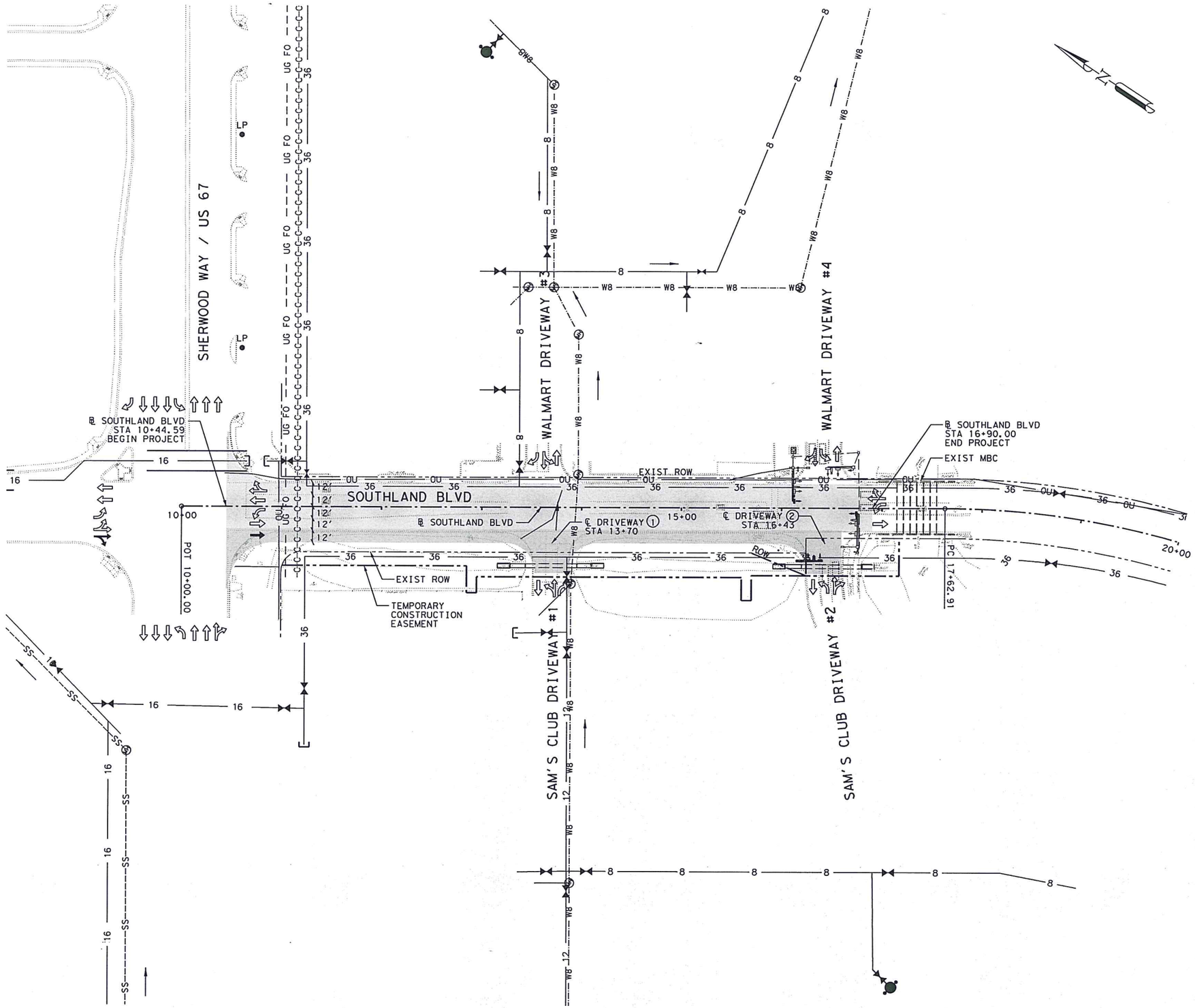


## LEGEND

- 6 — BURIED 6" WATER LINE PVC
- 8 — BURIED 8" WATER LINE PVC
- 12 — BURIED 12" WATER LINE PVC
- 16 — BURIED 16" WATER LINE AC
- 36 — BURIED 36" WATER LINE
- WATER VALVE
- SS — BURIED SANITARY SEWER LINE
- W8 — BURIED 8" SEWER LINE
- C — BURIED COPPER CABLE
- UG FO — BURIED FIBER OPTIC CABLE
- OU — EXISTING ELECTRIC LINE OVERHEAD
- GRAVITY FLOW DIRECTION
- MH — MANHOLE
- LP — LIGHT POLE

NOTES:

1. THE CONTRACTOR SHALL CONTACT TEXAS EXCAVATION SAFETY SYSTEM (800-DIG-TESS: 800-344-8377), CITY OF SAN ANGELO DISTRIBUTION OFFICE AT 325-657-4295, AND RELEVANT UTILITY COMPANIES 48 HOURS PRIOR TO LOCATING EXISTING UTILITIES AND/OR CONSTRUCTION ACTIVITIES.

09/23/2016

STATE OF TEXAS
MICHAEL C. COYLE
95634
LICENSED PROFESSIONAL ENGINEER

0' 25' 50' 100'
SCALE: 1"=100'

| REV. NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

LJA Engineering, Inc.
FRN - F-1386

THE CITY OF SAN ANGELO TEXAS

SOUTHLAND BOULEVARD

EXISTING UTILITY LAYOUT

SHEET 1 OF 1

SHEET NO. 46

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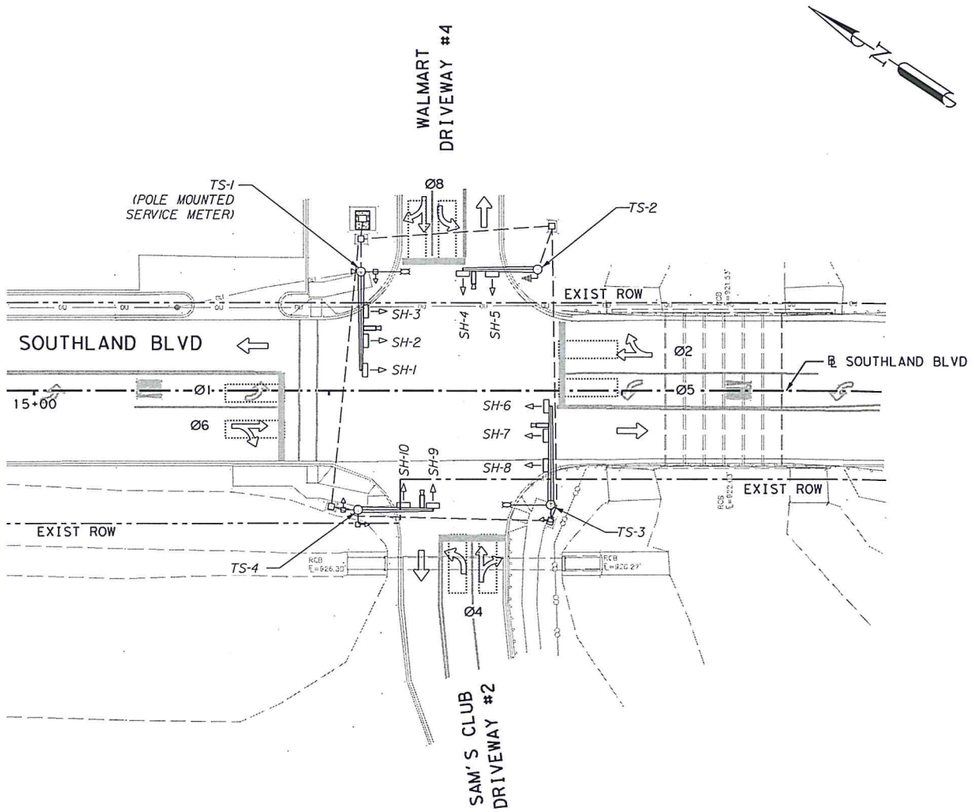
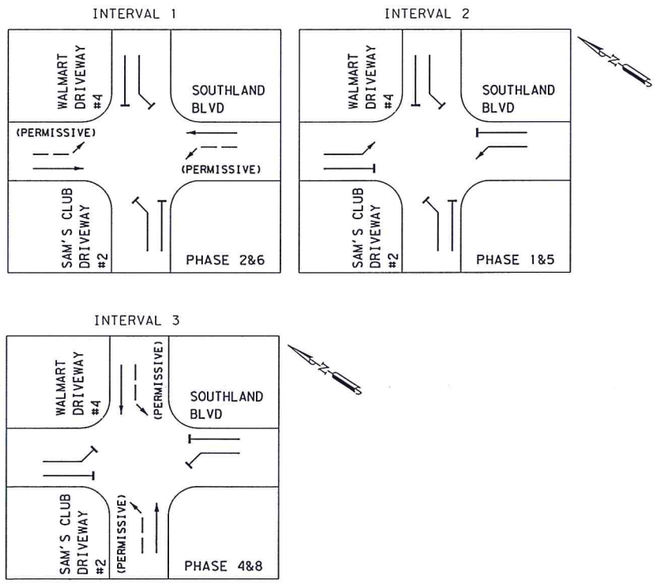



## EXISTING SIGNAL HEAD SCHEDULE

| R Y G | R Y ←Y G |
|---|---|
| SIGNALS | SIGNALS |
| SH-2 | SH-1 |
| SH-3 | SH-6 |
| SH-4 | |
| SH-5 | |
| SH-7 | |
| SH-8 | |
| SH-9 | |
| SH-10 | |

## LEGEND

- EXIST SIGNAL POLE
- EXIST MAST ARM
- EXIST SIGNAL CONTROLLER
- EXIST METER AND DISCONNECT
- EXIST HORIZONTAL SIGNAL HEAD
- EXIST PEDESTRIAN SIGNAL
- EXIST LUMINAIRE WITH ARM
- EXIST ANTENNA
- EXIST PULL BOX
- EXIST VIVDS CAMERA
- EXIST CONDUIT
- EXIST VIDEO DETECTION ZONE
- TRAFFIC FLOW




| SEQUENCE CHART | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| INTERVAL | PHASE 2&6 | | | PHASE 1&5 | | | PHASE 4&8 | | | FLASHING OPERATIONS |
| SIGNAL FACE | R/W | CLEAR 2&6 | CLEAR TO ALL PHASES | R/W | CLEAR 1&5 | CLEAR TO ALL PHASES | R/W | CLEAR 4&8 | CLEAR TO ALL PHASES | NORMAL AND EMERGENCY |
| SH-2, SH-3 | G | Y | R | R | R | R | R | R | R | R |
| SH-1 | G | Y | R | <G | <Y | R | R | R | R | R |
| SH-7, SH-8 | G | Y | R | R | R | R | R | R | R | R |
| SH-6 | G | Y | R | <G | <Y | R | R | R | R | R |
| SH-4, SH-5 | R | R | R | R | R | R | G | Y | R | R |
| SH-9, SH-10 | R | R | R | R | R | R | G | Y | R | R |

ABDULHALIM A. EL-HOUT
109844
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS
Sep. 23, 2016

0′ 25′ 50′
SCALE: 1"=50′

| REV. NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

LJA Engineering, Inc.
FRN - F-1386

THE CITY OF SAN ANGELO TEXAS

SOUTHLAND BOULEVARD
EXISTING SIGNAL CONDITIONS
AT SAM'S/WALMART DRIVEWAY

SHEET 1 OF 2

SHEET NO. 47

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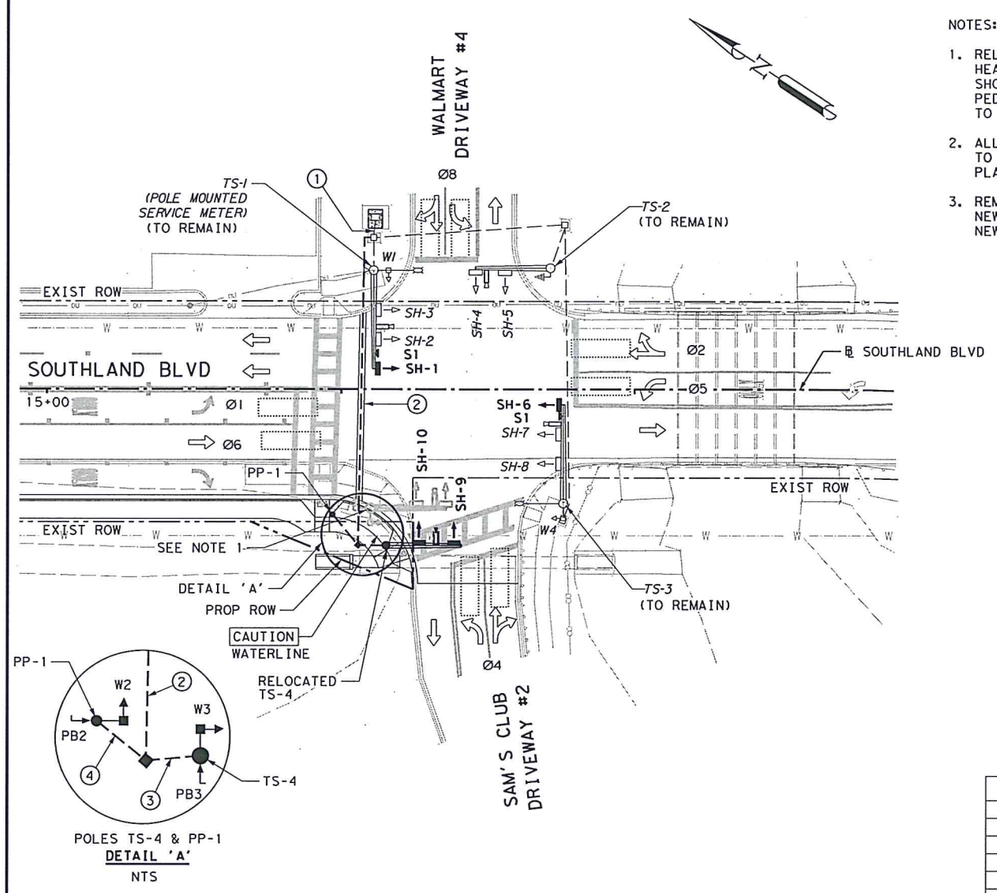
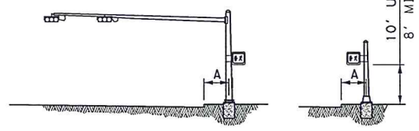



POLES TS-4 & PP-1
**DETAIL 'A'**
NTS

NOTES:

1. RELOCATE EXISTING SIGNAL POLE, SIGNAL HEADS, PUSH BUTTONS AND VIVDS CAMERA AS SHOWN ON THE PLAN. RELOCATE EXISTING PEDESTRIAN HEAD W2 AND PUSH BUTTON PB2 TO PROPOSED PEDESTAL POLE PP-1.
2. ALL OTHER EXISTING SIGNAL EQUIPMENTS ARE TO REMAIN UNLESS OTHERWISE NOTED ON THE PLAN.
3. REMOVE EXISTING SIGNAL HEADS AND INSTALL NEW SIGNAL HEADS FOR SH-1 & SH-6. CONNECT NEW SIGNAL HEADS TO EXISTING CABLES.




SIGNAL POLE PEDESTAL POLE

| SIGNAL POLE LOCATION | | | |
|---|---|---|---|
| POLE | A | STATION | OFFSET |
| **TS-4** | **4.5'** | **16+09.00** | **45.73' RT** |
| *TS-1* | | *EXISTING* | |
| *TS-2* | | *EXISTING* | |
| *TS-3* | | *EXISTING* | |
| **PP-1** | **5'** | **16+15.89** | **53.31' RT** |

## SIGNAL HEAD SCHEDULE

SIGNALS SH-2, SH-3, SH-4, SH-5, SH-7, SH-8 (EXISTING)

PEDESTRIAN SIGNALS W1, W4 (EXISTING)

**SIGNALS SH-1, SH-6 (PROPOSED)**

FY = FLASHING YELLOW

**SIGNALS SH-9, SH-10 (RELOCATED)**

PB1, PB4 (EXISTING)

**PEDESTRIAN SIGNALS W2, W3 (RELOCATED)**

**PB2 (RELOCATED)**

**PB3 (RELOCATED)**

## LEGEND

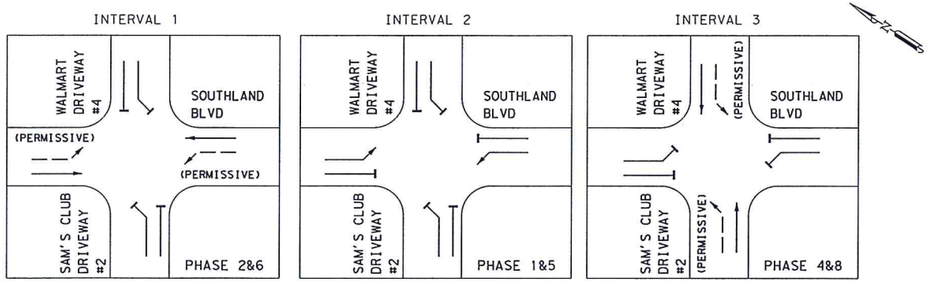
- EXIST SIGNAL POLE
- EXIST MAST ARM
- EXIST SIGNAL CONTROLLER
- EXIST METER AND DISCONNECT
- EXIST HORIZONTAL SIGNAL HEAD
- EXIST PEDESTRIAN SIGNAL
- EXIST PUSH BUTTON
- EXIST LUMINAIRE WITH ARM
- EXIST ANTENNA
- EXIST GROUND BOX
- EXIST VIVDS CAMERA
- EXIST CONDUIT
- VIDEO DETECTION ZONE
- PROP PEDESTAL POLE
- RELOCATED SIGNAL POLE
- RELOCATED MAST ARM
- RELOCATED/NEW HORIZONTAL SIGNAL HEAD
- RELOCATED PEDESTRIAN SIGNAL
- RELOCATED PUSH BUTTON
- RELOCATED VIVDS CAMERA
- PROP MAST ARM SIGN
- PROP CONDUIT (TRENCH)
- PROP CONDUIT (BORE)
- PROP GROUND BOX, TYPE D
- TRAFFIC FLOW

| SUMMARY OF CONDUIT AND CABLES | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RUN NO | CONDUIT | | | LENGTH | GRND | SIGNAL | | | VIVDS | |
| | TRENCH 2" | TRENCH 3" | BORE 3" | | #8 AWG (BARE) | 2/C #12 AWG | 5/C #12 AWG | 20/C #12 AWG | *3/C-#16 | COAXIAL |
| 1 | | EXIST | | 8' | | | | 1 | 1 | 1 |
| 2 | | | 1 | 108' | 1 | | | 1 | 1 | 1 |
| 3 | | 1 | | 10' | 1 | 1 | 1 | 1 | 1 | 1 |
| 4 | 1 | | | 14' | 1 | 1 | 1 | | | |
| | | | | | | | | | | |
| TOTAL | 14' | 10' | 108' | | 132' | 24' | 24' | 126' | 126' | 126' |

* SUBSIDIARY TO ITEM 6002

| SUMMARY OF QUANTITIES | | | | |
|---|---|---|---|---|
| ITEM | CODE | DESCRIPTION | UNIT | QTY |
| *0416 | 6030 | DRILL SHAFT (TRF SIG POLE) (24 IN) | LF | 6 |
| 0416 | 6031 | DRILL SHAFT (TRF SIG POLE) (30 IN) | LF | 12 |
| 0618 | 6023 | CONDT (PVC) (SCH 40) (2") | LF | 14 |
| 0618 | 6029 | CONDT (PVC) (SCH 40) (3") | LF | 10 |
| 0618 | 6030 | CONDT (PVC) (SCH 40) (3") (BORE) | LF | 108 |
| 0620 | 6007 | ELEC CONDR (NO. 8) BARE | LF | 140 |
| 0624 | 6010 | GROUND BOX TY D (162922) W/APRON | EA | 1 |
| 0684 | 6007 | TRF SIG CBL (TY A) (12 AWG) (2 CONDR) | LF | 30 |
| 0684 | 6010 | TRF SIG CBL (TY A) (12 AWG) (5 CONDR) | LF | 35 |
| 0684 | 6025 | TRF SIG CBL (TY A) (12 AWG) (20 CONDR) | LF | 130 |
| 0686 | 6282 | RELOC TRF SG PL AM(S) SNGL MST ARM POLE | EA | 1 |
| 0687 | 6001 | PED POLE ASSEMBLY | EA | 1 |
| 0690 | 6024 | REMOVAL OF SIGNAL HEAD ASSM | EA | 2 |
| 0690 | 6025 | REPLACE OF SIGNAL HEAD ASSM | EA | 2 |
| 0690 | 6029 | INSTALL OF SIGNAL RELATED SIGNS | EA | 2 |
| 6002 | 6005 | VIVDS COMMUNICATION CABLE (COAXIAL) | LF | 130 |

* SUBSIDIRARY TO ITEM 687




| SEQUENCE CHART | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| INTERVAL | PHASE 2&6 | | | PHASE 1&5 | | | PHASE 4&8 | | | FLASHING OPERATIONS |
| SIGNAL FACE | R/W | CLEAR 2&6 | CLEAR TO ALL PHASES | R/W | CLEAR 1&5 | CLEAR TO ALL PHASES | R/W | CLEAR 4&8 | CLEAR TO ALL PHASES | NORMAL AND EMERGENCY |
| SH-2, SH-3 | G | Y | R | R | R | R | R | R | R | R |
| SH-1 | <FY | <Y | <R | <G | <Y | <R | <R | <R | <R | <R |
| SH-7, SH-8 | G | Y | R | R | R | R | R | R | R | R |
| SH-6 | <FY | <Y | <R | <G | <Y | <R | <R | <R | <R | <R |
| SH-4, SH-5 | R | R | R | R | R | R | G | Y | R | R |
| SH-9, SH-10 | R | R | R | R | R | R | G | Y | R | R |

## SIGN DETAILS

S1

LEFT TURN
YIELD
ON FLASHING
YELLOW
ARROW

R10-17T
30"X30"

STATE OF TEXAS
ABDULHALIM A. EL-HOUT
109844
LICENSED
PROFESSIONAL ENGINEER
Sep. 23, 2016

0' 25' 50'
SCALE: 1"=50'

| REV. NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
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**LJA Engineering, Inc.**
FRN - F-1386

THE CITY OF SAN ANGELO TEXAS

SOUTHLAND BOULEVARD
SIGNAL MODIFICATION
AT SAM'S/WAL-MART DRIVEWAY

SHEET 2 OF 2

SHEET NO. 48

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## 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 ½ 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.

Texas Department of Transportation

Traffic Operations Division Standard

# ELECTRICAL DETAILS CONDUITS & NOTES

## ED(1)-14

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| | REVISIONS | | | | SOUTHLAND |
| | | DIST | COUNTY | | SHEET NO. |
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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.

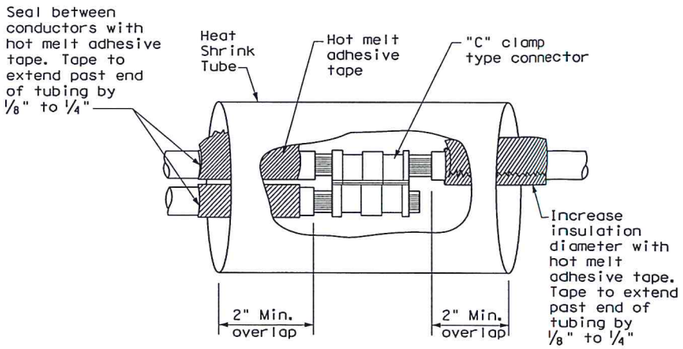
## GROUND RODS & GROUNDING ELECTRODES

### A. MATERIAL INFORMATION

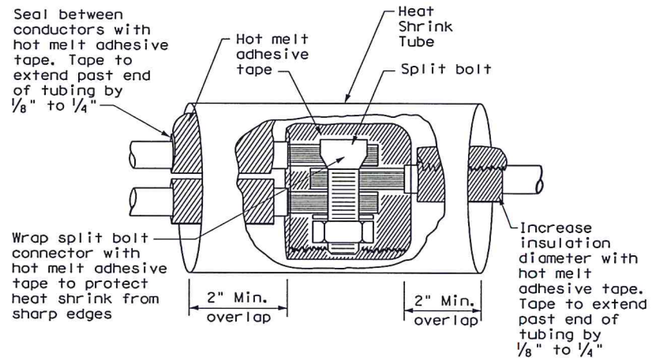
1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in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

### B. CONSTRUCTION METHODS

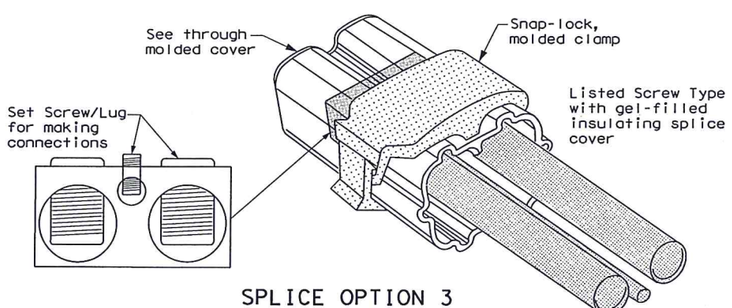
1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, 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 1
Compression Type




SPLICE OPTION 2
Split Bolt Type




SPLICE OPTION 3
Listed Screw Type

Texas Department of Transportation | Traffic Operations Division Standard

# ELECTRICAL DETAILS
# CONDUCTORS

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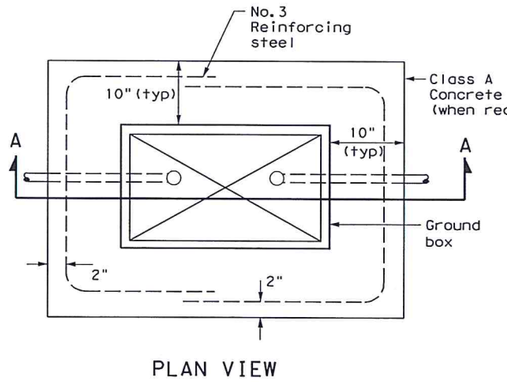
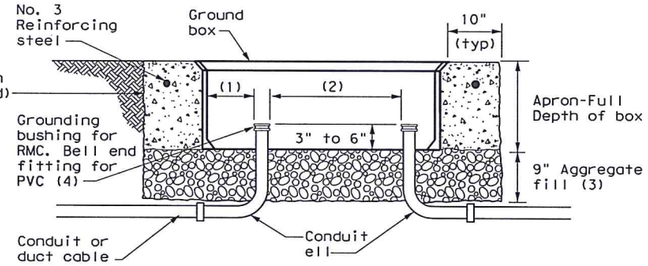



PLAN VIEW




SECTION A - A

## 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.

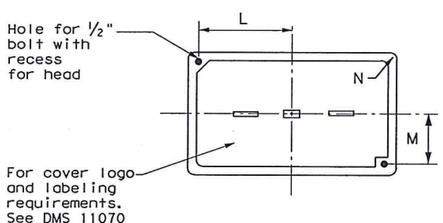
(2) Maintain sufficient space between conduits to allow for proper installation of bushings.

(3) Place aggregate under the box, not in the box. Aggregate should not encroach on the interior volume of the box.

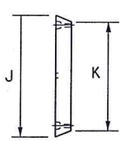
(4) Install a grounding bushing on the upper end of all RMC terminating in a ground box. Ground RMC elbows when any part of the elbow is less than 18 in. below the bottom of the ground box. Install a PVC bushing or bell end fitting on the upper end of all PVC conduits terminating in a ground box.

| 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 |

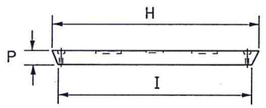
| GROUND BOX COVER DIMENSIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TYPE | DIMENSIONS (INCHES) | | | | | | | |
| | H | I | J | K | L | M | N | P |
| A, B & E | 23 1/4 | 23 | 13 3/4 | 13 1/2 | 9 7/8 | 5 1/8 | 1 3/8 | 2 |
| C & D | 30 1/2 | 30 1/4 | 17 1/2 | 17 1/4 | 13 1/4 | 6 3/4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

## ED(4)-14

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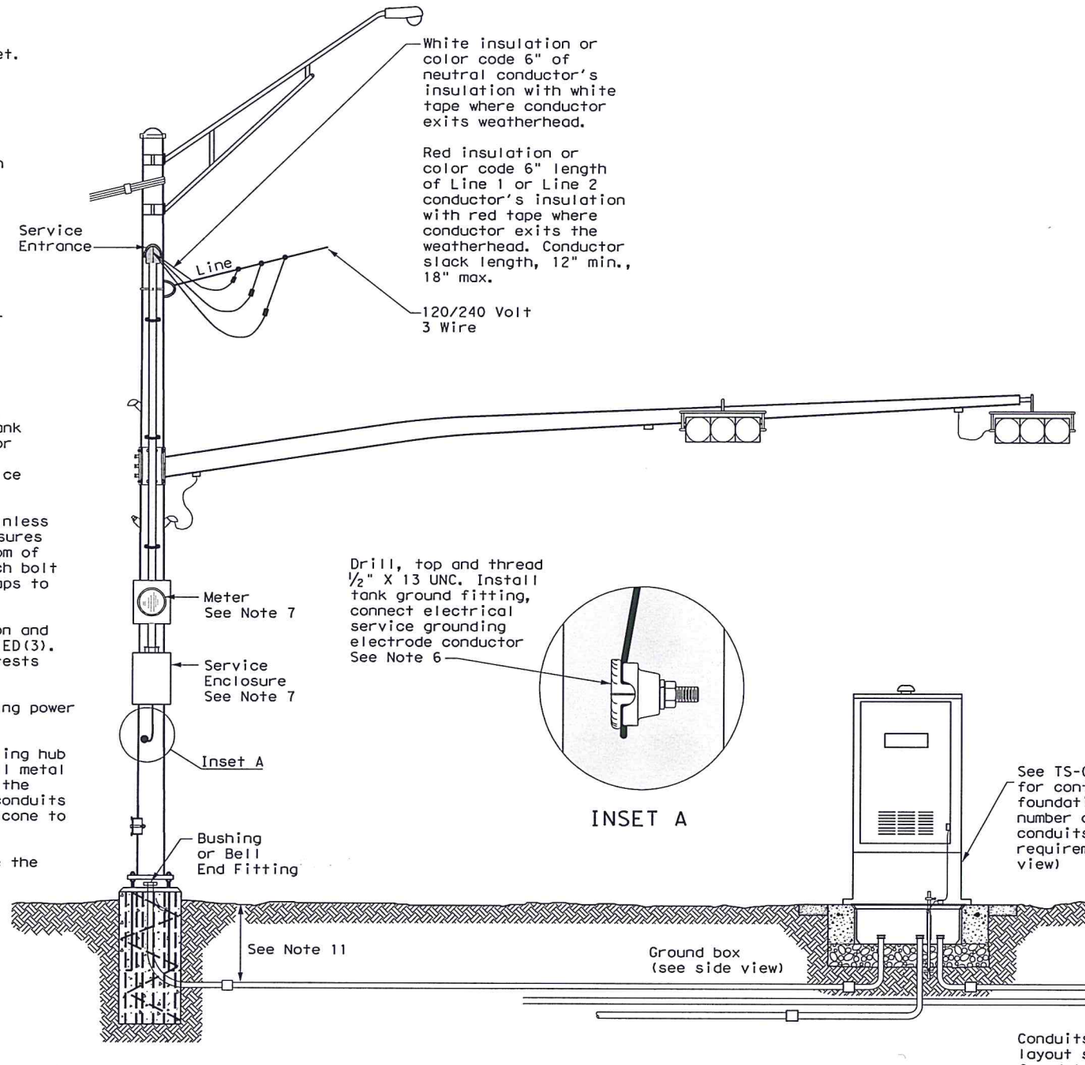
## TRAFFIC SIGNAL NOTES

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 ½ 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 ¾ 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".

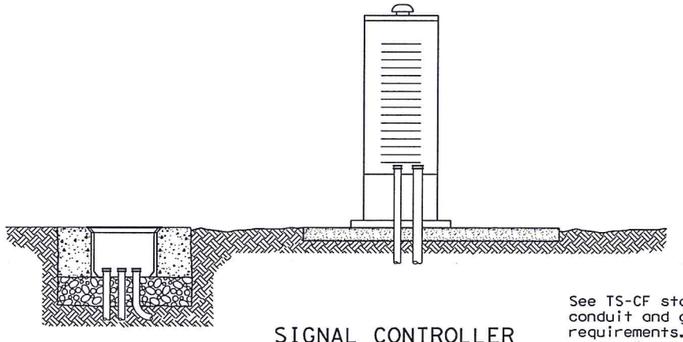



SIGNAL POLE WITH SERVICE

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.

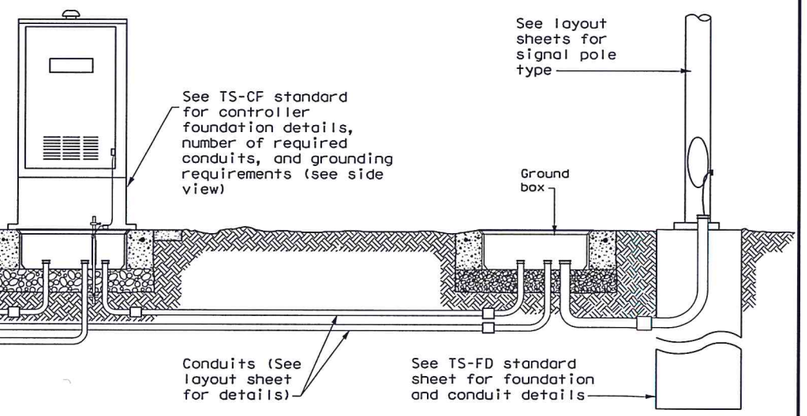



INSET A



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.




SIGNAL CONTROLLER FRONT VIEW




SIGNAL POLE

Texas Department of Transportation

Traffic Operations Division Standard

# ELECTRICAL DETAILS TYPICAL TRAFFIC SIGNAL SYSTEM DETAILS

# ED(8)-14

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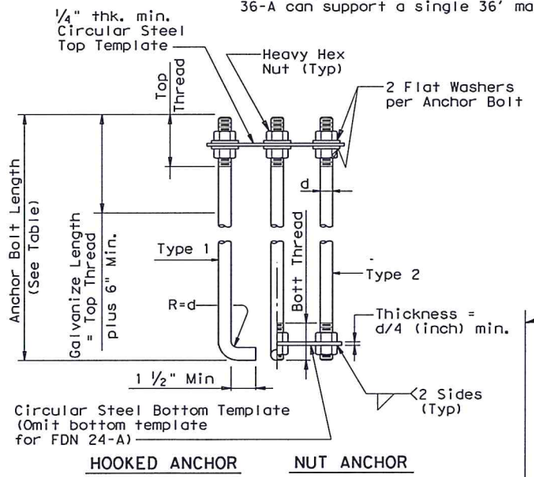
## FOUNDATION DESIGN TABLE

| 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 | 3/4" | 36 | 12 3/4" | 1 | 10 | 1 | Pedestal pole, pedestal mounted controller. |
| 30-A | 30" | 8- #9 | #3 at 6" | 11.3 | 10.3 | 8.0 | 1 1/2" | 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 3/4" | 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 1/4" | 55 | 23" | 2 | 271 | 9 | Mast arm assembly. (see Selection Table) |

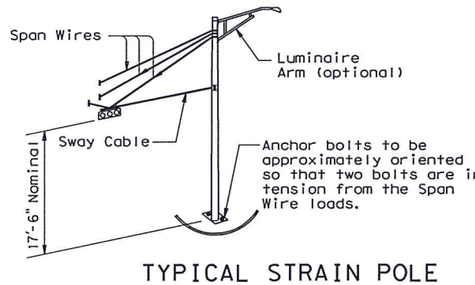
## FOUNDATION SELECTION TABLE FOR STANDARD MAST ARM PLUS ILSN SUPPORT ASSEMBLIES (ft)

| | | 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' |

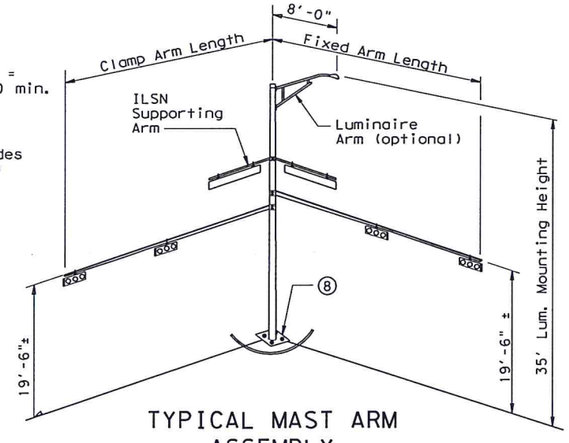
EXAMPLE:
1. For 80mph design wind speed, foundation 30-A can support up to a 32' arm with another arm up to 28'
2. For 100mph design wind speed, foundation 36-A can support a single 36' mast arm.




## ANCHOR BOLT ASSEMBLY

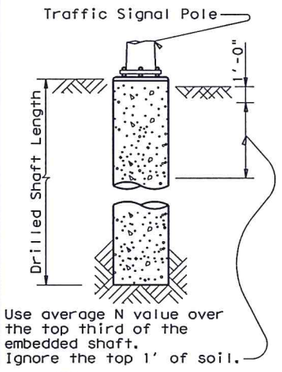



## TYPICAL STRAIN POLE ASSEMBLY




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

## TYPICAL MAST ARM ASSEMBLY



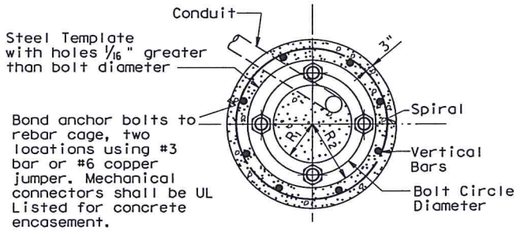

## NOTES:

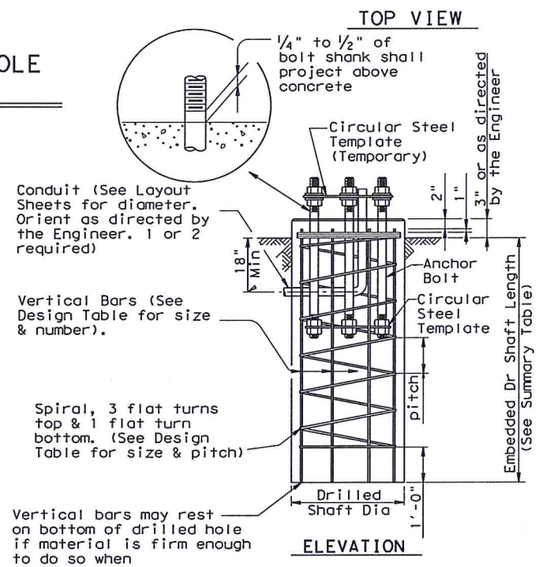
1. Anchor bolt design develops the foundation capacity given under Foundation Design Loads.
2. Foundation Design Loads are the allowable moments and shears at the base of the structure.
3. Foundations may be listed separately or grouped according to similarity of location and type. Quantities are for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

## ANCHOR BOLT & TEMPLATE SIZES

| BOLT DIA IN. | (7) BOLT LENGTH | TOP THREAD | BOTTOM THREAD | BOLT CIRCLE | R2 | R1 |
|---|---|---|---|---|---|---|
| 3/4" | 1'-6" | 3" | — | 12 3/4" | 7 1/8" | 5 5/8" |
| 1 1/2" | 3'-4" | 6" | 4" | 17" | 10" | 7" |
| 1 3/4" | 3'-10" | 7" | 4 1/2" | 19" | 11 1/4" | 7 3/4" |
| 2" | 4'-3" | 8" | 5" | 21" | 12 1/2" | 8 1/2" |
| 2 1/4" | 4'-9" | 9" | 5 1/2" | 23" | 13 3/4" | 9 1/4" |

(7) Min dimensions given, longer bolts are acceptable.




## FOUNDATION DETAILS

## FOUNDATION SUMMARY TABLE (3)

| LOCATION IDENTIFICATION | AVG. N BLOW /ft. | FDN TYPE | NO. EA | DRILLED SHAFT LENGTH (6) (FEET) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 24-A | 30-A | 36-A | 36-B | 42-A |
| TS-4 | 10 | | 1 | | 12 | | | |
| PP-1 | 10 | | 1 | 6 | | | | |
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| TOTAL DRILLED SHAFT LENGTHS | | | | 6 | 12 | | | |

## GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires 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".

STATE OF TEXAS
ABDULHALIM A. EL-HOUT
109844
LICENSED PROFESSIONAL ENGINEER
Sep. 23, 2016

Texas Department of Transportation
Traffic Operations Division

# TRAFFIC SIGNAL POLE FOUNDATION



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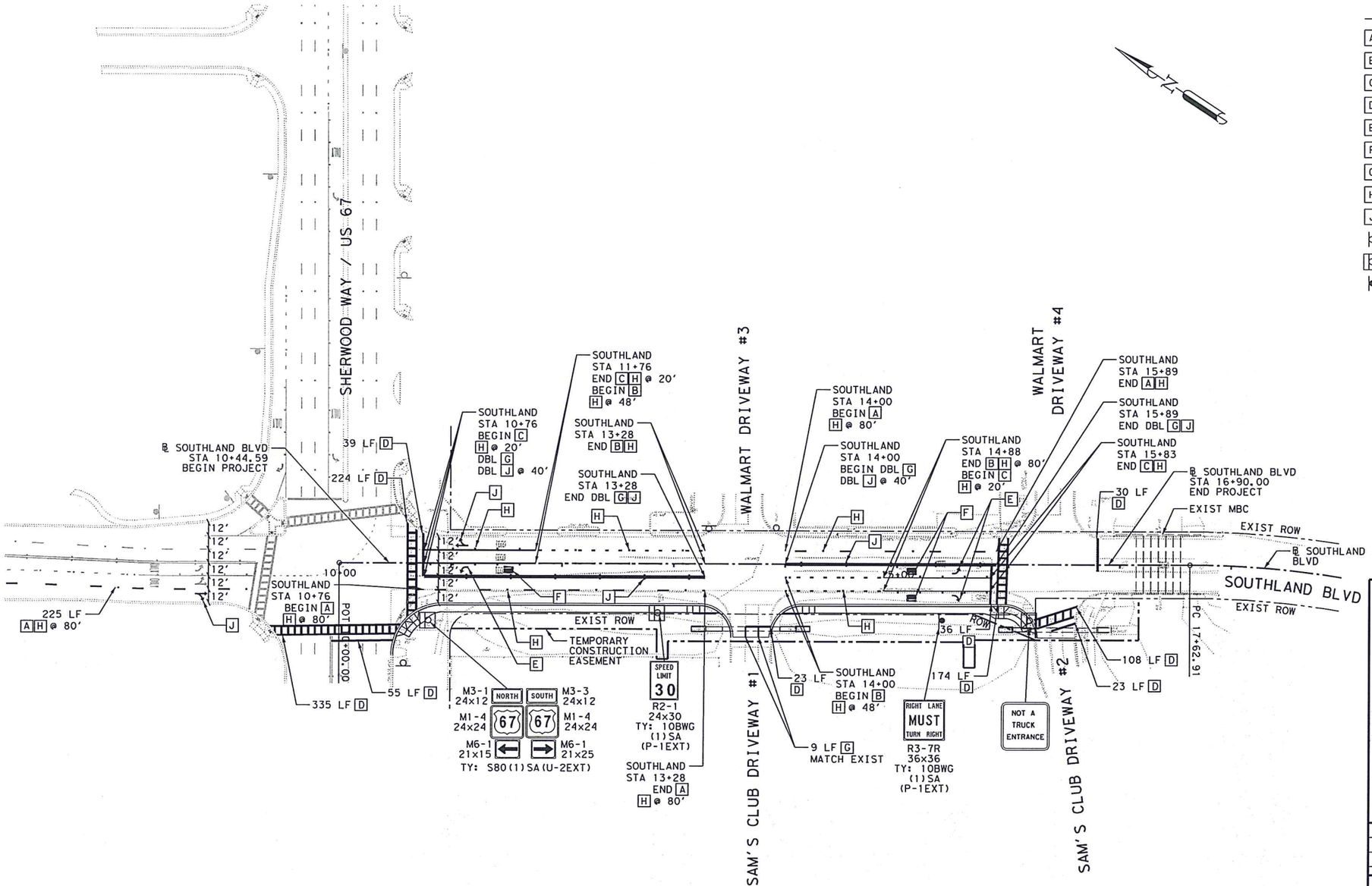


## LEGEND

- A REFL PAV MRK TY I (W)4"(BRK)(100MIL)
- B REFL PAV MRK TY I (W)8"(DOT)(100MIL)
- C REFL PAV MRK TY I (W)8"(SLD)(100MIL)
- D REFL PAV MRK TY I (W)24"(SLD)(100MIL)
- E REFL PAV MRK TY I (W)(ARROW)(100MIL)
- F REFL PAV MRK TY I (W)(WORD)(100MIL)
- G REFL PAV MRK TY I (Y)4"(SLD)(100MIL)
- H REFL PAV MRK TY I-C
- J REFL PAV MRKR TY II-A-A
- EXISTING SIGN TO REMAIN
- EXISTING SIGN TO RELOCATE
- PROPOSED SMALL SIGN

NOTES:

1. FOR ITEM "B" REFER TO TXDOT STANDARD PM(3)-12.
2. REFER TO PVMT MARK DETAIL SHEETS
3. EXISTING SIGNS SHALL REMAIN IN PLACE UNLESS NOTED OTHERWISE ON REMOVAL OR SIGNING AND MARKING SHEET.

09/23/2016

STATE OF TEXAS
MICHAEL C. COYLE
95634
LICENSED PROFESSIONAL ENGINEER

0' 25' 50' 100'
SCALE: 1"=100'

| REV. NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

LJA Engineering, Inc.
FRN-F-1386

THE CITY OF SAN ANGELO TEXAS

SOUTHLAND BOULEVARD
SIGNING AND PAVEMENT MARKING LAYOUT

SHEET 1 OF 1

SHEET NO. 54

6:11:57 PM 9/23/2016
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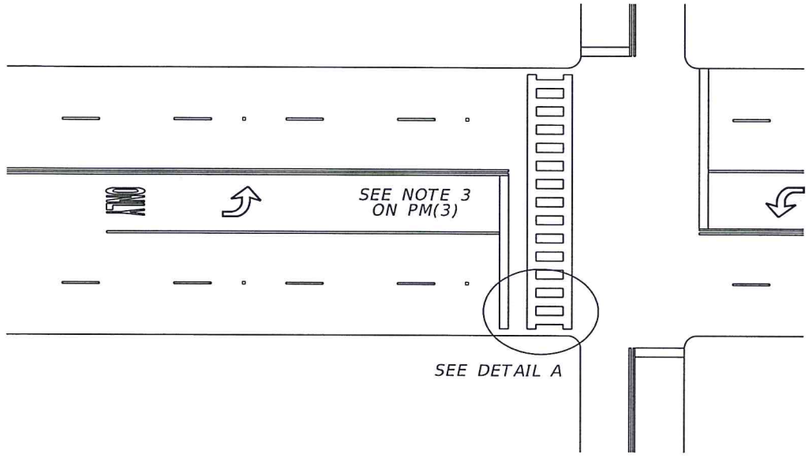
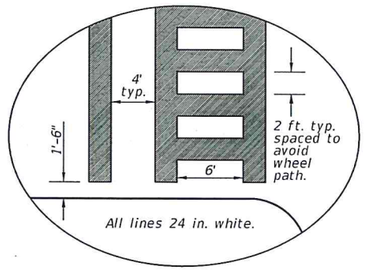
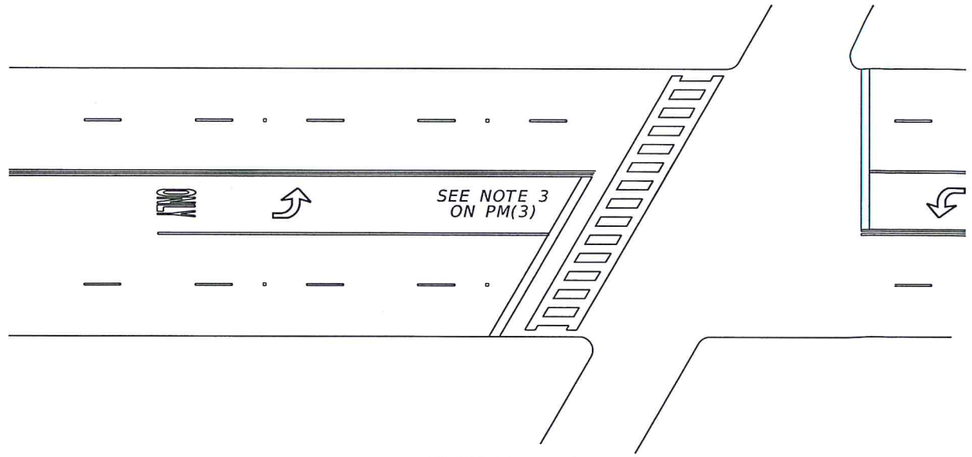



TYPICAL INTERSECTION
WITH PERPENDICULAR CROSSWALK



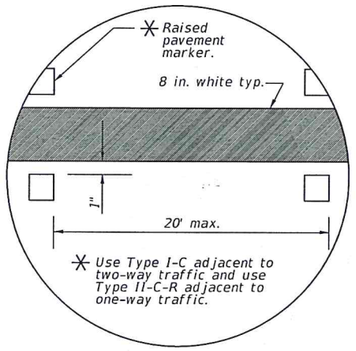

DETAIL A

*The Engineer will approve final placement of stop bar and crosswalk.*




TYPICAL INTERSECTION
WITH SKEWED CROSSWALK

NOTE: WHERE IN CONFLICT, DETAILS ON THIS SHEET SHALL SUPERCEDE THE PAVEMENT MARKING STANDARD SHEETS.

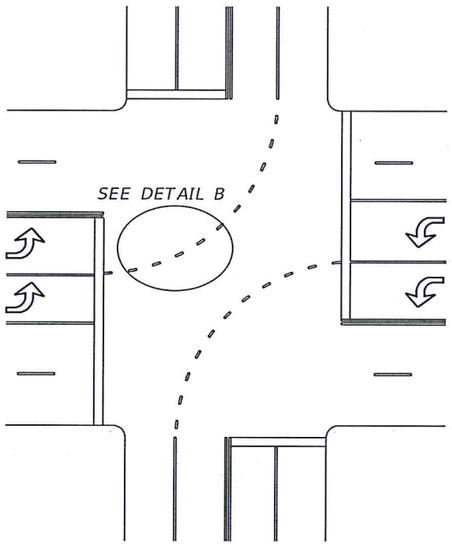



DETAIL C

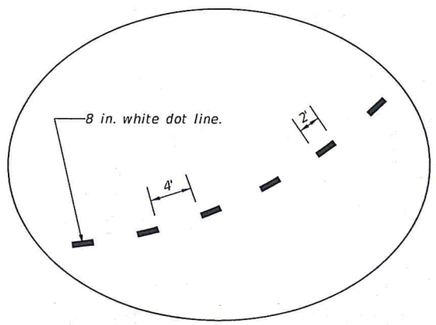
| PROJECT QUANTITIES OF WORDS AND ARROWS | | | | |
|---|---|---|---|---|
| ONLY | | | | |
| 3 | 2 | 1 | 0 | 0 |
| | | | | |
| 0 | 0 | 2 | 0 | 0 |

09/23/2016

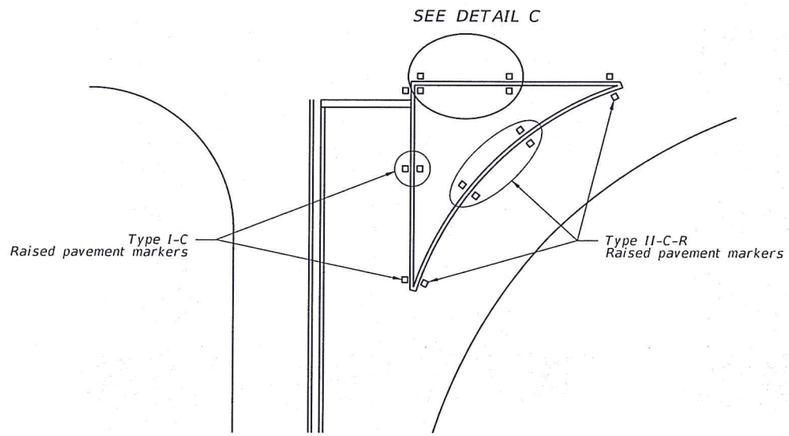
STATE OF TEXAS
MICHAEL C. COYLE
95634
LICENSED PROFESSIONAL ENGINEER




TYPICAL INTERSECTION
WITH "CAT TRACKS"




DETAIL B




TYPICAL INTERSECTION
WITH UNCURBED
CHANNELIZING ISLAND

| REV. NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

LJA Engineering, Inc.
FRN-F-1386

THE CITY OF SAN ANGELO TEXAS

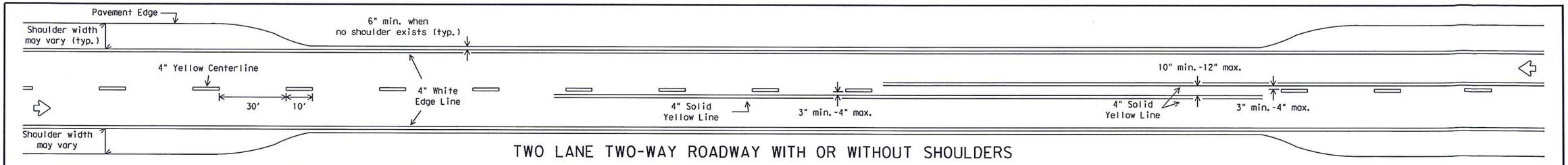
SOUTHLAND BOULEVARD

PAVEMENT MARKING DETAILS

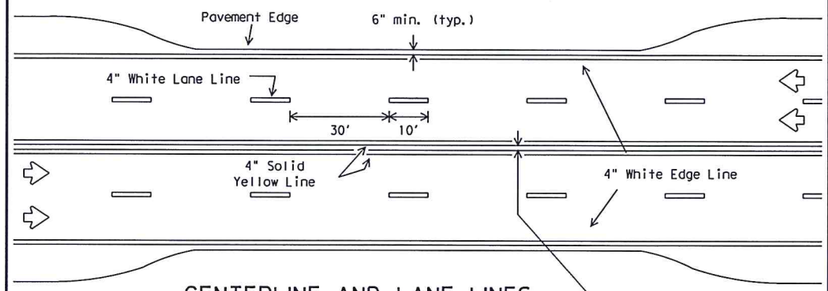
SHEET 1 OF 1

SHEET NO. 55

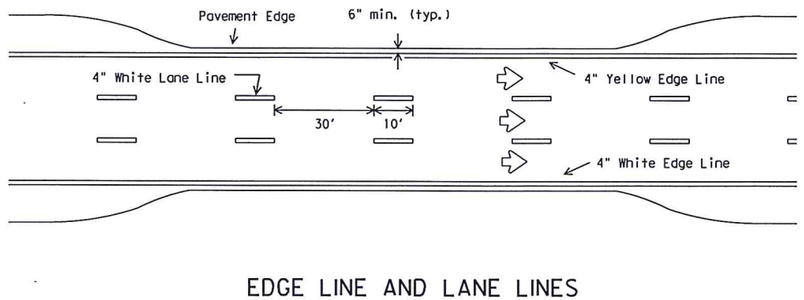
11:09:09 AM 9/23/2016
T:\2357\1601\CADD\SHEETS\05-Markings\SB-MM01.dgn



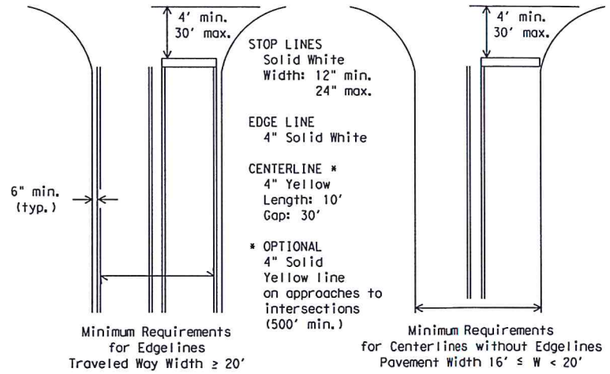

## TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS




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

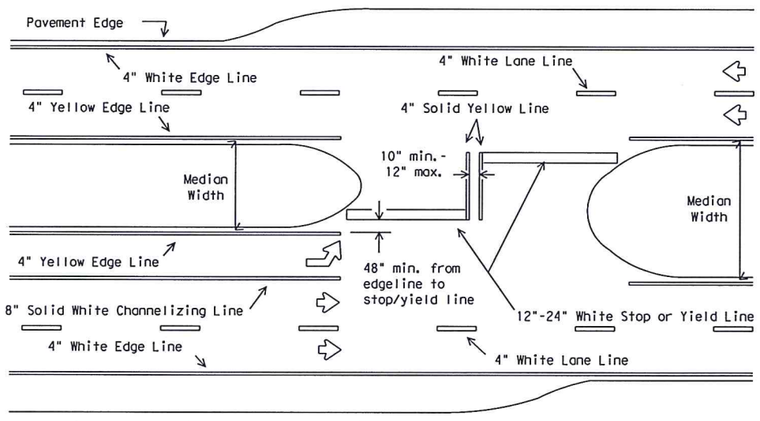



## EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



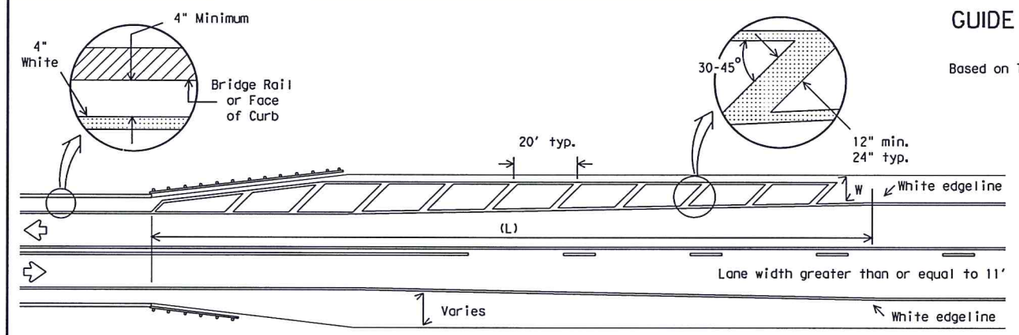

## GUIDE FOR PLACEMENT OF STOP LINES, EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths for Undivided Highways




All medians shall be field measured to determine the location of necessary striping. Stop/Yield bars and centerlines shall be placed when the median width is greater than 30 ft. The median width is defined as the area between two roadways of a divided highway measured from edge of traveled way to edge of traveled way. The median excludes turn lanes. The median width might be different between intersections, interchanges and of opposite approaches of the same intersection. The narrow median width will be the controlling width to determine if markings are required.

## FOUR LANE DIVIDED ROADWAY INTERSECTIONS




NOTES:

1. No-passing zone on bridge approach is optional but if used, it shall be a minimum 500 feet long.
2. For crosshatching length (L) see Table 1.
3. The width of the offset (W) and the required crosshatching width is the full shoulder width in advance of the bridge.
4. The crosshatching is not required if delineators or barrier reflectors are used along the structure.
5. For guard fence details, refer elsewhere in the plans.

## ROADWAYS WITH REDUCED SHOULDER WIDTHS ACROSS BRIDGE OR CULVERT

### TABLE 1 - TYPICAL LENGTH (L)

| Posted Speed * | Formula |
|---|---|
| ≤ 40 | $L = \frac{WS^2}{60}$ |
| ≥ 45 | L=WS |

* 85th Percentile Speed may be used on roads where traffic speeds normally exceed the posted speed limit. Crosshatching length should be rounded up to nearest 5 foot increment.

L=Length of Crosshatching (FT.) W=Width of Offset (FT.)
S=Posted Speed (MPH)

EXAMPLES:

An 8 foot shoulder in advance of a bridge reduces to 4 feet on a 70 MPH roadway. The length of the cross-hatching should be:

L = 8 x 70 = 560 ft.

A 4 foot shoulder in advance of a bridge reduces to 2 feet on a 40 MPH roadway. The length of the cross-hatching should be:

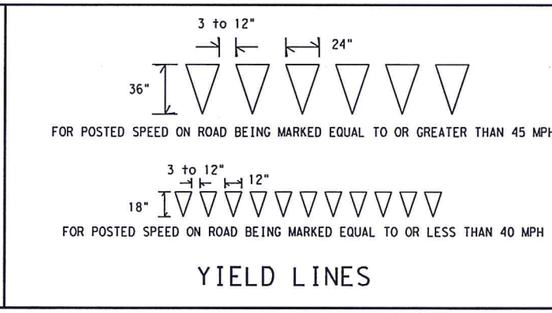
$L = 4(40)^2 / 60 = 106.67$ ft. rounded to 110 ft.

### GENERAL NOTES

1. Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should typically be placed a minimum of 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edgelines are not required in curb and gutter sections of roadways.
2. The traveled way includes only that portion of the roadway used for vehicular travel and not the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to inside of edgeline 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.




## YIELD LINES

Texas Department of Transportation
Traffic Operations Division

# TYPICAL STANDARD PAVEMENT MARKINGS

# PM(1)-12

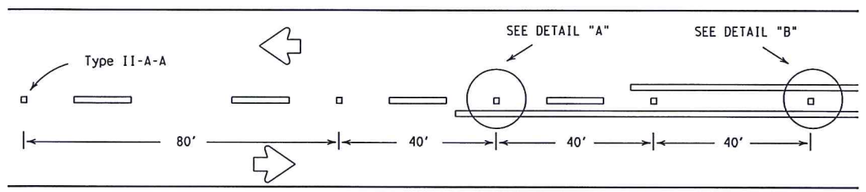


| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|
| CONT | SECT | JOB | HIGHWAY |
| | | | SOUTHLAND |
| DIST | COUNTY | | SHEET NO. |
| | TOM GREEN | | 56 |

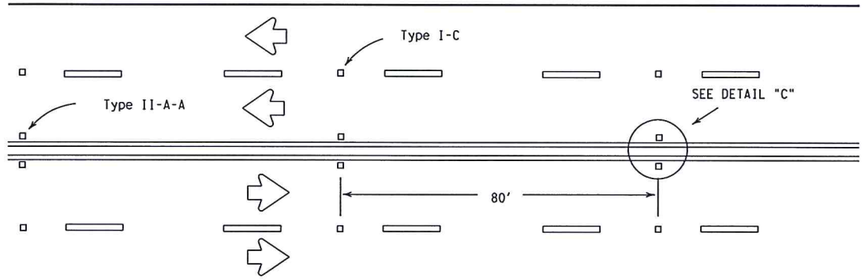
REVISIONS
8-95 2-12
5-00
8-00
3-03

DATE: 9/23/2016 11:09:10 AM
FILE: T:\2357\1601\CADD\SHEETS\05-Markings\Standards\PM1-12.dgn

# REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE

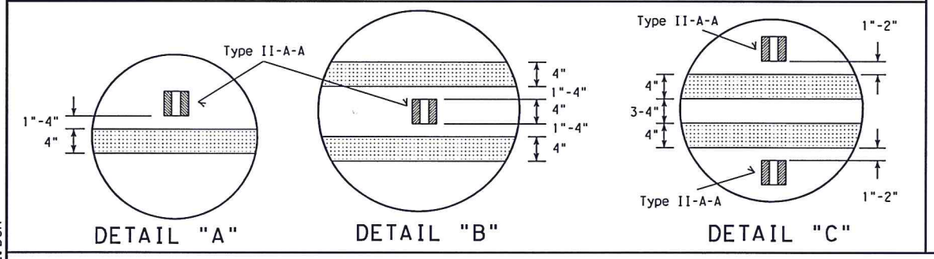


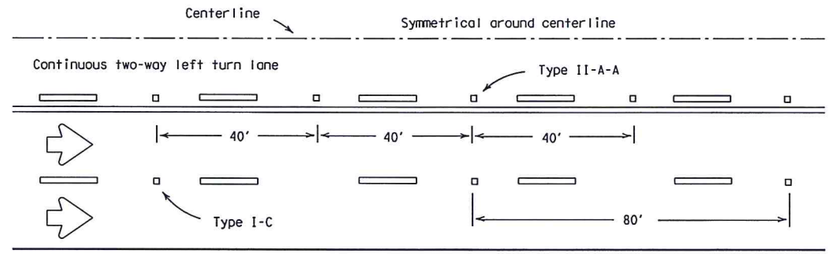

## CENTERLINE FOR ALL TWO LANE ROADWAYS



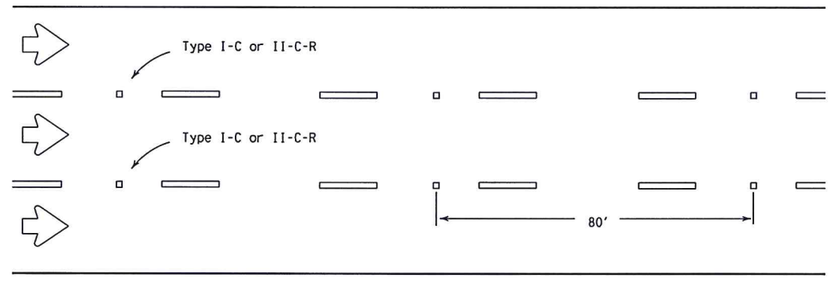

## CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY HIGHWAYS

Raised pavement marker Type I-C, clear face toward normal traffic, shall be placed on 80-foot centers.




## CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE

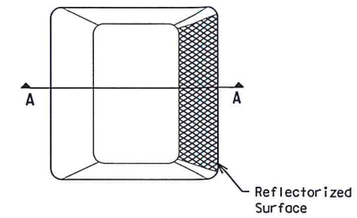



## LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

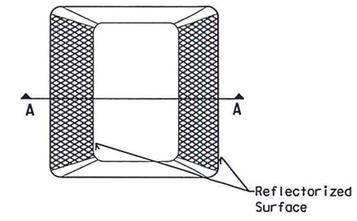
Raised pavement markers Type II-C-R shall have clear face toward normal traffic and red face toward wrong-way traffic.

| 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 |

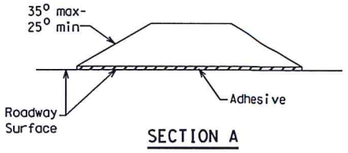
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.




Type I (Top View)

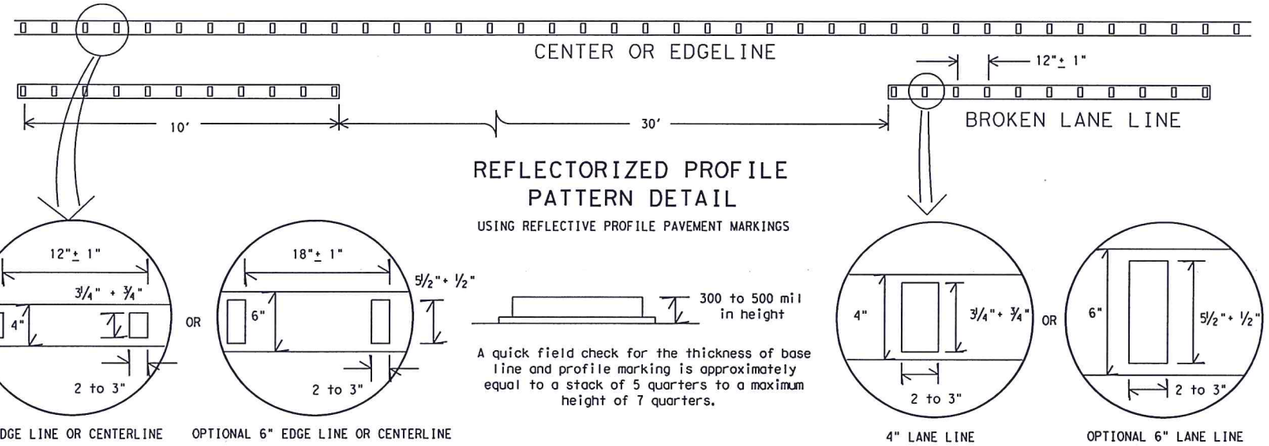



Type II (Top View)




SECTION A

## RAISED PAVEMENT MARKERS




## 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.

**NOTE:**
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

**GENERAL NOTES**

1. All raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.

*Texas Department of Transportation*
*Traffic Operations Division*

# POSITION GUIDANCE USING RAISED MARKERS
# REFLECTORIZED PROFILE MARKINGS
# PM(2)-12



| REVISIONS | | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|---|
| 4-92 | 2-10 | CONT | SECT | JOB | HIGHWAY |
| 5-00 | 2-12 | | | | SOUTHLAND |
| 8-00 | | DIST | COUNTY | | SHEET NO. |
| 2-08 | | | TOM GREEN | | 57 |

DATE: 9/23/2016 11:09:12 AM
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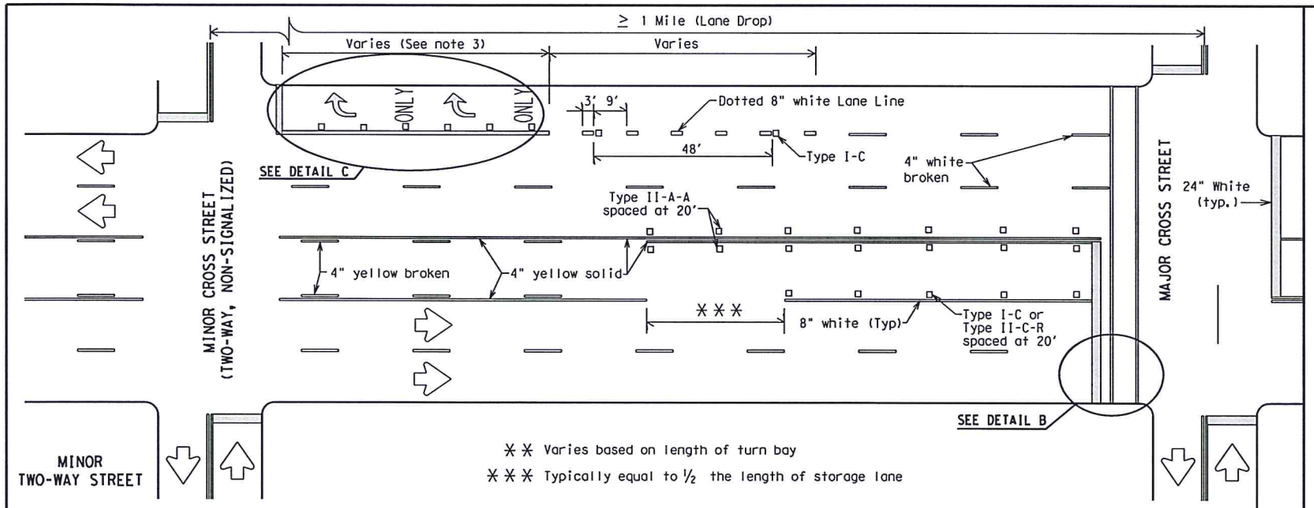
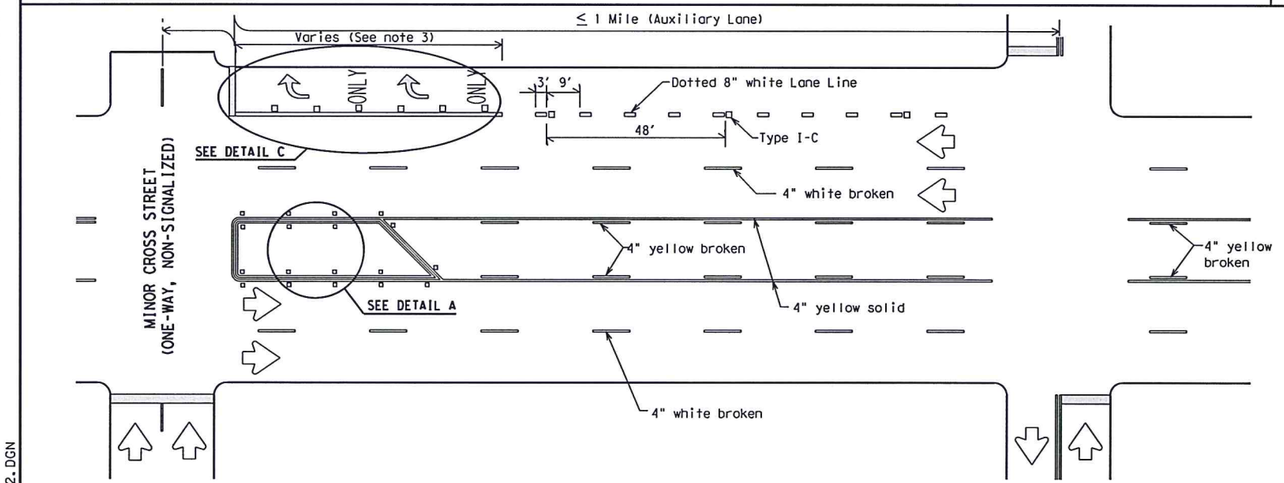
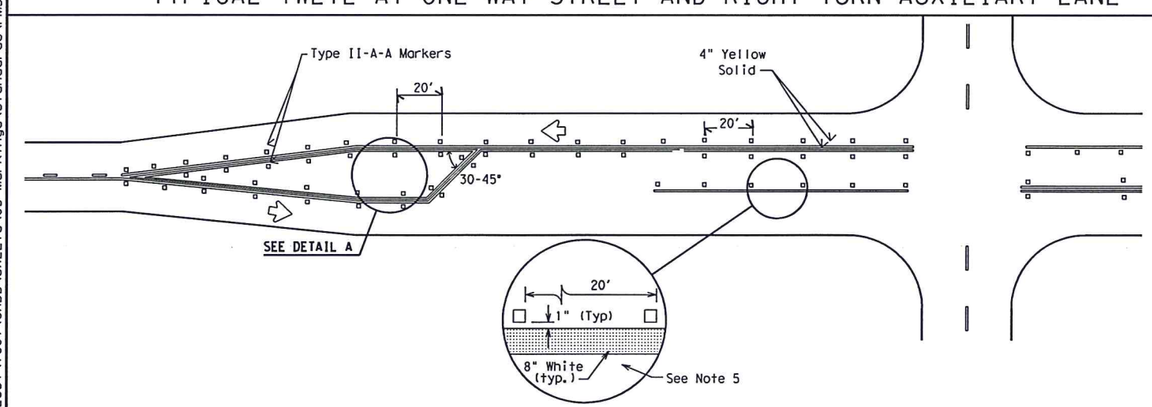


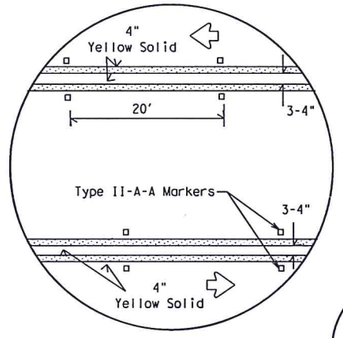

TYPICAL TWLTL AT TWO-WAY CROSS STREET AND RIGHT TURN LANE DROP



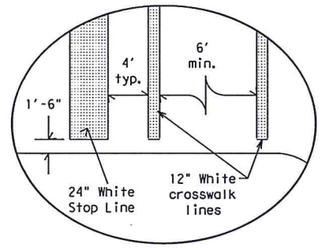

TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE




TYPICAL TWO-LANE HIGHWAY INTERSECTION WITH LEFT TURN BAYS

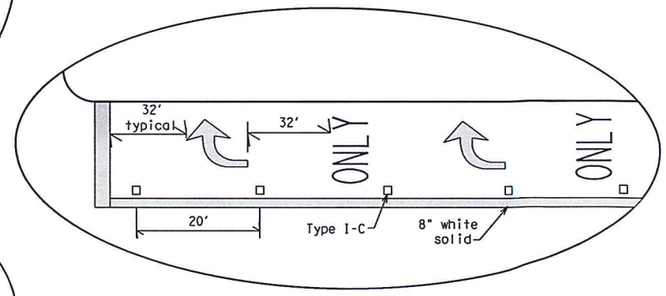



DETAIL A




Final placement of Stop Bar and Crosswalk shall be approved by the Engineer in the field.

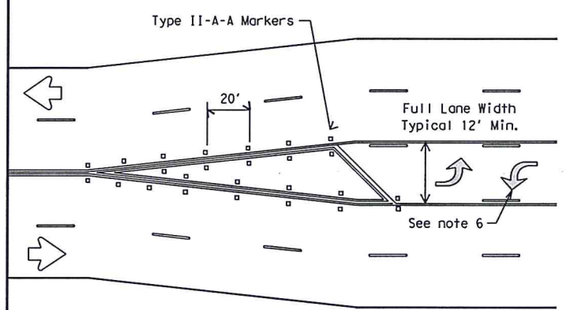
DETAIL B




DETAIL C

| 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 TRANSITION FOR TWLTL AND DIVIDED HIGHWAY

## GENERAL NOTES

1. Refer elsewhere in plans for additional RPM placement and details.
2. 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 as shown in the Standard Highway Sign Designs for Texas.
3. When lane used word 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.
4. Other crosswalk paterns as shown in the "Texas Manual on Uniform Traffic Control Devices" may be used.
5. Raised pavement marker Type I-C with undivided highways, flush medians and two way left turn lanes. Raised pavement marker Type II-C-R with divided highways and raised medians.
6. A two-way left-turn (TWLT) lane-use arrow pavement marking should be used at or just downstream from the beginning of a two-way left-turn lane within a corridor. Repeating the marking after each intersection or dedicated turn bay is not required unless stated elsewhere in the plans.

Texas Department of Transportation
Traffic Operations Division

# PAVEMENT MARKINGS FOR TWO-WAY LEFT TURN LANES DIVIDED HIGHWAYS AND RURAL LEFT TURN BAYS

PM(3)-12



| REVISIONS | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| 5-00 2-12 | CONT | SECT | JOB | HIGHWAY |
| 8-00 | | | | SOUTHLAND |
| 3-03 | DIST | COUNTY | | SHEET NO. |
| 2-10 | | TOM GREEN | | 58 |

DATE: 9/23/2016 11:09:13 AM
FILE: T:\2357\1601\CADD\SHEETS\05-Markings\Standards\PM3-12.DGN

# SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

SM RD SGN ASSM TY XXXXX(X)XX(X-XXXX)

**Post Type**

FRP = Fiberglass Reinforced Plastic Pipe (see SMD(FRP))
TWT = Thin-Walled Tubing (see SMD(TWT))
10BWG = 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))
S80 = Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

**Number of Posts (1 or 2)**

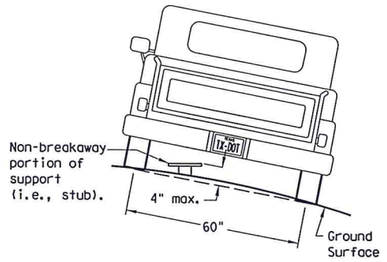
**Anchor Type**

UA = Universal Anchor - Concreted (see SMD(FRP) and (TWT))
UB = Universal Anchor - Bolted down (see SMD(FRP) and (TWT))
WS = Wedge Anchor Steel - (see SMD(TWT))
WP = Wedge Anchor Plastic (see SMD(TWT))
SA = Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))
SB = Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

**Sign Mounting Designation**

P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))
IF REQUIRED
1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))
WC = 1.12 #/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))
EXAL = Extruded Aluminum Sign Panels (see SMD(SLIP-1) to (SLIP-3))

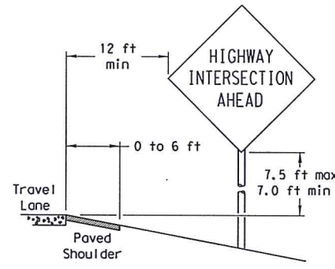
# REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT




To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

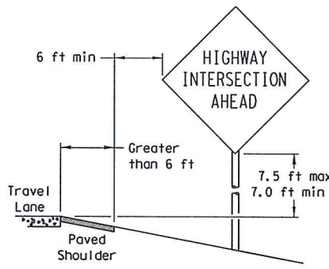
# SIGN LOCATION

## PAVED SHOULDERS




### LESS THAN 6 FT. WIDE

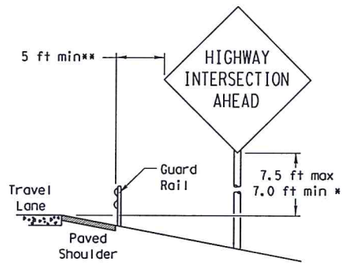
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



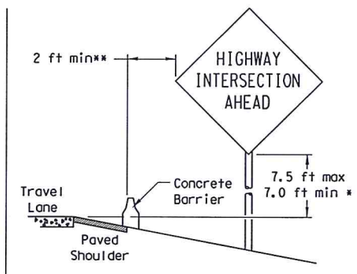

### GREATER THAN 6 FT. WIDE

When the shoulder is greater than 6 ft in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

## BEHIND BARRIER



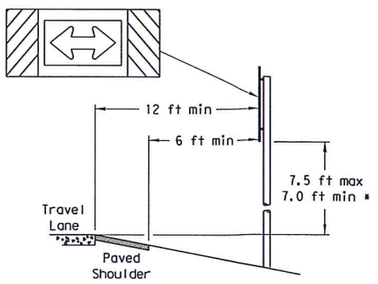

### BEHIND GUARDRAIL



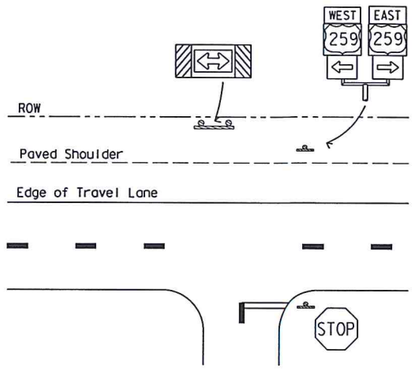

### BEHIND CONCRETE BARRIER

**Sign clearance based on distance required for proper guard rail or concrete barrier performance.

## T-INTERSECTION




When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.




* Signs shall be mounted using the following condition that results in the greatest sign elevation:

(1) a minimum of 7 to a maximum of 7.5 feet above the edge of the travel lane or

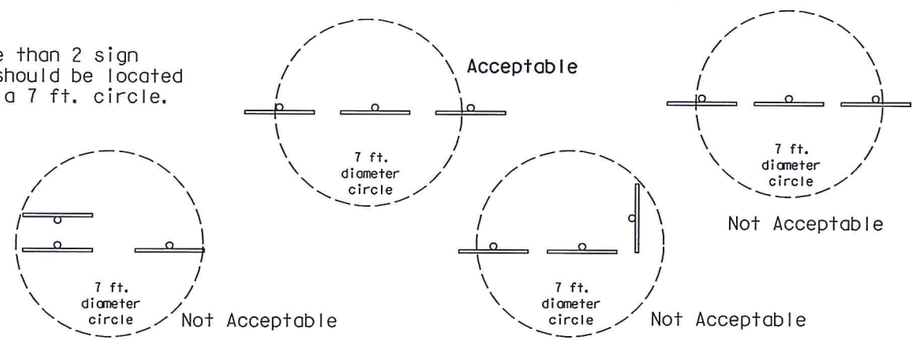
(2) a minimum of 7 to a maximum of 7.5 feet above the grade at the base of the support when sign is installed on the backslope.

The maximum values may be increased when directed by the Engineer.

See the Traffic Operations Division website for detailed drawings of sign clamps, Triangular Slipbase System components and Wedge Anchor System components.

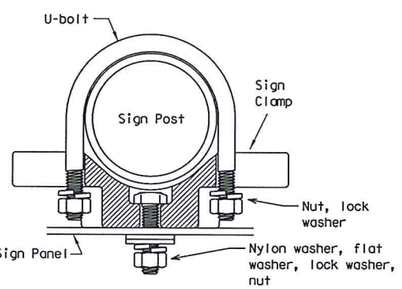
The website address is:
http://www.txdot.gov/publications/traffic.htm

No more than 2 sign posts should be located within a 7 ft. circle.




# TYPICAL SIGN ATTACHMENT DETAIL

## Single Signs

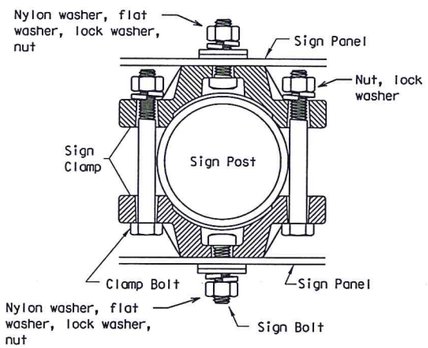



Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

When two sign clamps are used to mount signs back-to-back, use a 5/16-18 UNC galvanized hex head per ASTM A307 with nut and helical-spring lock washer. The approximate bolt lengths for various post sizes and sign clamp types are given in the table at right. The bolt length may need to be adjusted depending upon field conditions.

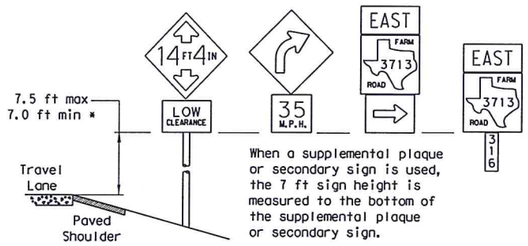
Sign clamps may be either the specific size clamp or the universal clamp.

## Back-to-Back Signs



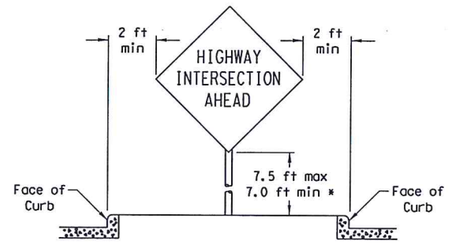

| Pipe Diameter | Approximate Bolt Length | |
|---|---|---|
| | Specific Clamp | Universal Clamp |
| 2" nominal | 3" | 3 or 3 1/2" |
| 2 1/2" nominal | 3 or 3 1/2" | 3 1/2 or 4" |
| 3" nominal | 3 1/2 or 4" | 4 1/2" |

## SIGNS WITH PLAQUES



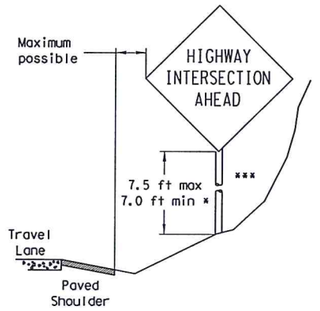

When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

## CURB & GUTTER OR RAISED ISLAND




## RESTRICTED RIGHT-OF-WAY

(When 6 ft min. is not possible.)




Right-of-way restrictions may be created by rocks, water, vegetation, forest, buildings, a narrow island, or other factors.

In situations where a lateral restriction prevents the minimum horizontal clearance from the edge of the travel lane, signs should be placed as far from the travel lane as practical.

*** Post may be shorter if protected by guardrail or if Engineer determines the post could not be hit due to extreme slope.

*Texas Department of Transportation*
*Traffic Operations Division*

# SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

## SMD(GEN)-08



| REVISIONS | DN: TXDOT | CK: TXDOT | DN: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| 9-08 | CONT | SECT | JOB | HIGHWAY |
| | | | | SOUTHLAND |
| | DIST | COUNTY | | SHEET NO. |
| | | TOM GREEN | | 59 |

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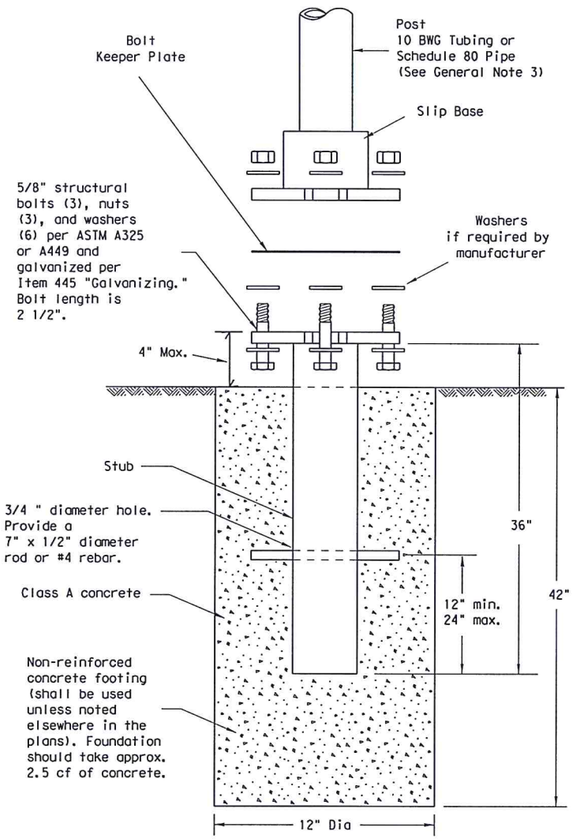
# TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS




SM RD SGN ASSM TY XXXXX(X)SA(X-XXXX)

NOTE

There are various devices approved for the Triangular Slipbase System. Please reference the Material Producer List for approved slip base systems. http://www.txdot.gov/business/producer_list.htm The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.

GENERAL NOTES:

1. Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
2. Material used as post with this system shall conform to the following specifications:
   10 BWG Tubing (2.875" outside diameter)
   - 0.134" nominal wall thickness
   - Seamless or electric-resistance welded steel tubing or pipe
   - Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
   - Other steels may be used if they meet the following:
     - 55,000 PSI minimum yield strength
     - 70,000 PSI minimum tensile strength
     - 20% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
   - Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
   - Galvanization per ASTM A123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.

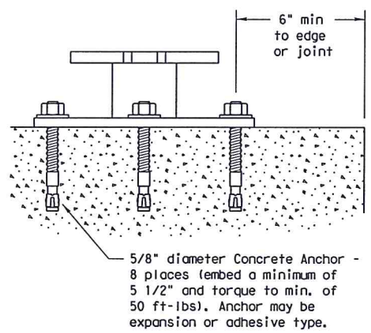
   Schedule 80 Pipe (2.875" outside diameter)
   - 0.276" nominal wall thickness
   - Steel tubing per ASTM A500 Gr C
   - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
     - 46,000 PSI minimum yield strength
     - 62,000 PSI minimum tensile strength
     - 21% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
   - Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
   - Galvanization per ASTM A123
3. See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is: http://www.txdot.gov/publications/traffic.htm
4. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

ASSEMBLY PROCEDURE

Foundation
1. Prepare 12-inch diameter by 42-inch deep hole. If solid rock is encountered, the depth of the foundation may be reduced such that it is embedded a minimum of 18 inches into the solid rock.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor-driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
3. Push the pipe end of the slip base stub into the center of the concrete. Rotate the stub back and forth while pushing it down into the concrete to assure good contact between the concrete and stub. Continue to work the stub into the concrete until it is between 2 to 4 inches above the ground.
4. Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
5. The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

Support
1. Cut support so that the bottom of the sign will be 7 to 7.5 feet above the edge of the travelway (i.e., edge of the closest lane) when slip plate is below the edge of pavement or 7 to 7.5 feet above slip plate when the slip plate is above the edge of the travelway. The cut shall be plumb and straight.
2. Attach sign to support using connections shown. When multiple signs are installed on the same support, ensure the minimum clearance between each sign is maintained. See SMD(SLIP-2) for clearances based on sign types.

## CONCRETE ANCHOR




SM RD SGN ASSM TY XXXXX(X)SB(X-XXXX)

Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. Heavy hex nut per ASTM A563, and hardened washer per ASTM F436. The stud bolt shall have a minimum yield and ultimate tensile strength of 50 and 75 KSI, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxies and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations. Top of bolt shall extend at least flush with top of the nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 5 1/2" minimum embedment, shall have a minimum allowable tension and shear of 3900 and 3100 psi, respectively.

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS
# SMALL ROADSIDE SIGNS
# TRIANGULAR SLIPBASE SYSTEM

## SMD(SLIP-1)-08



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
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REVISIONS
9-08

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| DIST | COUNTY | | SHEET NO. |
| | TOM GREEN | | 60 |

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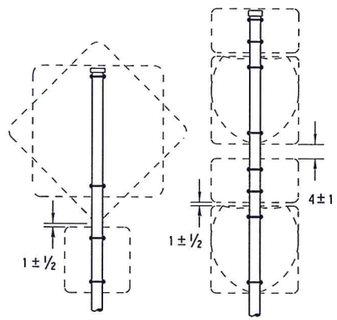
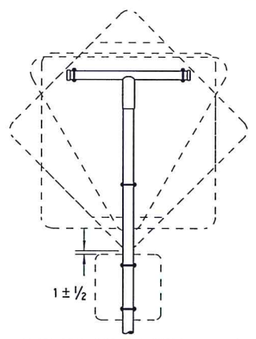
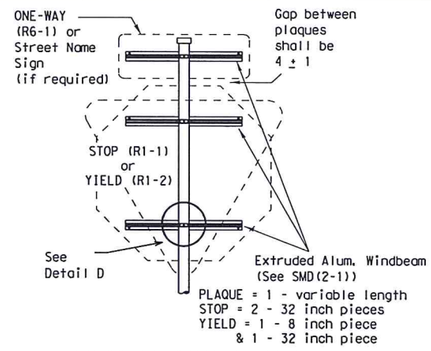


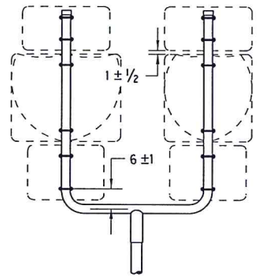

SM RD SGN ASSM TY XXXXX(1)XX(P)




SM RD SGN ASSM TY XXXXX(1)XX(T)




SM RD SGN ASSM TY XXXXX(1)XX(P-BM)

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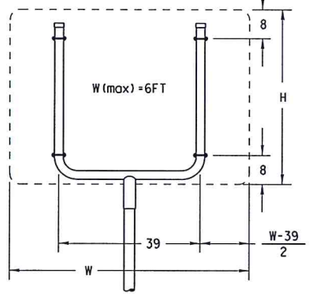
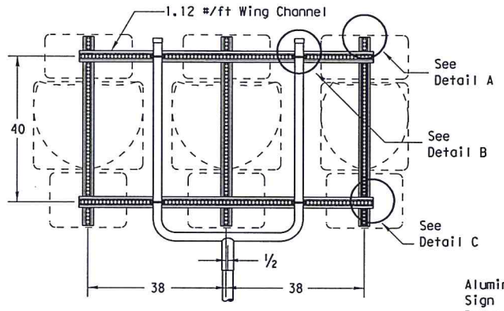
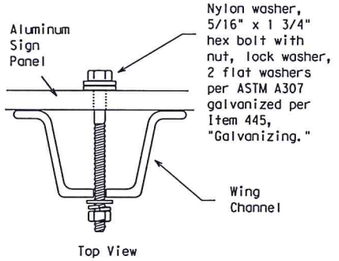


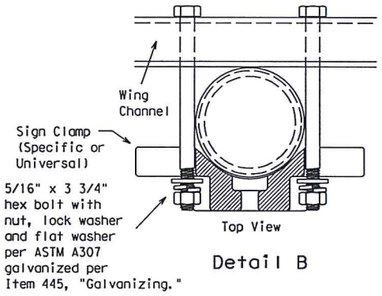

SM RD SGN ASSM TY XXXXX(1)XX(U)



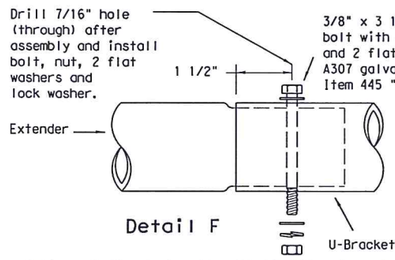

SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)




Detail A

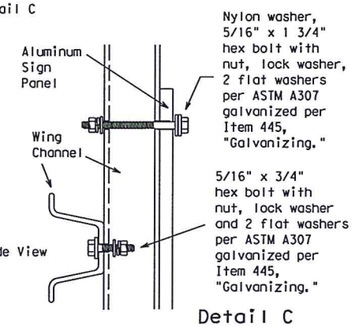



Detail B

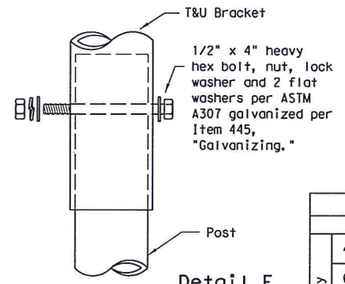



Detail F

Splices shall only be allowed behind the sign substrate.




Detail C



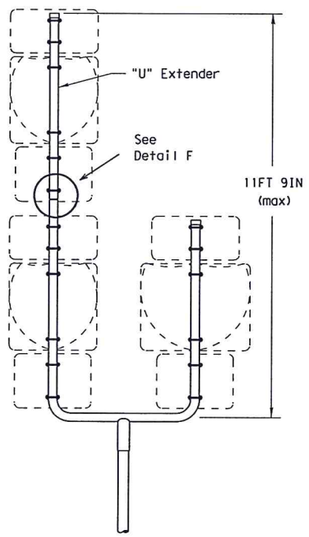

Detail E

**GENERAL NOTES:**

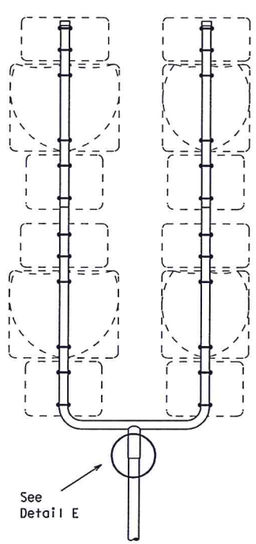
1.

| SIGN SUPPORT | # OF POSTS | MAX. SIGN AREA |
|---|---|---|
| 10 BWG | 1 | 16 SF |
| 10 BWG | 2 | 32 SF |
| Sch 80 | 1 | 32 SF |
| Sch 80 | 2 | 64 SF |

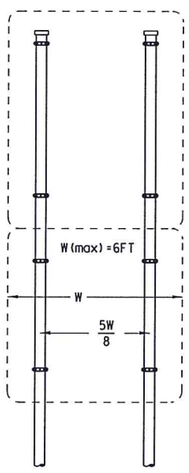
2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
6. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
10. Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
11. Additional sign clamp required on the "T-bracket" post for 24 inch height signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.
13. Sign blanks shall be the sizes and shapes shown on the plans.



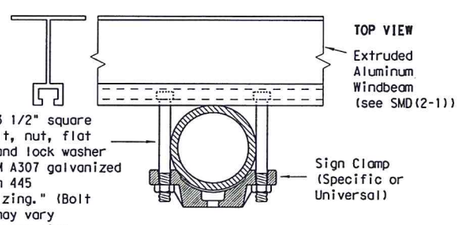

SM RD SGN ASSM TY S80(1)XX(U-1EXT)




SM RD SGN ASSM TY S80(1)XX(U-2EXT)

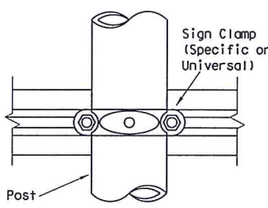



SM RD SGN ASSYM TY XXXXX(2)XX(P)

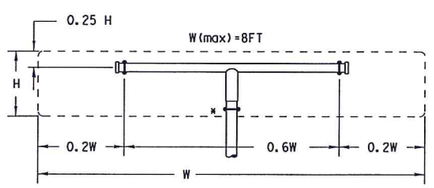



SIDE VIEW

Detail D



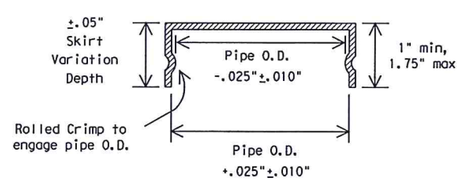

| REQUIRED SUPPORT | | |
|---|---|---|
| | SIGN DESCRIPTION | SUPPORT |
| Regulatory | 48-inch STOP sign (R1-1) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 60-inch YIELD sign (R1-2) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 48x16-inch ONE-WAY sign (R6-1) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 36x48, 48x36, and 48x48-inch signs | TY 10BWG(1)XX(T) |
| | 48x60-inch signs | TY S80(1)XX(T) |
| Warning | 48x48-inch signs (diamond or square) | TY 10BWG(1)XX(T) |
| | 48x60-inch signs | TY S80(1)XX(T) |
| | 48-inch Advance School X-ing sign (S1-1) | TY 10BWG(1)XX(T) |
| | 48-inch School X-ing sign (S2-1) | TY 10BWG(1)XX(T) |
| | Large Arrow sign (W1-6 & W1-7) | TY 10BWG(1)XX(T) |




All dimensions are in english unless detailed otherwise.

SM RD SGN ASSM TY XXXXX(1)XX(T)
(* - See Note 12)

## FRICTION CAP DETAIL




Friction caps may be manufactured from hot rolled or cold rolled steel sheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes.

The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture.

Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.

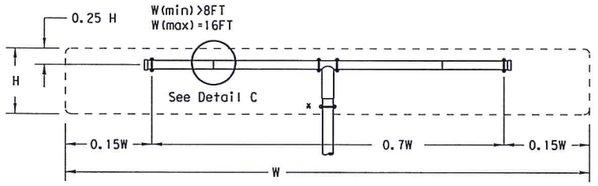
Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

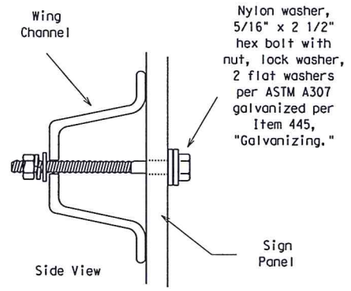
## SMD(SLIP-2)-08



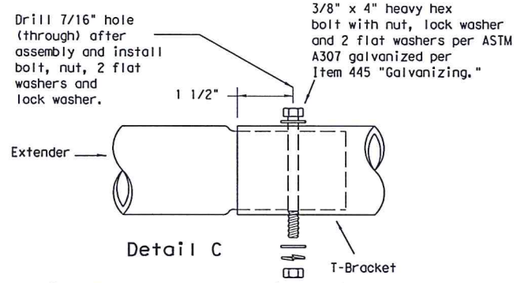
| REVISIONS | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| 9-08 | CONT | SECT | JOB | HIGHWAY |
| | | | | SOUTHLAND |
| | DIST | COUNTY | | SHEET NO. |
| | | TOM GREEN | | 61 |




SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)
(* - See Note 12)

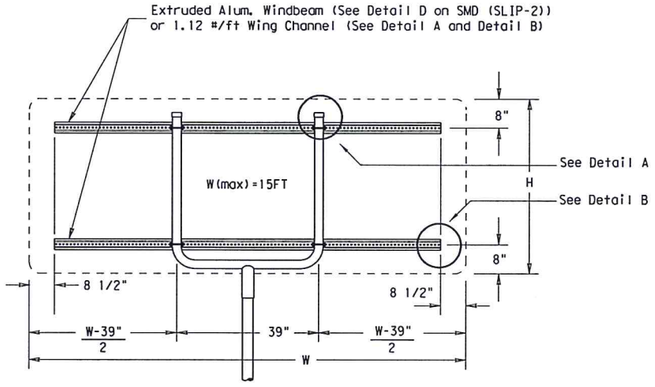



Detail B

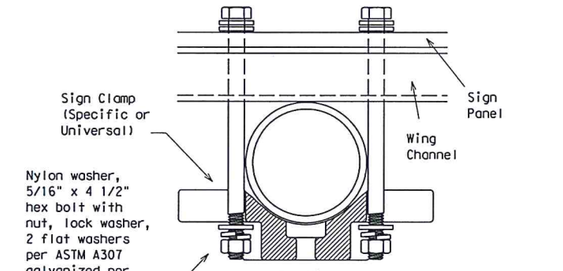



Detail C

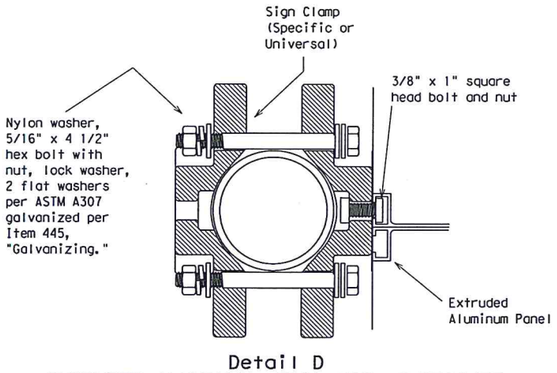
Splices shall only be allowed behind the sign substrate.



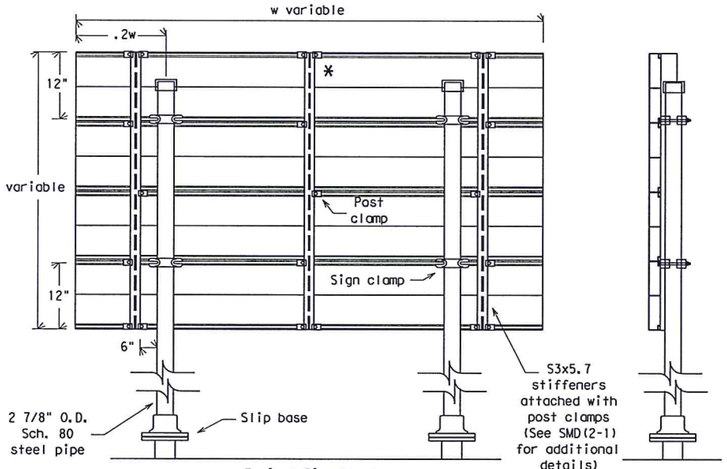

SM RD SGN ASSM TY XXXXX(1)XX(U-XX)




Detail A




Detail D
EXTRUDED ALUMINUM SIGN WITH T BRACKET



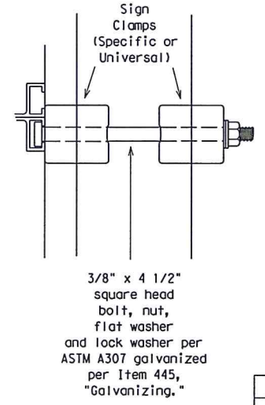

Typical Sign Mount

SM RD SGN ASSM TY S80(2)XX(P-EXAL)

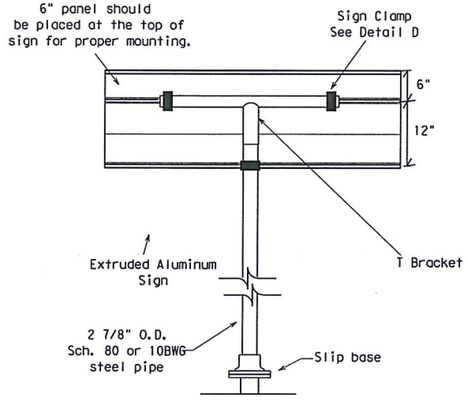
* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.



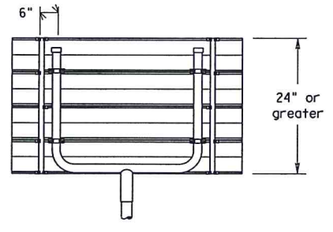
See Detail E
for clamp installation




Detail E




Extruded Aluminum Sign
With T Bracket




Use Extruded Alum. Windbeam as stiffeners
See SMD (2-1) for additional details

See Detail E
for clamp installation

**GENERAL NOTES:**

| SIGN SUPPORT | # OF POSTS | MAX. SIGN AREA |
|---|---|---|
| 10 BWG | 1 | 16 SF |
| 10 BWG | 2 | 32 SF |
| Sch 80 | 1 | 32 SF |
| Sch 80 | 2 | 64 SF |

2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
6. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
10. Sign blanks shall be the sizes and shapes shown on the plans.
11. Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.

REQUIRED SUPPORT

| | SIGN DESCRIPTION | SUPPORT |
|---|---|---|
| Regulatory | 48-inch STOP sign (R1-1) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 60-inch YIELD sign (R1-2) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 48x16-inch ONE-WAY sign (R6-1) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 36x48, 48x36, and 48x48-inch signs | TY 10BWG(1)XX(T) |
| | 48x60-inch signs | TY S80(1)XX(T) |
| Warning | 48x48-inch signs (diamond or square) | TY 10BWG(1)XX(T) |
| | 48x60-inch signs | TY S80(1)XX(T) |
| | 48-inch Advance School X-ing sign (S1-1) | TY 10BWG(1)XX(T) |
| | 48-inch School X-ing sign (S2-1) | TY 10BWG(1)XX(T) |
| | Large Arrow sign (W1-6 & W1-7) | TY 10BWG(1)XX(T) |

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

## SMD(SLIP-3)-08



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| | | | SOUTHLAND |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| | TOM GREEN | 62 |

REVISIONS
9-08

DATE: 9/23/2016 11:09:18 AM
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## SITE DESCRIPTION

The site description is accomplished using various sheets, each revealing separate details. This sheet's purpose is to direct the user to the appropriate location where the information required by the NPDES CGP can be found.

General location map, project limits, and project description: see title sheet of plans.

Intended sequence of major soil disturbing activities: see proposed sequence of construction

Total project area (acres): 0.539 AC

Total area to be disturbed (acres): 0.397 AC

Pre- construction weighted runoff coefficient: 0.376 AC

Post- construction weighted runoff coefficient: 0.732 AC

Existing condition of soil and vegetative cover: VEGETATIVE COVER= 0.397 AC

Percent of existing vegetative cover: 74%

Name and segment number of receiving waters: SOUTH CONCHO RIVER 1421 (TCEQ)

Storm water management:

Location of wetland or special aquatic sites on or near the project shall be shown on the site map for the SW3P sheets.

Drainage patterns, locations where storm water discharges to surface waters, slopes after major grading activities, typical areas of soil disturbance, areas which will not be disturbed, locations of control measures, and locations where stabilization practice will occur are depicted on the erosion control measures plan sheets and the landscape plan sheets.

Sediment must be removed from sediment traps and sedimentation ponds no later than the time that design capacity has been reduced by 50%.

If sediment escapes the site, accumulations must be removed at a frequency to minimize further negative effects, and whenever feasible, prior to the next rain.

Dust will be minimized by watering as necessary.

## SW3P REQUIREMENTS

THE SWP3 MUST HAVE A DETAILED SITE MAP INDICATING THE FOLLOWING:

A detailed site map (or maps) indicating the following:

(i) drainage patterns and approximate slopes anticipated after major grading activities; This is usually addressed by adding a copy of the typical sections to the living document.

(ii) areas where soil disturbance will occur;

(iii) locations of all controls and buffers, either planned or in place;

(iv) locations where temporary or permanent stabilization practices are expected to be used;

(v) locations of construction support activities, including off-site activities, that are authorized under the permittee's NOI, including material, waste, borrow, fill, or equipment or chemical storage areas;

(vi) surface waters (including wetlands) either at, adjacent, or in close proximity to the site, and also indicating those that are impaired waters;

(vii) locations where storm water discharges from the site directly to a surface water body or a municipal separate storm sewer system;

(viii) vehicle wash areas; and

(ix) designated points on the site where vehicles will exit onto paved roads (for instance, this applies to construction transition from unstable dirt areas to exterior paved roads).

THE SW3P MUST INCLUDE A DESCRIPTION OF CONSTRUCTION AND WASTE MATERIALS EXPECTED TO BE STORED ON-SITE AND A DESCRIPTION OF CONTROLS TO MINIMIZE POLLUTANTS FROM THESE MATERIALS.

THE SW3P MUST INCLUDE VELOCITY DISSIPATION DEVICES AT DISCHARGE LOCATIONS AND ALONG THE LENGTH OF ANY OUTFALL CHANNEL (I.E. RUNOFF CONVEYANCE) TO PROVIDE A NON-EROSIVE FLOW VELOCITY FROM THE STRUCTURE TO A WATER COURSE, SO THAT THE NATURAL PHYSICAL AND BIOLOGICAL CHARACTERISTICS AND FUNCTIONS ARE MAINTAINED AND PROTECTED.

## CONTROLS

(Check all that apply)

INTERIM SOIL STABILIZATION PRACTICES:

- ☑ SEEDING OR SODDING
- ☐ MULCHING
- ☐ SOIL RETENTION BLANKETS
- ☑ TOPSOIL OR COMPOST
- ☐ FLEXIBLE CHANNEL LINERS
- ☑ GROUND COVER

PERMANENT SOIL STABILIZATION PRACTICES:

- ☑ SEEDING OR SODDING
- ☐ MULCHING
- ☑ SOIL RETENTION BLANKETS
- ☑ TOPSOIL OR COMPOST
- ☐ FLEXIBLE CHANNEL LINERS
- ☑ GROUND COVER

INTERIM STRUCTURAL PRACTICES:

- ☑ TEMPORARY SEDIMENT CONTROL FENCE
- ☐ BALED HAY FOR EROSION CONTROL
- ☑ ROCK FILTER DAMS
- ☐ PIPE SLOPE DRAINS
- ☐ CHANNEL LINERS
- ☐ STORM SEWERS
- ☐ STORM INLET SEDIMENT TRAPS
- ☐ STONE OUTLET STRUCTURES
- ☐ DIVERSION, INTERCEPTOR, OR PERIMETER SWALES
- ☐ DIVERSION, INTERCEPTOR, OR PERIMETER DIKES
- ☐ PAVED FLUMES
- ☑ CONSTRUCTION EXITS
- ☐ DROP INLET SEDIMENT TRAPS
- ☐ CURB INLET SEDIMENT TRAPS
- ☐ SEDIMENT BASINS
- ☑ CURB AND GUTTER
- ☐ VELOCITY CONTROL DEVICES
- ☑ BIODEGRADABLE EROSION CONTROL LOGS

PERMANENT STRUCTURAL PRACTICES:

- ☐ TEMPORARY SEDIMENT CONTROL FENCE
- ☐ BALED HAY FOR EROSION CONTROL
- ☑ ROCK FILTER DAMS
- ☐ PIPE SLOPE DRAINS
- ☐ CHANNEL LINERS
- ☐ STORM SEWERS
- ☐ STORM INLET SEDIMENT TRAPS
- ☐ STONE OUTLET STRUCTURES
- ☐ DIVERSION, INTERCEPTOR, OR PERIMETER SWALES
- ☐ DIVERSION, INTERCEPTOR, OR PERIMETER DIKES
- ☐ PAVED FLUMES
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- ☐ DROP INLET SEDIMENT TRAPS
- ☐ CURB INLET SEDIMENT TRAPS
- ☐ SEDIMENT BASINS
- ☑ CURB AND GUTTER
- ☐ VELOCITY CONTROL DEVICES
- ☐ BIODEGRADABLE EROSION CONTROL LOGS

NARRATIVE (sequence of construction for storm water management activities)
The order of activities will be as follows:

Install silt fence/ECL/RFD as shown in the plans or as directed by the engineer.
Begin excavation and embankment for roadway.
Place storm drain and place proposed pavement structure.
Place remaining roadway items, i.e. sidewalks, driveways, signs, etc.
Construct surface course pavement.
Replace topsoil and drill seed fill and cut slopes in widened areas.
When all construction activity is complete and the site is stabilized and approved by the Project Engineer, remove all temporary structural controls.
Perform project cleanup.

NOTE: Limit the disturbed area such that construction activities will commence in that portion of the site within 14 days. Place stabilization measures in portions of the site no later than 14 days after construction activity has temporarily ceased.

The above indicated practices are proposed to control pollutants in storm water discharges. These practices are based on information contained in TxDOT storm water management guidelines. The schedule of implementation of these practices will be based on the intended sequence of major soil disturbing activities. Stabilization measures shall be initiated no later than 14 days after construction activity in that portion of the site has temporarily or permanently ceased.

Describe construction and waste materials expected to be stored on site and proposed controls to reduce pollutants from these materials (include storage practices, spill prevention and response):
Expected construction waste may include concrete rubble and concrete washout waste. Construction waste shall be removed from the project. Temporary stockpiles for waste material shall be located at an upland location approved by the Engineer. Any rubble waste stockpiled for more than 14 days shall require sedimentation control. This will not be paid for directly, but shall be considered subsidiary to the various bid items. Concrete wash-out waste shall be placed on concrete truck cleanout box and then disposed off project.

Describe pollutant sources from areas other than construction and measures implemented at those sites to minimize pollutant discharges:
Storm sewer system (if present) will be protected with structural controls.

## ABBREVIATIONS USED

BMP - Best Management Practice
CGP - Construction General Permit
EPIC - Environmental Permits, Issues, and Commitments
MSDS - Material Safety Data Sheet
NOI - Notice of Intent
NOT - Notice of Termination
NPDES - National Pollutant Discharge Elimination System
SW3P - Storm Water Pollution Prevention Plan

## INFORMATION

MAINTENANCE:
All erosion and sediment control and other protective measures identified in the SW3P must be maintained in effective operating conditions. If site inspections required by this permit identify BMP's that are not operating effectively, maintenance shall be performed before the next anticipated storm event, or as necessary to maintain the continued effectiveness of storm water controls. If maintenance prior to the next anticipated storm event impracticable, maintenance must be scheduled and accomplished as soon as possible.

INSPECTION:
Qualified personnel shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation, structural control measures, and locations where vehicles enter or exit the site, at intervals as indicated by check mark below:

- ☐ At least once every 14 calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater as recorded on a non-freezing rain gauge to be located at the project site.
- ☑ At least once every 7 calendar days. An inspection must occur regardless of whether or not there has been a rainfall event since the previous inspection.

Disturbed areas that are exposed to precipitation shall be inspected for evidence of, or the potential for pollutants entering the drainage system. Sediment and erosion control measures identified on the SW3P shall be observed to ensure that they are operating correctly. Locations where vehicles enter or exit site shall be inspected for evidence of off-site sediment tracking.
Based on the result of the inspection, the SW3P shall be revised to include additional or modified BMP's designed to correct the observed deficiency.
A report summarizing the scope, date, name and qualifications of Inspector, and major observations relating to the implementation of the SW3P shall be produced and retained as part of the SW3P for three years from date of final stabilization.

WASTE MATERIALS:
All waste materials will be collected and stored in a securely lidded metal dumpster. The dumpster will meet all state and local city solid waste management regulations. All trash and construction debris from the site will be deposited in the dumpster. The dumpster will be emptied as necessary or as required by local regulation, and the trash will be hauled to a local dump. No construction waste material will be buried on-site. This will not be paid directly, but shall be considered subsidiary to the various SW3P items.

SANITARY WASTE:
All sanitary waste will be collected from the portable units as necessary or as required by local regulation, by a licensed sanitary waste management contractor.

HAZARDOUS WASTE:
Hazardous waste includes paints, cleaning solvents, asphalt products, chemical additives for soil stabilization, or concrete curing compounds and additives. All hazardous waste shall be disposed of in accordance with all federal, state, and local regulations.
Provide MSDS sheets prior to beginning work.

REMARKS:
Disposal areas, stockpiles, and haul roads shall be constructed in a manner that will minimize and control the amount of sediment that may enter receiving waters. Disposal areas shall not be located in any wetland, water body or stream bed.
Construction staging areas and vehicle maintenance areas shall be constructed by the Contractor in a manner to minimize the runoff of pollutants.
All waterways shall be cleared as soon as practicable of temporary embankment, temporary bridges, matting, false work, piling, debris or other obstructions placed during construction operations that are not a part of the finished work.

INSPECTOR PAPERWORK CHECKLIST:
- ☑ Contact Form (#)
- ☑ NOI (# and %)
- ☑ NOT (%)
- ☑ Project Diary (%)
- ☑ SW3P Plan (%)
- ☑ Inspection and Maintenance Report (%)
- ☑ SW3P Certification Statement (signed by Area Engineer) (%)
- ☑ NPDES General Permit (Federal Register, dated July 6, 1998) (%)
- ☑ Historic Resources Information - EPIC Sheet (%)
- ☑ Inspector Qualification Form (%)
- ☑ Delegation of Signature Authority (all Inspectors signing reports) (%)

The symbol (#) indicates that the information should be displayed on the Project Bulletin Board.

The symbol (%) indicates that the information should be a part of the permanent SW3P file maintained at the office managing construction.

Any reportable quantity of Hazardous Material release must be reported to National Response Center at (800) 424-8802.

A copy of the Construction General Permit is a part of the SW3P.

| REV. NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

LJA Engineering, Inc.
FRN - F-1386

THE CITY OF SAN ANGELO TEXAS

STATE OF TEXAS
MICHAEL C. COYLE
95634
LICENSED PROFESSIONAL ENGINEER

SOUTHLAND BOULEVARD

SW3P INDEX

SHEET 1 OF 1

SHEET NO. 63

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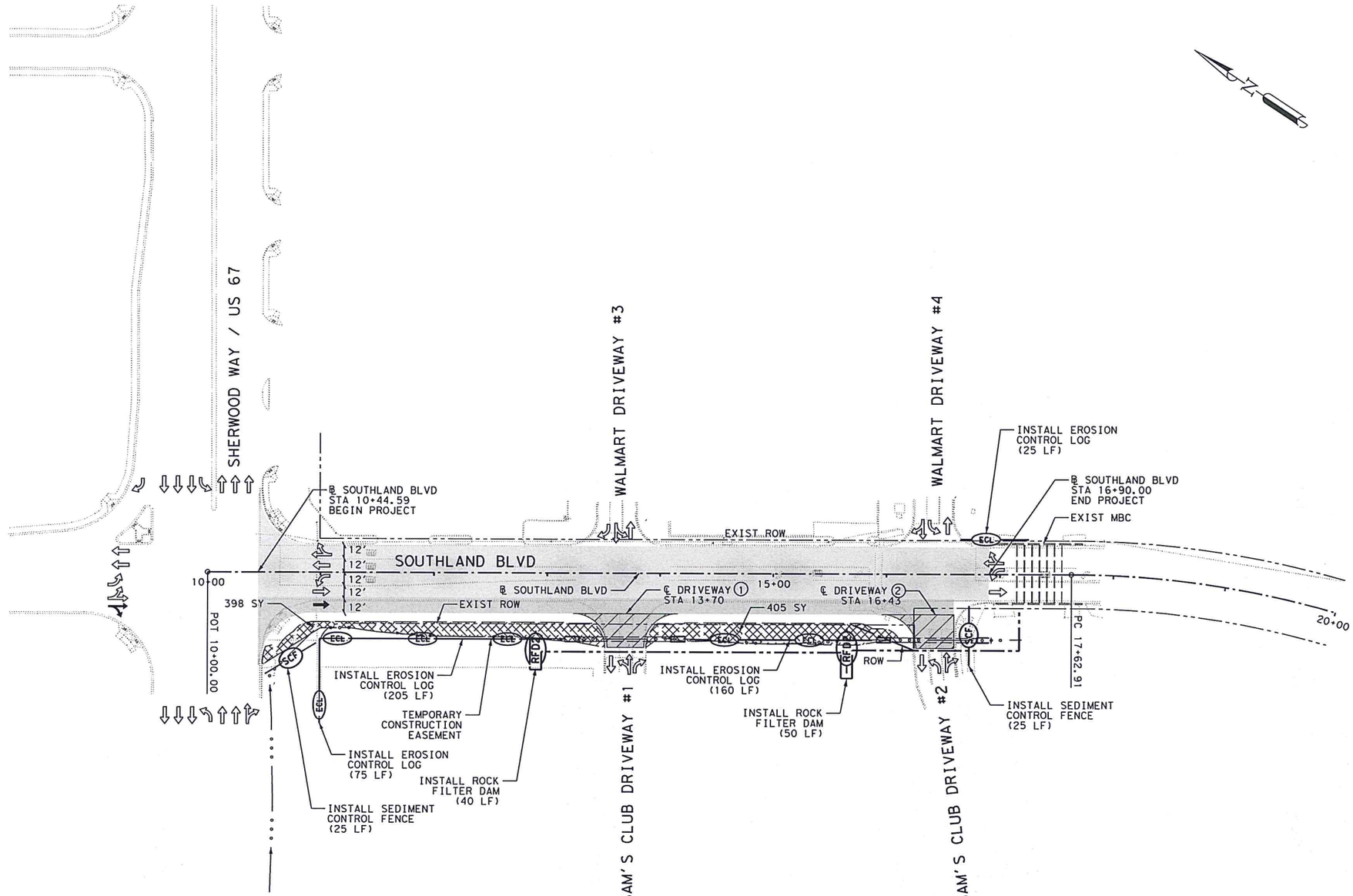


## LEGEND

- RIPRAP
- TOPSOIL AND SEEDING
- ECL — EROSION CONTROL LOG (TEMP)
- SCF — SEDIMENT CONTROL FENCE (TEMP)
- RFD2 — ROCK FILTER DAM TYPE 2
- FLOW DIRECTION TO INLETS
- FLOW DIRECTION IN DITCHES AND FLUMES

09/23/2016

STATE OF TEXAS
MICHAEL C. COYLE
95634
LICENSED PROFESSIONAL ENGINEER

0' 25' 50' 100'
SCALE: 1"=100'

| REV. NO. | DATE | DESCRIPTION | BY |
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LJA Engineering, Inc.
FRN-F-1386

THE CITY OF SAN ANGELO TEXAS

SOUTHLAND BOULEVARD
STORM WATER,
POLLUTION PREVENTION PLAN

SHEET 1 OF 1

SHEET NO. 64

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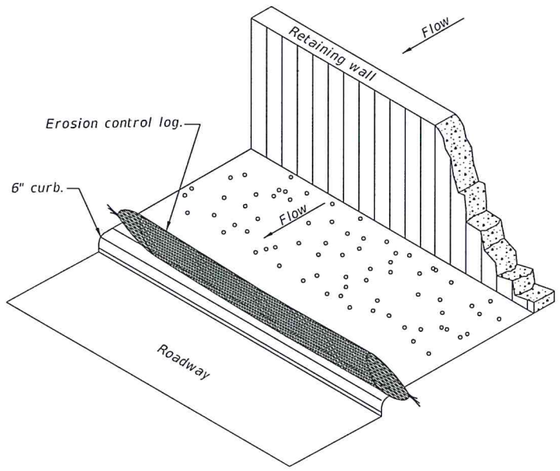
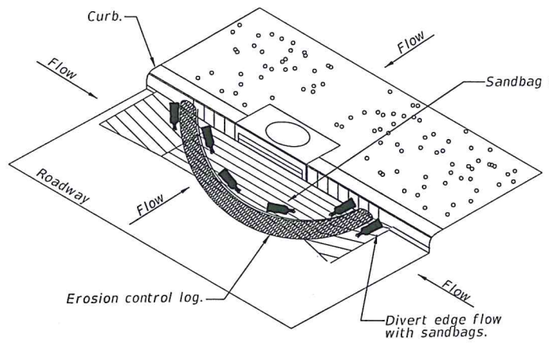
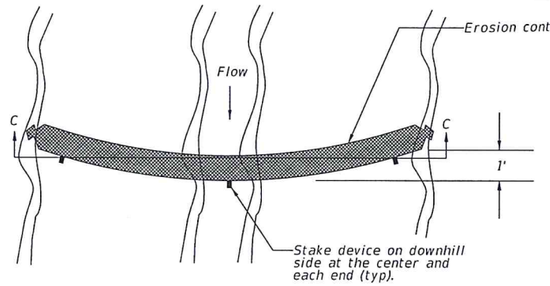


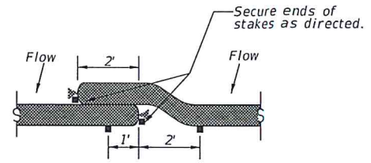

RETAINING WALL
EROSION CONTROL LOG



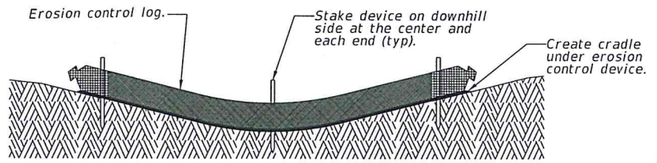

CURB INLET
EROSION CONTROL LOG




PLAN VIEW




TYPICAL LAP DETAIL

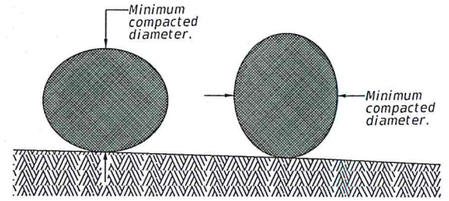



SECTION C-C

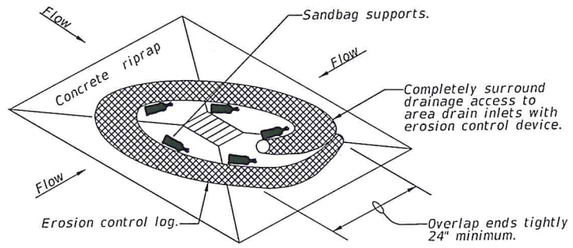
DOWNSTREAM EROSION CONTROL LOG

PAY ITEMS

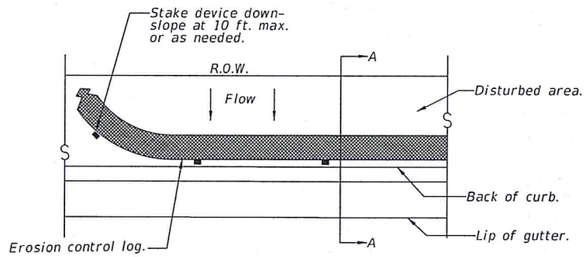
| | | |
|---|---|---|
| 0506 6035 | SANDBAGS FOR EROSION CONTROL | EA |
| 0506 6040 | BIODEG EROSN CONT LOGS (INSTL) (8") | LF |
| 0506 6041 | BIODEG EROSN CONT LOGS (INSTL) (12") | LF |
| 0506 6042 | BIODEG EROSN CONT LOGS (INSTL) (18") | LF |
| 0506 6043 | BIODEG EROSN CONT LOGS (REMOVE) | LF |



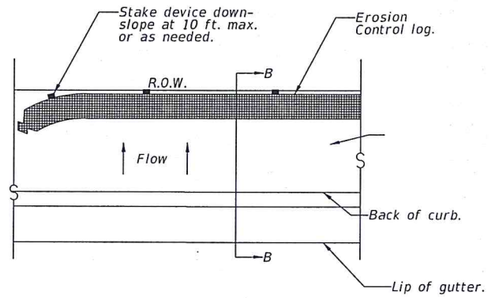

DIAMETER MEASUREMENTS OF
EROSION CONTROL LOGS



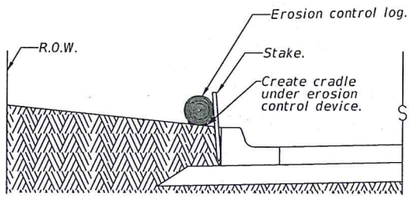

DROP INLET
EROSION CONTROL LOG




PLAN VIEW

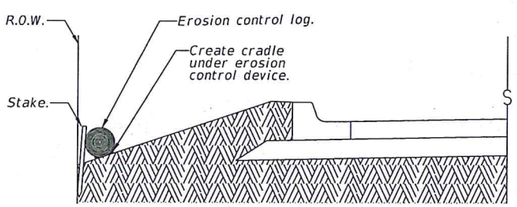



PLAN VIEW




SECTION A-A

BACK OF CURB
EROSION CONTROL LOG




SECTION B-B

EDGE OF RIGHT-OF-WAY
EROSION CONTROL LOG

## GENERAL NOTES

1. Furnish core material consisting of compost, mulch, aspen excelsior wood fibers, chipped site vegetation, coconut fiber, or 100% recyclable fibers.
2. Erosion control logs that are not designated for removal are considered temporary installations. For temporary erosion control logs, slice open the containment mesh and spread the core material evenly.
3. Recommended locations of erosion control logs include:
   a) Within drainage ditches spaced at ±500 ft. on center,
   b) Immediately preceding ditches, curb inlets and drop inlets,
   c) Just before the drainage enters a water course, and
   d) Just before the drainage leaves the right-of-way.
4. Erosion control logs should be cleaned when the capacity has been reduced by one half or the sediment has accumulated to a depth of one foot, whichever is less.
5. Laps will not be measured or paid separately.



NOT TO SCALE

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LJA Engineering, Inc.
FRN - F-1386

THE CITY OF SAN ANGELO TEXAS

SOUTHLAND BOULEVARD
BIODEGRADABLE EROSION
CONTROL LOG DETAILS

SHEET 1 OF 1

SHEET NO. 65

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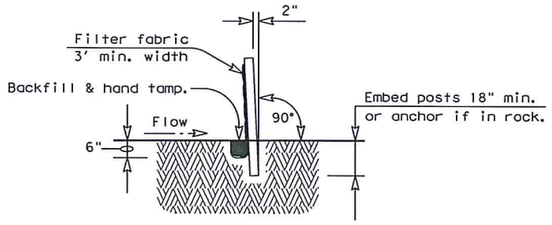



SECTION A-A

GENERAL NOTES

1. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

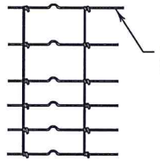
PLAN SHEET LEGEND

Sediment Control Fence —— SCF ——

SEDIMENT CONTROL FENCE USAGE GUIDELINES

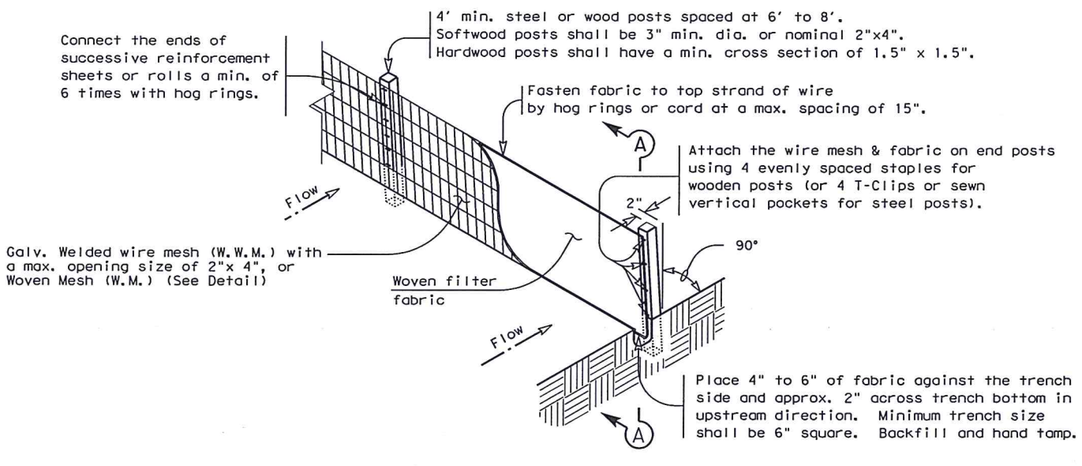
A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2 year storm frequency may be used to calculate the flow rate to be filtered.

Sediment control fence should be sized to filter a max. flow through rate of 100 GPM/FT$^2$. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.



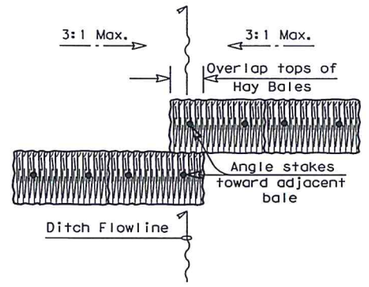

Galv. Hinge joint knot woven mesh (12.5 Ga. Min.) requires a minimum of five horizontal wires spaced at a max.12 inches apart and all vertical wires spaced at a max. 12 inches apart.

Hinge Joint Knot Woven Mesh (Option)

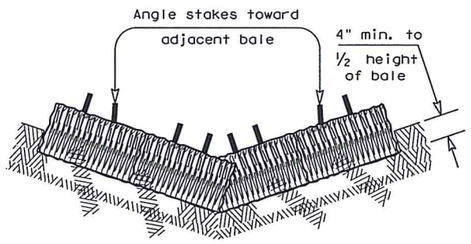



TEMPORARY SEDIMENT CONTROL FENCE

SCF




PLAN VIEW




PROFILE VIEW

PLANS SHEET LEGEND

Baled Hay —— BH ——

BALED HAY USAGE GUIDELINES

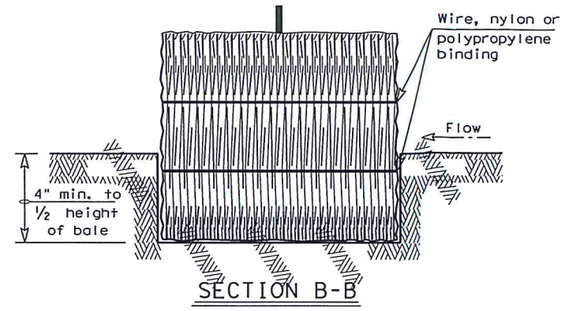
A Baled Hay installation may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A two year storm frequency may be used to calculate the flow rate to be filtered. The installation should be sized to filter a maximum flow thru rate of 5 GPM/FT$^2$ of cross sectional area. Baled hay may be used at the following locations:

1. Where the runoff approaching the baled hay flows over disturbed soil for less than 100'. If the slope of the disturbed soil exceeds 10%, the length of slope upstream the baled hay should be less than 50'.
2. Where the installation will be required for less than 3 months.
3. Where the contributing drainage area is less than ½ acre.

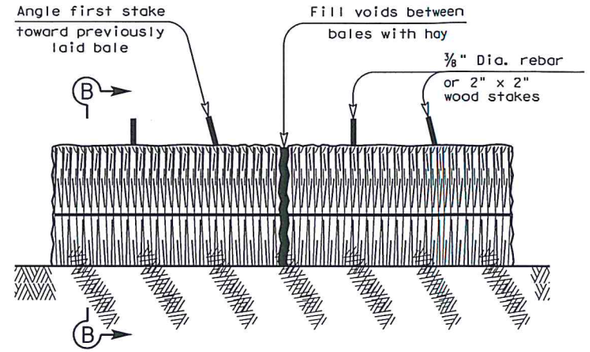
For Baled Hay installations in small ditches, the additional following considerations apply:

1. The ditch sideslopes should be graded as flat as possible to maximize the drainage flowrate thru the hay.
2. The ditch should be graded large enough to contain the overtopping drainage when sediment has filled to the top of the baled hay.

Bales should be replaced usually every 2 months or more often during wet weather when loss of structural integrity is accelerated.




SECTION B-B




BALED HAY FOR EROSION CONTROL

BH

GENERAL NOTES

1. Hay bales shall be a minimum of 30" in length and weigh a minimum of 50 Lbs.
2. Hay bales shall be bound by either wire or nylon or polypropylene string. The bales shall be composed entirely of vegetative matter.
3. Hay bales shall be embedded in the soil a minimum of 4" and where possible ½ the height of the bale.
4. Hay bales shall be placed in a row with ends tightly abutting the adjacent bales. The bales shall be placed with bindings parallel to the ground.
5. Hay bales shall be securely anchored in place with ⅜" Dia. rebar or 2" x 2" wood stakes, driven through the bales. The first stake shall be angled towards the previously laid bale to force the bales together.
6. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

Texas Department of Transportation | Design Division Standard

# TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

## FENCE & BALED HAY

## EC(1)-09

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| ©TxDOT June 1993 | CONT | SECT | JOB | HIGHWAY | |
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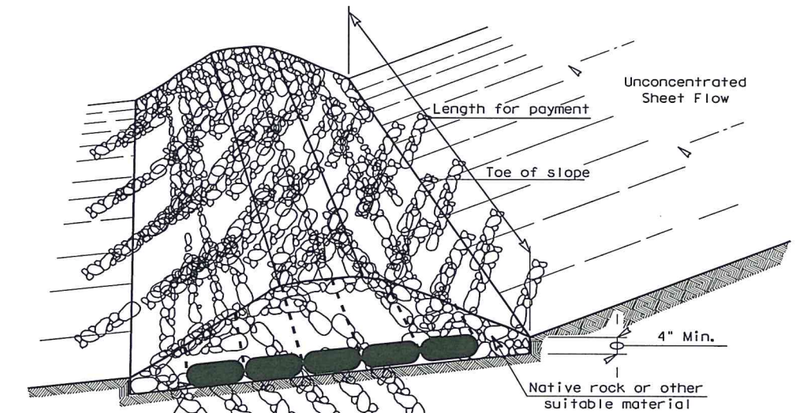
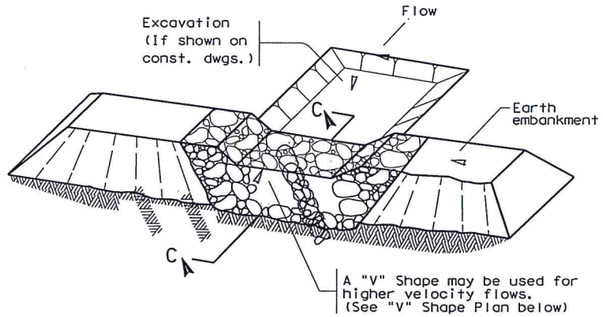


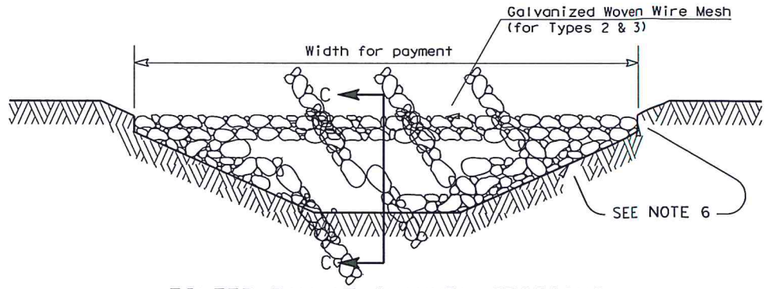

FILTER DAM AT TOE OF SLOPE

RFD1
TYPE 1



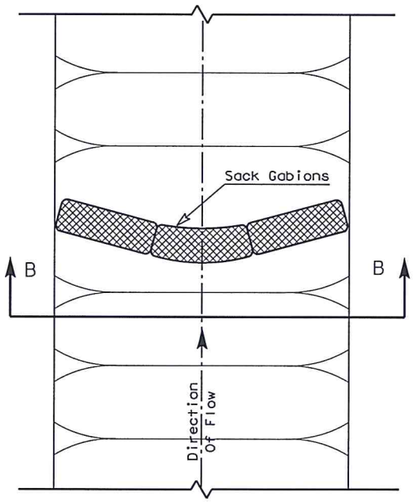

FILTER DAM AT SEDIMENT TRAP

RFD1 OR RFD2
TYPE 1 OR TYPE 2

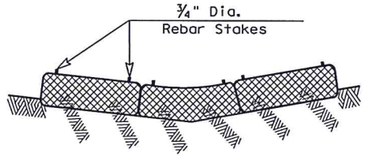



FILTER DAM AT CHANNEL SECTIONS

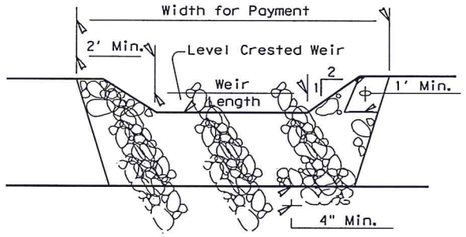
RFD1 OR RFD2 OR RFD3
TYPE 1 OR TYPE 2



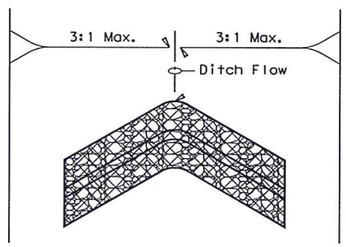

PLAN VIEW



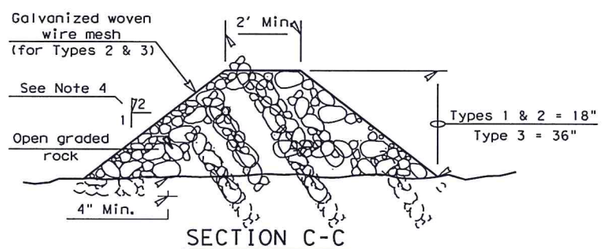

SECTION B-B




PROFILE



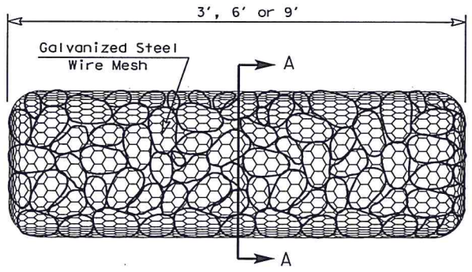

"V" SHAPE
(Plan View)



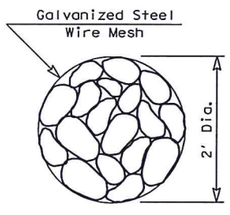

SECTION C-C

PLANS SHEET LEGEND

Type 1 Rock Filter Dam — RFD1
Type 2 Rock Filter Dam — RFD2
Type 3 Rock Filter Dam — RFD3




TYPE 4 (SACK GABIONS)




SECTION A-A

## ROCK FILTER DAM USAGE GUIDELINES

Rock Filter Dams should be constructed downstream from disturbed areas to intercept sediment from overland runoff and/or concentrated flow. The dams should be sized to filter a maximum flow through rate of 60 GPM/FT$^2$ of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

Type 1 (18" high with no wire mesh): Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approx. 8 Ft/Sec or more) in which aggregate wash out may occur. Sandbags may be used at the embedded foundation (4" deep min.) for better filtering efficiency of low flows if called for on the plans or directed by the Engineer.

Type 2 (18" high with wire mesh): Type 2 may be used in ditches and at dike or swale outlets.

Type 3 (36" high with wire mesh): Type 3 may be used in stream flow and should be secured to the stream bed.

Type 4 (Sack gabions): Type 4 May be used in ditches and smaller channels to form an erosion control dam.

## GENERAL NOTES

1. If shown on the plans or directed by the Engineer, filter dams should be placed near the toe of slopes where erosion is anticipated, upstream and/or downstream at drainage structures, and in roadway ditches and channels to collect sediment.
2. Materials (aggregate, wire mesh, sandbags, etc.) shall be as indicated by the specification for "Rock Filter Dams for Erosion and Sedimentation Control".
3. The rock filter dam dimensions shall be as indicated on the SW3P plans.
4. Side slopes should be 2:1 or flatter. Dams within the safety zone shall have sideslopes of 6:1 or flatter.
5. Maintain a minimum of 1' between top of rock filter dam weir and top of embankment for filter dams at sediment traps.
6. Filter dams should be embedded a minimum of 4" into existing ground.
7. The sediment trap for ponding of sediment laden runoff shall be of the dimensions shown on the plans.
8. Rock filter dam types 2 & 3 shall be secured with 20 gauge galvanized woven wire mesh with 1" diameter hexagonal openings. The aggregate shall be placed on the mesh to the height & slopes specified. The mesh shall be folded at the upstream side over the aggregate and tightly secured to itself on the downstream side using wire ties or hog rings. In stream use the mesh should be secured or staked to the stream bed prior to aggregate placement.
9. Sack Gabions should be staked down with ¾" dia. rebar stakes.
10. Flow outlet should be onto a stabilized area (vegetation, rock, etc.).
11. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

Texas Department of Transportation

Design Division Standard

# TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

## ROCK FILTER DAMS

## EC(2)-93

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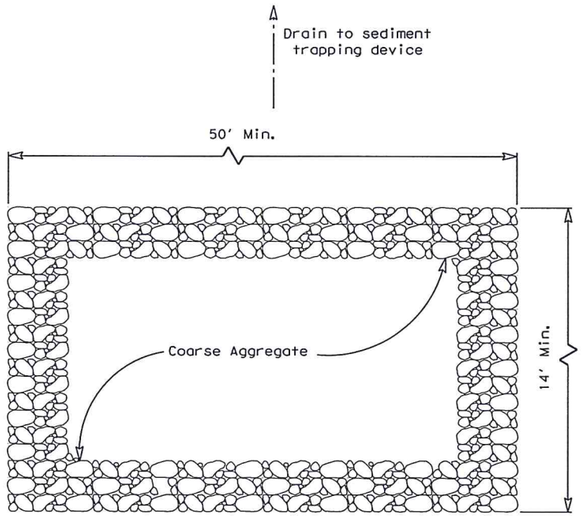


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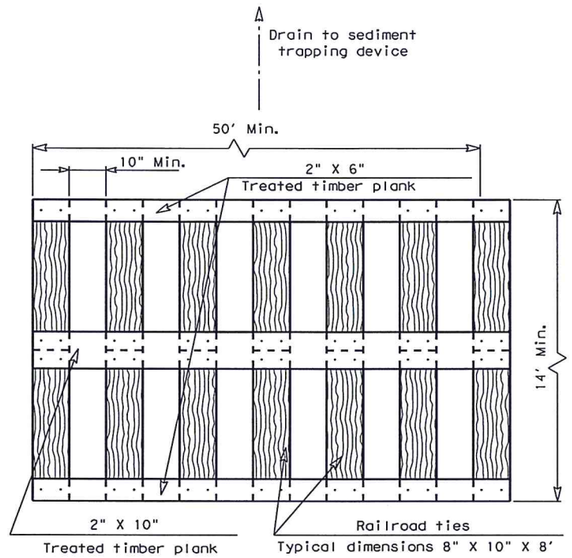


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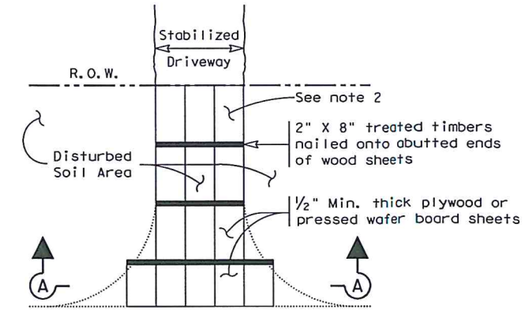
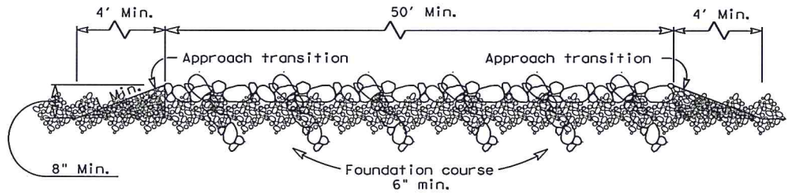



PLAN

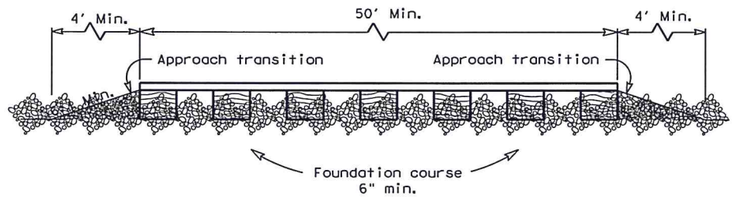



PROFILE

## CONSTRUCTION EXIT (TYPE 1)

### GENERAL NOTES

1. The length of the type 1 construction exit shall be as indicated on the plans, but not less than 50'.
2. The coarse aggregate should be open graded with a size of 4" to 8".
3. The approach transitions should be no steeper than 6:1 and constructed as directed by the Engineer.
4. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
5. The construction exit shall be graded to allow drainage to a sediment trapping device.
6. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

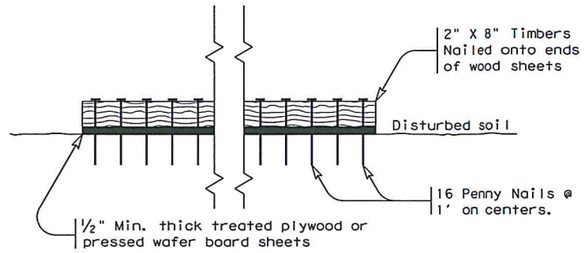



PROFILE

## CONSTRUCTION EXIT (TYPE 2)

### GENERAL NOTES

1. The length of the type 2 construction exit shall be as indicated on the plans, but not less than 50'.
2. The treated timber planks shall be attached to the railroad ties with ½"x 6" min. lag bolts. Other fasteners may be used as approved by the Engineer.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The approach transitions shall be no steeper than 6:1 and constructed as directed by the Engineer.
5. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
6. The construction exit should be graded to allow drainage to a sediment trapping device.
7. The guidelines shown hereon are suggestions only and may be modified by the Engineer.




SECTION A-A

## CONSTRUCTION EXIT (TYPE 3)

### GENERAL NOTES

1. The length of the type 3 construction exit shall be as shown on the plans, or as directed by the Engineer.
2. The type 3 construction exit may be constructed from open graded crushed stone with a size of two to four inches spread a min. of 4" thick to the limits shown on the plans.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

Texas Department of Transportation

Design Division Standard

# TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

## CONSTRUCTION EXITS

## EC(3)-93

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| | | TOM GREEN | | 68 |

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