

STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

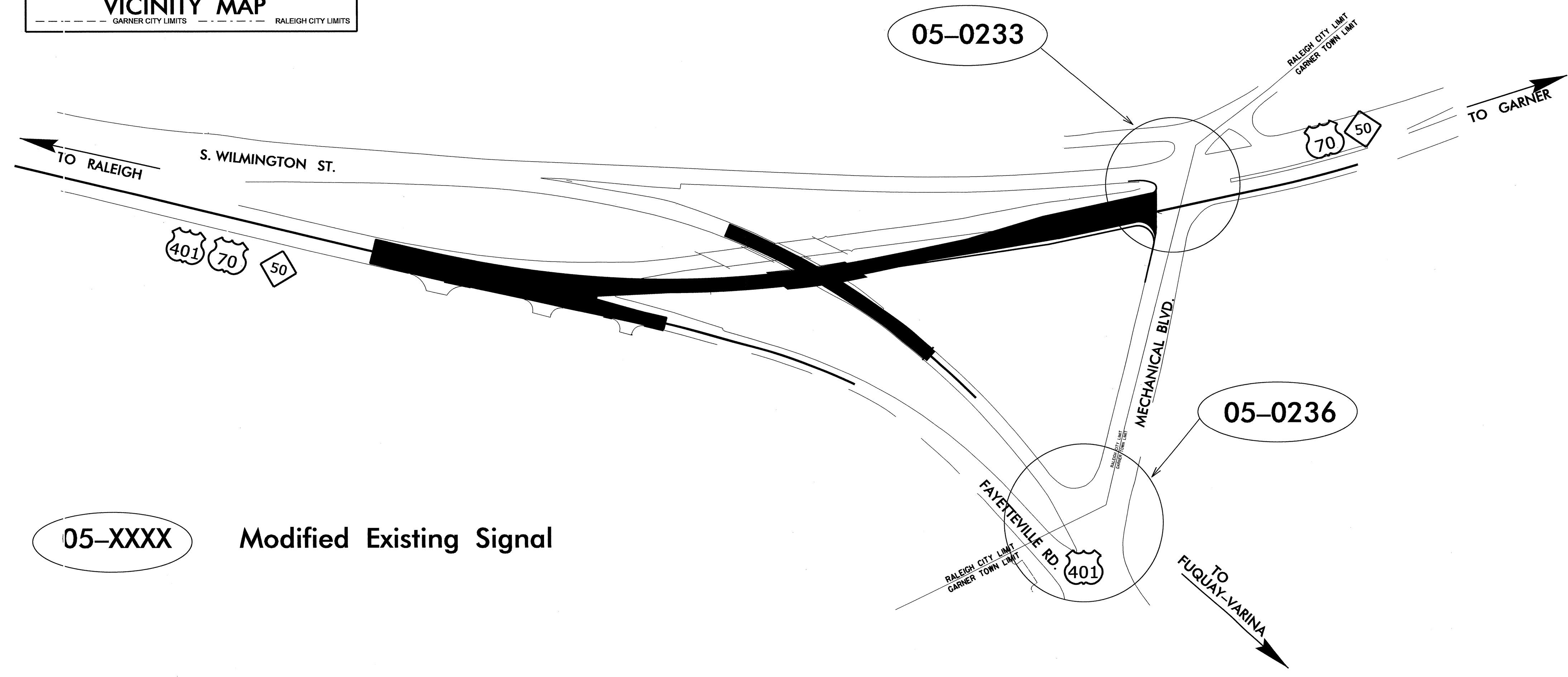
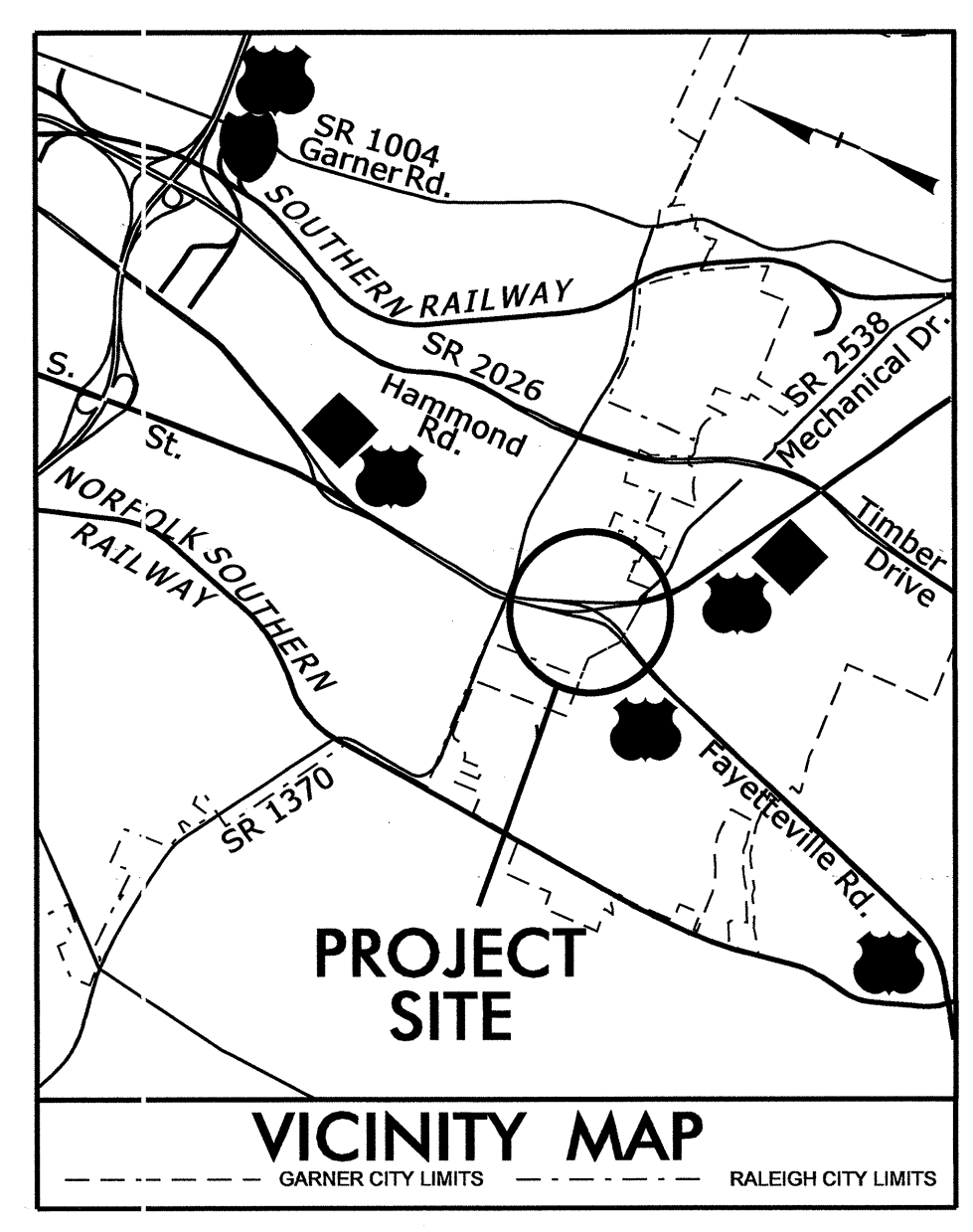
# WAKE COUNTY

LOCATION: BRIDGE #251 OVER US 401 ON US 70/NC 50

TYPE OF WORK: TRAFFIC SIGNALS



**Project: B-4946**



05-XXXX Modified Existing Signal

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

Index of Plans		
Sheet #	Sig. Inv. No.	Location/Description
Sig. 1	N/A	Title Sheet
Sig. 2-5	05-0233	US 70/NC 50 at SR 2538 (Mechanical Blvd.)
Sig. 6-7	05-0236	US 401 (Fayetteville Rd.) at SR 2538 (Mechanical Blvd.) and Garner Station Blvd.
Sig. 8-13	N/A	Standard Metal Pole Details

**INTELLIGENT TRANSPORTATION AND SIGNALS UNIT**  
Contacts:  
**Robert J. Ziemba, PE- Central Region Signals Project Engineer**  
**John T. Rowe, Jr., 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

21DEC2002 11:46 P:\Projects\B-4946\Traffic\Signals\Design\Titlesheet\B-4946-Sig.1.tsh.dgn

**CONTRACT: C203091**

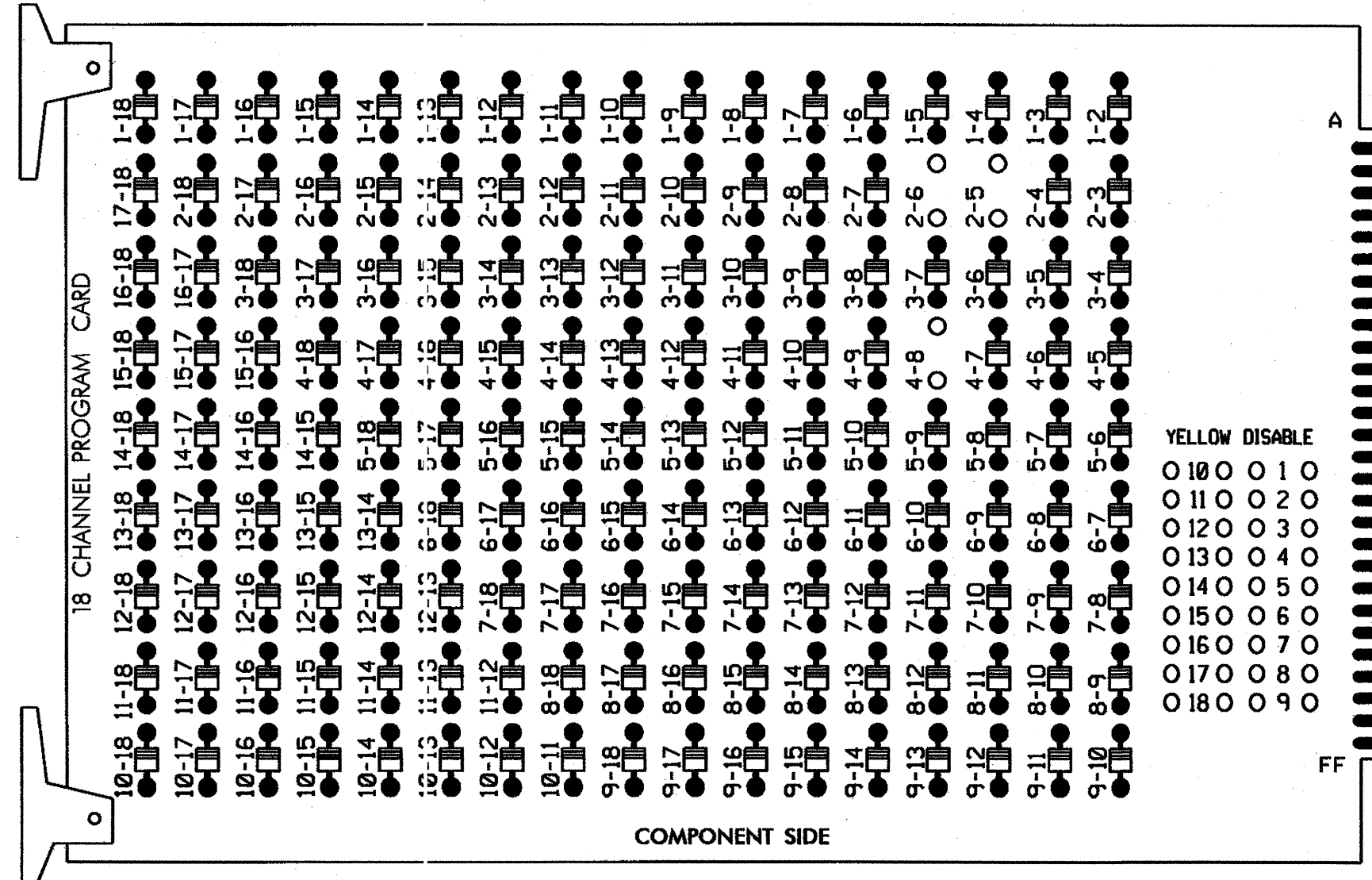




**EDI MODEL 2018ECL-NC CONFLICT MONITOR PROGRAMMING DETAIL**

(remove jumpers and set switches as shown)

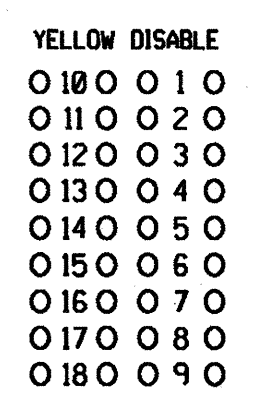
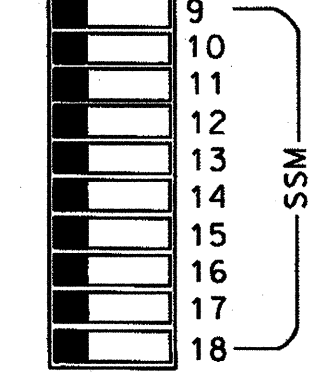
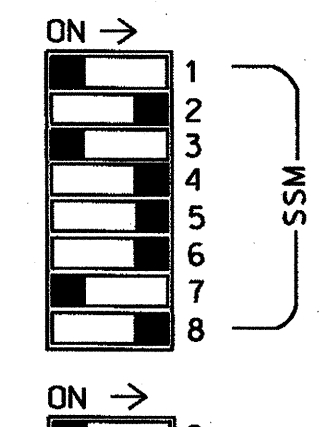
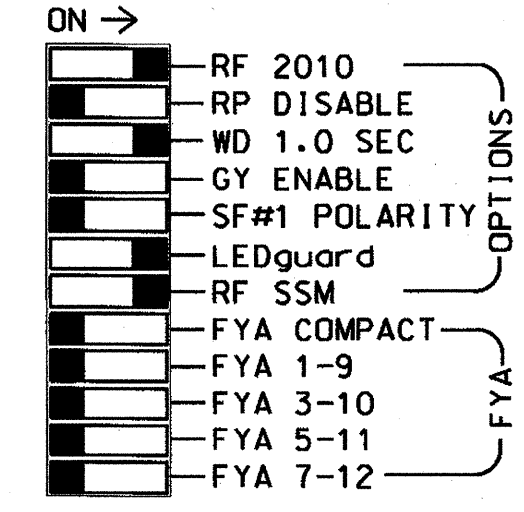
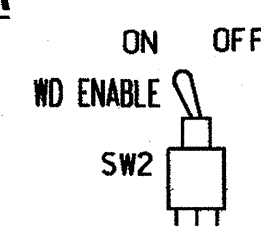
REMOVE DIODE JUMPERS 2-5, 2-6, and 4-8.



REMOVE JUMPERS AS SHOWN

**NOTES:**

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



■ = DENOTES POSITION OF SWITCH

**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. Program controller to start up in phases 2 and 6 green.
3. Enable simultaneous gap-out feature, on controller unit, for all phases.
4. Program phases 4 and 8, on controller unit, for dual entry.
5. Program phases 2 and 6, on controller unit, for volume density operation.
6. The cabinet and controller are part of the Raleigh Signal System.

**EQUIPMENT INFORMATION**

CONTROLLER.....2070L  
 CABINET.....332  
 SOFTWARE.....SE-PAC2070  
 CABINET MOUNT.....BASE  
 OUTPUT FILE POSITIONS...12  
 LOAD SWITCHES USED.....S2,S5,S7,S8,S11  
 PHASES USED.....2,4,5,6,8  
 OVERLAPS.....NONE

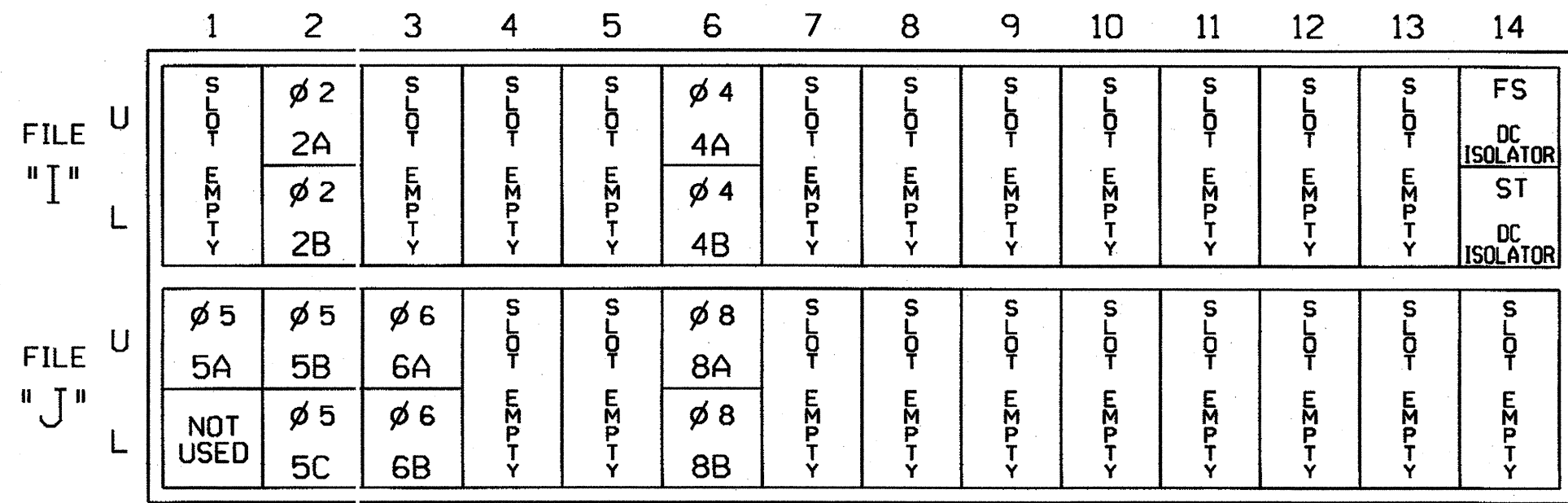
**SIGNAL HEAD HOOK-UP CHART**

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
CMU CHANNEL NO.	1	2	13	3	4	14	5	6	15	7	8	16
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED
SIGNAL HEAD NO.	NU	21,22	NU	NU	41,42	NU	42	51,52	61,62	NU	NU	81,82 83
RED		128			101				134			107
YELLOW		129			102				135			108
GREEN		130			103				136			109
RED ARROW								131				
YELLOW ARROW							132	132				
GREEN ARROW							133	133				

NU = Not Used

**INPUT FILE POSITION LAYOUT**

(front view)



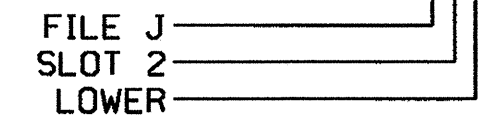
EX.: 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE  
 ST = STOP TIME

**INPUT FILE CONNECTION & PROGRAMMING CHART**

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	DETECTOR NO.	NEMA PHASE	DELAY TIME	EXTEND (STRETCH) TIME
2A	TB2-5,6	I2U	39	3	2		
2B	TB2-7,8	I2L	43	4	2		
4A	TB4-9,10	I6U	41	11	4	3	
4B	TB4-11,12	I6L	45	12	4		
5A	TB3-1,2	J1U	55	19	5		
5B	TB3-5,6	J2U	40	21	5		
5C	TB3-7,8	J2L	44	22	5	15	
6A	TB3-9,10	J3U	64	23	6		
6B	TB3-11,12	J3L	77	24	6		
8A	TB5-9,10	J6U	42	31	8	3	
8B	TB5-11,12	J6L	46	32	8	10	

INPUT FILE POSITION LEGEND: J2L



THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-0233T  
 DESIGNED: November 2012  
 SEALED: 12/17/12  
 REVISED: N/A

Signal Upgrade - Temporary Design (TMP Phase II)

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 70/NC 50 at SR 2538 (Mechanical Blvd.)

Division 5 Wake County Garner

PLAN DATE: December 2012 REVIEWED BY: JTR

PREPARED BY: S. Armstrong REVIEWED BY:

REVISIONS INIT. DATE

750 Greenfield Parkway, Garner, NC 27529

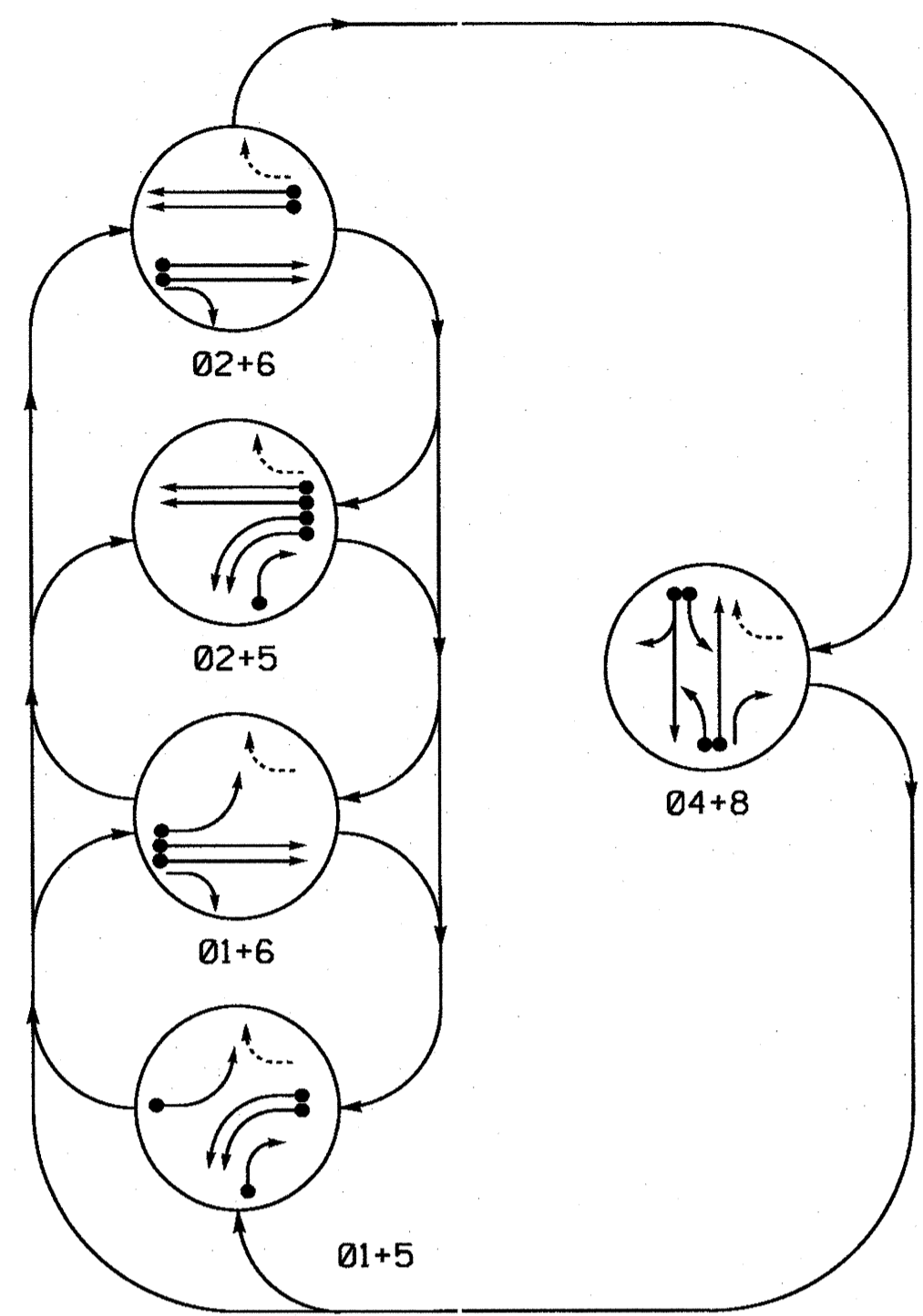
Seal: HUBERT CARROLL, PROFESSIONAL ENGINEER, 008453, JOHN T. ROWE, JR.

SIGNATURE: Mrs. Rowe DATE: 12-18-12

SIG. INVENTORY NO. 05-0233T

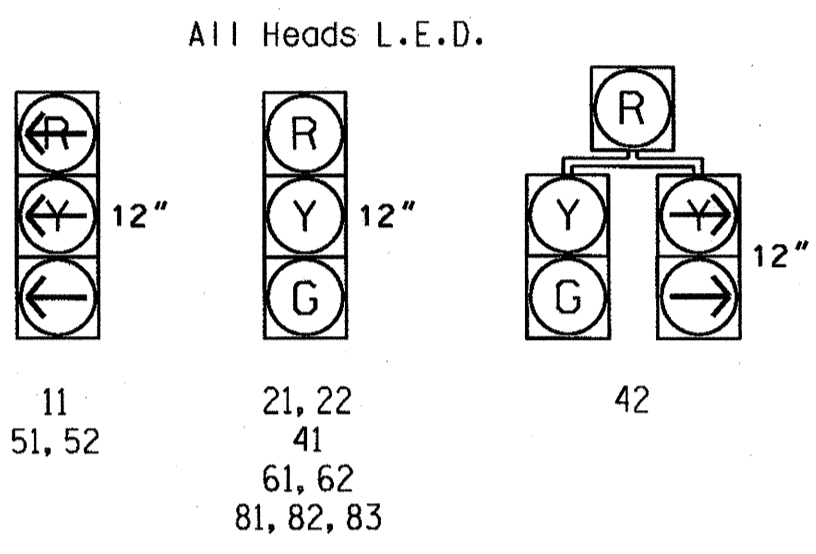
12-DEC-2012 09:36 S:\GIS\sw\k\groups\sig\mon\mtr\mtr\050233\_she10\_xxx.dgn

PHASING DIAGRAM



SIGNAL FACE	PHASE					
	01+5	01+6	02+5	02+6	04+8	04+8
11	←	←	←	←	←	←
21, 22	R	R	G	G	R	Y
41	R	R	R	R	G	R
42	R	R	R	R	G	R
51, 52	←	←	←	←	←	←
61, 62	R	G	R	G	R	Y
81, 82, 83	R	R	R	R	G	R

SIGNAL FACE I.D.



SE-PAC 2070 LOOP & DETECTOR UNIT INSTALLATION CHART

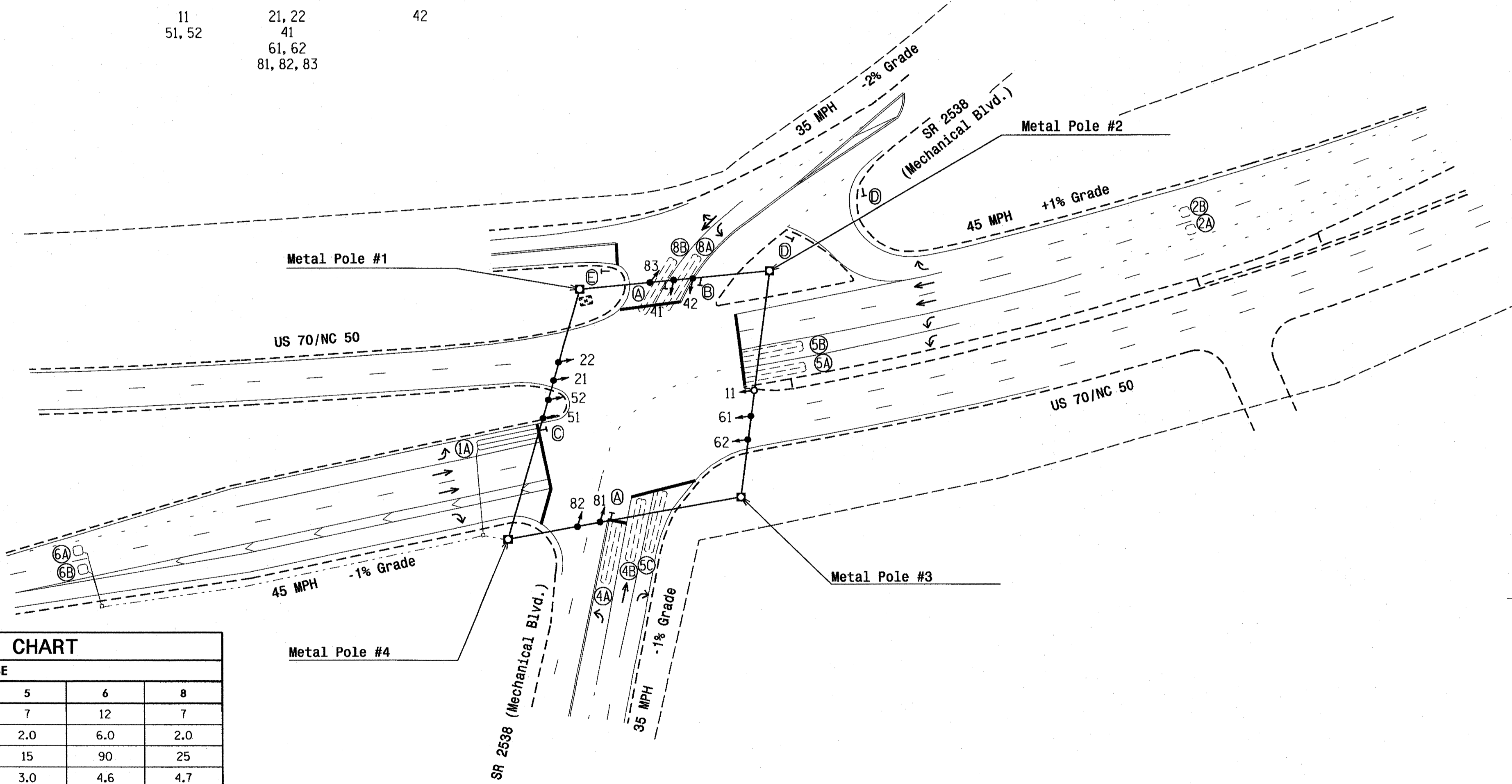
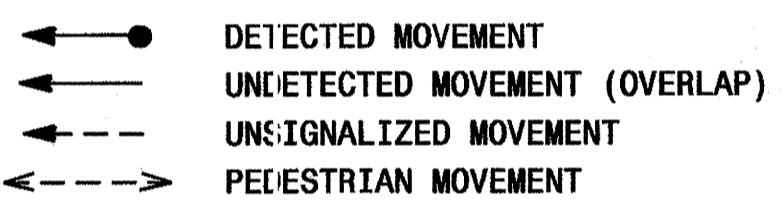
LOOP NO.	SIZE (ft)	TURNS	DIST. FROM STOPBAR (ft)	NEW	EXISTING	ASSIGNED PHASE	DETECTOR PROGRAMMING																		
							TIMING		OPERATION MODE							SWITCH	SYSTEM LOOP	STATUS							
							DELAY	EXTEND (STRETCH)	VEHICLE	PEDESTRIAN	1 CALL	STOP A	STOP B	PROTECT	PLATE				THROUGH	AND	NEW	EXISTING			
1A	6X40	2-4-2	0	X	-	1	-	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	X		
2A	6X6	5	300	-	X	2	-	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	X	
2B	6X6	5	300	-	X	2	-	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
4A	6X40	2-4-2	0	-	X	4	3	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
4B	6X40	2-4-2	0	-	X	4	-	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
5A	6X40	2-4-2	0	-	X	5	-	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
5B	6X40	2-4-2	0	-	X	5	-	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
5C	6X40	2-4-2	0	-	X	5	15	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
6A	6X6	5	300	X	-	6	-	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
6B	6X6	5	300	X	-	6	-	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
8A	6X40	2-4-2	+5	-	X	8	3	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X
8B	6X40	2-4-2	+5	-	X	8	10	SEC.	-	SEC.	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X

5 Phase Fully Actuated (Raleigh Signal System)

NOTES

- Refer to "Roadway Standard Drawings NCDOT" dated January 2012 and "Standard Specifications for Roads and Structures" dated January 2012.
- Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
- Phase 1 and/or phase 5 may be lagged.
- Reposition existing signal heads numbered 61 and 62.
- Set all detector units to presence mode.
- Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.

PHASING DIAGRAM DETECTION LEGEND

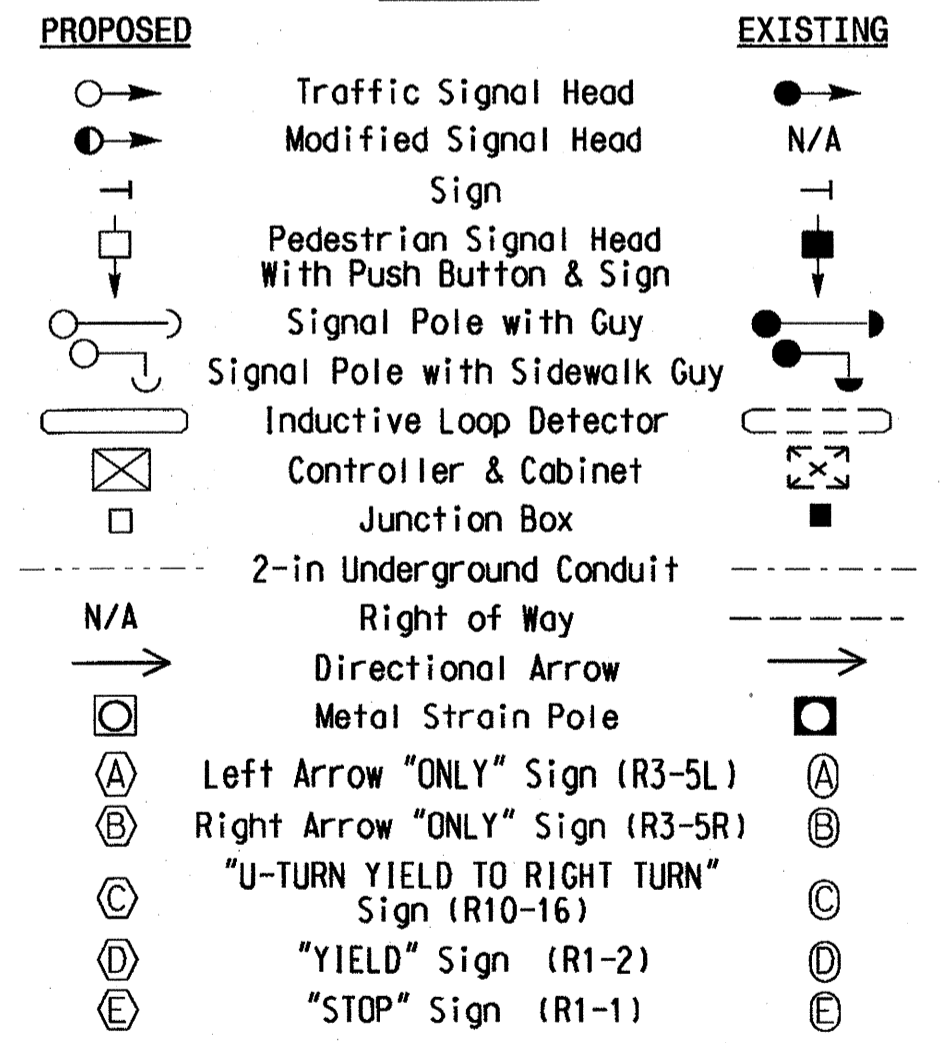


SE-PAC 2070 TIMING CHART

FEATURE	PHASE					
	2	4	5	6	8	
Min Green *	12	7	7	12	7	
Passage Gap *	2.0	6.0	2.0	2.0	6.0	2.0
Maximum Green *	15	90	25	15	90	25
Yellow Change	3.0	4.4	3.9	3.0	4.6	4.7
Red Clear	3.5	1.4	2.3	4.0	1.5	2.2
Walk *	-	-	-	-	-	-
Pedestrian Clear	-	-	-	-	-	-
Added Initial *	1.5	-	-	1.5	-	-
Maximum 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	NON-LOCK	LOCK	NON-LOCK	NON-LOCK	LOCK	NON-LOCK
Dual Entry	-	ON	-	-	ON	-
Simultaneous Gap	CN	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.

LEGEND



Signal Upgrade - Final Design

Prepared in the Offices of:

US 70/NC 50 at SR 2538 (Mechanical Blvd.)

Division 5 Wake County Garner

PLAN DATE: November 2012 REVIEWED BY:

PREPARED BY: R. Hough REVIEWED BY:

REVISIONS

SCALE: 1"=50'

SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER R. H. HOUGH 026486

DATE: 12/17/12

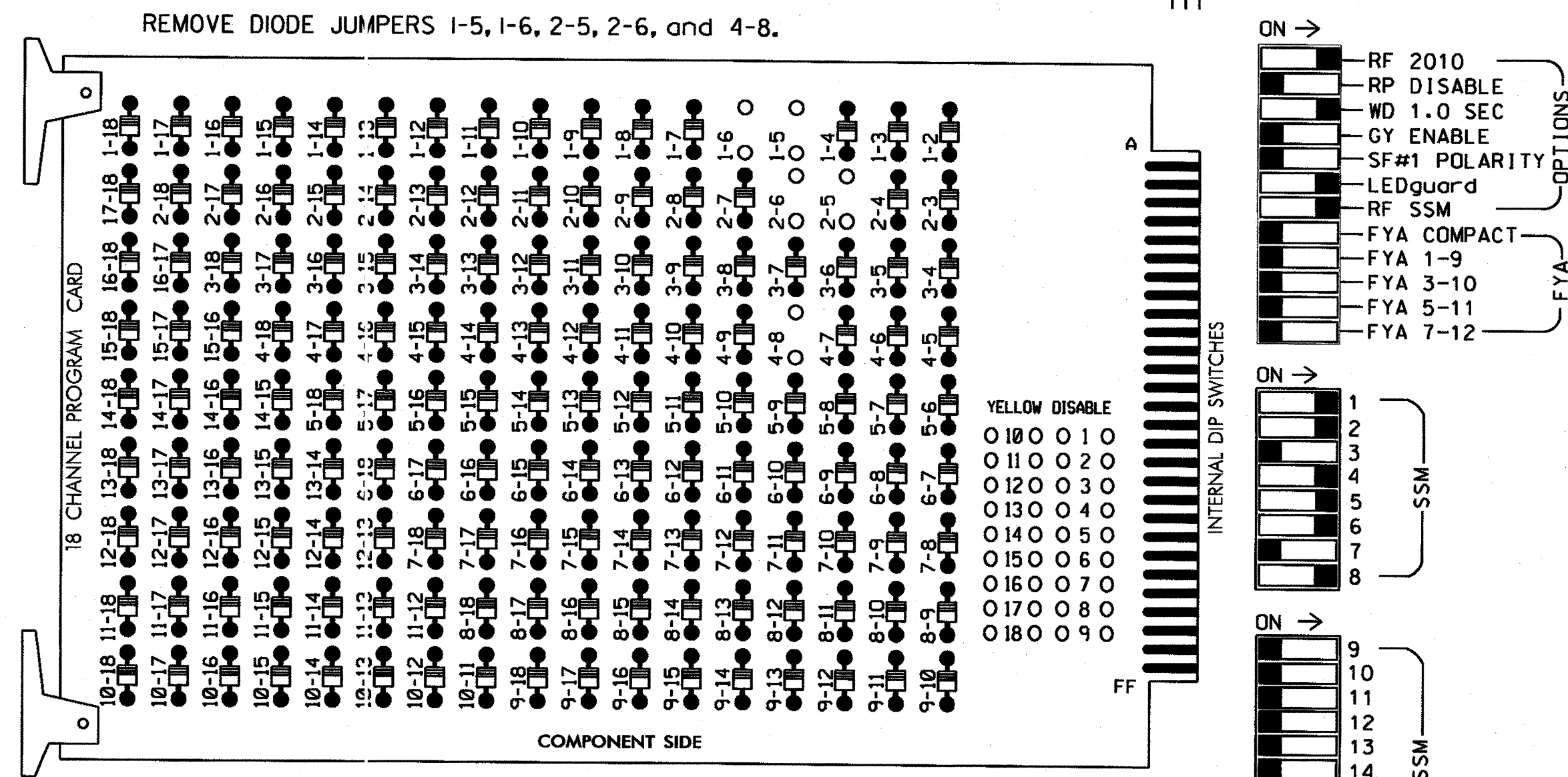
SIG. INVENTORY NO. 05-0233

17-DEC-2012 16:06 P:\IT\Projects-849446\off\cns\gms\gms05-0233\0233.slg.dwg 2012/12/17 5:21:50



**EDI MODEL 2018ECL-NC CONFLICT MONITOR  
PROGRAMMING DETAIL**

(remove jumpers and set switches as shown)



**NOTES:**

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

**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. Program controller to start up in phases 2 and 6 green.
3. Enable simultaneous gap-out feature, on controller unit, for all phases.
4. Program phases 4 and 8, on controller unit, for dual entry.
5. Program phases 2 and 6, on controller unit, for volume density operation.
6. The cabinet and controller are part of the Raleigh Signal System.

**EQUIPMENT INFORMATION**

CONTROLLER.....2070L  
 CABINET.....332  
 SOFTWARE.....SE-PAC2070  
 CABINET MOUNT.....BASE  
 OUTPUT FILE POSITIONS...12  
 LOAD SWITCHES USED.....S1,S2,S5,S7,S8,S11  
 PHASES USED.....1,2,4,5,6,8  
 OVERLAPS.....NONE

PROJECT REFERENCE NO.	SHEET NO.
B-4946	Sig. 5

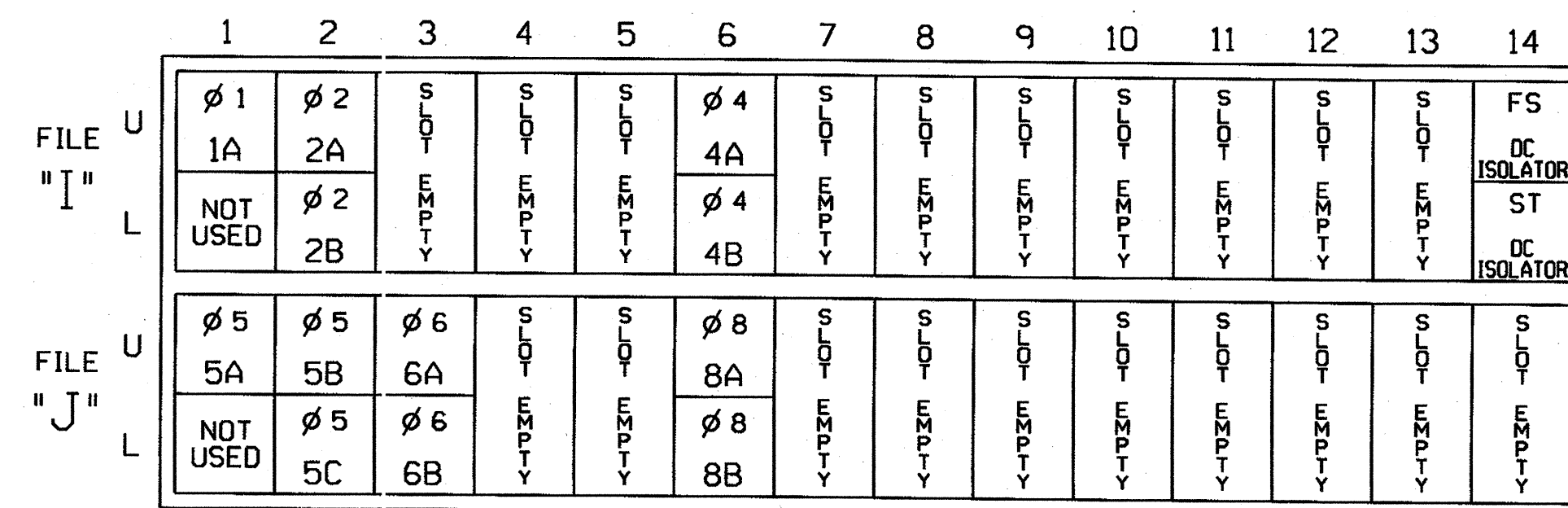
**SIGNAL HEAD HOOK-UP CHART**

LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
CMU CHANNEL NO.	1	2	13	3	4	14	5	6	15	7	8	16
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED
SIGNAL HEAD NO.	11	21,22	NU	NU	41,42	NU	42	51,52	61,62	NU	NU	81,82 83
RED		128			101				134			107
YELLOW		129			102				135			108
GREEN		130			103				136			109
RED ARROW	125								131			
YELLOW ARROW	126						132	132				
GREEN ARROW	127						133	133				

NU = Not Used

**INPUT FILE POSITION LAYOUT**

(front view)



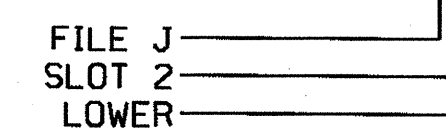
EX.: 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE  
 ST = STOP TIME

**INPUT FILE CONNECTION & PROGRAMMING CHART**

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	DETECTOR NO.	NEMA PHASE	DELAY TIME	EXTEND (STRETCH) TIME
1A	TB2-1,2	I1U	56	1	1		
2A	TB2-5,6	I2U	39	3	2		
2B	TB2-7,8	I2L	43	4	2		
4A	TB4-9,10	I6U	41	11	4	3	
4B	TB4-11,12	I6L	45	12	4		
5A	TB3-1,2	J1U	55	19	5		
5B	TB3-5,6	J2U	40	21	5		
5C	TB3-7,8	J2L	44	22	5	15	
6A	TB3-9,10	J3U	64	23	6		
6B	TB3-11,12	J3L	77	24	6		
8A	TB5-9,10	J6U	42	31	8	3	
8B	TB5-11,12	J6L	46	32	8	10	

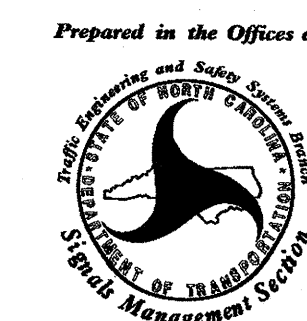
INPUT FILE POSITION LEGEND: J2L



THIS ELECTRICAL DETAIL IS FOR  
 THE SIGNAL DESIGN: 05-0233  
 DESIGNED: November 2012  
 SEALED: 12/17/12  
 REVISED: N/A

Signal Upgrade - Final Design

ELECTRICAL AND PROGRAMMING  
 DETAILS FOR:



Prepared in the Offices of:  
 NORTH CAROLINA PROFESSIONAL ENGINEERS AND SURVEYORS  
 STATE OF NORTH CAROLINA  
 Signal Management Division  
 750 Greenfield Parkway, Garner, NC 27529

US 70/NC 50  
 at  
 SR 2538 (Mechanical Blvd.)

Division 5 Wake County Garner

PLAN DATE: December 2012 REVIEWED BY: JTR

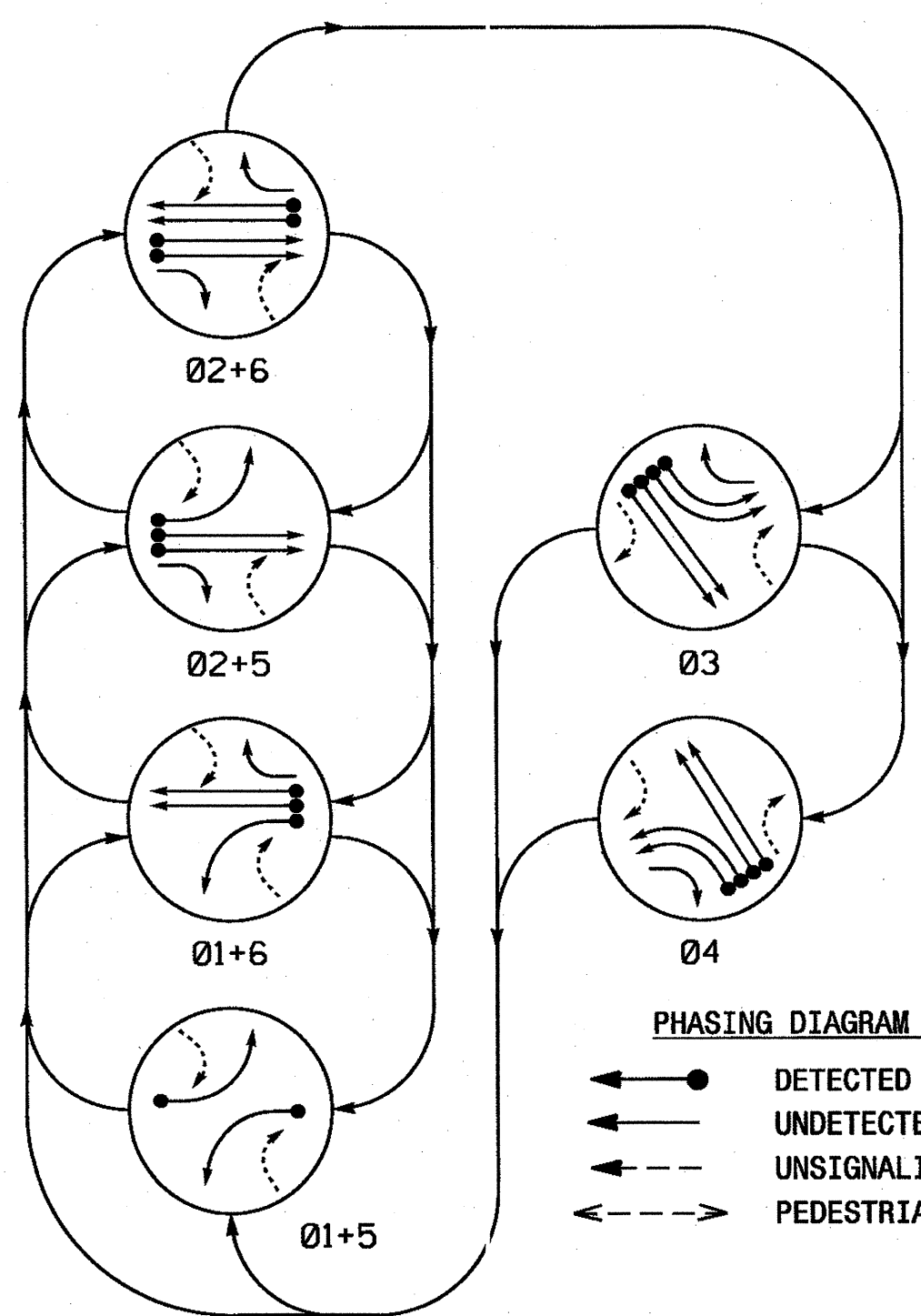
PREPARED BY: S. Armstrong REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL  
 NORTH CAROLINA  
 PROFESSIONAL ENGINEERS  
 SEAL 008453  
 JOHN T. ROWE, PE  
 SIGNATURE DATE 12-18-12  
 SIG. INVENTORY NO. 05-0233

18-BEC-2012 09:46 S:\IT\SSU\ITS Signal\Workgroups\519 Mon\Arms\trng\050233\_sml.e-xxx.dgn

**PHASING DIAGRAM**

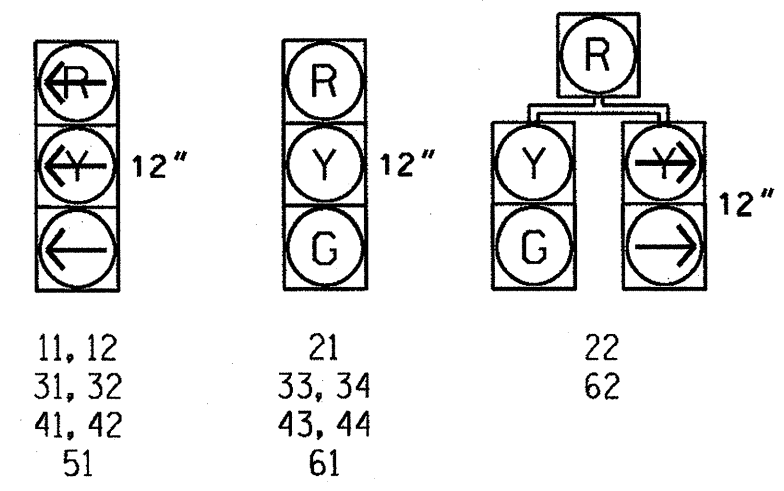


**PHASING DIAGRAM DETECTION LEGEND**  
 ● DETECTED MOVEMENT  
 ◄ UNDETECTED MOVEMENT (OVERLAP)  
 - - UNSIGNALIZED MOVEMENT  
 - - PEDESTRIAN MOVEMENT

**TABLE OF OPERATION**

SIGNAL FACE	PHASE					
	01+5	01+6	02+5	02+6	03	04
11, 12	←	←	←	←	←	←
21	R	R	G	G	R	Y
22	R	R	G	G	R	Y
31, 32	←	←	←	←	←	←
33, 34	R	R	R	R	G	R
41, 42	←	←	←	←	←	←
43, 44	R	R	R	R	G	R
51	←	←	←	←	←	←
61	R	G	R	G	R	Y
62	R	G	R	G	R	Y

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



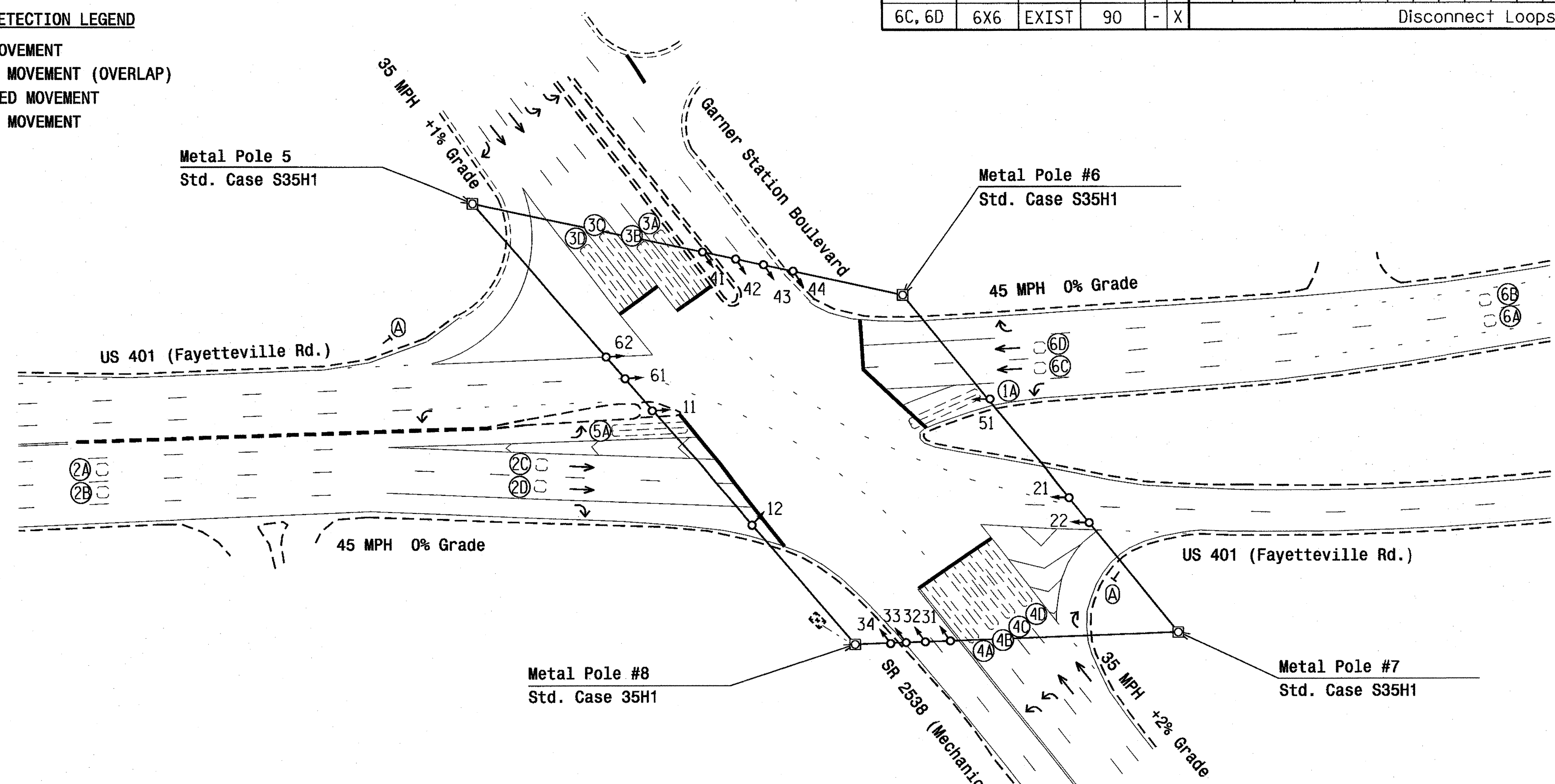
**LOOP & DETECTOR UNIT INSTALLATION CHART**  
SE-PAC 2070 CONTROLLER WITH 170 CABINET

LOOP NO.	SIZE (ft)	TURNS	DIST. FROM STOPBAR (ft)	NEW	EXISTING	ASSIGNED PHASE	TIMING		DETECTOR PROGRAMMING							STATUS		
							DELAY	EXTEND (STRETCH)	OPERATION MODE								SWITCH	SYSTEM LOOPS
									VEHICLE	PEDESTRIAN	STOP A	STOP B	STOP C	STOP D	STOP E			
1A	6X40	2-4-2	+5	-	X	1	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
2A	6X6	EXIST	330	-	X	2	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
2B	6X6	EXIST	330	-	X	2	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
2C, 2D	6X6	EXIST	90	-	X													
3A	6X40	2-4-2	0	-	X	3	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
3B	6X40	2-4-2	0	-	X	3	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
3C	6X40	2-4-2	0	-	X	3	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
3D	6X40	2-4-2	0	-	X	3	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
4A	6X40	2-4-2	0	-	X	4	3 SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
4B	6X40	2-4-2	0	-	X	4	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
4C	6X40	2-4-2	0	-	X	4	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
4D	6X40	2-4-2	0	-	X	4	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
5A	6X40	2-4-2	0	-	X	5	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
6A	6X6	EXIST	330	-	X	6	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
6B	6X6	EXIST	330	-	X	6	- SEC.	- SEC.	X	-	-	-	-	-	-	-	-	X
6C, 6D	6X6	EXIST	90	-	X													

**6 Phase Fully Actuated (Raleigh Signal System)**

**NOTES**

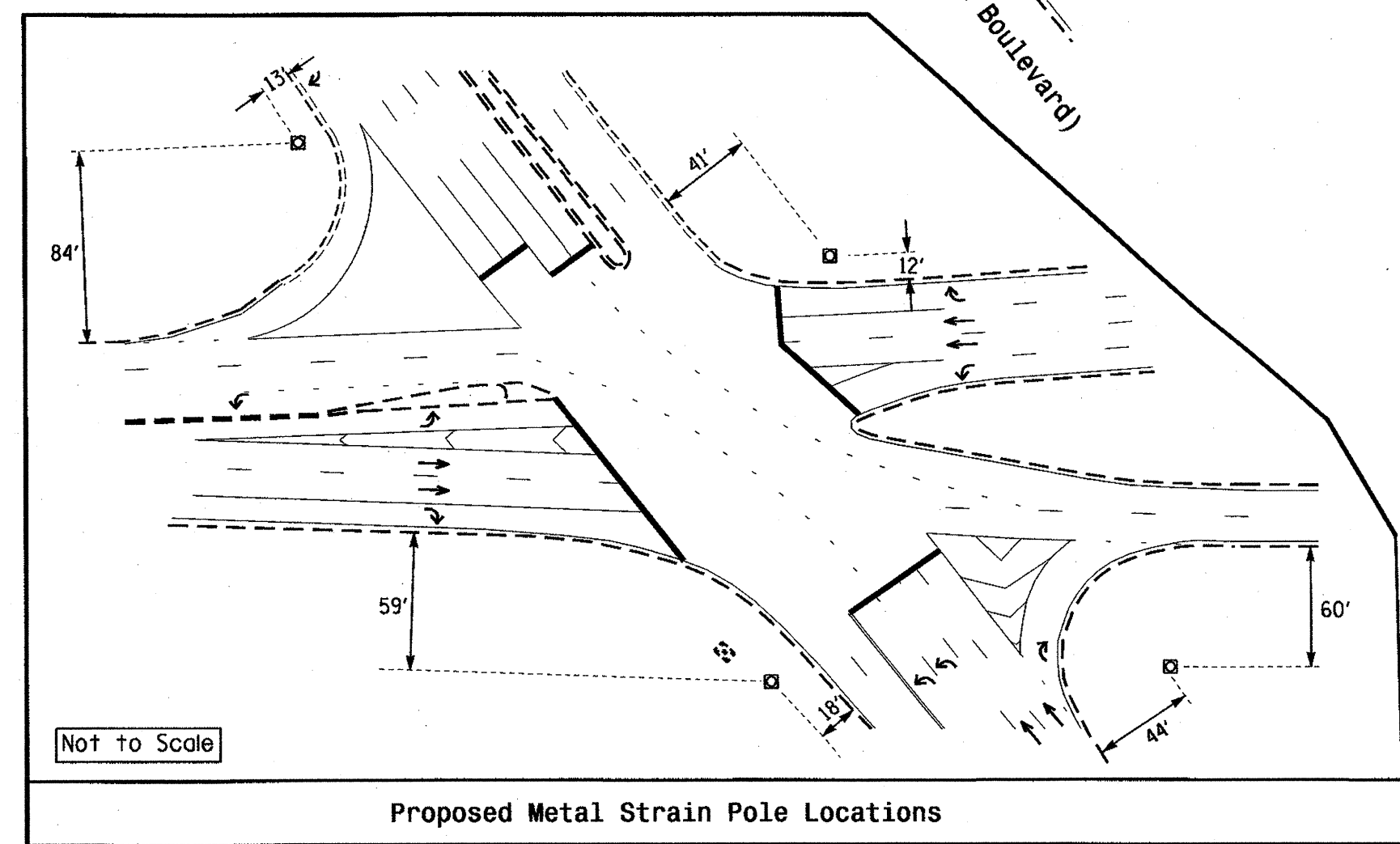
- Refer to "Roadway Standard Drawings NCDOT" dated January 2012 and "Standard Specifications for Roads and Structures" dated January 2012.
- Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
- Phase 1 and/or phase 5 may be lagged.
- The order of phase 3 and 4 may be reversed.
- Set all detector units to presence mode.
- Disconnect existing loops 2C, 2D, 6C, and 6D.
- Pavement markings are existing.
- Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



**SE-PAC 2070 TIMING CHART**

FEATURE	PHASE					
	1	2	3	4	5	6
Min Green *	7	12	7	7	7	12
Passage Gap *	2.0	6.0	2.0	2.0	2.0	6.0
Maximum Green *	15	90	25	25	15	90
Yellow Change	3.0	4.5	3.8	3.7	3.0	4.5
Red Clear	2.6	1.9	3.4	3.5	2.4	1.6
Walk *	-	-	-	-	-	-
Pedestrian Clear	-	-	-	-	-	-
Added Initial *	-	1.5	-	-	-	1.5
Maximum 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	NCN-LOCK	LOCK	NON-LOCK	NON-LOCK	NON-LOCK	LOCK
Dual Entry	-	-	-	-	-	-
Simultaneous Gap	ON	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.



**LEGEND**

PROPOSED	EXISTING
○ → Traffic Signal Head	● → N/A
○ → 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
- - Right of Way	- - Right of Way
→ Directional Arrow	→ Directional Arrow
⊠ Metal Strain Pole	⊠ Metal Strain Pole
⊠ "YIELD" Sign (R1-2)	⊠ "YIELD" Sign (R1-2)

**Signal Upgrade**

Prepared in the Offices of:  
 Transportation Mobility and Safety Division  
 NORTH CAROLINA PROFESSIONAL ENGINEERS  
 SEAL  
 ROBERT J. ZEMBA  
 ENGINEER  
 12/17/12

**US 401 (Fayetteville Rd.) at SR 2538 (Mechanical Blvd.) and Garner Station Blvd.**

Division 5 Wake County Raleigh  
 PLAN DATE: November 2012 REVIEWED BY:  
 PREPARED BY: R. Hough REVIEWED BY:  
 REVISIONS: INIT. DATE

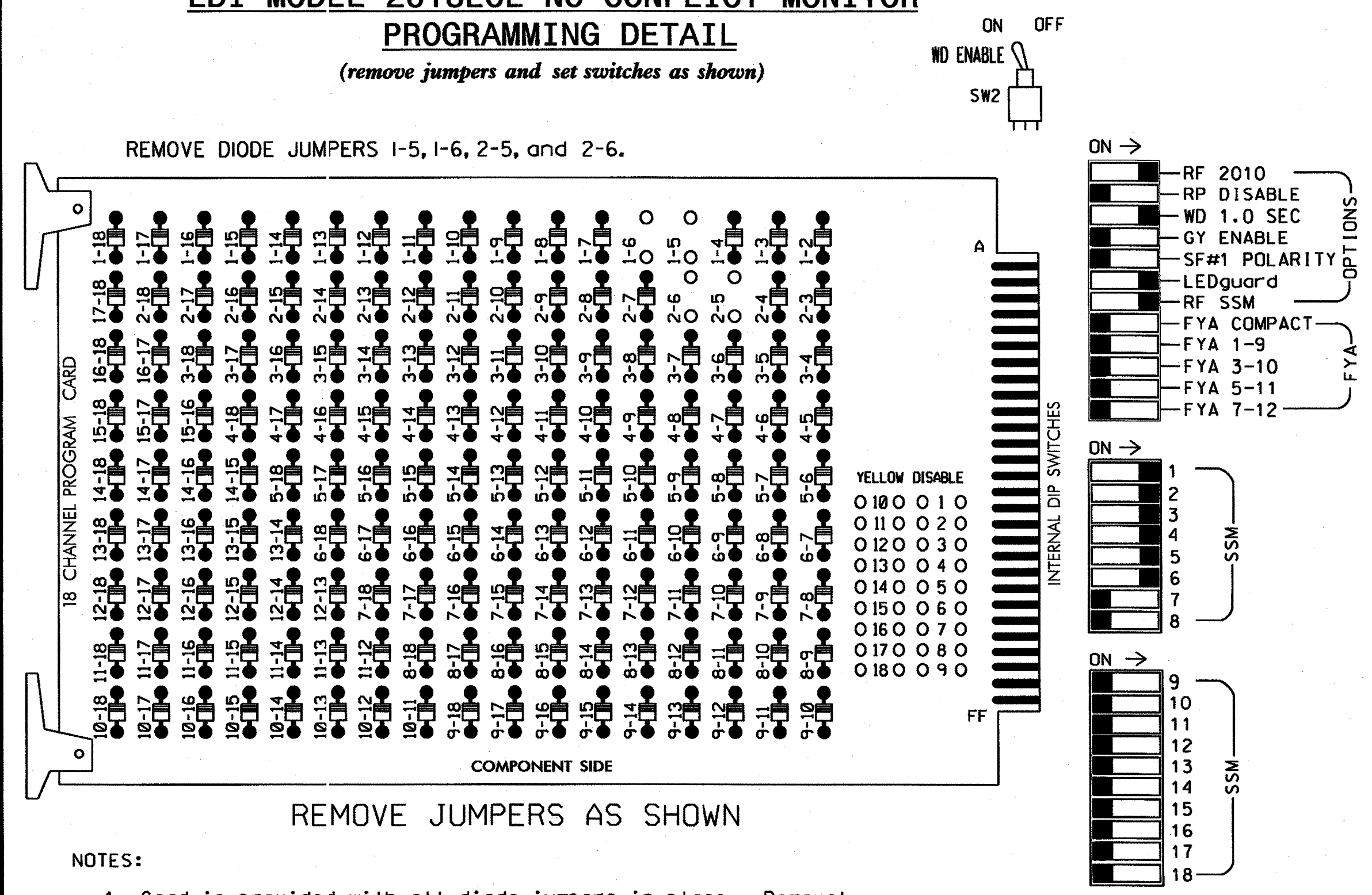
SCALE: 1"=50'

SIG. INVENTORY NO. 05-0236

17-DEC-2012 16:11 P:\IT\Projects-B\4946\Drawings\Signal\05-0236\050236.sig\_dsn\_2012.rvt.dgn



**EDI MODEL 2018ECL-NC CONFLICT MONITOR PROGRAMMING DETAIL**  
(remove jumpers and set switches 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 controller to start up in phases 2 and 6 green.
- Enable simultaneous gap-out feature, on controller unit, for all phases.
- Program phases 2 and 6, on controller unit, for volume density operation.
- The cabinet and controller are part of the Raleigh Signal System.

**SIGNAL HEAD HOOK-UP CHART**

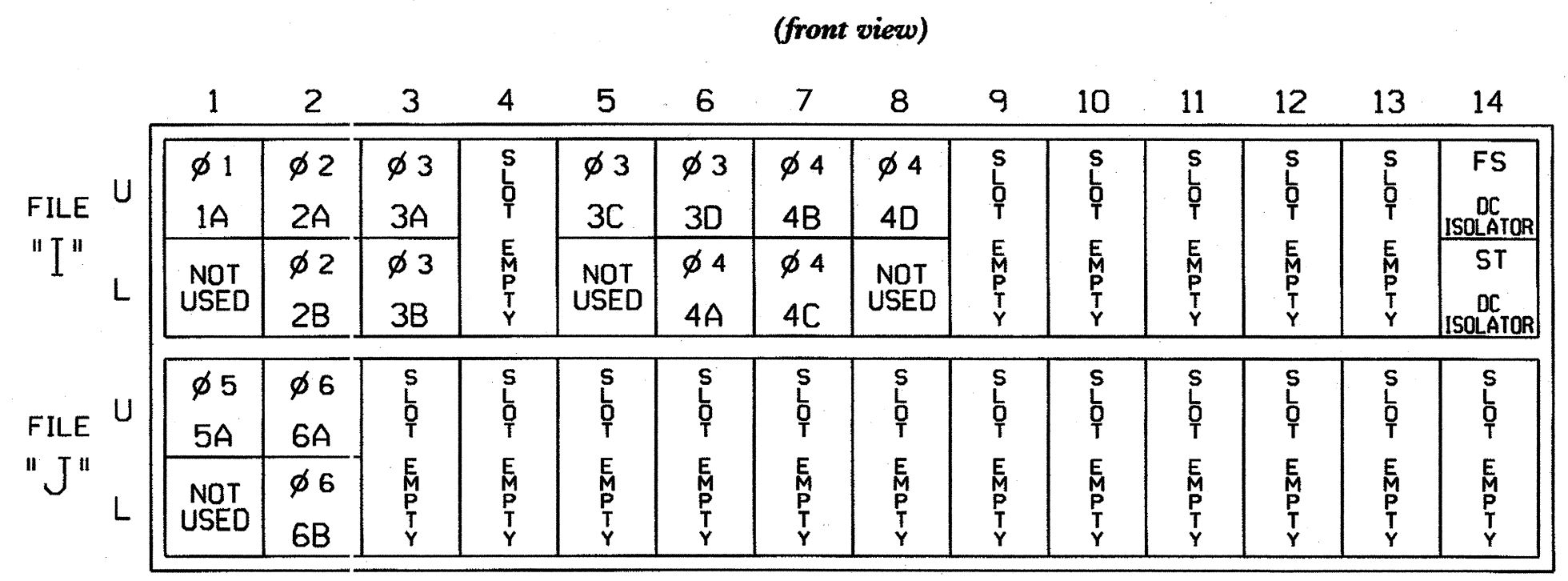
LOAD SWITCH NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12				
CMU CHANNEL NO.	1	2	13	3	4	14	5	6	15	7	8	16				
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED				
SIGNAL HEAD NO.	11,12	21,22	NU	31,32	33,34	62	22	41,42	43,44	NU	51	61,62	NU	NU	NU	NU
RED		128		116				101				134				
YELLOW		129		117				102				135				
GREEN		130		118				103				136				
RED ARROW	125			116				101				131				
YELLOW ARROW	126			117	117	102	102					132				
GREEN ARROW	127			118	118	103	103					133				
Hand icon																
Person icon																

NU = Not Used

**EQUIPMENT INFORMATION**

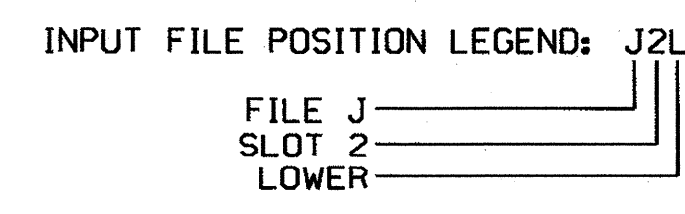
CONTROLLER.....2070L  
 CABINET.....332  
 SOFTWARE.....SE-PAC2070  
 CABINET MOUNT.....BASE  
 OUTPUT FILE POSITIONS...12  
 LOAD SWITCHES USED.....S1,S2,S4,S5,S7,S8  
 PHASES USED.....1,2,3,4,5,6  
 OVERLAPS.....NONE

**INPUT FILE POSITION LAYOUT**



**INPUT FILE CONNECTION & PROGRAMMING CHART**

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	DETECTOR NO.	NEMA PHASE	DELAY TIME	EXTEND (STRETCH) TIME
1A	TB2-1,2	I1U	56	1	1		
2A	TB2-5,6	I2U	39	3	2		
2B	TB2-7,8	I2L	43	4	2		
3A	TB2-9,10	I3U	63	5	3		
3B	TB2-11,12	I3L	76	6	3		
3C	TB4-5,6	I5U	58	9	3		
3D	TB4-9,10	I6U	41	11	3		
4A	TB4-11,12	I6L	45	12	4	3	
4B	TB6-1,2	I7U	65	13	4		
4C	TB6-3,4	I7L	78	14	4		
4D	TB6-5,6	I8U	49	15	4		
5A	TB3-1,2	J1U	55	19	5		
6A	TB3-5,6	J2U	40	21	6		
6B	TB3-7,8	J2L	44	22	6		



THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-0236  
 DESIGNED: November 2012  
 SEALED: 12/17/12  
 REVISED: N/A

Signal Upgrade

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 401 (Fayetteville Road) at SR 2538 (Mechanical Blvd.) and Garner Station Blvd.

Division 5 Wake County Raleigh

PLAN DATE: December 2012 REVIEWED BY: JTR

PREPARED BY: S. Armstrong

750 Greenfield Parkway, Garner, NC 27529

SEAL NORTH CAROLINA PROFESSIONAL ENGINEER JOHN T. ROWE, JR. SEAL 008453

SIGNATURE DATE 12-19-12

SIG. INVENTORY NO. 05-0236

18-DEC-2012 09:03 S:\ITS\SS\MTS\_Sig\work\groups\Sig\_Mon\mtrmon\05036\_sml\_e\_0000.dgn armstrong

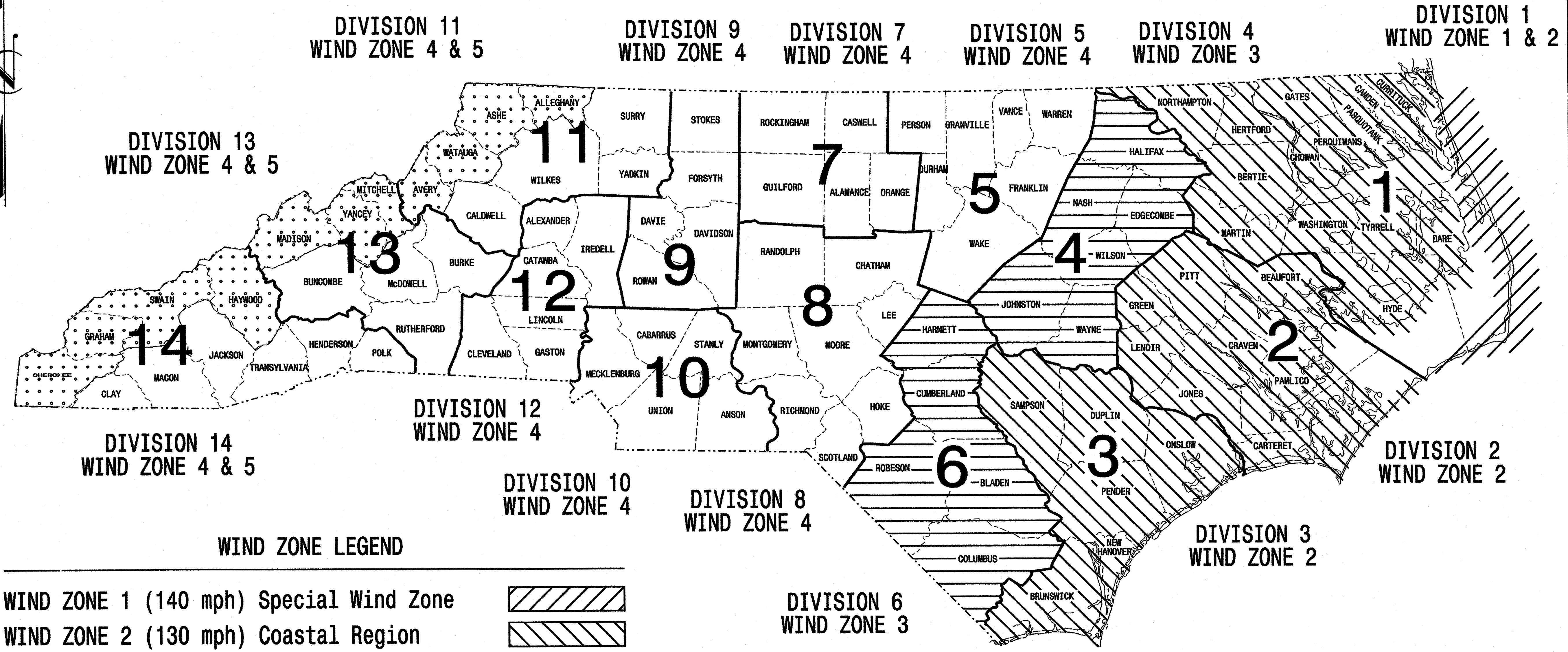


# NCDOT METAL POLE STANDARDS

## STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

STATE	PROJECT NO.	SHEET NO.
N.C.	B-4946	Sig. 8
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		

<http://www.ncdot.org/doh/preconstruct/traffic/ITSS/ws/mpoles/poles.html>

Prepared In the Offices of:

750 N. Greenfield Pkwy, Garner, NC 27529

Designed in conformance  
with the  
2002 Interim to the  
4th Edition 2001  
**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

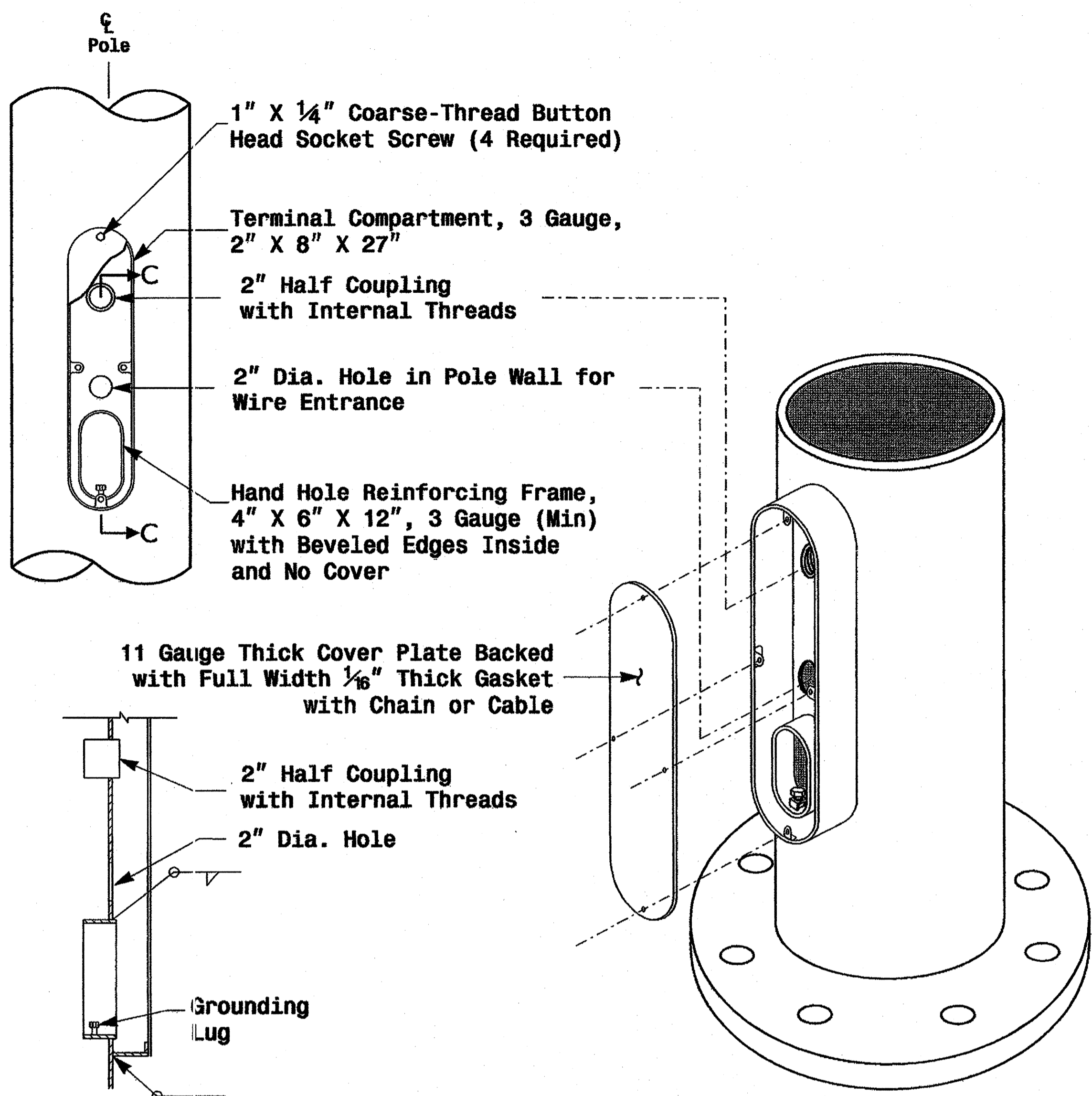
**NCDOT CONTACTS:**  
**MOBILITY AND SAFETY DIVISION - ITS and SIGNALS UNIT**

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, Jr. - ITS and Signals Structural Project Engineer  
 M. Aslam - ITS and Signals Structural Project Engineer  
 N. Bitting, P.E. - ITS and Signals Structural Project Engineer

SEAL

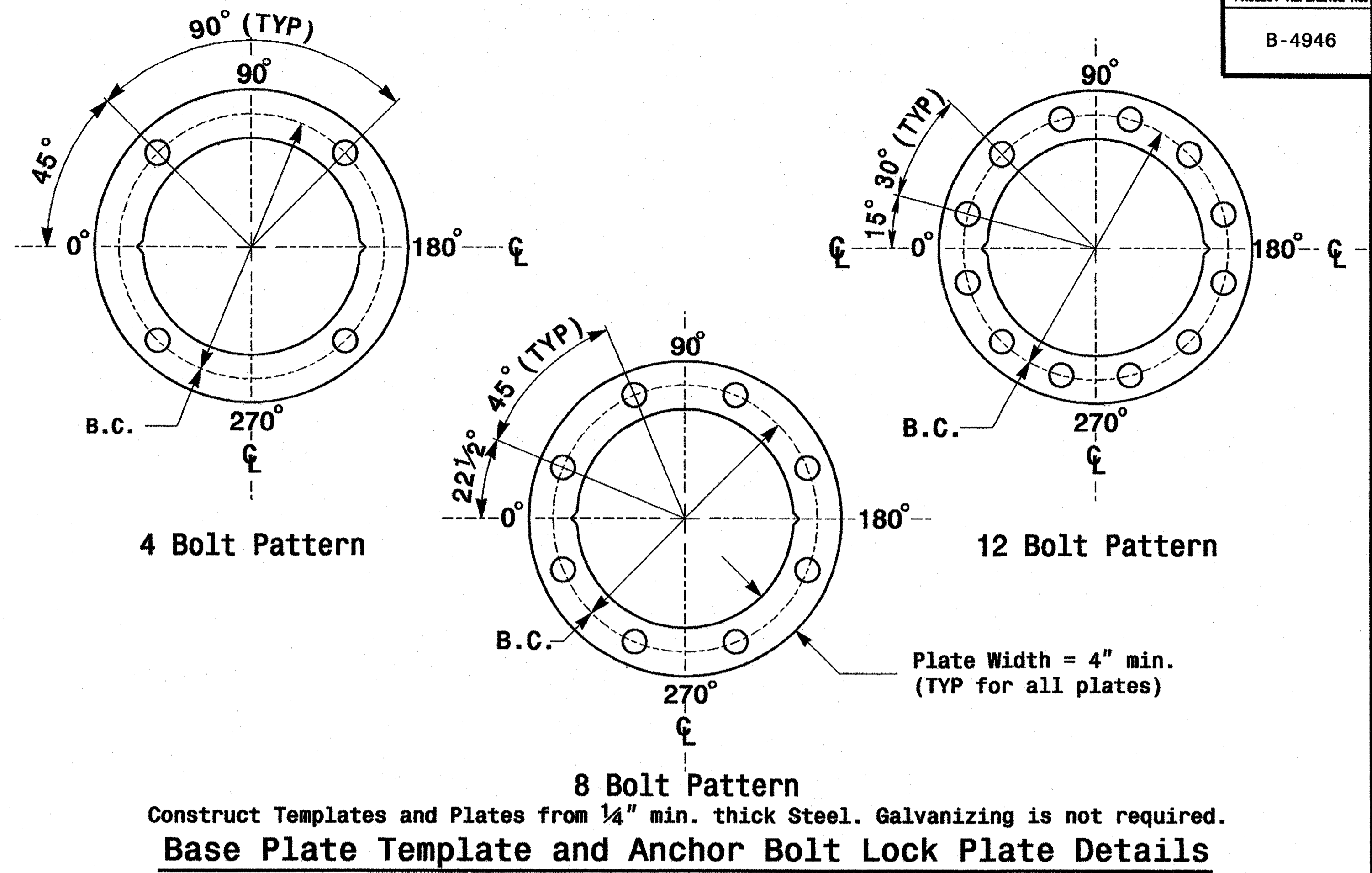
*D. Sarkar*      7.21.2009  
 SIGNATURE      DATE





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**



Construct Templates and Plates from 1/4" min. thick Steel. Galvanizing is not required.  
**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 _____	

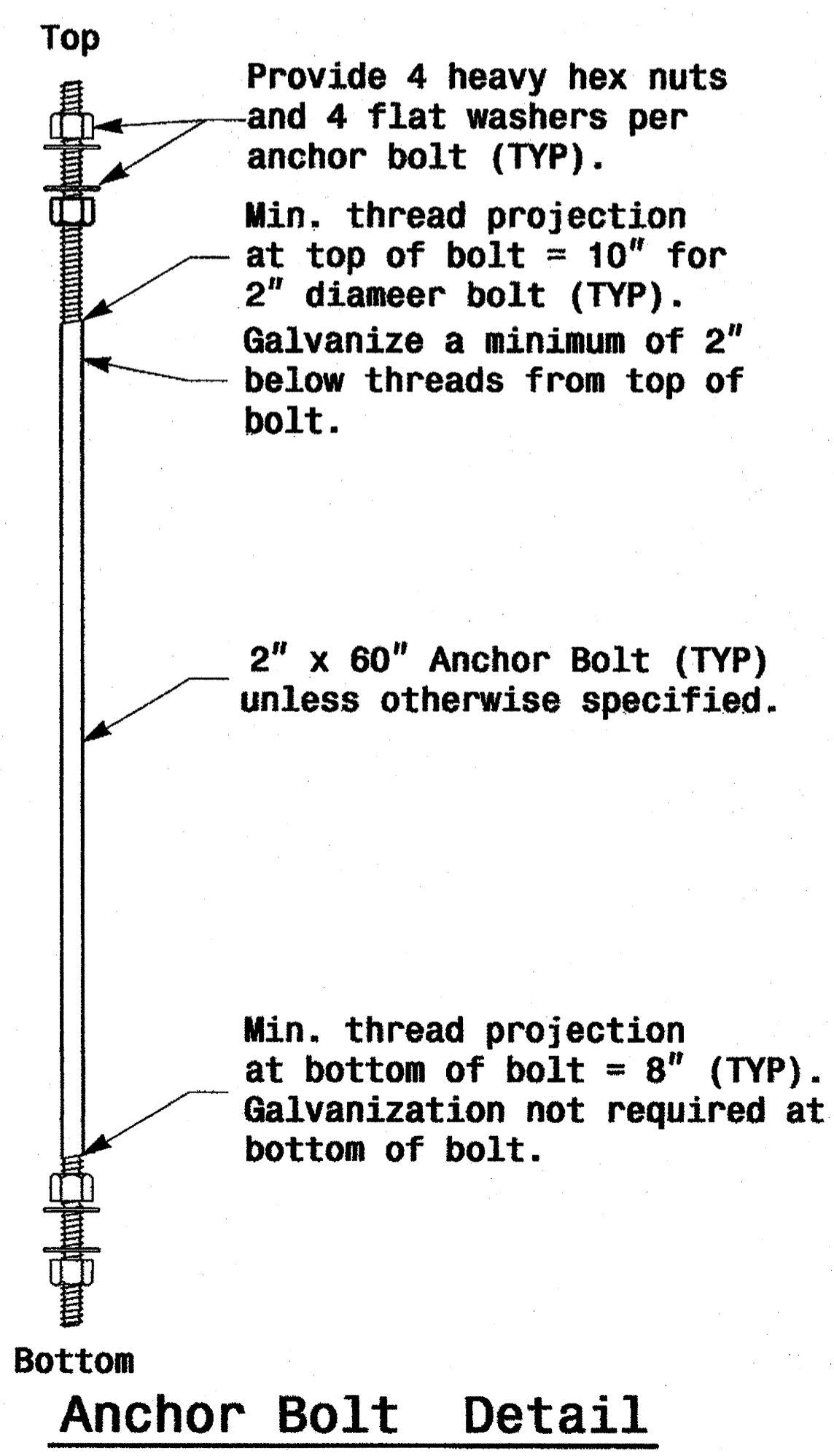
**Shaft I.D. Tag**  
 (Provide on Strain Poles and Mast Arm Poles)

- 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 plan pole I.D.
  - 5) See drawing M4 for mounting positions of I.D. tags.

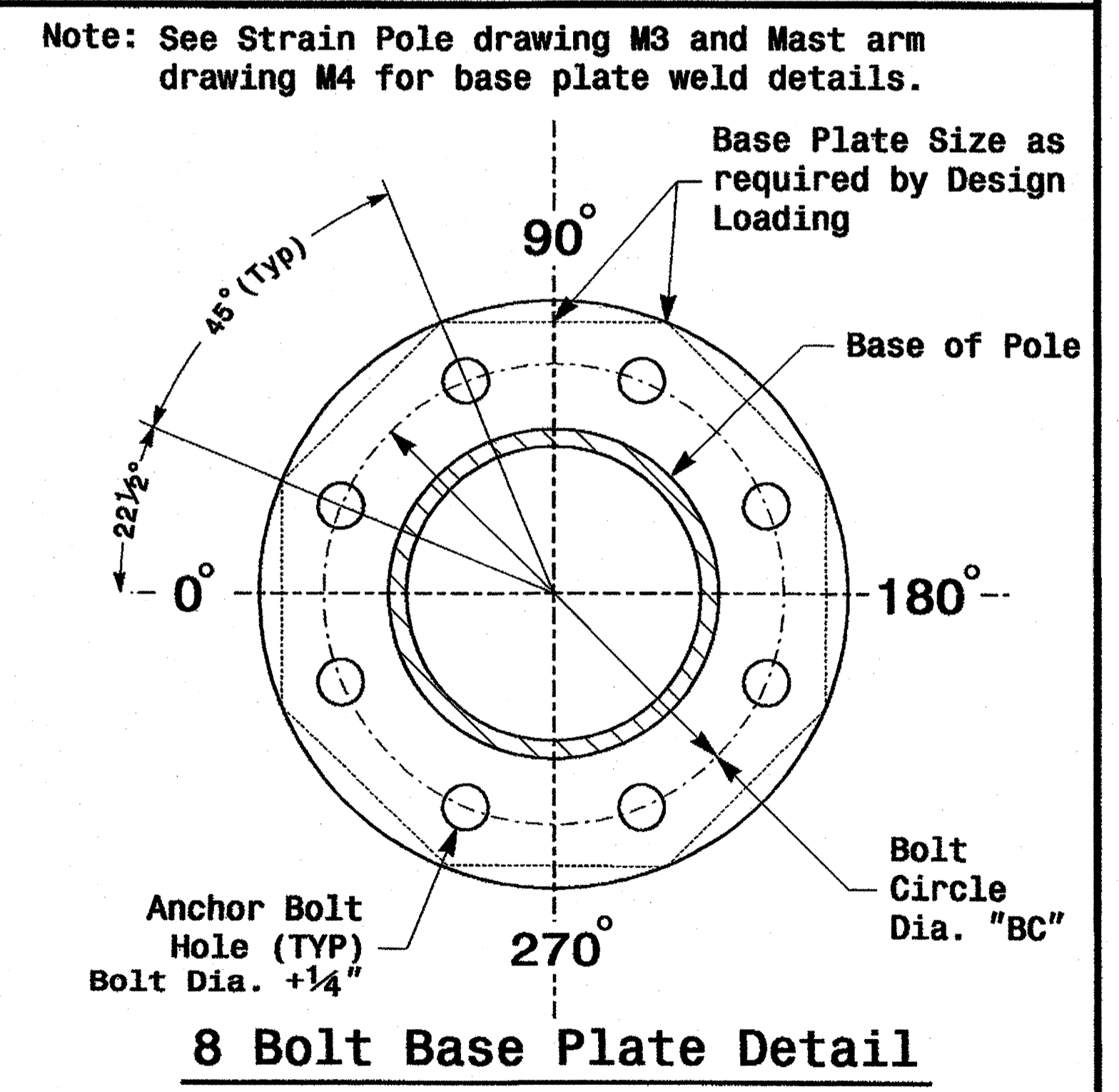
**Identification Tag Details**

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**



**8 Bolt Base Plate Detail**

Prepared in the Office of:



**Typical Fabrication Details Common To All Metal Poles**

PLAN DATE: May 2005	REVIEWED BY: C.F. Andrews
PREPARED BY: P.L. Alexander	REVIEWED BY: A.W. Esposito

REVISIONS	INIT.	DATE

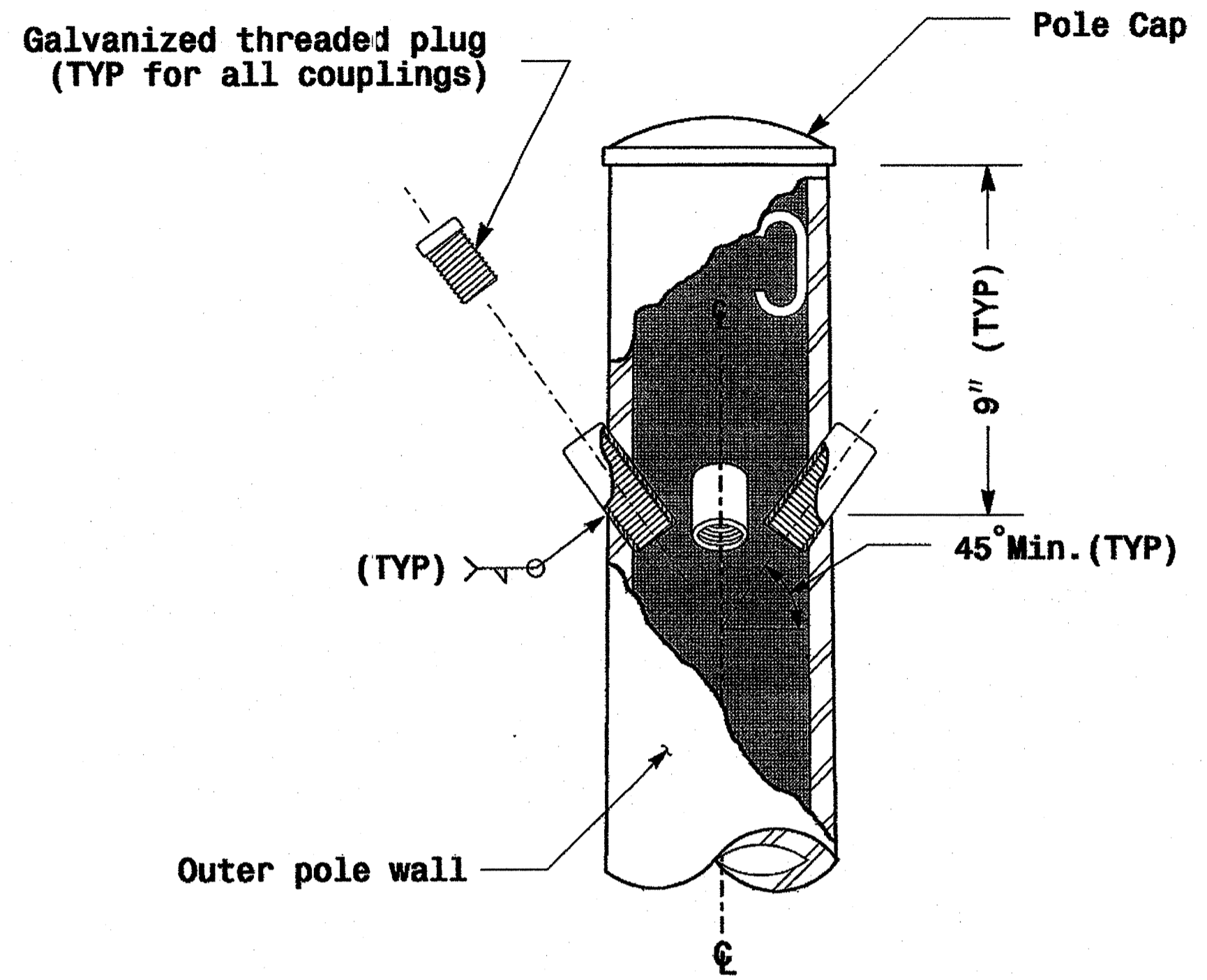
SCALE: 0 NA NONE

Signature: J. Sarkar 9.2.2005

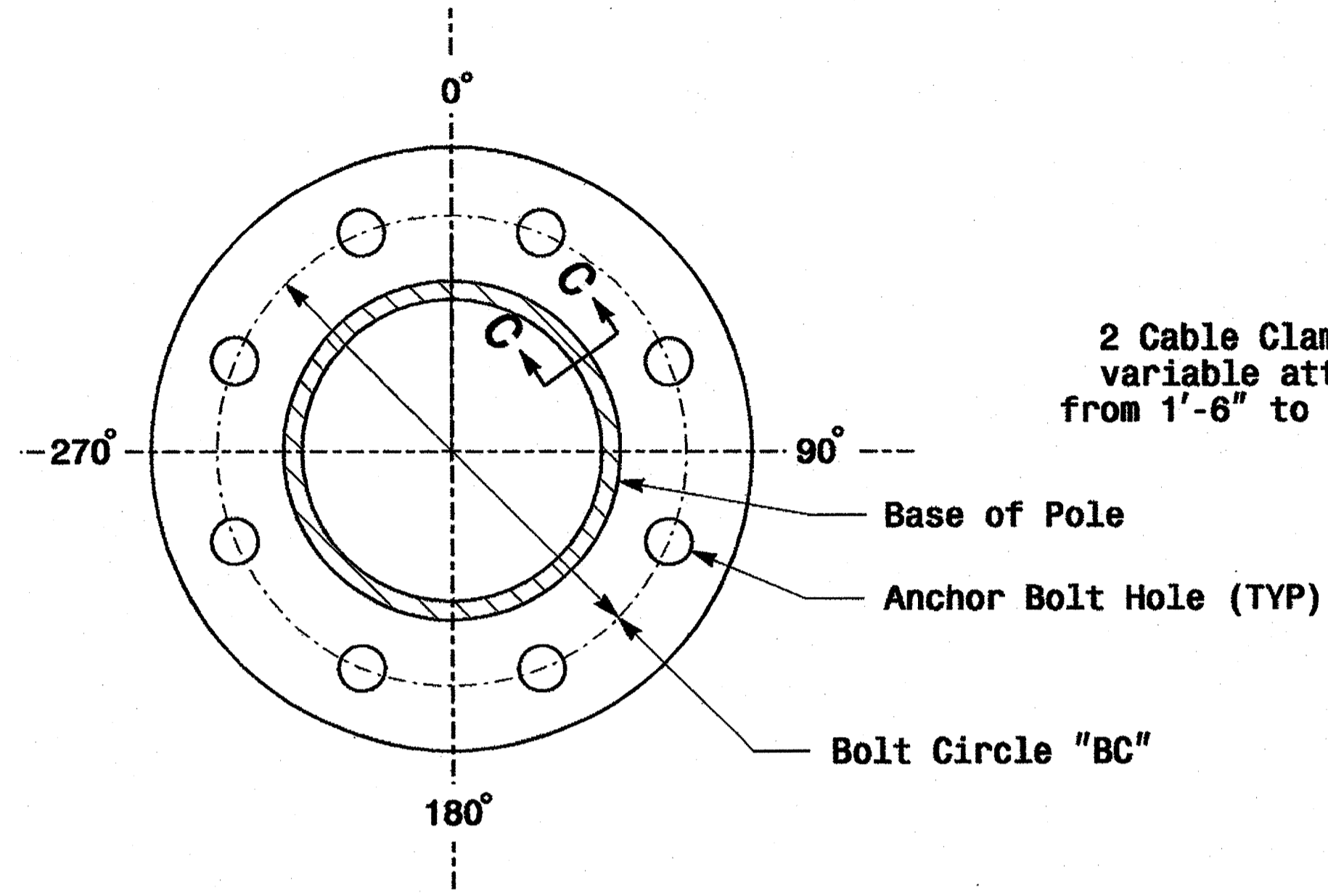
SIG. INVENTORY NO.

**Fabrication Details - All Poles**

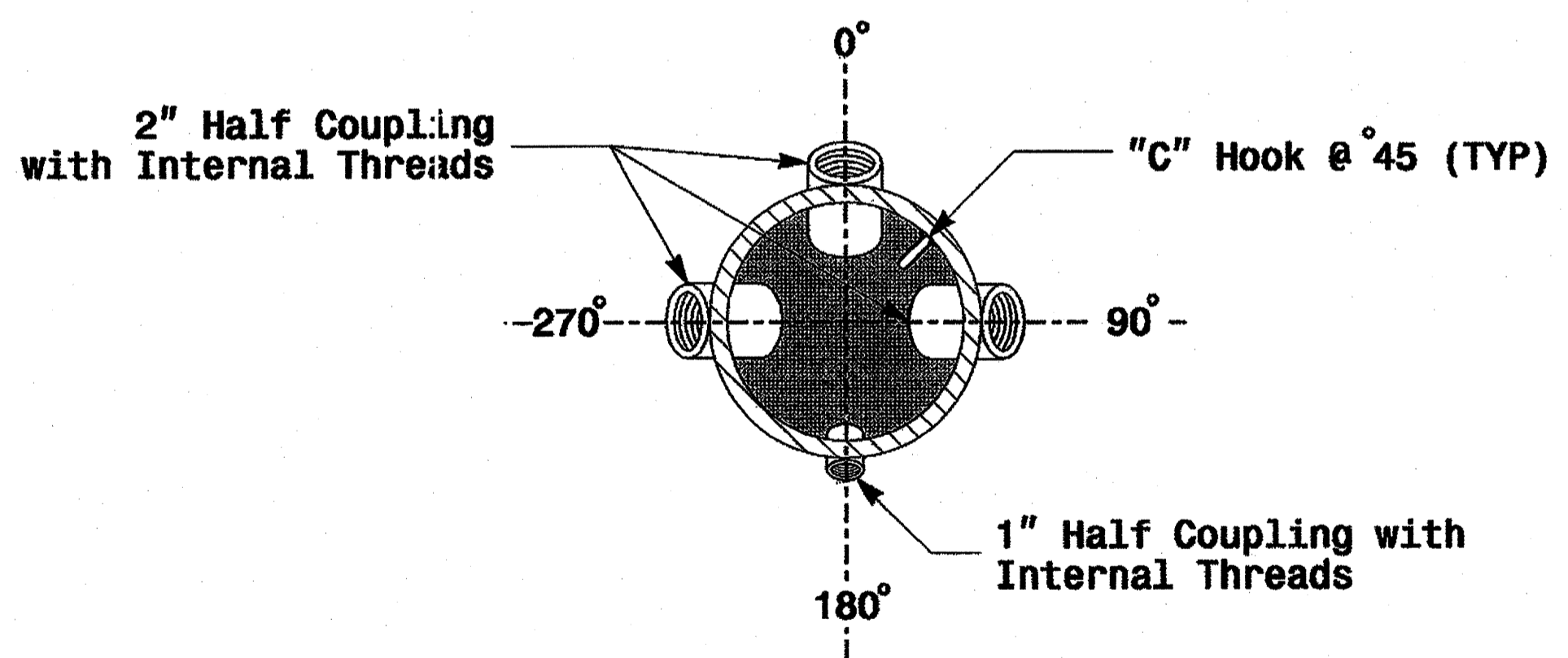
01-SEP-2005 18:22 D:\2004 Metro Pole Standard\2004.m2 thru mg.dgn condrews



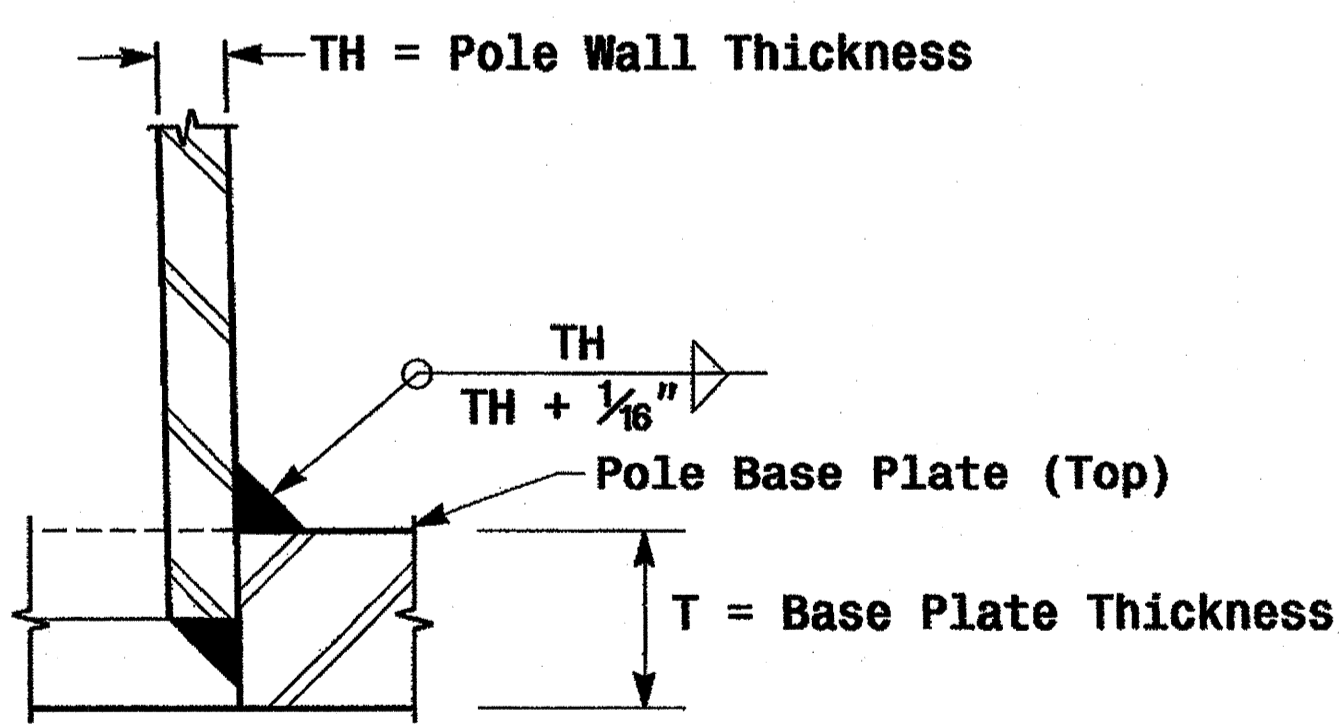
Cable Entrances at Top of Pole



Section B-B Pole Base Plate  
(See drawing M2)

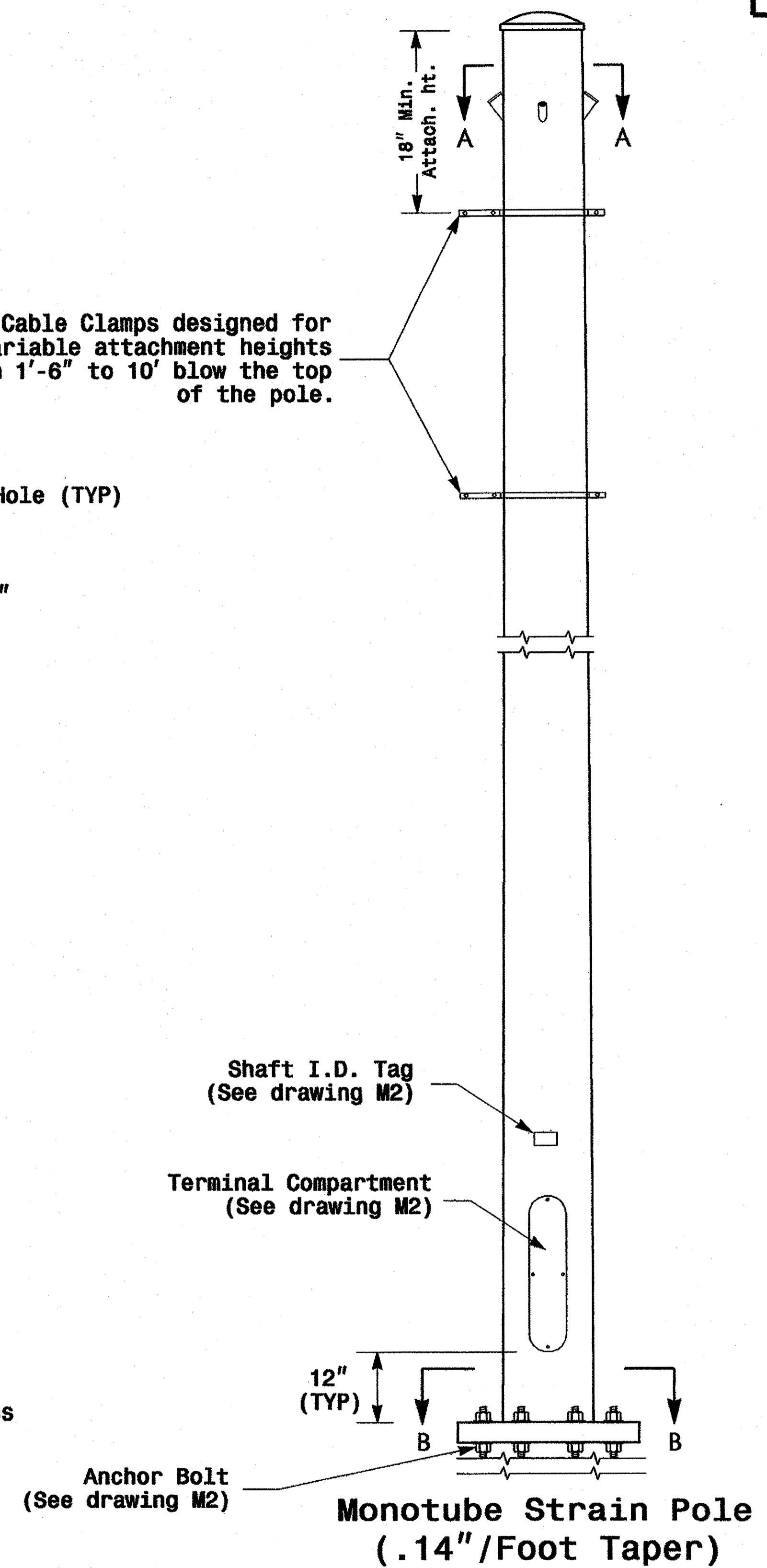


Section A-A Radial Orientation for Factory Installed Accessories at Top of Pole



Section C-C Socket Connection Weld Detail

2 Cable Clamps designed for variable attachment heights from 1'-6" to 10' below the top of the pole.

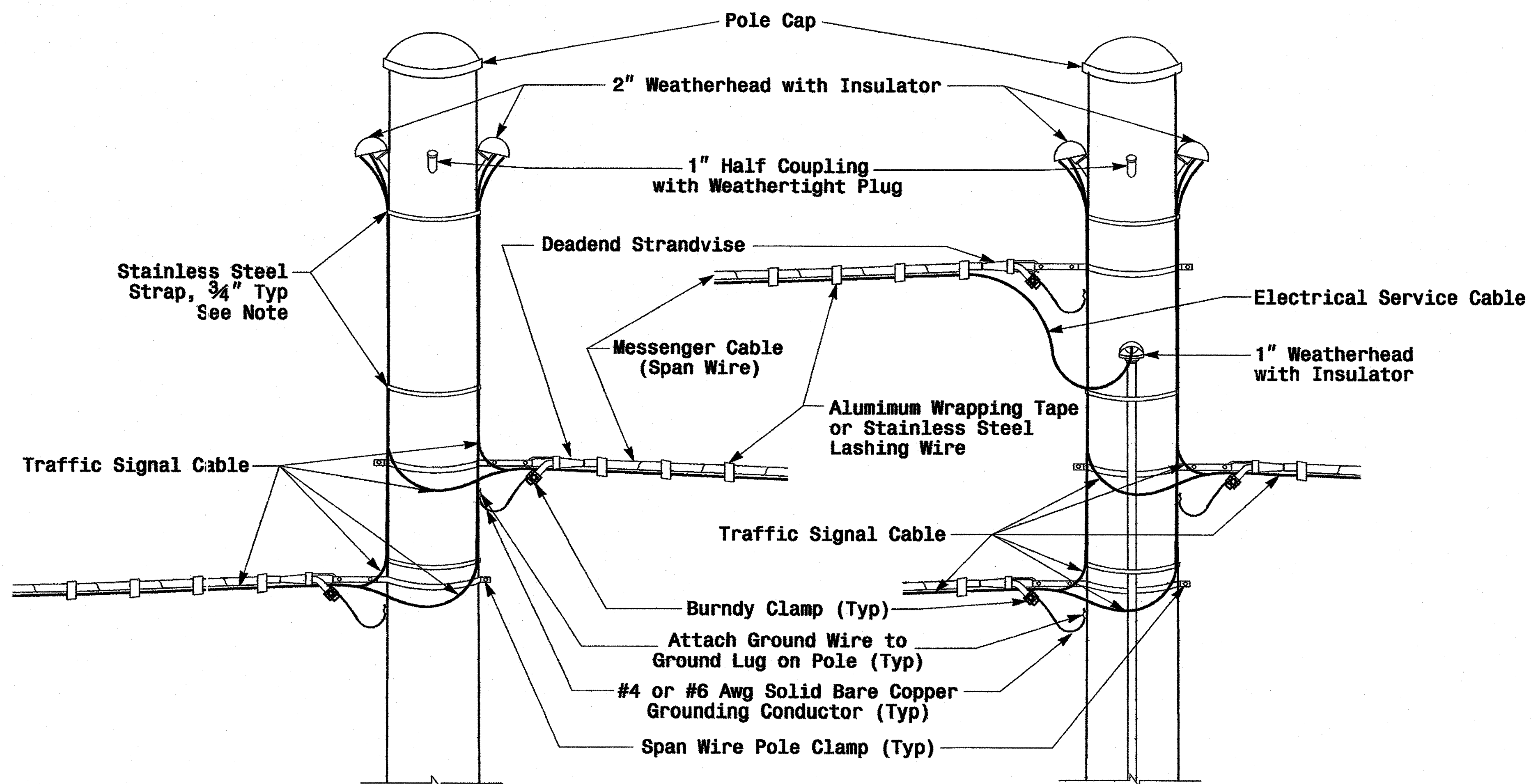


Fabrication Details - Strain Poles

01-SEP-2005 14:07 \\p001\es-un\pwork\kgrousa\2004\_metal\_pole\_standards\2004\_m3.dgn pol alexander

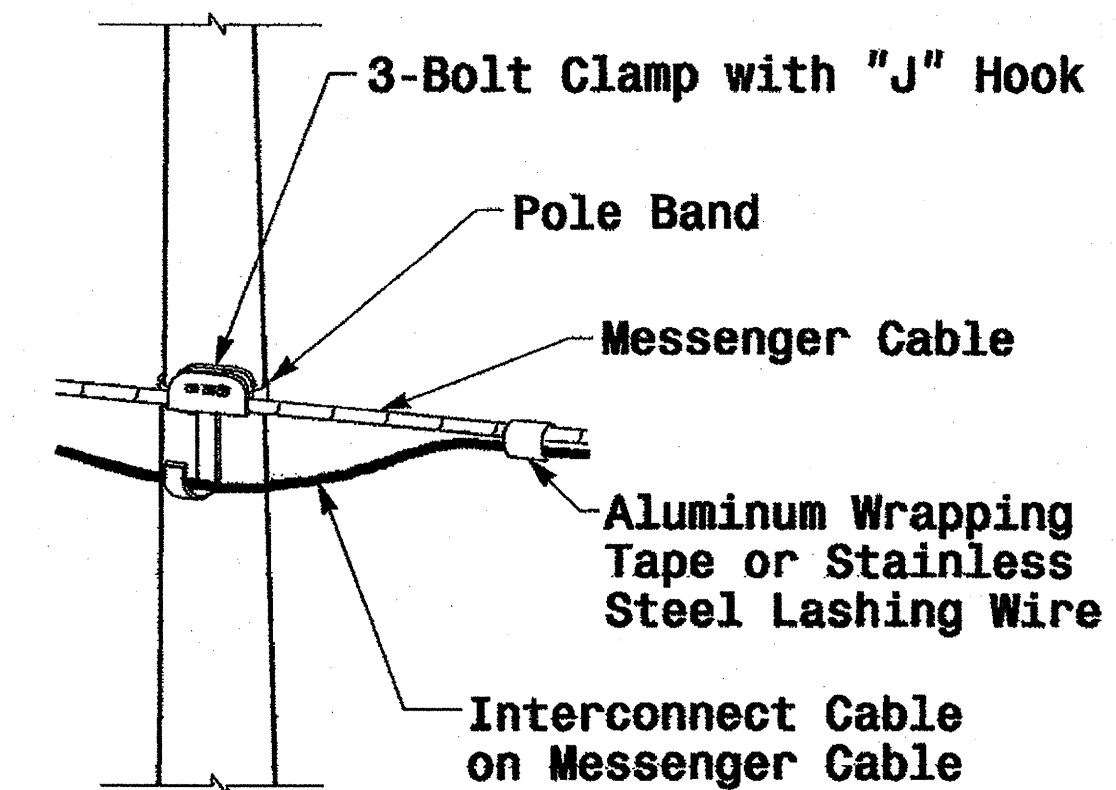
	<b>Typical Fabrication Details For Strain Poles</b>		
	PLAN DATE: <b>May 2005</b> PREPARED BY: <b>P.L. Alexander</b>	REVIEWED BY: <b>C.F. Andrews</b> REVIEWED BY: <b>A.M. Esposito</b>	
REVISIONS: _____		INIT. _____ DATE _____	SIGNATURE: <i>D. Sarkar</i> DATE: <b>9.2.2005</b>
SIG. INVENTORY NO. _____			



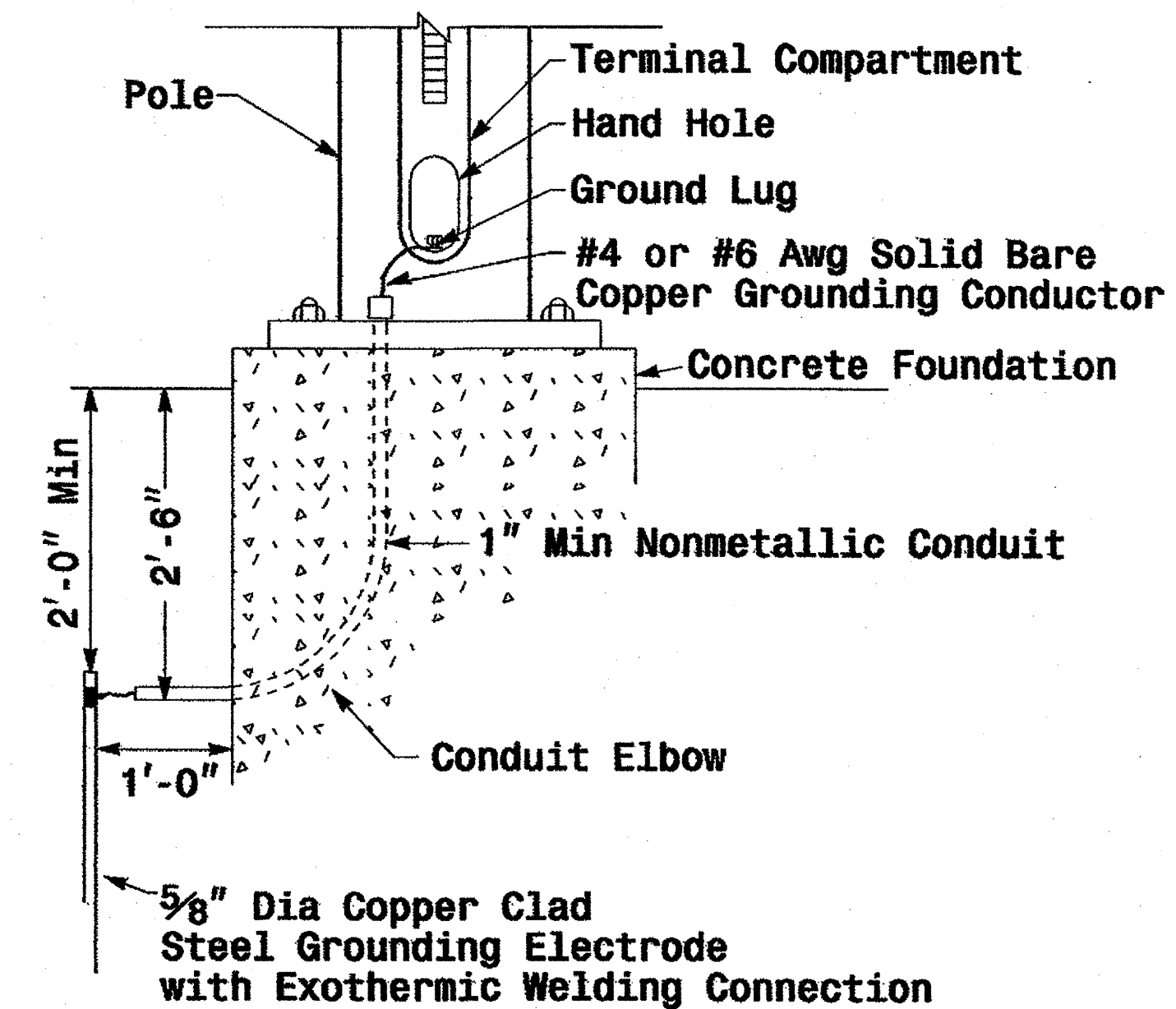


Note: Strap all signal cables to the side of the pole with 3/4\" stainless steel straps when the distance between the spanwire attachment clamp and the weatherheads exceeds 36\"

**Strain Pole Attachments**



**Attachment of Cable to Intermediate Metal Pole**



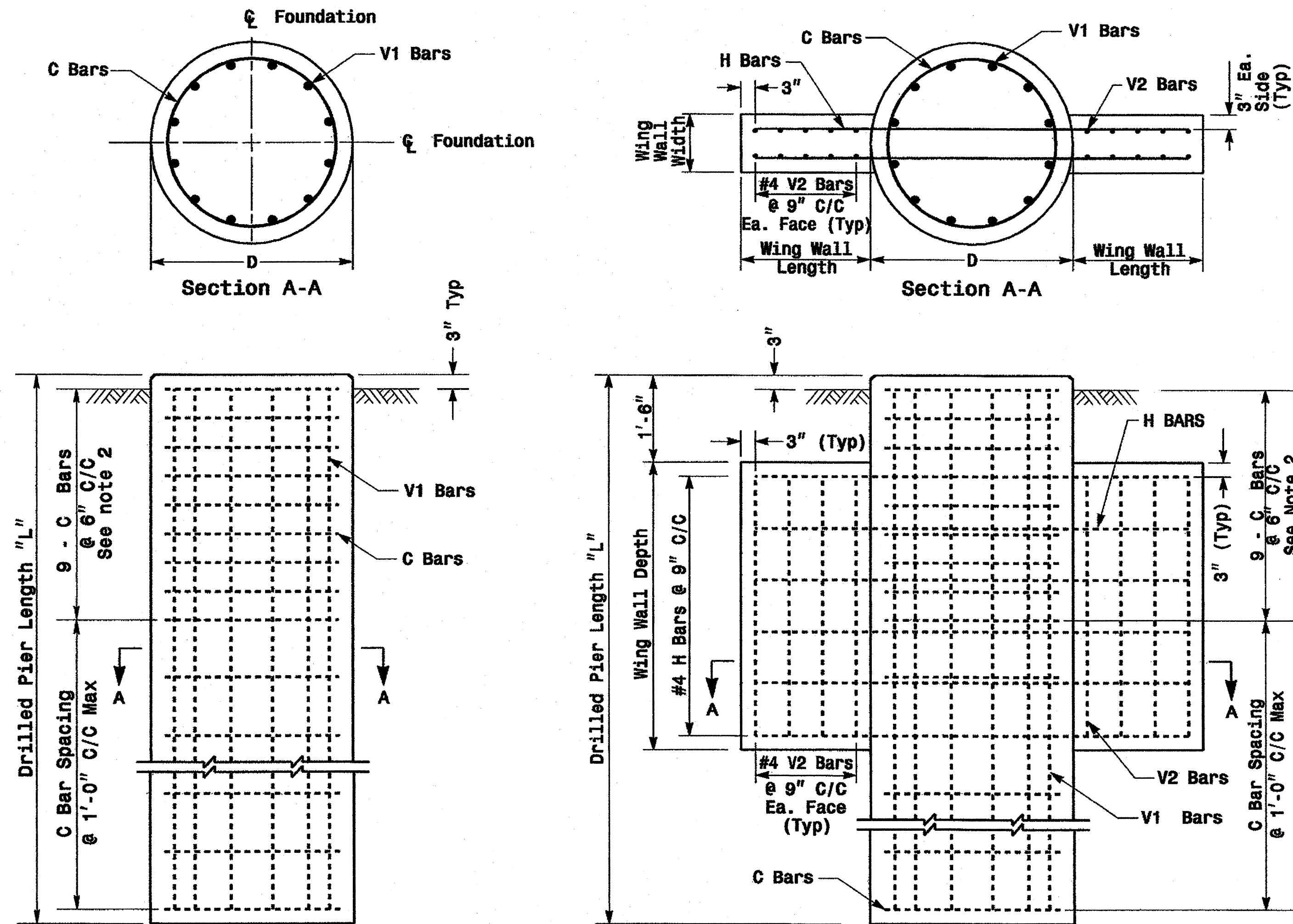
**Metal Pole Grounding Detail**

**Construction Details - Strain Poles**

01-SEP-2005 15:33 C:\wps\p01\un11\mstr\groups\2004\_mstr\pole\_strain\drw\2004\_ms.dgn pdalexander

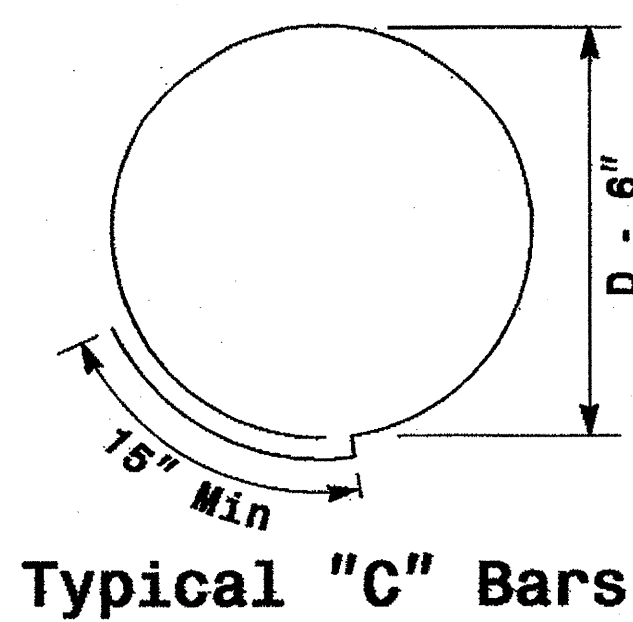
	<b>Construction Details Strain Poles</b>		
	PLAN DATE: <b>May 2005</b> PREPARED BY: <b>C.F. ANDREWS</b>	REVIEWED BY: <b>P.L. ALEXANDER</b> REVIEWED BY: <b>D.C. SARKAR</b>	
REVISIONS: _____ INHT. DATE: _____		SIGNATURE: <i>Milton I. Dean</i> <b>9-1-05</b> DATE: _____ SIG. INVENTORY NO.: _____	

## Reinforcing Steel Bars



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

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"

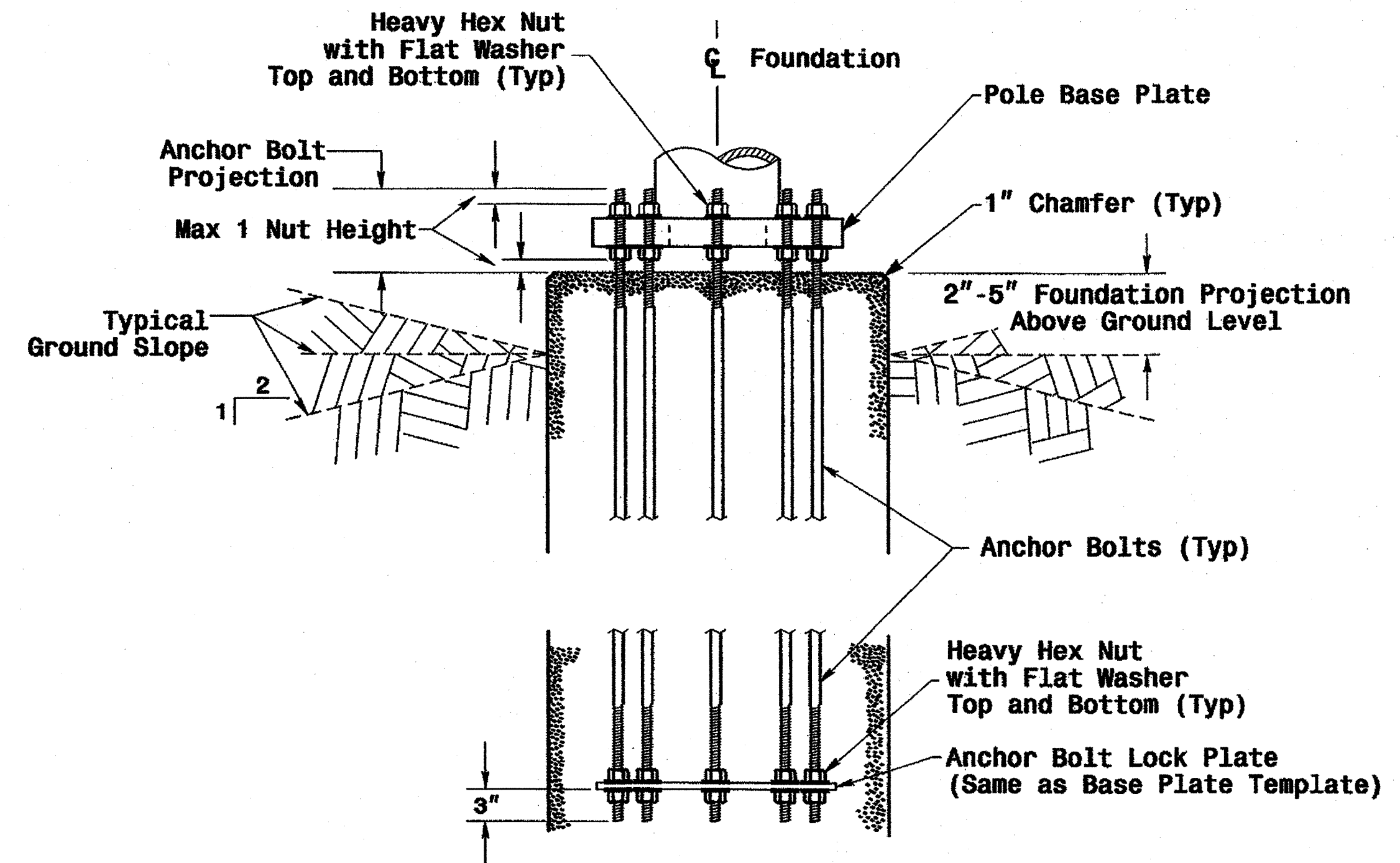
\* See Note No. 1  
\*\* See Note No. 3

Wing Wall 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

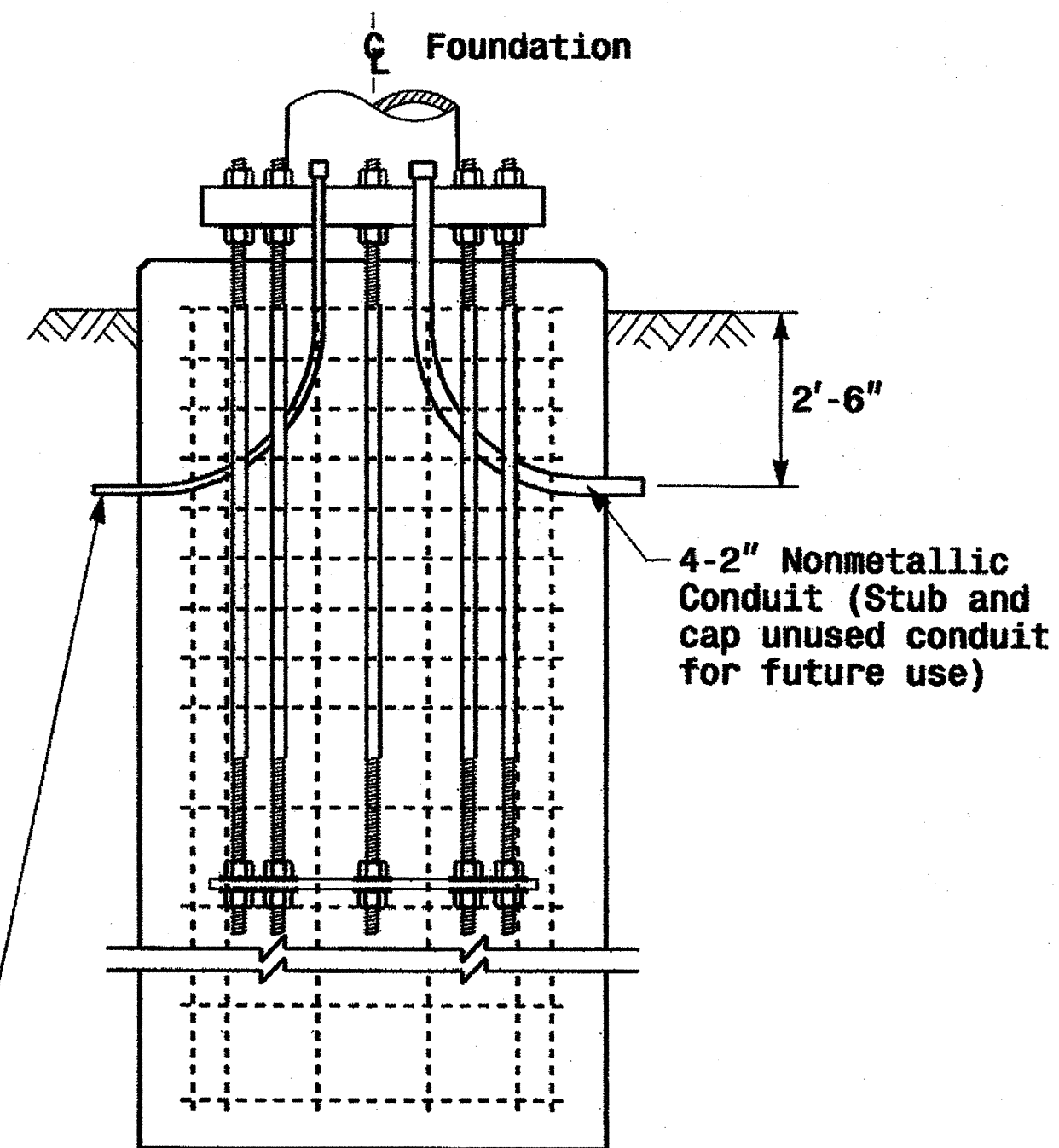
See Note No. 4

## Typical Foundation Anchor Bolt Details

(Reinforcing Cage Not Shown for Clarity)



## Typical Foundation Conduit Details



## 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.)

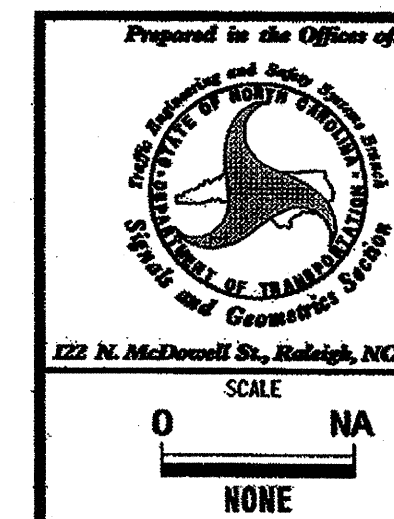
PROJECT REFERENCE NO.

SHEET NO.

B-4946

Sig. 12  
M 7

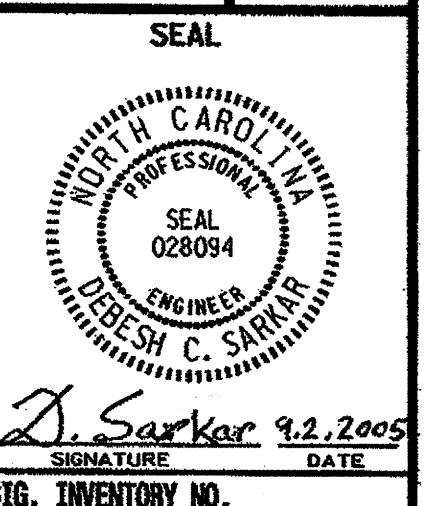
Construction Details - Foundations



### Construction Details Foundations

PLAN DATE: May 2005  
REVIEWED BY: P.L. ALEXANDER  
PREPARED BY: C.F. ANDREWS  
REVIEWED BY: A.W. ESPOSITO

SCALE: NONE



SIG. INVENTORY NO.



		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
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
	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
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
	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

Concrete Volume (cubic yards) = .356 X L

**Fabrication Design Notes:**

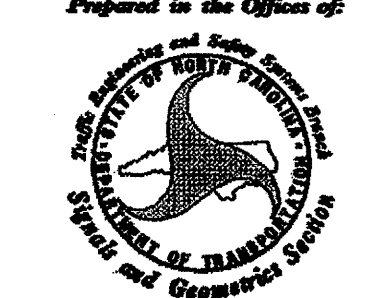
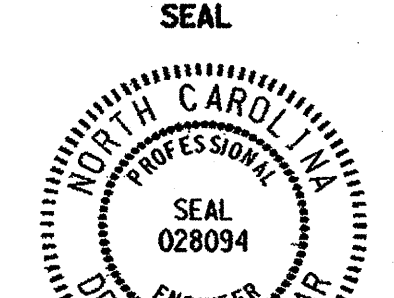
1. Values shown in "Moment at the Pole Base" column represents the minimum acceptable capacity allowable for design using a design CSR of 1.
2. Base plate thickness (T) is 2.0 inches.

**Foundation Selection:**

1. Perform a standard penetration test at each proposed foundation site to determine "N" value.
2. Select the appropriate wind zone from sheet M 1.
3. Select the soil type (Clay or Sand) that best describes the soil characteristics.
4. Get the appropriate pole case load number from the plans or from the Engineer.
5. 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

02-SEP-2005 12:42 \\fll\pwr\groups\2004 metal pole standard\std004.mxd std strain pole.dgn p.l.alexander

	<b>Standard Strain Poles and Standard Foundations</b>		
	PLAN DATE: <b>May 2005</b>	REVIEWED BY: <b>C.F. Andrews</b>	
SCALE: <b>NA</b> None	REVISIONS:	INIT.:	DATE:
		SIGNATURE: <i>D. Sarkar</i>	DATE: <b>9.2.2005</b>