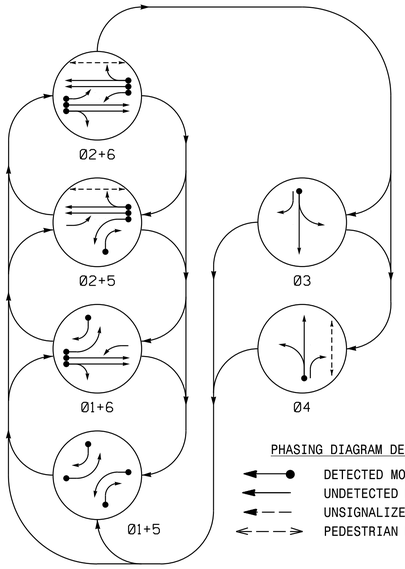
PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 8.7

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

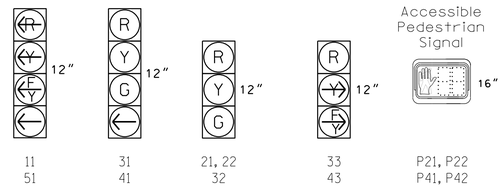
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 01+5	01+6	02+5	02+6	03	04	FLASH
11	←	←	F Y	F Y	R	R	Y
21, 22	R	R	G	G	R	R	Y
31	R	R	R	R	G ←	R	R
32	R	R	R	R	G	R	R
33	F Y →	F Y →	R	R	F Y →	R	R
41	R	R	R	R	R	G ←	R
42	R	R	R	R	R	G	R
43	F Y →	R	F Y →	R	R	F Y →	R
51	←	F Y	←	F Y	R	R	Y
61, 62	R	G	R	G	R	R	Y
P21, P22	DW	DW	W	W	DW	DW	DRK
P41, P42	DW	DW	DW	DW	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

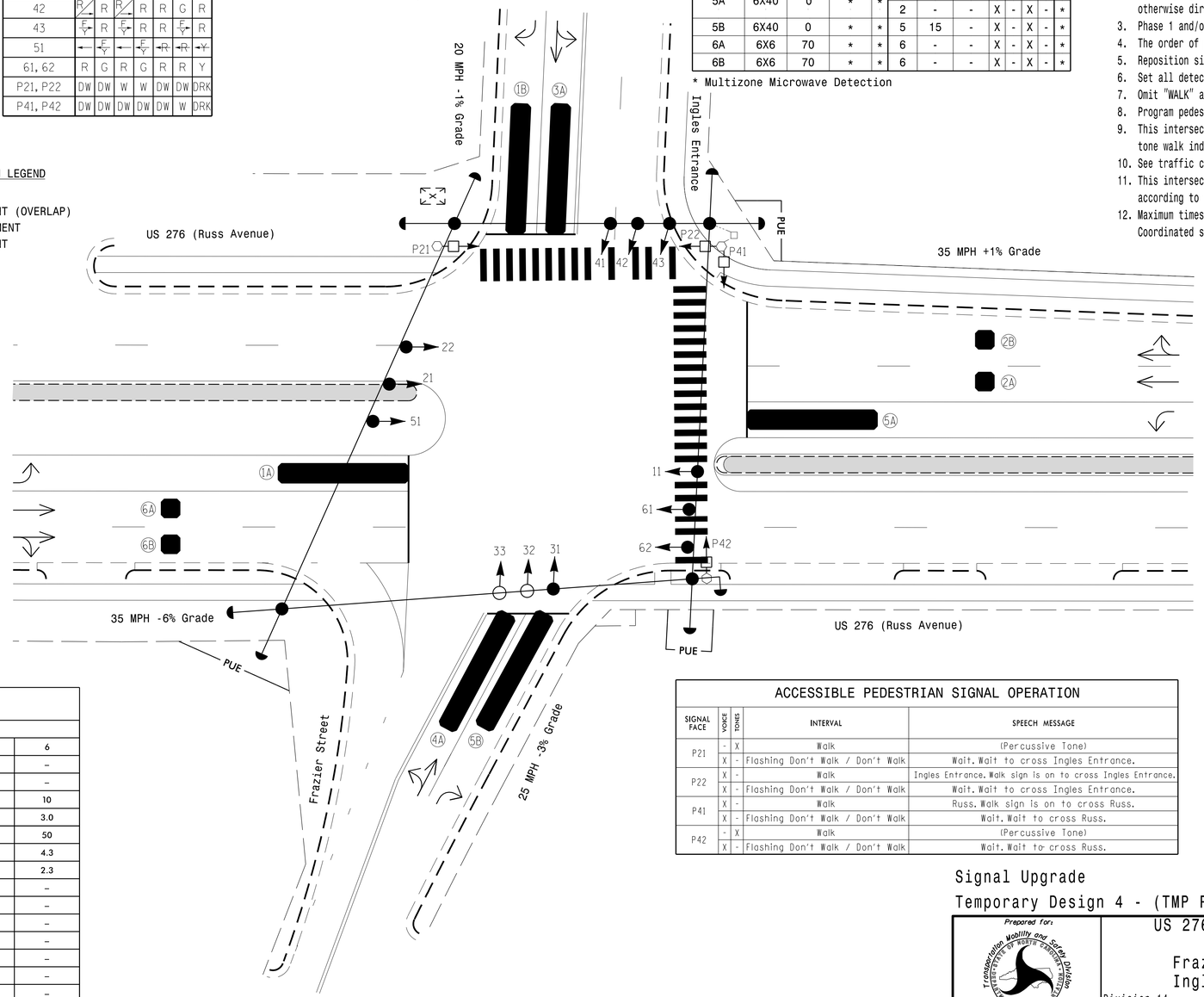
DETECTOR ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	PROGRAMMING CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	*	*	1	15	-	X	-	X	-	*
					6	-	-	X	-	X	-	*
2A	6X6	70	*	*	2	-	-	X	-	X	-	*
2B	6X6	70	*	*	2	-	-	X	-	X	-	*
3A	6X40	0	*	*	3	10	-	X	-	X	-	*
4A	6X40	0	*	*	4	3	-	X	-	X	-	*
5A	6X40	0	*	*	5	15	-	X	-	X	-	*
					2	-	-	X	-	X	-	*
5B	6X40	0	*	*	5	15	-	X	-	X	-	*
6A	6X6	70	*	*	6	-	-	X	-	X	-	*
6B	6X6	70	*	*	6	-	-	X	-	X	-	*

* Multizone Microwave Detection

6 Phase
Fully Actuated
D14-12_Waynesville

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 1 and/or phase 5 may be lagged.
4. The order of phase 3 and phase 4 may be reversed.
5. Reposition signal heads 21, 22, 31 and 51.
6. Set all detector units to presence mode.
7. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
8. Program pedestrian heads to countdown flashing "Don't Walk" time only.
9. This intersection features accessible pedestrian signals utilizing percussive tone walk indications and/or speech messages.
10. See traffic control plans for stop bar and crosswalk locations.
11. This intersection uses multizone microwave detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
12. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



ACCESSIBLE PEDESTRIAN SIGNAL OPERATION

SIGNAL FACE	VOICE	TONES	INTERVAL	SPEECH MESSAGE
P21	-	X	Walk	(Percussive Tone)
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Ingles Entrance.
P22	X	-	Walk	Ingles Entrance. Walk sign is on to cross Ingles Entrance.
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Ingles Entrance.
P41	X	-	Walk	Russ. Walk sign is on to cross Russ.
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Russ.
P42	-	X	Walk	(Percussive Tone)
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Russ.

LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Microwave Detection Zone	N/A
	Construction Zone	N/A
	Type II Signal Pedestal	
— PUE —	Proposed Utility Easement	N/A

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	7	–	7	–	–
Ped Clear *	–	17	–	24	–	–
Min Green	7	10	7	7	7	10
Passage *	2.0	3.0	2.0	2.0	2.0	3.0
Max 1 *	15	50	20	20	15	50
Yellow Change	3.1	4.3	3.0	3.3	3.0	4.3
Red Clear	2.9	2.3	3.4	2.9	3.1	2.3
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

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

Signal Upgrade
Temporary Design 4 - (TMP Phase III)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared for: Transportation Mobility and Safety Division, Signal Design Section, NC Department of Transportation

US 276 (Russ Avenue) at Frazier Street / Ingles Entrance

Division 14 Haywood County Waynesville

PLAN DATE: April 2023 REVIEWED BY: WJ Hamilton

PREPARED BY: TS Popelka RKA PROJ. NO.: 16085 (040)

SCALE 0 20 1"=20'

REVISIONS | INIT. | DATE

SEAL — North Carolina Professional Seal 32396 Engineer William J. Hamilton

DocuSigned by: William J. Hamilton — A0560D704684B4

SIGNATURE 04/11/2023 DATE

SIG. INVENTORY NO. I4-107574

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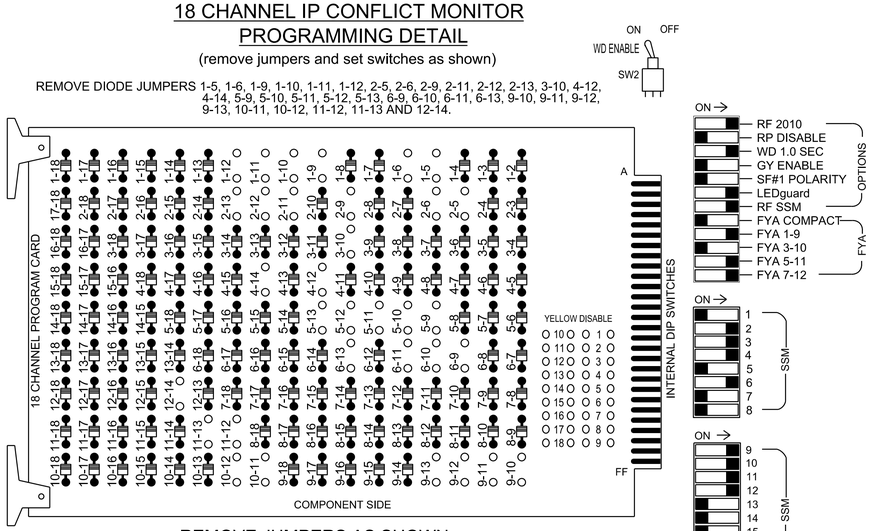
750 N.Greenfield Pkwy.Garner,NC 27529

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 8.8

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 1-5, 1-6, 1-9, 1-10, 1-11, 1-12, 2-5, 2-6, 2-9, 2-11, 2-12, 2-13, 3-10, 4-12, 4-14, 5-9, 5-10, 5-11, 5-12, 5-13, 6-9, 6-10, 6-11, 6-13, 9-10, 9-11, 9-12, 9-13, 10-11, 10-12, 11-12, 11-13 AND 12-14.



■ = DENOTES POSITION OF SWITCH

REMOVE JUMPERS AS SHOWN

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that the Red Enable is active at all times during normal operation.
4. Integrate monitor with Ethernet network in cabinet.

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 plan.
2. Program controller to start up in phase 2 Green Walk and 6 Green No Walk.
3. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
4. The cabinet and controller are part of the D14-12 Waynesville Signal System.

EQUIPMENT INFORMATION

Controller.....2070LX
Cabinet.....332 w/ Aux
Software.....Q-Free MAXTIME
Cabinet Mount.....Base
Output File Positions.....18 With Aux. Output File
Load Switches Used.....S1, S2, S3, S4, S5, S6, S7, S8, AUX S1, AUX S2, AUX S4, AUX S5
Phases Used.....1, 2, 2PED, 3, 4, 4PED, 5, 6
Overlap "1".....*
Overlap "2".....*
Overlap "3".....*
Overlap "4".....*

*See overlap programming detail on sheet 2

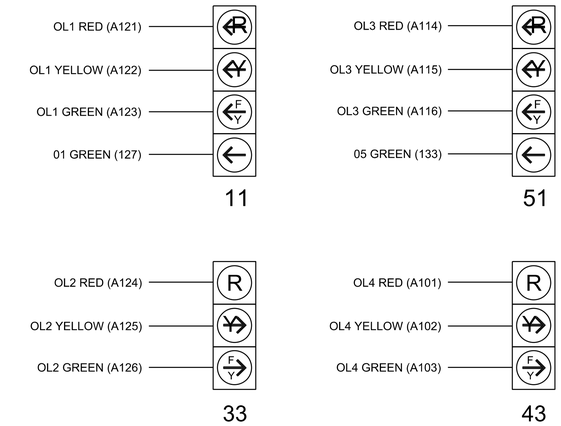
SIGNAL HEAD HOOK-UP CHART

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	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	11 ★	21,22	P21, P22	31	32	41	42	P41, P42	51 ★	61,62	NU	NU	NU	NU	11 ★	33 ★	NU	51 ★	43 ★	NU
RED		128		116	116	101	101			134						A124			A101	
YELLOW	*	129		117	117	102	102		*	135										
GREEN		130		118	118	103	103			136										
RED ARROW															A121			A114		
YELLOW ARROW															A122	A125		A115	A102	
FLASHING YELLOW ARROW															A123	A126		A116	A103	
GREEN ARROW	127			118		103			133											
✋			113					104												
🚶			115					106												

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

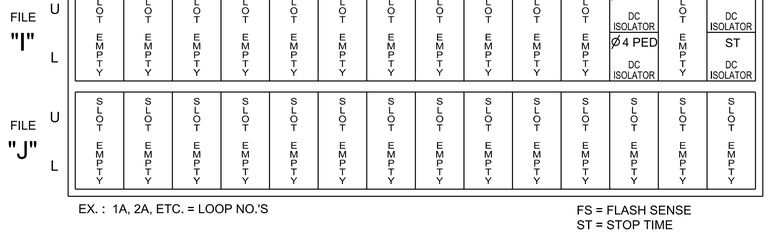
FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)



INPUT FILE POSITION LAYOUT

(front view)



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

FS = FLASH SENSE
ST = STOP TIME

SPECIAL DETECTOR NOTE

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

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
PED PUSH BUTTONS												
P21,P22	TB8-4,6	I12U	67	33	2	PED 2						
P41,P42	TB8-5,6	I12L	69	35	4	PED 4						

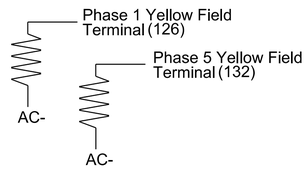
NOTE:
INSTALL DC ISOLATORS IN INPUT FILE SLOT I12.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown)

ACCEPTABLE VALUES	
Value (ohms)	Wattage
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-1075T4
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 1 of 2
Temporary Design 4 - (TMP Phase III)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 276 (Russ Avenue) at Frazier Street / Ingles Entrance

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO:	16085 (040)

REVISIONS	INIT.	DATE

Prepared for: NC Department of Transportation, Mobility and Safety Division, Traffic Engineering Branch, Signals Management Section

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SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

Document Signed by: William J. Hamilton
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SIGNATURE 04/11/2023 DATE

SIG. INVENTORY NO. 14-1075T4

4/12/2023
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User:JWendt

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 8.9

OVERLAP PROGRAMMING

Front Panel
Main Menu >Controller >Overlap >Overlap Parameters/Overlap Timings

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

Overlap	1	2	3	4
Type	FYA 4 - Section	FYA 4 - Section	FYA 4 - Section	FYA 4 - Section
Included Phases	2	1,3	6	4,5
Modifier Phases	1	1	5	-
Trail Green	0	0	0	0
Trail Yellow	0.0	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0	0.0

FLASHER CIRCUIT MODIFICATION DETAIL

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

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

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

COUNTDOWN PEDESTRIAN SIGNAL OPERATION

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

ACCESSIBLE PEDESTRIAN SIGNAL (APS) INSTALLATION NOTES

1. Install push buttons and APS equipment per manufacturer's instructions.
2. Provide a dedicated cable to each push button per manufacturer's instructions.
3. If APS equipment is mounted in cabinet, use filtered power (i.e., Controller Receptacle) to power APS equipment. Do not use Equipment Receptacle, which is a GFCI outlet.
4. Never attempt to operate a standard contact closure push button with the APS system unless cabinet is re-wired for standard button operation or unless explicitly allowed by the manufacturer.
5. Place manufacturer's instructions in cabinet with cabinet prints, signal plans, and electrical details.

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-1075T4
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 2 of 2
Temporary Design 4 - (TMP Phase III)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 276 (Russ Avenue)
at
Frazier Street /
Ingles Entrance

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO:	16085 (040)

REVISIONS	INIT.	DATE

Prepared for:
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Phone: 704-549-4260 | www.rameykemp.com | NC License No. F-1489

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

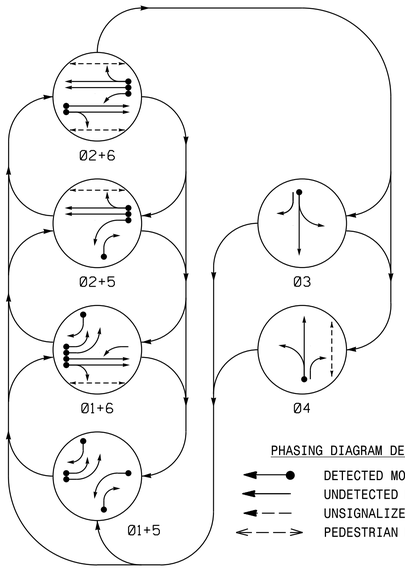
DocuSigned by: William J. Hamilton
A0560D704648484...
04/11/2023
SIGNATURE DATE

SIG. INVENTORY NO. 14-1075T4

4/12/2023
14-1075T4_sm_ele_2020mmdd.dgn
User:wendt

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 8.10

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

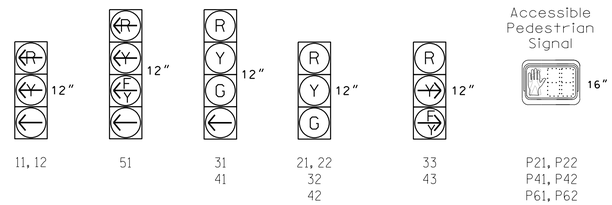
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 01+5	01+6	02+5	02+6	03	04	FLASH
11, 12	←	←	↑R	↑R	↑R	↑R	↑R
21, 22	R	R	G	G	R	R	Y
31	R	R	R	R	←G	R	R
32	R	R	R	R	G	R	R
33	←FY	←FY	R	R	←FY	R	R
41	R	R	R	R	R	←G	R
42	R	R	R	R	R	G	R
43	←FY	R	←FY	R	R	←FY	R
51	←	←FY	←	←FY	↑R	↑R	↑Y
61, 62	R	G	R	G	R	R	Y
P21, P22	DW	DW	W	W	DW	DW	DRK
P41, P42	DW	DW	DW	DW	DW	W	DRK
P61, P62	DW	W	DW	W	DW	DW	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



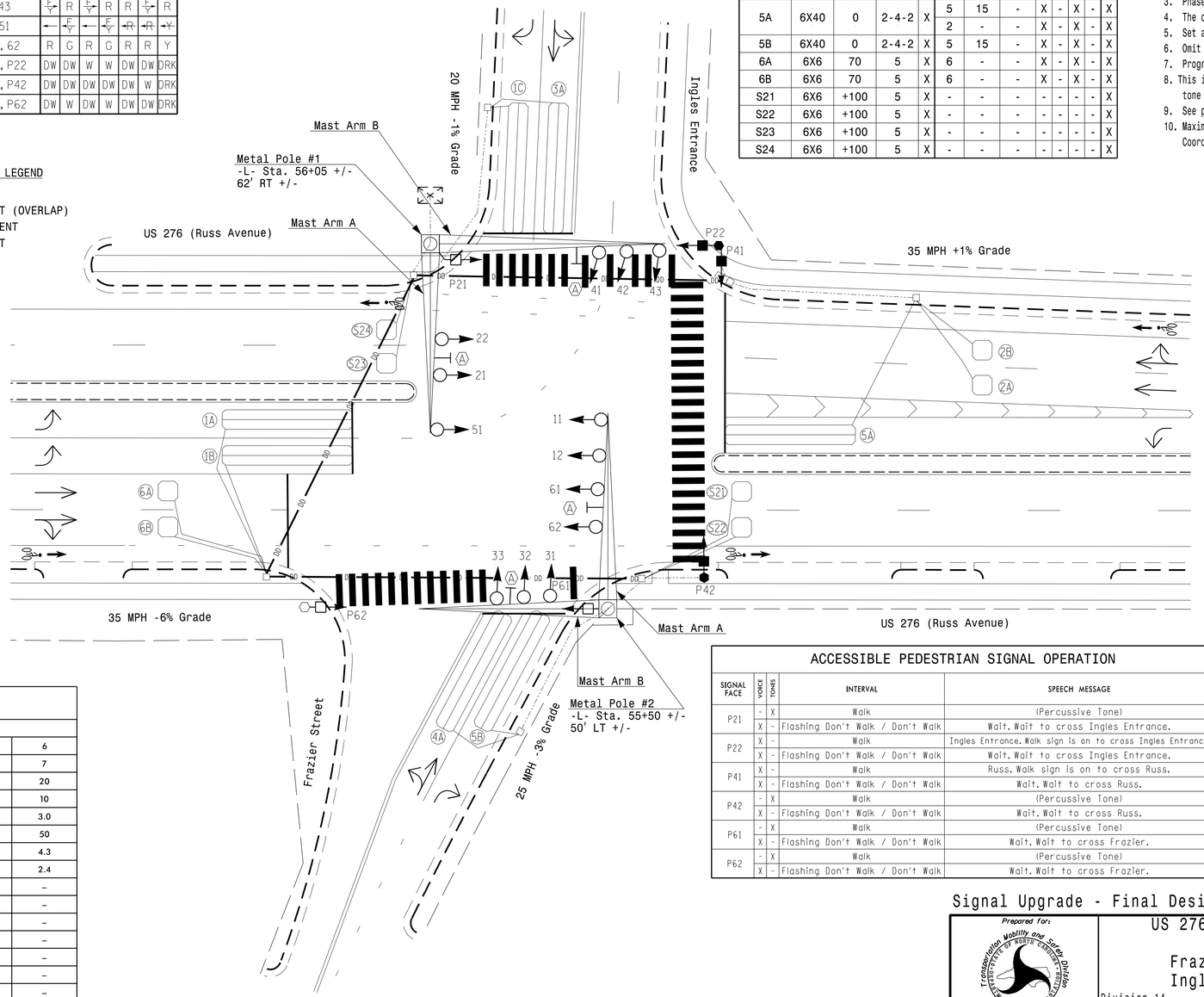
MAXTIME DETECTOR INSTALLATION CHART

DETECTOR					PROGRAMMING						
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	2-4-2	X	1	-	-	X -	X	-	X
1B	6X40	0	2-4-2	X	1	-	-	X -	X	-	X
1C	6X40	0	2-4-2	X	1	15	-	X -	X	-	X
2A	6X6	70	5	X	2	-	-	X -	X	-	X
2B	6X6	70	5	X	2	-	-	X -	X	-	X
3A	6X40	0	2-4-2	X	3	3	-	X -	X	-	X
4A	6X40	0	2-4-2	X	4	3	-	X -	X	-	X
5A	6X40	0	2-4-2	X	5	15	-	X -	X	-	X
					2	-	-	X -	X	-	X
5B	6X40	0	2-4-2	X	5	15	-	X -	X	-	X
6A	6X6	70	5	X	6	-	-	X -	X	-	X
6B	6X6	70	5	X	6	-	-	X -	X	-	X
S21	6X6	+100	5	X	-	-	-	- -	-	-	X
S22	6X6	+100	5	X	-	-	-	- -	-	-	X
S23	6X6	+100	5	X	-	-	-	- -	-	-	X
S24	6X6	+100	5	X	-	-	-	- -	-	-	X

6 Phase
Fully Actuated
D14-12_Waynesville

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 5 may be lagged.
4. The order of phase 3 and phase 4 may be reversed.
5. Set all detector units to presence mode.
6. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
7. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
8. This intersection features accessible pedestrian signals utilizing percussive tone walk indications and/or speech messages.
9. See pavement marking plans for stop bar and crosswalk locations.
10. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



ACCESSIBLE PEDESTRIAN SIGNAL OPERATION

SIGNAL FACE	VOICE	TONES	INTERVAL	SPEECH MESSAGE
P21	-	X	Walk	(Percussive Tone)
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Ingles Entrance.
P22	X	-	Walk	Ingles Entrance. Walk sign is on to cross Ingles Entrance.
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Ingles Entrance.
P41	X	-	Walk	Russ. Walk sign is on to cross Russ.
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Russ.
P42	-	X	Walk	(Percussive Tone)
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Russ.
P61	-	X	Walk	(Percussive Tone)
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Frazier.
P62	-	X	Walk	(Percussive Tone)
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Frazier.

LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
DD	Directional Drill	N/A
	Metal Pole with Mastarm	
	Type II Signal Pedestal	
A	Street Name Sign	A

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	7	–	7	–	7
Ped Clear *	–	18	–	24	–	20
Min Green	7	10	7	7	7	10
Passage *	2.0	3.0	2.0	2.0	2.0	3.0
Max 1 *	15	50	20	20	15	50
Yellow Change	3.1	3.8	3.0	3.3	3.0	4.3
Red Clear	3.3	2.1	3.4	2.9	2.9	2.4
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

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

Signal Upgrade - Final Design

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Phone: 704-545-4200 | www.rameykemp.com | NC License No. F-1409

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

US 276 (Russ Avenue)
at
Frazier Street /
Ingles Entrance

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO.:	16085 (040)

REVISIONS	INIT.	DATE

SCALE 0 20 1"=20'

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton
A05E0D7DAF6A4B4...
SIGNATURE 04/11/2023 DATE

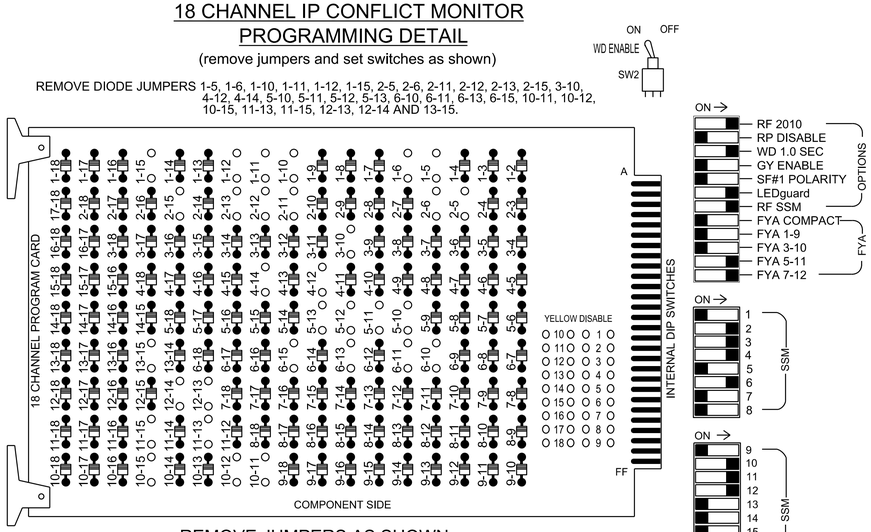
SIG. INVENTORY NO. 14-1075

4/12/2023
U-5839_sig_8.10_sig_dsn_2020mxds.dgn
User:JWendt

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 1-5, 1-6, 1-10, 1-11, 1-12, 1-15, 2-5, 2-6, 2-11, 2-12, 2-13, 2-15, 3-10, 4-12, 4-14, 5-10, 5-11, 5-12, 5-13, 6-10, 6-11, 6-13, 6-15, 10-11, 10-12, 10-15, 11-13, 11-15, 12-13, 12-14 AND 13-15.



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 the Red Enable is active at all times during normal operation.
4. Integrate monitor with Ethernet network in cabinet.

■ = 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 plan.
2. Program controller to start up in phase 2 Green Walk and 6 Green Walk.
3. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
4. The cabinet and controller are part of the D14-12 Waynesville Signal System.

EQUIPMENT INFORMATION

Controller.....2070LX
Cabinet.....332 w/ Aux
Software.....Q-Free MAXTIME
Cabinet Mount.....Base
Output File Positions.....18 With Aux. Output File
Load Switches Used.....S1, S2, S3, S4, S5, S6, S7, S8, AUX S2, AUX S4, AUX S5
Phases Used.....1, 2, 2PED, 3, 4, 4PED, 5, 6, 6PED
Overlap "1".....NOT USED
Overlap "2".....*
Overlap "3".....*
Overlap "4".....*

*See overlap programming detail on sheet 2

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 8.11

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	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	11,12	21,22	P21, P22	31	32	41	42	P41, P42	51 ★	61,62	P61, P62	NU	NU	NU	NU	33 ★	NU	51 ★	43 ★	NU
RED		128		116	116	101	101			134						A124			A101	
YELLOW		129		117	117	102	102		✱	135										
GREEN		130		118	118	103	103			136										
RED ARROW	125																	A114		
YELLOW ARROW	126															A125		A115	A102	
FLASHING YELLOW ARROW																A126		A116	A103	
GREEN ARROW	127			118		103			133											
✋			113					104			119									
🚶			115					106			121									

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

INPUT FILE CONNECTION & PROGRAMMING CHART

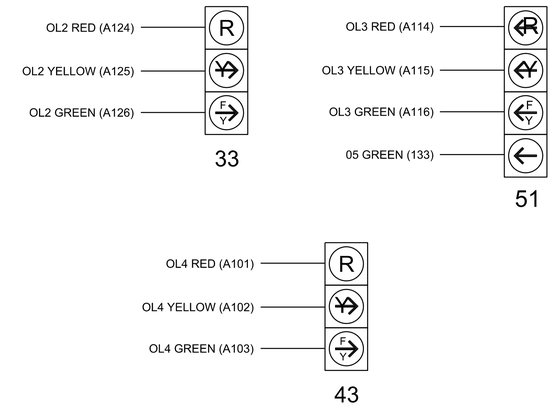
LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
1A	TB2-1,2	I1U	56	18	1	1			X		X	
1B	TB2-5,6	I2U	39	1	2	1			X		X	
1C	TB2-7,8	I2L	43	5	3	1	15		X		X	
2A	TB2-9,10	I3U	63	29	4	2			X		X	
2B	TB2-11,12	I3L	76	42	5	2			X		X	
3A	TB4-5,6	I5U	58	20	7	3	3		X		X	
4A	TB4-9,10	I6U	41	3	8	4	3		X		X	
*S21	TB6-9,10	I9U	60	22	13							
*S22	TB6-11,12	I9L	62	24	14							
5A	TB3-1,2	J1U	55	17	15	5	15		X		X	
				-	31	2			X		X	
5B	TB3-5,6	J2U	40	2	16	5	15		X		X	
6A	TB3-9,10	J3U	64	30	18	6			X		X	
6B	TB3-11,12	J3L	77	43	19	6			X		X	
*S23	TB7-9,10	J9U	59	21	27							
*S24	TB7-11,12	J9L	61	23	28							
PED PUSH BUTTONS												
P21,P22	TB8-4,6	I12U	67	33	2	PED 2						
P41,P42	TB8-5,6	I12L	69	35	4	PED 4						

NOTE: INSTALL DC ISOLATORS IN INPUT FILE SLOT I12.

*System detector only. Remove any assigned vehicle phase.

FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)



INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	1O	11	12	13	14
FILE "I"	U	Ø 1 1A	Ø 1 1B	Ø 2 2A	SLOT EMPTY	Ø 3 3A	Ø 4 4A	SLOT EMPTY	SLOT EMPTY	SYS. DET. S21	SLOT EMPTY	SLOT EMPTY	Ø 2 PED DC ISOLATOR	SLOT EMPTY	FS DC ISOLATOR
	L	NOT USED	Ø 1 1C	Ø 2 2B		NOT USED	NOT USED			SYS. DET. S22			Ø 4 PED DC ISOLATOR		ST DC ISOLATOR
FILE "J"	U	Ø 5 5A	Ø 5 5B	Ø 6 6A	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SYS. DET. S23	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L	NOT USED	NOT USED	Ø 6 6B						SYS. DET. S24					

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

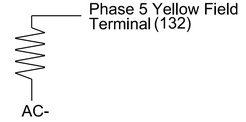
FS = FLASH SENSE
ST = STOP TIME

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

LOAD RESISTOR INSTALLATION DETAIL

(install resistor as shown)

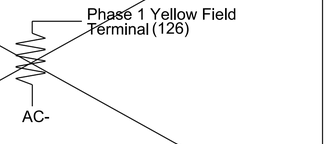
ACCEPTABLE VALUES	
Value (ohms)	Wattage
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



LOAD RESISTOR REMOVAL DETAIL

(remove resistor as shown)

ACCEPTABLE VALUES	
Value (ohms)	Wattage
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



REMOVE!

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-1075
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 1 of 2
Final Design

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 276 (Russ Avenue) at Frazier Street / Ingles Entrance

Division 14 Haywood County Waynesville

PLAN DATE: April 2023 | REVIEWED BY: WJ Hamilton
PREPARED BY: TS Popelka | RKA PROJ. NO: 16085 (040)

REVISIONS	INIT.	DATE

Prepared for: North Carolina Department of Transportation Mobility and Safety Division Traffic Engineering Branch Signals Management Section

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750 N.Greenfield Pkwy,Garner,NC 27529

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

Docusigned by: William J. Hamilton
A0560D704648484
SIGNATURE
04/11/2023
DATE

SIG. INVENTORY NO. 14-1075

4/12/2023
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User:Wendt

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 8.12

OVERLAP PROGRAMMING

Front Panel
Main Menu >Controller >Overlap >Overlap Parameters/Overlap Timings

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

Overlap	1	2	3	4
Type	Off	FYA 4 - Section	FYA 4 - Section	FYA 4 - Section
Included Phases	-	1,3	6	4,5
Modifier Phases	-	-	5	-
Trail Green	0	0	0	0
Trail Yellow	0.0	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0	0.0

ACCESSIBLE PEDESTRIAN SIGNAL (APS) INSTALLATION NOTES

1. Install push buttons and APS equipment per manufacturer's instructions.
2. Provide a dedicated cable to each push button per manufacturer's instructions.
3. If APS equipment is mounted in cabinet, use filtered power (i.e., Controller Receptacle) to power APS equipment. Do not use Equipment Receptacle, which is a GFCI outlet.
4. Never attempt to operate a standard contact closure push button with the APS system unless cabinet is re-wired for standard button operation or unless explicitly allowed by the manufacturer.
5. Place manufacturer's instructions in cabinet with cabinet prints, signal plans, and electrical details.

COUNTDOWN PEDESTRIAN SIGNAL OPERATION

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

FLASHER CIRCUIT MODIFICATION DETAIL

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

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

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

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-1075
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 2 of 2
Final Design

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 276 (Russ Avenue)
at
Frazier Street /
Ingles Entrance

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO:	16085 (040)

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton
A0560D7046484B4...
04/11/2023
SIGNATURE DATE

SIG. INVENTORY NO. 14-1075

Prepared for:
NC Department of Transportation Mobility and Safety Division Traffic Engineering Branch Signals Management Section

750 N.Greenfield Pkwy,Garner,NC 27529

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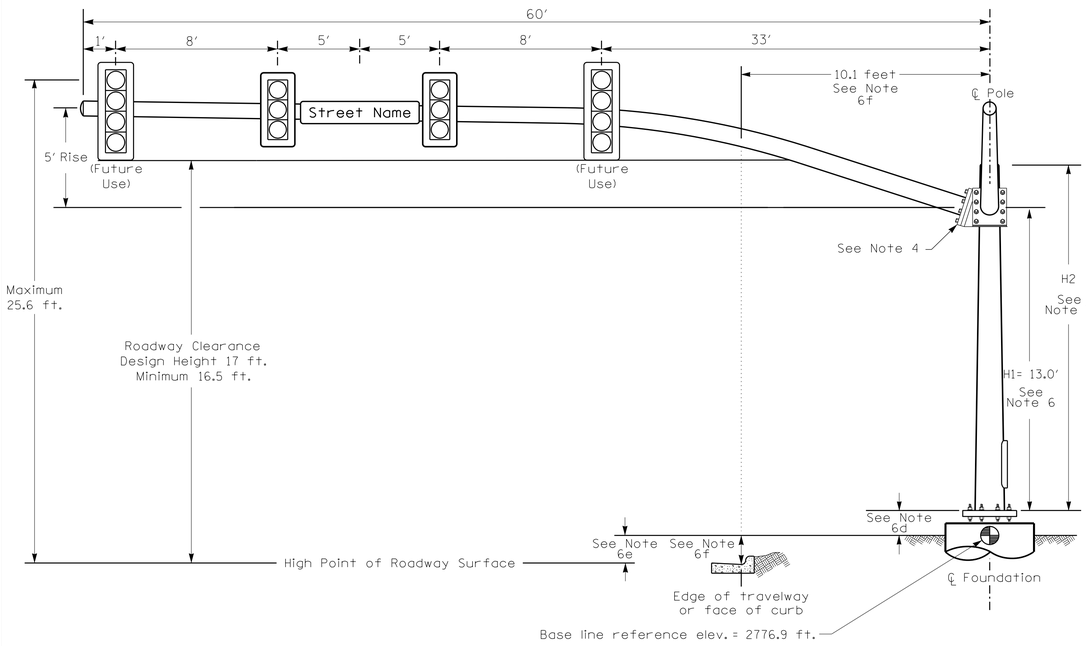
Phone: 704-549-4260 | www.rameykemp.com | NC License No. F-1489

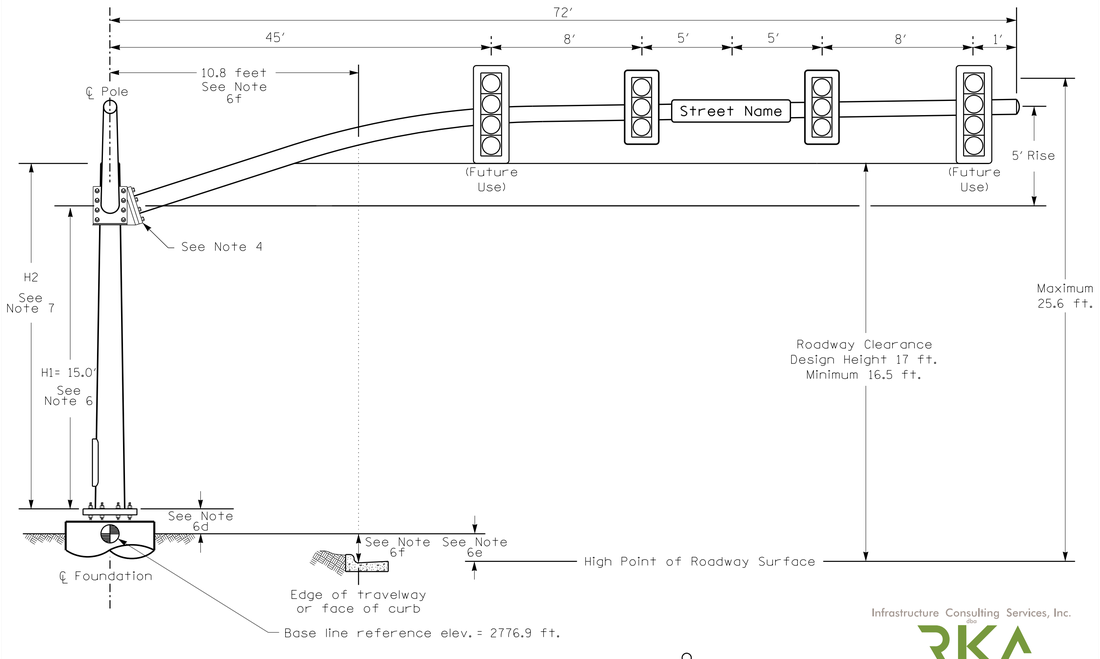
4/12/2023
16085_sm_ele_2020mod.dgn
User:mwindt

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°

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4/10/2023
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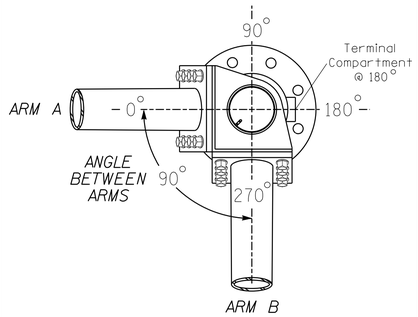
User:swilder

SPECIAL NOTE

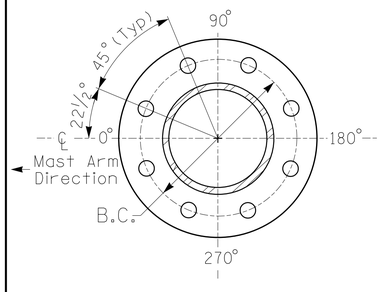
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

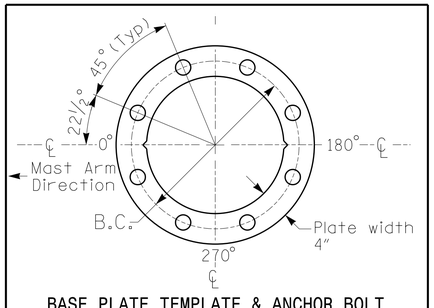
Elevation Differences for:	Arm A	Arm B
Baseline reference point at ℄ Foundation @ ground level ⊕	2776.9 ft.	2776.9 ft.
Elevation difference at High point of roadway surface	+2.0 ft.	+0.7 ft.
Elevation difference at Edge of travelway or face of curb	+0.6 ft.	-0.7 ft.



POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL



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

METAL POLE No. 1

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 8.13

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12″-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5″ W X 52.5″ L	60 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5″ W X 66.0″ L	74 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	12.0 S.F.	18.0″ W X 96.0″ L	27 LBS

NOTES

DESIGN REFERENCE MATERIAL

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

DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
6. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. 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.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
   f. Provide horizontal distance from the proposed centerline of the foundation to the edge of travelway. Refer to the Elevation Data Chart for elevation difference between the proposed foundation ground level and the edge of travelway. This information is necessary to ensure that the roadway clearance is maintained at the edge of the travelway and to aid in the camber design of the arm.
7. 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.
8. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
9. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
10. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

All metal poles and arms should be Hunter Green in color as specified in the project special provisions.

NCDOT Wind Zone 5 (120 mph)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared for: Transportation Mobility and Safety Division, North Carolina Department of Transportation, Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

US 276 (Russ Avenue) at Frazier Street / Ingles Entrance

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	REVIEWED BY:	16085 (040)

SCALE: 0 N/A N/A

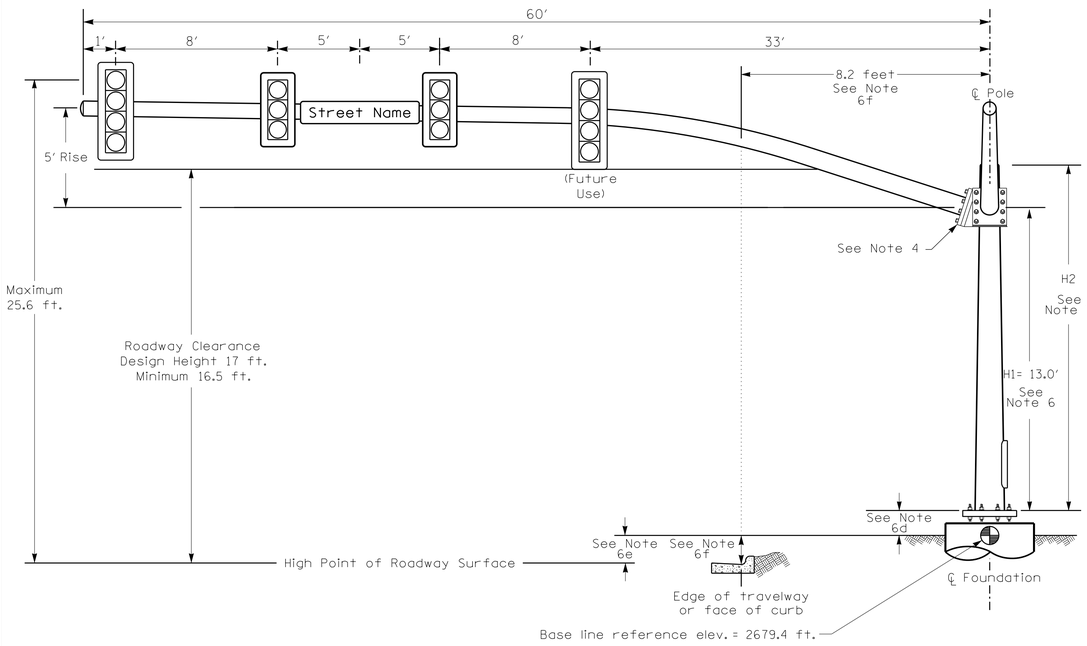
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton
A056DD704548484...
SIGNATURE 04/11/2023 DATE

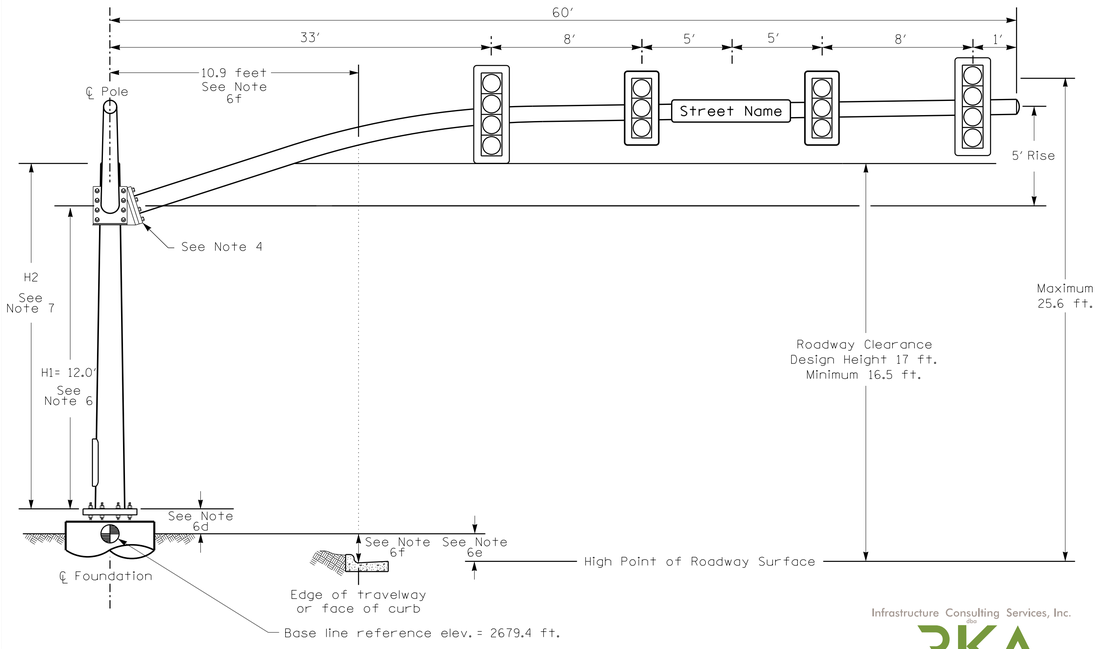
SIG. INVENTORY NO. I4-1075

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°

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Phone: 704-549-4260 | www.rameykemp.com | NC License No. F-1489

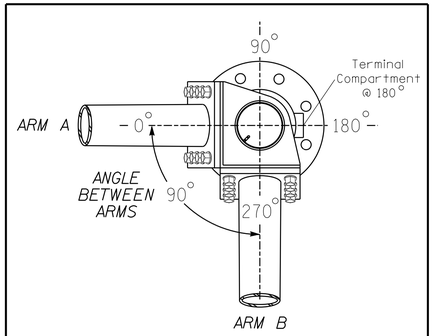
4/10/2023
W:\4\1075_sig_MP2_2020mast.dgn
User:swilder

SPECIAL NOTE

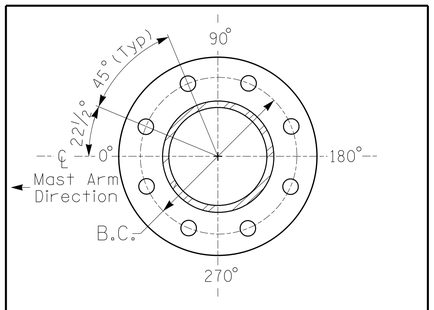
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

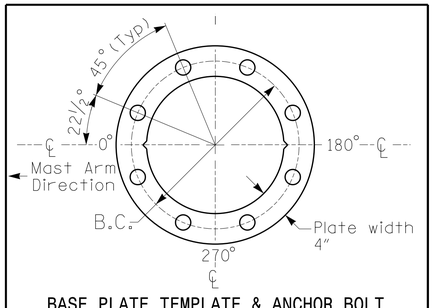
Elevation Differences for:	Arm A	Arm B
Baseline reference point at ℄ Foundation @ ground level	2679.4 ft.	2679.4 ft.
Elevation difference at High point of roadway surface	-1.3 ft.	-2.0 ft.
Elevation difference at Edge of travelway or face of curb	-1.1 ft.	-1.9 ft.



POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL



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

METAL POLE No. 2

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 8.14

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12″-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5″ W X 52.5″ L	60 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5″ W X 66.0″ L	74 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	12.0 S.F.	18.0″ W X 96.0″ L	27 LBS

NOTES

DESIGN REFERENCE MATERIAL

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

DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
6. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. 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.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
   f. Provide horizontal distance from the proposed centerline of the foundation to the edge of travelway. Refer to the Elevation Data Chart for elevation difference between the proposed foundation ground level and the edge of travelway. This information is necessary to ensure that the roadway clearance is maintained at the edge of the travelway and to aid in the camber design of the arm.
7. 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.
8. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
9. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
10. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

All metal poles and arms should be Hunter Green in color as specified in the project special provisions.

NCDOT Wind Zone 5 (120 mph)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared for: Transportation Mobility and Safety Division, North Carolina Department of Transportation, Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

US 276 (Russ Avenue) at Frazier Street / Ingles Entrance

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	REVIEWED BY:	16085 (040)

SCALE: 0 N/A N/A

REVISIONS	INIT.	DATE

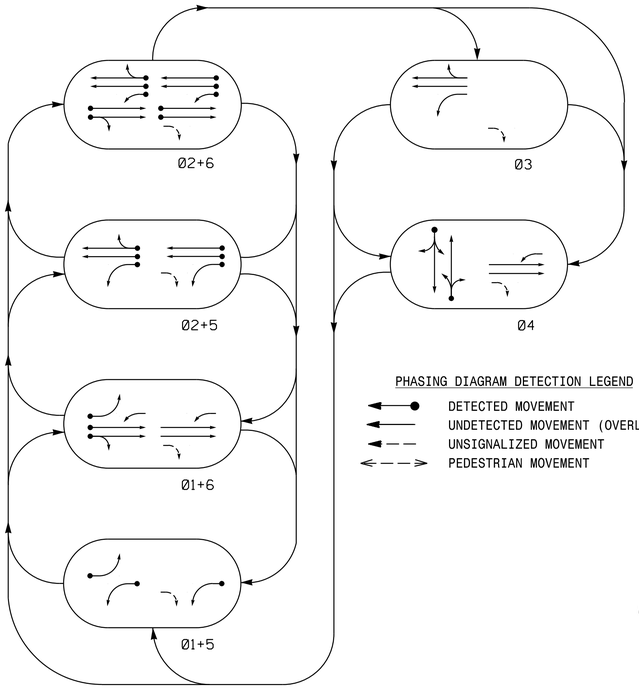
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton 04/11/2023
SIGNATURE DATE

SIG. INVENTORY NO. 14-1075

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.0

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

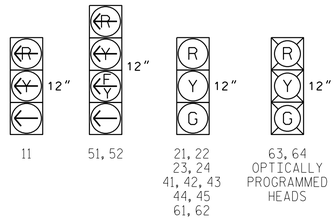
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 01+05	01+06	02+05	02+06	03	04	FLASH
11	←	—	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~
21, 22	R	R	G	G	R	R	Y
23, 24	R	R	G	G	G	R	Y
41, 42, 43	R	R	R	R	R	G	R
44, 45	R	R	R	R	R	G	R
51	←	~~F Y~~	←	~~F Y~~	~~R~~	~~F Y~~	~~Y~~
52	←	~~F Y~~	←	~~F Y~~	←	~~R~~	~~Y~~
61, 62	R	G	R	G	R	R	Y
63, 64	R	G	R	G	R	G	Y

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

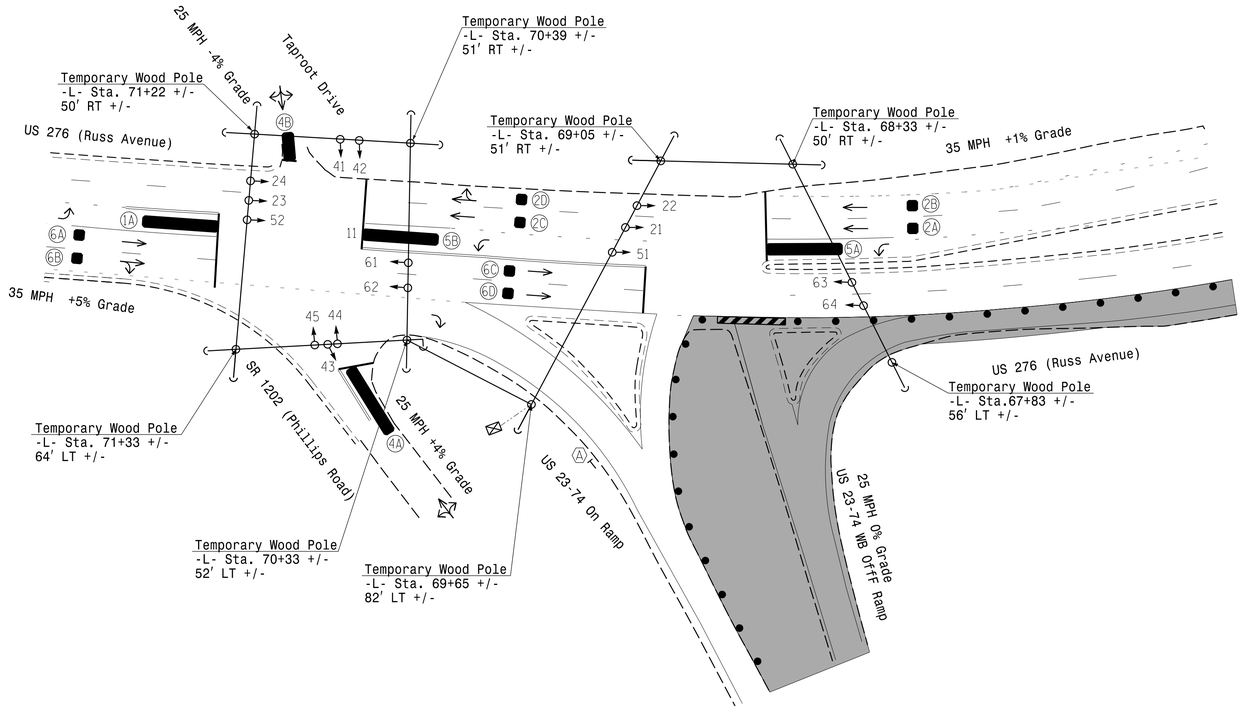
DETECTOR					PROGRAMMING						
ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	*	*	1	3	-	X	-	X	-	*
2A,2B	6X6	70	*	*	2	-	-	X	-	X	-	*
2C,2D	6X6	70	*	*	2	-	-	X	-	X	-	*
4A	6X40	0	*	*	4	10	-	X	-	X	-	*
4B	6X15	0	*	*	4	10	-	X	-	X	-	*
5A	6X40	0	*	*	5	15	-	X	-	X	-	*
					2	-	-	X	-	X	-	*
5B	6X40	0	*	*	5	15	-	X	-	X	-	*
					2	3	-	X	-	X	-	*
6A	6X6	70	*	*	6	-	-	X	-	X	-	*
6B	6X6	70	*	*	6	-	-	X	-	X	-	*

* Multizone Microwave Detection

6 Phase
Fully Actuated
D14-12_Waynesville

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 1 or phase 5 may be lagged.
4. Set all detector units to presence mode.
5. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
6. See traffic control plans for stop bar and crosswalk locations.
7. This intersection uses multizone microwave detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Microwave Detection Zone	N/A
	Construction Zone	N/A
	Construction Zone Drums	N/A
	Type III Barricade	N/A
Ⓐ	Yield Sign	Ⓐ

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	–	–	–	–	–
Ped Clear *	–	–	–	–	–	–
Min Green	7	10	7	7	7	10
Passage *	2.0	3.0	2.0	2.0	2.0	3.0
Max 1 *	15	60	15	15	15	60
Yellow Change	3.0	3.8	3.2	3.4	3.0	3.8
Red Clear	1.9	1.5	2.4	2.9	2.1	1.5
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

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

Signal Upgrade
Temporary Design 1 - (TMP Phase I, Step 1)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

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dba
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US 276 (Russ Avenue) at US 23 - 74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO.:	16085 (040)

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

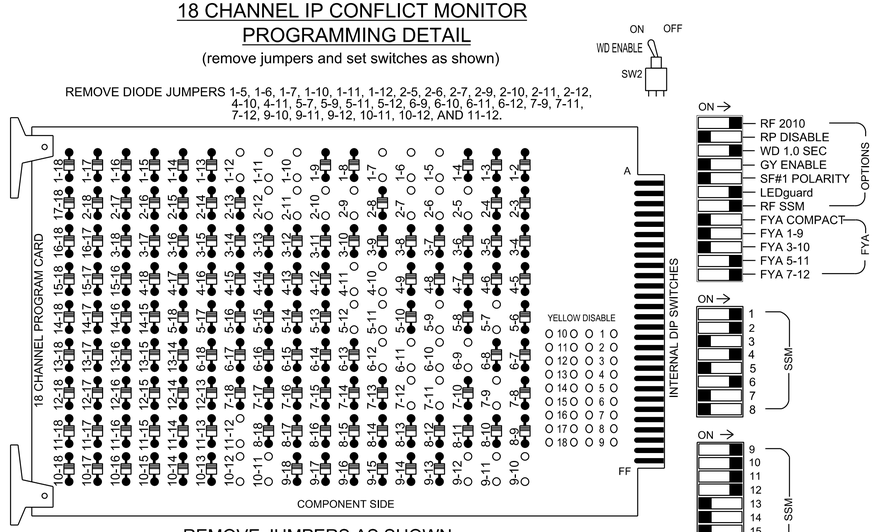
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton A0560D704648484...
04/11/2023
SIGNATURE DATE

SIG. INVENTORY NO. I4-0974TI

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



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 the Red Enable is active at all times during normal operation.
4. Integrate monitor with Ethernet network in cabinet.

■ = 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 plan.
2. Program controller to start up in phase 2 Green No Walk and 6 Green No Walk.
3. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
4. The cabinet and controller are part of the D14-12 Waynesville Signal System.

EQUIPMENT INFORMATION

Controller.....2070LX
Cabinet.....332 w/ Aux
Software.....Q-Free MAXTIME
Cabinet Mount.....Base
Output File Positions.....18 With Aux. Output File
Load Switches Used.....S1, S2, S5, S7, S8, S10, AUX S1, AUX S2, AUX S4, AUX S5
Phases Used.....1, 2, 3, 4, 5, 6
Overlap "1".....*
Overlap "2".....*
Overlap "3".....*
Overlap "4".....*
Overlap "7".....*

*See overlap programming detail on sheet 2

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.1

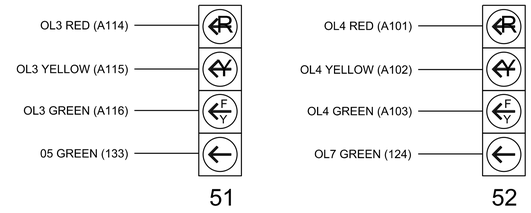
SIGNAL HEAD HOOK-UP CHART

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	OL7	8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	11	21,22	NU	NC	41,42, 43,44, 45	NU	51 ★	61,62	NU	52 ★	NU	NU	23,24	63,64	NU	51 ★	52 ★	NU
RED	.	128	.	.	101	.	.	134	.	.	.	.	A121	A124	.	.	.	.
YELLOW	.	129	.	.	102	.	*	135	.	*	.	.	A122	A125	.	.	.	.
GREEN	.	130	.	.	103	.	.	136	.	.	.	.	A123	A126	.	.	.	.
RED ARROW	125	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A114	A101	.
YELLOW ARROW	126	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A115	A102	.
FLASHING YELLOW ARROW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A116	A103	.
GREEN ARROW	127	.	.	.	.	.	133	.	.	124	.	.	.	.	.	.	.	.

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

FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)



INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	1O	11	12	13	14
FILE "I"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	FS DC ISOLATOR
	L														ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L														

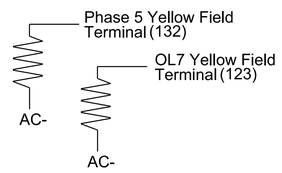
EX. : 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE
ST = STOP TIME

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown)

ACCEPTABLE VALUES	
Value (ohms)	Wattage
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



SPECIAL DETECTOR NOTE

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

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0974T1
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 1 of 2
Temporary Design 1 - (TMP Phase I, Step 1)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for:

750 N.Greenfield Pkwy,Garner,NC 27529

US 276 (Russ Avenue)
at
US 23-74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO:	16085 (040)

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton
SIGNATURE
04/11/2023
DATE

SIG. INVENTORY NO. 14-0974T1

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4/12/2023
14-0974T1_smple_2020mmsd.dgn
User:Wendt

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.2

OVERLAP PROGRAMMING

Front Panel
Main Menu >Controller >Overlap >Overlap Parameters/Overlap Timings

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

Overlap	1	2	3	4	7
Type	Normal	Normal	FYA 4 - Section	FYA 4 - Section	Normal
Included Phases	2,3	4,6	4,6	6	3,5
Modifier Phases	-	-	5	-	-
Modifier Overlaps	-	-	-	7	-
Trail Green	0	0	0	0	0
Trail Yellow	0.0	0.0	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0	0.0	0.0

OUTPUT CHANNEL CONFIGURATION

Front Panel
Main Menu >Controller >More>Channels>Channels Config

Web Interface
Home >Controller >Advanced IO>Channels>Channels Configuration

Channel Configuration

OVERLAP 7 IN CHANNEL 7 →

Channel	Control Type	Control Source	Flash Yellow	Flash Red	Flash Alt	MMU Channel
1	Phase Vehicle	1		X	X	1
2	Phase Vehicle	2	X			2
3	Phase Vehicle	3		X	X	3
4	Phase Vehicle	4		X		4
5	Phase Vehicle	5	X			5
6	Phase Vehicle	6	X		X	6
7	Overlap	7	X			7
8	Phase Vehicle	8		X	X	8
9	Overlap	1	X		X	9
10	Overlap	2	X		X	10
11	Overlap	3	X			11
12	Overlap	4	X			12
13	Phase Ped	2				13
14	Phase Ped	4				14
15	Phase Ped	6				15
16	Phase Ped	8				16
17	Overlap	5		X		17
18	Overlap	6		X		18

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0974T1
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 2 of 2
Temporary Design 1 - (TMP Phase I, Step 1)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for:
NC Department of Transportation Transportation Mobility and Safety Division Traffic Engineering & Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 276 (Russ Avenue)
at
US 23-74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO:	16085 (040)

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

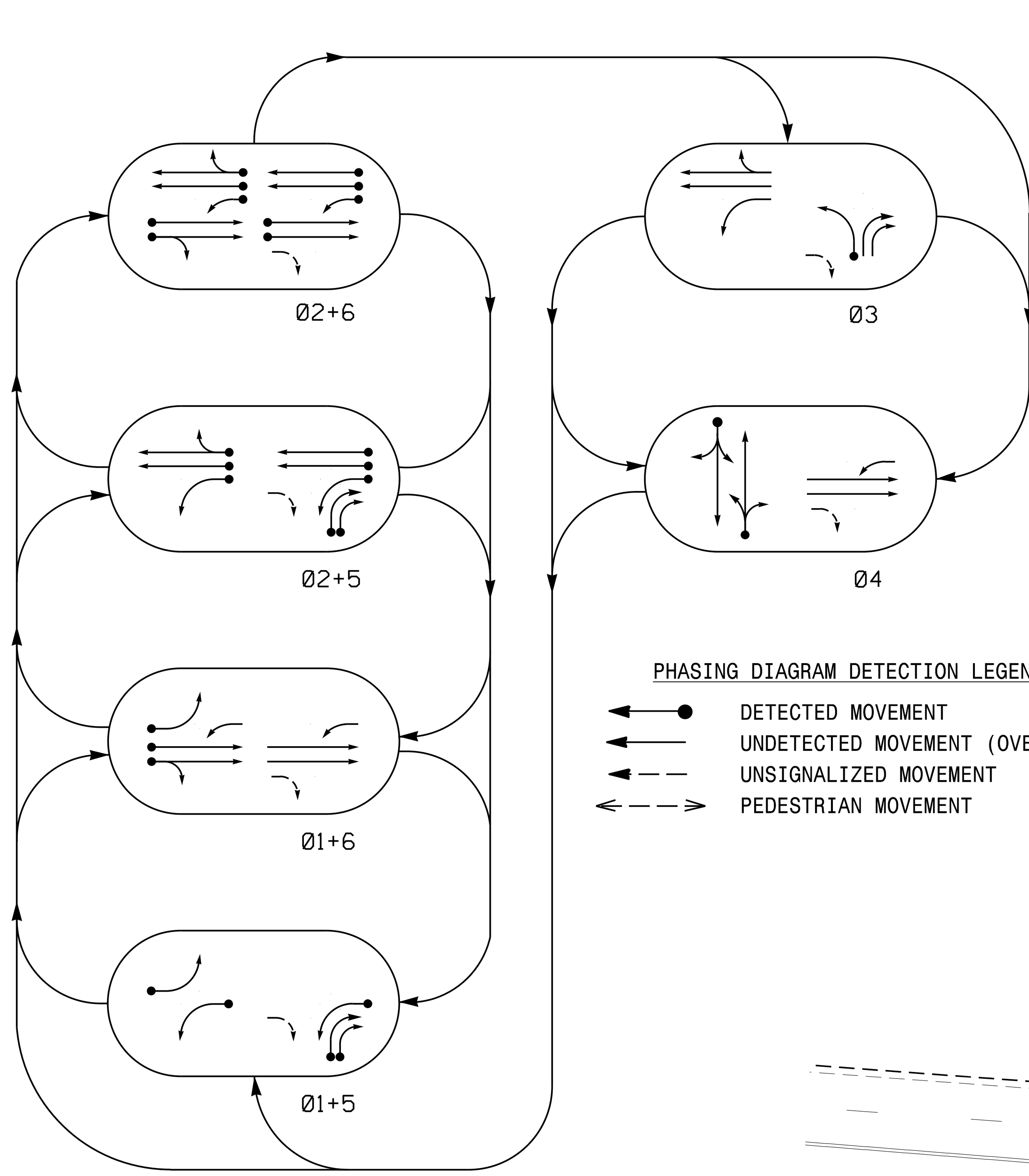
DocuSigned by: William J. Hamilton
ASSOCIATE/AGENT
SIGNATURE
04/11/2023
DATE

SIG. INVENTORY NO. 14-0974T1

4/12/2023
14-0974T1_sm_ele_2020mmcd.dgn
User:Wendt

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.3

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

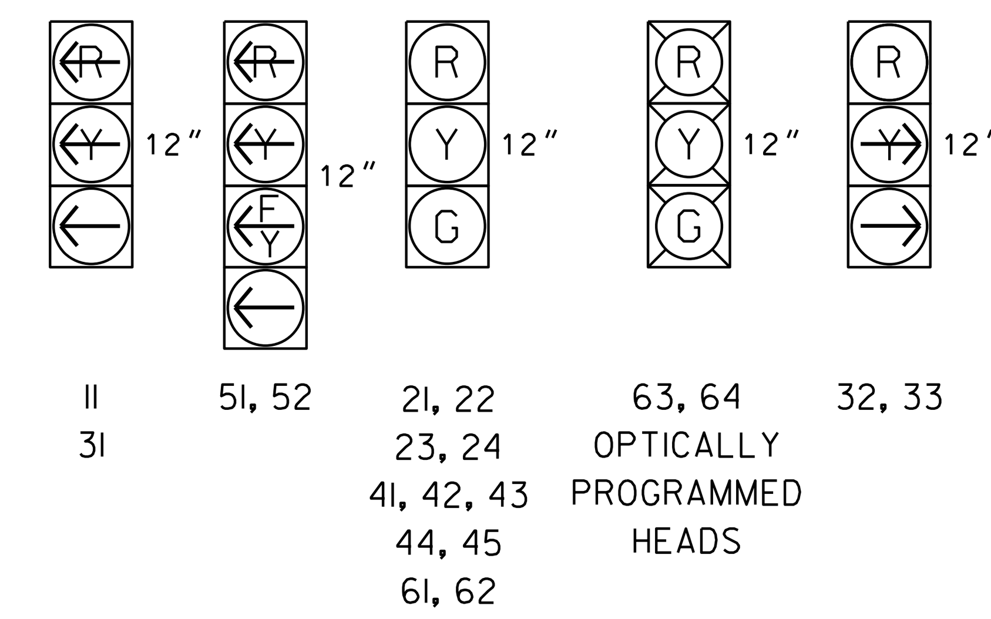
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE Ø1+5	Ø1+6	Ø2+5	Ø2+6	Ø3	Ø4	FLASH
11	←	←	←R	←R	←R	←R	←R
21, 22	R	R	G	G	R	R	Y
23, 24	R	R	G	G	G	R	Y
31	←R	←R	←R	←R	←	←R	←R
32, 33	→	R	→	R	→	R	R
41, 42, 43	R	R	R	R	R	G	R
44, 45	R	R	R	R	R	G	R
51	←	←FY	←	←FY	←R	←FY	←Y
52	←	←FY	←	←FY	←	←R	←Y
61, 62	R	G	R	G	R	R	Y
63, 64	R	G	R	G	R	G	Y

SIGNAL FACE I.D.

All Heads L.E.D.



MAXTIME DETECTOR INSTALLATION CHART

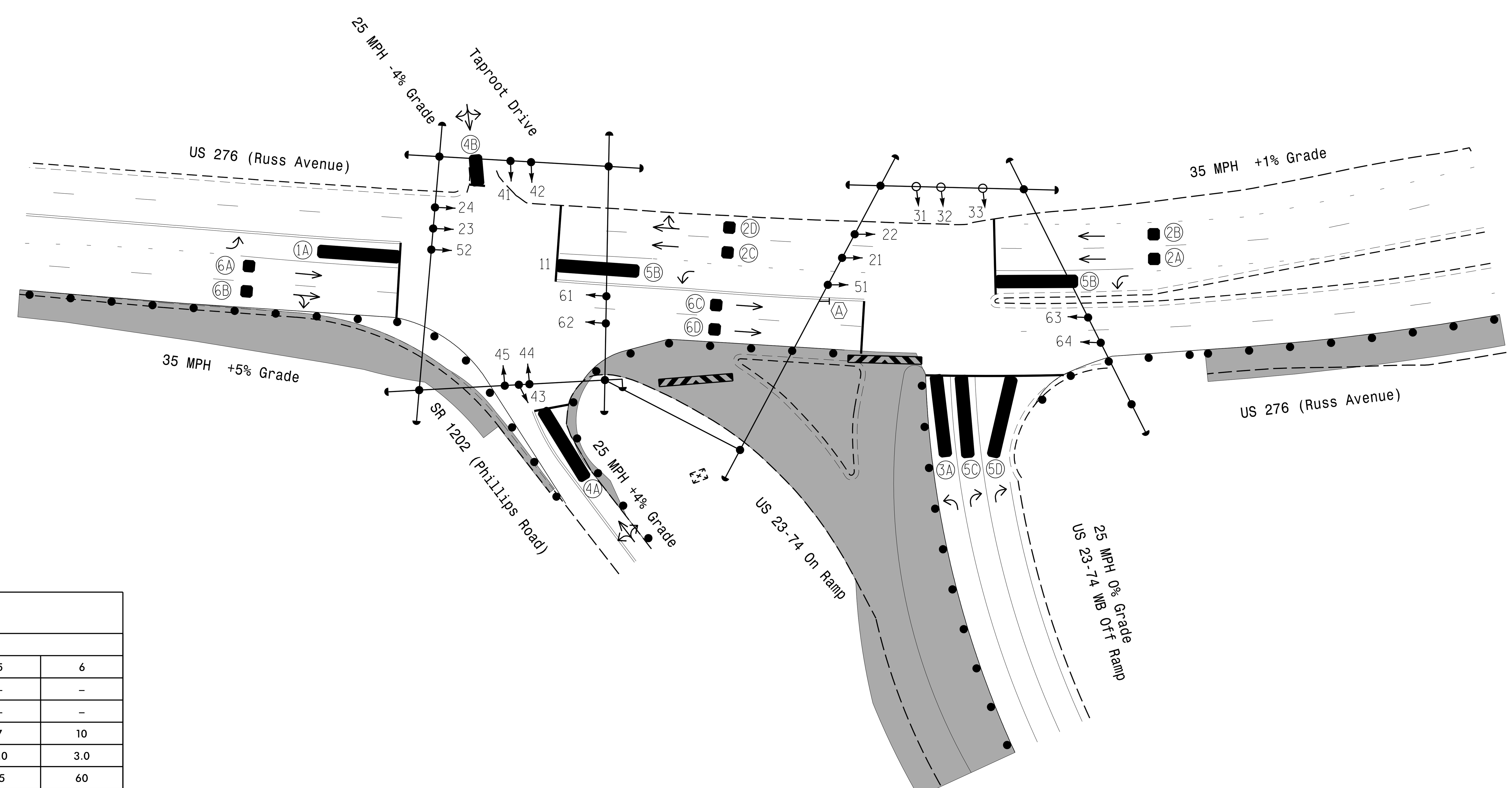
DETECTOR ZONE	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	PROGRAMMING CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	*	*	1	3	-	X	-	X	-	*
2A, 2B	6X6	70	*	*	2	-	-	X	-	X	-	*
2C, 2D	6X6	70	*	*	2	-	-	X	-	X	-	*
3A	6X40	0	*	*	3	-	-	X	-	X	-	*
4A	6X40	0	*	*	4	10	-	X	-	X	-	*
4B	6X15	0	*	*	4	10	-	X	-	X	-	*
5A	6X40	0	*	*	5	15	-	X	-	X	-	*
					2	-	-	X	-	X	-	*
5B	6X40	0	*	*	5	15	-	X	-	X	-	*
					2	3	-	X	-	X	-	*
5C	6X40	0	*	*	5	15	-	X	-	X	-	*
5D	6X40	0	*	*	5	15	-	X	-	X	-	*
6A, 6B	6X6	70	*	*	6	-	-	X	-	X	-	*
6C, 6D	6X6	70	*	*	6	-	-	X	-	X	-	*

* Multizone Microwave Detection

6 Phase
Fully Actuated
D14-12_Waynesville

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 1 or phase 5 may be lagged.
4. Reposition existing signal heads numbered 31, 33, 41 and 42.
5. Set all detector units to presence mode.
6. See traffic control plans for stop bar and crosswalk locations.
7. This intersection uses multizone microwave detection. Install detectors according to the manufacturer's instructions to achieve the desired detection.
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Microwave Detection Zone	N/A
	Construction Zone	N/A
	Construction Zone Drums	N/A
	Type III Barricade	N/A
A	R3-2 "No Left Turn" Sign	A

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	–	–	–	–	–
Ped Clear *	–	–	–	–	–	–
Min Green	7	10	7	7	7	10
Passage *	2.0	3.0	2.0	2.0	2.0	3.0
Max 1 *	15	60	15	15	15	60
Yellow Change	3.0	3.8	3.0	3.4	3.0	3.8
Red Clear	1.9	1.5	2.3	2.9	1.8	1.5
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

* 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.

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Signal Upgrade
Temporary Design 2 - (TMP Phase I, Step 2)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared for: Transportation Mobility and Safety Division, Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

US 276 (Russ Avenue) at US 23 - 74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE: April 2023	REVIEWED BY: WJ Hamilton
PREPARED BY: TS Popelka	RKA PROJ. NO.: 16085 (040)

REVISIONS | INIT. | DATE

SCALE 0 40 1"=40'

SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 32396 WILLIAM J. HAMILTON

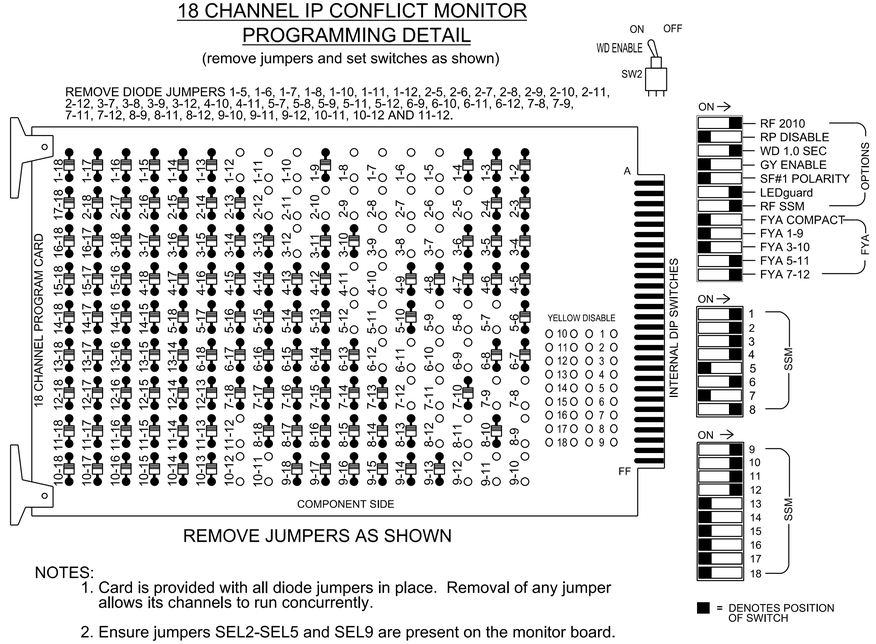
DocuSigned by: William J. Hamilton 04/11/2023
SIGNATURE DATE

SIG. INVENTORY NO. 14-0974T2

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)

REMOVE DIODE JUMPERS 1-5, 1-6, 1-7, 1-8, 1-10, 1-11, 1-12, 2-5, 2-6, 2-7, 2-8, 2-9, 2-10, 2-11, 2-12, 3-7, 3-8, 3-9, 3-12, 4-10, 4-11, 5-7, 5-8, 5-9, 5-11, 5-12, 6-9, 6-10, 6-11, 6-12, 7-8, 7-9, 7-11, 7-12, 8-9, 8-11, 8-12, 9-10, 9-11, 9-12, 10-11, 10-12 AND 11-12.



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 the Red Enable is active at all times during normal operation.
4. Integrate monitor with Ethernet network in cabinet.

■ = 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 plan.
2. Program controller to start up in phase 2 Green No Walk and 6 Green No Walk.
3. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
4. The cabinet and controller are part of the D14-12 Waynesville Signal System.

EQUIPMENT INFORMATION

Controller.....2070LX
Cabinet.....332 w/ Aux
Software.....Q-Free MAXTIME
Cabinet Mount.....Base
Output File Positions.....18 With Aux. Output File
Load Switches Used.....S1, S2, S4, S5, S7, S8, S10, S11, AUX S1, AUX S2, AUX S4, AUX S5
Phases Used.....1, 2, 3, 4, 5, 6
Overlap "1".....*
Overlap "2".....*
Overlap "3".....*
Overlap "4".....*
Overlap "7".....*
Overlap "8".....*

*See overlap programming detail on sheet 2

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.4

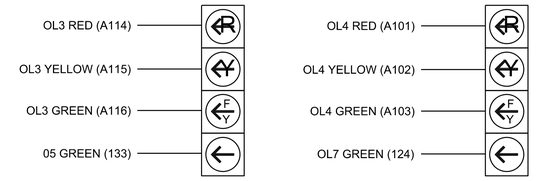
SIGNAL HEAD HOOK-UP CHART

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	OL7	OL8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	11	21,22	NU	31	41,42, 43,44, 45	NU	51★	61,62	NU	52★	32,33	NU	23,24	63,64	NU	51★	52★	NU
RED		128			101			134			107		A121	A124				
YELLOW		129			102		*	135		*			A122	A125				
GREEN		130			103			136					A123	A126				
RED ARROW	125			116												A114	A101	
YELLOW ARROW	126			117							108					A115	A102	
FLASHING YELLOW ARROW																A116	A103	
GREEN ARROW	127			118			133			124	109							

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

FYA SIGNAL WIRING DETAIL

(wire signal heads as shown)



INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	FS DC ISOLATOR
	L														ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L														

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

FS = FLASH SENSE
ST = STOP TIME

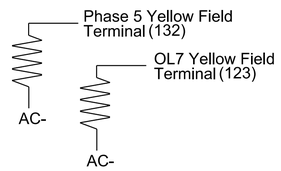
SPECIAL DETECTOR NOTE

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

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown)

ACCEPTABLE VALUES	
Value (ohms)	Wattage
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0974T2
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 1 of 2
Temporary Design 2 - (TMP Phase I, Step 2)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 276 (Russ Avenue)
at
US 23-74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO:	16085 (040)

REVISIONS	INIT.	DATE

Prepared for:
NC Department of Transportation, Mobility and Safety Division, Traffic Engineering Branch, Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

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SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER
WILLIAM J. HAMILTON
Docusigned by: William J. Hamilton
A0560272A4454A4...
SIGNATURE
04/11/2023
DATE
SIG. INVENTORY NO. 14-0974T2

4/12/2023
14-0974T2_sm_ele_2020mmsd.dgn
User:Wendt

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.5

OVERLAP PROGRAMMING

Front Panel
Main Menu >Controller >Overlap >Overlap Parameters/Overlap Timings

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

Overlap	1	2	3	4	7	8
Type	Normal	Normal	FYA 4 - Section	FYA 4 - Section	Normal	Normal
Included Phases	2,3	4,6	4,6	6	3,5	3,5
Modifier Phases	-	-	5	-	-	-
Modifier Overlaps	-	-	-	7	-	-
Trail Green	0	0	0	0	0	0
Trail Yellow	0.0	0.0	0.0	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0	0.0	0.0	0.0

OUTPUT CHANNEL CONFIGURATION

Front Panel
Main Menu >Controller >More>Channels>Channels Config

Web Interface
Home >Controller >Advanced IO>Channels>Channels Configuration

Channel Configuration

Channel	Control Type	Control Source	Flash Yellow	Flash Red	Flash Alt	MMU Channel
1	Phase Vehicle	1		X	X	1
2	Phase Vehicle	2	X			2
3	Phase Vehicle	3		X	X	3
4	Phase Vehicle	4		X		4
5	Phase Vehicle	5	X			5
6	Phase Vehicle	6	X		X	6
7	Overlap	7	X			7
8	Overlap	8		X	X	8
9	Overlap	1	X		X	9
10	Overlap	2	X		X	10
11	Overlap	3	X			11
12	Overlap	4	X			12
13	Phase Ped	2				13
14	Phase Ped	4				14
15	Phase Ped	6				15
16	Phase Ped	8				16
17	Overlap	5		X		17
18	Overlap	6		X		18

OVERLAP 7 IN CHANNEL 7 →
OVERLAP 8 IN CHANNEL 8 →

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0974T2
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 2 of 2
Temporary Design 2 - (TMP Phase I, Step 2)

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Infrastructure Consulting Services, Inc.
RAMEY KEMP ASSOCIATES
8210 University Executive Park Drive Suite 220 Charlotte, North Carolina 28262
Phone: 704-549-4260 | www.rameykemp.com | NC License No. F-1489

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for: NC Department of Transportation, Transportation Mobility and Safety Division, Traffic Engineering & Signals Management Section

750 N.Greenfield Pkwy,Garner,NC 27529

US 276 (Russ Avenue)
at
US 23-74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO:	16085 (040)

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

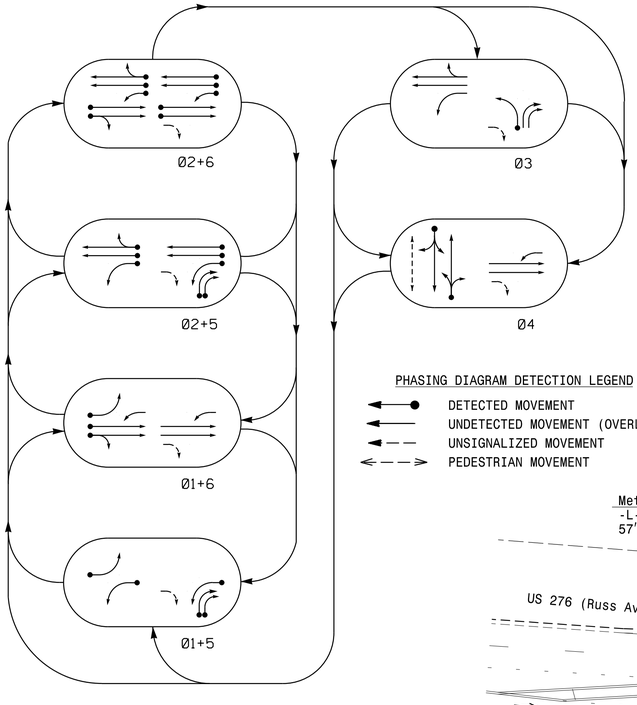
DocuSigned by: William J. Hamilton 04/11/2023
SIGNATURE DATE

SIG. INVENTORY NO. 14-0974T2

4/12/2023
14-0974T2_sm_ele_2020mmdd.dgn
User:Wendt

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.6

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

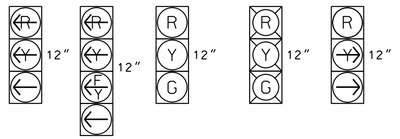
- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

TABLE OF OPERATION

SIGNAL FACE	PHASE 01+05	01+06	02+05	02+06	03	04	FLASH
11	~~←~~	~~←~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~
21, 22	R	R	G	G	R	R	Y
23, 24	R	R	G	G	G	R	Y
31	~~R~~	~~R~~	~~R~~	~~R~~	~~←~~	~~R~~	~~R~~
32, 33	→̶	R	→̶	R	→̶	R	R
41, 42, 43	R	R	R	R	R	G	R
44, 45	R	R	R	R	R	G	R
51	←̶	F Y	←̶	F Y	~~R~~	F Y	~~Y~~
52	←̶	F Y	←̶	F Y	←̶	~~R~~	~~Y~~
61, 62	R	G	R	G	R	R	Y
63, 64	R	G	R	G	R	G	Y
P41, P42	DW	DW	DW	DW	DW	W	DRK

SIGNAL FACE I.D.

All Heads L.E.D.



11
31

51, 52

21, 22
23, 24
41, 42, 43
44, 45
61, 62

63, 64
OPTICALLY
PROGRAMMED
HEADS

32, 33

Accessible Pedestrian Signal

P41, P42

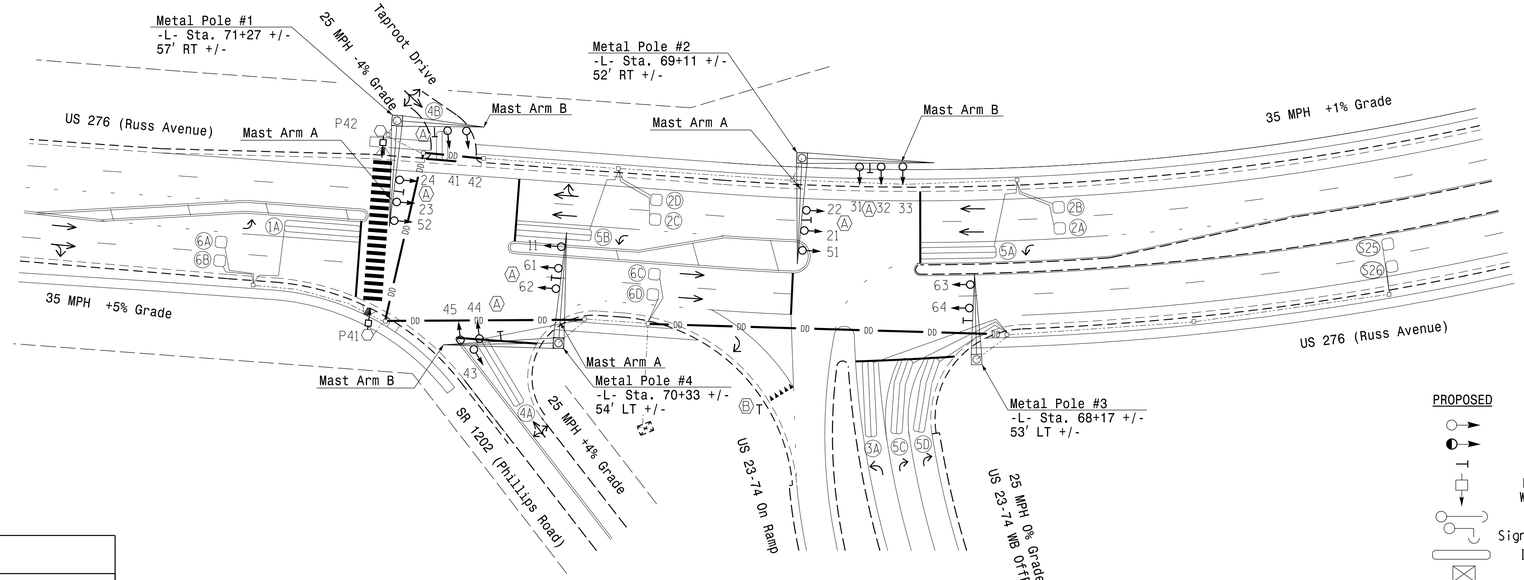
MAXTIME DETECTOR INSTALLATION CHART

DETECTOR					PROGRAMMING						
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN	NEW CARD
1A	6X40	0	2-4-2	X	1	-	-	X	-	X	-	X
2A,2B	6X6	70	5	X	2	-	-	X	-	X	-	X
2C,2D	6X6	70	5	X	2	-	-	X	-	X	-	X
3A	6X40	0	2-4-2	X	3	-	-	X	-	X	-	X
4A	6X40	0	2-4-2	X	4	10	-	X	-	X	-	X
4B	6X15	0	2-4-2	X	4	10	-	X	-	X	-	X
5A	6X40	0	2-4-2	X	5	15	-	X	-	X	-	X
					2	-	-	X	-	X	-	X
5B	6X40	0	2-4-2	X	5	15	-	X	-	X	-	X
					2	-	-	X	-	X	-	X
5C	6X40	0	2-4-2	X	5	15	-	X	-	X	-	X
5D	6X40	0	2-4-2	X	5	15	-	X	-	X	-	X
6A,6B	6X6	70	5	X	6	-	-	X	-	X	-	X
6C,6D	6X6	70	5	X	6	-	-	X	-	X	-	X
S25	6X6	+320	5	X	-	-	-	-	-	-	-	X
S26	6X6	+320	5	X	-	-	-	-	-	-	-	X

6 Phase
Fully Actuated
D14-12_Waynesville

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2018 and "Standard Specifications for Roads and Structures" dated January 2018.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 1 and/or phase 5 may be lagged.
4. Set all detector units to presence mode.
5. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
6. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
7. This intersection features accessible pedestrian signals utilizing percussive tone walk indications and/or speech messages.
8. See pavement marking plans for stop bar and crosswalk locations.
9. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
DD	Directional Drill	N/A
	Metal Pole with Mastarm	
	Type II Signal Pedestal	
A	Street Name Sign	A
B	Yeild Sign	B

MAXTIME TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Walk *	–	–	–	7	–	–
Ped Clear *	–	–	–	20	–	–
Min Green	7	10	7	7	7	10
Passage *	2.0	3.0	2.0	2.0	2.0	3.0
Max 1 *	15	60	15	15	15	60
Yellow Change	3.0	3.8	3.2	3.4	3.0	3.8
Red Clear	2.3	1.7	2.4	2.9	2.3	1.7
Added Initial *	–	–	–	–	–	–
Maximum Initial *	–	–	–	–	–	–
Time Before Reduction *	–	–	–	–	–	–
Time To Reduce *	–	–	–	–	–	–
Minimum Gap	–	–	–	–	–	–
Advance Walk	–	–	–	–	–	–
Non Lock Detector	X	–	X	X	X	–
Vehicle Recall	–	MIN RECALL	–	–	–	MIN RECALL
Dual Entry	–	–	–	–	–	–

* 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.

ACCESSIBLE PEDESTRIAN SIGNAL OPERATION

SIGNAL FACE	VOICE	TONES	INTERVAL	SPEECH MESSAGE
P41	-	X	Walk	(Percussive Tone)
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Russ.
P42	-	X	Walk	(Percussive Tone)
	X	-	Flashing Don't Walk / Don't Walk	Wait. Wait to cross Russ.

Infrastructure Consulting Services, Inc.
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Phone: 704-549-4260 | www.rameykemp.com | NC License No. F-1489

Signal Upgrade - Final Design

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared for: Transportation Mobility and Safety Division, Signal Design Section, North Carolina Department of Transportation

US 276 (Russ Avenue) at US 23 - 74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE: April 2023 REVIEWED BY: WJ Hamilton

PREPARED BY: TS Popelka RKA PROJ. NO.: 16085 (040)

750 N.Greenfield Pkwy.Garner,NC 27529

SCALE 0 40 1"=40'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton A05600D7A64A4A4...

04/11/2023
SIGNATURE DATE

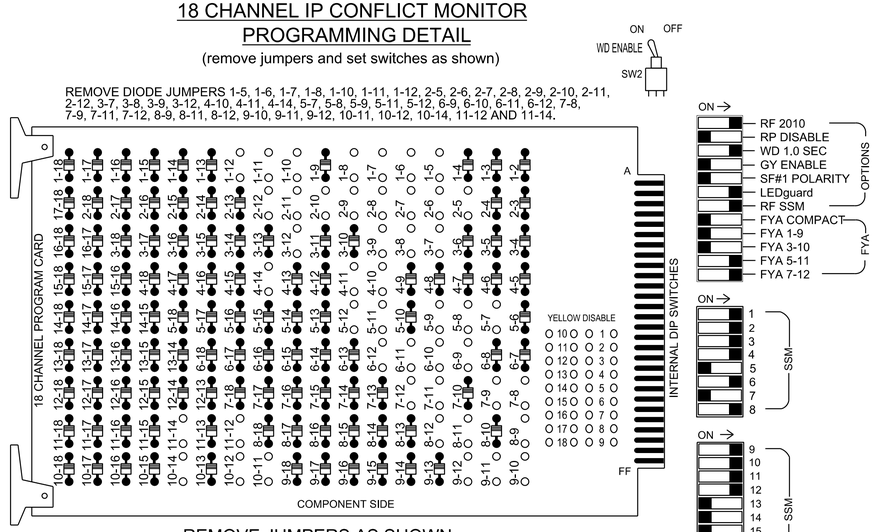
SIG. INVENTORY NO. 14-0974

4/12/2023
4:40:27 PM
User:JWendt
U-5839_sig_dsn_2020mmdd.dgn

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.7

18 CHANNEL IP CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



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 the Red Enable is active at all times during normal operation.
4. Integrate monitor with Ethernet network in cabinet.

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 plan.
2. Program controller to start up in phase 2 Green No Walk and 6 Green No Walk.
3. If this signal will be managed by an ATMS software, enable controller and detector logging for all detectors used at this location.
4. The cabinet and controller are part of the D14-12 Waynesville Signal System.

EQUIPMENT INFORMATION

Controller.....2070LX
Cabinet.....332 w/ Aux
Software.....Q-Free MAXTIME
Cabinet Mount.....Base
Output File Positions.....18 With Aux. Output File
Load Switches Used.....S1, S2, S4, S5, S6, S7, S8, S10, S11, AUX S1. AUX S2, AUX S4, AUX S5
Phases Used.....1, 2, 3, 4, 4PED, 5, 6
Overlap "1".....*
Overlap "2".....*
Overlap "3".....*
Overlap "4".....*
Overlap "7".....*
Overlap "8".....*

*See overlap programming detail on sheet 2

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	OL7	OL8	8 PED	OL1	OL2	SPARE	OL3	OL4	SPARE
SIGNAL HEAD NO.	11	21,22	NU	31	41,42, 43,44, 45	P41, P42	51 ★	61,62	NU	52 ★	32,33	NU	23,24	63,64	NU	51 ★	52 ★	NU
RED		128			101			134			107		A121	A124				
YELLOW		129			102		★	135		★			A122	A125				
GREEN		130			103			136					A123	A126				
RED ARROW	125			116												A114	A101	
YELLOW ARROW	126			117							108					A115	A102	
FLASHING YELLOW ARROW																A116	A103	
GREEN ARROW	127			118			133			124	109							
✋						104												
🚶						106												

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

INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I"	U	Ø 1 1A	Ø 2 2A,2B	SLOT EMPTY	SLOT EMPTY	Ø 3 3A	Ø 4 4A	SLOT EMPTY	SLOT EMPTY	SYS. DET. S25	SLOT EMPTY	SLOT EMPTY	NOT USED	SLOT EMPTY	FS DC ISOLATOR
	L	NOT USED	Ø 2 2C,2D			NOT USED	Ø 4 4B			SYS. DET. S26			Ø4 PED DC ISOLATOR		ST DC ISOLATOR
FILE "J"	U	Ø 5 5A	Ø 5 5B	Ø 6 6A,6B	SLOT EMPTY	SLOT EMPTY	Ø 5 5C	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L	NOT USED	NOT USED	Ø 6 6C,6D			Ø 5 5D								

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 POINT	DETECTOR NO.	CALL PHASE	DELAY TIME	EXTEND TIME	EXTEND	ADDED INITIAL	CALL	DELAY DURING GREEN
1A	TB2-1,2	I1U	56	18	1	1			X		X	
2A,2B	TB2-5,6	I2U	39	1	2	2			X		X	
2C,2D	TB2-7,8	I2L	43	5	3	2			X		X	
3A	TB4-5,6	I5U	58	20	7	3			X		X	
4A	TB4-9,10	I6U	41	3	8	4	10		X		X	
4B	TB4-11,12	I6L	45	7	9	4	10		X		X	
*S25	TB6-9,10	I9U	60	22	13							
*S26	TB6-11,12	I9L	62	24	14							
5A	TB3-1,2	J1U	55	17	15	5	15		X		X	
				-	31	2			X		X	
5B	TB3-5,6	J2U	40	2	16	5	15		X		X	
				-	33	2			X		X	
5C	TB5-9,10	J6U	42	4	22	5	15		X		X	
5D	TB5-11,12	J6L	46	8	23	5	15		X		X	
6A,6B	TB3-9,10	J3U	64	30	18	6			X		X	
6C,6D	TB3-11,12	J3L	77	43	19	6			X		X	
PED PUSH BUTTONS												
P41,P42	TB8-5,6	I12L	69	35	4	PED 4						

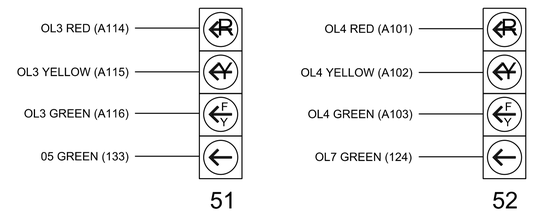
NOTE:
INSTALL DC ISOLATOR IN INPUT FILE SLOT I12.

*System detector only. Remove any assigned vehicle phase.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

FYA SIGNAL WIRING DETAIL

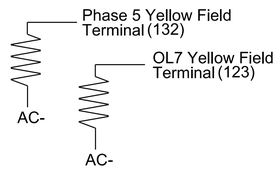
(wire signal heads as shown)



LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown)

ACCEPTABLE VALUES	
Value (ohms)	Wattage
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



COUNTDOWN PEDESTRIAN SIGNAL OPERATION

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

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0974
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 1 of 2
Final Design

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared for:
NC Department of Transportation Mobility and Safety Division Traffic Engineering Branch Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

Infrastructure Consulting Services, Inc.
RKA
RAMEY KEMP ASSOCIATES
8210 University Executive Park Drive Suite 220 Charlotte, North Carolina 28262
Phone: 704-549-4260 | www.rameykemp.com | NC License No. F-1489

US 276 (Russ Avenue)
at
US 23-74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO:	16085 (040)

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON
DocuSigned by: William J. Hamilton
A0560D70A64A4A4...
SIGNATURE 04/11/2023 DATE

SIG. INVENTORY NO. I4-0974

4/12/2023
14-0974_sm_ele_2020mds.dgn
User:Wendt

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.8

OVERLAP PROGRAMMING

Front Panel
Main Menu >Controller >Overlap >Overlap Parameters/Overlap Timings

Web Interface
Home >Controller >Overlap Configuration >Overlaps

Overlap Plan 1

Overlap	1	2	3	4	7	8
Type	Normal	Normal	FYA 4 - Section	FYA 4 - Section	Normal	Normal
Included Phases	2,3	4,6	4,6	6	3,5	3,5
Modifier Phases	-	-	5	-	-	-
Modifier Overlaps	-	-	-	7	-	-
Trail Green	0	0	0	0	0	0
Trail Yellow	0.0	0.0	0.0	0.0	0.0	0.0
Trail Red	0.0	0.0	0.0	0.0	0.0	0.0

ACCESSIBLE PEDESTRIAN SIGNAL (APS) INSTALLATION NOTES

1. Install push buttons and APS equipment per manufacturer's instructions.
2. Provide a dedicated cable to each push button per manufacturer's instructions.
3. If APS equipment is mounted in cabinet, use filtered power (i.e., Controller Receptacle) to power APS equipment. Do not use Equipment Receptacle, which is a GFCI outlet.
4. Never attempt to operate a standard contact closure push button with the APS system unless cabinet is re-wired for standard button operation or unless explicitly allowed by the manufacturer.
5. Place manufacturer's instructions in cabinet with cabinet prints, signal plans, and electrical details.

OUTPUT CHANNEL CONFIGURATION

Front Panel
Main Menu >Controller >More>Channels>Channels Config

Web Interface
Home >Controller >Advanced IO>Channels>Channels Configuration

Channel Configuration

Channel	Control Type	Control Source	Flash Yellow	Flash Red	Flash Alt	MMU Channel
1	Phase Vehicle	1	-	X	X	1
2	Phase Vehicle	2	X	-	-	2
3	Phase Vehicle	3	-	X	X	3
4	Phase Vehicle	4	-	X	-	4
5	Phase Vehicle	5	X	-	-	5
6	Phase Vehicle	6	X	-	X	6
7	Overlap	7	X	-	-	7
8	Overlap	8	-	X	X	8
9	Overlap	1	X	-	X	9
10	Overlap	2	X	-	X	10
11	Overlap	3	X	-	-	11
12	Overlap	4	X	-	-	12
13	Phase Ped	2	-	-	-	13
14	Phase Ped	4	-	-	-	14
15	Phase Ped	6	-	-	-	15
16	Phase Ped	8	-	-	-	16
17	Overlap	5	-	X	-	17
18	Overlap	6	-	X	-	18

OVERLAP 7 IN CHANNEL 7 →
OVERLAP 8 IN CHANNEL 8 →

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 14-0974
DESIGNED: Apr 2023
SEALED: 04/11/2023
REVISED: N/A

Electrical Detail - Sheet 2 of 2
Final Design

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ELECTRICAL AND PROGRAMMING DETAILS FOR:

US 276 (Russ Avenue)
at
US 23-74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	RKA PROJ. NO:	16085 (040)

REVISIONS	INIT.	DATE

Prepared for:
NC Department of Transportation Mobility and Safety Division Traffic Engineering Branch & Signals Management Section
750 N.Greenfield Pkwy,Garner,NC 27529

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SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON
DocuSigned by: William J. Hamilton
A0560D704648484
04/11/2023
SIGNATURE DATE

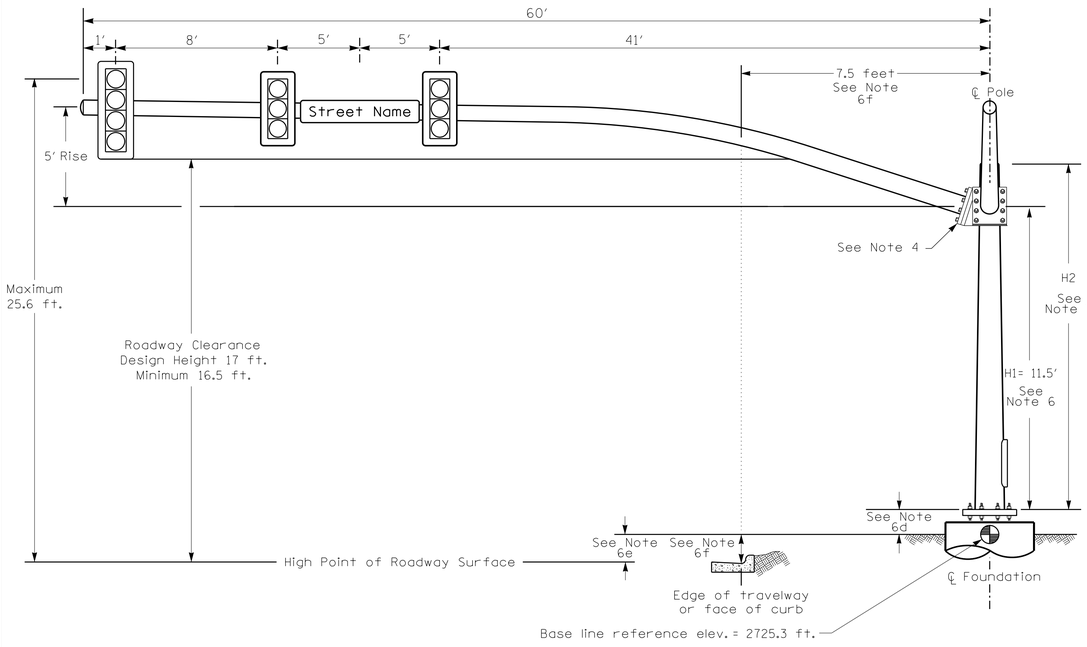
SIG. INVENTORY NO. 14-0974

4/12/2023
14-0974_sm_ele_2020mds.dgn
User:Weirdt

METAL POLE No. 1

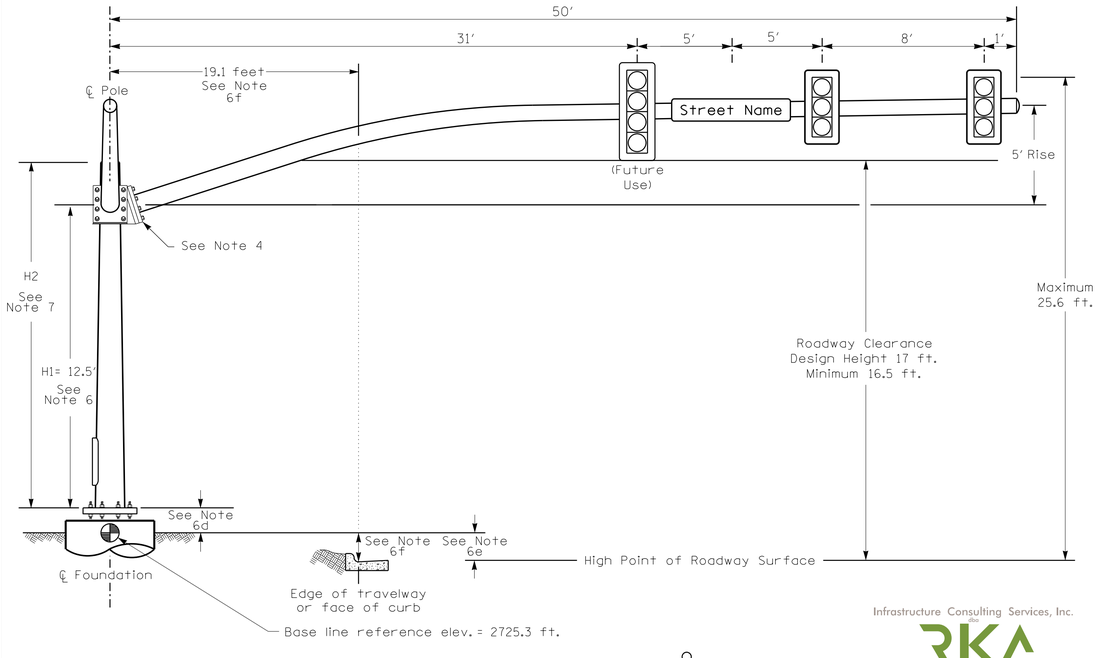
PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.9

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°

Infrastructure Consulting Services, Inc.

RAMEY KEMP ASSOCIATES

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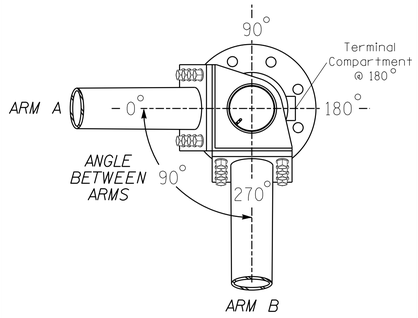
Phone: 704-549-4260 | www.rameykemp.com | NC License No. F-1489

SPECIAL NOTE

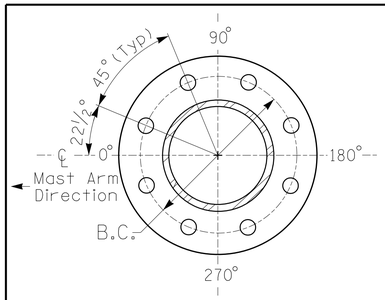
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

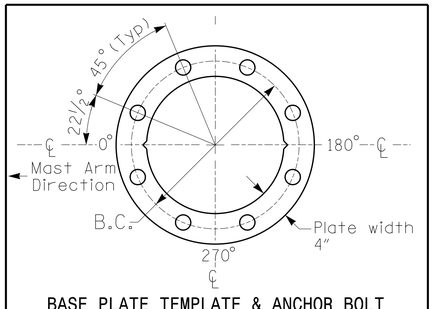
Elevation Differences for:	Arm A	Arm B
Baseline reference point at ℄ Foundation @ ground level	2725.3 ft.	2725.3 ft.
Elevation difference at High point of roadway surface	-2.9 ft.	-1.6 ft.
Elevation difference at Edge of travelway or face of curb	-3.1 ft.	-1.5 ft.



POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL



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

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12″-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5″ W X 52.5″ L	60 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5″ W X 66.0″ L	74 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	12.0 S.F.	18.0″ W X 96.0″ L	27 LBS

NOTES

DESIGN REFERENCE MATERIAL

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

DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
6. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. 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.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
   f. Provide horizontal distance from the proposed centerline of the foundation to the edge of travelway. Refer to the Elevation Data Chart for elevation difference between the proposed foundation ground level and the edge of travelway. This information is necessary to ensure that the roadway clearance is maintained at the edge of the travelway and to aid in the camber design of the arm.
7. 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.
8. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
9. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
10. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

All metal poles and arms should be Hunter Green in color as specified in the project special provisions.

NCDOT Wind Zone 5 (120 mph)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

US 276 (Russ Avenue)
at
US 23 - 74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	REVIEWED BY:	16085 (040)

REVISIONS	INIT.	DATE

SCALE: 0 N/A N/A

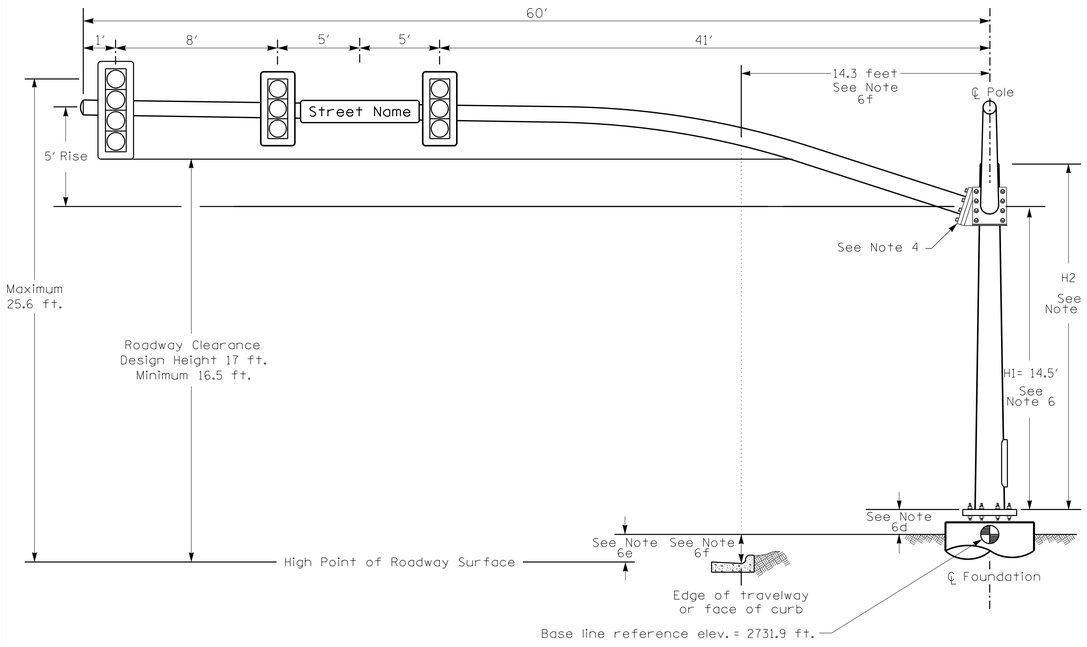
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton 04/11/2023
ASSOCIATE ENGINEER SIGNATURE DATE

SIG. INVENTORY NO. 14-0974

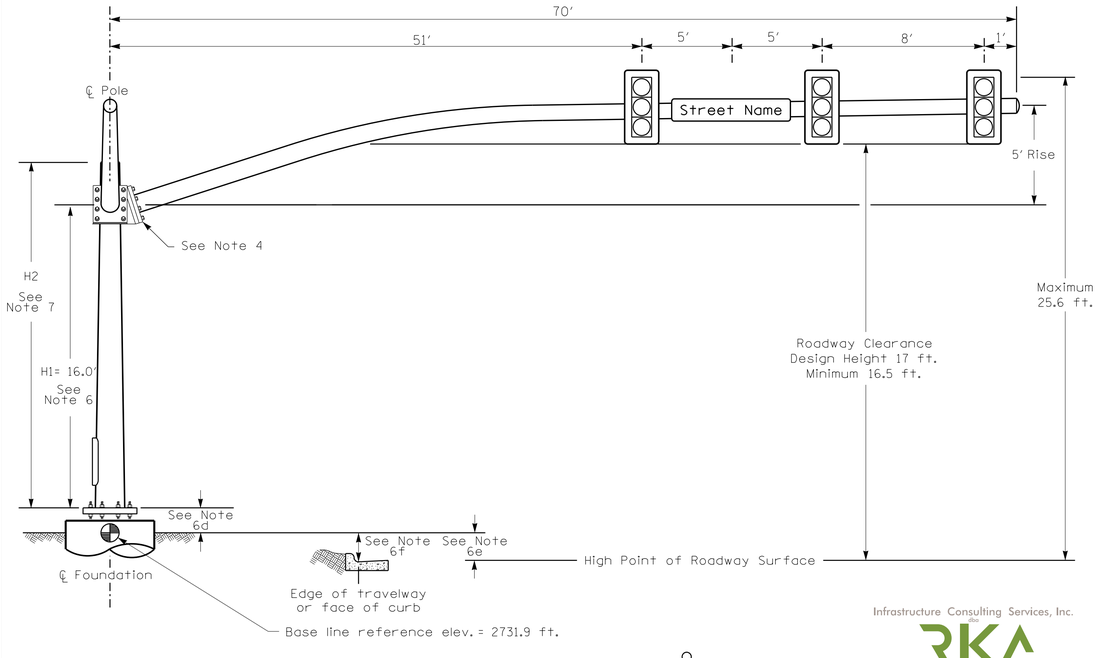
4/10/2023
U-5839_14_WJH_2020nmdc.dgn
User:swilder

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°

Infrastructure Consulting Services, Inc.
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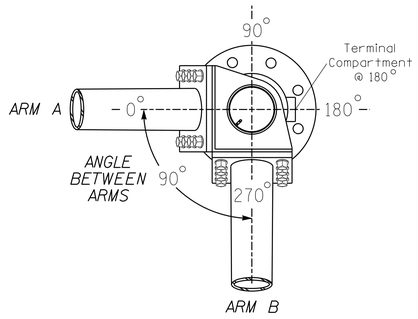
4/10/2023
4:/W4/0974_sig_MP2_2020nmdc.dgn
User:swilder

SPECIAL NOTE

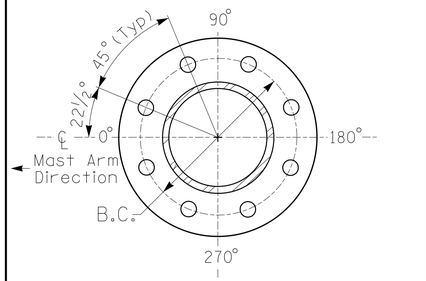
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

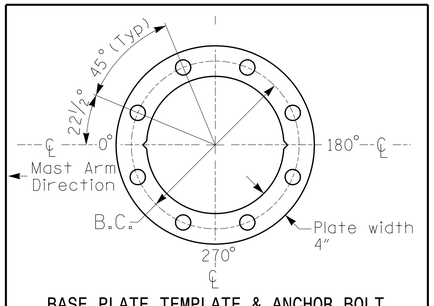
Elevation Differences for:	Arm A	Arm B
Baseline reference point at ℄ Foundation @ ground level	2731.9 ft.	2731.9 ft.
Elevation difference at High point of roadway surface	+0.4 ft.	+2.5 ft.
Elevation difference at Edge of travelway or face of curb	-1.4 ft.	-0.6 ft.



POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL



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

METAL POLE No. 2

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.11

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12″-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5″ W X 52.5″ L	60 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5″ W X 66.0″ L	74 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	12.0 S.F.	18.0″ W X 96.0″ L	27 LBS

NOTES

DESIGN REFERENCE MATERIAL

1. Design the traffic signal structure and foundation in accordance with:
   - The 6th Edition 2013 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, including all of the latest interim revisions.
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DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
6. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. 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.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
   f. Provide horizontal distance from the proposed centerline of the foundation to the edge of travelway. Refer to the Elevation Data Chart for elevation difference between the proposed foundation ground level and the edge of travelway. This information is necessary to ensure that the roadway clearance is maintained at the edge of the travelway and to aid in the camber design of the arm.
7. 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.
8. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
9. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
10. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

All metal poles and arms should be Hunter Green in color as specified in the project special provisions.

NCDOT Wind Zone 5 (120 mph)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

US 276 (Russ Avenue)
at
US 23 - 74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	REVIEWED BY:	16085 (040)

SCALE: 0 N/A N/A

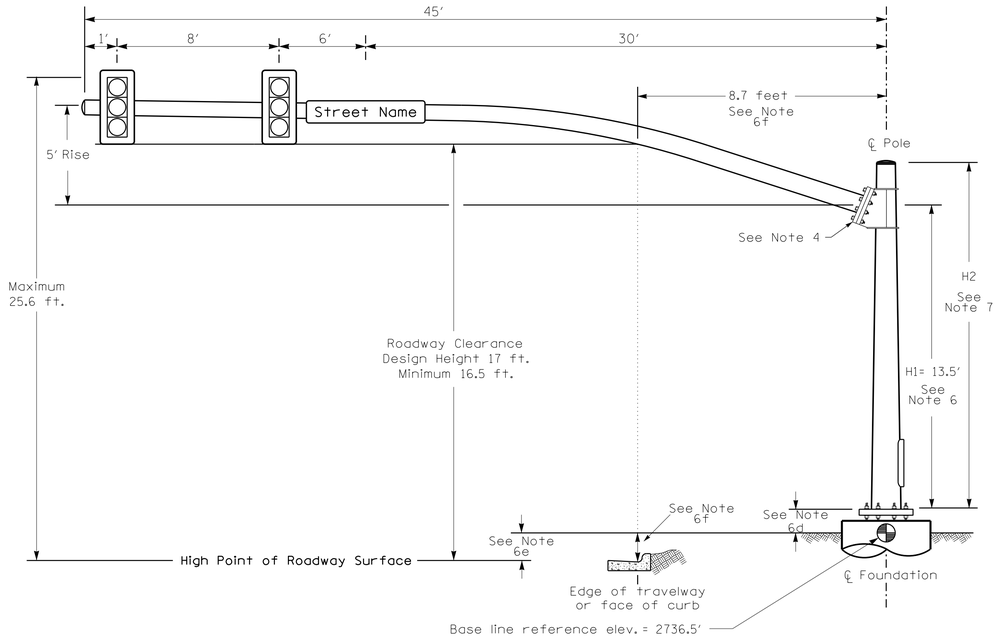
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton
A05600704684B4A
SIGNATURE 04/11/2023 DATE

SIG. INVENTORY NO. 14-0974

Design Loading for METAL POLE NO. 3



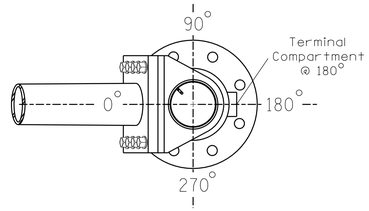
Elevation View

SPECIAL NOTE

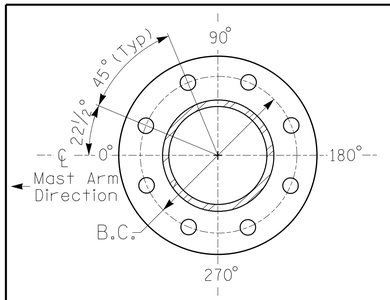
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

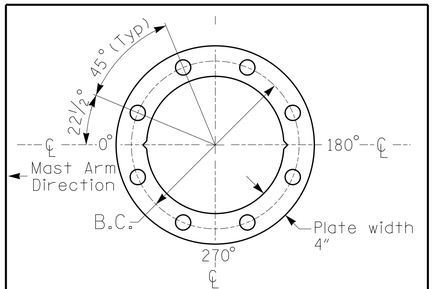
Elevation Differences for:	Pole 1	
Baseline reference point at ℄ Foundation @ ground level	2736.5 ft.	
Elevation difference at High point of roadway surface	0.0 ft.	
Elevation difference at Edge of travelway or face of curb	+0.1 ft.	



POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL



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

METAL POLE No. 3

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.12

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12"-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5" W X 52.5" L	60 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	12.0 S.F.	18.0" W X 96.0" L	27 LBS

NOTES

DESIGN REFERENCE MATERIAL

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

DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
6. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. 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.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
   f. Provide horizontal distance from the proposed centerline of the foundation to the edge of travelway. Refer to the Elevation Data Chart for elevation difference between the proposed foundation ground level and the edge of travelway. This information is necessary to ensure that the roadway clearance is maintained at the edge of the travelway and to aid in the camber design of the arm.
7. 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.
8. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
9. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
10. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

All metal poles and arms should be Hunter Green in color as specified in the project special provisions.

NCDOT Wind Zone 5 (120 mph)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Infrastructure Consulting Services, Inc.
RKA
RAMEY KEMP ASSOCIATES
5808 Farlingdon Place
Raleigh, North Carolina 27609
Phone: 919-872-5115
NC License No. F-1489
www.rameykemp.com

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

US 276 (Russ Avenue)
at
US 23 - 74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	REVIEWED BY:	16085 (040)

SCALE: 0 N/A N/A

REVISIONS	INIT.	DATE

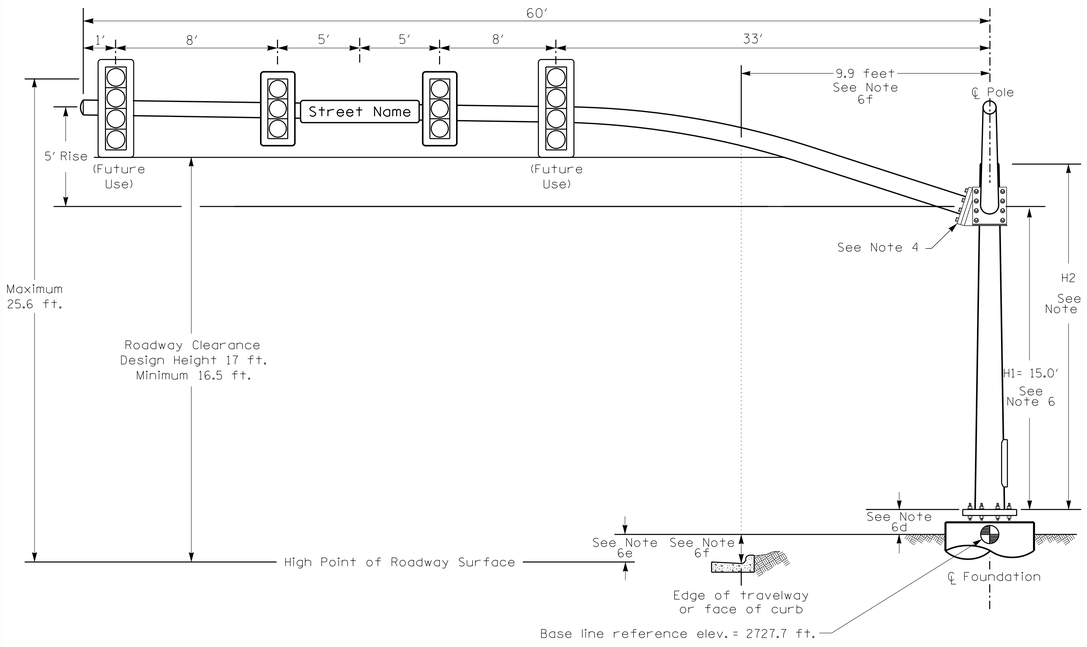
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON

DocuSigned by: William J. Hamilton 4/11/2023
SIGNATURE DATE

SIG. INVENTORY NO. 14-0974

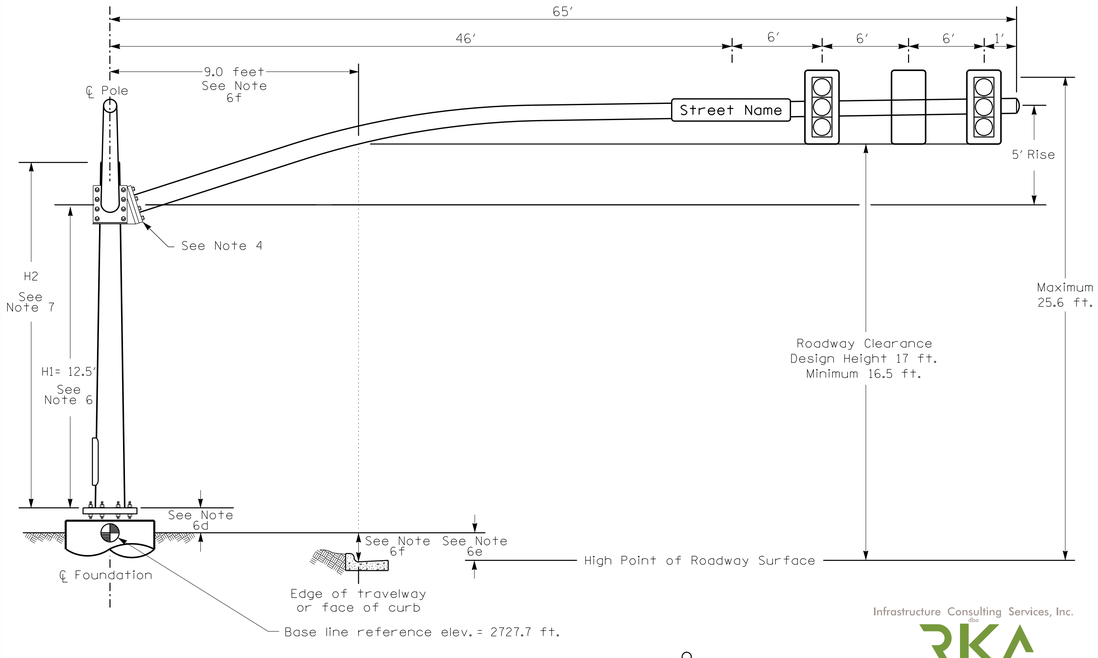
4/10/2023
14-0974_sig_MP3_2020mmds.dgn
User:swilder

Design Loading for METAL POLE NO. 4, MAST ARM A



Elevation View @ 270°

Design Loading for METAL POLE NO. 4, MAST ARM B



Elevation View @ 0°

Infrastructure Consulting Services, Inc.
RAMEY KEMP ASSOCIATES
8210 University Executive Park Drive Suite 220 Charlotte, North Carolina 28262
Phone: 704-549-4260 | www.rameykemp.com | NC License No. F-1489

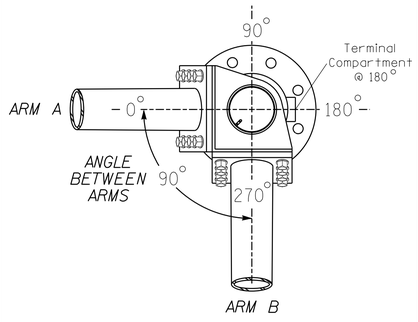
4/10/2023
J:\W\4037\4_sig_MP4_2020nmdc.dgn
User:swilder

SPECIAL NOTE

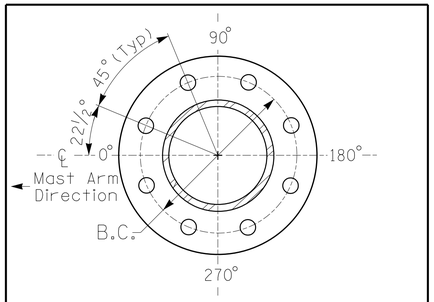
The contractor is responsible for verifying that the mast arm attachment height (H1) will provide the "Design Height" clearance from the roadway before submitting final shop drawings for approval. Verify elevation data below which was obtained by field measurement or from available project survey data.

Elevation Data for Mast Arm Attachment (H1)

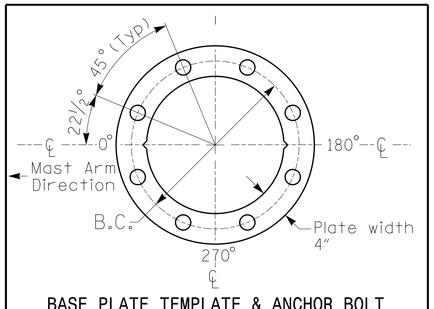
Elevation Differences for:	Arm A	Arm B
Baseline reference point at ℄ Foundation @ ground level	2727.7 ft.	2727.7 ft.
Elevation difference at High point of roadway surface	+1.0 ft.	-1.0 ft.
Elevation difference at Edge of travelway or face of curb	+0.7 ft.	-0.9 ft.



POLE RADIAL ORIENTATION



8 BOLT BASE PLATE DETAIL



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

METAL POLE No. 4

PROJECT REFERENCE NO.	SHEET NO.
U-5839	Sig 9.10

MAST ARM LOADING SCHEDULE

LOADING SYMBOL	DESCRIPTION	AREA	SIZE	WEIGHT
	RIGID MOUNTED SIGNAL HEAD 12″-3 SECTION-WITH BACKPLATE	9.3 S.F.	25.5″ W X 52.5″L	60 LBS
	RIGID MOUNTED SIGNAL HEAD 12″-4 SECTION-WITH BACKPLATE	11.5 S.F.	25.5″ W X 66.0″L	74 LBS
Street Name	STREET NAME SIGN RIGID MOUNTED	12.0 S.F.	18.0″ W X 96.0″L	27 LBS

NOTES

DESIGN REFERENCE MATERIAL

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

DESIGN REQUIREMENTS

2. Design the traffic signal structure using the loading conditions shown in the elevation views. These are anticipated worst case "design loads" and may not represent the actual loads that will be applied at the time of the installation. The contractor should refer to the traffic signal plans for the actual loads that will be applied at the time of the installation.
3. Design all signal supports using stress ratios that do not exceed 0.9.
4. 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.
5. Design base plate with 8 anchor bolt holes. Provide 2 inch x 60 inch anchor bolts.
6. The mast arm attachment height (H1) shown is based on the following design assumptions:
   a. 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.
   b. Signal heads are rigidly mounted and vertically centered on the mast arm.
   c. The roadway clearance height for design is as shown in the elevation views.
   d. The top of the pole base plate is 0.75 feet above the ground elevation.
   e. Refer to the Elevation Data Chart for the elevation differences between the proposed foundation ground level and the high point of the roadway.
   f. Provide horizontal distance from the proposed centerline of the foundation to the edge of travelway. Refer to the Elevation Data Chart for elevation difference between the proposed foundation ground level and the edge of travelway. This information is necessary to ensure that the roadway clearance is maintained at the edge of the travelway and to aid in the camber design of the arm.
7. 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.
8. If pole location adjustments are required, the contractor must gain approval from the Engineer as this may affect the mast arm lengths and arm attachment heights. The contractor may contact the Signal Design Section Senior Structural Engineer for assistance at (919) 814-5000.
9. The contractor is responsible for verifying that the mast arm length shown will allow proper positioning of the signal heads over the roadway.
10. The contractor is responsible for providing soil penetration testing data (SPT) to the pole manufacturer so site specific foundations can be designed.

All metal poles and arms should be Hunter Green in color as specified in the project special provisions.

NCDOT Wind Zone 5 (120 mph)

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared for: Transportation Mobility and Safety Division, North Carolina Department of Transportation, Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

US 276 (Russ Avenue)
at
US 23 - 74 WB Ramps

Division 14 Haywood County Waynesville

PLAN DATE:	April 2023	REVIEWED BY:	WJ Hamilton
PREPARED BY:	TS Popelka	REVIEWED BY:	16085 (040)

SCALE 0 N/A N/A

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 32396 ENGINEER WILLIAM J. HAMILTON
DocuSigned by: William J. Hamilton A0560D704648484...
04/11/2023
SIGNATURE DATE

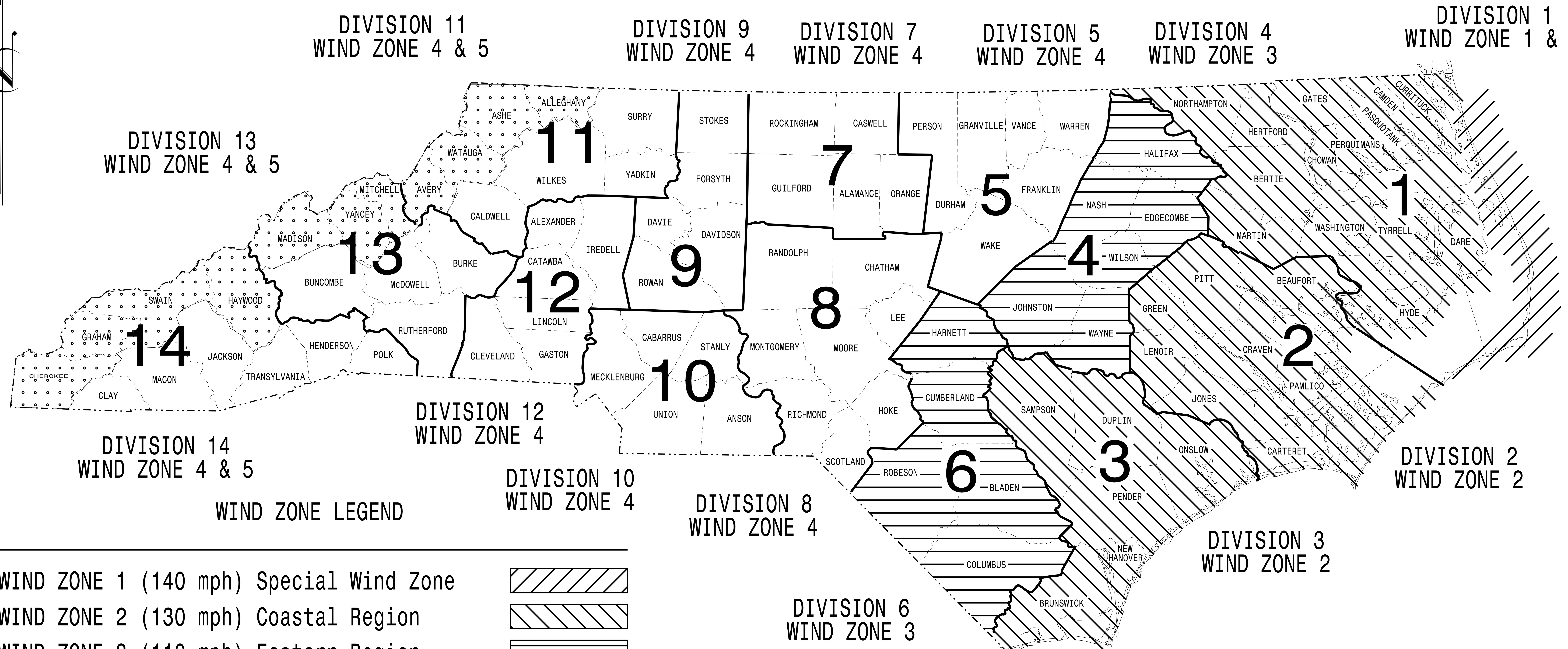
SIG. INVENTORY NO. 14-0974

NCDOT METAL POLE STANDARDS

PROJECT I.D. NO.	SHEET NO.
	Sig.M1

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

STANDARD DRAWINGS FOR ALL 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:

Transportation Mobility and Safety Division
Signal Design Section
State of North Carolina Department of Transportation

750 N.Greenfield Pkwy,
Garner,NC 27529

Designed in conformance with the latest 2015 Interim to the 6th Edition 2013

AASHTO

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

INDEX OF PLANS

DRAWING NUMBER	DESCRIPTION
Sig. M 1	Statewide Wind Zone Map
Sig. M 2	Typical Fabrication Details–All Metal Poles
Sig. M 3	Typical Fabrication Details–Strain Poles
Sig. M 4	Typical Fabrication Details–Mast Arm Poles
Sig. M 5	Typical Fabrication Details–Mast Arm Connection
Sig. M 6	Typical Fabrication Details–Strain Pole Attachments
Sig. M 7	Construction Details–Foundations
Sig. M 8	Standard Strain Pole Foundation–All Soil Conditions

NCDOT CONTACTS:

MOBILITY AND SAFETY DIVISION – ITS AND SIGNALS UNIT

M.M. MCDIARMID, P.E. – STATE ITS AND SIGNALS ENGINEER

J. P. GALLOWAY, P.E. – STATE SIGNALS ENGINEER

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

SEAL

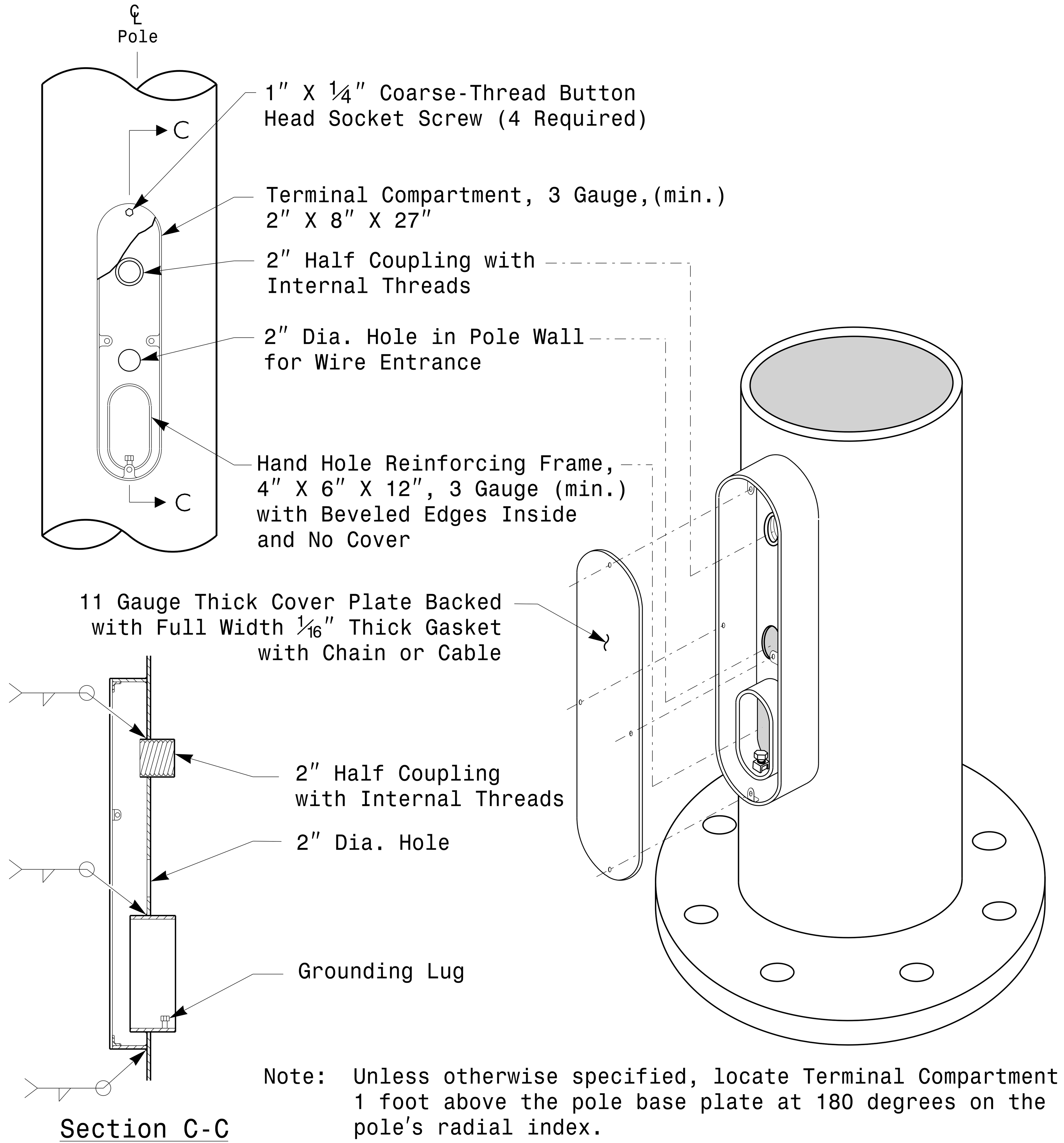
NORTH CAROLINA PROFESSIONAL SEAL 028094 ENGINEER DEBESH C. SARKAR

DocuSigned by: Debesh C. Sarkar

SIGNATURE: Debesh C. Sarkar | DATE: 10/11/2017

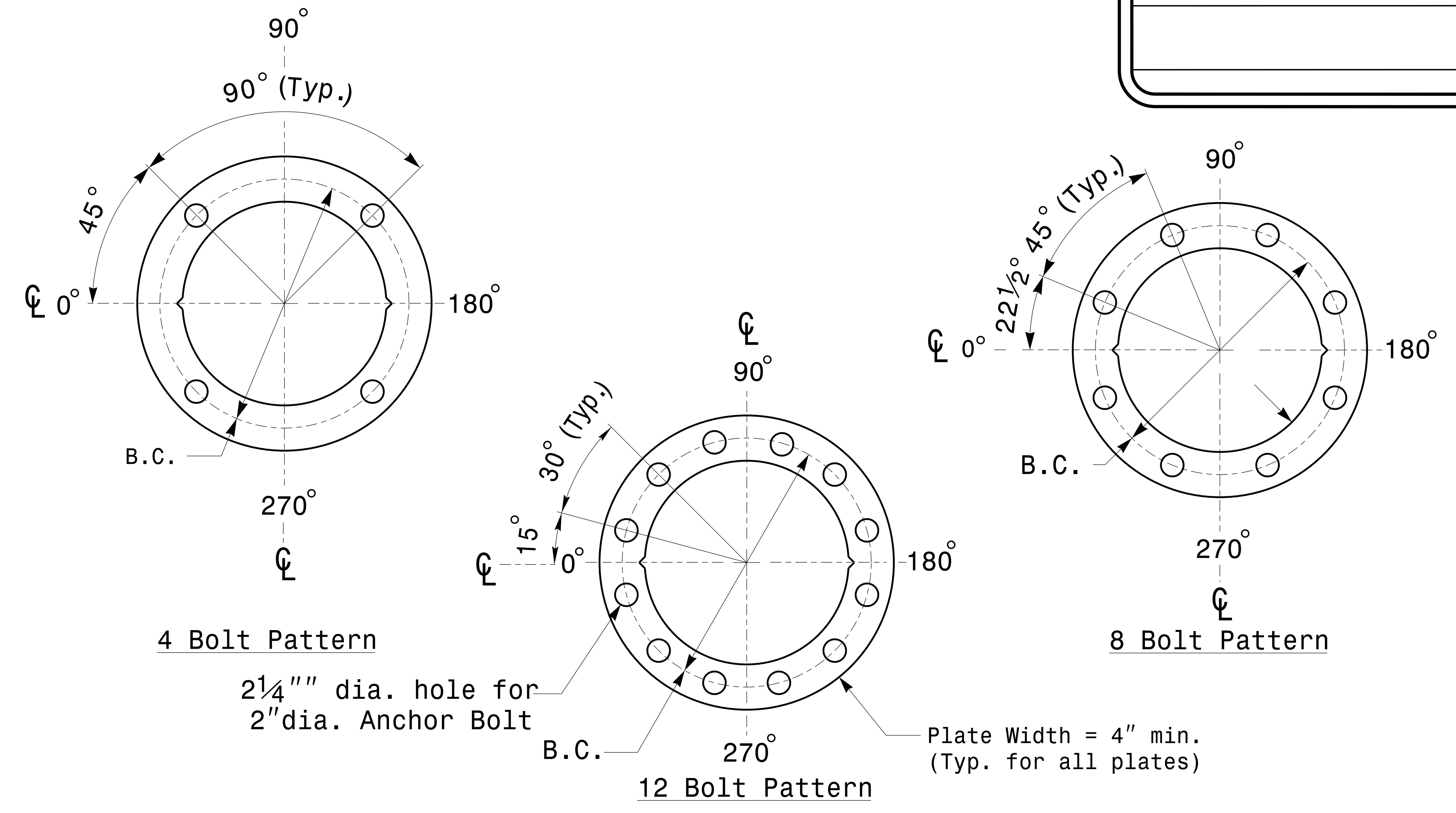
PROJECT ID. NO.	SHEET NO.
	Sig.M2

Fabrication Details – All Metal Poles



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 ¼″ 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 SIG. INV. NO. ________
NCDOT POLE NO. ________

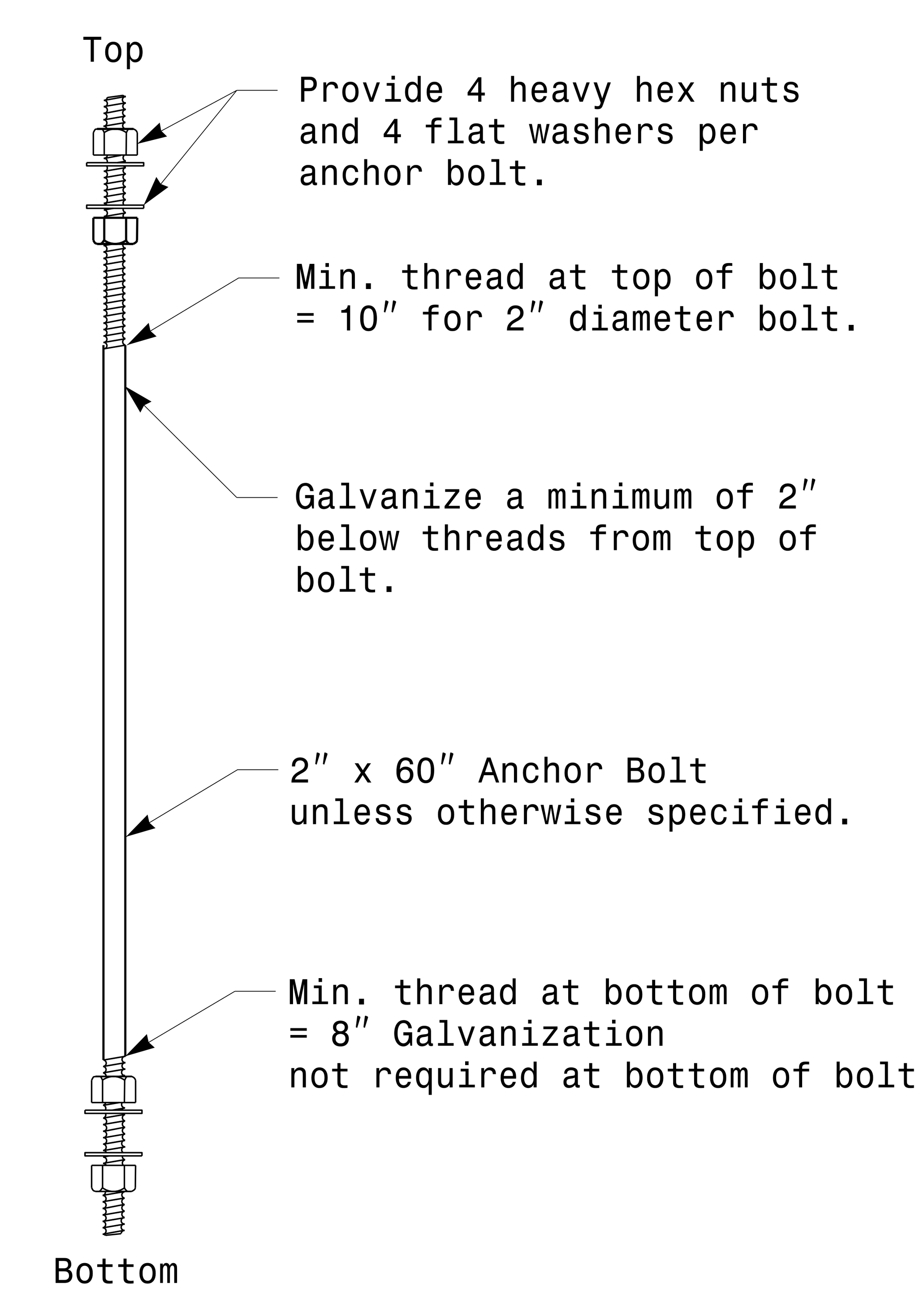
Shaft I.D. Tag
(Provide on Shaft of Strain Poles and Mast Arm Poles Shaft)

MFG ________ MFG. DATE: MM/YY
SECTION D/T/L/Y ___/___/___/___
NCDOT SIG. INV. NO. ________
NCDOT POLE NO. ________

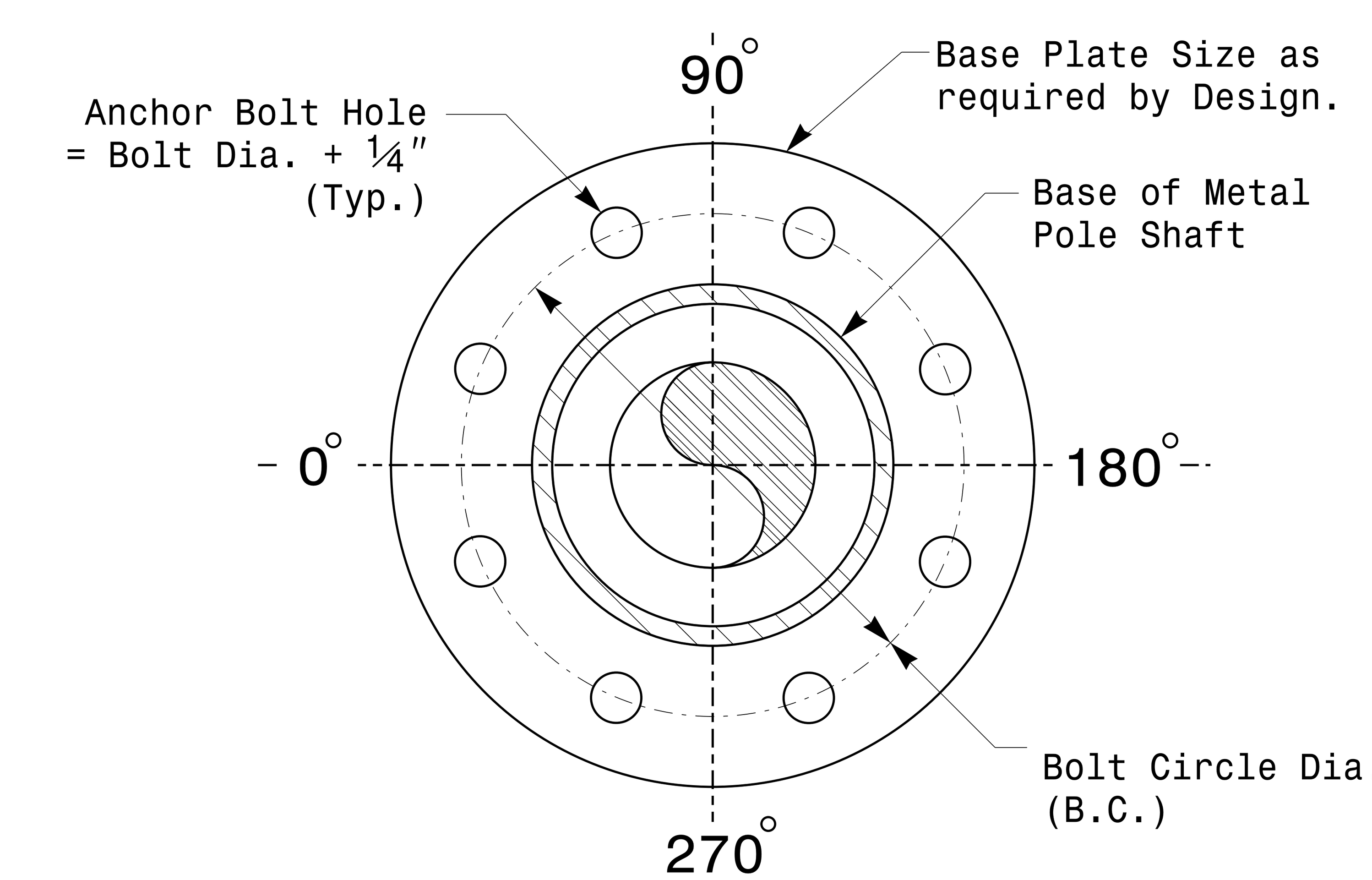
Arm I.D. Tag
(Provide on each section of a multi-section mast arm.)

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 Signal Inv. Number and pole I.D. number
5) See drawing M3 and M4 for mounting positions of I.D. tags.

Identification Tag Details



Anchor Bolt Detail



Note: Base plate may be circular,octagonal,square or rectangular in shape.

Typical Base Plate Detail

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

Typical Fabrication Details For All Metal Poles

PLAN DATE:	OCTOBER 2017	DESIGNED BY:	C.F.ANDREWS
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR

SCALE: 0 NA NONE

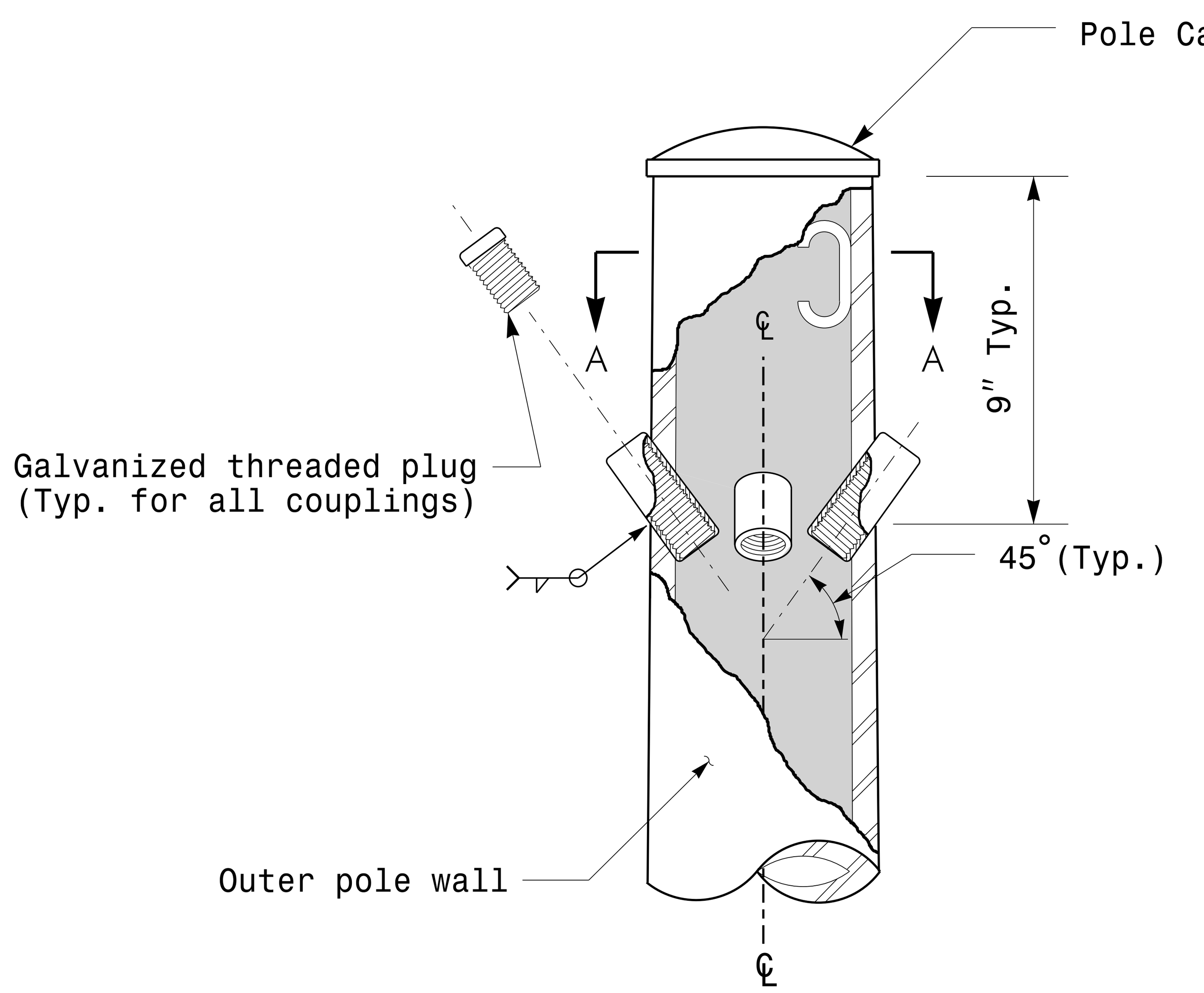
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 028094 ENGINEER DEBESH C. SARKAR

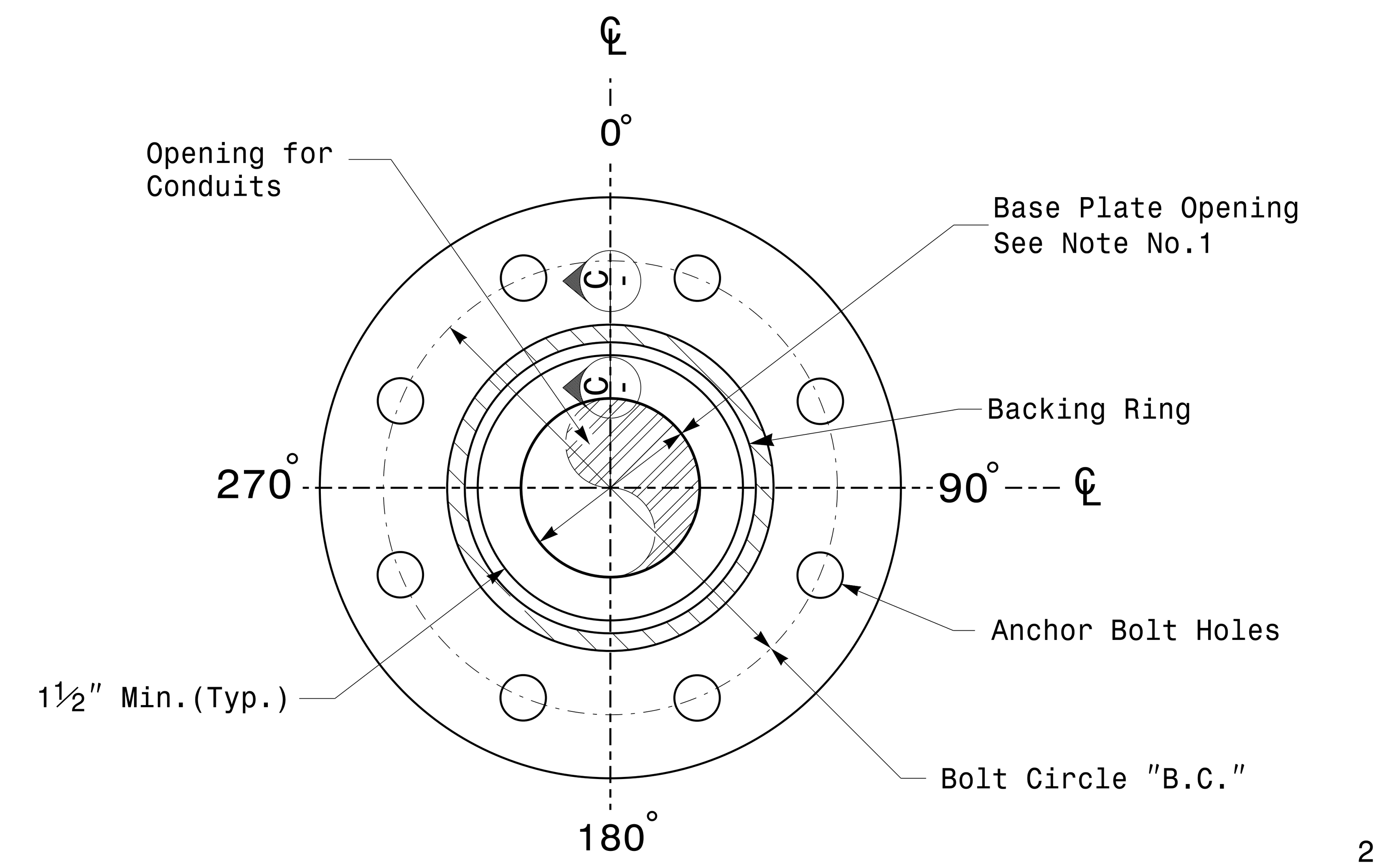
DocuSigned by: Debesh C. Sarkar
SIGNATURE 10/11/2017 DATE

PROJECT ID. NO.	SHEET NO.
	Sig.M3

Note:
1. Opening in pole base plate shall be equal to pole base inside diameter minus 3½″ but shall not be less than 8½″.

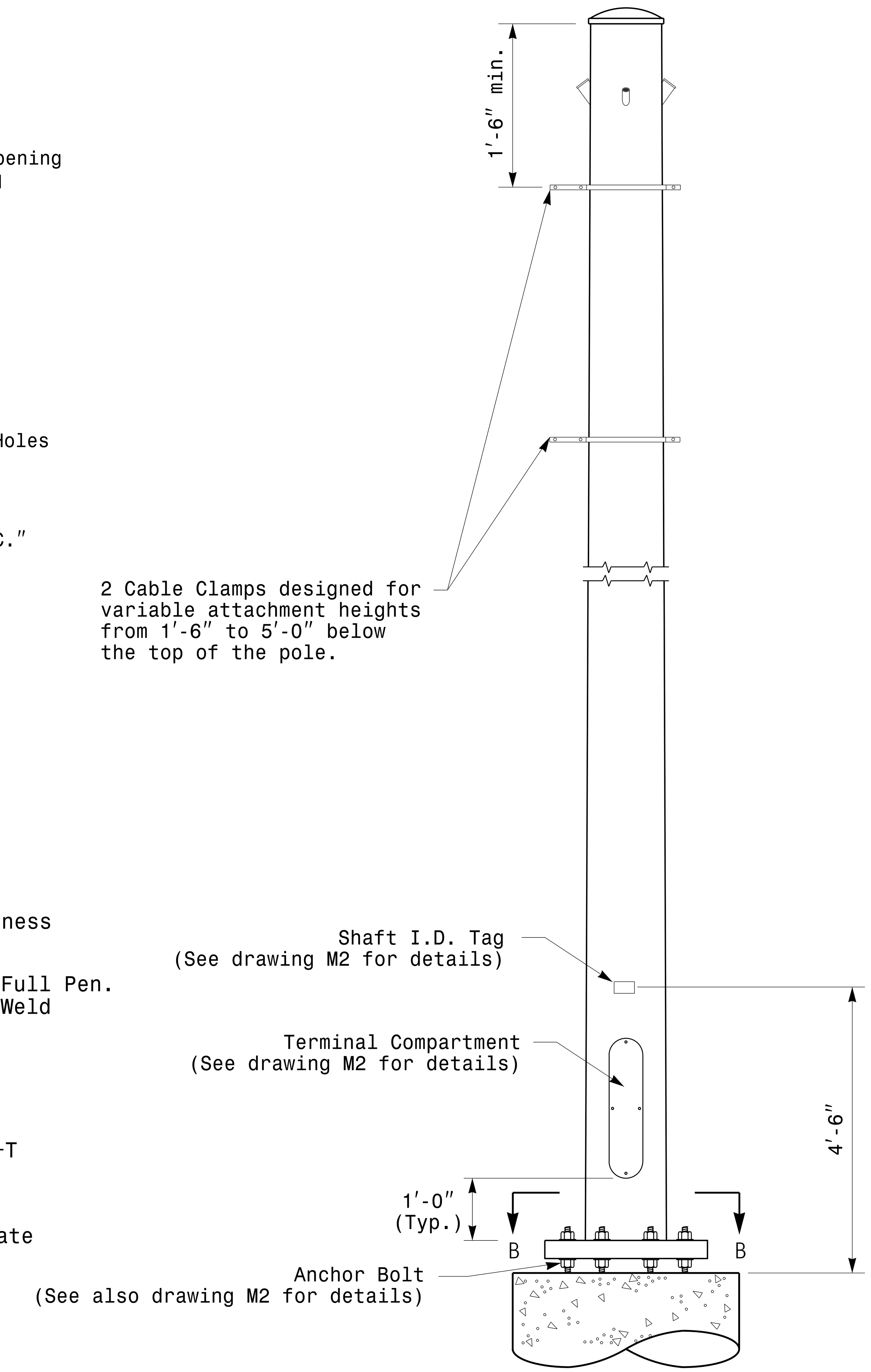


Cable Entrances at Top of Pole

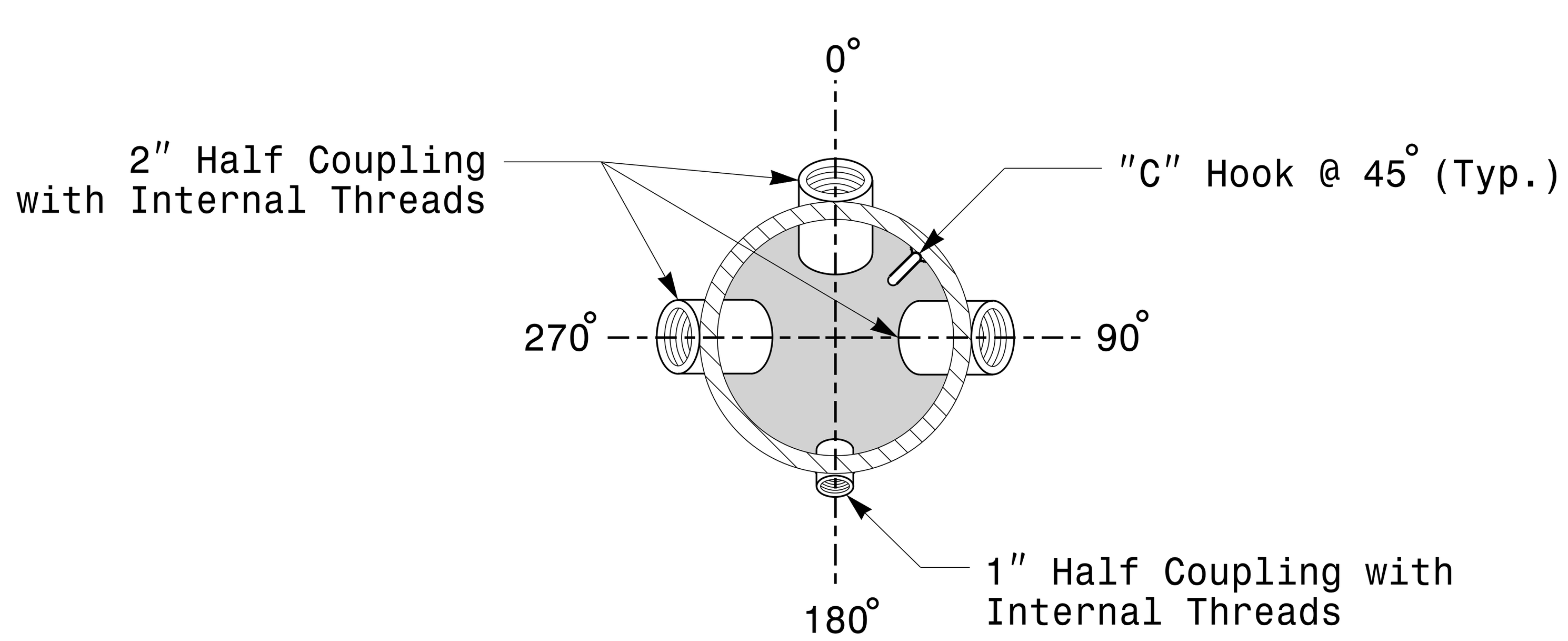


Section B-B

Pole Base Plate Details
(8 and 12 Bolt Pattern)

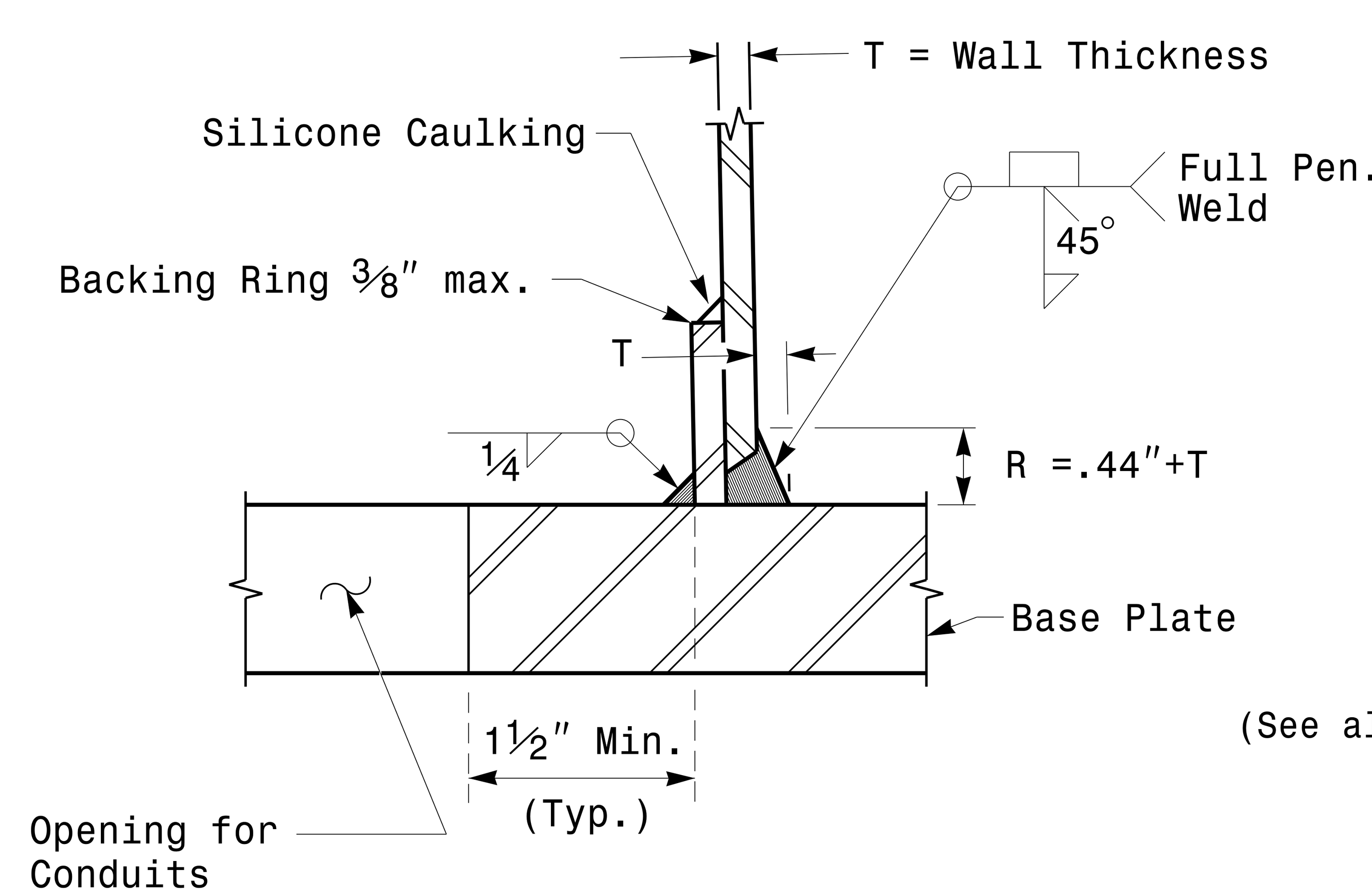


Monotube Strain Pole



Section A-A

Radial Orientation for Factory Installed Accessories at Top of Pole



Section C-C

(Pole Attachment to Base Plate)

Full-Penetration Groove Weld Detail

Fabrication Details – Strain Poles

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

Typical Fabrication Details
For
Strain Poles

PLAN DATE:	OCTOBER 2017	DESIGNED BY:	K.C.DURIGON
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR

SCALE
0 NA
NONE

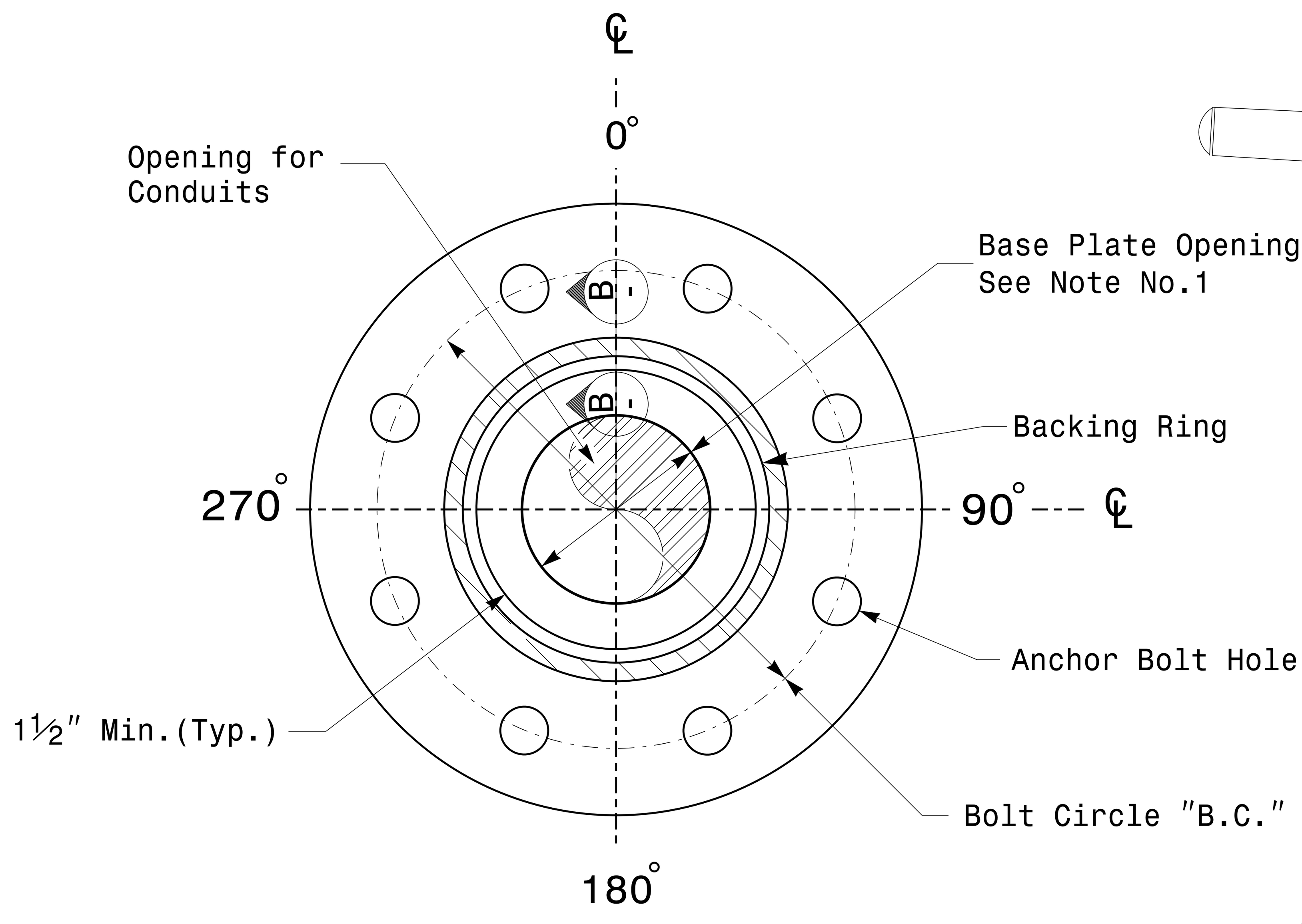
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA
PROFESSIONAL
SEAL
028094
ENGINEER
DEBESH C. SARKAR

DocuSigned by:
Debesh C. Sarkar
SIGNATURE
10/11/2017
DATE

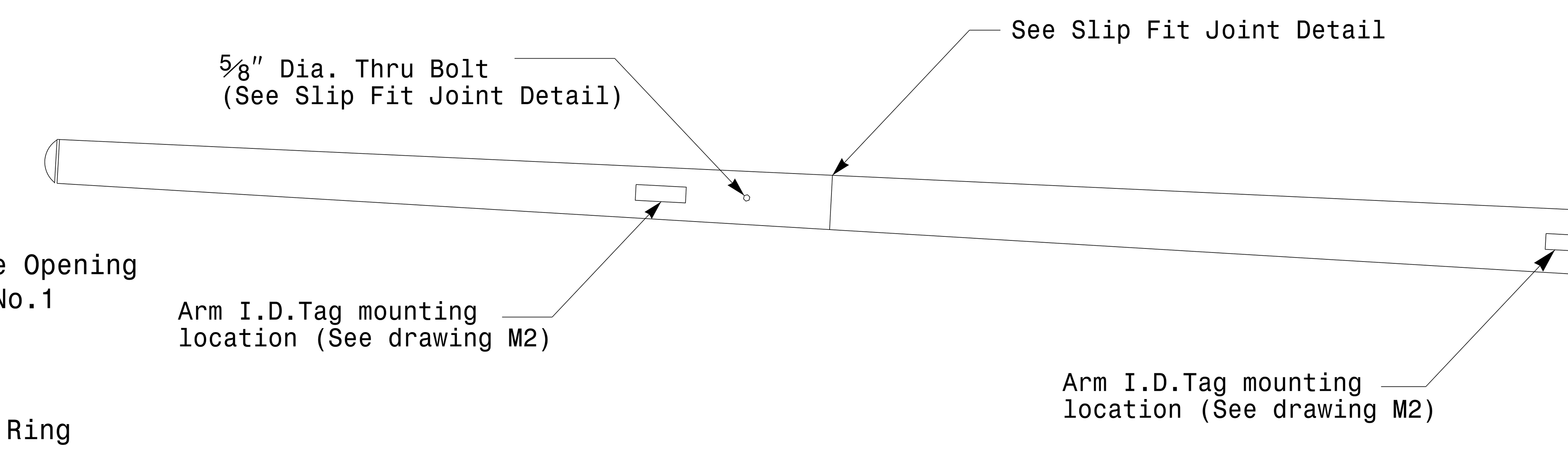
PROJECT ID. NO.	SHEET NO.
	Sig.M4

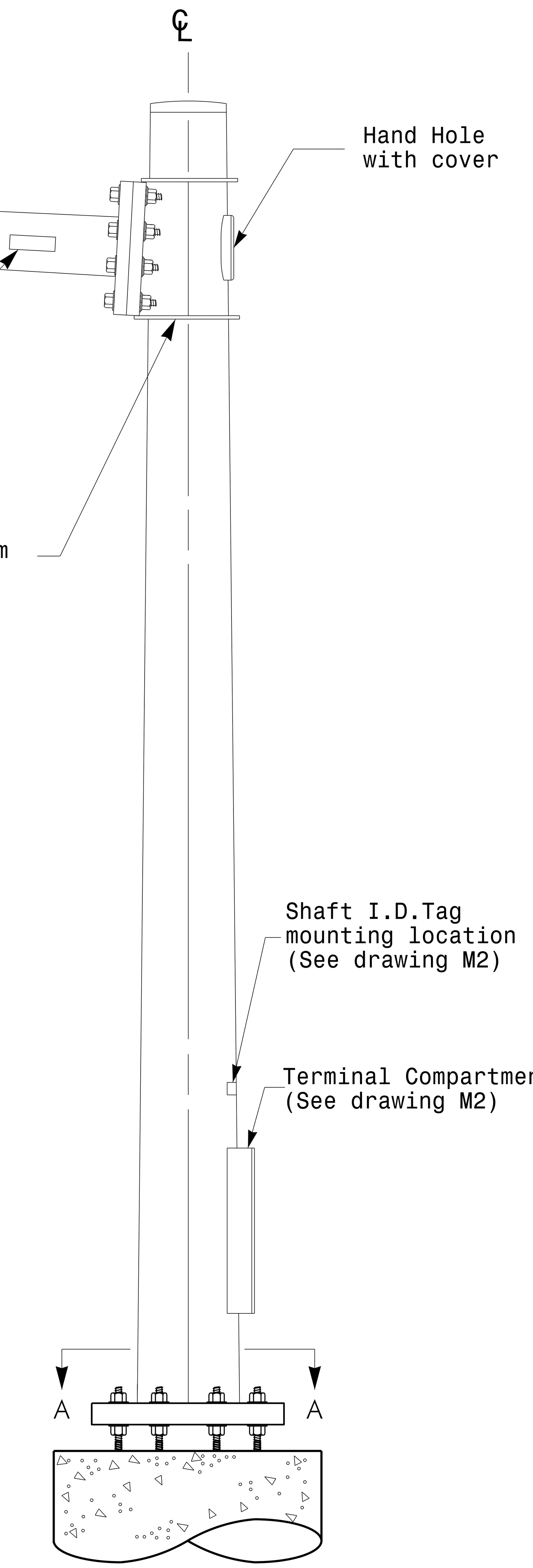
Note:
1. Opening in pole base plate shall be equal to pole base inside diameter minus 3½″ but shall not be less than 8½″.

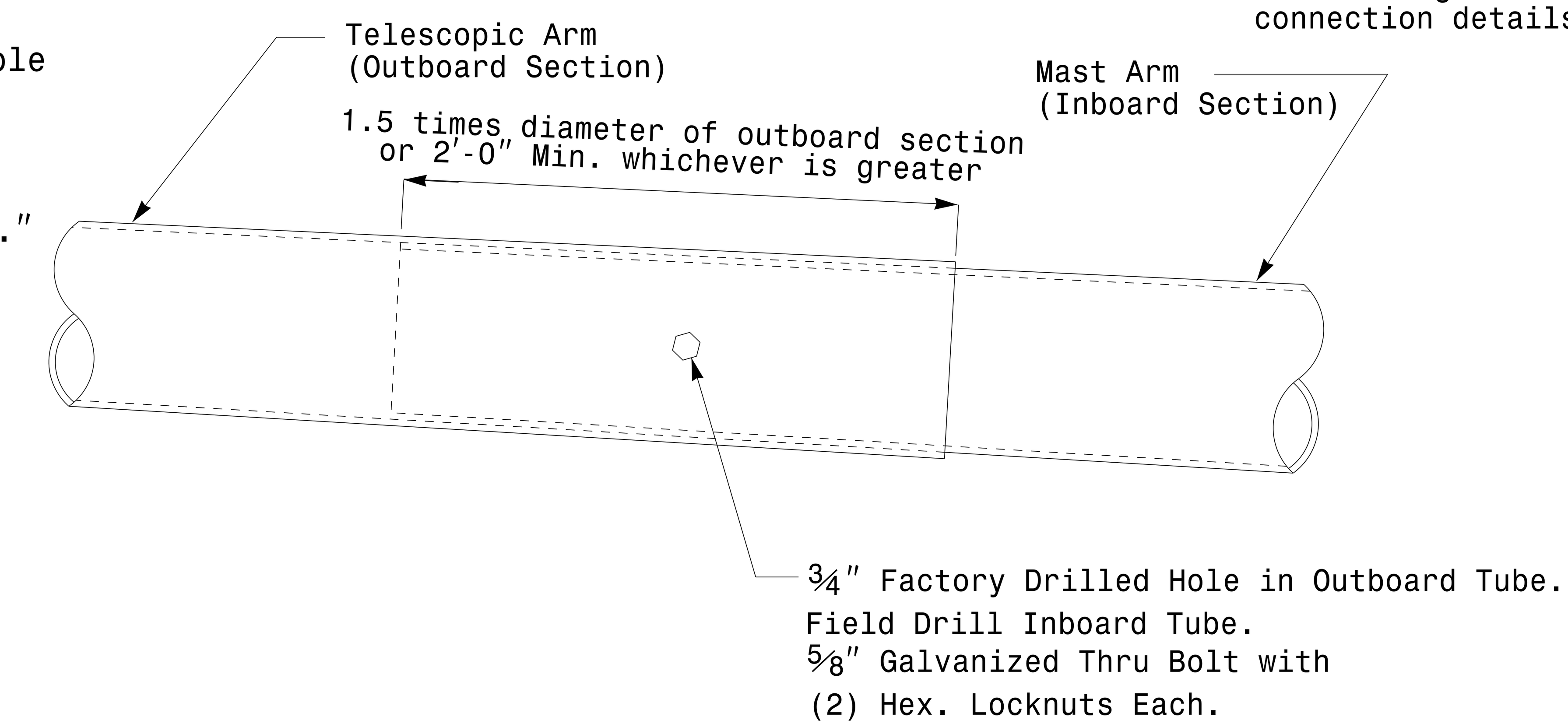


Section A-A

Pole Base Plate Details

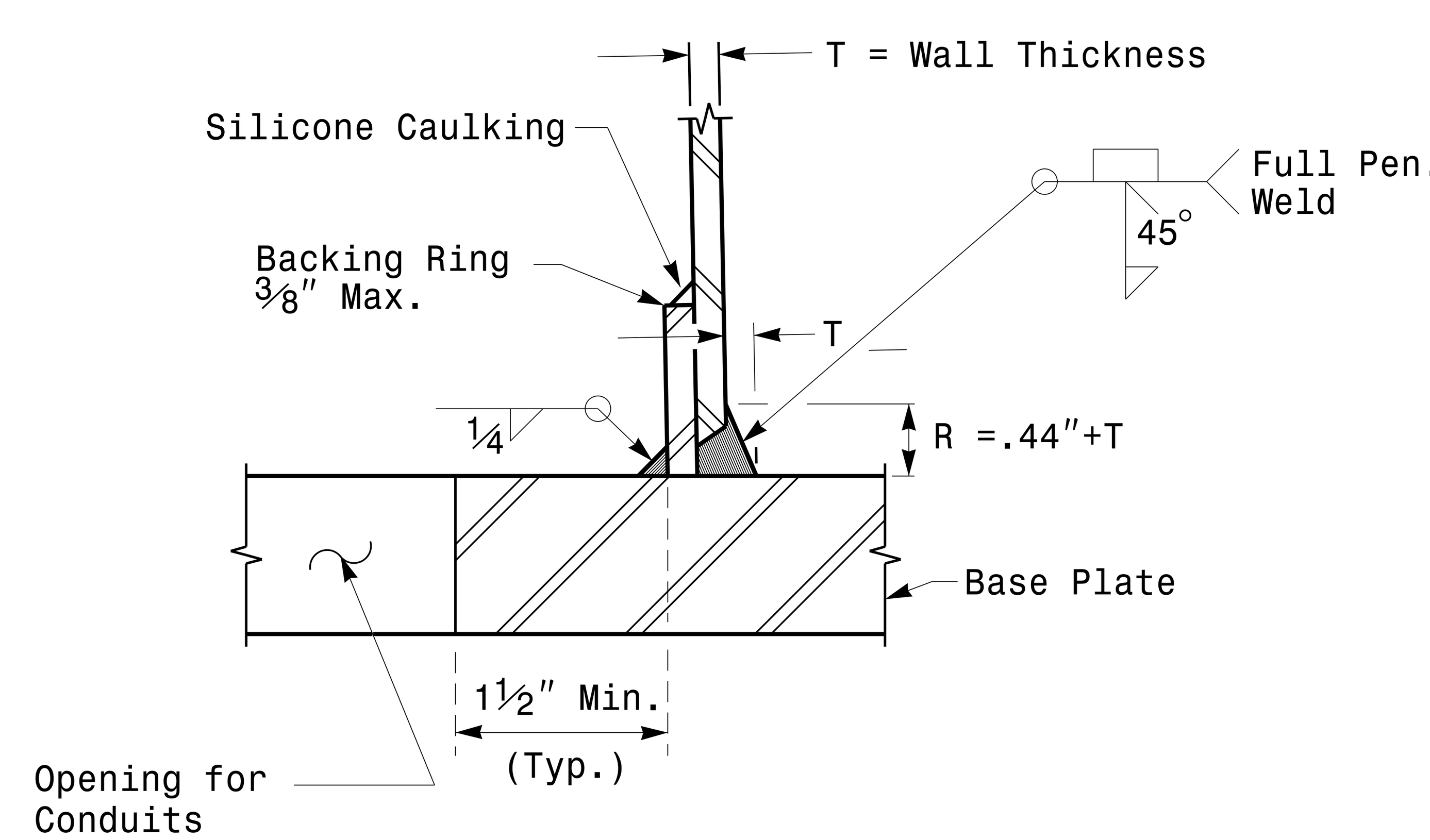






Slip Fit Joint Detail for Mast Arm

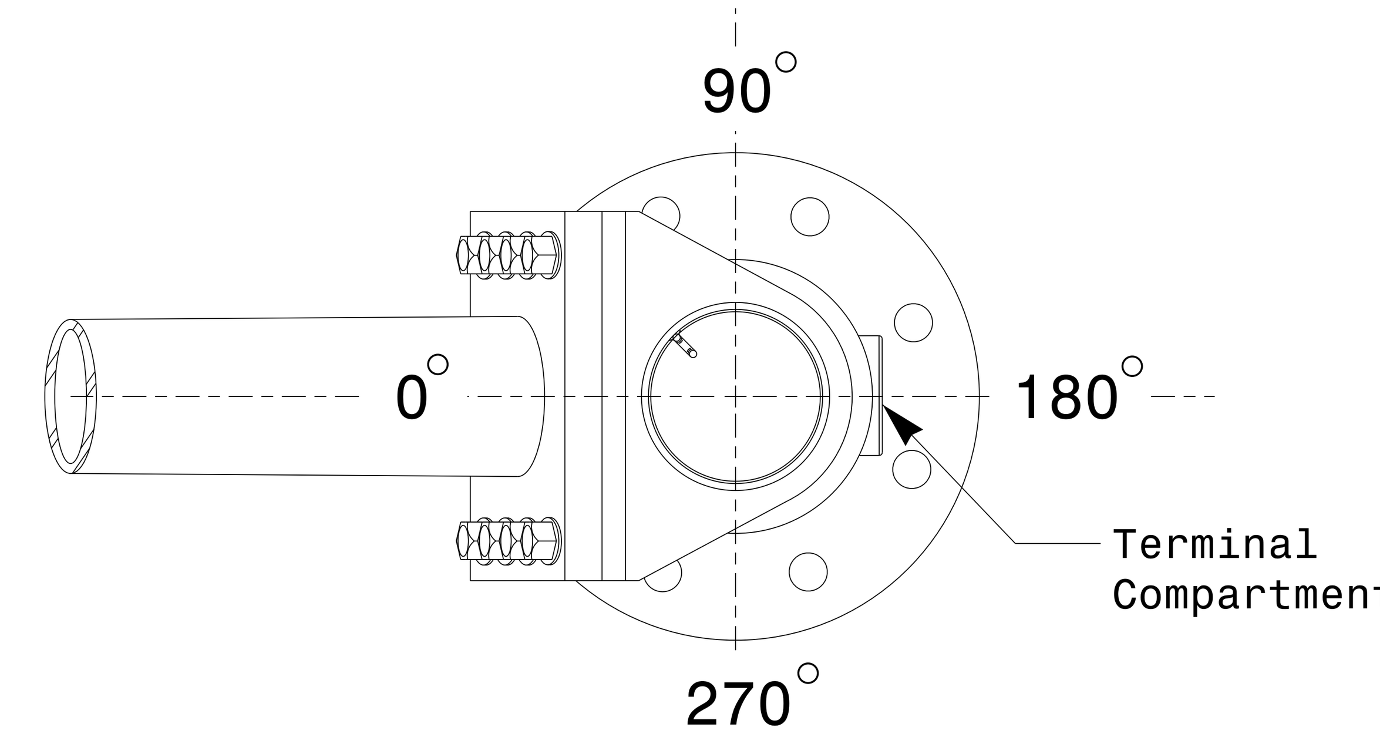
Mast Arm Pole



Section B-B

(Pole Attachment to Base Plate)

Full-Penetration Groove Weld Detail



Mast Arm Radial Orientation

Fabrication Details – Mast Arm Poles

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

Typical Fabrication Details
For
Mast Arm Poles

PLAN DATE:	OCTOBER 2017	DESIGNED BY:	K.C.DURIGON
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR

SCALE
0 NA
NONE

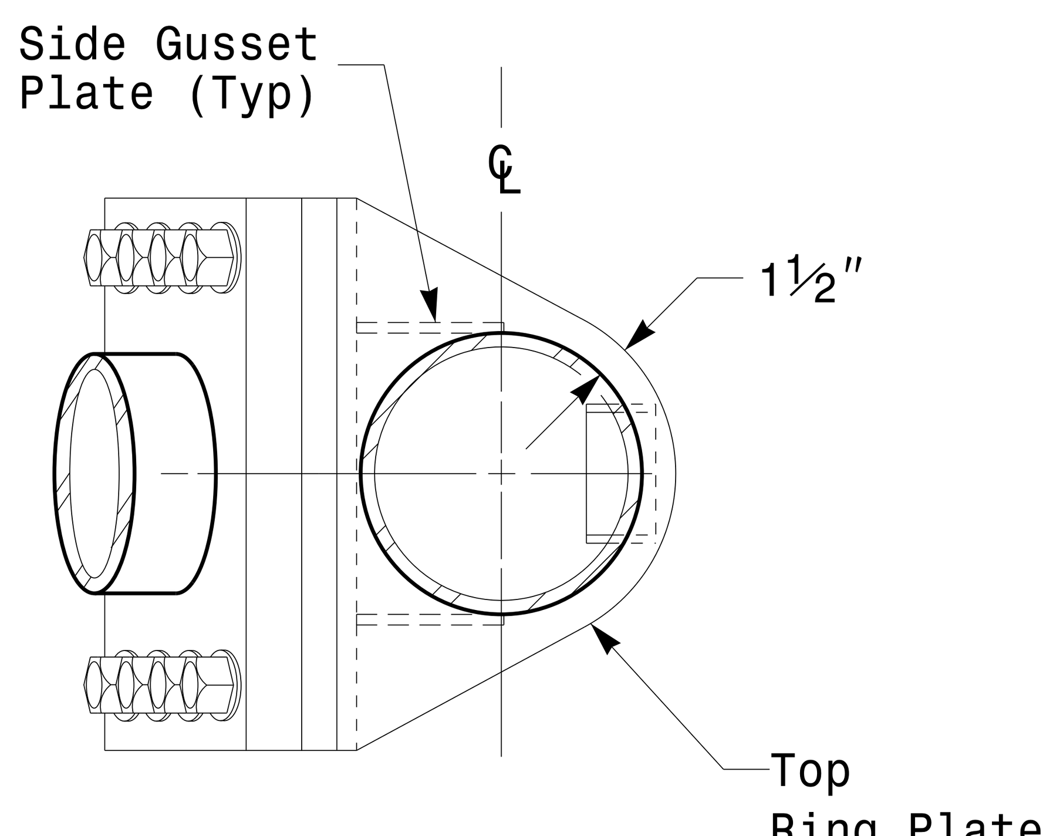
REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 028094 DEBESH C. SARKAR

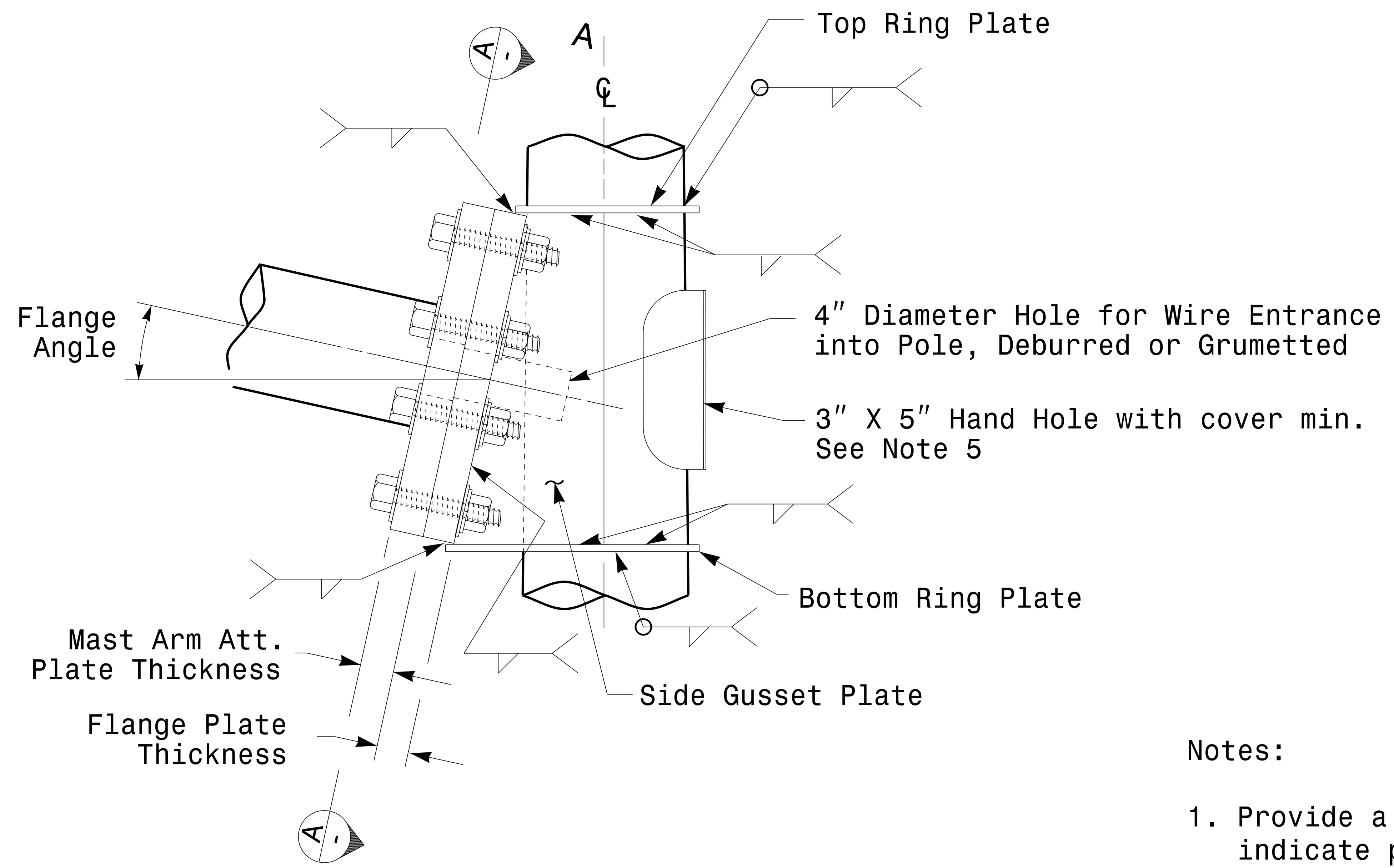
DocuSigned by: Debesh C. Sarkar
SIGNATURE 10/11/2017 DATE

PROJECT ID. NO.	SHEET NO.
	Sig.M5

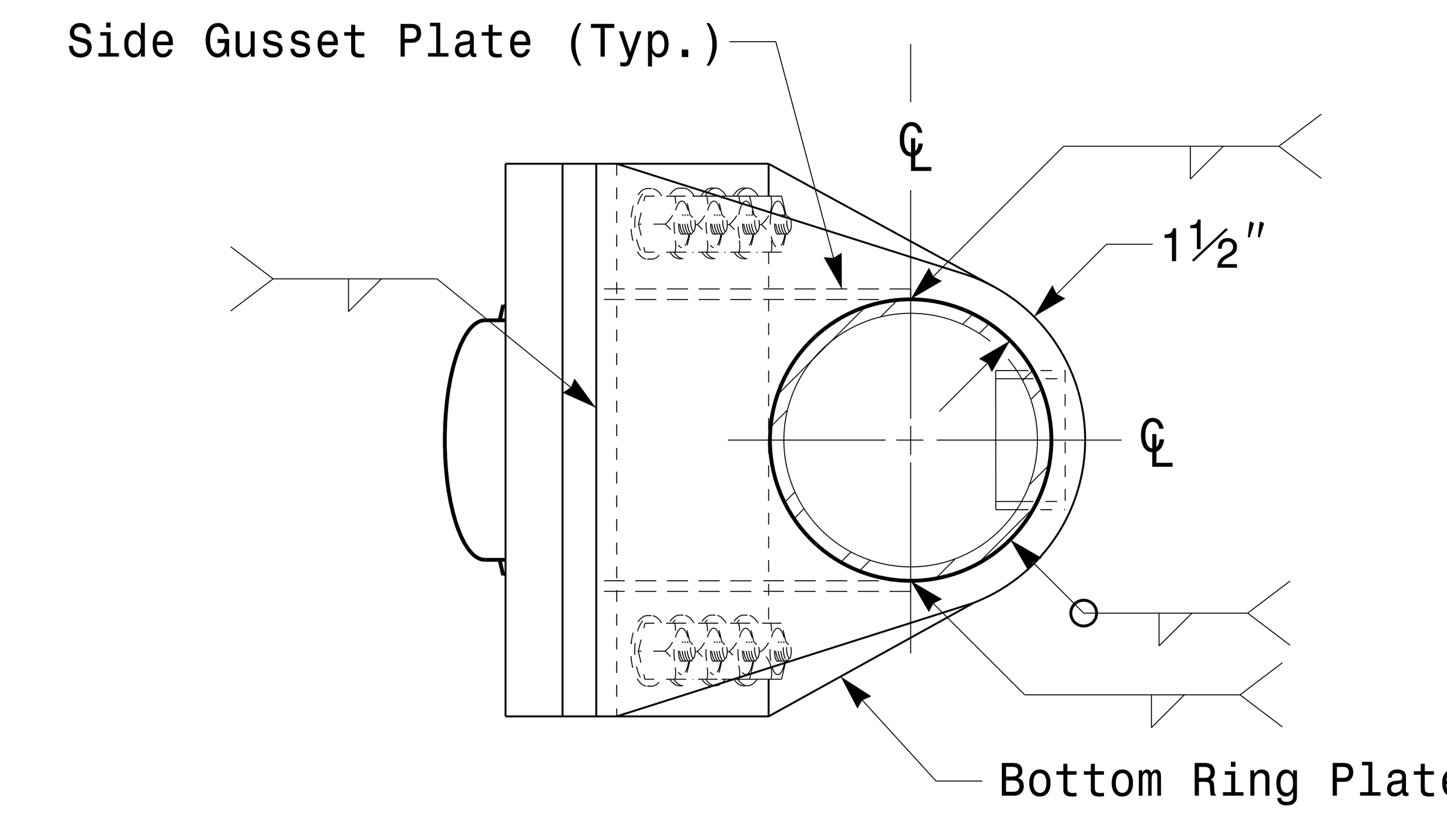
Welded Ring Stiffened Mast Arm Connection



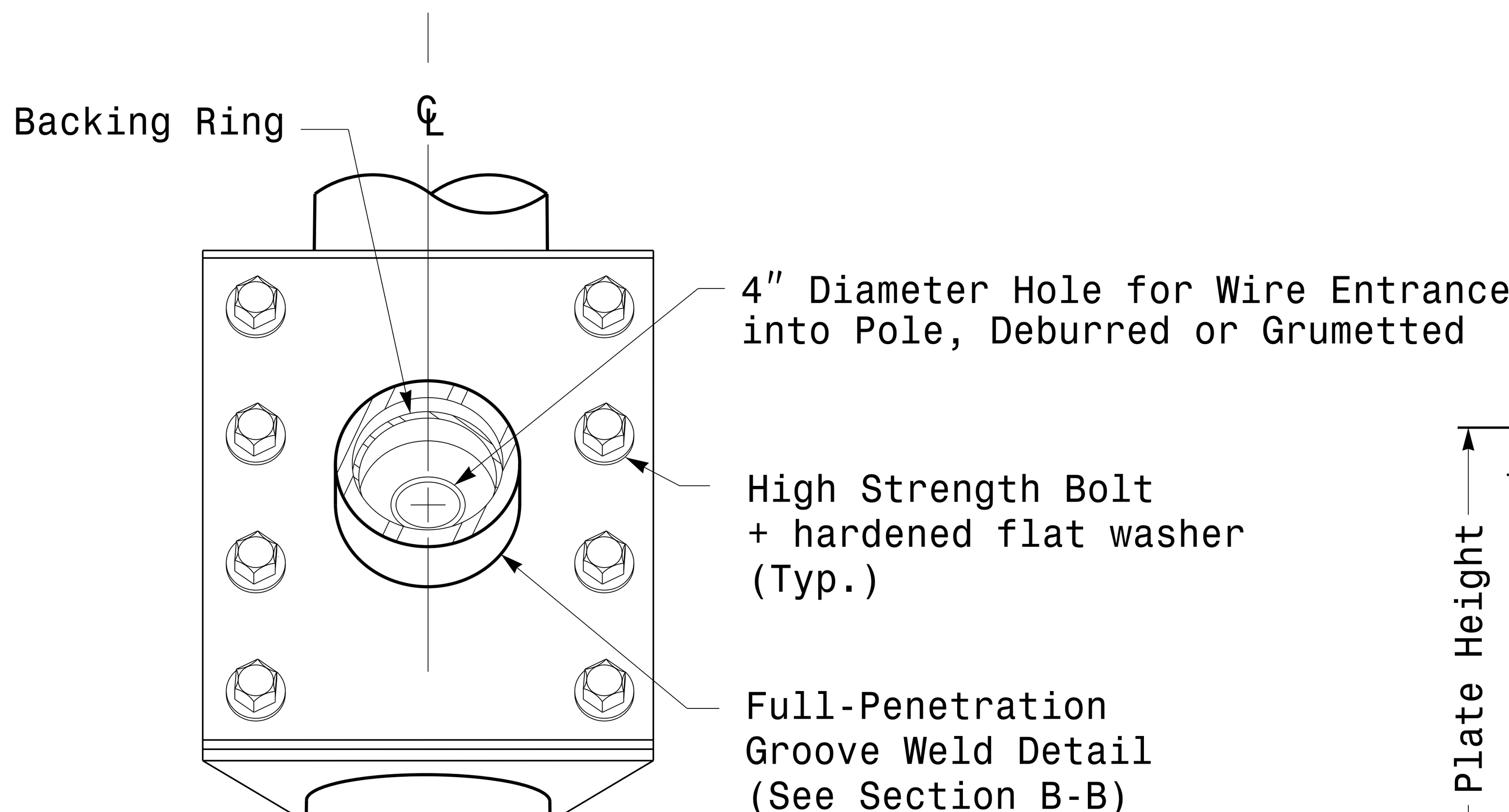
Plan View



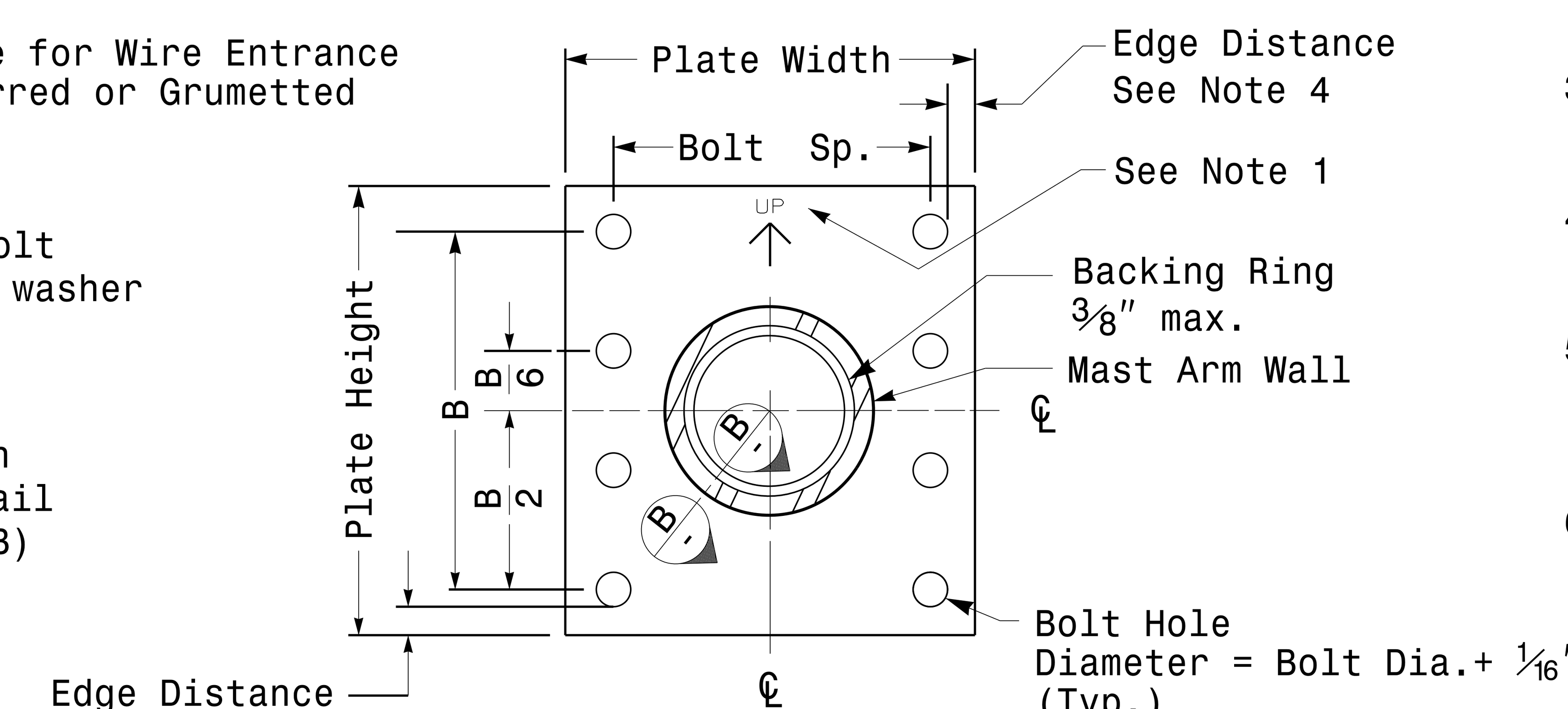
Side Elevation View



Bottom View



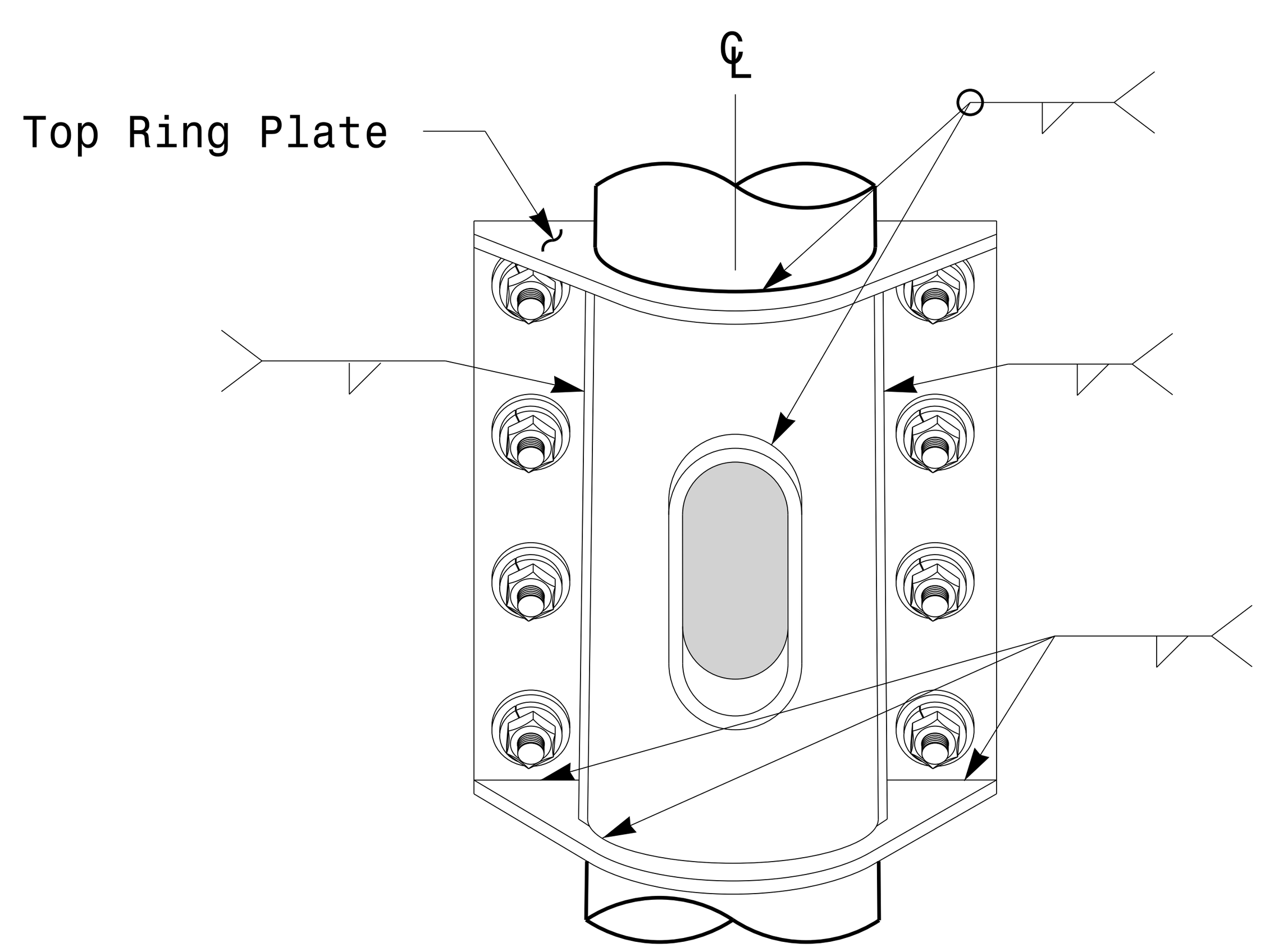
Front Elevation View



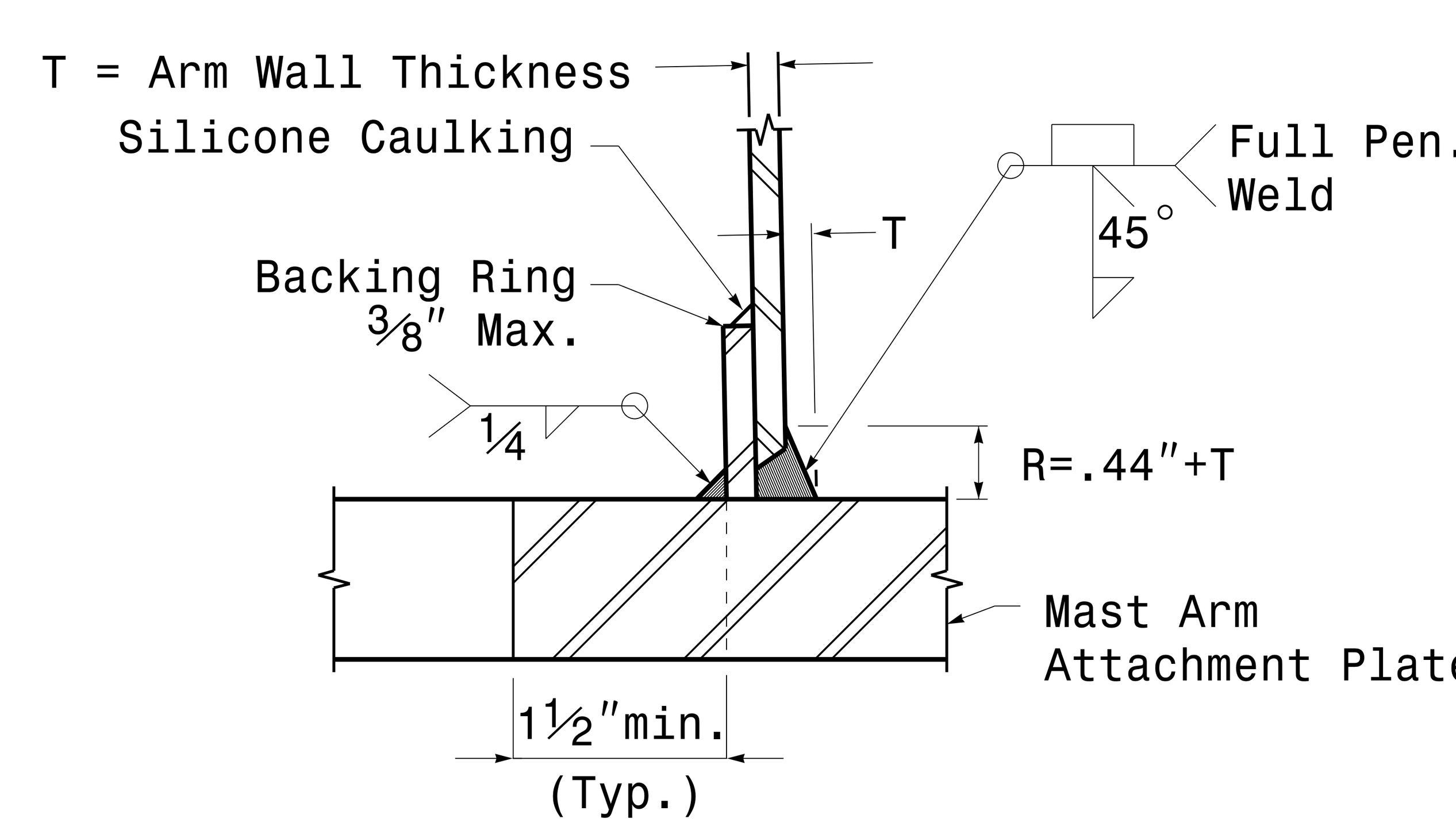
Section A-A
Mast Arm Attachment Plate

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. Fabricator is responsible for providing appropriate holes at drainage points to drain galvanizing materials.
4. For minimum edge distance follow AISC Table J3.4 and J3.5. For nominal bolt hole size use Table J3.3.
5. Provide upper handhole as necessary when shaft extensions are reguired for luminaire arms or camera. For poles without luminaires/camera, wiring can be done through the top of pole.
6. Allowable range of flange tilt angle will vary from 0° to as required.



Back Elevation View



Section B-B
Full-Penetration Groove Weld Detail

Fabrication Details – Mast Arm Connection

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

Typical Fabrication Details
For
Mast Arm Connection To Pole

PLAN DATE:	OCTOBER 2017	DESIGNED BY:	C.F.ANDREWS
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR

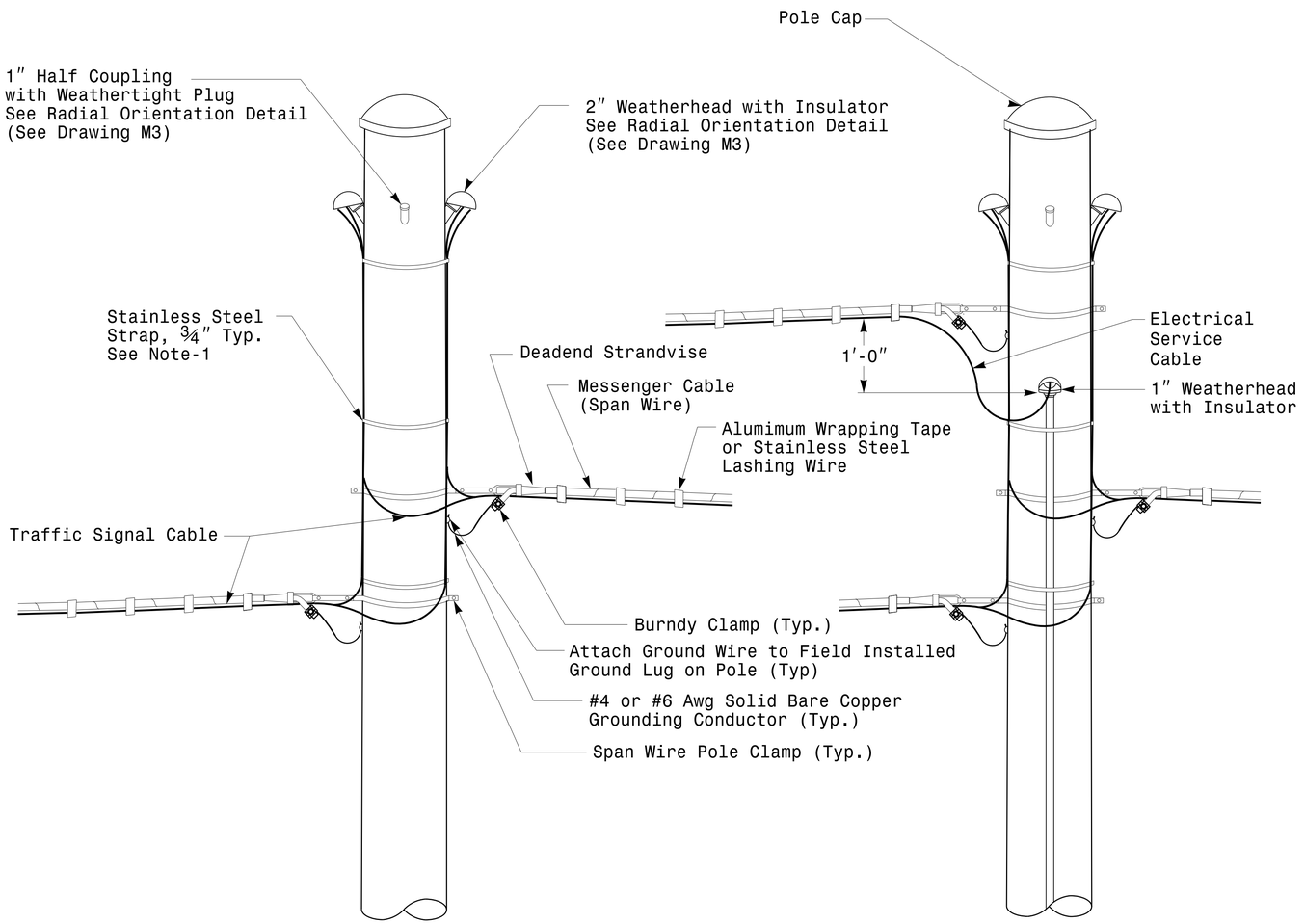
REVISIONS	INIT.	DATE

SCALE
0 NA
NONE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 028094 ENGINEER DEBESH C. SARKAR

DocuSigned by:
Debesh C. Sarkar
SIGNATURE
10/11/2017
DATE

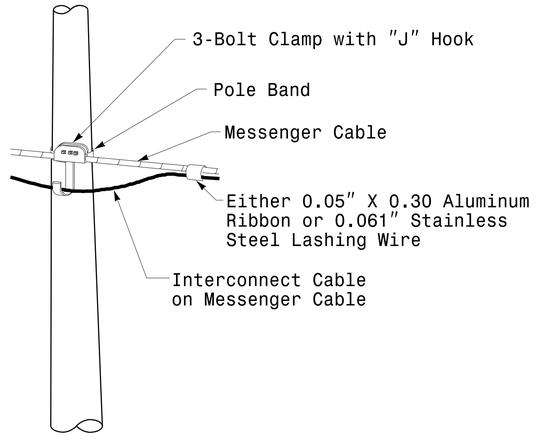
11-OCT-2017 08:35
S:*ITS&SU*ITS Signals*Signal Design Section*Eastern Region*M Sheets*2016*2014 Sig.M5 Std. Connection Fabrication Details-Mast Arm Poles.dgn
rnzinser



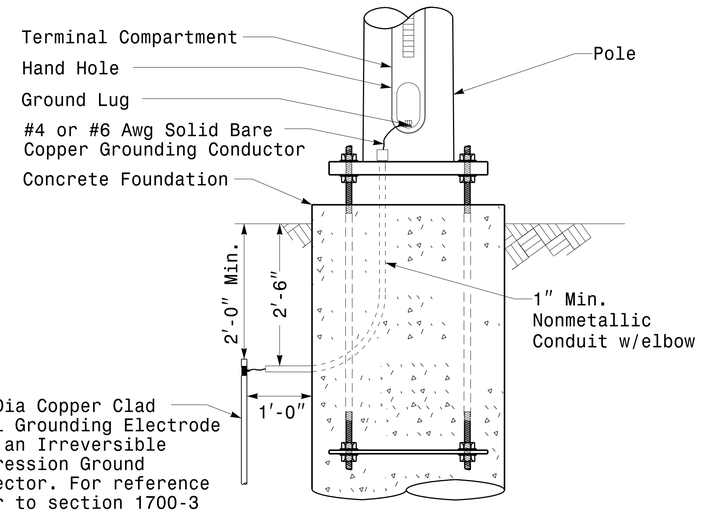
Strain Pole Attachments

NOTE:

1. Strap all signal cables to the side of the pole with ¾″ stainless steel straps when the distance between the spanwire attachment clamp and the weatherheads exceeds 3′-0″.
2. Provide minimum two spanwire pole clamps per pole.
3. It is prohibited to attach two span wires at one pole clamp.
4. For general requirements refer to NCDOT Standard Specifications for Roadway and Structures, January 2018.



Attachment of Cable to Intermediate Metal Pole



Metal Pole Grounding Detail For Strain Pole and Mast Arm

Fabrication Details – Strain Pole Attachments

PROJECT ID. NO.	SHEET NO.
	Sig.M6

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

SCALE
0 NA
NONE

Typical Fabrication Details
For
Strain Pole Attachments

PLAN DATE:	OCTOBER 2017	DESIGNED BY:	C.F.ANDREWS
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR

REVISIONS	INIT.	DATE

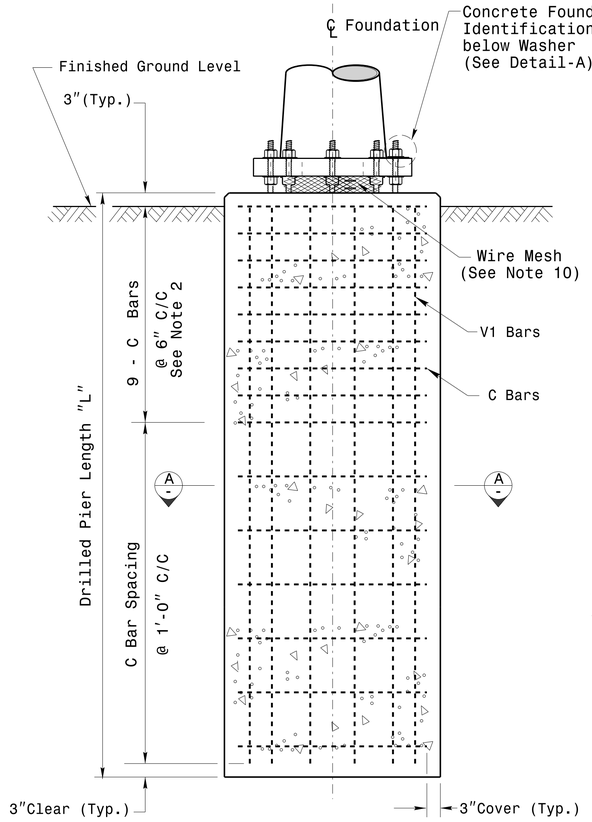
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 028094 ENGINEER DEBDISH C. SARKAR

DocuSigned by: Debdish C. Sarkar
SIGNATURE

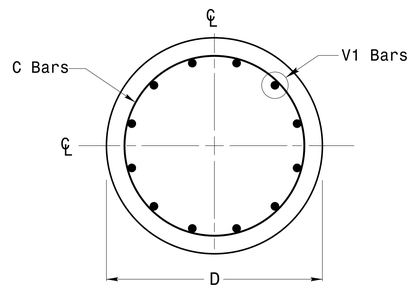
10/11/2017
DATE

PROJECT ID. NO.	SHEET NO.
	Sig.M7

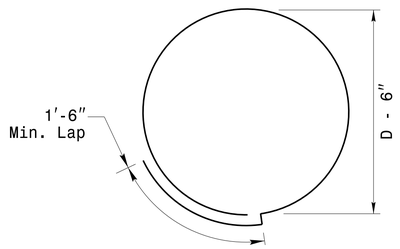
Construction Details – Foundations



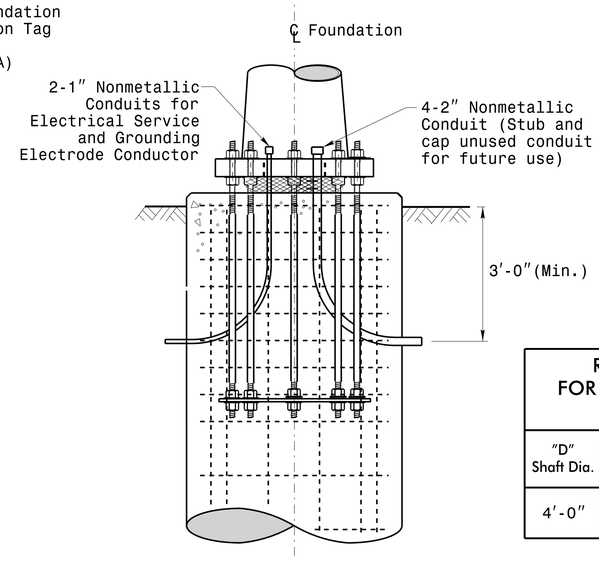
Concrete Shaft Elevation



Section A-A



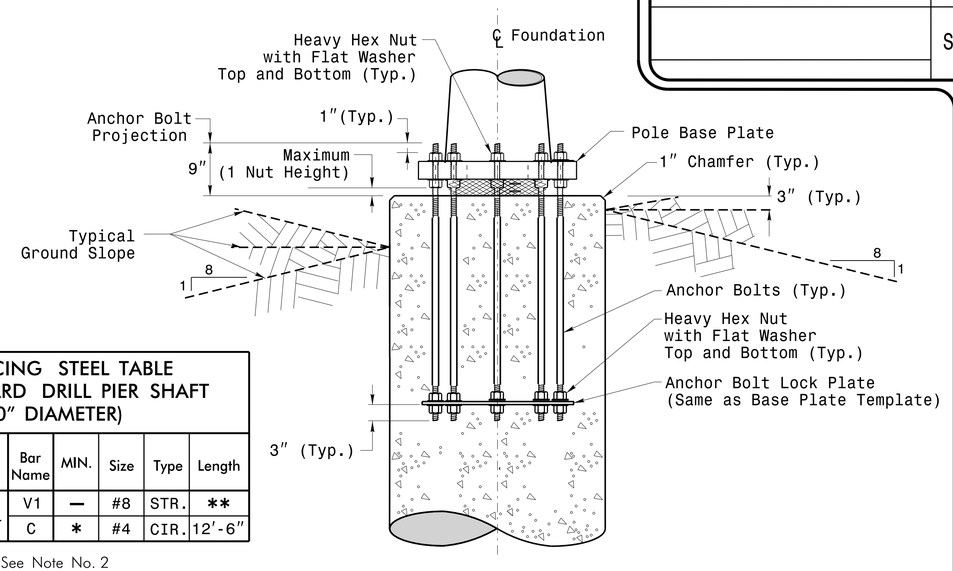
Typical "C" Bar Detail



Typical Foundation Conduit Details

REINFORCING STEEL TABLE FOR STANDARD DRILL PIER SHAFT (4′–0″ DIAMETER)						
"D" Shaft Dia.	Conc. Volume (cu. yds.)	Bar Name	MIN.	Size	Type	Length
4′-0″	.465 x L	V1	—	#8	STR.	**
		C	*	#4	CIR.	12′-6″

* See Note No. 2
** See Note No. 3



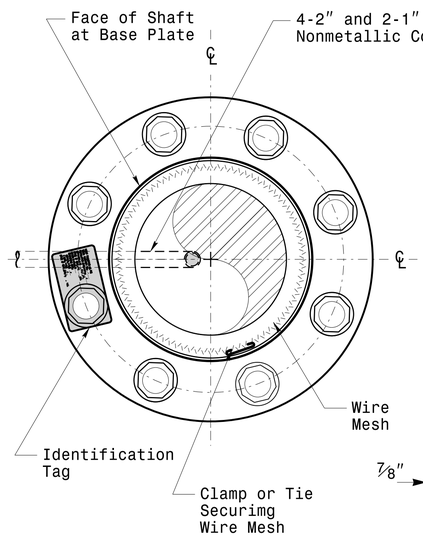
Typical Foundation Anchor Bolt Details

(Reinforcing Cage Not Shown for Clarity)

General Notes:

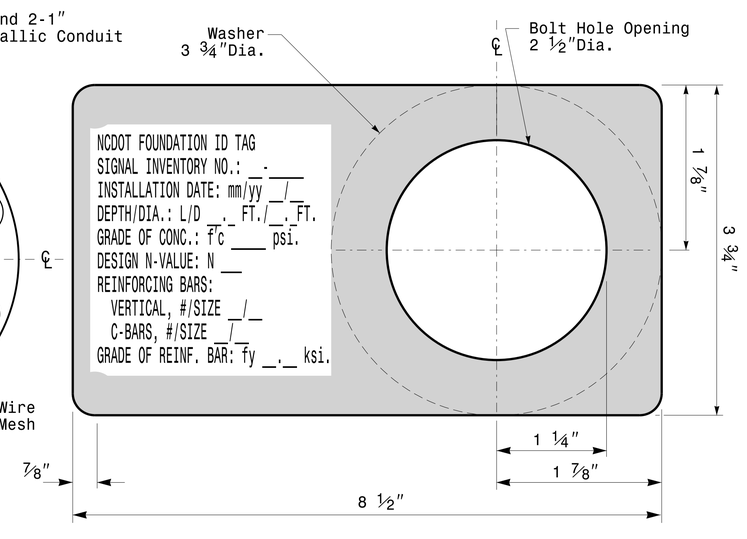
1. If actual subsurface conditions differ significantly from boring data contact the Engineer before excavating or placing concrete.
2. Circular tie reinforcing rings may be vertically adjusted by +/-3″ at a depth between 2′-0″ and 3′-0″ to facilitate the installation of electrical conduit entering in the cage.
3. For standard foundations, see sheet Sig. M8 for details. Vertical reinforcing bars (V1) may be horizontally adjusted by +/-3″ to facilitate the installation of electrical conduit entering into the cage.
4. Provide 2″ to 5″ foundation projection above ground level depending on the ground slope.
5. Unless otherwise shown, foundation designs are based on non-sloping level ground surfaces with slope ratios of 8:1 (H:V) or flatter. If actual ground line slopes are steeper contact the Engineer before excavating or placing concrete.
6. Construct foundations in accordance with NCDOT Standard Provisions SP09 R005- Foundations and Anchor Rod Assemblies for Metal Poles. All applicable 2018 NCDOT Standard Specifications are referenced in this provision. Refer to the NCDOT Resources/Specifications page located on the Connect NCDOT website.

   https://connect.ncdot.gov/resources/Specifications and Special Provisions.aspx
7. Use air entrained AA concrete mix with a compression strength of f′c=4500 psi.(min.) after 28 days.
8. Use ASTM A615 grade 60 deformed bars for all reinforcing steel. Maintain at least 3″ cover on all reinforcement.
9. Locate the Identification Tag on the top of the base plate, directly above the conduit's entry point.
10. Provide two layers of galvanized welded 23 gauge (0.25) 6″ wide 4 mesh wire around pipes under the base plate and secure it with ties if necessary.
11. Preferred location for the I.D. Tag is as shown in Detail-A; directly above the conduit entering the foundation.



D = Diameter
L = Length/Depth
mm = Month
yy = Year

Detail-A



Concrete Foundation Identification Tag Details

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

Construction Details For Foundations

PLAN DATE:	OCTOBER 2018	DESIGNED BY:	C.B.COGDELL
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR

SCALE: 0 NA — NONE

REV. NO.	COMMENTS	INIT.	DATE
1	Revised Foundation Tag Details	N.B.	5/11/2015

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 028094 ENGINEER DEBESH C. SARKAR

DocuSigned by: Debesh C. Sarkar 4AE8E3D3... SIGNATURE

10/11/2017 DATE

SOIL CONDITION

PROJECT ID. NO.	SHEET NO.
	Sig.M8

		STANDARD STRAIN POLES						STANDARD FOUNDATIONS 48″ Diameter Drilled Pier Length (L) – Feet							Reinforcement			
								Clay				Sand			Longitudinal		Stirrups	
		Case No.	Pole Height (Ft.)	Base Plate BC (In.)	Reactions at the Pole Base			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	Bar Size (#)	Quantity (ea.)	Bar Size (#)	Spacing (in.)
					Axial (kip)	Shear (kip)	Moment (ft-kip)											
WIND ZONE 1	LIGHT	S26L3	26	25	2	11	270	19	13	10	8	17	14.5	12.5	8	12	4	12
		S30L3	30	25	2	11	300	19.5	13.5	10	8	17.5	15	13	8	14	4	12
		S35L3	35	25	3	11	320	20	13.5	10.5	8	17.5	15	13	8	14	4	12
	HEAVY	S30H3	30	29	3	16	450	24.5	16	12	9	21	17.5	15	8	16	4	6
		S35H3	35	29	4	16	515	26	17	12.5	9.5	22	18.5	16	8	16	4	6
WIND ZONE 2	LIGHT	S26L2	26	23	2	10	245	18	12.5	9.5	8	16.5	14	12	8	12	4	12
		S30L2	30	23	2	10	270	18.5	12.5	10	8	16.5	14	12.5	8	12	4	12
		S35L2	35	23	3	10	300	19.5	13	10	8	17	14.5	13	8	12	4	12
	HEAVY	S30H2	30	29	3	15	415	23	15.5	11.5	9	20	17	14.5	8	16	4	6
		S35H2	35	29	4	15	475	25	16.5	12	9.5	21	17.5	15.5	8	16	4	6
WIND ZONE 3	LIGHT	S26L2	26	23	2	10	245	18	12.5	9.5	8	16.5	14	12	8	12	4	12
		S30L2	30	23	2	10	270	18.5	12.5	10	8	16.5	14	12.5	8	12	4	12
		S35L2	35	23	3	10	300	19.5	13	10	8	17	14.5	13	8	12	4	12
	HEAVY	S30H2	30	29	3	15	415	23	15.5	11.5	9	20	17	14.5	8	16	4	6
		S35H2	35	29	4	15	475	25	16.5	12	9.5	21	17.5	15.5	8	16	4	6
WIND ZONE 4	LIGHT	S26L1	26	22	2	8	190	16	11.5	8.5	8	15	12.5	11	8	12	4	12
		S30L1	30	22	2	8	205	16.5	11.5	9	8	15	13	11.5	8	12	4	12
		S35L1	35	22	3	8	230	17	12	9	8	15.5	13.5	11.5	8	12	4	12
	HEAVY	S30H1	30	25	3	12	320	20.5	13.5	10.5	8	18	15	13.5	8	16	4	6
		S35H1	35	25	4	12	350	21	14	10.5	8.5	18.5	15.5	13.5	8	16	4	6
WIND ZONE 5	LIGHT	S26L2	26	23	2	10	245	18	12.5	9.5	8	16.5	14	12	8	12	4	12
		S30L2	30	23	2	10	270	18.5	12.5	10	8	16.5	14	12.5	8	12	4	12
		S35L2	35	23	3	10	300	19.5	13	10	8	17	14.5	13	8	12	4	12
	HEAVY	S30H2	30	29	3	15	415	23	15.5	11.5	9	20	17	14.5	8	16	4	6
		S35H2	35	29	4	15	475	25	16.5	12	9.5	21	17.5	15.5	8	16	4	6

48″ Dia. Foundations Concrete Volume (cubic yards) = (0.465) x Drilled Pier Length

General Notes:

1. Values shown in the "Reactions at the Pole Base" column represent the minimum acceptable capacity allowed for design using a design CSR of 1.00.
2. Use chairs and spacers to maintain proper clearance.
3. For foundation, always use air-entrain concrete mix.

Foundation Selection:

1. Perform a standard penetration test at each proposed foundation site to determine "N" value.
2. Select the appropriate wind zone from M 1 drawing.
3. Select the soil type (Clay or Sand) that best describes the soil characteristics.
4. Get the appropriate standard pole case number from the plans or from the Engineer.
5. Select the appropriate column under "Standard Foundations" based on soil type and "N" value. Select the appropriate row based on the pole load case.
6. The foundation depth is the value shown in the "Standard Foundations" category where the column and the row intersect.
7. Use Construction Procedures and Design Methods prescribed by FHWA-NHI-10-016 for Reference Drilled Shafts.

Standard Strain Pole Foundation–All Soil Condition

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

Standard Strain Pole Foundation for All Soil Conditions

PLAN DATE:	OCTOBER 2017	DESIGNED BY:	C.B. COGDELL
PREPARED BY:	N. BITTING	REVIEWED BY:	D.C. SARKAR

REVISIONS	INIT.	DATE
Changed "Foundation Depth" to "Drilled Pier Length"in Conc. Eqn.	N.B.	7/12/2015

SCALE: 0 NA NONE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 028094 ENGINEER DEBESH C. SARKAR

DocuSigned by: Debesh C. Sarkar
SIGNATURE

10/11/2017
DATE