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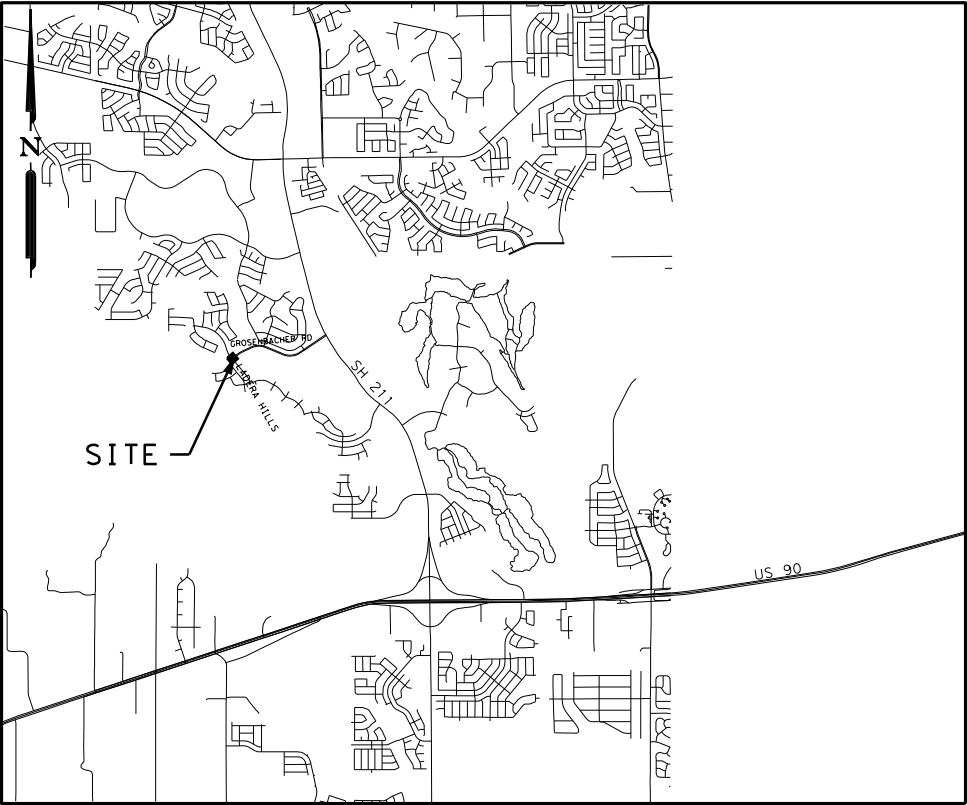
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# GROSENBACHER RD AT LADERA HILLS

## BEXAR COUNTY, TEXAS

### TRAFFIC SIGNAL PLANS

SHEET NO.	DESCRIPTION
GENERAL	
1	TITLE SHEET
2-5	GENERAL NOTES
6-7	QUANTITY SUMMARY
TRAFFIC CONTROL PLAN	
8	TMA SUMMARY SHEET
9-20	*BC (1-12)-21
21-22	*WZ(BTS-(1-2))-13
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24	EXISTING CONDITION & REMOVALS
25	PROPOSED TRAFFIC SIGNAL LAYOUT
26-27	CONDUIT & CONDUCTOR SCHEDULE
28	TRAFFIC SIGNAL WIRE DIAGRAM
29	RADAR DETECTION ZONES
30	PROPOSED PAVEMENT MARKINGS PLAN
31	*ED (1)-14
32-35	*ED (3-6)-14
36	*ED (8)-14
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38-39	*ED (11-12)-14
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41	*MA-C-12
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44-45	*SMA-80(1-2)-12
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47	*MA-DPD-20
48	*TS-BP-20
49	*MTS-18
50	*VD(2)-06
51-53	*PM (1 THRU 3)-22
54	*TCD-05
55	*BEXAR COUNTY SIGN DETAIL
56	*COSA CABINET DETAIL



LOCATION MAP  
N. T. S

PREPARED FOR:

LENNAR HOMES OF TEXAS LAND AND CONSTRUCTION, LTD  
1922 DRY CREEK WAY, SUITE 101  
SAN ANTONIO, TEXAS 78259



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800

THE STANDARD SHEETS SPECIFICALLY SHOWN  
WITH PRECEDING (\*), HAVE BEEN SELECTED  
BY ME OR UNDER MY RESPONSIBLE  
SUPERVISION AS BEING APPLICABLE TO THIS  
PROJECT.



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TRAFFIC SIGNAL NOTES:

- 1.INSTALL SIGNALS VERTICALLY ON MAST ARM, 18 FT .- 6 IN. ABOVE THE ROADWAY.
- 2.FURNISH YELLOW HOUSING FOR VEHICLE AND PEDESTRIAN SIGNALS. FURNISH BLACK VEHICLE SIGNAL HEAD BACK PLATES WITH REFLECTIVE BORDER.
- 3.FURNISH VEHICLE AND PEDESTRIAN SIGNALS WITH LIGHT EMITTING DIODE (LED) SIGNAL LAMP UNITS.
4. FURNISH PELCO MOUNTING HARDWARE REQUIRED FOR ATTACHING VEHICLE SIGNAL HEADS TO THE MAST ARM.
- 5.USE HIGH SPECIFIC INTENSITY REFLECTIVE SHEETING FOR SIGNS MOUNTED UNDER OR ADJACENT TO THE SIGNAL HEADS.
- 6.FURNISH SYMBOL TYPE PEDESTRIAN COUNTDOWN SIGNALS. INSTALL USING MOUNTING HEIGHT IN ACCORDANCE WITH THE LATEST TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
- 7.FURNISH MATERIALS NECESSARY TO INSTALL ACCESSIBLE PEDESTRIAN SIGNAL UNITS (APS) AND SIGNS AS SHOWN IN THE PLANS . INSTALL APS AT 3 FT. - 6 IN. TO 4 FT. - 0 IN. ABOVE THE SIDEWALK OR CONCRETE WALKWAY. THE PUSH BUTTON SIDE REACH MEASURED PERPENDICULAR TO THE BUTTON FACE UNBSTRUCTED AT GROUND LEVEL SHOULD NOT EXCEED 10 INCHES. IF BUTTON REACH EXCEEDS 10 INCHES, INSTALL TXDOT APPROVED PED PUSH BUTTON EXTENSION.
- 8.ROUTE CABLE FOR LUMINAIRES (TRAY CABLES) DIRECTLY TO THE SERVICE ENCLOSURE. SEE ELECTRICAL DETAIL SHEETS.
- 9.LOCATE CONTROLLER(S), SIGNAL POLES, DETECTORS, ETC. AS APPROVED.
- 10.REPAIR OR REPLACE PAVEMENT AND SIDEWALKS DAMAGED BY THE CONTRACTOR'S FORCES DURING CONSTRUCTION AT NO COST TO THE DEPARTMENT.
- 11.REMOVE THE EXISTING STOP SIGN(S) AND THOSE ITEMS DEEMED SALVAGEABLE BY THE ENGINEER AND RETURN THEM TO BEXAR COUNTY . STOCKPILE THOSE ITEMS ON THE RIGHT OF WAY. REMOVE AND DISPOSE OF OTHER ITEMS AT NO EXPENSE TO BEXAR COUNTY.
- 12.PLACE PAVEMENT MARKINGS AS SHOWN ON THE PLANS OR AS DIRECTED.
- 13.CAP SPARE CONDUITS INSTALLED IN POLE FOUNDATIONS AND GROUND BOXES USING APPROVED CAPPING DEVICES.
- 14.REPLACE STOP AHEAD SIGNS WITH SIGNAL AHEAD SIGNS AT ALL INTERSECTIONS.
- 15.DO NOT PLACE SIGNAL HEADS OVER THE ROADWAY UNTIL ALL NECESSARY MATERIALS ARE ON HAND AS APPROVED.
- 16.INSTALL TWO SET SCREWS ON ALL VEHICLE SIGNAL HEAD MOUNTING HARDWARE FITTINGS.
- 17.INSTALL A 5/8-IN. (MINIMUM) EYE BOLT FOR THE POINT OF ATTACHMENT BELOW THE SERVICE ENTRANCE WEATHERHEAD FOR THE SERVICE DROP TO STEEL OR WOOD POLE.

- 18.AIM LUMINAIRE ARMS MOUNTED ON TRAFFIC SIGNAL POLES PERPENDICULAR TO THE CENTERLINE OF THE ROADWAY IT IS INTENDED TO COVER, TO DEVELOP THE PROPER ILLUMINATION PATTERN FOR THE INTERSECTION.
- 19.PROVIDE 250 WATT EQUIVALENT LED LUMINAIRES OPERATING AT 120 VOLTS.
20. KEEP ALL SIGNAL HEADS ROTATED FACING DOWN UNTIL READY TO BE IN OPERATION. NO COVER OR BLACK PLASTIC SHEETING WILL BE REQUIRED FOR VEHICLE SIGNAL HEADS. PEDESTRIAN SIGNAL HEADS CAN BE COVERED USING BURLAP OR PLASTIC BAGS. IF PLASTIC BAGS ARE USED, ONLY POLYETHYLENE BLACK PLASTIC SHEETING MINIMUM OF 3 MILL THICKNESS SHALL BE PERMITTED. THE BAGS SHALL BE SECURELY LASHED DOWN SO THE WIND DOES NOT RIP THEM FROM THE PEDESTRIAN SIGNAL HEAD. ALL SIGNALS HEADS WHILE FACING DOWN SHALL BE DARK EITHER BY REMOVING, UNSCREWING, OR DISCONNECTING THE POWER TO THE LEDS. ANY EXISTING VEHICULAR OR PEDESTRIAN HEAD THAT IS NOT FUNCTIONAL SHALL BE REMOVED.
- 21.GROUND STEEL MAST ARM POLE ASSEMBLIES IN ACCORDANCE WITH REQUIREMENTS SHOWN ON THE LATEST TRAFFIC SIGNAL POLE FOUNDATION STANDARD . USE THE GROUNDING LUG ON THE POLE TO GROUND THE POLE TO THE GROUND CONDUCTORS FROM THE CONDUITS.
- 22.VERIFY THE CORRECT MAST ARM POLE LENGTHS FOR EACH SIGNALIZED INTERSECTION PRIOR TO ORDERING THE EQUIPMENT.
- 23.INSTALL A CLOSE NIPPLE WITH LOCK NUT AND BUSHING (SIZE AS REQUIRED) WHERE THE CABLE ENTERS THE UPPER PORTION OF THE SIGNAL POLE.
24. FURNISH ITERIS DETECTION SYSTEM CAPABLE OF BOTH VIDEO AND RADAR DETECTION. USE CABLES RECOMMENDED BY MANUFACTURER OR PURCHASE CABLE FROM THE SAME MANUFACTURER THAT SUPPLIED/PROVIDED THE ITERIS EQUIPMENT.
25. THE LOCATION OF THE DETECTION ZONE, IS SHOWN, IS APPROXIMATE. THE EXACT LOCATION WILL BE DETERMINED BY THE ENGINEER AND/OR DEPARTMENT'S TRAFFIC OPERATIONS SECTION.
- 26.CLAMP ALL CONDUITS ATTACHED TO SIGNAL POLE FOUNDATIONS OR WOOD POLES WITH CONDUIT STRAPS AND CLAMPS BACKS (MALLEABLE IRON) AT A MAXIMUM SPACING OF 5 FT .CENTER TO CENTER.
- 27.CONTRACTOR MUST FURNISH AND DELIVER CONTROLLER CABINET AND ASSEMBLY TO THE JUDSON SERVICE CENTER, 17310 JUDSON RD, SAN ANTONIO, TX 78247 FOR TESTING TWO WEEKS IN ADVANCE PRIOR TO CONTRACTOR INSTALLING EQUIPMENT IN THE FIELD, COORDINATE DROP OFF AND PICK UP WITH JOHNNY LUNA AT (JOHNNY.LUNA@BEXAR.ORG)
- 28.CONTACT MR. JOE JONES (TELEPHONE NUMBER 210-353-4643) WITH CPS ENERGY 2 DAYS PRIOR TO BEGINNING ANY UNDERGROUND WORK.
- 29.ELECTRICAL POWER TO OPERATE THE TRAFFIC SIGNAL INSTALLATION(S) WILL BE PLACED IN BEXAR COUNTY'S NAME. THIS INCLUDES ALL POWER TO OPERATE THE SIGNAL(S) DURING THE VARIOUS PHASES OF CONSTRUCTION AND DURING THE TEST PERIOD PRIOR TO ACCEPTANCE OF THE WORK BY BEXAR COUNTY. CONTACT ANGELICA MORALES ([ANGELICA.MORALES@BEXAR.ORG](mailto:ANGELICA.MORALES@BEXAR.ORG)) FOR COORDINATION.

NO. REVISION

DATE

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ENGINEERS

SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS

2000 HW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000

TYPE PERM REGISTRATION #470 | TBELS PERM REGISTRATION #1002800

LENNAR HOMES OF TEXAS, INC.

SAN ANOTNIO ETJ, TEXAS

GROSENBACHER RD @ LADERA HILLS

GENERAL NOTES 1 OF 4

JOB NO. 6445-93

DATE 3/4/2024

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SHEET 2

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30.CONTACT AND COORDINATE WITH THE LOCAL ELECTRICAL SERVICE PROVIDER FOR THE REMOVAL OF EXISTING LUMINAIRES.

TXDOT 2014 SPECIFICATION ITEMS:

--ITEM 5 "CONTROL OF THE WORK"--

REFERENCE ALL EXISTING STRIPING AND OTHER PAVEMENT MARKINGS TO ALLOW THESE MARKINGS TO BE RE-ESTABLISHED. ENSURE THE MARKINGS (LANE LINES, EDGE LINES, RAMP GORES, ETC.) ARE IN LINE WITH THE SIGN, TMS ARROWS, ETC. LOCATED ON OVERHEAD SIGN SUPPORTS. WHEN WORKING NEAR AERIAL ELECTRIC LINES OR UTILITY POLES, COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS. FOR ELECTRICAL LINES AND POLES SHOWN IN THE PLANS, IF THE LINES NEED TO BE DE-ENERGIZED OR IF POLES NEED TO BE BRACED, CONTACT THE ELECTRICAL COMPANY. WORK PERTAINING TO DE-ENERGIZING LINES, BRACING POLES, SHIELDING LINE AND OTHER PROTECTIVE MEASURES WILL NOT BE PAID FOR BY BEXAR COUNTY.

--ITEM 7 "LEGAL RELATIONS AND RESPONSIBILITIES"--

THE TOTAL DISTURBED AREAS WITHIN THE PROJECT IS ANTICIPATED AT LESS THAN ON (2) ACRE, THEREFORE IT IS CLASSIFIED AS "SURFACE WORK" CONSISTING OF RE-SURFACING AN EXISTING ROADWAY WITHOUT SHOULDER-UP DISTURBANCES. DUE TO THIS TYPE OF CONSTRUCTION, THE PROJECT QUALIFIES FOR EXCLUSION UNDER THE CONSTRUCTION GENERAL PERMIT (CGP) ISSUED BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) ON MARCH 5, 2003.

HOWEVER: SHOULD THE SUM OF THE ENGINEER'S ANTICIPATED DISTURBANCES AND THE CONTRACTOR'S (ON OR OFF RIGHT-OF-WAY) PSL'S EQUAL OR EXCEED THE ONE (1) ACRE THRESHOLD; BOTH BEXAR COUNTY AND THE CONTRACTOR HAVE PROJECT RESPONSIBILITIES UNDER THE CGP THAT REVERTS TO NON-EXCLUSION STATUS. OBTAIN APPROVAL FOR ALL NON-DEPICTED AREAS OF DISTURBANCE THAT INCREASES THE INITIAL SOIL AND VEGETATION DISTURBED AREA ESTIMATES BEFORE WORK STARTS AT THESE LOCATIONS. NOTIFY THE ENGINEER OF THE DISTURBED ACREAGE WITHIN ONE (1) MILE OF THE PROJECT LIMITS. OBTAIN AUTHORIZATION FROM THE TCEQ FOR CONTRACTOR PSL'S FOR CONSTRUCTION SUPPORT ACTIVITIES ON OR OFF RIGHT-OF-WAY.

--ITEM 100 "PREPARING RIGHT OF WAY"--

BEGIN CLEARING OPERATIONS AFTER TREES AND OTHER AREAS OF VEGETATION TO BE PROTECTED HAVE BEEN IDENTIFIED AND APPROVED. INSTALL FENCING AROUND FEATURES TO BE PROTECTED AS SHOWN IN THE PLANS OR AS DIRECTED. COORDINATE ALL RIGHT OF WAY CLEARING OPERATIONS WITH SW3P.

--ITEM 416 "DRILLED SHAFT FOUNDATIONS"--

EACH POLE FOUNDATION SHALL HAVE ON ADDITIONAL TWO (2) INCH CONDUIT STUBBET OUT TWO (2) FEET FROM THE FOUNDATION AND CAPPED. FURNISHING OF THIS CONDUIT SHALL BE PAID FOR SUBSIDIARY TO ITEM 416 "DRILLED SHAFT FOUNDATIONS" AND ITEM 686 "TRAFFIC SIGNAL POLE ASSEMBLIES (STEEL)."

--ITEM 618 "CONDUIT"--

IT MIGHT BE NECESSARY TO CUT CONCRETE FOR PLACEMENT OF CONDUIT. SAW CUT EXISTING CONCRETE, REMOVE THE CONCRETE FROM THE STEEL REINFORCEMENT (BARS OR FABRIC) AND BEND THE STEEL TO INSTALL THE CONDUIT. AFTER THE CONDUIT HAS BEEN PLACED, BEND THE STEEL BACK TO ITS ORIGINAL POSITION AND BACK-FILL THE TRENCH WITH AN APPROVED CONCRETE. THIS WORK IS SUBSIDIARY TO THIS ITEM.

THE CONDUIT DEPTH FOR ILLUMINATION UNDER STREETS IS THIRTY-SIX (36) INCHES.

USE MATERIALS FROM PRE-QUALIFIED MATERIAL PRODUCERS LIST AS SHOWN ON THE TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT) - CONSTRUCTION DIVISION'S (CST) MATERIALS PRODUCERS LIST. SEE [HTTP://WWW.DOT.STATE.TX.US/BUSINESS/PRODUCERS+LIST.HTM](http://www.dot.state.tx.us/business/producers+list.htm) FOR LIST OF PRE-QUALIFIED MANUFACTURERS. CATEGORY IS "ROADWAY ILLUMINATION AND ELECTRICAL SUPPLIES."

--ITEM 624 "GROUND BOXES"--

LEGIBLY IMPRINT THE GROUND BOX COVER WITH THE WORDS "DANGER HIGH VOLTAGE" AS REQUIRED BY THE "ELECTRICAL DETAILS" STATE STANDARD; ILLUMINATIONS, OR WHATEVER OTHER SYSTEM WILL BE HOUSED IN THE GROUND BOX. THE GROUND BOX LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND CAN BE ADJUSTED TO BETTER FIT FIELD CONDITIONS WHEN APPROVED.

--ITEM 628 "ELECTRICAL SERVICES"--

MAKE ALL ARRANGEMENTS FOR ELECTRICAL SERVICE, COMPLIANCE WITH LOCAL STANDARDS AND PRACTICES FOR PROPER INSTALLATIONS.

--ITEM 644 "SMALL ROADSIDE SIGN SUPPORTS AND ASSEMBLIES"--

EXISTING STREET NAME AND STOP SIGNS SHALL BE SALVAGED AND RETURNED TO THE COUNTY WHERE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF ANY WASTE MATERIAL. ANY TRAFFIC SIGNAL EQUIPMENT SHALL BE SALVAGED TO THE COUNTY TRAFFIC OPERATIONS CENTER, LOCATED AT 17310 JUDSON ROAD, OR AS DIRECTED BY THE TRAFFIC SIGNAL ENGINEER.

--ITEM 666 "REFLECTORIZED PAVEMENT MARKINGS"--

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LENNAR HOMES OF TEXAS, INC.

SAN ANOTNIO ETJ, TEXAS  
GROSENBACHER RD @ LADERA HILLS  
GENERAL NOTES 2 OF 4

JOB NO.	6445-93
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TY II PAVEMENT MARKINGS SHALL BE USED AS THE SEALER FOR THE TY I MARKINGS, PLACE THE TY II A MINIMUM OF FOURTEEN (14) CALENDAR DAYS (TO PROVIDE) ADEQUATE CURING BEFORE PLACING THE TY I MARKINGS. MEASUREMENT PAYMENT FOR THE TYPE II PAVEMENT MARKINGS SHALL BE SUBSIDIARY TO THE TYPE I PAVEMENT MARKINGS.

--ITEM 680 "INSTALLATION OF HIGHWAY TRAFFIC SIGNALS"--

FURNISH AND INSTALL ALL REQUIRED MATERIALS AND EQUIPMENT NECESSARY FOR THE COMPLETE AND OPERATING TRAFFIC SIGNAL INSTALLATION AT THE FOLLOWING INTERSECTIONS:

GROSENBACHER RD AT LADERA HILLS

THE LOCATIONS SHOWN ON THE PLANS FOR SIGNAL POLE FOUNDATIONS, CONTROLLER FOUNDATIONS, CONDUIT AND OTHER ITEMS MAY BE ADJUSTED TO BETTER FIT FIELD CONDITIONS AS APPROVED BY THE ENGINEER.

CONTRACTOR TO FURNISH AND INSTALL A COBALT ECONOLITE CONTROLLER WITH EOS SOFTWARE, TYPE 332 CABINET WITH A SEVEN-INCH COLOR DISPLAY, AND FIELD MONITORING DEVICE W/CELLULAR COMMUNICATIONS EQUIPMENT THAT PROVIDES FULL COMPATIBILITY WITH THE BEXAR COUNTY CENTRACS MOBILITYMANAGEMENT SYSTEM.

The 332 CABINET SHALL BE EQUIPPED WITH A RACK MOUNT TRIPP LITE POWER DISTRIBUTION UNIT. THE UNIT MUST BE HARDWIRED INTO THE POWER AND NOT PLUGGED IN DIRECTLY INTO THE EQUIPMENT OUTLET ON THE POWER DISTRIBUTION ASSEMBLY.

THE CONTRACTOR TO DELIVER THE CONTROLLER CABINET, CONTROLLER, AND MMU TO THE BEXAR COUNTY PUBLIC WORKS-JUDSON/NORTHEAST OFFICE AT 17310 JUDSON ROAD, SAN ANTONIO, TEXAS 78247 FOR PROGRAMMING AND TESTING 2 WEEKS PRIOR TO INSTALLING IN THE FIELD. DESIGN ENGINEER TO PROVIDE TIMING PLAN.

COORDINATE PICK-UP AND DROP-OFF WITH JOHNNY LUNA (JOHNNY.LUNA@BEXAR.ORG).

THE CONTROLLER FOUNDATION TY (332) SHALL CONTAIN TWO (2) ADDITIONAL TWO (2) INCH CONDUITS STUBBED OUT AND CAPPED FROM THE BASE OF THE SLAB APPROXIMATELY TWELVE (12) INCHES FOR FUTURE USE. THE SLAB SHALL BE SCORED WITH A "Y" WHERE THE STUBBED OUT CONDUITS PASS UNDER.

DEMONSTRATE THAT THE FIELD WIRING IS PROPERLY INSTALLED, INSTALL THE CONTROLLER ASSEMBLY, CONNECT THE WIRING AND TURN ON THE CONTROLLER.

SUBMIT 2 OR MORE VERIFICATION PHOTOS SO THAT THE REISTANCE TO EACH GROUND ROUND INSTALLED SHALL BE AS CLOSE TO A ZERO (0) BUT NO GREATER THAN TWENTY FIVE (25) OHMS PER NEC SECTION 250-56. USE A CLAMP-ON GROUND RESISTANCE TESTER CAPABLE OF MEASURING GROUND ROD AND GRID RESISTANCE IN ANY ENVIROMENT WITHOUT THE SUE OF AUXIIARY GROUND RODS. GROUND ROD READINGS SHALL BE DONE AT ELECTRICAL SERVICE AND THE CABINET FOUNDATION AT MINIMUM.

THREE (3) COPIES OF EQUIPMENT SUBMITTALS FOR ALL TRAFFIC SIGNAL COMPONENTS SHALL BE SENT TO THE BEXAR COUNTY PROJECT MANAGER. SUBMITTALS SHALL CONSIST OF THE APPROPRIATE COMBINATION OF CATALOG SHEETS, MATERIAL LISTS, MANUFACTURER'S BROCHURES, TECHNICAL BULLETINS, SPECIFICATIONS, DIAGRAMS, OR PRODUCT SAMPLES NECESSARY TO DESCRIBE A SYSTEM, PRODUCT OR ITEM. SPECIFIC ITEM NUMBERS AND PRODUCT CODES WILL BE CLEARLY IDENTIFIED WHEN MULTIPLE PRODUCT ARE LISTED ON THE SAME SHEET.

--ITEM 682 "VEHICLE AND PEDESTRIAN SIGNAL HEADS"--

PROVIDE ALL SIGNAL HEADS FROM THE SAME MANUFACTURER. PEDESTRIAN SIGNAL MAY BE A DIFFERENT MANUFACTURER THAN THE VEHICLE SIGNAL HEADS.

ALL PEDESTRIAN SIGNAL FACES SHALL BE SINGLE SECTION LED TYPE. DIE CAST POLYCARBONATE IS ACCEPTABLE IN LIEU OF DIA CAST ALUMINUM. ALL MOUNTED AS SHOWN ON THE PLANS.

FOR ALL PROPOSED MAST ARM POLE ASSEMBLIES, USE MOUNTING BRACKET ASSEMBLY OPTION "C" AS SHOWN ON THE STATE STANDARD SHEET(S) "SINGLE MAST ARM ASSEMBLIES."

FINAL ADJUSTMENT OF TRAFFIC SIGNAL HEADS (VEHICLE AND PEDESTRIAN), AS REQUIRED BY THE ENGINEER, SHALL BE DONE BY THE CONTRACTOR AND SHALL BE SUBSIDIARY TO FURNISHING AND INSTALLING TRAFFIC SIGNAL HEADS OR SECTIONS.

ALL TRAFFIC SIGNAL SECTION SHALL BE MADE OF POLYCARBONATE RESIN AND SHALL BE BY THE SAME MANUFACTURER.

ALL VEHICLE AND PEDESTRIAN SIGNAL FACES SHALL BE COVERED OR ROTATED SO THAT INDICATION(S) CANNOT BE SEEN FROM THE TIME OF INSTALLATION UNTIL PLACED IN OPERATION

--ITEM 684 "TRAFFIC SIGNAL CABLES"--

PROVIDE AN EXTRA TEN (10) FEET FOR EACH CABLE TERMINATING IN THE CONTROLLER CABINET. ALL CABLE SHALL BE CONTINUOUS WITHOUT SPLICES FROM TERMINAL POINT TO TERMINAL POINT. ALL PROPOSED SIGNAL CABLE SHALL BE #12 AWG AWG SOLID COPPER.

--ITEM 686 "TRAFFIC SIGNAL POLE ASSEMBLIES (STEEL)"--

PROVIDE ALL SIGNAL POLES FROM THE SAME MANUFACTURER. PEDESTRIAN POLES MAY BE FROM A DIFFERENT MANUFACTURER.

--ITEM 687 "PEDESTAL POLE ASSEMBLIES" --

PROVIDE POLE COLLAR ASSEMBLY TO ALL ALUMINIUM PEDESTRAIN POLES OVER 8 FEET IN LENGTH TO ADD STRENGTH.

LENNAR HOMES OF TEXAS, INC.

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GENERAL NOTES 3 OF 4

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SHEET 4

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--ITEM 688 "PEDESTRIAN DETECTORS AND VEHICLE LOOP DETECTORS"--

THE SEALANT USED MUST BE APPROVED.  
THE PEDESTRIAN PUSH BUTTON SHALL BE RAISED OR  
FLUSH AND A MINIMUM OF TWO (2) INCHES IN THE SMALLEST  
DIMENSION. THE FORCE TO ACTIVATE THE CONTROL SHALL BE  
NO GREATER THAN 5 LB/F. THE BUTTON PLACEMENT HAS TO BE  
COORDINATED WITH THE CONCRETE PAD TO ACCESS THE BUTTON.  
THE CONCRETE PAD (IF REQUIRED) SHALL BE PAID SEPARATELY.

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GENERAL NOTES 4 OF 4

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SHT NO	ITEM	* 0416-6030	0416-6032	0502-6001	0618-6046	0618-6047	0618-6053	0618-6054
	INTERSECTION	DRILL SHAFT (TRF SIG POLE) (24 IN)	DRILL SHAFT (TRF SIG POLE) (36 IN)	BARRICADES, SIGNS AND TRAFFIC HANDLING	CONDT (PVC) (SCH 80) (2")	CONDT (PVC) (SCH 80) (2") (BORE)	CONDT (PVC) (SCH 80) (3")	CONDT (PVC) (SCH 80) (3") (BORE)
		LF	LF	MO	LF	LF	LF	LF
1	EXISTING REMOVAL							
2	TRAFFIC	48	52	1	330	468	204	699
3	PROP PVMT MRKS							
	TOTALS	48	52	1	330	468	204	699

SHT NO	ITEM	0620-6007	0620-6009	0620-6010	0621-6005	0624-6010	0628-6164	0644-6076
	INTERSECTION	ELEC CONDR (NO.8) BARE	ELEC CONDR (NO.6) BARE	ELEC CONDR (NO.6) INSULATED	TRAY CABLE (4 CONDR) (12 AWG)	GROUND BOX TY D (162922)W/APRON	ELC SRV TY D 120/240 070(NS)AL(E)PS(U)	REMOVE SM RD SN SUP&AM
		LF	LF	LF	LF	EA	EA	EA
1	EXISTING REMOVAL							4
2	TRAFFIC	1447	22	44	989	4	1	
3	PROP PVMT MRKS							
	TOTALS	1447	22	44	989	4	1	4

SHT NO	ITEM	0666-6048	0666-6230	0677-6003	0677-6007	0678-6008	0680-6002	* 0680-XX01
	INTERSECTION	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	PAVEMENT SEALER 24"	ELIM EXT PAV MRK & MRKS (8")	ELIM EXT PAV MRK & MRKS (24")	PAV SURF PREP FOR MRK (24")	INSTALL HWY TRF SIG (ISOLATED)	COSA 332 CABINET AND CONCRETE FOUNDATION
		LF	LF	LF	LF	LF	EA	EA
1	EXISTING REMOVAL			15	45			
2	TRAFFIC						1	1
3	PROP PVMT MRKS	325	325			325		
	TOTALS	325	325	15	45	325	1	1

SHT NO	ITEM	*0680-XX02	*0680-XX03	*0680-XX04	0682-6001	0682-6002	0682-6003	0682-6004
	INTERSECTION	TRAFFIC SIGNAL CONTROLLER (ECONOLITE	MALFUNCTION MONITOR UNIT	COMMUNICATION PACKAGE APPLIED INFORMATION	VEH SIG SEC (12")LED(GRN)	VEH SIG SEC (12")LED(GRN ARW)	VEH SIG SEC (12")LED(YEL)	VEH SIG SEC (12")LED(YEL ARW)
		EA	EA	EA	EA	EA	EA	EA
1	EXISTING REMOVAL							
2	TRAFFIC	1	1	1	8	4	8	8
3	PROP PVMT MRKS							
	TOTALS	1	1	1	8	4	8	8

SHT NO	ITEM	0682-6005	0682-6006	0682-6018	0682-6054	0682-6055	0682-XXX1	0682-XXX2
	INTERSECTION	VEH SIG SEC (12")LED(RED)	VEH SIG SEC (12")LED(RED ARW)	PED SIG SEC (LED)(COUNTDOWN )	BACKPLATE W/REF BRDR(3 SEC)(VENT)ALUM	BACKPLATE W/REF BRDR(4 SEC)(VENT)ALUM	VEH SIG SEC (12") LED(GRN BIKE)	VEH SIG SEC (12") LED(YEL BIKE)
		EA	EA	EA	EA	EA	EA	EA
1	EXISTING REMOVAL							
2	TRAFFIC	8	4	8	10	4	2	2
3	PROP PVMT MRKS							
	TOTALS	8	4	8	10	4	2	2

\* FOR CONTRACTOR INFORMATION ONLY (SUBSIDIARY)

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ENGINEERS

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2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TYPE FPM REGISTRATION #410 | TYPE LS FPM REGISTRATION #1028800

LENNAR HOMES OF TEXAS, INC.

SAN ANOTNIO ETJ, TEXAS  
GROSENBACHER RD @ LADERA HILLS  
QUANTITY SUMMARY SHEET 1 OF 2

JOB NO. 6445-93

DATE 3/4/2024

DESIGNER JCH

CHECKED JWC DRAWN JCH

Plotted on: 3/4/2024

SHT NO	ITEM	0682-XXX3	0684-6009	0684-6010	0684-6025	0686-6043	0686-6045	0686-6047
	INTERSECTION	VEH SIG SEC (12") LED(RED BIKE)	TRF SIG CBL (TY A)(12 AWG)(4 CONDR)	TRF SIG CBL (TY A)(12 AWG)(5 CONDR)	TRF SIG CBL (TY A)(12 AWG)(20 CONDR)	INS TRF SIG PL AM(S)1 ARM(40')LUM	INS TRF SIG PL AM(S)1 ARM(44')	INS TRF SIG PL AM(S)1 ARM(44')LUM
		EA	LF	LF	LF	EA	EA	EA
1	EXISTING REMOVAL							
2	TRAFFIC	2	495	2435	979	2	1	1
3	PROP PVMT MRKS							
	TOTALS	2	495	2435	979	2	1	1

SHT NO	ITEM	0687-6001	0688-6001	0688-6003	6185-6002	6292-6001	6292-6003	* 6292-XX01
	INTERSECTION	PED POLE ASSEMBLY	PED DETECT PUSH BUTTON (APS)	PED DETECTOR CONTROLLER UNIT	TMA (STATIONARY)	RVDS(PRESENCE DETECTION ONLY)	RVDS(PRESENCE AND ADVANCE DET)	RVDS(PRESENCE DETECTION ONLY) COMM CABLE
		EA	EA	EA	DAY	EA	EA	LF
1	EXISTING REMOVAL							
2	TRAFFIC	8	8	1	4	2	2	738
3	PROP PVMT MRKS							
	TOTALS	8	8	1	4	2	2	738

SHT NO	ITEM	*6292-XX02
	INTERSECTION	RVDS(PRESENCE & ADVANCE DETECTION) COMM
		LF
1	EXISTING REMOVAL	
2	TRAFFIC	515
3	PROP PVMT MRKS	
	TOTALS	515

\* FOR CONTRACTOR INFORMATION ONLY (SUBSIDIARY)

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NO.	REVISION	DATE				



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS

2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000

TYPE FIRM REGISTRATION #470 | TPELS FIRM REGISTRATION #10028900

LENNAR HOMES OF TEXAS, INC.

SAN ANOTNIO ETJ, TEXAS

GROSENBACHER RD @ LADERA HILLS

QUANTITY SUMMARY SHEET 2 OF 2

JOB NO.6445-93

DATE3/4/2024

DESIGNERJCH

CHECKEDJWC\_DRAWNJCH

SHEET7



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BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

1. The Barricade and Construction Standard Sheets (BC sheets) are intended to show typical examples for placement of temporary traffic control devices, construction pavement markings, and typical work zone signs. The information contained in these sheets meet or exceed the requirements shown in the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
2. The development and design of the Traffic Control Plan (TCP) is the responsibility of the Engineer.
3. The Contractor may propose changes to the TCP that are signed and sealed by a licensed professional engineer for approval. The Engineer may develop, sign and seal Contractor proposed changes.
4. The Contractor is responsible for installing and maintaining the traffic control devices as shown in the plans. The Contractor may not move or change the approximate location of any device without the approval of the Engineer.
5. Geometric design of lane shifts and detours should, when possible, meet the applicable design criteria contained in manuals such as the American Association of State Highway and Transportation Officials (AASHTO), "A Policy on Geometric Design of Highways and Streets," the TxDOT "Roadway Design Manual" or engineering judgment.
6. When projects abut, the Engineer(s) may omit the END ROAD WORK, TRAFFIC FINES DOUBLE, and other advance warning signs if the signing would be redundant and the work areas appear continuous to the motorists. If the adjacent project is completed first, the Contractor shall erect the necessary warning signs as shown on these sheets, the TCP sheets or as directed by the Engineer. The BEGIN ROAD WORK NEXT X MILES sign shall be revised to show appropriate work zone distance.
7. The Engineer may require duplicate warning signs on the median side of divided highways where median width will permit and traffic volumes justify the signing.
8. All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition. Sign details not shown in this manual shall be shown in the plans or the Engineer shall provide a detail to the Contractor before the sign is manufactured.
9. The temporary traffic control devices shown in the illustrations of the BC sheets are examples. As necessary, the Engineer will determine the most appropriate traffic control devices to be used.
10. Where highway construction or maintenance work is being undertaken, other than mobile operations as defined by the Texas Manual on Uniform Traffic Control Devices, CSJ limit signs are required. CSJ limit signs are shown on BC(2). The OBEY WARNING SIGNS STATE LAW sign, STAY ALERT TALK OR TEXT LATER and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits. For mobile operations, CSJ limit signs are not required.
11. Traffic control devices should be in place only while work is actually in progress or a definite need exists.
12. The Engineer has the final decision on the location of all traffic control devices.
13. Inactive equipment and work vehicles, including workers' private vehicles must be parked away from travel lanes. They should be as close to the right-of-way line as possible, or located behind a barrier or guardrail, or as approved by the Engineer.


WORKER SAFETY NOTES:

1. Workers on foot who are exposed to traffic or to construction equipment within the right-of-way shall wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel," or equivalent revisions, and labeled as ANSI 107-2004 standard performance for Class 2 or 3 risk exposure. Class 3 garments should be considered for high traffic volume work areas or night time work.
2. Except in emergency situations, flagger stations shall be illuminated when flagging is used at night.

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

1. Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources.
2. Work zone traffic control devices shall be compliant with the Manual for Assessing safety Hardware (MASH).

THE DOCUMENTS BELOW CAN BE FOUND ON-LINE AT <a href="http://www.txdot.gov">http://www.txdot.gov</a>
COMPLIANT WORK ZONE TRAFFIC CONTROL DEVICES LIST (CWZTCD)
DEPARTMENTAL MATERIAL SPECIFICATIONS (DMS)
MATERIAL PRODUCER LIST (MPL)
ROADWAY DESIGN MANUAL - SEE "MANUALS (ONLINE MANUALS)"
STANDARD HIGHWAY SIGN DESIGNS FOR TEXAS (SHSD)
TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (TMUTCD)
TRAFFIC ENGINEERING STANDARD SHEETS



Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION  
GENERAL NOTES  
AND REQUIREMENTS

BC (1) - 21

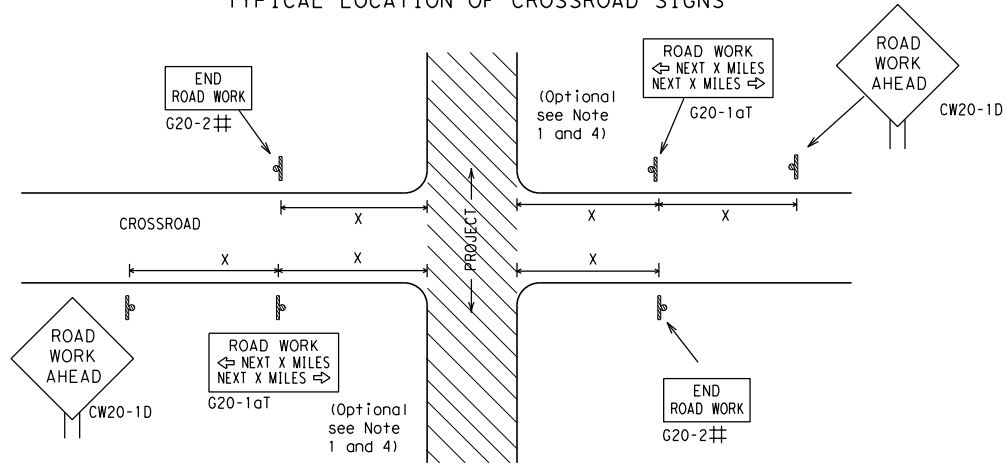
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© TxDOT	November 2002	CONT	SECT	JOB		HIGHWAY			
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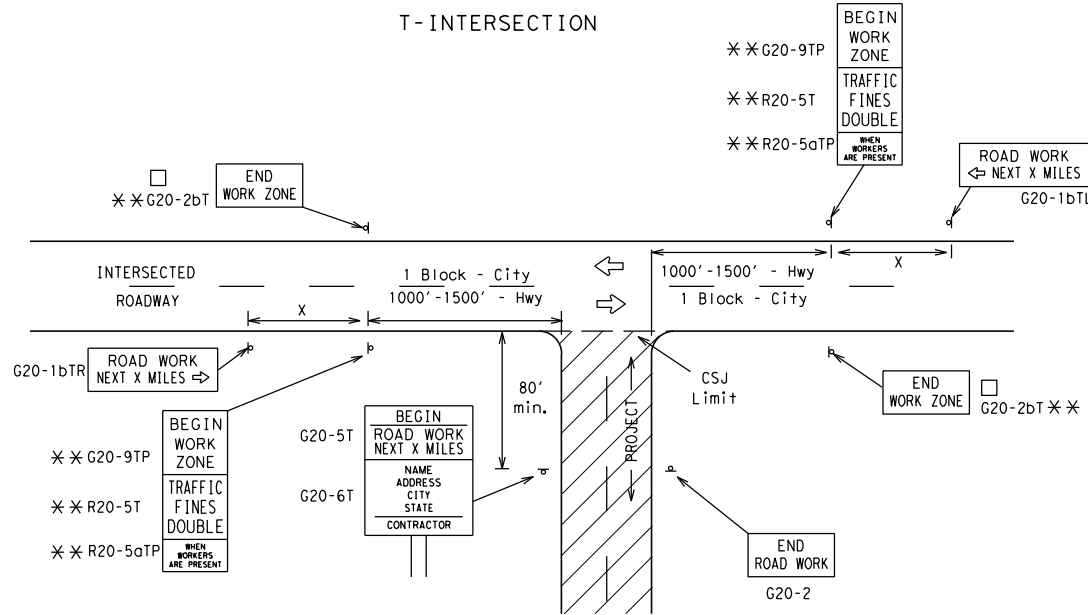
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### TYPICAL LOCATION OF CROSSROAD SIGNS



- ## May be mounted on back of "ROAD WORK AHEAD" (CW20-1D) sign with approval of Engineer. (See note 2 below)
- The typical minimum signing on a crossroad approach should be a "ROAD WORK AHEAD" (CW20-1D) sign and a (G20-2) "END ROAD WORK" sign, unless noted otherwise in plans.
  - The Engineer may use the reduced size 36" x 36" ROAD WORK AHEAD (CW20-1D) sign mounted back to back with the reduced size 36" x 18" "END ROAD WORK" (G20-2) sign on low volume crossroads (see Note 4 under "Typical Construction Warning Sign Size and Spacing"). See the "Standard Highway Sign Designs for Texas" manual for sign details. The Engineer may omit the advance warning signs on low volume crossroads. The Engineer will determine whether a road is low volume as per TMUTCD Part 5. This information shall be shown in the plans.
  - Based on existing field conditions, the Engineer/Inspector may require additional signs such as FLAGGER AHEAD, LOOSE GRAVEL, or other appropriate signs. When additional signs are required, these signs will be considered part of the minimum requirements. The Engineer/Inspector will determine the proper location and spacing of any sign not shown on the BC sheets, Traffic Control Plan sheets or the Work Zone Standard Sheets.
  - The "ROAD WORK NEXT X MILES" (G20-1aT) sign shall be required at high volume crossroads to advise motorists of the length of construction in either direction from the intersection. The Engineer will determine whether a roadway is considered high volume.
  - Additional traffic control devices may be shown elsewhere in the plans for higher volume crossroads.
  - When work occurs in the intersection area, appropriate traffic control devices, as shown elsewhere in the plans or as determined by the Engineer/Inspector, shall be in place.

### T-INTERSECTION



### CSJ LIMITS AT T-INTERSECTION

- The Engineer will determine the types and location of any additional traffic control devices, such as a flagger and accompanying signs, or other signs, that should be used when work is being performed at or near an intersection.
- If construction closes the road at a T-intersection, the Contractor shall place the "CONTRACTOR NAME" (G20-6T) sign behind the Type 3 Barricades for the road closure (see BC(10) also). The "ROAD WORK NEXT X MILES" left arrow (G20-1bTL) and "ROAD WORK NEXT X MILES" right arrow (G20-1bTR) signs shall be replaced by the detour signing called for in the plans.

### TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING<sup>1,5,6</sup>

Sign Number or Series	SIZE		SPACING	
	Conventional Road	Expressway/Freeway	Posted Speed MPH	Sign Spacing "X" Feet (Apprx.)
CW20 <sup>4</sup>	48" x 48"	48" x 48"	30	120
CW21			35	160
CW22			40	240
CW23			45	320
CW25			50	400
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"	55	500 <sup>2</sup>
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"	60	600 <sup>2</sup>
			65	700 <sup>2</sup>
			70	800 <sup>2</sup>
			75	900 <sup>2</sup>
*			80	1000 <sup>2</sup>
			*	*

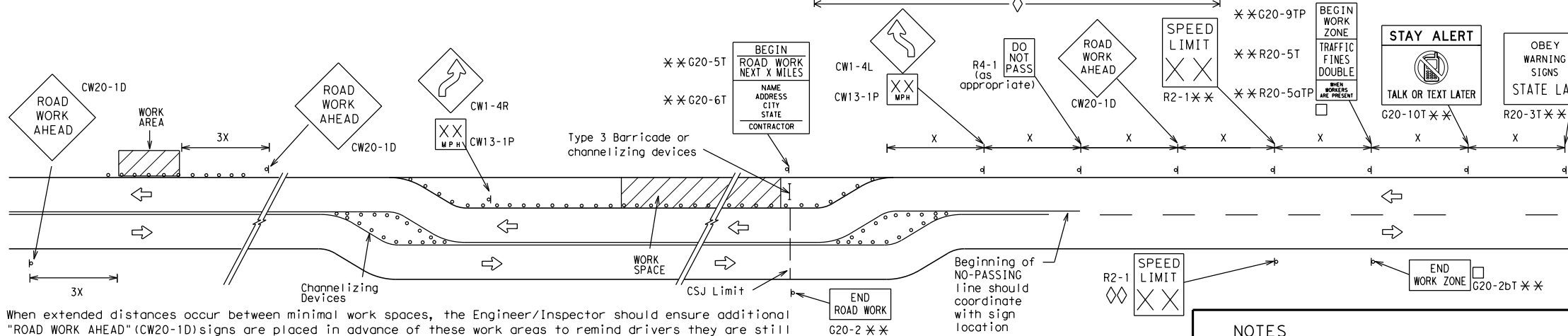
\* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

△ Minimum distance from work area to first Advance Warning sign nearest the work area and/or distance between each additional sign.

### GENERAL NOTES

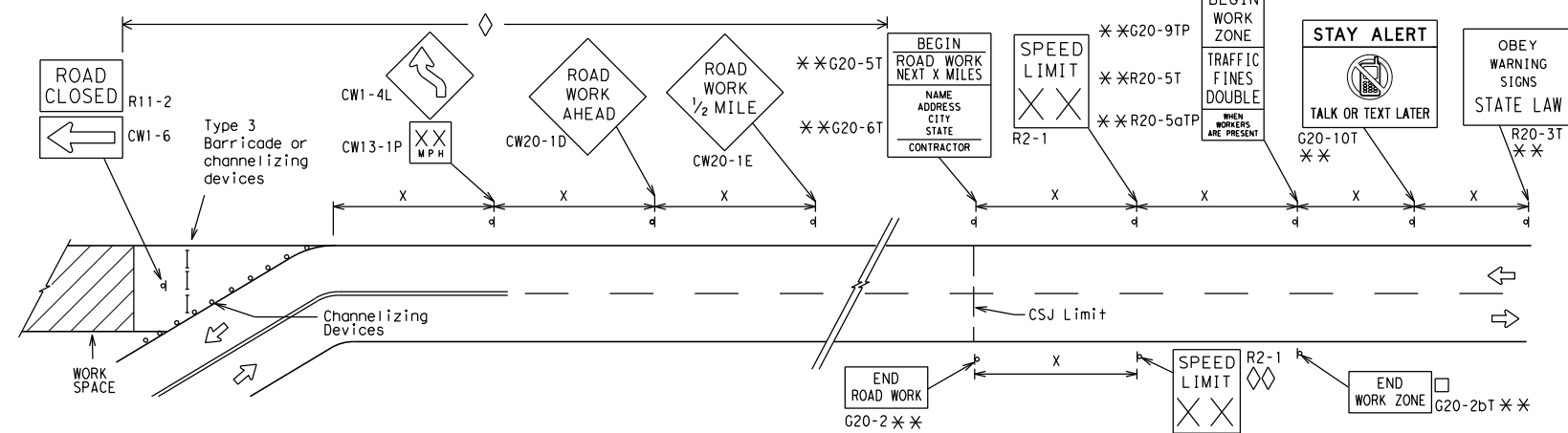
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be used on low volume crossroads at the discretion of the Engineer as per TMUTCD Part 5. See Note 2 under "Typical Location of Crossroad Signs".
- Only diamond shaped warning sign sizes are indicated.
- See sign size listing in "TMUTCD", Sign Appendix or the "Standard Highway Sign Designs for Texas" manual for complete list of available sign design sizes.

### WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

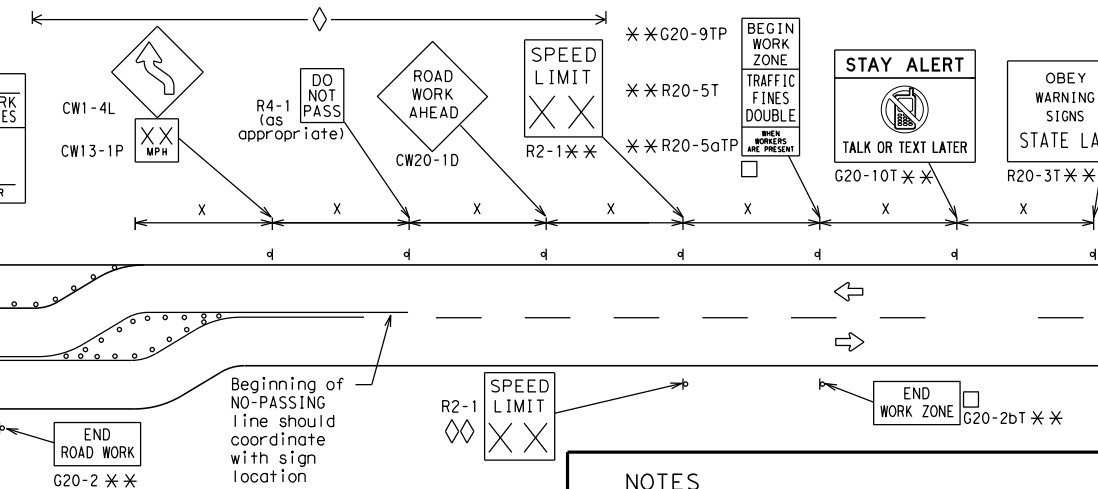


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD" (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing of signs and channelizing devices.

### SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING DOWNSTREAM OF THE CSJ LIMITS



### SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS



### NOTES

The Contractor shall determine the appropriate distance to be placed on the G20-1 series signs and "BEGIN ROAD WORK NEXT X MILES" (G20-5T) sign for each specific project. This distance shall replace the "X" and shall be rounded to the nearest whole mile with the approval of the Engineer. No decimals shall be used.

- The "BEGIN WORK ZONE" (G20-9TP) and "END WORK ZONE" (G20-2bT) shall be used as shown on the sample layout when advance signs are required outside the CSJ Limits. They inform the motorist of entering or leaving a part of the work zone lying outside the CSJ Limits where traffic fines may double if workers are present.

\*\* CSJ limit signing is required for highway construction and maintenance work, with the exception of mobile operations.

◇ Area for placement of "ROAD WORK AHEAD" (CW20-1D) sign and other signs or devices as called for on the Traffic Control Plan.

◇◇ Contractor will install a regulatory speed limit sign at the end of the work zone.

### LEGEND

— —	Type 3 Barricade
○ ○ ○	Channelizing Devices
—	Sign
X	See Typical Construction Warning Sign Size and Spacing chart or the TMUTCD for sign spacing requirements.

SHEET 2 OF 12



## BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC (2) - 21

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7-13 5-21						10			

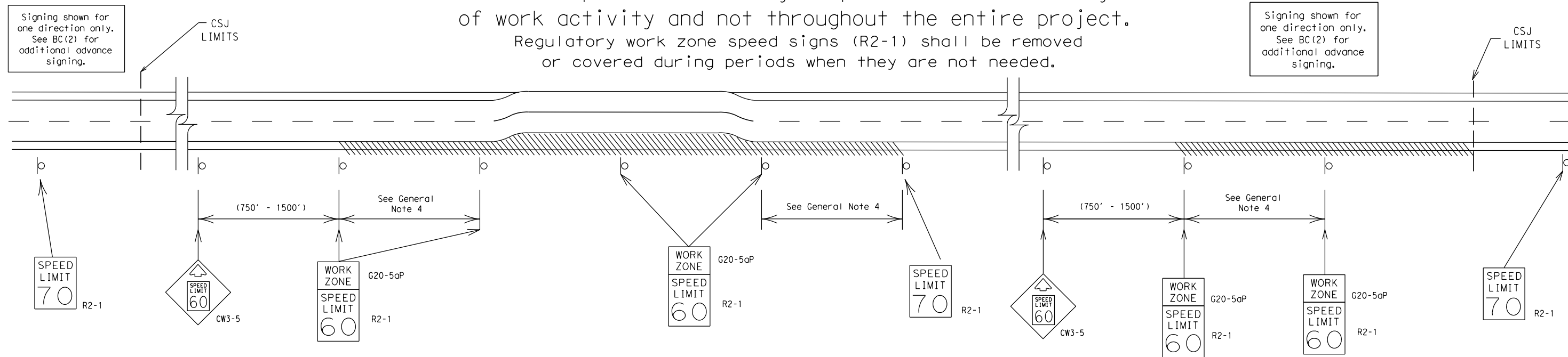
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# TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

Work zone speed limits shall be regulatory, established in accordance with the "Procedures for Establishing Speed Zones," and approved by the Texas Transportation Commission, or by City Ordinance when within Incorporated City Limits.

Reduced speeds should only be posted in the vicinity of work activity and not throughout the entire project. Regulatory work zone speed signs (R2-1) shall be removed or covered during periods when they are not needed.



## GUIDANCE FOR USE:

### LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

This type of work zone speed limit should be included on the design of the traffic control plans when restricted geometrics with a lower design speed are present in the work zone and modification of the geometrics to a higher design speed is not feasible.

Long/Intermediate Term Work Zone Speed Limit signs, when approved as described above, should be posted and visible to the motorist when work activity is present. Work activity may also be defined as a change in the roadway that requires a reduced speed for motorists to safely negotiate the work area, including:

- rough road or damaged pavement surface
- substantial alteration of roadway geometrics (diversions)
- construction detours
- grade
- width
- other conditions readily apparent to the driver

As long as any of these conditions exist, the work zone speed limit signs should remain in place.

### SHORT TERM WORK ZONE SPEED LIMITS

This type of work zone speed limit may be included on the design of the traffic control plans when workers or equipment are not behind concrete barrier, when work activity is within 10 feet of the traveled way or actually in the traveled way.

Short Term Work Zone Speed Limit signs should be posted and visible to the motorists only when work activity is present. When work activity is not present, signs shall be removed or covered. (See Removing or Covering on BC(4)).

## GENERAL NOTES

- Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
- Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
- Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
- Frequency of work zone speed limit signs should be:

40 mph and greater	0.2 to 2 miles
35 mph and less	0.2 to 1 mile
- Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
- Fabrication, erection and maintenance of the "ADVANCE SPEED LIMIT" (CW3-5) sign, "WORK ZONE" (G20-5aP) plaque and the "SPEED LIMIT" (R2-1) signs shall not be paid for directly, but shall be considered subsidiary to Item 502.
- Turning signs from view, laying signs over or down will not be allowed, unless as otherwise noted under "REMOVING OR COVERING" on BC(4).
- Techniques that may help reduce traffic speeds include but are not limited to:
  - Law enforcement.
  - Flagger stationed next to sign.
  - Portable changeable message sign (PCMS).
  - Low-power (drone) radar transmitter.
  - Speed monitor trailers or signs.
- Speeds shown on details above are for illustration only. Work Zone Speed Limits should only be posted as approved for each project.
- For more specific guidance concerning the type of work, work zone conditions and factors impacting allowable regulatory construction speed zone reduction see TxDOT form #1204 in the TxDOT e-form system.

SHEET 3 OF 12

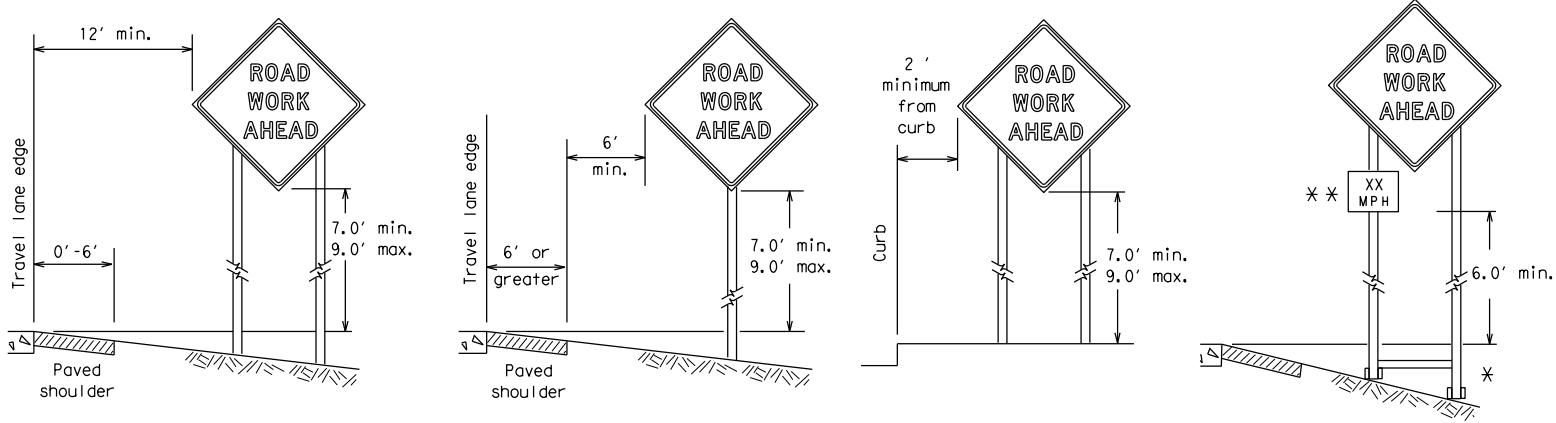
		<b>Traffic Safety Division Standard</b>	
<b>BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT</b>			
<b>BC (3) - 21</b>			
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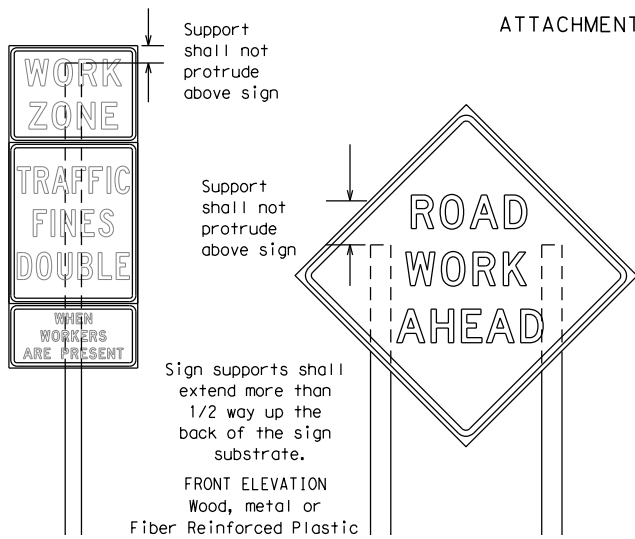
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS



✱ When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

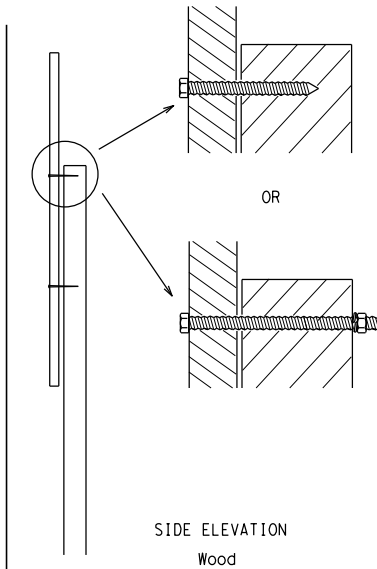
✱✱ When plaques are placed on dual-leg supports, they should be attached to the upright nearest the travel lane. Supplemental plaques (advisory or distance) should not cover the surface of the parent sign.

ATTACHMENT FOR SIGN SUPPORTS



Splicing embedded perforated square metal tubing in order to extend post height will only be allowed when the splice is made using four bolts, two above and two below the splice point. Splice must be located entirely behind the sign substrate, not near the base of the support. Splice insert lengths should be at least 5 times nominal post size, centered on the splice and of at least the same gauge material.

Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports



Nails shall NOT be allowed. Each sign shall be attached directly to the sign support. Multiple signs shall not be joined or spliced by any means. Wood supports shall not be extended or repaired by splicing or other means.

GENERAL NOTES FOR WORK ZONE SIGNS

- Contractor shall install and maintain signs in a straight and plumb condition and/or as directed by the Engineer.
- Wooden sign posts shall be painted white.
- Barricades shall NOT be used as sign supports.
- All signs shall be installed in accordance with the plans or as directed by the Engineer. Signs shall be used to regulate, warn, and guide the traveling public safely through the work zone.
- The Contractor may furnish either the sign design shown in the plans or in the "Standard Highway Sign Designs for Texas" (SHSD). The Engineer/Inspector may require the Contractor to furnish other work zone signs that are shown in the TMUTCD but may have been omitted from the plans. Any variation in the plans shall be documented by written agreement between the Engineer and the Contractor's Responsible Person. All changes must be documented in writing before being implemented. This can include documenting the changes in the Inspector's TxDOT diary and having both the Inspector and Contractor initial and date the agreed upon changes.
- The Contractor shall furnish sign supports listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCD) for small roadside signs. Supports for temporary large roadside signs shall meet the requirements detailed on the Temporary Large Roadside Signs (TLRS) standard sheets. The Contractor shall install the sign support in accordance with the manufacturer's recommendations. If there is a question regarding installation procedures, the Contractor shall furnish the Engineer a copy of the manufacturer's installation recommendations so the Engineer can verify the correct procedures are being followed.
- The Contractor is responsible for installing signs on approved supports and replacing signs with damaged or cracked substrates and/or damaged or marred reflective sheeting as directed by the Engineer/Inspector.
- Identification markings may be shown only on the back of the sign substrate. The maximum height of letters and/or company logos used for identification shall be 1 inch.
- The Contractor shall replace damaged wood posts. New or damaged wood sign posts shall not be spliced.

DURATION OF WORK (as defined by the "Texas Manual on Uniform Traffic Control Devices" Part 6)

- The types of sign supports, sign mounting height, the size of signs, and the type of sign substrates can vary based on the type of work being performed. The Engineer is responsible for selecting the appropriate size sign for the type of work being performed. The Contractor is responsible for ensuring the sign support, sign mounting height and substrate meets manufacturer's recommendations in regard to crashworthiness and duration of work requirements.
  - Long-term stationary - work that occupies a location more than 3 days.
  - Intermediate-term stationary - work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than one hour.
  - Short-term stationary - daytime work that occupies a location for more than 1 hour in a single daylight period.
  - Short, duration - work that occupies a location up to 1 hour.
  - Mobile - work that moves continuously or intermittently (stopping for up to approximately 15 minutes.)

SIGN MOUNTING HEIGHT

- The bottom of Long-term/Intermediate-term signs shall be at least 7 feet, but not more than 9 feet, above the paved surface, except as shown for supplemental plaques mounted below other signs.
- The bottom of Short-term/Short Duration signs shall be a minimum of 1 foot above the pavement surface but no more than 2 feet above the ground.
- Long-term/Intermediate-term Signs may be used in lieu of Short-term/Short Duration signing.
- Short-term/Short Duration signs shall be used only during daylight and shall be removed at the end of the workday or raised to appropriate Long-term/Intermediate sign height.
- Regulatory signs shall be mounted at least 7 feet, but not more than 9 feet, above the paved surface regardless of work duration.

SIZE OF SIGNS

- The Contractor shall furnish the sign sizes shown on BC (2) unless otherwise shown in the plans or as directed by the Engineer.

SIGN SUBSTRATES

- The Contractor shall ensure the sign substrate is installed in accordance with the manufacturer's recommendations for the type of sign support that is being used. The CWZTCD lists each substrate that can be used on the different types and models of sign supports.
- "Mesh" type materials are NOT an approved sign substrate, regardless of the tightness of the weave.
- All wooden individual sign panels fabricated from 2 or more pieces shall have one or more plywood cleat, 1/2" thick by 6" wide, fastened to the back of the sign and extending fully across the sign. The cleat shall be attached to the back of the sign using wood screws that do not penetrate the face of the sign panel. The screws shall be placed on both sides of the splice and spaced at 6" centers. The Engineer may approve other methods of splicing the sign face.

REFLECTIVE SHEETING

- All signs shall be retroreflective and constructed of sheeting meeting the color and retro-reflectivity requirements of DMS-8300 for rigid signs or DMS-8310 for roll-up signs. The web address for DMS specifications is shown on BC(1).
- White sheeting, meeting the requirements of DMS-8300 Type A, shall be used for signs with a white background.
- Orange sheeting, meeting the requirements of DMS-8300 Type B<sub>FL</sub> or Type C<sub>FL</sub>, shall be used for rigid signs with orange backgrounds.

SIGN LETTERS

- All sign letters and numbers shall be clear, and open rounded type uppercase alphabet letters as approved by the Federal Highway Administration (FHWA) and as published in the "Standard Highway Sign Design for Texas" manual. Signs, letters and numbers shall be of first class workmanship in accordance with Department Standards and Specifications.

REMOVING OR COVERING

- When sign messages may be confusing or do not apply, the signs shall be removed or completely covered.
- Long-term stationary or intermediate stationary signs installed on square metal tubing may be turned away from traffic 90 degrees when the sign message is not applicable. This technique may not be used for signs installed in the median of divided highways or near any intersections where the sign may be seen from approaching traffic.
- Signs installed on wooden skids shall not be turned at 90 degree angles to the roadway. These signs should be removed or completely covered when not required.
- When signs are covered, the material used shall be opaque, such as heavy mil black plastic, or other materials which will cover the entire sign face and maintain their opaque properties under automobile headlights at night, without damaging the sign sheeting.
- Burlap shall NOT be used to cover signs.
- Duct tape or other adhesive material shall NOT be affixed to a sign face.
- Signs and anchor stubs shall be removed and holes backfilled upon completion of work.

SIGN SUPPORT WEIGHTS

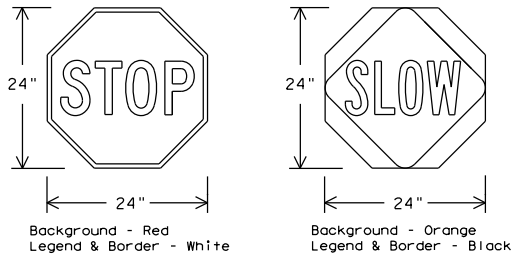
- Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand should be used.
- The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
- Rock, concrete, iron, steel or other solid objects shall not be permitted for use as sign support weights.
- Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
- Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as fire inner tubes) shall NOT be used.
- Rubber ballasts designed for channelizing devices should not be used for ballast on portable sign supports. Sign supports designed and manufactured with rubber bases may be used when shown on the CWZTCD list.
- Sandbags shall only be placed along or laid over the base supports of the traffic control device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners. Sandbags shall be placed along the length of the skids to weigh down the sign support.
- Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

FLAGS ON SIGNS

- Flags may be used to draw attention to warning signs. When used, the flag shall be 16 inches square or larger and shall be orange or fluorescent red-orange in color. Flags shall not be allowed to cover any portion of the sign face.

STOP/SLOW PADDLES

- STOP/SLOW paddles are the primary method to control traffic by flaggers. The STOP/SLOW paddle size should be 24" x 24".
- STOP/SLOW paddles shall be retroreflectorized when used at night.
- STOP/SLOW paddles may be attached to a staff with a minimum length of 6' to the bottom of the sign.
- Any lights incorporated into the STOP or SLOW paddle faces shall only be as specifically described in Section 6E.03 Hand Signaling Devices in the TMUTCD.




SHEETING REQUIREMENTS (WHEN USED AT NIGHT)		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	ORANGE	TYPE B <sub>FL</sub> OR C <sub>FL</sub> SHEETING
LEGEND & BORDER	WHITE	TYPE B OR C SHEETING
LEGEND & BORDER	BLACK	ACRYLIC NON-REFLECTIVE FILM

CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

- Permanent signs are used to give notice of traffic laws or regulations, call attention to conditions that are potentially hazardous to traffic operations, show route designations, destinations, directions, distances, services, points of interest, and other geographical, recreational, specific service (LOGO), or cultural information. Drivers proceeding through a work zone need the same, if not better route guidance as normally installed on a roadway without construction.
- When permanent regulatory or warning signs conflict with work zone conditions, remove or cover the permanent signs until the permanent sign message matches the roadway condition. For details for covering large guide signs see the TS-CD standard.
- When existing permanent signs are moved and relocated due to construction purposes, they shall be visible to motorists at all times.
- If existing signs are to be relocated on their original supports, they shall be installed on crashworthy bases as shown on the SMD Standard sheets. The signs shall meet the required mounting heights shown on the BC Sheets or the SMD Standards. This work should be paid for under the appropriate pay item for relocating existing signs.
- If permanent signs are to be removed and relocated using temporary supports, the Contractor shall use crashworthy supports as shown on the BC standard sheets, TLRS standard sheets or the CWZTCD list. The signs shall meet the required mounting heights shown on the BC, or the SMD standard sheets during construction. This work should be paid for under the appropriate pay item for relocating existing signs.
- Any sign or traffic control device that is struck or damaged by the Contractor or his/her construction equipment shall be replaced as soon as possible by the Contractor to ensure proper guidance for the motorists. This will be subsidiary to Item 502.

SHEET 4 OF 12

**Texas Department of Transportation**

**Traffic Safety Division Standard**

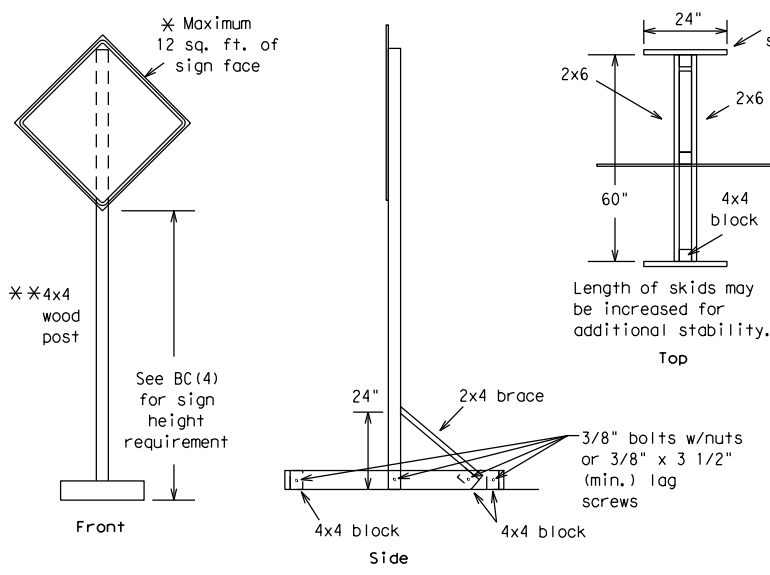
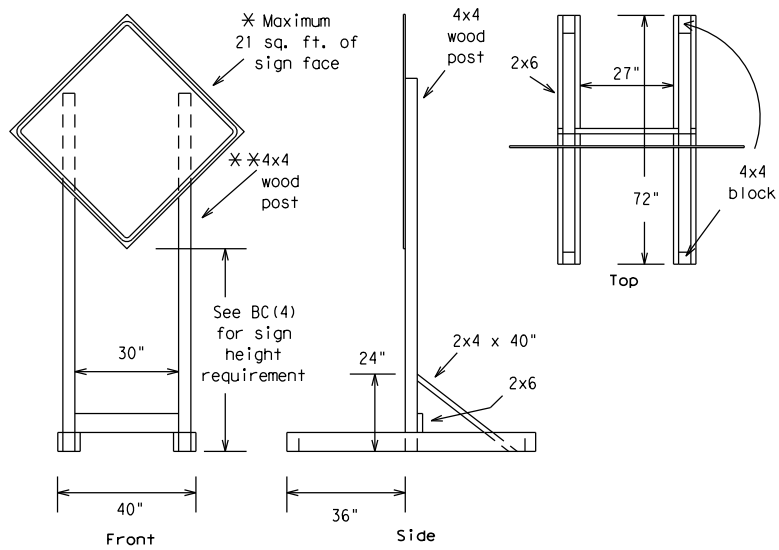
**BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES**

**BC (4) - 21**

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©TxDOT	November 2002	CONT	SECT	JOB		HIGHWAY			
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9-07	8-14								
7-13	5-21	DIST	COUNTY				SHEET NO.		
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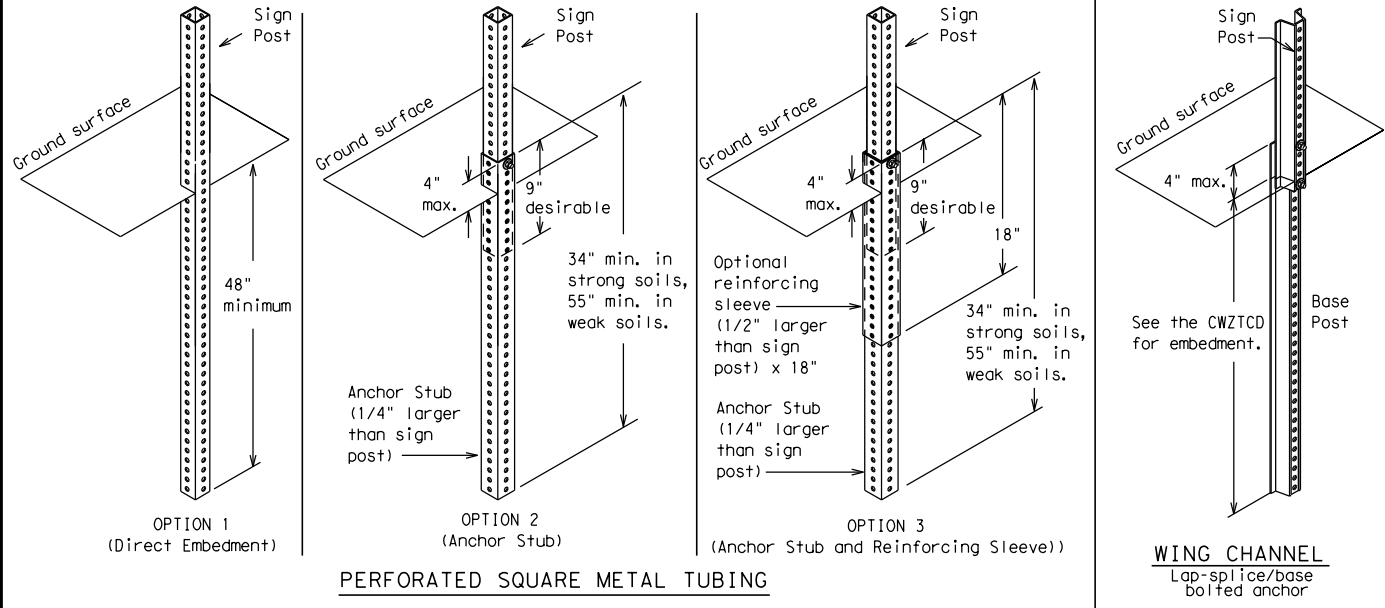
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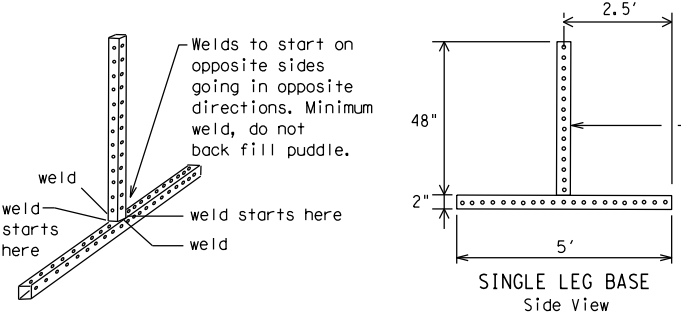
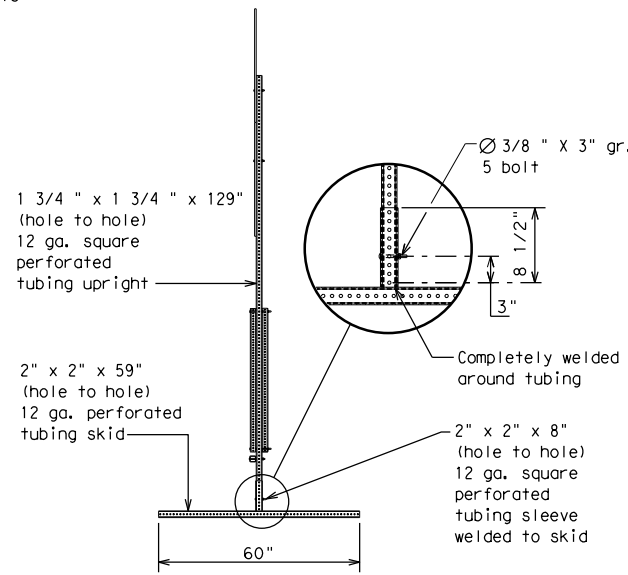
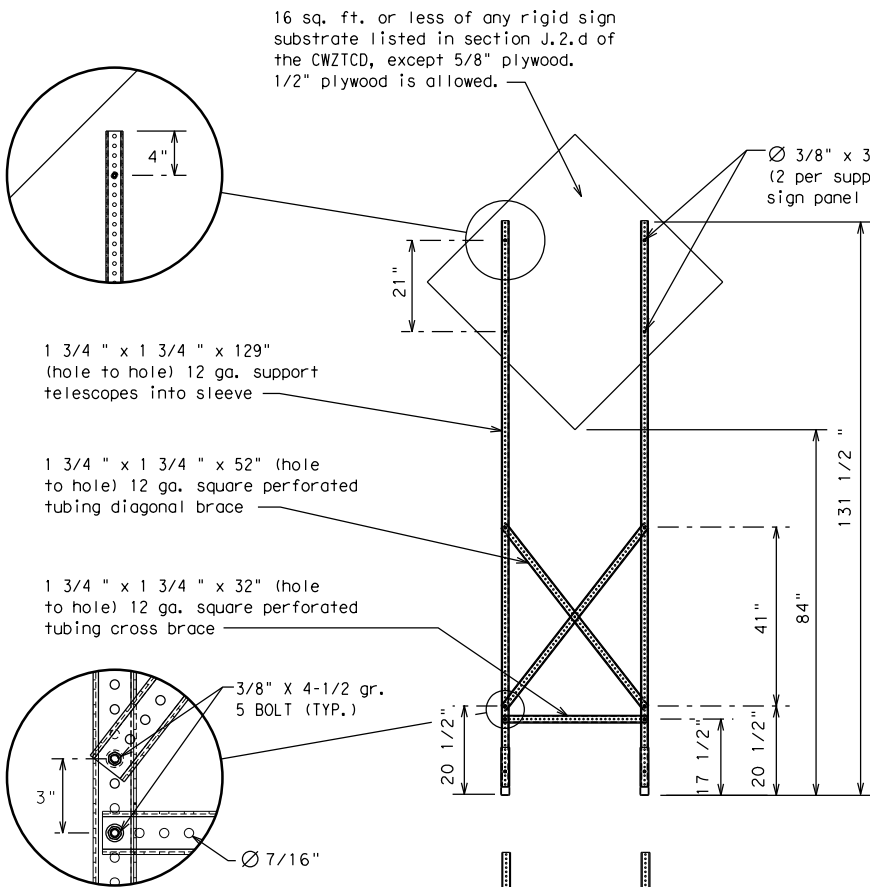
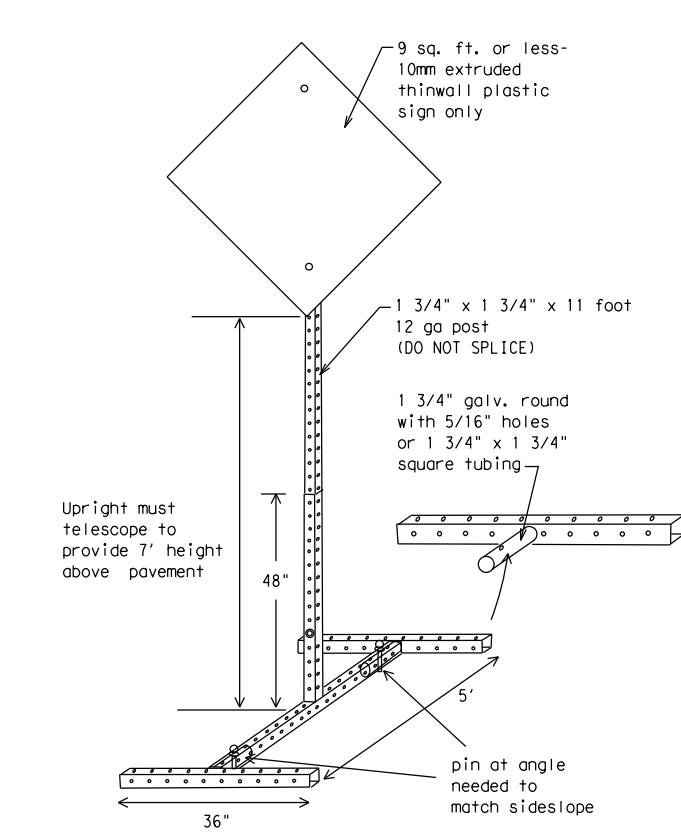
### SKID MOUNTED WOOD SIGN SUPPORTS

\* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS



### GROUND MOUNTED SIGN SUPPORTS

Refer to the CWZTCD and the manufacturer's installation procedure for each type sign support.  
The maximum sign square footage shall adhere to the manufacturer's recommendation.  
Two post installations can be used for larger signs.



### SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

\* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS

### WEDGE ANCHORS

Both steel and plastic Wedge Anchor Systems as shown on the SMD Standard Sheets may be used as temporary sign supports for signs up to 10 square feet of sign face. They may be set in concrete or in sturdy soils if approved by the Engineer. (See web address for "Traffic Engineering Standard Sheets" on BC(1)).

### OTHER DESIGNS

MORE DETAILS OF APPROVED LONG/INTERMEDIATE AND SHORT TERM SUPPORTS CAN BE FOUND ON THE CWZTCD LIST. SEE BC(1) FOR WEBSITE LOCATION.

#### GENERAL NOTES

1. Nails may be used in the assembly of wooden sign supports, but 3/8" bolts with nuts or 3/8" x 3 1/2" lag screws must be used on every joint for final connection.
2. No more than 2 sign posts shall be placed within a 7 ft. circle, except for specific materials noted on the CWZTCD List.
3. When project is completed, all sign supports and foundations shall be removed from the project site. This will be considered subsidiary to Item 502.

- \* See BC(4) for definition of "Work Duration."
- \*\* Wood sign posts MUST be one piece. Splicing will NOT be allowed. Posts shall be painted white.
- ☐ See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

SHEET 5 OF 12



### BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5) - 21

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WHEN NOT IN USE, REMOVE THE PCMS FROM THE RIGHT-OF-WAY OR PLACE THE PCMS BEHIND BARRIER OR GUARDRAIL WITH SIGN PANEL TURNED PARALLEL TO TRAFFIC

PORTABLE CHANGEABLE MESSAGE SIGNS

- The Engineer/Inspector shall approve all messages used on portable changeable message signs (PCMS).
- Messages on PCMS should contain no more than 8 words (about four to eight characters per word), not including simple words such as "TO," "FOR," "AT," etc.
- Messages should consist of a single phase, or two phases that alternate. Three-phase messages are not allowed. Each phase of the message should convey a single thought, and must be understood by itself.
- Use the word "EXIT" to refer to an exit ramp on a freeway; i.e., "EXIT CLOSED." Do not use the term "RAMP."
- Always use the route or interstate designation (IH, US, SH, FM) along with the number when referring to a roadway.
- When in use, the bottom of a stationary PCMS message panel should be a minimum 7 feet above the roadway, where possible.
- The message term "WEEKEND" should be used only if the work is to start on Saturday morning and end by Sunday evening at midnight. Actual days and hours of work should be displayed on the PCMS if work is to begin on Friday evening and/or continue into Monday morning.
- The Engineer/Inspector may select one of two options which are available for displaying a two-phase message on a PCMS. Each phase may be displayed for either four seconds each or for three seconds each.
- Do not "flash" messages or words included in a message. The message should be steady burn or continuous while displayed.
- Do not present redundant information on a two-phase message; i.e., keeping two lines of the message the same and changing the third line.
- Do not use the word "Danger" in message.
- Do not display the message "LANES SHIFT LEFT" or "LANES SHIFT RIGHT" on a PCMS. Drivers do not understand the message.
- Do not display messages that scroll horizontally or vertically across the face of the sign.
- The following table lists abbreviated words and two-word phrases that are acceptable for use on a PCMS. Both words in a phrase must be displayed together. Words or phrases not on this list should not be abbreviated, unless shown in the TMUTCD.
- PCMS character height should be at least 18 inches for trailer mounted units. They should be visible from at least 1/2 (.5) mile and the text should be legible from at least 600 feet at night and 800 feet in daylight. Truck mounted units must have a character height of 10 inches and must be legible from at least 400 feet.
- Each line of text should be centered on the message board rather than left or right justified.
- If disabled, the PCMS should default to an illegible display that will not alarm motorists and will only be used to alert workers that the PCMS has malfunctioned. A pattern such as a series of horizontal solid bars is appropriate.

WORD OR PHRASE	ABBREVIATION
Access Road	ACCS RD
Alternate	ALT
Avenue	AVE
Best Route	BEST RTE
Boulevard	BLVD
Bridge	BRDG
Cannot	CANT
Center	CTR
Construction Ahead	CONST AHD
CROSSING	XING
Detour Route	DETOUR RTE
Do Not	DONT
East	E
Eastbound	(route) E
Emergency	EMER
Emergency Vehicle	EMER VEH
Entrance, Enter	ENT
Express Lane	EXP LN
Expressway	EXPWY
XXXX Feet	XXXX FT
Fog Ahead	FOG AHD
Freeway	FRWY, FWY
Freeway Blocked	FWY BLKD
Friday	FRI
Hazardous Driving	HAZ DRIVING
Hazardous Material	HAZMAT
High-Occupancy	HOV
Vehicle Highway	HWY
Hour(s)	HR, HRS
Information	INFO
It Is	ITS
Junction	JCT
Left	LFT
Left Lane	LFT LN
Lane Closed	LN CLOSED
Lower Level	LWR LEVEL
Maintenance	MAINT

Roadway designation # IH-number, US-number, SH-number, FM-number

WORD OR PHRASE	ABBREVIATION
Major	MAJ
Miles	MI
Miles Per Hour	MPH
Minor	MNR
Monday	MON
Normal	NORM
North	N
Northbound	(route) N
Parking	PKING
Road	RD
Right Lane	RT LN
Saturday	SAT
Service Road	SERV RD
Shoulder	SHLDR
Slippery	SLIP
South	S
Southbound	(route) S
Speed	SPD
Street	ST
Sunday	SUN
Telephone	PHONE
Temporary	TEMP
Thursday	THURS
To Downtown	TO DWNTN
Traffic	TRAF
Travelers	TRVLRS
Tuesday	TUES
Time Minutes	TIME MIN
Upper Level	UPR LEVEL
Vehicles (s)	VEH, VEHS
Warning	WARN
Wednesday	WED
Weight Limit	WT LIMIT
West	W
Westbound	(route) W
Wet Pavement	WET PVMT
Will Not	WONT

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

(The Engineer may approve other messages not specifically covered here.)

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

FREEWAY  
CLOSED  
X MILE

FRONTAGE  
ROAD  
CLOSED

ROAD  
CLOSED  
AT SH XXX

SHOULDER  
CLOSED  
XXX FT

ROAD  
CLSD AT  
FM XXXX

RIGHT LN  
CLOSED  
XXX FT

RIGHT X  
LANES  
CLOSED

RIGHT X  
LANES  
OPEN

CENTER  
LANE  
CLOSED

DAYTIME  
LANE  
CLOSURES

NIGHT  
LANE  
CLOSURES

I-XX SOUTH  
EXIT  
CLOSED

VARIOUS  
LANES  
CLOSED

EXIT XXX  
CLOSED  
X MILE

EXIT  
CLOSED

RIGHT LN  
TO BE  
CLOSED

MALL  
DRIVEWAY  
CLOSED

X LANES  
CLOSED  
TUE - FRI

XXXXXXXX  
BLVD  
CLOSED

Other Condition List

ROADWORK  
XXX FT

ROAD  
REPAIRS  
XXXX FT

FLAGGER  
XXXX FT

LANE  
NARROWS  
XXXX FT

RIGHT LN  
NARROWS  
XXXX FT

TWO-WAY  
TRAFFIC  
XX MILE

MERGING  
TRAFFIC  
XXXX FT

CONST  
TRAFFIC  
XXX FT

LOOSE  
GRAVEL  
XXXX FT

UNEVEN  
LANES  
XXXX FT

DETOUR  
X MILE

ROUGH  
ROAD  
XXXX FT

ROADWORK  
PAST  
SH XXXX

ROADWORK  
NEXT  
FRI-SUN

BUMP  
XXXX FT

US XXX  
EXIT  
X MILES

TRAFFIC  
SIGNAL  
XXXX FT

LANES  
SHIFT

\* LANES SHIFT in Phase 1 must be used with STAY IN LANE in Phase 2.

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

MERGE  
RIGHT

FORM  
X LINES  
RIGHT

DETOUR  
NEXT  
X EXITS

USE  
XXXXX  
RD EXIT

USE  
EXIT XXX

USE EXIT  
I-XX  
NORTH

STAY ON  
US XXX  
SOUTH

USE  
I-XX E  
TO I-XX N

TRUCKS  
USE  
US XXX N

WATCH  
FOR  
TRUCKS

WATCH  
FOR  
TRUCKS

EXPECT  
DELAYS

EXPECT  
DELAYS

PREPARE  
TO  
STOP

REDUCE  
SPEED  
XXX FT

END  
SHOULDER  
USE

USE  
OTHER  
ROUTES

WATCH  
FOR  
WORKERS

STAY  
IN  
LANE

Location List

AT  
FM XXXX

BEFORE  
RAILROAD  
CROSSING

NEXT  
X  
MILES

PAST  
US XXX  
EXIT

XXXXXXXX  
TO  
XXXXXXXX

US XXX  
TO  
FM XXXX

Warning List

SPEED  
LIMIT  
XX MPH

MAXIMUM  
SPEED  
XX MPH

MINIMUM  
SPEED  
XX MPH

ADVISORY  
SPEED  
XX MPH

RIGHT  
LANE  
EXIT

USE  
CAUTION

DRIVE  
SAFELY

DRIVE  
WITH  
CARE

\*\* Advance Notice List

TUE-FRI  
XX AM-  
X PM

APR XX-  
XX  
X PM-X AM

BEGINS  
MONDAY

BEGINS  
MAY XX

MAY X-X  
XX PM -  
XX AM

NEXT  
FRI-SUN

XX AM  
TO  
XX PM

NEXT  
TUE  
AUG XX

TONIGHT  
XX PM-  
XX AM

\*\* See Application Guidelines Note 6.

APPLICATION GUIDELINES

- Only 1 or 2 phases are to be used on a PCMS.
- The 1st phase (or both) should be selected from the "Road/Lane/Ramp Closure List" and the "Other Condition List".
- A 2nd phase can be selected from the "Action to Take/Effect on Travel, Location, General Warning, or Advance Notice Phase Lists".
- A Location Phase is necessary only if a distance or location is not included in the first phase selected.
- If two PCMS are used in sequence, they must be separated by a minimum of 1000 ft. Each PCMS shall be limited to two phases, and should be understandable by themselves.
- For advance notice, when the current date is within seven days of the actual work date, calendar days should be replaced with days of the week. Advance notification should typically be for no more than one week prior to the work.

PCMS SIGNS WITHIN THE R.O.W. SHALL BE BEHIND GUARDRAIL OR CONCRETE BARRIER OR SHALL HAVE A MINIMUM OF FOUR (4) PLASTIC DRUMS PLACED PERPENDICULAR TO TRAFFIC ON THE UPSTREAM SIDE OF THE PCMS, WHEN EXPOSED TO ONE DIRECTION OF TRAFFIC. WHEN EXPOSED TO TWO WAY TRAFFIC, THE FOUR DRUMS SHOULD BE PLACED WITH ONE DRUM AT EACH OF THE FOUR CORNERS OF THE UNIT.


FULL MATRIX PCMS SIGNS

- When Full Matrix PCMS signs are used, the character height and legibility/visibility requirements shall be maintained as listed in Note 15 under "PORTABLE CHANGEABLE MESSAGE SIGNS" above.
- When symbol signs, such as the "Flagger Symbol" (CW20-7) are represented graphically on the Full Matrix PCMS sign and, with the approval of the Engineer, it shall maintain the legibility/visibility requirement listed above.
- When symbol signs are represented graphically on the Full Matrix PCMS, they shall only supplement the use of the static sign represented, and shall not substitute for, or replace that sign.
- A full matrix PCMS may be used to simulate a flashing arrow board provided it meets the visibility, flash rate and dimming requirements on BC(7), for the same size arrow.

WORDING ALTERNATIVES

- The words RIGHT, LEFT and ALL can be interchanged as appropriate.
- Roadway designations IH, US, SH, FM and LP can be interchanged as appropriate.
- EAST, WEST, NORTH and SOUTH (or abbreviations E, W, N and S) can be interchanged as appropriate.
- Highway names and numbers replaced as appropriate.
- ROAD, HIGHWAY and FREEWAY can be interchanged as needed.
- AHEAD may be used instead of distances if necessary.
- FT and MI, MILE and MILES interchanged as appropriate.
- AT, BEFORE and PAST interchanged as needed.
- Distances or AHEAD can be eliminated from the message if a location phase is used.

SHEET 6 OF 12



Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION  
PORTABLE CHANGEABLE  
MESSAGE SIGN (PCMS)

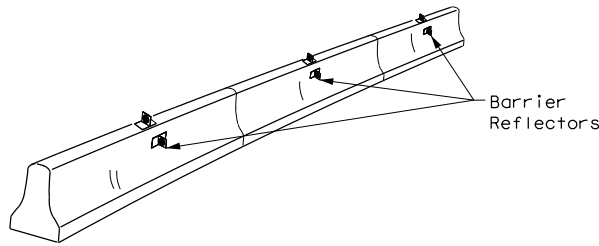
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REVISIONS									
9-07	8-14	DIST		COUNTY				SHEET NO.	
7-13	5-21								
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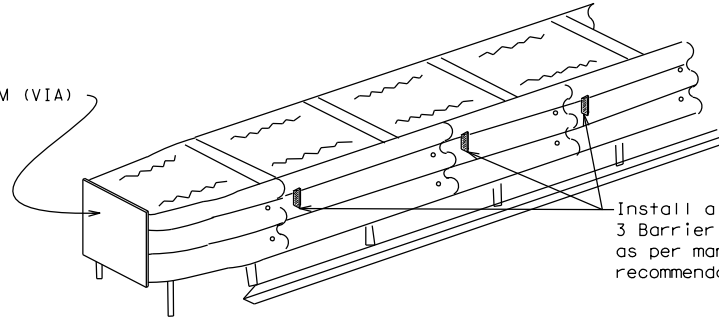
- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 512.



CONCRETE TRAFFIC BARRIER (CTB)

- Where traffic is on one side of the CTB, two (2) Barrier Reflectors shall be mounted in approximately the midsection of each section of CTB. An alternate mounting location is uniformly spaced at one end of each CTB. This will allow for attachment of a barrier grapple without damaging the reflector. The Barrier Reflector mounted on the side of the CTB shall be located directly below the reflector mounted on top of the barrier, as shown in the detail above.
- Where CTB separates two-way traffic, three barrier reflectors shall be mounted on each section of CTB. The reflector unit on top shall have two yellow reflective faces (Bi-Directional) while the reflectors on each side of the barrier shall have one yellow reflective face, as shown in the detail above.
- When CTB separates traffic traveling in the same direction, no barrier reflectors will be required on top of the CTB.
- Barrier Reflector units shall be yellow or white in color to match the edgeline being supplemented.
- Maximum spacing of Barrier Reflectors is forty (40) feet.
- Pavement markers or temporary flexible-reflective roadway marker tabs shall NOT be used as CTB delineation.
- Attachment of Barrier Reflectors to CTB shall be per manufacturer's recommendations.
- Missing or damaged Barrier Reflectors shall be replaced as directed by the Engineer.
- Single slope barriers shall be delineated as shown on the above detail.

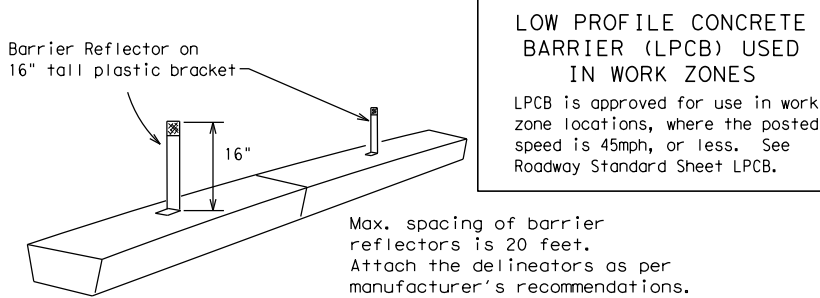
See D & OM (VIA)



DELINEATION OF END TREATMENTS

END TREATMENTS FOR CTB'S USED IN WORK ZONES

End treatments used on CTB's in work zones shall meet the appropriate crashworthy standards as defined in the Manual for Assessing Safety Hardware (MASH). Refer to the CWZTCD List for approved end treatments and manufacturers.



LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

LPCB is approved for use in work zone locations, where the posted speed is 45mph, or less. See Roadway Standard Sheet LPCB.

Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

LOW PROFILE CONCRETE BARRIER (LPCB)

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS

WARNING LIGHTS

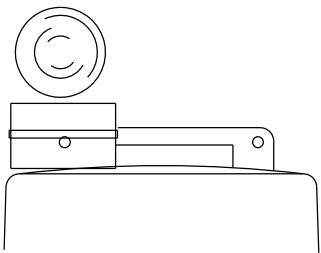
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet and/or other sheets of the plans by the designation "FL". The Type A Warning Lights shall not be used with signs manufactured with Type B<sub>FL</sub> or C<sub>FL</sub> Sheeting meeting the requirements of Departmental Material Specification DMS-8300.
- Type-C and Type D 360 degree Steady Burn Lights are intended to be used in a series for delineation to supplement other traffic control devices. Their use shall be as indicated on this sheet and/or other sheets of the plans by the designation "SB".
- The Engineer/Inspector or the plans shall specify the location and type of warning lights to be installed on the traffic control devices.
- When required by the Engineer, the Contractor shall furnish a copy of the warning lights certification. The warning light manufacturer will certify the warning lights meet the requirements of the latest ITE Purchase Specifications for Flashing and Steady-Burn Warning Lights.
- When used to delineate curves, Type-C and Type D Steady Burn Lights should only be placed on the outside of the curve, not the inside.
- The location of warning lights and warning reflectors on drums shall be as shown elsewhere in the plans.

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

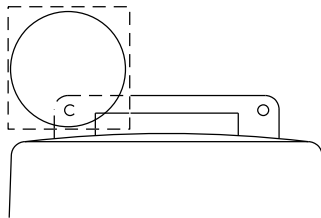
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing devices to form a merging taper may be used for delineation. If used, the successive flashing of the sequential warning lights should occur from the beginning of the taper to the end of the merging taper in order to identify the desired vehicle path. The rate of flashing for each light shall be 65 flashes per minute, plus or minus 10 flashes.
- Type C and D steady-burn warning lights are intended to be used in a series to delineate the edge of the travel lane on detours, on lane changes, on lane closures, and on other similar conditions.
- Type A, Type C and Type D warning lights shall be installed at locations as detailed on other sheets in the plans.
- Warning lights shall not be installed on a drum that has a sign, chevron or vertical panel.
- The maximum spacing for warning lights on drums should be identical to the channelizing device spacing.

WARNING REFLECTORS MOUNTED ON PLASTIC DRUMS AS A SUBSTITUTE FOR TYPE C (STEADY BURN) WARNING LIGHTS

- A warning reflector or approved substitute may be mounted on a plastic drum as a substitute for a Type C, steady burn warning light at the discretion of the Contractor unless otherwise noted in the plans.
- The warning reflector shall be yellow in color and shall be manufactured using a sign substrate approved for use with plastic drums listed on the CWZTCD.
- The warning reflector shall have a minimum retroreflective surface area (one-side) of 30 square inches.
- Round reflectors shall be fully reflectorized, including the area where attached to the drum.
- Square substrates must have a minimum of 30 square inches of reflectorized sheeting. They do not have to be reflectorized where it attaches to the drum.
- The side of the warning reflector facing approaching traffic shall have sheeting meeting the color and retroreflectivity requirements for DMS 8300-Type B or Type C.
- When used near two-way traffic, both sides of the warning reflector shall be reflectorized.
- The warning reflector should be mounted on the side of the handle nearest approaching traffic.
- The maximum spacing for warning reflectors should be identical to the channelizing device spacing requirements.



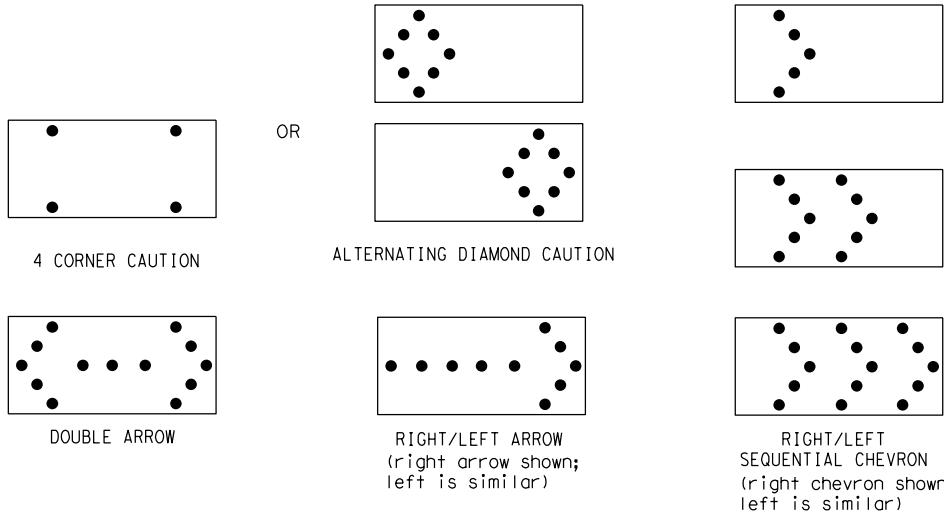
Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



Warning reflector may be round or square. Must have a yellow reflective surface area of at least 30 square inches

Arrow Boards may be located behind channelizing devices in place for a shoulder taper or merging taper, otherwise they shall be delineated with four (4) channelizing devices placed perpendicular to traffic on the upstream side of traffic.

- The Flashing Arrow Board should be used for all lane closures on multi-lane roadways, or slow moving maintenance or construction activities on the travel lanes.
- Flashing Arrow Boards should not be used on two-lane, two-way roadways, detours, diversions or work on shoulders unless the "CAUTION" display (see detail below) is used.
- The Engineer/Inspector shall choose all appropriate signs, barricades and/or other traffic control devices that should be used in conjunction with the Flashing Arrow Board.
- The Flashing Arrow Board should be able to display the following symbols:



- The "CAUTION" display consists of four corner lamps flashing simultaneously, or the Alternating Diamond Caution mode as shown.
- The straight line caution display is NOT ALLOWED.
- The Flashing Arrow Board shall be capable of minimum 50 percent dimming from rated lamp voltage. The flashing rate of the lamps shall not be less than 25 nor more than 40 flashes per minute.
- Minimum lamp "on time" shall be approximately 50 percent for the flashing arrow and equal intervals of 25 percent for each sequential phase of the flashing chevron.
- The sequential arrow display is NOT ALLOWED.
- The flashing arrow display is the TxDOT standard; however, the sequential chevron display may be used during daylight operations.
- The Flashing Arrow Board shall be mounted on a vehicle, trailer or other suitable support.
- A Flashing Arrow Board SHALL NOT BE USED to laterally shift traffic.
- A full matrix PCMS may be used to simulate a Flashing Arrow Board provided it meets visibility, flash rate and dimming requirements on this sheet for the same size arrow.
- Minimum mounting height of trailer mounted Arrow Boards should be 7 feet from roadway to bottom of panel.

REQUIREMENTS			
TYPE	MINIMUM SIZE	MINIMUM NUMBER OF PANEL LAMPS	MINIMUM VISIBILITY DISTANCE
B	30 x 60	13	3/4 mile
C	48 x 96	15	1 mile

ATTENTION
Flashing Arrow Boards shall be equipped with automatic dimming devices.

WHEN NOT IN USE, REMOVE THE ARROW BOARD FROM THE RIGHT-OF-WAY OR PLACE THE ARROW BOARD BEHIND CONCRETE TRAFFIC BARRIER OR GUARDRAIL.

FLASHING ARROW BOARDS

SHEET 7 OF 12

TRUCK-MOUNTED ATTENUATORS

- Truck-mounted attenuators (TMA) used on TxDOT facilities must meet the requirements outlined in the Manual for Assessing Safety Hardware (MASH).
- Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
- Refer to the CWZTCD for a list of approved TMAs.
- TMAs are required on freeways unless otherwise noted in the plans.
- A TMA should be used anytime that it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the work performance.
- The only reason a TMA should not be required is when a work area is spread down the roadway and the work crew is an extended distance from the TMA.



BARRICADE AND CONSTRUCTION ARROW PANEL, REFLECTORS, WARNING LIGHTS & ATTENUATOR

BC (7) -21

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GENERAL NOTES

- For long term stationary work zones on freeways, drums shall be used as the primary channelizing device.
- For intermediate term stationary work zones on freeways, drums should be used as the primary channelizing device but may be replaced in tangent sections by vertical panels, or 42" two-piece cones. In tangent sections, one-piece cones may be used with the approval of the Engineer but only if personnel are present on the project at all times to maintain the cones in proper position and location.
- For short term stationary work zones on freeways, drums are the preferred channelizing device but may be replaced in tapers, transitions and tangent sections by vertical panels, two-piece cones or one-piece cones as approved by the Engineer.
- Drums and all related items shall comply with the requirements of the current version of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) and the "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
- Drums, bases, and related materials shall exhibit good workmanship and shall be free from objectionable marks or defects that would adversely affect their appearance or serviceability.
- The Contractor shall have a maximum of 24 hours to replace any plastic drums identified for replacement by the Engineer/Inspector. The replacement device must be an approved device.

GENERAL DESIGN REQUIREMENTS

Pre-qualified plastic drums shall meet the following requirements:

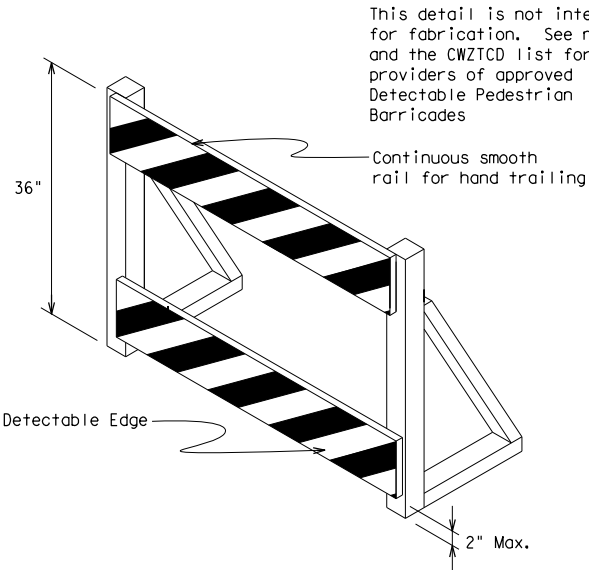
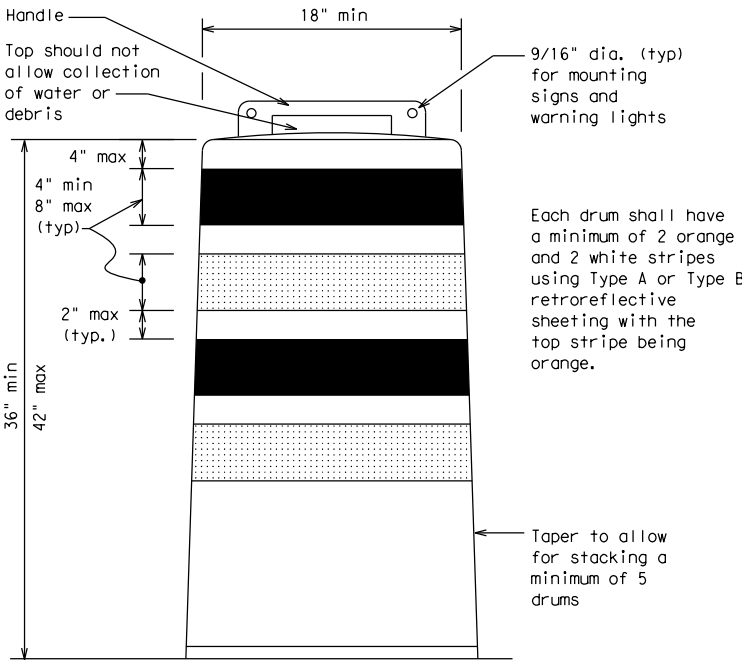
- Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
- The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents accidental separation due to normal handling and/or air turbulence created by passing vehicles.
- Plastic drums shall be constructed of lightweight flexible, and deformable materials. The Contractor shall NOT use metal drums or single piece plastic drums as channelization devices or sign supports.
- Drums shall present a profile that is a minimum of 18 inches in width at the 36 inch height when viewed from any direction. The height of drum unit (body installed on base) shall be a minimum of 36 inches and a maximum of 42 inches.
- The top of the drum shall have a built-in handle for easy pickup and shall be designed to drain water and not collect debris. The handle shall have a minimum of two widely spaced 9/16 inch diameter holes to allow attachment of a warning light, warning reflector unit or approved compliant sign.
- The exterior of the drum body shall have a minimum of four alternating orange and white retroreflective circumferential stripes not less than 4 inches nor greater than 8 inches in width. Any non-reflectORIZED space between any two adjacent stripes shall not exceed 2 inches in width.
- Bases shall have a maximum width of 36 inches, a maximum height of 4 inches, and a minimum of two footholds of sufficient size to allow base to be held down while separating the drum body from the base.
- Plastic drums shall be constructed of ultra-violet stabilized, orange, high-density polyethylene (HDPE) or other approved material.
- Drum body shall have a maximum unballasted weight of 11 lbs.
- Drum and base shall be marked with manufacturer's name and model number.

RETROREFLECTIVE SHEETING

- The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials." Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
- The sheeting shall be suitable for use on and shall adhere to the drum surface such that, upon vehicular impact, the sheeting shall remain adhered in-place and exhibit no delaminating, cracking, or loss of retroreflectivity other than that loss due to abrasion of the sheeting surface.

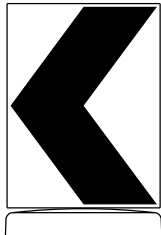
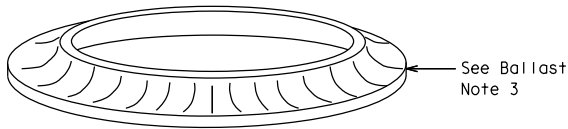
BALLAST

- Unballasted bases shall be large enough to hold up to 50 lbs. of sand. This base, when filled with the ballast material, should weigh between 35 lbs (minimum) and 50 lbs (maximum). The ballast may be sand in one to three sandbags separate from the base, sand in a sand-filled plastic base, or other ballasting devices as approved by the Engineer. Stacking of sandbags will be allowed, however height of sandbags above pavement surface may not exceed 12 inches.
- Bases with built-in ballast shall weigh between 40 lbs. and 50 lbs. Built-in ballast can be constructed of an integral crumb rubber base or a solid rubber base.
- Recycled truck tire sidewalls may be used for ballast on drums approved for this type of ballast on the CWZTCD list.
- The ballast shall not be heavy objects, water, or any material that would become hazardous to motorists, pedestrians, or workers when the drum is struck by a vehicle.
- When used in regions susceptible to freezing, drums shall have drainage holes in the bottoms so that water will not collect and freeze becoming a hazard when struck by a vehicle.
- Ballast shall not be placed on top of drums.
- Adhesives may be used to secure base of drums to pavement.

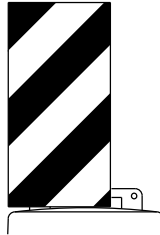


DETECTABLE PEDESTRIAN BARRICADES

- When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. Refer to WZ(BTS-2) for Pedestrian Control requirements for Sidewalk Diversions, Sidewalk Detours and Crosswalk Closures.
- Where pedestrians with visual disabilities normally use the closed sidewalk, a Detectable Pedestrian Barricade shall be placed across the full width of the closed sidewalk instead of a Type 3 Barricade.
- Detectable pedestrian barricades similar to the one pictured above, longitudinal channelizing devices, some concrete barriers, and wood or chain link fencing with a continuous detectable edging can satisfactorily delineate a pedestrian path.
- Tape, rope, or plastic chain strung between devices are not detectable, do not comply with the design standards in the "Americans with Disabilities Act Accessibility Guidelines (ADAAG)" and should not be used as a control for pedestrian movements.
- Warning lights shall not be attached to detectable pedestrian barricades.
- Detectable pedestrian barricades should use 8" nominal barricade rails as shown on BC(10) provided that the top rail provides a smooth continuous rail suitable for hand trailing with no splinters, burrs, or sharp edges.



Chevron CW1-8, Opposing Traffic Lane Divider, Driveway sign D70a, Keep Right R4 series or other signs as approved by Engineer




mount with diagonals sloping down towards travel way

Plywood, Aluminum or Metal sign substrates shall NOT be used on plastic drums

SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS

- Signs used on plastic drums shall be manufactured using substrates listed on the CWZTCD.
- Chevrons and other work zone signs with an orange background shall be manufactured with Type B<sub>FL</sub> or Type C<sub>FL</sub> Orange sheeting meeting the color and retroreflectivity requirements of DMS-8300, "Sign Face Material," unless otherwise specified in the plans.
- Vertical Panels shall be manufactured with orange and white sheeting meeting the requirements of DMS-8300 Type A or Type B. Diagonal stripes on Vertical Panels shall slope down toward the intended traveled lane.
- Other sign messages (text or symbolic) may be used as approved by the Engineer. Sign dimensions shall not exceed 18 inches in width or 24 inches in height, except for the R9 series signs discussed in note 8 below.
- Signs shall be installed using a 1/2 inch bolt (nominal) and nut, two washers, and one locking washer for each connection.
- Mounting bolts and nuts shall be fully engaged and adequately torqued. Bolts should not extend more than 1/2 inch beyond nuts.
- Chevrons may be placed on drums on the outside of curves, on merging tapers or on shifting tapers. When used in these locations, they may be placed on every drum or spaced not more than on every third drum. A minimum of three (3) should be used at each location called for in the plans.
- R9-9, R9-10, R9-11 and R9-11a Sidewalk Closed signs which are 24 inches wide may be mounted on plastic drums, with approval of the Engineer.

SHEET 8 OF 12



Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

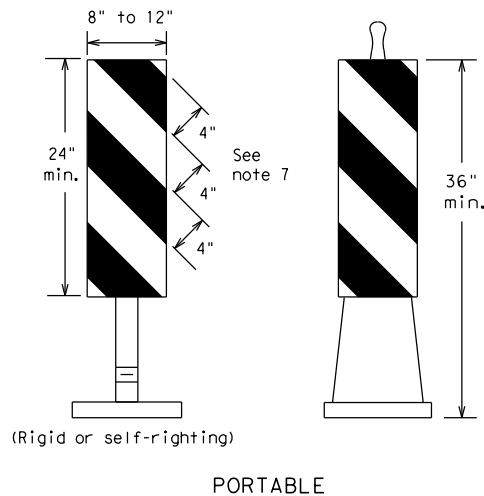
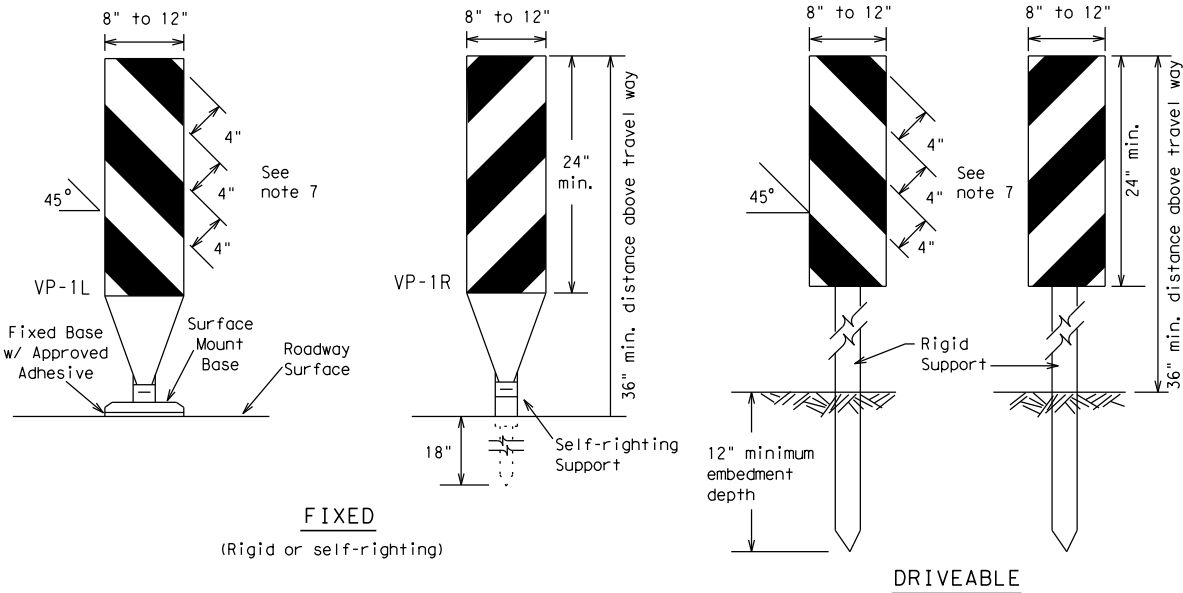
BC (8) - 21

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7-13									

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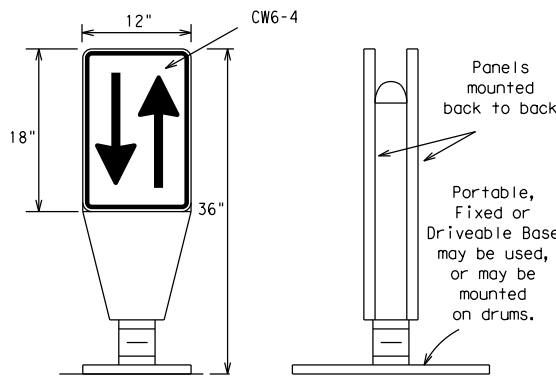
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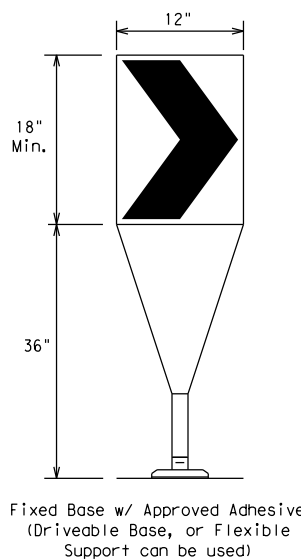
### VERTICAL PANELS (VPs)

- Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
- VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is required. The Engineer/Inspector shall refer to the Roadway Design Manual for additional requirements on the use VP's for drop-offs.
- VP's should be mounted back to back if used at the edge of cuts adjacent to two-way two lane roadways. Stripes are to be reflective orange and reflective white and should always slope downward toward the travel lane.
- VP's used on expressways and freeways or other high speed roadways, may have more than 270 square inches of retroreflective area facing traffic.
- Self-righting supports are available with portable base. See "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
- Sheeting for the VP's shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300, unless noted otherwise.
- Where the height of reflective material on the vertical panel is 36 inches or greater, a panel stripe of 6 inches shall be used.



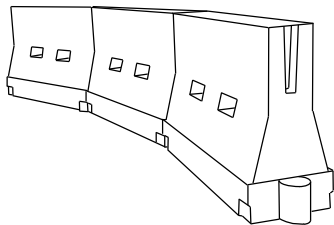
### OPPOSING TRAFFIC LANE DIVIDERS (OTLD)

- Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base is secured to the pavement with an adhesive or rubber weight to minimize movement caused by a vehicle impact or wind gust.
- The OTLD may be used in combination with 42" cones or VPs.
- Spacing between the OTLD shall not exceed 500 feet. 42" cones or VPs placed between the OTLD's should not exceed 100 foot spacing.
- The OTLD shall be orange with a black non-reflective legend. Sheeting for the OTLD shall be retroreflective Type B<sub>FL</sub> or Type C<sub>FL</sub> conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.



- The chevron shall be a vertical rectangle with a minimum size of 12 by 18 inches.
- Chevrons are intended to give notice of a sharp change of alignment with the direction of travel and provide additional emphasis and guidance for vehicle operators with regard to changes in horizontal alignment of the roadway.
- Chevrons, when used, shall be erected on the outside of a sharp curve or turn, or on the far side of an intersection. They shall be in line with and at right angles to approaching traffic. Spacing should be such that the motorist always has three in view, until the change in alignment eliminates its need.
- To be effective, the chevron should be visible for at least 500 feet.
- Chevrons shall be orange with a black nonreflective legend. Sheeting for the chevron shall be retroreflective Type B<sub>FL</sub> or Type C<sub>FL</sub> conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.
- For Long Term Stationary use on tapers or transitions on freeways and divided highways, self-righting chevrons may be used to supplement plastic drums but not to replace plastic drums.

### CHEVRONS



### LONGITUDINAL CHANNELIZING DEVICES (LCD)

- LCDs are crashworthy, lightweight, deformable devices that are highly visible, have good target value and can be connected together. They are not designed to contain or redirect a vehicle on impact.
- LCDs may be used instead of a line of cones or drums.
- LCDs shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
- LCDs should not be used to provide positive protection for obstacles, pedestrians or workers.
- LCDs shall be supplemented with retroreflective delineation as required for temporary barriers on BC(7) when placed roughly parallel to the travel lanes.
- LCDs used as barricades placed perpendicular to traffic should have at least one row of reflective sheeting meeting the requirements for barricade rails as shown on BC(10). Place reflective sheeting near the top of the LCD along the full length of the device.

### WATER BALLASTED SYSTEMS USED AS BARRIERS

- Water ballasted systems used as barriers shall not be used solely to channelize road users, but also to protect the work space per the appropriate Manual for Assessing Safety Hardware (MASH) crashworthiness requirements based on roadway speed and barrier application.
- Water ballasted systems used to channelize vehicular traffic shall be supplemented with retroreflective delineation or channelizing devices to improve daytime/nighttime visibility. They may also be supplemented with pavement markings.
- Water ballasted systems used as barriers shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
- Water ballasted systems used as barriers should not be used for a merging taper except in low speed (less than 45 MPH) urban areas. When used on a taper in a low speed urban area, the taper shall be delineated and the taper length should be designed to optimize road user operations considering the available geometric conditions.
- When water ballasted systems used as barriers have blunt ends exposed to traffic, they should be attenuated as per manufacturer recommendations or flared to a point outside the clear zone.

If used to channelize pedestrians, longitudinal channelizing devices or water ballasted systems must have a continuous detectable bottom for users of long canes and the top of the unit shall not be less than 32 inches in height.

### HOLLOW OR WATER BALLASTED SYSTEMS USED AS LONGITUDINAL CHANNELIZING DEVICES OR BARRIERS

### GENERAL NOTES

- Work Zone channelizing devices illustrated on this sheet may be installed in close proximity to traffic and are suitable for use on high or low speed roadways. The Engineer/Inspector shall ensure that spacing and placement is uniform and in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
- Channelizing devices shown on this sheet may have a driveable, fixed or portable base. The requirement for self-righting channelizing devices must be specified in the General Notes or other plan sheets.
- Channelizing devices on self-righting supports should be used in work zone areas where channelizing devices are frequently impacted by errant vehicles or vehicle related wind gusts making alignment of the channelizing devices difficult to maintain. Locations of these devices shall be detailed elsewhere in the plans. These devices shall conform to the TMUTCD and the "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
- The Contractor shall maintain devices in a clean condition and replace damaged, nonreflective, faded, or broken devices and bases as required by the Engineer/Inspector. The Contractor shall be required to maintain proper device spacing and alignment.
- Portable bases shall be fabricated from virgin and/or recycled rubber. The portable bases shall weigh a minimum of 30 lbs.
- Pavement surfaces shall be prepared in a manner that ensures proper bonding between the adhesives, the fixed mount bases and the pavement surface. Adhesives shall be prepared and applied according to the manufacturer's recommendations.
- The installation and removal of channelizing devices shall not cause detrimental effects to the final pavement surfaces, including pavement surface discoloration or surface integrity. Driveable bases shall not be permitted on final pavement surfaces. The Engineer/Inspector shall approve all application and removal procedures of fixed bases.

Posted Speed	Formula	Minimum Desirable Taper Lengths * *			Suggested Maximum Spacing of Channelizing Devices	
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'
35		205'	225'	245'	35'	70'
40		265'	295'	320'	40'	80'
45	L = WS	450'	495'	540'	45'	90'
50		500'	550'	600'	50'	100'
55		550'	605'	660'	55'	110'
60		600'	660'	720'	60'	120'
65		650'	715'	780'	65'	130'
70		700'	770'	840'	70'	140'
75		750'	825'	900'	75'	150'
80		800'	880'	960'	80'	160'

\* \*\*Taper lengths have been rounded off.  
L=Length of Taper (FT.) W=Width of Offset (FT.)  
S=Posted Speed (MPH)

### SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

SHEET 9 OF 12



## BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

### BC (9) - 21

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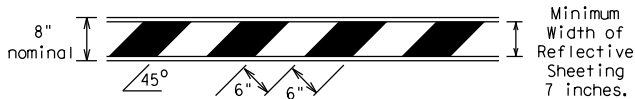
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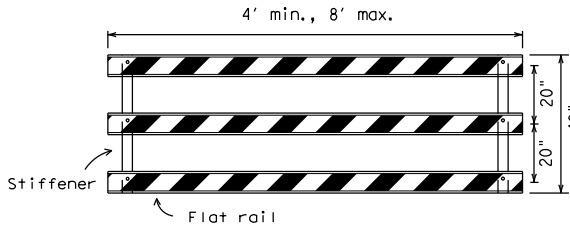
TYPE 3 BARRICADES

1. Refer to the Compliant Work Zone Traffic Control Devices List (CWZTCD) for details of the Type 3 Barricades and a list of all materials used in the construction of Type 3 Barricades.
2. Type 3 Barricades shall be used at each end of construction projects closed to all traffic.
3. Barricades extending across a roadway should have stripes that slope downward in the direction toward which traffic must turn in detouring. When both right and left turns are provided, the chevron striping may slope downward in both directions from the center of the barricade. Where no turns are provided at a closed road, striping should slope downward in both directions toward the center of roadway.
4. Striping of rails, for the right side of the roadway, should slope downward to the left. For the left side of the roadway, striping should slope downward to the right.
5. Identification markings may be shown only on the back of the barricade rails. The maximum height of letters and/or company logos used for identification shall be 1".
6. Barricades shall not be placed parallel to traffic unless an adequate clear zone is provided.
7. Warning lights shall NOT be installed on barricades.
8. Where barricades require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand is recommended. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight. Sand bags shall not be stacked in a manner that covers any portion of a barricade rails reflective sheeting. Rock, concrete, iron, steel or other solid objects will NOT be permitted. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs. Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as tire inner tubes) shall not be used for sandbags. Sandbags shall only be placed along or upon the base supports of the device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners.
9. Sheeting for barricades shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300 unless otherwise noted.

Barricades shall NOT be used as a sign support.



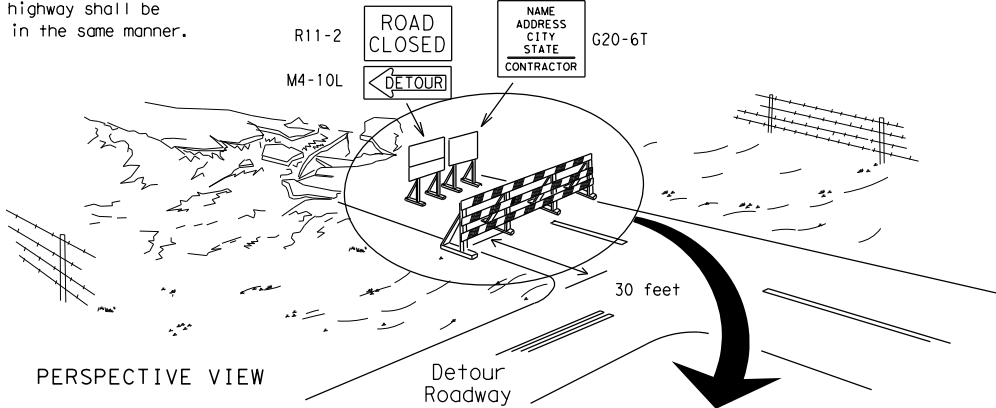
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



Stiffener may be inside or outside of support, but no more than 2 stiffeners shall be allowed on one barricade.

TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

Each roadway of a divided highway shall be barricaded in the same manner.

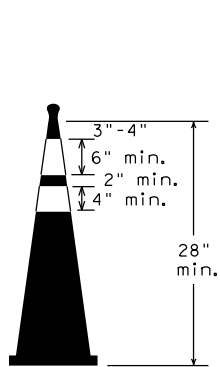


The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.

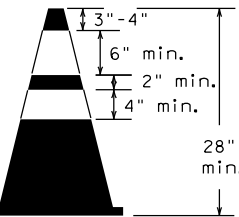
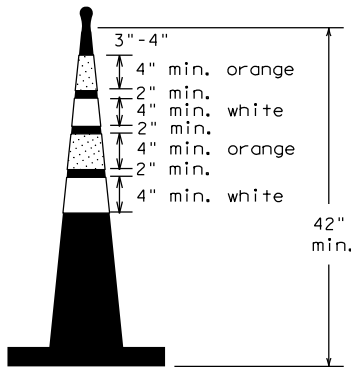
Barricade striping should slant downward in the direction of detour.

1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

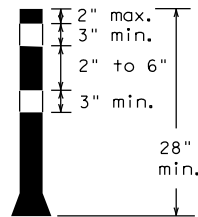
TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



Two-Piece cones



One-Piece cones

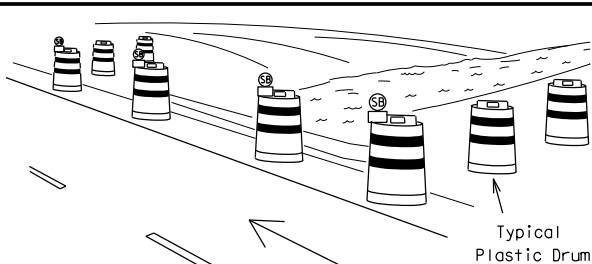


Tubular Marker

28" Cones shall have a minimum weight of 9 1/2 lbs.

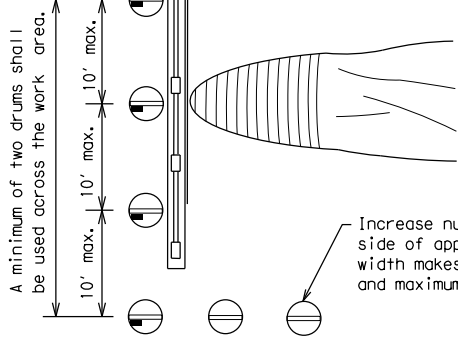
42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

1. Traffic cones and tubular markers shall be predominantly orange, and meet the height and weight requirements shown above.
2. One-piece cones have the body and base of the cone molded in one consolidated unit. Two-piece cones have a cone shaped body and a separate rubber base, or ballast, that is added to keep the device upright and in place.
3. Two-piece cones may have a handle or loop extending up to 8" above the minimum height shown, in order to aid in retrieving the device.
4. Cones or tubular markers shall have white or white and orange reflective bands as shown above. The reflective bands shall have a smooth, sealed outer surface and meet the requirements of Departmental Material Specification DMS-8300 Type A or Type B.
5. 28" cones and tubular markers are generally suitable for short duration and short-term stationary work as defined on BC(4). These should not be used for intermediate-term or long-term stationary work unless personnel is on-site to maintain them in their proper upright position.
6. 42" two-piece cones, vertical panels or drums are suitable for all work zone durations.
7. Cones or tubular markers used on each project should be of the same size and shape.



PERSPECTIVE VIEW

These drums are not required on one-way roadway



PLAN VIEW

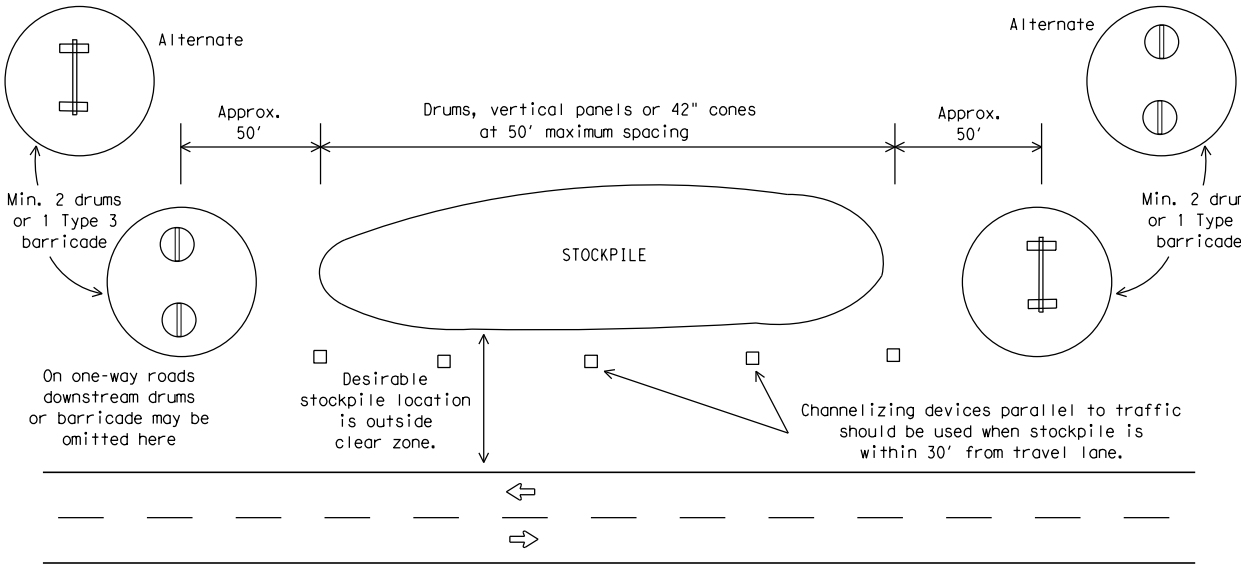
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS

1. Where positive redirection capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder width is greater than 12 feet, steady-burn lights may be omitted if drums are used.
5. Drums must extend the length of the culvert widening.

LEGEND

	LEGEND
	Plastic drum
	Plastic drum with steady burn light or yellow warning reflector
	Steady burn warning light or yellow warning reflector

Increase number of plastic drums on the side of approaching traffic if the crown width makes it necessary. (minimum of 2 and maximum of 4 drums)



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

SHEET 10 OF 12



Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC (10) - 21

FILE:	bc-21.dgn	DN:	TxDOT	CK:	TxDOT	DN:	TxDOT	CK:	TxDOT
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WORK ZONE PAVEMENT MARKINGS

GENERAL

1. The Contractor shall be responsible for maintaining work zone and existing pavement markings, in accordance with the standard specifications and special provisions, on all roadways open to traffic within the CSJ limits unless otherwise stated in the plans.
2. Color, patterns and dimensions shall be in conformance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
3. Additional supplemental pavement marking details may be found in the plans or specifications.
4. Pavement markings shall be installed in accordance with the TMUTCD and as shown on the plans.
5. When short term markings are required on the plans, short term markings shall conform with the TMUTCD, the plans and details as shown on the Standard Plan Sheet WZ(STPM).
6. When standard pavement markings are not in place and the roadway is opened to traffic, DO NOT PASS signs shall be erected to mark the beginning of the sections where passing is prohibited and PASS WITH CARE signs at the beginning of sections where passing is permitted.
7. All work zone pavement markings shall be installed in accordance with Item 662, "Work Zone Pavement Markings."

RAISED PAVEMENT MARKERS

1. Raised pavement markers are to be placed according to the patterns on BC(12).
2. All raised pavement markers used for work zone markings shall meet the requirements of Item 672, "RAISED PAVEMENT MARKERS" and Departmental Material Specification DMS-4200 or DMS-4300.

PREFABRICATED PAVEMENT MARKINGS

1. Removable prefabricated pavement markings shall meet the requirements of DMS-8241.
2. Non-removable prefabricated pavement markings (foil back) shall meet the requirements of DMS-8240.

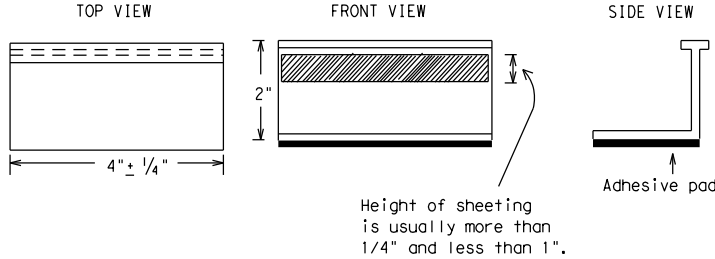
MAINTAINING WORK ZONE PAVEMENT MARKINGS

1. The Contractor will be responsible for maintaining work zone pavement markings within the work limits.
2. Work zone pavement markings shall be inspected in accordance with the frequency and reporting requirements of work zone traffic control device inspections as required by Form 599.
3. The markings should provide a visible reference for a minimum distance of 300 feet during normal daylight hours and 160 feet when illuminated by automobile low-beam headlights at night, unless sight distance is restricted by roadway geometrics.
4. Markings failing to meet this criteria within the first 30 days after placement shall be replaced at the expense of the Contractor as per Specification Item 662.

REMOVAL OF PAVEMENT MARKINGS

1. Pavement markings that are no longer applicable, could create confusion or direct a motorist toward or into the closed portion of the roadway shall be removed or obliterated before the roadway is opened to traffic.
2. The above shall not apply to detours in place for less than three days, where flaggers and/or sufficient channelizing devices are used in lieu of markings to outline the detour route.
3. Pavement markings shall be removed to the fullest extent possible, so as not to leave a discernable marking. This shall be by any method approved by TxDOT Specification Item 677 for "Eliminating Existing Pavement Markings and Markers".
4. The removal of pavement markings may require resurfacing or seal coating portions of the roadway as described in Item 677.
5. Subject to the approval of the Engineer, any method that proves to be successful on a particular type pavement may be used.
6. Blast cleaning may be used but will not be required unless specifically shown in the plans.
7. Over-painting of the markings SHALL NOT BE permitted.
8. Removal of raised pavement markers shall be as directed by the Engineer.
9. Removal of existing pavement markings and markers will be paid for directly in accordance with Item 677, "ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS," unless otherwise stated in the plans.
- 10.Black-out marking tape may be used to cover conflicting existing markings for periods less than two weeks when approved by the Engineer.

Temporary Flexible-Reflective  
Roadway Marker Tabs



STAPLES OR NAILS SHALL NOT BE USED TO SECURE  
TEMPORARY FLEXIBLE-REFLECTIVE ROADWAY MARKER  
TABS TO THE PAVEMENT SURFACE

1. Temporary flexible-reflective roadway marker tabs used as guidemarks shall meet the requirements of DMS-8242.
2. Tabs detailed on this sheet are to be inspected and accepted by the Engineer or designated representative. Sampling and testing is not normally required, however at the option of the Engineer, either "A" or "B" below may be imposed to assure quality before placement on the roadway.
  - A. Select five (5) or more tabs at random from each lot or shipment and submit to the Construction Division, Materials and Pavement Section to determine specification compliance.
  - B. Select five (5) tabs and perform the following test. Affix five (5) tabs at 24 inch intervals on an asphaltic pavement in a straight line. Using a medium size passenger vehicle or pickup, run over the markers with the front and rear tires at a speed of 35 to 40 miles per hour, four (4) times in each direction. No more than one (1) out of the five (5) reflective surfaces shall be lost or displaced as a result of this test.
3. Small design variances may be noted between tab manufacturers.
4. See Standard Sheet WZ(STPM) for tab placement on new pavements. See Standard Sheet TCP(7-1) for tab placement on seal coat work.

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS


1. Raised pavement markers used as guidemarks shall be from the approved product list, and meet the requirements of DMS-4200.
2. All temporary construction raised pavement markers provided on a project shall be of the same manufacturer.
3. Adhesive for guidemarks shall be bituminous material hot applied or butyl rubber pad for all surfaces, or thermoplastic for concrete surfaces.

Guidemarks shall be designated as:  
YELLOW - (two amber reflective surfaces with yellow body).  
WHITE - (one silver reflective surface with white body).

DEPARTMENTAL MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
TRAFFIC BUTTONS	DMS-4300
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY REMOVABLE, PREFABRICATED PAVEMENT MARKINGS	DMS-8241
TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS	DMS-8242

A list of prequalified reflective raised pavement markers, non-reflective traffic buttons, roadway marker tabs and other pavement markings can be found at the Material Producer List web address shown on BC(1).

SHEET 11 OF 12



Texas Department of Transportation

Traffic  
Safety  
Division  
Standard

BARRICADE AND CONSTRUCTION  
PAVEMENT MARKINGS

BC ( 11 ) - 21

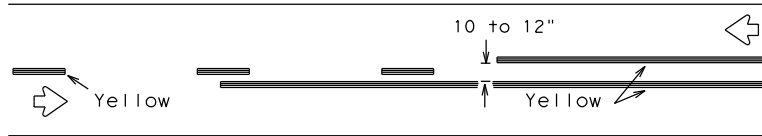
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© TxDOT	February 1998	CONT	SECT	JOB	HIGHWAY				
REVISIONS									
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1-02	7-13	DIST		COUNTY			SHEET NO.		
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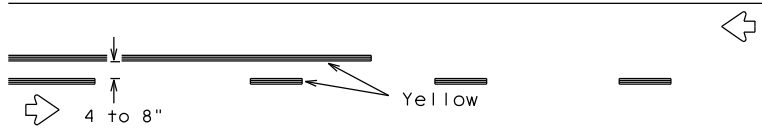
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## PAVEMENT MARKING PATTERNS

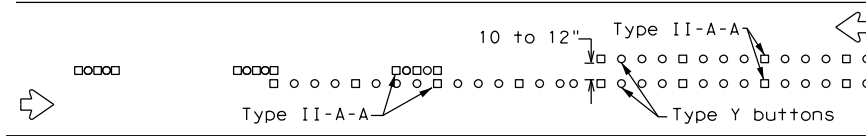


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

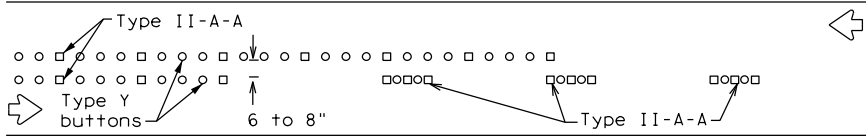


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

Pattern A is the TxDOT Standard, however Pattern B may be used if approved by the Engineer.  
Prefabricated markings may be substituted for reflectORIZED pavement markings.

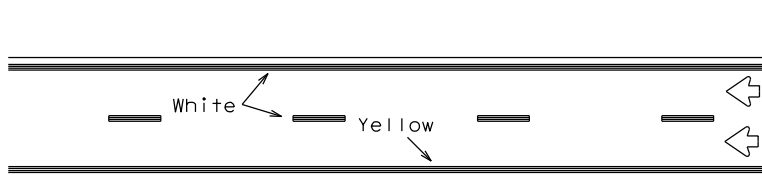


RAISED PAVEMENT MARKERS - PATTERN A



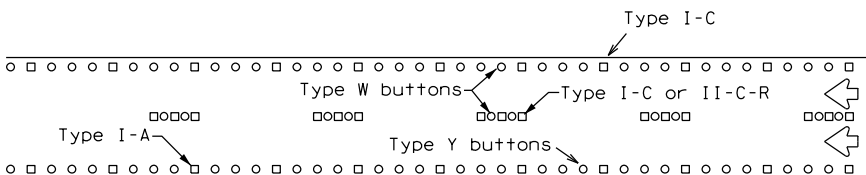
RAISED PAVEMENT MARKERS - PATTERN B

## CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO-LANE, TWO-WAY HIGHWAYS



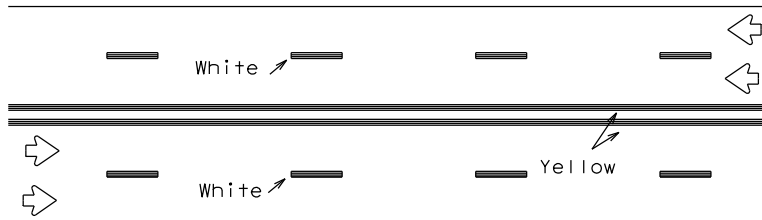
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



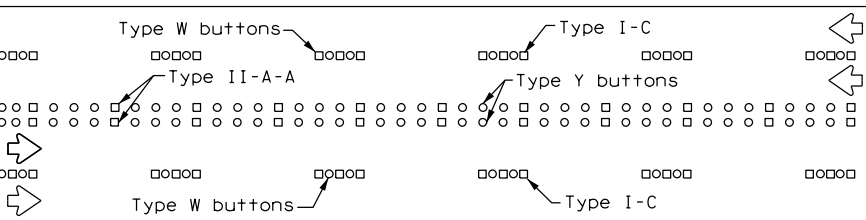
RAISED PAVEMENT MARKERS

## EDGE & LANE LINES FOR DIVIDED HIGHWAY



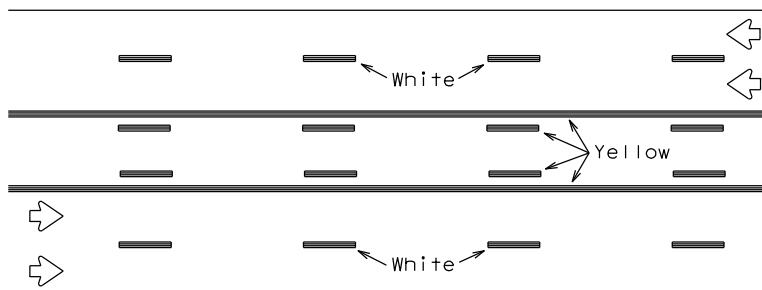
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



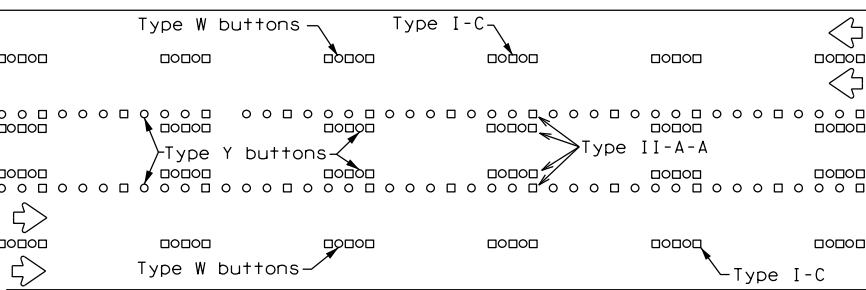
RAISED PAVEMENT MARKERS

## LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

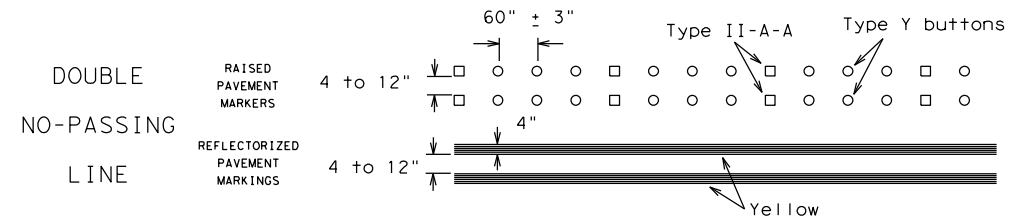
Prefabricated markings may be substituted for reflectORIZED pavement markings.



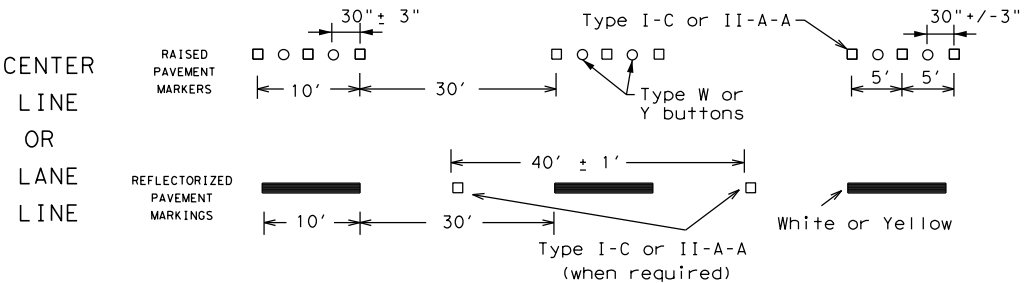
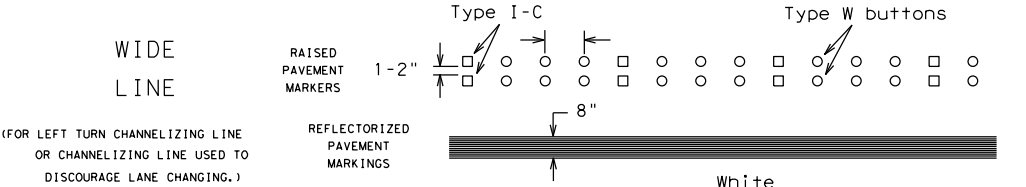
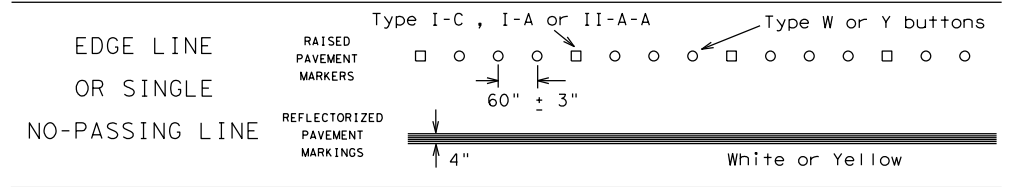
RAISED PAVEMENT MARKERS

## TWO-WAY LEFT TURN LANE

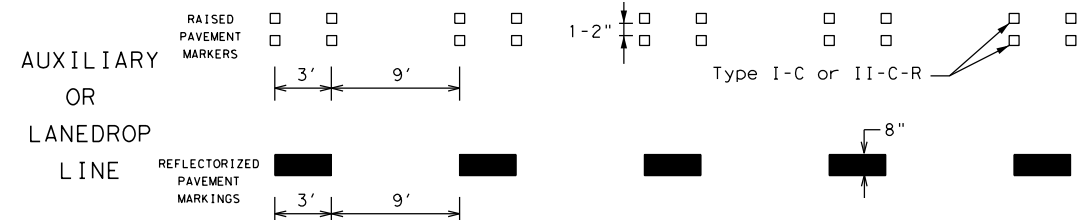
## STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



## SOLID LINES

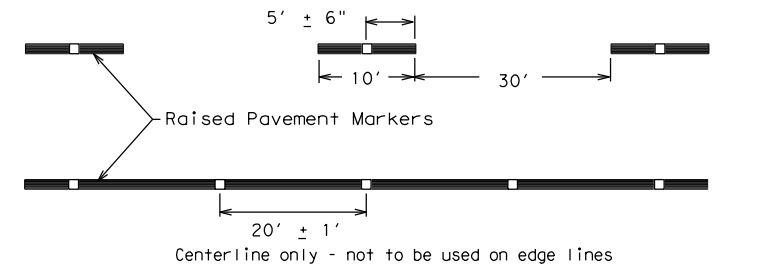


## BROKEN LINES



## REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

If raised pavement markers are used to supplement REMOVABLE markings, the markers shall be applied to the top of the tape at the approximate mid length of tape used for broken lines or at 20 foot spacing for solid lines. This allows an easier removal of raised pavement markers and tape.



SHEET 12 OF 12



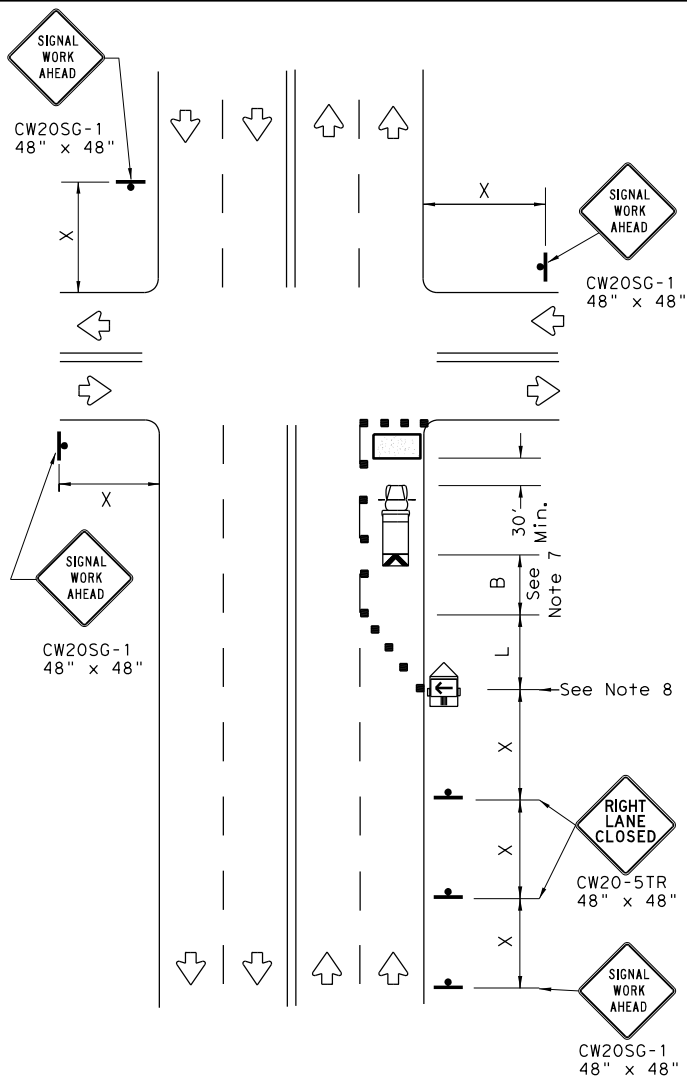
## BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC (12) - 21

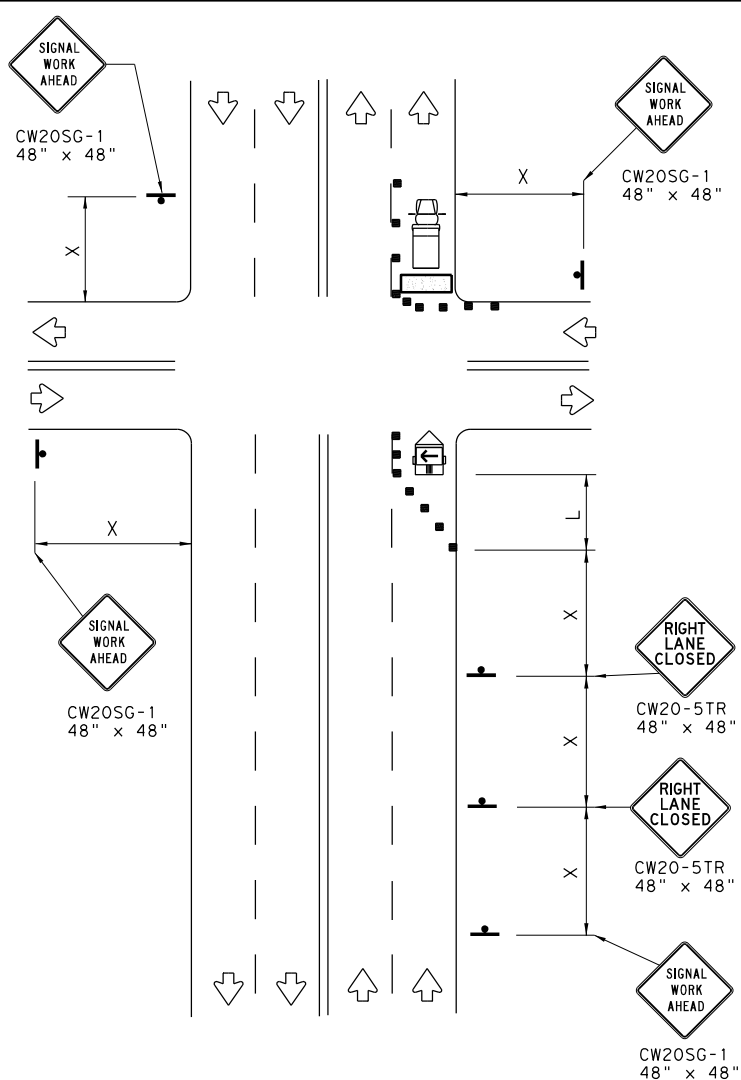
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REVISIONS				
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2-98 7-13				
11-02 8-14				
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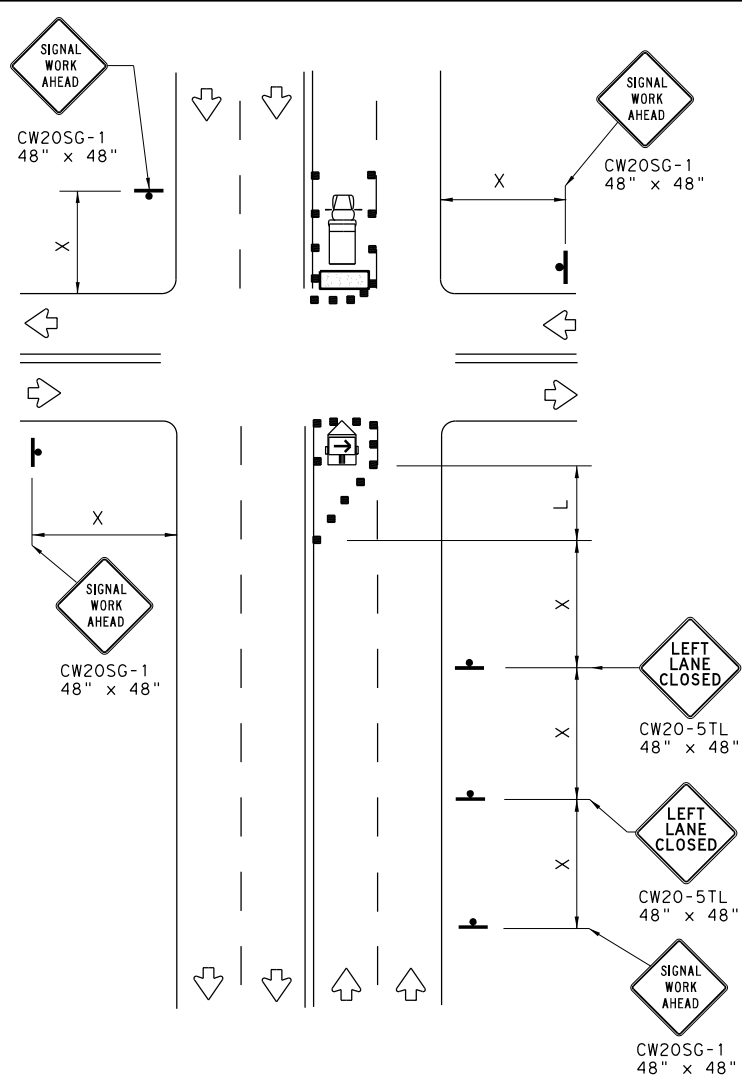
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NEAR SIDE LANE CLOSURE  
SHORT DURATION OR SHORT TERM STATIONARY



FAR SIDE RIGHT LANE CLOSURE  
SHORT DURATION OR SHORT TERM STATIONARY



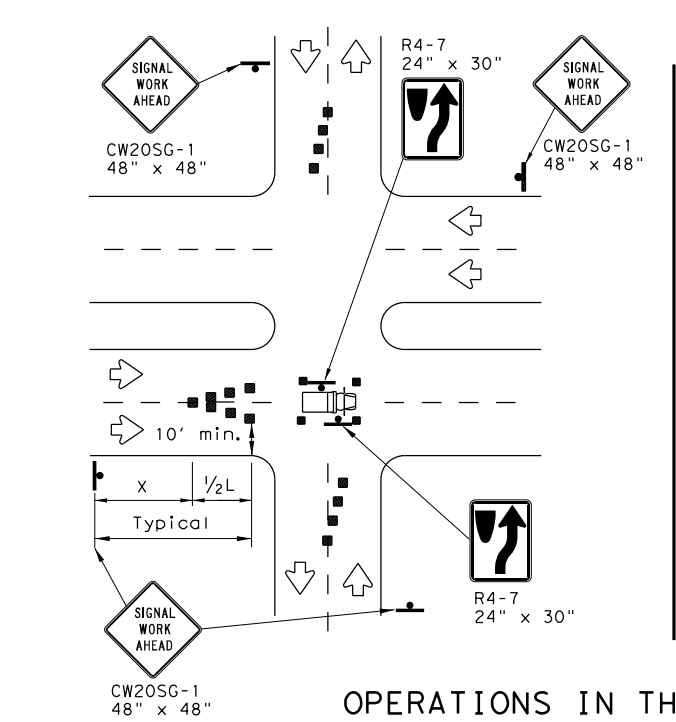
FAR SIDE LEFT LANE CLOSURE  
SHORT DURATION OR SHORT TERM STATIONARY

LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board		Portable Changeable Message Sign (PCMS)
	Sign		Traffic Flow
	Flag		Flagger

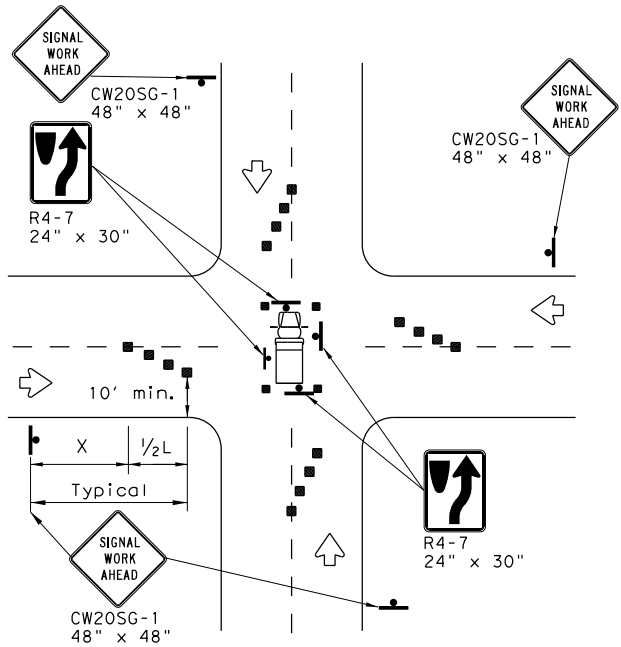
Posted Speed *	Formula	Minimum Desirable Taper Lengths * X			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40		265'	295'	320'	40'	80'	240'	155'
45	L = WS	450'	495'	540'	45'	90'	320'	195'
50		500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

\* Conventional Roads Only  
\*\* Taper lengths have been rounded off.  
L=Length of Taper (FT) W=Width of Offset (FT) S=Posted Speed (MPH)

WORKERS IN BUCKET TRUCKS SHALL NOT  
WORK ABOVE OPEN LANES OF TRAFFIC.



OPERATIONS IN THE INTERSECTION  
SHORT DURATION



### GENERAL NOTES

- The minimum size channelizing device is the 28" cone. 42" Two-piece cones, drums, vertical panels or barricades will be required when the device must be left unattended at night.
- Obstructions or hazards at the work area shall be clearly marked and delineated at all times.
- Flaggers and Flagger Symbol (CW20-7) signs may be required according to field conditions.
- Vehicles parked in roadway shall be equipped with at least two high intensity rotating, flashing, oscillating or strobe type lights.
- High level warning devices (flag trees) may be used at corners of the vehicle.
- When work operations are performed on existing signals, the signals may be placed in flashing red mode when approved by the engineer. If existing signals do not have power, All-Way Stop (R1-1 and R1-3P) signs may be implemented when approved by the engineer.
- For Short-Term Stationary work the buffer space "B" from the above table should be used if field conditions permit. For Short Duration (less than 1 hour) any buffer space provided will enhance the safety of the setup.
- The arrow board at this location may be omitted for Short Duration work if the work vehicle has an arrow board in operation. As an option, the arrow board may be placed at the end of the taper in the closed lane if space is not available at the beginning of the taper.
- Signs and devices for the NEAR SIDE LANE CLOSURE may be altered for a left lane closure by using a LEFT LANE CLOSED (CW20-5TL) and adding channelizing devices on the centerline to protect the work space from opposing traffic.

SHEET 1 OF 2

**Texas Department of Transportation**

**Traffic Operations Division Standard**

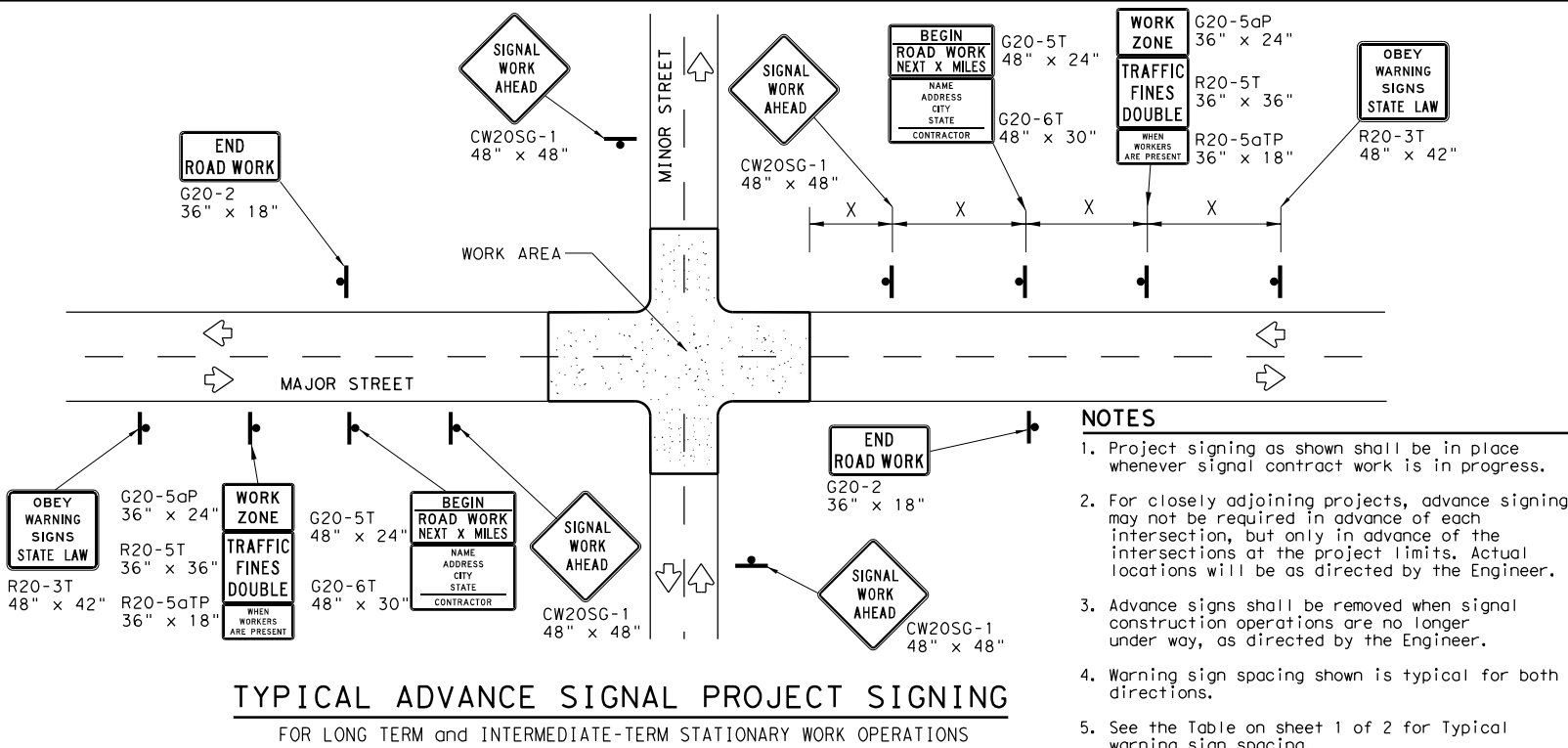
TRAFFIC SIGNAL WORK  
TYPICAL DETAILS

WZ(BTS-1)-13

FILE: wzbtts-13.dgn	DN: TxDOT	CK: TxDOT	DN: TxDOT	CK: TxDOT
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REVISIONS				
2-98 10-99 7-13	DIST	COUNTY		SHEET NO.
4-98 3-03				21

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#### GENERAL NOTES FOR WORK ZONE SIGNS

- Signs shall be installed and maintained in a straight and plumb condition.
- Wooden sign posts shall be painted white.
- Barricades shall NOT be used as sign supports.
- Nails shall NOT be used to attach signs to any support.
- All signs shall be installed in accordance with the plans or as directed by the Engineer.
- The Contractor shall furnish the sign design shown in the plans or in the "Standard Highway Sign Designs for Texas" (SHSD).
- The Contractor shall furnish sign supports and substrates listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCD), installed as per the manufacturer's recommendations.
- Temporary signs that have damaged or cracked substrates and/or damaged or marred reflective sheeting shall be replaced as directed by the Engineer.
- Identification markings may be shown only on the back of the sign substrate. The maximum height of letters and/or company logos used for identification shall be 1".
- Damaged wood posts shall be replaced. Splicing wood posts will not be allowed.

#### DURATION OF WORK

- Work zone durations are defined in Part 6, Section 6G.02 of the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

#### SIGN MOUNTING HEIGHT

- Sign height of Long-term/Intermediate-term warning signs shall be as shown on Figure 6F-1 of the TMUTCD.
- Sign height of Short-term/Short Duration warning signs shall be as shown on Figure 6F-2 of the TMUTCD.
- Regulatory signs shall be mounted at least 7 feet, but not more than 9 feet, above the paved surface regardless of work duration.

#### REMOVING OR COVERING

- When sign messages may be confusing or do not apply, the signs shall be removed or completely covered, unless otherwise approved by the Engineer.
- When signs are covered, the material used shall be opaque, such as heavy mil black plastic, or other materials which will cover the entire sign face and maintain their opaque properties under automobile headlights at night without damaging the sign sheeting. Burlap, or heavy materials such as plywood or aluminum shall not be used to cover signs.
- Duct tape or other adhesive material shall NOT be affixed to a sign face.
- Signs and anchor stubs shall be removed and holes back filled upon completion of the work.

#### REFLECTIVE SHEETING

- All signs shall be retroreflective and constructed of sheeting meeting the requirements of the DMS and color usage table shown on this sheet.

#### SIGN SUPPORT WEIGHTS

- Weights used to keep signs from turning over should be sandbags filled with dry, cohesionless material.
- The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
- Rock, concrete, iron, steel or other solid objects will not be permitted for use as sign support weights.
- Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
- Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber, such as tire inner tubes, shall not be used.
- Rubber ballasts designed for channelizing devices should not be used for ballast on portable sign supports. Sign supports designed and manufactured with rubber bases may be used when shown on the CWZTCD list.
- Sandbags shall only be placed along or laid over the base supports of the traffic control device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners. Sandbags shall be placed along the length of the skids to weigh down the sign support.
- Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

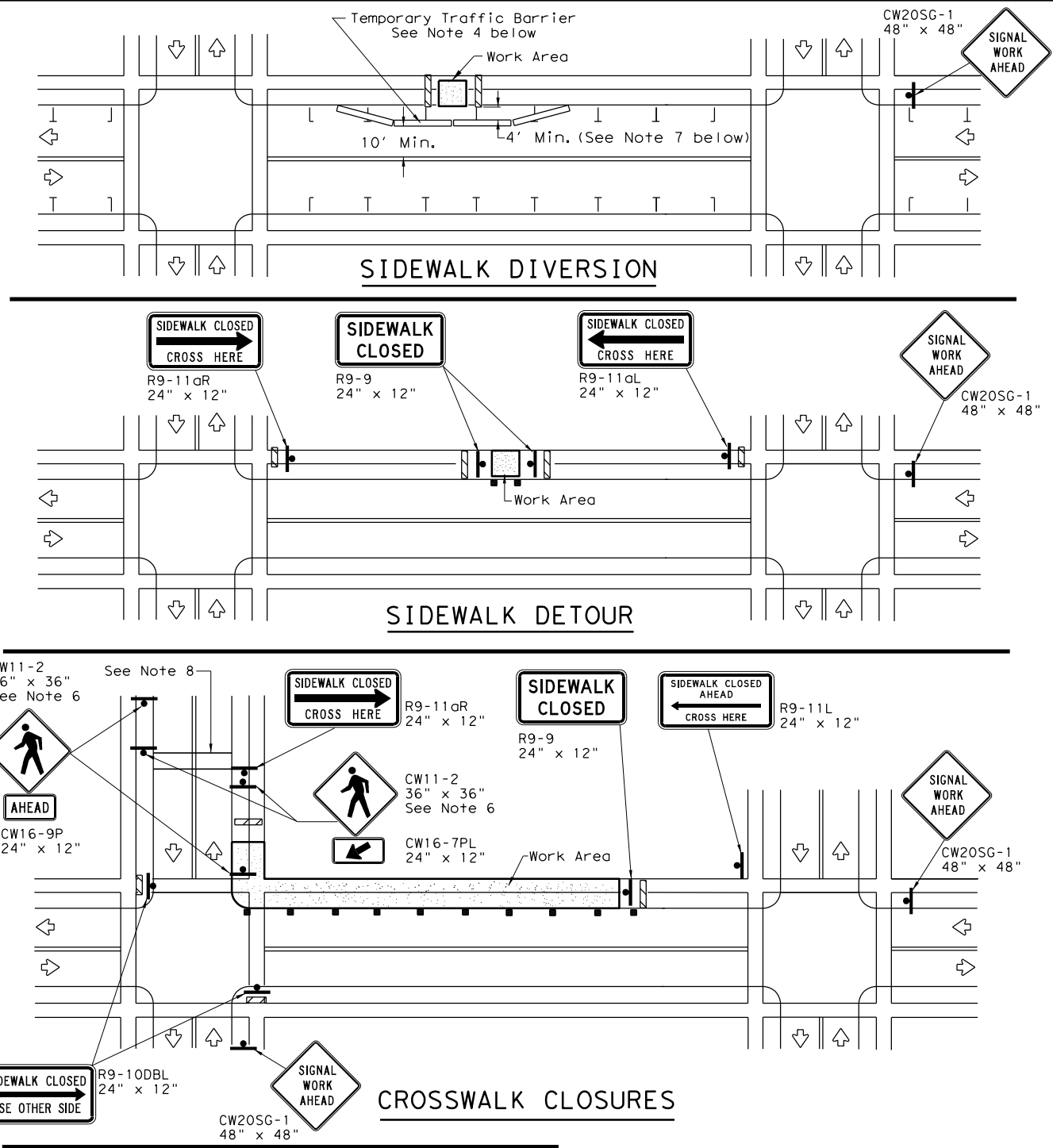
LEGEND	
	Sign
	Channelizing Devices
	Type 3 Barricade

#### DEPARTMENTAL MATERIAL SPECIFICATIONS

SIGN FACE MATERIALS	DMS-8300
FLEXIBLE ROLL-UP REFLECTIVE SIGNS	DMS-8310

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B <sub>FL</sub> OR TYPE C <sub>FL</sub> SHEETING
WHITE	BACKGROUND	TYPE A SHEETING
BLACK	LEGEND & BORDERS	ACRYLIC NON-REFLECTIVE SHEETING

Only pre-qualified products shall be used. A copy of the "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found at the following web address:  
[http://www.txdot.gov/txdot\\_library/publications/construction.htm](http://www.txdot.gov/txdot_library/publications/construction.htm)



#### PEDESTRIAN CONTROL

- Holes, trenches or other hazards shall be adequately protected by covering, delineating or surrounding the hazard with orange plastic pedestrian fencing or longitudinal channelizing devices, or as directed by the Engineer.
- "CROSSWALK CLOSURES" as detailed above will require the Engineer's approval prior to installation.
- R9 series signs shown may be placed on supports detailed on the BC standards or CWZTCD list, or when fabricated from approved lightweight plastic substrates, they may be mounted on top of a plastic drum at or near the location shown.
- For speeds less than 45 mph longitudinal channelizing devices may be used instead of traffic barriers when approved by the Engineer. Attenuation of blunt ends and installation of water filled devices shall be as per BC(9) and manufacturer's recommendations.
- Location of devices are for general guidance. Actual device spacing and location must be field adjusted to meet actual conditions.
- Where pedestrians with visual disabilities normally use the closed sidewalk Detectable Pedestrian Barricades should be used instead of the Type 3 Barricades shown.
- The width of existing sidewalk should be maintained if practical.
- Pavement markings for mid-block crosswalks shall be paid for under the appropriate bid items.
- When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

SHEET 2 OF 2

**Texas Department of Transportation**

**Traffic Operations Division Standard**

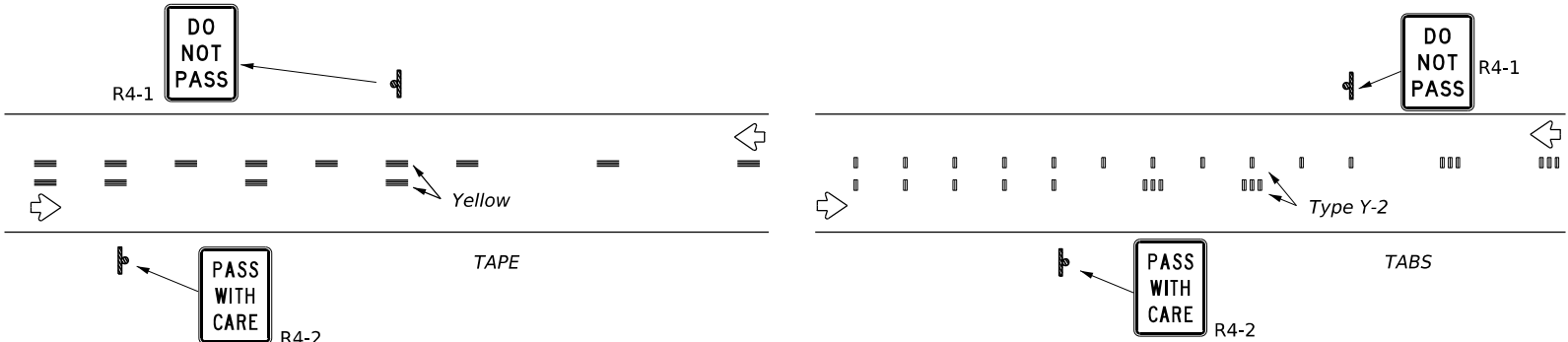
**TRAFFIC SIGNAL WORK BARRICADES AND SIGNS**

**WZ(BTS-2) - 13**

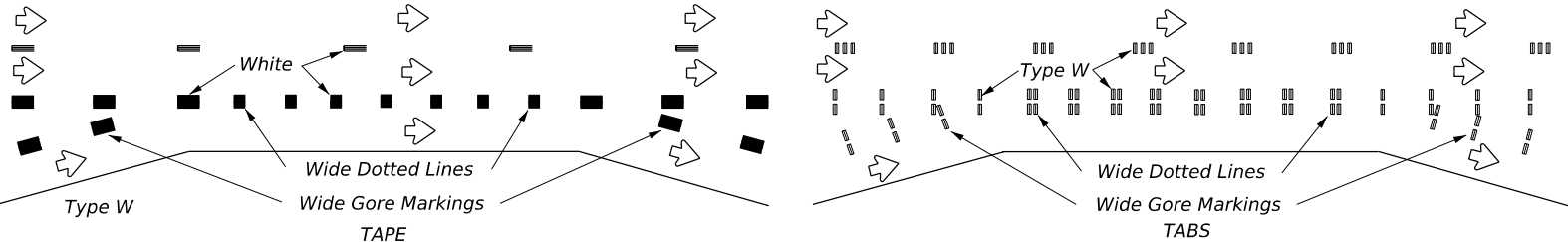
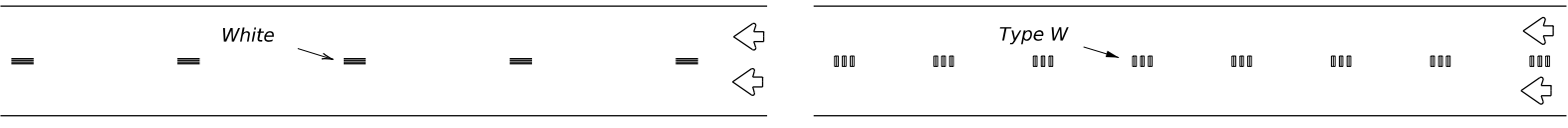
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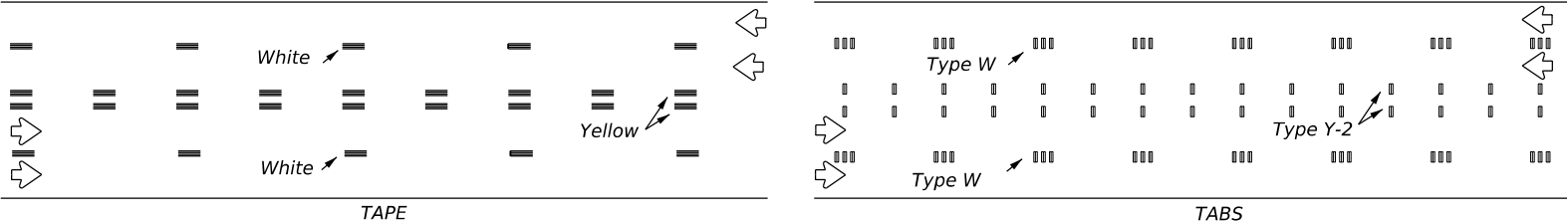
## WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



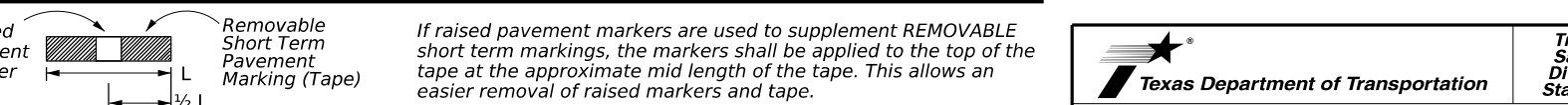
## CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



## LANE LINES FOR DIVIDED HIGHWAY



## LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



*TWO-WAY LEFT TURN LANE*

1. Short term pavement markings may be prefabricated markings (stick down tape) or temporary flexible reflective roadway marker tabs unless otherwise specified elsewhere in plans.
2. Short term pavement markings shall NOT be used to simulate edge lines.
3. Dimensions indicated on this sheet are typical and approximate. Variations in size and height may occur between markers or devices made by manufacturers, by as much as 1/4 inch, unless otherwise noted.
4. Temporary flexible-reflective roadway marker tabs will require normal maintenance replacement when used on roadways with an ADT per lane of up to 7500 vehicles with no more than 10% truck mix. When roadways exceed these values, additional maintenance replacement of devices should be planned.
5. No segment of roadway open to traffic shall remain without permanent pavement markings for a period greater than 14 calendar days. The Contractor will be responsible for maintaining short term pavement markings until permanent pavement markings are in place. When the Contractor is responsible for placement of permanent pavement markings, no segment of roadway shall remain without permanent pavement markings for a period greater than 14 calendar days unless weather conditions prohibit placement. Permanent pavement markings shall be placed as soon as weather permits.
6. For two lane, two-way roadways, DO NOT PASS signs shall be erected to mark the beginning of sections where passing is prohibited and PASS WITH CARE signs shall be erected to mark the beginning of sections where passing is permitted. Signs shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) and may be used to indicate the limits of no-passing zones for up to 14 calendar days. Permanent pavement markings should then be placed.
7. For low volume two lane, two-way roadways of 4000 ADT or less, no-passing lines may be omitted when approved by the Engineer. DO NOT PASS and PASS WITH CARE signs shall be erected (see note 6).
8. For exit gores where a lane is being dropped place wide gore markings or retroreflective channelizing devices to guide motorist through the exit. If channelizing devices are to be used it should be noted elsewhere in the plans. One piece cones are not allowed for this purpose.

1. *Temporary flexible-reflective roadway marker tabs detailed on this sheet will be designated Type Y-2 (two amber reflective surfaces with yellow body); Type Y (one amber reflective surface with yellow body); and Type W (one white or silver reflective surface with white body). Additional details may be found on BC(11).*
2. *Tabs shall meet requirements of Departmental Material Specification DMS-8242.*
3. *When dry, tabs shall be visible for a minimum distance of 200 feet during normal daylight hours and when illuminated by automobile low-beam head light at night, unless sight distance is restricted by roadway geometrics.*
4. *No two consecutive tabs nor four tabs per 1000 feet of line shall be missing or fail to meet the visual performance requirements of Note 3.*

1. *Temporary Removable Prefabricated Pavement Markings shall meet the requirements of DMS-8241.*

- ## RAISED PAVEMENT MARKERS

- ## DEPARTMENTAL MATERIAL SPECIFICATIONS (DMS) & MATERIAL PRODUCER LISTS (MPL)

1. DMSs referenced above can be found along with embedded links to their respective MPLs at the following website:

[http://www.txdot.gov/business/contractors\\_consultants/material\\_specifications/default.htm](http://www.txdot.gov/business/contractors_consultants/material_specifications/default.htm)



**WZ(STPM)-23**

FILE: wzstpm-23.dgn		DN:		CK:		DW:		CK:	
© TxDOT February 2023		CONT		SECT		JOB		HIGHWAY	
REVISONS									
4-92	7-13	DIST		COUNTY				SHEET NO.	
1-97	2-23								
3-03								23	

Plotted on: 3/4/2024

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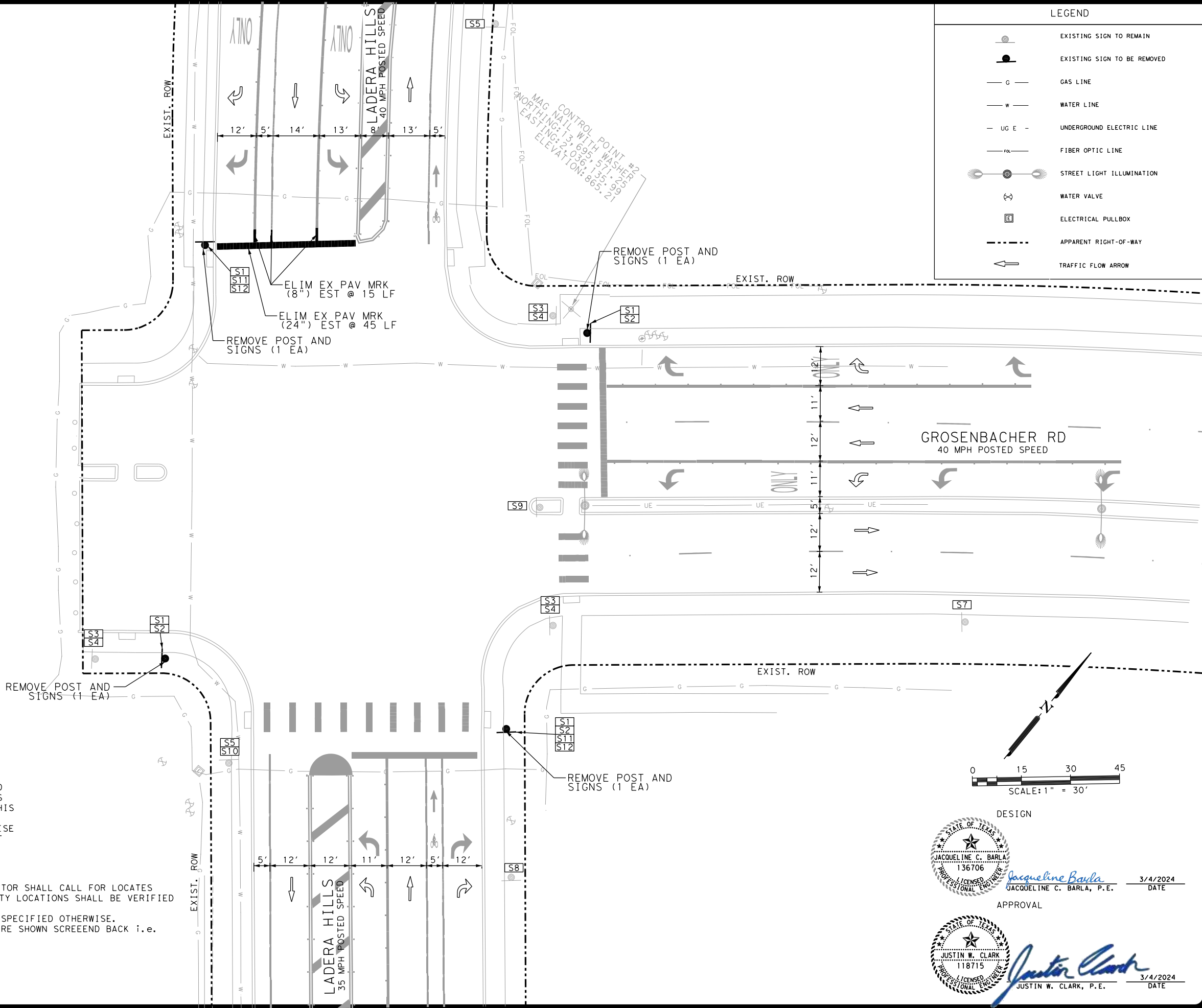
EXISTING SIGNS		
LEGEND	TYPE	KEY
	R1-1 (36" x 36")	[S1]
	R1-3P (30" x 12")	[S2]
	S1-1 (36" x 36")	[S3]
	SW16-7PL (24" x 12")	[S4]
	R3-17 (30" x 24")	[S5]
	R3-8a (48" x 30")	[S6]
	R3-8a (48" x 30")	[S7]
	R10-3eR (9" x 12")	[S8]
	R3-8a (48" x 30")	[S9]
	R3-8a (48" x 30")	[S10]
	R3-8a (48" x 30")	[S11]
	R3-8a (48" x 30")	[S12]

CONTRACTOR SHALL CONTACT  
DIGTESS @ 1-800-DIG-TESS OR  
TEXAS-811 FOR UTILITY LOCATION  
AT LEAST 72 HOURS PRIOR TO  
BEGINNING CONSTRUCTION

CAUTION:  
THE CONTRACTOR IS SPECIFICALLY CAUTIONED  
THAT UNDERGROUND UTILITIES INCLUDING GAS  
ARE KNOWN TO EXIST IN THE VICINITY OF THIS  
WORK. CONTRACTOR SHALL CALL FOR LOCATES  
PRIOR TO BEGINNING WORK AND SHALL EXERCISE  
CAUTION WHEN INSTALLING SIGNAL EQUIPMENT  
INCLUDING POLE FOUNDATIONS AND CONDUITS

NOTES:

- UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR SHALL CALL FOR LOCATES  
PRIOR TO COMMENCING EXCAVATION. ALL UTILITY LOCATIONS SHALL BE VERIFIED  
IN THE FIELD BY THE CONTRACTOR.
- ALL DIMENSIONS SHOWN ARE IN FEET UNLESS SPECIFIED OTHERWISE.
- ALL EXISTING FEATURES THAT WILL REMAIN ARE SHOWN SCREEEND BACK i.e.  
FADED.



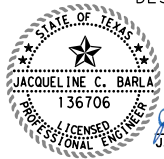
LEGEND

- EXISTING SIGN TO REMAIN
- EXISTING SIGN TO BE REMOVED
- GAS LINE
- WATER LINE
- UNDERGROUND ELECTRIC LINE
- FIBER OPTIC LINE
- STREET LIGHT ILLUMINATION
- WATER VALVE
- ELECTRICAL PULLBOX
- APPARENT RIGHT-OF-WAY
- TRAFFIC FLOW ARROW

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ENGINEERS**

SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TYPE FPM REGISTRATION #470 | TPELS FPM REGISTRATION #1002800

**LENNAR HOMES OF TEXAS, INC.**  
SAN ANOTNIO ETJ, TEXAS  
GROSENBACHER RD @ LADERA HILLS  
EXISTING CONDITION & REMOVALS



Jacqueline Barla  
JACQUELINE C. BARLA, P.E.

3/4/2024  
DATE



Justin Clark  
JUSTIN W. CLARK, P.E.

3/4/2024  
DATE

JOB NO. 6445-93  
DATE 3/4/2024  
DESIGNER JCH  
CHECKED JWC DRAWN JCH

SHEET 24



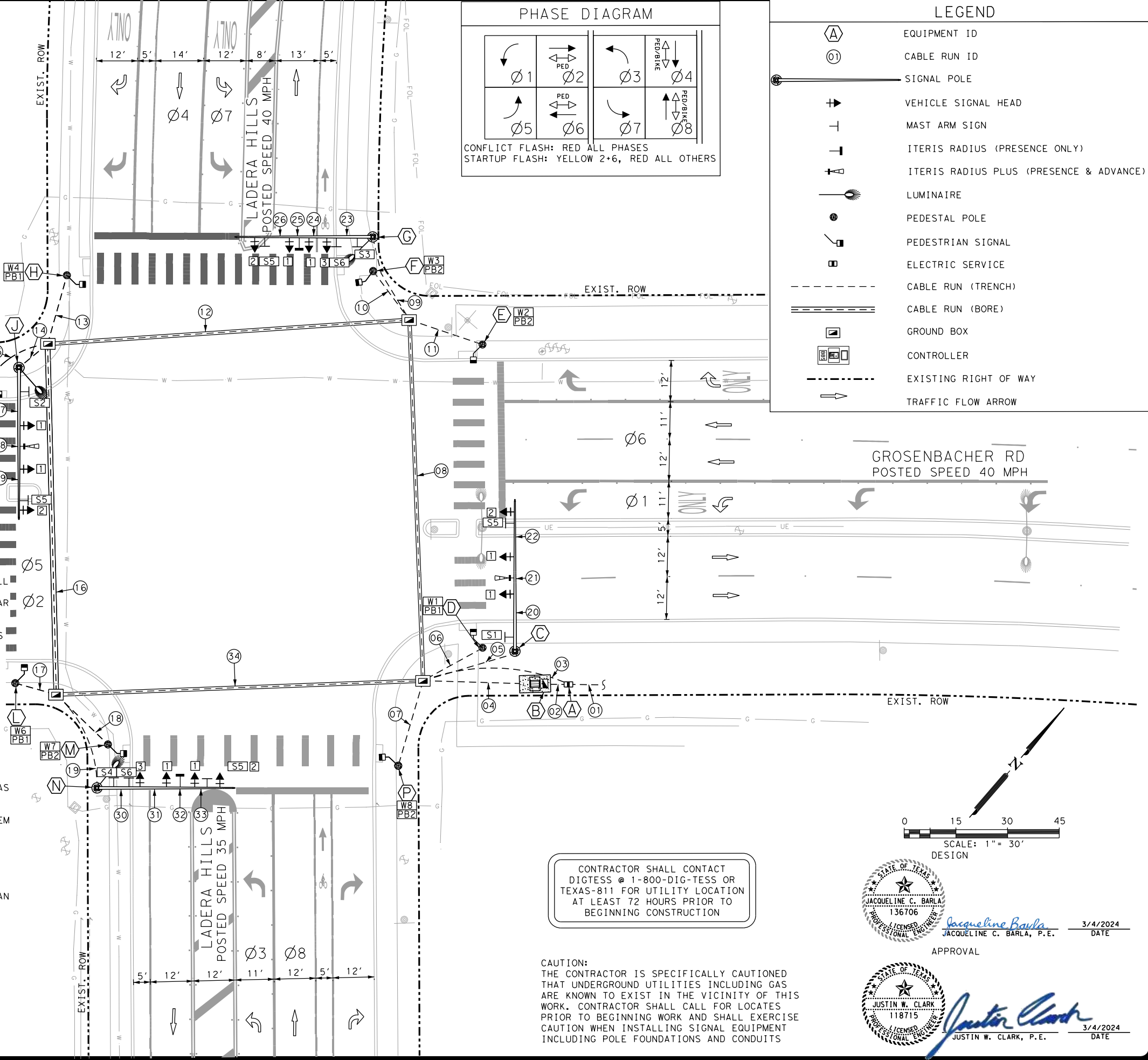
Plotted on: 3/4/2024

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TRAFFIC SIGNAL HEADS			
12" LED VEHICLE SIGNAL SECTIONS WITH RETROREFLECTIVE VENTED BACKPLATES		16" x 18" LED COUNTDOWN PEDESTRIAN SIGNALS	
SIGNAL FACES			
KEY	1	2	3
QTY	8	4	2

TRAFFIC SIGNS		
LEGEND	TYPE	KEY
	SEE SIGNING DETAILS	S1
		S2
		S3
		S4
	R10-17T (30" x 30")	S5
	R10-10b, (18" x 24")	S6
	R10-3EL (12" x 18")	PB1
	R10-3ER (12" x 18")	PB2

- NOTES:
- ALL DIMENSIONS ARE SHOWN IN FEET UNLESS SPECIFIED OTHERWISE. ALL EXISTING FEATURES ARE SHOWN SCREENED BACK I.E. FADED.
  - CONTRACTOR SHALL POTHOLE SIGNAL POLE FOUNDATION LOCATIONS NEAR UNDERGROUND UTILITIES PRIOR TO INSTALLING POLE FOUNDATION.
  - UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR SHALL CALL FOR LOCATES PRIOR TO COMMENCING EXCAVATION. ALL UTILITY LOCATIONS SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR.
  - LOCATION OF TRAFFIC SIGNAL POLES, CABINET AND ELECTRICAL SERVICE SHALL BE VERIFIED AND APPROVED BY BEXAR COUNTY PRIOR TO CONSTRUCTION.
  - CONTRACTOR SHALL CONNECT FIELD WIRING TO CONTROLLER.
  - SIGNAL HEADS SHALL HAVE A MINIMUM OF 19 FEET OF CLEARANCE ABOVE THE ROADWAY SURFACE.
  - TRAY CABLE SHALL BE RUN IN 2" CONDUIT SEPARATE FROM SIGNAL CABLE.
  - AN ADDITIONAL 2" SCHEDULE 80 PVC SHALL BE INSTALLED AT EACH POLE FOUNDATION STUBBED OUT 2' FROM THE FACE OF THE FOUNDATION. STUB OUTS SHALL BE APPROPRIATELY CAPPED BELOW GRADE FOR FUTURE USE.
  - LUMINAIRES ARE SHOWN FOR CLARITY PURPOSES ONLY; ORIENT THEM AS DIRECTED BY THE ENGINEER.
  - CONTRACTOR SHALL REMOVE EXISTING STOP SIGNS WHEN TRAFFIC SIGNAL BECOMES OPERATIONAL. REMOVAL IS SUBSIDIARY TO BID ITEM 680.
  - CONTRACTOR SHALL FURNISH AND DELIVER TWO TYPE 2 CONTROLLER CABINET AND ASSEMBLY TO BEXAR COUNTY FOR PROGRAMMING AND TESTING FOUR WEEKS IN ADVANCE PRIOR TO CONTRACTOR INSTALLING EQUIPMENT IN THE FIELD. CONTACT TONY VASQUEZ OR KURT FRANZ TO DETERMINE LOCATION.
  - BATTERY BACK UP SYSTEM (BBS) SHALL BE INSTALLED PER CITY OF SAN ANTONIO SPECIFICATIONS.
  - THE CONTRACTOR SHALL SUPPLY AND INSTALL THE ADDRESS IN PERMANENT NUMBERS AND LETTERS TO THE STREET SIDE OF THE SERVICE ENCLOSURE. SAID ADDRESS SHALL ALSO BE RECORDED AND GIVEN TO THE BEXAR COUNTY INSPECTOR FOR THEIR RECORDS.
  - NEATLY CAP/COIL ALL WIRES AND CABLES IN GROUND BOX OR AT TERMINATION.
  - SIGNAL OPERATION WILL BE MONITORED AFTER CONSTRUCTION AND MODIFIED AS NECESSARY.
  - CONTRACTOR SHALL CONTACT BEXAR COUNTY A MINIMUM OF FOURTEEN (14) DAYS PRIOR TO THE TRAFFIC SIGNAL TURN-ON.
  - FURNISH AND INSTALL AN APPLIED TECHNOLOGIES MODEM FOR THE TRANSFER OF COMMUNICATIONS BETWEEN SIGNAL CONTROLLER AND ADVANCED MANAGEMENT SYSTEM CENTRAL SOFTWARE.



**PAPE-DAWSON ENGINEERS**

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2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TYPE FPM REGISTRATION #470 | TPELS FPM REGISTRATION #1002800













**LENNAR HOMES OF TEXAS, INC.**

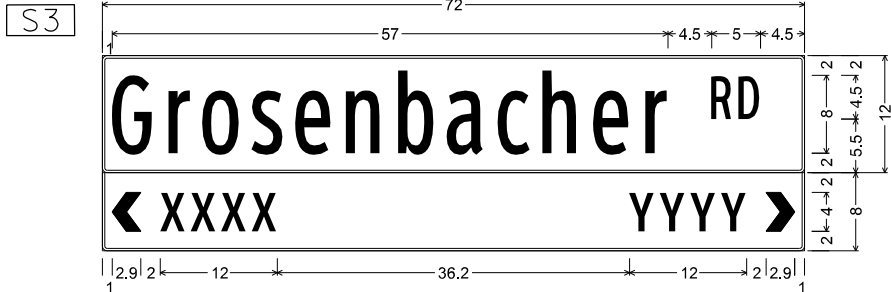
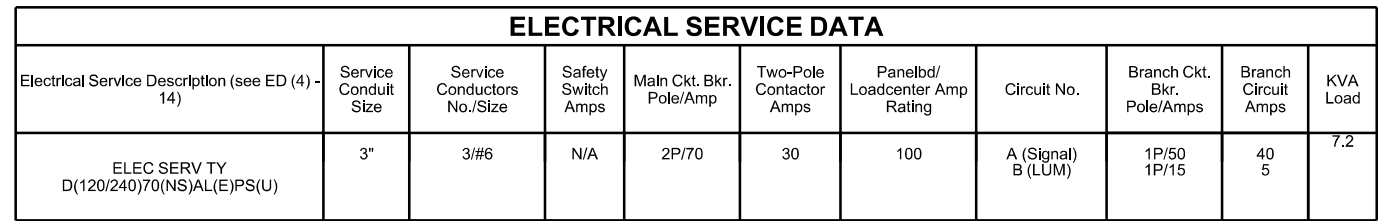
SAN ANTONIO ETJ, TEXAS  
GROSENBACHER RD @ LADERA HILLS  
PROPOSED TRAFFIC SIGNAL LAYOUT

JOB NO. 6445-93  
DATE 3/4/2024  
DESIGNER JCH  
CHECKED JWC DRAWN JCH

SHEET 25



Signal Head and Pole Placement (ft)											
Pole	Dimension										
	T	U	V	W	X	Y	Z	No. of Heads	8' Lum.	Pole Type	Bury Depth
	9	17	11	13	44	19	19	3	-	36-A	13
							10	N/A	N/A	24-A	6
							10	N/A	N/A	24-A	6
							10	N/A	N/A	24-A	6
	11	13	5,6	10	40	19	30	4	1	36-A	13
							10	N/A	N/A	24-A	6
	9	17	13	12	44	19	30	3	1	36-A	13
							10	N/A	N/A	24-A	6
							10	N/A	N/A	24-A	6
							10	N/A	N/A	24-A	6
	10	13	8,8	7	40	19	30	4	1	36-A	13
							10	N/A	N/A	24-A	6



0.5" Radius, 0.3" Border, White on Blue;  
 "Grosenbacher", ClearviewHwy-1-W specified length;  
 "RD", ClearviewHwy-1-W specified length;  
 0.5" Radius, 0.3" Border, White on Blue;  
 Symbol CW1-8; "XXXX", ClearviewHwy-2-W specified length;  
 "YYYY", ClearviewHwy-2-W specified length; Symbol CW1-8;

A circular professional engineer seal for the State of Texas. The outer ring contains the text "STATE OF TEXAS" at the top and "PROFESSIONAL ENGINEER" at the bottom, separated by stars. The center of the seal features a five-pointed star above the name "JUSTIN W. CLARK" and the license number "118715". Below the license number, the words "LICENSED" and "ENGINEER" are written in a smaller font, with "LICENSED" on the left and "ENGINEER" on the right.

APPROVAL

 *Justin Clark*

JUSTIN W. CLARK, P.E. 3/4/2024  
DATE

**PAPE-DAWSON  
ENGINEERS**

SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS

20200 HW LOOP 410 | SAN ANTONIO, TX 78243 | 210.375.9000

TYPE FIRM REGISTRATION #470 | TBALS FIRM REGISTRATION #1026800

JOB NO. 6445-93  
 DATE 3/4/2024  
 DESIGNER JCH  
 CHECKED JWC DRAWN JCH

Plotted on: 3/4/2024

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ELECTRICAL SCHEDULE

ELECTRICAL SCHEDULE																																				
ITEM	TOTAL QTY.	RUN NUMBER	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱	⑲	⑳	㉑	㉒	㉓	㉔	㉕	㉖	㉗	㉘	㉙	㉚	㉛	㉜		
		RUN LENGTH (FT)	150	10	35	35	30	20	60	105	10	20	25	105	25	10	20	105	15	20	30	17	11	16	13	5	6	16	17	13	14	13	8	8	12	110
POWER	20	1/C #6 INSULATED	CABLES PULLED BY CPS	2																																
	10	1/C #6 BARE		1																																
	1315	1/C #8 BARE			1	3	1	1	1	3	2	1	1	3	1	2	1	2	1	1	2															
LUMINAIRE	785	4/C-#12 AWG TRAY CABLE			3					3	1			2		1		1			1															
PEDESTRIAN SIGNAL	1745	5/C-#12 AWG				8		1	1	6		1	1	4	1		1	2	1	1																
VEHICLE SIGNAL	210	4/C-#12 AWG																				2	1		3	2	1		2	1		3	2	1		
	169	5/C-#12 AWG																				1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	850	20/C-#12 AWG				4	1			3	1			2		1		1			1			1												
ITERIS RADIUS (PRESENCE)	611	ITERIS RADIUS				2				2	1			1				1			1				1	1	1	1				1	1	1	1	
ITERIS RADIUS PLUS (PRESENCE + ADVANCE)	408	ITERIS RADIUS PLUS				2	1			1				1		1						1	1	1					1	1	1					
CONDUITS	300	2"(SCHD. 80)	1	1			1	1		1	1	1		1	1	1		1	1	1																
	425	2"(SCHD. 80) BORE							1				1				1																		1	
	185	3"(SCHD. 80)			3	1				1						1					1															
	635	3"(SCHD. 80) BORE							2				2				1																		1	

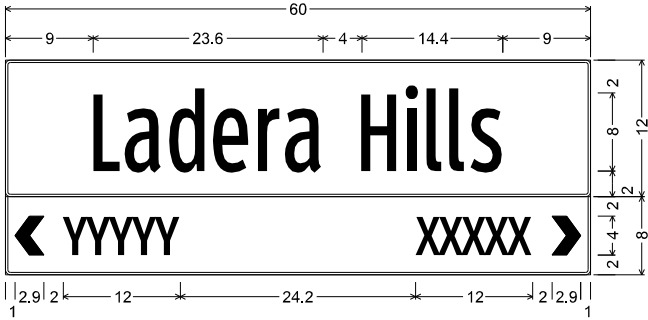
\* RUN LUMINAIRE CABLES IN SEPARATE CONDUIT FROM ALL OTHER CABLES.

INSIDE POLES	12 AWG			ITERIS RADIUS	ITERIS RADIUS PLUS
	4/C LUM (FT)	4/C (FT)	5/C (FT)		
POLE C		40	30		20
POLE D			10		
POLE E		40	30		
POLE F			10		
POLE G	30	60	30	20	
POLE H			10		
POLE J	30	40	30		20
POLE K			10		
POLE L			10		
POLE M			10		
POLE N	30	60	30	20	
POLE P			10		
TOTAL	90	240	220	40	40

INSIDE ARMS	12 AWG			ITERIS RADIUS	ITERIS RADIUS PLUS
	4/C LUM (FT)	4/C (FT)	5/C (FT)		
POLE C-44'		45	44		44
POLE G-40'	8	55	40	40	
POLE J-44'	8	47	44		44
POLE N-40'	8	63	40	40	
TOTAL	24	210	168	80	88

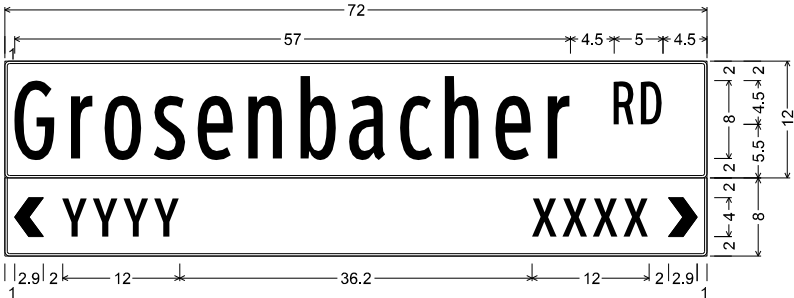
INSIDE CABINET	12 AWG		ITERIS RADIUS	ITERIS RADIUS PLUS	#6 AWG (INS)	#6 AWG (BARE)
	5/C (FT)	20/C (FT)				
TOTAL	80	40	20	20	20	10

S2



0.5" Radius, 0.3" Border, White on Blue;  
"Ladera Hills", ClearviewHwy-1-W specified length;  
"", ClearviewHwy-1-W specified length;  
0.5" Radius, 0.3" Border, White on Blue;  
Symbol CW1-8; "YYYYY", ClearviewHwy-2-W specified length;  
"XXXXX", ClearviewHwy-2-W specified length; Symbol CW1-8;

S4



0.5" Radius, 0.3" Border, White on Blue;  
"Groesenbacher", ClearviewHwy-1-W specified length;  
"RD", ClearviewHwy-1-W specified length;  
0.5" Radius, 0.3" Border, White on Blue;  
Symbol CW1-8; "YYYYY", ClearviewHwy-2-W specified length;  
"XXXXX", ClearviewHwy-2-W specified length; Symbol CW1-8;

DESIGN

STATE OF TEXAS

JACQUELINE C. BARLA

136706

PROFESSIONAL ENGINEER

*Jacqueline Barla*

3/4/2024

DATE

APPROVAL

STATE OF TEXAS

JUSTIN W. CLARK

118715

PROFESSIONAL ENGINEER

*Justin W. Clark*

3/4/2024

DATE

NO. REVISION

DATE

PAPE-DAWSON

ENGINEERS

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2000 HW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TXPE PFM REGISTRATION #470 | TPELS PFM REGISTRATION #1028800

LENNAR HOMES OF TEXAS, INC.

SAN ANOTNIO ETJ, TEXAS  
GROSENBACHER RD @ LADERA HILLS  
CONDUIT AND CONDUCTOR SCHEDULE

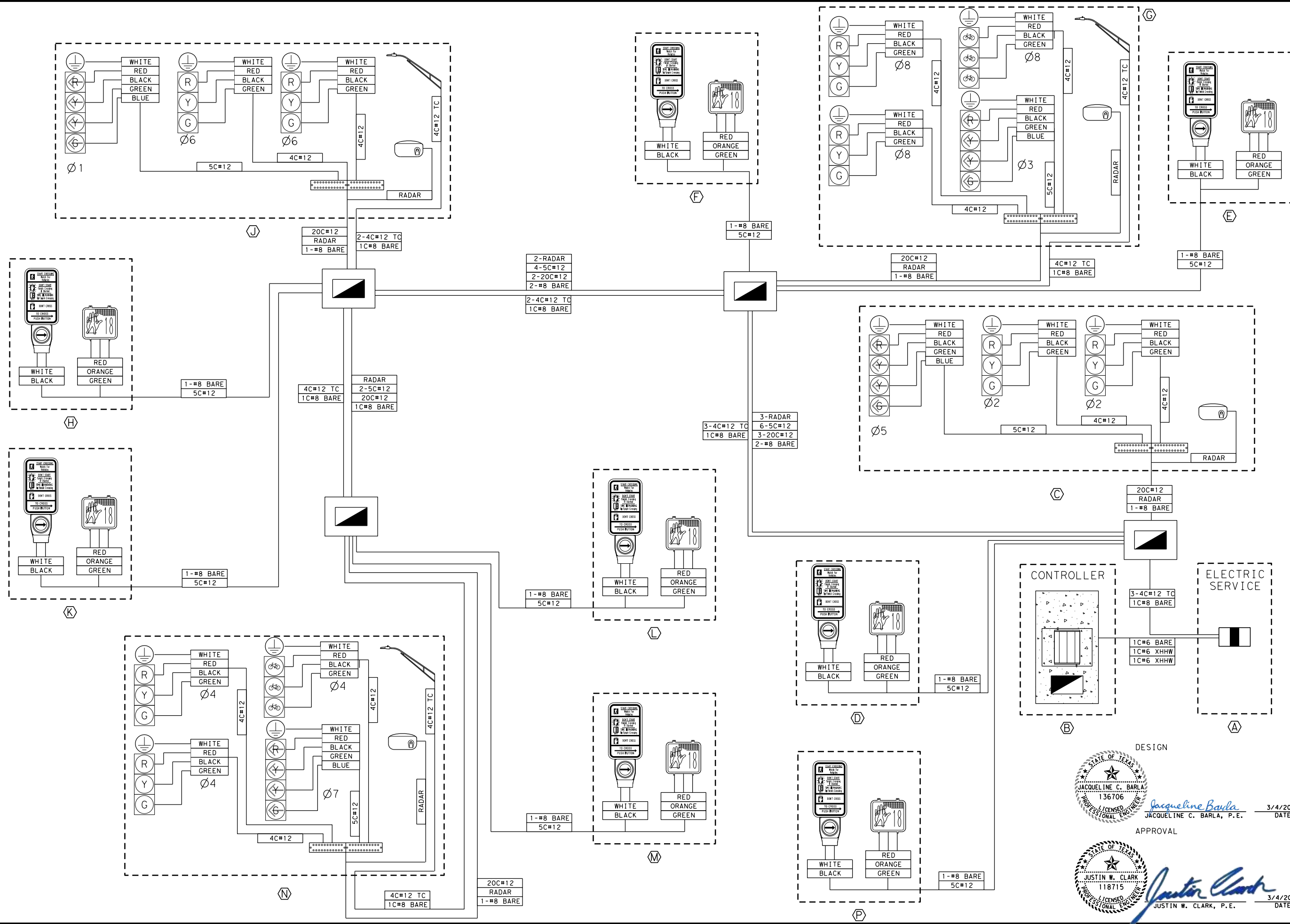
JOB NO. 6445-93

DATE 3/4/2024

DESIGNER JCH

CHECKED JWC DRAWN JCH

SHEET 27



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TBPB FIRM REGISTRATION #470 | TBPB FIRM REGISTRATION #10028800

SAN ANOTNIO ETJ, TEXAS  
GROSENBACHER RD @ LADERA HILLS  
TRAFFIC SIGNAL WIRE DIAGRAM

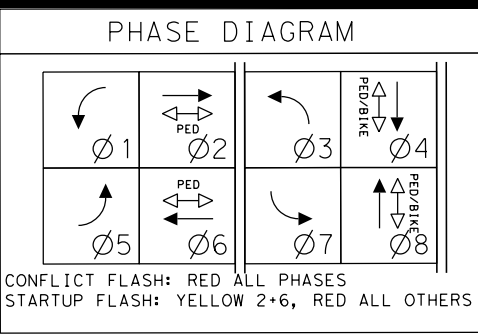
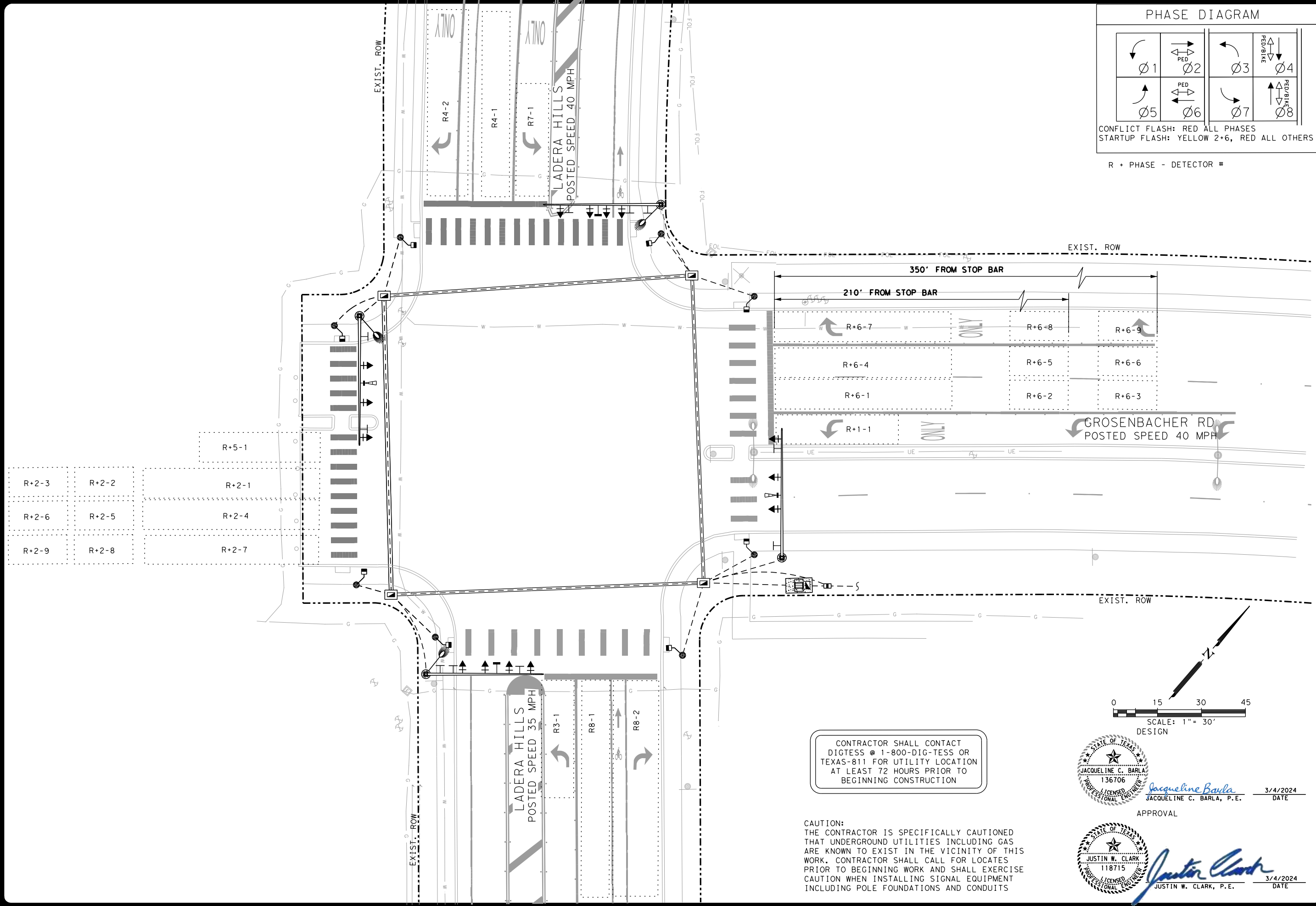
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SHEET 28

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TYPE FIRM REGISTRATION #470 | TBELS FIRM REGISTRATION #1028800

**LENNAR HOMES OF TEXAS, INC.**

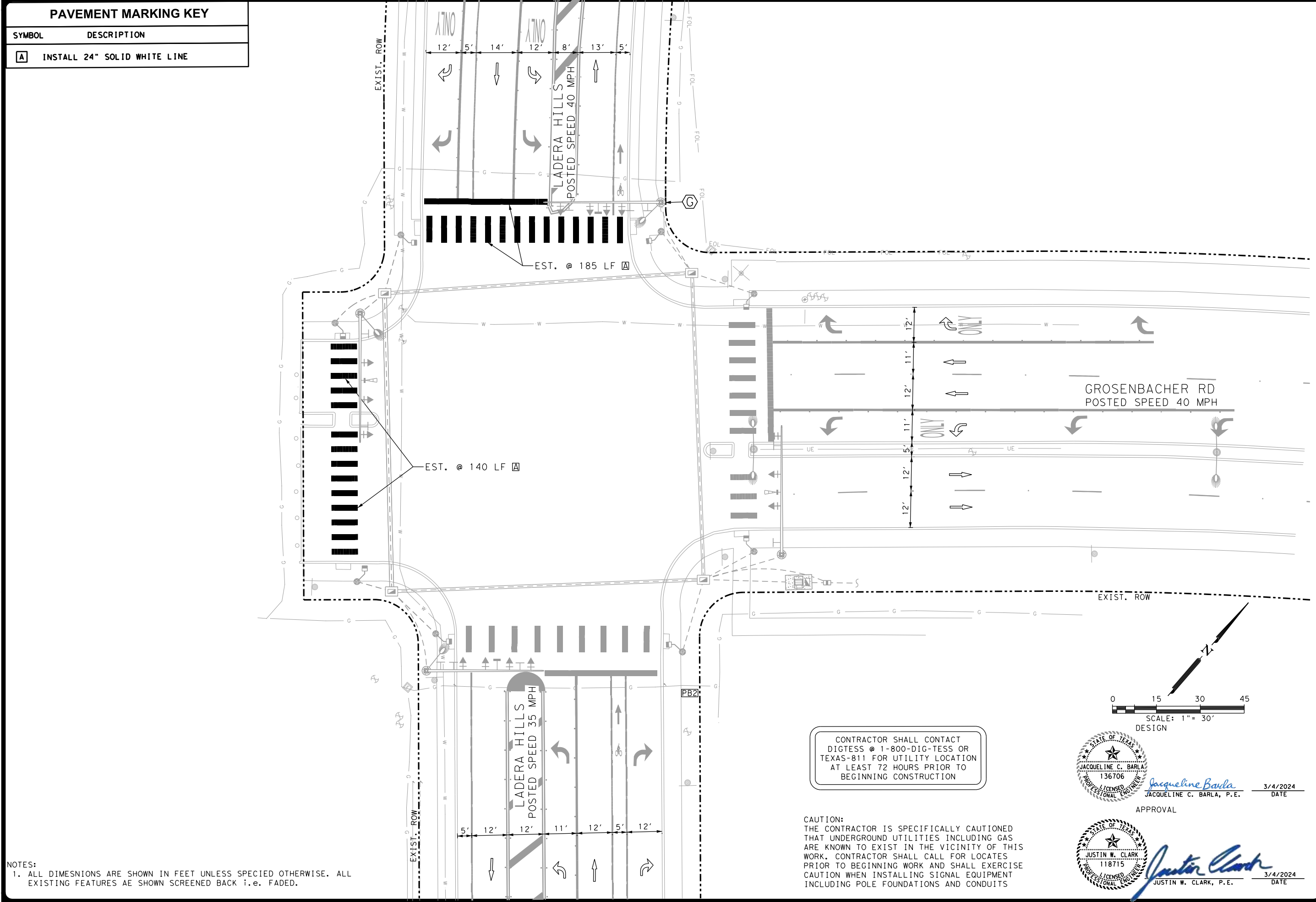
SAN ANOTNIO ETJ, TEXAS  
GROSENBACHER RD @ LADERA HILLS  
RADAR DETECTION ZONES

JOB NO.	6445-93
DATE	3/4/2024
DESIGNER	JCH
CHECKED	JWC DRAWN JCH
SHEET	29



Plotted on: 3/4/2024

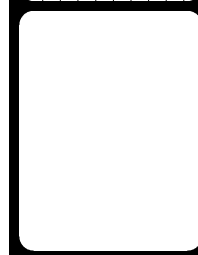
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NOTES:  
1. ALL DIMENSIONS ARE SHOWN IN FEET UNLESS SPECIED OTHERWISE. ALL EXISTING FEATURES ARE SHOWN SCREENED BACK i.e. FADED.

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NO.	REVISION	DATE



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2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TYPE FIRM REGISTRATION #470 | TPELS FIRM REGISTRATION #1028800

**LENNAR HOMES OF TEXAS, INC.**  
SAN ANOTNIO ETJ, TEXAS  
GROSENBACHER RD @ LADERA HILLS  
PROPOSED PAVEMENT MARKINGS PLAN

JOB NO.	6445-93
DATE	3/4/2024
DESIGNER	JCH
CHECKED	JWC DRAWN JCH
SHEET	30

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DATE: 3/4/2024 9:26:29 AM  
FILE: P:\64\45\93\Design\Civil\Standards\ed1-14.dgn

GENERAL NOTES FOR ALL ELECTRICAL WORK

1. The location of all conduits, junction boxes, ground boxes, and electrical services is diagrammatic and may be shifted to accommodate field conditions.
2. Provide new and unused materials. Ensure that all materials and installations comply with the applicable articles of the National Electrical Code (NEC), TxDOT standards and specifications, National Electrical Manufacturers Association (NEMA), and are listed by Underwriters Laboratories (UL) or a Nationally Recognized Testing Lab (NRTL). NRTLs such as Canadian Standard Association (CSA), Intertek Testing Services NA Inc., or FM Approvals LLC can be considered equivalent to UL. Where reference is made to NEMA listed devices, International Electrotechnical Commission (IEC) listed devices will not be considered an acceptable equal to a NEMA listed device. Acceptable devices may have both a NEMA and IEC listing. Faulty fabrication or poor workmanship in any material, equipment, or installation is justification for rejection. Replace or reinstall rejected material or equipment at no additional cost to the Department.
3. Miscellaneous nuts, bolts and hardware, except for high strength bolts, may be stainless steel when plans specify galvanized, provided the bolt size is 1/2 in. or less in diameter.
4. Provide the following test equipment as required by the Engineer to confirm compliance with the contract and the NEC: voltmeter, ammeter, megohm meter (1000 volt DC), ground resistance tester, torque wrenches, and torque screwdrivers. Ensure all equipment has been properly calibrated within the last year. Provide calibration certification to the Engineer upon request. Operate test equipment during inspection as requested by the Engineer.
5. Install grounding as shown on the plans and in accordance with the NEC. Ensure all metallic conduits; metal poles; luminaires; and metal enclosures are bonded to the equipment grounding conductor. Provide stranded bare copper or green insulated grounding conductors. Ground rods, connectors, and bonding jumpers are subsidiary to the various bid items.
6. When required by the Engineer, notify the Department in writing of materials from the Material Producers List (MPL) intended for use on each project. Prequalified materials are listed on the MPL on TxDOT's website under "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials on this list.

CONDUIT

A. MATERIALS

1. Provide conduit, junction boxes, fittings, and hardware as per TxDOT Departmental Material Specification (DMS) 11030 "Conduit" and Item 618 "Conduit" of TxDOT's "Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges," latest edition. Provide conduits listed under Item 618 on the MPL under "Roadway Illumination and Electrical Supplies." Provide conduit types according to the descriptive code or as shown on the plans. Do not substitute other types of conduits for those shown. Provide liquidtight flexible metal conduit (LFMC) when flexible conduit is called for on galvanized steel rigid metallic conduit (RMC) systems. Provide liquidtight flexible nonmetallic conduit (LFNC) when flexible conduit is called for on polyvinyl chloride (PVC) systems.
2. Provide galvanized steel RMC for all exposed conduits, unless otherwise shown on the plans. Properly bond all metal conduits.
3. Unless otherwise shown on the plans, provide junction boxes with a minimum size as shown in the following table, which applies to the greatest number of conductors entering the box through one conduit with no more than four conduits per box. When a mixture of conductor sizes is present, count the conductors as if all are of the larger size. For situations not applicable to the table, size junction boxes in accordance with NEC.


AWG	3 CONDUCTORS	5 CONDUCTORS	7 CONDUCTORS
#1	10" x 10" x 4"	12" x 12" x 4"	16" x 16" x 4"
#2	8" x 8" x 4"	10" x 10" x 4"	12" x 12" x 4"
#4	8" x 8" x 4"	10" x 10" x 4"	10" x 10" x 4"
#6	8" x 8" x 4"	8" x 8" x 4"	10" x 10" x 4"
#8	8" x 8" x 4"	8" x 8" x 4"	8" x 8" x 4"

4. Junction boxes with an internal volume of less than 100 cu. in. and supported by entering raceways must have threaded entries or hubs identified for the intended purpose and supported by connection of two or more rigid metal conduits. Secure conduit within 3 ft. of the enclosure or within 18 in. of the enclosure if all conduit entries are on the same side. Mechanically secure all junction boxes with an internal volume greater than 100 cu. inches.
5. Provide hot dipped galvanized cast iron or sand cast aluminum outlet boxes for junction boxes containing only 10 AWG or 12 AWG conductors. Do not use die cast aluminum boxes. Size outlet boxes according to the NEC.
6. Do not use intermediate metal conduit (IMC) or electrical metallic tubing (EMT) unless specifically required by the plan sheets. When EMT is called for, provide junction boxes made from galvanized steel sheeting, listed and approved for outdoor use, unless otherwise noted on the plans. Size all galvanized steel junction boxes in accordance with the NEC. Provide junction boxes for IMC conduit systems that meet the same requirements for junction boxes used with RMC systems.
7. Provide PVC junction boxes intended for outdoor use on PVC conduit systems, unless otherwise noted on the plans.

8. Provide PVC elbows in PVC conduit systems, unless otherwise shown on the plans. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the PVC conduit system. When galvanized steel RMC elbows are specifically called for in the plans and any portion of the RMC elbow is buried less than 18 in., ground the RMC elbow by means of a grounding bushing on a rigid metal extension. Grounding of the rigid metal elbow is not required if the entire RMC elbow is encased in a minimum of 2 in. of concrete. PVC extensions are allowed on these concrete encased rigid metal elbows. RMC or PVC elbows are subsidiary to various bid items.
9. When required, provide High-Density Polyethylene (HDPE) conduit with factory installed internal conductors according to Item 622 "Duct Cable." At the Contractor's request and with approval by the Engineer, substitute HDPE conduit with no conductors for bored schedule 40 or schedule 80 PVC conduit bid under Item 618. Ensure bored HDPE substituted for PVC is schedule 40 and of the same size PVC called for in the plans. Ensure the substituted HDPE meets the requirements of Item 622, except that the conduit is supplied without factory-installed conductors. Make the transition of the HDPE conduit to PVC (or RMC elbow when required) at the bore pit. Provide conduit of the size and schedule as shown on the plans. Do not extend substituted conduit into ground boxes or foundations. Provide PVC or galvanized steel RMC elbows as called for at all ground boxes and foundations.
10. Use two-hole straps when supporting 2 in. and larger conduits. On electrical service poles, properly sized stainless steel or hot dipped galvanized one-hole standoff straps are allowed on the service riser conduit.

B. CONSTRUCTION METHODS

1. Provide and install expansion joint conduit fittings on all structure-mounted conduits at the structure's expansion joints to allow for movement of the conduit. In addition, provide and install expansion joint fittings on all continuous runs of galvanized steel RMC conduit externally exposed on structures such as bridges at maximum intervals of 150 ft. When requested by the project Engineer, supply manufacturer's specification sheet for expansion joint conduit fittings. Repair or replace expansion joint fittings that do not allow for movement at no additional cost to the Department. Provide the method of determining the amount of expansion to the Engineer upon request. Do not use LFMC or LFNC as a substitute for the required expansion conduit fittings.
2. Space all conduit supports at maximum intervals of 5 ft. Install conduit spacers when attaching metal conduit to surface of concrete structures. See "Conduit Mounting Options" on ED(2). Install conduit support within 3 ft. of all enclosures and conduit terminations.
3. Do not attach conduit supports directly to pre-stressed concrete beams except as shown specifically in the plans or as approved by the Engineer.
4. Unless otherwise shown on the plans, jack or bore conduit placed beneath existing roadways, driveways, sidewalks, or after the base or surfacing operation has begun. Backfill and compact the bore pits below the conduit per Item 476 "Jacking, Boring, or Tunneling Pipe or Box" prior to installing conduit or duct cable to prevent bending of the connections.
5. When placing conduit in the sub-grade of new roadways, backfill all trenches with excavated material unless otherwise noted on the plans. When placing conduit in the sub-base of new roadways, backfill all trenches with cement-stabilized base as per requirements of Items 110 "Excavation", 400 "Excavation and Backfill for Structures", 401 "Flowable Backfill", 402 "Trench Excavation Protection", and 403 "Temporary Special Shoring."
6. Provide and place warning tape approximately 10 in. above all trenched conduit as per Item 618.
7. During construction, temporarily cap or plug open ends of all conduit and raceways immediately after installation to prevent entry of dirt, debris and animals. Temporary caps constructed of durable duct tape are allowed. Tightly fix the tape to the conduit opening. Clean out the conduit and prove it clear in accordance with Item 618 prior to installing any conductors.
8. Ensure conduit entry into the top of any enclosure is waterproof by installing conduit sealing hubs or using boxes with threaded bosses. This includes surface mounted safety switches, meter cans, service enclosures, auxiliary enclosures and junction boxes. Grounding bushings on water tight sealing hubs are not required.
9. Fit the ends of all PVC conduit terminations with bushings or bell end fittings. Provide and install a grounding type bushing on all metal conduit terminations.
10. Install a bonding jumper from each grounding bushing to the nearest ground rod, grounding lug, or equipment grounding conductor. Ensure all bonding jumpers are the same size as the equipment grounding conductor. Bonding of conduit used as a casing under roadways for duct cable is not required, if the duct extends the full length through the casing.
11. At all electrical services, install a 6 AWG solid copper grounding electrode conductor.
12. Place conduits entering ground boxes so that the conduit openings are between 3 in. and 6 in. from the bottom of the box. See the ground box detail on sheet ED(4).
13. Seal ends of all conduits with duct seal, expandable foam, or by other methods approved by the Engineer. Seal conduit immediately after completion of conductor installation and pull tests. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a conduit sealant.
14. File smooth the cut ends of all mounting strut and conduit. Before installing, paint the field cut ends of all mounting strut and RMC (threaded or non-threaded) with zinc rich paint (94% or more zinc content) to alleviate overspray. Use zinc rich paint to touch up galvanized material as allowed under Item 445 "Galvanizing." Do not paint non-galvanized material with a zinc rich paint as an alternative for materials required to be galvanized.



Traffic  
Operations  
Division  
Standard

ELECTRICAL DETAILS  
CONDUITS & NOTES

ED(1) - 14

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ELECTRICAL CONDUCTORS

A. MATERIAL INFORMATION

1. Provide Type XHHW insulated conductors in accordance with Departmental Material Specification (DMS)11040 "Conductors" and Item 620 "Electrical Conductors." Provide conductors as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 620. Color code insulated conductors in conformance with the NEC. Identify grounded (neutral) conductors with white insulation. Identify grounding conductors (ground wires) with green insulation or bare conductors. Identify ungrounded (hot) conductors with any color insulation except green, white, or gray. Keep color scheme consistent throughout the wiring system. Identify conductors 6 American Wire Gauge (AWG) and smaller by continuous color jacket. Identify electrical conductors 4 AWG and larger by continuous color jacket or by colored tape. When identifying conductors with colored tape, mark at least 6 in. of the conductor's insulation with half laps of tape.
2. Provide a solid copper 6 AWG grounding electrode conductor to bond the electrical service equipment to the concrete encased grounding electrode or the ground rod at the service location. Connect the grounding electrode conductor to the ground rod with a UL listed connector in accordance with DMS 11040. Connect the grounding electrode conductor to the concrete encased grounding electrode as shown in the plans.
3. Where two or more circuits are present in one conduit or enclosure, permanently identify the conductors of each branch circuit by attaching a non-metallic tag around both circuit conductors at each accessible location. Provide tags with two straps, large enough to indicate circuit number, letter, or other identification as shown in the plans. Print circuit identification on the tag with a permanent marker.
4. Use listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors for splicing as specified in DMS 11040. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Provide UL listed gel-filled insulating splice covers. Splicing materials, insulating materials, breakaway disconnects, splice covers, and fuse holders are subsidiary to various bid items.

B. CONSTRUCTION METHODS

1. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull test. If a conductor cannot be freely pulled, make any needed alterations or repairs at no additional cost to the department. Perform insulation resistance tests in accordance with Item 620. Coordinate with the Engineer to witness the tests.
2. Leave 2 ft. minimum, 3 ft. maximum length for each conductor up to the splice in ground boxes. Leave 3 ft. minimum, 4 ft. maximum length of conductor in ground boxes when pulled through with no splice. Leave 1 ft. minimum, 1.5 ft. maximum length of conductor at enclosures, weatherheads and pole bases.
3. Make splices only in junction boxes, ground boxes, pole bases, or electrical enclosures and use only listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors. Insulate splices with heavy wall heat shrink tubing or gel-filled insulating splice covers to provide a watertight splice. Overlap conductor insulation with heat shrink tubing a minimum of 2 in. past both sides of the splice. Where heat shrink tubing may not shrink sufficiently to provide a watertight seal around the individual conductors, prior to heating the tubing, increase the diameter of the conductor insulation using hot melt adhesive tape to provide a watertight seal between the individual conductors and the heat shrink tubing. Ensure the tape extends past the heat shrink tubing. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Heat shrink tubing that appears to have been burned, or overheated, is considered defective and must be replaced.
4. Size and install gel-filled insulating splice covers according to manufacturer's specifications when used in place of heat shrink tubing.
5. Wire nuts with factory applied waterproof sealant may be used for 8 AWG or smaller conductors in above ground junction boxes, but not in pole bases or ground boxes. Install wire nuts in an upright position to prevent the accumulation of water.
6. Support conductors in illumination poles with a J-hook at the top of the pole.
7. When terminating conductors, remove the insulation and jacketing material without nicking the individual strands of the conductor. Conductors with nicked individual conductor strands or removed strands will be considered damaged.
8. Replace conductors and cables that are damaged beyond repair or that fail an insulation resistance test at no additional cost to the department.
9. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Use only approved splicing methods.
10. Do not terminate more than one conductor under a single connector, unless the connector is rated for multiple conductors. Do not exceed the pressure connector's listing for maximum number and size of conductors allowed.
11. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a breakaway support device. Follow manufacturer's instructions when terminating conductors to breakaway connectors. Properly torque threaded connections. Proper terminations are critical to the safe operation of breakaway devices. Trim waterproofing boots on breakaway connectors to fit snugly around the conductor to ensure waterproof connection. Only one conductor may enter a single opening in a boot. Provide waterproof boots with the correct number of openings. Leave unused openings factory sealed. Use prequalified breakaway connectors as shown on the MPL.

12. Provide and install a separate stranded equipment grounding conductor (EGC) in all conduits that contain circuit wiring of 50 volts or more. Unless shown elsewhere, size the EGC to be the same size as the largest current carrying conductor contained in the conduit. Ensure all EGCs are bonded together at every accessible location. For traffic signal installations, provide a minimum size 8 AWG EGC. The EGC is paid for under Item 620.

C. TEMPORARY WIRING

1. Install temporary conductors and electrical equipment in accordance with the NEC article "Temporary Installations" and Department standard sheets.
2. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins and refrigerators located outdoors at grade. GFCI may be any one of the following: molded cord and plug set, receptacle, or circuit breaker type.
3. Use listed wire nuts with factory applied sealant for temporary wiring where approved.
4. Enclose conductor splices within a listed enclosure or ground box, or ensure the splices are more than 10 ft. above grade vertically and more than 5 ft. horizontally from any metal structure. Where installing temporary conductors in areas subject to vehicle traffic or mobile construction equipment, ensure the vertical clearance to ground is at least 18 ft. when measured at the lowest point. Ground messenger wires that support power conductors in conformance with the NEC.
5. Protect and when necessary repair any existing electrical conduits uncovered during the construction process in a timely manner and in conformance with the NEC.

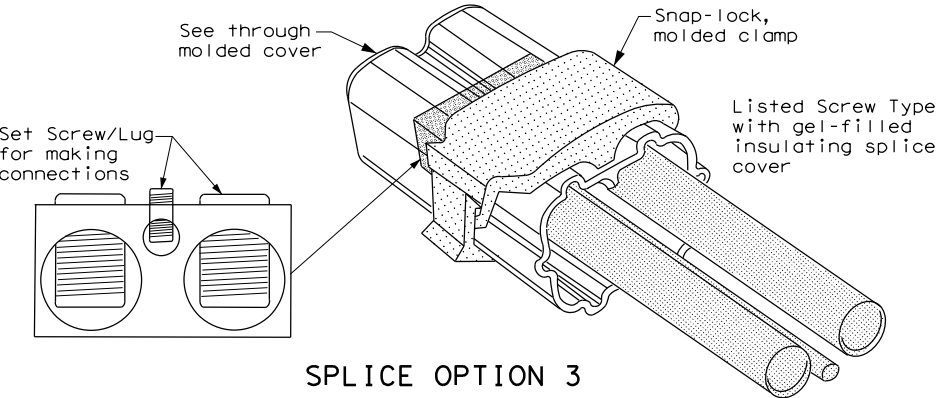
GROUND RODS & GROUNDING ELECTRODES

A. MATERIAL INFORMATION

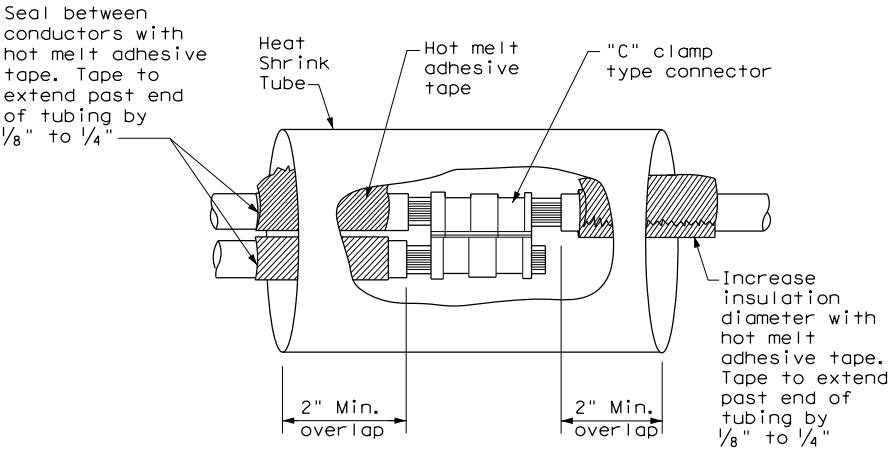
1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in specific locations including electrical service, see individual plan sheets.

B. CONSTRUCTION METHODS

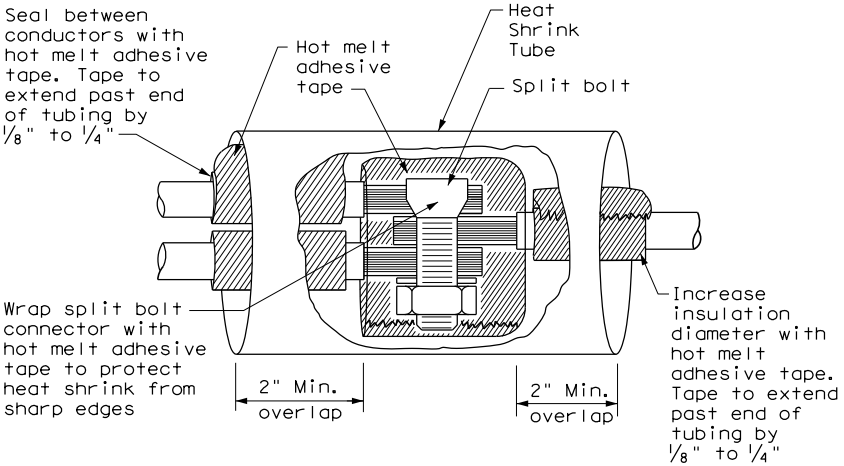
1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, ensure that the upper end is between 2 to 4 in. below finished grade.
2. Do not place ground rods in the same drilled hole as a timber pole.
3. Install ground rods so the imprinted part number is at the upper end of the rod.
4. Remove all non-conductive coatings such as concrete splatter from the rod at the clamp location.
5. Route all conductors as short and straight as possible for connection to lightning protection ground rods. When a bend is required, ensure a minimum radius bend of four inches for these conductors.
6. Unless otherwise called for in the plans, protect grounding electrode conductors with non-metallic conduit. When protecting grounding electrode conductors with metal conduit, provide and install a grounding type bushing and properly sized bonding jumper on each end of the metal conduit.
7. Written authorization is required before installing a ground rod in a horizontal trench for rocky soil or a solid rock bottom.



SPLICE OPTION 3  
Listed Screw Type



SPLICE OPTION 1  
Compression Type



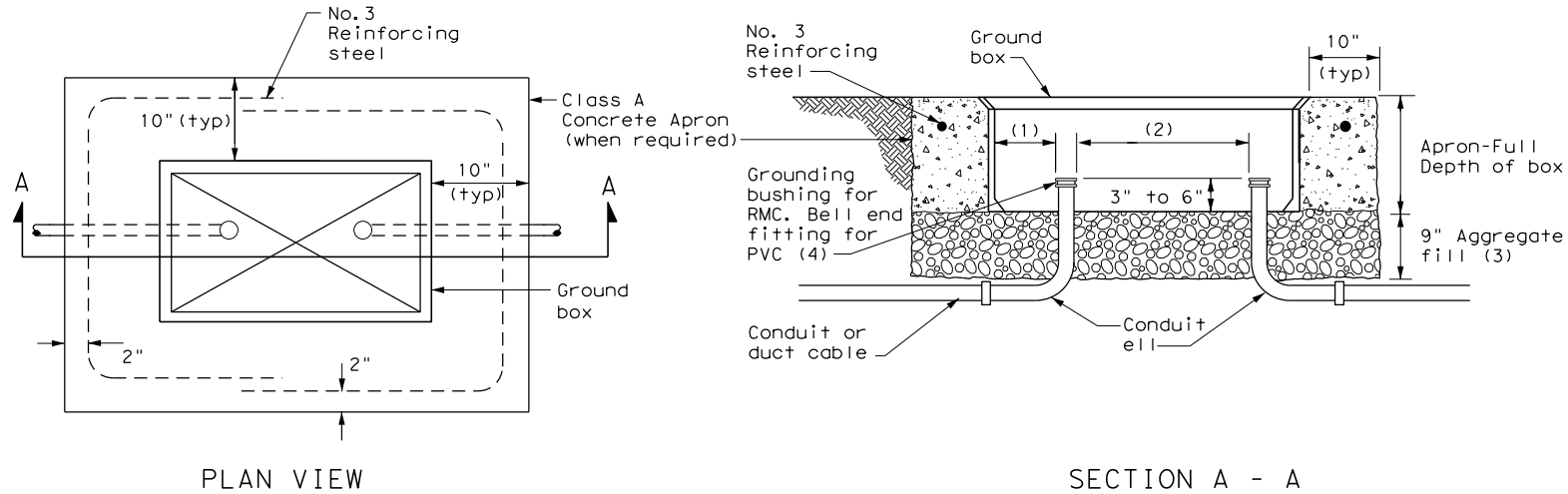
SPLICE OPTION 2  
Split Bolt Type

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ELECTRICAL DETAILS CONDUCTORS				
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FILE: ed3-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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### APRON FOR GROUND BOX

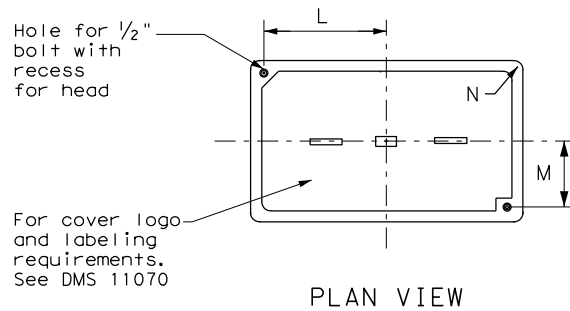
- (1) Uniformly space ends of conduits within the ground box. Position ends of conduits so that ground box walls do not interfere with the installation of grounding bushings or bell end fittings.
- (2) Maintain sufficient space between conduits to allow for proper installation of bushing.
- (3) Place aggregate under the box, not in the box. Aggregate should not encroach on the interior volume of the box.
- (4) Install a grounding bushing on the upper end of all RMC terminating in a ground box. Ground RMC elbows when any part of the elbow is less than 18 in. below the bottom of the ground box. Install a PVC bushing or bell end fitting on the upper end of all PVC conduits terminating in a ground box.

### GROUND BOX DIMENSIONS

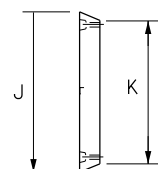
TYPE	OUTSIDE DIMENSIONS (INCHES) (Width x Length X Depth)
A	12 X 23 X 11
B	12 X 23 X 22
C	16 X 29 X 11
D	16 X 29 X 22
E	12 X 23 X 17

### GROUND BOX COVER DIMENSIONS

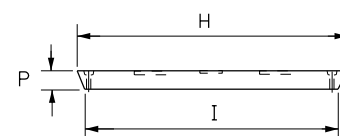
TYPE	DIMENSIONS (INCHES)							
	H	I	J	K	L	M	N	P
A, B & E	23 1/4	23	13 3/4	13 1/2	9 7/8	5 1/8	1 3/8	2
C & D	30 1/2	30 1/4	17 1/2	17 1/4	13 1/4	6 3/4	1 3/8	2



PLAN VIEW



END



SIDE

### GROUND BOX COVER

### GROUND BOXES

#### A. MATERIALS


1. Provide polymer concrete ground boxes measuring 16x30x24 in. (WxLxD) or smaller in accordance with Departmental Material Specification (DMS) 11070 "Ground Boxes" and Item 624 "Ground Boxes."
2. Provide Type A, B, C, D, and E ground boxes as shown in the plans, and as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 624.

3. Ensure ground box cover is correctly labeled in accordance with DMS 11070.

4. Provide larger ground boxes in accordance with Item 624 and as shown in the plans.

#### B. CONSTRUCTION METHODS

1. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure aggregate bed is in place and at least 9 inches deep, prior to setting the ground box. Install ground box on top of aggregate.
2. Cast ground box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Ground box aprons, including concrete and reinforcing steel, are subsidiary to ground boxes when called for by descriptive code.
3. Keep bolt holes in the box clear of dirt. Bolt covers down when not working in ground boxes.
4. Install all conduits and ells in a neat and workmanlike manner. Uniformly space conduits so grounding bushings and bell end fittings can easily be installed.
5. Temporarily seal all conduits in the ground box until conductors are installed.
6. Permanently seal conduits immediately after the completion of conductor installation and pull tests. Permanently seal the ends of all conduits with duct seal, expandable foam, or other method as approved. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a sealant.
7. When a ground rod is present in a ground box, bond all equipment grounding conductors together and to the ground rod with listed connectors.
8. When a type B or D ground box is stacked to meet volume requirements, it is allowable to cut an appropriately sized hole for conduit entry in the side wall at least 18 inches below grade.
9. If an existing ground box in the contract has a metal cover, bond the cover to the equipment grounding conductor with a 3 ft. long stranded bonding jumper the same size as the grounding conductor. The bonding jumper is subsidiary to various bid items. Verify existing ground boxes with metal covers are shown on the plans, with notes fully describing the work required.
10. If other ground boxes with metal covers are within the project limits but are not part of the contract, the Engineer may direct the Contractor to bond the metal covers, identifying the specific boxes in writing. This work will be paid for separately.
11. Bond metal ground box covers to the grounding conductor with a tank ground type lug.



Texas Department of Transportation

Traffic  
Operations  
Division  
Standard

ELECTRICAL DETAILS

GROUND BOXES

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ELECTRICAL SERVICES NOTES

1. Provide new materials. Ensure installation and materials comply with the applicable provisions of the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA) standards. Ensure material is Underwriters Laboratories (UL) listed. Provide and install electrical service conduits, conductors, disconnects, contactors, circuit breaker panels, and branch circuit breakers as shown on the Electrical Service Data chart in the plans. Faulty fabrication or poor workmanship in material, equipment, or installation is justification for rejection. Where manufacturers provide warranties and guarantees as a customary trade practice, furnish these to the State.
2. Provide electrical services in accordance with Electrical Details standard sheets, Departmental Material Specification (DMS) 11080 "Electrical Services," DMS 11081 "Electrical Services-Type A," DMS 11082 "Electrical Services-Type C," DMS 11083 "Electrical Services-Type D," DMS 11084 "Electrical Services-Type T," DMS 11085 "Electrical Services-Pedestal (PS)", and Item 628 "Electrical Services" of the Standard Specifications. Provide electrical service types A, C, and D, as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 628. Provide other service types as detailed on the plans.
3. Provide all work, materials, services, and any incidentals needed to install a complete electrical service as specified in the plans.
4. Coordinate with the Engineer and the utility provider for metering and compliance with utility requirements. Primary line extensions, connection charges, meter charges, and other charges by the utility company to provide power to the location are paid for in accordance with Item 628. Get approval for the costs associated with these charges prior to engaging the utility company to do the work. Consult with the utility provider to determine costs and requirements, and coordinate the work as approved.
5. The enclosure manufacturer will provide Master Lock Type 2 with brass tumblers keyed #2195 for all custom electrical enclosures. Installing Contractor is to provide Master Lock #2195 Type 2 with brass tumblers for "off the shelf" enclosures. Master Lock #2195 keys and locks become property of the State. Unless otherwise approved, do not energize electrical service equipment until locks are installed.
6. Enclosures with external disconnects that de-energize all equipment inside the enclosure do not need a dead front trim. Protect incoming line terminations from incidental contact as required by the NEC.
7. When galvanized is specified for nuts, screws, bolts or miscellaneous hardware, stainless steel may be used.
8. Provide wiring and electrical components rated for 75°C. Provide red, black, and white colored XHHW service entrance conductors of minimum size 6 American Wire Gauge (AWG). Identify size 6 AWG conductors by continuous color jacket. Identify electrical conductors sized 4 AWG and larger by continuous color jacket or by colored tape. Mark at least 6 inches of the conductor's insulation with half laps of colored tape, when identifying conductors. Ensure each service entrance conductor exits through a separately bushed non-metallic opening in the weatherhead. The lengths of the conductors outside the weatherhead are to be 12 inches minimum, 18 inches maximum, or as required by utility.
9. All electrical service conduit and conductors attached to the electrical service including the riser or the elbow below ground are subsidiary to the electrical service. For an underground utility feed, all service conduit and conductors after the elbow, including service conduit and conductors for the utility pole riser when furnished by the Contractor, will be paid for separately.
10. Provide rigid metal conduit (RMC) for all conduits on service, except for the 1/2 in. PVC conduit containing the electrical service grounding electrode conductor. Size the service entrance conduit as shown in the plans. Ensure conduit for branch circuit entry to enclosure is the same size as that shown on the layout sheets for branch circuit conduit. Extend all rigid metal conduits a minimum of 6 inches underground and then couple to the type and schedule of the conduit shown on the layout for that particular branch circuit. Install a grounding bushing on the RMC where it terminates in the service enclosure.
11. Use of liquidtight flexible metal conduit (LFMC) is allowed between the meter and service enclosure when they are mounted 90 to 180 degrees to each other. Size the LFMC the same size as service entrance conduit. LFMC must not exceed 3 feet in length. Strap LFMC within 1 foot of each end. LFMC less than 12 inches in length need not be strapped. Each end of LFMC must have a grounding bushing or be terminated with a grounding fitting. The LFMC must contain a grounded (neutral) conductor. Ensure any bend in LFMC never exceeds 180 degrees. A pull test is required on all installed conductors, with at least six inches of free conductor movement demonstrated to the satisfaction of the Engineer.
12. Ensure all mounting hardware and installation details of services conform to utility company specifications.
13. For all electrical service enclosures listed under Item 628 on the MPL, the UL 508 enclosure manufacturers will prepare and submit a schematic drawing unique to each service. Before shipment to the job site, place the applicable laminated schematic drawings and the laminated plan sheet showing the electrical service data chart used to build the enclosure in the enclosure's data pocket. The installing contractor will copy and laminate the actual project plan sheets detailing all equipment and branch circuits supplied by that service. The laminated plan sheets are to be placed in the service enclosure's document pocket. Reduce 11 in. x 17 in. plan sheets to 8 1/2 in. x 11 in. before laminating. If the installation differs from the plan sheets, the installing contractor is to redline plan sheets before laminating.
14. When providing an "Off The Shelf" Type D or Type T service, provide laminated plan sheets detailing equipment and branch circuits supplied by that service. Reduce 11 in. x 17 in. plan sheets to 8 1/2 in. x 11 in before laminating. Deliver these drawings before completion of the work to the Engineer, instead of placing in enclosure that has no door pocket.
15. Do not install conduit in the back wall of a service enclosure where it would penetrate the equipment mounting panel inside the enclosure. Provide grounding bushings on all metal conduits, and terminate bonding jumpers to grounding bus. Grounding bushings are not required when the end of the metal conduit is fitted with a conduit sealing hub or threaded boss, such as a meter base hub.

SERVICE ASSEMBLY ENCLOSURE

1. Provide threaded hub for all conduit entries into the top of enclosure.
2. Type galvanized steel (GS) enclosures may be used for Type C panelboards and for Type D and T services that do not use an enclosure mounted photocell or lighting contactor. Provide GS enclosures in accordance with DMS 11080, 11082, 11083, and 11084.
3. Provide aluminum (AL) and stainless steel (SS) enclosures for Types A, C, and D in accordance with DMS 11080, 11081, 11082, 11083, and 11084. Do not paint stainless steel.
4. Provide pedestal service (PS) enclosures in accordance with ED(9) and DMS 11080 and 11085. Do not provide GS pedestal services. If GS is shown in the PS descriptive code, provide an AL enclosure.

MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS

1. Field drill flange-mounted remote operator handle if needed, to ensure handle is lockable in both the "On" and "Off" positions.
2. When the utility company provides a transformer larger than 50 KVA, verify that the available fault current is less than the circuit breaker's ampere interrupting capacity (AIC) rating and provide documentation from the electric utility provider to the Engineer.

PHOTOELECTRIC CONTROL

1. Provide photocell as listed on the MPL. Move, adjust, or shield the photocell from stray or ambient night time light to ensure proper operation. Mount photocell facing north when practical. Mount top of pole photocells as shown on Top Mounted Photocell Detail.

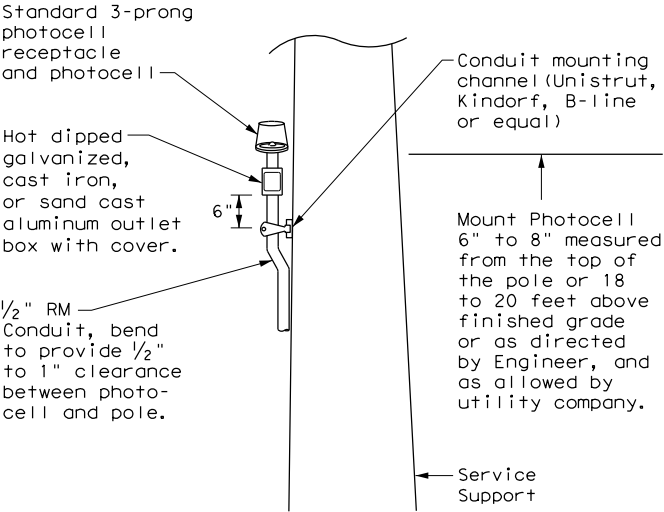
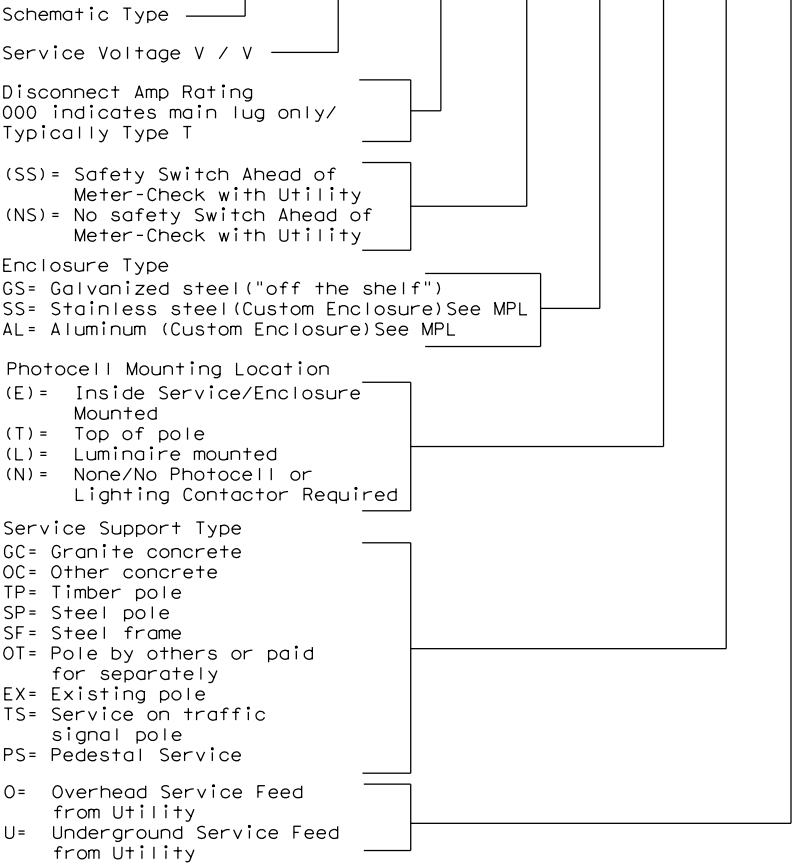
* ELECTRICAL SERVICE DATA												
Elec. Service ID	Plan Sheet Number	Electrical Service Description	Service Conduit *xSize	Service Conductors No./Size	Safety Switch Amps	Main Ckt. Bkr. Pole/Amps	Two-Pole Contractor Amps	Panelbdr/ Loadcenter Amp Rating	Branch Circuit ID	Branch Ckt. Bkr. Pole/Amps	Branch Circuit Amps	KVA Load
SB 183	289	ELC SRV TY A 240/480 100(SS)AL(E)SF(U)	2"	3/#2	100	2P/100	100	N/A	Lighting NB	2P/40	26	28.1
									Lighting SB	2P/40	25	
									Underpass	1P/20	15	
NB Access	30	ELC SRV TY D 120/240 060(NS)SS(E)TS(O)	1 1/4"	3/#6	N/A	2P/60		100	Sig. Controller	1P/30	23	5.3
							30		Luminaïres	2P/20	9	
									CCTV	1P/20	3	
2nd & Main	58	ELC SRV TY T 120/240 000(NS)GS(N)SP(O)	1 1/4"	3/#6	N/A	N/A	N/A	70	Flashing Beacon 1	1P/20	4	1.0
									Flashing Beacon 2	1P/20	4	

\* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.

\*\* Verify service conduit size with utility. Size may change due to utility meter requirements. Ensure conduit size meets the National Electrical Code.

EXPLANATION OF ELECTRICAL SERVICE DESCRIPTIVE CODE

ELEC SERV TY X XXX/XXX XXX (XX) XX (X) XX (X)



TOP MOUNTED PHOTOCELL

Install conduit strap maximum 3 feet from box. 5 foot maximum spacing between straps supporting conduit.

Traffic Operations Division Standard

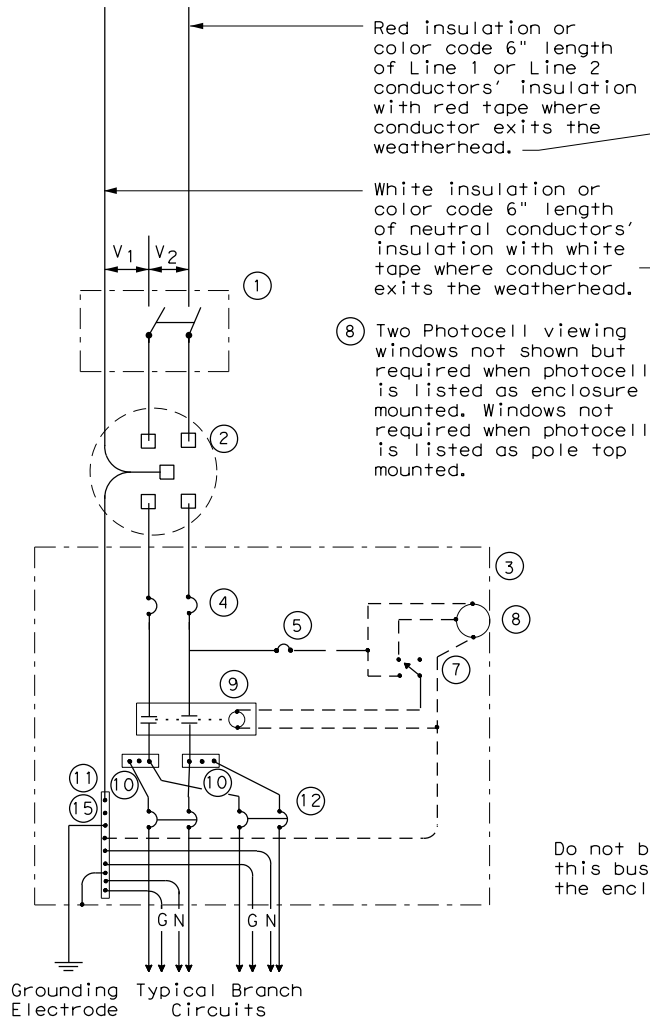
ELECTRICAL DETAILS  
SERVICE NOTES & DATA

ED(5) - 14

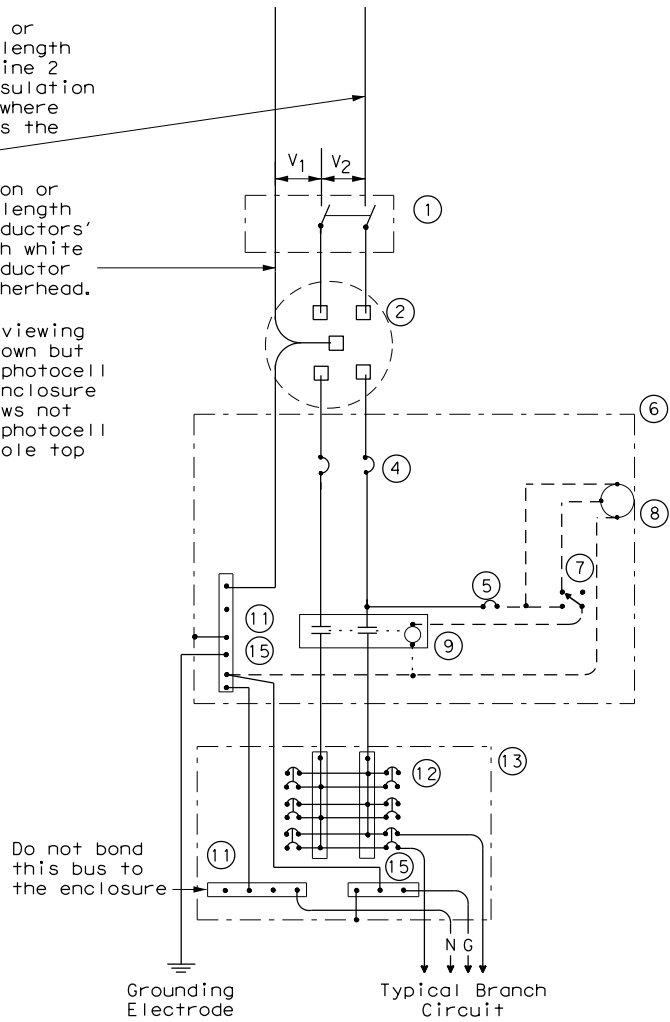
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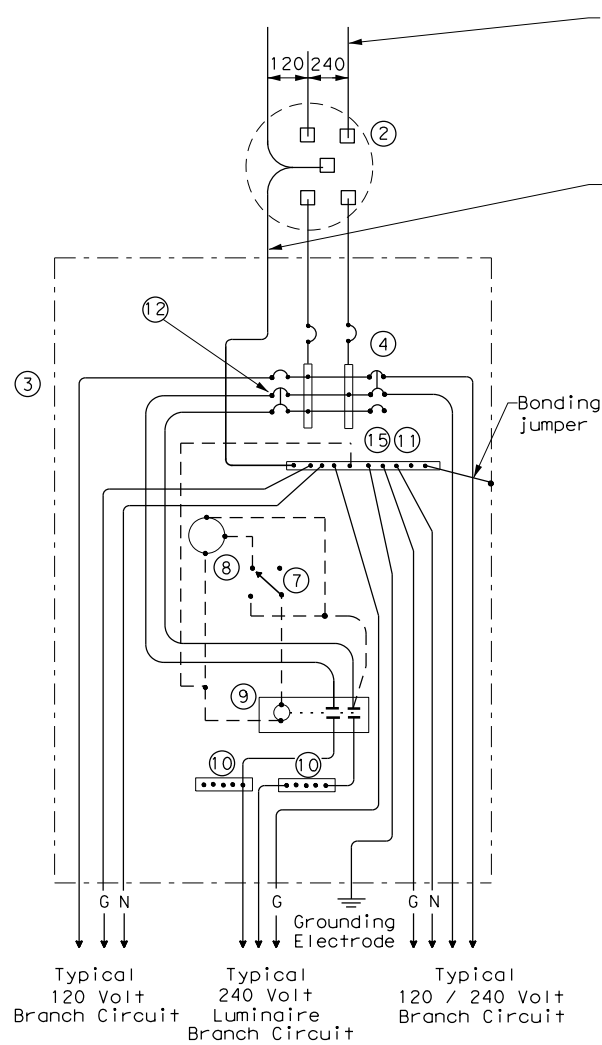
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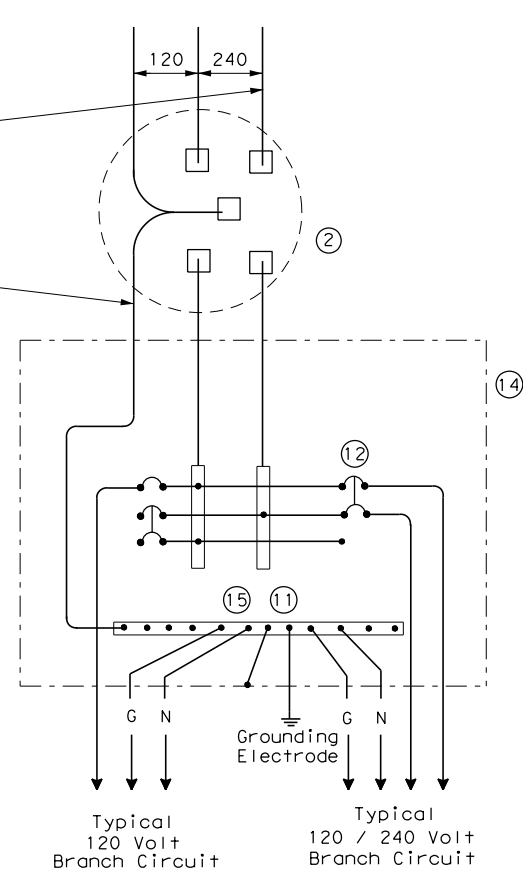
SCHEMATIC TYPE A  
THREE WIRE



SCHEMATIC TYPE C  
THREE WIRE




SCHEMATIC TYPE D - CUSTOM  
120/240 VOLTS - THREE WIRE



SCHEMATIC TYPE T  
120/240 VOLTS - THREE WIRE  
Galvanized steel-"Buy Off The Shelf" only. When required install photocell top of the pole or on luminaire only, no lighting contractor will be installed.

WIRING LEGEND	
—	Power Wiring
- - - -	Control Wiring
—N—	Neutral Conductor
—G—	Equipment grounding conductor-always required

SCHEMATIC LEGEND	
1	Safety Switch (when required)
2	Meter (when required-verify with electric utility provider)
3	Service Assembly Enclosure
4	Main Disconnect Breaker (See Electrical Service Data)
5	Circuit Breaker, 15 Amp (Control Circuit)
6	Auxiliary Enclosure
7	Control Station ("H-O-A" Switch)
8	Photo Electric Control (enclosure-mounted shown)
9	Lighting Contactor
10	Power Distribution Terminal Blocks
11	Neutral Bus
12	Branch Circuit Breaker (See Electrical Service Data)
13	Separate Circuit Breaker Panelboard
14	Load Center
15	Ground Bus

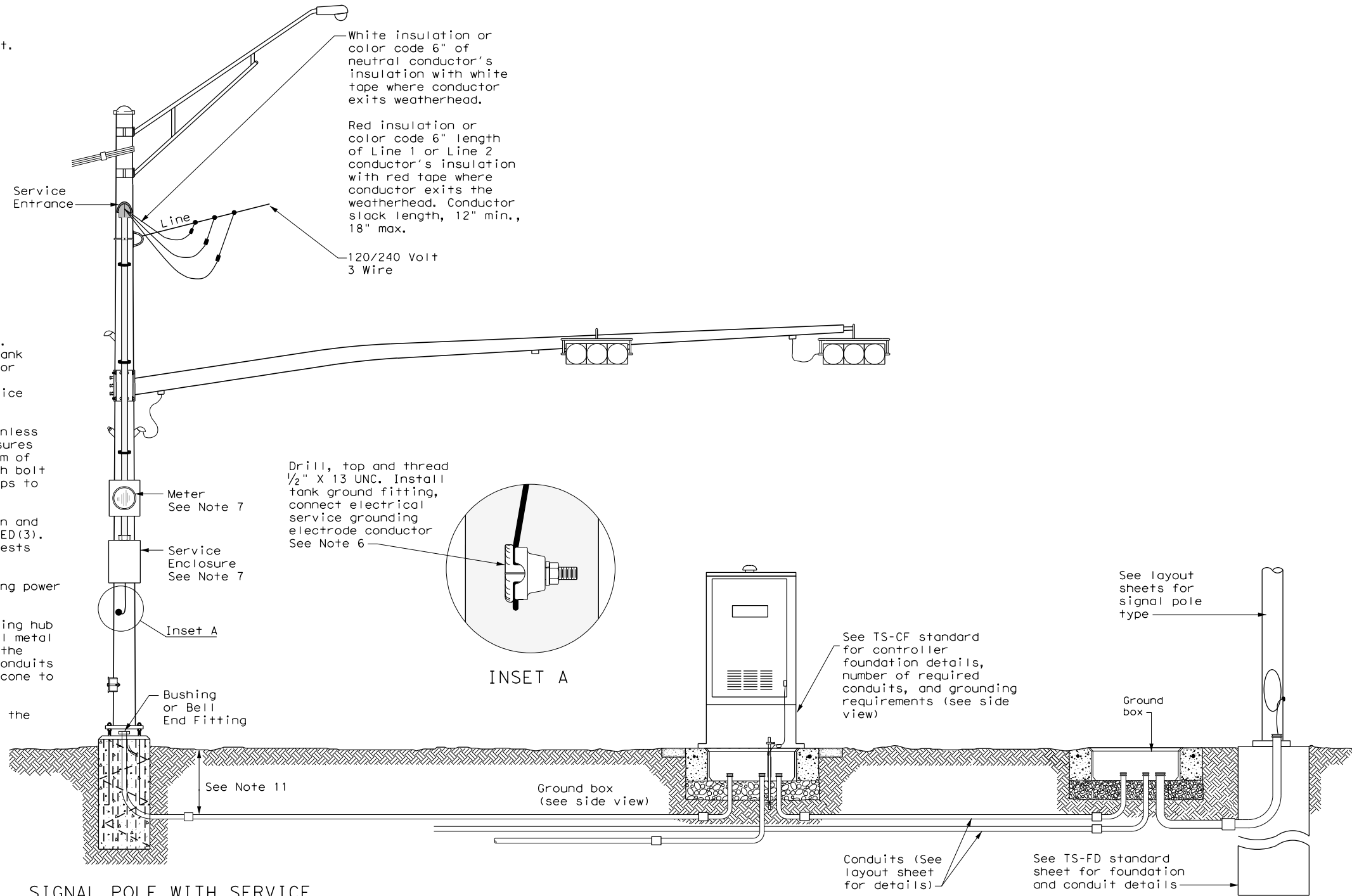
 <b>Texas Department of Transportation</b>		<b>Traffic Operations Division Standard</b>	
<div>ELECTRICAL DETAILS</div> <div>SERVICE ENCLOSURE</div> <div>AND NOTES</div> <div>ED (6) - 14</div>			
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	DIST	COUNTY	SHEET NO.
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TRAFFIC SIGNAL NOTES

1. Do not pass luminaire conductors through the signal controller cabinet.
2. Include an equipment grounding conductor in all conduits throughout the electrical system. Bond all exposed metal parts to the grounding conductor.
3. Provide roadway luminaires, when required, in accordance with the material and construction sections of Item 610, "Roadway Illumination Assemblies," except for performance testing of luminaires. Test installed roadway luminaires for proper operation as a part of the associated traffic signal system test.
4. If internally illuminated street name signs are approved for use, ground the fixture to the pole with a 12 AWG green XHHW conductor.
5. Bond anchor bolts to rebar cage in two locations using #3 bars or 6 AWG stranded copper conductors. Use listed mechanical connectors rated for embedment in concrete. See TxDOT standard TS-FD for further details.
6. Drill and tap signal poles for 1/2 in. X 13 UNC tank ground fitting. Provide and install tank ground fitting 4 in. to 6 in. directly below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Connect the electrical service grounding electrode conductor to the tank ground fitting. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. See Inset A detail for further information. Size service entrance conduit and branch circuit conduit as shown in the plans.
7. Mount electrical service enclosure and meter to signal pole with stainless steel bands. Ensure bands are a minimum width of 3/4 in. Secure enclosures to bands using two-bolt brackets. Install brackets near top and bottom of each enclosure. Install properly sized stainless steel washers on each bolt in the enclosure. Band or drill and tap properly sized stand-off straps to signal pole for attaching conduit.
8. Conduct pull tests and insulation resistance tests on all illumination and power conductors as required in Item 620 "Electrical Conductors" and ED(3). To prevent electronics damage, do not conduct insulation resistance tests on traffic signal cables after termination.
9. Lock all enclosures and bolt down all ground box covers before applying power to the signal installation.
10. Terminate conduits entering the top of enclosures with a conduit-sealing hub or threaded boss such as meter hub. Install a grounding bushing on all metal conduits not connected to conduit-sealing hub or threaded boss. Bond the grounding bushing to the ground bus with a bonding jumper. Seal all conduits entering enclosures with duct seal or expanding foam. Do not use silicone to seal conduit ends.
11. For all conduits, ensure the burial depth is a minimum of 18". Ensure the minimum burial depth for conduit placed under a roadway is 24".

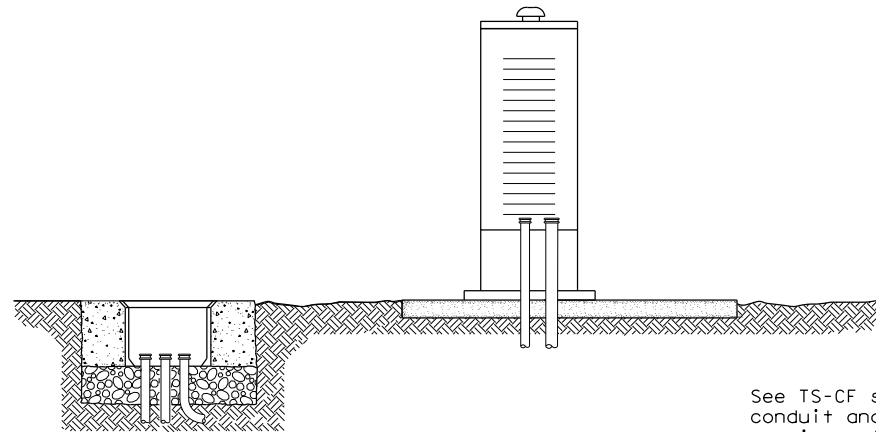


SIGNAL POLE WITH SERVICE

Type T electrical service mounted on signal pole shown as an example. See electrical details, layout sheets, and electrical service data chart for additional details.


SIGNAL CONTROLLER FRONT VIEW

SIGNAL POLE



SIGNAL CONTROLLER SIDE VIEW

See TS-CF standard for conduit and grounding requirements. See layout sheets for ground box locations and any additional conduits that are required.



Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS  
TYPICAL TRAFFIC SIGNAL  
SYSTEM DETAILS

ED(8) - 14

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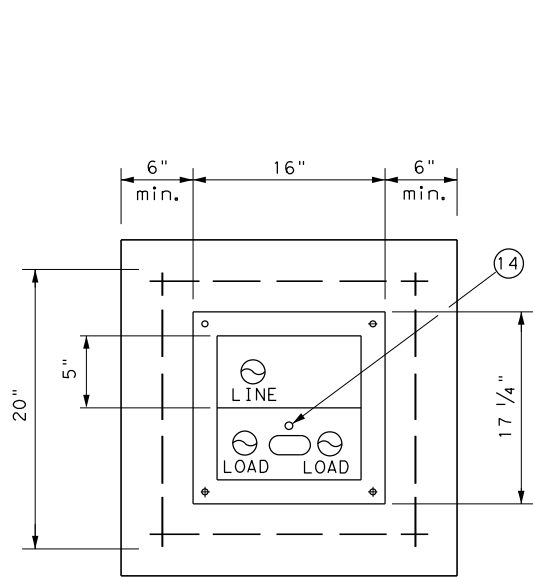
71H

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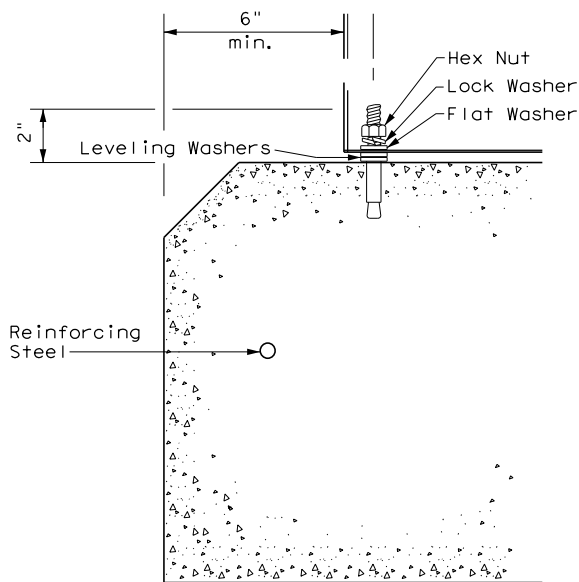
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PEDESTAL SERVICE NOTES

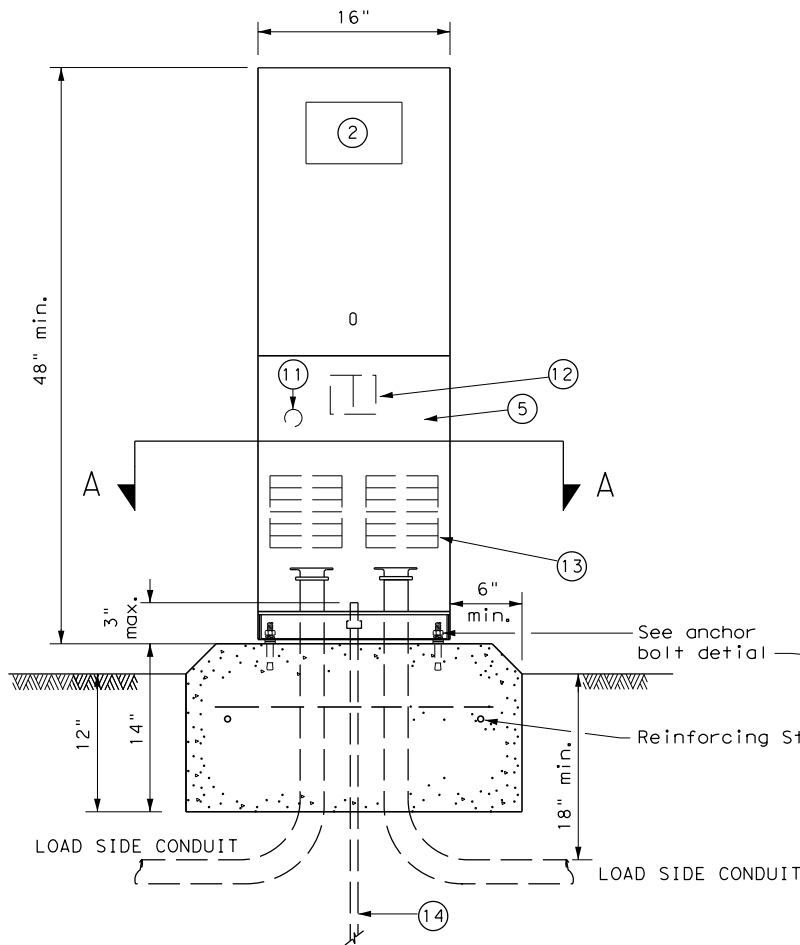
1. Manufacture pedestal electrical services in accordance with Departmental Material Specifications (DMS)11080 "Electrical Services", 11085 "Electrical Services-Pedestal (PS)" and Item 628 "Electrical Services. "Provide pedestal electrical services as listed on the Material Producers list (MPL) on the Department's web site under "Roadway Illumination and Electrical Supplies," Item 628. Ensure all mounting hardware and installation details of services meet utility company specifications. Contact the local utility company for approval of pedestal details prior to installing the electrical pedestal service. Submit any changes required by the utility company prior to manufacturing the pedestal enclosure.
2. When a meter socket is required, provide a socket with a minimum 100 amp rating that complies with local utility requirements.
3. Provide Class A or C concrete for pedestal service foundations in accordance with Item 420, "Concrete Substructures," except that concrete will not be paid for directly but is considered subsidiary to Item 628.
4. Provide #4 reinforcing steel for foundations in accordance with Item 440, "Reinforcement for Concrete."
5. Install 1/2 in. X 2 1/6 in. minimum length concrete single expansion type anchors for mounting pedestal enclosure to foundation. Anchor location to match mounting holes in each corner of enclosure. Secure each of the four corners of the pedestal enclosure to the anchors in the foundation with a 1/2 in. galvanized or stainless steel machine thread bolt, a properly sized locknut and a flat washer.
6. Finish top of concrete foundation in a neat and workmanlike manner. If leveling washers are used, ensure no more than 1/8 in. gap at any corner. Do not exceed a maximum dip or rise in the foundation of 1/8 in. per foot. When properly installed, ensure the top of the service enclosure is level front to back and side to side within 1/4 in. Repair rocking or movement of the service enclosure at no additional cost to the department.
7. Do not use liquidtight flexible metal conduit (LFMC) on pedestal type services.
8. Ensure all elbows in the foundation are sized as per utility provider's conduit requirements for underground conduit and feeders. PVC extensions may be installed provided the ends of the rigid metal conduits are more than 2 in. below the top of the concrete foundation. Where extension conduits are metal, grounding bushings must be installed with a bonding jumper properly terminated.



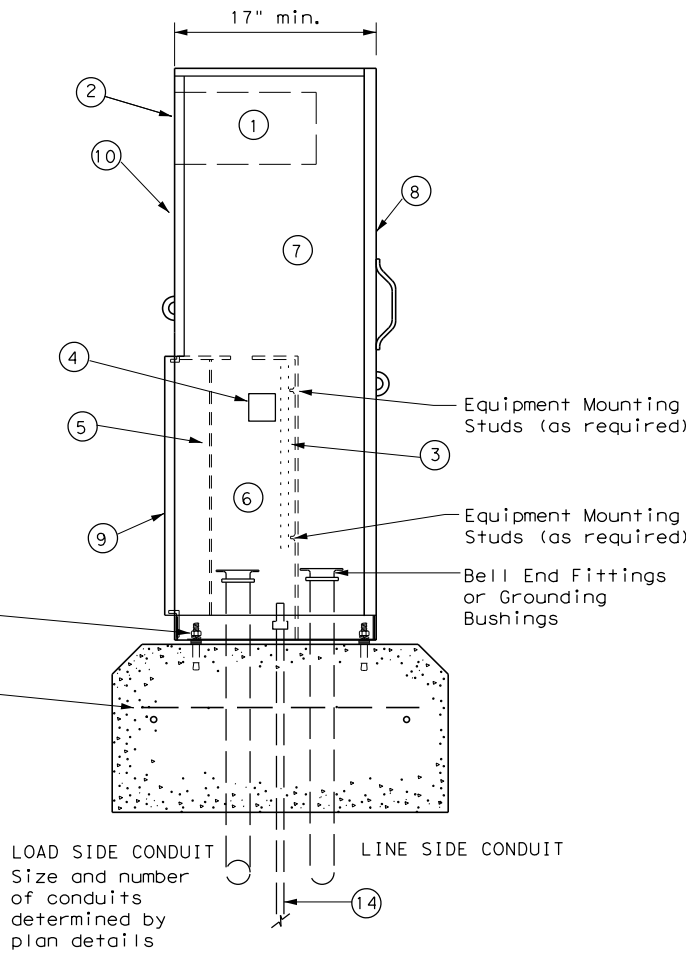
SECTION A-A



ANCHOR BOLT DETAIL



FRONT VIEW




SIDE VIEW

TYPE C shown, TYPE A similar except that TYPE A shall have individual circuit breakers (CB) mounted on an equipment mounting panel. CB Handles shall protrude through hinged deadfront trim.

LEGEND

1	Meter Socket, (when required)
2	Meter Socket Window, (when required)
3	Equipment Mounting Panel
4	Photo Electric Control Window, (When required)
5	Hinged Deadfront Trim
6	Load Side Conduit Trim
7	Line Side Conduit Area
8	Utility Access Door, with handle
9	Pedestal Door
10	Hinged Meter Access
11	Control Station (H-O-A Switch)
12	Main Disconnect
13	Branch Circuit Breakers
14	Copper Clad Ground Rod - 5/8" X 10'

**Texas Department of Transportation**

**Traffic Operations Division Standard**

**ELECTRICAL DETAILS**  
**ELECTRICAL SERVICE SUPPORT**  
**PEDESTAL SERVICE TYPE PS**  
**ED(9) - 14**

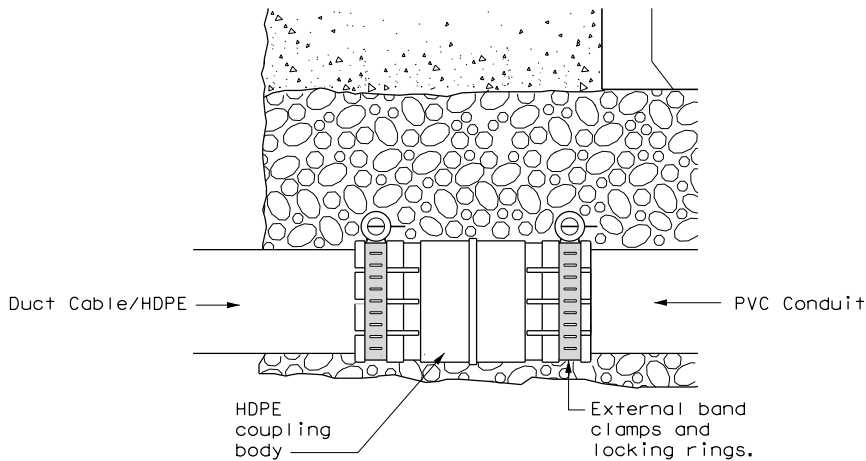
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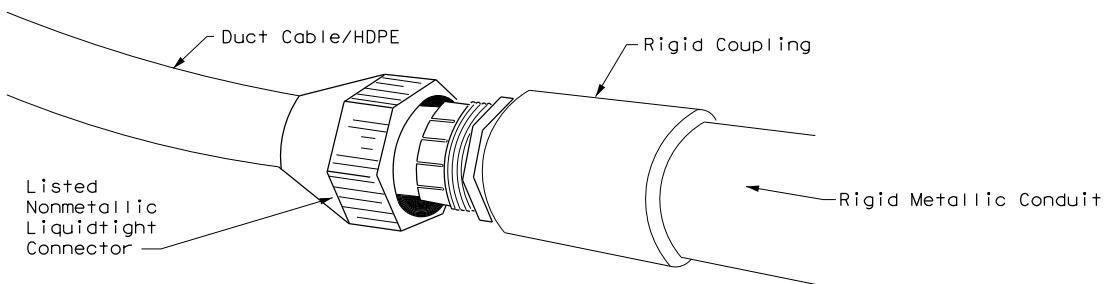
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DUCT CABLE & HDPE CONDUIT NOTES

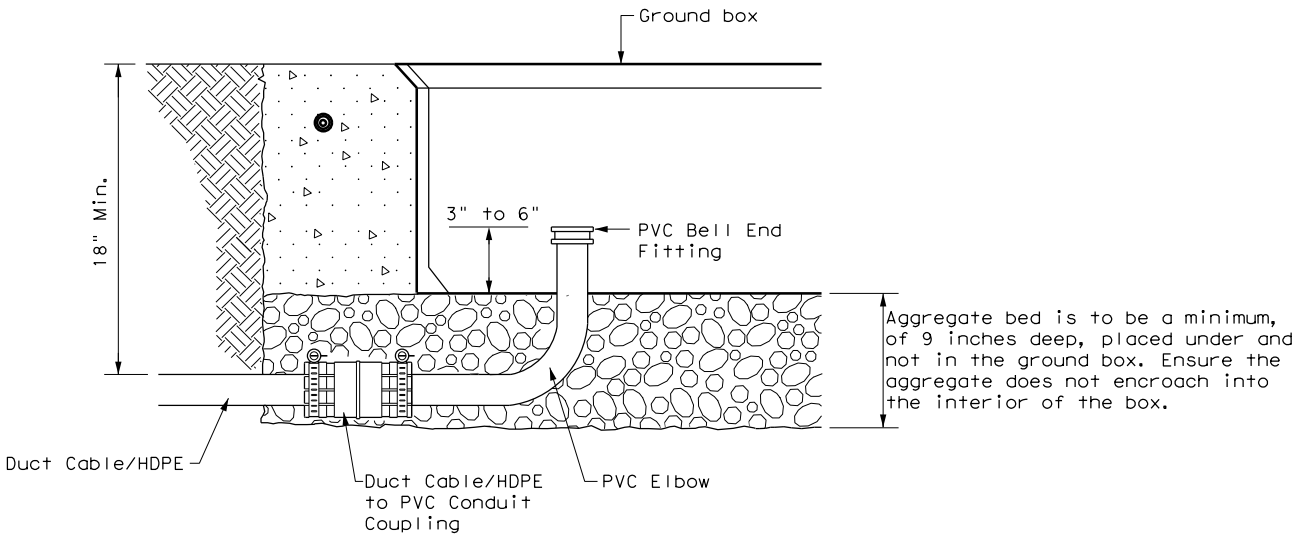
1. Provide duct cable in accordance with Departmental Material Specification (DMS) 11060 "Duct Cable" and Item 622 "Duct Cable." Provide duct cable as listed on the Material Producer List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 622.
2. Provide High-Density Polyethylene (HDPE) conduit in accordance with DMS 11060 and Item 618, "Conduit." Provide HDPE as listed on the MPL on the Department web site under "Roadway Illumination and Electrical Supplies," Item 618.
3. Supply duct cable with a minimum 2 in. diameter, unless otherwise shown in the plans. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Bend duct cable and HDPE conduit as recommended by the manufacturer, with a minimum bending radius of 26 in. for 2 in. duct. Follow manufacturers' recommendations when handling duct cable and HDPE conduit reels and during installation of duct cable and HDPE conduit.
4. Do not splice conductors within duct cable or HDPE conduit. Couple duct cable and HDPE entering a ground box or foundation to a PVC elbow. When galvanized steel RMC elbows are called for in the plans and any portion of the RMC elbow is buried less than 18" from possible contact, ground the RMC elbow.
5. Furnish and install duct cable with factory installed conductors, sized as shown in the plans and as required by the National Electrical Code (NEC). The NEC contains specific requirements for duct cable in Article, "Nonmetallic Underground Conduit with Conductors: Type NUCC."
6. When conduit casing is called for in the plans, extend duct cable or HDPE conduit through the conduit casing in one continuous length without connection to the casing.
7. Seal the ends of duct cable or HDPE conduit with duct seal, expandable foam, or other approved method after completing the pull tests required by Item 622.
8. Provide minimum cover of 24 in. under roadways, 18 in. in other locations, or as shown on the plans.
9. Furnish and install listed fittings to couple duct cable or HDPE conduit to other types of conduit. Duct cable and HDPE conduit may be field-threaded and spliced with PVC or RMC threaded couplings; connected with listed tie-wrap fittings; connected using listed coupling made of HDPE with stainless steel external banding clamps and locking rings; connected with approved electrofusion conduit couplings; or connected using an approved chemical fusion method using an epoxy or adhesive specifically designed for HDPE couplings and connectors all installed in accordance with their manufacturer's instructions. Do not use PVC glue on HDPE. Do not use water pipe fittings, or connect conduit with heat shrink tubing.



DUCT CABLE/HDPE TO PVC

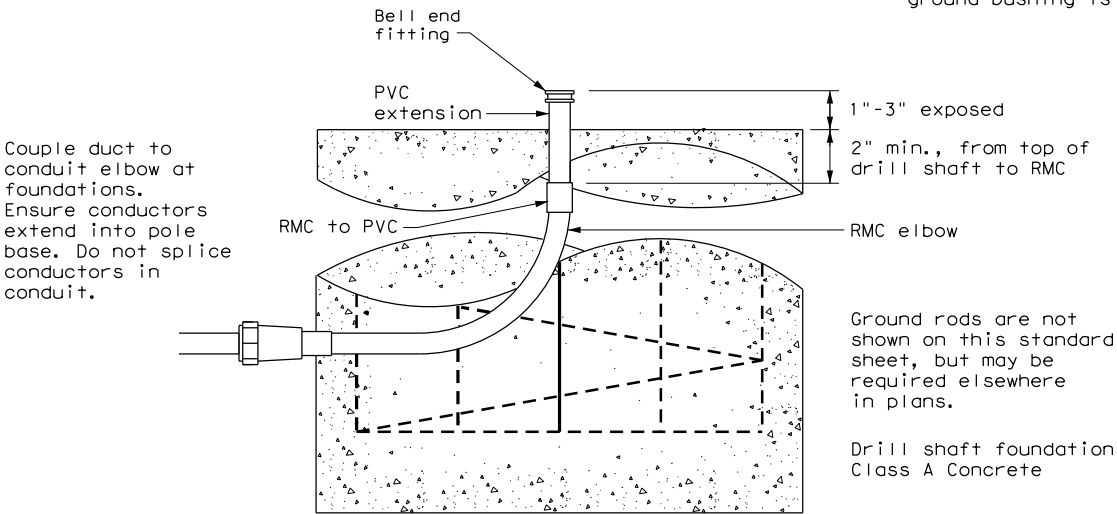


DUCT CABLE/HDPE TO RMC

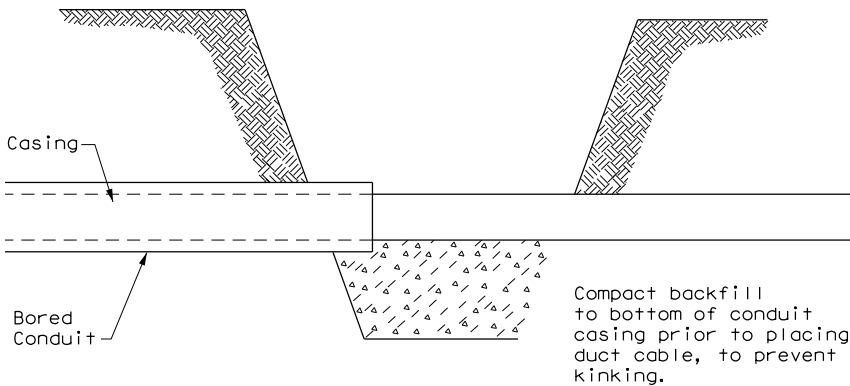


DUCT CABLE/HDPE AT GROUND BOX

When the upper end of an RMC Ell does not enter the ground box, it may be extended with a SCH-40 PVC conduit nipple and bell end, provided there is a minimum of 18" of cover over all parts of the elbow. If not, a rigid extension and ground bushing is required.



DUCT CABLE / HDPE AT FOUNDATION



BORE PIT DETAIL

Traffic  
Operations  
Division  
Standard

ELECTRICAL DETAILS  
DUCT CABLE/  
HDPE CONDUIT

ED(11) - 14

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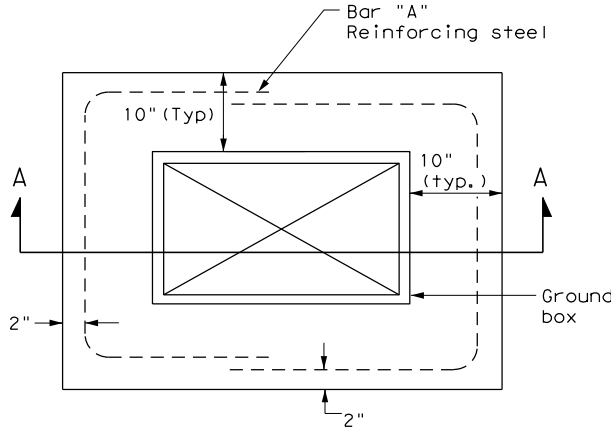
BATTERY BOX GROUND BOXES NOTES

A. MATERIALS

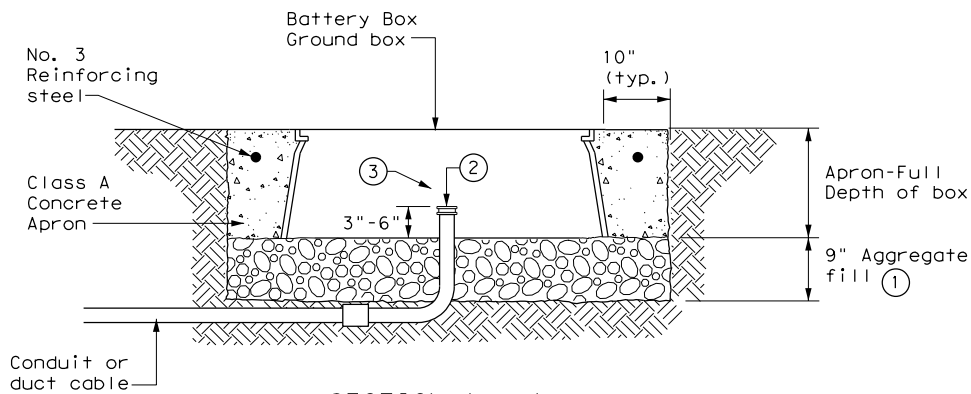
1. Provide polymer concrete or fiberglass reinforced plastic (FRP) battery box ground box and cover in accordance with Departmental Material Specification (DMS) 11071 "Battery Box Ground Boxes." Battery box will accommodate up to 4 batteries, each measuring 8 in. x 13.5 in. x 10 in. (W x L x D). Label battery box ground box cover in accordance with DMS 11071.
2. Supply a marine grade batteries with covers. Secure the marine grade batteries with covers to the stainless steel rack in the bottom of the ground box with tie down straps.

B. CONSTRUCTION METHODS

1. Ensure conduit entry will not interfere with placement of the batteries in the battery box ground box.
2. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting battery box ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure the aggregate bed is in place and is a minimum of 9 in. deep prior to setting the box. Install battery box ground box on top of aggregate.
3. Cast battery box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Battery box ground box aprons, including concrete and reinforcing steel, are subsidiary to battery box ground boxes when called for by descriptive code.
4. Bolt covers down when not working in battery box ground boxes. Keep bolt holes in the box clear of dirt.



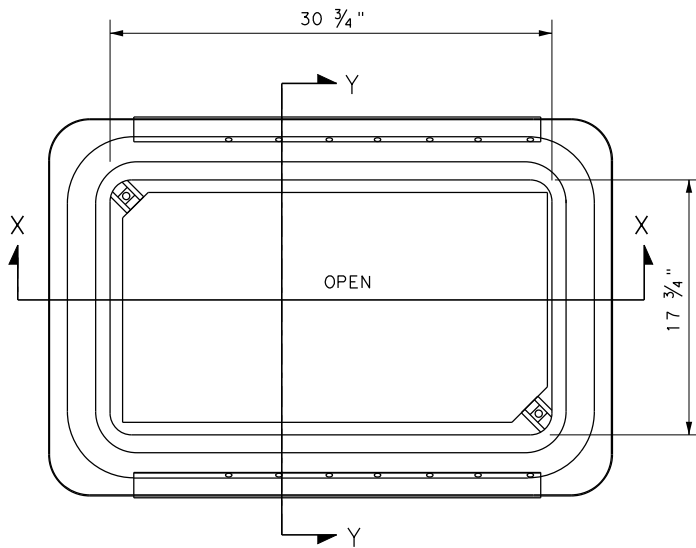
PLAN VIEW



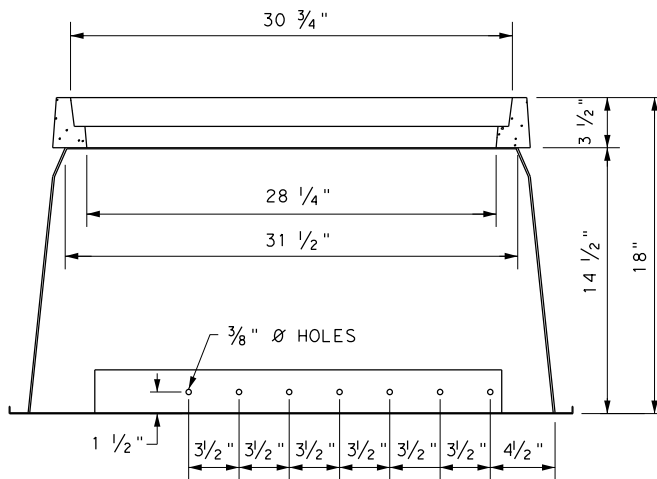
SECTION A - A

APRON FOR BATTERY BOX GROUND BOXES

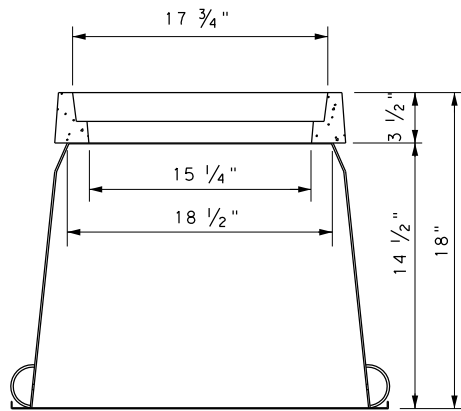
- ① Place aggregate under the box and not in the box. Aggregate should not encroach on the interior volume of the box.
- ② Install bushing or bell end fitting on the upper end of all ells.
- ③ Install all conduits in a neat and workmanlike manner.



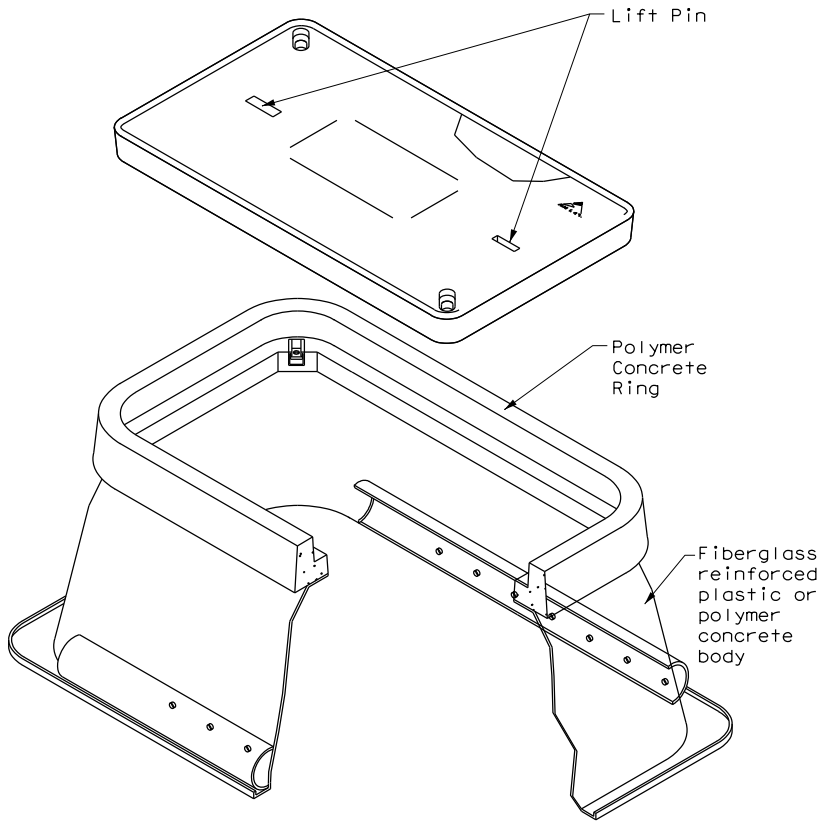
BATTERY BOX TOP VIEW




SECTION X-X



SECTION Y-Y





Texas Department of Transportation

Traffic Operations Division Standard

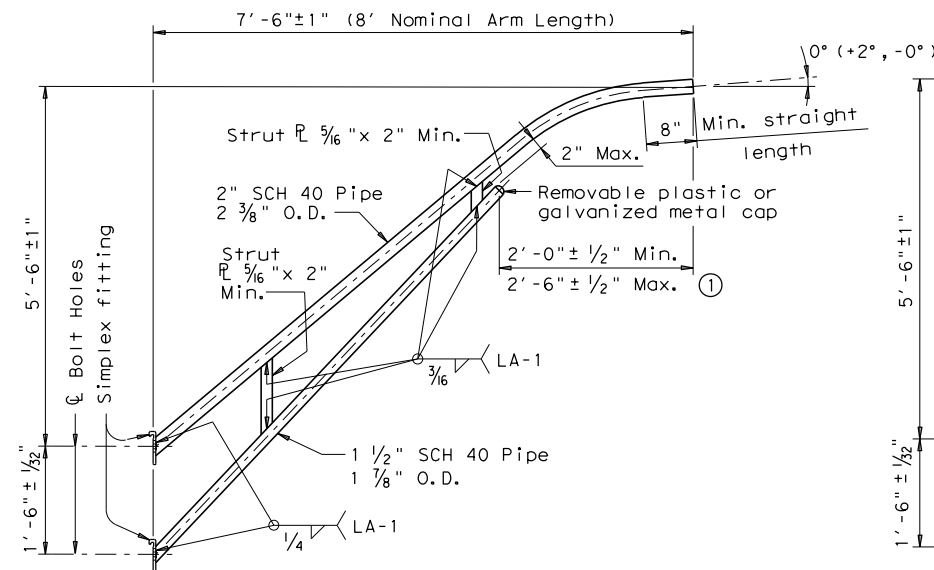
ELECTRICAL DETAILS  
BATTERY BOX  
GROUND BOXES

ED(12) - 14

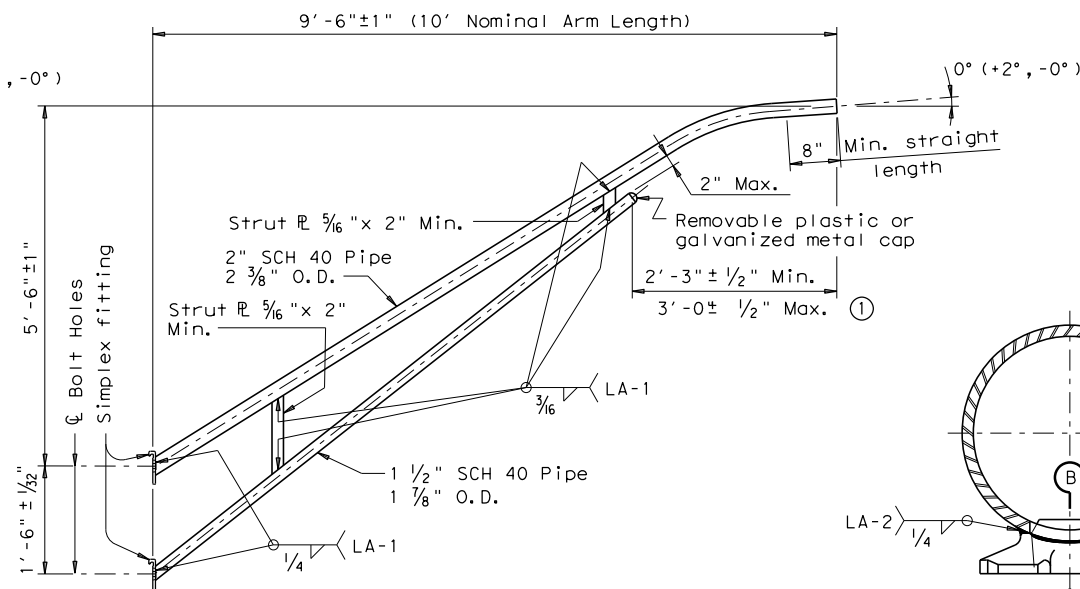
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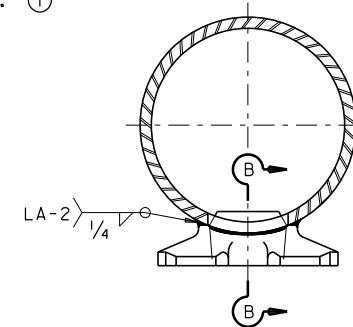
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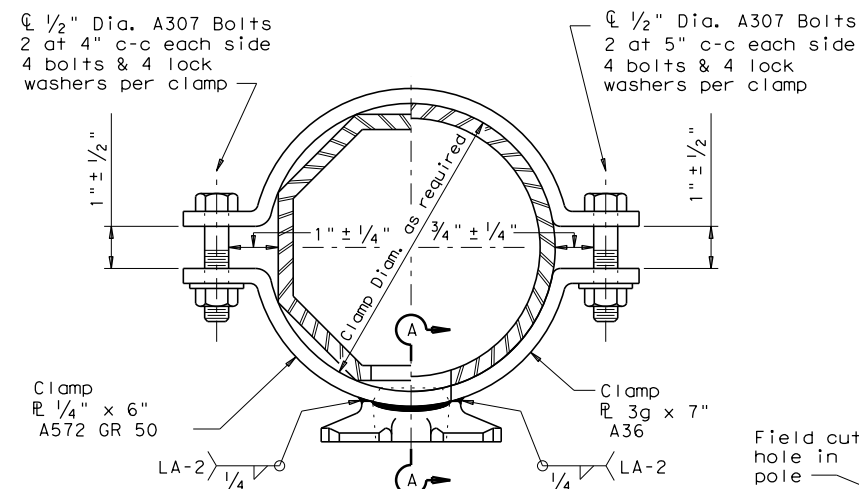
8-FOOT LUMINAIRE ARM



10-FOOT LUMINAIRE ARM

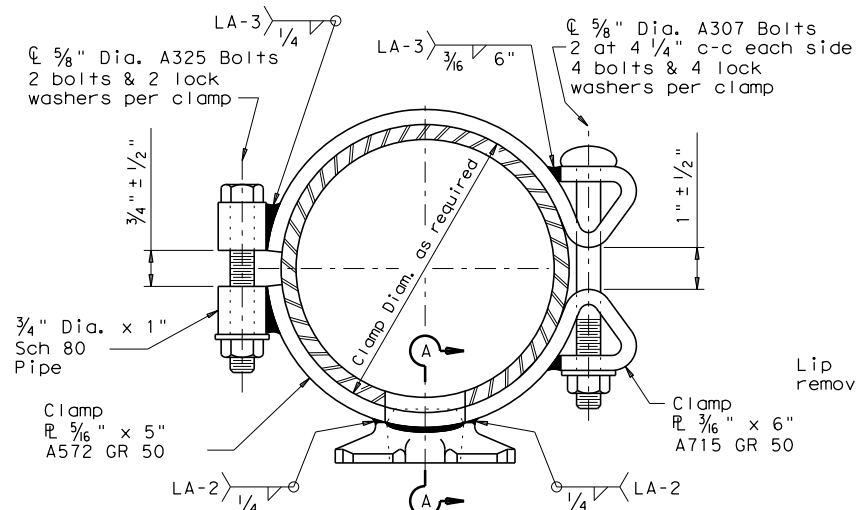


DIRECT ATTACHMENT DETAIL



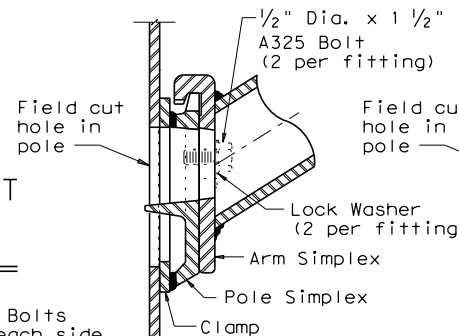
CLAMP ATTACHMENT DETAIL NO. 1 (HALF SECTION)

CLAMP ATTACHMENT DETAIL NO. 2 (HALF SECTION)

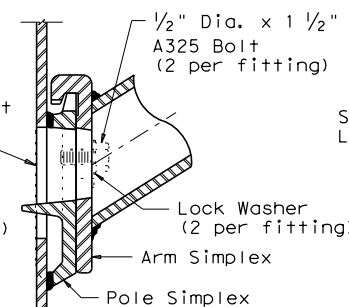


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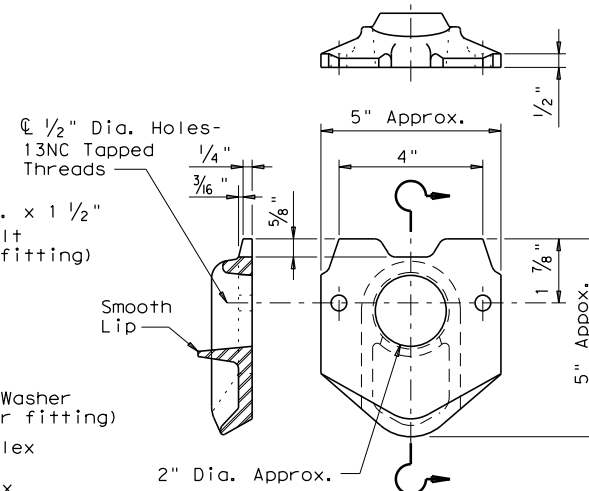
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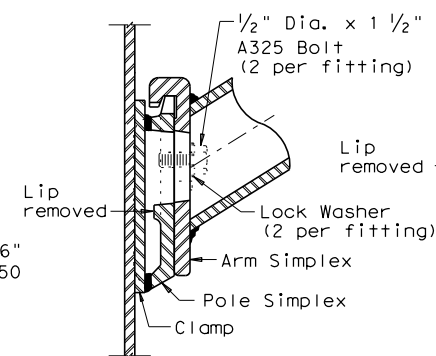
UPPER SIMPLEX FITTING



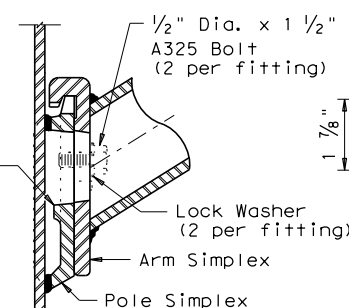
UPPER SIMPLEX FITTING



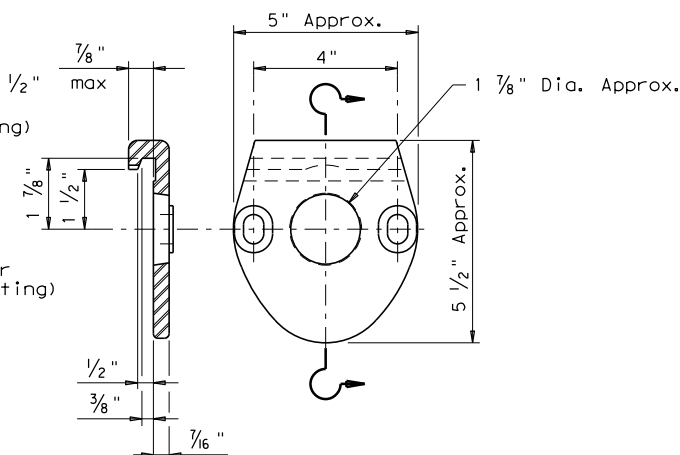
POLE SIMPLEX DETAIL



LOWER SIMPLEX FITTING



LOWER SIMPLEX FITTING



ARM SIMPLEX DETAIL

MATERIALS	
Pole or Arm Simplex	ASTM A27 Gr.65-35 or A148 Gr.80-50, A576 Gr.1021 ③, or A36 (Arm only)
Arm Pipes	ASTM A53 Gr.B, A501, A1008 HSLAS-F Gr.50 ④, or A1011 HSLAS-F Gr.50 ④
Arm Strut Plates ②	ASTM A36, A572 Gr.50 ④, or A588
Misc.	ASTM designations as noted

- ① Dimensional limits are given to show acceptable variation in design. All of a Fabricator's production of a particular arm length shall have the same dimensions within specified tolerances.
- ② Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.
- ③ A576 must be suitable for forging and also meet minimum tensile strength of 65 ksi, minimum yield of 35 ksi, and elongation in 2 inches of 22 percent.
- ④ ASTM A572, A1008 HSLAS-F, and A1011 HSLAS-F may have higher yield strengths but shall not have less elongation than the grade indicated.

GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Revisions thereto. Design Wind Speed equals 90 mph plus a 1.3 gust factor. Arms are designed to support a 60 lb. luminaire having an effective projected area (actual area times drag coefficient) of 1.6 sq. ft.

Materials and fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. In the absence of specified Fabrication tolerances, dimensions shall be within the tolerances generally obtainable in normal fabrication practice.

Unless otherwise noted, all parts shall be galvanized after fabrication in accordance with Item 445, "Galvanizing".

Deviation from the details and dimensions shown herein require submission of shop drawings in accordance with Item 441, "Steel Structures". Alternate designs are not acceptable.

Each pole simplex fitting shall be supplied with 2 ASTM A325 bolts and 2 lock washers of the size specified. The bolts and lock washers shall be secured to the pole with the other hardware items called for in the plans. When clamp attachment is specified, the Fabricator shall ship the clamp assembly securely attached to the pole at the location shown on the plans.

If clamp assemblies are ordered without poles, the Fabricator shall ship one upper and one lower clamp assembly together in a single package, including all nuts and washers required for the clamps and simplex fittings.

Texas Department of Transportation  
Traffic Operations Division

STANDARD ASSEMBLY  
DRAWINGS FOR LUMINAIRE  
SUPPORT STRUCTURES

ARM DETAILS

LUM-A-12

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5-96 1-99 1-12	REVISIONS	CONT	SECT	JOB
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Technical drawing of a 12-inch diameter, 12-foot long pole assembly. The drawing shows a cross-section of the pole with a 4-inch diameter hole for a pole and a 2 1/2-inch diameter hole in the plate. It also shows a side view of the pole with dimensions A, B, C, D, D1, and E. The pole is made of MC-1 material, and the plate is made of MC-2 material. The pole is secured with 1/4 inch MC-3 bolts. The drawing includes a note: "Deburr holes and offset as shown for drainage".

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MC-1  $\frac{3}{16}$  or 7g  $\frac{3}{16} \times \frac{3}{16}$

$\frac{1}{4}$   $\frac{1}{16} \times \frac{1}{4}$

B

D

D<sub>1</sub>

Base  
O.D.

Arm

1  $\frac{3}{4}$ "

$\frac{3}{8}$ " Gussets R  
(top & bottom)

See "Detail A"  
(Option #1)

See "Detail B"  
(Option #2)

$\frac{3}{8}$ " Gusset R

Conn. Bolts  
(4 total with  
1 flat & 1 lock  
washer each)

A

C

#

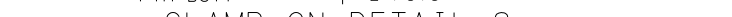
Pole

5/16" MC-2

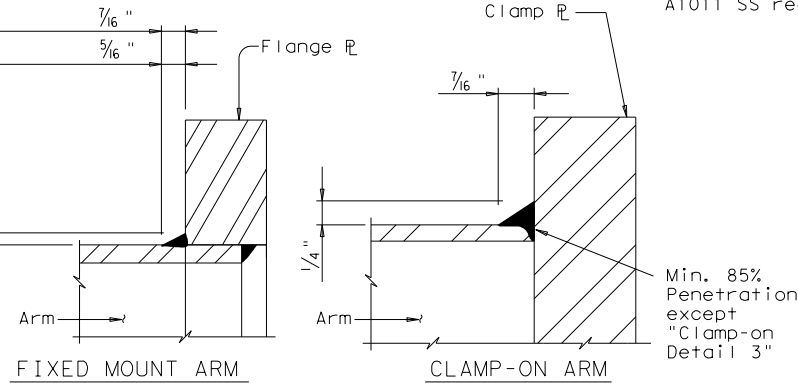
2  $\frac{1}{2}$ " dia hole  
in pole & plate

Deburr holes and  
offset as shown  
for drainage

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[illegible]

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[illegible]

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- ① ASTM A572, A1008 HSLAS, A1011 HSLAS, A1008 HSLAS-F, A1011 HSLAS-F or A1011 SS may have higher yield strengths but shall not have less elongation than the grade indicated.
- ② ASTM A1011 SS Gr.50 material shall also have a minimum elongation of 18 percent in 8 inches or 23 percent in 2 inches. Material thickness in excess of those stipulated under A1011 SS will be acceptable providing the material meets all other A1011 SS requirements and the requirements of this item.



Min. 85% Penetration except "Clamp-on Detail 3"

Clamp-on details are

Fixed mount details are used for single mast arm assemblies and for the first arm on dual mast arm assemblies.

Where duplicate parts occur on a detail, welds shown for one part shall apply to all similar parts on the detail.

Pin bolts are required to prevent rotation of clamp-on arms under design wind forces.

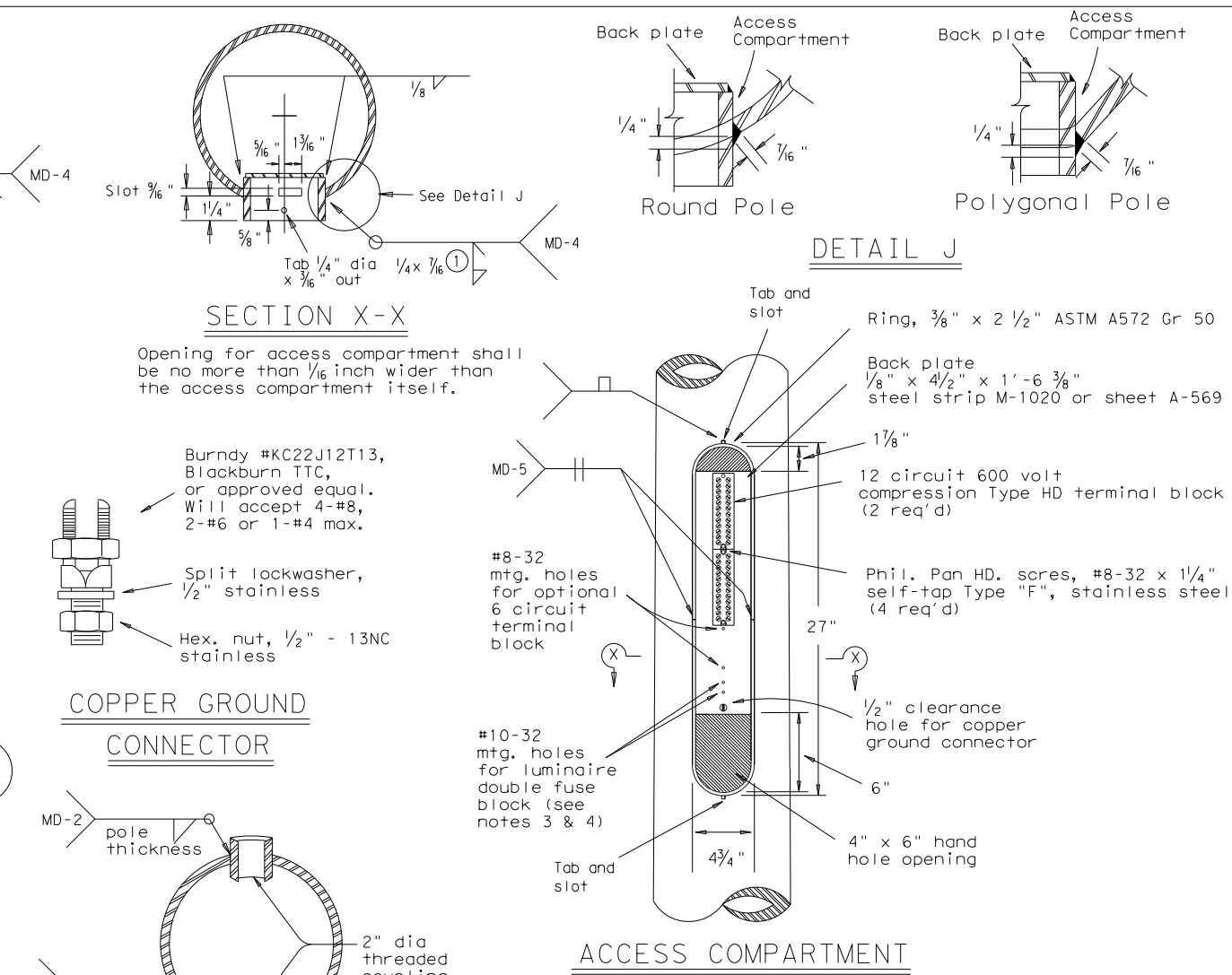
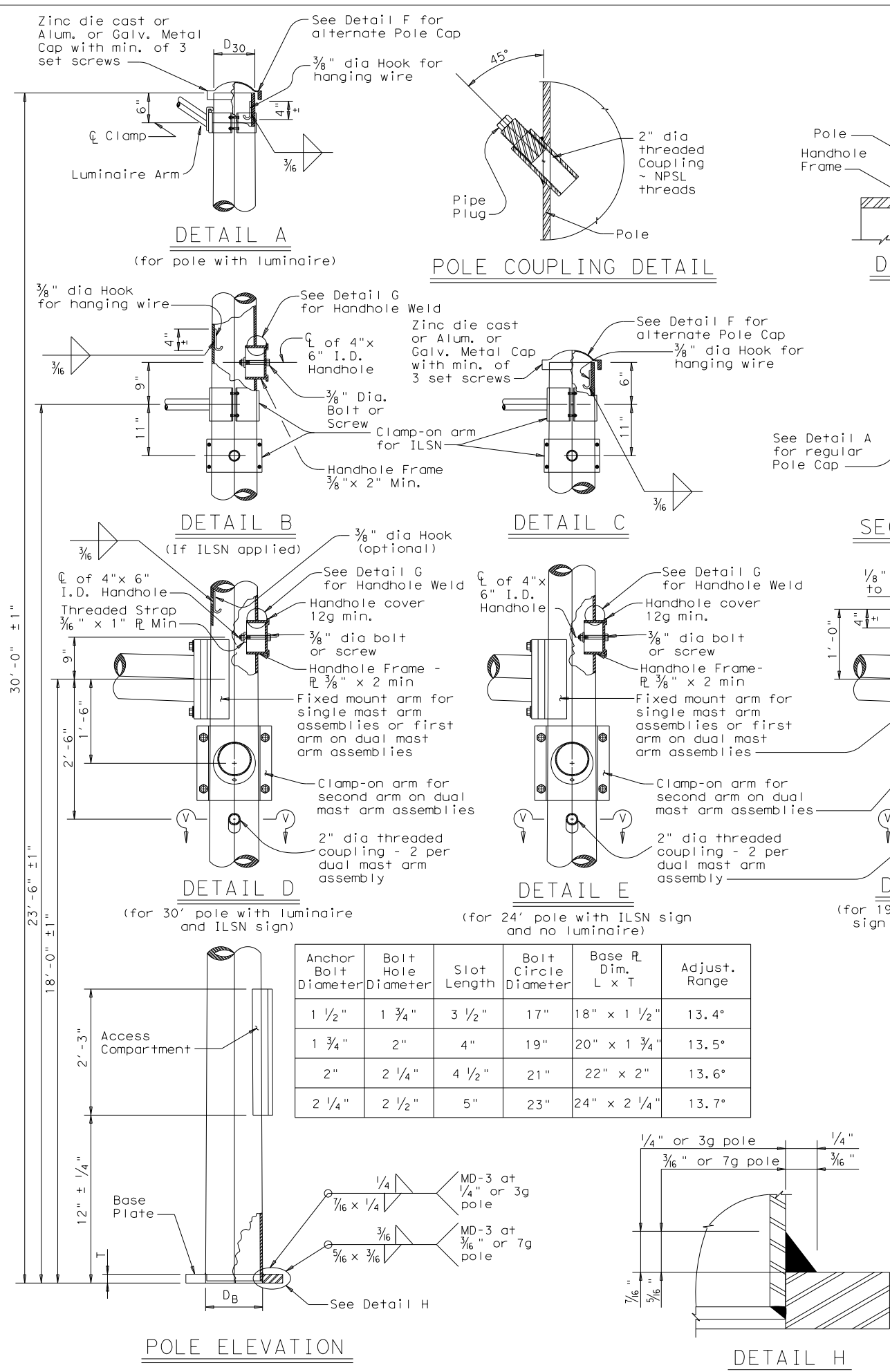
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Texas Department of Transportation  
Traffic Operations Division

TRAFFIC SIGNAL  
SUPPORT STRUCTURES  
MAST ARM POLE DETAILS

MA-D-12

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8-99 1-12	REVISIONS	CONT	SECT	JOB
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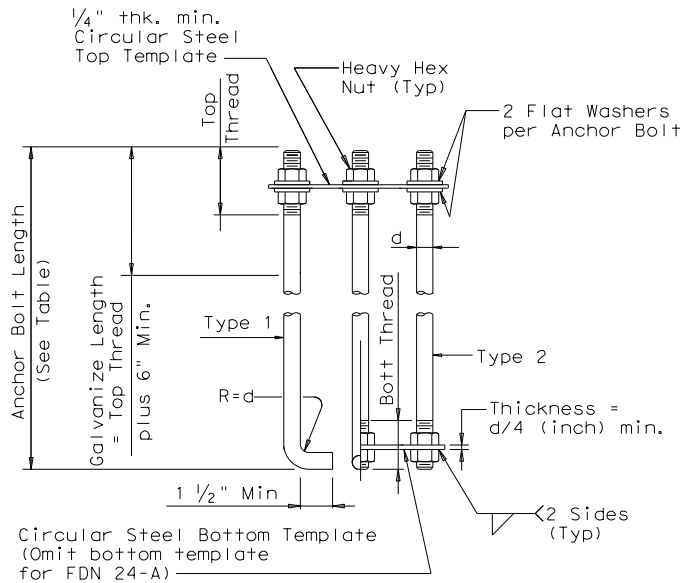
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FOUNDATION DESIGN TABLE													
FDN TYPE	DRILLED SHAFT DIA	REINFORCING STEEL		EMBEDDED DRILLED SHAFT LENGTH-ft ④, ⑤, ⑥			ANCHOR BOLT DESIGN ①				FOUNDATION DESIGN LOAD ②		TYPICAL APPLICATION
		VERT BARS	SPIRAL & PITCH	TEXAS CONE PENETROMETER N blows/ft			ANCHOR BOLT DIA	Fy (ksi)	BOLT CIR DIA	ANCHOR TYPE	MOMENT K-ft	SHEAR Kips	
				10	15	40							
24-A	24"	4- #5	#2 at 12"	5.7	5.3	4.5	¾"	36	12 ¾"	1	10	1	Pedestal pole, pedestal mounted controller.
30-A	30"	8- #9	#3 at 6"	11.3	10.3	8.0	1 ½"	55	17"	2	87	3	Mast arm assembly. (see Selection Table)
36-A	36"	10- #9	#3 at 6"	13.2	12.0	9.4	1 ¾"	55	19"	2	131	5	Mast arm assembly. (see Selection Table) 30' strain pole with or without luminaire.
36-B	36"	12- #9	#3 at 6"	15.2	13.6	10.4	2"	55	21"	2	190	7	Mast arm assembly. (see Selection Table) Strain pole taller than 30' & strain pole with mast arm
42-A	42"	14- #9	#3 at 6"	17.4	15.6	11.9	2 ¼"	55	23"	2	271	9	Mast arm assembly. (see Selection Table)

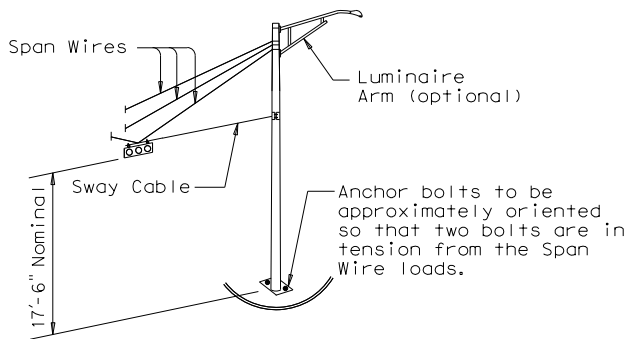
FOUNDATION SELECTION TABLE FOR STANDARD MAST ARM PLUS ILSN SUPPORT ASSEMBLIES (ft)					
		FDN 30-A	FDN 36-A	FDN 36-B	FDN 42-A
80 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH	32'	48'		
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS	24' X 24'			
		28' X 28'			
		32' X 28'	32' X 32'		
			36' X 36'		
			40' X 36'		
			44' X 28'	44' X 36'	
100 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH		36'	44'	
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS		24' X 24'		
			28' X 28'		
			32' X 24'	32' X 32'	
				36' X 36'	
				40' x24'	40' X 36'
					44' x 36'

- EXAMPLE:
- For 80mph design wind speed, foundation 30-A can support up to a 32' arm with another arm up to 28'
  - For 100mph design wind speed, foundation 36-A can support a single 36' mast arm.

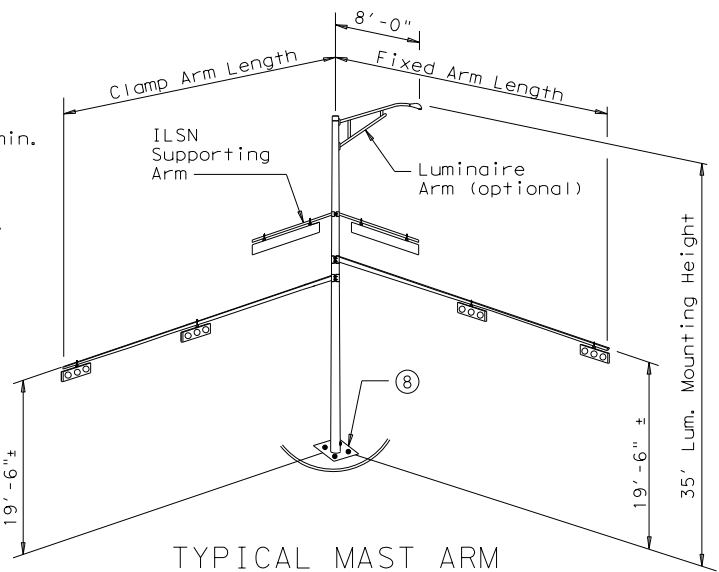


ANCHOR BOLT ASSEMBLY

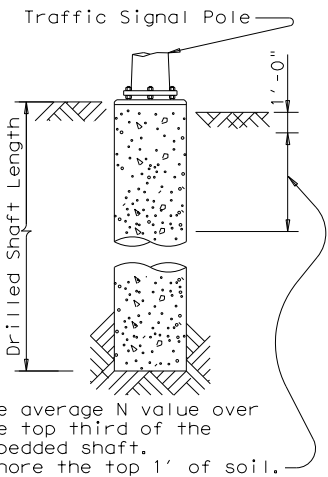
⑧ Orient anchor bolts orthogonal with the fixed arm direction to ensure that two bolts are in tension under dead load.



TYPICAL STRAIN POLE ASSEMBLY



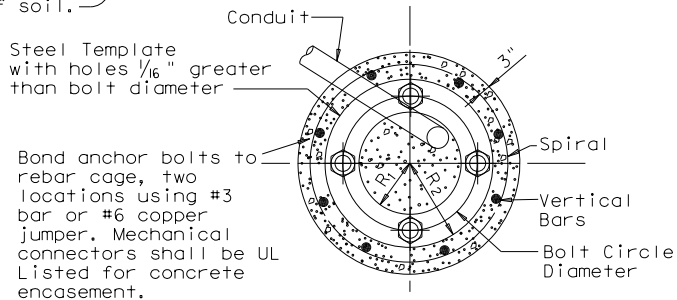
TYPICAL MAST ARM ASSEMBLY



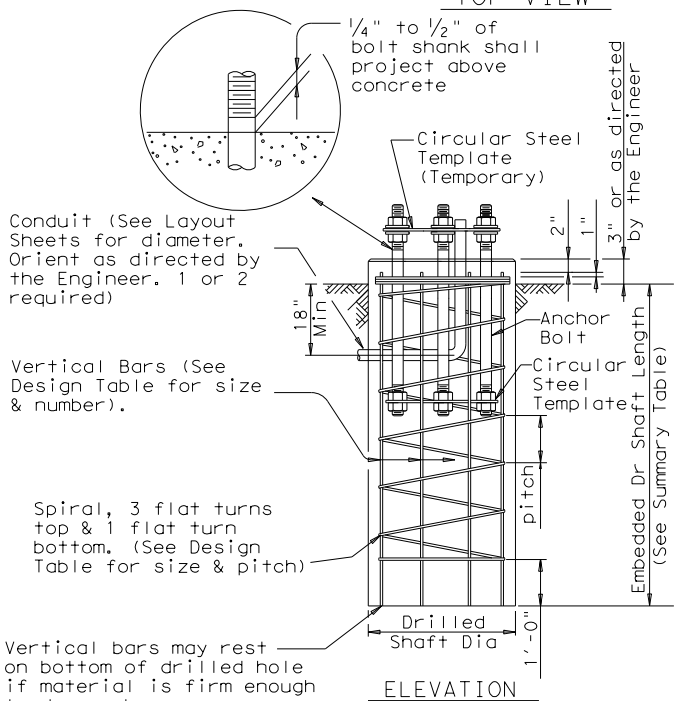
Use average N value over the top third of the embedded shaft. Ignore the top 1' of soil.

ANCHOR BOLT & TEMPLATE SIZES						
BOLT DIA IN.	⑦ BOLT LENGTH	TOP THREAD	BOTTOM THREAD	BOLT CIRCLE	R2	Rt
¾"	1'-6"	3"	—	12 ¾"	7 ⅞"	5 ⅝"
1 ½"	3'-4"	6"	4"	17"	10"	7"
1 ¾"	3'-10"	7"	4 ½"	19"	11 ¼"	7 ¾"
2"	4'-3"	8"	5"	21"	12 ½"	8 ½"
2 ¼"	4'-9"	9"	5 ½"	23"	13 ¾"	9 ¼"

⑦ Min dimensions given, longer bolts are acceptable.



TOP VIEW



ELEVATION

FOUNDATION DETAILS

#### NOTES:

- Anchor bolt design develops the foundation capacity given under Foundation Design Loads.
- Foundation Design Loads are the allowable moments and shears at the base of the structure.
- Foundations may be listed separately or grouped according to similarity of location and type. Quantities are for the Contractor's information only.
- Field Penetrometer readings at a depth of approximately 3 to 5 feet may be used to adjust shaft lengths.
- If rock is encountered, the Drilled Shaft shall extend a minimum of two diameters into solid rock.
- Decimal lengths in Design Table are to allow interpolation for other penetrometer values. Round to nearest foot for entry into Summary Table.

#### FOUNDATION SUMMARY TABLE ③

LOCATION IDENTIFICATION	AVG. N BLOW /ft.	FDN TYPE	NO. EA	DRILLED SHAFT LENGTH (FEET) ⑥				
				24-A	30-A	36-A	36-B	42-A
POLE C	10	36-A	1			13		
POLE G	10	36-A	1			13		
POLE J	10	36-A	1			13		
POLE N	10	36-A	1			13		
POLE H	10	24-A	1	6				
POLE F	10	24-A	1	6				
POLE E	10	24-A	1	6				
POLE D	10	24-A	1	6				
POLE P	10	24-A	1	6				
POLE M	10	24-A	1	6				
POLE L	10	24-A	1	6				
POLE K	10	24-A	1	6				
TOTAL DRILLED SHAFT LENGTHS				48		52		

#### GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminares and Traffic Signals and interim revisions thereto.

Reinforcing steel shall conform to Item 440, "Reinforcing Steel".

Concrete shall be Class "C".

Threads for anchor bolts and nuts shall be rolled or cut threads of 8UN series up to 2" in diameter or UNC series for all sizes. Bolts and nuts shall have Class 2A and 2B fit tolerances. Galvanized nuts shall be tapped after galvanizing.

Anchor bolts that are larger than 1" in diameter shall conform to "alloy steel" or "medium-strength mild steel" per Item 449, "Anchor Bolts". Anchor bolts that are 1" in diameter or less shall conform to ASTM A36. Galvanize a minimum of the top end thread length plus 6" for all anchor bolts unless otherwise noted. Exposed washers and exposed nuts shall be galvanized. All galvanizing shall be in accordance with Item 445, "Galvanizing".

Templates and embedded nuts need not be galvanized. Lubricate and tighten anchor bolts when erecting the structure in accordance with Item 449, "Anchor Bolts".



## TRAFFIC SIGNAL POLE FOUNDATION

TS-FD-12

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5-96 11-99 1-12	REVISIONS		CONT	SECT	JOB	HIGHWAY
			DIST			COUNTY
						SHEET NO.
					43	

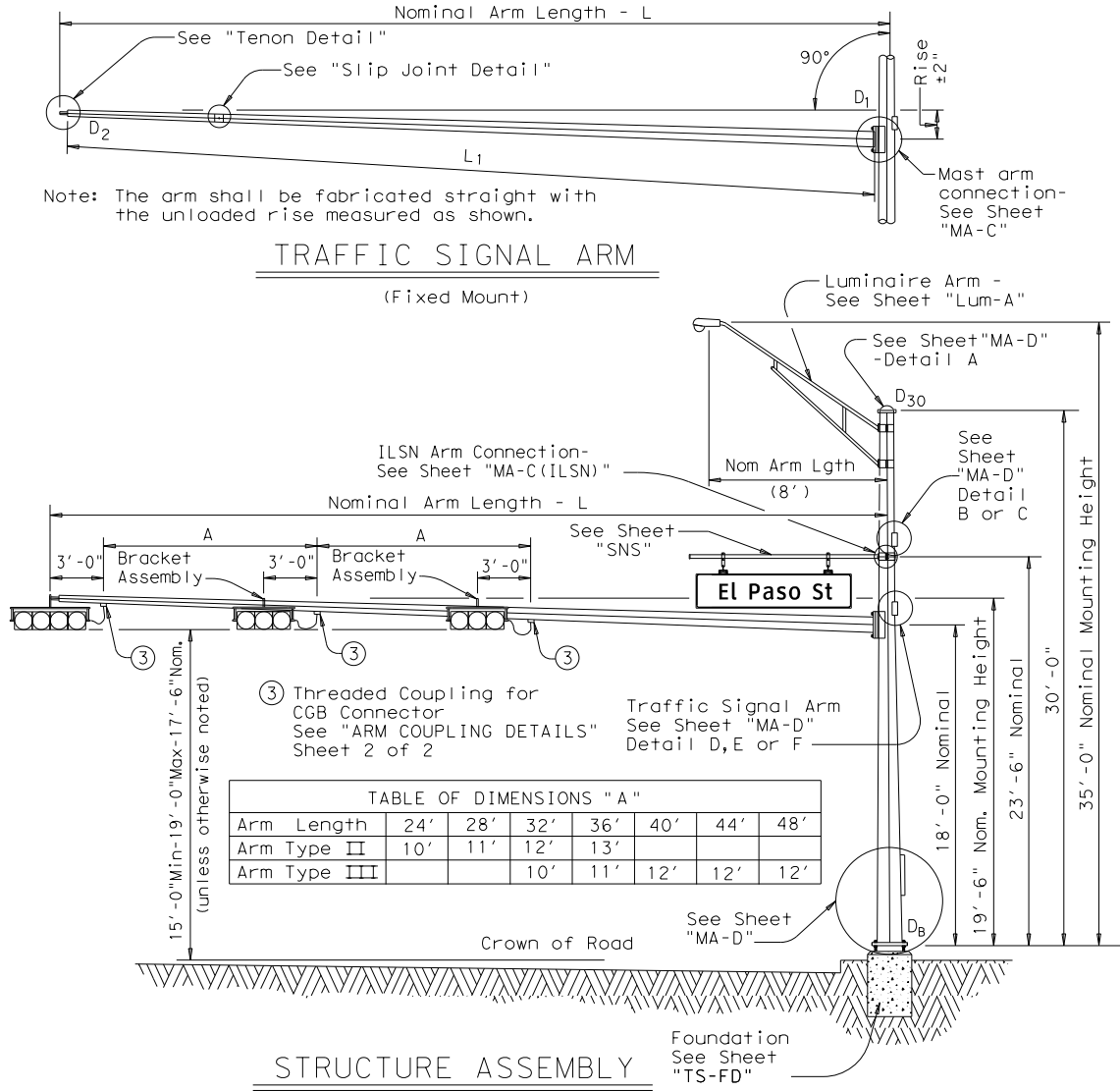
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Arm Length	ROUND POLES					POLYGONAL POLES					Foundation Type
	D <sub>B</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	① thk	D <sub>B</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	① thk	
ft.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	
20	10.5	7.8	7.1	6.3	.179	11.5	8.5	7.7	6.8	.179	30-A
24	11.0	8.3	7.6	6.8	.179	12.0	9.0	8.2	7.3	.179	30-A
28	11.5	8.8	8.1	7.3	.179	12.5	9.5	8.7	7.8	.179	30-A
32	12.5	9.8	9.1	8.3	.179	12.0	9.0	8.2	7.3	.239	30-A
36	12.0	9.3	8.6	7.8	.239	12.5	9.5	8.7	7.8	.239	36-A
40	12.0	9.3	8.6	7.8	.239	13.5	10.5	9.7	8.8	.239	36-A
44	12.5	9.8	9.1	8.3	.239	14.0	11.0	10.2	9.3	.239	36-A
48	13.0	10.3	9.6	8.8	.239	15.0	12.0	11.2	10.3	.239	36-A

Arm Length	ROUND ARMS					POLYGONAL ARMS				
	L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	① thk	Rise	L <sub>1</sub>	D <sub>1</sub>	② D <sub>2</sub>	① thk	Rise
ft.	ft.	in.	in.	in.		ft.	in.	in.	in.	
20	19.1	6.5	3.8	.179	1'-9"	19.1	7.0	3.5	.179	1'-8"
24	23.1	7.5	4.3	.179	1'-10"	23.1	7.5	3.5	.179	1'-9"
28	27.1	8.0	4.2	.179	1'-11"	27.1	8.0	3.5	.179	1'-10"
32	31.0	9.0	4.7	.179	2'-1"	31.0	9.0	3.5	.179	2'-0"
36	35.0	9.5	4.6	.179	2'-4"	35.0	10.0	3.5	.179	2'-1"
40	39.0	9.5	4.1	.239	2'-8"	39.0	9.5	3.5	.239	2'-3"
44	43.0	10.0	4.1	.239	2'-11"	43.0	10.0	3.5	.239	2'-6"
48	47.0	10.5	4.1	.239	3'-4"	47.0	11.0	3.5	.239	2'-9"

- D<sub>B</sub> = Pole Base O.D.  
D<sub>19</sub> = Pole Top O.D. with no Luminaire and no ILSN  
D<sub>24</sub> = Pole Top O.D. with ILSN w/out Luminaire  
D<sub>30</sub> = Pole Top O.D. with Luminaire  
D<sub>1</sub> = Arm Base O.D.  
D<sub>2</sub> = Arm End O.D.  
L<sub>1</sub> = Shaft Length  
L = Nominal Arm Length
- ① Thickness shown are minimums, thicker materials may be used.  
② D<sub>2</sub> may be increased by up to 1" for polygonal arms.



## SHIPPING PARTS LIST

Ship each pole with the following attached: enlarged hand hole, pole cap, fixed-arm connection bolts and washers and any additional hardware listed in the table.

Nominal Arm Length	30' Poles With Luminaire		24' Poles With ILSN		19' Poles With No Luminaire and No ILSN	
	Above hardware plus: One (or two if ILSN attached) small hand hole, clamp-on simplex		Above hardware plus one small hand hole		See note above	
ft	Designation	Quantity	Designation	Quantity	Designation	Quantity
20	20L-80		20S-80		20-80	
24	24L-80		24S-80		24-80	
28	28L-80		28S-80		28-80	
32	32L-80		32S-80		32-80	
36	36L-80		36S-80		36-80	
40	40L-80	2	40S-80		40-80	
44	44L-80	1	44S-80		44-80	1
48	48L-80		48S-80		48-80	

Traffic Signal Arms (1 per Pole) Ship each arm with the listed equipment attached

Nominal Arm Length	Type I Arm (1 Signal)		Type II Arm (2 Signals)		Type III Arm (3 Signals)	
	1 CGB connector		1 Bracket Assembly and 2 CGB Connectors		2 Bracket Assemblies and 3 CGB Connectors	
ft	Designation	Quantity	Designation	Quantity	Designation	Quantity
20	20I-80					
24	24I-80		24II-80			
28	28I-80		28II-80			
32			32II-80		32III-80	
36			36II-80		36III-80	
40					40III-80	2
44					44III-80	2
48					48III-80	

Luminaire Arms (1 per 30' pole)

Nominal Arm Length	Quantity
8' Arm	3

ILSN Arm (Max. 2 per pole) Ship with clamps, bolts and washers

Nominal Arm Length	Quantity
7' Arm	
9' Arm	

Anchor Bolt Assemblies (1 per pole)

Anchor Bolt Diameter	Anchor Bolt Length	Quantity	Each anchor bolt assembly consists of the following: Top and Bottom templates, 4 anchor bolts, 8 nuts, 8 flat washers, and 4 nut anchor devices (Type 2) per Standard Drawing "TS-FD".
1 1/2"	3'-4"		Templates may be removed for shipment.
1 3/4"	3'-10"	4	

SHEET 1 OF 2



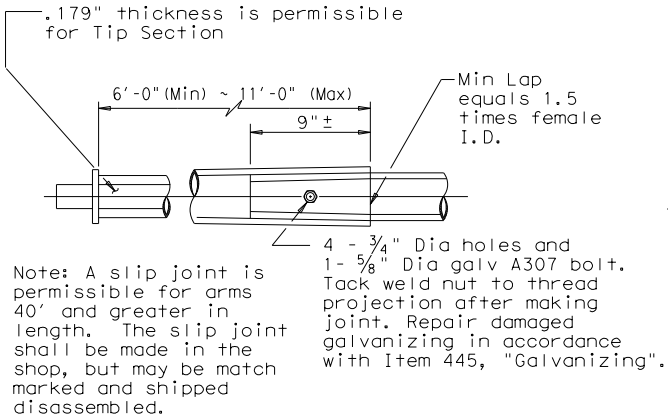
## TRAFFIC SIGNAL SUPPORT STRUCTURES SINGLE MAST ARM ASSEMBLY (80 MPH WIND ZONE) SMA-80(1)-12

© TxDOT August 1995		DN: MS		CK: JSY	DW: MMF	CK: JSY	
5-96 11-99 1-12	REVISIONS		CONT		SECT	JOB	HIGHWAY
			DIST		COUNTY		SHEET NO.
							44

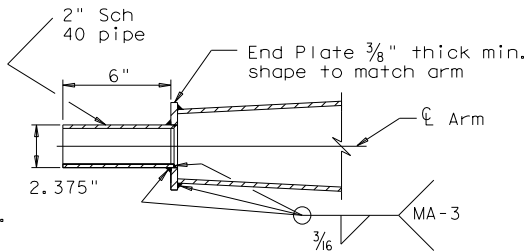
122A

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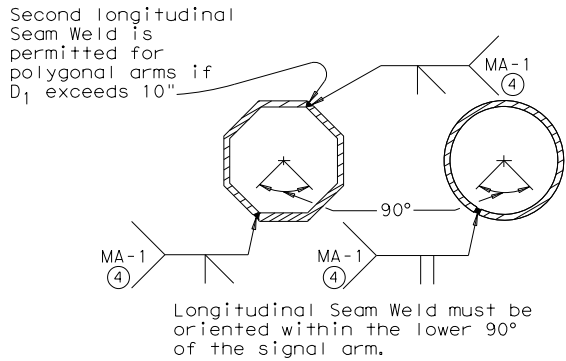
SLIP JOINT DETAIL



TENON DETAIL

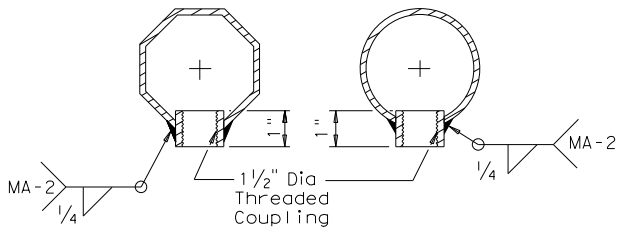
Stainless steel bands (or Cables) and cast bracket as in "Astro-Brac", "Sky Bracket" or "Easy Bracket" with 1 1/2" Dia Threaded Coupling.

BRACKET ASSEMBLY



ARM WELD DETAIL

④ 60% Min. penetration  
100% pemetration within 6" of circumferential base welds.



ARM COUPLING DETAILS

## VIBRATION WARNING

Mast Arms of SMA and DMA structures and clamp-on Arms of LMA structures of approximately 40 ft or longer are subject to harmonic vertical vibrations in light wind conditions due to the aeroelastic characteristics of a few of the myriads of possible combinations of the following: signal numbers, weights and positions; existence/solidity of backplates; presence of additional attachments to the arm, such as signs and cameras; arm-wind orientation; and arm-pole stiffness.

Such vibrations may cause fatigue damage to the structure and may lead to galloping in moderate wind conditions which may further damage the structure and alarm the public. Tests have indicated that when wind is blowing toward the back side of signal heads having un-vented backplates attached the probability of unacceptable harmonic vibration and/or galloping is rather high.

If backplates are not required for improved visibility they should not be applied to the signal heads or, if they must be applied, they should be vented as a first and inexpensive measure to mitigate vibrations.

The traffic signal mast arms shall be visually inspected in 5 to 20 mph wind conditions after installation of signal heads and any attachments, including any required backplates. If vertical movements with a total excursion (maximum upward excursion to maximum downward excursion) of more than approximately 8" are observed at the arm tip, a damping plate shall be fitted to the arm. See "Damping Plate Mounting Details" on standard sheet, MA-DPD-10.

This visual inspection shall be repeated after each modification of the structure that could affect its aeroelastic response. Excessive vibrations shall not be allowed to continue for more than two days.

## GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Specifications thereto. Design Wind Speed equals 80 mph plus a 1.3 gust factor.

Poles are designed to support one 8'-0" luminaire arm, one 9'-0" internally lighted street name sign and one traffic signal arm with a length as tabulated. The specified luminaire load applied at the end of the luminaire arm equals 60 lbs vertical dead load plus the horizontal wind load on an effective projected area of 1.6 sq ft. The specified internally lighted street name sign load applied 4.5 ft from the centerline of the pole equals 85 lbs vertical dead load plus horizontal wind load on an effective projected area of 11.5 sq ft. The specified signal load applied at the end of the traffic signal arm equals 180 lbs vertical dead load plus the horizontal wind load on an effective projected area of 32.4 sq ft (actual area times drag coefficient).

See Standard Sheet "MA-D" for pole details, "MA-C" for traffic signal arm connection details, "MA-C (ILSN)" for internally lighted street name sign arm connection details, "LUM-A" for luminaire arm and connection details, "SNS" for internally lighted street name sign details, and "TS-FD" for anchor bolt and foundation details. See "MA-C" for material specifications.

Fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. Materials, fabrication tolerances, and shipping practices shall meet the requirements of this sheet and Item 686, "Traffic Signal Pole Assemblies (Steel)".

Unless otherwise noted, all parts shall be galvanized in accordance with Item 445, "Galvanizing", after fabrication.

Deviation from the details and dimensions shown herein require submission of shop drawings in accordance with Item 441, "Steel Structures". Alternate designs are not acceptable.

SHEET 2 OF 2



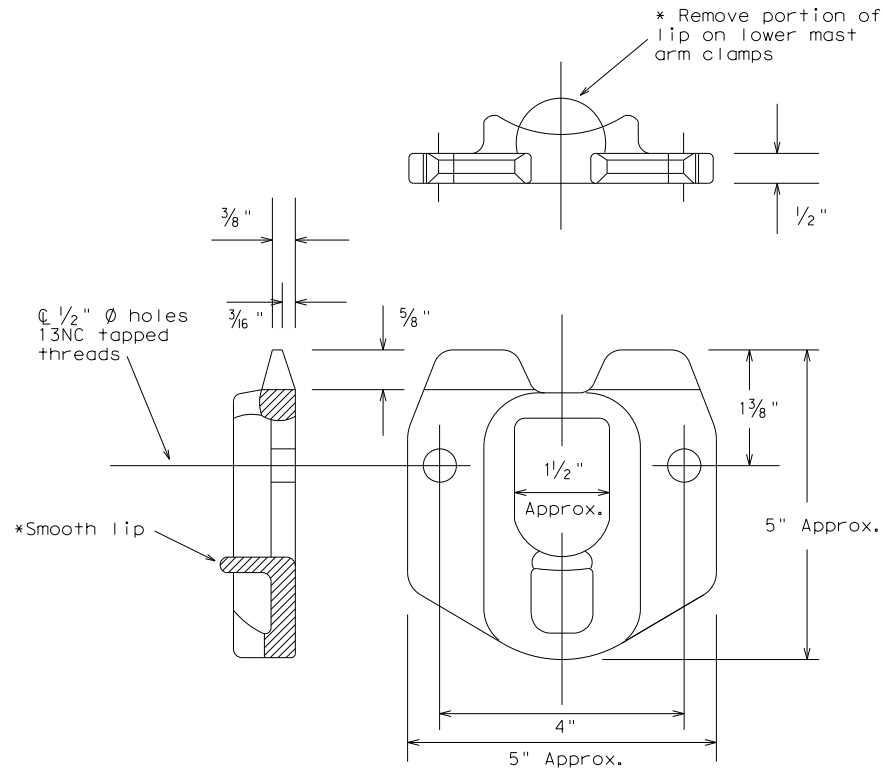
## TRAFFIC SIGNAL SUPPORT STRUCTURES SINGLE MAST ARM ASSEMBLY (80 MPH WIND ZONE)

SMA-80(2)-12

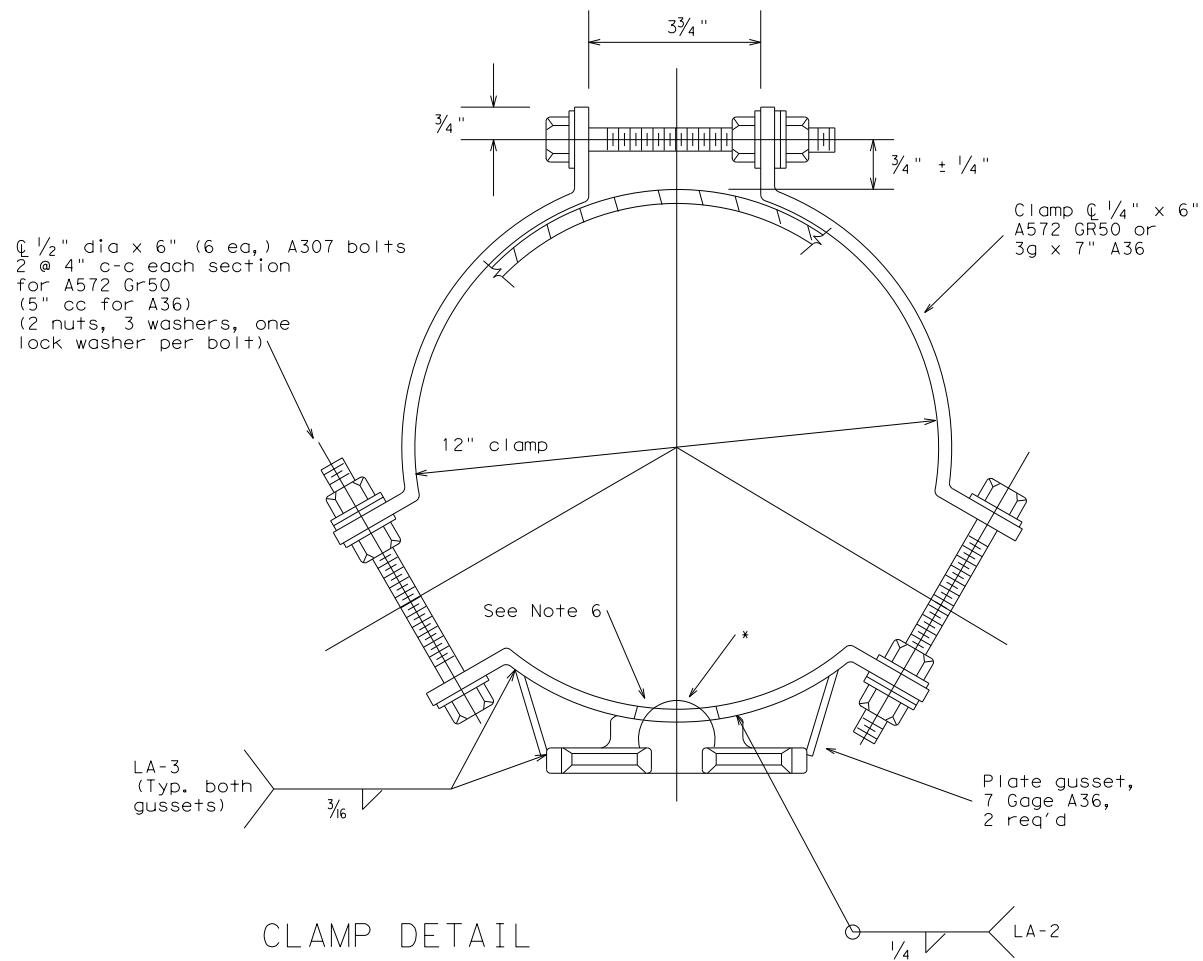
© TxDOT August 1995	DN: MS	CK: JSY	DW: MMF	CK: JSY
5-96 1-12	REVISIONS			
	CONT	SECT	JOB	HIGHWAY
	DIST	COUNTY		SHEET NO.
122B				45

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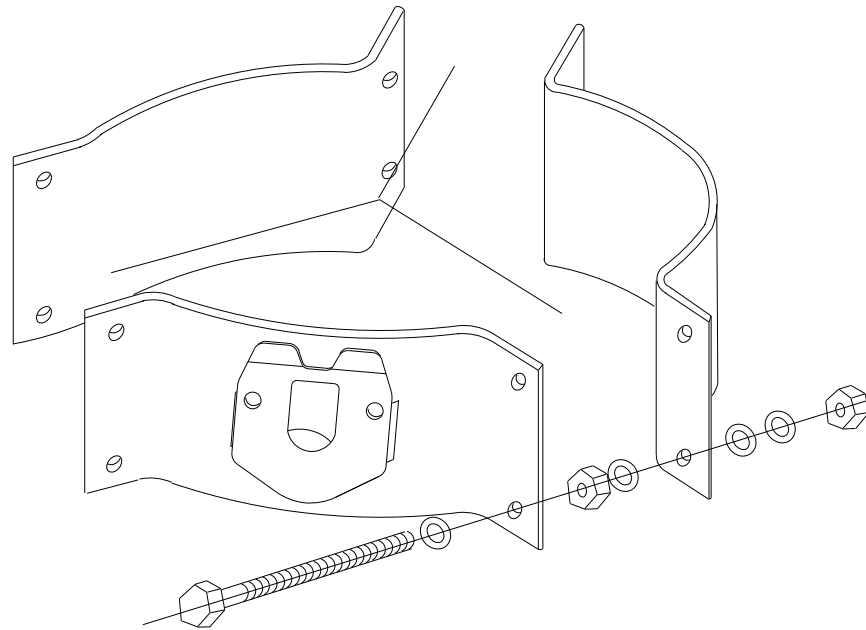
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POLE SIMPLEX DETAILS



CLAMP DETAIL



PROJECTION

For 8.9 - 12 inch diameter Signal Poles  
(Two req'd for each mast arm)

OTHER MATERIALS:

1. Pole simplex shall be ASTM A27 GR65-35 or A148 GR80-50 or A576 GR1021. ASTM A576 must be suitable for forging and also meet minimum tensile of 65ksi, minimum yield of 35ksi, and a minimum elongation of 22 percent in 2 inches.
2. Welded tabs and backplates shall be ASTM A-36 steel or better.
3. Nylon insert locknuts shall conform to ASTM A563.

GENERAL NOTES:

1. Materials and fabrication shall be in accordance with Standard Sheet "MA-C" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. In the absence of specified fabrication tolerances, dimensions shall be within the tolerances generally obtainable in normal fabrication practice.
2. All parts shall be galvanized after fabrication in accordance with Item 445, "Galvanizing". The throat of the Simplex shall be made free of all rough or sharp edges resulting from the galvanizing process.
3. Each simplex fitting shall be supplied with 2 ASTM A325 bolts, 1/2 in. X 1 1/2 in. and 2 lock washers. The bolts and lock washers shall be secured to the clamp with the other hardware items. The Fabricator shall ship clamp assembly together in a single package, including all bolts, nuts, and washers required for the clamp and simplex fitting.
4. Design conforms to 1994 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" and interim revisions thereto. Design Wind Speed equals 80 mph plus a 1.3 gust factor. Clamps are designed to support a 60 lb. luminaire having an effective projected area (actual area times drag coefficient) of 1.6 sq. ft., 12 ft. maximum arm length.
5. Each assembly shall consist of one upper piece simplex fitting having a smooth lip and one lower piece simplex fitting with the lip removed.
6. Approximately 2 in. diameter hole in upper mast arm clamp.



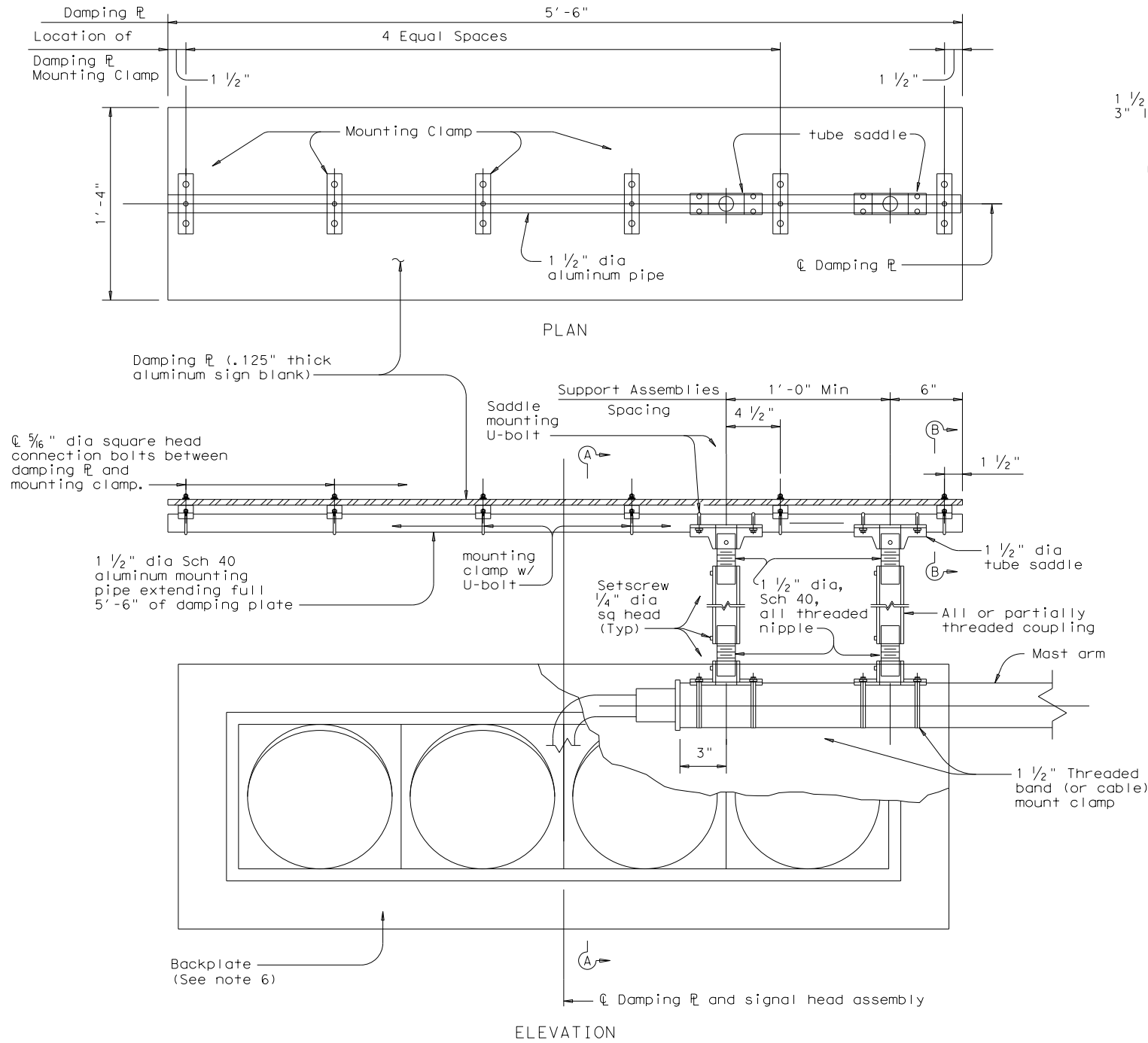
CLAMP ON  
FITTING ASSEMBLY FOR  
LUMINAIRE MAST ARM

CFA-12

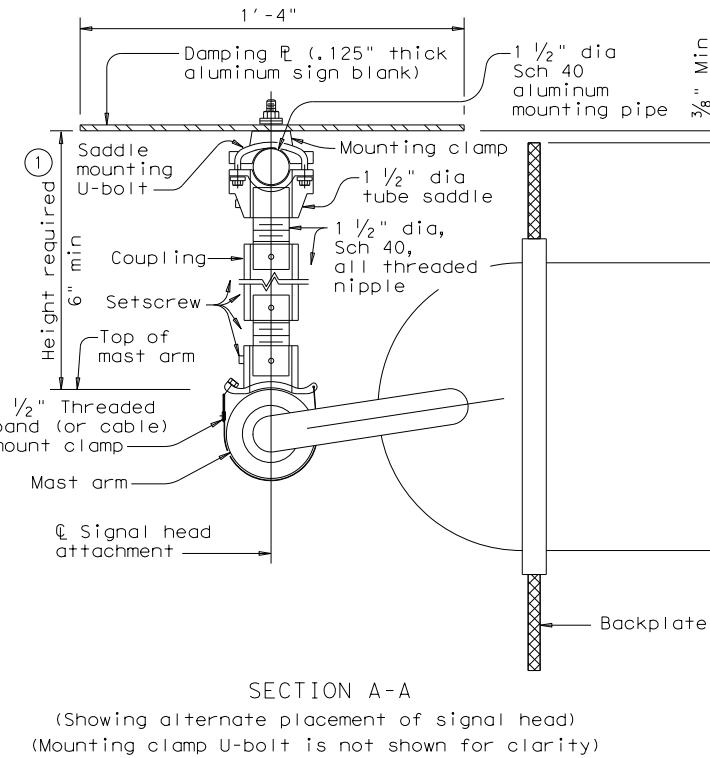
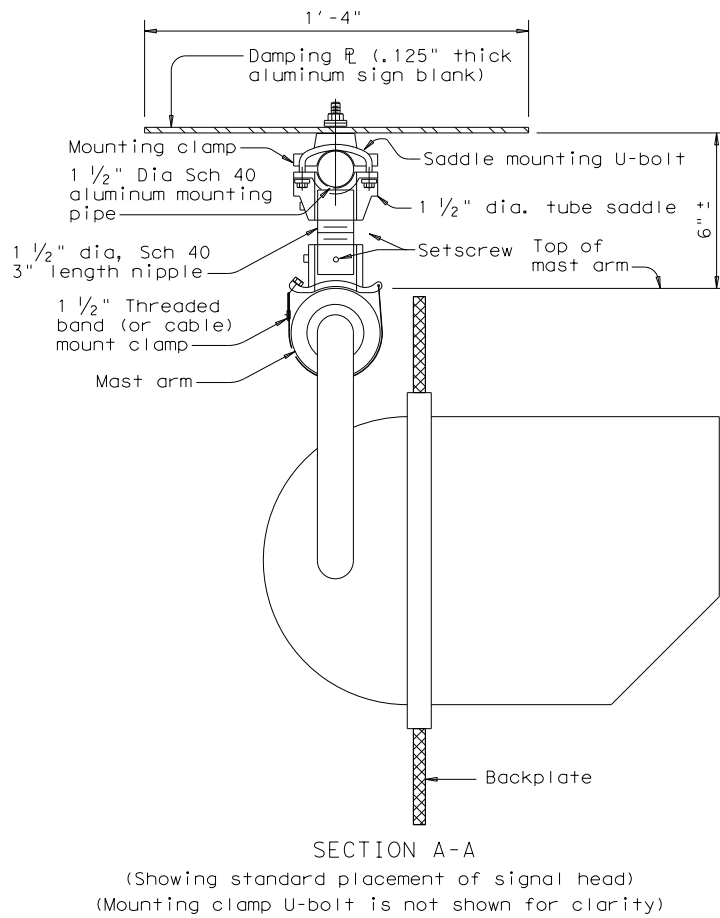
© TxDOT		DN: KAB	CK: RES	DW: FDN	CK: CAL
11-99 1-12	REVISIONS		CONT	SECT	JOB
			DIST		COUNTY
					SHEET NO.

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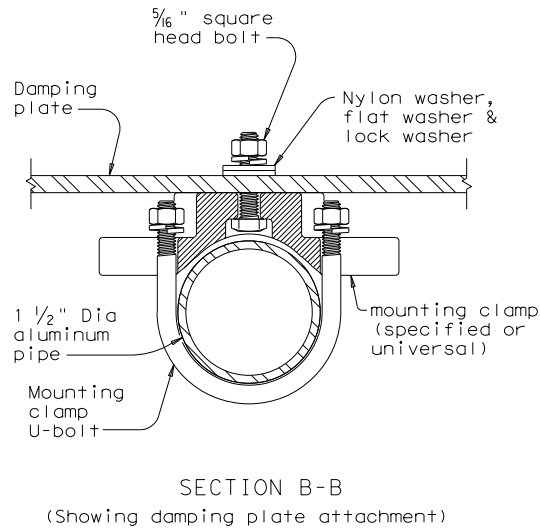




DAMPING PLATE MOUNTING DETAILS  
(Showing alternate placement of signal head)



① Recommended supporting assemblies to achieve required height for horizontal section heads			
Height required	One nipple each length	Two nipples each length plus	One coupling each length
6"-6 3/4"	3"	-	-
7"-8 1/2"	4"	-	-
9"-10 1/2"	6"	-	-
11"-15 1/2"	-	4"	5"
16"-24"	-	6"	10"

- GENERAL NOTES:
- In accordance with the findings of TxDOT sponsored research, the installation of a damping plate in accordance with the details shown here at the end of signal mast arms of SMA and DMA standard structures reduces excessive harmonic vertical vibration, and thus fatigue damage. Any deviation from these details may reduce the effectiveness of this damping device.
  - Aluminum sign blank for damping plate will conform to Departmental Material Specifications DMS-7110. Materials for mast arm mounting clamp and tube saddle will be aluminum castings or aluminum alloys as in accordance with manufacturers' stipulations. Mounting pipe, pipe nipple and coupling will be aluminum alloy 6061-T6 or 6063-T6. Damping plate mounting clamp and U-bolt assemblies will conform to Standard sheet SMD(GEN). U-bolts for saddle mounting will have a minimum yield strength of 36 ksi.
  - Damping plate will be mounted horizontally. Position centerline of damping plate to align with centerline of mast arm or horizontal signal head assembly. Vertical clearance between signal head (with or without backing plate) and bottom of damping plate will be maintained as shown. The attachments shown here are examples only, other supporting details which meet both alignment and vertical clearance requirements are also acceptable.
  - Unless stipulated by the manufacturers, all steel parts will be galvanized finish in accordance with Standard Specification Item 445, "Galvanizing".
  - Contractor will verify applicable field dimensions before the installation.
  - Backplates are optional for traffic signals. When backplates are used, Backplates will have a 2-inch fluorescent yellow AASHTO Type BFL or CFL retroreflective border conforming to TxDOT DMS-8300 "Sign Face Materials." See Sheet TS-BP-20 for backplate details.





## MAST ARM DAMPING PLATE DETAILS

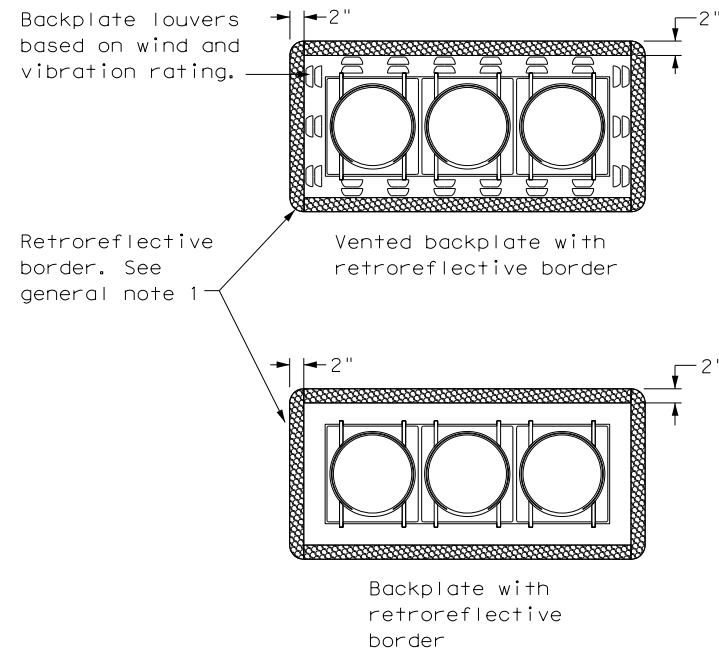
### MA-DPD-20

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© TxDOT January 2012	CONT	SECT	JOB	HIGHWAY
6-20	DIST	COUNTY	SHEET NO.	
			47	

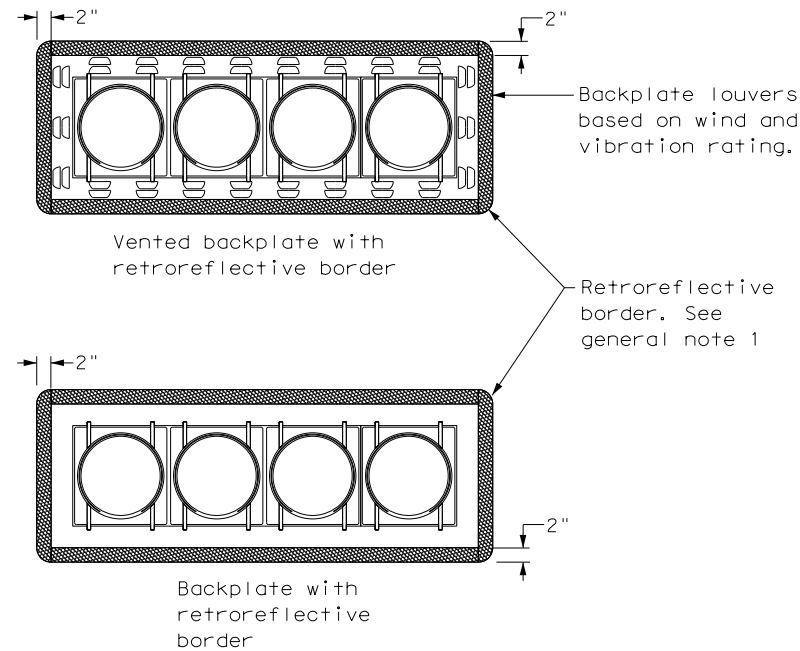


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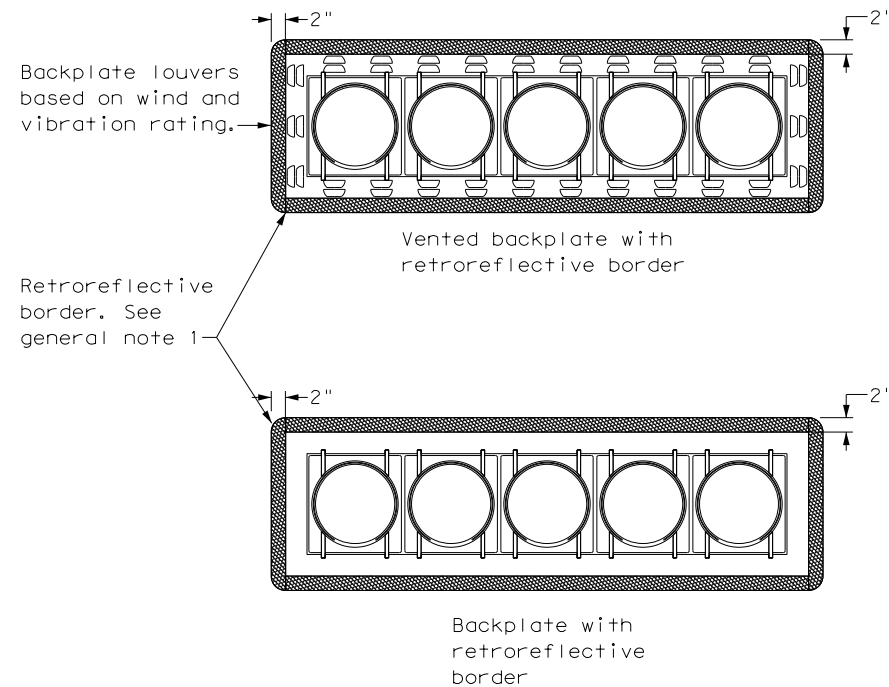
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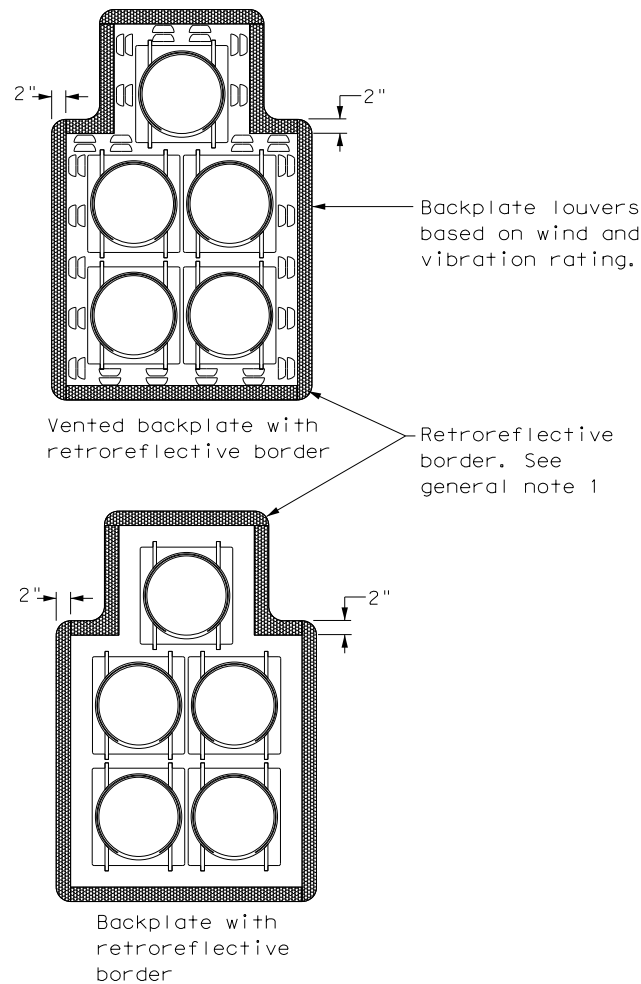
THREE-SECTION HEAD  
HORIZONTAL OR VERTICAL



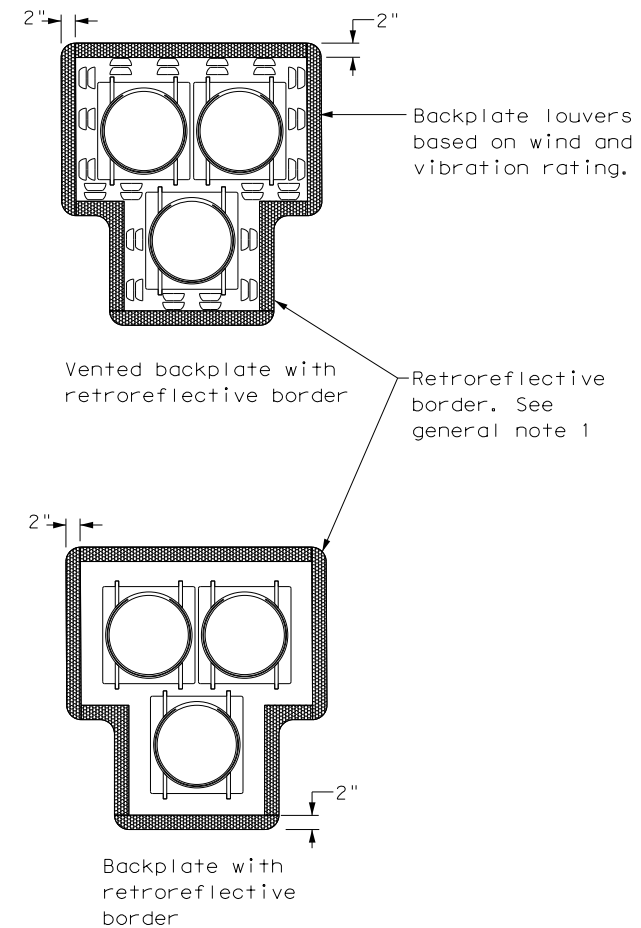
FOUR-SECTION HEAD  
HORIZONTAL OR VERTICAL



FIVE-SECTION HEAD  
HORIZONTAL OR VERTICAL




FIVE-SECTION HEAD  
CLUSTER

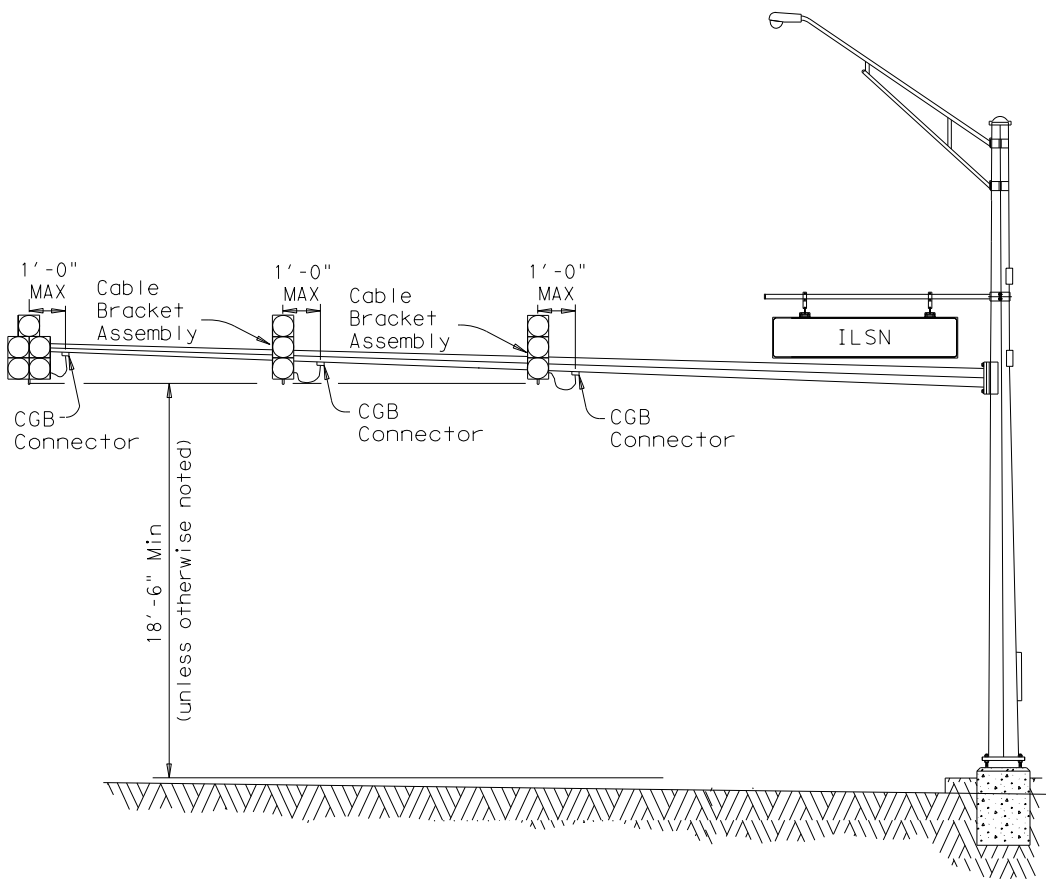


PEDESTRIAN HYBRID  
BEACON

#### GENERAL NOTES:

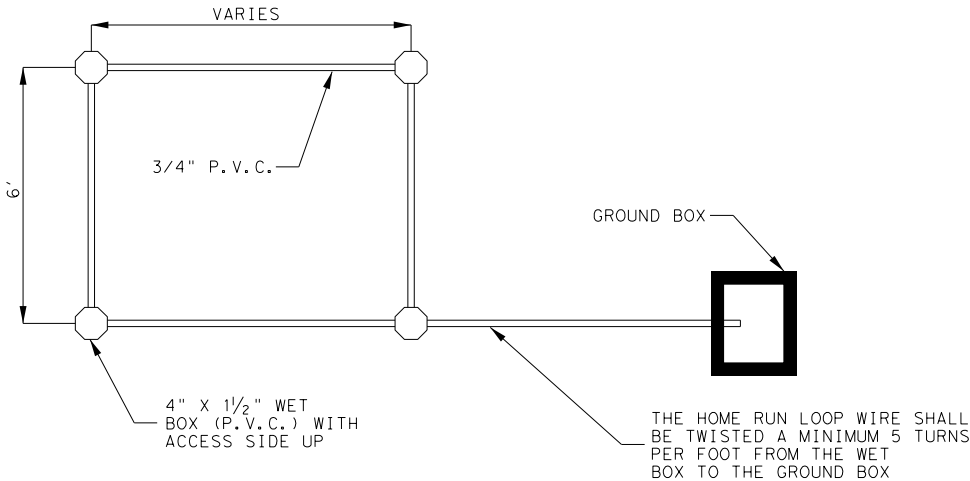
1. Backplates are optional for traffic signals and pedestrian hybrid beacons. When backplates are used, a 2-inch wide fluorescent yellow AASHTO Type B<sub>FL</sub> or C<sub>FL</sub> retroreflective border conforming to TxDOT DMS-8300 is required. Place on all approaches when used.
2. Signal head and backplate compatibility must be verified by the contractor prior to installation.
3. When using backplates on signal heads, venting is preferred to reduce cyclic vibration stress.
4. When a vented backplate is used, the retroreflective border must not be placed over the louvers.
5. This standard sheet applies to all signal heads with backplates, including but not limited to:
  - Pole mounted
  - Overhead mounted
  - Span wire mounted
  - Mast arm mounted
  - Vertical signal heads
  - Horizontal signal heads
  - Clustered signal heads
  - Pedestrian hybrid beacons

 <b>Texas Department of Transportation</b>				<b>Traffic Safety Division Standard</b>					
<h1>TRAFFIC SIGNAL HEAD WITH BACKPLATE</h1> <h2>TS-BP-20</h2>									
FILE: ts-bp-20.dgn		DN: TxDOT		CK: TxDOT		DW: TxDOT		CK: TxDOT	
© TxDOT June 2020		CONT	SECT	JOB			HIGHWAY		
REVISIONS		DIST	COUNTY					SHEET NO.	
								48	



TYPICAL MAST ARM INSTALLATION

BACKPLATES ARE NOT SHOWN FOR CLARITY



NOTES:

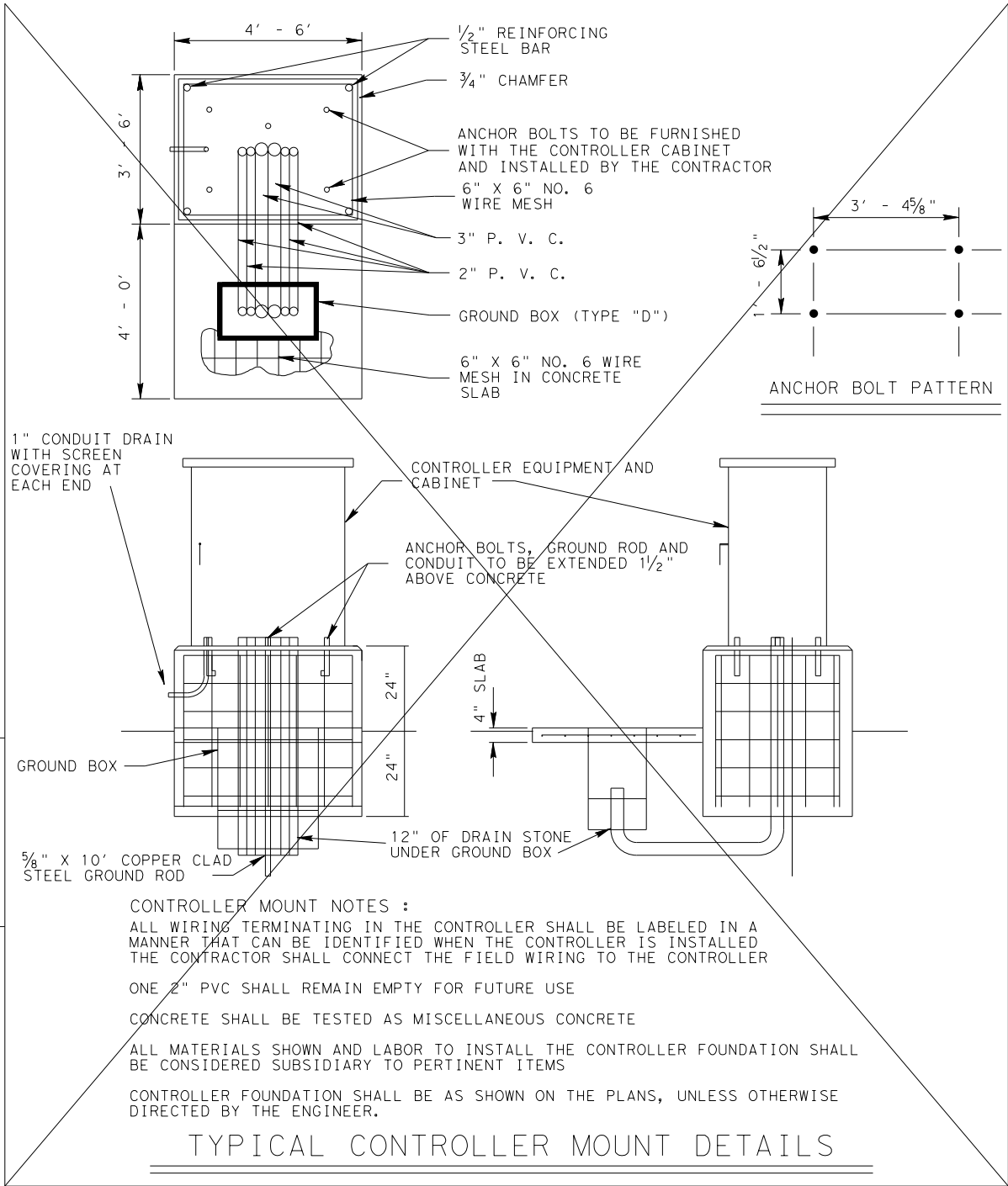
SHALL INSTALL CONDUIT ENCASED LOOPS AT THE LOCATIONS SHOWN ON THE PLANS USING 3/4 " DIAMETER PVC SCHEDULE 40 OR AT NO ADDITIONAL COST 1" DIAMETER PVC SCHEDULE 80.

LOOP LOCATIONS MAY BE STAGGERED SLIGHTLY (6") TO ACCOMMODATE HOME RUN PLACEMENT.

INDIVIDUAL HOME RUN CONDUITS SHALL BE EXTENDED TO THE GROUND BOX SHOWN ON THE PLANS FOR EACH LOOP INSTALLED.

THE NUMBER OF LOOP WIRE TURNS SHALL BE AS SHOWN ON THE TYPICAL LOOP DETECTOR DETAILS.

CONDUIT ENCASED LOOPS



CONTROLLER MOUNT NOTES :

ALL WIRING TERMINATING IN THE CONTROLLER SHALL BE LABELED IN A MANNER THAT CAN BE IDENTIFIED WHEN THE CONTROLLER IS INSTALLED THE CONTRACTOR SHALL CONNECT THE FIELD WIRING TO THE CONTROLLER

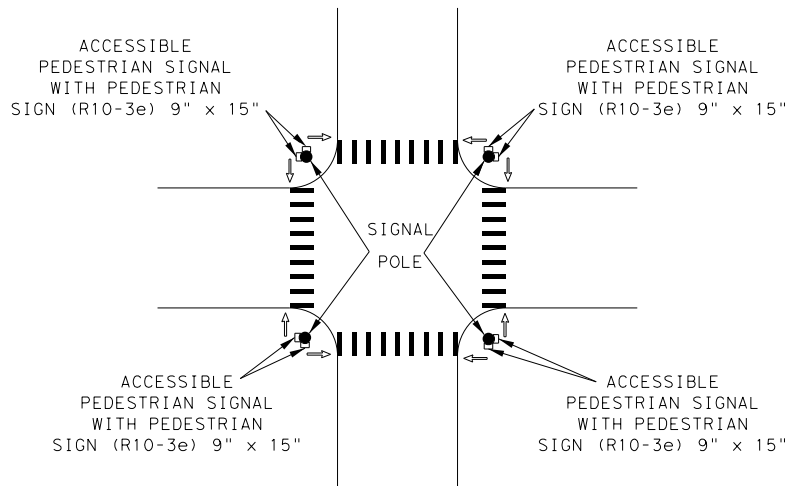
ONE 2" PVC SHALL REMAIN EMPTY FOR FUTURE USE

CONCRETE SHALL BE TESTED AS MISCELLANEOUS CONCRETE

ALL MATERIALS SHOWN AND LABOR TO INSTALL THE CONTROLLER FOUNDATION SHALL BE CONSIDERED SUBSIDIARY TO PERTINENT ITEMS

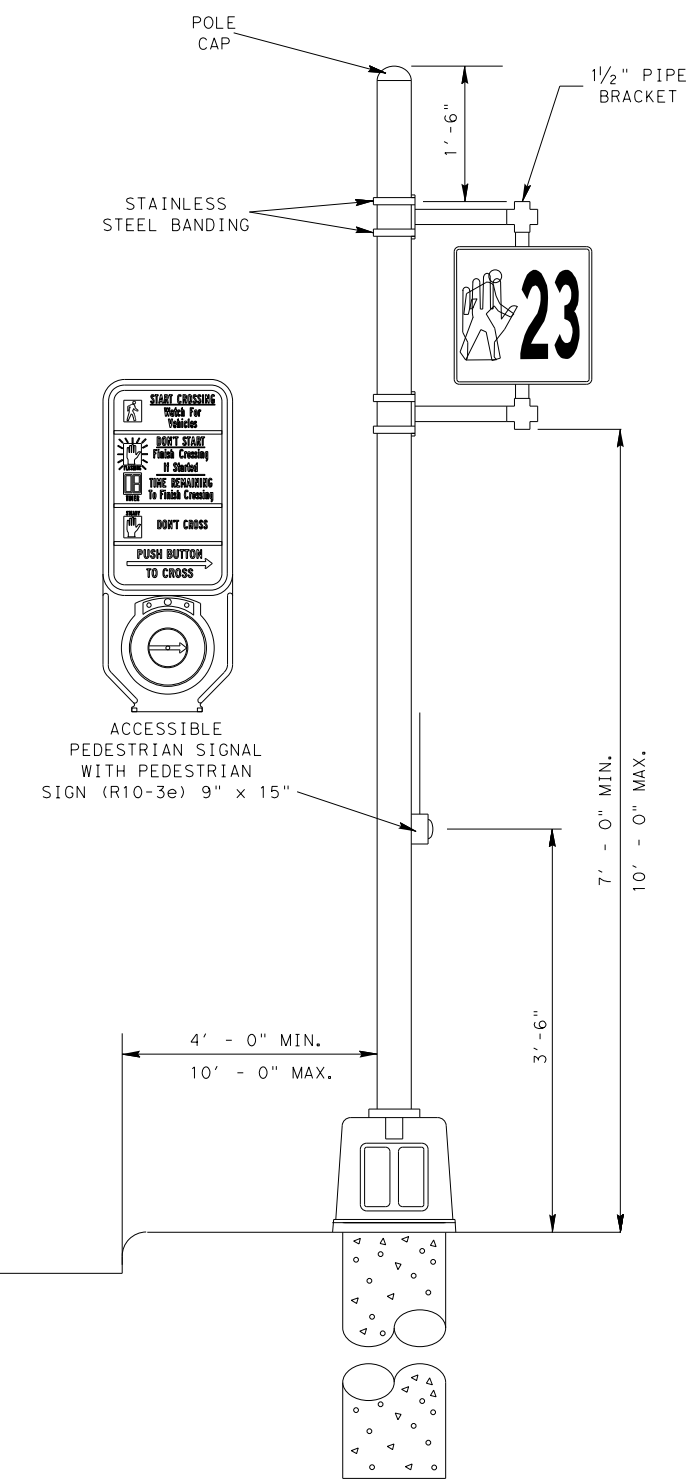
CONTROLLER FOUNDATION SHALL BE AS SHOWN ON THE PLANS, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

TYPICAL CONTROLLER MOUNT DETAILS




TYPICAL PED PUSH BUTTON LOCATION

THE ENGINEER SHALL VERIFY ALL PEDESTRIAN SIGNAL AND PEDESTRIAN PUSH BUTTON LOCATIONS PRIOR TO INSTALLATION.



TYPICAL PEDESTAL POLE ASSEMBLY

<div> <b>Texas Department of Transportation</b> © 2018</div>				
<b>San Antonio District Standard</b>				
<b>MISCELLANEOUS TRAFFIC SIGNAL DETAILS</b>				
SCALE: NS		MTS-18		
REVISIONS	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		SHEET NO.
FEB 2006	6	\$FAP-NO\$		49
OCT 2007		STATE	DIST.	COUNTY
MAR 2017		TEXAS		
MAY 2018		CONT.	SECT.	JOB
				HIGHWAY NO.

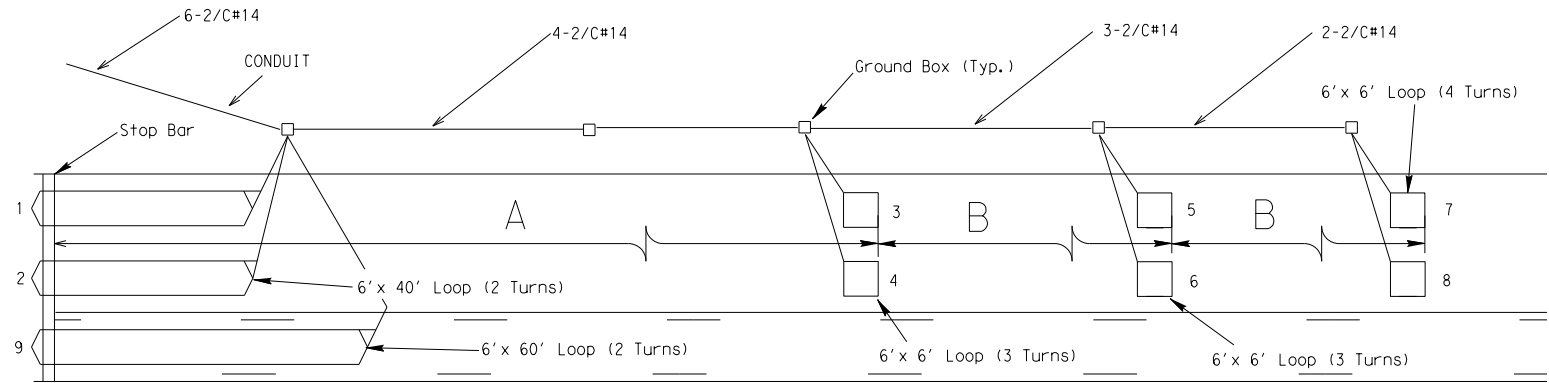
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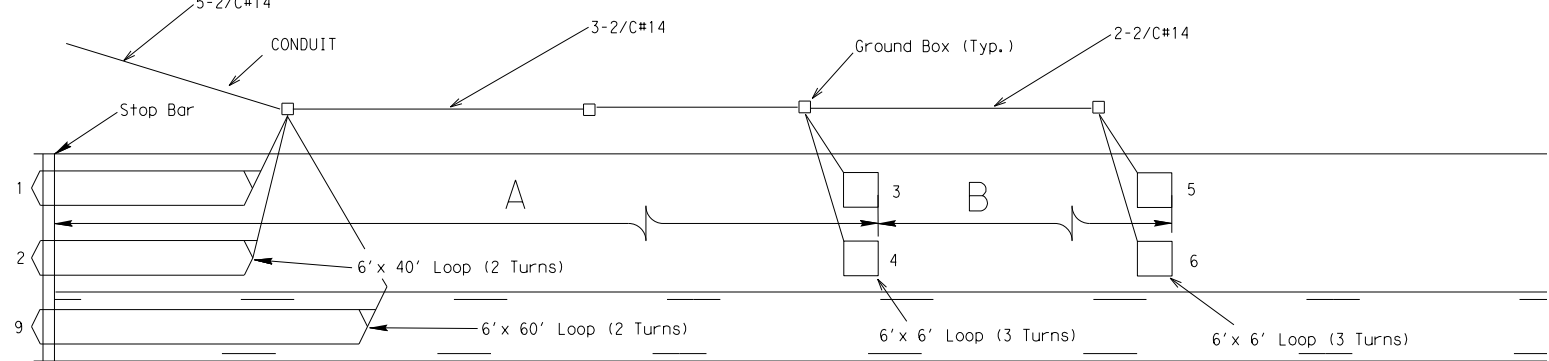
LEVELS DISPLAYED

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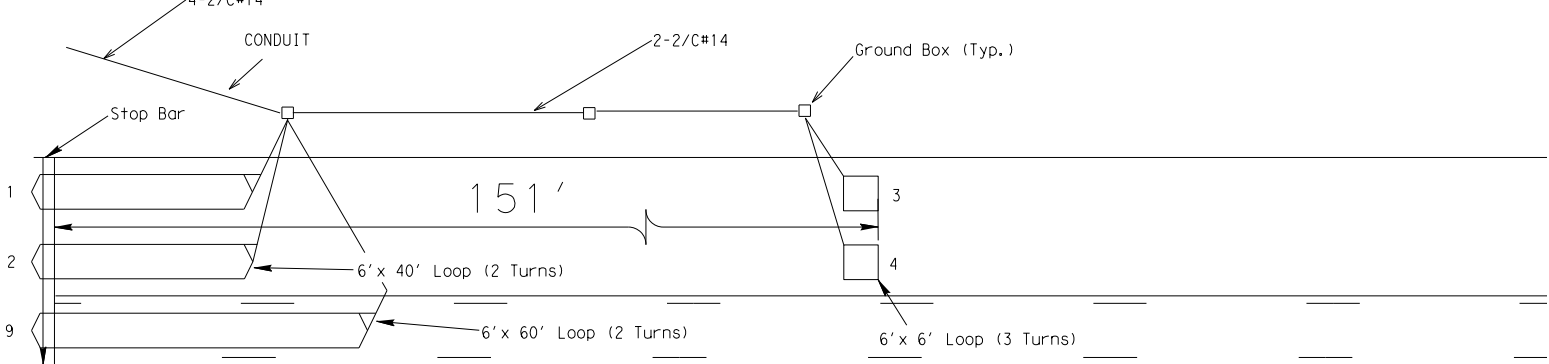
LOOP DETECTOR PLACEMENT DETAILS



55 MPH ( A=231', B=95' )      60 MPH ( A=281', B=100' )  
65 MPH ( A=326', B=110' )      70 MPH ( A=356', B=125' )



35 MPH ( A=96', B=100' )      40 MPH ( A=116', B=130' )  
45 MPH ( A=181', B=115' )      50 MPH ( A=226', B=130' )



30 MPH

LOOP DETECTOR GENERAL NOTES (55 MPH TO 70 MPH):

Loops 1 and 2 shall be connected to the controller cabinet by means of the same loop lead-in (2/C #14 AWG).

Loops 3 and 4 shall be connected to the controller cabinet by means of the same loop lead-in (2/C #14 AWG).

Loops 5 and 6 shall be connected to the controller cabinet by means of the same loop lead-in (2/C #14 AWG).

Loops 7 and 8 shall be connected to the controller cabinet by means of individual loop lead-in (2/C #14 AWG).

Loop 9 shall be connected to the controller cabinet by means of a loop lead-in (2/C #14 AWG). Loop 9 shall be placed only when a left turn lane exists.

LOOP DETECTOR GENERAL NOTES (35 MPH TO 50 MPH):

Loops 1 and 2 shall be connected to the controller cabinet by means of the same loop lead-in (2/C #14 AWG).

Loops 3 and 4 shall be connected to the controller cabinet by means of the same loop lead-in (2/C #14 AWG).

Loops 5 and 6 shall be connected to the controller cabinet by means of individual loop lead-in (2/C #14 AWG).

Loop 9 shall be connected to the controller cabinet by means of a loop lead-in (2/C #14 AWG). Loop 9 shall be placed only when a left turn lane exists.

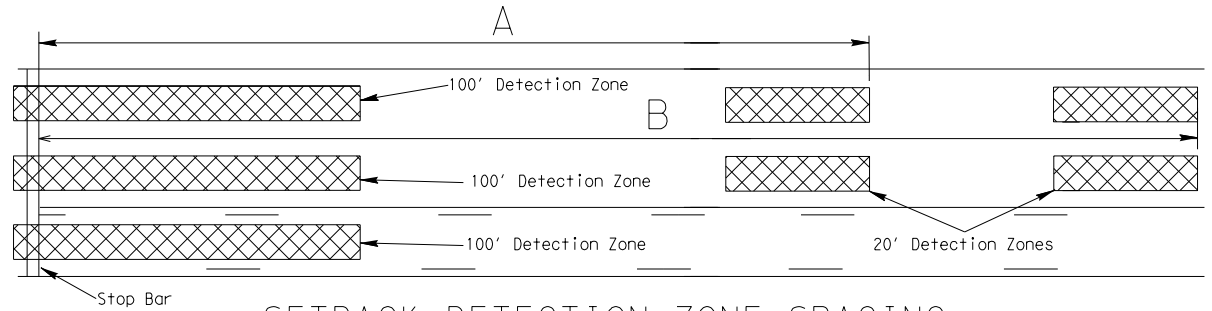
LOOP DETECTOR GENERAL NOTES (30 MPH):

Loops 1 and 2 shall be connected to the controller cabinet by means of the same loop lead-in (2/C #14 AWG).

Loops 3 and 4 shall be connected to the controller cabinet by means of individual loop lead-in (2/C #14 AWG).

Loop 9 shall be connected to the controller cabinet by means of a loop lead-in (2/C #14 AWG). Loop 9 shall be placed only when a left turn lane exists.

VIDEO DETECTION PLACEMENT DETAILS



SETBACK DETECTION ZONE SPACING  
(SPEEDS GREATER THAN OR EQUAL TO 45 MPH)

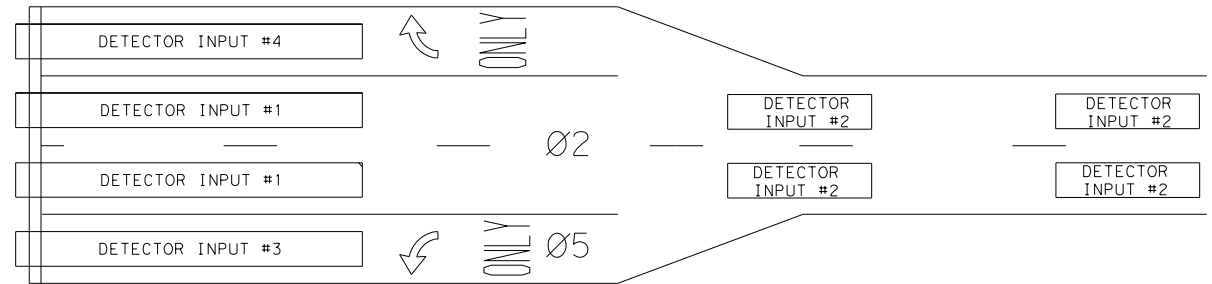
45 MPH (A=210', B=350')	50 MPH (A=235', B=390')
55 MPH (A=255', B=430')	60 MPH (A=280', B=470')
65 MPH (A=305', B=510')	70 MPH (A=330', B=550')

NOTE: SPEEDS EQUAL OR GREATER THAN 45 MPH WILL REQUIRE THE USE OF TWO VIVDS CAMERAS.

UTILIZATION OF CAMERA ONE FOR STOP BAR DETECTION AND CAMERA TWO FOR SET BACK DETECTION ZONES.

STOP BAR DETECTION ZONES SHALL BE PROVIDED FOR EACH LANE OF EACH APPROACH.

STOP BAR DETECTION AND SET BACK DETECTION SHOULD DRIVE A SEPARATE DETECTOR INPUT INTO THE CONTROLLER. IN ADDITION, DETECTORS IN EXCLUSIVE TURN LANES SHOULD DRIVE A SEPARATE DETECTOR INPUT INTO THE CONTROLLER. SEE TYPICAL LAYOUT BELOW.



DETECTOR INPUT #	PHASE
1	Ø2 STOP BAR
2	Ø2 SET BACK
3	Ø5 STOP BAR
4	Ø2 RT LANE

NOTE:  
ALL DETECTOR PLACEMENTS  
ARE BASED ON THE POSTED  
SPEED LIMIT

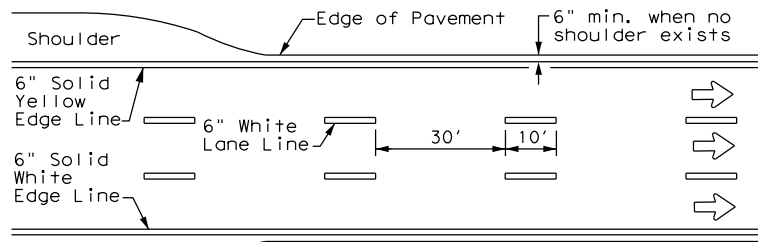


San Antonio District Standard  
VEHICLE DETECTOR  
PLACEMENT DETAILS

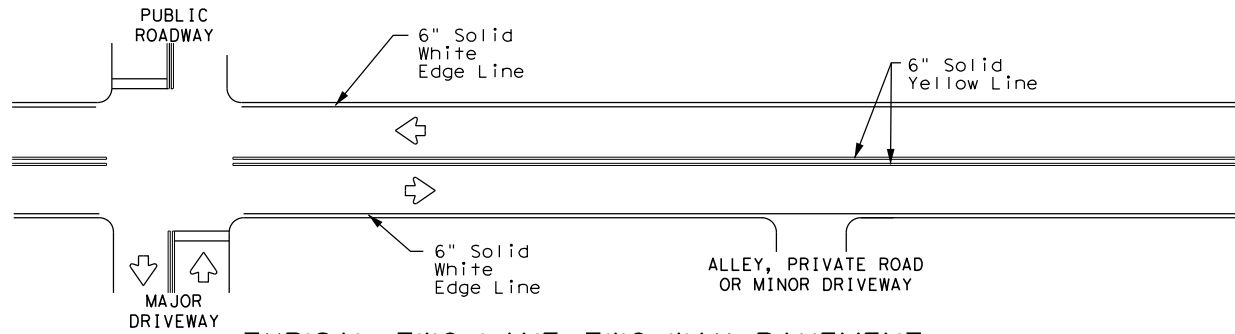
SCALE: NS		VD (2) -06	
REVISIONS	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	SHEET NO.
FEB 2006	6	\$FAP-NO\$	50
STATE	DIST.	COUNTY	
TEXAS			
CONT.	SECT.	JOB	HIGHWAY NO.

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

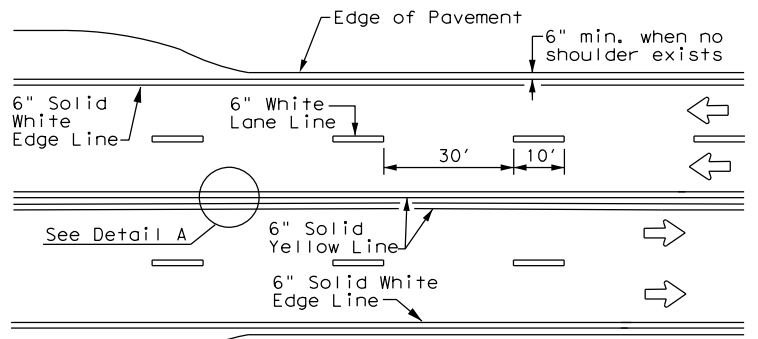
DATE: 3/4/2024 9:26:53 AM  
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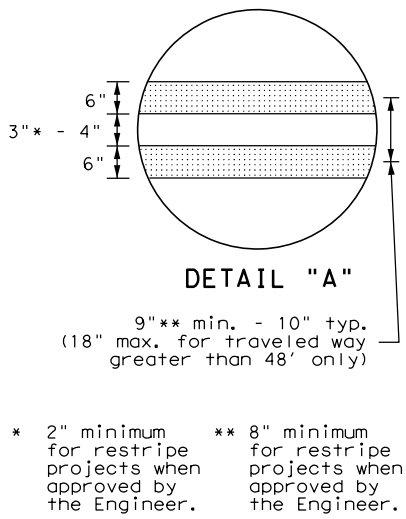
EDGE LINE AND LANE LINES  
ONE-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS



TYPICAL TWO-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS



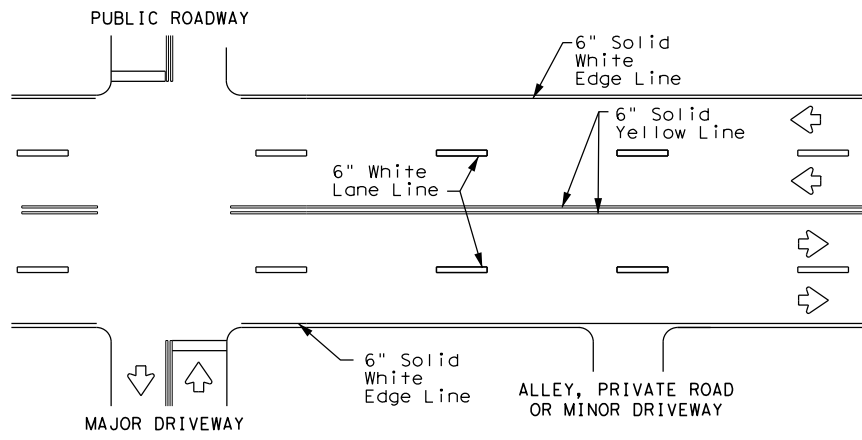
CENTERLINE AND LANE LINES  
FOUR LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS



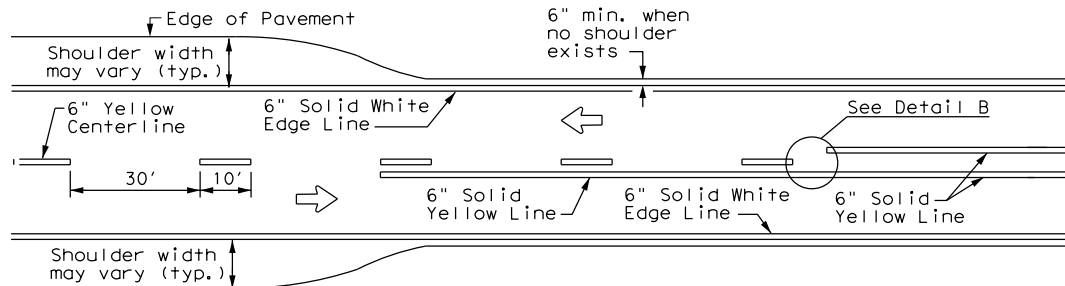
DETAIL "A"

9" min. - 10" typ.  
(18" max. for traveled way  
greater than 48' only)

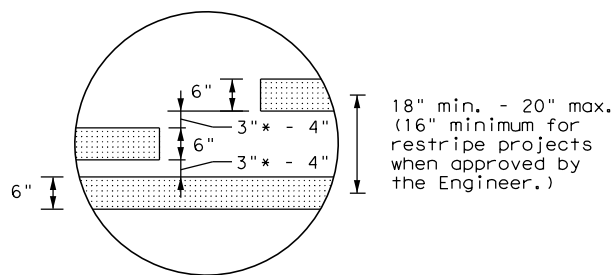
\* 2" minimum  
for restripe  
projects when  
approved by  
the Engineer.  
\*\* 8" minimum  
for restripe  
projects when  
approved by  
the Engineer.



TYPICAL MULTI-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS



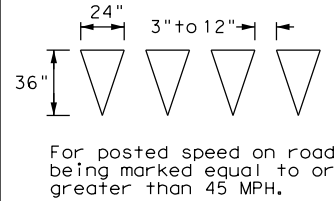
TWO LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS



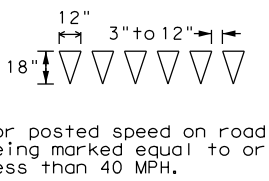
DETAIL "B"

18" min. - 20" max.  
(16" minimum for  
restripe projects  
when approved by  
the Engineer.)

\* 2" minimum for restripe projects  
when approved by the Engineer.



YIELD LINES



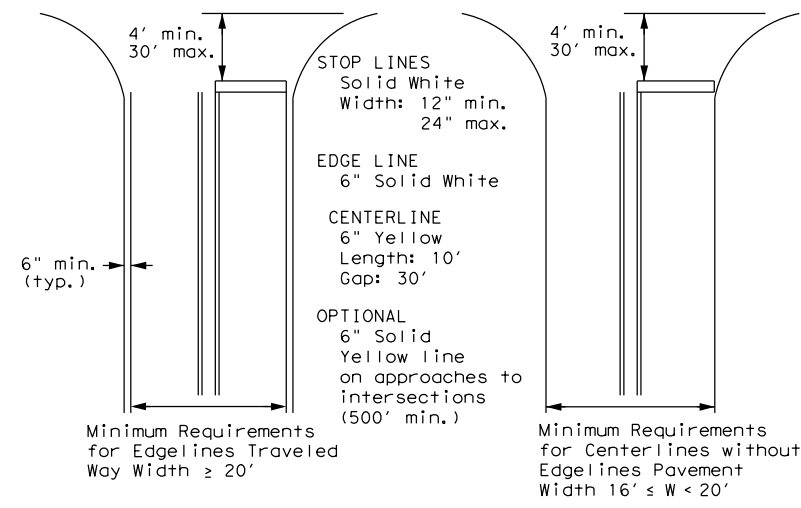
For posted speed on road  
being marked equal to or  
less than 40 MPH.

GENERAL NOTES

- Edge line striping shall be as shown in the plans or as directed by the Engineer. The edge line should not be placed less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edge lines are not required in curb and gutter sections of roadways.
- The traveled way includes only that portion of the roadway used for vehicular travel. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the center of edge line to the center of edge line of a two lane roadway.

MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

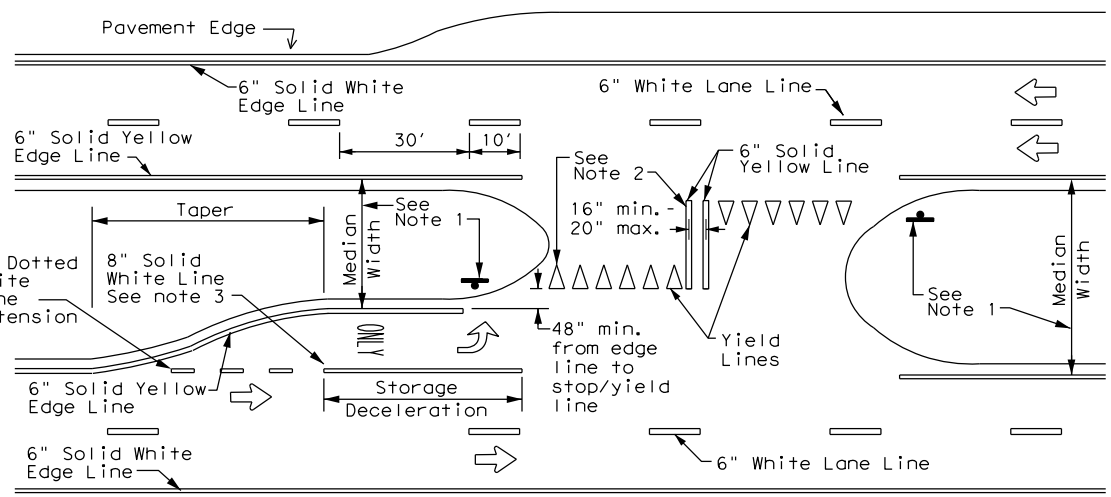
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



NOTE: Traveled way is exclusive of shoulder widths.  
Refer to General Note 2 for additional details.

GUIDE FOR PLACEMENT OF STOP LINES,  
EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths  
for Undivided Roadways



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

- Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs and stop bars are optional as determined by the Engineer.
- Install median striping (double yellow centerlines and stop lines/yield lines) when a 50' or greater median centerline can be placed. Stop lines shall only be used with stop signs. Yield lines shall only be used with yield signs.
- Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.



TYPICAL STANDARD  
PAVEMENT MARKINGS

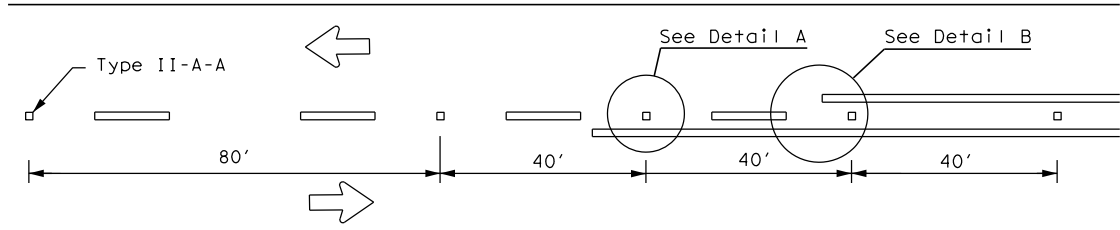
PM(1) - 22

FILE: pml-22.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
11-78 8-00 6-20	DIST	COUNTY	SHEET NO.	51
8-95 3-03 12-22				
5-00 2-12				

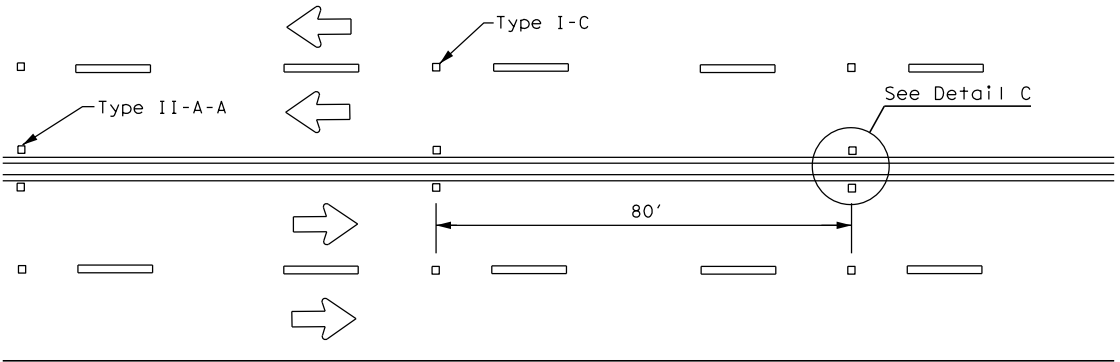
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: 3/4/2024 9:26:55 AM  
FILE: P:\64\45\Design\Civil\Standards\pm2-22.dgn

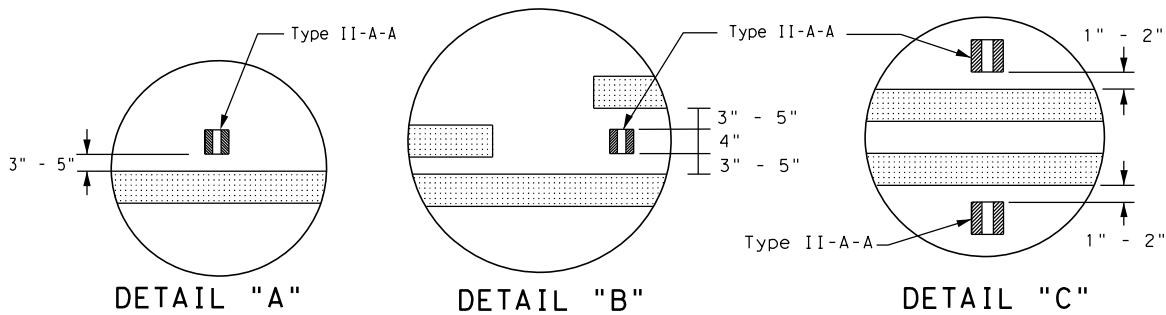
REFLECTIVE RAISED PAVEMENT MARKERS  
FOR VEHICLE POSITIONING GUIDANCE



CENTERLINE FOR ALL TWO LANE TWO-WAY ROADWAYS



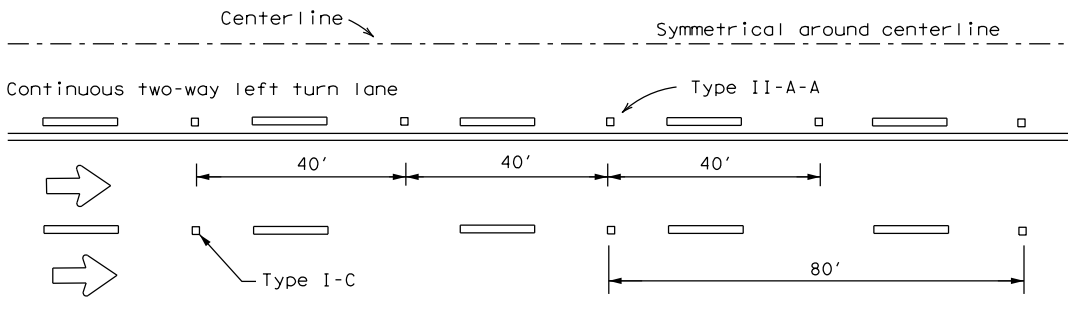
CENTERLINE & LANE LINES  
FOR FOUR LANE TWO-WAY ROADWAYS



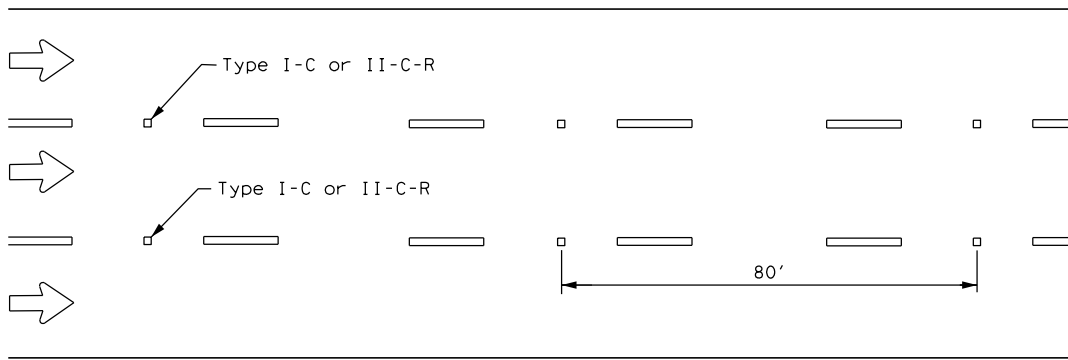
DETAIL "A"

DETAIL "B"

DETAIL "C"

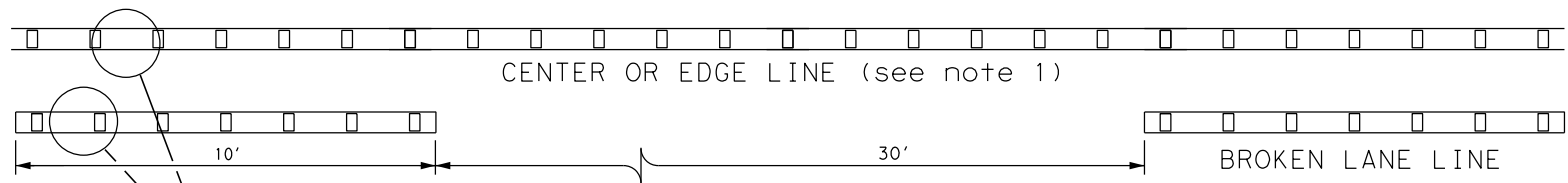


CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



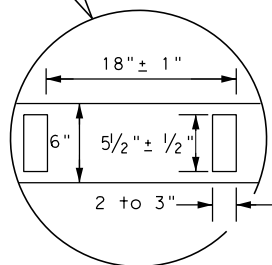
LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

Raised pavement markers Type II-C-R shall have clear face toward normal traffic and red face toward wrong-way traffic.  
See Note 3.



CENTER OR EDGE LINE (see note 1)

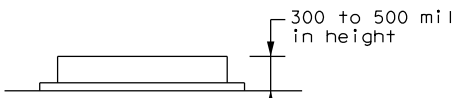
BROKEN LANE LINE



6" EDGE LINE, 6" CENTERLINE  
OR 6" LANE LINE

REFLECTORIZED PROFILE  
PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS



A quick field check for the thickness of base line and profile marking is approximately equal to a stack of 5 quarters to a maximum height of 7 quarters.

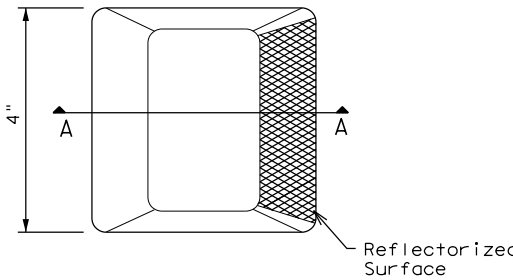
NOTES

- Edge lines should typically be 6" wide and the materials shall be specified in the plans.
- Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

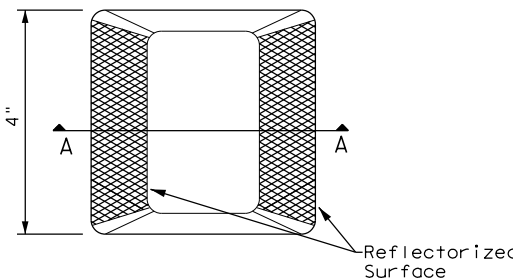
MATERIAL SPECIFICATIONS

PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

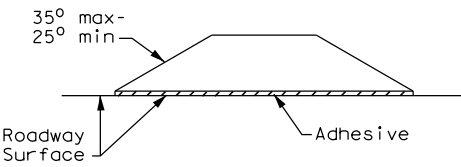
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)



Type II (Top View)



SECTION A

RAISED PAVEMENT MARKERS

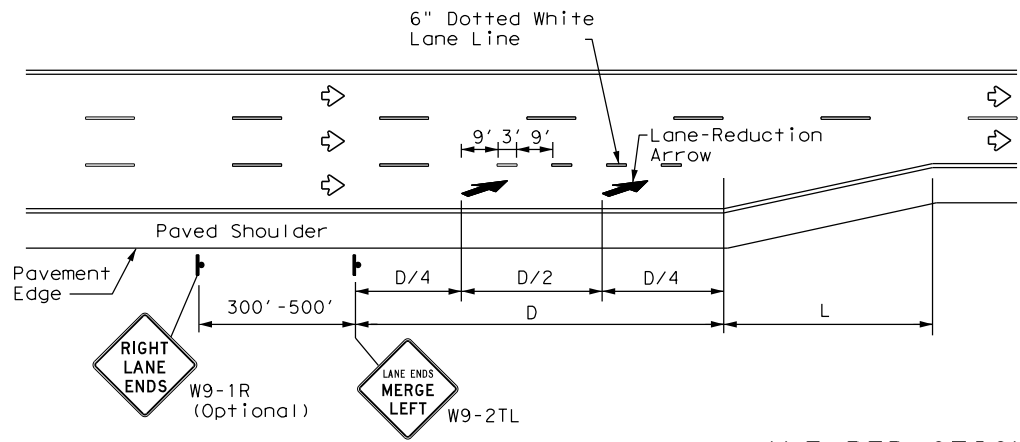


POSITION GUIDANCE USING  
RAISED MARKERS  
REFLECTORIZED PROFILE  
MARKINGS  
PM(2) - 22

FILE: pm2-22.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
4-77 8-00 6-20	DIST	COUNTY	SHEET NO.	52
4-92 2-10 12-22				
5-00 2-12				

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DATE: 3/4/2024 9:26:56 AM  
FILE: P:\64\45\93\Design\Civil\Standards\pm3-22.dgn



LANE REDUCTION

NOTES

- Lane reduction pavement markings are used where the number of through lanes is reduced because of narrowing of the roadway or because of a section of on-street parking in what would otherwise be a through lane. For Texas Super 2 Passing Lanes, see TS2(PL) standard sheets.
- On divided highways, an additional RIGHT LANE ENDS (W9-1R) sign may be installed in the median aligned with the W9-1R sign on the right side of the highway.
- Lane reduction arrows are required for speeds of 45 mph or greater. An optional third lane reduction arrow may be added based on engineering judgement. If used, the optional third lane reduction arrow should be centered between the first and last lane reduction arrows.
- For lane reductions on Freeways and Expressways, signing shall conform to the TxDOT Freeway Signing Handbook.

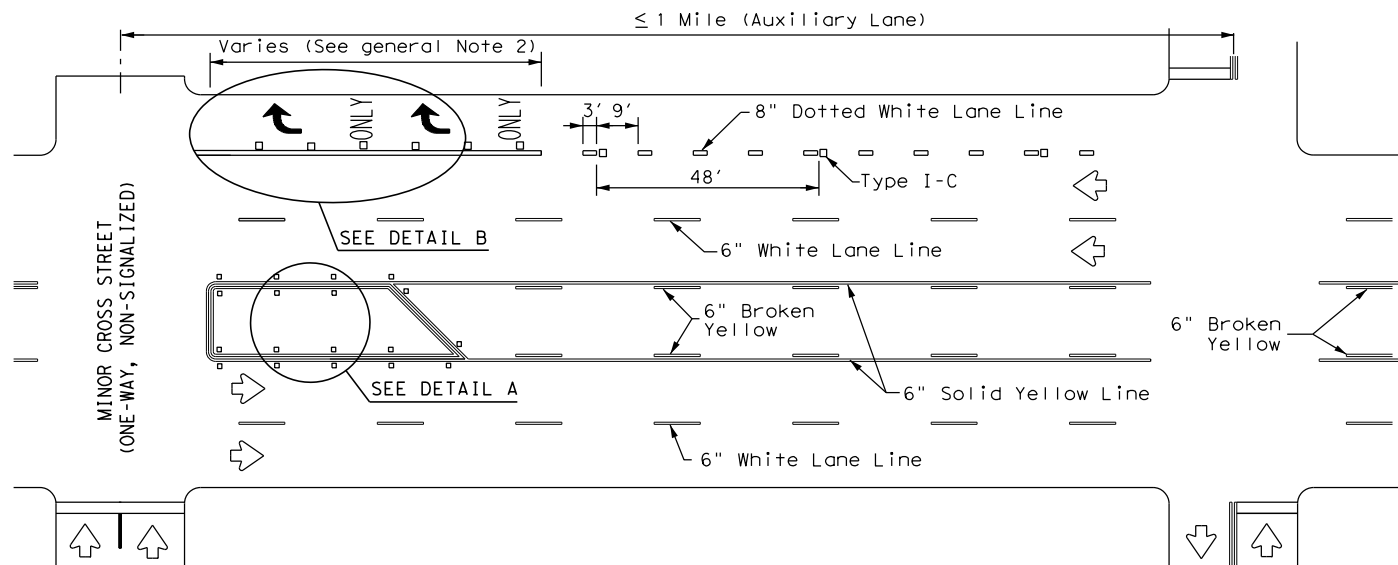
ADVANCED WARNING SIGN DISTANCE (D)		
Posted Speed	D (ft)	L (ft)
30 MPH	460	$L = \frac{WS^2}{60}$
35 MPH	565	
40 MPH	670	L=WS
45 MPH	775	
50 MPH	885	
55 MPH	990	
60 MPH	1,100	
65 MPH	1,200	
70 MPH	1,250	
75 MPH	1,350	

GENERAL NOTES

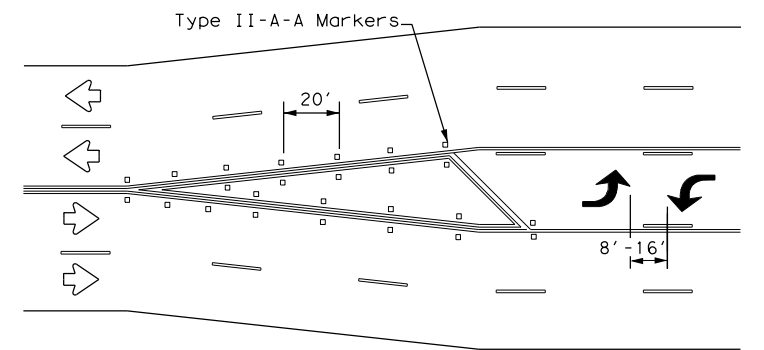
- Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn bays for emphasis. Details for words and arrows are as shown in the Standard Highway Sign Designs for Texas.
- When lane-use words and arrow markings are used, two sets of arrows should be used if the length of the bay is greater than 180 feet. When a single lane use arrow or word and arrow marking is used for a short turn lane, it should be located at or near the upstream end of the full-width turn lane.
- Use raised pavement marker Type I-C with undivided highways, flush medians and two way left turn lanes. Use raised pavement marker Type II-C-R with divided highways and raised medians.
- Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer. See Chapter 3 of the Roadway Design Manual for additional information on turning lanes or storage lengths.

MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

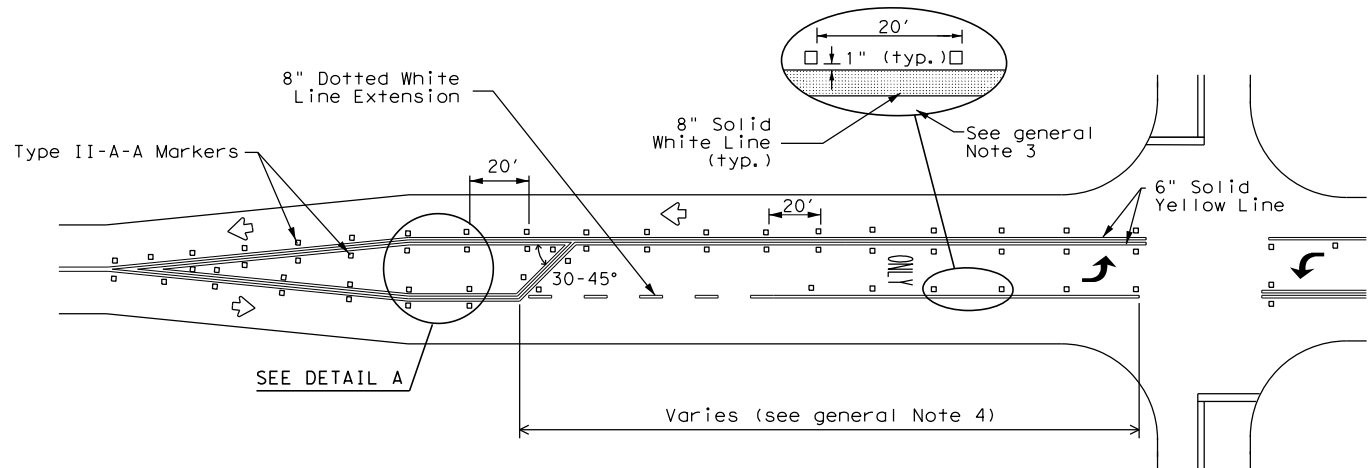
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



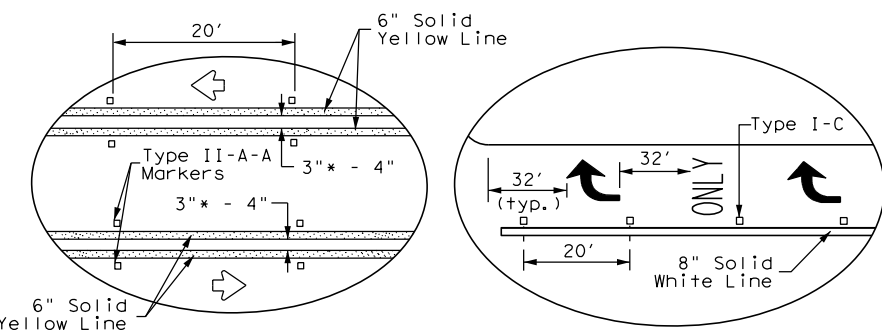
TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE



TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY



TYPICAL TWO-LANE ROADWAY INTERSECTION WITH LEFT TURN BAYS



DETAIL A

DETAIL B

\* 2" minimum allowed for restripe projects when approved by the Engineer.

Traffic Safety Division Standard

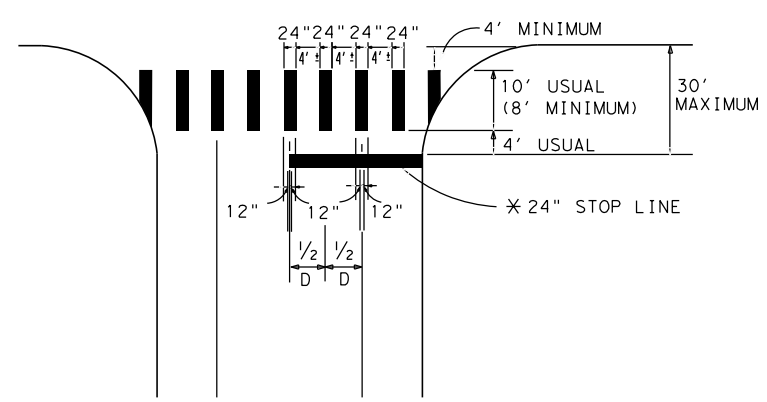
### TWO-WAY LEFT TURN LANES, RURAL LEFT TURN BAYS, AND LANE REDUCTION PAVEMENT MARKINGS

## PM(3) - 22

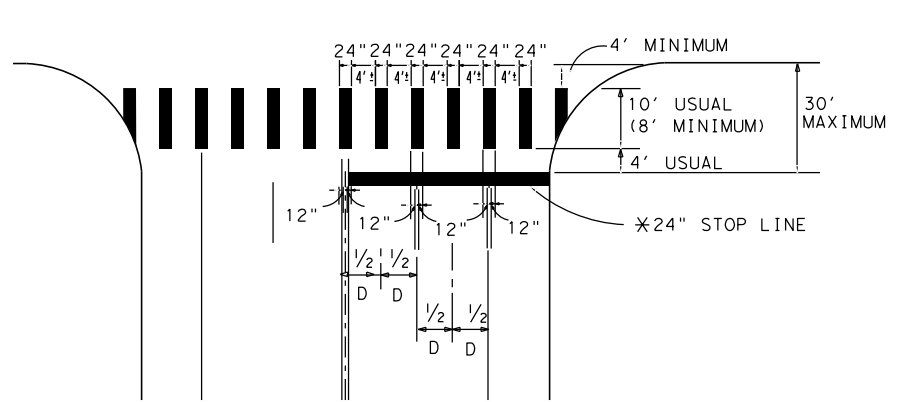
FILE: pm3-22.dgn	DN:	CK:	DW:	CK:
©TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY	SHEET NO.	
4-98 3-03 6-20			53	
5-00 2-10 12-22				
8-00 2-12				



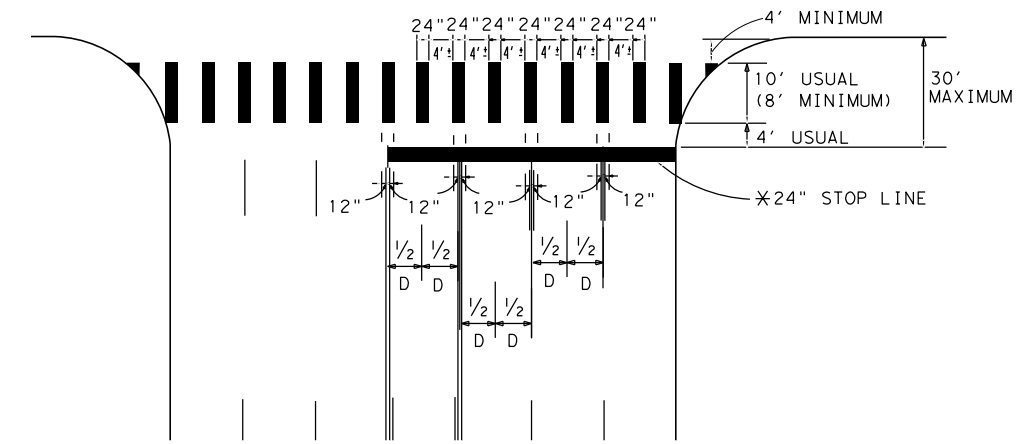
ACC:  
LEVELS DISPLAYED  
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16  
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32  
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48  
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63



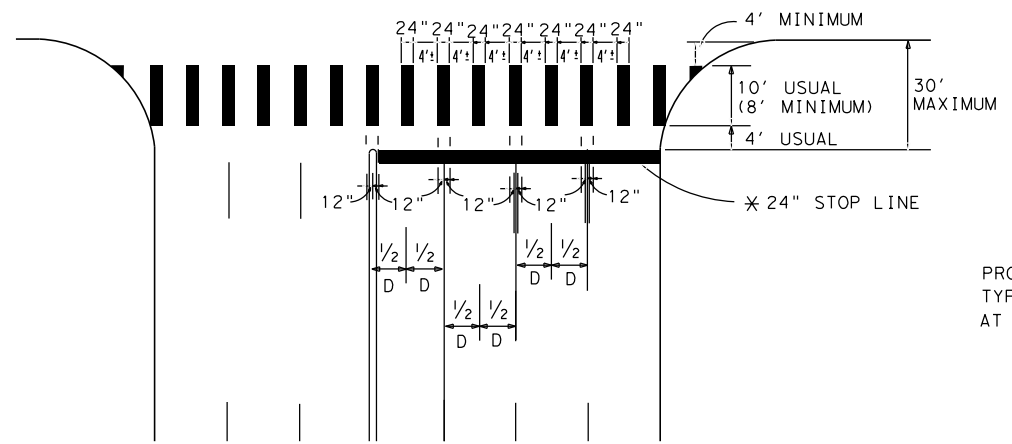
TWO LANES WITH SHOULDERS



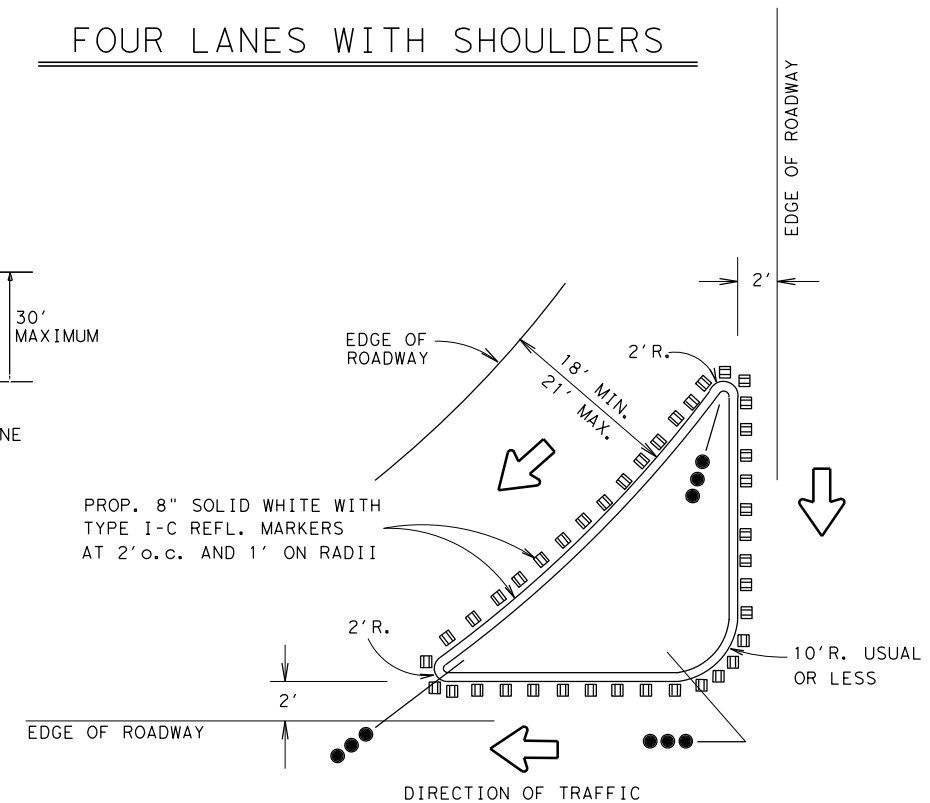
FOUR LANES WITH SHOULDERS



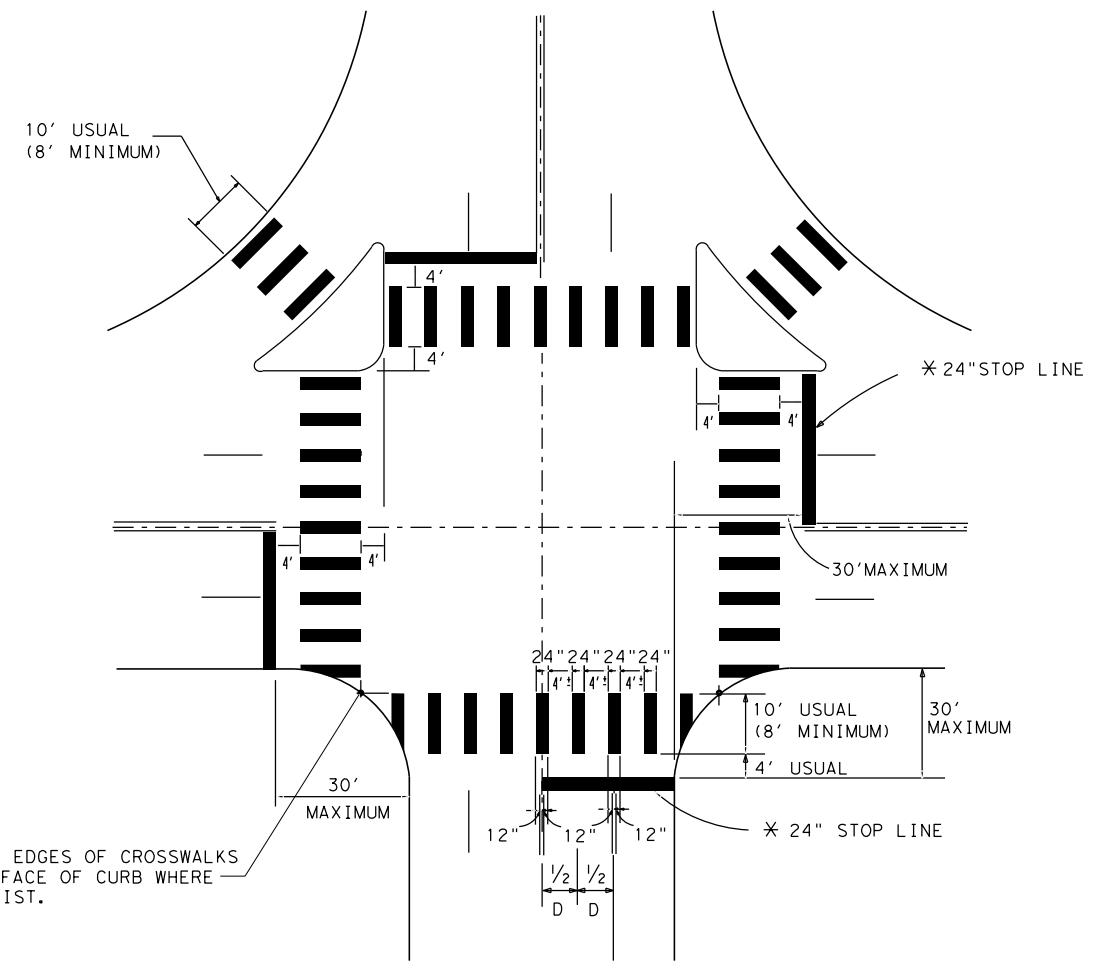
MULTI - LANES



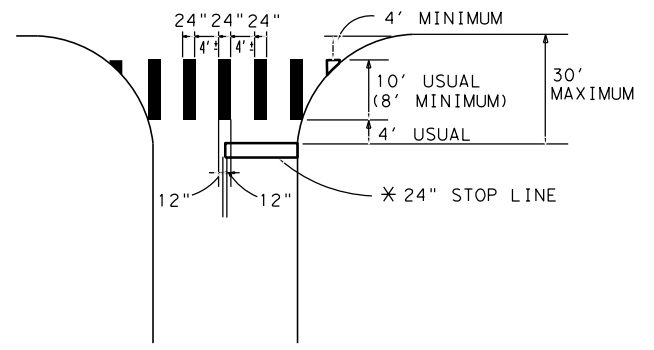
MULTI - LANE WITH MEDIAN



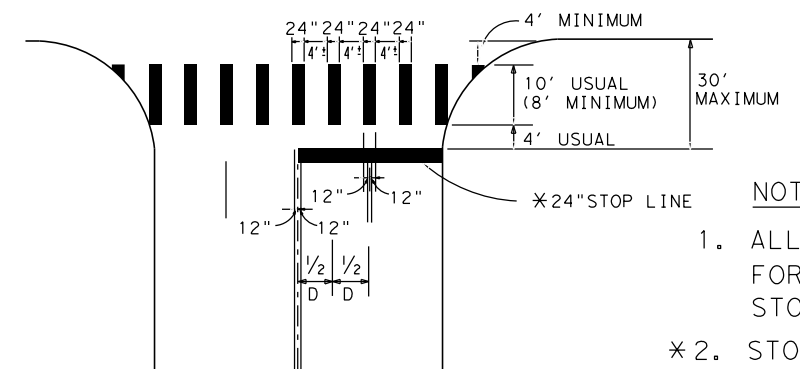
TYPICAL RIGHT TURN ISLAND WITH DELINEATION



INTERSECTION WITH RIGHT - TURN ISLANDS



TWO LANES



FOUR LANES

NOTES:

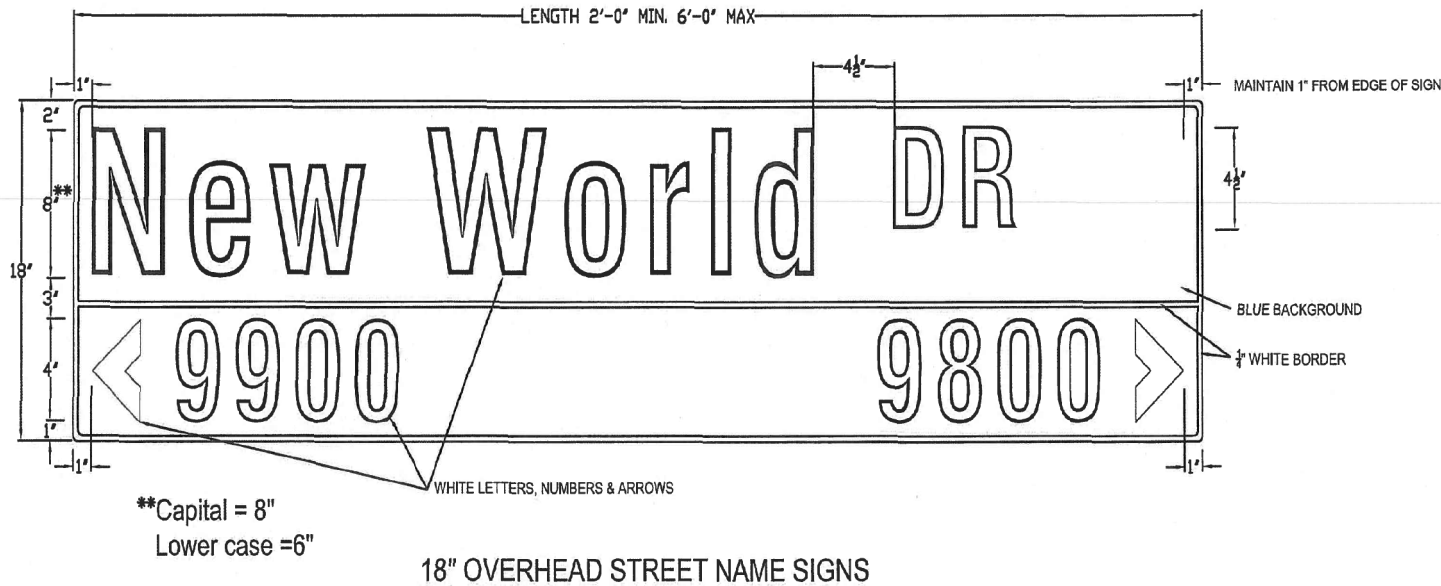
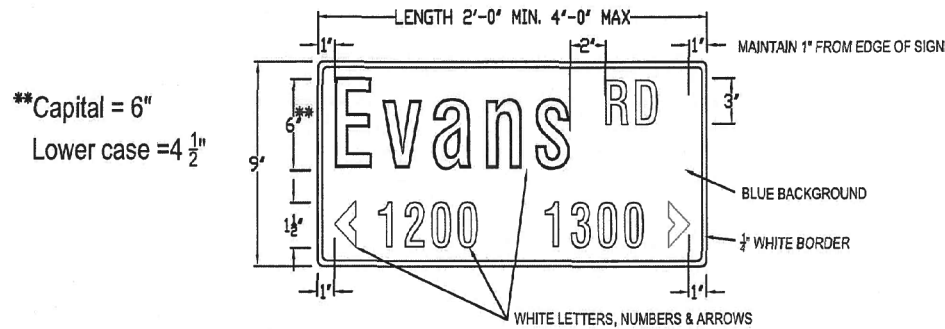
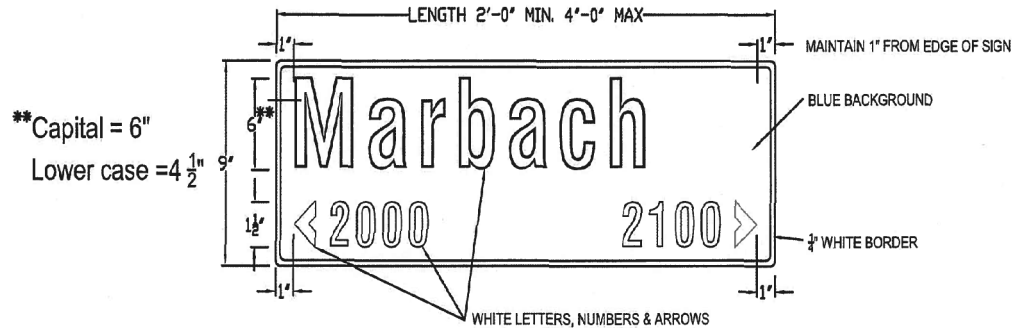
1. ALL LONGITUDINAL LINES FORMING CROSSWALK AND STOP LINES SHALL BE WHITE
- \* 2. STOP LINES AS REQUIRED ON DETAILED PAVEMENT MARKING PLANS.
3. "D" IS EQUAL TO ONE HALF THE DISTANCE.

San Antonio District Standard  
TYPICAL CROSSWALK  
DETAILS

TCD-05

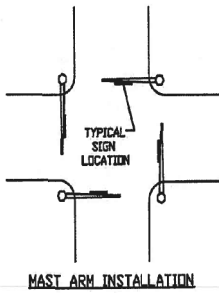
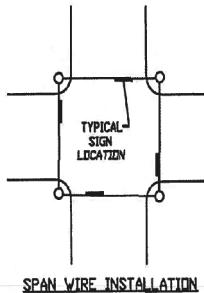
© 2006 Texas Department of Transportation

REVISIONS	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	SHEET NO.
DEC 1999 AUG 2005	6		54
	STATE	DIST.	COUNTY
	TEXAS	SAT	
	CONT.	SECT.	JOB
			HIGHWAY NO.



	18" OVERHEAD SIGN	9" GROUND MOUNT SIGNS
HEIGHT	18" (381 mm)	9" (228 mm)
LENGTH	48" (1200 mm) MIN. 72" (1800 mm) MAX. 1" (30mm) INCREMENTS OF LENGTH	24" (600 mm) MIN. 48" (1200 mm) MAX. 6" (150mm) INCREMENTS OF LENGTH
THICKNESS	0.125" (3 mm)	
SUBSTRATE	ALUMINUM ALLOY, 5052-H38 (ASTM B-209) GOLD CHROMATE FINISH	
SIGN FACE MATERIALS	BLUE FILM * OVER DIAMOND GRADE - ASTM Type XI Non-Fluorescent	BLUE FILM * OVER HIGH INTENSITY PRISMATIC- ASTM Type IV
LEGENDS AND SYMBOLS	SERIES D, B OR C IF NAME OTHERWISE EXCEEDS MAXIMUM SIGN LENGTH	
COLOR	WHITE LEGEND ON BLUE BACKGROUND	
LETTER TRACKING	17% (USUAL) 10% (MIN.)	10%

\* ACRYLIC ELECTRONIC CUTTABLE FILM



SIGN FACE MATERIALS  
SHALL CONFORM TO:

1. STANDARD SPECIFICATIONS FOR CONSTRUCTION OF ROADS & BRIDGES ON FEDERAL HIGHWAY PROJECTS - FP-03 U.S. CUSTOMARY UNITS SECTION 718
2. GENERAL SERVICES ADMINISTRATION FEDERAL SPECIFICATIONS L-S-300C
3. ASTM D 4956 - 09e1

BEXAR COUNTY  
PUBLIC WORKS DEPARTMENT



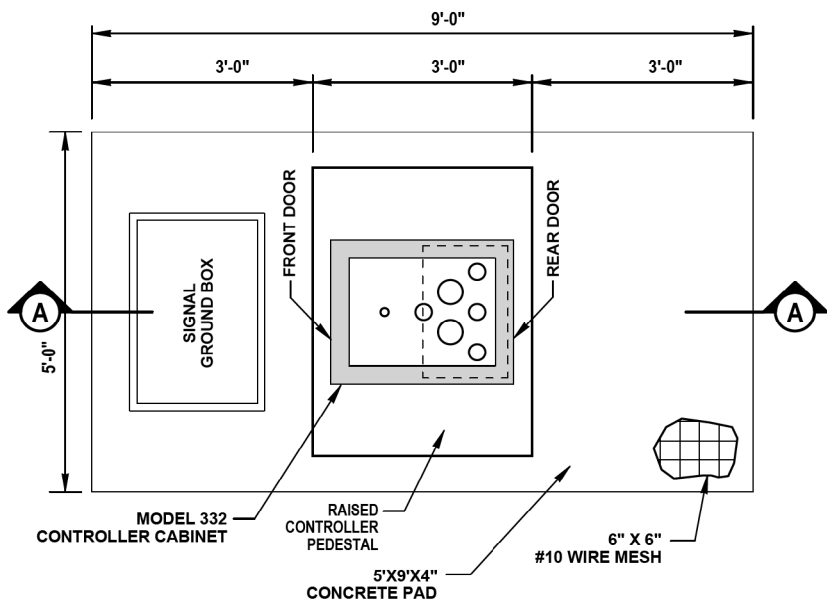
STREET NAME SIGNING DETAILS

DESIGN BY:	DATE:
CHECKED BY:	DATE:
FILE NO:	DATE:
SHEET	176

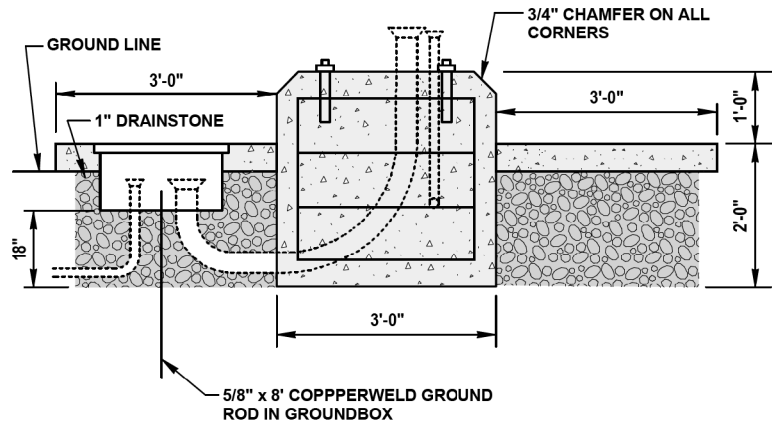
LENNAR HOMES OF TEXAS, INC.  
SAN ANTONIO ETJ, TEXAS  
GROSENBACHER RD @ LADERA HILLS  
BEXAR COUNTY SIGN DETAIL

PAPE-DAWSON  
ENGINEERS  
SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 HW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TYPE FPM REGISTRATION #470 | TPELS FPM REGISTRATION #1028800

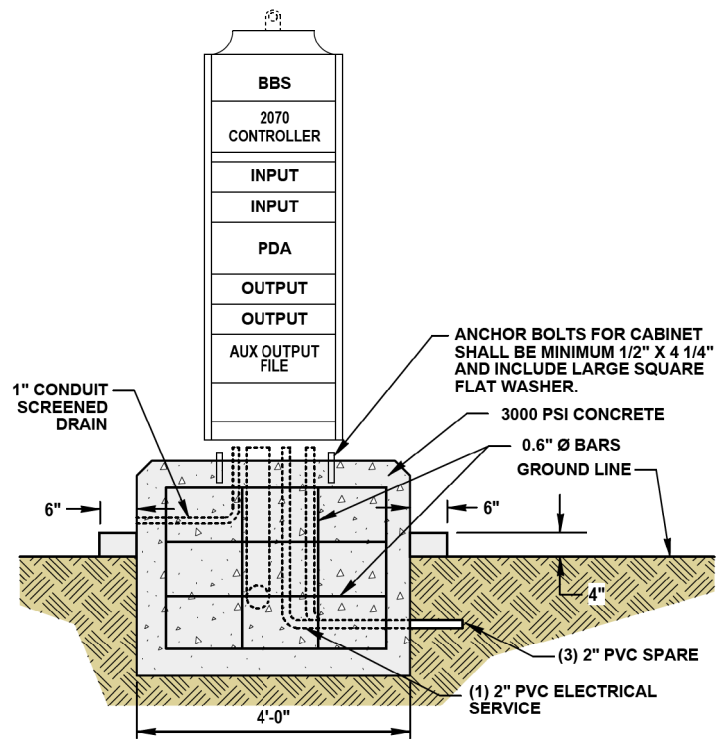
JOB NO. 6445-93  
DATE 3/4/2024  
DESIGNER JCH  
CHECKED JWC, DRAWN JCH



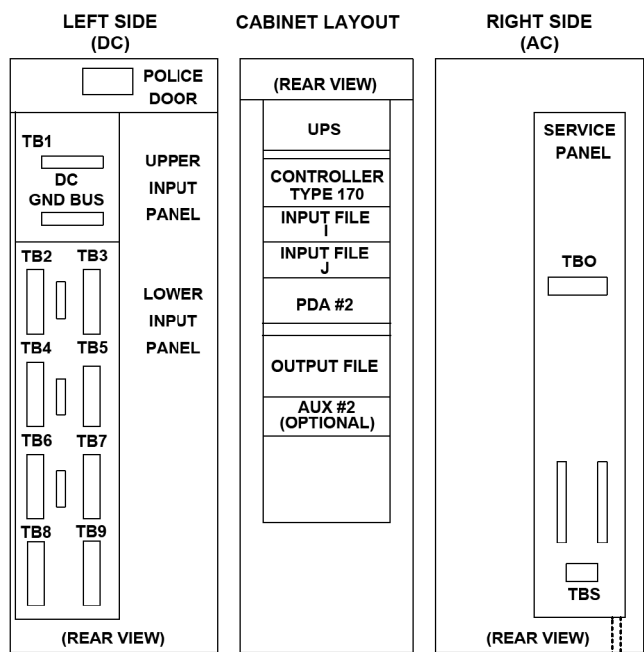
**TOP VIEW**  
(NEW FOUNDATION)



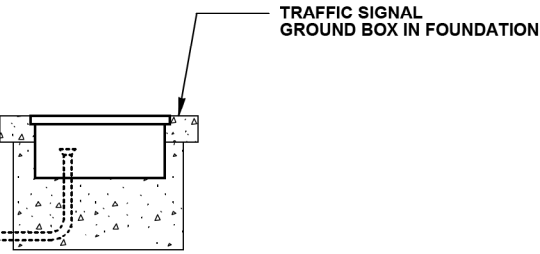
**SECTION A-A**



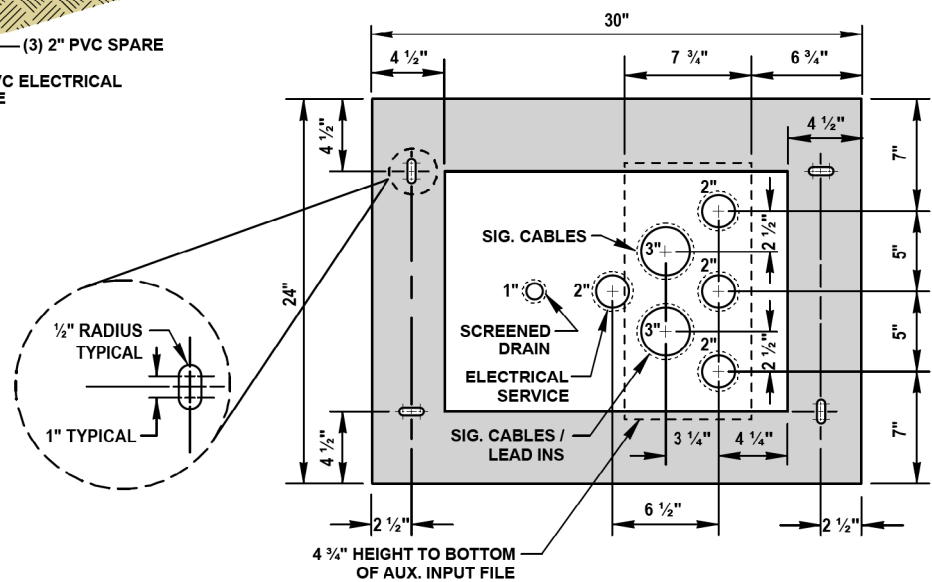
**REAR VIEW**



**NOTES:**  
1. CONTRACTOR TO INSTALL GROUNDBOX, CONDUIT, CONTROLLER FOUNDATION, CONCRETE SLAB AND CONDUIT FROM GROUNDBOX TO CABINET.



**REAR VIEW SCHEMATIC**



**BASE PLATE TEMPLATE**

MARCH 2017

CITY OF SAN ANTONIO			
TRANSPORTATION & CAPITAL IMPROVEMENTS DEPARTMENT			
TRAFFIC STANDARDS			
TYPE 332 CABINET FOUNDATION			
SHEET 1 OF 1			
60 % SUBMITTAL	PROJECT NO.: 6445-93	DATE: 3/4/2024	
DRWN. BY: PD	DSGN. BY: Pape-Dawson	CHKD. BY: MAB	SHEET NO.: 56