

TIP PROJECT: U-4410DB

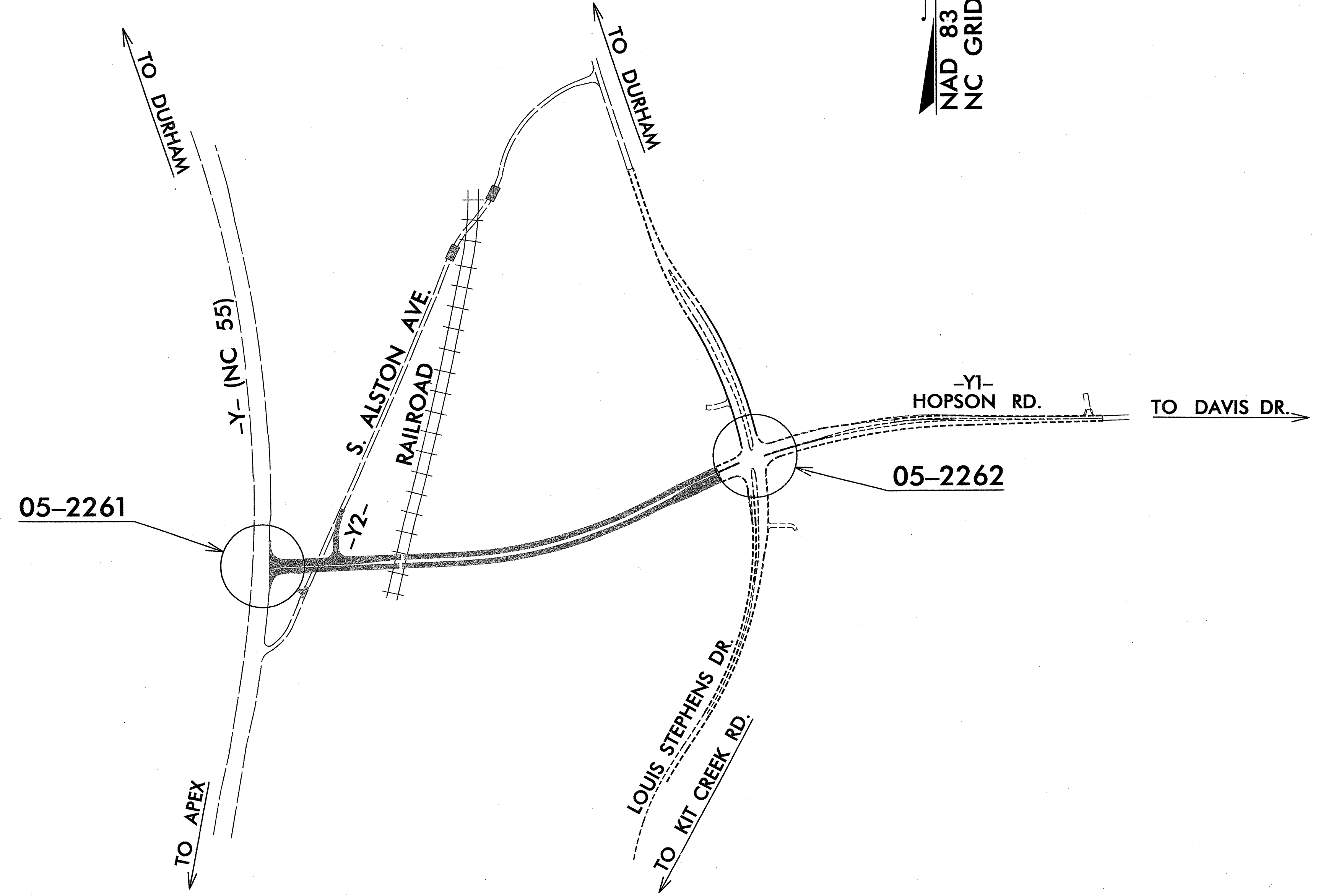
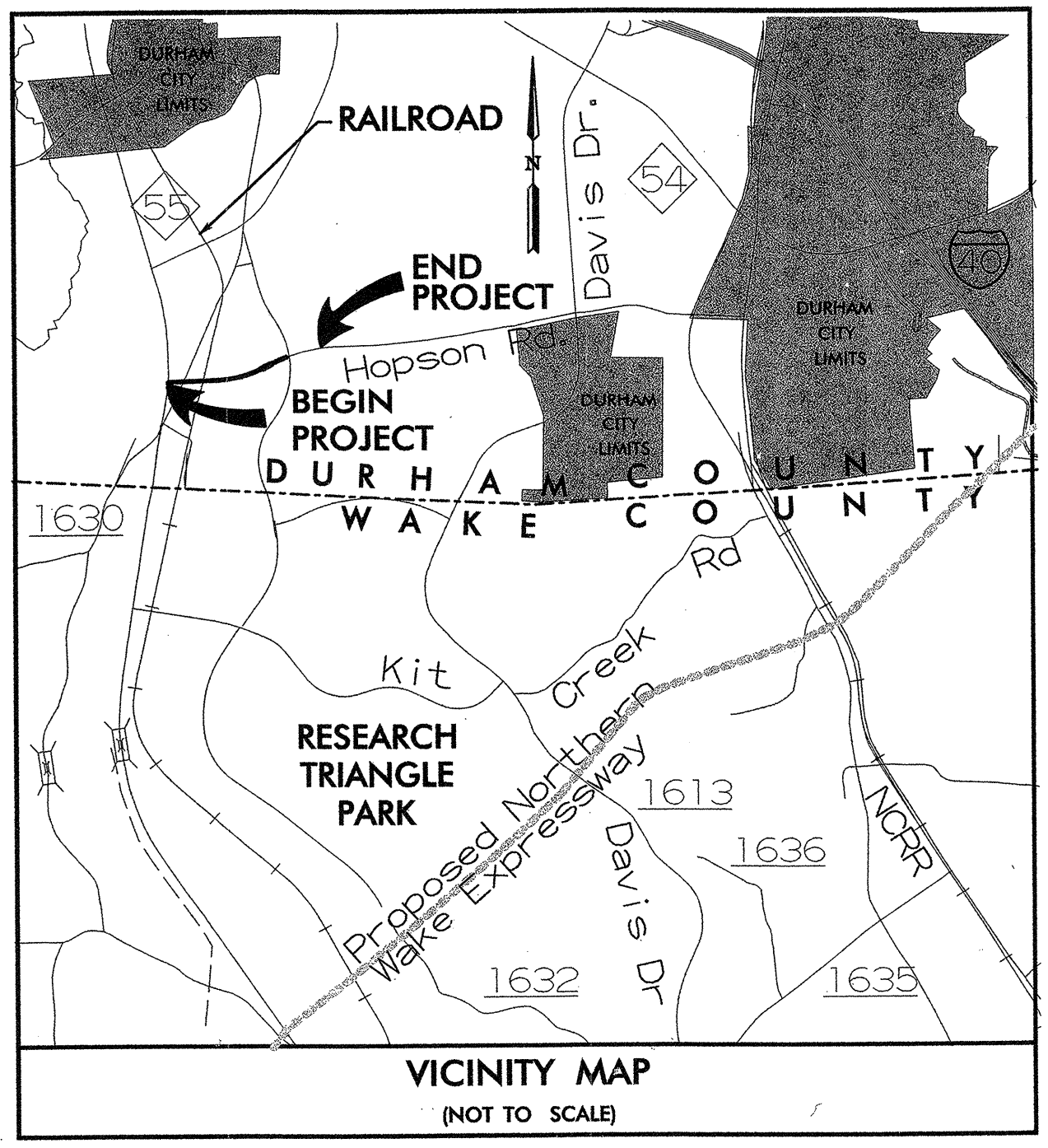
CONTRACT:

RESEARCH TRIANGLE FOUNDATION PROJECT	SHEET NO.	TOTAL SHEETS
U-4410DB	SIG-1	

STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

**DURHAM COUNTY**

LOCATION: HOPSON ROAD FROM NC 55 TO LOUIS STEPHENS DRIVE  
TYPE OF WORK: TRAFFIC SIGNALS



**CH ENGINEERING**  
PO BOX 30128 TELE 919.788.0224  
RALEIGH, NC 27622 FAX 919.788.0232

**INDEX OF SHEETS**

SHEET #	SIG INV. #	DESCRIPTION /LOCATION
SIG.1	N/A	TITLE SHEET
SIG.2 - SIG.5	05-2261	-Y- (NC 55) & -Y1- (HOPSON RD)
SIG.6 - SIG.9	05-2262	-L- (L. STEPHENS DR) & -Y1- (HOPSON RD)
SIG.10 - SIG.14		METAL POLE STANDARDS

RTF CONTACT : LIZ ROOKS  
PROJECT MANAGER

NCDOT CONTACTS: TIMOTHY J. WILLIAMS, P.E.  
S&G CONTRACTS & PEF SUPPORT ENGINEER

GEORGE C. BROWN, P.E.  
SIGNAL EQUIPMENT DESIGN ENGINEER

Prepared In the Office of:

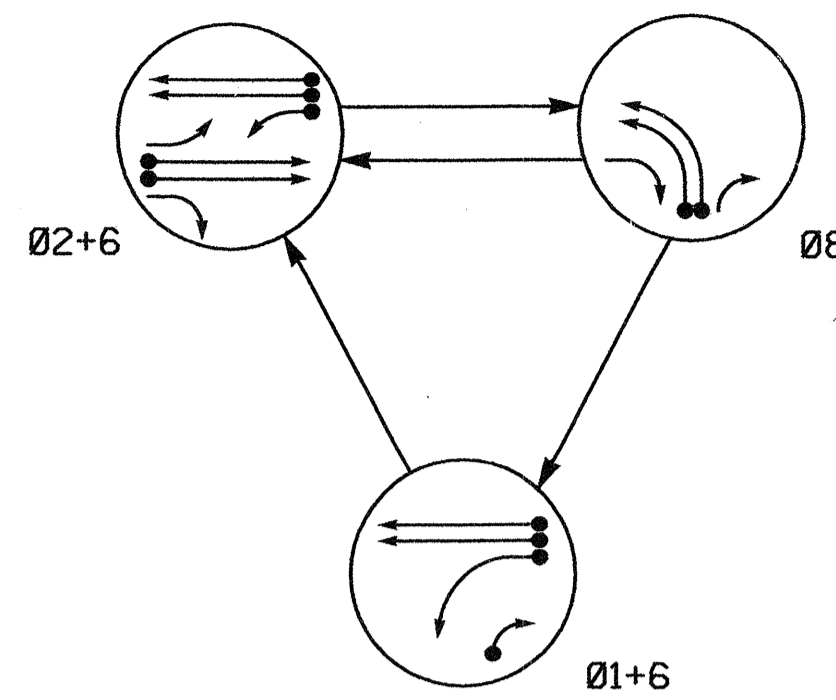
**CH ENGINEERING**  
2006 STANDARD SPECIFICATIONS

THOMAS R. HEPLER, PE  
TRAFFIC DESIGN ENGINEER

TRAFFIC ENGINEER

SIGNATURE: *Thomas R. Hepler* P.E.

PHASING DIAGRAM



SIGNAL FACE	PHASE			
	Ø 1+6	Ø 2+6	Ø 8	LEGION
21, 22	R	G	R	Y
23	R	G	R	Y
61	G	R	Y	
62	G	R	Y	
81, 82	R	R	R	R
83	R	R	R	R

2070L LOOP & DETECTOR INSTALLATION												
INDUCTIVE LOOPS					DETECTOR PROGRAMMING							
LOOP	SIZE (FT)	TURNS	DISTANCE FROM STOPBAR (FT)	NEW LOOP	PHASE	CALLING	EXTENSION	FULL TIME DELAY	SYSTEM LOOP	STRETCH TIME	DELAY TIME	NEW CARD
1A	6 X 40	2-4-2	0	X	1	Y	Y				15	Y
1B	6 X 40	2-4-2	0	X	6	Y	Y	Y			3	Y
2A	6 X 6	6	420	X	2	Y	Y					Y
2B	6 X 6	6	420	X	2	Y	Y					Y
6A	6 X 6	5	420	X	6	Y	Y					Y
6B	6 X 6	5	420	X	6	Y	Y					Y
8A	6 X 40	2-4-2	0	X	8	Y	Y					Y
8B	6 X 40	2-4-2	0	X	8	Y	Y					Y

3-Phase Fully Actuated (Isolated)

NOTES

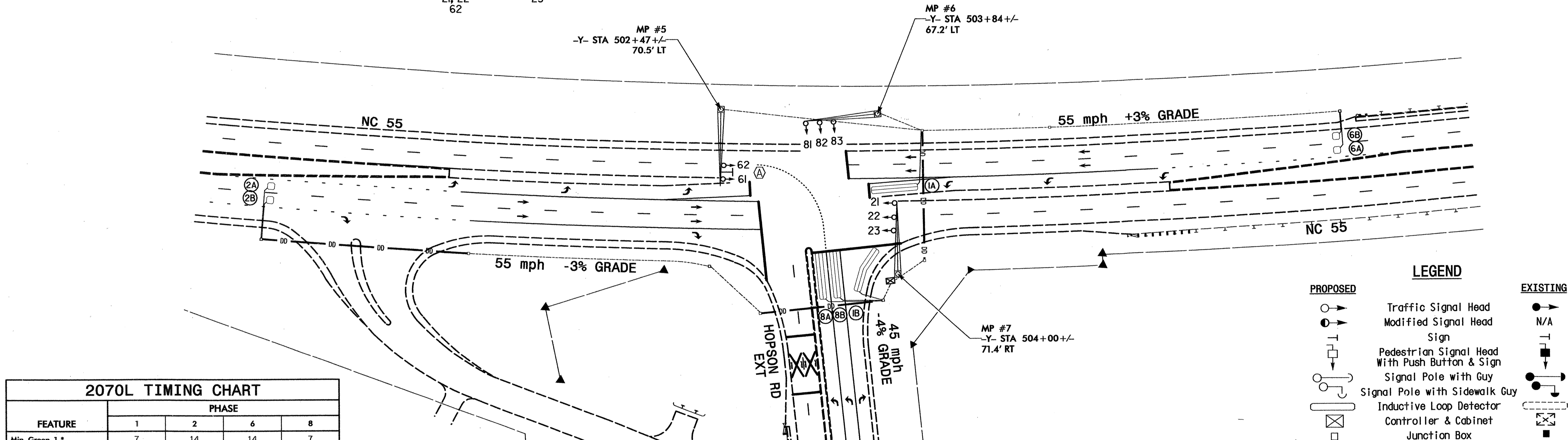
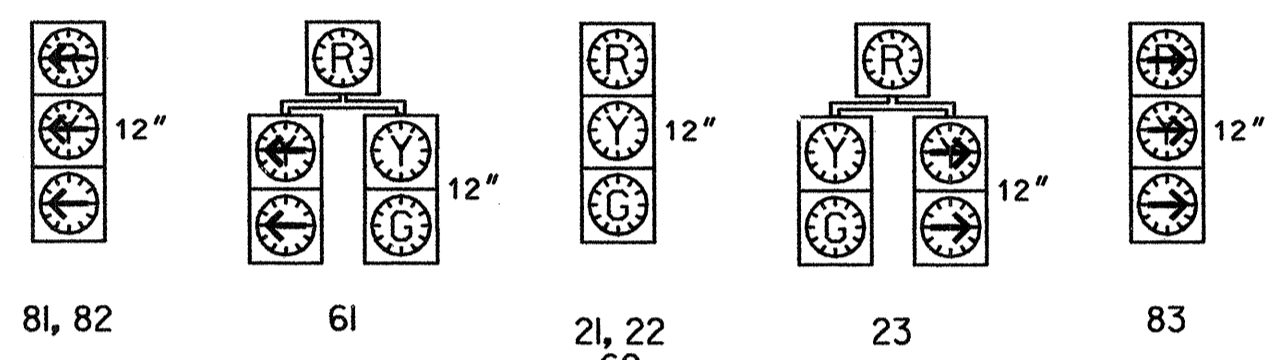
- Refer to "Roadway Standard Drawings NCDOT" dated July 2006 and "Standard Specifications for Roads and Structures" dated July 2006.
- Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
- Omit phase 1 during phase 2 on.
- Program controller to clear from phase 2+6 to phase 1+6 by progressing through phase 8 (see Electrical Details).
- Set all detector units to presence mode.
- Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.

SIGNAL FACE I.D.

Denotes L.E.D.

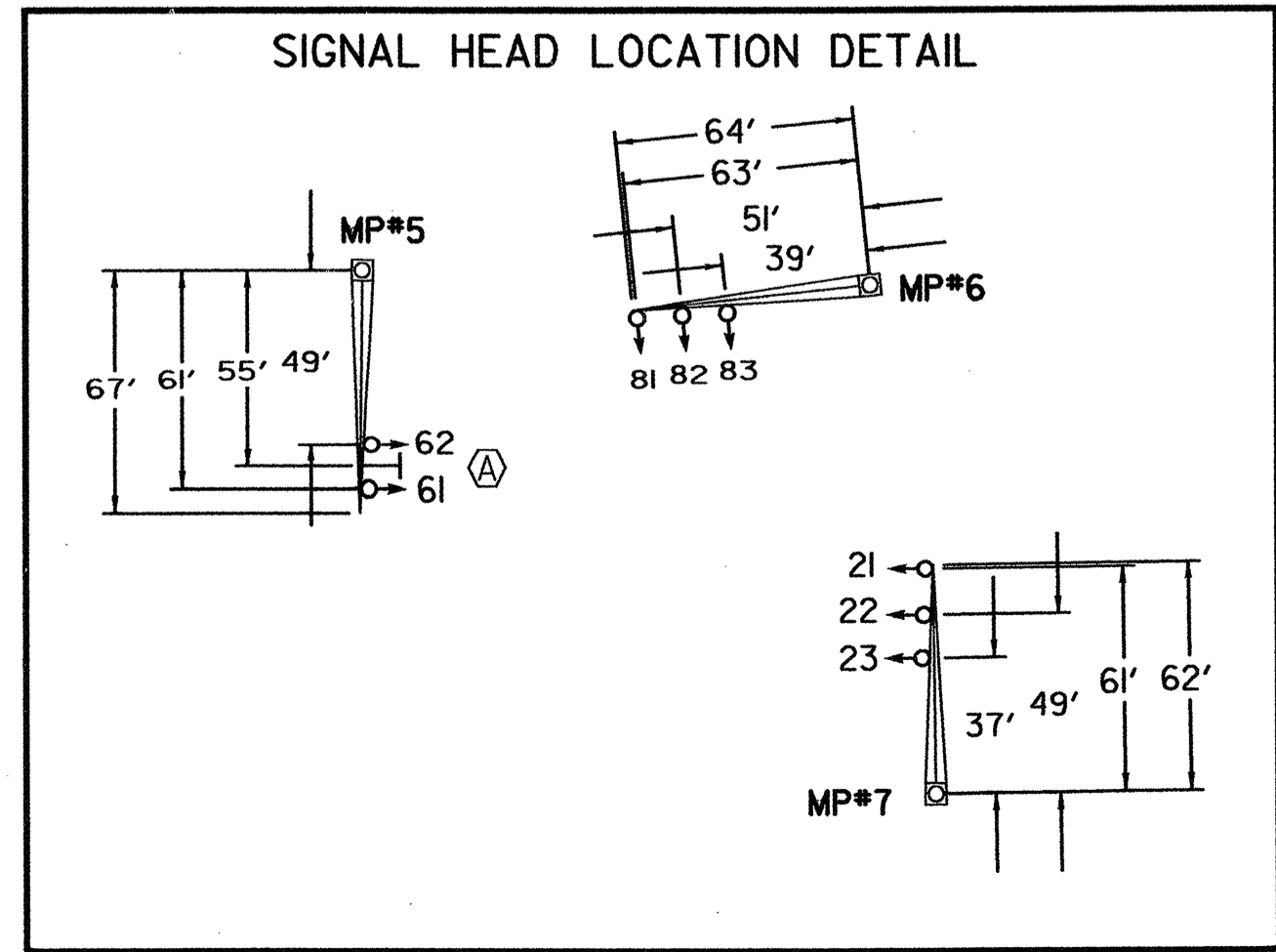
PHASING DIAGRAM DETECTION LEGEND

- ← ● DETECTED MOVEMENT
- ← ○ UNDETECTED MOVEMENT (OVERLAP)
- ← ○ UNSIGNALIZED MOVEMENT
- ← ○ PEDESTRIAN MOVEMENT



FEATURE	PHASE			
	1	2	6	8
Min Green 1 *	7	14	14	7
Extension 1 *	2.0	6.0	6.0	2.0
Max Green 1 *	35	85	85	35
Yellow Clearance	3.0	5.5	4.9	3.0
Red Clearance	2.8	1.8	1.0	3.3
Walk 1 *	-	-	-	-
Don't Walk 1	-	-	-	-
Seconds Per Actuation *	-	1.5	1.5	-
Max Variable Initial *	-	46	46	-
Time Before Reduction *	-	15	15	-
Time To Reduce *	-	30	30	-
Minimum Gap	-	3	3	-
Recall Mode	-	MIN RECALL	MIN RECALL	-
Vehicle Call Memory	-	YELLOW	YELLOW	-
Dual Entry	-	-	-	-
Simultaneous Gap	-	ON	ON	-

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



LEGEND	
PROPOSED	EXISTING
○ → Traffic Signal Head	● → N/A
○ → Modified Signal Head	○ → N/A
○ → Sign	○ → N/A
○ → Pedestrian Signal Head With Push Button & Sign	○ → N/A
○ → Signal Pole with Guy	○ → N/A
○ → Signal Pole with Sidewalk Guy	○ → N/A
○ → Inductive Loop Detector	○ → N/A
○ → Controller & Cabinet	○ → N/A
○ → Junction Box	○ → N/A
○ → 2-in Underground Conduit	○ → N/A
○ → Right of Way	○ → N/A
○ → Directional Arrow	○ → N/A
○ → Pavement Marking Arrow	○ → N/A
○ → Metal Pole with Mastarm	○ → N/A
○ → "U-Turn YIELD TO RIGHT TURN" Sign (R10-16)	○ → N/A

New Installation

Prepared for: **NC 55 at Hopson Road Extension**

Division 5 Durham County RTP

PLAN DATE: January 2007 REVIEWED BY: T Hepler

PREPARED BY: K Bisby REVIEWED BY:

REVISIONS INIT. DATE

SCALE: 1"=50'

CH ENGINEERING  
PO BOX 3028 TELE 919.788.0224 RALEIGH, NC 27622 FAX 919.788.0232

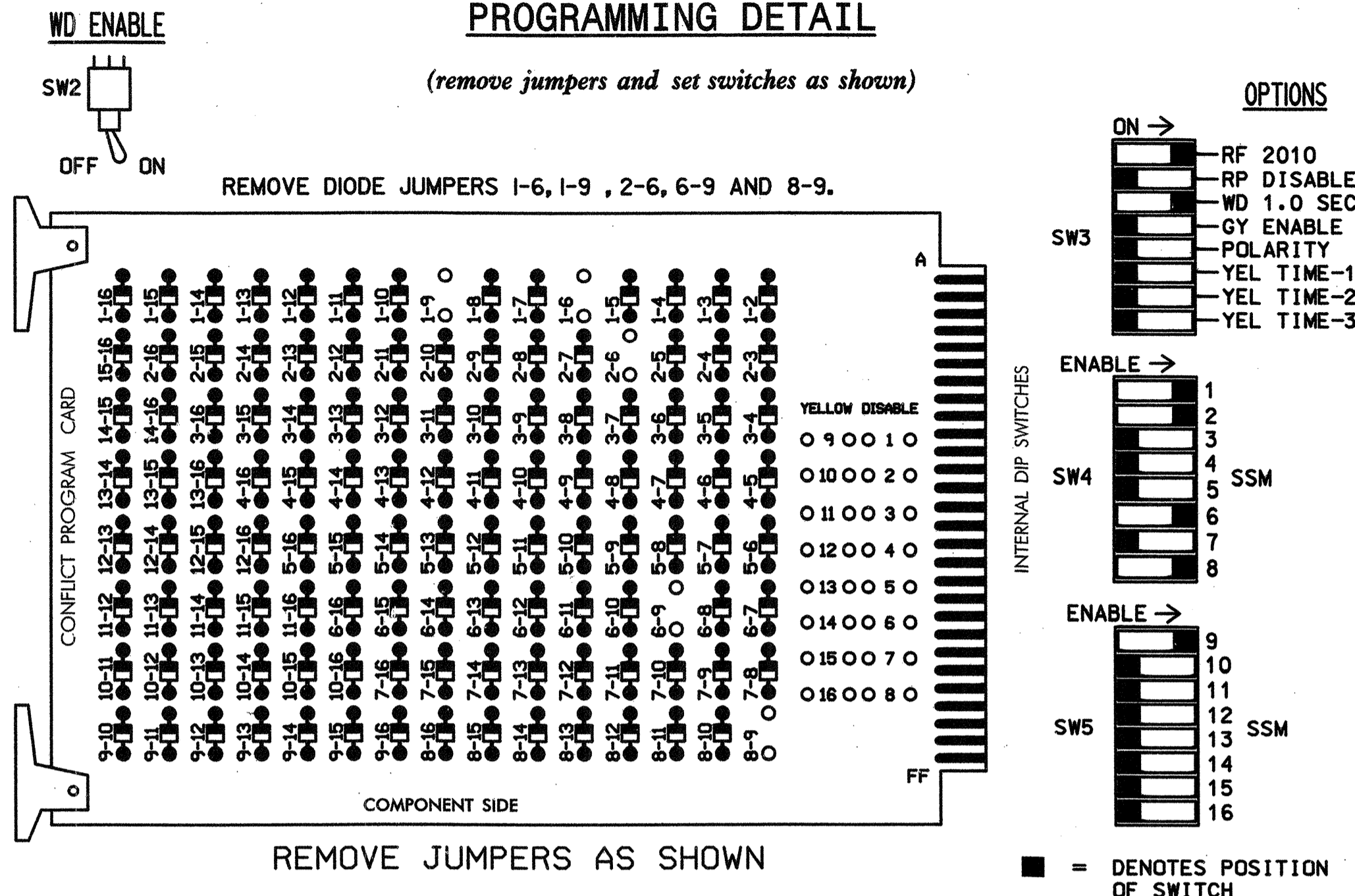
122 N. McDowell St., Raleigh, NC 27603

SEAL  
NORTH CAROLINA PROFESSIONAL ENGINEER  
SEAL 10359  
THOMAS R. HEPLER

SIG. INVENTORY NO. 05-2261

**EDI MODEL 2010ECL CONFLICT MONITOR**

**PROGRAMMING DETAIL**



**NOTES:**

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Make sure jumpers sel1-sel5 are present on the monitor board.

**NOTES**

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.
2. Ensure that Red Enable is active at all times during normal operation. To prevent Red Failures on unused monitor channels, tie unused red monitor inputs 3,4,5, 7,10,11,12,13,14,15 & 16 to load switch AC+ per the cabinet manufacturer's instructions.
3. Program phases 2 and 6, on the controller unit, for Start Up In Green.
4. Enable Simultaneous Gap-Out, on the controller unit, for all phases.
5. Program phases 2 and 6, on the controller unit, for Variable Initial and Gap Reduction.

**EQUIPMENT INFORMATION**

CONTROLLER.....CONTRACTOR SUPPLIED 2070L  
 CABINET .....CONTRACTOR SUPPLIED 332  
 SOFTWARE .....ECONOLITE OASIS  
 CABINET MOUNT.....BASE  
 OUTPUT FILE POSITIONS...18 (12-STD, 6-AUX)  
 LOAD SWITCHES USED.....S1,S2,S6,S8,S9  
 PHASES USED.....1,2,6,8  
 OVERLAPS.....OLA = 1+8

**FIELD CONNECTION HOOK-UP CHART**

LOAD SWITCH NO.	S1	S2	S2P	S3	S4	S4P	S5	S6	S6P	S7	S8	S8P	S9	S10	S11	S12	S13	S14
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED	OLA**	OLB	SPARE	OLC	OLD	SPARE
SIGNAL HEAD NO.	61	21,22 23	NU	NU	NU	NU	NU	61,62	NU	NU	81,82	23	NU	83	NU	NU	NU	NU
RED	*	128						134										
YELLOW		129						135										
GREEN		130						136										
RED ARROW											107		A121					
YELLOW ARROW	126										108	108	A122					
GREEN ARROW	127										109	109	A123					

NU = Not Used  
 \* Denotes install load resistor. See load resistor installation detail this sheet.  
 \*\* Re-wire load switch S9 to flash concurrent with heads 81 and 82.

**INPUT FILE POSITION LAYOUT**

(front view)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I" U	FS	Ø 2	Ø 1	Ø 1	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
L	2A	1A	1B	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
FILE "J" U	FS	Ø 6	FS	FS	FS	Ø 8	FS	FS	FS	FS	FS	FS	FS	FS
L	2B	1A	NOT USED	FS	FS	8A	FS	FS	FS	FS	FS	FS	FS	FS
	6A	FS	FS	FS	FS	8B	FS	FS	FS	FS	FS	FS	FS	FS
	6B	FS	FS	FS	FS	8B	FS	FS	FS	FS	FS	FS	FS	FS

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

FS = FLASH SENSE  
 ST = STOP TIME

**OVERLAP PROGRAMMING DETAIL**

(program controller as shown below)

From Main Menu press '8' (Overlaps), then '1' (Vehicle Overlap Settings).

```

PAGE 1: VEHICLE OVERLAP 'A' SETTINGS
PHASE: |12345678910111213141516
VEH OVL PARENTS: |X      X
VEH OVL NOT VEH: |
VEH OVL NOT PED: |
VEH OVL GRN EXT: |
STARTUP COLOR:  - RED  - YELLOW  - GREEN
FLASH COLORS:   - RED  - YELLOW  - GREEN
SELECT VEHICLE OVERLAP OPTIONS: (Y/N)
FLASH YELLOW IN CONTROLLER FLASH?...N
GREEN EXTENSION (0-255 SEC).....0
YELLOW CLEAR (0=PARENT,3-25.5 SEC)...0.0
RED CLEAR (0=PARENT,0.1-25.5 SEC)...0.0
OUTPUT AS PHASE # (0=NONE, 1-16)....0
    
```

OVERLAP PROGRAMMING COMPLETE

**BACK-UP PROTECTION PROGRAMMING DETAIL**

(program controller as shown below)

1. From Main Menu press '2' (Phase Control), then '1' (Phase Control Functions). Scroll to the bottom of the menu and enable Dynamic/Backup Control Function 1.
2. From Phase Control Functions Menu press '2' (Dynamic/Backup Control Functions).

```

DYNAMIC/BACKUP CONTROL FUNCTION #01
OVERLAPS: |ABCDEFHIJKLMNPO
IF OVERLAPS ARE ACTIVE |
OR PHASES: |12345678910111213141516
IF PHASES ARE ON |X
OMIT PHASES |X
CALL PHASES |X
    
```

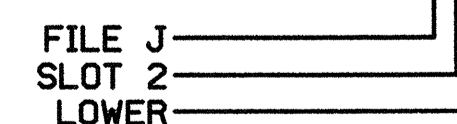
BACKUP PROTECTION PROGRAMMING COMPLETE

**INPUT FILE CONNECTION & PROGRAMMING CHART**

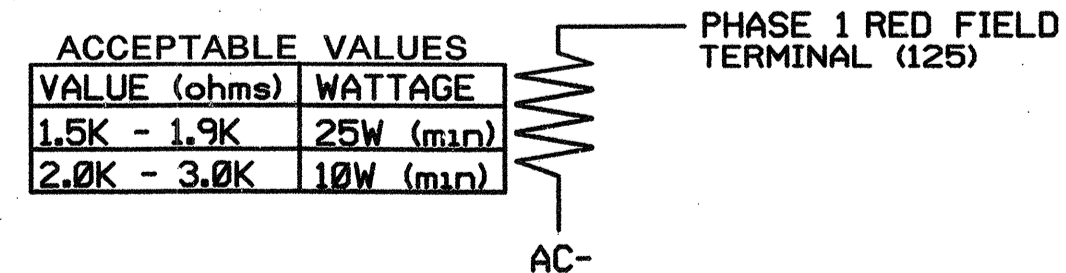
LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT ASSIGNMENT NO.	DETECTOR NO.	NEMA PHASE	CALL	EXTEND	FULL TIME DELAY	STRETCH TIME	DELAY TIME
2A	TB2-5,6	I2U	39	1	2	2	Y	Y			
2B	TB2-7,8	I2L	43	5	12	2	Y	Y			
1A <sup>1</sup>	TB2-9,10	I3U	63	25	32	1	Y	Y			15
	TB2-11,12	I3L	76	38	42	6	Y	Y	Y		3
1B	TB4-1,2	I4U	47	9	22	1	Y	Y			15
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			

<sup>1</sup>ADD JUMPERS FROM TB2-9 TO TB2-11, AND FROM TB2-10 TO TB2-12.

**INPUT FILE POSITION LEGEND: J2L**



**LOAD RESISTOR INSTALLATION DETAIL**



NOTE: The purpose of this resistor is to load the channel red monitor input 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.

New Installation

ELECTRICAL AND PROGRAMMING DETAILS FOR:

NC 55 at Hopson Road Extension

Division 5 Durham County RTP

PLAN DATE: May 2007 REVIEWED BY: N.M. Rodevick

PREPARED BY: T.R. Terrell REVIEWED BY: H.L. Winstead

REVISIONS: INIT. DATE

SIGNATURE: *Natasha M. Rodevick* DATE: 5-30-07

SEAL

SIG. INVENTORY NO. 05-2261

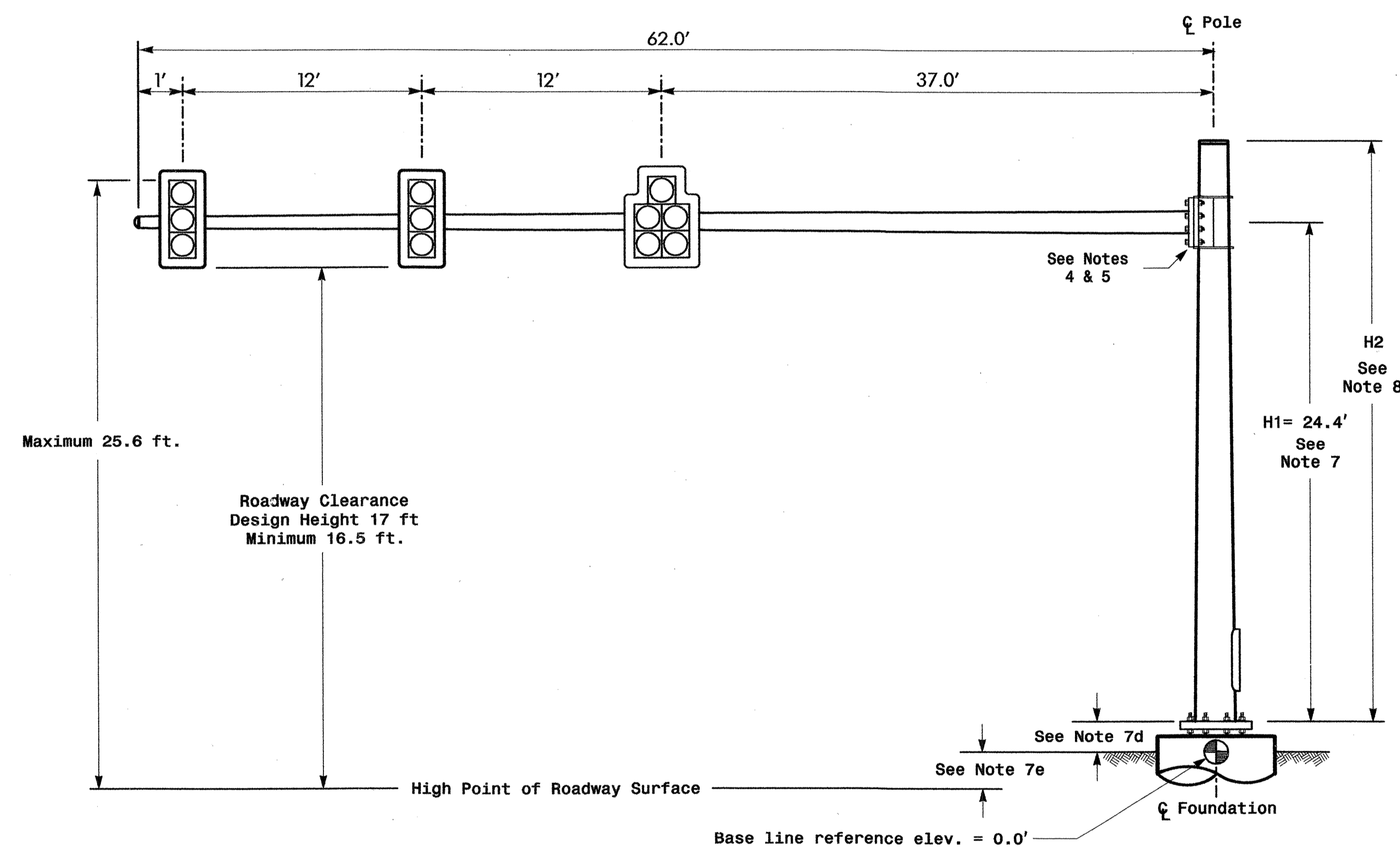


**SPECIAL NOTE**  
 The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available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

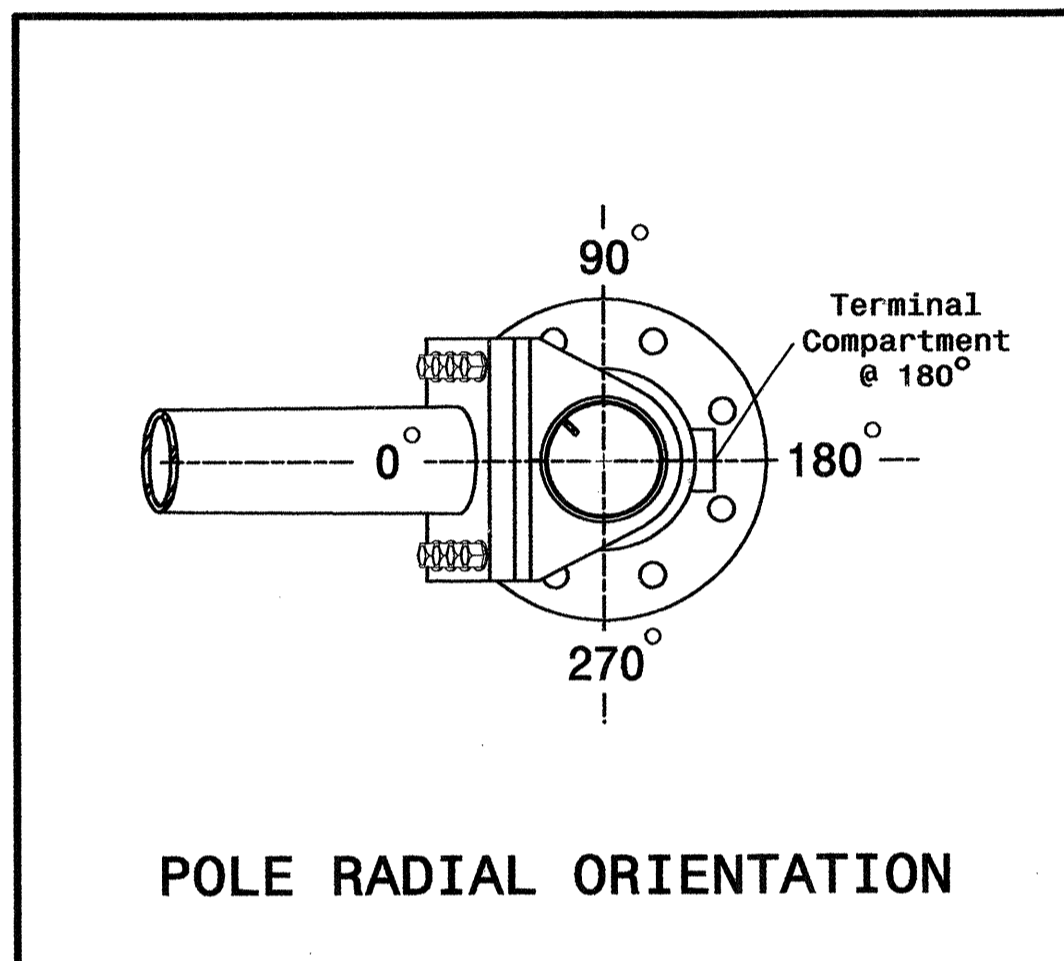
Elevation Data for Mast Arm Attachment (H1)	
Elevation Differences for:	Pole 7
Baseline reference point at $\phi$ Foundation @ ground level	0.0 ft.
Elevation difference at High point of roadway surface	5.8 ft.
Elevation difference at Edge of travelway or face of curb	4.7 ft.

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
	STREET NAME SIGN RIGID MOUNTED WITH ASTRO-SIGN-BRAC	12.0 S.F.	18.0" W X 96.0" L	27 LBS

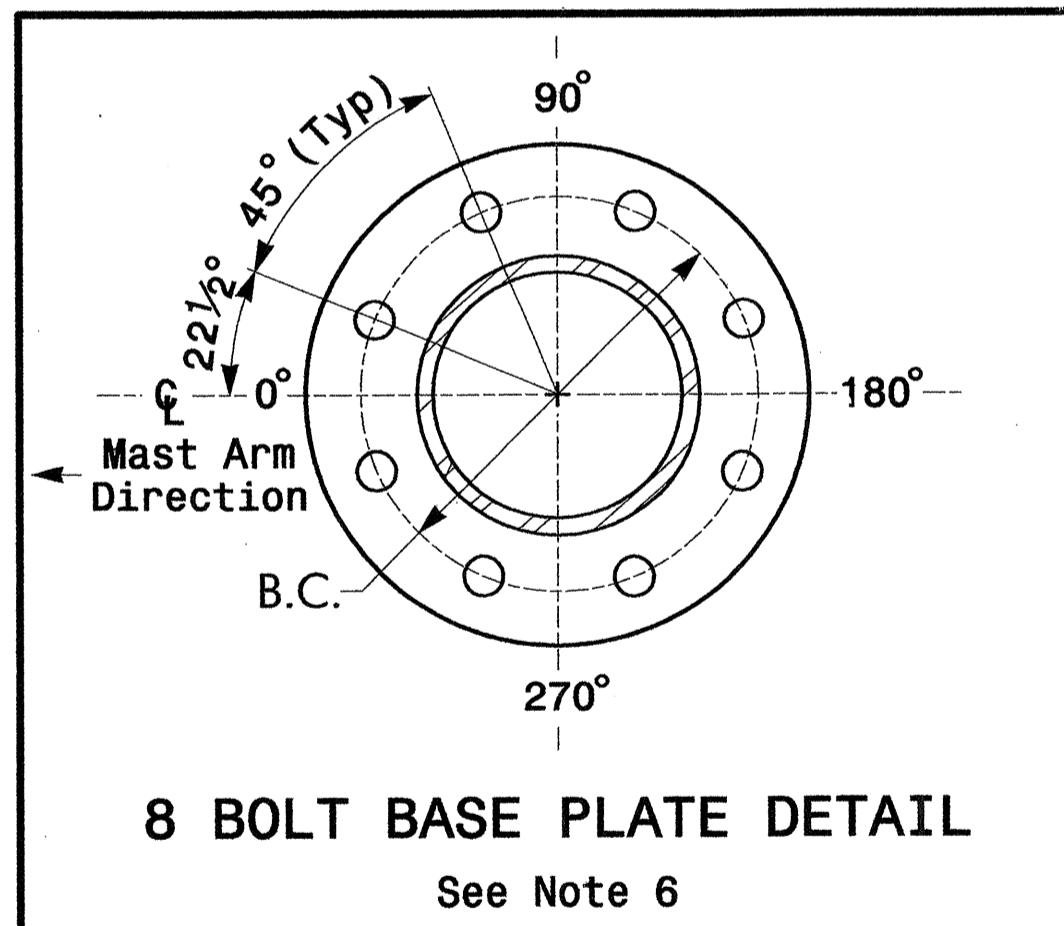
**Design Loading for METAL POLE NO. 7**



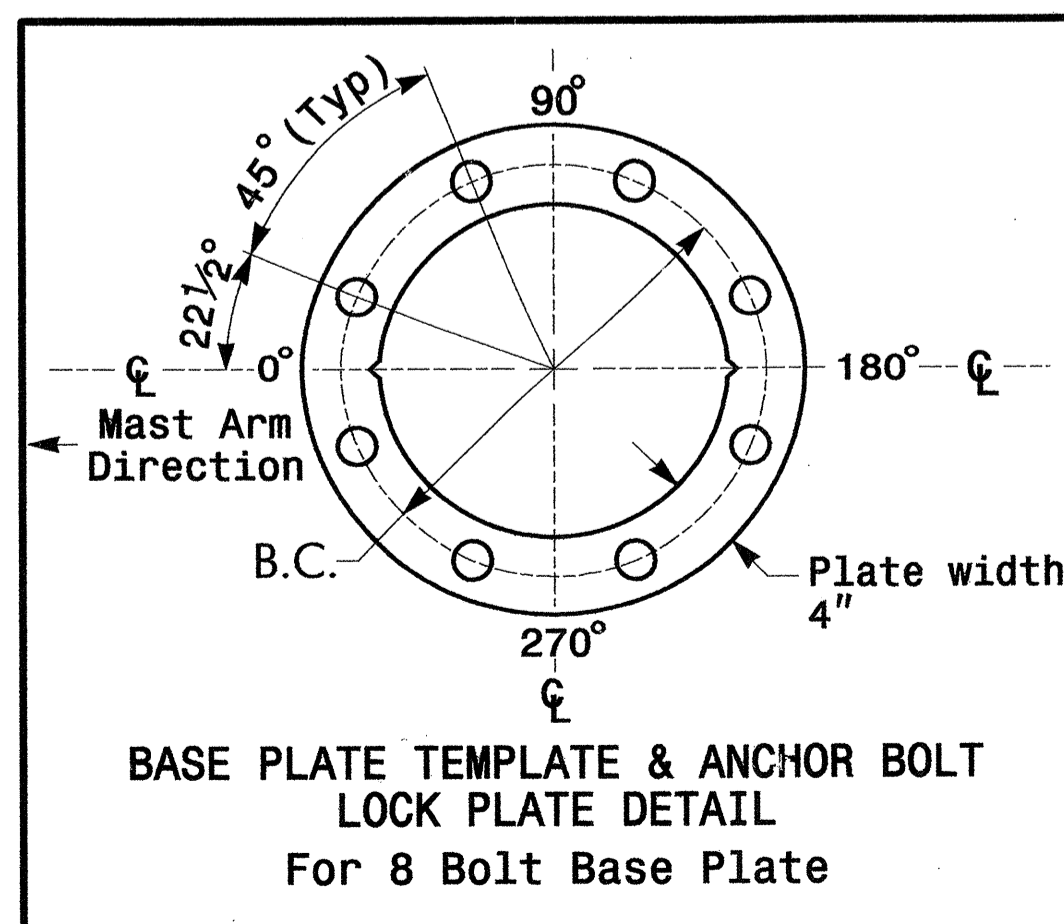
**Elevation View**



**POLE RADIAL ORIENTATION**



**8 BOLT BASE PLATE DETAIL**



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

**NOTES**

**Design Reference Material**

- Design the traffic signal structure and foundation in accordance with:
  - The 4th Edition 2001 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
  - The 2006 NCDOT "Standard Specifications for Roads and Structures". The latest addenda to these specifications can be found in the traffic signal project special provisions.
  - The 2006 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.htm>

**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.
- The camber design for mast arm deflection should provide an appearance of a low pitched arch where the tip or the free end of the mast arm does not deflect below horizontal when fully loaded.
- 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 is a high strength connection. Use Direct Tension Indicators (ASTM F959) for each bolt.
- The mast arm attachment height (H1) shown is based on the following design assumptions:
  - Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
  - 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.
- The pole manufacturer will determine the total height (H2) of each pole using the greater of the following:
  - Mast arm attachment height (H1) plus 2 feet, or
  - H1 plus 1/2 of the total height of the mast arm attachment assembly plus 1 foot.
- 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 Signals & Geometrics Structural Engineer for assistance at (919) 733-3915.
- 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)

PO BOX 30128 TELE 919.788.0224  
 RALEIGH, NC 27622 FAX 919.788.0232

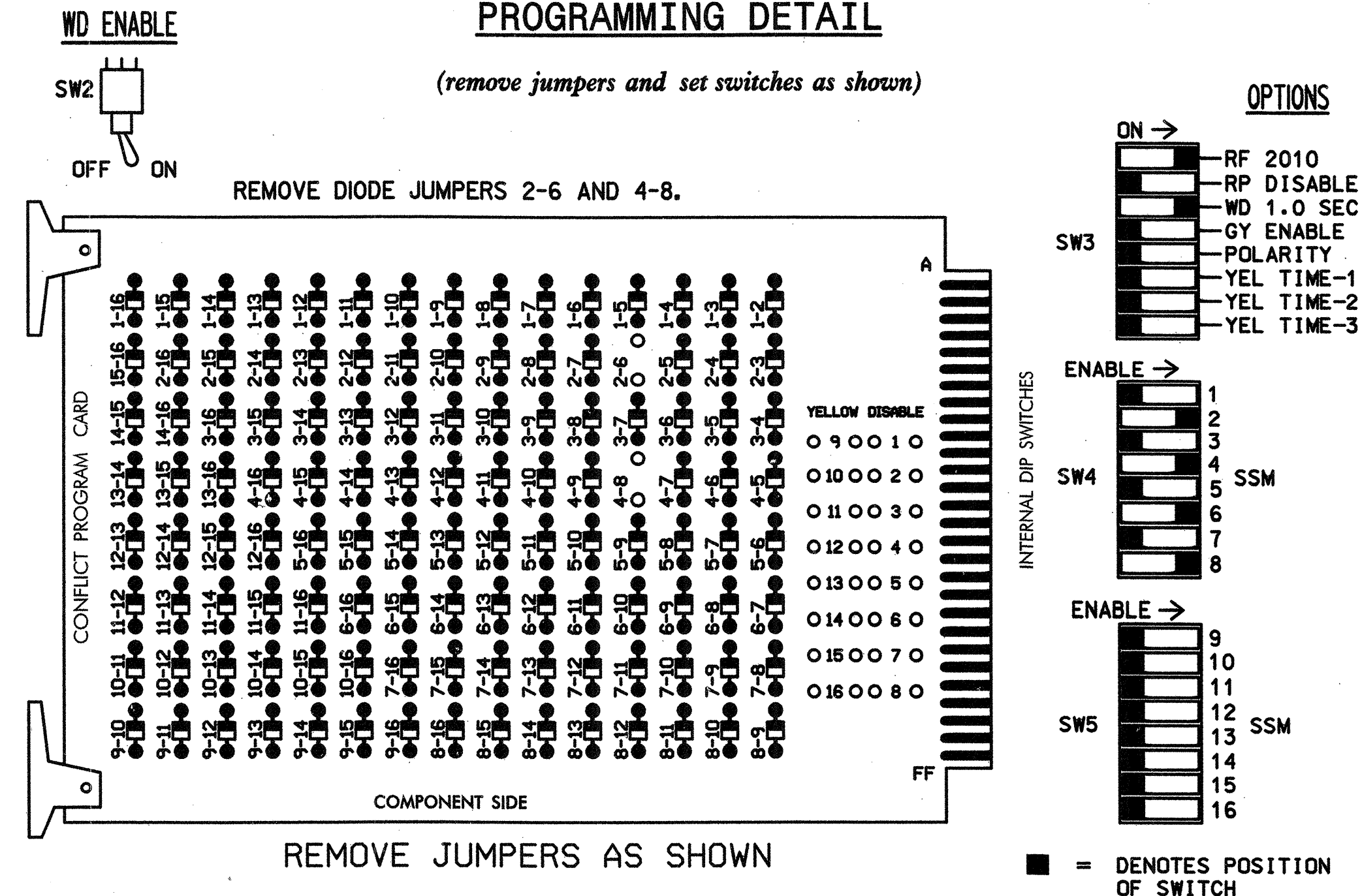
	<b>NC 55</b> at <b>Hopson Road Extension</b>	
	Division 5 Durham County RTP	
Prepared in the Offices of:  122 N. McDowell St., Raleigh, NC 27603	PREPARED BY: K. Bisby SCALE: N/A	REVIEWED BY: T. Hepler DATE:
SCALE: N/A	REVISIONS:	SIGNATURE:  DATE:
SIG. INVENTORY NO. 05-2261		SEAL

5/21/2007 10:48:48 PM Y:\BHE\RTF\ASIG\sig\metr\pole.nc 85 GT-Hobson.dgn



EDI MODEL 2010ECL CONFLICT MONITOR

PROGRAMMING DETAIL



NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Make sure jumpers SEL1-SEL5 are present on the monitor board.

NOTES

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.
2. Ensure that Red Enable is active at all times during normal operation. To prevent Red Failures on unused monitor channels, tie unused red monitor inputs 1,3,5,7, 9,10,11,12,13,14,15 & 16 to load switch AC+ per the cabinet manufacturer's instructions.
3. Program phases 2 and 6, on the controller unit, for Start Up In Green.
4. Enable Simultaneous Gap-Out, on the controller unit, for all phases.
5. Program phases 4 and 8, on the controller unit, for Dual Entry.
6. Program phases 2 and 6, on the controller unit, for Variable Initial and Gap Reduction.

FIELD CONNECTION HOOK-UP CHART

LOAD SWITCH NO.	S1	S2	S2P	S3	S4	S4P	S5	S6	S6P	S7	S8	S8P
PHASE	1	2	2 PED	3	4	4 PED	5	6	6 PED	7	8	8 PED
SIGNAL HEAD NO.	NU	21,22 23	NU	NU	41,42	NU	NU	61,62 63	NU	NU	81,82 83	NU
RED		128			101			134			107	
YELLOW		129			102			135			108	
GREEN		130			103			136			109	
RED ARROW												
YELLOW ARROW												
GREEN ARROW												
PEDESTRIAN												
BIAS												

NU = Not Used

EQUIPMENT INFORMATION

CONTROLLER.....CONTRACTOR SUPPLIED 2070L  
 CABINET.....CONTRACTOR SUPPLIED 332  
 SOFTWARE.....ECONOLITE OASIS  
 CABINET MOUNT.....BASE  
 OUTPUT FILE POSITIONS...12  
 LOAD SWITCHES USED.....S2,S4,S6,S8  
 PHASES USED.....2,4,6,8  
 OVERLAPS.....NONE

INPUT FILE POSITION LAYOUT

(front view)

FILE	1	2	3	4	5	6	7	8	9	10	11	12	13	14
U	FS	∅ 2	∅ 2	FS	FS	∅ 4	∅ 4	FS	FS	FS	FS	FS	FS	FS
I	2A	2C	NOT USED	FS	FS	∅ 4	∅ 4	FS	FS	FS	FS	FS	FS	FS
L	2B	NOT USED	FS	FS	∅ 4	∅ 4	FS	FS	FS	FS	FS	FS	FS	FS
U	FS	∅ 6	∅ 6	FS	∅ 8	∅ 8	∅ 8	∅ 8	FS	FS	FS	FS	FS	FS
J	6A	6C	NOT USED	FS	NOT USED	∅ 8	∅ 8	NOT USED	FS	FS	FS	FS	FS	FS
L	6B	NOT USED	FS	NOT USED	∅ 8	∅ 8	NOT USED	FS	FS	FS	FS	FS	FS	FS

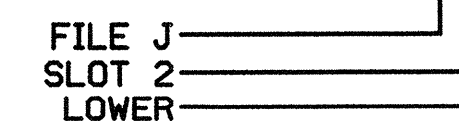
EX. : 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE  
 ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT 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			
2C	TB2-9,10	I3U	63	25	32	2	Y	Y	Y		3
4A	TB4-9,10	I6U	41	3	4	4	Y	Y			
4B	TB4-11,12	I6L	45	7	14	4	Y	Y			
4C	TB6-1,2	I7U	65	27	34	4	Y	Y	Y	2	5
4D	TB6-3,4	I7L	78	40	44	4	Y	Y			30
6A	TB3-5,6	J2U	40	2	6	6	Y	Y			
6B	TB3-7,8	J2L	44	6	16	6	Y	Y			
6C	TB3-9,10	J3U	64	26	36	6	Y	Y	Y		3
8A	TB5-5,6	J5U	57	19	7	8		Y			
8B	TB5-9,10	J6U	42	4	8	8		Y			
8C	TB5-11,12	J6L	46	8	18	8	Y	Y			
8D	TB7-1,2	J7U	66	28	38	8	Y	Y	Y	2	5
8E	TB7-3,4	J7L	79	41	48	8	Y	Y	Y	2	5
8F	TB7-5,6	J8U	50	12	28	8	Y	Y			30

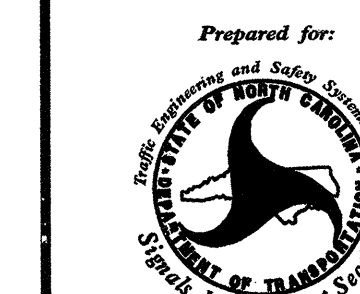
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THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 05-2262  
 DESIGNED: March 2007  
 SEALED: 05-22-07  
 REVISED:

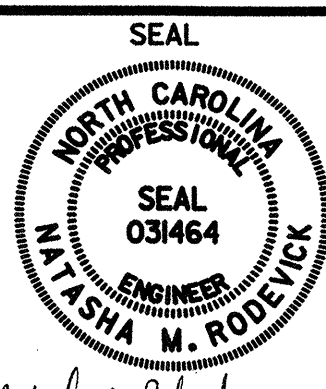
New Installation

ELECTRICAL AND PROGRAMMING DETAILS FOR:



122 N. McDowell St., Raleigh, NC 27603

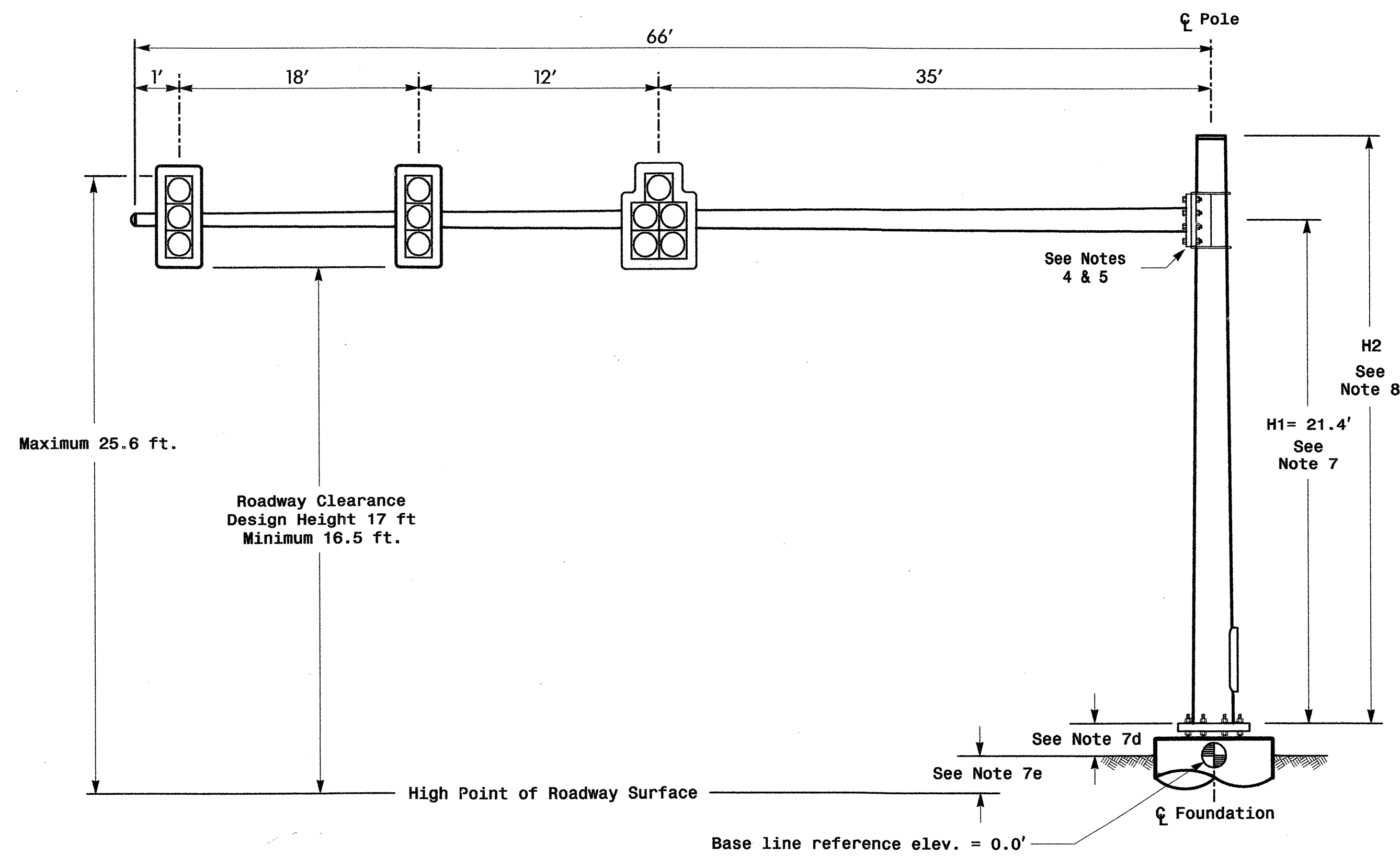
Prepared for:		Hopson Rd Extension at Louis Stephens Drive	
Division 5		Durham County RTP	
PLAN DATE: May 2007	REVIEWED BY: N.M. Rodevick		
PREPARED BY: T.R. Terrell	REVIEWED BY: H.L. Winstead		
REVISIONS	INIT.	DATE	



SIGNATURE: N. M. Rodevick DATE: 5-22-07  
 SIG. INVENTORY NO. 05-2262

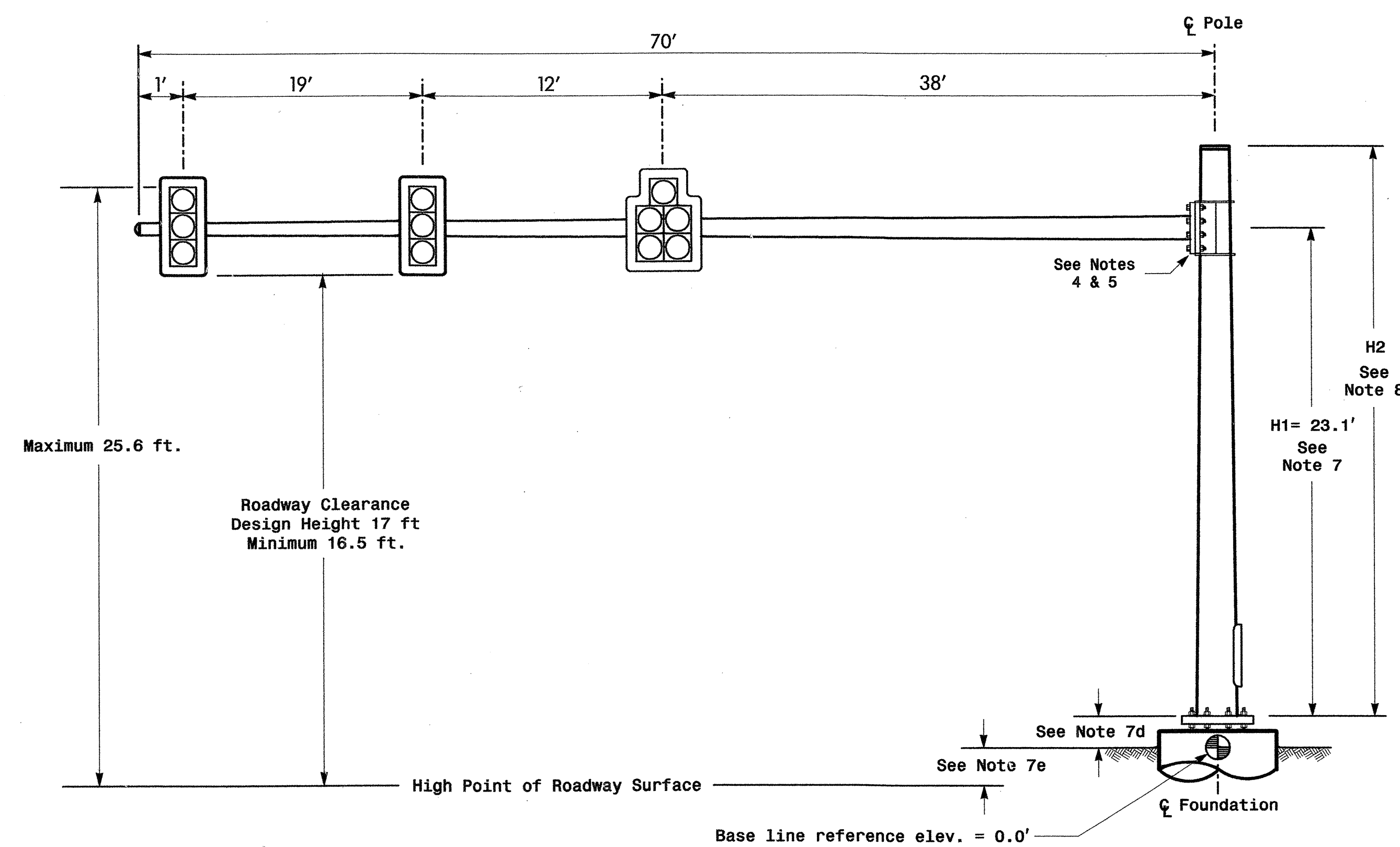
**HNTB** HNTB NORTH CAROLINA, P.C.  
 343 E. Six Forks Road, Suite 200  
 Raleigh, North Carolina 27609

Design Loading for METAL POLE NO. 1



Elevation View

Design Loading for METAL POLE NO. 2



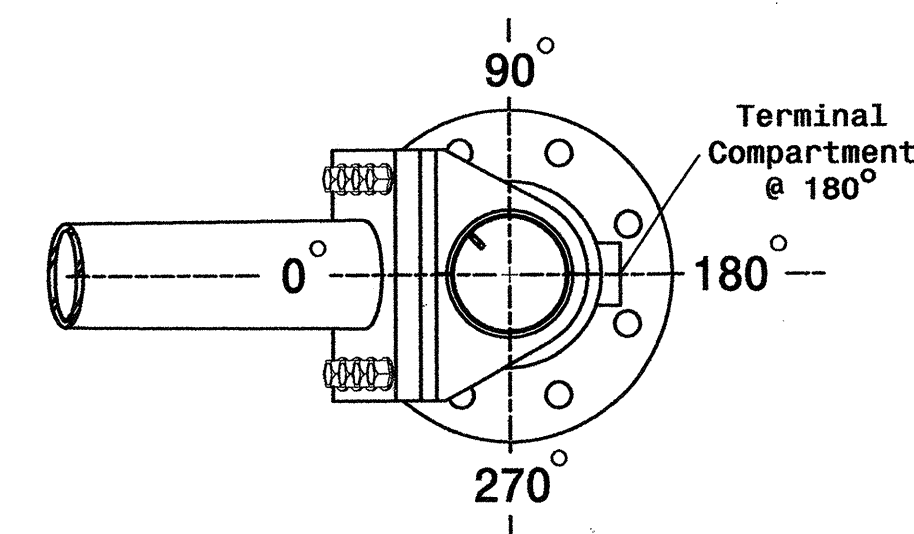
Elevation View

SPECIAL NOTE

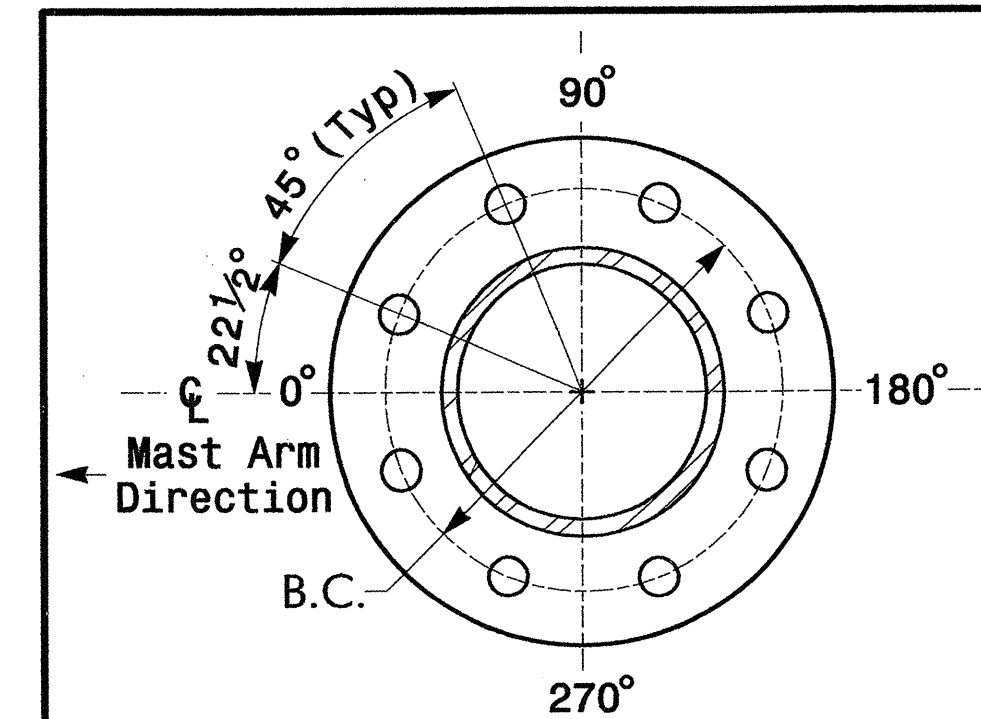
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

Elevation Differences for:	Pole 1	Pole 2
Baseline reference point at Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	2.8 ft.	4.5 ft.
Elevation difference at Edge of travelway or face of curb	2.8 ft.	4.5 ft.

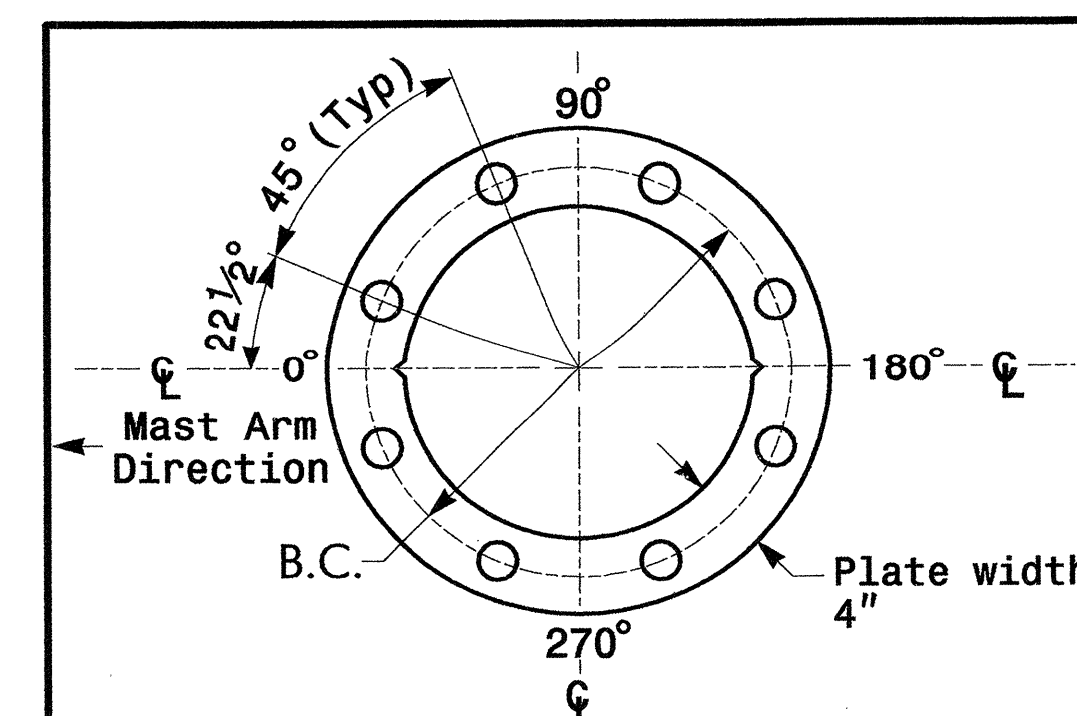


POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL

See Note 6



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

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	SIGNAL HEAD 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
	STREET NAME SIGN RIGID MOUNTED WITH ASTRO-SIGN-BRAC	12.0 S.F.	18.0" W X 96.0" L	27 LBS

NOTES

Design Reference Material

- Design the traffic signal structure and foundation in accordance with:
  - The 4th Edition 2001 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
  - The 2006 NCDOT "Standard Specifications for Roads and Structures". The latest addenda to these specifications can be found in the traffic signal project special provisions.
  - The 2006 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.htm>

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.
- The camber design for mast arm deflection should provide an appearance of a low pitched arch where the tip or the free end of the mast arm does not deflect below horizontal when fully loaded.
- 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 is a high strength connection. Use Direct Tension Indicators (ASTM F959) for each bolt.
- 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:
  - Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
  - 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.
- The pole manufacturer will determine the total height (H2) of each pole using the greater of the following:
  - Mast arm attachment height (H1) plus 2 feet, or
  - H1 plus 1/2 of the total height of the mast arm attachment assembly plus 1 foot.
- 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 Signals & Geometrics Structural Engineer for assistance at (919) 733-3915.
- 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.



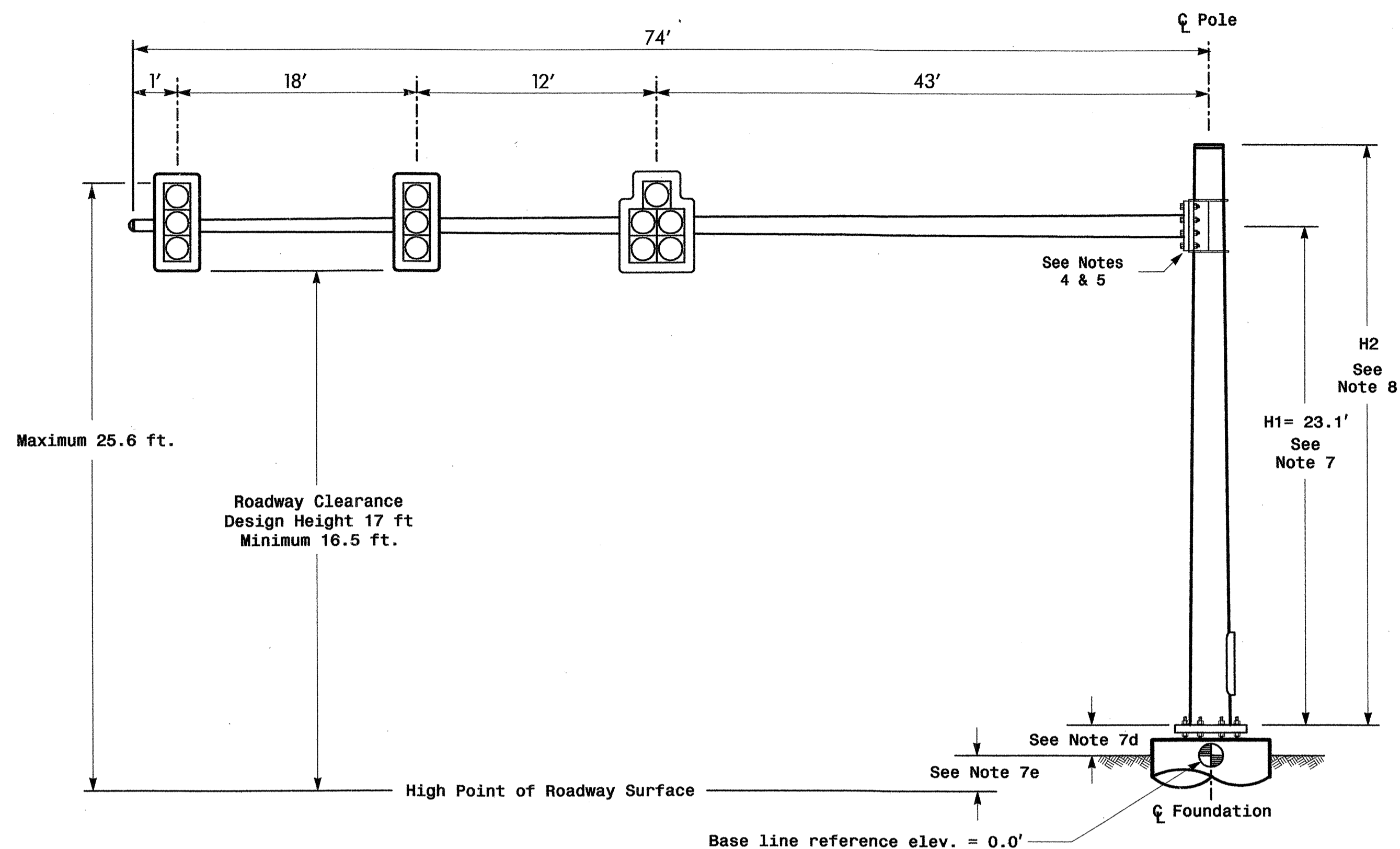
PO BOX 30128 RALEIGH, NC 27622 TELE 919.788.0224 FAX 919.788.0232

NCDOT Wind Zone 4 (90 mph)

	Prepared in the Offices of: Hopson Road Extension at Louis Stephens Drive		
	Division 5 Durham County RTP PLAN DATE: March 2007 PREPARED BY: K. Bisby	REVIEWED BY: T. Hepler REVIEWED BY:	
REVISIONS:		INIT. DATE	SIGNATURE: <i>Thomas R. Hepler</i> DATE: 5/21/07
SIG. INVENTORY NO. 05-2262			

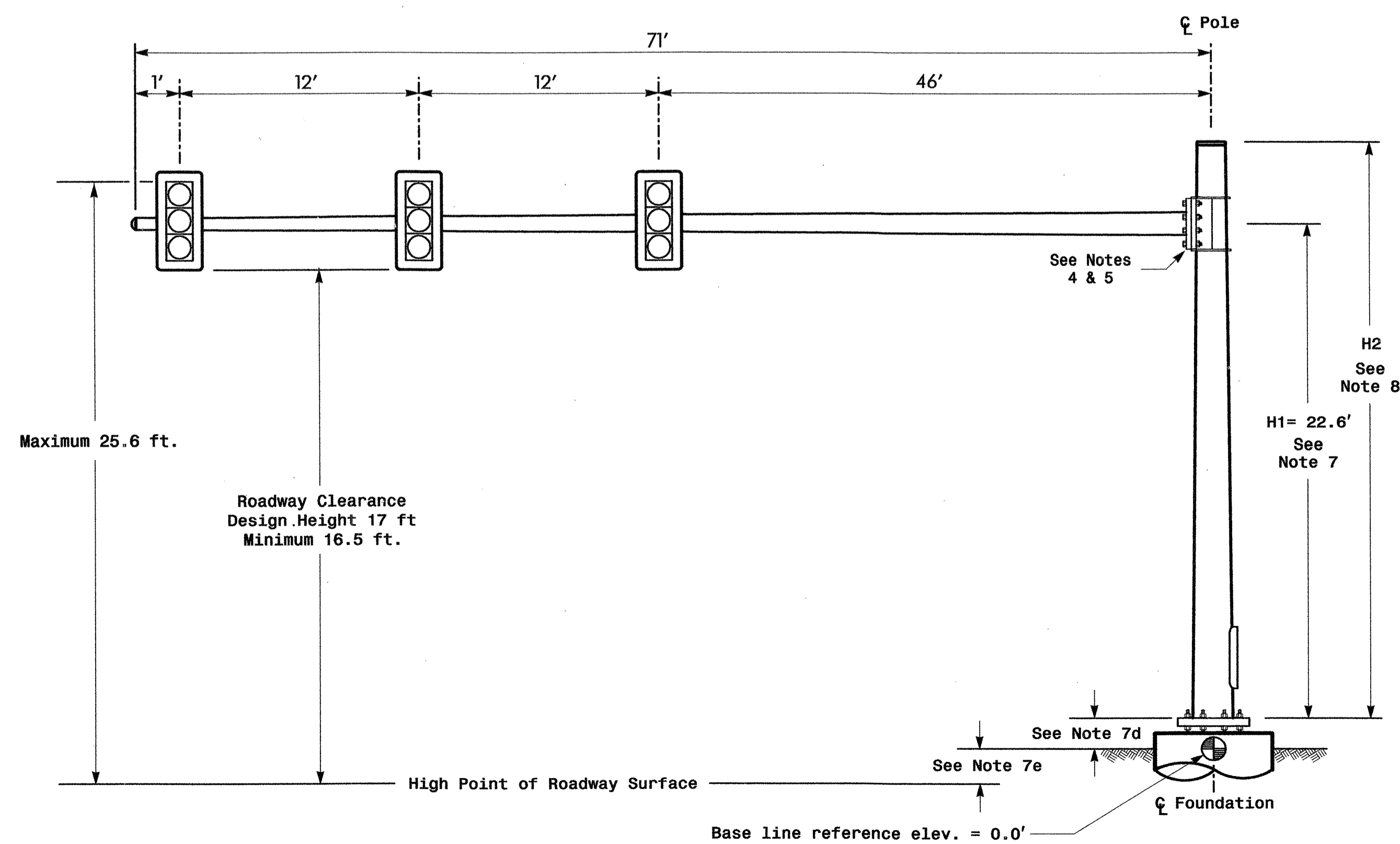


Design Loading for METAL POLE NO. 3



Elevation View

Design Loading for METAL POLE NO. 4

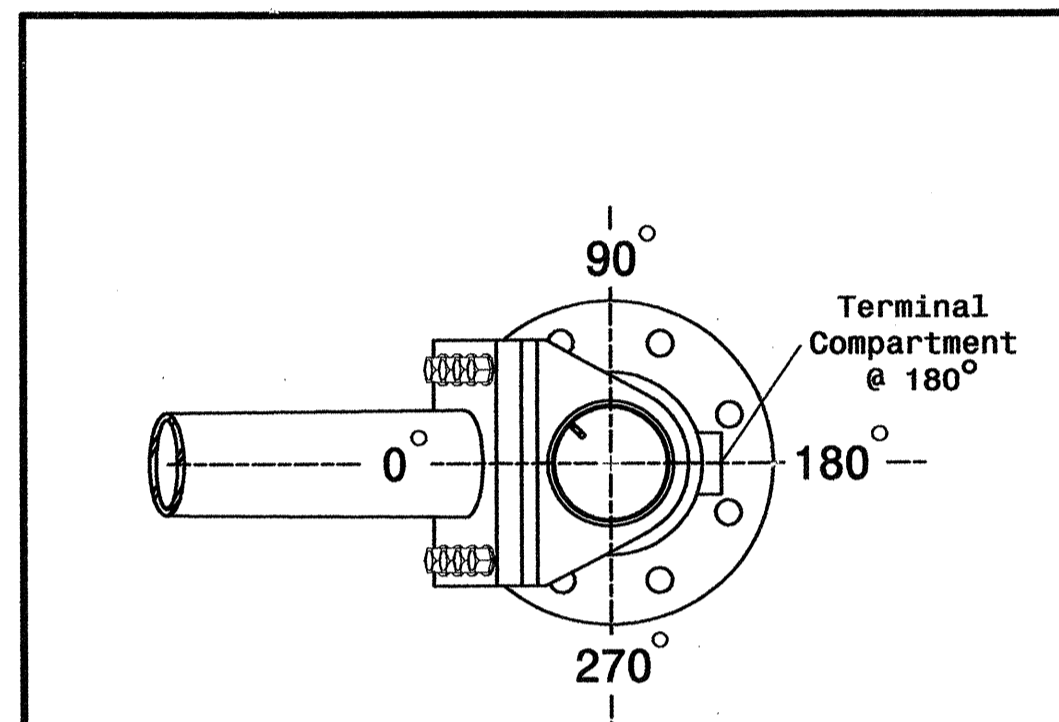


Elevation View

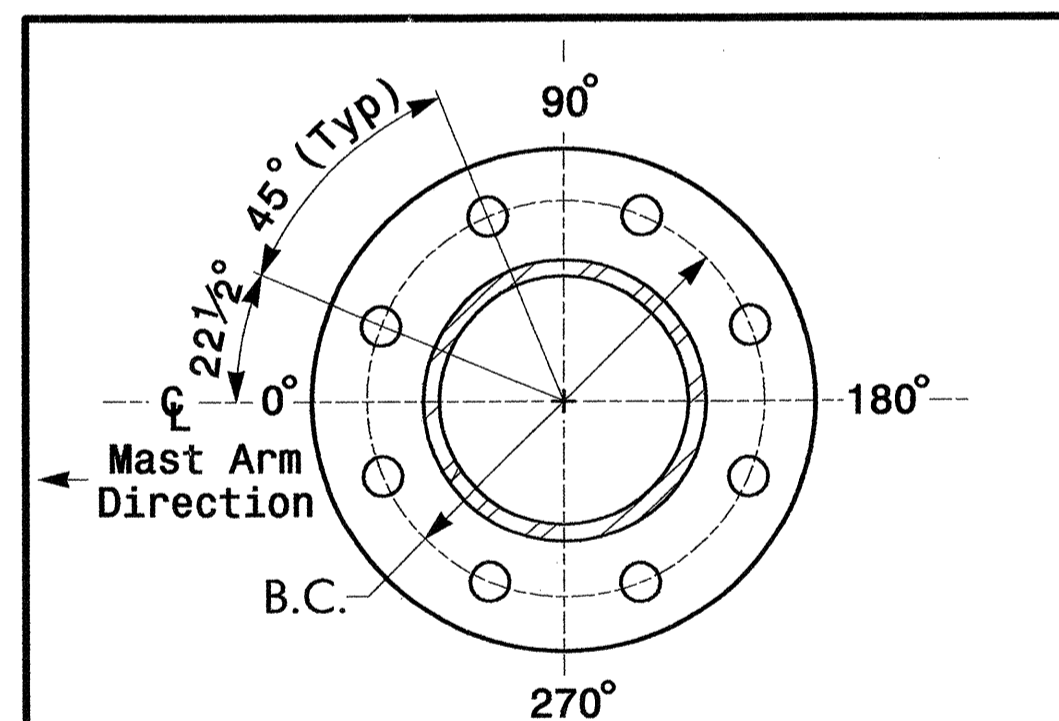
**SPECIAL NOTE**  
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available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

**Elevation Data for Mast Arm Attachment (H1)**

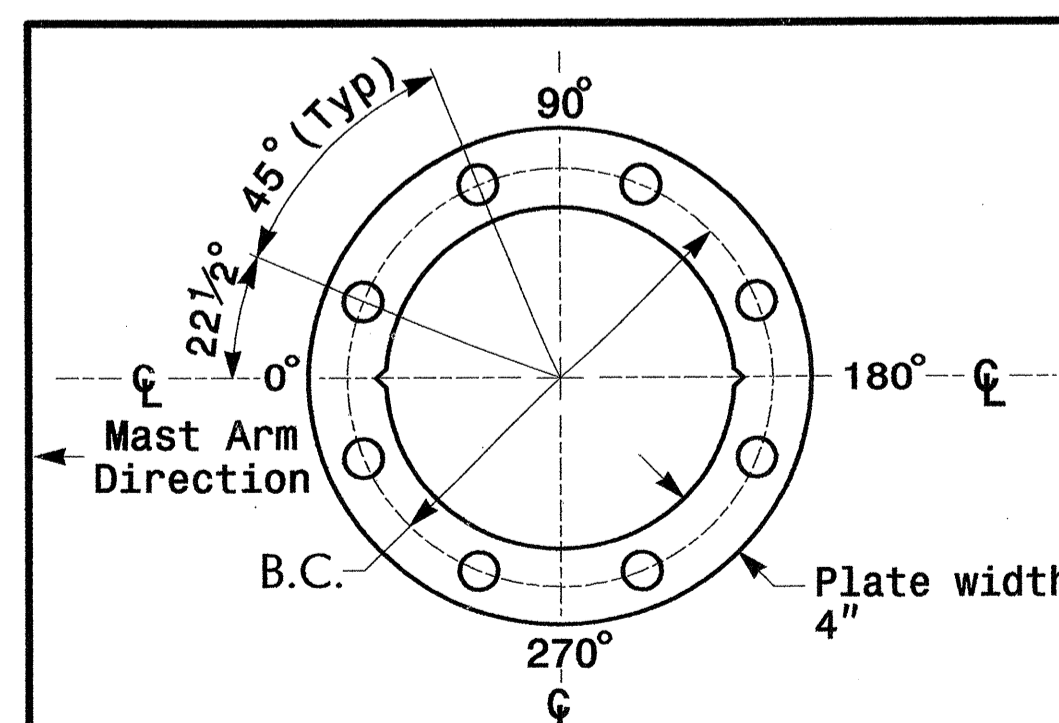
Elevation Differences for:	Pole 3	Pole 4
Baseline reference point at $\odot$ Foundation @ ground level	0.0 ft.	0.0 ft.
Elevation difference at High point of roadway surface	4.5 ft.	4.0 ft.
Elevation difference at Edge of travelway or face of curb	3.4 ft.	2.8 ft.



POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL  
See Note 6



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

MAST ARM LOADING SCHEDULE

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- The mast arm attachment height (H1) shown is based on the following design assumptions:
  - Mast arm slope and deflection are not considered in determining the arm attachment height as they are assumed to offset each other.
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  - 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.
- The pole manufacturer will determine the total height (H2) of each pole using the greater of the following:
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PO BOX 30128 TELE 919.788.0224  
RALEIGH, NC 27622 FAX 919.788.0232

NCDOT Wind Zone 4 (90 mph)

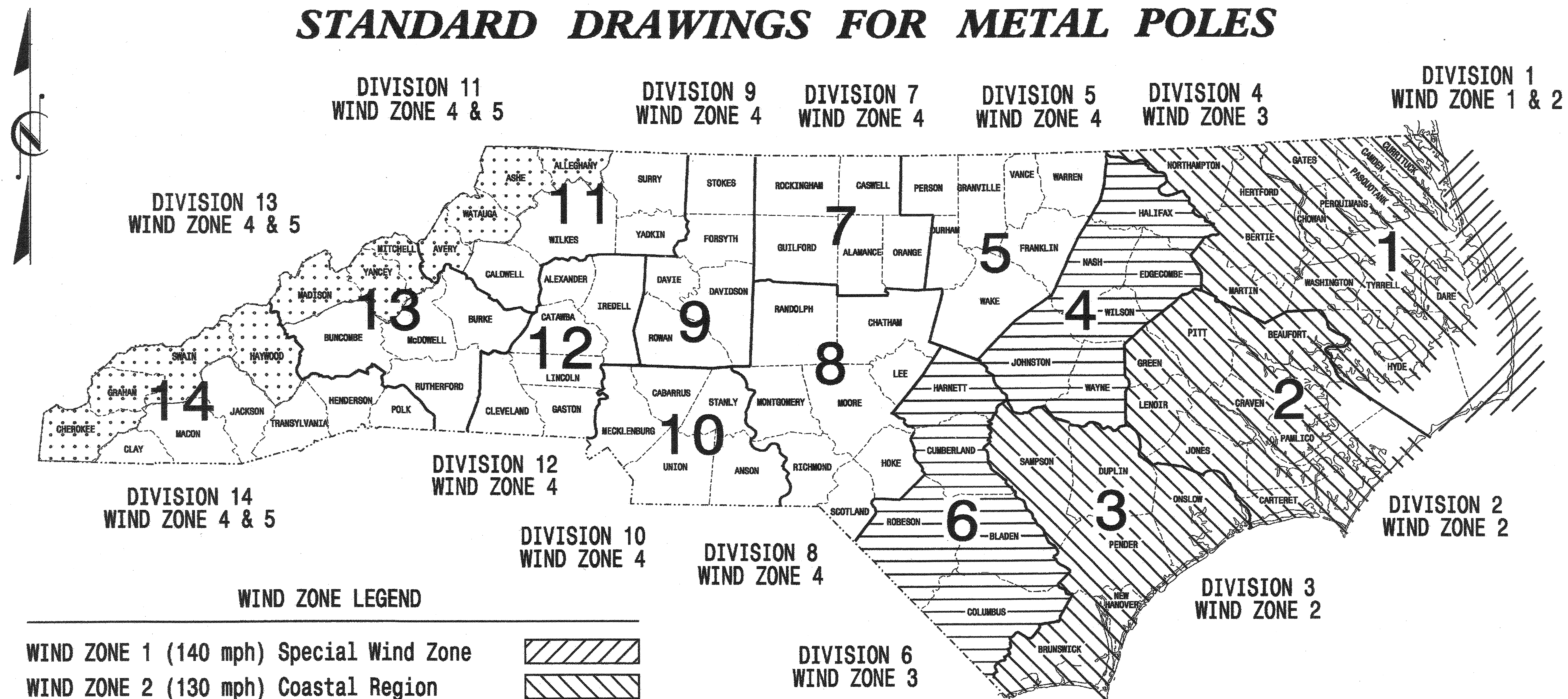
	<p>Hopson Road Extension at Louis Stephens Drive</p>		
	<p>Division 5 Durham County RTP</p>	<p>PLANNING DATE: March 2007 REVIEWED BY: T. Hepler</p>	
<p>SCALE: 0 N/A</p>		<p>REVISIONS:</p>	
<p>INIT. DATE</p>		<p>SIGNATURE DATE</p>	
<p>SIG. INVENTORY NO. 05-2262</p>			

5/21/2007 2:24:43 PM T:\BIRNIE\PROJECTS\ASIG\SIG\MetalPoles\Louis\_Stephens\_OT\_Hopson.dgn

# STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

STATE	PROJECT NO.	SHEET NO.
N.C.	U-4410DB	Sig. 10
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/tmsu/ws/default.htm>

Prepared in the Offices of:  
Traffic Engineering and Safety Systems Branch  
DEPARTMENT OF TRANSPORTATION  
Signals and Geometrics Section  
122 N. McDowell St., Raleigh, NC 27603

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

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:**  
**TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH**

G. A. Fuller, P.E. - State ITS and Signals Engineer  
 R. E. Mullinax, P.E. - Signals and Geometrics Engineer  
 P. L. Alexander, P.E. - Signals and Geometrics Special Projects Engineer  
 D. C. Sarkar, P.E. - Signals and Geometrics Structural Engineer  
 A. M. Esposito, P.E. - Signals and Geometrics Project Engineer  
 C. F. Andrews, Jr. - Signals and Geometrics Project Engineer

SEAL

D. C. Sarkar      9.2.2005  
 SIGNATURE      DATE







