.2	X X
2	255 0.0 0.0	X XX
3	0 0.0 0.0	
4	0 0.0 0.0	
5	1 0.0 0.0	X X

EXIT CALLS	OPTIONS
PRIORITY (Y/N TO SELECT)	HIGH
DELAY TIMER (0-255 SEC)	0
MIN GREEN BEFORE PRE (0= DEFAULT)....	1
PED CLEAR BEFORE PRE (0= DEFAULT)....	0
YELLOW CLEAR BEFORE PRE (0= DEFAULT)...	3.8
RED CLEAR BEFORE PRE (0= DEFAULT)....	1.6
DWELL MIN TIMER (0-255 SEC)	10
DWELL MAX TIMER (0-OFF,1-255MIN)	0
DWELL HOLD-OVER TIMER (0-255)	0
LATCH CALL?	N
LINK TO NEXT PREEMPT?	N
ENABLE BACKUP PROTECTION?	N
HOLD CLEAR 1 PHASES DURING DELAY? ..	N
FAST GREEN FLASH DWELL PHASES?	N
PED CLEARANCE THROUGH YELLOW?	N
INHIBIT OVERLAP GREEN EXTENSION? ..	N
SERVICE DURING SOFTWARE FLASH?	N
REST IN RED DURING DWELL INTERVAL? ..	N
FLASH DWELL INTERVAL?	N
ALLOW PEDS IN DWELL INTERVAL?	N
RE-TIME DWELL INTERVAL?	N
OVERLAPS:	ABCDEFGHIJKLMN
DWELL INT FLASH YELLOW	X
OMIT OVERLAPS:	X X

PREEMPT 1 AC ISOLATOR (MODEL 252) OUTPUT PROGRAMMING DETAIL

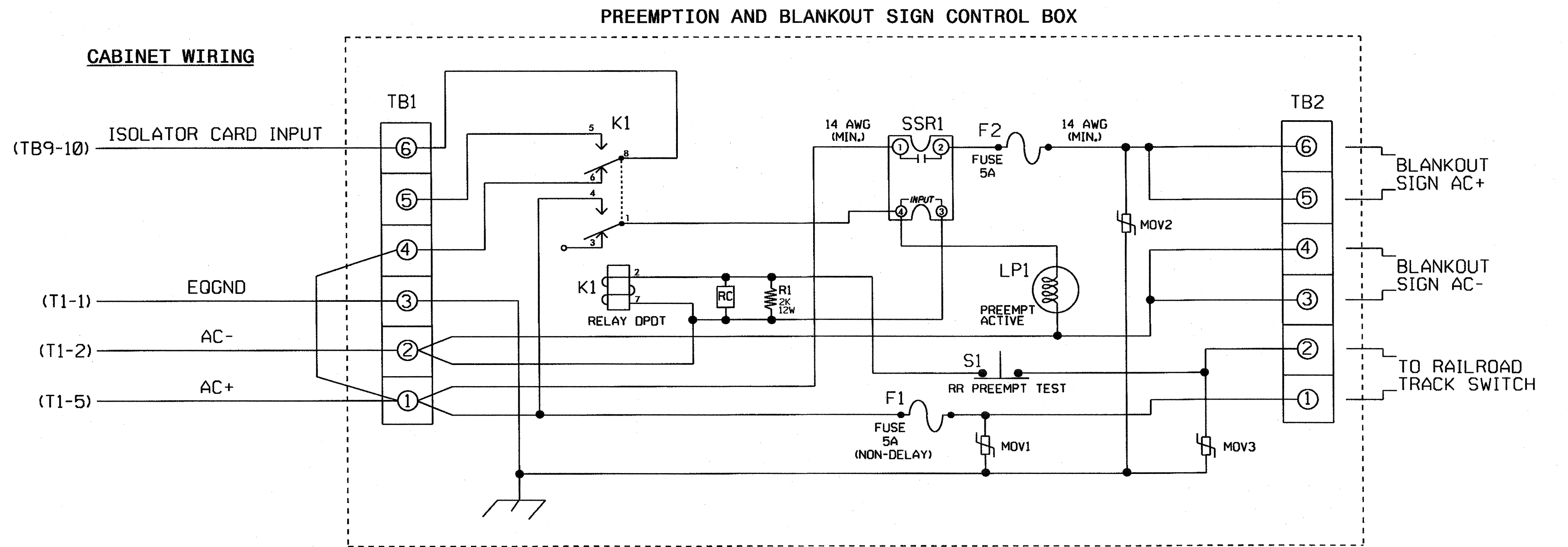
(set DIP switches as shown below)



NOTE: IF ANOTHER MANUFACTURER TYPE OF AC ISOLATOR IS USED, OUTPUT PROGRAMMING IS LIKELY NOT TO EQUATE TO THAT SHOWN ABOVE.

RAILROAD PREEMPTION WIRING DETAIL

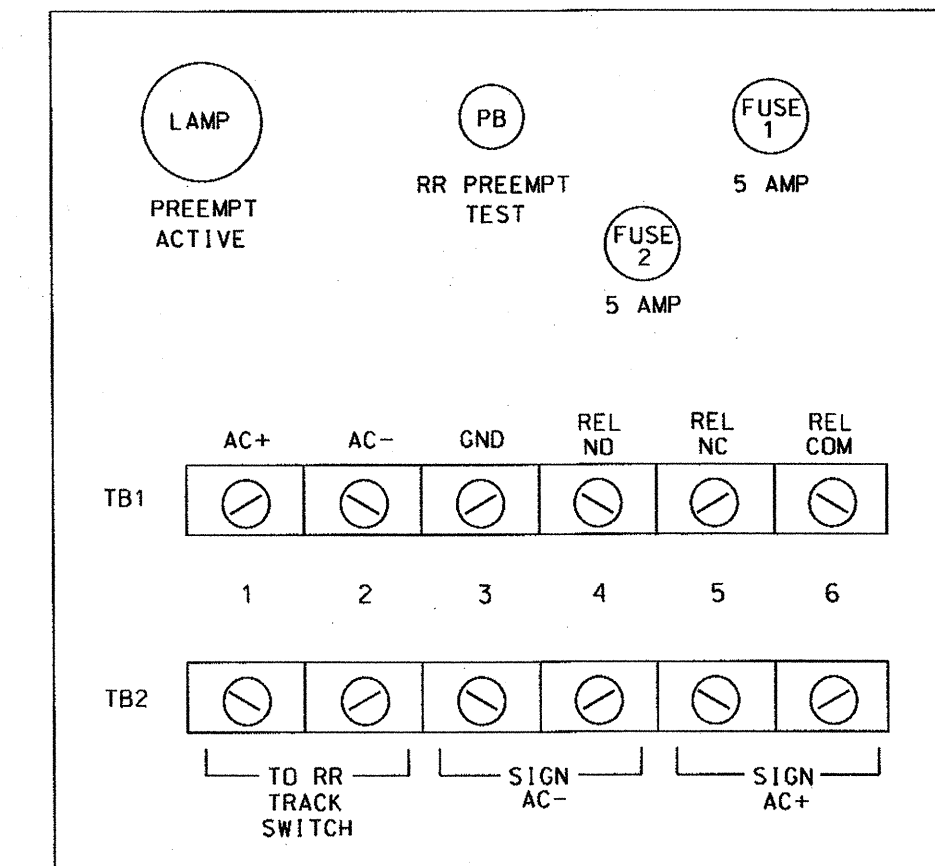
(wire as shown below)



NOTES

- Relay K1 is shown in the energized (Preempt not active) normal operation state.
- Relay K1 is a DPDT with 120VAC coil with octal base.
- Relay SSR1 is a SPST (normally open) Solid State Relay with AC input and AC (25 amp) output.
- 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.
- IMPORTANT!!** A jumper must be added between input file terminals J14-E and J14-K if not already present. Also, terminal TB9-12 (on input panel) shall be connected to AC neutral (jumper may have to be added).

FRONT VIEW



Electrical Detail - Sheet 3 of 3

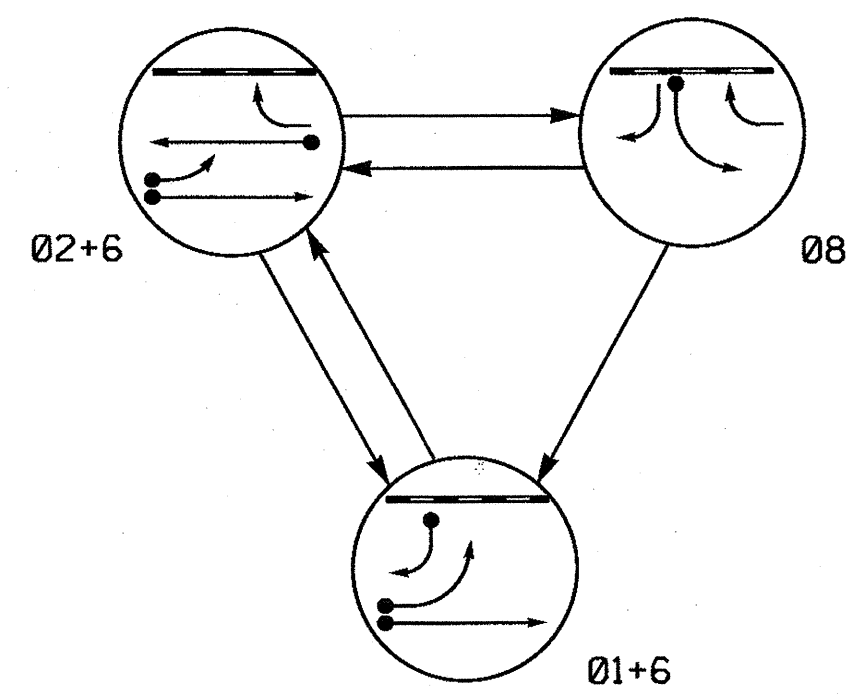
<p>Prepared In the Offices of:</p> <p>750 N. Greenfield Pkwy, Garner, NC 27529</p>	<p>SR 2739 (N. Main Street) at SR 1210 (Ryder Ave.)</p>		<p>SEAL</p>							
	<p>Division 9 Rowan County Landis</p>	<p>PLANNED BY: August 2013</p>								
	<p>PREPARED BY: C. Strickland</p>	<p>REVIEWED BY: <i>T. J. ...</i></p>		<p>REVISIONS</p> <table border="1"> <tr> <th>NO.</th> <th>DATE</th> <th>INIT.</th> <th>DATE</th> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>	NO.	DATE	INIT.	DATE		
NO.	DATE	INIT.	DATE							

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 09-0311
DESIGNED: August 2013
SEALED: 8/29/13
REVISED: N/A

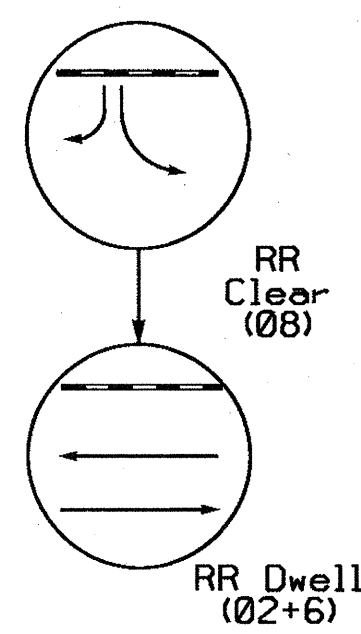
George C. Brown 9/4/13
DATE

SIG. INVENTORY NO. 09-0311

PHASING DIAGRAM



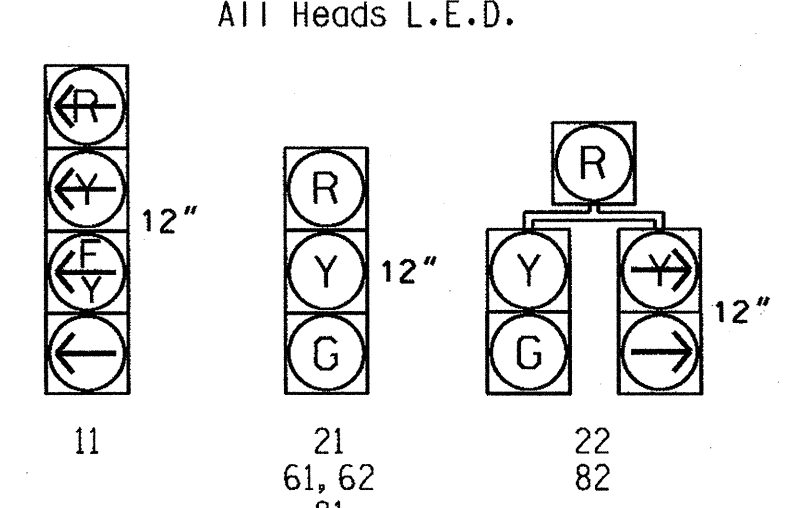
RAIL PREEMPT PHASES
(High Priority)



SIGNAL FACE	PHASE							
	01+6	02+6	08	RR CLR	RR DWL	RR FL	RR HS	RR SH
11	←	←	←	←	←	←	←	←
21	R	G	R	R	G	Y		
22	R	G	R	R	G	Y		
61, 62	G	G	R	R	G	Y		
81	R	R	G	G	R	R		
82	R	R	G	G	R	R		
SIGN B	OFF	OFF	OFF	ON	ON	*		

← = Flashing Yellow Arrow
* See Note 6

SIGNAL FACE I.D.
All Heads L.E.D.

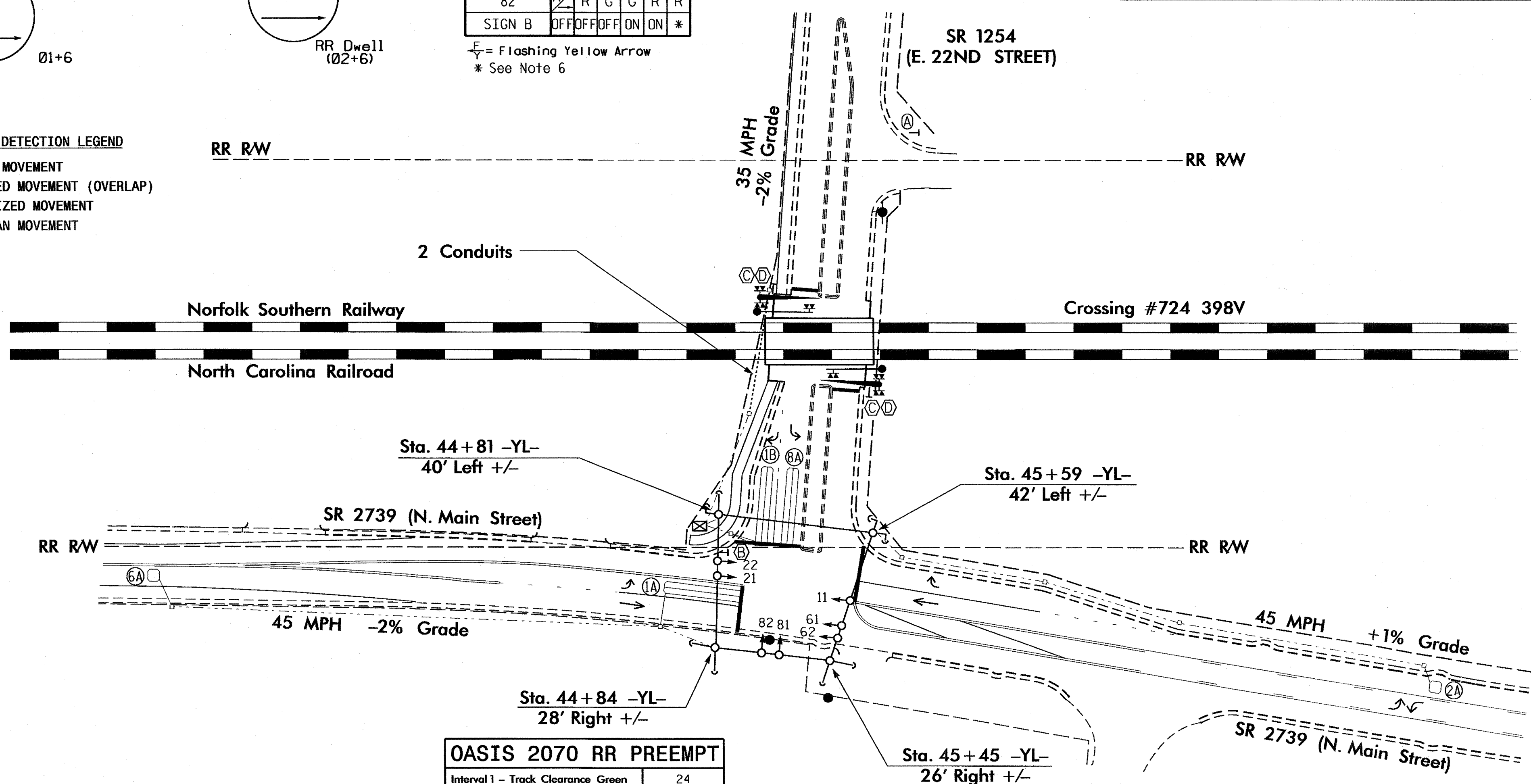


OASIS 2070 LOOP & DETECTOR INSTALLATION CHART

LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	DETECTOR PROGRAMMING				SYSTEM LOOP	NEW CARD	
					PHASE	CALLING	EXTENSION	FULL TIME DELAY			
1A	6x60	0	2-4-2	-	1	Y	Y	-	15	-	Y
					6	Y	Y	Y	3	-	Y
1B	6x60	0	2-4-2	-	1	Y	Y	-	15	-	Y
2A	6x6	300	5	-	2	Y	Y	-	-	-	Y
6A	6x6	300	5	-	6	Y	Y	-	-	-	Y
8A	6x60	0	2-4-2	-	8	Y	Y	-	-	-	Y

PHASING DIAGRAM DETECTION LEGEND

- ← ● DETECTED MOVEMENT
- ← UNDETECTED MOVEMENT (OVERLAP)
- ← UN SIGNALIZED MOVEMENT
- ← PEDESTRIAN MOVEMENT



3 Phase w/ RR Preemption Fully Actuated (Isolated)

- NOTES**
- Refer to "Roadway Standard Drawings NCDOT" dated January 2012 and "Standard Specifications for Roads and Structures" dated January 2012.
 - This location contains railroad preemption phasing. Do not program signal for late night flashing operation.
 - Phase 1 may be lagged.
 - Set all detector units to presence mode.
 - Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
 - Ensure flashing operation does not alter operation of blankout signs.
 - Program parent phases for Overlap "P" for all phases used in normal operation.

LEGEND

PROPOSED	EXISTING
○ → Traffic Signal Head	● → Traffic Signal Head
● → Modified Signal Head	N/A
↑ Sign	↑ Sign
○ → Pedestrian Signal Head With Push Button & Sign	○ → Pedestrian Signal Head With Push Button & Sign
○ → Signal Pole with Guy	○ → Signal Pole with Guy
○ → Signal Pole with Sidewalk Guy	○ → Signal Pole with Sidewalk Guy
□ → Inductive Loop Detector	□ → Inductive Loop Detector
□ → Controller & Cabinet	□ → Controller & Cabinet
□ → Junction Box	□ → Junction Box
--- 2-in Underground Conduit	--- 2-in Underground Conduit
N/A Right of Way	N/A Right of Way
→ Directional Arrow	→ Directional Arrow
--- 2-in Rigid Metal Conduit	N/A
N/A Railroad Tracks	N/A Railroad Tracks
N/A Railroad Cantilever	N/A Railroad Cantilever
N/A Railroad Gate and Flasher	N/A Railroad Gate and Flasher
(A) "STOP" Sign (R1-1)	(A) "STOP" Sign (R1-1)
(B) "NO RIGHT TURN - TRAIN" L.E.D. Blankout Sign	(B) "NO RIGHT TURN - TRAIN" L.E.D. Blankout Sign
(C) "DO NOT STOP ON TRACKS" Sign (R8-8)	(C) "DO NOT STOP ON TRACKS" Sign (R8-8)
(D) "STOP HERE WHEN FLASHING" Sign (R8-10)	(D) "STOP HERE WHEN FLASHING" Sign (R8-10)

OASIS 2070 TIMING CHART

FEATURE	PHASE			
	1	2	6	8
Min Green 1 *	7	12	12	7
Extension 1 *	2.0	6.0	6.0	2.0
Max Green 1 *	20	60	60	30
Yellow Clearance	3.0	4.7	4.7	3.0
Red Clearance	1.9	1.0	1.0	2.1
Red Revert	2.0	2.0	2.0	2.0
Walk 1 *	-	-	-	-
Don't Walk 1	-	-	-	-
Seconds Per Actuation *	-	2.5	2.5	-
Max Variable Initial *	-	34	34	-
Time Before Reduction *	-	15	15	-
Time To Reduce *	-	30	30	-
Minimum Gap	-	3.0	3.0	-
Recall Mode	-	MIN RECALL	MIN RECALL	-
Vehicle Call Memory	-	YELLOW	YELLOW	-
Dual Entry	-	-	-	-
Simultaneous Gap	ON	ON	ON	ON

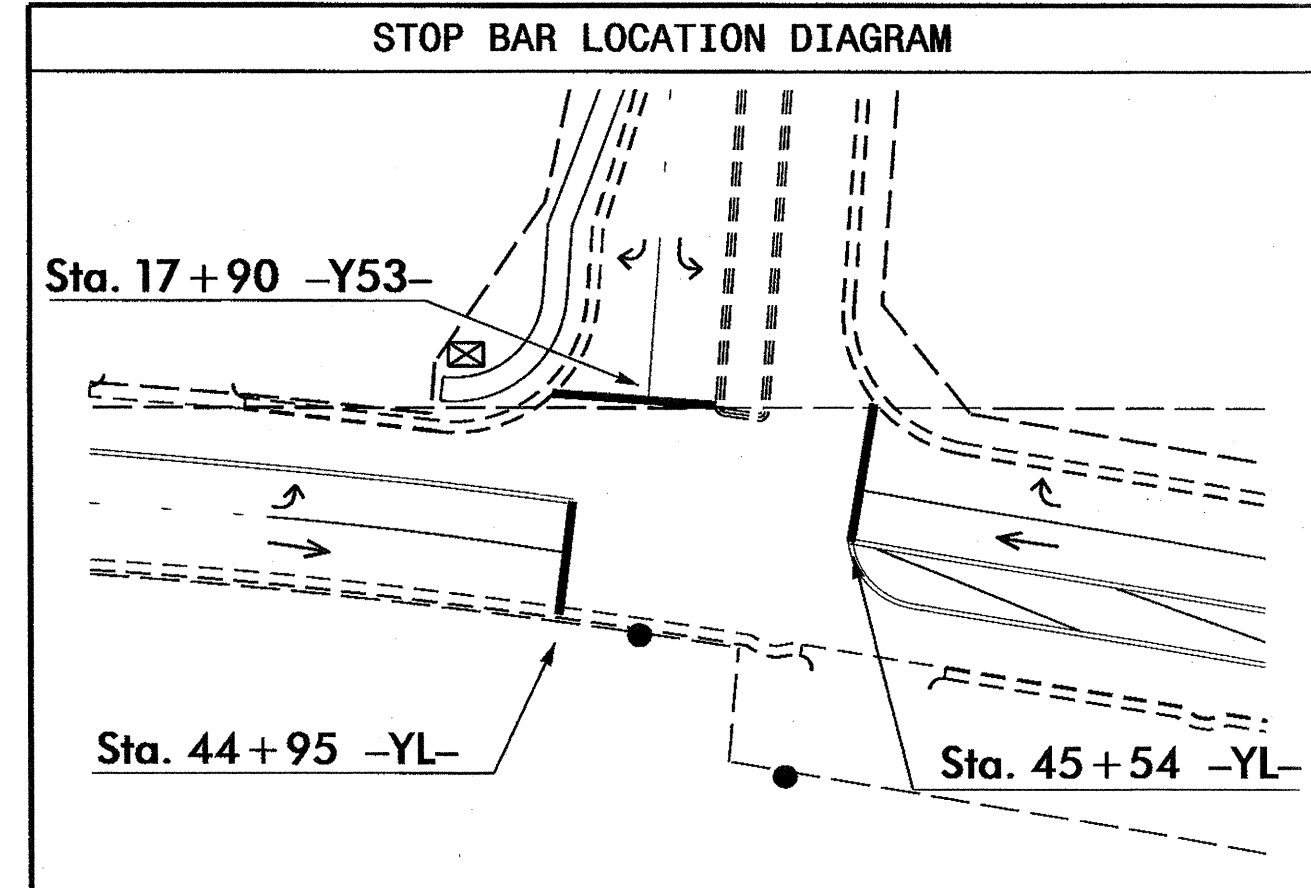
* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

OASIS 2070 RR PREEMPT

Interval 1 - Track Clearance Green	24
Interval 1 - Track Clearance Yellow	3.0
Interval 1 - Track Clearance Red	2.1
Interval 2 - Dwell Green	255
Interval 2 - Dwell Yellow	0.0*
Interval 2 - Dwell Red	0.0*
Interval 5 - Exit Green	1
Interval 5 - Yellow	0.0
Interval 5 - Red	0.0
Exit Phase(s)	8
Priority	HIGH
Delay Time	0
Min Green Before Pre	1
Ped Clear Before Pre	0
Yellow Clear Before Pre	4.7
Red Clear Before Pre	1.0
Dwell Min Time	12
Enable Backup Protect	N
Ped Clear Through Yellow	N
Omit Overlaps	A, E, P

* Time defaults to time used for phase during normal operation.

This signal was designed for advanced preemption.



New Installation

Prepared in the Offices of:

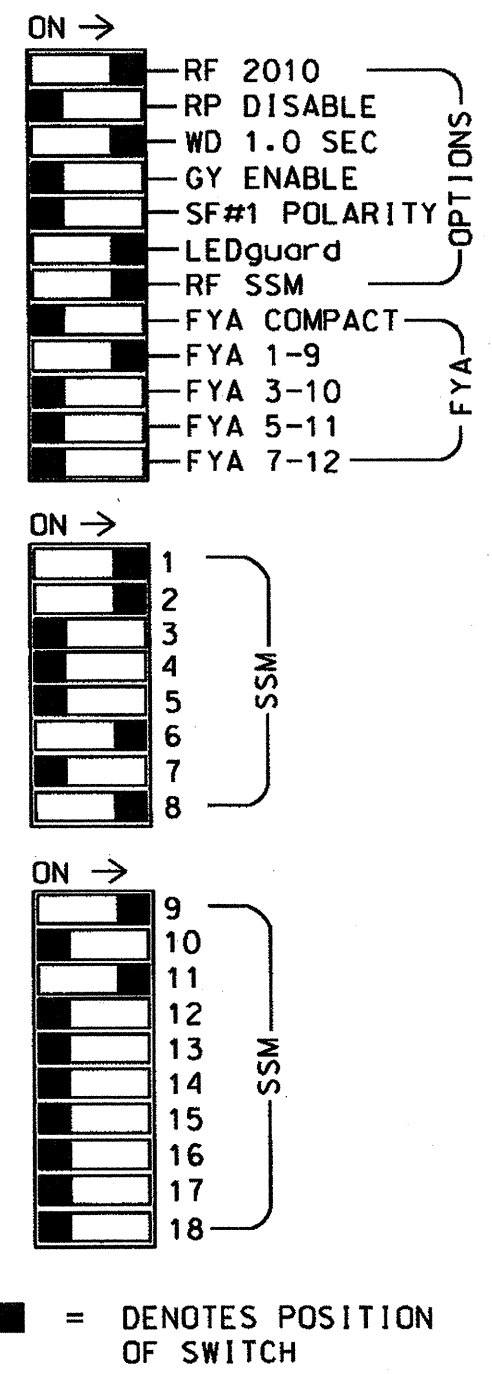
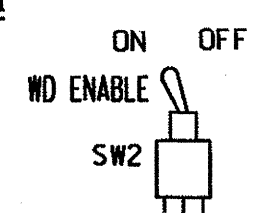
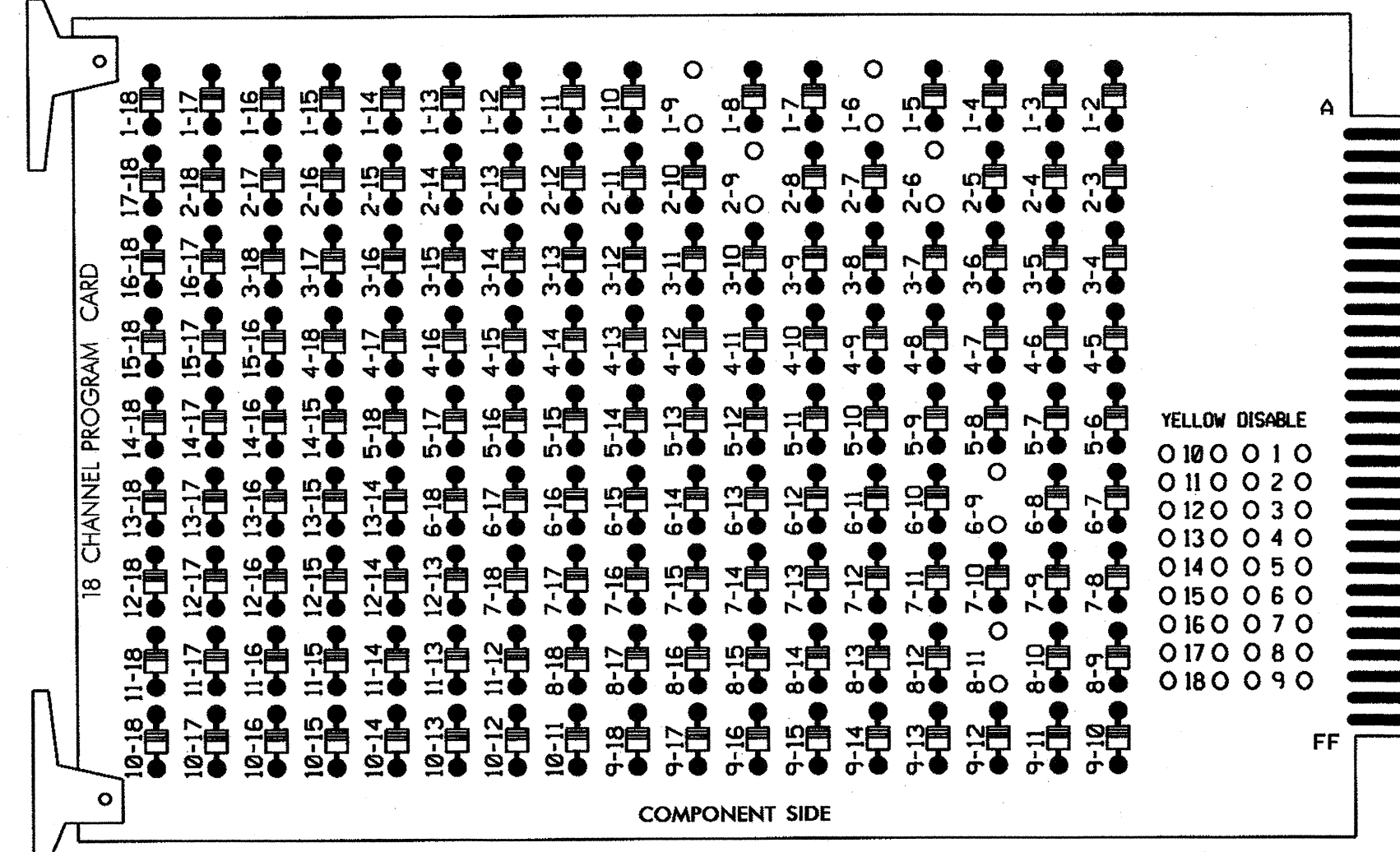
SR 2739 (N. Main Street) at SR 1254 (E. 22nd Street)
 Division 9 Rowan County Kannapolis
 PLAN DATE: August 2013 REVIEWED BY:
 PREPARED BY: R. J. Ziemba REVIEWED BY:
 REVISIONS: INIT. DATE
 SCALE: 1" = 40'
 SIGNATURE: [Signature] DATE: 8/29/13
 SIG. INVENTOR NO. 09-1092

04-SEP-2013 17:47 S:\ATSS\175\Sig\175\Sig.dgn 9:45:52 AM P-5206D\Sig\175\Sig.dgn 20130829-dgn 21mm

EDI MODEL 2018ECL-NC CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 1-6, 1-9, 2-6, 2-9, 6-9 and 8-11.



REMOVE JUMPERS AS SHOWN

NOTES:

- Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
- Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
- Ensure that Red Enable is active at all times during normal operation.
- Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

NOTES

- 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.
- Enable Simultaneous Gap-Out for all phases.
- Program phases 2 and 6 for Variable Initial and Gap Reduction.
- Program phases 2 and 6 for Start Up In Green.
- Program phases 2 and 6 for Yellow Flash, and overlap 1 as Wag Overlaps.

EQUIPMENT INFORMATION

CONTROLLER.....2070L
 CABINET.....332 /W/ AUX
 SOFTWARE.....ECONOLITE OASIS 3.03.26E OR LATEST APPROVED VERSION
 CABINET MOUNT.....BASE
 OUTPUT FILE POSITIONS...18 WITH AUX. OUTPUT FILE
 LOAD SWITCHES USED.....S1,S2,S8,S11,AUX S1,AUX S4
 PHASES USED.....1,2,6,8
 OVERLAP "A".....1+2
 OVERLAP "B".....NOT USED
 OVERLAP "C".....8
 OVERLAP "D".....NOT USED
 OVERLAP "P".....1+2+6+8

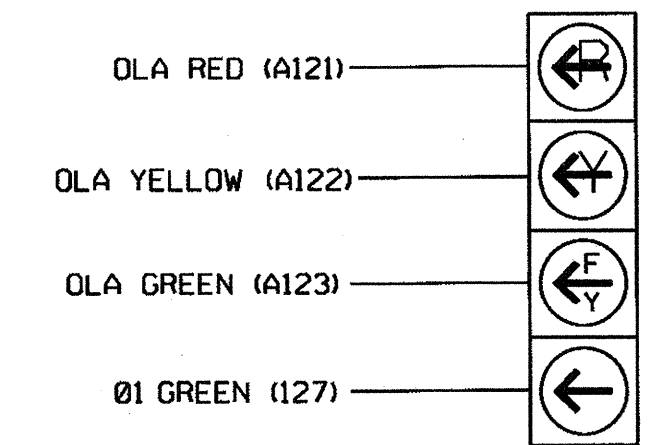
SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	AUX S1	AUX S2	AUX S3	AUX S4	AUX S5	AUX S6
CMU CHANNEL NO.	1	2	13	3	4	14	5	6	15	7	8	16	9	10	17	11	12	18
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED	OLA	OLB	SPARE	OLC	OLD	SPARE
SIGNAL HEAD NO.	11*	82	21,22	NU	NU	NU	NU	61,62	NU	NU	81,82	NU	11*	NU	NU	22	NU	NU
RED		*	128					134			107					*		
YELLOW			129					135			108							
GREEN			130					136			109							
RED ARROW													A121					
YELLOW ARROW			126										A122			A115		
FLASHING YELLOW ARROW													A123					
GREEN ARROW	127	127																A116

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

4 SECTION FYA PPLT SIGNAL WIRING DETAIL

(wire signal head as shown)



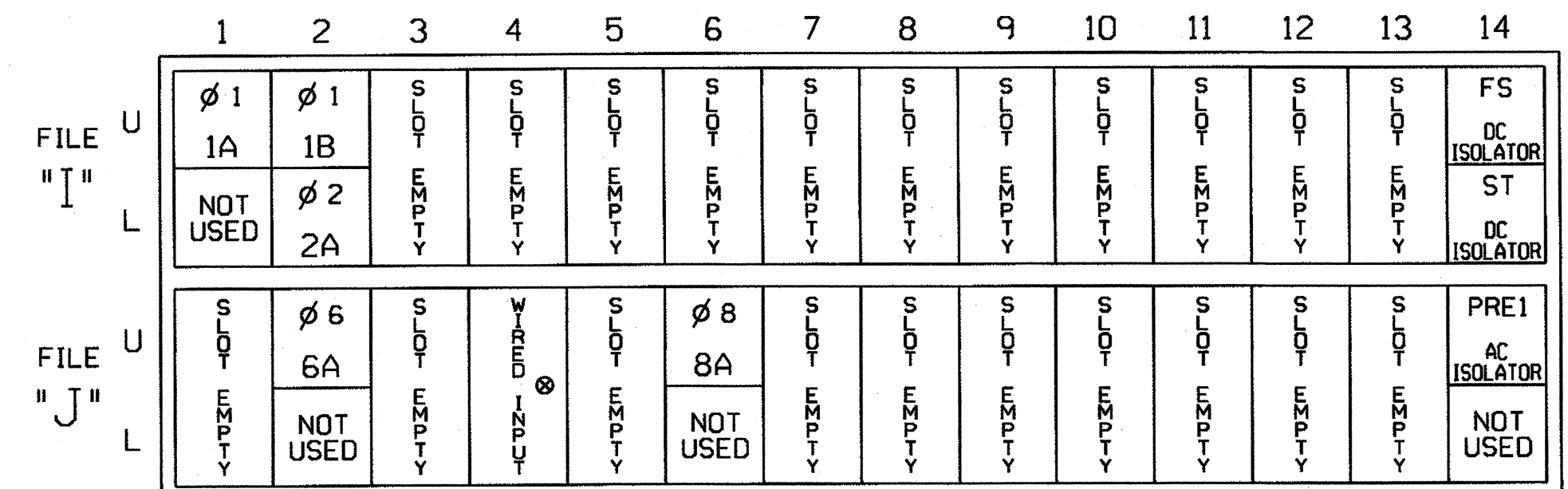
11

NOTE

- The sequence display for this signal requires special logic programming. See sheet 2 for programming instructions.

INPUT FILE POSITION LAYOUT

(front view)



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

FS = FLASH SENSE
 ST = STOP TIME
 PRE = PREEMPT

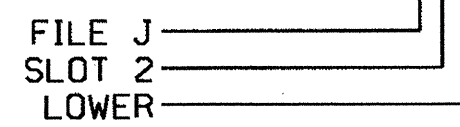
⊗ Wired Input - Do not populate slot with detector card

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT ASSIGNMENT NO.	DETECTOR NO.	NEMA PHASE	CALL	EXTEND	FULL TIME DELAY	STRETCH TIME	DELAY TIME
1A ¹	TB2-1,2	I1U	56	18	1	1	Y	Y			15
		J4U	48	10	26	6	Y	Y	Y		3
1B	TB2-5,6	I2U	39	1	2	1	Y	Y			15
2A	TB2-7,8	I2L	43	5	12	2	Y	Y			
6A	TB3-5,6	J2U	40	2	6	6	Y	Y			
8A	TB5-9,10	J6U	42	4	8	8	Y	Y			

¹Add jumper from I1-W to J4-W. on rear of input file.

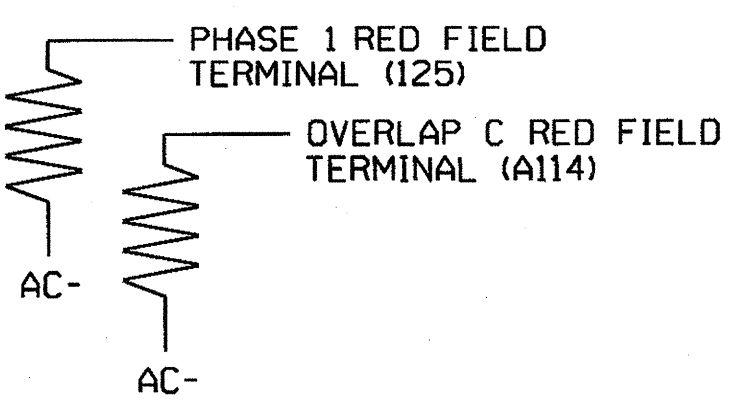
INPUT FILE POSITION LEGEND: J2L



LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

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.

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 09-1092
 DESIGNED: August 2013
 SEALED: 8/29/13
 REVISED: N/A

Electrical Detail - Sheet 1 of 3

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared In the Offices of:

750 N. Greenfield Pkwy, Garner, NC 27529

SR 2739 (N. Main Street) at SR 1254 (E. 22nd Street)

Division 9 Rowan County Kannapolis

PLAN DATE: August 2013 REVIEWED BY: T. J. J.

PREPARED BY: C. Strickland REVIEWED BY:

REVISIONS INIT. DATE

SEAL NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 022013 GEORGE C. BROWN

Signature: [Signature] DATE: [Date]

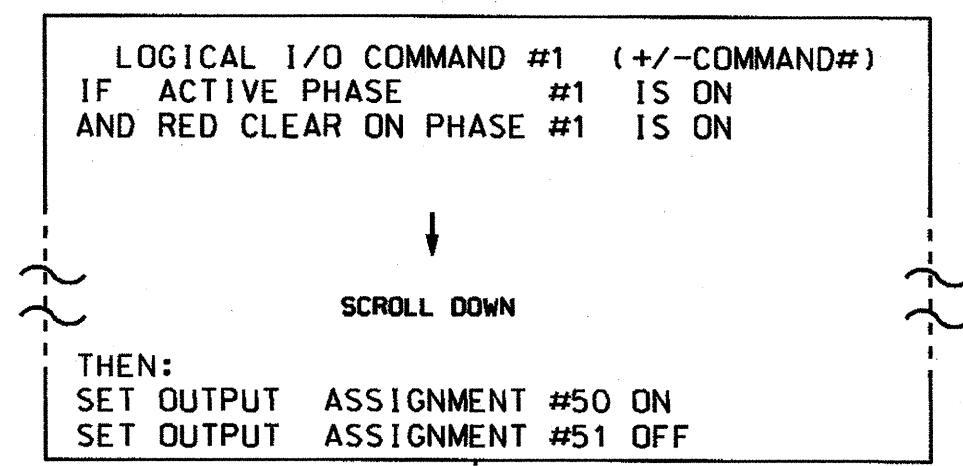
SIG. INVENTORY NO. 09-1092

30-AUG-2013 12:47 S:\1755\1755\SIGNAL\SWR\KGROUPS\10_Man\Strickland\091092_sml.dwg (a.xxx.dgn) C:\STRICKLAND

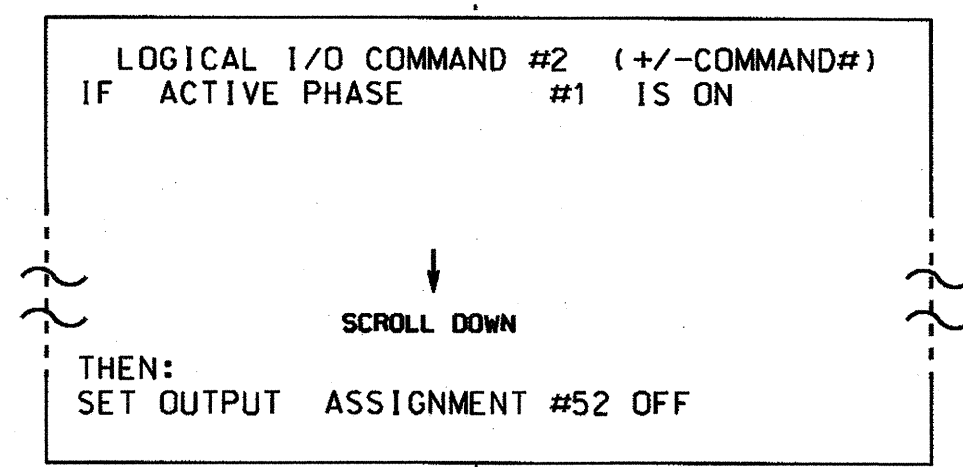
**LOGICAL I/O PROCESSOR PROGRAMMING DETAIL
TO PRODUCE SPECIAL FYA-PPLT SIGNAL SEQUENCE**

(program controller as shown below)

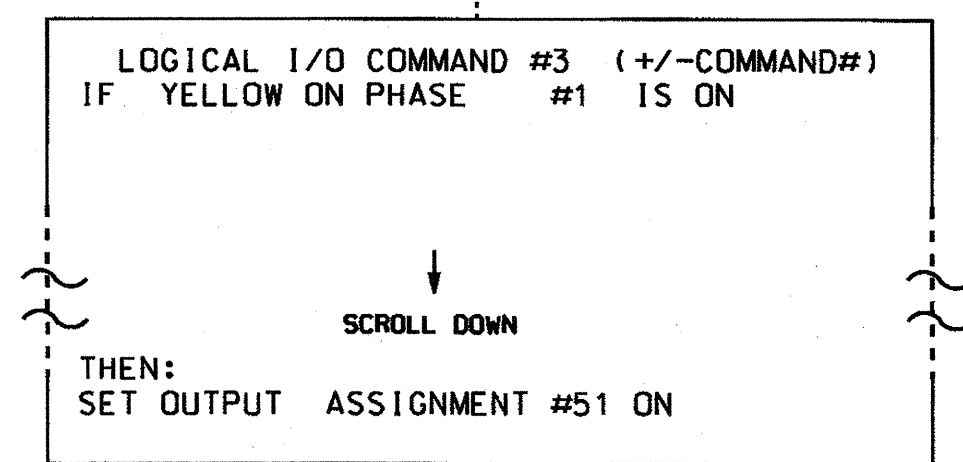
- FROM MAIN MENU PRESS '2' (PHASE CONTROL), THEN '1' (PHASE CONTROL FUNCTIONS). SCROLL TO THE BOTTOM OF THE MENU AND ENABLE ACT LOGIC COMMANDS 1, 2 AND 3.
- FROM MAIN MENU PRESS '6' (OUTPUTS), THEN '3' (LOGICAL I/O PROCESSOR).



NOTE: LOGIC FOR PHASE 1 RED CLEAR WHEN TRANSITIONING FROM PHASE 1 TO PHASE 2 (HEAD 11).



NOTE: LOGIC FOR SWITCHING FLASHING YELLOW ARROW "OFF" DURING PHASE 1 (HEAD 11).



NOTE: LOGIC FOR YELLOW ARROW CLEARANCE FROM PHASE 1 (HEAD 11).

LOGIC I/O PROCESSOR PROGRAMMING COMPLETE

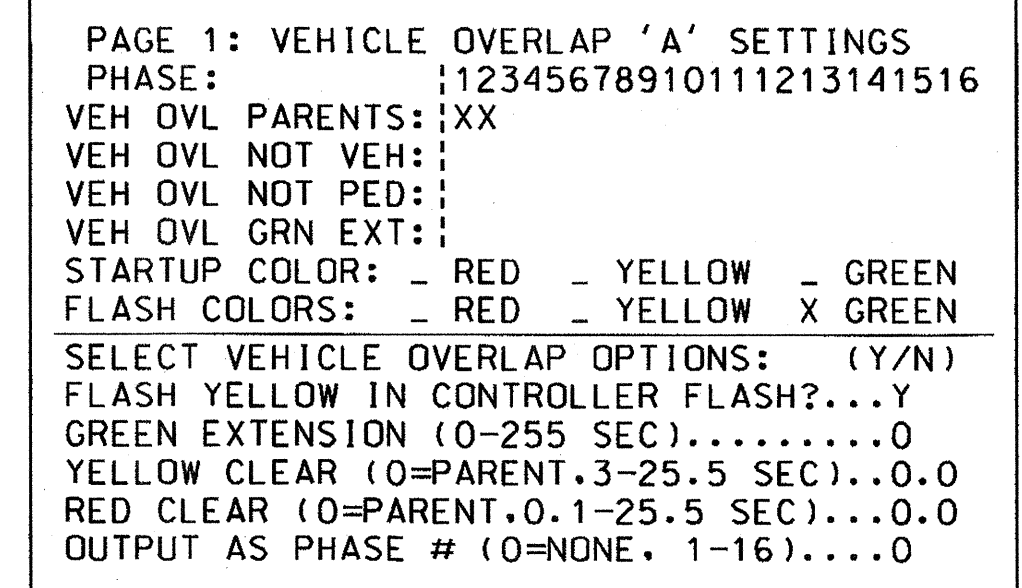
OUTPUT REFERENCE SCHEDULE

- OUTPUT 50 = Overlap A Red
- OUTPUT 51 = Overlap A Yellow
- OUTPUT 52 = Overlap A Green

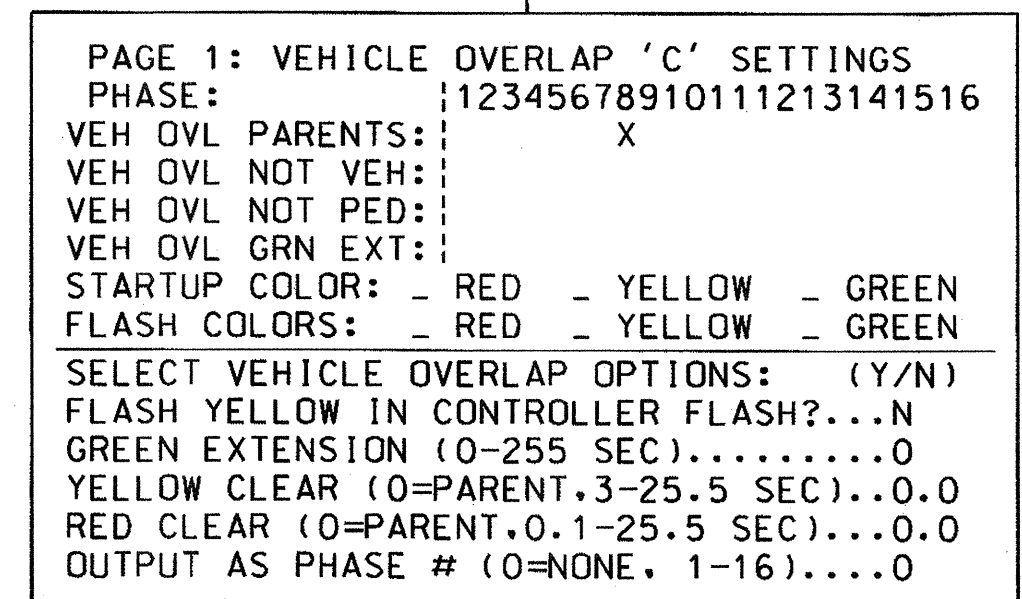
OVERLAP PROGRAMMING DETAIL

(program controller as shown below)

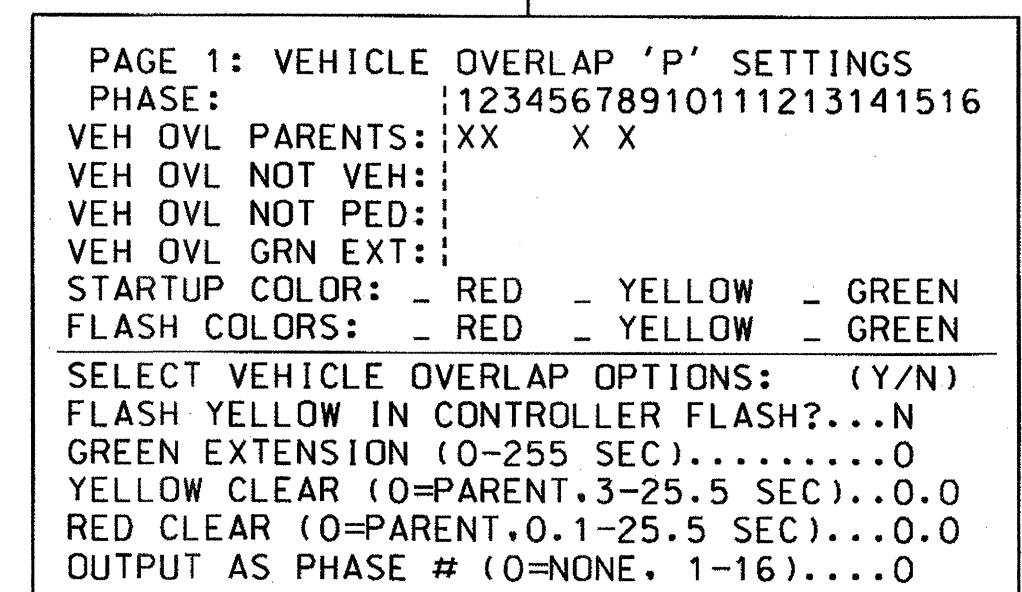
FROM MAIN MENU PRESS '8' (OVERLAPS), THEN '1' (VEHICLE OVERLAP SETTINGS).



PRESS '+' TWICE



USING + OR - KEY POSITION ON OVERLAP 'P'



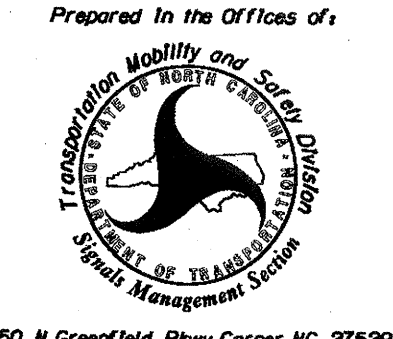

OVERLAP PROGRAMMING COMPLETE

The utilization of overlap P ensures consistent clearance timing during transition to preemption

30-AUG-2013 12:48 S:\15\AS\15\15\SIGNAL\SW\KOR\output\sig_Memo\FY13\1092_sml_e_XXX.dgn

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 09-1092
DESIGNED: August 2013
SEALED: 8/29/13
REVISED: N/A

Electrical Detail - Sheet 2 of 3

	Prepared In the Offices of: SR 2739 (N. Main Street) at SR 1254 (E. 22nd Street)		
	Division 9 PLAN DATE: August 2013 PREPARED BY: C. Strickland	Rowan County REVIEWED BY: <i>T. J. J.</i> REVIEWED BY:		Kannapolis REVIEWED BY:
REVISIONS			INIT. DATE SIGNATURE DATE SIG. INVENTORY NO. 09-1092

RAILROAD PREEMPTION PROGRAMMING DETAIL

(program controller as shown below)

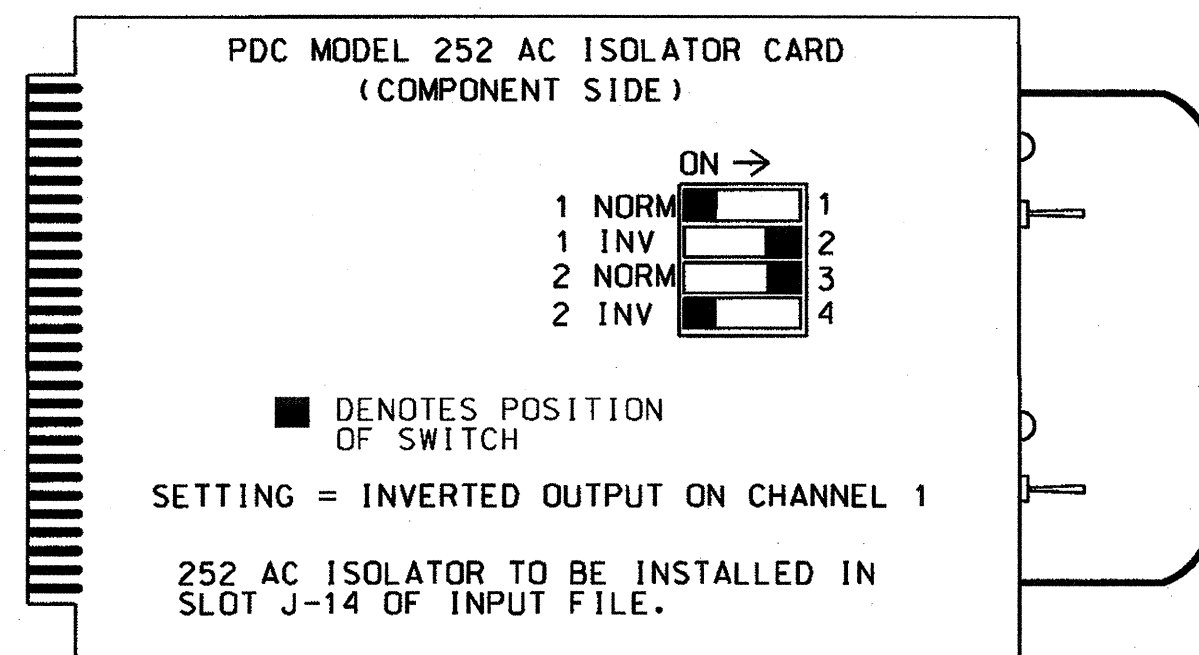
From Main Menu press 'A' (Preemption), then '1' (Standard Preemptions).

PREEMPTION #1	SETTINGS (NEXT:1-10)
INTERVAL/TIMING	CLEAR/DWELL PHASES
GRN YEL RED	12345678910111213141516
1 24 3.0 2.1	X X
2 255 0.0 0.0	X X
3 0 0.0 0.0	
4 0 0.0 0.0	
5 1 0.0 0.0	X

EXIT CALLS	OPTIONS
PRIORITY (Y/N TO SELECT)	.....HIGH
DELAY TIMER (0-255 SEC)	.....0
MIN GREEN BEFORE PRE (0= DEFAULT)	.....1
PED CLEAR BEFORE PRE (0= DEFAULT)	.....0
YELLOW CLEAR BEFORE PRE (0= DEFAULT)	.....4.7
RED CLEAR BEFORE PRE (0= DEFAULT)	.....1.0
DWELL MIN TIMER (0-255 SEC)	.....12
DWELL MAX TIMER (0-OFF,1-255MIN)	.....0
DWELL HOLD-OVER TIMER (0-255)	.....0
LATCH CALL?	.....N
LINK TO NEXT PREEMPT?	.....N
ENABLE BACKUP PROTECTION?	.....N
HOLD CLEAR 1 PHASES DURING DELAY?	.....N
FAST GREEN FLASH DWELL PHASES?	.....N
PED CLEARANCE THROUGH YELLOW?	.....N
INHIBIT OVERLAP GREEN EXTENSION?	.....N
SERVICE DURING SOFTWARE FLASH?	.....N
REST IN RED DURING DWELL INTERVAL?	.....N
FLASH DWELL INTERVAL?	.....N
ALLOW PEDS IN DWELL INTERVAL?	.....N
RE-TIME DWELL INTERVAL?	.....N
OVERLAPS:	ABCDEFGHIJKLMN
DWELL INT FLASH YELLOW	X X
OMIT OVERLAPS:	X X

PREEMPT 1 AC ISOLATOR (MODEL 252) OUTPUT PROGRAMMING DETAIL

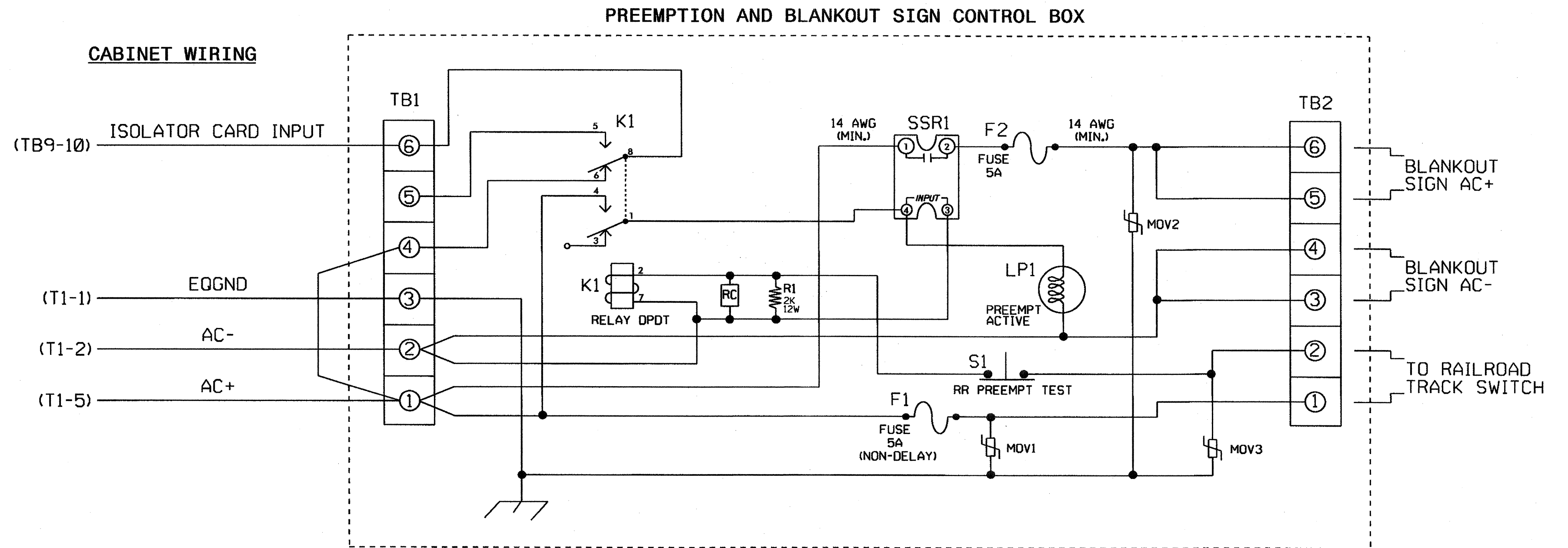
(set DIP switches as shown below)



NOTE: IF ANOTHER MANUFACTURER TYPE OF AC ISOLATOR IS USED, OUTPUT PROGRAMMING IS LIKELY NOT TO EQUATE TO THAT SHOWN ABOVE.

RAILROAD PREEMPTION WIRING DETAIL

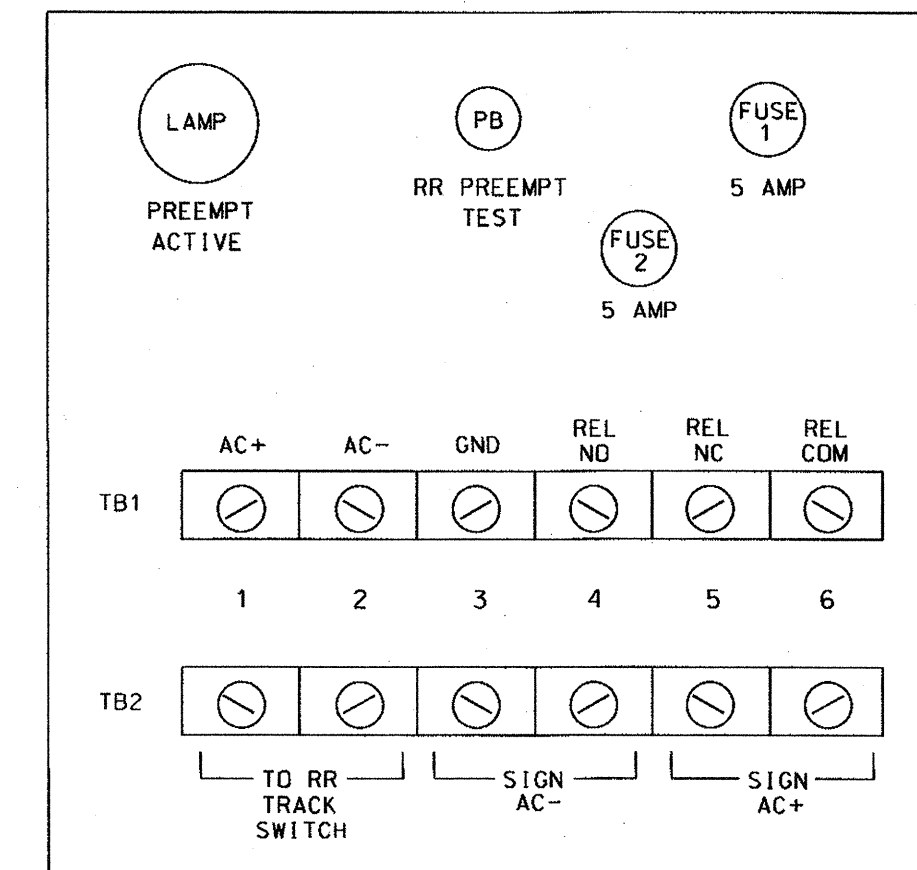
(wire as shown below)



NOTES

- Relay K1 is shown in the energized (Preempt not active) normal operation state.
- Relay K1 is a DPDT with 120VAC coil with octal base.
- Relay SSR1 is a SPST (normally open) Solid State Relay with AC input and AC (25 amp) output.
- 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.
- IMPORTANT!!** A jumper must be added between input file terminals J14-E and J14-K if not already present. Also, terminal TB9-12 (on input panel) shall be connected to AC neutral (jumper may have to be added).

FRONT VIEW



Electrical Detail - Sheet 3 of 3

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 09-1092
DESIGNED: August 2013
SEALED: 8/29/13
REVISED: N/A

Electrical and Programming Details For:

Prepared In the Offices of:

750 N. Greenfield Pkwy, Garner, NC 27529

SR 2739 (N. Main Street) at SR 1254 (E. 22nd Street)

Division 9 Rowan County Kannapolis

PLAN DATE: August 2013 REVIEWED BY: T. J. J. J.

PREPARED BY: C. Strickland REVIEWED BY:

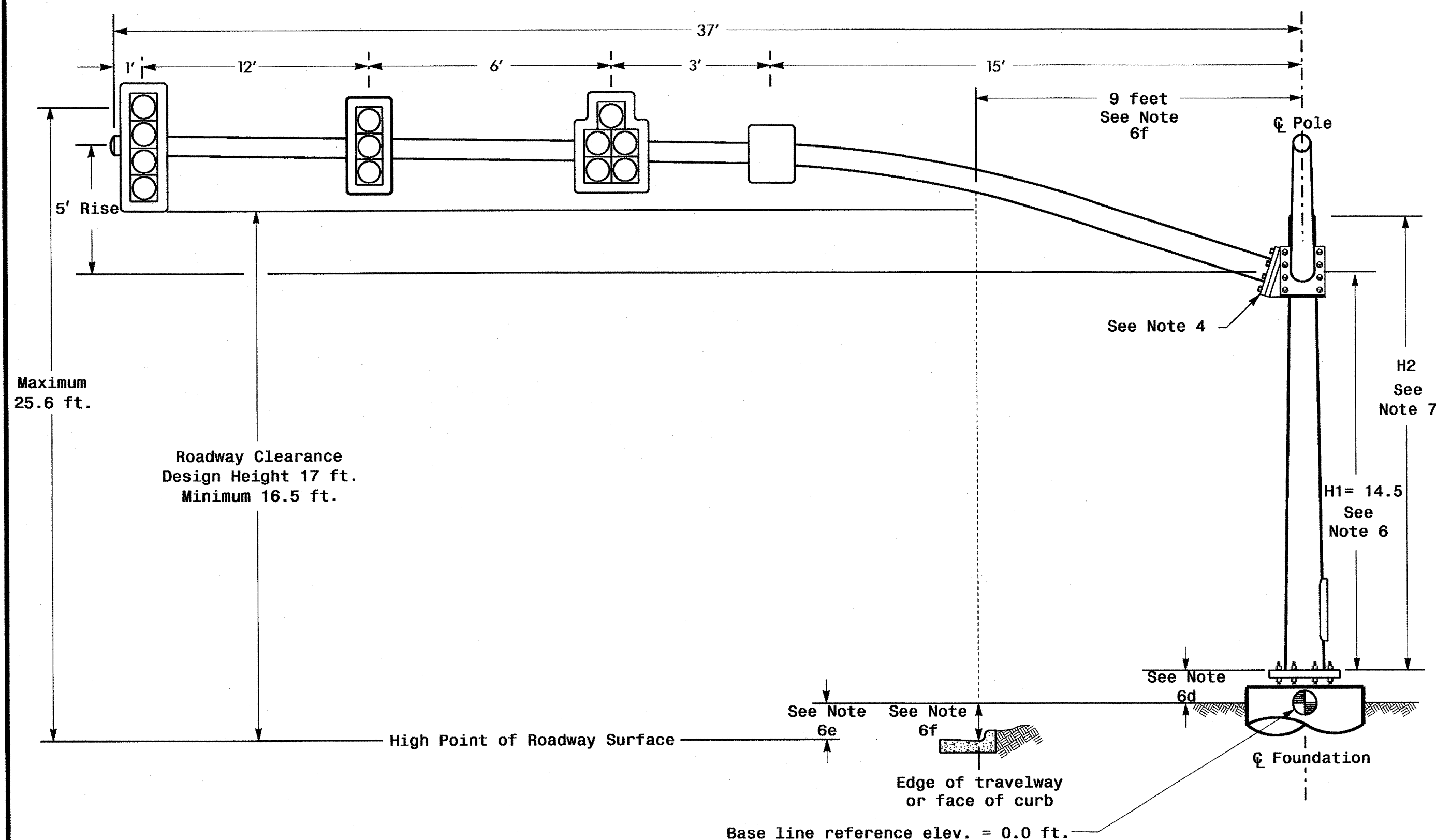
REVISIONS	INIT.	DATE

SEAL NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 022013 GEORGE C. BROWN

Signature: George C. Brown 9/4/13

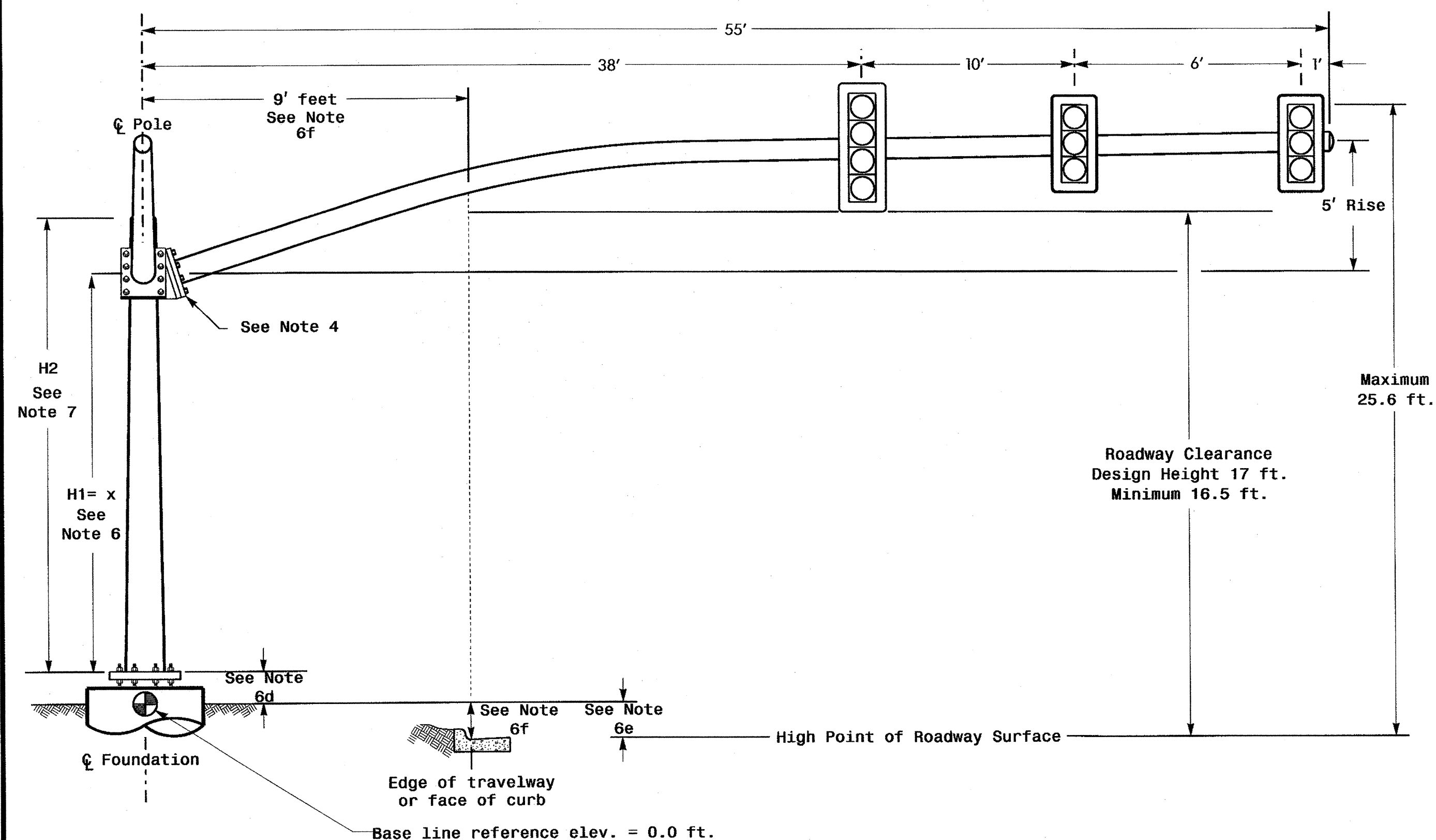
SIG. INVENTORY NO. 09-1092

Design Loading for METAL POLE NO. 1, MAST ARM A



Elevation View @ 270°

Design Loading for METAL POLE NO. 1, MAST ARM B



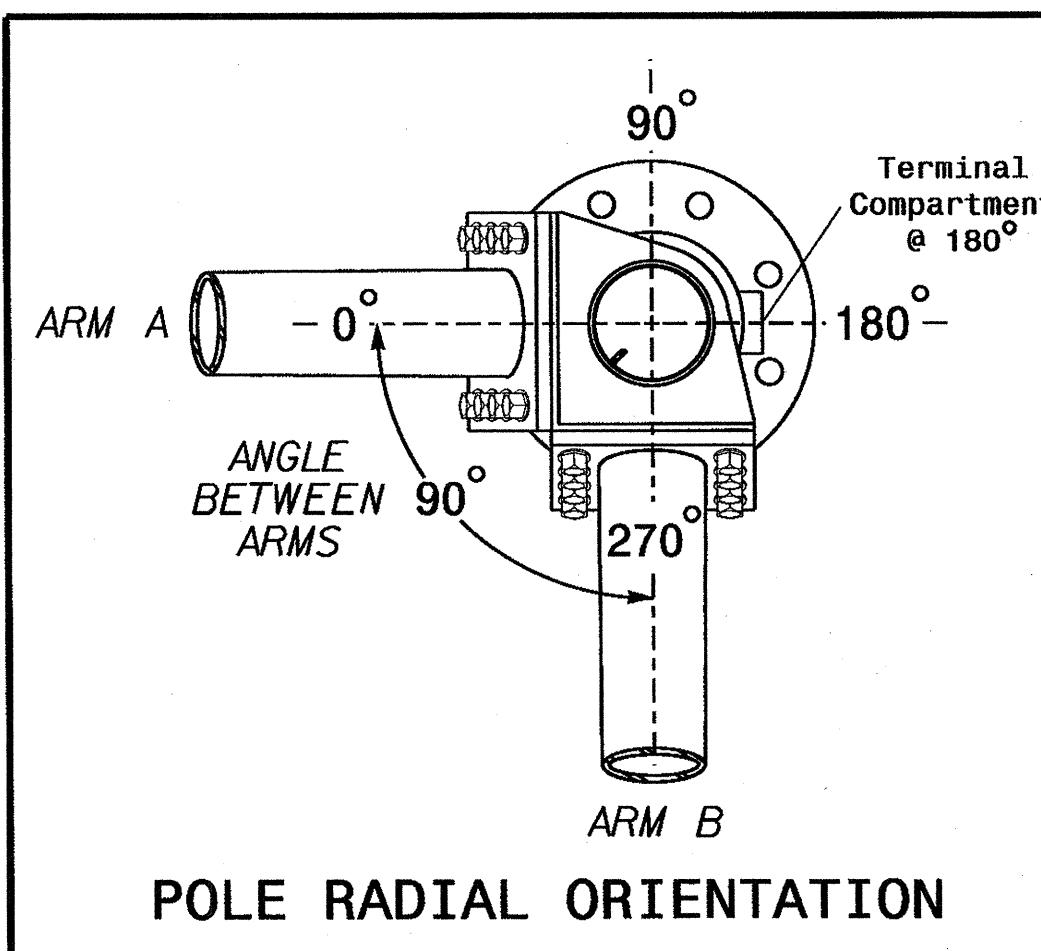
Elevation View @ 0°

SPECIAL NOTE

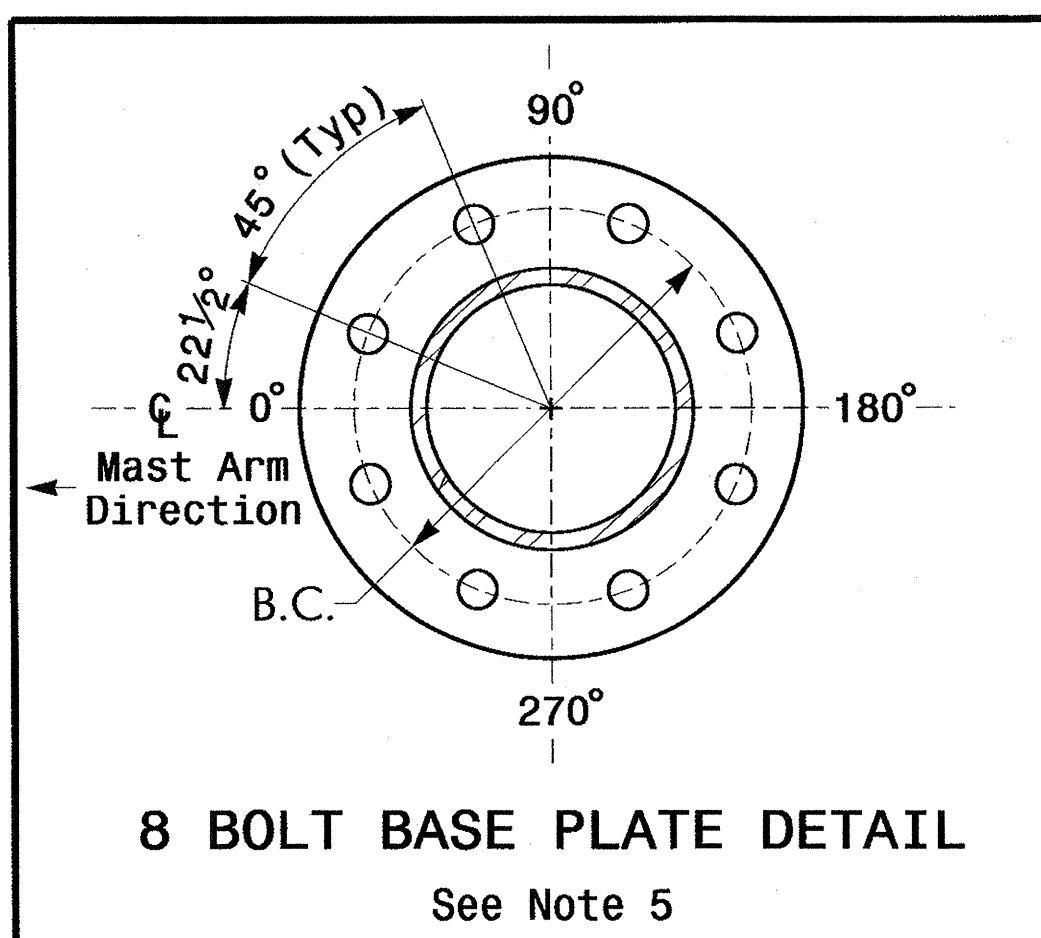
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

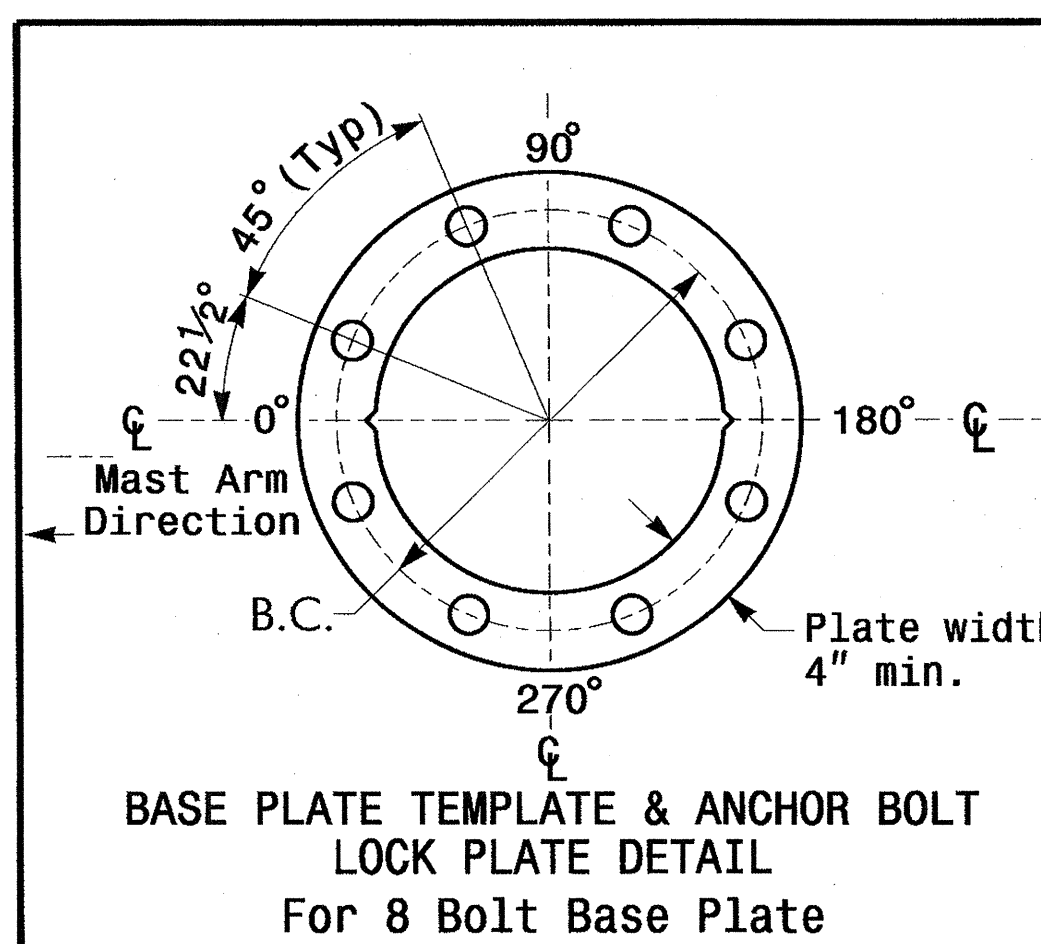
Elevation Differences for:	Arm "A"	Arm "B"
Baseline reference point at ϕ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	+0.1 ft.	-0.6 ft.
Elevation difference at Edge of travelway or face of curb	+0.1 ft.	+0.1 ft.



POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL
See Note 5



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

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	SIGNAL HEAD 12"-5 SECTION-WITH BACKPLATE AND ASTRO-BRAC	16.3 S.F.	42.0" W X 56.0" L	103 LBS
	SIGNAL HEAD 12"-4 SECTION-WITH BACKPLATE AND ASTRO-BRAC	11.5 S.F.	25.5" W X 66.0" L	74 LBS
	SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE AND ASTRO-BRAC	9.3 S.F.	25.5" W X 52.5" L	60 LBS
	SIGN RIGID MOUNTED WITH ASTRO-SIGN-BRAC	5.0 S.F.	24.0" W X 30.0" L	11 LBS

NOTES

Design Reference Material

- Design the traffic signal structure and foundation in accordance with:
 - The 5th Edition 2009 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
 - The 2012 NCDOT "Standard Specifications for Roads and Structures". The latest addenda to these specifications can be found in the traffic signal project special provisions.
 - The 2012 NCDOT Roadway Standard Drawings.
 - The traffic signal project plans and special provisions.
 - The NCDOT "Metal Pole Standards" located at the following NCDOT website: <http://www.ncdot.org/doh/preconstruct/traffic/ITSS/ws/mpoles/poles.html>

Design Requirements

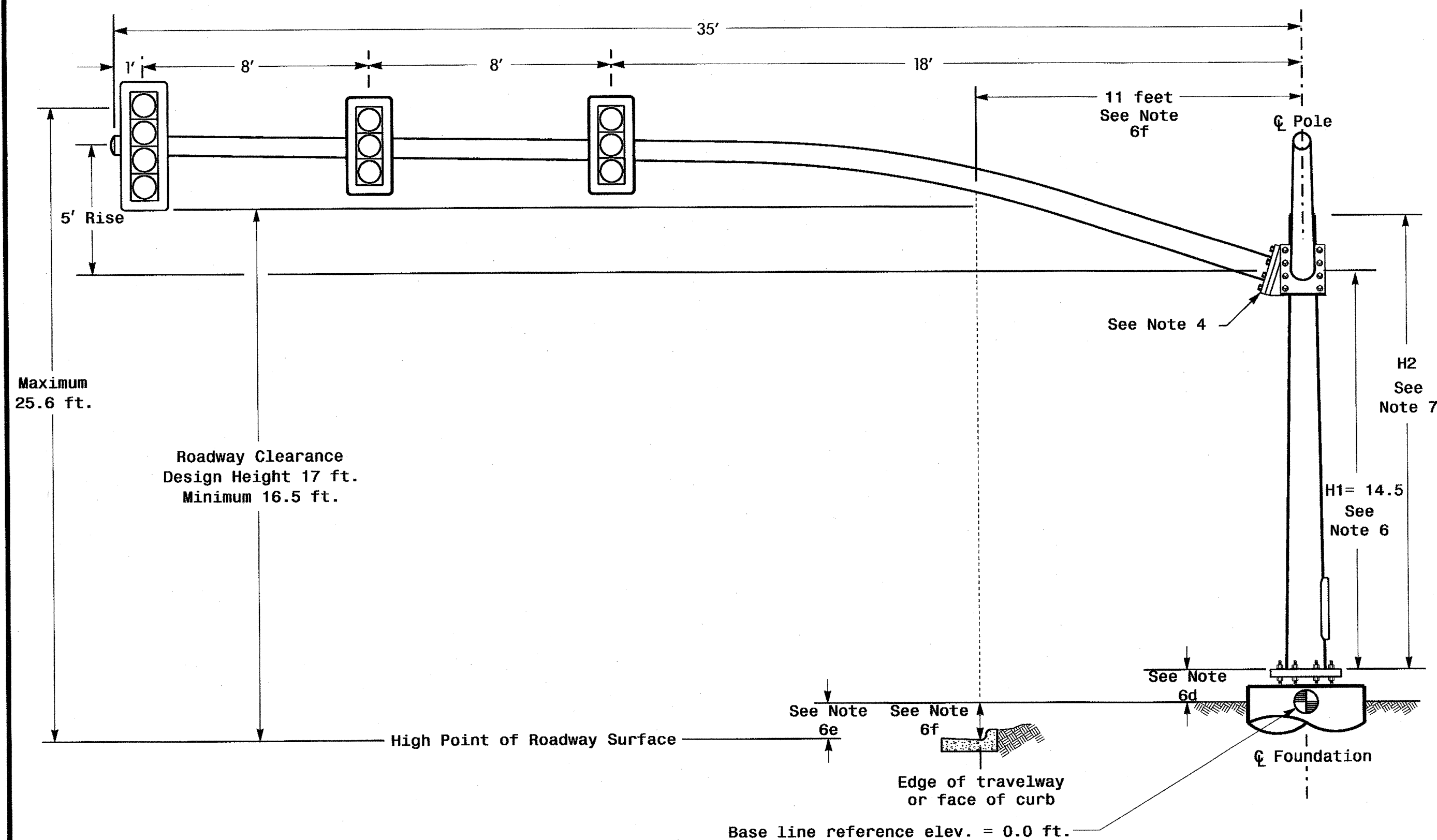
- Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "Design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
- Design all signal supports using stress ratios that do not exceed 0.9.
- A clamp-type bolted mast arm-to-pole connection may be used instead of the welded ring stiffened box connection shown as long as the connection meets all of the design requirements. This requires staggering the connections. Use elevation data for each arm to determine appropriate connection points.
- Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
- The mast arm attachment height (H1) shown is based on the following design assumptions:
 - Nominal vertical rise in mast arm is 5 feet as measured from the centerline of the arm base to the centerline of the free end of the arm.
 - Signal heads attached to the mast arm are rigid mounted and vertically centered on the arm.
 - The roadway clearance height for design is as shown in the elevation views.
 - The top of the pole base plate is .75 feet above the ground elevation.
 - Refer to the Elevation Data chart for elevation differences between the proposed foundation ground level and the high point on the roadway.
 - Provide horizontal distance from proposed centerline of foundation to edge of travelway. Refer to the Elevation Data chart above for elevation difference between the proposed foundation ground level and the edge of travelway. This information is necessary when arched arms are specified to ensure that the roadway clearance is maintained at the edge of the travelway and to assist in the camber design of the mast arm.
- The pole manufacturer will determine the total height (H2) of the 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.
- 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 Structural Engineer for assistance at (919) 773-2800.
- The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
- 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)

	<p>SR 2739 (N. Main Street) at SR 1210 (Ryder Avenue)</p>	<p>SEAL</p>
	<p>Division 9 Rowan County Landis</p> <p>PLAN DATE: August 2013 REVIEWED BY:</p> <p>PREPARED BY: C.E. Carter REVIEWED BY:</p>	
<p>SCALE: 0 N/A</p>	<p>REVISIONS</p>	<p>INIT. DATE</p>
<p>750 N. Greenfield Phyl/Garnar, NC 27529</p>		<p>SIGNATURE: </p> <p>DATE: 9/13</p> <p>SIG. INVENTORY NO. 09-0311</p>

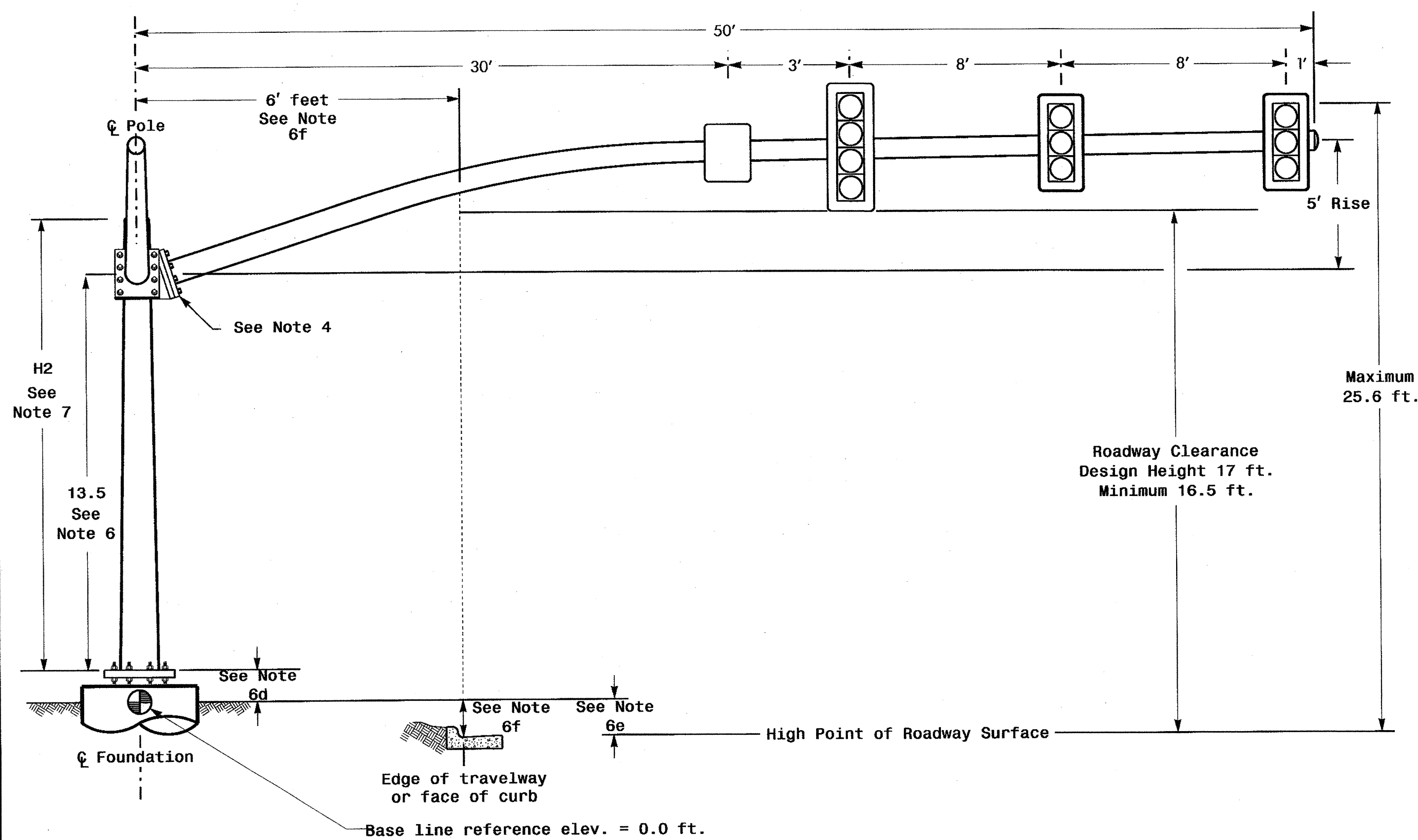
C:_SEP-2013_17117...
 S:_TESS\17117...
 P:\...
 F:\...

Design Loading for METAL POLE NO. 2, MAST ARM A



Elevation View @ 270°

Design Loading for METAL POLE NO. 2, MAST ARM B

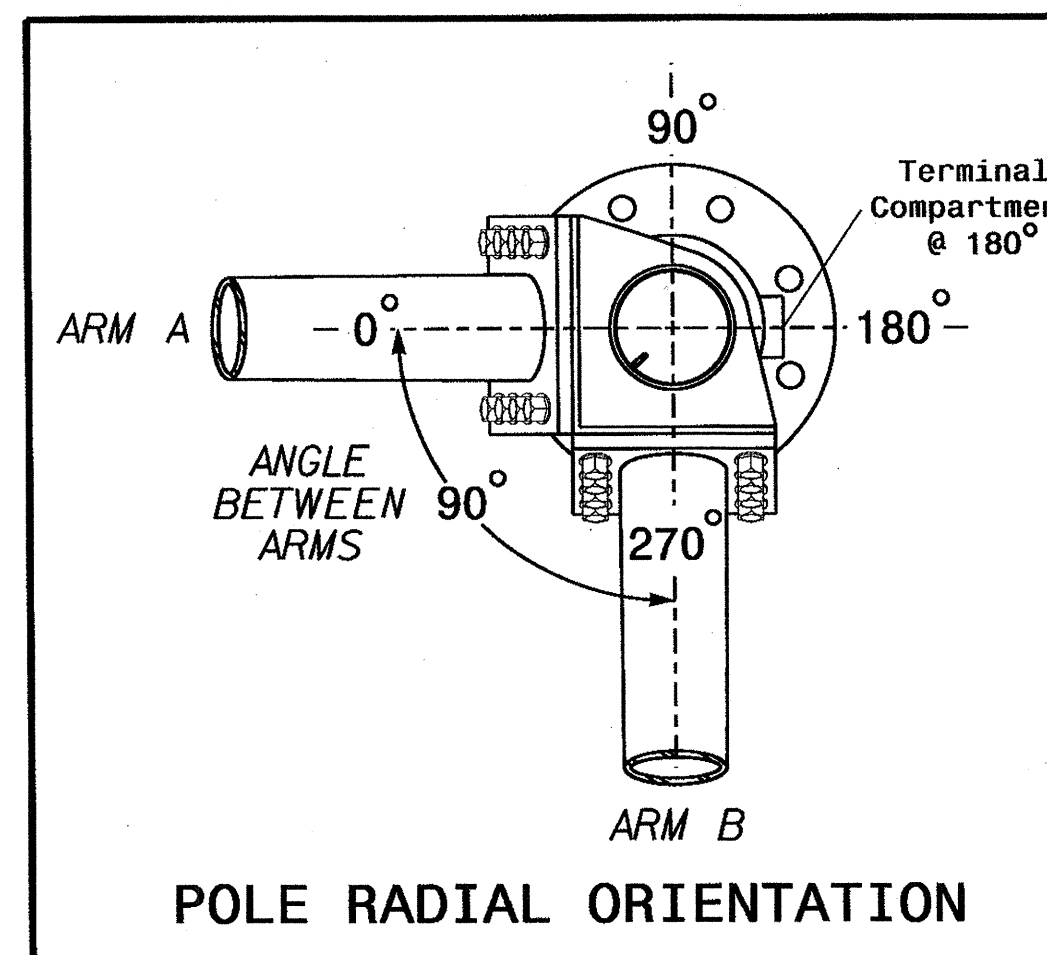


Elevation View @ 0°

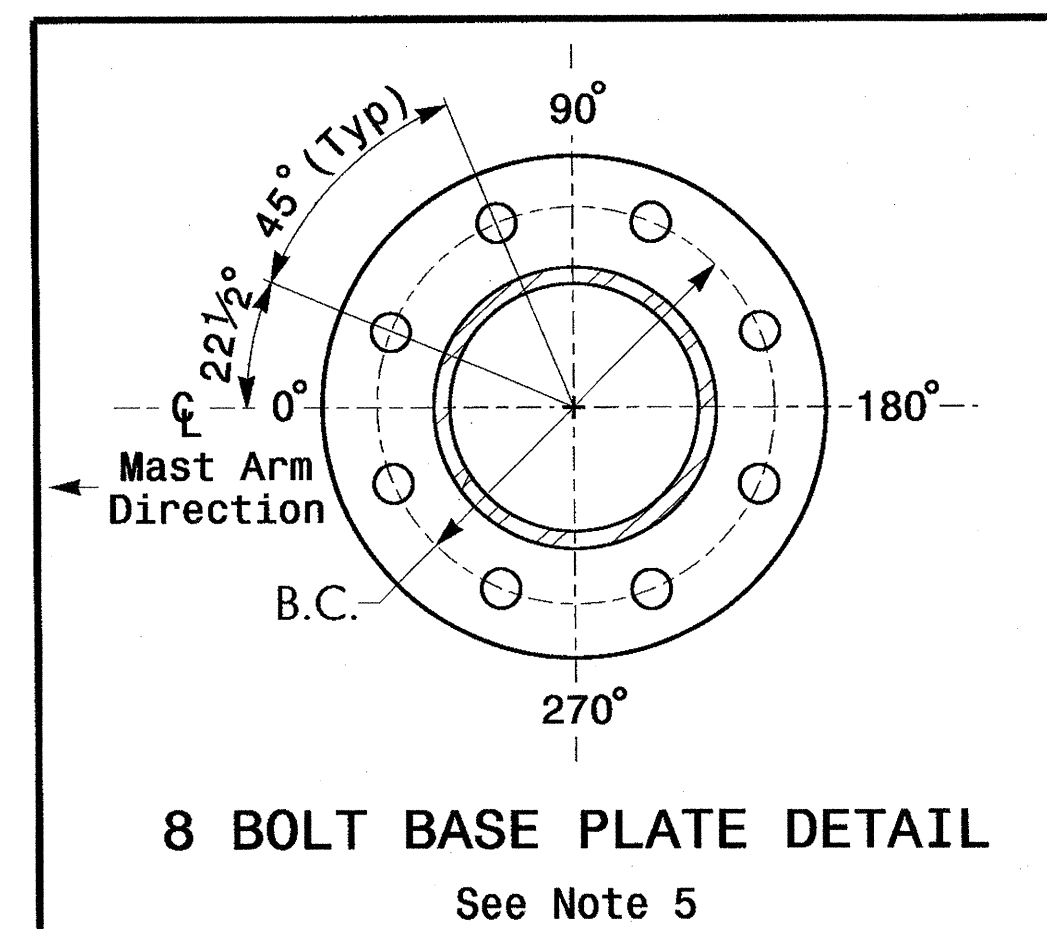
SPECIAL NOTE
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project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

Elevation Data for Mast Arm Attachment (H1)

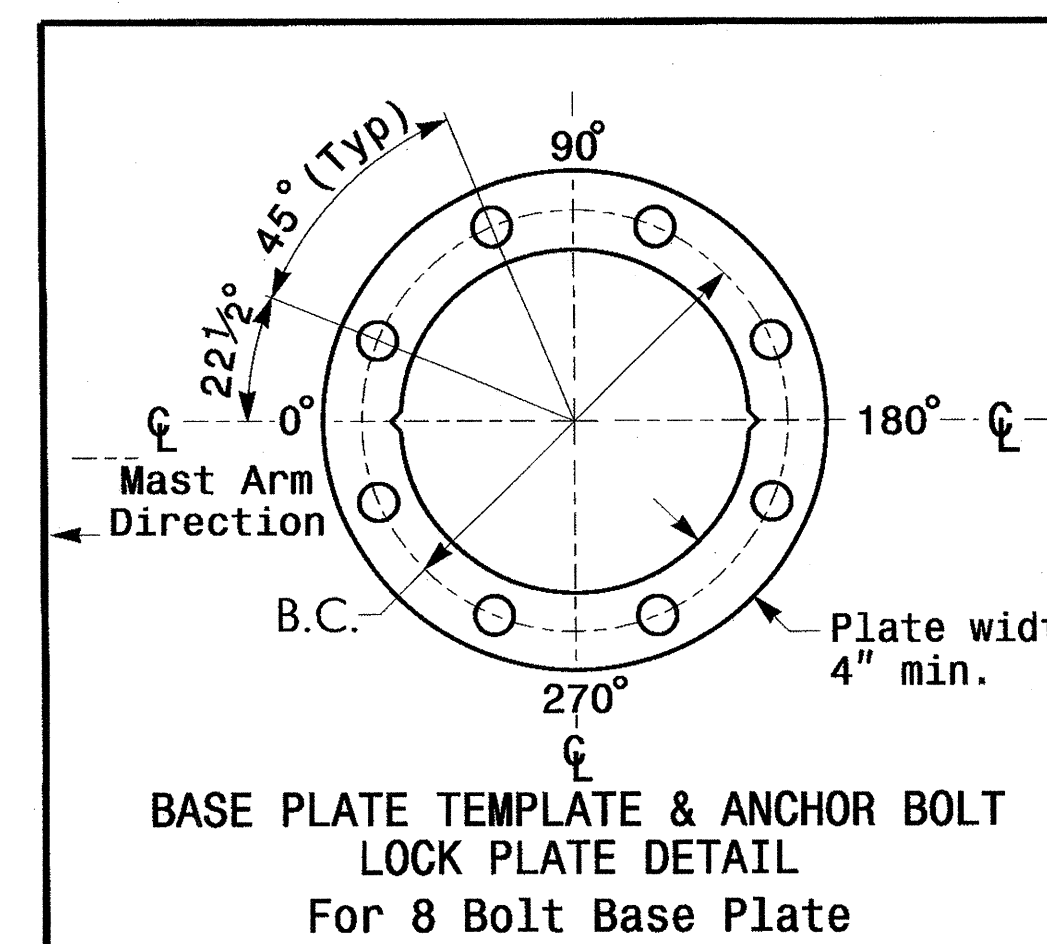
Elevation Differences for:	Arm "A"	Arm "B"
Baseline reference point at Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	+0.1 ft.	-0.5 ft.
Elevation difference at Edge of travelway or face of curb	-0.2 ft.	-0.2 ft.



POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL
See Note 5



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

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
[Symbol]	SIGNAL HEAD 12"-5 SECTION-WITH BACKPLATE AND ASTRO-BRAC	16.3 S.F.	42.0" W X 56.0" L	103 LBS
[Symbol]	SIGNAL HEAD 12"-4 SECTION-WITH BACKPLATE AND ASTRO-BRAC	11.5 S.F.	25.5" W X 66.0" L	74 LBS
[Symbol]	SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE AND ASTRO-BRAC	9.3 S.F.	25.5" W X 52.5" L	60 LBS
[Symbol]	SIGN RIGID MOUNTED WITH ASTRO-SIGN-BRAC	5.0 S.F.	24.0" W X 30.0" L	11 LBS

NOTES

Design Reference Material

- Design the traffic signal structure and foundation in accordance with:
 - The 5th Edition 2009 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
 - The 2012 NCDOT "Standard Specifications for Roads and Structures". The latest addenda to these specifications can be found in the traffic signal project special provisions.
 - The 2012 NCDOT Roadway Standard Drawings.
 - The traffic signal project plans and special provisions.
 - The NCDOT "Metal Pole Standards" located at the following NCDOT website: <http://www.ncdot.org/doh/preconstruct/traffic/ITSS/ws/mpoles/poles.html>

Design Requirements

- 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.
- Design all signal supports using stress ratios that do not exceed 0.9.
- A clamp-type bolted mast arm-to-pole connection may be used instead of the welded ring stiffened box connection shown as long as the connection meets all of the design requirements. This requires staggering the connections. Use elevation data for each arm to determine appropriate connection points.
- Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
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 - Nominal vertical rise in mast arm is 5 feet as measured from the centerline of the arm base to the centerline of the free end of the arm.
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 - 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.
- 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 Structural Engineer for assistance at (919) 773-2800.
- The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
- The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

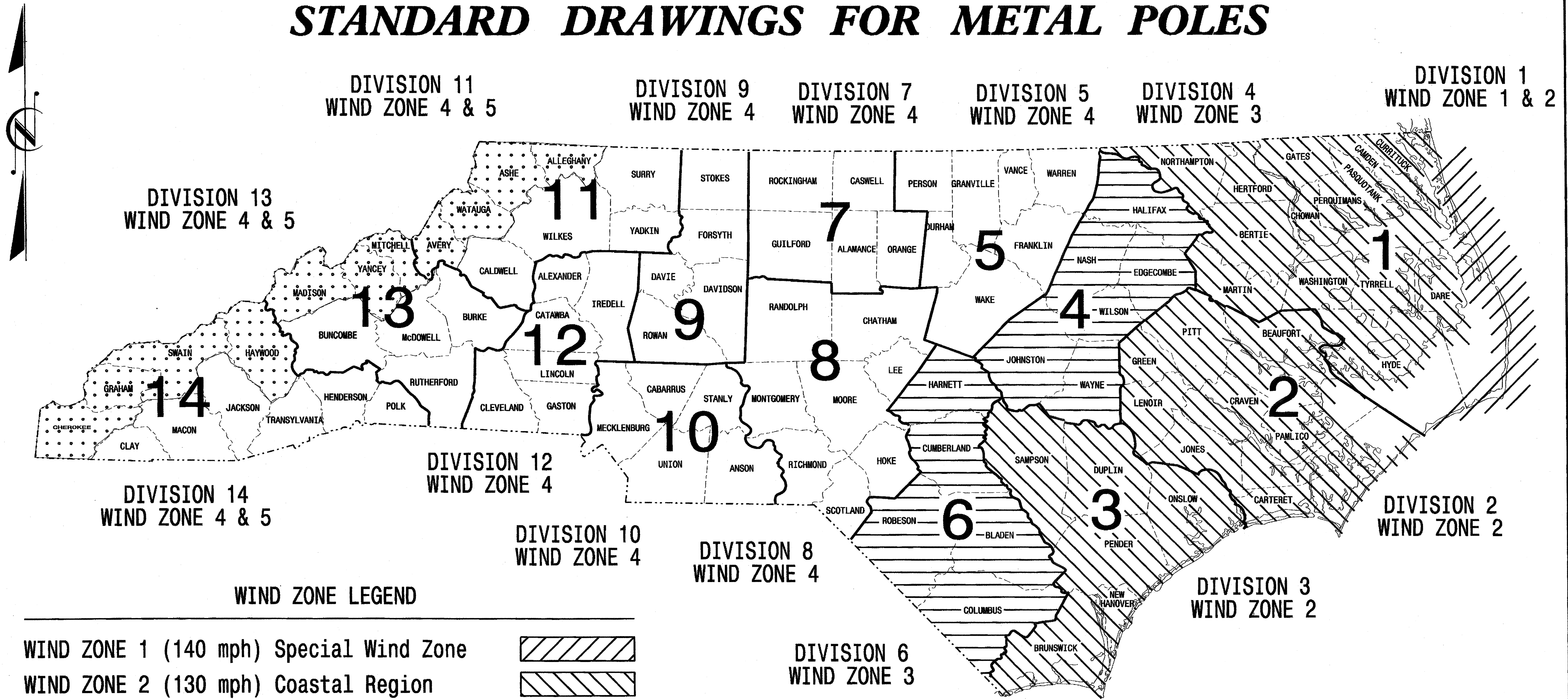
NCDOT Wind Zone 4 (90 MPH)

	SR 2739 (N. Main Street) at SR 1210 (Ryder Avenue)		SEAL NORTH CAROLINA PROFESSIONAL ENGINEER ROBERT J. ZIEBBA 026486 4/13
	Division 9 Rowan County Landis	PLAN DATE: August 2013 REVIEWED BY: PREPARED BY: C.E. Carter REVIEWED BY:	
SCALE 0 N/A N/A	REVISIONS	INIT. DATE	SIGNATURE DATE

STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

STATE	PROJECT NO.	SHEET NO.
N.C.	P-5206D	Sig. 12
F.A. PROJ. NO.	M 1	
PROJECT ID. NO.		

STANDARD DRAWINGS FOR METAL POLES



WIND ZONE LEGEND

WIND ZONE 1 (140 mph) Special Wind Zone	
WIND ZONE 2 (130 mph) Coastal Region	
WIND ZONE 3 (110 mph) Eastern Region	
WIND ZONE 4 (90 mph) Central & Mtn. Region	
WIND ZONE 5 (120 mph) Special Wind Zone	

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

Prepared in the Offices of:

750 N. Greenfield Pkwy, Garner, NC 27529

Designed in conformance with the latest 2012 Interim to the 5th Edition 2009

AASHTO

Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals

INDEX OF PLANS	
DRAWING NUMBER	DESCRIPTION
M 1	Title Sheet
M 2	Fabrication Details - All Poles
M 3	Fabrication Details - Strain Poles
M 4,5	Fabrication Details - Mast Arm Poles
M 6	Construction Details - Strain Poles
M 7	Construction Details - Foundations
M 8	Standard Strain Poles

NCDOT CONTACTS:

MOBILITY AND SAFETY DIVISION - ITS AND SIGNALS UNIT

G. A. FULLER, P.E. - STATE ITS AND SIGNALS ENGINEER

G. G. MURR, JR., P.E. - STATE SIGNALS ENGINEER

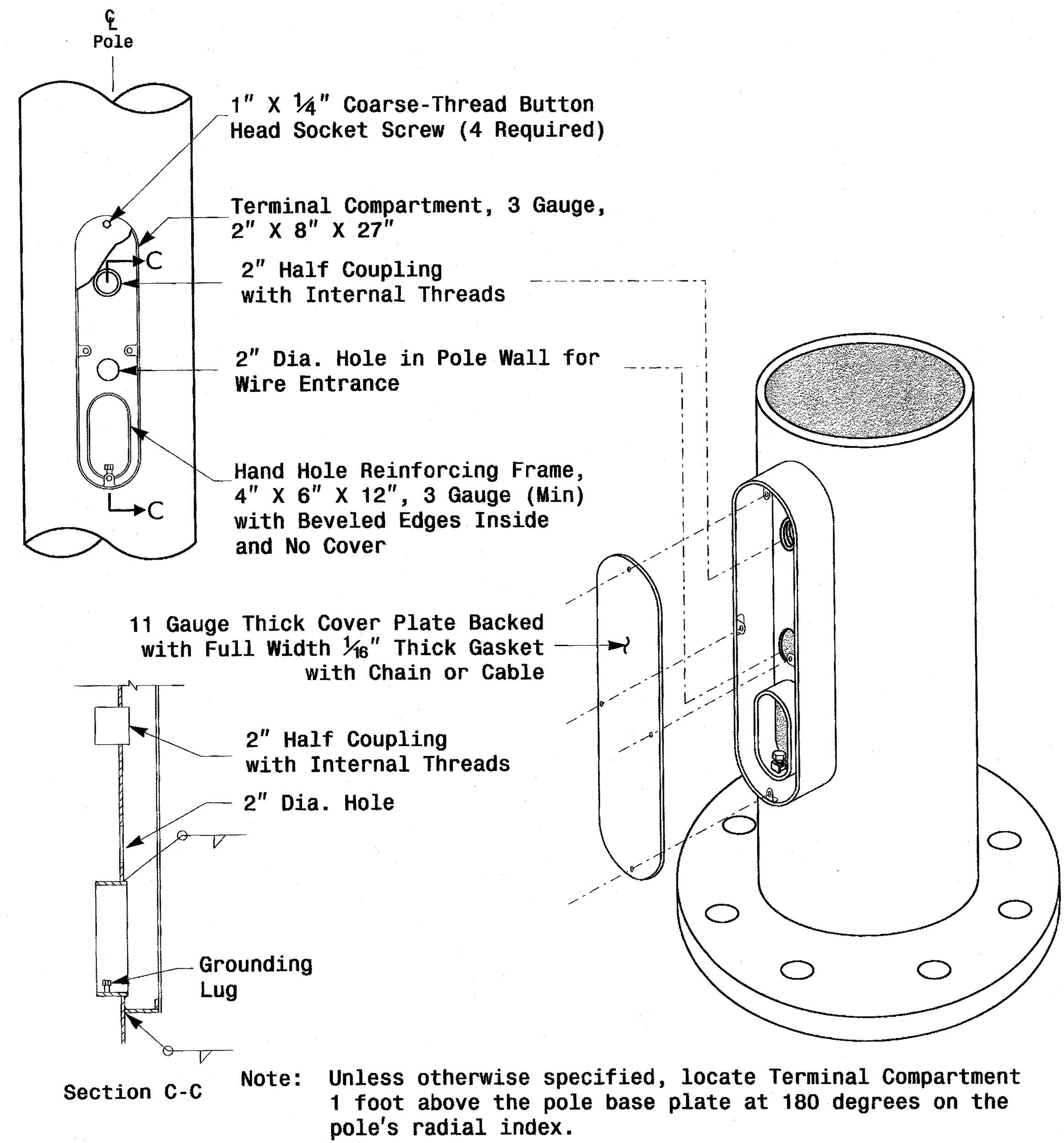
D.C. SARKAR, P.E. - ITS AND SIGNALS SENIOR STRUCTURAL ENGINEER

C.F. ANDREWS - ITS AND SIGNALS JOURNEY STRUCTURAL ENGINEER

SEAL

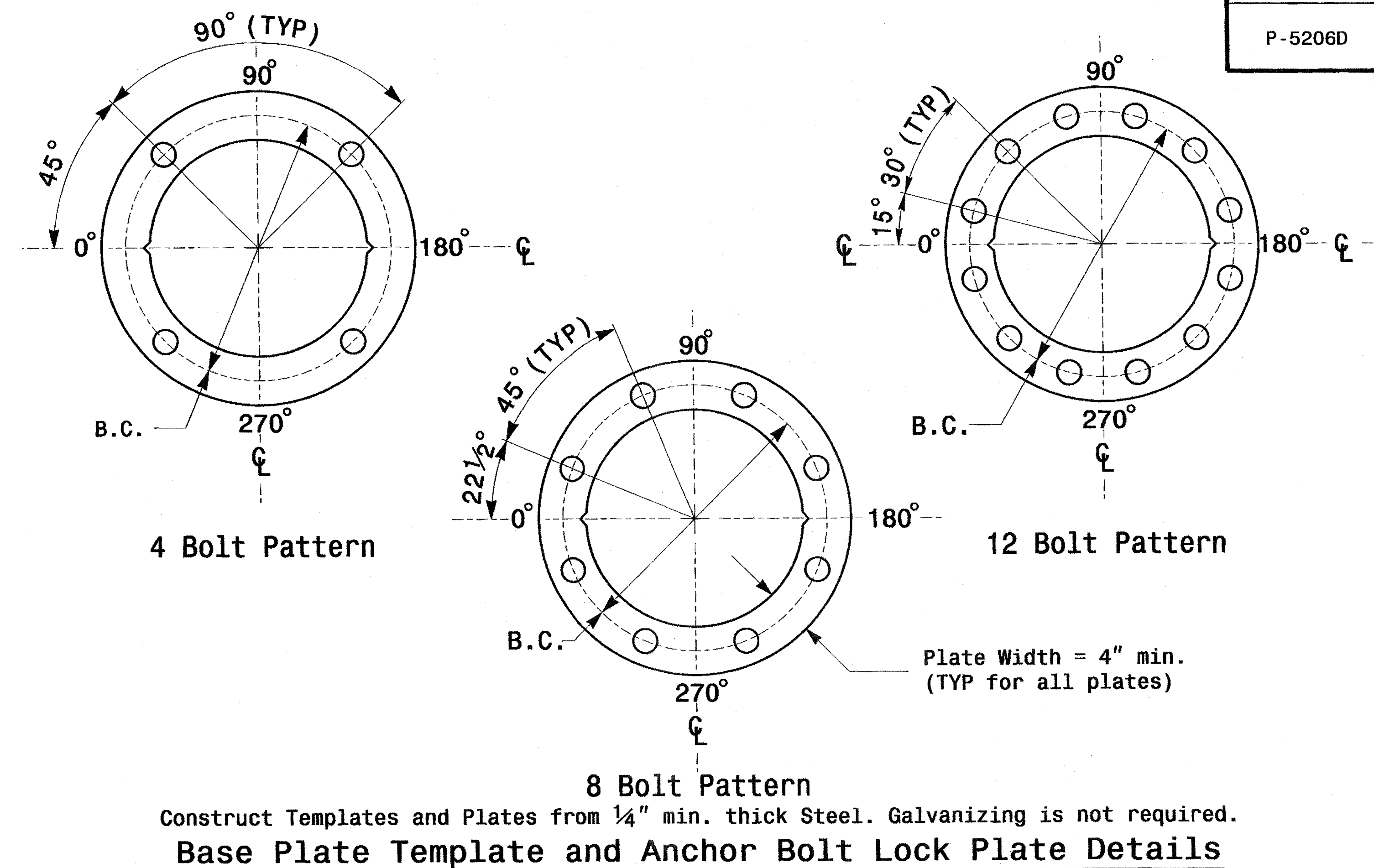
DEBESH C. SARKAR
ENGINEER
SEAL 028094

Signature: *D. Sarkar* 8.7.2013
DATE



Note: Unless otherwise specified, locate Terminal Compartment 1 foot above the pole base plate at 180 degrees on the pole's radial index.

Terminal Compartment Detail



Base Plate Template and Anchor Bolt Lock Plate Details

MFG _____	MFG. DATE: MM/YY _____
SHAFT D/T/L/Y _____	
ARM-A D/T/L/Y _____	
ARM-B D/T/L/Y _____	
A.B. DIA./B.C./L/Y _____	
NCDOT STANDARD _____	

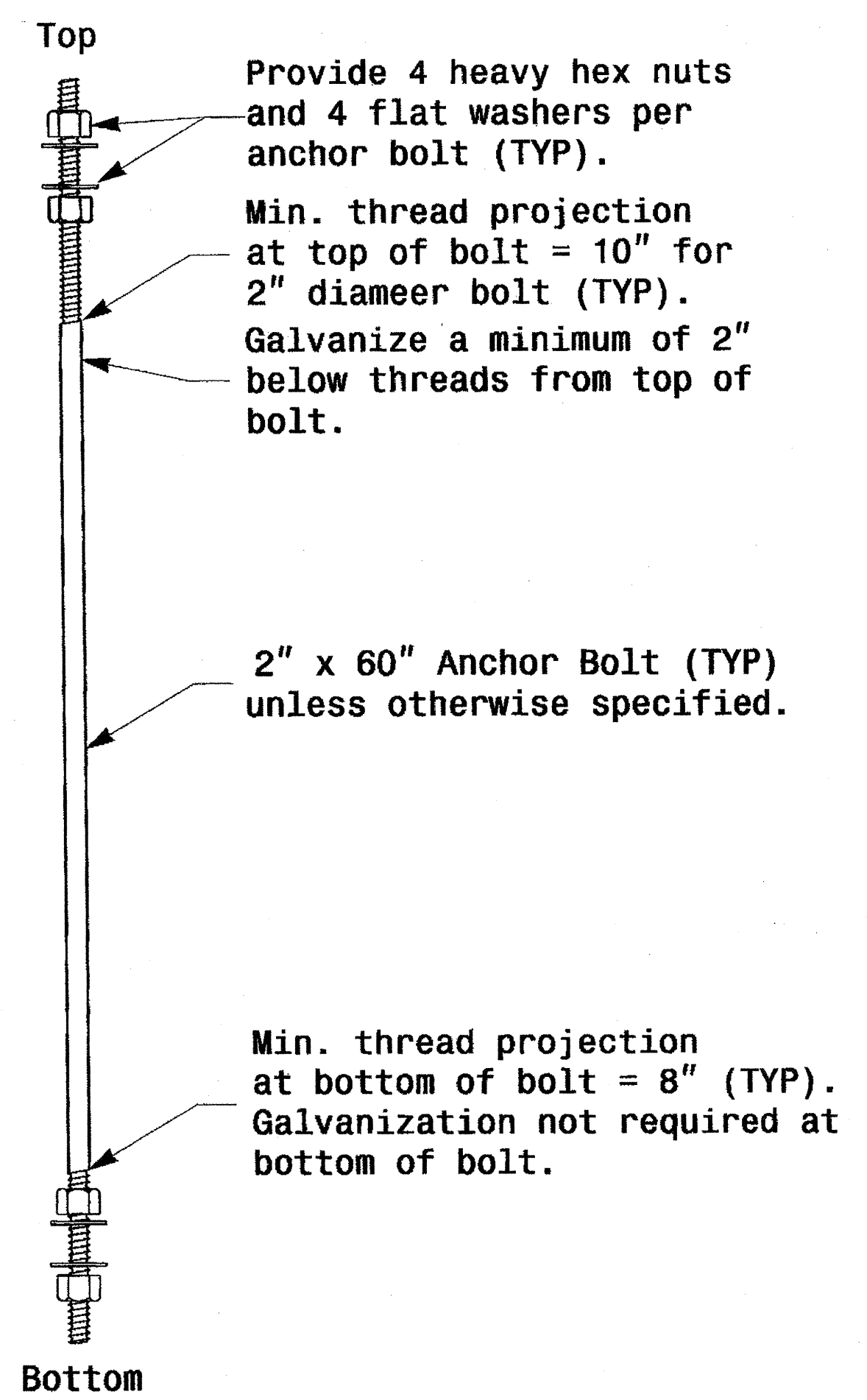
Shaft I.D. Tag
(Provide on Strain Poles and Mast Arm Poles)

- Notes:
- 1) D= Diameter, T= Thickness, L= Length, Y= Yield Strength
 - 2) A.B. = Anchor Bolt
 - 3) B.C. = Bolt Circle of Anchor Bolts
 - 4) If Custom Design, use "NCDOT STANDARD" line for pole I.D. number and Signal Inv. Number.
 - 5) See drawing M4 for mounting positions of I.D. tags.

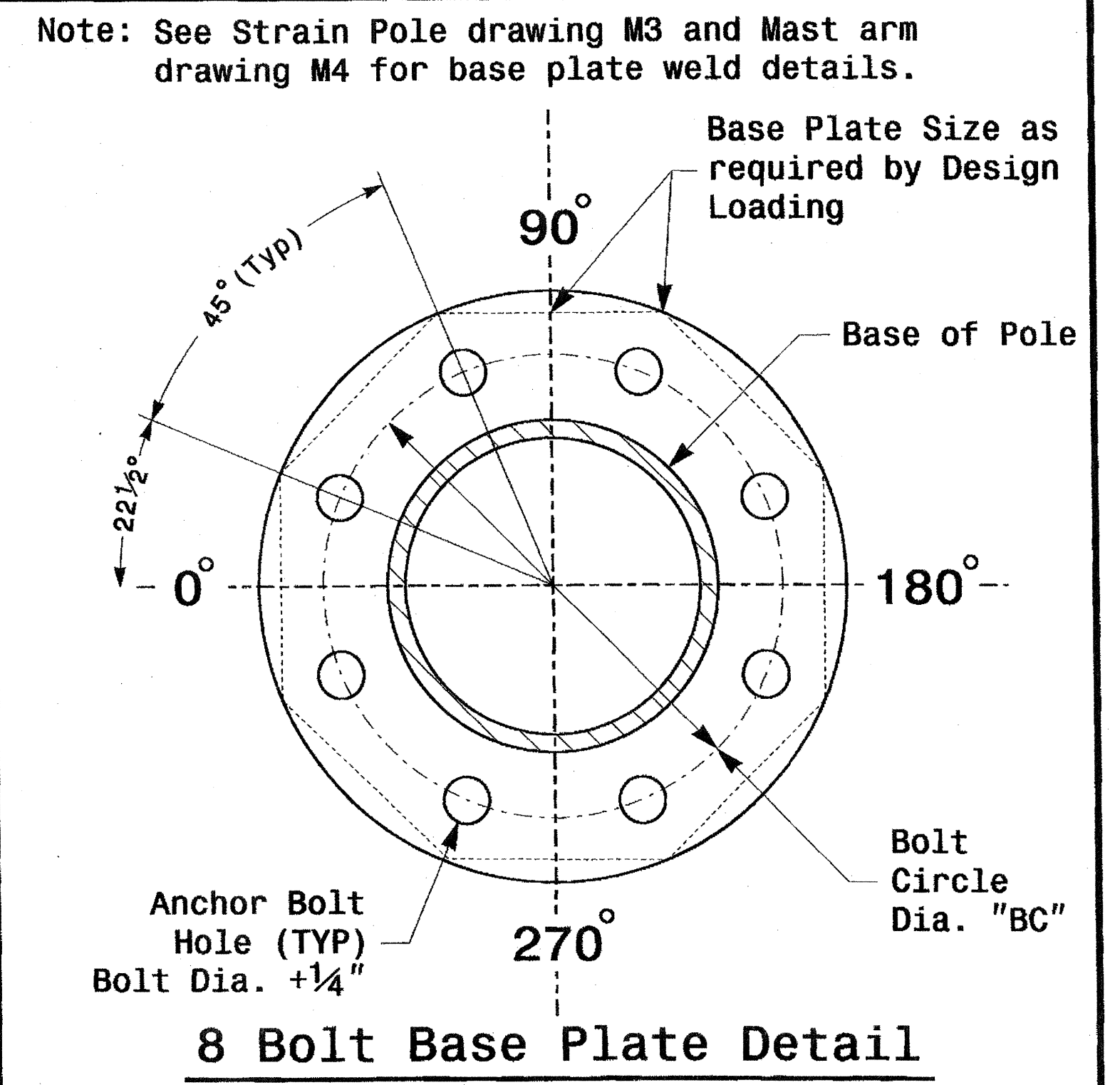
Identification Tag Details

MFG _____	MFG. DATE: MM/YY _____
SECTION D/T/L/Y _____	
NCDOT STANDARD _____	

Arm I.D. Tag
(Provide on each section of a multi-section mast arm)



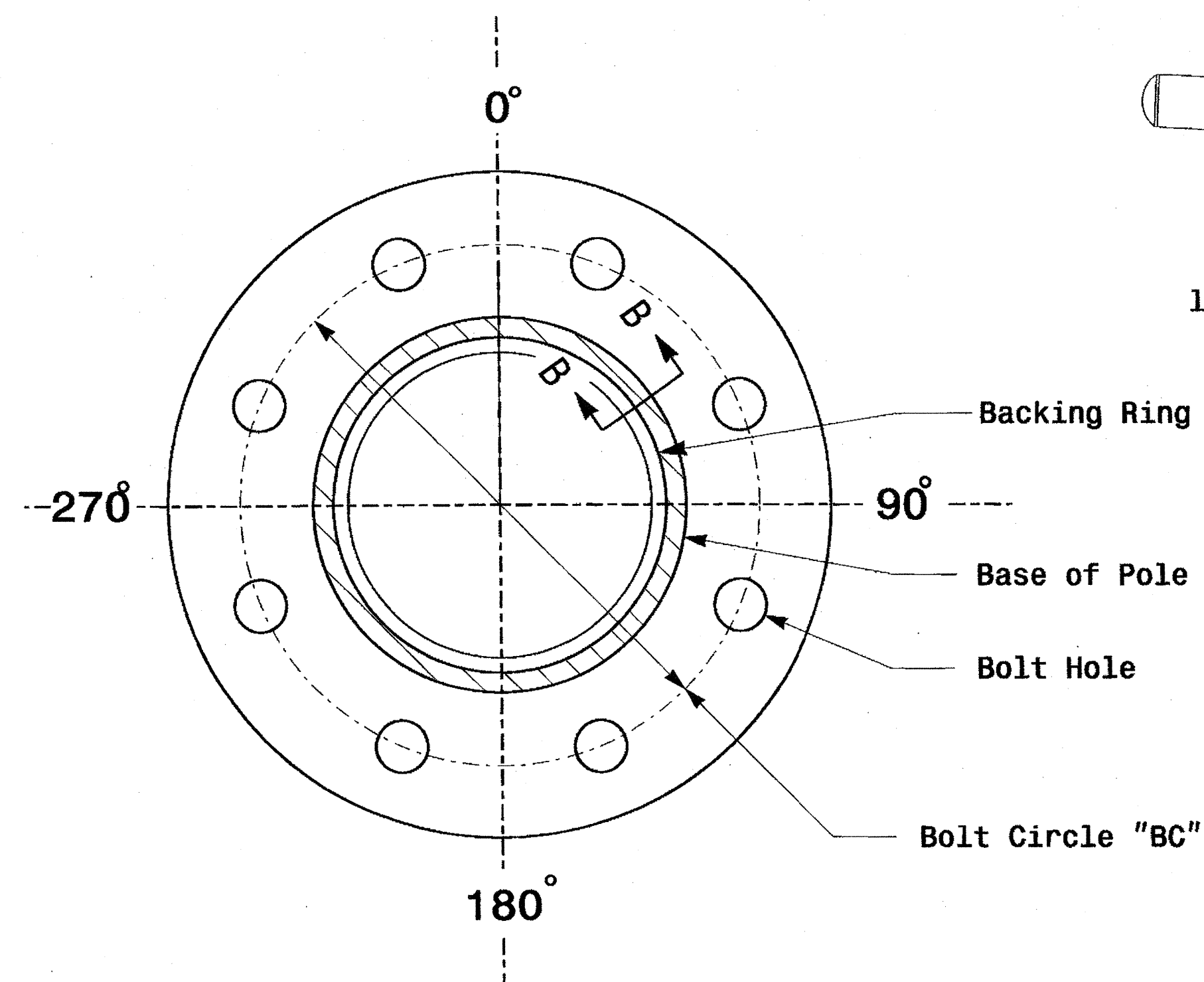
Anchor Bolt Detail



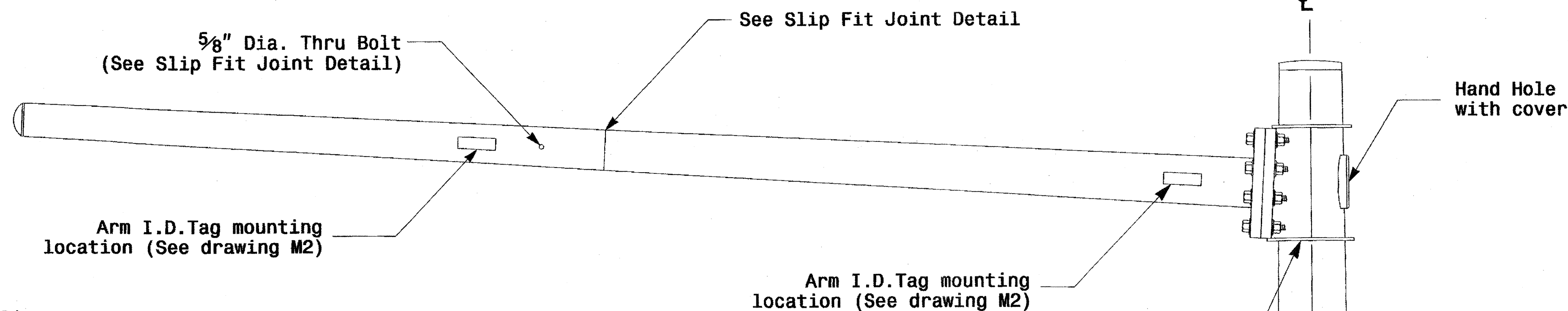
	Typical Fabrication Details Common To All Metal Poles	
	PLAN DATE: AUGUST 2013 PREPARED BY: N. BITTING	DESIGNED BY: C.F. ANDREWS REVIEWED BY: D.C. SARKAR
SCALE: NONE	REVISIONS:	INIT. DATE:
Signature: <i>D.C. Sarkar</i> 8.7.2013		SIG. INVENTORY NO.

Fabrication Details - All Poles

07-AUG-2013 13:15 S:\ITS\SSU\ITS Signal\work\pools\Structure\Drawings\2012 Standard Strain Pole Design\012.m2.dgn



Section A-A
(See drawing M 2)
Pole Base Plate



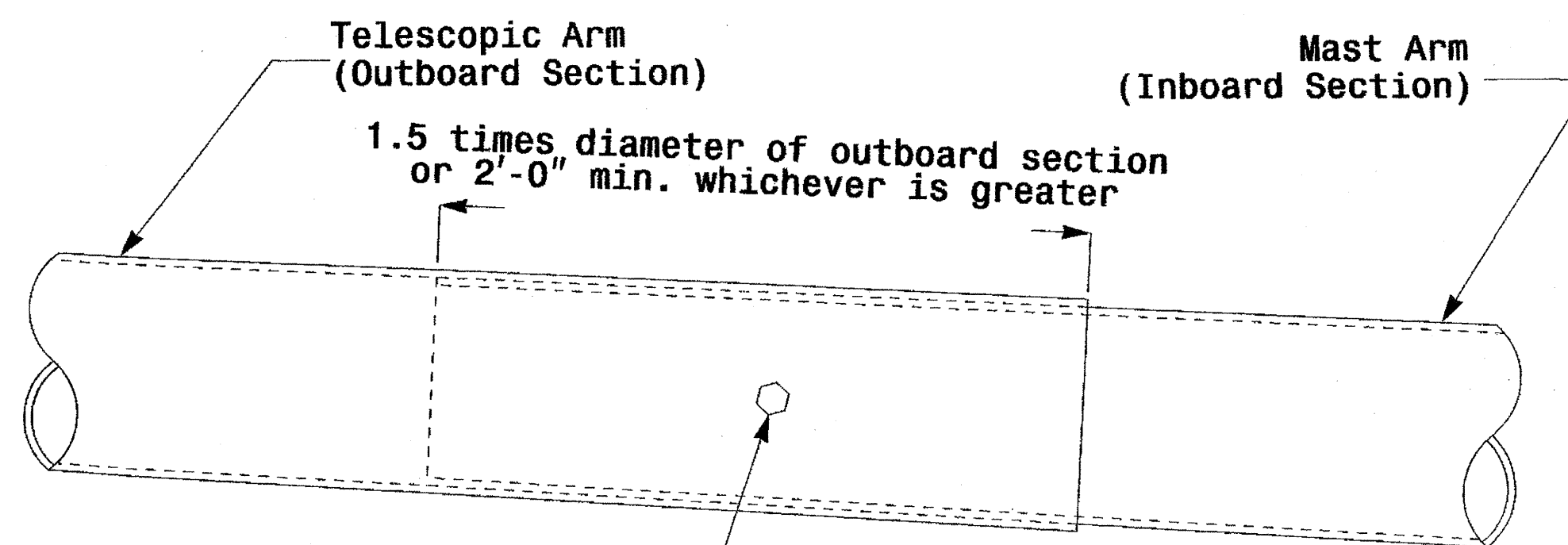
5/8" Dia. Thru Bolt
(See Slip Fit Joint Detail)

See Slip Fit Joint Detail

Arm I.D. Tag mounting location (See drawing M2)

Arm I.D. Tag mounting location (See drawing M2)

Hand Hole with cover

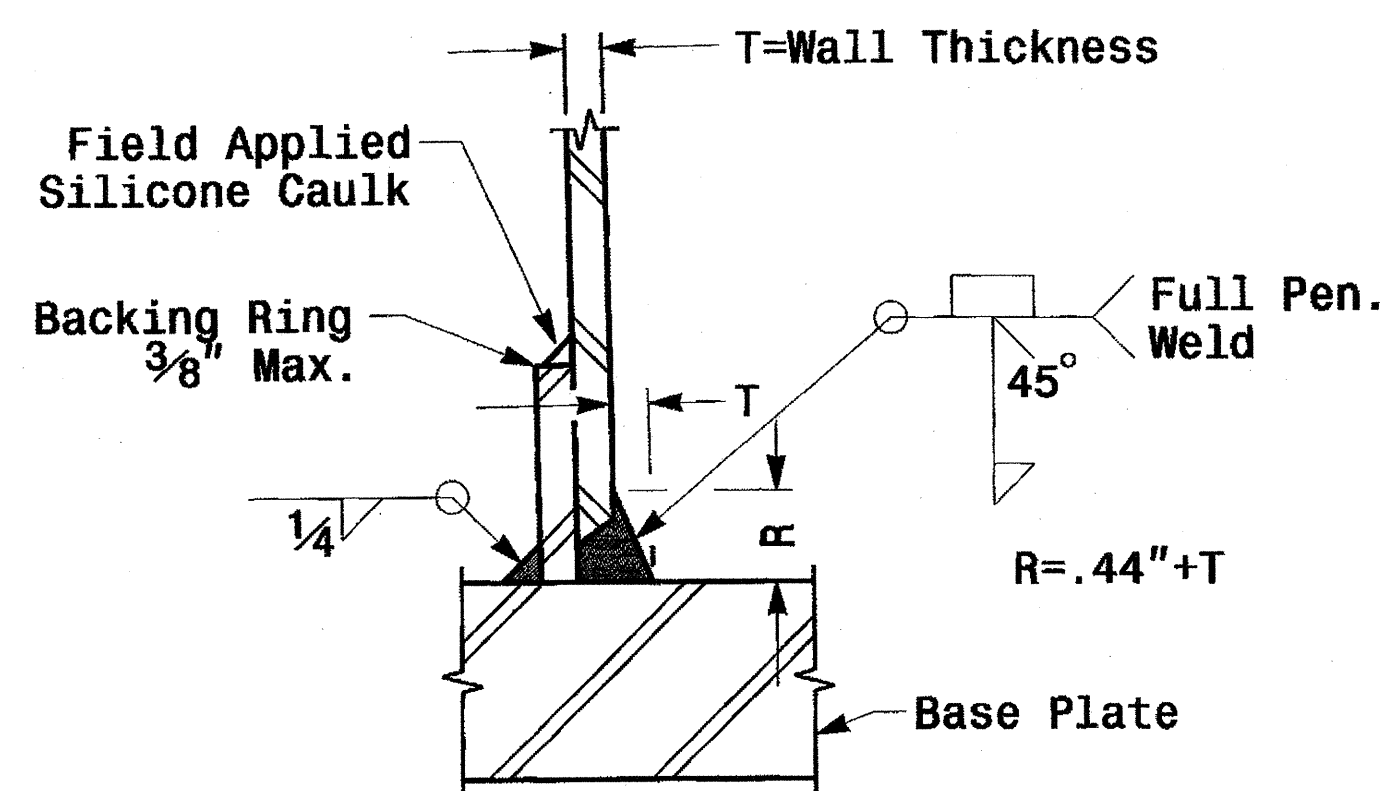


See drawing M5 for Mast Arm connection details

Shaft I.D. Tag mounting location (See drawing M2)

Terminal Compartment (See drawing M2)

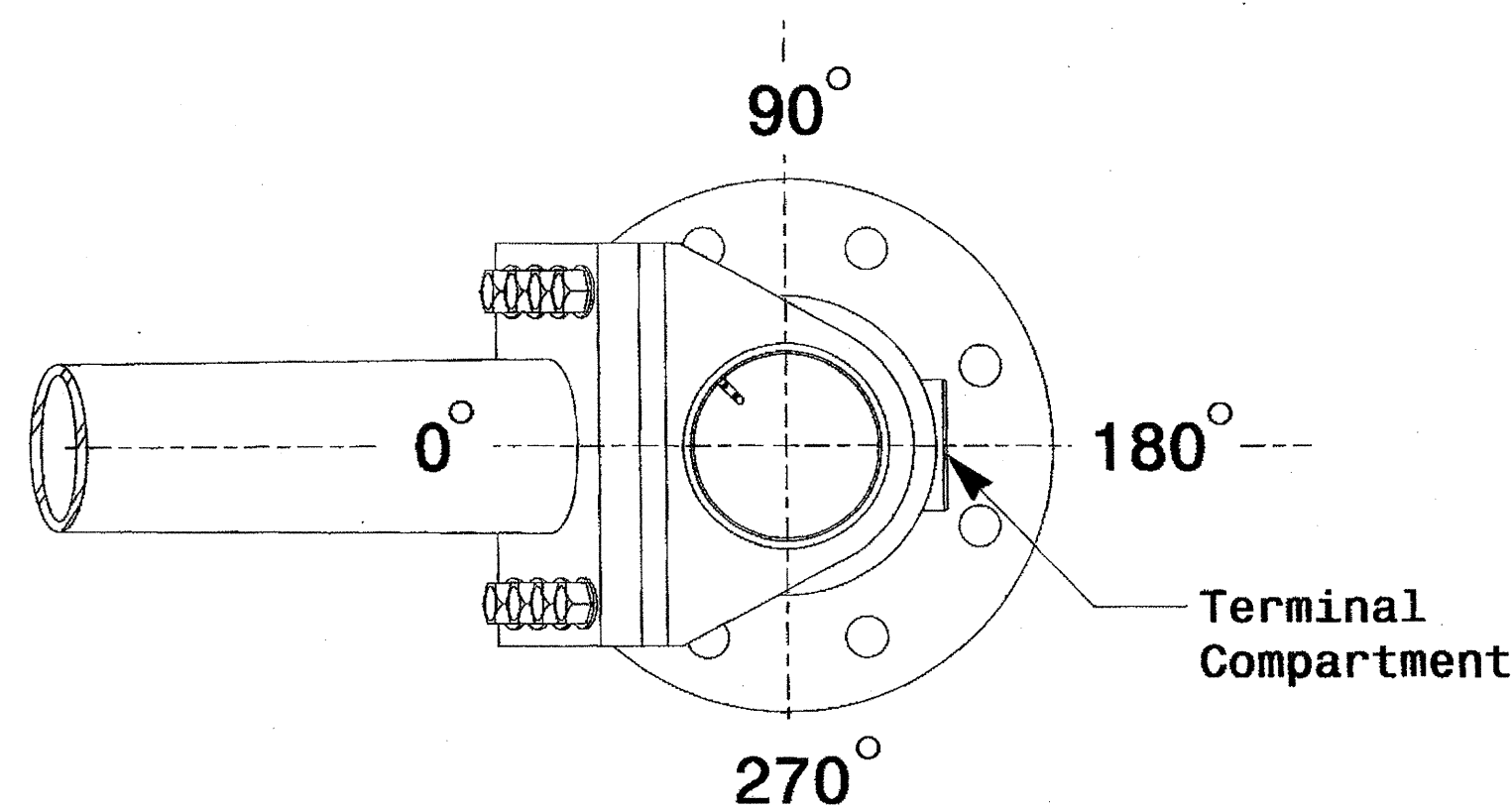
Monotube Mast Arm Pole
(.14in./ft. taper)



Section B-B
(Pole Attachment to Base Plate)

Full-Penetration Groove Weld Detail

Slip Fit Joint Detail for Mast Arm

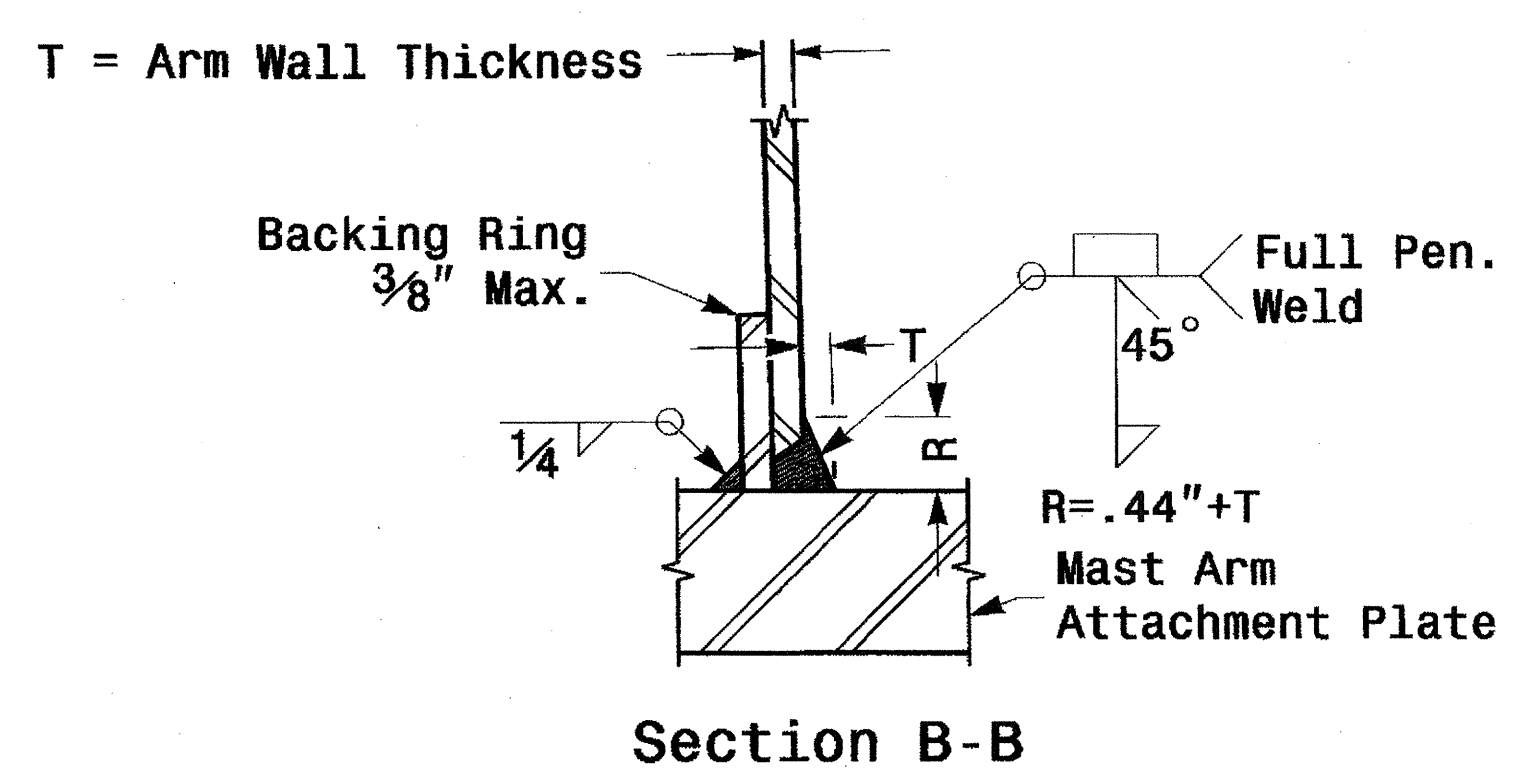
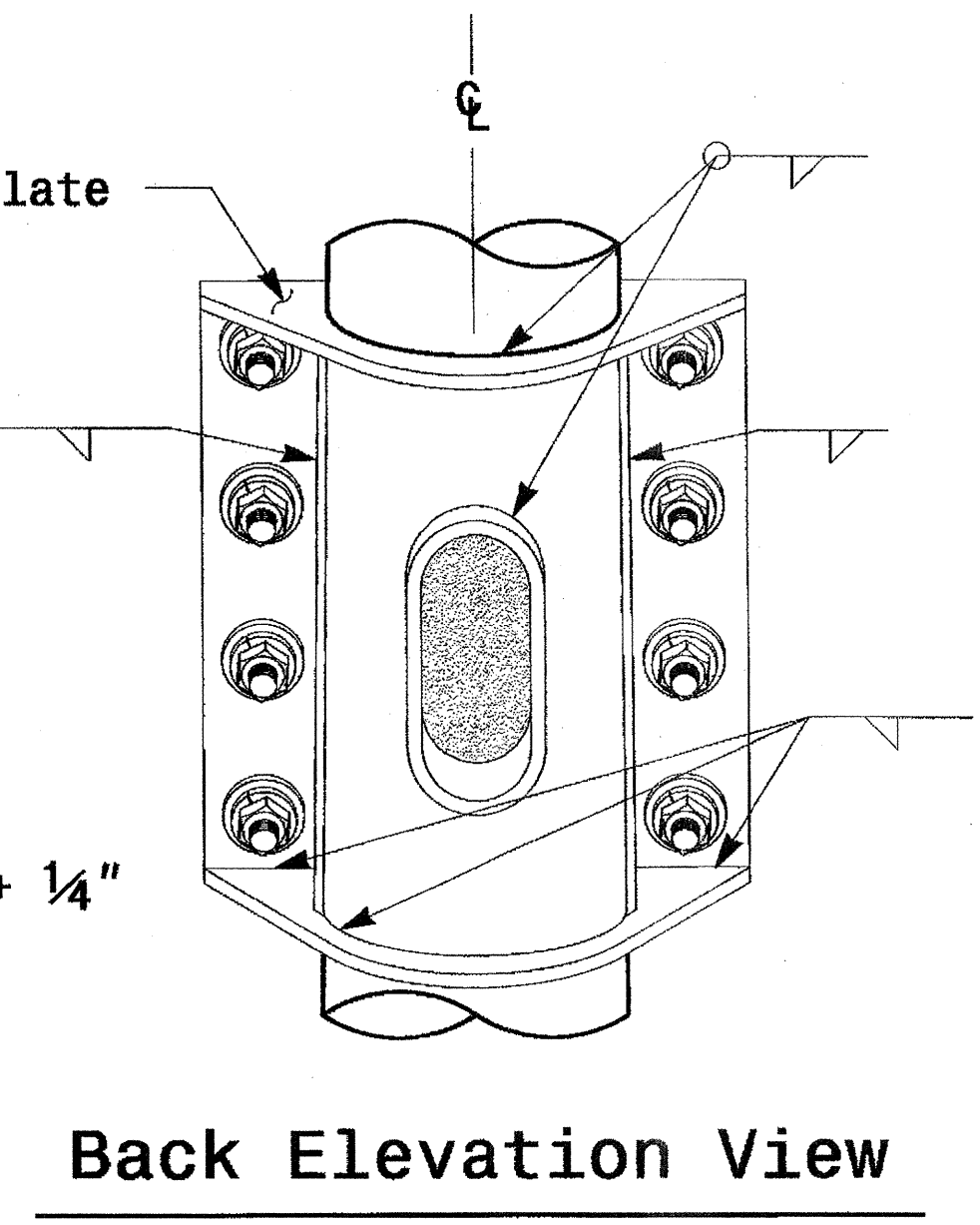
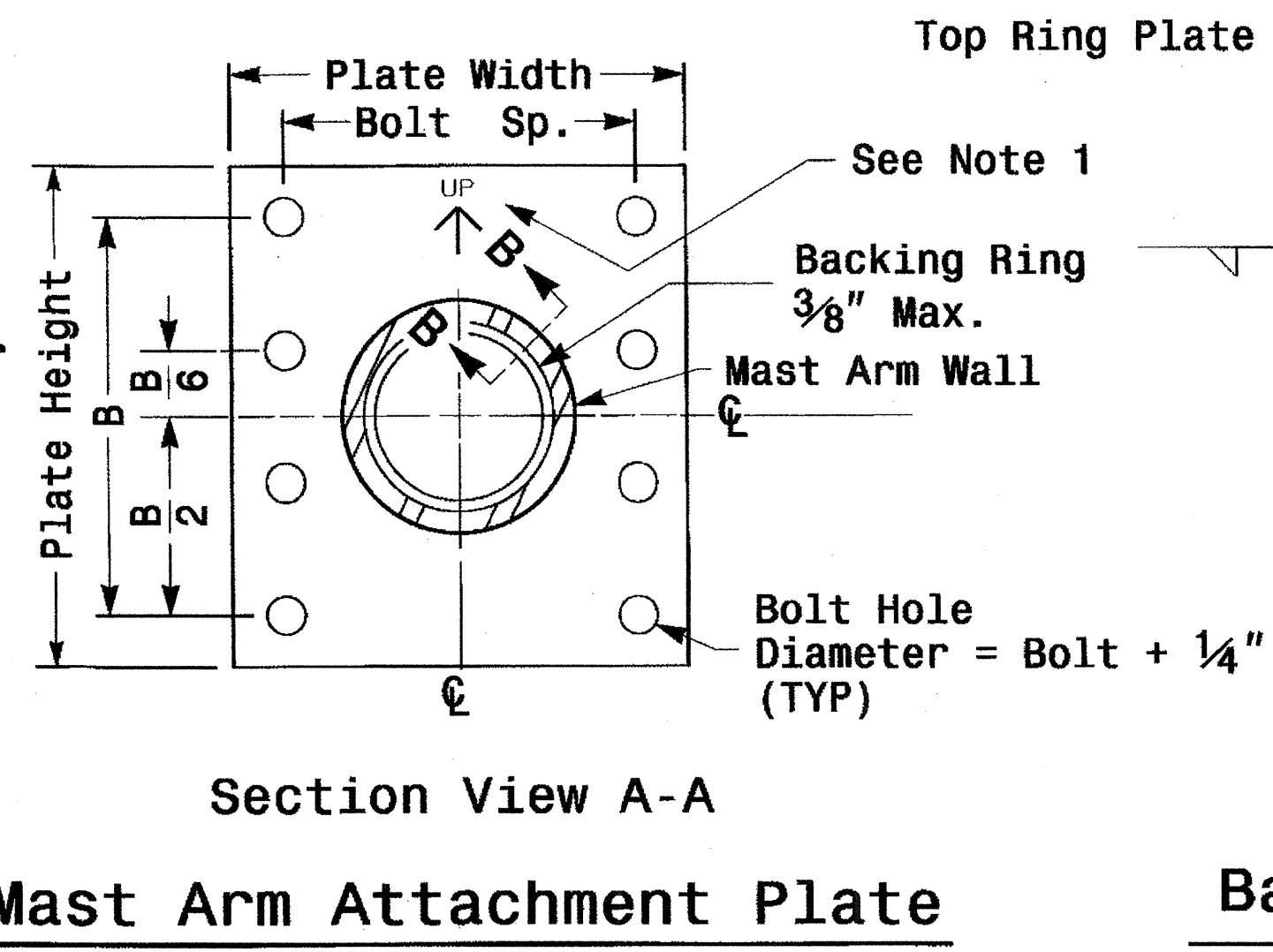
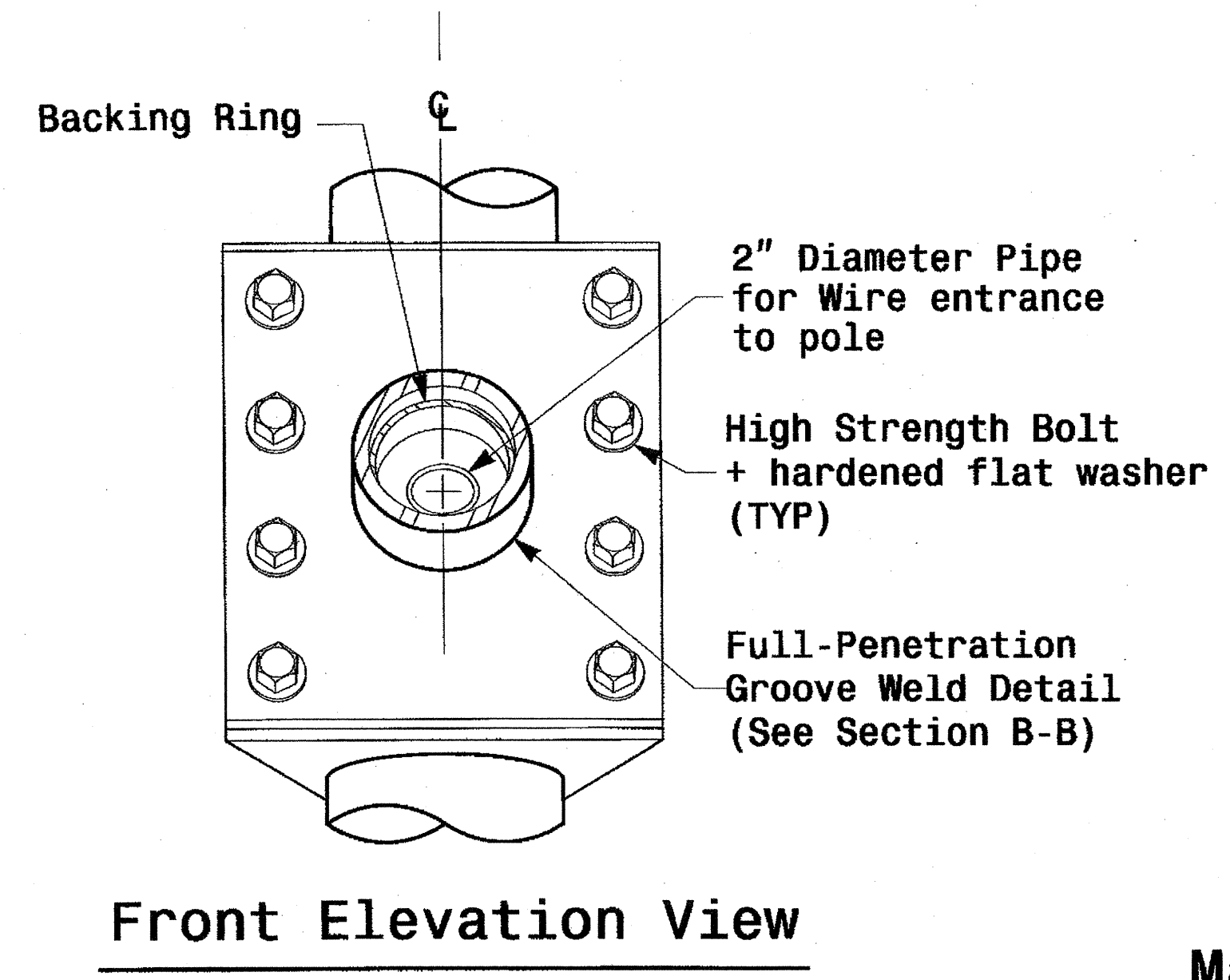
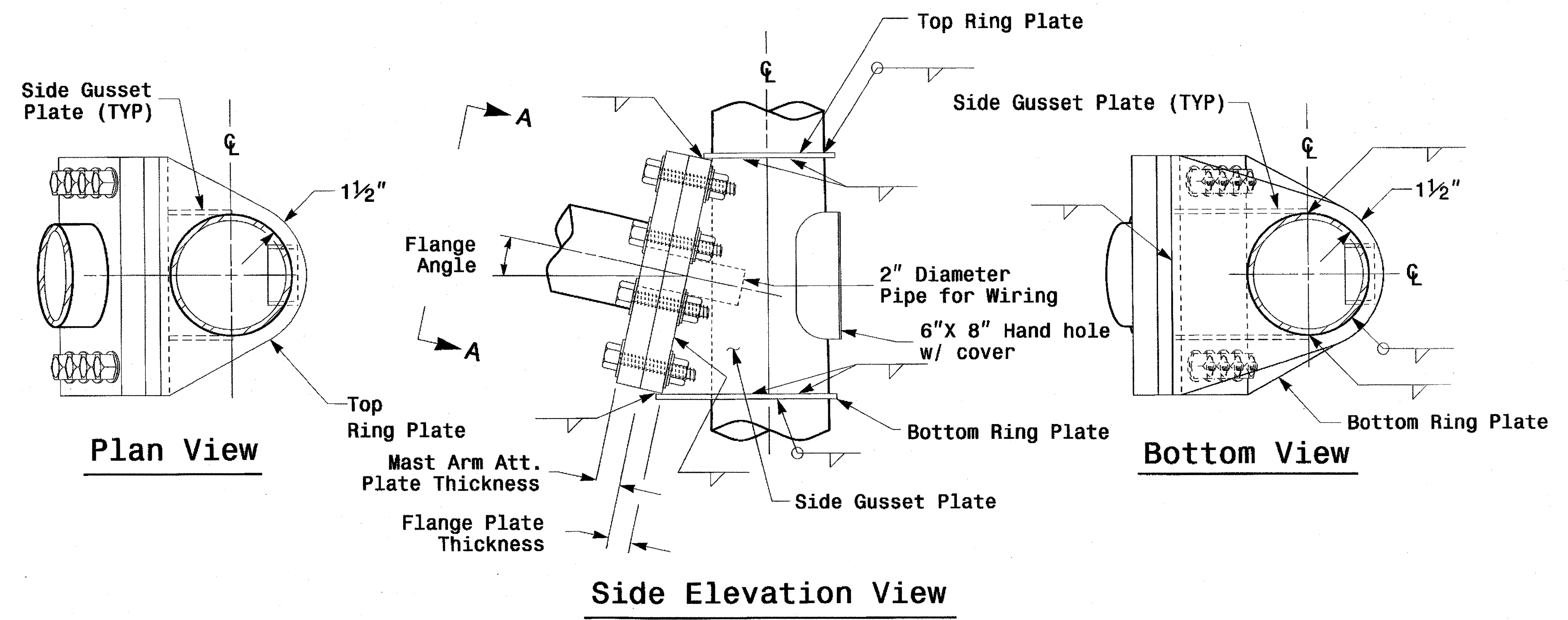


Mast Arm Radial Orientation

	Typical Fabrication Details for Mast Arm Poles		
	PLAN DATE: AUGUST 2013 PREPARED BY: N. BITTING	DESIGNED BY: C.F. ANDREWS REVIEWED BY: D.C. SARKAR		SCALE: 0 NA NONE
REVISIONS		INIT. DATE	SIGNATURE: <i>D. Sarkar</i> DATE: 8.7.2013
SIG. INVENTORY NO.			

Fabrication Details - Mast Arm Poles

Welded Ring Stiffened Mast Arm Connection



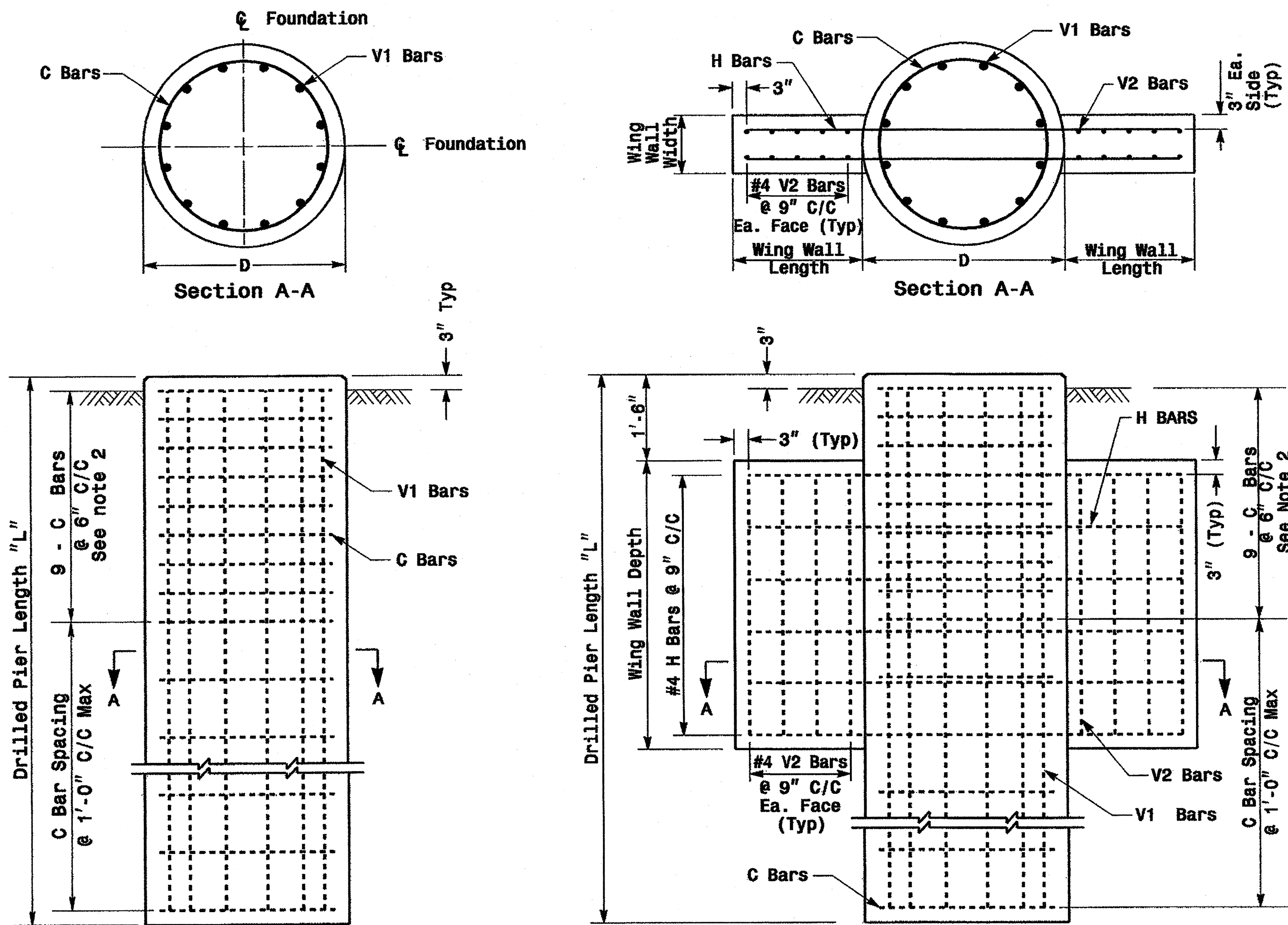
- Notes:
1. Provide a permanent means of identification above the mast arm to indicate proper attachment orientation of the mast arm.
 2. Designer will determine the size of all structural components, plates, fasteners, and welds shown unless they are already specified.
 3. Designer is responsible for providing appropriate drainage points.

07-AUG-2013 13:37 C:\Users\mjb\Documents\Projects\2012 Standard Strain Pole Design\2012 m6.dgn

Fabrication Details - Mast Arm Poles

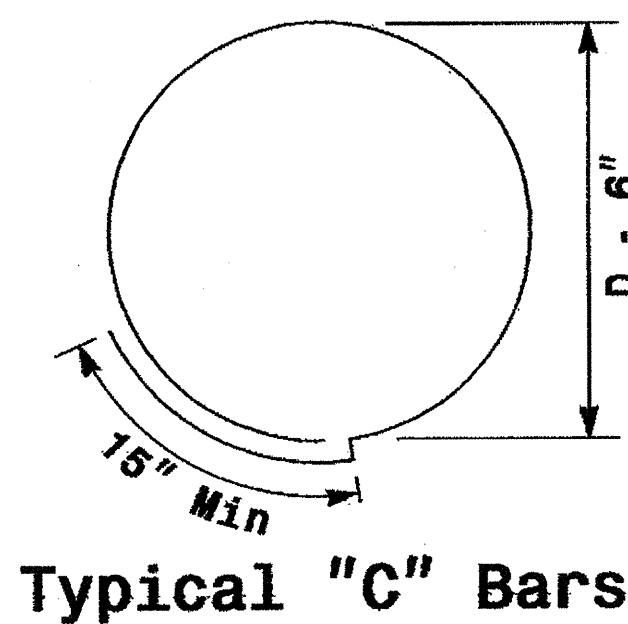
	<p>Fabrication Details For Mast Arm Connection To Pole</p>	
	<p>PLAN DATE: AUGUST 2013</p>	<p>DESIGNED BY: C.F. ANDREWS</p>
<p>PREPARED BY: N. BITTING</p>	<p>REVIEWED BY: D.C. SARKAR</p>	<p>SCALE: 0 NA NONE</p>
<p>REVISIONS</p>	<p>INIT. DATE</p>	<p>SIGNATURE: <i>D. Sarkar</i> 8.7.2013</p>
<p>SIG. INVENTORY NO.</p>		<p>SEAL</p>

Reinforcing Steel Bars



REINFORCING STEEL TABLE FOR STANDARD DRILL PIER SHAFT (42" & 48" DIAMETER)						
Shaft Dia. (in.)	Conc. Volume (cu. yds.)	Bar Name	No.	Size	Type	Length
42"	.356 x L	V1	9	#8	STR.	**
		C	*	#4	CIR.	10'-9"
48"	.465 x L	V1	12	#8	STR.	**
		C	*	#4	CIR.	12'-6"

* See Note No. 1
** See Note No. 3



Typical "C" Bars

REINFORCING STEEL TABLE FOR STANDARD 42" and 48" DRILL PIER SHAFT WITH TYPE 1 AND TYPE 2 WING WALLS						
Wing Wall Type	Drill Pier Shaft Dia. (in.)	Reinforcing Steel				
		Bar Name	No.	Size	Type	Length
TYPE 1	42"	V1	9	#8	STR.	**
		V2	12	#4	STR.	2'-6"
		H	8	#4	STR.	6'-0"
		C	*	#4	CIR.	10'-9"
TYPE 2	42"	V1	9	#8	STR.	**
		V2	16	#4	STR.	4'-6"
		H	12	#4	STR.	9'-0"
		C	*	#4	CIR.	10'-9"
TYPE 2	48"	V1	12	#8	STR.	**
		V2	16	#4	STR.	4'-6"
		H	12	#4	STR.	9'-6"
		C	*	#4	CIR.	12'-6"

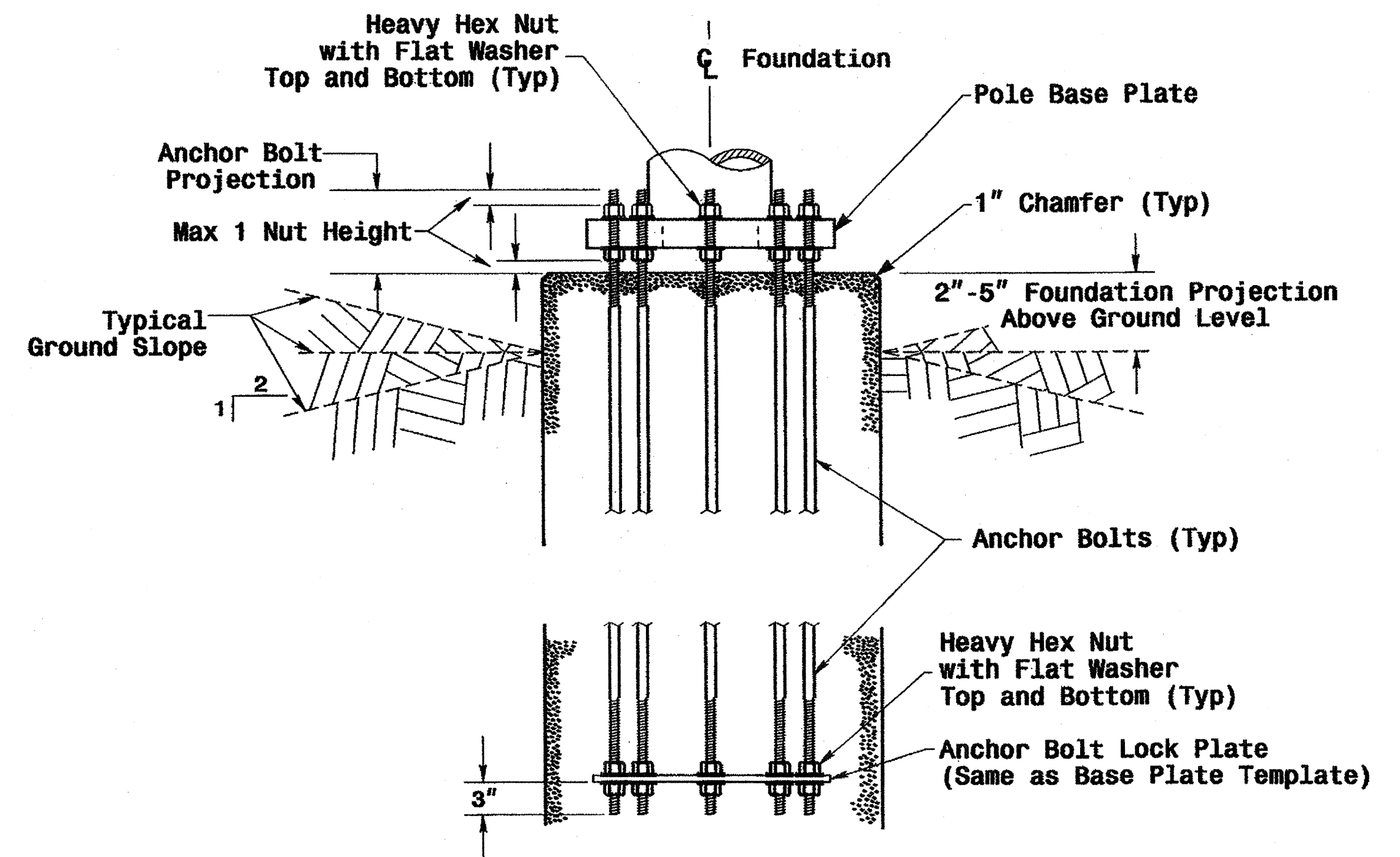
* See Note No. 1
** See Note No. 3

WING WALL DETAILS				
Wing Wall Type	Wing Wall Length (Ft.)	Wing Wall Width (Ft.)	Wing Wall Depth (Ft.)	Concrete Volume (Cu. Yds.)
TYPE 1	1'-6"	1'-0"	3'-0"	.4
TYPE 2	3'-0"	1'-0"	5'-0"	1.2

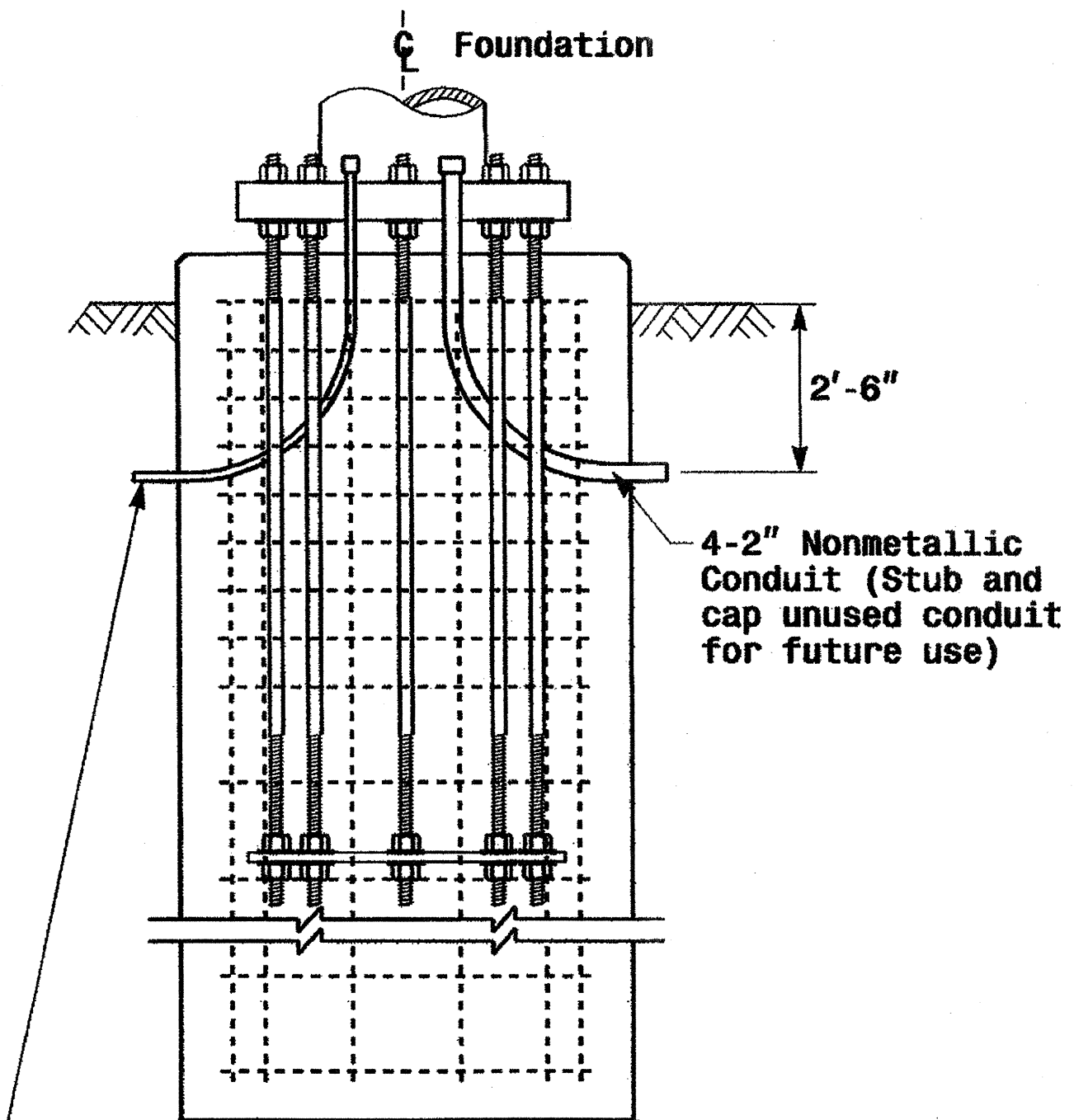
See Note No. 4

Typical Foundation Anchor Bolt Details

(Reinforcing Cage Not Shown for Clarity)



Typical Foundation Conduit Details



2-1" Nonmetallic Conduits for Electrical Service and Grounding Electrode Conductor

Notes

- The number of C-bars is based on foundation depth. For standard foundations, see sheet M 8.
- Circular tie reinforcing rings may be vertically adjusted by +/- 3" at a depth between 2'-0" and 3'-0" to facilitate the installation of electrical conduit entering in the cage.
- The length of V1-bars is based on foundation depth. For standard foundations, see sheet M 8.
- The quantities for steel and concrete shown in the Wing Wall Details Chart reflect the amount of material for 1 pair of wing walls (2 wing walls per drilled pier shaft.)

	Construction Details Foundations	
	PLAN DATE: May 2005 PREPARED BY: C.F. ANDREWS SCALE: 0 NA NONE	REVIEWED BY: P.L. ALEXANDER REVIEWED BY: A.W. ESPOSITO REVISIONS: _____ INIT. DATE

		STANDARD STRAIN POLES				STANDARD FOUNDATIONS 42" Diameter Drilled Pier Length (L) - Feet						
Case No.	Pole Height (Ft.)	Base Plate BC (In.)	Moment at the Pole Base (ft-kp)	Clay				Sand				
				Medium N-Value 4-8	Stiff N-Value 9-15	Very Stiff N-Value 16-30	Hard N-Value >30	Loose N-Value 4-10	Medium N-Value 11-30	Dense N-Value >30		
WIND ZONE 1	LIGHT	S26L3	26	25	280	20.5	14.0	11.5	9.5	18.0	16.0	14.0
		S30L3	30	25	310	21.0	14.5	11.5	9.5	18.5	16.5	14.5
		S35L3	35	25	350	22.5	15.0	12.0	10.0	19.5	17.5	15.5
	HEAVY	S30H3	30	29	450	25.5	16.5	13.0	11.0	21.0	18.5	16.5
		S35H3	35	29	540	26.0	17.0	13.5	11.5	22.0	19.5	17.0
WIND ZONE 2	LIGHT	S26L2	26	23	250	19.5	13.5	11.0	9.0	18.0	15.5	14.0
		S30L2	30	23	290	20.0	14.0	11.5	9.5	18.5	16.0	14.0
		S35L2	35	23	315	21.0	14.5	11.5	9.5	19.0	16.5	14.5
	HEAVY	S30H2	30	29	415	24.5	16.0	13.0	10.5	21.0	18.5	16.0
		S35H2	35	29	485	25.5	16.5	13.5	11.0	21.5	19.0	16.5
WIND ZONE 3	LIGHT	S26L2	26	23	250	18.5	13.0	10.5	9.0	17.5	15.0	13.5
		S30L2	30	23	290	19.5	13.5	11.0	9.0	18.0	15.5	14.0
		S35L2	35	23	315	20.0	14.0	11.5	9.5	18.5	16.0	14.5
	HEAVY	S30H2	30	29	415	23.0	15.5	12.5	10.0	20.5	17.5	16.0
		S35H2	35	29	485	24.0	16.0	13.0	10.5	21.0	18.0	16.5
WIND ZONE 4	LIGHT	S26L1	26	22	195	18.0	13.0	10.5	9.0	16.5	14.5	13.0
		S30L1	30	22	225	18.5	13.0	10.5	9.0	17.0	15.0	13.5
		S35L1	35	22	255	19.0	13.5	11.0	9.0	17.5	15.5	14.0
	HEAVY	S30H1	30	25	330	22.0	15.0	12.0	9.5	19.5	17.0	15.0
		S35H1	35	25	385	23.0	15.5	12.5	10.0	20.0	17.5	15.5
WIND ZONE 5	LIGHT	S26L2	26	23	250	19.0	13.5	10.5	9.0	17.5	15.5	13.5
		S30L2	30	23	290	20.0	14.0	11.0	9.5	18.0	16.0	14.0
		S35L2	35	23	315	21.0	14.5	11.5	10.0	19.0	16.5	14.5
	HEAVY	S30H2	30	29	415	23.5	15.5	12.5	10.5	21.0	18.0	16.0
		S35H2	35	29	485	25.0	16.5	13.0	11.0	21.5	18.5	16.5

Fabrication Design Notes:


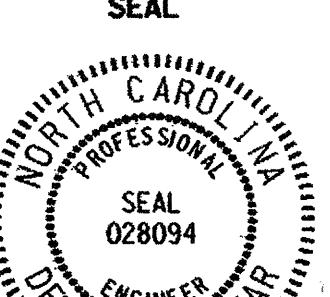
- Values shown in "Moment at the Pole Base" column represents the minimum acceptable capacity allowable for design using a design CSR of 1.
- Base plate thickness (T) is 2.0 inches.

Foundation Selection:

- Perform a standard penetration test at each proposed foundation site to determine "N" value.
- Select the appropriate wind zone from sheet M 1.
- Select the soil type (Clay or Sand) that best describes the soil characteristics.
- Get the appropriate pole case load number from the plans or from the Engineer.
- Select the appropriate column in the chart based on soil type and "N" value. Select the appropriate row based on the pole load case. The foundation depth is the value where the column and the row intersect.

Standard Strain Poles

Concrete Volume (cubic yards) = .356 X L

	Standard Strain Poles and Standard Foundations		
	PLAN DATE: May 2005 REVISIONS: SCALE: None	REVIEWED BY: C.F. Andrews PREPARED BY: P.L. Alexander REVISIONS:		REVIEWED BY: A.W. Esposito INIT. DATE:
222 N. McDowell St., Raleigh, NC 27603		SIGNATURE: <i>D. Sarker</i> 9.2.2005 DATE:	