

FHWA TEXAS DIVISION	PROJECT NO.	SHEET NO.	
STATE	STP 2022(897)HES	1	
TEXAS	DISTRICT	COUNTY	
CONTROL	SECTION	JOB	HIGHWAY NO.
0931	04	034	FS 357

SEE SHEET 2 FOR INDEX OF SHEETS

STATE OF TEXAS  
DEPARTMENT OF TRANSPORTATION

FUNCTIONAL CLASS.: MINOR COLLECTOR

\* DESIGN SPEED = 30 MPH  
ADT (2020) = 265  
ADT (2030) = 300

\* DESIGN SPEED APPLICABLE ONLY TO THE DESIGN ELEMENTS AFFECTED BY THE SCOPE OF THE HSIP PROJECT.

PLANS OF PROPOSED  
STATE HIGHWAY IMPROVEMENT  
PROJECT NO. STP 2022(897)HES  
FS 357  
TRINITY COUNTY

FINAL PLANS

NET LENGTH OF PROJECT = 6,795.360 FT. = 1.287 MI.

LIMITS: FROM END OF PAVEMENT TO FM 357 / FM 233  
FOR THE CONSTRUCTION OF SAFETY IMPROVEMENT PROJECTS  
CONSISTING OF PROVIDE ADDITIONAL PAVED SURFACE WIDTH TO 26',  
SAFETY TREAT FIXED OBJECTS, PROFILE EDGELINE MARKINGS, PROFILE  
CENTERLINE MARKINGS

LETTING DATE: \_\_\_\_\_  
DATE CONTRACTOR BEGAN WORK: \_\_\_\_\_  
DATE WORK WAS COMPLETED: \_\_\_\_\_  
DATE WORK WAS ACCEPTED: \_\_\_\_\_  
FINAL CONTRACT COST: \$ \_\_\_\_\_  
CONTRACTOR: \_\_\_\_\_

CONSTRUCTION WORK ON THIS PROJECT WAS PERFORMED IN ACCORDANCE WITH PLANS, CONTRACT AND APPROVED CHANGE ORDERS.

\_\_\_\_\_ DATE \_\_\_\_\_

BEGIN PROJECT

CSJ: 0931-04-034  
STA 360+00.00  
REF MRK = 698-0.071  
LAT 31.2564525°  
LONG -95.0897693°

PREVIOUS PROJECT TIE

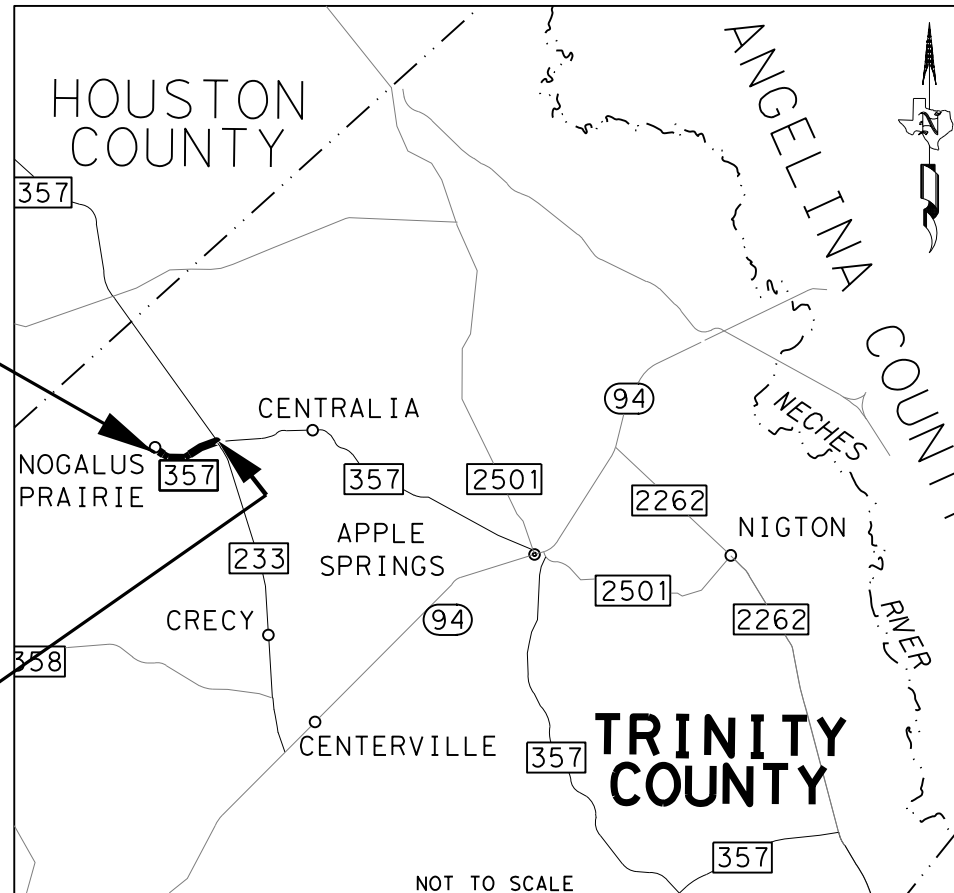
PROJECT NO: BR 92(58)  
CSJ: 0931-04-019  
TIE-IN STA 52+29.48

END PROJECT

CSJ: 0931-04-034  
STA 428+45.27  
REF MRK = 698+1.216  
LAT 31.2574620°  
LONG -95.0698771°

PREVIOUS PROJECT TIE

PROJECT NO: BR 92(58)  
CSJ: 0934-04-019  
TIE-IN STA 65+48.39



BARRICADES AND WARNING SIGNS

PROVIDE AND ERECT BARRICADES AND WARNING SIGNS IN ACCORDANCE WITH THE BARRICADE & CONSTRUCTION STANDARDS, TCP STANDARDS, THE "TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND AS DIRECTED.



RECOMMENDED FOR LETTING: \_\_\_\_\_ APPROVED FOR LETTING: \_\_\_\_\_

NO EXCEPTIONS, NO EQUATIONS, NO RAILROAD CROSSINGS

DocuSigned by:  
*celm31, P.E.* 5/27/2022  
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DISTRICT DESIGN ENGINEER

DocuSigned by:  
*Kelly O. Morris, P.E.* 5/27/2022  
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DISTRICT ENGINEER

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL-AID CONSTRUCTION CONTRACTS (FORM FHWA 1273, MAY 2012).

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FILE: \\ttdot\projectwiseonline.com\TXDOT3\Documents\11 - LFK\Design Projects\093104034\4 - Design\Plan Set\1. General\LFK\*TitleSheet\*Dist Rev.dgn  
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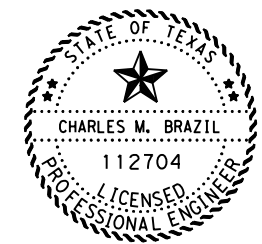
<u>SHEET NO.</u>	<u>DESCRIPTION</u>
<b>GENERAL</b>	
1	TITLE SHEET
2	INDEX OF SHEETS
3	TYPICAL SECTIONS
4, 4A-4F	GENERAL NOTES
5, 5A	ESTIMATE & QUANTITY SHEET
6-10	QUANTITY SUMMARIES
11-12	SUMMARY OF SMALL SIGNS
<b>TRAFFIC CONTROL PLAN</b>	
# 13-24	BC (1)-21 THRU BC(12)-21
# 25	TCP(2-1)-18
# 26	TCP(2-2)-18
# 27	TCP(3-1)-13
# 28	TCP(3-3)-14
# 29	TCP(S-1)-08A
# 30	TCP(S-2C)-08A
# 31	TCP(S-2)-10
# 32	WZ(STPM)-13
# 33	WZ(BRK)-13
# 34	WZ(RS)-22
<b>ROADWAY DETAILS</b>	
35	SUPERELEVATION DATA
36	DRIVEWAY & SIDE ROAD DETAILS
37	TREE REMOVAL AND TRIMMING DETAILS
<b>DRAINAGE DETAILS</b>	
38-39	MISCELLANEOUS DRAINAGE DETAILS
40-41	DRAINAGE AREA MAP & HYDRAULIC DATA SHEET
42-43	CULVERT LAYOUTS
44	BCS
# 45-46	SCC-5 & 6
# 47-49	SETB-FW-S
# 50	PW
# 51	PSET-SC
# 52	PSET-SP

<u>TRAFFIC SIGNAL ITEMS</u>	
# 53	ED(1)-14
# 54	ED(3)-14
# 55	ED(4)-14
# 56	ED(5)-14
# 57	ED(6)-14
# 58	ED(7)-14
# 59	RID(1)-20
# 60	RID(2)-20
# 61-64	RIP(1)-19 THRU RIP(4)-19

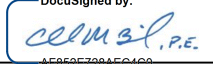
<u>TRAFFIC ITEMS</u>	
65	SIGN DETAILS
66	ILLUMINATION LAYOUT
# 67	SMD(GEN)-08
# 68	SMD(SLIP-1)-08
# 69	SMD(SLIP-2)-08
# 70	SMD(SLIP-3)-08
# 71	SMD(TWT)-08
# 72	TSR(3)-13
# 73	TSR(4)-13
# 74	TSR(5)-13
# 75	PM(1)-20
# 76	PM(2)-20
# 77	RS(3)-13
# 78	RS(4)-13
# 79	D & OM(1)-20
# 80	D & OM(2)-20
# 81	D & OM(3)-20
# 82	D & OM(4)-20
# 83	D & OM(5)-20
# 84	D & OM(VIA)-20

<u>ENVIRONMENTAL ISSUES</u>	
85	TXDOT SWP3 INDEX
86-87	EPIC
88-90	SWP3 LAYOUTS
# 91	EC(1)-16
# 92	EC(2)-16
# 93	EC(3)-16


<u>MISCELLANEOUS ITEMS</u>	
94	MAILBOX TURNOUT DETAILS
# 95-98	MB(1)-21 THRU MB(4)-21



THE STANDARD SHEETS SPECIFICALLY IDENTIFIED BY \* HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

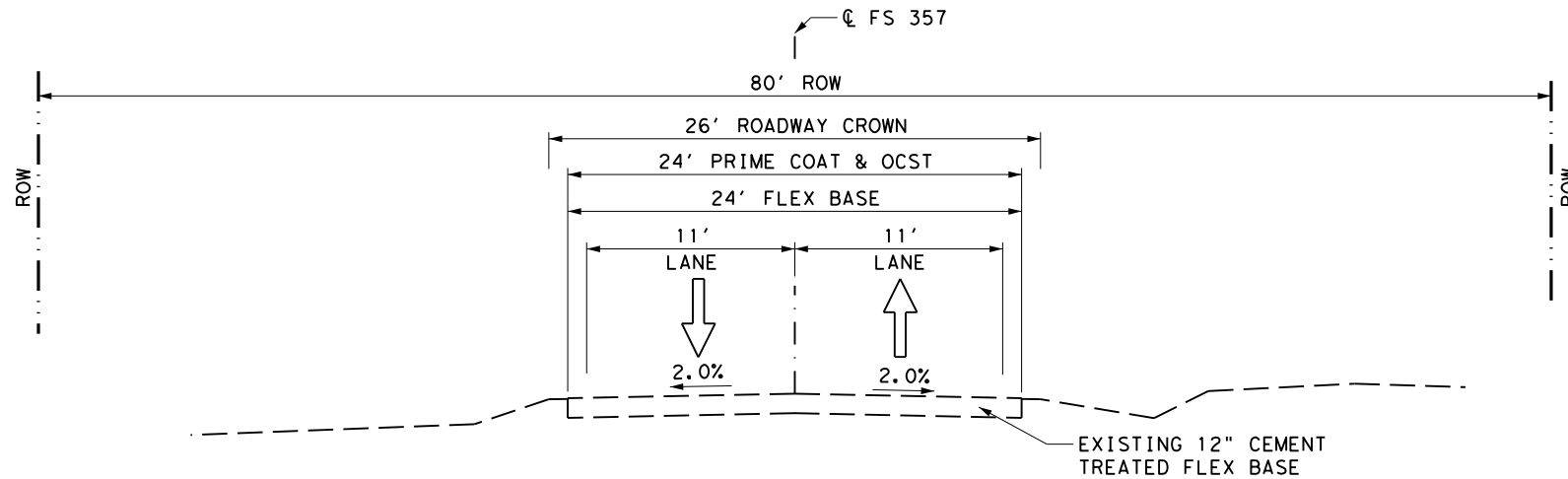
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 CHARLES M. BRAZIL, P.E.      6/1/2022  
 DATE

INDEX OF SHEETS

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CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST		COUNTY	SHEET NO.
LFK		TRINITY	2

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**EXISTING TYPICAL SECTION**

STA 360+00.00 TO STA 428+45.27

**NOTE:**

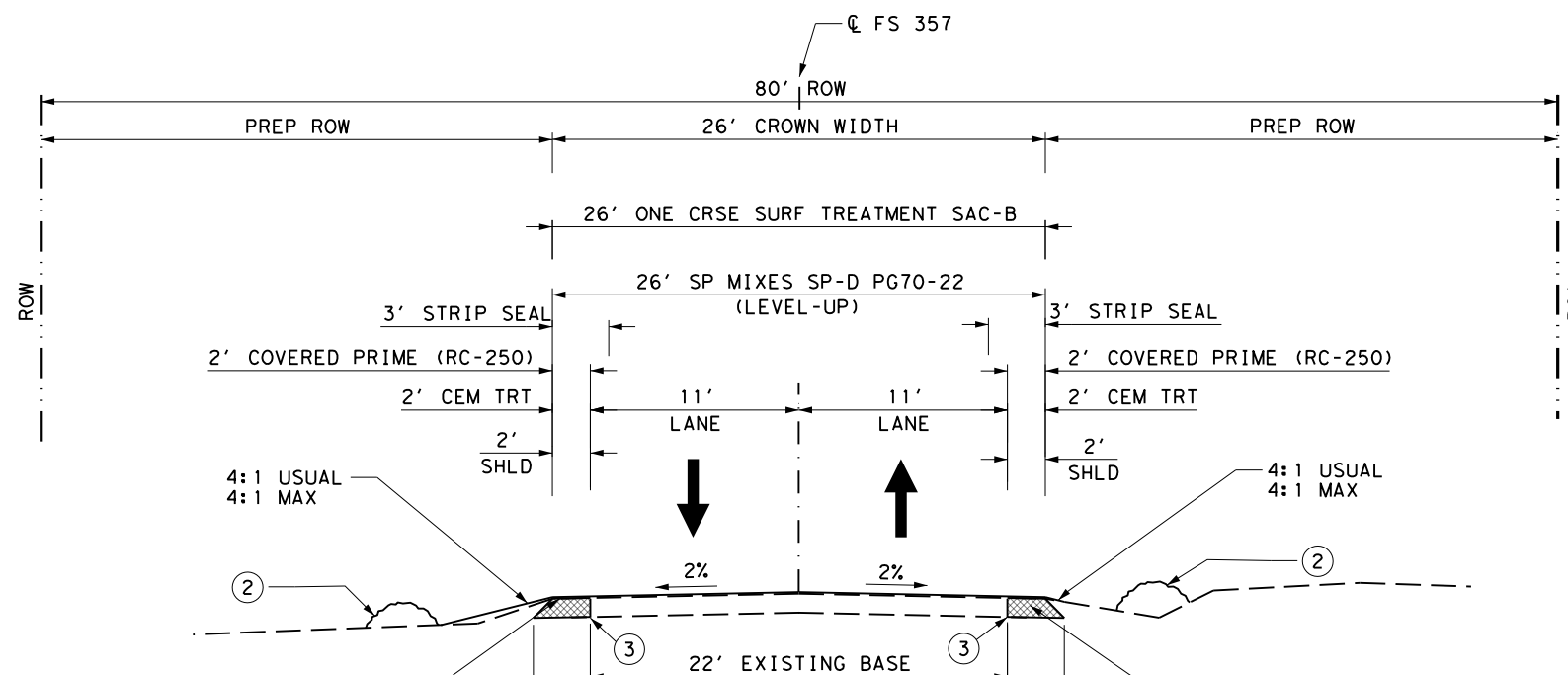
- ① USE CARE WHEN WIDENING & MIXING OVER CROSS-DRAINAGE STRUCTURES. DEPTH OF WIDENING MAY NEED TO BE REDUCED TO ACCOMMODATE DRAINAGE FEATURES.
- ② BLADE 6" OF EXISTING TOPSOIL AND WINDROW OUTSIDE WORK AREA, THEN RETURN SLOPES UPON COMPLETION OF ROADWAY WORK. THIS OPERATION WILL BE PAID FOR ONCE UNDER ITEM 150, BLADING. IF ADDITIONAL MATERIAL IS NEEDED TO RETURN SLOPES, THIS WILL BE PAID FOR UNDER ITEM 132, EMBANKMENT (VEH) (ORD COMP) (TY B) (CY) AS DIRECTED.
- ③ REMOVAL OF EXISTING SURFACE AND/OR BASE WILL BE SUBSIDIARY TO ITEM 112 "SUBGRADE WIDENING".
- ④ SP TY-B (64-22) (12") MAY BE USED AT THE OPTION OF THE CONTRACTOR IN LIEU OF CEM TRT (PLNT MX) (CL N) (TY D) (GR 1-2 OR GR 5). PLACE IN 2 LIFTS UNLESS OTHERWISE APPROVED.

**SEQUENCE OF CONSTRUCTION**

1. CORRECT SUPERELEVATION.
2. WIDEN SUBGRADE LT & RT.
3. 2' CEM TRT (PLNT MX), PLACE COVERED PRIME WEEKLY.
4. APPLY STRIP SEAL.
5. APPLY LEVEL-UP AND REMOVE PAVEMENT MARKINGS.
6. APPLY ONE COURSE SURFACE TREATMENT.
7. PLACE MESSAGE BOARDS 2 WEEKS IN ADVANCE OF INSTALLING PROPOSED STOP SIGNS ON FS 357 & FM 233.
8. PLACE FINAL PAVEMENT MARKINGS AND MARKERS.
9. SEED & FERTILIZE.

**NOTICE:**

THERE ARE LOCATIONS WITHIN THE PROJECT LIMITS WHERE TXDOT MAINTENANCE FORCES HAVE REPAIRED BASE FAILURES. THESE LOCATIONS WERE REPAIRED WITH APPROXIMATELY 12" CEMENT TREATED BASE OR HMA. THE LOCATION AND LENGTH OF REPAIRS IS UNKNOWN. REGARDLESS OF EXISTING MATERIAL ENCOUNTERED, SCARIFY AND RESHAPE TO DEPTHS AND WIDTHS SHOWN ON TYPICAL SECTIONS. THERE WILL BE NO ADDITIONAL COMPENSATION FOR AREAS PREVIOUSLY REPAIRED WITH TXDOT MAINTENANCE FORCES.

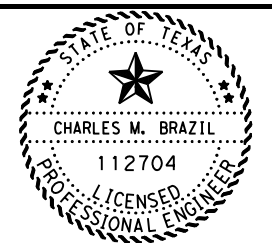


**PROPOSED TYPICAL SECTION**

STA 360+00.00 TO STA 428+45.27

- ④ CEM TRT (PLNT MX) (CL N) (TY D) (GR 1-2 OR GR 5) (12") PLACE IN 2 LIFTS
- ① 3' SUBGRADE WIDENING (ORD COMP)
- ③ 22' EXISTING BASE
- ② 4:1 USUAL 4:1 MAX
- ④ CEM TRT (PLNT MX) (CL N) (TY D) (GR 1-2 OR GR 5) (12") PLACE IN 2 LIFTS
- ① 3' SUBGRADE WIDENING (ORD COMP)

N. T. S.



DocuSigned by:  
  
 6/1/2022

**TYPICAL SECTIONS**

TEXAS DEPARTMENT OF TRANSPORTATION ©2022			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY		SHEET NO.
LFK	TRINITY		3

**GENERAL NOTES:**

Existing regulatory, warning and guide signs within project limits are to remain visible to the traveling public at all times. If a sign must be repositioned during construction operations, move and install the sign to an approved location. Use care when working near existing signs and repair or replace signs damaged by work operations. All work involved repositioning existing signs will be subsidiary to various bid items.

Furnish materials and make repairs to the existing roadway at any location damaged by construction operations. This work shall be done in an approved manner and will be subsidiary to various bid items.

Ensure drainage structures and outfall channels constructed on this project are free of silt and debris at the time of project acceptance. Final clean out work will be subsidiary to various bid items.

Maintain adequate surface drainage throughout the project limits during all phases of construction.

Provide suitable access at all times to adjacent businesses, private property and side roads.

When construction work necessitates the moving of mailboxes, temporarily relocate them as necessary to keep them clear of construction operations and convenient for the mail carrier. Mounts for temporarily relocating mailboxes shall conform to the Department's "Compliant Work Zone Traffic Control Device List" or the mailbox standard. Temporary relocation of mailboxes will be subsidiary to various bid items.

Remove dirt, silt, rocks, debris and other foreign matter that accumulates in structures due to the Contractor's operations as directed. Keep stream channels open at all times. This work will not be paid for directly, but will be subsidiary to pertinent Items.

Contractor questions on this project are to be addressed to the following individual(s):

Jesse Sisco, Area Engineer

[Jesse.Sisco@txdot.gov](mailto:Jesse.Sisco@txdot.gov)

Praveen Ramanathan, Asst. Area Engineer

[Praveen.Ramanathan@txdot.gov](mailto:Praveen.Ramanathan@txdot.gov)

Contractor questions will be accepted through email, phone, and in person by the above individuals.

All contractor questions will be reviewed by the Engineer. Once a response is developed, it will be posted to TxDOT's Public FTP at the following Address:

<https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting%20Responses/>

All questions submitted that generate a response will be posted through this site. The site is organized by District, Project Type (Construction or Maintenance), Letting Date, CCSJ/Project Name.

The contractor's attention is directed to the EPIC sheet(s) included in this plan set for additional information regarding environmental permits, issues, and commitments.

**Project Mowing**

Mow the highway right of way within the project limits a maximum of 3 cycles per year as directed. Mowing will not be measured or paid for directly, but will be subsidiary to various bid items.

The equipment used for mowing shall consist of approved mowing units capable of mowing on slopes without marring finished slope surfaces or injuring existing growth. The minimum cutting width shall not be less than 5 ft., unless otherwise approved.

Mow all areas of existing vegetation and vegetation placed during the project as directed. The mowing height shall be 5 in. unless otherwise directed. Repair portions of sod or grass that are injured during mowing operations as directed.

Mow as close as possible to all fixed objects, exercising extreme care not to damage trees, plants, shrubs, signs, delineators or other appurtenances which are part of the facility. Hand trim around such objects, unless otherwise specified.

Use safety chains or other manufacturer's safety device to prevent damage to people or property caused by flying debris propelled out from under rotary mowers. Chains shall be a minimum size of 5/16 in. and links spaced side by side around the mower's front, sides and rear. When mowing at the specified cutting height, the chains shall be long enough to drag the ground. If at any time, it is determined mowing or trimming equipment is defective to the point that it may affect the quality of work or create an unsafe condition, then that equipment shall be immediately repaired or replaced.

**Litter Pickup**

Remove litter from the right of way in the limits of this project a maximum of 3 cycles per year as directed. Litter pickup will not be measured or paid for directly, but will be subsidiary to various bid items.

The equipment used for litter pickup shall be approved.

Collect and dispose of all litter deposited by construction operations or the traveling public including cans, bottles, paper, plastic items, metal scraps, lumber, etc. from within the project right of way or as directed. Properly dispose of all collected litter. Do not dump or stockpile collected litter on State property.



For removal of large dead animals, contact nearest TxDOT maintenance section for disposal instructions. Do not bury animal carcasses on State property.

#### Item 5: Control of the Work

In the event utility lines needing unforeseen adjustments are encountered during construction operations, alter operations and continue to prosecute the contract in such a manner that will allow utility adjustments to be made by others. An extension of working time may be granted for any delays caused by the utility adjustments if deemed necessary.

Precast Alternate Proposals. When a precast or cast-in-place concrete element is included in the plans, a precast concrete alternate may be submitted in accordance with "Standard Operating Procedure for Alternate Precast Proposal Submission" found online at <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/publications/bridge.html#design>. Acceptance or denial of an alternate is at the sole discretion of the Engineer. Impacts to the project schedule and any additional costs resulting from the use of alternates are the sole responsibility of the Contractor.

#### Item 7: Legal Relations and Responsibilities

No significant traffic generator events identified.

This project has a soil disturbance of 5 acres or more.

The Department will be considered a primary operator for Operational Control Over Plans and Specifications as defined in TPDES GP TXR 150000 for construction activities in the right of way. The Department will post a large site notice, file a notice of intent (NOI), notice of change (NOC), if applicable, and a notice of termination (NOT) along with other requirements per TPDES GP TXR 150000 as the entity having operational control over plans and specifications for work shown on the plans in the right of way.

The Contractor will be considered a primary operator for Day-to-Day Operational Control as defined in TPDES GP TXR 150000 for construction activities in the right of way. In addition to the Department's actions, the Contractor shall file a NOI, NOC, if applicable, and NOT and post a large site notice along with other requirements as the entity of having day-to-day operational control of the work shown on the plans in the right of way. This is in addition to the Contractor being responsible for TPDES GP TXR 150000 requirements for on- right of way and off- right of way PSL's. Adhere to all requirements of the SWP3 as shown on the plans.

Dispose of all vegetative matter and any other materials removed from State Right of Way in accordance with applicable environmental laws, rules, regulations and requirements.

Burning locations must be approved by the Engineer prior to beginning. Burning activities must be conducted in compliance with Texas Commission on Environmental Quality (TCEQ) regulations. Notify the Engineer when burning activities will take place.

In order to maintain compliance with Chapter 64 of the Texas Parks and Wildlife Code and Migratory Bird Treaty Act (MBTA), construction activities that may affect nests (i.e. tree removal, tree limbing, bridge work) shall be conducted outside of the nesting season (March 15 to September 15). In the event birds or active nests (eggs and/or nestlings present) are encountered, contact the engineer prior to conducting work.

#### Item 8: Prosecution and Progress

For this project, working days will be computed and charged in accordance with Item 8, Section 3.1.4 Standard Workweek.

Submit monthly progress schedules no later than the 20<sup>th</sup> calendar day of the month. Failure to comply with this deadline may result in the Engineer withholding progress (monthly) payments.

Provide a Critical Path Method (CPM) Construction Schedule unless otherwise approved.

A 90 day delay has been included to allow the Contractor time to order materials.

#### Item 100: Preparing Right of Way

The equipment used to trim limbs shall be approved. A boom axe will not be allowed.

#### Item 132: Embankment

Hauling materials with scrapers across or along existing roadways will not be permitted without written permission.

Drying of material deeper than 6 inches below subgrade elevations will not be permitted without written permission.

Grading required for shaping driveways and side road turnouts for pipe culverts at all access locations, will be subsidiary to various bid items.

All blading, rolling, and scraper work to construct and remove temporary slopes adjacent to pavement drop-offs, will be subsidiary to various bid items.

Compact embankment material used to reshape existing slopes to a density comparable with adjacent undisturbed material to the satisfaction of the Engineer.

#### Item 150: Blading

Use blading to reshape slopes and ditches as directed.

Mix a minimum width of 6 ft. from the edge of pavement and a depth of 6 inches using approved equipment prior to blading operations to reshape front slopes. Mixing will be subsidiary to Item 150.

**Item 158: Specialized Excavation Work**

Use specialized excavation work at structures to improve drainage as directed.

**Item 166: Fertilizer**

Fertilize all seeded or sodded areas.

**Item 168: Vegetative Watering**

Equip water trucks with sprinkler systems capable of watering all of the entire seeded or sodded areas from the roadway.

Water all newly placed sodded or seeded areas at the time of installation. Thereafter, maintain the sodded or seeded areas in a well-watered condition, at no time allow the areas to dry to a condition where water stress is evident.

**Item 247: Flexible Base**

Provide flexible base with a minimum plasticity index of 2.

Provide flexible base material with a minimum Bar Linear Shrinkage of 2% as determined by Test Method Tex-107-E, Part II.

Stockpiling of base material will not be required if testing has been performed and the material has been approved at the source. Deliver approved specified materials to the project.

**Item 275: Cement Treatment (Road-Mixed)**

No strength requirement is specified. The target cement content is 3%.

Compact and sprinkle pulverized sections for dust control as directed for traffic use.

Cement treat pulverized sections within 2 days, unless otherwise approved.

Pulverization and cement treatment of the existing roadway will not be allowed from October 1 through March 31 without written permission.

Provide all profile measurement to the Engineer in electronic data files within 3 days after placement of the prime coat using the format specified in Tex-1001-S. The Engineer will use Department software to evaluate longitudinal profiles to determine areas requiring corrective action. Correct 0.1-mi. sections having an average international roughness index (IRI) value greater than 100.0 in. per mile to an IRI value of 100.0 in. per mile or less for each wheel path, unless otherwise shown on the plans.

**Item 276: Cement Treatment (Plant-Mixed)**

Cement treated material shall be placed in lifts no greater than 6 inches, unless otherwise approved.

No strength requirement is specified. The target cement content is 3%.

**Item 302: Aggregates for Surface Treatments**

When using Type E, furnish Type E aggregate consisting of crushed stone or natural limestone rock asphalt.

When using Type PE aggregate, furnish Type PE aggregate consisting of precoated crushed stone or natural limestone rock asphalt.

Aggregate stockpile locations shall be approved prior to stockpiling.

Locate aggregate stockpiles off the highway right of way unless otherwise approved.

When directed, flush aggregate stockpiled for surface treatment with water to remove excessive dust particles, in such sequence that will permit free water to drain from the stockpiled aggregate prior to surfacing operations. This work will be subsidiary to various bid items.

Furnish aggregates for the final surfaces of travel lanes with a minimum class A surface aggregate classification.

**Item 316: Seal Coat**

Apply the covered prime weekly.

Open season for asphalt placement is from May 1 thru August 31. Do not place asphalt outside the open season without written approval.

The uniformity and rate of distribution of asphaltic material will be checked periodically during construction. Apply the seal coat in lane widths unless otherwise directed. Where extra width of surfacing has been provided in transitions and climbing lanes, seal the entire surface width.

Resurface county road turnouts and intersection areas as directed.

Place surface on driveways and other road turnouts prior to placing the final roadway surface.

Cease application of asphalt 2 hr. before sunset unless otherwise directed.

Cure the first course of the surface treatment as directed prior to placing the second course.

Cure the surface treatment as directed prior to placement of the overlay.

Cure the covered prime a minimum of 14 days prior to placement of the surface treatment.

Use precast aggregate with AC-15P or CRS-2P and use non-precast aggregate with RC-250.

Furnish medium pneumatic tire rollers in accordance Item 210, "Rolling". Provide enough rollers to perform the work as directed.

Sweep all roadways with a powered rotary broom prior to placement of the surface treatment to remove all loose or excess material or debris. After rolling, sweep as soon as aggregate has sufficiently bonded to remove excess. Use a vacuum broom on all roadway sections having curb and gutter and all roadway sections within the city limits of any city.

Blade the existing paved shoulders prior to surface treatment operations to remove existing overgrowth. This work will be subsidiary to Item 316.

#### **Item 420: Concrete Substructures**

Limit work on structures crossing the roadway to one side of the roadway at a time. No work shall begin on the opposite side of the roadway until backfilling of the initially extended portion of the structure is completed.

#### **Item 421: Hydraulic Cement Concrete**

The Engineer will provide curing facilities and strength testing equipment for acceptance testing.

#### **Item 427: Surface Finishes for Concrete**

Provide a rub finish for Surface Area I.

#### **Item 432: Riprap**

Stone riprap will require the placement of filter fabric prior to placement of stones.

Welded wire fabric will not be allowed for reinforcing concrete riprap. Reinforcing shall consist of No. 3 or 4 bars meeting the requirements of grade 60 reinforcing steel. Place bars on 12 in. centers in each direction, supported on reinforcing chairs.

#### **Item 462: Concrete Box Culverts and Drains**

Limit work on box culverts crossing the roadway to one side of the roadway at a time. No work shall begin on the opposite side of the roadway until backfilling of the first side of the box culvert being extended is complete.

#### **Item 464: Reinforced Concrete Pipe**

Lay each private entrance or side road pipe culvert to the line and grade as directed.

At locations where existing driveway pipes are to be removed and replaced, replace the top 6 in. of the existing driveway with material equal to or better than the existing driveway material. This work will be subsidiary to various bid items.

Limit work on pipe culverts crossing the road to one side of the roadway at a time. No work shall begin on the opposite side of the roadway until backfilling the first side of the pipe culvert being extended is complete.

When excavation does not generate enough material to complete the backfill, additional material must be approved prior to use and will be paid for under Item 132.

#### **Item 465: Junction Boxes, Manholes, and Inlets**

All junction boxes, manholes, and inlets are to be precast unless otherwise shown on the plans or directed by the Engineer.

#### **Item 466: Headwalls and Wingwalls**

Provide cast-in-place headwalls and wingwalls.

#### **Item 467: Safety End Treatment**

Use Type II precast concrete units of the same style and design.

Provide 12 in. deep toewalls on Type II precast safety end treatments.

To improve drainage, grade existing ditch within ten feet of proposed safety end treatment. This work shall be subsidiary to Item 467.

When excavation does not generate enough material to complete the backfill, additional material must be approved prior to use. Additional material will be subsidiary to various bid items.

Check each location where safety end treatments are to be installed to verify pipe lengths shown will produce the desired slope. Extra pipe will be paid for but removing and replacing safety end treatment units previously installed under this Contract will not be paid for.

Place safety end treatments along the same slope as the pipe.

#### **Item 496: Removing Structures**

Place salvageable county road pipe at the Right of Way line.

#### **Item 502: Barricades, Signs, and Traffic Handling**

Traffic Control Plan (TCP):

Ensure the Contractor's Responsible Person (CRP) or their alternate for Barricades, Signs and Traffic Handling is available at all times and able to receive instructions from the Engineer or

authorized Department representative. The CRP shall be a person that is usually at the project site during normal working hours.

For protection of the traveling public, direct traffic through the work area using signs, flaggers, and other devices. Required signs are shown in the plans on the Barricade and Construction Standards and Traffic Control Plan Sheets. The latest edition of the "Texas Manual on Uniform Traffic Control Devices" shall also be used as a guide for handling traffic on this project.

Use "Do Not Pass" (R4-1) signs to mark the beginnings of roadway sections where passing is prohibited and use "Pass With Care" (R4-2) signs to mark the beginnings of roadway sections where passing is permitted. Install signs at the time signing for project limits are erected. Sign placement shall be verified and approved.

When pavement work begins, use flashing arrow panels and flaggers 24 hr. per day during inclement weather or as directed.

Install "No Center Line" (CW8-12) signs at 2-mile intervals. Install "Loose Gravel" (CW8-7) and "Next XX Miles" (CW7-3aP) signs as directed prior to the start of surface treatment operations.

In general, restrict construction work to single lane widths. Control traffic in accordance with standard drawings WZ(BTS-1) "Traffic Signal Installation Typical Details"; WZ(BTS-2) "Traffic Signal Installation Barricades and Signs"; and Part VI of the "Texas Manual on Uniform Traffic Control Devices for Streets and Highways". Unless otherwise approved, use an advance warning, flashing arrow panel in addition to the necessary signs, barricades, or other traffic control devices at the work area.

Restrict construction work to single lane widths with only minor disruptions in traffic flow. Lane closures shall conform to the Traffic Control Plan for lane closures as shown in the plans. No overnight closures will be permitted.

Limit lane closures for 2 lane roads to 1 mi. in length, unless otherwise approved.

Lane closure lengths can exclude the end tapers.

Plan the sequence of work to minimize the time lane closures are in place. Install lane closures only where construction operations are anticipated to start within 1 hr. and limited to the amount of lane that can be reached by the construction activity within 2 hr. unless otherwise approved.

Provide flashing arrow panels to supplement required signs and devices for lane closures.

Provide temporary rumble strips as shown on work zone rumble strip standards.

Provide a pilot car to lead traffic through the work area. The pilot car will not be paid for directly but will be subsidiary to various bid items.

Halt traffic during the time asphalt is being applied to the roadway. No vehicles will be allowed to pass the asphalt distributor during asphalt application.

Provide adequate flaggers to protect the traveling public when working on or near a roadway carrying traffic. All flaggers shall wear hardhats and reflective vests.

Install "Be Prepared to Stop" (CW3-4) and "Flagger Ahead" (CW20-7aD) signs when flaggers are present. Position the signs where good visibility and traffic control can be maintained.

Use a flashing arrow board in addition to the required signs to warn motorists of flaggers.

Use additional flaggers at roadway intersections to direct traffic entering the work area, when deemed necessary by the Engineer.

Open all traffic lanes to traffic at the close of work each day.

Install "Pavement Ends" (CW8-3) and "30 mph" (CW13-1P) signs where the paved surface of the road ends. Use flashing arrow panels to supplement these signs during nighttime hours.

Provide one high-intensity yellow, rotating dome-light on all equipment such as distributors, spreader boxes, lay-down machines, dump trucks, rollers, backhoes, road graders, loaders, etc. within the work zone. Mount lights high enough to be visible from all directions and operating when the equipment is in the work zone. On all other equipment such as automobiles, trailers, etc. use emergency flashers while within the work zone.

Install "Shoulder Drop-Off" (CW8-17) and "Uneven Lanes" (CW8-11) signs at one-half mile spacings as the hot mix asphalt is placed, unless otherwise directed. Maintain signs until the condition is eliminated.

Install vertical panels or drums at 100-ft. spacings where drop-offs or construction work occurs along edges of existing pavement. Unless otherwise authorized, these shall remain in place until final striping.

Install "Slow Down on Wet Road" (CW8-5aT), "Shoulder Drop-Off" (CW8-17), "Uneven Lanes" (CW8-11), "Bump" (CW8-1) and "Soft Shoulder" (CW8-4) signs during construction as directed.

Restrict construction operations so that no drop off along the edge of pavement will remain overnight.

All blading, rolling and scraper work to construct and remove temporary slopes adjacent to pavement drop-offs, will be considered subsidiary to various bid items.

Notify the Engineer prior to placing any materials or equipment on the right of way. Locate equipment, stockpiles or other materials not in use as far as possible from the driving lanes and in no case closer than 30 ft. unless otherwise authorized. Any equipment, stockpiles, or materials placed within 30 ft. of the driving lane must have adequate signs, barricades or other

warning devices as approved. As a minimum place an 8 ft. wide TY III Barricade or barrels on the approach side of each site that is within 30 ft. of the driving lane. Use TY III Barricade or barrels for the site similarly on the departure side if the location is within 30 ft. of the opposing traffic lane.

The Contractor Force Account "Safety Contingency" that has been established for this project is intended to be utilized for work zone enhancements, to improve the effectiveness of the Traffic Control Plan, that could not be foreseen in the project planning and design stage. These enhancements will be mutually agreed upon by the Engineer and the Contractor's Responsible Person based on weekly or more frequent traffic management reviews on the project. The Engineer may choose to use existing bid items if it does not slow the implementation of enhancement.

Texas Transportation Code 547.105 authorizes the use of warning lights to promote safety and provides an effective means of gaining the travelling public's attention as they drive in areas where construction crews are present. In order to influence the public to move over when high risk construction activities are taking place, minimize the utilization of blue warning lights. These lights must be used only while performing work on or near the travel lanes or shoulder where the travelling public encounters construction crews that are not protected by a standard work zone set up such as a lane closure, shoulder closure, or one-way traffic control. Refrain from leaving the warning lights engaged while travelling from one work location to another or while parked on the right of way away from the pavement or a work zone.

Temporary stop lines as shown on TCP (2-2)-18 should be omitted.

Provide an illuminated flagger station when nighttime work is performed.

Install "Stay Alert" (G20-10T) and "OBEY" (R20-3T) signs at the beginning of the construction zone at "T" intersections as directed.

All workers on TxDOT right-of-way shall wear reflective clothing meeting ANSI Class II requirements during the day and ANSI Class III requirements during the night

#### **Item 504: Field Office and Laboratory**

Provide a Type D Structure. Asphalt content will be determined by the ignition method.

#### **Item 506: Temporary Erosion, Sedimentation, and Environmental Controls**

Locations and types of BMPs may require adjustments prior to or after placement as directed by the Engineer. Adjustments should be made to ensure BMPs are working effectively and maintain compliance with the Construction General Permit. Notify the Engineer prior to making adjustments.

#### **Item 530: Intersections, Driveways, and Turnouts**

Welded wire fabric will not be allowed for reinforcing concrete driveways. Use reinforcing steel consisting of No. 3 or 4 bars meeting the requirements of grade 60 reinforcing steel. Place bars on 12 in. centers in each direction, supported on reinforcing chairs.

Unless otherwise directed, install 1/2 in. pre-molded expansion joint material between existing concrete and new concrete.

#### **Item 560: Mailbox Assemblies**

Repair and, if necessary, replace mailboxes damaged by construction operations.

The number and type of mailbox assemblies shown in the plans are for estimating purposes; actual quantities may vary.

Use 1 size 3 reflector mounted on the upstream and downstream sides of the post as directed for single and double mailbox assemblies.

Use 1 strip of reflective sheeting on the upstream and downstream sides of post for multiple mailbox assemblies in lieu of the Type 2 object marker shown on the mailbox standards. Each strip shall be approximately 12 in. wide. Use reflective sheeting conforming to DMS-8600.

#### **Item 618: Conduit**

When conduit is laid in a trench or bored, minimum depth to the top of the conduit shall be 3 ft. Where obstructions prevent laying conduit at this depth, place conduit at the maximum depth possible.

Where a trench for laying conduit is cut through pavement, surfaced shoulder, median or driveway, replace the base and surfacing with similar materials equal in appearance and quality to the original construction. Replacing base and surfacing will be subsidiary to Item 618.

Place conduit under existing pavement by boring unless otherwise directed. Pits for boring shall not be closer than 2 ft. from edge of pavement unless otherwise approved. Water jetting will not be permitted. At the close of work each day, cover all open pits and barricade for safety.

When boring is used for under-pavement conduit installations, maximum allowable overcut shall be 1 in. diameter.

Use of a pneumatically driven device for punching holes beneath pavement (commonly known as a "missile") will not be permitted on this project.

All underground conduit bends of 45° or more in PVC conduit systems, including bends into ground boxes, shall be made with rigid metal conduit. Where rigid metal conduit is exposed at any point and where rigid metal conduit extends into ground boxes, bond the metal conduit to the grounding conduction with grounding type bushings or by other approved UL listed grounding



connectors. Rigid metal bends will not be paid for separately but will be incidental to the PVC conduit system.

The location of conduits is diagrammatic only and may be shifted to accommodate field conditions as directed.

#### **Item 624: Ground Boxes**

Location and estimated number of ground boxes are diagrammatic only. The location and number of ground boxes may vary to accommodate field conditions as directed.

#### **Item 644: Small Roadside Sign Assemblies**

Install adjacent signs with bottom edges at equal heights.

Sign placement shall be in accordance with the "Sign Crew Field Book" and as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Stake all sign support locations for verification and approval.

Existing supports shall not be reused and shall become the property of the Contractor.

Salvage all sign blanks to be removed and deliver the same day to TxDOT's facility at Trinity County Maintenance Facility, 710 Sunset (US 287 West), Groveton, TX 75845.

Prior to ordering signs, advisory speeds at horizontal curves shall be verified by the department.

#### **Item 656: Foundations for Traffic Control Devices**

Note and heed all utility warnings before digging in the vicinity of underground utilities.

Before excavating for foundations, take adequate precautions, by probing or uncovering by hand, to prevent damage to storm sewers and public or private utilities. Locations of utility lines and cables shown in the plans are approximate. Other lines and cables may have been installed since completion of these plans.

#### **Item 662: Work Zone Pavement Markings**

Standard work zone pavement markings shall be paint and glass beads or thermoplastic.

Place short term pavement markings on the surface treatment and level-up course immediately following final rolling.

After placement of permanent striping on the finish course, remove all short term pavement markings.

Furnish Type II glass beads conforming to DMS-8290, "Glass Traffic Beads", for hot applied thermoplastic and traffic paint markings.

#### **Item 666: Reflectorized Pavement Markings`**

Remove loose aggregate immediately prior to placing pavement markings.

Place reflectorized pavement markings no sooner than 3 days nor later than 14 days after placement of the surface treatment.

Type I markings must meet the minimum retroreflectivity values for edgeline markings, centerline or no passing barrier-line, and lane lines when measured any time after 3 days, but not later than 10 days after application.

Before construction operations begin, observe and mark existing passing/no passing zones. Passing/no passing zones shall be verified prior to placement of permanent pavement markings.

Furnish Type II glass beads conforming to DMS-8290, "Glass Traffic Beads", for Type I and II Markings.

Use Type II pavement markings as a sealer for Type I pavement markings.

Place a minimum of 500 ft. of 4 in. double yellow no passing lines on the approach to all stop condition intersections for two lane roads unless otherwise shown in the plans or directed.

#### **Item 672: Raised Pavement Markers**

Place permanent raised pavement markers after permanent striping has been completed.

#### **Item 6185: Truck Mounted Attenuator (TMA) and Trailer Attenuator (TA)**

Two (2) TMAs (stationary) will be required for this project. The contractor will be responsible for determining if multiple operations will be ongoing at the same time to determine the total number of TMAs needed for the project.

Three (3) TMAs will be required on all divided highways for mobile operations and two (2) TMAs will be required on all other roadways for each mobile operation. Quantities were estimated based on one mobile working operation, as per the number of working days. If multiple crews are utilized, additional TMAs will be required.



CONTROLLING PROJECT ID 0931-04-034

DISTRICT Lufkin  
HIGHWAY FS 357

COUNTY Trinity

# Estimate & Quantity Sheet

CONTROL SECTION JOB				0931-04-034		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00178002			
COUNTY				Trinity			
HIGHWAY				FS 357			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	100-6002	PREPARING ROW	STA	68.000		68.000	
	104-6017	REMOVING CONC (DRIVEWAYS)	SY	274.000		274.000	
	112-6001	SUBGRADE WIDENING (ORD COMP)	STA	68.450		68.450	
	132-6019	EMBANKMENT (VEHICLE)(ORD COMP)(TY B)	CY	1,814.000		1,814.000	
	150-6001	BLADING	STA	68.450		68.450	
	158-6003	SPEC EXCAV WORK (HYD EXCAVATOR)	HR	16.000		16.000	
	162-6002	BLOCK SODDING	SY	598.000		598.000	
	164-6009	BROADCAST SEED (TEMP) (WARM)	SY	10,382.000		10,382.000	
	164-6011	BROADCAST SEED (TEMP) (COOL)	SY	10,382.000		10,382.000	
	164-6021	CELL FBR MLCH SEED(PERM)(RURAL)(SANDY)	SY	442.000		442.000	
	164-6054	BOND FBR MTRX SEED (PERM)(RURAL)(SAND)	SY	20,765.000		20,765.000	
	168-6001	VEGETATIVE WATERING	MG	851.380		851.380	
	204-6003	SPRINKLING (DUST CONTROL)	MG	198.000		198.000	
	276-6232	CEM TRT(PLNT MX) (CLN)(TYA)(GR1-2)(12")	SY	3,044.000		3,044.000	
	316-6060	ASPH (RC-250)	TON	3.000		3.000	
	316-6417	AGGR (TY E OR L GR 5)	CY	21.000		21.000	
	316-6433	AGGR(TY PE,TY-PL,TY-E,TY-L GR-4)(SAC-B)	CY	180.000		180.000	
	316-6530	ASPH (AC-15P OR CRS-2P)	TON	40.000		40.000	
	420-6071	CL C CONC (COLLAR)	EA	2.000		2.000	
	432-6024	RIPRAP (STONE COMMON)(DRY)(12 IN)	CY	50.000		50.000	
	462-6051	CONC BOX CULV (5 FT X 3 FT)(EXTEND)	LF	22.000		22.000	
	462-6057	CONC BOX CULV (6 FT X 6 FT)(EXTEND)	LF	25.000		25.000	
	464-6003	RC PIPE (CL III)(18 IN)	LF	528.000		528.000	
	464-6005	RC PIPE (CL III)(24 IN)	LF	24.000		24.000	
	466-6193	WINGWALL (PW - 2) (HW=4 FT)	EA	2.000		2.000	
	466-6197	WINGWALL (PW - 2) (HW=8 FT)	EA	2.000		2.000	
	467-6358	SET (TY II) (18 IN) (RCP) (4: 1) (C)	EA	6.000		6.000	
	467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	52.000		52.000	
	467-6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)	EA	4.000		4.000	
	496-6016	REMOV STR (PIPE)	EA	18.000		18.000	
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	8.000		8.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	160.000		160.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	160.000		160.000	
	506-6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	222.000		222.000	
	506-6024	CONSTRUCTION EXITS (REMOVE)	SY	222.000		222.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	2,290.000		2,290.000	



DISTRICT	COUNTY	CCSJ	SHEET
Lufkin	Trinity	0931-04-034	5



CONTROLLING PROJECT ID 0931-04-034

DISTRICT Lufkin  
HIGHWAY FS 357

COUNTY Trinity

# Estimate & Quantity Sheet

CONTROL SECTION JOB				0931-04-034		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00178002			
COUNTY				Trinity			
HIGHWAY				FS 357			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	2,290.000		2,290.000	
	530-6004	DRIVEWAYS (CONC)	SY	250.000		250.000	
	530-6005	DRIVEWAYS (ACP)	SY	550.000		550.000	
	530-6009	TURNOUTS (SURF TREAT)	SY	755.000		755.000	
	530-6016	DRIVEWAYS (BASE)	SY	1,246.000		1,246.000	
	560-6007	MAILBOX INSTALL-S (WC-POST) TY 3	EA	16.000		16.000	
	560-6008	MAILBOX INSTALL-D (WC-POST) TY 3	EA	2.000		2.000	
	610-6214	IN RD IL (TY SA) 40T-8 (250W EQ) LED	EA	1.000		1.000	
	618-6046	CONDT (PVC) (SCH 80) (2")	LF	85.000		85.000	
	620-6007	ELEC CONDR (NO.8) BARE	LF	85.000		85.000	
	620-6008	ELEC CONDR (NO.8) INSULATED	LF	170.000		170.000	
	624-6001	GROUND BOX TY A (122311)	EA	1.000		1.000	
	628-6009	ELC SRV TY A 120/240 060(NS)SS(E)SP(O)	EA	1.000		1.000	
	644-6007	IN SM RD SN SUP&AM TY10BWG(1)SA(U)	EA	2.000		2.000	
	644-6060	IN SM RD SN SUP&AM TYTWT(1)WS(P)	EA	12.000		12.000	
	644-6061	IN SM RD SN SUP&AM TYTWT(1)WS(T)	EA	3.000		3.000	
	658-6101	INSTL OM ASSM (OM-2Z)(WFLX)SRF)SRF	EA	12.000		12.000	
	662-6095	WK ZN PAV MRK REMOV (Y)4"(SLD)	LF	56.000		56.000	
	662-6111	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	EA	575.000		575.000	
	666-6343	REF PROF PAV MRK TY I(W)6"(SLD)(100MIL)	LF	13,691.000		13,691.000	
	666-6346	REF PROF PAV MRK TY I(Y)6"(BRK)(100MIL)	LF	2,683.000		2,683.000	
	666-6347	REF PROF PAV MRK TY I(Y)6"(SLD)(100MIL)	LF	13,691.000		13,691.000	
	668-6076	PREFAB PAV MRK TY C (W) (24") (SLD)	LF	51.000		51.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	164.000		164.000	
	678-6001	PAV SURF PREP FOR MRK (4")	LF	2,683.000		2,683.000	
	3077-6021	SP MIXESSP-CPG70-22	TON	3,194.000		3,194.000	
	3077-6075	TACK COAT	GAL	1,978.000		1,978.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN	EA	2.000		2.000	
	6056-6002	PREFORMED CENTERLINE RUMBLE STRIP	LF	102.000		102.000	
	6185-6002	TMA (STATIONARY)	DAY	78.000		78.000	
	6185-6005	TMA (MOBILE OPERATION)	DAY	3.000		3.000	
	18	SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000	
		EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000		1.000	

DISTRICT	COUNTY	CCSJ	SHEET
Lufkin	Trinity	0931-04-034	05A

**ROADWAY SUMMARY**

STATION TO STATION	ITEM			112	132	150	204	276	316						3077						
	LENGTH	WIDTH	AREA	6001	6019	6001	6003	6232	*	6060	6417	*	6530	6433	*	6530	6433	6021	6075		
				SUBGRADE WIDENING (ORD COMP)			EMBANKMENT (VEHICLE) (ORD COMP) (TY B)	BLADING	SPRINKLING (DUST CONTROL)	CEM TRT (PLNT MX) (CLN) (TYA) (GR1-2) (12")	COVERED PRIME			STRIP SEAL			ONE CRSE SURF TREAT			SP MIXES SP-C PG70-22	TACK COAT
				ASPH (RC-250)	ASPH (RC-250)	AGGR (TY E OR L GR 5)					ASPH (AC-15P OR CRS-2P)	ASPH (AC-15P OR CRS-2P)	AGGR (TY PE, TY-PL, TY-E, TY-L GR-4) (SAC-B)	ASPH (AC-15P OR CRS-2P)	ASPH (AC-15P OR CRS-2P)	AGGR (TY PE, TY-PL, TY-E, TY-L GR-4) (SAC-B)					
20 CY/STA	10 GAL/SY	0.25 GAL/SY	0.25 GAL/SY	1 CY/145 SY	0.25 GAL/SY	0.25 GAL/SY	1 CY/135 SY	0.42 GAL/SY	0.42 GAL/SY	1 CY/135 SY	165 LBS/SY	0.1 GAL/SY									
FT	FT	SY	STA	CY	STA	MG	SY	GAL	TON	CY	GAL	TON	CY	GAL	TON	CY	TON	GAL			
360+00.00	-	428+45.27	6,845	26	19,775	68.45	1370	68.45	198	3044					8,306	35	146	1,631	1,978		
360+01.00	-	428+46.27	6,845	4	3,042						761	3	21								
360+02.00	-	428+47.27	6,845	6	4,564								1,141	5	34						
SUPERELEVATION CORRECTION																		1,563			
<b>CSJ: 0931-04-034 TOTALS</b>				<b>68.45</b>	<b>1,370</b>	<b>68</b>	<b>198</b>	<b>3,044</b>	<b>761</b>	<b>3</b>	<b>21</b>	<b>1,141</b>	<b>5</b>	<b>34</b>	<b>8,306</b>	<b>35</b>	<b>146</b>	<b>3,194</b>	<b>1,978</b>		

\* CONTRACTOR INFORMATION ONLY  
 TONS =  $\frac{\text{RATE} * (\text{SGA}) * \text{SY}}{2000}$   
 SPECIFIC GRAVITY OF ASPHALT  
 (SGA) ESTIMATED AT 1.02 \* 8.3268

WORK ZONE PAVEMENT MARKINGS SUMMARY				
STATION TO STATION	ITEM 662		ITEM 611	
	6095	6111		
	(2)	(1)		
	WK ZN PAV MRK REMOV (Y) 4" (SLD)	WK ZN PAV MRK SHT TERM (TAB) TY Y-2		
LF	EA			
360+00.00	-	428+45.27	56	575
<b>CSJ: 0931-04-034 TOTALS</b>			<b>56</b>	<b>575</b>


(1) ONE APPLICATION ON 1CST  
 (2) ONE APPLICATION ON FINAL SURF

PREP ROW SUMMARY				
STATION TO STATION	ITEM 100		ITEM 6002	
	6002	6005	PREPARING ROW	
			STA	
360+00.00	-	428+45.27	68	
<b>CSJ: 0931-04-034 TOTALS</b>			<b>68</b>	

NOTE: SEE TREE REMOVAL AND TRIMMING DETAIL SHEET FOR ADDITIONAL INFORMATION.

MISCELLANEOUS ITEMS SUMMARY					
STATION TO STATION (AS DIRECTED)	ITEM 6185		ITEM 6001		
	6002	6005	6002		
	TMA (STATIONARY)	TMA (MOBILE OPERATION)	PORTABLE CHANGEABLE MESSAGE SIGN		
	DAY	DAY	EA		
360+00.00	-	428+45.27	78	3	2
<b>CSJ: 0931-04-034 TOTALS</b>			<b>78</b>	<b>3</b>	<b>2</b>

**QUANTITY SUMMARIES**


 TEXAS DEPARTMENT OF TRANSPORTATION ©2022 SHEET 1 OF 5			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY		SHEET NO.
LFK	TRINITY		6

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SUMMARY OF CROSS DRAINAGE STRUCTURES															
STATION	DESCRIPTION		ITEM 132	ITEM 158	ITEM 164	ITEM 168	420	ITEM 432	ITEM 462		ITEM 464	ITEM 466		ITEM 467	ITEM 467
	EXISTING STRUCTURE	PROPOSED STRUCTURE	6019	6003	6021	6001	6071	6024	6057	6051	6003	6197	6193	6358	6101
			EMBANKMENT (VEHICLE) (ORD COMP) (TY B)	SPEC EXCAV WORK (HYD EXCAVATOR)	CELL FBR MLCH SEED (PERM) (RURAL) (SANDY)	VEGETATIVE WATERING 10 GAL/SY 2 APPS	CL C CONC (COLLAR)	RIPRAP (STONE COMMON) (DRY) (12 IN)	CONC BOX CULV (6 FT X 6 FT) (EXTEND)	CONC BOX CULV (5 FT X 3 FT) (EXTEND)	RC PIPE (CL III) (18 IN)	WINGWALL (PW - 2) (HW=8 FT)	WINGWALL (PW - 2) (HW=4 FT)	SET (TY II) (18 IN) (RCP) (4:1) (C)	INSTL OM ASSM (OM-2Z) (WFLX) SRF
CY	HR	SY	MG	EA	CY	LF	LF	LF	EA	EA	EA	EA			
371+60	6' X 6' X 32' SC-NA W/FW-N	REMOVE EXIST FW-N WINGWALL, EXTEND 15' W/CONC BOX CULV (6 FT X 6 FT), ADD WINGWALL (PW - 2) (HW=8 FT) LT; REMOVE EXIST FW-N WINGWALL, EXTEND 10' W/CONC BOX CULV (6 FT X 6 FT), ADD WINGWALL (PW - 2) (HW=8 FT) RT.	95	4	105	2.100		25	25			2			4
381+45	18" X 36' RCP W/SET (3:1)	REMOVE EXIST SET, ADD CONC COLLAR, EXTEND W/18"X11' RC PIPE (CL III) (18 IN), ADD SET (TY II) (18 IN) (RCP) (4:1) (C) LT; REMOVE EXIST SET, ADD CONC COLLAR, EXTEND W/18"X11' RC PIPE (CL III) (18 IN), & ADD SET (TY II) (18 IN) (RCP) (4:1) (C) RT.	57	4	90	1.800	2				22			2	2
389+60	2 - 18" X 34' RCP W/SET (3:1)	REMOVE EXIST SETS (TY II) (18 IN) (RCP) (3:1) (C) & ADD SETS (TY II) (18 IN) (RCP) (4:1) (C) LT; REMOVE EXIST SETS (TY II) (18 IN) (RCP) (3:1) (C) & ADD SETS (TY II) (18 IN) (RCP) (4:1) (C) RT	19	4	100	2.000								4	2
415+61	5' X 3' X 30' FMC-2-30° RT FWD SKEW	REMOVE EXIST HDWL & WINGS, EXTEND 12' W/CONC BOX CULV (5 FT X 3 FT), ADD (PW-2) (HW=4FT) LT; REMOVE EXIST HDWL & WINGS, EXTEND 10' W/CONC BOX CULV (5 FT X 3 FT), ADD (PW-2) (HW=4FT) RT	273	4	147	2.940		25		22			2		4
<b>PROJECT TOTALS</b>			<b>444</b>	<b>16</b>	<b>442</b>	<b>8.840</b>	<b>2</b>	<b>50</b>	<b>25</b>	<b>22</b>	<b>22</b>	<b>2</b>	<b>2</b>	<b>6</b>	<b>12</b>

NOTE: INSTALL DELINEATORS ON HORIZONTAL SECTIONS OF PW-2 WINGWALLS.

**QUANTITY SUMMARIES**

 TEXAS DEPARTMENT OF TRANSPORTATION ©2022			
SHEET 2 OF 5			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY		SHEET NO.
LFK	TRINITY		7



DRIVEWAY & SIDEROAD SUMMARY

ID	STATION	OFFSET	MATERIAL	RCS	WIDTH	LENGTH	RADIUS		EXIST PIPE OFFSET FROM CL	PROP PIPE OFFSET FROM CL	EXISTING PIPE	PROPOSED	104	162	168	464	464	467	467	496	530	530	530	
							6017	6002					6001	6003	6005	6363	6395	6016	6004	6005	6016			
							REMOVING CONC (DRIVEWAYS)	BLOCK SODDING					VEGETATIVE WATERING 10 GAL/SY 2 APPS	RC PIPE (CL III) (18 IN)	RC PIPE (CL III) (24 IN)	SET (TY II) (18 IN) (RCP) (6: 1) (P)	SET (TY II) (24 IN) (RCP) (6: 1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP)	DRIVEWAYS (BASE)			
LT	RT	SY	SY	MG	LF	LF	EA	EA	EA	SY	SY**	SY												
D1	362+20.00	RT	ASPHALT	C	95	10	15	15			NO PIPE											116		
D2	364+10.00	RT	DIRT	R	40	27	15	15	24	24	18" X 24' RCP	EXTEND W/ 18" X 4' RCP-LT; ADD SET LT & RT		22	0.440	4		2						131
D3	364+80.00	RT	ASPHALT	R	10	27	15	15	24	28	16" STEEL PIPE	REMOVE EXIST PIPE; INSTALL 18" X 24' RCP W/SET		22	0.440	24		2		1			41	
D4	365+85.00	RT	ASPHALT	R	15	27	15	15	24	24	18" X 24' RCP	ADD SET LT & RT		22	0.440			2					56	
D5	366+16.00	LT	ASPHALT	R	12	27	15	15	24	24	15" RCP	REMOVE EXIST PIPE; INSTALL 18" X 24' RCP W/SET		22	0.440	24		2		1			47	
D6	368+13.00	LT	CONC	C	12	27	25	25	24	24	18" X 24' RCP	EXTEND W/ 18" X 4' RCP-LT, EXTEND W/ 18"x6' RCP-RT; ADD SET LT & RT.		22	0.440	10		2						
D7	372+80.00	LT	GRAVEL	R	11	27	15	15	25	25	15" X 23' STEEL PIPE	REMOVE EXIST PIPE; INSTALL 18" X 30' RCP W/SET		22	0.440	30		2		1				44
D8	373+15.00	RT	DIRT/GRASS	R	21	27	15	15	28	28	18" X 28' RCP	ADD 18" X 4' RCP-LT; ADD SET LT & RT		22	0.440	4		2						74
D9	375+13.00	LT	GRAVEL	R	15	27	15	15	26	26	18" X 20' PLASTIC	REMOVE EXIST PIPE; INSTALL 18" X 24' RCP W/SET		22	0.440	24		2		1				56
D10	376+07.00	LT	GRAVEL	R	15	27	15	15	25	25	14" X 24' STEEL PIPE	REMOVE EXIST PIPE; INSTALL 18" X 24' RCP W/SET		22	0.440	24		2		1				56
D11	377+38.00	LT	DIRT/GRASS	R	18	27	15	15	26	26	15" X 22' CMP	REMOVE EXIST PIPE; INSTALL 18" X 24' RCP W/SET		22	0.440	24		2		1				65
D12	378+31.00	LT	DIRT/GRASS	R	16	27	15	15	33	33	18" X 19' CMP	REMOVE EXIST PIPE; INSTALL 18" X 20' RCP W/SET		22	0.440	20		2		1				59
D13	383+50.00	RT	CONC	R	15	27	15	15	22	26	15" PLASTIC PIPE	REMOVE EXIST PIPE; INSTALL 18" X 36' RCP W/SET	56	22	0.440	36		2		1	56			56
D14	392+97.00	LT	DIRT/GRASS	R	18	27	15	15			NO PIPE													65
D15	394+74.00	RT	GRAVEL	S	15	27	25	25	24	28	24" PLASTIC PIPE	REMOVE EXIST PIPE; INSTALL 24" X 24' RCP W/SET		26	0.520		24		2	1				75
D16	396+89.00	RT	DIRT/GRASS	R	15	27	15	15	28	28	18" RCP	ADD 18" X 4' RT; ADD SET LT & RT		22	0.440	4		2						56
D17	397+34.00	LT	CONC	R	15	27	15	15	24	24	15" PLASTIC PIPE	REMOVE EXIST PIPE; INSTALL 18" X 24' RCP W/SET	56	22	0.440	24		2		1	56			56
SHEET TOTALS												112	334	6.680	252	24	28	2	10	112	260	793		

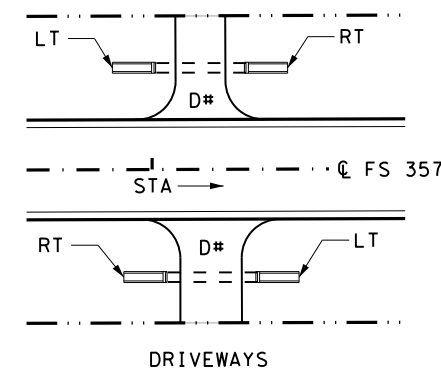
\*\* 4" DRIVEWAYS EST @ 440 LBS/SY  
6" SIDEROADS EST @ 660 LBS/SY

R - RESIDENTIAL  
C - COMMERCIAL  
S - SIDEROAD

1) PROVIDE 12" DEEP TOEWALL FOR ALL SET'S.

BLOCK SOD	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
30"	16

3) A FULL TOPOGRAPHICAL SURVEY WAS NOT PERFORMED. STATIONS WERE ACQUIRED USING A DIGITAL MEASURING INSTRUMENT (DMI). THE STATIONS SHOWN ARE APPROXIMATE AND SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORK.



QUANTITY SUMMARIES

TEXAS DEPARTMENT OF TRANSPORTATION ©2022			
SHEET 3 OF 5			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST		COUNTY	SHEET NO.
LFK		TRINITY	8

DRIVEWAY & SIDEROAD SUMMARY (CONT)

ID	DMI STATION	OFFSET	MATERIAL	RCS	WIDTH	LENGTH	RADIUS		EXIST PIPE OFFSET FROM CL	PROP PIPE OFFSET FROM CL	EXISTING PIPE	ITEM PROPOSED	104	162	168	464	464	467	467	496	530	530	530
							6017	6002					6001	6003	6005	6363	6395	6016	6004	6005	6016		
							REMOVING CONC (DRIVEWAYS)	BLOCK SODDING					VEGETATIVE WATERING 10 GAL/SY 2 APPS	RC PIPE (CL III) (18 IN)	RC PIPE (CL III) (24 IN)	SET (TY II) (18 IN) (RCP) (6: 1) (P)	SET (TY II) (24 IN) (RCP) (6: 1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP)	DRIVEWAYS (BASE)		
							SY	SY					MG	LF	LF	EA	EA	EA	SY	SY	SY		
D18	397+72.00	RT	DIRT/GRASS	R	17	27	15	15	25	25	18"X22' RCP	ADD 18" X 8' & SET LT & RT		22	0.440	8		2				62	
D19	400+02.00	RT	ASPHALT	R	11	27	15	15	24	24	18"X25' RCP	ADD 18" X 4' RT; ADD SET LT & RT		22	0.440	4		2				44	
D20	400+42.00	LT	CONC	R	21	27	15	15	23	23	18" X 37' PLASTIC PIPE	REMOVE EXIST PIPE; INSTALL 18" X 40' RCP W/SET	74	22	0.440	40		2		1	74		
D21	401+58.00	RT	GRAVEL/DIRT	R	13	27	15	15	26	26	15" X 28' CMP & RCP	REMOVE EXIST PIPE; INSTALL 18" X 32' RCP W/SET		22	0.440	32		2		1			
D22	404+41.00	LT	GRAVEL	R	15	27	15	15	25	25	12"X24' CMP	REMOVE EXIST PIPE; INSTALL 18" X 24' RCP W/SET		22	0.440	24		2		1			
D23	406+39.00	LT	ASPHALT	R	11	27	15	15			NO PIPE											44	
D24	408+20.00	RT	CONCRETE	R	11	27	15	15	26	26	18" CMP	REMOVE EXIST PIPE; INSTALL 18" X 24' RCP W/SET	44	22	0.440	24		2		1	44		
D25	409+88.00	LT	CONCRETE	R	11	27	15	15	28	28	16"X23' CMP	REMOVE EXIST PIPE; INSTALL 18" X 28' RCP W/SET	44	22	0.440	28		2		1	44		
D26	410+80.00	LT	ASPHALT	R	18	27	15	15	29	29	18" X 25' PLASTIC PIPE	REMOVE EXIST PIPE; INSTALL 18" X 26' RCP W/SET		22	0.440	26		2		1			
D27	412+27.00	LT	ASPHALT	S	21	27	15	15			NO PIPE											74	
D28	412+87.00	RT	GRAVEL	R	21	27	15	15	31	31	18" X 24' RCP	REMOVE 4' JT-RT; ADD 18" X 4'-RT; INSTALL SET LT & RT		22	0.440	4		2					
D29	413+77.00	RT	GRAVEL/DIRT	R	12	27	15	15	30	30	15"X22' RCP	REMOVE 4' JT-LT; ADD 18" X 4'-LT; INSTALL SET LT & RT		22	0.440	4		2					
D30	414+52.00	LT	GRAVEL	S	11	27	10	25			NO PIPE											50	
D31	417+40.00	RT	GRAVEL/DIRT	R	17	27	15	15	30	30	18"X26' CMP	REMOVE EXIST PIPE; INSTALL 18" X 26' RCP W/SET		22	0.440	26		2		1			
D32	425+70.00	RT	ASPHALT	S	11	27	25	25	22	22	18" X 30' RCP	REMOVE EXIST PIPE; INSTALL 18" X 34' RCP		22	0.440	34		2		1			
D33	427+59.00	RT	GRAVEL	S	29	27	25	25			NO PIPE											117	
D34	428+00.00	RT	GRAVEL	S	40	27	10	25			NO PIPE											137	
<b>SHEET TOTALS</b>												<b>162</b>	<b>264</b>	<b>5.280</b>	<b>254</b>	<b>0</b>	<b>24</b>	<b>0</b>	<b>8</b>	<b>162</b>	<b>290</b>	<b>655</b>	

\*\* 4" DRIVEWAYS EST @ 440 LBS/SY  
6" SIDEROADS EST @ 660 LBS/SY

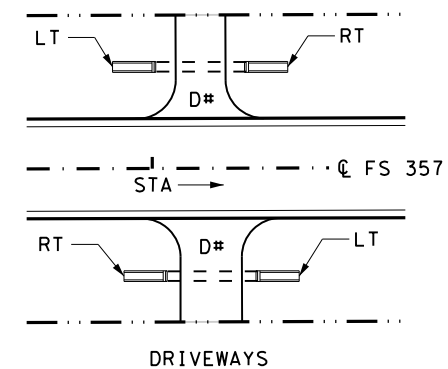
R - RESIDENTIAL  
C - COMMERCIAL  
S - SIDEROAD

1) PROVIDE 12" DEEP TOEWALL FOR ALL SET'S.

2)

BLOCK SOD	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
30"	16

3) A FULL TOPOGRAPHICAL SURVEY WAS NOT PERFORMED. STATIONS WERE ACQUIRED USING A DIGITAL MEASURING INSTRUMENT (DMI). THE STATIONS SHOWN ARE APPROXIMATE AND SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORK.



QUANTITY SUMMARIES

TEXAS DEPARTMENT OF TRANSPORTATION ©2022			
SHEET 4 OF 5			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST		COUNTY	SHEET NO.
LFK		TRINITY	9

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MAILBOXES & MAILBOX TURNOUTS SUMMARY				
LOCATION (STATION)	OFFSET	ITEM 530	ITEM 560	
		6009	6007	6008
		TURNOUTS (SURF TREAT)	MAILBOX INSTALL-S (WC-POST) TY 3	MAILBOX INSTALL-D (WC-POST) TY 3
		SY	EA	EA
364+88	RT	32	1	
366+45	RT	46	1	
373+20	RT	33	1	
374+87	RT	46	1	
375+85	RT	46	1	
377+12	RT	46	1	
378+00	RT	46	1	
383+05	RT	40	1	
391+71	RT	46	1	
394+90	RT	32	1	
396+68	RT	30		1
401+25	RT	46	1	
406+15	RT	46	1	
407+95	RT	51	1	
409+80	RT	46	1	
413+97	RT	46	1	
417+25	RT	31	1	
425+36	RT	46		1
<b>PROJECT TOTALS</b>		<b>755</b>	<b>16</b>	<b>2</b>

PERMANENT PAVEMENT MARKINGS & MARKERS SUMMARY									
STATION TO STATION	ITEM 666			ITEM 668	ITEM 672	ITEM 678	ITEM 6056		
	6343	6346	6347	6076	6009	6001	6002		
	REF PROF PAV MRK TY I (W) 6" (SLD) (100MIL)	REF PROF PAV MRK TY I (Y) 6" (BRK) (100 MIL)	REF PROF PAV MRK TY I (Y) 6" (SLD) (100 MIL)	PREFAB PAV MRK TY C (W) (24") (SLD)	REFL PAV MRKR TY II-A-A	PAV SURF PREP FOR MRK (4")	PREFORMED CENTERLINE RUMBLE STRIP		
	LF	LF	LF	LF	EA	LF	LF		
360+00.00	-	428+45.27	13,691	2,683	13,691	51	164	2,683	102
<b>CSJ: 0931-04-034 TOTALS</b>			<b>13,691</b>	<b>2,683</b>	<b>13,691</b>	<b>51</b>	<b>164</b>	<b>2,683</b>	<b>102</b>

SMALL ROAD SIGN ASSEMBLIES SUMMARY					
STATION TO STATION	ITEM 644				
	6060	6061	6007		
	IN SM RD SN SUP&AM TYTWT (1) WS (P)	IN SM RD SN SUP&AM TYTWT (1) WS (T)	IN SM RD SN SUP&AM TY10BWG (1) SA (U)		
	EA	EA	EA		
360+00.00	-	428+45.27	12	3	2
<b>CSJ: 0931-04-034 TOTALS</b>			<b>12</b>	<b>3</b>	<b>2</b>

ILLUMINATION SUMMARY								
STATION TO STATION	ITEM 610	ITEM 618	ITEM 620		ITEM 624	ITEM 628		
	6214	6046	6007	6008	6001	6009		
	IN RD IL (TY SA) 40T-8 (250W EQ) LED	CONDT (PVC) (SCH 80) (2")	ELEC CONDR (NO. 8) BARE	ELEC CONDR (NO. 8) INSULATED	GROUND BOX TY A (122311)	ELC SRV TY A 120/240 060 (NS) SS (E) SP (O)		
	EA	LF	LF	LF	EA	EA		
360+00.00	-	428+45.27	1	85	85	170	1	1
<b>CSJ: 0931-04-034 TOTALS</b>			<b>1</b>	<b>85</b>	<b>85</b>	<b>170</b>	<b>1</b>	<b>1</b>

EROSION CONTROL SUMMARY												
STATION TO STATION	ITEM 164			ITEM 168	ITEM 506							
	6009	6011	6054	6001	6002	6011	6020	6024	6038	6039		
	BROADCAST SEED (TEMP) (WARM)	BROADCAST SEED (TEMP) (COOL)	BOND FBR MTRX SEED (PERM) (RURAL) (SAND)	VEGETATIVE WATERING	ROCK FILTER DAMS (INSTALL) (TY 2)	ROCK FILTER DAMS (REMOVE)	CONSTRUCTION EXITS (INSTALL) (TY 1)	CONSTRUCTION EXITS (REMOVE)	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)		
	SY	SY	SY	(10 GA/SY) (2 APPS)	MG	LF	LF	(20' x 50')	(20' x 50')	LF	LF	
360+00.00	-	428+45.27	10,382	10,382	20,765	830.58	160	160	222	222	2,290	2,290
<b>CSJ: 0931-04-034 TOTALS</b>			<b>10,382</b>	<b>10,382</b>	<b>20,765</b>	<b>830.58</b>	<b>160</b>	<b>160</b>	<b>222</b>	<b>222</b>	<b>2,290</b>	<b>2,290</b>

NOTE: LOCATIONS AND TYPES OF BMPs MAY REQUIRE ADJUSTMENTS PRIOR TO OR AFTER PLACEMENT AS DIRECTED BY THE ENGINEER. ADJUSTMENTS SHOULD BE MADE TO ENSURE BMPs ARE WORKING EFFECTIVELY AND MAINTAIN COMPLIANCE WITH THE CONSTRUCTION GENERAL PERMIT. NOTIFY ENGINEER PRIOR TO MAKING ADJUSTMENTS.

QUANTITY SUMMARIES

TEXAS DEPARTMENT OF TRANSPORTATION  
 ©2022 SHEET 5 OF 5

CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	10	

# SUMMARY OF SMALL SIGNS

DATE: 5/24/2022 4:51:34 PM  
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PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX)				BRIDGE MOUNT CLEARANCE SIGNS (See Note 2)
							POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION	
							FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	1 or 2	UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	PREFABRICATED P = "Plain" T = "T" U = "U"	
1	1	R1-1	STOP	36 x 36	1		TWT	1	WS	P	
1	2	R1-1	STOP	36 x 36	1		TWT	1	WS	P	
1	3	R1-1	STOP	36 x 36	1		TWT	1	WS	P	
1	4	R1-1	STOP	36 x 36	1		TWT	1	WS	P	
1	5	M1-6F	<FM SHIELD> FARM ROAD (ROUTE #) (FM 357)	24 x 24	1		10BWG	1	SA	U	
1	5	M6-6L	<ARROWS - STRGHT & LEFT> <AUXILIARY SIGN>	21 x 15							
1	5	M1-6F	<FM SHIELD> FARM ROAD (ROUTE #) (FM 233)	24 x 24							
1	5	M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15							
1	6	W1-2L	SYMBOL - HORIZ CURVE LEFT	36 x 36	1		10BWG	1	SA	P	
1	6	W13-1P	(SPEED) MPH <ADVISORY SPEED PLAQUE> (45 MPH)	18 x 18							
1	7	M2-1	JCT <AUXILIARY SIGN>	21 x 15	1		10BWG	1	SA	U	
1	7	M1-6F	<FM SHIELD> FARM ROAD (ROUTE #) (FM 357)	24 x 24							
1	7	M2-1	JCT <AUXILIARY SIGN>	21 x 15							
1	7	M1-6F	<FM SHIELD> FARM ROAD (ROUTE #) (FM 233)	24 x 24							
1	8	W1-2R	SYMBOL - HORIZ CURVE RIGHT	36 x 36	1		10BWG	1	SA	P	
1	8	W13-1P	(SPEED) MPH <ADVISORY SPEED PLAQUE>	18 x 18							
2	9	D21-1aTL	(DESTINATION - 2 LINE) <LEFT> (MOORE CEMETERY ROAD)	66 x 24	1		10BWG	1	SA	T	
3	10	R1-1	STOP	36 x 36	1		TWT	1	WS	P	
3	11	R1-1	STOP	36 x 36	1		TWT	1	WS	P	
3	12	D21-1aTR	(DESTINATION - 2 LINE) (MOORE CEMETERY ROAD) <RIGHT>	96 x 24	1		10BWG	1	SA	T	
3	13	W5-1	ROAD NARROWS	36 x 36	1		10BWG	1	SA	P	
3	13	SW16-2aP	(FEET) FEET <1 LINE> (1000)	24 x 12							
3	14	W1-2L	SYMBOL - HORIZ CURVE LEFT	36 x 36	1		TWT	1	WS	P	
3	15	R2-1	SPEED LIMIT (SPEED) (55 MPH)	30 x 36	1		TWT	1	WS	P	

ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080"
7.5 to 15	0.100"
Greater than 15	0.125"

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.  
<http://www.txdot.gov/>

- NOTE:**
- Sign supports shall be located as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise shown on the plans, the Contractor shall stake and the Engineer will verify all sign support locations.
  - For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS) Standard Sheet.
  - For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

SHEET 1 OF 2



## SUMMARY OF SMALL SIGNS

### SOSS

FILE: sums16.dgn	DW: TxdOT	CK: TxdOT	DW: TxdOT	CK: TxdOT
© TxdOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
4-16	DIST	COUNTY	SHEET NO.	
8-16	LFK	TRINITY	11	





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DATE:  
FILE:

**BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:**

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

**WORKER SAFETY NOTES:**



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

**COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES**

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

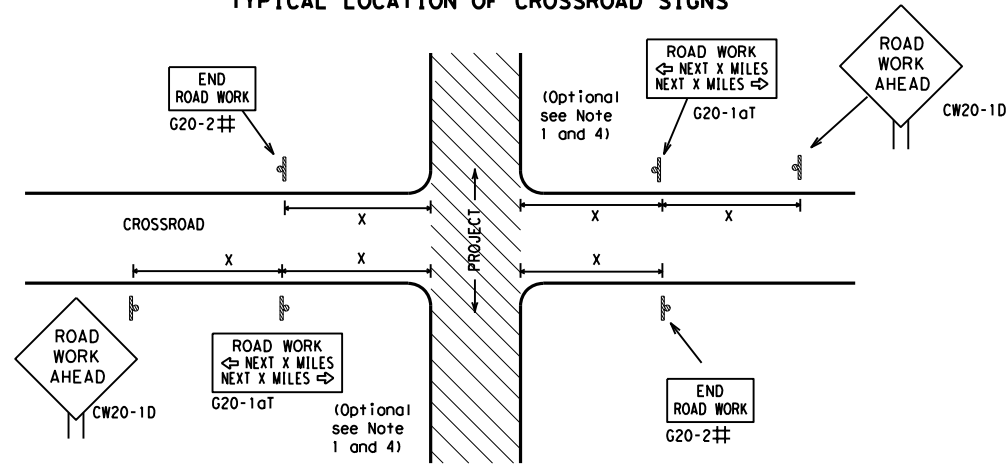
<p><b>THE DOCUMENTS BELOW CAN BE FOUND ON-LINE AT</b>  <a href="http://www.txdot.gov">http://www.txdot.gov</a></p>
COMPLIANT WORK ZONE TRAFFIC CONTROL DEVICES LIST (CWZTCD)
DEPARTMENTAL MATERIAL SPECIFICATIONS (DMS)
MATERIAL PRODUCER LIST (MPL)
ROADWAY DESIGN MANUAL - SEE "MANUALS (ONLINE MANUALS)"
STANDARD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

SHEET 1 OF 12

 Texas Department of Transportation		 Traffic Safety Division Standard	
<p><b>BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS</b></p> <p><b>BC (1) - 21</b></p>			
FILE:	bc-21.dgn	DN:	TxDOT
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REVISIONS	CONT	SECT	JOB
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9-07 8-14			FS 357
5-10 5-21	DIST	COUNTY	SHEET NO.
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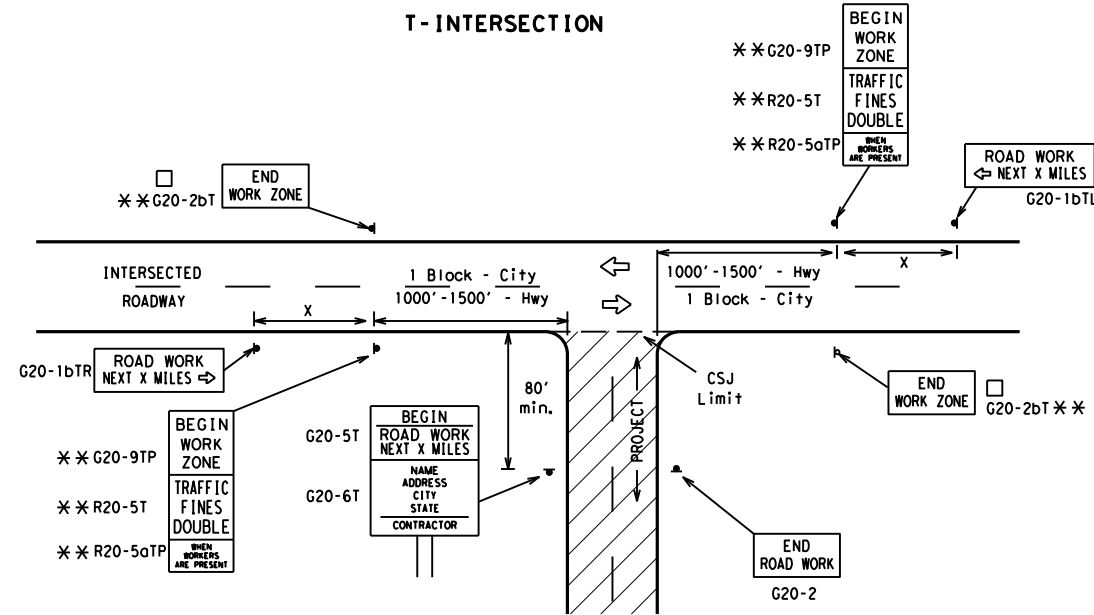
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**TYPICAL LOCATION OF CROSSROAD SIGNS**



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

**T-INTERSECTION**



**CSJ LIMITS AT T-INTERSECTION**

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

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

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

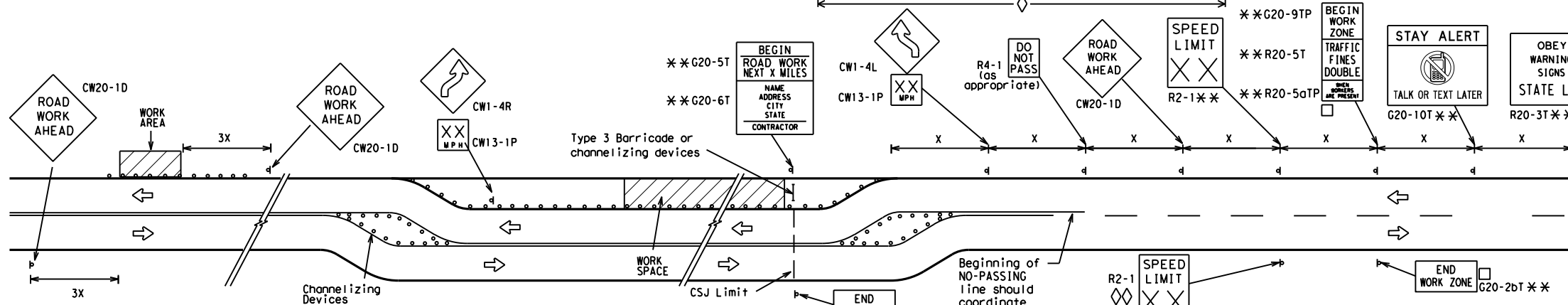
\* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

**GENERAL NOTES**

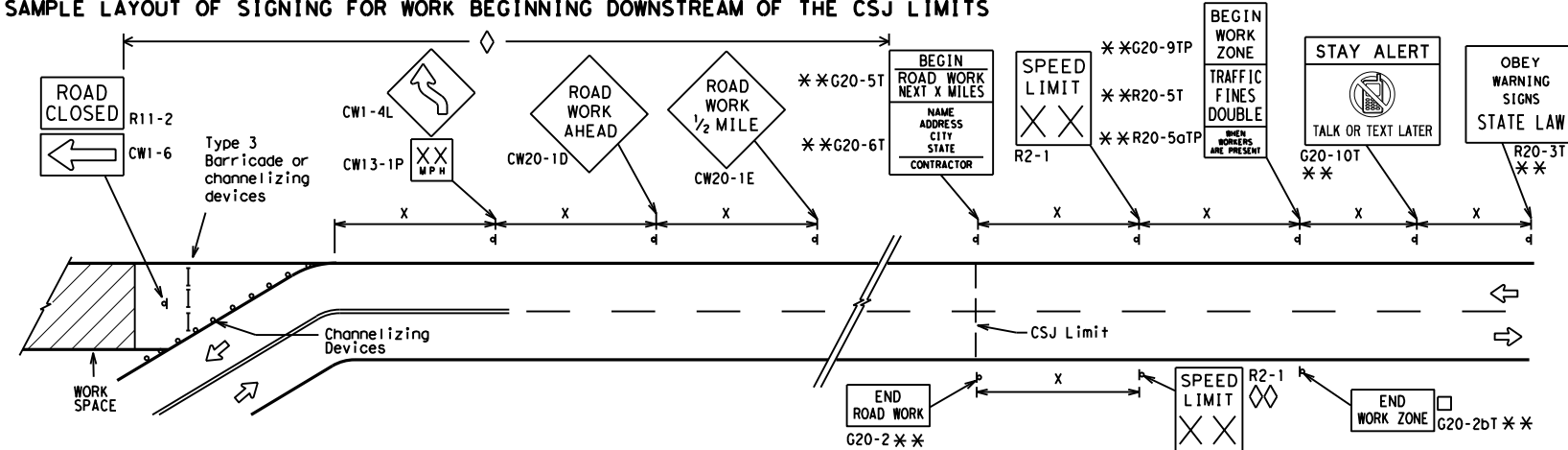
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be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

**WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS**



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

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



**NOTES**

- The Contractor shall determine the appropriate distance to be placed on the G20-1 series signs and "BEGIN ROAD WORK NEXT X MILES" (G20-5T) sign for each specific project. This distance shall replace the "x" and shall be rounded to the nearest whole mile with the approval of the Engineer. No decimals shall be used.
- The "BEGIN WORK ZONE" (G20-9TP) and "END WORK ZONE" (G20-2bT) shall be used as shown on the sample layout when advance signs are required outside the CSJ Limits. They inform the motorist of entering or leaving a part of the work zone lying outside the CSJ Limits where traffic fines may double if workers are present.
  - CSJ limit signing is required for highway construction and maintenance work, with the exception of mobile operations.
  - Area for placement of "ROAD WORK AHEAD" (CW20-1D) sign and other signs or devices as called for on the Traffic Control Plan.
  - Contractor will install a regulatory speed limit sign at the end of the work zone.

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

SHEET 2 OF 12



**BARRICADE AND CONSTRUCTION PROJECT LIMIT**

**BC(2)-21**

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
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REVISIONS	0931	04	034	FS 357
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	LFK	TRINITY	14	

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# TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

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



## GUIDANCE FOR USE:

### LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

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

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

### SHORT TERM WORK ZONE SPEED LIMITS

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

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

## GENERAL NOTES

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

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

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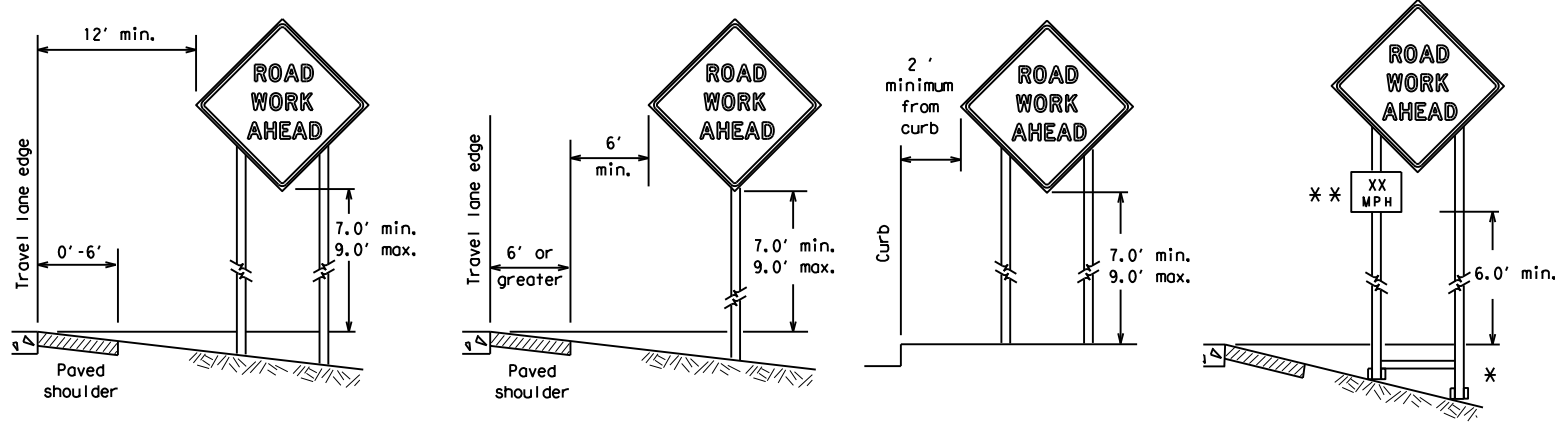
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SHEET 3 OF 12

		Traffic Safety Division Standard	
<h2>BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT</h2>			
<h3>BC (3) -21</h3>			
FILE:	bc-21.dgn	DW:	TxDOT
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		SECT:	04
		JOB:	034
		HIGHWAY:	FS 357
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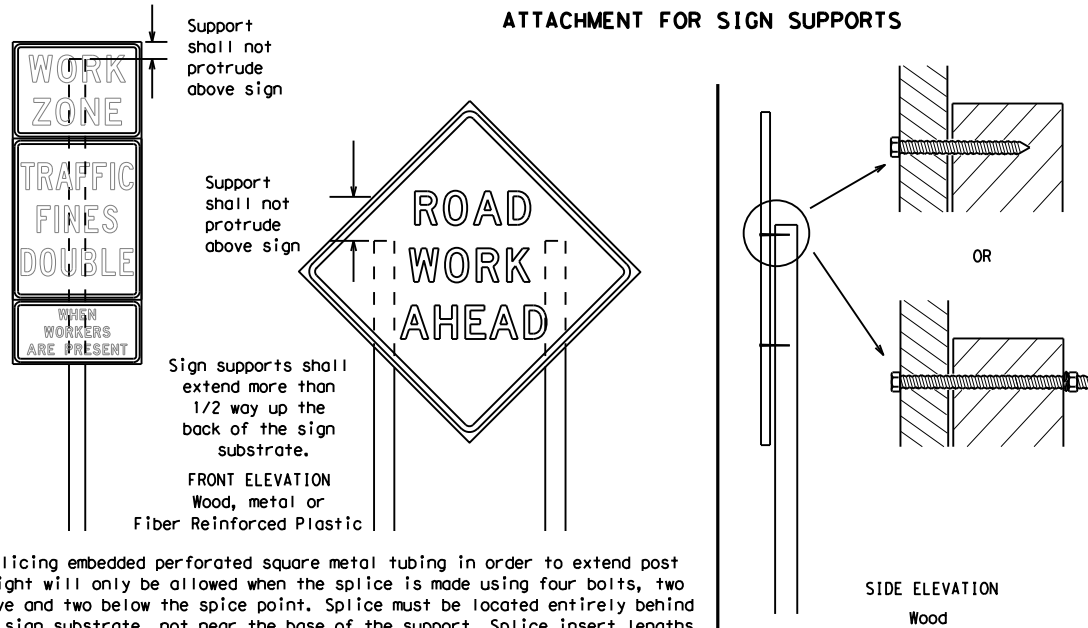
**TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS**



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

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

**ATTACHMENT FOR SIGN SUPPORTS**



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

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

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

**GENERAL NOTES FOR WORK ZONE SIGNS**

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

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

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

**SIGN MOUNTING HEIGHT**

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

**SIZE OF SIGNS**

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

**SIGN SUBSTRATES**

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

**REFLECTIVE SHEETING**

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

**SIGN LETTERS**

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

**REMOVING OR COVERING**

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

**SIGN SUPPORT WEIGHTS**

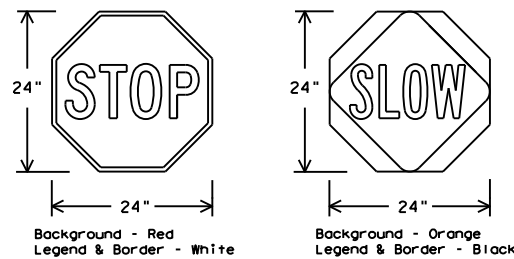
- Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand should be used.
- The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
- Rock, concrete, iron, steel or other solid objects shall not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

**FLAGS ON SIGNS**

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

**STOP/SLOW PADDLES**

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



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

**CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS**

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

SHEET 4 OF 12



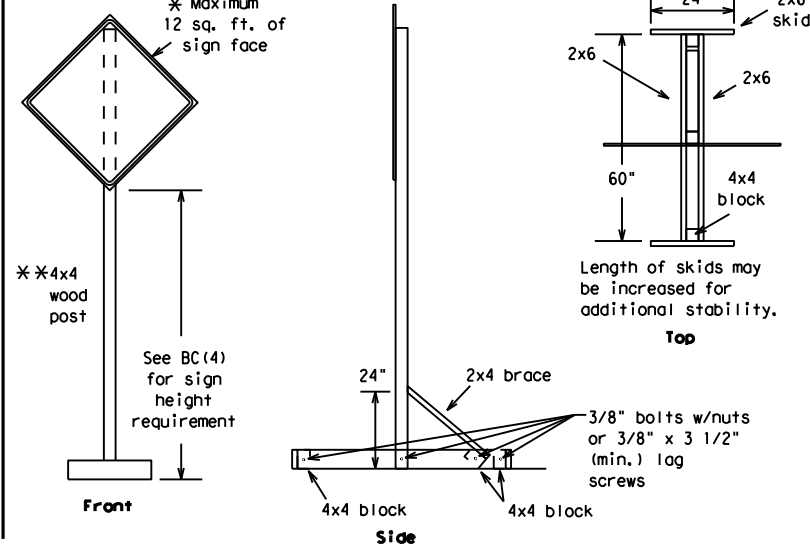
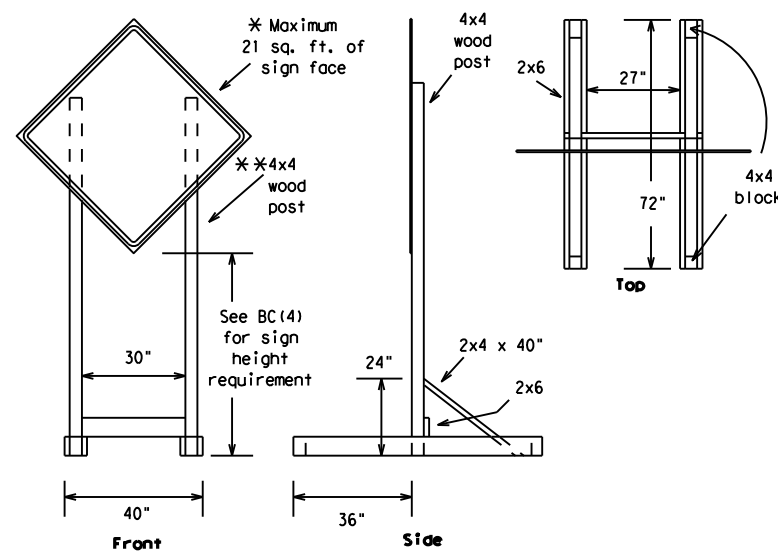
**BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES**

BC (4) - 21

FILE: bc-21.dgn	DN: TxDOT	CR: TxDOT	OW: TxDOT	CK: TxDOT
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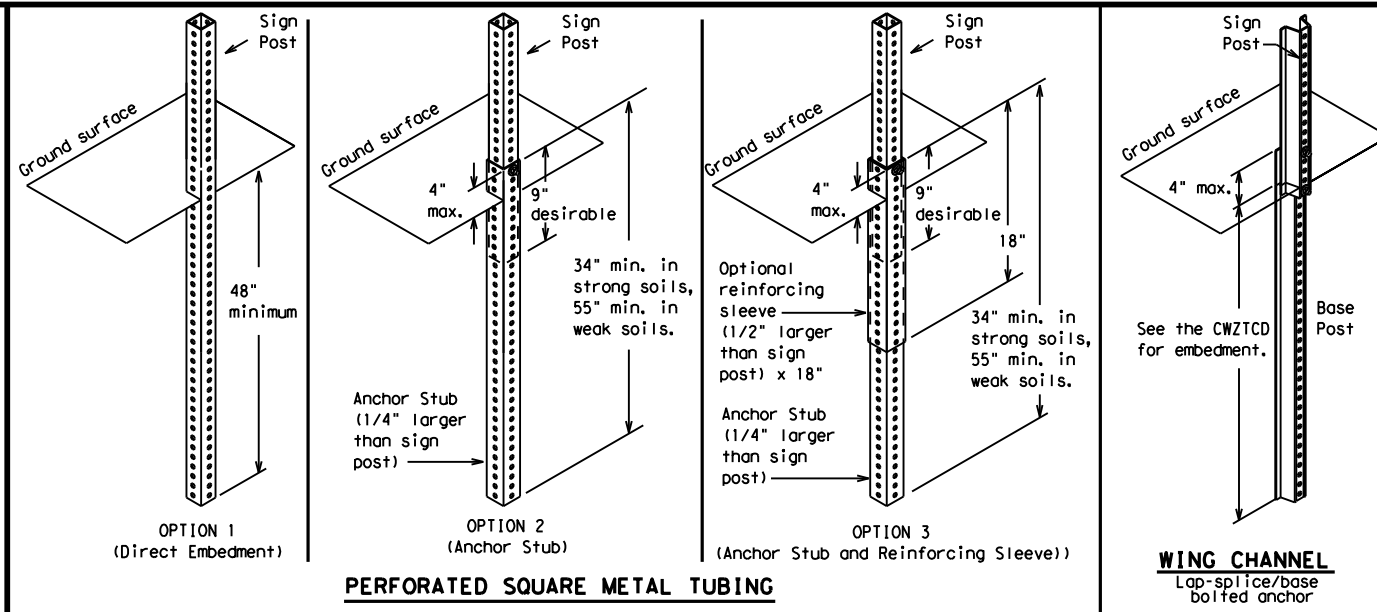
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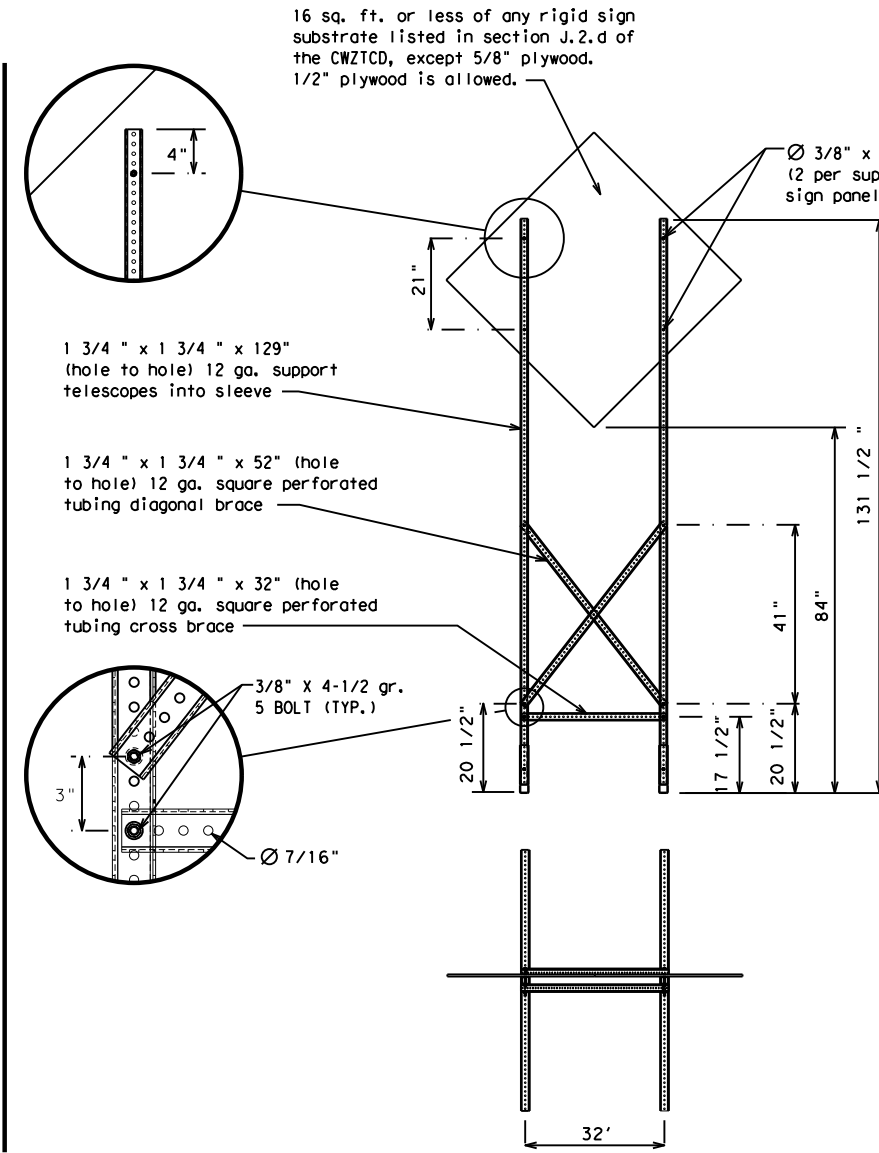
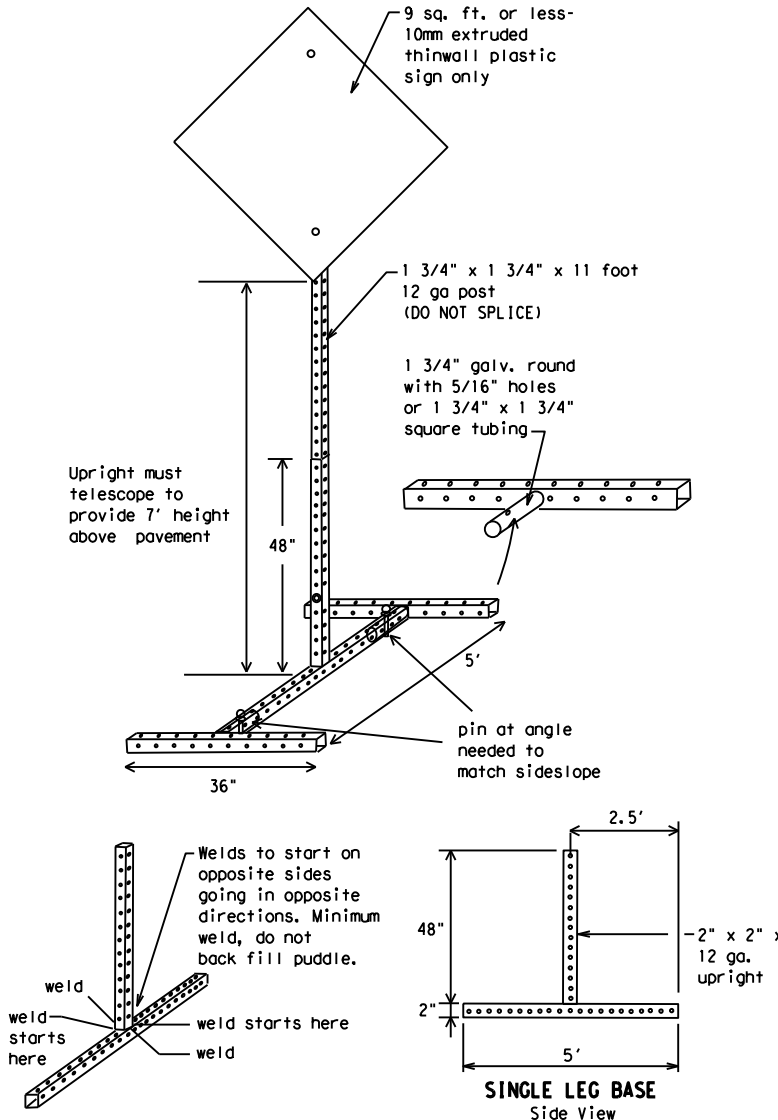
### SKID MOUNTED WOOD SIGN SUPPORTS

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



### GROUND MOUNTED SIGN SUPPORTS

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



### SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

### WEDGE ANCHORS

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

### OTHER DESIGNS

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

### GENERAL NOTES

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

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

SHEET 5 OF 12



## BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5) - 21

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© TxDOT	November 2002	CONT:	SECT:	JOB:	HIGHWAY:				
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WHEN NOT IN USE, REMOVE THE PCMS FROM THE RIGHT-OF-WAY OR PLACE THE PCMS BEHIND BARRIER OR GUARDRAIL WITH SIGN PANEL TURNED PARALLEL TO TRAFFIC

# RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

## PORTABLE CHANGEABLE MESSAGE SIGNS

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

## Phase 1: Condition Lists

### Road/Lane/Ramp Closure List

FREEWAY CLOSED X MILE	FRONTAGE ROAD CLOSED
ROAD CLOSED AT SH XXX	SHOULDER CLOSED XXX FT
ROAD CLSD AT FM XXXX	RIGHT LN CLOSED XXX FT
RIGHT X LANES CLOSED	RIGHT X LANES OPEN
CENTER LANE CLOSED	DAYTIME LANE CLOSURES
NIGHT LANE CLOSURES	I-XX SOUTH EXIT CLOSED
VARIOUS LANES CLOSED	EXIT XXX CLOSED X MILE
EXIT CLOSED	RIGHT LN TO BE CLOSED
MALL DRIVEWAY CLOSED	X LANES CLOSED TUE - FRI
XXXXXXXX BLVD CLOSED	

### Other Condition List

ROADWORK XXX FT	ROAD REPAIRS XXXX FT
FLAGGER XXXX FT	LANE NARROWS XXXX FT
RIGHT LN NARROWS XXXX FT	TWO-WAY TRAFFIC XX MILE
MERGING TRAFFIC XXXX FT	CONST TRAFFIC XXX FT
LOOSE GRAVEL XXXX FT	UNEVEN LANES XXXX FT
DETOUR X MILE	ROUGH ROAD XXXX FT
ROADWORK PAST SH XXXX	ROADWORK NEXT FRI-SUN
BUMP XXXX FT	US XXX EXIT X MILES
TRAFFIC SIGNAL XXXX FT	LANES SHIFT *

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

## Phase 2: Possible Component Lists

### Action to Take/Effect on Travel List

MERGE RIGHT	FORM X LINES RIGHT
DETOUR NEXT X EXITS	USE XXXXX RD EXIT
USE EXIT XXX	USE EXIT I-XX NORTH
STAY ON US XXX SOUTH	USE I-XX E TO I-XX N
TRUCKS USE US XXX N	WATCH FOR TRUCKS
WATCH FOR TRUCKS	EXPECT DELAYS
EXPECT DELAYS	PREPARE TO STOP
REDUCE SPEED XXX FT	END SHOULDER USE
USE OTHER ROUTES	WATCH FOR WORKERS
STAY IN LANE *	

### Location List

AT FM XXXX
BEFORE RAILROAD CROSSING
NEXT X MILES
PAST US XXX EXIT
XXXXXXXX TO XXXXXX
US XXX TO FM XXXX

### Warning List

SPEED LIMIT XX MPH
MAXIMUM SPEED XX MPH
MINIMUM SPEED XX MPH
ADVISORY SPEED XX MPH
RIGHT LANE EXIT
USE CAUTION
DRIVE SAFELY
DRIVE WITH CARE

### \*\* Advance Notice List

TUE-FRI XX AM-X PM
APR XX-XX X PM-X AM
BEGINS MONDAY
BEGINS MAY XX
MAY X-X XX PM - XX AM
NEXT FRI-SUN
XX AM TO XX PM
NEXT TUE AUG XX
TONIGHT XX PM-XX AM

\*\* See Application Guidelines Note 6.

## APPLICATION GUIDELINES

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

## WORDING ALTERNATIVES

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

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

## FULL MATRIX PCMS SIGNS

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

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WORD OR PHRASE	ABBREVIATION	WORD OR PHRASE	ABBREVIATION
Access Road	ACCS RD	Major	MAJ
Alternate	ALT	Miles	MI
Avenue	AVE	Miles Per Hour	MPH
Best Route	BEST RTE	Minor	MNR
Boulevard	BLVD	Monday	MON
Bridge	BRDG	Normal	NORM
Canal	CANT	North	N
Center	CTR	Northbound	(route) N
Construction Ahead	CONST AHD	Parking	PKING
CROSSING	XING	Road	RD
Detour Route	DETOUR RTE	Right Lane	RT LN
Do Not	DONT	Saturday	SAT
East	E	Service Road	SERV RD
Eastbound	(route) E	Shoulder	SHLDR
Emergency	EMER	Slippery	SLIP
Emergency Vehicle	EMER VEH	South	S
Entrance, Enter	ENT	Southbound	(route) S
Express Lane	EXP LN	Speed	SPD
Expressway	EXPWY	Street	ST
XXXX Feet	XXXX FT	Sunday	SUN
Fog Ahead	FOG AHD	Telephone	PHONE
Freeway	FRWY, FWY	Temporary	TEMP
Freeway Blocked	FWY BLKD	Thursday	THURS
Friday	FRI	To Downtown	TO DWNTN
Hazardous Driving	HAZ DRIVING	Traffic	TRAF
Hazardous Material	HAZMAT	Travelers	TRVLR
High-Occupancy Vehicle	HOV	Tuesday	TUES
Highway	HWY	Time Minutes	TIME MIN
Hour(s)	HR, HRS	Upper Level	UPR LEVEL
Information	INFO	Vehicles (s)	VEH, VEHS
It Is	ITS	Warning	WARN
Junction	JCT	Wednesday	WED
Left	LFT	Weight Limit	WT LIMIT
Left Lane	LFT LN	West	W
Lane Closed	LN CLOSED	Westbound	(route) W
Lower Level	LWR LEVEL	Wet Pavement	WET PVMT
Maintenance	MAINT	Will Not	WONT

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



## BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC (6) - 21

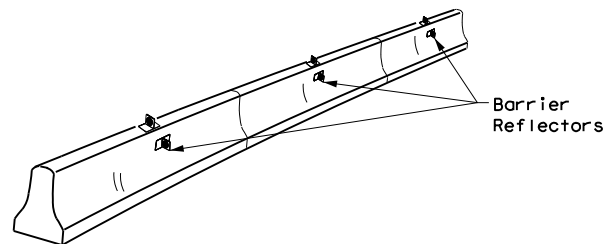
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© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	LFK	TRINITY	18	

DATE: FILE:



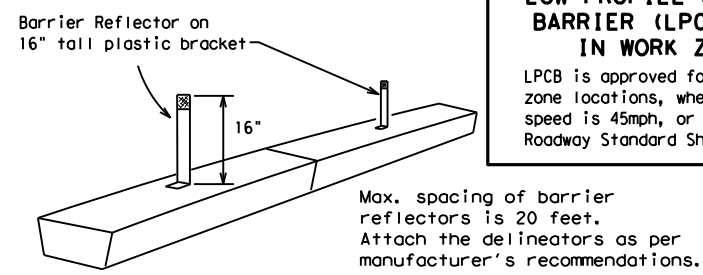
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 512.



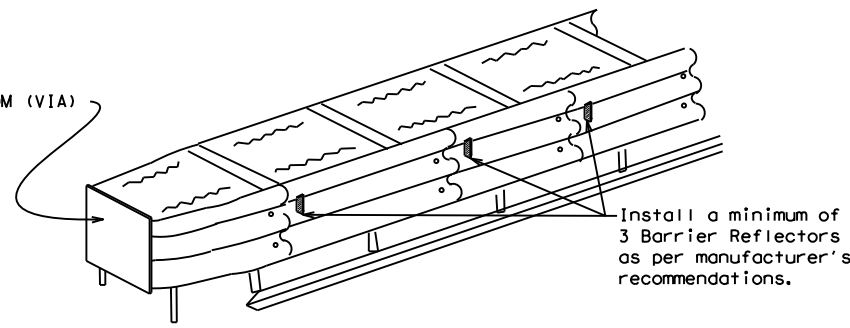
**CONCRETE TRAFFIC BARRIER (CTB)**

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



**LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES**  
 LPCB is approved for use in work zone locations, where the posted speed is 45mph, or less. See Roadway Standard Sheet LPCB.

**LOW PROFILE CONCRETE BARRIER (LPCB)**



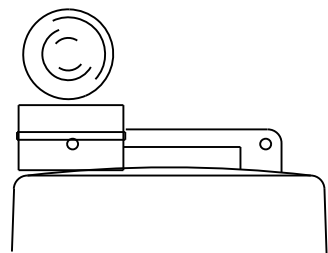
**DELINEATION OF END TREATMENTS**

**END TREATMENTS FOR CTB'S USED IN WORK ZONES**  
 End treatments used on CTB's in work zones shall meet the appropriate crashworthy standards as defined in the Manual for Assessing Safety Hardware (MASH). Refer to the CWZTCD List for approved end treatments and manufacturers.

**BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS**

**WARNING LIGHTS**

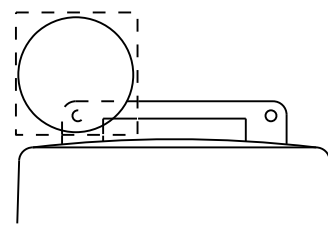
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet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



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

**WARNING LIGHTS MOUNTED ON PLASTIC DRUMS**

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



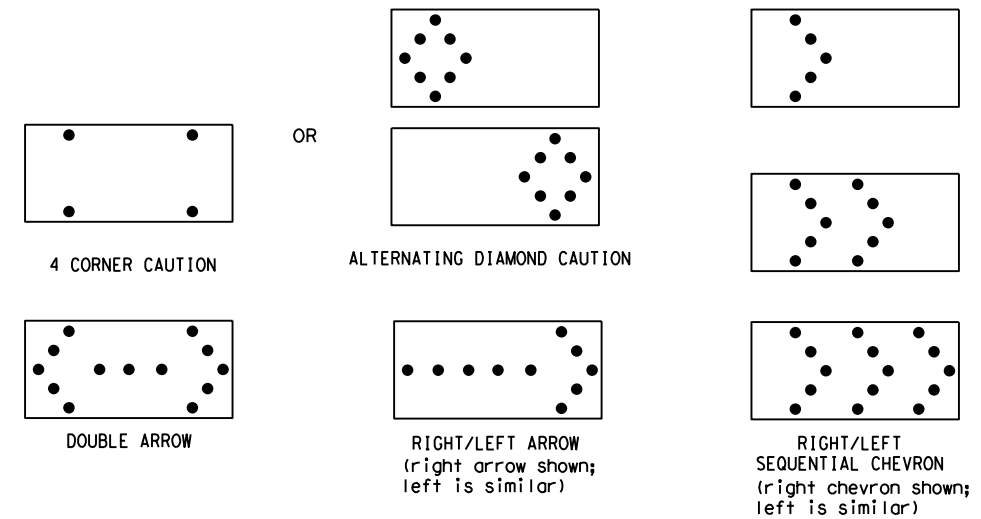
Warning reflector may be round or square. Must have a yellow reflective surface area of at least 30 square inches

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

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

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

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



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

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

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

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

**FLASHING ARROW BOARDS**

SHEET 7 OF 12

**TRUCK-MOUNTED ATTENUATORS**

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



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

**BC (7) -21**

FILE: bc-21.dgn	DN: TxDOT	CR: TxDOT	OW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	LFK	TRINITY	19	

DATE:  
FILE:

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**GENERAL NOTES**

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

**GENERAL DESIGN REQUIREMENTS**

Pre-qualified plastic drums shall meet the following requirements:

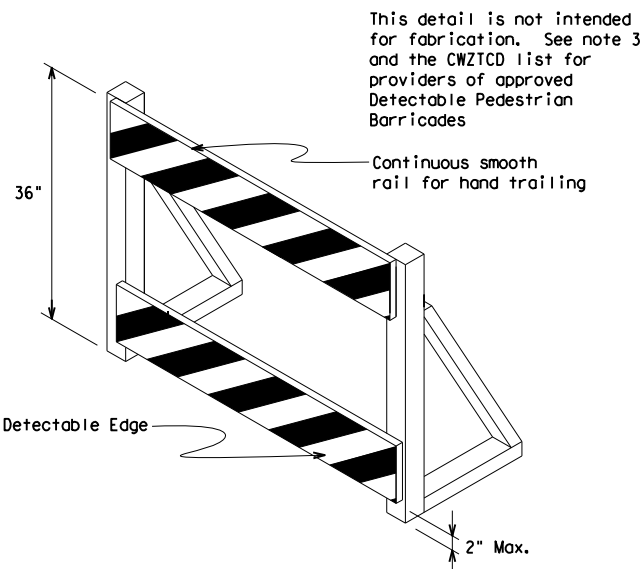
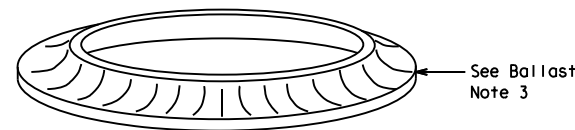
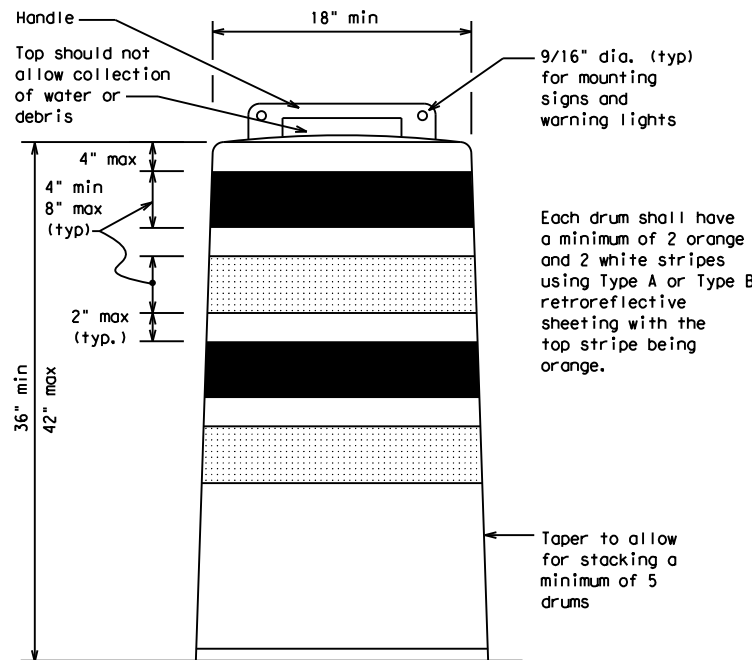
- Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
- The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

**RETROREFLECTIVE SHEETING**

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

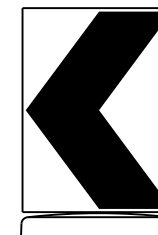
**BALLAST**

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

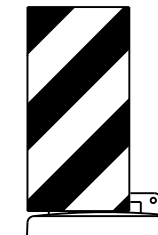


**DETECTABLE PEDESTRIAN BARRICADES**

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



18" x 24" Sign  
(Maximum Sign Dimension)  
Chevron CW1-8, Opposing Traffic Lane  
Divider, Driveway sign D70a, Keep Right  
R4 series or other signs as approved  
by Engineer



12" x 24"  
Vertical Panel  
mount with diagonals  
sloping down towards  
travel way

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

**SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS**

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

SHEET 8 OF 12



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC(8) - 21**

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**FIXED**  
(Rigid or self-righting)

**DRIVEABLE**



**PORTABLE**

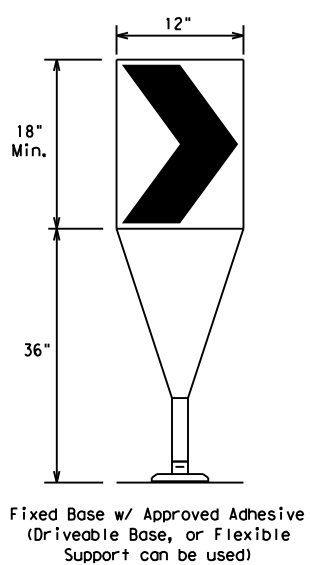
**VERTICAL PANELS (VPs)**

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



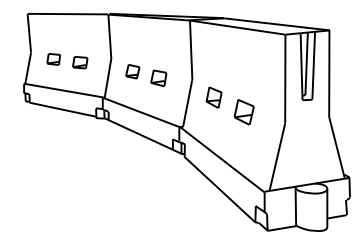
**OPPOSING TRAFFIC LANE DIVIDERS (OTLD)**

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



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

**CHEVRONS**



**LONGITUDINAL CHANNELIZING DEVICES (LCD)**

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

**WATER BALLASTED SYSTEMS USED AS BARRIERS**

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

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

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

**GENERAL NOTES**

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

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

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

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

SHEET 9 OF 12



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC (9) - 21**

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**TYPE 3 BARRICADES**

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

Barricades shall NOT be used as a sign support.



**TYPICAL STRIPING DETAIL FOR BARRICADE RAIL**



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

**TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES**

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



PERSPECTIVE VIEW

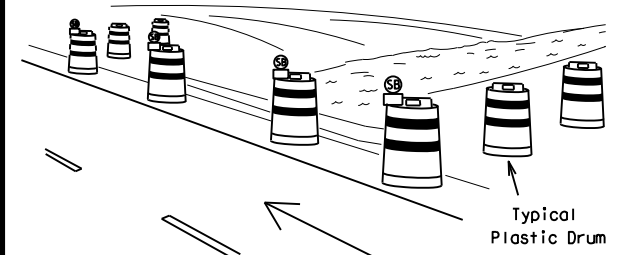
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



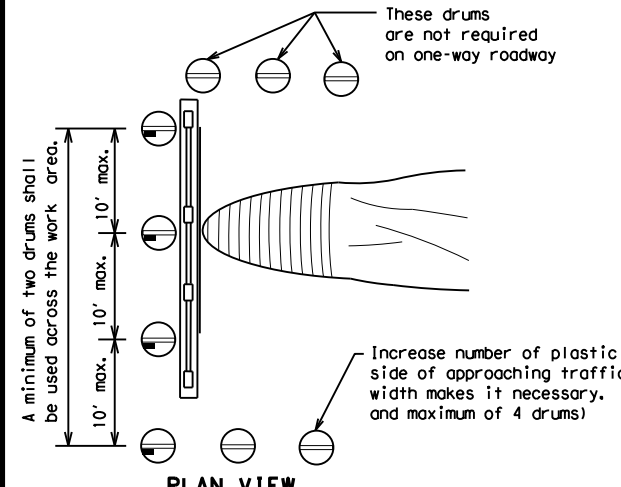
PLAN VIEW

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

**TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION**



PERSPECTIVE VIEW



PLAN VIEW

**CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS**

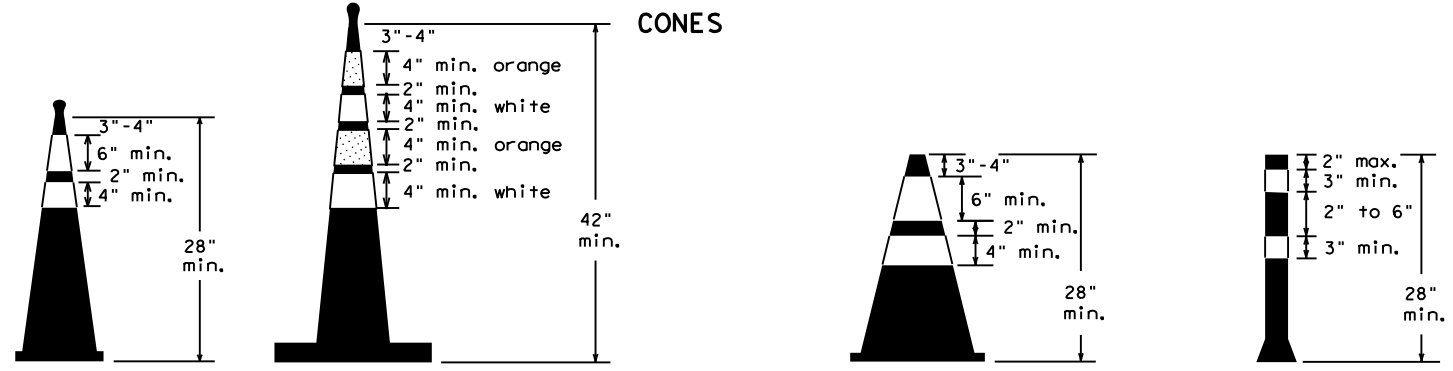
1. Where positive redirection capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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

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

A minimum of two drums shall be used across the work area.

These drums are not required on one-way roadway

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

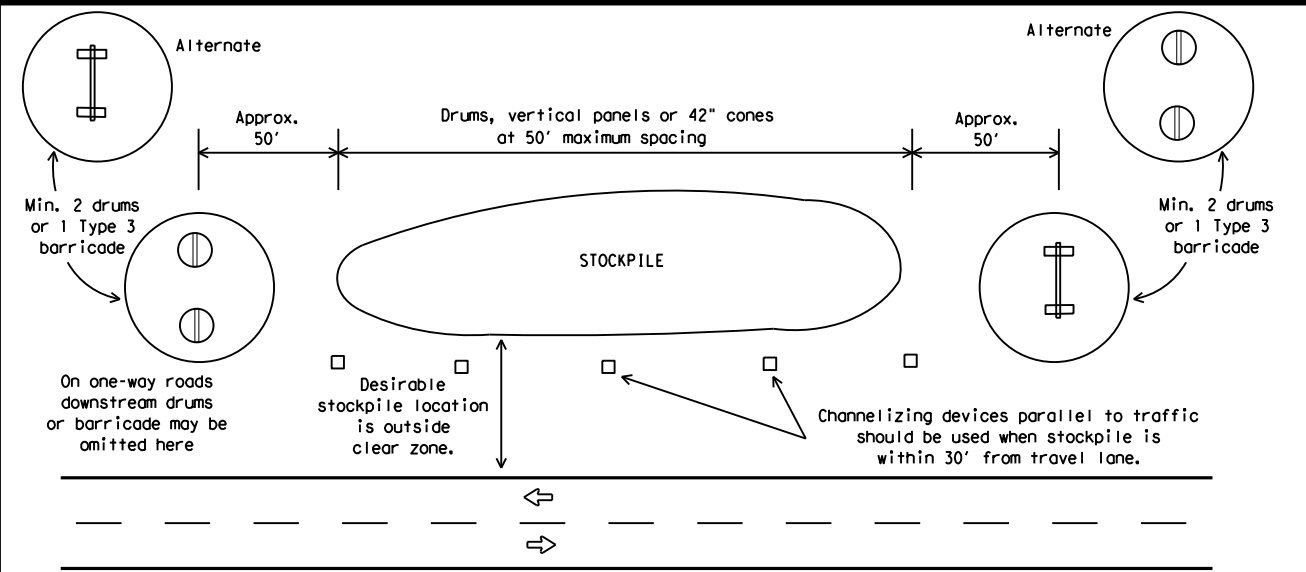


Two-Piece cones

One-Piece cones

Tubular Marker

28" Cones shall have a minimum weight of 9 1/2 lbs.  
42" 2-piece cones shall have a minimum weight of 30 lbs. including base.



**TRAFFIC CONTROL FOR MATERIAL STOCKPILES**

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



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC (10) - 21**

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## WORK ZONE PAVEMENT MARKINGS

### GENERAL

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

### RAISED PAVEMENT MARKERS

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

### PREFABRICATED PAVEMENT MARKINGS

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

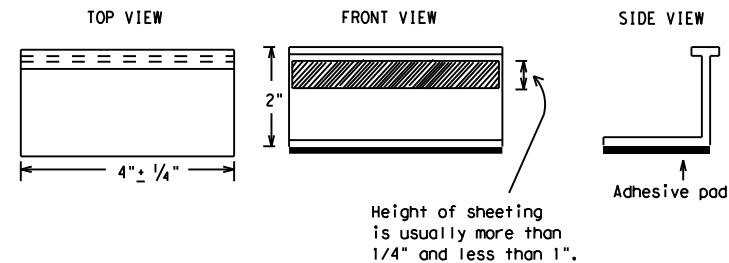
### MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

### REMOVAL OF PAVEMENT MARKINGS

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

## Temporary Flexible-Reflective Roadway Marker Tabs



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

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

### RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

SHEET 11 OF 12



## BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

**BC(11)-21**

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2-98 9-07 5-21	DIST	COUNTY	SHEET NO.	
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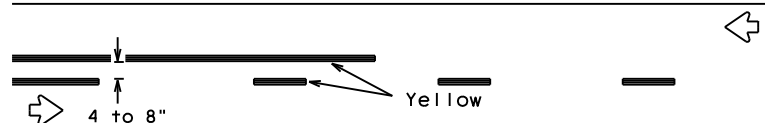
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## PAVEMENT MARKING PATTERNS

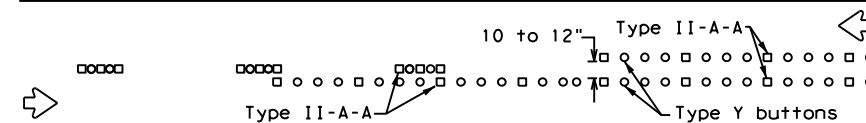


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

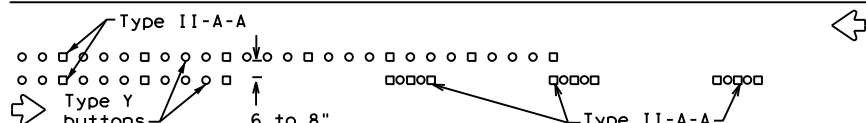


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

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



RAISED PAVEMENT MARKERS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN B

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



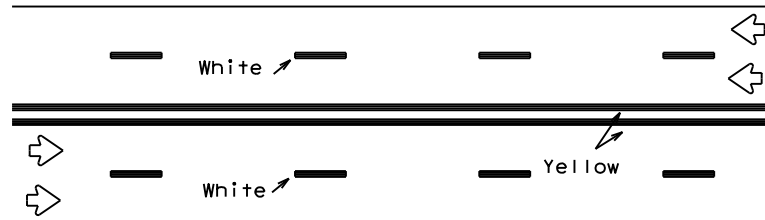
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



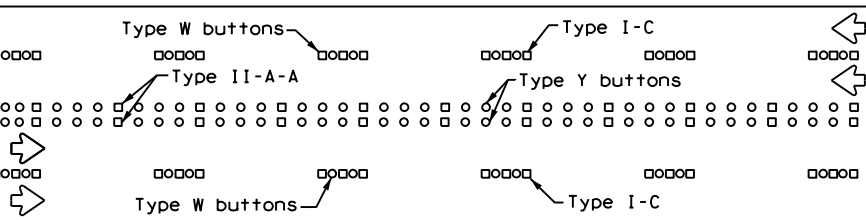
RAISED PAVEMENT MARKERS

## EDGE & LANE LINES FOR DIVIDED HIGHWAY



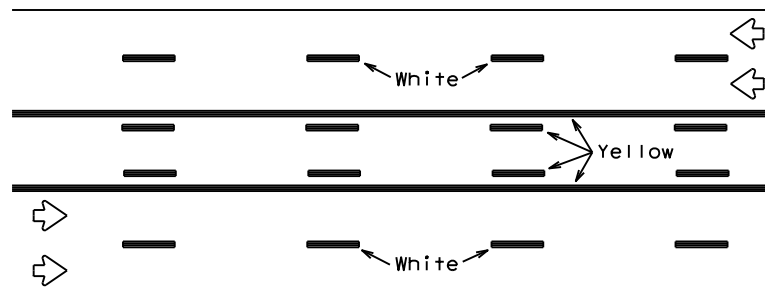
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



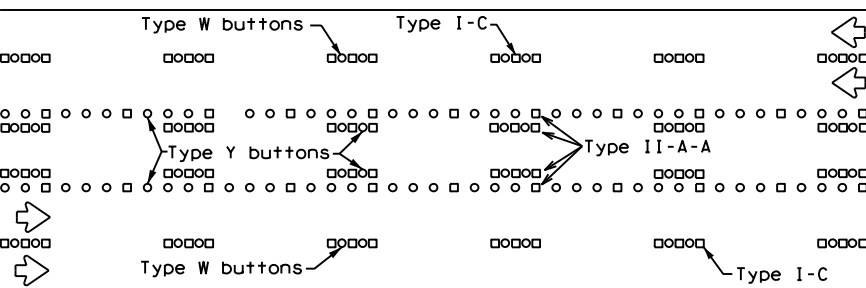
RAISED PAVEMENT MARKERS

## LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

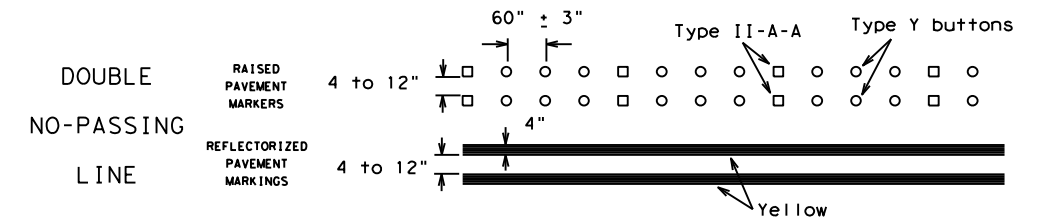
Prefabricated markings may be substituted for reflectORIZED pavement markings.



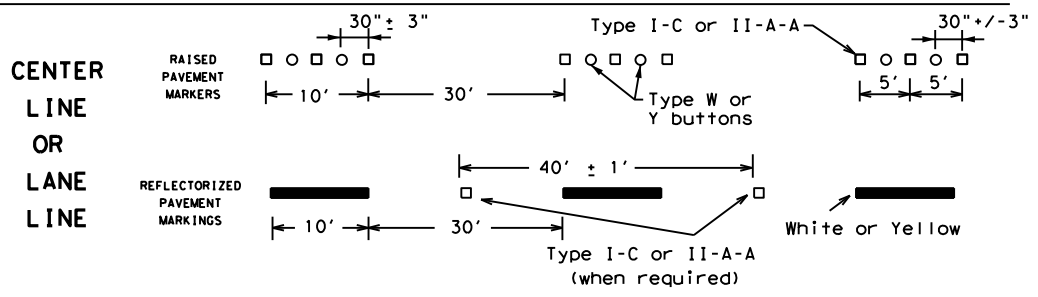
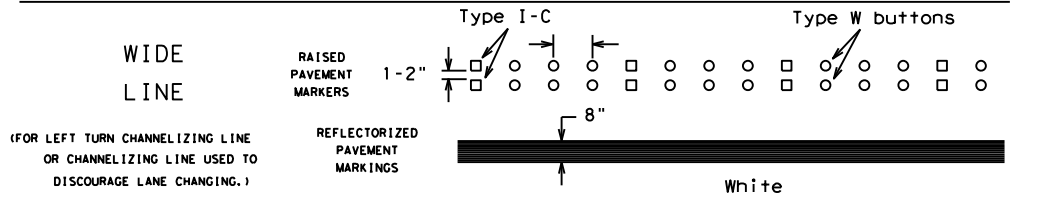
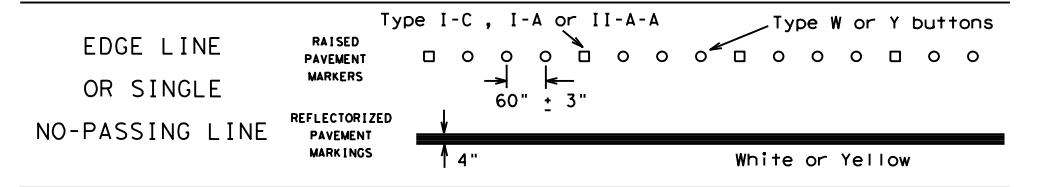
RAISED PAVEMENT MARKERS

## TWO-WAY LEFT TURN LANE

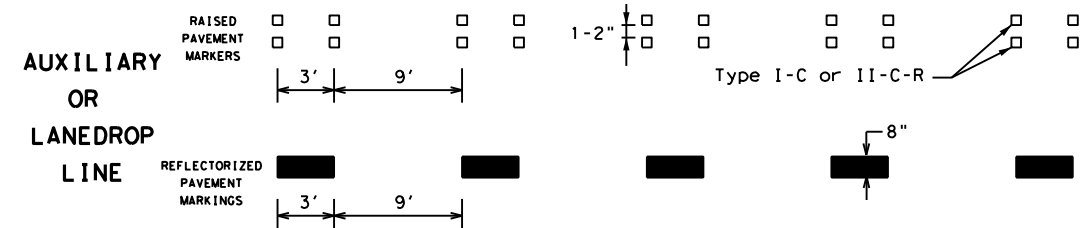
## STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



### SOLID LINES

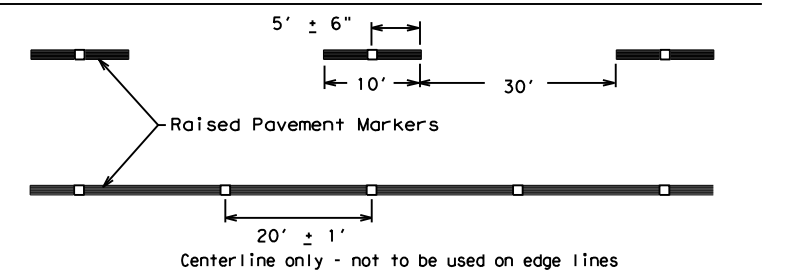


### BROKEN LINES



### REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



SHEET 12 OF 12



## BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

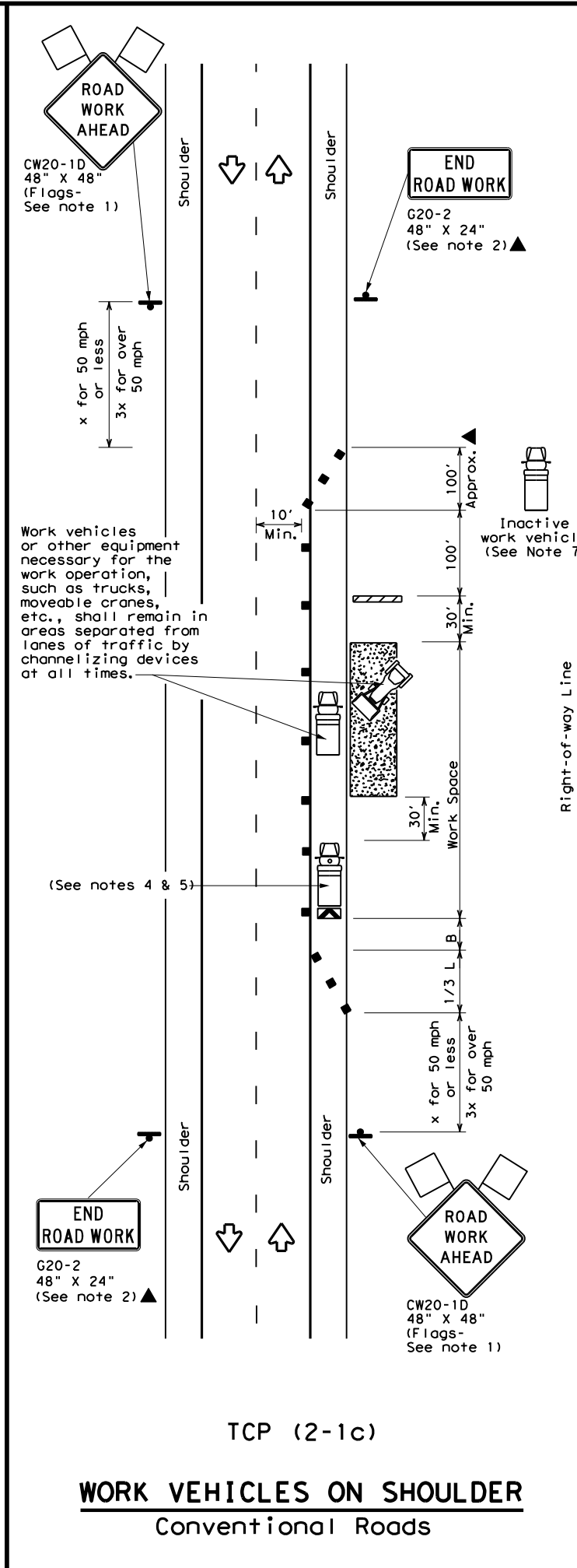
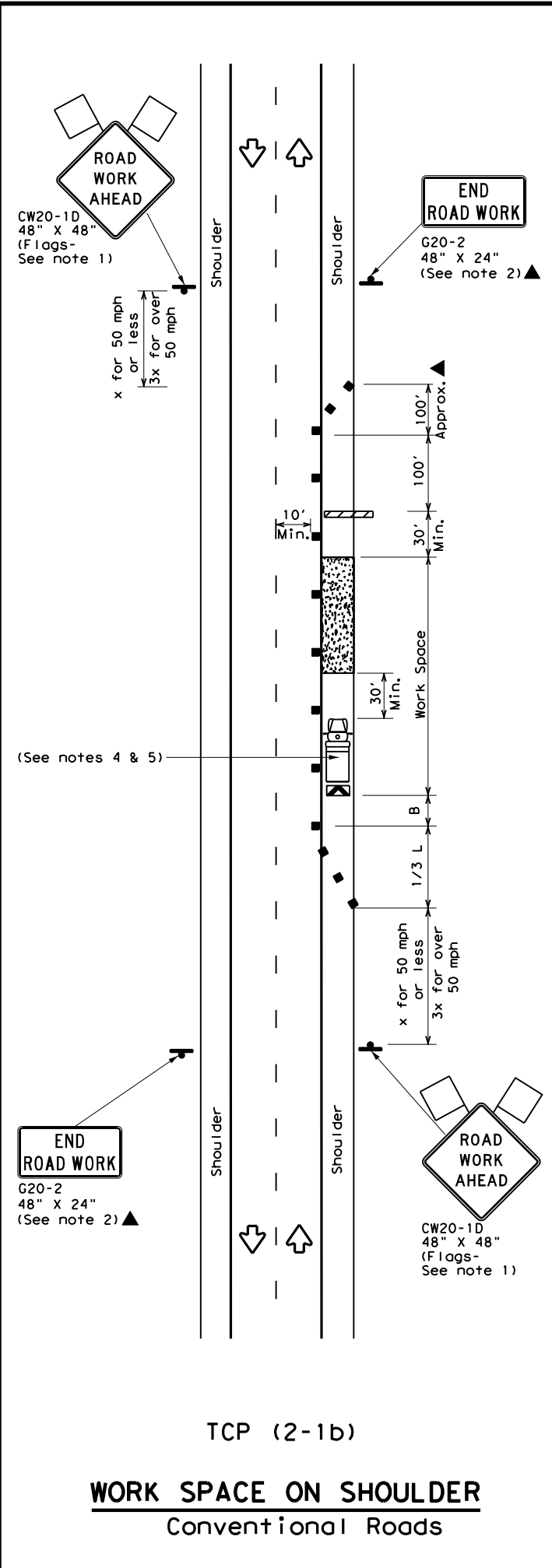
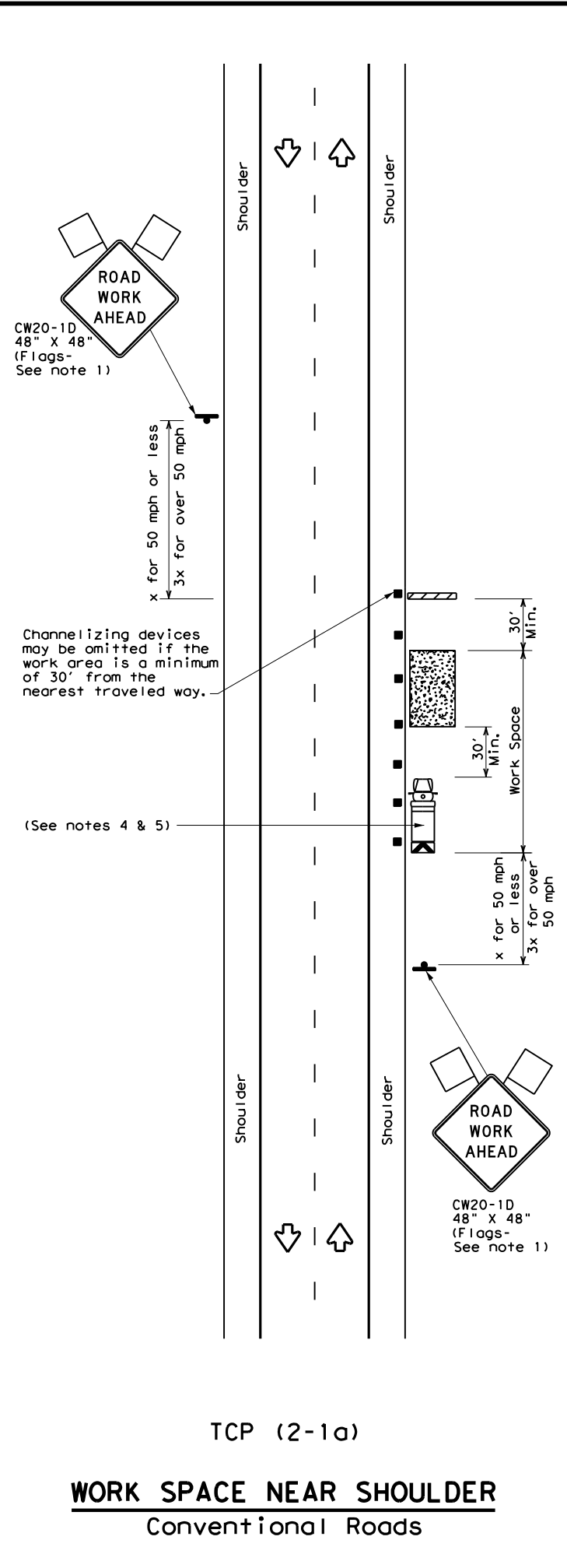
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©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
1-97 9-07 5-21	DIST	COUNTY	SHEET NO.	
2-98 7-13	LFK	TRINITY	24	
11-02 8-14				

Raised pavement markers used as standard pavement markings shall be from the approved products list and meet the requirements of Item 672 "RAISED PAVEMENT MARKERS."

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DATE: FILE:

DATE: 5/24/2022 4:52:31 PM  
 FILE: \\txdot.projectwiseonline.com\TXDOT3\Documents\11 - LFK\Design Projects\09210904\09210904.dgn  
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LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board		Portable Changeable Message Sign (PCMS)
	Sign		Traffic Flow
	Flag		Flagger

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

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓	✓	✓

- GENERAL NOTES**
- Flags attached to signs where shown, are REQUIRED.
  - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated in the plans, or for routine maintenance work, when approved by the Engineer.
  - Stockpiled material should be placed a minimum of 30 feet from nearest traveled way.
  - Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
  - Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.
  - See TCP(5-1) for shoulder work on divided highways, expressways and freeways.
  - Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
  - CW21-5 "SHOULDER WORK" signs may be used in place of CW20-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.

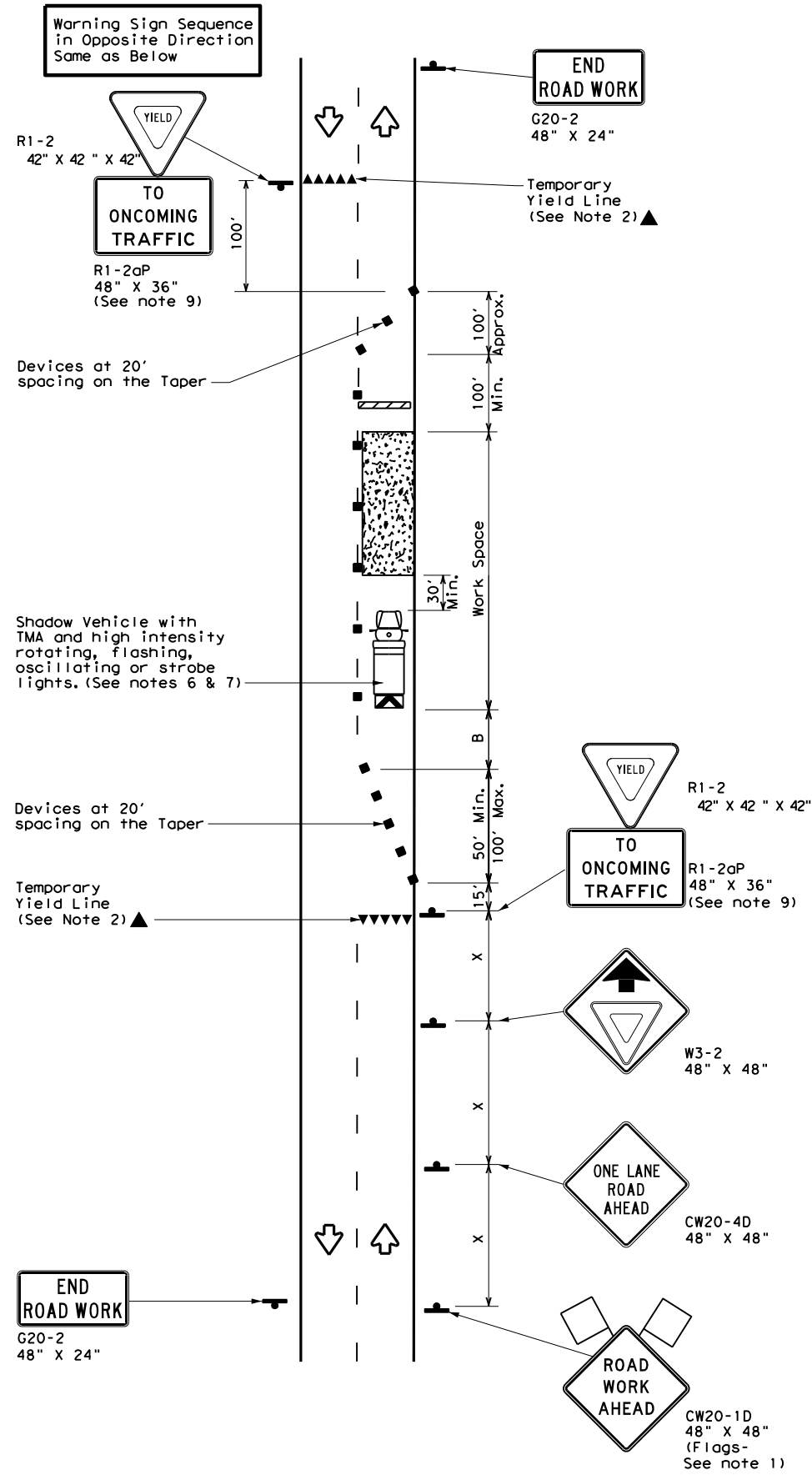
Texas Department of Transportation  
 Traffic Operations Division Standard

**TRAFFIC CONTROL PLAN**  
**CONVENTIONAL ROAD**  
**SHOULDER WORK**

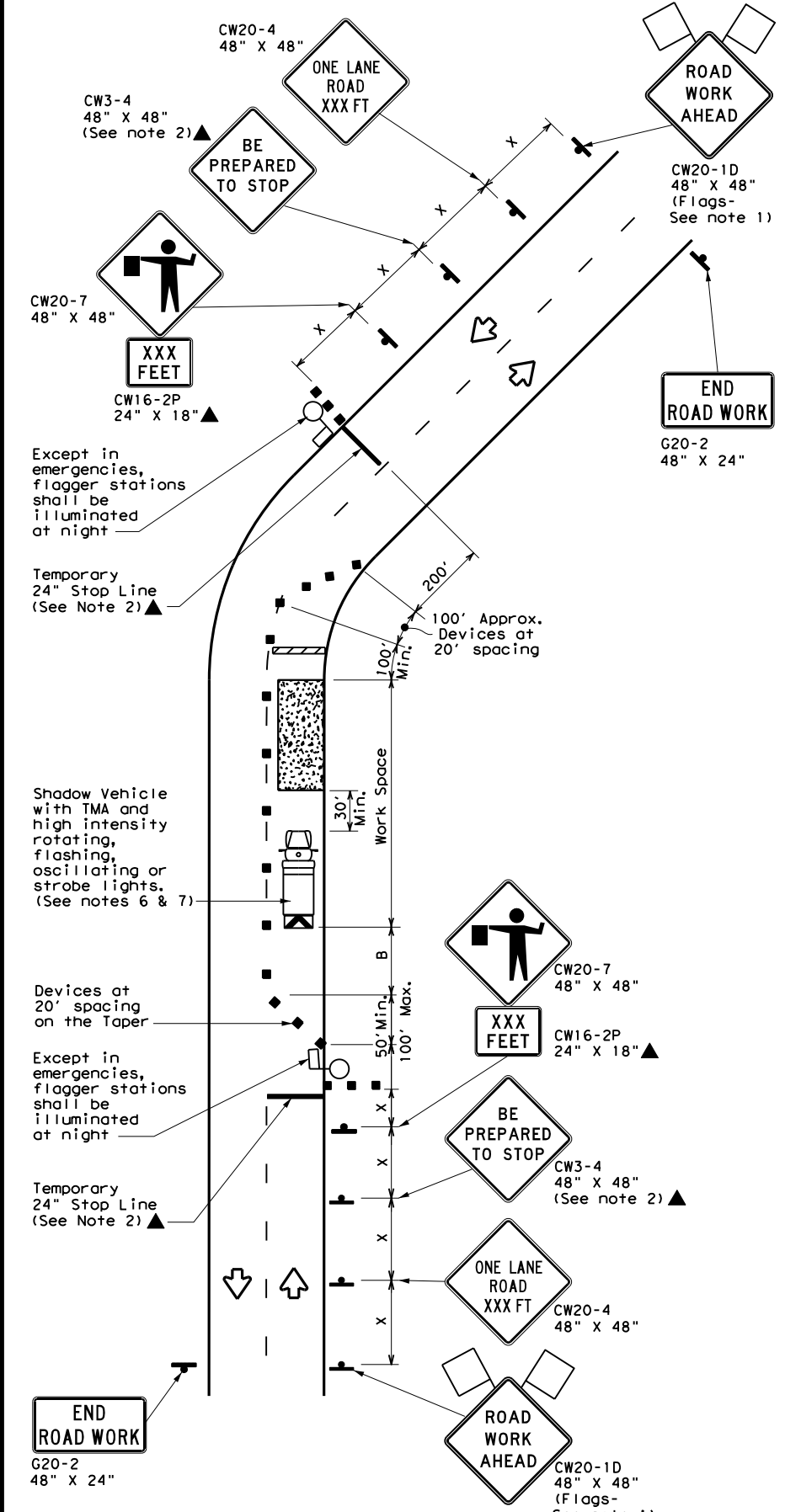
**TCP (2-1) - 18**

FILE: tcp2-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CON:	SECT:	JOB:	HIGHWAY:
REVISIONS	0931	04	034	FS 357
2-94 4-98	DIST:	COUNTY:	SHEET NO.:	
8-95 2-12	LFK	TRINITY	25	
1-97 2-18				

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TCP (2-2a)  
2-LANE ROADWAY WITHOUT PAVED SHOULDERS  
ONE LANE TWO-WAY  
CONTROL WITH YIELD SIGNS  
(Less than 2000 ADT - See Note 9)



TCP (2-2b)  
2-LANE ROADWAY WITHOUT PAVED SHOULDERS  
ONE LANE TWO-WAY  
CONTROL WITH FLAGGERS

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

Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "x" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent			
30	L = WS <sup>2</sup> / 60	150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	L = WS	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60		600'	660'	720'	60'	120'	600'	350'	570'
65		650'	715'	780'	65'	130'	700'	410'	645'
70		700'	770'	840'	70'	140'	800'	475'	730'
75		750'	825'	900'	75'	150'	900'	540'	820'

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓	✓	

GENERAL NOTES

- Flags attached to signs where shown, are REQUIRED.
  - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
  - The CW3-4 "BE PREPARED TO STOP" sign may be installed after the CW20-4 "ONE LANE ROAD XXX FT" sign, but proper sign spacing shall be maintained.
  - Flaggers should use two-way radios or other methods of communication to control traffic.
  - Length of work space should be based on the ability of flaggers to communicate.
  - A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
  - Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.
- TCP (2-2a)
- The R1-2 "YIELD" sign traffic control may be used on projects with approaches that have adequate sight distance. For projects in urban areas, work space should be no longer than one half city block. In rural areas, roadways with less than 2000 ADT, work space should be no longer than 400 feet.
  - The R1-2aP "YIELD TO ONCOMING TRAFFIC" sign shall be placed on a support at a 7 foot minimum mounting height.
- TCP (2-2b)
- Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
  - If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain stopping sight distance to the flagger and a queue of stopped vehicles. (See table above).
  - Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situations.

Texas Department of Transportation Traffic Operations Division Standard

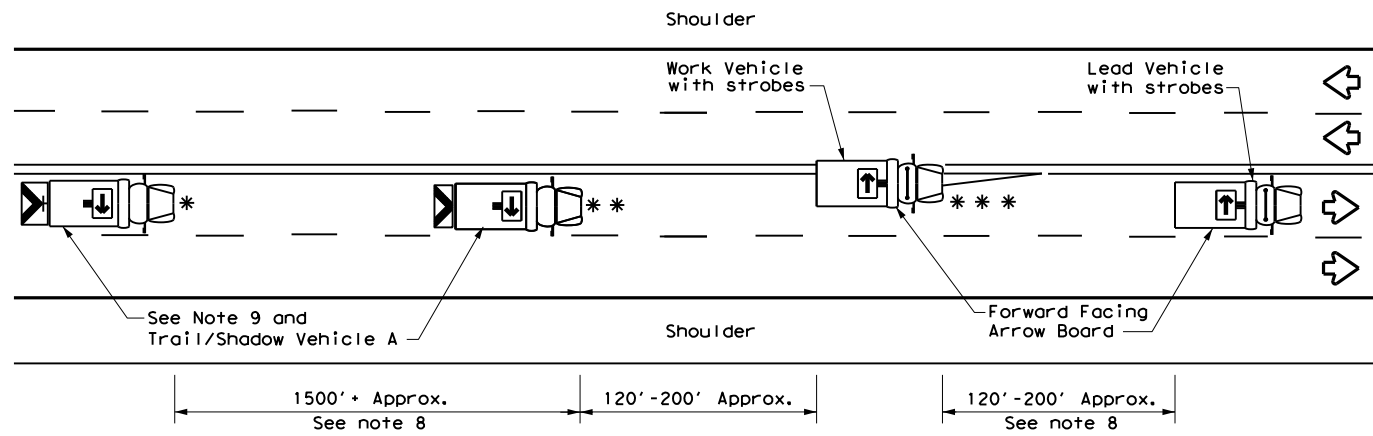
## TRAFFIC CONTROL PLAN ONE-LANE TWO-WAY TRAFFIC CONTROL

### TCP (2-2) - 18

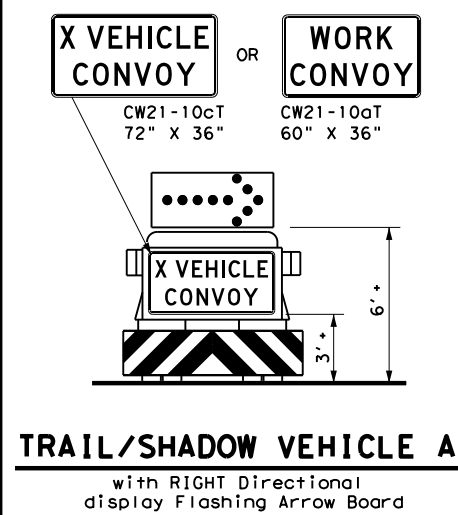
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© TxDOT December 1985	CON:	SECT:	JOB:	HIGHWAY:
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8-95 3-03	DIST:	COUNTY:	SHEET NO.:	
1-97 2-12	LFK	TRINITY	26	
4-98 2-18				

DATE:  
FILE:

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**TCP (3-1a)**  
**UNDIVIDED MULTILANE ROADWAY**



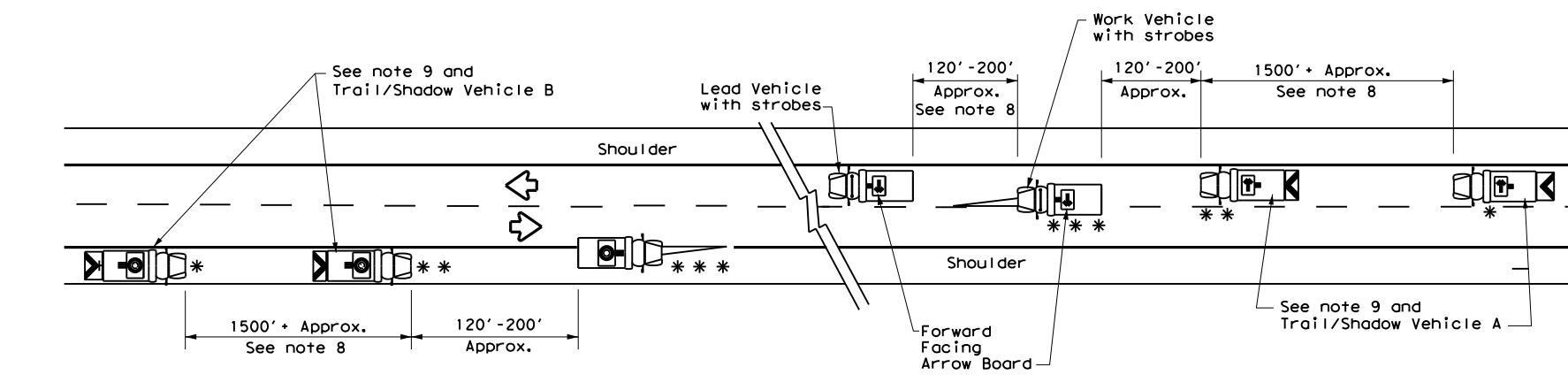
**TRAIL/SHADOW VEHICLE A**  
with RIGHT Directional display Flashing Arrow Board

LEGEND			
*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
***	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow		CAUTION (Alternating Diamond or 4 Corner Flash)

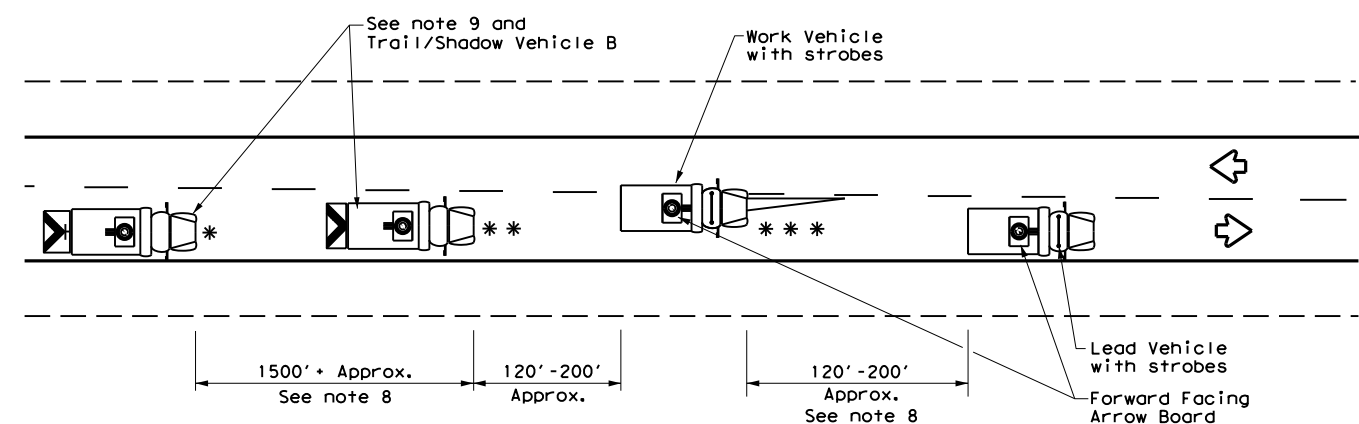
TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
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**GENERAL NOTES**

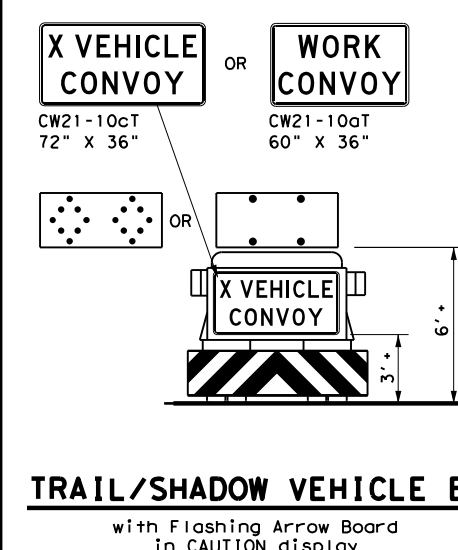
- TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used the WORK vehicle must be equipped with an arrow board. The Engineer will determine if the LEAD VEHICLE and/or TRAIL VEHICLE are required based on prevailing roadway conditions, traffic volume, and sight distance restrictions.
- The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
- The use of truck mounted attenuators (TMA) on the SHADOW VEHICLE and TRAIL VEHICLE are required.
- Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DEPARTMENTAL MATERIAL SPECIFICATION DMS 8300, Type A.
- Flashing arrow boards shall be Type B or Type C as per the Barricade and Construction (BC) standards. The board shall be controlled from inside the vehicle.
- Each vehicle shall have two-way radio communication capability.
- When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
- Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE and vehicle spacing between WORK VEHICLE and LEAD VEHICLE may vary according to terrain, work activity and other factors.
- "X VEHICLE CONVOY" (CW21-10cT) or "WORK CONVOY" (CW21-10aT) signs shall be used on TRAIL VEHICLES and SHADOW VEHICLES as shown. As an option 48" X 48" diamond shaped "WORK CONVOY" (CW21-10T) or "X VEHICLE CONVOY" (CW21-10bT) signs may be used where adequate mounting space exists. When used, the X VEHICLE CONVOY sign shall have the number of the convoy vehicles displayed on the sign in the number designation "X" location. The "X VEHICLE CONVOY" sign shall not be used on the SHADOW VEHICLE if a TRAIL VEHICLE is used.
- On two-lane two-way roadways, the work and protection vehicles should pull over periodically to allow motor vehicle traffic to pass. If motorists are not allowed to pass the work convoy, a "DO NOT PASS" (R4-1) sign should be placed on the back of the rearmost protection vehicle.



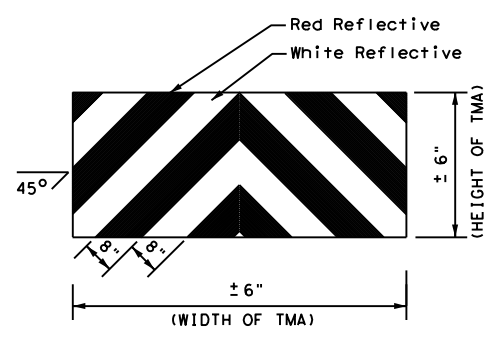
**TCP (3-1b)**  
**TWO-WAY ROADWAY WITH PAVED SHOULDERS**



**TCP (3-1c)**  
**TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS**



**TRAIL/SHADOW VEHICLE B**  
with Flashing Arrow Board in CAUTION display



**STRIPING FOR TMA**

**TRAFFIC CONTROL PLAN  
MOBILE OPERATIONS  
UNDIVIDED HIGHWAYS**

**TCP (3-1) - 13**

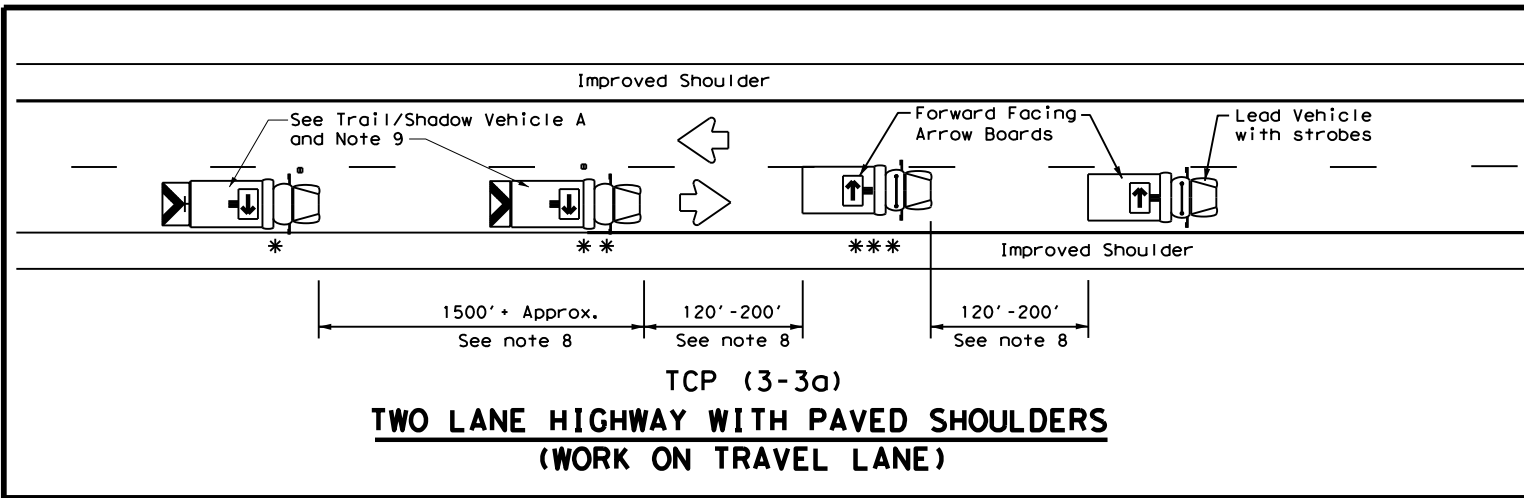
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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 7-13	LFK	TRINITY	27	
1-97				

DATE: FILE:

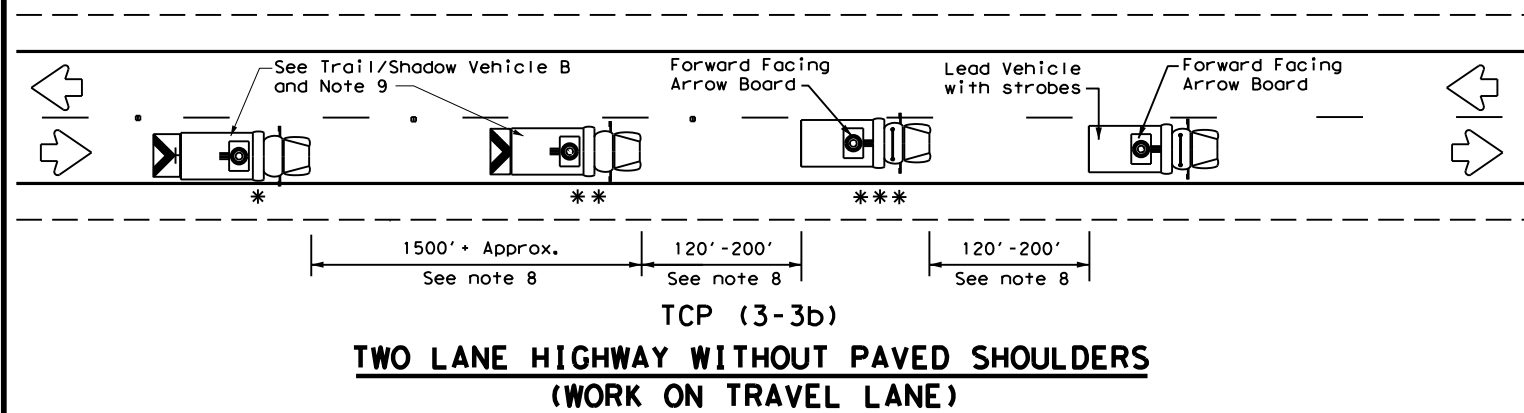


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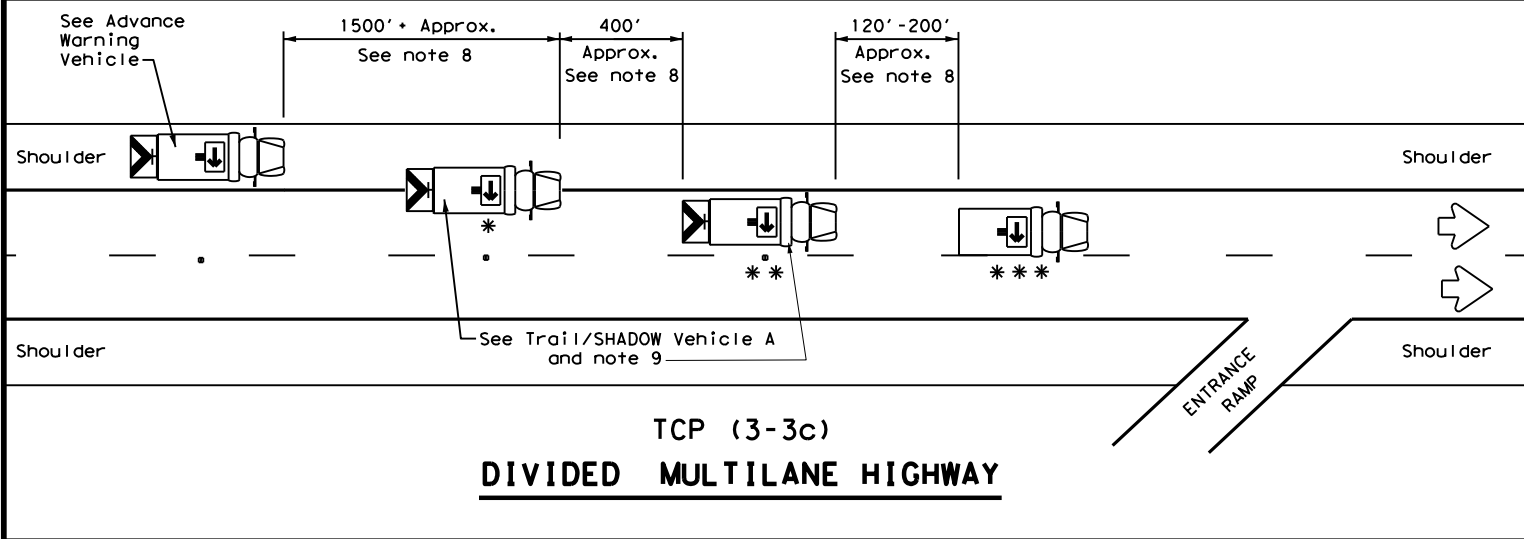
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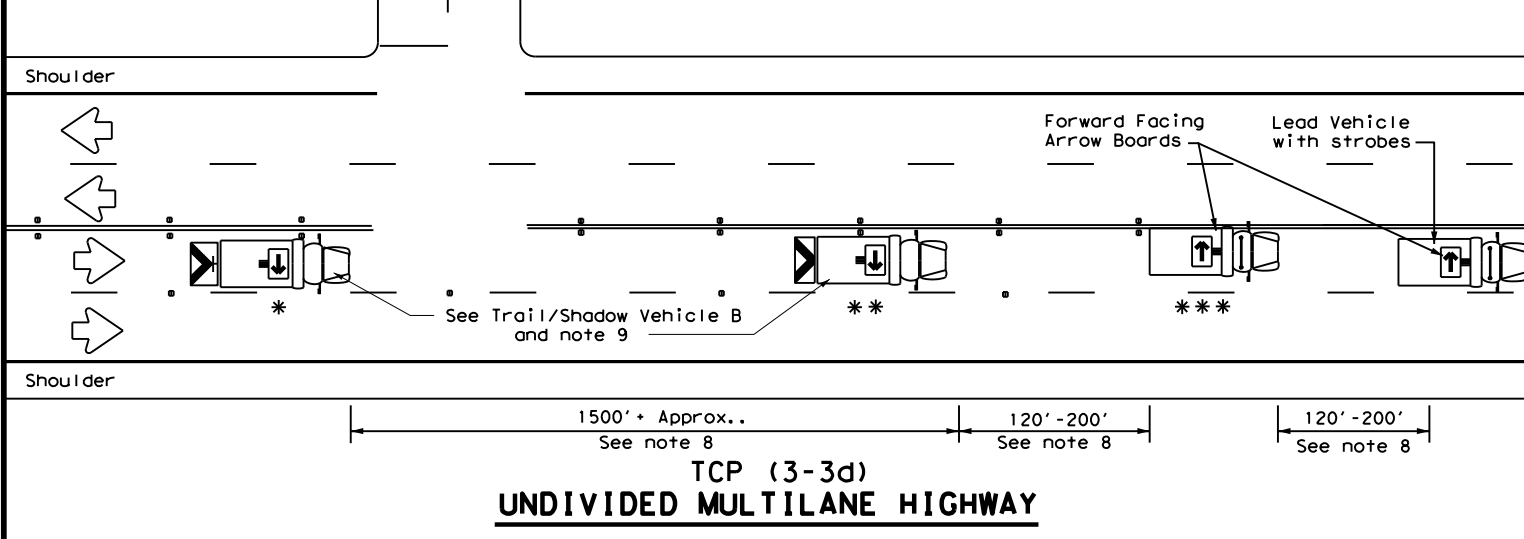
**TCP (3-3a)**  
**TWO LANE HIGHWAY WITH PAVED SHOULDERS**  
**(WORK ON TRAVEL LANE)**



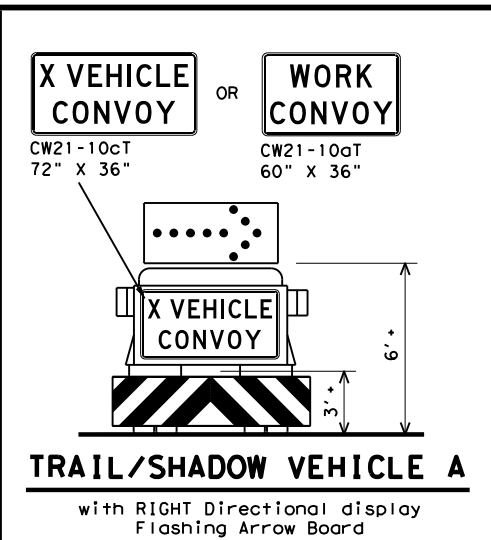
**TCP (3-3b)**  
**TWO LANE HIGHWAY WITHOUT PAVED SHOULDERS**  
**(WORK ON TRAVEL LANE)**



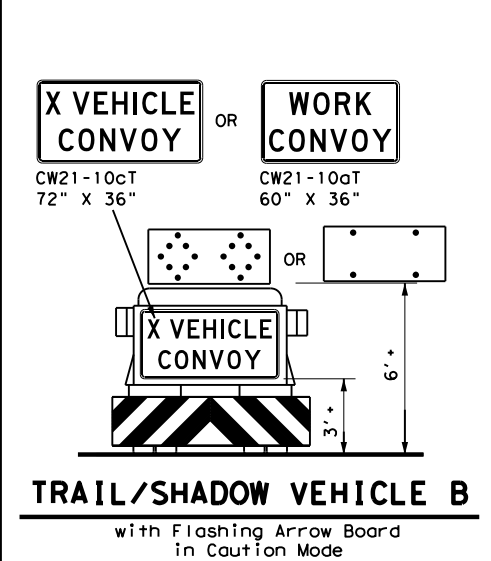
**TCP (3-3c)**  
**DIVIDED MULTILANE HIGHWAY**



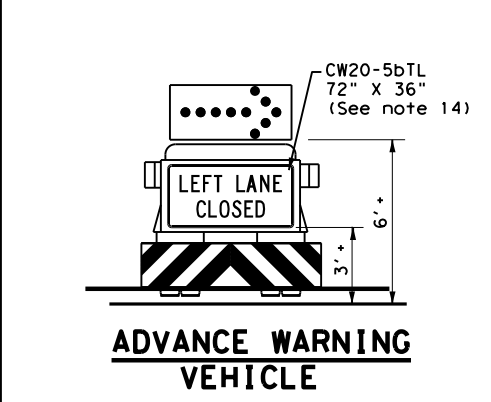
**TCP (3-3d)**  
**UNDIVIDED MULTILANE HIGHWAY**



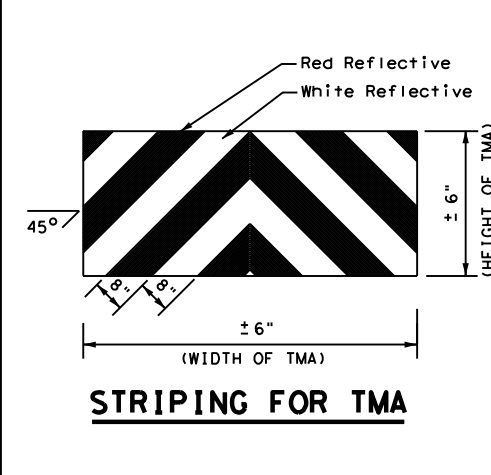
**TRAIL/SHADOW VEHICLE A**  
 with RIGHT Directional display  
 Flashing Arrow Board



**TRAIL/SHADOW VEHICLE B**  
 with Flashing Arrow Board  
 in Caution Mode



**ADVANCE WARNING VEHICLE**



**STRIPING FOR TMA**

LEGEND		
* Trail Vehicle		ARROW BOARD DISPLAY
** Shadow Vehicle		
*** Work Vehicle		RIGHT Directional
		LEFT Directional
		Double Arrow
		CAUTION (Alternating Diamond or 4 Corner Flash)

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
✓				

**GENERAL NOTES**

- TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used on two way roads the WORK vehicle must have an arrow board. For divided roadways, the arrow board on the WORK vehicle is optional based on the type of work being performed. The Engineer will determine if the LEAD vehicle and/or TRAIL vehicle are required based on prevailing roadway conditions, traffic volume, and sight distance restrictions.
- The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating, or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
- The use of truck mounted attenuators (TMA) on the SHADOW VEHICLE, ADVANCE WARNING and TRAIL VEHICLE are required.
- Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DEPARTMENTAL MATERIAL SPECIFICATION DMS 8300, Type A.
- Flashing arrow boards shall be Type B or Type C as per the Barricade and Construction (BC) standards. The board shall be controlled from inside the vehicle.
- Each vehicle shall have two-way radio communication capability.
- When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
- Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE and vehicle spacing between WORK VEHICLE and LEAD VEHICLE may vary according to terrain, work activity and other factors.
- X VEHICLE CONVOY (CW21-10cT) or WORK CONVOY (CW21-10aT) signs shall be used on TRAIL VEHICLES and SHADOW VEHICLES as shown. As an option 48" x 48" diamond shaped WORK CONVOY (CW21-10T) or X VEHICLE CONVOY (CW21-10bT) signs may be used where adequate mounting space exists. When used, the X VEHICLE CONVOY sign shall have the number of the convoy vehicles displayed on the sign in the number designation "X" location. The X VEHICLE CONVOY sign shall not be used on the SHADOW VEHICLE if a TRAIL VEHICLE is used.
- For divided highways with two or three lanes in one direction, the appropriate LEFT LANE CLOSED (CW20-5bTL), RIGHT LANE CLOSED (CW20-5bTR), or CENTER LANE CLOSED (CW20-5dT) sign should be used on the Advance Warning Vehicle. As an option, a portable changeable message sign (PCMS) or truck mounted changeable message sign (TMCMS) with a minimum character height of 12", and displaying the same legend may be substituted for these signs. An appropriate directional arrow display, simulating the size and legibility of the flashing arrow board may be used in the second phase of the PCMS/TMCMS message. When this is done, the arrow board will not be required on the Advance Warning Vehicle.
- A double arrow shall not be displayed on the arrow board on the Advance Warning Vehicle.
- For divided highways with three or four lanes in each direction, use TCP(3-2).
- Standard diamond shape versions of the CW20-5 series signs may be used as an option if the rectangular signs shown are not available.
- The Advance Warning Vehicle may straddle the edgeline when Shoulder width makes it necessary.
- On two-lane two-way roadways, the work and protection vehicles should pull over periodically to allow motor vehicle traffic to pass. If motorists are not allowed to pass the work convoy, a DO NOT PASS (R4-1) sign should be placed on the back of the rearmost protection vehicle.

Texas Department of Transportation  
 Traffic Operations Division Standard

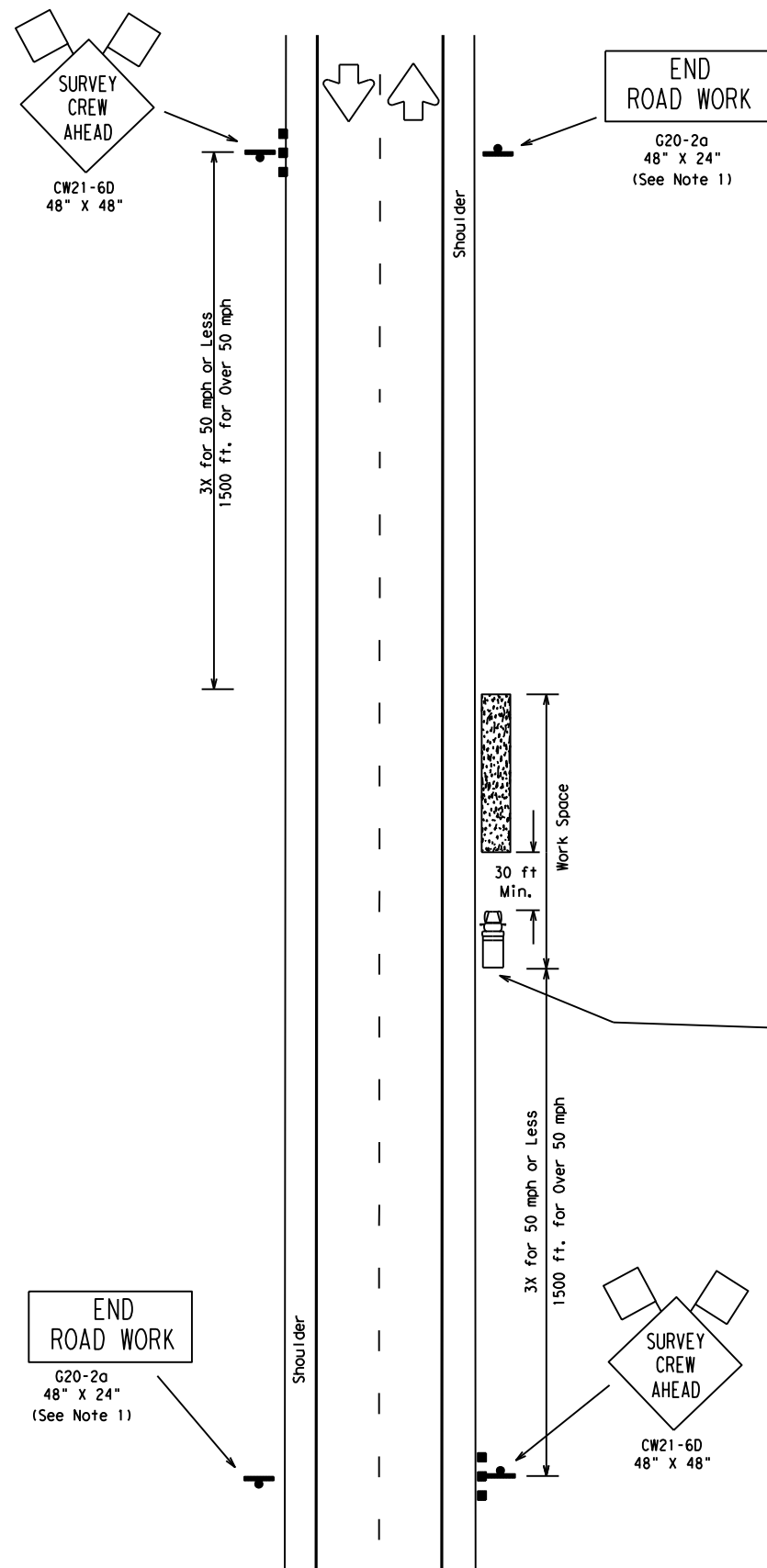
**TRAFFIC CONTROL PLAN**  
**MOBILE OPERATIONS**  
**RAISED PAVEMENT**  
**MARKER INSTALLATION/REMOVAL**  
**TCP (3-3) - 14**

FILE: tcp3-3.dgn	DN: TxDOT	CK: TxDOT	OW: TxDOT	CK: TxDOT
© TxDOT September 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 7-13	LFK	TRINITY		28
1-97 7-14				

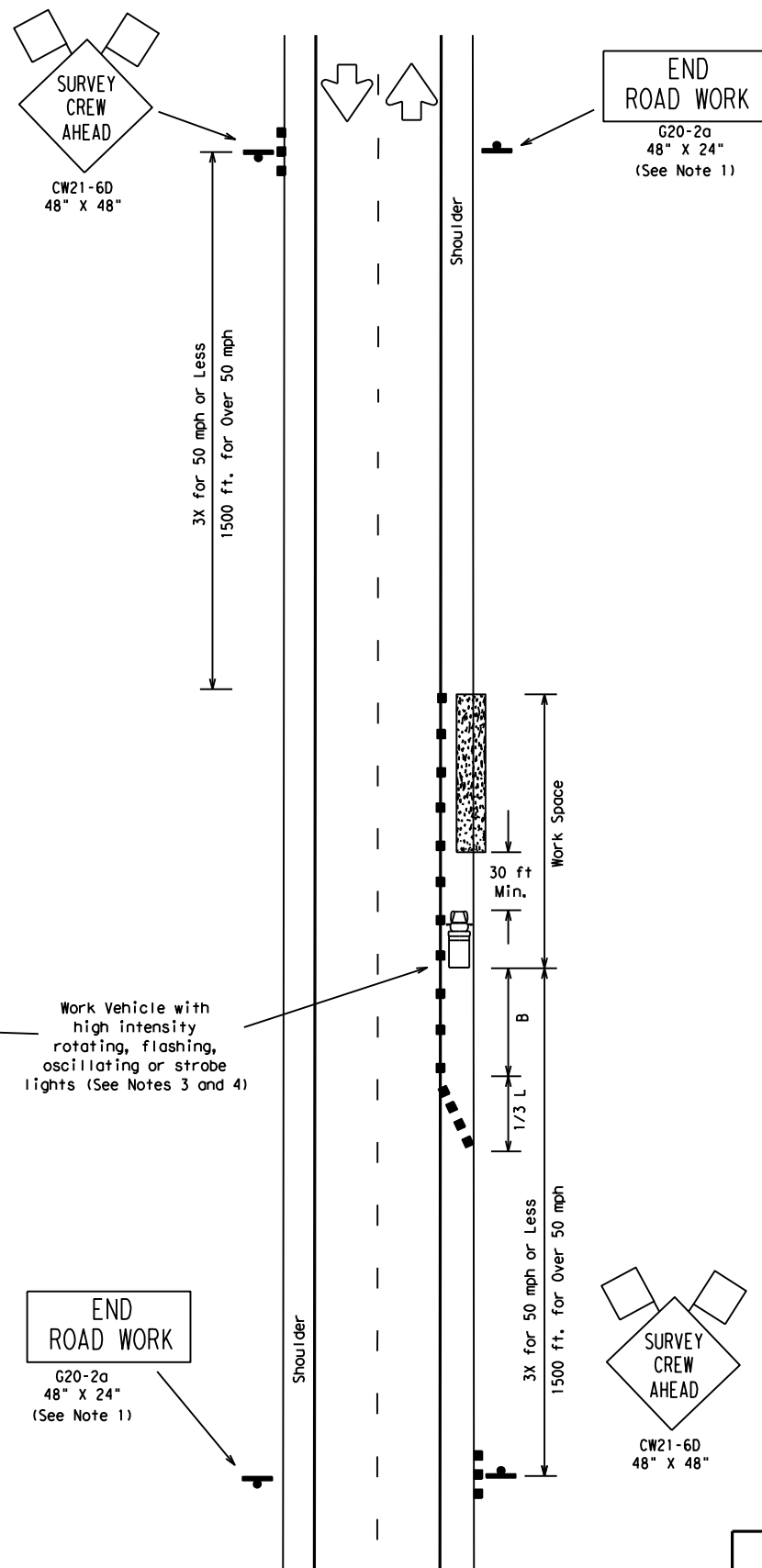


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DATE:  
FILE:



TCP (S-1a)  
WORK OFF SHOULDER  
OR PAVED SURFACE



TCP (S-1b)  
WORK ON SHOULDER

WHENEVER POSSIBLE, SURVEY PARTIES SHOULD AVOID, BY THE USE OF OFFSET LINES, ANY UNNECESSARY PERIODS OF TIME ON THE ROAD SURFACE.

8-18-08 Revision  
 Corrected misspelling.

LEGEND

	Type III Barricade		Channelizing Devices		Flag
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)		
	Trailer Mounted Flashing Arrow Panel		Portable Changeable Message Sign (PCMS)		
	Flagger		Sign Post		

Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Device		Min. Sign Spacing "X" Distance	Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60' - 75'	120'	90'
35		205'	225'	245'	35'	70' - 90'	160'	120'
40		265'	295'	320'	40'	80' - 100'	240'	155'
45		450'	495'	540'	45'	90' - 110'	320'	195'
50		500'	550'	600'	50'	100' - 125'	400'	240'
55		550'	605'	660'	55'	110' - 140'	500'	295'
60		600'	660'	720'	60'	120' - 150'	600'	350'
65	650'	715'	780'	65'	130' - 165'	700'	410'	
70	700'	770'	840'	70'	140' - 175'	800'	475'	
75	750'	825'	900'	75'	150' - 185'	900'	540'	

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

TYPICAL USAGE:

MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓		

DEFINITIONS:  
 SHORT DURATION - work that occupies a location up to 1 hour.  
 SHORT TERM STATIONARY - daytime work that occupies a location for more than 1 hour within a single daylight period.

- GENERAL NOTES:
- The G20-2a "END ROAD WORK" sign may be placed on the back of the CW21-6D "SURVEY CREW AHEAD" sign or may be omitted for short duration (less than 1 hour) work.
  - Channelizing devices on the shoulder taper and tangent section may be omitted for short duration (less than 1 hour) work.
  - If line-of-sight requirements for surveying operations will preclude the placement of the Work Vehicle to protect workers, the channelizing devices mentioned in Note 2 are required.
  - A Shadow Vehicle with a Truck Mounted Attenuator and flashing warning lights/arrow panel in caution mode may be used in lieu of the Work Vehicle to protect the work space.
  - The CW20-1D "ROAD WORK AHEAD" sign may be substituted for the CW21-6D "SURVEY CREW AHEAD" sign.
  - This plan may also be used for shoulder work or off shoulder work for multilane undivided roadways.
  - The CW21-6D "SURVEY CREW AHEAD" sign for low volume intersecting side roads is desirable, but is not required when working less than 15 minutes in area of the side road, as determined by the Engineer.
- TCP (S-1a)
- Cones may be placed at edge of pavement adjacent to the work space to enhance safety.

Texas Department of Transportation  
Traffic Operations Division

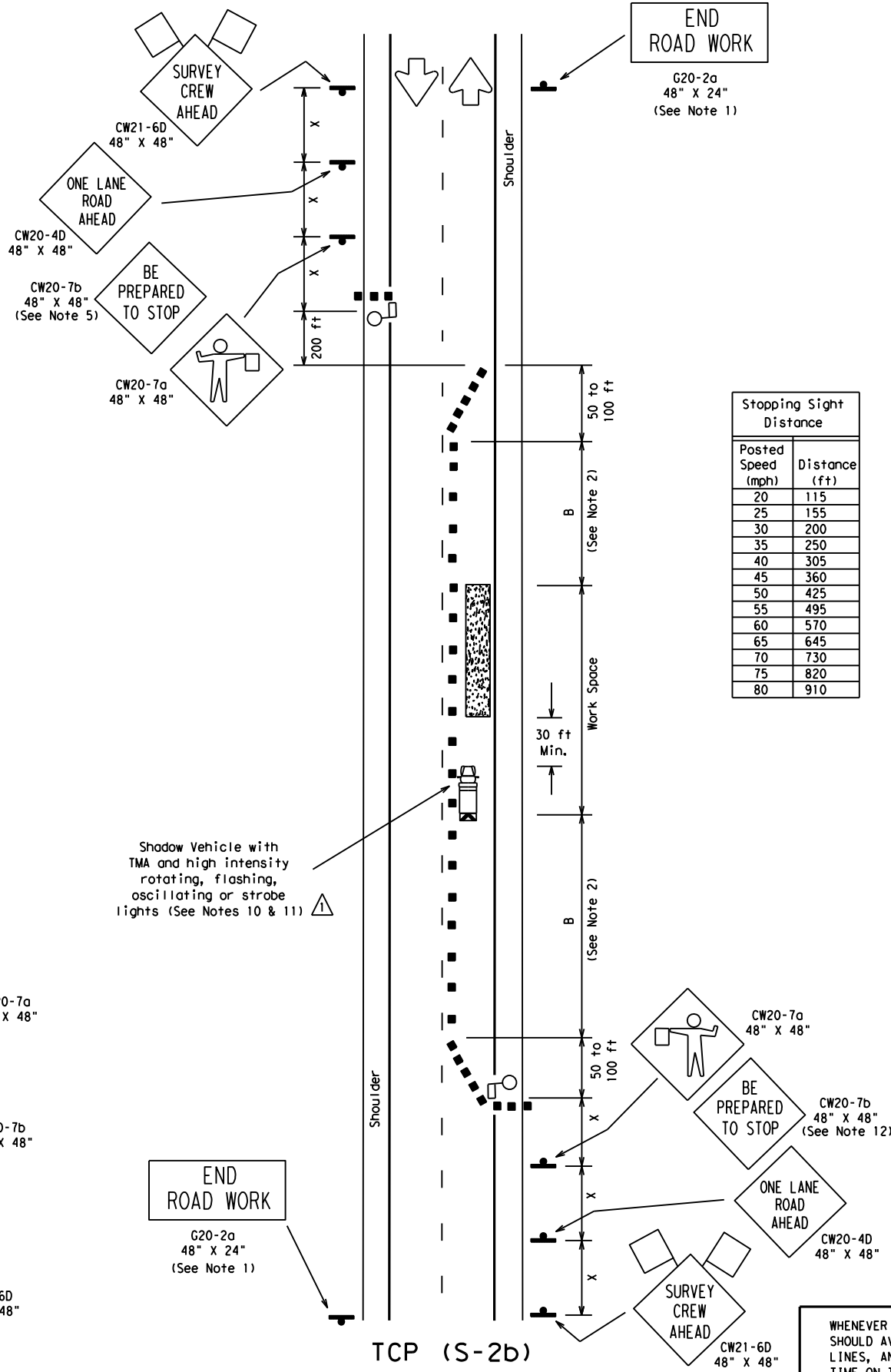
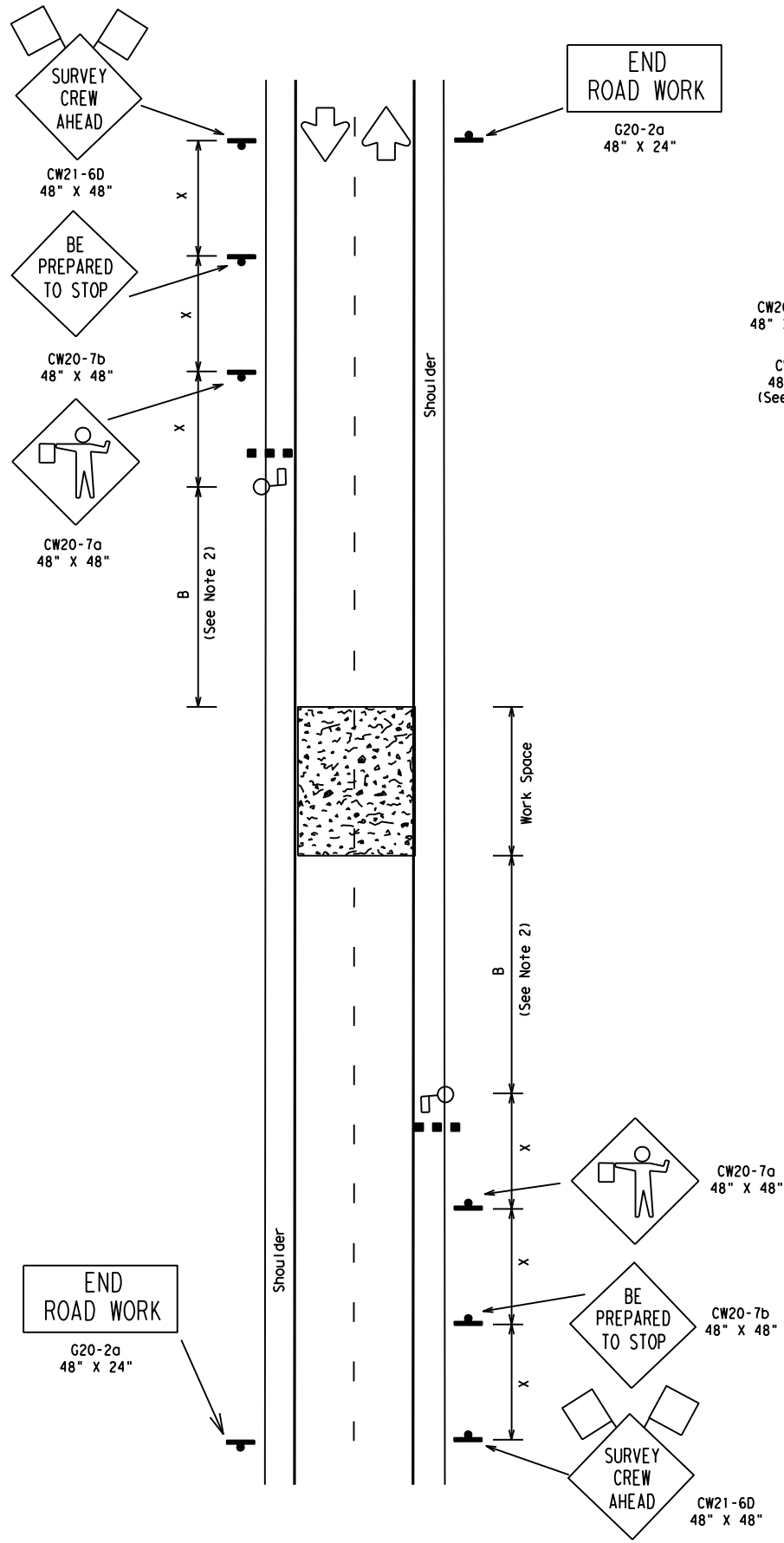
## TRAFFIC CONTROL PLAN FOR SURVEYING OPERATIONS

### TCP (S-1) - 08A

© TxDOT August 2008		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
8-08	REVISIONS		CONT	SECT	JOB
			0931	04	034
			DIST	COUNTY	SHEET NO.
		LFK	TRINITY	29	

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DATE:  
FILE:



Posted Speed (mph)	Distance (ft)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820
80	910

**LEGEND**

- Type III Barricade
- Channelizing Devices
- Flag
- Heavy Work Vehicle
- Truck Mounted Attenuator (TMA)
- Trailer Mounted Flashing Arrow Panel
- Portable Changeable Message Sign (PCMS)
- Flagger
- Sign Post

Posted Speed $\times$	Formula	Minimum Desirable Taper Lengths $\times$			Suggested Maximum Spacing of Device		Min. Sign Spacing "X" Distance	Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'-75'	120'	90'
35		205'	225'	245'	35'	70'-90'	160'	120'
40		265'	295'	320'	40'	80'-100'	240'	155'
45		450'	495'	540'	45'	90'-110'	320'	195'
50		500'	550'	600'	50'	100'-125'	400'	240'
55	$L = WS$	550'	605'	660'	55'	110'-140'	500'	295'
60		600'	660'	720'	60'	120'-150'	600'	350'
65		650'	715'	780'	65'	130'-165'	700'	410'
70		700'	770'	840'	70'	140'-175'	800'	475'
75		750'	825'	900'	75'	150'-185'	900'	540'

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

MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓		

**DEFINITIONS:**  
 SHORT DURATION - work that occupies a location up to 1 hour.  
 SHORT TERM STATIONARY - daytime work that occupies a location for more than 1 hour within a single daylight period.

- GENERAL NOTES:**
- The G20-2a "END ROAD WORK" sign may be placed on the back of the CW21-6D "SURVEY CREW AHEAD" sign or may be omitted for short duration (less than 1 hour) work.
  - Adequate Stopping Sight Distance (see Stopping Sight Distance table) should be maintained from approaching traffic to the flagger or a queue of stopped vehicles. The Buffer Space "B" should be extended around curves or other obstacles, when necessary, to have adequate Stopping Sight Distance to the flagger station.
  - Flaggers should use two-way radios or other means of communication while flagging.
  - The length of the work space should be based on the ability of the flaggers to communicate.
  - CW20-1D "ROAD WORK AHEAD" signs may be substituted for CW21-6D "SURVEY CREW AHEAD" signs.
  - The CW21-6D "SURVEY CREW AHEAD" sign for low volume intersecting side roads is desirable, but is not required when working less than 15 minutes in area of the side road, as determined by the Engineer.

- TCP (S-2a)**
- Road closures shall be less than 20 minutes. Closures less than 5 minutes are desirable.
  - Sign spacing should be increased if traffic repeatedly queues past the CW20-7b "BE PREPARED TO STOP" sign.
  - The surveying instrument should not be located on the paved surface.
- TCP (S-2b)**
- For short duration work the Shadow Vehicle with a TMA may be replaced by another Work Vehicle with high intensity rotating, flashing or strobe lights.
  - Shadow Vehicles with a TMA are desirable when workers or equipment are in the work space. When approved by the engineer, Type III barricades or other channelizing devices may be substituted for the Shadow Vehicle.
  - The CW20-7b "BE PREPARED TO STOP" sign is optional. When used, it should be installed after the CW20-4D "ONE LANE ROAD AHEAD" sign.

WHENEVER POSSIBLE, SURVEY PARTIES SHOULD AVOID, BY THE USE OF OFFSET LINES, ANY UNNECESSARY PERIODS OF TIME ON THE ROAD SURFACE.

8-18-08 Revision  
 ⚠ Corrected reference to notes.

**Texas Department of Transportation**  
 Traffic Operations Division

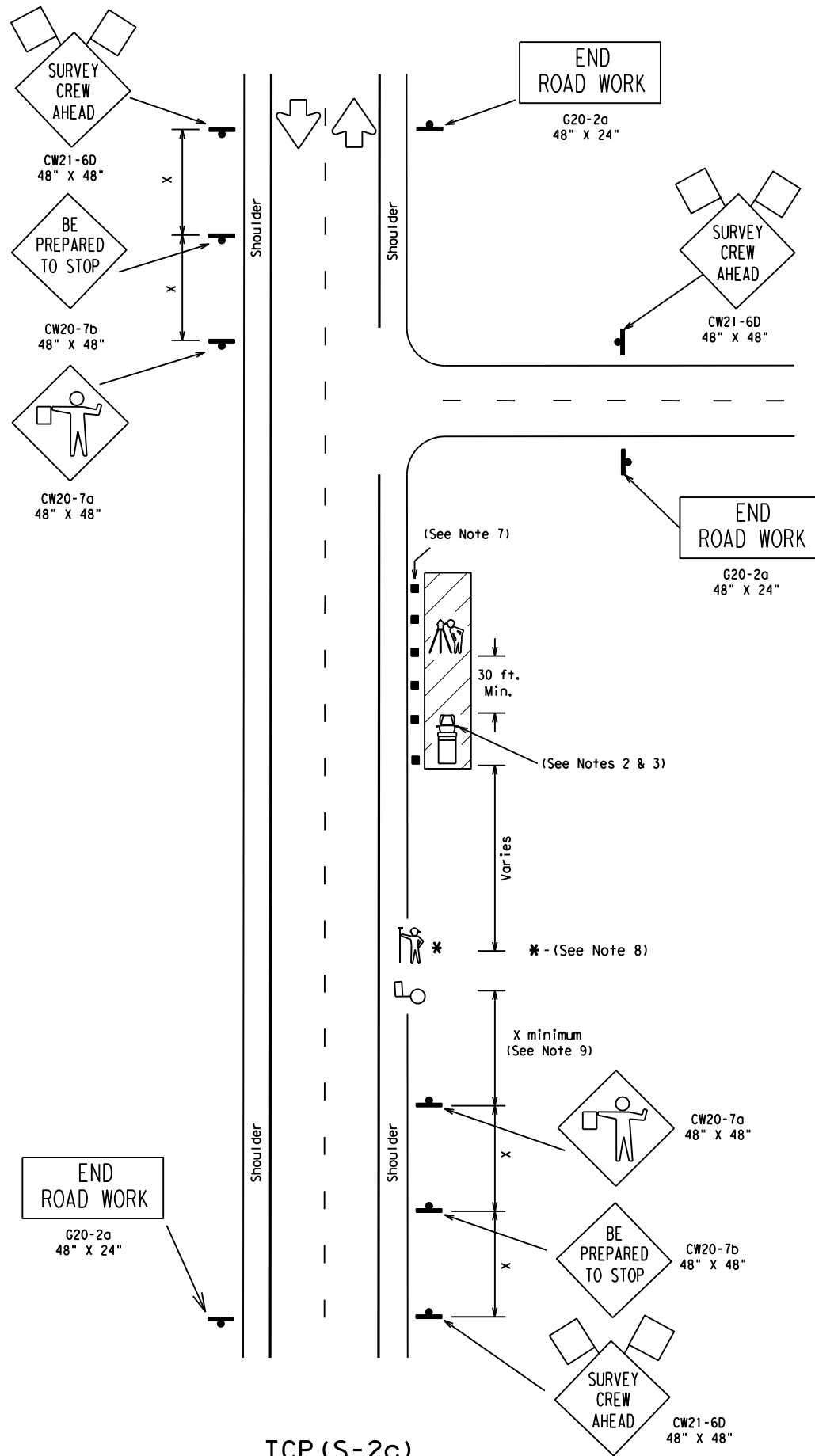
**TRAFFIC CONTROL PLAN FOR SURVEYING OPERATIONS**

**TCP (S-2) -08A**

© TxDOT August 2008		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
8-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
		0931	04	034	FS 357
		DIST	COUNTY	SHEET NO.	
		LFK	TRINITY	30	

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DATE:  
FILE:



TCP (S-2c)

Posted Speed (mph)	Distance (ft)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820
80	910

LEGEND

- Type III Barricade
- Channelizing Devices
- Flag
- Work Vehicle
- Truck Mounted Attenuator (TMA)
- Flagger
- Sign Post
- Survey Rodman
- Instrument Person

Posted Speed %	Formula	Minimum Desirable Taper Lengths %			Suggested Maximum Spacing of Device		Min. Sign Spacing "x" Distance	Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60' - 75'	120'	90'
35		205'	225'	245'	35'	70' - 90'	160'	120'
40		265'	295'	320'	40'	80' - 100'	240'	155'
45	L=WS	450'	495'	540'	45'	90' - 110'	320'	195'
50		500'	550'	600'	50'	100' - 125'	400'	240'
55		550'	605'	660'	55'	110' - 140'	500'	295'
60		600'	660'	720'	60'	120' - 150'	600'	350'
65		650'	715'	780'	65'	130' - 165'	700'	410'
70		700'	770'	840'	70'	140' - 175'	800'	475'
75		750'	825'	900'	75'	150' - 185'	900'	540'

\* Conventional Roads Only

\*\* Taper lengths have been rounded off.

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

	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
MOBILE	✓	✓		

DEFINITIONS:

MOBILE - work that moves continuously or intermittently (stopping up to approximately 15 minutes).

SHORT DURATION - work that occupies a location up to 1 hour.

SHORT TERM STATIONARY - daytime work that occupies a location for more than 1 hour within a single daylight period.

GENERAL NOTES:

- The G20-2a "END ROAD WORK" sign may be placed on the back of the CW21-6D "SURVEY CREW AHEAD" sign or may be omitted for short duration (less than 1 hour) work.
- Work Vehicle with high intensity rotating, flashing, oscillating or strobe lights should be used to protect work space.
- When approved by the engineer, Type III barricades or other channelizing devices may be substituted for the Heavy Work Vehicle.
- CW20-1D "ROAD WORK AHEAD" signs may be substituted for CW21-6D "SURVEY CREW AHEAD" SIGNS.
- The CW21-6D "SURVEY CREW AHEAD" sign for low volume intersecting side roads may be omitted when approved by the Engineer.
- The Surveying Instrument shall not be located on the paved surface.
- Cones at edge of pavement adjacent to instrument person may be omitted when approved by the Engineer.
- Rodman may only enter roadway when accompanied by flagger and as traffic allows.
- The distance between the advance warning signs and the work should not exceed a two mile maximum.
- Flaggers and Survey Crew should use two-way radios or other means of communication.
- Survey Crew and Flaggers shall wear high-visibility apparel meeting the ANSI 107-2007 standard performance for Class 2 or Class 3 risk exposure.
- Additional traffic control devices may be required to address local site conditions.
- Stopping Sight Distance shall be maintained from approaching traffic to the flagger. See "Stopping Sight Distance" table.

SURVEY PARTIES SHOULD AVOID ANY UNNECESSARY PERIODS OF TIME ON THE ROAD SURFACE.

This TCP is to cover two lane rural type roadways as determined by the Engineer. All other type roadways will be covered by other established Survey TCP'S.



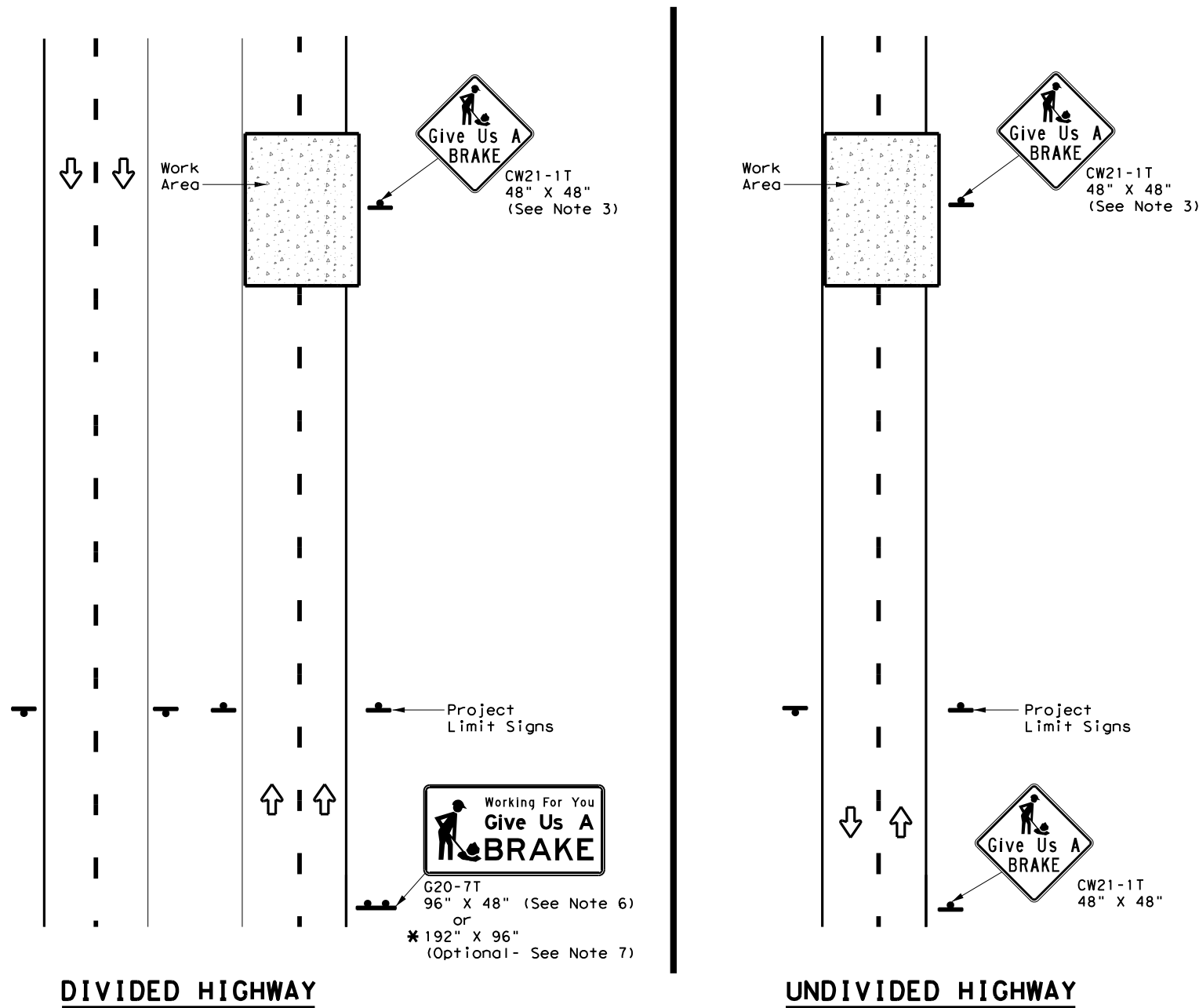
TRAFFIC CONTROL PLAN FOR SURVEYING OPERATIONS

TCP (S-2c) - 10

© TxDOT January 2010		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
REVISIONS		CONT	SECT	JOB	HIGHWAY
		0931	04	034	FS 357
		DIST	COUNTY		SHEET NO.
		LFK	TRINITY		31

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DATE:  
FILE:



SIGNS ARE SHOWN FOR ONE DIRECTION OF TRAVEL

\* When the optional larger WORKING FOR YOU GIVE US A BRAKE (G20-7T) 192" x 96" sign is required, the locations shall be noted elsewhere in the plans.

SUMMARY OF LARGE SIGNS

BACKGROUND COLOR	SIGN DESIGNATION	SIGN	SIGN DIMENSIONS	REFLECTIVE SHEETING	SQ FT	GALVANIZED STRUCTURAL STEEL		DRILLED SHAFT
						Size	(LF)	
							① ②	24" DIA. (LF)
Orange	G20-7T		96" X 48"	Type B <sub>FL</sub> or C <sub>FL</sub>	32	▲	▲ ▲	▲
Orange	G20-7T		192" X 96"	Type B <sub>FL</sub> or C <sub>FL</sub>	128	W8x18	16 17	12

▲ See Note 6 Below

LEGEND	
	Sign
	Large Sign
	Traffic Flow

DEPARTMENTAL MATERIAL SPECIFICATIONS	
PLYWOOD SIGN BLANKS	DMS-7100
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

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

GENERAL NOTES

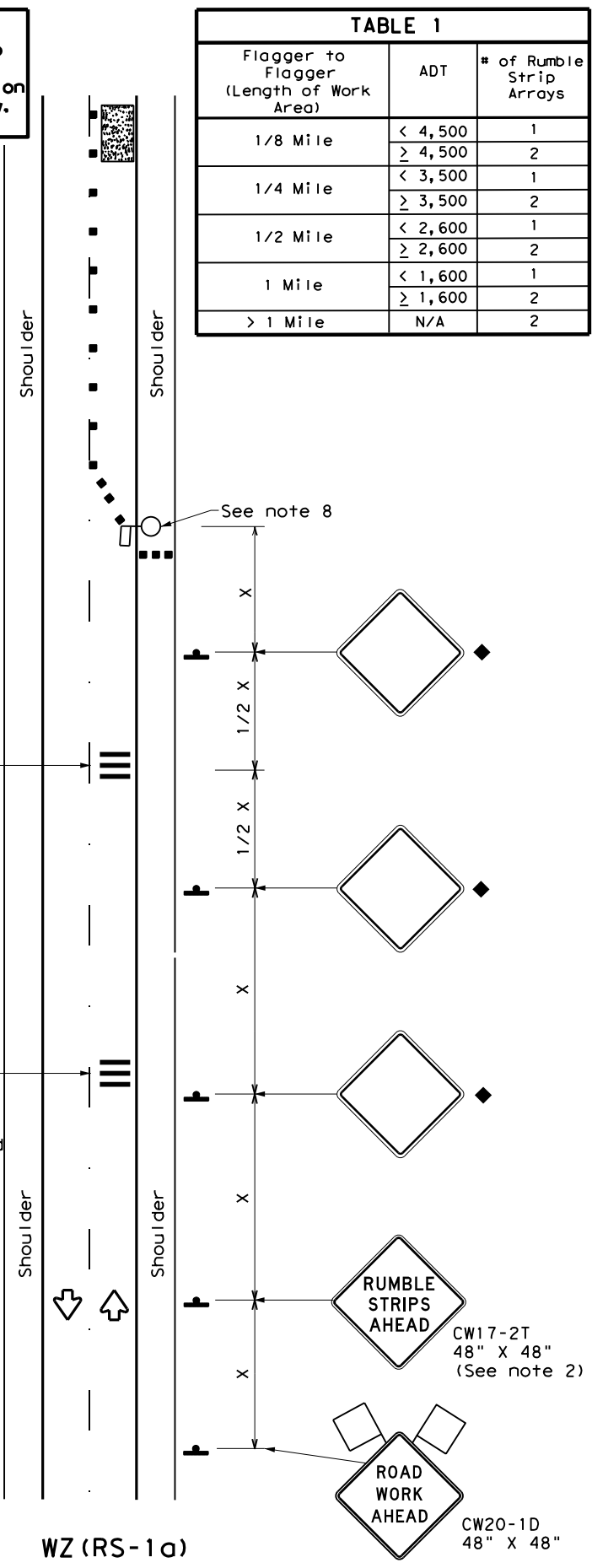
- See BC and SMD sheets for additional sign support details.
- Sign locations shall be approved by the Engineer.
- For projects more than two miles in length, Give Us a BRAKE signs should be repeated halfway through the project. The Give Us a Brake (CW21-1T) may be used for this purpose.
- Work zone speed limits are sometimes used in conjunction with GIVE US A BRAKE signing. See BC(3) for location and spacing of construction speed zone signing when required.
- Give Us a Brake (CW21-1T) signs and supports shall be considered subsidiary to Item 502, "Barricades, Signs and Traffic Handling."
- The 96" X 48" Working For You Give Us A BRAKE (G20-7T) may use a 1/2" or 5/8" plywood substrate or 0.125" aluminum sheeting substrate and may be supported by two 4" x 6" wood posts with drilled holes for breakaway as per BC(5) and will be subsidiary to Item 502.
- The Working For You Give Us A BRAKE (G20-7T) 192" X 96" sign shall be paid for under the following specification items:  
 Item 636 - Aluminum Signs  
 Item 647 - Large Roadside Sign Supports and Assemblies.  
 Item 416 - Drilled Shaft Foundations
- All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition. Sign details not shown in this manual shall be shown in the plans or the Engineer shall provide a detail to the Contractor before the sign is manufactured.

		Traffic Operations Division Standard	
<b>WORK ZONE "GIVE US A BRAKE" SIGNS</b>			
<b>WZ (BRK) - 13</b>			
FILE: wzbrk-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
©TxDOT August 1995	CONT	SECT	JOB
REVISIONS	0931	04	034
6-96 5-98 7-13	DIST	COUNTY	SHEET NO.
8-96 3-03	LFK	TRINITY	33

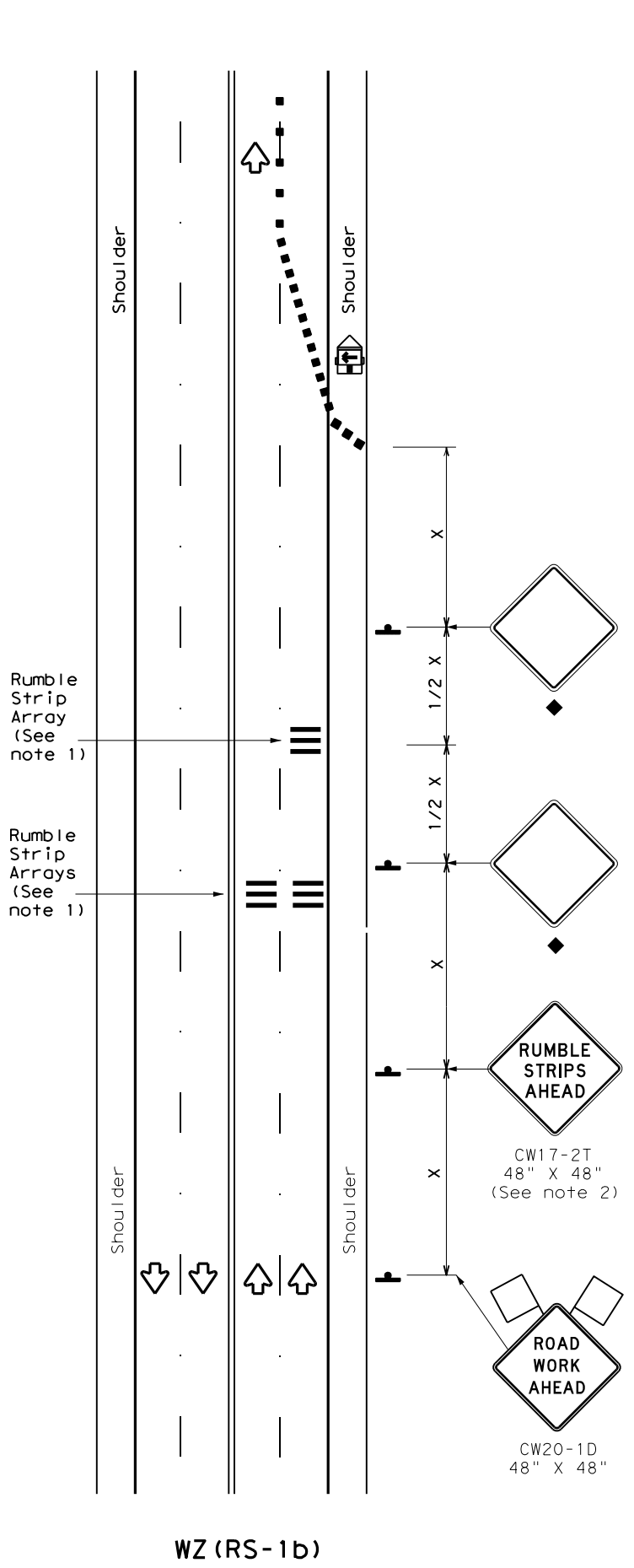
DATE: 5/24/2022 4:53:24 PM  
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Warning sign and rumble strip sequence in opposite direction is same as below.

Flagger to Flagger (Length of Work Area)	ADT	# of Rumble Strip Arrays
1/8 Mile	< 4,500	1
	≥ 4,500	2
1/4 Mile	< 3,500	1
	≥ 3,500	2
1/2 Mile	< 2,600	1
	≥ 2,600	2
1 Mile	< 1,600	1
	≥ 1,600	2
> 1 Mile	N/A	2



**RUMBLE STRIPS ON ONE-LANE TWO-WAY APPLICATION**



**RUMBLE STRIPS FOR LANE CLOSURE ON CONVENTIONAL ROADWAY**

**GENERAL NOTES**

- Each Rumble Strip Array should consist of three rumble strips spaced center to center at the spacing shown in Table 2, placed transverse across the lane at locations shown.
- The CW17-2T "RUMBLE STRIPS AHEAD" sign should be located after the CW20-1D "ROAD WORK AHEAD" sign and spaced as shown. If traffic is observed to be queuing, or is expected to queue beyond the Rumble Strips, the CW17-2T sign and the first Rumble Strip Array may be located upstream of the CW20-1D sign as necessary to provide needed warning.
- Temporary Rumble Strips will be considered subsidiary to Item 502, and shall be a product listed on the Compliant Work Zone Traffic Control Devices.
- Remove Temporary Rumble Strips before removing the advanced warning signs.
- Temporary Rumble Strips should not be used on horizontal curves, loose gravel, soft or bleeding asphalt, heavily rutted pavements or unpaved surfaces.
- Temporary Rumble Strips shall be installed and maintained as per manufacturer's recommendations.
- This standard sheet shall be used in conjunction with other appropriate TCP standard, TMUTCD typical application or project specific detail for the project.
- The one-lane two-way application may utilize a flagger, an Automated Flagger Assistance Device (AFAD) or a Portable Traffic Signal (PTS).
- Replace defective Temporary Rumble Strips as directed by the Engineer.
- Temporary Rumble Strips may be used on freeways or expressways based on engineering judgment and written direction from the Engineer.

Speed	Approximate distance between strips in an array
≤ 40 MPH	10'
> 40 MPH & ≤ 55 MPH	15'
= 60 MPH	20'
≥ 65 MPH	* 35' +

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

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

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

MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓		

◆ Signs are for illustrative purposes only. Signs required may vary depending on the TCP, TMUTCD Typical Application, or project specific details for the project.  
 \* For posted speeds in excess of 65 MPH, it is recommended that spacing is increased as speed limits increase. Increasing space between rumble strips will improve effectiveness.

Texas Department of Transportation  
 Traffic Safety Division Standard

## TEMPORARY RUMBLE STRIPS

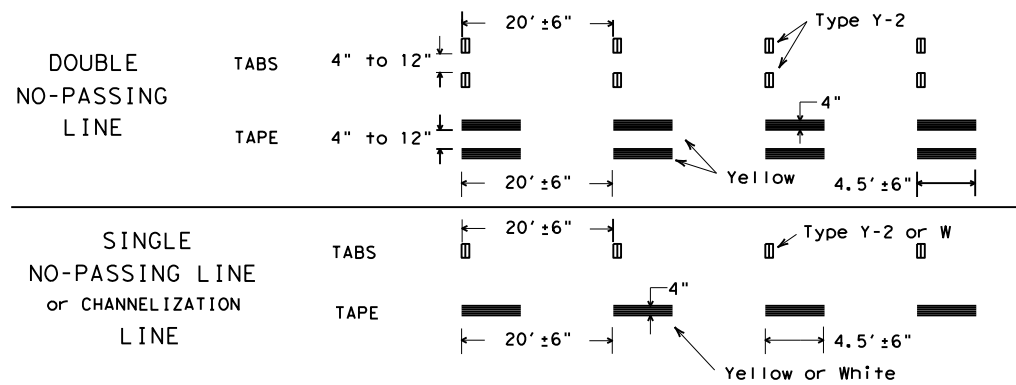
### WZ (RS) - 22

FILE: wzrs22.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
2-14 1-22	DIST	COUNTY	SHEET NO.	
4-16	LFK	TRINITY	34	

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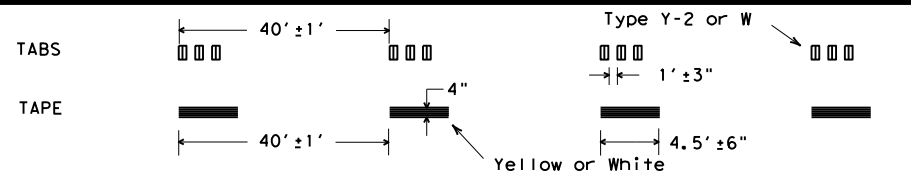
## WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS

### SOLID LINES



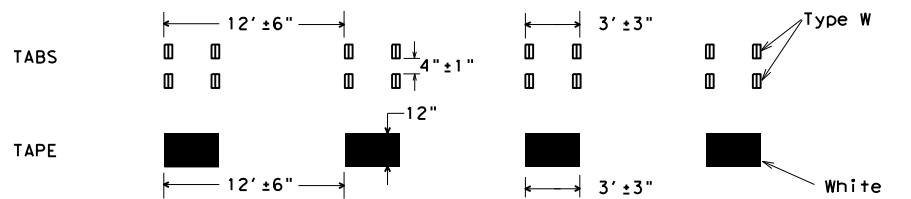
### BROKEN LINES

(FOR CENTER LINE OR LANE LINE)

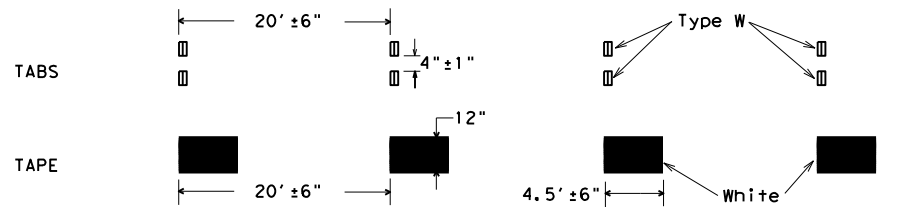


### WIDE DOTTED LINES

(FOR LANE DROP LINES)



### WIDE GORE MARKINGS



#### NOTES:

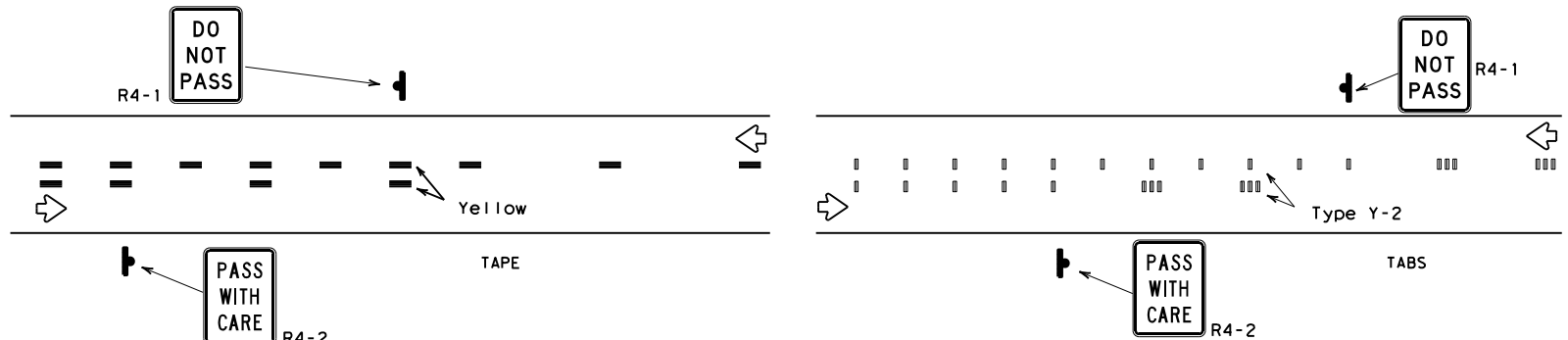
- Short term pavement markings may be prefabricated markings (stick down tape) or temporary flexible-reflective roadway marker tabs unless otherwise specified elsewhere in plans.
- Short term pavement markings shall NOT be used to simulate edge lines.
- Dimensions indicated on this sheet are typical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

#### TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

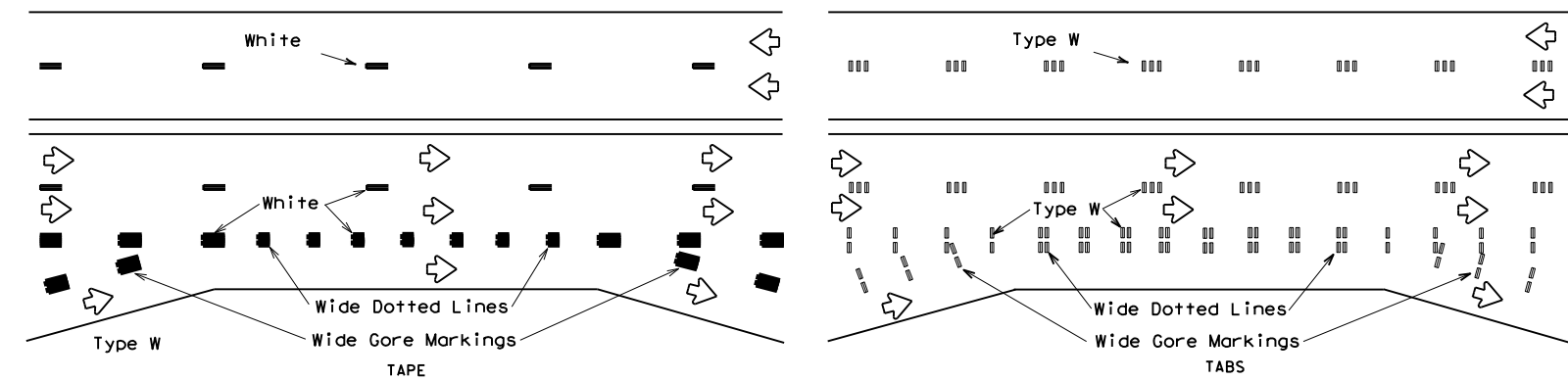
- Temporary flexible-reflective roadway marker tabs detailed on this sheet will be designated Type Y-2 (two amber reflective surfaces with yellow body); Type Y (one amber reflective surface with yellow body); and Type W (one white or silver reflective surface with white body). Additional details may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

DATE:  
FILE:

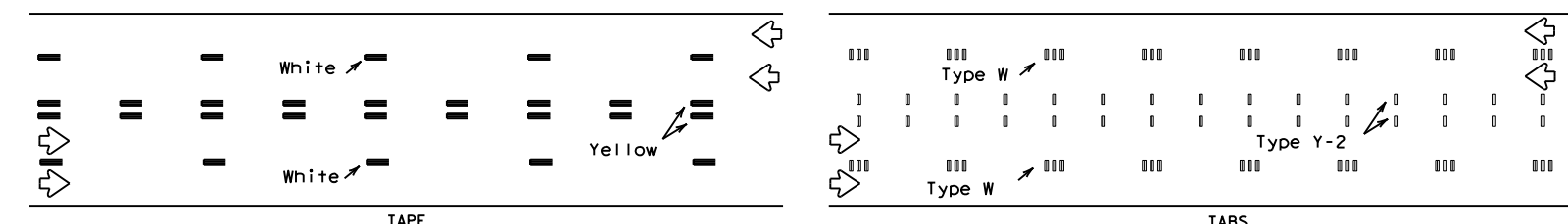
## WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



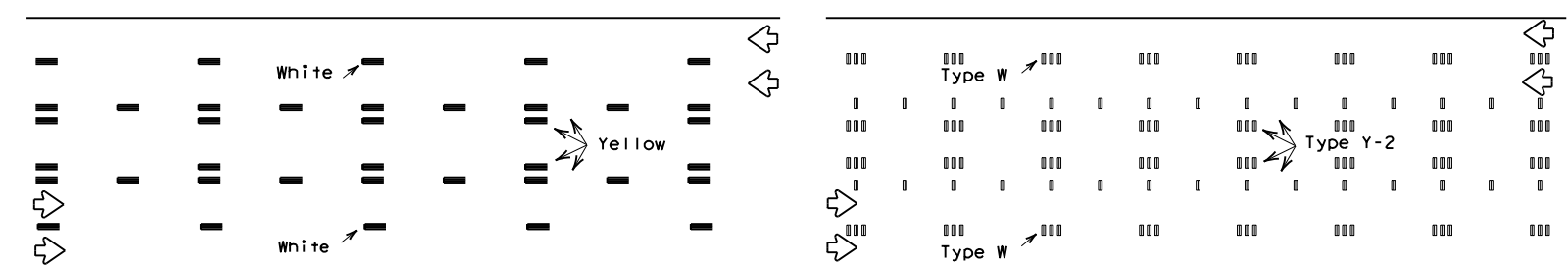
### CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



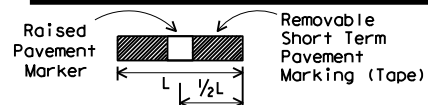
### LANE LINES FOR DIVIDED HIGHWAY



### LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



### TWO-WAY LEFT TURN LANE



If raised pavement markers are used to supplement REMOVABLE short term markings, the markers shall be applied to the top of the tape at the approximate mid length of the tape. This allows an easier removal of raised markers and tape.

#### PREFABRICATED PAVEMENT MARKINGS

- Temporary Removable Prefabricated Pavement Markings shall meet the requirements of DMS-8241.
- Non-removable Prefabricated Pavement Markings shall meet the requirements of either DMS-8240 "Permanent Prefabricated Pavement Markings" or DMS-8243 "Temporary Construction-Grade Prefabricated Pavement Markings."

#### RAISED PAVEMENT MARKERS

- All raised pavement markers used for work zone markings shall meet the requirements of Item 672, "RAISED PAVEMENT MARKERS" and DMS-4200.

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

- DMSs referenced above can be found along with embedded links to their respective MPLs at the following website:  
[http://www.txdot.gov/business/contractors\\_consultants/material\\_specifications/default.htm](http://www.txdot.gov/business/contractors_consultants/material_specifications/default.htm)



## WORK ZONE SHORT TERM PAVEMENT MARKINGS

### WZ (STPM) - 13

FILE:	wzstpm-13.dgn	DN:	TxDOT	CK:	TxDOT	OW:	TxDOT	CK:	TxDOT
© TxDOT	April 1992	CONT:	0931	SECT:	04	JOB:	034	HIGHWAY:	
REVISIONS:		DIST:	LFK	COUNTY:	TRINITY	SHEET NO.:		34	

LEGEND

 ADDITIONAL LEVEL-UP TO CORRECT SUPER-ELEVATION

FS 357			TRAVEL LANE CROSS SLOPE LEFT (%)	SHOULDER CROSS SLOPE RIGHT (%)
BEGIN PROJECT			-2.00	-2.00
367+03	END NC	>	-2.00	-2.00
SUPERELEVATION TRANSITION				
369+07	BEGIN FS		-6.00	6.00
370+40	END FS	>	-6.00	6.00
SUPERELEVATION TRANSITION				
372+44	BEGIN NC		-2.00	-2.00
393+72	END NC	>	-2.00	-2.00
SUPERELEVATION TRANSITION				
395+76	BEGIN FS		6.00	-6.00
399+86	END FS	>	6.00	-6.00
SUPERELEVATION TRANSITION				
401+90	BEGIN NC		-2.00	-2.00
409+80	END NC	>	-2.00	-2.00
SUPERELEVATION TRANSITION				
411+84	BEGIN FS		6.00	-6.00
415+82	END FS	>	6.00	-6.00
SUPERELEVATION TRANSITION				
417+86	BEGIN NC		-2.00	-2.00
END PROJECT			-2.00	-2.00

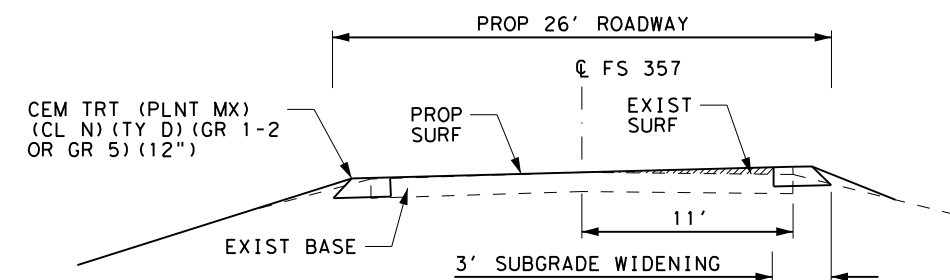
69 TONS SP-C

1311 TONS SP-C

183 TONS SP-C

NC = NORMAL CROWN  
FS = FULL SUPERELEVATION

NOTE: ALL TRANSITIONS ARE LINEAR; 55 MPH DESIGN SPEED;  
30% RUNOFF WITHIN CURVE; SHOULDER SLOPES MATCH LANES

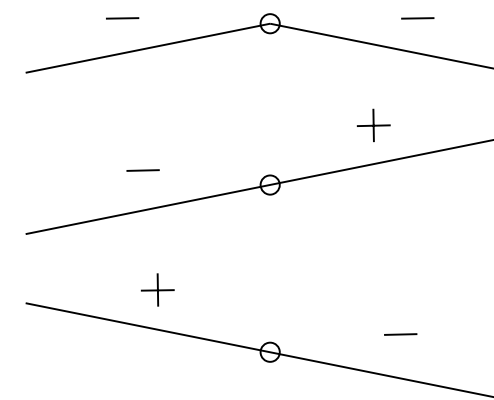


SUPERELEVATION CORRECTION DETAIL

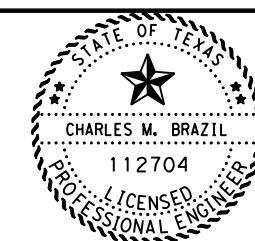
STA 367+03 TO STA 417+86  
(CURVES 1-3)

NOT TO SCALE

SIGN CONVENTION



○ = AXIS OF ROTATION



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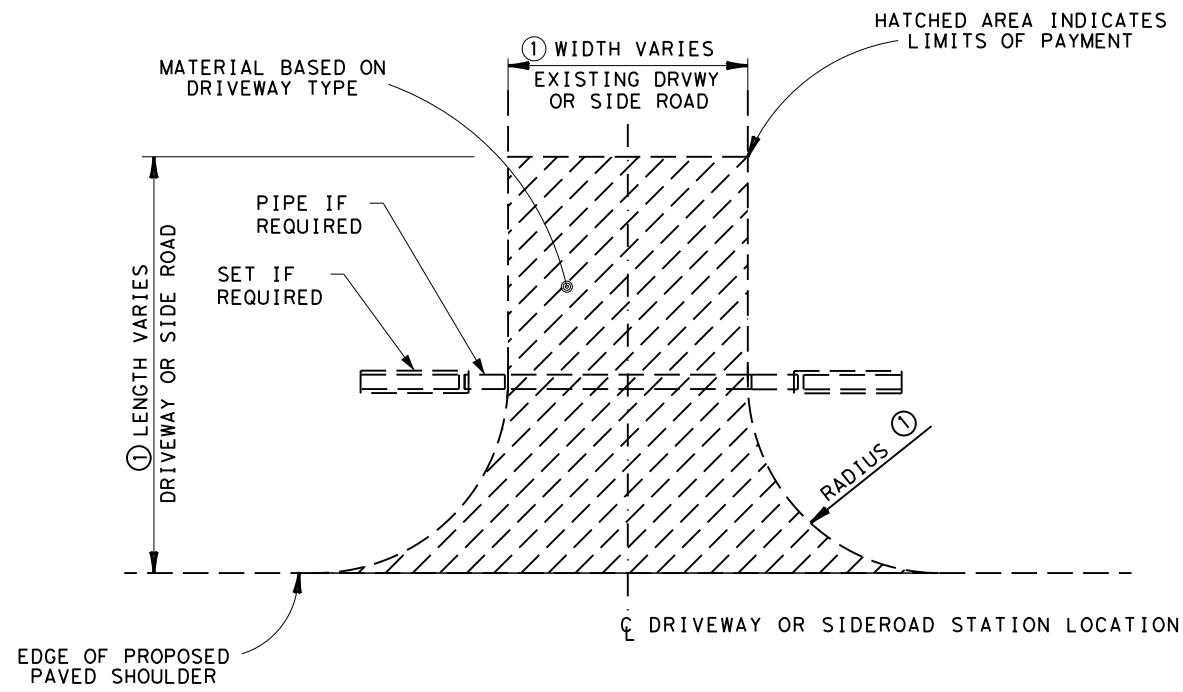
SUPERELEVATION DATA



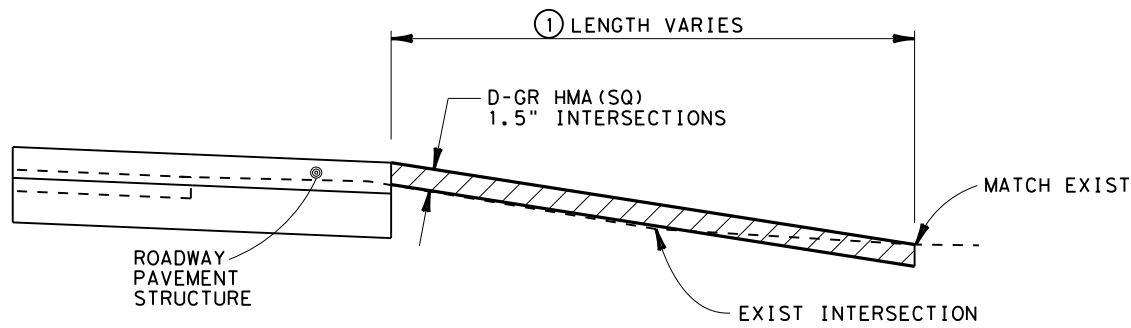
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	35	

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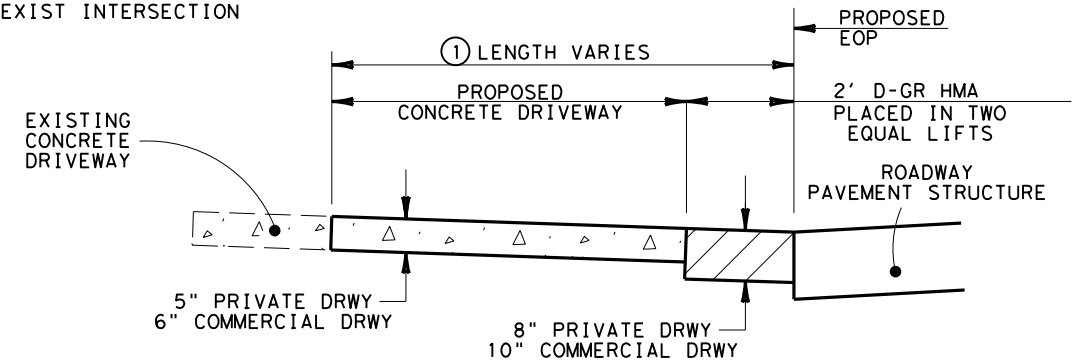
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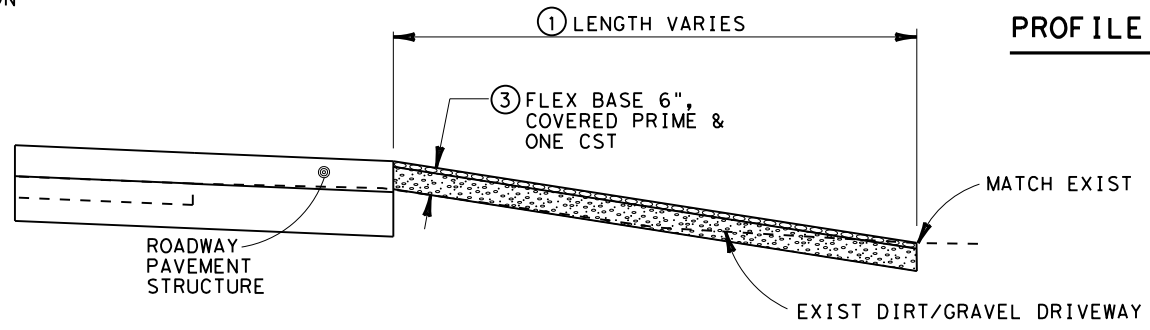
**TYPICAL PLAN VIEW OF NON-CONC DRIVEWAYS & SIDE ROADS**



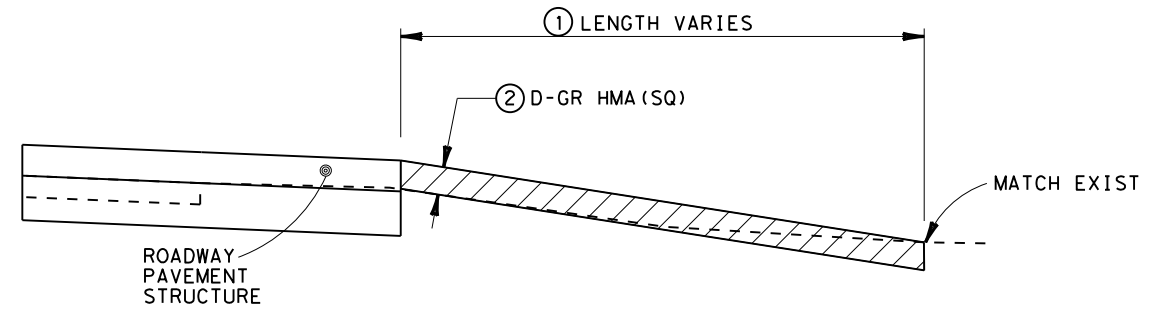
**PROFILE OF FM INTERSECTIONS**



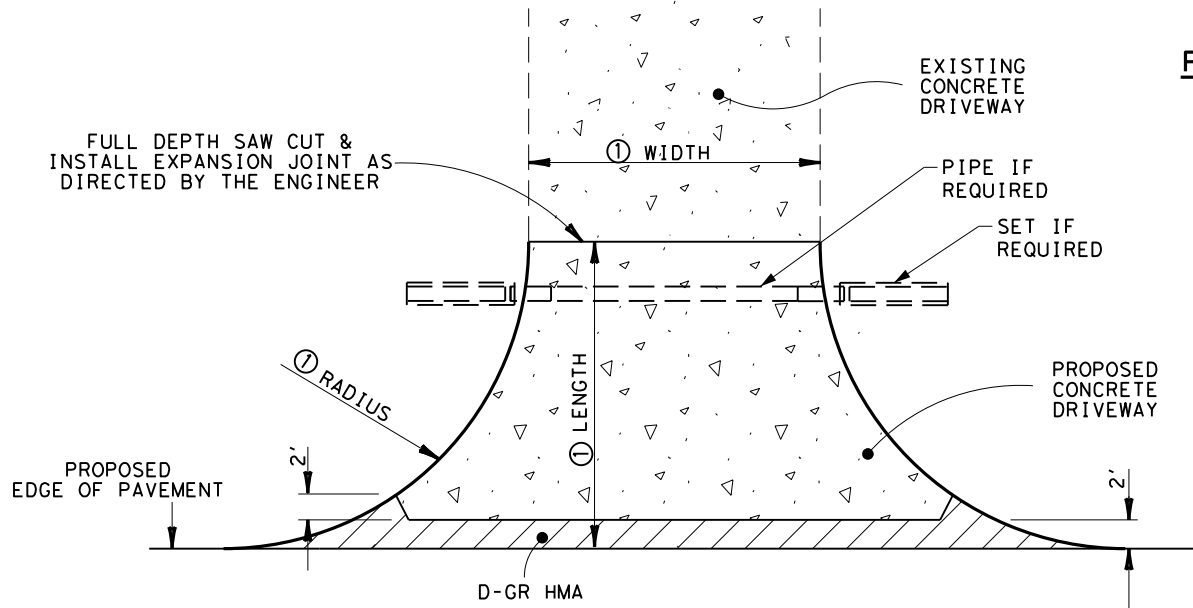
**PROFILE OF CONCRETE DRIVEWAYS**



**PROFILE OF DIRT/GRAVEL DRIVEWAYS/COUNTY SIDE ROADS**



**PROFILE OF ASPHALT DRIVEWAY/COUNTY SIDE ROADS**



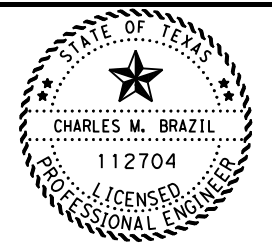
**TYPICAL PLAN VIEW OF CONCRETE DRIVEWAYS**

**GENERAL NOTES:**

1. CONCRETE SURFACE - USE REINFORCING STEEL CONSISTING OF NO.3 OR 4 BARS MEETING THE REQUIREMENTS OF GRADE 60 REINFORCING STEEL. PLACE BARS ON 12 INCH CENTERS IN EACH DIRECTION, SUPPORTED ON REINFORCING CHAIRS.
2. CONCRETE SURFACE - WELDED WIRE FABRIC WILL NOT BE ALLOWED FOR REINFORCING.
3. CONCRETE SURFACE - UNLESS OTHERWISE DIRECTED, INSTALL 1/2 INCH PREMOLDED EXPANSION JOINT MATERIAL BETWEEN EXISTING CONCRETE AND NEW CONCRETE.
4. PREPARATION AND CONSTRUCTION OF DRIVEWAYS/SIDEROADS SHALL BE PAID FOR UNDER ITEM 530 INTERSECTIONS, DRIVEWAYS, AND TURNOUTS. NO ADDITIONAL PAYMENT WILL BE MADE FOR REMOVAL OF EXISTING GRAVEL AND DIRT DRIVEWAYS. THE NECESSARY EXCAVATION, GRADING, COMPACTION, HMA AND INCIDENTALS WILL BE CONSIDERED SUBSIDIARY TO ITEM 530.
5. D-GR HMA TYPE & RATE AS SHOWN ELSEWHERE IN PLANS. FOR D-GR HMA THICKER THAN 4", PLACE IN 2 LIFTS.

**DETAIL NOTES:**

- ① SEE SUMMARY ELSEWHERE IN PLANS FOR LENGTH, WIDTH AND RADIUS.
- ② THICKNESS SHOWN ELSEWHERE IN THE PLANS.
- ③ FULL DEPTH HMA MAY BE USED IN LIEU OF FLEX BASE, COVERED PRIME & ONE CST.



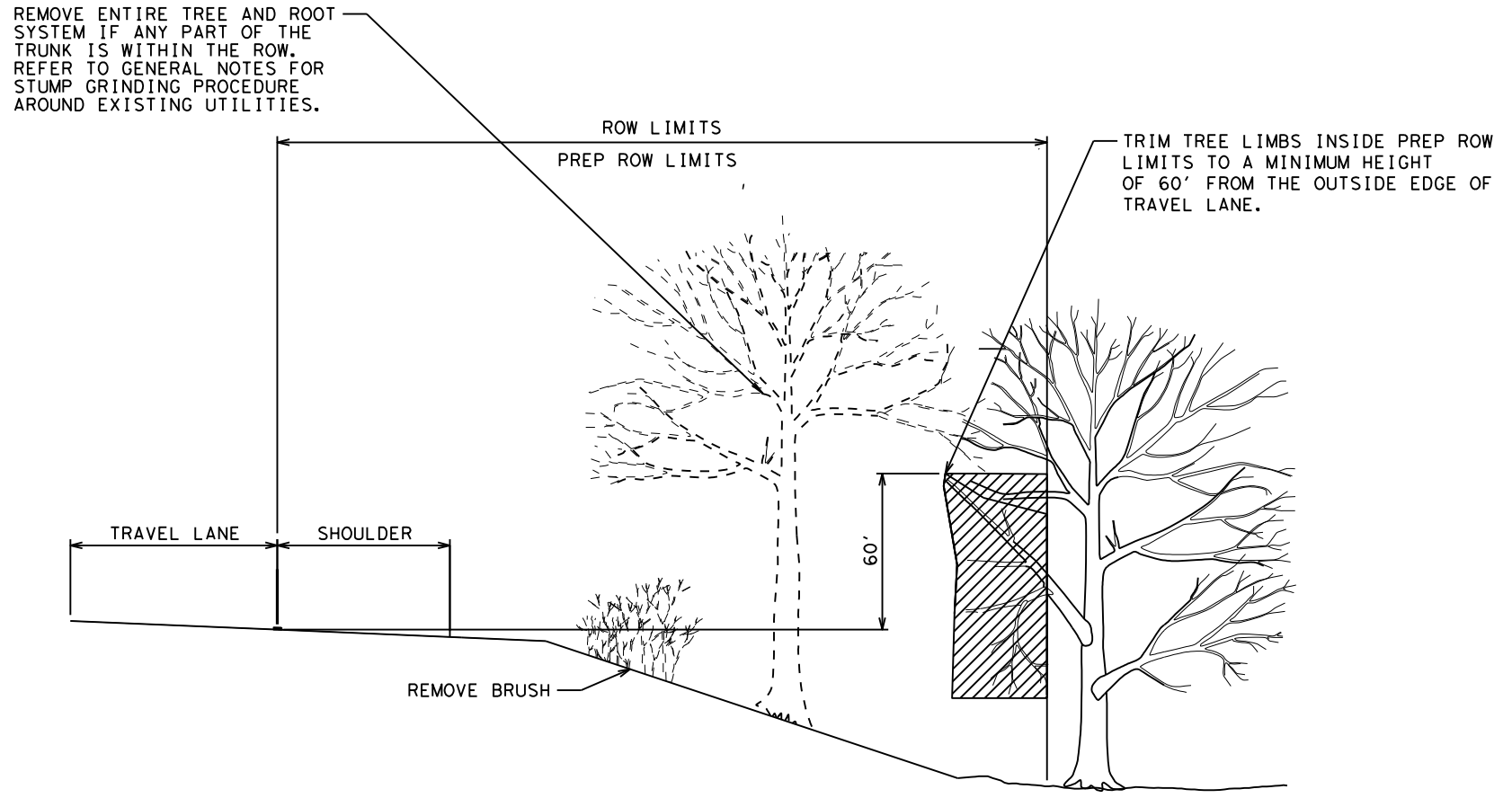
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**DRIVEWAY & SIDE ROAD DETAILS**

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CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST		COUNTY	SHEET NO.
LFK		TRINITY	36



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TYPICAL REMOVAL AND TRIM DETAIL

N. T. S.

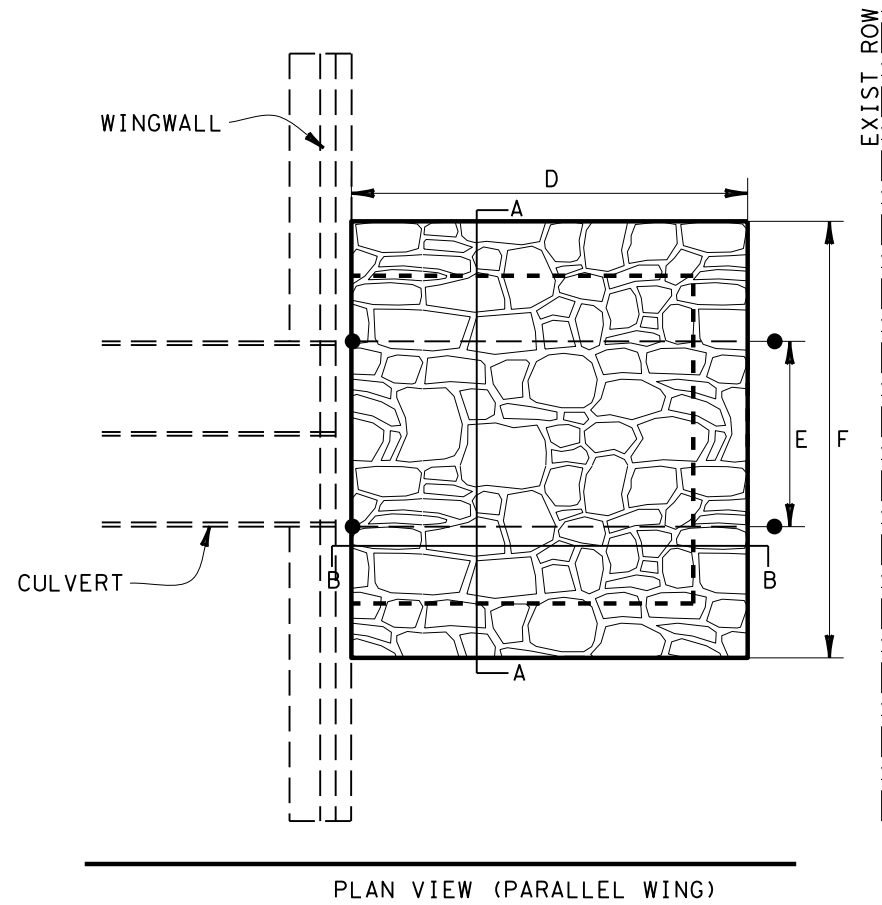
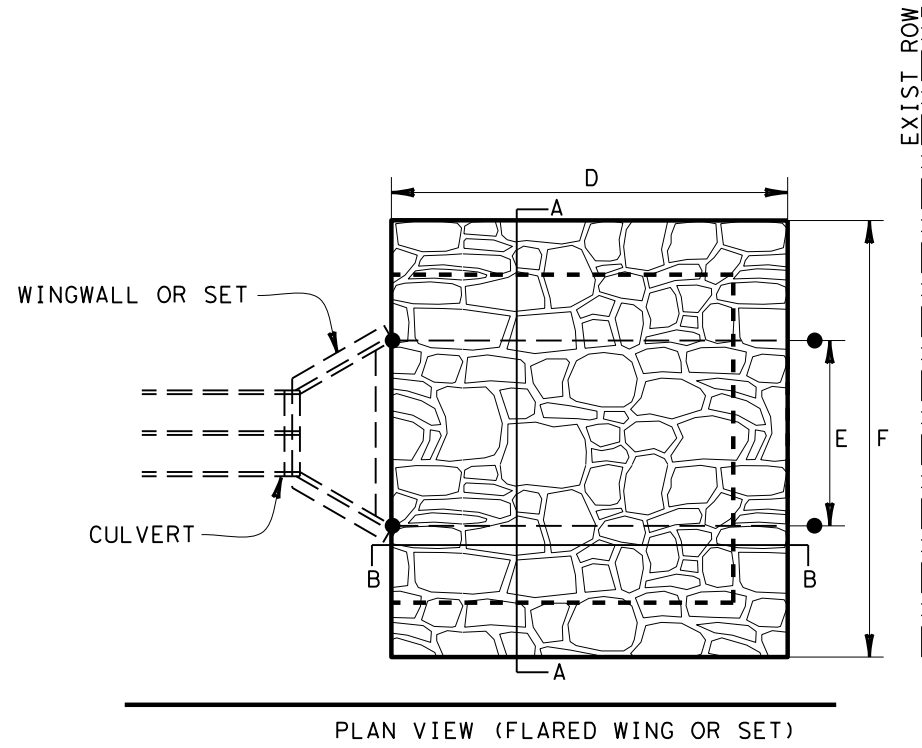
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 6/1/2022

**TREE REMOVAL  
AND  
TRIMMING  
DETAILS**

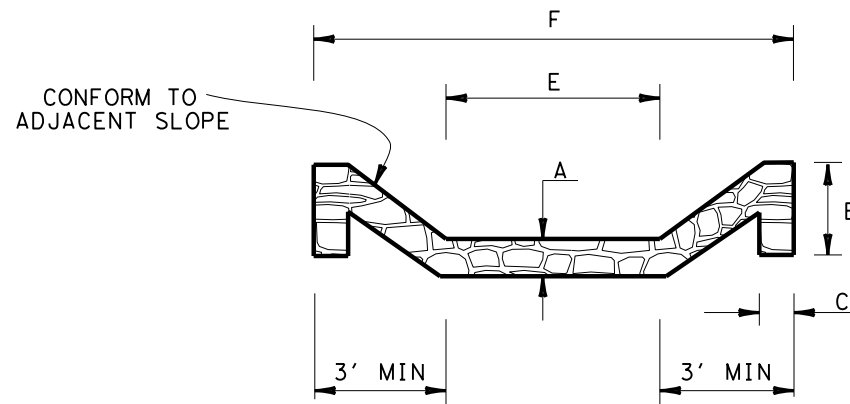
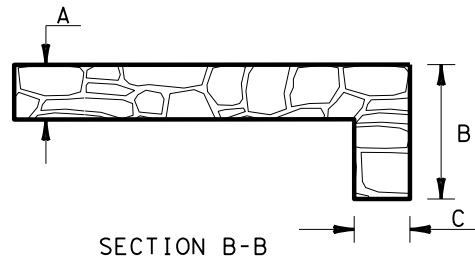
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CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY		SHEET NO.
LFK	TRINITY		37

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**RIPRAP DETAIL**  
NOT TO SCALE

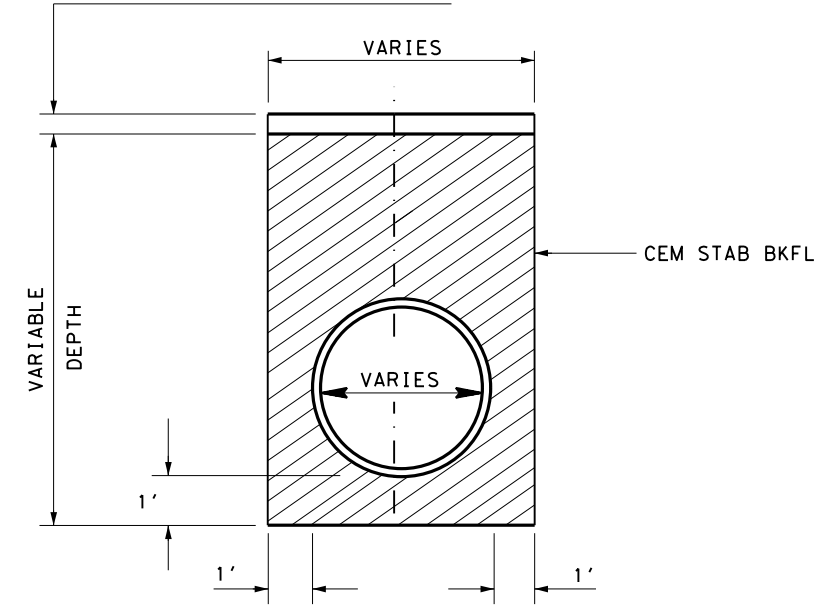


**ELEVATION VIEWS**

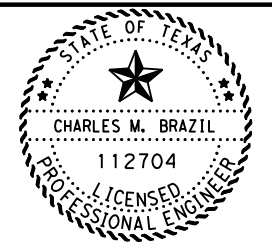
NOTE: CEMENT STABILIZE BACKFILL AS DIRECTED

- ① ESTIMATED USING CULVERT LAYOUTS
- ② WIDTH OF CHANNEL TO BE VERIFIED IN THE FIELD

10" CUT & RESTORE PAVEMENT  
D-GR HMA (TY B) (SQ) (PG 64-22)  
PLACE IN 2 LIFTS W/OCST  
ASPH (AC-15P) OR (AC-10-2TR) OR (CRS-2P)  
AGGR (TY-E GR3 OR TY-L GR3)



RIPRAP DIMENSIONS				
USUAL DIMENSIONS	A	B	C	Riprap Size
	1.0'	2.0'	1.5'	12"
LOCATION	① D	E	② F	CY
FS 357 (CSJ:0931-04-034)				
<b>STA 371+60</b>	<b>16'</b>	<b>6'</b>	<b>12'</b>	25
<b>STA 415+61</b>	<b>16'</b>	<b>6'</b>	<b>12'</b>	25
PROJECT TOTAL				50

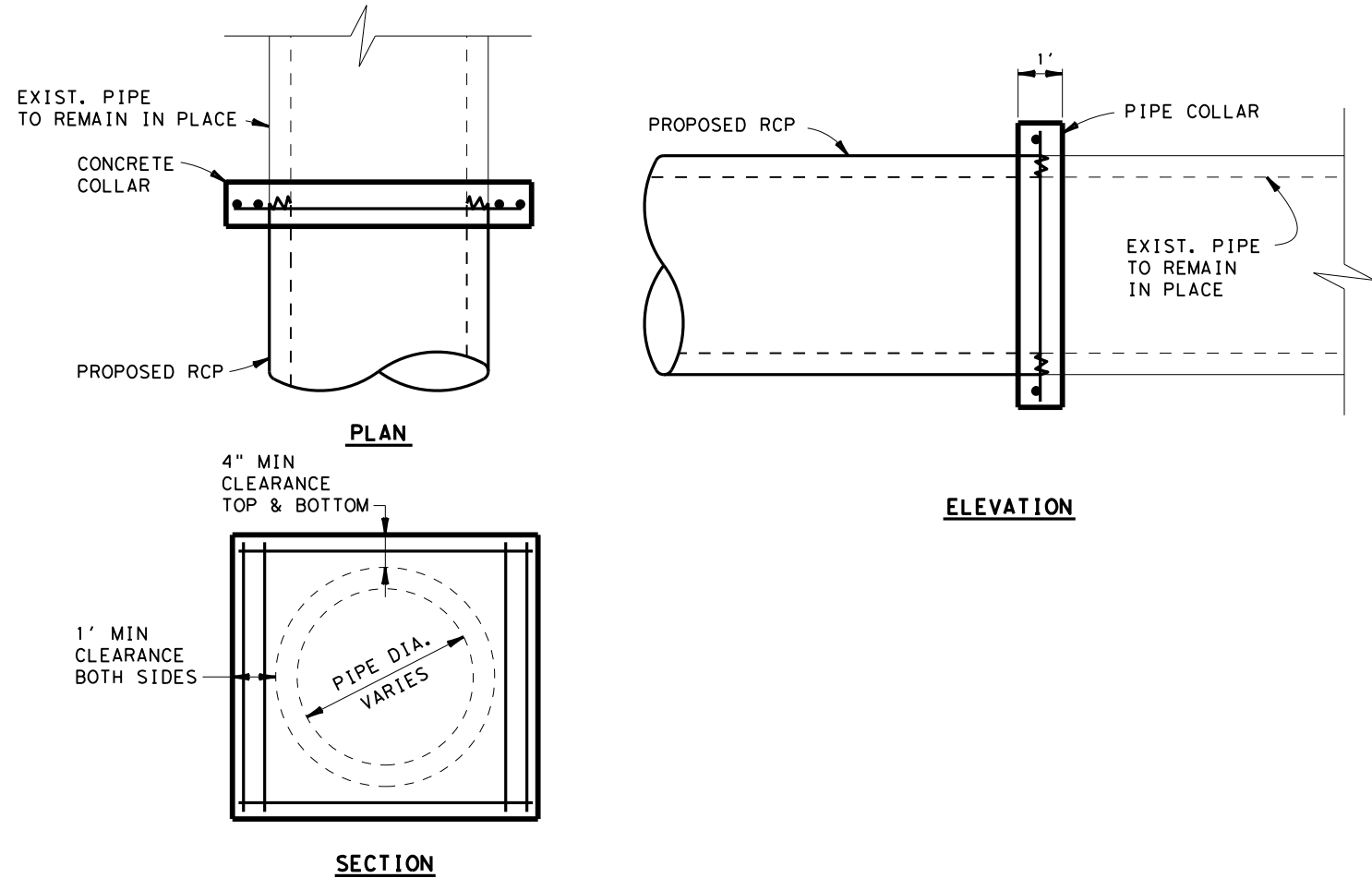


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**MISCELLANEOUS DRAINAGE DETAILS**

<b>TEXAS DEPARTMENT OF TRANSPORTATION</b>			
©2022 SHEET 1 OF 2			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY		SHEET NO.
LFK	TRINITY		38

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**CONCRETE COLLAR NOTES:**

1. A CLASS "C" CONCRETE COLLAR SHALL BE USED WHERE CONNECTING RCP TO EXISTING CMP & RCP, WHEN INSTALLING VERTICAL RCP BENDS AND AS DIRECTED BY THE ENGINEER.
2. REINFORCEMENT SHALL BE #4 BARS FIELD CUT TO FIT INSTALLATION.
3. REINFORCING BARS SHALL HAVE A MINIMUM OF 1 1/2" OF CLEAR COVER.
4. CONCRETE COLLAR SHALL CONFORM TO THE OUTSIDE DIAMETER OF THE RCP.

**CONCRETE COLLAR**

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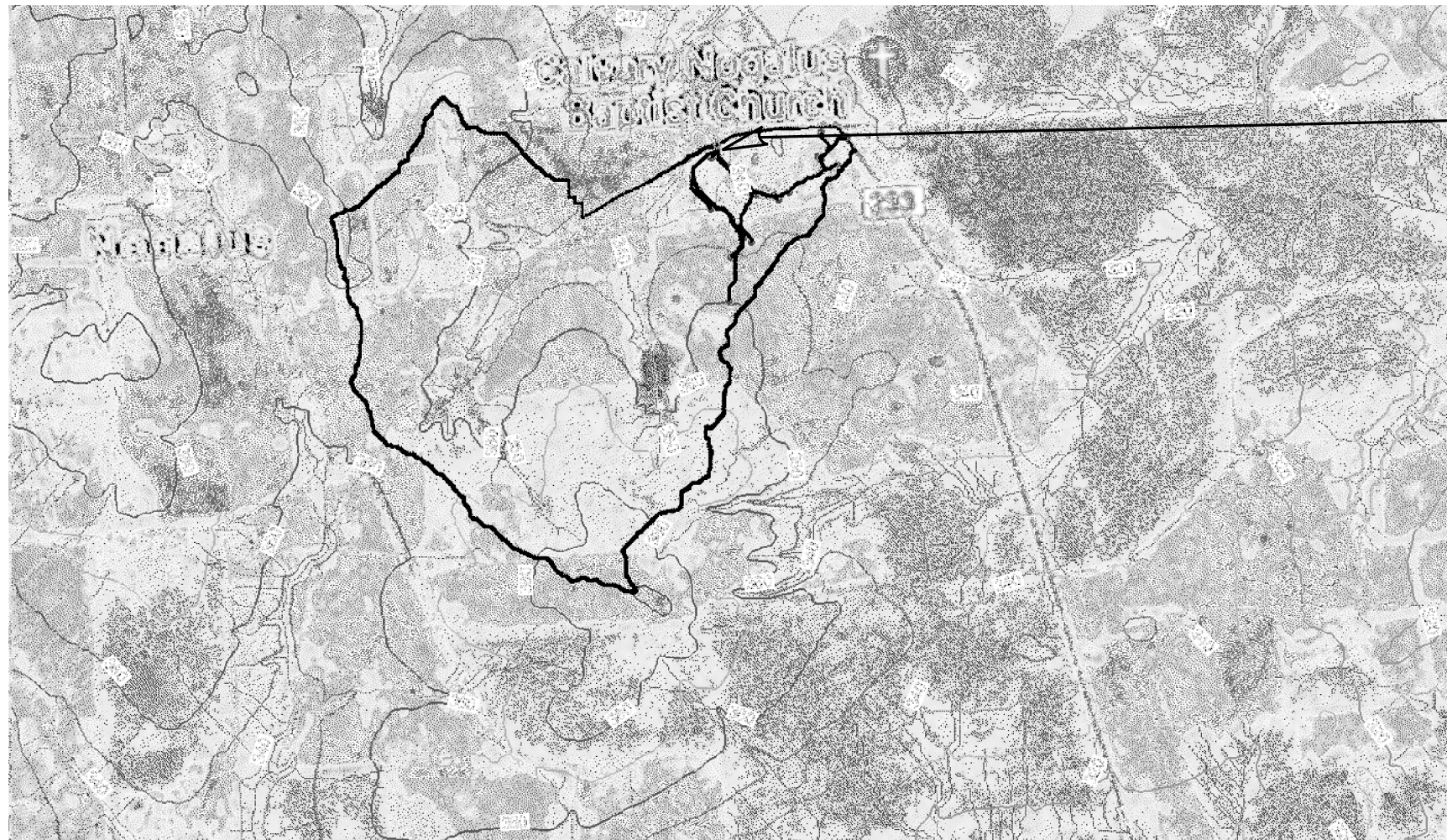
**MISCELLANEOUS  
DRAINAGE  
DETAILS**

**TEXAS DEPARTMENT OF TRANSPORTATION**  
©2022 SHEET 2 OF 2

CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST		COUNTY	SHEET NO.
LFK		TRINITY	39



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CULVERT LOCATION



FS 357  
STA 371+60

HYDROLOGIC DATA									
ROADWAY	STATION	METHOD	TIME OF CONCENTRATION	AREA	INTENSITY		COMPOSITE CURVE NUMBER	FLOW RATE	
			MIN		ACRE	10 YR		100 YR	10 YR
					IN/HR		CFS		
FS 357	371+60	SCS CURVE NUMBER	37.69	249.79	4.06	6.51	46.25	56.80	279.13

HYDRAULIC DATA										
ROADWAY	STATION	FREQUENCY	EXIST CULVERT			ALLOW HW	PROPOSED CULVERT			
			HW	TW	V (OUT)		HW	TW	V (OUT)	
			FT	FT	FPS	FT	FT	FT	FPS	
FS 357	371+60	EXIST	10-YR	328.47	328.07	3.88	342.68	328.48	328.07	3.83
		PROPOSED	100-YR	335.24	334.30	7.36		335.25	334.30	7.35

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6/1/2022

**DRAINAGE  
AREA MAP &  
HYDRAULIC  
DATA SHEET**

TEXAS DEPARTMENT OF TRANSPORTATION			
©2022 SHEET 1 OF 2			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY		SHEET NO.
LFK	TRINITY		40

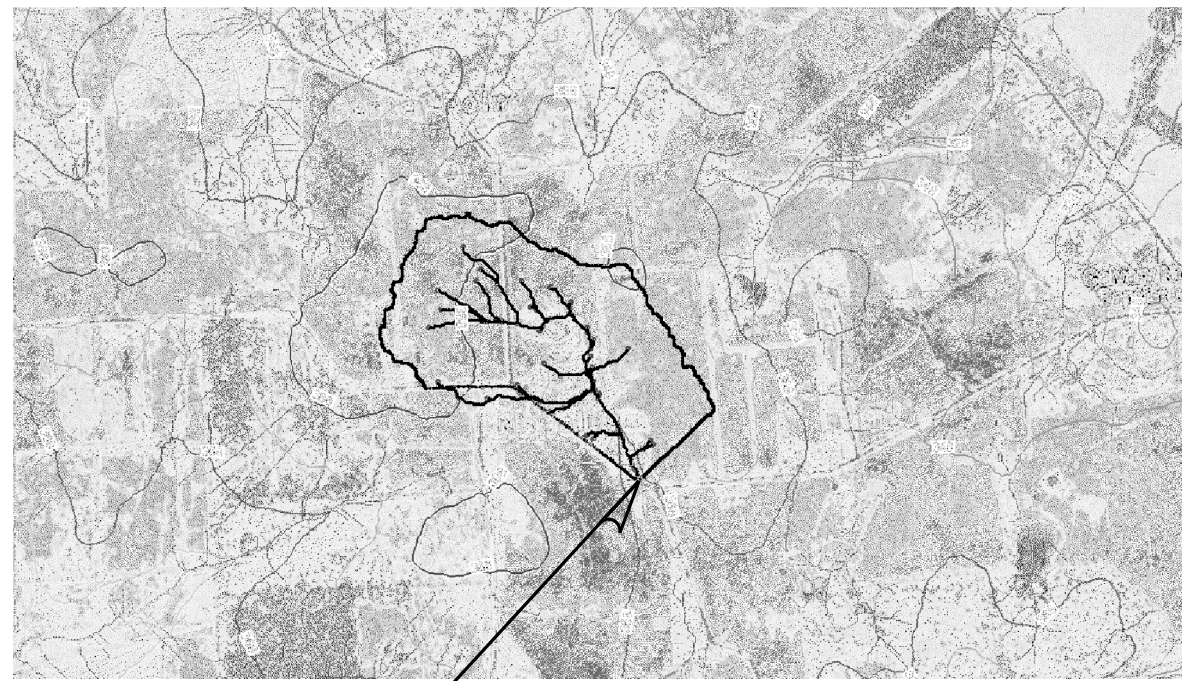


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FS 357  
STA 381+45

CULVERT  
LOCATION



FS 357  
STA 415+61

CULVERT  
LOCATION



HYDROLOGIC DATA									
ROADWAY	STATION	METHOD	TIME OF CONCENTRATION	AREA	INTENSITY		RUNOFF COEFFICIENT	FLOW RATE	
			MIN	ACRE	10 YR	100 YR		10 YR	100 YR
						CFS			
FS 357	381+45	RATIONAL	10.52	1.54	7.46	11.66	0.25	2.90	15.41
FS 357	415+61	RATIONAL	30.62	86.45	4.52	7.24	0.25	97.69	156.47

HYDRAULIC DATA											
ROADWAY	STATION		FREQUENCY	EXIST CULVERT			ALLOW HW	PROPOSED CULVERT			
				HW	TW	V (OUT)		HW	TW	V (OUT)	
				FT			FT				
				FPS			FPS				
FS 357	381+45		EXIST	10-YR	340.02	339.21	4.27	342.68	328.48	328.07	3.83
			PROPOSED	100-YR	343.39	340.02	8.53		340.06	339.21	4.53
FS 357	415+61		EXIST	10-YR	368.59	365.71	13.78	368.89	368.61	365.71	13.52
			PROPOSED	100-YR	370.26	366.76	14.79		370.27	366.76	14.74

N. T. S

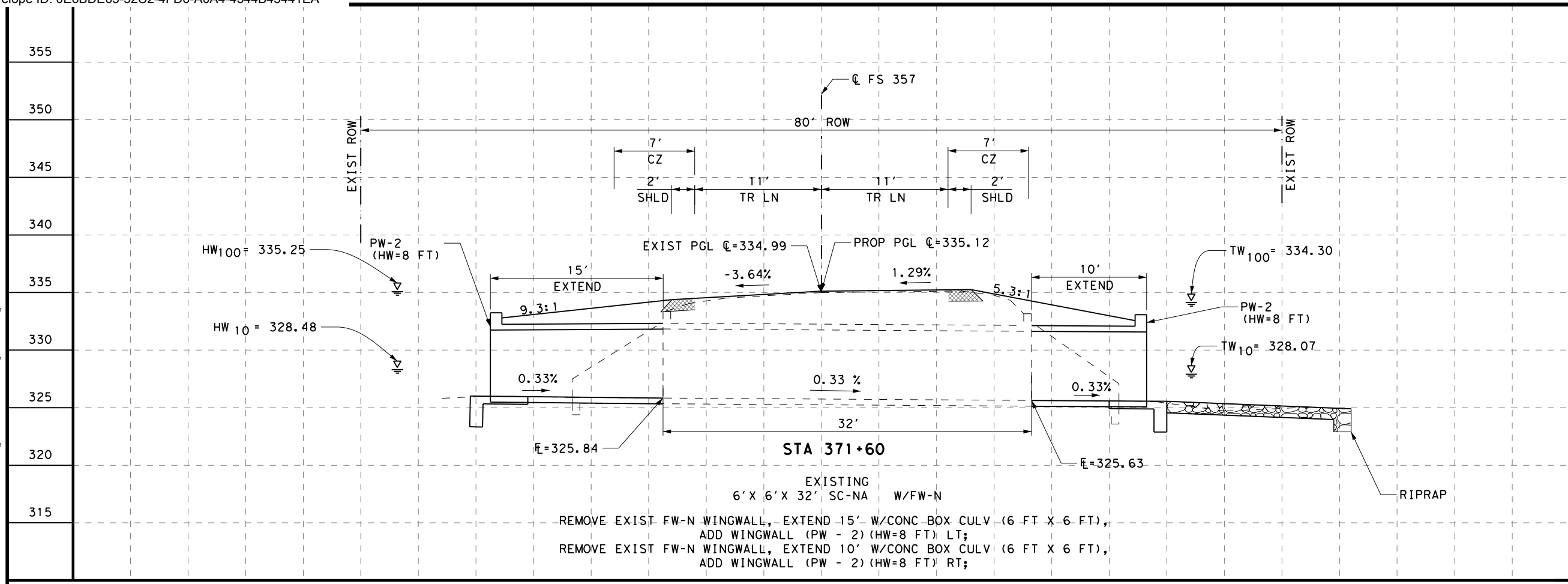
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**DRAINAGE  
AREA MAP &  
HYDRAULIC  
DATA SHEET**

TEXAS DEPARTMENT OF TRANSPORTATION			
©2022 SHEET 2 OF 2			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY		SHEET NO.
LFK	TRINITY		41

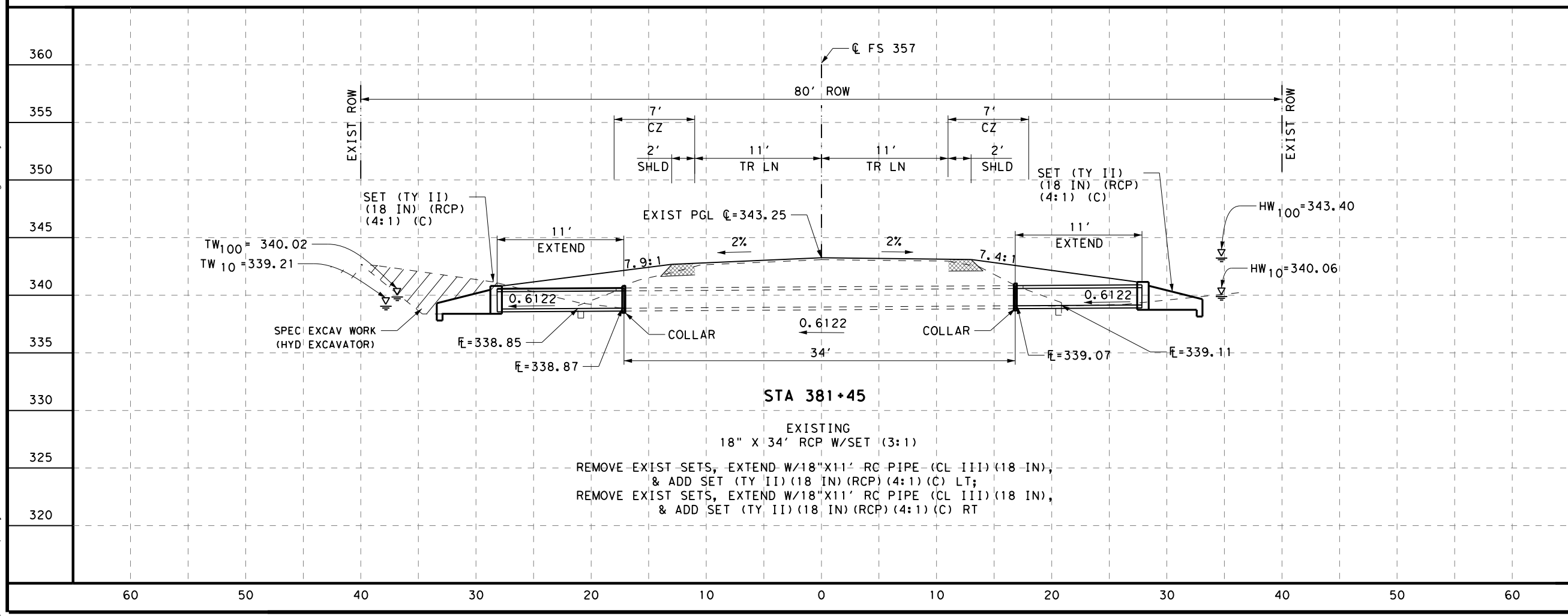


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EXISTING  
6' X 6' X 32' SC-NA W/FW-N

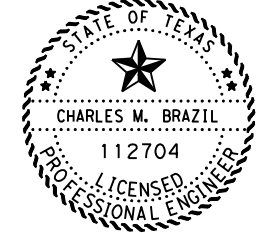
REMOVE EXIST FW-N WINGWALL, EXTEND 15' W/CONC BOX CULV (6 FT X 6 FT),  
ADD WINGWALL (PW - 2) (HW=8 FT) LT;  
REMOVE EXIST FW-N WINGWALL, EXTEND 10' W/CONC BOX CULV (6 FT X 6 FT),  
ADD WINGWALL (PW - 2) (HW=8 FT) RT;



EXISTING  
18" X 34' RCP W/SET (3:1)

REMOVE EXIST SETS, EXTEND W/18"X11' RC PIPE (CL III) (18 IN),  
& ADD SET (TY II) (18 IN) (RCP) (4:1) (C) LT;  
REMOVE EXIST SETS, EXTEND W/18"X11' RC PIPE (CL III) (18 IN),  
& ADD SET (TY II) (18 IN) (RCP) (4:1) (C) RT

SCALE 1" = 10'

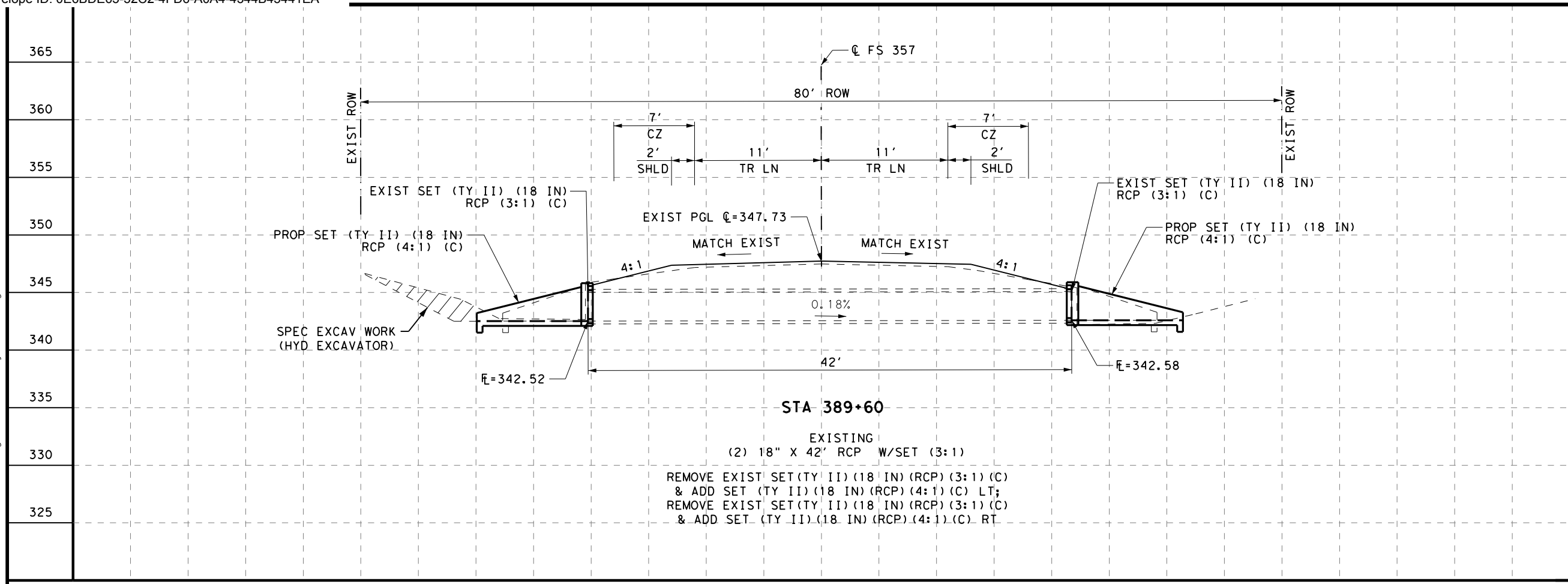


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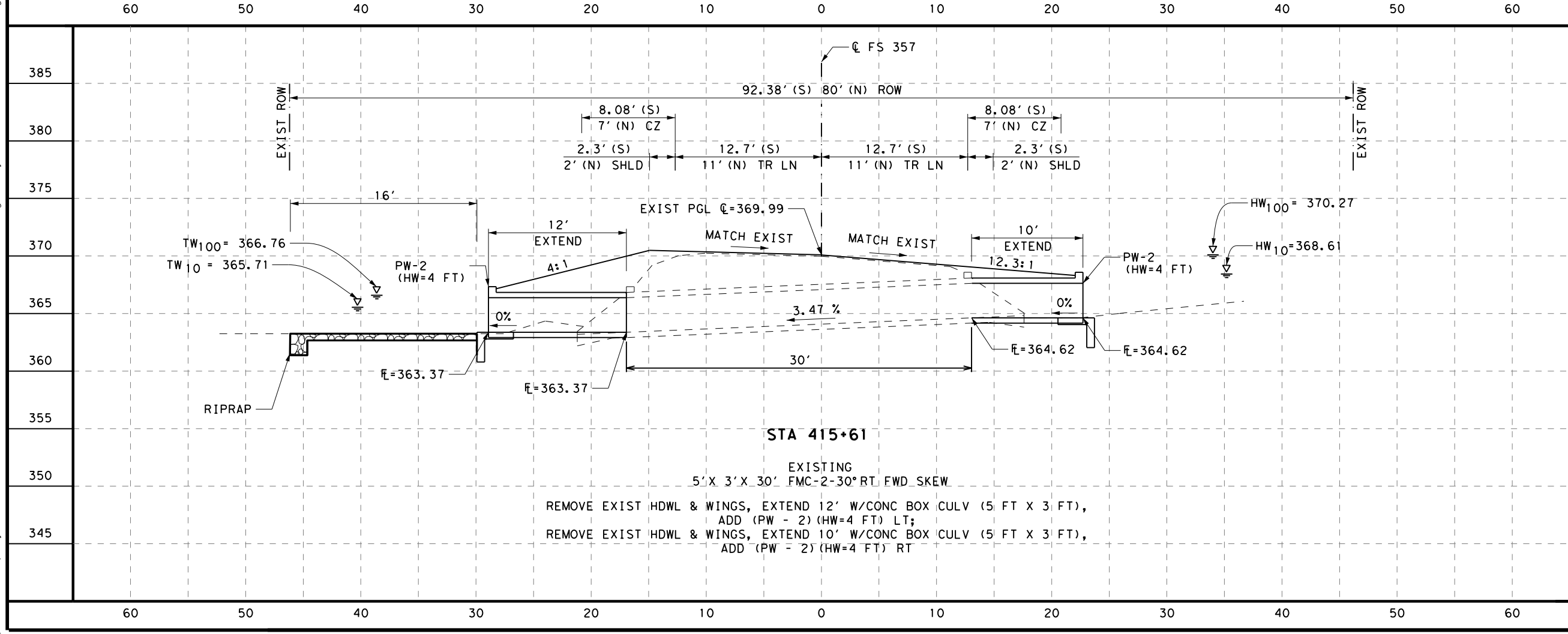
CULVERT LAYOUTS

TEXAS DEPARTMENT OF TRANSPORTATION		
©2022 SHEET 1 OF 2		
CONT	SECT	JOB
0931	04	034
DIST		HIGHWAY
LFK		FS 357
COUNTY		SHEET NO.
TRINITY		42

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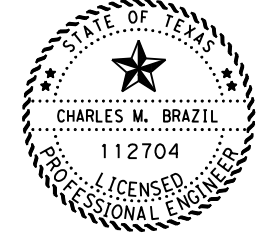


**STA 389+60**  
 EXISTING  
 (2) 18" X 42' RCP W/SET (3:1)  
 REMOVE EXIST SET (TY II) (18 IN) (RCP) (3:1) (C)  
 & ADD SET (TY II) (18 IN) (RCP) (4:1) (C) LT;  
 REMOVE EXIST SET (TY II) (18 IN) (RCP) (3:1) (C)  
 & ADD SET (TY II) (18 IN) (RCP) (4:1) (C) RT



**STA 415+61**  
 EXISTING  
 5' X 3' X 30' FMC-2-30° RT FWD SKEW  
 REMOVE EXIST HDWL & WINGS, EXTEND 12' W/CONC BOX CULV (5 FT X 3 FT),  
 ADD (PW - 2) (HW=4 FT) LT;  
 REMOVE EXIST HDWL & WINGS, EXTEND 10' W/CONC BOX CULV (5 FT X 3 FT),  
 ADD (PW - 2) (HW=4 FT) RT

SCALE 1" = 10'



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**CULVERT LAYOUTS**

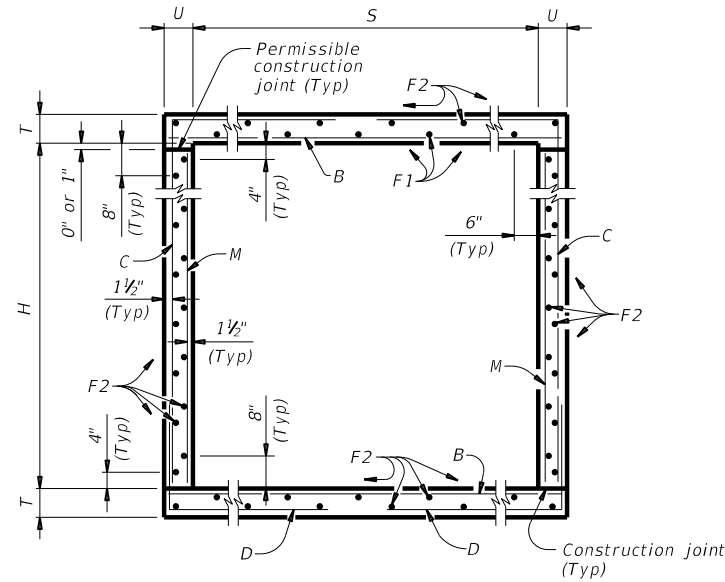
TEXAS DEPARTMENT OF TRANSPORTATION			
©2022 SHEET 2 OF 2			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	43	



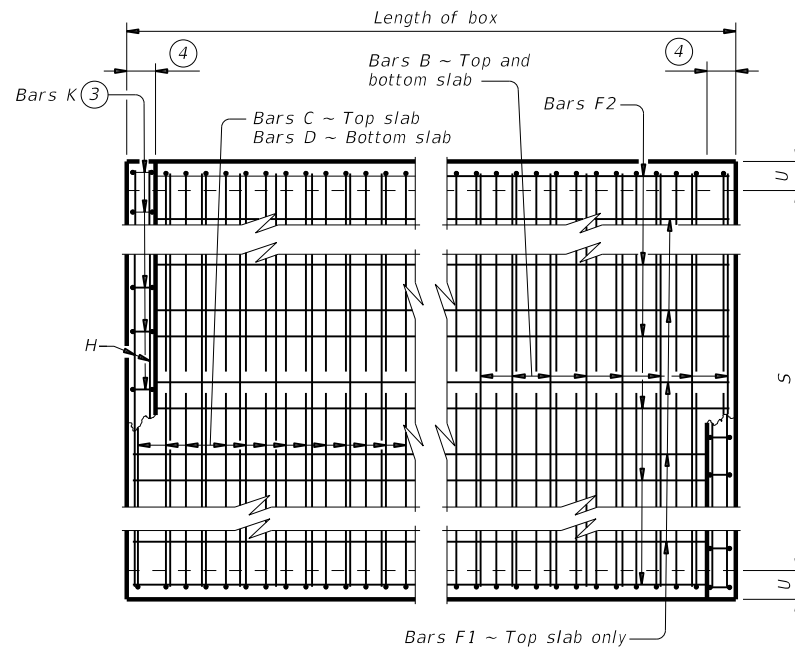


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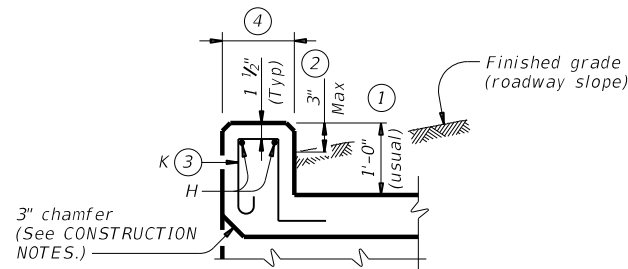
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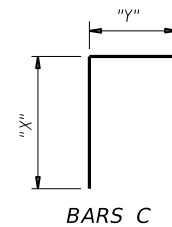
**TYPICAL SECTION**



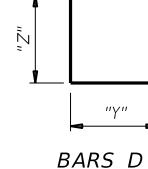
**PLAN OF REINF STEEL**



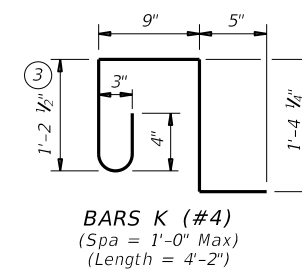
**SECTION THRU CURB**



BARS C



BARS D



BARS K (#4)  
 (Spa = 1'-0" Max)  
 (Length = 4'-2")

- ① 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Rail Anchorage Curb (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
- ② For vehicle safety, the following requirements must be met:
  - For structures without bridge rail, construct curbs no more than 3" above finished grade.
  - For structures with bridge rail, construct curbs flush with finished grade. Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- ③ For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.
- ④ 1'-0" typical. 2'-3" when the Rail Anchorage Curb (RAC) standard sheet is referred to elsewhere in the plans.

The Contractor may replace Bars B, C, D, E, F1, F2, M, Y, and/or Z with deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 4" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes. The lap length required for WWR is never less than the lap length required for uncoated #4 bars.

Example conversion: Replacing No. 6 Gr 60 at 6" Spacing with WWR.  
 Required WWR = (0.44 sq. in. per 0.5 ft.) x (60 ksi / 70 ksi) = 0.755 sq. in. per ft.  
 If D30.6 wire is used to meet the 0.755 sq. in. per ft. requirement in this example, the required spacing = (0.306 sq. in.) / (0.755 sq. in. per ft.) x (12 in. per ft.) = 4.86" Max spacing. Required lap length for the provided D30.6 wire is 2'-1" (the same minimum lap length required for uncoated #5 bars, as listed under MATERIAL NOTES).

**CONSTRUCTION NOTES:**

- Do not use permanent forms.
- Chamfer the bottom edge of the top slab 3" at the entrance.
- Optionally, raise construction joints shown at the flow line by a maximum of 6". If this option is taken, Bars M may be cut off or raised, Bars C and D may be reversed.

**MATERIAL NOTES:**

- Provide Grade 60 reinforcing steel.
- Provide galvanized reinforcing steel if required elsewhere in the plans.
- Provide Class C concrete (f'c = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of:
  - culverts with overlay,
  - culverts with 1-to-2 course surface treatment, or
  - culverts with the top slab as the final riding surface.
- Provide bar laps, where required, as follows:
  - Uncoated or galvanized ~ #4 = 1'-8" Min
  - Uncoated or galvanized ~ #5 = 2'-1" Min
  - Uncoated or galvanized ~ #6 = 2'-6" Min

**GENERAL NOTES:**

- Designed according to AASHTO LRFD Bridge Design Specifications for the range of fill heights shown.
- See the Single Box Culverts Cast-In-Place Miscellaneous Detail (SCC-MD) standard sheet for details pertaining to skewed ends, angle sections, and lengthening.

Cover dimensions are clear dimensions, unless noted otherwise.  
 Reinforcing bar dimensions shown are out-to-out of bar.

HL93 LOADING

SHEET 1 OF 2



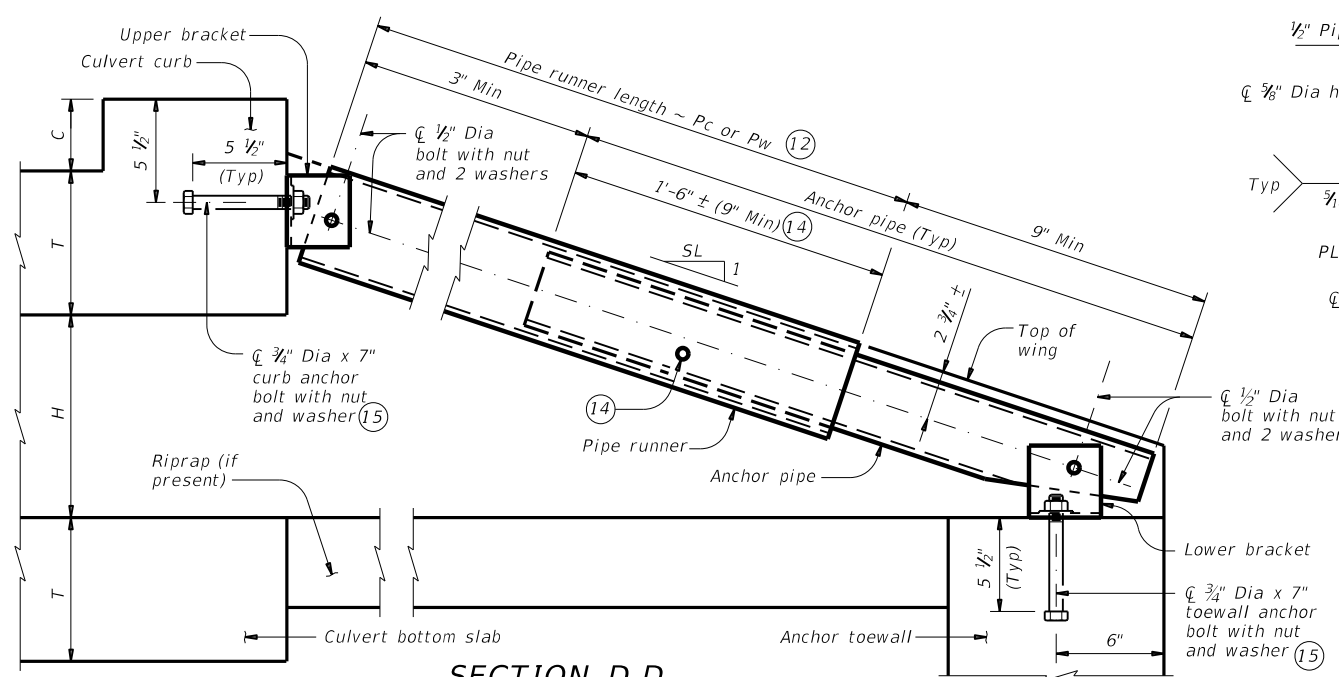
**SINGLE BOX CULVERTS  
 CAST-IN-PLACE  
 0' TO 30' FILL**

**SCC-5 & 6**

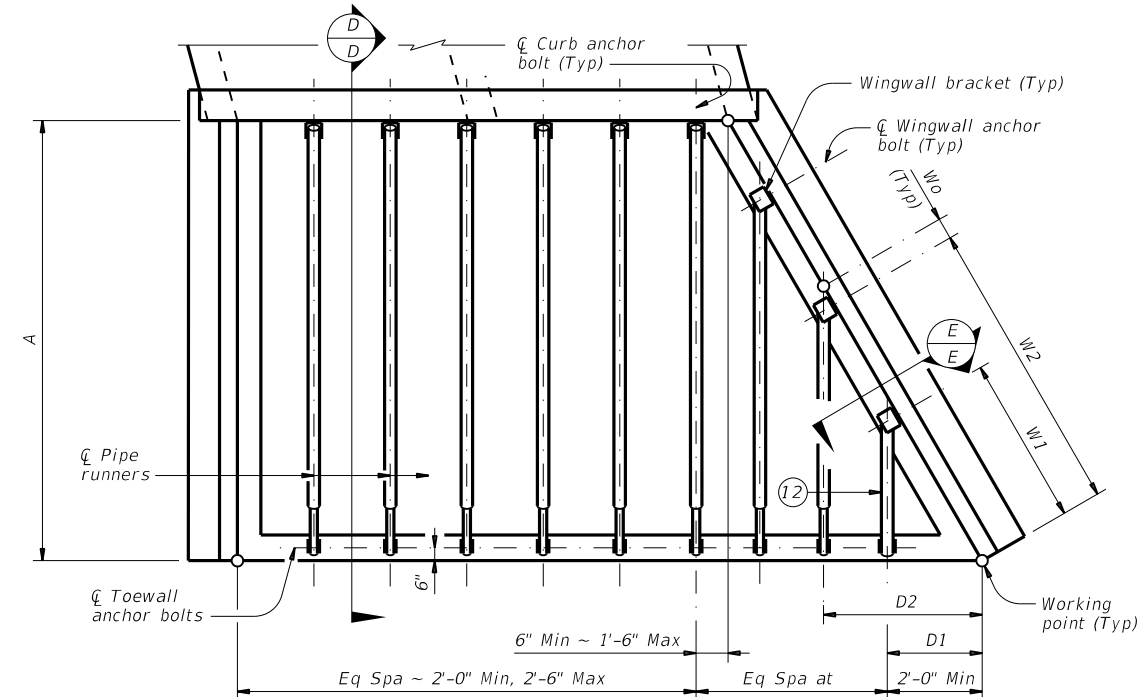
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©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
04/2021 Updated X values.	DIST	COUNTY	SHEET NO.	
	LFK	TRINITY	45	



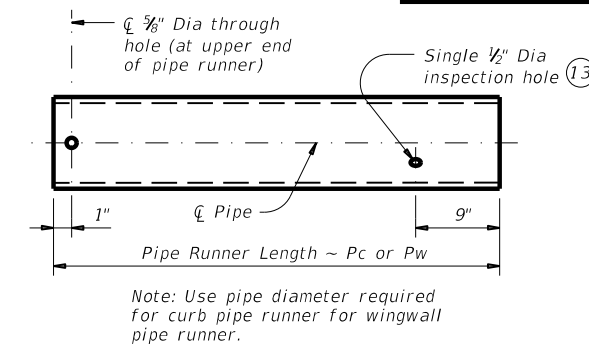
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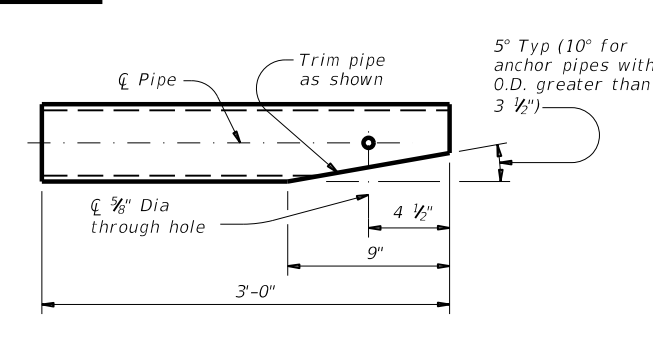
**SECTION D-D**  
 (Showing curb pipe runner. Except for upper bracket, wingwall pipe runners are similar.)



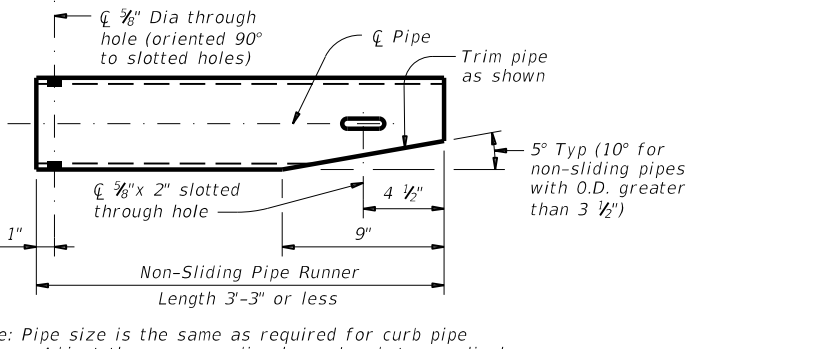
**PIPE RUNNER PLAN**



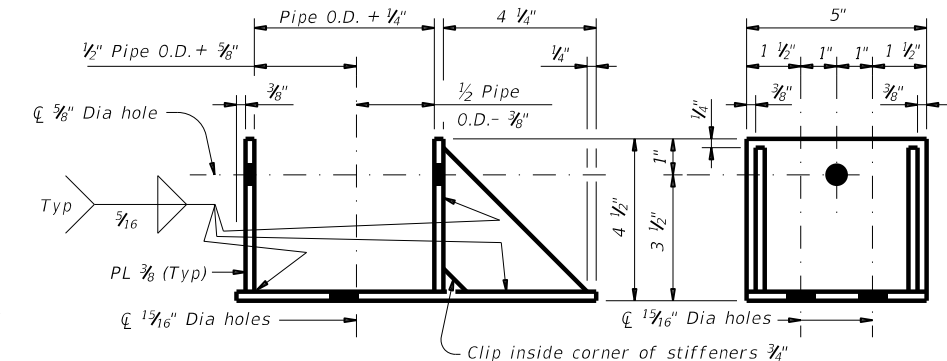
**PIPE RUNNER DETAILS**



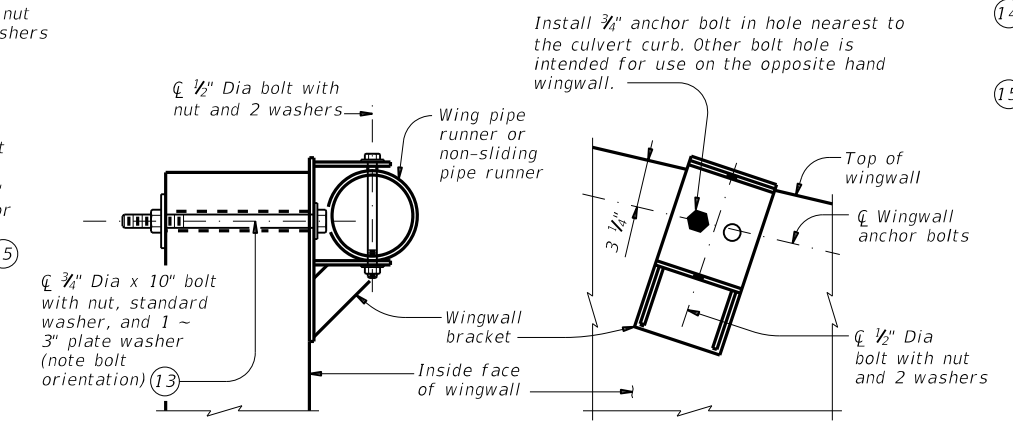
**ANCHOR PIPE DETAILS**



**NON-SLIDING PIPE RUNNER DETAILS**

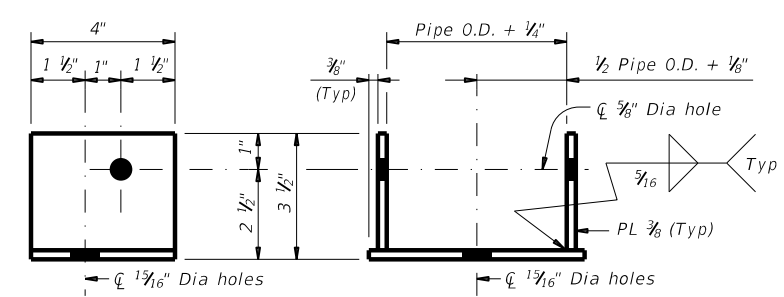


**ELEVATION SIDE VIEW**



**SECTION E-E ELEVATION**  
 (Showing installed bracket.) (Showing installed bracket normal to wall. Pipe not shown for clarity.)

**WINGWALL BRACKET DETAILS**  
 Note: Match wingwall bracket to the upper curb bracket size.



**SIDE VIEW ELEVATION**  
 Note: Match upper and lower brackets, except for the brackets used with non-sliding pipe runners, to the required pipe diameters as shown in the table.

**UPPER AND LOWER BRACKET DETAILS**

Maximum Pipe Runner Length (Pc or Pw)	Required Pipe Runner Size			Required Anchor Pipe Size		
	Pipe Size	Pipe O.D.	Pipe I.D.	Pipe Size	Pipe O.D.	Pipe I.D.
9'-4"	3" STD	3.500"	3.068"	2" STD	2.375"	2.067"
19'-0"	4" STD	4.500"	4.026"	3" STD	3.500"	3.068"
33'-6"	5" STD	5.563"	5.047"	4" STD	4.500"	4.026"

- 12 If pipe runner length (Pw) is 1'-9" or less, replace the normal pipe runner and anchor pipe with a single non-sliding pipe runner. See Non-Sliding Pipe Runner Details for additional information.
- 13 At Contractor's option, 3/8" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.
- 14 After installation of pipe runner, use the 1/2" inspection hole to ensure that the lap of the anchor pipe with the pipe runner is adequate.
- 15 At Contractor's option, an adhesive anchor may be used. Provide 3/4" Dia adhesive anchors that meet the requirements of ASTM A307, Gr A fully threaded rods. Embed threaded rods into curb, wingwalls, and toewall using a Type III, Class C, D, E, or F anchor adhesive. Minimum embedment depth is 5 1/2". Provide anchor adhesive able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use.

**PIPE RUNNER DIMENSION CALCULATIONS:**

$Wn = (K3) (Dn) - (Wo)$   
 $Pwn = (Dn) (K2) - (2.063')$   
 $Pw1 \text{ Non-Sliding Pipe Runner (If required)} = (D1) (K2) - (0.563')$   
 $Pc = (A) (K1) - (1.688')$

$Wn$  = Distance from working point to centerline anchor bolt measured along bottom inside face of wing (feet)  
 $Dn$  = Distance from working point to centerline pipe runner measured along outside face of anchor toewall (feet)  
 $Pw$  = Wingwall pipe runner length (feet)  
 $Pc$  = Curb pipe runner length (feet)  
 $K$  = Constant values for use in formulas  
 Slope SL:1 K1 K2-15° Skew K2-30° Skew  
 3:1 ~ 1.054 ~ 1.826 ~ 1.054  
 4:1 ~ 1.031 ~ 1.785 ~ 1.031  
 6:1 ~ 1.014 ~ 1.756 ~ 1.014  
 $K3$  = 15° Skew ~ 2.000  
 30° Skew ~ 1.414  
 $n$  = Wing pipe runner number  
 $Wo$  = 15° Skew ~ 5"  
 30° Skew ~ 2 1/2"

Texas Department of Transportation  
 Bridge Division Standard

**SAFETY END TREATMENT WITH FLARED WINGS**  
 FOR 15° AND 30° SKEW BOX CULVERTS  
 TYPE I ~ CROSS DRAINAGE

**SETB-FW-S**

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**TABLE OF DIMENSIONS AND REINFORCING STEEL**  
(Wings for One Structure End)

Maximum Wingwall Height (10) Hw	Dimensions				Variable Reinforcing				Estimated Quantities per ft of wing length (Two-Wings) (3)	
	W	X	Y	Z	Bars J1		Bars J2		Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'-8"	1'-9"	1'-3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'-2"	2'-0"	1'-6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'-8"	2'-3"	1'-9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'-2"	2'-6"	2'-0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'-8"	2'-9"	2'-3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'-2"	3'-0"	2'-6"	9"	#7	6"	#5	6"	162.29	0.721

**TABLE OF WINGWALL REINFORCING (Two-Wings)**

Bar	Size	No.	Spa
DL & DS	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
RL	#5	3	~
RS	#5	3	~
V	#4	~	1'-0"

**TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES**

Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)	2.45		
Conc (CY/Ft)	0.037		

**TABLE OF ESTIMATED ANCHOR TOEWALL QUANTITIES**

Bar	Size	No.	Spa
K	#4	~	1'-0"
N	#5	6	~
OL	#4	3	~
OS	#4	3	~
Reinf (Lb/Ft)	9.82		
Conc (CY/Ft)	0.074		

- Extend Bars P 3'-0" Min into bottom slab of box culvert.
- Adjust to fit as necessary to maintain 11#2" clearcover and 4" Min between bars.
- Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by 0.5 (A+Lw).
- Recommended values of slope are: 3:1, 4:1, and 6:1. Provide 3:1 or flatter slope.
- When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, extend construction joints or grooved joints, oriented in the direction of flow, across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B is not required.
- At Contractor's option, end the culvert toewall flush with wingwall toewall. Adjust reinforcing as needed.
- 3" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet.
- For vehicle safety, reduce curb heights, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.
- Culvert skew (limit to 15° or 30°)
- See Table of Maximum Wing Heights for various slopes. Height is limited based on a 33'-6" maximum safety pipe runner length.
- Typical wingwall angle for all skews.

**TABLE OF MAXIMUM WING HEIGHTS**

Side Slope	Hw Max
3:1	11'-5"
4:1	8'-10"
6:1	6'-1"

**WING DIMENSION CALCULATIONS:**

Formulas:  
 $Hw = H + T + C - 0.250^{(10)}$   
 $A = (Hw - 0.333') (SL)$   
 $B = (A) [\tan(\theta + 15^\circ)]$   
 $Lw = (A) \div [\cos(\theta + 15^\circ)]$   
 For cast-in-place culverts:  
 $Ltw = [(N)(S) + (N + 1)(U)] \div (\cos \theta)$   
 For precast culverts:  
 $Ltw = [(N)(2U + S) + (N - 1)(0.500')] \div (\cos \theta)$   
 $Lc = (Ltw) - (2U) \div (\cos \theta)$   
 $Atw = (Lc) + (B)$   
 Total Wingwall Area (two wings ~ S.F.)  
 $= (0.5) (Hw + 0.333') (Lw + A)$

Hw = Height of wingwall (feet)  
 SL:1 = Side slope ratio (horizontal : 1 vertical)  
 Lw = Length of wingwall (feet)  
 Ltw = Culvert toewall length (feet)  
 Lc = Culvert curb between wings (feet)  
 Atw = Anchor toewall length (feet)  
 N = Number of culvert spans  
 θ = Culvert skew  
 See applicable box culvert standard for H, S, T, and U values.  
 See Table of Maximum Wall Heights for limits on Hw.

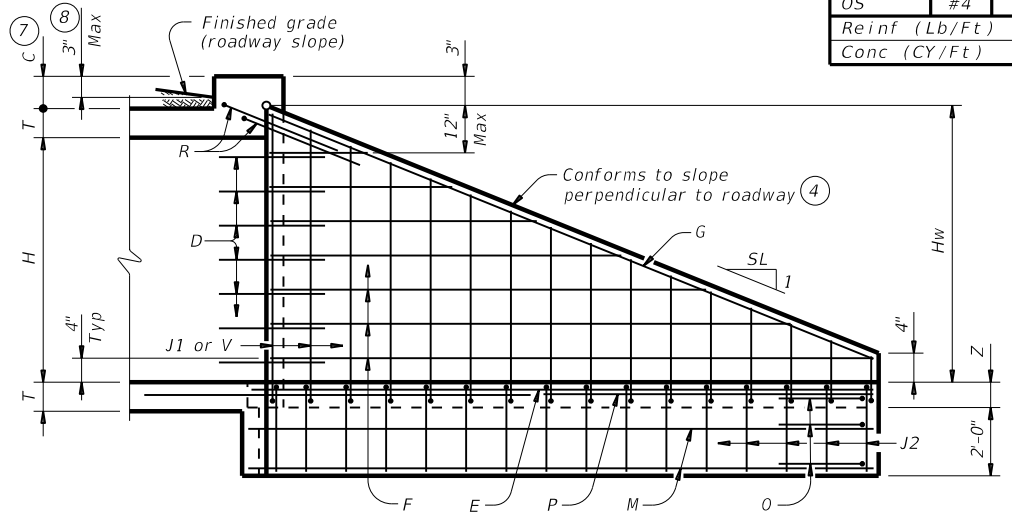
**MATERIAL NOTES:**

Provide Grade 60 reinforcing steel.  
 Provide galvanized reinforcing steel if required elsewhere in the plans.  
 Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.  
 Provide Class "C" concrete (f'c = 3,600 psi).  
 Adjust reinforcing as necessary to provide a minimum clear cover of 1 1/2".  
 Provide pipe runners and anchor pipes meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.  
 Provide ASTM A307 bolts and nuts.  
 Provide ASTM A36 steel plates.  
 Galvanize all steel components, except reinforcing unless required elsewhere in the plans, after fabrication.  
 Repair galvanizing damaged during transport or construction in accordance with the Item 445, "Galvanizing".  
 For optional adhesive anchors, install adhesive anchorages in accordance with the manufacturer's instructions including hole size, drilling equipment and method, hole cleaning equipment and method, mixing and dispensing adhesive, and anchor insertion. Do not alter the manufacturer's mixing nozzle or dispenser. Provide anchorage rods that are clean and free of grease, oil, or any other foreign material. Demonstrate hole cleaning method to the Engineer for approval and continue the approved process for all anchorage locations. Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

**GENERAL NOTES:**

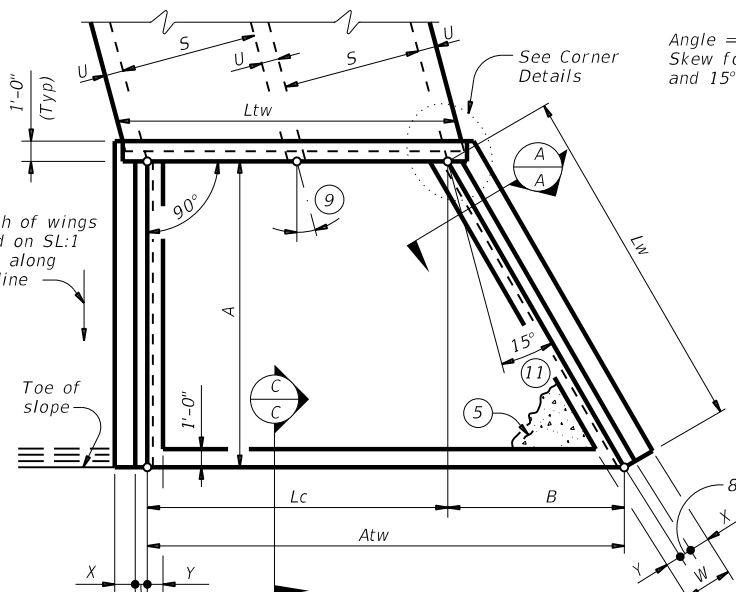
Designed according to AASHTO LRFD Bridge Design Specifications.  
 The safety end treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.  
 Pipe runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.  
 When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.  
 All bolts, nuts, washers, brackets, angles, and pipe runners are considered parts of the safety end treatment for payment.  
 The quantities for pipe runners, reinforcing steel, and concrete, resulting from the formulas given herein are for Contractor's information only.  
 See Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.

Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing dimensions are out-to-out of bars.



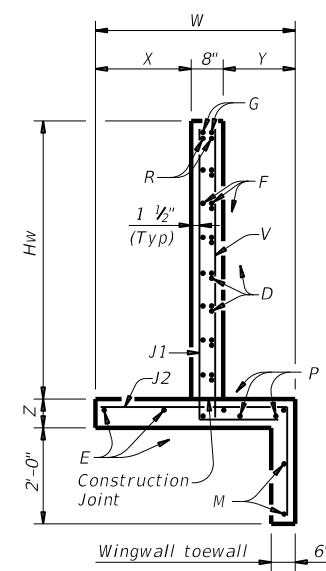
**INSIDE ELEVATION OF WINGWALL**

(Showing reinforcing. Culvert and culvert toewall reinforcing not shown for clarity.)

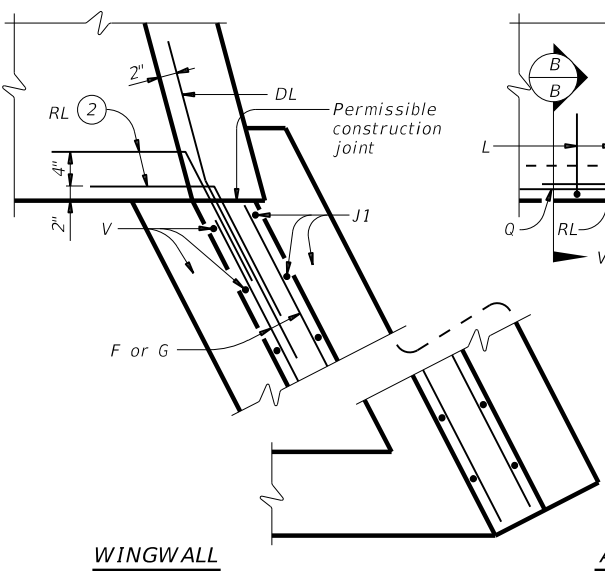


**PLAN**

(Showing dimensions and 15° skew.)

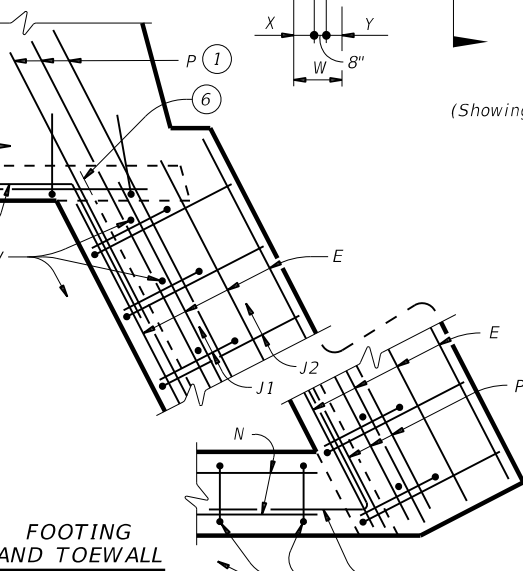


**SECTION A-A**

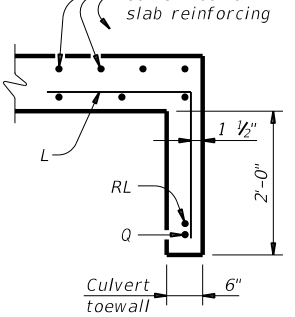


**CORNER DETAILS**

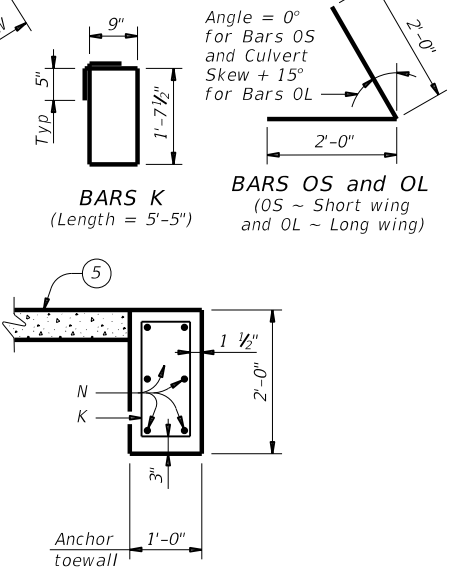
(Culvert and culvert toewall reinforcing not shown for clarity.)



**FOOTING AND TOEWALL**



**SECTION B-B**



**SECTION C-C**

BARS K (Length = 5'-5")  
 BARS OS and OL (OS ~ Short wing and OL ~ Long wing)

BARS DS and DL (DS ~ Short wing and DL ~ Long wing)

BARS RS and RL (RS ~ Short wing and RL ~ Long wing)

BARS J1

BARS V

BARS L

BARS J2

		<b>Bridge Division Standard</b>	
<b>SAFETY END TREATMENT WITH FLARED WINGS</b>			
<b>FOR 15° AND 30° SKEW BOX CULVERTS TYPE I ~ CROSS DRAINAGE</b>			
<b>SETB-FW-S</b>			
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093104	034	FS 357	
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	48	



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**TABLE OF DIMENSIONS AND REINFORCING STEEL**  
(Wings for one structure end)

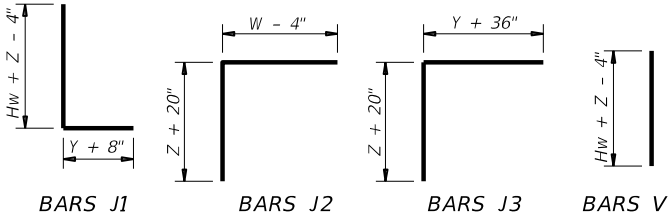
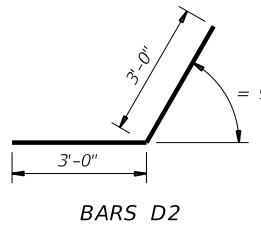
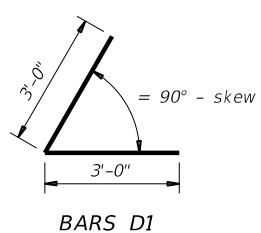
Maximum Wingwall Height Hw	Dimensions				Variable Reinforcing				Estimated Quantities per ft of wing (2-wings) ④		Estimated Quantities per ft of Toewall (1-toewall)	
	W	X	Y	Z	Bars J1		Bars J2		Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
					Size	Spa	Size	Spa				
2'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	48.64	0.406	6.85	0.071
2'-9"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	49.31	0.424	6.85	0.071
3'-0"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	49.98	0.444	6.85	0.071
3'-3"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	53.32	0.462	6.85	0.071
3'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	53.98	0.480	6.85	0.071
4'-0"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	#4	1'-0"	55.77	0.532	6.85	0.071
4'-6"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	#4	1'-0"	59.77	0.568	6.85	0.071
5'-0"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	#4	1'-0"	63.45	0.632	6.96	0.075
5'-6"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	#4	1'-0"	67.46	0.668	6.96	0.075
6'-0"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	#5	1'-0"	80.67	0.730	7.07	0.078
6'-6"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	#5	1'-0"	85.05	0.768	7.07	0.078
7'-0"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	#5	1'-0"	92.15	0.864	8.07	0.093
7'-6"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	#5	1'-0"	96.54	0.902	8.07	0.093
8'-0"	5'-6"	2'-8"	1'-10"	8"	#5	6"	#5	6"	139.04	0.962	8.13	0.095
8'-6"	5'-6"	2'-8"	1'-10"	8"	#5	6"	#5	6"	144.47	1.000	8.13	0.095
9'-6"	6'-0"	2'-10"	2'-2"	9"	#5	6"	#5	6"	156.93	1.136	8.41	0.110
10'-6"	6'-5"	3'-0"	2'-5"	9"	#6	6"	#5	6"	196.27	1.234	8.57	0.117
11'-6"	7'-2"	3'-6"	2'-8"	11"	#6	6"	#6	6"	230.13	1.438	9.52	0.140
12'-6"	7'-8"	3'-9"	2'-11"	1'-0"	#7	6"	#6	6"	283.41	1.592	9.74	0.157
13'-6"	8'-2"	4'-0"	3'-2"	1'-2"	#8	6"	#6	6"	348.72	1.804	10.02	0.186
14'-6"	8'-10"	4'-5"	3'-5"	1'-4"	#9	6"	#6	6"	432.94	2.046	10.30	0.218
15'-6"	9'-6"	4'-10"	3'-8"	1'-6"	#9	6"	#7	6"	489.52	2.302	11.24	0.253
16'-0"	9'-11"	5'-0"	3'-11"	1'-7"	#9	6"	#7	6"	505.72	2.448	11.47	0.279

**TABLE OF WINGWALL REINFORCING**  
(2-wings)

Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

**TABLE OF TOEWALL REINFORCING**

Bar	Size	No.	Spa
J3	#4	~	1'-0"
M2	#4	2	~
E2	#4	~	1'-0"



**WING DIMENSION FORMULAS:**  
(All values are in feet.)

$Hw = H + T + C$   
 $Lw = (Hw)(SL) \div \cosine(\theta)$  for Type PW-1  
 $Lw = (Hw - 1')(SL) \div \cosine(\theta)$  for Type PW-2 and  $Hw \geq 4'$   
 $Lw = (Hw - 0.5')(SL) \div \cosine(\theta)$  for Type PW-2 and  $Hw < 4'$

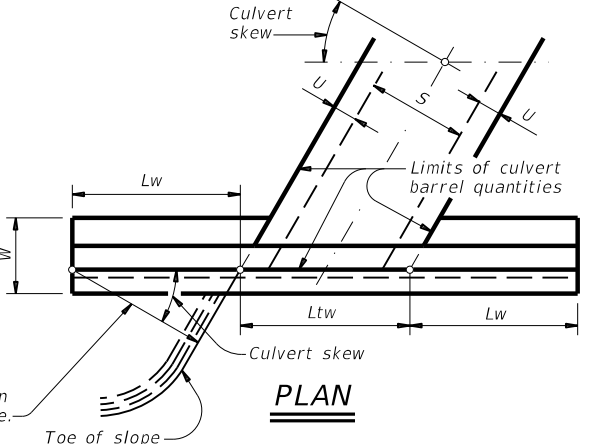
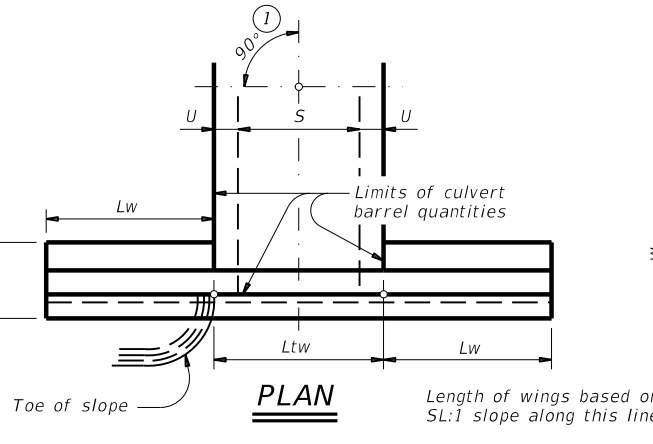
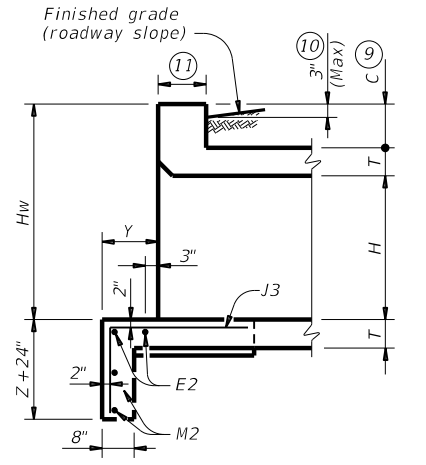
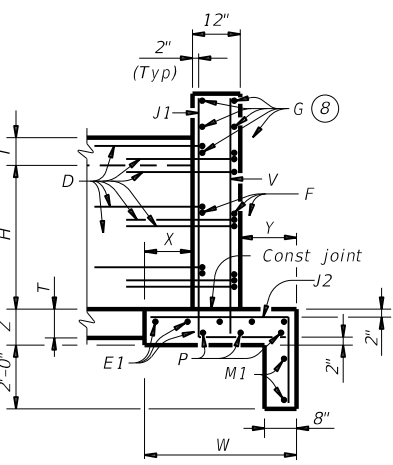
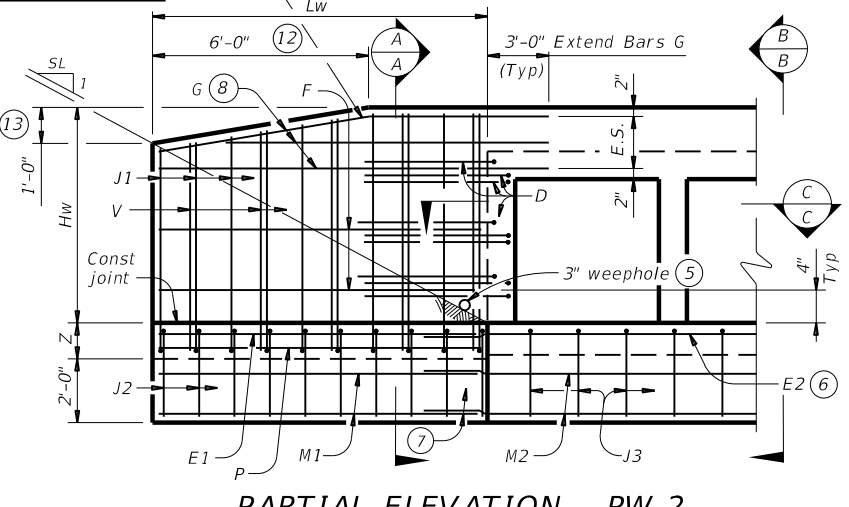
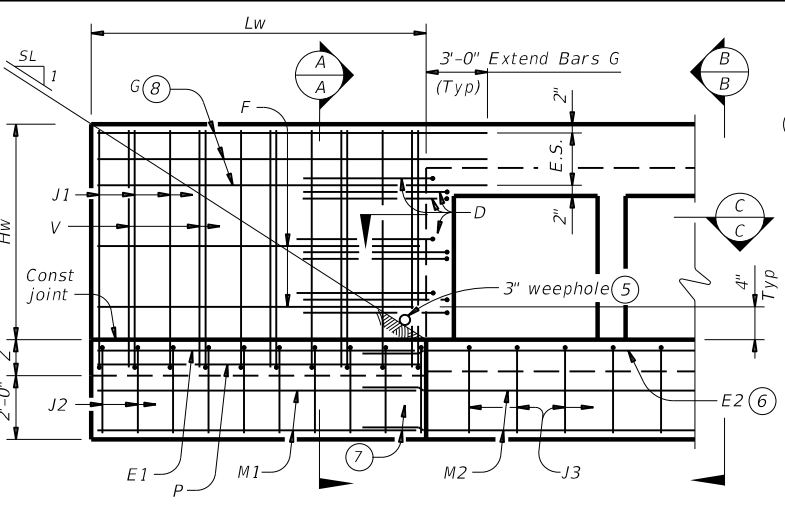
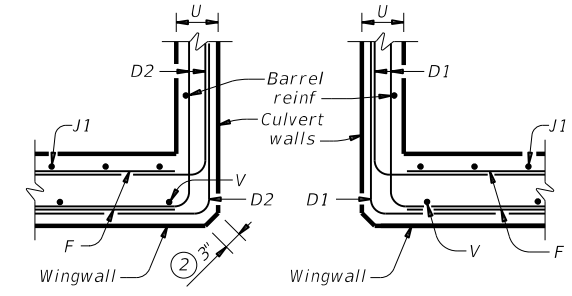
For cast-in-place culverts:  
 $Ltw = [(N)(S) + (N + 1)(U)] \div \cosine(\theta)$

For precast culverts:  
 $Ltw = [(N)(2U + S) + (N - 1)(0.5')] \div \cosine(\theta)$   
 Total Wingwall Area (two wings ~ SF)  
 $= (2)(Hw)(Lw)$  for Type PW-1  
 $= (2)(Hw)(Lw) - 6 SF$  for Type PW-2 and  $Hw \geq 4'$   
 $= (2)(Hw)(Lw) - 1.5 SF$  for Type PW-2 and  $Hw < 4'$

$Hw$  = Height of wingwall  
 $Lw$  = Length of wingwall  
 $Ltw$  = Culvert toewall length  
 $N$  = Number of culvert spans  
 $SL:1$  = Channel slope ratio, (horizontal: 1 vertical, usual value is 2:1)  
 $\theta$  = Culvert skew

See applicable box culvert standard sheet for S, H, T, and U values.

- Skew = 0°
- At discharge end, chamfer may be 3/4" minimum.
- For 15° skew ~ 1"  
For 30° skew ~ 2"  
For 45° skew ~ 3"
- Quantities shown are for two Type PW-1 wings. Adjust concrete volume for Type PW-2 wings. To determine estimated quantities for two wings, multiply the tabulated values by Lw. Quantities shown do not include weight of Bars D.
- Provide weepholes for Hw = 5'-0" and greater. Fill around weepholes with coarse gravel.
- Extend Bars E2 1'-6" minimum into the wingwall footing.
- Lap Bars M1 1'-6" minimum with Bars M2.
- Place Bars G as shown, equally spaced at 8" maximum. Provide at least two pairs of Bars G per wing.
- 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0, refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
- For vehicle safety, the following requirements must be met:
  - For structures without bridge rail, construct curbs no more than 3" above finished grade.
  - For structures with bridge rail, construct curbs flush with finished grade.
 Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elsewhere in the plans.
- 3'-0" for Hw < 4'.
- 6" for Hw < 4'.



**DETAILS FOR NON-SKEWED BOX CULVERTS**

**DETAILS FOR SKEWED BOX CULVERTS**  
(Showing 30° skew.)

**DESIGNER NOTES:**  
 Type PW-1 can be used for all applications and must be used if railing is to be mounted to the wingwall.  
 Type PW-2 can only be used for applications without a railing mounted to the wingwall.

**MATERIAL NOTES:**  
 Provide Class C concrete (f'c=3,600 psi).  
 Provide Grade 60 reinforcing steel.  
 Provide galvanized reinforcing steel if required elsewhere in the plans.

**GENERAL NOTES:**  
 Designed in accordance with AASHTO LRFD Bridge Design Specifications.  
 Depth of toewalls for wingwalls and culverts may be reduced or eliminated when founded on solid rock, when directed by the Engineer.  
 See Box Culvert Supplement (BCS) standard sheet for wingwall type and additional dimensions and information.  
 Quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for the Contractor's information only.

Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing dimensions are out-to-out of bars.

		<b>Bridge Division Standard</b>	
<b>CONCRETE WINGWALLS WITH PARALLEL WINGS FOR BOX CULVERTS TYPES PW-1 AND PW-2</b>			
<b>PW</b>			
FILE: pwstde01-20.dgn	DN: GAF	CK: CAT	DW: TxDOT
REVISIONS	CONTRACT	SECTION	JOB
0931	04	034	FS 357
DIST: LFK	COUNTY: TRINITY	SHEET NO. 50	

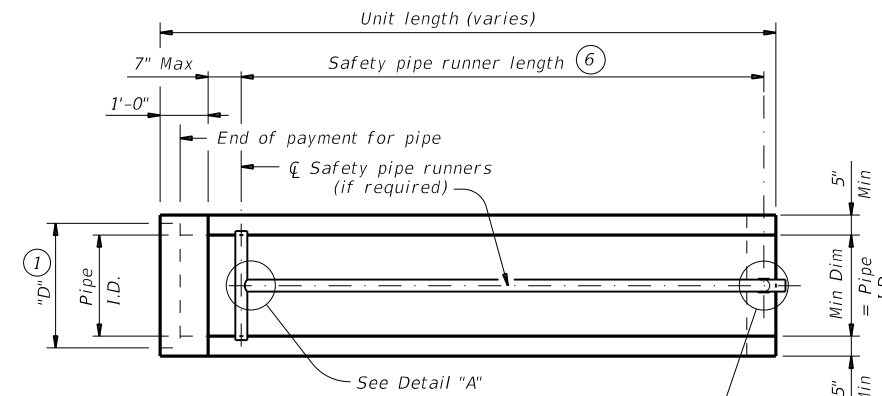
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 DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units.

## REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (8)	"D" (1)	Slope	Min Length of Unit	Single Pipe		Multiple Pipes	
						Skew	Pipe Runners Required	Skew	Pipe Runners Required
12"	2"	1.15"	17.00"	3:1	2' - 11"	≤ 45°	No	≤ 45°	No
				4:1	3' - 6"				
				6:1	4' - 9"				
15"	2 1/4"	1.30"	20.50"	3:1	3' - 8"	≤ 45°	No	≤ 45°	No
				4:1	4' - 7"				
				6:1	6' - 5"				
18"	2 1/2"	1.60"	24.00"	3:1	4' - 6"	≤ 45°	No	≤ 45°	No
				4:1	5' - 8"				
				6:1	8' - 0"				
24"	3"	1.95"	31.00"	3:1	6' - 2"	≤ 45°	No	= 30°	No
				4:1	7' - 10"				
				6:1	11' - 3"				
30"	3 1/2"	2.65"	38.50"	3:1	7' - 10"	= 15°	No	= 15°	No
				4:1	10' - 1"				
				6:1	14' - 8"				
36"	4"	2.75"	45.50"	3:1	9' - 5"	= 0°	No	≥ 0°	Yes
				4:1	12' - 3"				
				6:1	17' - 11"				
42"	4 1/2"	2.7"	52.50"	3:1	11' - 1"	≥ 0°	Yes	≥ 0°	Yes
				4:1	14' - 5"				
				6:1	21' - 2"				

## SAFETY PIPE RUNNER DIMENSIONS

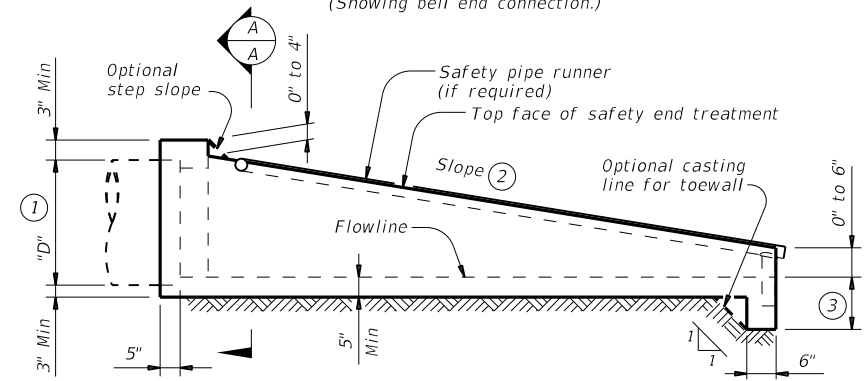
Max Safety Pipe Runner Length	Required Pipe Runner Size		
	Pipe Size	Pipe O.D.	Pipe I.D.
11' - 2"	3" STD	3.500"	3.068"
15' - 6"	3 1/2" STD	4.000"	3.548"
20' - 10"	4" STD	4.500"	4.026"
35' - 4"	5" STD	5.563"	5.047"



Pocket is to be formed to fit O.D. of pipe support post if safety pipe runners are used.

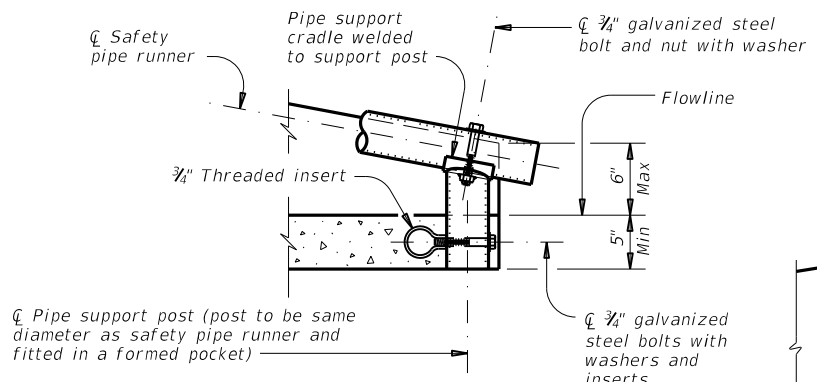
### PLAN

(Showing bell end connection.)



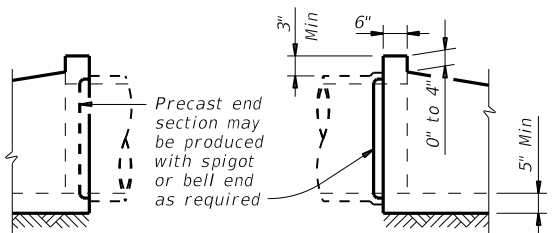
### LONGITUDINAL ELEVATION

(Showing bell end connection.)



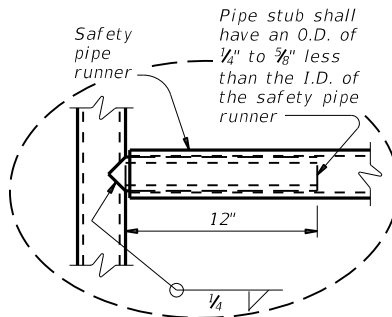
### END DETAIL FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)

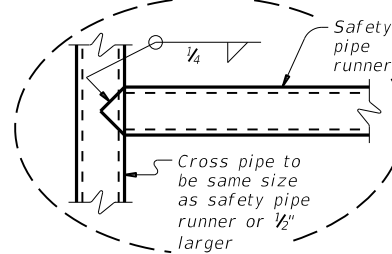


### OPTIONAL JOINT FOR RCP

(Showing joint between RCP and precast safety end treatment)



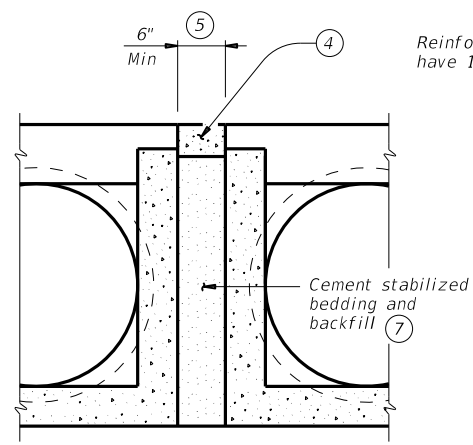
### OPTION A



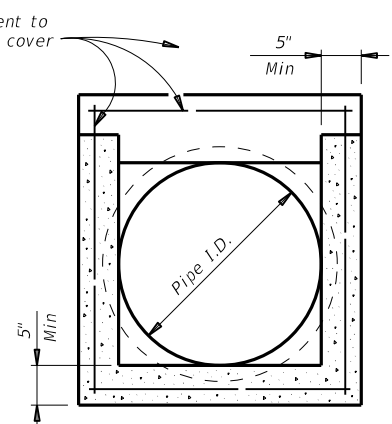
### OPTION B

### DETAIL A

(If required)

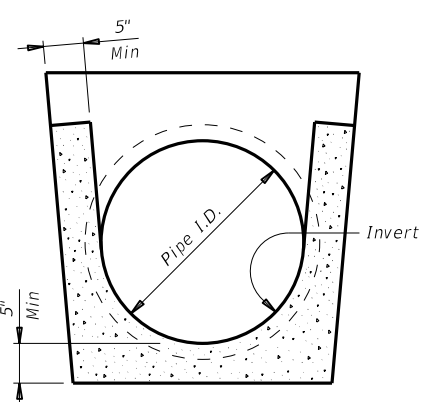


### MULTIPLE PIPE INSTALLATION

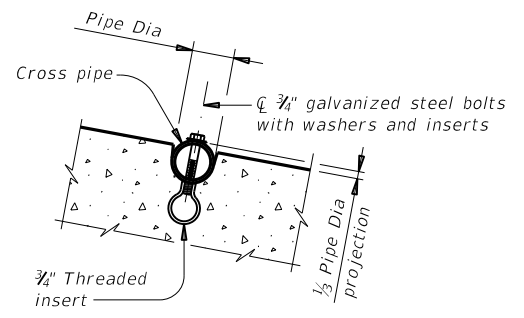


### OPTION WITH SQUARE BOTTOM

### SECTION A-A



### OPTION WITH INVERT BOTTOM



### INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)

- 1 Dimension "D" is based on reinforced concrete pipe (RCP) meeting the requirements of ASTM C-76, Class III, (RCP Wall "B" thickness). Adjust "D" for any other wall thickness used. For thermoplastic pipe (TP) take into account the annular space requirements for grouted connections.
- 2 Slope as shown elsewhere in plans. Slope of 3:1 or flatter is required for vehicle safety.
- 3 Toewall to be used only when dimension is shown elsewhere in the plans.
- 4 Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".
- 5 Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.
- 6 Measured along slope.
- 7 Provide cement stabilized bedding and backfill in accordance with the Item 400, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.
- 8 Thermoplastic pipe wall thickness may vary. Adjust accordingly. Thermoplastic pipe requires the safety end treatments to have a bell end for grouted connections.

### GENERAL NOTES:

Precast safety end treatment for reinforced concrete pipe (RCP), and thermoplastic pipe (TP) may be used for TYPE II end treatment as specified in Item "Safety End Treatment".

When precast safety end treatment is used as a Contractor's alternate to mitered RCP, riprap will not be required unless noted otherwise on the plans.

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

Manufacture this product in accordance with Item 467, "Safety End Treatment" except as noted below:

- A. Provide minimum reinforcing of #4 at 6" (Grade 40) or #4 at 9" (Grade 60) each way or 6"x6" - D12 x D12 or 5"x5" - D10 x D10 welded wire reinforcement (WWR).
- B. For precast (steel formed) sections, provide Class "C" concrete (f'c = 3,600 psi).

At the option and expense of the Contractor, the next larger size of safety end treatment may be furnished as long as the "D" dimension cast is that of the required size of pipe.

Pipe runners are designed for a traversing load of 1,800 Lbs at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

Provide safety pipe runners, cross pipes, pipe support posts, and pipe stubs meeting the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Galvanize all steel components except reinforcing steel after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

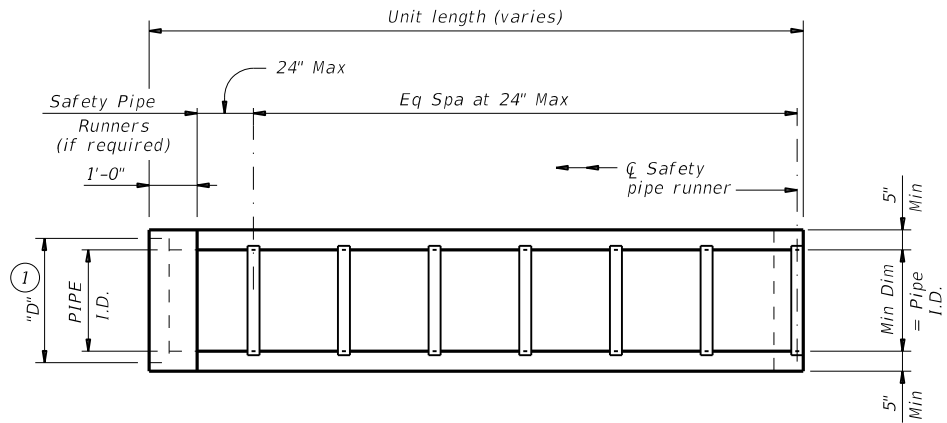
Connect RCP using the Optional Joint for RCP detail shown or in accordance with Item 464 "Reinforced Concrete Pipe". Connect TP by grouting. See Pipe and Box Grouted Connections (PBGC) standard for grouted connections with TP and precast safety end treatment.

		<b>Bridge Division Standard</b>	
<b>PRECAST SAFETY END TREATMENT</b>			
<b>TYPE II ~ CROSS DRAINAGE</b>			
<b>PSET-SC</b>			
FILE: psetscs5-21.dgn	DN: RLW	CK: KLR	DW: JTR
©TxDOT February 2020	CON: 093104	SECT: 034	JOB: FS 357
REVISIONS 12-21: Added 42" TP	DIST: LFK	COUNTY: TRINITY	SHEET NO: 51



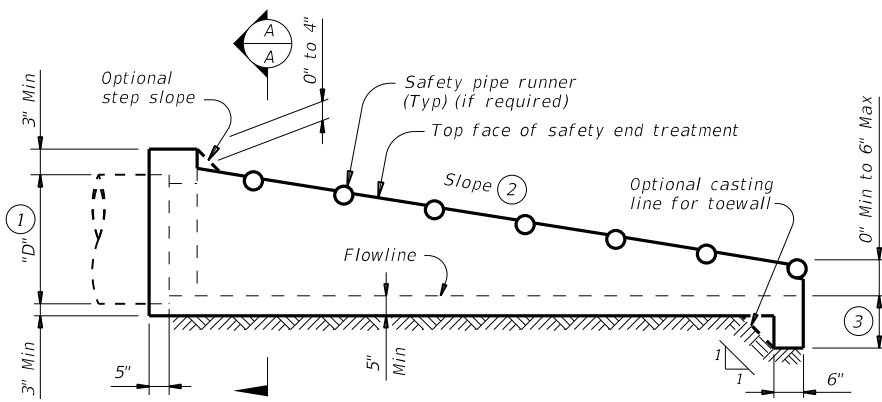
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DATE: FILE:



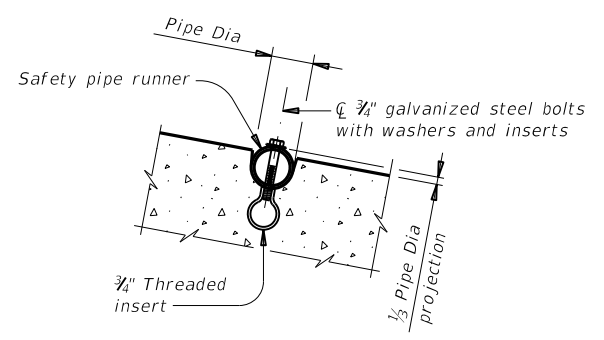
**PLAN**

(Showing bell end connection.)



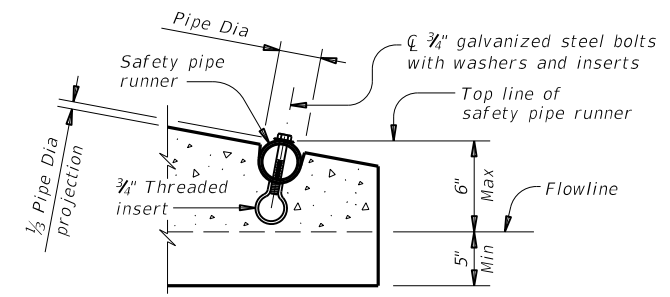
**LONGITUDINAL ELEVATION**

(Showing bell end connection.)

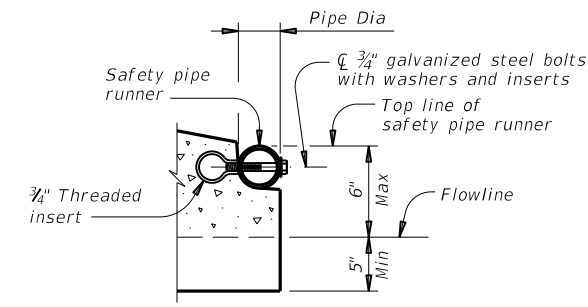


**INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS**

(If required)



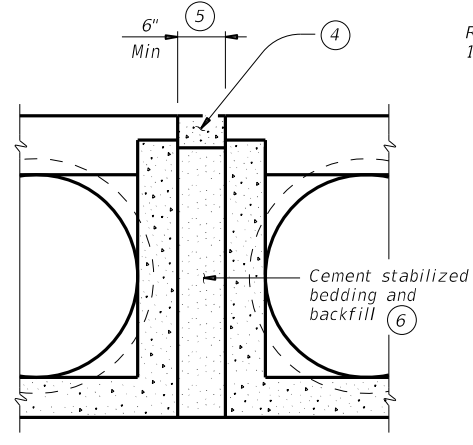
**OPTION A**



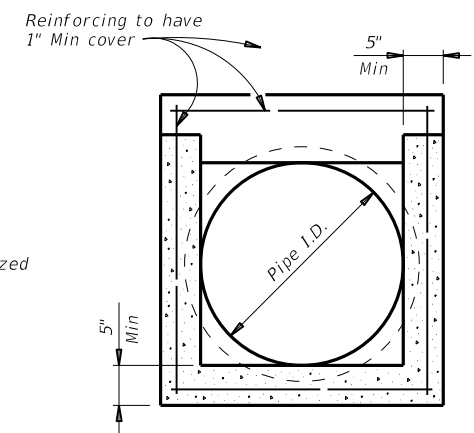
**OPTION B**

**END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS**

(If required)

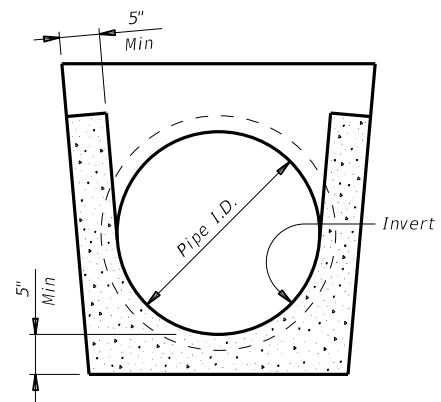


**MULTIPLE PIPE INSTALLATION**

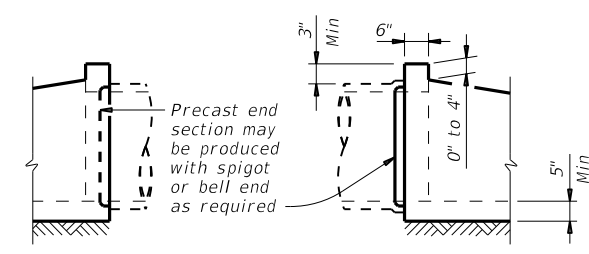


**OPTION WITH SQUARE BOTTOM**

**SECTION A-A**



**OPTION WITH INVERT BOTTOM**



**OPTIONAL JOINT FOR RCP**

(Showing joint between RCP and precast safety end treatment.)

**REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS**

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (7)	"D" (1)	Slope	Min Length	Pipe Runners Required		Required Pipe Runner Size		
						Single Pipe	Multiple Pipe	Nominal Dia.	O.D.	I.D.
12"	2"	1.15"	17.00"	6:1	4' - 9"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
15"	2 1/4"	1.30"	20.50"	6:1	6' - 5"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
18"	2 1/2"	1.60"	24.00"	6:1	8' - 0"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
24"	3"	1.95"	31.00"	6:1	11' - 3"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
30"	3 1/2"	2.65"	38.50"	6:1	14' - 8"	No	Yes	4" STD	4.500"	4.026"
36"	4"	2.75"	45.50"	6:1	17' - 11"	Yes	Yes	4" STD	4.500"	4.026"
42"	4 1/2"	2.7"	52.50"	6:1	21' - 2"	Yes	Yes	4" STD	4.500"	4.026"

- Dimension "D" is based on reinforced concrete pipe (RCP) meeting the requirements of ASTM C-76, Class III, (RCP Wall "B" thickness). Adjust "D" for any other wall thickness used. For thermoplastic pipe (TP) take into account the annular space requirements for grouted connections.
- Slope as shown elsewhere in the plans. Slope of 6:1 or flatter is required for vehicle safety.
- Toewall to be used only when dimension is shown elsewhere in the plans.
- Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".
- Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.
- Provide cement stabilized bedding and backfill in accordance with the Item 400, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.
- Thermoplastic pipe wall thickness may vary. Adjust accordingly. Thermoplastic pipe requires the safety end treatments to have a bell end for grouted connections.

**GENERAL NOTES:**

Precast safety end treatment for reinforced concrete pipe (RCP), and thermoplastic pipe (TP) may be used for TYPE II end treatment as specified in Item "Safety End Treatment".

When precast safety end treatment is used as a Contractor's alternate to mitered RCP, riprap will not be required unless noted otherwise on the plans.

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

Manufacture this product in accordance with Item 467, "Safety End Treatment" except as noted below:

A. Provide minimum reinforcing of #4 at 6" (Grade 40) or #4 at 9" (Grade 60) each way or 6"x6" - D12 x D12 or 5"x5" - D10 x D10 welded wire reinforcement (WWR).

B. For precast (steel formed) sections, provide Class "C" concrete (f'c = 3,600 psi).

At the option and expense of the Contractor the next larger size of safety end treatment may be furnished; as long as the "D" dimension cast is that of the required size of pipe.

Pipe runners are designed for a traversing load of 10,000 Lbs at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

Provide pipe runners meeting the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Galvanize all steel components except reinforcing steel after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

Connect RCP using the Optional Joint for RCP detail shown or in accordance with Item 464, "Reinforced Concrete Pipe". Connect TP by grouting. See Pipe and Box Grouted Connections (PBGC) standard for grouted connections with TP and precast safety end treatment.

Texas Department of Transportation  
 Bridge Division Standard

**PRECAST SAFETY END TREATMENT TYPE II ~ PARALLEL DRAINAGE**

**PSET-SP**

FILE: psetsps-21.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: Added 42" TP	0931	04	034	FS 357
	DIST	COUNTY	SHEET NO.	
	LFK	TRINITY	52	

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DATE: FILE:

## GENERAL NOTES FOR ALL ELECTRICAL WORK

- The location of all conduits, junction boxes, ground boxes, and electrical services is diagrammatic and may be shifted to accommodate field conditions.
- 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.
- Miscellaneous nuts, bolts and hardware, except for high strength bolts, may be stainless steel when plans specify galvanized, provided the bolt size is 1/2 in. or less in diameter.
- 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.
- 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.
- 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

- 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.
- Provide galvanized steel RMC for all exposed conduits, unless otherwise shown on the plans. Properly bond all metal conduits.
- 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"

- 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.
- 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.
- 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.
- Provide PVC junction boxes intended for outdoor use on PVC conduit systems, unless otherwise noted on the plans.

- 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.
- 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.
- 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

- 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.
- 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.
- Do not attach conduit supports directly to pre-stressed concrete beams except as shown specifically in the plans or as approved by the Engineer.
- 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.
- 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."
- Provide and place warning tape approximately 10 in. above all trenched conduit as per Item 618.
- 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.
- 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.
- 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.
- 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.
- At all electrical services, install a 6 AWG solid copper grounding electrode conductor.
- 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).
- 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.
- 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.

				<b>Traffic Operations Division Standard</b>	
<h1>ELECTRICAL DETAILS CONDUITS &amp; NOTES</h1>					
<h2>ED(1) - 14</h2>					
FILE:	ed1-14.dgn	DWG:	CK:	DW:	CK:
© TxDOT	October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS		0931	04	034	FS 357
		DIST	COUNTY		SHEET NO.
		LFK	TRINITY		53

# 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.

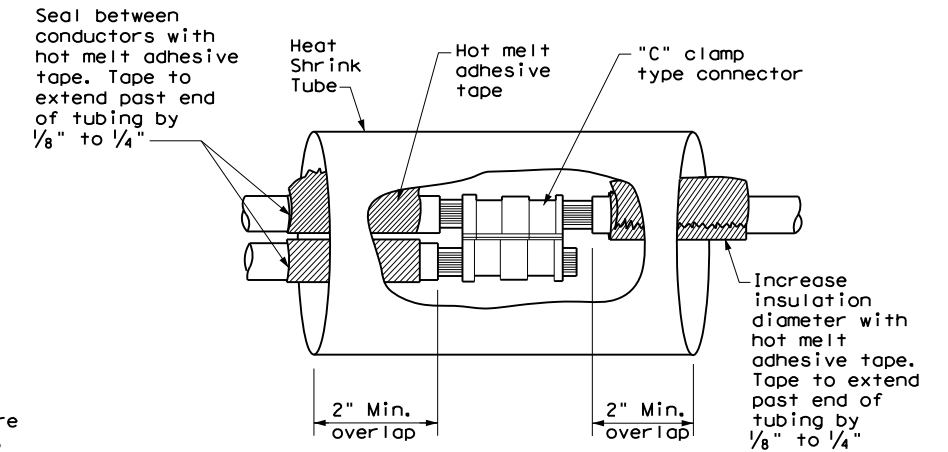
## B. CONSTRUCTION METHODS

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.



**SPLICE OPTION 1  
Compression Type**

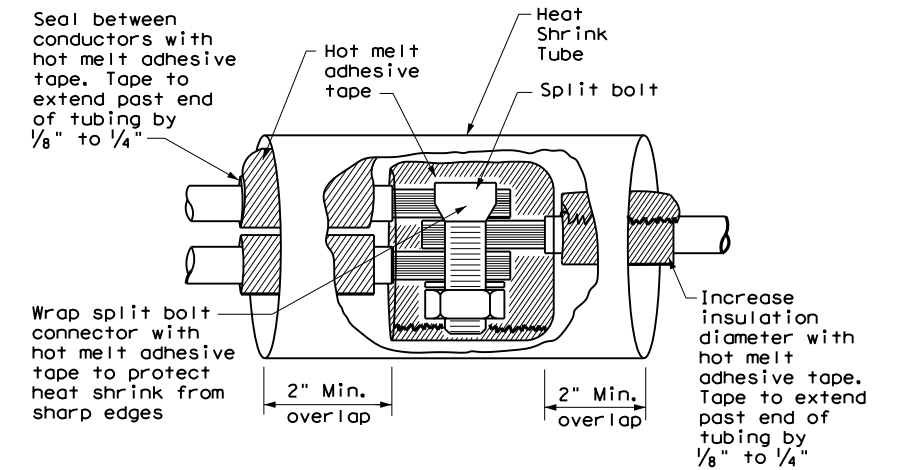
## GROUND RODS & GROUNDING ELECTRODES

### A. MATERIAL INFORMATION

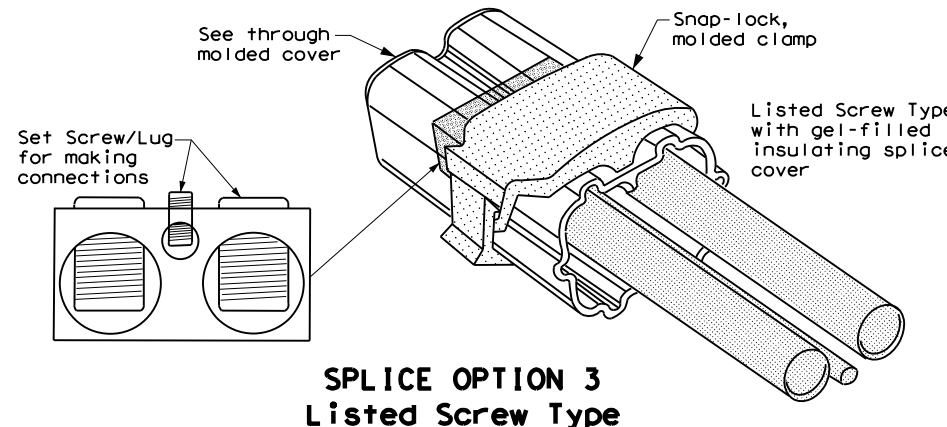
1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in 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 2  
Split Bolt Type**



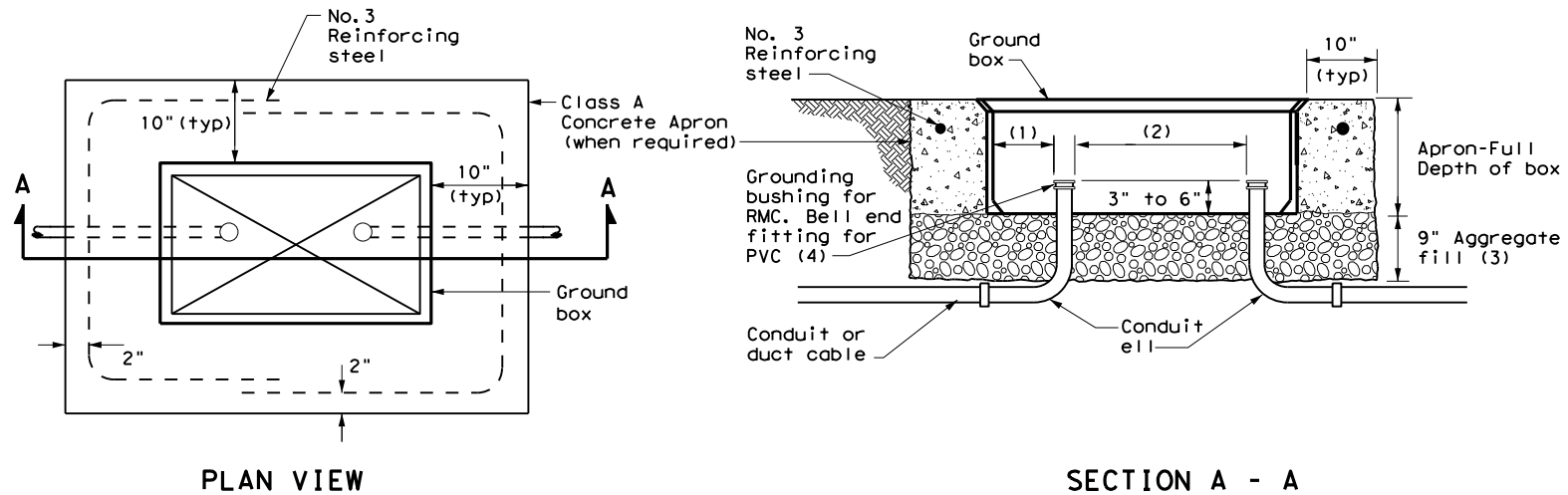
**SPLICE OPTION 3  
Listed Screw Type**

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DATE: FILE:

		Traffic Operations Division Standard	
<h1>ELECTRICAL DETAILS CONDUCTORS</h1>			
<h2>ED(3) - 14</h2>			
FILE: ed3-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2014	CONT	SECT	JOB
REVISIONS	0931	04	034
	DIST	COUNTY	SHEET NO.
	LFK	TRINITY	56

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**APRON FOR GROUND BOX**

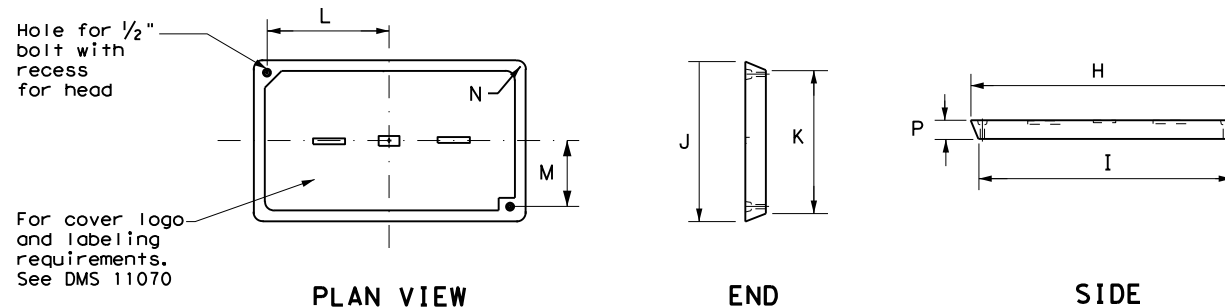
- (1) Uniformly space ends of conduits within the ground box. Position ends of conduits so that ground box walls do not interfere with the installation of grounding bushings or bell end fittings.
- (2) Maintain sufficient space between conduits to allow for proper installation of bushing.
- (3) Place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

**GROUND BOX DIMENSIONS**

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

**GROUND BOX COVER DIMENSIONS**

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



**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.

		<b>Traffic Operations Division Standard</b>	
<h2>ELECTRICAL DETAILS GROUND BOXES</h2>			
<h3>ED(4) - 14</h3>			
FILE: ed4-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2014	CONT: 0931	SECT: 04	JOB: 034
REVISIONS	DIST: LFK	COUNTY: TRINITY	HIGHWAY: FS 357
			SHEET NO.: 57

DATE: FILE:

**ELECTRICAL SERVICES NOTES**

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

**SERVICE ASSEMBLY ENCLOSURE**

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

**MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS**

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

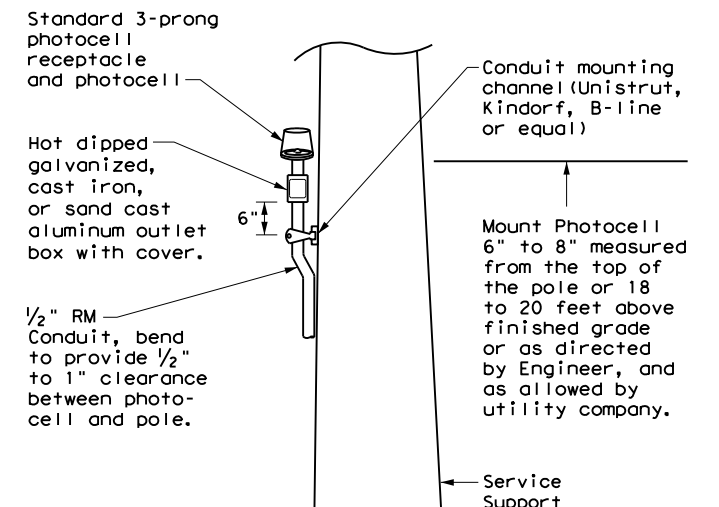
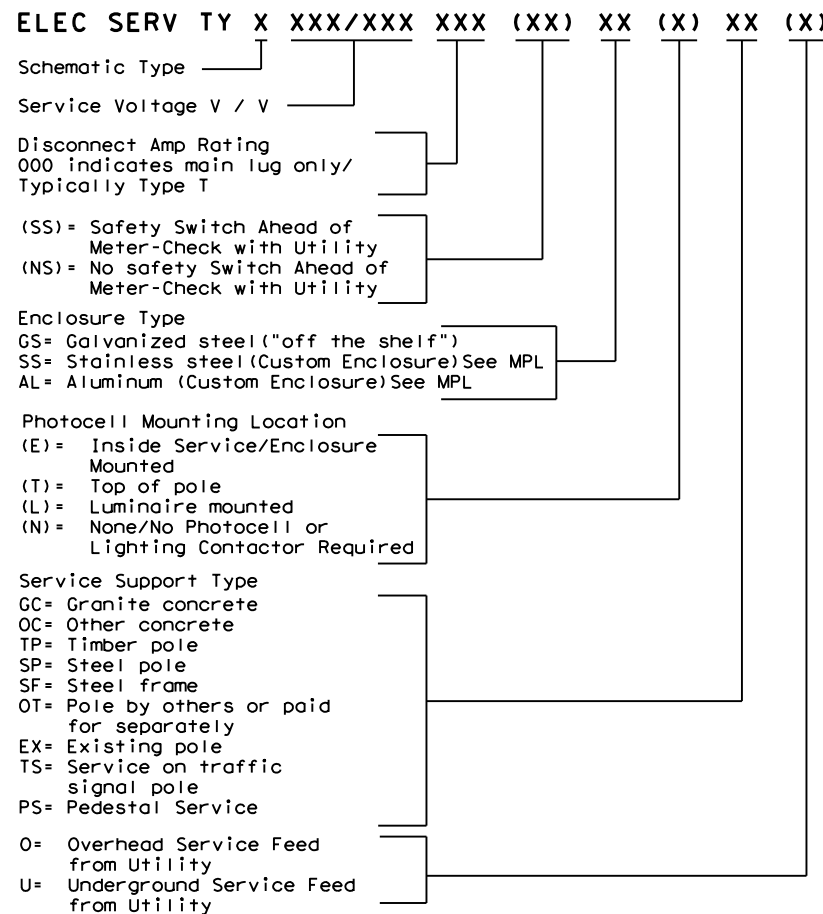
**PHOTOELECTRIC CONTROL**

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

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

\* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.  
 \*\* Verify service conduit size with utility. Size may change due to utility meter requirements. Ensure conduit size meets the National Electrical Code.

**EXPLANATION OF ELECTRICAL SERVICE DESCRIPTIVE CODE**



**TOP MOUNTED PHOTOCELL**

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

Texas Department of Transportation  
 Traffic Operations Division Standard

**ELECTRICAL DETAILS SERVICE NOTES & DATA**

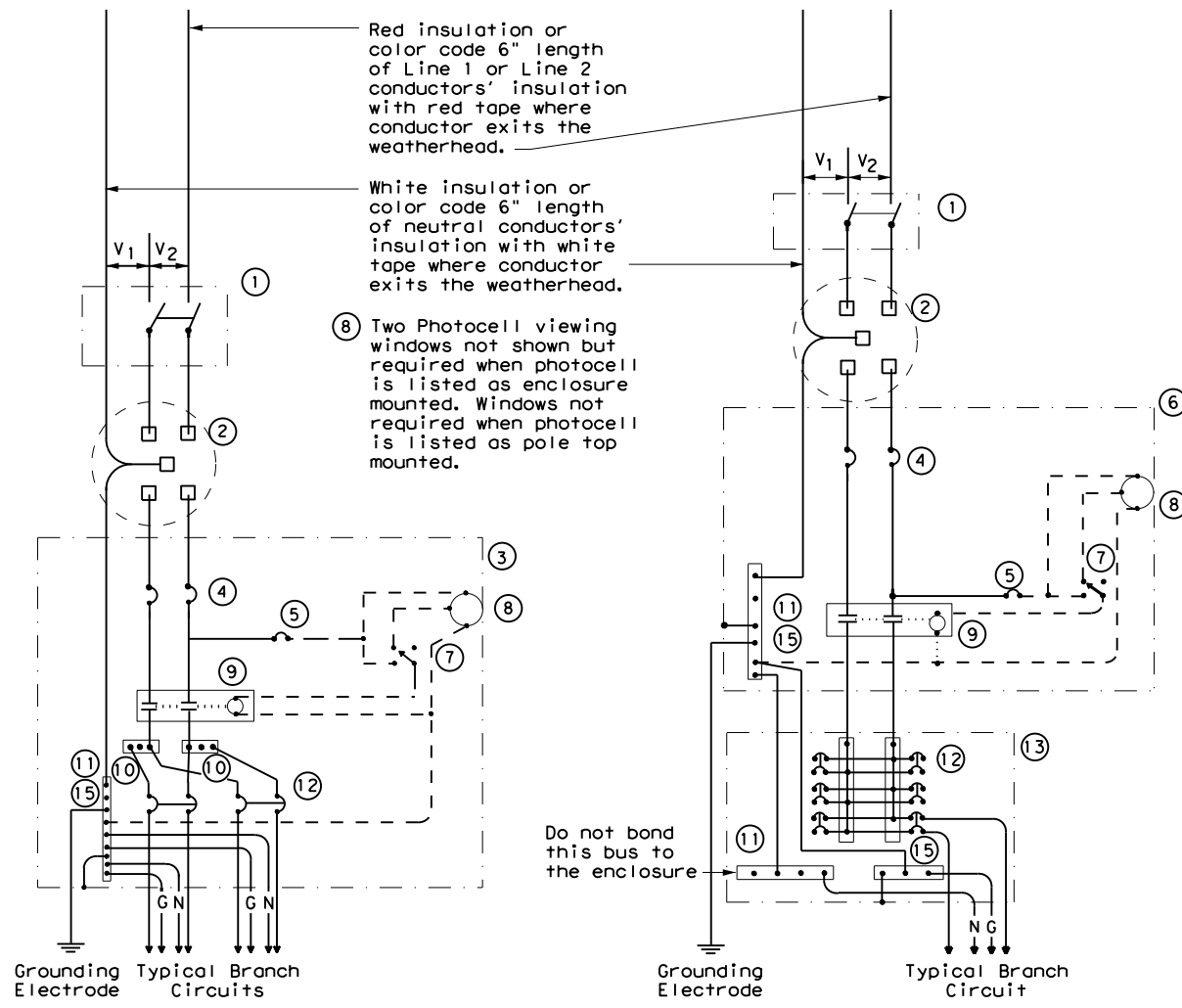
**ED(5) - 14**

FILE: ed5-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
	DIST	COUNTY	SHEET NO.	
	LFK	TRINITY	58	

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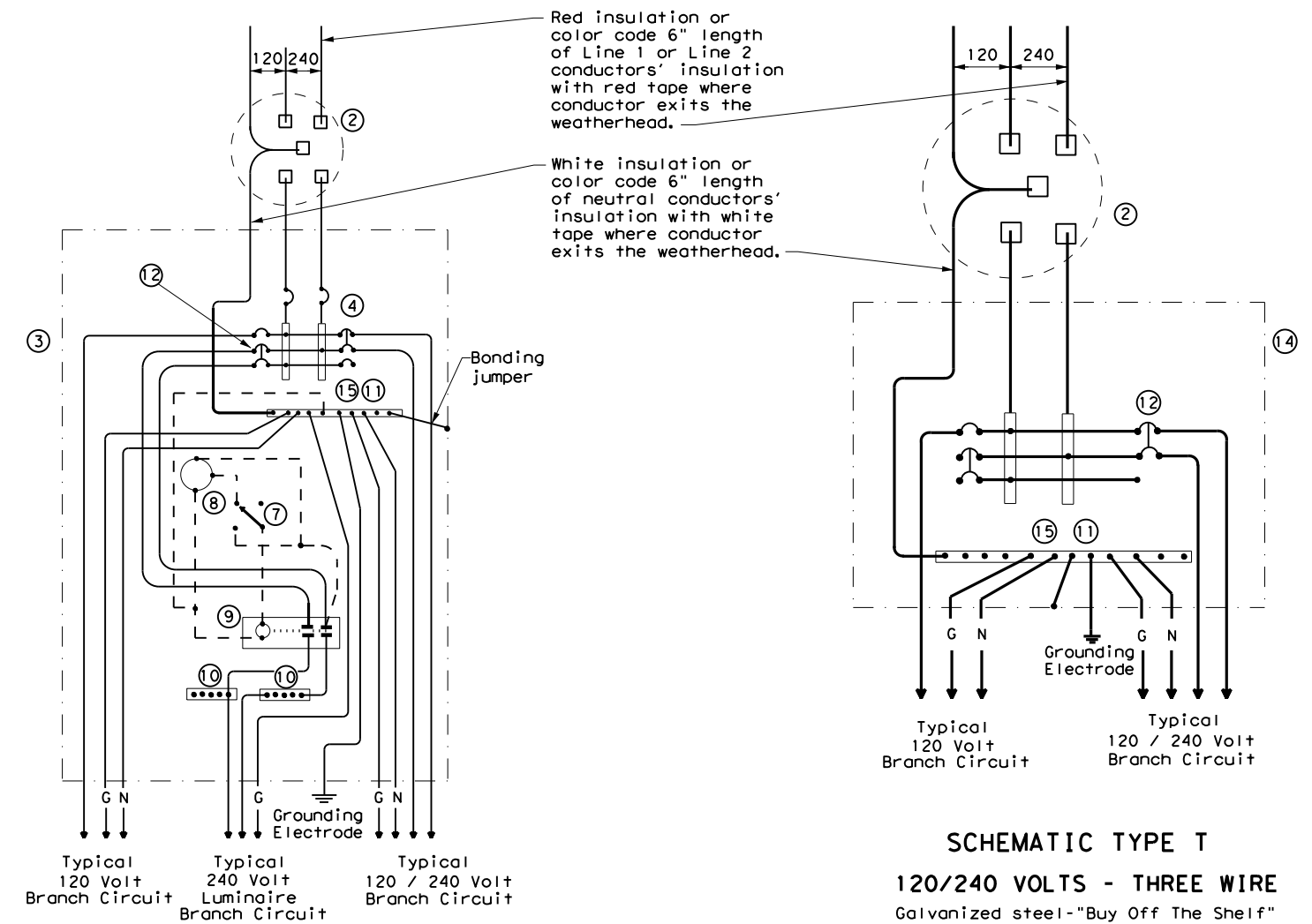
DATE:  
FILE:



**SCHEMATIC TYPE A  
THREE WIRE**

**SCHEMATIC TYPE C  
THREE WIRE**

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



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

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

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

				Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS SERVICE ENCLOSURE AND NOTES</b>					
<b>ED(6) - 14</b>					
FILE: ed6-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT	
© TxDOT October 2014	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0931	04	034	FS 357	
	DIST	COUNTY		SHEET NO.	
	LFK	TRINITY		59	

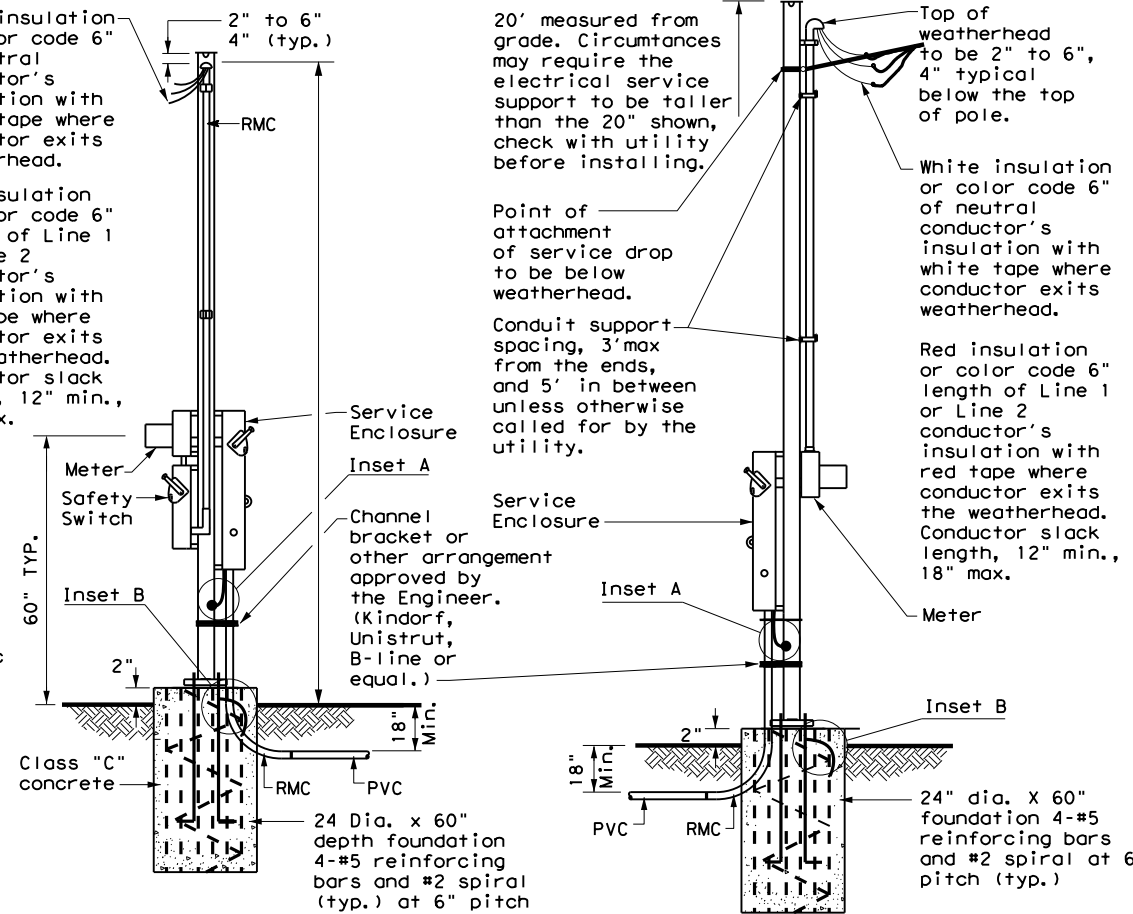
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**SUPPORT TYPE STEEL POLE (SP) AND STEEL FRAME (SF)**

1. Provide steel pole and steel frame supports as per TxDOT Departmental Material Specification (DMS)11080 "Electrical Services." Mount all equipment and conduit on 12 gauge galvanized steel or stainless steel channel strut, 1 1/2 in. or 1 3/8 in. wide by 1 in. up to 3 3/4 in. deep Unistrut, Kindorf, B-line or equal. Bolt or weld all channel and hardware to vertical members as approved. Do not stack channel. File smooth and paint field cut ends of all channel with zinc-rich paint before installing.
2. Provide poles for overhead service with an eyebolt or similar fitting for attachment of the service drop to the pole in conformance with the electric utility provider's specifications.
3. Provide and install galvanized 3/4 in. x 18 in. x 4 in. (dia. x length x hook length) anchor bolts for underground service supports. Provide and install galvanized 3/4 in. x 56 in. x 4 in. anchor bolts for overhead service supports. Ensure anchor bolts have 3 in. of thread, with 3 1/4 in. to 3 1/2 in. of the exposed anchor bolt projecting above finished foundation. Provide and install leveling nuts for all anchor bolts.
4. Bond one of the anchor bolts to the rebar cage with 6 AWG bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. See Inset B.
5. Furnish and install rigid metallic ellis in all steel pole and steel frame foundations for all conduits entering the service from underground.
6. Use class C concrete for foundations. Ensure reinforcing steel is Grade 60 with 3" of unobstructed concrete cover.
7. Drill and tap steel poles and frames for 1/2 in. X 13 UNC tank ground fitting. For steel pole service supports, provide and install tank ground fitting 4 in. to 6 in. below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. For steel frame service supports, provide and install tank ground fitting on steel frame post. Install service grounding electrode conductor in a non-metallic conduit or tubing from the enclosure to the steel frame post. Connect electrical service grounding electrode conductor to the tank ground fitting. See steel frame and steel pole details and Inset A for more information. Size service entrance conduit and branch circuit conduit as shown in the plans. For underground conduit runs from the electrical service, extend RMC from the service enclosure to an RMC elbow, and then connect the schedule type and size of conduit shown in the plans. Provide and install grounding bushings where RMC terminates in the enclosure. Grounding bushings are not required when RMC is fitted into a sealing hub or threaded boss.
8. If Steel pole or frame is painted, bond each separate painted piece with a bonding jumper attached to a tapped hole.
9. Provide 1/4" - 20 machine screws for bonding. Do not use sheet metal screws. Remove all non-conductive material at contact points. Terminate bonding jumpers with listed devices. Install minimum size 6 AWG stranded copper bonding jumpers. Make up all threaded bonding connections wrench tight.
10. Avoid contact of the service drop and service entrance conductors with the metal pole to prevent abrasion of the insulated conductors.
11. Shop drawings are not required for service support structure unless specifically stated elsewhere or directed by the Engineer.

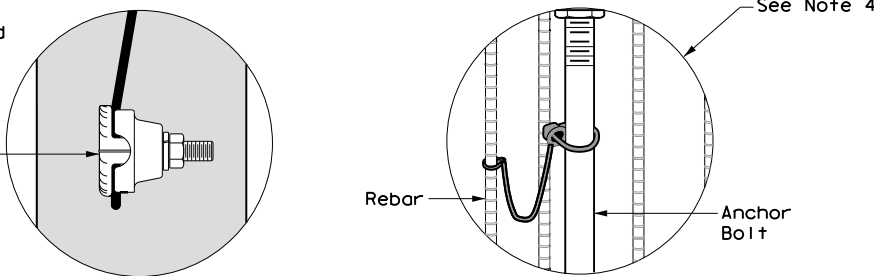
White insulation or color code 6" of neutral conductor's insulation with white tape where conductor exits weatherhead.

Red insulation or color code 6" length of Line 1 or Line 2 conductor's insulation with red tape where conductor exits the weatherhead. Conductor slack length, 12" min., 18" max.

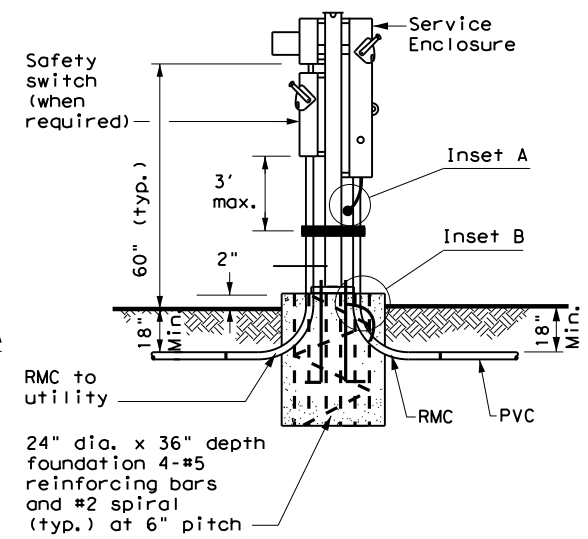


WITH SAFETY SWITCH      WITHOUT SAFETY SWITCH  
**SERVICE SUPPORT TYPE SP (O) - OVERHEAD SERVICE**

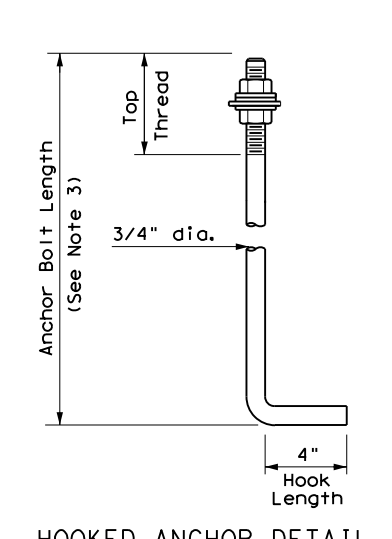
Drill, top, and thread 1/2" X 13 UNC. Install tank ground fitting, connect electrical service grounding electrode conductor. See Note 7.



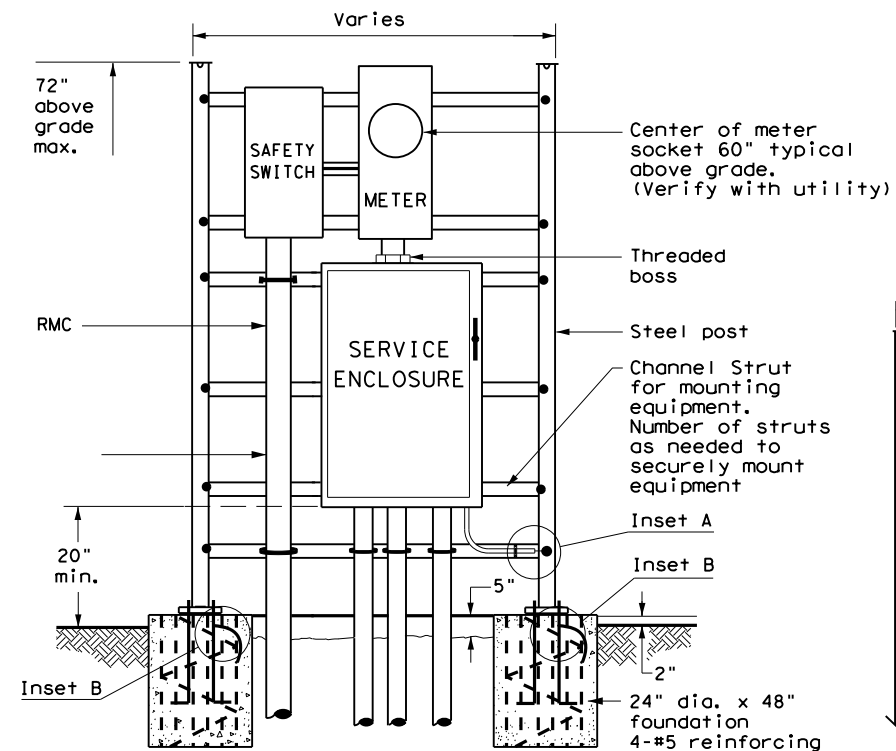
FRONT VIEW INSET A      INSET B



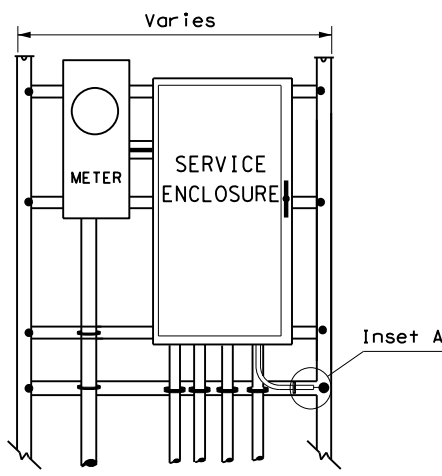
WITH SAFETY SWITCH  
**SERVICE SUPPORT TYPE SP (U) - UNDERGROUND SERVICE**



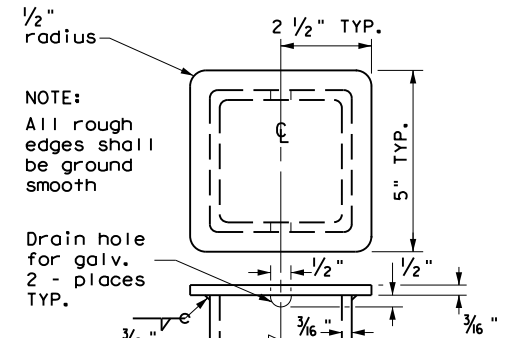
**HOOKED ANCHOR DETAIL**



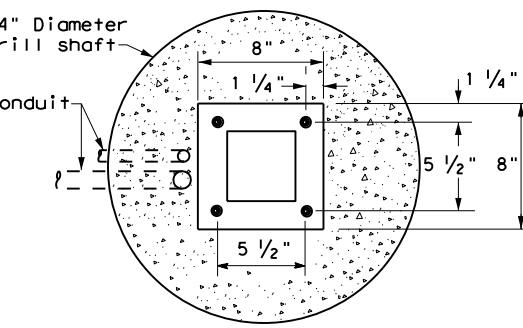
WITH SAFETY SWITCH  
**FRONT VIEW**  
**SERVICE SUPPORT TYPE SF (U) - UNDERGROUND SERVICE**



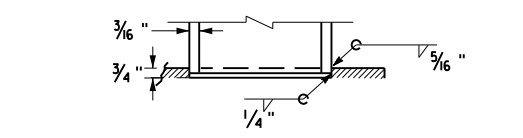
WITHOUT SAFETY SWITCH



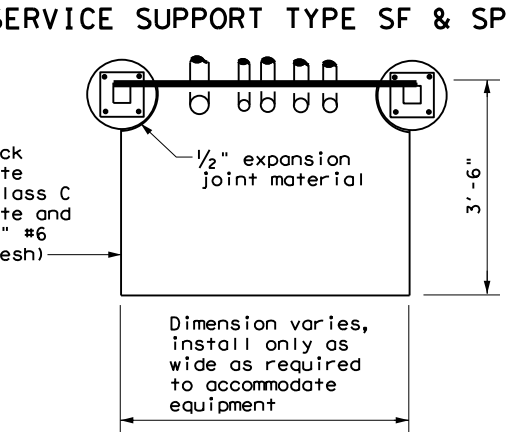
**POLE TOP PLATE**



**BASE PLATE DETAIL**



**BOTTOM OF POLE**



**TOP VIEW**

**SERVICE SUPPORT TY SF (O) & SF (U)**

		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS</b> <b>SERVICE SUPPORT</b> <b>TYPES SF &amp; SP</b> <b>ED(7)-14</b>			
FILE: ed7-14.dgn	DWG: TxDOT	CHK: TxDOT	DWG: TxDOT
©TxDOT October 2014	CONTRACT: 093104	SECTION: 034	HIGHWAY: FS 357
REVISIONS	DIST: LFK	COUNTY: TRINITY	SHEET NO.: 60

DATE: FILE:



# ROADWAY ILLUMINATION ASSEMBLY NOTES

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DATE: FILE:

1. Details apply to roadway lighting installations bid or referenced under Item 610, "Roadway Illumination Assemblies." Provide, furnish, and install all other materials not shown on the plans which may be necessary for complete and proper construction. Where manufacturers provide warranties or guarantees as a customary trade practice, furnish to the State such warranties or guarantees.
2. The locations of poles and fixtures may be shifted by the Engineer to accommodate local conditions. Install or remove poles and luminaires located near overhead electrical lines using established industry and utility safety practices and in accordance with laws governing such work. Consult with the appropriate utility company prior to beginning such work.
3. 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, Intertek Testing Services NA Inc., or FM Approvals LLC can be considered equivalent to UL. Faulty fabrication or poor workmanship in any material, equipment, or installation is justification for rejection.
4. Provide Roadway Illumination Light Fixtures as per TxDOT Departmental Material Specification (DMS) 11010, Item 610, and as shown on the Material Producers List (MPL) for Roadway Illumination and Electrical Supplies.
5. Fabricate steel roadway illumination poles in accordance with Roadway Illumination Poles (RIP) standards and Item 610. Poles fabricated according to RIP standards do not require shop drawing submittals.
  - a. Alternate designs to RIP standards or the use of aluminum to fabricate poles will require the submission of shop drawings electronically. For instructions on submitting shop drawings electronically see "Guide to Electronic Shop Drawing Submittal" on the TxDOT web site.
  - b. Limitations on use of the RIP standard: The RIP standard details were developed for installations in locations where the 3-second gust basic maximum wind speed is 110 mph, and where the elevation of the base of the pole is less than (i.e. not more than) 25' above the elevation of the surrounding terrain, in accordance with the "AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals," 6th Edition (2013) of the AASHTO Design Specifications. For poles to be installed in regions where the maximum basic wind speed exceeds 110 mph or to be mounted more than 25' above the surrounding terrain, provide poles meeting the following requirements:
    - i. Submittals. Following the electronic shop drawing submittal process (see Guide to Electronic Shop Drawing Submittal on the TxDOT web site), submit to the Engineer for approval fabrication drawings and calculations for the poles, sealed by a Texas licensed professional engineer (P.E.).
    - ii. Luminaire Structural Support Requirements. Provide light poles, arms, and anchor bolt assemblies with a 25 year design life to safely resist dead loads, ice loads and the required basic wind speeds at the location of installation in accordance with the 6th edition (2013) of the AASHTO Design Specifications. For transformer base poles, include transformer base and connecting hardware in calculations and shop drawing submittals. Structurally test all transformer bases to resist the theoretical plastic moment capacity of the pole. Submit certification of the plastic moment load test and FHWA breakaway requirement test of the model of base being furnished with the shop drawings. Show breakaway base model number, manufacturer's name, and logo on shop drawings. Include on manufacturer's shop drawings the ASTM designations for all materials to be used.
6. For both transformer and shoe-base type illumination poles, provide and install double-pole breakaway fuse holders as specified by DMS-11040. Breakaway fuse holders are listed on the MPL for Roadway Illumination and Electrical Supplies under Items 610 & 620. Provide 10 amp time delay fuses for breakaway connectors in light poles, or inside the light fixture for underpass luminaires. In each pole, connect luminaires to the breakaway connector with continuous stranded 12 AWG copper conductors as listed on the MPL. Bond all equipment grounding conductors together and to the ground lug in the transformer base or hand hole.
7. Tighten anchor bolts for shoe base, concrete traffic barrier base, and bridge mount roadway illumination poles, in accordance with Item 449.
8. Install T-Base with following procedure:
  - a. Anchor Bolt Tightening.
    - i. Coat the threads of the anchor bolts with electrically conductive lubricant.
    - ii. Place the T-base over the anchor bolts. Foundation must be level and flat. The maximum permissible gap under any one corner of the t-base is 1/8" before nuts are tightened.
    - iii. Coat the bearing surfaces of the nuts and washers with electrically conductive lubricant. Install (1) 1/2" hold down washer, (1) lock washer, and (1) nut on each anchor bolt. Turn the nuts onto the bolts so that each is hand-tight against the washer.
    - iv. Using a torque wrench, tighten each nut to 150 ft-lb. Uniform contact is required between the foundation and the T-base in the corner regions of the T-base, and all corner gaps must be closed after applying torque. If a gap still exists after torquing to 150 ft-lbs, continue torquing each bolt incrementally until gap is closed or maximum allowable torque of 250 ft. pound is reached, whichever comes first. If 250 ft-lbs is not enough to close the gap the foundation must be leveled. Gaps along the straight sides of the T-bases and the foundation are permissible. Ensure that no high point of contact occurs between the straight sides of the T-base and the foundation.
    - v. Check top of T-base for level. If not level then foundation must be leveled.
  - b. Top Bolt Procedure
    - i. Erect pole over T-base with crane. Coat bolts, nuts, washers, and lock washers with electrically conductive lubricant.

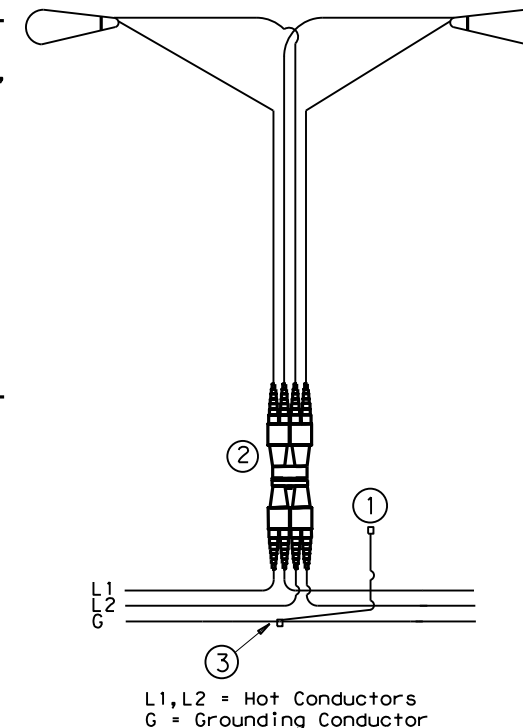
- ii. Install bolts and 1/2" connecting washers from the inside of the T-base, thread up through the pole base. Install flat washers, lock washers and nuts snug tight according to Item 447, "Structural Bolting."
  - iii. Tighten each nut to 150 ft-lb. using a torque wrench.
- c. Level and Plumb
- i. Ensure pole is plumb and mast arm is perpendicular to the roadway according to plans to within 5 degrees.
9. Construct luminaire pole foundations in accordance with Item 416, "Drilled Shaft Foundations," and TxDOT standard sheet RID(2).
  10. Provide and install underpass luminaires in accordance with Item 610, DMS-11010, and TxDOT standard sheet RID(3). Typical luminaire size for underpass luminaires is 150W HPS or 150W EQ LED.
  11. Mount luminaires on arms level as shown by the luminaire level indicator.
  12. Orient luminaires perpendicular to the roadway intended to be lit unless otherwise shown on the plans.

## Wiring Diagram Notes:

- ① Use 1/2 in. -13 UNC threaded, copper or tin-plated copper, pole bonding connector, sized appropriately for conductors, bonded to T-base, or use ground lug in handhole as available.
- ② Use pre-qualified two-pole breakaway connectors for all luminaire pole installations. For luminaires fed by a circuit with a neutral conductor, use double pole breakaway connectors with the neutral side unfused and marked white.
- ③ Split Bolt or other connector.

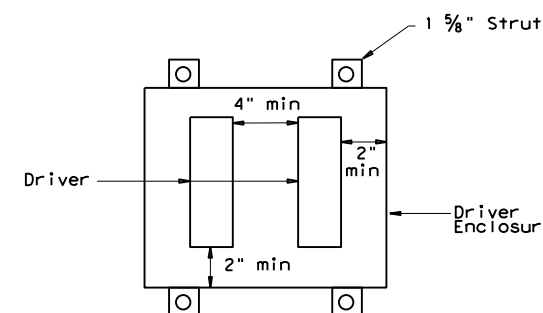
## Decorative LED Lighting Notes:

1. LED Drivers in Remote Outdoor enclosures (for drivers that do not include an enclosure as part of a factory assembly):
  - a. Provide NEMA 3R outdoor enclosure or as approved.
  - b. Install enclosure at least 12" above ground or other horizontal surface. Mount vertically or on ceiling, and avoid direct sun where possible.
  - c. Install drivers with at least 2 inches of space from enclosure walls.
  - d. For multiple drivers in an enclosure, provide at least 4 inches side to side and 1 inch end to end from other drivers or electronic equipment
  - e. For drivers mounted on back wall of enclosure, mount enclosure on 1 5/8" strut or other standoff to dissipate heat, or mount driver to side of the enclosure or to the metal cover.
  - f. Provide remote drivers with a maximum of 100 watts
  - g. Provide drivers with documentation of 100,000 hr lifetime at Tcase of 65C or higher.



## TYPICAL WIRING DIAGRAM

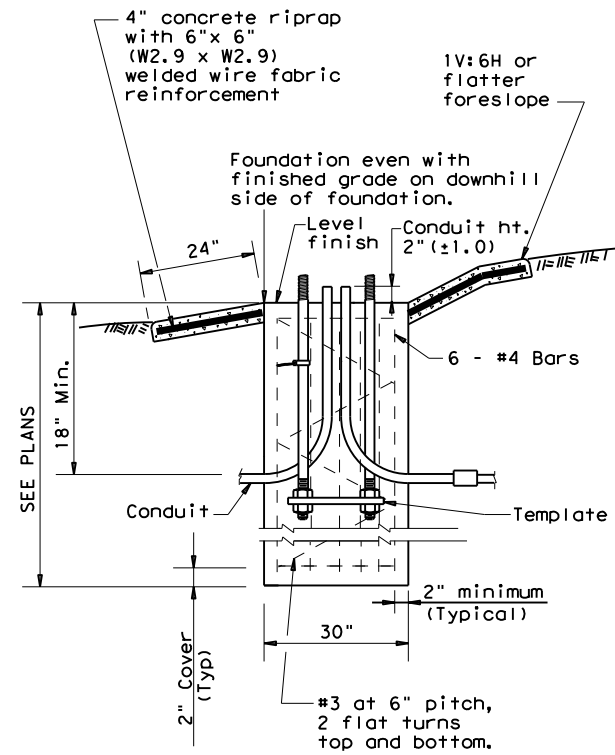
LUMINAIRES SERVED AT 480V ON 240/480 VOLT SERVICE OR LUMINAIRES SERVED AT 240V FOR 120/240 VOLT SERVICE.



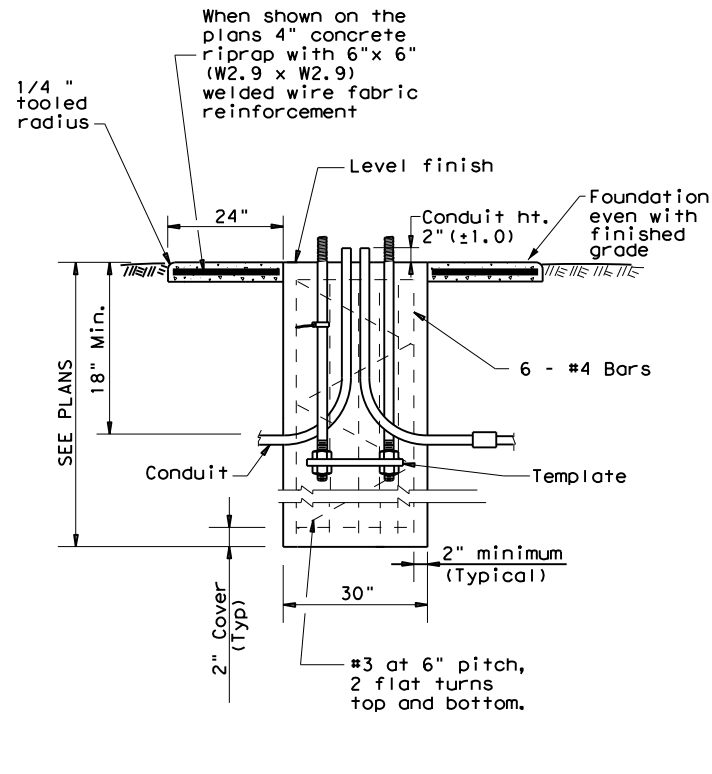
Driver Spacing In Remote Enclosure

		<b>Traffic Safety Division Standard</b>	
<h2>ROADWAY ILLUMINATION DETAILS</h2> <h3>RID(1)-20</h3>			
FILE: rid1-20.dgn	DN:	CK:	DW:
© TxDOT January 2007	CONT	SECT	JOB
REVISIONS	0931	04	034
7-17	DIST	COUNTY	SHEET NO.
12-20	LFK	TRINITY	61

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**SECTION A-A**  
SHOWING SLOPED GRADE



**SECTION A-A**  
SHOWING CONSTANT GRADE

**TABLE 1**

**ANCHOR BOLTS**

POLE MOUNTING HEIGHT	BOLT CIRCLE		ANCHOR BOLT SIZE
	Shoe Base	T-Base	
<40 ft.	13 in.	14 in.	1 in. x 30 in.
40-50 ft.	15 in.	17 1/4 in.	1 1/4 in. x 30 in.

**TABLE 2**

**RECOMMENDED FOUNDATION LENGTHS**  
(See note 1)

MOUNTING HEIGHT	TEXAS CONE PENETROMETER N Blows/ft		
	10	15	40
≤20 ft.	6'	6'	6'
>20 ft. to 30 ft.	8'	6'	6'
>30 ft. to 40 ft.	8'	8'	6'
>40 ft. to 50 ft.	10'	8'	6'

**TABLE 3**

**PAY QUANTITY OF RIPRAP PER FOUNDATION**  
(Install only when shown on the plans)

Foundation Diameter	RIPRAP DIAMETER	RIPRAP (CONC) (CL B)
30 in.	78 in.	0.35 CY

**GENERAL NOTES:**

1. "Recommended Foundation Lengths" table is for information purposes only. Foundation lengths shall be as shown on the plans, or as directed by the Engineer. Foundations will be paid for under Item 416, "Drilled Shaft Foundations," unless otherwise shown on the plans.
2. Erect roadway illumination assembly poles plumb and true. Form and level the top 6" of the foundation so the pole will be plumb. Use leveling nuts to plumb shoe base poles. Do not use shims or leveling nuts under transformer bases. Do not grout between baseplate and the foundation.
3. Ensure Class 2A and 2B fit for anchor bolts and nuts. Tap and chase nuts after galvanizing. Anchor bolt body with rolled threads need not be full size.
4. Use appropriate class of concrete as specified in Items 416 and 432. Concrete for riprap may be upgraded to Class C at no extra cost to the Department.
5. Place riprap around the foundation when called for elsewhere in the plans. Riprap will be paid for under Item 432.
6. Locate breakaway roadway illumination assemblies as shown in the placement table, unless otherwise dimensioned on the plans. Protect non-breakaway illumination assemblies from vehicular impact (i.e. 2.5 ft. behind guard rail or mounted on traffic barrier), or located outside the clear zone, except that 2.5 ft. from curb face is minimum desired for light poles on city streets, 45 mph or less. See Roadway Design Manual for further information.
7. Use 4 hold down and 4 connecting washers on transformer base poles as recommended by the manufacturer and supplied with base.
8. Install a minimum of 2 conduits in each foundation. See lighting layout sheets for locations of foundations with more than 2 conduits. Cap unused conduits in foundations on both ends.
9. Conduit location in foundations is critical for breakaway devices. Place conduits 2 in. apart on centerline as shown.
10. Bond anchor bolt to rebar cage with #6 bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. The bonded steel in the foundation creates a concrete encased grounding electrode which replaces the ground rod.
11. Grade earthwork around T-base foundations even with the finished grade as shown in Section A-A to ensure proper function of the breakaway device. Use riprap on T-base foundations that are located on sloped grades, and as shown on the plans for level grades.

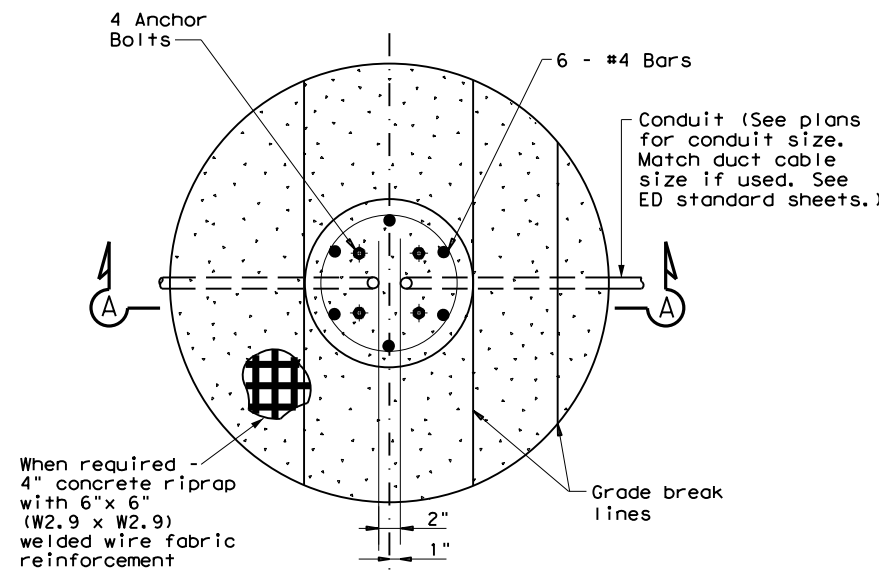
**TABLE 4**

**BREAKAWAY POLE PLACEMENT (See note 6)**

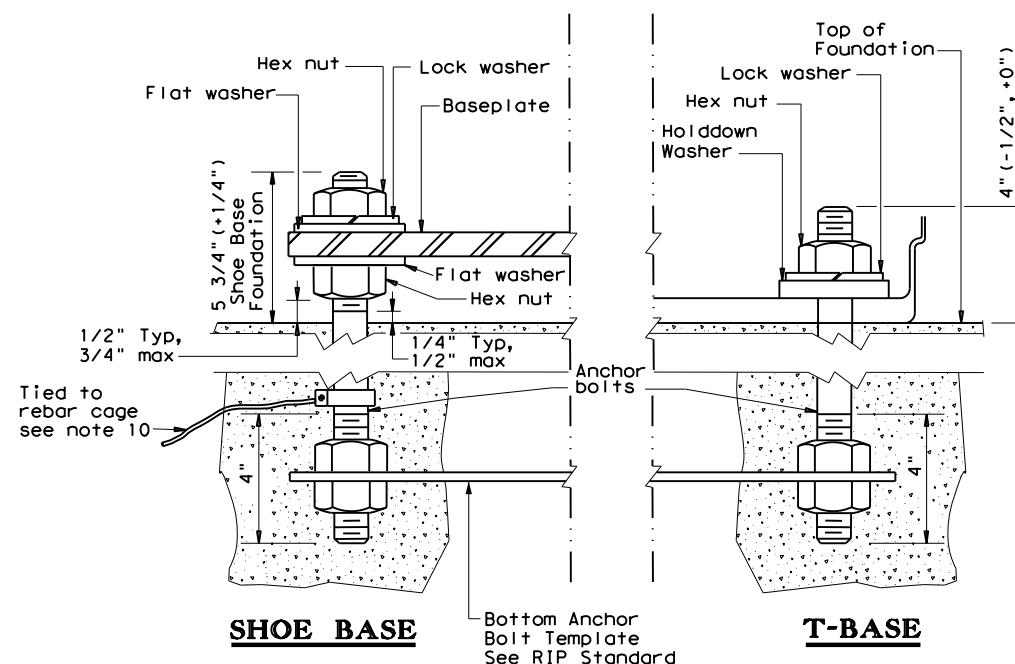
ROADWAY FUNCTIONAL CLASSIFICATION	** POLE OFFSET (DISTANCE TO FACE OF TRANSFORMER BASE)
Freeway Mainlanes (roadway with full control of access)	15 ft. (minimum and typical) from lane edge
All curbed, 45 mph or less design speed	2.5 ft. minimum (15 ft. desirable) from curb face
All others	10 ft. minimum*(15 ft. desirable) from lane edge

\* or as close to ROW line as is practical

\*\* provide 2/5 of the luminaire mounting height behind the pole for "falling area" to prevent encroachment on the other travel lanes. See design guidelines.



**FOUNDATION DETAIL**



**ANCHOR BOLT DETAIL**

**ROADWAY ILLUMINATION DETAILS**  
(RDWY ILLUM FOUNDATIONS)  
**RID(2)-20**

FILE: rid2-20.dgn	DN:	CK:	DW:	CK:
© TxDOT January 2007	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
1-11	DIST	COUNTY	SHEET NO.	
7-17	LFK	TRINITY	62	
12-20				

DATE:  
FILE:

**SHIPPING PARTS LIST - POLES AND LUMINAIRE ARMS**

Nominal Mounting Ht. (ft)	Shoe Base					T-Base					CSB/SSCB Mounted				
	Designation				Quantity	Designation				Quantity	Designation				Quantity
	Pole	A1	A2	Luminaire		Pole	A1	A2	Luminaire		Pole	A1	A2	Luminaire	
20	(Type SA 20 S - 4)			(150W EQ) LED		(Type SA 20 T - 4)			(150W EQ) LED						
	(Type SA 20 S - 4 - 4)			(150W EQ) LED		(Type SA 20 T - 4 - 4)			(150W EQ) LED						
30	(Type SA 30 S - 4)			(250W EQ) LED		(Type SA 30 T - 4)			(250W EQ) LED			(Type SP 28 S - 4)	(250W EQ) LED		
	(Type SA 30 S - 4 - 4)			(250W EQ) LED		(Type SA 30 T - 4 - 4)			(250W EQ) LED			(Type SP 28 S - 4 - 4)	(250W EQ) LED		
40	(Type SA 40 S - 4)			(250W EQ) LED		(Type SA 40 T - 4)			(250W EQ) LED			(Type SP 28 S - 8)	(250W EQ) LED		
	(Type SA 40 S - 4 - 4)			(250W EQ) LED		(Type SA 40 T - 4 - 4)			(250W EQ) LED			(Type SP 28 S - 8 - 8)	(250W EQ) LED		
50	(Type SA 50 S - 4)			(400W EQ) LED		(Type SA 50 T - 4)			(400W EQ) LED			(Type SP 38 S - 4)	(250W EQ) LED		
	(Type SA 50 S - 4 - 4)			(400W EQ) LED		(Type SA 50 T - 4 - 4)			(400W EQ) LED			(Type SP 38 S - 4 - 4)	(250W EQ) LED		

OTHER				
Designation				Quantity
Pole	A1	A2	Luminaire	

**GENERAL NOTES:**

- All work, materials and services not shown on the plans which may be necessary for complete and proper construction shall be performed, furnished and installed by the Contractor. Faulty fabrication or poor workmanship in any material, equipment or installation will be considered justification for rejection. Where manufacturers provide warranties or guarantees as a customary trade practice, furnish to the Department such warranties or guarantees.
- The location of poles and fixtures are diagrammatic only and may be shifted by the Engineer to accommodate local conditions. Install or remove poles and luminaires located near overhead electrical lines using established industry and utility safety practices and in accordance with laws governing such work. Consult with the appropriate utility company prior to beginning such work.
- Standard Steel Pole Designs. Steel poles fabricated in accordance with the details and dimensions shown herein, shall be considered standard designs. Submission of shop drawings and design calculations for standard designs is not required.
- Optional Steel Pole Designs. Multi-sided steel poles may be allowed as optional designs, if steel poles are permitted or required, pending approval by the Department as outlined below.
  - Shop Drawings. Optional designs require submission of shop drawings and design calculations bearing the seal of an engineer licensed in the State of Texas, in accordance with Item 441, "Steel Structures." The Department may elect to pre-approve some shop drawings for optionally designed poles. Submission of shop drawings and design calculations is not required for structures fabricated in accordance with the details of shop drawings on the pre-approved list maintained by the TxDOT Traffic Operations Division. Any deviation from the pre-approved shop drawings will require submission of shop drawings of the complete assembly and design calculations as described above.
  - Structural Support Design for Luminaires. Lighting support structures shall be designed for a 25 year design life in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 6th Edition (2013) and Interim Revisions thereto. All poles shall be designed for 110 mph 3-second gust wind speeds. The Gust Factor, G, and Wind Importance Factor, Ir, shall be applied as per the AASHTO Specifications assuming a 25-year design life. The design wind pressure for hurricane wind velocities greater than 100 mph shall not be less than the design wind pressure using 100 mph with the non-hurricane Wind Importance Factor, Ir, value. For transformer base poles, fabricator shall include transformer base and connecting hardware in design calculations and shop drawing submittals. All transformer bases shall have been structurally tested to resist the theoretical plastic moment capacity of the pole. Certification of the plastic moment load test and FHWA breakaway requirement test of the model of base being furnished shall be submitted with the shop drawings. Shop drawings shall show breakaway base model number, and manufacturer's name and logo. Manufacturer's shop drawings shall include the ASTM designations for all materials to be used.
  - Mast Arm Attachments. All poles and attachments shall be structurally designed to support two 12-foot mast arms and luminaires. Poles shall be supplied with mast arm combinations as shown in the plans. All mast arms shall be designed for a 60-pound luminaire having an effective projected area of 1.6 square feet.
  - Anchor Bolt Assembly. Anchor bolt assemblies for optionally designed poles shall be the same as those shown herein.
- Aluminum Pole Designs. Aluminum pole designs may be allowed, if aluminum poles are permitted or required, pending approval by the Department as outlined below.
  - Meet all of the requirements stated above for optional steel pole designs and the following:
    - Aluminum poles shall be fabricated in accordance with "Structural Welding Code-Aluminum" AWS D1.2.
    - Aluminum pole designs shall use the same anchor bolt assembly and be subject to the same geometric restraints and other requirements for steel poles specified herein.
    - Aluminum poles shall be equipped with vibration mitigation devices, as approved by the engineer.
    - Pole components shall be constructed using the following material:
      - Shaft: ASTM B221 or B241 Alloy 6063-T6, ASTM B209 Alloy 5086-H34, ASTM B221 Alloy 6005-T5.
      - Base Flange: ASTM B26 Alloy 356.0-T6 or ASTM B108 Alloy 356.0-T6 (Yield strength test required).
      - Mast Arm Fitting: ASTM B209 Alloy 6061-T6 or ASTM B221 Alloy 6005-T5.
      - Mast Arms: ASTM B241 Alloy 6061-T6 or Alloy 6063-T6.
      - Pole Cap: ASTM B209 Alloy 5086-H32 or ASTM B108 or B26 Alloy 356.0-T6.
      - Bolts: Stainless Steel AISI 300 series. Bolts threading into aluminum threads shall be treated with anti-seize compound, Never-Seez Compound, Permatex 133K or equal.
- Special Designs. Poles with architectural treatments shall meet the requirements shown elsewhere in the plans.
- Luminaire Mounting Height. Actual luminaire mounting height shall be the nominal mounting height given on RIP(2) for all pole-arm combinations except for poles with 4 ft. luminaire arms, which shall be 3'-0" lower than the nominal height, unless otherwise shown or directed.

**EXPLANATION OF ROADWAY ILLUMINATION ASSEMBLY DESIGNATIONS**

(TYPE SA 50 T - X - X) (400W EQ) LED

SA: Pole and mast arm may be steel or aluminum.  
 ST: Pole and mast arm must be steel.  
 AL: Pole and mast arm must be aluminum.  
 SP: Special (ovalized) steel or aluminum pole for installing on CSB or SSCB. See standard sheet CSB (4), or SSCB (4).

Two numerical digits denote nominal mounting height in feet.

Next letter denotes type of base, (S-Shoe Base, T-Transformer Base, or B-Bridge/Ret.Wall Mount)

First number denotes length of mast arm in feet.

Use of second mast arm is indicated by second dashed number which denotes length in feet.

Luminaire rating in watts (i.e. 400W). Equivalent wattage LED fixtures will include EQ (i.e. 400W EQ)

Last letters indicate light source (S - High Pressure Sodium; LED - LED luminaire)

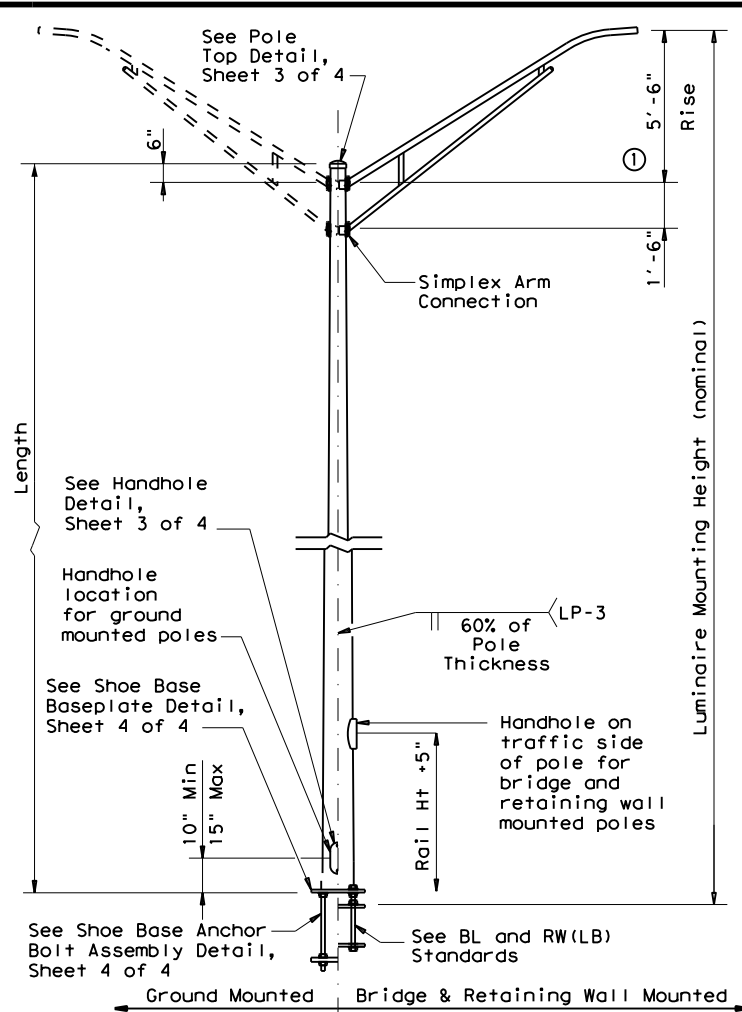
SHEET 1 OF 4

		<b>Texas Department of Transportation</b>		Traffic Safety Division Standard
<h1>ROADWAY ILLUMINATION POLES</h1> <h2>RIP(1)-19</h2>				
FILE:	rip-19.dgn	DWG:	CK:	DW:
©TxDOT	January 2007	CONT:	SECT:	HIGHWAY:
		0931	04	034
7-17		DIST:	COUNTY:	SHEET NO.:
12-19		LFK	TRINITY	63

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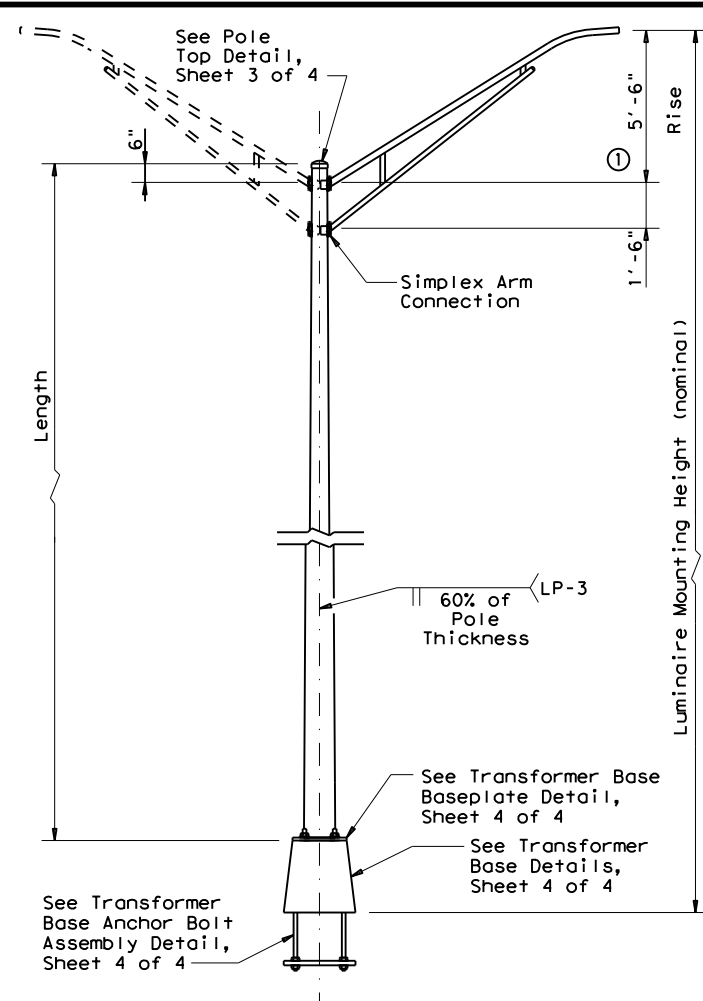
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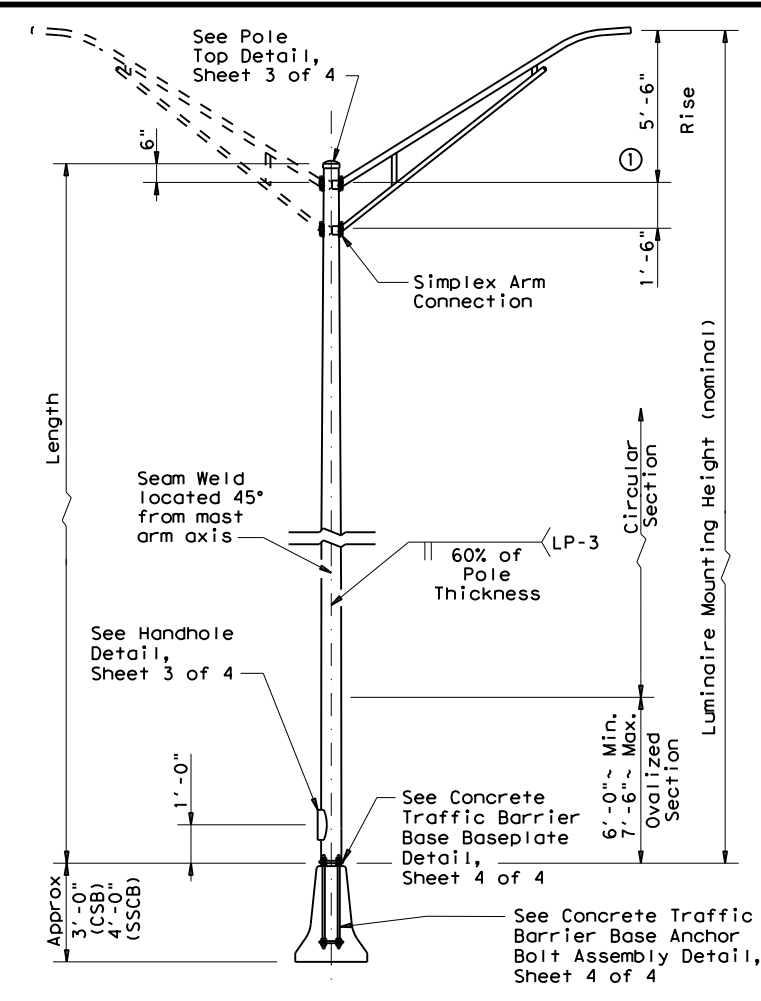
**SHOE BASE POLE**

SHOE BASE POLE					
Luminaire Mounting Height (Nominal) (ft)	Base Diameter (in)	Top Diameter (in)	Length (ft)	Pole Thickness (in)	Design Moment (K-ft)
20.00	7.00	4.90	15.00	0.1196	7.1
30.00	7.50	4.00	25.00	0.1196	13.2
31.00-39.00	8.00	4.36-3.24	26.00-34.00	0.1196	20.7
40.00	8.50	3.60	35.00	0.1196	20.7
50.00	10.50	4.20	45.00	0.1196	30.3



**TRANSFORMER BASE POLE**

TRANSFORMER BASE POLE					
Luminaire Mounting Height (Nominal) (ft)	Base Diameter (in)	Top Diameter (in)	Length (ft)	Pole Thickness (in)	Design Moment (K-ft)
20.00	7.00	5.11	13.50	0.1196	7.1
30.00	7.50	4.21	23.50	0.1196	13.2
31.00-39.00	8.00	4.57-3.45	24.50-32.50	0.1196	20.7
40.00	8.50	3.81	33.50	0.1196	20.7
50.00	10.00	3.91	43.50	0.1196	30.3



**CONCRETE TRAFFIC BARRIER BASE POLE**

CONCRETE TRAFFIC BARRIER BASE POLE (CSB/SSCB)						
Luminaire Mounting Height (Nominal) (ft)	Base Diameter (in)	Top Diameter (in)	Length (ft)	Pole Thickness (in)	Design Moment (K-ft)	
					About C of Rail	Perp. to Rail
28.00	9.00	5.78	23.00	0.1196	10.3	13.2
38.00	9.00	4.38	33.00	0.1196	16.6	20.8
48.00	10.50	4.48	43.00	0.1345	25.1	30.5

**GENERAL NOTES:**

- Designs conform to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 6th Edition (2013) and Interim Revisions thereto. Design 3-Second Gust Wind Speed equals 110 mph with a 1.14 gust factor. A wind importance factor of 0.80 is applied to adjust the wind speed to a 25 year recurrence interval. Design moments listed in tables assume base of pole is 25' above natural ground level.
- Structures are designed to support two 12' luminaire mast arms and luminaires. Mast arms are designed to support a 60-pound luminaire having an effective projected area of 1.6 square feet.
- Fabrication shall be in accordance with the Specifications and with the details, dimensions, and weld procedures shown herein. Do not submit shop drawings for roadway illumination pole assemblies fabricated in accordance with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. Materials, fabrication tolerances, and shipping practices shall meet the requirements of these sheets and the Specifications. In the absence of specified fabrication tolerances, dimensions shall be within the tolerances generally obtainable in normal fabrication practice.
- For mounting heights between values shown in the tables, use base diameter and thickness values for the larger height.
- Unless otherwise noted, all steel parts shall be galvanized in accordance with Item 445, "Galvanizing."
- Steel poles shall be fabricated in accordance with Item 441, "Steel Structures." Longitudinal seam welds for pole sections shall have 60% minimum penetration. All welding shall be in accordance with AWS D1.1, Structural Welding Code-Steel.
- Two-section poles joined by circumferential welds will not be permitted, unless otherwise shown on the plans. Poles may be fabricated in two sections and field-assembled by the lap-joint method. The two sections shall telescope together with a lap length of not less than 1-1/2 times the shaft diameter at the lap joint.
- Alternate material equal to or better than material specified may be substituted with the approval of the Engineer.
- Lubricate and tighten anchor bolts, when erecting shoe base poles and concrete traffic barrier base poles, in accordance with Item 449, "Anchor Bolts."
- All poles, except Transformer Base Poles, shall have hand holes with reinforcing frames and covers. For ground mounted shoe base poles, hand holes shall be placed 90 degrees to mast arm unless otherwise noted on the plans. For poles mounted on a concrete traffic barrier with one luminaire arm, hand holes shall be located 180 degrees from luminaire arm. For poles mounted on a concrete traffic barrier with two luminaire arms, all hand holes shall be on the same side of the barrier. For poles mounted on a bridge lighting bracket or a retaining wall lighting bracket, hand hole shall be on traffic side of the pole, at a height that will clear the barrier.
- The finished pole shall have a smooth, uniform finish free of pits, blisters, or other defects. Scratched, chipped, and other damaged galvanized areas on poles and mast arms shall be repaired in accordance with Item 445, "Galvanizing."
- Pole length is based on a 5'-6" luminaire arm rise. 4 ft. luminaire arms have a 2'-6" rise. A pole with 4 ft. luminaire arms will have an actual mounting height 3'-0" less than the nominal mounting height. Increasing the pole length to meet the nominal mounting height is allowed, but unnecessary unless otherwise directed by the engineer.
- Erect transformer base poles in accordance with sheet RID(1).

**MATERIAL DATA**

COMPONENT	ASTM DESIGNATION	MIN. YIELD (ksi)
Pole Shaft (0.14"/ft. Taper)	A572 Gr 50, A595 Gr A, A1011 HSLAS Gr 50 Cl 2 ③, or A1008 HSLAS Gr 50 Cl 2	50
Base Plate and Handhole Frame	A572 Gr.50, or A36	36
T-Base Connecting Bolts	F3125 Gr A325	92
Anchor Bolts	F1554 Gr 55, A193-B7 or A321	55 105
Anchor Bolt Templates	A36	36
Heavy Hex (H.H.) Nuts	A194 Gr 2H, or A563 Gr DH	
Flat Washers	F436	

**NOTES:**

- 2'-6" rise for 4 ft. luminaire arms.
- Before ovalized as shown on Concrete Traffic Barrier Base Baseplate details, Sheet 4 of 4.
- A1011 SS Gr 50 may be used instead of HSLAS, provided the material meets the elongation requirements for HSLAS.

**POLE ASSEMBLY FABRICATION TOLERANCES TABLE**

DIMENSION	TOLERANCE
Shaft length	+1"
I.D. of outside piece of slip fitting pieces	+1/8", -1/16"
O.D. of inside piece of slip fitting pieces	+1/32", -1/8"
Shaft diameter: other	+3/16"
Out of "round"	1/4"
Straightness of shaft	±1/4" in 10 ft
Twist in multi-sided shaft	4° in 50 ft
Perpendicular to baseplate	1/8" in 24"
Pole centered on baseplate	±1/4"
Location of Attachments	±1/4"
Bolt hole spacing	±1/16"

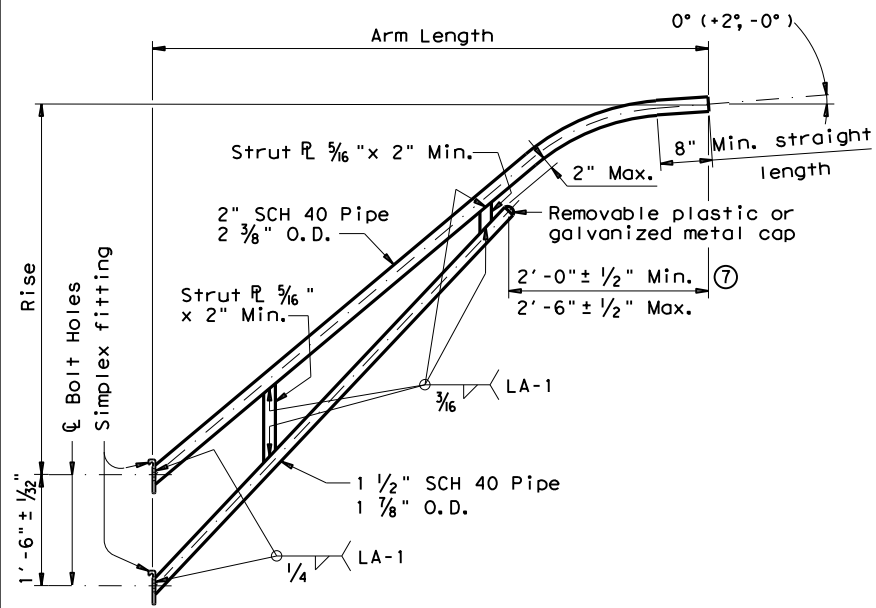
SHEET 2 OF 4



**ROADWAY ILLUMINATION POLES  
RIP(2)-19**

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© TxDOT January 2007	CON:	SECT:	JOB:	HIGHWAY:
REVISIONS	093104	034	FS 357	
7-17	DIST:	COUNTY:	SHEET NO.:	
12-19	LFK	TRINITY	64	

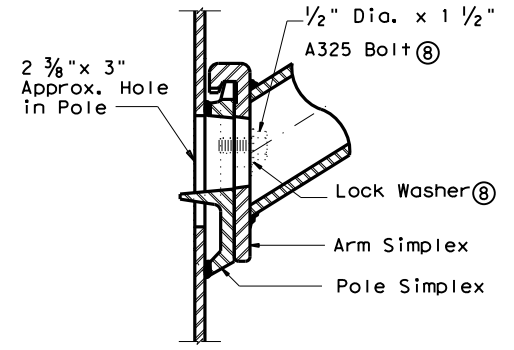
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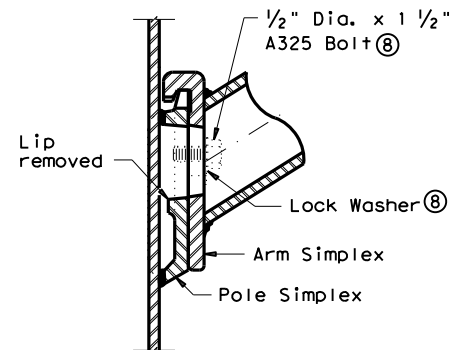
**LUMINAIRE ARM**

LUMINAIRE ARM DIMENSIONS		
Nominal Arm Length	Arm Length	Rise
4'-0"	3'-6"	2'-6"
6'-0"	5'-6"	5'-6"
8'-0"	7'-6"	5'-6"
10'-0"	9'-6"	5'-6"
12'-0"	11'-6"	5'-6"

ARM ASSEMBLY FABRICATION TOLERANCES TABLE	
DIMENSION	TOLERANCE
Arm Length	±1"
Arm Rise	±1"
Deviation from flat	1/8" in 12"
Spacing between holes	±1/32"

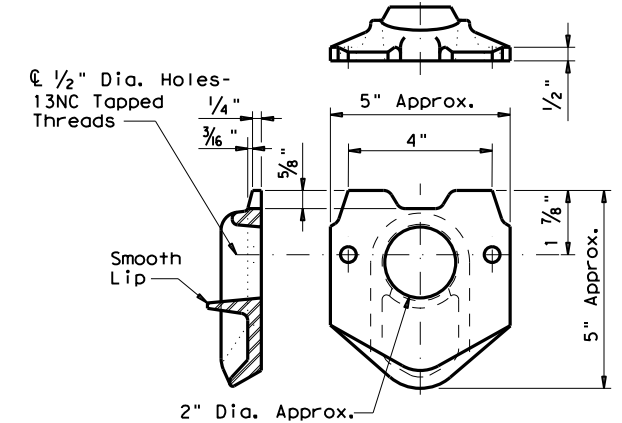


**UPPER SIMPLEX FITTING**  
(Gusset not shown for clarity)

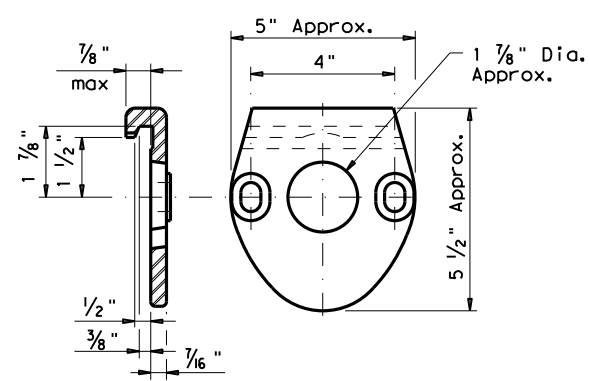


**LOWER SIMPLEX FITTING**  
(Gusset not shown for clarity)

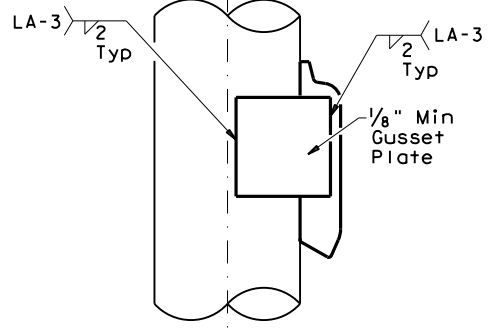
**SECTION B-B**



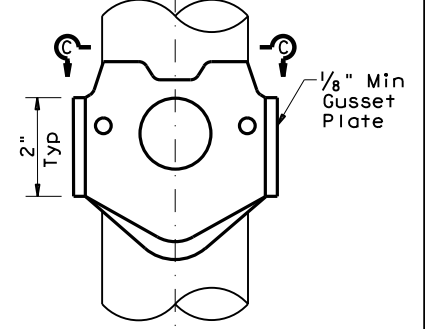
**POLE SIMPLEX DETAIL**



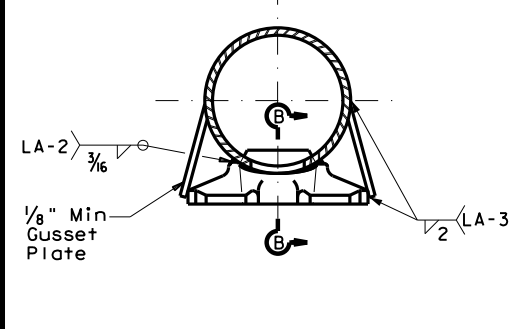
**ARM SIMPLEX DETAIL**



**SIDE**

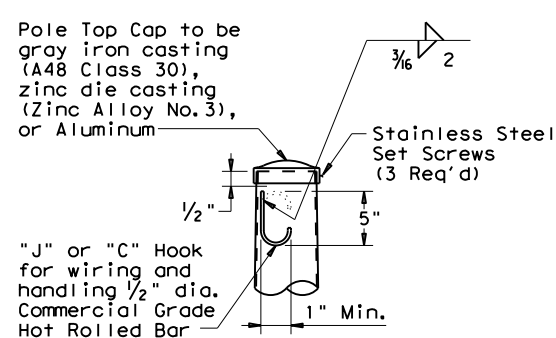


**ELEVATION**

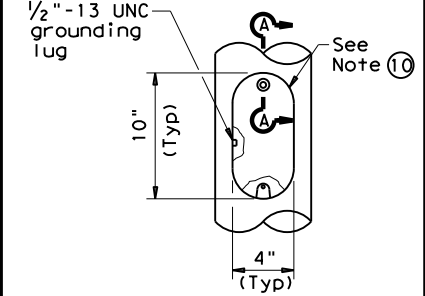


**SECTION C-C**

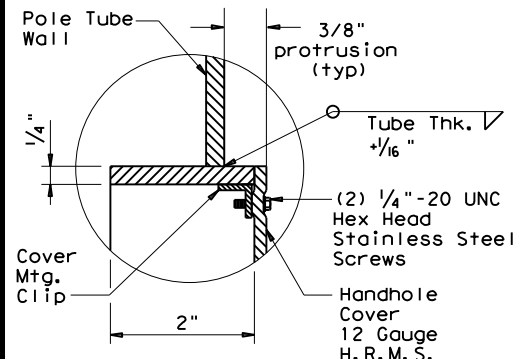
**SIMPLEX ATTACHMENT DETAIL**



**POLE TOP**



**ELEVATION**



**SECTION A-A**

**NOTES:**

- ④ Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.
- ⑤ A576 must be suitable for forging and also meet minimum tensile strength of 65 ksi, minimum yield of 35 ksi, and elongation in 2 inches of 22 percent.
- ⑥ A572, A1008 HSLAS-F, and A1011 HSLAS-F materials may have higher yield strengths but shall not have less elongation than the grade indicated.
- ⑦ Dimensional limits are given to show acceptable variation in design. All of a Fabricator's production of a particular arm length shall have the same dimensions within specified tolerances.
- ⑧ Each pole simplex fitting shall be supplied with 2 bolts and 2 lock washers of the size specified. The bolts and lock washers shall be secured to the pole with the other hardware items called for in the plans.
- ⑨ Proposed deviations in arm simplex dimensions or materials must be submitted to the Department for approval.
- ⑩ A welded handhole frame is permissible. Maximum of two (2) CJP weld splices is allowed.

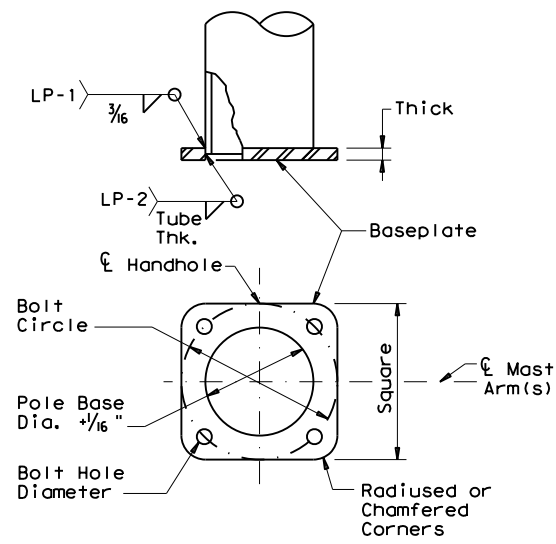
**MATERIALS**

Pole or Arm Simplex	ASTM A27 Gr 65-35 or Gr 70-36, A148 Gr 80-50, A576 Gr 1021 ⑤, or A36 (Arm only)
Arm Pipes	ASTM A53 Gr A or B, A500 Gr B, A501, A 1008 HSLAS-F Gr 50 ⑥, or A1011 HSLAS-F Gr 50 ⑥
Arm Struts and Gusset Plates ④	ASTM A36, A572 Gr 50 ⑥, or A588
Misc.	ASTM designations as noted

**ROADWAY ILLUMINATION POLES**  
**RIP(3) - 19**

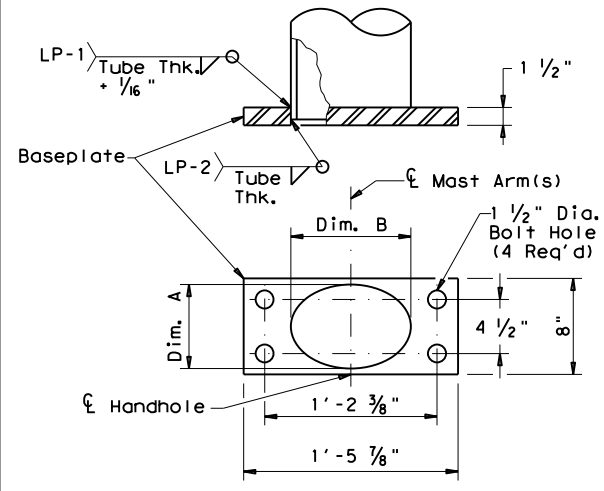
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©TxDOT January 2007	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
7-17	DIST	COUNTY	SHEET NO.	
12-19	LFK	TRINITY	65	

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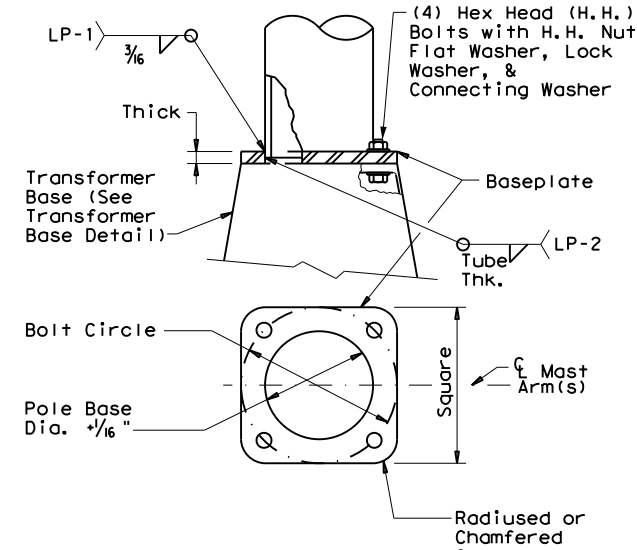
**SHOE BASE BASEPLATE**

SHOE BASE BASEPLATE TABLE				
MOUNTING HEIGHTS (nominal)	BOLT CIRCLE	SQUARE	THICK	BOLT HOLE DIAMETER
20' - 39'	13"	13"	1 1/4"	1 1/4"
40'	15"	15"	1 1/4"	1 1/2"
50'	15"	15"	1 1/2"	1 1/2"



**CONCRETE TRAFFIC BARRIER BASE BASEPLATE**

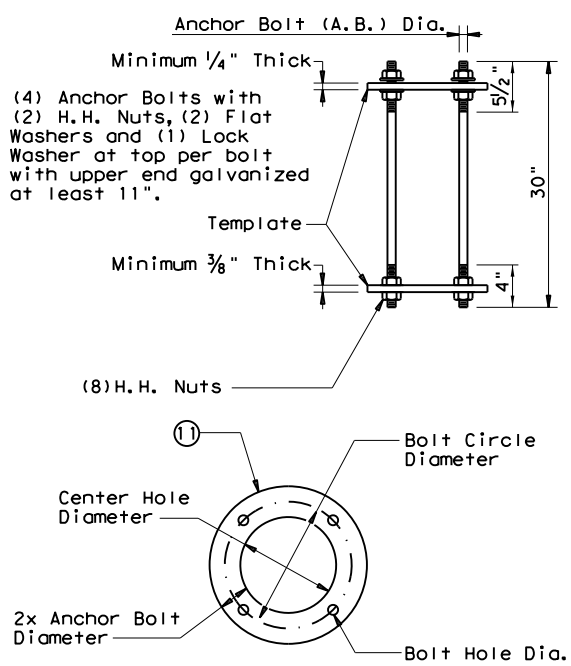
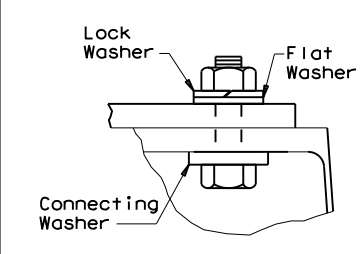
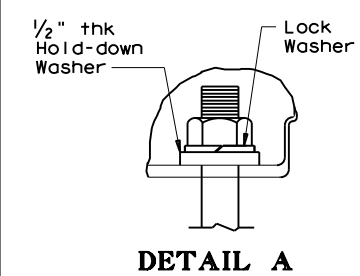
CONCRETE TRAFFIC BARRIER BASE BASEPLATE TABLE			
MOUNTING HEIGHTS (nominal)	POLE DIA. (1)	DIM. A	DIM. B
28' - 38'	9"	7" ± 1/4"	10" ± 1/4"
48'	10 1/2"	7" ± 1/4"	13" ± 1/4"



**TRANSFORMER BASE BASEPLATE**

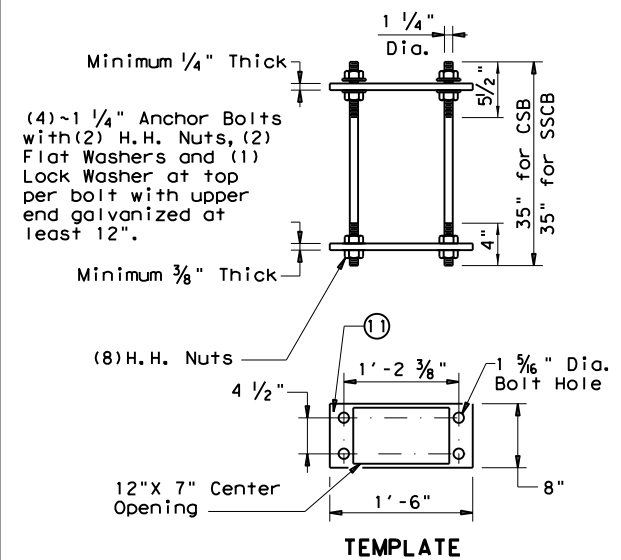
TRANSFORMER BASE BASEPLATE TABLE						
MOUNTING HEIGHTS (nominal)	BOLT CIRCLE	SQUARE	THICK	CONNECTING BOLT DIA.	BOLT HOLE DIAMETER	TRANSFORMER BASE TYPE
20' - 39'	13"	13"	1 1/4"	1"	1 1/4"	A
40'	15"	15"	1 1/4"	1 1/4"	1 1/2"	B
50'	15"	15"	1 1/2"	1 1/4"	1 1/2"	B

TRANSFORMER BASE TABLE		
TYPE	TOP B.C.	BTM. B.C.
A	13"	14"
B	15"	17 1/4"



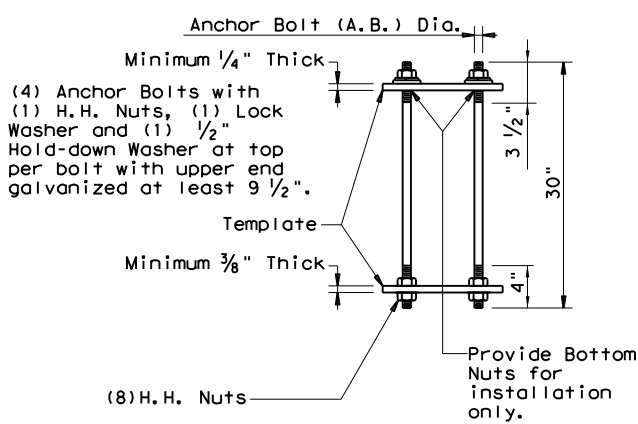
**SHOE BASE ANCHOR BOLT ASSEMBLY**

SHOE BASE ANCHOR BOLT ASSEMBLY TABLE				
MOUNTING HEIGHTS (nominal)	A.B. Dia.	BOLT CIRCLE DIAMETER	CTR. HOLE DIAMETER	BOLT HOLE DIAMETER
20' - 39'	1"	13"	11"	1 1/16"
40' - 50'	1 1/4"	15"	12 1/2"	1 5/16"

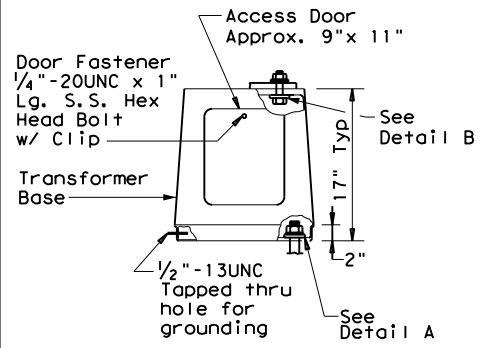
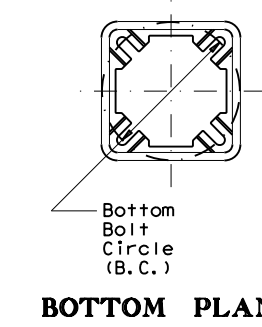
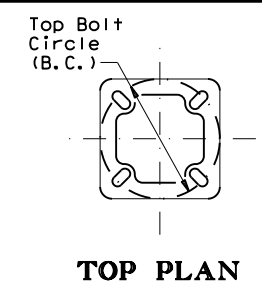


**CONCRETE TRAFFIC BARRIER BASE ANCHOR BOLT ASSEMBLY**

CONCRETE TRAFFIC BARRIER BASE ANCHOR BOLT ASSEMBLY TABLE				
MOUNTING HEIGHTS (nominal)	A.B. Dia.	BOLT CIRCLE DIAMETER	CTR. HOLE DIAMETER	BOLT HOLE DIAMETER
20' - 39'	1"	14"	12"	1 1/16"
40' - 50'	1 1/4"	17 1/4"	14 3/4"	1 5/16"



**TRANSFORMER BASE ANCHOR BOLT ASSEMBLY**



**TRANSFORMER BASE DETAILS**

**GENERAL NOTES:**

- For mounting heights between those shown in the table, use the values in the table for the larger mounting height.
- All breakaway bases shall meet the breakaway requirements of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 6th Edition (2013) and Interim Revisions thereto, and shall have been tested by FHWA-approved methods. All bases shall have been structurally tested to resist 150% of the design moment.
- Transformer bases shall be cast from aluminum, ASTM B108 or B26 Alloy 356.0-T6, or other material approved by the Engineer. Four Hex Head (H.H.) bolts with four H.H. nuts, four lock washers, four flat washers, and connecting and hold-down washers as recommended by the manufacturer, galvanized to ASTM A153 Class C or D, or B695 Class 50, shall be provided with each transformer base for connecting the pole. Bolts shall be ASTM A325 or approved equal. Nuts shall be ASTM A563 grade DH galvanized.
- Bases shall be stamped, incised or by other approved permanent means, marked to show fabricator's name or logo, and model number. Such information shall be placed in a readily seen location, inside or outside the base, but shall not be placed on the door.
- Doors for transformer bases shall be made of plastic, fiberglass or other non-metallic material approved by the Engineer and shall be attached with stainless steel screws or bolts. Transformer bases shall be cleaned by grit blast cleaning after heat treatment. Certification by the manufacturer of heat treatment shall be furnished with transformer bases. The certification shall show the metal alloy and temper and that the base meets those requirements, chemical and physical. The certification shall also show the material ASTM specification. Transformer bases shall be cast with a removable tab bar for material testing. Some bars may have been removed by the manufacturer for testing.

**NOTES:**

- Anchor Bolt Templates do not need to be galvanized.
- Pole diameter before ovalized.

ANCHOR BOLT FABRICATION TOLERANCES TABLE	
DIMENSION	TOLERANCE
Length	± 1/2"
Threaded length	± 1/2"
Galvanized length (if required)	- 1/4"

SHEET 4 OF 4

Texas Department of Transportation  
 Traffic Safety Division Standard

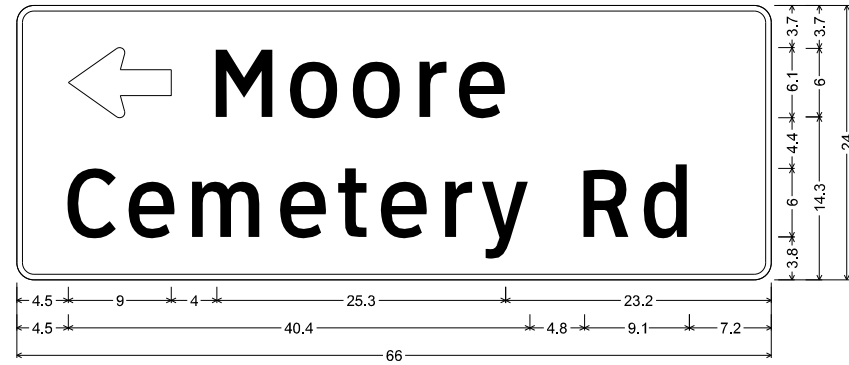
## ROADWAY ILLUMINATION POLES

### RIP(4) - 19

FILE: rip-19.dgn	DWG: CK:	DWG: DW:	CK:
© TxDOT January 2007	CONTRACT: 093104	SECTION: 034	HIGHWAY: FS 357
7-17	DIST: LFK	COUNTY: TRINITY	SHEET NO.: 66

DATE: FILE:

S9



D21-1aTL\_VARx24;

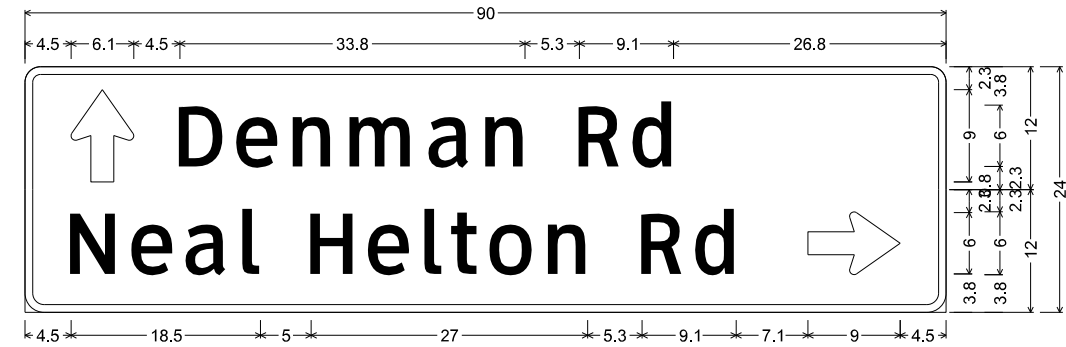
1.5" Radius, 0.5" Border, White on, Green;  
 Standard Arrow Custom 9.0" X 6.1" 180'; "Moore", ClearviewHwy-3-W;  
 "Cemetery Rd", ClearviewHwy-3-W;

Table of letter and object lefts

←	M	o	o	r	e
4.5	17.5	24.0	29.5	35.2	38.8

C	e	m	e	t	e	r	y	R	d
4.5	9.9	15.4	23.1	28.1	31.9	37.4	40.7	49.7	54.9

S16



D21-2T\_VARx24;

1.5" Radius, 0.8" Border, White on, Green;  
 Standard Arrow Custom 9.0" X 6.1" 90'; "Denman Rd", ClearviewHwy-3-W;

1.9" Radius, 0.8" Border, White on, Green;

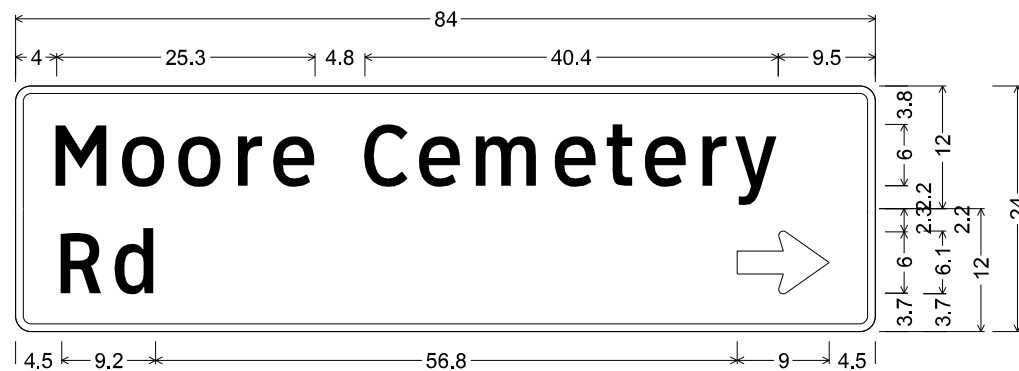
"Neal Helton Rd", ClearviewHwy-3-W; Standard Arrow Custom 9.0" X 6.1" 0';

Table of letter and object lefts

↑	D	e	n	m	a	n	R	d
4.5	15.1	20.8	26.3	31.8	39.5	45.0	54.1	59.4

N	e	a	l	H	e	l	t	o	n	R	d	→
4.5	10.5	15.8	21.4	28.0	33.6	39.1	41.6	45.5	51.1	60.3	65.5	76.5

S12



D21-1aTL\_VARx24;

1.5" Radius, 0.8" Border, White on, Green;

"Moore Cemetery", ClearviewHwy-3-W;

1.5" Radius, 0.8" Border, White on, Green;

"Rd", ClearviewHwy-3-W; Standard Arrow Custom 9.0" X 6.1" 0';

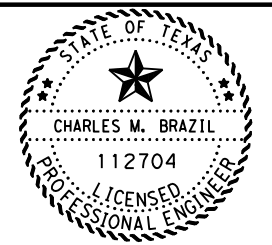
Table of letter and object lefts

M	o	o	r	e	C	e	m	e	t	e	r	y
4.0	10.5	16.0	21.7	25.3	34.1	39.5	45.1	52.7	57.8	61.6	67.1	70.3

R	d	→
4.5	9.8	70.5

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N. T. S.



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 ccm31.p.e.  
 6/1/2022

**SIGN  
 DETAILS**

TEXAS DEPARTMENT OF TRANSPORTATION ©2022			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	65	



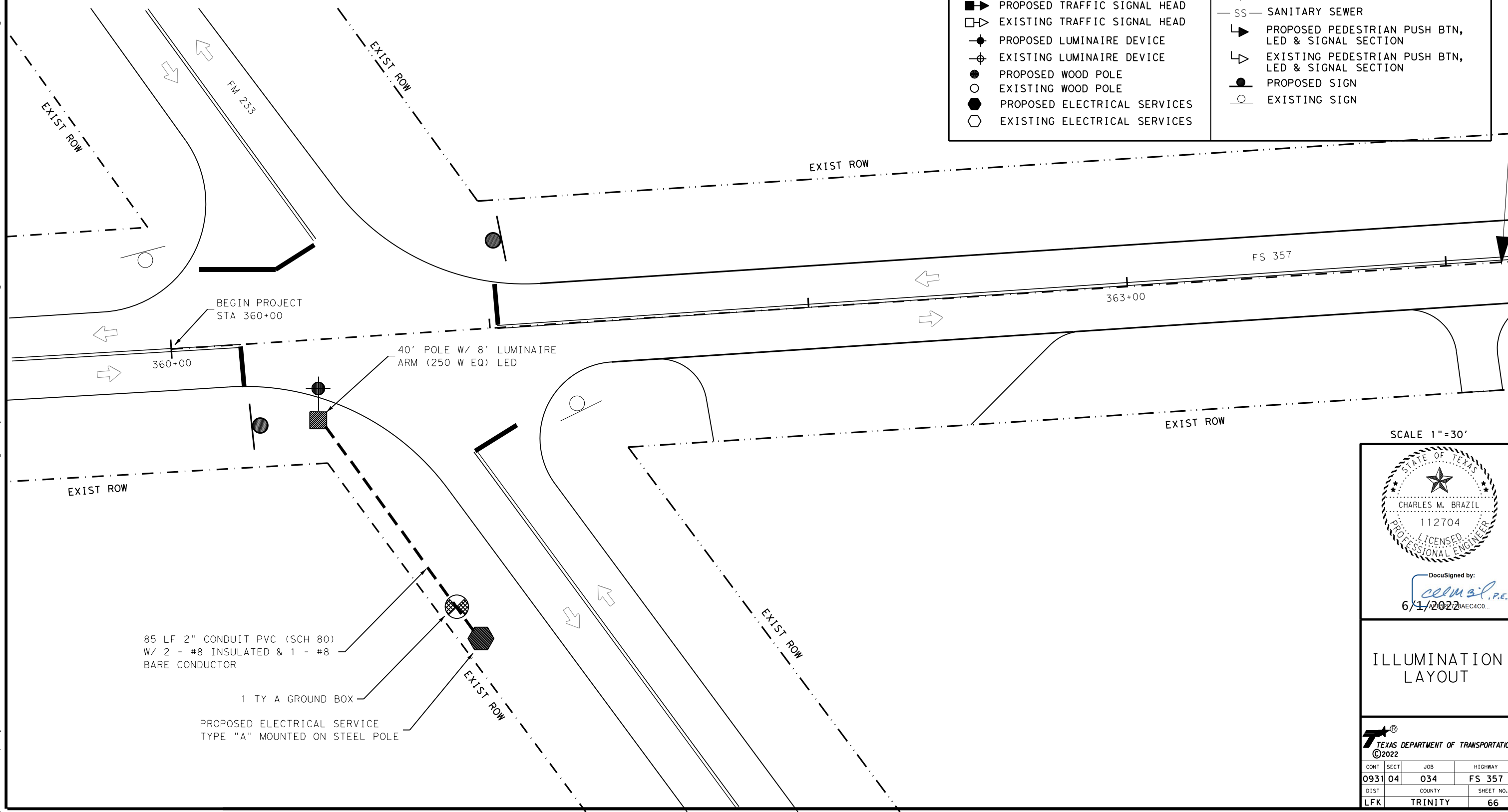
NOTES:

1. LOCATIONS AS SHOWN ON THIS SHEET ARE APPROXIMATE AND MUST BE STAKED, VERIFIED AND APPROVED BY THE ENGINEER PRIOR TO INSTALLING PROPOSED SERVICE/CONTROLLER AND ROADSIDE FLASHING BEACON ASSEMBLY. LOCATIONS MAY NEED TO BE ADJUSTED AS DIRECTED TO MEET FIELD CONDITIONS.
2. SEE TRAFFIC DETAILS PAGES FOR ELECTRICAL SERVICE AND CONDUIT/WIRE RUN INFORMATION.

### LEGEND

■	PROPOSED TRAFFIC SIGNAL POLE	—	PROPOSED CONDUIT RUN (IN TRENCH)
□	EXISTING TRAFFIC SIGNAL POLE	—	EXISTING CONDUIT RUN (IN TRENCH)
⊗	PROPOSED GROUND BOX	—	PROPOSED ROAD BORE
⊗	EXISTING GROUND BOX	—	EXISTING ROAD BORE
⊠	PROPOSED TRAFFIC CONTROLLER GROUND MOUNTED	⊕	TYPICAL CONDUIT & WIRE RUN NO.
⊠	EXISTING TRAFFIC CONTROLLER GROUND MOUNTED	—OE—	OVERHEAD ELECTRICITY
●	PROPOSED VIVDS CAMERA ASSEMBLY	—W—	WATER LINE
○	EXISTING VIVDS CAMERA ASSEMBLY	—G—	GAS LINE
■	PROPOSED TRAFFIC SIGNAL HEAD	—T—	TELEPHONE (UNDERGROUND)
□	EXISTING TRAFFIC SIGNAL HEAD	—SS—	SANITARY SEWER
◆	PROPOSED LUMINAIRE DEVICE	▶	PROPOSED PEDESTRIAN PUSH BTN, LED & SIGNAL SECTION
⊕	EXISTING LUMINAIRE DEVICE	◀	EXISTING PEDESTRIAN PUSH BTN, LED & SIGNAL SECTION
●	PROPOSED WOOD POLE	●	PROPOSED SIGN
○	EXISTING WOOD POLE	○	EXISTING SIGN
●	PROPOSED ELECTRICAL SERVICES		
○	EXISTING ELECTRICAL SERVICES		

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SCALE 1"=30'

STATE OF TEXAS  
  
 CHARLES M. BRAZIL  
 112704  
 LICENSED PROFESSIONAL ENGINEER

DocuSigned by:  
  
 6/1/2022

## ILLUMINATION LAYOUT

**TEXAS DEPARTMENT OF TRANSPORTATION**  
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CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	66	

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## 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)

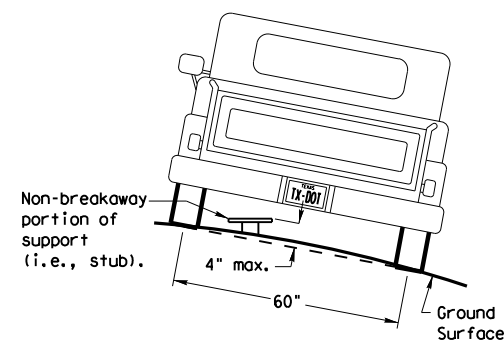
### Anchor Type

- 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-3))

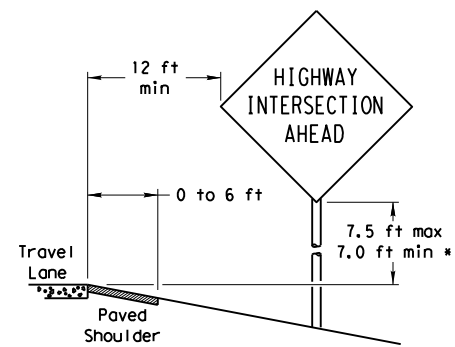
## REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



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).

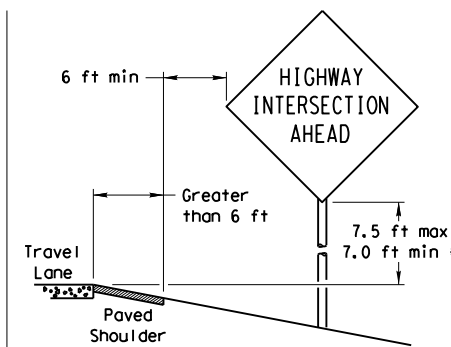
## SIGN LOCATION

### PAVED SHOULDERS



#### LESS THAN 6 FT. WIDE

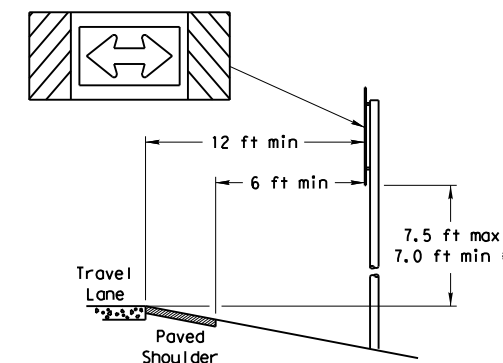
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



#### GREATER THAN 6 FT. WIDE

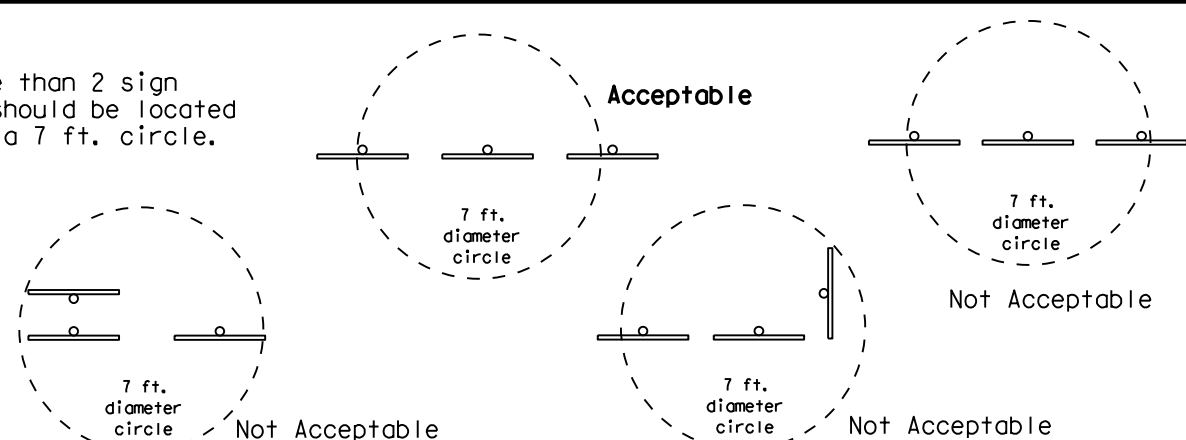
When the shoulder is greater than 6 ft. in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

### T-INTERSECTION

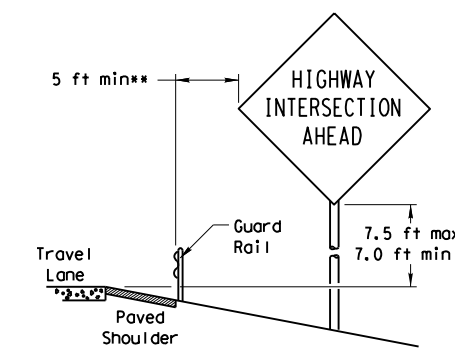


When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.

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

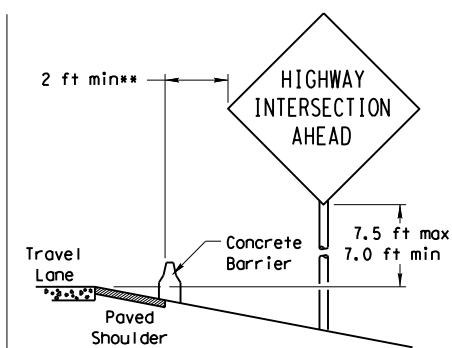


### BEHIND BARRIER



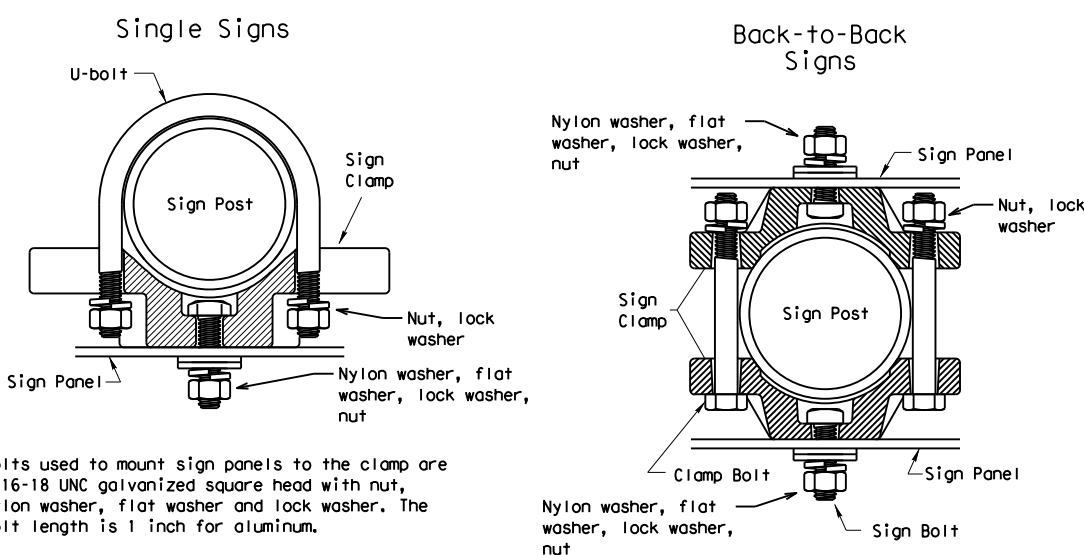
#### BEHIND GUARDRAIL

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



#### BEHIND CONCRETE BARRIER

## TYPICAL SIGN ATTACHMENT DETAIL



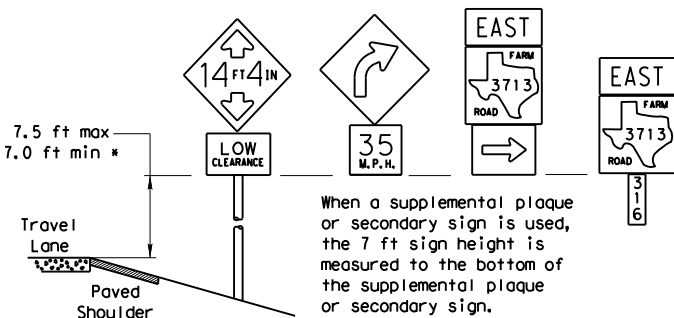
Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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.

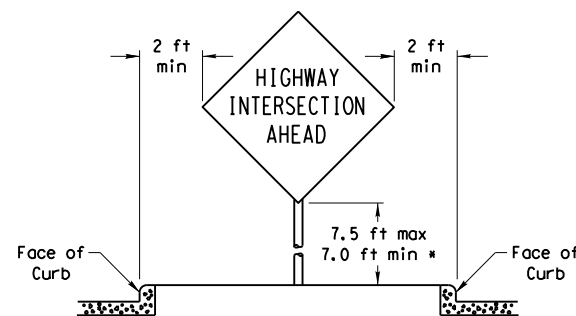
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

### SIGNS WITH PLAQUES

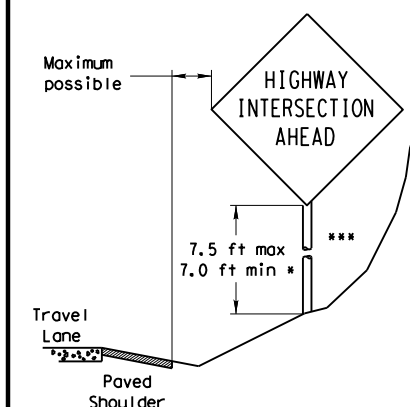


When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

### 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.

\* 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>

Texas Department of Transportation  
Traffic Operations Division

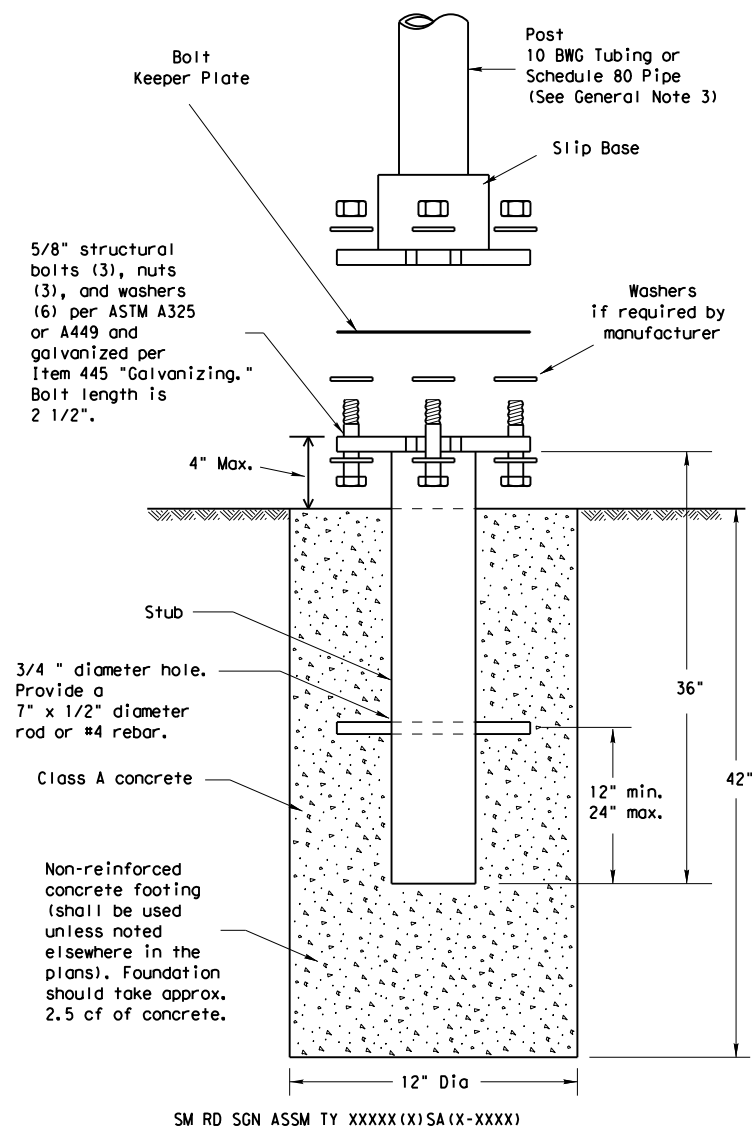
## SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

© TxDOT July 2002	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
9-08	REVISIONS	CONTRACT	SECTION	JOB
		0931	04	034
		DIST	COUNTY	SHEET NO.
		LFK	TRINITY	67

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## TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



### 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](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:

- 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.
- 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
- 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>
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

### ASSEMBLY PROCEDURE

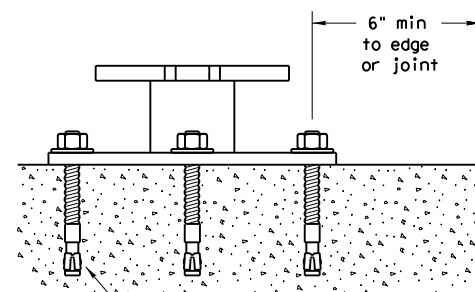
#### Foundation

- 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.
- 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.
- 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.
- Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
- The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

#### Support

- 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.
- 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



5/8" diameter Concrete Anchor - 8 places (embed a minimum of 5 1/2" and torque to min. of 50 ft-lbs). Anchor may be expansion or adhesive type.

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, "Epoxyes 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.

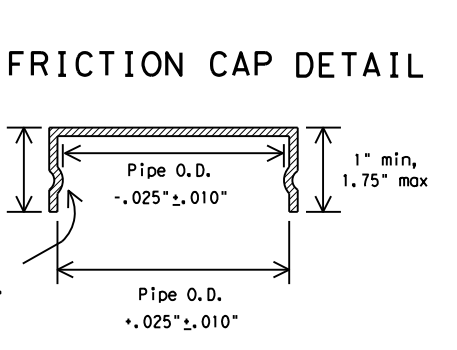
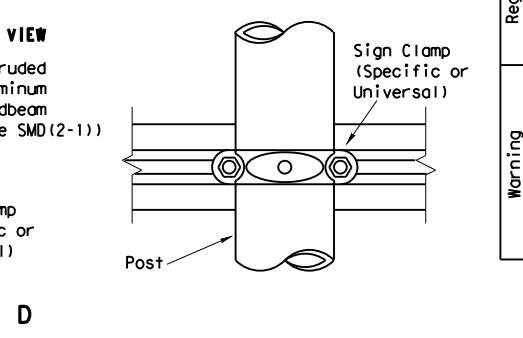
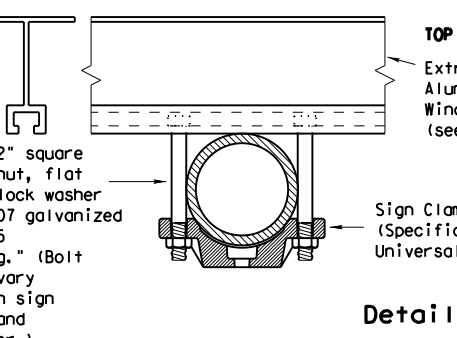
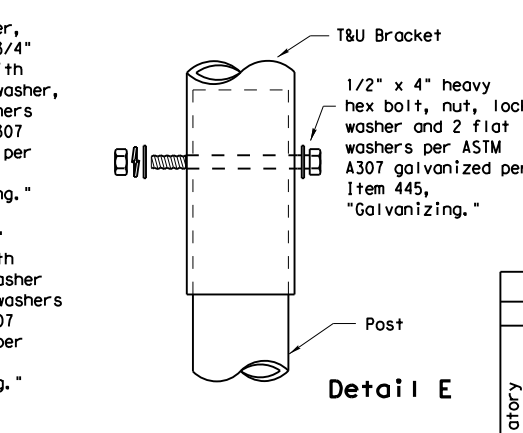
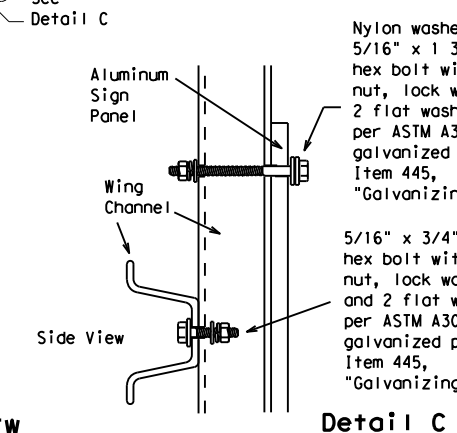
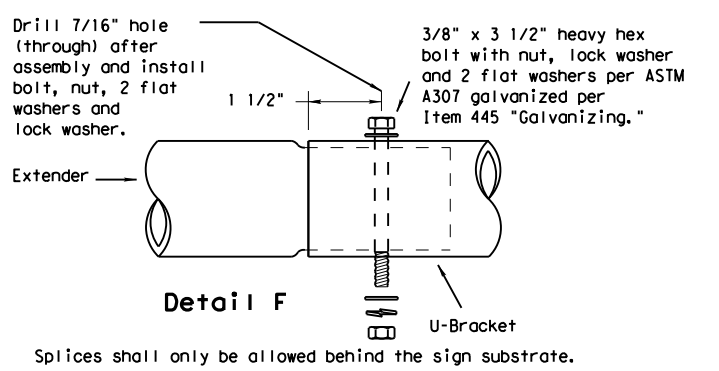
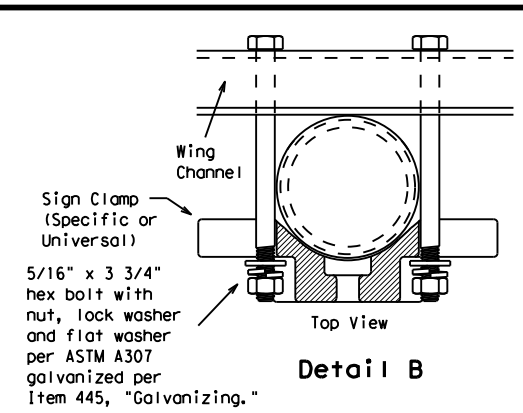
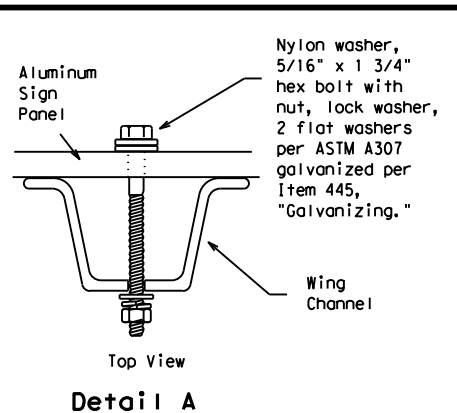
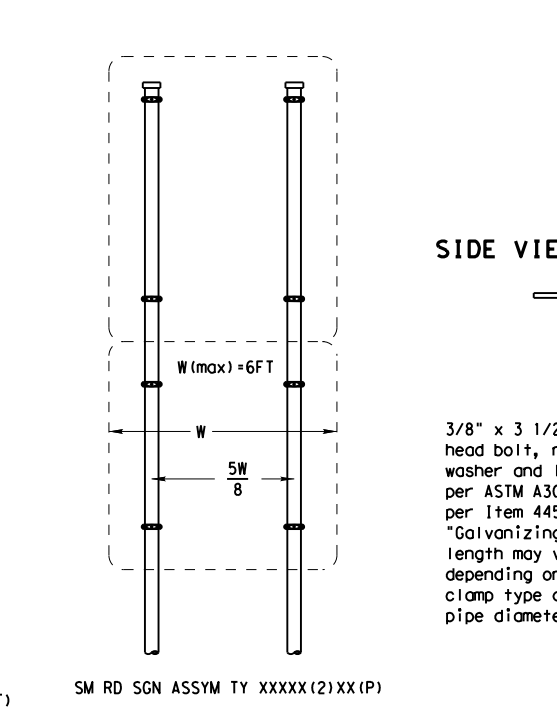
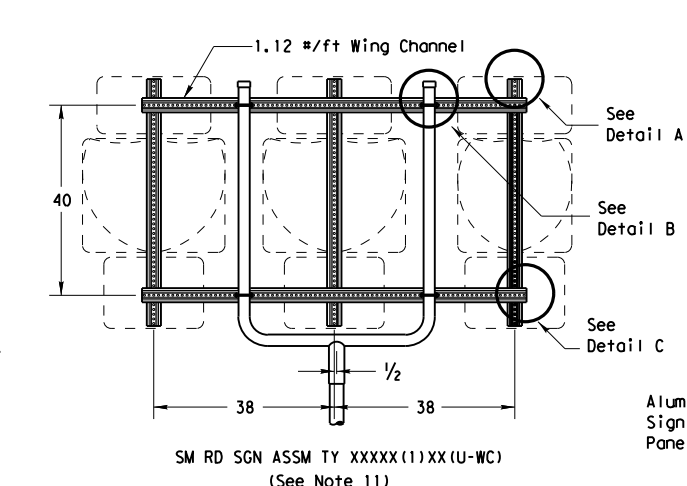
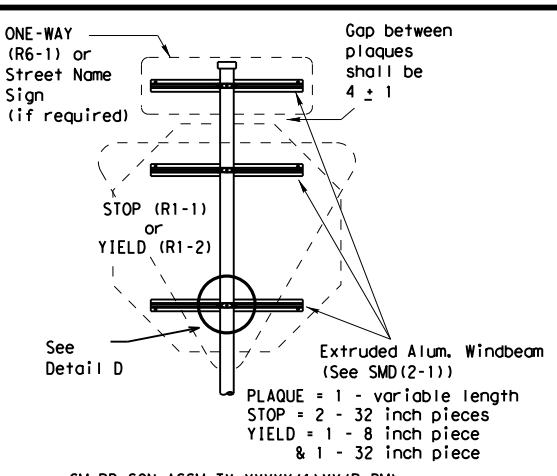
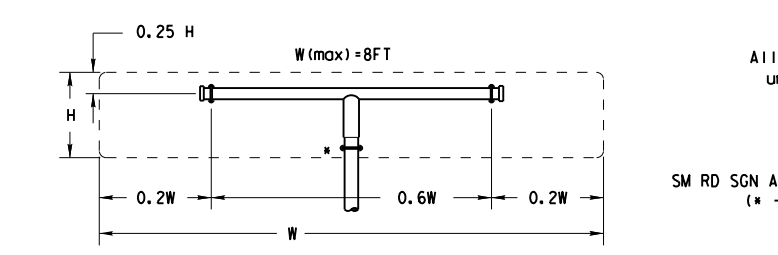
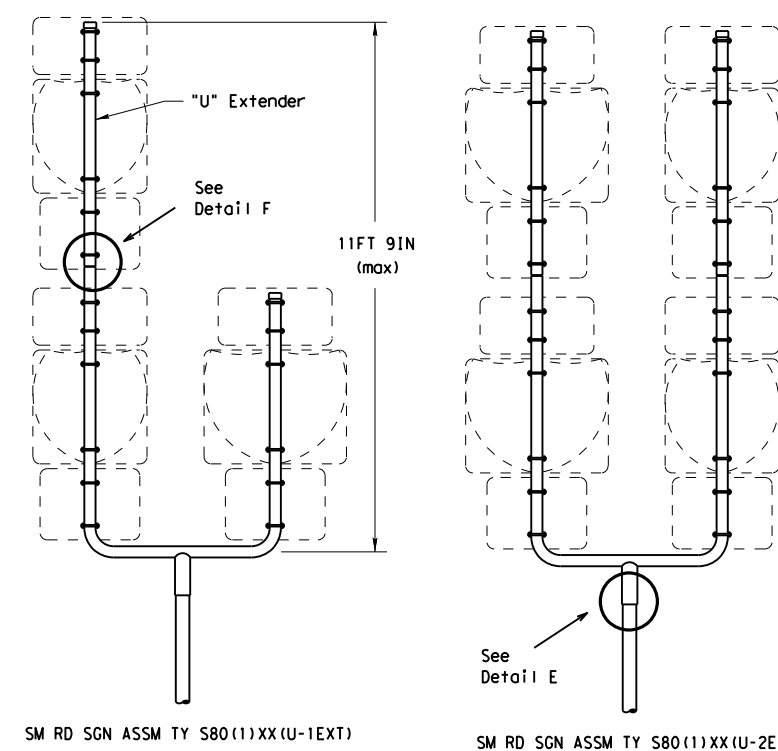
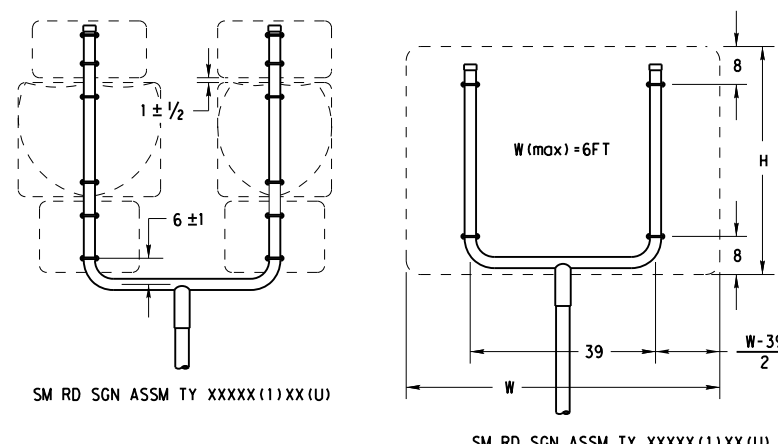
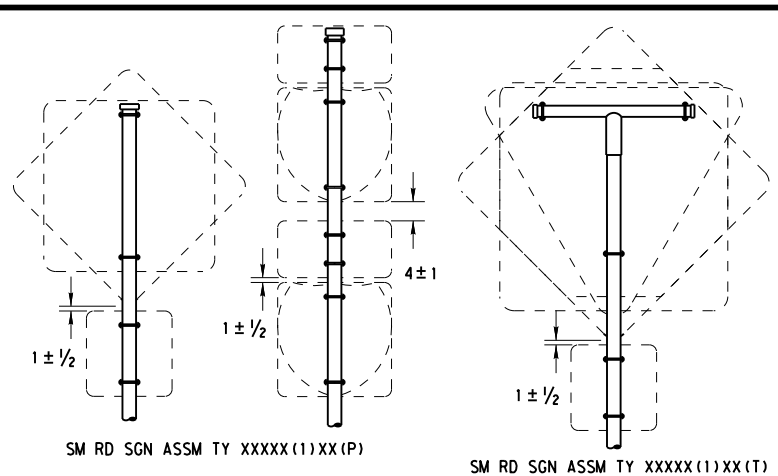


## SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-1)-08

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9-08	REVISIONS		CONT	SECT	JOB	HIGHWAY
			0931	04	034	FS 357
	DIST	COUNTY			SHEET NO.	
	LFK	TRINITY			68	

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All dimensions are in english unless detailed otherwise.

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.

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.

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)
Warning	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	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)	



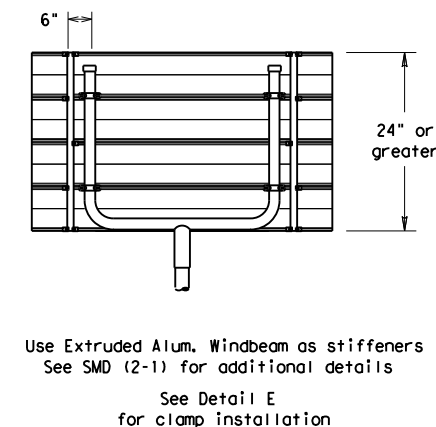
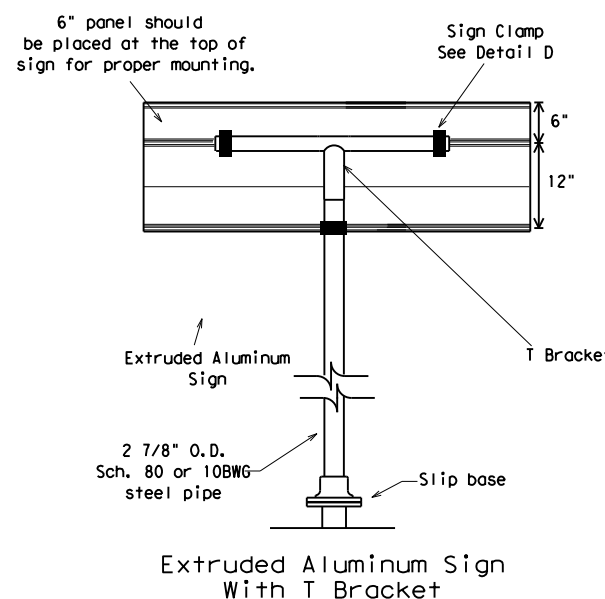
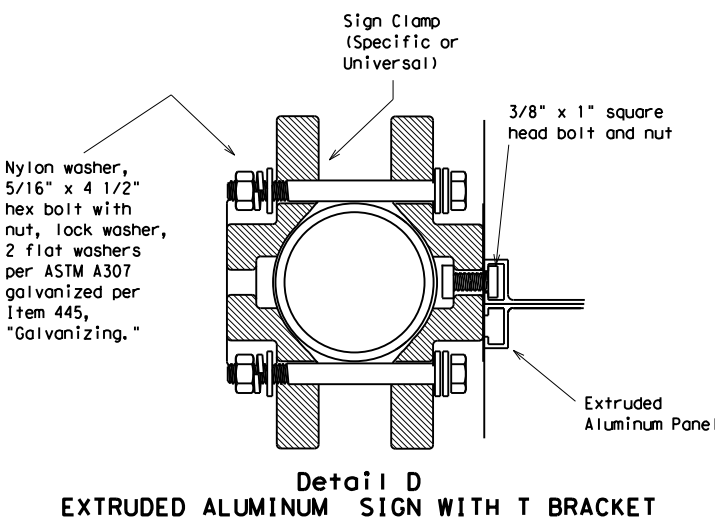
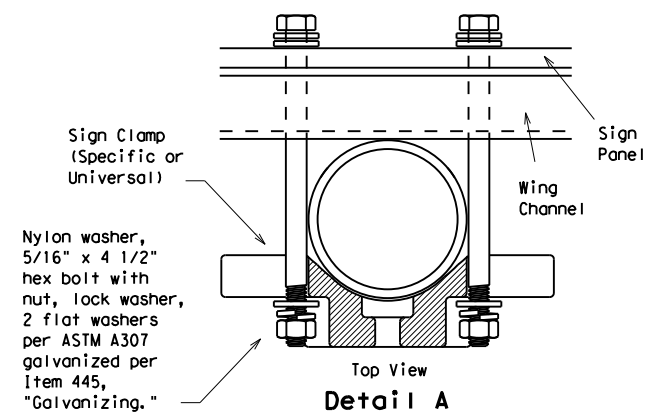
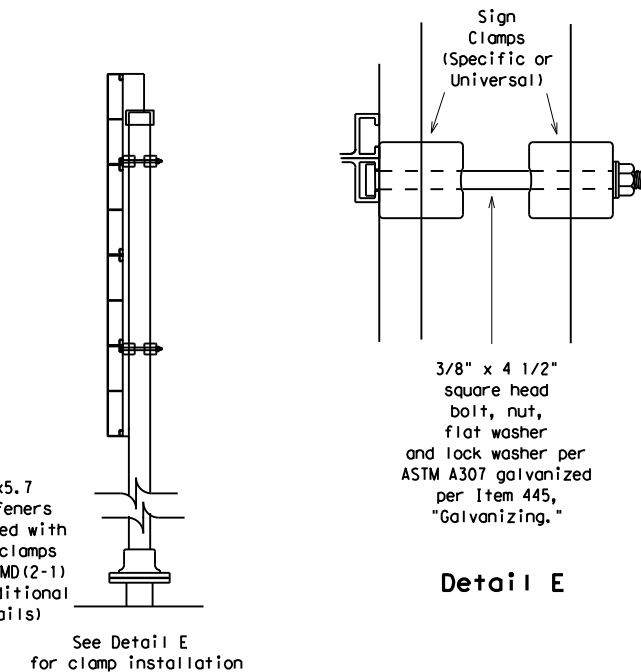
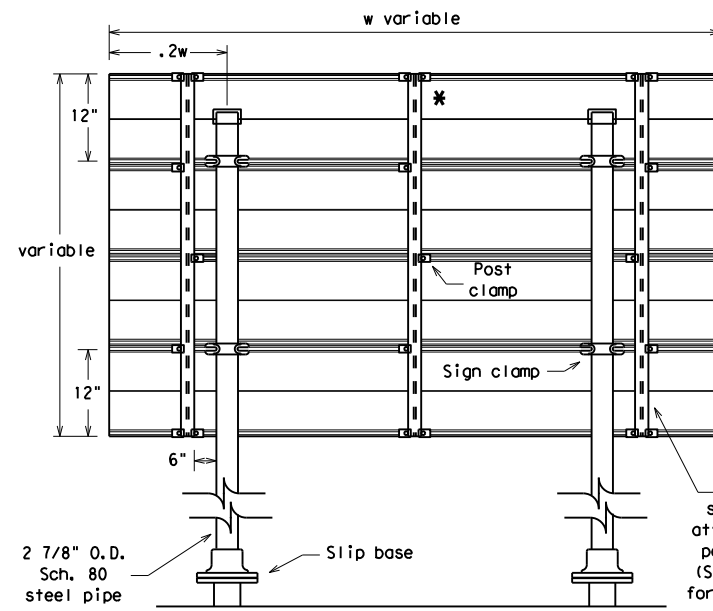
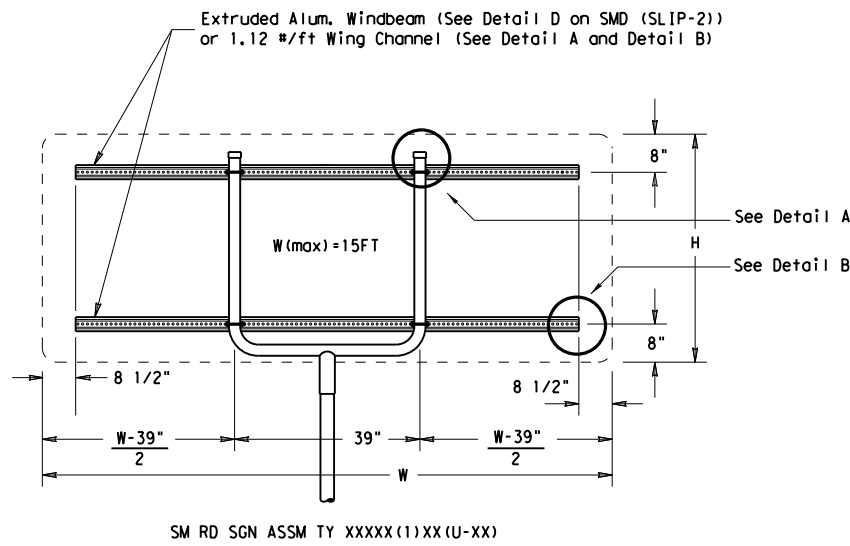
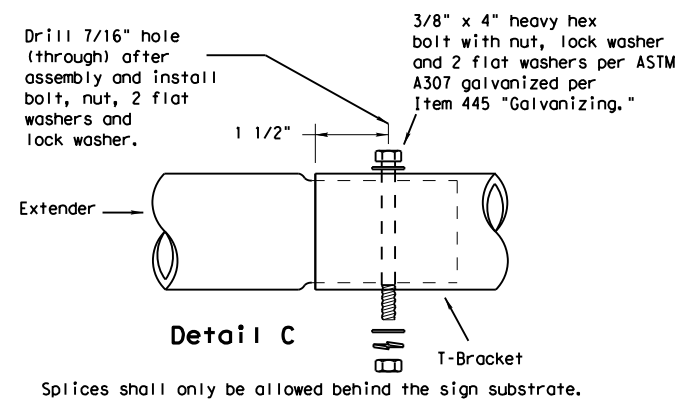
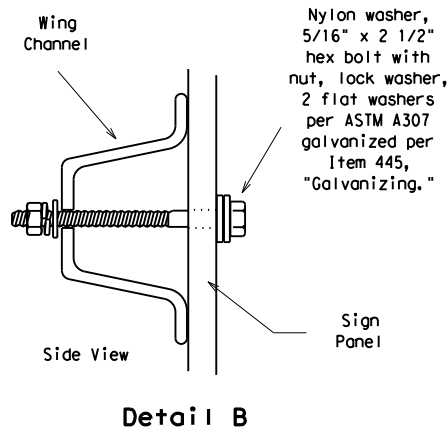
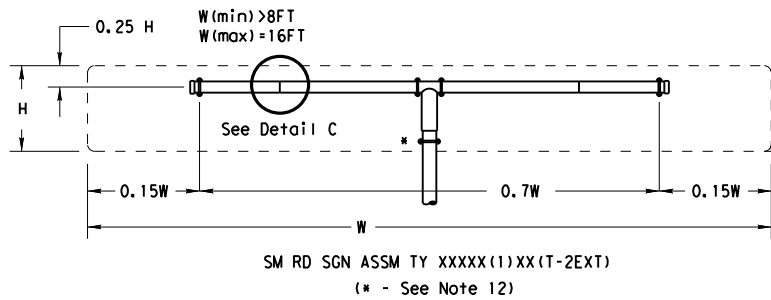
SIGN MOUNTING DETAILS  
SMALL ROADSIDE SIGNS  
TRIANGULAR SLIPBASE SYSTEM  
SMD(SLIP-2)-08

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9-08	REVISIONS	CON: 0931	SECT: 04	JOB: 034	HIGHWAY: FS 357
		DIST: LFK	COUNTY: TRINITY	SHEET NO. 69	

DATE:  
FILE:

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DATE:  
FILE:



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          |
- 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.
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
- 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.
- Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
- 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.
- 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.
- Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
- 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."
- Sign blanks shall be the sizes and shapes shown on the plans.
- 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.
- 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)

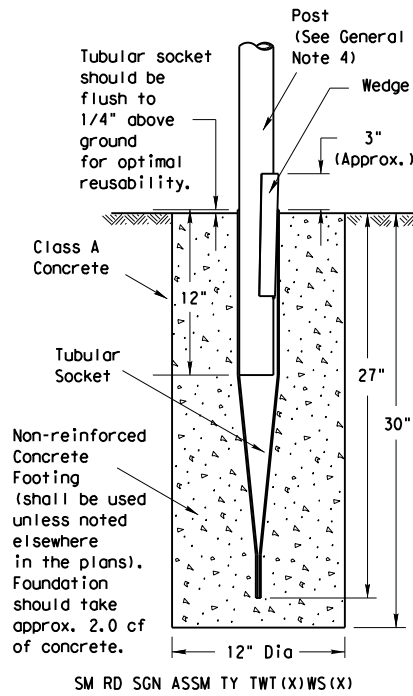
Texas Department of Transportation  
Traffic Operations Division

SIGN MOUNTING DETAILS  
SMALL ROADSIDE SIGNS  
TRIANGULAR SLIPBASE SYSTEM  
SMD(SLIP-3)-08

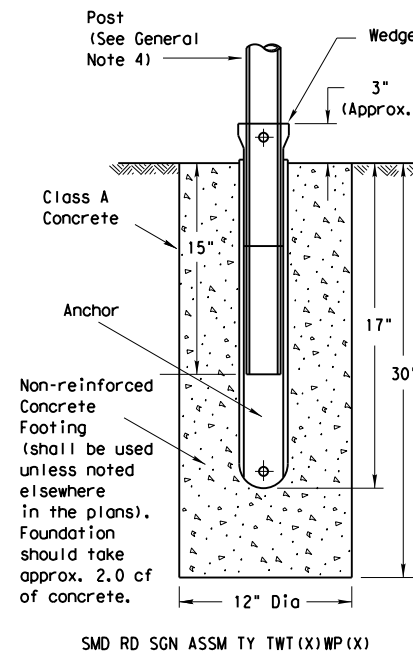
© TxDOT July 2002		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
		0931	04	034	FS 357
		DIST	COUNTY		SHEET NO.
		LFK	TRINITY		70

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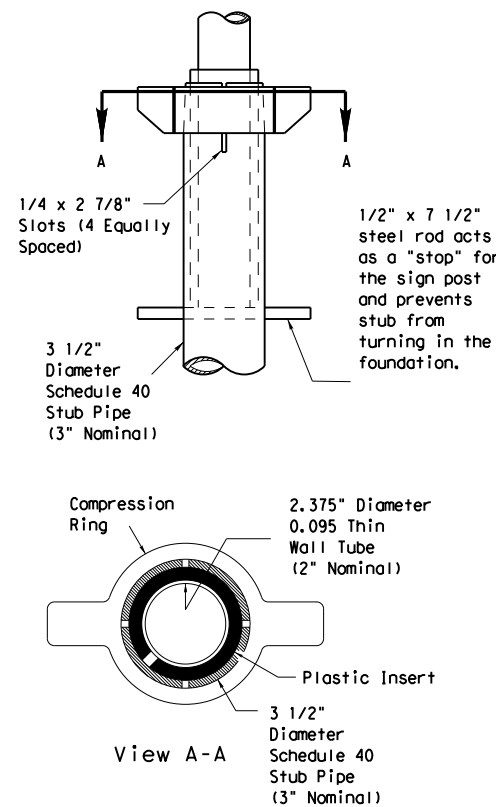
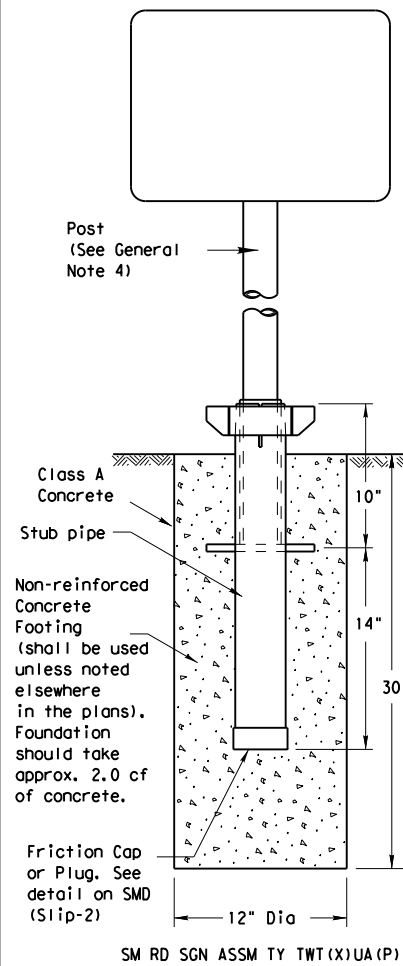
### Wedge Anchor Steel System



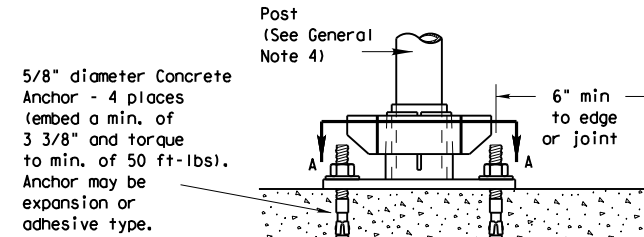
### Wedge Anchor High Density Polyethylene (HDPE) System



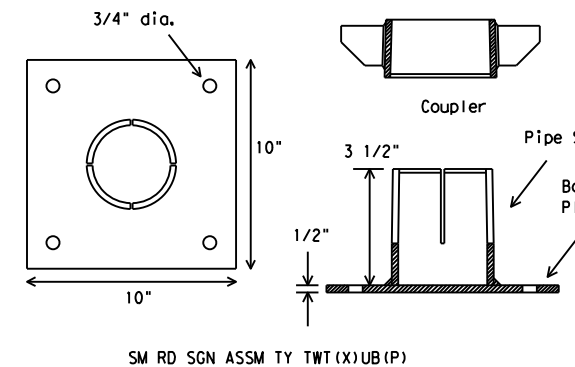
### Universal Anchor System with Thin-Walled Tubing Post



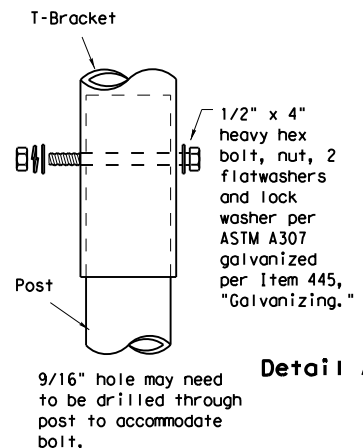
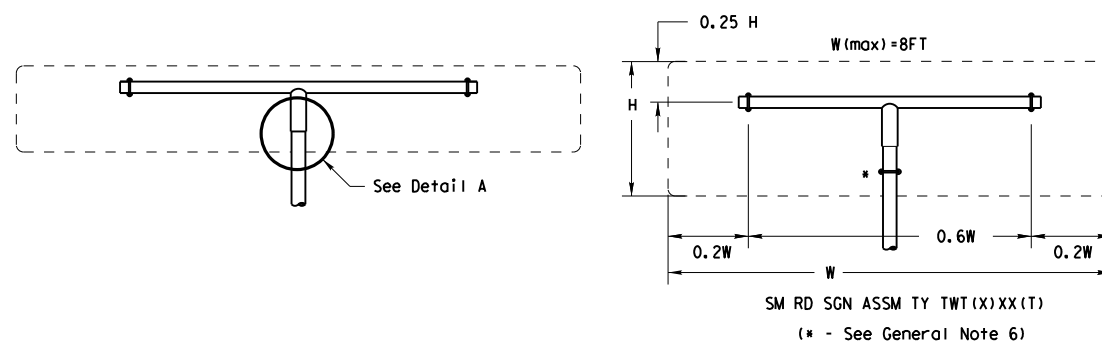
Plastic insert must be used when using the TWT with either the Universal Anchor System or the Bolt Down Universal Anchor System. The insert should be approx. 10" long and cover the tubing from just above the top of the stub pipe to the bottom of the sign post when using the Universal Anchor System. The insert should be cut to approx. 4 1/2" when used with the Bolt Down Universal Anchor System.



Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. A heavy hex nut per ASTM A563 and hardened washer per ASTM F436. The stud bolt shall have minimum yield and ultimate tensile strengths of 50 and 75 ksi, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Top of bolt shall extend at least flush with top of nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 3/8" minimum embedment, shall have a minimum allowable tension and shear of 2450 and 1525 psi, respectively. Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxy and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations.



### Sign Installation Using a Prefabricated T-Bracket for Thin-Wall Tubing Post



#### NOTE

The devices shall be installed per manufacturer's recommendations. Installation procedures shall be provided to the Engineer by Contractor.

#### GENERAL NOTES:

- The Wedge Anchor System and the Universal Anchor System with thin wall tubing post may be used to support up to 10 square feet of sign area.
- The tubular socket, wedge and prefabricated T-bracket shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to the approval of the TxDOT Traffic Standards Engineer.
- Except for posts (13 BWG Tubing), clamps, nuts and bolts, all components shall be prequalified. A list of prequalified vendors may be obtained from the Material Producer List web page. The website address is: [http://www.txdot.gov/business/producer\\_list.htm](http://www.txdot.gov/business/producer_list.htm)
- Material used as post with this system shall conform to the following specifications:
  - 13 BWG Tubing (2.375" outside diameter) (TWT)
    - 0.095" nominal wall thickness
    - Seamless or electric-resistance welded steel tubing
    - Steel shall be HSLA 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
      - 18% minimum elongation in 2"
    - Wall thickness (uncoated) shall be within the range of .083" to .099"
    - Outside diameter (uncoated) shall be within the range of 2.369" to 2.381"
    - Galvanization per ASTM 123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.
- Sign blanks shall be the sizes and shapes shown on the plans.
- Additional sign clamp required on the "T-bracket" post for 24" high signs. Place clamp at least 3" above bottom of sign when possible.
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
- See the Traffic Operations Division website for detailed drawings of sign clamps and Wedge Anchor System components. The website address is: <http://www.txdot.gov/publications/traffic.htm>

#### WEDGE ANCHOR SYSTEM INSTALLATION PROCEDURE

- Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
- 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. Place concrete into hole until it is approximately flush with the ground. Concrete shall be Class A.
- Insert tubular socket into concrete until top of socket is approximately 1/4" above the concrete footing.
- Plumb the socket. Allow a minimum 4 days for concrete to set, unless otherwise directed by Engineer.
- Attach the sign to the sign post.
- Insert the sign post into socket and align sign face with roadway.
- Drive the wedge into the socket to secure post. This will leave approximately 3 inches of the wedge exposed.

#### UNIVERSAL ANCHOR SYSTEM INSTALLATION PROCEDURE

- Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
- Insert base post in hole to depths shown and backfill hole with concrete.
- Level and plumb the base post using a torpedo level and allow concrete adequate time to set. The bottom of the slots provided in the stub pipe shall remain above the top of the concrete foundation.
- Attach the sign to the sign post.
- Install plastic insert around bottom of post.
- Insert sign post into base post. Lower until the post comes to rest on steel rod.
- Seat compression ring using a hammer. Typically, the top of compression ring will be approximately level with top of stub post when optimally installed.
- Check sign post by hand to ensure it is unable to turn. If loose, increase the tightening of the compression ring.

Texas Department of Transportation  
Traffic Operations Division

## SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS WEDGE & UNIVERSAL ANCHOR WITH THIN WALL TUBING POST SMD(TWT) - 08

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9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
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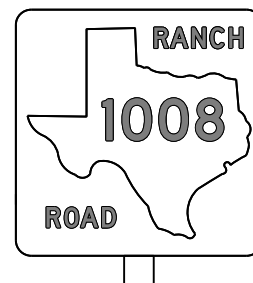
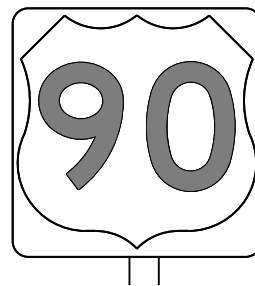


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DATE: FILE:

## REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

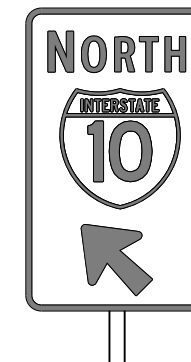
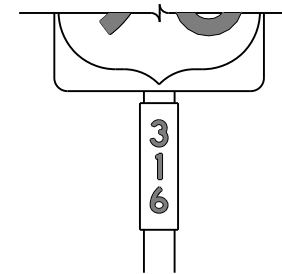
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE A SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B or C SHEETING



TYPICAL EXAMPLES

## REQUIREMENTS FOR BLUE, BROWN & GREEN D AND I SERIES GUIDE SIGNS

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	ALL	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE D SHEETING
LEGEND, SYMBOLS & BORDERS	ALL OTHERS	TYPE B OR C SHEETING



TYPICAL EXAMPLES

### GENERAL NOTES

- Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
- White legend shall use the Clearview Alphabet. The following Clearview fonts shall be used to replace the existing white Federal Highway Administration (FHWA) Standard Highway Alphabets, when not specified in the SHSD, or in the plans.

B	CV-1W
C	CV-2W
D	CV-3W
E	CV-4W
Emod	CV-5WR
F	CV-6W

- Route sign legend (ie. IH, US, SH and FM shields) shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets B, C, D, E, Emod or F).
- Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
- Independent mounted route sign with white or colored legend and borders shall be applied by screening process with transparent color ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof. White legend, symbols and borders on all other signs shall be cut-out white sheeting applied to colored background sheeting.
- Information regarding borders and radii for signs is found in the "Standard Highway Sign Designs for Texas". Dimensions shown and described for borders and corner radii on parent sign are nominal. Borders may vary in width as much as 1/2 inch. Corner radii above 3 inches may vary in width as much as 1 inch. Borders and corner radii within a parent sign must be of matching widths. The sign area outside the corner radius should be trimmed or rounded.
- Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
- Mounting details of roadside signs are shown in the "SMD series" Standard Plan Sheets.

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080
7.5 to 15	0.100
Greater than 15	0.125

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website:  
<http://www.txdot.gov/>

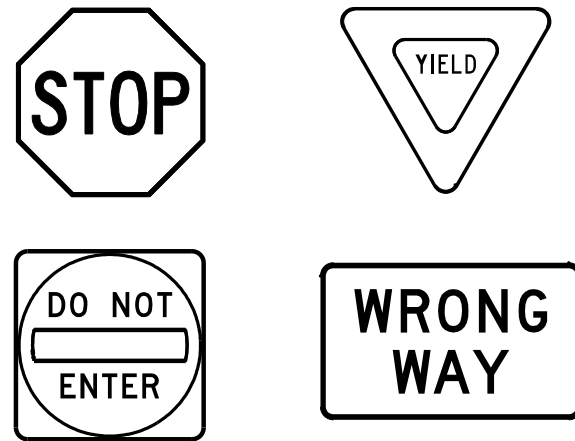
Texas Department of Transportation		Traffic Operations Division Standard		
<h2 style="margin: 0;">TYPICAL SIGN REQUIREMENTS</h2> <h3 style="margin: 0;">TSR(3) - 13</h3>				
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© TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
12-03 7-13	DIST	COUNTY	SHEET NO.	
9-08	LFK	TRINITY	72	

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DATE: FILE:

### REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS

(STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



#### REQUIREMENTS FOR FOUR SPECIFIC SIGNS ONLY

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	WHITE	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE B OR C SHEETING
LEGEND	RED	TYPE B OR C SHEETING

### REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS

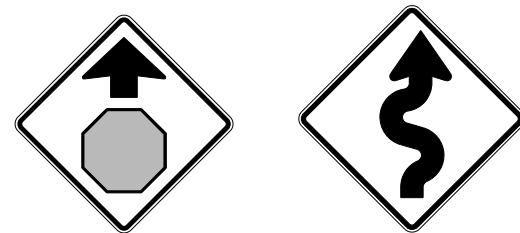
(EXCLUDING STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



#### TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND, BORDERS AND SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

### REQUIREMENTS FOR WARNING SIGNS



#### TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLOURESCENT YELLOW	TYPE B <sub>FL</sub> OR C <sub>FL</sub> SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

### REQUIREMENTS FOR SCHOOL SIGNS



#### TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	FLOURESCENT YELLOW GREEN	TYPE B <sub>FL</sub> OR C <sub>FL</sub> SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
SYMBOLS	RED	TYPE B OR C SHEETING

### GENERAL NOTES

- Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
- Sign legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod or F).
- Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
- Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
- White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
- Colored legend shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to background sheeting, or combination thereof.
- Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
- Mounting details for roadside mounted signs are shown in the "SMD series" Standard Plan Sheets.

#### ALUMINUM SIGN BLANKS THICKNESS

Square Feet	Minimum Thickness
Less than 7.5	0.080
7.5 to 15	0.100
Greater than 15	0.125

#### DEPARTMENTAL MATERIAL SPECIFICATIONS

ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

<http://www.txdot.gov/>



## TYPICAL SIGN REQUIREMENTS

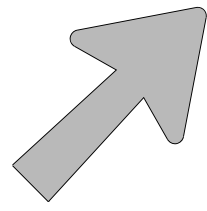
### TSR(4) - 13

FILE:	tsr4-13.dgn	DN:	TxDOT	CK:	TxDOT	DW:	TxDOT	CR:	TxDOT
© TxDOT	October 2003	CONT	SECT	JOB	HIGHWAY				
REVISIONS		0931	04	034	FS 357				
12-03	7-13	DIST	COUNTY	SHEET NO.					
9-08		LFK	TRINITY	73					

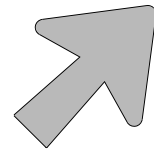
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### ARROW DETAILS

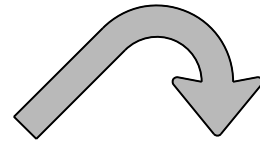
for Large Ground-Mounted and Overhead Guide Signs



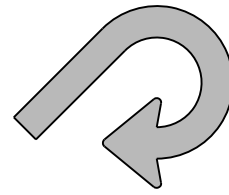
Type A



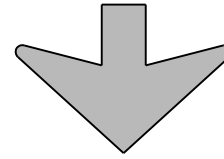
Type B



E-3



E-4



Down Arrow

TYPE	LETTER SIZE	USE
A-1	10.67" U/L and 10" Caps	Single Lane Exits
A-2	13.33" U/L and 12" Caps	
A-3	16" & 20" U/L	
B-1	10.67" U/L and 10" Caps	Multiple Lane Exits
B-2	13.33" U/L and 12" Caps	
B-3	16" & 20" U/L	

CODE	USED ON SIGN NO.
E-3	E5-1aT
E-4	E5-1bT

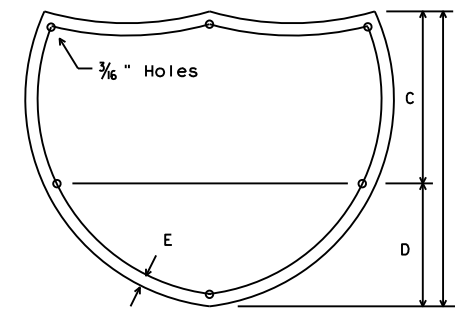
**NOTE**

Arrow dimensions are shown in the "Standard Highway Sign Designs for Texas" manual.

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

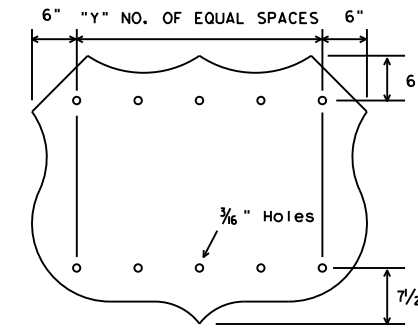
<http://www.txdot.gov/>

### SIGN BLANK PUNCHING DETAILS FOR ATTACHMENTS WHEN SPECIFIED TO BE TYPE A ALUMINUM SIGNS (FOR MOUNTING TO GUIDE SIGN FACE)



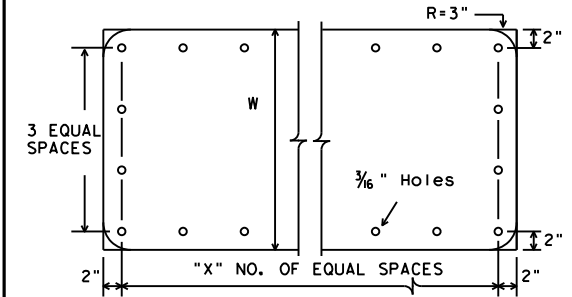
INTERSTATE ROUTE MARKERS

A	C	D	E
36	21	15	1 1/2
48	28	20	1 3/4



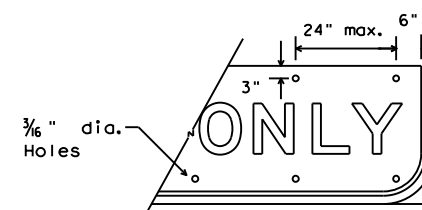
U.S. ROUTE MARKERS

Sign Size	"Y"
24x24	2
30x24	3
36x36	3
45x36	4
48x48	4
60x48	5



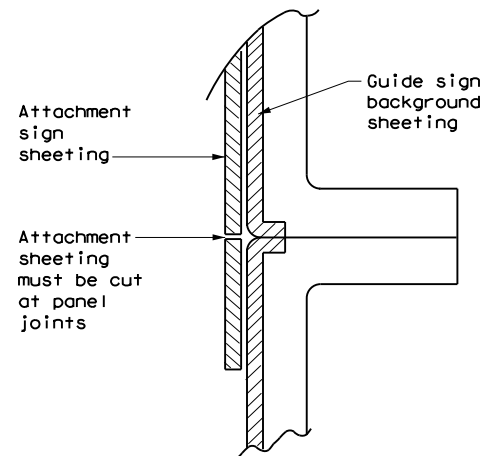
STATE ROUTE MARKERS

No. of Digits	W	X
4	24	4
4	36	5
4	48	6
3	24	3
3	36	4
3	48	5

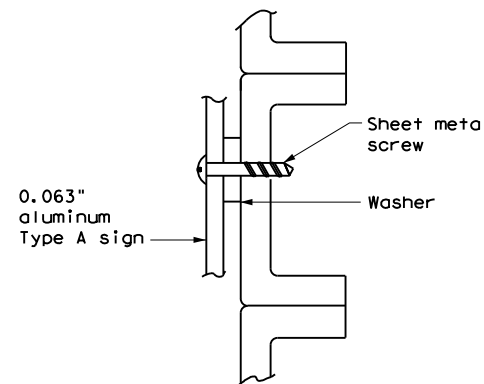


EXIT ONLY PANEL

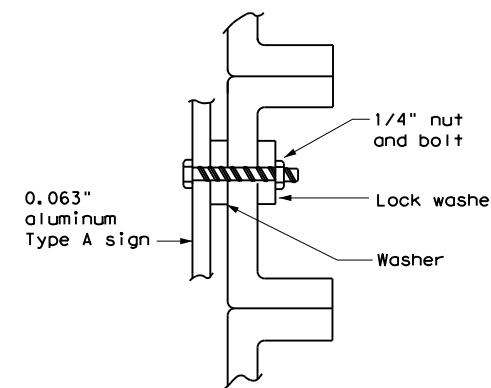
### MOUNTING DETAILS OF ATTACHMENTS TO GUIDE SIGN FACE ("EXIT ONLY" AND "LEFT EXIT" PANELS, ROUTE MARKERS AND OTHER ATTACHMENTS)



DIRECT APPLIED ATTACHMENT



SCREW ATTACHMENT

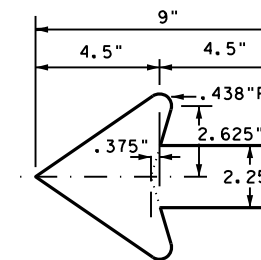


NUT/BOLT ATTACHMENT

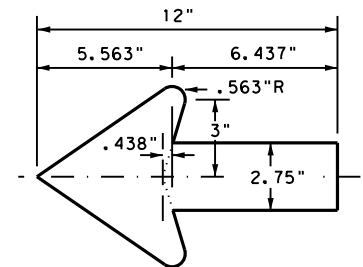
**NOTE:**

- Sheeting for legend, symbols, and borders must be cut at panel joints.
- Direct applied attachment signs will be subsidiary to "Aluminum Signs" or "Fiberglass Signs".

### ARROW DETAILS for Destination Signs (Type D)



Standard arrow to be used with 6 inch letters.



Standard arrow to be used with 8 inch letters.



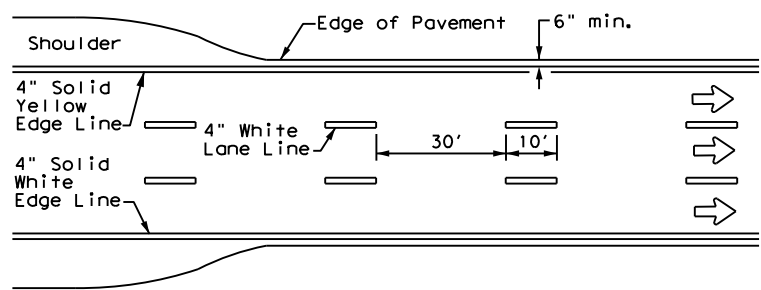
## TYPICAL SIGN REQUIREMENTS

### TSR (5) - 13

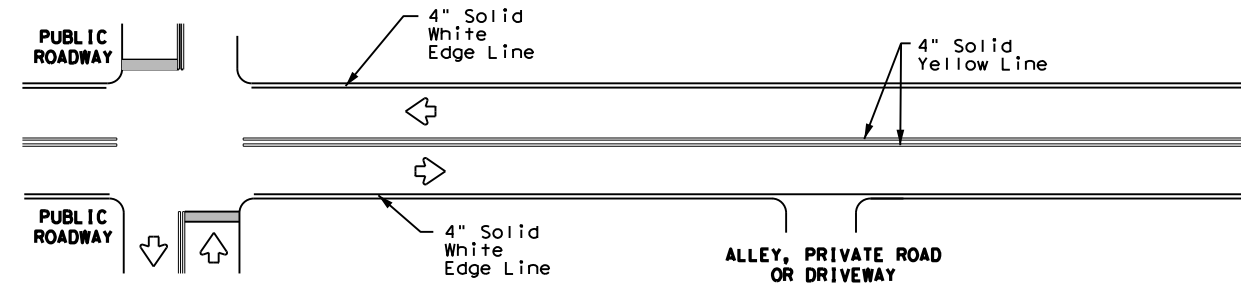
FILE: tsr5-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
© TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
12-03 7-13	DIST	COUNTY	SHEET NO.	
9-08	LFK	TRINITY	74	

DATE: FILE:

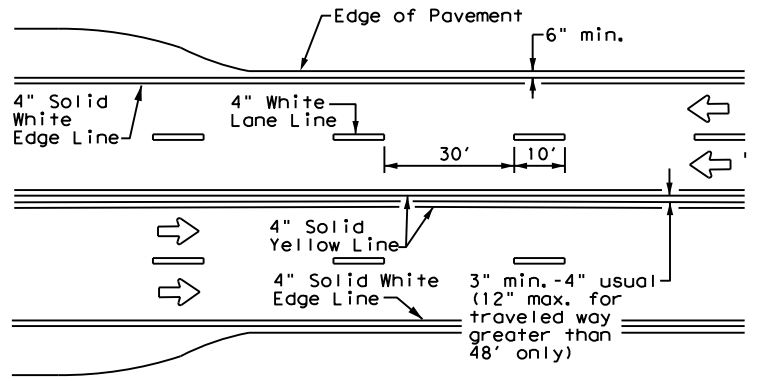
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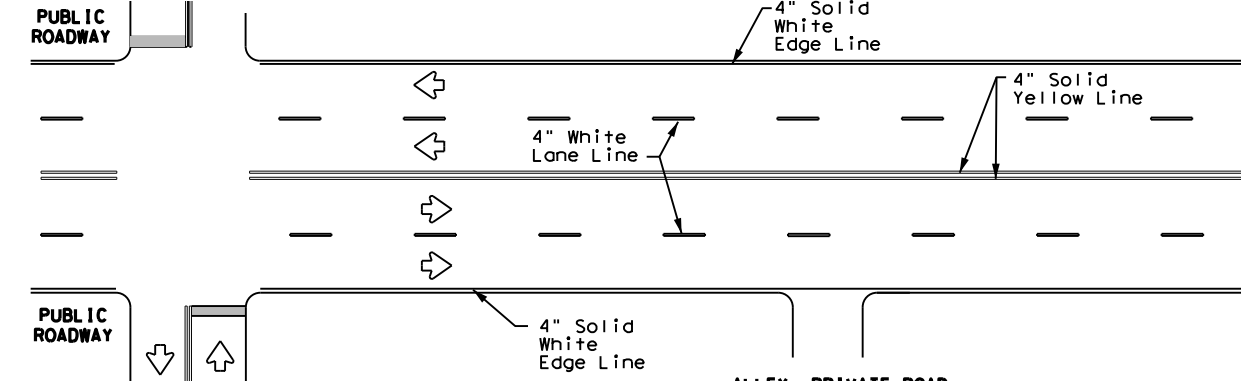
**EDGE LINE AND LANE LINES  
ONE-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**



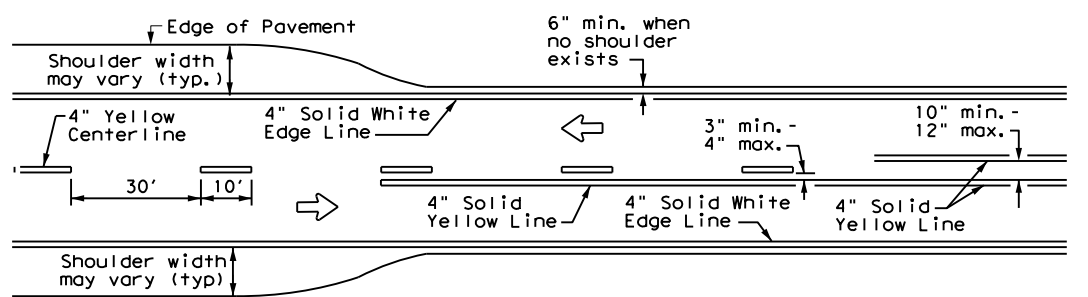
**TYPICAL TWO-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS**



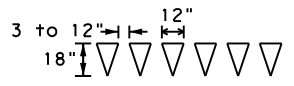
**CENTERLINE AND LANE LINES  
FOUR LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**



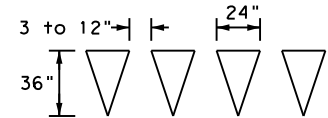
**TYPICAL MULTI-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS**



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



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



For posted speed on road being marked equal to or greater than 45 MPH.

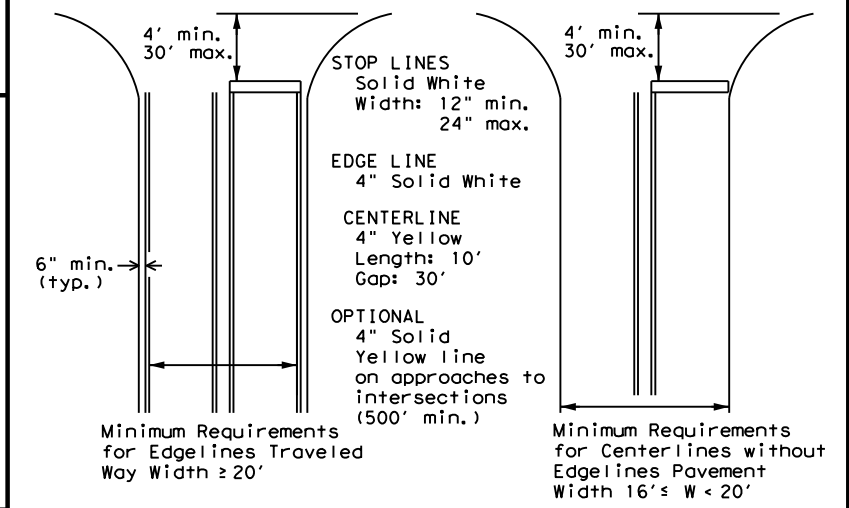
**YIELD LINES**

**GENERAL NOTES**

1. Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should not be placed less than 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. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to the 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.



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

Based on Traveled Way and Pavement Widths for Undivided Highways



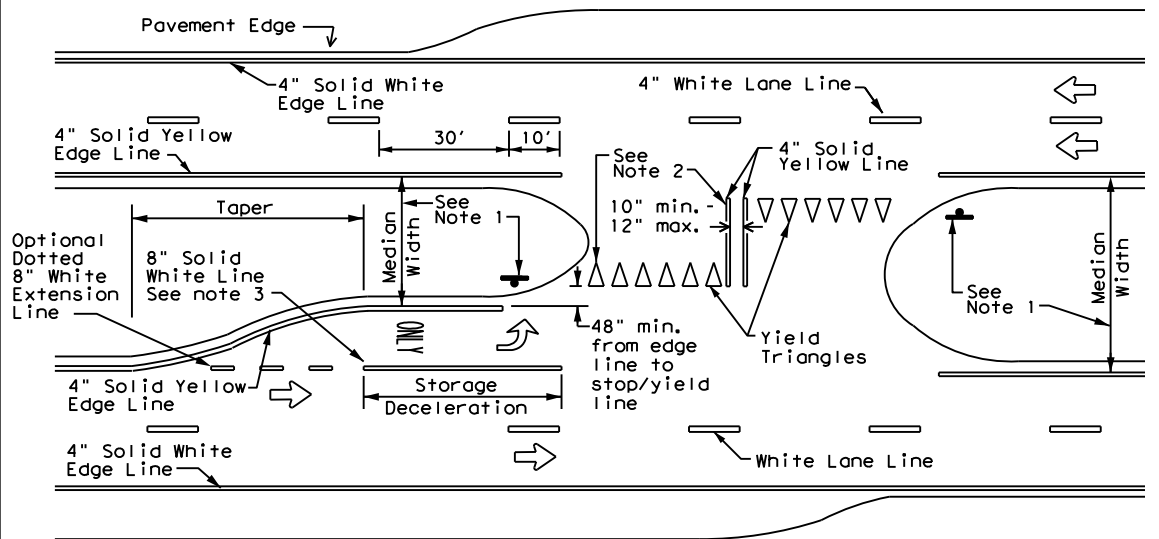
**TYPICAL STANDARD  
PAVEMENT MARKINGS**

**PM(1) - 20**

FILE: pm1-20.dgn	DN:	CK:	DW:	CK:
© TxDOT November 1978	CONT	SECT	JOB	HIGHWAY
8-95 3-03 REVISIONS	0931	04	034	FS 357
5-00 2-12	DIST	COUNTY		SHEET NO.
8-00 6-20	LFK	TRINITY		75

**NOTES**

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

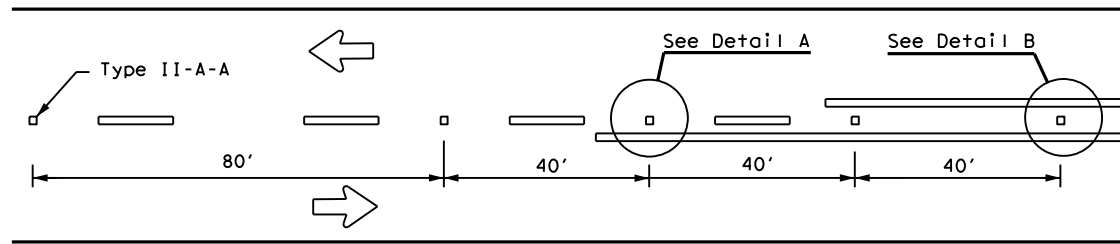


**FOUR LANE DIVIDED ROADWAY CROSSOVERS**

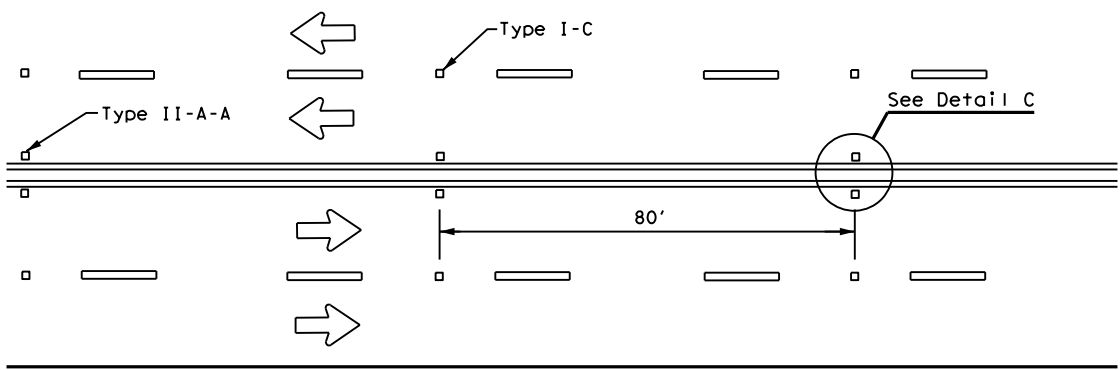
DATE:  
FILE:

# REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE

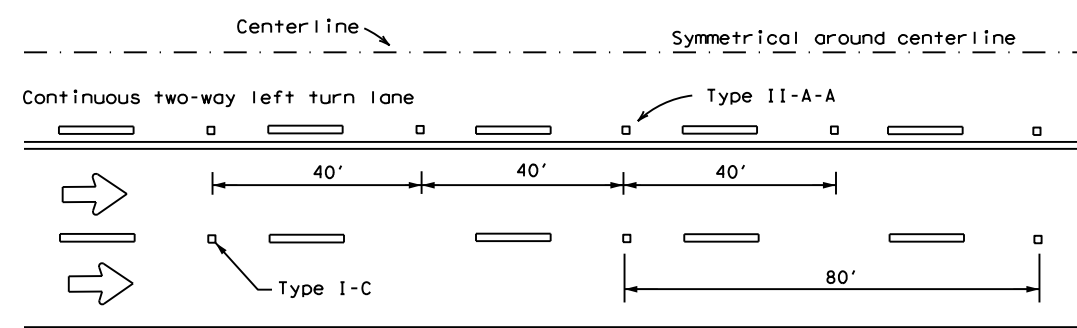
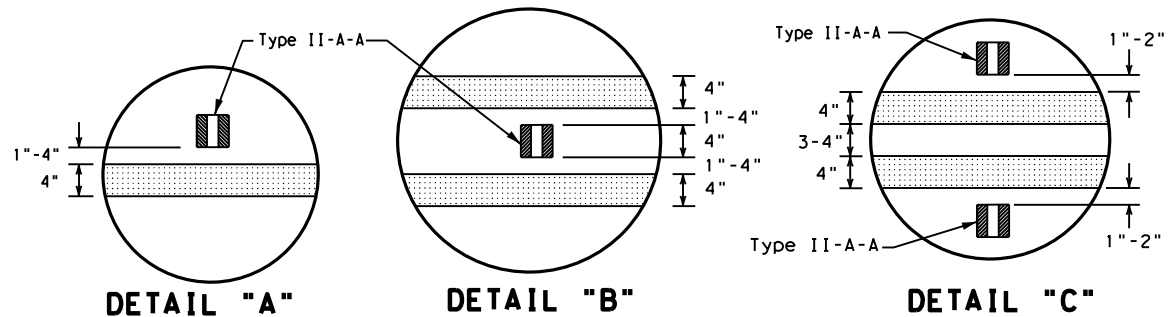
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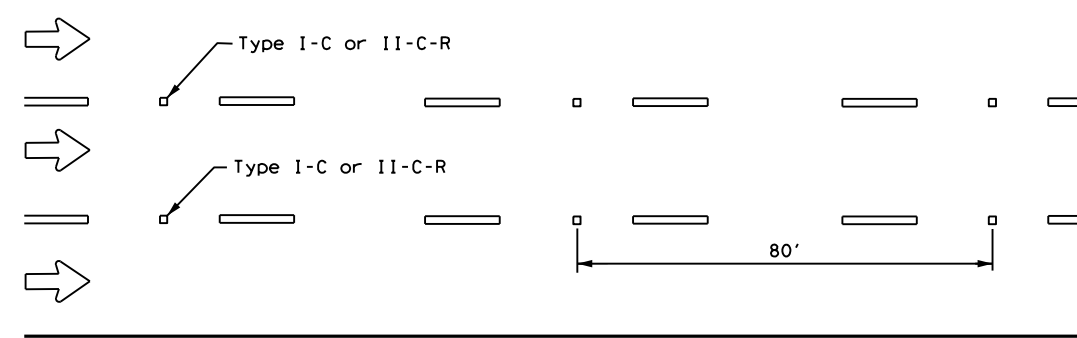
**CENTERLINE FOR ALL TWO LANE ROADWAYS**



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



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

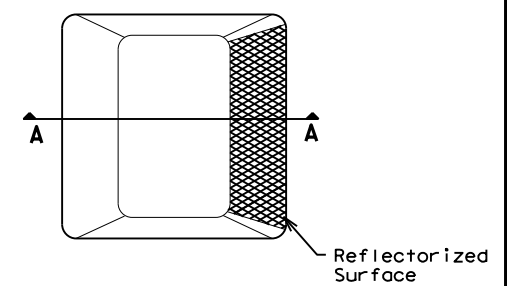


**LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)**

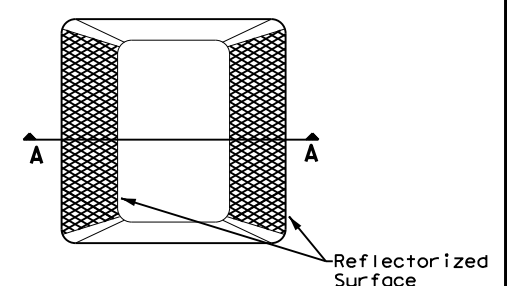
Raised pavement markers Type II-C-R shall have clear face toward normal traffic and red face toward wrong-way traffic.

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

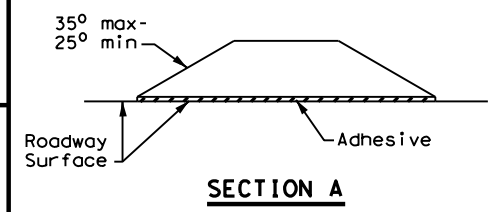
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



**Type I (Top View)**



**Type II (Top View)**



**RAISED PAVEMENT MARKERS**

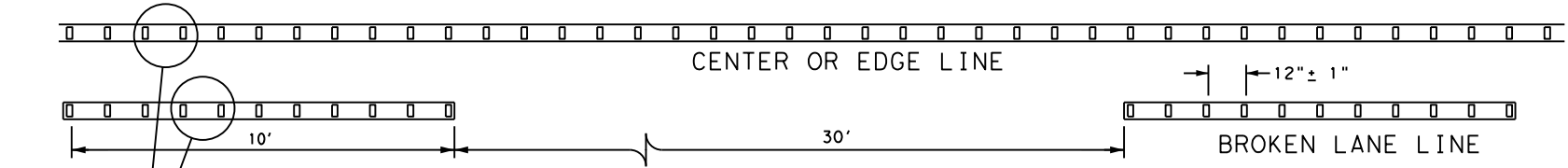
**GENERAL NOTES**

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



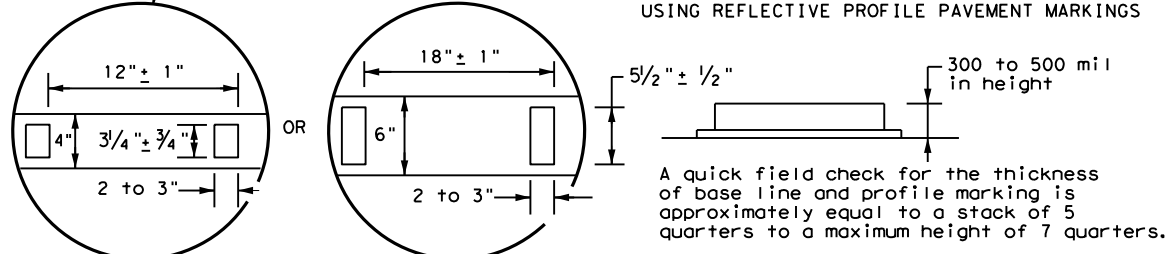
## POSITION GUIDANCE USING RAISED MARKERS REFLECTORIZED PROFILE MARKINGS PM(2) - 20

FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1977	CONT	SECT	JOB	HIGHWAY
4-92 2-10 REVISIONS	0931	04	034	FS 357
5-00 2-12	DIST	COUNTY		SHEET NO.
8-00 6-20	LFK	TRINITY		76



**REFLECTORIZED PROFILE  
PATTERN DETAIL**

USING REFLECTIVE PROFILE PAVEMENT MARKINGS

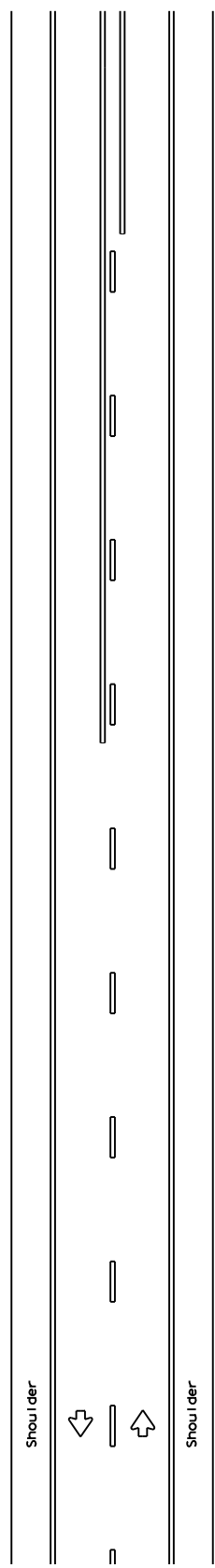


**NOTE**  
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

DATE:  
FILE:

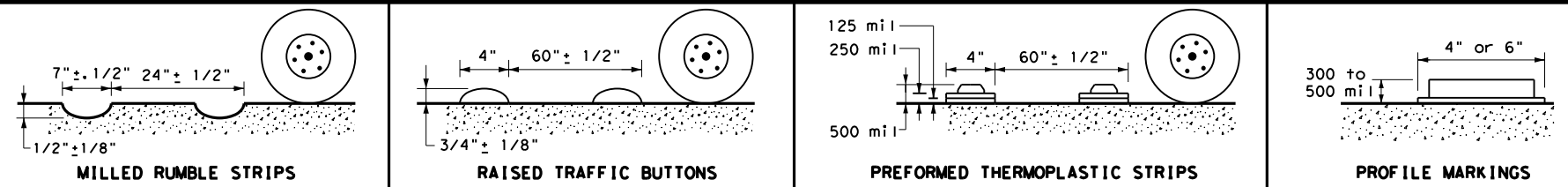
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DATE:  
FILE:

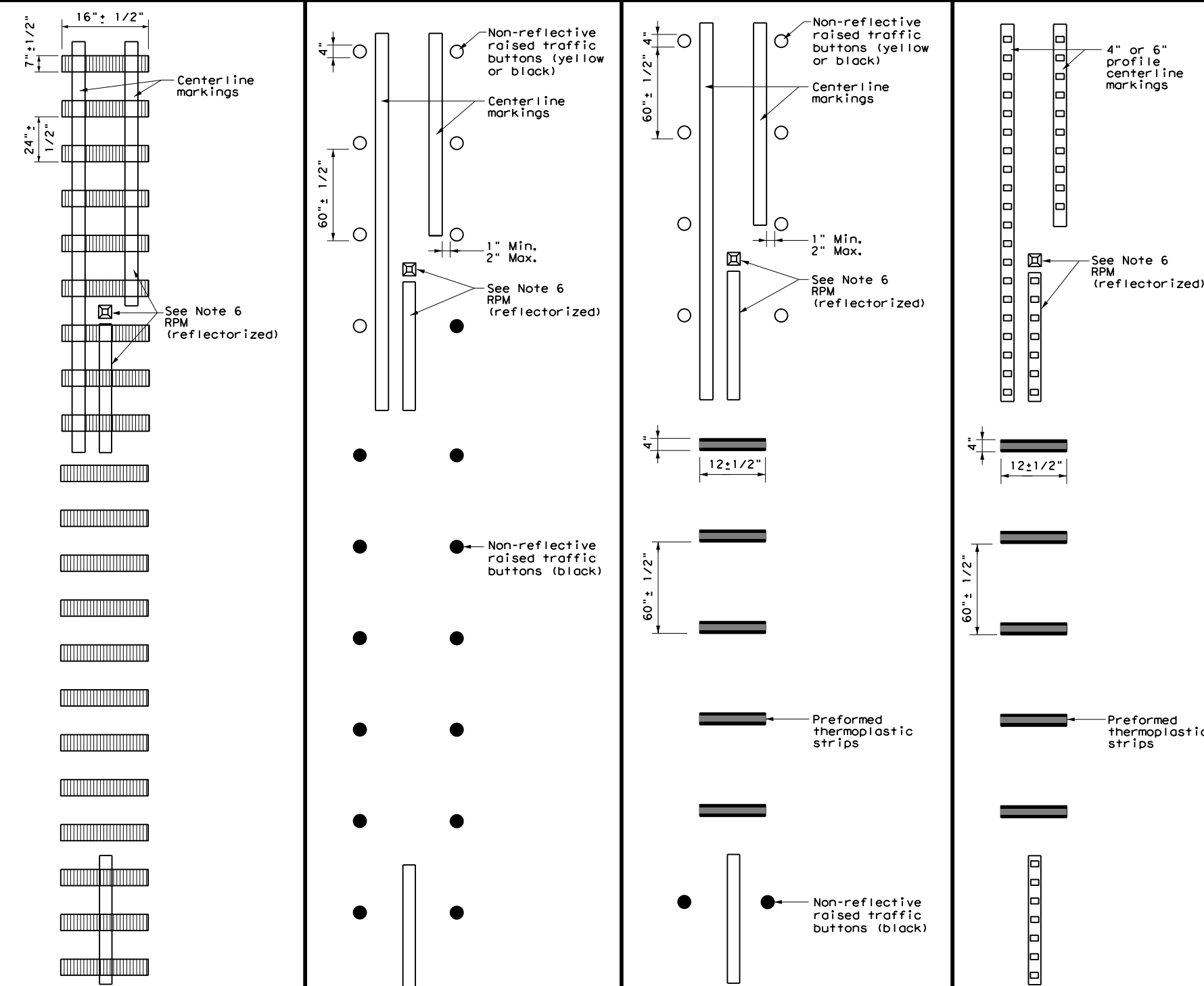


**TWO LANE TWO-WAY ROADWAYS**

**CENTERLINE RUMBLE STRIPS**



**PROFILE VIEW**



**MILLED CENTERLINE RUMBLE STRIPS**

**RAISED CENTERLINE RUMBLE STRIPS**

**RAISED CENTERLINE RUMBLE STRIPS AND PREFORMED THERMOPLASTIC STRIPS**

**PROFILE CENTERLINE MARKINGS AND PREFORMED THERMOPLASTIC STRIPS**

**GENERAL NOTES**

1. This standard sheet provides guidelines for installing centerline rumble strips on two-lane highways with or without shoulders.
2. Centerline and edgeline rumble strips or profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
3. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
4. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
5. Breaks in milled centerline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks.
6. Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, and dimensions pavement markings and profile markings.
7. Consideration should be given to noise levels when centerline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inch depth of milled rumble strip may be considered in these areas.
8. Pavement markings must be applied over milled centerline rumble strips.

**WHEN INSTALLING CENTERLINE RUMBLE STRIPS:**

9. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per manufacturer's recommendations.
10. When using non-reflective raised traffic buttons as a centerline rumble strip, the button shall be placed adjacent to the pavement marking delineating the centerline. The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
11. The color of the button should be yellow for a continuous no passing roadway. Black buttons should be used in areas where passing is allowed.

**WHEN INSTALLING EDGELINE RUMBLE STRIPS WITH OR WITHOUT CENTERLINE RUMBLE STRIPS ON UNDIVIDED HIGHWAYS:**

12. See standard sheet RS(4).

**Texas Department of Transportation**  
Traffic Operations Division Standard

**CENTERLINE RUMBLE STRIPS ON TWO LANE TWO-WAY HIGHWAYS**

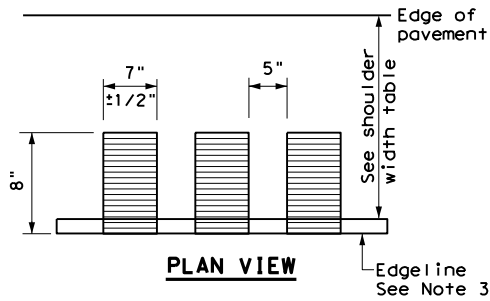
**RS(3) - 13**

FILE: r's(3) - 13.dgn	DW: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
	DIST	COUNTY	SHEET NO.	
	LFK	TRINITY	77	

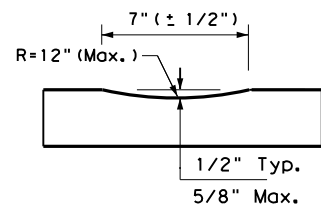


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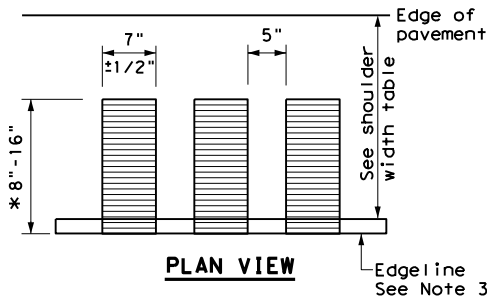


PLAN VIEW

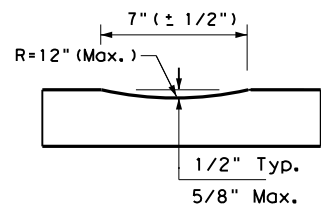


PROFILE VIEW  
OPTION 1

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

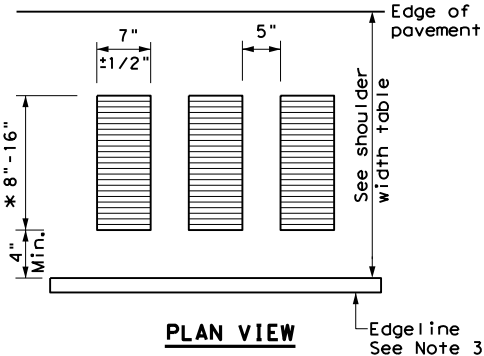


PLAN VIEW



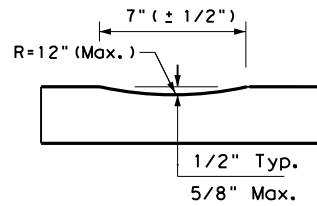
PROFILE VIEW  
OPTION 2

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



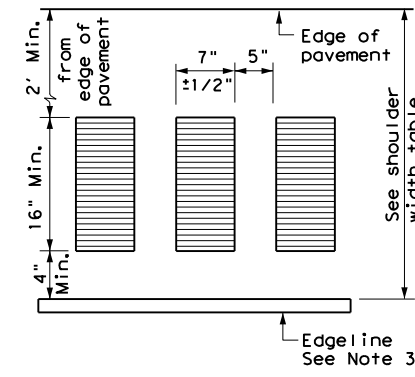
PLAN VIEW

\* This distance may vary based on width of shoulder

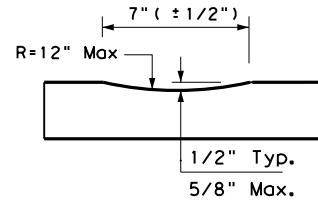


PROFILE VIEW  
OPTION 3

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

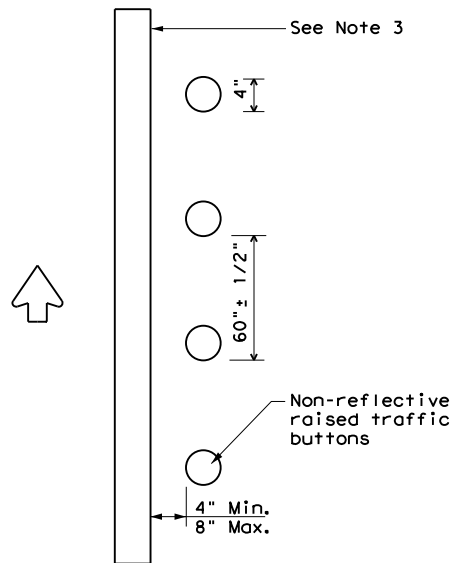


PLAN VIEW



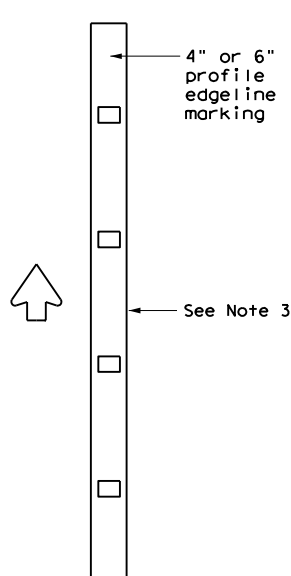
PROFILE VIEW  
OPTION 4

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



PLAN VIEW  
OPTION 5

RAISED EDGELINE RUMBLE STRIPS



PLAN VIEW  
OPTION 6

PROFILE EDGELINE MARKINGS

SHOULDER WIDTH TABLE		
EQUAL TO OR LESS THAN 2 FEET	GREATER THAN 2 FEET LESS THAN 4 FEET	EQUAL TO OR GREATER THAN 4 FEET
Option 1, 5 OR 6	Option 1, 2, 3 5 OR 6	Option 2, 4, 5 OR 6

GENERAL NOTES

- Rumble strips and profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
- Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
- Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings, and profile markings.
- See the table below for determining what options may be used for edgeline rumble strips.

WHEN INSTALLING MILLED DEPRESSION EDGELINE RUMBLE STRIPS:

- See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
- Pavement markings can be applied over milled shoulder rumble strips to create an edgeline rumble stripe.
- Breaks in edgeline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks when installed on conventional highways.
- Rumble strips shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
- Consideration should be given to noise levels when edgeline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inches depth of milled rumble strip may be considered in these areas.

- On roadways with high bicycle activity, consideration should be given before the installation of edgeline rumble strips. Things to consider include size of rumble strips, rumble strip material and location of rumble strips on the shoulder. If the designer determines that gaps are needed in the rumble strips due to bicycle use of the road, then follow the requirement shown in FHWA Technical Advisory T5040.39, or latest version. A detail of the spacing shall be included in the plans.

WHEN INSTALLING RAISED OR PROFILE EDGELINE RUMBLE STRIPS:

- Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per the manufacturer's recommendations.
- Non-reflective traffic buttons shall be placed adjacent to the pavement marking delineating the edgeline when used as a rumble strip. The color of the button should match the color of the adjacent edgeline marking (white or yellow). The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
- Non-reflective traffic buttons shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
- Breaks in edgeline rumble strips using raised traffic buttons shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossing, intersections and driveways with high usage of large trucks when installed on conventional highways.
- The minimum distance between the edgeline and the buttons should be used if the shoulder is less than 8 feet in width.
- Raised profile thermoplastic markings used as edgelines may substitute for buttons.

Texas Department of Transportation Traffic Operations Division Standard

## EDGELINE RUMBLE STRIPS ON UNDIVIDED OR TWO LANE HIGHWAYS RS(4)-13

FILE: rs(4)-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
	DIST	COUNTY	SHEET NO.	
	LFK	TRINITY	78	

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DATE: FILE:

REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS				DELINEATORS				D & OM DESCRIPTIVE CODES		
DEVICE	SIZE 1	SIZE 2	SIZE 3	SIZE 4	SINGLE		DOUBLE		INSTL DEL ASSM (D-XX)SZ X (XXXX)XXX(XX) NUMBER OF REFLECTORS S = Single D = Double COLOR OF REFLECTORS W = White Y = Yellow R = Red REFLECTOR UNIT SIZE 1 or 2 TYPE OF POST OR DELINEATOR WC = Wing Channel Post YFLX = Yellow Flexible Post WFLX = White Flexible Post BRFL = Barrier Reflector TYPE OF MOUNT GND = Embedded (drivable or set in concrete) CTB = Concrete Barrier Mount GF1 or GF2 = Guard Fence Attachment SRF = Surface Mount DIRECTION If Required BI = Bi-Directional BR = Bi-Directional with red on back	
SHEETING	Yellow, White or Red Type B or C reflective sheeting				Yellow, White or Red Type B or C Reflective Sheeting				INSTL OM ASSM (OM-XX) (XXXX)XXX(XX) TYPE OF OBJECT MARKER 1, 2, 3, or 4 NUMBER OF REFLECTORS OR DIRECTION X = 3-Size 2 reflector unit (Type 2 only) Y = 1-Size 3 reflector unit (Type 2 only) Z = 3-Size 1 or 1-Size 4 reflector unit(s) (Type 2 only) L = Left Side (Type 3 Object Marker only) R = Right Side (Type 3 Object Marker only) C = Center (Type 3 Object Marker only) TYPE OF POST WC = Wing Channel Post WFLX = White Flexible Post TWT = Thin Walled Tubing TYPE OF MOUNT GND = Embedded (drivable) SRF = Surface Mount WAS = Wedge Anchor Steel WAP = Wedge Anchor Plastic DIRECTION If Required BI = Bi-Directional	
NOTE	1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (fix). 2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.				POST TYPE	WC	YFLX, WFLX	WC		YFLX, WFLX
					MOUNT TYPE	GND	GND, SRF	GND		GND, SRF

OBJECT MARKERS								
DEVICE	Type 1 (OM-1)	Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)
	OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4
SHEETING	Yellow-Type B <sub>FL</sub> or C <sub>FL</sub> Sheeting	Yellow - Type B or C Sheeting			Alternating acrylic black and retroreflective yellow - Type B <sub>FL</sub> or C <sub>FL</sub> Sheeting			Red -Type B <sub>FL</sub> or C <sub>FL</sub> Sheeting
POST TYPE	TWT	WC	WC	WFLX	TWT			TWT
MOUNT TYPE	WAS, WAP	GND	GND	GND, SRF	WAS, WAP			WAS, WAP

DEPARTMENTAL MATERIAL SPECIFICATIONS	
FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES)	DMS-4400
SIGN FACE MATERIALS	DMS-8300
DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS	DMS-8600

BARRIER REFLECTORS (BRF)			CHEVRONS				ONE DIRECTION LARGE ARROW		NOTE: Delineator and object marker substrates and sign substrates shall be 0.080" Aluminum sign blank to conform to ASTM B-209 Alloy 6061-T6 or approved alternative.
DEVICE	GF1	GF2	CTB	W1-8				W1-6	
SHEETING	Yellow, White, Red								
NOTE	1. Barrier reflectors shall meet the requirements of DMS 8600. 2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov.			1. CHEVRON (W1-8) signs and ONE DIRECTION LARGE ARROW (W1-6) Signs shall be installed per Sign Mounting Details (SMD) Standard Sheets and paid under Item 644 (Small Roadside Sign Assemblies). 2. When there is a need to increase conspicuity, the Texas version of the ONE DIRECTION LARGE ARROW sign (W1-9T) may be used instead of the ONE DIRECTION LARGE ARROW (W1-6).					
	SIZE (W x L)	18" x 24" (Conventional)	24" x 30" (Conventional Oversize)	30" x 36" (Expressway)	36" x 48" (Freeway)	SIZE (W x L)	48" x 24" (Conventional)	60" x 30" (Expressway & Freeway)	
	MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only		MOUNTING HEIGHT	7'-0"		



**DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION**  
**D & OM(1)-20**

FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	OW: TXDOT	CR: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	LFK	TRINITY	79	

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POST TYPE AND SUPPORT FOUNDATION DETAILS				TYPE OF BARRIER MOUNTS	
WING CHANNEL (WC)	FLEXIBLE POSTS (YFLX, WFLX)		WEDGE ANCHOR SYSTEMS		GUARD FENCE ATTACHMENT
GND	GND	SRF	WAS	WAP	GF 1
	EMBEDDED	SURFACE MOUNT	STEEL	PLASTIC	GF 2
<b>NOTES</b> 1. Embedded Wing Channel (WC) post option may be used for Type 2 Object Markers and Delineators only. 2. 1.12 lbs/ft steel per ASTM A 1011 SS Gr. 50, or ASTM A499.	<b>NOTES</b> 1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices. 2. Install per manufacturer's recommendations. 3. Post length may vary to meet field conditions. 4. When using yellow delineators with flexible posts to separate opposing direction of travel, such as centerline or median use, the flexible posts shall be yellow.		<b>NOTE</b> 1. Install per manufacturer's recommendations.		

TYPE OF BARRIER MOUNTS	
GUARD FENCE ATTACHMENT	
GF 1	GF 2
<b>CONCRETE TRAFFIC BARRIER (CTB)</b>	
<b>GENERAL NOTES</b>	
1. Place delineators on a section of roadway at a consistent distance from the edge of pavement. 2. Where a restriction prevents consistent placement from the pavement edge, place the affected object markers in line with the innermost edge of the obstruction. 3. When Type 2 object markers and delineators are more than 8'-0" from the edge of the pavement, it may not be possible to maintain a height of approximately 4'-0". If this is the case, place the object marker or delineator as close to the desired height as possible. 4. Install all delineators, object markers and barrier reflectors in accordance with the manufacturer's recommendation. 5. Barrier reflectors should be installed a minimum of 18 inches above the edge of the pavement surface. 6. Diagonal stripes on Type 3 object markers shall slope down toward the intended travel lane.	

TYPES 1,3, AND 4 OBJECT MARKERS AND CHEVRONS
<b>NOTE</b> Mounting at 4 feet to the bottom of the chevron is permitted for chevrons that will not exceed a height of 6'-6" to the top of the chevron (sizes 24" x 30" and smaller)

CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN
<b>NOTE</b> Chevrons 30" x 36" and larger shall be mounted at a height of 7' to the bottom of the chevron. Chevron sign and ONE DIRECTION LARGE ARROW sign (W1-9T) shall be installed per SMD standard sheets and paid under item 644.

DELINEATORS AND TYPE 2 OBJECT MARKERS
<b>NOTE</b> 2'-0" to 8'-0" or in front of object being marked See general notes 1, 2 and 3.

Texas Department of Transportation  
Traffic Safety Division Standard

## DELINEATOR & OBJECT MARKER INSTALLATION

### D & OM(2)-20

FILE: dom2-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	LFK	TRINITY	80	

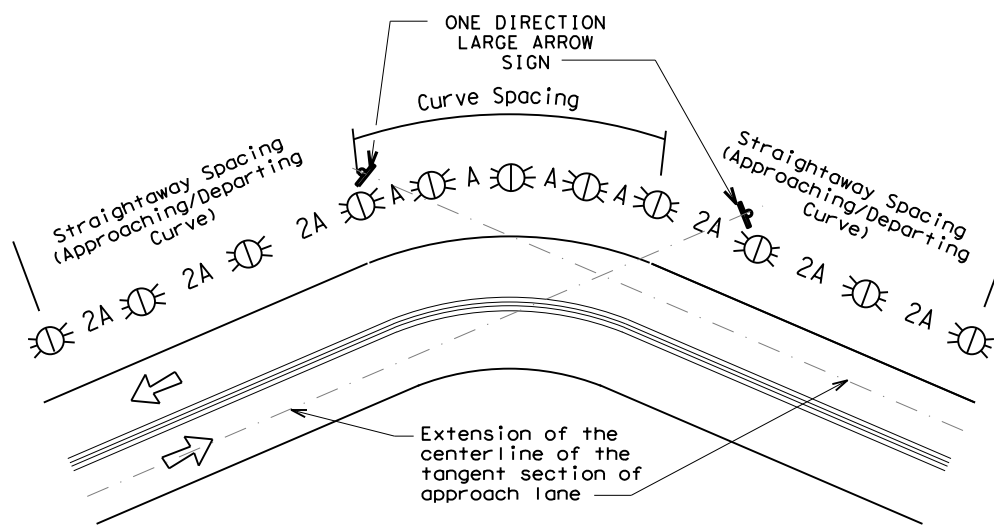
DATE: FILE:

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### MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

Amount by which Advisory Speed is less than Posted Speed	Curve Advisory Speed	
	Turn (30 MPH or less)	Curve (35 MPH or more)
5 MPH & 10 MPH	• RPMs	• RPMs
15 MPH & 20 MPH	• RPMs and One Direction Large Arrow sign	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons.
25 MPH & more	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons	• RPMs and Chevrons

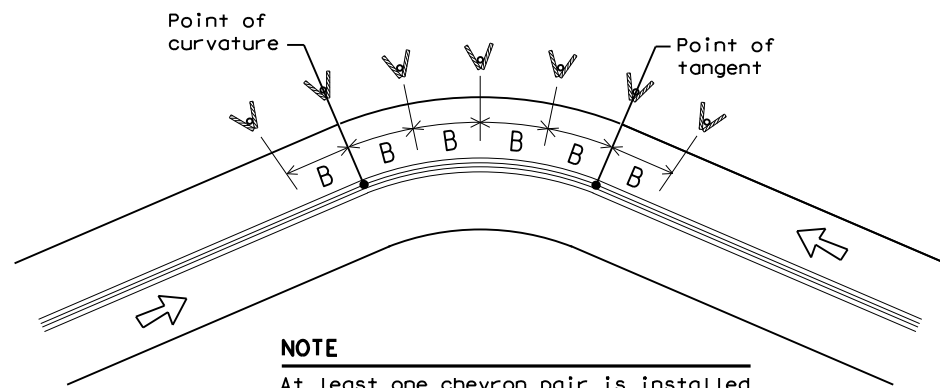
### SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



**NOTE**

ONE DIRECTION LARGE ARROW (W1-6) sign should be located at approximately and perpendicular to the extension of the centerline of the tangent section of approach lane.

### SUGGESTED SPACING FOR CHEVRONS ON HORIZONTAL CURVES



**NOTE**

At least one chevron pair is installed beyond the point of tangent in tangent section.

### DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS KNOWN				
Degree of Curve	FEET			
	Radius of Curve	Spacing in Curve	Spacing in Straightaway	Chevron Spacing in Curve
		A	2A	B
1	5730	225	450	—
2	2865	160	320	—
3	1910	130	260	200
4	1433	110	220	160
5	1146	100	200	160
6	955	90	180	160
7	819	85	170	160
8	716	75	150	160
9	637	75	150	120
10	573	70	140	120
11	521	65	130	120
12	478	60	120	120
13	441	60	120	120
14	409	55	110	80
15	382	55	110	80
16	358	55	110	80
19	302	50	100	80
23	249	40	80	80
29	198	35	70	40
38	151	30	60	40
57	101	20	40	40

Curve delineator approach and departure spacing should include 3 delineators spaced at 2A. This spacing should be used during design preparation or when the degree of curve is known.

### DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS NOT KNOWN			
Advisory Speed (MPH)	Spacing in Curve	Spacing in Straightaway	Chevron Spacing in Curve
	A	2xA	B
65	130	260	200
60	110	220	160
55	100	200	160
50	85	170	160
45	75	150	120
40	70	140	120
35	60	120	120
30	55	110	80
25	50	100	80
20	40	80	80
15	35	70	40

If the degree of curve is not known, delineator spacing may be determined based on the Advisory Speed of the curve. Use the delineator curve spacing for each Advisory Speed (MPH).

### DELINEATOR AND OBJECT MARKER APPLICATION AND SPACING

CONDITION	REQUIRED TREATMENT	MINIMUM SPACING
Frwy./Exp. Tangent	RPMs	See PM-series and FPM-series standard sheets
Frwy./Exp. Curve	Single delineators on right side	See delineator spacing table
Frwy/Exp. Ramp	Single delineators on at least one side of ramp (should be on outside of curves) (see Detail 3 on D&OM(4))	100 feet on ramp tangents Use delineator spacing table for ramp curves ("straightway spacing" does not apply to ramp curves)
Acceleration/Deceleration Lane	Double delineators (see Detail 3 on D&OM(4))	100 feet (See Detail 3 on D & OM (4))
Truck Escape Ramp	Single red delineators on both sides	50 feet
Bridge Rail (steel or concrete) and Metal Beam Guard Fence	Bi-Directional Delineators when undivided with one lane each direction Single Delineators when multiple lanes each direction	Equal spacing (100' max) but not less than 3 delineators
Concrete Traffic Barrier (CTB) or Steel Traffic Barrier	Barrier reflectors matching the color of the edge line	Equal spacing 100' max
Cable Barrier	Reflectors matching the color of the edge line	Every 5th cable barrier post (up to 100' max)
Guard Rail Terminus/Impact Head	Divided highway - Object marker on approach end Undivided 2-lane highways - Object marker on approach and departure end	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5) and D & OM (6)
Bridges with no Approach Rail	Type 3 Object Marker (OM-3) at end of rail and 3 single delineators approaching rail	See D & OM(5)
Reduced Width Approaches to Bridge Rail	Type 2 and Type 3 Object Markers (OM-3) and 3 single delineators approaching bridge	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5)
Culverts without MBGF	Type 2 Object Markers	See Detail 2 on D & OM(4)
Crossovers	Double yellow delineators and RPMs	See Detail 1 on D & OM (4)
Pavement Narrowing (lane merge) on Freeways/Expressway	Single delineators adjacent to affected lane for full length of transition	100 feet

**NOTES**

- Unless indicated otherwise, the delineator or barrier reflector color shall conform to the color of the pavement edge line on the side of the road where the delineators or barrier reflectors are placed.
- Barrier reflectors may be used to replace required delineators.
- Single red delineators may be mounted on the back side of delineator posts for wrong way driver applications

LEGEND	
	Bi-directional Delineator
	Delineator
	Sign

Texas Department of Transportation  
Traffic Safety Division Standard

## DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

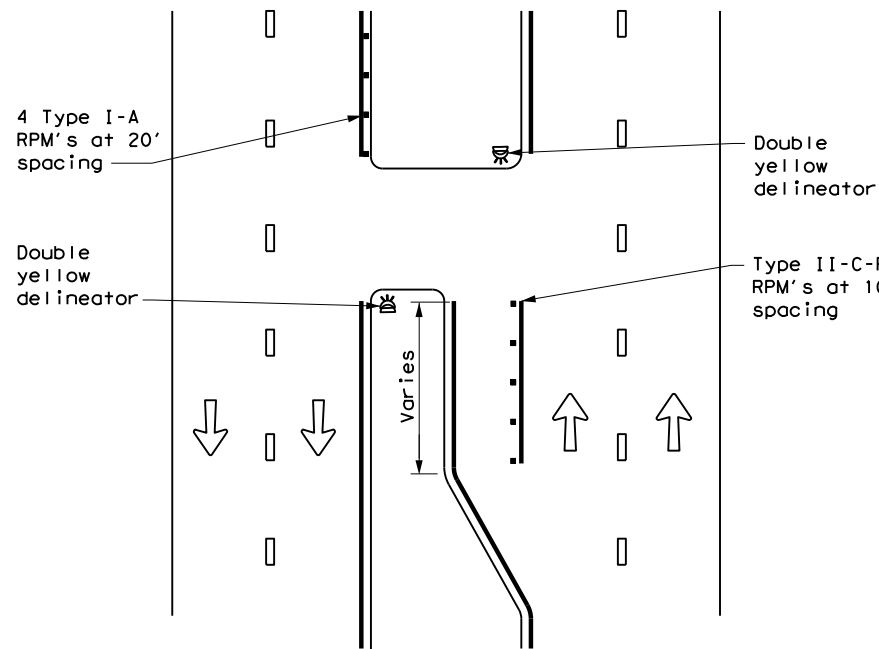
### D & OM(3)-20

FILE: dom3-20.dgn	DW: TXDOT	CK: TXDOT	OW: TXDOT	CR: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
3-15 8-15	DIST	COUNTY	SHEET NO.	
8-15 7-20	LFK	TRINITY	81	

DATE:  
FILE:

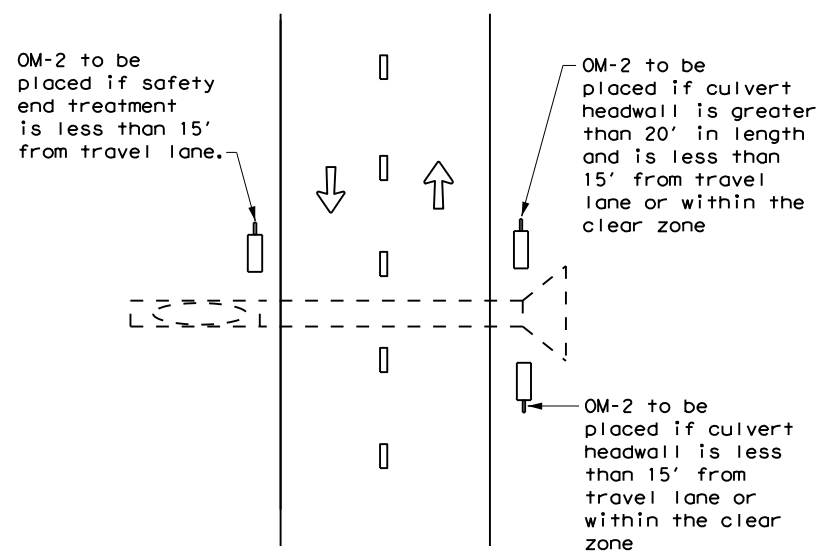
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**CROSSOVERS**



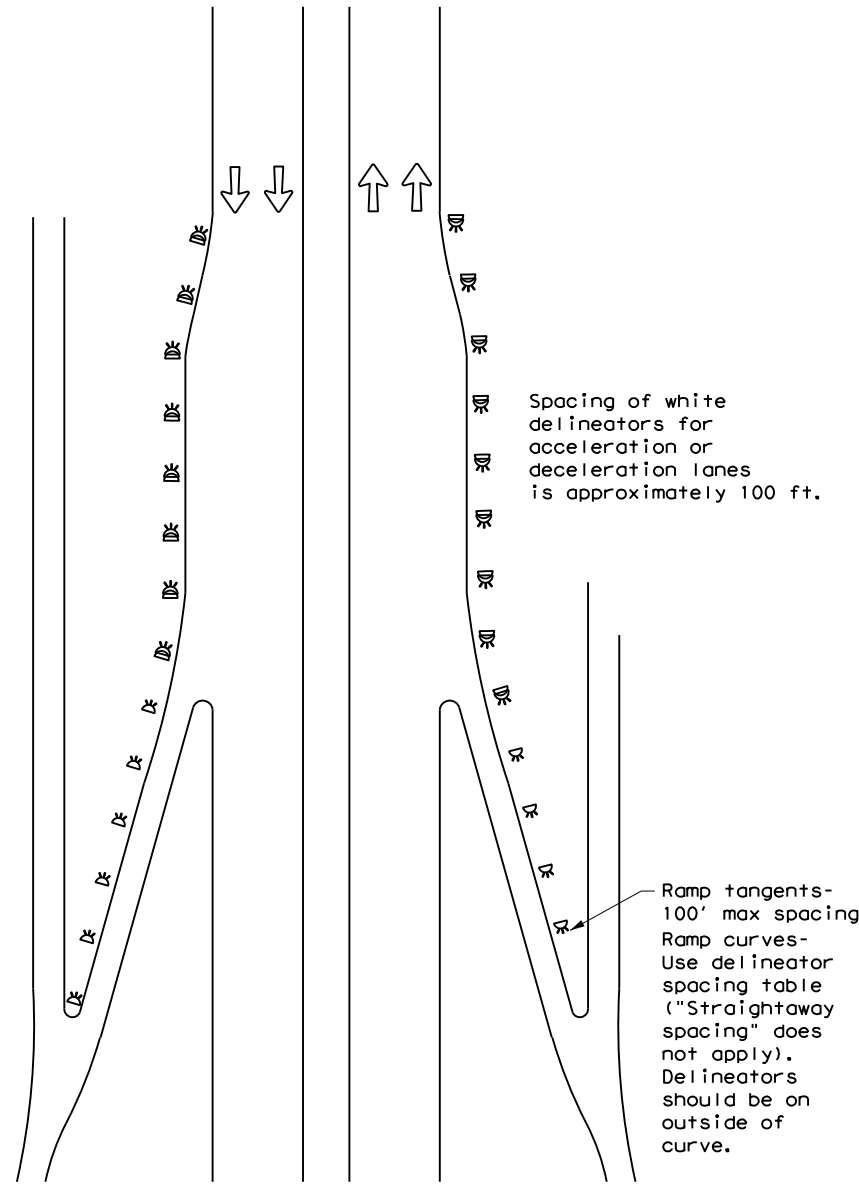
**DETAIL 1**

**FOR CULVERTS WITHOUT MBGF**



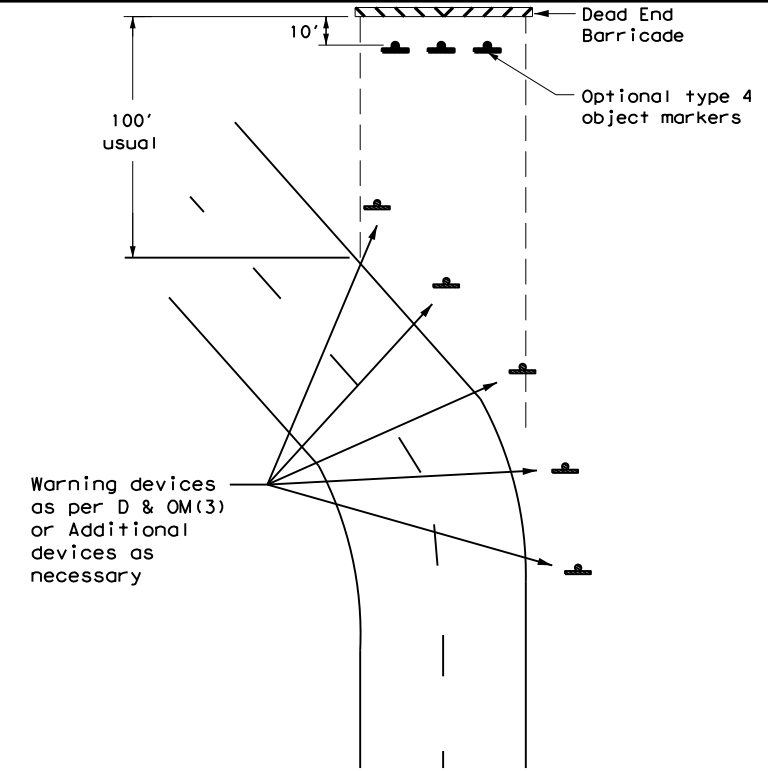
**DETAIL 2**

**FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES**



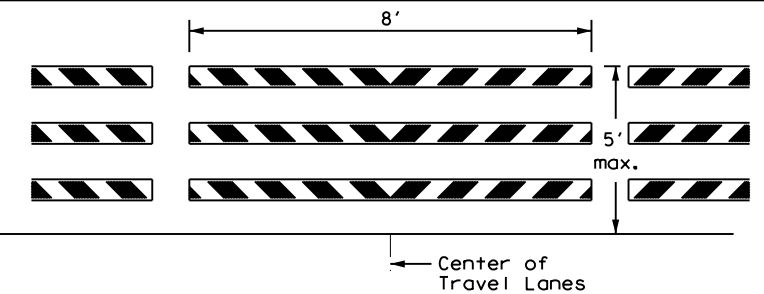
**DETAIL 3**

**TYPICAL APPLICATION OF DEAD END BARRICADE**



**DETAIL 4**

**TYPICAL DEAD END BARRICADE INSTALLATION**



**NOTES**

1. Barricade striping shall be red and white reflective sheeting for all permanent road closures.
2. Barricade striping is red and white sloping toward the center of the roadway.
3. Type 3 Barricade Supports should be anchored to soil or pavement as described in compliant Work Zone Traffic Control Devices List, section D.2.f and D.2.g.

**DETAIL 5**

LEGEND	
	Bidirectional Delineator
	Delineator
	OM-3
	Barricade
	Sign
	OM-2
	Double Delineator



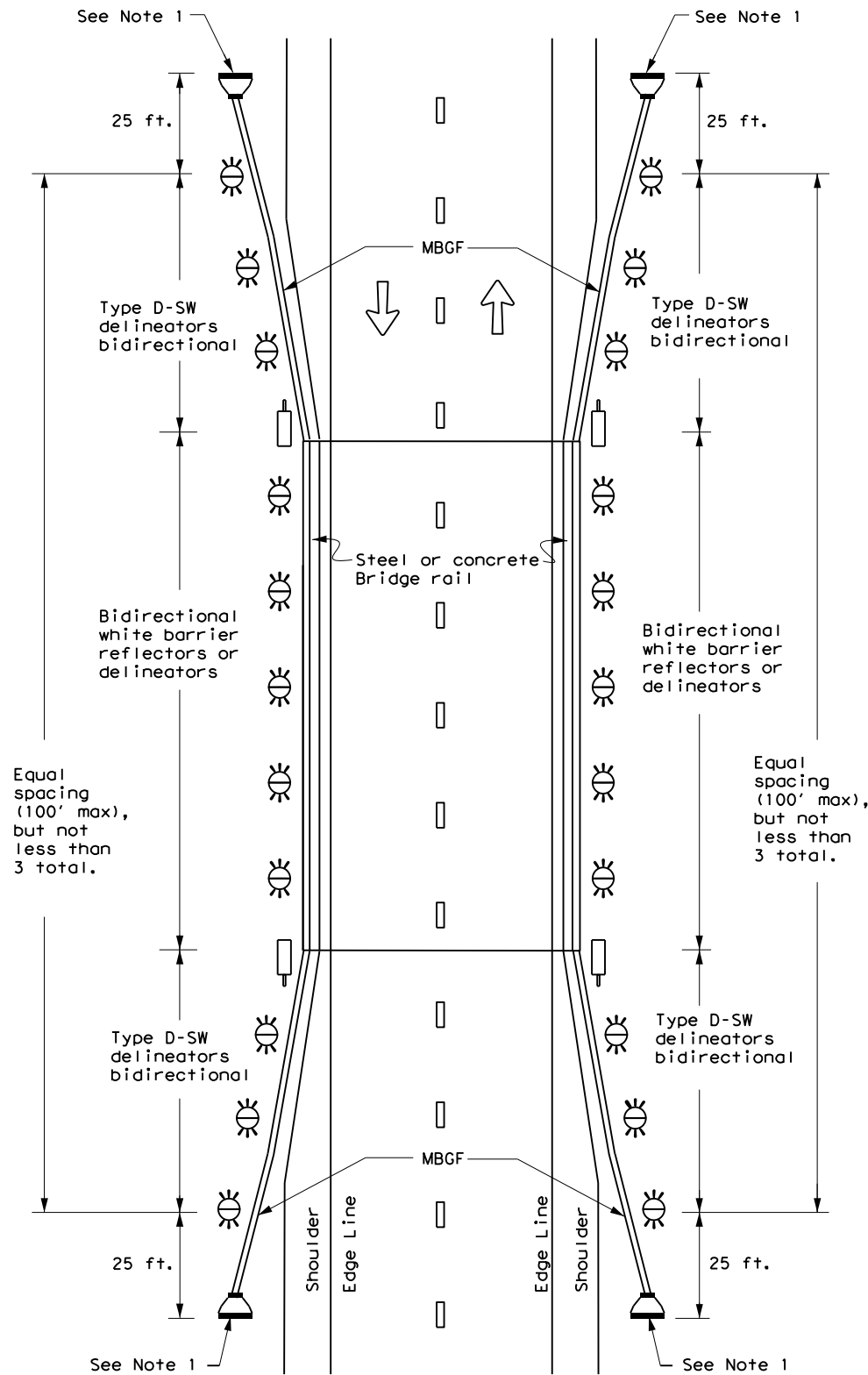
**DELINEATOR & OBJECT MARKER PLACEMENT DETAILS**

**D & OM(4) -20**

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	OW: TXDOT	CR: TXDOT
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REVISIONS	0931	04	034	FS 357
3-15	DIST	COUNTY	SHEET NO.	
7-20	LFK	TRINITY	82	

DATE:  
FILE:

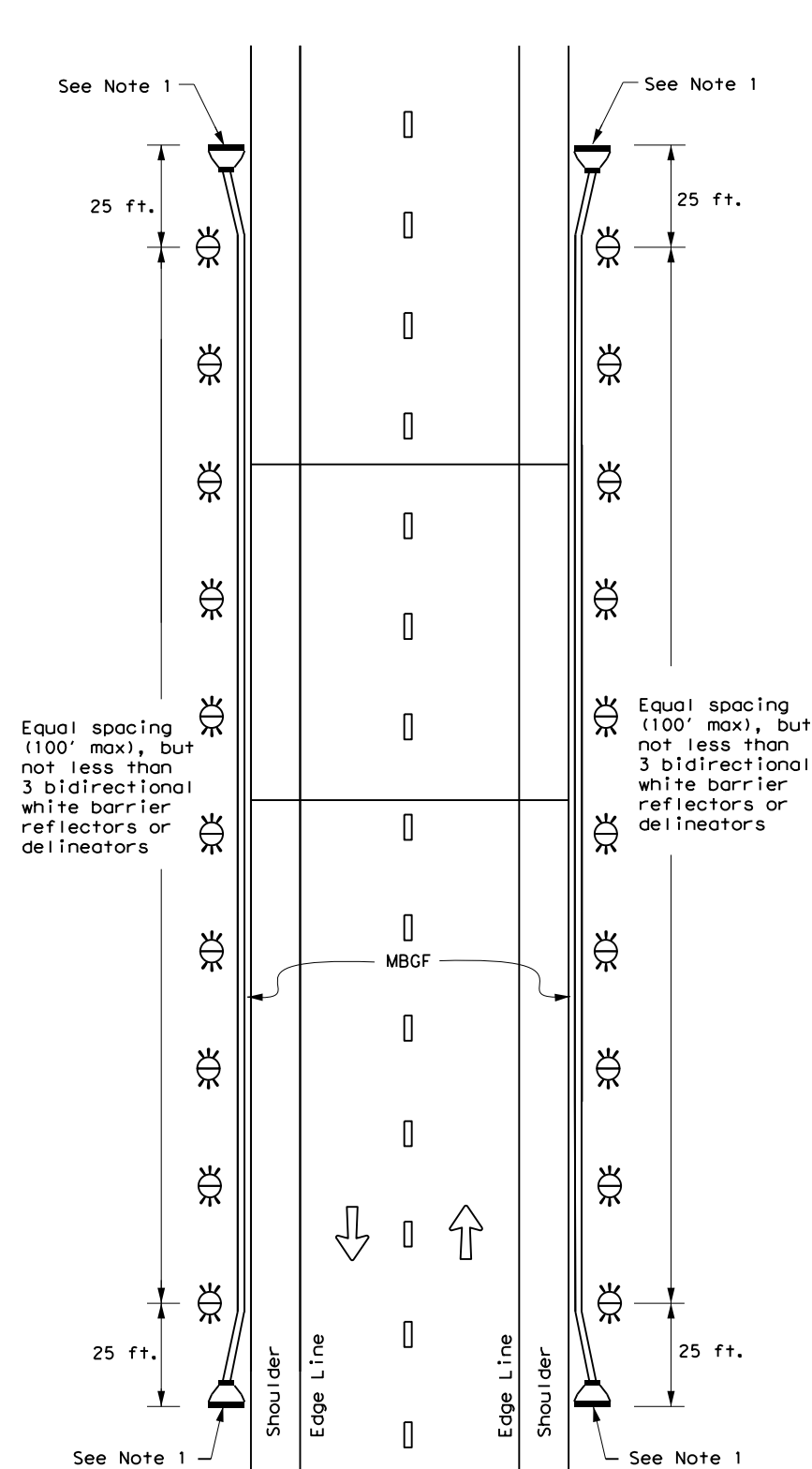
**TWO-WAY, TWO LANE ROADWAY  
WITH REDUCED WIDTH APPROACH RAIL**



**NOTE:**

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

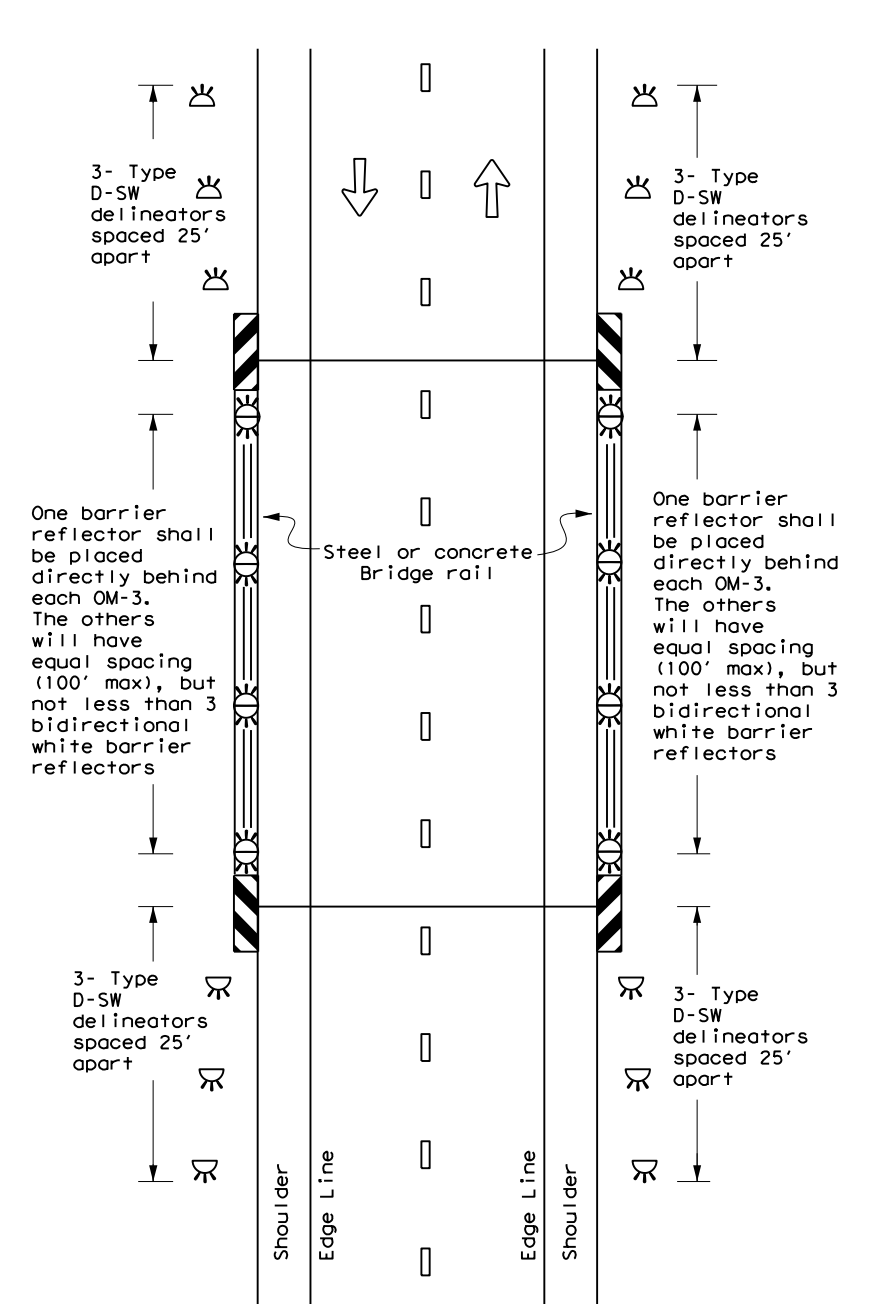
**TWO-WAY, TWO LANE ROADWAY  
WITH METAL BEAM GUARD FENCE (MBGF)**



**NOTE:**

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

**TWO-WAY, TWO LANE ROADWAY  
BRIDGE WITH NO APPROACH RAIL**



**LEGEND**

	Bidirectional Delineator
	Delineator
	OM-3
	OM-2
	Terminal End
	Traffic Flow



**DELINEATOR &  
OBJECT MARKER  
PLACEMENT DETAILS**

**D & OM(5) - 20**

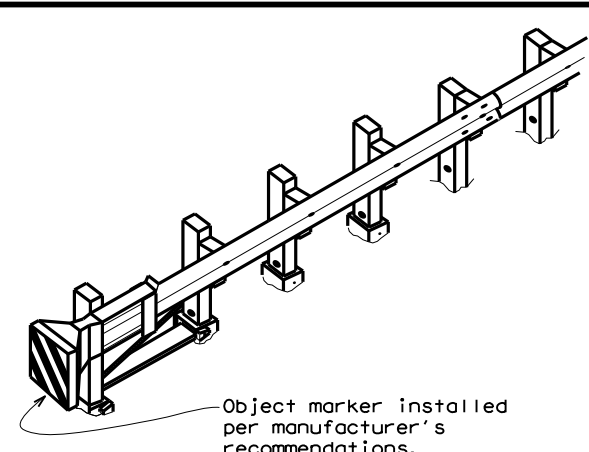
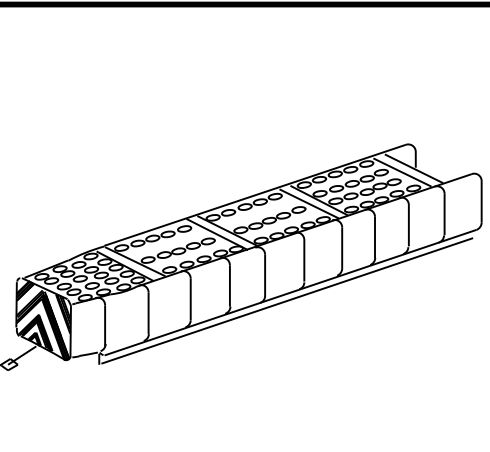
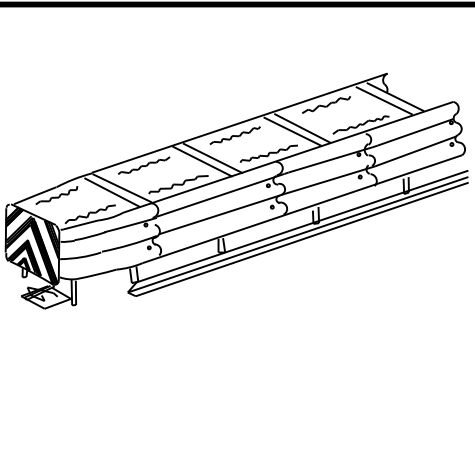
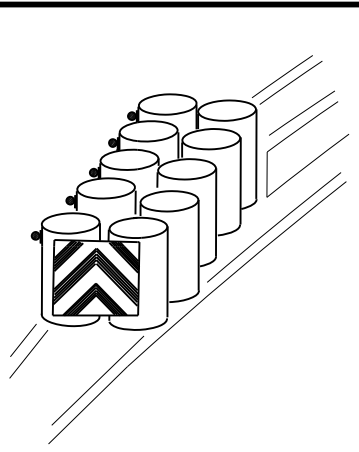
FILE: dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
7-20	DIST	COUNTY	SHEET NO.	
	LFK	TRINITY	83	

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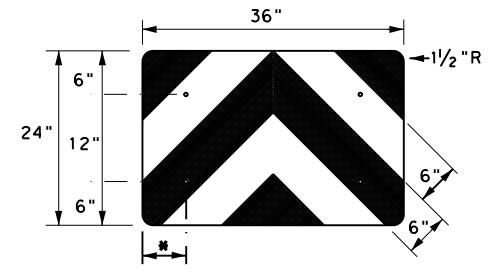
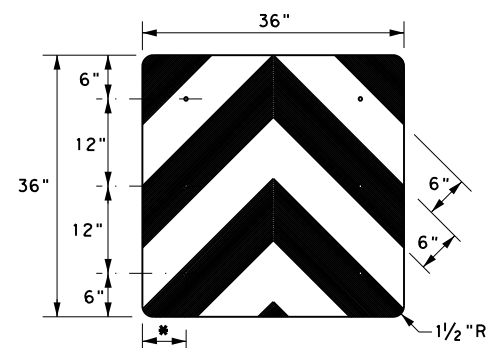
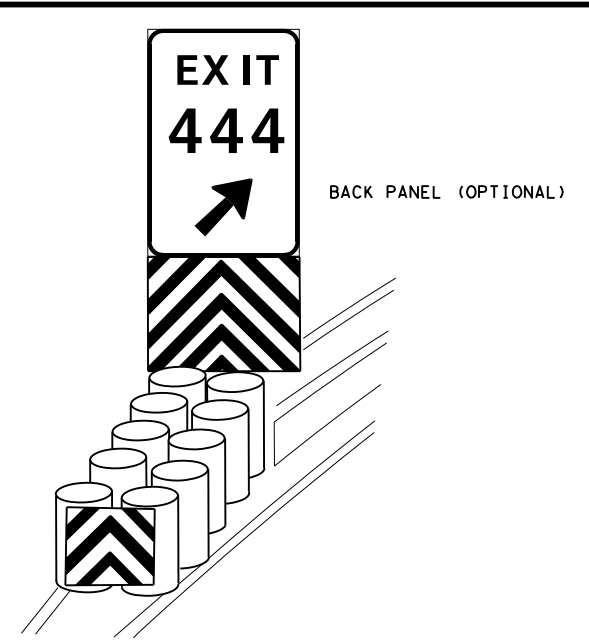
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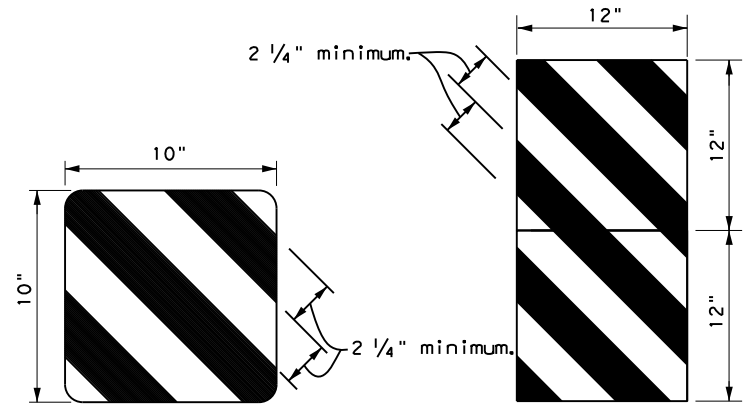
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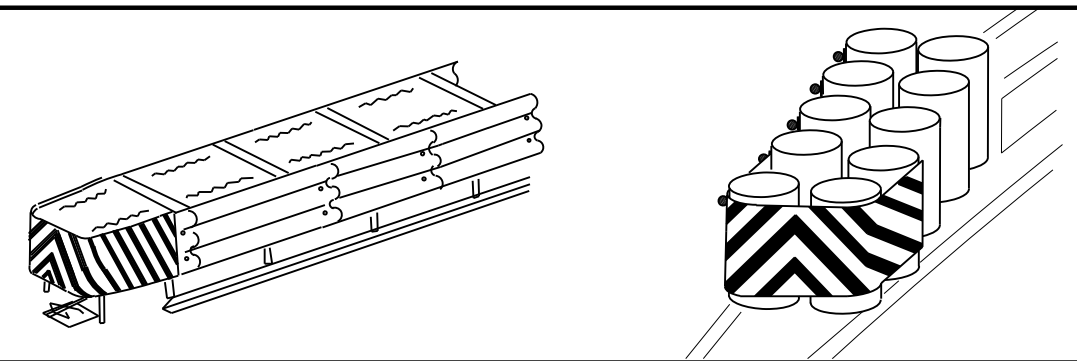
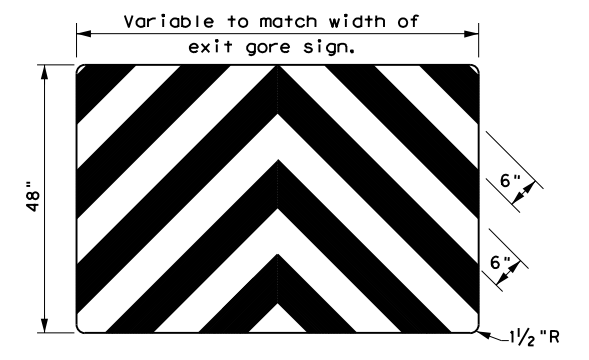
Object marker installed per manufacturer's recommendations.



\* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer



OBJECT MARKERS SMALLER THAN 3 FT<sup>2</sup>

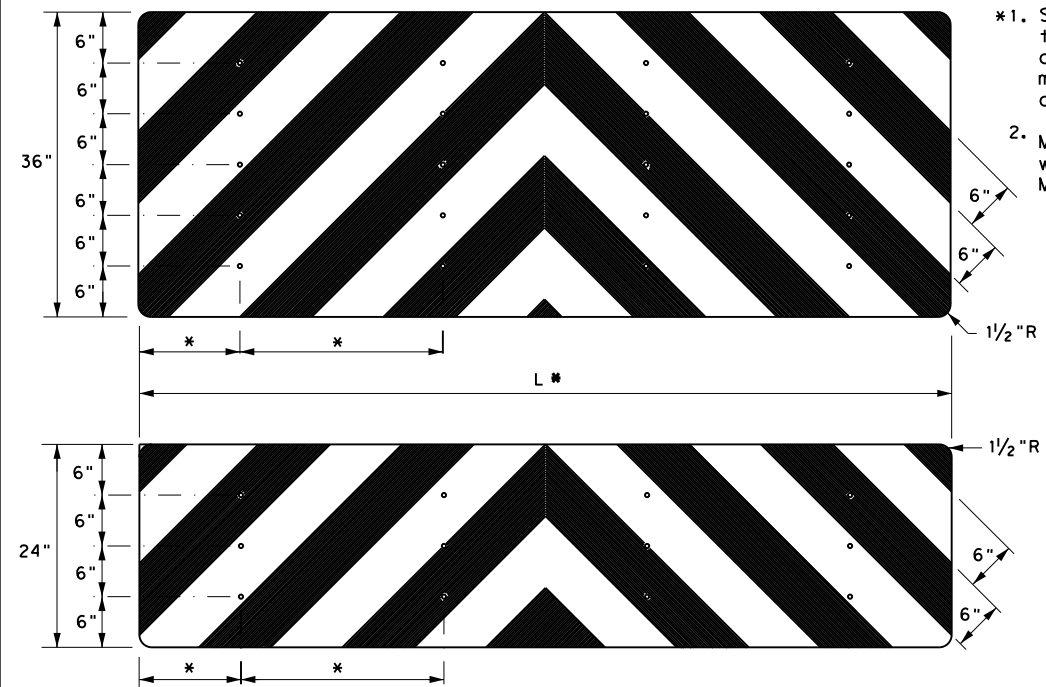


**NOTES**

- Object Markers shall conform to the Texas MUTCD and meet the color and reflectivity requirement of Department Material Specification DMS 8300. Background shall be yellow reflective sheeting (Type B or C) and Chevron shall be black.
- Object Markers may be fabricated from adhesive backed reflective sheeting applied directly to guardrail end treatment, or applied directly to an "end cap" as per the manufacturer's recommendation. Direct applied sheeting shall provide a smooth surface and have no wrinkles, air bubbles, cuts or tears. A radius at the corners is not required for direct applied sheeting.
- Object Marker size may be reduced to fit smaller devices. Width of alternating black and yellow stripes are typically 6". Object Markers smaller than 3ft may have reduced width stripes of a minimum of 2 1/4".
- Pop rivets, screws, or nuts and bolts may be used to attach object markers and reflectors. Holes, slots or other openings may be cut or drilled through object markers to allow cable or other attachments.
- Object Marker at nose of attenuator is subsidiary to the attenuator.
- See D & OM (1-4) for required barrier reflectors.

**NOTES**

- Spacing should be adjusted to attach through centerline of drum, per attenuator manufacturer's recommendation, or as directed by the Engineer.
- Mounting should be flush with top of attenuator. Minimum size 96" x 24".



		Traffic Safety Division Standard	
<b>DELINEATOR &amp; OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS</b> <b>D &amp; OM(VIA) -20</b>			
FILE: domvia20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT
© TXDOT December 1989	CONT	SECT	JOB
REVISIONS		0931 04	034 FS 357
4-92 8-04			
8-95 3-15			
4-98 7-20			
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	84	
20G			

DATE:  
FILE:

5/24/2022 5:00:54 PM pw:\xdot\projectwiseonline.com\TXDOT3\Documents\11 - LFK\Design Projects\093104034\4 - Design\Plan Set\9. Environmental\SWP3\Index\Large disturbance.dgn

**NOTES:**

- (1) THE PURPOSE OF THIS SHEET IS TO POINT THE USER TO THE APPROPRIATE LOCATIONS TO FIND THE REQUIRED CONTENT OF THE SWP3.
- (2) THE PROJECT LIMITS SHOWN ON THE TITLE SHEET AND LIMITS OF TXDOT RIGHT OF WAY SHALL ALSO BE THE LIMITS OF COVERAGE OF THE SWP3.

**PROJECT DESCRIPTION**

- A. NATURE OF ACTIVITY: SAFETY TREAT FIXED OBJECTS, PROFILE EDGELINE MARKINGS, ADDITIONAL PAVED SURFACE WIDTH, PROFILE CENTERLINE MARKINGS
- B. POTENTIAL POLLUTANTS AND THEIR SOURCES: POLLUTANT: SEDIMENT  
SOURCE: DISTURBED SOIL POLLUTANT: OIL AND GREASE,  
SOURCE: EQUIPMENT AND VEHICLES
- C. INTENDED SEQUENCE OF ACTIVITIES: SEE CONSTRUCTION SCHEDULE FOR ESTIMATED START DATES AND DURATION OF SOIL-DISTURBING ACTIVITIES
- D. TOTAL AREA OF SITE: 12.480 ACRE AREA TO BE DISTURBED: 8.457 ACRE
- E. DATA DESCRIBING THE SOIL OR QUALITY OF ANY DISCHARGE FROM THE SITE:  
29% FULLER FINE SANDY LOAM, 0 TO 1 PERCENT SLOPES, 62% FULLER FINE SANDY LOAM, 1 +TO 3 PERCENT SLOPES, 9% HERTY LOAM, 1 TO 3 PERCENT SLOPES
- F. GENERAL LOCATION MAP: SEE TITLE SHEET OF THE PROJECT PLANS
- G. DETAILED SITE MAP/MAPS INDICATING THE FOLLOWING:
  - i. DRAINAGE PATTERNS: SEE SWP3 LAYOUTS
  - ii. ANTICIPATED SLOPES AFTER MAJOR GRADING ACTIVITIES: SEE TYPICAL SECTIONS
  - iii. AREAS WHERE SOIL DISTURBANCE WILL OCCUR: SEE SWP3 LAYOUTS
  - iv. LOCATIONS OF ALL CONTROLS OR BUFFERS (PLANNED/IN PLACE): SEE SWP3 LAYOUTS
  - v. LOCATIONS WHERE TEMPORARY OR PERMANENT STABILIZATION PRACTICES ARE EXPECTED TO BE USED: SEE SWP3 LAYOUTS
  - vi. LOCATION OF CONSTRUCTION SUPPORT ACTIVITIES: SEE SWP3 LAYOUTS
  - vii. SURFACE WATERS, INCLUDING WETLANDS, AT, ADJACENT, OR IN CLOSE PROXIMITY TO THE SITE (\* INDICATES IMPAIRED WATERS): SEE SWP3 LAYOUTS
  - viii. LOCATIONS WHERE STORMWATER DISCHARGES DIRECTLY TO A SURFACE WATER BODY OR MS4: SEE SWP3 LAYOUTS
  - ix. VEHICLE WASH AREAS: N/A
  - x. DESIGNATED POINTS ON THE SITE WHERE VEHICLES WILL EXIT FROM UNSTABLE DIRT TO PAVED ROAD: SEE SWP3 SHEETS (CONSTRUCTION EXITS)
- H. LOCATION AND DESCRIPTION OF CONSTRUCTION SUPPORT ACTIVITIES AUTHORIZED UNDER THE PERMITTEE'S NOI: CONSTRUCTION SUPPORT ACTIVITIES ARE NOT COVERED UNDER THIS SWP3 AS IT IS NOT AUTHORIZED UNDER THIS PERMITTEE'S CGP. THE PERMITTEE WILL MAKE REFERENCE TO CONSTRUCTION SUPPORT ACTIVITIES THAT ARE COVERED UNDER THE CONTRACTOR'S SWP3 AND CGP ON SWP3 LAYOUTS
- I. NAME OF RECEIVING WATER(S) AT OR NEAR SITE:  
AN ASTERISK (\*) INDICATES AN IMPAIRED WATER.  
UNNAMED TRIBUTARIES TO MOSSY CREEK AND  
UNNAMED TRIBUTARIES TO NORTH FORK CEDAR CREEK  
  
NEAREST CLASSIFIED SEGMENT NUMBER: 0604  
  
CLASSIFIED SEGMENT NAME: NECHES RIVER BELOW LAKE PALESTINE
- J. COPY OF TPDES GENERAL PERMIT: SEE SWP3 FILE
- K. NOI AND ACKNOWLEDGEMENT CERTIFICATE OR SITE NOTICE: SEE SWP3 FILE
- L. STORMWATER AND ALLOWABLE NON-STORMWATER DISCHARGE LOCATIONS: SEE SWP3 LAYOUTS
- M. LOCATIONS OF POLLUTANT GENERATING ACTIVITIES: ACTIVITIES AUTHORIZED UNDER THIS PERMITTEE'S CGP CAN BE FOUND ON SWP3 LAYOUTS. THIS SHEET WILL ALSO REFERENCE THE LOCATION OF POLLUTANT GENERATING ACTIVITIES THAT ARE COVERED BY THE CONTRACTOR'S CGP AND SWP3.

**DESCRIPTION OF BMPS**

A. GENERAL REQUIREMENTS: EROSION AND SEDIMENT CONTROLS SHOWN ON SWP3 LAYOUTS WERE DESIGNED TO RETAIN SEDIMENT ON-SITE TO THE EXTENT PRACTICABLE WITH CONSIDERATION OF LOCAL TOPOGRAPHY, SOIL TYPE, AND RAINFALL. THE EROSION AND SEDIMENT CONTROLS WILL BE INSTALLED AND MAINTAINED ACCORDING TO MANUFACTURER AND TXDOT STORM WATER MANAGEMENT GUIDELINES. CONTROLS TO MINIMIZE THE OFF-SITE TRANSPORT OF LITTER, CONSTRUCTION DEBRIS, AND CONSTRUCTION MATERIALS INCLUDE: CONSTRUCTION MATERIALS TO BE STORED IN LOCATIONS THAT MINIMIZE THEIR EXPOSURE TO PRECIPITATION & STORM WATER RUNOFF; COLLECTION OF CONSTRUCTION DEBRIS IN RECEPTACLES WITH A SECURE COVER MEETING STATE AND LOCAL SOLID WASTE MANAGEMENT REGULATIONS; HAULING AND EMPTYING RECEPTACLES AT APPROVED LANDFILL SITES; PROHIBITING THE BURIAL OF CONSTRUCTION DEBRIS; COLLECTION OF SANITARY WASTE FROM PORTABLE UNITS AS NECESSARY OR AS REQUIRED BY LOCAL REGULATIONS BY A LICENSED SANITARY WASTE MANAGEMENT CONTRACTOR.

B. EROSION CONTROL AND STABILIZATION PRACTICES

T/P	TEMP/PERM SEEDING	PROTECTION OF TREES AND VEGETATION
-	MULCHING (HAY OR STRAW)	GEOTEXTILES
-	VEGETATIVE BUFFER STRIPS	SLOPE TEXTURING
-	SOD STABILIZATION	TEMP VELOCITY DISSIPATION DEVICES
P	BLOCK SOD	FLOW DIVERSION MECHANISMS
-	OTHER	T = TEMPORARY; P = PERMANENT

- DATES:
- MAJOR GRADING ACTIVITIES: SEE CONSTRUCTION SCHEDULE FOR DATES
  - WHEN CONSTRUCTION ACTIVITIES TEMPORARILY OR PERMANENTLY CEASE ON A PORTION OF THE SITE: \_\_\_\_\_
  - WHEN STABILIZATION MEASURES ARE INITIATED: \_\_\_\_\_

INITIATE EROSION CONTROL AND STABILIZATION MEASURES IMMEDIATELY IN THAT PORTION OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY CEASED AND WILL NOT RESUME FOR A PERIOD EXCEEDING 14 CALENDAR DAYS. INITIATE STABILIZATION MEASURES THAT PROVIDE A PROTECTIVE COVER IMMEDIATELY IN THAT PORTION OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE PERMANENTLY CEASED. "IMMEDIATELY" MEANS NO LATER THAN THE NEXT WORK DAY FOLLOWING THE DAY WHEN THE SOIL-DISTURBING ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED. STABILIZATION MEASURES MUST BE COMPLETED NO MORE THAN 14 CALENDAR DAYS AFTER INITIATION BEGINS.

THE SCHEDULE OF IMPLEMENTATION OF THESE PRACTICES WILL BE BASED ON THE INTENDED SEQUENCE OF MAJOR SOIL-DISTURBING ACTIVITIES. SEE CONSTRUCTION SCHEDULE

C. SEDIMENT CONTROL PRACTICES

T	SILT FENCE	P	VEGETATIVE BUFFER STRIPS
T	OTHER		

IF SITE WILL DISTURB 10 OR MORE ACRES WITHIN A COMMON DRAINAGE LOCATION AND A SEDIMENTATION BASIN IS NOT FEASIBLE, PROVIDE REASON: PROJECT DOES NOT DISTURB 10 OR MORE ACRES; THEREFORE A SEDIMENTATION BASIN IS NOT REQUIRED.

THE SCHEDULE OF IMPLEMENTATION OF THESE PRACTICES WILL BE BASED ON THE INTENDED SEQUENCE OF MAJOR SOIL-DISTURBING ACTIVITIES. SEE CONSTRUCTION SCHEDULE

**DESCRIPTION OF PERMANENT STORM WATER CONTROLS**

PROVIDE A DESCRIPTION OF ANY MEASURES THAT WILL BE INSTALLED DURING THE CONSTRUCTION PROCESS TO CONTROL POLLUTANTS IN STORM WATER DISCHARGES THAT MAY OCCUR AFTER CONSTRUCTION OPERATIONS HAVE BEEN COMPLETED: N/A

**OTHER REQUIRED CONTROLS AND BMPS**

TXDOT WILL UTILIZE ROCK AT CONSTRUCTION ENTRANCES AND SPRINKLING, AS NEEDED, TO MINIMIZE OFF-SITE VEHICLE TRACKING OF SEDIMENTS AND THE GENERATION OF DUST.

SEE SECTION A ABOVE FOR DESCRIPTION OF CONSTRUCTION AND WASTE MATERIALS AND CONTROLS USED FOR THOSE THAT MAY BE STORED ON-SITE.

AT A MINIMUM, ANY PRODUCTS IN THE FOLLOWING CATEGORIES ARE CONSIDERED TO BE HAZARDOUS: PAINTS, ACIDS FOR CLEANING MASONRY SURFACES, CLEANING SOLVENTS, FUELS, MOTOR OIL, ASPHALT PRODUCTS, CHEMICAL ADDITIVES FOR SOIL STABILIZATION, OR CONCRETE CURING COMPOUNDS AND ADDITIVES. STORE MATERIAL IN ACCORDANCE WITH APPLICABLE REGULATIONS. CONTACT THE SPILL COORDINATOR IMMEDIATELY IN THE EVENT OF A SPILL WHICH MAY BE HAZARDOUS.

**MAINTENANCE REQUIREMENTS**

EFFECTIVELY MAINTAIN THE OPERATING CONDITIONS OF ALL EROSION AND SEDIMENT CONTROL AND OTHER PROTECTIVE MEASURES IDENTIFIED IN THE SWP3. 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 IS UNPRACTICABLE, SCHEDULE AND ACCOMPLISH MAINTENANCE AS SOON AS PRACTICAL. CONTROLS THAT HAVE BEEN INTENTIONALLY DISABLED, RUN-OVER, REMOVED OR OTHERWISE RENDERED INEFFECTIVE MUST BE REPLACED OR CORRECTED IMMEDIATELY UPON DISCOVERY. IF A CONTROL HAS BEEN USED INCORRECTLY, IS PERFORMING INADEQUATELY OR IS DAMAGED, THE OPERATOR SHALL REPLACE OR MODIFY THE CONTROL AS SOON AS PRACTICABLE AFTER THE DISCOVERY.

**INSPECTION OF CONTROLS**

A) 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, ONCE EVERY 7 CALENDAR DAYS. 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 SWP3 SHALL BE OBSERVED TO ENSURE THAT THEY ARE OPERATING CORRECTLY. LOCATIONS WHERE VEHICLES ENTER OR EXIT THE SITE SHALL BE INSPECTED FOR EVIDENCE OF OFF-SITE SEDIMENT TRACKING.

D) THE SWP3 MUST BE MODIFIED BASED ON THE RESULTS OF INSPECTION TO BETTER CONTROL POLLUTANTS IN RUNOFF. REVISIONS TO THE SWP3 MUST BE COMPLETED WITHIN 7 CALENDAR DAYS FOLLOWING THE INSPECTION. IF EXISTING BMPS ARE MODIFIED OR ADDITIONAL BMPS ARE NECESSARY, AN IMPLEMENTATION SCHEDULE MUST BE DESCRIBED IN THE SWP3. IMPLEMENTATION OF CHANGES SHOULD BE DONE PRIOR TO THE NEXT STORM EVENT IF POSSIBLE, OTHERWISE, THEY SHOULD BE DONE AS SOON AS PRACTICABLE.

E) A REPORT SUMMARIZING THE SCOPE, DATE, NAME AND QUALIFICATIONS OF INSPECTOR, AND MAJOR OBSERVATIONS RELATING TO THE IMPLEMENTATION OF THE SWP3 SHALL BE PRODUCED AND RETAINED AS PART OF THE SWP3. MAJOR OBSERVATIONS INCLUDE: LOCATIONS OF DISCHARGES OF SEDIMENT OR OTHER POLLUTANTS FROM THE SITE, LOCATIONS OF BMPS THAT NEED TO BE MAINTAINED, LOCATIONS OF BMPS THAT FAILED TO OPERATE AS DESIGNED OR PROVED INADEQUATE FOR A PARTICULAR LOCATION AND LOCATIONS WHERE BMPS ARE NEEDED. ACTIONS TAKEN AS A RESULT OF INSPECTIONS MUST BE DESCRIBED WITHIN AND RETAINED AS PART OF THE SWP3. REPORTS MUST IDENTIFY ANY INCIDENTS OF NON-COMPLIANCE. WHERE THE REPORT DOES NOT IDENTIFY ANY INCIDENTS OF NON-COMPLIANCE, THE REPORT MUST CONTAIN A CERTIFICATION THAT THE SITE IS IN COMPLIANCE WITH THE SWP3 AND PERMIT.

**OTHER SWP3 CONTENT**

TXDOT WILL ENSURE THE APPROPRIATE POLLUTION PREVENTION MEASURES (I.E. VEGETATED BUFFER STRIPS, SILT FENCE, ETC.) ARE IDENTIFIED AND IMPLEMENTED FOR ALL ELIGIBLE NON-STORMWATER WATER COMPONENTS OF DISCHARGE SUCH AS WASHING OF VEHICLES, STRUCTURES, AND PAVEMENT WHERE SOAPS AND DETERGENTS ARE NOT USED AND THE PURPOSE IS TO REMOVE DIRT, MUD OR DUST; UNCONTAMINATED WATER USED FOR DUST CONTROL; AND LAWN WATERING AND SIMILAR IRRIGATION DRAINAGE.

**CHECKLIST FOR CONTENTS OF AREA OFFICE SWP3 FILE:**

- |   |                      |
|---|----------------------|
| <input type="checkbox"/> CONTACT FORM *   |                      |
| <input type="checkbox"/> NOI AND ACKNOWLEDGEMENT CERTIFICATE (IF EQUAL OR GREATER THAN 5 ACRES) |                      |
| <input type="checkbox"/> APPLICABLE CONSTRUCTION SITE NOTICE *                                  |                      |
| <input type="checkbox"/> SWP3 CERTIFICATION STATEMENT (SIGNED BY AE)                            | NOTE:                |
| <input type="checkbox"/> TPDES GENERAL PERMIT   | THIS DOCUMENT IS     |
| <input type="checkbox"/> SWP3 PLAN  | RELEASED FOR THE     |
| <input type="checkbox"/> INSPECTION AND MAINTENANCE REPORT                                      | PURPOSE OF INTERIM   |
| <input type="checkbox"/> INSPECTOR QUALIFICATION FORM   | REVIEW UNDER THE     |
| <input type="checkbox"/> DELEGATION OF SIGNATURE AUTHORITY (ALL INSPECTORS SIGNING REPORTS)     | AUTHORITY OF         |
| <input type="checkbox"/> NOTICE OF TERMINATION  | CHARLES M. BRAZIL    |
|   | P.E. 112704          |
|   | ON 5/24/2022         |
|   | IT IS NOT TO BE USED |
|   | FOR CONSTRUCTION     |
|   | OR BIDDING PURPOSES. |

\* SYMBOL INDICATES THAT THE INFORMATION SHOULD BE DISPLAYED ON THE PROJECT BULLETIN BOARD

ANY REPORTABLE QUANTITY OF HAZARDOUS MATERIAL RELEASE MUST BE REPORTED TO NATIONAL RESPONSE CENTER AT 1-800-424-8802 AND TO STATE OF TEXAS SPILL-REPORTING HOTLINE AT 1-800-832-8224

**TXDOT SWP3 INDEX (SWP31)**

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CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY		SHEET NO.
LFK	TRINITY		85

DATE: 5/24/2022 5:01:01 PM  
 FILE: \\txdot.projectwiseonline.com\TXDOT3\Documents\11 - LFK\Design Project\1109.dwg  
 DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or the accuracy of any data or information contained herein.

**I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402**

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

1. N/A

No Action Required  Required Action

Action No.

This project disturbs more than 5 acres ; therefore, the following actions are required:

1. Prevent Stormwater Pollution by controlling erosion and sedimentation in accordance to TPDES CGP Permit TXR150000.
2. Comply with SWP3 site plan and revise when necessary to control pollution or required by Engineer.
3. Posting of Large Construction Site Notice with Construction and SWP3 info on or near site accessible to the public and TCEQ, EPA, or other inspectors. Notice of Intent (NOI) is required to be file with TCEQ and Notice of Termination (NOT) is required to be filed with TCEQ when final stabilization has been achieved.

**II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS CLEAN WATER ACT SECTIONS 401 AND 404**

USACE Permit required for filling, dredging, excavating or other work in any water bodies, rivers, creeks, streams, wetlands or wet areas.

The Contractor must adhere to all of the terms and conditions associated with the following permit(s):

- No Permit Required
- Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)
- Nationwide Permit 14 - PCN Required (1/10 to <1/2 acre, 1/3 in tidal waters)
- Individual 404 Permit Required
- Other Nationwide Permit Required: NWP# 3A and 3C

Required Actions: List waters of the US permit applies to, location in project and check Best Management Practices planned to control erosion, sedimentation and post-project TSS.

1. STA 371+60 Unnamed Tributary to North Fork Cedar Creek
2. STA 415+61 Unnamed Tributary to Mossy Creek
3. STA 381+45 and STA 389+60 Unnamed ephemeral streams
4. Refer to EPIC sheet 2 of 2 for Nationwide Permit #3A and 3C non-PCN requirements for work activities, stream flow, access, and conditions.
5. Work activities MUST be conducted within the existing ROW.

**Best Management Practices:**

<b>Erosion</b>	<b>Sedimentation</b>	<b>Post-Construction TSS</b>
<input type="checkbox"/> Temporary Vegetation	<input checked="" type="checkbox"/> Silt Fence	<input type="checkbox"/> Vegetative Filter Strips
<input checked="" type="checkbox"/> Blankets/Matting	<input checked="" type="checkbox"/> Rock Berm	<input type="checkbox"/> Retention/Irrigation Systems
<input type="checkbox"/> Mulch	<input type="checkbox"/> Triangular Filter Dike	<input type="checkbox"/> Extended Detention Basin
<input checked="" type="checkbox"/> Sodding	<input type="checkbox"/> Sand Bag Berm	<input type="checkbox"/> Constructed Wetlands
<input type="checkbox"/> Interceptor Swale	<input type="checkbox"/> Straw Bale Dike	<input type="checkbox"/> Wet Basin
<input type="checkbox"/> Diversion Dike	<input type="checkbox"/> Brush Berms	<input type="checkbox"/> Erosion Control Compost
<input type="checkbox"/> Erosion Control Compost	<input type="checkbox"/> Erosion Control Compost	<input type="checkbox"/> Mulch Filter Berm and Socks
<input type="checkbox"/> Mulch Filter Berm and Socks	<input type="checkbox"/> Mulch Filter Berm and Socks	<input type="checkbox"/> Compost Filter Berm and Socks
<input type="checkbox"/> Compost Filter Berm and Socks	<input type="checkbox"/> Compost Filter Berm and Socks	<input checked="" type="checkbox"/> Vegetation Lined Ditches
	<input type="checkbox"/> Stone Outlet Sediment Traps	<input type="checkbox"/> Sand Filter Systems
	<input type="checkbox"/> Sediment Basins	<input type="checkbox"/> Grassy Swales

**III. CULTURAL RESOURCES**

Refer to TxDOT Standard Specifications in the event historical issues or archeological artifacts are found during construction. Upon discovery of archeological artifacts (bones, burnt rock, flint, pottery, etc.) cease work in the immediate area and contact the Engineer immediately.

No Action Required  Required Action

Action No.

1. N/A

**IV. VEGETATION RESOURCES**

Preserve native vegetation to the extent practical. Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 193, 506, 730, 751, 752 in order to comply with requirements for invasive species, beneficial landscaping, and tree/brush removal commitments.

No Action Required  Required Action

Action No.

1. N/A

**V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRDS.**

If any of the listed species are observed, cease work in the immediate area, do not disturb species or habitat and contact the Engineer immediately.

No Action Required  Required Action

In order to maintain compliance with Chapter 64 of the Texas Parks and Wildlife Code and Migratory Bird Treaty Act (MBTA), construction activities that may affect nests (i.e. tree removal, tree limbing, bridg work) shall be conducted outside of the nesting season (March 15 to Septemeber 15). In the event birds or active nests (eggs and/or nestlings present) are encountered, contact the engineer prior to conducting work.

Action No.

1. Southern crawfish frog, Strecker's chorus frog, Eastern box turtle, Slender glass lizard Western box turtle, and Eastern spotted skunk may occur in the project area. Avoid harming species if encountered and allow them to safely leave the project area.
2. Cover trenches left open overnight and examine trenches prior to backfilling to ensure no wildlife is trapped. Examine heavy equipment stored on site before use, particularly after rain events, to ensure use will not harm wildlife that may be seeking refuge.
3. Project specific locations (PSLs) proposed within the state-owned ROW should be located in uplands away from aquatic features.
4. Install and maintain Water Quality BMPs associated with Section 404 & 401 permits (i.e. silt fence, rock filter dams, avoid/minimize impacts to WOTUS, etc.) around creeks and streams that cross the project area to avoid impacts to aquatic wildlife.

**LIST OF ABBREVIATIONS**

BMP: Best Management Practice	SPCC: Spill Prevention Control and Countermeasure
CGP: Construction General Permit	SWP3: Storm Water Pollution Prevention Plan
DSHS: Texas Department of State Health Services	PCN: Pre-Construction Notification
FHWA: Federal Highway Administration	PSL: Project Specific Location
MOA: Memorandum of Agreement	TCEQ: Texas Commission on Environmental Quality
MOU: Memorandum of Understanding	TPDES: Texas Pollutant Discharge Elimination System
MS4: Municipal Separate Stormwater Sewer System	TPWD: Texas Parks and Wildlife Department
MBTA: Migratory Bird Treaty Act	TxDOT: Texas Department of Transportation
NOT: Notice of Termination	T&E: Threatened and Endangered Species
NWP: Nationwide Permit	USACE: U.S. Army Corps of Engineers
NOI: Notice of Intent	USFWS: U.S. Fish and Wildlife Service

**VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES**

General (applies to all projects):

Comply with the Hazard Communication Act (the Act) for personnel who will be working with hazardous materials by conducting safety meetings prior to beginning construction and making workers aware of potential hazards in the workplace. Ensure that all workers are provided with personal protective equipment appropriate for any hazardous materials used. Obtain and keep on-site Material Safety Data Sheets (MSDS) for all hazardous products used on the project, which may include, but are not limited to the following categories: Paints, acids, solvents, asphalt products, chemical additives, fuels and concrete curing compounds or additives. Provide protected storage, off bare ground and covered, for products which may be hazardous. Maintain product labelling as required by the Act. Maintain an adequate supply of on-site spill response materials, as indicated in the MSDS. In the event of a spill, take actions to mitigate the spill as indicated in the MSDS, in accordance with safe work practices, and contact the District Spill Coordinator immediately. The Contractor shall be responsible for the proper containment and cleanup of all product spills.

Contact the Engineer if any of the following are detected:

- \* Dead or distressed vegetation (not identified as normal)
- \* Trash piles, drums, canister, barrels, etc.
- \* Undesirable smells or odors
- \* Evidence of leaching or seepage of substances

Does the project involve any bridge class structure rehabilitation or replacements (bridge class structures not including box culverts)?

Yes  No

If "No", then no further action is required.

If "Yes", then TxDOT is responsible for completing asbestos assessment/inspection.

Are the results of the asbestos inspection positive (is asbestos present)?

Yes  No

If "Yes", then TxDOT must retain a DSHS licensed asbestos consultant to assist with the notification, develop abatement/mitigation procedures, and perform management activities as necessary. The notification form to DSHS must be postmarked at least 15 working days prior to scheduled demolition.

If "No", then TxDOT is still required to notify DSHS 15 working days prior to any scheduled demolition.

In either case, the Contractor is responsible for providing the date(s) for abatement activities and/or demolition with careful coordination between the Engineer and asbestos consultant in order to minimize construction delays and subsequent claims.

Any other evidence indicating possible hazardous materials or contamination discovered on site. Hazardous Materials or Contamination Issues Specific to this Project:

No Action Required  Required Action

Action No.

1. N/A

**VII. OTHER ENVIRONMENTAL ISSUES**

(Includes regional issues, such as, Edwards Aquifer District, etc...)

No Action Required  Required Action

Action No.

1. N/A

**Design Division Standard**

## EPIC

### (ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS)

SHEET 1 OF 2

FILE: eptc.dgn	DW: TxDOT	CK: RG	DW: VP	CK: AR
© TxDOT: February 2015	CONT	SECT	JOB	HIGHWAY
12-12-2011 (DS) REVISIONS	0931	04	034	FS 357
05-07-14 ADDED NOTE SECTION IV.	DIST	COUNTY	SHEET NO.	
01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	LFK	TRINITY	86	

NWP GENERAL CONDITIONS

AS APPLICABLE TO  
THIS PROJECT

2. AQUATIC LIFE MOVEMENTS. NO ACTIVITY MAY SUBSTANTIALLY DISRUPT THE NECESSARY LIFE CYCLE MOVEMENTS OF THOSE SPECIES OF AQUATIC LIFE INDIGENOUS TO THE WATERBODY, INCLUDING THOSE SPECIES THAT NORMALLY MIGRATE THROUGH THE AREA, UNLESS THE ACTIVITY'S PRIMARY PURPOSE IS TO IMPOUND WATER.
3. SPAWNING AREAS. ACTIVITIES IN SPAWNING AREAS DURING SPAWNING SEASONS MUST BE AVOIDED TO THE MAXIMUM EXTENT PRACTICABLE. ACTIVITIES THAT RESULT IN THE PHYSICAL DESTRUCTION (E.G., THROUGH EXCAVATION, FILL, OR DOWNSTREAM SMOTHERING BY SUBSTANTIAL TURBIDITY) OF AN IMPORTANT SPAWNING AREA ARE NOT AUTHORIZED.
6. SUITABLE MATERIAL. NO ACTIVITY MAY USE UNSUITABLE MATERIAL (E.G., TRASH, DEBRIS, CAR BODIES, ASPHALT, ETC.). MATERIAL USED FOR CONSTRUCTION OR DISCHARGED MUST BE FREE FROM TOXIC POLLUTANTS IN TOXIC AMOUNTS (SEE SECTION 307 OF THE CLEAN WATER ACT).
8. ADVERSE EFFECTS FROM IMPOUNDMENTS. IF THE ACTIVITY CREATES AN IMPOUNDMENT OF WATER, ADVERSE EFFECTS TO THE AQUATIC SYSTEM DUE TO ACCELERATING THE PASSAGE OF WATER, AND/OR RESTRICTING ITS FLOW MUST BE MINIMIZED TO THE MAXIMUM EXTENT PRACTICABLE.
9. MANAGEMENT OF WATER FLOWS. TO THE MAXIMUM EXTENT PRACTICABLE, THE PRE-CONSTRUCTION COURSE, CONDITION, CAPACITY, AND LOCATION OF OPEN WATERS MUST BE MAINTAINED FOR EACH ACTIVITY, INCLUDING STREAM CHANNELIZATION AND STORM WATER MANAGEMENT ACTIVITIES, EXCEPT AS PROVIDED BELOW. THE ACTIVITY MUST BE CONSTRUCTED TO WITHSTAND EXPECTED HIGH FLOWS. THE ACTIVITY MUST NOT RESTRICT OR IMPEDE THE PASSAGE OF NORMAL OR HIGH FLOWS, UNLESS THE PRIMARY PURPOSE OF THE ACTIVITY IS TO IMPOUND WATER OR MANAGE HIGH FLOWS. THE ACTIVITY MAY ALTER THE PRE-CONSTRUCTION COURSE, CONDITION, CAPACITY, AND LOCATION OF OPEN WATERS IF IT BENEFITS THE AQUATIC ENVIRONMENT (E.G., STREAM RESTORATION OR RELOCATION ACTIVITIES).
11. EQUIPMENT. HEAVY EQUIPMENT WORKING IN WETLANDS OR MUD FLATS MUST BE PLACED ON MATS, OR OTHER MEASURES MUST BE TAKEN TO MINIMIZE SOIL DISTURBANCE.
12. SOIL EROSION AND SEDIMENT CONTROLS. APPROPRIATE SOIL EROSION AND SEDIMENT CONTROLS MUST BE USED AND MAINTAINED IN EFFECTIVE OPERATING CONDITION DURING CONSTRUCTION, AND ALL EXPOSED SOIL AND OTHER FILLS, AS WELL AS ANY WORK BELOW THE ORDINARY HIGH WATER MARK OR HIGH TIDE LINE, MUST BE PERMANENTLY STABILIZED AT THE EARLIEST PRACTICABLE DATE. PERMITTEES ARE ENCOURAGED TO PERFORM WORK WITHIN WATERS OF THE UNITED STATES DURING PERIODS OF LOW-FLOW OR NO-FLOW.
13. REMOVAL OF TEMPORARY FILLS. TEMPORARY FILLS MUST BE REMOVED IN THEIR ENTIRETY AND THE AFFECTED AREAS RETURNED TO PRE-CONSTRUCTION ELEVATIONS. THE AFFECTED AREAS MUST BE REVEGETATED, AS APPROPRIATE.
14. PROPER MAINTENANCE. ANY AUTHORIZED STRUCTURE OR FILL SHALL BE PROPERLY MAINTAINED, INCLUDING MAINTENANCE TO ENSURE PUBLIC SAFETY AND COMPLIANCE WITH APPLICABLE NWP GENERAL CONDITIONS, AS WELL AS ANY ACTIVITY-SPECIFIC CONDITIONS ADDED BY THE DISTRICT ENGINEER TO AN NWP AUTHORIZATION.
23. MITIGATION. THE DISTRICT ENGINEER WILL CONSIDER SEVERAL FACTORS WHEN DETERMINING APPROPRIATE AND PRACTICABLE MITIGATION NECESSARY TO ENSURE THAT ADVERSE EFFECTS ON THE AQUATIC ENVIRONMENT ARE MINIMAL.
25. WATER QUALITY. WHERE STATES AND AUTHORIZED TRIBES, OR EPA WHERE APPLICABLE, HAVE NOT PREVIOUSLY CERTIFIED COMPLIANCE OF AN NWP WITH CWA SECTION 401, INDIVIDUAL 401 WATER QUALITY CERTIFICATION MUST BE OBTAINED OR WAIVED (SEE 33 CFR 330.4(C)). THE DISTRICT ENGINEER OR STATE OR TRIBE MAY REQUIRE ADDITIONAL WATER QUALITY MANAGEMENT MEASURES TO ENSURE THAT THE AUTHORIZED ACTIVITY DOES NOT RESULT IN MORE THAN MINIMAL DEGRADATION OR WATER QUALITY.
27. REGIONAL AND CASE-BY-CASE CONDITIONS. THE ACTIVITY MUST COMPLY WITH ANY REGIONAL CONDITIONS THAT MAY HAVE BEEN ADDED BY THE DIVISION ENGINEER (SEE 33 CFR 330.4(E)) AND WITH ANY CASE SPECIFIC CONDITIONS ADDED BY THE CORPS OR BY THE STATE, INDIAN TRIBE, OR U.S. EPA IN ITS SECTION 401 WATER QUALITY CERTIFICATION, OR BY THE STATE IN ITS COASTAL ZONE MANAGEMENT ACT CONSISTENCY DETERMINATION.

**FOR A COMPLETE LIST OF GENERAL CONDITIONS GO TO:**

<http://www.swf.usace.army.mil/Missions/Regulatory/Permitting/NationwideGeneralPermits.aspx>

USACE - PERMIT #3(A) & (C)

AS APPLICABLE TO  
THIS PROJECT

(A) THE REPAIR, REHABILITATION, OR REPLACEMENT OF ANY PREVIOUSLY AUTHORIZED, CURRENTLY SERVICEABLE STRUCTURE, OR FILL, OR OF ANY CURRENTLY SERVICEABLE STRUCTURE OR FILL AUTHORIZED BY 33 CFR 330.3, PROVIDED THAT THE STRUCTURE OR FILL IS NOT TO BE PUT TO USES DIFFERING FROM THOSE USES SPECIFIED OR CONTEMPLATED FOR IT IN THE ORIGINAL PERMIT OR THE MOST RECENTLY AUTHORIZED MODIFICATION. MINOR DEVIATIONS IN THE STRUCTURE'S CONFIGURATION OR FILLED AREA, INCLUDING THOSE DUE TO CHANGES IN MATERIALS, CONSTRUCTION TECHNIQUES, REQUIREMENTS OF OTHER REGULATORY AGENCIES, OR CURRENT CONSTRUCTION CODES OR SAFETY STANDARDS THAT ARE NECESSARY TO MAKE THE REPAIR, REHABILITATION, OR REPLACEMENT ARE AUTHORIZED. ANY STREAM CHANNEL MODIFICATION IS LIMITED TO THE MINIMUM NECESSARY FOR THE REPAIR, REHABILITATION, OR REPLACEMENT OF THE STRUCTURE OR FILL; SUCH MODIFICATIONS, INCLUDING THE REMOVAL OF MATERIAL FROM THE STREAM CHANNEL, MUST BE IMMEDIATELY ADJACENT TO THE PROJECT. THIS NWP ALSO AUTHORIZES THE REMOVAL OF ACCUMULATED SEDIMENT AND DEBRIS WITHIN, AND IN THE IMMEDIATE VICINITY OF, THE STRUCTURE OR FILL. THIS NWP ALSO AUTHORIZES THE REPAIR, REHABILITATION, OR REPLACEMENT OF THOSE STRUCTURES OR FILLS DESTROYED OR DAMAGED BY STORMS, FLOODS, FIRE OR OTHER DISCRETE EVENTS, PROVIDED THE REPAIR, REHABILITATION, OR REPLACEMENT IS COMMENCED, OR IS UNDER CONTRACT TO COMMENCE, WITHIN TWO YEARS OF THE DATE OF THEIR DESTRUCTION OR DAMAGE. IN CASES OF CATASTROPHIC EVENTS, SUCH AS HURRICANES OR TORNADOES, THIS TWO-YEAR LIMIT MAY BE WAIVED BY THE DISTRICT ENGINEER, PROVIDED THE PERMITTEE CAN DEMONSTRATE FUNDING, CONTRACT, OR OTHER SIMILAR DELAYS.

(C) THIS NWP ALSO AUTHORIZES TEMPORARY STRUCTURES, FILLS AND WORK, INCLUDING THE USE OF TEMPORARY MATS, NECESSARY TO CONDUCT THE MAINTENANCE ACTIVITY. APPROPRIATE MEASURES MUST BE TAKEN TO MAINTAIN NORMAL DOWNSTREAM FLOWS AND MINIMIZE FLOODING TO THE MAXIMUM EXTENT PRACTICABLE, WHEN TEMPORARY STRUCTURES, WORK AND DISCHARGES, INCLUDING COFFERDAMS, ARE NECESSARY FOR CONSTRUCTION ACTIVITIES, ACCESS FILLS, OR DEWATERING OF CONSTRUCTION SITES. TEMPORARY FILLS MUST CONSIST OF MATERIALS, AND BE PLACED IN A MANNER, THAT WILL NOT BE ERODED BY EXPECTED HIGH FLOWS. TEMPORARY FILLS MUST BE REMOVED IN THEIR ENTIRETY AND THE AFFECTED AREAS RETURNED TO PRE-CONSTRUCTION ELEVATIONS. THE AREAS AFFECTED BY TEMPORARY FILLS MUST BE REVEGETATED, AS APPROPRIATE.


NOTE: THIS NWP AUTHORIZES THE REPAIR, REHABILITATION, OR REPLACEMENT OF ANY PREVIOUSLY AUTHORIZED STRUCTURE OR FILL THAT DOES NOT QUALIFY FOR THE CLEAN WATER ACT SECTION 404(F) EXEMPTION FOR MAINTENANCE.

NOTE:

THE PROJECT CROSSES JURISDICTIONAL WATERS OF THE U.S. AND A NWP #3A AND 3C WILL BE UTILIZED. THIS PERMIT AUTHORIZES THE REPAIR, REHABILITATION, OR REPLACEMENT OF CURRENTLY SERVICEABLE STRUCTURES OR FILL THAT WERE PREVIOUSLY AUTHORIZED. THE NWP GENERAL CONDITIONS AND THE NWP GUIDELINES MUST BE FOLLOWED IN ORDER TO MAINTAIN COMPLIANCE WITH THE NWP. NO COORDINATION HAS TAKEN PLACE WITH THE USACE. IF COORDINATION MAY BE NEEDED, CONTACT THE TXDOT LUFKIN DISTRICT ENVIRONMENTAL SECTION AT 1-800-687-8087.

**ENVIRONMENTAL PERMITS,  
ISSUES AND COMMITMENTS (EPIC) □**

**USACE**



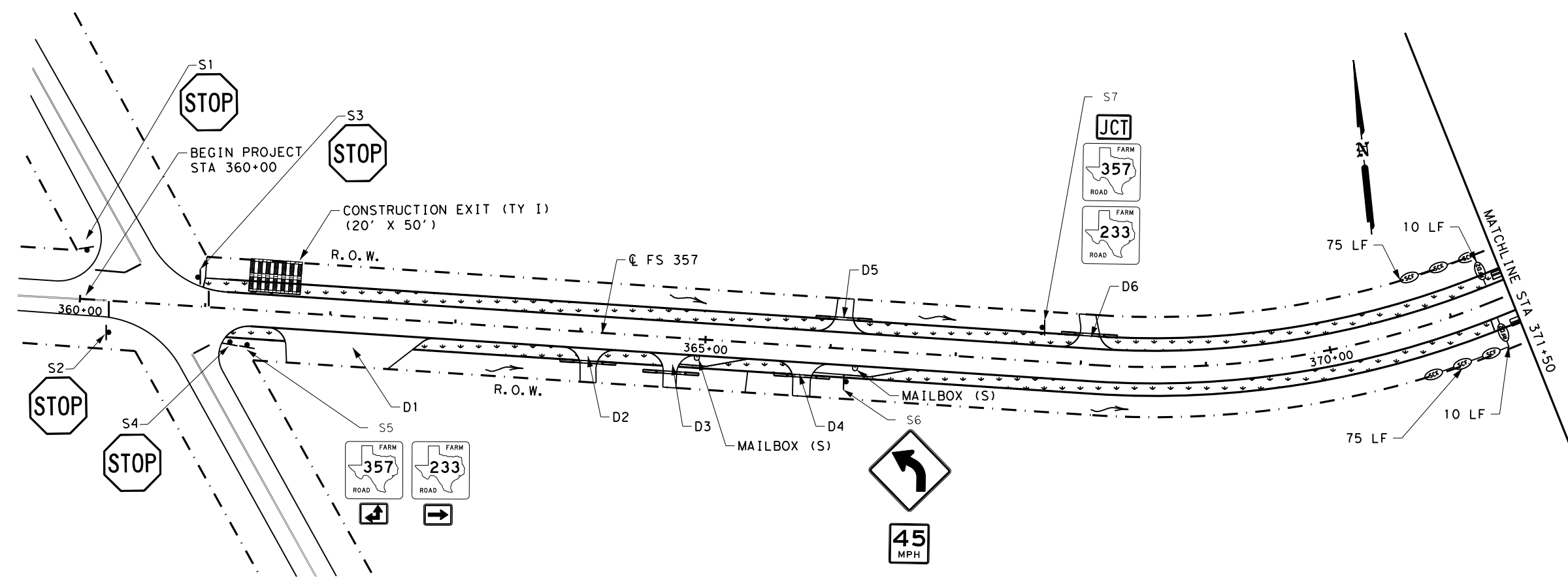
**EPIC**  
**(ENVIRONMENTAL PERMITS,  
ISSUES AND COMMITMENTS)**

SHEET 2 OF 2

FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR
©TxDOT: February 2015	CONT	SECT	JOB	HIGHWAY
12-12-2011 (DS) REVISIONS	0931	04	034	FS 357
05-07-14 ADDED NOTE SECTION IV.	DIST	COUNTY		SHEET NO.
01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	LFK	TRINITY		87

DATE: 5/24/2022 5:01:08 PM  
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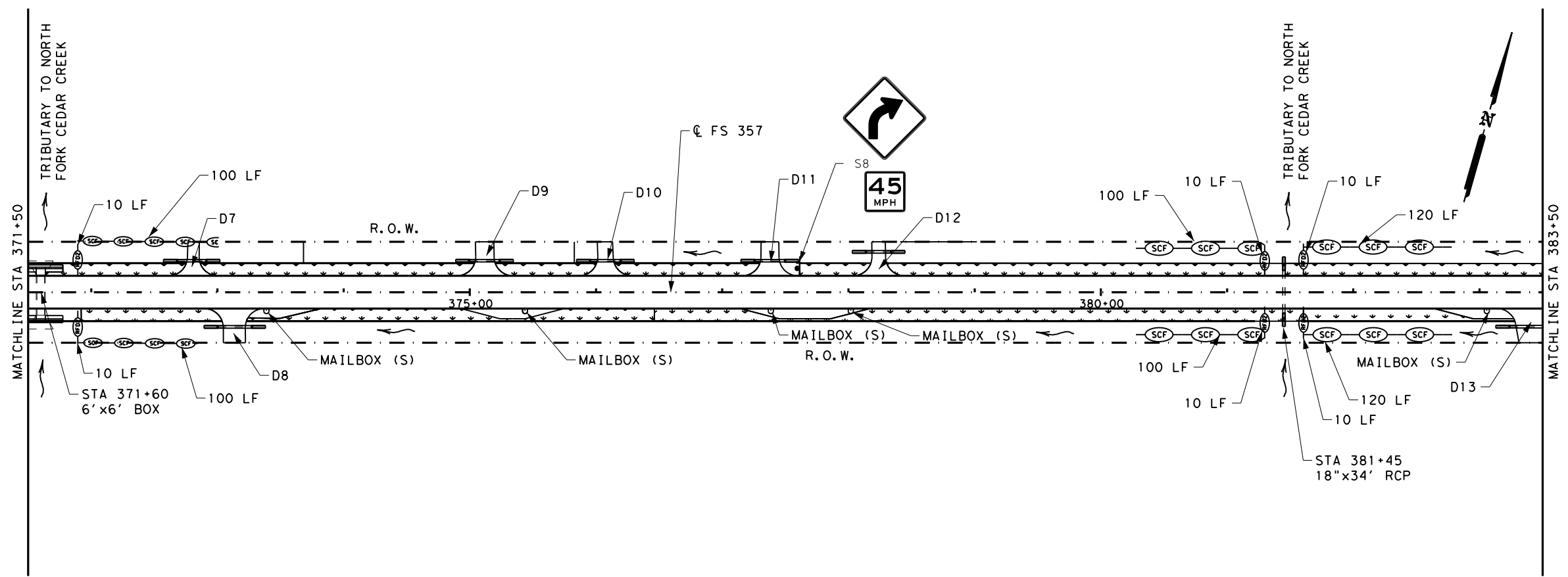
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### LEGEND

- RFD2 ROCK FILTER DAM (TY 2)
- SCF SEDIMENT CONT FENCE
- BONDED FIBER MATRIX / SOIL DISTURBANCE AREA
- CONSTRUCTION EXIT
- FLOW DIRECTION
- MAILBOX
- SIGN

NOTE: LOCATIONS OF CONSTRUCTION EXITS MAY BE ADJUSTED IN THE FIELD AS DIRECTED BY THE ENGINEER.



SCALE 1" = 100'

DocuSigned by:  
*Charles M. Brazil, P.E.*  
6/1/2022

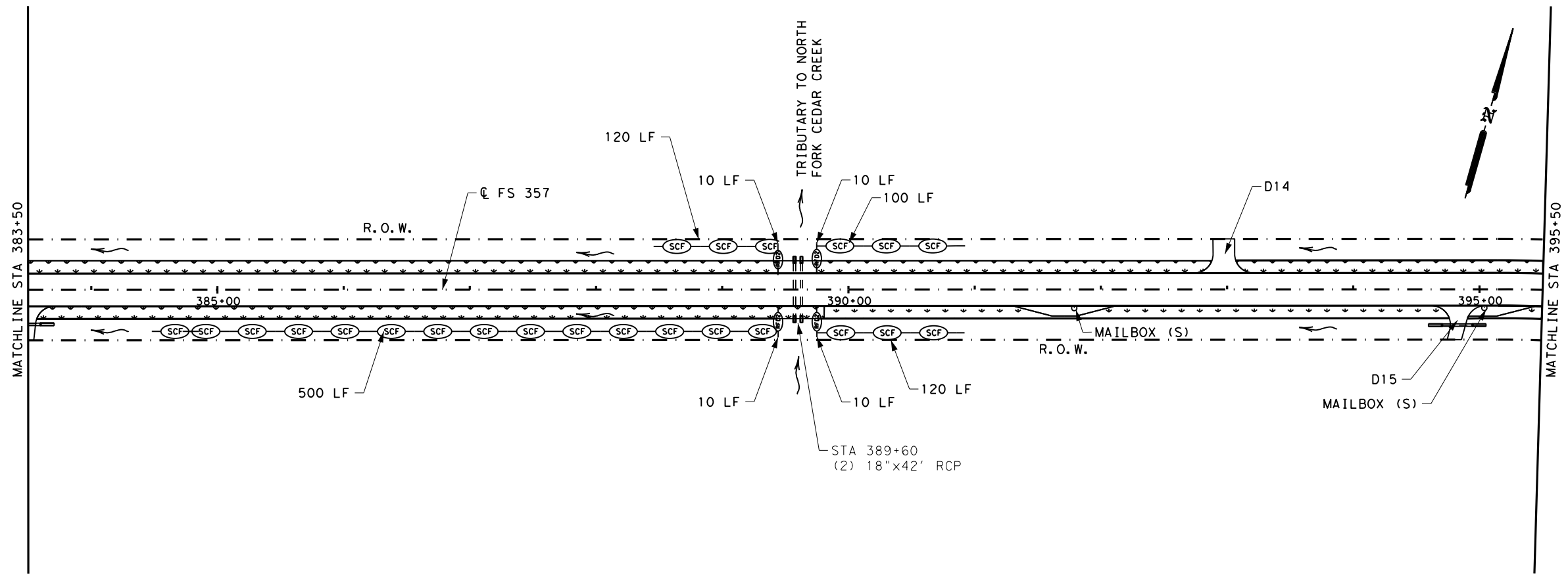
## SWP3 LAYOUTS

**TEXAS DEPARTMENT OF TRANSPORTATION**  
©2022 SHEET 1 OF 3

CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	88	

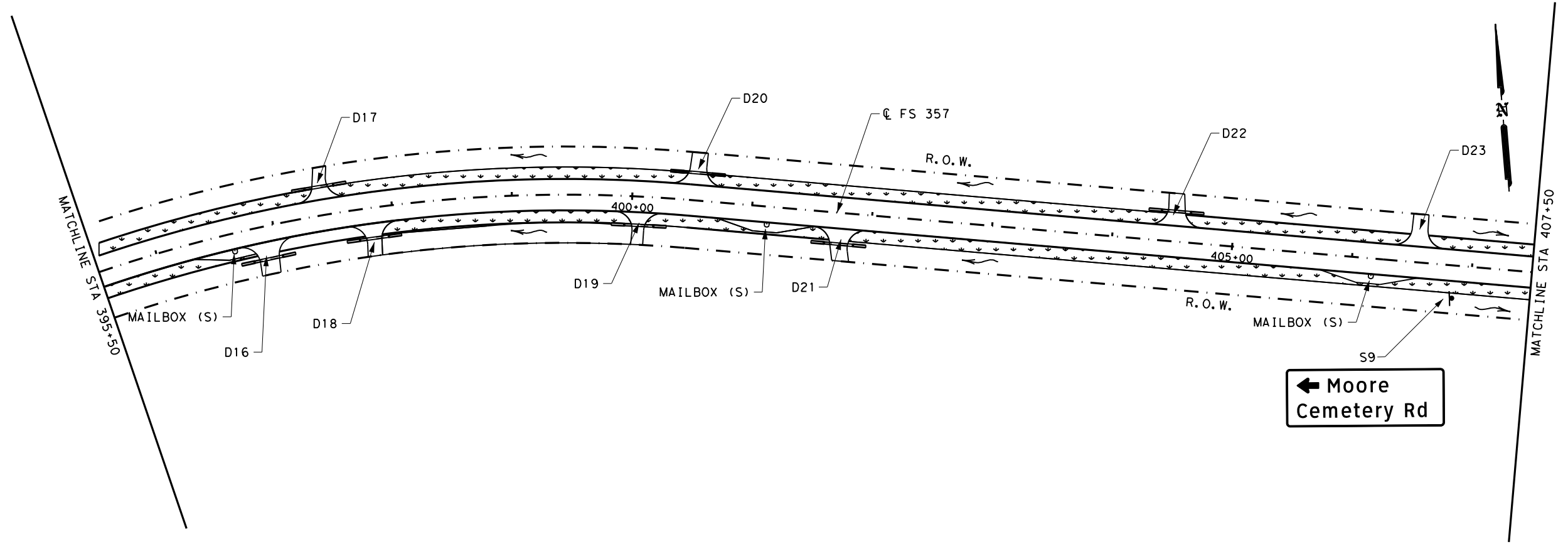


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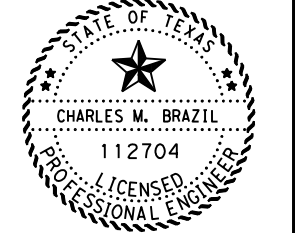


- ### LEGEND
- ROCK FILTER DAM (TY 2)
  - SEDIMENT CONT FENCE
  - BONDED FIBER MATRIX / SOIL DISTURBANCE AREA
  - CONSTRUCTION EXIT
  - FLOW DIRECTION
  - MAILBOX
  - SIGN

NOTE: LOCATIONS OF CONSTRUCTION EXITS MAY BE ADJUSTED IN THE FIELD AS DIRECTED BY THE ENGINEER.



SCALE 1" = 100'



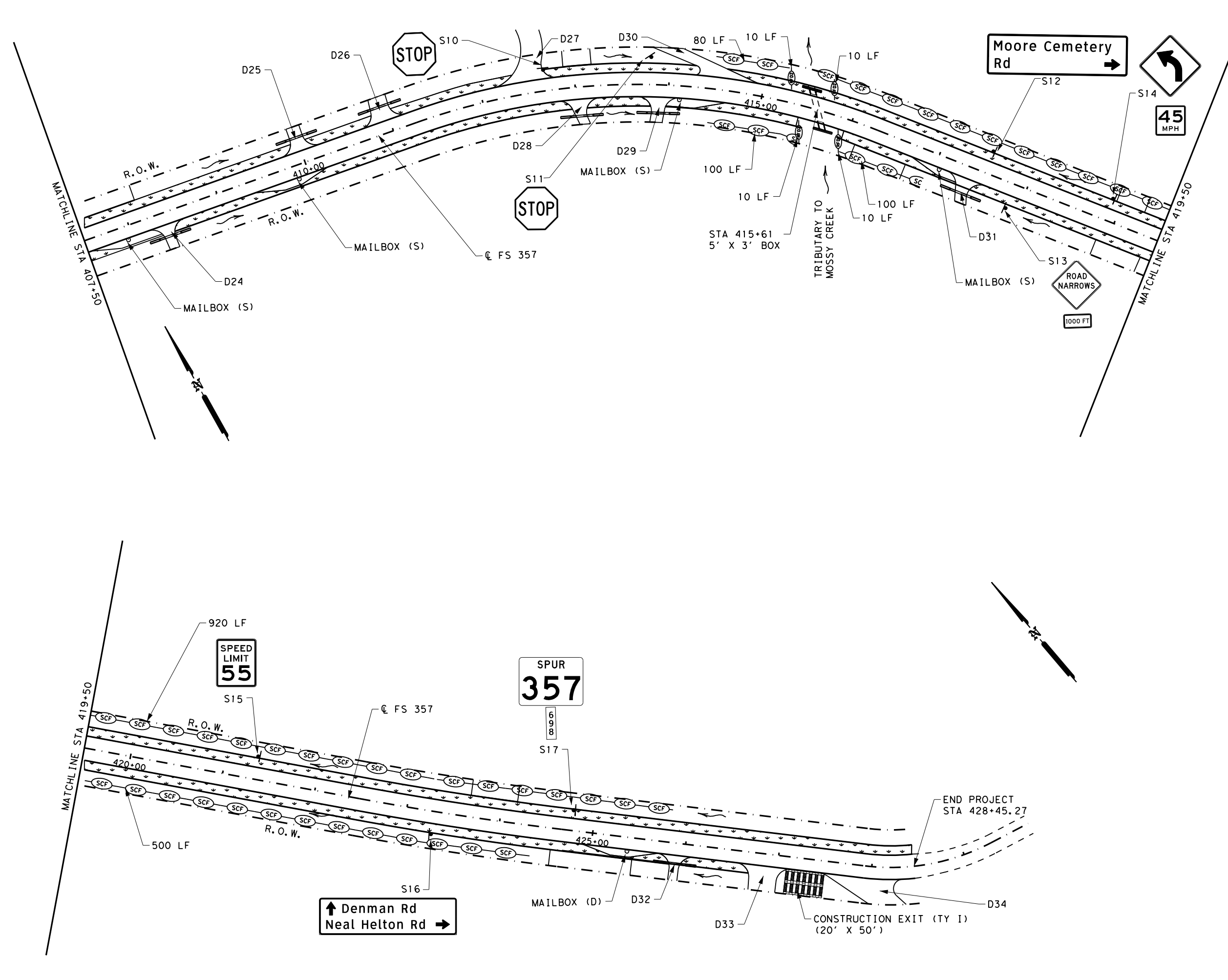
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 6/1/2022

## SWP3 LAYOUTS

TEXAS DEPARTMENT OF TRANSPORTATION ©2022 SHEET 2 OF 3			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	89	



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### LEGEND

- RFD2 ROCK FILTER DAM (TY 2)
- SCF SEDIMENT CONT FENCE
- BONDED FIBER MATRIX/ SOIL DISTURBANCE AREA
- CONSTRUCTION EXIT
- FLOW DIRECTION
- MAILBOX
- SIGN

NOTE: LOCATIONS OF CONSTRUCTION EXITS MAY BE ADJUSTED IN THE FIELD AS DIRECTED BY THE ENGINEER.

SCALE 1" = 100'

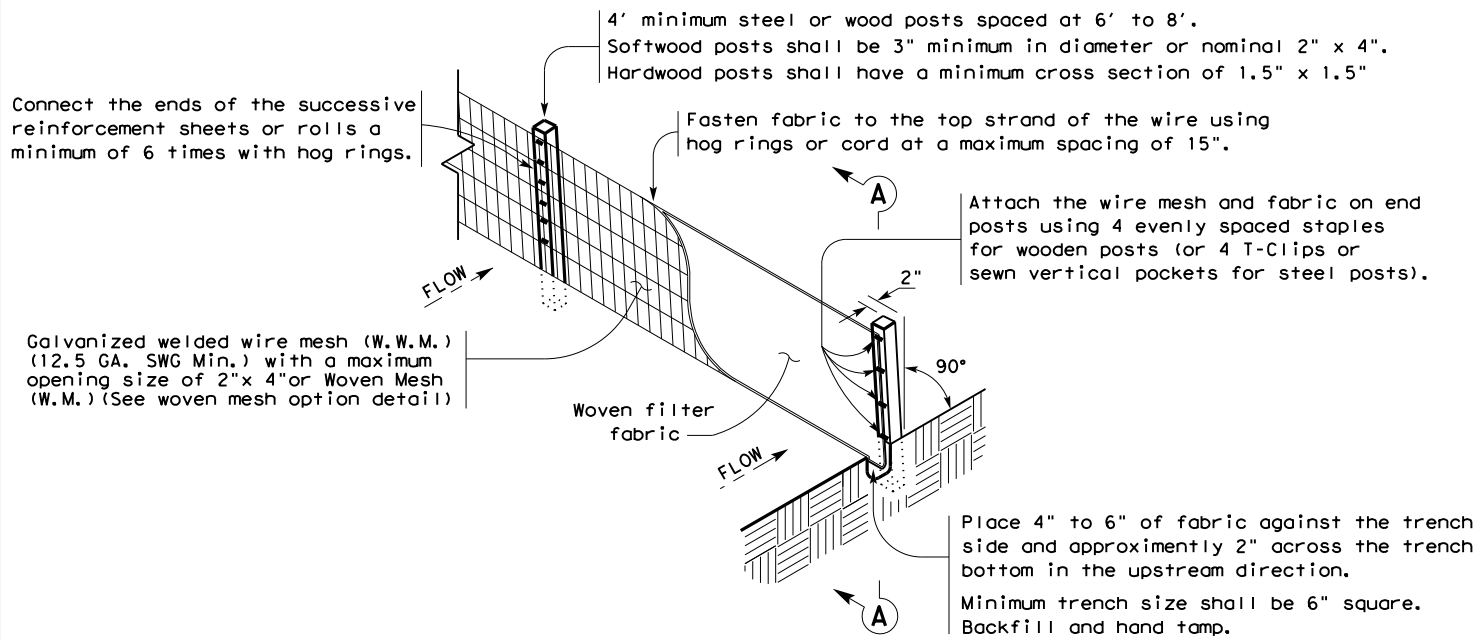
DocuSigned by:  
*Charles M. Brazil, P.E.*  
6/1/2022

## SWP3 LAYOUTS

TEXAS DEPARTMENT OF TRANSPORTATION ©2022 SHEET 3 OF 3			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY	SHEET NO.	
LFK	TRINITY	90	

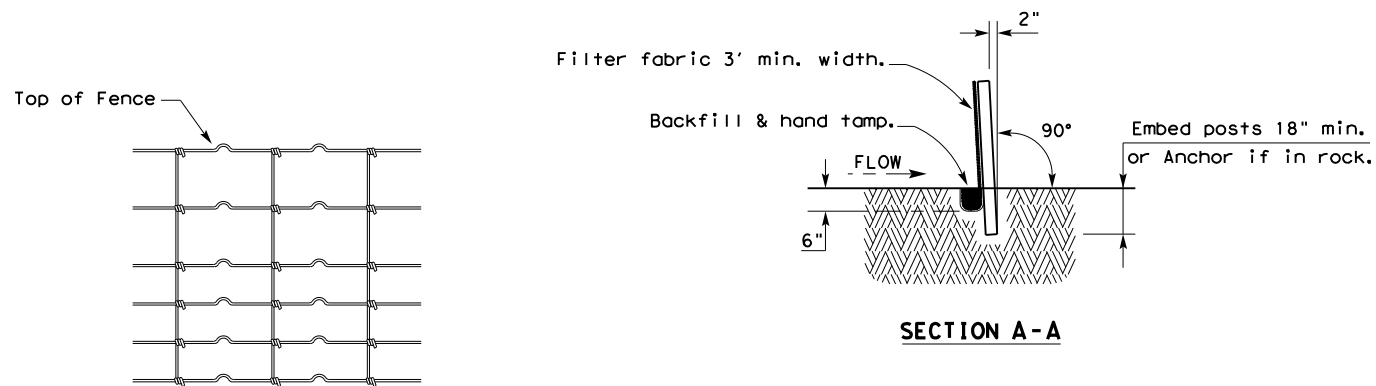
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DATE  
FILE



**TEMPORARY SEDIMENT CONTROL FENCE**

SCF



**HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL**

Galvanized hinge joint knot woven mesh (12.5 GA. SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

**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 maximum flow through rate of 100 GPM/FT<sup>2</sup>. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

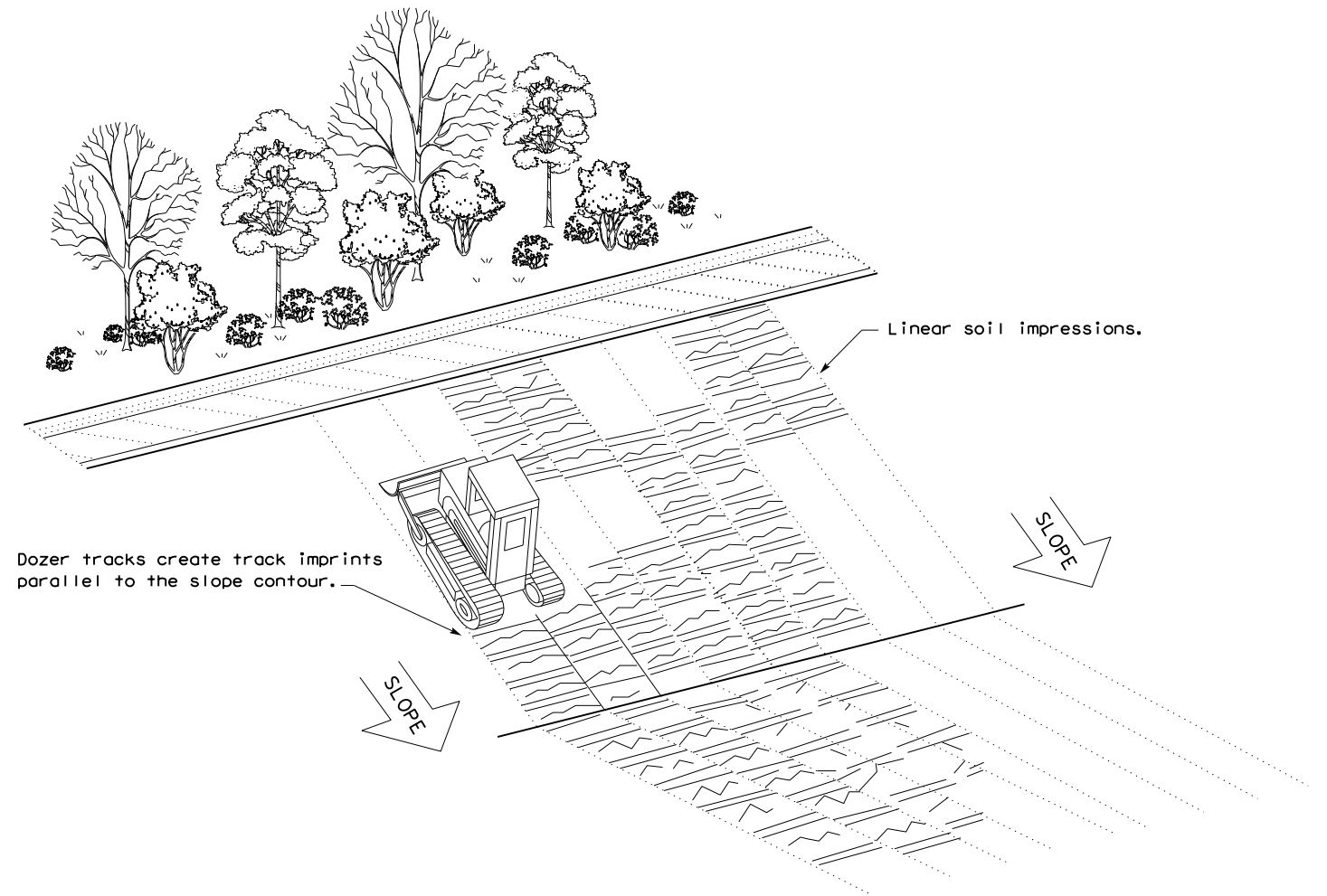
**LEGEND**

Sediment Control Fence

SCF

**GENERAL NOTES**

1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continuous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.

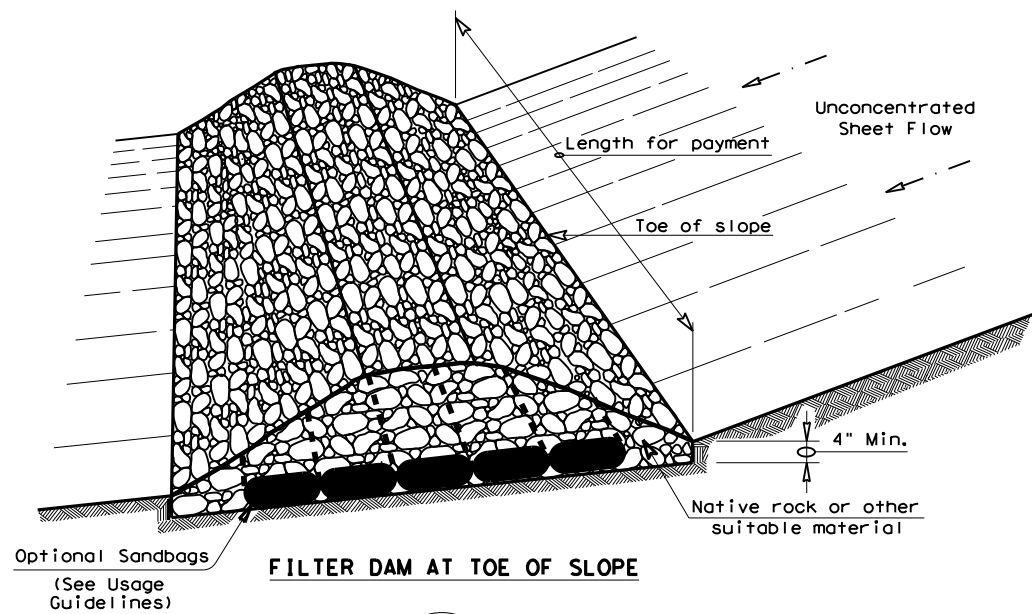


**VERTICAL TRACKING**

				Design Division Standard	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES FENCE &amp; VERTICAL TRACKING EC(1)-16</b>					
FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0931	04	034	FS 357	
	DIST	COUNTY		SHEET NO.	
	LFK	TRINITY		91	

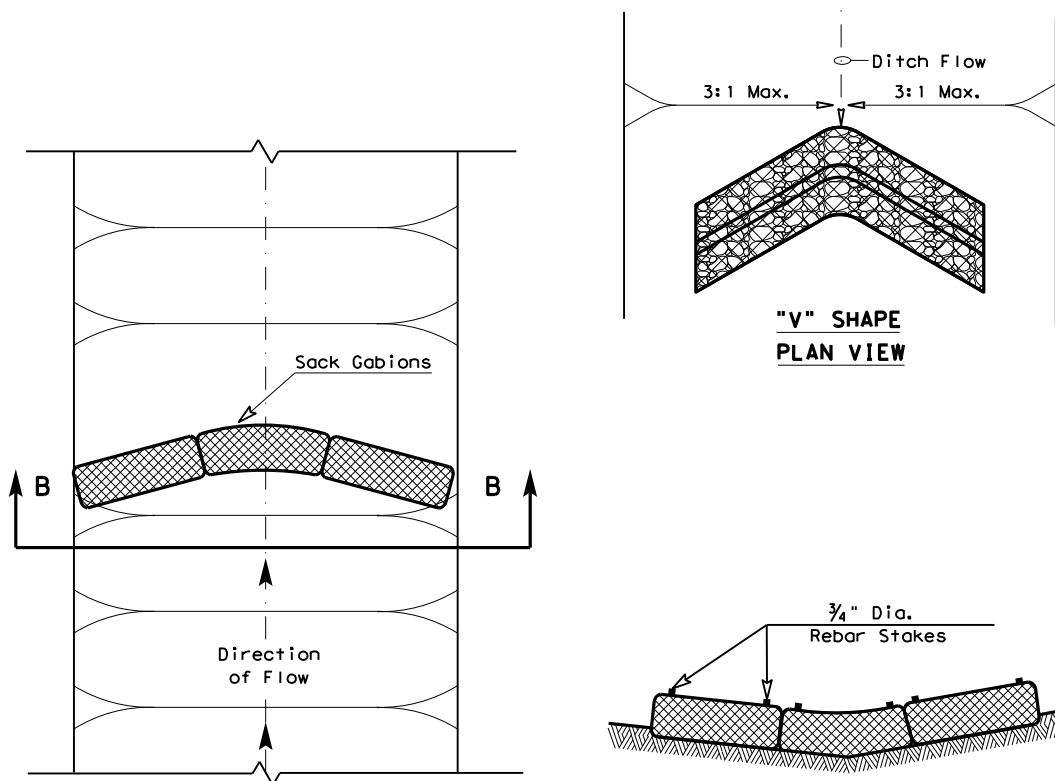
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DATE: FILE:



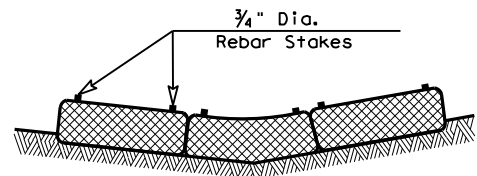
**FILTER DAM AT TOE OF SLOPE**

(RFD1)

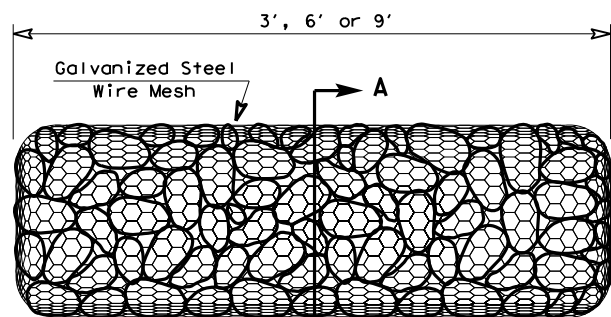


**"V" SHAPE PLAN VIEW**

**PLAN VIEW**

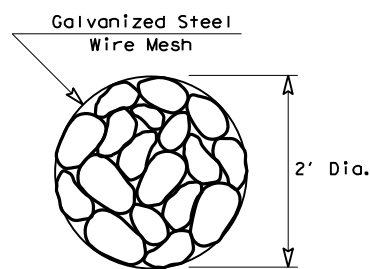


**SECTION B-B**

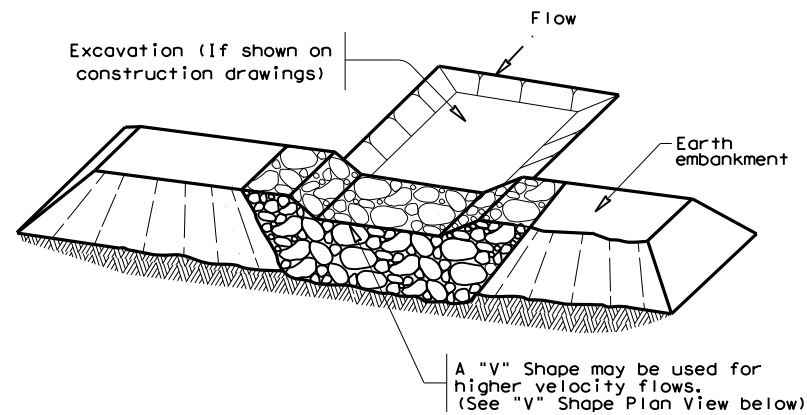


**TYPE 4 (SACK GABIONS)**

(RFD4)

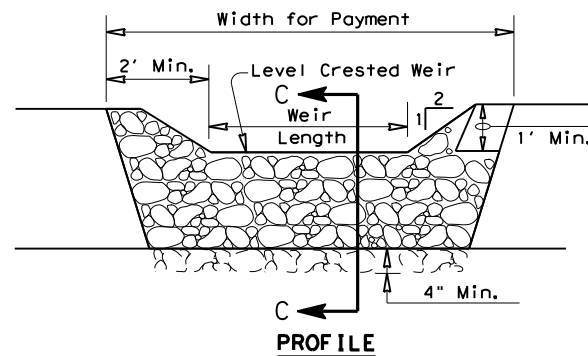


**SECTION A-A**

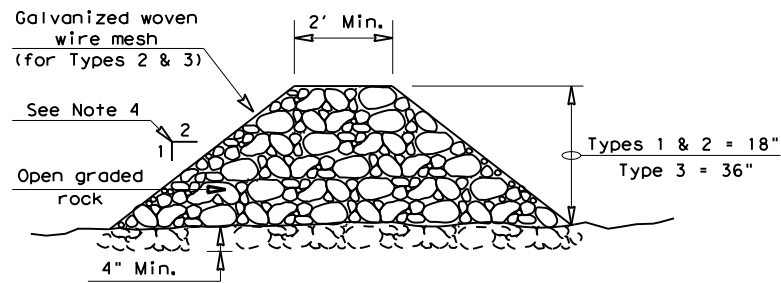


**FILTER DAM AT SEDIMENT TRAP**

(RFD1) OR (RFD2)



**PROFILE**



**SECTION C-C**

**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<sup>2</sup> of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

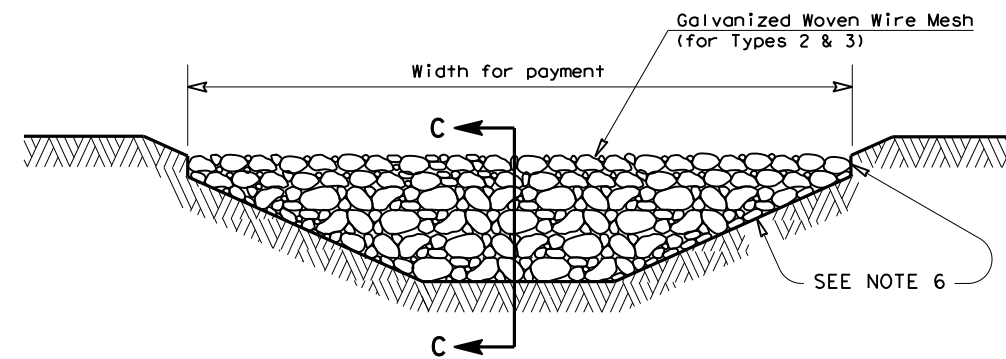
**Type 1 (18" high with no wire mesh) (3" to 6" aggregate):** Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approximately 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) (3" to 6" aggregate):** Type 2 may be used in ditches and at dike or swale outlets.

**Type 3 (36" high with wire mesh) (4" to 8" aggregate):** Type 3 may be used in stream flow and should be secured to the stream bed.

**Type 4 (Sack gabions) (3" to 6" aggregate):** Type 4 May be used in ditches and smaller channels to form an erosion control dam.

**Type 5:** Provide rock filter dams as shown on plans.



**FILTER DAM AT CHANNEL SECTIONS**

(RFD1) OR (RFD2) OR (RFD3)

**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. For 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 3/4" dia. rebar stakes, and have a double-twisted hexagonal weave with a nominal mesh opening of 2 1/2" x 3 1/4".
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.

**PLAN SHEET LEGEND**

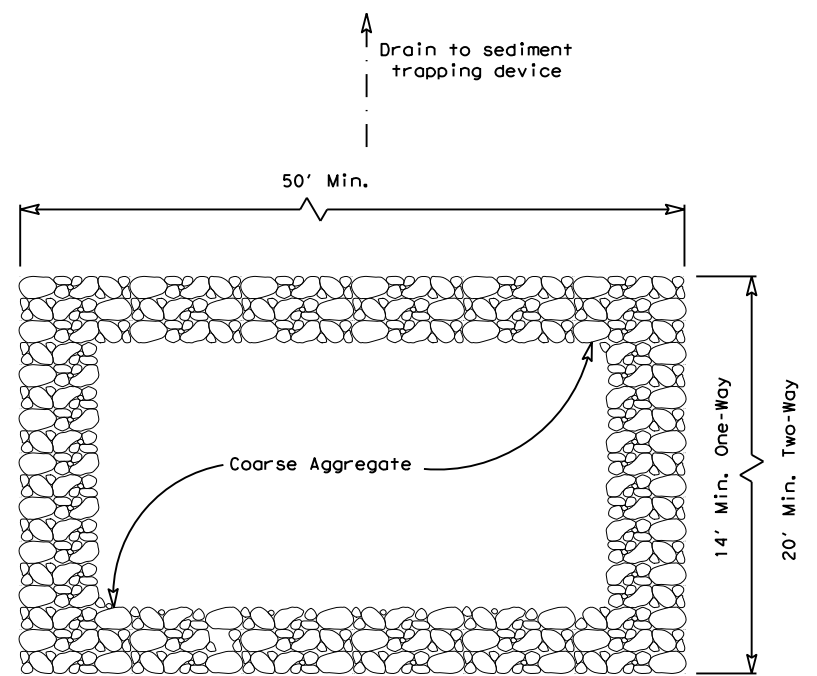
- Type 1 Rock Filter Dam (RFD1)
- Type 2 Rock Filter Dam (RFD2)
- Type 3 Rock Filter Dam (RFD3)
- Type 4 Rock Filter Dam (RFD4)



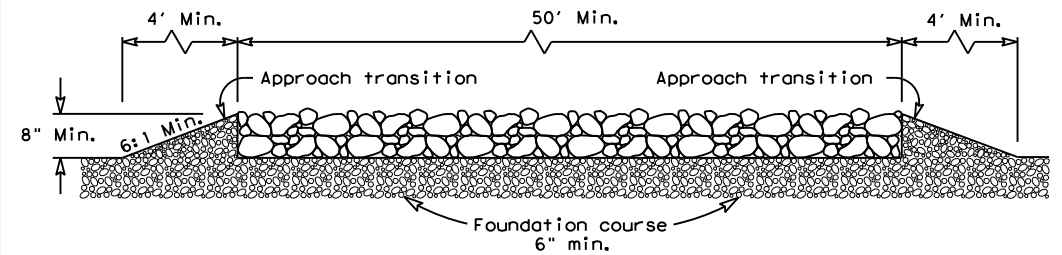
**TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES  
ROCK FILTER DAMS  
EC(2) - 16**

FILE: ec216	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
	DIST	COUNTY	SHEET NO.	
	LFK	TRINITY	92	

DATE: 5/24/2022  
 FILE: \\txdot.projectwiseonline.com:TXDOT3\Documents\11 - LFK\Design Projects\093104034\4 - Design\Plan Set\9. Environmental\ec316.dgn  
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PLAN VIEW

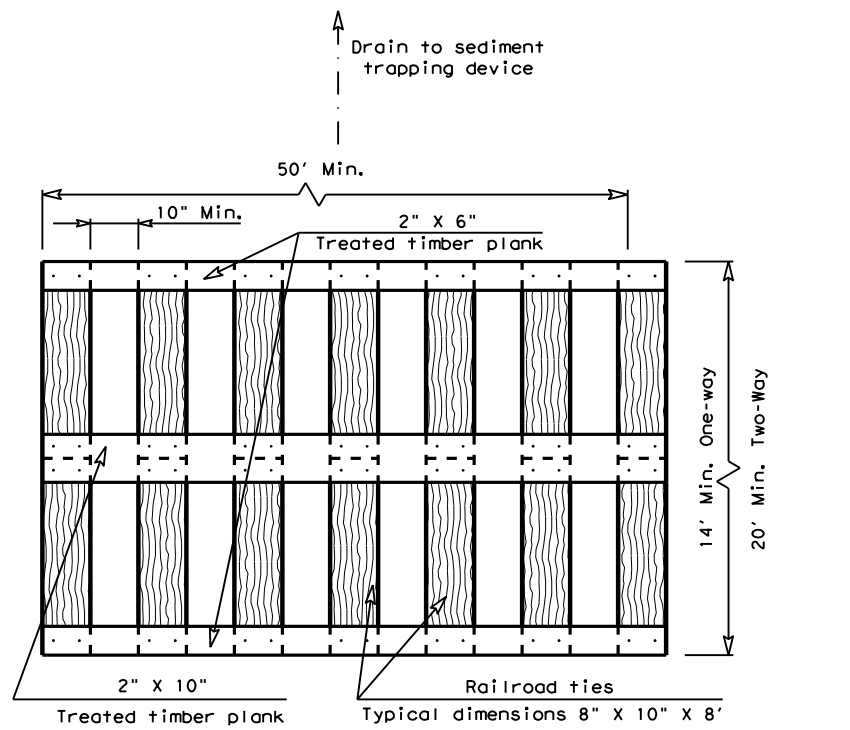


ELEVATION VIEW

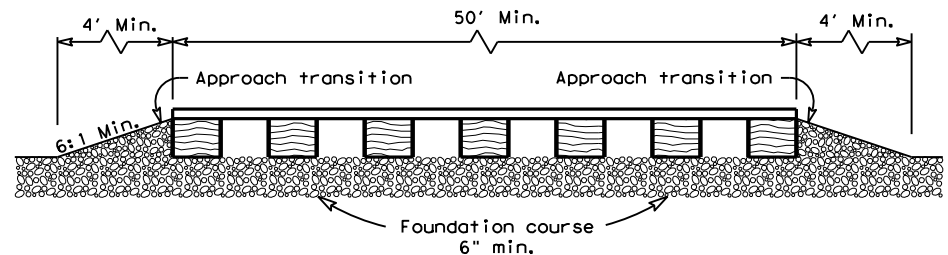
CONSTRUCTION EXIT (TYPE 1)  
ROCK CONSTRUCTION (LONG TERM)

**GENERAL NOTES (TYPE 1)**

- The length of the type 1 construction exit shall be as indicated on the plans, but not less than 50'.
- The coarse aggregate should be open graded with a size of 4" to 8".
- The approach transitions should be no steeper than 6:1 and constructed as directed by the Engineer.
- The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other materials approved by the Engineer.
- The construction exit shall be graded to allow drainage to a sediment trapping device.
- The guidelines shown hereon are suggestions only and may be modified by the Engineer.
- Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.



PLAN VIEW

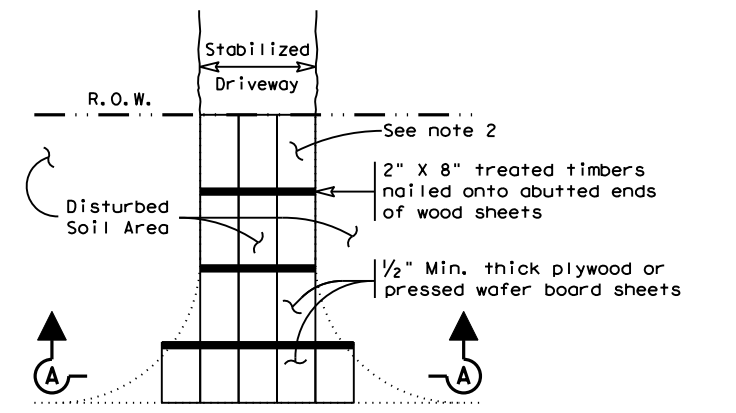


ELEVATION VIEW

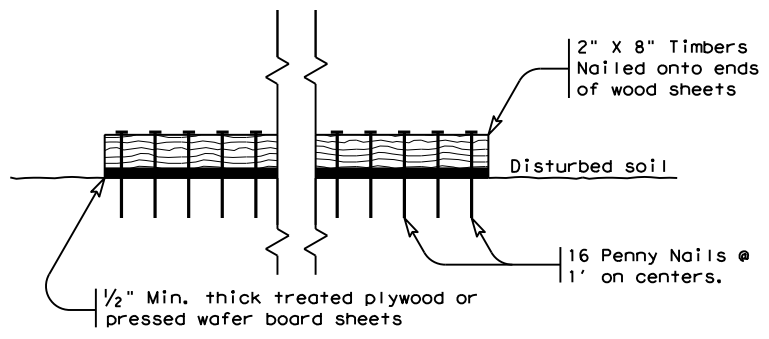
CONSTRUCTION EXIT (TYPE 2)  
TIMBER CONSTRUCTION (LONG TERM)

**GENERAL NOTES (TYPE 2)**

- The length of the type 2 construction exit shall be as indicated on the plans, but not less than 50'.
- The treated timber planks shall be attached to the railroad ties with 1/2" x 6" min. lag bolts. Other fasteners may be used as approved by the Engineer.
- The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
- The approach transitions shall be no steeper than 6:1 and constructed as directed by the Engineer.
- The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
- The construction exit should be graded to allow drainage to a sediment trapping device.
- The guidelines shown hereon are suggestions only and may be modified by the Engineer.
- Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.



PLAN VIEW



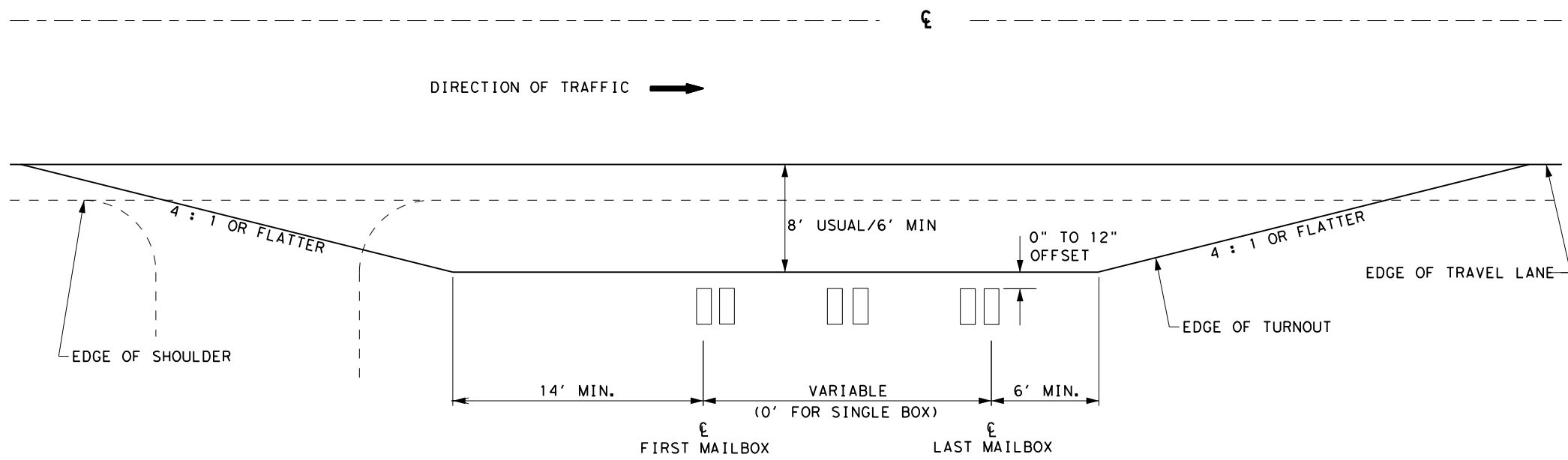
SECTION A-A  
CONSTRUCTION EXIT (TYPE 3)  
SHORT TERM

**GENERAL NOTES (TYPE 3)**

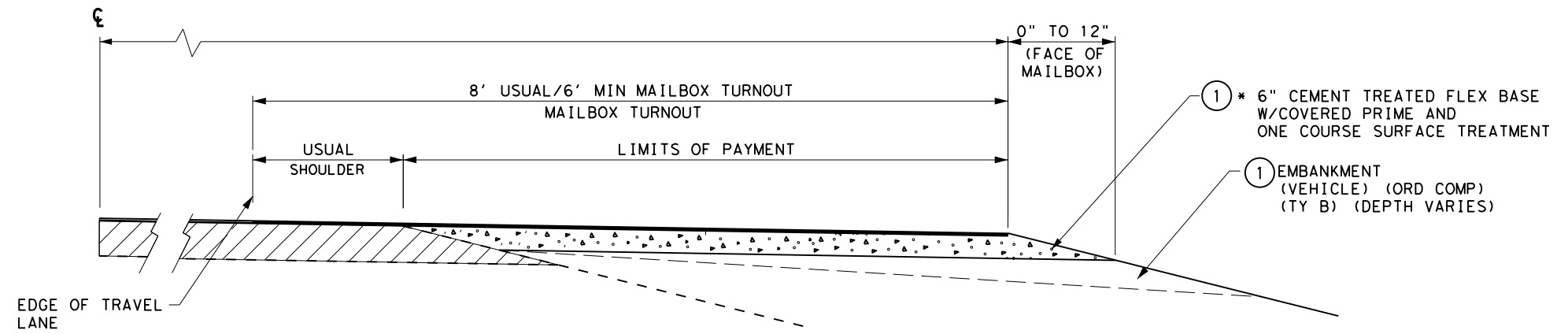
- The length of the type 3 construction exit shall be as shown on the plans, or as directed by the Engineer.
- The type 3 construction exit may be constructed from open graded crushed stone with a size of two to four inches spread a min. of 4" thick to the limits shown on the plans.
- The treated timber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

		Design Division Standard	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES CONSTRUCTION EXITS EC(3)-16</b>			
FILE: ec316	DN: TxDOT	CK: KM	DW: VP
© TxDOT: JULY 2016	CONT	SECT	JOB
REVISIONS	0931 04	034	FS 357
	DIST	COUNTY	SHEET NO.
	LFK	TRINITY	93

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**PLAN**

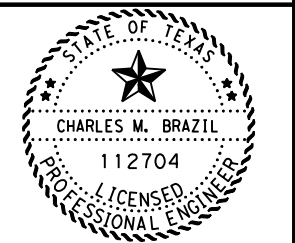


**TYPICAL SECTION**  
 ① SUBSIDIARY TO ITEM 530 (TURNOUTS)

- ① \* 6" CEMENT TREATED FLEX BASE W/COVERED PRIME AND ONE COURSE SURFACE TREATMENT
- ① EMBANKMENT (VEHICLE) (ORD COMP) (TY B) (DEPTH VARIES)

\* D-GR HMA TY-D PG64-22 (5") MAY BE USED AT THE OPTION OF THE CONTRACTOR IN LIEU OF CEMENT TREAT, FLEX BASE, COVERED PRIME AND SURFACE TREATMENT. PLACE IN 2 LIFTS UNLESS OTHERWISE APPROVED.

NOT TO SCALE



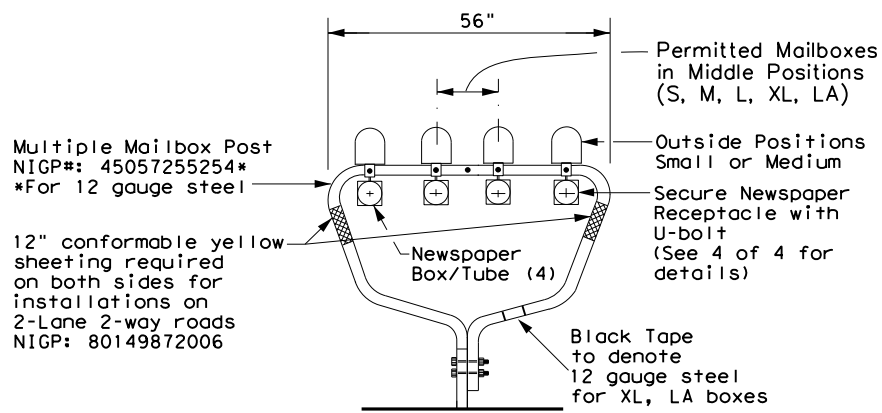
DocuSigned by:  
*Charles M. Brazil, P.E.*  
 6/1/2022

**MAILBOX TURNOUT DETAILS**

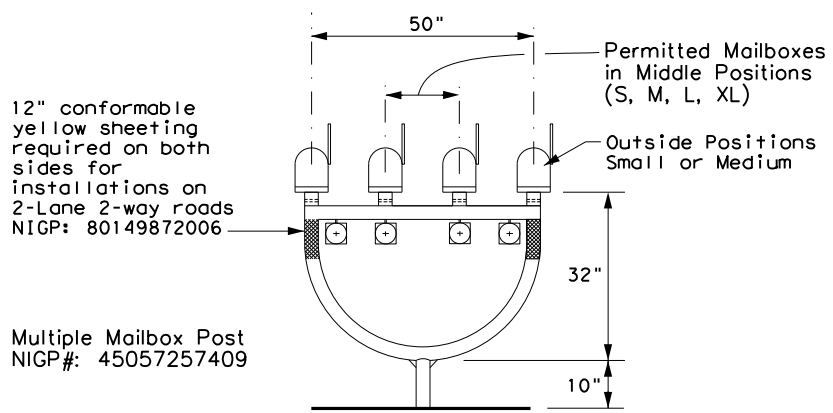
TEXAS DEPARTMENT OF TRANSPORTATION ©2022			
CONT	SECT	JOB	HIGHWAY
0931	04	034	FS 357
DIST	COUNTY		SHEET NO.
LFK	TRINITY		96

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### TYPE 1 - MULTIPLE



### TYPE 4 - MULTIPLE



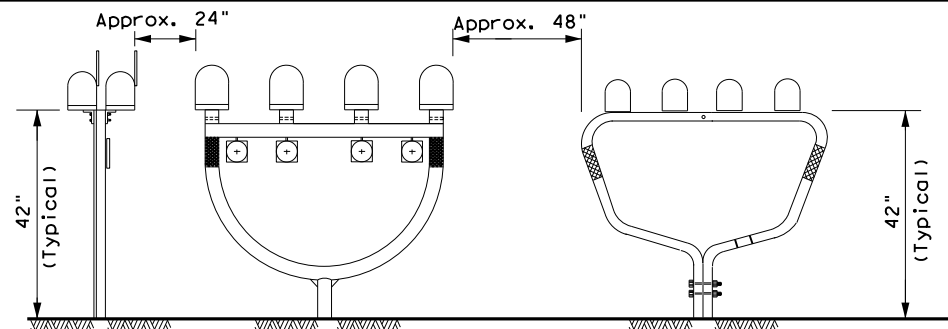
### MAILBOX SIZES

MAILBOX SIZE	TYPICAL DIMENSIONS			MAX **
	LENGTH	WIDTH	HEIGHT	WEIGHT
SMALL	19 1/2"	6"	7"	6 LBS
MEDIUM	22 1/2" *	8" *	11 1/2" *	8 LBS
LARGE	23 1/2"	11 1/2"	13 1/2"	11 LBS
EXTRA LARGE	18"	14"	12"	13 LBS
LOCKABLE	18"	11 1/2"	15"	23 LBS

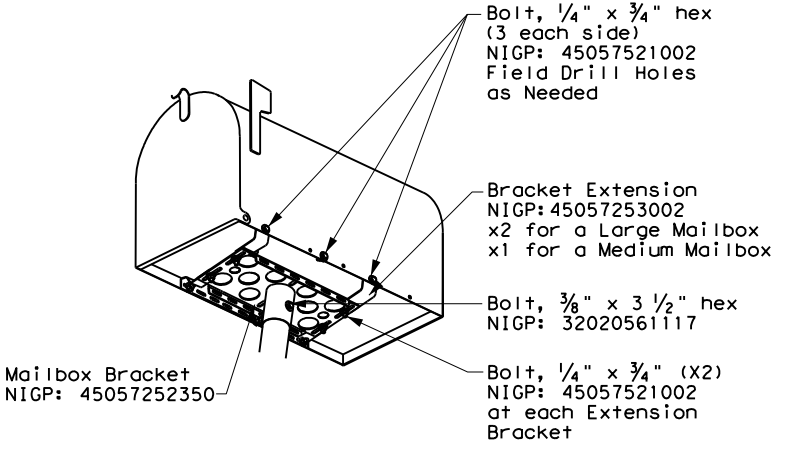
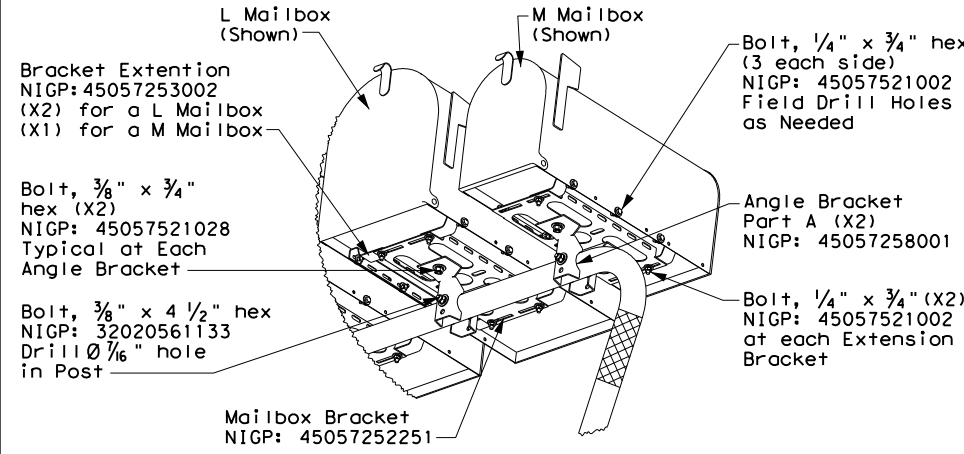
- GENERAL NOTES:**
- Dimensions shown (length, width, and height) are typical, not maximums. However, anytime a medium size mailbox is mounted on a single/double mount or on the outside position on a multi mount, the dimensions shown are maximums.
  - Mailboxes shall be made of light weight sheet metal or light weight plastic. Heavy steel, cast iron or decorative mailboxes shall not be used on the state highway system.

\* See Note 1.  
 \*\* Excluding Molded Plastic on 4 X 4 Post

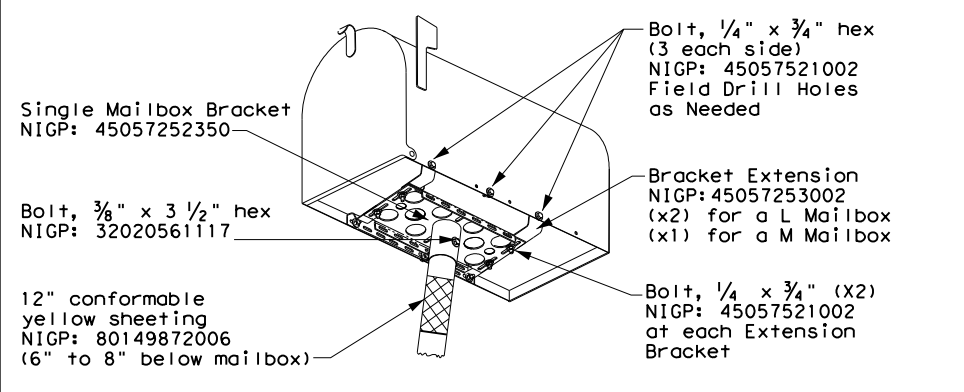
### TYPICAL INSTALLATION MEASUREMENTS



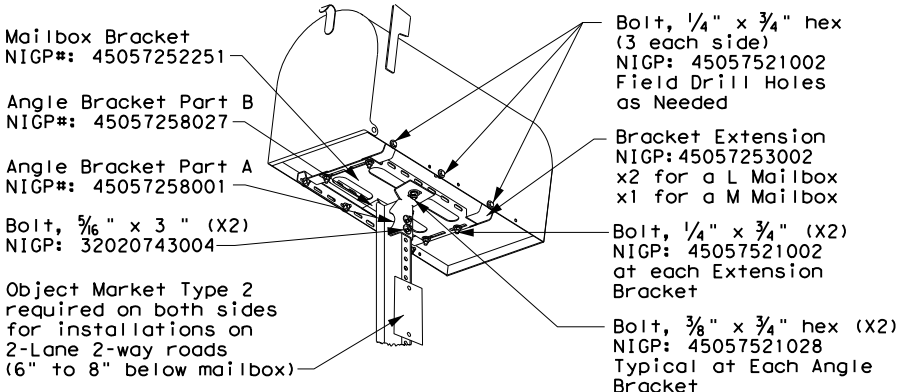
**NOTE:**  
 Mailbox installations in sidewalk areas shall be in accordance with the latest TxDOT Design Standard sheets PED-Pedestrian Facilities Curb Ramps.



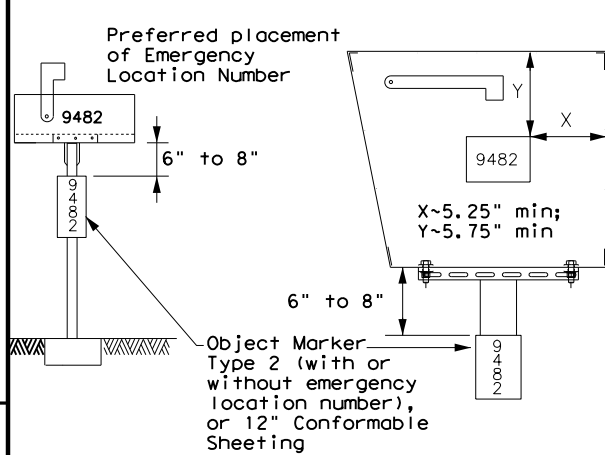
### TYPE 2 and 4 - SINGLE/DOUBLE



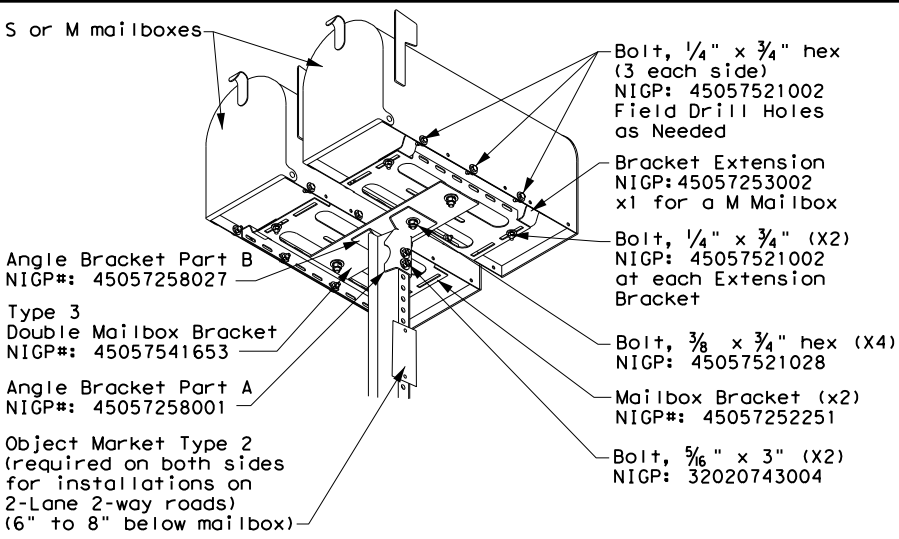
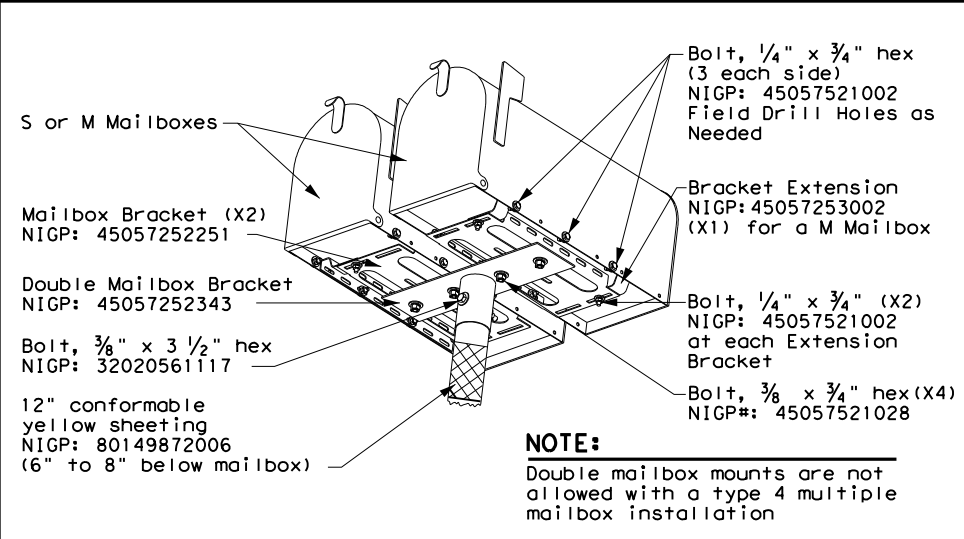
### TYPE 3 - SINGLE/DOUBLE



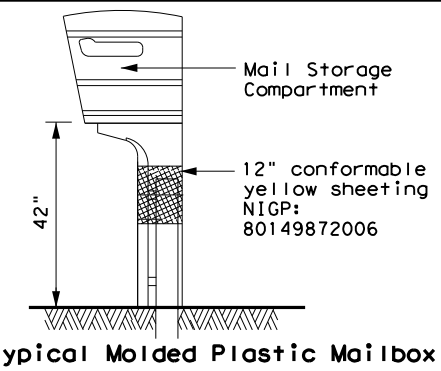
### PLACEMENT OF EMERGENCY LOCATION NUMBER



- NOTES:**
- Location numbers are provided by homeowner. Minimum size 1" height.
  - Location number is typically placed on the mailbox in a contrasting color.
  - Black numbers may be placed on the Type 2 object marker if the numbers cannot be placed on the mailbox.
  - Alternatively, a green or blue plate with white numbers attached may be mounted below the object marker. Other contrasting color configuration, as approved, may be used.
  - See 3 of 4 for Foundation details.
  - See 4 of 4 for Hardware details.



### TYPE 5



SHEET 1 OF 4



## MAILBOX MOUNTING AND ASSEMBLY

MB(1)-21

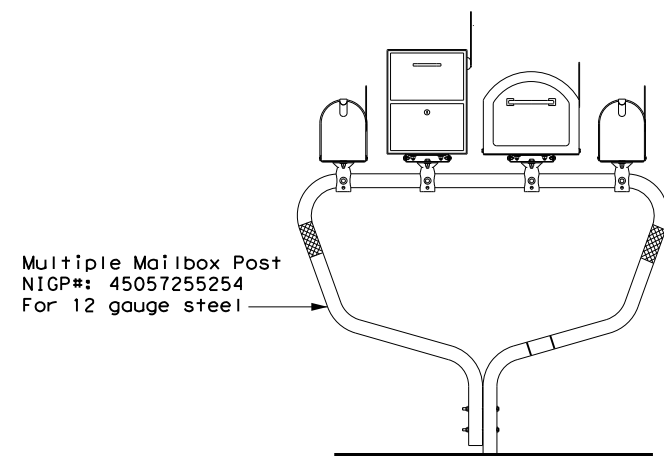
FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	093104	034	FS 357	
2/2005	11/2009	4/2015		
6/2005	1/2011			
11/2006	7/2014			
	DIST	COUNTY	SHEET NO.	
	LFK	TRINITY	97	

DATE: FILE:

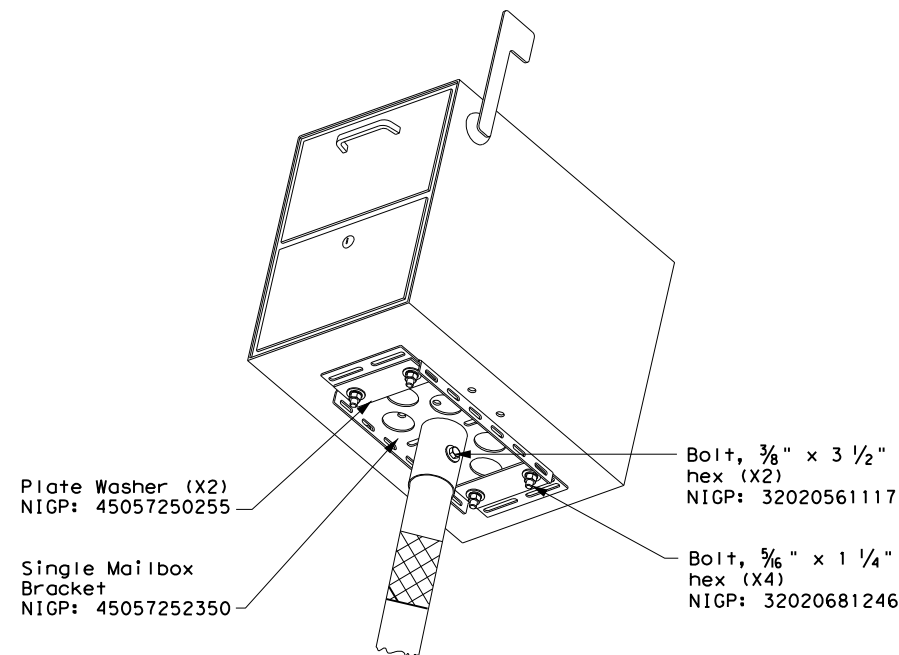


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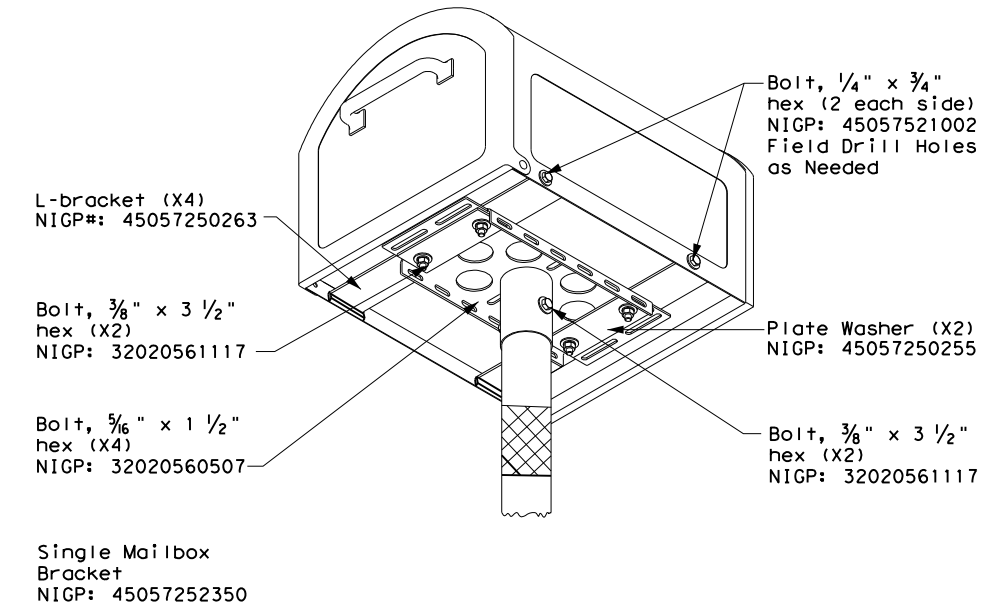
**TYPE 1 - MULTI LOCKABLE AND XL MAILBOX**



**TYPE 2/4 - SINGLE LOCKABLE MAILBOX**

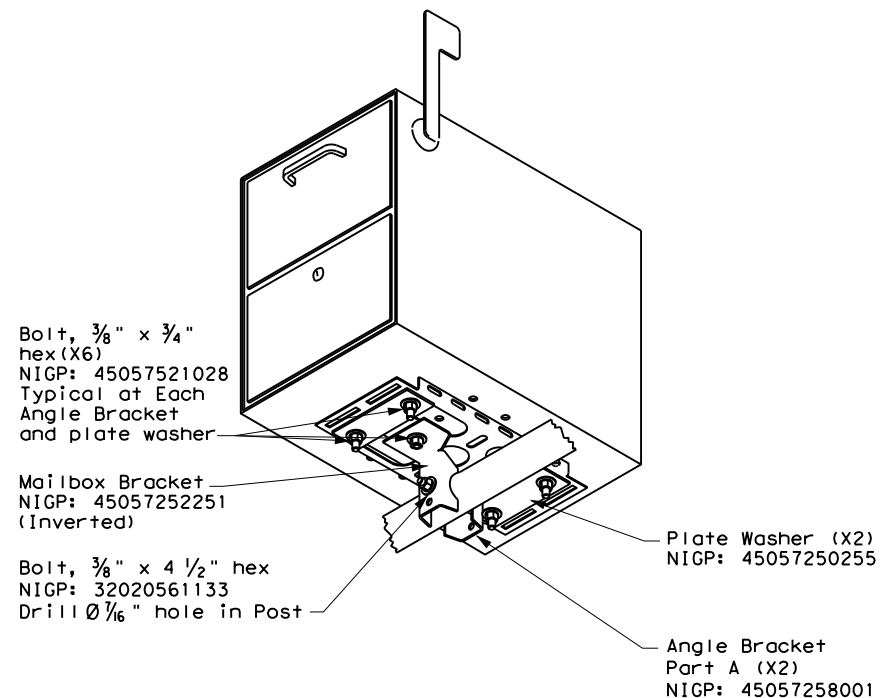


**TYPE 2/4 - SINGLE XL MAILBOX**

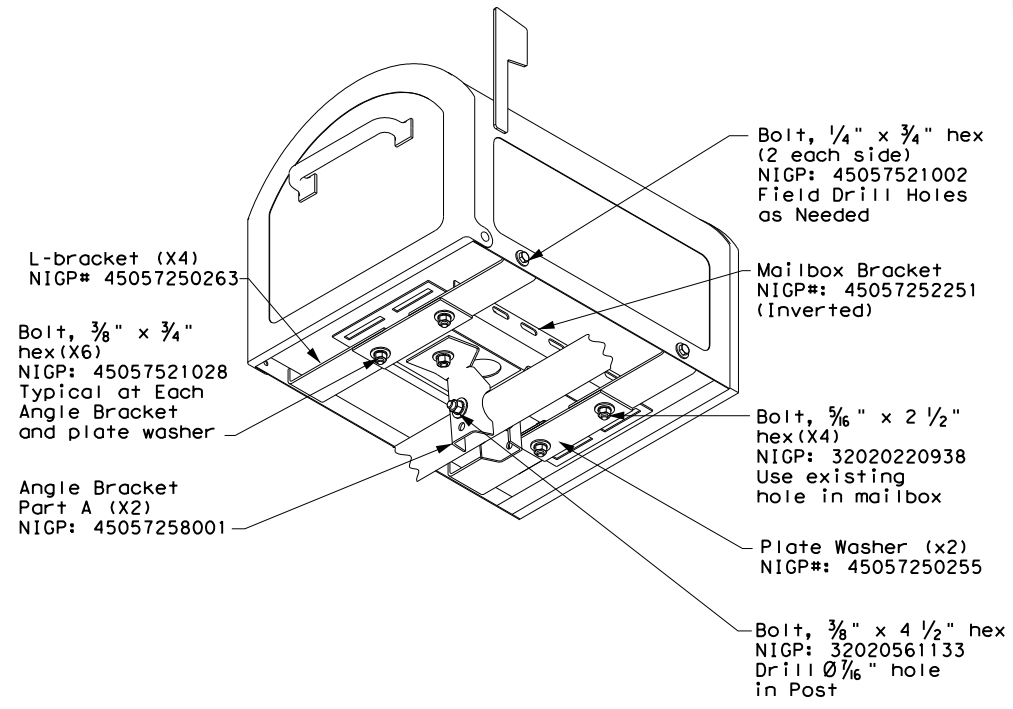


**NOTE:**  
Follow same configuration when mounting an XL mailbox on a Type 4 multi post.

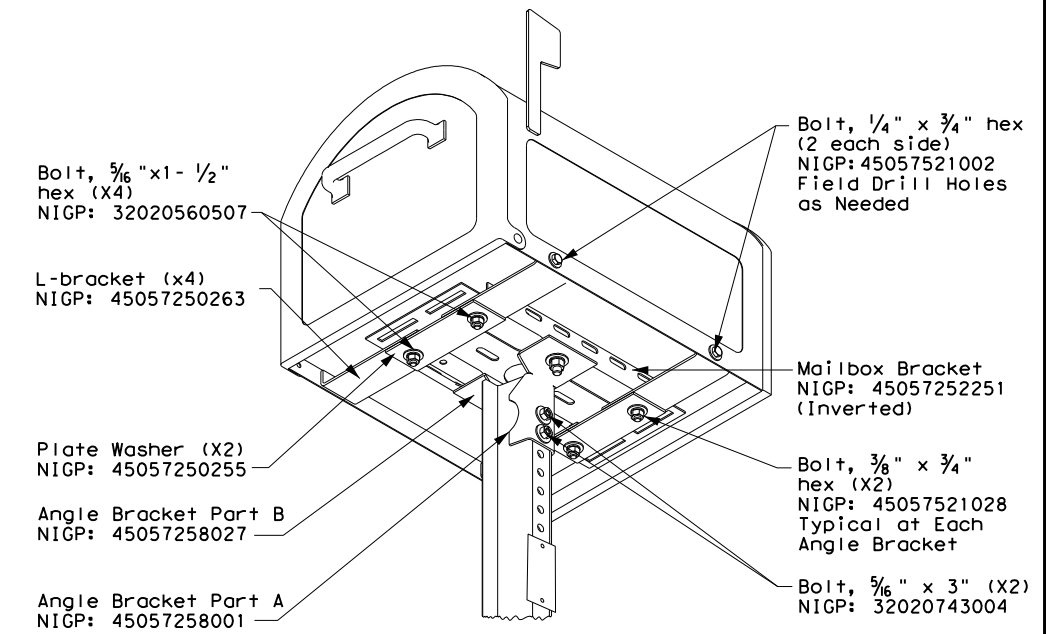
**TYPE 1 MULTI - LOCKABLE ARCHITECTURAL (LA)**



**TYPE 1 MULTI - XL MAILBOX**



**TYPE 3 - XL MAILBOX MOUNTING**



SHEET 2 OF 4

Texas Department of Transportation Maintenance Division Standard

**XL AND LOCKABLE ARCHITECTURAL MAILBOX ASSEMBLY MB (2) - 21**

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
2/2005	09304		034	FS 357
6/2005		DIST	COUNTY	SHEET NO.
11/2006		LFK	TRINITY	96

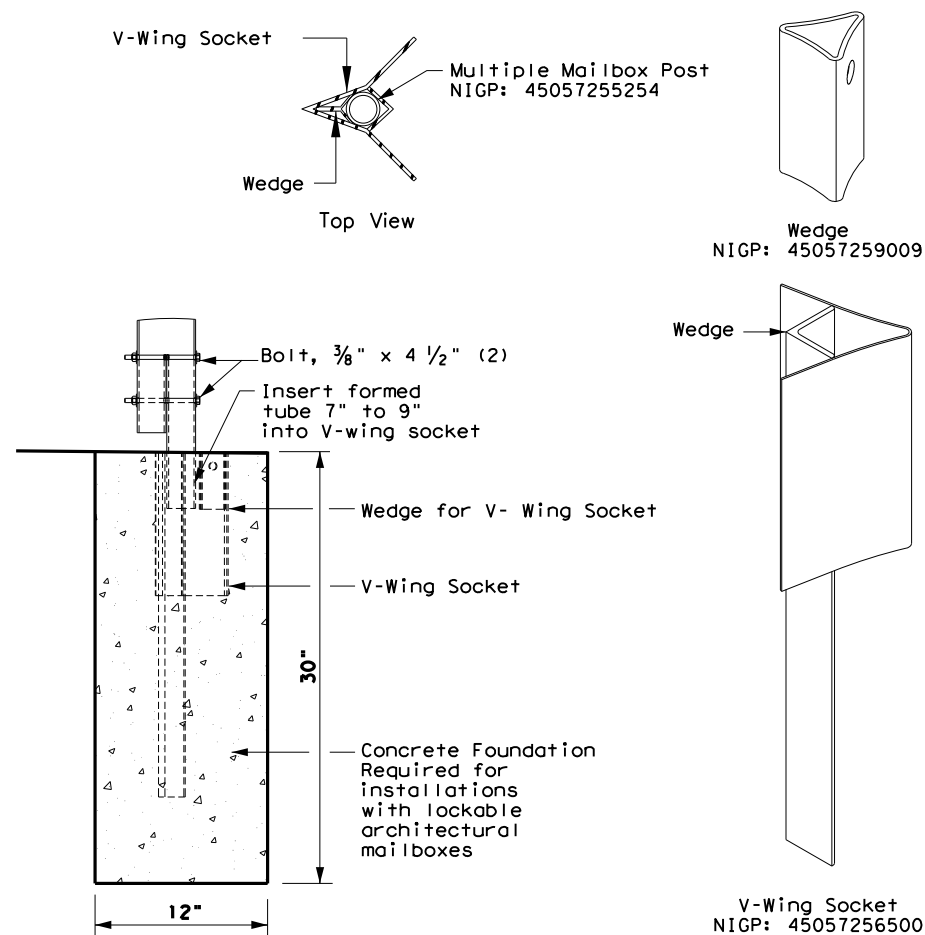
DATE:  
FILE:

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for the accuracy of the information contained herein. The user of this standard shall be responsible for its use.

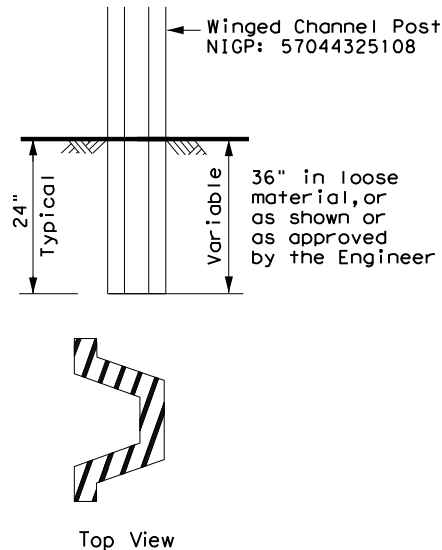
DATE: 5/24/2022 5:02:39 PM  
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### TYPE 1 - SUPPORT/FOUNDATION

Thin Wall Tube w/ V-LOC Anchorage



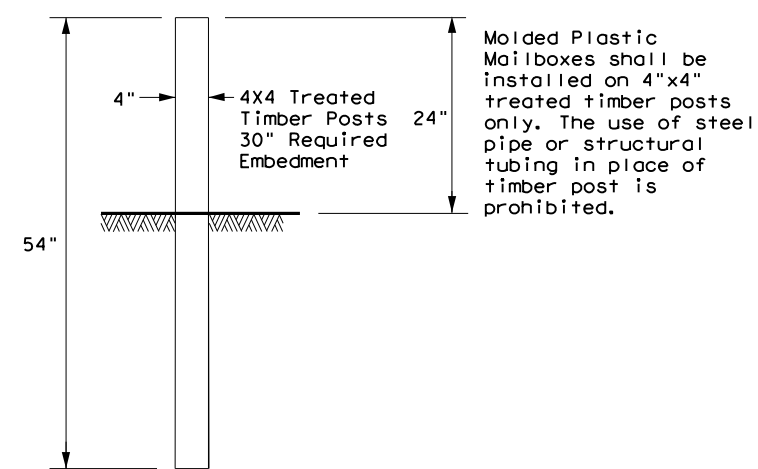
### TYPE 3 - SUPPORT/FOUNDATION



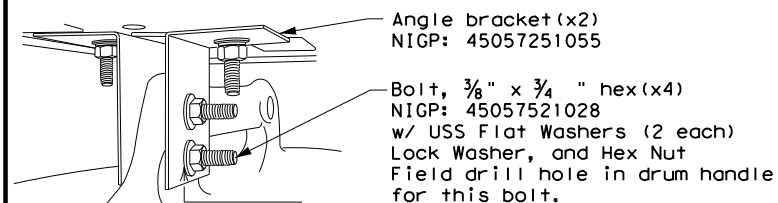
#### NOTES:

1. Attach Object Marker (OM) facing direction of traffic.
2. OM will also be required on opposite side if installed on a 2-Lane, 2-Way roadway.

### TYPE 5 - SUPPORT/FOUNDATION



### TYPE 6 - TEMPORARY MAILBOX SUPPORT



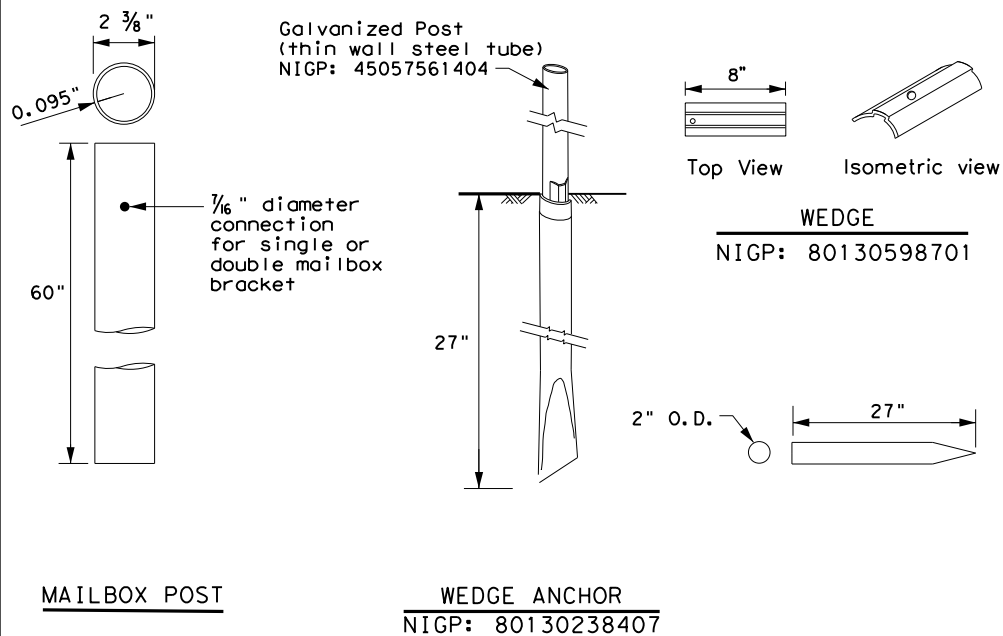
Plastic Drum NIGP: 55093383655  
 Rubber Collar NIGP: 55093387102

#### NOTES:

1. Place on approved plastic drum as shown in the Compliant Work Zone Traffic Control Devices (CWZTCD).
2. Existing attachment hardware shall be used unless damaged. Damaged hardware shall be replaced.

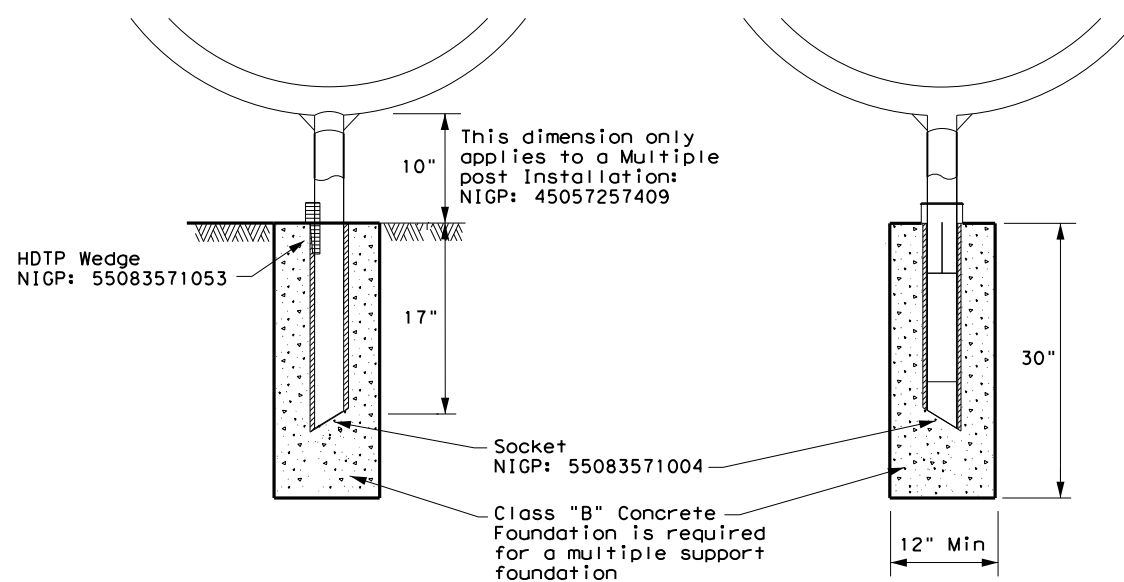
### TYPE 2 - SUPPORT/FOUNDATION

Thin Wall Steel Tube w/Wedge Anchor System



### TYPE 4 - SUPPORT/FOUNDATION

Whitecoated steel post NIGP: 45057561107  
 Multiple post NIGP: 45057257409  
 Recycled Rubber post (RR) NIGP: 45057561057



#### GENERAL NOTES:

1. Erect post plumb or vertical.
2. When galvanized part is required galvanize in accordance with Item 445.
3. Use a concrete footing as shown or when directed. Concrete footing will be required when soils do not hold the support/foundations in a stable condition, only on Type 1, Type 2, and Type 4

SHEET 3 OF 4



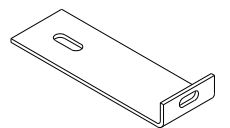
## MAILBOX SUPPORT AND FOUNDATION

MB (3) - 21

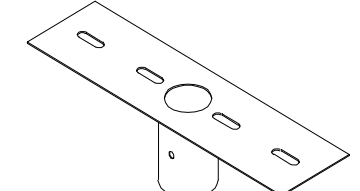
FILE: MB-21.dgn	DN:	CK:	DW:	CK:
© TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0931	04	034	FS 357
2/2005	11/2009	4/2015	DIST	COUNTY
6/2005	1/2011		LFK	TRINITY
11/2006	7/2014			SHEET NO. 97

DATE: 5/24/2022 5:02:32 PM  
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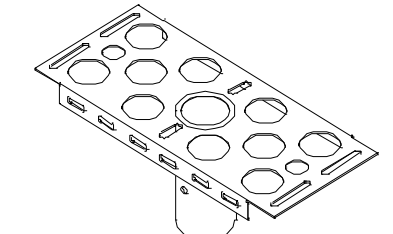
TYPE	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	TYPE 6
Configuration	Multiple	Single or Double	Single or Double	Single	Double	Multiple
Mailbox Size NIGP #	Outside Position: S or M Inside Position: S, M, L, XL, or LA	Single: S, M, L, XL, or LA Double: SS, SM, MM	Single: S, M, L, or XL Double: SS, SM, MM	S, M, L, XL, or LA	SS, SM, or MM	Outside Position: S or M Inside Position: S, M, L, or XL
Mailbox Post NIGP #	45057255254 (Galvanized Multiple)	45057561404 (Thin Walled Govanize)	57044325108 (Wing Channel Post)	45057561107 (Thin walled white powder coated) 45057561057 (Recycled Rubber Post: S or M only)	45057561107 (Thin Walled White Powder Coated)	45057257409 (White Powder Coated Multiple)
Post and Mailbox Hardware NIGP #	45057259009 (Wedge) 45057256500 (V-Wing Socket) 45057253002 (Bracket Extension) 45057252251 (Mailbox Bracket) 45057258001 (Part A Angle Bracket x2) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket for XL x4)	80130598701 (Wedge) 80130238407 (Wedge Anchor) 45057253002 (Bracket Extension) 45057252343 (Double MB Bracket) 45057252350 (S. Mailbox Bracket) 45057252251 (Mailbox Bracket) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket for XL x4)	45057541653 (Type 3 Double Mailbox Bracket) 45057252251 (Mailbox Bracket) 45057253002 (Bracket Extension) 45057258001 (Part A Angle Bracket) 45057258027 (Part B Angle Bracket) 45057250255 (Plate Washer for XL x2) 45057250263 (L-Bracket for XL x4)	55083571053 (Wedge) 55083571004 (Socket) 45057252350 (Single Mailbox Bracket) 45057253002 (Bracket Extension) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket for XL x4)	55083571053 (Wedge) 55083571004 (Socket) 45057253002 (Bracket Extension) 45057252343 (Double Mount Bracket) 45057252251 (Mailbox Bracket x2)	55083571053 (Wedge) 55083571004 (Socket) 45057253002 (Bracket Extension) 45057252350 (Single Mount Bracket) 45057250255 (Plate Washer for XL x2) 45057250263 (L-Bracket for XL x4)
Foundation Used	Class B Concrete (Required for LA Mailboxes)	Class B Concrete (Required for LA Mailboxes)	None	Class B Concrete (not used with recycled rubber post, required for LA Mailboxes)	Class B Concrete (not required)	Class B Concrete



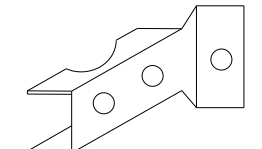
NIGP: 45057250263  
L-Bracket x4 for XL sized mailboxes



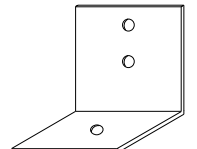
NIGP: 45057252343  
Double Mailbox Bracket For Type 2 and Type 4 double mount



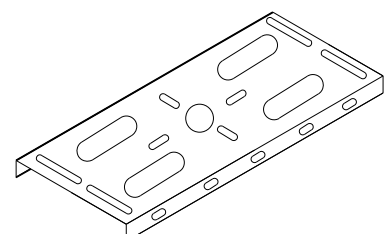
NIGP: 45057252350  
Single Mailbox Bracket For Type 2 single and for Type 4 single and multi mount



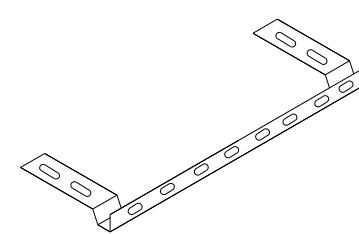
NIGP: 45057258001  
Part "A" Angle Bracket For Type 1 multi (2 per mailbox) and Type 3 single and double



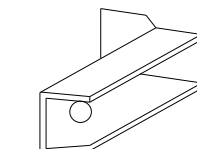
NIGP: 45057251055  
Type 6 Angle Bracket (2 per mailbox)



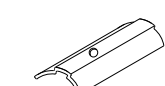
NIGP: 45057252251  
Mailbox Bracket For Type 1 multi and any double mount (use 2)




NIGP: 45057253002  
Bracket Extension Use 1 for a medium Mailbox Use 2 for a Large Mailbox



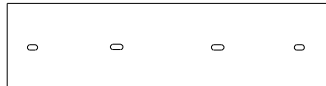
NIGP: 45057258027  
Part "B" Angle Bracket For Type 3 single and double



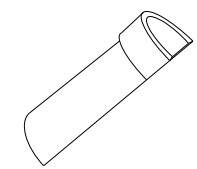
NIGP: 80130598701  
Wedge for Type 2



NIGP: 45057250255  
Plate Washer for Architecural and XL Mailboxes




NIGP: 45057541653  
Type 3 double mailbox bracket



NIGP: 55083571053  
Type 4 Mailbox Wedge



NIGP: 55083571004  
Type 4 Mailbox Socket



NIGP: 80130238407  
Type 2 Wedge Anchor



NIGP: 45057259009  
Wedge for Type 1 V-wing Socket



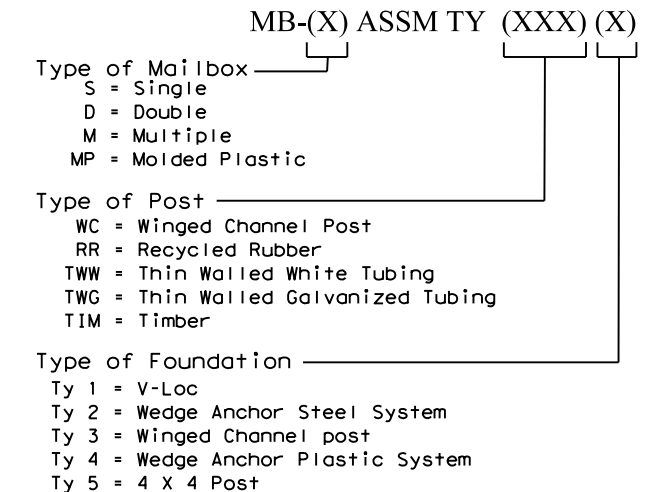
NIGP: 45057256500  
V-wing Socket for Type 1 Foundation

NIGP #	OBJECT MARKERS AND CONFORMABLE SHEETING
55008311759	Type 2 OM 4"x4" (3 Needed) for Type 3 Wing Channel Post
55008312906	Type 2 OM 6"x12" (1 needed) for Type 3 Wing Channel Post
80149872006	12" Conformable Reflective Yellow Sheeting for Flexible Posts


**NOTES:**

- Type 2 object marker in accordance with Traffic Engineering Standard Delineators & Object Markers.
- A light weight receptacle for newspaper delivery can be attached to mailbox posts if the receptacle does not touch the mailbox, present a hazard to traffic or delivery of the mail, extend beyond the front of the mailbox, or display advertising, except the publication title.

**BID CODES FOR CONTRACTS**



SHEET 4 OF 4

 Texas Department of Transportation				Maintenance Division Standard	
<h2>NIGP PARTS LIST AND COMPATIBILITY</h2> <h3>MB(4)-21</h3>					
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©TxDOT March 2004	CONT	SECT	JOB	HIGHWAY	
2/2005	0931	04	034	FS 357	
6/2005					
11/2006					
	DIST	COUNTY	SHEET NO.		
	LFK	TRINITY	98		