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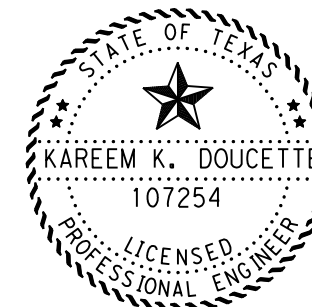
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*THE STANDARD SHEETS SPECIFICALLY IDENTIFIED ABOVE HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

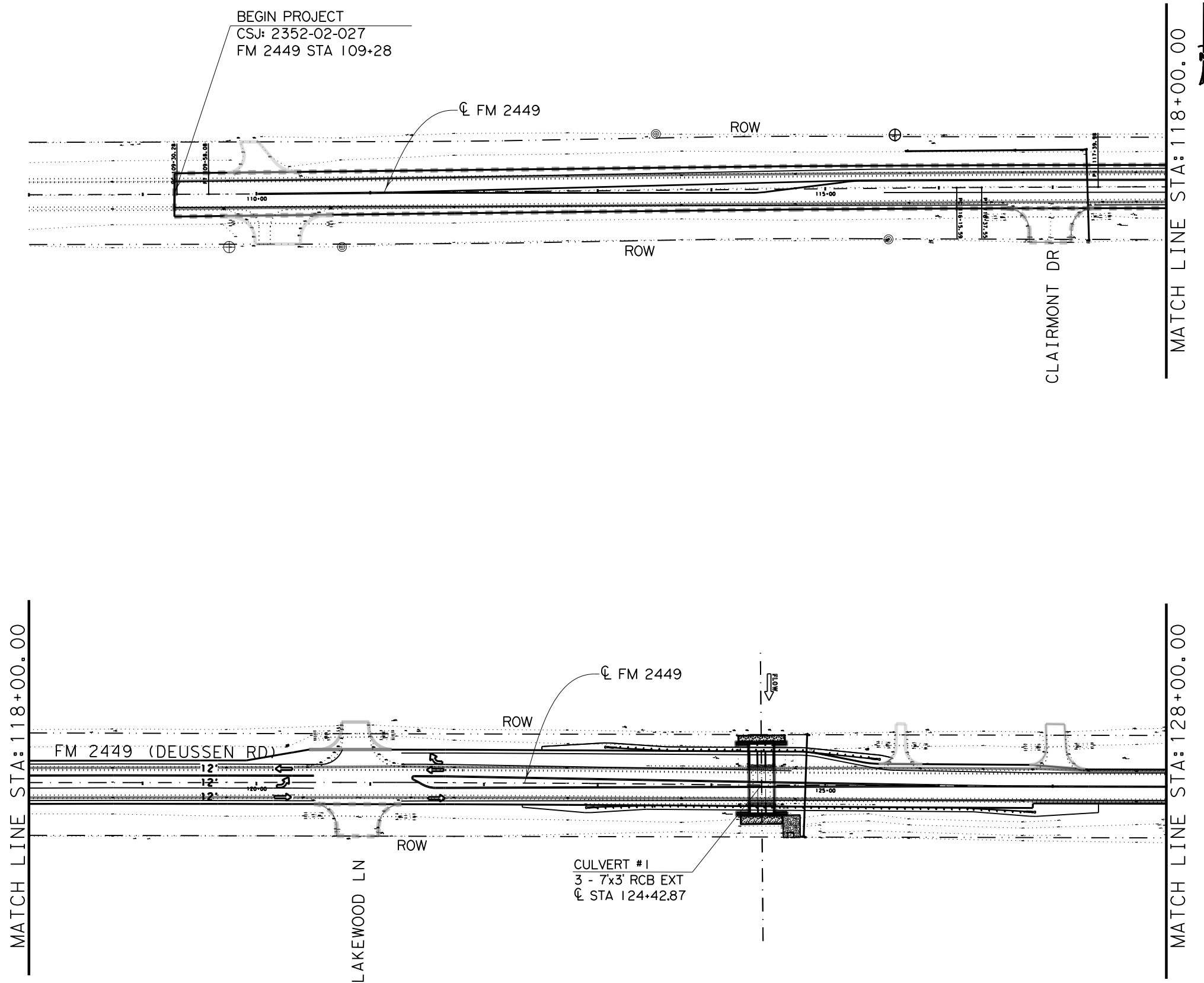
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Kareem Doucette, P.E. 9/27/2022
 Signature of Registrant & Date
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FM 2449
INDEX OF SHEETS

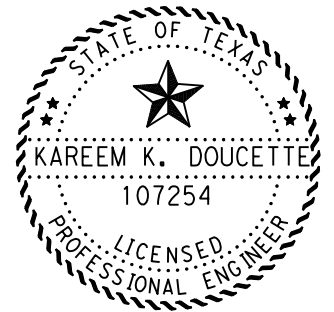
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DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
KKD	6	(See Title Sheet)		FM2449
GRAPHICS	KKD	STATE	DISTRICT	COUNTY
CHECK	TEXAS	DAL	DENTON	SHEET NO.
CHECK	CONTROL	SECTION	JOB	2
	2352	02	027	

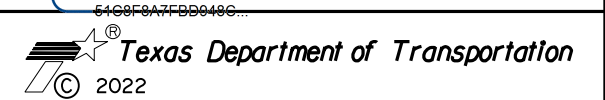


NOTE:

THE PROJECT'S ADVANCE WARNING SIGNAGE SHALL BE PLACED ACCORDING TO THE BC STANDARDS (BC (2)-21). SIGNS MAY REQUIRE ADJUSTMENTS IN THE FIELD BUT ONLY WITH APPROVAL OF THE ENGINEER.



DocuSigned by:
Kareem Doucette 9/20/2022

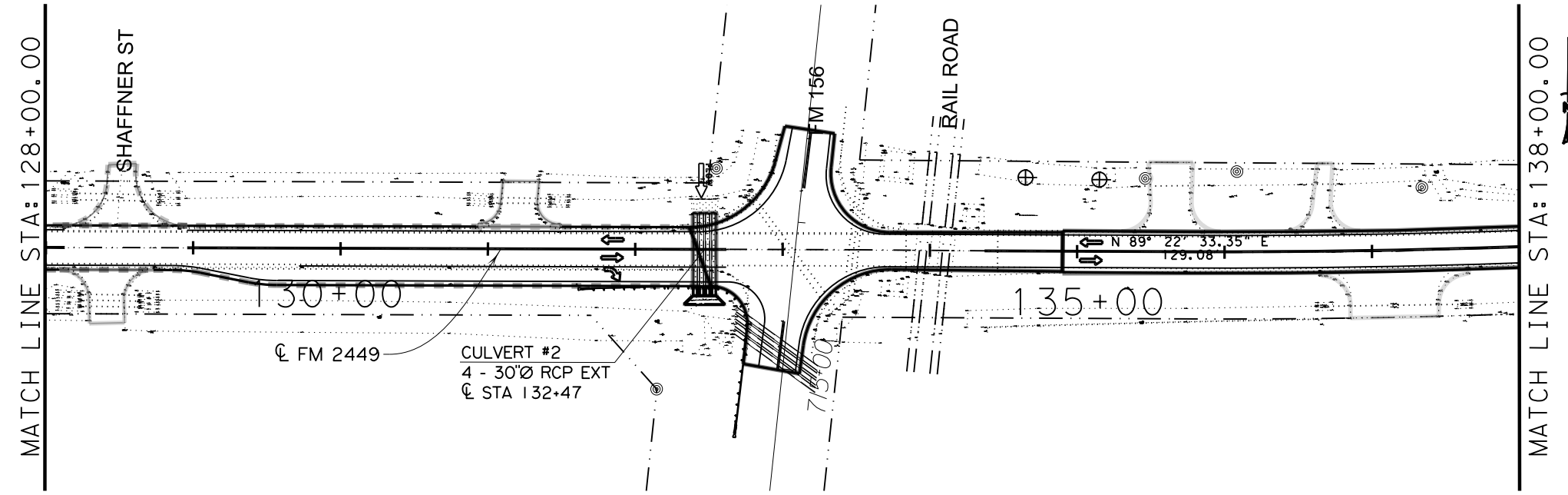


FM 2449 PROJECT LAYOUT

BEGIN PROJECT to STA 128+00

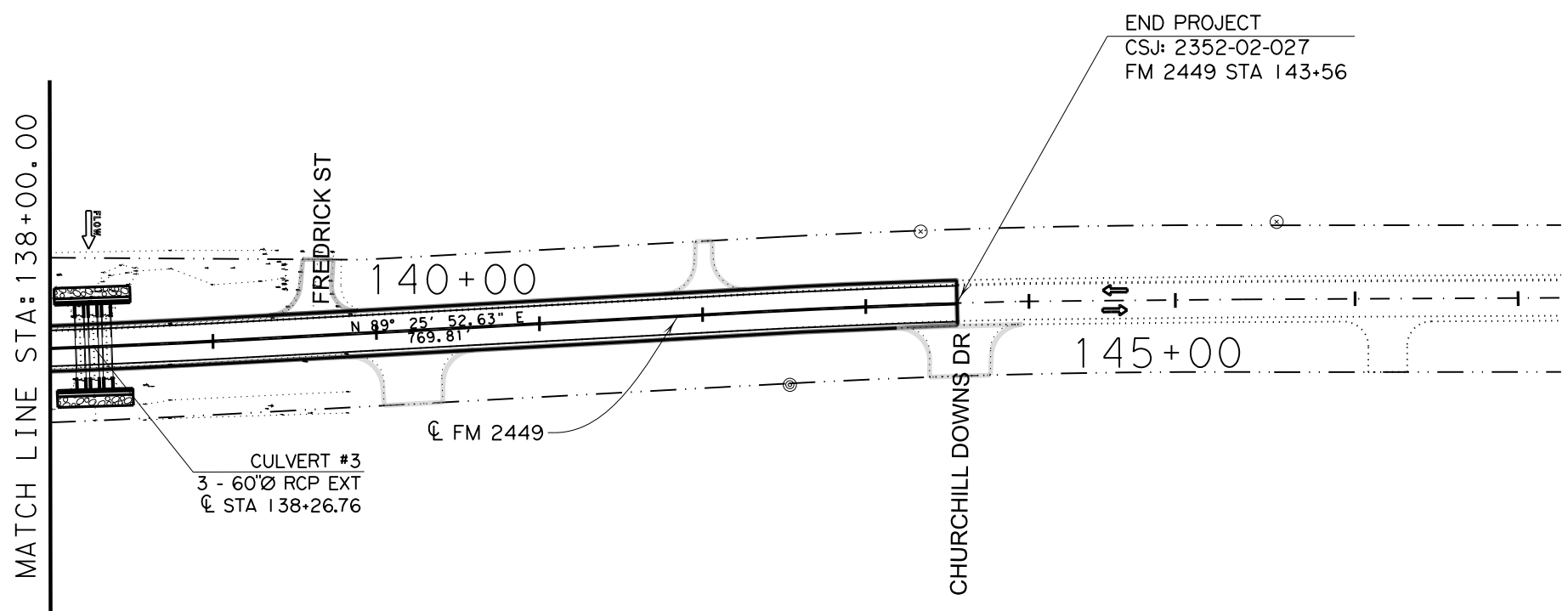
SCALE: 1" = 100' SHEET 1 OF 2

DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
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CHECK	TEXAS	SECTION 02	JOB 027	
CHECK	2352			

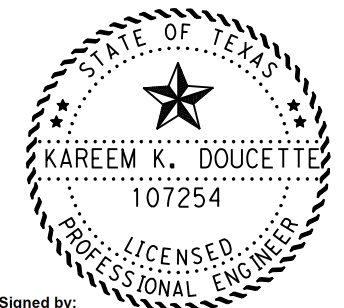


NOTE:

THE PROJECT'S ADVANCE WARNING SIGNAGE SHALL BE PLACED ACCORDING TO THE BC STANDARDS (BC (2)-21). SIGNS MAY REQUIRE ADJUSTMENTS IN THE FIELD BUT ONLY WITH APPROVAL OF THE ENGINEER.



END PROJECT
CSJ: 2352-02-027
FM 2449 STA 143+56



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Kareem Doucette 9/20/2022
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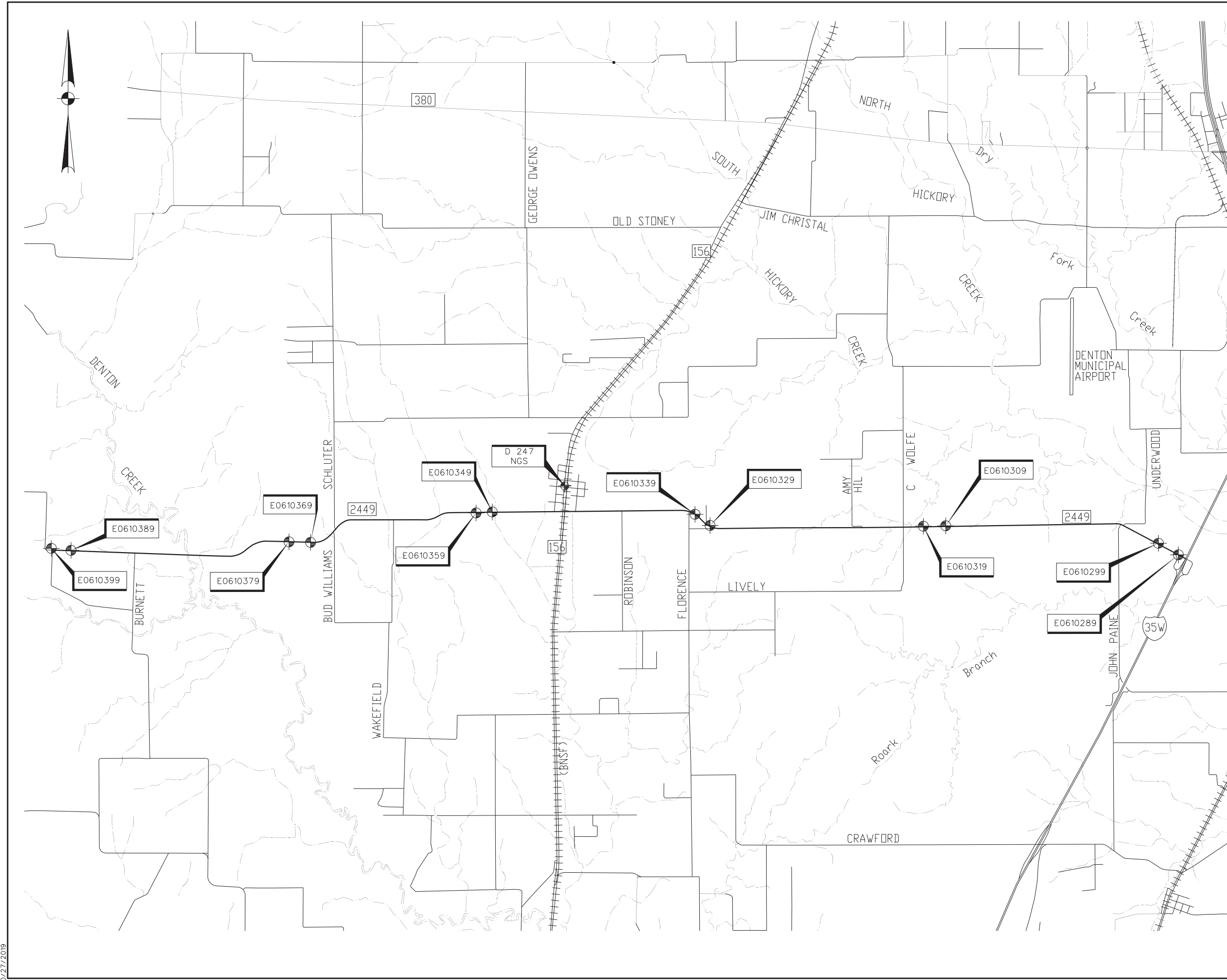


FM 2449 PROJECT LAYOUT

STA 128+00 to END OF PROJECT

SCALE: 1" = 100' SHEET 2 OF 2

DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
GRAPHICS KKD	STATE	DISTRICT DAL	COUNTY DENTON	SHEET NO. 4
CHECK	TEXAS	SECTION 02	JOB 027	
CHECK	2352			



NOTES:
 ALL COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, NORTH CENTRAL ZONE 4202, NAD83 (2011 ADJ) EPOCH 2010.00 GEOID 12A DETERMINED BY GPS OBSERVATIONS CALCULATED FROM DALLAS CORS ARP (PID-DF8984), FORT WORTH WAAS 1 CORS ARP (PID-DF4385), AND COLLIN COUNTY CORS ARP (PID-DF8982). ALL DISTANCES AND COORDINATES ARE SURFACE WITH A GRID TO GROUND SCALE FACTOR OF 1.000150630.

PROJECT BENCHMARK:
 NGS MONUMENT DESIGNATION: D 247
 PID DN0632 (NAVD88): BENCH MARK DISK STAMPED "D 247 1934" SET AT THE STATE BANK IN PONDER, TEXAS AT THE SOUTHEAST CORNER OF THE THIRD CONCRETE STEP TO THE DOOR. APPROXIMATELY 100 FEET WEST OF THE RAILROAD DEPOT.

NORTH: 7,116,656.547 (MEASURED)
 EAST: 2,339,789.026 (MEASURED)
 ELEV: 732.99 (PUBLISHED)



Elliott Pat Busby 10/28/2019
 ELLIOTT PAT BUSBY DATE
 RPLS NO. 5561

NO.	REVISIONS	BY	DATE



SURVEY CONTROL

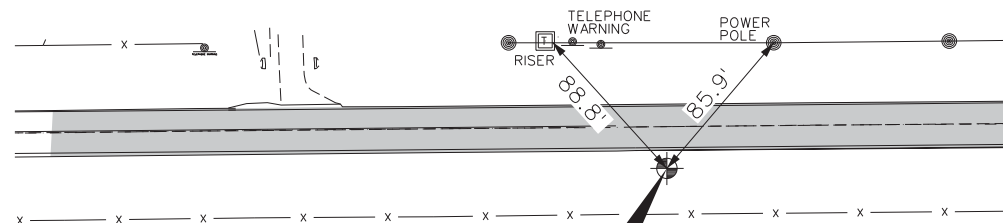
SHEET 1 OF 7		
FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	SHEET NO.
STATE	DISTRICT	COUNTY
TEXAS	DALLAS	DENTON
CONTROL	SECTION	JOB
2352	02	023 & 024
		HIGHWAY NO.
		FM 2449



CONTROL MONUMENT DESCRIPTION:

A 3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "E0610359".

SKETCH
(NOT TO SCALE)



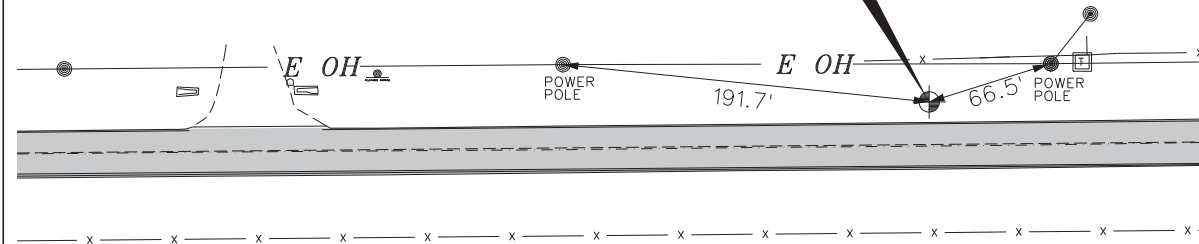
E0610359
SURFACE
COORDINATES
N= 7,115,246.266
E= 2,335,160.193
ELEV= 750.868



CONTROL MONUMENT DESCRIPTION:

A 3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "E0610349".

SKETCH
(NOT TO SCALE)



E0610349
SURFACE
COORDINATES
N= 7,115,298.066
E= 2,336,006.194
ELEV= 743.494

NOTES:

ALL COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, NORTH CENTRAL ZONE 4202, NAD83 (2011 ADJ) EPOCH 2010.00 GEOID 12A DETERMINED BY GPS OBSERVATIONS CALCULATED FROM DALLAS CORS ARP (PID-DF8984), FORT WORTH WAAS 1 CORS ARP (PID-DF4385), AND COLLIN COUNTY CORS ARP (PID-DF8982). ALL DISTANCES AND COORDINATES ARE SURFACE WITH A GRID TO GROUND SCALE FACTOR OF 1.000150630.

PROJECT BENCHMARK:

NGS MONUMENT DESIGNATION: D 247
PID DN0632 (NAVD88): BENCH MARK DISK STAMPED "D 247 1934" SET AT THE STATE BANK IN PONDER, TEXAS AT THE SOUTHEAST CORNER OF THE THIRD CONCRETE STEP TO THE DOOR. APPROXIMATELY 100 FEET WEST OF THE RAILROAD DEPOT.

NORTH: 7,116,656.547 (MEASURED)
EAST: 2,339,789.026 (MEASURED)
ELEV: 732.99 (PUBLISHED)



Elliott Pat Busby 10/28/2019
ELLIOTT PAT BUSBY DATE
RPLS NO. 5561

CONTROL POINT E0610359

APPROXIMATE LOCATION:

A 3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "E0610359" LOCATED IN THE SOUTH RIGHT-OF-WAY OF FM 2449, APPROXIMATELY 0.9 MILES WEST OF FM 156, AND BEING 85.9 FEET SOUTHWEST OF A POWER POLE AND 88.8 FEET SOUTHEAST OF A TELEPHONE RISER.

US SURVEY FEET
TEXAS NORTH CENTRAL ZONE 4202
NORTH AMERICAN DATUM OF 1983 (NAD83)
GEOID 12A MODEL
DATE SET: AUGUST 18, 2019
DALLAS COUNTY SCALE FACTOR: 1.000150630

GRID NORTHING: 7,114,174.658
GRID EASTING: 2,334,808.501
SURFACE NORTHING: 7,115,246.266
SURFACE EASTING: 2,335,160.193
NAVD88 ELEVATION: 750.868

CONTROL POINT E0610349

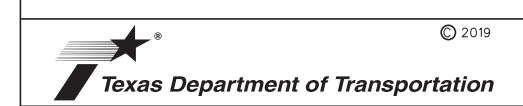
APPROXIMATE LOCATION:

A 3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "E0610349" LOCATED IN THE NORTH RIGHT-OF-WAY OF FM 2449, APPROXIMATELY 0.7 MILES WEST OF FM 156, AND BEING 66.5 FEET SOUTHWEST OF A FENCE CORNER AND 191.7 FEET SOUTHEAST OF A POWER POLE.

US SURVEY FEET
TEXAS NORTH CENTRAL ZONE 4202
NORTH AMERICAN DATUM OF 1983 (NAD83)
GEOID 12A MODEL
DATE SET: AUGUST 18, 2019
DALLAS COUNTY SCALE FACTOR: 1.000150630

GRID NORTHING: 7,114,226.450
GRID EASTING: 2,335,654.374
SURFACE NORTHING: 7,115,298.066
SURFACE EASTING: 2,336,006.194
NAVD88 ELEVATION: 743.494

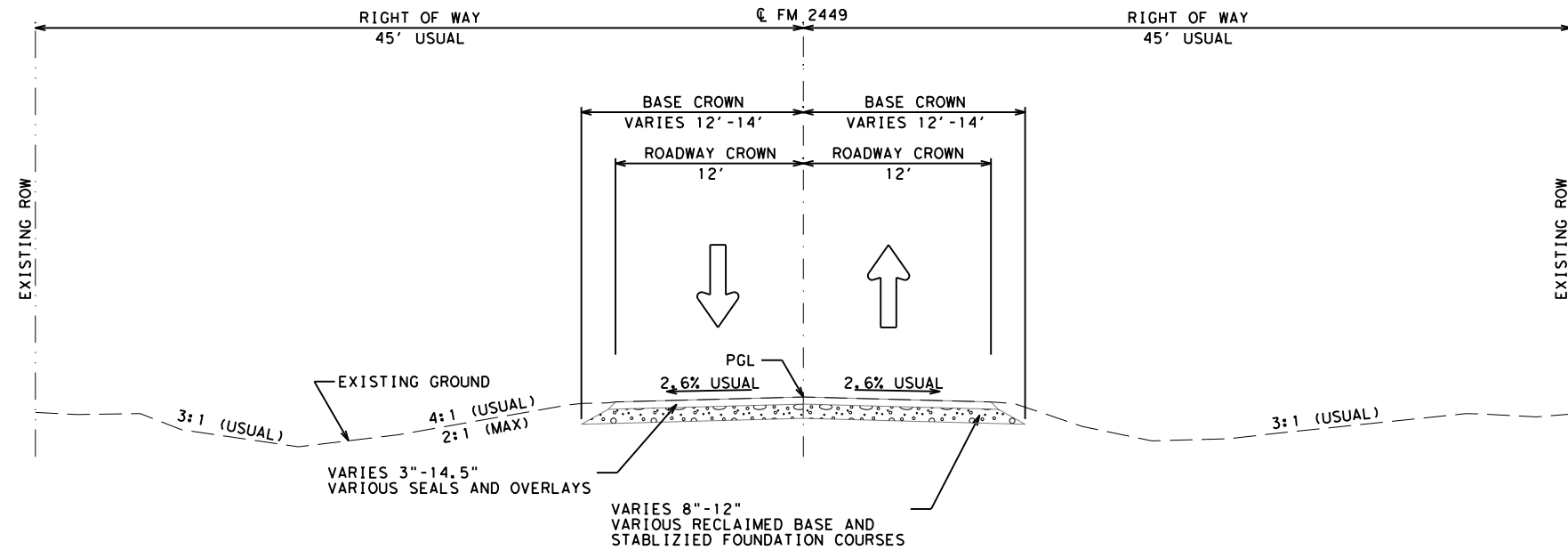
NO.	REVISIONS	BY	DATE



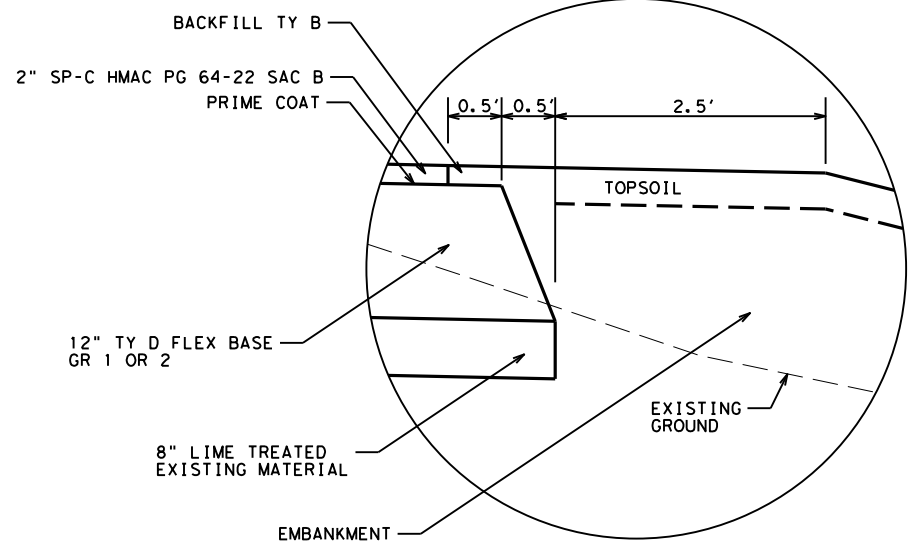
SURVEY CONTROL
SHEET 4 OF 7

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	SHEET NO.	
STATE	DISTRICT	COUNTY	5A
TEXAS	DALLAS	DENTON	
CONTROL	SECTION	JOB	HIGHWAY NO.
2352	02	023 & 024	FM 2449

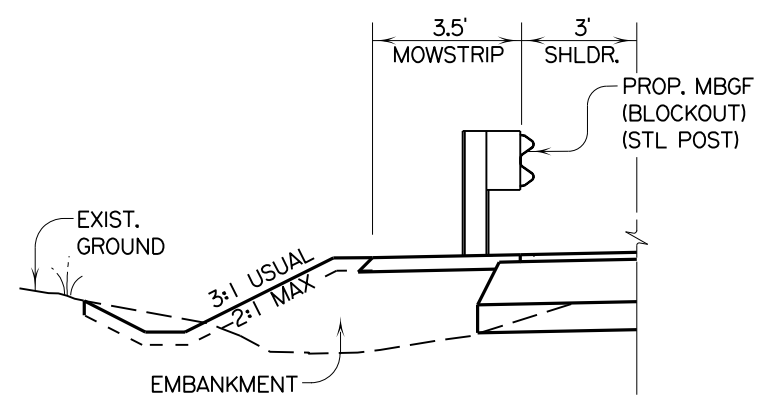
10/27/2019



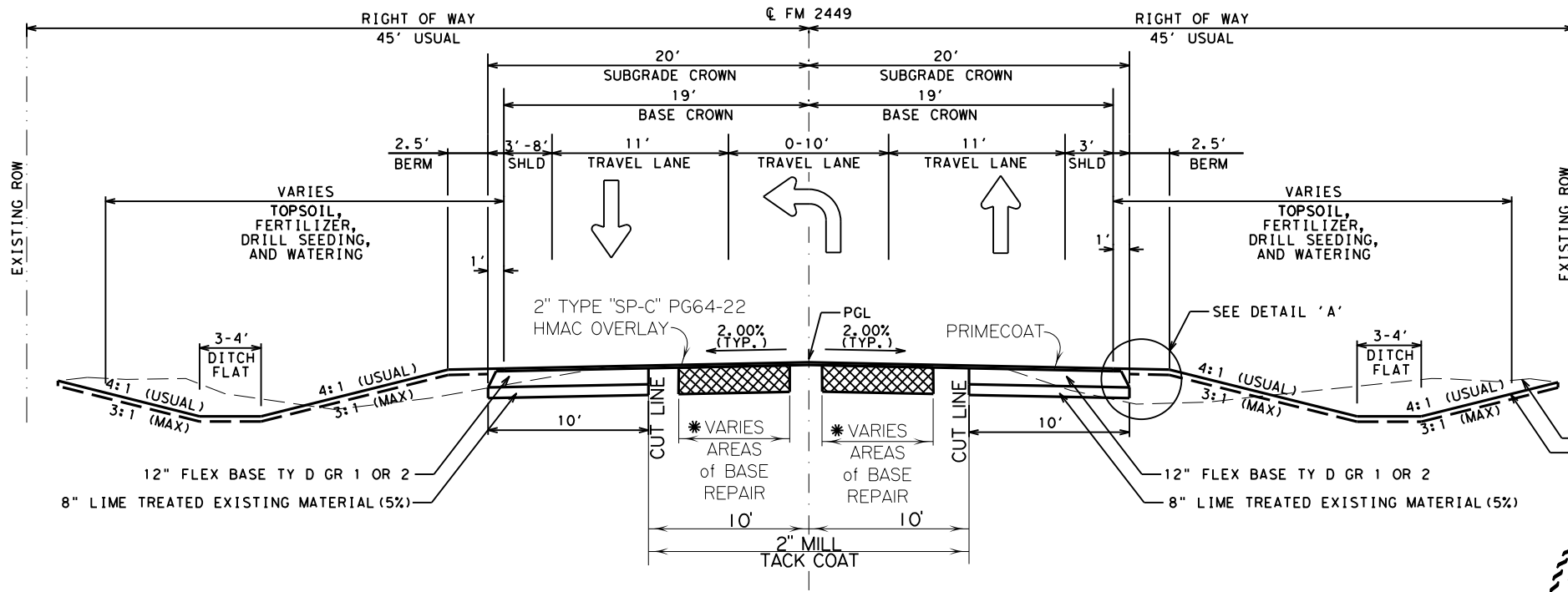
EXISTING TYPICAL SECTION
STA. 109+27 TO STA. 143+56



DETAIL 'A'



PROPOSED TYPICAL MGBF-SECTION
CULVERT 1 STA 122+51 to STA 125+59 LT
CULVERT 2 STA 131+61 to STA 132+76 RT (FM2449)
STA 122+33 to STA 126+03 RT STA 714+53 to STA 715+29 RT (FM 156)

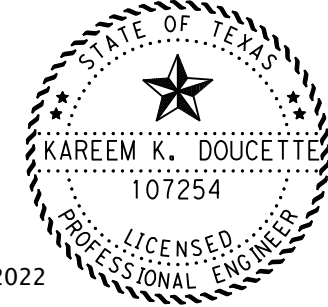


PROPOSED TYPICAL SECTION
STA. 109+28.00 TO STA. 120+54.90
STA. 125+48.00 TO STA. 126+79.76

FLEXIBLE PAVEMENT REPAIR (12" SP-B PG 64-22)

* NOTE: BASE REPAIR LOCATIONS TO BE DETERMINED BY THE ENGINEER.

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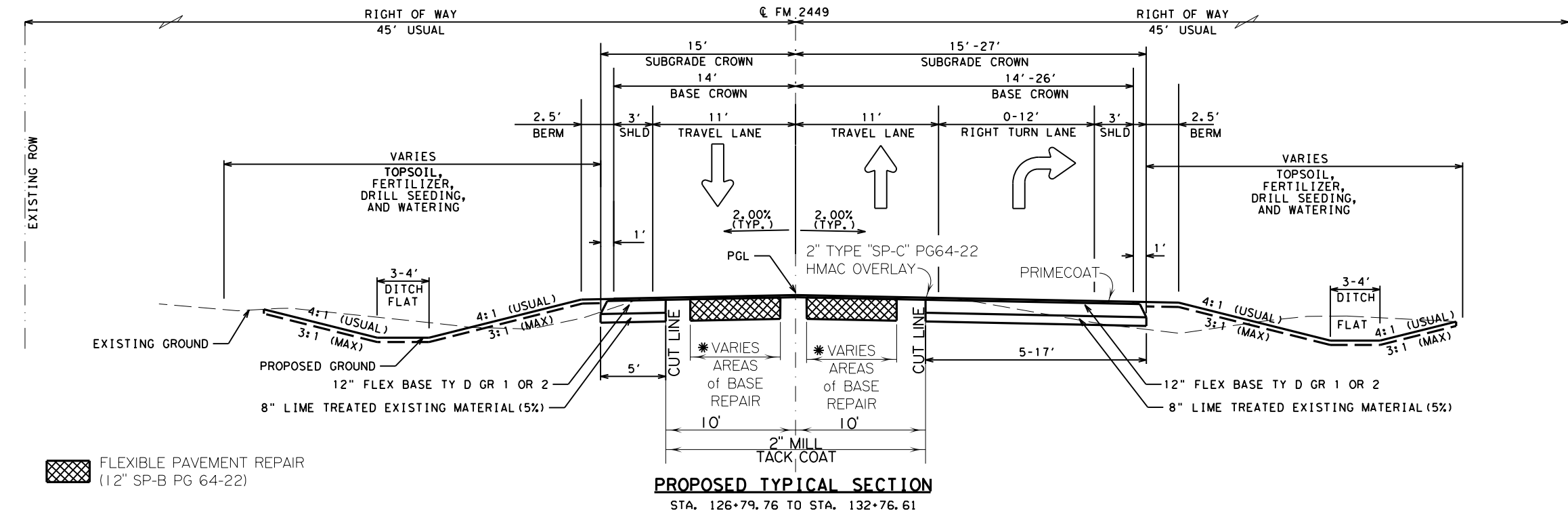
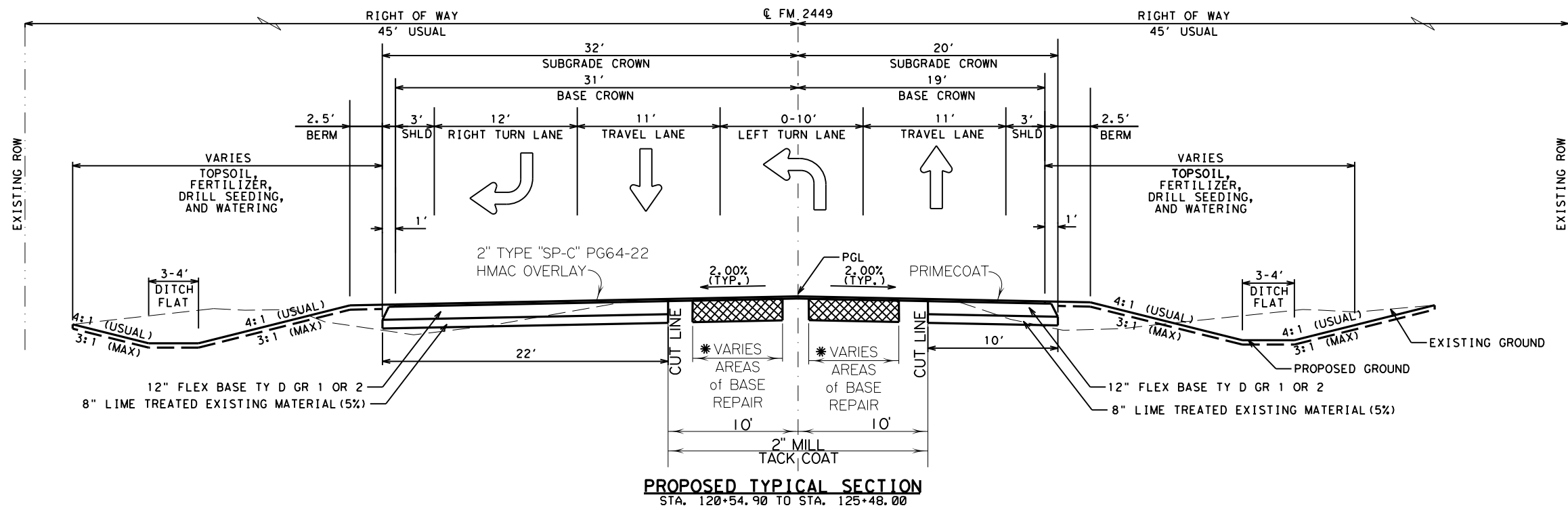


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FM 2449
TYPICAL SECTIONS

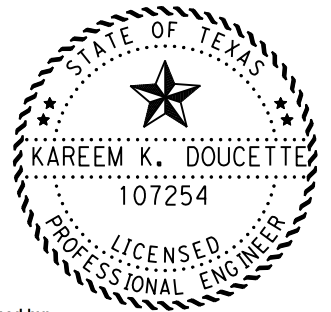
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DESIGN KKD	FED. RD. DIV. NO. 6	STATE PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
GRAPHICS KKD	STATE TEXAS	DISTRICT DAL	COUNTY DENTON	SHEET NO. 6
CHECK KKD	CONTROL 2352	SECTION 02	JOB 027	



FLEXIBLE PAVEMENT REPAIR
(12" SP-B PG 64-22)

* NOTE: BASE REPAIR LOCATIONS TO BE DETERMINED BY THE ENGINEER.



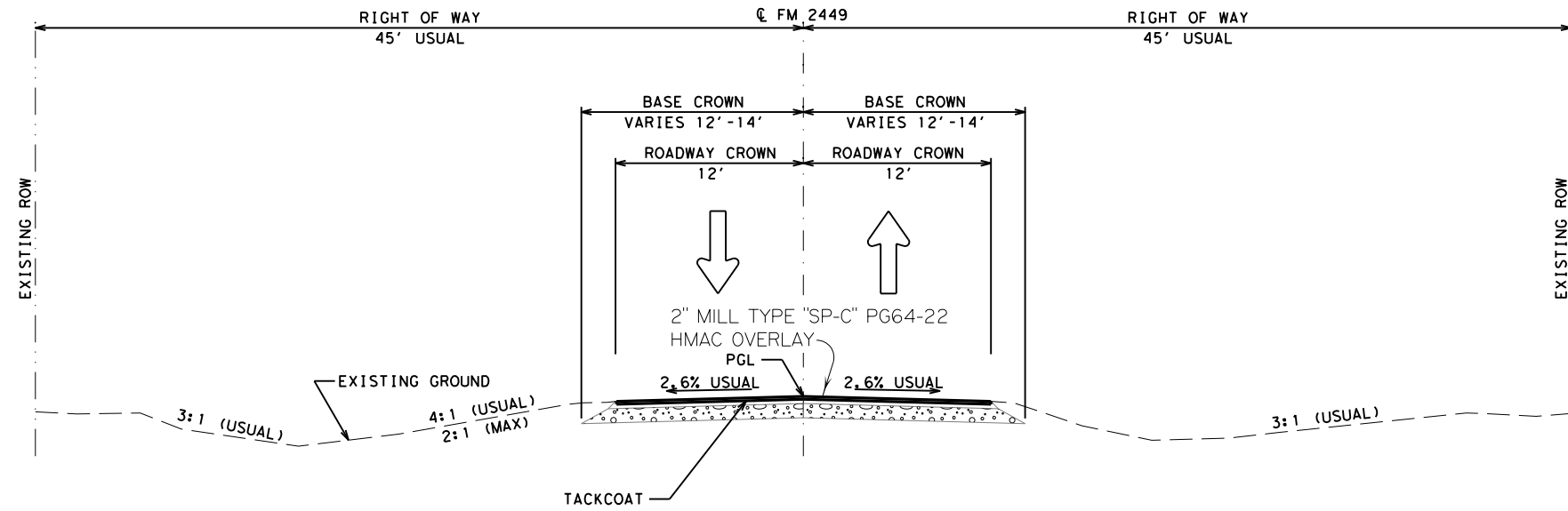
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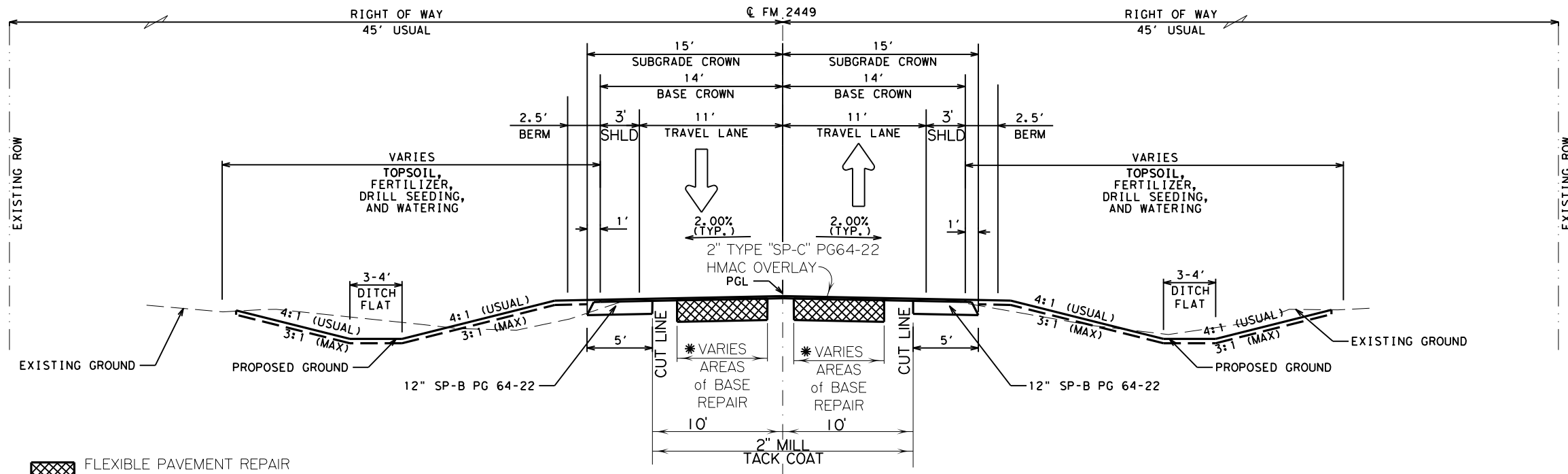
FM 2449 TYPICAL SECTIONS

SHEET 2 OF 3

DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
GRAPHICS KKD	STATE TEXAS	DISTRICT DAL	COUNTY DENTON	SHEET NO. 7
CHECK CHECK	CONTROL 2352	SECTION 02	JOB 027	



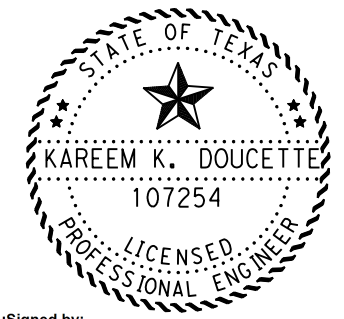
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 STA. 132+76.61 TO STA. 134+90.06
 CL STA. DOUBLE TRACK RR=134+03.29



PROPOSED TYPICAL SECTION
 STA. 134+90.06 TO STA. 143+56

FLEXIBLE PAVEMENT REPAIR
 (12" SP-B PG 64-22)

* NOTE: BASE REPAIR LOCATIONS TO BE DETERMINED BY THE ENGINEER.



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**FM 2449
 TYPICAL SECTIONS**

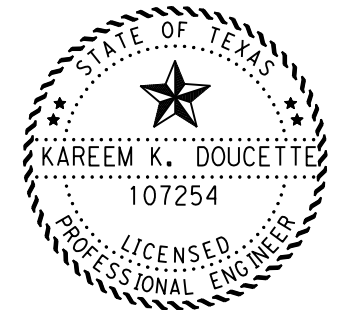
SHEET 3 OF 3

DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
GRAPHICS KKD	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DAL	DENTON	8
CHECK	CONTROL	SECTION	JOB	
	2352	02	027	



EXISTING ROADWAY INVESTIGATION
 Texas Department of Transportation
 FM 2449, from IH 35W to County Line
 CSJ: 2352-02-027
 County: Denton

Boring No.	Coordinates		Asphalt (Inches)	Flexbase (Inches)
	Latitude	Longitude		
C-21	33.179718	-97.278924	2.8	9.0
C-22	33.179691	-97.283842	13.0	10.0
C-23	33.179650	-97.288737	3.6	9.0
C-24	33.179646	-97.293650	14.5	8.0
C-25	33.179669	-97.298567	3.6	10.0
C-26	33.179646	-97.303497	10.5	12.0



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Kareem Doucette 9/20/2022
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**FM 2449
 CORE DATA**

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
KKD	6	(See Title Sheet)		FM2449
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
KKD	TEXAS	DAL	DENTON	9
CHECK	CONTROL	SECTION	JOB	
CHECK	2352	02	027	

County: Denton

Highway: FM 2449

SPECIFICATION DATA

Table 1: Soil Constants Requirements				
Item	Description	Plasticity Index		Note
		Max	Min	
132	EMBANKMENT (FINAL)(Density Control)(TY C)	40	8	1

Note 1: Material excavated from the project must meet the PI requirements when used in the top 10 feet of embankment that supports the pavement structure or other locations shown in the plans. Do not use shale and obtain approval to incorporate shaley clay produced by the construction project.

Table 2: Basis of Estimate for Permanent Construction					
Item	Description	Thickness	Rate		Quantity
162	Block Sod	N/A	See Specifications		2660 SY
164	Drill Seed (Perm) (R) (C)	N/A	See Specifications		15115 SY
166 *	Fertilizer (12-6-6)	N/A	500	Lbs./Ac	0.92 Ton
168	Vegetative Watering (Warm)**	N/A	12	MG/Ac/Day	2645 MG
260	Hydrated Lime (slurry)	8"	5	% by wt.	64.4 Ton
3077	SP MIXES	See Plans	110	Lbs./SY/In	1466 Ton
3077	Tack Coat (Undiluted Application Rate)	Milled HMA	0.11	Gal/SY	1466 Gal
*For contractor's information only **Use Summer rate for calculation, adjust for actual field conditions/temperatures as necessary. See Vegetation Establishment Plan Sheet for estimated daily rates.					
Note: (1) Base material weight based on 1.50 Ton/CY (dry- compacted) (2) Asphalt weight based on 110 Lbs./SY/In (3) Subgrade weight based on 1.5 Ton/CY (dry-compacted) (4) Item 314 Residual Asphalt 0.20 Gal/SY					

County: Denton

Highway: FM 2449

Table 3: Basis of Estimate for Temporary Erosion Control Items				
Item	Description	Rate		Quantity
164	Drill Seeding (Temp) (Warm or Cool)	See Specifications		8888 SY
166*	Fertilizer (12-6-6)	500	Lb/Ac	0.46 Ton
168	Vegetative Watering (Warm)**	12	MG/Ac/Day	1322 MG
*For Contractor's Information Only. **Use Summer rate for calculation, adjust for Actual Field Conditions/Temperatures as Necessary. See Vegetation Establishment Sheet for estimated daily rates.				

GENERAL

The construction, operation and maintenance of the proposed project will be consistent with the state implementation plan as prepared by the Texas Commission on Environmental Quality.

The disturbed area for this project, as shown on the plans is 3.67 acres. However, the Total Disturbed Area (TDA) will establish the required authorization for storm water discharges. The TDA of this project will be determined by the sum of the disturbed area in all project locations in the contract, and all disturbed area on all Project-Specific Locations (PSL) located in the project limits and/or within 1 mile of the project limits. The department will obtain an authorization to discharge storm water from the Texas Commission on Environmental Quality (TCEQ) for the construction site as shown on the plans, according to the TDA of the project. The contractor will obtain any required authorization from the TCEQ for the discharge of storm water from any PSL for construction support activities on or off of the project row according to the TDA of the project. When the TDA for the project exceeds 1 acre, provide a copy of the appropriate application of permit (NOI, or Construction Site Notice) to the engineer, for any PSL located in the project limits or within 1 mile of the project limits. Follow the directives and adhere to all requirements set forth in the TCEQ, Texas Pollution Discharge Elimination System, Construction General Permit (TPDES, CGP).

This project required permitting with environmental resources agencies as outlined in the Environmental Permits, Issues and Commitments (EPIC) Sheet. There is a high probability that an environmentally sensitive area could be encountered on the contractor designated Project-Specific Locations (PSL) for this project (haul roads, equipment staging areas, borrow pits, disposal sites, field offices, storage areas, parking areas, etc.). Item 7.6 "Project-Specific Locations", provides a listing of regulatory agencies that may need to be contacted regarding this project.

Install traffic marking signs prior to sealcoat application and remove within three days after placement of traffic markings.

County: Denton

Highway: FM 2449

Leave all right of way areas undisturbed until actual construction is to be performed in said areas.

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

Travis Campbell Travis.Campbell@txdot.gov
Christopher Rocha Christopher.Rocha@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.

Paper copies of cross-sections may be produced by using the provided .pdf file located on the above FTP Website at the bidders' expense and at copying companies. This data is for non-construction purposes only and it is the responsibility of the prospective bidder to validate the enclosed data with appropriate plans, specifications and estimate for the project(s).

Item 5:

Underground utilities owned by the Texas Department of Transportation may be present within the Right-Of-Way on this project. For signal, illumination, surveillance, and communications & control maintained by TxDOT, call the TxDOT Traffic Signal Office (214-320-6682) for locates a minimum of 48 hours in advance of excavation. For irrigation systems, call TxDOT Landscape Office (214-320-6205) for locates a minimum of 48 hours in advance of excavation. If city or town owned irrigation facilities are present, call the appropriate department of the local city or town a minimum of 48 hours in advance of excavation. The Contractor is liable for all damages when utilities are damaged due to Contractor's negligence including, but not limited to, repair or replacement at the Contractor's expense.

For the project to be deemed complete, permanently stabilize all unpaved disturbed areas of the project with a vegetative cover at a minimum of 70% density for the control of erosion.

Place construction stakes/station markings at intervals of no more than 100 feet or as directed by the Engineer. Place stakes and markings so as not to interfere with normal construction operations.

Item 7:

Repair or replace any structures and utilities that might have been damaged by negligence or a failure to have utility locates performed.

Perform all electrical work in accordance with the National Electrical Code and Texas Department of Transportation Specifications.

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Consult with appropriate electric company representatives according to their respective area to coordinate electrical services installations.

Holiday restrictions – the engineer may decide that no lane closures or construction operations shall be allowed during the restricted periods listed in the following holiday schedule. TxDOT has the right to lengthen, shorten, or otherwise modify these restricted periods as actual, or expected, traffic conditions may warrant. Working days will not be charged for these restricted periods. No additional compensation will be allowed for these closures (i.e., overhead, delays, stand-by, barricades or any other associated cost impacts).

- New Year's Eve and Day (5 am on December 31 thru 10:00 pm January 1)
- Easter Holiday weekend (5 am on Friday thru 10:00 pm Sunday)
- Memorial Day weekend (5 am on Friday thru 10:00pm Monday)
- Independence Day (5 am on July 3 thru 10:00 pm on July 5)
- Labor Day weekend (5 am on Friday thru 10:00 pm Monday)
- Thanksgiving Holiday (5 am on Wednesday thru 10:00 pm Sunday)
- Christmas Holiday (5 am on December 23 thru 10:00 pm December 26)

No significant traffic generator events identified.

Item 8:

This Project will be a Standard Workweek.

Meet weekly with the engineer to notify him or her of planned work for the upcoming week.

Provide the engineer with a daily work schedule of planned work.

Critical Path Method (CPM) schedule in P6 format will be required for this project. Submit baseline schedule and obtain approval prior to beginning construction. The Estimate will be held if monthly schedule update is not submitted.

Item 100:

Remove the existing roadway small signs, delineators and object markers as shown on the plans, or as directed, during construction within the right of way. Small sign, delineator and object marker removals are subsidiary to this Item.

The limits of preparing right of way will be measured from Sta. 109+27 to Sta. 133+48 along the centerline of construction.

Item 104:

In those areas where the pavement is not to be overlaid, provide a smooth surface after the curb removal. Planing or grinding is considered an acceptable method at these locations. Measurement and payment is in accordance with this item.

Sawing of concrete is not paid for directly, but is considered subsidiary to this item.

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Items 105 and 354:

Saw existing asphalt along neat lines where portions are to be left in place temporarily or permanently. Sawing is not paid for directly, but is subsidiary to this item.

Take possession of recycled asphalt pavement from the project and recycle the material.

Properly dispose of unsalvageable material at your own expense.

Item 110:

Excavated shale is not an acceptable material for embankment.

Items 110 and 132:

Scarify and loosen the excavated areas, unpaved surface areas, except rock, to a depth of at least 8 inches and compact in accordance with the specifications.

Excavation and embankment for driveways, sleeper slabs, alleys and intersections will not be paid for directly, but will be considered subsidiary to these items.

Item 132:

Excavated material from the project site has not been determined to be suitable for embankment. The bidder assumes all risk for the use of excavated materials for embankment and is expected to meet all material requirements for embankment regardless of the source.

Perform Tex-106-E (Plasticity Index) by an approved laboratory on excavated soils from sources outside right of way when used in roadway embankment. Provide the test results at no expense to the department. The engineer will sample and test soils produced by the construction project for specification requirements or material sources specified in the plans.

Earth embankment Type C, is mainly composed of material other than shale. Furnish material that is free from vegetation or other objectionable material and that conforms to the requirements of Table 1 (Sheet A). If necessary, treat material with lime slurry in accordance with Item 260, "Lime Treatment (Road-Mixed)" in order to meet these requirements. Use Tex-121-E, figure 1, page 4 to calculate the amount of lime required. When lime treated subgrade is specified, 3000 PPM is the maximum allowed sulfate content in the top 3 feet when material comes from borrow source. Follow recommendations of 260.4.4 for mixing and mellowing. The engineer will test material placed or excavated to a depth of one foot below and laterally to one foot outside the proposed treatment limit. Lime treatment of this material will not be paid for directly, but will be considered subsidiary to this item.

Do not use shaley clays in embankment unless approved in writing.

Item 134:

Start backfilling pavement edges as soon as possible after the surface course is started.

Backfill and compact the pavement edges to produce a smooth surface adjacent to the pavement with no vertical edges.

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Use Type "A" or "B" material to backfill pavement edges as shown in plans. Type "A" or "B" material shall consist of suitable material that when compacted will support the pavement edge. Rap is considered suitable Type "A" or "B" material.

Blade the existing vegetation into a neat wind-row prior to overlay. After placing Ty A or Ty B backfill and placing seeding, the material from the wind-row shall be replaced on the completed slopes. Emulsion shall be placed at a 50/50 solution of water to emulsion over disturbed area. Emulsion rate=0.15 Gal/SY residual. This work, materials and equipment shall be subsidiary to Item 134.

Item 160:

Sequence construction operations to salvage topsoil from one location and spread on areas ready to receive topsoil. Keep stockpiling of topsoil to a minimum.

Use fertile clay or loam from the project site not more than six inches below natural grade as topsoil.

Item 161:

Provide tickets representing quantity of compost delivered to site.

Item 247:

Construct uniform layer thickness of 12 inches, or less with the required density and moisture content. Minimum PI is equal to three (3) for all grades.

Item 260:

Furnish and distribute MS-2 smoothly and evenly at the rate of 0.20 gallons per square yard to cure lime, as directed.

Provide hydrated Lime Slurry and apply lime by slurry placement method.

Item 301:

Provide liquid antistripping agents unless otherwise directed. Add the minimum dosage determined by the manufacturer or higher dosage determined by design requirement and try subsequent trials at 0.25% increments.

Item 320:

Use a self-propelled wheel mounted MTV capable of receiving mix from the haul trucks, separate from the paver. It shall have a minimum storage capacity of approximately 25 tons. It shall be equipped with a pivoting discharge conveyor and shall completely and thoroughly remix the material prior to placement. The effectiveness of the MTV's remixing ability is subject to the approval of the Engineer. In addition, the paver shall have a surge storage insert with a minimum capacity of 20 tons.

The use of windrow pick-up equipment is allowed except on the first course of roadway material placed over the subgrade.

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Item 354:

Slope longitudinal faces greater than 1 1/4" to a minimum of 1:1 slope at the end of the work period if traffic is able to traverse the joint. Slope transverse tapers to a minimum of 36:1 at the end of the workday. Remove the taper prior to continuing the milling.

For open shoulder sections, plane the asphalt so the flow of water is not impeded at the shoulder edge or across the surface. Added planing up to three feet in width outside the lines and grades of the plans, necessary to provide proper drainage, will be subsidiary to the bid item.

Remove the loose material from the roadway before opening to traffic.

Patch pavement cut to excessive depth by equipment failure with an approved epoxy material. Re-plane patched area to an acceptable approved ride quality. Payment for these corrections is subsidiary to this item.

Item 400:

Structural Excavation is not paid for directly but is considered subsidiary to pertinent Items.

When placing concrete storm drain pipe on slopes of greater than 10 percent, provide cement stabilized backfill to a depth shown on the plans.

Item 420:

Apply an ordinary surface finish to all concrete surfaces within 30 days after form removal.

NATIONAL BRIDGE INVENTORY NUMBERS:

Provide National Bridge Inventory (NBI) numbers on all bridge structures and bridge class culverts.

Where beam types allow access to the face of abutment backwall, place NBI numbers on the face of each abutment backwall using 3" block numbers. Locate NBI numbers between the outside beams at opposite corners of the bridge.

Where beam types do not allow access to the face of abutment backwall, place NBI numbers on the face of each abutment cap using 3" block numbers. Locate NBI numbers below the outside beams at opposite corners of the bridge.

Where a bridge begins, ends or contains a bent common to multiple structures, place NBI numbers on both faces near both ends of the common bent cap. The number placed at each of the four locations will correspond to the NBI number assigned to the bridge immediately above the number. Locate NBI numbers below the outside beam. Place using 3" Block Numbers.

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For Bridge Class Culverts, place National Bridge Inventory numbers at the middle of the downstream headwall using 3" block letters.

For Bent Numbering and NBI Numbering, furnish materials that conform to the pertinent requirements of the following items:

- Stencil ink, black 11 oz., spray can (lead, CFC, and CFHC free). Black spray will be waterproof, weather resistance and dry instantly on all surfaces, without smearing, smudging or rippling and
- Die cut stencils or
- Brass stencil, 3 in., numbers and letters, adjustable interlocking stencil, set content 92 piece numbers and letters, legend height 3 in., symbol height 3 in. Stencils must be industrial grade and interlocking.

All materials, labor and incidentals associated with placing NBI numbers are subsidiary to the various bid items.

Item 421:

Furnish mix designs to the Engineer in a format compatible to the latest version of the Department's Construction Management System (Site Manager). Mix Design templates will be provided by the Engineer.

Provide sulfate resistant concrete for box culverts and all drilled shafts.

Strength evaluation using maturity testing, Tex-426-A, may be used for all concrete elements except drilled shafts and mass concrete pours.

Provide a digital hydraulic compression testing Machine and accessories. The machine shall have a minimum testing range of 2500 pounds force to 250,000 pounds force with a hydraulic switching valve to allow for rapid advancing, hold, controlled advancing and rapid retracting. The machine shall have a load cell to measure compressive forces within the testing range and shall be calibrated and verified in accordance with ASTM latest version. The Machine can meet or exceed the following when approved by the Engineer:

ELE International ACCU-TEK250 Digital Compression Tester including accessories or Forney F-250EX Standard Compression Machine including accessories or TxDOT approved equal.

Supply the Engineer with a list of certified personnel and copies of their current ACI certificates before beginning production and when personnel changes are made. Supply hard copies of calibration reports for testing equipment when required by the Engineer.

Item 464:

The concrete collars and the connections of pipes to existing or proposed concrete boxes or pipe will not be paid for directly but will be considered subsidiary to the various bid items.

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At locations where storm drains dead-end, plug with a concrete plug of a thickness equal to 1 ½ inches per foot of diameter of pipe with a minimum thickness of 3 inches. The cost of the plugs shall be included in the unit price bid per foot of the various storm drain pipes.

Item 500:

Material On Hand (MOH) will not be used in calculating partial payments for Mobilization.

Item 502:

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.

Access will be provided to all business and residences at all times. Where turning radii are limited during phased construction at intersections, provide all weather surfaces such as RAP or base in turning movements to accommodate and to protect the traffic from edge drop-offs. Materials, labor, maintenance and removal for these temporary accesses and radii will not be paid for directly but will be considered subsidiary to the various bid items.

Provide a person on the project at all times (24 hours/day, 7 days/week) to patrol, monitor, and maintain the traffic control devices and signs. The person must be knowledgeable of TxDOT Guidelines for traffic control devices and signs.

Provide written proposed lane closure information by 1:00 pm on the business day prior to the proposed closures. Do not close lanes when this requirement is not met.

When excavation is required next to a pavement lane carrying traffic and the widening is not completed by the end of the work day, backfill against the edge of the pavement with at least a 3:1 slope using an acceptable material to support vehicular traffic. Carefully remove and dispose of this material when work resumes. Backfilling pavement edges, and the materials required for the work will be subsidiary to this item.

Place barricades and signs in locations that do not obstruct the sight distance of drivers entering the highway from driveways or side streets.

Provide rectangular shape (CW12-2P) Temporary Clearance Signs on all bridges where the existing vertical clearance has changed. Install Signs to the satisfaction of the Engineer prior to opening to traffic. Plywood sign blanks will have minimum dimensions of 84" X 12". Work performed and materials are subsidiary to this item.

Do not commence work on the road before sunrise. Do not operate or park any equipment/machinery closer than 30 feet from the traveled roadway after sunset unless authorized by the engineer.

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When moving unlicensed equipment on or across any pavement or public highways, protect the pavement from all damage using an acceptable method.

Limit lane closures along FM 2449 to the hours between 9:00 am and 3:30 pm. Work in other areas of the project is not restricted to this time frame.

Item 506:

Take all practicable precautions to prevent debris from being discharged into the Waters of Texas or a designated wetland. Install Best Management Practices before demolition begins and maintain them during the demolition. Remove any debris or construction material that escapes containment devices and are discharged into the restricted areas, before the next rain event or within 24 hours of the discharge.

Provide SW3P Signs. Obtain from the Engineer a copy of the project's completed TPDES Storm Water Program Construction Site Notice and Contractor Site Notice. Laminate the sheets and bond with adhesive to 36" X 36" plywood sign blanks. Ensure the sheets remain dry. Apply Type C Blue reflective sheeting as the background and add the text "SW3P" in 5" white lettering, centered at the top. Attach the signs to approved temporary mounts and locate at each of the project limits just inside the right of way line at a readable height or as directed by the Engineer. If the sign cannot be placed outside the clear zone, it must adhere to the TMUTCD. SW3P signs, maintenance, and reposting (for replacement or as needed to ensure readability) will be subsidiary to Item 502.

Concrete Washouts are required per the CGP. The Concrete Washout Area(s) structural controls must consist of temporary berms, temporary shallow pits, and/or temporary storage tanks to prevent contaminated runoff and must be lined as to prevent contamination of underlying soil. Ensure pits properly maintained including removal of concrete as not to allow over flow. The location(s) of washout area will be approved by the Engineer. When washout pits are no longer needed, they will be removed and area will be restored to original condition. This work, materials and labor will not be measured or paid for directly but will be subsidiary to Item 506, "Temporary Erosion, Sedimentation, and Environmental Controls."

Item 530:

Provide Class "HES" concrete for concrete intersections and driveways listed or shown on the plans.

Item 540:

Furnish one type of post throughout the project except as specifically noted in the plans.

Item 585:

Use Surface Test Type A on all intersections and driveways.

Use Surface Test Type B pay adjustment schedule 3 on the travel lanes.

Item 644:

Provide two (2) sets of shop drawings for signs. The shop drawings shall conform to the details shown on the plans. The shop drawings shall show the details of the panels, wind beams, stiffeners, joint backing plates, splices, fasteners, brackets, and sign support connections. The

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shop drawings shall show letter types and sizes, interline spacing and message arrangements.

Affix a sign identification decal to the back of all signs in accordance with Item 643.

Prior to taking elevations to determine lengths for fabrication of sign posts and/or sign support towers, obtain verification of all proposed locations.

All sign mounts shall have a clamp base system for all small roadside sign assemblies.

Item 662 and 672:

Black adhesive will be used on asphalt pavements and white adhesive will be used on concrete pavements.

Item 730:

At the discretion of the Engineer, mow non-paved areas within the project prior to placement of permanent vegetation. Mow up to three (3) cycles per growing season.

Item 3077:

Use aggregate that meets the Surface Aggregate Classification (SAC) requirement of Class B.

Provide PG binder 64-22 in Type SP-C mixture.

Item 6185:

The total number of truck mounted attenuators (TMAs) or trailer attenuators (TAs) required when utilizing the traffic control standards are shown in the tables below.

TCP 2 Series	Scenario	Required TMA/TA	
(2-1)-18 / (2-2)-18	All	1	
(2-3)-18	A B	1	2

TCP 3 Series	Scenario	Required TMA/TA
(3-1)-13	All	2
(3-3)-14	A B D	2
	C	3

The contractor will be responsible for determining if one or more of these operations will be ongoing at the same time to determine the total number of TMAs/TAs needed for the project. Additional TMAs/TAs used that are not specified in the plans in which the contractor expects compensation will require prior approval from the Engineer.



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Estimate & Quantity Sheet

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PROJECT ID				A00183095			
COUNTY				Denton			
HIGHWAY				FM 2449			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	100-6002	PREPARING ROW	STA	32.100		32.100	
	104-6017	REMOVING CONC (DRIVEWAYS)	SY	867.000		867.000	
	105-6019	REMOVING STAB BASE & ASPH PAV(14")	SY	715.000		715.000	
	105-6096	REMOV STAB BASE AND ASPH PAV (0"-12")	SY	1,128.000		1,128.000	
	110-6001	EXCAVATION (ROADWAY)	CY	1,368.000		1,368.000	
	132-6006	EMBANKMENT (FINAL)(DENS CONT)(TY C)	CY	3,182.000		3,182.000	
	134-6002	BACKFILL (TY B)	STA	32.100		32.100	
	161-6017	COMPOST MANUF TOPSOIL (4")	SY	17,775.000		17,775.000	
	162-6002	BLOCK SODDING	SY	2,660.000		2,660.000	
	164-6039	DRILL SEEDING (PERM) (URBAN) (CLAY)	SY	15,115.000		15,115.000	
	164-6051	DRILL SEED (TEMP)(WARM OR COOL)	SY	8,888.000		8,888.000	
	168-6001	VEGETATIVE WATERING	MG	3,967.000		3,967.000	
	247-6313	FL BS (CMP IN PLC)(TY D GR1-2)(12")	SY	3,864.000		3,864.000	
	260-6002	LIME (HYDRATED LIME (SLURRY))	TON	64.400		64.400	
	260-6027	LIME TRT (EXST MATL)(8")	SY	3,449.000		3,449.000	
	314-6021	EMULS ASPH (PRIME)(MS-2 OR SS-1)	GAL	773.000		773.000	
	351-6008	FLEXIBLE PAVEMENT STRUCTURE REPAIR(12")	SY	450.000		450.000	
	354-6002	PLAN & TEXT ASPH CONC PAV(0" TO 2")	SY	8,888.000		8,888.000	
	403-6001	TEMPORARY SPL SHORING	SF	302.000		302.000	
	432-6001	RIPRAP (CONC)(4 IN)	CY	8.400		8.400	
	432-6026	RIPRAP (STONE COMMON)(DRY)(18 IN)	CY	60.900		60.900	
	432-6045	RIPRAP (MOW STRIP)(4 IN)	CY	56.300		56.300	
	462-6014	CONC BOX CULV (7 FT X 3 FT)	LF	90.000		90.000	
	464-6003	RC PIPE (CL III)(18 IN)	LF	413.000		413.000	
	464-6005	RC PIPE (CL III)(24 IN)	LF	407.000		407.000	
	464-6007	RC PIPE (CL III)(30 IN)	LF	143.000		143.000	
	464-6010	RC PIPE (CL III)(48 IN)	LF	68.000		68.000	
	464-6012	RC PIPE (CL III)(60 IN)	LF	60.000		60.000	
	466-6007	HEADWALL (CH - FW - 0) (DIA= 30 IN)	EA	1.000		1.000	
	466-6105	HEADWALL (CH - PW - 0) (DIA= 60 IN)	EA	2.000		2.000	
	466-6180	WINGWALL (PW - 1) (HW=5 FT)	EA	2.000		2.000	
	467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	16.000		16.000	
	467-6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)	EA	14.000		14.000	
	467-6423	SET (TY II) (30 IN) (RCP) (6: 1) (P)	EA	10.000		10.000	
	467-6480	SET (TY II) (48 IN) (RCP) (6: 1) (P)	EA	4.000		4.000	
	480-6001	CLEAN EXIST CULVERTS	EA	10.000		10.000	
	496-6004	REMOV STR (SET)	EA	48.000		48.000	

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COUNTY Denton

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PROJECT ID				A00183095			
COUNTY				Denton			
HIGHWAY				FM 2449			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	496-6005	REMOV STR (WINGWALL)	EA	4.000		4.000	
	496-6007	REMOV STR (PIPE)	LF	1,001.000		1,001.000	
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	7.000		7.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	165.000		165.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	165.000		165.000	
	506-6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	253.000		253.000	
	506-6024	CONSTRUCTION EXITS (REMOVE)	SY	253.000		253.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	242.000		242.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	242.000		242.000	
	506-6041	BIODEG EROSN CONT LOGS (IN STL) (12")	LF	643.000		643.000	
	506-6043	BIODEG EROSN CONT LOGS (REMOVE)	LF	643.000		643.000	
	530-6001	INTERSECTIONS (CONC)	SY	276.000		276.000	
	530-6002	INTERSECTIONS (ACP)	SY	371.000		371.000	
	530-6005	DRIVEWAYS (ACP)	SY	515.000		515.000	
	530-6017	DRIVEWAYS (CONC) (HES)	SY	833.000		833.000	
	533-6003	RUMBLE STRIPS (SHOULDER) ASPHALT	LF	4,370.000		4,370.000	
	533-6004	RUMBLE STRIPS (CENTERLINE) ASPHALT	LF	2,185.000		2,185.000	
	540-6002	MTL W-BEAM GD FEN (STEEL POST)	LF	330.000		330.000	
	542-6001	REMOVE METAL BEAM GUARD FENCE	LF	250.000		250.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	6.000		6.000	
	544-6003	GUARDRAIL END TREATMENT (REMOVE)	EA	4.000		4.000	
	560-6011	MAILBOX INSTALL-S (TWW-POST) TY 4	EA	2.000		2.000	
	636-6001	ALUMINUM SIGNS (TY A)	SF	28.500		28.500	
	644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	13.000		13.000	
	644-6004	IN SM RD SN SUP&AM TY10BWG(1)SA(T)	EA	1.000		1.000	
	644-6007	IN SM RD SN SUP&AM TY10BWG(1)SA(U)	EA	2.000		2.000	
	644-6036	IN SM RD SN SUP&AM TYS80(1)SA(U-BM)	EA	2.000		2.000	
	658-6061	IN STL DEL ASSM (D-SW)SZ 1(BRF)GF2	EA	16.000		16.000	
	658-6099	IN STL OM ASSM (OM-2Z)(WFLX)GND	EA	7.000		7.000	
	662-6004	WK ZN PAV MRK NON-REMOV (W)4"(SLD)	LF	10,580.000		10,580.000	
	662-6016	WK ZN PAV MRK NON-REMOV (W)24"(SLD)	LF	40.000		40.000	
	662-6034	WK ZN PAV MRK NON-REMOV (Y)4"(SLD)	LF	7,775.000		7,775.000	
	662-6111	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	EA	265.000		265.000	
	666-6054	REFL PAV MRK TY I (W)(ARROW)(100MIL)	EA	6.000		6.000	
	666-6078	REFL PAV MRK TY I (W)(WORD)(100MIL)	EA	6.000		6.000	
	666-6093	REFL PAV MRK TY I (W)(RR XING)(100MIL)	EA	2.000		2.000	

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COUNTY Denton

CONTROL SECTION JOB				2352-02-027		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00183095			
COUNTY				Denton			
HIGHWAY				FM 2449			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	666-6178	REFL PAV MRK TY II (W) 8" (SLD)	LF	1,255.000		1,255.000	
	666-6182	REFL PAV MRK TY II (W) 24" (SLD)	LF	110.000		110.000	
	666-6303	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	LF	10,580.000		10,580.000	
	666-6315	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	LF	7,775.000		7,775.000	
	672-6007	REFL PAV MRKR TY I-C	EA	32.000		32.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	195.000		195.000	
	685-6005	RELOCT RDSO FLSH BCN AM (SOLAR PWRD)	EA	2.000		2.000	
	730-6003	SPOT MOWING	AC	3.000		3.000	
	3077-6013	SP MIXESSP-CSAC-B PG64-22	TON	1,466.000		1,466.000	
	3077-6075	TACK COAT	GAL	1,244.000		1,244.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN	EA	4.000		4.000	
	6185-6002	TMA (STATIONARY)	DAY	90.000		90.000	
	6185-6005	TMA (MOBILE OPERATION)	DAY	10.000		10.000	
	08	CONTRACTOR FORCE ACCOUNT SAFETY CONTINGENCY (NON-PARTICIPATING)	LS	1.000		1.000	
		CONTRACTOR FORCE ACCOUNT EROSION CONTROL MAINTENANCE (NON-PARTICIPATING)	LS	1.000		1.000	

SUMMARY OF DRAINAGE ITEMS

LOCATION	432 6001	432 6026	462 6014	464 6007	464 6012	466 6007	466 6105	466 6180	480 6001	496 6004	496 6005
	RIPRAP (CONC)(4 IN)	RIPRAP (STONE COMMON)(DRY)(18 IN)	CONC BOX CULV (7 FT X 3 FT)	RC PIPE (CL III)(30 IN)	RC PIPE (CL III)(60 IN)	HEADWALL (CH - FW - 0) (DIA 30 IN)	HEADWALL (CH - PW - 0) (DIA 60 IN)	WINGWALL (PW - 1) (HW=5 FT)	CLEAN EXIST CULVERTS	REMOV STR (SET)	REMOV STR (WINGWAL L)
	CY	CY	LF	LF	LF	EA	EA	EA	EA	EA	EA
Culvert 1	8.4	15.4	90					2	3		2
Culvert 2				32		1			4	4	
Culvert 3		45.5			60		2		3		2
PROJECT TOTALS	8.4	60.9	90	32	60	1	2	2	10	4	4

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**FM 2449
DRAINAGE SUMMARY**

DESIGN KKD	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM 2449
GRAPHICS KKD	STATE TEXAS	DISTRICT DALLAS	COUNTY DENTON	SHEET NO. 14
CHECK KKD	CONTROL 2352	SECTION 02	JOB 027	
CHECK TC				

SUMMARY OF ROADWAY ITEMS

LOCATION	100 6002	105 6019	110 6001	132 6006	134 6004	247 6313	260 6002	260 6027	314 6021	351 6008	354 6002	403 6001
	PREPARING ROW	REMOVING STAB BASE & ASPH PAV(14")	EXCAVATION (ROADWAY)	EMBANKMENT (FINAL) (DENS CONT)(TY C)	BACKFILL (TY A OR B)	FL BS (CMP IN PLC)(TY D GR1-2)(1 2")	LIME (HYDRATED LIME (SLURRY))	LIME TRT (EXST MATL)(8")	EMULS ASPH (PRIME)(MS-2 OR SS-1)	FLEXIBLE PAVEMENT STRUCTURE REPAIR(1 2")	PLAN & TEXT ASPH CONC PAV(0" TO 2")	TEMPORARY SPL SHORING
	STA	SY	CY	CY	STA	SY	TON	SY	GAL	SY	SY	SF
FM 2449	32.1	715	1368	3182	32.1	3864	64.4	3449	773	450	8888	302
PROJECT TOTALS	32.1	715	1368	3182	32.1	3864	64.4	3449	773	450	8888	302

SUMMARY OF ROADWAY ITEMS CONTINUES

LOCATION	432 6045	533 6003	533 6004	540 6002	542 6001	544 6001	544 6003	560 6011	730 6003	3077 6013	3077 6075
	RIPRAP (MOW STRIP)(4 IN)	RUMBLE STRIPS (SHOULDER) ASPHALT	RUMBLE STRIPS (CENTERLINE) ASPHALT	MTL W-BEAM GD FEN (STEEL POST)	REMOVE METAL BEAM GUARD FENCE	GUARDRAIL END TREATMENT (INSTALL)	GUARDRAIL END TREATMENT (REMOVE)	MAILBOX INSTALL-S (TWW-POST) TY 4	SPOT MOWING	SP MIXES SP-C SAC-B PG64-22	TACK COAT
	CY	LF	LF	LF	LF	EA	EA	EA	AC	TON	GAL
FM 2449	56.3	4370	2185	330	250	6	4	2	3	1466	1244
PROJECT TOTALS	56.3	4370	2185	330	250	6	4	2	3	1466	1244

DATE: 9/19/2022 FILE NAME: T:\DENDES\Projects\FM2449\2352-02-027 Ponder 15D\PLANS\06 ESTIMATE\SUMMARY SHEET.dgn



**FM 2449
ROADWAY SUMMARY**

DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
KKD	6	(See Title Sheet)		FM 2449
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
KKD	TEXAS	DALLAS	DENTON	15
CHECK	CONTROL	SECTION	JOB	
TC	2352	02	023, ETC.	

SUMMARY OF PAVEMENT MARKING ITEMS

LOCATION	636 6001	644 6001	644 6004	644 6007	644 6036	658 6061	658 6099	666 6054	666 6078	666 6093	666 6178	666 6182
	ALUMINUM SIGNS (TY A)	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	IN SM RD SN SUP&AM TY10BWG(1)SA(T)	IN SM RD SN SUP&AM TY10BWG(1)SA(U)	IN SM RD SN SUP&AM TYS80(1) SA(U-BM)	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2	INSTL OM ASSM (OM-2Z)(WFLX)GND	REFL PAV MRK TY I (W)(ARRO W)(100MIL)	REFL PAV MRK TY I (W)(WORD) (100MIL)	REFL PAV MRK TY I (W)(RR XING)(10 0MIL)	REFL PAV MRK TY II (W) 8" (SLD)	REFL PAV MRK TY II (W) 24" (SLD)
	SF	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF	LF
FM 2449	28.5	13	1	2	2	16	7	6	6	2	1255	110
PROJECT TOTALS	28.5	13	1	2	2	16	7	6	6	2	1255	110

SUMMARY OF PAVEMENT MARKING ITEMS

LOCATION	666 6303	666 6315	672 6007	672 6009	*685 6005
	RE PM W/RET REQ TY I (W)4"(SLD)(I 00MIL)	RE PM W/RET REQ TY I (Y)4"(SLD)(I 00MIL)	REFL PAV MRKR TY I-C	REFL PAV MRKR TY II-A-A	RELOCT RDSD FLSH BCN AM (SOLAR PWRD)
	LF	LF	EA	EA	EA
FM 2449	10580	7775	32	195	2
PROJECT TOTALS	10580	7775	32	195	2

*NOTE: DRILL SHAFT FOUNDATION; SEE STANDARD TS- FD-12 FOR MORE INFORMATION; THIS WORK WILL BE SUBSIDIARY TO THIS ITEM

SUMMARY OF WORKZONE TRAFFIC CONTROL ITEMS

LOCATION	662 6004	662 6016	662 6034	662 6111	6001 6002	6185 6002	6185 6005
	WK ZN PAV MRK NON-REMOV (W)4"(SL D)	WK ZN PAV MRK NON-REMOV (W)24"(S LD)	WK ZN PAV MRK NON-REMOV (Y)4"(SL D)	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	PORTABLE CHANGEAB LE MESSAGE SIGN	TMA (STATION ARY)	TMA (MOBILE OPERATIO N)
	LF	LF	LF	EA	EA	DAY	DAY
	10580	40	7775	265	4	90	10
PROJECT TOTALS	10580	40	7775	265	4	90	10



**FM 2449
PAVEMENT MARKING SMALL SIGN
&
WORK ZONE TRAFFIC CONTROL
SUMMARY**


DESIGN KKD	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
GRAPHICS KKD	6	(See Title Sheet)		FM 2449
CHECK KKD	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK TC	TEXAS	DALLAS	DENTON	16
	CONTROL	SECTION	JOB	
	2352	02	023, ETC.	

SUMMARY OF EROSION CONTROL ITEMS

LOCATION	161 6017	162 6002	164 6035	164 6051	168 6001	506 6002	506 6011	506 6020	506 6024	506 6038	506 6039	506 6041	506 6043
	COMPOST MANUF TOPSOIL (4")	BLOCK SODDING	DRILL SEEDING (PERM) (RURAL) (CLAY)	DRILL SEED (TEMP)(W ARM OR COOL)	VEGETATIV E WATERING	ROCK FILTER DAMS (INSTALL) (TY 2)	ROCK FILTER DAMS (REMOVE)	CONSTRUCT ION EXITS (INSTALL) (TY 1)	CONSTRUCT ION EXITS (REMOVE)	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)	BIODEG EROSN CONT LOGS (INSTL) (12")	BIODEG EROSN CONT LOGS (REMOVE)
	SY	SY	SY	SY	MG	LF	LF	SY	SY	LF	LF	LF	LF
FM 2449	17775	2660	15115	8888	3967	165	165	230	230	220	220	585	585
ADDITIONAL 10%								23	23	22	22	58	58
PROJECT TOTALS	17775	2660	15115	8888	3967	165	165	253	253	242	242	643	643

ADDITIONAL QUANTITIES OF PERISHABLE BMP'S INCLUDED TO ALLOW FOR PERIODIC REPLACEMENT DUE TO NORMAL WEAR AND CHANGING SITE CONDITIONS.

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**FM 2449
EROSION CONTROL
SUMMARY**

DESIGN KKD	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
GRAPHICS KKD	6	(See Title Sheet)		FM 2449
CHECK KKD	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK TC	TEXAS	DALLAS	DENTON	17
	CONTROL	SECTION	JOB	
	2352	02	023, ETC.	

DATE: 9/19/2022 FILE NAME: T:\DENDES\Projects\FM2449\2352-02-027 Ponder 15D\PLANS\06 ESTIMATE\SUMMARY SHEET.dgn

DRIVEWAY/ INTERSECTION NO. CSJ# 2352-02-027	THROAT WIDTH	RADII	104 6017 REMOVING CONC (DRIVEWAYS)	105 6096 REMOV STAB BASE AND ASPH PAV (0" -12")	464 6003 RC PIPE (CL III)(18 IN)	464 6005 RC PIPE (CL III)(24 IN)	464 6007 RC PIPE (CL III)(30 IN)	464 6010 RC PIPE (CL III)(48 IN)	467 6363 SET (TY II)(18 IN)(RCP) (6: 1)(P)	467 6395 SET (TY II)(24 IN)(RCP) (6: 1)(P)	467 6423 SET (TY II)(30IN)(RCP)(6: 1)(P)	467 6480 SET (TY II)(48IN)(RCP)(6: 1)(P)	496 6004 REMOVE STRUC (SET)	496 6007 REMOVE STRUC (PIPE)	530 6001 INTERSECTI ON (CONC)	530 6002 INTERSECTI ON (ACP)	530 6005 DRIVEWA Y (ACP)	530 6017 DRIVEWAY (CONC) (HES)
	FT	FT	SY	SY	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	SY	SY	SY	SY
1	16.0	15, 25		82													82	
2	40.0	20	137		80				2				2	80				137
3, CLAIRMONT DR	36.0	20	141			78				2			2	78	141			
4	24.0	20	100		96				4				4	96				100
5, LAKEWOOD LN	37.0	20	135			65				2			2	65	135			
6	12.0	15		45	22				2				2	22			45	
7	17.0	15, 20		87		34				2			2	34			87	
8, SHAFFNER ST	19.0	30, 35		141		112				4			4	112		141		
9	24.0	20	115				111				6		6	111				115
10	25.0	15		96		78				4			4	78				96
11	30.0	20		166	50				2				2	50			166	
12	10.5	20		79	25				2				2	25			79	
13	60.0	20	239		90				2				2	92				239
14, FREDRICK ST	17.0	20, 15		83				68				4	4	68		83		
15	36.0	20		146	50				2				2	50				146
16	10.3	20		56		40					4		4	40			56	
17	37.4	20		147												147		
PROJECT TOTAL			867	1128	413	407	111	68	16	14	10	4	44	1001	276	371	515	833



**FM 2449
DRIVEWAY/INTERSECTION
SUMMARY**

DESIGN KKD	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM 2449
GRAPHICS KKD	STATE TEXAS	DISTRICT DALLAS	COUNTY DENTON	SHEET NO.
CHECK KKD	CONTROL TC	SECTION 2352	JOB 02	18
CHECK TC			023, ETC.	

DATE: 9/19/2022 FILE NAME: T:\DENDES\Projects\FM2449\2352-02-027 Ponder 15D\PLANS\06 ESTIMATE\SUMMARY SHEET.dgn

EARTHWORK SUMMARY		
STATION	132	110
	6006	6001
	EMBANKMENT	EXCAVATION
	CY	CY
109+50	15	12
110+00	20	25
110+50	11	25
111+00	26	25
111+50	45	25
112+00	51	25
112+50	57	25
113+00	64	25
113+50	73	25
114+00	83	24
114+50	90	24
115+00	91	24
115+50	85	24
116+00	75	23
116+50	57	23
117+00	32	25
117+50	33	24
118+00	44	24
118+50	42	25
119+00	37	25
119+50	34	25
120+00	40	25
120+50	32	25
121+00	15	29
121+50	24	36
122+00	36	38
122+50	36	38
123+00	46	38
123+50	49	38
124+00	58	33
124+50	125	22
125+00	116	27
125+50	63	35
126+00	67	28
126+50	63	24
127+00	53	20
127+50	44	16
128+00	60	16
128+50	42	16
129+00	44	16
129+50	88	19
130+00	97	21
130+50	97	21
131+00	90	21
131+50	83	21

EARTHWORK SUMMARY		
STATION	132	110
	6006	6001
	EMBANKMENT	EXCAVATION
	CY	CY
132+00	84	22
132+50	93	23
133+00	0	0
133+50	0	0
134+00	0	0
134+50	0	0
135+00	17	11
135+50	23	11
136+00	27	11
136+50	25	11
137+00	19	11
137+50	22	11
138+00	48	11
138+50	72	11
139+00	59	11
139+50	25	11
140+00	9	11
140+50	8	11
141+00	12	11
141+50	16	11
142+00	19	11
142+50	23	11
143+00	22	11
143+50	26	11
TOTAL	3182	1368



FM 2449 EARTHWORK SUMMARY

DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
KKD	6	(See Title Sheet)		FM 2449
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
KKD	TEXAS	DALLAS	DENTON	19
CHECK	CONTROL	SECTION	JOB	
TC	2352	02	023, ETC.	

SUGGESTED SEQUENCE OF WORK

PHASE I

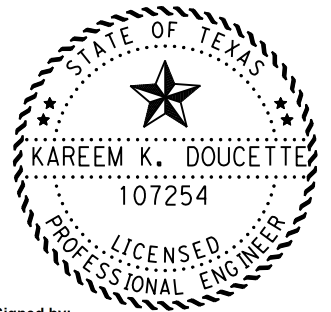
1. ERECT PROJECT SIGNS & ADVANCE WARNING SIGNS AS SPECIFIED IN BC STANDARDS, AND AS DIRECTED BY THE ENGINEER.
2. PLACE SW3P DEVICES PER LAYOUTS AND STANDARD OR AS DIRECTED BY THE ENGINEER, BUT NOT SOONER THAN TWO WEEKS PRIOR TO SOIL DISTURBANCE OR POTENTIAL POLLUTANT-GENERATING ACTIVITIES IN THEIR CONTROLLED AREAS.
3. CONSTRUCT CULVERT EXTENSION/HEADWALLS IN ACCORDANCE WITH TCP(2-2)-18 AND BC(10)-21.
4. PREPARE EDGE ALONG THE EDGE OF SHOULDER AS SHOWN ON TYPICAL SECTIONS.

PHASE II ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH TCP(2-2)-18
 BEGIN PROPOSED WIDENING PHASE II LEFT OF CENTERLINE.
 REPEAT PROPOSED WIDENING PHASE II RIGHT OF CENTERLINE.

1. DELINEATE PAVEMENT EDGE WITH VERTICAL PANELS. SALVAGE EXISTING TOPSOIL FROM WORK AREA.
2. EXCAVATE AND HAUL SUBGRADE AND EMBANKMENT AS PER THE DEPTH ACCORDING TO EACH CROSS SECTION.
3. LIME TREAT SUBGRADE ACCORDING TO TYPICAL SECTION.
4. PLACE NEW BASE ACCORDING TO TYPICAL SECTION.

PHASE III

1. MILL 2 INCHES AS SHOWN ON TYPICAL SECTION.
2. CONSTRUCT FLEXIBLE PAVEMENT REPAIR AREA AS DIRECTED BY THE ENGINEER.
3. RECONSTRUCT DRIVEWAYS AND INTERSECTIONS.
4. PLACE PRIME/TACKCOAT AND FINAL SURFACE TREATMENT 2" SP-C, PG64-22, SAC-B.
5. RE-GRADE DITCHES AND BACK FILL PAVEMENT EDGES.
6. ERECT PERMANENT SIGNS AND PLACE PERMANENT PAVEMENT MARKINGS.
7. ESTABLISH PERMANENT VEGETATION.
8. REMOVE SW3P DEVICES ONCE FINAL STABILIZATION HAS BEEN ACHIEVED IN THEIR CONTROLLED AREAS AND AS AUTHORIZED OR DIRECTED BY ENGINEER.
9. PERFORM FINAL SITE CLEAN UP AS DIRECTED BY THE ENGINEER AND REMOVE PROJECT LIMIT/ADVANCE WARNING SIGNS.



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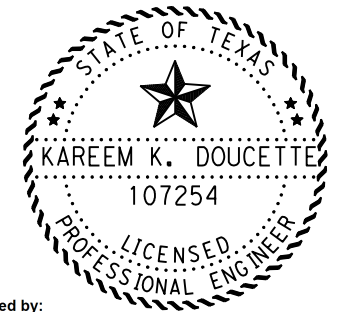
**FM 2449
 TCP
 SEQUENCE OF WORK**

SHEET 1 OF 2

DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
GRAPHICS KKD	STATE TEXAS	DISTRICT DAL	COUNTY DENTON	SHEET NO. 20
CHECK	CONTROL 2352	SECTION 02	JOB 027	

TCP GENERAL NOTES

1. SUBMIT FOR APPROVAL A TRAFFIC CONTROL PLAN (TCP), FOLLOWING THE SUGGESTED SEQUENCE OF WORK, OUTLINING IN DETAIL THE METHOD OF HANDLING TRAFFIC WITHIN AND ADJACENT TO THE WORK ZONE BEFORE BEGINNING WORK ON THE PROJECT.
2. OVERNIGHT LANE CLOSURES WILL NOT BE PERMITTED.
3. THE CONTRACTOR WILL PROVIDE WRITTEN NOTICE TO THE ENGINEER BEFORE 1:00 PM ON THE BUSINESS DAY PRECEDING PROPOSED LANE CLOSURES. LANE CLOSURES WILL NOT BE PERMITTED WITHOUT THIS NOTIFICATION.
4. THE CONTRACTOR WILL PROVIDE AND MAINTAIN SKILLED FLAGGERS EQUIPPED WITH TWO-WAY RADIOS TO HANDLE TRAFFIC THROUGH THE WORK AREAS FOR THE SAFETY AND CONVENIENCE OF THE TRAVELING PUBLIC AND CONTRACTOR PERSONNEL. PAY ATTENTION FOR OVERHEAD UTILITIES. AT THE END OF EACH WORKDAY, ALL PAVEMENT EDGE DROP-OFFS SHALL BE BACK FILLED BY A SUITABLE MATERIAL TO FORM A STABLE 3:1 SLOPE OR FLATTER AND SUBSIDIARY TO VARIOUS BID ITEMS. PAVEMENT EDGE DROP-OFFS WILL NOT BE ALLOWED TO REMAIN.
5. COMPLY WITH TCP (7-1)-13, WHICH INCLUDES PROVISIONS FOR CERTAIN SIGNS TO BE INSTALLED AND TO REMAIN UNTIL PERMANENT PAVEMENT MARKINGS ARE IN PLACE. THESE SIGNS ARE IN ADDITION TO SIGNS THAT MAY BE REQUIRED BY THE VARIOUS TCP AND BC STANDARDS.
6. MAINTAIN DRIVEWAY AND SIDE STREET ACCESS AT ALL TIMES WITH AN ALL WEATHER SURFACE CONSISTING OF RAP OR BASE. WORK PERFORM WILL BE SUBSIDIARY TO VARIOUS BID ITEMS.
7. MAINTAIN POSITIVE DRAINAGE DURING CONSTRUCTION.
8. TEMPORARY SW3P EROSION CONTROL MEASURES SHALL ONLY BE PLACED IN AREAS WHERE SOIL DISTURBANCE IS EXPECTED TO OCCUR WITHIN TWO WEEKS.
9. TEMPORARY SW3P EROSION CONTROL MEASURES SHALL BE REMOVED IN EACH AREA WITHIN TWO WEEKS OF VEGETATION ESTABLISHMENT OR AS APPROVED BY THE ENGINEER.
10. ALL TCP DEVICES AND SIGNS SHOWN ON TCP PLANS ARE CONSIDERED MINIMUM, ADDITIONAL DEVICES AND SIGNS MAY BE NECESSARY AND SUBSIDIARY TO ITEM 502.
11. ALL TRAFFIC CONTROL SHALL CONFORM TO THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, ALL APPLICABLE TXDOT STANDARDS AND AS DIRECTED BY THE ENGINEER.

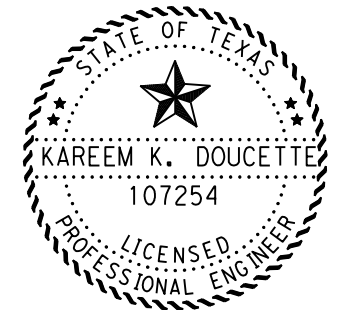
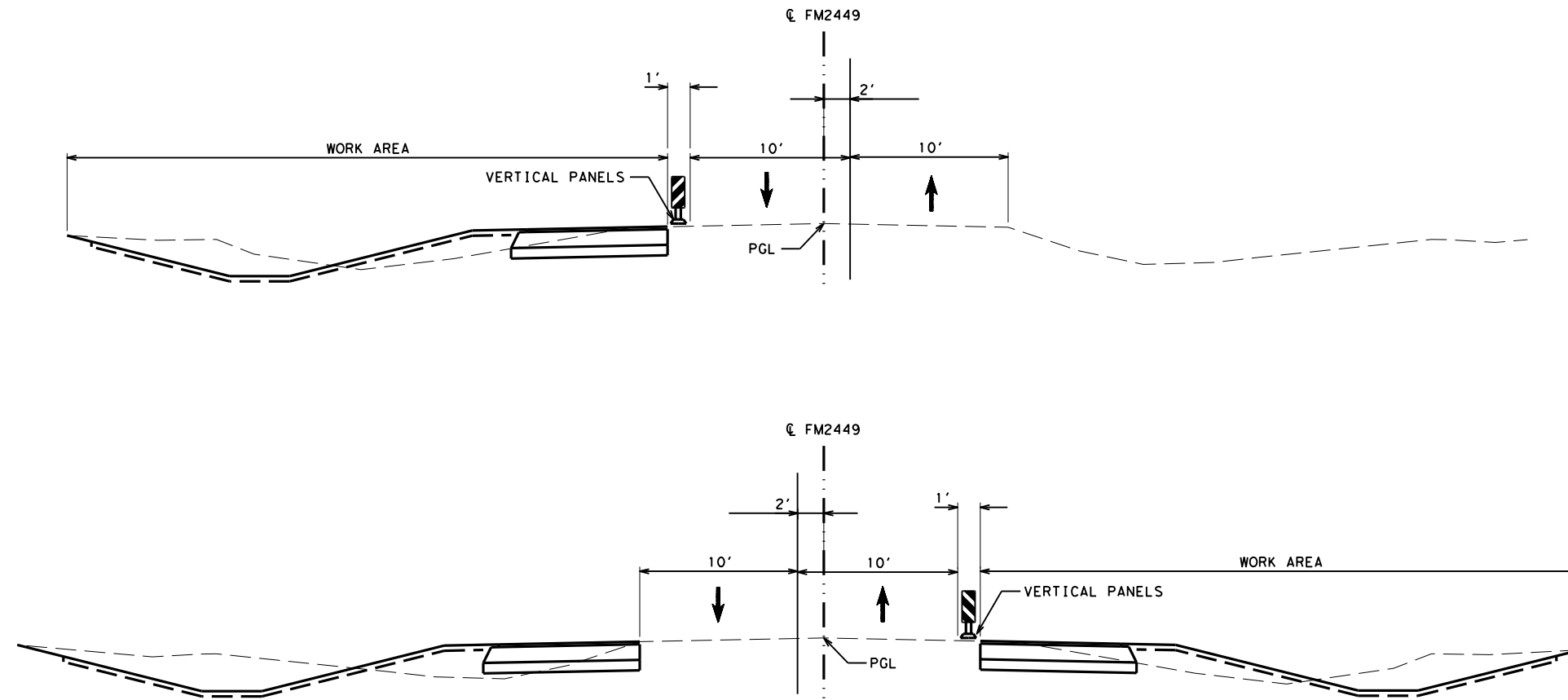


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**FM 2449
 TCP
 SEQUENCE OF WORK**

DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
GRAPHICS KKD	STATE TEXAS	DISTRICT DAL	COUNTY DENTON	SHEET NO. 21
CHECK	CONTROL 2352	SECTION 02	JOB 027	

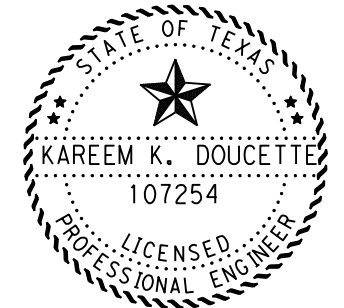
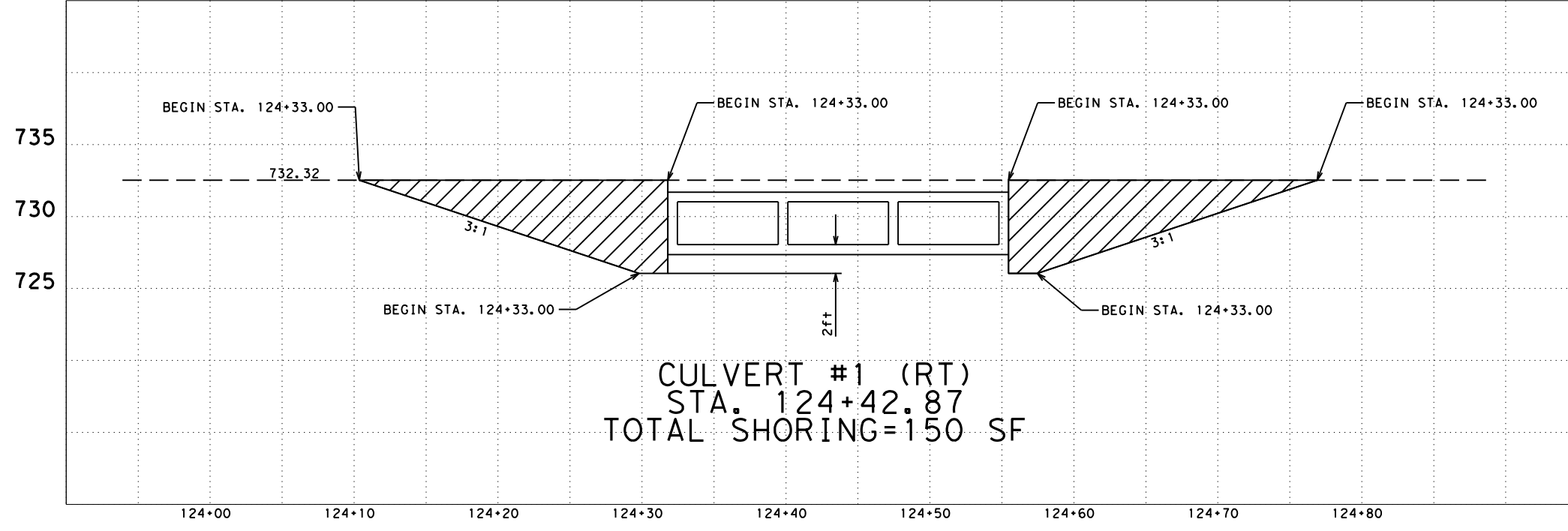
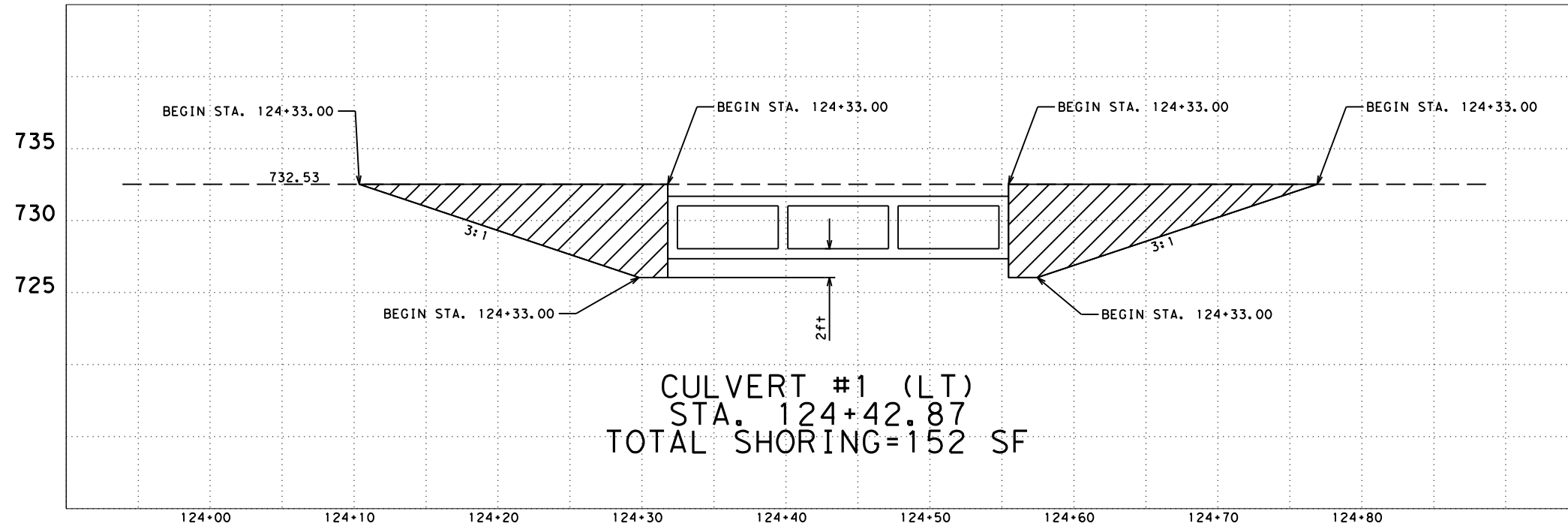


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FM 2449
TCP
 TYPICAL SECTIONS

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
KKD	6	(See Title Sheet)		FM2449
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
KKD	TEXAS	DAL	DENTON	22
CHECK	CONTROL	SECTION	JOB	
CHECK	2352	02	027	



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FM 2449
TEMPORARY
SPECIAL SHORING
CULVERT #1

SCALE: 1" = 100'

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
KKD	6	(See Title Sheet)		FM 2449
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DAL	DENTON	23
TGM	CONTROL	SECTION	JOB	
CHECK	2352	02	027	

DATE: 9/19/2022 2:11:08 PM
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BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

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

WORKER SAFETY NOTES:

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

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

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

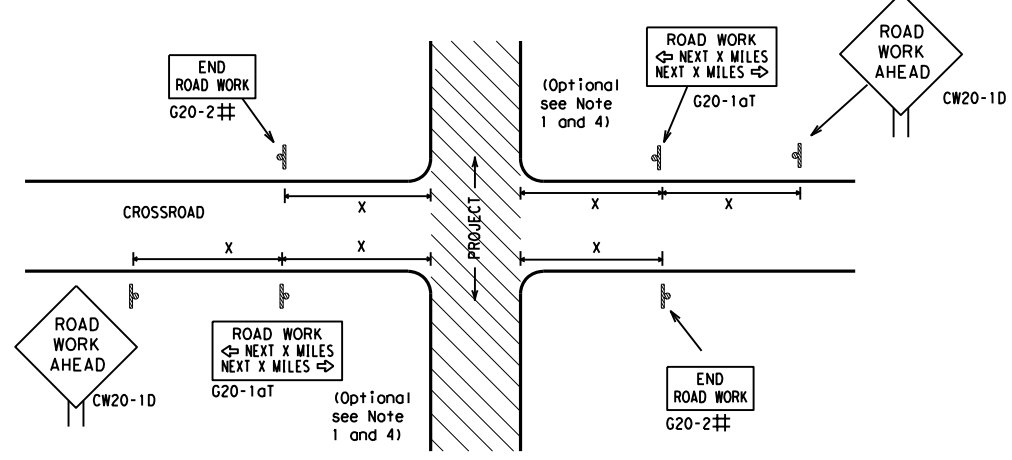
<p>THE DOCUMENTS BELOW CAN BE FOUND ON-LINE AT http://www.txdot.gov</p>
COMPLIANT WORK ZONE TRAFFIC CONTROL DEVICES LIST (CWZTCD)
DEPARTMENTAL MATERIAL SPECIFICATIONS (DMS)
MATERIAL PRODUCER LIST (MPL)
ROADWAY DESIGN MANUAL - SEE "MANUALS (ONLINE MANUALS)"
STANDARD HIGHWAY SIGN DESIGNS FOR TEXAS (SHSD)
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>BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS</p> <p>BC (1) - 21</p>		
FILE:	bc-21.dgn	DN: TxDOT
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REVISIONS	2352 02	DW: TxDOT
4-03 7-13	027	ck: TxDOT
9-07 8-14	FM 2449	JOB
5-10 5-21	DIST	HIGHWAY
DAL	COUNTY	SHEET NO.
DAL	DENTON	24

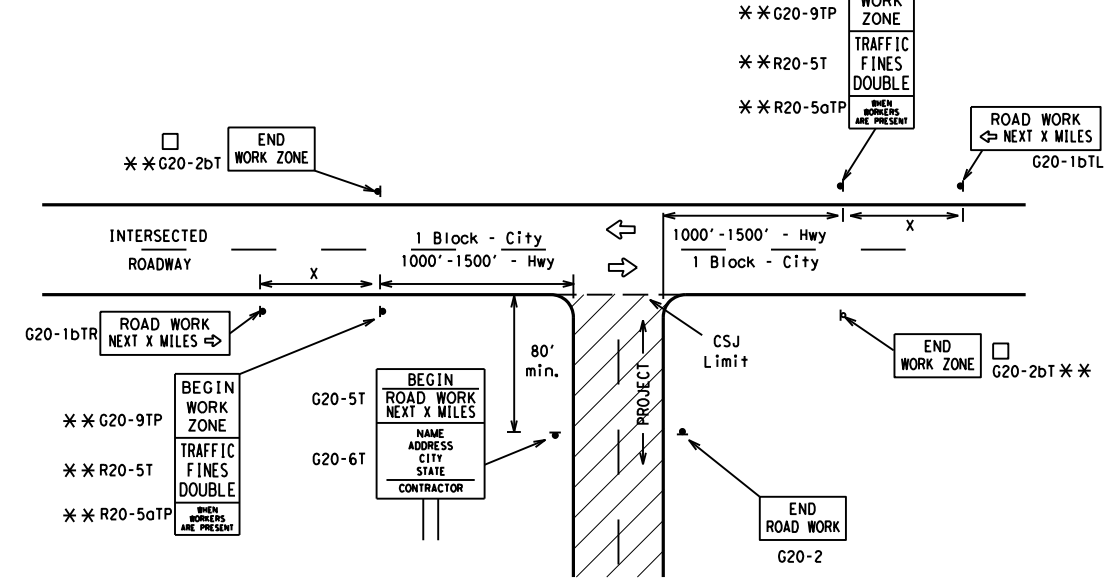
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TYPICAL LOCATION OF CROSSROAD SIGNS



- ## 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^{1,5,6}

Sign Number or Series	SIZE		SPACING	
	Conventional Road	Expressway/Freeway	Posted Speed MPH	Sign Δ Spacing "x" Feet (Apprx.)
CW20 ⁴	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 ²
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"	60	600 ²
			65	700 ²
			70	800 ²
			75	900 ²
			80	1000 ²
			*	* ³

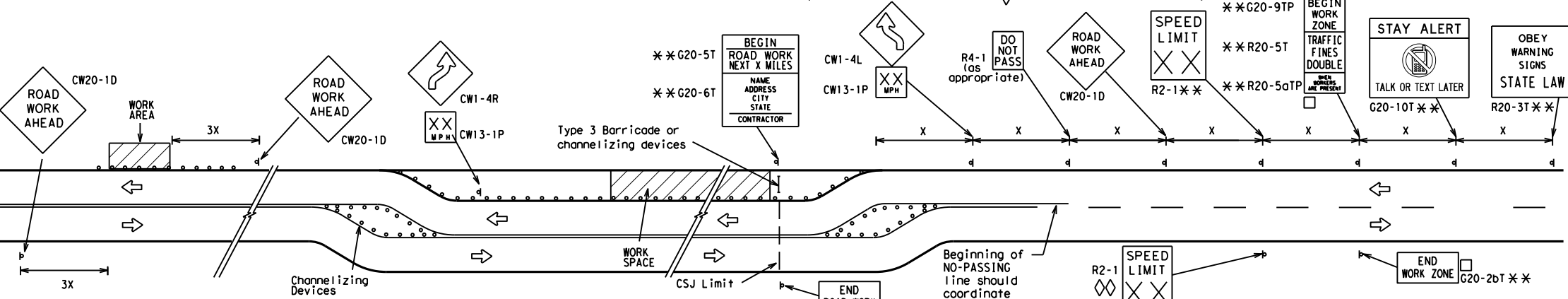
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

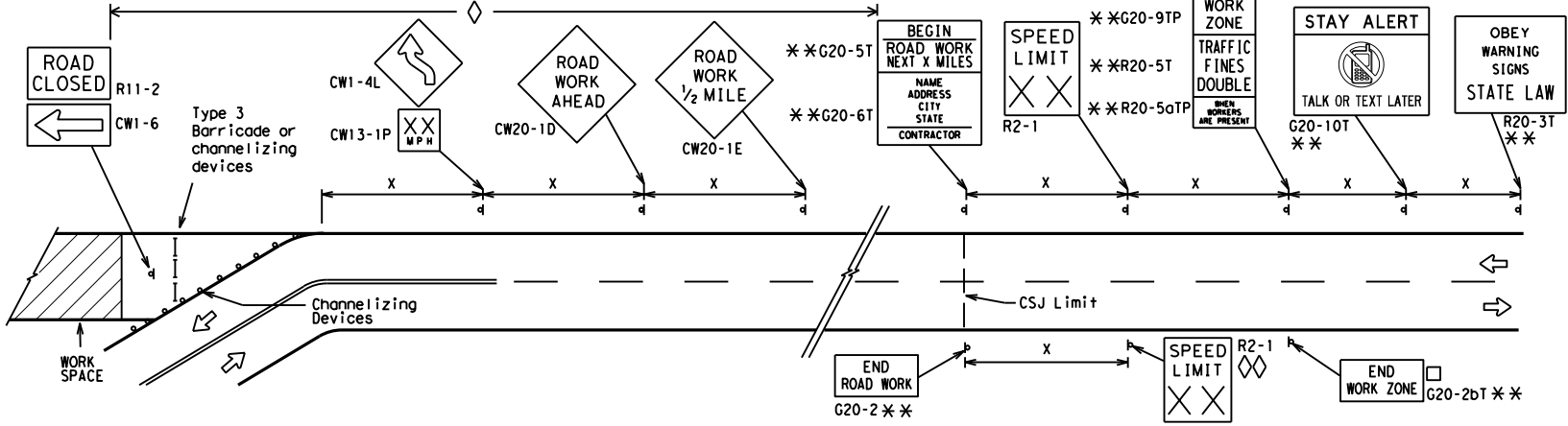
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be 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

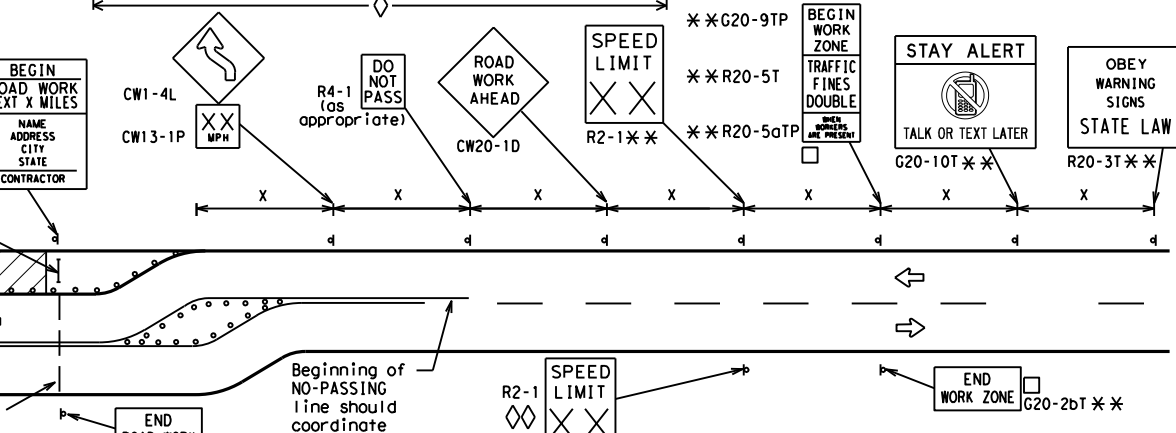


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD" (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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

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



SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS



NOTES

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

LEGEND

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

SHEET 2 OF 12



BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM 2449
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	DAL	DENTON	25	

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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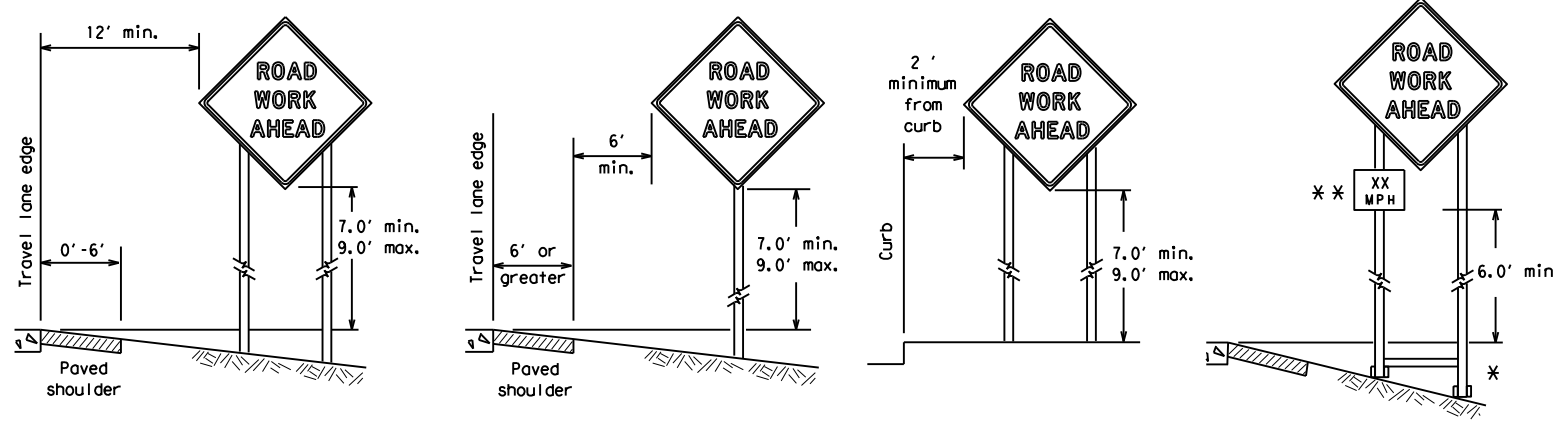
SHEET 3 OF 12

		Traffic Safety Division Standard	
<h2>BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT</h2>			
<h3>BC (3) - 21</h3>			
FILE:	bc-21.dgn	DW: TxDOT	CK: TxDOT
© TxDOT	November 2002	CONT	SECT
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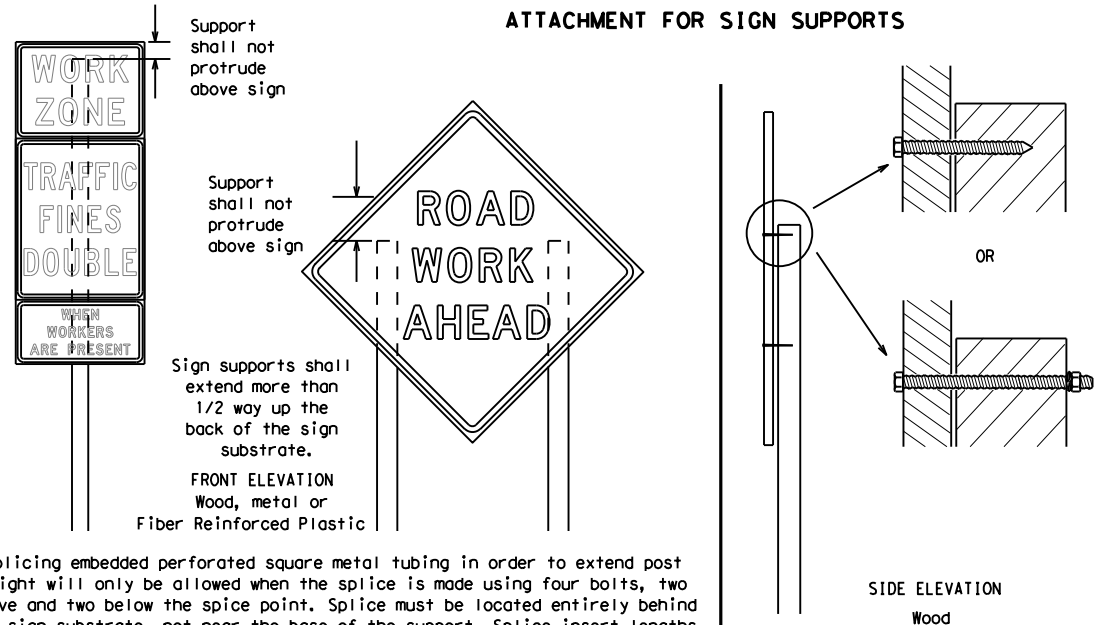
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS



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

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

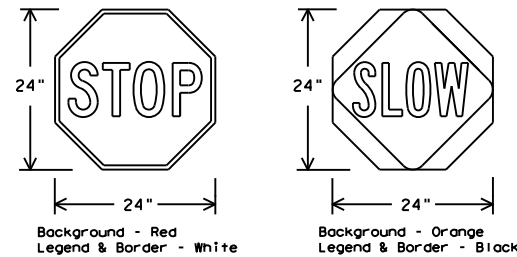
ATTACHMENT FOR SIGN SUPPORTS



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

STOP/SLOW PADDLES

1. STOP/SLOW paddles are the primary method to control traffic by flaggers. The STOP/SLOW paddle size should be 24" x 24".
2. STOP/SLOW paddles shall be retroreflective when used at night.
3. STOP/SLOW paddles may be attached to a staff with a minimum length of 6' to the bottom of the sign.
4. 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 _{FL} OR C _{FL} 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

1. 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.
2. 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.
3. When existing permanent signs are moved and relocated due to construction purposes, they shall be visible to motorists at all times.
4. 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.
5. 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 CWZTC 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.
6. 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.

GENERAL NOTES FOR WORK ZONE SIGNS

1. Contractor shall install and maintain signs in a straight and plumb condition and/or as directed by the Engineer.
2. Wooden sign posts shall be painted white.
3. Barricades shall NOT be used as sign supports.
4. 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.
5. 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.
6. The Contractor shall furnish sign supports listed in the "Compliant Work Zone Traffic Control Device List" (CWZTC) 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.
7. 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.
8. 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.
9. 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)

1. 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.
 - a. Long-term stationary - work that occupies a location more than 3 days.
 - b. 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.
 - c. Short-term stationary - daytime work that occupies a location for more than 1 hour in a single daylight period.
 - d. Short, duration - work that occupies a location up to 1 hour.
 - e. Mobile - work that moves continuously or intermittently (stopping for up to approximately 15 minutes.)

SIGN MOUNTING HEIGHT

1. 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.
2. 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.
3. Long-term/Intermediate-term Signs may be used in lieu of Short-term/Short Duration signing.
4. 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.
5. 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

1. 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

1. 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 CWZTC lists each substrate that can be used on the different types and models of sign supports.
2. "Mesh" type materials are NOT an approved sign substrate, regardless of the tightness of the weave.
3. 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

1. 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).
2. White sheeting, meeting the requirements of DMS-8300 Type A, shall be used for signs with a white background.
3. Orange sheeting, meeting the requirements of DMS-8300 Type B_{FL} or Type C_{FL}, shall be used for rigid signs with orange backgrounds.

SIGN LETTERS

1. 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

1. When sign messages may be confusing or do not apply, the signs shall be removed or completely covered.
2. 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.
3. 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.
4. 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.
5. Burlap shall NOT be used to cover signs.
6. Duct tape or other adhesive material shall NOT be affixed to a sign face.
7. Signs and anchor stubs shall be removed and holes backfilled upon completion of work.

SIGN SUPPORT WEIGHTS

1. Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand should be used.
2. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
3. Rock, concrete, iron, steel or other solid objects shall not be permitted for use as sign support weights.
4. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
5. Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as tire inner tubes) shall NOT be used.
6. 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 CWZTC list.
7. 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.
8. Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

FLAGS ON SIGNS

1. 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.

SHEET 4 OF 12

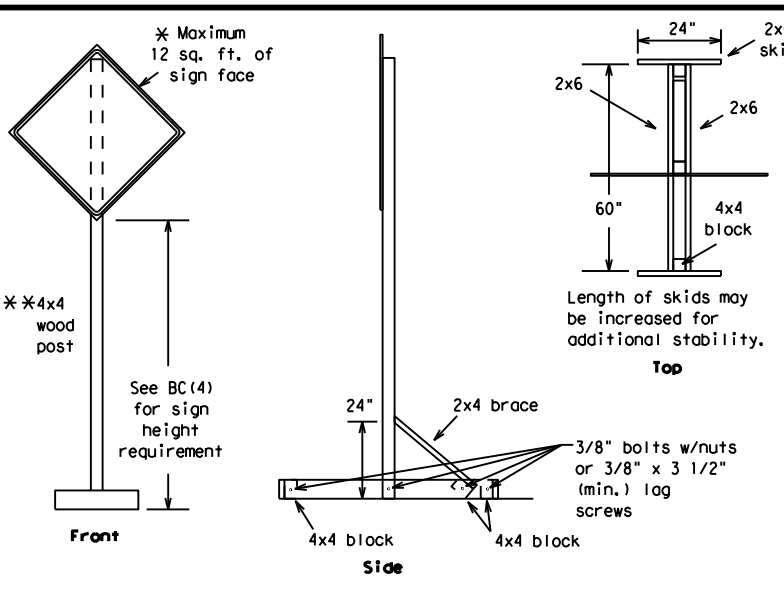
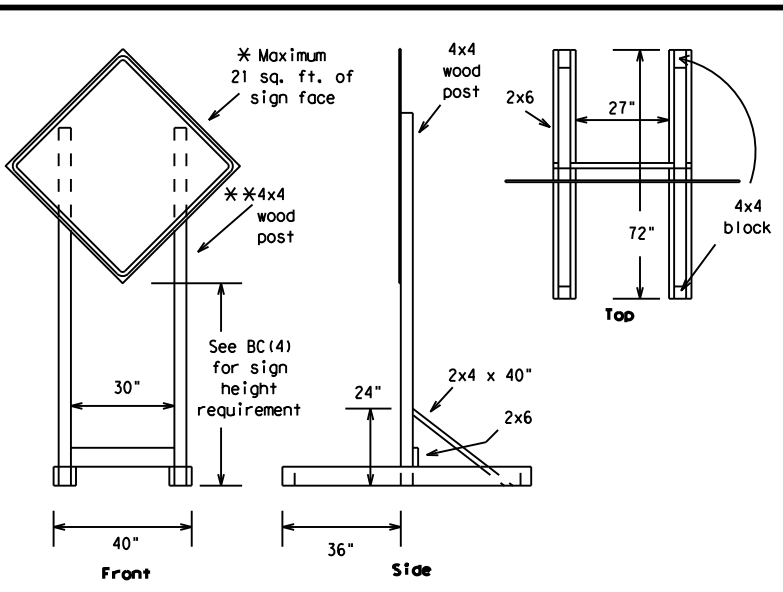


BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC (4) - 21

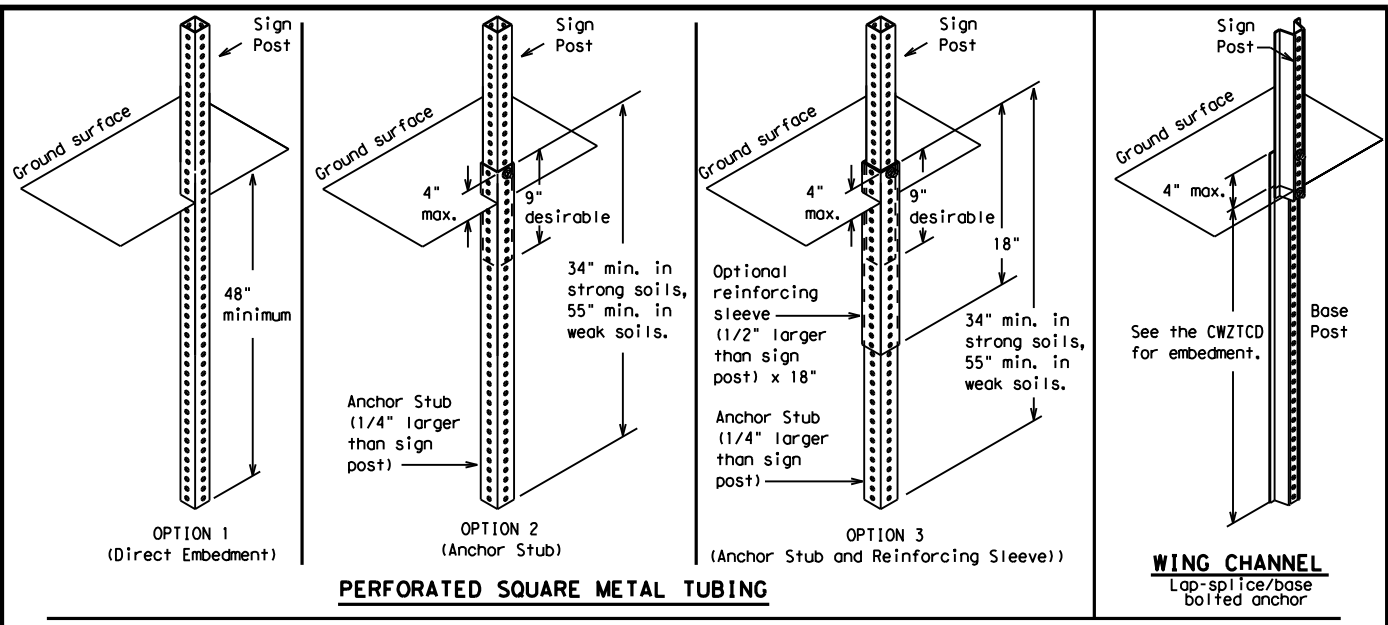
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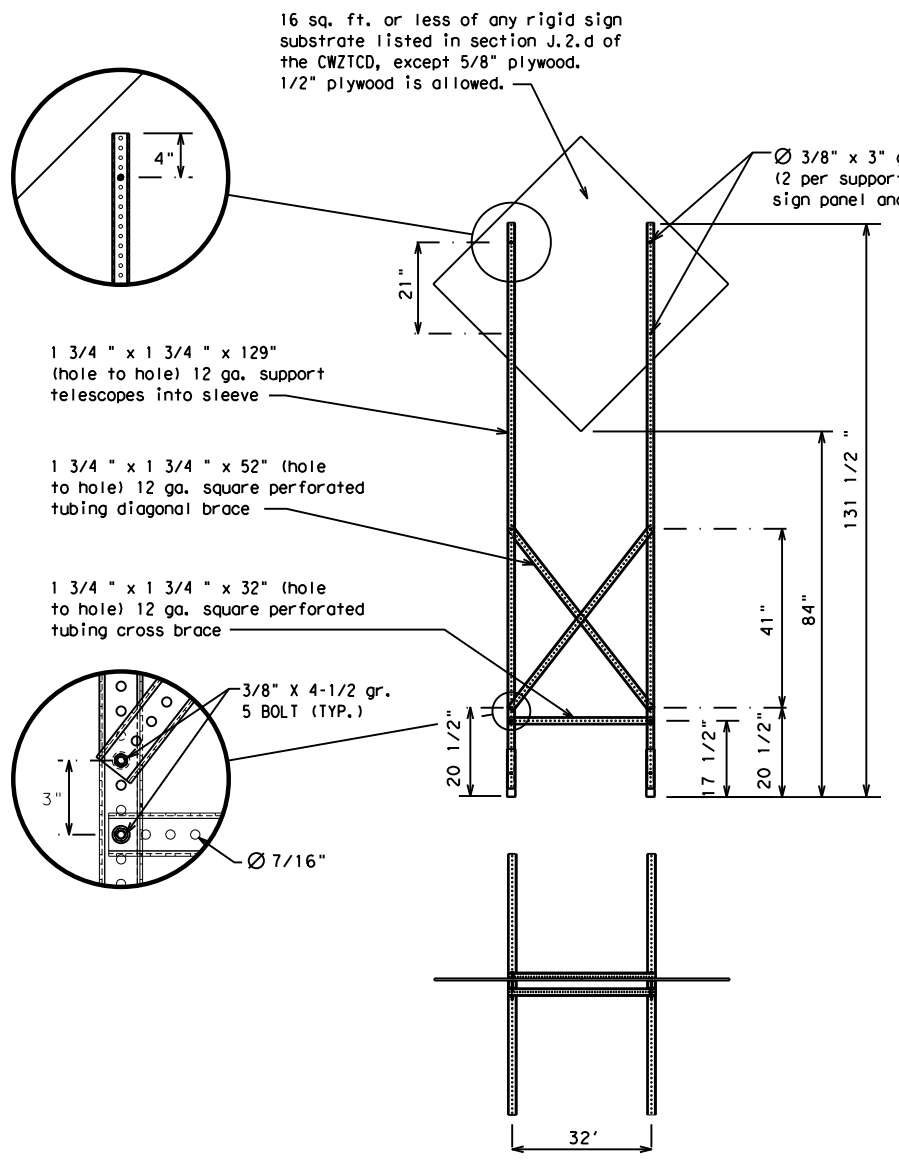
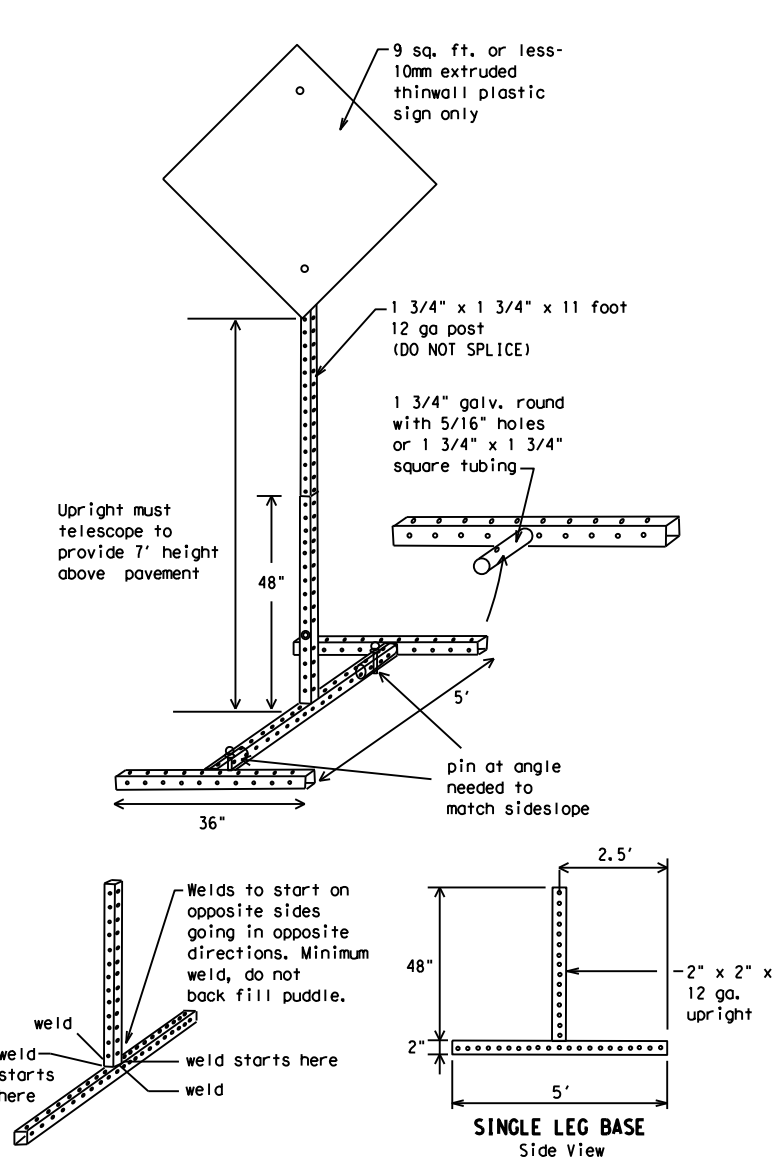
SKID MOUNTED WOOD SIGN SUPPORTS

* 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.

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5) - 21

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9-07	8-14	DIST	COUNTY	SHEET NO.					
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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
Hour(s)	HR, HRS	Time Minutes	TIME MIN
Information	INFO	Upper Level	UPR LEVEL
It Is	ITS	Vehicles (s)	VEH, VEHS
Junction	JCT	Warning	WARN
Left	LFT	Wednesday	WED
Left Lane	LFT LN	Weight Limit	WT LIMIT
Lane Closed	LN CLOSED	West	W
Lower Level	LWR LEVEL	Westbound	(route) W
Maintenance	MAINT	Wet Pavement	WET PVMT
		Will Not	WONT

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



Texas Department of Transportation
Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

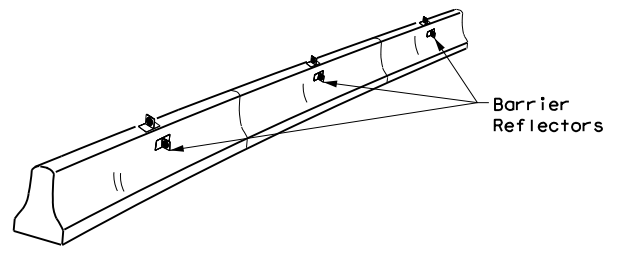
BC (6) - 21

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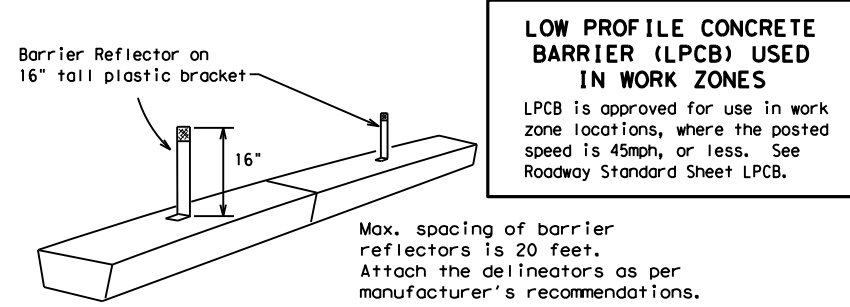
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors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



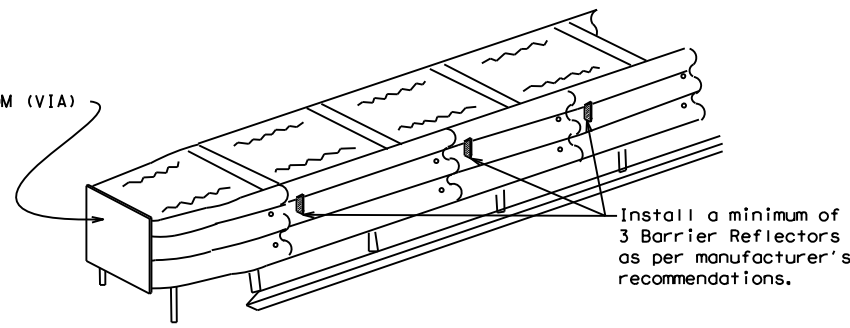
CONCRETE TRAFFIC BARRIER (CTB)

- 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

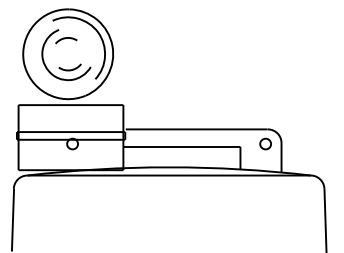
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet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

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

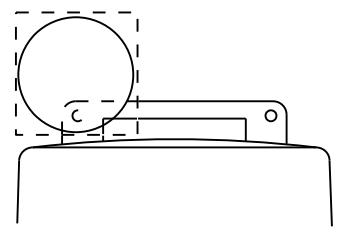
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing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

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

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



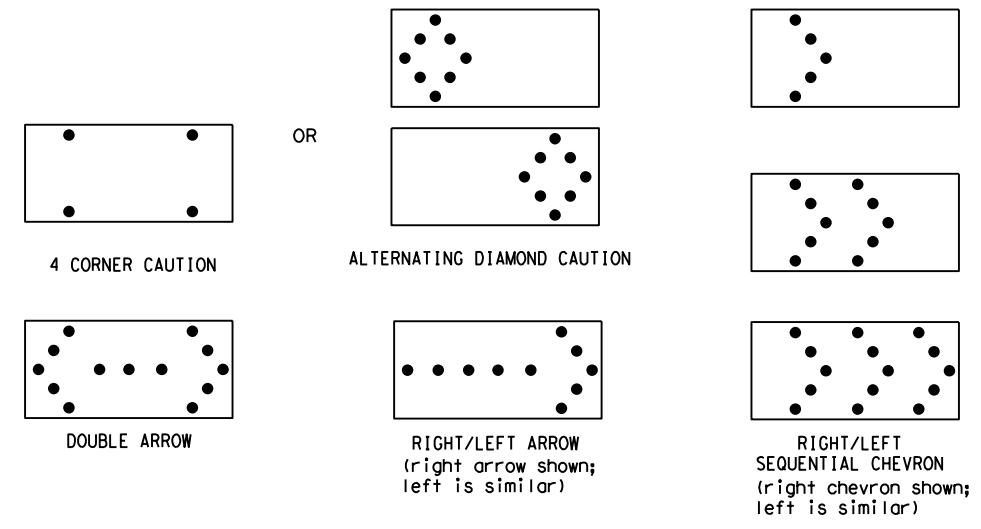
Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



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

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

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



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

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

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

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

FLASHING ARROW BOARDS

SHEET 7 OF 12

TRUCK-MOUNTED ATTENUATORS

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



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

BC (7) -21

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GENERAL NOTES

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

GENERAL DESIGN REQUIREMENTS

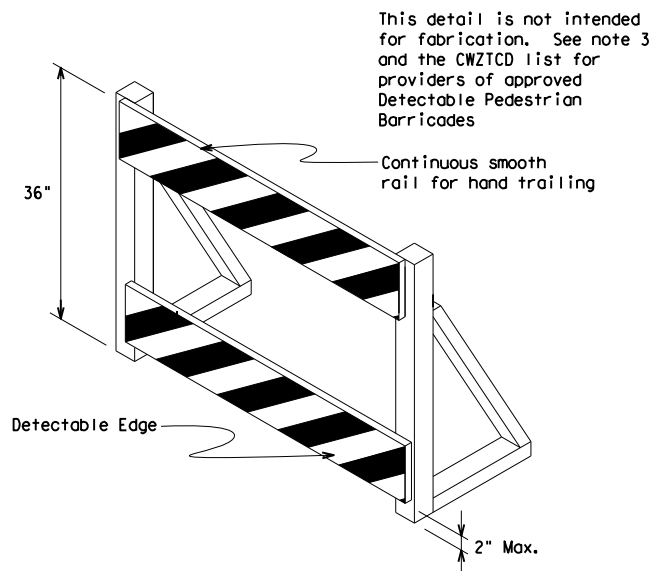
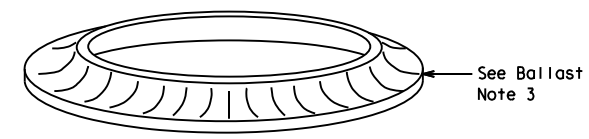
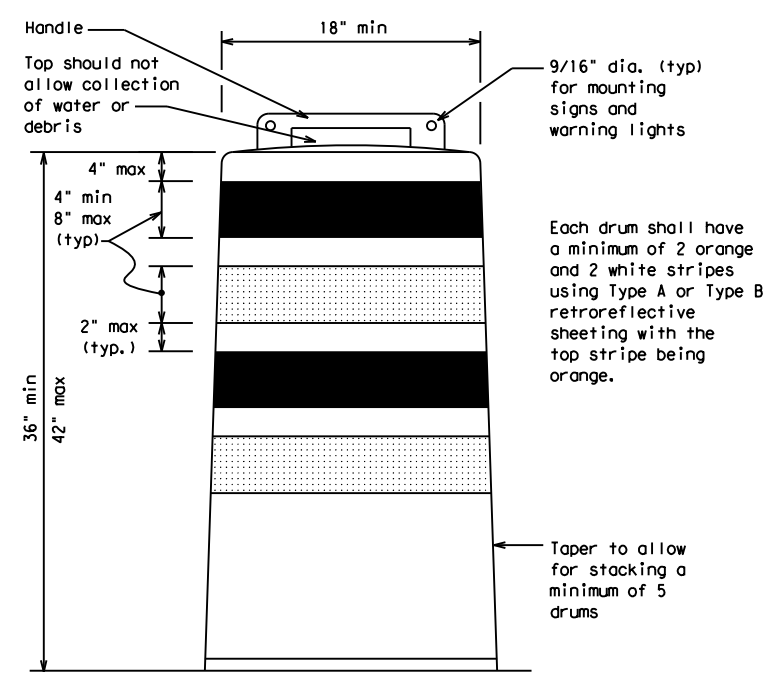
- Pre-qualified plastic drums shall meet the following requirements:
- Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
 - The body and base shall lock together in such a manner that the body separates from the base when impacted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

RETROREFLECTIVE SHEETING

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

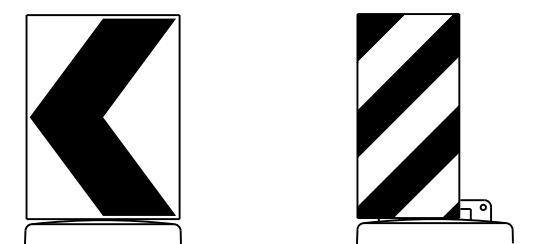
BALLAST

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



DETECTABLE PEDESTRIAN BARRICADES

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



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_{FL} or Type C_{FL} 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



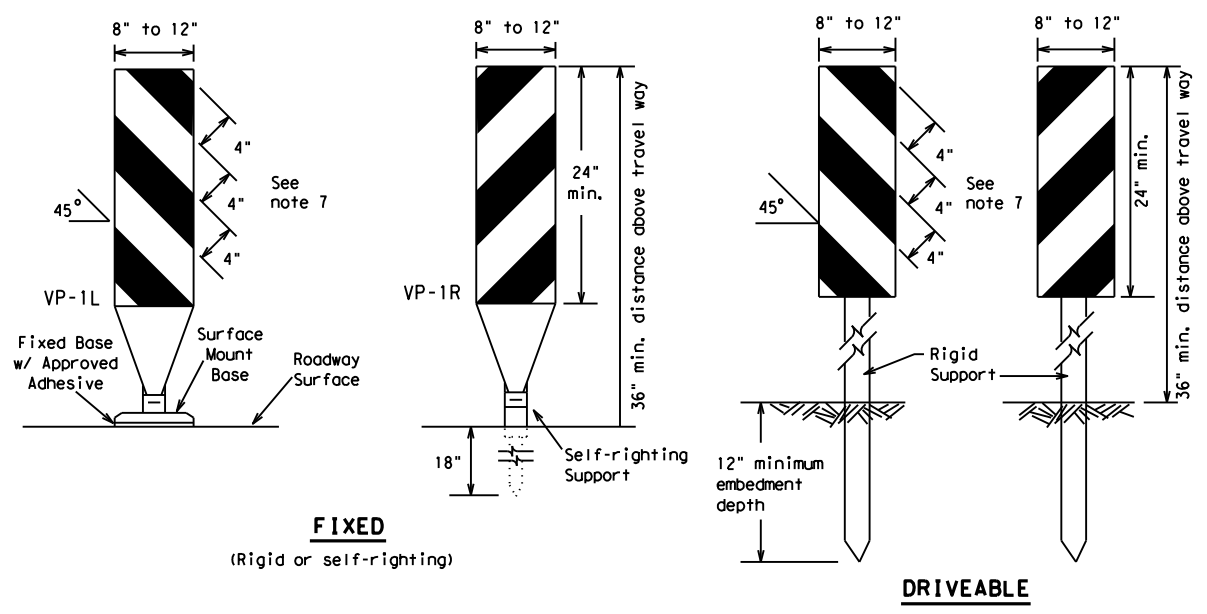
BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC (8) - 21

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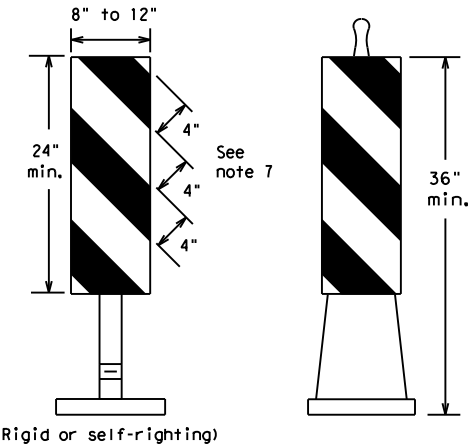
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FIXED
(Rigid or self-righting)

DRIVEABLE

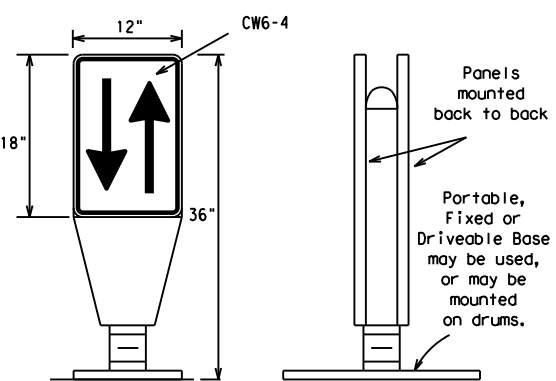


(Rigid or self-righting)

PORTABLE

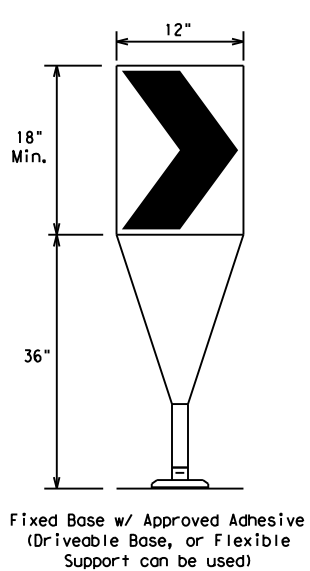
VERTICAL PANELS (VPs)

- 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)

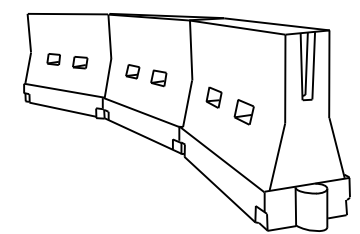
- Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base 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_{FL} or Type C_{FL} conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.



Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

- 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_{FL} or Type C_{FL} 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 ² / 60	150'	165'	180'	30'	60'
35		205'	225'	245'	35'	70'
40		265'	295'	320'	40'	80'
45	L = WS	450'	495'	540'	45'	90'
50		500'	550'	600'	50'	100'
55		550'	605'	660'	55'	110'
60		600'	660'	720'	60'	120'
65		650'	715'	780'	65'	130'
70		700'	770'	840'	70'	140'
75		750'	825'	900'	75'	150'
80		800'	880'	960'	80'	160'

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC (9) - 21

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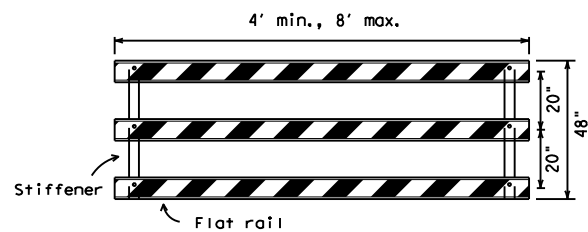
TYPE 3 BARRICADES

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.

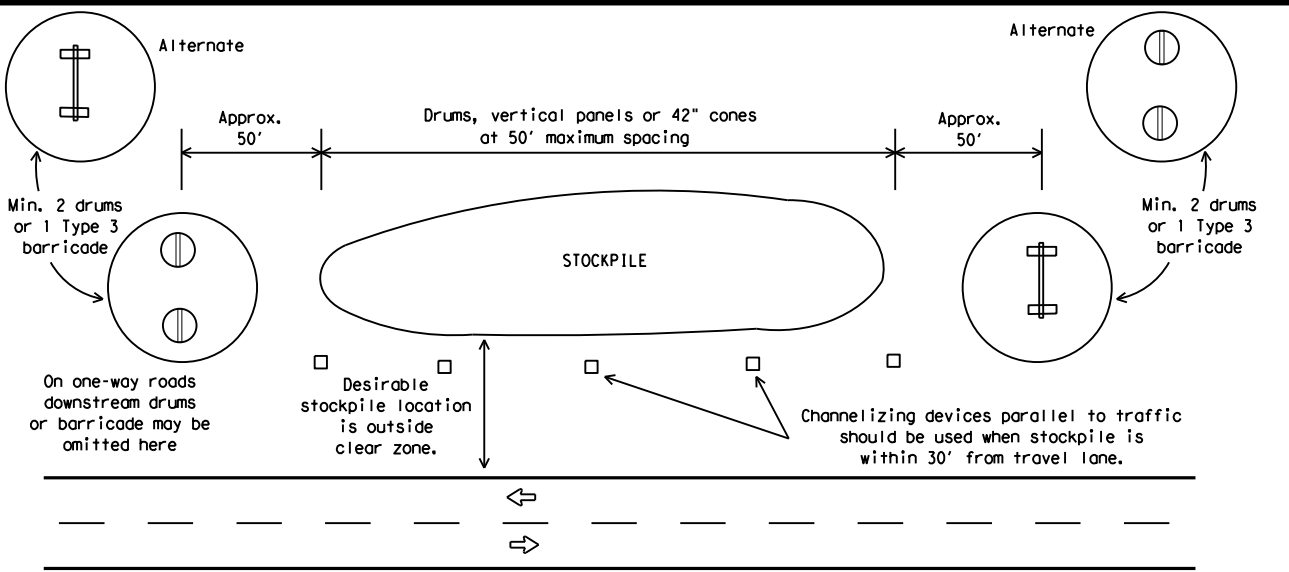


TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



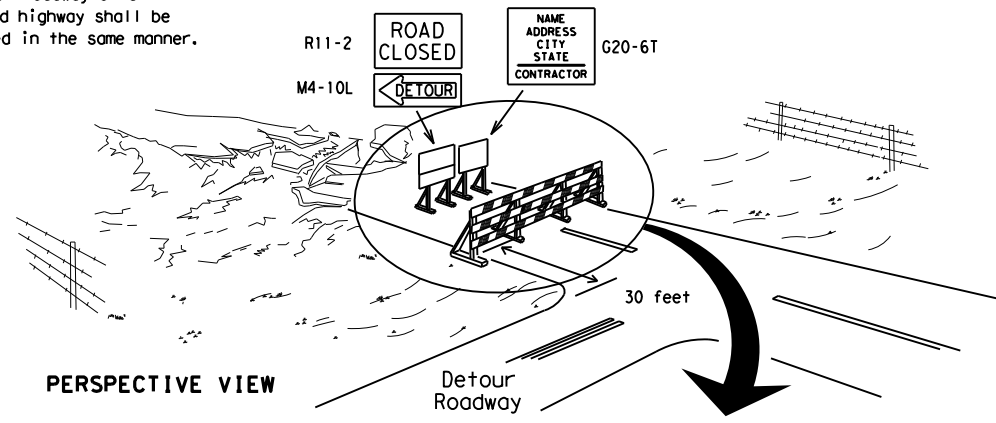
Stiffener may be inside or outside of support, but no more than 2 stiffeners shall be allowed on one barricade.

TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES



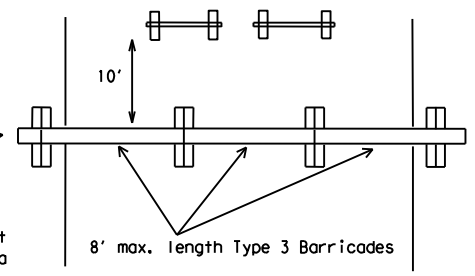
TRAFFIC CONTROL FOR MATERIAL STOCKPILES

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



PERSPECTIVE VIEW

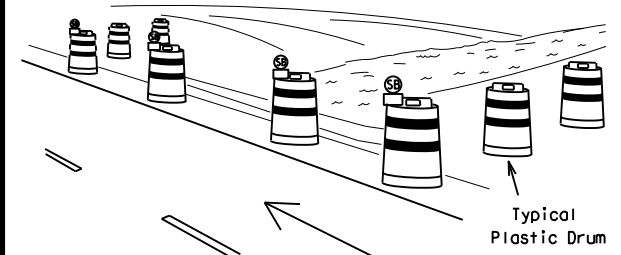
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



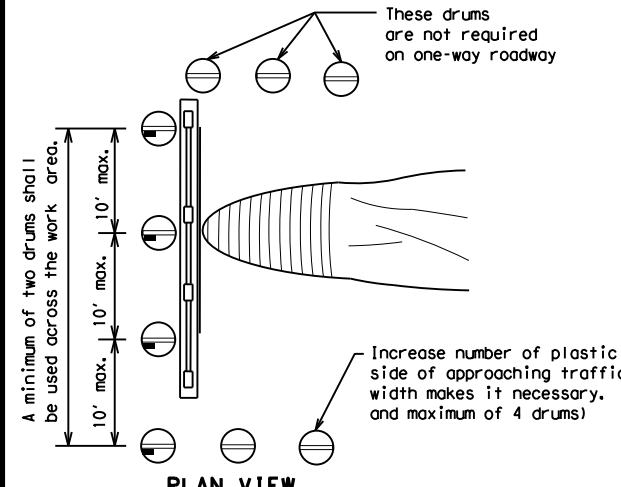
PLAN VIEW

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



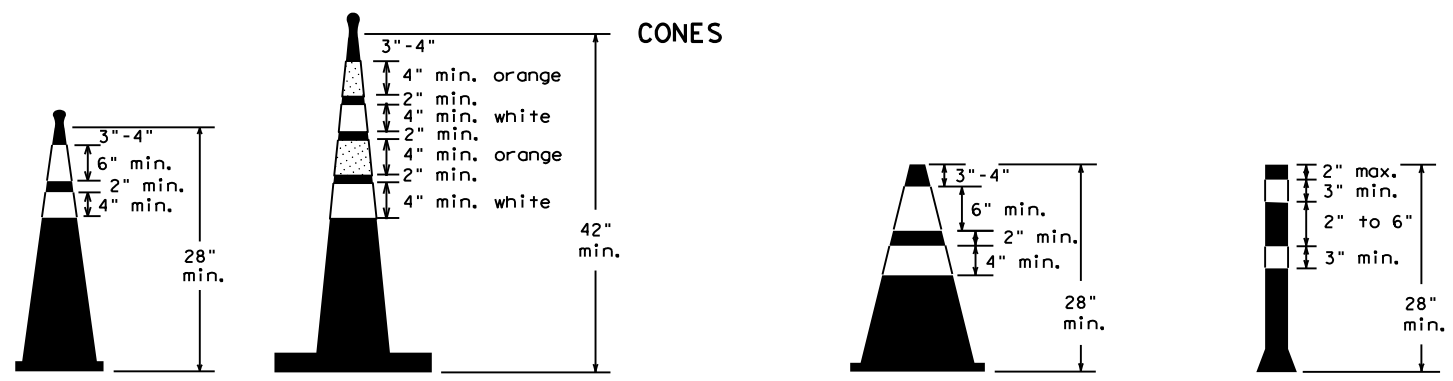
PLAN VIEW

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)

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

CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



Two-Piece cones

One-Piece cones

Tubular Marker

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

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

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.

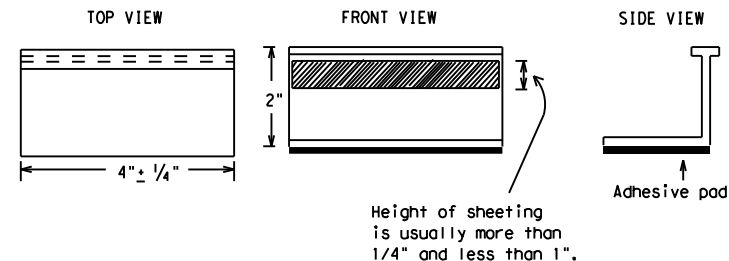
MAINTAINING WORK ZONE PAVEMENT MARKINGS

- 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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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.



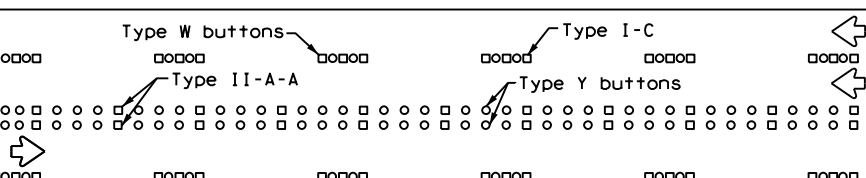
RAISED PAVEMENT MARKERS

EDGE & LANE LINES FOR DIVIDED HIGHWAY



REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



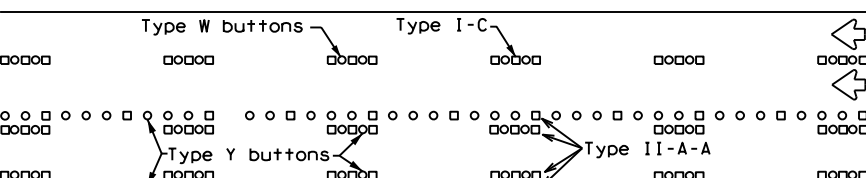
RAISED PAVEMENT MARKERS

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



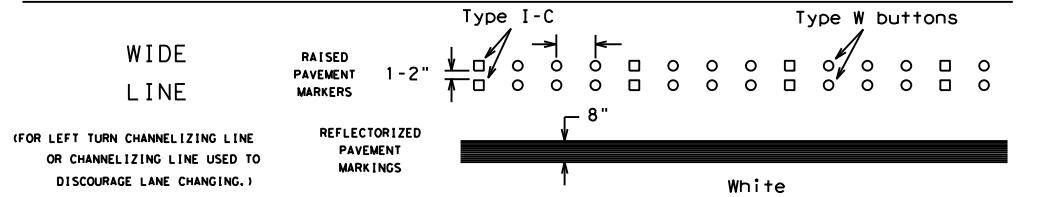
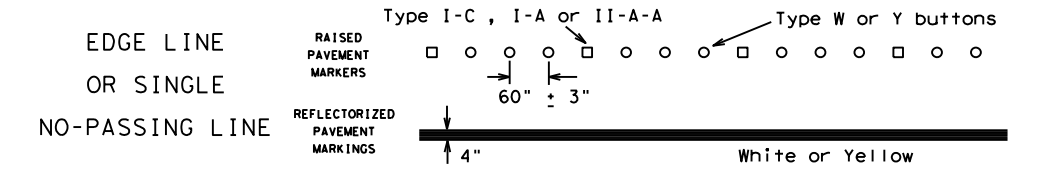
RAISED PAVEMENT MARKERS

TWO-WAY LEFT TURN LANE

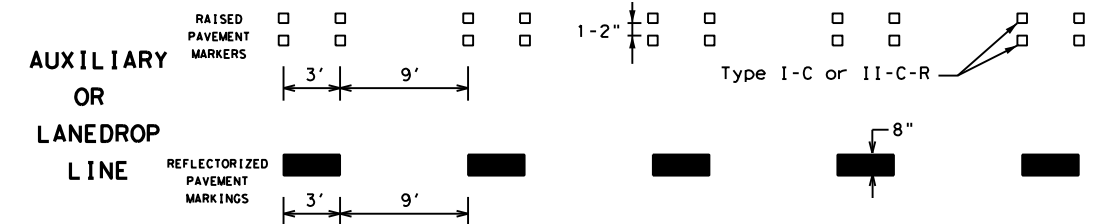
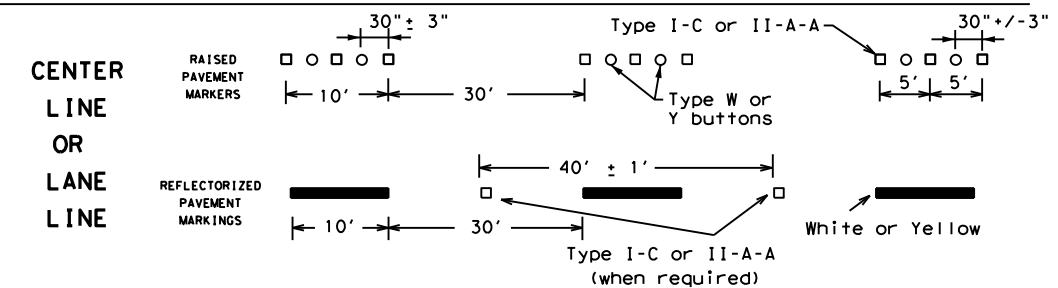
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



SOLID LINES

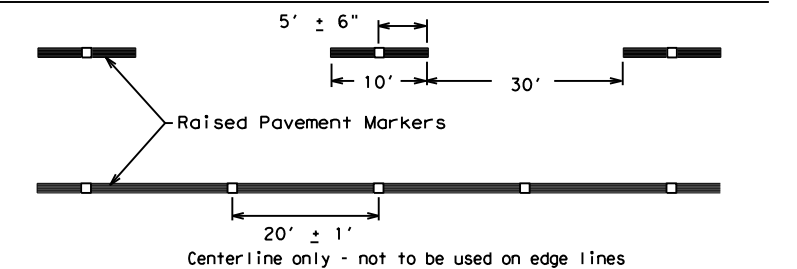


BROKEN LINES



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

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	OW: TxDOT	CR: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM 2449
1-97 9-07 5-21	DIST	COUNTY	SHEET NO.	
2-98 7-13	DAL	DENTON	35	
11-02 8-14				

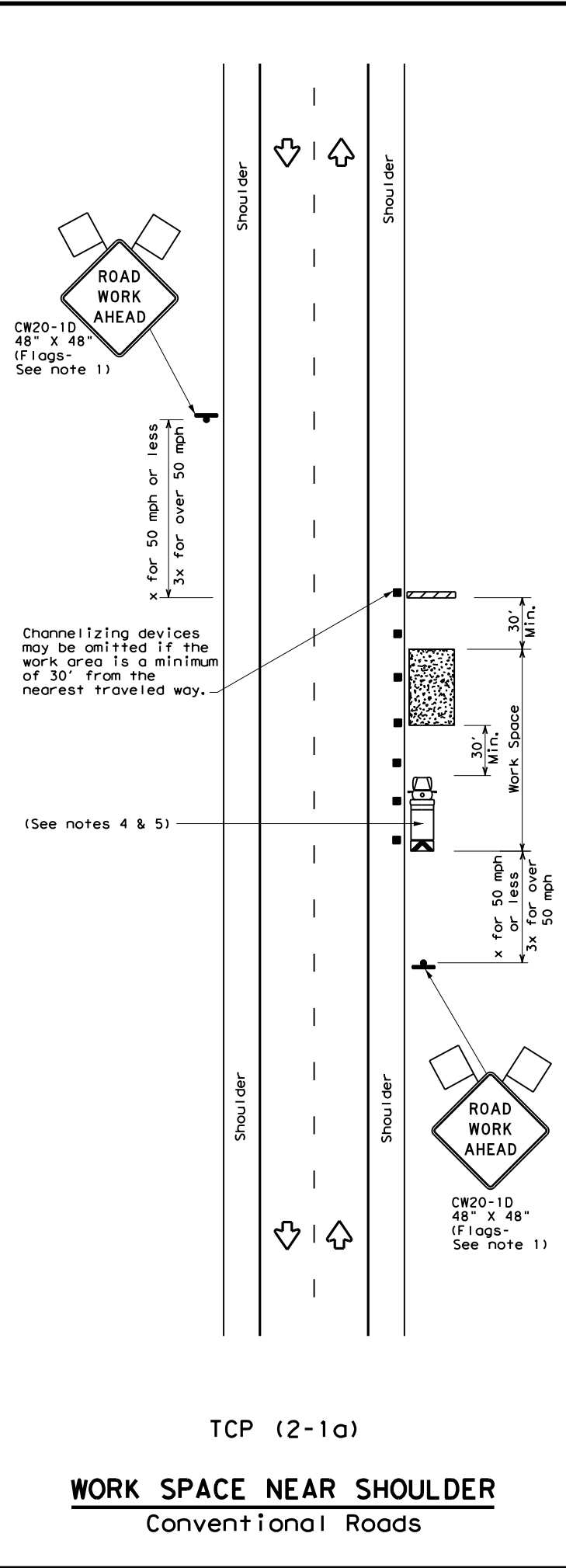
Raised pavement markers used as standard pavement markings shall be from the approved products list and meet the requirements of Item 672 "RAISED PAVEMENT MARKERS."

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DATE: 9/19/2022 2:11:25 PM
FILE: I:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\07 TCP\STANDARDS\bc-21.dgn

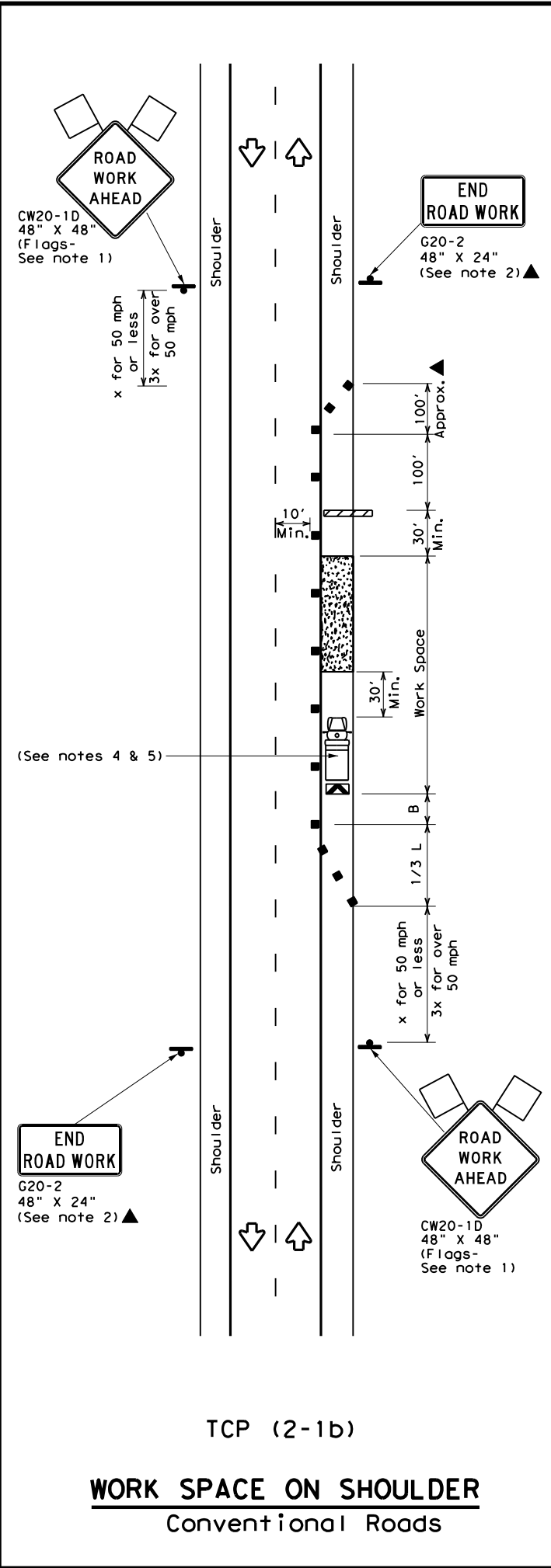
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: 9/19/2022 2:11:26 PM
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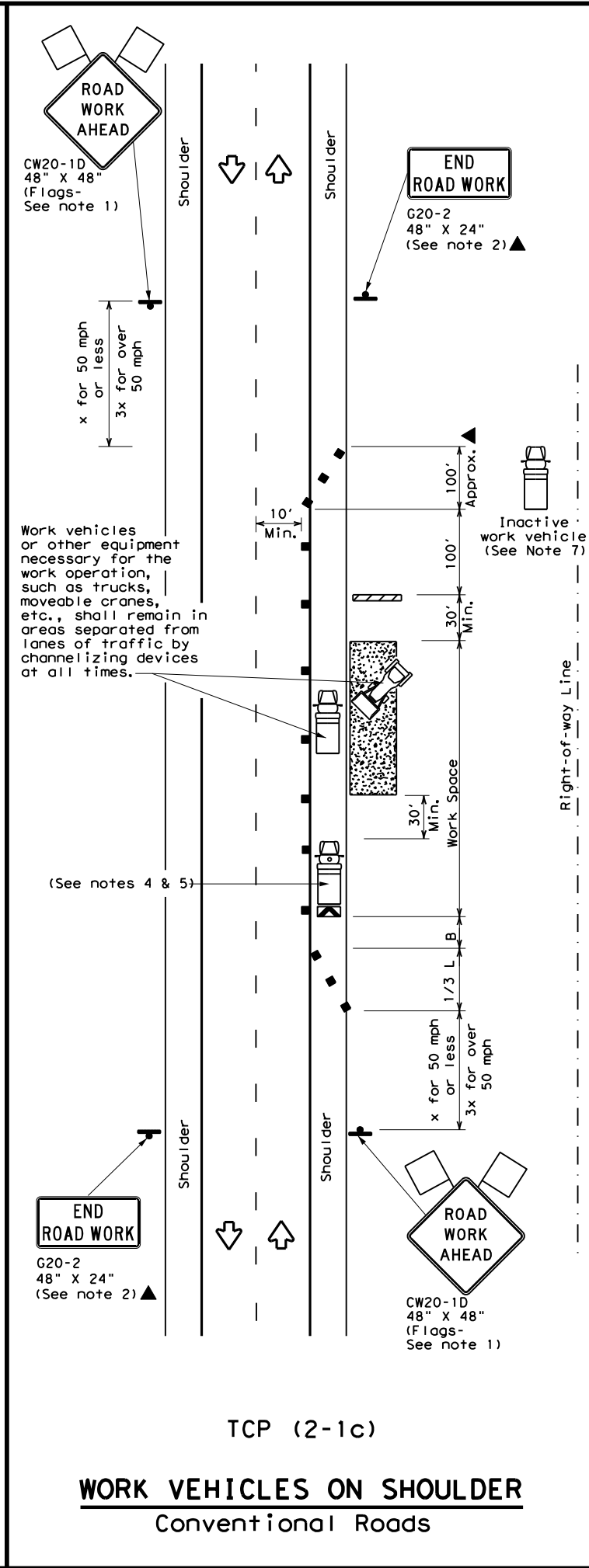
TCP (2-1a)

WORK SPACE NEAR SHOULDER
 Conventional Roads



TCP (2-1b)

WORK SPACE ON SHOULDER
 Conventional Roads



TCP (2-1c)

WORK VEHICLES ON SHOULDER
 Conventional Roads

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.
 - Additional 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 CW21-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.



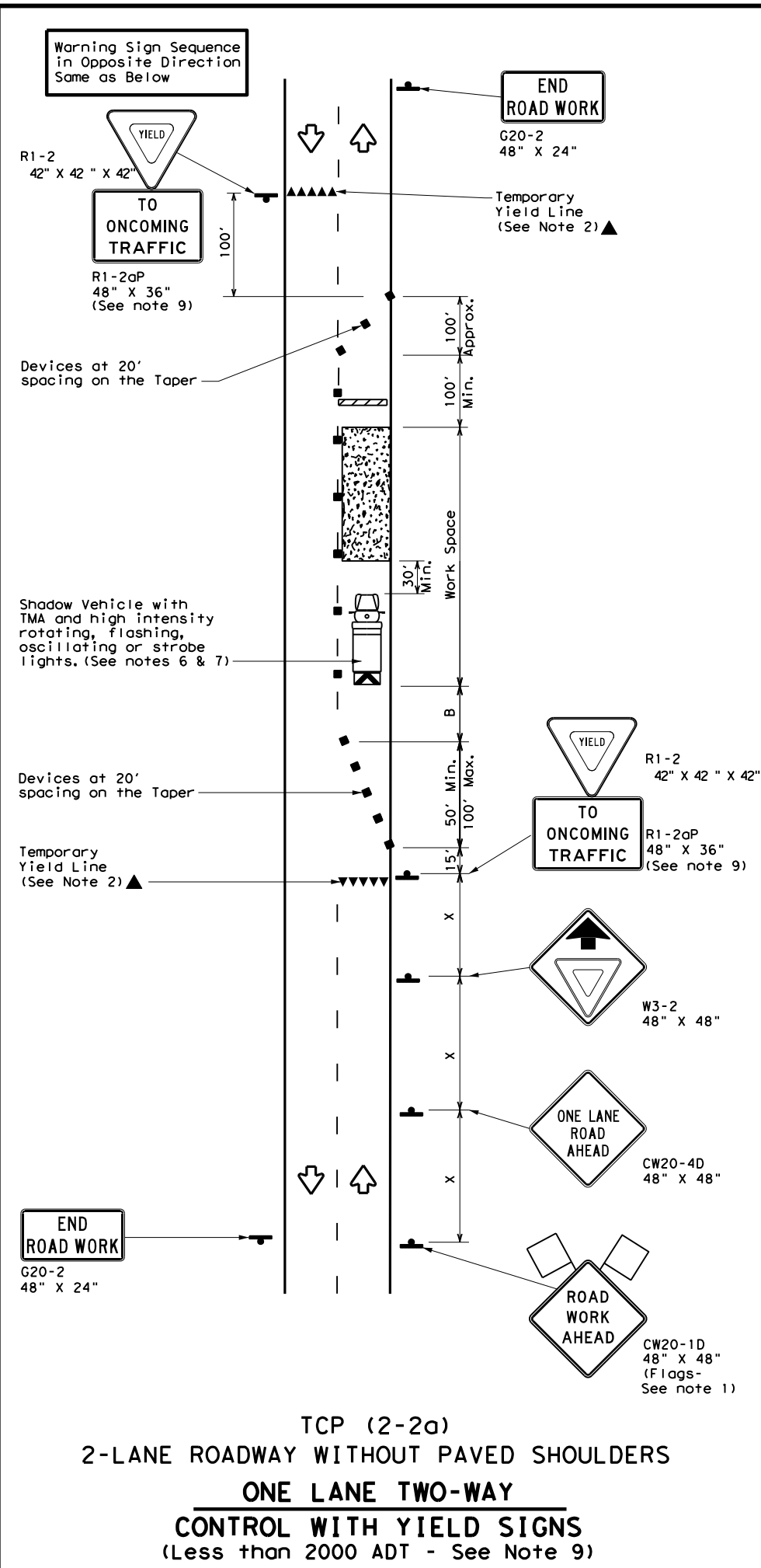
TRAFFIC CONTROL PLAN
CONVENTIONAL ROAD
SHOULDER WORK

TCP (2-1) - 18

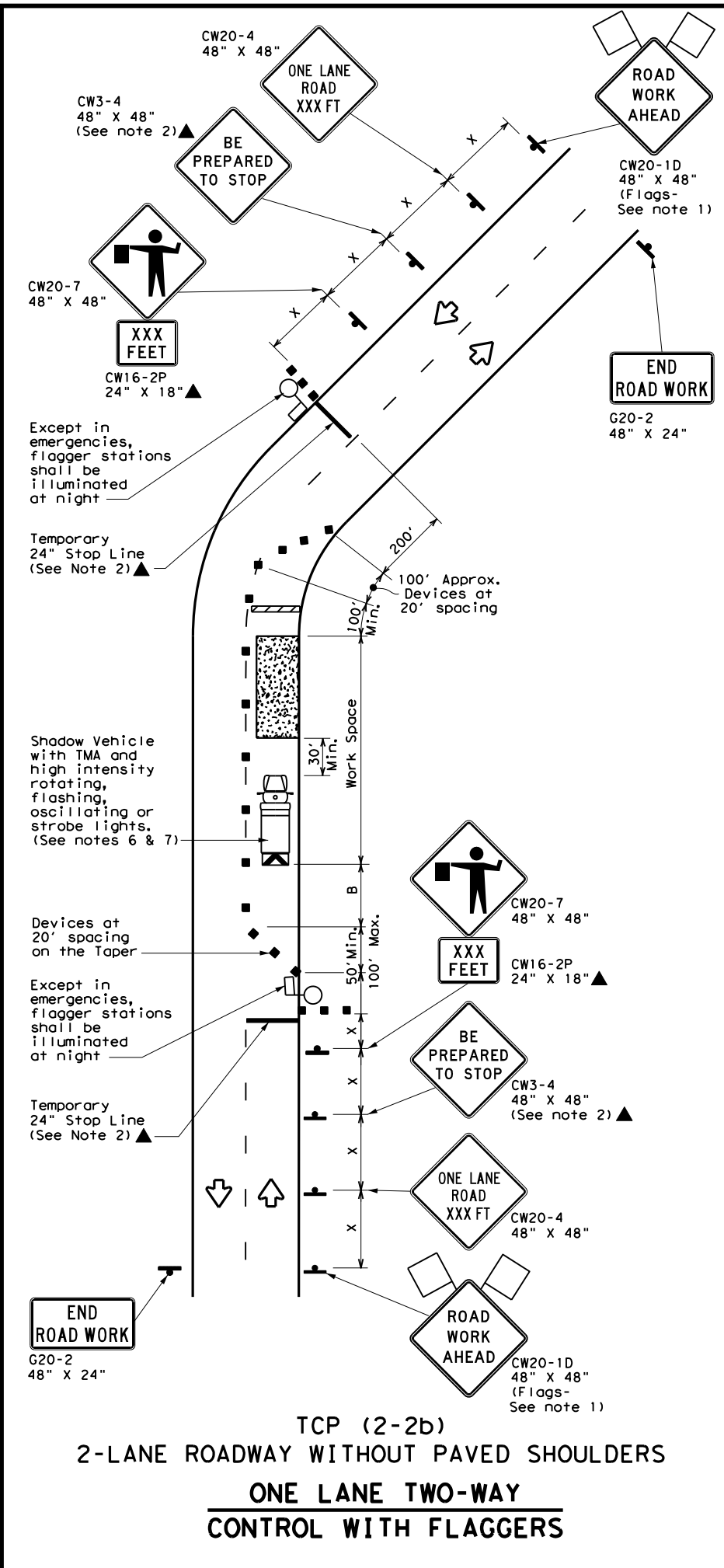
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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM 2449
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 2-12	DAL	DENTON	36	
1-97 2-18				

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DATE: 9/19/2022 2:11:28 PM
 FILE: I:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\07 TCP\STANDARDS\TCP2-2a-18-2-2a.dwg



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 ² / 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
	✓	✓	✓	

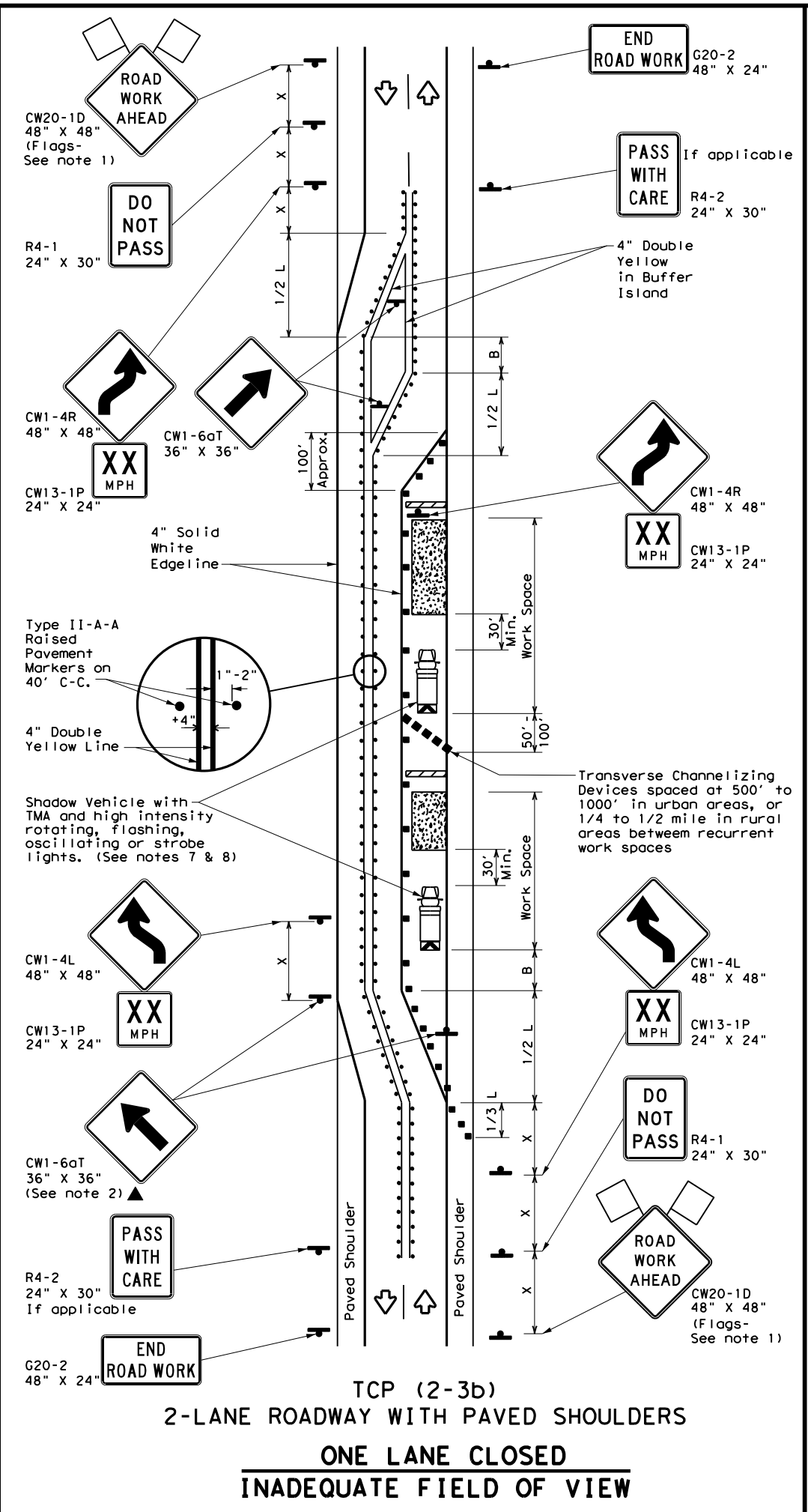
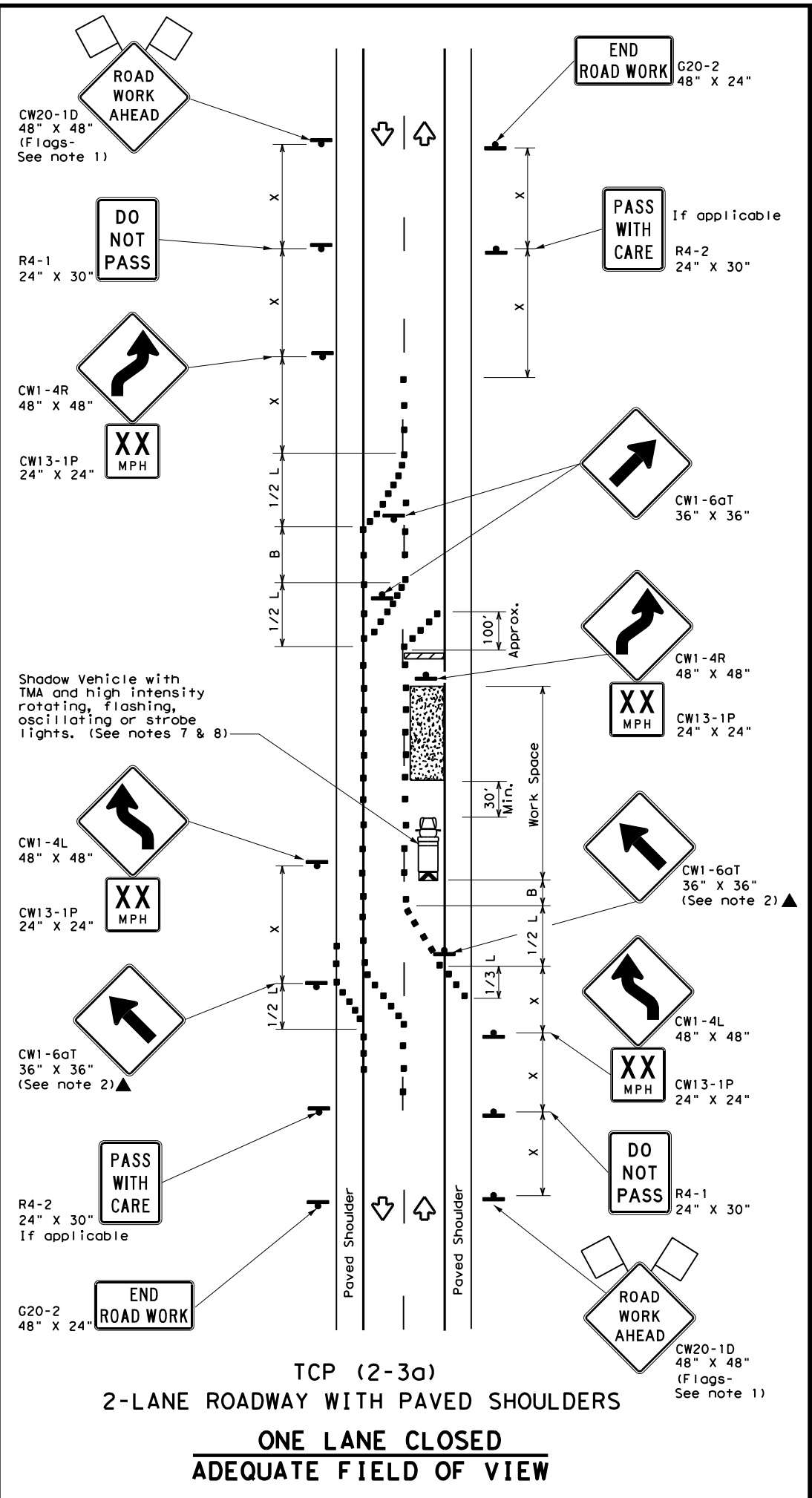
GENERAL NOTES

- 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.

		Traffic Operations Division Standard	
TRAFFIC CONTROL PLAN ONE-LANE TWO-WAY TRAFFIC CONTROL			
TCP (2-2) - 18			
FILE:	tcp2-2-18.dgn	DN:	CK:
© TxDOT	REVISIONS	CON:	SECT:
8-95	3-03	2352	02
1-97	2-12		
4-98	2-18		
		JOB:	HIGHWAY:
		027	FM 2449
		DIST:	COUNTY:
		DAL	DENTON
		SHEET NO.:	37

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DATE: 9/19/2022 2:11:30 PM
 FILE: I:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\07 TCP\STANDARDS\TCP (2-3) - 18.dgn



LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board		Raised Pavement Markers Ty II-AA
	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 ² / 60	150'	165'	180'	30'	120'	90'	
35		205'	225'	245'	35'	160'	120'	
40		265'	295'	320'	40'	240'	155'	
45	L = WS	450'	495'	540'	45'	320'	195'	
50		500'	550'	600'	50'	400'	240'	
55		550'	605'	660'	55'	500'	295'	
60		600'	660'	720'	60'	600'	350'	
65		650'	715'	780'	65'	700'	410'	
70		700'	770'	840'	70'	800'	475'	
75		750'	825'	900'	75'	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
			✓	✓
				TCP (2-3b) ONLY

- 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.
 - When work space will be in place less than three days existing pavement markings may remain in place. Channelizing devices shall be used to separate traffic.
 - Flagger control should NOT be used unless roadway conditions or heavy traffic volume require additional emphasis to safely control traffic. Flagger should be positioned at end of traffic queue.
 - The R4-1 "DO NOT PASS," R4-2 "PASS WITH CARE" and construction regulatory speed zone signs may be installed within CW20-1D "ROAD WORK AHEAD" signs. Proper spacing of signs shall be maintained.
 - Conflicting pavement marking shall be removed for long term projects.
 - 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.
 - 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 (2-3a)**
- Conflicting pavement markings shall be removed for long-term projects. For shorter durations where traffic is directed over a yellow centerline, channelizing devices which separate two-way traffic should be spaced on tapers at 20' or 15' if posted speeds are 35 mph or slower, and for tangent sections, at 1/2(S) where S is the speed in mph. This tighter device spacing is intended for the area of the conflicting markings, not the entire work zone.

Traffic Operations Division Standard

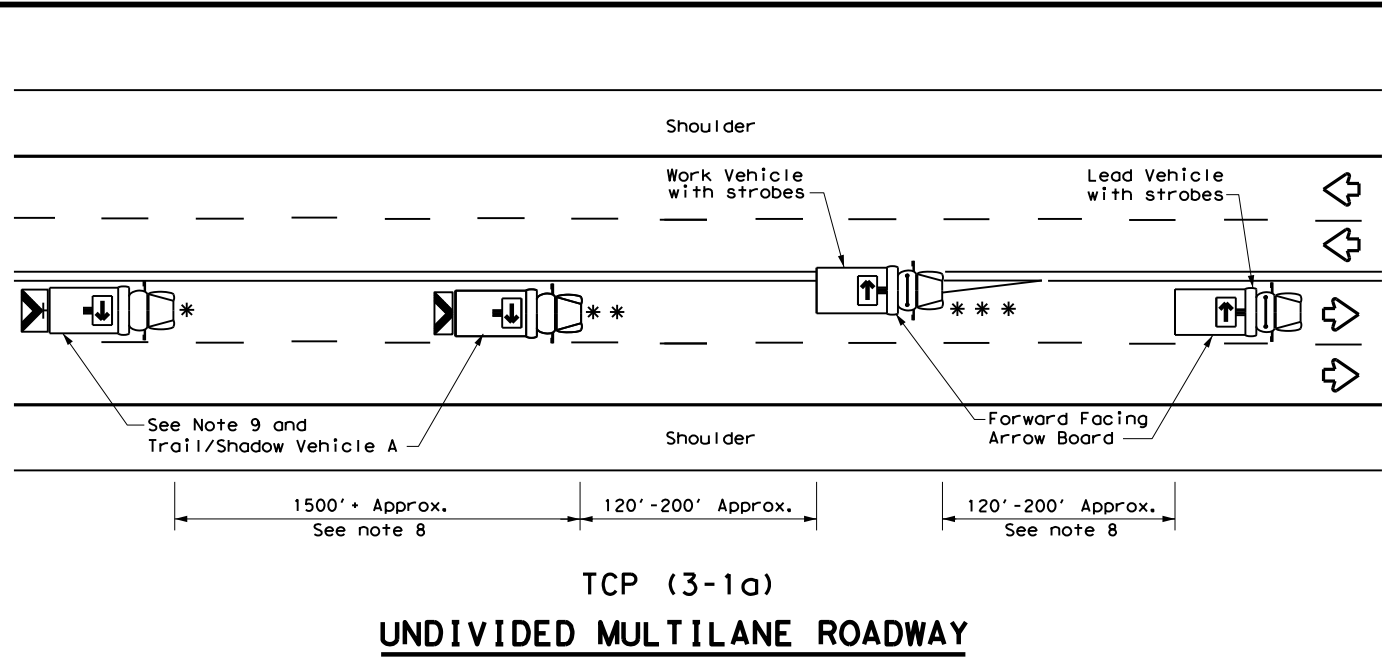
TRAFFIC CONTROL PLAN
TRAFFIC SHIFTS ON
TWO-LANE ROADS

TCP (2-3) - 18

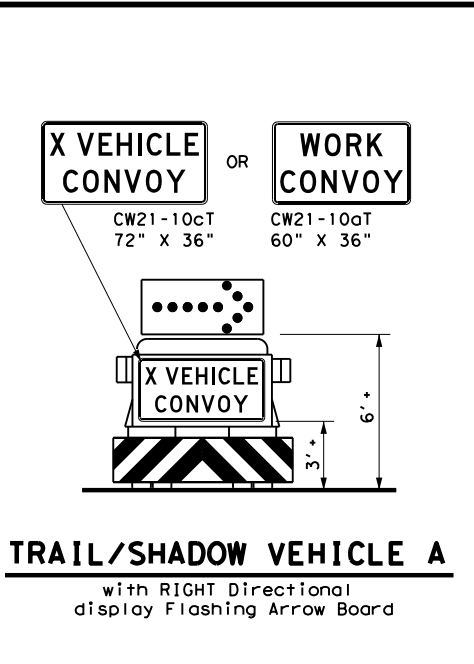
FILE: tcp(2-3)-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM 2449
8-95 3-03	DIST	COUNTY	SHEET NO.	
1-97 2-12	DAL	DENTON	38	
4-98 2-18				

163

DATE: 9/19/2022 2:11:31 PM
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TCP (3-1a)
UNDIVIDED MULTILANE ROADWAY



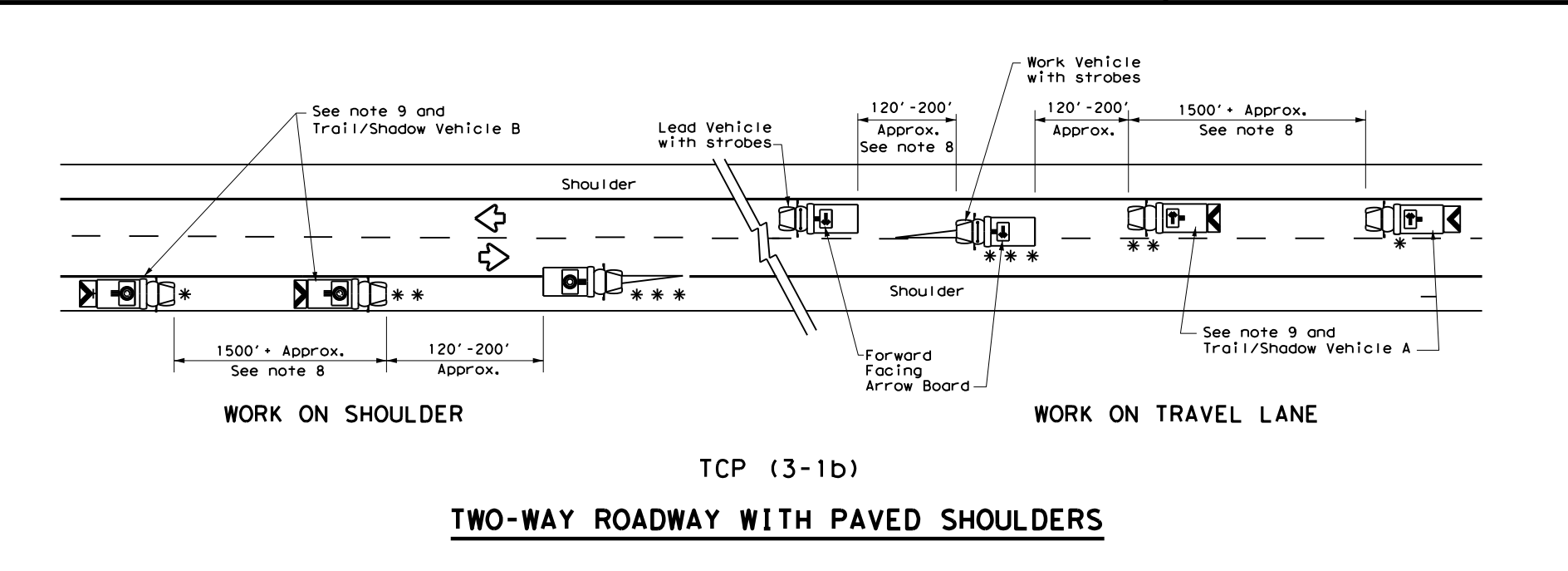
TRAIL/SHADOW VEHICLE A
with RIGHT Directional display Flashing Arrow Board

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)

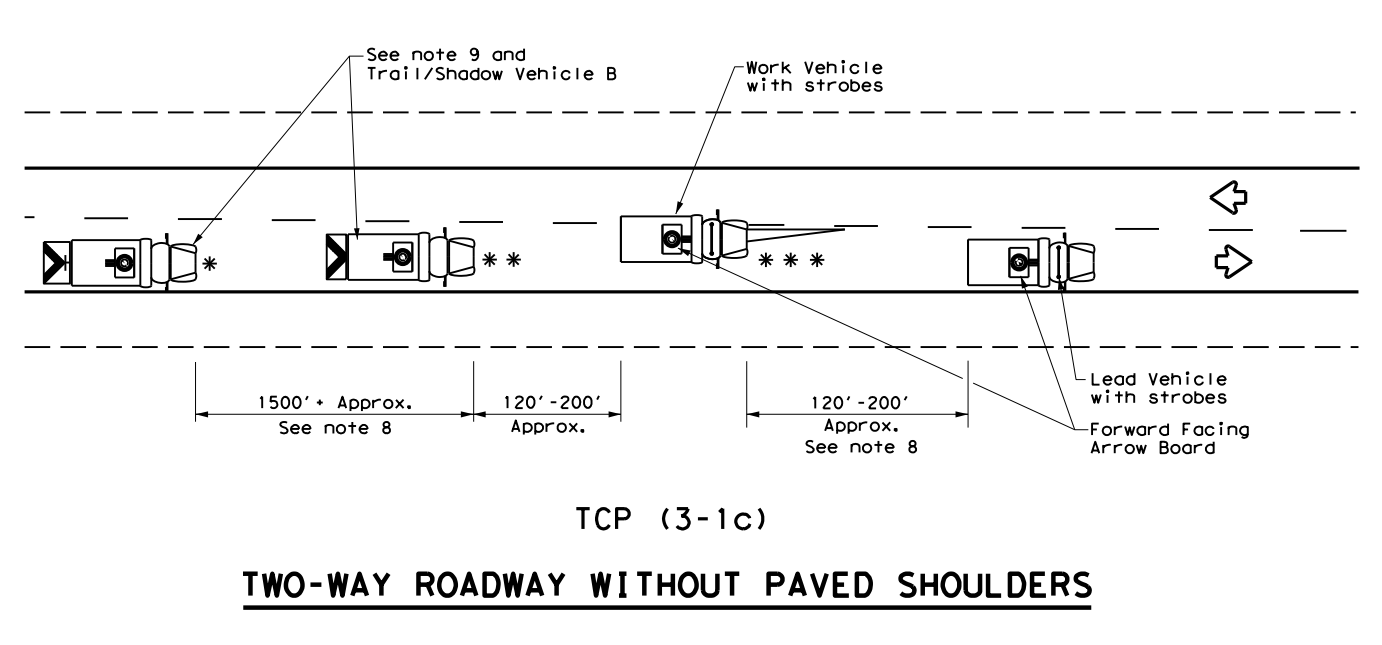
TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
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GENERAL NOTES

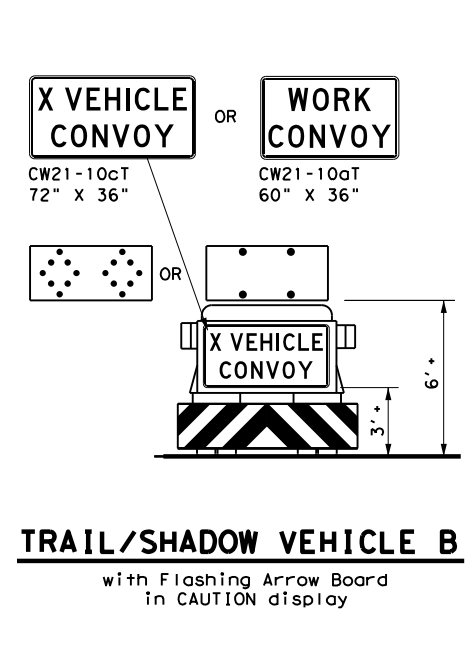
1. TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used the WORK vehicle must be equipped with an arrow board. The Engineer will determine if the LEAD VEHICLE and/or TRAIL VEHICLE are required based on prevailing roadway conditions, traffic volume, and sight distance restrictions.
2. 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.
3. The use of truck mounted attenuators (TMA) on the SHADOW VEHICLE and TRAIL VEHICLE are required.
4. 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.
5. 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.
6. Each vehicle shall have two-way radio communication capability.
7. When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
8. 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.
9. "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.
10. 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.



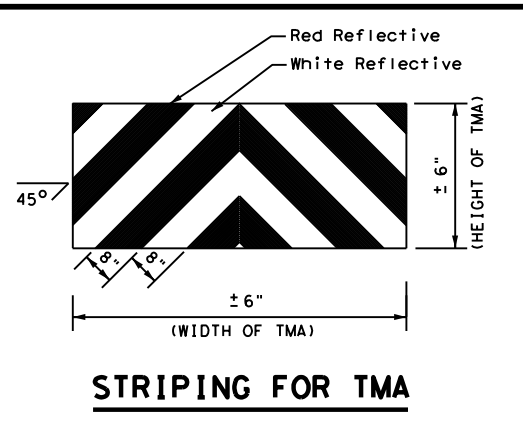
TCP (3-1b)
TWO-WAY ROADWAY WITH PAVED SHOULDERS



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



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



STRIPING FOR TMA

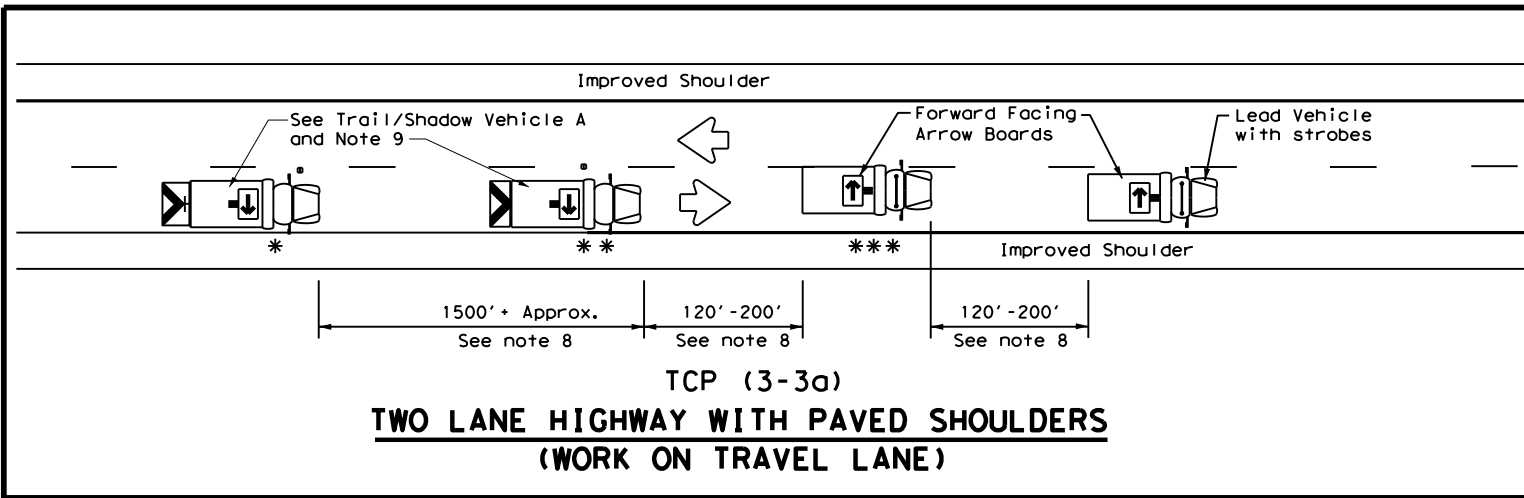
Traffic Operations Division Standard

**TRAFFIC CONTROL PLAN
MOBILE OPERATIONS
UNDIVIDED HIGHWAYS**

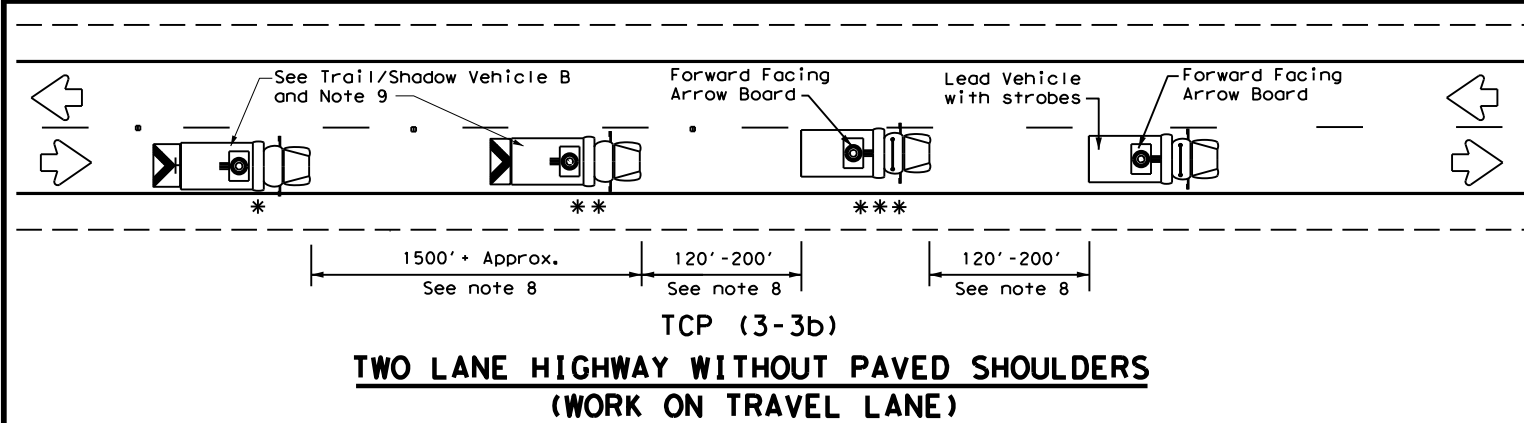
TCP(3-1)-13

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© TxDOT	December 1985	CONT:	2352	SECT:	02	JOB:	027	HIGHWAY:	FM 2449
REVISIONS:									
2-94	4-98								
8-95	7-13								
1-97									
DIST:	DAL	COUNTY:	DENTON	SHEET NO.:	39				

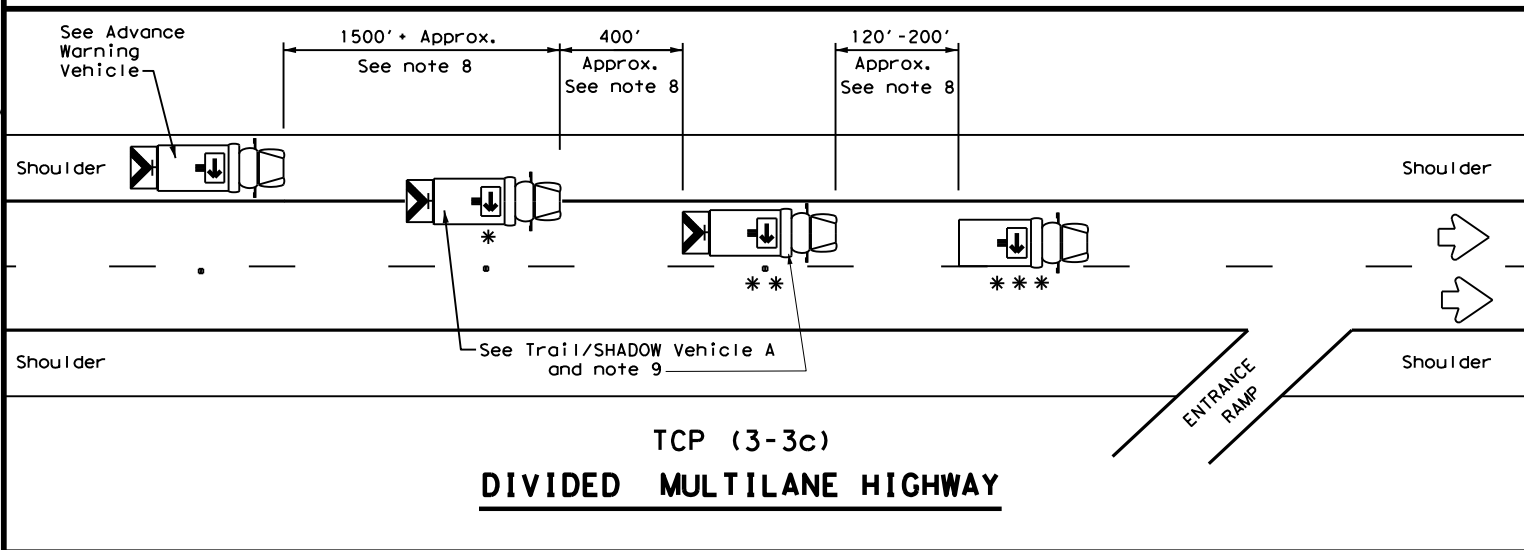
DATE: 9/19/2022 2:11:33 PM
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 Ponder ISD\PLANS\07 TCP\STANDARDS\TRAFFIC CONTROL PLAN\TRAFFIC CONTROL PLAN.dgn
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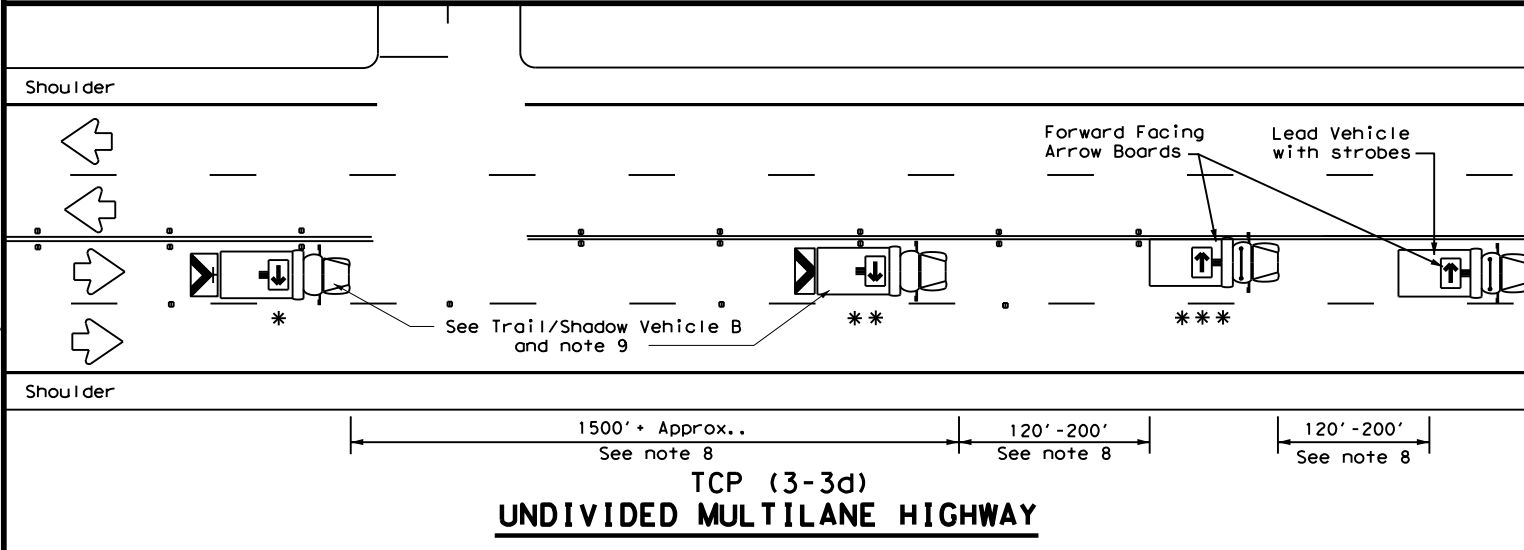
TCP (3-3a)
TWO LANE HIGHWAY WITH PAVED SHOULDERS
(WORK ON TRAVEL LANE)



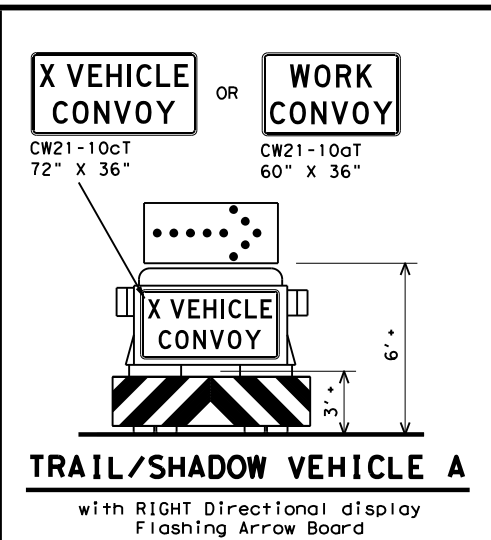
TCP (3-3b)
TWO LANE HIGHWAY WITHOUT PAVED SHOULDERS
(WORK ON TRAVEL LANE)



TCP (3-3c)
DIVIDED MULTILANE HIGHWAY

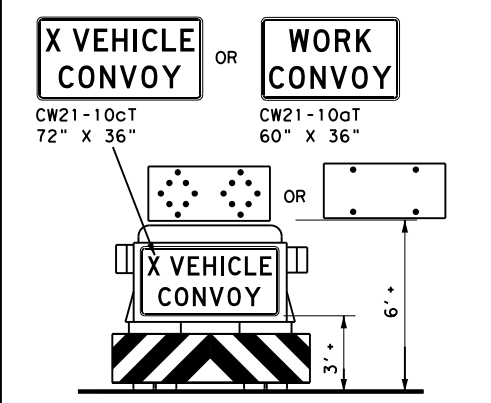


TCP (3-3d)
UNDIVIDED MULTILANE HIGHWAY



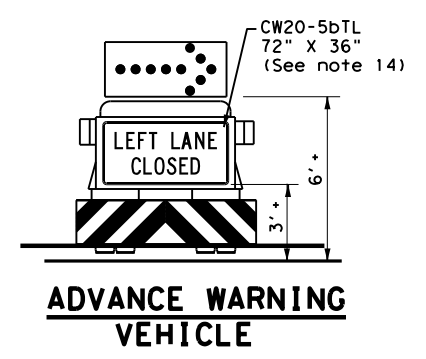
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display
Flashing Arrow Board

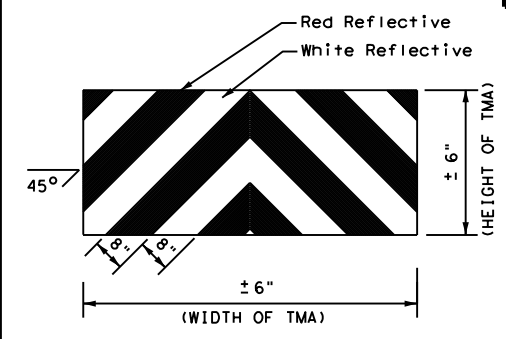


TRAIL/SHADOW VEHICLE B

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
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
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

GENERAL NOTES

1. 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.
2. 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.
3. The use of truck mounted attenuators (TMA) on the SHADOW VEHICLE, ADVANCE WARNING and TRAIL VEHICLE are required.
4. 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.
5. 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.
6. Each vehicle shall have two-way radio communication capability.
7. When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
8. 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.
9. 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.
10. 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.
11. A double arrow shall not be displayed on the arrow board on the Advance Warning Vehicle.
12. For divided highways with three or four lanes in each direction, use TCP(3-2).
13. Standard diamond shape versions of the CW20-5 series signs may be used as an option if the rectangular signs shown are not available.
14. The Advance Warning Vehicle may straddle the edgeline when Shoulder width makes it necessary.
15. 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.

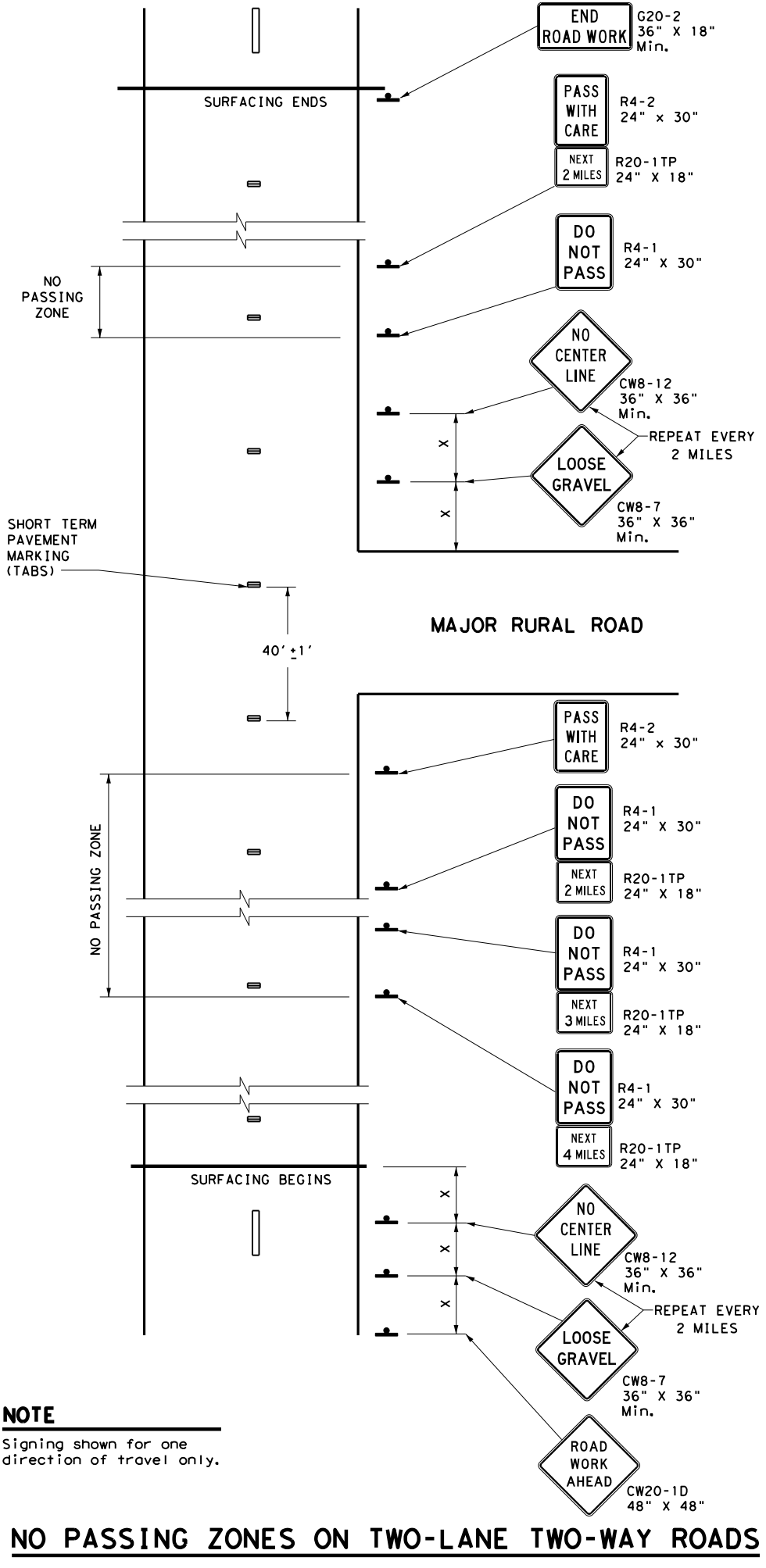
Texas Department of Transportation
 Traffic Operations Division Standard

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

FILE: tcp3-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT September 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM 2449
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8-95 7-13				
1-97 7-14				
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		40

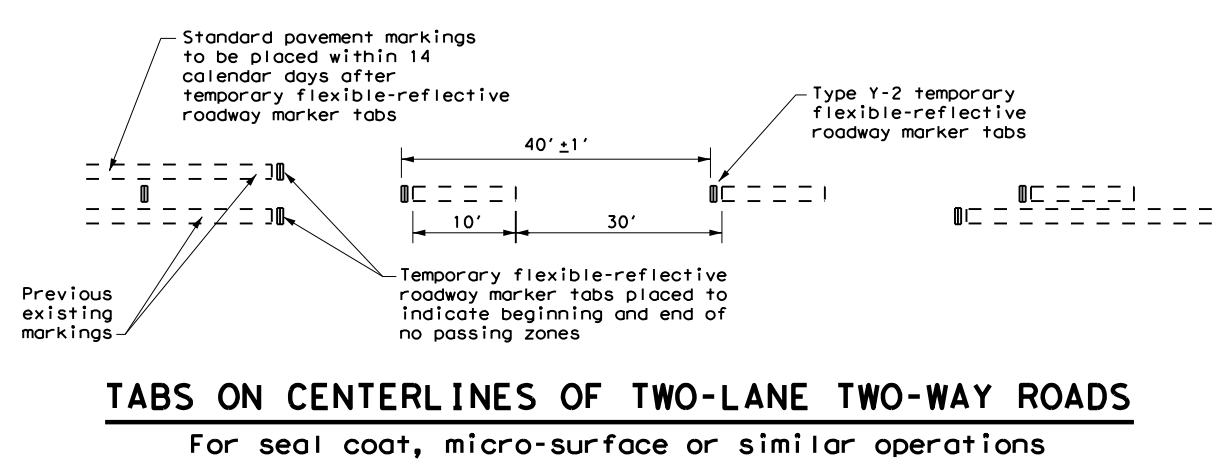
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NOTE
 Signing shown for one direction of travel only.

NO PASSING ZONES ON TWO-LANE TWO-WAY ROADS



TABS ON CENTERLINES OF TWO-LANE TWO-WAY ROADS
 For seal coat, micro-surface or similar operations

"DO NOT PASS" SIGN (R4-1) and NO-PASSING ZONES

- A. Prior to the beginning of construction, all currently striped no-passing zones shall be signed with the DO NOT PASS (R4-1) signs and PASS WITH CARE (R4-2) signs placed at the beginning and end of each zone for each direction of travel except as otherwise provided herein. Signs marking these individual no-passing zones need not be covered prior to construction if the signs supplement the existing pavement markings.
- B. At the discretion of the Engineer, in areas of numerous no-passing zones, several zones may be combined as a single zone. If passing is to be prohibited over one or more lengthy sections, a DO NOT PASS sign and a NEXT XX MILES (R20-1TP) plaque may be used at the beginning of such zones. The DO NOT PASS sign and the NEXT XX MILES plaque should be repeated every mile to the end of the no-passing zone. In areas where there is considerable distance between no-passing zones, the end of the no-passing zone may be signed with a PASS WITH CARE sign and a NEXT XX MILES plaque.
- C. Depending on traffic volumes and length of sections, it may be desirable to prohibit passing throughout the project to prevent damage to windshield and lights. The DO NOT PASS sign and NEXT XX MILES plaque should be used and repeated as often as necessary for this purpose. Where several existing zones are to be combined into one individual no-passing zone, the sign at the beginning of the zone should be covered until the surfacing operation has passed this location so as not to have the DO NOT PASS sign conflict with the existing pavement markings. Also, unless one days operation completes the entire length of such combined zones, appropriate DO NOT PASS and PASS WITH CARE signs should be placed at the beginning and end of the no-passing zones where the surfacing operation has stopped for the day.
- D. R4-1 and R4-2 are to remain in place until standard pavement markings are installed.

"NO CENTER LINE" SIGN (CW8-12)

- A. Center line markings are yellow pavement markings that delineate the separation of travel lanes that have opposite directions of travel on a roadway. Divided highways do not typically have center line markings.
- B. At the time construction activity obliterates the existing center line markings (low volume roads may not have an existing centerline), a NO CENTER LINE (CW8-12) sign should be erected at the beginning of the work area, at approximately 2 mile intervals within the work area, beyond major intersections and other locations deemed necessary by the Engineer.
- C. The NO CENTER LINE signs are to remain in place until standard pavement markings are installed.

"LOOSE GRAVEL" SIGN (CW8-7)

- A. When construction begins, a LOOSE GRAVEL (CW8-7) sign should be erected at each end of the work area and repeated at intervals of approximately 2 miles in rural areas and closer in urban areas.
- B. The LOOSE GRAVEL signs are to remain in place until the condition no longer exists.

PAVEMENT MARKINGS

- A. Temporary markings for surfacing projects shall be Temporary Flexible-reflective Roadway Marker Tabs unless otherwise approved by the Engineer. Tabs are to be installed to provide true alignment for striping crews or as directed by the Engineer. Tabs will be placed at the spacing indicated. Tabs should be applied to the pavement no more than two (2) days before the surfacing is applied. After the surfacing is rolled and swept, the cover over the reflective strip shall be removed.
- B. Tabs shall not be used to simulate edge lines.
- C. Tab placement for overlay/inlay operations shall be as shown on the WZ(STPM) standard sheet.

COORDINATION OF SIGN LOCATIONS

- A. The location of warning signs at the beginning and end of a work area are to be coordinated with other signing typically shown on the Barricade and Construction Standards for project limits to ensure adequate sign spacing.
- B. Where possible the ROAD WORK AHEAD (CW20-1D), LOOSE GRAVEL (CW8-7), and NO CENTER LINE (CW8-12) signs should be placed in the sequence shown following the OBEY WARNING SIGNS STATE LAW (R20-3T) and the TRAFFIC FINES DOUBLE (R20-5T) sign, and one "X" sign spacing prior to the CONTRACTOR (G20-6T) sign typically located at or near the limits of surfacing. LOOSE GRAVEL and NO CENTER LINE signs will then be repeated as described above.

Posted Speed *	Minimum Sign Spacing "X" Distance
30	120'
35	160'
40	240'
45	320'
50	400'
55	500'
60	600'
65	700'
70	800'
75	900'

* Conventional Roads Only

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

GENERAL NOTES

- 1. The traffic control devices detailed on this sheet will be furnished and erected as directed by the Engineer on sections of roadway where tabs must be placed prior to the surfacing operation which will cover or obliterate the existing pavement markings.
- 2. The devices shown on this sheet are to be used to supplement those required by the BC Standards or others required elsewhere in the plans.
- 3. Signs shall be erected as detailed on the BC Standards or the Compliant Work Zone Traffic Control Devices List (CWZTCD) on supports approved for Long-Term / Intermediate-Term Work Zone Sign Supports.
- 4. When surfacing operations take place on divided highways, freeways or expressways, the size of diamond shaped construction warning signs shall be 48" x 48".
- 5. Signs on divided highways, freeways and expressways will be placed on both right and left sides of the roadway based on roadway conditions as directed by the Engineer.

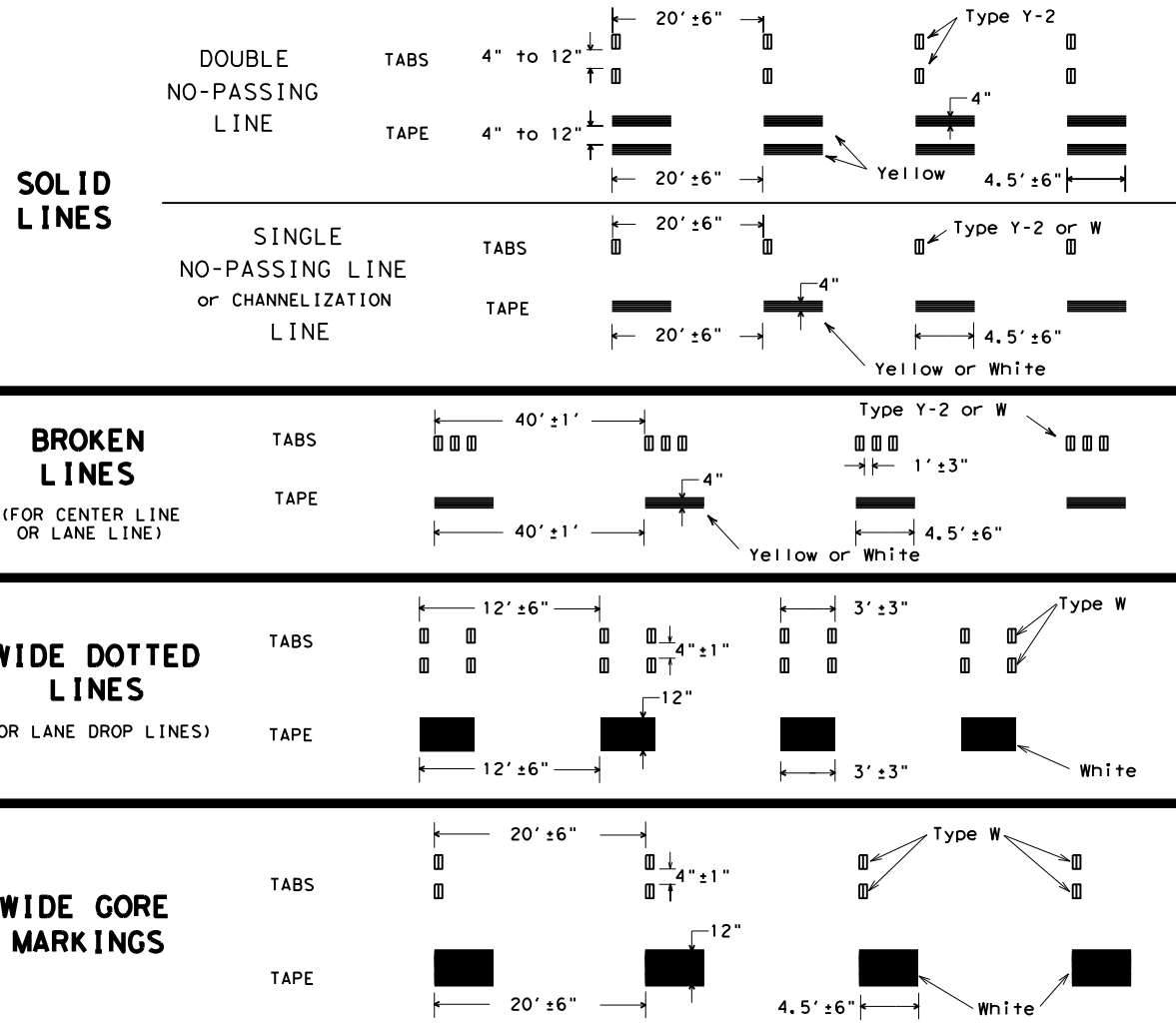


TRAFFIC CONTROL DETAILS FOR SURFACING OPERATIONS
TCP (7-1) - 13

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© TxDOT	March 1991	CONT:	2352	SECT:	02	JOB:	027	HIGHWAY:	FM 2449
REVISIONS:		DIST:	DAL	COUNTY:	DENTON	SHEET NO.:			

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WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



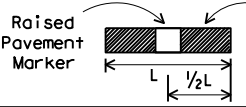
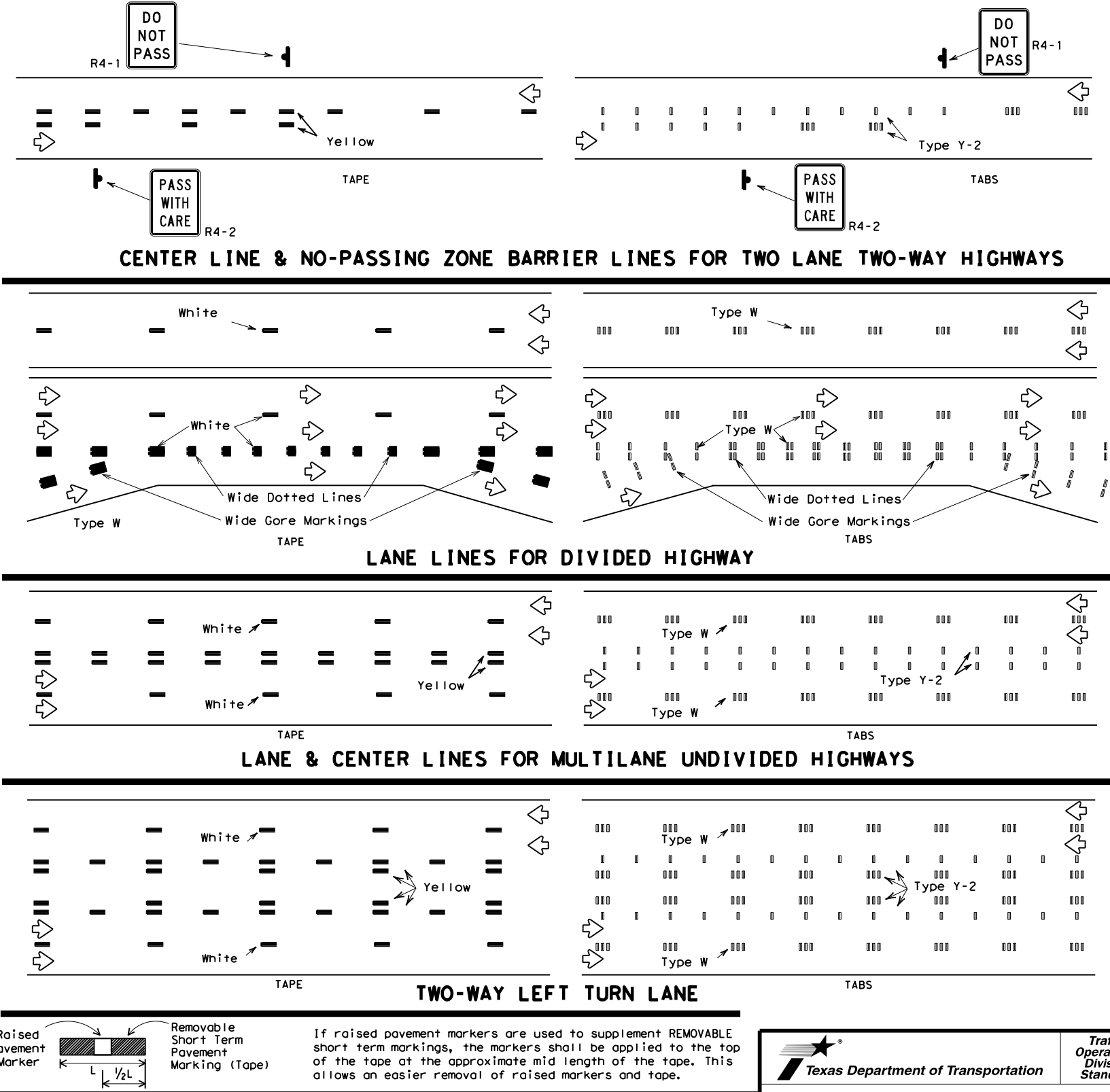
NOTES:

- 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.

WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



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

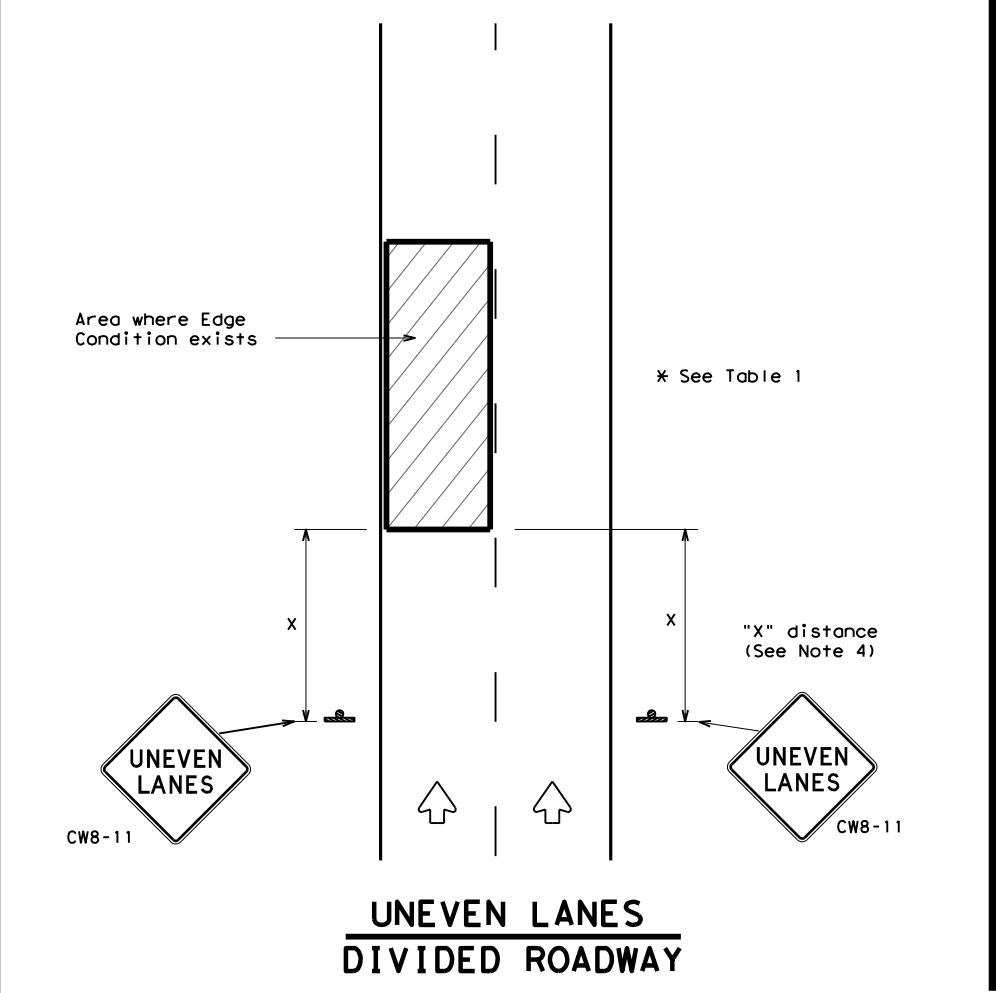
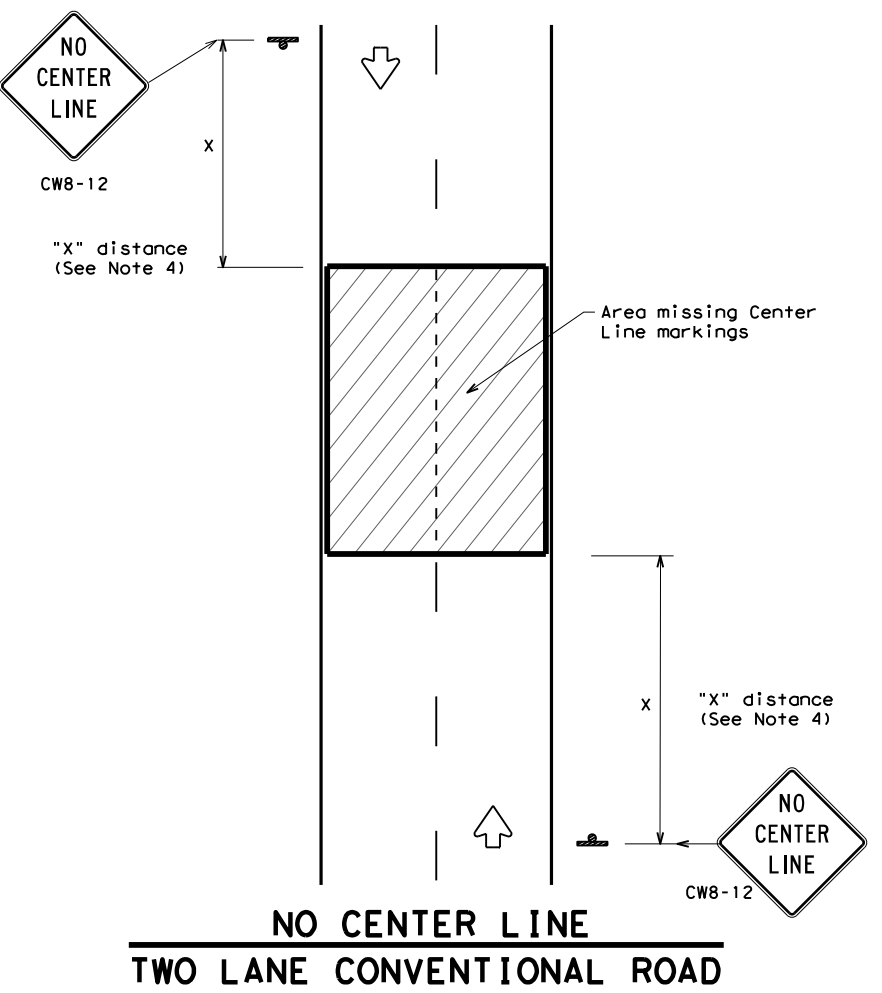
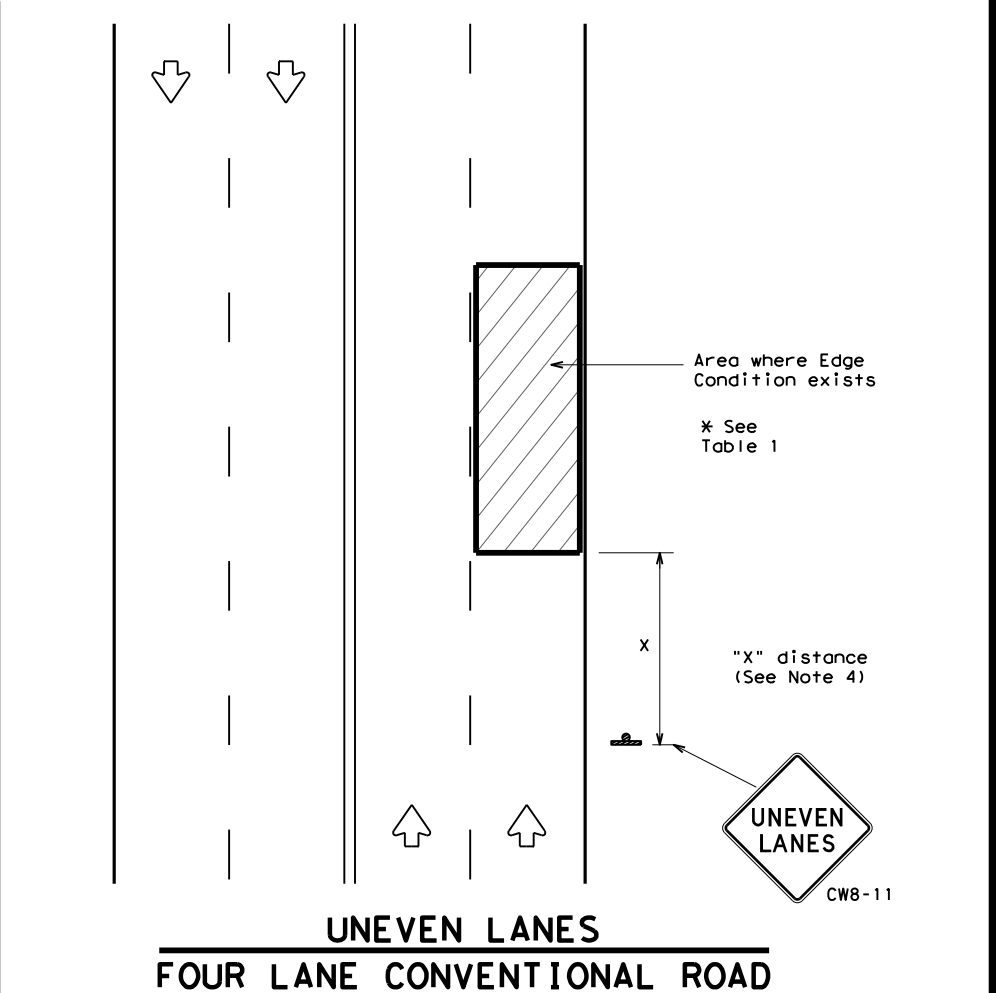
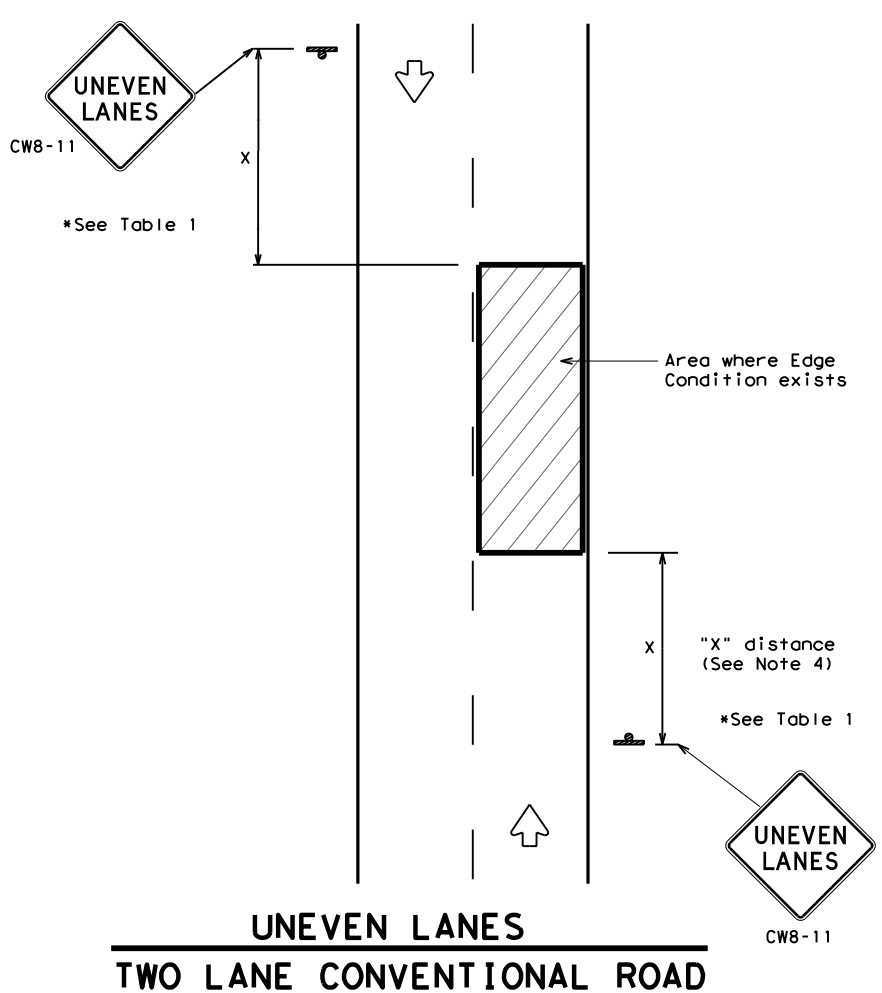
WORK ZONE SHORT TERM PAVEMENT MARKINGS

WZ (STPM) - 13

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© TxDOT	April 1992	CONT:	2352	SECT:	02	JOB:	027	FM:	2449
REVISIONS:		DIST:		COUNTY:		SHEET NO.:			
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3-03									
7-13									

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DEPARTMENTAL MATERIAL SPECIFICATIONS	
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY (REMOVABLE) PREFABRICATED PAVEMENT MARKINGS	DMS-8241
SIGN FACE MATERIALS	DMS-8300

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B _{FL} OR TYPE C _{FL} SHEETING
BLACK	LEGEND & BORDERS	ACRYLIC NON-REFLECTIVE SHEETING

GENERAL NOTES

1. If spalling or holes occur, ROUGH ROAD (CW8-8) signs should be placed in advance of the condition and be repeated every two miles where the condition persists.
2. UNEVEN LANES (CW8-11) signs shall be installed in advance of the condition and repeated every mile. Signs installed along the uneven lane condition may be supplemented with the NEXT XX MILES (CW7-3aP) plaque or Advisory Speed (CW13-1P) plaque.
3. NO CENTER LINE (CW8-12) signs and temporary pavement markings as per the WZ(STPM) standard shall be installed if yellow centerlines separating two way traffic are obscured or obliterated. Repeat NO CENTER LINE signs every two miles where the center line markings are not in place. The signs and markings shall remain in place until permanent pavement markings are installed.
4. Signs shall be spaced at the distances recommended as per BC standards.
5. Additional signs may be required as directed by the Engineer. Signs shall remain in place until final surface is applied. Signs shall be considered subsidiary to Item 502 "BARRICADES, SIGNS AND TRAFFIC HANDLING."
6. Signs shall be fabricated and mounted on supports as shown on the BC standards and/or listed on the "Compliant Work Zone Traffic Control Devices" list.
7. Short term markings shall not be used to simulate edge lines.
8. All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition.

Edge Condition	Edge Height (D)	* Warning Devices
①	Less than or equal to: 1/4" (maximum-planing) 1/2" (typical-overlay)	Sign: CW8-11
②	Less than or equal to 3"	Sign: CW8-11
③	Distance "D" may be a maximum of 3" if uneven lanes with edge condition 2 or 3 are open to traffic after work operations cease. Uneven lanes should not be open to traffic when "D" is greater than 3".	

TRAFFIC CONTROL DURING PLANING, OVERLAY AND LEVELING OPERATIONS ARE SHOWN ELSEWHERE IN THE PLANS.

MINIMUM WARNING SIGN SIZE	
Conventional roads	36" x 36"
Freeways/expressways, divided roadways	48" x 48"



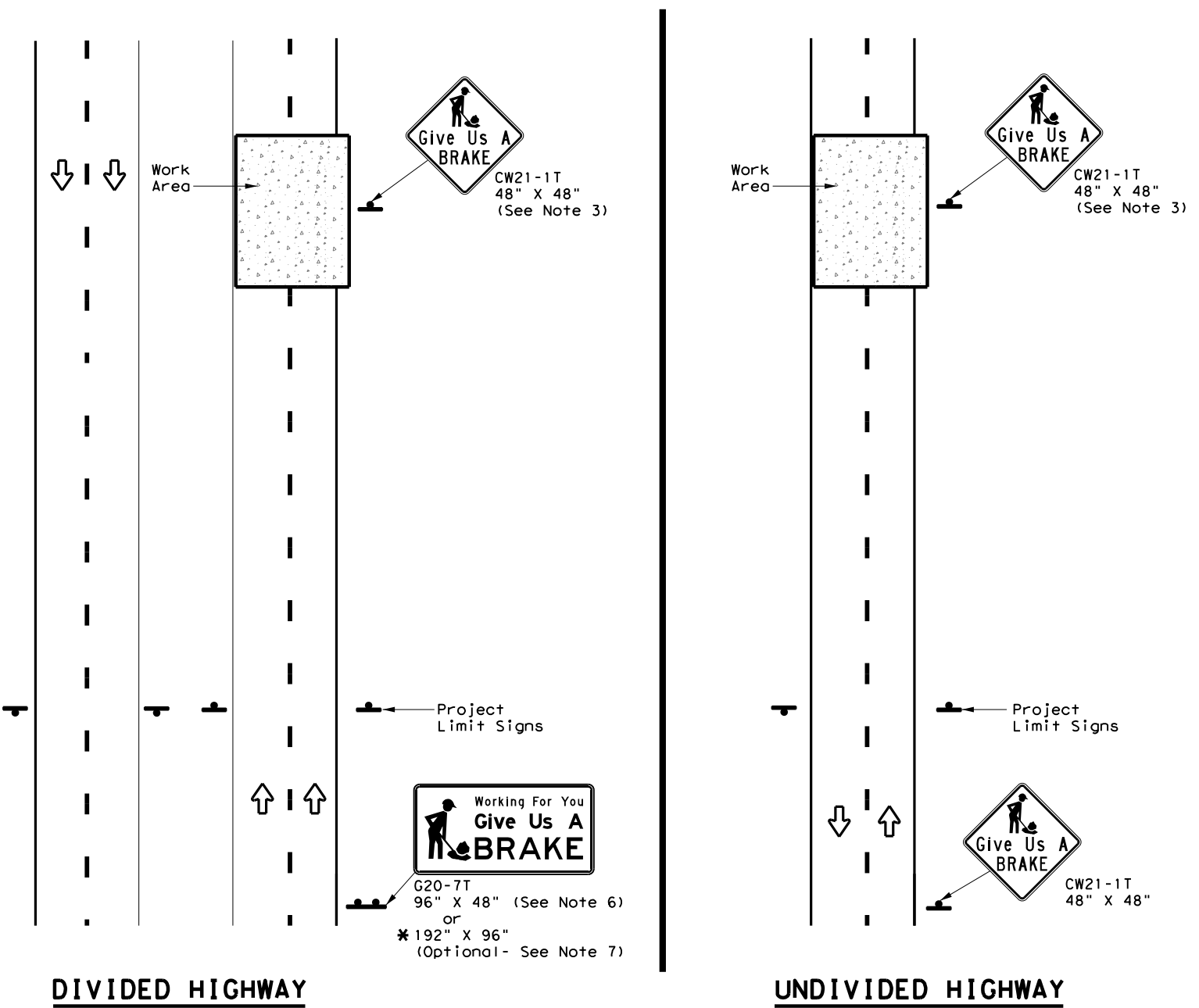
SIGNING FOR UNEVEN LANES

WZ (UL) - 13

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8-95 2-98 7-13	DIST	COUNTY	SHEET NO.	
1-97 3-03	DAL	DENTON	43	

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DIVIDED HIGHWAY

UNDIVIDED HIGHWAY

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 _{FL} or C _{FL}	32	▲	▲	▲
Orange	G20-7T		192" X 96"	Type B _{FL} or C _{FL}	128	W8x18	16	17

▲ 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 _{FL} OR TYPE C _{FL}
BLACK	LEGEND & BORDERS	NON-REFLECTIVE ACRYLIC FILM

GENERAL NOTES

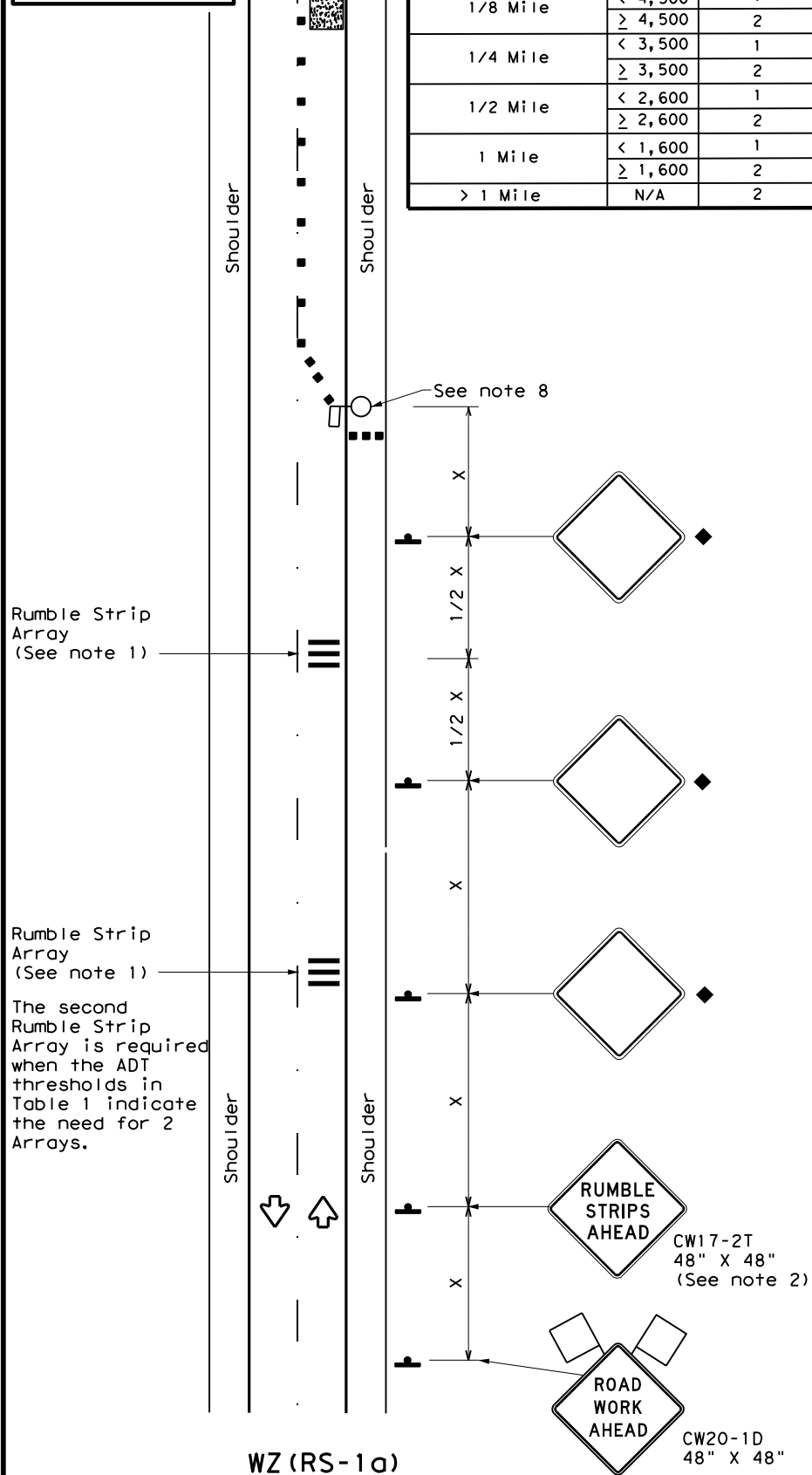
- See BC and SMD sheets for additional sign support details.
- Sign locations shall be approved by the Engineer.
- For projects more than two miles in length, Give Us a BRAKE signs should be repeated halfway through the project. The Give Us a Brake (CW21-1T) may be used for this purpose.
- Work zone 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	
WORK ZONE "GIVE US A BRAKE" SIGNS					
WZ (BRK) - 13					
FILE:	wzbrk-13.dgn	DN:	TxDOT	CK:	TxDOT
©TxDOT	August 1995	CONT	SECT	JOB	HIGHWAY
REVISIONS		2352	02	027	FM 2449
6-96	5-98	7-13	DIST	COUNTY	SHEET NO.
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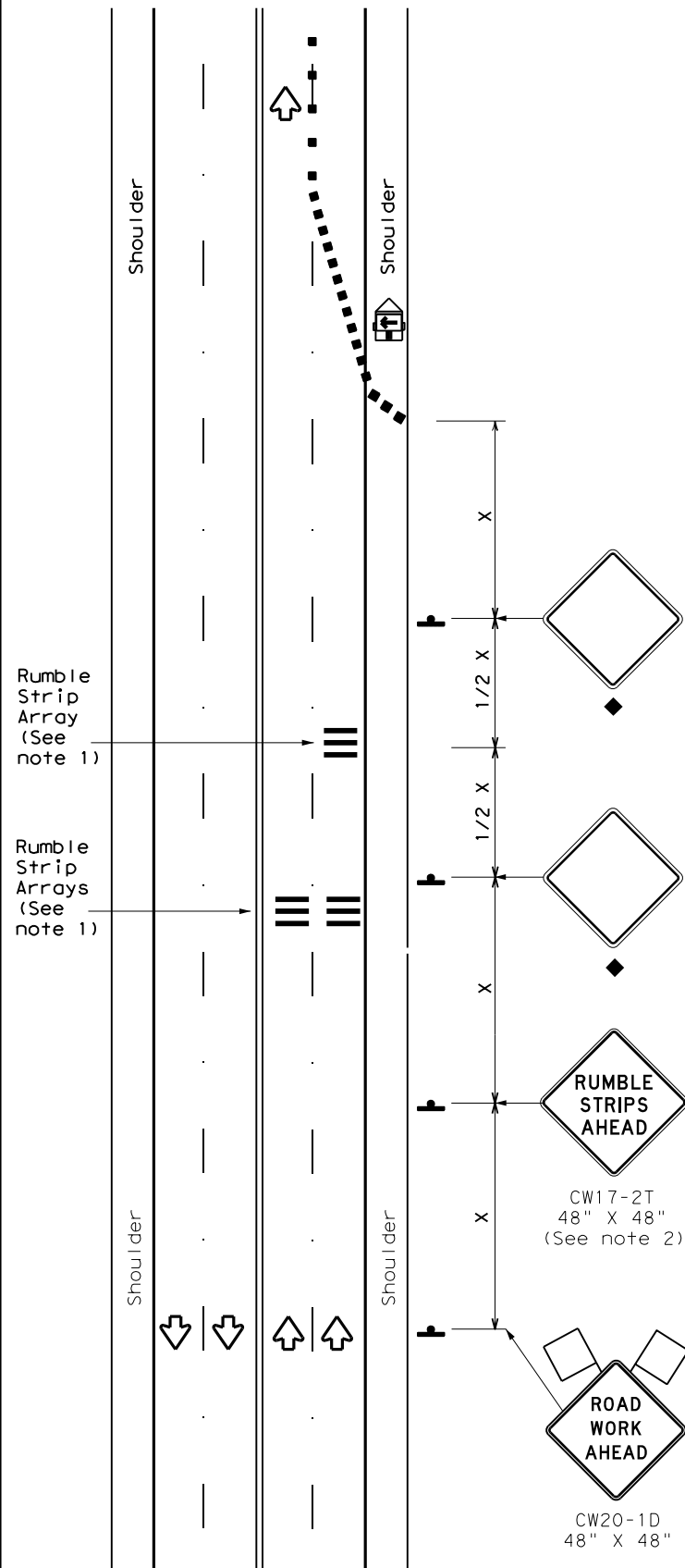
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Warning sign and rumble strip sequence in opposite direction is same as below.

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/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)

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	2352	02	027	FM 2449
2-14 1-22	DIST	COUNTY	SHEET NO.	
4-16	DALLAS	DENTON	45	

<* 1 DESCRIBE CHAIN PCL

Chain PCL contains:
PCL01 CUR PCL1 PCL2 PCL02 CUR PCL3 CUR PCL4 PCL03

Beginning chain PCL description

Point PCL01 N 7,115,283.5269 E 2,336,918.4429 Sta 105+00.00

Course from PCL01 to PC PCL1 N 89° 20' 23.49" E Dist 430.2832

Curve Data

Curve PCL1
P.I. Station 109+44.18 N 7,115,288.6445 E 2,337,362.5953
Delta = 0° 16' 40.70" (LT)
Degree = 1° 00' 00.00"
Tangent = 13.8987
Length = 27.7973
Radius = 5,729.5780
External = 0.0169
Long Chord = 27.7973
Mid. Ord. = 0.0169
P.C. Station 109+30.28 N 7,115,288.4844 E 2,337,348.6976
P.T. Station 109+58.08 N 7,115,288.8721 E 2,337,376.4921
C.C. = N 89° 20' 23.49" E
Back = N 89° 03' 42.78" E
Ahead = N 89° 12' 03.14" E
Chord Bear = N 89° 12' 03.14" E

Course from PT PCL1 to PC PCL2 N 89° 03' 42.78" E Dist 657.5050

Curve Data

Curve PCL2
P.I. Station 116+26.57 N 7,115,299.8168 E 2,338,044.8885
Delta = 0° 13' 10.62" (RT)
Degree = 1° 00' 00.00"
Tangent = 10.9809
Length = 21.9617
Radius = 5,729.5780
External = 0.0105
Long Chord = 21.9617
Mid. Ord. = 0.0105
P.C. Station 116+15.59 N 7,115,299.6371 E 2,338,033.9091
P.T. Station 116+37.55 N 7,115,299.9545 E 2,338,055.8685
C.C. = N 89° 03' 42.78" E
Back = N 89° 16' 53.41" E
Ahead = N 89° 10' 18.10" E
Chord Bear = N 89° 10' 18.10" E

Course from PT PCL2 to PCL02 N 89° 16' 53.41" E Dist 102.4313

Point PCL02 N 7,115,301.2390 E 2,338,158.2918 Sta 117+39.98

Course from PCL02 to PC PCL3 N 89° 45' 21.72" E Dist 1,838.3703

Curve Data

Curve PCL3
P.I. Station 137+44.26 N 7,115,309.7733 E 2,340,162.5588
Delta = 3° 19' 02.54" (LT)
Degree = 1° 00' 00.00"
Tangent = 165.9150
Length = 331.7372
Radius = 5,729.5780
External = 2.4017
Long Chord = 331.6909
Mid. Ord. = 2.4007
P.C. Station 135+78.35 N 7,115,309.0668 E 2,339,996.6454
P.T. Station 139+10.09 N 7,115,320.0794 E 2,340,328.1534
C.C. = N 89° 45' 21.72" E
Back = N 86° 26' 19.18" E
Ahead = N 88° 05' 50.45" E
Chord Bear = N 88° 05' 50.45" E

Course from PT PCL3 to PC PCL4 N 86° 26' 19.18" E Dist 311.3445

Curve Data

Curve PCL4
P.I. Station 143+62.41 N 7,115,348.1766 E 2,340,779.6058
Delta = 2° 49' 08.61" (RT)
Degree = 1° 00' 00.00"
Tangent = 140.9814
Length = 281.9059
Radius = 5,729.5780
External = 1.7342
Long Chord = 281.8775
Mid. Ord. = 1.7337
P.C. Station 142+21.43 N 7,115,339.4192 E 2,340,638.8966
P.T. Station 145+03.34 N 7,115,350.0030 E 2,340,920.5753
C.C. = N 87° 50' 53.49" E
Back = N 86° 26' 19.18" E
Ahead = N 89° 15' 27.79" E
Chord Bear = N 87° 50' 53.49" E

Course from PT PCL4 to PCL03 N 89° 15' 27.79" E Dist 397.6640

Point PCL03 N 7,115,355.1547 E 2,341,318.2059 Sta 149+01.00

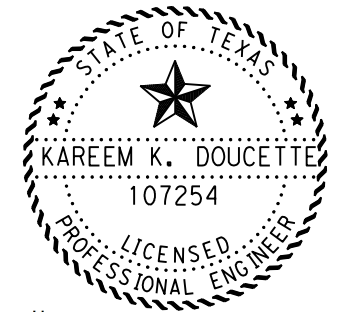
Ending chain PCL description

<* 1 PRINT PROFILE PCL_PRO

Beginning profile PCL_PRO description:

	STATION	ELEV	GRADE	TOTAL L	BACK L	AHEAD L
VPI	1 105+00.00	751.4237				
VPC	105+50.00	752.4307	2.0139	K = 168.0	SSD = 602.1	
High Point	108+88.33	755.8375				
VPI	2 110+50.00	762.5000		1,000.0000	500.0000	500.0000
VPT	115+50.00	742.8077	-3.9385			
VPC	115+50.00	742.8077	-3.9385	K = 92.6		
VPI	3 117+00.00	736.9000		300.0000	150.0000	150.0000
VPT	118+50.00	735.8500	-0.7000			
VPC	121+00.00	734.1000	-0.7000	K = 235.8		
VPI	4 122+00.00	733.4000		200.0000	100.0000	100.0000
Low Point	122+65.09	733.5222				
VPT	123+00.00	733.5480	0.1480			
VPC	123+75.00	733.6590	0.1480	K = 217.7	SSD = 1641.2	
High Point	124+07.22	733.6828				
VPI	5 124+50.00	733.7700		150.0000	75.0000	75.0000
VPT	125+25.00	733.3643	-0.5409			
VPC	133+13.60	729.0984	-0.5409	K = 6.1		
Low Point	133+16.91	729.0895				
VPI	6 133+31.00	729.0043		34.8000	17.4000	17.4000
VPT	133+48.40	729.9005	5.1508			
VPC	133+71.60	731.0955	5.1508	K = 5.2	SSD = 178.4	
VPI	7 133+89.00	731.9917		34.8000	17.4000	17.4000
High Point	133+98.35	731.7844				
VPT	134+06.40	731.7220	-1.5504			
VPI	8 134+42.00	731.1700	-1.5504			
VPC	137+50.00	728.2515	-0.9476	K = 149.7		
VPI	9 138+50.00	727.3039		200.0000	100.0000	100.0000
Low Point	138+91.90	727.5792				
VPT	139+50.00	727.6919	0.3880			
VPI	10 139+80.04	727.8085	0.3880			

Ending profile PCL_PRO description

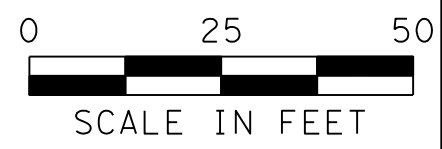


DocuSigned by:
Kareem Doucette 9/20/2022
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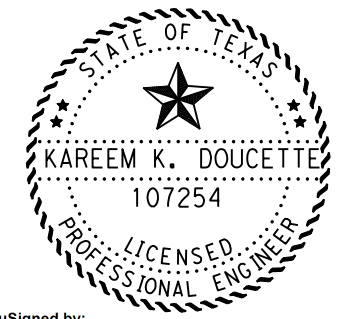
**FM 2449
HORIZONTAL & VERTICAL
ALIGNMENT DATA**

DESIGN KKD	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
GRAPHICS KKD	6	(See Title Sheet)		FM2449
CHECK	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DAL	DENTON	46
CHECK	CONTROL	SECTION	JOB	
	2352	02	027	



LEGEND

- DIRECTION OF TRAFFIC
- ☒ DRIVEWAY IDENTIFICATION No.



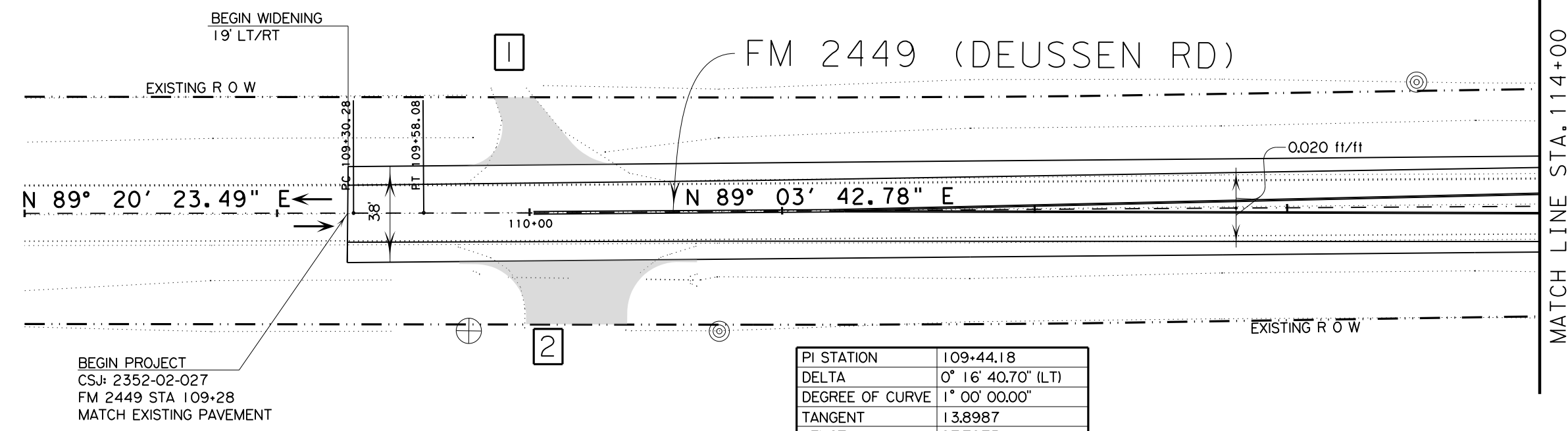
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Kareem Doucette 9/20/2022
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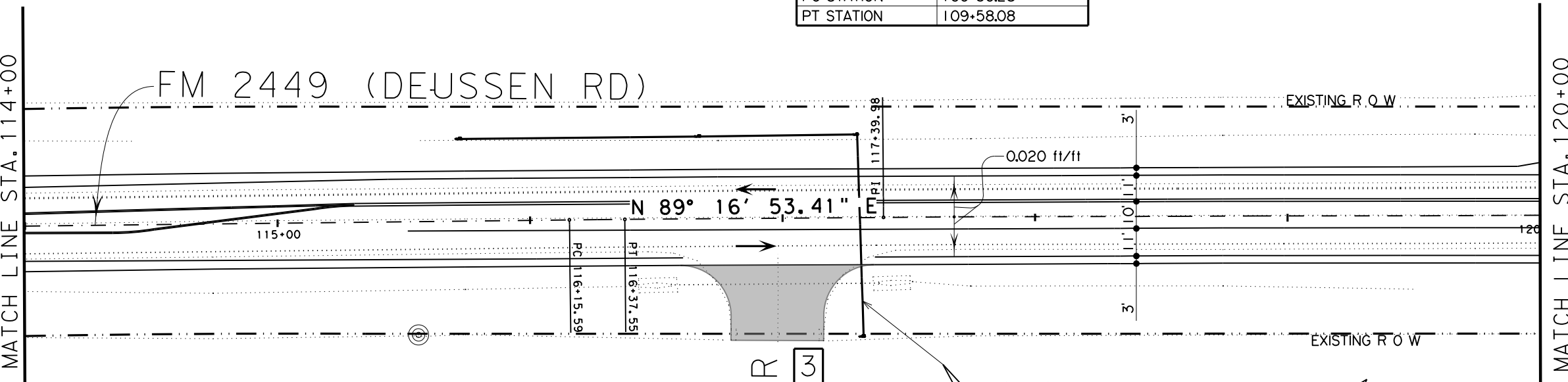
**FM 2449
 PLAN LAYOUT**

BEGIN PROJECT to STA 120+00

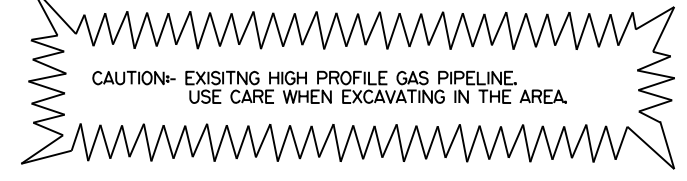
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CHECK	2352	02	027	

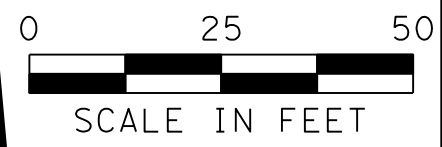
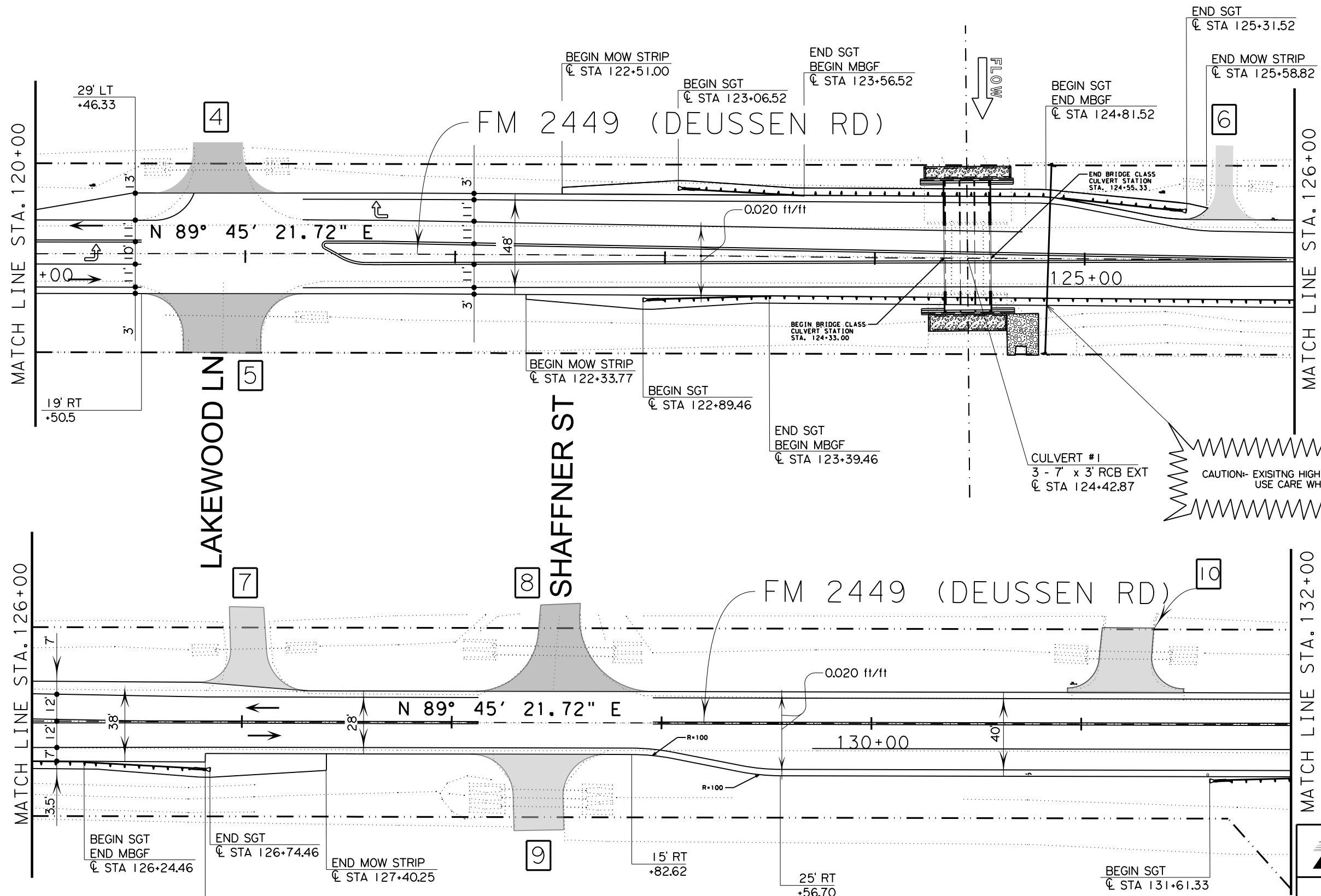


PI STATION	109+44.18
DELTA	0° 16' 40.70" (LT)
DEGREE OF CURVE	1° 00' 00.00"
TANGENT	13.8987
LENGTH	27.7973
RADIUS	5729.5780
PC STATION	109+30.28
PT STATION	109+58.08



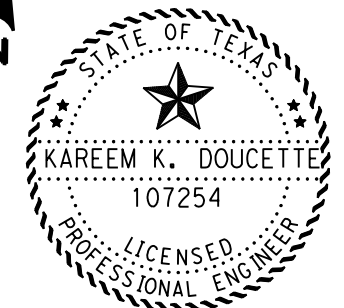
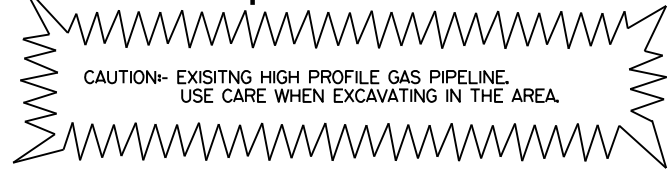
PI STATION	116+26.57
DELTA	0° 13' 10.62" (RT)
DEGREE OF CURVE	1° 00' 00.00"
TANGENT	10.9809
LENGTH	21.9617
RADIUS	5729.5780
PC STATION	116+15.59
PT STATION	116+37.55





LEGEND

- DIRECTION OF TRAFFIC
- ☒ DRIVEWAY IDENTIFICATION No.



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Kareem Doucette 9/26/2022
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FM 2449 PLAN LAYOUT

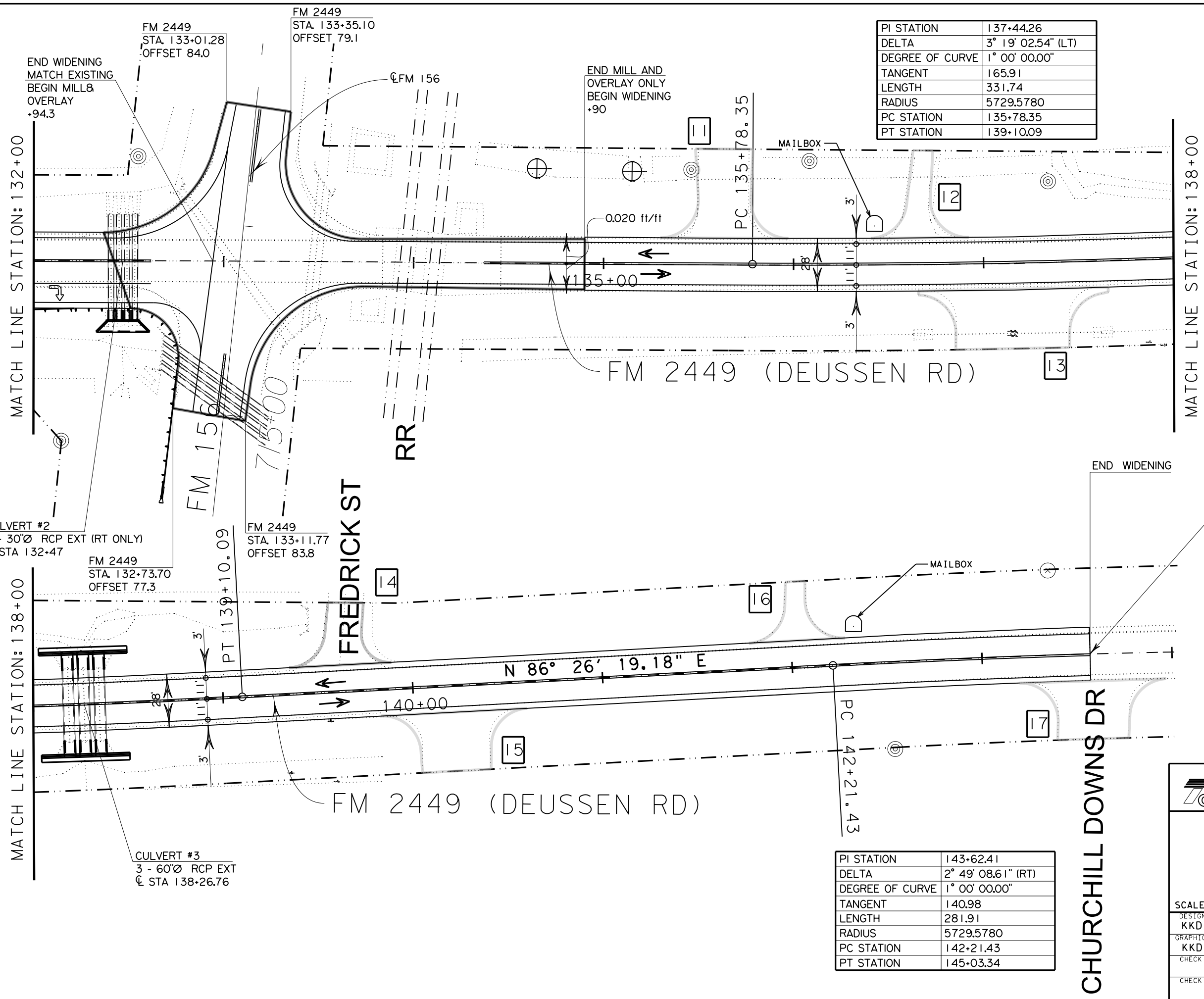
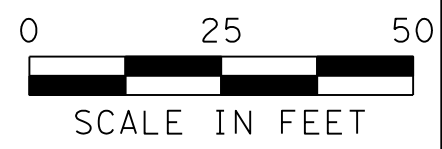
STA 120.00 to STA 132+00

SCALE: 1" = 50'			SHEET 2 OF 3	
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GRAPHICS KKD	STATE	DISTRICT DAL	COUNTY DENTON	SHEET NO. 48
CHECK	TEXAS	SECTION	JOB 027	
CHECK	2352	02	027	

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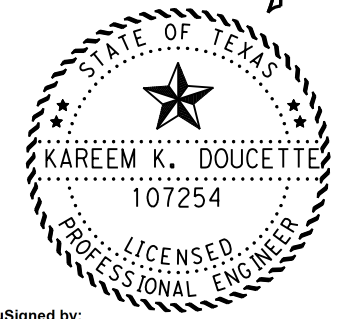
9/26/2022 11:32:58 AM

PI STATION	137+44.26
DELTA	3° 19' 02.54" (LT)
DEGREE OF CURVE	1° 00' 00.00"
TANGENT	165.91
LENGTH	331.74
RADIUS	5729.5780
PC STATION	135+78.35
PT STATION	139+10.09



PI STATION	143+62.41
DELTA	2° 49' 08.61" (RT)
DEGREE OF CURVE	1° 00' 00.00"
TANGENT	140.98
LENGTH	281.91
RADIUS	5729.5780
PC STATION	142+21.43
PT STATION	145+03.34

END PROJECT
CSJ: 2352-02-027
FM 2449 STA 143+56



DocuSigned by:
Kareem Doucette 9/26/2022
51C8F8A7FBD948C...

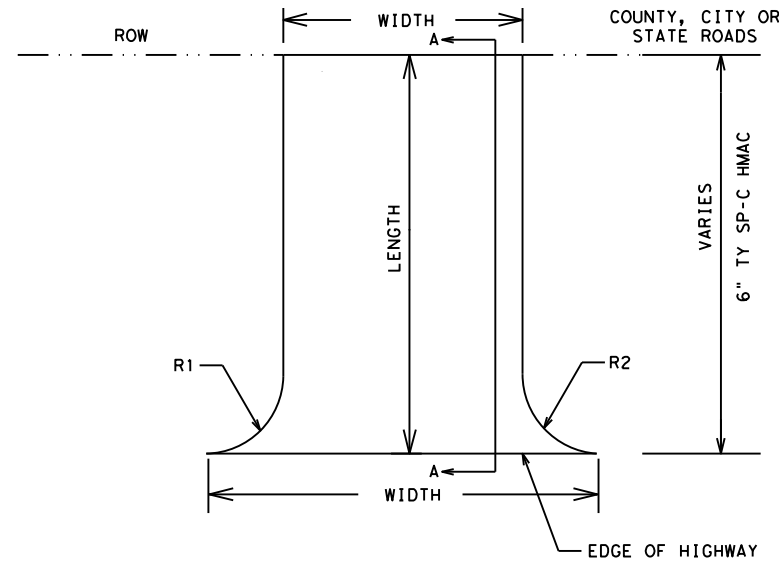
Texas Department of Transportation
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FM 2449 PLAN LAYOUT

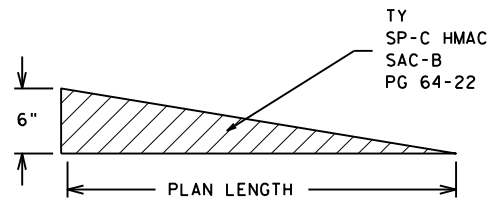
STA 132+00 to END OF PROJECT

SCALE: 1" = 50'				SHEET 3 OF 3
DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
GRAPHICS	6	(See Title Sheet)		FM2449
CHECK	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DAL	DENTON	49
CHECK	CONTROL	SECTION	JOB	
	2352	02	027	

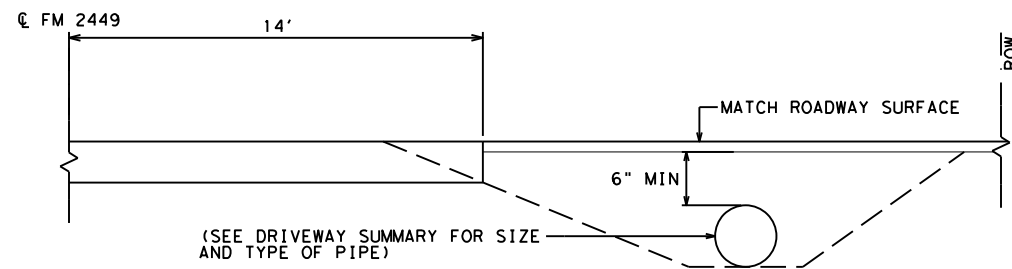
ASPHALT CONCRETE PAVEMENT DRIVEWAY COUNTY, CITY, OR STATE ROAD OVERLAY DETAILS



PLAN VIEW



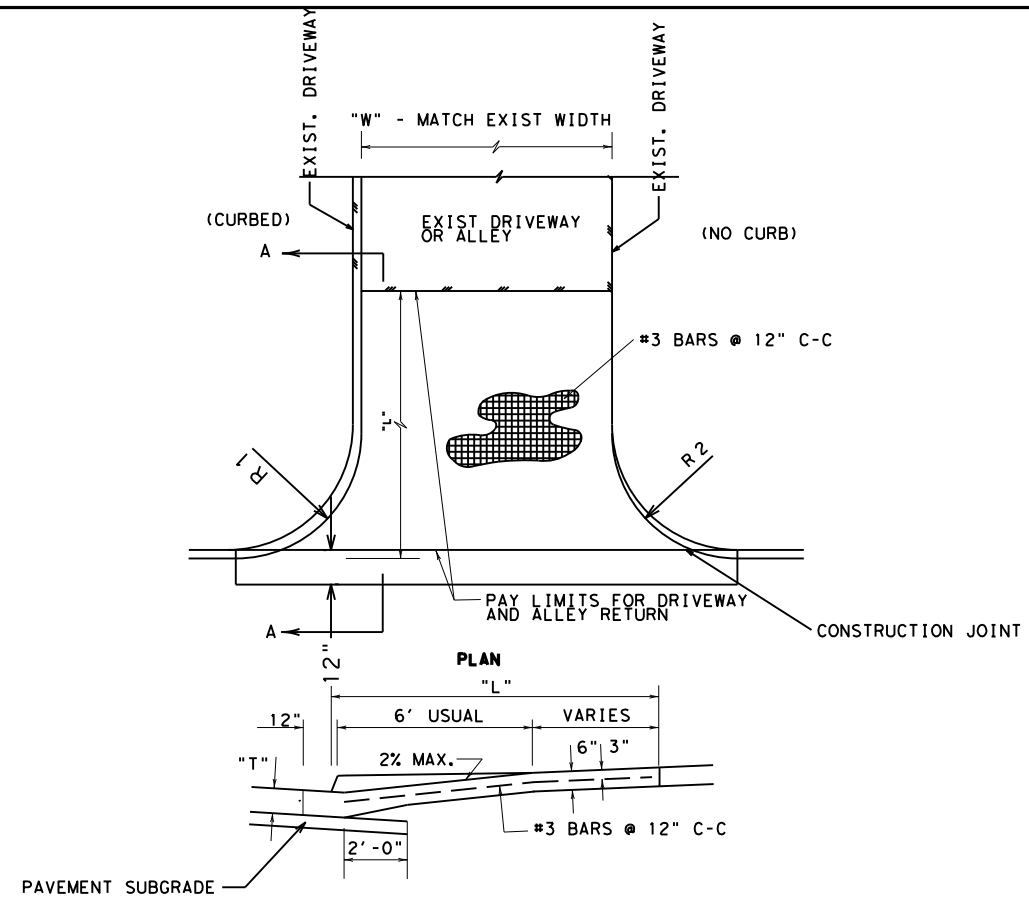
SECTION A-A



CROSS SECTION DRIVEWAY WITH PIPE

NOTE:

1. SEE "DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL INFORMATION.
2. CUT AND RESTORE FOR DRIVEWAY & INTERSECTIONS WILL BE SUBSIDIARY TO VARIOUS BID ITEMS.
3. FLOWABLE BACKFILL FOR DRIVEWAY AND INTERSECTION RCP WILL BE SUBSIDIARY TO VARIOUS BID ITEMS

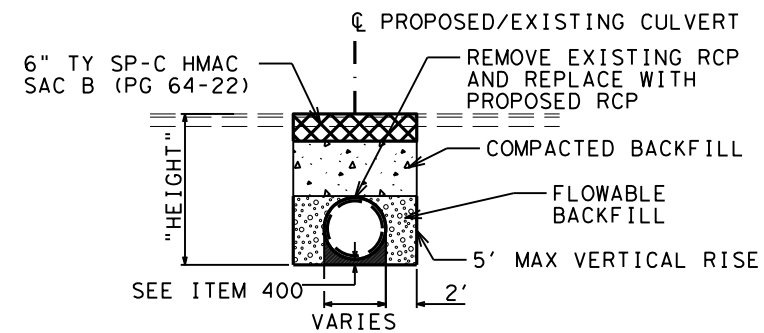


SECTION A-A

NOTES:

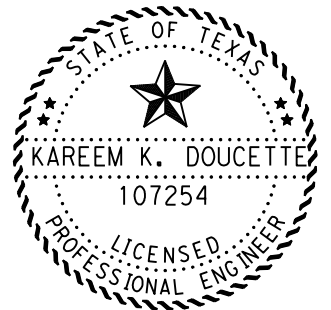
- 1) DRIVEWAY LOCATIONS MAY BE SHIFTED AT TIME OF CONSTRUCTION AS DIRECTED BY THE ENGINEER TO MATCH EXISTING CONDITIONS.
- 2) OMIT PAYMENT FOR CURB WITHIN LIMITS OF DRIVEWAY. CURBS ON DRIVEWAYS SHALL BE CONSIDERED SUBSIDIARY TO THE PRICE BID PER SQUARE YARD FOR DRIVEWAY AND WILL NOT BE PAID FOR DIRECTLY.

CONCRETE DRIVEWAYS



CUT & RESTORE DETAIL AT INTERSECTIONS

SIDE VIEW



DocuSigned by:

Kareem Doucette

9/20/2022

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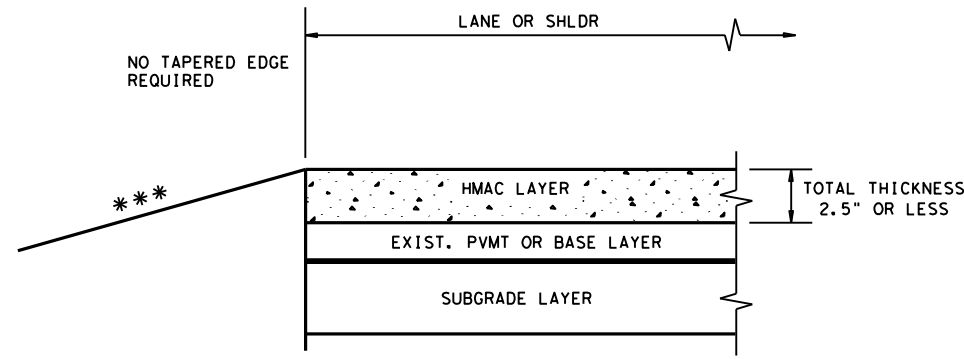


FM 2449 DRIVEWAY and INTERSECTION DETAILS

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
KKD	6	(See Title Sheet)		FM2449
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
KKD	TEXAS	DAL	DENTON	50
CHECK	CONTROL	SECTION	JOB	
CHECK	2352	02	027	

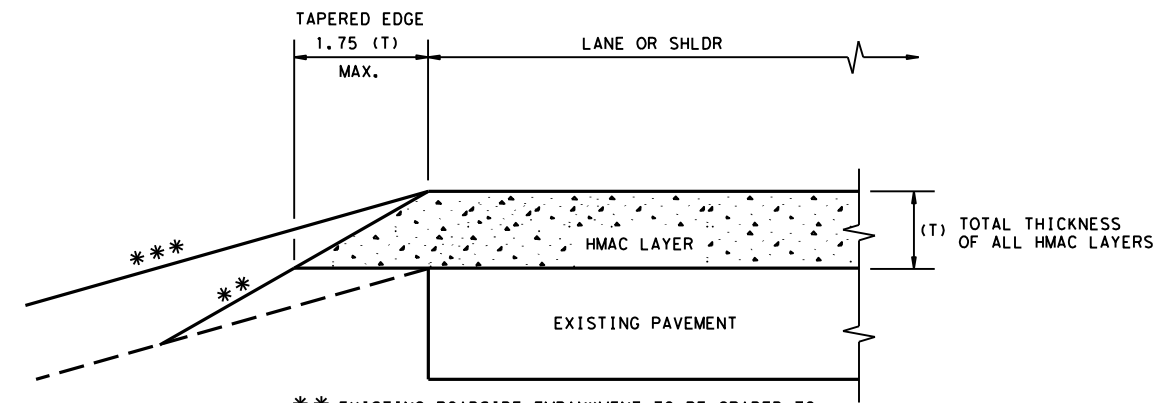
DISCLAIMER:
 The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: 9/19/2022
 FILE: T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\08 ROADWAY DETAILS\STANDARDS\tehmacc11.dgn



*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

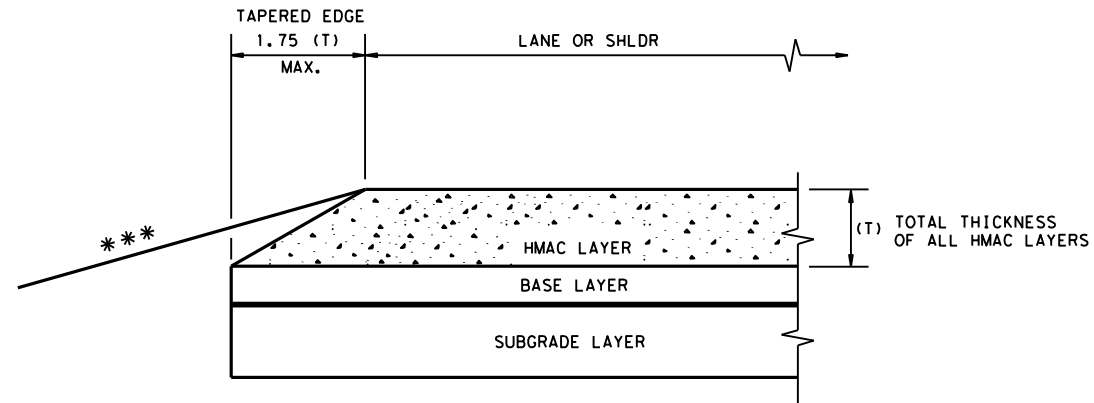
CONDITION - 1
 THIN HMAC SURFACES OR HMAC OVERLAY
 WITH THICKNESS OF 2.5" OR LESS



** EXISTING ROADSIDE EMBANKMENT TO BE GRADED TO PRODUCE A SMOOTH LEVEL SURFACE FOR PLACEMENT OF TAPERED EDGE. THIS WORK IS SUBSIDIARY TO THE VARIOUS BID ITEMS.

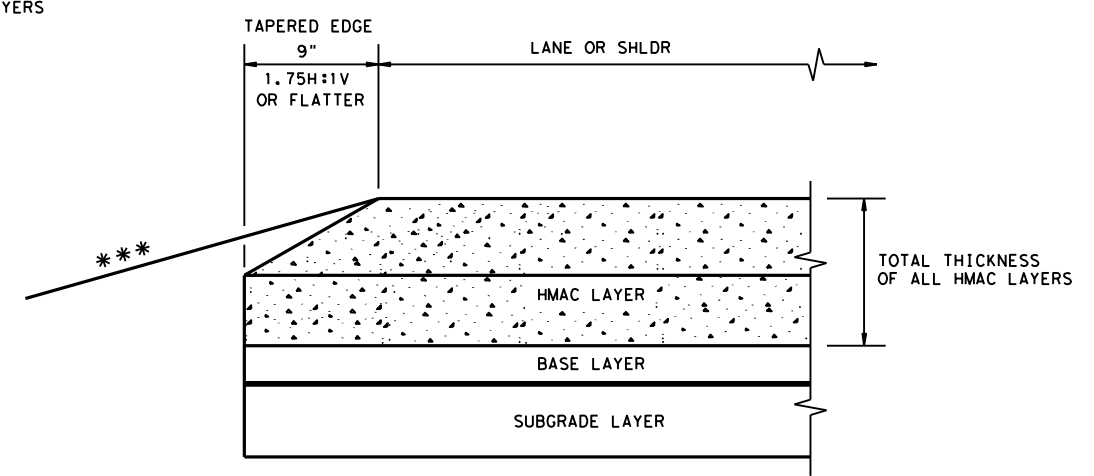
*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

CONDITION - 2
 OVERLAY OF EXISTING PAVEMENT
 HMAC THICKNESS 2.5" TO 5"



*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

CONDITION - 3
 NEW OR RECONSTRUCTED PAVEMENT
 HMAC THICKNESS 2.5" TO 5"



*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

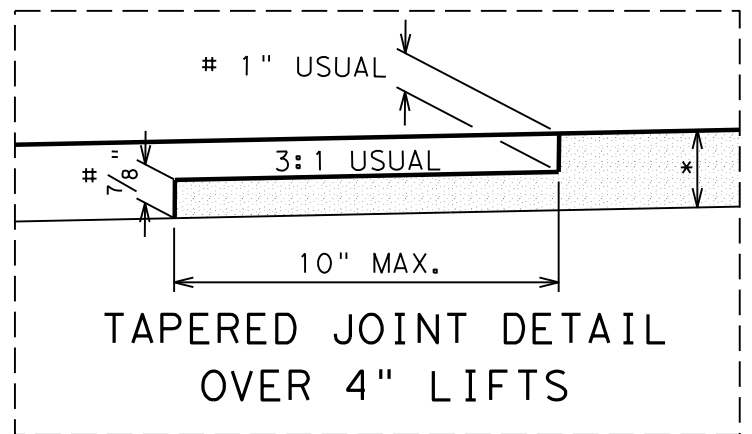
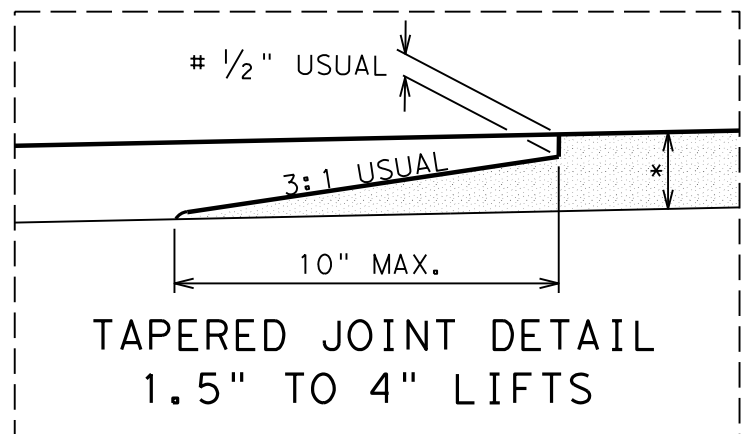
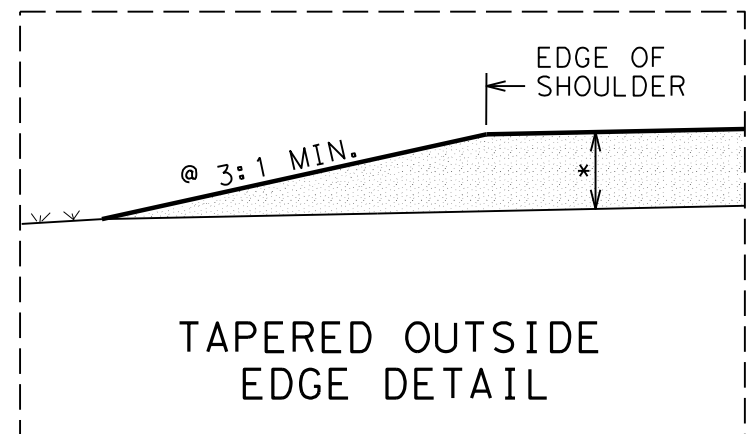
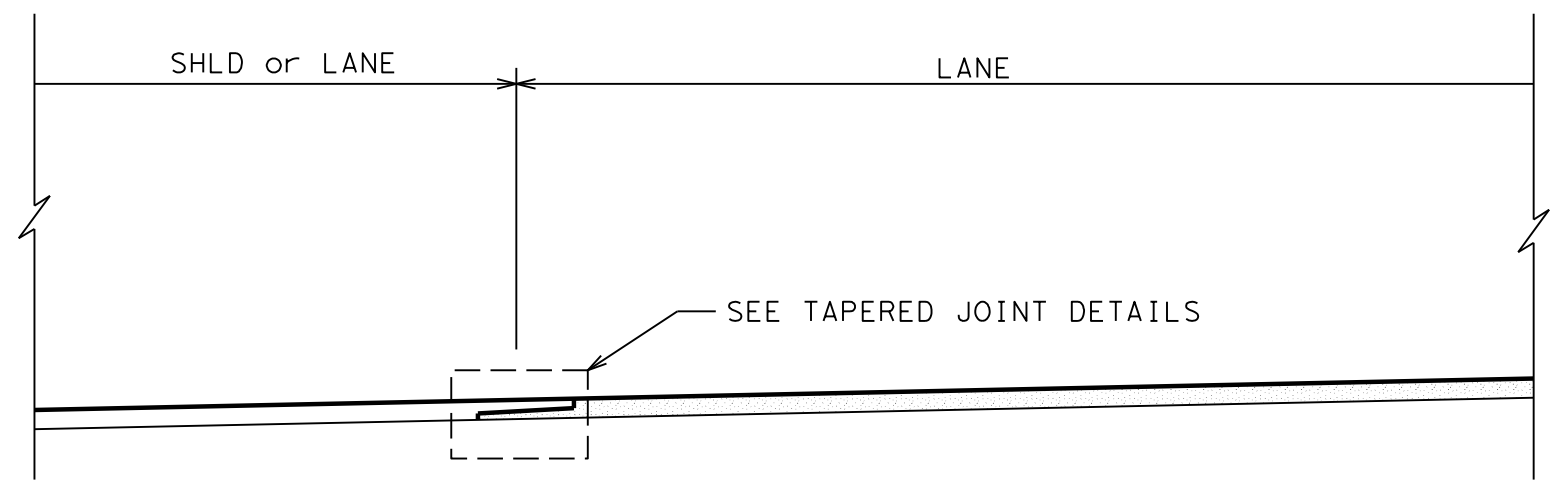
CONDITION - 4
 NEW OR RECONSTRUCTED PAVEMENT
 HMAC THICKNESS 5" OR GREATER

GENERAL NOTES

1. UNLESS OTHERWISE SHOWN IN THE PLANS, A VERTICAL EDGE IS PERMISSIBLE FOR HMAC PLACED GREATER THAN 5" BELOW THE EDGE OF PAVEMENT AND FOR THICKNESS OF HMAC LESS THAN 2.5".
2. FOR FURTHER INFORMATION REGARDING THE ROADSIDE AND PAVEMENT DETAILS, SEE TYPICAL SECTIONS.
3. PAYMENT FOR TAPERED EDGE WILL BE IN ACCORDANCE WITH APPLICABLE ITEMS IN THE CONTRACT.
4. THE SLOPE OF THE TAPERED EDGE SHALL BE 1.75H:1V OR FLATTER.
5. THE TAPERED EDGE SHALL BE PRODUCED BY USE OF A SCREED ATTACHMENT CAPABLE OF PRODUCING A SMOOTH COMPACTED SURFACE. ADDITIONAL COMPACTING EFFORT BEHIND THE SCREED IS NOT REQUIRED.

(NOT TO SCALE)

					Design Division Standard	
TAPERED EDGE DETAILS HMAC PAVEMENT						
TE (HMAC) - 11						
FILE: tehmacc11.dgn	DN: TxDOT	CK: RL	DW: KB	CK:		
© TxDOT January 2011	CONT	SECT	JOB	HIGHWAY		
REVISIONS			2352 02	027	FM2449	
DIST	COUNTY		SHEET NO.			
DAL	DENTON		51			




@ IF BACKFILLED SLOPE IS LESS THAN 3:1, COVER WEDGE WITH APPROVED BACKFILL.

* SEE TYPICAL SECTION FOR DEPTH AND TYPE OF HMA.
 # NOTCH DEPTH SHALL NOT BE LESS THAN NOMINAL AGGREGATE SIZE.

NOTES:

1. THE ABOVE DETAILS SHALL BE CONSTRUCTED BY TAPERING THE BITUMINOUS MAT. THE TAPERED PORTION SHALL EXTEND BEYOND THE NORMAL LANE WIDTH AND BE LAID MONOLITHICALLY WITH ADJOINING MAT. THE TAPERED PORTION OF THE MAT SHALL BE CONSTRUCTED BY THE USE OF AN APPROVED STRIKE-OFF DEVICE THAT WILL PROVIDE A UNIFORM SLOPE AND WILL NOT RESTRICT THE MAIN SCREED. CLEAN WEDGE PRIOR TO PLACEMENT OF TACK COAT. TACK COAT SHALL BE APPLIED UNIFORMLY TO THE IN-PLACE TAPER WITH A DISTRIBUTOR BEFORE THE ADJACENT MAT IS PLACED. FINAL DENSITY REQUIREMENTS FOR THE ENTIRE PAVEMENT, INCLUDING THE TAPER AREA, WILL REMAIN UNCHANGED. COMPACTION OF THE INITIAL TAPER SECTION WILL BE REQUIRED AS NEAR TO FINAL DENSITY AS POSSIBLE. ROLL ADJACENT MAT FROM HOT SIDE TO COLD.
2. THE TYPE OF DEVICE TO PRODUCE ABOVE REFERENCED DETAILS SHALL PROVIDE INITIAL COMPACTION EQUIVALENT TO LAYDOWN MACHINE, WITH FINAL DENSITY ADHERING TO NOTE 1, AND BE APPROVED BY THE ENGINEER.
3. HOT MIX MATERIAL AND PLACEMENT SHALL BE PAID FOR UNDER THE PERTINENT ITEM. ANY ADDITIONAL SURFACE PREPARATION, TACK COAT, TACK COAT PLACEMENT, EQUIPMENT, LABOR, TOOLS AND INCIDENTALS TO PRODUCE TAPERED EDGE AND JOINTS AS DESCRIBED ABOVE SHALL BE CONSIDERED SUBSIDIARY TO THE HOT MIX ITEM.
4. THE TAPERED JOINT DETAIL IS NOT INTENDED FOR USE ON 2 WAY 2 LANE ROADBED CENTERLINE WITH LESS THAN 22' OVERALL WIDTH.
5. FULL PAVING OF ALL LANES AND SHOULDRS BY THE END OF EACH DAY PRODUCTION WILL NOT REQUIRE A TAPERED JOINT.


HOT MIX EDGE AND LONGITUDINAL JOINT DETAILS
DALLAS DISTRICT STANDARD
LJD(1-1)-07

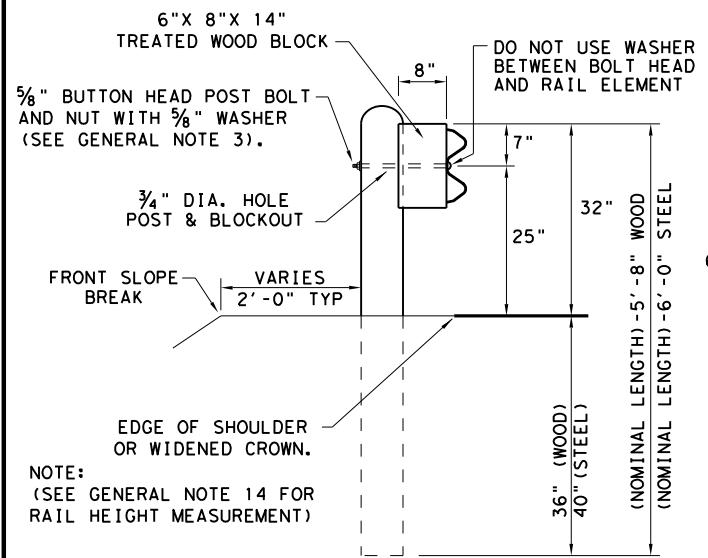
FED. RD. DIV. NO.	PROJECT NUMBER	SHEET NUMBER
18		52
STATE	DISTRICT	COUNTY
TEXAS	DALLAS	DENTON
CONTROL	SECTION	SECTION HIGHWAY NUMBER
2352	02	027 FM 2449

REVISED ON 9/10/08

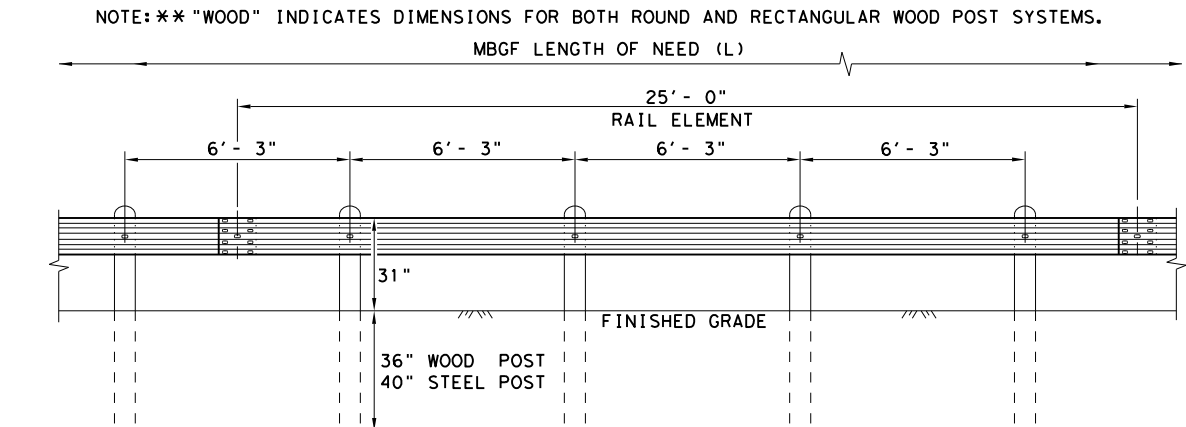
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DATE: 9/19/2022
 FILE: T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\08 ROADWAY DETAILS\STANDARDS\gf3119.dgn

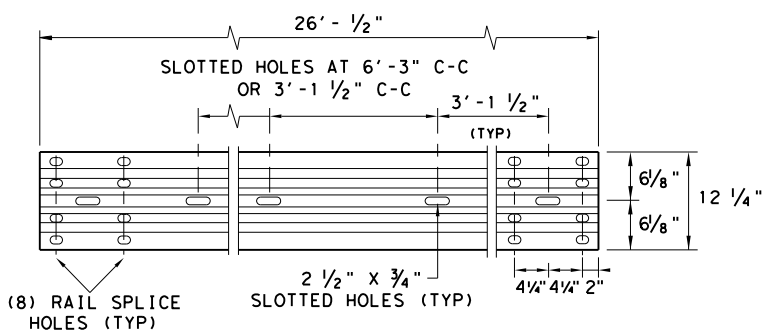


TYPICAL POST PLACEMENT



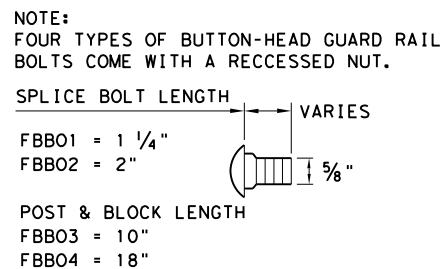
ELEVATION MID-SPAN RAIL SPLICE

SHOWING A 25'-0" SECTION OF W-BEAM RAIL. (SEE GENERAL NOTE 2)



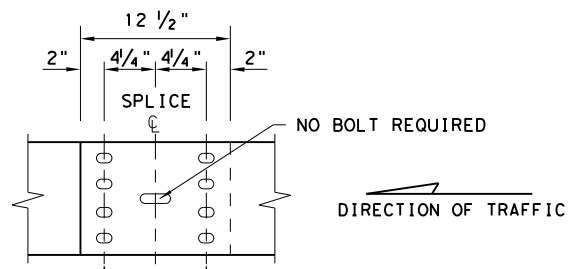
ELEVATION 25'-0" (NOM.) W-BEAM SECTION

NOTES: SEE GENERAL NOTE 2 FOR ALLOWABLE RAIL TYPES. SEE RAIL SPLICE DETAIL FOR REQUIRED HARDWARE.



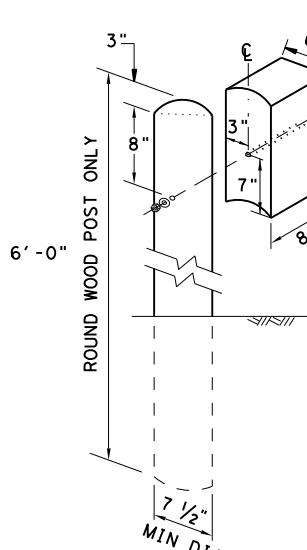
BUTTON HEAD BOLT

NOTE: SEE GENERAL NOTE 3 FOR SPLICE & POST BOLT DETAILS.

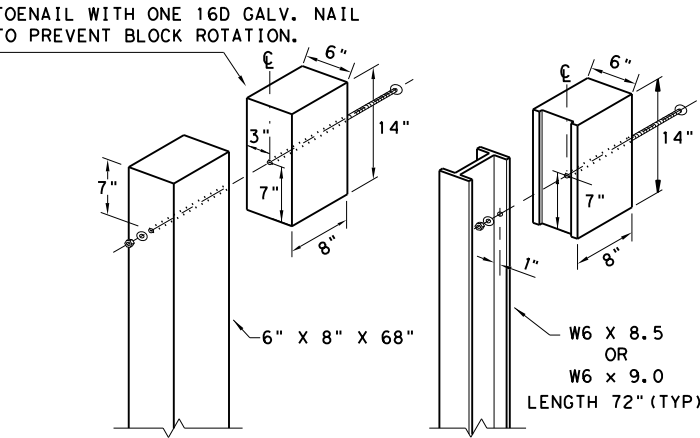


MID-SPAN RAIL SPLICE DETAIL

NOTE: GF(31), MID-SPAN RAIL SPLICES ARE REQUIRED WITH 6'-3" POST SPACINGS.



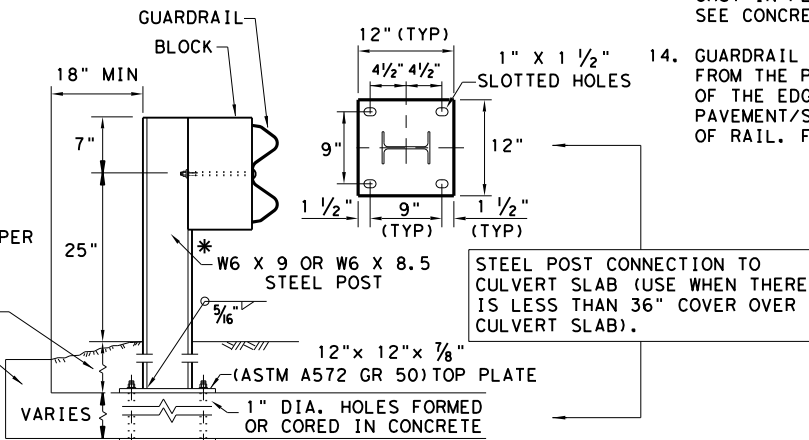
WOOD BLOCK TO ROUND WOOD POST



WOOD BLOCK TO RECTANGULAR WOOD POST

ROUTED WOOD BLOCK TO I-BEAM STEEL POST

* POST(S) MAY REQUIRE FIELD MODIFICATION TO ENSURE PROPER GUARDRAIL HEIGHT.



LOW FILL CULVERT POST

NOTE: TWO INSTALLATION OPTIONS.

- BOLT-THROUGH OPTION:** REQUIRES A 6" MIN. SLAB THICKNESS. 7/8" DIA (ASTM A449) HEAVY HEX BOLTS WITH TWO HARDENED WASHER EACH AND HEAVY HEX NUTS. NOTE: BOLT LENGTH = SLAB PLUS 2 1/4" MIN.
- EPOXY ANCHOR OPTION:** THIS OPTION MAY ONLY BE USED IF THE CULVERT SLAB IS 9" MIN. THICK. THREADED ANCHOR RODS MUST BE 7/8" DIA. ASTM A449 OR A193 GRADE B7 WITH HEAVY HEX NUT, AND ONE HARDENED WASHER EACH. EMBED ANCHOR RODS 6" WITH HILTI HIT RE 500 EPOXY ADHESIVE. OTHER TYPE III CLASS C EPOXY ADHESIVES MEETING THE REQUIREMENTS OF DMS-6100, "EPOXIES AND ADHESIVES", MAY BE USED IF IT CAN BE DEMONSTRATED THAT THEY MEET OR EXCEED THE STRENGTH OF HILTI HIT RE 500 WITH THE SAME EMBEDMENT DEPTH AND THREADED ROD DIA. FOLLOW THE MANUFACTURER'S REQUIREMENTS FOR INSTALLING EPOXIED THREADED RODS. EXTEND RODS 1/4" MIN. BEYOND NUT.

NOTE: CULVERTS OF 25 FT. OR LESS, SEE GF(31)LS STANDARD FOR "LONG SPAN" OPTION.

GENERAL NOTES

- THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
- RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'-0", OR 12'-6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE DOWNSTREAM ANCHOR TERMINAL (DAT) AND THE TRANSITION SECTIONS OF GUARDRAIL.
- BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 3/8" WASHER (FWC16G) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
- FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
- CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
- THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A MAXIMUM SLOPE OF 1V:10H.
- IF SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER, THE GUARD FENCE MAY BE FLARED AT A RATE OF 25:1 OR FLATTER.
- UNLESS OTHERWISE SHOWN IN THE PLANS, GUARD FENCE PLACED IN THE VICINITY OF CURBS SHALL BE POSITIONED SO THAT THE FACE OF CURB IS LOCATED DIRECTLY BELOW OR BEHIND THE FACE OF THE RAIL. RAIL PLACED OVER CURBS SHALL BE INSTALLED SO THAT THE POST BOLT IS LOCATED APPROXIMATELY 25 INCHES ABOVE THE GUTTER PAN OR EDGE OF SHOULDER.
- APPLICATIONS IN SOLID ROCK ARE ONLY ALLOWED WITH STEEL POSTS. IF SOLID ROCK IS ENCOUNTERED WITHIN 0 TO 18" OF THE FINISHED GRADE, DRILL A 24" DIA. HOLE, 24" INTO THE ROCK. IF SOLID ROCK IS ENCOUNTERED BELOW 18", DRILL A 12" DIA. HOLE, 12" INTO THE ROCK OR TO THE STANDARD EMBEDMENT DEPTH, WHICHEVER MAYBE LESS. ANY EXCESS POST LENGTH, AFTER MEETING THESE DEPTHS, MAY BE FIELD CUT TO ENSURE PROPER GUARDRAIL MOUNTING HEIGHT. BACKFILL WITH COARSE AGGREGATE MATERIAL.
- POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
- SPECIAL FABRICATION WILL BE REQUIRED AT INSTALLATION LOCATIONS HAVING A CURVATURE OF LESS THAN 150 FT. RADIUS.
- UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210 ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
- FOR THE LOW FILL CULVERT OPTION, POSTS LOCATED PARTIALLY OR WHOLLY BETWEEN PRECAST BOX CULVERT UNITS, THE USE OF A CAST-IN-PLACE CONCRETE CLOSURE BETWEEN BOXES IS REQUIRED. THE LENGTH OF THE CAST-IN-PLACE CONCRETE CLOSURE SHALL ACCOMMODATE THE PLACEMENT OF THE LOW FILL CULVERT OPTION. SEE CONCRETE CLOSURE DETAILS ON BRIDGE STANDARD SCP-MD.
- GUARDRAIL HEIGHT MEASUREMENT: WHEN THE GUARDRAIL IS LOCATED ABOVE PAVEMENT, MEASURE THE HEIGHT FROM THE PAVEMENT TO THE TOP OF THE W-BEAM RAIL. WHEN THE GUARDRAIL IS LOCATED UP TO 2 FT. OFF OF THE EDGE OF PAVEMENT OR FOR A PAVEMENT OVERLAY, USE A 10-FOOT STRAIGHTEDGE TO EXTEND THE PAVEMENT/SOULDER SLOPE TO THE BACK OF RAIL, MEASURE FROM THE BOTTOM OF STRAIGHTEDGE TO THE TOP OF RAIL. FOR GUARDRAIL LOCATED DOWN A 10:1 SLOPE, MEASURE FROM THE NOMINAL TERRAIN.

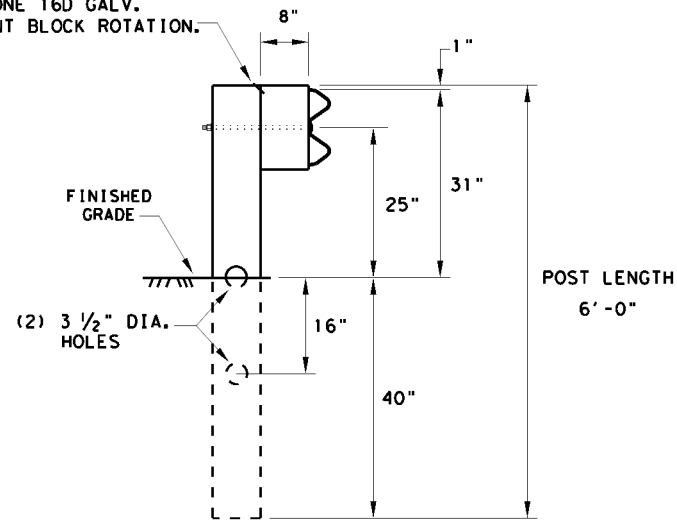
NOTE: TRANSITIONS TO BRIDGE RAILS OR TRAFFIC BARRIERS. SEE GF(31)TL3 TR STANDARD FOR HIGH-SPEED TL-3 TRANSITIONS. SEE GF(31)TL2 TR STANDARD FOR LOW-SPEED TL-2 TRANSITIONS.

				Design Division Standard	
METAL BEAM GUARD FENCE TL-3 MASH COMPLIANT GF(31)-19					
FILE: gf3119.dgn	DN: TXDOT	CK: KM	DW: VP	CK: CGL/AG	
© TXDOT: NOVEMBER 2019		CONT	SECT	JOB	HIGHWAY
REVISIONS		2352	02	027	FM 2449
DIST	COUNTY			SHEET NO.	
DAL	DENTON			53	

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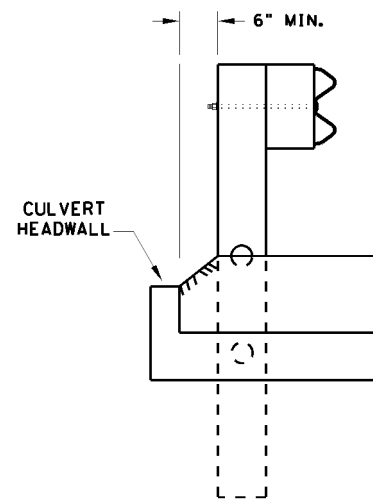
DATE: 9/26/2022
 FILE: T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\08 ROADWAY DETAILS\STANDARDS\gf31ls19.dgn

NOTE: TOENAIL WITH ONE 16D GALV. NAIL TO PREVENT BLOCK ROTATION.



**RECTANGULAR CRT POST
(6" X 8" X 6' LONG)**

(6) CRT REQUIRED
SEE ELEVATION DETAIL FOR LOCATIONS



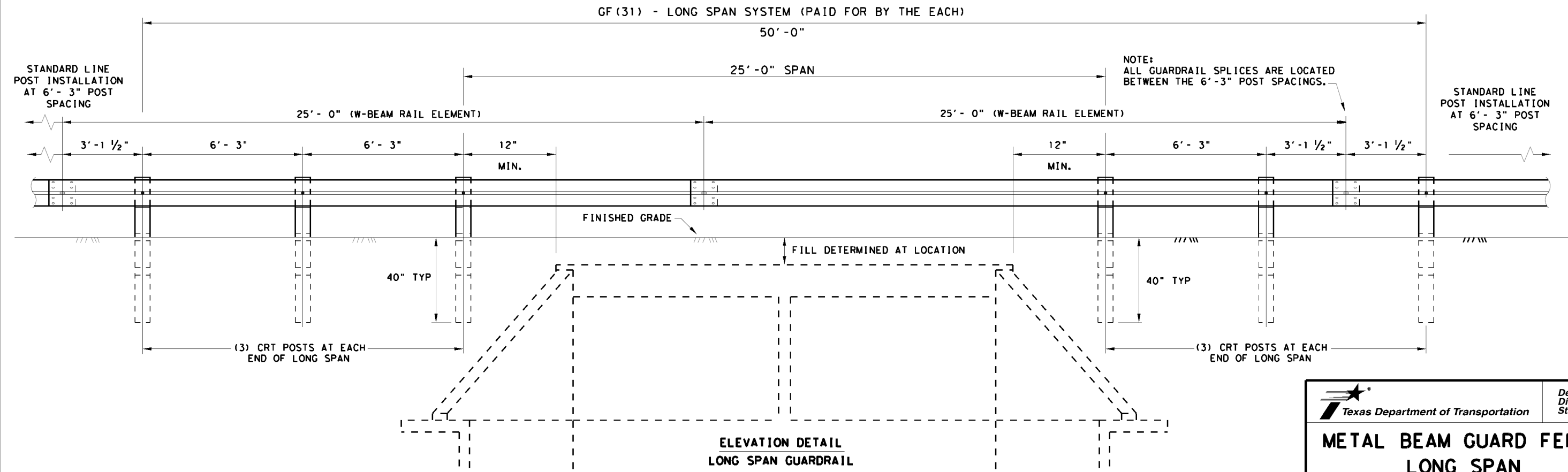
**LATERAL OFFSET BETWEEN THE
GUARDRAIL AND THE CULVERT HEADWALL**

GENERAL NOTES

1. THE TYPE OF LINE POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF THE TRANSITIONS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENT SHALL MEET ALL REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 12'-6" OR 25'-0" NOMINAL LENGTHS.
3. RAIL POST HOLES ARE OFFSET 3'-1 1/2" FROM STANDARD GUARDRAIL TO ACCOMMODATE THE MIDSPAN SPLICING.
4. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 5/8" WASHER (FWC160) AND NO MORE THAN 1" BEYOND IT.
5. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
7. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
8. REFER TO GF (31) STANDARD SHEET FOR ADDITIONAL DETAILS.
9. FLAME CUTTING OF HOLES IN GUARDRAIL SHALL NOT BE PERMITTED. IF YOU ENCOUNTER MIS-ALIGNED BOLT HOLES IN GUARDRAIL CONTACT THE DESIGN DIVISION FOR ADDITIONAL INFORMATION & OPTIONS.

NOTE: SEE GF (31) STANDARD FOR STANDARD LINE POSTS.

DIRECTION OF TRAFFIC

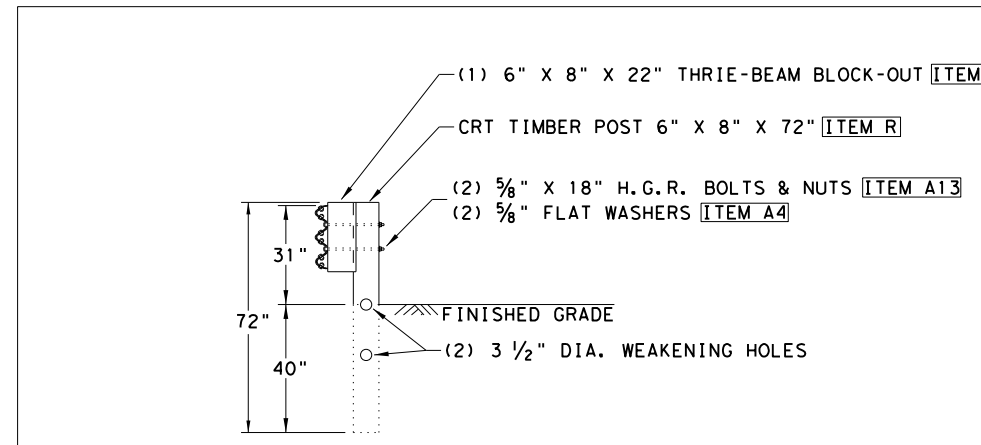
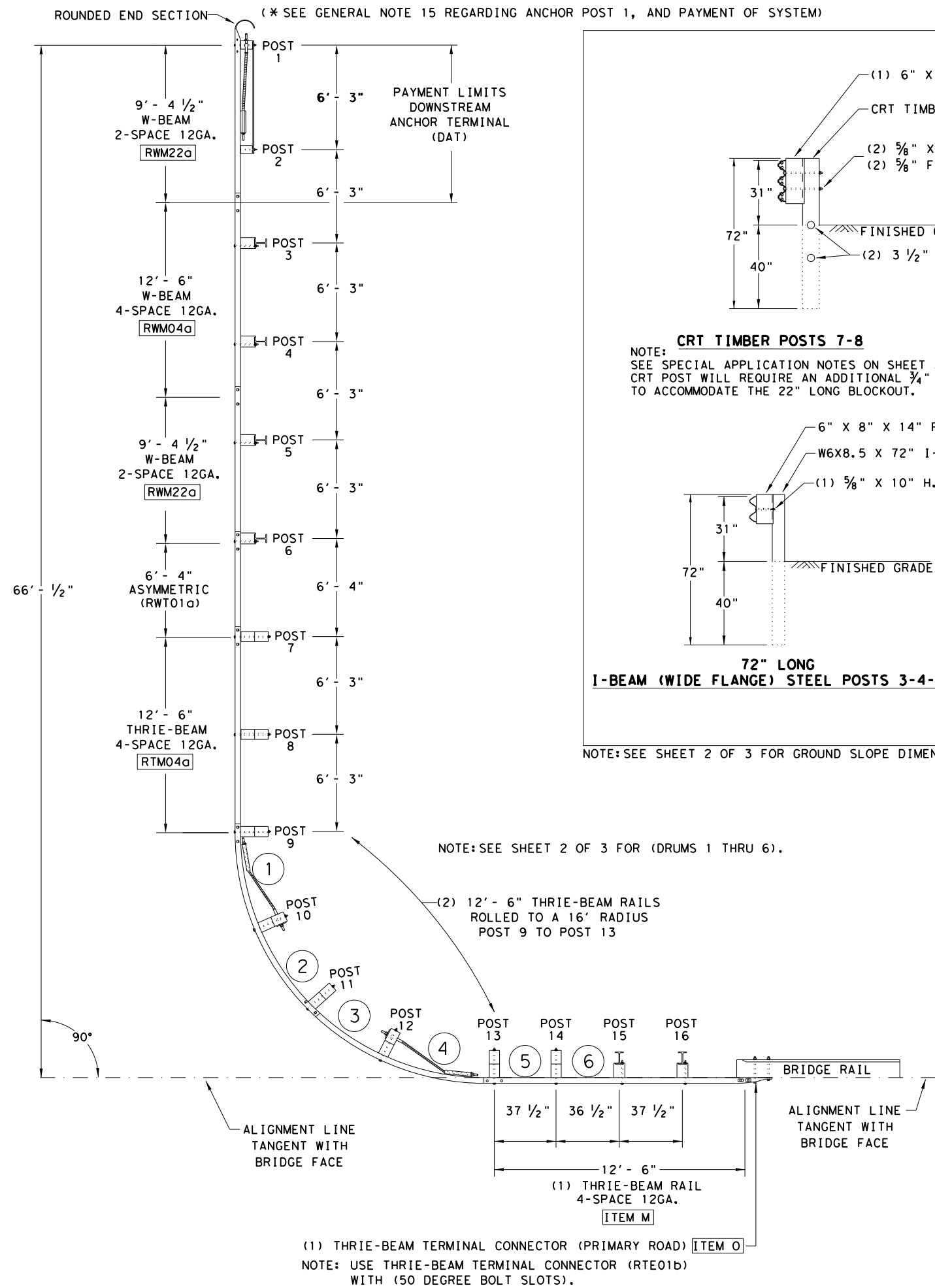


**ELEVATION DETAIL
LONG SPAN GUARDRAIL**

		Design Division Standard	
METAL BEAM GUARD FENCE LONG SPAN TL-3 MASH COMPLIANT			
GF (31) LS-19			
FILE: gf31ls19.dgn	DN: TxDOT	CK: KM	DW: VP
© TxDOT: NOVEMBER 2019	CONT: 2352	SECT: 02	JOB: 027
REVISIONS	2352	02	027
DIST: DAL	COUNTY: DENTON	SHEET NO. 53A	

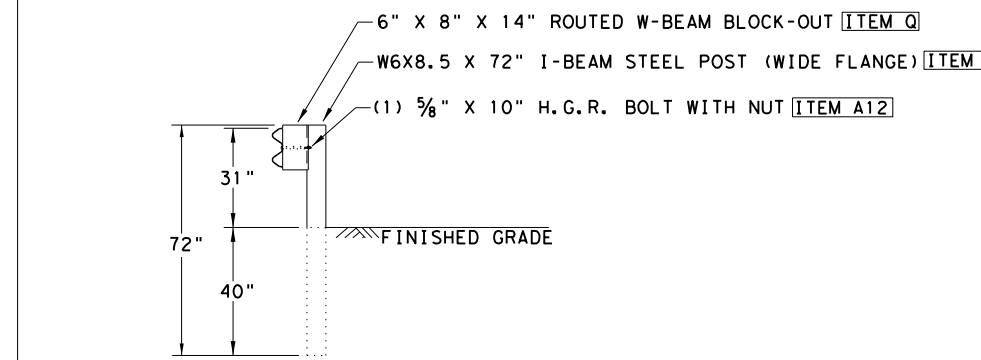
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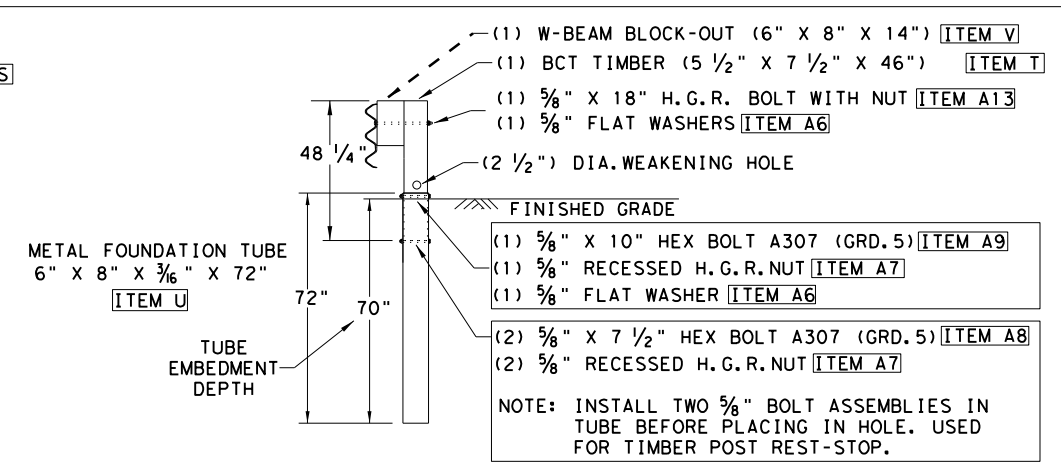
CRT TIMBER POSTS 7-8

NOTE: SEE SPECIAL APPLICATION NOTES ON SHEET 3 OF 3. CRT POST WILL REQUIRE AN ADDITIONAL 3/4" HOLE TO ACCOMMODATE THE 22" LONG BLOCKOUT.



72" LONG I-BEAM (WIDE FLANGE) STEEL POSTS 3-4-5-6

NOTE: SEE SHEET 2 OF 3 FOR GROUND SLOPE DIMENSIONS.

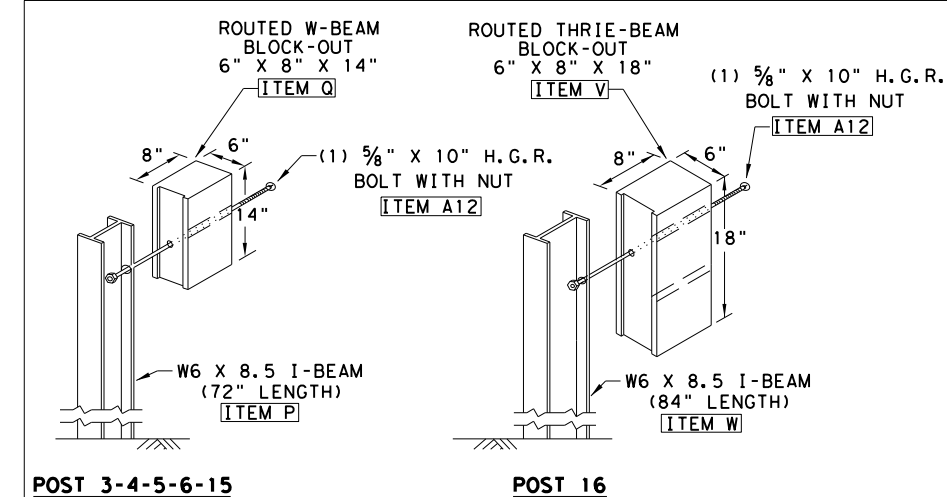
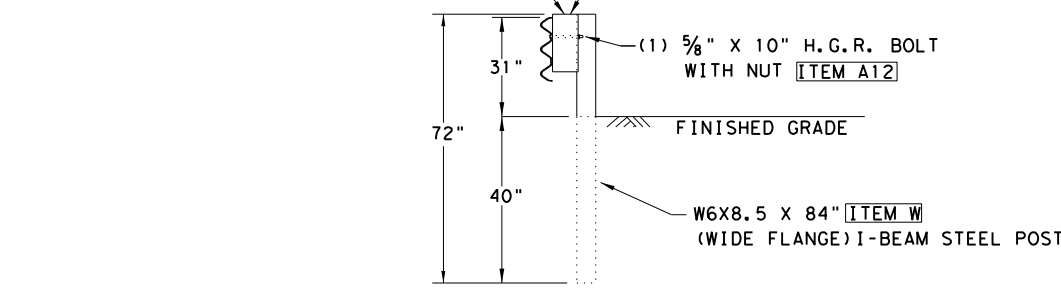


BCT TIMBER POSTS WITH METAL FOUNDATION TUBES

9-10-11-12-13-14

NOTE: FOR I-BEAM (POST 15) USE (1) 6" X 8" X 14" ROUTED WOOD BLOCK-OUT [ITEM A9] (1) H.G.R. BOLT & NUT [ITEM V]

NOTE: FOR I-BEAM (POST 16) USE (1) 6" X 8" X 18" ROUTED WOOD BLOCK-OUT [ITEM A9] (1) H.G.R. BOLT & NUT [ITEM X]



INSTALLATION DETAIL ROUTED WOOD BLOCK-OUT WITH WIDE FLANGE STEEL POST

NOTE: POST SYSTEM USES TWO TYPES OF 14" WOOD BLOCK-OUTS. FOR CRT & BCT WOOD POSTS USE: (PDB01a) FOR I-BEAM STEEL POSTS USE: (PDB01b)

POST (3-4-5-6)	USE: 14" BLOCK-OUT (PDB01b)
POST (7-8)	USE: 22" BLOCK-OUT (PDB02)
POST (9 THRU 14)	USE: 14" BLOCK-OUT (PDB01a)
POST (15)	USE: 14" BLOCK-OUT (PDB01b)
POST (16)	USE: 18" BLOCK-OUT (PDB01)

(MASH TL-2 COMPLIANT)
 TESTED TO MASH TL-2 WITH A 3:1 SLOPE

SHEET 1 OF 3

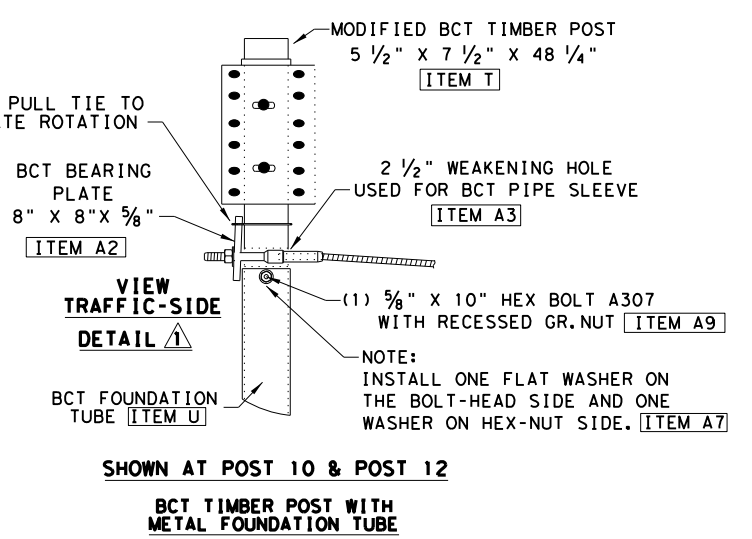
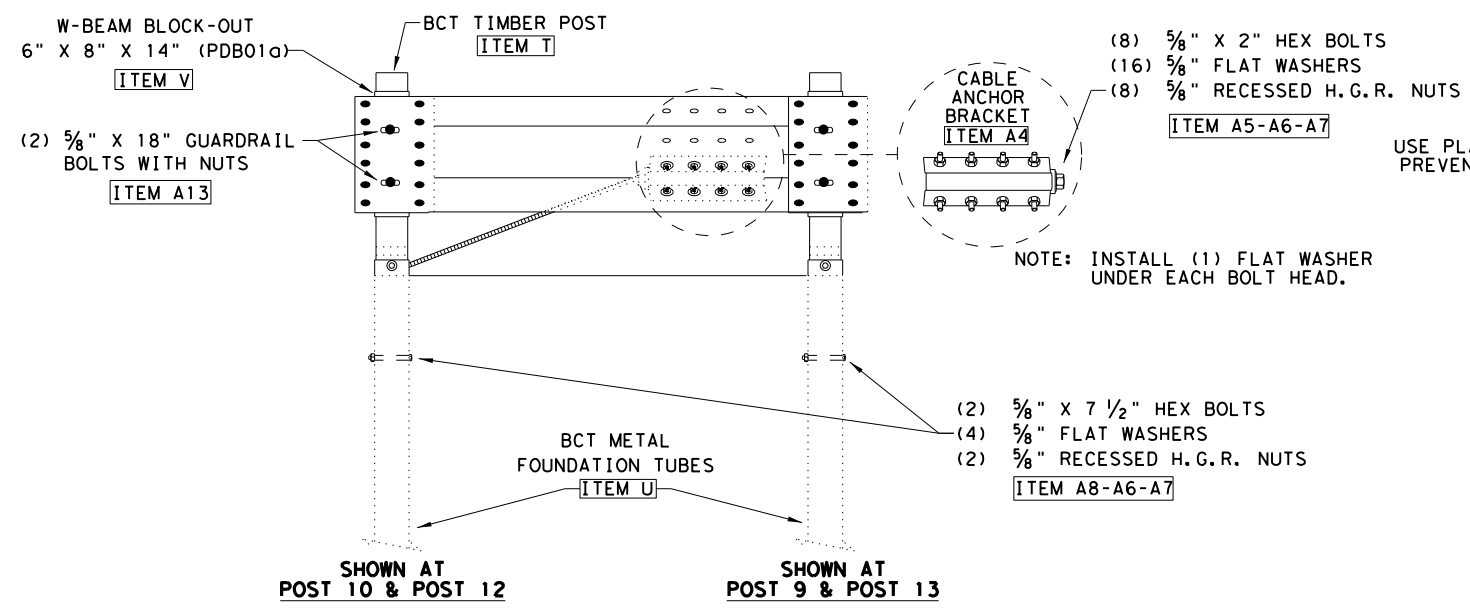
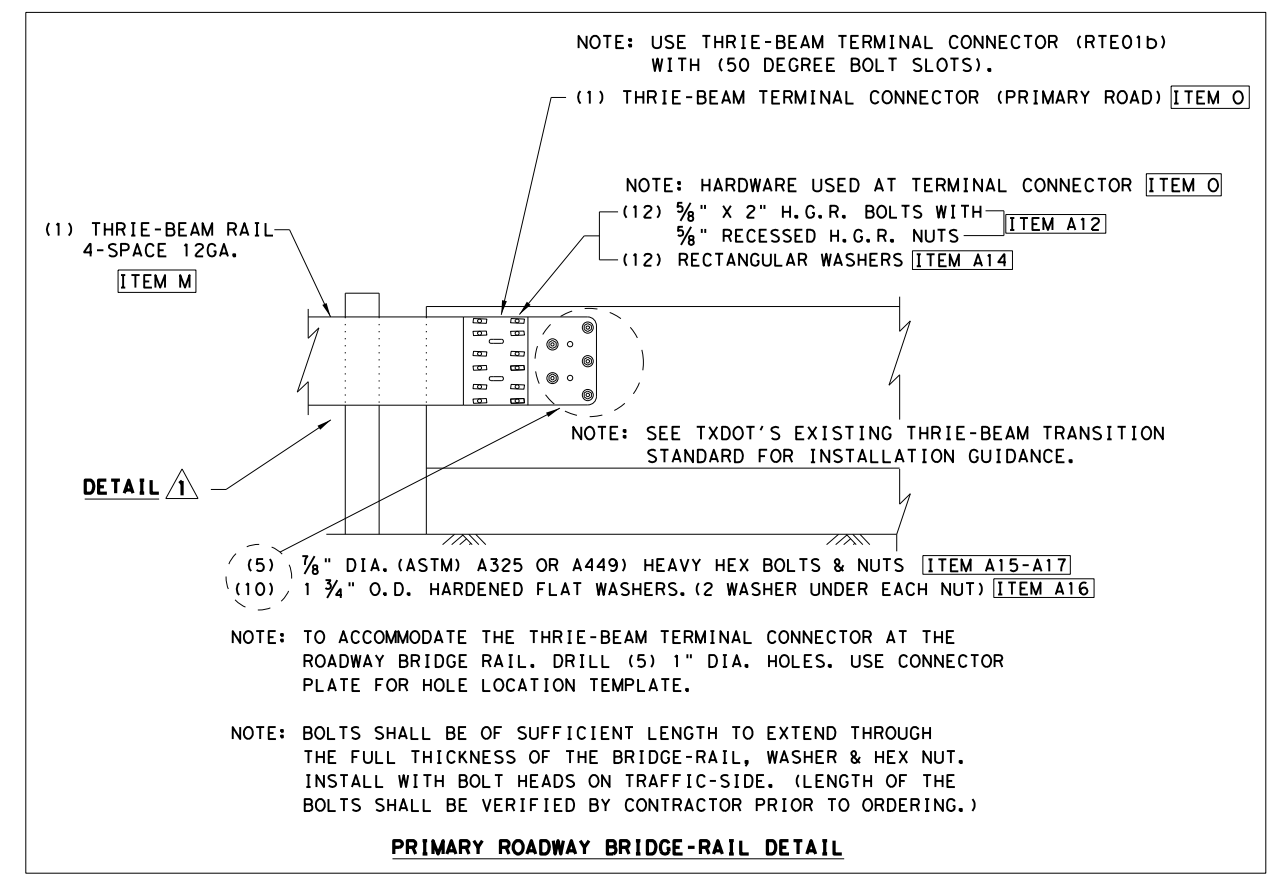
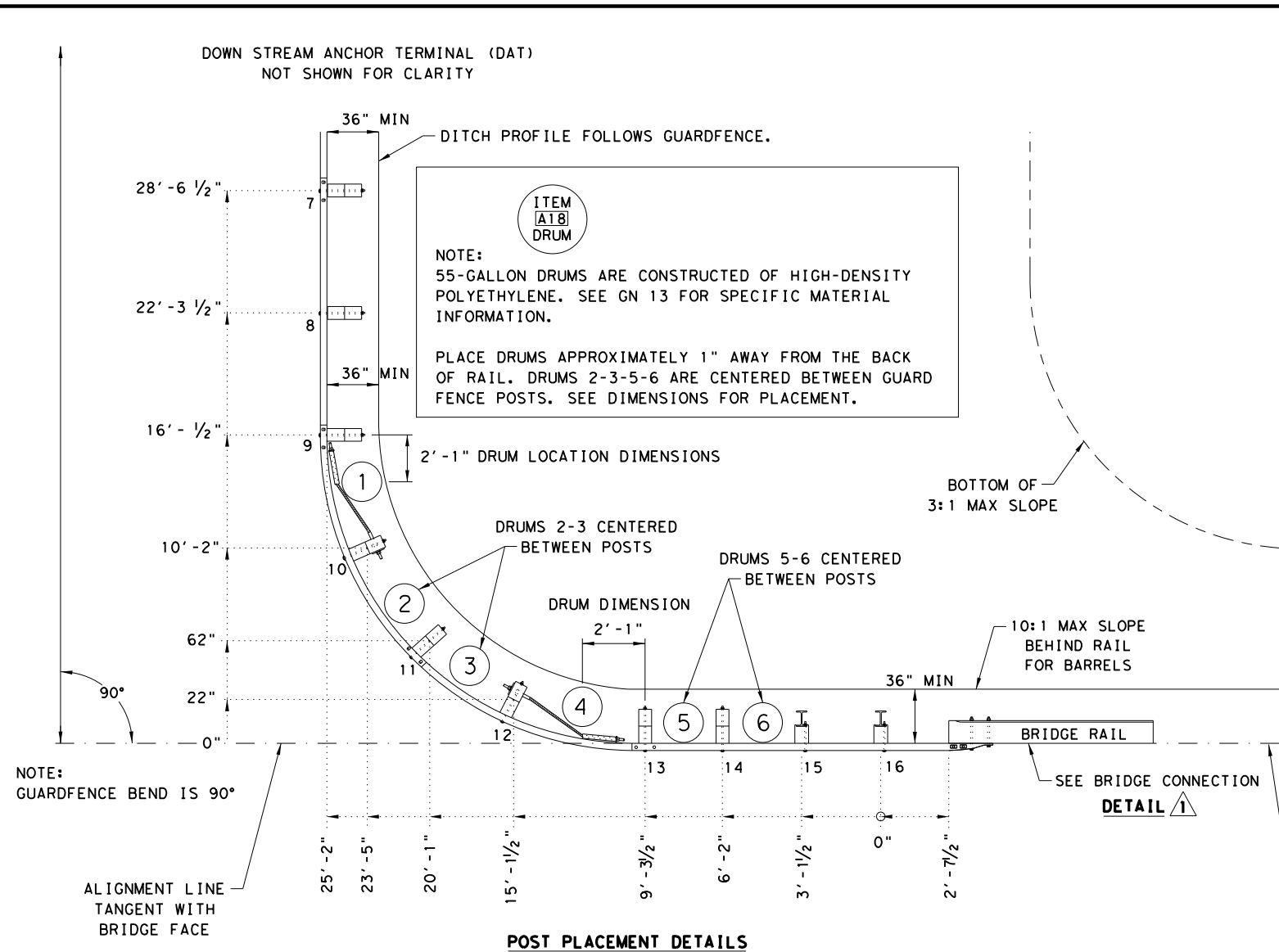
Design Division Standard

TL-2 SHORT RADIUS GUARDRAIL MASH COMPLIANT SRG (TL-2) -21

FILE: srqt1221	TxDOT	CK:KM	DN:VP	CK:CGL
© TxDOT: FEBRUARY 2021 REVISIONS	CONT	SECT	JOB	HIGHWAY
	2352	02	027	FM 2449
	DIST	COUNTY	SHEET NO.	
	DAL	DENTON	54	

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(MASH TL-2 COMPLIANT)
TESTED TO MASH TL-2 WITH A 3:1 SLOPE

SHEET 2 OF 3

		Design Division Standard	
TL-2 SHORT RADIUS GUARDRAIL MASH COMPLIANT SRG (TL-2) -21			
FILE: srqt1221	TxDOT	CK:KM	DN:VP
© TXDOT: FEBRUARY 2021	CONT	SECT	JOB
REVISIONS	2352	02	027
	DIST	COUNTY	SHEET NO.
	DAL	DENTON	55

DATE: 9/19/2022
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ITEM	ALL LARGE & SMALL COMPONENT DESCRIPTIONS	TL-2 DOWNSTREAM ANCHOR TERMINAL (DAT) <input type="checkbox"/> (PAYABLE BY EA.)		TL-2 SHORT RADIUS GUARDRAIL COMPLETE SYSTEM (INCL DAT) <input type="checkbox"/> (ALL PAY ITEMS)	
		ITEM	QTY	ITEM	TOTAL QTY
A	POST 1 & 2 BCT TIMBER (5 1/2" X 7 1/2" X 48 1/4") (PDF01)	A	2	A	2
B	POST 1 & 2 BCT TUBE (6" X 8" X 3/8" X 72" LENGTH) (PTE05)	B	2	B	2
C	POST 1 & 2 CHANNEL STRUTS (C3 X 5 X 80") A36	C	2	C	2
D	POST 1 SHELF ANGLE BRACKET (6" X 7 1/2" X 1/4") SEE DAT DETAIL	D	1	D	1
E	POST 1 BCT POST SLEEVE (FM020)	E	1	E	1
F	POST 1 BCT CABLE BEARING PLATE (5/8" X 8" X 8") (FPB01)	F	1	F	1
G	BCT CABLE ANCHOR ASSEMBLIES (3/4" X 6'-6 3/4" LENGTH) (FCA01)	G	1	G	1
H	W-BEAM RAIL (ROUNDED END ANCHOR-TYPE) 12GA. (RWE030)	H	1	H	1
I	W-BEAM RAIL (LENGTH 9'-4 1/2") 12GA. (RWM220)	I	2	I	2
J	W-BEAM RAIL (LENGTH 12'-6") 12GA. (4 SPACE) (RWM040)			J	1
K	W-BEAM RAIL (LENGTH 9'-4 1/2") 12GA. (RWM220)			K	1
L	W-BEAM TO THRIE-BEAM ASYMMETRIC RAIL (RWT010). (LENGTH 6'-4")			L	1
M	THRIE-BEAM RAIL (LENGTH 12'-6") 12GA. (4 SPACE) (RTM040)			M	1
N	THRIE-BEAM RAIL (LENGTH 12'-6") 12GA. (16' RADIUS) (RTM020)			N	2
O	THRIE BEAM RAIL (TERMINAL CONNECTOR) (BRIDGE-RAIL) (RTE01B)			O	1
P	POSTS 3,4,5,6 I-BEAM POSTS (LENGTH W6X8.5 X 72") (PWE01)			P	4
Q	POSTS 3,4,5,6,15 ROUTED W-BEAM BLOCK-OUTS (6" X 8" X 14") (PDB01B)			Q	5
R	POSTS 7,8 CRT TIMBER POSTS (LENGTH 6" X 8" X 72") (PDE09)			R	2
S	POSTS 7,8 THRIE-BEAM BLOCK-OUTS (6" X 8" X 22") (PDB020)			S	2
T	POSTS 9,10,11,12,13,14 BCT TIMBER (5 1/2" X 7 1/2" X 46") (PDF04)			T	6
U	POSTS 9,10,11,12,13,14 BCT TUBE (6" X 8" X 3/8" X 72") (PTE05)			U	6
V	POSTS 9,10,11,12,13,14, W-BEAM BLOCK-OUTS (6" X 8" X 14") (PDB010)			V	6
W	POSTS 15,16 I-BEAM POSTS (LENGTH W6X8.5 X 84") (PWE07)			W	2
X	POSTS 16 ROUTED THRIE-BEAM BLOCK-OUT (6" X 8" X 18") (PDB01)			X	1
A1	MODIFIED BCT CABLE ANCHOR ASSEMBLIES (3/4" X LENGTH 5'-5")			A1	2
A2	BCT CABLE BEARING PLATE (5/8" X 8" X 8") (POST 10 & POST 12) (FPB01)			A2	2
A3	BCT CABLE POST SLEEVE (POST 10 & POST 12) (FM020)			A3	2
A4	BCT CABLE ANCHOR BRACKET (AT POST 9 & POST 13) (FPA01)			A4	2
A5	5/8" X 2" HEX BOLTS A307 GRD.5 (FOR CABLE ANCHOR BRACKETS)	A5	8	A5	24
A6	5/8" FLAT WASHER A307 GRD.5 (1 WASHER UNDER BOLT & 1 WASHER UNDER NUT)	A6	18	A6	48
A7	5/8" RECESSED H.G.R. NUTS (FOR ALL 5/8" BOLTS)	A7	20	A7	152
A8	5/8" X 7 1/2" HEX BOLTS A307 GRD.5 BCT POSTS (9-10-11-12-13-14)	A8	4	A8	12
A9	5/8" X 10" HEX BOLTS A307 GRD.5 BCT POSTS (9-10-11-12-13-14)	A9	2	A9	6
A10	5/8" X 1 1/4" H.G.R. BOLTS SPLICES AT POST (2-3-4-5-6-7-9-11-13) (FBB01)	A10	4	A10	72
A11	5/8" X 2" H.G.R. BOLTS (ROUND TERM-POST 10-END SPLICE) (FBB02)			A11	18
A12	5/8" X 10" H.G.R. BOLTS (I-BEAM POSTS RAIL & BLOCKOUT) (FBB03)	A12	2	A12	10
A13	5/8" X 18" H.G.R. BOLTS (POSTS 9,10,11,12,13,14) (FBB04)			A13	10
A14	RECTANGULAR WASHERS (FWRO3) (FOR TERMINAL CONNECTOR RTE01B)			A14	12
A15	7/8" X (LENGTH VARIES) HEX BOLTS A325 OR A449 GR.5			A15	5
A16	1 3/4" O.D. HARDENED FLAT WASHER A325			A16	10
A17	7/8" HEX NUT GR.5 A325			A17	5
A18	55 GALLON DRUM - FILLED WITH SAND 700-715lbs.			A18	6

GENERAL NOTES

- FOR ADDITIONAL INSTALLATION INFORMATION AND GUIDANCE CONTACT: TEXAS DEPARTMENT OF TRANSPORTATION, (TXDOT'S DESIGN DIVISION). (512) 416-2678. THE EXACT POSITION OF MGBF SHALL BE SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER. THE SIGHT DISTANCE OF THE INSTALLATION WILL NEED TO BE VERIFIED WITH RESPECT TO THE SPECIFIC SITE PLACEMENT.
- STEEL POSTS ARE NOT PERMITTED AT CRT OR BCT POST POSITIONS.
- RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 12 1/2" OR 25 FOOT NOMINAL LENGTHS.
- BUTTON HEAD "POST" BOLTS (ASTM A307) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND TYPE A (1 3/4" O.D.) WASHER AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPlice" BOLTS (ASTM A307) ARE 5/8" X 1 1/4" OR 2" LONG AT TRIPLE RAIL SPLICES WITH A DOUBLE RECESSED NUT (ASTM A563).
- FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
- CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
- THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A SLOPE RATE OF NOT MORE THAN 1V:10H.
- IT IS NOT RECOMMENDED THAT GUARD FENCE BE PLACED IN THE VICINITY OF CURBS.
- GUARDRAIL POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
- SPECIAL RAIL FABRICATION WILL BE REQUIRED FOR THRIE BEAM RAIL RADIUS (ITEM J).
- ALL MATERIAL AND WORK INVOLVED IS SUBSIDIARY TO SHORT RADIUS BID ITEM, INCLUDING, BUT NOT LIMITED TO FOUNDATIONS, GRADING, THRIE BEAM RAIL, SAND DRUMS, AND OTHER PARTS.
- ALL CABLE ASSEMBLIES SHOULD BE TAUT AFTER INSTALLATION. WHEN CABLES ARE MANIPULATED BY HAND THE CABLES SHOULD NOT MOVE MORE THAN 1" IN ANY DIRECTION PERPENDICULAR TO THE CABLE.
- THE DRUMS ARE EAGLE MODEL 1656 FILLED WITH 715 LB (+/-15) SAND WITH THE PLASTIC LEVER-LOCK; OR AN APPROVED EQUIVALENT. THE APPROXIMATE HEIGHT OF THE DRUM IS 37" (+/-).
- WHEN THE SHORT RADIUS SYSTEM IS TERMINATED BY A DAT, REFER TO THE LATEST DAT STANDARD FOR INSTALLATION OF THE DAT SYSTEM. IF THE SYSTEM IS TERMINATED BY ANOTHER END TERMINAL SYSTEM, REFER TO THE CORRESPONDING END TERMINAL STANDARD.
- WHEN THE PLANNED LOCATION OF POST (I) IS WITHIN THE RIGHT-OF-WAY AND WITHIN THE CLEAR ZONE OF THE DIRECTION OF THE OPPOSING TRAFFIC, AN APPROPRIATE CRASHWORTHY END TERMINAL SHALL BE INSTALLED IN PLACE OF THE DOWNSTREAM ANCHOR TERMINAL (DAT). THE PAYMENT OF THE COMPLETE SHORT RADIUS SYSTEM WITH A DAT AT THE TERMINUS WILL BE WITH BID ITEMS: 540 6016 DOWNSTREAM ANCHOR TERMINAL SECTION, AND 540 6046 TL-2 31" SHORT RADIUS (W/O DAT). THE PAYMENT OF THE SYSTEM TERMINATED BY A CRASHWORTHY END TERMINAL (IN LIEU OF THE DAT) WILL BE WITH BID ITEMS: 540 6046 TL-2 31" SHORT RADIUS (W/O DAT), AND 544 6001 GUARDRAIL END TREATMENT (INSTALL).
- TESTED TO MASH WITH A 3:1 SLOPE OR SHALLOWER IS PREFERABLE IN THE LIMITS OF THE TOP AND BOTTOM OF THE SLOPE AS SHOWN IN THE PLAN VIEW. IF FIELD CONDITIONS REQUIRE A STEEPER SLOPE, THIS MAY BE ALLOWABLE UP TO A 2:1 SLOPE. CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE.

* NOTE: SEE SHEET 1 OF 3.


SPECIAL APPLICATION NOTES.

- THIS IS A MASH COMPLIANT TL-2 SHORT RADIUS GUARDRAIL SYSTEM 31 INCHES TALL. THE SYSTEM REQUIRES A MINIMUM PLACEMENT FOOTPRINT OF 35' ALONG THE PRIMARY ROAD AND 30' ALONG THE SECONDARY DRIVEWAY.
- THE SYSTEM ALSO REQUIRES A MINIMUM 3' WIDE (WORK ZONE) DIRECTLY BEHIND THE GUARDRAIL SYSTEM, WITH A SLOPE AT 1V:10H, FROM THERE A 3:1 SLOPE IS RECOMMENDED. SEE SHEET 2 OF 3 FOR SLOPE DETAILS.
- NOTE FOR INSTALLER: THE TWO (2) CRT POSTS ITEM (R), AT POST LOCATIONS 7 & 8., WILL REQUIRE THE FOLLOWING FIELD ADJUSTMENT. USING A 3/4" X 10" LONG SPADE BIT DRILL ONE (1) ADDITIONAL HOLE 7-7/8" DIRECTLY BELOW THE EXISTING TOP HOLE TO ACCOMMODATE THE HARDWARE FOR THE 22" LONG BLOCKOUT.

OPTION FOR ADDITIONAL 3/4" HOLE. THE 22" LONG BLOCKOUT (PDB010) IS MANUFACTURED WITH TWO 3/4" DRILLED HOLES FOR THE POST HARDWARE, THEREFORE THE BLOCKOUT CAN BE USED AS A TEMPLATE GUIDE FOR THE BOTTOM 3/4" HOLE. AFTER INSTALLING THE CRT POST USE THE TOP HOLE TO MOUNT THE 22" LONG BLOCKOUT TO POST, USE THE BLOCKOUT'S PRE-DRILLED HOLE AS A GUIDE FOR THE BOTTOM 3/4" HOLE.

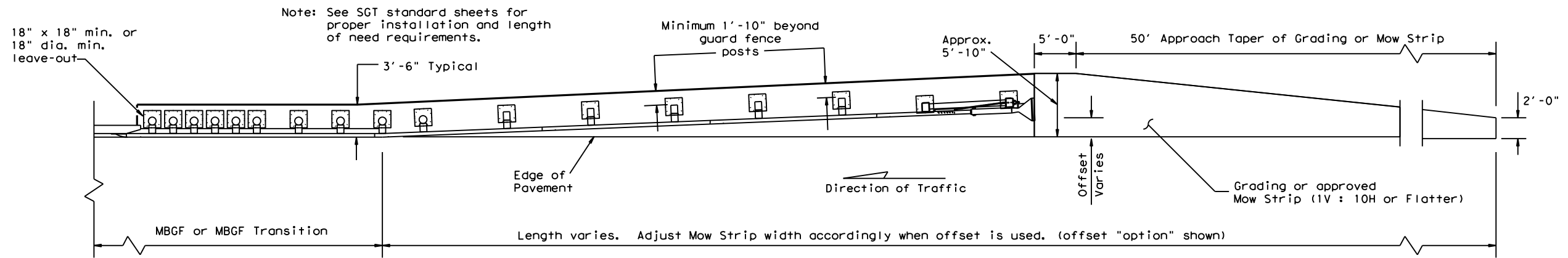
(MASH TL-2 COMPLIANT)
TESTED TO MASH TL-2 WITH A 3:1 SLOPE

SHEET 3 OF 3

 Texas Department of Transportation		Design Division Standard	
TL-2 SHORT RADIUS GUARDRAIL MASH COMPLIANT SRG (TL-2) -21			
FILE: srgt1221	TxDOT	CK:KM	DN:VP
© TxDOT: FEBRUARY 2021	CONT	SECT	JOB
REVISIONS	2352	02	027
	DIST	COUNTY	SHEET NO.
	DAL	DENTON	56

DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TXDOT FOR ANY PURPOSE WHATSOEVER. TXDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.

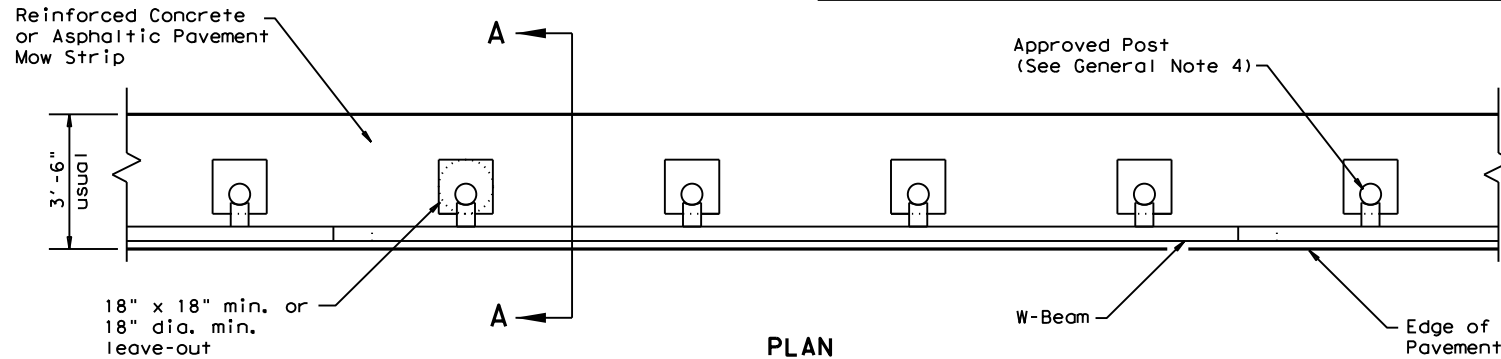
DATE: 9/19/2022
 FILE: T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\08 ROADWAY DETAILS\STANDARDS\gf31ms19.dgn



Note: See SGT standard sheets for proper installation and length of need requirements.

GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS

Note: Site Condition(s)
 Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.
 Approach grading or mow strip may be decreased or eliminated, as directed by the Engineer.

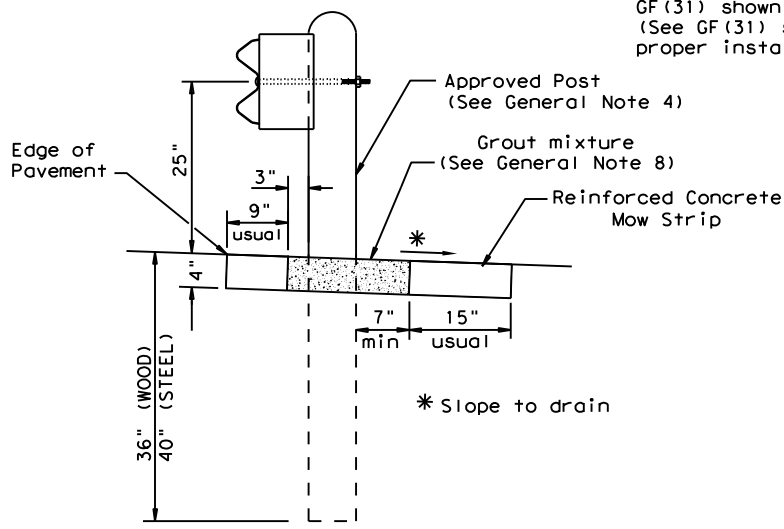


PLAN

GF(31) shown with Mow Strip (See GF(31) standard sheet for proper installation)

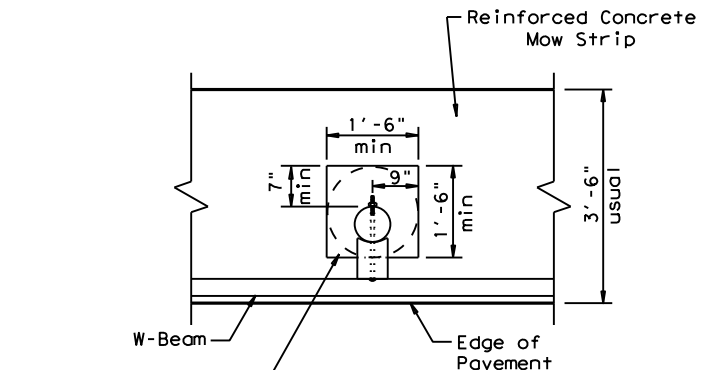
GENERAL NOTES

1. This mow strip design is for use with metal beam guard fence, guard fence transitions, and guard fence end treatments. See applicable GF(31) MBGF or GF(31) Transition Standard sheet for additional information.
2. Mow strips shall be reinforced concrete with (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item. Reinforced concrete shall be placed in accordance with Item 432, "Riprap." The use of the synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Material Producer List (MPL), maintained by TxDOT, Construction Division.
3. The leave-out behind the post shall be a minimum of 7".
4. Only steel (W6 x 8.5 or W6 x 9.0), or 7 1/2" Dia. round wood posts are acceptable for use in the mow strip. See GF(31) Standard for additional details.
5. Other curb placement options may be used. Curbs are not considered part of the mow strip and will be paid for under other pertinent bid item.
6. Thickness of the mow strip will be 4".
7. The limits of payment for reinforced concrete will include leave-outs for the posts.
8. The leave-outs shall be filled with a Grout mixture consisting of: 2719 pounds sand, 188 pounds Type I or II cement, and 550 pounds of water per cubic yard, with a 28-day compressive strength of approximately 230 psi or less. Provide grout with a consistency that will flow into and completely fill all voids. Due to auger size, larger leave-out dimensions are acceptable from both an impact performance and maintenance repair standpoint (Suggested Maximum leave-out of 20"). Payment for furnishing and placing the grout mixture will be subsidiary to the pay item of riprap mow strip.



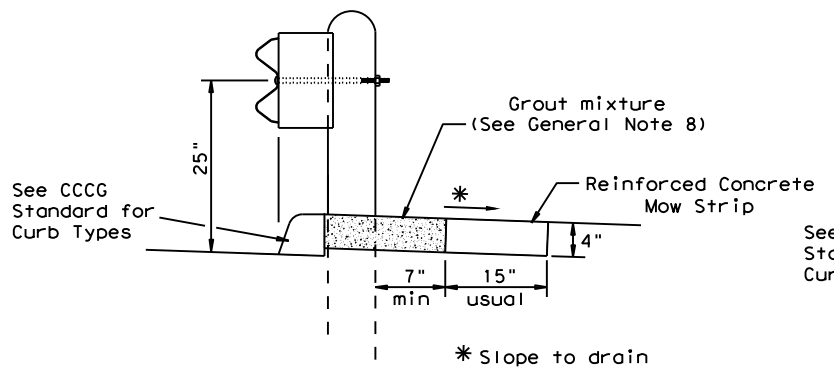
SECTION A-A

Typical



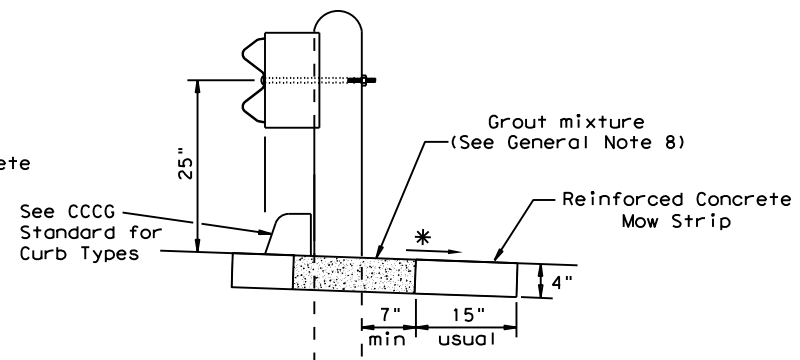
MOW STRIP DETAIL

Reinforced Concrete Mow Strip with 18" x 18" Square or 18" Dia. minimum leave-out.



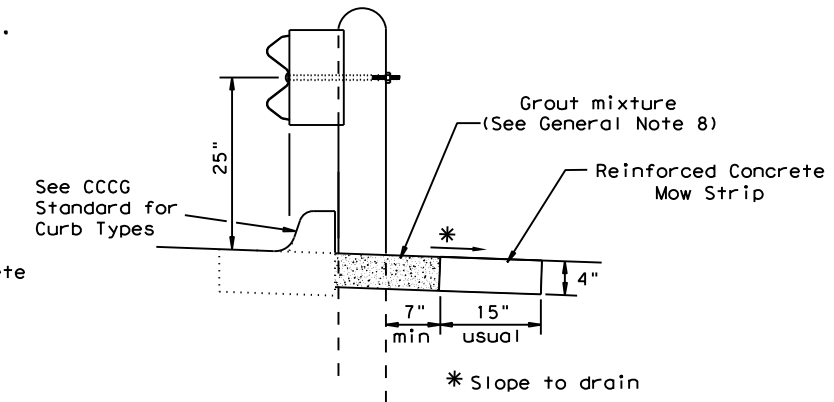
CURB OPTION (1)

This option will increase the post embedment throughout the system.



CURB OPTION (2)

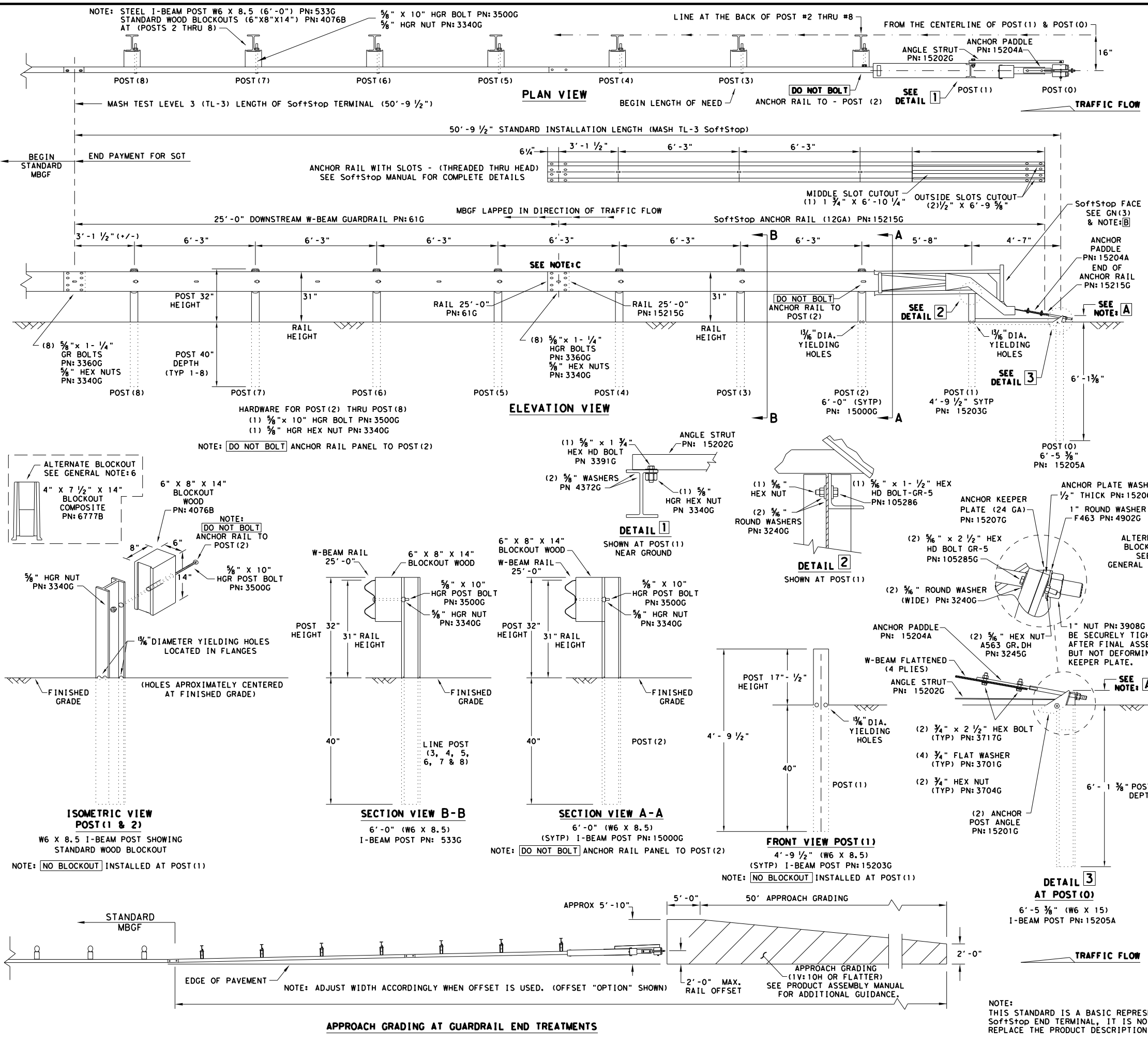
Curb shown on top of mow strip



CURB OPTION (3)

		Design Division Standard	
METAL BEAM GUARD FENCE (MOW STRIP) TL-3 MASH COMPLIANT GF(31)MS-19			
FILE: gf31ms19.dgn	DN: TxDOT	CK: KM	DW: VP
©TXDOT: NOVEMBER 2019	CONT	SECT	JOB
REVISIONS	2352	02	027
	DIST	COUNTY	SHEET NO.
	DAL	DENTON	57

DATE: 9/19/2022
 FILE: T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\08 ROADWAY DETAILS\STANDARDS\sgt10s3116.dgn



- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY AT 1(888)323-6374, 2525 N. STEMMONS FREEWAY, DALLAS, TX 75207
 - FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE SoftStop END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL. PN:620237B
 - APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
 - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
 - HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
 - A COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
 - IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL AND REFER TO THE LATEST ROADWAY MBBG STANDARD FOR INSTALLATION GUIDANCE.
 - POSTS SHALL NOT BE SET IN CONCRETE.
 - IT IS ACCEPTABLE TO INSTALL THE SoftStop IMPACT HEAD PARALLEL TO THE GRADE LINE OR WITH AN UPWARD TILT.
 - DO NOT ATTACH THE SoftStop SYSTEM DIRECTLY TO A RIGID BARRIER.
 - UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE SoftStop SYSTEM BE CURVED.
 - A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCRoaching ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.

NOTE: A THE INSTALLATION HEIGHT OF FULLY ASSEMBLED ANCHOR POST WILL VARY FROM 3-3/4" MIN. TO 4" MAX. ABOVE FINISHED GRADE.

NOTE: B PART PN:5852B RIGHT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING) PART PN:5851B LEFT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING)

NOTE: C W-BEAM SPLICE LOCATED BETWEEN LINE POST (4) AND LINE POST (5) GUARDRAIL PANEL 25'-0" PN:61G ANCHOR RAIL 25'-0" PN:15215G LAP GUARDRAIL IN DIRECTION OF TRAFFIC FLOW.

PART	QTY	MAIN SYSTEM COMPONENTS
620237B	1	PRODUCT DESCRIPTION ASSEMBLY MANUAL (LATEST REV.)
15208A	1	SoftStop HEAD (SEE MANUAL FOR RIGHT-LEFT APPROACH)
15215G	1	SoftStop ANCHOR RAIL (12GA) WITH CUTOUT SLOTS
61G	1	SoftStop DOWNSTREAM W-BEAM RAIL (12GA) (25'-0")
15205A	1	POST #0 - ANCHOR POST (6'-5 3/8")
15203G	1	POST #1 - (SYTP) (4'-9 1/2")
15000G	1	POST #2 - (SYTP) (6'-0")
533G	6	POST #3 THRU #8 - I-BEAM (W6 X 8.5) (6'-0")
4076B	7	BLOCKOUT - WOOD (ROUTED) (6" X 8" X 14")
6777B	7	BLOCKOUT - COMPOSITE (4" X 7 1/2" X 14")
15204A	1	ANCHOR PADDLE
15207G	1	ANCHOR KEEPER PLATE (24 GA)
15206G	1	ANCHOR PLATE WASHER (1/2" THICK)
15201G	2	ANCHOR POST ANGLE (10" LONG)
15202G	1	ANGLE STRUT

HARDWARE		
4902G	1	1" ROUND WASHER F436
3908G	1	1" HEAVY HEX NUT A563 GR.DH
3717G	2	3/4" X 2 1/2" HEX BOLT A325
3701G	4	3/4" ROUND WASHER F436
3704G	2	3/4" HEAVY HEX NUT A563 GR.DH
3360G	16	5/8" X 1 1/4" W-BEAM RAIL SPLICE BOLTS HGR
3340G	25	5/8" W-BEAM RAIL SPLICE NUTS HGR
3500G	7	5/8" X 10" HGR POST BOLT A307
3391G	1	5/8" X 1 3/4" HEX HD BOLT A325
4489G	1	5/8" X 9" HEX HD BOLT A325
4372G	4	5/8" WASHER F436
105285G	2	5/8" X 2 1/2" HEX HD BOLT GR-5
105286G	1	5/8" X 1 1/2" HEX HD BOLT GR-5
3240G	6	5/8" ROUND WASHER (WIDE)
3245G	3	5/8" HEX NUT A563 GR.DH
5852B	1	HIGH INTENSITY REFLECTIVE SHEETING - SEE NOTE: B

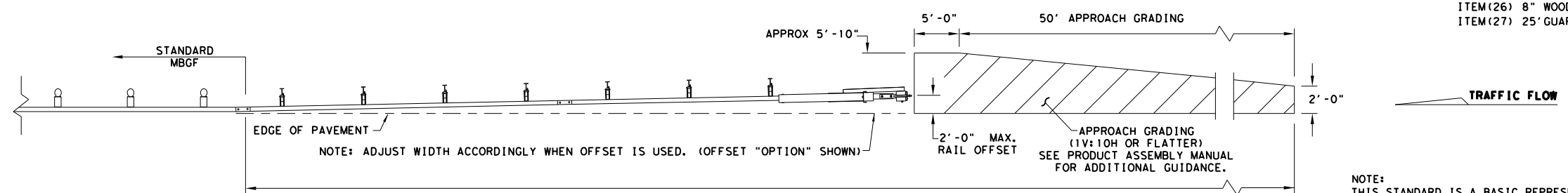
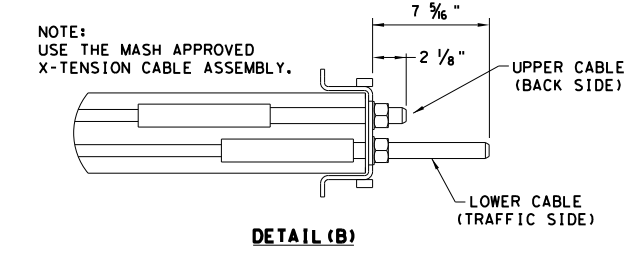
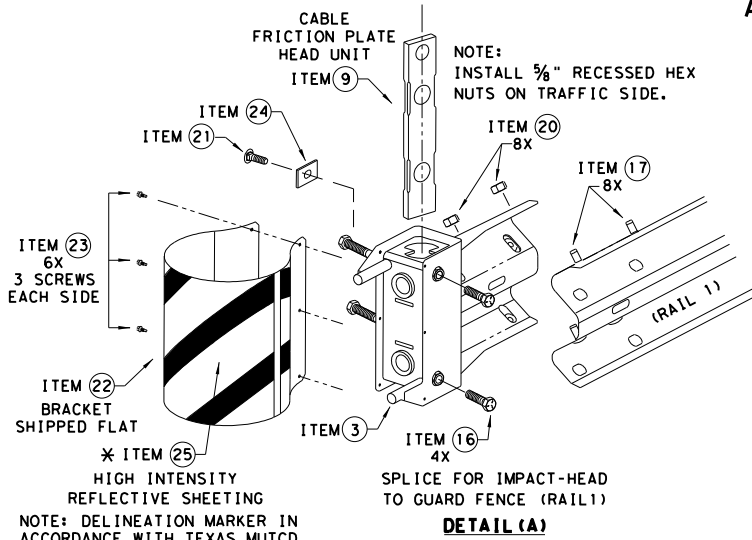
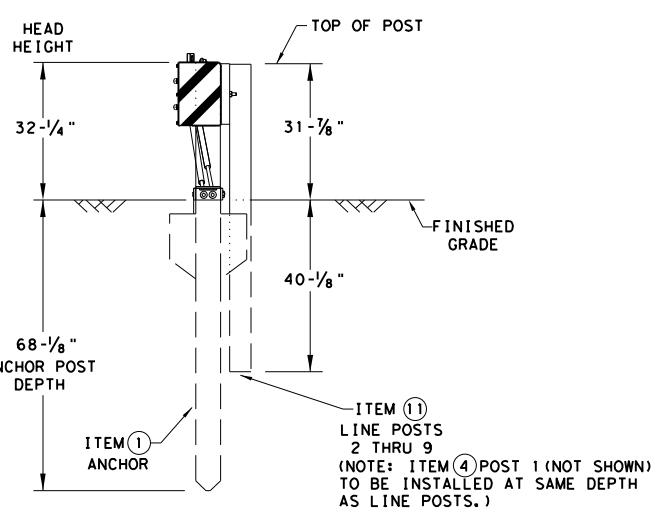
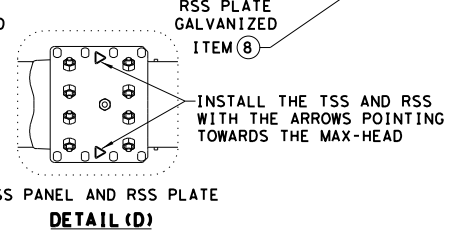
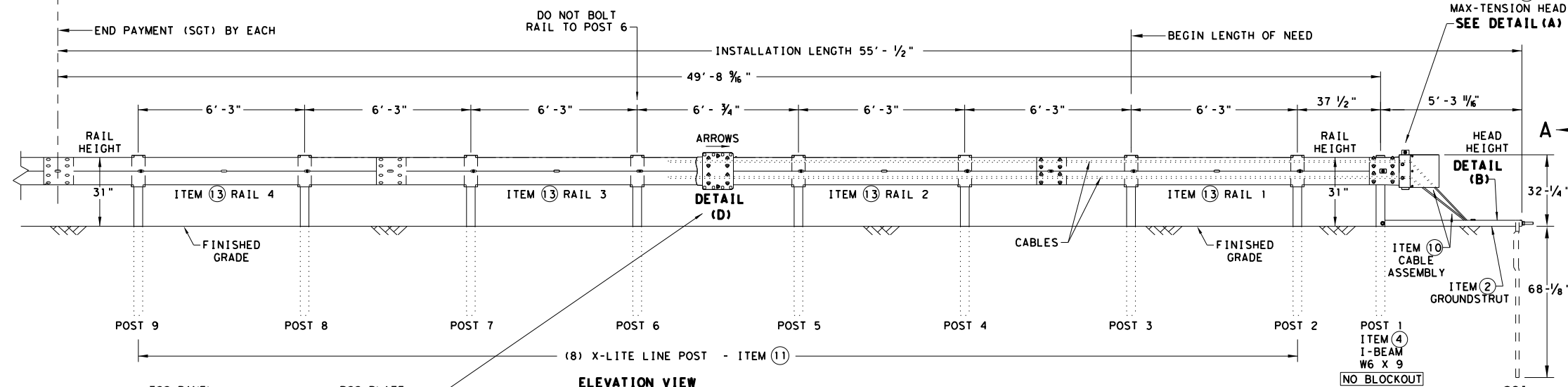
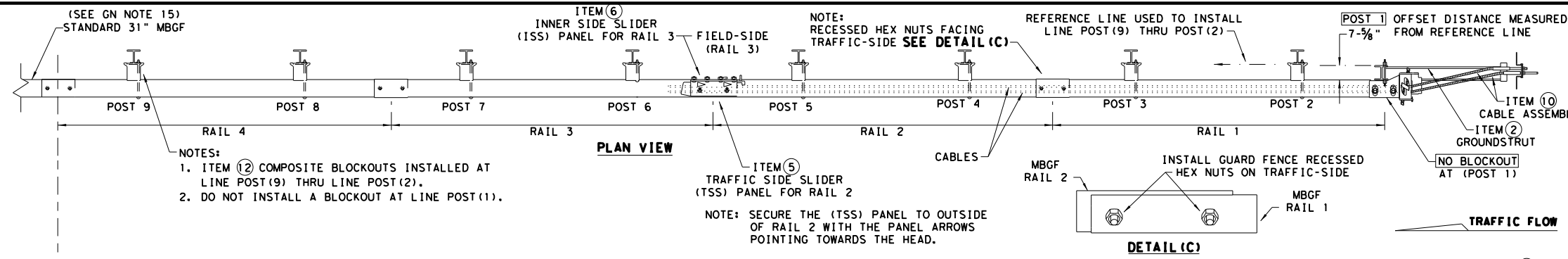
Texas Department of Transportation
 Design Division Standard

**TRINITY HIGHWAY
 SOFTSTOP END TERMINAL
 MASH - TL-3
 SGT (10S) 31-16**

FILE: sgt10s3116	DN: TXDOT	CK: KM	DW: VP	CK: MB/VP
©TXDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM 2449
DIST	COUNTY	SHEET NO.		
DAL	DENTON	58		

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 incorrect results or damages resulting from its use.

DATE: 9/19/2022
 FILE: T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\08 ROADWAY DETAILS\MBGF\sgt11s3118.dgn



GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800
- FOR INSTALLATION, REPAIR, & MAINTENANCE REFER TO THE MAX-TENSION INSTALLATION INSTRUCTION MANUAL, P/N MANMAX REV D (ECN 3516).
- APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
- FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TxDOT'S LATEST ROADWAY MOW STRIP STANDARD.
- ALL STEEL COMPONENTS ARE GALVANIZED PER ASTM A123 OR EQUIVALENT UNLESS OTHERWISE STATED.
- SYSTEM SHOWN USING STEEL WIDE FLANGE POST WITH COMPOSITE BLOCKOUTS.
- COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
- REFER TO INSTALLATION MANUAL FOR SPECIFIC PANEL LAPPING GUIDANCE.
- IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL FOR INSTALLATION GUIDANCE.
- POSTS SHALL NOT BE SET IN CONCRETE.
- A DRIVING CAP WITH A TIMBER OR PLASTIC INSERT SHALL BE USED WHEN DRIVING POST TO PREVENT DAMAGE TO THE GALVANIZING ON TOP OF THE POST.
- MAX-TENSION SYSTEM SHALL NEVER BE INSTALLED WITHIN A CURVED SECTION OF GUARDRAIL.
- IF A DELINEATION MARKER IS REQUIRED, MARKER SHALL BE IN ACCORDANCE WITH TEXAS MUTCD.
- THE SYSTEM IS SHOWN WITH 12'-6" MBGF PANELS, 25'-0" MBGF PANELS ARE ALSO ALLOWED.
- A MINIMUM OF 12'-6" OF 12GA. MBGF IS REQUIRED IMMEDIATELY DOWNSTREAM OF THE MAX-TENSION SYSTEM.

ITEM #	PART NUMBER	DESCRIPTION	QTY
1	BSI-1610060-00	SOIL ANCHOR - GALVANIZED	1
2	BSI-1610061-00	GROUND STRUT - GALVANIZED	1
3	BSI-1610062-00	MAX-TENSION IMPACT HEAD	1
4	BSI-1610063-00	W6x9 I-BEAM POST 6FT. -GALVANIZED	1
5	BSI-1610064-00	TSS PANEL - TRAFFIC SIDE SLIDER	1
6	BSI-1610065-00	ISS PANEL - INNER SIDE SLIDER	1
7	BSI-1610066-00	TOOTH - GEOMET	1
8	BSI-1610067-00	RSS PLATE - REAR SIDE SLIDER	1
9	B061058	CABLE FRICTION PLATE - HEAD UNIT	1
10	BSI-1610069-00	CABLE ASSEMBLY - MASH X-TENSION	2
11	BSI-1012078-00	X-LITE LINE POST - GALVANIZED	8
12	B090534	8" W-BEAM COMPOSITE-BLOCKOUT XT110	8
13	BSI-4004386	12'-6" W-BEAM GUARD FENCE PANELS 12GA.	4
14	BSI-1102027-00	X-LITE SQUARE WASHER	1
15	BSI-2001886	3/8" X 7" THREAD BOLT HH (GR.5)GEOMET	1
16	BSI-2001885	3/4" X 3" ALL-THREAD BOLT HH (GR.5)GEOMET	4
17	4001115	5/8" X 1 1/4" GUARD FENCE BOLTS (GR.2)MGAL	48
18	2001840	5/8" X 10" GUARD FENCE BOLTS MGAL	8
19	2001636	5/8" WASHER F436 STRUCTURAL MGAL	2
20	4001116	5/8" RECESSED GUARD FENCE NUT (GR.2)MGAL	59
21	BSI-2001888	3/8" X 2" ALL THREAD BOLT (GR.5)GEOMET	1
22	BSI-1701063-00	DELINEATION MOUNTING (BRACKET)	1
23	BSI-2001887	1/4" X 3/4" SCREW SD HH 410SS	7
24	4002051	GUARDRAIL WASHER RECT AASHTO FWRO3	1
25	SEE NOTE BELOW	HIGH INTENSITY REFLECTIVE SHEETING	1
26	4002337	8" W-BEAM TIMBER-BLOCKOUT, PDB01B	8
27	BSI-4004431	25' W-BEAM GUARDRAIL PANEL, 8-SPACE, 12GA.	2
28	MANMAX Rev-(D)	MAX-TENSION INSTALLATION INSTRUCTIONS	1

* TO BE PROVIDED BY DISTRIBUTOR OR CONTRACTOR.
 ** ALTERNATIVE ITEMS NOT SHOWN.
 ITEM(26) 8" WOOD-BLOCKOUTS
 ITEM(27) 25' GUARD FENCE PANELS

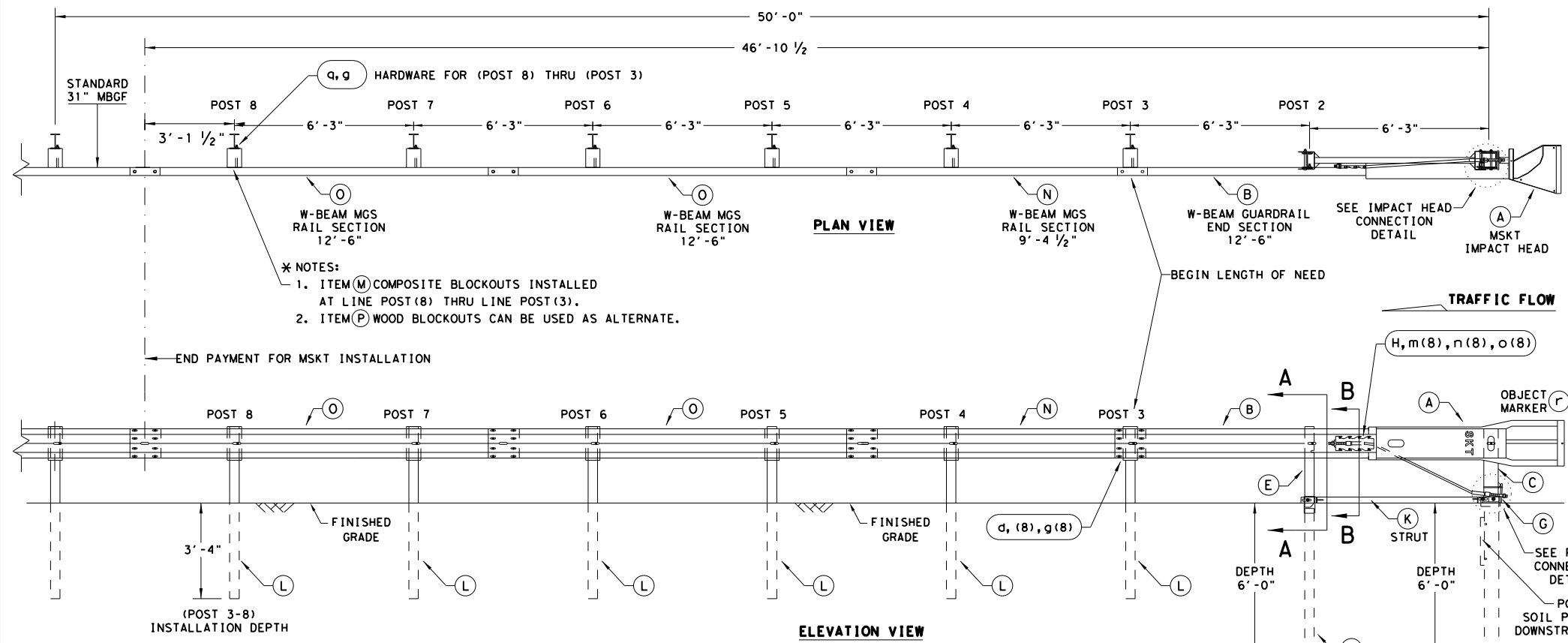
Texas Department of Transportation
 Design Division Standard

**MAX-TENSION END TERMINAL
 MASH - TL-3
 SGT (11S) 31-18**

FILE: sgt11s3118.dgn	DN: TxDOT	CK: KM	DW: TxDOT	CK: CL
© TxDOT: FEBRUARY 2018	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352 02	027	FM2449	
DIST	COUNTY	SHEET NO.		
DAL	DENTON	59		

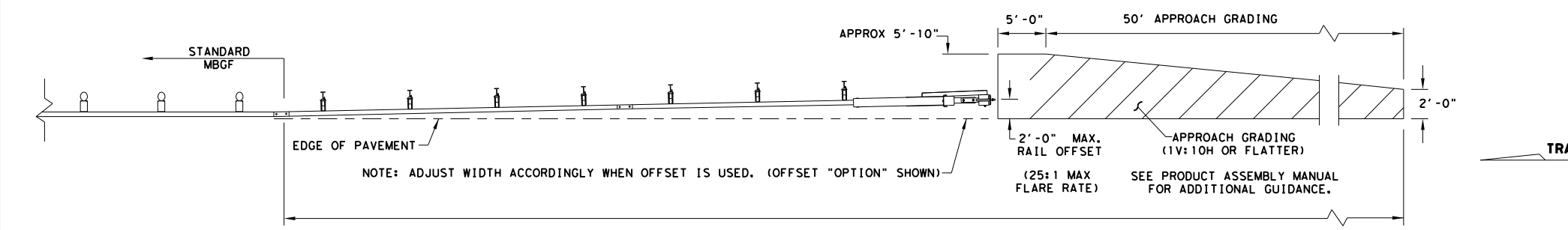
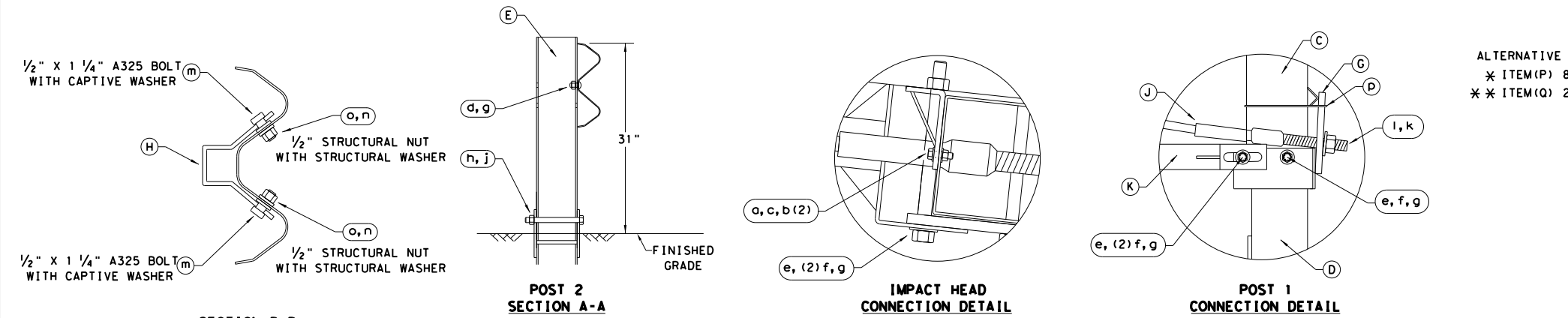
NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE MAX-TENSION END TERMINAL, IT IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

DATE: 9/19/2022
 FILE: T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\08 ROADWAY DETAILS\STANDARDS\sgt12s3118.dgn
 DISCLAIMER: THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TxDOT FOR ANY PURPOSE WHATSOEVER. TxDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.



- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: ROAD SYSTEMS, INC. (432)263-2435. 3616 OLD HOWARD COUNTY AIRPORT, BIG SPRING, TX 79720
 - FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE: MSKT END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL (PUBLICATION-062717).
 - APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
 - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TxDOT'S LATEST ROADWAY MOW STRIP STANDARD.
 - HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
 - SYSTEM SHOWN USING STEEL WIDE FLANGE POSTS WITH COMPOSITE BLOCKOUTS.
 - A COMPOSITE MATERIAL BLOCKOUTS THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
 - IF SOLID ROCK IS ENCOUNTERED IN THE AREA OF (POST 1) AND / OR (POST 2) CONTACT THE MANUFACTURER, & REFER TO THE LATEST ROADWAY MOW STRIP STANDARD FOR INSTALLATION GUIDANCE.
 - POSTS SHALL NOT BE SET IN CONCRETE.
 - SYSTEM MUST BE ATTACHED TO STANDARD 31" MBGF.
 - UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE MSKT SYSTEM BE CURVED.
 - A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCRANCHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.
 - THE SYSTEM IS SHOWN WITH TWO 12'-6" MBGF PANELS, ONE 25'-0" MBGF PANEL IS ALSO ALLOWED IN ITS PLACE.
 - A DRIVING CAP WITH A TIMBER OR PLASTIC INSERT SHALL BE USED WHEN DRIVING POSTS 3-8 TO PREVENT DAMAGE TO THE GALVANIZING ON TOP OF THE POST. SPECIAL DRIVING CAP TO BE USED ON LOWER POSTS 1 & 2 TO PREVENT DAMAGE TO THE WELDED PLATES.

ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM NUMBERS
A	1	MSKT IMPACT HEAD	MS3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Go.	SF1303
C	1	POST 1 - TOP (6" X 6" X 1/8" TUBE)	MTPHP1A
D	1	POST 1 - BOTTOM (6' W6X15)	MTPHP1B
E	1	POST 2 - ASSEMBLY TOP	UHP2A
F	1	POST 2 - ASSEMBLY BOTTOM (6' W6X9)	HP2B
G	1	BEARING PLATE	E750
H	1	CABLE ANCHOR BOX	S760
J	1	BCT CABLE ANCHOR ASSEMBLY	E770
K	1	GROUND STRUT	MS785
L	6	W6X9 OR W6X8.5 STEEL POST	P621
M	6	COMPOSITE BLOCKOUTS	CBSP-14
N	1	W-BEAM MGS RAIL SECTION (9'-4 1/2")	G12025
O	2	W-BEAM MGS RAIL SECTION (12'-6")	G1203A
P	6	WOOD BLOCKOUT 6" X 8" X 14"	P675
Q	1	W-BEAM MGS RAIL SECTION (25'-0")	G1209
SMALL HARDWARE			
a	2	5/8" x 1" HEX BOLT (GRD 5)	B5160104A
b	4	5/8" WASHER	W0516
c	2	5/8" HEX NUT	N0516
d	25	5/8" Dia. x 1 1/4" SPLICE BOLT (POST 2)	B580122
e	2	5/8" Dia. x 9" HEX BOLT (GRD A449)	B580904A
f	3	5/8" WASHER	W050
g	33	5/8" Dia. H.G.R NUT	N050
h	1	3/4" Dia. x 8 1/2" HEX BOLT (GRD A449)	B340854A
j	1	3/4" Dia. HEX NUT	N030
k	2	1 ANCHOR CABLE HEX NUT	N100
l	2	1 ANCHOR CABLE WASHER	W100
m	8	1/2" x 1 1/4" A325 BOLT WITH CAPTIVE WASHER	SB12A
n	8	1/2" STRUCTURAL NUTS	N012A
o	8	1 1/8" O.D. x 3/8" I.D. STRUCTURAL WASHERS	W012A
p	1	BEARING PLATE RETAINER TIE	CT-100ST
q	6	5/8" x 10" H.G.R. BOLT	B581002
r	1	OBJECT MARKER 18" X 18"	E3151



Design Division Standard

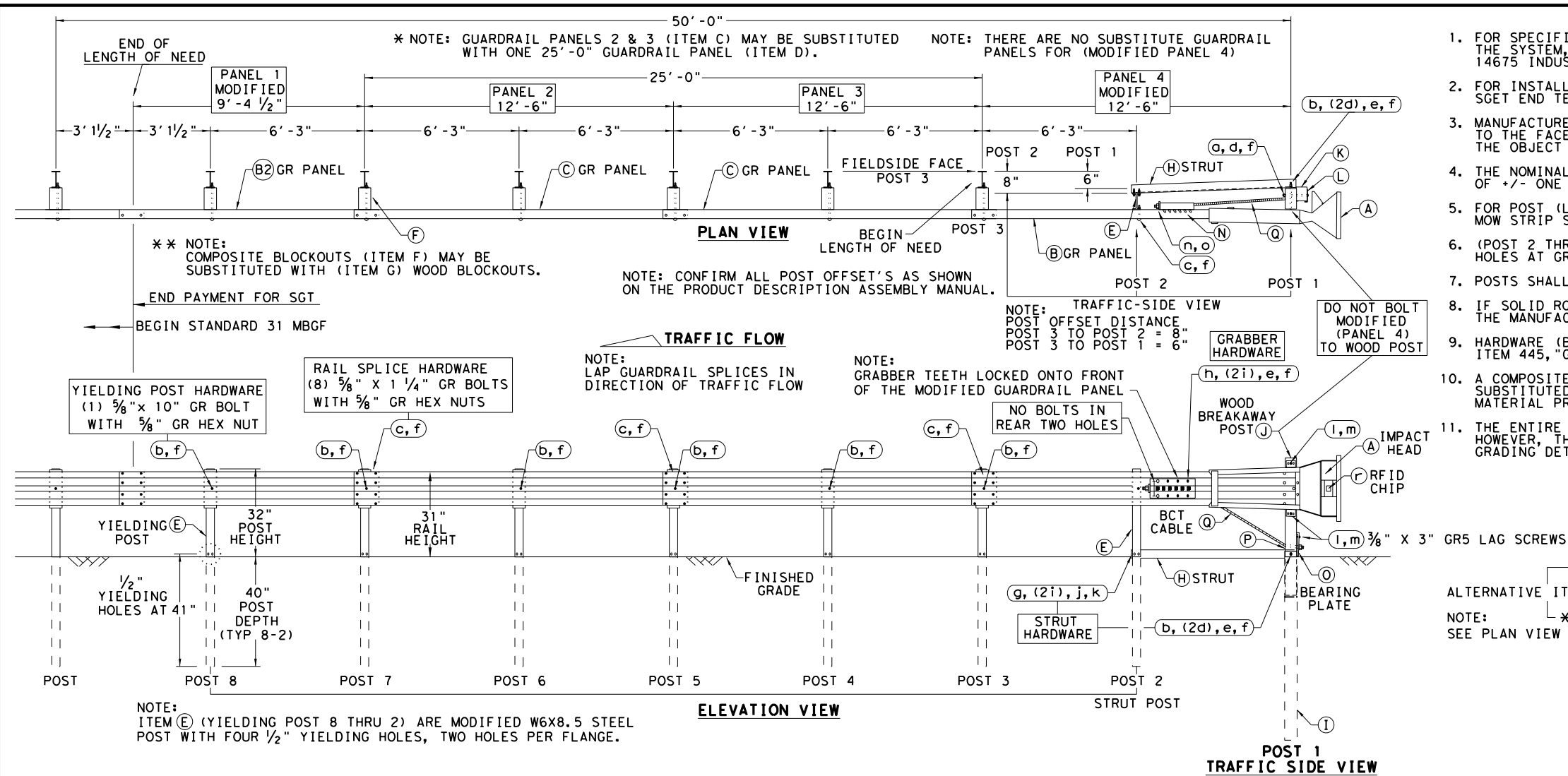
SINGLE GUARDRAIL TERMINAL

MSKT-MASH-TL-3

SGT (12S) 31-18

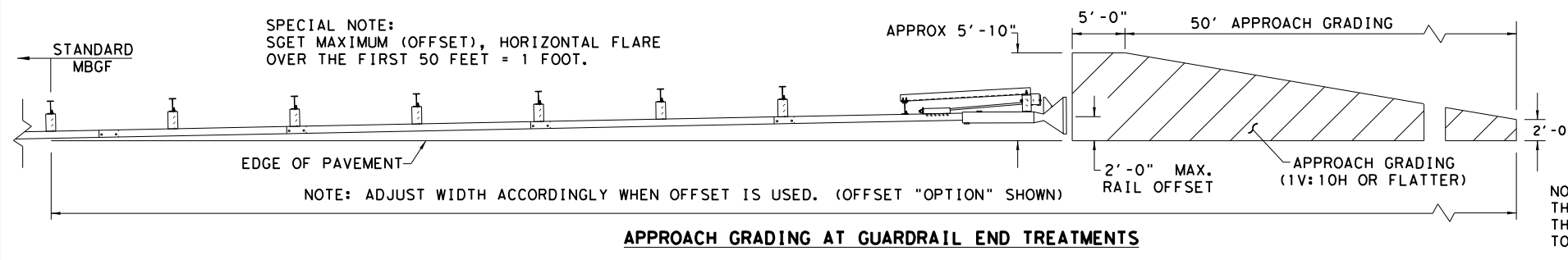
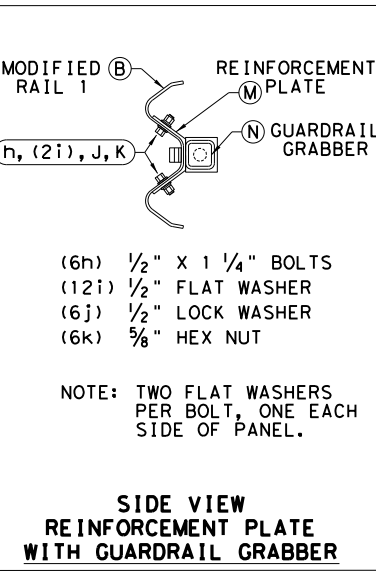
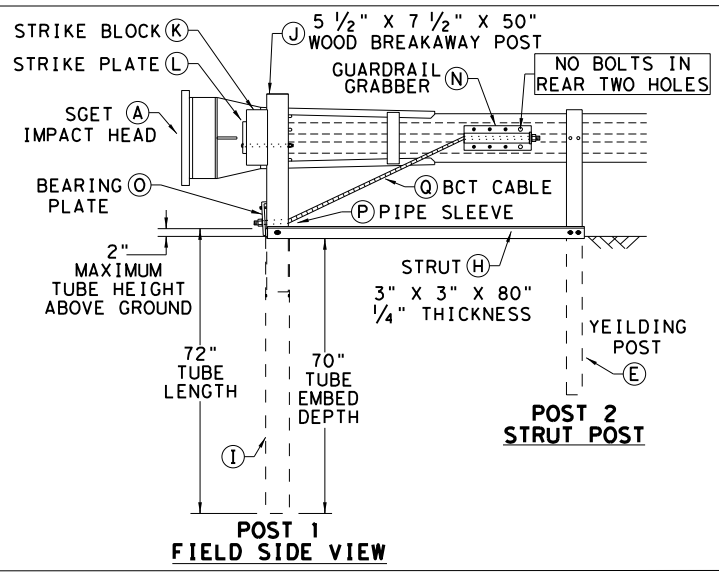
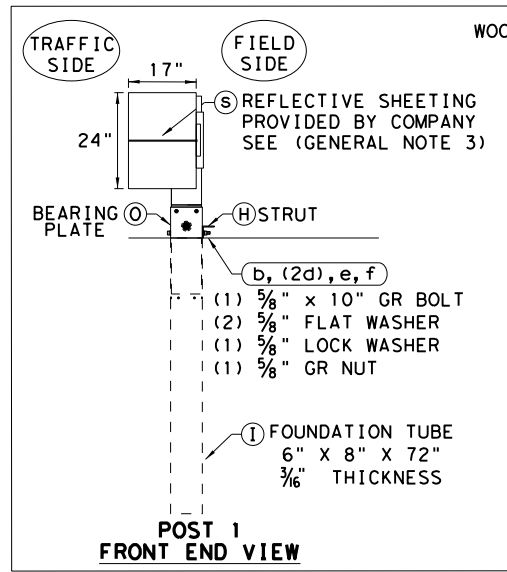
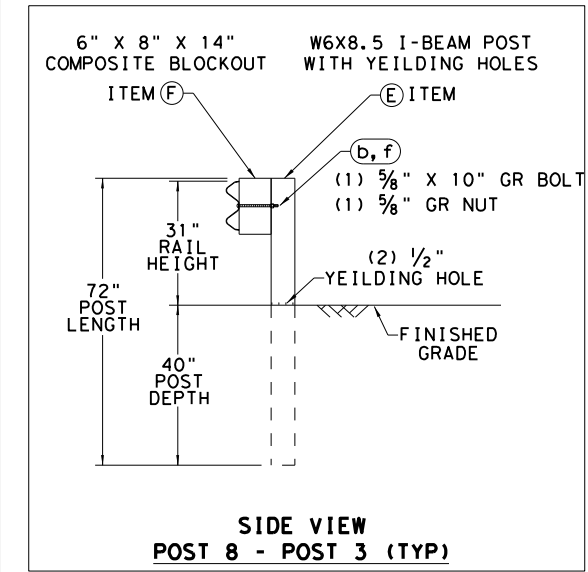
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© TxDOT: APRIL 2018	CONT SECT	JOB	HIGHWAY	
REVISIONS	2352 02	027	FM2449	
DIST	COUNTY	SHEET NO.		
DAL	DENTON	60		

9/19/2022
 DATE: 9/19/2022
 FILE: T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\08 ROADWAY DETAILS\STANDARDS\sgt153120.dgn
 DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TXDOT FOR ANY PURPOSE WHATSOEVER. TXDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.



- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: SPIG INDUSTRY, INC. AT 1(267) 644-9510. 14675 INDUSTRIAL PARK RD; BRISTOL, VA 24202
 - FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE MANUFACTURER'S; SGET END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL.
 - MANUFACTURER WILL APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" TO THE FACE PLATE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. THE OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
 - THE NOMINAL HEIGHT OF THE GUARDRAIL BEAM IS 31 INCHES WITH A TOLERANCE OF +/- ONE INCH.
 - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
 - (POST 2 THROUGH POST 8) ARE MODIFIED STEEL-YIELDING POSTS WITH YIELDING HOLES AT GROUND LEVEL. THERE ARE NO SUBSTITUTE POSTS.
 - POSTS SHALL NOT BE SET IN CONCRETE.
 - IF SOLID ROCK IS ENCOUNTERED FOR ANY OF THE POSTS IN THE SYSTEM, CONTACT THE MANUFACTURER FOR SPECIFIC INSTALLATION GUIDANCE.
 - HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
 - A COMPOSITE MATERIAL BLOCKOUT THAT MEETS DMS-7210 REQUIREMENTS MAY BE SUBSTITUTED FOR AN APPROVED WOOD BLOCKOUT. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
 - THE ENTIRE SYSTEM MUST BE INSTALLED IN A STRAIGHT LINE WITHOUT ANY CURVE. HOWEVER, THE SYSTEM CAN BE OFFSET BY TWO FEET AS SHOWN ON THE APPROACH GRADING DETAIL TO HELP OFF-SET THE IMPACT HEAD FROM SHOULDER OF THE ROAD.

ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM #
A	1	SGET IMPACT HEAD	SIH1A
B	1	MODIFIED GUARDRAIL PANEL 12'-6" 12GA	126SPZGP
B2	1	MODIFIED GUARDRAIL PANEL 9'-4 1/2" 12GA	GP94
C	2	STANDARD GUARDRAIL PANEL 12'-6" 12GA	GP126
D	1	STANDARD GUARDRAIL PANEL 25'-0" 12GA	GP25
E	7	MODIFIED YIELDING I-BEAM POST W6x8.5	YP6MOD
F	6	COMPOSITE BLOCKOUT 6" X 8" X 14"	CBO8
G	6	WOOD BLOCKOUT 6" X 8" X 14"	WBO8
H	1	STRUT 3" X 3" X 80" X 1/4" A36 ANGLE	STR80
I	1	FOUNDATION TUBE 6" X 8" X 72" X 3/8"	FNDT6
J	1	WOOD BREAKAWAY POST 5 1/2" X 7 1/2" X 50"	WBRK50
K	1	WOOD STRIKE BLOCK	WSBK14
L	1	STRIKE PLATE 1/4" A36 BENT PLATE	SPLT8
M	1	REINFORCEMENT PLATE 12 GA. GR55	REPLT17
N	1	GUARDRAIL GRABBER 2 1/2" X 2 1/2" X 16 1/2"	GR17
O	1	BEARING PLATE 8" X 8 5/8" X 5/8" A36	BPLT8
P	1	PIPE SLEEVE 4 1/4" X 2 3/8" O.D. (2 1/8" I.D.)	PSLV4
Q	1	BCT CABLE 3/4" X 81" LENGTH	CBL81
SMALL HARDWARE			
o	1	5/8" X 12" GUARDRAIL BOLT 307A HDG	12GRBLT
b	7	5/8" X 10" GUARDRAIL BOLT 307A HDG	10GRBLT
c	33	5/8" X 1 1/4" GR SPlice BOLTS 307A HDG	1GRBLT
d	3	5/8" FLAT WASHER F436 A325 HDG	58FW436
e	1	5/8" LOCK WASHER HDG	58LW
f	39	5/8" GUARDRAIL HEX NUT HDG	58HN563
g	2	1/2" X 2" STRUT BOLT A325 HDG	2BLT
h	6	1/2" X 1 1/4" PLATE BOLT A325 HDG	125BLT
i	16	1/2" FLAT WASHER F436 A325 HDG	12FWF436
j	8	1/2" LOCK WASHER HDG	12LW
k	8	1/2" HEX NUT A563 HDG	12HN563
l	4	3/8" X 3" HEX LAG SCREW GR5 HDG	38LS
m	4	3/8" FLAT WASHER F436 A325 HDG	38FW844
n	2	1" FLAT WASHER F436 A325 HDG	1FWF436
o	2	1" HEX NUT A563HD HDG	1HN563
p	1	18" TO 24" LONG ZIP TIE RATED 175-200LB	ZPT18
q	1	1 1/2" X 4" SCH-40 PVC PIPE	PSPCR4
r	1	RFID CHIP RATED MIL-STD-810F	RFID810F
s	1	IMPACT HEAD REFLECTIVE SHEETING	RS30M

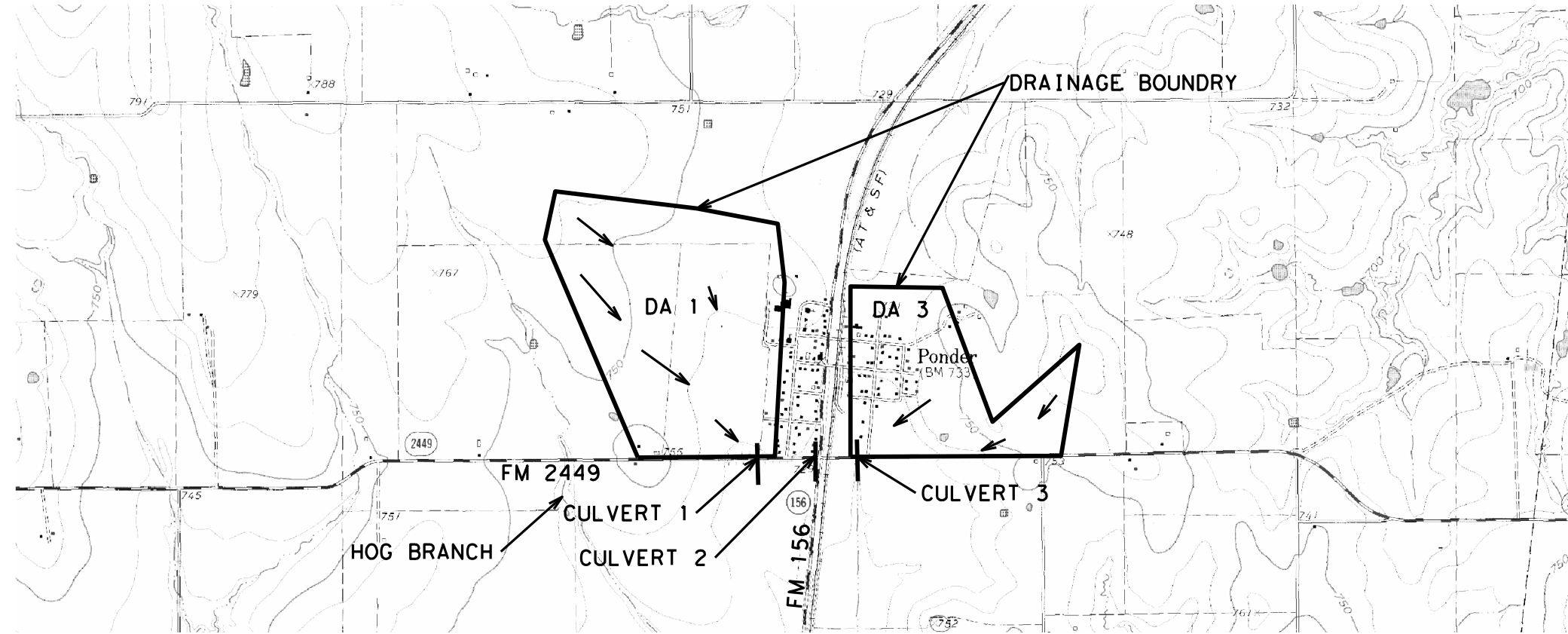


NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE SGET TERMINAL SYSTEM AND IS NOT INTENDED TO REPLACE THE MANUFACTURER'S ASSEMBLY MANUAL.

Design Division Standard

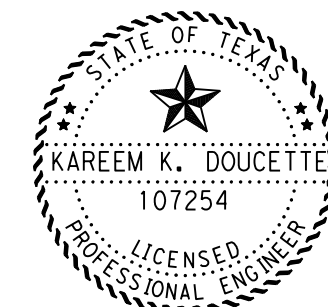
SPIG INDUSTRY, LLC
 SINGLE GUARDRAIL TERMINAL
 SGET - TL-3 - MASH
 SGT (15) 31-20

FILE: sgt153120.dgn	DN: TXDOT	CK: KM	DW: VP	CK: VP
© TXDOT: APRIL 2020	CONT: 2352	SECT: 02	JOB: 027	HIGHWAY: FM 2449
REVISIONS				
DIST: DAL	COUNTY: DENTON	SHEET NO. 61		



RUNOFF CALCULATIONS

STR. #	DA NO	STA.	METHOD	AREA		SLOPE (ft/ft)	OmegaEM	C	TC (min)	10 YR			25 YR			100 YR		
				(acres)	(mi ²)					P (in)	I (in/hr)	Q (cfs)	P (in)	I (in/hr)	Q (cfs)	P (in)	I (in/hr)	Q (cfs)
1	1	124+42.87	NRCS	215	0.34	0.003	0.061	N/A	N/A	N/A	N/A	N/A	37	N/A	193.61	37	N/A	248.33
2	2	132+47.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	3	138+26.79	RATIONAL	113	0.18	0.005	0.061	0.028	10	N/A	7.6	226.6	N/A	N/A	N/A	N/A	10.99	347.7



DocuSigned by:
Kareem Doucette 9/20/2022



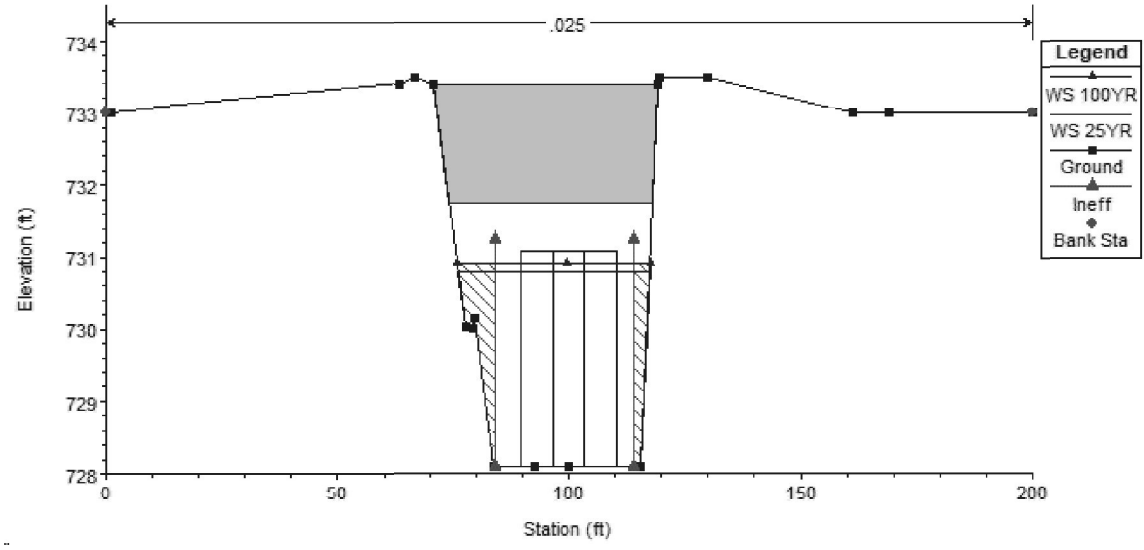
FM 2449
CULVERT 1
HYDRAULIC DATA SHEET

SHEET 1 OF 2

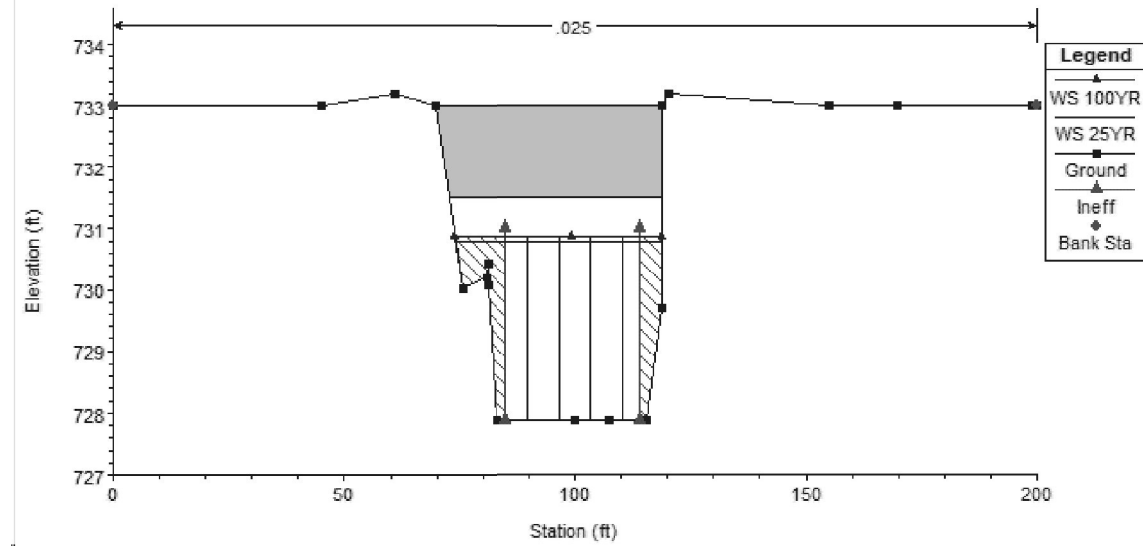
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GRAPHICS KKD	STATE TEXAS	DISTRICT DAL	COUNTY DENTON	SHEET NO. 62
CHECK	CONTROL 2352	SECTION 02	JOB 027	

USER
\$ TIMES \$
\$ DATES \$
\$ FILES \$
NODE

FM 2449 Local Plan: CL1-PROP 4/12/2022

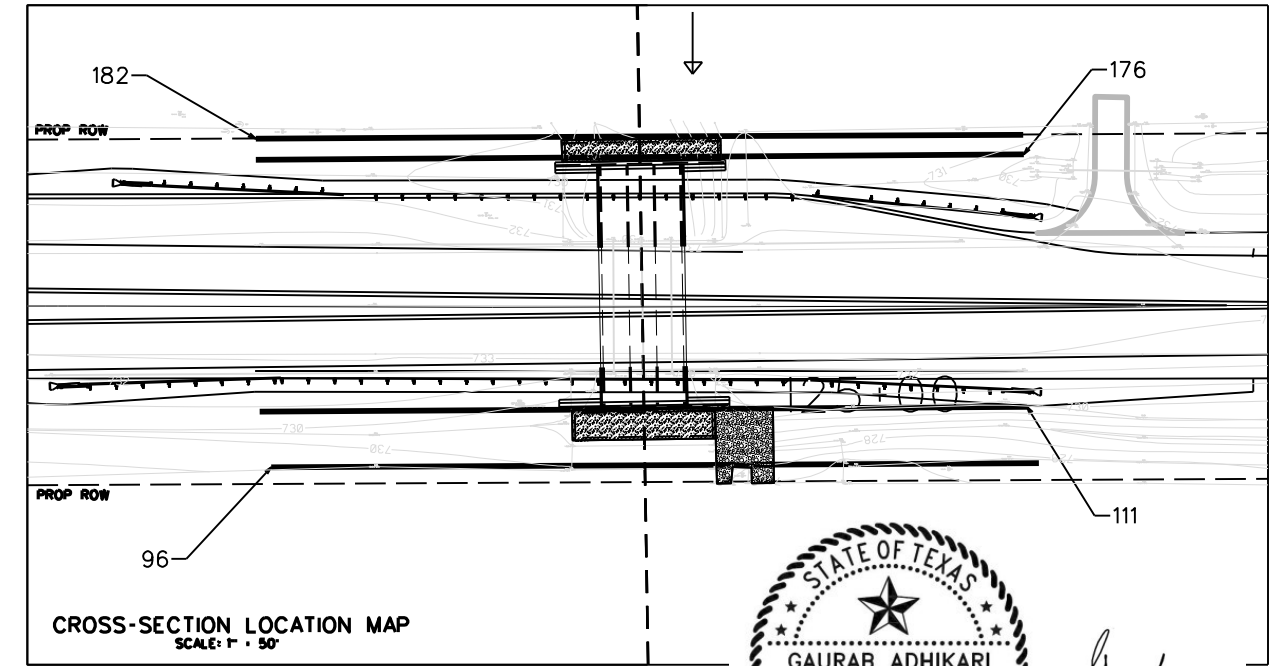


FM 2449 Local Plan: CL1-PROP 4/12/2022

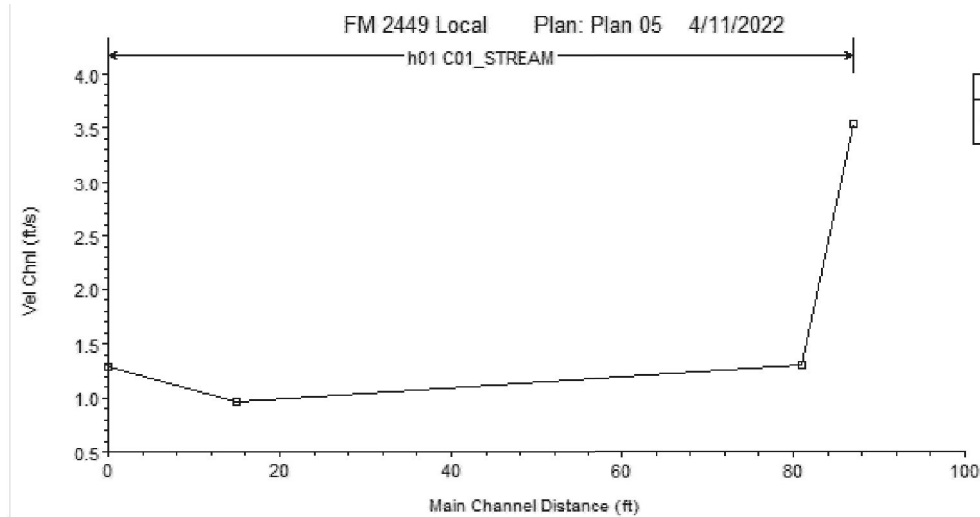
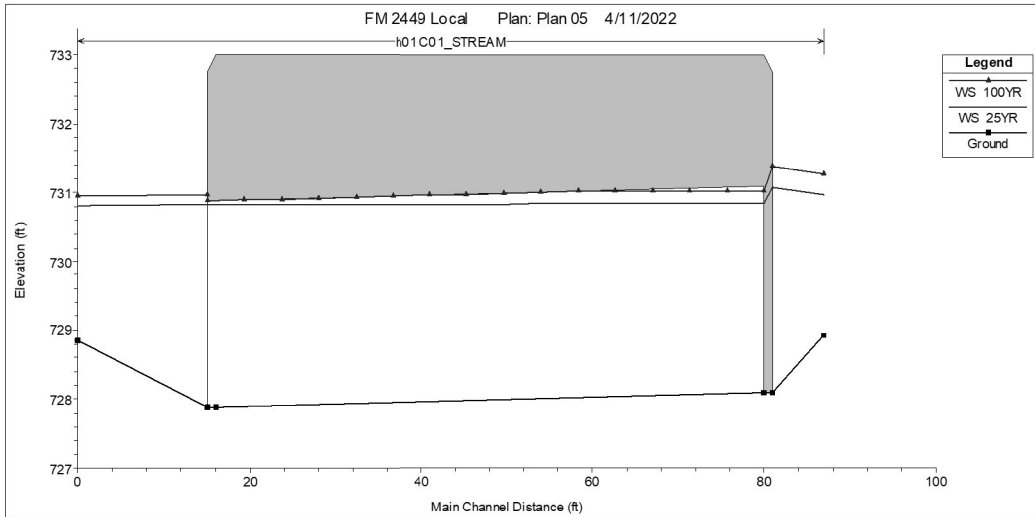


- NOTES:**
- 1) USACE HEC-RAS VERSION 6.2.0 UTILIZED FOR THE ANALYSIS.
 - 2) ALL ELEVATIONS BASED ON THE NAVD88 VERTICAL DATUM.
 - 3) THE DOWNSTREAM BOUNDARY CONDITION WAS ESTABLISHED USING DOWNSTREAM SLOPE S= 0.0005
- REFERENCES:**
- 1) TXDOT'S HYDRAULIC DESIGN MANUAL (JULY 2019)
 - 2) THIS CROSSING IS NOT IN ANY FEMA MAPPING.

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
C01_STREAM	182	25YR	CL1PROP	193.61	728.92	730.97		731.15	0.002172	3.43	56.47	40.63	0.51
C01_STREAM	182	25YR	CL1EXIST	193.61	728.92	730.96	730.49	731.35	0.006048	4.98	38.92	40.45	0.64
C01_STREAM	182	100YR	CL1PROP	248.33	728.92	731.27		731.46	0.002883	3.54	70.19	59.62	0.57
C01_STREAM	182	100YR	CL1EXIST	248.33	728.92	731.16		731.68	0.007071	5.76	43.12	47.05	0.71
C01_STREAM	176	25YR	CL1PROP	193.61	728.09	731.07	729.11	731.1	0.000479	1.39	139.32	124.64	0.23
C01_STREAM	155	25YR	CL1EXIST	193.61	727.99	731.1	729.42	731.24	0.000582	3.02	64.14	36.15	0.3
C01_STREAM	176	100YR	CL1PROP	248.33	728.09	731.38	729.3	731.4	0.000526	1.31	189.87	199.99	0.24
C01_STREAM	155	100YR	CL1EXIST	248.33	727.99	731.34	729.67	731.54	0.000743	3.59	69.21	36.87	0.35
C01_STREAM	143.5												
C01_STREAM													
C01_STREAM													
C01_STREAM	120	25YR	CL1EXIST	193.61	727.9	731	729.29	731.13	0.000557	2.98	65.01	35.13	0.3
C01_STREAM	111	25YR	CL1PROP	193.61	727.88	730.84		730.85	0.000166	0.84	231.82	200	0.14
C01_STREAM	120	100YR	CL1EXIST	248.33	727.9	731.14	729.53	731.35	0.000785	3.65	68.07	35.52	0.36
C01_STREAM	111	100YR	CL1PROP	248.33	727.88	730.97		730.99	0.000189	0.96	259	200	0.15
C01_STREAM	96	25YR	CL1EXIST	193.61	728.86	731.07	730.17	731.09	0.000501	1.29	215.74	200	0.18
C01_STREAM	96	25YR	CL1PROP	193.61	728.86	730.82	730.13	730.84	0.000501	1.17	165.99	200	0.23
C01_STREAM	96	100YR	CL1EXIST	248.33	728.86	731.26	730.3	731.28	0.0005	1.39	253.74	200	0.18
C01_STREAM	96	100YR	CL1PROP	248.33	728.86	730.95	730.22	730.98	0.0005	1.29	192.85	200	0.23



Gaurab Adhikari
09/19/2022

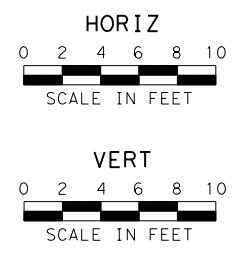
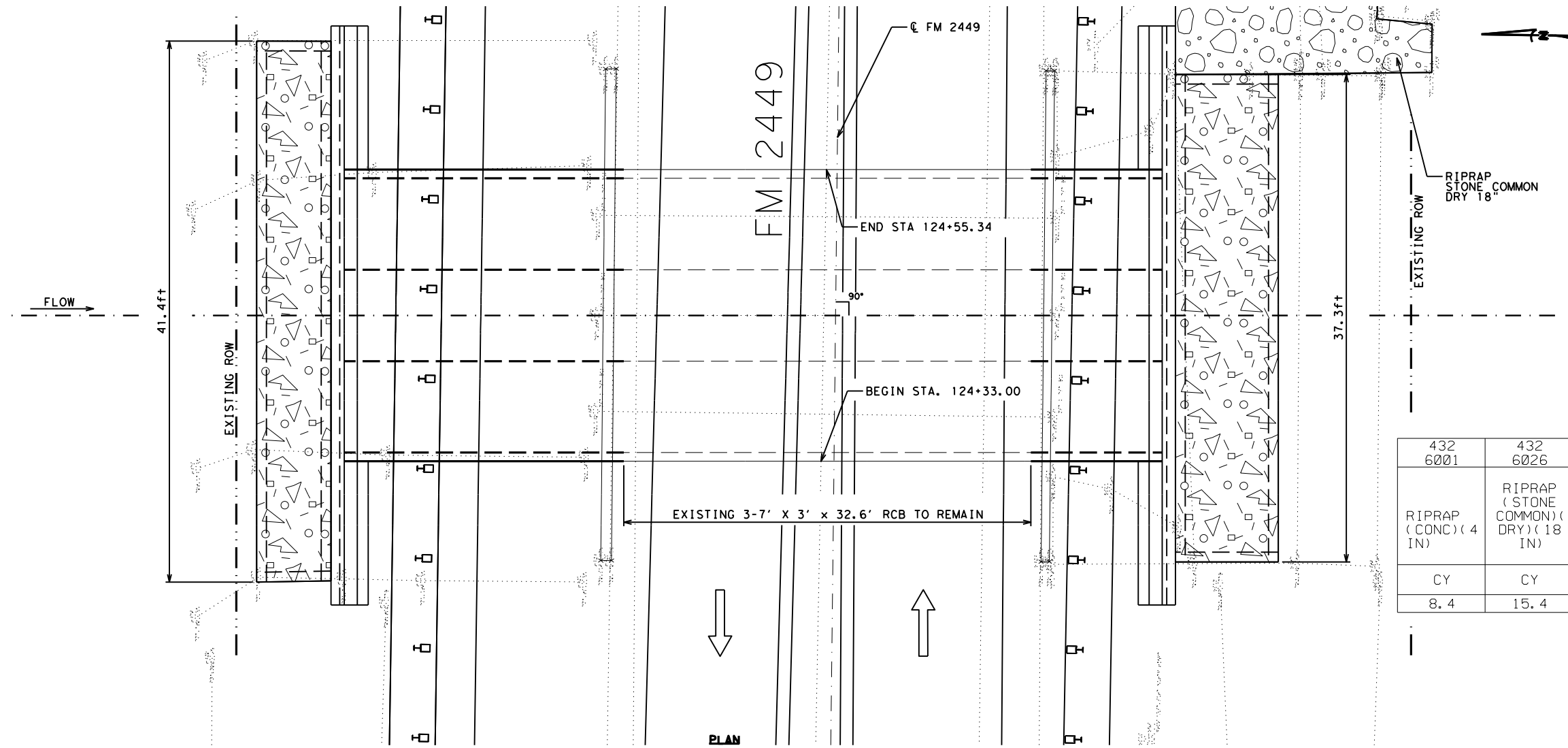


Texas Department of Transportation
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**FM 2449
CULVERT 1
HYDRAULIC DATA SHEET**

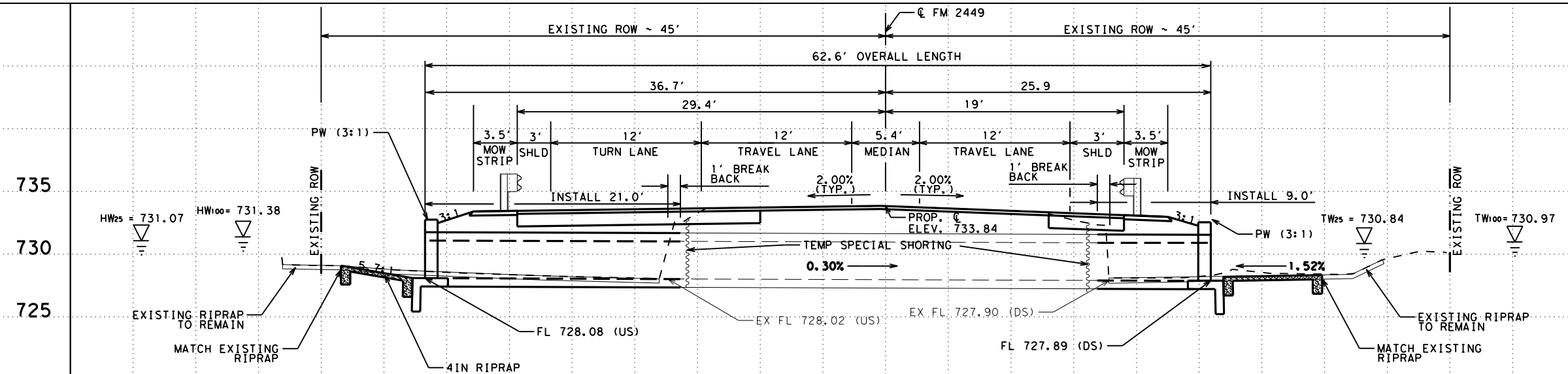
SHEET 2 OF 2

DESIGN	FED. RD. DIV. NO. 6	STATE PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
GRAPHICS	STATE TEXAS	DISTRICT DALLAS	COUNTY DENTON	SHEET NO. 63
CHECK	CONTROL 2352	SECTION 02	JOB 027	



432 6001	432 6026	462 6014	466 6180	480 6001	496 6005
RIPRAP (CONC) (4 IN)	RIPRAP (STONE COMMON) (DRY) (18 IN)	CONC BOX CULV (7 FT X 3 FT)	WINGWALL (PW - 1) (HW=5 FT)	CLEAN EXIST CULVERTS	REMOV STR (WINGWALL)
CY	CY	LF	EA	EA	EA
8.4	15.4	90	2	3	2

PLAN

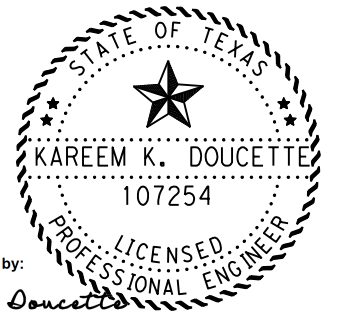


**CULVERT #1
STA. 124+42.87**

EXISTING: 3 - 7' X 3' X 32.6' RCB
 PROPOSED: BREAKBACK 1' AND INSTALL 21.0' - 7' X 3' RCB W/ PW (3:1) (LT.)
 BREAKBACK 1' AND INSTALL 9.0' - 7' X 3' RCB W/ PW (3:1) (RT.)

MC-7-10, MC-MD, PW, SRR

PROFILE



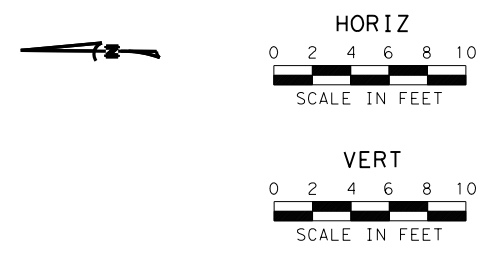
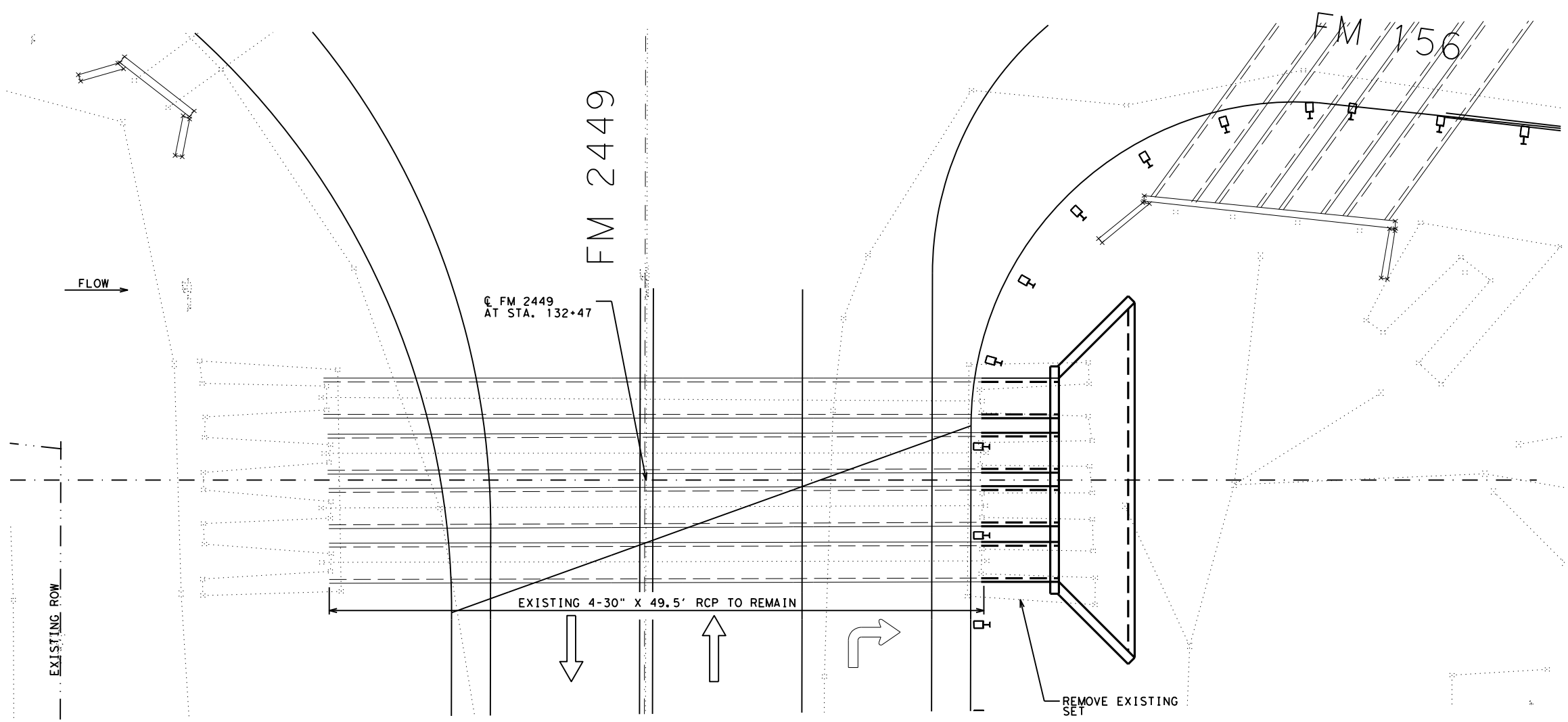
DocuSigned by:
 Kareem Doucette
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 9/20/2022
 NBI:180610235202004



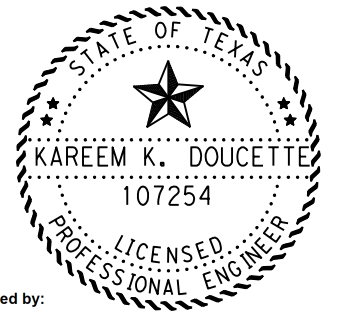
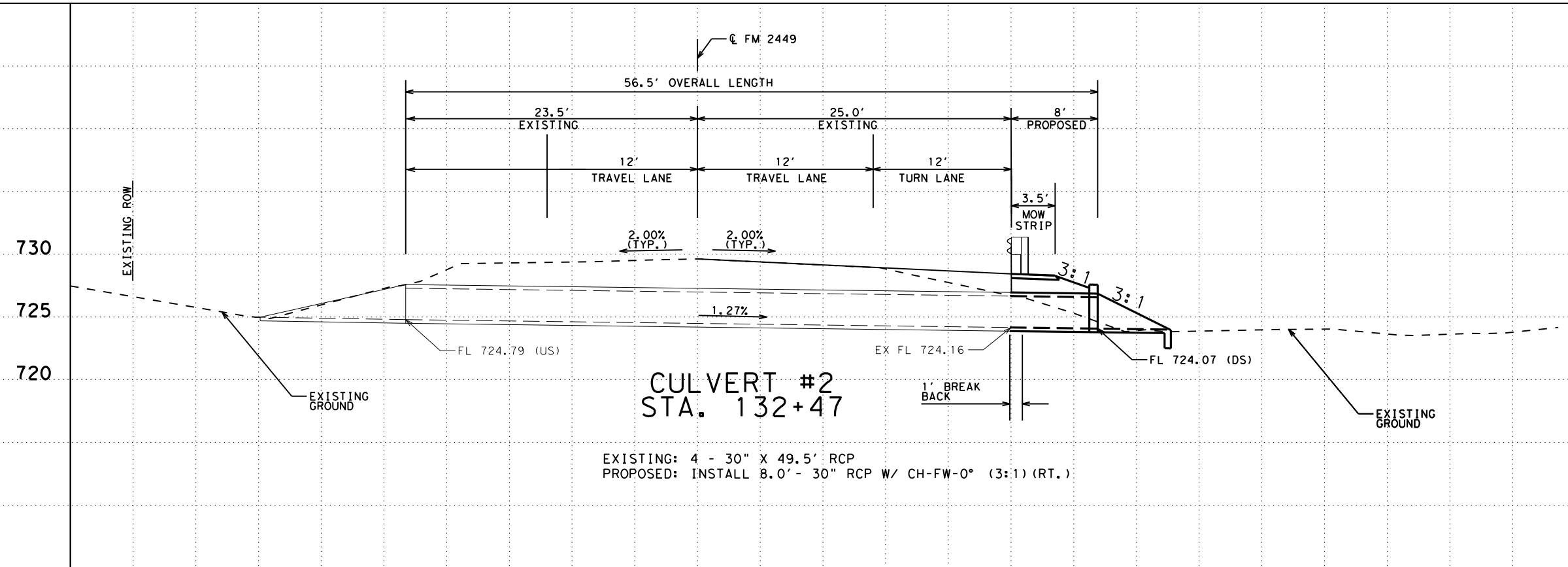
**FM 2449
CULVERT LAYOUT #1**
 STA 124+42.87

SCALE: HORZ: 1" = 10'
 VERT: 1" = 10' SHEET 1 OF 3

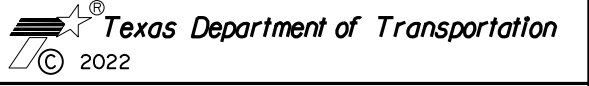
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GRAPHICS	STATE TEXAS	DISTRICT DAL	COUNTY DENTON	SHEET NO. 64
CHECK	CONTROL 2352	SECTION 02	JOB 027	



464 6007	466 6007	480 6001	496 6004
RC PIPE (CL III)(30 IN)	HEADWALL (CH - FW - 0) (DIA 30 IN)	CLEAN EXIST CULVERTS	REMOV STR (SET)
LF	EA	EA	EA
32	1	4	4



DocuSigned by:
Kareem Doucette 9/26/2022
54C8F8A7EBD048C...

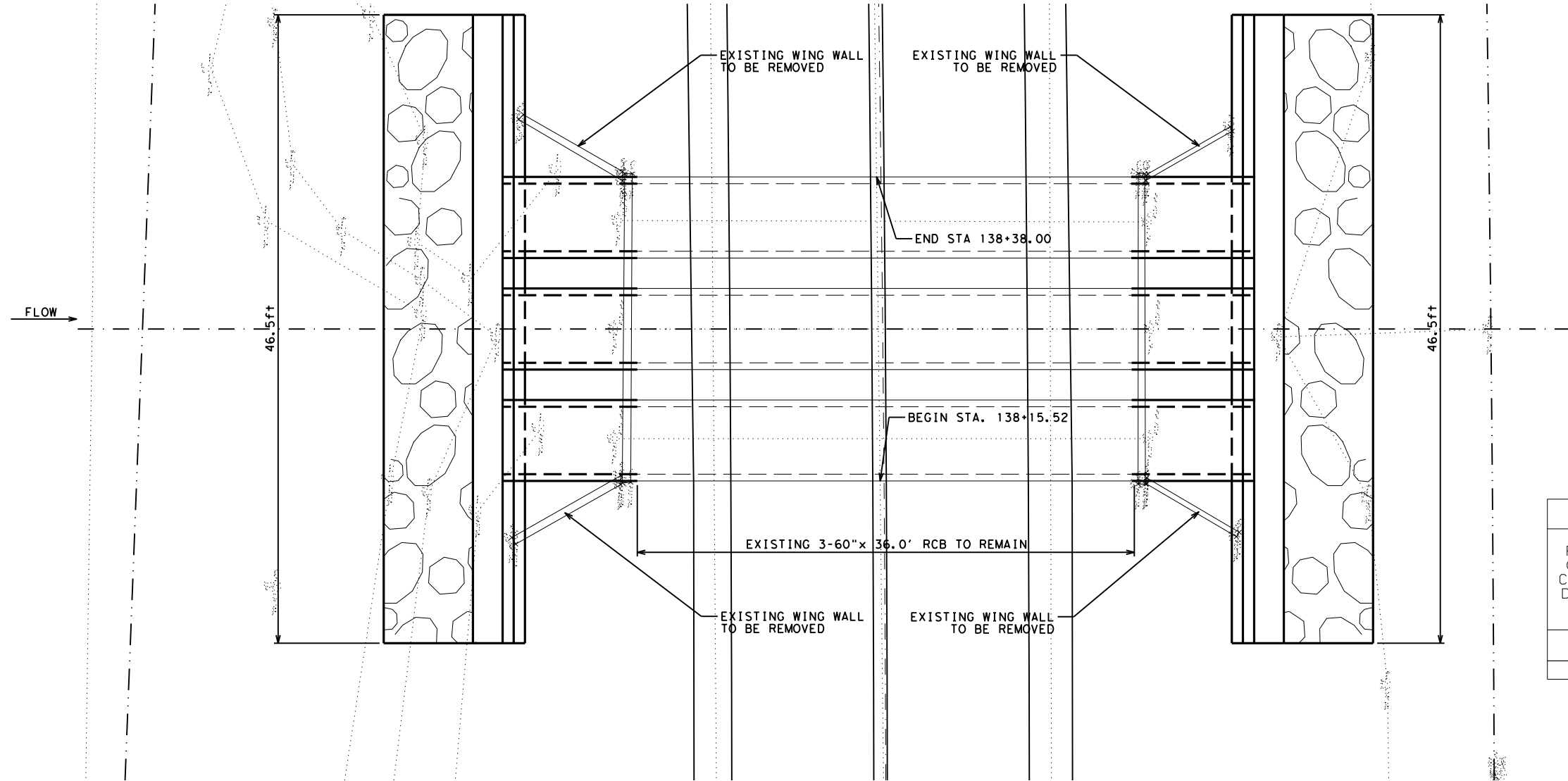
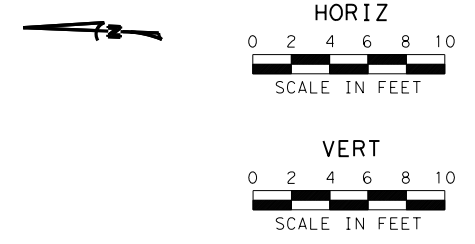


**FM 2449
CULVERT LAYOUT #2**
STA 132+47

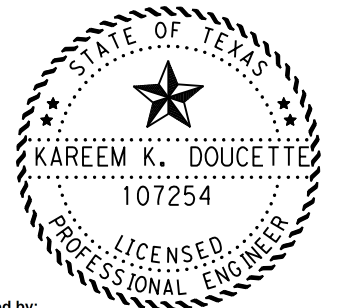
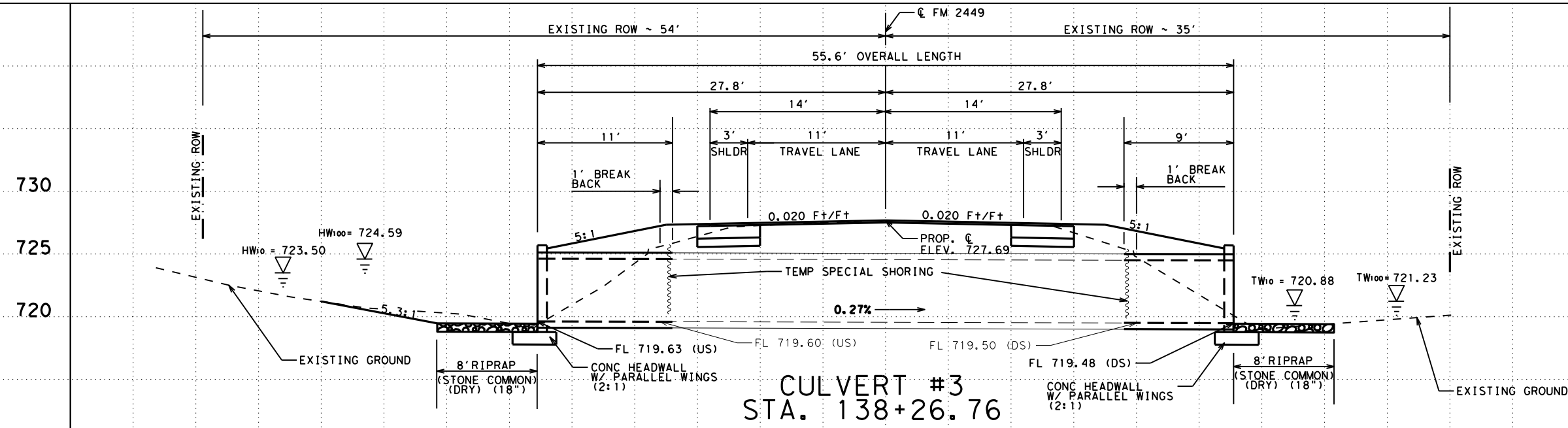
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VERT: 1" = 10' SHEET 2 OF 3

DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)	HIGHWAY NO. FM 2449
GRAPHICS	STATE TEXAS	DISTRICT DAL	COUNTY DENTON
CHECK	CONTROL 2352	SECTION 02	JOB 027
CHECK			65

FLOW →



432 6026	464 6012	466 6105	480 6001	496 6005
RIPRAP (STONE COMMON) (DRY) (18 IN)	RC PIPE (CL III) (60 IN)	HEADWALL (CH - PW - 0) (DIA 60 IN)	CLEAN EXIST CULVERTS	REMOV STR (WINGWAL L)
CY	LF	EA	EA	EA
45.5	60	2	3	2



DocuSigned by:
Kareem Doucette 9/26/2022

51C8F8A7FBD948C...
Texas Department of Transportation
© 2022

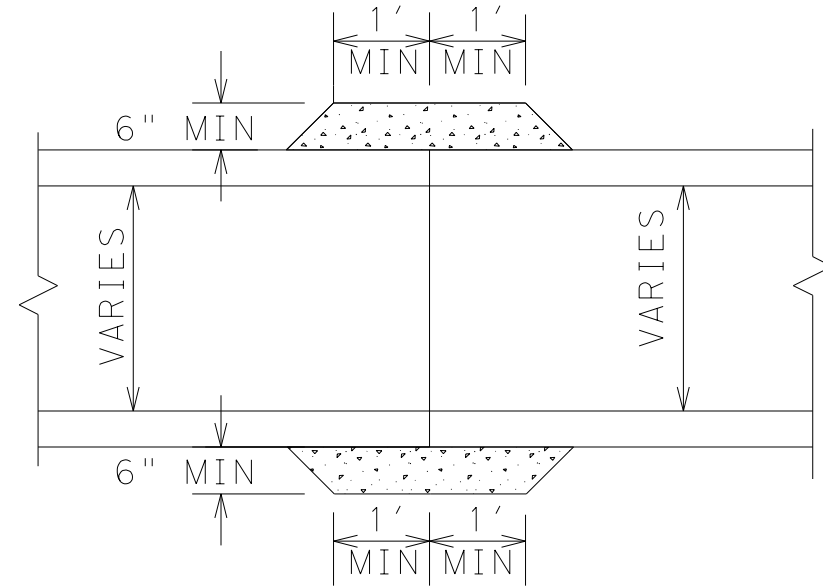
**FM 2449
CULVERT LAYOUT #3**
STA 138+26.76

SCALE: HORZ: 1" = 10'
VERT: 1" = 10' SHEET 3 OF 3

DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)	HIGHWAY NO. FM 2449
GRAPHICS	STATE TEXAS	DISTRICT DAL	COUNTY DENTON
CHECK	CONTROL 2352	SECTION 02	JOB 027
CHECK			66

**CULVERT #3
STA. 138+26.76**

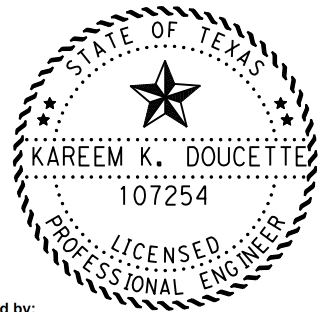
EXISTING: 3 - 60" X 38.0' RCP
PROPOSED: BREAKBACK 1' AND INSTALL 11'-60" RCP W/ HEADWALL (CH-PW-0) (3:1) (DIA=60 IN) (LT.)
BREAKBACK 1' AND INSTALL 9'-60" RCP W/ HEADWALL (CH-PW-0) (3:1) (DIA=60 IN) (RT.)



CONCRETE COLLAR FOR PIPE CONNECTION DETAIL

THIS DETAIL IS TO ALSO BE USED
ON ALL CONNECTIONS BETWEEN
NEW AND EXISTING PIPES

NOTE: SUBSIDIARY TO VARIOUS PAY ITEMS.



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Kareem Doucette

9/20/2022

51C8F8A7FBD948C...



FM 2449 CONCRETE COLLAR DETAIL

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
KKD	6	(See Title Sheet)		FM2449
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
KKD	TEXAS	DAL	DENTON	67
CHECK	CONTROL	SECTION	JOB	
CHECK	2352	02	027	

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9/20/2022 9:14:22 AM
T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\10 DRAINAGE DET AT\STANDARD\BCS\10-SS1.rvt
DET AT\STANDARD\BCS\10-SS1.rvt

Culvert Station and/or Creek Name followed by applicable end (Lt, Rt or Both)	Description of Box Culvert No. Spans ~ Span X Height	Max Fill Height (Ft)	Applicable Box Culvert Standard (4)	Applicable Wingwall or End Treatment Standard	Skew Angle (0°, 15°, 30° or 45°)	Side Slope or Channel Slope Ratio (SL:1)	T Culvert Top Slab Thickness (In)	U Culvert Wall Thickness (In)	C Estimated Curb Height (Ft)	Hw Height of Wingwall (Ft)	A Curb to End of Wingwall (Ft)	B Offset of End of Wingwall (Ft)	Lw Length of Longest Wingwall (Ft)	Ltw Culvert Toewall Length (Ft)	Atw Anchor Toewall Length (Ft)	Riprap Apron (CY)	Class "C" Conc (Curb) (CY)	Class "C" Conc (Wingwall) (CY)	Total Wingwall Area (SF)
Culvert 1 station: 124+42.87 (Both)	3 ~ 7'x 3'	1'	MC-7-10	PW-1	0°	3:1	8"	7"	1.000'	4.667'	N/A	N/A	14.000'	23.333'	N/A	0.0	1.8	21.2	262

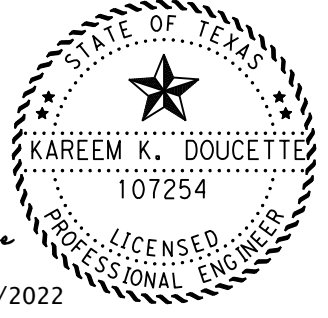
NOTES:
Skew = 0° on SW-0, FW-0, SETB-CD, SETB-SW-0, and SETB-FW-0 standard sheets;
30° maximum for safety end treatment


SL:1 = Horizontal : 1 Vertical
• Side slope at culvert for flared or straight wingwalls.
• Channel slope for parallel wingwalls.
• Slope must be 3:1 or flatter for safety end treatments.

T = Box culvert top slab thickness. Dimension can be found on the applicable box culvert standard sheet.
U = Box culvert wall thickness. Dimension can be found on the applicable box culvert standard sheet.
C = Curb height
See applicable wing or end treatment standard sheets for calculations of Hw, A, B, Lw, Ltw, Atw, and Total Wingwall Area.
Hw = Height of wingwall
A = Distance from face of curb to end of wingwall (not applicable to parallel or straight wingwalls)
B = Offset of end of wingwall (not applicable to parallel or straight wingwalls)
Lw = Length of longest wingwall.
Ltw = Length of culvert toewall (not applicable when using riprap apron)
Atw = Length of anchor toewall (applicable to safety end treatment only)
Total Wingwall Area = Wingwall area in sq. ft. for two wingwalls (one structure end) if Lt or Rt.
Area for four wingwalls (two structure ends) if Both.

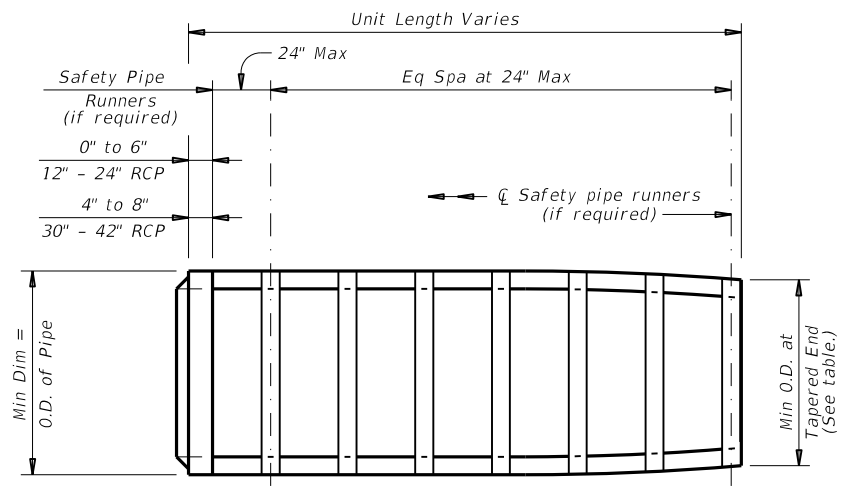
- 1 Round the wall heights shown to the nearest foot for bidding purposes.
- 2 Concrete volume shown is for box culvert curb only. For curbs using the Box Culvert Rail Mounting Details (RAC) standard sheet quantities shown must be increased by a factor of 2.25. If Class S concrete is required for the top slab of the culvert, also provide Class S concrete for the curb. Curb concrete is considered part of the Box Culvert for payment.
- 3 Concrete volume shown is total of wings, footings, culvert toewall (if any), anchor toewalls (if any) and wingwall toewalls. Riprap aprons, culverts, and curb quantities are not included.
- 4 Regardless of the type of culvert shown on this sheet, the Contractor has the option of furnishing cast-in-place or precast culverts unless otherwise shown elsewhere on the plans. If the Contractor elects to provide culverts of a different type than those shown on this sheet, it is the Contractor's responsibility to make the necessary adjustments to the dimensions and quantities shown.

DocuSigned by:
Kareem Doucette
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9/20/2022

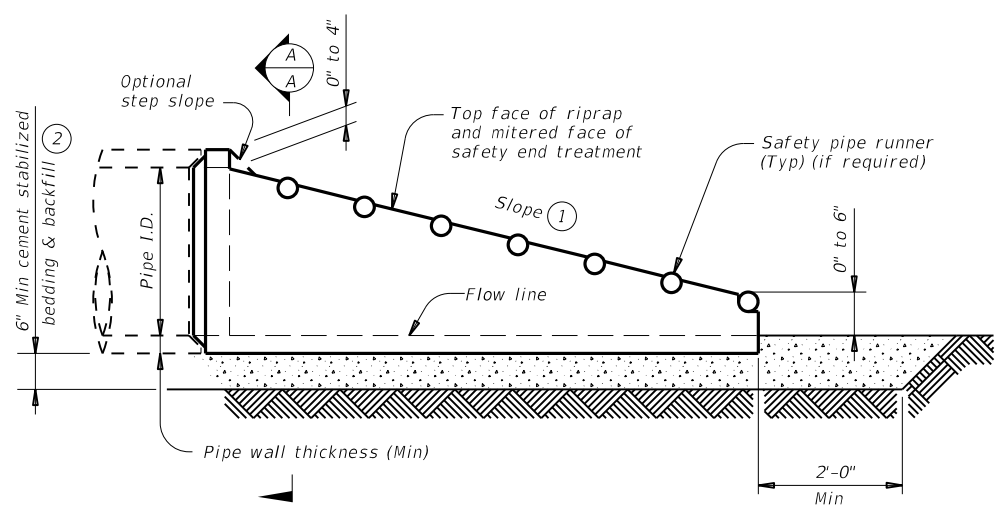


 Texas Department of Transportation				Bridge Division Standard	
BOX CULVERT SUPPLEMENT WINGS AND END TREATMENTS					
BCS					
FILE: bcsstdel-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
©TxDOT February 2020	CONT: 2352	SECT: 02	JOB: 027	HIGHWAY: FM 2449	
REVISIONS					
DIST: DAL		COUNTY: DENTON		SHEET NO: 68	

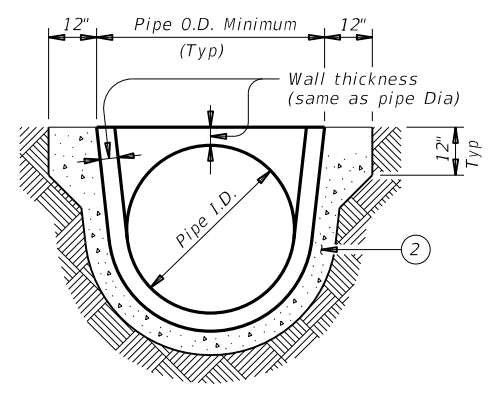
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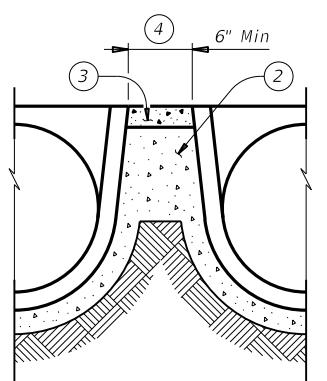
PLAN VIEW - 12" THRU 24"
(Showing spigot end connection.)



LONGITUDINAL ELEVATION - 12" THRU 24"
(Showing spigot end connection.)

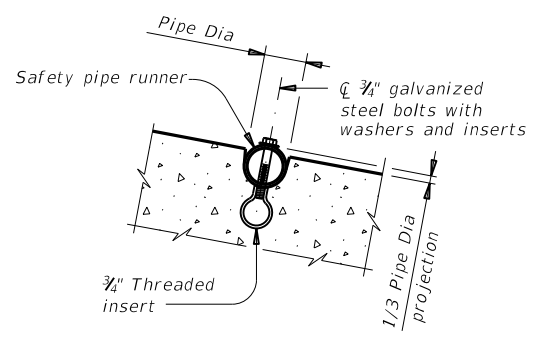


SECTION A-A

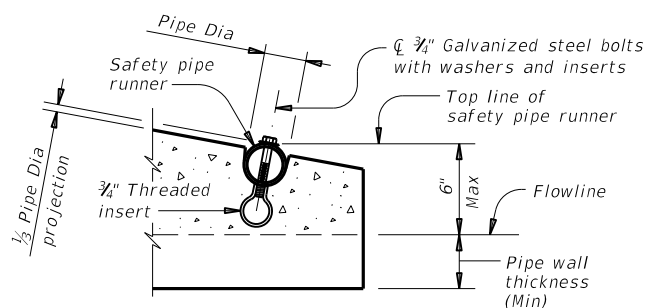


MULTIPLE PIPE INSTALLATION

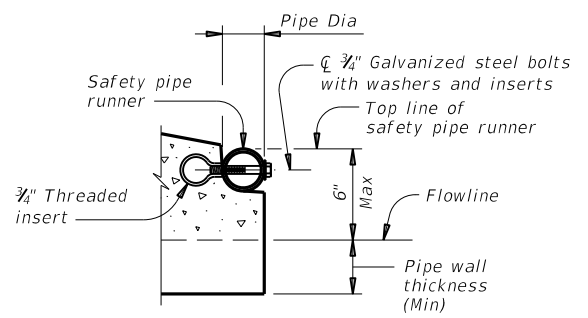
- ① Slope as shown elsewhere in the plans. Slope of 6:1 or flatter is required for vehicle safety.
- ② Provide cement stabilized bedding and backfill in accordance with the Item, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.
- ③ 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".
- ④ Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.
- ⑤ Safety pipe runners are required for multiple pipe culverts with more than two pipes.



INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS
(If required)



OPTION A



OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS
(If required)

REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	Min Wall Thickness	Min O.D.	Min O.D. at Tapered End	Min Reinf Requirements (sq. in. per ft. of Pipe)	Max Slope	Min Length of Unit	Pipe Runner Requirements		Required Pipe Runner Sizes		
							Single Pipe	Multiple Pipe	Nominal Dia	O.D.	I.D.
12"	2"	16"	16"	0.07 Circ.	6:1	4'-0"	No	⑤	3" STD	3.500"	3.068"
15"	2 1/4"	19 1/2"	19"	0.07 Circ.	6:1	5'-8"	No	⑤	3" STD	3.500"	3.068"
18"	2 1/2"	23"	21 1/2"	0.07 Circ.	6:1	7'-3"	No	⑤	3" STD	3.500"	3.068"
24"	3"	30"	27"	0.07 Circ.	6:1	10'-6"	No	⑤	3" STD	3.500"	3.068"
30"	3 1/2"	37"	31"	0.18 Circ.	6:1	12'-1"	No	Yes	4" STD	4.500"	4.026"
36"	4"	44"	36"	0.19 Ellip.	6:1	15'-4"	Yes	Yes	4" STD	4.500"	4.026"
42"	4 1/2"	51"	41 1/2"	0.23 Ellip.	6:1	18'-7"	Yes	Yes	4" STD	4.500"	4.026"

MATERIAL NOTES:
 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 pipe runners meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.
 Galvanize steel components except reinforcing steel after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

GENERAL NOTES:
 Precast safety end treatment for reinforced concrete pipe (RCP) may be used for TYPE II end treatment as specified in Item 467, "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.
 Manufacture precast concrete end sections in accordance with Item 464, "Reinforced Concrete Pipe" and in accordance with ASTM Specification C-76, Class III, Wall B for circular pipe.
 Provide precast concrete end sections with a spigot or bell end for compatibility to upstream or downstream end conditions with sufficient annular space to allow for grout, mortar, cold applied asphalt joint compound or pre-formed plastic gasket material.
 Methods of lifting shall be provided by the manufacturer for ease of loading, unloading and installation.
 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.

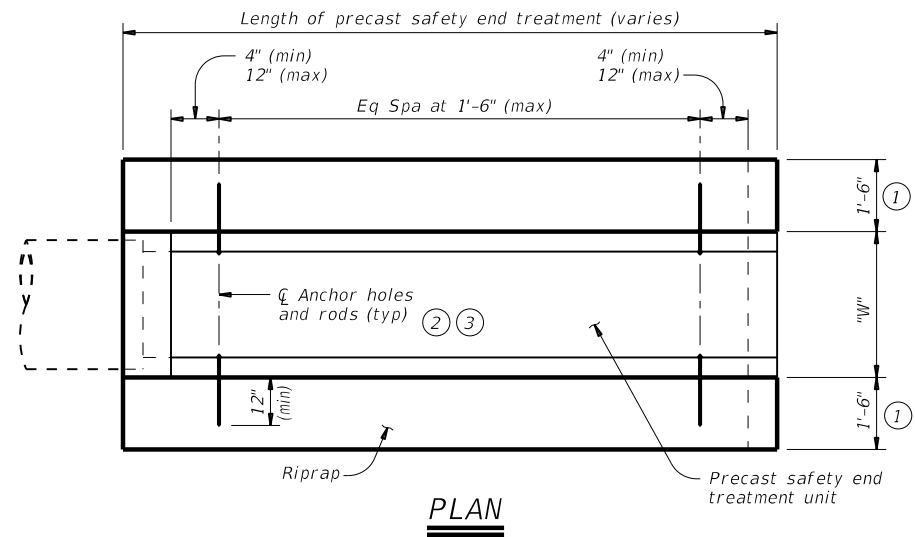
Bridge Division Standard

PRECAST SAFETY END TREATMENT
TYPE II ~ PARALLEL DRAINAGE
PSET-RP

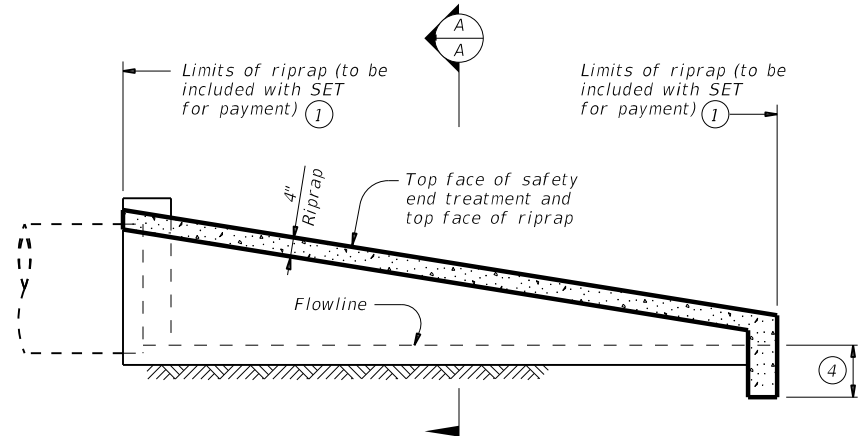
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©TxDOT February 2020	CONT: 2352	SECT: 02	JOB: 027	HIGHWAY: FM 2449
REVISIONS	DIST: DAL	COUNTY: DENTON	SHEET NO. 69	

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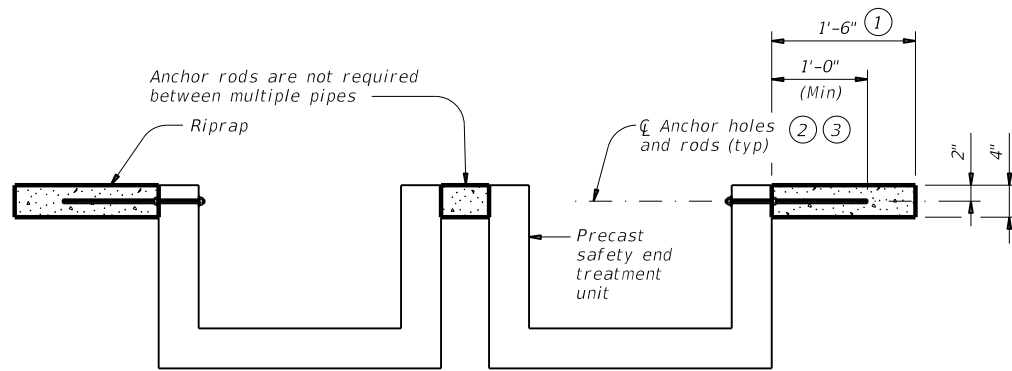
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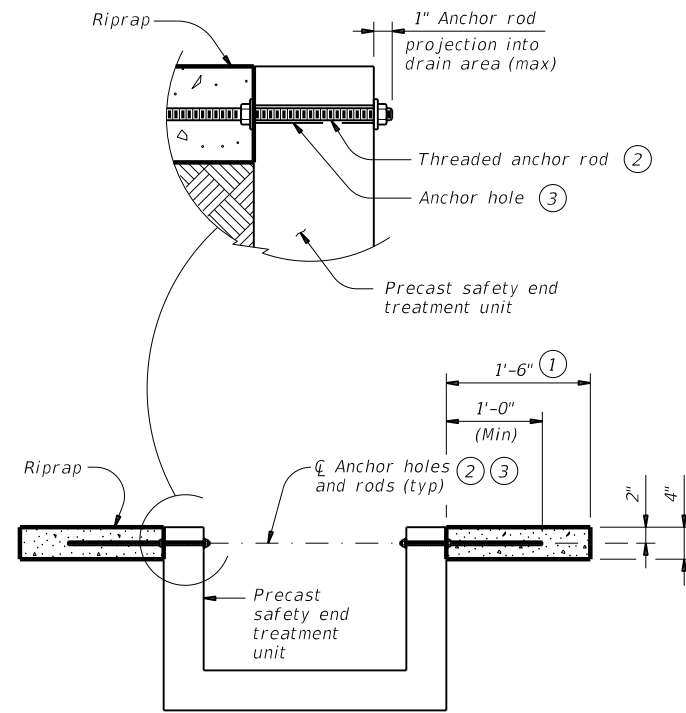
PLAN



LONGITUDINAL ELEVATION



MULTIPLE PIPE INSTALLATION



SINGLE PIPE INSTALLATION

SECTION A-A

ESTIMATED CONCRETE RIPRAP QUANTITIES (CY)

Nominal Culvert (Pipe) I.D.	PSET-SC and PSET-SP Standards					PSET-RC and PSET-RP Standards		
	Unit Width "W"	Side Slope			Unit Width "W"	Side Slope		
		3:1	4:1	6:1		3:1	4:1	6:1
12"	23.0"	0.1	0.2	0.2	16.0"	0.1	0.1	0.2
15"	26.5"	0.2	0.2	0.3	19.5"	0.1	0.2	0.2
18"	30.0"	0.2	0.2	0.3	23.0"	0.2	0.2	0.3
24"	37.0"	0.3	0.3	0.5	30.0"	0.2	0.3	0.4
30"	44.5"	0.3	0.4	0.6	37.0"	0.3	0.3	0.5
36"	51.5"	0.4	0.5	0.7	44.0"	0.3	0.4	0.6
42"	58.5"	0.5	0.6	0.8	51.0"	0.4	0.5	0.7

- ① Riprap placed beyond the limits shown will be paid as concrete riprap in accordance with Item 432, "Riprap". When riprap is cast integrally with the precast safety end treatment, this dimension is 1'-0" minimum.
- ② 1#2" Dia ASTM A307 Gr A threaded anchor rod with 2 nuts and 2 washers. Galvanize all components in accordance with Item 445, "Galvanizing". Repair galvanizing that is damaged during transport or construction in accordance with the specifications.
- ③ 3#4" through holes in walls of safety end treatment for riprap anchor rods may be drilled with rotary (coring or masonry) type drilling equipment or may be formed. Do not use percussive (star) type drilling equipment. If holes are drilled, patch spalls in the inside face of the wall exceeding 1#2" from the holes.
- ④ Provide riprap toe wall when dimension is shown elsewhere in the plans or when field conditions require a toe wall.
- ⑤ Quantities shown are for one end of one reinforced concrete pipe culvert. For multiple pipe culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only. Quantities are based on the minimum unit lengths shown on the Precast Safety End Treatment (SET) standard sheets.

MATERIAL NOTES:

Provide Class "B" riprap in accordance with Item 432, "Riprap". 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. The anchor rods shown are always required.

GENERAL NOTES:

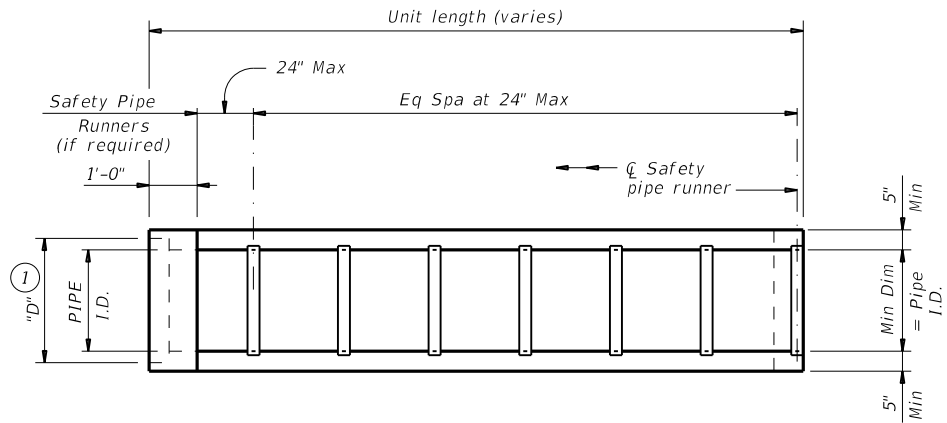
Precast safety end treatment for reinforced concrete pipe may be used for TYPE II end treatment as specified in Item 467, "Safety End Treatment". Refer to PSET-SC or PSET-SP standard sheets for details of square safety end treatments not shown. Refer to PSET-RC or PSET-RP standard sheets for details of round safety end treatments not shown. For precast units with integrally cast riprap, substitute reinforcing steel in the amount on 0.26 in./ft. minimum for the threaded anchor rods shown. When requested, submit sealed engineering drawings for approval prior to construction. Shop drawings will not be required. Note that a proprietary precast unit with integral riprap is available from L&R Precast Concrete Works, Inc. (956) 583-6293 or www.lrpccast.com. Payment for riprap and toewalls is included in the price bid for each safety end treatment.

These riprap details are only applicable when notes that require placement of riprap with precast safety end treatments are shown elsewhere in the plans.

Precast units with integrally cast riprap are permitted unless noted otherwise on the plans.

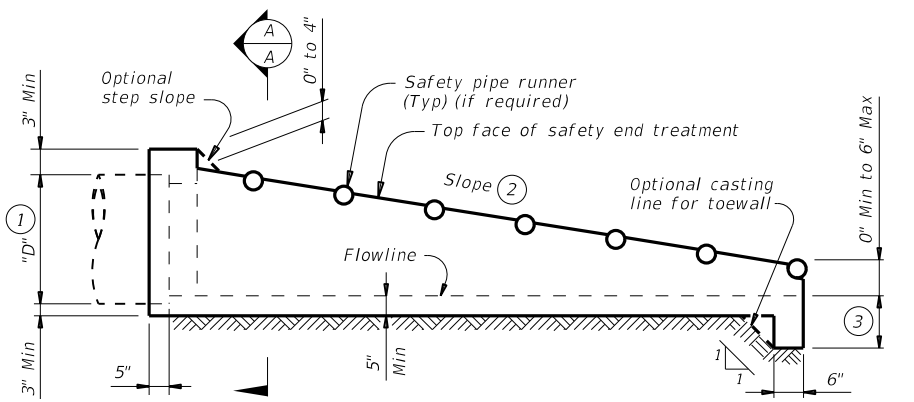
				Bridge Division Standard	
PRECAST SAFETY END TREATMENT TYPE II RIPRAP DETAILS					
PSET-RR					
FILE: psetrrse-20.dgn	DN: GAF	CK: TxDOT	DW: JRP	CK: GAF	
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY	
REVISIONS	2352	02	027	FM	2449
DIST	COUNTY		SHEET NO.		
DAL	DENTON		70		

DATE: 9/19/2022 2:12:46 PM
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 Ponder ISD\PLANS\10 DRAINAGE DETAILS\STANDARDS\21.dgn
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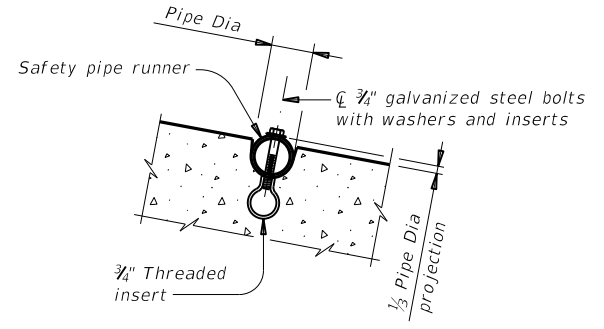
PLAN

(Showing bell end connection.)



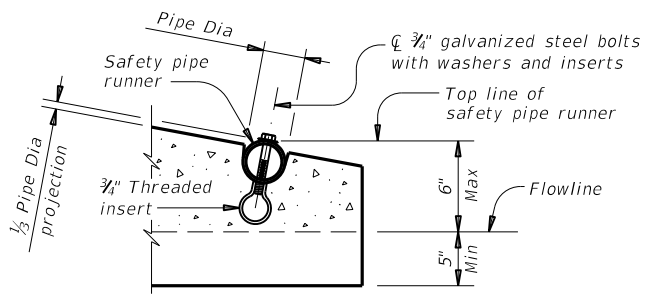
LONGITUDINAL ELEVATION

(Showing bell end connection.)

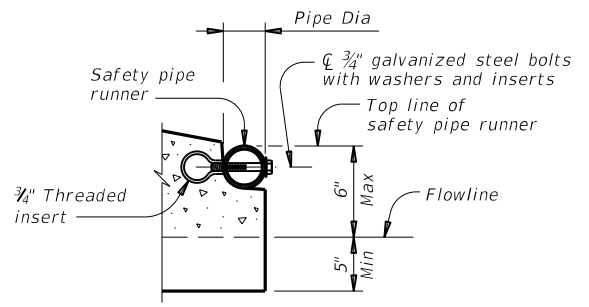


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



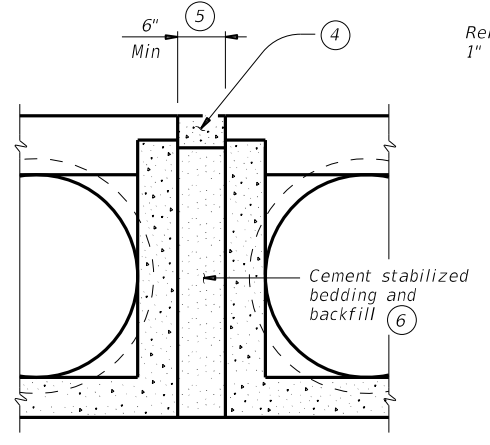
OPTION A



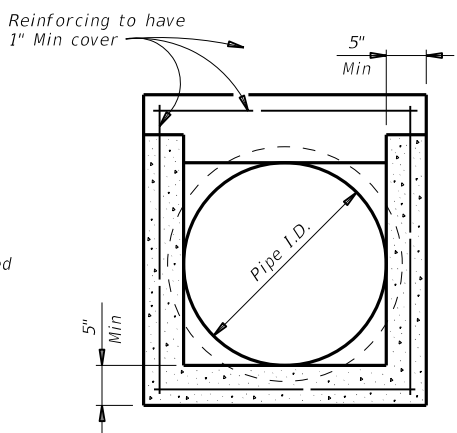
OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)

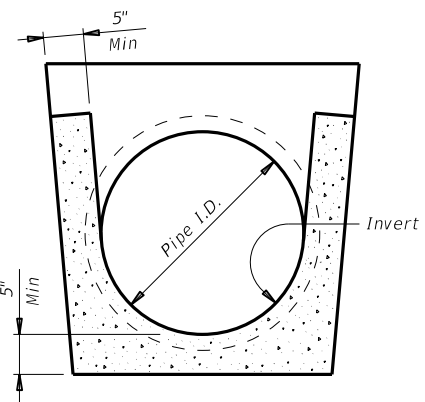


MULTIPLE PIPE INSTALLATION

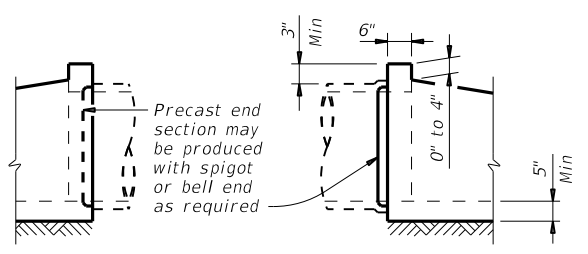


OPTION WITH SQUARE BOTTOM

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	"D"	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	2352	02	027	FM 2449
12-21: Added 42" TP	DIST	COUNTY	SHEET NO.	
	DAL	DENTON	71	

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

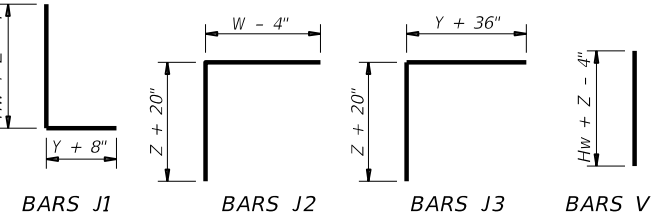
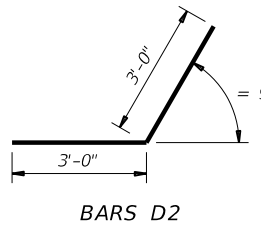
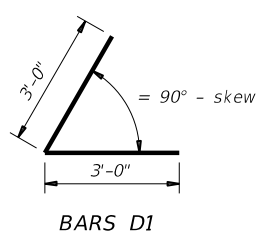
Maximum Wingwall Height Hw	Dimensions				Variable Reinforcing				Estimated Quantities per ft of wing (2-wings) ④		Estimated Quantities per ft of Toewall (1-toewall)	
	W	X	Y	Z	Bars J1		Bars J2		Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
					Size	Spa	Size	Spa				
2'-6"	2'-10"	10"	1'-0"	7"	#4	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
 $= (Hw - 1')(SL) \div \cosine(\theta)$ for Type PW-2 and $Hw \ge 4'$
 $= (Hw - 0.5')(SL) \div \cosine(\theta)$ for Type PW-2 and $Hw < 4'$

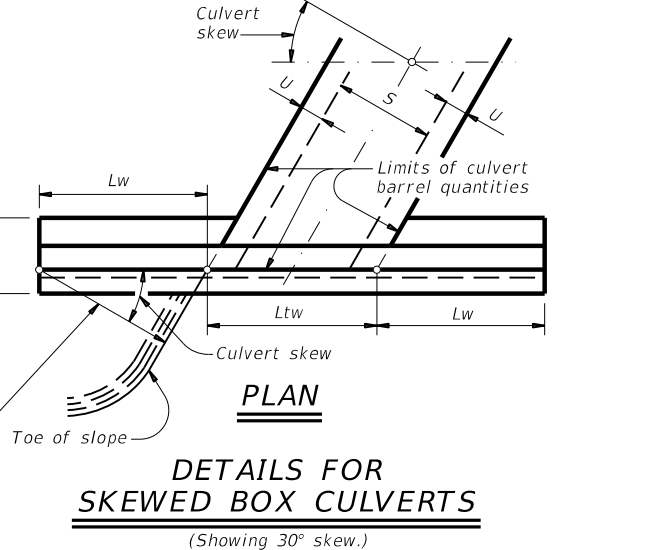
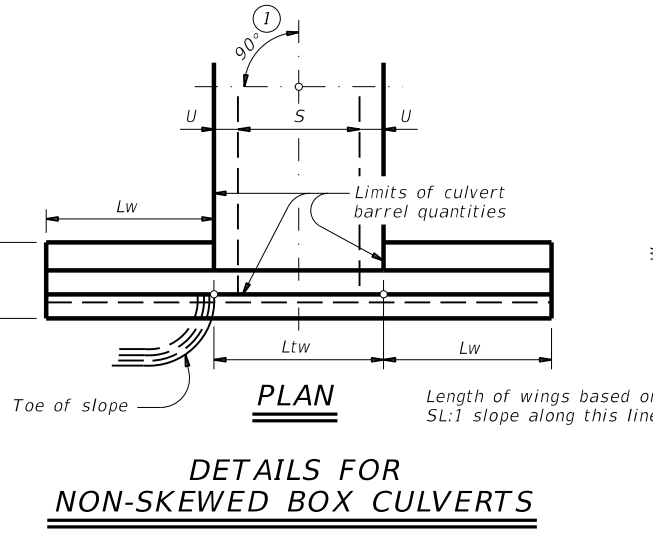
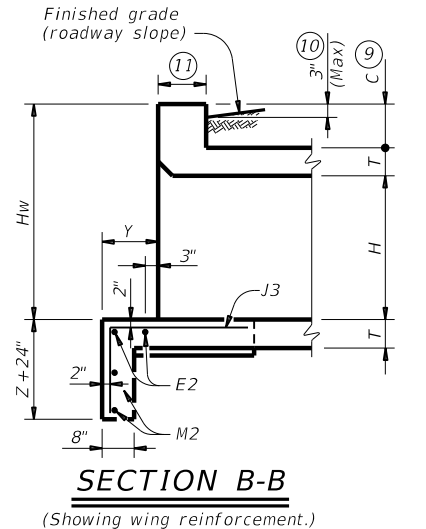
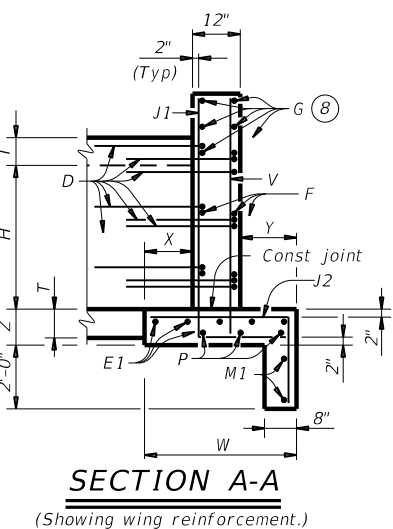
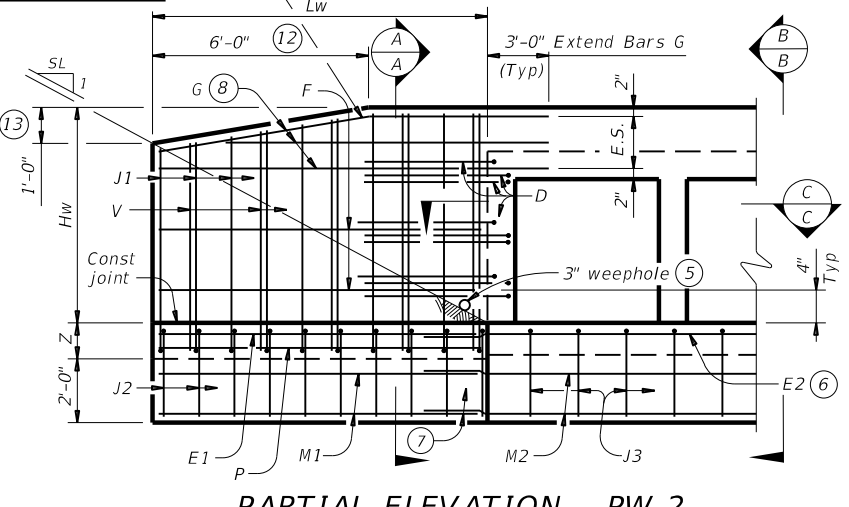
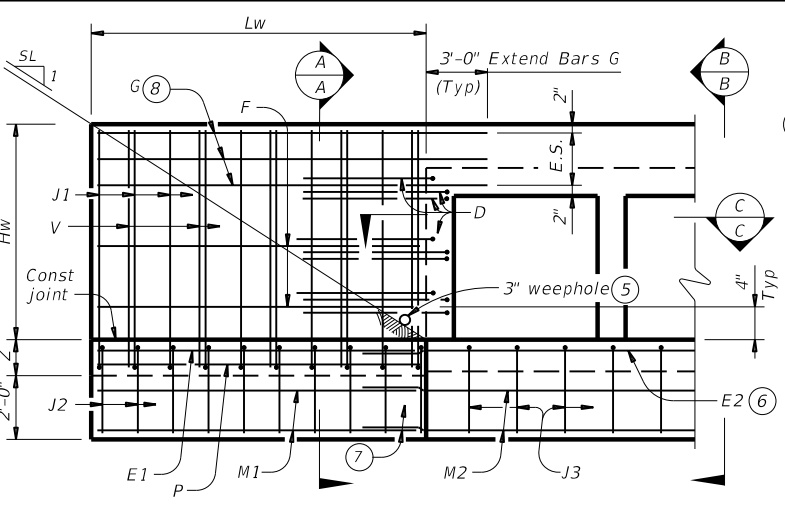
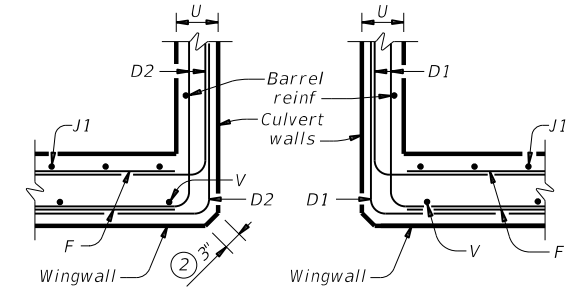
For cast-in-place culverts:
 $Ltw = [(N)(S) + (N + 1)(U)] \div \cosine(\theta)$

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 $Hw \ge 4'$
 $= (2)(Hw)(Lw) - 1.5 SF$ 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)
 θ = 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'.



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.

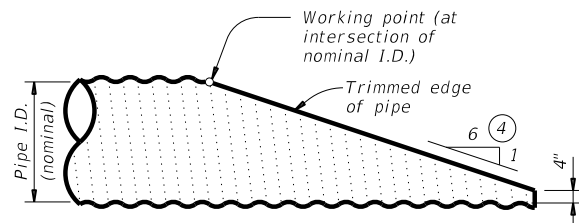
Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing dimensions are out-to-out of bars.

Bridge Division Standard

CONCRETE WINGWALLS WITH PARALLEL WINGS FOR BOX CULVERTS
TYPES PW-1 AND PW-2
PW

FILE: pwstde01-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONV: 2352	SECT: 02	JOB: 027	HIGHWAY: FM 2449
REVISIONS	DIST: DAL	COUNTY: DENTON	SHEET NO.: 72	

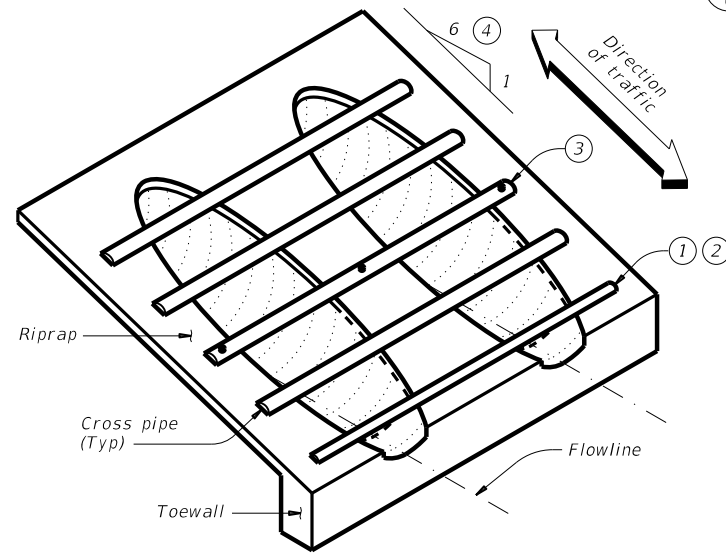
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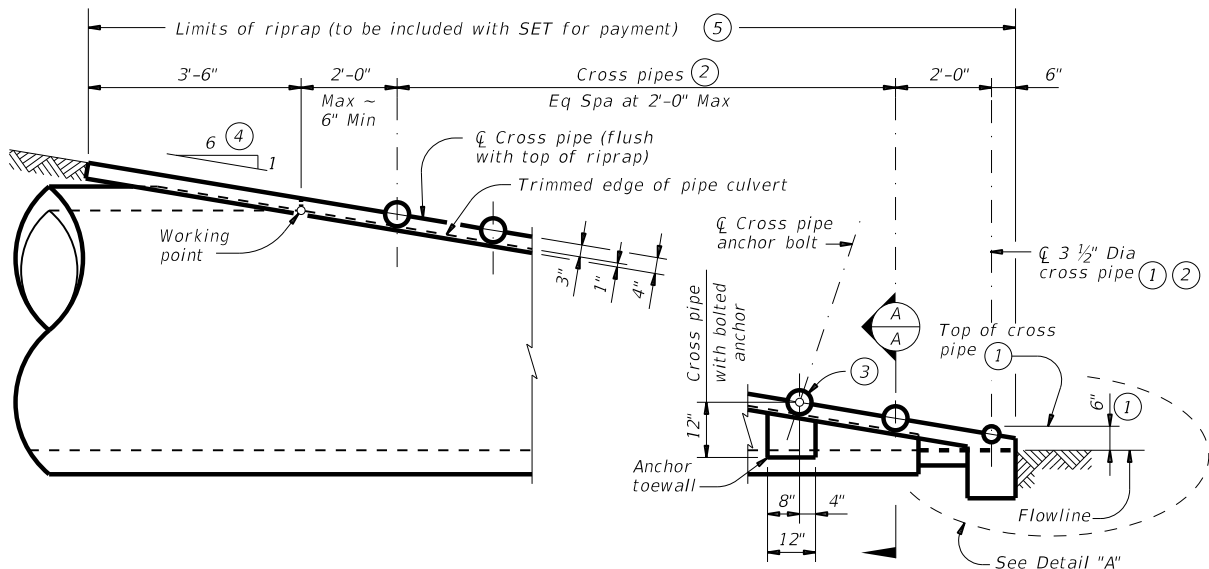
NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

(Showing corrugated metal pipe (CMP) culvert. Details at reinforced concrete pipe (RCP) culvert are similar.)

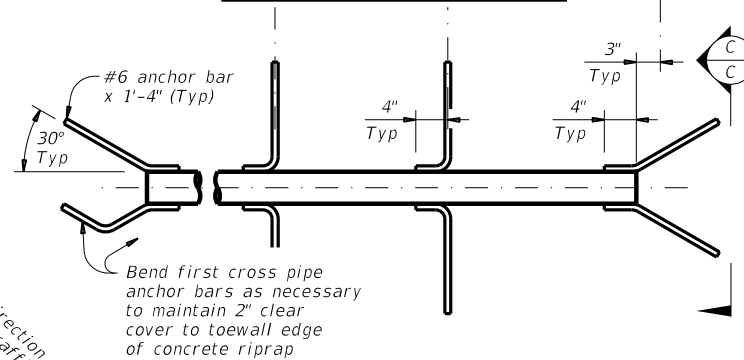
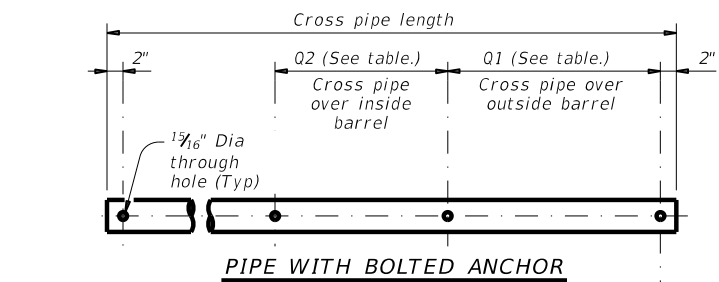


ISOMETRIC VIEW OF TYPICAL INSTALLATION

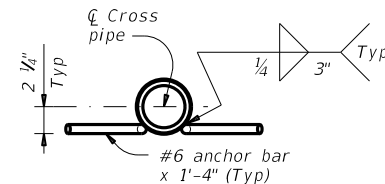


SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing reinforced concrete pipe (RCP) culvert. Details at corrugated metal pipe (CMP) culvert are similar.)

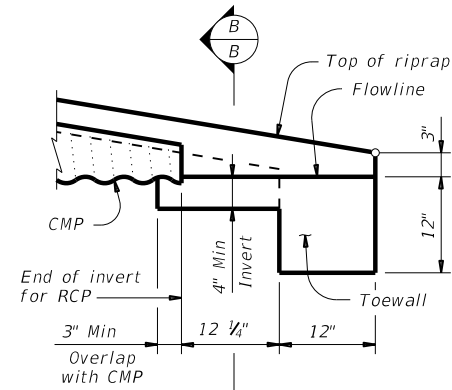


PIPE WITH ANCHOR BARS



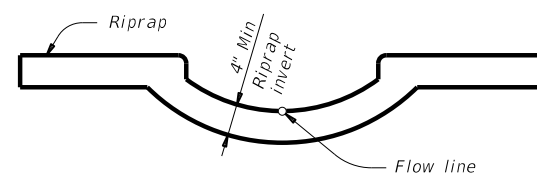
SECTION C-C

CROSS PIPE DETAILS



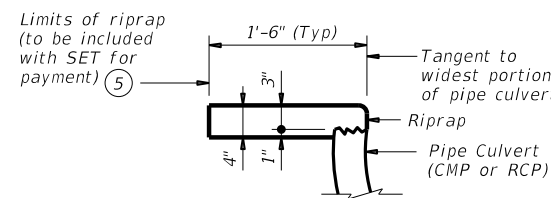
DETAIL "A"

(Showing invert with corrugated metal pipe (CMP) culvert. Reinforced concrete pipe (RCP) culvert details are similar. Cross pipes not shown for clarity.)

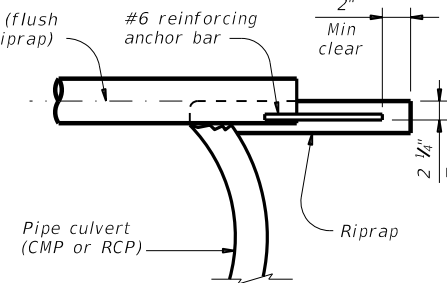


SECTION B-B

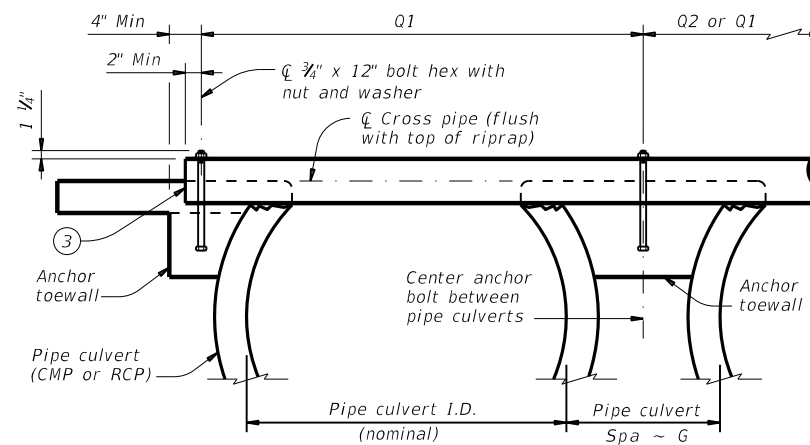
(Cross pipes not shown for clarity.)



SHOWING TYPICAL PIPE CULVERT AND RIPRAP



SHOWING CROSS PIPE WITH ANCHOR BAR



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, AND RIPRAP QUANTITIES

Nominal Culvert I.D.	Conc Riprap (CY) (6)	Pipe Culvert Spa ~ G	Single Barrel ~ Q1	Multi-Barrel ~ Q1	Q2	Conditions for Use of Cross Pipes	Cross Pipe Sizes
12"	0.6	0' - 9"	N/A	2' - 1"	1' - 9"	3 or more pipe culverts	3" Std (3.500" O.D.)
15"	0.7	0' - 11"	N/A	2' - 5"	2' - 2"		
18"	0.8	1' - 2"	N/A	2' - 10"	2' - 8"		
21"	0.9	1' - 4"	N/A	3' - 2"	3' - 1"		
24"	0.9	1' - 7"	N/A	3' - 6"	3' - 7"	3 or more pipe culverts	3 1/2" Std (4.000" O.D.)
27"	1.0	1' - 8"	N/A	3' - 10"	3' - 11"	2 or more pipe culverts	
30"	1.1	1' - 10"	N/A	4' - 2"	4' - 4"	All pipe culverts	
33"	1.2	1' - 11"	4' - 2"	4' - 5"	4' - 8"	All pipe culverts	4" Std (4.500" O.D.)
36"	1.3	2' - 1"	4' - 5"	4' - 9"	5' - 1"	All pipe culverts	
42"	1.5	2' - 4"	4' - 11"	5' - 5"	5' - 10"	All pipe culverts	5" Std (5.563" O.D.)
48"	1.7	2' - 7"	5' - 5"	6' - 0"	6' - 7"	All pipe culverts	
54"	2.0	3' - 0"	5' - 11"	6' - 9"	7' - 6"	All pipe culverts	
60"	2.2	3' - 3"	6' - 5"	7' - 4"	8' - 3"	All pipe culverts	
66"	2.4	3' - 3"	6' - 11"	7' - 10"	8' - 9"	All pipe culverts	
72"	2.7	3' - 4"	7' - 5"	8' - 5"	9' - 4"	All pipe culverts	

- The proper installation of the first cross pipe is critical for vehicle safety. Place the top of the first cross pipe no more than 6" above the flowline.
- Provide cross pipes, except the first bottom pipe, of the size shown in the table. Provide a 3 1/2" standard pipe (4" O.D.) for the first bottom pipe.
- Install the third cross pipe from the bottom of the culvert using a bolted connection. Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, install all other cross pipes using the bolted connection details.
- Match cross slope as shown elsewhere in the plans. Cross slope of 6:1 or flatter is required for vehicle safety.
- Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".
- Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. For multiple pipe culverts or for corrugated metal pipe (CMP) culverts, quantities will need to be adjusted. Riprap quantities are for contractor's information only.

MATERIAL NOTES:

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 cross pipes that meet the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 (Gr B), or API 5LX52. Provide ASTM A307 bolts and nuts. Galvanize all steel components, except concrete reinforcing, after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

GENERAL NOTES:

Cross pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981. Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the cross pipes. Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap". Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

		Bridge Division Standard	
SAFETY END TREATMENT FOR 12" DIA TO 72" DIA PIPE CULVERTS TYPE II ~ PARALLEL DRAINAGE			
SETP-PD			
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©TxDOT February 2020	CON: 2352	SECT: 02	JOB: 027
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TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (5)

Slope	Dia of Pipe (D)	Values for One Pipe					Values to be Added for Each Add'l Pipe			
		W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
2:1	12"	4'-7 1/2"	2'-6"	2'-10"	3'-3 1/4"	88	0.6	1'-9"	20	0.2
	15"	5'-5 3/4"	2'-9 1/2"	3'-4"	3'-10 1/4"	103	0.7	2'-2"	24	0.3
	18"	6'-4 1/4"	3'-1"	3'-10"	4'-5"	124	0.9	2'-8"	32	0.3
	21"	7'-2 3/4"	3'-4 1/2"	4'-4"	5'-0"	143	1.1	3'-1"	43	0.4
	24"	8'-2 1/2"	3'-9 1/2"	4'-10"	5'-7"	164	1.3	3'-7"	50	0.5
	27"	9'-1"	4'-1"	5'-4"	6'-2"	179	1.5	3'-11"	56	0.6
	30"	9'-11 1/2"	4'-4 1/2"	5'-10"	6'-8 3/4"	203	1.7	4'-4"	65	0.8
	33"	10'-10"	4'-8"	6'-4"	7'-3 3/4"	224	2.0	4'-8"	71	0.9
	36"	11'-8 1/4"	4'-11 1/2"	6'-10"	7'-10 3/4"	249	2.2	5'-1"	81	1.0
	42"	13'-5 1/4"	5'-6 1/2"	7'-10"	9'-0 1/2"	298	2.8	5'-10"	97	1.3
	48"	15'-9"	6'-1 1/2"	9'-4"	10'-9 1/4"	360	3.8	6'-7"	117	1.7
	54"	17'-5 3/4"	6'-8 1/2"	10'-4"	11'-11 1/4"	427	4.5	7'-6"	151	2.1
60"	19'-2 3/4"	7'-3 1/2"	11'-4"	13'-1"	481	5.3	8'-3"	174	2.5	
66"	20'-11 1/2"	7'-10 1/2"	12'-4"	14'-3"	544	6.2	8'-9"	194	2.9	
72"	22'-8 1/2"	8'-5 1/2"	13'-4"	15'-4 3/4"	601	7.1	9'-4"	213	3.3	
3:1	12"	6'-3"	2'-6"	4'-3"	4'-11"	118	0.8	1'-9"	22	0.2
	15"	7'-5"	2'-9 1/2"	5'-0"	5'-9 1/4"	137	1.1	2'-2"	28	0.3
	18"	8'-6 3/4"	3'-1"	5'-9"	6'-7 3/4"	170	1.3	2'-8"	37	0.5
	21"	9'-8 3/4"	3'-4 1/2"	6'-6"	7'-6"	195	1.6	3'-1"	48	0.6
	24"	11'-0"	3'-9 1/2"	7'-3"	8'-4 1/2"	227	2.0	3'-7"	58	0.7
	27"	12'-2"	4'-1"	8'-0"	9'-2 3/4"	251	2.3	3'-11"	67	0.8
	30"	13'-4"	4'-4 1/2"	8'-9"	10'-1 1/4"	293	2.7	4'-4"	77	1.0
	33"	14'-5 3/4"	4'-8"	9'-6"	10'-11 3/4"	318	3.1	4'-8"	84	1.2
	36"	15'-7 3/4"	4'-11 1/2"	10'-3"	11'-10"	351	3.5	5'-1"	96	1.4
	42"	17'-11 1/2"	5'-6 1/2"	11'-9"	13'-6 3/4"	432	4.5	5'-10"	119	1.7
	48"	21'-1 3/4"	6'-1 1/2"	14'-0"	16'-2"	537	6.1	6'-7"	146	2.3
	54"	23'-5 1/2"	6'-8 1/2"	15'-6"	17'-10 3/4"	630	7.3	7'-6"	186	2.9
60"	25'-9 1/4"	7'-3 1/2"	17'-0"	19'-7 1/2"	719	8.7	8'-3"	219	3.4	
66"	28'-1"	7'-10 1/2"	18'-6"	21'-4 1/4"	811	10.1	8'-9"	242	3.9	
72"	30'-4 3/4"	8'-5 1/2"	20'-0"	23'-1 1/4"	924	11.7	9'-4"	272	4.4	
4:1	12"	7'-10 3/4"	2'-6"	5'-8"	6'-6 1/2"	148	1.1	1'-9"	24	0.3
	15"	9'-4"	2'-9 1/2"	6'-8"	7'-8 1/2"	181	1.5	2'-2"	32	0.4
	18"	10'-9 1/2"	3'-1"	7'-8"	8'-10 1/4"	221	1.9	2'-8"	42	0.5
	21"	12'-2 3/4"	3'-4 1/2"	8'-8"	10'-0"	260	2.3	3'-1"	57	0.7
	24"	13'-9 1/2"	3'-9 1/2"	9'-8"	11'-2"	301	2.8	3'-7"	67	0.9
	27"	15'-3"	4'-1"	10'-8"	12'-3 3/4"	334	3.3	3'-11"	77	1.0
	30"	16'-8 1/4"	4'-4 1/2"	11'-8"	13'-5 3/4"	385	3.8	4'-4"	89	1.3
	33"	18'-1 3/4"	4'-8"	12'-8"	14'-7 1/2"	425	4.5	4'-8"	101	1.4
	36"	19'-7"	4'-11 1/2"	13'-8"	15'-9 1/4"	472	5.1	5'-1"	115	1.7
	42"	22'-5 3/4"	5'-6 1/2"	15'-8"	18'-1"	583	6.5	5'-10"	141	2.1
	48"	26'-6 1/4"	6'-1 1/2"	18'-8"	21'-6 3/4"	730	8.9	6'-7"	175	2.8
	54"	29'-5"	6'-8 1/2"	20'-8"	23'-10 1/4"	875	10.7	7'-6"	226	3.6
60"	32'-3 3/4"	7'-3 1/2"	22'-8"	26'-2"	996	12.7	8'-3"	264	4.3	
66"	35'-2 1/2"	7'-10 1/2"	24'-8"	28'-5 3/4"	1,140	14.9	8'-9"	300	4.9	
72"	38'-1 1/4"	8'-5 1/2"	26'-8"	30'-9 1/2"	1,297	17.3	9'-4"	334	5.6	
6:1	12"	11'-2"	2'-6"	8'-6"	9'-9 3/4"	224	1.9	1'-9"	28	0.4
	15"	13'-2 1/4"	2'-9 1/2"	10'-0"	11'-6 1/2"	268	2.5	2'-2"	37	0.5
	18"	15'-2 1/2"	3'-1"	11'-6"	13'-3 1/4"	330	3.2	2'-8"	50	0.7
	21"	17'-2 3/4"	3'-4 1/2"	13'-0"	15'-0 1/4"	387	3.9	3'-1"	69	0.9
	24"	19'-4 1/2"	3'-9 1/2"	14'-6"	16'-9"	453	4.8	3'-7"	80	1.2
	27"	21'-4 3/4"	4'-1"	16'-0"	18'-5 3/4"	512	5.7	3'-11"	96	1.4
	30"	23'-5 1/4"	4'-4 1/2"	17'-6"	20'-2 1/2"	593	6.7	4'-4"	110	1.7
	33"	25'-5 1/2"	4'-8"	19'-0"	21'-11 1/4"	675	7.8	4'-8"	127	2.0
	36"	27'-5 3/4"	4'-11 1/2"	20'-6"	23'-8"	735	9.0	5'-1"	144	2.3
	42"	31'-6 1/4"	5'-6 1/2"	23'-6"	27'-1 1/2"	922	11.5	5'-10"	179	3.0
	48"	37'-3 1/2"	6'-1 1/2"	28'-0"	32'-4"	1,191	15.9	6'-7"	231	4.0
	54"	41'-4 1/4"	6'-8 1/2"	31'-0"	35'-9 1/2"	1,424	19.2	7'-6"	300	5.0
60"	45'-4 3/4"	7'-3 1/2"	34'-0"	39'-3"	1,631	22.9	8'-3"	353	6.0	

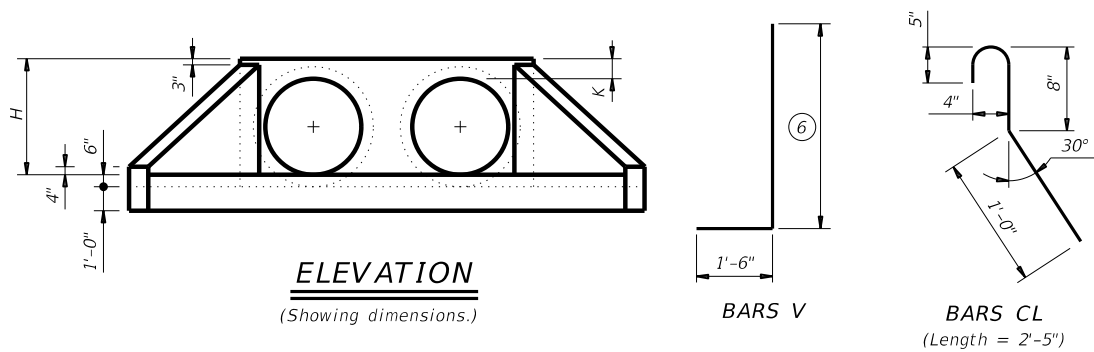
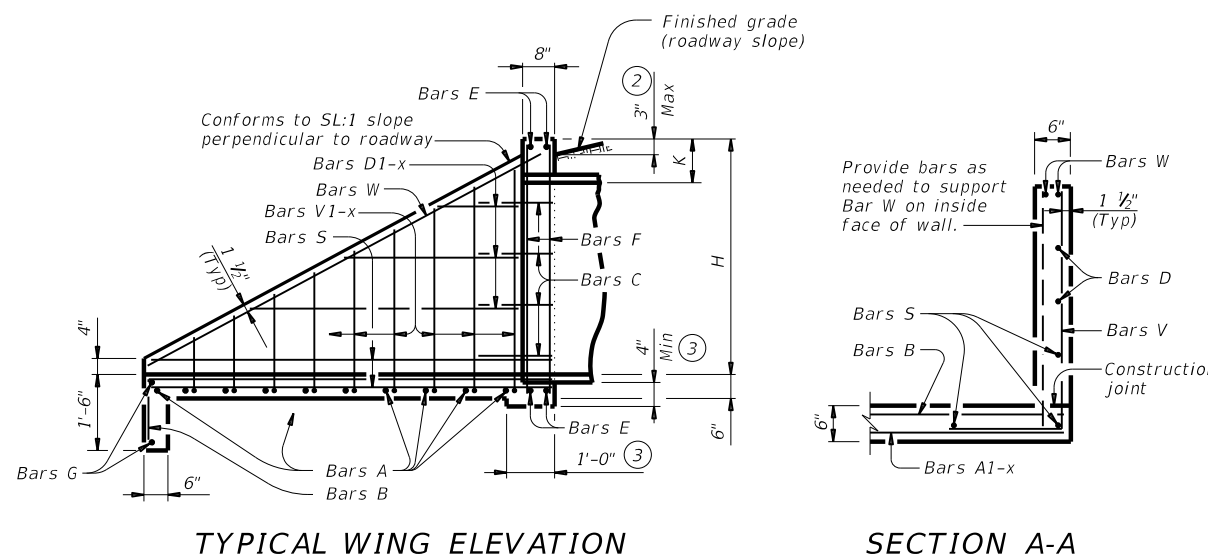
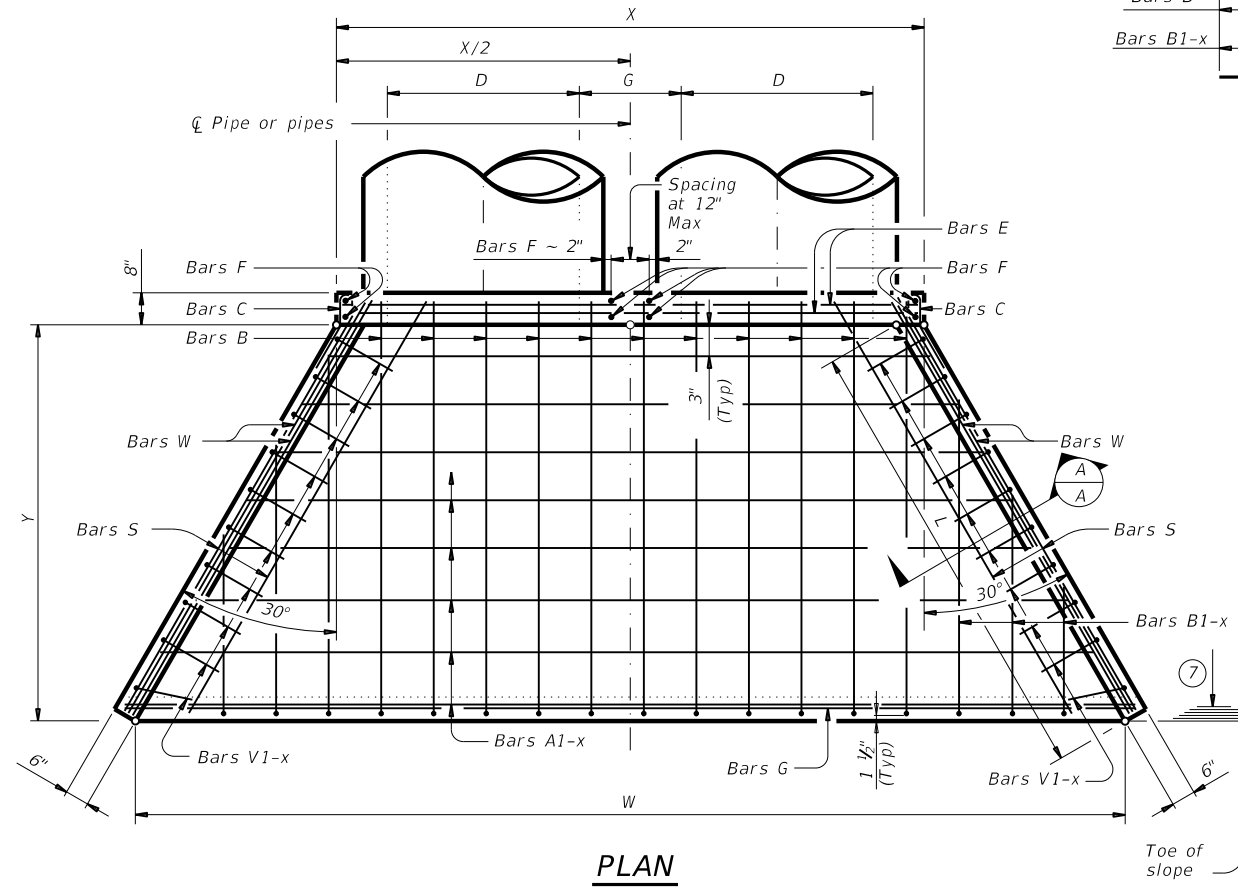
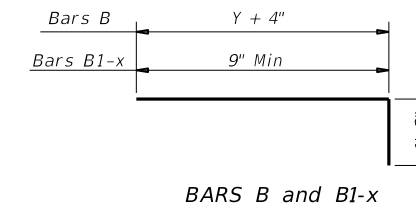


TABLE OF REINFORCING STEEL (5)

Bar	Size	Spa	No.
A	#4	1'-0"	~
B	#3	1'-6"	~
C	#4	1'-0"	~
D	#3	1'-0"	~
E	#5	~	4
F	#5	~	~
G	#3	~	2
S	#4	~	6
V	#4	1'-0"	~
W	#5	~	4

TABLE OF CONSTANT DIMENSIONS

Dia of Pipe (D)	G	K (4)	H
12"	0'-9"	1'-0"	2'-0"
15"	0'-11"	1'-0"	2'-3"
18"	1'-2"	1'-0"	2'-6"
21"	1'-4"	1'-0"	2'-9"
24"	1'-7"	1'-0"	3'-0"
27"	1'-8"	1'-0"	3'-3"
30"	1'-10"	1'-0"	3'-6"
33"	1'-11"	1'-0"	3'-9"
36"	2'-1"	1'-0"	4'-0"
42"	2'-4"	1'-0"	4'-6"
48"	2'-7"	1'-3"	5'-3"
54"	3'-0"	1'-3"	5'-9"
60"	3'-3"	1'-3"	6'-3"
66"	3'-3"	1'-3"	6'-9"
72"	3'-4"	1'-3"	7'-3"



- Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.
- For vehicle safety, construct curbs no more than 3" above finished grade. Reduce curb heights, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- Provide a 1'-0" footing as shown where required to maintain 4" minimum cover for pipes.
- Dimensions shown are usual and maximum.
- Quantities shown are for one structure end only (one headwall).
- Min Length = $6" + 3" \times \left(\frac{12 \times H - 7}{12 \times L} \right)$
Max Length = $12 \times H - 3" \times \left(\frac{12 \times H - 7}{12 \times L} \right) - 1"$
- Lengths of wings based on SL:1 slope along this line.

MATERIAL NOTES:
 Provide Grade 60 reinforcing steel.
 Provide Class C concrete (f'c = 3,600 psi).

GENERAL NOTES:
 Designed according to AASHTO LRFD Bridge Design Specifications.
 Do not mount bridge rails of any type directly to these culvert headwalls.
 This standard may not be used for wall heights, H, exceeding the values shown.

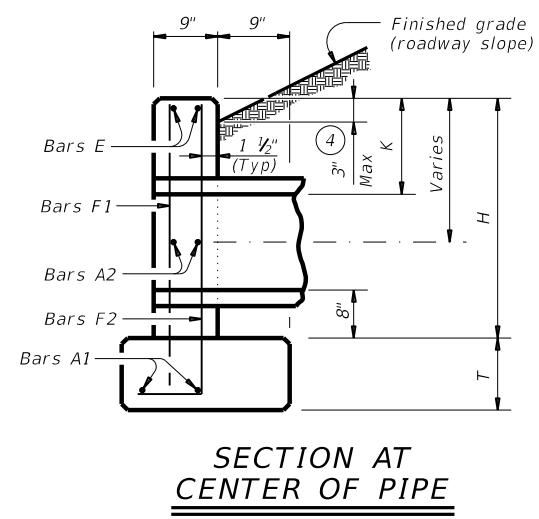
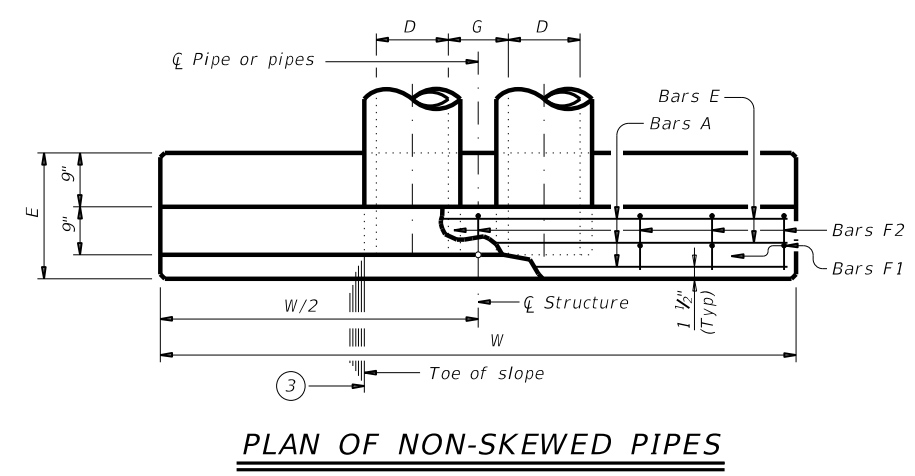
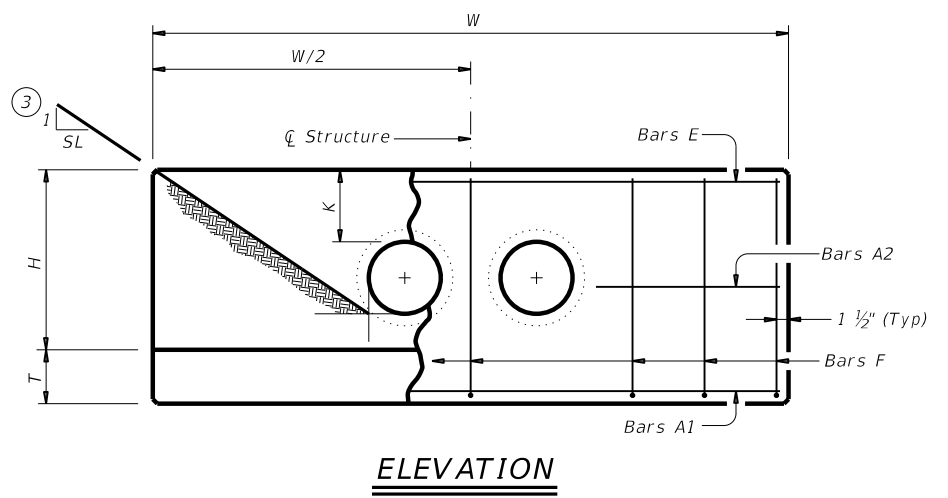
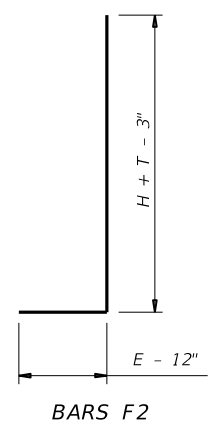
Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing dimensions are out-to-out of bars.

		Bridge Division Standard	
CONCRETE HEADWALLS WITH FLARED WINGS FOR 0° SKEW PIPE CULVERTS			
CH-FW-0			
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©TxDOT February 2020	CONT: 2352	SECT: 02	JOB: 027
REVISIONS			HIGHWAY: FM 2449
DIST: DAL	COUNTY: DENTON	SHEET NO. 74	

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**TABLE OF VARIABLE DIMENSIONS (5)
AND QUANTITIES FOR ONE HEADWALL**

Slope	Dia of Pipe (D)	Values for One Pipe			Values To Be Added for Each Add'l Pipe		
		W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)
2:1	12"	9'-0"	122	1.1	1'-9"	15	0.2
	15"	10'-3"	136	1.3	2'-2"	16	0.2
	18"	11'-6"	163	1.5	2'-8"	19	0.3
	21"	12'-9"	200	1.8	3'-1"	31	0.4
	24"	14'-0"	217	2.1	3'-7"	34	0.4
	27"	15'-3"	254	2.4	3'-11"	37	0.5
	30"	16'-6"	272	2.7	4'-4"	40	0.6
	33"	17'-9"	314	3.1	4'-8"	43	0.6
	36"	19'-0"	371	3.9	5'-1"	46	0.8
	42"	21'-6"	442	4.9	5'-10"	52	1.0
	48"	25'-0"	569	6.4	6'-7"	59	1.3
	54"	27'-6"	701	7.5	7'-6"	82	1.6
60"	30'-0"	794	8.8	8'-3"	90	1.8	
66"	32'-6"	894	10.2	8'-9"	96	2.0	
72"	35'-0"	1,055	11.7	9'-4"	103	2.3	
3:1	12"	13'-0"	175	1.6	1'-9"	14	0.2
	15"	14'-9"	193	1.9	2'-2"	17	0.2
	18"	16'-6"	228	2.2	2'-8"	19	0.3
	21"	18'-3"	299	2.6	3'-1"	31	0.4
	24"	20'-0"	323	3.0	3'-7"	33	0.4
	27"	21'-9"	371	3.5	3'-11"	37	0.5
	30"	23'-6"	415	4.0	4'-4"	40	0.5
	33"	25'-3"	469	4.6	4'-8"	43	0.6
	36"	27'-0"	556	5.7	5'-1"	46	0.8
	42"	30'-6"	675	7.1	5'-10"	52	1.0
	48"	35'-6"	837	9.2	6'-7"	59	1.3
	54"	39'-0"	1,015	11.0	7'-6"	84	1.6
60"	42'-6"	1,171	12.9	8'-3"	91	1.8	
66"	46'-0"	1,298	14.9	8'-9"	98	2.0	
72"	49'-6"	1,561	17.1	9'-4"	103	2.3	
4:1	12"	17'-0"	229	2.0	1'-9"	15	0.2
	15"	19'-3"	266	2.4	2'-2"	17	0.2
	18"	21'-6"	308	2.9	2'-8"	19	0.3
	21"	23'-9"	382	3.5	3'-1"	31	0.3
	24"	26'-0"	430	3.9	3'-7"	34	0.4
	27"	28'-3"	486	4.7	3'-11"	37	0.5
	30"	30'-6"	539	5.2	4'-4"	40	0.6
	33"	32'-9"	603	6.0	4'-8"	42	0.6
	36"	35'-0"	738	7.5	5'-1"	47	0.8
	42"	39'-6"	881	9.3	5'-10"	52	1.0
	48"	46'-0"	1,102	12.1	6'-7"	61	1.3
	54"	50'-6"	1,364	14.4	7'-6"	84	1.6
60"	55'-0"	1,547	16.9	8'-3"	91	1.8	
66"	59'-6"	1,741	19.5	8'-9"	98	2.0	
72"	64'-0"	2,077	22.4	9'-4"	102	2.3	
6:1	12"	25'-0"	336	3.0	1'-9"	14	0.2
	15"	28'-3"	384	3.6	2'-2"	17	0.2
	18"	31'-6"	452	4.2	2'-8"	19	0.3
	21"	34'-9"	581	5.1	3'-1"	31	0.4
	24"	38'-0"	644	5.8	3'-7"	34	0.4
	27"	41'-3"	737	6.9	3'-11"	37	0.5
	30"	44'-6"	807	7.7	4'-4"	39	0.6
	33"	47'-9"	912	8.9	4'-8"	44	0.6
	36"	51'-0"	1,108	11.0	5'-1"	48	0.8
	42"	57'-6"	1,318	13.7	5'-10"	54	1.0
	48"	67'-0"	1,682	17.9	6'-7"	59	1.3
	54"	73'-6"	2,072	21.3	7'-6"	83	1.6
60"	80'-0"	2,351	24.9	8'-3"	89	1.8	
66"	86'-6"	2,643	28.9	8'-9"	96	2.0	
72"	93'-0"	3,121	33.1	9'-4"	101	2.3	



- ① Total quantities include one 3'-1" lap for bars over 60' in length.
- ② Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.
- ③ Indicated slope is perpendicular to centerline pipe or pipes.
- ④ For vehicle safety, construct curbs no more than 3" above finished grade. Reduce curb heights, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- ⑤ Dimensions shown are usual and maximum.
- ⑥ Quantities shown are for one structure end only (one headwall).

TABLE OF CONSTANT DIMENSIONS

Dia of Pipe (D)	G	K (5)	H	T	E
12"	0'-9"	1'-0"	2'-8"	0'-9"	1'-9"
15"	0'-11"	1'-0"	2'-11"	0'-9"	1'-9"
18"	1'-2"	1'-0"	3'-2"	0'-9"	1'-9"
21"	1'-4"	1'-0"	3'-5"	0'-9"	2'-0"
24"	1'-7"	1'-0"	3'-8"	0'-9"	2'-0"
27"	1'-8"	1'-0"	3'-11"	0'-9"	2'-3"
30"	1'-10"	1'-0"	4'-2"	0'-9"	2'-3"
33"	1'-11"	1'-0"	4'-5"	0'-9"	2'-6"
36"	2'-1"	1'-0"	4'-8"	1'-0"	2'-6"
42"	2'-4"	1'-0"	5'-2"	1'-0"	2'-9"
48"	2'-7"	1'-3"	5'-11"	1'-0"	3'-0"
54"	3'-0"	1'-3"	6'-5"	1'-0"	3'-3"
60"	3'-3"	1'-3"	6'-11"	1'-0"	3'-6"
66"	3'-3"	1'-3"	7'-5"	1'-0"	3'-9"
72"	3'-4"	1'-3"	7'-11"	1'-0"	4'-0"

TABLE OF REINFORCING STEEL (6)

Bar	Size	Spa	No.
A1	#5	~	2
A2	#5	1'-6"	~
E	#5	~	2
F	#5	1'-0"	~

MATERIAL NOTES:
 Provide Grade 60 reinforcing steel.
 Provide Class C concrete (f'c = 3,600 psi).

GENERAL NOTES:
 Designed according to AASHTO LRFD Bridge Design Specifications.
 Do not mount bridge rails of any type directly to these culvert headwalls.
 This standard may not be used for wall heights, H, exceeding the values shown.

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

Bridge Division Standard

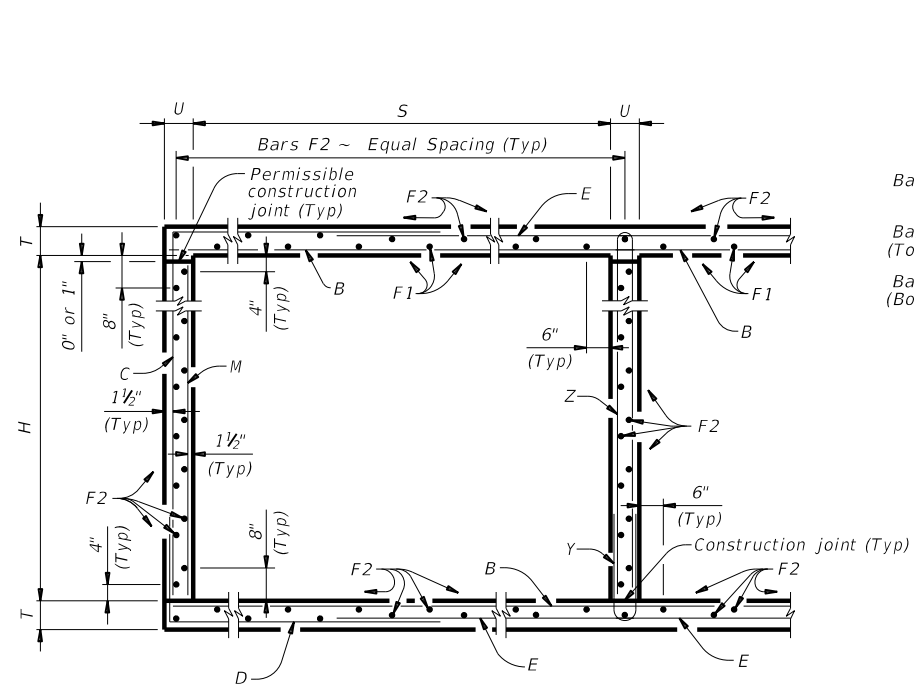
CONCRETE HEADWALLS WITH PARALLEL WINGS FOR NON-SKEWED PIPE CULVERTS

CH-PW-0

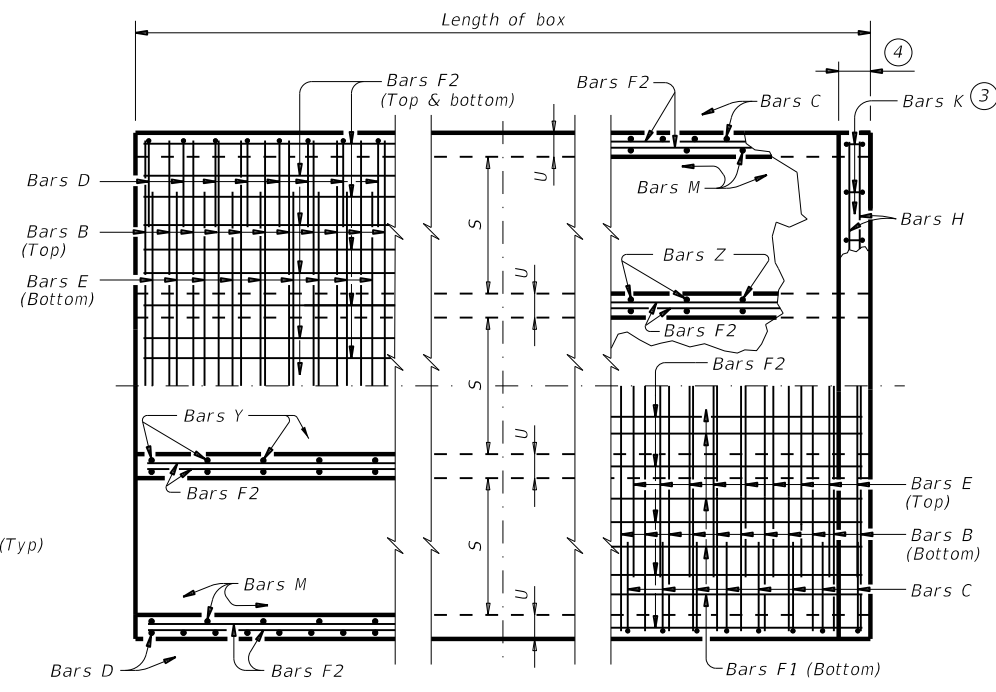
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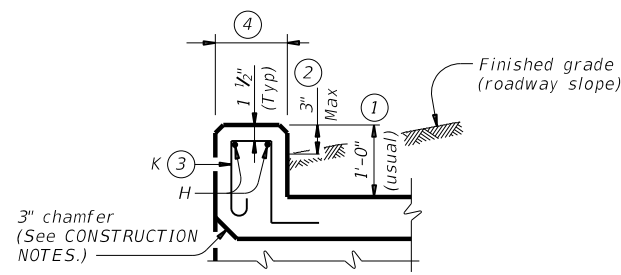


TYPICAL SECTION



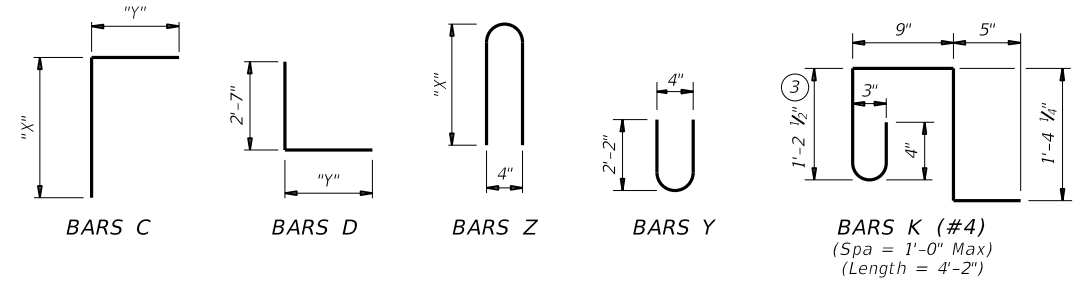
BOTTOM SLAB **TOP SLAB**

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
3'-0"	3'-6 1/2"	4'-5"
4'-0"	4'-6 1/2"	4'-5"
5'-0"	5'-6 1/2"	4'-5"
6'-0"	6'-6 1/2"	4'-5"
7'-0"	7'-6 1/2"	4'-5"



- 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.
- 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.
- 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.
- 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, and Bars Y and Z 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 Multiple Box Culverts Cast-In-Place Miscellaneous Detail (MC-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

Texas Department of Transportation Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
 7'-0" SPAN
 0' TO 10' FILL

MC-7-10

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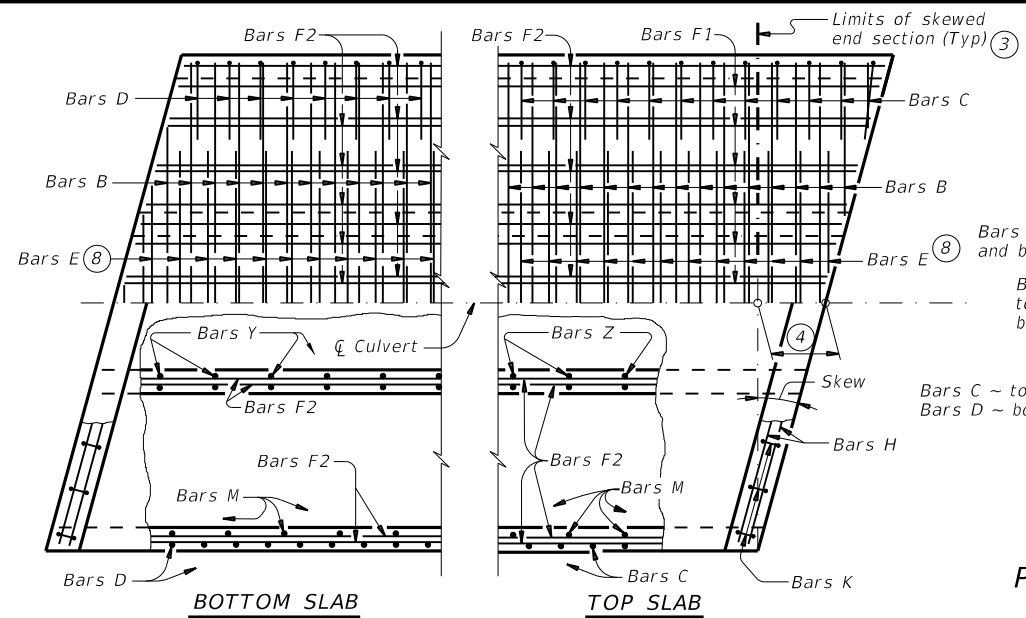
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NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																												QUANTITIES																								
					Bars B				Bars C & D				Bars E				Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4				Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total																
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Bars C		Bars D		No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Bars Y		Bars Z		Length	Wt	No.	Wt	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)
													Length	Wt	Length	Wt																												Length	Wt	Length	Wt										
2	7'-0"	3'-0"	8"	7"	108	#6	9"	15'-6"	2,514	162	#5	6"	7'-11"	1,338	7'-0"	1,183	108	#6	9"	11'-5"	1,852	10	18"	39'-9"	266	54	18"	39'-9"	1,434	108	9"	3'-0"	216	54	9"	4'-7"	165	7'-3"	262	15'-6"	41	34	95	0.972	230.8	1.2	136	40.0	9,366								
3	7'-0"	3'-0"	8"	7"	108	#6	9"	23'-1"	3,744	162	#5	6"	7'-11"	1,338	7'-0"	1,183	108	#6	9"	19'-0"	3,082	15	18"	39'-9"	398	77	18"	39'-9"	2,045	108	9"	3'-0"	216	108	9"	4'-7"	331	7'-3"	523	23'-1"	62	50	139	1.412	321.5	1.7	201	58.2	13,061								
4	7'-0"	3'-0"	8"	7"	108	#6	9"	30'-8"	4,975	162	#5	6"	7'-11"	1,338	7'-0"	1,183	108	#6	9"	26'-7"	4,312	20	18"	39'-9"	531	100	18"	39'-9"	2,655	108	9"	3'-0"	216	162	9"	4'-7"	496	7'-3"	785	30'-8"	82	64	178	1.851	412.3	2.3	260	76.3	16,751								
5	7'-0"	3'-0"	8"	7"	108	#6	9"	38'-3"	6,205	162	#5	6"	7'-11"	1,338	7'-0"	1,183	108	#6	9"	34'-2"	5,542	25	18"	39'-9"	664	123	18"	39'-9"	3,266	108	9"	3'-0"	216	216	9"	4'-7"	661	7'-3"	1,046	38'-3"	102	80	223	2.290	503.0	2.8	325	94.4	20,446								
6	7'-0"	3'-0"	8"	7"	108	#6	9"	45'-10"	7,435	162	#5	6"	7'-11"	1,338	7'-0"	1,183	108	#6	9"	41'-9"	6,773	30	18"	39'-9"	797	146	18"	39'-9"	3,877	108	9"	3'-0"	216	270	9"	4'-7"	827	7'-3"	1,308	45'-10"	122	94	262	2.729	593.9	3.4	384	112.6	24,138								
2	7'-0"	4'-0"	8"	7"	108	#6	9"	15'-6"	2,514	162	#5	6"	8'-11"	1,507	7'-0"	1,183	108	#6	9"	11'-5"	1,852	10	18"	39'-9"	266	54	18"	39'-9"	1,434	108	9"	4'-0"	289	54	9"	4'-7"	165	9'-3"	334	15'-6"	41	34	95	1.037	238.6	1.2	136	42.6	9,680								
3	7'-0"	4'-0"	8"	7"	108	#6	9"	23'-1"	3,744	162	#5	6"	8'-11"	1,507	7'-0"	1,183	108	#6	9"	19'-0"	3,082	15	18"	39'-9"	398	77	18"	39'-9"	2,045	108	9"	4'-0"	289	108	9"	4'-7"	331	9'-3"	667	23'-1"	62	50	139	1.498	331.2	1.7	201	61.6	13,447								
4	7'-0"	4'-0"	8"	7"	108	#6	9"	30'-8"	4,975	162	#5	6"	8'-11"	1,507	7'-0"	1,183	108	#6	9"	26'-7"	4,312	20	18"	39'-9"	531	100	18"	39'-9"	2,655	108	9"	4'-0"	289	162	9"	4'-7"	496	9'-3"	1,001	30'-8"	82	64	178	1.959	423.7	2.3	260	80.6	17,209								
5	7'-0"	4'-0"	8"	7"	108	#6	9"	38'-3"	6,205	162	#5	6"	8'-11"	1,507	7'-0"	1,183	108	#6	9"	34'-2"	5,542	25	18"	39'-9"	664	123	18"	39'-9"	3,266	108	9"	4'-0"	289	216	9"	4'-7"	661	9'-3"	1,335	38'-3"	102	80	223	2.420	516.3	2.8	325	99.6	20,977								
6	7'-0"	4'-0"	8"	7"	108	#6	9"	45'-10"	7,435	162	#5	6"	8'-11"	1,507	7'-0"	1,183	108	#6	9"	41'-9"	6,773	30	18"	39'-9"	797	146	18"	39'-9"	3,877	108	9"	4'-0"	289	270	9"	4'-7"	827	9'-3"	1,668	45'-10"	122	94	262	2.881	608.9	3.4	384	118.6	24,740								
2	7'-0"	5'-0"	8"	7"	108	#6	9"	15'-6"	2,514	162	#5	6"	9'-11"	1,676	7'-0"	1,183	108	#6	9"	11'-5"	1,852	10	18"	39'-9"	266	60	18"	39'-9"	1,593	108	9"	5'-0"	361	54	9"	4'-7"	165	11'-3"	406	15'-6"	41	34	95	1.102	250.4	1.2	136	45.2	10,152								
3	7'-0"	5'-0"	8"	7"	108	#6	9"	23'-1"	3,744	162	#5	6"	9'-11"	1,676	7'-0"	1,183	108	#6	9"	19'-0"	3,082	15	18"	39'-9"	398	85	18"	39'-9"	2,257	108	9"	5'-0"	361	108	9"	4'-7"	331	11'-3"	812	23'-1"	62	50	139	1.584	346.1	1.7	201	65.1	14,045								
4	7'-0"	5'-0"	8"	7"	108	#6	9"	30'-8"	4,975	162	#5	6"	9'-11"	1,676	7'-0"	1,183	108	#6	9"	26'-7"	4,312	20	18"	39'-9"	531	110	18"	39'-9"	2,921	108	9"	5'-0"	361	162	9"	4'-7"	496	11'-3"	1,217	30'-8"	82	64	178	2.067	441.8	2.3	260	85.0	17,932								
5	7'-0"	5'-0"	8"	7"	108	#6	9"	38'-3"	6,205	162	#5	6"	9'-11"	1,676	7'-0"	1,183	108	#6	9"	34'-2"	5,542	25	18"	39'-9"	664	135	18"	39'-9"	3,585	108	9"	5'-0"	361	216	9"	4'-7"	661	11'-3"	1,623	38'-3"	102	80	223	2.549	537.5	2.8	325	104.8	21,825								
6	7'-0"	5'-0"	8"	7"	108	#6	9"	45'-10"	7,435	162	#5	6"	9'-11"	1,676	7'-0"	1,183	108	#6	9"	41'-9"	6,773	30	18"	39'-9"	797	160	18"	39'-9"	4,248	108	9"	5'-0"	361	270	9"	4'-7"	827	11'-3"	2,029	45'-10"	122	94	262	3.032	633.2	3.4	384	124.7	25,713								
2	7'-0"	6'-0"	8"	7"	108	#6	9"	15'-6"	2,514	162	#5	6"	10'-11"	1,845	7'-0"	1,183	108	#6	9"	11'-5"	1,852	10	18"	39'-9"	266	66	18"	39'-9"	1,752	108	9"	6'-0"	433	54	9"	4'-7"	165	13'-3"	478	15'-6"	41	34	95	1.167	262.2	1.2	136	47.8	10,624								
3	7'-0"	6'-0"	8"	7"	108	#6	9"	23'-1"	3,744	162	#5	6"	10'-11"	1,845	7'-0"	1,183	108	#6	9"	19'-0"	3,082	15	18"	39'-9"	398	93	18"	39'-9"	2,469	108	9"	6'-0"	433	108	9"	4'-7"	331	13'-3"	956	23'-1"	62	50	139	1.671	361.0	1.7	201	68.6	14,642								
4	7'-0"	6'-0"	8"	7"	108	#6	9"	30'-8"	4,975	162	#5	6"	10'-11"	1,845	7'-0"	1,183	108	#6	9"	26'-7"	4,312	20	18"	39'-9"	531	120	18"	39'-9"	3,186	108	9"	6'-0"	433	162	9"	4'-7"	496	13'-3"	1,434	30'-8"	82	64	178	2.175	459.9	2.3	260	89.3	18,655								
5	7'-0"	6'-0"	8"	7"	108	#6	9"	38'-3"	6,205	162	#5	6"	10'-11"	1,845	7'-0"	1,183	108	#6	9"	34'-2"	5,542	25	18"	39'-9"	664	147	18"	39'-9"	3,903	108	9"	6'-0"	433	216	9"	4'-7"	661	13'-3"	1,912	38'-3"	102	80	223	2.679	558.7	2.8	325	110.0	22,673								
6	7'-0"	6'-0"	8"	7"	108	#6	9"	45'-10"	7,435	162	#5	6"	10'-11"	1,845	7'-0"	1,183	108	#6	9"	41'-9"	6,773	30	18"	39'-9"	797	174	18"	39'-9"	4,620	108	9"	6'-0"	433	270	9"	4'-7"	827	13'-3"	2,390	45'-10"	122	94	262	3.183	657.6	3.4	384	130.7	26,687								
2	7'-0"	7'-0"	8"	7"	108	#6	9"	15'-6"	2,514	162	#5	6"	11'-11"	2,014	7'-0"	1,183	108	#6	9"	11'-5"	1,852	10	18"	39'-9"	266	66	18"	39'-9"	1,752	108	9"	7'-0"	505	54	9"	4'-7"	165	15'-3"	550	15'-6"	41	34	95	1.231	270.0	1.2	136	50.4	10,937								
3	7'-0"	7'-0"	8"	7"	108	#6	9"	23'-1"	3,744	162	#5	6"	11'-11"	2,014	7'-0"	1,183	108	#6	9"	19'-0"	3,082	15	18"	39'-9"	398	93	18"	39'-9"	2,469	108	9"	7'-0"	505	108	9"	4'-7"	331	15'-3"	1,100	23'-1"	62	50	139	1.757	370.7	1.7	201	72.0	15,027								
4	7'-0"	7'-0"	8"	7"	108	#6	9"	30'-8"	4,975	162	#5	6"	11'-11"	2,014	7'-0"	1,183	108	#6	9"	26'-7"	4,312	20	18"	39'-9"	531	120	18"	39'-9"	3,186	108	9"	7'-0"	505	162	9"	4'-7"	496	15'-3"	1,650	30'-8"	82	64	178	2.283	471.3	2.3	260	93.6	19,112								
5	7'-0"	7'-0"	8"	7"	108	#6	9"	38'-3"	6,205	162	#5	6"	11'-11"	2,014	7'-0"	1,183	108	#6	9"	34'-2"	5,542	25	18"	39'-9"	664	147	18"	39'-9"	3,903	108	9"	7'-0"	505	216	9"	4'-7"	661	15'-3"	2,200	38'-3"	102	80	223	2.809	571.9	2.8	325	115.2	23,202								
6	7'-0"	7'-0"	8"	7"	108	#6	9"	45'-10"	7,435	162	#5	6"	11'-11"	2,014	7'-0"	1,183	108	#6	9"	41'-9"	6,773	30	18"	39'-9"	797	174	18"	39'-9"	4,620	108	9"	7'-0"	505	270	9"	4'-7"	827	15'-3"	2,750	45'-10"	122	94	262	3.334	672.6	3.4	384	136.8	27,288								

HL93 LOADING SHEET 2 OF 2

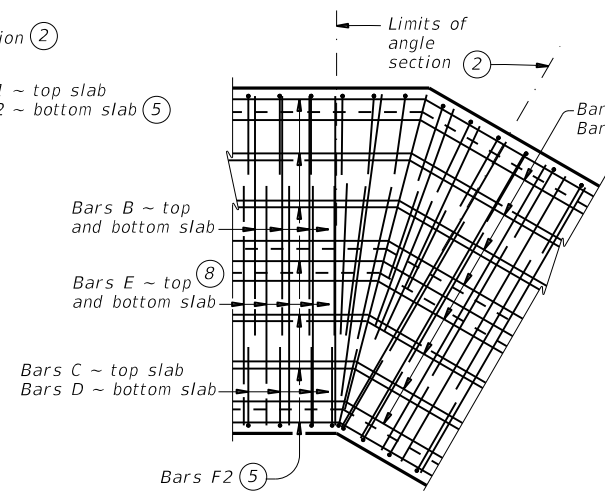
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MULTIPLE BOX CULVERTS CAST-IN-PLACE 7'-0" SPAN 0' TO 10' FILL			
MC-7-10			
FILE: mc710ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT
CTxDOT February 2020	CONT SECT	JOB	HIGHWAY
REVISIONS	2352 02	027	FM 2449
DIST	COUNTY	SHEET NO.	
DAL	DENTON		77

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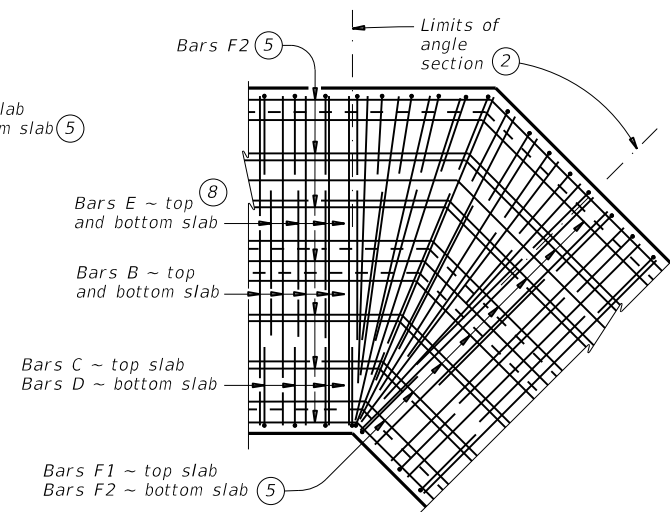


PLAN OF SKEWED ENDS ~ FROM 0° TO 15°^⑦

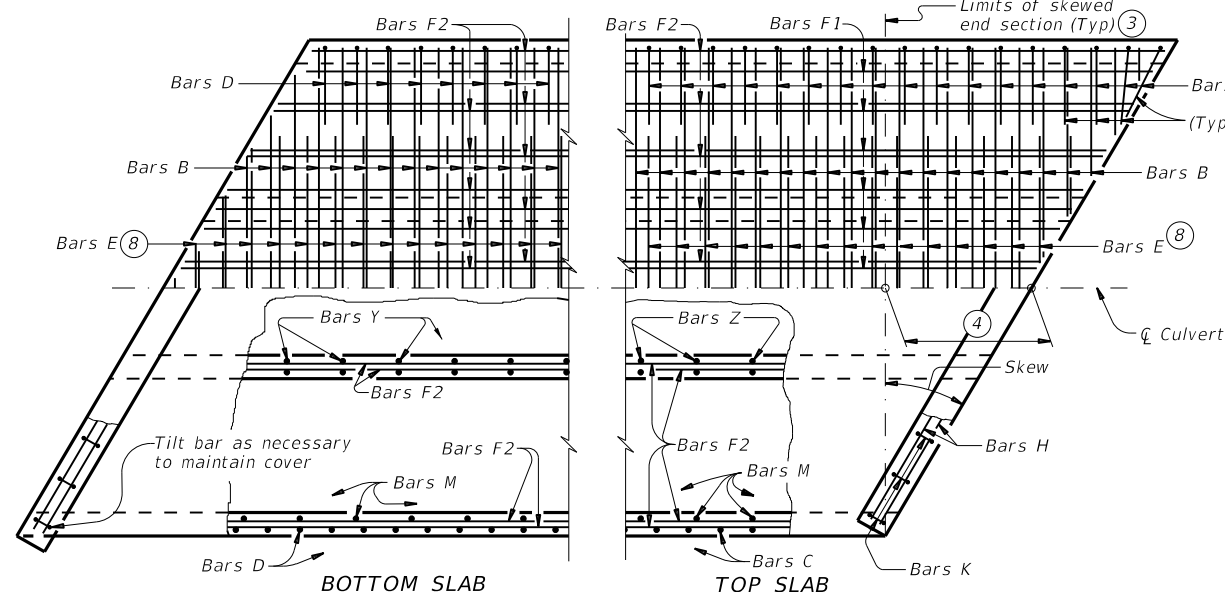
PLAN OF ANGLE SECTION ~ FROM 0° TO 15°



PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



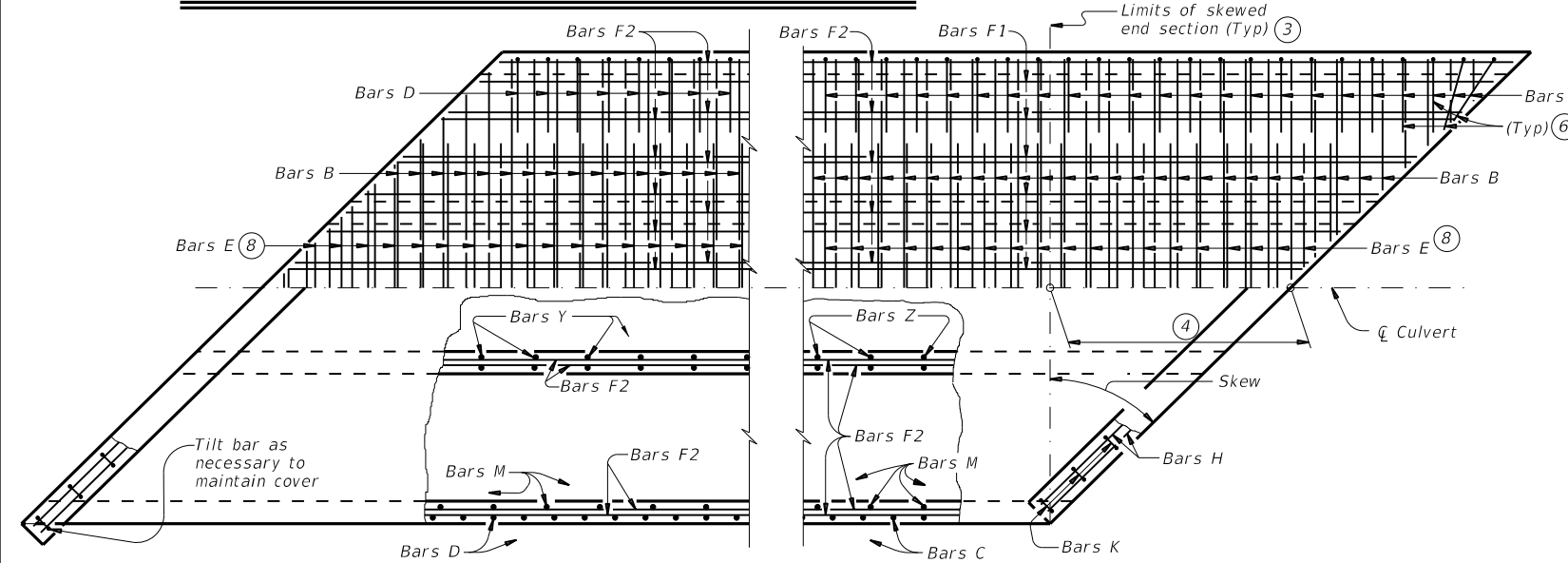
PLAN OF ANGLE SECTION ~ OVER 30° TO 45°



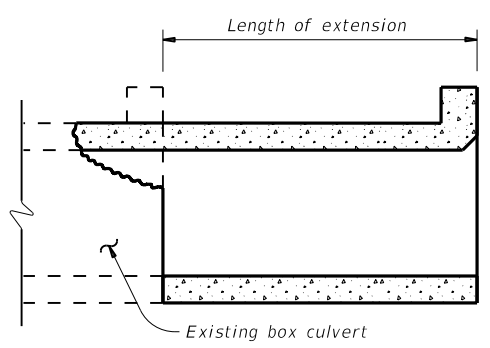
PLAN OF SKEWED ENDS ~ OVER 15° TO 30°

- ① For skewed box culverts with less than 2'-0" of fill, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension.
 For non-skewed box culverts with less than 2'-0" of fill and for skewed or non-skewed culverts with a fill depth of 2'-0" or greater, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension. Alternatively, if the box is non-skewed, embed #6 anchor bars with a Type III, Class C, D, E, or F anchor adhesive into the existing walls, top and bottom slab at 1'-6" center-to-center spacing. Minimum embedment depth is 8". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, N_{ba}, of 26.4 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. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing." Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.
 Break back wings and apron as necessary to install the extension. Clean and extend the exposed wingwall and apron reinforcing into the extension. When lengthening existing box culverts with dimensions different than current standard dimensions, form horizontal and vertical transitions as directed by the Engineer. Match bottom slabs to maintain an uninterrupted flow line. Field bend existing and new reinforcing into transitions and maintain specified cover requirements. For top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface, adjust the "H" dimension to provide a smooth riding surface.
- ② When the spacing between Bars B or Bars E becomes less than half of the normal spacing, cut bars to avoid conflict.
- ③ The length of Bars B and Bars E will vary in the skewed end sections.
- ④ $[0.5 \times \text{overall width}] \times [\text{tangent of the skew angle}]$
- ⑤ Place Bars F1 and F2 continuously through the angle section. Bend Bars F1 and F2 to remain parallel to the walls of the box culvert.
- ⑥ When necessary to avoid conflict in acute corners, shorten the slab extension leg of Bars C and Bars D to a minimum of 1'-6" for skews of 30° thru 45°.
- ⑦ At the Contractor's option, for skews of 15° or less, place Bars B, C, D, and E parallel to the skewed end while maintaining spacing along centerline of box. Increase lengths of Bars B and Bars E shown on the Multiple Box Culverts Cast-In-Place (MC) standard sheets to accommodate the skew.
- ⑧ Extend Bars E as shown on the MC standard sheet for direct traffic culverts.

- CONSTRUCTION NOTES:**
 Do not use permanent forms.
 When required, lap Bars H 1'-8" for uncoated or galvanized bars.
 Provide a minimum of 1 1/2" clear cover.
- 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) with these exceptions:
 provide Class S concrete (f'c = 4,000 psi) for top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface.
- GENERAL NOTES:**
 Designed according to AASHTO LRFD Bridge Design Specifications.
 Refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets for details of straight sections of culvert.
 For skewed sections and angle sections, refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets for slab and wall dimensions, bar sizes, maximum bar spacing, and any other details not shown.
 For skewed ends with curbs, adjust length of Bars H, number of Bars K, curb concrete volume, and reinforcing steel weight by dividing the values shown on the Multiple Box Culverts Cast-In-Place (MC) standard sheets by the cosine of the skew angle.



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°



LENGTHENING DETAIL^①

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation
 Bridge Division Standard

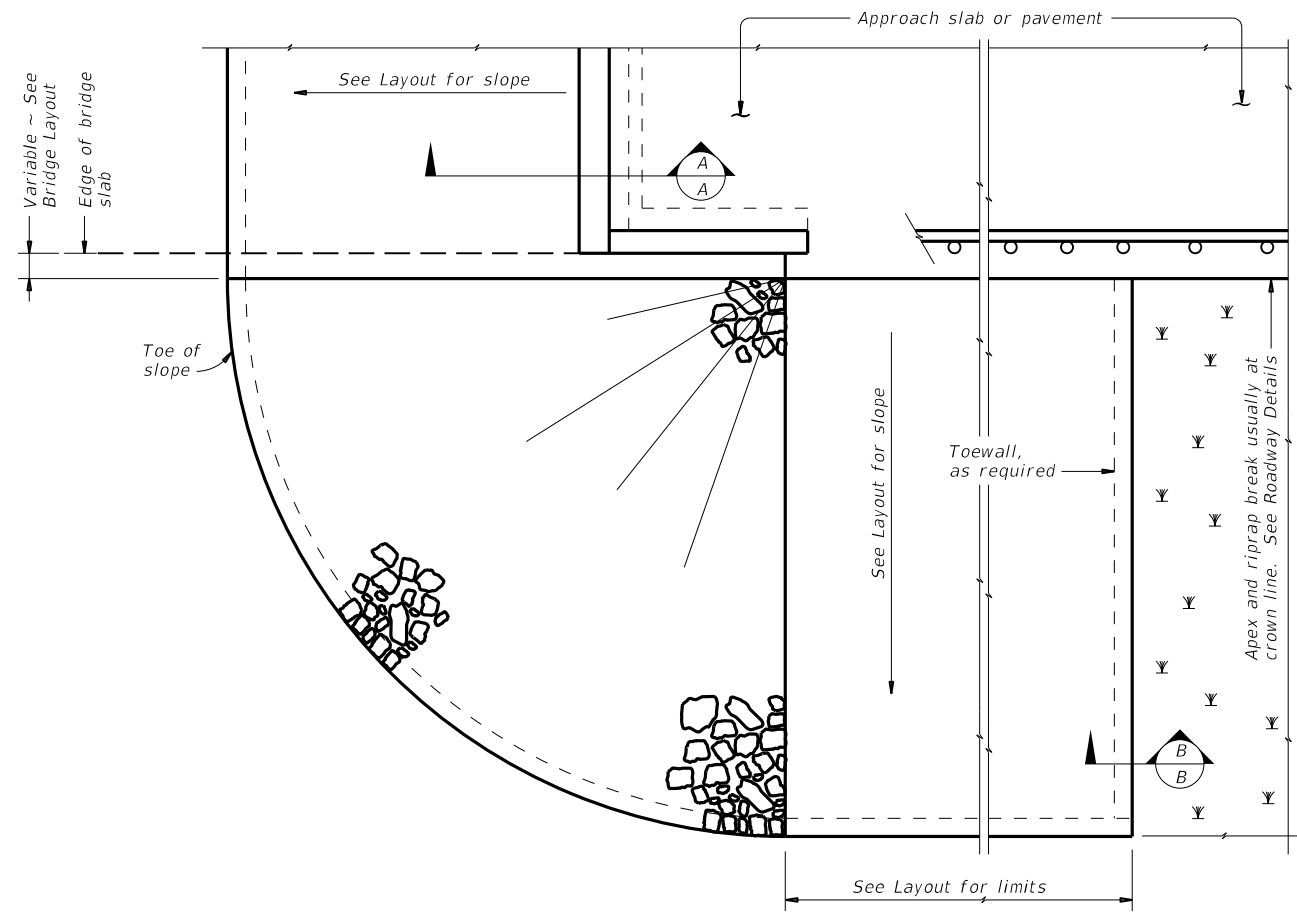
MULTIPLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

MC-MD

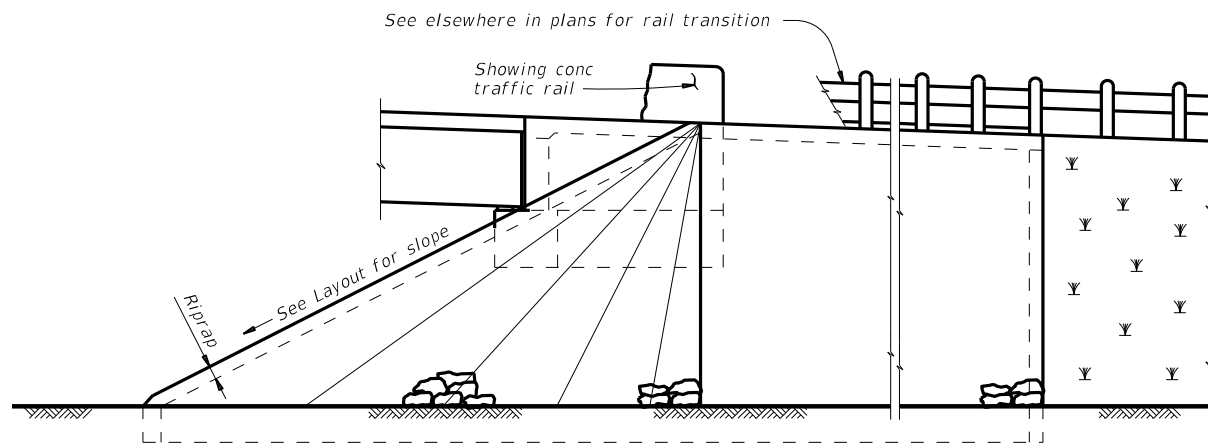
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©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM 2449
DIST	COUNTY	SHEET NO.		
DAL	DENTON	78		

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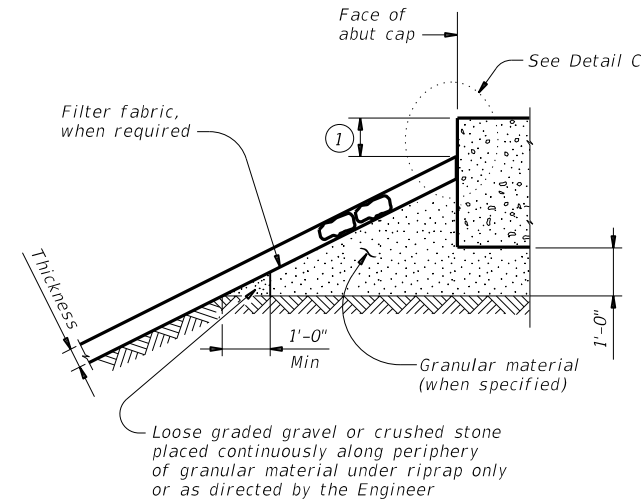
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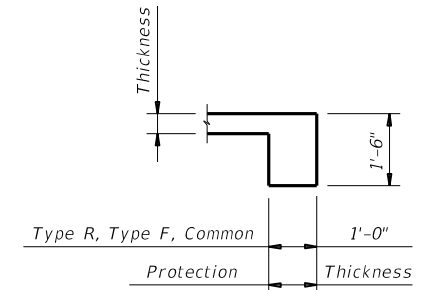
PLAN



ELEVATION

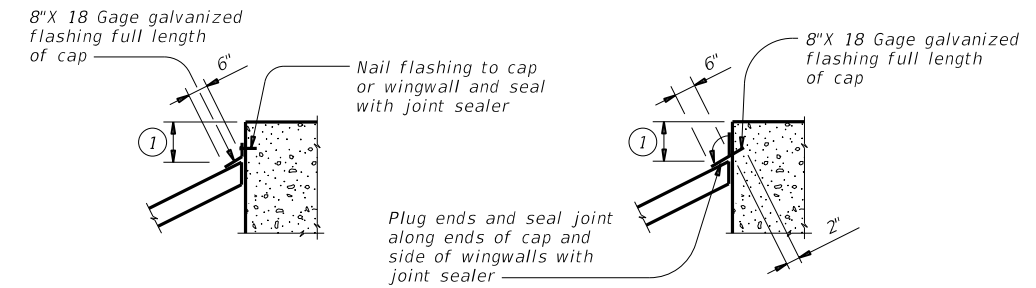


SECTION A-A AT CAP



SECTION B-B

Provide toewall when shoulder drain is located adjacent to limits of stone riprap. Omit toewall when thickness of protection riprap is greater than 18".



CAP OPTION A

CAP OPTION B

DETAIL C

① Top of cap to top of riprap dimension varies as directed by the Engineer. Provide 9" Min for beam/slab type bridges and 1'-6" for slab span, box beam, or slab beam bridges.

GENERAL NOTES:

Refer to Item 432, "Riprap" for stone size and gradation, and construction details. See Layout for limits and thickness of riprap specified.
 See elsewhere in plans for locations and details of shoulder drains.

SHEET 1 OF 2

		Bridge Division Standard	
<h1>STONE RIPRAP</h1>			
<h2>SRR</h2>			
FILE: srrstd1-19.dgn	DN: AES	CK: JGD	DW: BWH
©TxDOT April 2019	CONT	SECT	HIGHWAY
REVISIONS	2352	02	027 FM 2449
DIST	COUNTY	SHEET NO.	
DAL	DENTON	79	

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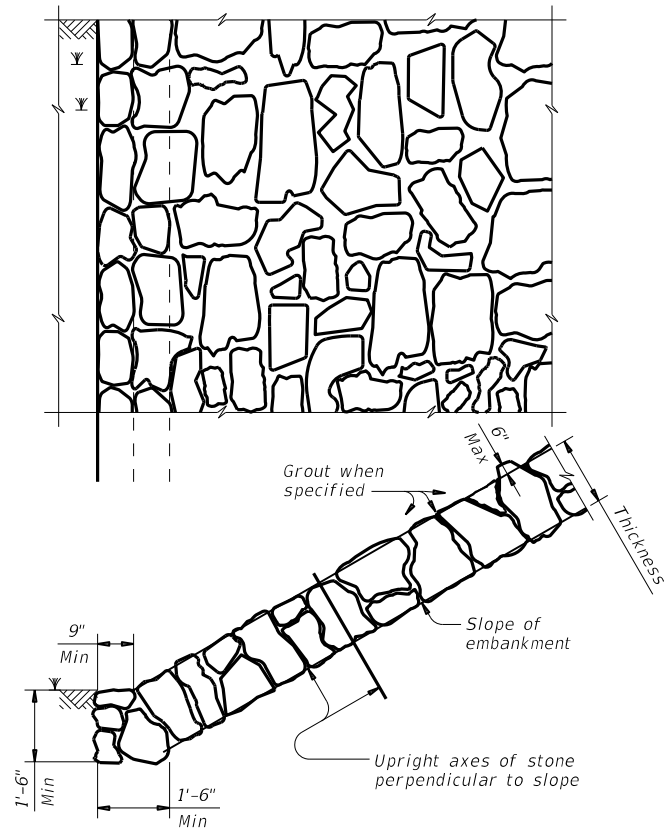


FIGURE 1 ~ TYPE R STONE RIPRAP
dry or grouted

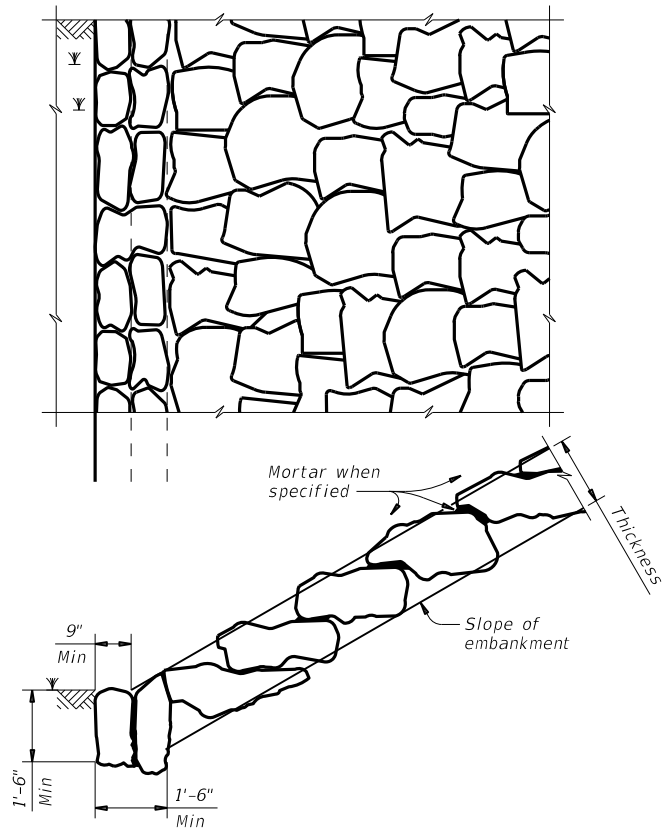


FIGURE 2 ~ TYPE F STONE RIPRAP
dry or mortared

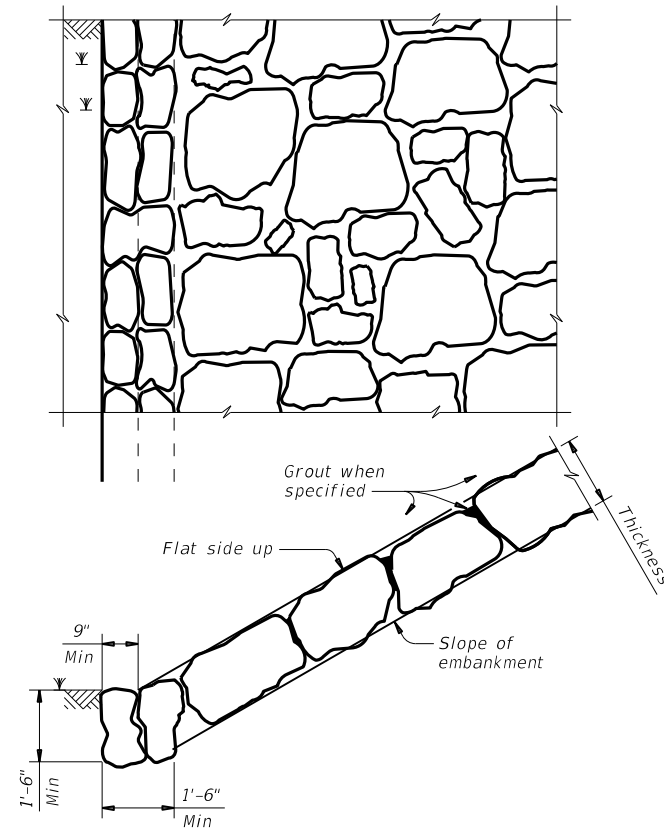
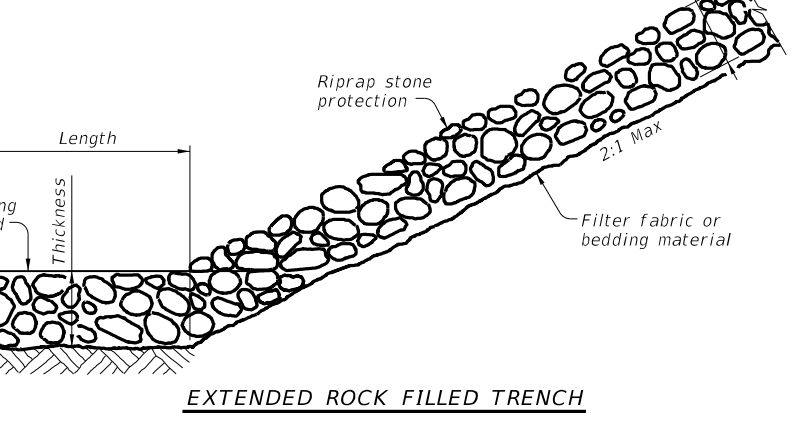
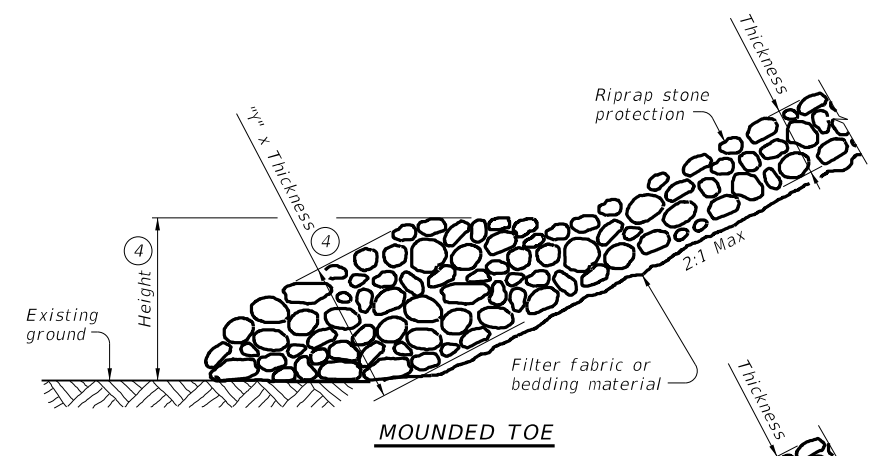


FIGURE 3 ~ TYPE F STONE RIPRAP
grouted

- ② Provide bedding material instead of filter fabric if shown elsewhere in plans. See Layout for thickness of bedding material.
- ③ Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.
- ④ "Y" and Height need to be defined. See layout or detail sheet for values if this option is used.
- ⑤ List Stone Protection as size (XX inch) and thickness (YY inch) on the layout.
Example: Riprap (Stone Protection) XX inch, Thickness = YY inch.



PROTECTION STONE RIPRAP TOE OPTIONS ⑤

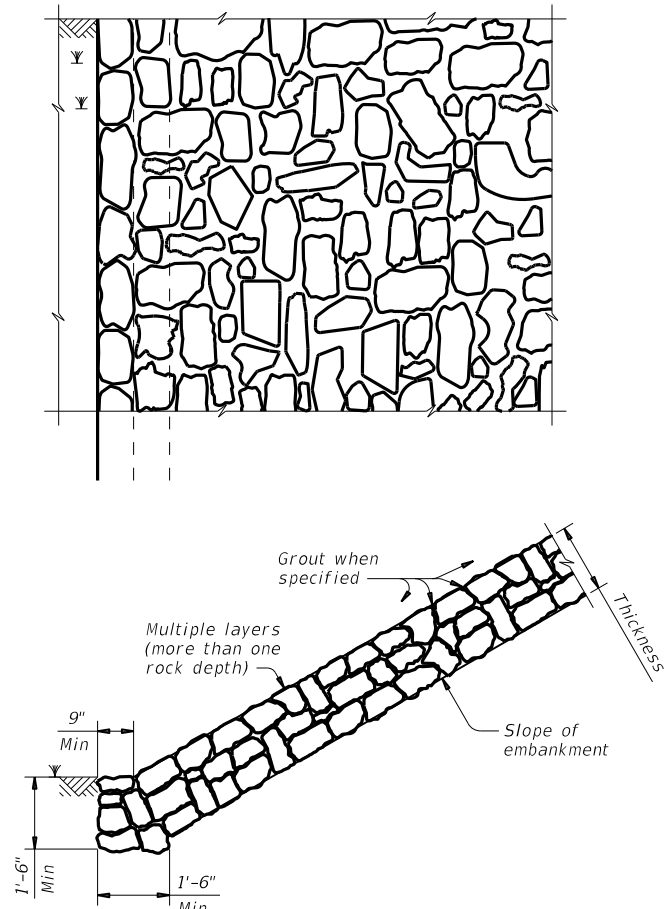


FIGURE 4 ~ COMMON STONE RIPRAP
dry or grouted

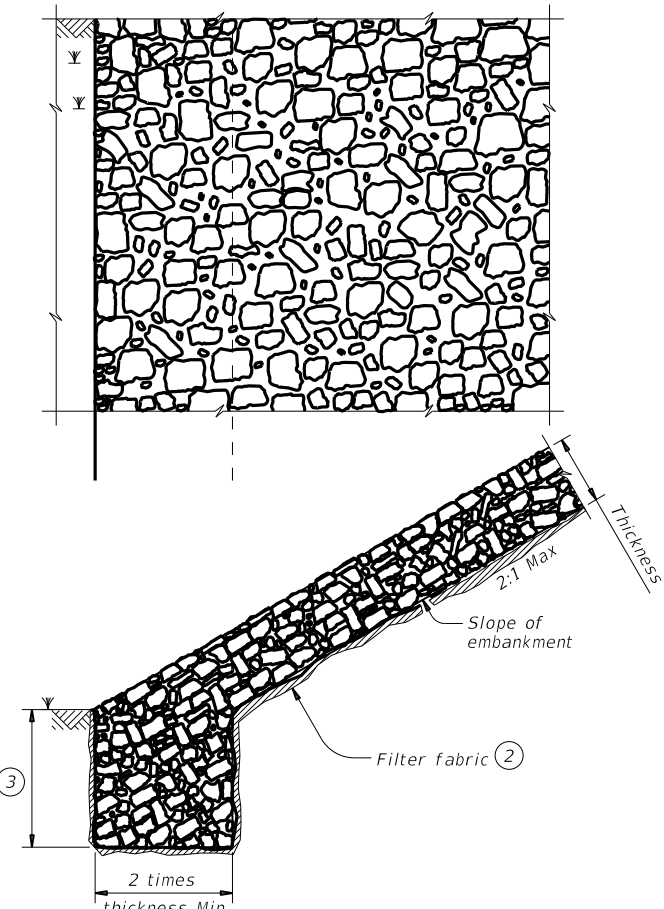


FIGURE 5 ~ PROTECTION STONE RIPRAP ⑤

		Bridge Division Standard	
<h2>STONE RIPRAP</h2>			
<h3>SRR</h3>			
FILE: srrside1-19.dgn	DN: AES	CK: JGD	DW: BWH
©TxDOT April 2019	CONT SECT	JOB	HIGHWAY
REVISIONS	2352 02	027	FM 2449
DIST	COUNTY	SHEET NO.	
DAL	DENTON	80	

SUMMARY OF SMALL SIGNS

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 DATE: 9/19/2022 2:13:05 PM
 FILE: I:\DENDES\Projects\FM2449\2352-02-027 Ponder_ISD\PLANS\13 TRAFFIC ITEMS\BLS\Signs.dgn

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"		1EXT or 2EXT = # of Ext BM = Extruded Wind Beam WC = 1.12 #/ft Wing Channel EXAL= Extruded Alum Sign Panels
1	1	S1-1 S4-3P W13-1P S4-4P	SYMBOL - PED CROSSING <PENTAGONAL> SCHOOL <PLAQUE> (SPEED) MPH <ADVISORY SPEED PLAQUE> WHEN FLASHING <PLAQUE>	36 x 36 24 x 8 18 x 18 24 x 10	X X X X		MOUNT ON SOLAR	POWER FLASHING BEACON				
1	2	M2-1 M1-6F	JCT <AUXILIARY SIGN> <FM SHIELD> FARM ROAD (ROUTE #)	21 x 15 24 x 24	X X		10BWG	1	SA	P		
1	3	R1-1	STOP	36 x 36	X		10BWG	1	SA	P		
1	4	R1-1	STOP	36 x 36	X		10BWG	1	SA	P		
1	5	R1-1	STOP	36 x 36	X		10BWG	1	SA	P		
1	6	W3-3	SYMBOL - SIGNALIZED INTERSECTION AHEAD	36 x 36	X		10BWG	1	SA	P		
1	7	D1-2	(DESTINATION - 2 LINE)	84 x 30	X		S80	1	SA	U	BM	
1	8	S1-1 S4-3P W13-1P S4-4P	SYMBOL - PED CROSSING <PENTAGONAL> SCHOOL <PLAQUE> (SPEED) MPH <ADVISORY SPEED PLAQUE> WHEN FLASHING <PLAQUE>	36 x 36 24 x 8 18 x 18 24 x 10	X X X X		MOUNT ON SOLAR	POWER FLASHING BEACON				
1	9	R2-1	SPEED LIMIT (SPEED)	30 x 36	X		10BWG	1	SA	P		
2	1	M3-3 M1-6F	SOUTH <AUXILIARY SIGN> <FM SHIELD> FARM ROAD (ROUTE #)	24 x 12 24 x 24	X X		10BWG	1	SA	P		
2	2	R12-1T	WEIGHT LIMIT/GROSS (WEIGHT) LBS	24 x 36	X		10BWG	1	SA	P		
2	3	W10-1	SYMBOL - GRADE XING ADVANCED WARNING	36 diameter	X		10BWG	1	SA	P		
2	4	M1-6F M6-4 W10-1	<FM SHIELD> FARM ROAD (ROUTE #) <ARROW - DUAL LEFT & RIGHT> <AUX. SIGN> SYMBOL - GRADE XING ADVANCED WARNING	24 x 24 21 x 15 36 diameter	X X X		10BWG	1	SA	U		
2	5	R8-8 W10-11A	DO NOT STOP ON TRACKS (FEET) FEET BETWEEN TRACKS AND HIGHWAY	24 x 30 30 x 36	X X		10BWG	1	SA	U		
2	6	M3-2 M1-6F	EAST <AUXILIARY SIGN> <FM SHIELD> FARM ROAD (ROUTE #)	24 x 12 24 x 24	X X		10BWG	1	SA	P		
2	7	R2-1	SPEED LIMIT (SPEED)	30 x 36	X		10BWG	1	SA	P		
2	8	R1-1	STOP	36 x 36	X		10BWG	1	SA	P		
2	9	D1-2	(DESTINATION - 2 LINE)	84 x 30	X		S80	1	SA	U	BM	
2	10	D2-1	(DESTINATION) (DISTANCE) <1 LINE>	72 x 18	X		10BWG	1	SA	T		
2	11	W10-1	SYMBOL - GRADE XING ADVANCED WARNING	36 diameter	X		10BWG	1	SA	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/>

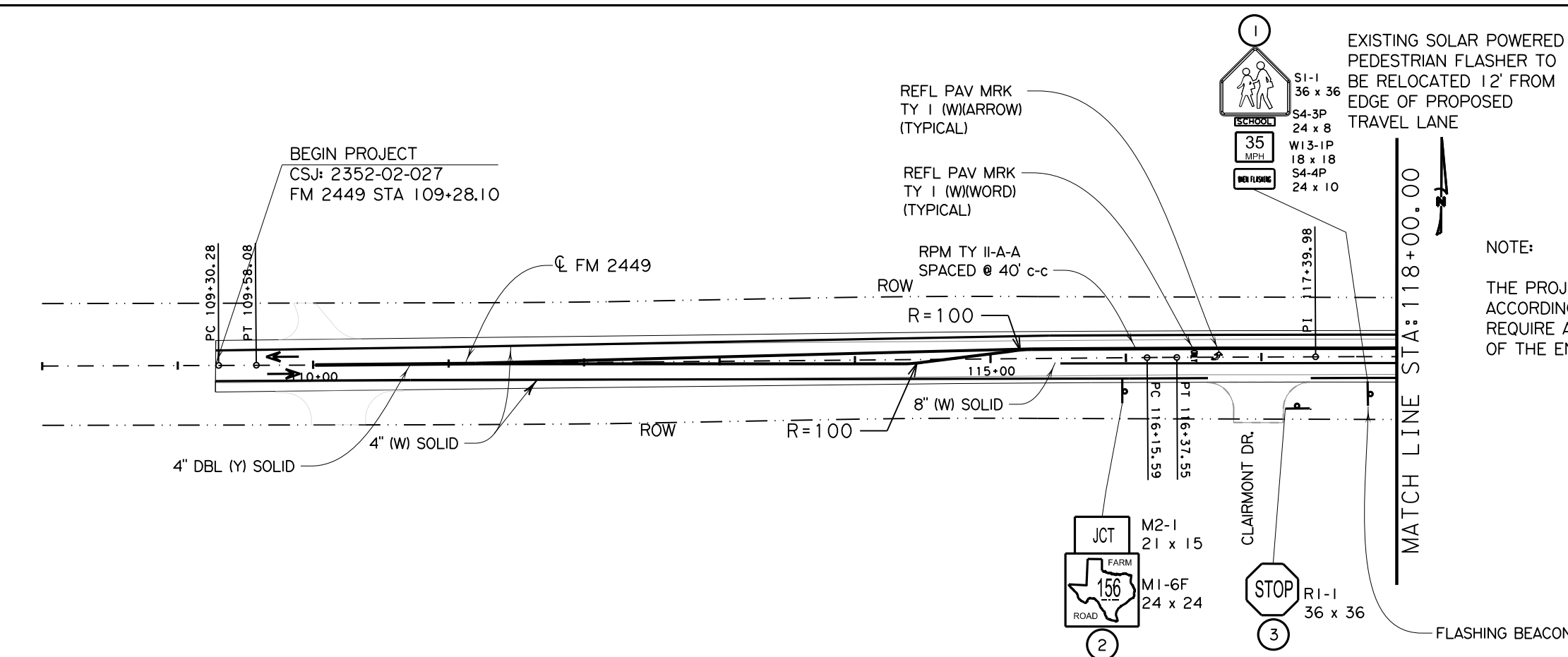
- NOTE:**
- Sign supports shall be located as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise shown on the plans, the Contractor shall stake and 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).



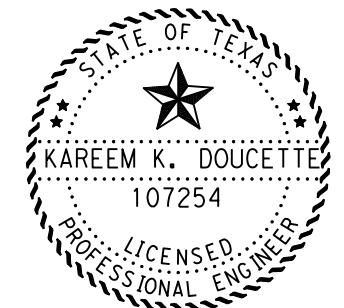
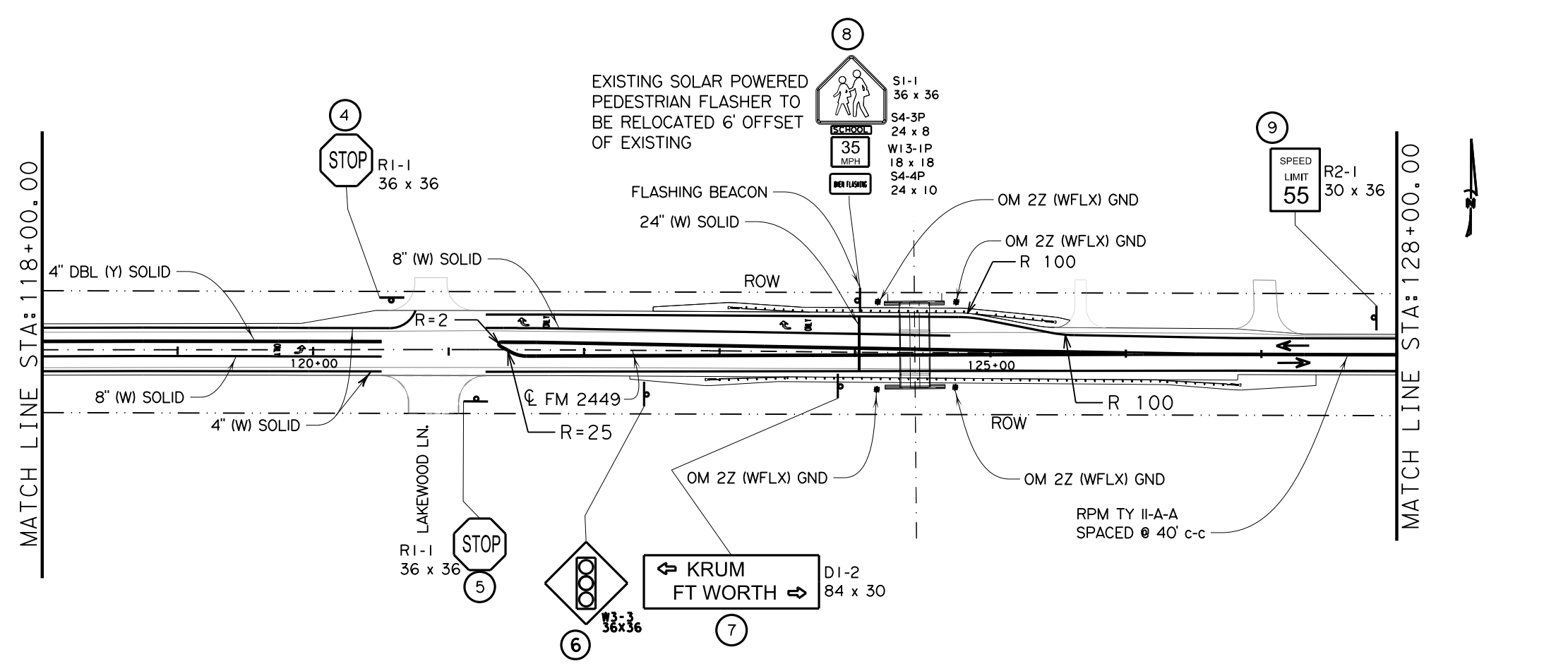
SUMMARY OF SMALL SIGNS

SOSS

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© TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
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4-16	DIST	COUNTY	SHEET NO.	
8-16	DAL	DENTON	81	

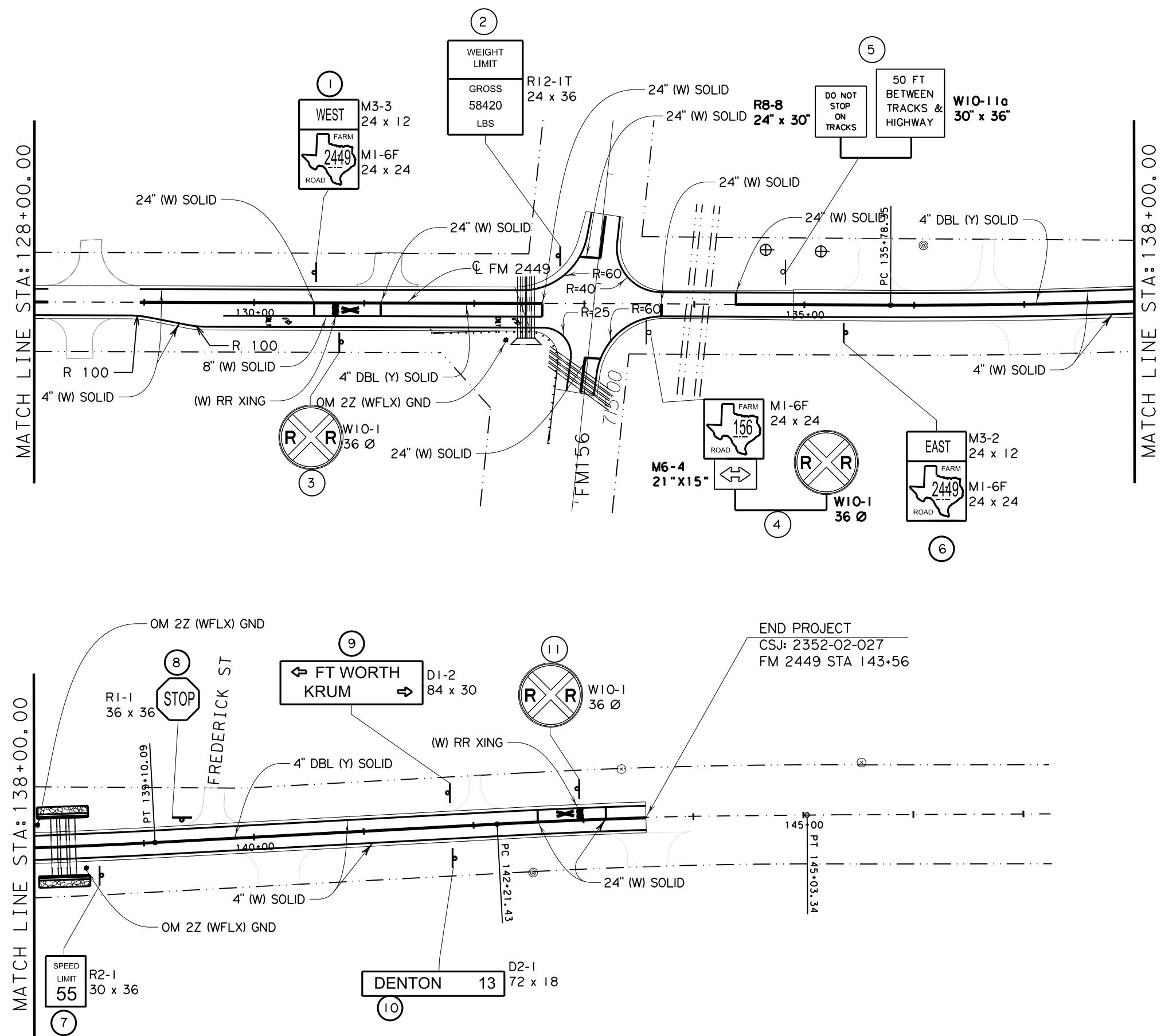
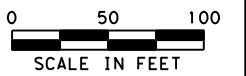


NOTE:
 THE PROJECT'S ADVANCE WARNING SIGNAGE SHALL BE PLACED ACCORDING TO THE BC STANDARDS (BC (2)-2.1). SIGNS MAY REQUIRE ADJUSTMENTS IN THE FIELD BUT ONLY WITH APPROVAL OF THE ENGINEER.

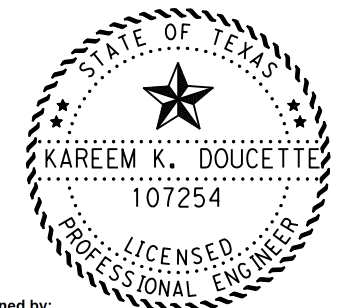


DocuSigned by:
 Kareem Doucette 9/26/2022
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Texas Department of Transportation			
© 2022			
FM 2449			
PAVEMENT MARKING, SIGNING & DELINEATION			
STA 109+28.10 to STA 128+00.00			
SCALE: 1" = 100'		SHEET 1 OF 2	
DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)	
GRAPHICS KKD	STATE TEXAS	DISTRICT DAL	COUNTY DENTON
CHECK KKD	CONTROL 2352	SECTION 02	JOB 027
			82



NOTE:
THE PROJECT'S ADVANCE WARNING SIGNAGE SHALL BE PLACED ACCORDING TO THE BC STANDARDS (BC (2)-2.1). SIGNS MAY REQUIRE ADJUSTMENTS IN THE FIELD BUT ONLY WITH APPROVAL OF THE ENGINEER.



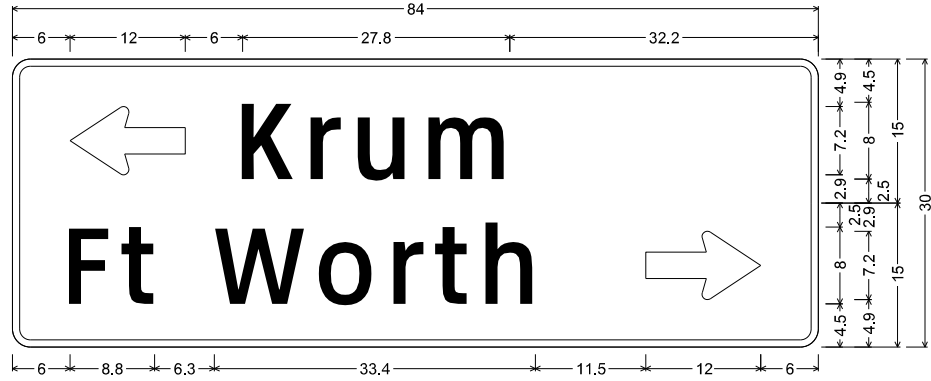
DocuSigned by:
Kareem Doucette 9/20/2022
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FM 2449
PAVEMENT MARKING,
SIGNING & DELINEATION
STA 128+00.00 to STA 133+07.87

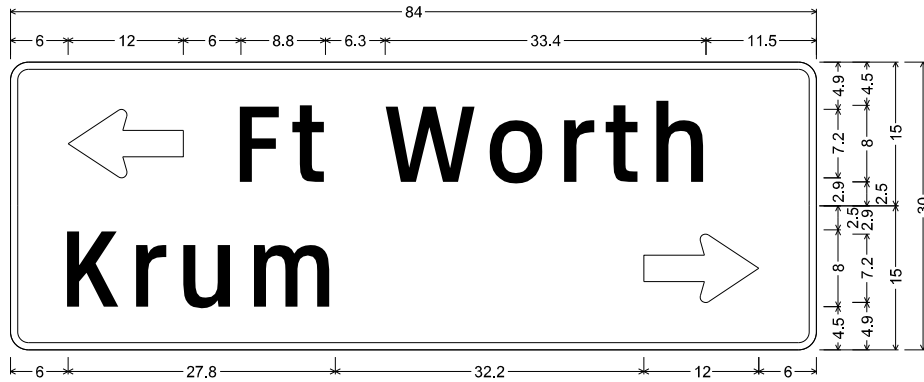
SCALE: 1" = 100' SHEET 2 OF 2

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
KKD	6	(See Title Sheet)		FM2449
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DAL	DENTON	83
CHECK	CONTROL	SECTION	JOB	
	2352	02	027	



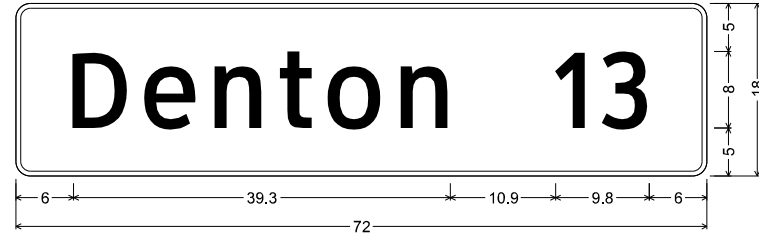
D1-2 8in LT-RT;
 1.9" Radius, 0.8" Border, White on Green;
 Standard Arrow Custom 12.0" X 7.1" 180"; "Krum", ClearviewHwy-3-W;
 1.9" Radius, 0.8" Border, White on Green;
 "Ft Worth", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0°;

SHEET 1 (S-7)



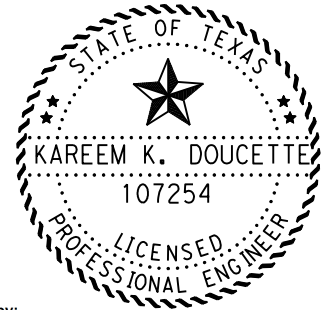
D1-2 8in LT-RT;
 1.9" Radius, 0.8" Border, White on Green;
 Standard Arrow Custom 12.0" X 7.1" 180"; "Ft Worth", ClearviewHwy-3-W;
 1.9" Radius, 0.8" Border, White on Green;
 "Krum", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0°;

SHEET 2 (S-9)



D2-1 8in;
 1.5" Radius, 0.5" Border, White on Green;
 "Denton", ClearviewHwy-3-W; "13", ClearviewHwy-3-W;

SHEET 2 (S-10)



DocuSigned by:
Kareem Doucette 9/20/2022
 51C8F8A7FBD948C...

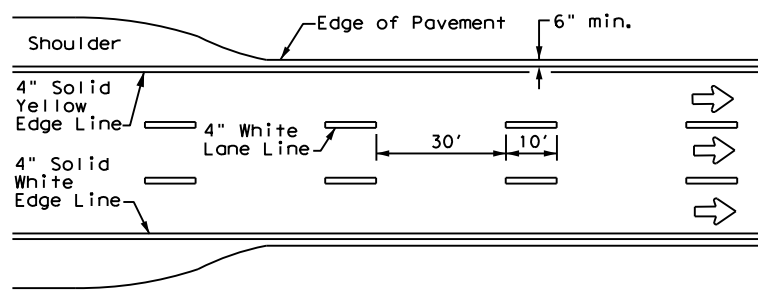


**FM 2449
 SIGN DETAILS**

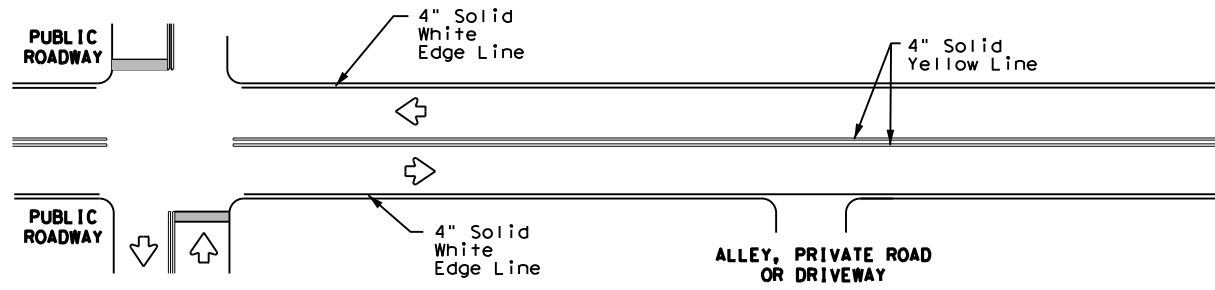
SHEET 1 OF 1

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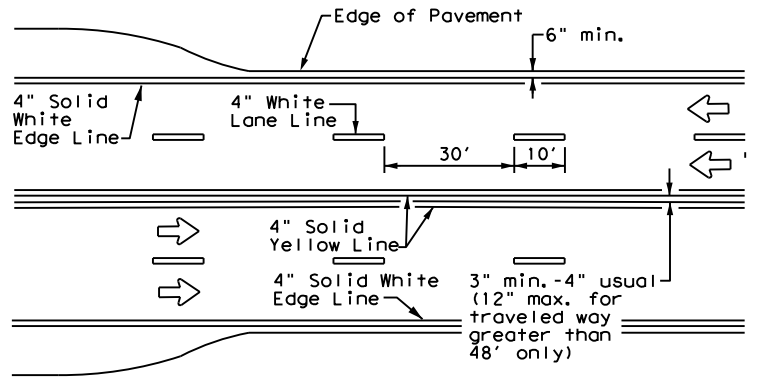
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 Ponder ISD\PLANS\13 TRAFFIC ITEMS\13 STANDARD PAVEMENT MARKINGS.dwg
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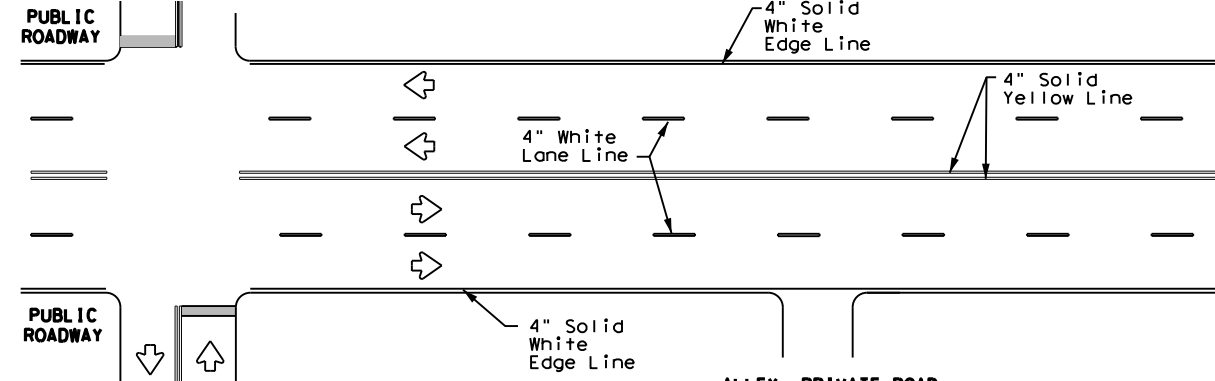
**EDGE LINE AND LANE LINES
ONE-WAY ROADWAY
WITH OR WITHOUT SHOULDERS**



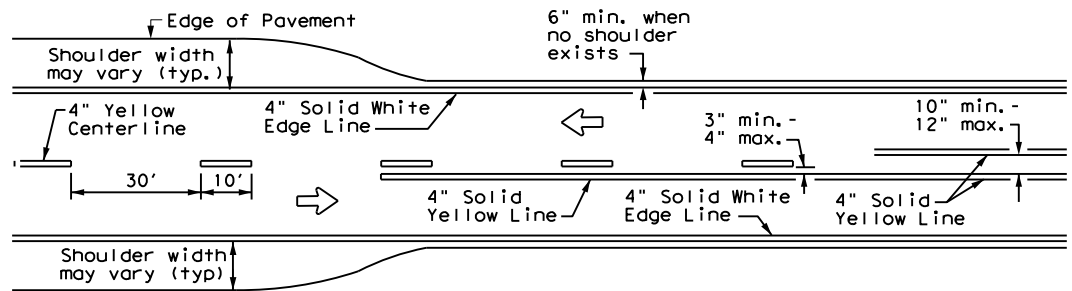
**TYPICAL TWO-LANE, TWO-WAY PAVEMENT
MARKINGS THROUGH INTERSECTIONS**



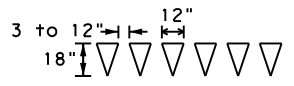
**CENTERLINE AND LANE LINES
FOUR LANE TWO-WAY ROADWAY
WITH OR WITHOUT SHOULDERS**



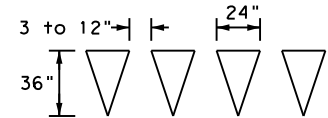
**TYPICAL MULTI-LANE, TWO-WAY PAVEMENT
MARKINGS THROUGH INTERSECTIONS**



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

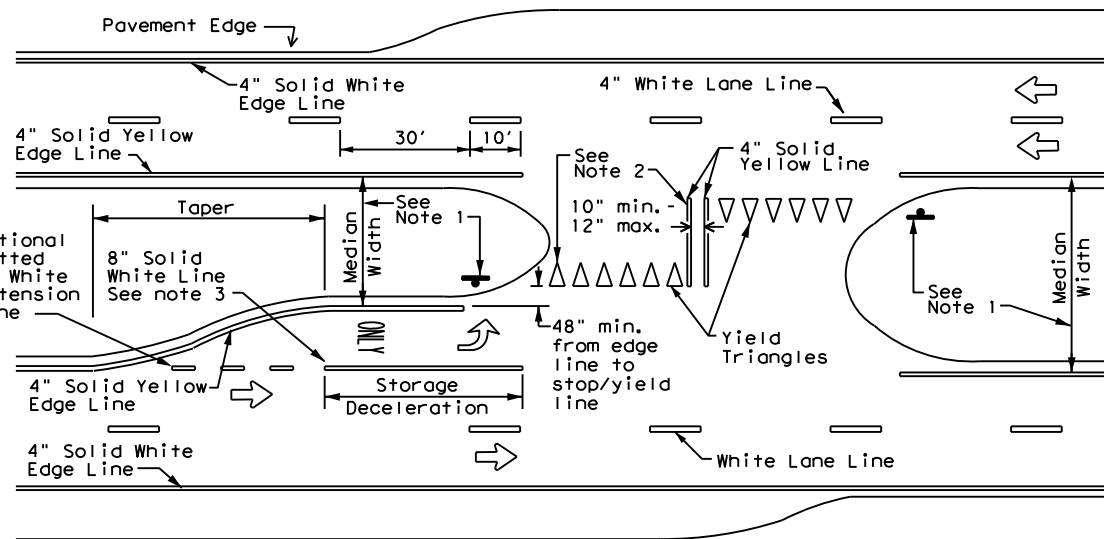


For posted speed on road being marked equal to or less than 40 MPH.



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

YIELD LINES



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

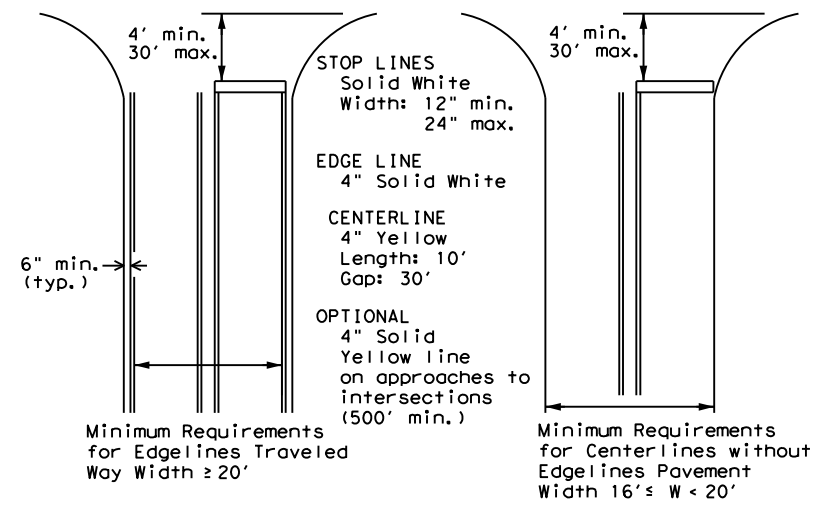
- Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs are optional as determined by the Engineer.
- 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.
- Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

GENERAL NOTES

- 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.
- 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



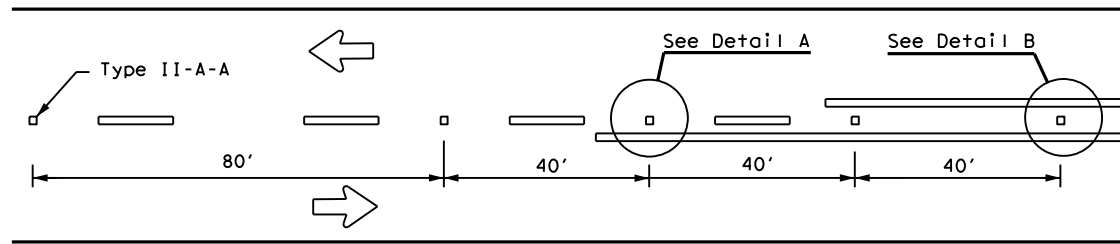
**TYPICAL STANDARD
PAVEMENT MARKINGS**

PM(1)-20

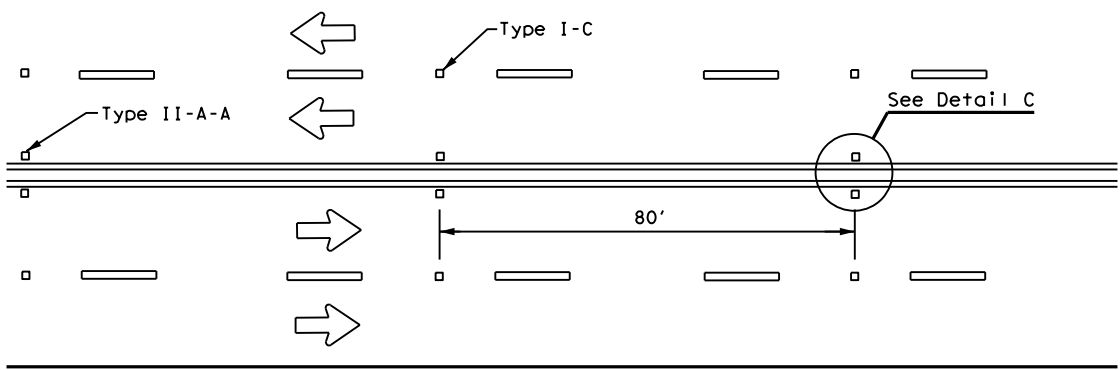
FILE: pm1-20.dgn	DN:	CK:	DW:	CK:
© TxDOT November 1978	CONT	SECT	JOB	HIGHWAY
8-95 3-03 REVISIONS	2352	02	027	FM 2449
5-00 2-12	DIST	COUNTY	SHEET NO.	
8-00 6-20	DAL	DENTON	85	

REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE

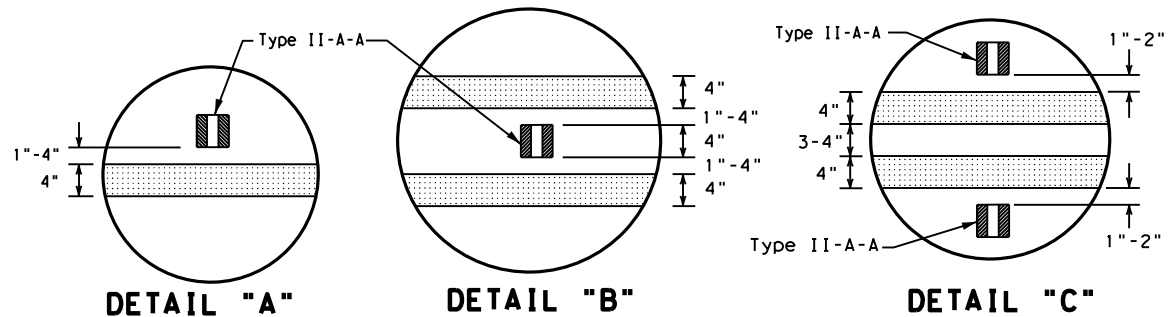
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of items to metric units or for incorrect results or damages resulting from its use.
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CENTERLINE FOR ALL TWO LANE ROADWAYS



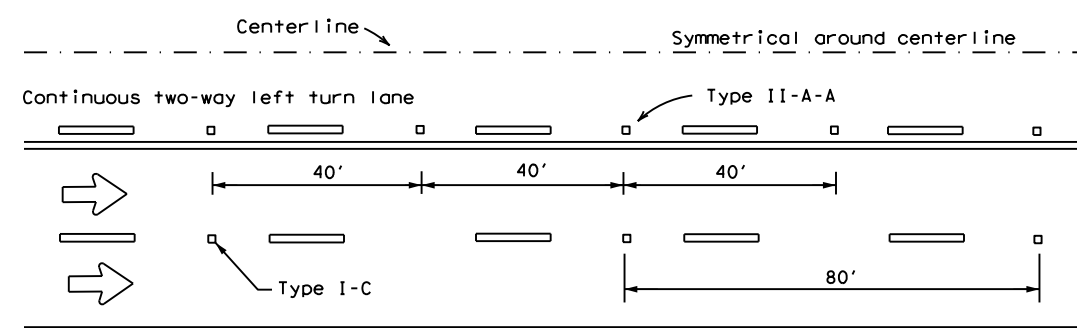
**CENTERLINE & LANE LINES
FOR FOUR LANE TWO-WAY HIGHWAYS**



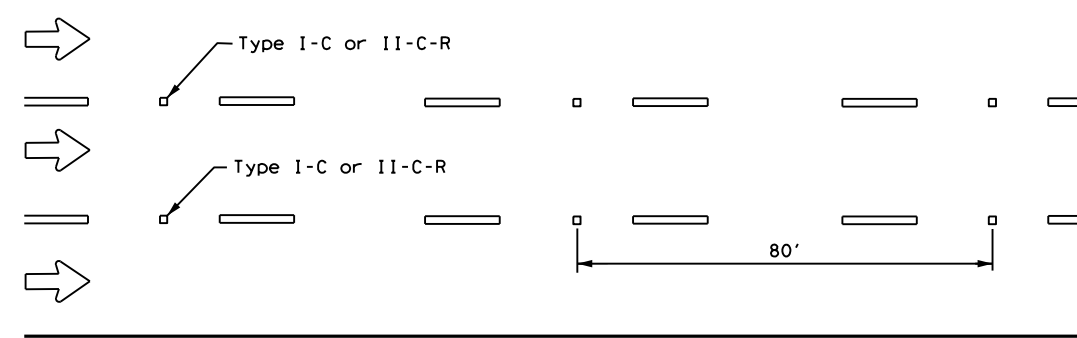
DETAIL "A"

DETAIL "B"

DETAIL "C"

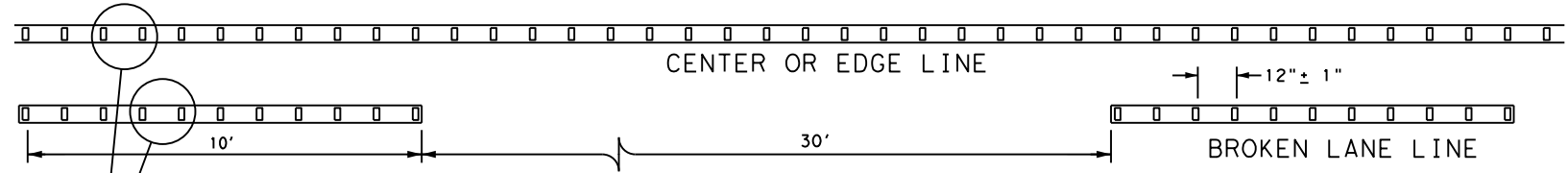


CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



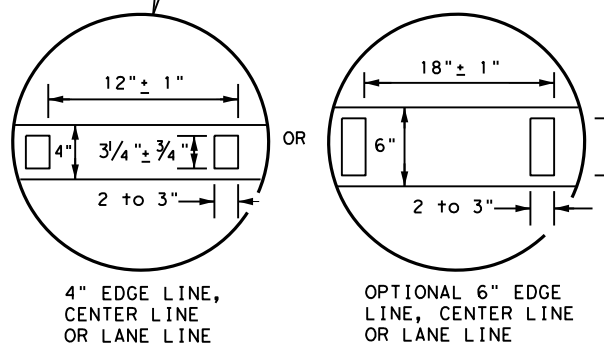
LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

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



**REFLECTORIZED PROFILE
PATTERN DETAIL**

USING REFLECTIVE PROFILE PAVEMENT MARKINGS



**4" EDGE LINE,
CENTER LINE
OR LANE LINE**

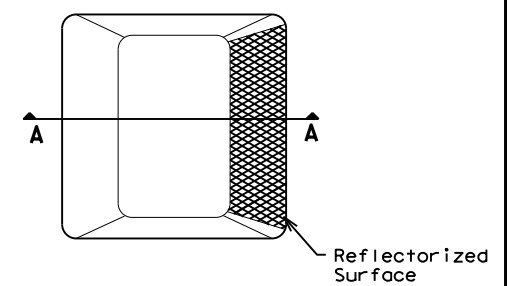
**OPTIONAL 6" EDGE
LINE, CENTER LINE
OR LANE LINE**

NOTE

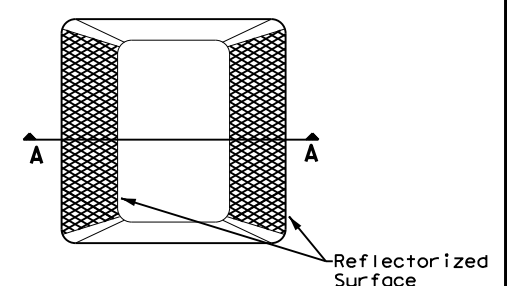
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

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

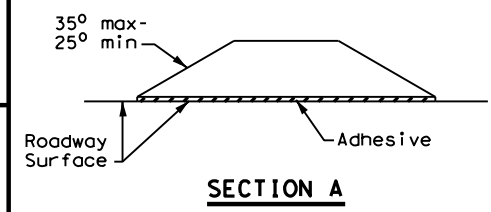
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)



Type II (Top View)



RAISED PAVEMENT MARKERS

GENERAL NOTES

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

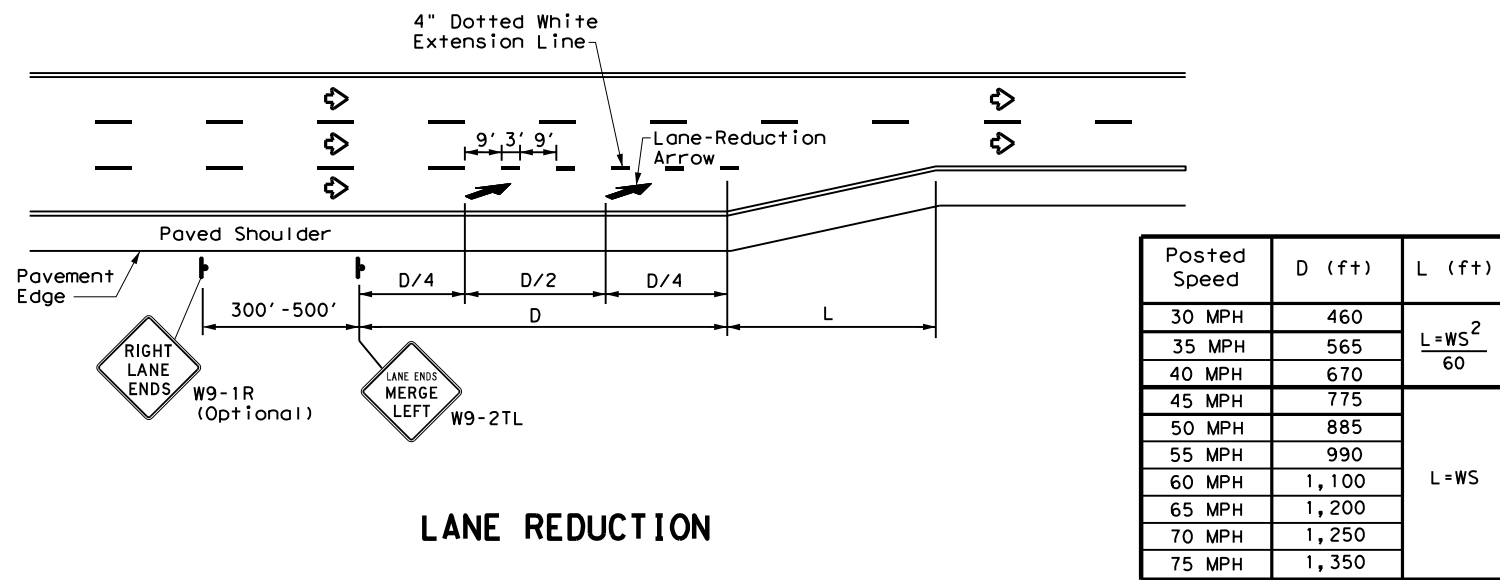
Texas Department of Transportation

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	2352	02	027	FM 2449
5-00 2-12	DIST	COUNTY		SHEET NO.
8-00 6-20	DAL	DENTON		86

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DATE: 04/13/2006 2:13:44 PM
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Posted Speed	D (ft)	L (ft)
30 MPH	460	$L = \frac{WS^2}{60}$
35 MPH	565	
40 MPH	670	L = WS
45 MPH	775	
50 MPH	885	
55 MPH	990	
60 MPH	1,100	
65 MPH	1,200	
70 MPH	1,250	
75 MPH	1,350	

NOTES

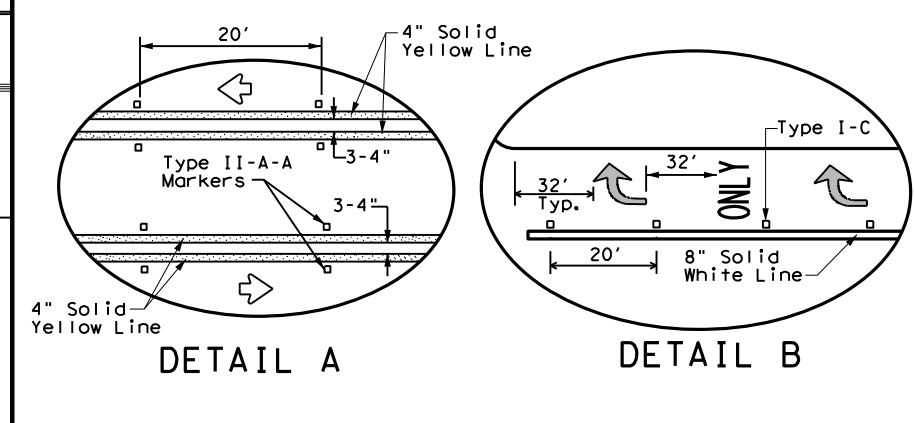
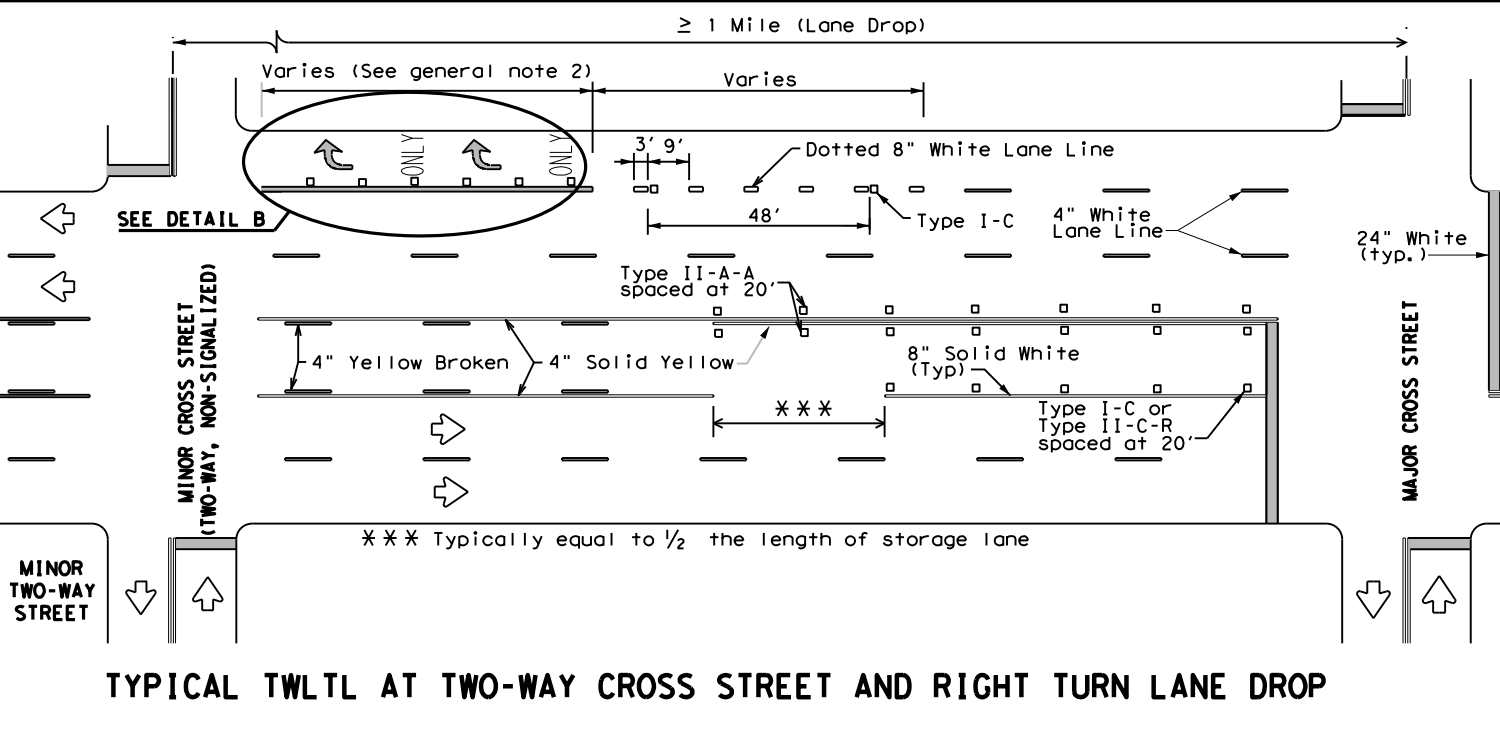
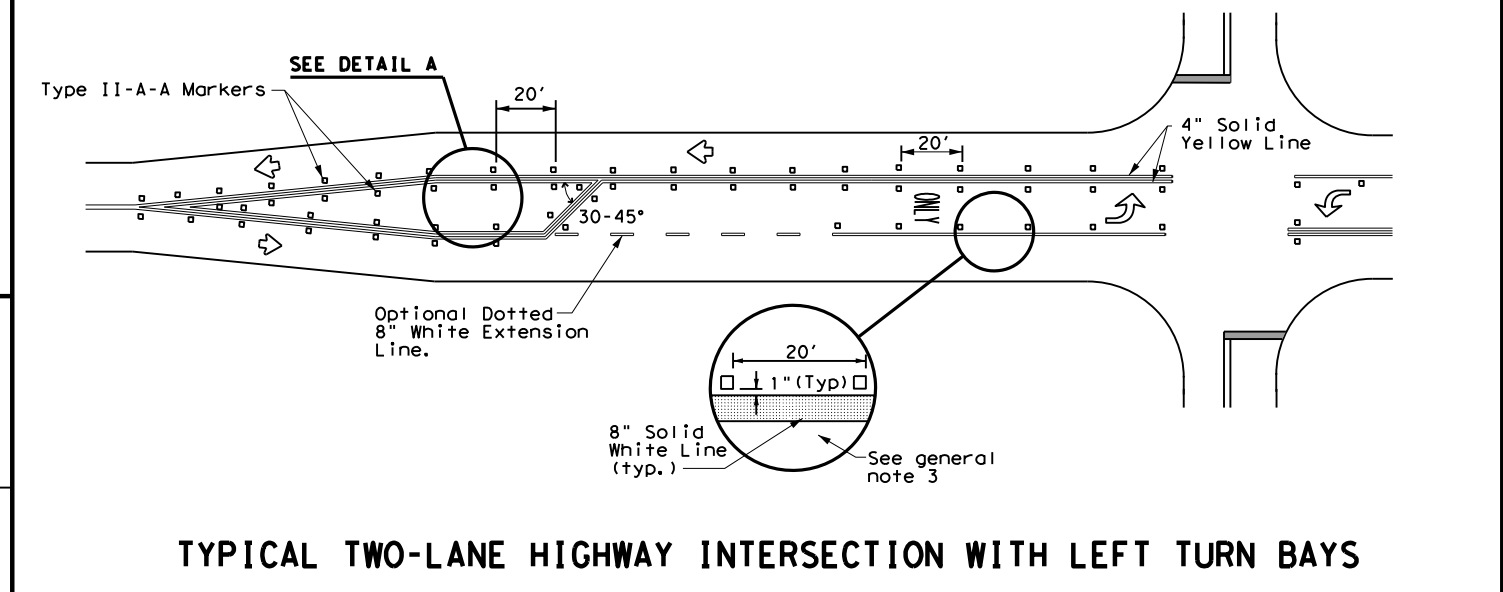
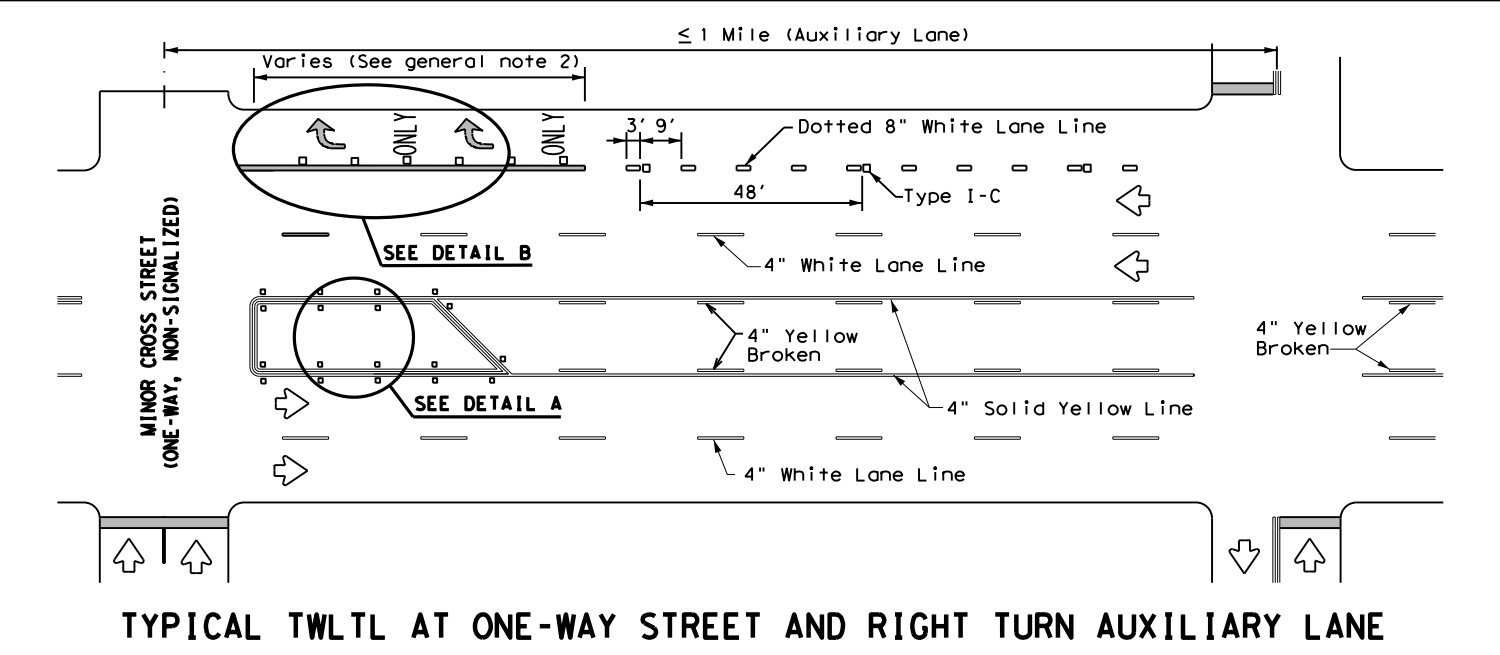
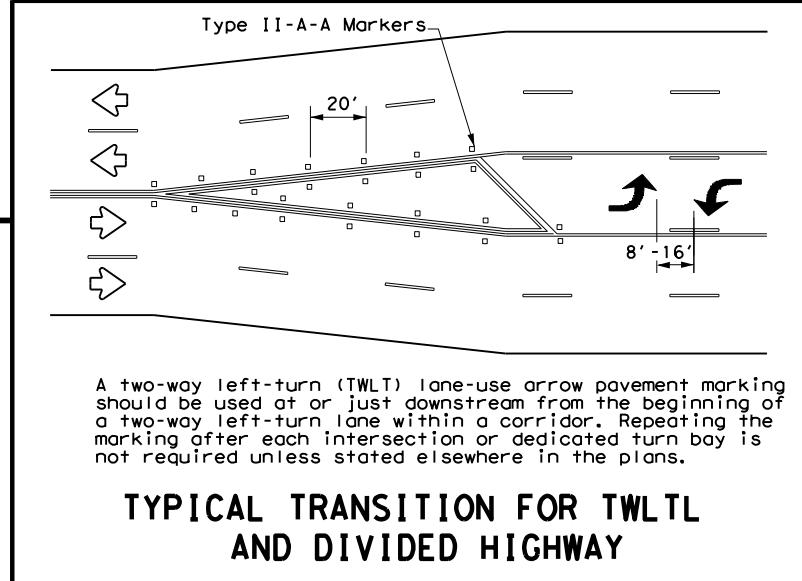
- Lane reduction pavement markings are used where the number of through lanes is reduced because of narrowing of the roadway or because of a section of on-street parking in what would otherwise be a through lane. For Texas Super 2 Passing Lanes, see TS2(PL) standard sheets.
- On divided highways, an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

GENERAL NOTES

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

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.



Texas Department of Transportation
 Traffic Safety Division Standard

TWO-WAY LEFT TURN LANES,
 RURAL LEFT TURN BAYS,
 AND LANE REDUCTION
 PAVEMENT MARKINGS
 PM(3)-20

FILE: pm3-20.dgn	DWG: CK:	DW: CK:
© TxDOT April 1998	CONT SECT	JOB HIGHWAY
REVISIONS	2352 02	027 FMH049
5-00 2-10	DIST	COUNTY SHEET NO.
8-00 2-12	D&E	DEWITT 87
3-03 6-20		

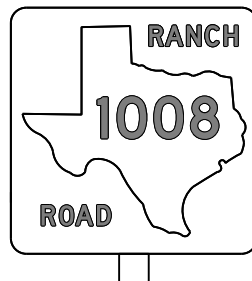
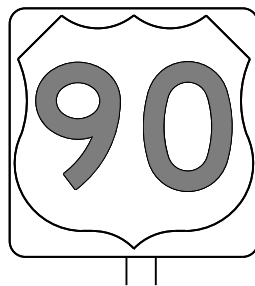
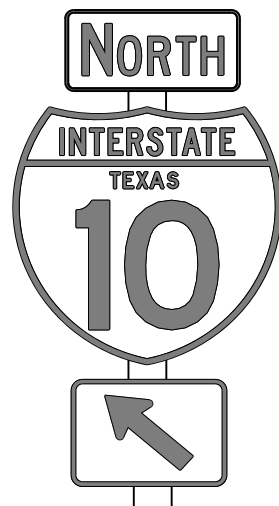
22C

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DATE: 9/19/2022 2:13:45 PM
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REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

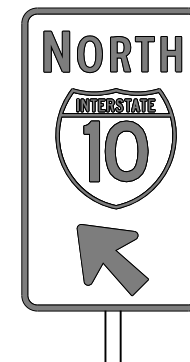
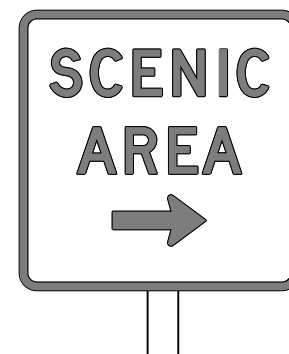
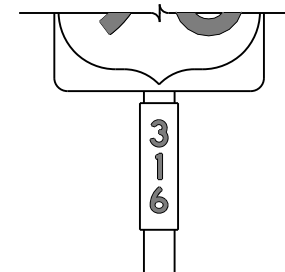
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE A SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B or C SHEETING



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/>

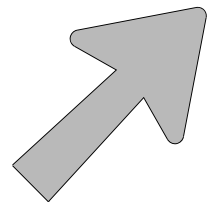
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<h3>TSR(3) - 13</h3>			
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©TxDOT	October 2003	CK:	TxDOT
REVISIONS		DW:	TxDOT
		CONT	SECT
		2352	02
		JOB	027
		HIGHWAY	FM2449
12-03	7-13	DIST	COUNTY
9-08		DAL	DENTON
		SHEET NO.	88

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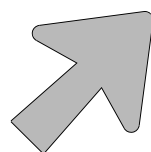
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ARROW DETAILS

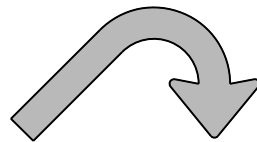
for Large Ground-Mounted and Overhead Guide Signs



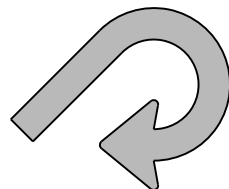
Type A



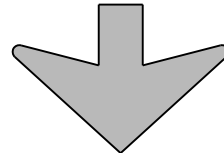
Type B



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

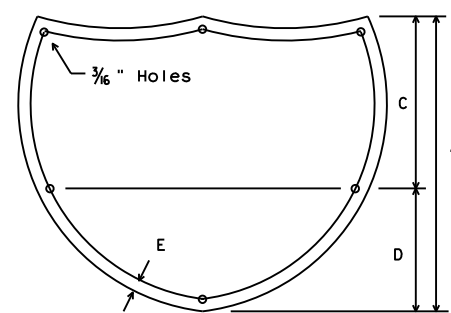
NOTE

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.

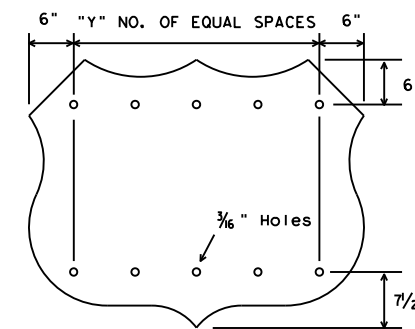
<http://www.txdot.gov/>

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



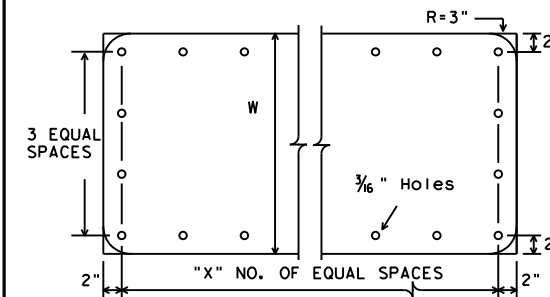
INTERSTATE ROUTE MARKERS

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



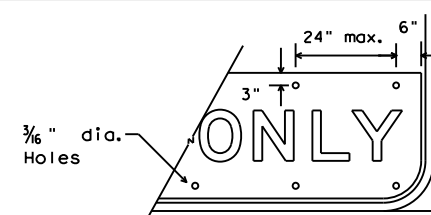
U.S. ROUTE MARKERS

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



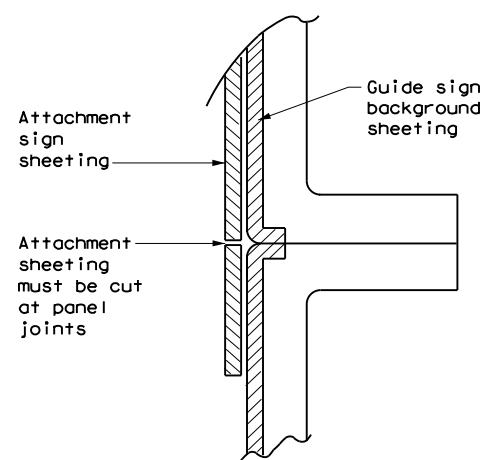
STATE ROUTE MARKERS

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

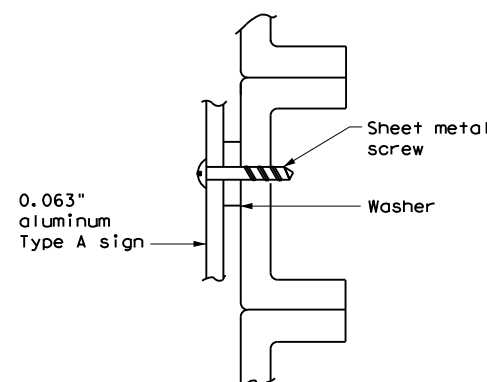
MOUNTING DETAILS OF ATTACHMENTS TO GUIDE SIGN FACE ("EXIT ONLY" AND "LEFT EXIT" PANELS, ROUTE MARKERS AND OTHER ATTACHMENTS)



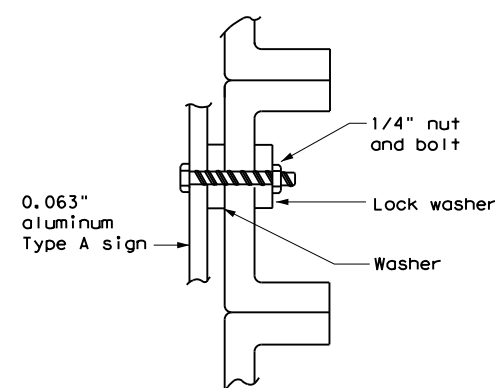
DIRECT APPLIED ATTACHMENT

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".



SCREW ATTACHMENT

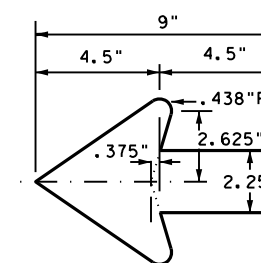


NUT/BOLT ATTACHMENT

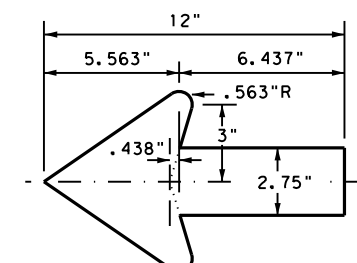
NOTE:

Furnish Type A aluminum sign attachments only when specified in the plans. These signs will be paid for under "Aluminum 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	CR: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM2449
12-03 7-13	DIST	COUNTY	SHEET NO.	
9-08	DAL	DENTON	90	

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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)

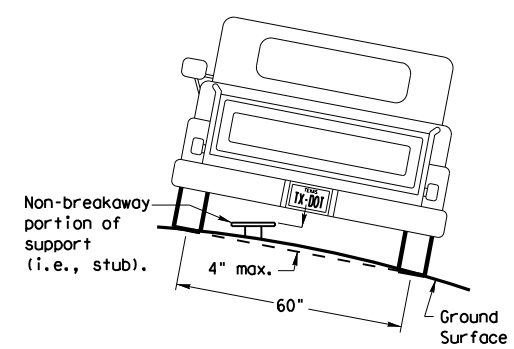
Post Type
 FRP = Fiberglass Reinforced Plastic Pipe (see SMD(FRP))
 TWT = Thin-Walled Tubing (see SMD(TWT))
 10BWG = 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))
 S80 = Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

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))

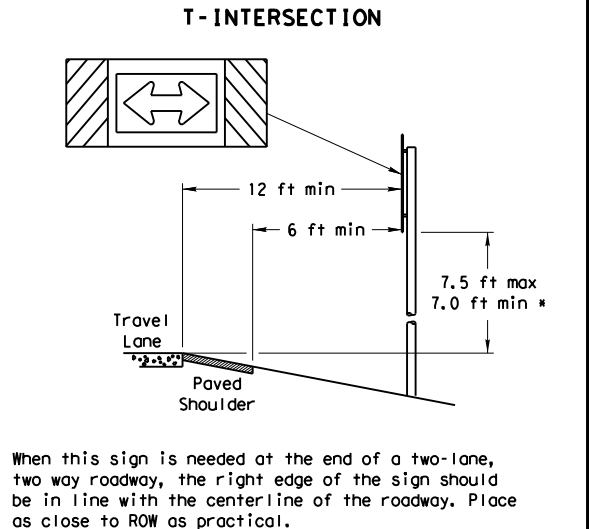
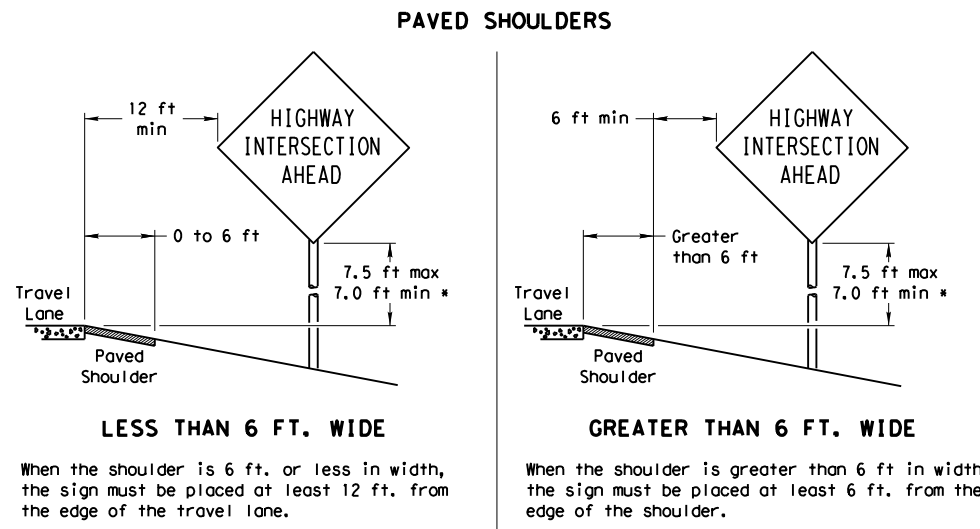
Sign Mounting Designation
 P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
 T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
 U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))
 IF REQUIRED
 1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
 BM = Extruded Wind Beam (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

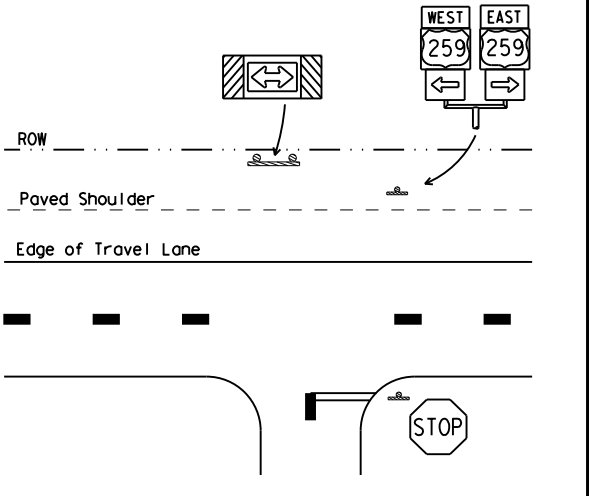
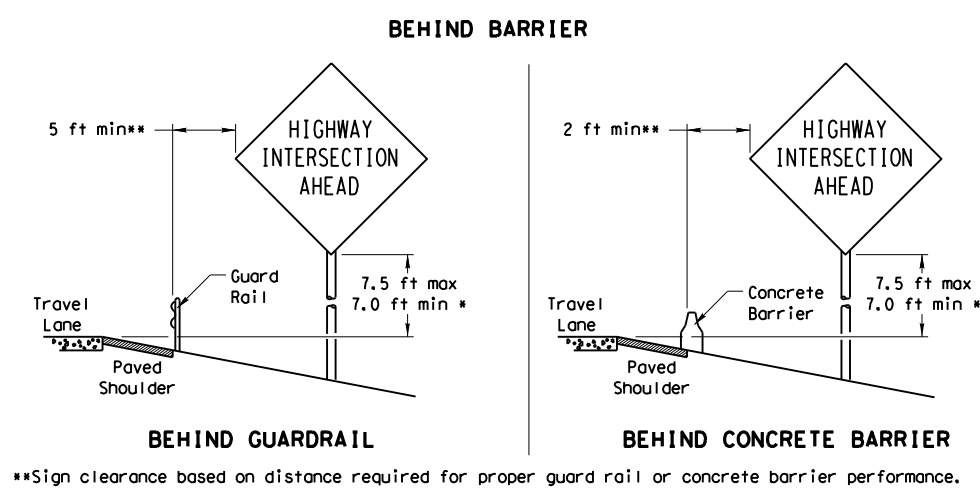
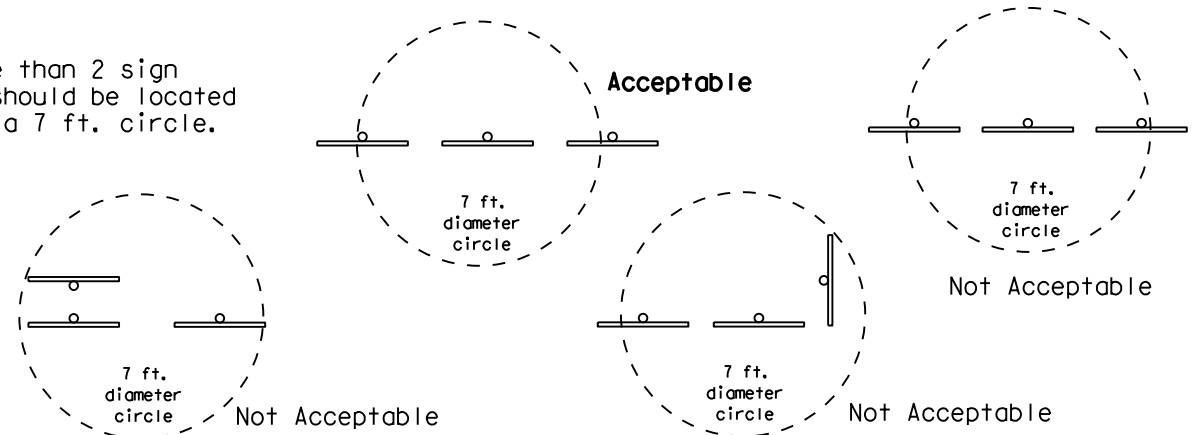


To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

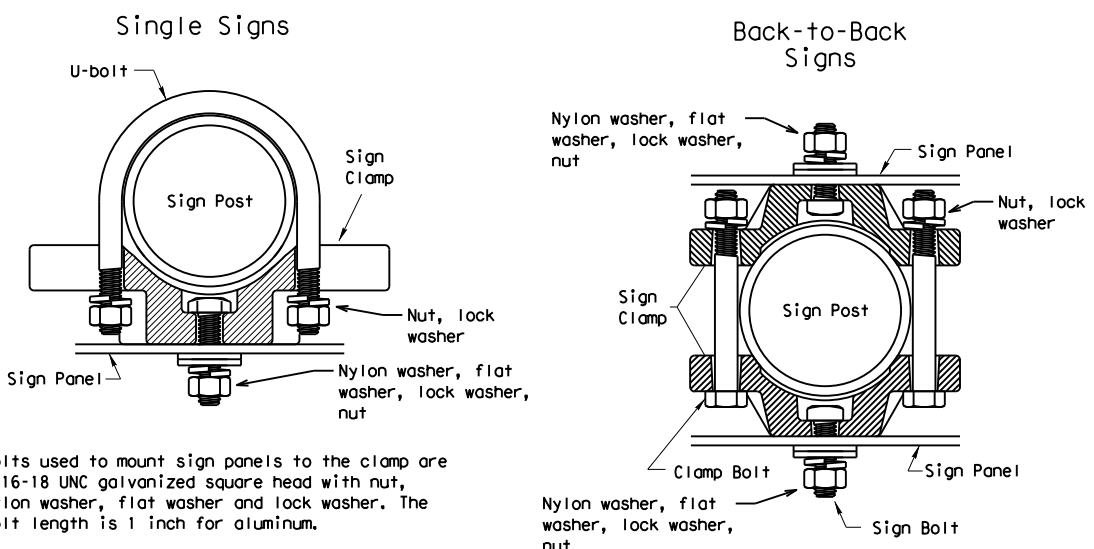
SIGN LOCATION



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



TYPICAL SIGN ATTACHMENT DETAIL



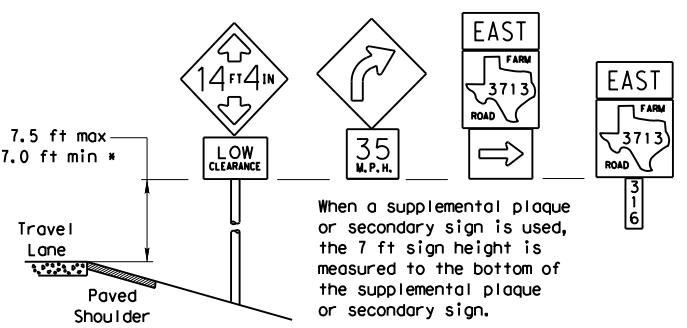
Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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.

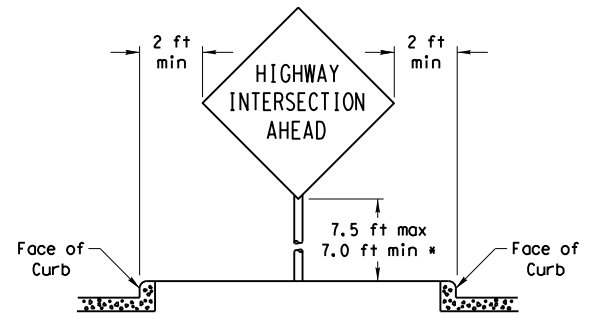
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES

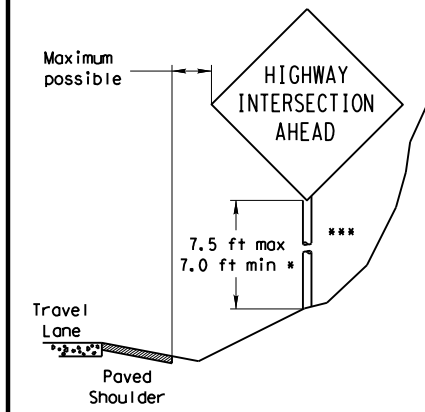


When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

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>

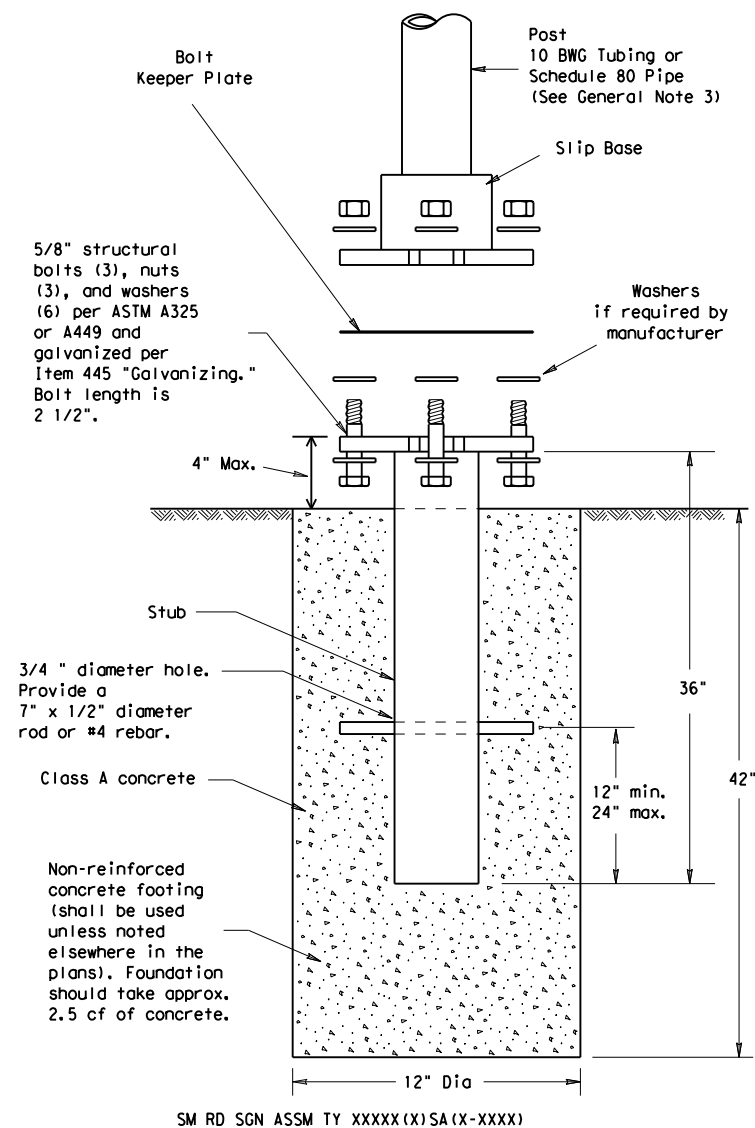


SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS SMD(GEN)-08

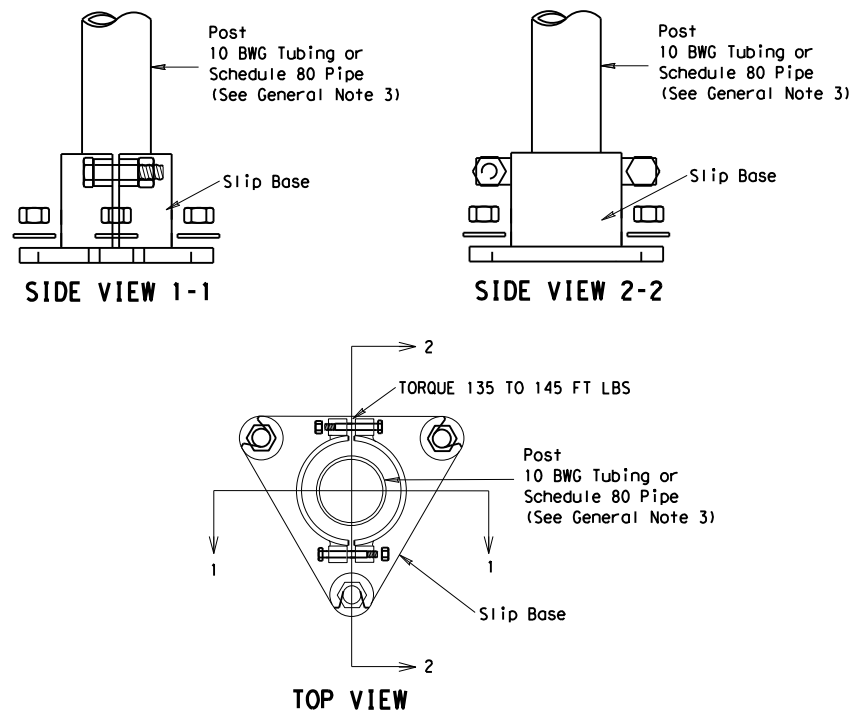
© TxDOT July 2002		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
		2352	02	027	FM2449
		DIST	COUNTY		SHEET NO.
		DAL	DENTON		91

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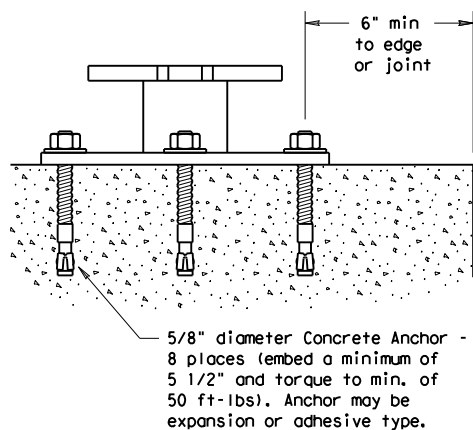
TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



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



CONCRETE ANCHOR



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.

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.

ADDED DETAIL A FOR CLAMP BASE
10-2010

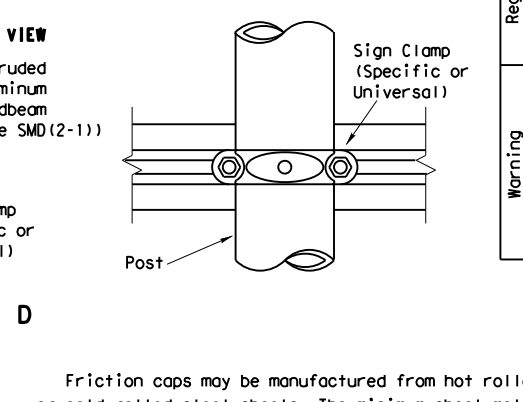
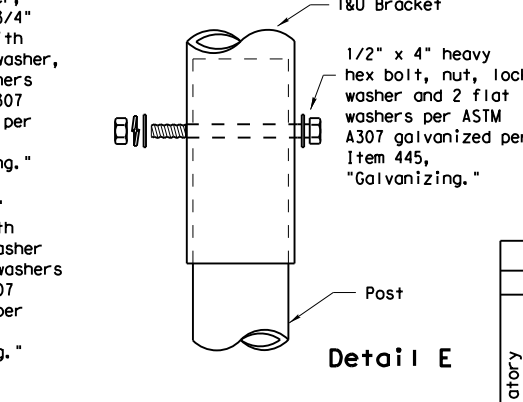
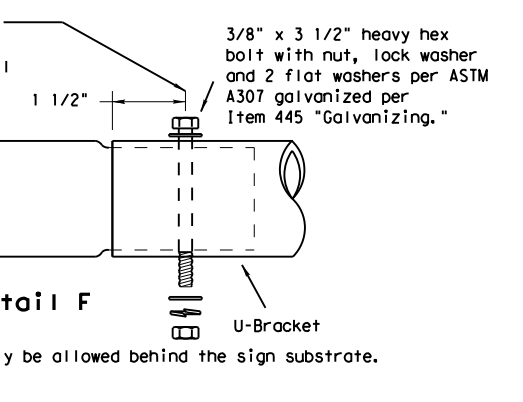
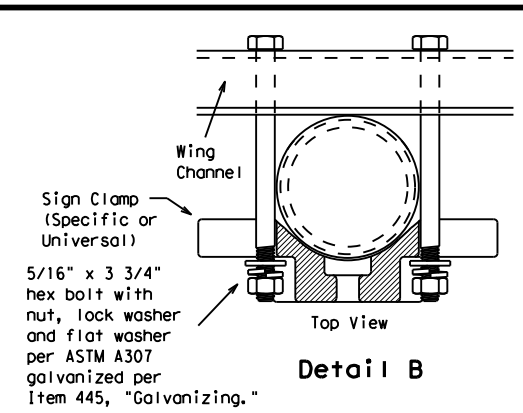
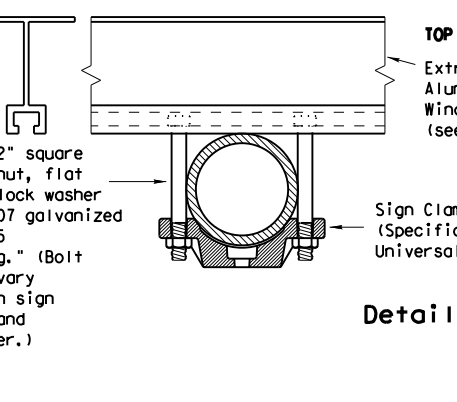
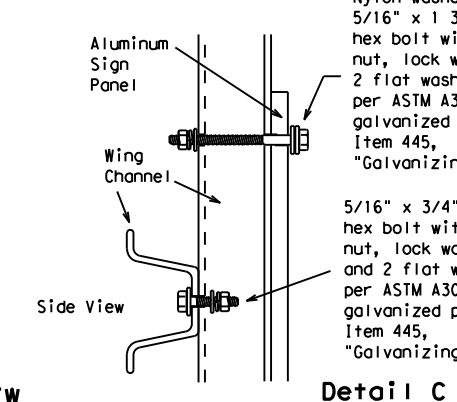
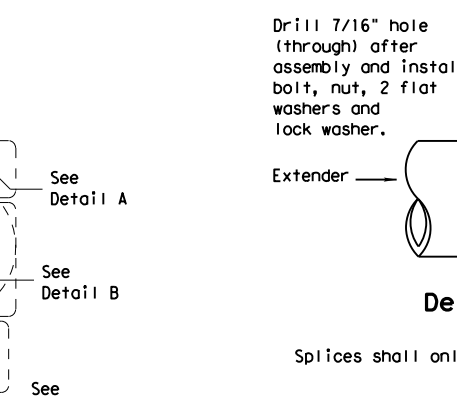
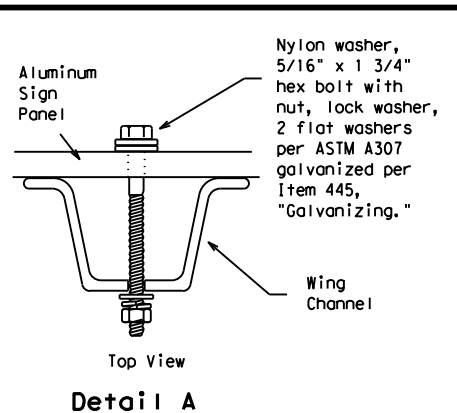
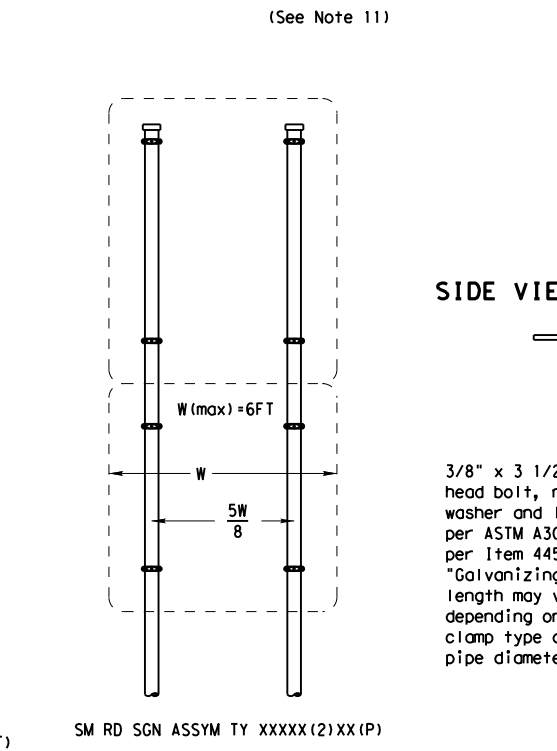
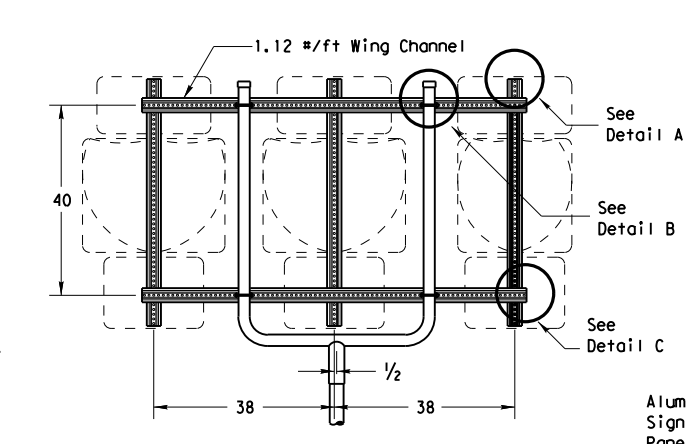
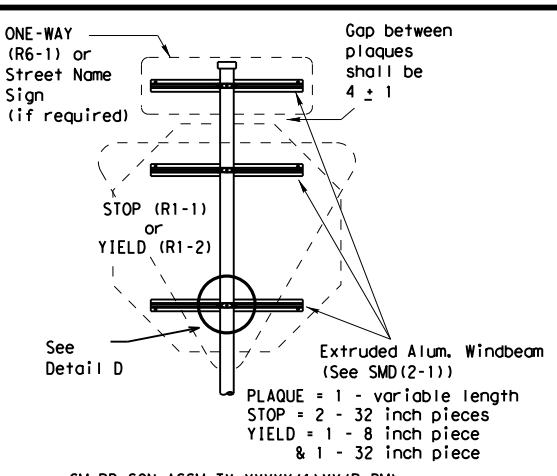
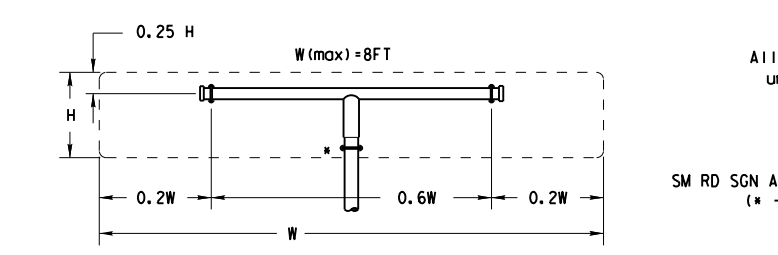
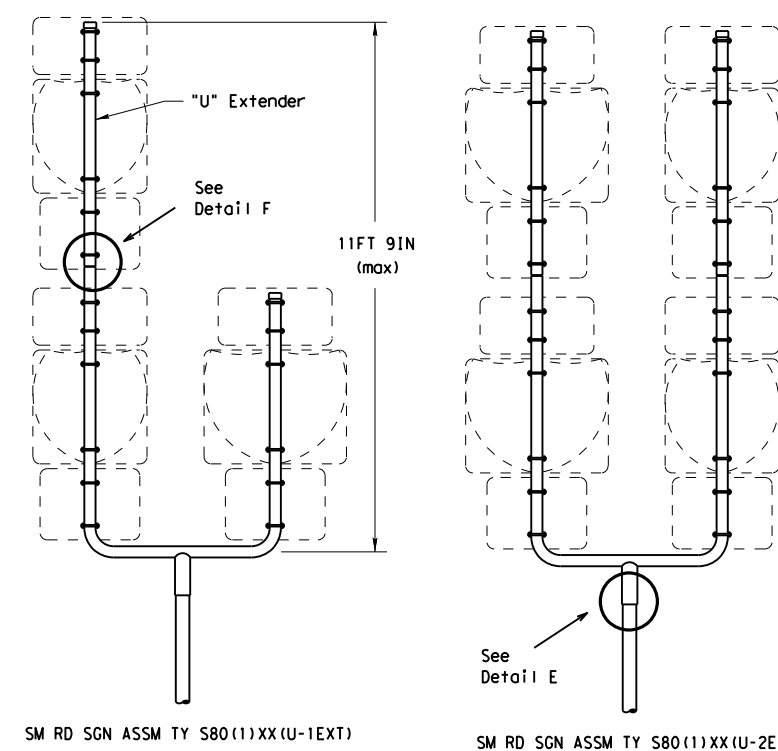
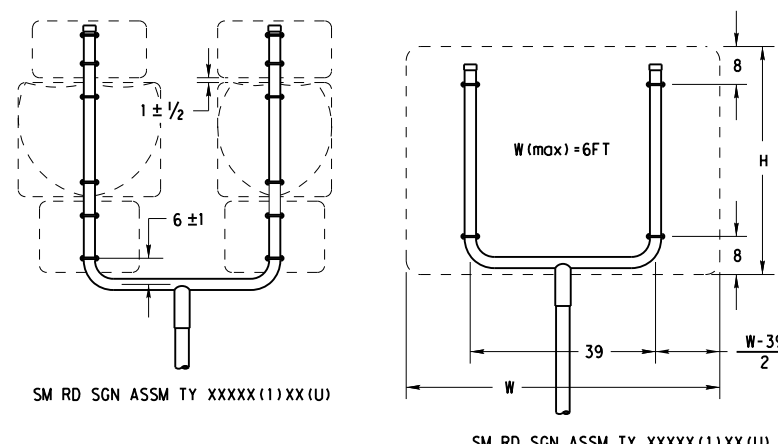
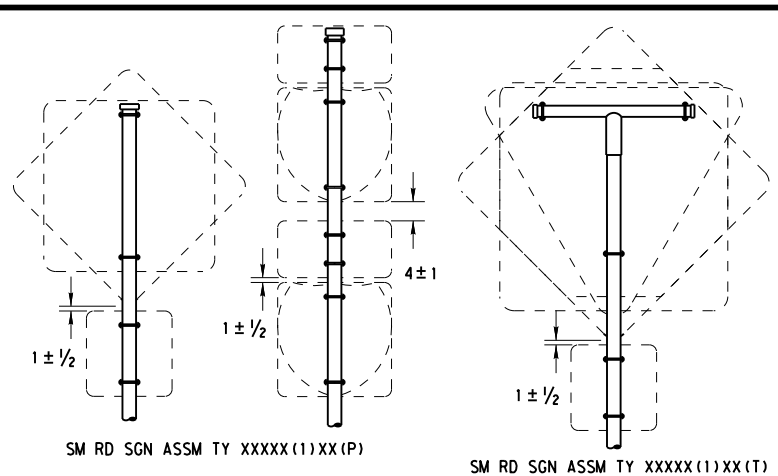


SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM SMD(SLIP-1)-08(DAL)

© TxDOT July 2002		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
12-10 (DISTRICT)		2352	02	027	FM2449
ADDED CLAMP BASE DETAIL FOR SLIP BASE INSTALLATION		DIST	COUNTY	SHEET NO.	
		DAL	DENTON	92	

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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."
- Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
- 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.
- Post open ends shall be fitted with Friction Caps.
- Sign blanks shall be the sizes and shapes shown on the plans.

REQUIRED SUPPORT

Regulatory	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)

All dimensions are in english unless detailed otherwise.

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

Friction caps may be manufactured from hot rolled or cold rolled steel sheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes. The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture. Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.

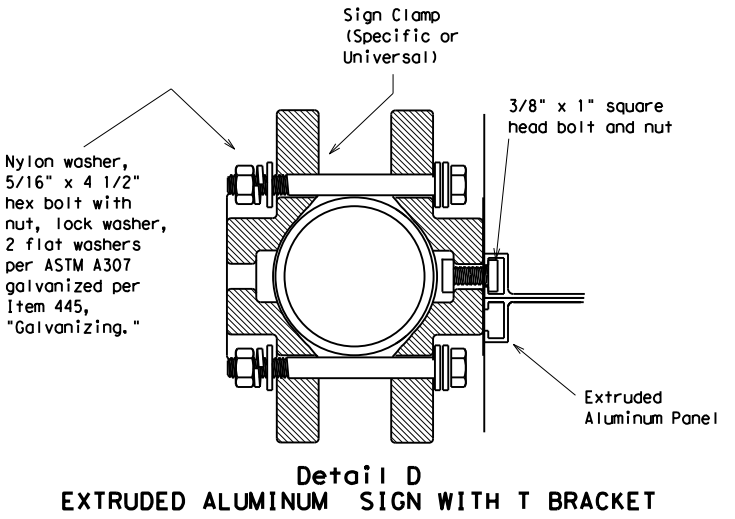
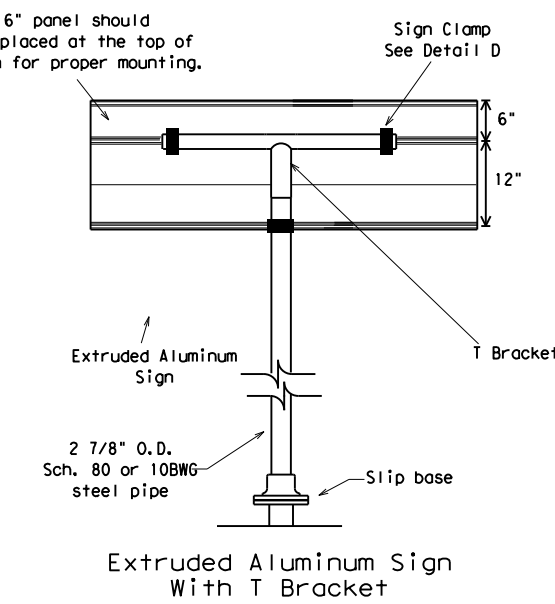
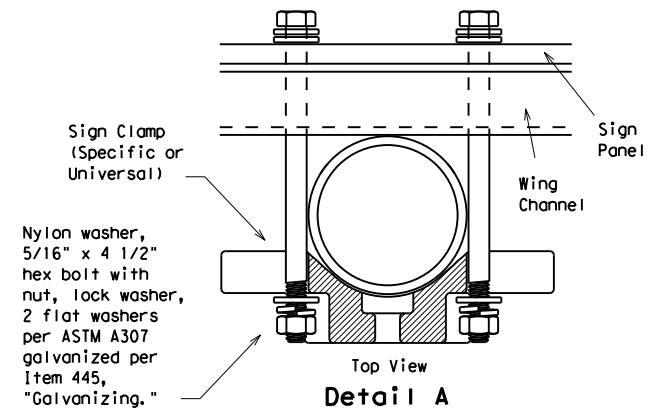
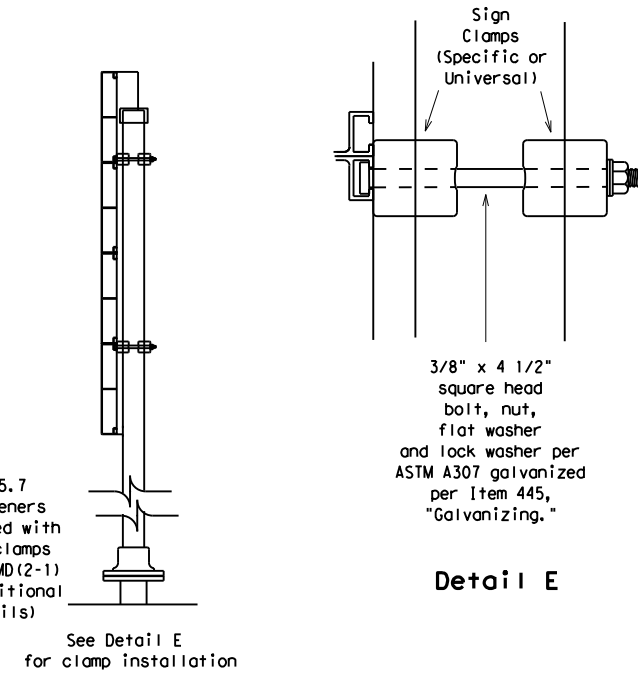
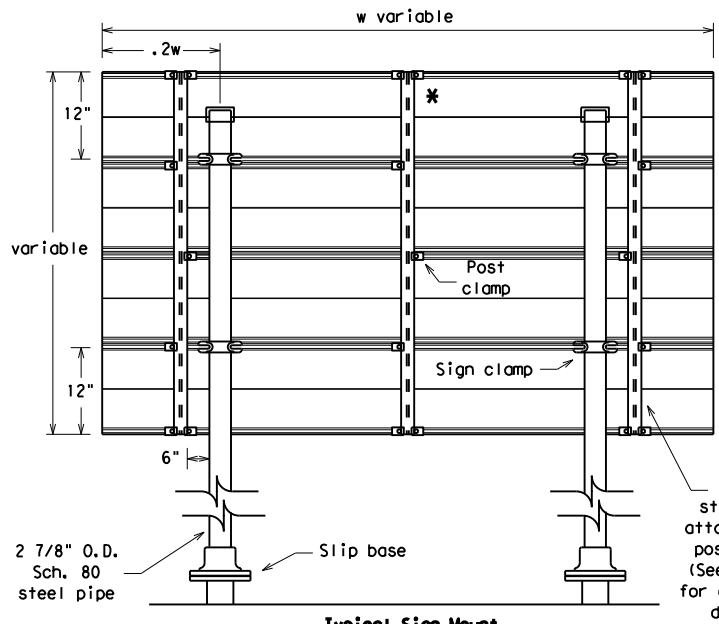
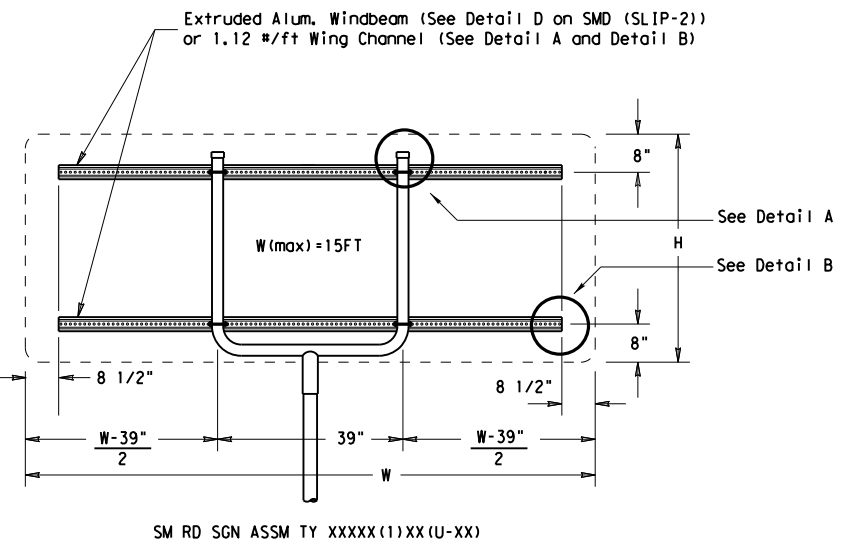
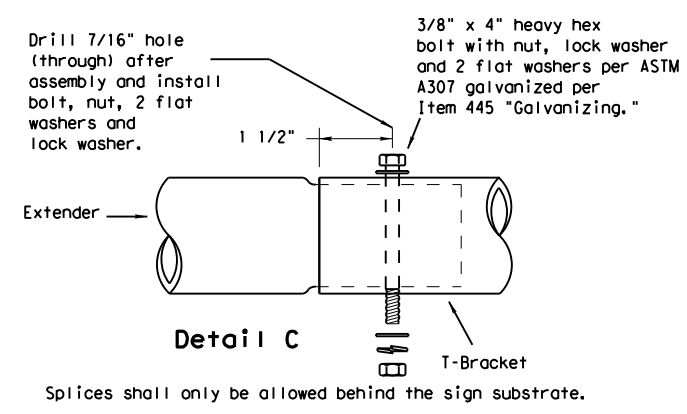
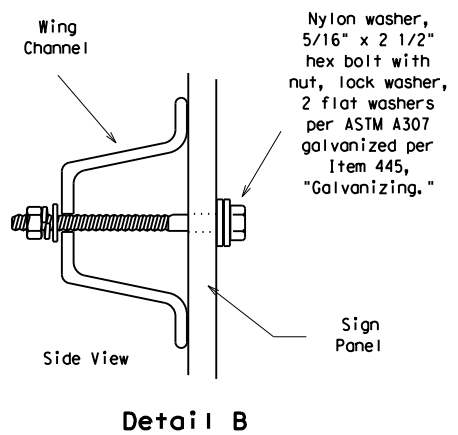
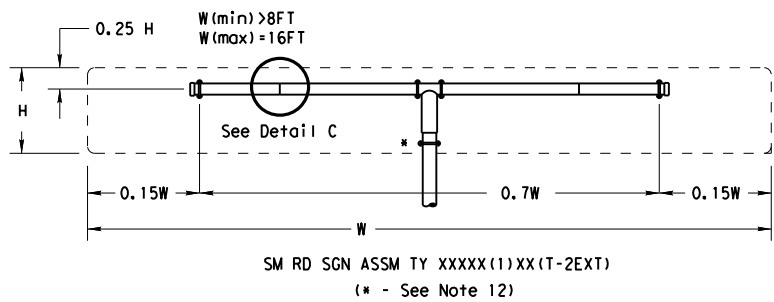
Texas Department of Transportation
 Traffic Operations Division

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

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9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
		2352	02	027	FM 2449
		DIST	COUNTY	SHEET NO.	
		DAL	DENTON	93	

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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)
Warning	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-3)-08**

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9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
		2352	02	027	FM2449
		DIST	COUNTY		SHEET NO.
		DAL	DENTON		94

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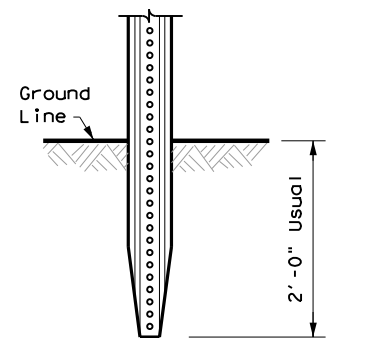
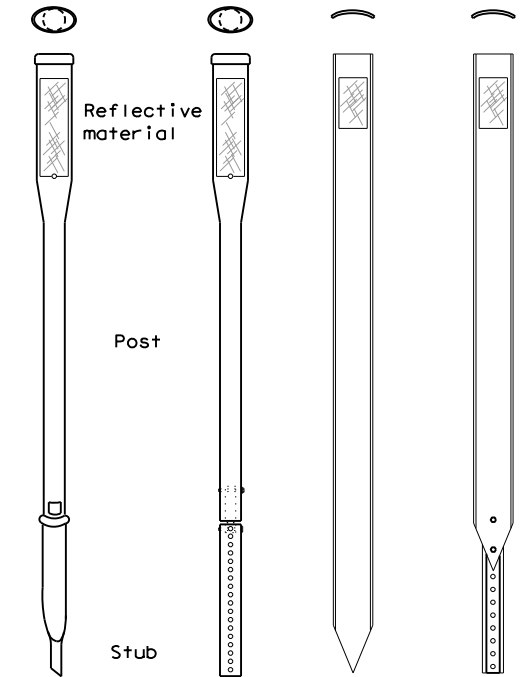
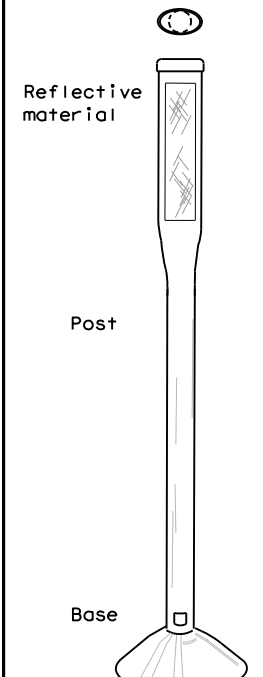
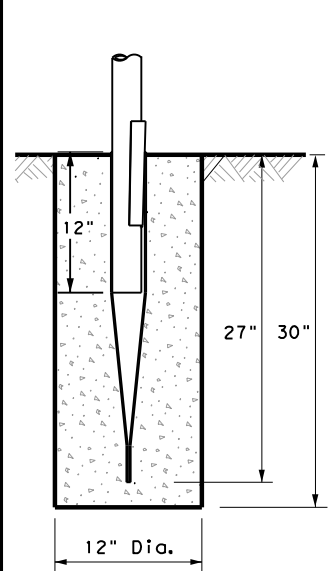
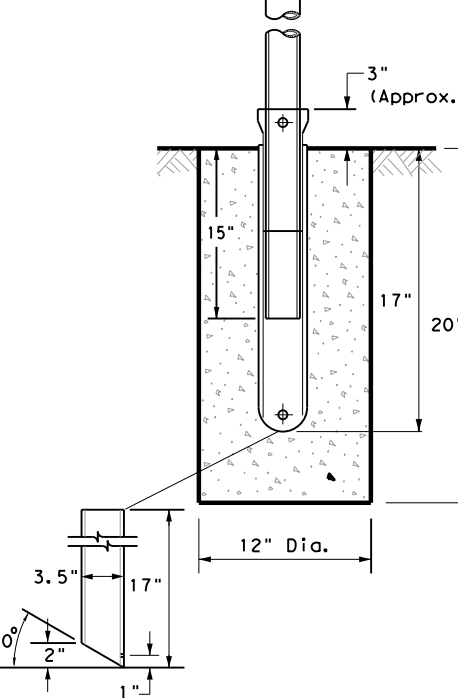
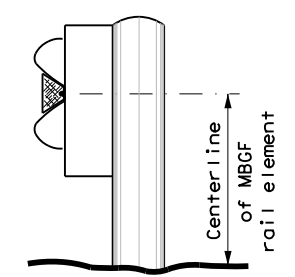
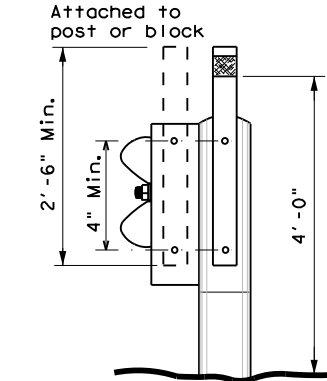
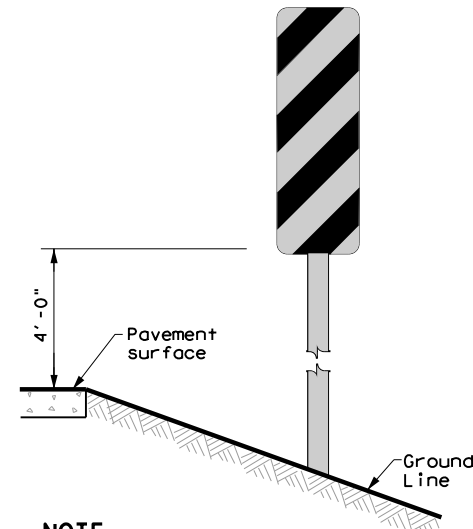
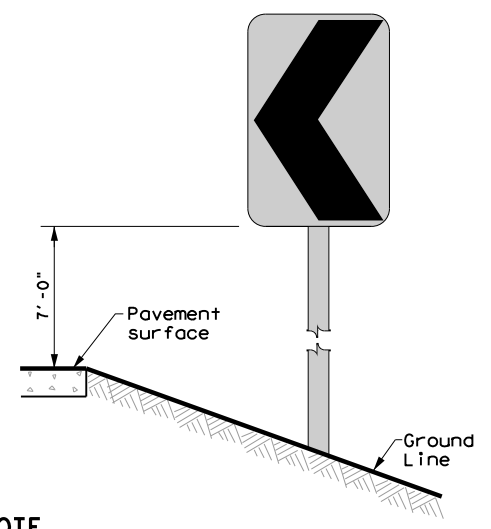
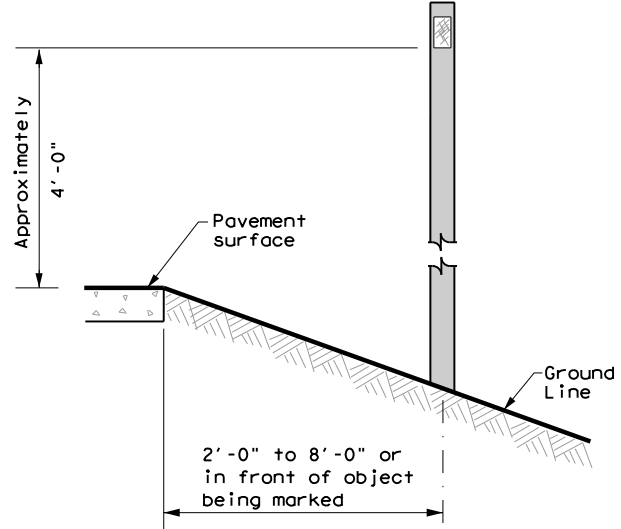
REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS				DELINEATORS				D & OM DESCRIPTIVE CODES	
DEVICE	SIZE 1	SIZE 2	SIZE 3	SIZE 4	DEVICE	SINGLE	DOUBLE	INSTL DEL ASSM (D-XX)SZ X (XXXX)XXX (XX)	
								NUMBER OF REFLECTORS S = Single D = Double COLOR OF REFLECTORS W = White Y = Yellow R = Red REFLECTOR UNIT SIZE 1 or 2 TYPE OF POST OR DELINEATOR WC = Wing Channel Post YFLX = Yellow Flexible Post WFLX = White Flexible Post BRF = 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	
SHEETING: Yellow, White or Red Type B or C reflective sheeting				SHEETING: Yellow, White or Red Type B or C Reflective Sheeting				DIRECTION: If Required BI = Bi-Directional BR = Bi-Directional with red on back	
POST TYPE: WC, YFLX, WFLX				MOUNT TYPE: GND, SRF				INSTL OM ASSM (OM-XX) (XXXX)XXX (XX)	


OBJECT MARKERS								D & OM DESCRIPTIVE CODES			
DEVICE	Type 1 (OM-1)	Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)	INSTL OM ASSM (OM-XX) (XXXX)XXX (XX)		
		OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4	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	
SHEETING: Yellow-Type B _{FL} or C _{FL} Sheeting		SHEETING: Yellow - Type B or C Sheeting			SHEETING: Alternating acrylic black and retroreflective yellow - Type B _{FL} or C _{FL} Sheeting			SHEETING: Red -Type B _{FL} or C _{FL} Sheeting		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	
POST TYPE: TWT		POST TYPE: WC			POST TYPE: WFLX			POST TYPE: TWT		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.	
MOUNT TYPE: WAS, WAP		MOUNT TYPE: GND			MOUNT TYPE: GND, SRF			MOUNT TYPE: WAS, WAP		Texas Department of Transportation Traffic Safety Division Standard DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION D & OM(1)-20	

BARRIER REFLECTORS (BRF)			CHEVRONS				ONE DIRECTION LARGE ARROW		NOTE:		
DEVICE	GF1	GF2	CTB	W1-8				W1-6		1. 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.	
SHEETING: Yellow, White, Red			SHEETING: Yellow, White, Red				SHEETING: Yellow, White, Red		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.		
NOTE: 1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches.			NOTE: 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"			MOUNTING HEIGHT: 4'-0" or 7'-0"				MOUNTING HEIGHT: 7'-0" Only		MOUNTING HEIGHT: 7'-0"		FILE: dom1-20.dgn DNE: TXDOT CK: TXDOT DW: TXDOT CR: TXDOT © TXDOT August 2004 REVISIONS: 2352 02 10-09 3-15 4-10 7-20
JOB: 2352 02			JOB: 027				JOB: FM 2449		SHEET NO.: 95		

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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	CONCRETE TRAFFIC BARRIER (CTB)	
NOTES 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.			NOTE 1. Install per manufacturer's recommendations.		GENERAL NOTES 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.	
NOTES 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.						
TYPES 1,3, AND 4 OBJECT MARKERS AND CHEVRONS		CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN		DELINEATORS AND TYPE 2 OBJECT MARKERS		
						
NOTE 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)		NOTE 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.		See general notes 1, 2 and 3.		



Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

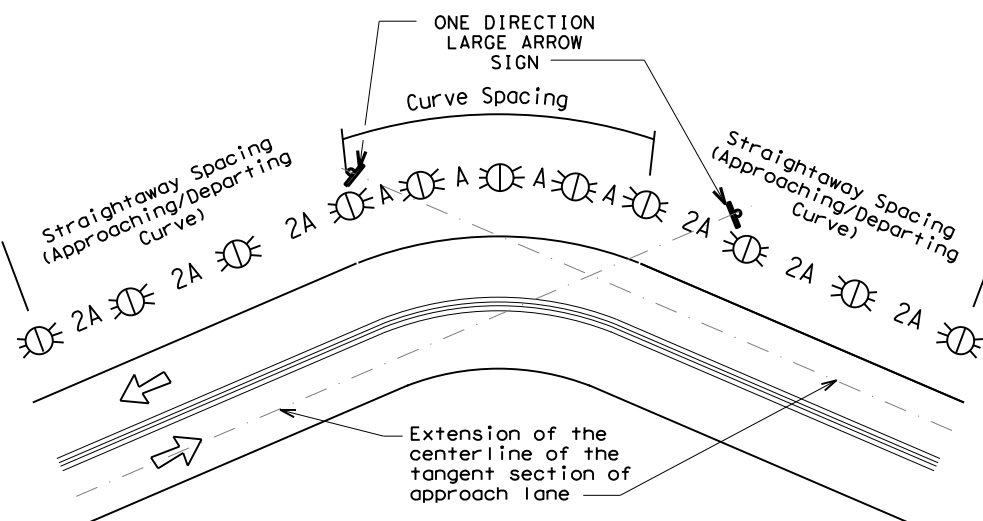
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© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM 2449
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	DAL	DENTON	96	

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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

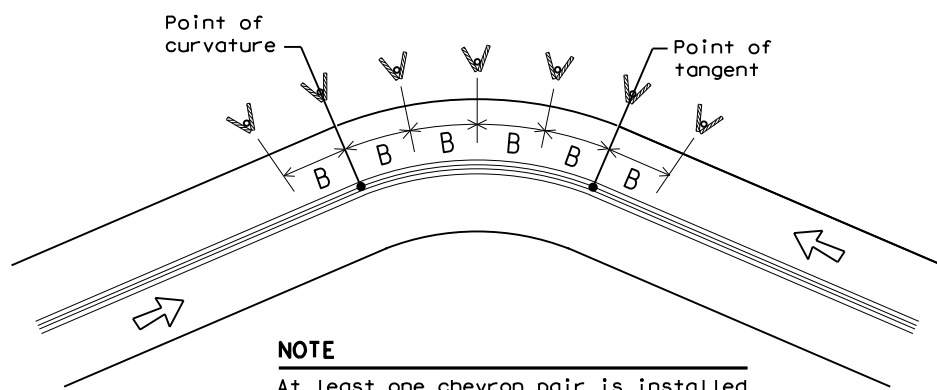
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



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

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(3)-20

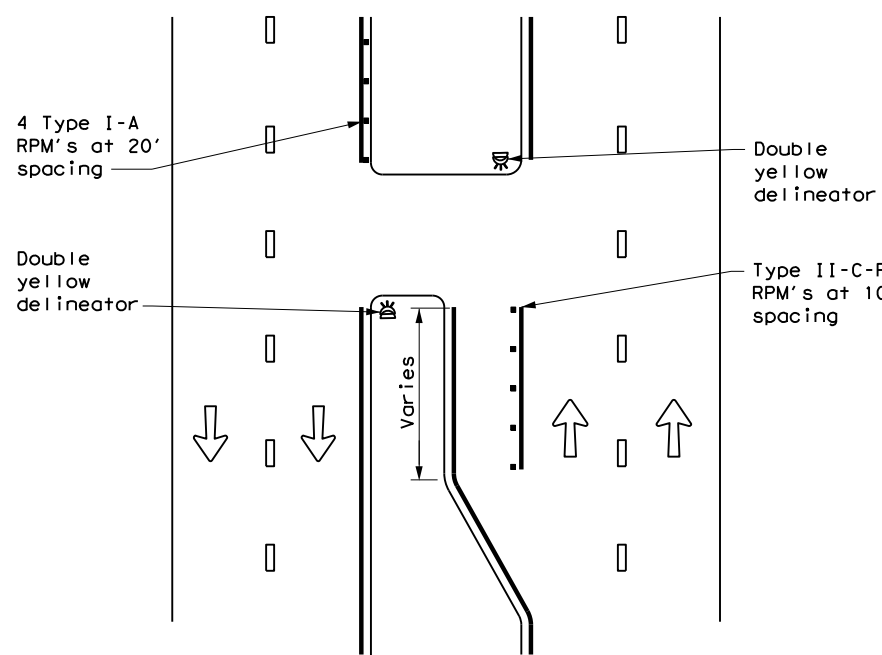
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© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM 2449
3-15 8-15	DIST	COUNTY	SHEET NO.	
8-15 7-20	DAL	DENTON	97	

20C

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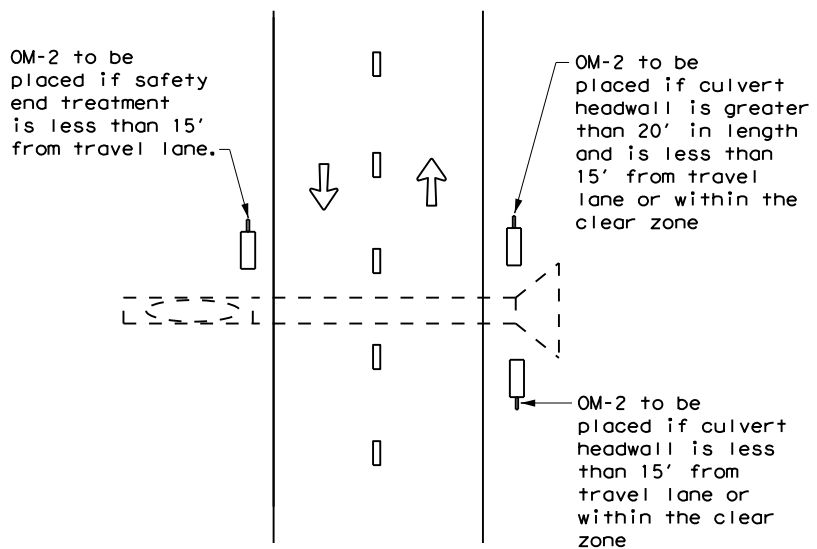
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CROSSOVERS



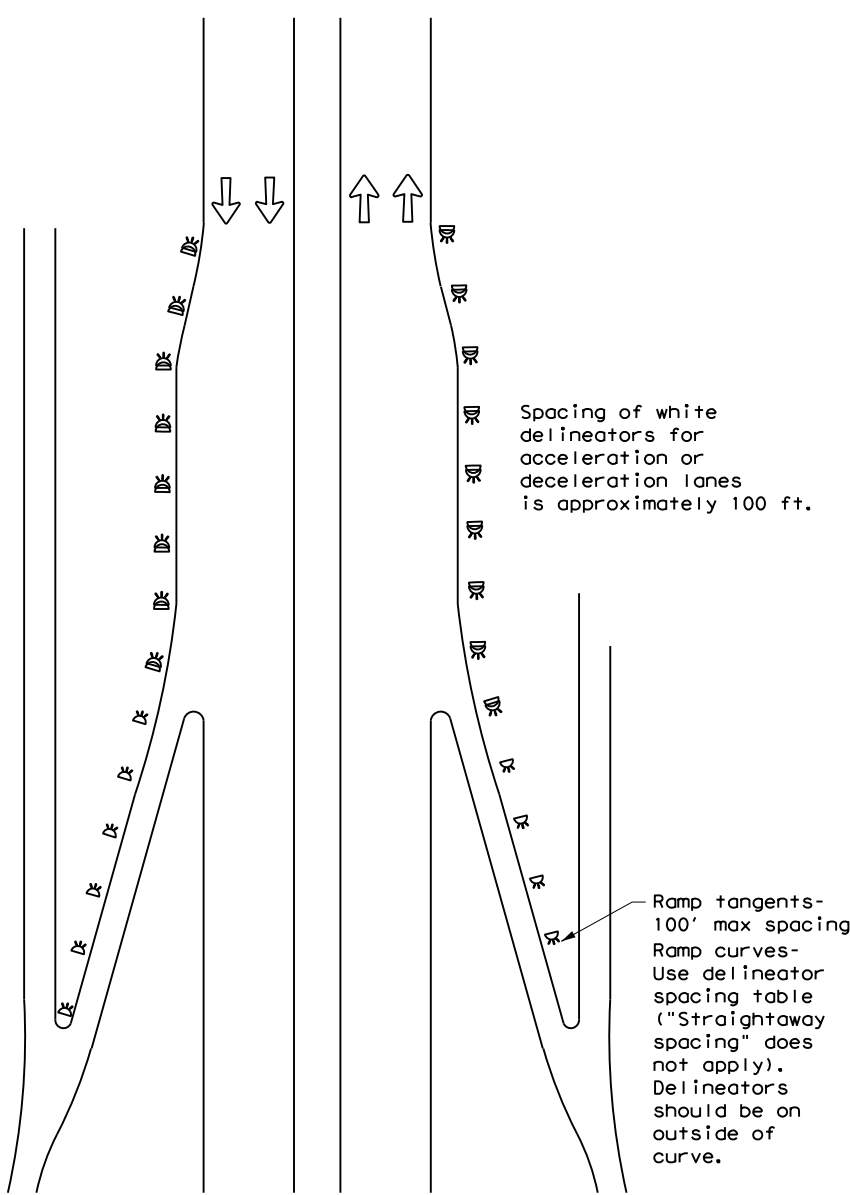
DETAIL 1

FOR CULVERTS WITHOUT MBGF



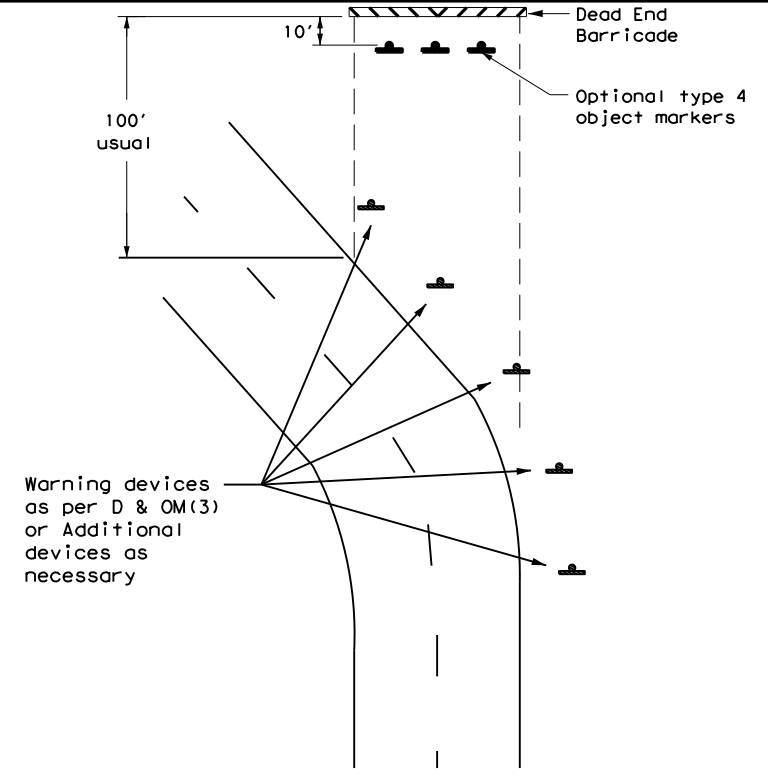
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



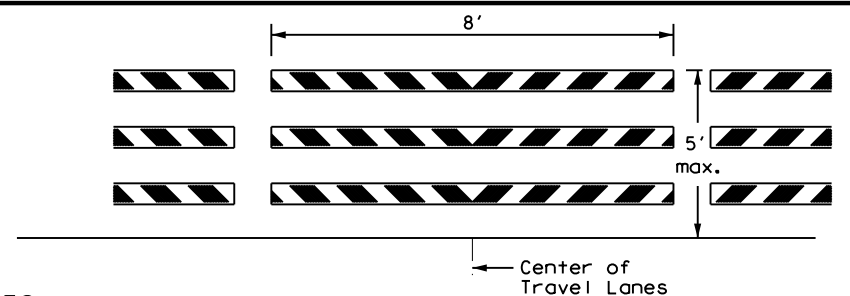
DETAIL 3

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



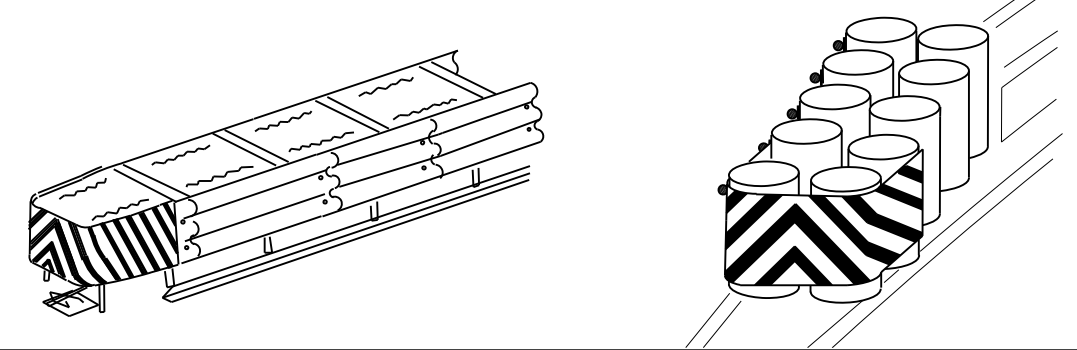
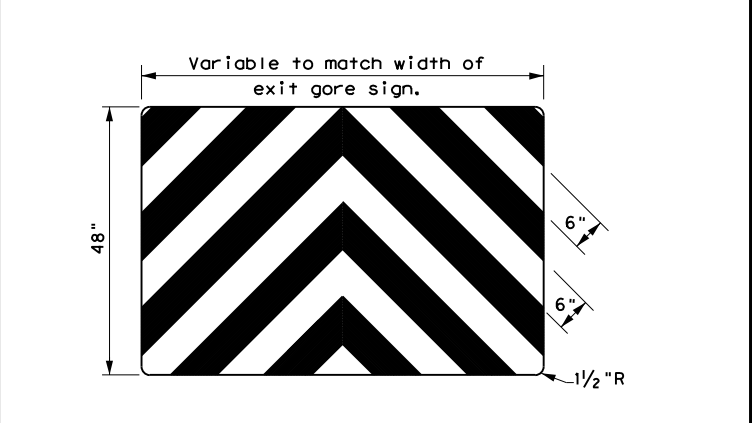
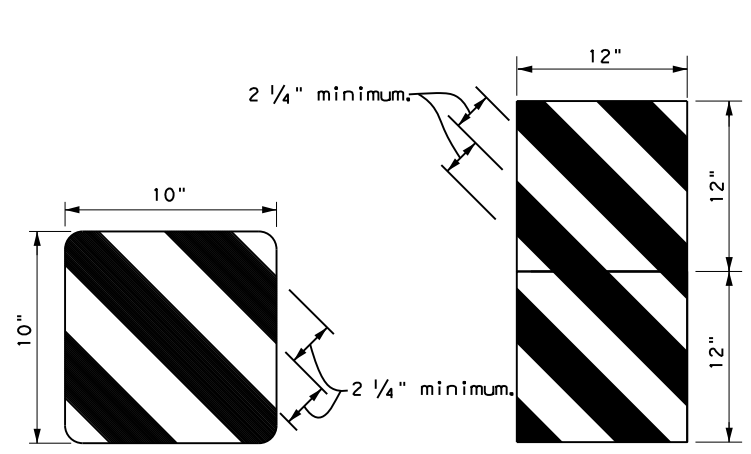
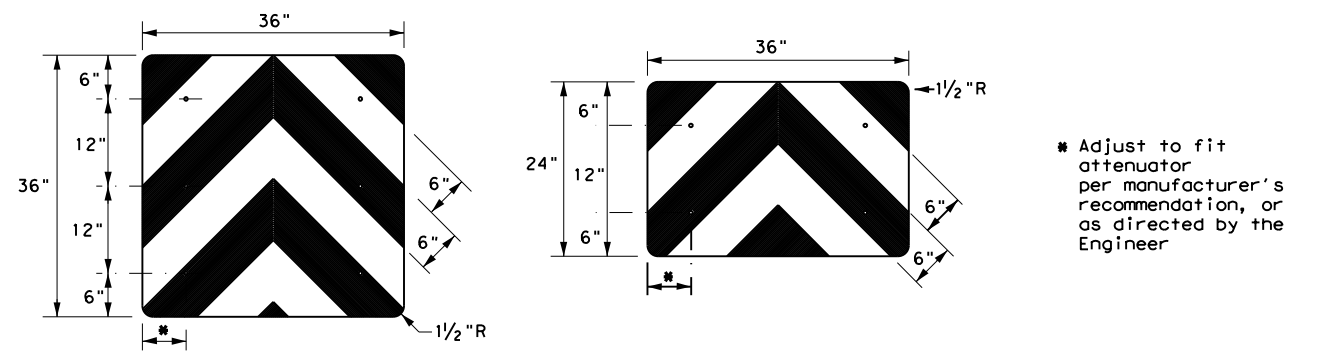
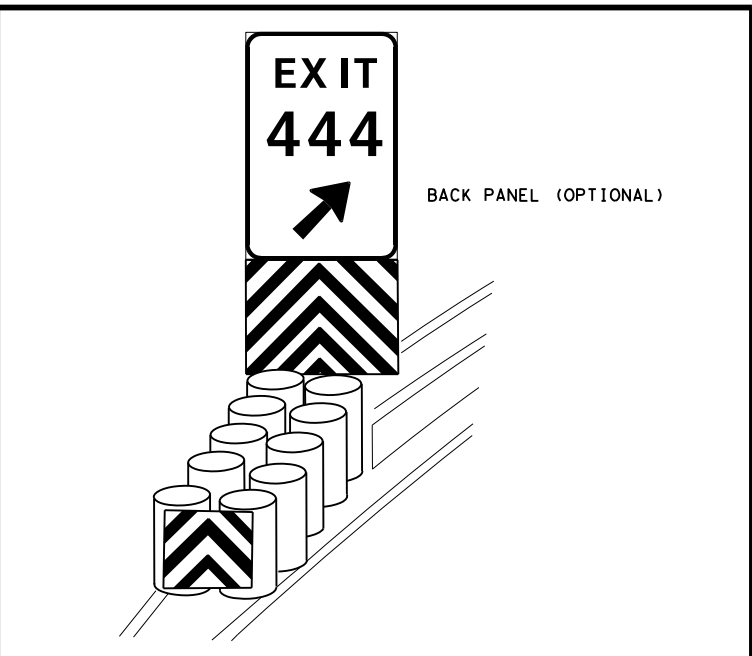
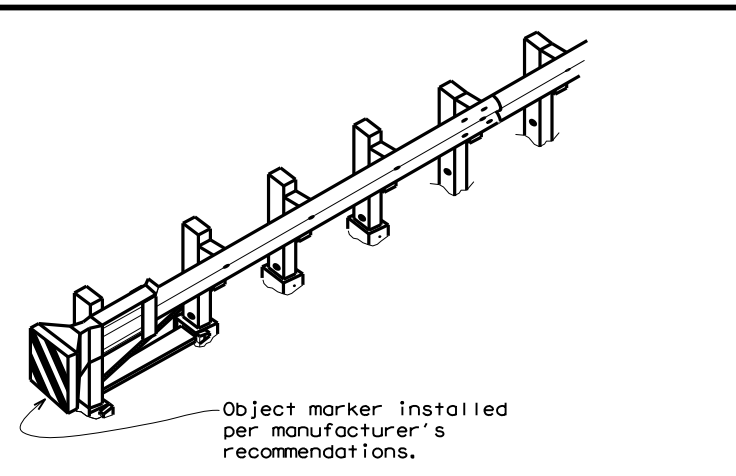
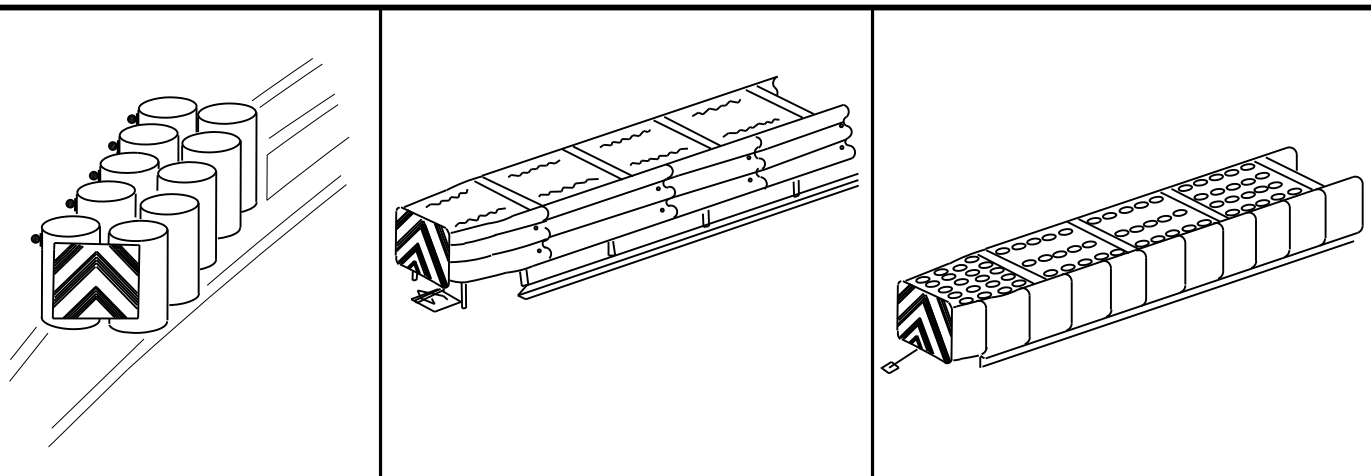
DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(4) -20

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	OW: TXDOT	CK: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
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3-15	DIST	COUNTY	SHEET NO.	
7-20	DAL	DENTON	98	

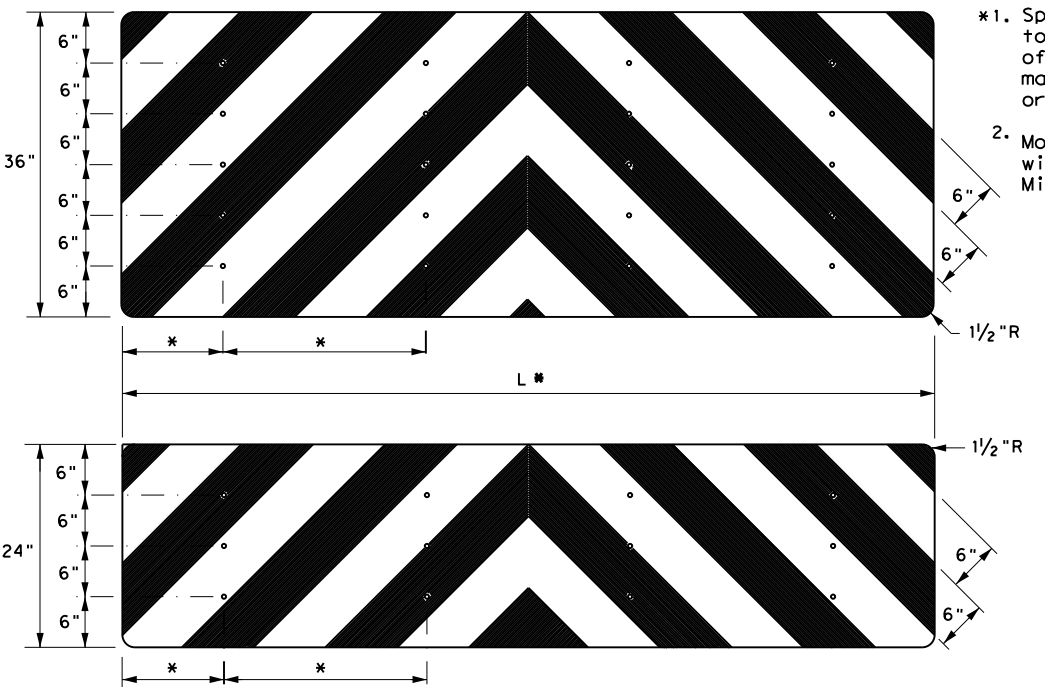
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OBJECT MARKERS SMALLER THAN 3 FT²

- NOTES**
- *1. Spacing should be adjusted to attach through centerline of drum, per attenuator manufacturer's recommendation, or as directed by the Engineer.
 - 2. Mounting should be flush with top of attenuator. Minimum size 96" x 24".



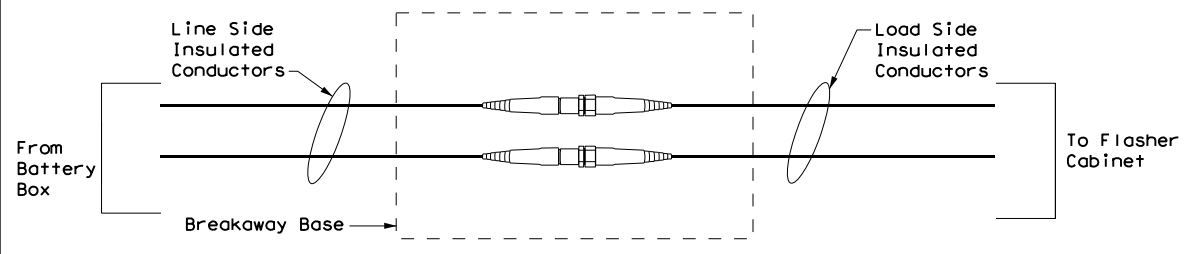
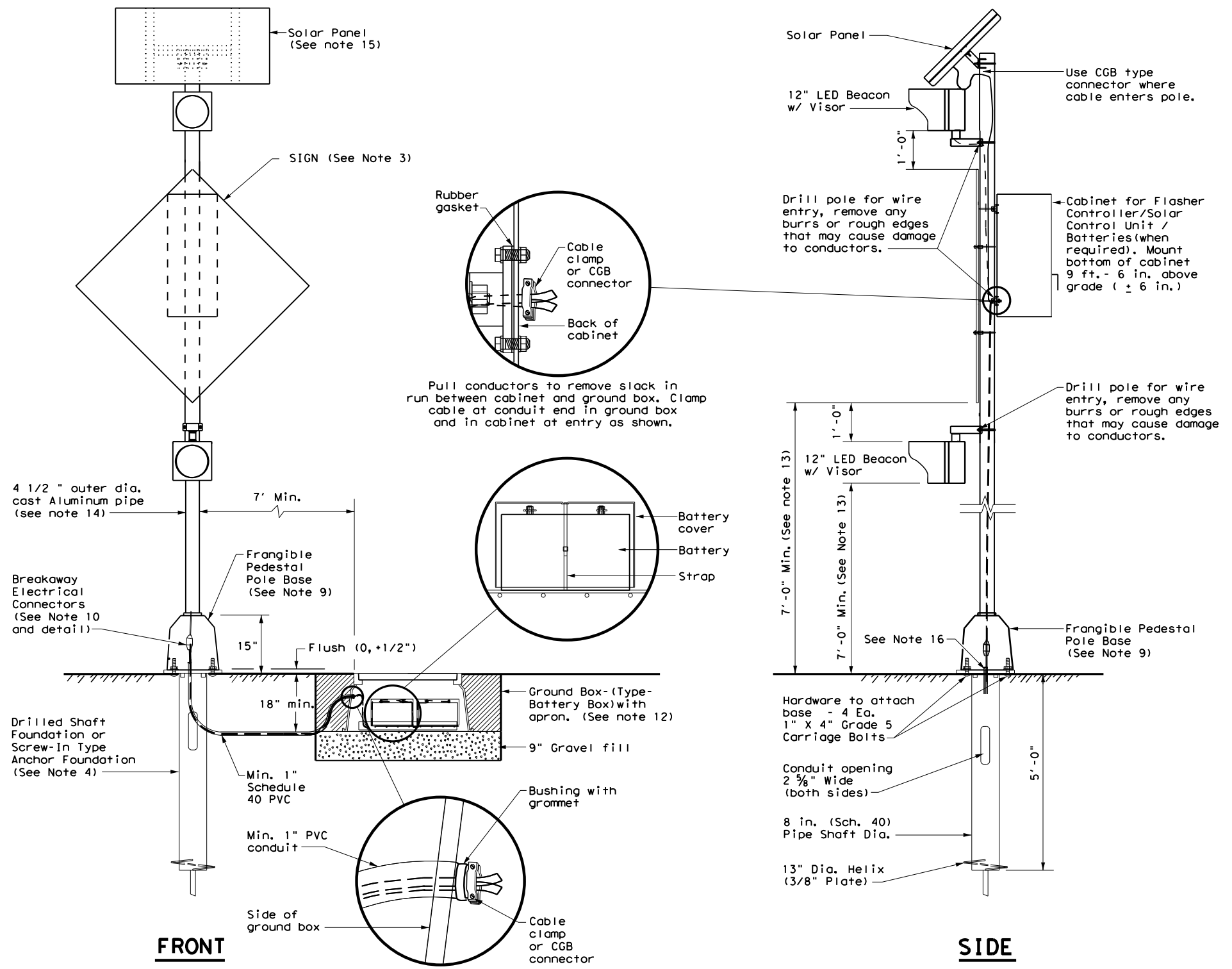
- NOTES**
1. Object Markers shall conform to the Texas MUTCD and meet the color and reflectivity requirement of Department Material Specification DMS 8300. Background shall be yellow reflective sheeting (Type B or C) and Chevron shall be black.
 2. Object Markers may be fabricated from adhesive backed 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.
 3. 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".
 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.
 5. Object Marker at nose of attenuator is subsidiary to the attenuator.
 6. See D & OM (1-4) for required barrier reflectors.

		Traffic Safety Division Standard	
DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS			
D & OM(VIA) -20			
FILE: domvia20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT
© TXDOT December 1989	CONT	SECT	JOB
REVISIONS		2352 02	027 FM 2449
4-92 8-04	DIST	COUNTY	SHEET NO.
8-95 3-15	DAL	DENTON	99
4-98 7-20			
20G			

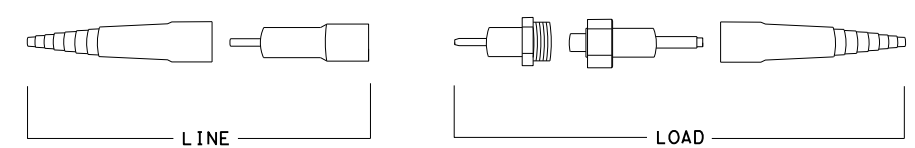
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GENERAL NOTES:

- Details show a typical warning sign with two flashing beacon heads, other arrangements are possible. When only one beacon is required, install the upper beacon.
- See Item 685, "Roadside Flashing Beacon Assemblies" for further requirements.
- See SMD standard sheets for lateral and vertical clearances and sign mounting details. Install signs as shown on the sign layout sheets.
- Use either a Screw-In Type Anchor Foundation or a Drilled Shaft Foundation as shown elsewhere in the plans. When plans require a Drilled Shaft Foundation, see standard sheet TS-FD. Install the Screw-In Type Anchor Foundation as per manufacturer's recommendations. On a slope, install one edge at ground level. Screw-In/Drilled Shaft Foundation is subsidiary to Item 685. Installation of a ground rod is not required for solar powered flashing beacon assemblies.
- When used, provide Screw-In Type Anchor Foundations as shown on TxDOT's Material Producer List (MPL) in the file "Highway Traffic Signals".
- Use materials specifically designed for attaching cabinets, beacon heads, solar panels, etc., to poles.
- Install beacon heads as shown here, as shown elsewhere on the plans, or as directed. Use hardware specifically designed for mounting beacon heads on poles.
- Conduit in foundation and within 6 in. of foundation is subsidiary to the Item 685, "Roadside Flashing Beacon Assemblies."
- Per manufacturer's recommendations, engage all threads on the pedestal pole base and pipe unless the pipe is fully seated into base. In high winds, use a pole and base collar assembly to add strength and prevent loosening on connection.
- Provide single pole non-fused watertight breakaway electrical connectors for frangible pedestal pole bases, as shown on TxDOT's MPL in the file "Roadway Illumination and Electrical Supplies." Approved models are listed under Item 685. For ungrounded (hot) conductors, install a breakaway connector with a dummy fuse slug. For grounded (neutral) conductors, install a breakaway connector with a white colored marking and a permanently installed dummy fuse (slug).
- Install the batteries in a battery box. Place the batteries on a 3/16" thick plastic sheet and connect together. Place a plastic cover (battery bell jar) over the top of each battery and secure the battery bell jar to the battery with a strap. The batteries, bell jars, straps and 3/16" plastic sheet are subsidiary to the Item 685, "Roadside Flashing Beacon Assemblies." When required, install batteries in the flasher cabinet. Wire batteries according to manufacturers recommendations. Provide the number of batteries as required by the manufacturer.
- See standard sheet Electrical Details (ED) for additional requirements regarding the installation of ground boxes/battery boxes, conduit, and cabinets.
- Provide clearance as shown above the sidewalk or pavement grade at the edge of the road. When a bottom beacon is not used, mount the bottom of the sign at least 7 ft. above the sidewalk or pavement grade at the edge of the road.
- Unless otherwise shown on the plans, pole shaft shall be one piece, Schedule 40 Aluminum pipe, ASTM B429 or B221 (Alloy 6061-T6 only). Aluminum conduit will not develop the necessary strength and will not be allowed.
- Orient solar panel for optimum exposure to sunlight (face to the south). Prior to installation, check the location to ensure there is no overhead obstruction that would block the solar panel from receiving full sunlight. Unless specified elsewhere, mount a minimum of 14' above grade.
- Ensure height of conduit is below top of anchor bolts.



NON-FUSED BREAKAWAY ELECTRICAL CONNECTORS



**NON-FUSED BREAKAWAY ELECTRICAL CONNECTORS
EXPLODED VIEW**

SOLAR POWERED ROADSIDE FLASHING BEACON ASSEMBLY DETAILS
SPRFBA (1) - 13

FILE: spb1-13.dgn	DW: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT May 2003	CONT: 2352	SECT: 02	JOB: 027	HIGHWAY: FM 2449
12-04	DIST: DAL	COUNTY: DENTON	SHEET NO.: 100	

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FOUNDATION DESIGN TABLE

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

NOTES:

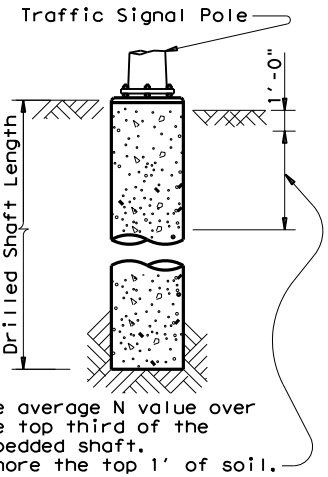
- Anchor bolt design develops the foundation capacity given under Foundation Design Loads.
- Foundation Design Loads are the allowable moments and shears at the base of the structure.
- Foundations may be listed separately or grouped according to similarity of location and type. Quantities are for the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

FOUNDATION SUMMARY TABLE (3)

LOCATION IDENTIFICATION	AVG. N BLOW /ft.	FDN TYPE	NO. EA	DRILLED SHAFT LENGTH (6) (FEET)				
				24-A	30-A	36-A	36-B	42-A
SIGN # 1&8	10	24-A	2	12				
TOTAL DRILLED SHAFT LENGTHS				12				

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

80 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH	FDN 30-A	FDN 36-A	FDN 36-B	FDN 42-A
		MAXIMUM DOUBLE ARM LENGTH COMBINATIONS	24' X 24' 28' X 28' 32' X 28'	32' X 32' 36' X 36' 40' X 36' 44' X 28'	44' X 36'
100 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH		36'	44'	
		MAXIMUM DOUBLE ARM LENGTH COMBINATIONS	24' X 24' 28' X 28' 32' X 24'	32' X 32' 36' X 36' 40' X 24'	40' X 36' 44' X 36'

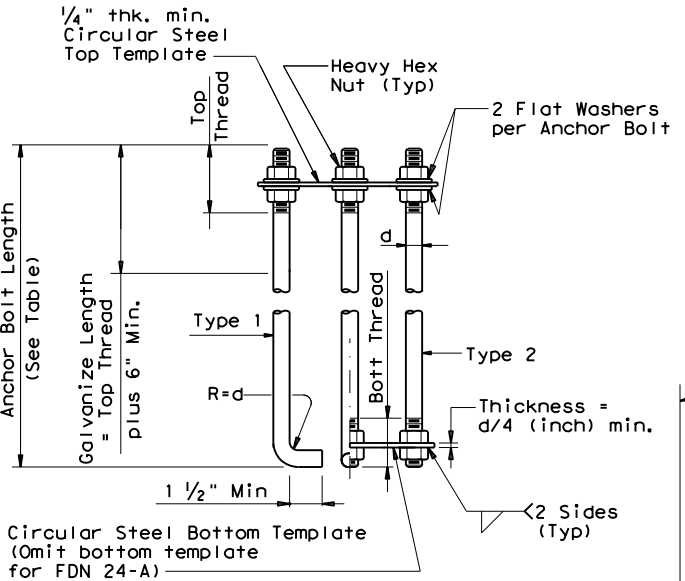


ANCHOR BOLT & TEMPLATE SIZES

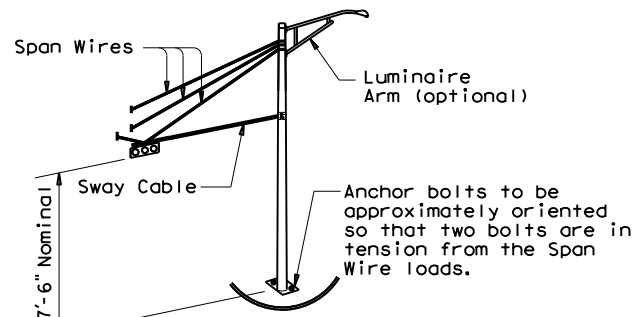
BOLT DIA IN.	(7) BOLT LENGTH	TOP THREAD	BOTTOM THREAD	BOLT CIRCLE	R2	R1
3/4"	1'-6"	3"	—	12 3/4"	7 1/8"	5 5/8"
1 1/2"	3'-4"	6"	4"	17"	10"	7"
1 3/4"	3'-10"	7"	4 1/2"	19"	11 1/4"	7 3/4"
2"	4'-3"	8"	5"	21"	12 1/2"	8 1/2"
2 1/4"	4'-9"	9"	5 1/2"	23"	13 3/4"	9 1/4"

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

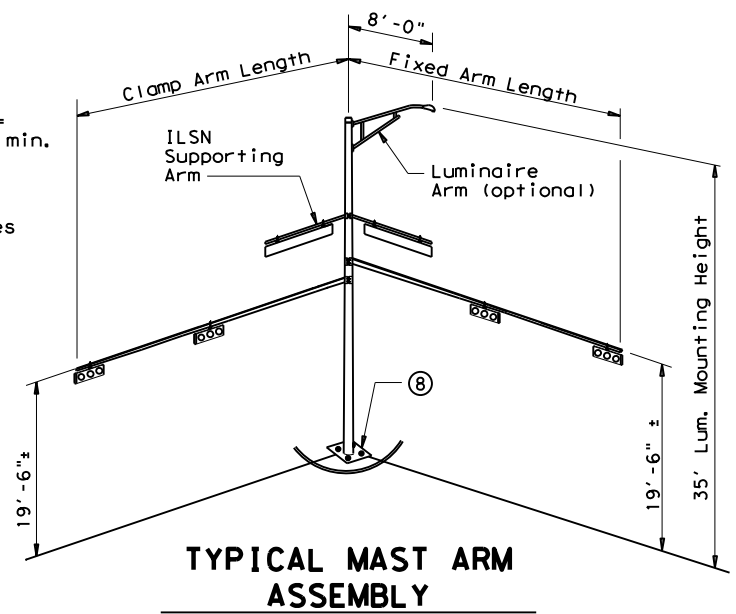
- EXAMPLE:**
- For 80mph design wind speed, foundation 30-A can support up to a 32' arm with another arm up to 28'
 - For 100mph design wind speed, foundation 36-A can support a single 36' mast arm.



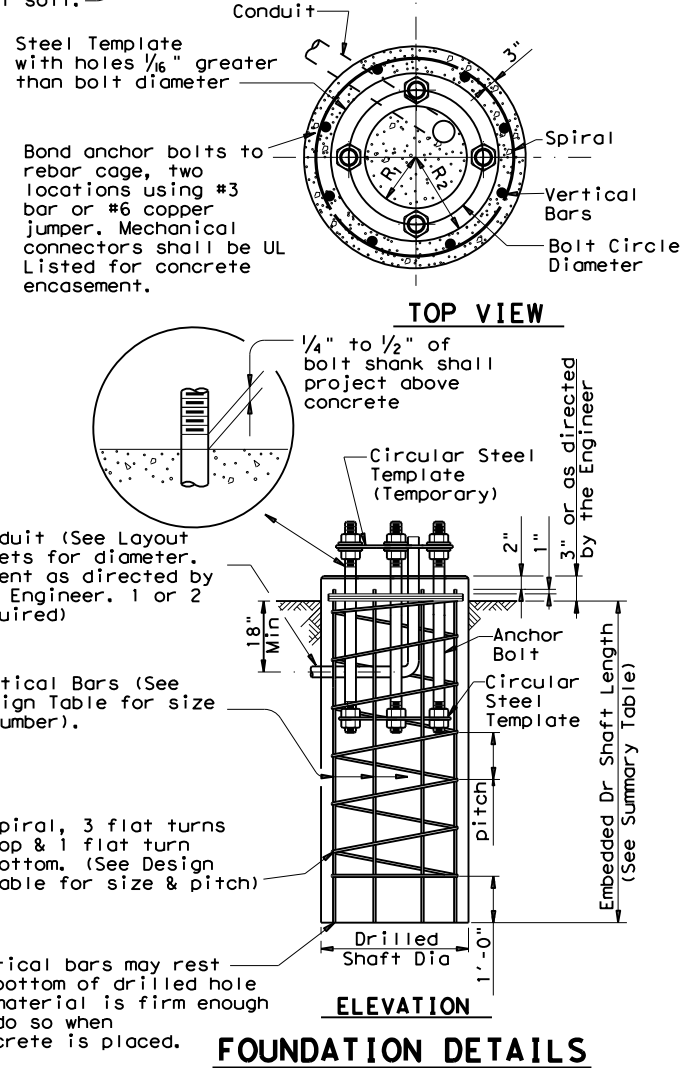
ANCHOR BOLT ASSEMBLY



TYPICAL STRAIN POLE ASSEMBLY



TYPICAL MAST ARM ASSEMBLY



FOUNDATION DETAILS

GENERAL NOTES:

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

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

Concrete shall be Class "C".

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

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

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



TRAFFIC SIGNAL POLE FOUNDATION

TS-FD-12

© TxDOT August 1995		DN: MS	CK: JSY	DW: MAQ/MMF	CK: JSY/TEB
REVISIONS	CONT	SECT	JOB	HIGHWAY	
	2352	02	027	FM 2449	
	DIST	COUNTY		SHEET NO.	
	DAL	DENTON		101	

A. GENERAL SITE DATA

1. **PROJECT LIMITS:** FM 2449 - CSJ:2352-02-027
FROM WEST OF FM 156 TO EAST FM 156

Begin Project Coordinates : Latitude (N) : 33.179655 Longitude (W) : -- 97.295489
End Project Coordinates : Latitude (N) : 33.179667 Longitude (W) : -- 97.285468

2. **PROJECT SITE MAPS:**

- * Project Location Map: The Title Sheet and Plans THE TITLE SHEET 1 & PROJECT LAYOUT SHEETS 3-4
- * Drainage Patterns: Drainage Area Maps SHEET 62
- * Slopes Anticipated After Major Gradings or Areas of Soil Disturbance: Typical Sections SHEET 7
- * Location of Erosion and Sediment Controls: SW3P Site Maps SHEETS 104- 105
- * Surface Waters and Discharge Locations: Drainage and Culvert Layouts SHEETS 64 - 65
- * Project Specific Location(s) (PSL): To be determined by the project Construction Personnel. Location(s) shown on SW3P Site Map (if PSL location(s) is within one mile of project) and information located in project SW3P Binder (Reference Item *10 below).

3. **PROJECT DESCRIPTION:**

ADD TURN LANES, ADDITIONAL PAVEMENT SURFACE, OVERLAY AND PAVEMENT MARKINGS

4. **MAJOR SOIL DISTURBING ACTIVITIES:**

1. INSTALL EROSION CONTROL DEVICES TWO WEEKS IN ADVANCE OF SCHEDULED START OF CONSTRUCTION.
2. INSTALL/EXTEND CULVERTS AND GRADE FRONT AND BACK SLOPES ACCORDING TO PLANS.
3. COMPLETE ROADWAY PAVEMENT CONSTRUCTION.
4. INSTALL SIGNS/PAVEMENT MARKINGS.
5. PROVIDE SEEDING FOR EROSION STABILIZATION.
6. REMOVE EROSION CONTROL DEVICES AS DIRECTED BY THE ENGINEER.

5. **EXISTING CONDITION OF SOIL & VEGETATIVE COVER AND % OF EXISTING VEGETATIVE COVER:**

The existing soil type composition is wilson clay loam, ponder loam and justin fine sandy. The existing soils are in good condition and is covered with approximately 90% grassy vegetative cover that is maintained.

6. **TOTAL PROJECT AREA:** 7.08 Acres

7. **TOTAL AREA TO BE DISTURBED:** 3.67 Acres (51 %)

8. **WEIGHTED RUNOFF COEFFICIENT**

BEFORE CONSTRUCTION: 0.60
AFTER CONSTRUCTION: 0.60

9. **NAME OF RECEIVING WATERS:**

Hog Branch which flows to Denton Creek (0826A).
No water quality impairments.

10. **PROJECT SW3P Binder:**

- A. For projects disturbing one to five acres, TxDOT will maintain a SW3P Binder at the project field office (if there is not a project field office, should be kept at the Area Office) which contains the following: Index Sheet, TCEQ Signature Authority, TxDOT's and Contractor's Small Construction Site Notice, SW3P Inspector Qualification Statements, EPIC Sheet, SW3P Sheet, Site Location Maps, Inspection and Maintenance Reports (Form 2118), Construction Stage Gate Checklists (CSGC), Stored Material Lists specifying associated control measures and the Appendix which contains the TPDES Construction General Permit, TxDOT and Contractor MS4 Operator Notification(s) and the Construction PSL Permits per all applicable requirements.
- B. For projects disturbing 5 acres or more, TxDOT will follow the actions listed in (10.A.) above with the addition of the following: TxDOT and Contractor Notice Of Intent (N.O.I.) and Fee Payment Form, TxDOT and Contractor Large Construction Site Notice (to be used instead of Small Site Notice), and TPDES Permit Coverage Notice.
- C. For projects disturbing less than one acre, actions described in (10.A.) and (10.B.) above are not required. Acreage is calculated by adding Total Area To Be Disturbed Acres on project (See *7 above) and the PSL(s) acreage located within one mile of project.

B. EROSION AND SEDIMENT CONTROLS

1. **SOIL STABILIZATION PRACTICES:** (Select T = Temporary or P = Permanent, as applicable)

- | | |
|--|--|
| <input type="checkbox"/> T TEMPORARY SEEDING | <input type="checkbox"/> I/P PRESERVATION OF NATURAL RESOURCES |
| <input type="checkbox"/> MULCHING (Hay or Straw) | <input type="checkbox"/> FLEXIBLE CHANNEL LINER |
| <input type="checkbox"/> BUFFER ZONES | <input type="checkbox"/> RIGID CHANNEL LINER |
| <input type="checkbox"/> PLANTING | <input type="checkbox"/> SOIL RETENTION BLANKET |
| <input type="checkbox"/> P SEEDING | <input type="checkbox"/> COMPOST MANUFACTURED TOPSOIL |
| <input type="checkbox"/> SODDING | <input type="checkbox"/> T VERTICAL TRACKING |
| | <input type="checkbox"/> OTHER: (Specify Practice) |

2. **STRUCTURAL PRACTICES:** (Select T = Temporary or P = Permanent, as applicable)

- SILT FENCES
- T EROSION CONTROL LOGS
- EROSION CONTROL COMPOST BERMS (Low Velocity)
- T ROCK FILTER DAMS
- DIVERSION, INTERCEPTOR, OR PERIMETER DIKES
- DIVERSION, INTERCEPTOR, OR PERIMETER SWALES
- DIVERSION DIKE AND SWALE COMBINATIONS
- PIPE SLOPE DRAINS
- PAVED FLUMES
- T ROCK BEDDING AT CONSTRUCTION EXIT
- TIMBER MATTING AT CONSTRUCTION EXIT
- CHANNEL LINERS
- SEDIMENT TRAPS
- SEDIMENT BASINS
- STORM INLET SEDIMENT TRAP
- STONE OUTLET STRUCTURES
- CURBS AND GUTTERS
- STORM SEWERS
- P VELOCITY CONTROL DEVICES (RIPRAP) (STONE RIPRAP)
- OTHER: (Specify Practice)

NOTE: TOP OF BMP'S SHOULD NOT BE HIGHER THAN ROADWAY ELEVATION AS NOT TO FLOOD ROADWAY UNLESS PRIOR APPROVAL FROM ENGINEER IS OBTAINED.

3. **STORM WATER MANAGEMENT:** (Example Below - May be used as applicable, or revised)

- A. Storm water drainage will be provided by ditches which carry drainage within the R.O.W. to the lows within the roadway and project site which drains to natural facilities.
- B. Other permanent erosion controls include hydraulic design to limit structure outlet velocities and grading design generally consisting of 4 :1 or flatter slopes with permanent vegetative cover.
- C. Sedimentation basins are not feasible on this project due to limited room within the TxDOT R.O.W. Alternate BMPs have been included in the SW3P to provide equivalent sedimentation control.

4. **STORM WATER MANAGEMENT ACTIVITIES:** (Sequence of Construction)

1. SEE TCP SEQUENCE OF WORK FOR GENERAL SEQUENCE OF CONSTRUCTION ACTIVITIES.
2. SEE CONSTRUCTION PROGRESS SCHEDULE FOR SCHEDULE AND DURATIONS OF RELEVANT SOIL DISTURBANCE AND STABILIZATION ACTIVITIES.
3. INSTALL SW3P CONTROL DEVICES (BMPS) TO PROTECT RECEIVING WATER AND ACTIVE ROADWAYS PRIOR TO SOIL DISTURBING ACTIVITIES IN THEIR VICINITY, PER SITE MAP AND AS DIRECTED BY OR AUTHORIZED BY ENGINEER
4. AVOID STORING PORTABLE SANITARY UNITS, CONCRETE WASHOUTS OR CHEMICALS WITHIN 50 FEET UPGRADIENT OF A RECEIVING WATER OR DRAINAGE CONVEYANCE WITHOUT ADEQUATE POLLUTION CONTROL.
5. PRESERVE EXISTING VEGETATION, MAINTAIN A VEGETATIVE BUFFER ALONG RECEIVING WATERS, AND PHASE CONSTRUCTION ACTIVITIES TO MINIMIZE EXPOSURE OF DISTURBED SOIL TO THE EXTENT PRACTICABLE.
6. WHERE WORK HAS TEMPORARILY CEASED IN THE AREA, STABILIZED DISTURBED SOIL WITH TEMPORARY SEEDING AND/OR VERTICAL TRACKING, PER TXR150000 &/OR AS DIRECTED BY ENGINEER.
7. RE-VEGETATE DISTURBED SOILS IN COMPLETED PROJECT AREAS (WHERE NOT OTHERWISE PAVED, HARDSCAPED OR LANDSCAPED) AS SOON AS PRACTICABLE OR AS DIRECTED BY ENGINEER.
8. WHEN CONSTRUCTION ACTIVITIES IS COMPLETED, PROJECT AREA IS STABILIZED, AND AS DIRECTED OR AUTHORIZED BY ENGINEER, REMOVE ALL TEMPORARY SW3P CONTROLS.
9. **NON-STORM WATER DISCHARGES:**

Filter non-storm water discharges, or hold in retention basins, before being allowed to mix with storm water. These discharges consist of, but not limited to, non-polluted ground water, spring water, foundation or footing drain water, water used for dust control or pavement washing and vehicle washwater containing no detergents.

C. OTHER REQUIREMENTS & PRACTICES

1. **MAINTENANCE:**

Maintain all erosion and sediment controls in good working order. Perform any necessary cleaning/repairs/replacements at the earliest possible date prior to next rain event, but no later than 7 calendar days. Ensure the surrounding ground has dried sufficiently to prevent damage from equipment. "Too Wet" is the only reason for not adhering to timeframes described. When construction activities permanently or temporarily cease and are not expected to resume for 14 or more days on a disturbed portion of the site, stabilization measures must be initiated immediately.

2. **INSPECTION:**

A TxDOT Inspector will perform a regularly scheduled SW3P Inspection every 7 calendar days. An Inspection and Maintenance Report, signed by the TxDOT Inspector and the Contractor, will be filed for each inspection. Revise/clean/repair/replace each BMP control device in accordance with the current Field Inspection and Maintenance Report (Form 2118) and Item 1 (Maintenance) above.

3. **WASTE MATERIALS:**

On a daily basis, or as may be directed, collect all waste materials, trash and debris from the construction site and deposit into a metal dumpster having a secure cover and which meets all state and local city solid waste management requirements. Empty the dumpster as required by regulation, or as may be directed, at a local approved landfill site. Do not bury construction waste on the construction project site.

4. **HAZARDOUS WASTE & SPILL REPORTING:**

As a minimum, any products in the following categories are considered to be hazardous: Paints, Acids, Solvents, Fuels, Asphalt Products, Chemical Additives for Soil Stabilization, and Concrete Curing Compounds or Additives. When storing hazardous material on the project site, or at a Project Specific Location, take all practicable precaution to prevent and/or contain any spillage of these materials. In the event of a spill, contact the spill coordinator immediately.

5. **SANITARY WASTE:**

Use a licensed sanitary waste management contractor to collect all sanitary waste from portable units as may be required by local regulation, or as directed.

6. **CONSTRUCTION VEHICLE TRACKING:**

On a regular basis, or as may be directed, dampen haul roads for dust control and construct construction entrances/exits. Provide for a motorized broom or vacuum type sweeper to be available on a daily basis, or as may be directed, to remove sediment from paved roadways on project, abutting and traversing the project site.

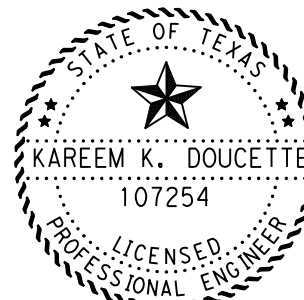
7. **MANAGEMENT PRACTICES:**

- A. Construct disposal areas, stockpiles, haul roads and PSL's in a manner that will minimize and control the amount of sediment that may enter receiving waters. Do not locate disposal areas in any wetland, waterbody or streambed.
- B. Locate construction staging areas, vehicle maintenance and PSL's areas in a manner to minimize the runoff of pollutants.
- C. When working in or near a wetland, install and maintain operating soil erosion and sediment controls at all times during construction and isolate the work from the wetland.
- D. Clear all waterways as soon as practicable of temporary embankment, temporary bridges, matting, falsework, piling, debris or other obstructions placed during construction operations that are not a part of the finished work.
- E. Procedures and/or practices should be taken to control dust.
- F. Sediment to be removed from roadways daily or when work begins after weather events if construction activities have ceased due to weather event.

FILE NAME

DATE

DESIGNER



DocuSigned by: 9/26/2022
Kareem Doucette P.E.
Signature of Registrant & Date
51C8E8A7EBD948C



DALLAS DISTRICT ENVIRONMENTAL

STORM WATER POLLUTION PREVENTION PLAN (SW3P)

TEMPLATE REVISION DATE: 02/07/18

DESIGN KKD	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
GRAPHICS KKD	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK KKD	TEXAS	DALLAS	DENTON	102
CHECK KKD	CONTROL	SECTION	JOB	
TC	2352	02	027	

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

Notes To Designer:
 1. Do not alter Sheet Design or Font style, size or weight - match text attributes.
 2. If additional space is needed for a numbered section, fence and adjust sections up or down as needed for proportioning and readability but do not relocate from its relative position.
 3. All areas should be addressed thoroughly and verify the necessary pay items are set up to support actions needed.
 Filled Out: XX/XX/XXXX
 Prepared By: Name/Section

I. STORMWATER POLLUTION PREVENTION PLAN-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 adjacent MS 4 Operator(s) that receive discharges from this project. They need to be notified prior to construction activities.
 (Note: Leave blank only if no adjacent MS 4 Operator(s) are affected.)

- 1.
 - 2.
- No Action Required Required Action

Action Number:

1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000.
2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.
3. Post Construction Site Notice (CSN) with SW3P information on or near the site, accessible to the public and TCEQ, EPA or other inspectors.
4. When Contractor project specific locations (PSL's) increase disturbed soil area to 5 acres or more, submit NOI to TCEQ and the Engineer.

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. No equipment is allowed in any stream channel below the ordinary High Water Mark except on approved temporary stream crossings or drill pads.

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# 3(a)

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.
- 2.
- 3.

The elevation of the ordinary high water marks of any areas requiring work to be performed in the waters of the US requiring the use of a nationwide permit can be found on the Bridge Layouts.

Best Management Practices for applicable 401 General Conditions:
 (Note: If CORP Permit not required, do not check boxes.)

Erosion	Sedimentation	Post-Construction TSS
<input type="checkbox"/> Temporary Vegetation	<input type="checkbox"/> Silt Fence	<input type="checkbox"/> Vegetative Filter Strips
<input type="checkbox"/> Blankets/Matting	<input 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 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 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 Number:

- 1.
- 2.

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 Number:

- 1.
- 2.

V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRDS TREATY ACT.

- No Action Required Required Action

Action Number:

1. The following species could occur in the project area: Woodhouse's toad. Follow the special notes and BMPs listed below to protect the species.
2. Contractor to implement the following BMPs from "Beneficial Management Practices: Avoiding, Minimizing, and Mitigating Impacts of Transportation Projects on State Natural Resources" available at <https://ftp.txdot.gov/pub/txdot-info/env/toolkit/300-01-bmp.pdf>.
 - a. Section 2.6.2 Aquatic Amphibian and Reptile BMP (barrier fencing not required)
 - b. Section 2.6.2 Terrestrial Amphibian and Reptile BMP
 - c. Section 1.4 Water Quality BMP
 - d. Section 1.2 Vegetation BMP

Special Notes:

1. Avoid harming all wildlife species if encountered and allow them to safely leave the project site. Due diligence should be used to avoid killing or harming any wildlife species in the implementation of transportation projects.
2. 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. The work may not remove active nests from bridges and other structures during nesting season of the birds associated with the nests. If caves or sinkholes are discovered, cease work in the immediated area, and contact the Engineer immediately.
3. The Migratory Bird Act of 1918 states that it is unlawful to kill, capture, collect, possess, buy, sell, trade or transport any migratory bird, nest, young, feather or egg in part or in whole, without a federal permit issued in accordance within the Act's policies and regulations. The contractor would remove all old migratory bird nests from any structure or trees where work would be done from October 1 to February 15. In addition, the contractor would be prepared to prevent migratory birds from building nest(s) between February 15 to October 1. In the event that migratory birds are encountered on-site during project construction, efforts to avoid adverse impacts on protected birds, active nests, eggs and/or young would be observed.

LIST OF ABBREVIATIONS

BMP: Best Management Practice	SPCC: Spill Prevention Control and Countermeasure
CGP: Construction General Permit	SW3P: 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 Corp 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 Safety Data Sheets (SDS) 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 SDS. In the event of a spill, take actions to mitigate the spill as indicated in the SDS, 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, canisters, barrels, etc.
- * Undesirable smells or odors
- * Evidence of leaching or seepage of substances

Does the project involve any bridge class structure rehabilitation(s) or replacement(s) (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 Number:

- 1.
- 2.
- 3.

VII. OTHER ENVIRONMENTAL ISSUES

(includes regional issues such as Edwards Aquifer District, etc.)

- No Action Required Required Action

Action Number:

- 1.



ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS (EPIC)

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
6	SEE TITLE SHEET		FM 2449
STATE	DISTRICT	COUNTY	
TEXAS	DALLAS	Denton	SHEET NO.
CONTROL	SECTION	JOB	
2352	02	027	103

GENERAL NOTE:

Any change orders and/or deviations from the final design must be reported to the Engineer prior to commencement of construction activities, as additional environmental clearance may be required.

DATE DISTURBED _____
DATE STABILIZED _____

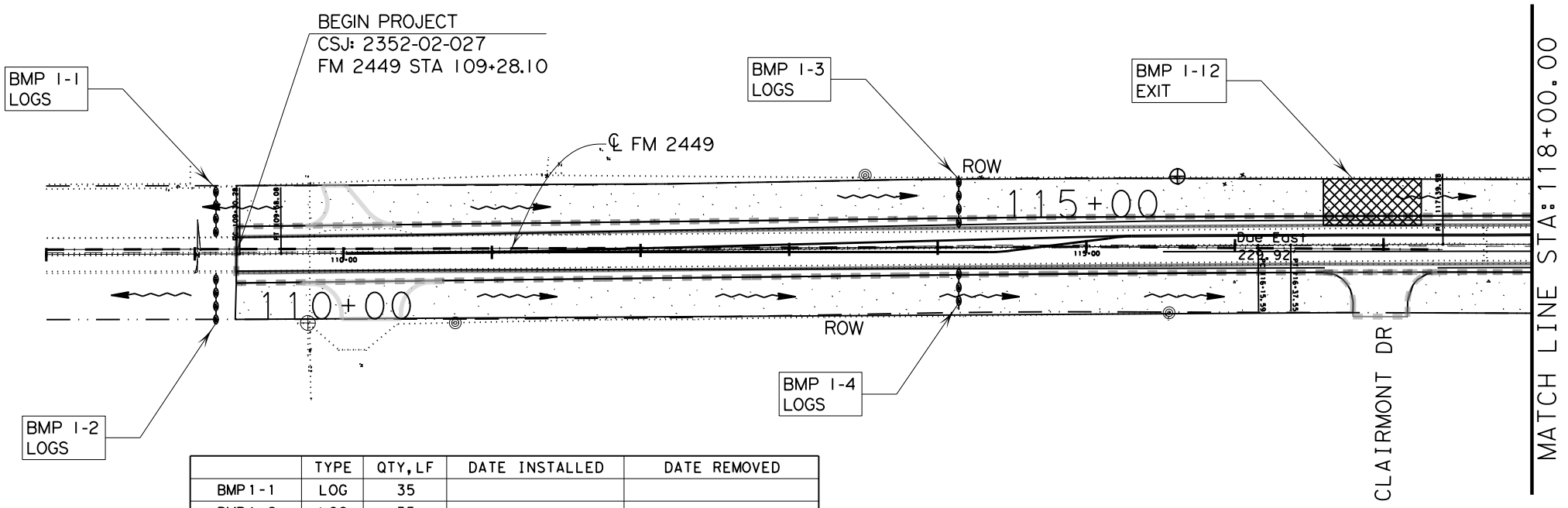


LEGEND

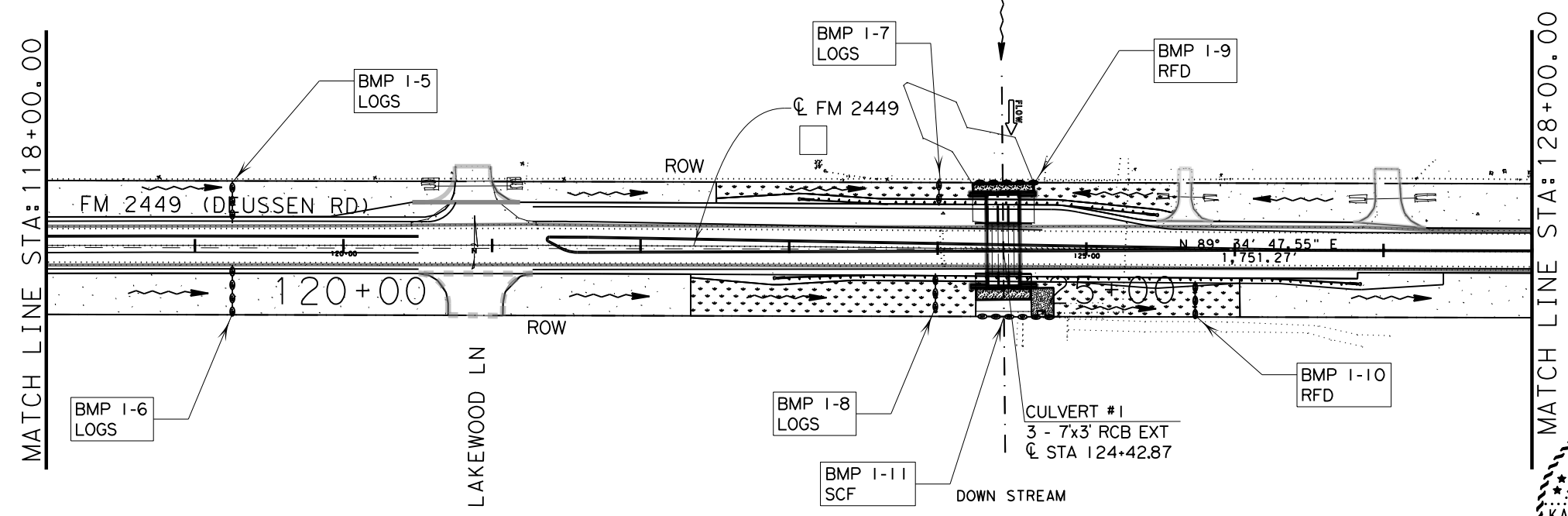
- DIRECTION OF FLOW
- LOGS
- BIODEGRADABLE EROSION CONTROL LOGS
- RFD ROCK FILTER DAM (TY 2)
- SCF SILT FENCE
- SEEDING
- BLOCK SOD
- CONSTRUCTION EXIT

NOTES:

- 1) ADJUST CONSTRUCTION EXIT(S) AS NEEDED AND APPROVED BY THE ENGINEER
- 2) BMP'S SHALL NOT BE INSTALLED IN THE CONTROL AREA NO SOONER THAN 2 WEEKS PRIOR TO SOIL BEING DISTURBED.
- 3) ROCK FILTER DAMS SHOULD BE PLACED AT EACH CROSSING CULVERT AT THE DOWNSTREAM END.
- 4) EXACT LOCATION OF ROCK FILTER DAM, CONSTRUCTION EXITS, AND EROSION CONTROL LOGS TO BE DETERMINED BY THE ENGINEER.
- 5) ADJUST BMP AS APPROPRIATE TO PROTECT ALL CULVERTS AND DOWNSLOPE PERIMETERS FROM SEDIMENTATION.
- 6) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.
- 7) PRESERVE TREES AND STREAM BANK VEGETATION TO THE EXTENT PRACTICABLE.
- 8) SEDIMENT CONTROL FENCE MAY BE USED IN LIEU OF OTHER STORM WATER BMP'S WHERE CONDITIONS WARRANT, AS AUTHORIZED OR DIRECTED BY THE ENGINEER.

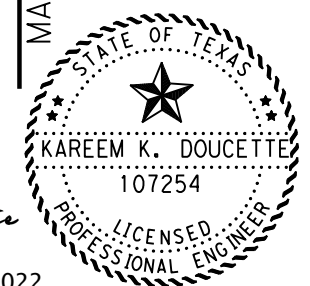


BMP	TYPE	QTY, LF	DATE INSTALLED	DATE REMOVED
BMP 1-1	LOG	35		
BMP 1-2	LOG	35		
BMP 1-3	LOG	35		
BMP 1-4	LOG	30		
BMP 1-5	LOG	30		
BMP 1-6	LOG	30		
BMP 1-7	LOG	20		
BMP 1-8	LOG	30		
BMP 1-9	RFD	40		
BMP 1-10	RFD	25		
BMP 1-11	SCF	50		
BMP 1-12	EXIT	SY=230		



TEMPORARY SEEDING	
DATE PLACED	COMPOS MANUF TOPSOIL AS PER TYPICAL SECTIONS
DATE PLACED	PERMANENT SEEDING/BLOCK SOD
DATE PLACED	

DocuSigned by:
Kareem Doucette
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9/20/2022



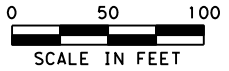
Texas Department of Transportation
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**FM 2449
SW3P SITE MAP**
BEGIN PROJECT to STA 128+00

SCALE: 1" = 100' SHEET 1 OF 2

DESIGN KKD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM2449
GRAPHICS KKD	STATE	DISTRICT DAL	COUNTY DENTON	SHEET NO. 104
CHECK	TEXAS	SECTION 2352	JOB 02	
CHECK	CONTROL			

DATE DISTURBED _____
 DATE STABILIZED _____



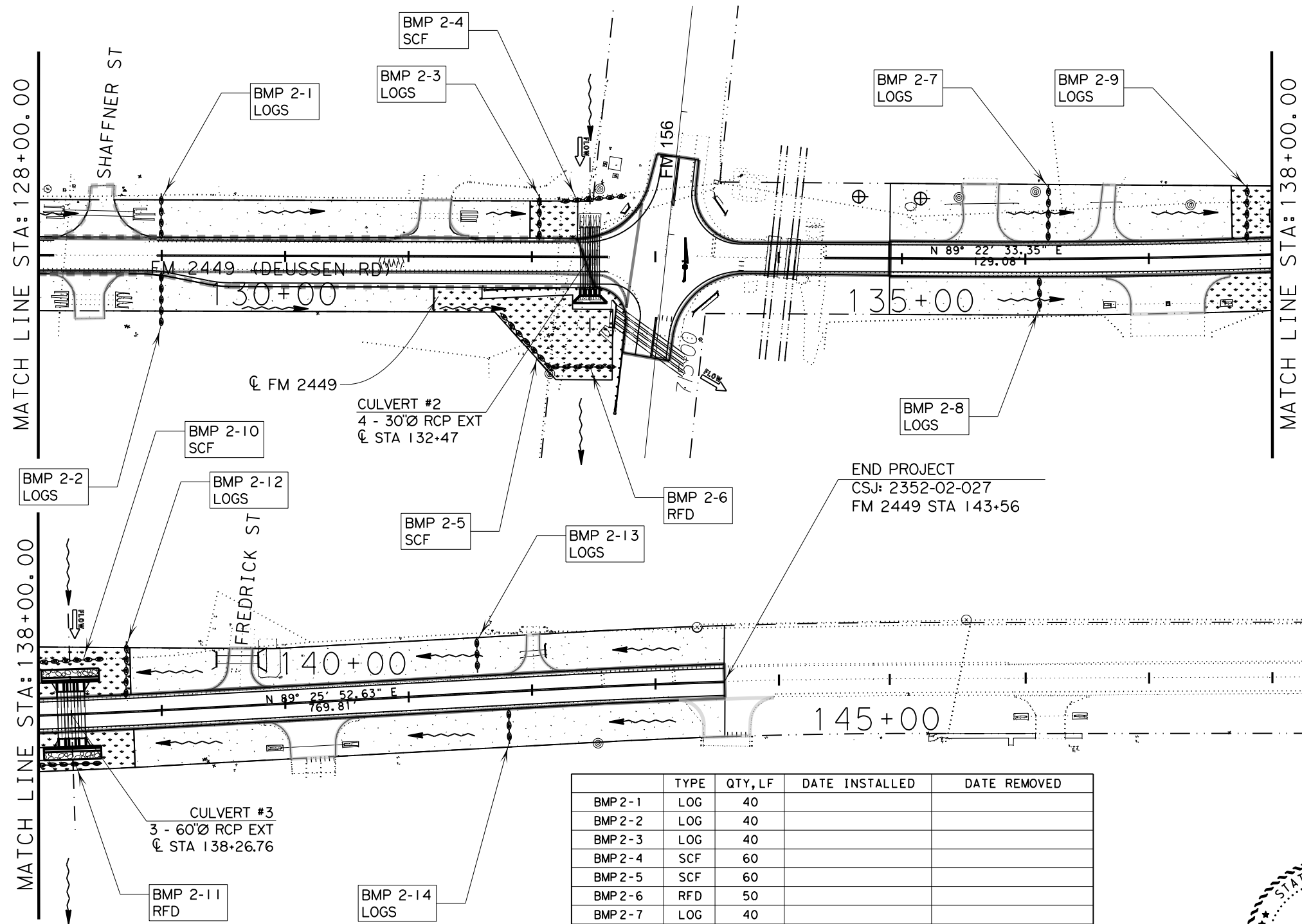
TEMPORARY SEEDING	
DATE PLACED	COMPOS MANUF TOPSOIL AS PER TYPICAL SECTIONS
DATE PLACED	PERMANENT SEEDING/BLOCK SOD
DATE PLACED	

LEGEND

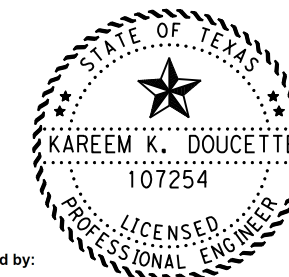
- DIRECTION OF FLOW
- LOGS BIODEGRADABLE EROSION CONTROL LOGS
- RFD ROCK FILTER DAM (TY 2)
- SCF SILT FENCE
- SEEDING
- BLOCK SOD

NOTES:

- 1) CONSTRUCTION EXIT(S) TO BE PLACED AT A LOCATION APPROVED BY THE ENGINEER
- 2) BMP'S SHALL NOT BE INSTALLED IN THE CONTROL AREA NO SOONER THAN 2 WEEKS PRIOR TO SOIL BEING DISTURBED.
- 3) 30 LF OF ROCK FILTER DAMS SHOULD BE PLACED AT EACH CROSSING CULVERT AT THE DOWNSTREAM END.
- 4) EXACT LOCATION OF ROCK FILTER DAM, CONSTRUCTION EXITS, AND EROSION CONTROL LOGS TO BE DETERMINED BY THE ENGINEER.
- 5) PERFORM FINAL SEEDING AS SHOWN IN THE TYPICAL SECTIONS.
- 6) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.
- 7) PRESERVE TREES AND STREAM BANK VEGETATION TO THE EXTENT PRACTICABLE.
- 8) SEDIMENT CONTROL FENCE MAY BE USED IN LIEU OF OTHER STORM WATER BMP'S WHERE CONDITIONS WARRANT, AS AUTHORIZED OR DIRECTED BY THE ENGINEER.



	TYPE	QTY, LF	DATE INSTALLED	DATE REMOVED
BMP 2-1	LOG	40		
BMP 2-2	LOG	40		
BMP 2-3	LOG	40		
BMP 2-4	SCF	60		
BMP 2-5	SCF	60		
BMP 2-6	RFD	50		
BMP 2-7	LOG	40		
BMP 2-8	LOG	40		
BMP 2-9	LOG	40		
BMP 2-10	SCF	50		
BMP 2-11	RFD	50		
BMP 2-12	LOG	50		
BMP 2-13	LOG	50		
BMP 2-14	LOG	50		



DocuSigned by:
 Kareem Doucette 9/20/2022
 51C8F8A7FBD948C...

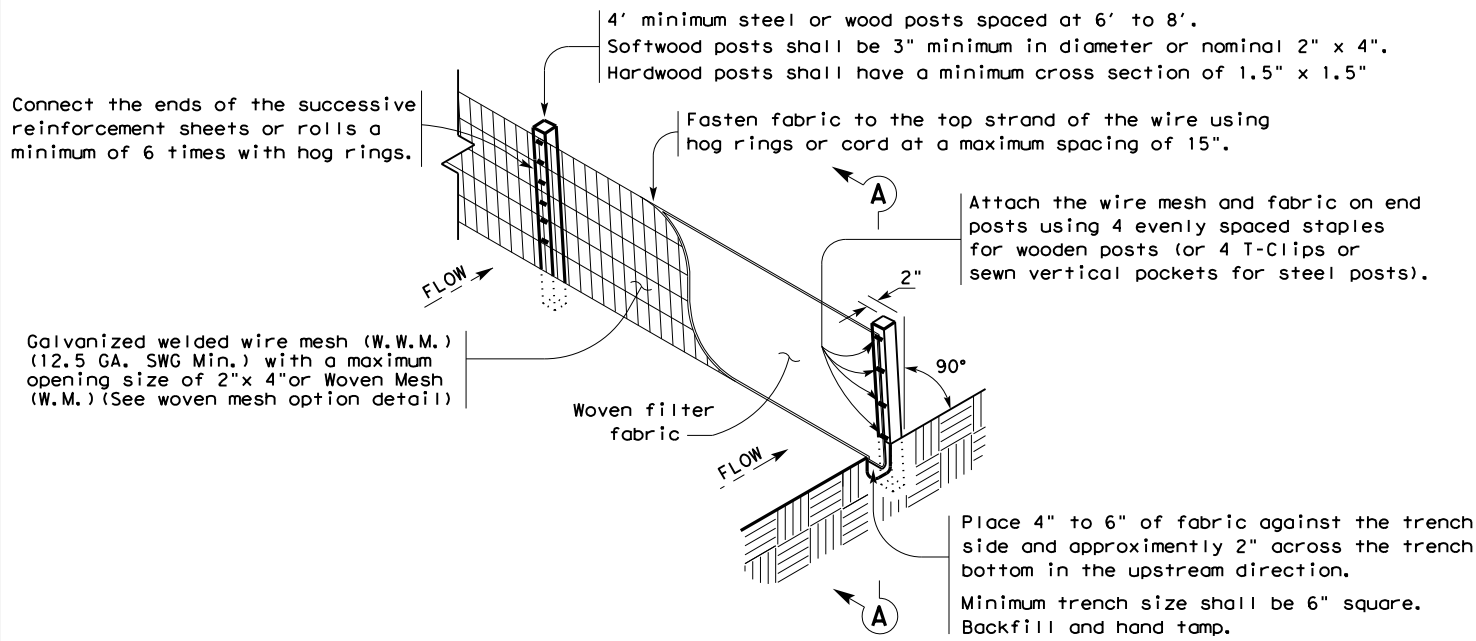


**FM 2449
 SW3P SITE MAP**

STA 128+00 to END OF PROJECT

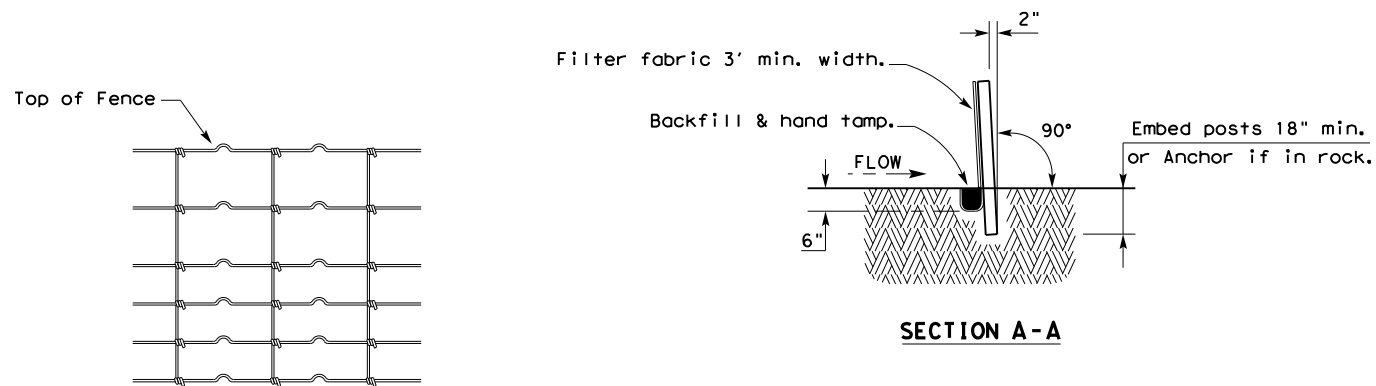
SCALE: 1" = 100'		SHEET 2 OF 2	
DESIGN KDD	FED. RD. DIV. NO. 6	PROJECT NO. (See Title Sheet)	HIGHWAY NO. FM2449
GRAPHICS KDD	STATE TEXAS	DISTRICT DAL	COUNTY DENTON
CHECK	CONTROL 2352	SECTION 02	JOB 027
			105

90A92022
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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/FT². Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

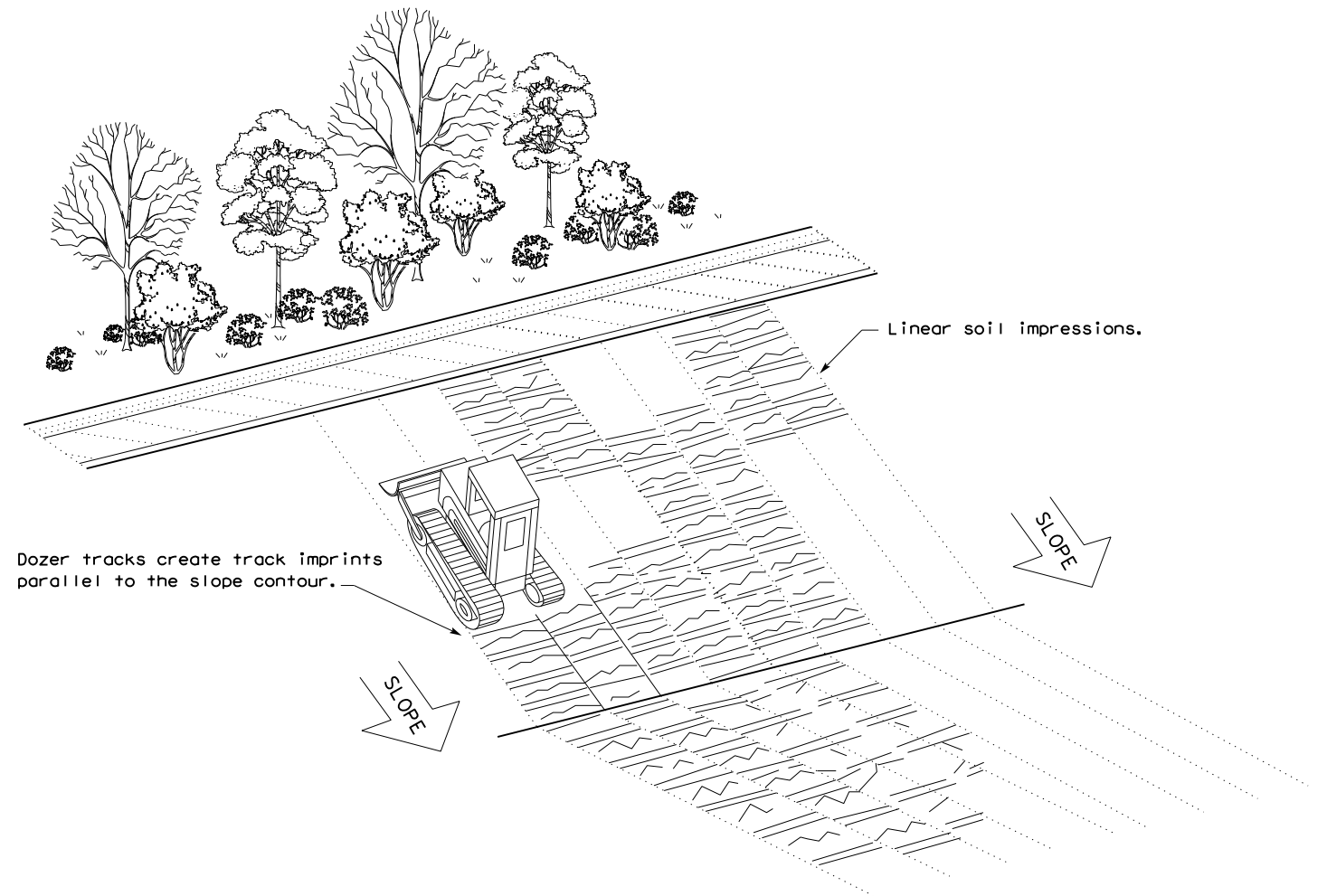
LEGEND

Sediment Control Fence

SCF

GENERAL NOTES

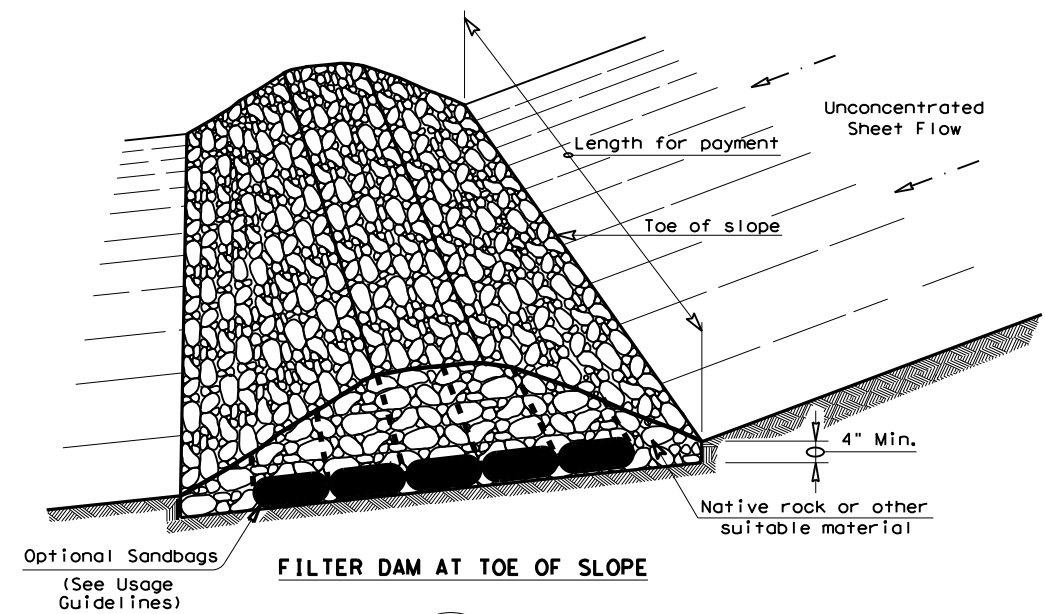
1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum 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

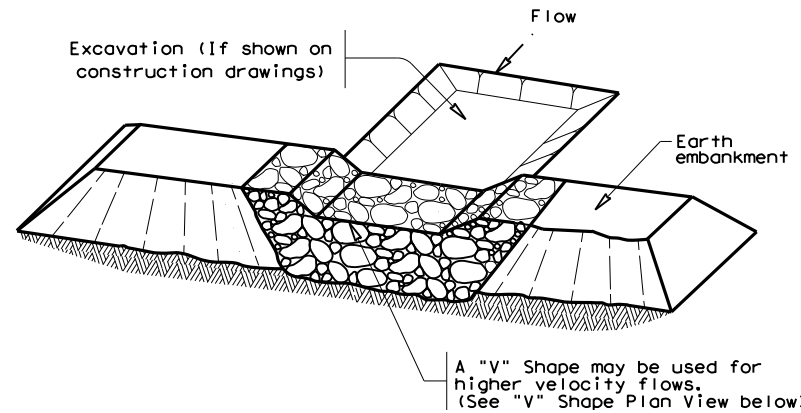
				Design Division Standard	
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES FENCE & VERTICAL TRACKING EC(1)-16					
FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	2352	02	027	FM2449	
	DIST	COUNTY		SHEET NO.	
	DAL	DENTON		106	

DATE: 9/19/2022
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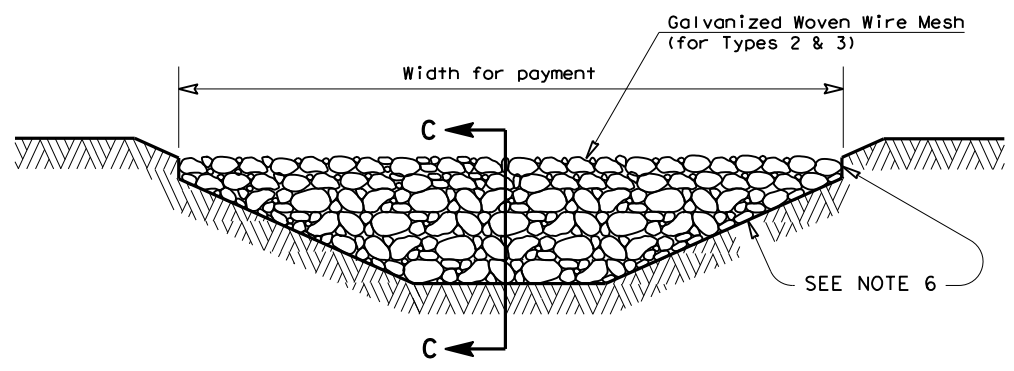
FILTER DAM AT TOE OF SLOPE

(RFD1)



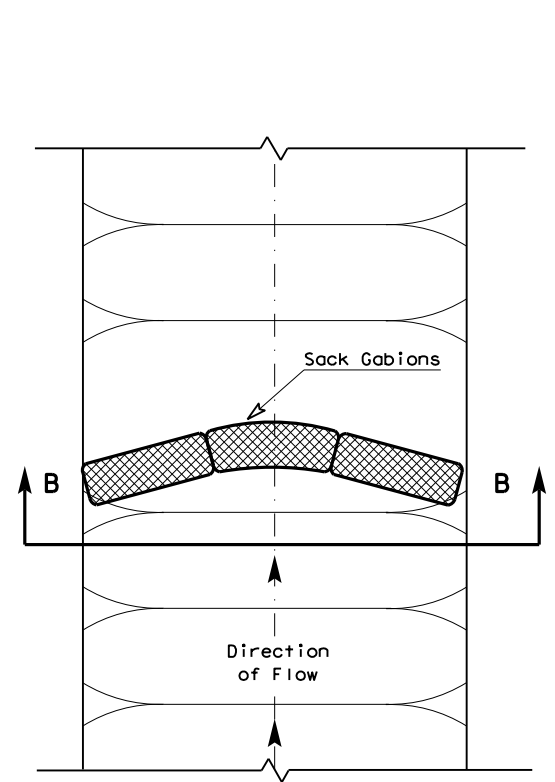
FILTER DAM AT SEDIMENT TRAP

(RFD1) OR (RFD2)

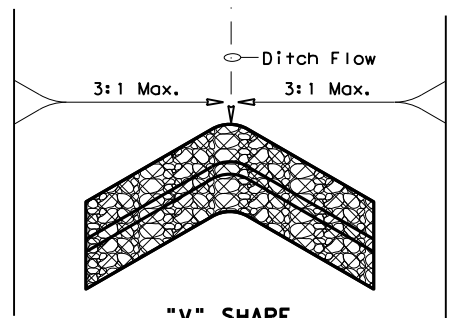


FILTER DAM AT CHANNEL SECTIONS

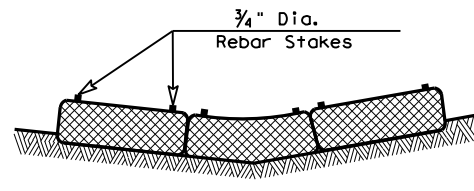
(RFD1) OR (RFD2) OR (RFD3)



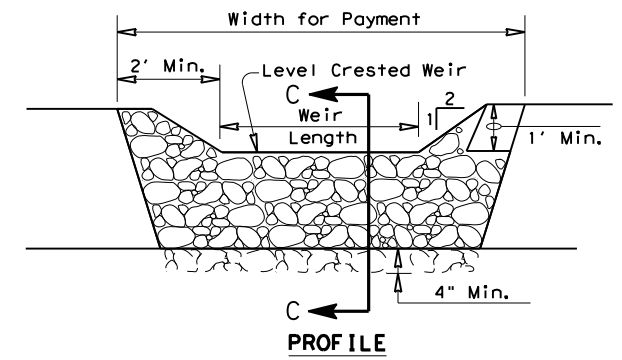
PLAN VIEW



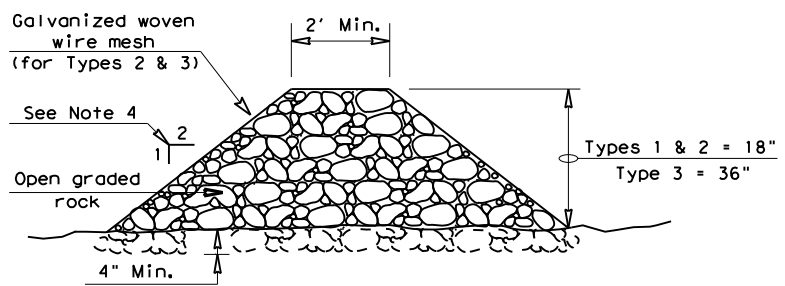
"V" SHAPE PLAN VIEW



SECTION B-B



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/FT² 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.

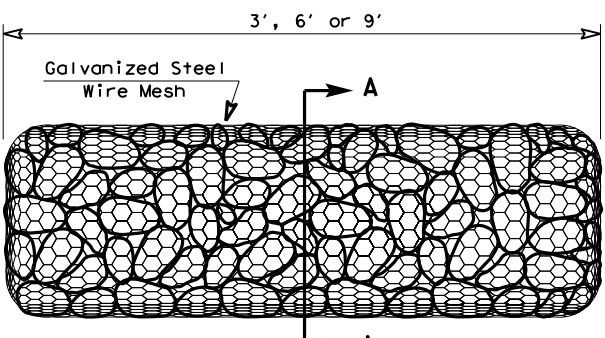
Type 5: Provide rock filter dams as shown on plans.

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.

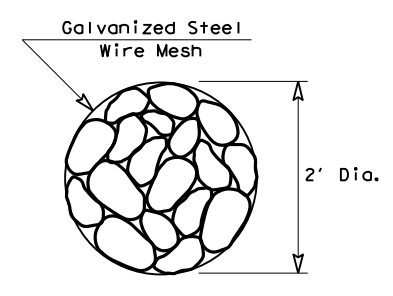
PLAN SHEET LEGEND

- Type 1 Rock Filter Dam (RFD1)
- Type 2 Rock Filter Dam (RFD2)
- Type 3 Rock Filter Dam (RFD3)
- Type 4 Rock Filter Dam (RFD4)



TYPE 4 (SACK GABIONS)

(RFD4)

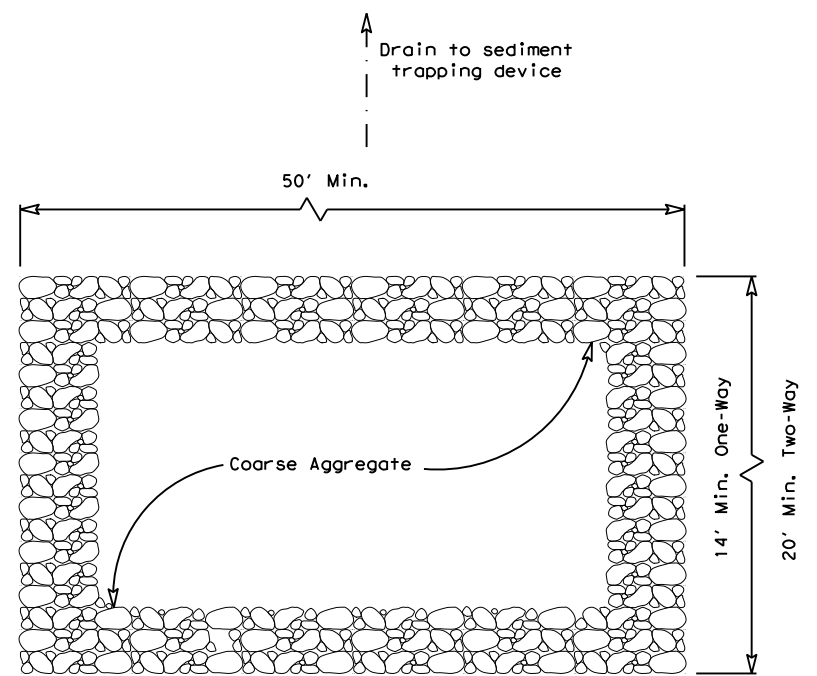


SECTION A-A

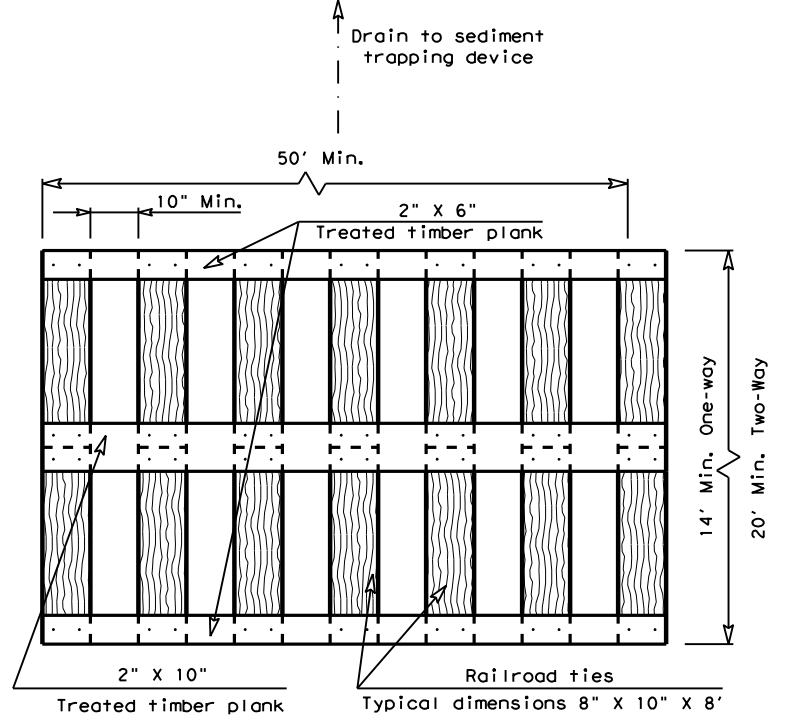
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TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES ROCK FILTER DAMS EC(2) - 16			
FILE: ec216	DN: TxDOT	CK: KM	DW: VP
© TxDOT: JULY 2016	CONT: 2352	SECT: 02	JOB: 027
REVISIONS			HIGHWAY: FM2449
DIST: DAL	COUNTY: DENTON	SHEET NO.: 107	

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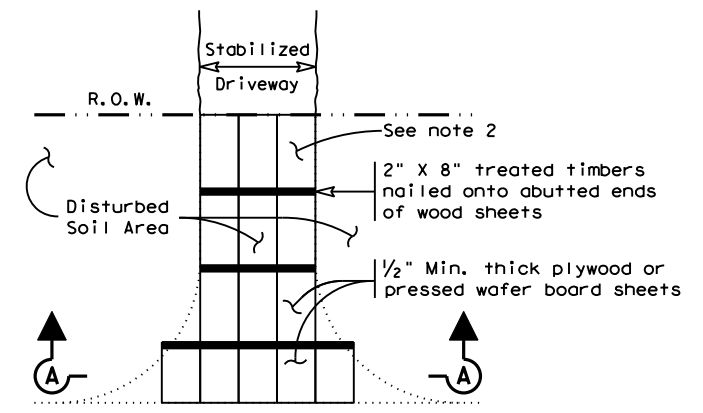
DATE: 9/19/2022
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PLAN VIEW

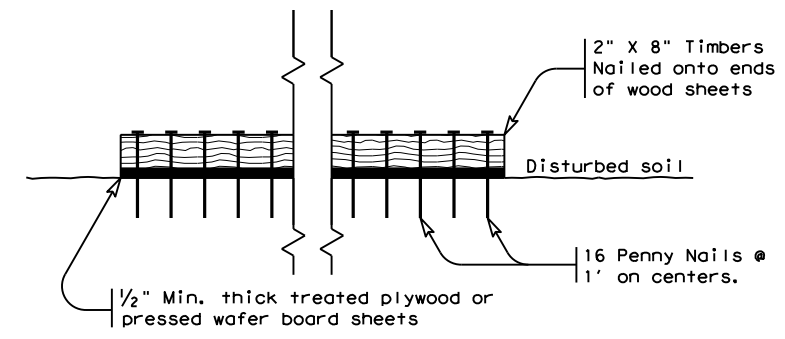


PLAN VIEW



Paved Roadway

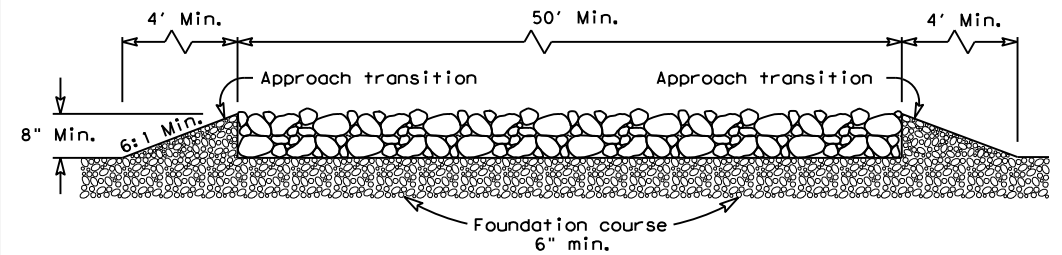
PLAN VIEW



SECTION A-A

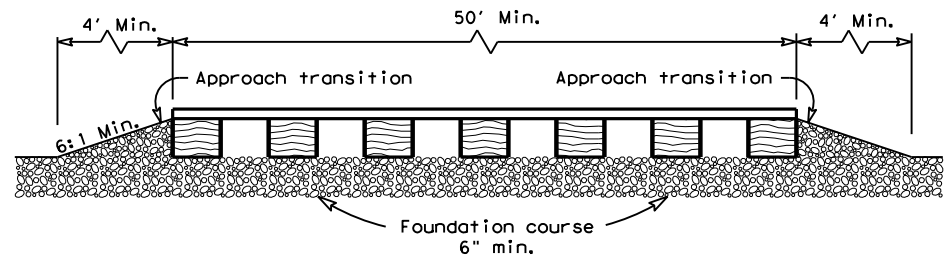
CONSTRUCTION EXIT (TYPE 3)

SHORT TERM



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 1)
 ROCK CONSTRUCTION (LONG TERM)



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 2)
 TIMBER CONSTRUCTION (LONG TERM)

GENERAL NOTES (TYPE 1)

1. The length of the type 1 construction exit shall be as indicated on the plans, but not less than 50'.
2. The coarse aggregate should be open graded with a size of 4" to 8".
3. The approach transitions should be no steeper than 6:1 and constructed as directed by the Engineer.
4. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other materials approved by the Engineer.
5. The construction exit shall be graded to allow drainage to a sediment trapping device.
6. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
7. 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.

GENERAL NOTES (TYPE 2)

1. The length of the type 2 construction exit shall be as indicated on the plans, but not less than 50'.
2. The treated timber planks shall be attached to the railroad ties with 1/2"x 6" min. lag bolts. Other fasteners may be used as approved by the Engineer.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The approach transitions shall be no steeper than 6:1 and constructed as directed by the Engineer.
5. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
6. The construction exit should be graded to allow drainage to a sediment trapping device.
7. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
8. 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.

GENERAL NOTES (TYPE 3)

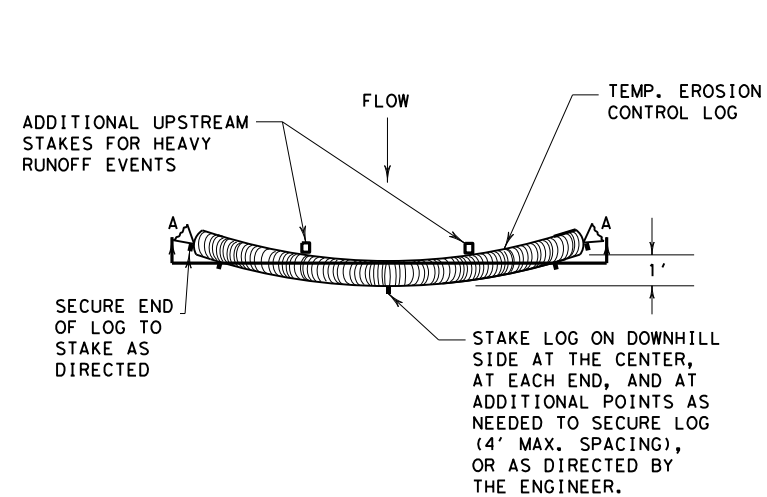
1. The length of the type 3 construction exit shall be as shown on the plans, or as directed by the Engineer.
2. The type 3 construction exit may be constructed from open graded crushed stone with a size of two to four inches spread a min. of 4" thick to the limits shown on the plans.
3. The treated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



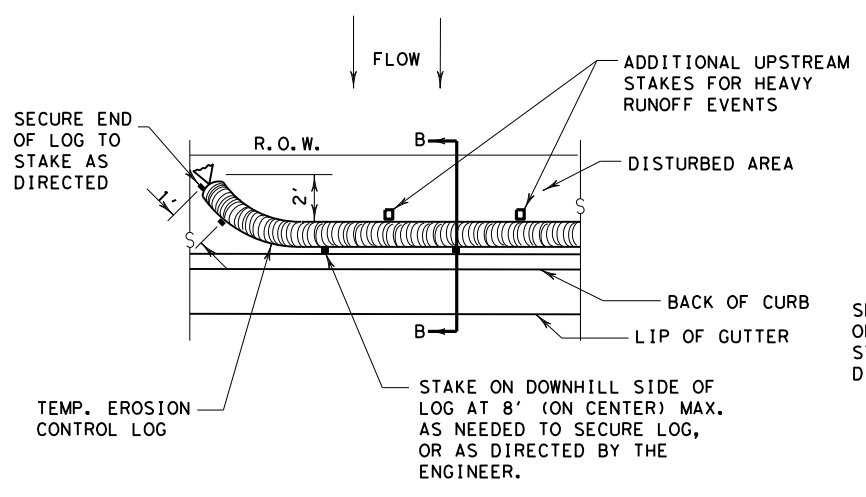
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES
 CONSTRUCTION EXITS
 EC(3)-16

FILE: ec316	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM2449
DIST	COUNTY	SHEET NO.		
DAL	DENTON	108		

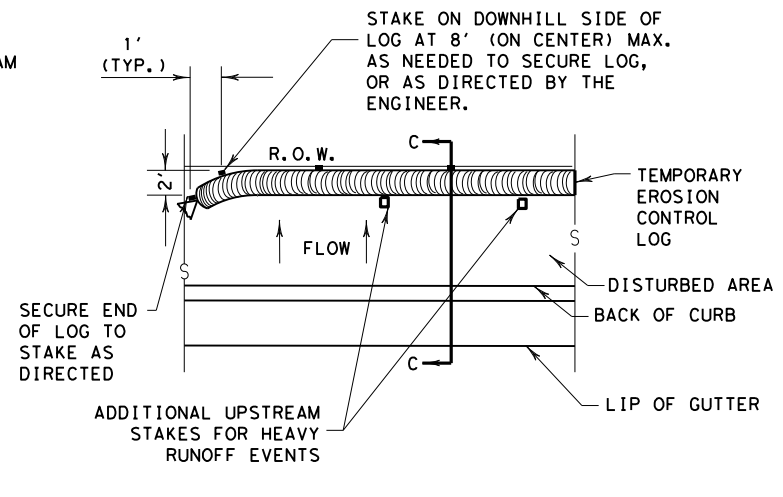
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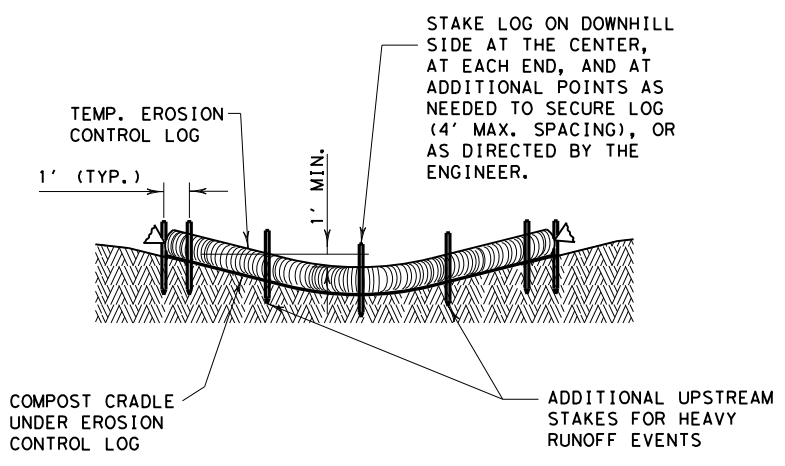
PLAN VIEW



PLAN VIEW



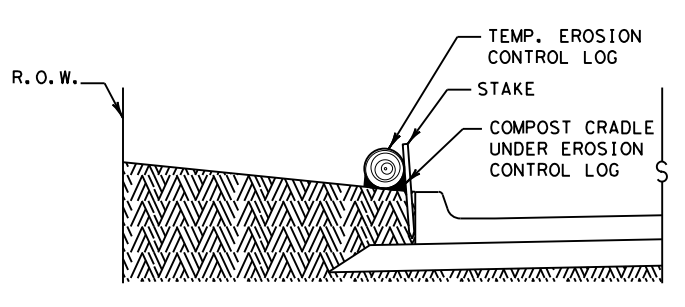
PLAN VIEW



SECTION A-A

EROSION CONTROL LOG DAM

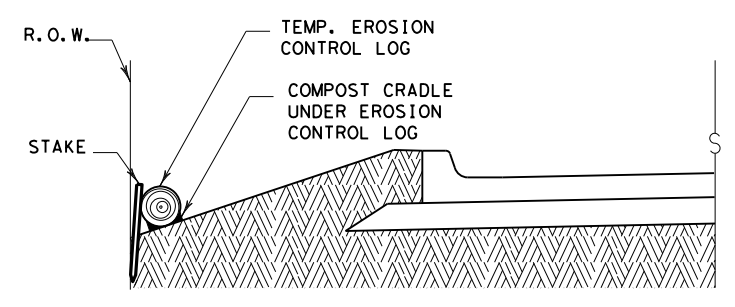
CL-D



SECTION B-B

EROSION CONTROL LOG AT BACK OF CURB

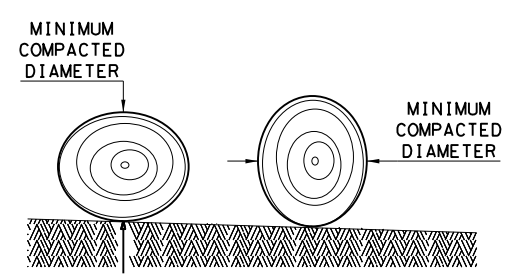
CL-BOC



SECTION C-C

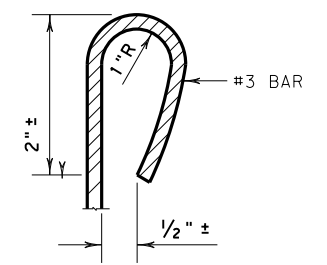
EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY

CL-ROW



DIAMETER MEASUREMENTS OF EROSION CONTROL LOGS SPECIFIED IN PLANS

- LEGEND**
- CL-D EROSION CONTROL LOG DAM
 - CL-BOC EROSION CONTROL LOG AT BACK OF CURB
 - CL-ROW EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY
 - CL-SST EROSION CONTROL LOGS ON SLOPES STAKE AND TRENCHING ANCHORING
 - CL-SSL EROSION CONTROL LOGS ON SLOPES STAKE AND LASHING ANCHORING
 - CL-DI EROSION CONTROL LOG AT DROP INLET
 - CL-CI EROSION CONTROL LOG AT CURB INLET
 - CL-GI EROSION CONTROL LOG AT CURB & GRATE INLET



REBAR STAKE DETAIL

SEDIMENT BASIN & TRAP USAGE GUIDELINES

An erosion control log sediment trap may be used to filter sediment out of runoff draining from an unstabilized area.
Log Traps: The drainage area for a sediment trap should not exceed 5 acres. The trap capacity should be 1800 CF/Acre (0.5" over the drainage area).
 Control logs should be placed in the following locations:
 1. Within drainage ditches spaced as needed or min. 500' on center
 2. Immediately preceding ditch inlets or drain inlets
 3. Just before the drainage enters a water course
 4. Just before the drainage leaves the right of way
 5. Just before the drainage leaves the construction limits where drainage flows away from the project.
 The logs should be cleaned when the sediment has accumulated to a depth of 1/2 the log diameter.
 Cleaning and removal of accumulated sediment deposits is incidental and will not be paid for separately.

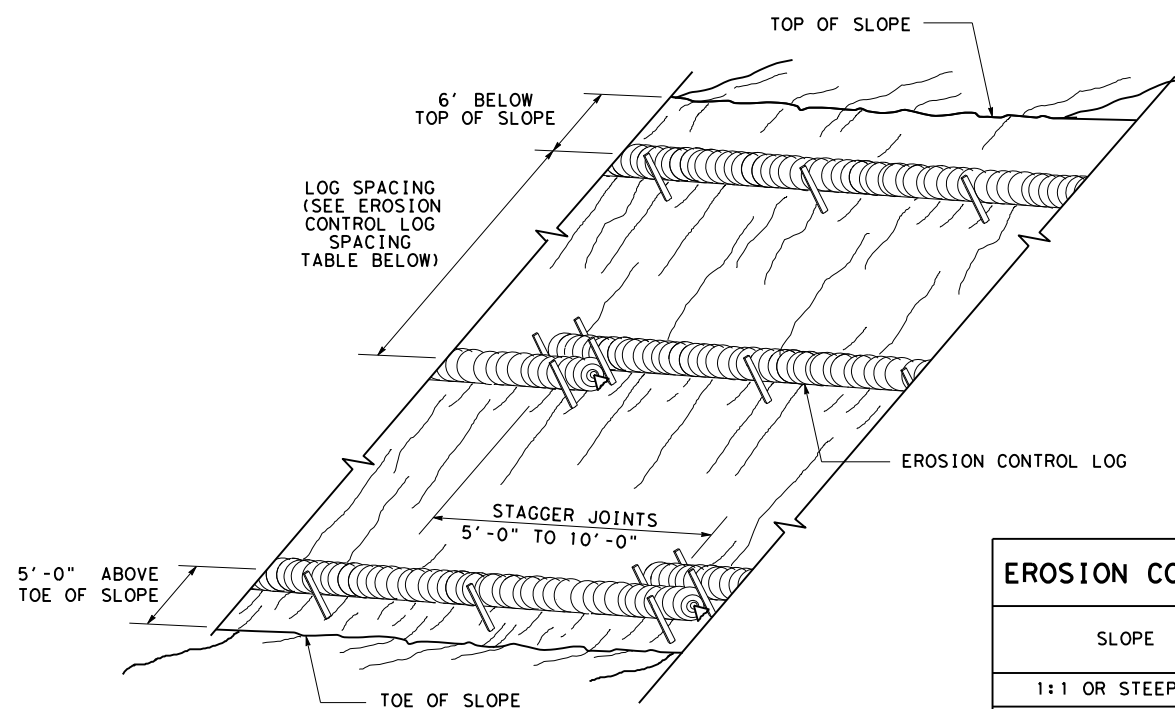
GENERAL NOTES:

1. EROSION CONTROL LOGS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, OR AS DIRECTED BY THE ENGINEER.
2. LENGTHS OF EROSION CONTROL LOGS SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AS REQUIRED FOR THE PURPOSE INTENDED.
3. UNLESS OTHERWISE DIRECTED, USE BIODEGRADABLE OR PHOTODEGRADABLE CONTAINMENT MESH ONLY WHERE LOG WILL REMAIN IN PLACE AS PART OF A VEGETATIVE SYSTEM. FOR TEMPORARY INSTALLATIONS, USE RECYCLABLE CONTAINMENT MESH.
4. FILL LOGS WITH SUFFICIENT FILTER MATERIAL TO ACHIEVE THE MINIMUM COMPACTED DIAMETER SPECIFIED IN THE PLANS WITHOUT EXCESSIVE DEFORMATION.
5. STAKES SHALL BE 2" X 2" WOOD OR #3 REBAR, 2'-4' LONG, EMBEDDED SUCH THAT 2" PROTRUDES ABOVE LOG, OR AS DIRECTED BY THE ENGINEER.
6. DO NOT PLACE STAKES THROUGH CONTAINMENT MESH.
7. COMPOST CRADLE MATERIAL IS INCIDENTAL & WILL NOT BE PAID FOR SEPARATELY.
8. SANDBAGS USED AS ANCHORS SHALL BE PLACED ON TOP OF LOGS & SHALL BE OF SUFFICIENT SIZE TO HOLD LOGS IN PLACE.
9. TURN THE ENDS OF EACH ROW OF LOGS UPSLOPE TO PREVENT RUNOFF FROM FLOWING AROUND THE LOG.
10. FOR HEAVY RUNOFF EVENTS, ADDITIONAL UPSTREAM STAKES MAY BE NECESSARY TO KEEP LOG FROM FOLDING IN ON ITSELF.

SHEET 1 OF 3

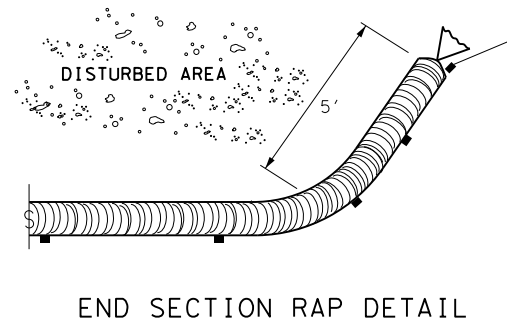
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FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT
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DIST: DAL	COUNTY: DENTON	SHEET NO. 109	

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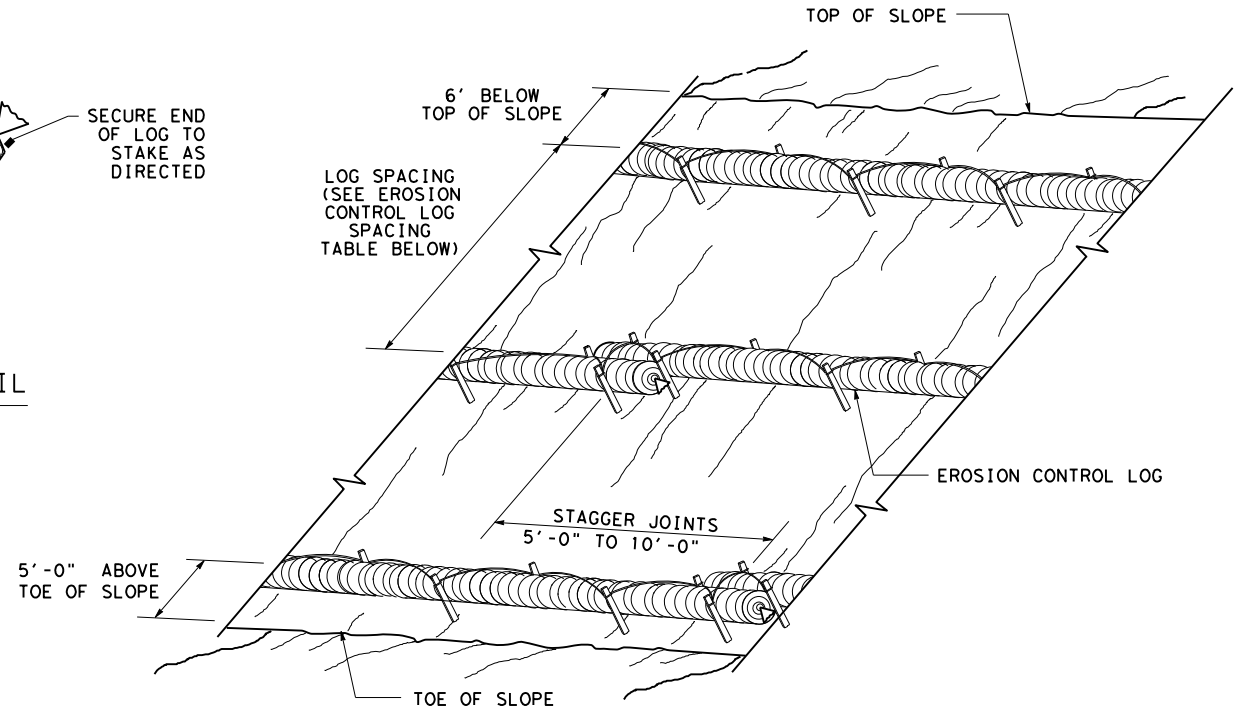
**EROSION CONTROL LOGS ON SLOPES
STAKE AND TRENCHING ANCHORING**

CL-SST



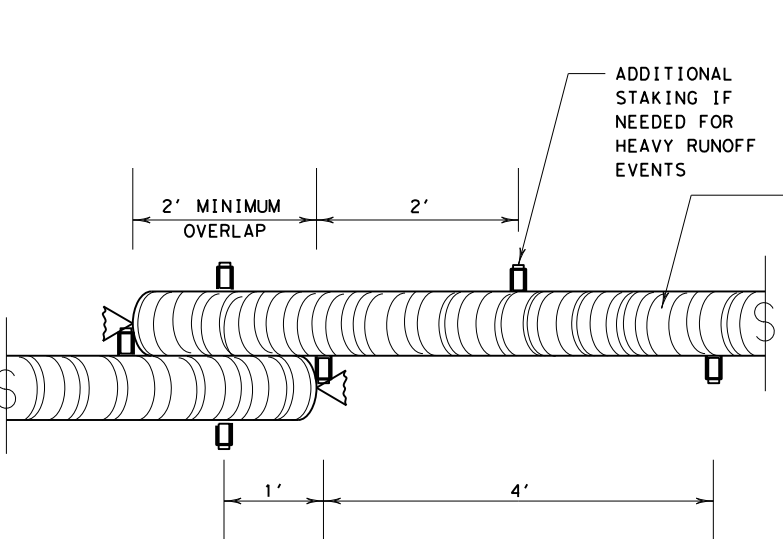
SLOPE	LOG DIAMETER			
	6"	8"	12"	18"
1:1 OR STEEPER	5'	10'	15'	20'
2:1	10'	20'	30'	40'
3:1	15'	30'	45'	60'
4:1 OR FLATTER	20'	40'	60'	80'

* ADJUSTMENTS CAN BE MADE FOR SOIL TYPE:
 SOFT, LOAMY SOILS-ADJUST ROWS CLOSER TOGETHER;
 HARD, ROCKY SOILS- ADJUST ROWS FARTHER APART



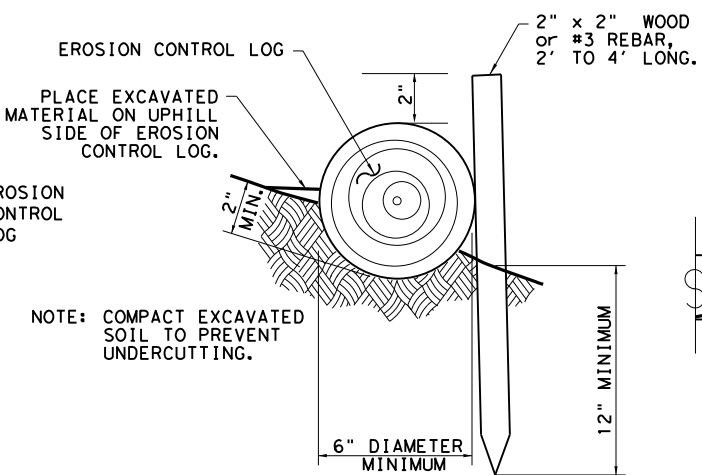
**EROSION CONTROL LOGS ON SLOPES
STAKE AND LASHING ANCHORING**

CL-SSL



STAKE AND TRENCHING ANCHORING DETAIL

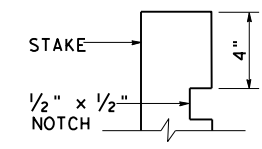
CL-SST



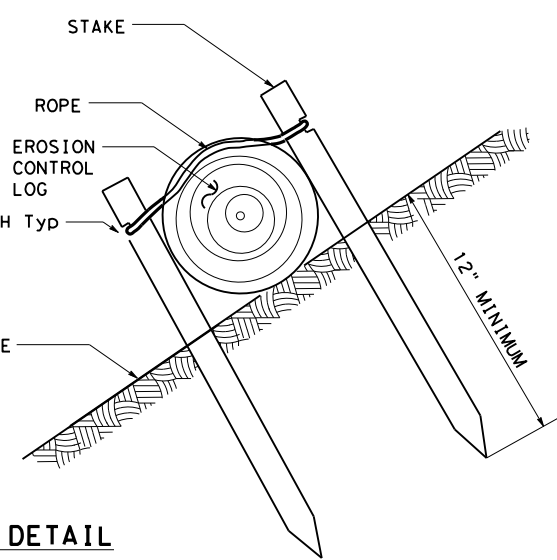
STAKE AND LASHING ANCHORING DETAIL

CL-SSL

LOG DIAMETER	DEPTH
6"	2"
8"	3"
12"	4"
18"	5"



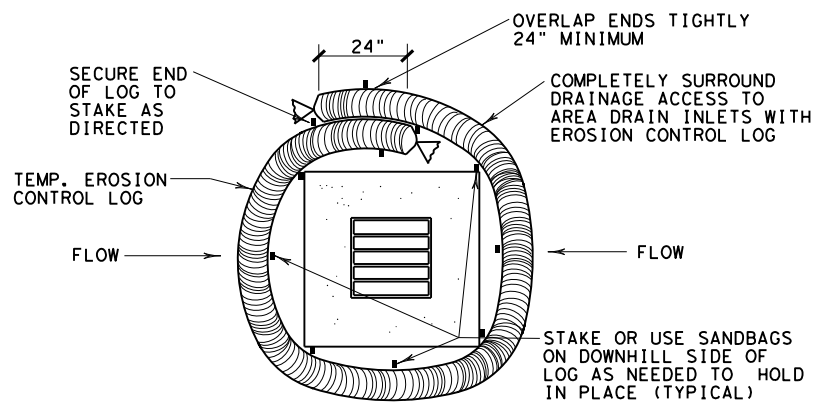
STAKE NOTCH DETAIL



SHEET 2 OF 3

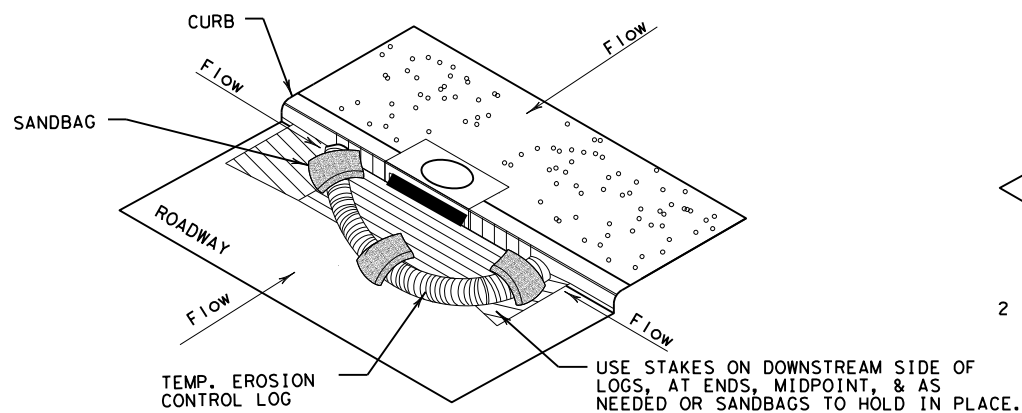
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TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES EROSION CONTROL LOG EC (9) - 16			
FILE: ec116	DN: TxDOT	CK: KM	DW: LS/PT
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REVISIONS			HIGHWAY: FM2449
DIST: DAL	COUNTY: DENTON	SHEET NO.: 110	

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 FILE: T:\DENDES\Projects\FM2449\2352-02-027 Ponder ISD\PLANS\14 ENVIRONMENTAL ISSUES\STANDARDS\ec916.dgn
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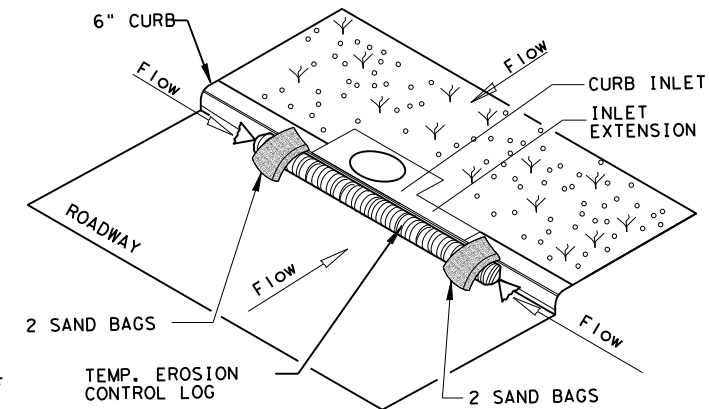
EROSION CONTROL LOG AT DROP INLET

CL-DI



EROSION CONTROL LOG AT CURB INLET

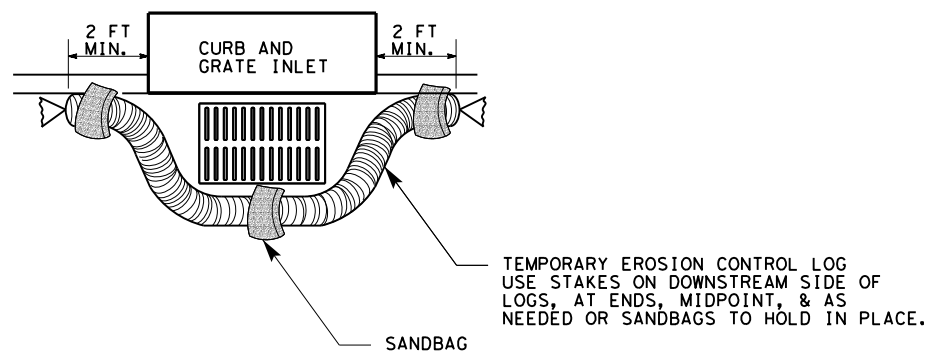
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EROSION CONTROL LOG AT CURB INLET

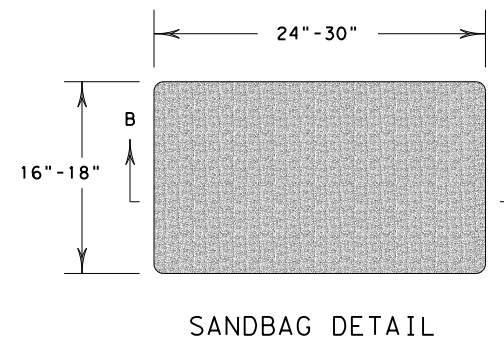
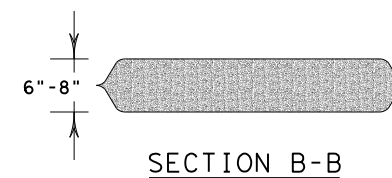
CL-CI

NOTE:
 EROSION CONTROL LOGS USED AT CURB INLETS SHOULD ONLY BE USED IF THEY WILL NOT IMPEDE TRAFFIC OR FLOOD THE ROADWAY OR WHEN THE STORM SEWER SYSTEM IS NOT FULLY FUNCTIONAL.



EROSION CONTROL LOG AT CURB & GRADE INLET

CL-GI



SHEET 3 OF 3



**TEMPORARY EROSION,
 SEDIMENT AND WATER
 POLLUTION CONTROL MEASURES
 EROSION CONTROL LOG
 EC (9) - 16**

FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	2352	02	027	FM2449
DIST	COUNTY		SHEET NO.	
DAL	DENTON		111	

SURFACE PREPARATION ITEM 160* TOPSOIL SY / ITEM 161* COMPOST MANUF. TOPSOIL (BOS) (4") SY

SURFACE PREPARATION

Prepare planting area surface BEFORE placing Topsoil, Compost, Fertilizer, Seed and/or Sod. Once project area has been completed to final lines, grade and compaction, remove objectionable materials from planting area surface and cultivate existing surface to a depth of 4 inches, unless otherwise specified or directed.

Refer to Items 160 and 161 of TxDOT 2014 Standard Specifications* for specifications, dimensions, volumes, and measurements that have been modified or not shown in plans. Materials and construction shall meet all specifications.

TOPSOIL NOTES:

- When Topsoil is specified under Item 160, use suitable material salvaged from the project ROW in accordance with Item 160 specifications, and/or secure additional good material from approved sources.
- Topsoil shall include only the top 6 inches of its native surface, and be easily cultivated, fertile, erosion-resistant and free of objectionable materials.
- Topsoil obtained from sites outside of the ROW must come from approved sources and have a pH between 5.5 and 8.5 su.
- Place Topsoil on pre-cultivated surface, spread to a uniform loose cover at thickness specified, and shape per plans. Water and roll the finished surface with a light roller or other suitable equipment per Item 160.3; do not over-compact.

COMPOST NOTES:

- When Compost Manufactured Topsoil (4") is specified under Item 161, use compost meeting all requirements of Item 161.2 and Table 1. Provide quality control (QC) documentation and obtain Engineer approval prior to compost delivery.
- Contractor shall provide tickets/invoices that document material type, quantity and placement for all compost delivered.
- Additional topsoil may be required to be imported to achieve the compost/topsoil mix ratio. Topsoil must meet Item 160 specifications.

APPLICATION OF COMPOST MANUFACTURED TOPSOIL (4")

AFTER Surface Preparation, uniformly spread a 1-inch layer of compost on-grade with 3 inches topsoil over pre-cultivated planting area. (25% compost and 75% topsoil = 1" compost and 3" topsoil.) Then mix compost and topsoil together by cultivating the compost into the topsoil (by till or disk) to a 4-inch (4") depth. Roll the finished surface with a light corrugated drum; do not over-compact.

FERTILIZER ITEM 166* FERTILIZER AC

SOIL ANALYSIS FOR FERTILIZER APPLICATION RATE

Unless otherwise stated in the plans, Contractor shall perform at least one soil analysis on each project before fertilization, and submit results to Engineer with recommended fertilizer rates based on soil analysis. Engineer may direct sample location(s). Soil analysis may be waived if both compost and sod are used on entire project.

FERTILIZER NOTES:

- Refer to Item 166 of TxDOT 2014 Standard Specifications* for specifications, dimensions, volumes, and measurements that have been modified or not shown in plans. Materials and construction shall meet all specifications.
- Apply fertilizer BEFORE seeding, or AFTER placing sod.
- Use fertilizer containing nitrogen (N), phosphoric acid (P) and potash (K) nutrients, unless otherwise specified. At least 50% of the Nitrogen component shall be a slow-release sulfur-coated urea as described in Item 166.3. Do not apply more than 60 lbs Nitrogen per acre without Engineer concurrence.
- Deliver fertilizer in bags, clearly labeled to show contents, unless otherwise specified or approved prior to delivery. When non-bagged, loose fertilizer is approved, provide documentation for each load of material delivered, to validate authenticity of the material.
- Apply fertilizer uniformly, as a dry, granular material, essentially dust-free, and do not mix with water for application as a slurry.
- When both temporary and permanent seeding are specified for the same area, apply half of the required fertilizer before the temporary seeding operation and the other half before the permanent seeding operation.

SEEDING FOR EROSION CONTROL ITEM 164* DRILL SEEDING AC

RECOMMENDED PLANTING SEASON	PERMANENT RURAL SEED MIX ITEM 164 - DRILL SEEDING (PERM) (RURAL) (CLAY)	PERMANENT URBAN SEED MIX ITEM 164 - DRILL SEEDING (PERM) (URBAN) (CLAY)	TEMPORARY DRILL SEED MIX ITEM 164 - DRILL SEEDING (TEMP) (WARM OR COOL)																														
WARM SEASON Mar. 15th, April, May, June, July, August, Sept. 15th	<table border="1"> <tr><td>Green Sprangletop (Van Horn)</td><td>- 1.0 lbs/AC</td></tr> <tr><td>Sideoats Grama (Haskell)</td><td>- 1.0 lbs/AC</td></tr> <tr><td>Texas Grama (Atascosa)</td><td>- 1.0 lbs/AC</td></tr> <tr><td>Hairy Grama (Chaparral)</td><td>- 0.4 lbs/AC</td></tr> <tr><td>Shortspike Windmillgrass (Welder)</td><td>- 0.2 lbs/AC</td></tr> <tr><td>Little Bluestem (OK Select)</td><td>- 0.8 lbs/AC</td></tr> <tr><td>Purple Prairie Clover (Cuero)</td><td>- 0.6 lbs/AC</td></tr> <tr><td>Engelmann Daisy (Eldorado)</td><td>- 0.75 lbs/AC</td></tr> <tr><td>Illinois Bundlesflower</td><td>- 1.3 lbs/AC</td></tr> <tr><td>Awnless Bushsunflower (Plateau)</td><td>- 0.2 lbs/AC</td></tr> </table>	Green Sprangletop (Van Horn)	- 1.0 lbs/AC	Sideoats Grama (Haskell)	- 1.0 lbs/AC	Texas Grama (Atascosa)	- 1.0 lbs/AC	Hairy Grama (Chaparral)	- 0.4 lbs/AC	Shortspike Windmillgrass (Welder)	- 0.2 lbs/AC	Little Bluestem (OK Select)	- 0.8 lbs/AC	Purple Prairie Clover (Cuero)	- 0.6 lbs/AC	Engelmann Daisy (Eldorado)	- 0.75 lbs/AC	Illinois Bundlesflower	- 1.3 lbs/AC	Awnless Bushsunflower (Plateau)	- 0.2 lbs/AC	<table border="1"> <tr><td>Green Sprangletop (Leptochloa dubia)</td><td>- 0.3 lbs/AC</td></tr> <tr><td>Sideoats Grama (El Reno) (Bouteloua curtipendula)</td><td>- 3.6 lbs/AC</td></tr> <tr><td>Buffalograss (Texoka) (Buchloe dactyloides)</td><td>- 1.6 lbs/AC</td></tr> <tr><td>Bermudagrass (Cynodon dactylon)</td><td>- 2.4 lbs/AC</td></tr> </table>	Green Sprangletop (Leptochloa dubia)	- 0.3 lbs/AC	Sideoats Grama (El Reno) (Bouteloua curtipendula)	- 3.6 lbs/AC	Buffalograss (Texoka) (Buchloe dactyloides)	- 1.6 lbs/AC	Bermudagrass (Cynodon dactylon)	- 2.4 lbs/AC	<table border="1"> <tr><td>Foxtail Millet (Setaria italica)</td><td>- 34 lbs/AC</td></tr> </table>	Foxtail Millet (Setaria italica)	- 34 lbs/AC
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Foxtail Millet (Setaria italica)	- 34 lbs/AC																																
COOL SEASON Sept 16th, Oct, Nov, Dec, Jan, Feb, Mar 14th			<table border="1"> <tr><td>Tall Fescue (Festuca arundinaceae)</td><td>- 4.5 lbs/AC</td></tr> <tr><td>Western Wheatgrass (Agropyron smithii)</td><td>- 5.6 lbs/AC</td></tr> <tr><td>Red Winter Wheat (Triticum aestivum)</td><td>- 34 lbs/AC</td></tr> <tr><td>Cereal Rye</td><td>- 34 lbs/AC</td></tr> </table>	Tall Fescue (Festuca arundinaceae)	- 4.5 lbs/AC	Western Wheatgrass (Agropyron smithii)	- 5.6 lbs/AC	Red Winter Wheat (Triticum aestivum)	- 34 lbs/AC	Cereal Rye	- 34 lbs/AC																						
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Cereal Rye	- 34 lbs/AC																																

SEEDING NOTES:

- When seeding is specified under Item 164, refer to TxDOT 2014 Standard Specifications* for specifications, dimensions, volumes, and measurements that have been modified or not shown. Materials and construction shall meet specifications.
- Conduct seeding upon completion of each applicable construction stage (dependent upon planting season requirements), without compensation for additional move-ins.
- Place seed AFTER preparing planting area surface. Refer to Surface Preparation detail in this sheet, as well as Topsoil Item 160 and Compost Manufactured Topsoil Item 161 when specified. Apply fertilizer per Item 166 BEFORE seeding, per specifications and this sheet, to help drill the fertilizer into the soil.
- When temporary grasses are well-established and more than 2 inches tall, mow planting area before seeding permanent grasses; mowing for this purpose will be subsidiary. When vegetation is not already well-established, cultivate planting area to a depth as described in Item 164.3, before temporary seeding and before permanent seeding.
- Seed material must be appropriate to the location, soil type and season. Use the seed mix species and pure live seed rates designated in Tables 1-4 of the TxDOT 2014 Standard Specifications* for Item 164, unless otherwise specified.
- All seed shall meet labeling, delivery, analysis, and testing requirements described in Item 164.2.1. Deliver seed in labeled, unopened bags or containers to Engineer prior to planting.
- Uniformly plant seed over the designated planting area, along the contour of slopes, and drill seed to a depth as described in Item 164.3.4.
- Hydroseeding may be allowed, when specified or Engineer concurs.
- Implement and continue Vegetative Watering per the schedule, rate and volume specified under Item 168.

TxDOT REFERENCE MATERIALS:

- "STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF HIGHWAYS, STREETS, AND BRIDGES" 2014
- "A GUIDANCE TO ROADSIDE VEGETATION ESTABLISHMENT" 2004
- ONLINE TRAINING COURSE: MNT415 REVEGETATION DURING CONSTRUCTION
- DALLAS DISTRICT "VEGETATION ESTABLISHMENT GUIDELINES"

SODDING FOR EROSION CONTROL ITEM 162* BLOCK SOD (BERMUDA) SY

BLOCK OR ROLL SOD	COMMON NAME	BOTANICAL NAME
	Common Bermuda Grass	Cynodon dactylon

SODDING NOTES:

- Refer to Item 162 of TxDOT 2014 Standard Specifications* for specifications, dimensions, volumes, and measurements that have been modified or not shown in plans. Materials and construction shall meet all specifications.
- Place sod between the average date of the last freeze in the Spring and 6 weeks before the average date of the first freeze in the Fall, per the Texas Almanac for the project area.
- Place sod only AFTER soil surface preparation is complete as detailed in this sheet. Dry soil may require pre-watering.
- Place all sod (blocks or rolls) within 24 hours of delivery to the site, and keep moist from the time it is dug up until it is planted. Sod with dried roots will not be accepted.
- Place sod with joints alternating on each row to prevent all joints from lining up, and place blocks firmly against adjacent blocks. Roll, tamp and trim sod per Item 162.3.
- Place fertilizer promptly AFTER sodding operation is complete in each area.
- Water sod immediately following placement, and continue Vegetative Watering per Item 168.

VEGETATIVE WATERING FOR ESTABLISHING SEED AND SOD ITEM 168* VEGETATIVE WATERING MG

SEASON (Usual Months)	RATE	TIME SCHEDULE	TOTAL WATER ESTIMATE
SPRING & FALL (March, April, May, October)	7,000 gallons/acre per working day	Vegetative watering for seed shall begin on the day after rainfall described below and continue for 60 consecutive working days; vegetative watering for sod shall begin on the day the sod is placed and continue for a minimum of 15 consecutive working days.	420,000 gallons/acre (60 working days)
SUMMER (June, July, August, September)	12,000 gallons/acre per working day		720,000 gallons/acre (60 working days)
WINTER (November through February)	1,000 gallons/acre per working day	Vegetative watering for seed and/or sod shall begin on the day after placement for 15 consecutive working days	15,000 gallons/acre (15 working days)

Notes: Rate and frequency may be adjusted, with the approval of the Engineer, to meet site conditions (especially with sod). For informational purposes only: 1,000 gallons equals 1 MG

VEGETATIVE WATERING NOTES:

- Refer to Item 168 of TxDOT 2014 Standard Specifications* for specifications, dimensions, volumes, and measurements that have been modified or not shown in plans. Materials and construction shall meet all specifications.
- Use clean water free of industrial waste and other substances harmful to vegetation growth, per Item 168.2.
- Use Vegetative Watering to keep the seed bed moist during germination; not to provide initial watering. After drill seeding, postpone watering operations until site receives at least 1/2-inch of natural rainfall in a single day. Delay watering operations for warm season grasses until soil temperature exceeds 70 degrees F.
- For sod, water immediately.
- All water distribution equipment shall be furnished and operated to provide water at a uniform and controllable rate. Use a metering device on all watering equipment.
- Evenly distribute water over entire area designated for seeding and/or sodding, using even spray patterns that do not disturb seed bed and/or dislodge seed from seed bed.
- Do not water between the hours of 12:00 p.m. and 6:00 p.m. when daytime temperatures exceed 95 degrees F.
- After initial establishment period, continue intermittent watering of newly established seed or sod at a rate of approximately 1-inch water/week, during summer months until end of contract.
- If 1/4-inch or more of rainfall occurs on site on any given working day, no vegetative watering will be needed on that working day. (Note: 1/4-inch rain equals 7,000 gallons of water per acre.)
- Should the Contractor fail to apply the specified amount of water within the time allowed, any seed or sod in poor condition shall be replaced, fertilized, and watered at Contractor's expense.


ROADSIDE MOWING ITEM 730* PROJECT MAINTENANCE AC

MOWING NOTES:

- During project construction, once seed is established, use mowing to promote permanent grasses by mowing any remaining temporary grasses.
- Also mow established turf and ROW grasses in designated areas of project limits as specified or directed by Engineer.
- Remove litter and debris prior to mowing.
- Do not mow on wet ground when soil rutting can occur.
- Hand-trim around obstructions and stormwater control devices as needed.
- Maintain paved surfaces free of tracked soils and clipped vegetation.

SEQUENCE OF WORK:

- CULTIVATE SURFACE SOIL.
- PREPARE / PLACE TOPSOIL, OR
- PREPARE / PLACE COMPOST MANUFACTURED TOPSOIL.
- APPLY FERTILIZER AND THEN PLACE SEEDING, OR
- PLACE SOD AND THEN APPLY FERTILIZER.
- CONDUCT VEGETATIVE WATERING.
- CONDUCT ROADSIDE MOWING, AS DIRECTED.


Texas Department of Transportation
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VEGETATION ESTABLISHMENT SHEET

(DALLAS DISTRICT)

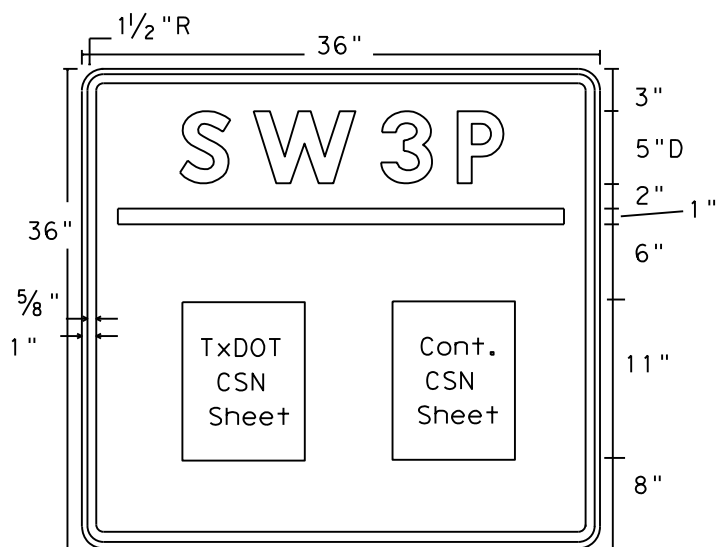
TEMPLATE REVISION DATE: 02/21/19

DESIGN CPB	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (See Title Sheet)		HIGHWAY NO. FM 2449
GRAPHICS XXX	STATE TEXAS	DISTRICT DALLAS	COUNTY DENTON	SHEET NO. 112
CHECK XXX	CONTROL 2352	SECTION 02	JOB 027	

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PATH:

LEVELS DISPLAYED



Sign Dimensions

36" X 36"

- Letters - White
- Numbers - White
- Border - White
- Background - Blue

SW3P SIGN

TxDOT & Contractor
Construction Site Note
(CSN)

GENERAL NOTES:

1. The alphabets and lateral spacing between letters and numerals shall conform with the "Texas Manual on Uniform Traffic Control Devices for Streets and Highways", (TMUTCD) latest edition, and the "Compliant Work Zone Traffic Control Devices List". Lateral spacing of text shall provide a balanced appearance. All materials shall conform to Department Specifications.
2. Legend and border may be applied by reverse screening process with transparent colored ink, cut-out white reflective sheeting applied to colored background or combination thereof. Background shall be reflective sheeting Type C.
3. CSN Sheets will be laminated and attached to the sign with an adhesive. Ensure sheets remain dry. (See Figure 1).
4. SW3P Signs should be placed just inside the ROW line at the project limits at a readable height. It may be placed perpendicular or parallel to ROW line. If the sign cannot be placed outside the clear zone, it will be mounted per TMUTCD requirements.
5. Final location of the signs will be as approved by the Engineer.

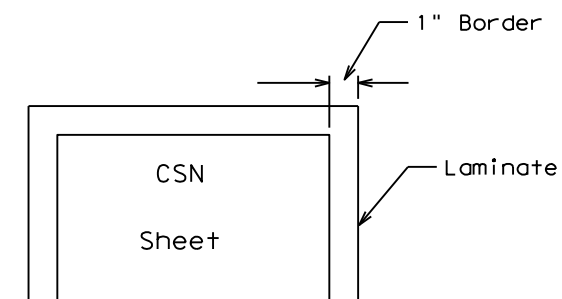
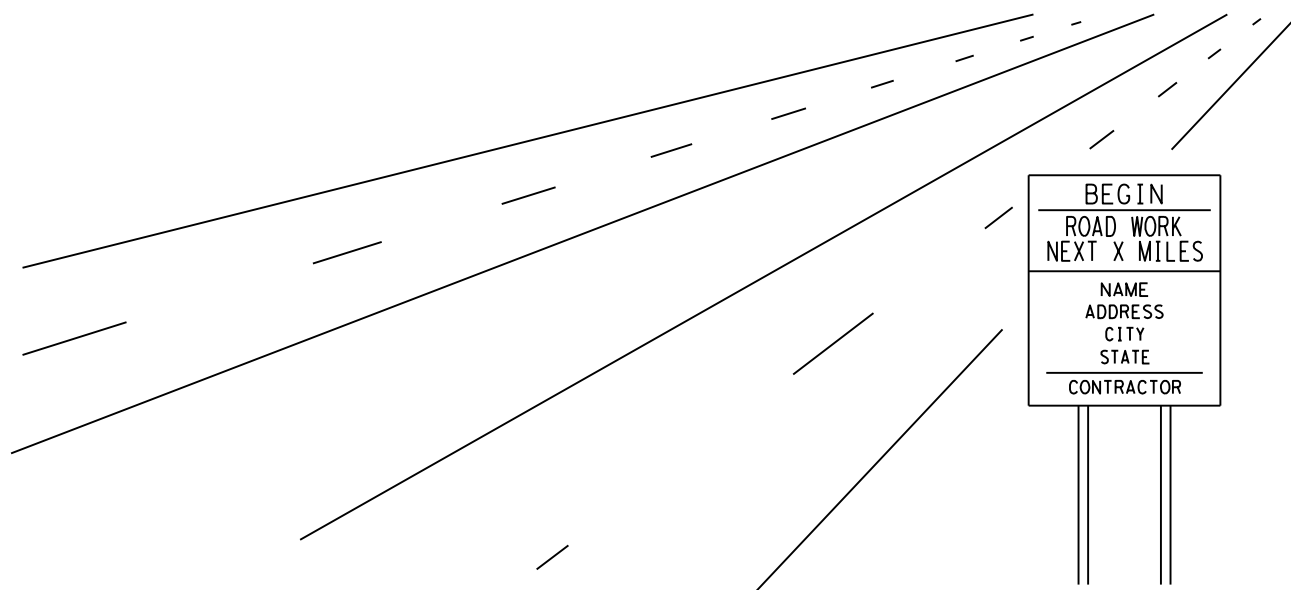


Figure 1



DEPARTMENT MATERIAL SPECIFICATIONS	
PLYWOOD SIGN BLANKS	DMS-7100
FLAT SURFACE REFLECTIVE SHEETING	DMS-8300
VINYL NON-REFLECTIVE DECAL SHEETING	DMS-8320

COLOR	USAGE	REFLECTIVE SHEETING OR OTHER MATERIAL
BLUE	BACKGROUND	TYPE C (FLUORESCENT PRISMATIC)
WHITE	LEGEND & BORDERS	VINYL NON-REFLECTIVE DECAL SHEETING

Texas Department of Transportation
DALLAS DISTRICT STANDARD

SW3P SIGN SHEET

FILE#	DN# TxDOT	CR#	DW#	CK#
©TxDOT 2016	DISTRICT	STATE PROJECT		SHEET
REVISION DATE: 10-16-15	18	SEE TITLE SHEET		113
	COUNTY	CONTROL	SECT	JOB
	DENTON	2352	02	027
				FM 2419

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DATE: _____
 FILE: _____

I. WORK AT CROSSING LOCATIONS (AT GRADE, HIGHWAY OVERPASS, HIGHWAY UNDERPASS, PEDESTRIAN, OR CLOSED/ABANDONED)

DOT #: 020563G
 Crossing Type: At-grade
 RR Company Owning Track at Crossing: BNSF
 Operating RR Company at Track: BNSF
 RR MP: 377.030
 RR Subdivision: Fort Worth
 City: Ponder
 County: Denton
 CSJ at this Crossing: 2352-02-027
 Highway/Roadway name crossing the railroad: FM 2449
 # of regularly scheduled trains per day at this crossing: 38
 # of switching movements per day at this crossing: 2
 % of estimated contract cost of work within railroad ROW: <1%

Scope of Work at this Crossing to Be Performed by State Contractor:
 State's contractor will perform mill and overlay and pavement installation work in the RR ROW. No widening will be performed within 50 feet of the RR ROW.

Scope of Work at this Crossing to Be Performed by Railroad Company:
 N/A

** Choose: Highway Overpass, Highway Underpass, At Grade, Pedestrian, or Closed/Abandoned

II. OTHER PROJECT WORK WITHIN RAILROAD RIGHTS-OF-WAY (ROW)

N/A

III. FLAGGING & INSPECTION

of Days of Railroad Flagging Expected: 6

On this project, night or weekend flagging is:

- Expected
 Not Expected

Flagging services will be provided by:

- Railroad Company: TxDOT will pay flagging invoices
 Outside Party: Contractor will pay flagging invoices, to be reimbursed by TxDOT

Contractor must incorporate flaggers into anticipated construction schedule. The Railroad requires a 30 day notice if their flaggers are to be utilized. If Contractor falls behind schedule due to their own negligence and is not ready for scheduled flaggers, any flagging charges will be paid by Contractor.

Contact Information for Flagging:

- UPRR - UP.info@railpros.com
 Call Center 877-315-0513, Select #1 for flagging
 BNSF - BNSF.info@railpros.com
 Call Center 877-315-0513, Select #1 for flagging
 KCS - KCS.info@railpros.com
 Call Center 877-315-0513, Select #1 for flagging
 - Bottom Line On-Track Safety Services
 bottomline076@aol.com, 903-767-7630

OTHERS _____

IV. CONSTRUCTION WORK TO BE PERFORMED BY THE RAILROAD

On this project, construction work to be performed by a railroad company is:

- Required
 Not Required

Coordinate with TxDOT for any work to be performed by the Railroad Company. TxDOT must issue a work order for any work done by the Railroad Company prior to the work being performed.

V. RAILROAD INSURANCE REQUIREMENTS

Railroad reference number shall be provided by TxDOT CST or DO.

The Contractor shall confirm the insurance requirements with the Railroad as the insurance limits are subject to change without notice.

Insurance policies must be issued for and on behalf of the Railroad. Where more than one Railroad Company is operating on the same right of way or where several Railroad Companies are involved and operate on their own separate rights of way, provide separate insurance policies in the name of each Railroad Company.

No direct compensation will be made to the Contractor for providing the insurance coverages shown below or any deductibles. These costs are incidental to the various bid items.

Type of Insurance	Amount of Coverage (Minimum)
Workers Compensation	\$500,000 / \$500,000 / \$500,000
Commercial General Liability	\$2,000,000 / \$4,000,000
Business Automobile	\$2,000,000 combined single limit

Railroad Protective Liability	
<input type="checkbox"/> Not Required	
<input checked="" type="checkbox"/> Non - Bridge Projects	\$2,000,000 / \$6,000,000
<input type="checkbox"/> Bridge Projects	\$5,000,000 / \$10,000,000
<input type="checkbox"/> Other	

VI. CONTRACTOR'S RIGHT OF ENTRY (ROE) AGREEMENT

On this project, an ROE agreement is:

- Not Required
 Required: TxDOT CST to assist in obtaining with the UPRR (see Item 5, Article 8.3)
 Required: UPRR Maintenance Consent Letter. TxDOT CST to assist.
 Required: Contractor to obtain (see Item 5, Article 8.4)

With the following railroad companies: BNSF
<https://www.bnsf.com/about-bnsf/faqs.page#permits>

To view previously approved ROE Agreement templates agreed upon between the State and Railroad, see:

<http://www.txdot.gov/inside-txdot/division/rail/samples.html>

Approved ROE Agreement templates are not to be modified by the Contractor.

Contractor shall not operate within Railroad Right of Way without an executed Construction & Maintenance Agreement between the State and the Railroad and an executed ROE agreement between the Contractor and the Railroad if required on project.

Contractor must incorporate Construction Inspection into anticipated construction schedule.

- Not Required
 Required: Contact Information for Construction Inspection:

VII. RAILROAD COORDINATION MEETING

On this project, a Railroad Coordination Meeting is:

- Not Required
 Required

See Item 5, Article 8.1 for more details.

VIII. SUBCONTRACTORS

Contractor shall not subcontract work without written consent of TxDOT. Subcontractors are required to maintain the same insurance coverage as required of the Contractor.

IX. EMERGENCY NOTIFICATION

In Case of Railroad Emergency
Call BNSF Railroad Emergency Line
at 800-832-5452
Location: DOT# 020563G
RR Milepost 377.030
Subdivision Fort Worth

Texas Department of Transportation				Rail Division	
RAILROAD SCOPE OF WORK					
PROJECT SPECIFIC DETAILS					
FILE:	RR Scope of Work.dgn	DN: TxDOT	CK:	DW:	CK:
© TxDOT	June 2014	CONT	SECT	JOB	HIGHWAY
9/2021	REVISIONS	2352	02	027	FM 2449
DIST	COUNTY	SHEET NO.			
DAL	Denton	114			

PART 1 - GENERAL

1.01 DESCRIPTION

This project includes construction work within the right of way and/or properties of the Railroad and adjacent to its tracks, wire lines and other facilities. These sheets describe the minimum special requirements for coordination with the Railroad when working upon, over or under Railroad Right of Way or when impacting current or future Railroad operations. Coordinate with the Railroad while performing the work outlined herein, and afford the same cooperation with the Railroad as with TxDOT. Complete all submittals and work in accordance with TxDOT Standard Specifications, Railroad Guidelines and AREMA recommendations as modified by these minimum special requirements or as directed in writing by the Railroad Designated Representative.

For purposes of this project, the Railroad Designated Representative is the person or persons designated by the Railroad Manager of Industry and Public Projects to handle specific tasks related to the project.

1.02 REQUEST FOR INFORMATION / CLARIFICATION

Submit Requests for Information ("RFI") involving work within any Railroad Right of Way to the TxDOT Engineer. The TxDOT Engineer will submit the RFI to the Railroad Designated Representative for review and approval for RFI's corresponding to work within Railroad Right of Way. Allow six (6) weeks total time for review and approval, which includes four (4) weeks for review and approval by the Railroad.

1.03 PLANS / SPECIFICATIONS

TxDOT has received written Railroad approval of the plans and specifications for this project. Any revisions or changes in the plans after award of the Contract must have the approval of TxDOT and the Railroad.

PART 2 - UTILITIES AND FIBER OPTIC

Construct all utility installations in accordance with current AREMA recommendations, Railroad, TxDOT and owning utility specifications and requirements. Railroad general guidelines can be found on the Railroad website or by contacting the Railroad Designated Representative.

PART 3 - CONSTRUCTION

3.01 GENERAL

- A. Perform all work in compliance with all applicable Railroad, Federal Railroad Administration (FRA), and TxDOT rules and regulations. Arrange and conduct work in a manner that does not endanger or interfere with the safe operation of the tracks and property of the Railroad and the traffic moving on such tracks, or the wires, signals and other property of the Railroad, its tenants or licensees, at or in the vicinity of the Work. The safe operation of railroad train movements takes precedence over any work to be performed by the Contractor. The Contractor is responsible for train delay cost and lost revenue claims due to any delays or interruption of train operations resulting from Contractor's construction or other activities.
- B. Construction activities within 15 feet of the operational tracks will only be allowed if absolutely necessary and the Railroad's Designated Representative grants approval. Construction activities within 15 feet of the operational track(s) preferably allow the tracks to stay operational. In such cases, coordination and approval by the Railroad Track Manager is required with regard to schedule, flagging, and slow orders. See Sections 3.07 and 3.08 for additional information.
- C. Provide track protection for all work equipment (including rubber tired equipment) operating within 25 feet from nearest rail. When not in use, keep Contractor machinery and materials at least 50 feet from the Railroad's nearest track.
- D. Vehicular crossings of railroad track are allowed only at existing crossings, or haul road crossings developed with Railroad approval.
- E. The Contractor is also advised that new railroad facilities within the project may be built by the Railroad. If applicable, these facilities are delineated in the plans. Be aware of the limits of responsibilities and coordinate efforts with the Railroad and TxDOT.
- F. Railroad requirements do not allow work within 50 feet of track centers when a train passes the work site and all personnel must clear the area within 50 feet of the track centerline and secure all equipment. Additional allowances may be pursued as outlined in 3.02 and 3.03.
- G. All permanent clearances shall be verified before project closing.

3.02 RAILROAD OPERATIONS

- A. Trains and/or equipment are expected on any track, at any time, in either direction. Become familiar with the train schedules in this location and structure bid assuming intermittent track windows in this period, as defined in Paragraph B that follows.
- B. All railroad tracks within and adjacent to the contract site are active, and rail traffic over these facilities shall be maintained throughout the Project. Activities may include both through moves and switching moves to local customers. railroad traffic and operations will occur continuously throughout the day and night on these tracks and shall be maintained at all times as defined herein. Coordinate and schedule the work so that construction activities do not interfere with railroad operations.
- C. Coordinate work windows with TxDOT and the Railroad's Designated Representative. Types of work windows include Conditional Work Windows and Absolute Work Windows, as defined below:
 - 1. Conditional Work Window: A Conditional Work Window is a period of time that railroad operations have priority over construction activities. When construction activities may occur on and/or adjacent to the railroad tracks within 25 feet of the nearest track, a railroad flag person will be required. At the direction of the railroad flag person, upon approach of a train, and when trains are present on the tracks, the tracks must be cleared (i.e., no construction equipment, materials or personnel within 25 feet, or as directed by the Railroad Designated Representative, from the tracks). Conditional Work Windows are available for the Project.
 - 2. Absolute Work Window: An Absolute Work Window is a period of time that construction activities are given priority over railroad operations. During this time frame, the designated railroad track(s) will be inactive for train movements and may be fouled by the Contractor. At the end of an Absolute Work Window, the railroad tracks and/or signals must be completely operational for train operations and all Railroad, Public Utilities Commission (PUC) and FRA requirements, codes and regulations for operational tracks must be satisfied. In the situation where the operating tracks and/or signals have been affected, the Railroad will perform inspections of the work prior to placing that track back into service. Railroad flag persons will be required for construction activities requiring an Absolute Work Window. Absolute Work Windows will not generally be granted. Any request will require a detailed explanation for Railroad review.

3.03 RIGHT OF ENTRY, ADVANCE NOTICE AND WORK STOPPAGES

- A. Do not perform any work within Railroad Right of Way without a valid executed Right of Entry Agreement if required on this project.
- B. Give advance notice to the Railroad as required in the "Contractor's Right of Entry Agreement" before commencing work in connection with construction upon or over Railroad Right of Way and observe the Railroad's rules and regulations with respect thereto.
- C. Perform all work upon Railroad Right of Way in a manner to avoid interference with or endanger the operations of the Railroad. Whenever work may affect the operations or safety of trains, submit the work method to the Railroad Designated Representative for approval. Approval does not relieve the Contractor from liability. Do not commence any work which requires flagging service or inspection service until the flagging protection required by the Railroad is available at the job site. See Section 3.15 for railroad flagging requirements.
- D. Make requests in writing for both Absolute and Conditional Work Windows, at least 30 days in advance of any work. Include in the written request:
 - 1. Exactly what the work entails.
 - 2. The days and hours that work will be performed.
 - 3. The exact location of work, and proximity to the tracks.
 - 4. The type of window requested and the amount of time requested.
 - 5. The designated contact person.
 Provide a written confirmation notice to the Railroad at least 48 hours before commencing work in connection with approved work windows when work is within 25 feet of nearest rail. Perform all work in accordance with previously approved work plans.
- E. Make provisions to protect operations and property of the Railroad should a condition arising from, or in connection with the work, require immediate and unusual action. If in the judgment of the Railroad Designated Representative such provisions are insufficient, the Railroad Designated Representative may require or provide such provisions as deemed necessary. In any event, such provisions shall be at the Contractor's expense and without cost to the Railroad or TxDOT. The Railroad or TxDOT shall have the right to order the Contractor to temporarily cease operations in the event of an emergency or, if in the opinion of the Railroad Designated Representative, the Contractor's operations could endanger railroad operations. In the event of such an order, immediately notify TxDOT of the order.

3.04 INSURANCE

Do not begin work upon or over Railroad Right of Way until furnishing the Railroad with the insurance policies, binders, certificates and endorsements required by the "Contractor's Right of Entry Agreement", and until the Railroad Designated Representative has advised TxDOT that such insurance is in accordance with the Agreement.

3.05 RAILROAD SAFETY ORIENTATION

- A. Complete the railroad course "Orientation for Contractor's Safety", and maintain current registration prior to working on railroad property. This course is required to be completed annually by Contractor and Subcontractor personnel working on site.

"UPRR, BNSF, KCS/TEXMEX will not accept on-track safety training certificates from other railroads. Refer to Railroad specific contractor right of entry for training information."
- B. Know and follow the "Contractor's Right of Entry Agreement" EXHIBIT D, MINIMUM SAFETY REQUIREMENTS regarding clothing, personal protective equipment, and general safety requirements.

3.06 COOPERATION

The Railroad will cooperate with Contractor so that work may be conducted in an efficient manner, and will cooperate with Contractor in enabling use of Railroad Right of Way in performing the work.



3.07 MINIMUM CONSTRUCTION CLEARANCES FOR FALSEWORK AND OTHER TEMPORARY STRUCTURES

Abide by the following minimum temporary clearances during the course of construction:
A. 15' - 0" (BNSF) (UPRR) and 14' - 0" (KCS) horizontal from centerline of track
B. 22' (KCS) and 21' - 6" (UPRR & BNSF) vertically above top of rail.

For construction clearance less than listed above, obtain local Railroad Operating Unit review and approval.

3.08 APPROVAL OF REDUCED CLEARANCES

- A. Maintain minimum track clearances during construction as specified in Section 3.07.
- B. Submit any proposed infringement on the specified minimum clearances to the Railroad Designated Representative through TxDOT at least 30 days in advance of the work. Do not proceed with such infringement without written approval by the Railroad Designated Representative.
- C. Do not commence work involving an approved infringement without receiving written assurance from the Railroad Designated Representative that arrangements have been made for any necessary flagging service.

					
RAILROAD REQUIREMENTS FOR NON-BRIDGE CONSTRUCTION PROJECTS					
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	DIST	COUNTY	SHEET NO.		
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3.09 MAINTENANCE OF RAILROAD FACILITIES

- A. Maintain all ditches and drainage structures free of silt or other obstructions resulting from Contractor's operations. Repair eroded areas and any other damage within Railroad Right of Way and repair any other damage to the property of the Railroad, or its tenants.
- B. Perform all such maintenance and repair of damages due to the Contractor's operations at Contractor's expense.
- C. Submit a proposed method of erosion control for review by the Railroad prior to beginning any grading on the project site. Comply with all applicable local, state and federal regulations when developing and implementing such erosion control.

3.10 SITE INSPECTIONS BY RAILROAD'S DESIGNATED REPRESENTATIVE

- A. In addition to the office reviews of construction submittals, site inspections may be performed by the Railroad Designated Representative at significant points during construction, including the following if applicable:
 1. Pre-construction meetings.
 2. Pile driving/drilling of caissons or drilled shafts.
 3. Reinforcement and concrete placement for railroad bridge substructure and/or superstructure.
 4. Erection of precast concrete or steel bridge superstructure.
 5. Placement of waterproofing (prior to placing ballast on bridge deck).
 6. Completion of the bridge structure.
- B. Site inspection is not limited to the milestone events listed above. Site visits to check progress of the work may be performed at any time throughout the construction as deemed necessary by the Railroad.
- C. Provide a detailed construction schedule, including the proposed temporary horizontal and vertical clearances and construction sequence for all work to TxDOT for submittal to the Railroad Designated Representative for review prior to commencement of work. Include the anticipated dates when the above listed events will occur. Update this schedule for the above listed events as necessary and each month at a minimum to allow the Railroad to schedule site inspections.

3.11 RAILROAD REPRESENTATIVES

Railroad representatives, conductors, flag person or watch person will be provided by the Railroad at expense of TxDOT to protect Railroad facilities, property and movements of its trains or engines. In general, the Railroad will furnish such personnel or other protective services as follows:

- A. When any part of any equipment is standing or being operated within 25 feet, measured horizontally, from nearest rail of any track on which trains may operate, or when any object is off the ground and any dimension thereof could extend inside the 25 foot limit, or when any erection or construction activities are in progress within such limits, regardless of elevation above or below track.
- B. For any excavation below elevation of track subgrade if, in the opinion of the Railroad Designated Representative, track or other railroad facilities may be subject to settlement or movement.
- C. During any clearing, grubbing, excavation or grading in proximity to railroad facilities, which, in the opinion of the Railroad Designated Representative, may endanger railroad facilities or operations.
- D. During any Contractor's operations when, in the opinion of the Railroad Designated Representative, railroad facilities, including, but not limited to, tracks, buildings, signals, wire lines, or pipe lines, may be endangered.
- E. Arrange with the Railroad Designated Representative to provide the adequate number of flag persons to accomplish the work.

3.12 COMMUNICATIONS AND SIGNAL LINES

If required, the Railroad will rearrange its communications and signal lines, its grade crossing warning devices, train signals and tracks, and facilities that are in use and maintained by the Railroad's forces in connection with its operation at expense of TxDOT. This work by the Railroad will be done by its own forces and it is not a part of the Work under this Contract.

3.13 TRAFFIC CONTROL

Coordinate any operations that control traffic across or around railroad facilities with the Railroad Designated Representative.

3.14 CONSTRUCTION EXCAVATIONS AND BORING ACTIVITIES UNDER TRACK

- A. Take special precaution and care in connection with excavating and shoring. Excavations for construction of footings, piers, columns, walls or other facilities that require shoring shall comply with requirements of TxDOT, OSHA, AREMA and Railroad "Guidelines for Temporary Shoring".
- B. The project plans indicate whether there are fiber optic lines or other such telecommunications systems that require consideration. Regardless, contact the necessary call center to determine if such cable systems are present:

UPRR 1-800-336-9193
7:00 AM to 9:00 PM CST Monday-Friday except holidays,
staffed 24 hrs/day for emergencies
48 hrs notice required

BNSF 1-800-533-2891
24 hour number
5 working days notice required

KCS 1-800-344-8377
Texas One Call, a 24 hour number
48 hrs notice required, excluding weekends and holidays

If a telecommunications system is buried anywhere on or near railroad property, coordinate with TxDOT, the Railroad and the Telecommunication Company(ies) to arrange for relocation or protective measures prior to beginning work on or near railroad property. Refer to the project General Notes for additional information.


- C. Projects involving a boring or jack and bore operation under track such as drainage pipes or culverts and utilities require an installation plan reviewed and approved by the Railroad and TxDOT prior to proceeding with such construction. A railroad inspector and contractor assisted monitoring of ground and track movement is required to maintain safe passage of rail traffic. Stop installation and do not allow passage of trains if movements in excess of 1/4 inch vertical or horizontal is detected in the tracks. Immediately repair the damage to the satisfaction of TxDOT and the Railroad before proceeding.

3.15 RAILROAD FLAGGING

Per the Right of Entry Agreement for flagging, notify the Railroad Representative at least 10 working days in advance of Contractor's work and at least 30 working days in advance of any Contractor's work in which any person or equipment will be within 25 feet of nearest rail or as specified in the Contractor Right of Entry (CROE).

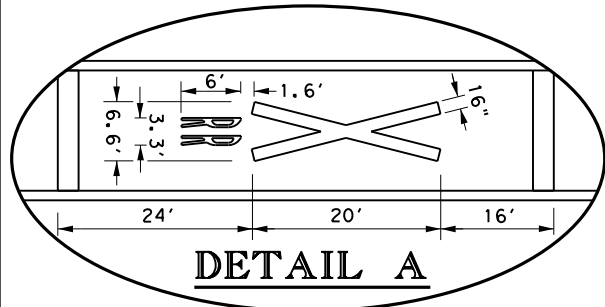
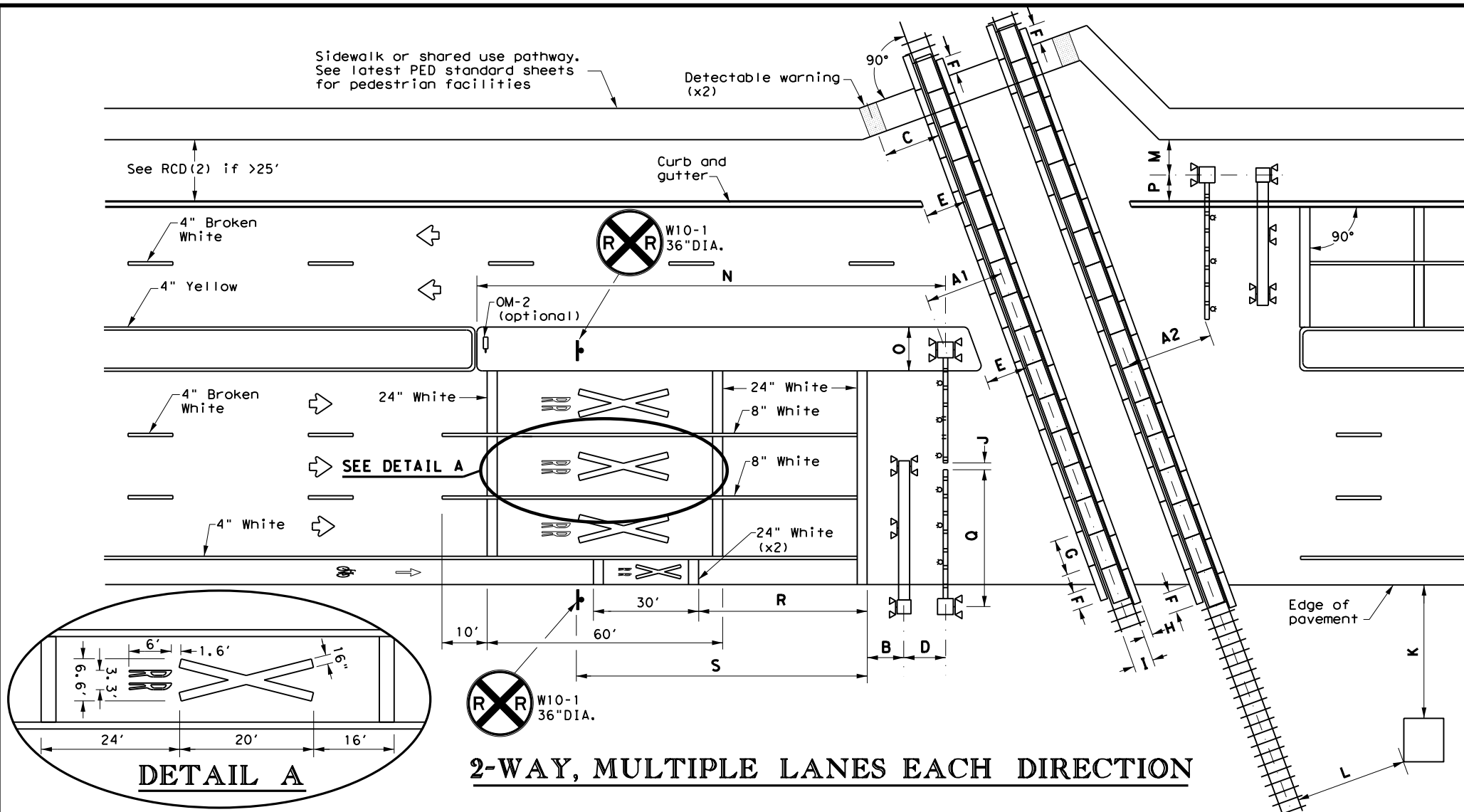
3.16 CLEANING OF RIGHT-OF-WAY

When work is complete, remove all tools, implements, and other materials brought into Railroad Right of Way and leave the right of Way in a clean and presentable condition to the satisfaction of TxDOT and the Railroad.

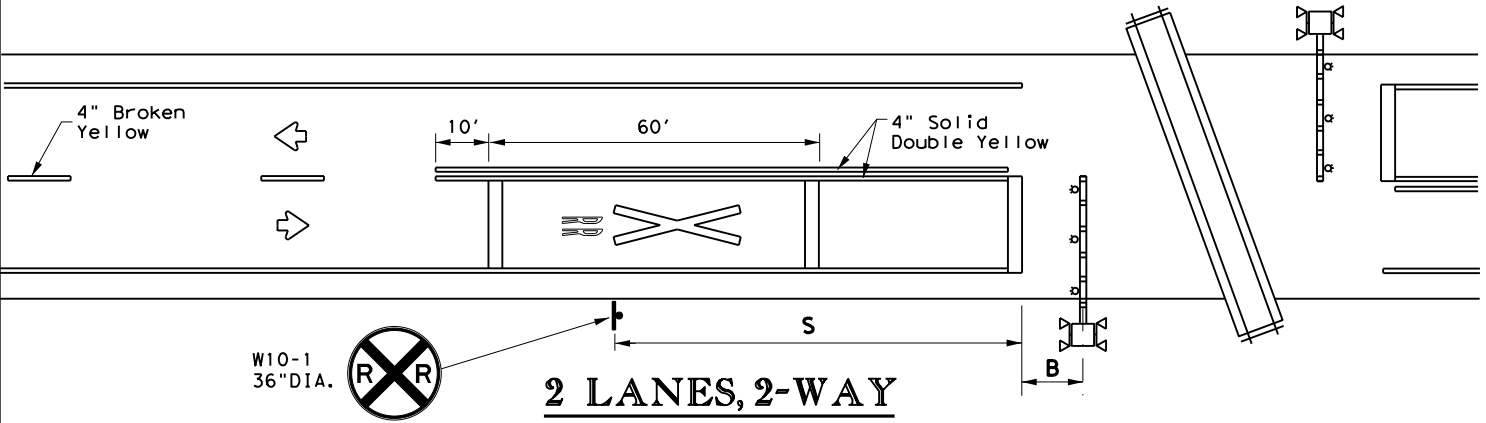
 Texas Department of Transportation				Rail Division	
RAILROAD REQUIREMENTS FOR NON-BRIDGE CONSTRUCTION PROJECTS					
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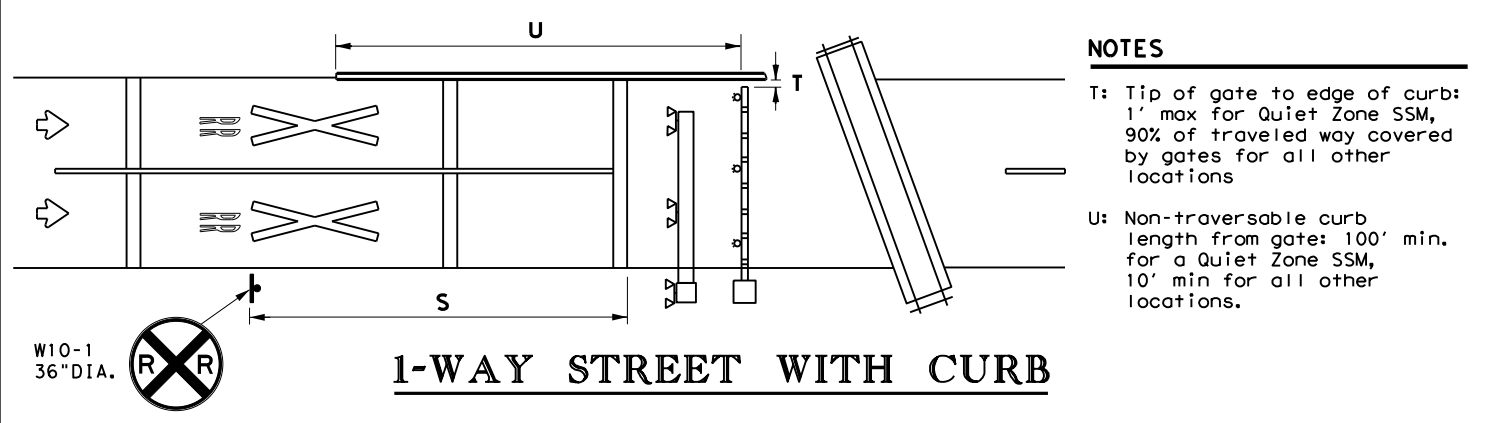
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2-WAY, MULTIPLE LANES EACH DIRECTION



2 LANES, 2-WAY



1-WAY STREET WITH CURB

- NOTES**
- T: Tip of gate to edge of curb: 1' max for Quiet Zone SSM, 90% of traveled way covered by gates for all other locations
 - U: Non-traversable curb length from gate: 100' min. for a Quiet Zone SSM, 10' min for all other locations.

NOTES

- A1: Center of RR mast to center of rail: 12' minimum, 15' typical.
- A2: Tip of gate to center of rail: 12' minimum, 15' typical.
- B: Center of mast (cantilever, gate, or mast flasher) of nearest active traffic control device to stop line: 8' (NOTE: Stop line may be moved as needed, but should be at least 8' back from gates, if present).
- C: Center of detectable warning device to nearest rail: 6' minimum
- D: Center of gate mast to center of cantilever mast: 6' typical. NOTE: Cantilever may be located in front or behind gates.
- E: Edge of median or curb to nearest rail: 10' typical. NOTE: Design median edge to be parallel with rail.
- F: Edge of planking panel from edge of pavement or sidewalk: 3' minimum. NOTE: Field panels need not be in line with gauge panels.
- G: Length of panels along rail: 8' typical.
- H: Width of field panel: 2' typical (check with railroad company).
- I: Distance between rails: 4'-8.5\".
- J: Tip of gate to tip of gate: 2' maximum for Quiet Zone SSM or 90% of traveled way covered by gates for all other locations.
- K: Nearest edge of RR cabin from edge of pavement: 30' typical. NOTE: Cabinet not required to be parallel to edge of pavement.
- L: Nearest edge of RR cabin from nearest rail: 25' typical.
- M: Center of RR mast to edge of sidewalk: 6' minimum.
- N: Center of gate mast to leading edge of non-traversable median: 100' minimum to qualify as a Quiet Zone SSM. NOTE: 60' will suffice if there is a street intersection within the 100' and all street intersections within 60' are closed.
- O: Width of median: 8'-6\" minimum, 10' typical when using median gates. NOTE: Center of gate mast minimum 4'-3\" from face of curb.
- P: Center of RR mast to face of curb: 4'-3\" minimum. Center of RR mast to edge of pavement (with shoulder): 6' minimum. Center of RR mast to edge of pavement (no shoulder): 8'-3\" minimum. NOTE: BNSF prefers 5'-3\", 7', and 9'-3\" minimums, respectively.
- Q: Gate length: 28' or less typical, but railroad company may allow up to 32' under special circumstances.
- R: Stop line to first RR Crossing transverse line (bike lane): 50' typical.
- S: Stop line to GRADE CROSSING ADVANCE WARNING (W10-1) sign and adjacent RR Crossing pavement markings. See Table 1. See RCD(2) for other signs.

TABLE 1

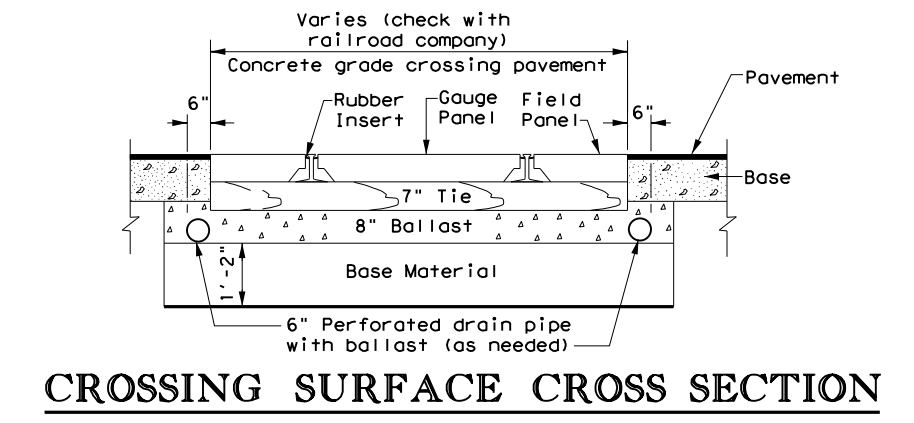
Approach Speed (mph)	Desirable Placement (feet)
20	100
25	100
30	100
35	100
40	125
45	175
50	250
55	325
60	400
65	475
70	550
75	650

LEGEND

	Sign
	Object Marker
	Traffic Flow
	Cantilever
	Gate Assembly
	Mast Flasher Pair

GENERAL NOTES

- Medians and curbs must be non-traversable to qualify as a Quiet Zone Supplementary Safety Measure (SSM). Non-traversable curbs in Quiet Zones are 6\" tall minimum and used on roadways where speed does not exceed 40 mph.
- Raised pavement markers may be used to supplement striping. See PM(2) and PM(3) standard sheets.
- Medians preferred whenever possible to prevent vehicles from driving around gates.
- Longitudinal edge striping may be continued thru crossing as needed. Illumination may also be considered for nighttime visibility.
- See SMD standard sheets for sign mounting details.
- See the Standard Highway Sign Design for Texas (SHSD) manual for sign and pavement marking details.



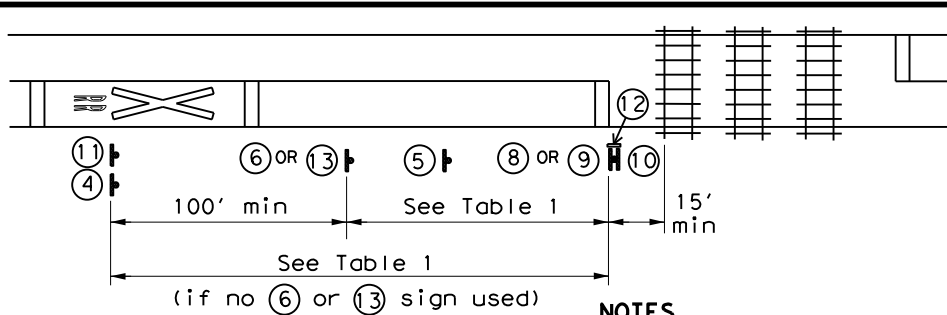
CROSSING SURFACE CROSS SECTION

Texas Department of Transportation
Traffic Operations Division Standard

**RAILROAD CROSSING DETAILS
SIGNING, STRIPING, AND
DEVICE PLACEMENT
RCD(1)-16**

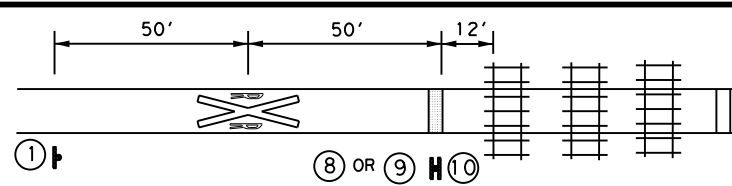
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PASSIVE CROSSING

- NOTES**
1. Stop or yield sign may also be installed to the left of the crossbuck sign, rather than below it.
 2. A 2" white retroreflective strip shall be installed on front and back of crossbuck sign post.



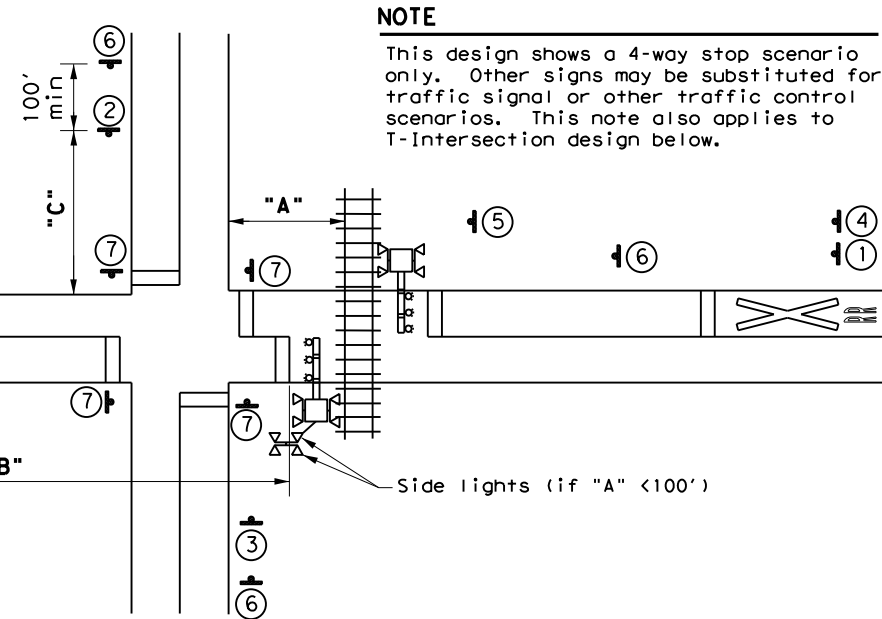
PATHWAY CROSSING

- NOTES**
1. A shared use pathway is considered a separate pathway crossing when more than 25' from traveled way of adjacent roadway.
 2. Detectable warning used at stop bar.
 3. Smaller sign sizes preferred than shown to the right on this sheet.

Approach Speed (mph)	Desirable Placement (feet)
20	100
25	100
30	100
35	100
40	125
45	175
50	250
55	325
60	400
65	475
70	550
75	650

GENERAL NOTES

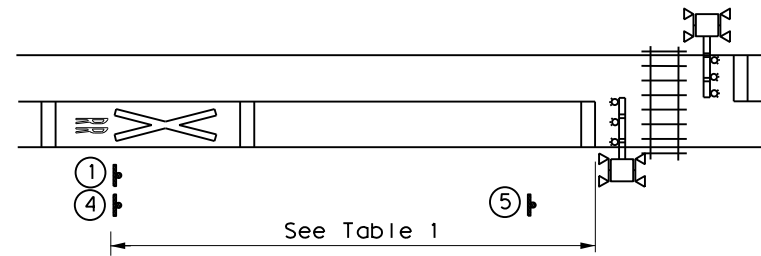
1. Railroad company to provide active traffic control devices, CROSSBUCK (R15-1), NUMBER OF TRACKS Plaque (R15-2P) (if more than 1 track), and EMERGENCY NOTIFICATION (I-13) signs.
2. LOW GROUND CLEARANCE (W10-5) signs may be relocated further upstream of crossing to provide advance warning of alternate route.
3. GRADE CROSSING AND INTERSECTION ADVANCE WARNING (W10-2) signs may be modified as needed to fit roadway geometry.
4. Table 1 placement distances may vary per Sect. 2C.05 of the TMUTCD.
5. See Table 1 to determine placement of STOP AHEAD (W3-1) and YIELD AHEAD (W3-2) signs unless shown otherwise.
6. DO NOT STOP ON TRACKS (R8-8) signs installed when potential for vehicles stopping on tracks is significant as determined by sealing engineer. Install so sign does not block view of RR mast.
7. See the Standard Highway Sign Design for Texas (SHSD) manual for sign and pavement marking details.



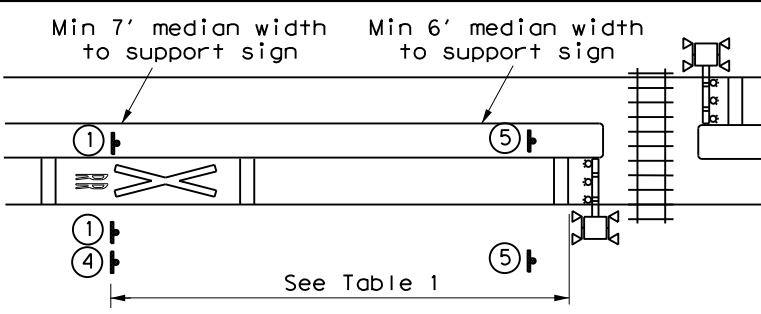
NOTE
 This design shows a 4-way stop scenario only. Other signs may be substituted for traffic signal or other traffic control scenarios. This note also applies to T-intersection design below.

	"A" < 100'	"A" ≥ 100'
"B"	See Table 1. Place pavement markings and signs on opposite side of intersection from rail if spacing from Table 1 would put markings within intersection.	See Table 1. Place pavement markings and signs between rail and intersection if spacing from Table 1 would put markings within intersection.
"C"	See Table 1.	GRADE CROSSING AND INTERSECTION ADVANCE WARNING (W10-2, W10-3, W10-4) signs should only be installed if W10-1 sign is not between intersection and railroad crossing. If needed, see Table 1.

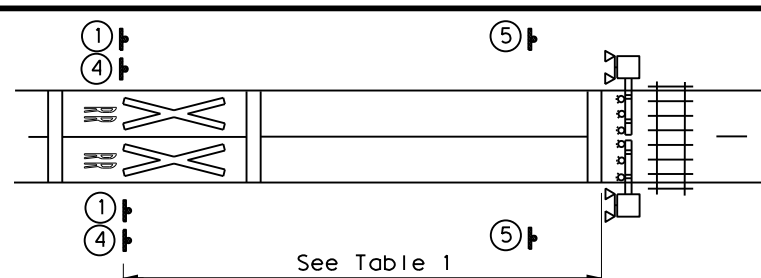
GRADE CROSSING NEAR A PARALLEL STREET



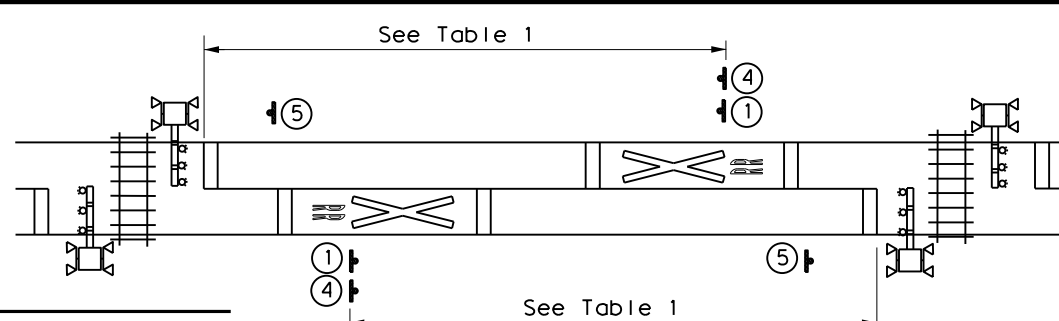
2-WAY



2-WAY WITH MEDIAN



1-WAY

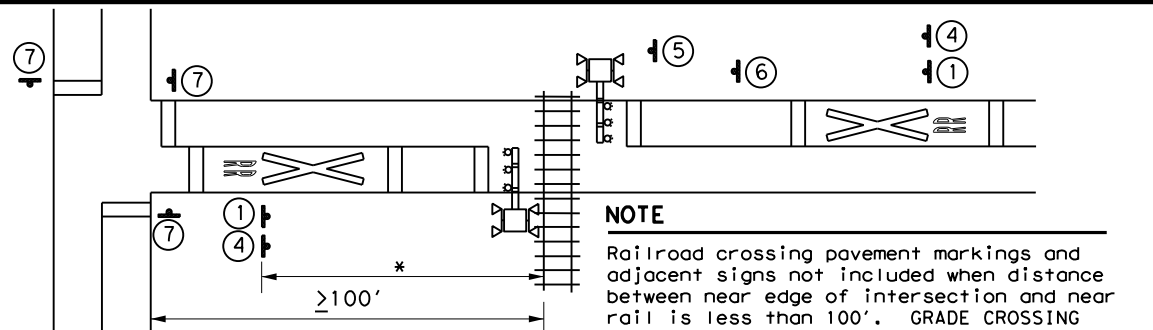


NOTE
 Separate active traffic control devices, railroad crossing pavement markings, and adjacent signs required when tracks are more than 100' apart.

2 ADJACENT CROSSINGS

SIGNS

**** Includes a NO TRAIN HORN Plaque (W10-9P) if crossing is in a Quiet Zone. LOW GROUND CLEARANCE Plaque (W10-5P) if needed is mounted below W10-2/W10-3/W10-4 signs.**



NOTE
 Railroad crossing pavement markings and adjacent signs not included when distance between near edge of intersection and near rail is less than 100'. GRADE CROSSING AND INTERSECTION ADVANCE WARNING (W10-3) signs installed on roadway parallel with rail in this case.

T-INTERSECTION

Texas Department of Transportation

Traffic Operations Division Standard

RAILROAD CROSSING DETAILS SIGNING & STRIPING

RCD(2)-16

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