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DESIGN	FED. RD. DIV. NO.	STATE PROJECT NO.		HIGHWAY NO.
JR	6	C 2355 -1 -006		FM 2451
GRAPHICS JR	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	1
CHECK LS	CONTROL	SECTION	JOB	
	2355	01	006, ETC	

FINAL PLANS

NAME OF CONTRACTOR: _____

DATE OF LETTING: _____

DATE WORK BEGAN: _____

DATE WORK COMPLETED: _____

DATE WORK ACCEPTED: _____

SUMMARY OF CHANGE ORDERS:

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

STATE PROJECT NO.
C 2355 -1 -6

CCSJ: 2355-01-006, ETC.

FM 2451

KAUFMAN COUNTY

DESIGN SPEED = 35 MPH (2R)
FUNCTIONAL CLASSIFICATION: 6 - RURAL MINOR COLLECTOR

ADT (CCSJ: 2355-01-006) FM 2451 600 (2022) --- 900 (2042)
ADT (CSJ: 2355-02-008) FM 2451 1,200 (2022) --- 1,600 (2042)

NOTE:
SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014, AND THE CONTRACT PROVISIONS LISTED AND DATED AS FOLLOWS SHALL GOVERN ON THIS PROJECT: SPECIAL LABOR PROVISIONS FOR STATE PROJECTS (000-008)

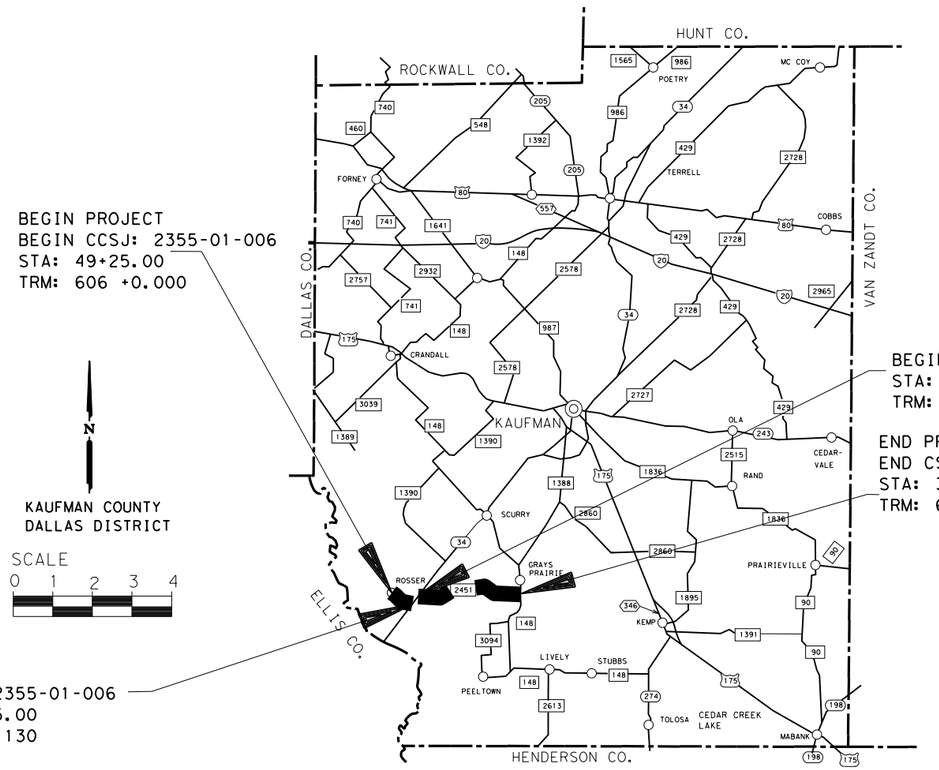
CCSJ: 2355-01-006
LIMITS: FROM MIDLAND DRIVE
TO SH 34

TOTAL LENGTH OF PROJECT =			
ROADWAY	= 6,050.00 FT.	= 1.146 MI.	
BRIDGE	= 00.00 FT.	= 0.000 MI.	
TOTAL	= 6,050.00 FT.	= 1.146 MI.	

CSJ: 2355-02-008
LIMITS: FROM SH 34
TO FM 148

TOTAL LENGTH OF PROJECT =			
ROADWAY	= 27,092.00 FT.	= 5.131 MI.	
BRIDGE	= 00.00 FT.	= 0.000 MI.	
TOTAL	= 27,092.00 FT.	= 5.131 MI.	

FOR THE CONSTRUCTION REHABILITATION OF EXISTING ROAD
CONSISTING OF: RESTORE EXISTING PAVEMENT AND ADD SHOULDERS



BEGIN PROJECT
BEGIN CCSJ: 2355-01-006
STA: 49+25.00
TRM: 606 +0.000

BEGIN CSJ: 2355-02-008
STA: 128+84.00
TRM: 608-0.986

END PROJECT
END CSJ: 2355-02-008
STA: 399+76.00
TRM: 610+2.084

END CCSJ: 2355-01-006
STA: 109+75.00
TRM: 606+1.130

N

KAUFMAN COUNTY
DALLAS DISTRICT

SCALE
0 1 2 3 4

EQUATIONS: NONE
EXCEPTIONS: NONE
RAILROAD CROSSINGS: NONE

TEXAS DEPARTMENT OF TRANSPORTATION

SUBMITTED FOR LETTING: 10/26/2021
DocuSigned by: Talon Renfroe, P.E.
BF3C6897A5A0481... DESIGN ENGINEER

RECOMMENDED FOR LETTING: 10/26/2021
DocuSigned by: , P.E.
CD6 DIRECTOR OF TRANSPORTATION PLANNING & DEVELOPMENT

RECOMMENDED FOR LETTING: 10/26/2021
DocuSigned by: Lane Selman, P.E.
29F92BAF0 AREA ENGINEER

APPROVED FOR LETTING: 10/26/2021
DocuSigned by: , P.E.
E2527 DISTRICT ENGINEER

WORK WAS COMPLETED ACCORDING TO THE PLANS AND CONTRACT.

_____, P.E.
Signature of Registrant & Date

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INDEX OF SHEETS

I. GENERAL

	1	TITLE SHEET
	2	INDEX OF SHEETS
	3	PROJECT LAYOUT
	4-7	TYPICAL SECTIONS
	8, 8A-8F	GENERAL NOTES
	9, 9A-9B	ESTIMATE & QUANTITY
	10-14	QUANTITY SUMMARY
	15-18	DRIVEWAY SUMMARY
	19-26	SOSS

II. TRAFFIC CONTROL PLAN

	27, 27A	TRAFFIC CONTROL PLAN - PHASE NARRATIVE
	28	TRAFFIC CONTROL PLAN - CULVERT REPLACEMENT TYPICALS
	29	TRAFFIC CONTROL PLAN - CULVERT EXTENSIONS TYPICALS
	30	TRAFFIC CONTROL PLAN - TYPICAL SECTIONS
*	31-42	BC (1)-21 THRU BC (12)-21
*	43	WZ (STPM)-13
*	44	WZ (UL)-13
*	45	WZ (RS)-16
*	46	TCP (1 - 6)-18
*	47	TCP (2 - 1)-18
*	48	TCP (2 - 2)-18
*	49	TCP (2 - 3)-18
*	50	TCP (3 - 1)-13
*	51	TCP (3 - 3)-14
*	52	TCP (7 - 1)-13
*	53	TCP(SC-1)-21
*	54	TCP(SC-4)-21
*	55	TCP(SC-6)-21
*	56	TCP(SC-7)-21

III. ROADWAY DETAILS

	57-61	ALIGNMENT DATA
	62-66	BORING DATA
	67-81	PLAN
	82	DRIVEWAY / INTERSECTION DETAILS
	83	ROADWAY DETAILS (PVMN TRANSITION & MAILBOX PLACEMENT)
*	84-87	MB(1)-21 THRU MB(4)-21
**	88	LJD (1-1)-07 (DAL)
*	89	TE (HMAC)-11

IV. RETAINING WALL DETAILS

NONE

V. DRAINAGE DETAILS

	90	DRAINAGE AREA MAP
	91	DRAINAGE AREA 5A & 5B MAP
	92	HYDRAULIC COMPUTATIONS
	93-95	CULVERT 5 COTTONWOOD CREEK HYDRAULIC DATA SHEET
	96	HYDRAULIC CALCULATIONS SHEET DA 10
	97-109	CULVERT LAYOUTS
	110	MISC PIPE CONNECTION DETAILS
	111-115	TEMPORARY SPL SHORING
*	116	BCS
*	117-119	SETB-FW-0
*	120-122	SETB-FW-S
*	123	SCC-MD
*	124-125	SCC-5&6
*	126	SCP-MD
*	127	SCP-3
*	128	SCP-4
*	129	SCP-5
*	130	MC-MD
*	131-132	MC-5-20
*	133-134	MC-9-10
*	135	FW-0
*	136	FW-S
*	137	PW
*	138	CH-PW-S
*	139-140	SETP-CD
*	141	SETP-PD
*	142-144	SETP-FW-0
*	145-147	SETP-FW-30
*	148	PSET-SC
*	149	PSET-SP
*	150	PSET-RC
*	151	PSET-RP
*	152	PSET-RR
*	153	CRR
*	154-155	SRR

VI. BRIDGE

NONE

VII. TRAFFIC ITEMS

	156-170	SIGNING AND PAVEMENT MARKINGS
	171-172	SIGN DETAILS
*	173	SMD (GEN)-08
**	174	SMD (SLIP-1)-08 (DAL)
*	175	SMD (SLIP-2)-08
*	176	SMD (SLIP-3)-08
*	177-179	TSR(3)-13, TSR(4)-13, TSR(5)-13
*	180-181	PM(1)-20, PM(2)-20
*	182-185	D&OM(1)-20, D&OM(2)-20, D&OM(3)-20, D&OM(4)-20
*	186-187	RS(3)-13, RS(4)-13
**	188	TWO-LANE HIGHWAY CURVE SIGNING & MARKINGS (DAL)

VIII. RAILROAD

NONE

IX. ENVIRONMENTAL ISSUES

	189-190	ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS
	191	STORMWATER POLLUTION PREVENTION PLAN (SW3P)
	192-206	SW3P SITE MAP
*	207-209	EC (1)-16, EC (2)-16, EC (3)-16
*	210-212	EC (9)-16
**	213	VEGETATION ESTABLISHMENT SHEET (DAL)
**	214	SW3P SIGN SHEET (DAL)

X. MISCELLANEOUS ITEMS

NONE

* STATEWIDE STANDARDS
** DALLAS DISTRICT STANDARDS

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

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 11/23/2021
Signature of Registrant & Date

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INDEX OF SHEETS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS FR	STATE	DISTRICT	COUNTY	SHEET NO.
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CHECK JR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

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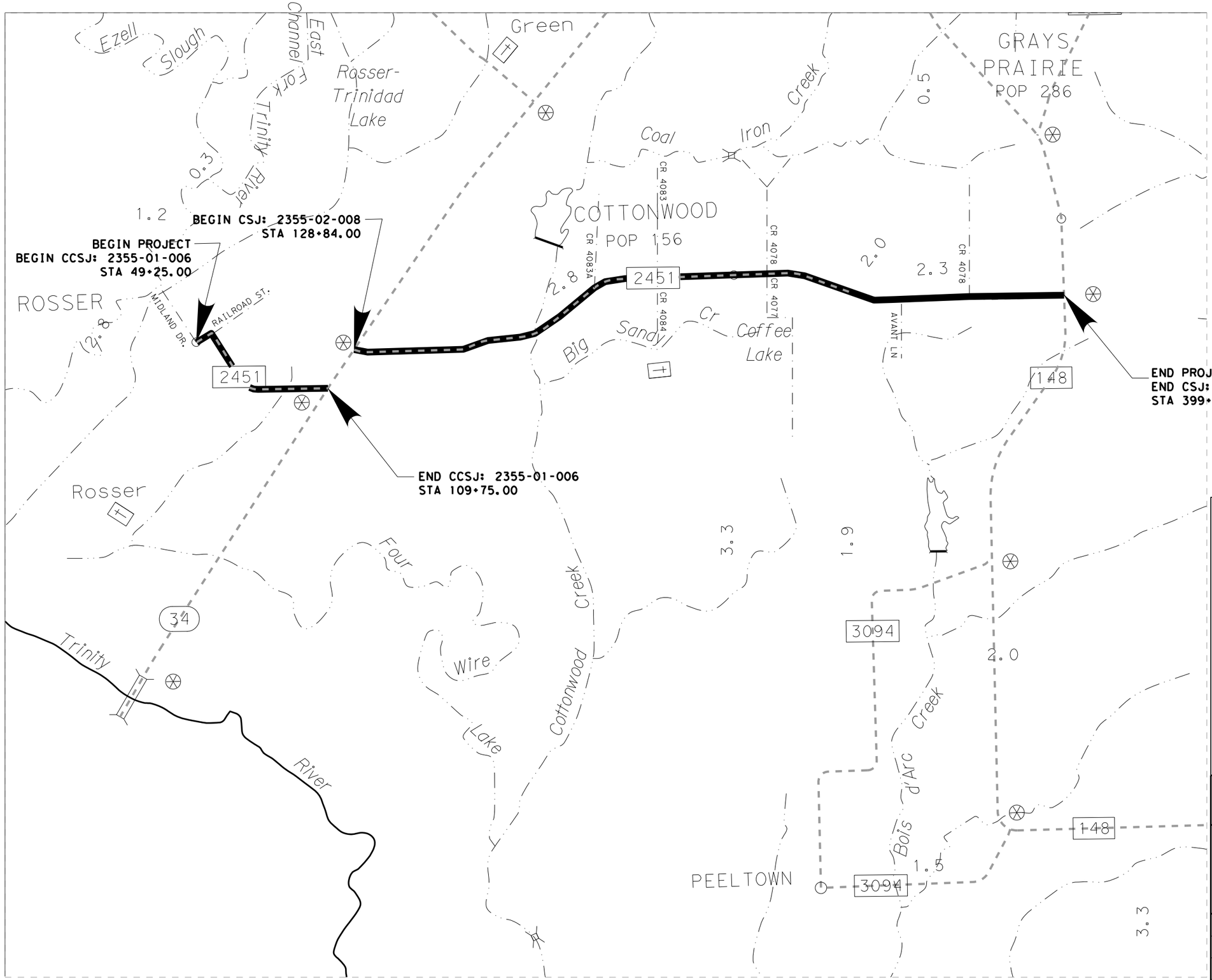

STATE OF TEXAS
FALON J. RENFROE
131914
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PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 10/18/2021
Signature of Registrant & Date

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FM 2451
PROJECT LAYOUT

SCALE: 1"=2000'

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS: SB	STATE	DISTRICT	COUNTY	SHEET NO.
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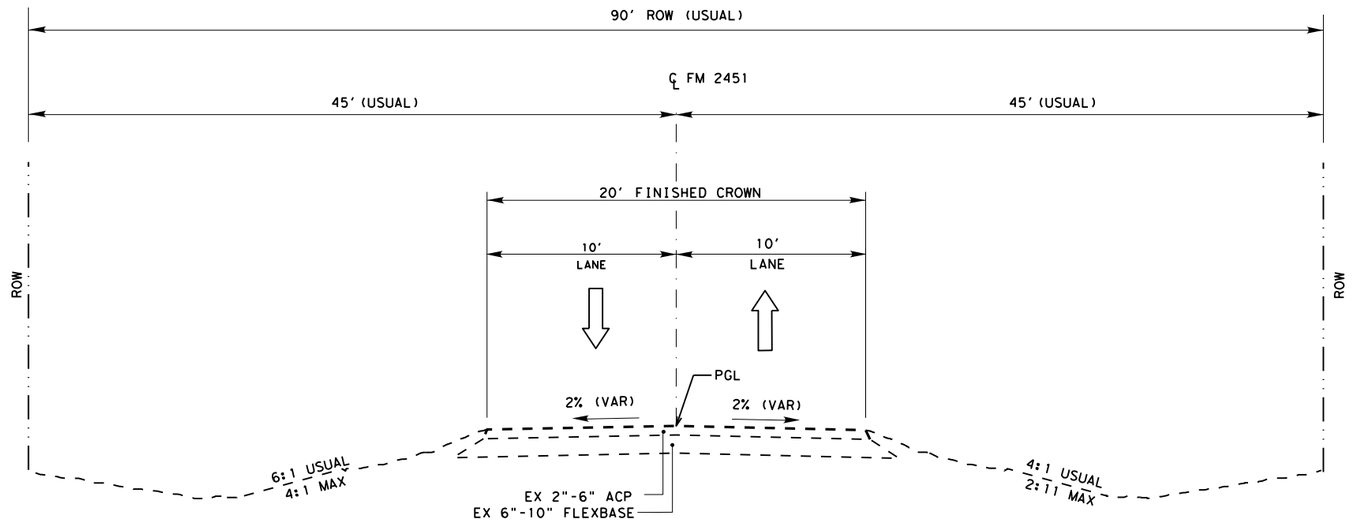

EXISTING TYPICAL SECTION

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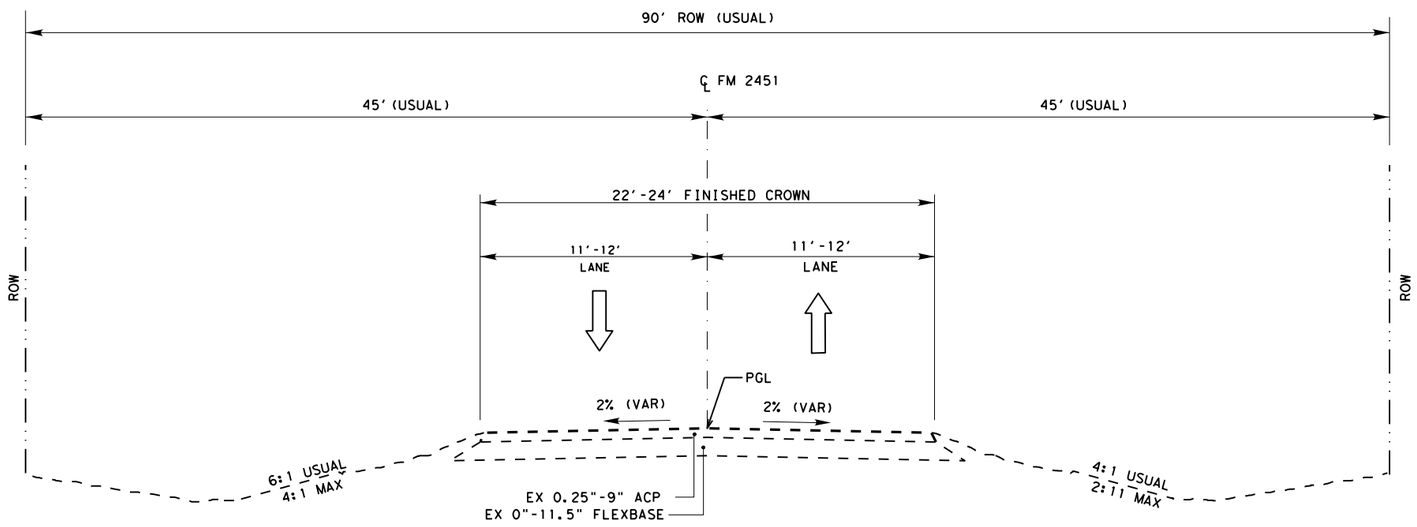

EXISTING TYPICAL SECTION

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STATE OF TEXAS
FALON J. RENFROE
131914
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PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 10/18/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451 TYPICAL SECTONS

SCALE: NTS SHEET 1 OF 4

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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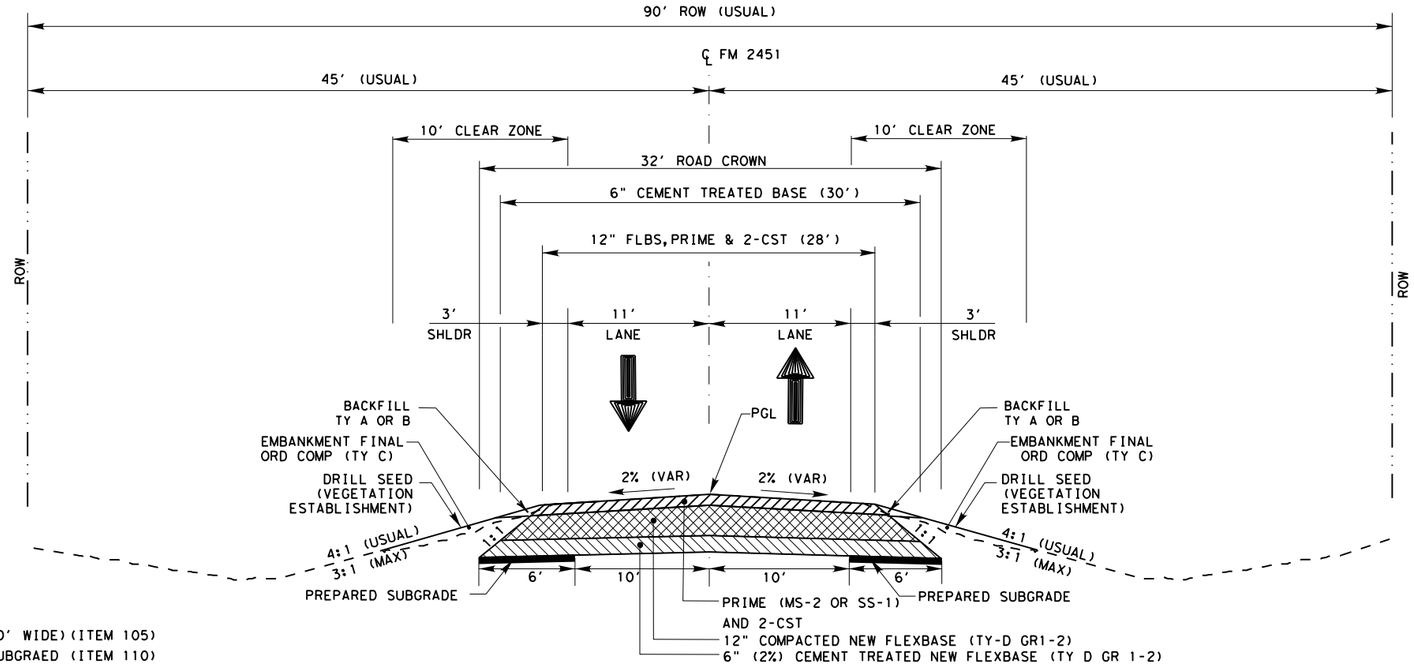
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

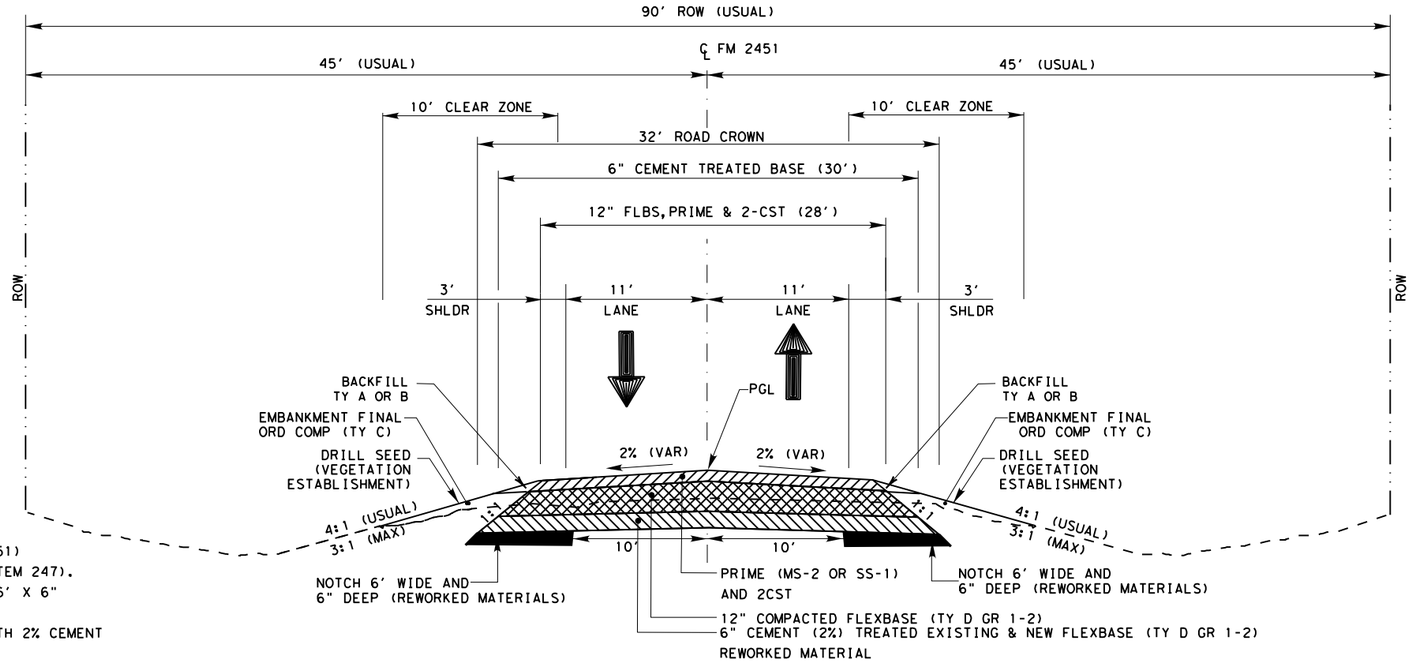


1. REMOVE 10"-12" OF EXISTING MATERIAL (20' WIDE)(ITEM 105)
2. EXCAVATE TO TOP OF PROPOSED PREPARED SUBGRAED (ITEM 110)
3. PLACE 6" NEW FLEXIBLE BASE MATERIAL (ITEM 247)(30' WIDE) AND MIX WITH 2% CEMENT (ITEM 275).
4. PLACE 12" OF NEW FLEXIBLE BASE (28' WIDE) (ITEM 247).
5. APPLY PRIME (ITEM 314) & TWO COURSE SURFACE TREATMENT (ITEM 316) (28'WIDE).
6. PGL WILL BE 0-8" HIGHER THAN EXISTING.

PROPOSED TYPICAL SECTION

CSJ: 2355-01-006
STA 49+25.00 TO STA 51+25.00
STA 107+75.00 TO STA 109+75.00

NOTES:
1. SUPERELEVATION ARE SHOWN ON PLAN SHEETS
2. BACKFILL IS ONLY TO BE USED AFTER THE FINAL SURFACE IS PLACED AND IS LIMITED TO 2 FEET FROM THE EDGE OF PAVEMENT.
3. SIDESLOPES AT CULVERT ARE SHOWN IN CULVERT LAYOUTS.
4. PROPOSED FRONT SLOPE WILL MEET AT OR BEFORE DITCHLINE EXCEPT CROSS CULVERT AREA.
5. LIMITS OF EXIST PVMT & BASE DEPTHS WERE ESTIMATED BY INTERPOLATING BTWN CORE DATA LOCATIONS. CONTRACTOR SHALL FIELD VERIFY TO ENSURE MAX 50% RAP FOR REWORKED BASE.



1. PERFORM SUBGRADE WIDENING (ITEM 112)
2. REWORK 10" OF MATERIAL (20'WIDE)(ITEM 251) WITH NEW FLEX BASE ROAD DELIVERY (2") (ITEM 247). AND SPREAD OUT OVER 30' SECTION AN FILL 6' X 6" NOTCHES ON EACH SIDE.
3. CEMENT TREAT 6" OF REWORKED MATERIAL WITH 2% CEMENT (ITEM 275)(30' WIDE)
4. PLACE 12" OF NEW FLEXIBLE BASE (28' WIDE) (ITEM 247)
5. APPLY PRIME (ITEM 314) & TWO COURSE SURFACE TREATMENT (28' WIDE) (ITEM 316)
6. PGL WILL BE 8" HIGHER THAN EXISTING

PROPOSED TYPICAL SECTION

CSJ: 2355-01-006
STA 51+25.00 TO STA 107+75.00

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 11/3/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451 TYPICAL SECTONS

SCALE: NTS SHEET 2 OF 4

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	5
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CHECK				
FR				

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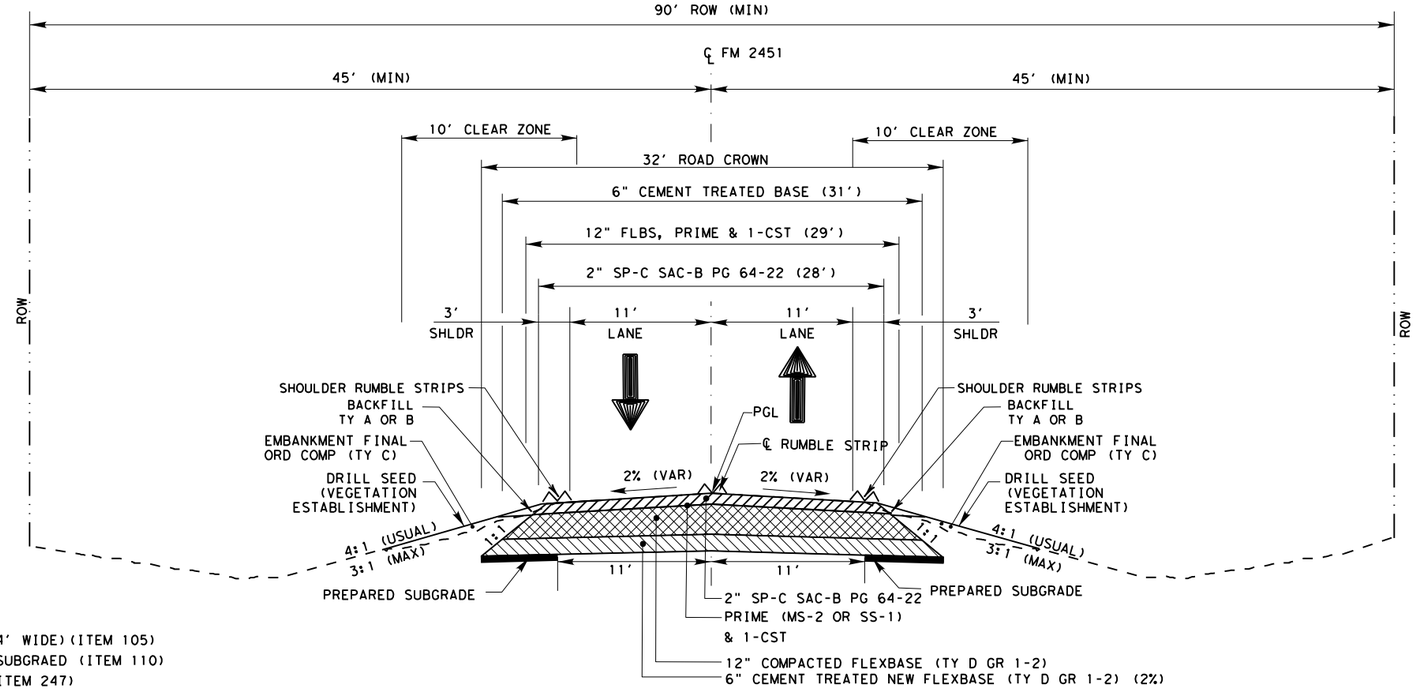
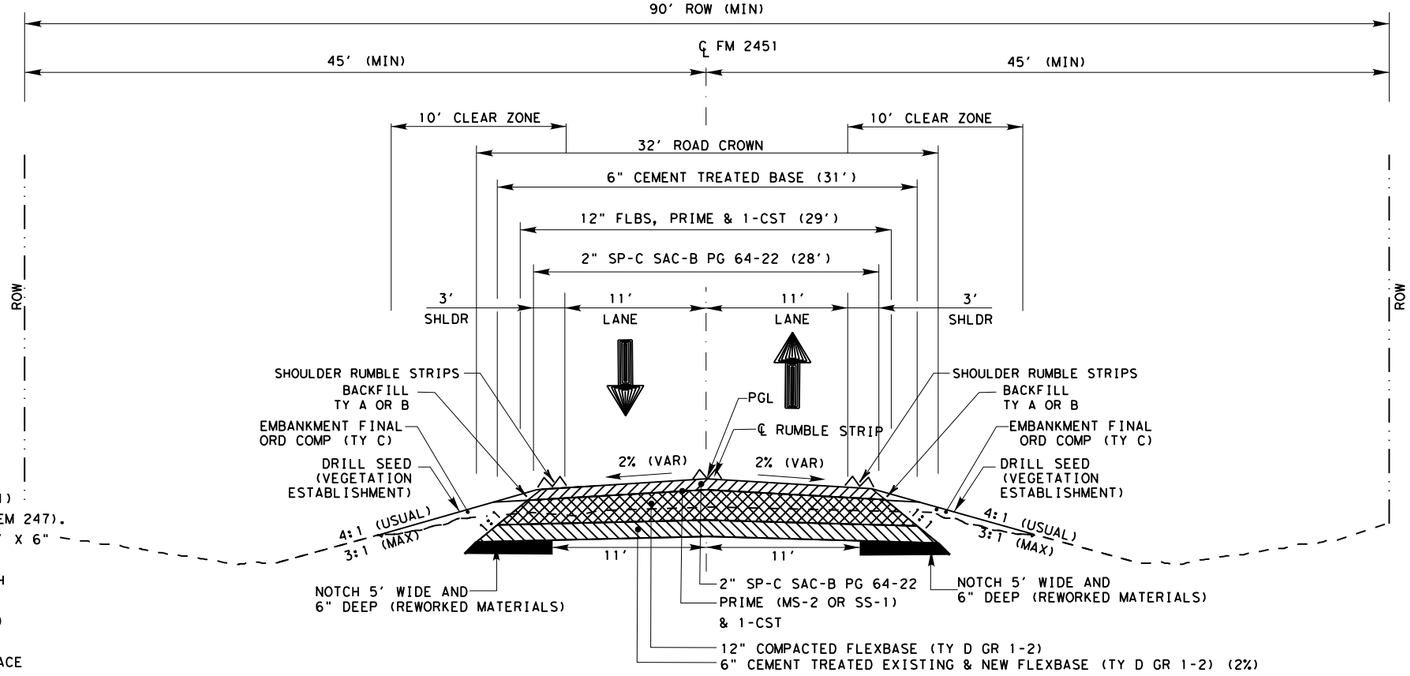


1. REMOVE 9"-14" OF EXISTING MATERIAL (24' WIDE)(ITEM 105)
2. EXCAVATE TO TOP OF PROPOSED PREPARED SUBGRAED (ITEM 110)
3. PLACE 6" NEW FLEXIBLE BASE MATERIAL (ITEM 247) (31' WIDE) AND MIX WITH 2% CEMENT (ITEM 275).
4. PLACE 12" OF NEW FLEXIBLE BASE (ITEM 247)(29' WIDE).
5. APPLY PRIME (ITEM 314) & ONE COURSE SURFACE TREATMENT (ITEM 316) (29' WIDE).
6. PLACE 2" OF SP-C SAC B PG 64-22 (ITEM 3077)(28' WIDE).
7. PGL WILL BE 0-10" HIGHER THAN EXISTING.

PROPOSED TYPICAL SECTION

CSJ: 2355-02-008
STA 128+84.00 TO STA 130+84.00
STA 189+41.00 TO STA 191+41.00
STA 199+46.00 TO STA 201+46.00
STA 397+76.00 TO STA 399+76.00



1. PERFORM SUBGRADE WIDEINING (ITEM 112).
2. REWORK 10" OF MATERIAL (22'WIDE)(ITEM 251) WITH NEW FLEX BASE ROAD DELIVERY (1") (ITEM 247). AND SPREAD OUT OVER 31' SECTION AN FILL 5' X 6" NOTCHES ON EACH SIDE.
3. CEMENT TREAT 6" OF REWORKED MATERIAL WITH 2% CEMENT (ITEM 275)(31' WIDE).
4. PLACE 12" OF NEW FLEXIBLE BASE (ITEM 247) (29' WIDE).
5. APPLY PRIME (ITEM 314) & ONE COURSE SURFACE TREATMENT (ITEM 316) (29' WIDE) (ITEM 316).
6. PLACE 2" OF SP-C SAC B PG64-22 (28' WIDE) (ITEM 3077).
7. PGL WILL BE 10" HIGHER THAN EXISTING.

PROPOSED TYPICAL SECTION

CSJ: 2355-02-008
STA 130+84.00 TO STA 189+41.00
STA 201+46.00 TO STA 397+76.00

NOTES:
1. SUPERELEVATION ARE SHOWN ON PLAN SHEETS
2. BACKFILL IS ONLY TO BE USED AFTER THE FINAL SURFACE IS PLACED AND IS LIMITED TO 2 FEET FROM THE EDGE OF PAVEMENT.
3. SIDESLOPES AT CULVERT ARE SHOWN IN CULVERT LAYOUTS.
4. PROPOSED FRONT SLOPE WILL MEET AT OR BEFORE DITCHLINE EXCEPT CROSS CULVERT AREA.
5. LIMITS OF EXIST PVMT & BASE DEPTHS WERE ESTIMATED BY INTERPOLATING BTWN CORE DATA LOCATIONS. CONTRACTOR SHALL FIELD VERIFY TO ENSURE MAX 50% RAP FOR REWORKED BASE.

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 11/3/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451 TYPICAL SECTONS

SCALE: NTS SHEET 3 OF 4

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	6
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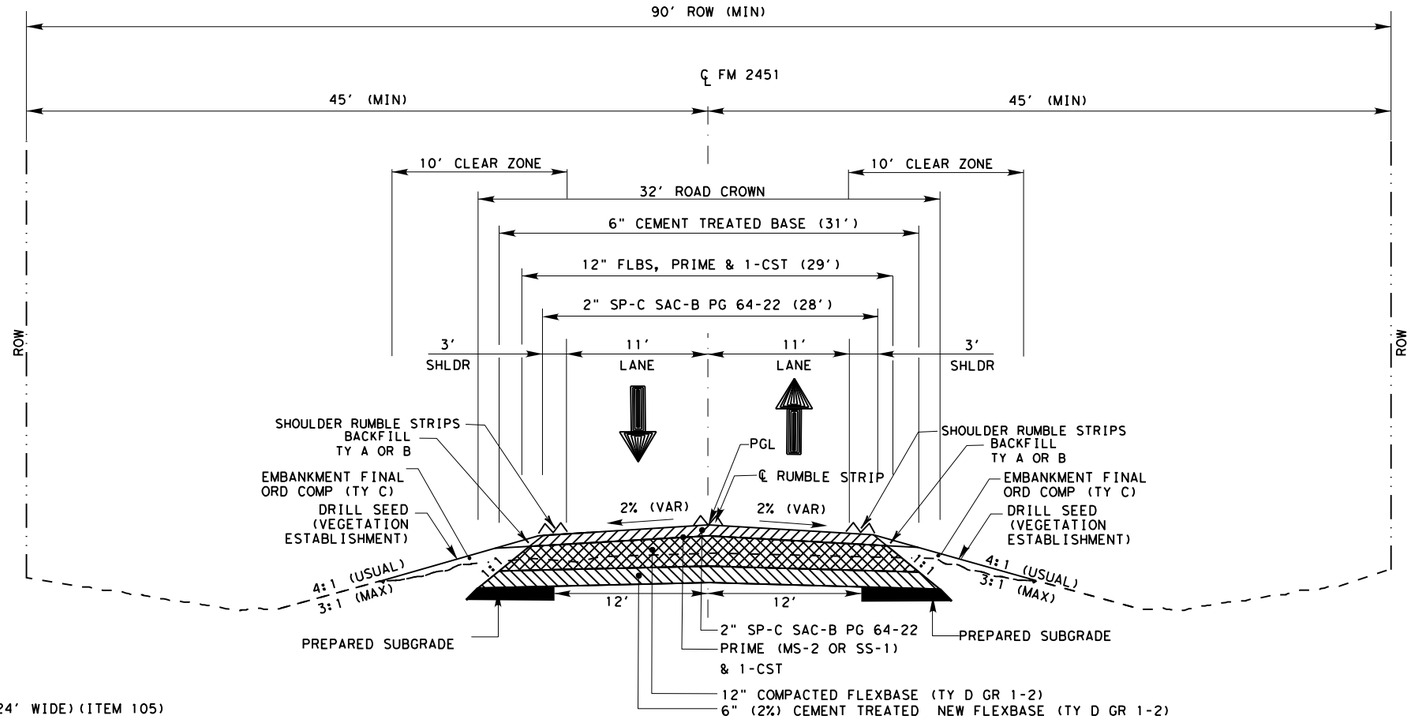

1. REMOVE 9"-14" OF EXISTING MATERIAL (24' WIDE)(ITEM 105)
2. EXCAVATE TO TOP OF PROPOSED PREPARED SUBGRAED (ITEM 110). TOTAL REMOVAL DEPTH OF EXISTING MATERIAL AND EXCAVATION IS 20".
3. PLACE 6" NEW FLEXIBLE BASE MATERIAL (ITEM 247) (31' WIDE) AND MIX WITH 2% CEMENT (ITEM 275).
4. PLACE 12" OF NEW FLEXIBLE BASE (ITEM 247)(29' WIDE).
5. APPLY PRIME (ITEM 314) & ONE COURSE SURFACE TREATMENT (ITEM 316) (29' WIDE).
6. PLACE 2" OF SP-C SAC B PG64-22 (ITEM 3077)(28' WIDE).
7. PGL WILL MATCH EXISTING.

PROPOSED TYPICAL SECTION

CSJ: 2355-02-008
STA 191+41.00 TO STA 199+46.00

NOTES:
1. SUPERELEVATION ARE SHOWN ON PLAN SHEETS
2. BACKFILL IS ONLY TO BE USED AFTER THE FINAL SURFACE IS PLACED AND IS LIMITED TO 2 FEET FROM THE EDGE OF PAVEMENT.
3. SIDESLOPES AT CULVERT ARE SHOWN IN CULVERT LAYOUTS.
4. PROPOSED FRONT SLOPE WILL MEET AT OR BEFORE DITCHLINE EXCEPT CROSS CULVERT AREA.
5. LIMITS OF EXIST PVMT & BASE DEPTHS WERE ESTIMATED BY INTERPOLATING BTWN CORE DATA LOCATIONS. CONTRACTOR SHALL FIELD VERIFY TO ENSURE MAX 50% RAP FOR REWORKED BASE.

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 11/3/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451 TYPICAL SECTONS

SCALE: NTS SHEET 4 OF 4

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
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SPECIFICATION DATA

Table 1: Soil Constants Requirements				
Item	Description	Plasticity Index		Note
		Max	Min	
132	EMBANKMENT (FINAL)(DC)(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
164	Drill Seed (Perm) (R) (C/S)	N/A	See Specifications		257,815 SY
166 *	Fertilizer (12-6-6)	N/A	500	Lbs./Ac	13.32 Ton
168	Vegetative Watering (Warm)**	N/A	12	MG/Ac/Day	38,353 MG
314	Emuls Asph	N/A	0.20	Gal/SY	20,627 Gal
3077	SP MIXES	See Plans	110	Lbs./SY/In	9,275 Ton
3077	Tack Coat	New HMA	0.06	GAL/SY	5,057 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. ***Portland Concrete Cement					
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 1.7 Ton/CY (dry-compacted) (4) Item 314 Residual Asphalt 0.20 Gal/SY					

CSJ: 2355-01-006, ETC Sheet 8

County: KAUFMAN

Highway: FM 2451

Table 3: Basis of Estimate for Temporary Erosion Control Items				
Item	Description	Rate		Quantity
164	Drill Seeding (Temp) (Warm or Cool)	See Specifications		105,360 SY
166*	Fertilizer (12-6-6)	500	Lb/Ac	5.33 Ton
168	Vegetative Watering (Warm)**	12	MG/Ac/Day	19,183 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 60.45 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 coordination and permits with environmental resources agencies, as outlined in the plan set 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.

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):

Lane Selman Lane.Selman@txdot.gov
Nicholas Wadlington Nicholas.Wadlington@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.

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).

CSJ: 2355-01-006, ETC **Sheet 8** A

County: KAUFMAN

Highway: FM 2451

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

Neatly trim trees, overhanging branches and all underbrush at the ROW line to produce an 18' vertical clear area within the limits of ROW.

The limits of preparing right of way will be measured from Sta. 49+25.00 to Sta. 109+75.00 for CCSJ 2355-01-006 & from Sta. 128+84.00 to Sta. 399+76.00 for CSJ 2355-02-008 along the centerline of construction.

Item 104:
Sawing of concrete is not paid for directly, but is considered subsidiary to this item.

Item 105:
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.

Items 110 and Items 132:
Excavated shale is not an acceptable material for embankment.

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.

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.

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.

CSJ: 2355-01-006, ETC **Sheet 8B**

County: KAUFMAN

Highway: FM 2451

Item 152:
Use road grader work to windrow sod/topsoil (6” depth), construct slopes, prepare driveways, grade ditches as necessary to establish continuous drainage and redistribute sod/topsoil on finished slopes.

Redistribute sod/topsoil shall be free of rock, rap, base material, and other objectionable materials.

Cut ditches to proposed grade in the immediate vicinity of cross drain structures prior to placing Storm water BMP devices at the early stages of the project.

If excess material is generated under this item, it may be utilized to construct slopes, or wasted as approved.

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.

Flexible Base shall not contain more than 1% by weight of clay balls.

Roadway delivery flexbase measured by the Ton shall be used as additional base material to construct superelevation sections to rates shown in the plans. Processing of this material will not be paid for directly, but will be considered subsidiary to the various bid items.
Place blue top hubs for alignment and elevations of new base at centerline and edge of pavement.

Measure roadway profile smoothness with a high speed or lightweight inertial profiler that is certified by the Texas Transportation Institute. Acceptance for locations constructed under traffic will be based on no 0.10-mile section having an average IRI value greater than 125 inches per mile. Acceptance for locations not constructed under traffic will be based on no 0.10 mile section having an average IRI value greater than 95 inches per mile and no individual wheel path spike greater than 105. Following corrections, re-profile the roadway to verify that corrective actions were successful.

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 314:
Apply MS-2 or SS-1 as a prime, dilute the asphalt with base finish water, distribute in successive applications, and work into the top 1/4" of flex base. Residual asphalt 0.20 Gal/SY.

Item 316:

	AC20-5TR, AC20-XP AC15-P	CRS-2P	RC-250
JANUARY			REQUIRES INTERMEDIATE COURSE TO BE PLACED
FEBRUARY			
MARCH		REFER TO STANDARD SPECIFICATIONS ITEM 316 FOR TEMPERATURE REQUIREMENTS	
APRIL			
MAY	REFER TO STANDARD SPECIFICATIONS ITEM 316 FOR TEMPERATURE REQUIREMENTS		
JUNE			
JULY			
AUGUST			
SEPTEMBER		REFER TO STANDARD SPECIFICATIONS ITEM 316 FOR TEMPERATURE REQUIREMENTS	
OCTOBER			
NOVEMBER			REQUIRES INTERMEDIATE COURSE TO BE PLACED
DECEMBER			

RC-250 is only allowed as a first course in accordance with table above.

Utilize an asphalt distributor capable of providing a transversely varied asphalt rate. The Engineer will select the pavements where the transversely varied asphalt rate is required. When a transversely varied rate is required, the asphalt rate outside of the wheel paths will be between 22 and 32% higher than the asphalt rate applied in the wheel paths. Provide calibration documents to the Engineer that include a description of the spray bar(s) and nozzles that will be used and the percentage difference in asphalt rate achieved by each tested spray bar and nozzle arrangement. The nozzles proposed for use shall be clearly stamped or marked from the factory identifying the manufacturer.

CSJ: 2355-01-006, ETC **Sheet 8C**

County: KAUFMAN

Highway: FM 2451

First Course				
ITEM	APPLICATION			
	Emul. Asphalt Treatment	1st Course		
*Asphalt Type	MS-2 or SS-1	CRS-2P	AC20-5TR, AC20-XP, AC15-P	RC-250 #
*Asph. Rate (Gal/SY)	0.20	0.50	0.42	0.28
Aggregate Type		B or L	B or L	B or L
Aggregate Grade		3	3	5
Aggr. Rate (CY/SY)		1:105	1:105	1:125
Min. Cure Time	24 hrs	14 days (Emulsion)		

When RC-250 is used as the 1st course, an intermediate course will be required and will be placed as soon as temperature allows which will be before 2nd Course is placed.

Intermediate Seal	
ITEM	APPLICATION
	Intermediate Course
*Asphalt Type	CRS-2P
*Asph. Rate (Gal/SY)	0.44
Aggregate Type	B or L
Aggregate Grade	4
Aggr. Rate (CY/SY)	1:120

Second Course	
ITEM	APPLICATION
	2nd Course
*Asphalt Type	AC20-5TR, AC20-XP, AC15-P
*Asph. Rate (Gal/SY)	0.36
Aggregate Type	PB or PL
Aggregate Grade	4
Aggr. Rate (CY/SY)	1:120

* The information above is intended to provide general guidance and as a basis of estimate. Based on the season and weather conditions at the time, the engineer will determine the asphalt type and rates to be used at the time of application.

In addition to the temperature requirements of this Item, AC Asphalts used in Surface Treatments and Sealcoats must be placed between May 15 and August 31. Emulsions may be substituted for AC Asphalts outside this timeframe only with the approval of the Engineer.

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.

Item 420:
Apply an ordinary surface finish to all concrete surfaces within 30 days after form removal.

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.

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 440:
All ties, chairs and other appurtenances used with epoxy coated reinforcing shall be epoxy coated or non-metallic.

Fiber Reinforced Concrete (FRC) can be used as a substitute for Non-Structural Class Reinforced Concrete in Mow-Strip and Rip Rap Items as approved. FRC may also be used for other Non-Structural Class Reinforced Concrete Items as approved.

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.

Item 496:
Properly remove and dispose of pipes, SET, headwalls and wingwalls is subsidiary to this item.

Item 500:
Material On Hand (MOH) will not be used in calculating partial payments for Mobilization.

CSJ: 2355-01-006, ETC **Sheet 8 D**

County: KAUFMAN

Highway: FM 2451

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 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.

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.

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

Traffic Control Plans with Lane Closures causing backups of 8 minutes or greater in duration will be modified by the Engineer.

Both travel lanes on FM 2451 shall be open at the end of each workday.

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.

If temporary construction stream crossings are allowed under a Nationwide Permit, submit in writing for approval the type and location of each temporary stream crossing. Use temporary

bridges, timber mats, or other structurally sound and non-eroding material for temporary stream crossings. A temporary culvert crossing will consist of storm sewer pipes and 4- to 8-inch nominal size rock. Temporary stream crossings must not cause more than minimal changes to the hydraulic flow characteristics of the stream, increase flooding, or cause more than minimal degradation of water quality. Remove the temporary stream crossings in their entirety and return the affected areas to their pre-existing elevation. All work and materials use for temporary construction stream crossings will not be paid for directly but are subsidiary to pertinent Items.

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 585:
Use Surface Test Type A on all intersections and driveways.

Use Surface Test Type B pay adjustment schedule 2 on the travel lanes.

Items 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 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.

CSJ: 2355-01-006, ETC **Sheet 8** E

County: KAUFMAN

Highway: FM 2451

Items 662 & 672:
Place work zone tabs before sundown on all roadway surfaces sealed during a work day. Black adhesive will be used on asphalt pavements.

Cut, remove and properly dispose of the upright portions of all work zone tabs prior to acceptance of any roadway.

No section of highway included in this contract will be without standard pavement markings for a period longer than 14 calendar days

Item 666:
Dispose of all paint waste in accordance with EPA and Texas Commission on Environmental Quality (TCEQ) rules and regulations or as directed. Furnishing cleaning agents and disposal of paint waste is subsidiary to this item.

Place pavement markings according to the "Texas Manual on Uniform Traffic Control Devices" and the applicable plan sheets.

No contract stripe will be placed unless the striping inspector is present and at least 24 hours advance notice has been given by the Contractor.

Lay out pilot lines for approval 24 hours prior to all final pavement marking applications. Use equipment with footage counters capable of measuring the linear footage placed. Calibrate counters prior to the beginning of striping operations.

Use a double-drop bead system with an application rate of 7.0 lbs/gal Type II and 7.0 lbs/gal Type III beads. Apply the Type II beads before applying Type III beads. Use a gravity flow applicator to funnel beads onto the stripe. Reduce truck speed enough to ensure that the beads drop onto the stripe and do not roll in the paint film.

Apply all stripes in one coat.

A portable retro reflectometer may be used in accordance to the specifications for this project if total quantity of striping is less than 200,000 linear foot.

Due to problems in traffic handling, do not place a dash center stripe and edge line at the same time.

Remove all Type tabs within the limits to be striped immediately prior to the placement of Permanent

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 1 Series	Scenario	Required TMA/TA
(1-1)-18 / (1-2)-18	ALL	1
(1-6)-18	ALL	1

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

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.

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 2355-01-006 **DISTRICT** Dallas **COUNTY** Kaufman
HIGHWAY FM 2451

			CONTROL SECTION JOB		**2355-01-006**		**2355-02-008**		TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00064055**		**A00064054**			
			COUNTY		**Kaufman**		**Kaufman**			
			HIGHWAY		**FM 2451**		**FM 2451**			
ALT	**BID CODE**	**DESCRIPTION**		**UNIT**	EST.	FINAL	EST.	FINAL		
	100-6002	PREPARING ROW		STA	60.500		270.920		331.420	
	100-6012	PREP ROW (TREE) (18"-36" DIA.)		EA			4.000		4.000	
	104-6011	REMOVING CONC (MEDIANS)		SY			65.000		65.000	
	104-6017	REMOVING CONC (DRIVEWAYS)		SY	130.000		495.000		625.000	
	105-6043	REMOVING STAB BASE & ASPH PAV (0-6")		SY	4,375.000		7,735.000		12,110.000	
	105-6055	REMOVING STAB BASE AND ASPH PAV(9"-14")		SY			4,283.000		4,283.000	
	105-6058	REMOVING STAB BASE & ASPH PAV (10"-12")		SY	890.000				890.000	
	110-6001	EXCAVATION (ROADWAY)		CY	450.000		1,501.000		1,951.000	
	112-6001	SUBGRADE WIDENING (ORD COMP)		STA	56.500		254.870		311.370	
	132-6005	EMBANKMENT (FINAL)(ORD COMP)(TY C)		CY	1,592.000		10,637.000		12,229.000	
	134-6004	BACKFILL (TY A OR B)		STA	60.500		270.920		331.420	
	152-6001	ROAD GRADER WORK (ORD COMP)		STA	60.500		270.920		331.420	
	161-6017	COMPOST MANUF TOPSOIL (4")		SY	47,095.000		210,720.000		257,815.000	
	164-6035	DRILL SEEDING (PERM) (RURAL) (CLAY)		SY	47,095.000		210,720.000		257,815.000	
	164-6051	DRILL SEED (TEMP)(WARM OR COOL)		SY	23,548.000		105,360.000		128,908.000	
	168-6001	VEGETATIVE WATERING		MG	10,511.000		47,025.000		57,536.000	
	247-6073	FL BS (CMP IN PLC)(TY D GR 1-2) (6")		SY	1,334.000		5,529.000		6,863.000	
	247-6133	FL BS (RDWY DEL) (TY D GR 1-2)		TON	1,832.000		4,268.000		6,100.000	
	247-6313	FL BS (CMP IN PLC)(TY D GR1-2)(12")		SY	18,824.000		87,300.000		106,124.000	
	251-6073	REWRKING BS MATL (TY C)(10")(ORD COMP)		SY	12,556.000		62,303.000		74,859.000	
	275-6001	CEMENT		TON	118.000		550.000		668.000	
	275-6003	CEMENT TREAT (NEW BASE) (6")		SY	1,334.000		5,529.000		6,863.000	
	275-6004	CEMENT TREAT (MX EXST MTL & NW BS) (6")		SY	18,834.000		87,790.000		106,624.000	
	314-6021	EMULS ASPH (PRIME)(MS-2 OR SS-1)		GAL	3,766.000		16,861.000		20,627.000	
	316-6024	ASPH (CRS-2P)		GAL	5,901.000		14,050.000		19,951.000	
	316-6029	ASPH (RC-250)		GAL	1,759.000		7,871.000		9,630.000	
	316-6403	AGGR (TY-B GR-5 OR TY-L GR-5)		CY	51.000		227.000		278.000	
	316-6419	ASPH (AC-15P, AC-20-5TR OR AC-20XP)		GAL	9,413.000		11,805.000		21,218.000	
	316-6434	AGGR (TY-PB GR-4 OR TY-PL GR-4 (SAC-B)		CY	159.000				159.000	
	316-6435	AGGR (TY-B GR-4 OR TY-L GR-4 SAC-B)		CY	159.000				159.000	
	316-6440	AGGR (TY-B GR-3 OR TY-L GR-3)(SAC-B)		CY	120.000		536.000		656.000	
	400-6006	CUT & RESTORING PAV		SY	22.000				22.000	
	403-6001	TEMPORARY SPL SHORING		SF			3,196.000		3,196.000	
	432-6002	RIPRAP (CONC)(5 IN)		CY	2.090		21.450		23.540	
	432-6022	RIPRAP (STONE COMMON)(DRY)(6 IN)		CY			64.930		64.930	
	462-6001	CONC BOX CULV (3 FT X 2 FT)		LF	56.000				56.000	
	462-6048	CONC BOX CULV (4 FT X 3 FT)(EXTEND)		LF			42.000		42.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 2355-01-006 **DISTRICT** Dallas **COUNTY** Kaufman
HIGHWAY FM 2451

				CONTROL SECTION JOB	2355-01-006		2355-02-008		TOTAL EST.	TOTAL FINAL
				PROJECT ID	A00064055		A00064054			
				COUNTY	Kaufman		Kaufman			
				HIGHWAY	FM 2451		FM 2451			
ALT	BID CODE	DESCRIPTION	UNIT		EST.	FINAL	EST.	FINAL		
	462-6050	CONC BOX CULV (5 FT X 2 FT)(EXTEND)	LF				10.000		10.000	
	462-6051	CONC BOX CULV (5 FT X 3 FT)(EXTEND)	LF				32.000		32.000	
	462-6056	CONC BOX CULV (6 FT X 5 FT)(EXTEND)	LF				18.000		18.000	
	462-6072	CONC BOX CULV (9 FT X 9 FT)(EXTEND)	LF				32.000		32.000	
	464-6003	RC PIPE (CL III)(18 IN)	LF		824.000		2,728.000		3,552.000	
	464-6005	RC PIPE (CL III)(24 IN)	LF		24.000		724.000		748.000	
	464-6007	RC PIPE (CL III)(30 IN)	LF				56.000		56.000	
	464-6018	RC PIPE (CL IV)(24 IN)	LF		24.000		16.000		40.000	
	464-6019	RC PIPE (CL IV)(30 IN)	LF				32.000		32.000	
	464-6021	RC PIPE (CL IV)(42 IN)	LF				16.000		16.000	
	464-6022	RC PIPE (CL IV)(48 IN)	LF				16.000		16.000	
	466-6135	HEADWALL (CH - PW - S) (DIA= 42 IN)	EA				1.000		1.000	
	466-6136	HEADWALL (CH - PW - S) (DIA= 48 IN)	EA				2.000		2.000	
	466-6171	WINGWALL (PW - 1) (HW=10 FT)	EA				2.000		2.000	
	466-6179	WINGWALL (PW - 1) (HW=4 FT)	EA				2.000		2.000	
	466-6181	WINGWALL (PW - 1) (HW=6 FT)	EA				2.000		2.000	
	467-6105	SET (TY I)(S=3 FT)(HW=3FT)(3:1)(C)	EA		2.000				2.000	
	467-6143	SET (TY I)(S= 4 FT)(HW= 4 FT)(3:1) (C)	EA				2.000		2.000	
	467-6171	SET (TY I)(S= 5 FT)(HW= 3 FT)(3:1) (C)	EA				2.000		2.000	
	467-6175	SET (TY I)(S= 5 FT)(HW= 4 FT)(3:1) (C)	EA				4.000		4.000	
	467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA		58.000		193.000		251.000	
	467-6388	SET (TY II) (24 IN) (RCP) (3: 1) (C)	EA		4.000		2.000		6.000	
	467-6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)	EA		2.000		50.000		52.000	
	467-6417	SET (TY II) (30 IN) (RCP) (3: 1) (C)	EA				4.000		4.000	
	467-6423	SET (TY II) (30 IN) (RCP) (6: 1) (P)	EA				4.000		4.000	
	480-6001	CLEAN EXIST CULVERTS	EA		1.000		11.000		12.000	
	496-6004	REMOV STR (SET)	EA		10.000		20.000		30.000	
	496-6005	REMOV STR (WINGWALL)	EA		2.000		12.000		14.000	
	496-6006	REMOV STR (HEADWALL)	EA		2.000		9.000		11.000	
	496-6008	REMOV STR (BOX CULVERT)	LF		50.000				50.000	
	496-6016	REMOV STR (PIPE)	EA		24.000		111.000		135.000	
	500-6001	MOBILIZATION	LS		0.190		0.810		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO		15.000				15.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF		260.000		1,175.000		1,435.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF		260.000		1,175.000		1,435.000	
	506-6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY				1,139.000		1,139.000	
	506-6024	CONSTRUCTION EXITS (REMOVE)	SY				1,139.000		1,139.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 2355-01-006 **DISTRICT** Dallas **COUNTY** Kaufman
HIGHWAY FM 2451

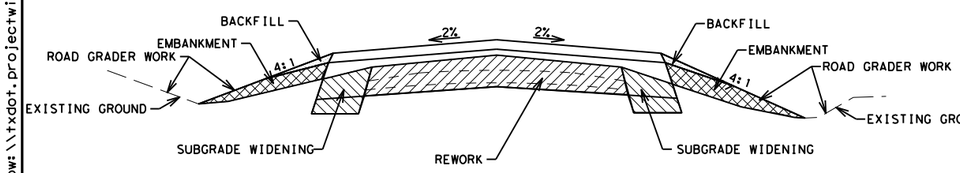
			CONTROL SECTION JOB		**2355-01-006**		**2355-02-008**		TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00064055**		**A00064054**			
			COUNTY		**Kaufman**		**Kaufman**			
			HIGHWAY		**FM 2451**		**FM 2451**			
ALT	**BID CODE**	**DESCRIPTION**		**UNIT**	EST.	FINAL	EST.	FINAL		
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)		LF	305.000		1,834.000		2,139.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)		LF	305.000		1,834.000		2,139.000	
	506-6041	BIODEG EROSN CONT LOGS (INSTL) (12")		LF	966.000		3,784.000		4,750.000	
	506-6043	BIODEG EROSN CONT LOGS (REMOVE)		LF	966.000		3,784.000		4,750.000	
	530-6005	DRIVEWAYS (ACP)		SY	2,663.000		7,059.000		9,722.000	
	530-6017	DRIVEWAYS (CONC) (HES)		SY	140.000		554.000		694.000	
	533-6003	RUMBLE STRIPS (SHOULDER) ASPHALT		LF			54,184.000		54,184.000	
	533-6004	RUMBLE STRIPS (CENTERLINE) ASPHALT		LF			27,092.000		27,092.000	
	560-6011	MAILBOX INSTALL-S (TWW-POST) TY 4		EA			65.000		65.000	
	560-6012	MAILBOX INSTALL-D (TWW-POST) TY 4		EA			2.000		2.000	
	644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)		EA	37.000		69.000		106.000	
	644-6004	IN SM RD SN SUP&AM TY10BWG(1)SA(T)		EA	2.000		5.000		7.000	
	644-6005	IN SM RD SN SUP&AM TY10BWG(1)SA(T-2EXT)		EA			1.000		1.000	
	644-6033	IN SM RD SN SUP&AM TYS80(1)SA(U)		EA	1.000		5.000		6.000	
	644-6034	IN SM RD SN SUP&AM TYS80(1)SA(U-1EXT)		EA	1.000				1.000	
	644-6036	IN SM RD SN SUP&AM TYS80(1)SA(U-BM)		EA	2.000		4.000		6.000	
	658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)		EA	4.000		31.000		35.000	
	662-6111	WK ZN PAV MRK SHT TERM (TAB)TY Y-2		EA	605.000		2,710.000		3,315.000	
	666-6018	REFL PAV MRK TY I (W)6"(DOT)(100MIL)		LF	99.000				99.000	
	666-6048	REFL PAV MRK TY I (W)24"(SLD)(100MIL)		LF	82.000		158.000		240.000	
	666-6170	REFL PAV MRK TY II (W) 4" (SLD)		LF			54,184.000		54,184.000	
	666-6207	REFL PAV MRK TY II (Y) 4" (SLD)		LF	6,050.000		54,184.000		60,234.000	
	666-6303	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)		LF	9,351.000		43,465.000		52,816.000	
	666-6309	RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)		LF	2,277.000		10,174.000		12,451.000	
	666-6312	RE PM W/RET REQ TY I (Y)4"(BRK)(100MIL)		LF	950.000		4,560.000		5,510.000	
	666-6315	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)		LF	7,382.000		19,071.000		26,453.000	
	672-6009	REFL PAV MRKR TY II-A-A		EA	141.000		528.000		669.000	
	730-6107	FULL - WIDTH MOWING		CYC	3.000		3.000		6.000	
	3077-6013	SP MIXESSP-CSAC-B PG64-22		TON			9,275.000		9,275.000	
	3077-6075	TACK COAT		GAL			5,057.000		5,057.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN		EA	2.000		2.000		4.000	
	6185-6002	TMA (STATIONARY)		DAY	47.000		199.000		246.000	
	6185-6003	TMA (MOBILE OPERATION)		HR	56.000		112.000		168.000	
	08	SAFETY CONTINGENCY (NON-PART)		LS	1.000				1.000	
		EROSION CONTROL MAINTENANCE (NON-PART)		LS	1.000				1.000	

SUMMARY OF ROADWAY ITEMS

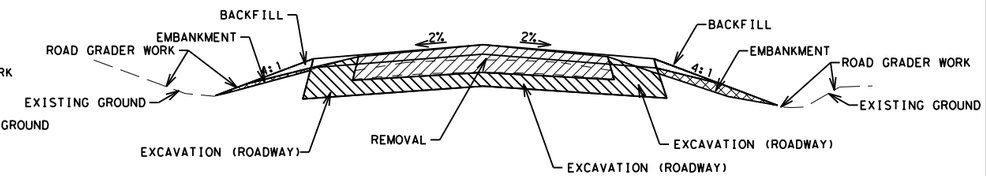
LOCATION		LENGTH	REMOVE OR REWORK BASE WIDTH	CEMENT TREATED WIDTH	FLEX BASE WIDTH	SURFACE	100 6002 PREPARING ROW	104 6011 REMOVING CONC (MEDIANS)	105 6055 REMOVING STAB BASE AND ASPH PAV(9"-14")	105 6058 REMOVING STAB BASE & ASPH PAV (10"-12")	110 6001 EXCAVATION (ROADWAY)	112 6001 SUBGRADE WIDENING (ORD COMP)	132 6005 EMBANKMENT (FINAL) (ORD COMP) (TY C)	134 6004 BACKFILL (TY A OR B)
STA	STA	FT	FT	FT	FT	FT	STA	SY	SY	SY	CY	STA	CY	STA
CCSJ 2355-01-006														
49+25.00	51+25.00	200.00	20	30	28	28	2.00			445	287		34	2.00
51+25.00	107+75.00	5650.00	20	30	28	28	56.50					56.50	1518	56.50
107+75.00	109+75.00	200.00	20	30	28	28	2.00			445	163		40	2.00
CCSJ 2355-01-006 TOTALS							60.50			890	450	56.50	1592	60.50
CSJ 2355-02-008														
128+84.00	130+84.00	200.00	24	31	29	28	2.00	45	534		430		31	2.00
130+84.00	189+41.00	5857.00	22	31	29	28	58.57					58.57	2900	58.57
189+41.00	191+41.00	200.00	24	31	29	28	2.00		534		77		50	2.00
191+41.00	199+46.00	805.00	24	31	29	28	8.05		2147		578		193	8.05
199+46.00	201+46.00	200.00	24	31	29	28	2.00		534		157		41	2.00
201+46.00	397+76.00	19630.00	22	31	29	28	196.30					196.30	7387	196.30
397+76.00	399+76.00	200.00	24	31	29	28	2.00	20	534		259		35	2.00
CCSJ 2355-02-008 TOTALS							270.92	65	4283		1501	254.87	10637	270.92
PROJECT TOTALS							**331.42**	**65**	**4283**	**890**	**1951**	**311.37**	**12229**	**331.42**

SUMMARY OF ROADWAY ITEMS

LOCATION		LENGTH	REMOVE OR REWORK BASE WIDTH	CEMENT TREATED WIDTH	FLEX BASE WIDTH	SURFACE	152 6001 ROAD GRADER WORK (ORD COMP)	247 6073 FL BS (CMP IN PLC) (TY D GR 1-2) (6")	247 6133 FL BS (RDWY DEL) (TY D GR 1-2)	247 6313 FL BS (CMP IN PLC) (TY D GR1-2) (12")	251 6073 REWRKING BS MATL (TY C) (10") (ORD COMP)	275 6001 CEMENT	275 6003 CEMENT TREAT (NEW BASE) (6")	275 6004 CEMENT TREAT (MX EXST MTL & NW BS) (6"
STA	STA	FT	FT	FT	FT	FT	STA	SY	TON	SY	SY	TON	SY	SY
CCSJ 2355-01-006														
49+25.00	51+25.00	200.00	20	30	28	28	2.00	667		623		4	667	
51+25.00	107+75.00	5650.00	20	30	28	28	56.50		1832	17578	12556	110		18834
107+75.00	109+75.00	200.00	20	30	28	28	2.00	667		623		4	667	
CCSJ 2355-01-006 TOTALS							60.50	1334	1832	18824	12556	118	1334	18834
CSJ 2355-02-008														
128+84.00	130+84.00	200.00	24	31	29	28	2.00	689		645		5	689	
130+84.00	189+41.00	5857.00	22	31	29	28	58.57		981	18873	14318	118		20175
189+41.00	191+41.00	200.00	24	31	29	28	2.00	689		645		5	689	
191+41.00	199+46.00	805.00	24	31	29	28	8.05	2773		2594		17	2773	
199+46.00	201+46.00	200.00	24	31	29	28	2.00	689		645		5	689	
201+46.00	397+76.00	19630.00	22	31	29	28	196.30		3287	63253	47985	395		67615
397+76.00	399+76.00	200.00	24	31	29	28	2.00	689		645		5	689	
CCSJ 2355-02-008 TOTALS							270.92	5529	4268	87300	62303	550	5529	87790
PROJECT TOTALS							**331.42**	**6863**	**6100**	**106124**	**74859**	**668**	**6863**	**106624**



TYPICAL EARTHWORK FOR REWORK SECTION
NTS



TYPICAL EARTHWORK REMOVAL SECTION
NTS

Texas Department of Transportation
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FM 2451
QUANTITY SUMMARY

SCALE: NTS

SHEET 1 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
FR	TEXAS	DAL	KAUFMAN	10
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
JR				

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SUMMARY OF ROADWAY ITEMS

LOCATION		LENGTH	REMOVE OR REWORK BASE WIDTH	CEMENT TREATED WIDTH	FLEX BASE WIDTH	SURFACE	314 6021	316 6024		316 6029	316 6403	316 6419		316 6434
							EMULS ASPH (PRIME) (MS-2 OR SS-1)	ASPH (CRS-2P) ①	ASPH (CRS-2P) ②	ASPH (RC-250) ①	AGGR (TY-B GR-5 OR TY-L GR-5) ①	ASPH (AC-15P, AC-20-5TR OR AC-20XP) ①	ASPH (AC-15P, AC-20-5TR OR AC-20XP) ③	AGGR (TY-PB GR-4 OR TY-PL GR-4 (SAC-B) ③
STA	STA	FT	FT	FT	FT	FT	GAL	GAL	GAL	GAL	CY	GAL	GAL	CY
CCSJ 2355-01-006														
49+25.00	51+25.00	200.00	20	30	28	28	125	104	92	59	2	88	224	6
51+25.00	107+75.00	5650.00	20	30	28	28	3516	2930	2579	1641	47	2461	6328	147
107+75.00	109+75.00	200.00	20	30	28	28	125	104	92	59	2	88	224	6
CCSJ 2355-01-006 TOTALS							3766	3138	2763	1759	51	2637	6776	159
CSJ 2355-02-008														
128+84.00	130+84.00	200.00	24	31	29	28	125	104		59	2	88		
130+84.00	189+41.00	5857.00	22	31	29	28	3645	3037		1701	49	2552		
189+41.00	191+41.00	200.00	24	31	29	28	125	104		59	2	88		
191+41.00	199+46.00	805.00	24	31	29	28	501	418		234	7	351		
199+46.00	201+46.00	200.00	24	31	29	28	125	104		59	2	88		
201+46.00	397+76.00	19630.00	22	31	29	28	12215	10179		5700	163	8550		
397+76.00	399+76.00	200.00	24	31	29	28	125	104		59	2	88		
CCSJ 2355-02-008 TOTALS							16861	14050		7871	227	11805		
COURSE TOTALS								17188	2763			14442	6776	
PROJECT TOTALS							**20627**	**19951**		**9630**	**278**	**21218**		**159**

SUMMARY OF ROADWAY ITEMS

LOCATION		LENGTH	REMOVE OR REWORK BASE WIDTH	CEMENT TREATED WIDTH	FLEX BASE WIDTH	SURFACE	316 6435	316 6440	3077 6013	3077 6075
							AGGR (TY-B GR-4 OR TY-L GR-4 SAC-B) ②	AGGR (TY-B GR-3 OR TY-L GR-3) (SAC-B) ①	SP MIXES SP-C SAC-B PG64-24	TACK COAT
STA	STA	FT	FT	FT	FT	FT	CY	CY	TON	GAL
CCSJ 2355-01-006										
49+25.00	51+25.00	200.00	20	31	29	28	6	4		
51+25.00	107+75.00	5650.00	20	31	29	28	147	112		
107+75.00	109+75.00	200.00	20	31	29	28	6	4		
CCSJ 2355-01-006 TOTALS							159	120		
CSJ 2355-02-008										
128+84.00	130+84.00	200.00	24	31	29	28		4	69	37
130+84.00	189+41.00	5857.00	22	31	29	28		116	2005	1093
189+41.00	191+41.00	200.00	24	31	29	28		4	69	37
191+41.00	199+46.00	805.00	24	31	29	28		16	276	150
199+46.00	201+46.00	200.00	24	31	29	28		4	69	37
201+46.00	397+76.00	19630.00	22	31	29	28		388	6718	3664
397+76.00	399+76.00	200.00	24	31	29	28		4	69	37
CCSJ 2355-02-008 TOTALS								536	9275	5057
PROJECT TOTALS							**159**	**656**	**9275**	**5057**

NOTE:

① FIRST COURSE
② INTERMEDIATE COURSE
③ SECOND COURSE

Texas Department of Transportation
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FM 2451
QUANTITY SUMMARY

SCALE: NTS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
FR	TEXAS	DAL	KAUFMAN	11
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
JR				

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SUMMARY OF DRAINAGE ITEMS

LOCATION	100 6012	400 6006	403 6001	432 6002	432 6022	462 6001	462 6048	462 6050	462 6051	462 6056	462 6072	464 6018	464 6019	464 6021	464 6022	466 6135
	PREP ROW (TREE) (18"-36" DIA.)	CUT & RESTORING PAV	TEMPORARY SPL SHORING	RIPRAP (CONC) (5 IN)	RIPRAP (STONE COMMON) (DRY) (6 IN)	CONC BOX CULV (3 FT X 2 FT)	CONC BOX CULV (4 FT X 3 FT) (EXTEND)	CONC BOX CULV (5 FT X 2 FT) (EXTEND)	CONC BOX CULV (5 FT X 3 FT) (EXTEND)	CONC BOX CULV (6 FT X 5 FT) (EXTEND)	CONC BOX CULV (9 FT X 9 FT) (EXTEND)	RC PIPE (CL IV) (24 IN)	RC PIPE (CL IV) (30 IN)	RC PIPE (CL IV) (42 IN)	RC PIPE (CL IV) (48 IN)	HEADWALL (CH - PW - S) (DIA= 42 IN)
	EA	SY	SF	CY	CY	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA
CCSJ 2355-01-006																
CULVERT #1 - STA 90+47.15												24				
CULVERT #2 - STA 109+47.09		22		2.09		56										
CCSJ 2355-01-006 TOTALS		22		2.09		56						24				
CSJ 2355-02-008																
CULVERT #3 - STA 140+10.65			598							18						
CULVERT #4 - STA 155+60.92													16			
CULVERT #5 - STA 196+49.14	4		1812		27.30						32					
CULVERT #6 - STA 216+79.53					1.85							16				
CULVERT #7 - STA 227+57.82			291	10.00										16		1
CULVERT #8 - STA 264+93.11			294		4.74										16	
CULVERT #9 - STA 312+87.69				4.00	21.40		10									
CULVERT #10 - STA 339+91.98				5.14	3.50		32									
CULVERT #11 - STA 365+16.91				2.31				10								
CULVERT #12 - STA 374+01.37			201		5.06				32							
CULVERT #13 - STA 394+71.75					1.08								16			
CSJ 2355-02-008 TOTALS	4		3196	21.45	64.93		42	10	32	18	32	16	32	16	16	1
PROJECT TOTALS	**4**	**22**	**3196**	**23.54**	**64.93**	**56**	**42**	**10**	**32**	**18**	**32**	**40**	**32**	**16**	**16**	**1**

SUMMARY OF DRAINAGE ITEMS

LOCATION	466 6136	466 6171	466 6179	466 6181	467 6105	467 6143	467 6171	467 6175	467 6388	467 6417	480 6001	496 6005	496 6006	496 6008	658 6100
	HEADWALL (CH - PW - S) (DIA= 48 IN)	WINGWALL (PW - 1) (HW=10 FT)	WINGWALL (PW - 1) (HW=4 FT)	WINGWALL (PW - 1) (HW=6 FT)	SET (TY I) (S=3 FT) (HW=3FT) (3:1) (C)	SET (TY I) (S= 4 FT) (HW= 4 FT) (3:1) (C)	SET (TY I) (S= 5 FT) (HW= 3 FT) (3:1) (C)	SET (TY I) (S= 5 FT) (HW= 4 FT) (3:1) (C)	SET (TY II) (24 IN) (RCP) (3: 1) (C)	SET (TY II) (30 IN) (RCP) (3: 1) (C)	CLEAN EXIST CULVERTS	REMOV STR (WINGWALL)	REMOV STR (HEADWALL)	REMOV STR (BOX CULVERT)	INSTL OM ASSM (OM-2Z) (WF LX) GND (BI)
	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF	EA
CCSJ 2355-01-006															
CULVERT #1 - STA 90+47.15									4		1		2		2
CULVERT #2 - STA 109+47.09					2							2		50	2
CCSJ 2355-01-006 TOTALS					2				4		1	2	2	50	4
CSJ 2355-02-008															
CULVERT #3 - STA 140+10.65				2							1	2			4
CULVERT #4 - STA 155+60.92										2	1		2		2
CULVERT #5 - STA 196+49.14		2									1	2			4
CULVERT #6 - STA 216+79.53									2		1		2		2
CULVERT #7 - STA 227+57.82											1		1		3
CULVERT #8 - STA 264+93.11	2										1		2		4
CULVERT #9 - STA 312+87.69						2					1	2			2
CULVERT #10 - STA 339+91.98								4			1	2			4
CULVERT #11 - STA 365+16.91							2				1	2			2
CULVERT #12 - STA 374+01.37			2								1	2			2
CULVERT #13 - STA 394+71.75										2	1		2		2
CSJ 2355-02-008 TOTALS	2	2	2	2		2	2	4	2	4	11	12	9		31
PROJECT TOTALS	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**4**	**6**	**4**	**12**	**14**	**11**	**50**	**35**

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FM 2451
QUANTITY SUMMARY

SCALE: NTS

SHEET 3 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS FR	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	12
CHECK JR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

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SUMMARY OF PAVEMENT MARKING ITEMS

LOCATION		LENGTH	533 6003	533 6004	666 6018	666 6048	666 6170	666 6207	666 6303	666 6309	666 6312	666 6315	672 6009
			RUMBLE STRIPS (SHOULDER) ASPHALT	RUMBLE STRIPS (CENTERLINE) ASPHALT	REFL PAV MRK TY I (W)6"(DOT)(100MIL)	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	REFL PAV MRK TY II (W) 4" (SLD)	REFL PAV MRK TY II (Y) 4" (SLD)	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)	RE PM W/RET REQ TY I (Y)4"(BRK)(100MIL)	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	REFL PAV MRKR TY II-A-A
STA	STA	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA
CCSJ 2355-01-006													
49+25.00	69+50.00	2025			99	66		2025	3323	254	270	2702	48
69+50.00	92+83.00	2333						2333	2644	2023	310	3235	56
92+83.00	109+75.00	1692				16		1692	3384		370	1445	37
CCSJ 2355-01-006 TOTALS		6050			99	82		6050	9351	2277	950	7382	141
128+84.00	150+54.00	2170	4340	2170		52	4340	4340	4266		380	1314	35
150+54.00	173+69.00	2315	4630	2315			4630	4630	3497	1134	390	2208	47
173+69.00	196+85.00	2316	4632	2316			4632	4632	1824	2809		4632	116
196+85.00	219+90.00	2305	4610	2305			4610	4610	2960	1651	80	3994	58
219+90.00	243+11.00	2321	4642	2321		10	4642	4642	2710	1880	230	3223	52
243+11.00	266+11.00	2300	4600	2300			4600	4600	4600		580		29
266+11.00	289+11.00	2300	4600	2300		20	4600	4600	4471		580		29
289+11.00	312+15.00	2304	4608	2304			4608	4608	3497	1103	440	1103	36
312+15.00	335+27.00	2312	4624	2312		24	4624	4624	2882	1597	380	1597	39
335+27.00	358+27.00	2300	4600	2300			4600	4600	4600		580		29
358+27.00	381+30.00	2303	4606	2303		10	4606	4606	4534		580		29
381+30.00	399+76.00	1846	3692	1846		42	3692	3692	3624		340	1000	30
CCSJ 2355-02-008 TOTALS		27092	54184	27092		158	54184	54184	43465	10174	4560	19071	528
PROJECT TOTALS			54184	27092	99	240	54184	60234	52816	12451	5510	26453	669

SUMMARY OF MAILBOX ITEMS

LOCATION	560 6011	560 6012
	MAILBOX INSTALL-S (TWW-POST) TY 4	MAILBOX INSTALL-D (TWW-POST) TY 4
	EA	EA
CCSJ 2355-01-006		
SHEET 1 OF 15		
SHEET 2 OF 15		
SHEET 3 OF 15		
CCSJ 2355-01-006 TOTALS		
CCSJ 2355-02-008		
SHEET 4 OF 15		
SHEET 5 OF 15	4	
SHEET 6 OF 15	2	
SHEET 7 OF 15	1	
SHEET 8 OF 15	4	
SHEET 9 OF 15	5	
SHEET 10 O 15	5	
SHEET 11 OF 15	7	
SHEET 12 OF 15	7	
SHEET 13 OF 15	13	
SHEET 14 OF 15	9	1
SHEET 15 OF 15	8	1
CSJ 2355-02-008 TOTALS	65	2
PROJECT TOTALS	65	2

SUMMARY OF WORKZONE TRAFFIC CONTROL ITEMS

LOCATION	662 6111	6001 6002	6185 6002	6185 6003
	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	PORTABLE CHANGEABLE MESSAGE SIGN	TMA (STATIONARY)	TMA (MOBILE OPERATION)
	EA	EA	DAY	HR
CCSJ 2355-01-006				
STA 49+25.00 TO STA 109+75.00	605	2	47	56
CCSJ 2355-01-006 TOTALS	605	2	47	56
CSJ 2355-02-008				
STA. 128+84.00 TO STA. 399+76.00	2710	2	199	112
CSJ 2355-02-008 TOTALS	2710	2	199	112
PROJECT TOTALS	**3315**	**4**	**246**	**168**

SUMMARY OF SIGNING ITEMS

LOCATION	644 6001	644 6004	644 6005	644 6033	644 6034	644 6036
	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(T-2EXT)	IN SM RD SN SUP&AM TYS80(1)SA(U)	IN SM RD SN SUP&AM TYS80(1)SA(U-1EXT)	IN SM RD SN SUP&AM TYS80(1)SA(U-BM)
	EA	EA	EA	EA	EA	EA
CCSJ 2355-01-006						
SUMMARY OF SMALL SIGNS	37	2		1	1	2
CCSJ 2355-01-006 TOTALS	37	2		1	1	2
CSJ 2355-02-008						
SUMMARY OF SMALL SIGNS	69	5	1	5		4
CSJ 2355-02-008 TOTALS	69	5	1	5		4
PROJECT TOTALS	106	7	1	6	1	6

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FM 2451
QUANTITY SUMMARY

SCALE: NTS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
FR	TEXAS	DAL	KAUFMAN	13
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
JR				

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SUMMARY OF EROSION CONTROL ITEMS

LOCATION	161 6017	164 6035	164 6051	168 6001	506 6002	506 6011	506 6020	506 6024	506 6038	506 6039	506 6041	506 6043	730 6107
	COMPOST MANUF TOPSOIL (4")	DRILL SEEDING (PERM) (RURAL) (CLAY)	DRILL SEED (TEMP) (WARM OR COOL)	VEGETATIVE WATERING	ROCK FILTER DAMS (INSTALL) (TY 2)	ROCK FILTER DAMS (REMOVE)	CONSTRUCTION EXITS (INSTALL) (TY 1)	CONSTRUCTION EXITS (REMOVE)	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)	BIODEG EROSN CONT LOGS (INSTL) (12"	BIODEG EROSN CONT LOGS (REMOVE)	FULL - WIDTH MOWING
	SY	SY	SY	MG	LF	LF	SY	SY	LF	LF	LF	LF	CYC
CCSJ 2355-01-006													
SHEET 1 OF 15	15750	15750	7875	3515					150	150	440	440	
SHEET 2 OF 15	18146	18146	9073	4050	140	140			140	140	200	200	3
SHEET 3 OF 15	13199	13199	6600	2946	120	120					280	280	
ADDITIONAL 5%**									15	15	46	46	
CCSJ 2355-01-006 TOTALS	47095	47095	23548	10511	260	260			305	305	966	966	3
CCSJ 2355-02-008													
SHEET 4 OF 15	16878	16878	8439	3767	120	120	223	223	290	290	200	200	
SHEET 5 OF 15	18006	18006	9003	4018	120	120			120	120	220	220	
SHEET 6 OF 15	18014	18014	9007	4020	60	60	170	170	60	60	280	280	
SHEET 7 OF 15	17928	17928	8964	4001	180	180	140	140	580	580	280	280	
SHEET 8 OF 15	18053	18053	9027	4029	120	120			167	167	240	240	
SHEET 9 OF 15	17889	17889	8945	3992	120	120			90	90	280	280	
SHEET 10 O 15	17889	17889	8945	3992							320	320	3
SHEET 11 OF 15	17920	17920	8960	3999							320	320	
SHEET 12 OF 15	17983	17983	8992	4013	60	60			70	70	300	300	
SHEET 13 OF 15	17889	17889	8945	3992	80	80	250	250	70	70	340	340	
SHEET 14 OF 15	17913	17913	8957	3998	200	200	302	302	160	160	464	464	
SHEET 15 OF 15	14358	14358	7179	3204	115	115			140	140	360	360	
ADDITIONAL 5% **							54	54	87	87	180	180	
CSJ 2355-02-008 TOTALS	210720	210720	105360	47025	1175	1175	1139	1139	1834	1834	3784	3784	3
PROJECT TOTALS	257815	257815	128908	57536	1435	1435	1139	1139	2139	2139	4750	4750	6

** 5% INCREASE FOR SW3P QUANTITIES TO ACCOUNT FOR REPLACEMENTS DUE TO DAMAGE OR DIFFERING SITE CONDITIONS.

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FM 2451
QUANTITY SUMMARY

SCALE: NTS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
FR	TEXAS	DAL	KAUFMAN	14
CHECK FR	CONTROL	SECTION	JOB	
CHECK JR	2355	01	006, ETC.	

DATE: 11/3/2021 11:33:01 AM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\005 SUMMARY SHEETS.dgn

SUMMARY OF DRIVEWAY AND INTERSECTIONS

DW #	STATION (LT/RT)	EXISTING DESCRIPTION	EXISTING PIPE	PROPOSED LENGTH *	PROPOSED WIDTH *	PROPOSED RADIUS (R1) *	PROPOSED RADIUS (R2) *	104 6017 Removing Conc (DRWY)	105 6043 Removing (DRWY)	464 6003 RC PIPE (CL III) (18 IN)	464 6005 RC PIPE (CL III) (24 IN)	464 6007 RC PIPE (CL III) (30 IN)	467 6363 SET (TY II) (18IN) (RCP) (6:1) (P)	467 6395 SET(TY II) (24IN) (RCP) (6:1)(P)	467 6423 SET(TY II) (30 IN) (RCP) (6:1) (P)	496 6004 REMOV STR (SET)	496 6016 REMOVE PIPE	530 6005 HMAC	530 6017 CONC (HES)
				LF	LF	FT	FT	SY	SY	LF	LF	LF	EA	EA	EA	EA	EA	SY	SY
DW-1	49+65 LT ENNIS ST.	ASPHALT		36	18	30	30		132									115	
DW-1A	50+52.71 LT MIDLAND ST.	ASPHALT		36	18	30	30		132									115	
DW-2	50+73.17 RT	ASPHALT		36	38	15	15		90									163	
DW-3	51+81.90 RT	GRAVEL		36	18	15	15		85									83	
DW-4	51+79.83 LT	GRAVEL		36	20	20	35		1201									119	
DW-5	53+01.30 RT TERRELL ST.	ASPHALT		36	26	25	25		197									134	
DW-6	55+87.43 LT	GRAVEL	1-18" X 40' RCP	36	20	20	20		111	40			2				1	100	
DW-7	56+67.84 LT	GRAVEL		40	10	15	15		40	20			2					56	
DW-8	56+60.35 LT RAILROAD ST.	ASPHALT		70	18	1	35		465									170	
DW-9	59+47.59 RT	CONCRETE	1-18" X 20' RCP	36	16	15	15	64		24			2			2	1		75
DW-10	60+58.89 PARIS ST.	ASPHALT	1-18" X 32' RCP	36	20	25	25		125	36			2				1	110	
DW-11	62+30.98 RT	GRAVEL	1-18" X 20' RCP	36	12	15	15		74	24			2				1	59	
DW-12	64+09.47 RT GREENVILLE ST.	ASPHALT	1-18" X 32' RCP	36	20	25	25		128	36			2			2	1	110	
DW-13	65+18.96 LT	ASPHALT	1-18" X 20' CMP	30	10	15	15		31	20			2				1	45	
DW-14	65+59.13 LT	GRAVEL		30	10	15	15		41	20			2					45	
DW-15	66+42.45 RT	GRAVEL	1-18" X 28' RCP	36	10	15	15		52	32			2				1	51	
DW-16	66+52.11 LT	GRAVEL		30	10	15	15		65	20			2					45	
DW-17	67+57.00 RT COOPER ST.	ASPHALT	1-18" X 32' RCP	36	18	25	25		123	36			2			2	1	102	
DW-18	69+33.99 RT	GRAVEL	1-18" X 20' RCP	30	10	15	15		47	24							1	45	
DW-19	72+10.50 RT	CONCRETE	1-18" X 20' CMP	30	16	15	15	66		24			2			2	1		65
DW-20	74+36.47 RT	GRAVEL		30	30	25	25		164				2					130	
DW-21	77+52.88 RT	DIRT	1-18" X 16' CMP	31	10	15	15		59	24			2			2	1	46	
DW-22	77+47.88 LT	GRAVEL	1-18" X 24' CMP	30	10	15	15		57	24			2				1	45	
DW-23	79+06.26 LT	DIRT	1-18" X 20' CMP	30	10	15	15		58	24			2				1	45	
DW-24	80+77.09 RT	DIRT	1-18" X 44' CMP	30	10	15	15		64	44			2				1	45	
DW-25	84+04.50 LT	GRAVEL	1-18" X 22' CMP	30	10	15	15		45	24			2				1	45	
DW-26	87+34.02 LT	GRAVEL	1-18" X 22' CMP	30	10	15	15		57	24			2				1	45	
DW-27	92+29.20 LT	DIRT	1-24" X 20' CMP	30	10	15	15		63		24			2			1	45	
DW-28	93+33.83 LT	GRAVEL	1-18" X 18' CMP	30	10	15	15		45	24			2				1	45	
DW-29	95+38.43 LT	GRAVEL	1-18" X 18' CMP	30	10	15	15		51	24			2				1	45	
DW-30	99+02.18 LT	GRAVEL		30	16	15	15		75	32			2					65	
DW-31	101+78.47 LT	GRAVEL		30	12	15	15		56	32			2					51	
DW-32	103+34.30 LT	DIRT	1-18" X 32' CMP	30	12	15	20		73	32			2				1	55	
DW-33	104+66.06 LT	GRAVEL	1-18" X 32' CMP	30	12	15	15		61	32			2				1	51	
DW-34	106+19.02 LT	GRAVEL	1-18" X 45' CMP	30	12	20	20		95	48			2				1	60	
DW-35	106+22.09 RT	GRAVEL	1-18" X 33' CMP	32	14	20	20		79	36			2				1	69	
DW-36	108+74.61 LT	DIRT		36	10	15	15		68	20			2					51	
DW-37	109+28.16 LT	DIRT	1-18" X 18' RCP	42	10	15	15		66	24			2				1	58	
CSJ 2355-01-006 TOTALS								130	4375	824	24	0	58	2	0	10	24	2663	140

* FOR CONTRACTORS INFORMATION ONLY

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FM 2451
DRIVEWAY SUMMARY

SCALE: NTS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
FR	TEXAS	DAL	KAUFMAN	15
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
JR				

DATE: 11/3/2021 11:44:41 AM
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SUMMARY OF DRIVEWAY AND INTERSECTIONS

DW#	STATION (LT/RT)	EXISTING DESCRIPTION	EXISTING PIPE	PROPOSED LENGTH *	PROPOSED WIDTH *	PROPOSED RADIUS (R1) *	PROPOSED RADIUS (R2) *	104 6017 Removing Conc (DRWY)	105 6043 Removing (DRWY)	464 6003 RC PIPE (CL III) (18 IN)	464 6005 RC PIPE (CL III) (24 IN)	464 6007 RC PIPE (CL III) (30 IN)	467 6363 SET (TY II) (18IN) (RCP) (6:1) (P)	467 6395 SET(TY II) (24IN) (RCP) (6:1) (P)	467 6423 SET(TY II) (30 IN) (RCP) (6:1) (P)	496 6004 REMOV STR (SET)	496 6016 REMOVE PIPE	530 6005 HMAC	530 6017 CONC (HES)
				LF	LF	FT	FT	SY	SY	LF	LF	LF	EA	EA	EA	EA	EA	SY	SY
DW-38	132+69.70 RT	GRAVEL	1-18" X 22' CMP	30	10	15	15		46	24			2				1		
DW-39	132+93.76 LT	GRAVEL	1-24" X 42' CMP	33	20	15	15		104		44			2			1		
DW-40	141+86.34 RT C.O. 4086	ASPHALT		30	20	30	30		106									111	
DW-41	155+00.69 LT	GRAVEL	1-24" X 22' CMP	33	10	15	15		44		24			2			1	50	
DW-42	158+25.32 LT	GRAVEL	1-18" X 32' CMP	33	10	15	15		47	36			2				1	48	
DW-43	162+17.43 RT	GRAVEL	1-18" X 32' CMP	30	12	15	15		57	36			2				1		
DW-44	163+10.40 RT	GRAVEL	1-18" X 24' CMP	33	12	15	15		170	24			2				1	55	
DW-45	164+22.74 LT	DIRT	1-18" X 10' CMP	31	10	15	15		144	24			2				1	46	
DW-46	168+27.00 LT	DIRT	1-18" X 20' RCP	49	14	15	15		92	24			2			1	1	87	
DW-47	168+93.15 LT	GRAVEL	1-18" X 28' RCP	48	14	15	15		91	32			2			1	1	86	
DW-48	171+05.72 LT	DIRT		42	16	15	15		92									86	
DW-49	173+18.75 LT	GRAVEL	1-18" X 36' CMP	31	12	20	20		65	36			2			2	1	61	
DW-50	174+92.29 RT	GRAVEL	1-18" X 18' RCP	31	10	20	20		66	24			2				1	54	
DW-51	176+10.05 RT	GRAVEL	1-18" X 18' RCP	31	10	15	15		140	24			2				1	46	
DW-52	178+10.96 LT	GRAVEL	1-18" X 21' CMP	31	12	15	15		59	24			2			2	1	53	
DW-53	178+45.53 RT	GRAVEL	1-24" X 36' CMP	31	14	15	15		60		40			2		2	1	59	
DW-54	179+26.65 LT	GRAVEL	1-18" X 34' RCP	31	22	20	20		93	36			2			2	1	95	
DW-55	189+78.16 LT	GRAVEL	1-24" X 21' RCP	32	20	15	15		81		20			2			1	82	
DW-56	190+01.90 RT	GRAVEL	1-24" X 21' RCP	30	16	15	15		62					2			1	65	
DW-57	205+48.86 LT	GRAVEL		37	14	20	20		135	28						2		77	
DW-58	206+18.60 RT	DIRT	1-18" X 22' RCP	30	12	15	15		70	28			2			2	1	51	
DW-59	211+53.44 LT	GRAVEL	1-18" X 21' RCP	32	16	15	15		66	28			2			2	1	68	
DW-60	221+62.82 RT	GRAVEL		33	10	15	15		63								1	48	
DW-61	221+62.82 RT C.O. 4083A	ASPHALT	1-18" X 30' CMP	33	18	30	20		94	28			2				1	98	
DW-62	224+49.56 LT	GRAVEL		32	12	15	15		42	28			2					54	
DW-63	228+40.80 RT	ASPHALT	1-24" X 30' CMP	30	10	15	15		42		40			2			1	45	
DW-64	230+06.77 LT	GRAVEL	2-24" X 31' CMP	33	10	20	20		62		64			4			2	56	
DW-65	236+40.05 LT	GRAVEL	1-24" X 20' CMP	33	16	15	15		62		24			2				70	
DW-66	238+20.27 LT	GRAVEL	1-18" X 21' RCP	33	14	15	15		59	24			2				1	63	
DW-67	238+20.27 RT	GRAVEL	1-18" X 51' CMP	30	20	25	25		148	52			2				1	97	
DW-68	245+85.06 LT	GRAVEL	1-18" X 42' CMP	32	14	15	15		60	44			2				1	61	
DW-69	247+97.70 RT	GRAVEL	1-15" X 25' RCP	31	18	15	15		87	24			2				1	73	
DW-70	250+17.97 LT	GRAVEL	1-18" X 21' RCP	31	12	15	15		52	24			2				1	53	
DW-71	255+23.89 LT	GRAVEL	1-15" X 32' CMP	31	24	15	15		104	36			2				1	94	
DW-72	258+50.07 LT	GRAVEL	1-15" X 33' CMP	31	24	15	15		84	36			2				1	94	
DW-73	262+84.15 LT	GRAVEL	1-18" X 32' CMP	30	14	15	15		55	36			2			2	1	58	
DW-74	262+93.40 RT	GRAVEL		33	14	15	15		72	24			2					63	
DW-75	267+81.96 LT	ASPHALT	1-18" X 25' CMP	30	14	15	15		64	32			2				1	58	
DW-76	269+58.69 LT	GRAVEL	1-18" X 19' CMP	30	12	15	15		49	32			2				1	51	
DW-77	271+43.00 LT	DIRT	1-18" X 25' CMP	30	10	15	15		87	32			2				1	45	
DW-78	273+38.73 LT	GRAVEL	1-18" X 25' CMP	30	10	15	15		45	36			2				1	45	
DW-79	274+88.27 LT	CONCRETE	2-18" X 25' RCP	30	14	15	15	59		56			4				2		58
DW-80	276+44.28 RT C.O. 4084	GRAVEL	1-18" X 27' RCP	33	20	25	25		122	36			2				1	104	
DW-81	276+56.68 LT C.O. 4083	GRAVEL	2-18" X 28' RCP	30	18	25	25		88	80			5				2	90	
DW-82	277+20.63 RT	GRAVEL	1-18" X 20' CMP	32	10	15	15		45	24			2				1	47	
DW-83	278+39.55 RT	GRAVEL	1-24" X 24' CMP	32	10	15	15		50		28			2			1	47	
DW-84	281+88.03 RT	GRAVEL	1-18" X 25' CMP	32	10	15	15		38	28			2				1	47	
DW-85	284+95.75 RT	GRAVEL	1-18" X 21' CMP	32	10	15	15		54	24			2				1	47	
DW-86	289+28.96 RT	GRAVEL		33	10	15	15		41									48	
DW-87	289+38.32 LT	GRAVEL	1-18" X 22' CMP	30	10	15	15		40	28			2				1	45	
SHEET TOTAL								59	3699	1192	284	0	77	20	0	18	46	2981	58

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FM 2451
DRIVEWAY SUMMARY

SCALE: NTS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
FR	TEXAS	DAL	KAUFMAN	16
CHECK FR	CONTROL	SECTION	JOB	
CHECK JR	2355	01	006, ETC.	

DATE: 11/3/2021 11:45:33 AM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\D07_ DRWY SUMMARY.dgn

SUMMARY OF DRIVEWAY AND INTERSECTIONS

DW#	STATION (LT/RT)	EXISTING DESCRIPTION	EXISTING PIPE	PROPOSED LENGTH *	PROPOSED WIDTH *	PROPOSED RADIUS (R1) *	PROPOSED RADIUS (R2) *	104 6017 Removing Conc (DRWY)	105 6043 Removing (DRWY)	464 6003 RC PIPE (CL III) (18 IN)	464 6005 RC PIPE (CL III) (24 IN)	464 6007 RC PIPE (CL III) (30 IN)	467 6363 SET (TY II) (18IN) (RCP) (6:1) (P)	467 6395 SET(TY II) (24IN) (RCP) (6:1) (P)	467 6423 SET(TY II) (30 IN) (RCP) (6:1) (P)	496 6004 REMOV STR (SET)	496 6016 REMOVE PIPE	530 6005 HMAC	530 6017 CONC (HES)
				LF	LF	LF	LF	SY	SY	LF	LF	LF	EA	EA	EA	EA	EA	SY	SY
DW-88	291+38.45 LT	GRAVEL	1-18" X 22' CMP	30	10	15	15		34	28			2				1	45	
DW-89	292+66.69 LT	GRAVEL	1-18" X 26' CMP	30	10	15	15		40	28			2				1	97	
DW-90	294+21.54 RT	GRAVEL	1-18" X 21' CMP	32	10	15	15		37	24			2				1	97	
DW-91	296+43.63 RT	GRAVEL	1-18" X 24' CMP	32	10	15	15		37	28			2				1	97	
DW-92	299+93.62 RT	CONCRETE	1-24" X 20' CMP	32	20	15	15	73			32			2			1		97
DW-93	301+37.31 RT	GRAVEL	1-18" X 23' CMP	32	10	15	15		68	28			2				1	97	
DW-94	308+91.85 LT	GRAVEL	1-18" X 32' CMP	32	12	15	15		61	36			2				1	97	
DW-95	309+98.80 LT	GRAVEL	1-24" X 20' CMP	32	10	15	15		41		24			2			1	97	
DW-96	312+42.16 LT C.O. 4078	ASPHALT	1-18" X 35' RCP	33	18	20	25		135	40			4				1	97	
DW-97	312+60.67 RT C.O. 4077	ASPHALT		32	24	30	25		153									97	
DW-98	314+39.75 RT	CONCRETE	1-18" X 20' CMP	32	18	15	15	79		24			2				1		97
DW-99	314+79.63 LT	GRAVEL	1-18" X 20' CMP	32	12	15	15		50	24			2				1	97	
DW-100	316+07.06 RT	GRAVEL	1-18" X 26' CMP	31	16	15	15		65	24			2				1	97	
DW-101	316+55.90 LT	CONCRETE	1-18" X 20' CMP	32	12	15	15		69	24			2				1	97	
DW-102	317+86.10 RT	DIRT	1-18" X 20' CMP	31	10	15	15		53	24			2				1	97	
DW-103	318+44.91 RT	GRAVEL	1-18" X 20' CMP	31	12	15	15	64		24			2				1		97
DW-104	325+24.76 LT	GRAVEL	1-18" X 38' CMP	33	22	15	15		116	44			2				1	97	
DW-105	327+65.15 RT	GRAVEL	1-18" X 34' CMP	30	10	15	15		67	24			2				1	97	
DW-106	327+77.85 LT	GRAVEL	1-15" X 31' CMP	33	10	15	15		57	28			2				1	48	
DW-107	331+96.36 RT	ASPHALT	1-24" X 22' RCP	32	14	15	15		86		24			2			1	61	
DW-108	335+16.94 RT	GRAVEL	1-18" X 23' CMP	33	10	15	15		53	28			2				1	48	
DW-109	336+01.89 RT	GRAVEL	1-18" X 23' CMP	33	10	15	15		54	28			2				1	48	
DW-110	336+26.57 LT	ASPHALT	2-30" X 23' CMP	30	12	15	15		72			56			4		2	51	
DW-111	338+12.60 RT	GRAVEL	1-24" X 23' RCP	33	10	15	15		53		28			2			1	48	
DW-112	338+64.03 RT	GRAVEL	1-18" X 22' CMP	33	10	15	15		46	28			2				1	48	
DW-113	340+62.26 RT	GRAVEL	1-18" X 24' CMP	32	10	15	15		45	28			2				1	47	
DW-114	341+85.03 RT	GRAVEL	1-18" X 21' RCP	32	10	15	15		45	24			2				1	47	
DW-115	343+24.02 LT	ASPHALT	2-18" X 26' CMP	30	12	15	15		64	56			4				2	51	
DW-116	343+56.73 RT	GRAVEL	1-18" X 22' CMP	32	14	15	15		68	28			2				1	61	
DW-117	345+32.08 RT	GRAVEL	1-18" X 26' CMP	32	10	15	15		55	28			2				1	47	
DW-118	347+75.24 RT	GRAVEL	1-18" X 23' CMP	33	10	15	15		54	28			2				1	48	
DW-119	349+15.50 RT	GRAVEL	1-18" X 22' CMP	32	10	15	15		43	24			2				1	47	
DW-120	349+80.81 LT	CONCRETE	1-24" X 22' CMP	30	12	15	15	94			28			2			1		51
DW-121	350+62.32 RT	GRAVEL	1-18" X 23' CMP	35	10	15	15		61	28			2				1	50	
DW-122	352+54.54 RT	GRAVEL		32	10	15	15		35									47	
DW-123	353+74.10 RT	GRAVEL		32	10	15	15		41									47	
DW-124	354+48.15 LT	DIRT	1-18" X 20' RCP	30	10	15	15		67	24			2				1	45	
DW-125	356+57.33 RT	GRAVEL		32	10	15	15		43	20			2					47	
DW-126	358+10.60 RT	GRAVEL		32	10	15	15		40	20			2					47	
DW-127	358+85.27 RT	GRAVEL		32	10	15	15		42	20			2					47	
DW-128	359+04.86 LT	DIRT	1-18" X 22' CMP	31	10	15	15		64	24			2				1	46	
DW-129	359+51.22 RT	GRAVEL	1-18" X 20' CMP	32	10	15	15		58	20			2					47	
DW-130	360+49.34 RT	GRAVEL		32	14	25	25		79	24			2					80	
DW-131	361+46.55 LT	DIRT	1-18" X 17' RCP	31	10	15	15		47	24			2				1	46	
DW-132	362+07.91 LT	GRAVEL	1-18" X 33' CMP	31	12	15	15		53	36			2				1	53	
DW-133	362+44.38 RT	GRAVEL		31	24	25	25		200	48			2					113	
DW-134	364+31.27 LT	GRAVEL	1-24" X 32' CMP	31	16	15	15		72		36			2			1	66	
DW-135	366+00.62 RT	GRAVEL	1-18" X 18' CMP	31	10	15	15		47	24			2				1	46	
DW-136	367+15.20 LT	GRAVEL	1-18" X 24' CMP	32	10	15	15		54	28			2				1	47	
DW-137	367+22.86 RT	GRAVEL	1-18" X 20' CMP	31	10	15	15		52	24			2				1	46	
SHEET TOTAL								310	2876	1116	172	56	84	12	4	0	43	3017	341

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FM 2451
DRIVEWAY SUMMARY

SCALE: NTS

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
FR	TEXAS	DAL	KAUFMAN	17
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
JR				

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SUMMARY OF DRIVEWAY AND INTERSECTIONS

DW#	STATION (LT/RT)	EXISTING DESCRIPTION	EXISTING PIPE	PROPOSED LENGTH *	PROPOSED WIDTH *	PROPOSED RADIUS (R1) *	PROPOSED RADIUS (R2) *	104 6017 Removing Conc (DRWY)	105 6043 Removing (DRWY)	464 6003 RC PIPE (CL III) (18 IN)	464 6005 RC PIPE (CL III) (24 IN)	464 6007 RC PIPE (CL III) (30 IN)	467 6363 SET (TY II) (18IN) (RCP) (6:1) (P)	467 6395 SET(TY II) (24IN) (RCP) (6:1) (P)	467 6423 SET(TY II) (30 IN) (RCP) (6:1) (P)	496 6004 REMOV STR (SET)	496 6016 REMOVE PIPE	530 6005 HMAC	530 6017 CONC (HES)
				LF	LF	LF	LF	SY	SY	LF	LF	LF	EA	EA	EA	EA	EA	SY	SY
DW-138	368+93.17 LT	GRAVEL	1-18" X 18' CMP	31	10	15	15		40	24			2				1	46	
DW-139	369+92.68 RT AVANT LN.	ASPHALT		31	16	30	30		105		72			4				99	
DW-140	371+33.16 RT	CONCRETE	1-24" X 22' CMP	31	18	15	15	53			24			2			1		73
DW-141	372+30.46 LT	ASPHALT	1-18" X 20' CMP	31	10	15	15		47	24			2				1	46	
DW-142	372+79.84 RT	DIRT	1-24" X 20' CMP	31	10	15	15		45		24			2			1	46	
DW-143	374+61.10 RT	GRAVEL	1-24" X 22' CMP	31	14	15	15		50		24			2			1	59	
DW-144	376+67.92 RT	GRAVEL	1-24" X 25' CMP	31	10	15	15		51		28			2			1	46	
DW-145	377+97.18 RT	GRAVEL	1-18" X 33' CMP	31	10	15	15		42	36			2				1	46	
DW-146	381+99.72 RT	CONCRETE	1-18" X 21' RCP	32	20	15	15	73		28			2			2	1		82
DW-147	382+18.70 LT C.O. 4079	GRAVEL	1-24" X 26' RCP	30	18	20	20		127		72			4			1	80	
DW-148	384+20.14 RT	GRAVEL	1-18" X 23' CMP	32	12	15	15		70	28			2				1	54	
DW-149	384+87.47 RT	GRAVEL	1-18" X 18' CMP	32	10	15	15		39	24			2				1	47	
DW-150	385+17.44 LT	GRAVEL	1-24" X 20' RCP	30	10	15	15		50		24			2			1	45	
DW-151	387+29.12 LT	GRAVEL	1-18" X 18' CMP	30	12	15	15		55	24			2				1	51	
DW-152	389+23.30 RT	GRAVEL	1-18" X 21' RCP	34	10	15	15		65	24			2				1	49	
DW-153	389+26.91 LT	GRAVEL	1-18" X 21' RCP	29	10	15	15		43	24			2				1	43	
DW-154	391+33.70 LT	GRAVEL	1-18" X 18' CMP	31	10	15	15		37	24			2				1	46	
DW-155	391+83.67 RT	GRAVEL	1-18" X 23' CMP	31	10	15	15		52	24			2				1	46	
DW-156	392+61.43 RT	GRAVEL	1-18" X 22' CMP	31	12	15	15		48	24			2				1	53	
DW-157	396+30.80 LT	GRAVEL	1-18" X 19' CMP	32	12	15	15		45	24			2				1	54	
DW-158	396+72.87 RT	GRAVEL	2-18" X 32' CMP	30	12	15	15		82	64			4				2	51	
DW-159	397+48.41 LT	GRAVEL	1-18" X 23' CMP	32	12	15	15		67	24			2				1	54	
	END OF CSJ 2355-02-008																		
SHEET TOTAL								126	1160	420	268	0	32	18	0	2	22	1061	155
CSJ 2355-02-008 TOTAL								495	7735	2728	724	56	193	50	4	20	111	7059	554
CSJ 2355-01-006 TOTAL								130	4375	824	24	0	58	2	0	10	24	2663	140
PROJECT TOTAL								625	12110	3552	748	56	251	52	4	30	135	9722	694

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FM 2451
DRIVEWAY SUMMARY

SCALE: NTS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS FR	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	18
CHECK JR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

DATE: 11/3/2021 11:51:40 AM
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SUMMARY OF SMALL SIGNS

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN CCSJ: 2355-01-006	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX) POST TYPE FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	POSTS 1 or 2	ANCHOR TYPE UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	MOUNTING DESIGNATION 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	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE TY N TY S
1	1	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
1	2	M3-2	EAST <AUXILIARY SIGN>	24 x 12	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		D10-7AT	<606 - VERTICAL NUMBER>	3 x 10								
		D10-7AT	<606 - VERTICAL NUMBER>	3 x 10								
1	3	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
1	4	R5-2a	NO TRUCKS	24 x 24	x		10BWG	1	SA	P		
1	5	R2-1	SPEED LIMIT (35)	30 x 36	x		10BWG	1	SA	P		
1	6	W1-1R	SYMBOL - HORIZ ALN TURN RIGHT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(15) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
1	7	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
1	8	W11-8R	SYMBOL - BE ALERT FOR EMRGNCY VEHS RT	36 x 36	x		10BWG	1	SA	P		
1	9	W1-7	<BI-DIRECTIONAL LARGE ARROW>	48 x 24	x		10BWG	1	SA	T		
1	10	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
1	11	R2-1	SPEED LIMIT (30)	30 x 36	x		10BWG	1	SA	P		
1	12	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
1	13	W1-1L	SYMBOL - HORIZ ALN TURN LEFT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(15) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
1	14	R2-1	SPEED LIMIT (45)	30 x 36	x		10BWG	1	SA	P		
1	15	R2-1	SPEED LIMIT (35)	30 x 36	x		10BWG	1	SA	P		
1	16	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
1	17	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
2	1	W1-2L	SYMBOL - HORIZ CURVE LEFT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(45) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
2	2	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
2	3	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
2	4	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
2	5	M3-2	EAST <AUXILIARY SIGN>	24 x 12	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							

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:

1. 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.
2. For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS)Standard Sheet.
3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

SHEET 1 OF 8

Texas Department of Transportation

Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

SOSS

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
4-16	DIST	COUNTY		SHEET NO.
8-16	DAL	KAUFMAN		19

18

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SUMMARY OF SMALL SIGNS

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

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	POSTS 1 or 2	ANCHOR TYPE UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	MOUNTING DESIGNATION: PREFABRICATED P = "Plain" T = "T" U = "U"	MOUNTING DESIGNATION 1EXT or 2EXT = # of Ext BM = Extruded Wind Beam WC = 1.12 #/ft Wing Channel EXAL= Extruded Alum Sign Panels	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE TY N TY S
2	6	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
2	7	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
2	8	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
2	9	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
2	10	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
2	11	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
2	12	W1-2R	SYMBOL - HORIZ CURVE RIGHT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(45) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
2	13	W2-4	SYMBOL - TEE INTERSECTION AHEAD	30 x 30	x		10BWG	1	SA	P		
3	1	M2-1	JCT <AUXILIARY SIGN>	21 x 15	x		10BWG	1	SA	P		
		M1-6T	(34) TEXAS	24 x 24	x							
3	2	M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x		10BWG	1	SA	P		
		M5-1L	<ARROW - STRAIGHT THEN LEFT> <AUX. SIGN>	21 x 15	x							
3	3	W3-1	SYMBOL - STOP AHEAD	30 x 30	x		10BWG	1	SA	P		
3	4	D1-1	Rossier 1	60 x 18	x		10BWG	1	SA	T		
3	5	D2-2	⇦ Kaufman Ennis ⇨	84 x 30	x		S80	1	SA	U	BM	
3	6	R2-1	SPEED LIMIT (45)	30 x 36	x		10BWG	1	SA	P		
3	7	M3-4	WEST <AUXILIARY SIGN>	24 x 12	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
3	8	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
3	9	M3-3	SOUTH <AUXILIARY SIGN>	24 x 12	x		S80	1	SA	U		
		M1-6T	(34) TEXAS	24 x 24	x							
		M6-3	<ARROW - VERTICAL STRGHT> <AUX. SIGN>	21 x 15	x							
		M3-4	WEST <AUXILIARY SIGN>	24 x 12	x							
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	x							
3	10	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							

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:

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3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

SHEET 2 OF 8

Texas Department of Transportation

Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

SOSS

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REVISIONS 4-16 8-16	DIST DAL		COUNTY KAUFMAN	SHEET NO. 20

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SUMMARY OF SMALL SIGNS

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

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	POSTS 1 or 2	ANCHOR TYPE UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	MOUNTING DESIGNATION PREFABRICATED P = "Plain" T = "T" U = "U"	MOUNTING DESIGNATION 1EXT or 2EXT = # of Ext BM = Extruded Wind Beam WC = 1.12 #/ft Wing Channel EXAL= Extruded Alum Sign Panels	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE TY N TY S
3	11	W1-7T	<BI-DIRECTIONAL LRG ARRW w/ CHEVRONS>	96 x 36	x		S80	1	SA	U	BM	
3	12	M1-6T	(34) TEXAS	24 x 24	x		10BWG	1	SA	P		
		M6-4	<ARROW - DUAL LEFT & RIGHT> <AUX. SIGN>	21 x 15	x							
3	13	M3-4	WEST <AUXILIARY SIGN>	24 x 12	x		S80	1	SA	U	1EXT	
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	x							
		M3-1	NORTH <AUXILIARY SIGN>	24 x 12	x							
		M1-6T	(34) TEXAS	24 x 24	x							
		M6-3	<ARROW - VERTICAL STRGHT> <AUX. SIGN>	21 x 15	x							
		M3-2	EAST <AUXILIARY SIGN>	24 x 12	x							
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		M6-3	<ARROW - VERTICAL STRGHT> <AUX. SIGN>	21 x 15	x							

ALUMINUM SIGN BLANKS THICKNESS

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Texas Department of Transportation

Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

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REVISIONS 4-16 8-16	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		21

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SUMMARY OF SMALL SIGNS

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

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE: FRP = Fiberglass, TWT = Thin-Wall, 10BWG = 10 BWG, S80 = Sch 80	POSTS: 1 or 2	ANCHOR TYPE: UA=Universal Conc, UB=Universal Bolt, SA=Slipbase-Conc, SB=Slipbase-Bolt, WS=Wedge Steel, WP=Wedge Plastic	MOUNTING DESIGNATION – PREFABRICATED: P = "Plain", T = "T", U = "U"	MOUNTING DESIGNATION: 1EXT or 2EXT = # of Ext, BM = Extruded Wind Beam, WC = 1.12 #/ft Wing Channel, EXAL= Extruded Alum Sign Panels	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE: TY N, TY S
			CSJ: 2355-02-008									
4	1	W1-7T	<BI-DIRECTIONAL LRG ARRW w/ CHEVRONS>	96 x 36	x		S80	1	SA	U	BM	
4	2	M1-6T	(34) TEXAS	24 x 24	x		10BWG	1	SA	P		
		M6-4	<ARROW - DUAL LEFT & RIGHT> <AUX. SIGN>	21 x 15	x							
4	3	M3-3	SOUTH <AUXILIARY SIGN>	24 x 12	x		S80	1	SA	U		
		M1-6T	(34) TEXAS	24 x 24	x							
		M6-3	<ARROW - VERTICAL STRGHT> <AUX. SIGN>	21 x 15	x							
		M3-2	EAST <AUXILIARY SIGN>	24 x 12	x							
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	x							
4	4	M3-1	NORTH <AUXILIARY SIGN>	24 x 12	x		S80	1	SA	U		
		M1-6T	(34) TEXAS	24 x 24	x							
		M6-3	<ARROW - VERTICAL STRGHT> <AUX. SIGN>	21 x 15	x							
		M3-2	EAST <AUXILIARY SIGN>	24 x 12	x							
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	x							
4	5	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
4	6	M3-2	EAST <AUXILIARY SIGN>	24 x 12	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
4	7	1-2AT	Rosser CITY LIMIT POP 400	42 x 24	x		10BWG	1	SA	T		
4	8	R2-1	SPEED LIMIT (SPEED)	30 x 36	x		10BWG	1	SA	P		
4	9	D2-2	← Ennis / Kaufman →	84 x 30	x		S80	1	SA	U	BM	
4	10	W3-1	SYMBOL - STOP AHEAD	30 x 30	x		10BWG	1	SA	P		
4	11	D1-1	Cottonwood 3	96 x 18	x		10BWG	1	SA	T		
4	12	M3-2	EAST <AUXILIARY SIGN>	24 x 12	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		M5-1L	<ARROW - STRAIGHT THEN LEFT> <AUX. SIGN>	21 x 15	x							
4	13	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
4	14	M2-1	JCT <AUXILIARY SIGN>	21 x 15	x		10BWG	1	SA	P		
		M1-6T	(34) TEXAS	24 x 24	x							
4	15	W2-4	SYMBOL - TEE INTERSECTION AHEAD	30 x 30	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.
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NOTE:

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SHEET 4 OF 8

Texas Department of Transportation — Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

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REVISIONS 4-16, 8-16	DIST DAL	COUNTY KAUFMAN		SHEET NO. 22

18

SUMMARY OF SMALL SIGNS

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

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE (FRP = Fiberglass; TWT = Thin-Wall; 10BWG = 10 BWG; S80 = Sch 80)	POSTS (1 or 2)	ANCHOR TYPE (UA=Universal Conc; UB=Universal Bolt; SA=Slipbase-Conc; SB=Slipbase-Bolt; WS=Wedge Steel; WP=Wedge Plastic)	MOUNTING DESIGNATION: PREFABRICATED (P = "Plain"; T = "T"; U = "U")	MOUNTING DESIGNATION (1EXT or 2EXT = # of Ext; BM = Extruded Wind Beam; WC = 1.12 #/ft Wing Channel; EXAL= Extruded Alum Sign Panels)	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) (TY = TYPE: TY N, TY S)
5	1	1-2AT	Cottonwood CITY LIMIT POP 185	66 x 24	x		10BWG	1	SA	T		
5	2	W1-2L	SYMBOL - REVERSE CURVE LEFT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(50) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
5	3	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
5	4	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
5	5	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
5	6	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
5	7	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
5	8	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
5	9	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
5	10	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
6	1	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
6	2	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
6	3	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
6	4	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
6	5	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
6	6	M3-4	WEST <AUXILIARY SIGN>	24 x 12	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		D10-7AT	<608 - VERTICAL NUMBER>	3 x 10								
		D10-7AT	<608 - VERTICAL NUMBER>	3 x 10								
6	7	W1-4L	SYMBOL - REVERSE CURVE LEFT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(50) MPH ADVISORY SPEED PLAQUE	18 x 18	x							

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"

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Texas Department of Transportation — Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

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SUMMARY OF SMALL SIGNS

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

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE: FRP = Fiberglass, TWT = Thin-Wall, 10BWG = 10 BWG, S80 = Sch 80	POSTS: 1 or 2	ANCHOR TYPE: UA=Universal Conc, UB=Universal Bolt, SA=Slipbase-Conc, SB=Slipbase-Bolt, WS=Wedge Steel, WP=Wedge Plastic	MOUNTING DESIGNATION – PREFABRICATED: P = "Plain", T = "T", U = "U"	MOUNTING DESIGNATION: 1EXT or 2EXT = # of Ext, BM = Extruded Wind Beam, WC = 1.12 #/ft Wing Channel, EXAL= Extruded Alum Sign Panels	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE: TY N, TY S
7	1	W1-2R	SYMBOL - HORIZ CURVE RIGHT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(50) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
7	2	W1-2R	SYMBOL - HORIZ CURVE RIGHT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(50) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
8	1	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
8	2	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
8	3	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
8	4	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
8	5	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
8	6	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
8	7	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
8	8	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
8	9	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
8	10	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
8	11	W1-2L	SYMBOL - HORIZ CURVE LEFT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(45) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
10	1	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
10	2	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
11	1	M3-2	EAST <AUXILIARY SIGN>	24 x 12	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		D10-7AT	<610 - VERTICAL NUMBER>	6 x 10								
		D10-7AT	<610 - VERTICAL NUMBER>	6 x 10								
11	2	W1-2R	SYMBOL - HORIZ CURVE RIGHT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(50) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
11	3	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
11	4	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							

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Texas Department of Transportation — Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

SOSS

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS 4-16, 8-16	DIST DAL		COUNTY KAUFMAN	SHEET NO. 24

18

SUMMARY OF SMALL SIGNS

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

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE: FRP = Fiberglass, TWT = Thin-Wall, 10BWG = 10 BWG, S80 = Sch 80	POSTS: 1 or 2	ANCHOR TYPE: UA=Universal Conc, UB=Universal Bolt, SA=Slipbase-Conc, SB=Slipbase-Bolt, WS=Wedge Steel, WP=Wedge Plastic	MOUNTING DESIGNATION – PREFABRICATED: P = "Plain", T = "T", U = "U"	MOUNTING DESIGNATION: 1EXT or 2EXT = # of Ext, BM = Extruded Wind Beam, WC = 1.12 #/ft Wing Channel, EXAL= Extruded Alum Sign Panels	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE: TY N, TY S
11	5	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
11	6	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
11	7	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
11	8	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
11	9	W1-2L	SYMBOL - HORIZ CURVE LEFT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(50) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
11	10	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
12	1	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
12	2	W1-2L	SYMBOL - HORIZ CURVE LEFT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(45) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
12	3	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
12	4	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
12	5	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
12	6	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
12	7	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
12	8	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
12	9	1-2AT	Cottonwood CITY LIMIT POP 185	66 x 24	x		10BWG	1	SA	T		
13	1	W1-8L	<CHEVRON LEFT>	24 x 30	x		10BWG	1	SA	P		
		W1-8R	<CHEVRON RIGHT>	24 x 30	x							
13	2	W1-2R	SYMBOL - HORIZ CURVE RIGHT	36 x 36	x		10BWG	1	SA	P		
		W13-1P	(45) MPH ADVISORY SPEED PLAQUE	18 x 18	x							
13	3	1-2AT	Grays Prairie CITY LIMIT POP 337	72 x 24	x		10BWG	1	SA	T		

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:

1. 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.
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Texas Department of Transportation — Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

SOSS

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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SUMMARY OF SMALL SIGNS

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

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	POSTS 1 or 2	ANCHOR TYPE UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	MOUNTING DESIGNATION: PREFABRICATED P = "Plain" T = "T" U = "U"	MOUNTING DESIGNATION 1EXT or 2EXT = # of Ext BM = Extruded Wind Beam WC = 1.12 #/ft Wing Channel EXAL= Extruded Alum Sign Panels	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE TY N TY S
14	1	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
14	2	W2-4	SYMBOL - TEE INTERSECTION AHEAD	36 x 36	x		10BWG	1	SA	P		
15	1	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
15	2	M2-1	JCT <AUXILIARY SIGN>	21 x 15	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (148)	24 x 24	x							
15	3	D1-1	Cottonwood 2	96 x 18	x		10BWG	1	SA	T	2EXT	
15	4	R3-9d	END	30 x 12	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
15	5	W3-1	SYMBOL - STOP AHEAD	36 x 36	x		10BWG	1	SA	P		
15	6	R2-1	SPEED LIMIT (55)	30 x 36	x		10BWG	1	SA	P		
15	7	D2-2	⇦ Crandall Kemp ⇨	78 x 30	x		S80	1	SA	U	BM	
15	8	M3-4	WEST <AUXILIARY SIGN>	24 x 12	x		10BWG	1	SA	P		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		D10-7AT	<612 - VERTICAL NUMBER>	6 x 10								
		D10-7AT	<612 - VERTICAL NUMBER>	6 x 10								
15	9	R1-1	STOP	36 x 36	x		10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP (PLAQUE)	24 x 12	x							
15	10	M3-4	WEST <AUXILIARY SIGN>	24 x 12	x		S80	1	SA	U		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	x							
		M3-3	SOUTH <AUXILIARY SIGN>	24 x 12	x							
		M1-6F	FM SHIELD FARM ROAD (148)	24 x 24	x							
		M6-3	<ARROW - VERTICAL STRGHT> <AUX. SIGN>	21 x 15	x							
15	11	W1-7T	<BI-DIRECTIONAL LRG ARRW w/ CHEVRONS>	96 x 36	x		S80	1	SA	U	BM	
15	12	M3-1	NORTH <AUXILIARY SIGN>	24 x 12	x		S80	1	SA	U		
		M1-6F	FM SHIELD FARM ROAD (148)	24 x 24	x							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	x							
		M3-3	SOUTH <AUXILIARY SIGN>	24 x 12	x							
		M1-6F	FM SHIELD FARM ROAD (148)	24 x 24	x							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	x							
15	13	M3-4	WEST <AUXILIARY SIGN>	24 x 12	x		S80	1	SA	U		
		M1-6F	FM SHIELD FARM ROAD (2451)	24 x 24	x							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	x							
		M3-1	NORTH <AUXILIARY SIGN>	24 x 12	x							
		M1-6F	FM SHIELD FARM ROAD (148)	24 x 24	x							
		M6-3	<ARROW - VERTICAL STRGHT> <AUX. SIGN>	21 x 15	x							

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"

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NOTE:

1. 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.
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Texas Department of Transportation
Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

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18

TCP GENERAL NOTES

WORK IN PREVIOUS PHASE SHALL BE FULLY COMPLETED PRIOR TO STARTING THE NEXT PHASE UNLESS APPROVAL FROM THE ENGINEER IS OBTAINED. THE WORK OUTINED IN PHASE 1 FOR CCSJ 2355-01-006 FM 2451 FROM MIDLAND DRIVE TO SH 34 SHALL BE COMPLETED BEFORE PROCEEDING TO THE NEXT PHASE FM 2451 FROM SH 34 TO FM 148.

LANE CLOSURES WILL BE IN ACCORDANCE WITH TCP, WZ STANDARDS, AND AS DIRECTED BY THE ENGINEER. OVERNIGHT LANE CLOSURES WILL NOT BE PERMITTED.

COMPLY WITH TCP (7-1)-1, WHICH INCLUDES PROVISIONS FOR CERTAIN SIGNS TO BE INSTALLED AND ARE 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.

THE CONTRACTOR SHALL PROVIDE AND MAINTAIN SKILLED FLAGGERS EQUIPPED WITH TWO -WAY RADIOS TO HANDLE THE TRAFFIC THROUGHOUT THE WORK AREAS FOR THE SAFETY AND CONVENIENCE OF THE TRAVELING PUBLIC AND CONTRACTOR PERSONNEL.

TEMPORARY SW3P EROSION CONTROL MEASURES SHALL ONLY BE PLACED IN AREAS WHERE SOIL DISTURBANCE IS EXPECTED TO OCCUR WITHIN TWO WEEKS. TEMPORARY SW3P EROSION CONTROL MEASURES SHALL BE REMOVED IN EACH AREA WITHIN TWO WEEKS OF VEGETATION ESTABLISHMENT OR AS DIRECTED BY THE ENGINEER.

LOCATION OF CONSTRUCTION EXITS WILL BE DETERMINED IN THE FIELD BY THE ENGINEER.

THE CONTRACTOR SHALL COVER OR REMOVE ANY CONFLICTING SIGNS OR PAVEMENT MARKINGS DURING CONSTRUCTION AS DIRECTED BY THE ENGINEER. THIS WORK SHALL BE SUBSIDIARY TO ITEM 502.

MAINTAIN DRIVEWAY AND SIDE STREET ACCESS AT ALL TIMES WITH AN ALL WEATHER SURFACE CONSISTING OF RAP OR BASE.

INTERMITTENT ONE -WAY TRAFFIC CONTROL (LANE CLOSURE) WILL BE IN ACCORDANCE WITH TCP & WZ STANDARD AND AS DIRECTED BY THE ENGINEER.

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.

PAVEMENT EDGE DROP- OFFS WILL NOT BE ALLOWED TO REMAIN OVERNIGHT. AT THE END OF EACH WORKDAY, ALL PAVEMENT EDGE DROP- OFFS SHALL BE BACK FILLED WITH A SUITABLE MATERIAL TO FORM A STABLE 3:1 SLOPE OR FLATTER.

LIMIT THE LENGTH OF DAILY WORK TO THE AREA OF OPERATION THAT CAN BE COMPLETED IN ONE WORKING DAY IN ORDER TO ALLOW FOR TWO -WAY TRAFFIC AT NIGHT. SUCH AREAS MUST NOT EXCEED (1) MILE UNLESS APPROVED BY THE ENGINEER. WITHIN THE (1) MILE SECTION, ONLY CLOSE OFF THE AREA WHERE ACTUAL WORK IS BEING PERFORMED. COMPLETE THE (1) MILE SECTION TO FIRST COURSE TREATMENT BEFORE PROCEEDING TO THE NEXT SECTION UNLESS APPROVED BY THE ENGINEER.

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 11/3/2021
Signature of Registrant & Date

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FM 2451
TCP NARRATIVE

SCALE: NTS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
FR	TEXAS	DAL	KAUFMAN	27
CHECK FR	CONTROL	SECTION	JOB	
CHECK JR	2355	01	006, ETC.	

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TRAFFIC CONTROL PLAN/SEQUENCE OF WORK

PHASE 1 - CCSJ: 2355-01-006
MIDLAND DRIVE TO SH 34

STEP 1- CULVERT EXTENSIONS/ REPLACEMENT

1. ERECT PROJECT SIGNS AND ADVANCED WARNING SIGNS AS SHOWN ON THE BC STANDARDS, TCP, OR AS DIRECTED BY THE ENGINEER.
2. PLACE SW3P DEVICES AS PER PLANS, STANDARDS, AND AS DIRECTED BY THE ENGINEER.
3. SET CHANNELIZATION DEVICES AND CONSTRUCT CULVERT EXTENSIONS/REPLACEMENT. DURING CONSTRUCTION ALWAYS PROVIDE POSITIVE DRAINAGE.
4. PREP ROW AS DIRECTED IN THE PLANS AND THE ENGINEER.
5. CONSTRUCT UPSTREAM AND OR DOWNSTREAM CULVERT EXTENSIONS/REPLACEMENT ONE SIDE AT A TIME WITHOUT INTERRUPTION OF TRAFFIC FLOW. USE TCP (2-1)-18a AND TCP (2-2)-18b FOR THIS WORK.

STEP 2- ROADWAY WORK & DRIVEWAYS

1. DELINEATE PAVEMENT EDGE AND CENTERLINE WITH VERTICAL PANELS. SALVAGE EXISTING TOPSOIL FROM WORK AREA.
2. REMOVE EXISTING PAVEMENT AS DETAILED IN THE TYPICAL SECTIONS .THIS WORK WILL BE DONE IN ACCORDANCE WITH TCP (2-2)-18.
3. REMIX EXISTING WITH NEW FLBS & CEMENT OR PLACE NEW FLBS & CEMENT AS SHOWN IN TYPICAL SECTIONS. THIS WORK WILL BE DONE IN ACCORDANCE WITH TCP (2-2)-18. REWORK EACH SEGMENT FULL WIDTH EACH DAY TO WHERE NO GRADE DIFFERENCE IS PRESENT AT CENTERLINE.
4. PLACE NEW BASE SECTION IN HALF WIDTH. SEQUENCE OPERATIONS TO CONSTRUCT FULL WIDTH BASE SECTIONS WHERE NO GRADE DIFFERENCE IS PRESENT AT COMPLETION OF DAILY OPERATIONS. THIS WORK WILL BE DONE IN ACCORDANCE WITH TCP (2-2)-18.
5. PLACE TEMPORARY SEEDING AFTER THE NEW BASE IS PLACED FOR EACH ONE MILE SECTION. CONTRACTOR SHALL NOT PROCEED TO THE NEXT 1 MILE SECTION UNTIL TEPORARY SEEDING IS COMPLETED OR AS OTHERWISE DIRECTED BY THE ENGINEER
6. CONSTRUCT DRIVEWAYS AND DRIVEWAY CULVERTS USING TCP (2-1)-18 TCP (2-2)-18.
7. APPLY PRIME AND THE FIRST COURSE OF THE TWO-COURSE SURFACE TREATMENT IN ACCORDANCE WITH THE TRAFFIC CONTROL PLAN FOR SEAL COAT OPERATIONS STANDARDS.
8. APPLY CENTERLINE STRIPE (TY II PVMNT MARKINGS) WITHIN 14 DAYS OF PLACING THE FIRST COURSE.

STEP 3- FINAL SURFACE, BACKFILL, & SIGNS

1. PLACE FINAL SURFACE USING TRAFFIC CONTROL PLAN FOR SEAL COAT STANDARDS.
2. PLACE PERMANENT PAVEMENT MARKINGS AS SHOWN IN THE PLANS USING TCP(3-3)-14.
3. BACKFILL THE PAVEMENT EDGES USING TCP (2-1)-18.
4. REPLACE EXISTING SIGNS & MAILBOXES.
5. PLACE PERMANENT PAVEMENT MARKINGS AS SHOWN IN THE PLANS USING TCP(3-3)-14.
6. RE -VEGETATE DISTURBED SOILS AND REMOVE SW3P AS DIRECTED BY THE ENGINEER.

PHASE 2 - CSJ: 2355-02-008
SH 34 TO FM 148

STEP 1- CULVERT EXTENSIONS

1. ERECT PROJECT SIGNS AND ADVANCED WARNING SIGNS AS SHOWN ON THE BC STANDARDS, TCP, OR AS DIRECTED BY THE ENGINEER.
2. PLACE SW3P DEVICES AS PER PLANS, STANDARDS, AND AS DIRECTED BY THE ENGINEER.
3. SET CHANNELIZATION DEVICES AND CONSTRUCT CULVERT EXTENSIONS/REPLACEMENT. DURING CONSTRUCTION ALWAYS PROVIDE POSITIVE DRAINAGE.
4. PREP ROW AS DIRECTED IN THE PLANS AND THE ENGINEER.
5. CONSTRUCT UPSTREAM AND OR DOWNSTREAM CULVERT EXTENSIONS ONE SIDE AT A TIME WITHOUT INTERRUPTION OF TRAFFIC FLOW. USE TCP (2-1)-18a AND TCP (2-2)-18b FOR THIS WORK.

STEP 2- ROADWAY WORK & DRIVEWAYS

1. DELINEATE PAVEMENT EDGE AND CENTERLINE WITH VERTICAL PANELS. SALVAGE EXISTING TOPSOIL FROM WORK AREA.
2. REMOVE EXISTING PAVEMENT AS DETAILED IN THE TYPICAL SECTIONS .THIS WORK WILL BE DONE IN ACCORDANCE WITH TCP (2-2)-18.
3. REMIX EXISTING WITH NEW FLBS & CEMENT OR PLACE NEW FLBS & CEMENT AS SHOWN IN TYPICAL SECTIONS. THIS WORK WILL BE DONE IN ACCORDANCE WITH TCP (2-2)-18. REWORK EACH SEGMENT FULL WIDTH EACH DAY TO WHERE NO GRADE DIFFERENCE IS PRESENT AT CENTERLINE. LIMIT WORK TO 1 MILE SECTIONS.
4. PLACE NEW BASE SECTION IN HALF WIDTH. SEQUENCE OPERATIONS TO CONSTRUCT FULL WIDTH BASE SECTIONS WHERE NO GRADE DIFFERENCE IS PRESENT AT COMPLETION OF DAILY OPERATIONS. THIS WORK WILL BE DONE IN ACCORDANCE WITH TCP (2-2)-18.LIMIT WORK TO 1 MILE SECTIONS.
5. PLACE TEMPORARY SEEDING AFTER THE NEW BASE IS PLACED FOR EACH ONE MILE SECTION. CONTRACTOR SHALL NOT PROCEED TO THE NEXT 1 MILE SECTION UNTIL TEPORARY SEEDING IS COMPLETED OR AS OTHERWISE DIRECTED BY THE ENGINEER.
6. CONSTRUCT DRIVEWAYS AND DRIVEWAY CULVERTS USING TCP (2-1)-18 TCP (2-2)-18.
7. APPLY PRIME AND ONE COURSE TREATMENT IN ACCORDANCE WITH THE TRAFFIC CONTROL PLAN FOR SEAL COAT OPERATIONS STANDARDS.
8. APPLY CENTERLINE STRIPE (TY II PVMNT MARKINGS) WITHIN 14 DAYS OF PLACING THE FIRST COURSE.

STEP 3- FINAL SURFACE, BACKFILL, & SIGNS

1. PLACE FINAL SURFACE USING TCP(2-2)-18 & TCP (7-1)-13.
2. PLACE PERMANENT PAVEMENT MARKINGS AS SHOWN IN THE PLANS USING TCP(3-3)-14.
3. BACKFILL THE PAVEMENT EDGES USING TCP (2-1)-18.
4. REPLACE EXISTING SIGNS & MAILBOXES.
5. PLACE PERMANENT PAVEMENT MARKINGS AND RUMBLE STRIPS AS SHOWN IN THE PLANS USING TCP(3-3)-14.
6. RE -VEGETATE DISTURBED SOILS AND REMOVE SW3P AS DIRECTED BY THE ENGINEER.

PHASE 3 - CCSJ:2355-01-006 & CSJ:2355-02-008
FINAL CLEAN UP

1. COMPLETE PUNCH-LIST ITEMS
2. PERFORM CLEAN- UP AS DIRECTED BY THE ENGINEER.
3. REMOVE BARRICADES AND TEMPORARY SIGNS AS APPROVED OR DIRECTED BY THE ENGINEER

STATE OF TEXAS
FALON J. RENFROE
131914
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PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 11/3/2021
Signature of Registrant & Date

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FM 2451
TCP NARRATIVE

SCALE: NTS SHEET 2 OF 2

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS FR	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	27A
CHECK JR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

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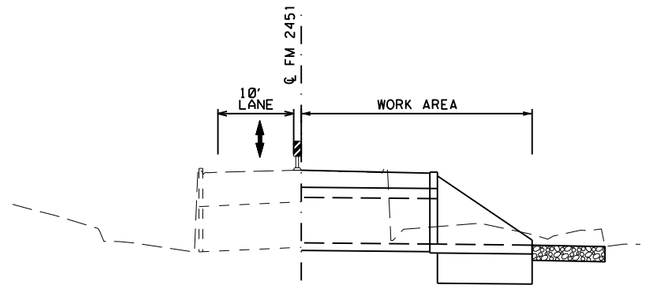
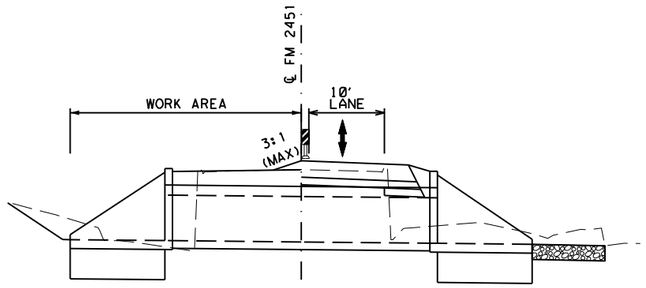
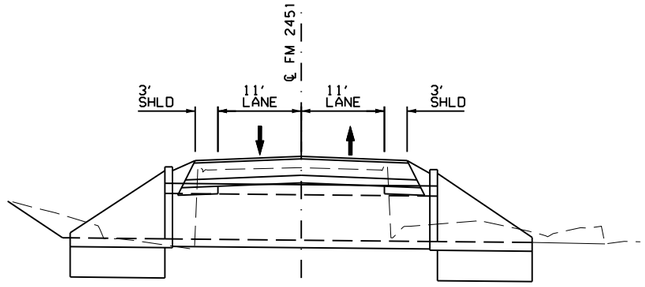


CULVERT #2
STEP 1



CULVERT #2
STEP 2



CULVERT #2
STEP 3

NOTES:
1. TWO-WAY TRAFFIC SHALL BE ESTABLISHED AT THE END OF EACH WORK DAY.
2. PROVIDE & MAINTAIN SMOOTH SURFACE & PAVEMENT MARKINGS AS NEEDED AFTER THE COMPLETION OF THE CULVERT EXTENSIONS.
3. SEE CULVERT LAYOUTS FOR ADDITION DETAIL.
4. CONSTRUCT 3:1 SAFETY SLOPE AT THE END OF DAILY OPPERATIONS UNTIL BOTH SIDES OF THE ROADWAY ARE THE SAME ELEVATION.

VERTICAL PANEL

STATE OF TEXAS
FALON J. REMFROE
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FM 2451
CULVERT REPLACEMENT
TYPICALS

SCALE: NTS SHEET 1 OF 1

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS: SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK: FR	TEXAS	DAL	KAUFMAN	28
CHECK: FR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

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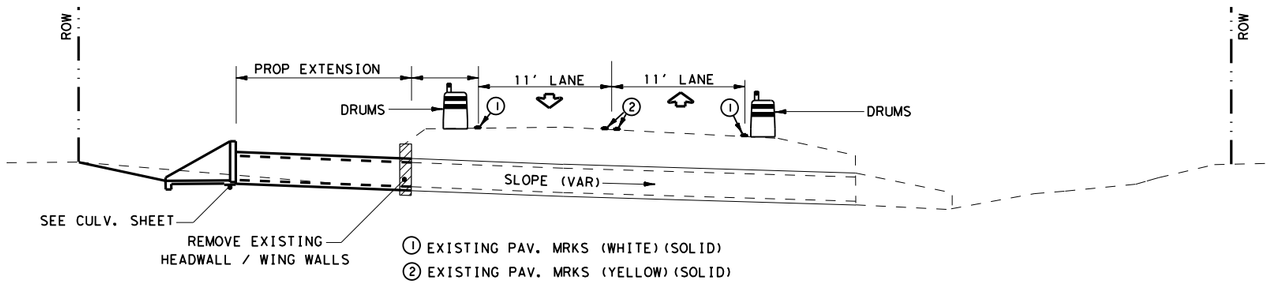
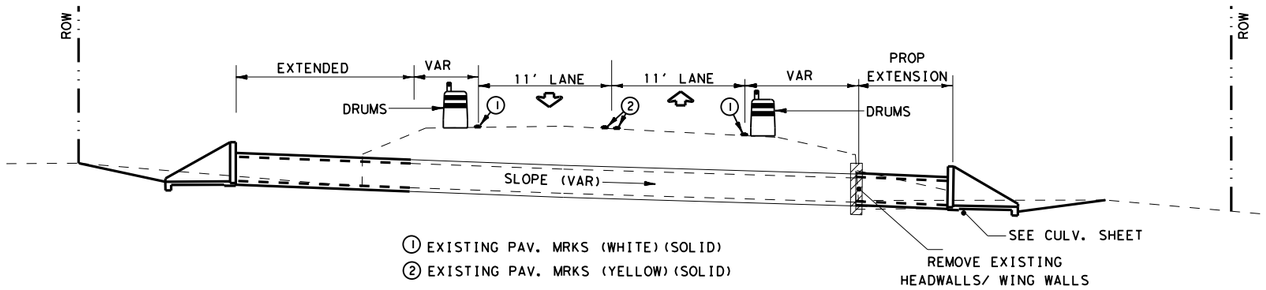


TYPICAL TCP FOR CULVERT EXTENSION
STEP-1



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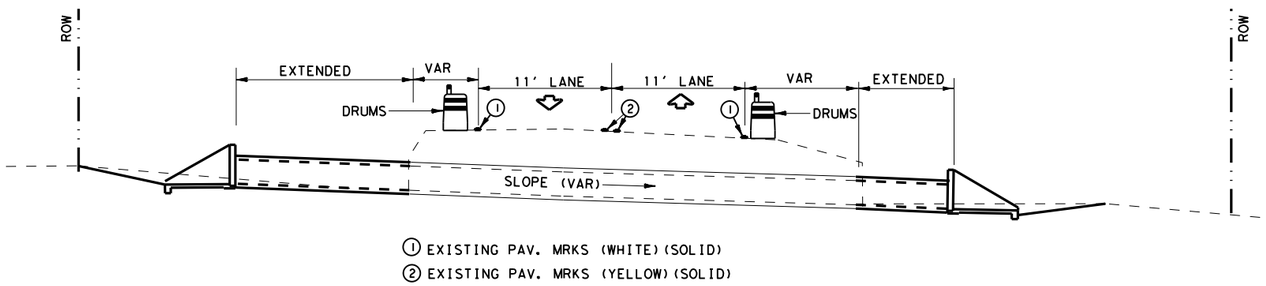
STEP-2



TYPICAL TCP FOR CULVERT EXTENSION
STEP-3

NOTE: SEE "BC (1-12)-21, TCP AND SEQUENCE OF WORK FOR DETAILS".

NOTES:
1. TWO-WAY TRAFFIC SHALL BE ESTABLISHED AT THE END OF EACH WORK DAY.
2. PROVIDE & MAINTAIN SMOOTH SURFACE & PAVEMENT MARKINGS AS NEEDED AFTER THE COMPLETION OF THE CULVERT EXTENSIONS.
3. SEE CULVERT LAYOUTS FOR ADDITION DETAIL.

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 10/18/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451
CULVERT EXTENSION
TYPICALS

SCALE: NTS SHEET 1 OF 1

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	29
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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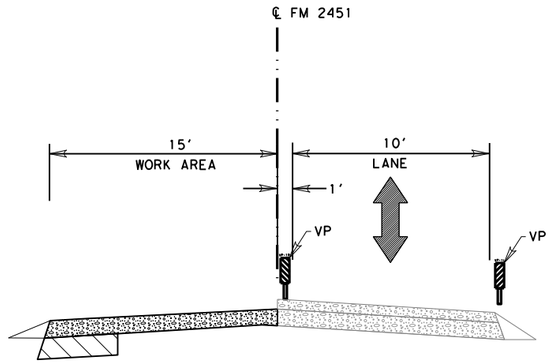
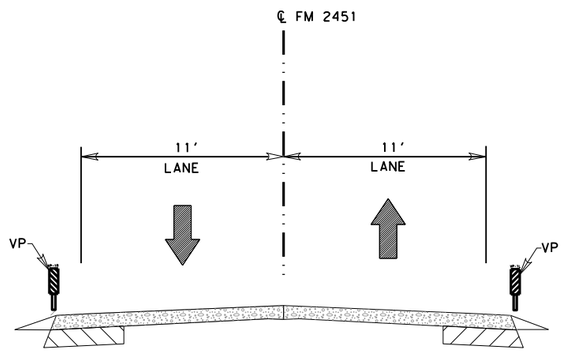


PHASE II
CONSTRUCTION OPERATION PRESENT

CCSJ: 2355-01-006 STA 50+52.00 TO STA 109+75.00
CSJ: 2355-02-008 STA 128+84.00 TO STA 399+76.00



PHASE II
CONSTRUCTION OPERATION NOT PRESENT

CCSJ: 2355-01-006 STA 50+52.00 TO STA 109+75.00
CSJ: 2355-02-008 STA 128+84.00 TO STA 399+76.00

NOTES:

1. CENTERLINE CHANNELIZATION DEVICES MAY BE OMITTED WHEN A PILOT CAR IS LEADING TRAFFIC IN ACCORDING WITH TCP(2-2)-18.
2. AT ANY REMOVAL OF EXISTING PAVEMENT AREA, CONTRACTOR SHALL SEQUENCE OPERATIONS TO PLACE FIRST LIFT OF FLEXBASE SAME DAY AS REMOVAL.
3. EXISTING SUBGRADE HAS NOT BEEN DETERMINED SUITABLE FOR DIRECT TRAFFIC.
4. CONSTRUCT 3:1 SAFETY SLOPE AT THE END OF DAILY OPERATIONS UNTIL BOTH SIDES OF THE ROADWAY ARE AT THE SAME ELEVATION.

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 10/18/2021
Signature of Registrant & Date

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FM 2451
TCP TYPICAL SECTIONS

SCALE: NTS SHEET 1 OF 1

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	30
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

1. The Barricade and Construction Standard Sheets (BC sheets) are intended to show typical examples for placement of temporary traffic control devices, construction pavement markings, and typical work zone signs. The information contained in these sheets meet or exceed the requirements shown in the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).

2. The development and design of the Traffic Control Plan (TCP)is the responsibility of the Engineer.

3. The Contractor may propose changes to the TCP that are signed and sealed by a licensed professional engineer for approval. The Engineer may develop, sign and seal Contractor proposed changes.

4. The Contractor is responsible for installing and maintaining the traffic control devices as shown in the plans. The Contractor may not move or change the approximate location of any device without the approval of the Engineer.

5. Geometric design of lane shifts and detours should, when possible, meet the applicable design criteria contained in manuals such as the American Association of State Highway and Transportation Officials (AASHTO), "A Policy on Geometric Design of Highways and Streets," the TxDOT "Roadway Design Manual" or engineering judgment.

6. When projects abut, the Engineer(s) may omit the END ROAD WORK, TRAFFIC FINES DOUBLE, and other advance warning signs if the signing would be redundant and the work areas appear continuous to the motorists. If the adjacent project is completed first, the Contractor shall erect the necessary warning signs as shown on these sheets, the TCP sheets or as directed by the Engineer. The BEGIN ROAD WORK NEXT X MILES sign shall be revised to show appropriate work zone distance.

7. The Engineer may require duplicate warning signs on the median side of divided highways where median width will permit and traffic volumes justify the signing.

8. All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition. Sign details not shown in this manual shall be shown in the plans or the Engineer shall provide a detail to the Contractor before the sign is manufactured.

9. The temporary traffic control devices shown in the illustrations of the BC sheets are examples. As necessary, the Engineer will determine the most appropriate traffic control devices to be used.

10. Where highway construction or maintenance work is being undertaken, other than mobile operations as defined by the Texas Manual on Uniform Traffic Control Devices, CSJ limit signs are required. CSJ limit signs are shown on BC(2). The OBEY WARNING SIGNS STATE LAW sign, STAY ALERT TALK OR TEXT LATER and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits. For mobile operations, CSJ limit signs are not required.

11. Traffic control devices should be in place only while work is actually in progress or a definite need exists.

12. The Engineer has the final decision on the location of all traffic control devices.

13. Inactive equipment and work vehicles, including workers' private vehicles must be parked away from travel lanes. They should be as close to the right-of-way line as possible, or located behind a barrier or guardrail, or as approved by the Engineer.

WORKER SAFETY NOTES:

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

2. Except in emergency situations, flagger stations shall be illuminated when flagging is used at night.

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

1. Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources.

2. Work zone traffic control devices shall be compliant with the Manual for Assessing safety Hardware (MASH).

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-03 7-13	2355	01	006, ETC.	FM 2451
9-07 8-14	DIST	COUNTY		SHEET NO.
5-10 5-21	DAL	KAUFMAN		31

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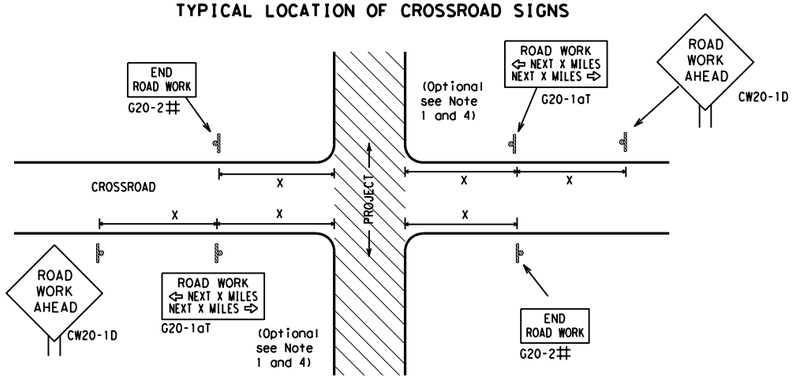
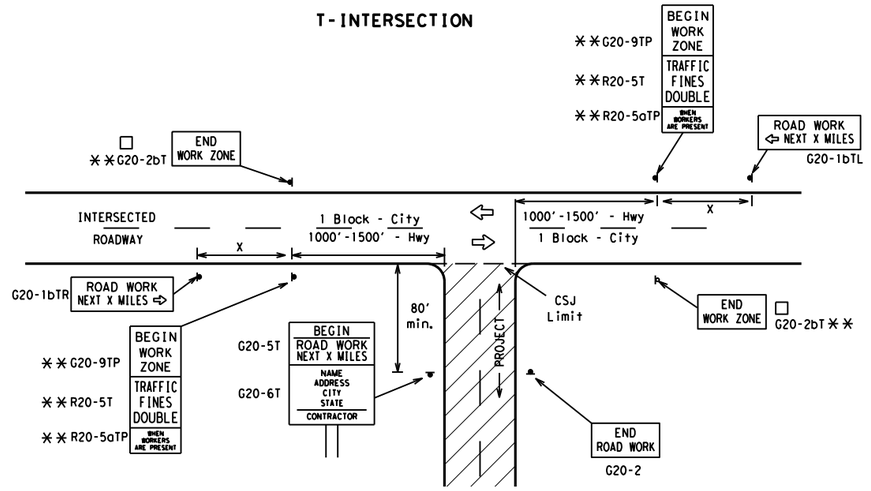
TYPICAL LOCATION OF CROSSROAD SIGNS



May be mounted on back of "ROAD WORK AHEAD"(CW20-1D) sign with approval of Engineer. (See note 2 below)

1. 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.
2. 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.
3. 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.
4. 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.
5. Additional traffic control devices may be shown elsewhere in the plans for higher volume crossroads.
6. 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

1. 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.
2. 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]

SIZE

Sign Number or Series	Conventional Road	Expressway/ Freeway
CW20[4] CW21 CW22 CW23 CW25	48" x 48"	48" x 48"
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"

SPACING

Posted Speed	Sign △ Spacing "X"
MPH	Feet (Apprx.)
30	120
35	160
40	240
45	320
50	400
55	500[2]
60	600[2]
65	700[2]
70	800[2]
75	900[2]
80	1000[2]
*	*[3]

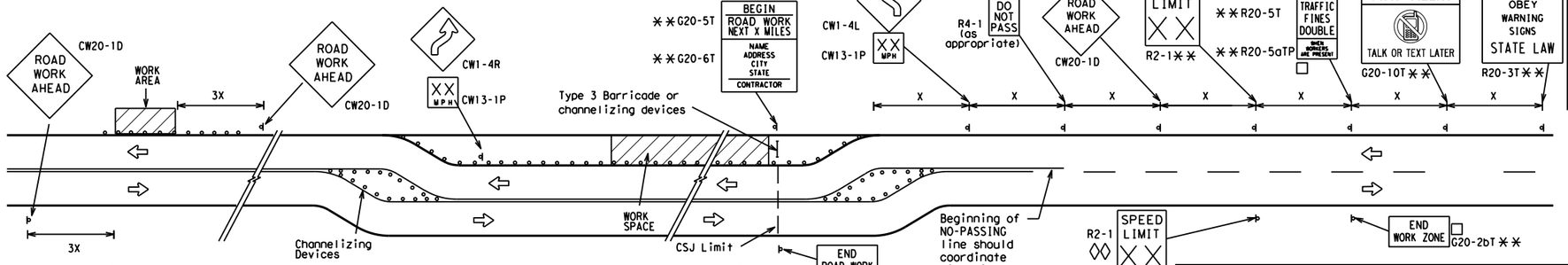
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have 1/2 mile or more advance warning.
4. 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".
5. Only diamond shaped warning sign sizes are indicated.
6. 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.

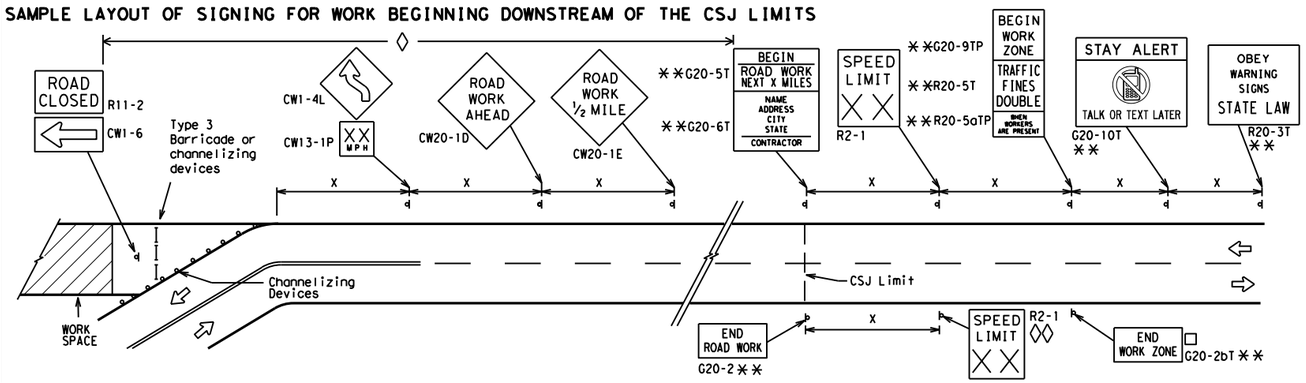
WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS



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 AT THE CSJ LIMITS

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



NOTES

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

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

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

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

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

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

Texas Department of Transportation — Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	2355	01	006, ETC.	FM 2451
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	DAL	KAUFMAN		32

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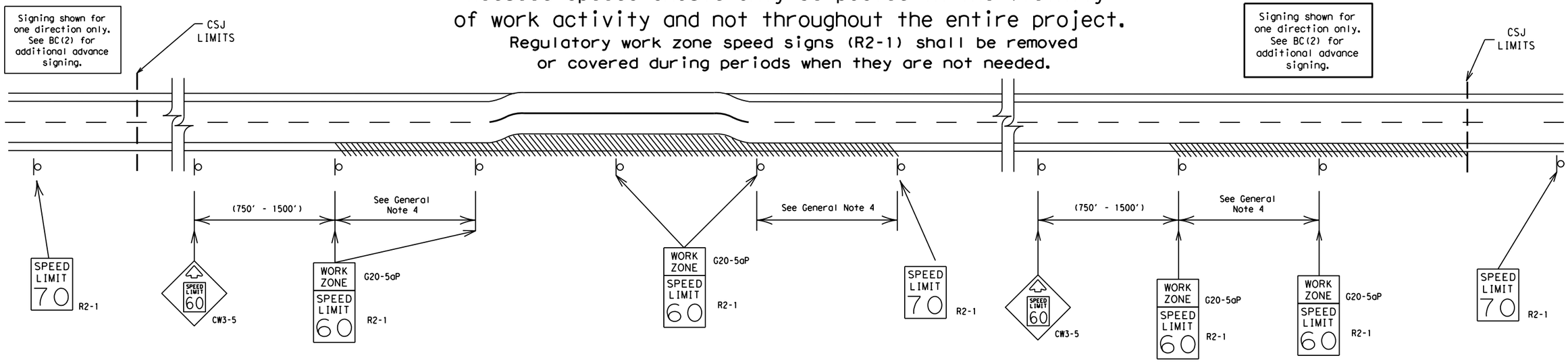
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

Reduced speeds should only be posted in the vicinity of work activity and not throughout the entire project.

Regulatory work zone speed signs (R2-1) shall be removed or covered during periods when they are not needed.



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

a) rough road or damaged pavement surface
b) substantial alteration of roadway geometrics (diversions)
c) construction detours
d) grade
e) width
f) 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

1. Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
2. Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
3. Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
4. 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
5. Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
6. 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.
7. Turning signs from view, laying signs over or down will not be allowed, unless as otherwise noted under "REMOVING OR COVERING" on BC(4).
8. Techniques that may help reduce traffic speeds include but are not limited to:
   A. Law enforcement.
   B. Flagger stationed next to sign.
   C. Portable changeable message sign (PCMS).
   D. Low-power (drone) radar transmitter.
   E. Speed monitor trailers or signs.
9. Speeds shown on details above are for illustration only. Work Zone Speed Limits should only be posted as approved for each project.
10. 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.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

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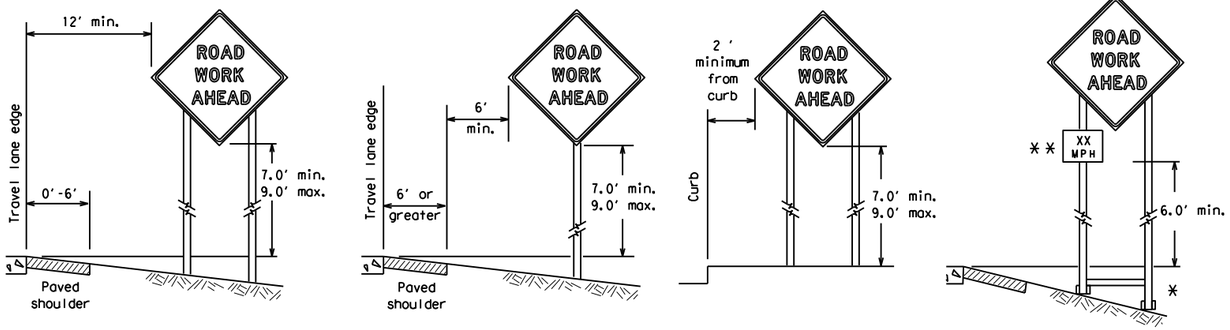
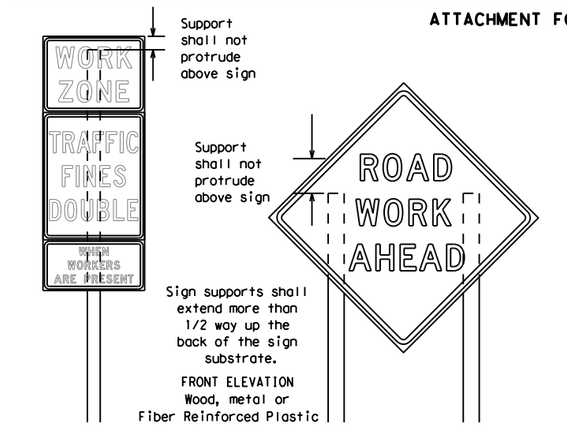
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

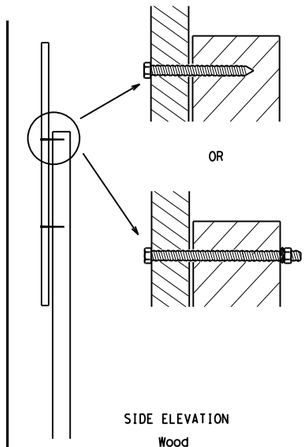


* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

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

ATTACHMENT FOR SIGN SUPPORTS





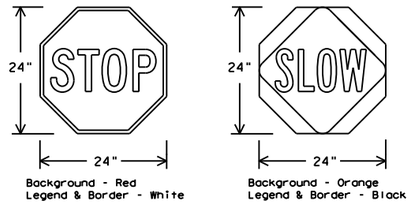
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

Splicing embedded perforated square metal tubing in order to extend post height will only be allowed when the splice is made using four bolts, two above and two below the spice 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 retroreflectorized 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 CWZTCD list. The signs shall meet the required mounting heights shown on the BC, or the SMD standard sheets during construction. This work should be paid for under the appropriate pay item for relocating existing signs.
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" (CWZTCD) for small roadside signs. Supports for temporary large roadside signs shall meet the requirements detailed on the Temporary Large Roadside Signs (TLRS) standard sheets. The Contractor shall install the sign support in accordance with the manufacturer's recommendations. If there is a question regarding installation procedures, the Contractor shall furnish the Engineer a copy of the manufacturer's installation recommendations so the Engineer can verify the correct procedures are being followed.
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 CWZTCD 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 CWZTCD 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.

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC(4)-21

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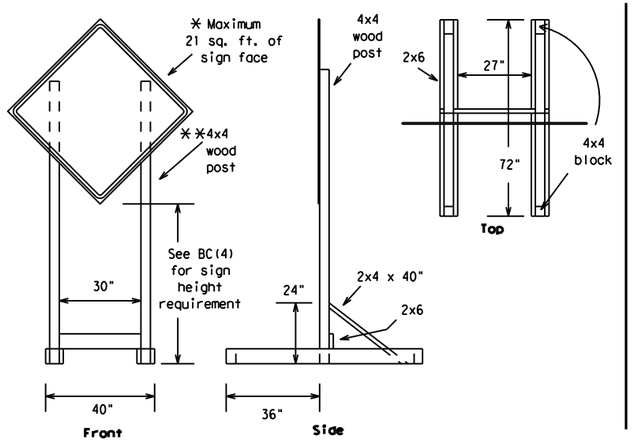
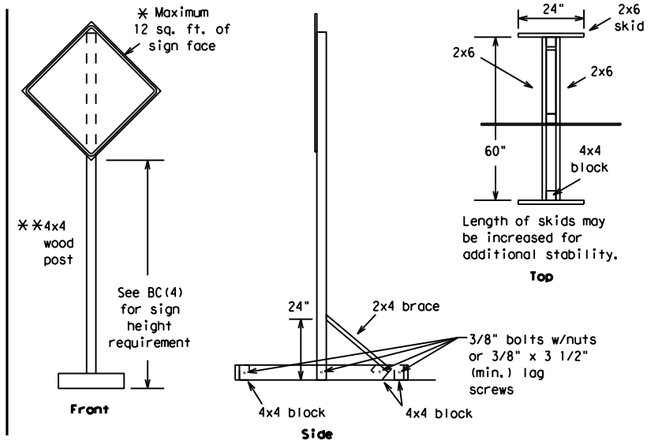
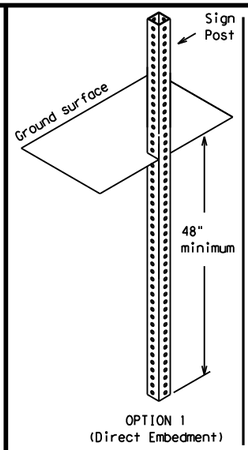
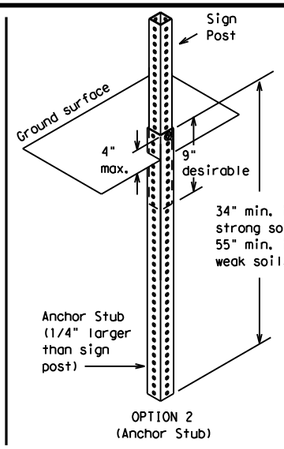


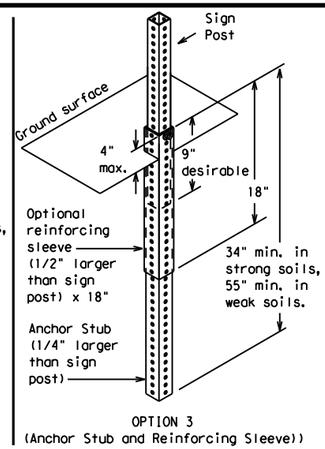


SKID MOUNTED WOOD SIGN SUPPORTS

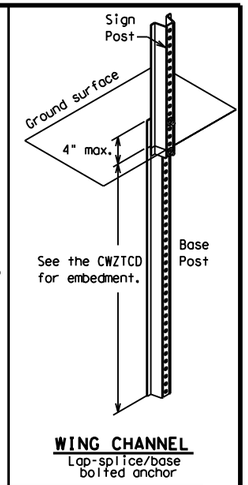
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS







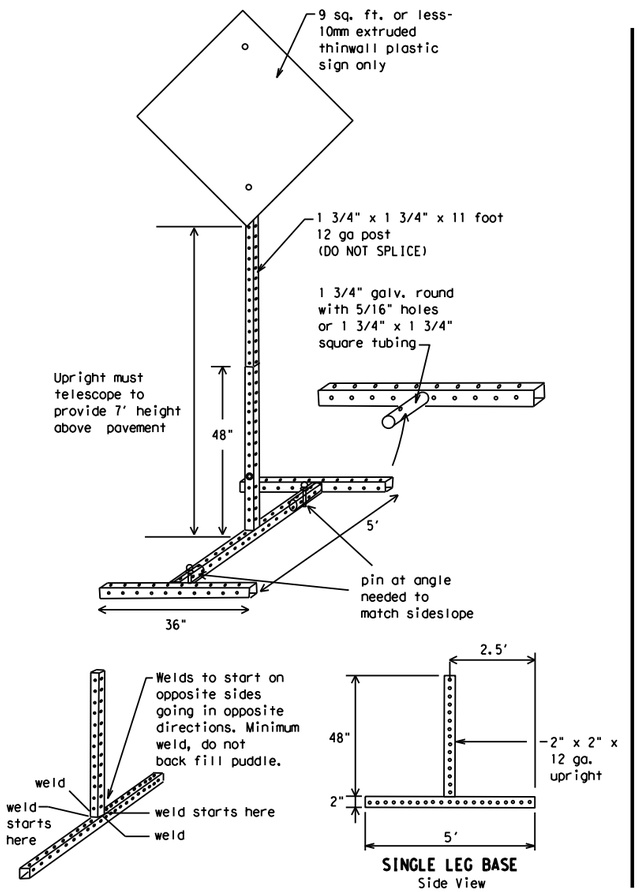
PERFORATED SQUARE METAL TUBING

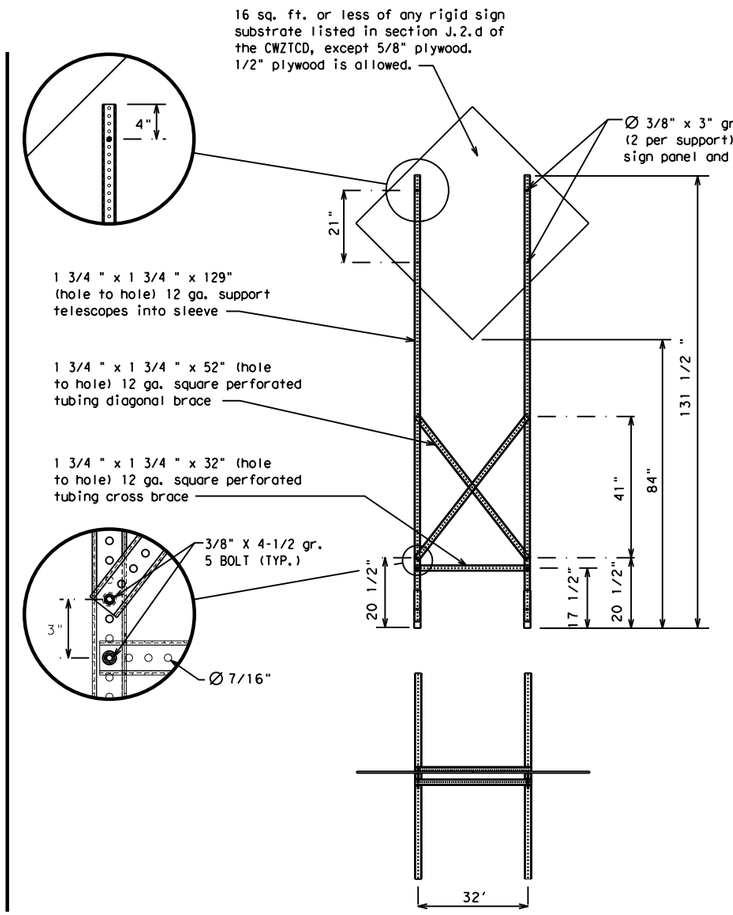


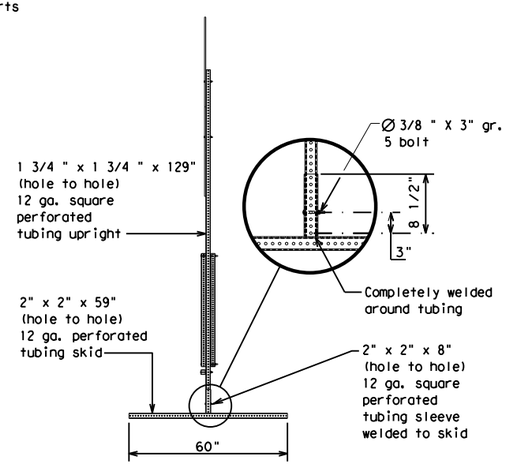
WING CHANNEL
Lap-splice/base bolted anchor

GROUND MOUNTED SIGN SUPPORTS

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







SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

WEDGE ANCHORS

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

OTHER DESIGNS

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

GENERAL NOTES

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

* See BC(4) for definition of "Work Duration."

** Wood sign posts MUST be one piece. Splicing will NOT be allowed. Posts shall be painted white.

☐ See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

SHEET 5 OF 12

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

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

PORTABLE CHANGEABLE MESSAGE SIGNS

1. The Engineer/Inspector shall approve all messages used on portable changeable message signs (PCMS).
2. 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.
3. 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.
4. Use the word "EXIT" to refer to an exit ramp on a freeway; i.e., "EXIT CLOSED." Do not use the term "RAMP."
5. Always use the route or interstate designation (IH, US, SH, FM) along with the number when referring to a roadway.
6. When in use, the bottom of a stationary PCMS message panel should be a minimum 7 feet above the roadway, where possible.
7. 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.
8. 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.
9. Do not "flash" messages or words included in a message. The message should be steady burn or continuous while displayed.
10. 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.
11. Do not use the word "Danger" in message.
12. Do not display the message "LANES SHIFT LEFT" or "LANES SHIFT RIGHT" on a PCMS. Drivers do not understand the message.
13. Do not display messages that scroll horizontally or vertically across the face of the sign.
14. 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.
15. 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.
16. Each line of text should be centered on the message board rather than left or right justified.
17. If disabled, the PCMS should default to an illegible display that will not alarm motorists and will only be used to alert workers that the PCMS has malfunctioned. A pattern such as a series of horizontal solid bars is appropriate.

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

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

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

Phase 1: Condition Lists

Road/Lane/Ramp Closure List		Other Condition List	
FREEWAY CLOSED X MILE	FRONTAGE ROAD CLOSED	ROADWORK XXX FT	ROAD REPAIRS XXXX FT
ROAD CLOSED AT SH XXX	SHOULDER CLOSED XXX FT	FLAGGER XXXX FT	LANE NARROWS XXXX FT
ROAD CLSD AT FM XXXX	RIGHT LN CLOSED XXX FT	RIGHT LN NARROWS XXXX FT	TWO-WAY TRAFFIC XX MILE
RIGHT X LANES CLOSED	RIGHT X LANES OPEN	MERGING TRAFFIC XXXX FT	CONST TRAFFIC XXX FT
CENTER LANE CLOSED	DAYTIME LANE CLOSURES	LOOSE GRAVEL XXXX FT	UNEVEN LANES XXXX FT
NIGHT LANE CLOSURES	I-XX SOUTH EXIT CLOSED	DETOUR X MILE	ROUGH ROAD XXXX FT
VARIOUS LANES CLOSED	EXIT XXX CLOSED X MILE	ROADWORK PAST SH XXXX	ROADWORK NEXT FRI-SUN
EXIT CLOSED	RIGHT LN TO BE CLOSED	BUMP XXXX FT	US XXX EXIT X MILES
MALL DRIVEWAY CLOSED	X LANES CLOSED TUE - FRI	TRAFFIC SIGNAL XXXX FT	LANES SHIFT *
XXXXXXXX BLVD CLOSED			

* 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		Location List	Warning List	** Advance Notice List
MERGE RIGHT	FORM X LINES RIGHT	AT FM XXXX	SPEED LIMIT XX MPH	TUE-FRI XX AM- X PM
DETOUR NEXT X EXITS	USE XXXXX RD EXIT	BEFORE RAILROAD CROSSING	MAXIMUM SPEED XX MPH	APR XX-XX X PM-X AM
USE EXIT XXX	USE EXIT I-XX NORTH	NEXT X MILES	MINIMUM SPEED XX MPH	BEGINS MONDAY
STAY ON US XXX SOUTH	USE I-XX E TO I-XX N	PAST US XXX EXIT	ADVISORY SPEED XX MPH	BEGINS MAY XX
TRUCKS USE US XXX N	WATCH FOR TRUCKS	XXXXXXX TO XXXXXXX	RIGHT LANE EXIT	MAY X-X XX PM - XX AM
WATCH FOR TRUCKS	EXPECT DELAYS	US XXX TO FM XXXX	USE CAUTION	NEXT FRI-SUN
EXPECT DELAYS	PREPARE TO STOP		DRIVE SAFELY	XX AM TO XX PM
REDUCE SPEED XXX FT	END SHOULDER USE		DRIVE WITH CARE	NEXT TUE AUG XX
USE OTHER ROUTES	WATCH FOR WORKERS			TONIGHT XX PM- XX AM
STAY IN LANE *				

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

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

1. Only 1 or 2 phases are to be used on a PCMS.
2. The 1st phase (or both) should be selected from the "Road/Lane/Ramp Closure List" and the "Other Condition List".
3. A 2nd phase can be selected from the "Action to Take/Effect on Travel, Location, General Warning, or Advance Notice Phase Lists".
4. A Location Phase is necessary only if a distance or location is not included in the first phase selected.
5. 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.
6. 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

1. The words RIGHT, LEFT and ALL can be interchanged as appropriate.
2. Roadway designations IH, US, SH, FM and LP can be interchanged as appropriate.
3. EAST, WEST, NORTH and SOUTH (or abbreviations E, W, N and S) can be interchanged as appropriate.
4. Highway names and numbers replaced as appropriate.
5. ROAD, HIGHWAY and FREEWAY can be interchanged as needed.
6. AHEAD may be used instead of distances if necessary.
7. FT and MI, MILE and MILES interchanged as appropriate.
8. AT, BEFORE and PAST interchanged as needed.
9. 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

1. 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.
2. 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.
3. 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.
4. 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.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

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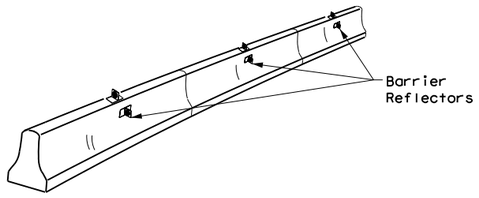
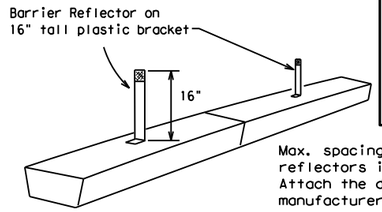
1. Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost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



CONCRETE TRAFFIC BARRIER (CTB)

3. 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.
4. 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.
5. When CTB separates traffic traveling in the same direction, no barrier reflectors will be required on top of the CTB.
6. Barrier Reflector units shall be yellow or white in color to match the edgeline being supplemented.
7. Maximum spacing of Barrier Reflectors is forty (40) feet.
8. Pavement markers or temporary flexible-reflective roadway marker tabs shall NOT be used as CTB delineation.
9. Attachment of Barrier Reflectors to CTB shall be per manufacturer's recommendations.
10. Missing or damaged Barrier Reflectors shall be replaced as directed by the Engineer.
11. Single slope barriers shall be delineated as shown on the above detail.

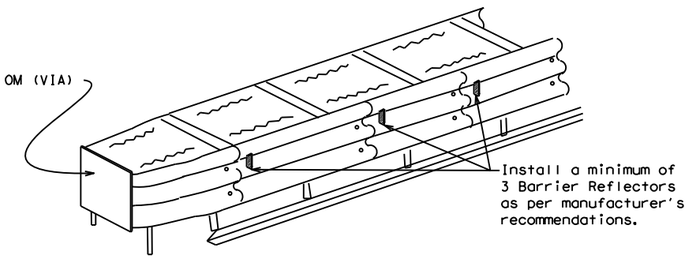


Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

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)

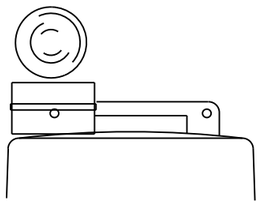


DELINEATION OF END TREATMENTS

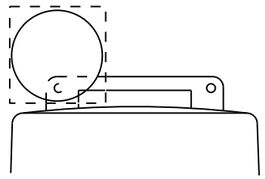
END TREATMENTS FOR CTB'S USED IN WORK ZONES

End treatments used on CTB's in work zones shall meet the apppropriate 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



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

WARNING LIGHTS

1. Warning lights shall meet the requirements of the TMUTCD.
2. Warning lights shall NOT be installed on barricades.
3. 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.
4. 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".
5. The Engineer/Inspector or the plans shall specify the location and type of warning lights to be installed on the traffic control devices.
6. 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.
7. 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.
8. The location of warning lights and warning reflectors on drums shall be as shown elsewhere in the plans.

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

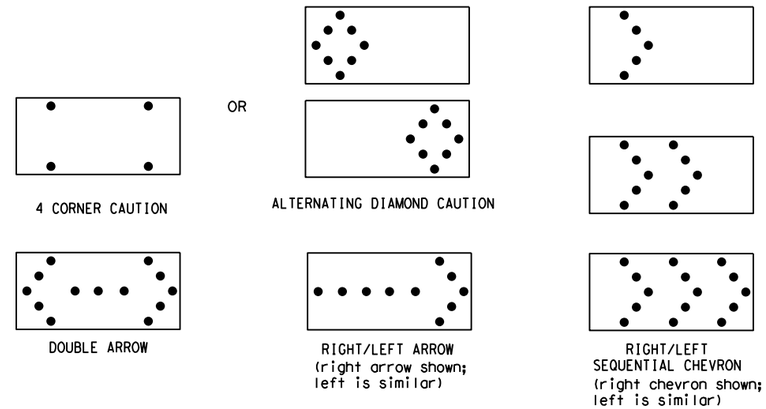
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing 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.
4. 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.
5. Type A, Type C and Type D warning lights shall be installed at locations as detailed on other sheets in the plans.
6. Warning lights shall not be installed on a drum that has a sign, chevron or vertical panel.
7. 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

1. 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.
2. 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.
3. The warning reflector shall have a minimum retroreflective surface area (one-side) of 30 square inches.
4. Round reflectors shall be fully reflectorized, including the area where attached to the drum.
5. 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.
6. 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.
7. When used near two-way traffic, both sides of the warning reflector shall be reflectorized.
8. The warning reflector should be mounted on the side of the handle nearest approaching traffic.
9. The maximum spacing for warning reflectors should be identical to the channelizing device spacing requirements.

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

1. 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.
2. 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.
3. 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.
4. The Flashing Arrow Board should be able to display the following symbols:



4 CORNER CAUTION

ALTERNATING DIAMOND CAUTION

DOUBLE ARROW

RIGHT/LEFT ARROW
(right arrow shown;
left is similar)

RIGHT/LEFT
SEQUENTIAL CHEVRON
(right chevron shown;
left is similar)

5. The "CAUTION" display consists of four corner lamps flashing simultaneously, or the Alternating Diamond Caution mode as shown.
6. The straight line caution display is NOT ALLOWED.
7. 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.
8. 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.
9. The sequential arrow display is NOT ALLOWED.
10. The flashing arrow display is the TxDOT standard; however, the sequential chevron display may be used during daylight operations.
11. The Flashing Arrow Board shall be mounted on a vehicle, trailer or other suitable support.
12. A Flashing Arrow Board SHALL NOT BE USED to laterally shift traffic.
13. 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.
14. 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

TRUCK-MOUNTED ATTENUATORS

1. Truck-mounted attenuators (TMA) used on TxDOT facilities must meet the requirements outlined in the Manual for Assessing Safety Hardware (MASH).
2. Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
3. Refer to the CWZTCD for a list of approved TMAs.
4. TMAs are required on freeways unless otherwise noted in the plans.
5. 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.
6. 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.

Texas Department of Transportation

Traffic Safety Division Standard

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

BC(7)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	DAL	KAUFMAN		37

101

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GENERAL NOTES

1. For long term stationary work zones on freeways, drums shall be used as the primary channelizing device.
2. 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.
3. 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.
4. 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).
5. 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.
6. 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:

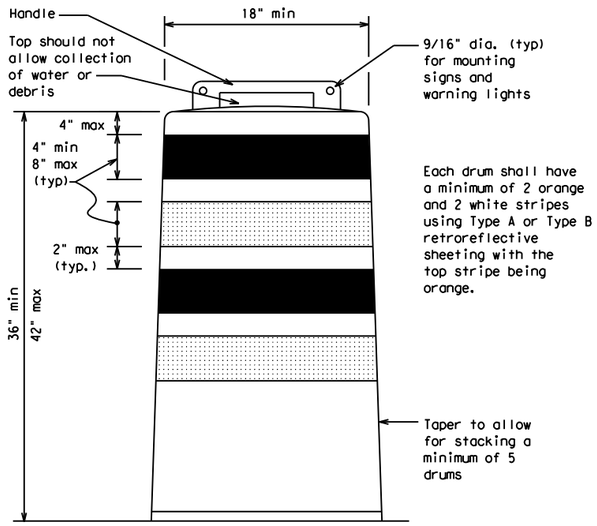
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents accidental separation due to normal handling and/or air turbulence created by passing vehicles.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. Plastic drums shall be constructed of ultra-violet stabilized, orange, high-density polyethylene (HDPE) or other approved material.
9. Drum body shall have a maximum unballasted weight of 11 lbs.
10. Drum and base shall be marked with manufacturer's name and model number.

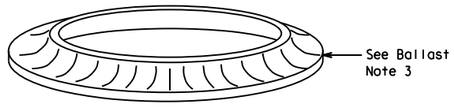
RETROREFLECTIVE SHEETING

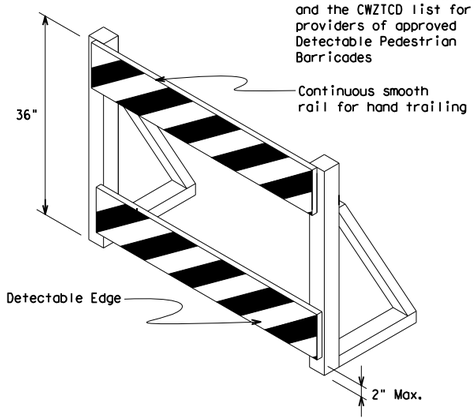
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials," Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall 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

1. 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.
2. 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.
3. Recycled truck tire sidewalls may be used for ballast on drums approved for this type of ballast on the CWZTCD list.
4. 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.
5. 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.
6. Ballast shall not be placed on top of drums.
7. Adhesives may be used to secure base of drums to pavement.

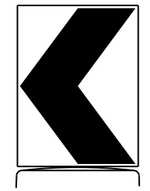




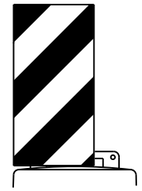


DETECTABLE PEDESTRIAN BARRICADES

1. 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.
2. 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.
3. 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.
4. 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.
5. Warning lights shall not be attached to detectable pedestrian barricades.
6. 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

1. Signs used on plastic drums shall be manufactured using substrates listed on the CWZTCD.
2. 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.
3. 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.
4. 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.
5. Signs shall be installed using a 1/2 inch bolt (nominal) and nut, two washers, and one locking washer for each connection.
6. Mounting bolts and nuts shall be fully engaged and adequately torqued. Bolts should not extend more than 1/2 inch beyond nuts.
7. 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.
8. 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.

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(8)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
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102

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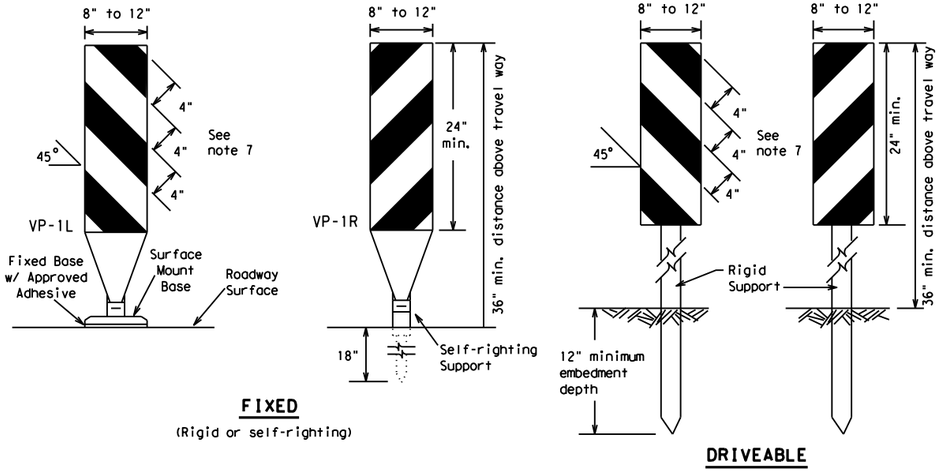
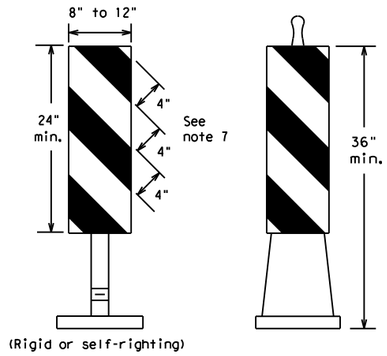


FIXED
(Rigid or self-righting)

DRIVEABLE

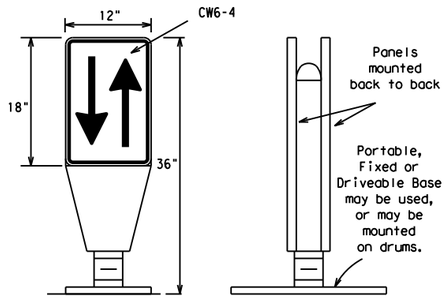


(Rigid or self-righting)

PORTABLE

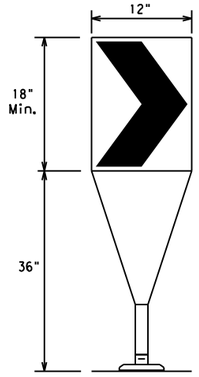
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is required. The Engineer/Inspector shall refer to the Roadway Design Manual for additional requirements on the use VP's for drop-offs.
3. 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.
4. VP's used on expressways and freeways or other high speed roadways, may have more than 270 square inches of retroreflective area facing traffic.
5. Self-righting supports are available with portable base. See "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
6. Sheeting for the VP's shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300, unless noted otherwise.
7. Where the height of reflective material on the vertical panel is 36 inches or greater, a panel stripe of 6 inches shall be used.

VERTICAL PANELS (VPs)



1. 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.
2. The OTLD may be used in combination with 42" cones or VPs.
3. Spacing between the OTLD shall not exceed 500 feet. 42" cones or VPs placed between the OTLD's should not exceed 100 foot spacing.
4. 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.

OPPOSING TRAFFIC LANE DIVIDERS (OTLD)



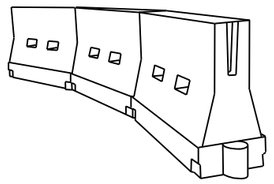
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

1. The chevron shall be a vertical rectangle with a minimum size of 12 by 18 inches.
2. 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.
3. 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.
4. To be effective, the chevron should be visible for at least 500 feet.
5. 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.
6. 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

GENERAL NOTES

1. 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).
2. 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.
3. 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).
4. 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.
5. Portable bases shall be fabricated from virgin and/or recycled rubber. The portable bases shall weigh a minimum of 30 lbs.
6. 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.
7. 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.



LONGITUDINAL CHANNELIZING DEVICES (LCD)

1. 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.
2. LCDs may be used instead of a line of cones or drums.
3. LCDs shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. LCDs should not be used to provide positive protection for obstacles, pedestrians or workers.
5. LCDs shall be supplemented with retroreflective delineation as required for temporary barriers on BC(7) when placed roughly parallel to the travel lanes.
6. 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

1. 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.
2. 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.
3. 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.
4. 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.
5. 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

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

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

SHEET 9 OF 12

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

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7-13 5-21	DAL	KAUFMAN		39

103

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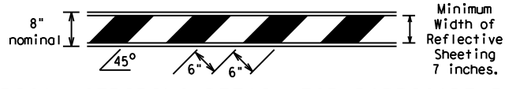
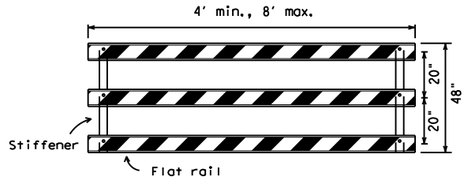
TYPE 3 BARRICADES

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

Barricades shall NOT be used as a sign support.



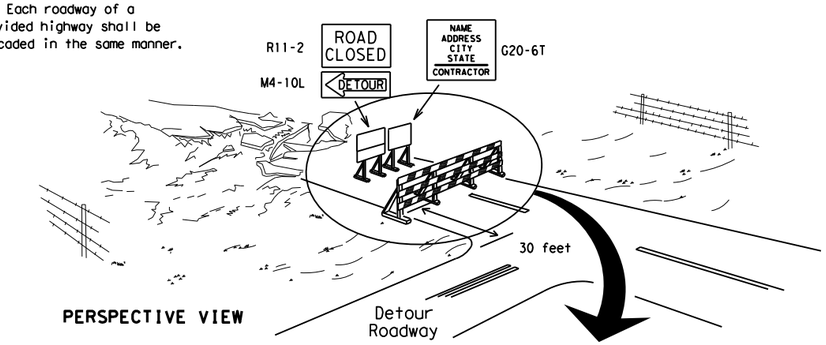
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

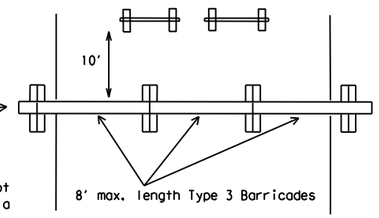
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

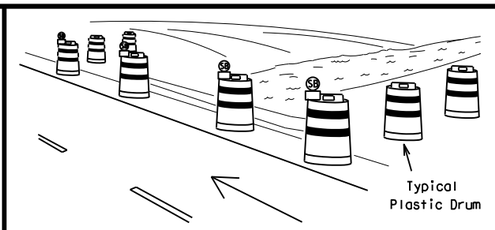
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

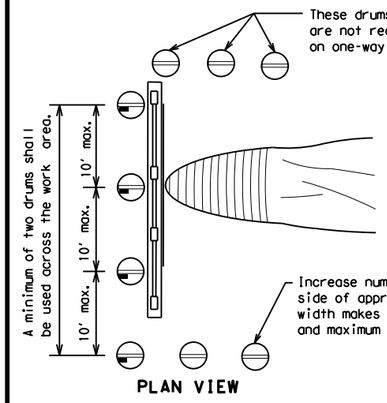
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

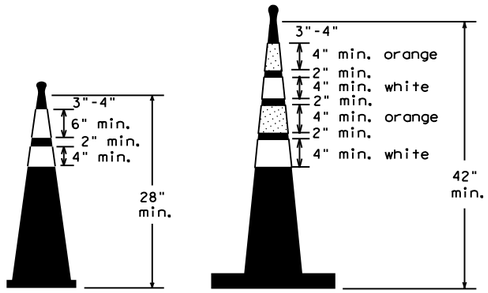
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder 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
SB	Steady burn warning light or yellow warning reflector

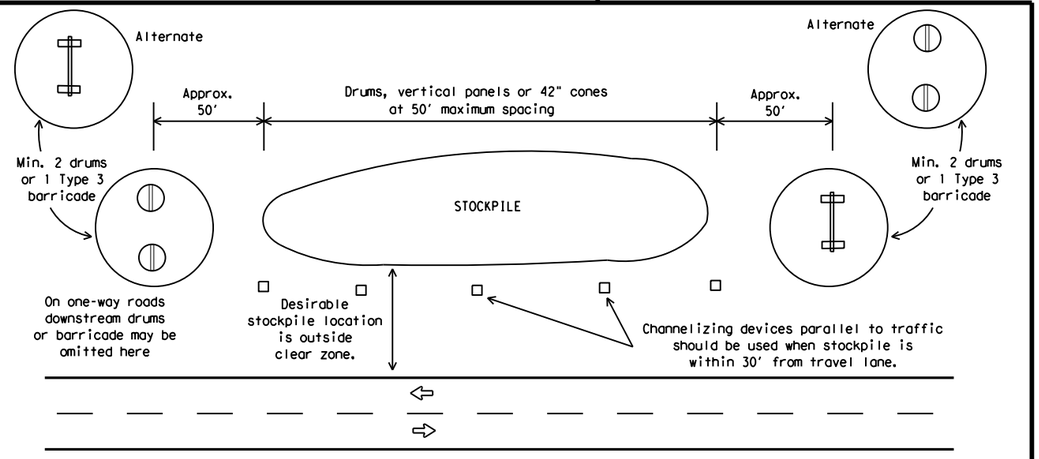
PLAN VIEW

CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



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.



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

SHEET 10 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-21

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104

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WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

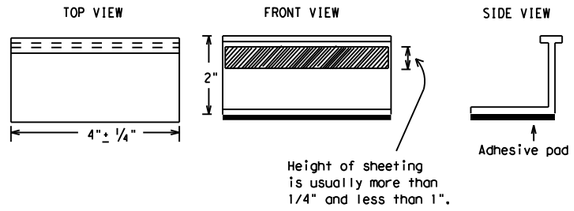
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

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105

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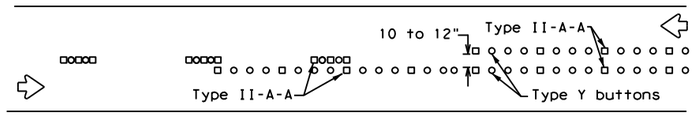
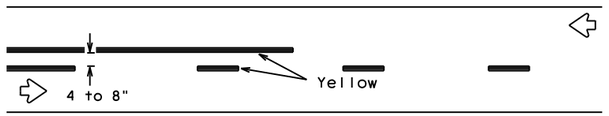
PAVEMENT MARKING PATTERNS

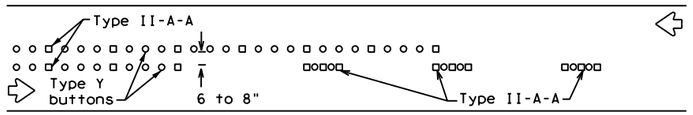
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



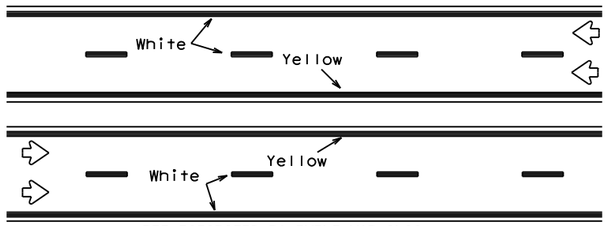
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



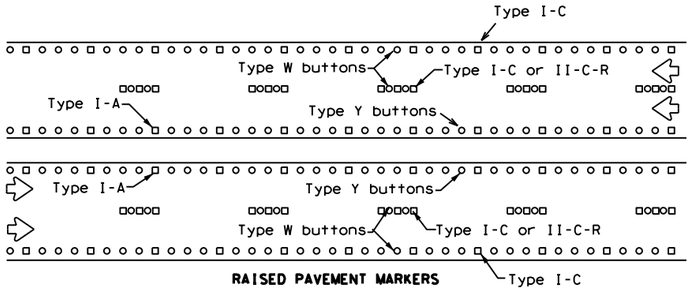
RAISED PAVEMENT MARKERS - PATTERN B

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.

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



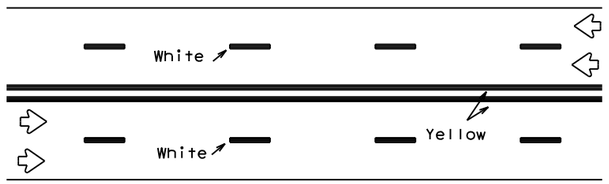
REFLECTORIZED PAVEMENT MARKINGS



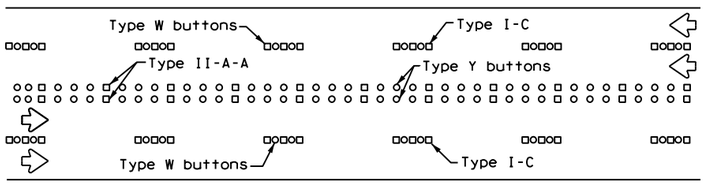
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



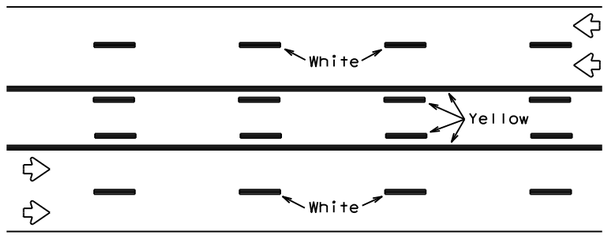
REFLECTORIZED PAVEMENT MARKINGS



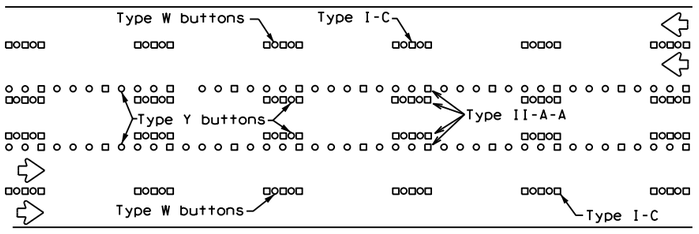
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

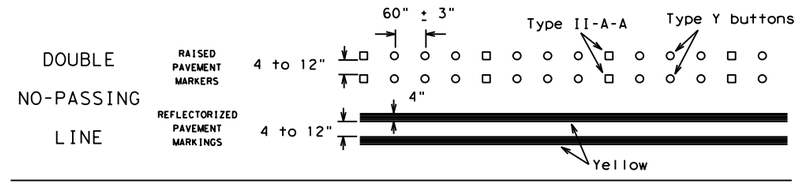
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

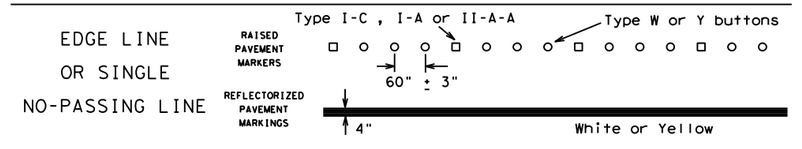
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

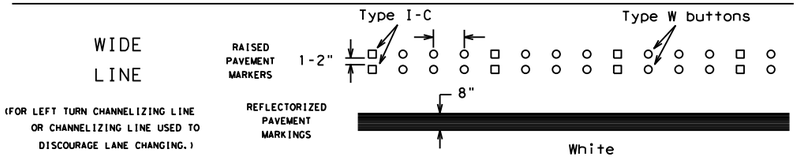


EDGE LINE OR SINGLE NO-PASSING LINE



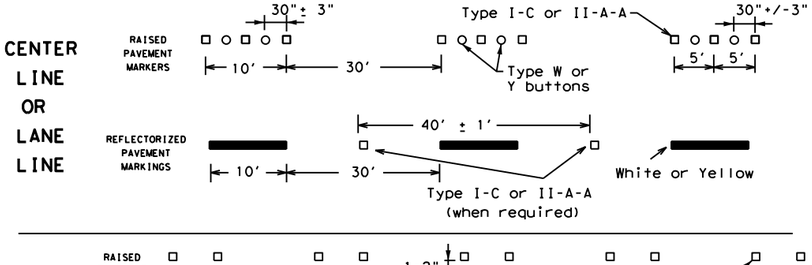
WIDE LINE

(FOR LEFT TURN CHANNELIZING LINE OR CHANNELIZING LINE USED TO DISCOURAGE LANE CHANGING.)

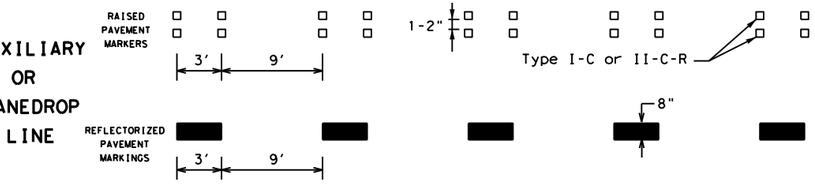


BROKEN LINES

CENTER LINE OR LANE LINE

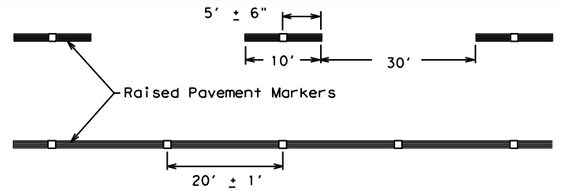


AUXILIARY OR LANEDROP LINE



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.



Centerline only - not to be used on edge lines

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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BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

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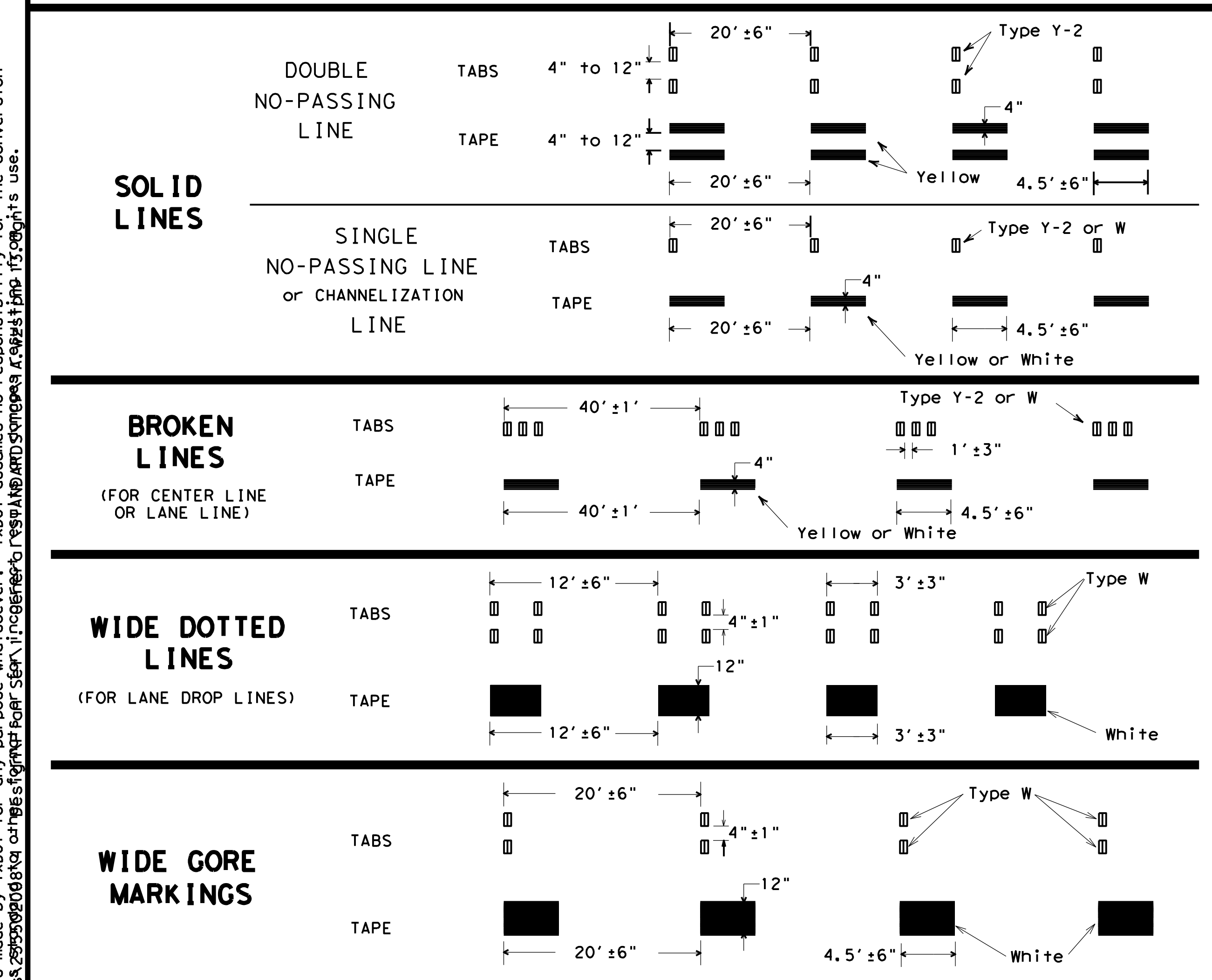
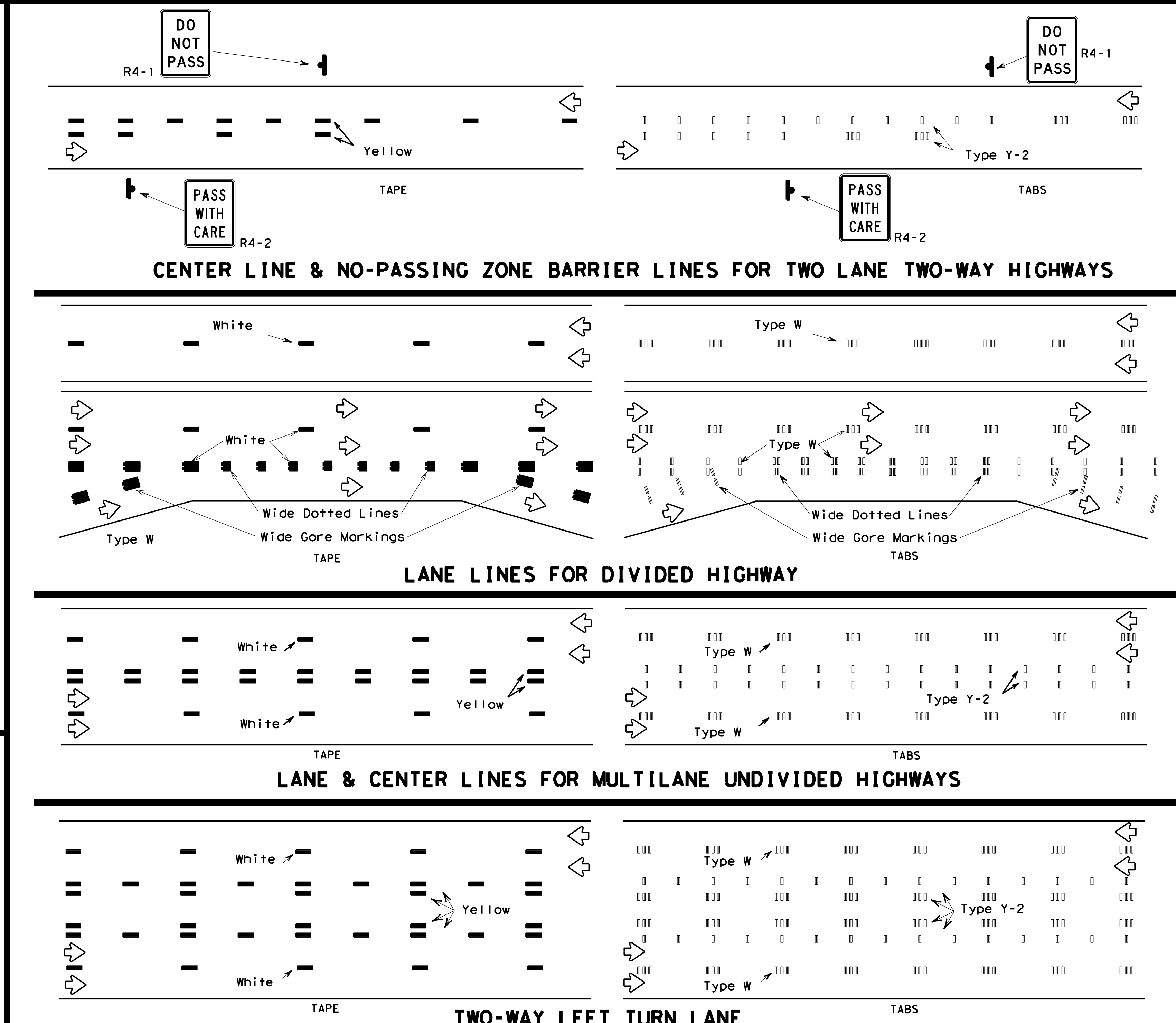
11-02 8-14	DAL	KAUFMAN		42

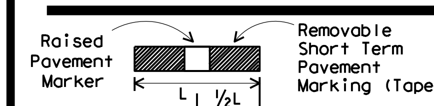
106

WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



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.

NOTES:

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

TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

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

PREFABRICATED PAVEMENT MARKINGS

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

RAISED PAVEMENT MARKERS

1. 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)

1. DMSs referenced above can be found along with embedded links to their respective MPLs at the following website:
http://www.txdot.gov/business/contractors_consultants/material_specifications/default.htm

Texas Department of Transportation — Traffic Operations Division Standard

WORK ZONE SHORT TERM PAVEMENT MARKINGS

WZ(STPM)-13

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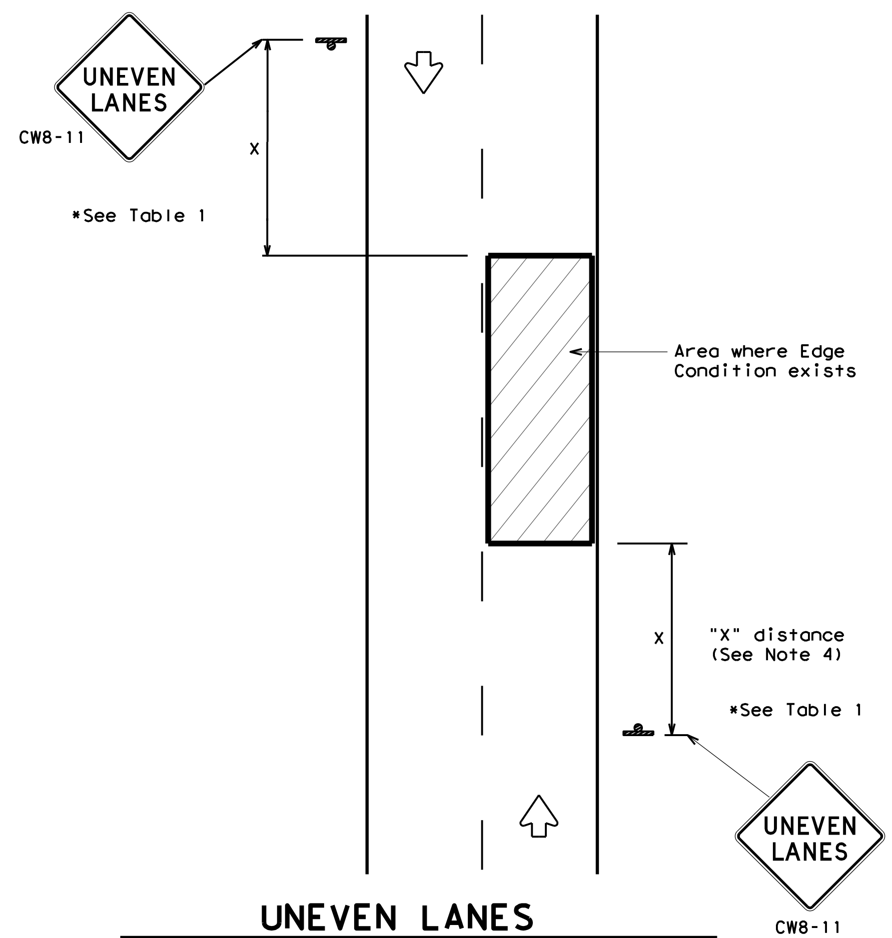
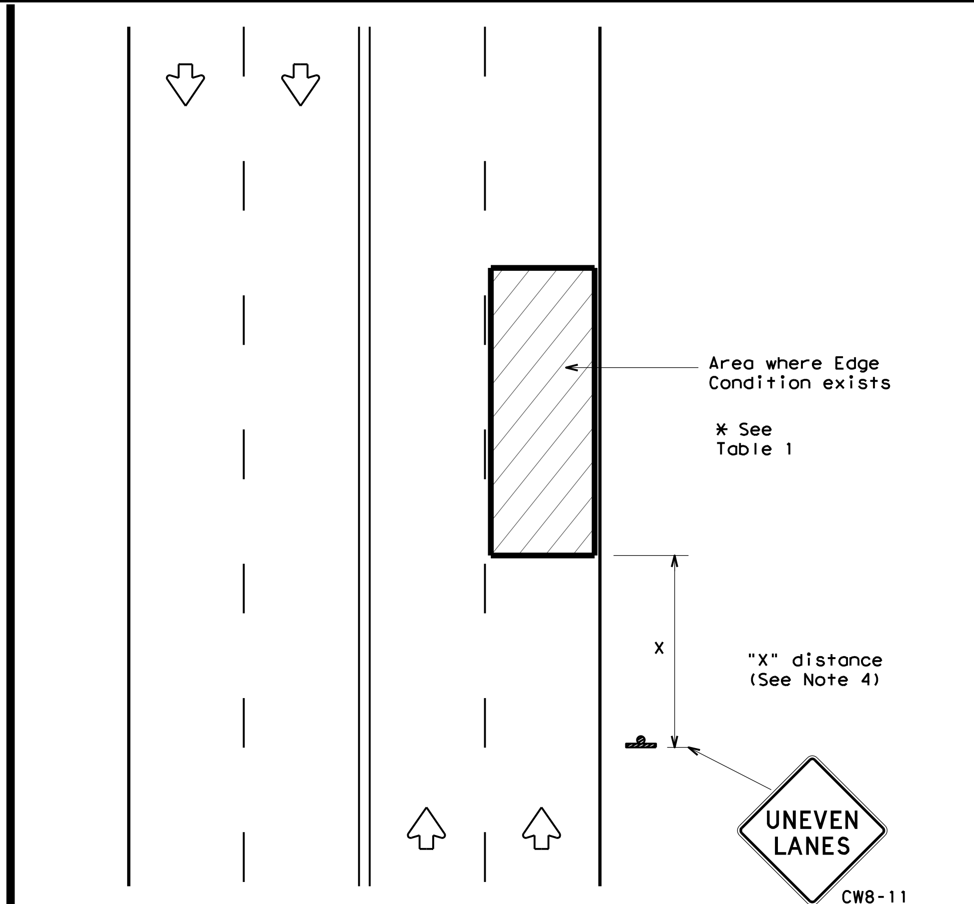
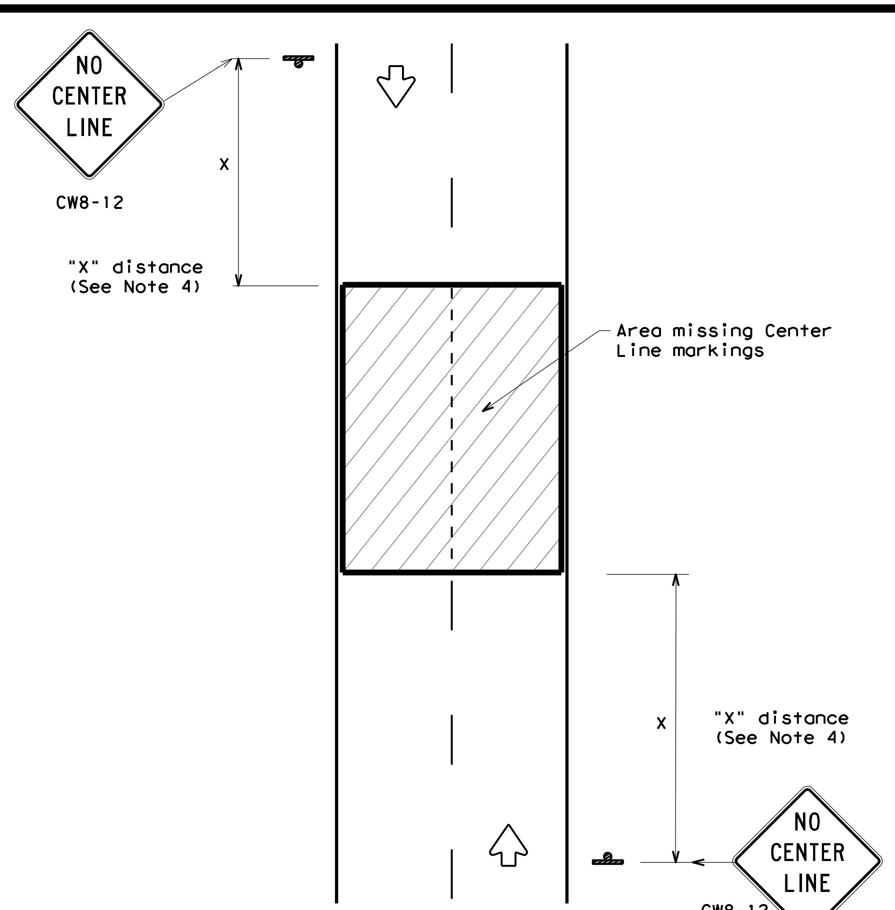


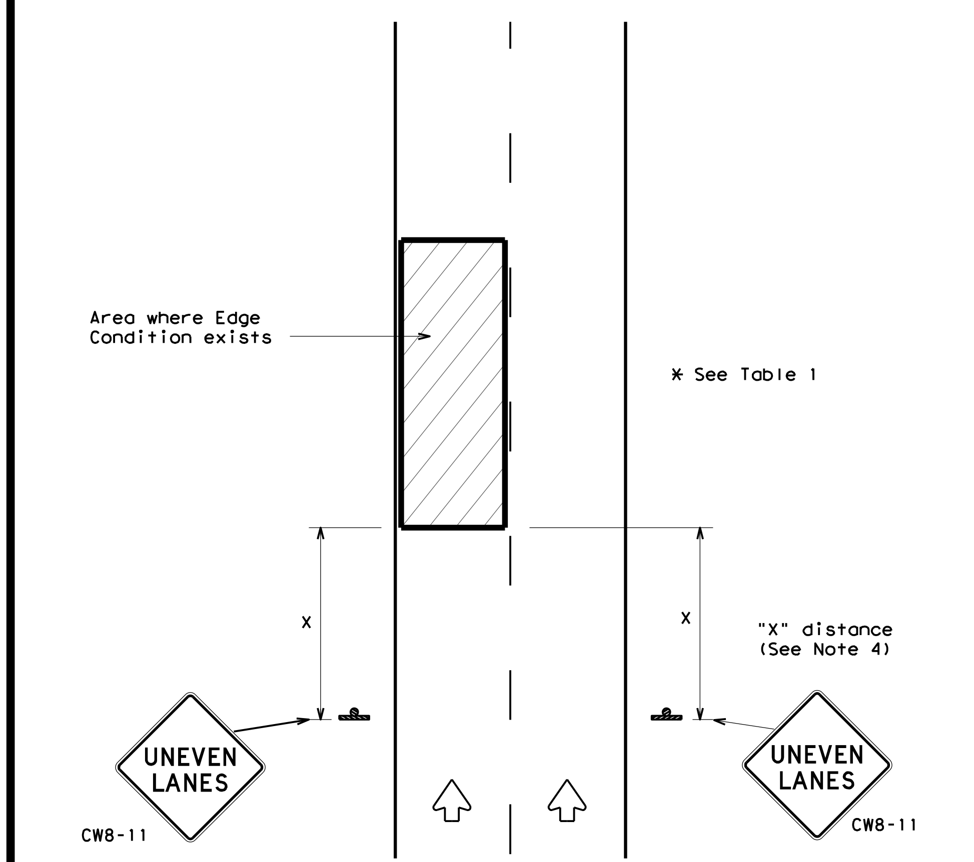
UNEVEN LANES
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
FOUR LANE CONVENTIONAL ROAD



NO CENTER LINE
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
DIVIDED ROADWAY

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.

TABLE 1

Edge Condition	Edge Height (D)	* Warning Devices
① (D)	Less than or equal to: $1\frac{1}{4}$" (maximum-planing) $1\frac{1}{2}$" (typical-overlay)	Sign: CW8-11
	Distance "D" may be a maximum of 1 1/4 " for planing operations and 2" for overlay operations if uneven lanes with edge condition 1 are open to traffic after work operations cease.	
② (>3, 1, D)	Less than or equal to 3"	Sign: CW8-11
③ (0" to 3/4", D, 12") Notched Wedge Joint	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"

Texas Department of Transportation — Traffic Operations Division Standard

SIGNING FOR UNEVEN LANES

WZ(UL)-13

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112

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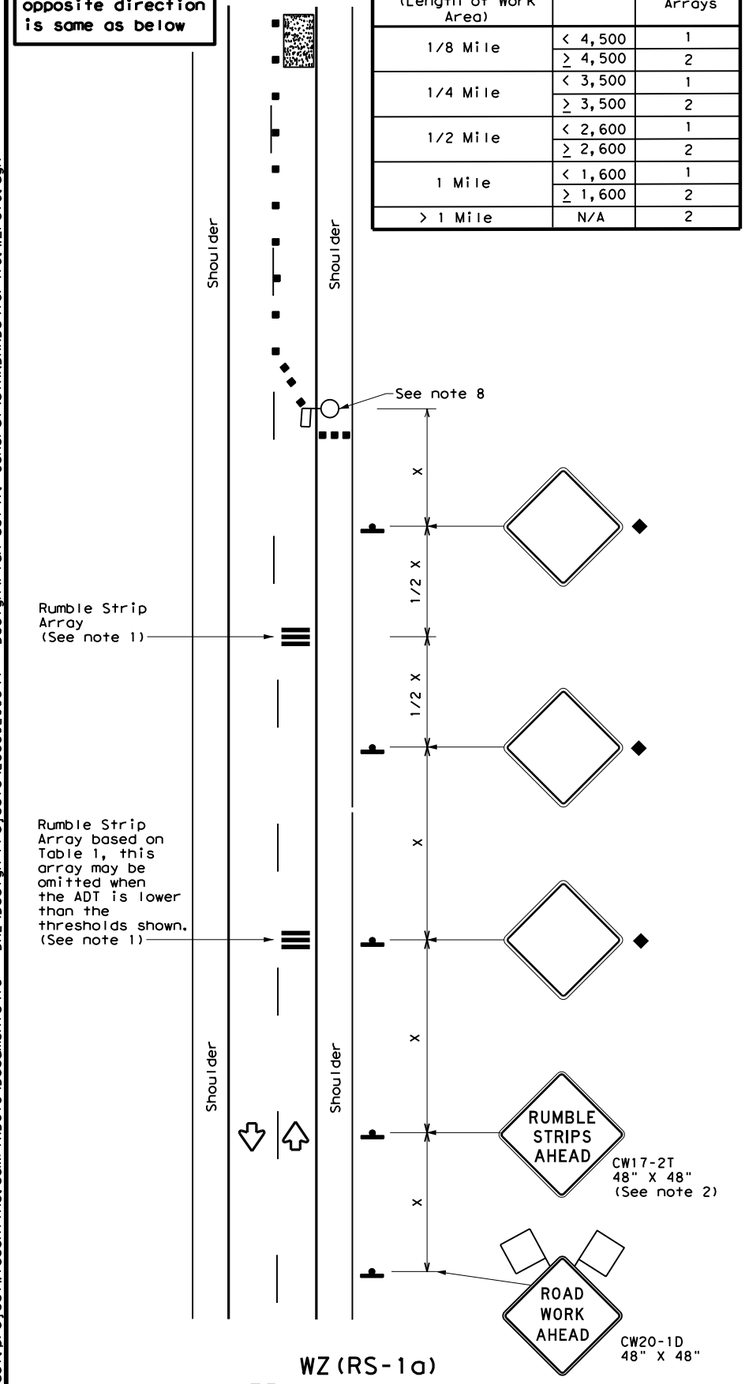
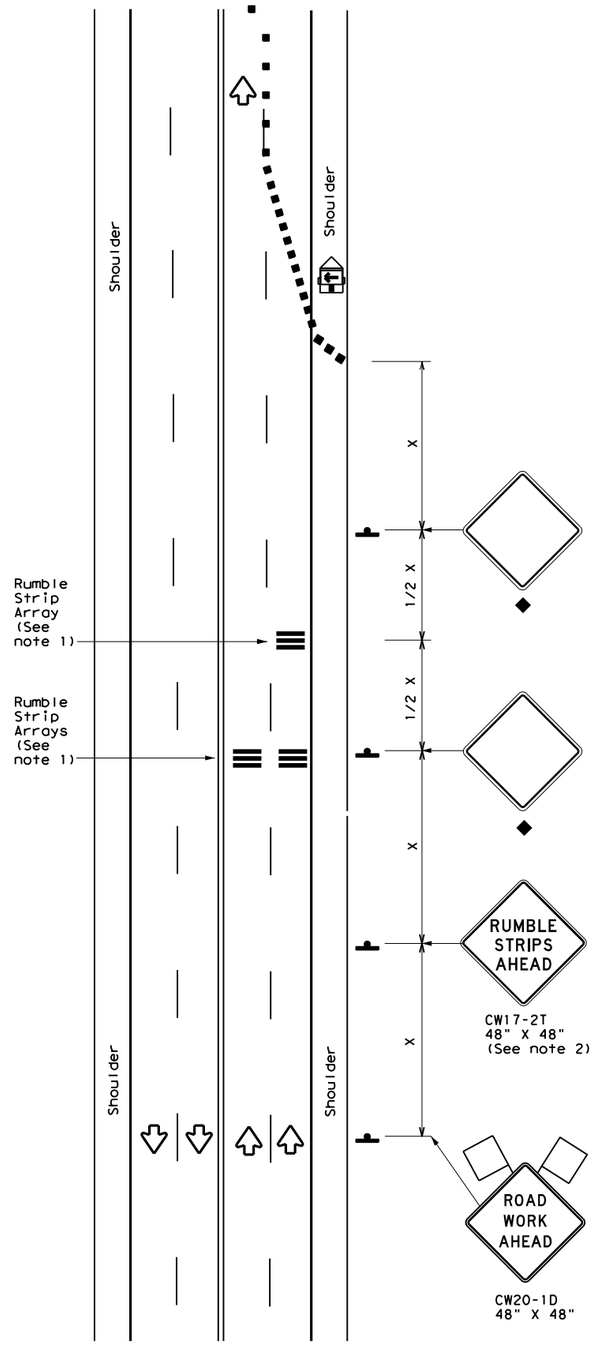
Warning sign and rumble strip sequence in opposite direction is same as below

TABLE 1		
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



WZ(RS-1a)
75 mph or Less

RUMBLE STRIPS ON ONE-LANE TWO-WAY APPLICATION



WZ(RS-1b)
75 mph or Less

RUMBLE STRIPS FOR LANE CLOSURE ON CONVENTIONAL ROADWAY

GENERAL NOTES

1. 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.
2. 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.
3. Temporary Rumble Strips will be considered subsidiary to Item 502, and shall be a product listed on the Compliant Work Zone Traffic Control Devices.
4. Removal of the Temporary Rumble Strips should be accomplished before removing the advance warning signs.
5. Temporary Rumble Strips should not be used on horizontal curves, loose gravel, soft or bleeding asphalt, heavily rutted pavements or unpaved surfaces.
6. Temporary Rumble Strips shall be installed and maintained as per manufacturer's recommendations.
7. This standard sheet shall be used in conjunction with other appropriate TCP standard, TMUTCD typical application or project specific detail for the project.
8. The one-lane two-way application may utilize a flagger, an AFAD or a portable traffic signal.
9. Temporary Rumble Strips may be used on freeways or expressways based on engineering judgment.

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

Posted Speed *	Formula	Minimum Desirable Taper Lengths ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent	Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
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
	✓	✓		

◆ **Signs are for illustrative purposes only. Signs required may vary depending on the TCP, TMUTCD Typical Application, or project specific details for the project.**

TABLE 2	
Speed	Approximate distance between strips in an Array
≤ 40 MPH	10'
> 40 MPH & ≤ 55 MPH	15'
> 55 MPH	20'

Texas Department of Transportation

Traffic Operations Division Standard

TEMPORARY RUMBLE STRIPS

WZ(RS)-16

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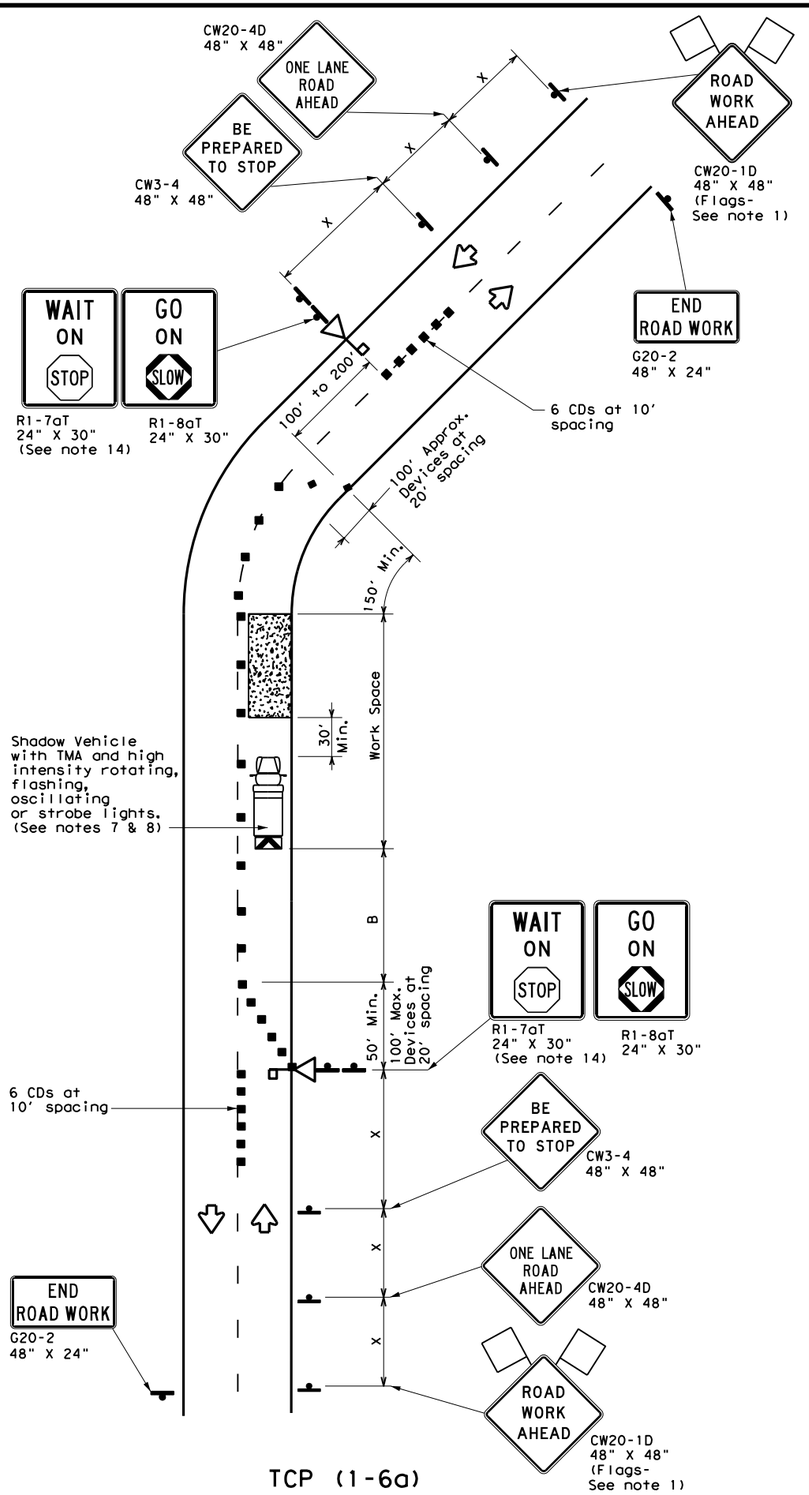
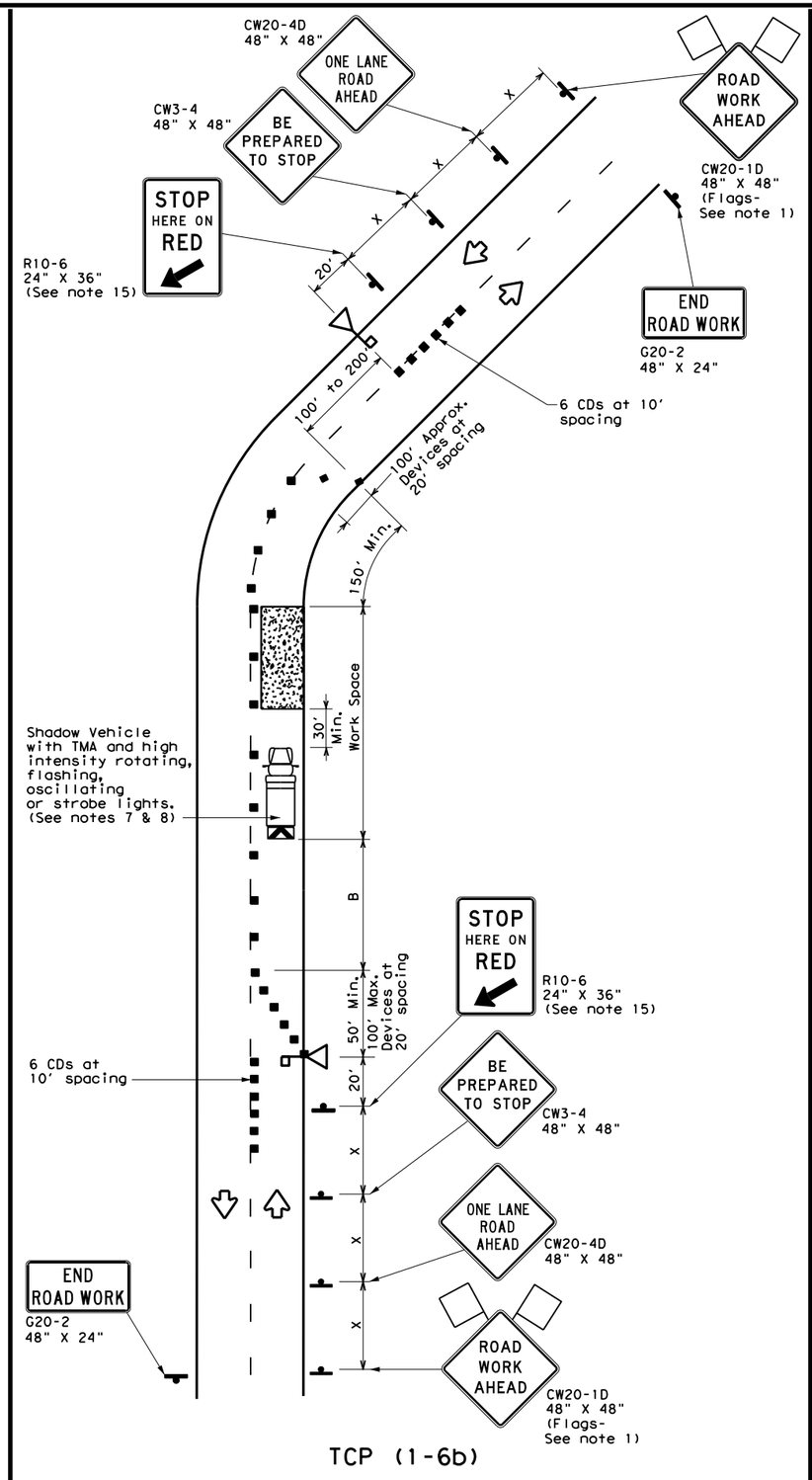


TCP (1-6a)

ONE LANE TWO-WAY CONTROL WITH STOP/SLOW AFADs



TCP (1-6b)

ONE LANE TWO-WAY CONTROL WITH RED/YELLOW LENS AFADs

LEGEND			
	Type 3 Barricade		Channelizing Devices (CDs)
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Automated Flagger Assistance Device (AFAD)	M	Portable Changeable Message Sign (PCMS)
	Sign		Traffic Flow
	Flag		Flagger

Posted Speed *	Formula	Minimum Desirable Taper Lengths ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent	Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
30	$L=\frac{WS^2}{60}$	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

1. Flags attached to signs where shown are REQUIRED.
2. AFADs shall only be used in situations where there is one lane of approaching traffic in the direction to be controlled.
3. Adequate stopping sight distance must be provided to each AFAD location for approaching traffic. (See table above).
4. Each AFAD shall be operated by a qualified/certified flagger. Flaggers operating AFADs shall not leave them unattended while they are in use.
5. One flagger may operate two AFADs only when the flagger has an unobstructed view of both AFADs and of the approaching traffic in both directions.
6. When pilot cars are used, a flagger controlling traffic shall be located on each approach. AFADs shall not be operated by the pilot car operator.
7. All AFADs shall be equipped with gate arms with an orange or fluorescent red-orange flag attached to the end of the gate arm. The flag shall be a minimum of 16" square.
8. 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.
9. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
10. Flaggers should use two-way radios or other methods of communication to control traffic.
11. Length of work space should be based on the ability of flaggers to communicate.
12. 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 AFAD.
13. Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
14. The R1-7aT "WAIT ON STOP" sign and the R1-8aT "GO ON SLOW" sign shall be installed at the AFAD location on separate supports or they may be fabricated as one 48" x 30" sign. They shall not obscure the face of the STOP/SLOW AFAD.
15. The R10-6 "STOP HERE ON RED" arrow sign shall be offset so as not to obscure the lenses of the AFAD.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN AUTOMATED FLAGGER ASSISTANCE DEVICES (AFADS)

TCP(1-6)-18

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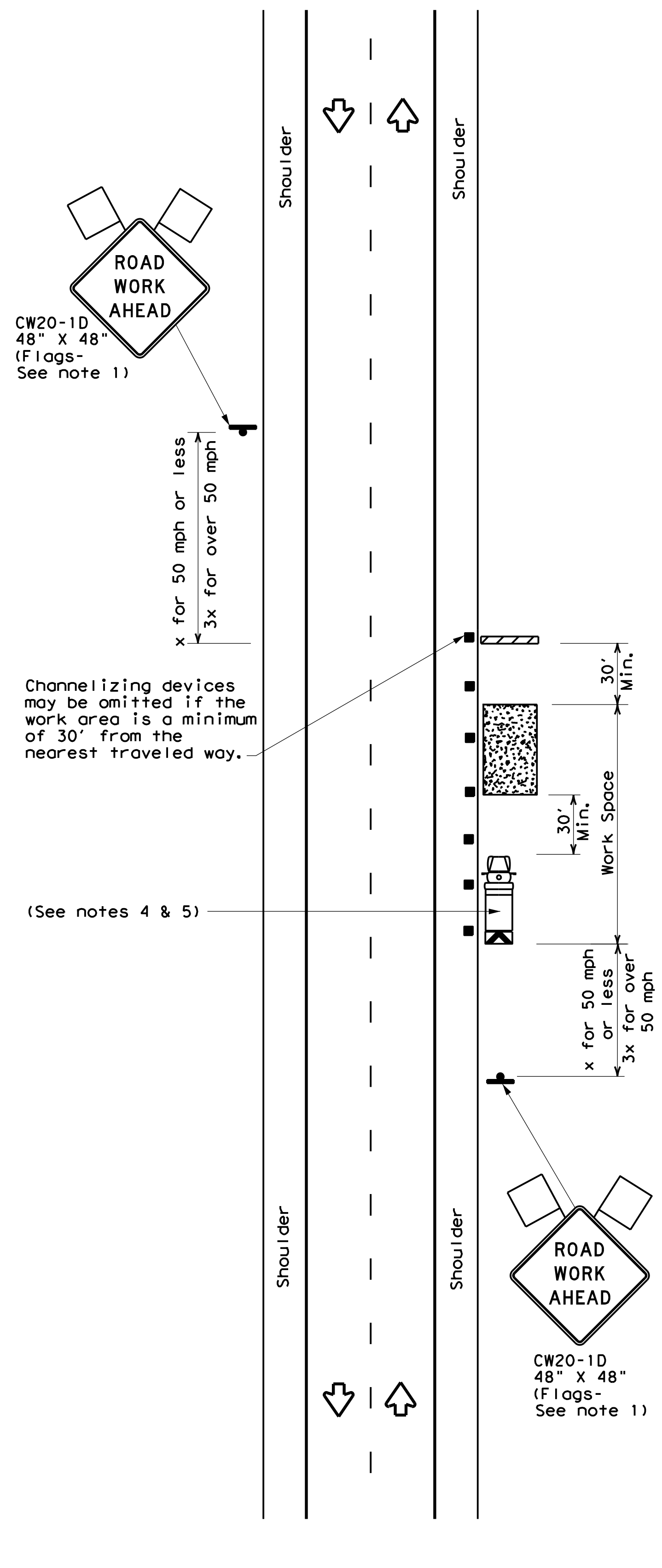
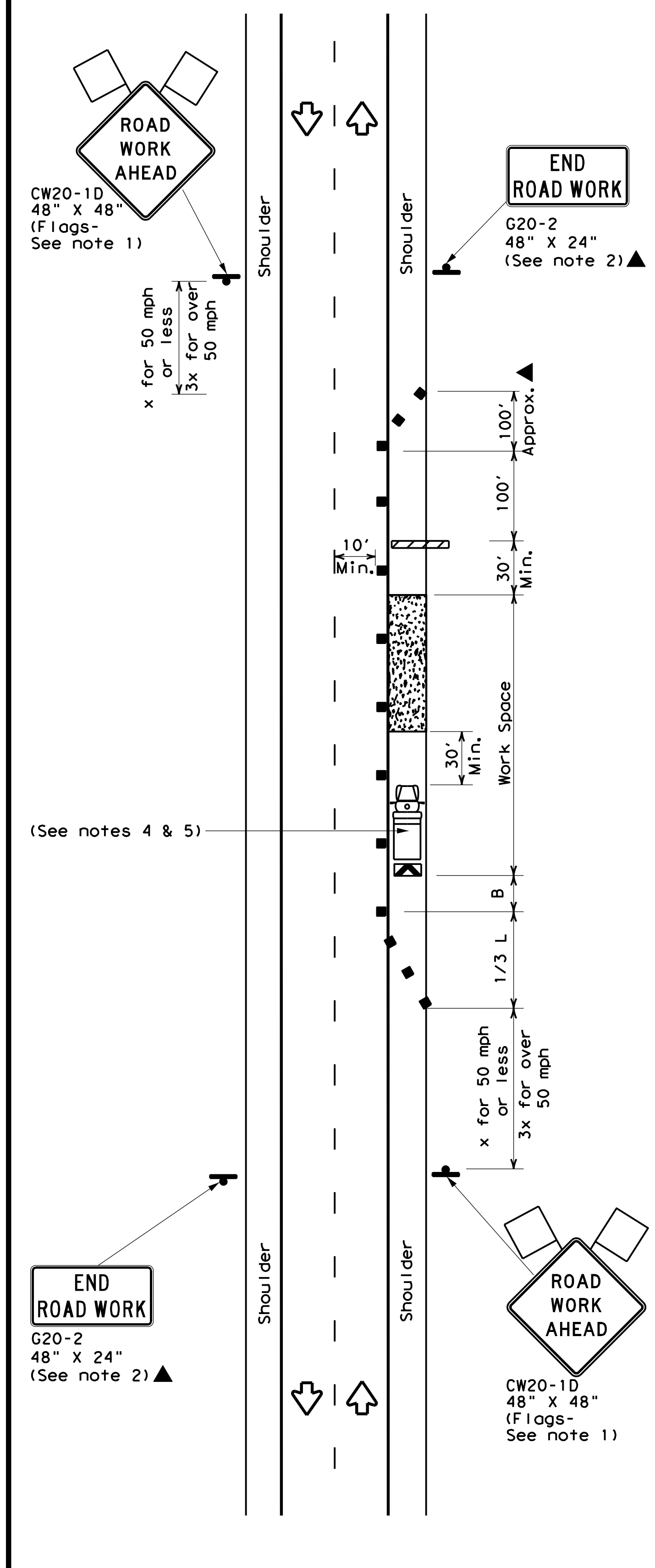


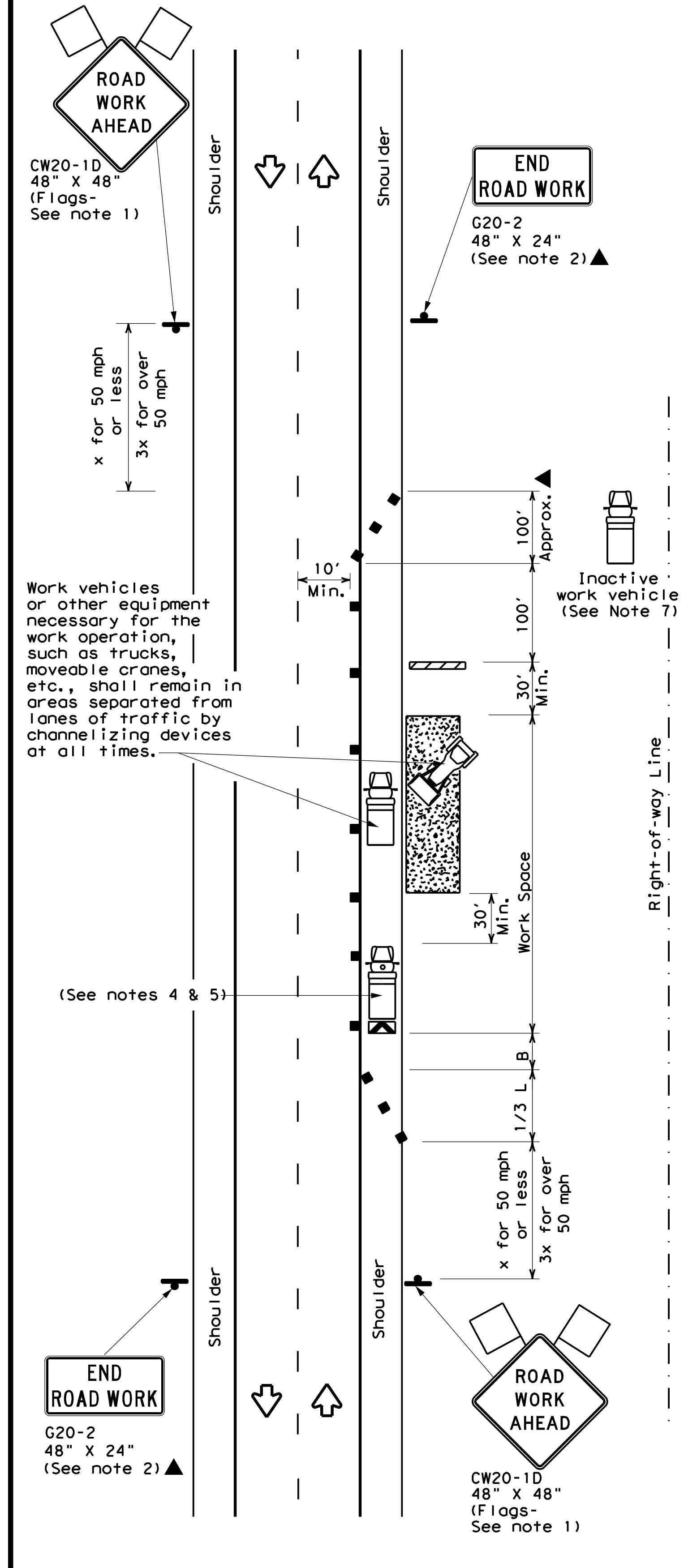
TCP (2-1a)

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

Symbol	Description	Symbol	Description
	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 ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent	Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
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

1. Flags attached to signs where shown, are REQUIRED.
2. 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.
3. Stockpiled material should be placed a minimum of 30 feet from nearest traveled way.
4. 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.
5. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.
6. See TCP(5-1) for shoulder work on divided highways, expressways and freeways.
7. Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
8. CW21-5 "SHOULDER WORK" signs may be used in place of CW20-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.

Texas Department of Transportation — Traffic Operations Division Standard

TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

TCP(2-1)-18

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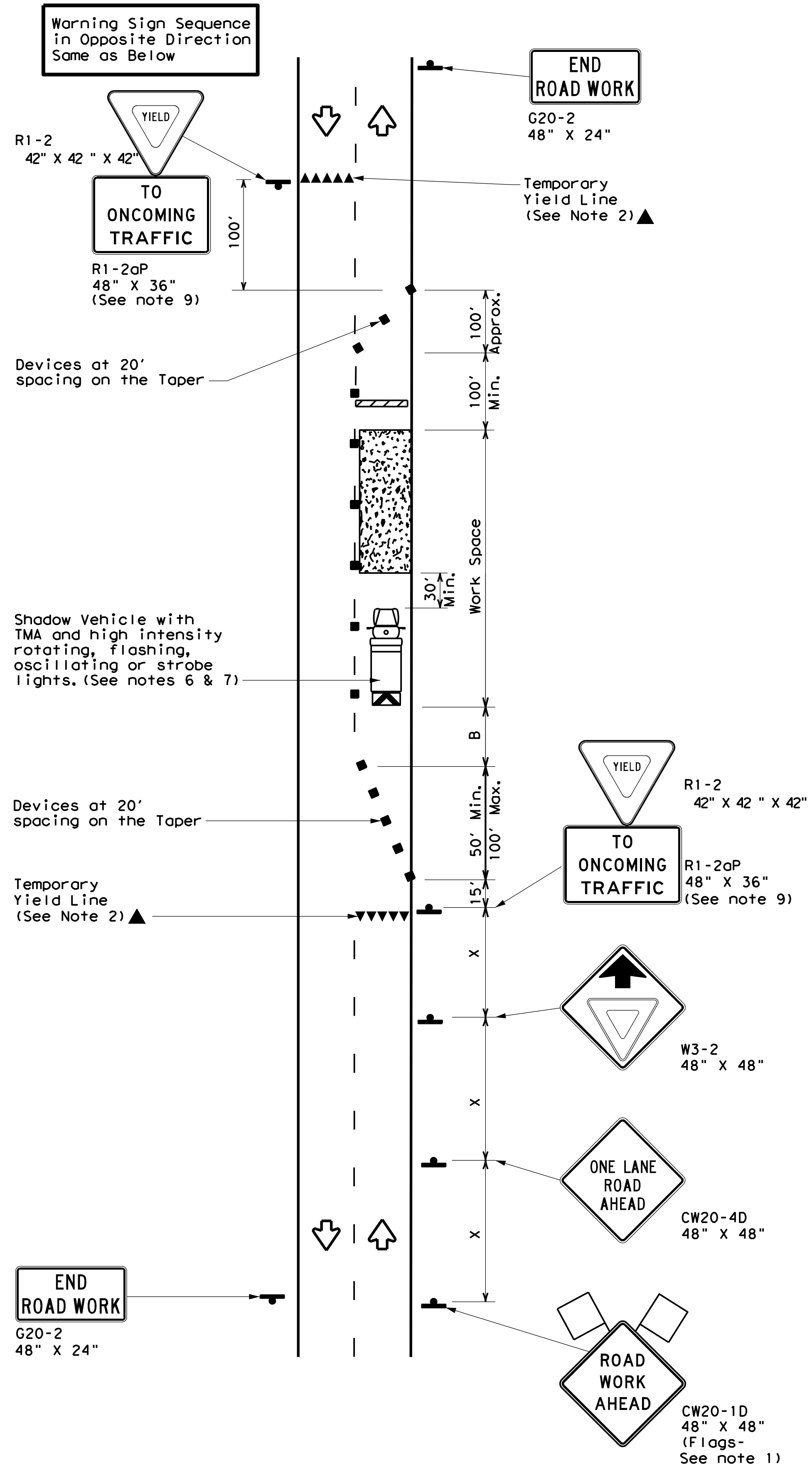
	DAL		KAUFMAN	47

161



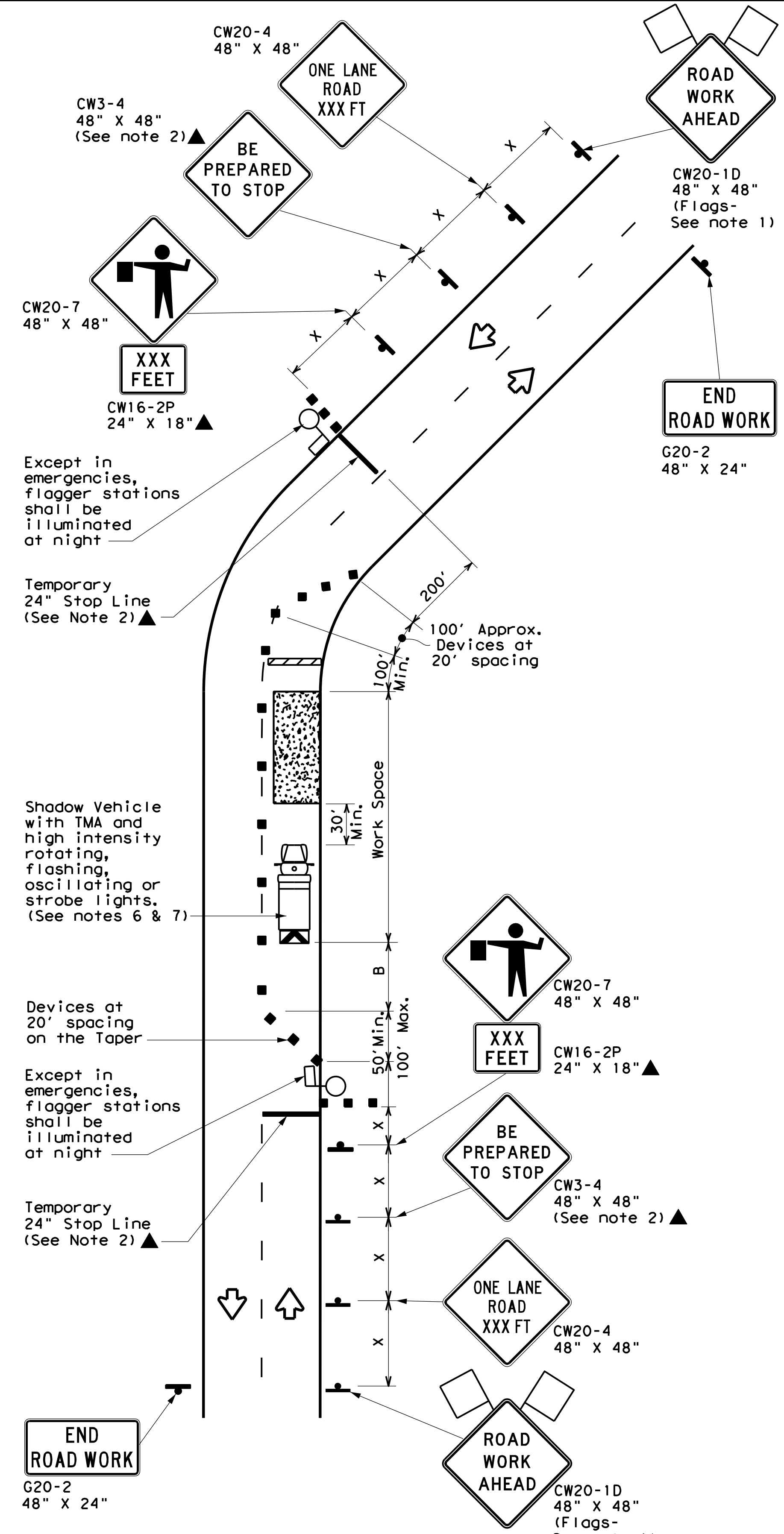
TCP (2-2a)

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	$L = \frac{WS^2}{60}$	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

1. Flags attached to signs where shown, are REQUIRED.
2. 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.
3. 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.
4. Flaggers should use two-way radios or other methods of communication to control traffic.
5. Length of work space should be based on the ability of flaggers to communicate.
6. 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.
7. 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)

8. 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.
9. The R1-2aP "YIELD TO ONCOMING TRAFFIC" sign shall be placed on a support at a 7 foot minimum mounting height.

TCP (2-2b)

10. Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
11. 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).
12. Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situtations.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN ONE-LANE TWO-WAY TRAFFIC CONTROL

TCP(2-2)-18

FILE: tcp2-2-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03 1-97 2-12 4-98 2-18	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		48

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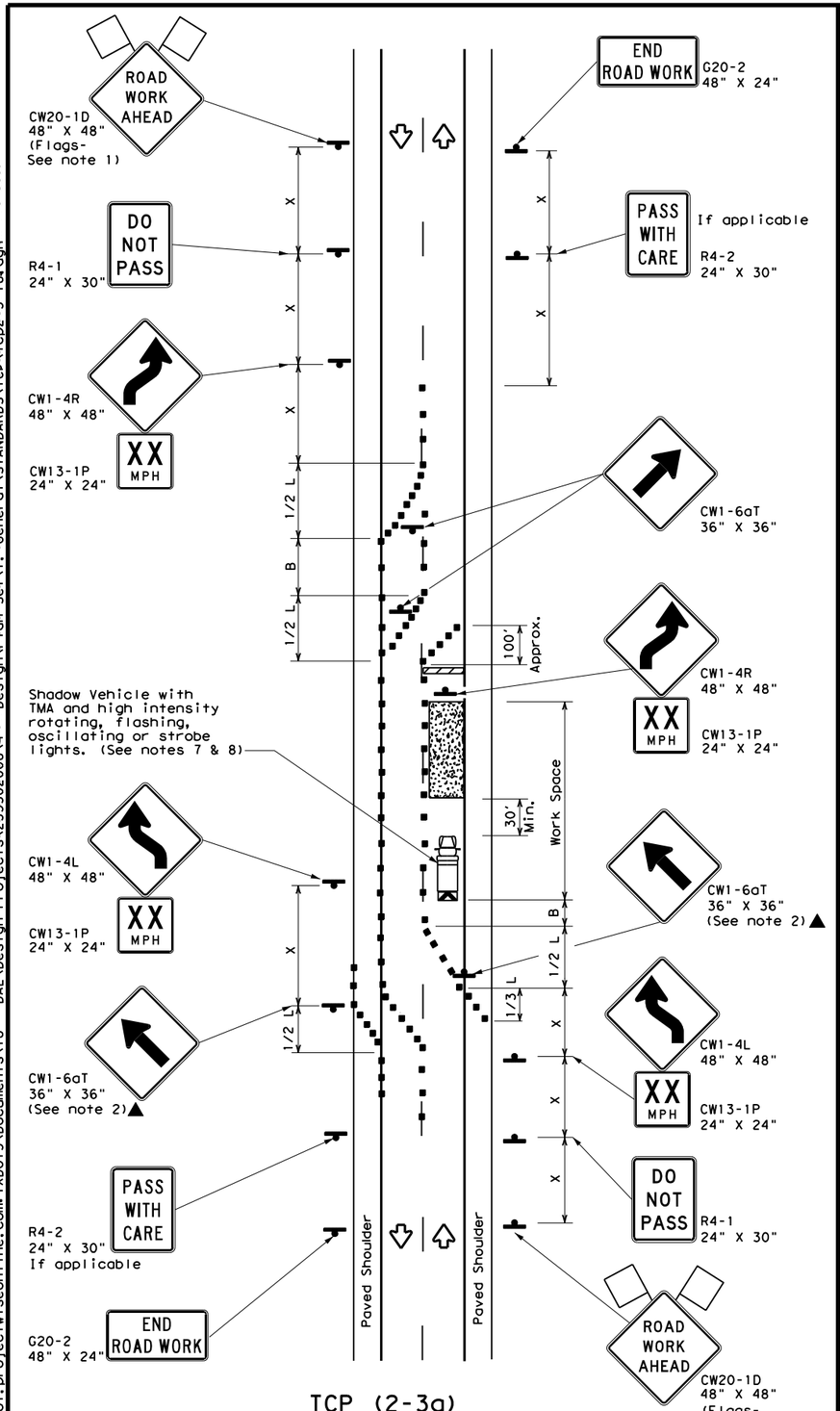
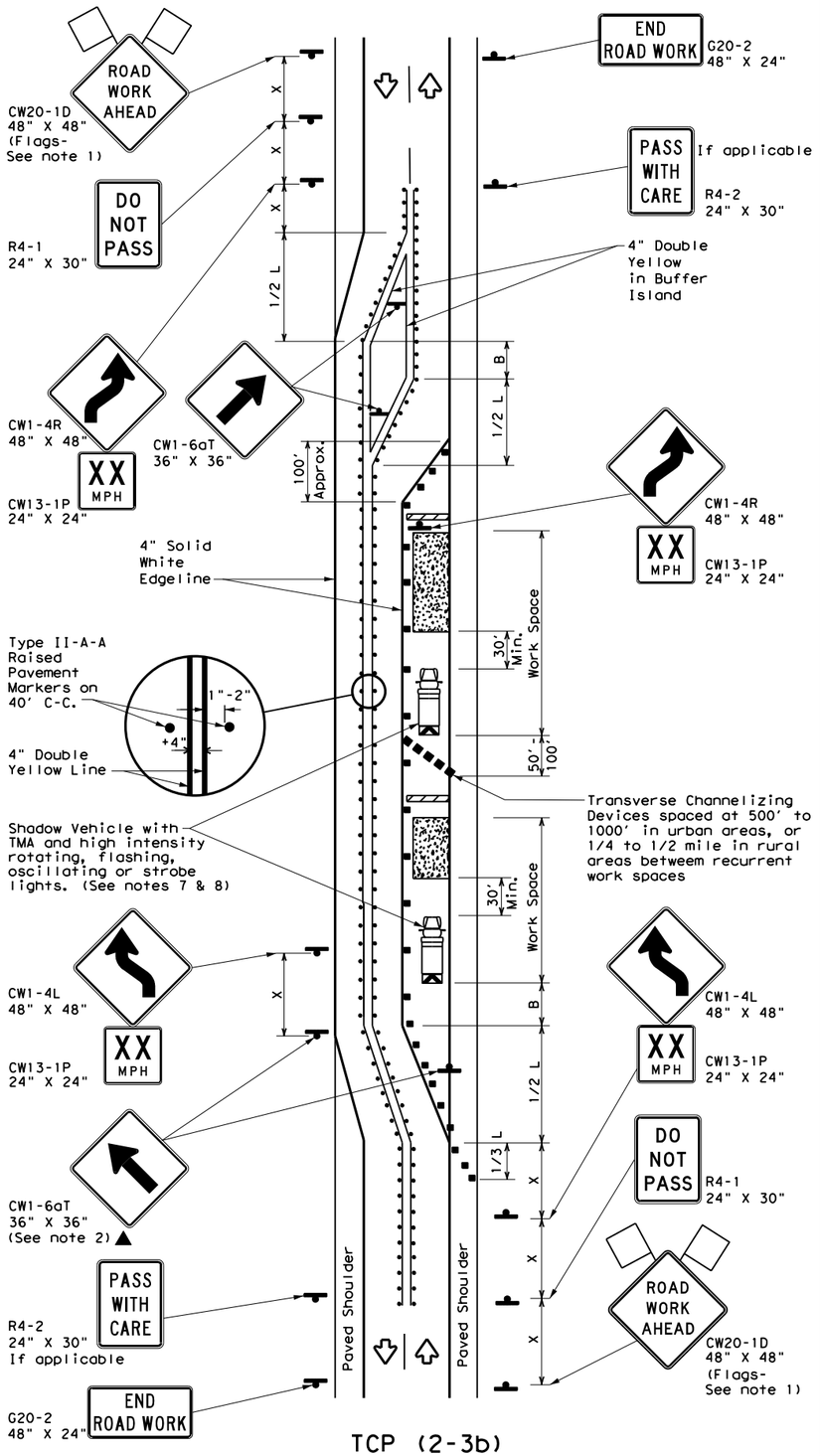


TCP (2-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS

ONE LANE CLOSED
ADEQUATE FIELD OF VIEW



TCP (2-3b)
2-LANE ROADWAY WITH PAVED SHOULDERS

ONE LANE CLOSED
INADEQUATE FIELD OF VIEW

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 ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent	Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
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
				TCP(2-3b)ONLY
			✓	✓

GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. 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.
3. 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.
4. 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.
5. 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.
6. Conflicting pavement marking shall be removed for long term projects.
7. 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.
8. 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)

9. 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.

Texas Department of Transportation — *Traffic Operations Division Standard*

TRAFFIC CONTROL PLAN TRAFFIC SHIFTS ON TWO-LANE ROADS

TCP(2-3)-18

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
8-95 3-03	DIST	COUNTY		SHEET NO.
1-97 2-12	DAL	KAUFMAN		49
4-98 2-18				

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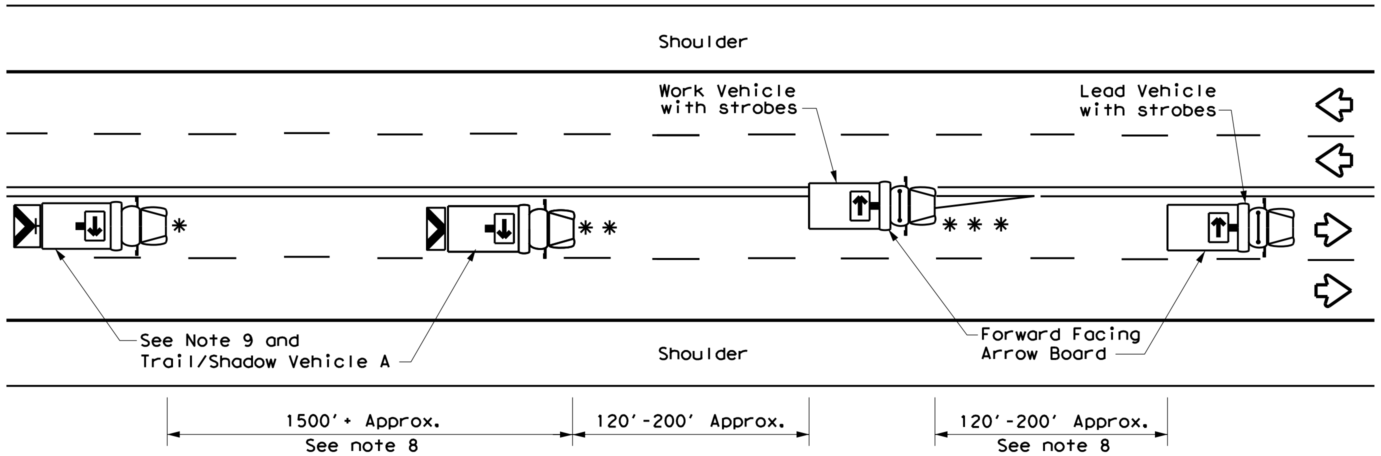
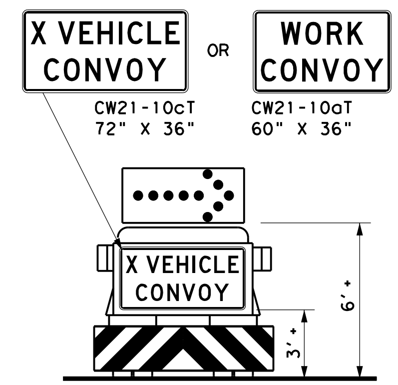


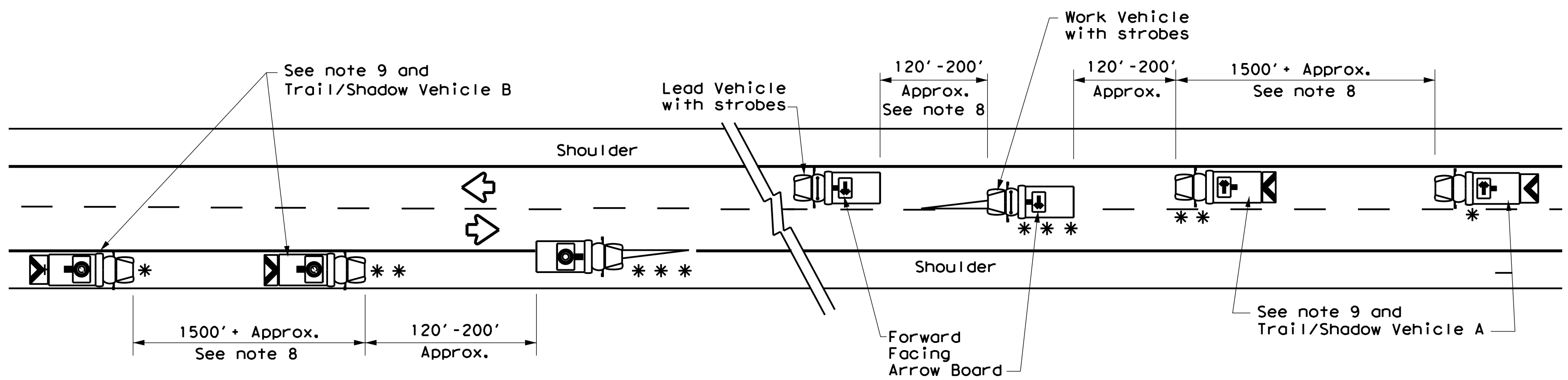
TCP (3-1a)

UNDIVIDED MULTILANE ROADWAY



TRAIL/SHADOW VEHICLE A

with RIGHT Directional display Flashing Arrow Board

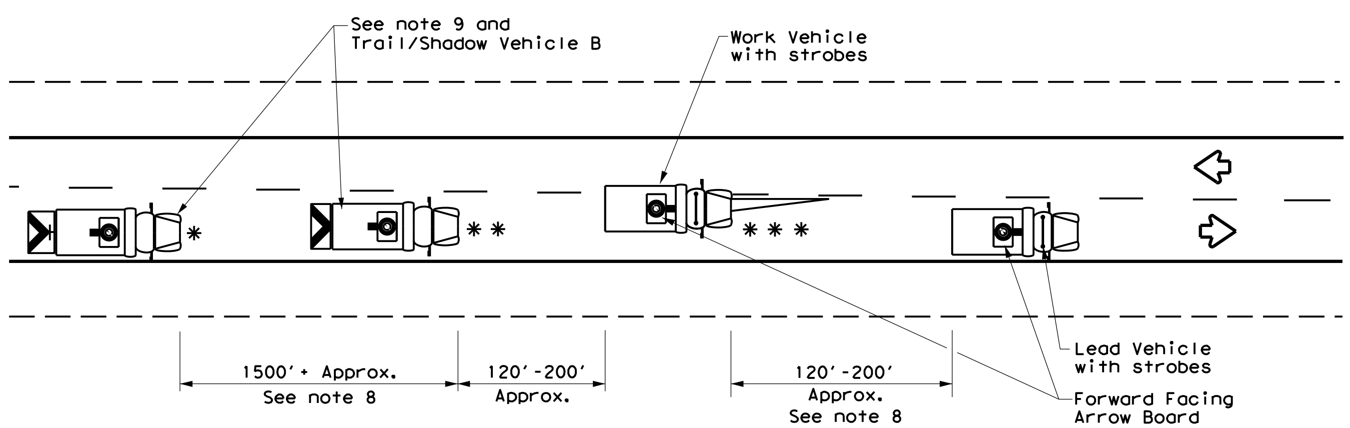


WORK ON SHOULDER

WORK ON TRAVEL LANE

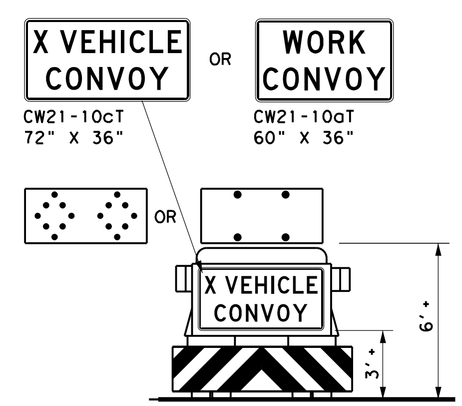
TCP (3-1b)

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

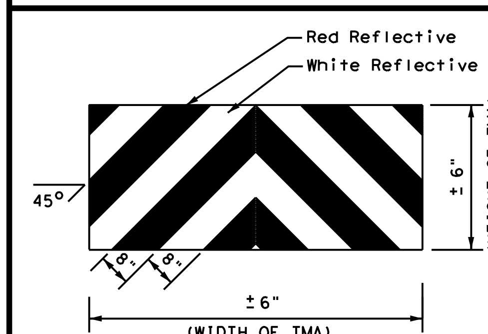
LEGEND

Symbol	Description	Symbol	Arrow Board Display
*	Trail Vehicle		ARROW BOARD DISPLAY
* *	Shadow Vehicle		
* * *	Work Vehicle	[→]	RIGHT Directional
[vehicle]	Heavy Work Vehicle	[←]	LEFT Directional
[TMA]	Truck Mounted Attenuator (TMA)	[↔]	Double Arrow
[arrow]	Traffic Flow	[◉]	CAUTION (Alternating Diamond or 4 Corner Flash)

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

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.



STRIPING FOR TMA

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS UNDIVIDED HIGHWAYS

TCP(3-1)-13

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 7-13 1-97	2355	01	006, ETC.	FM 2451
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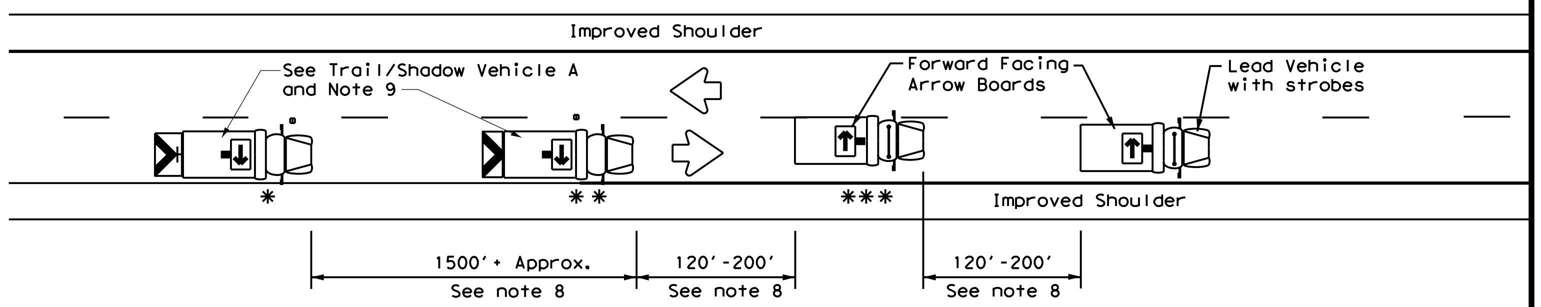
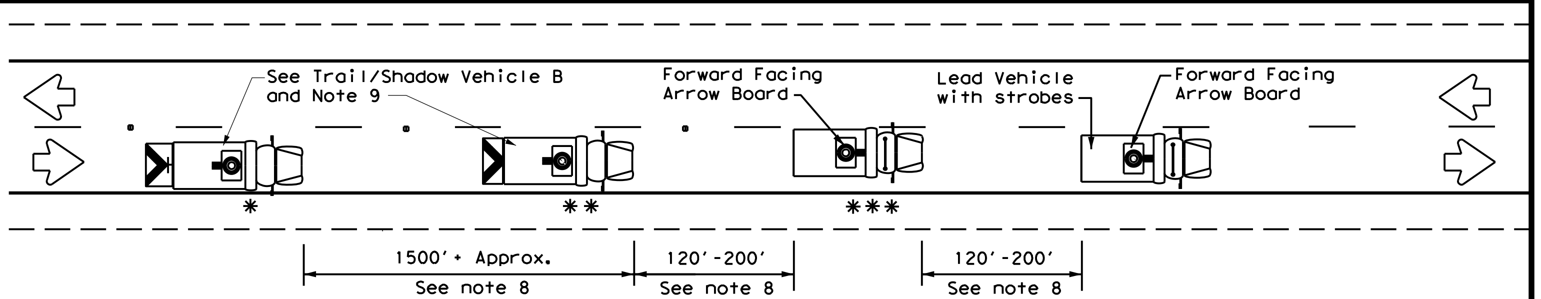
	DAL		KAUFMAN	50



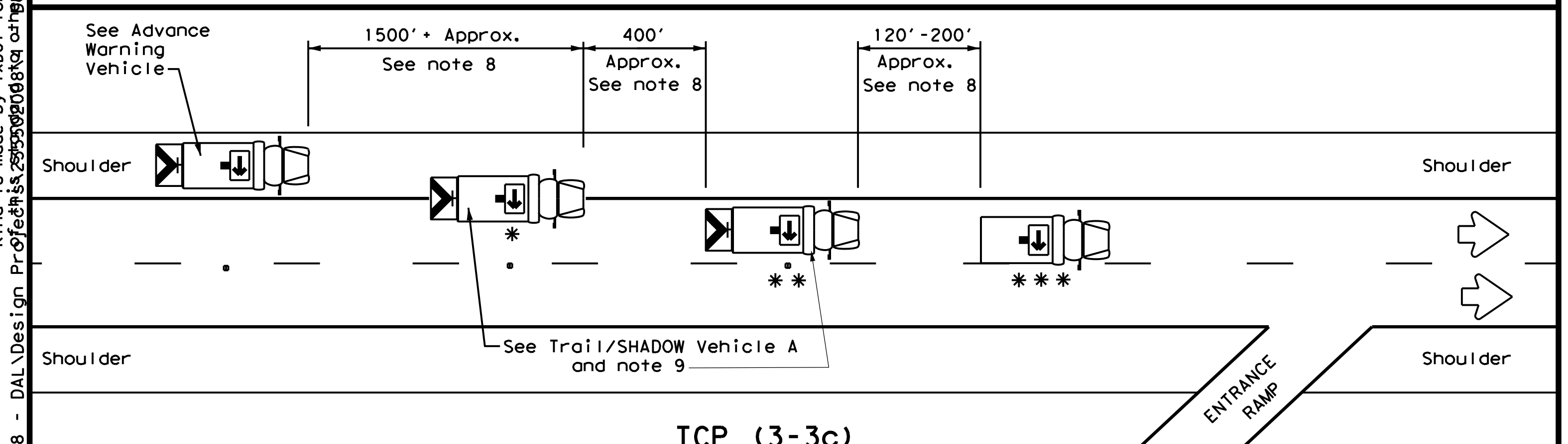
TCP (3-3a)

TWO LANE HIGHWAY WITH PAVED SHOULDERS
(WORK ON TRAVEL LANE)



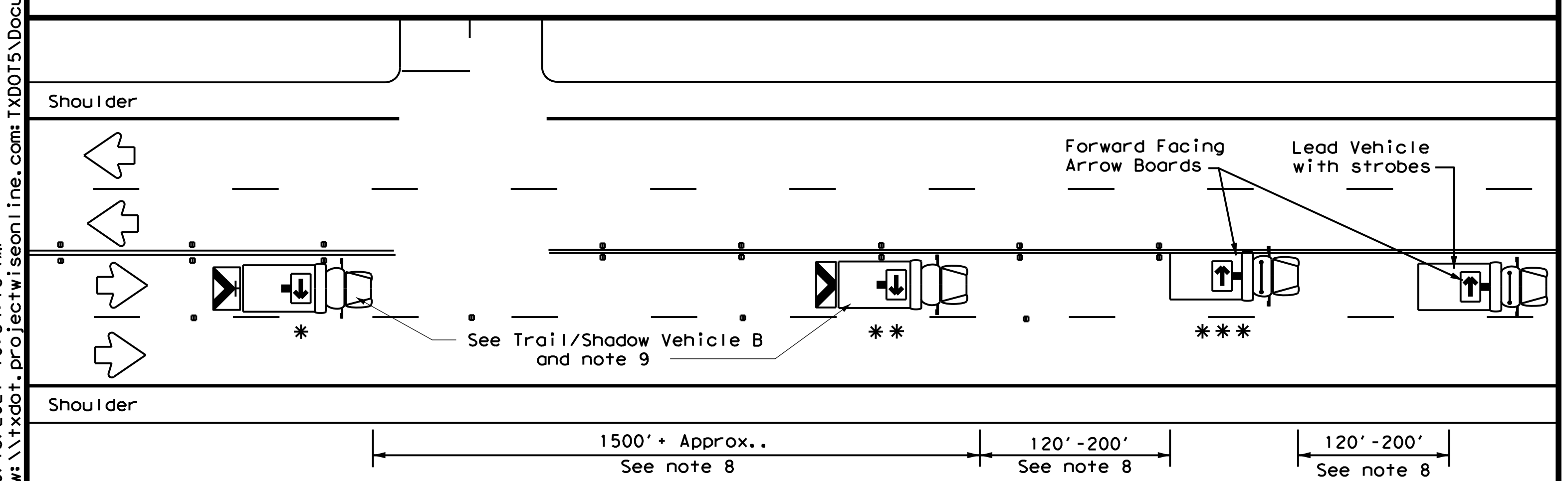
TCP (3-3b)

TWO LANE HIGHWAY WITHOUT PAVED SHOULDERS
(WORK ON TRAVEL LANE)



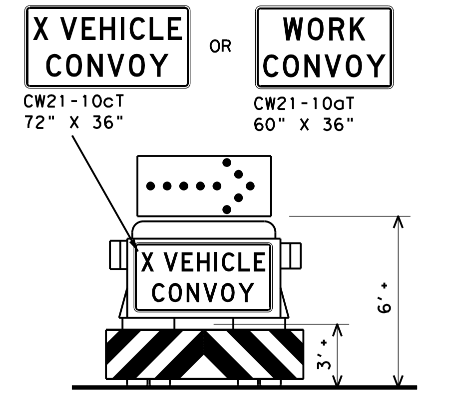
TCP (3-3c)

DIVIDED MULTILANE HIGHWAY



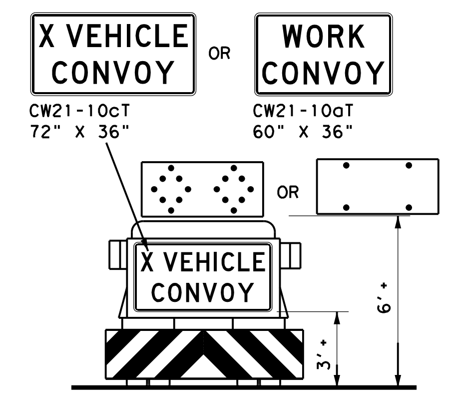
TCP (3-3d)

UNDIVIDED MULTILANE HIGHWAY



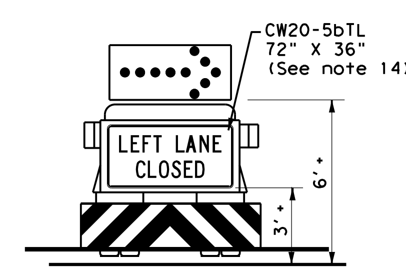
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display Flashing Arrow Board

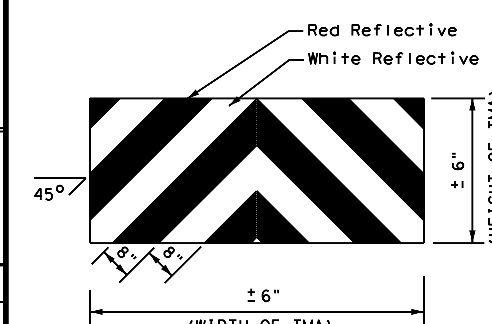


TRAIL/SHADOW VEHICLE B

with Flashing Arrow Board in Caution Mode



ADVANCE WARNING VEHICLE



STRIPING FOR TMA

LEGEND

Symbol	Description	ARROW BOARD DISPLAY	
*	Trail Vehicle		
**	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
✓				

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

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©TxDOT September 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 7-13 1-97 7-14	2355	01	006, ETC.	FM 2451
	DIST		COUNTY	SHEET NO.
	DAL		KAUFMAN	51

177

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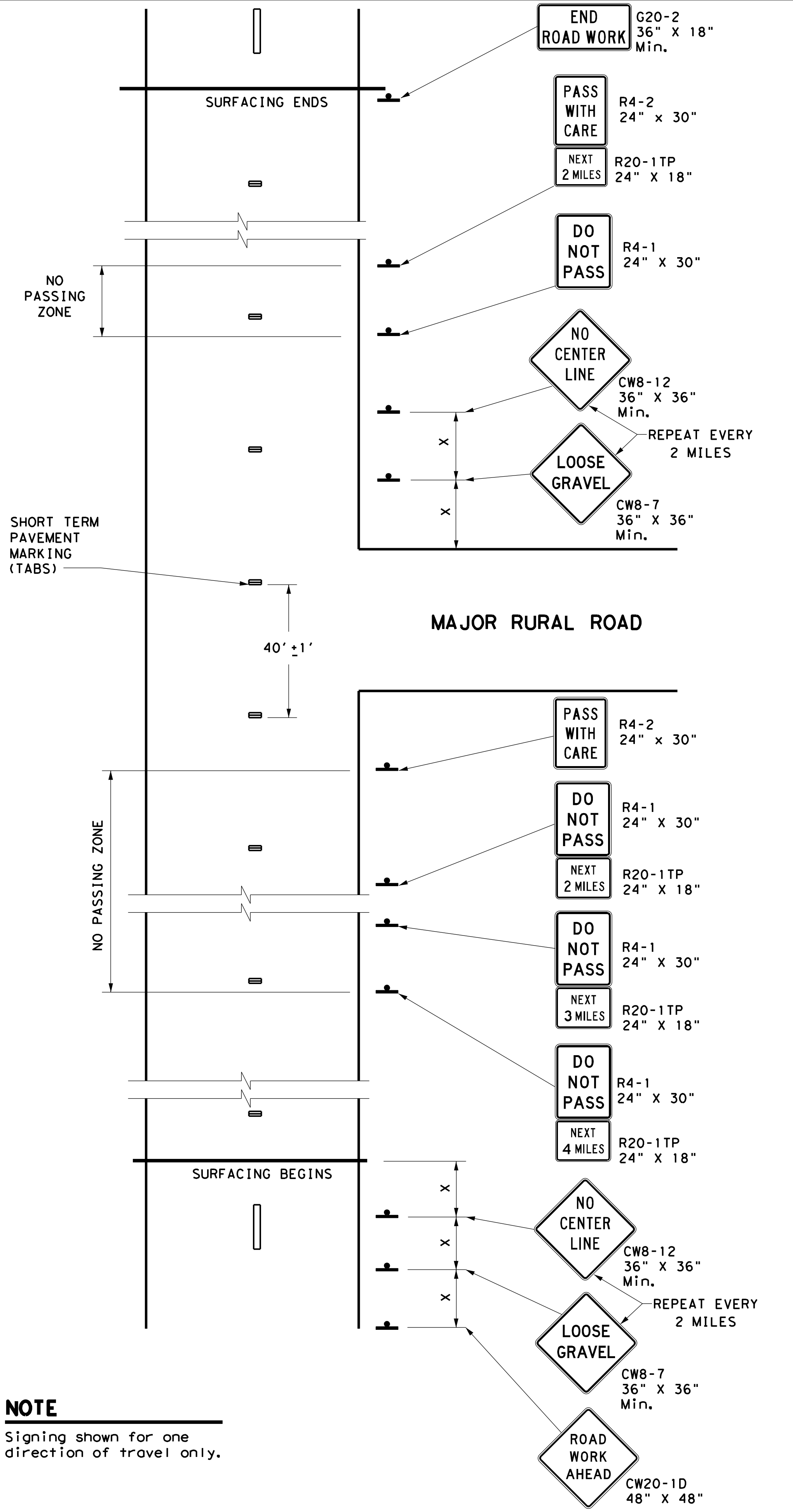
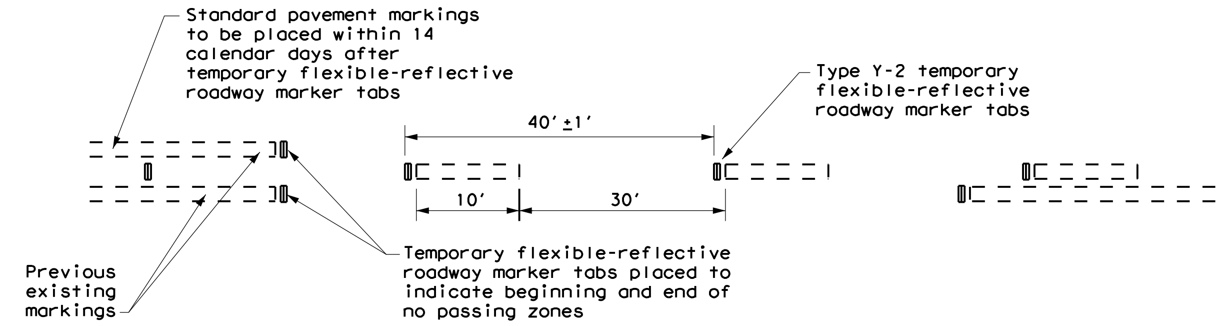


NOTE

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.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL DETAILS FOR SURFACING OPERATIONS

TCP(7-1)-13

FILE: tcp7-1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT March 1991	CONT 2355	SECT 01	JOB 006, ETC.	HIGHWAY FM 2451
REVISIONS 4-92 4-98 1-97 7-13	DIST DAL	COUNTY KAUFMAN		SHEET NO. 52

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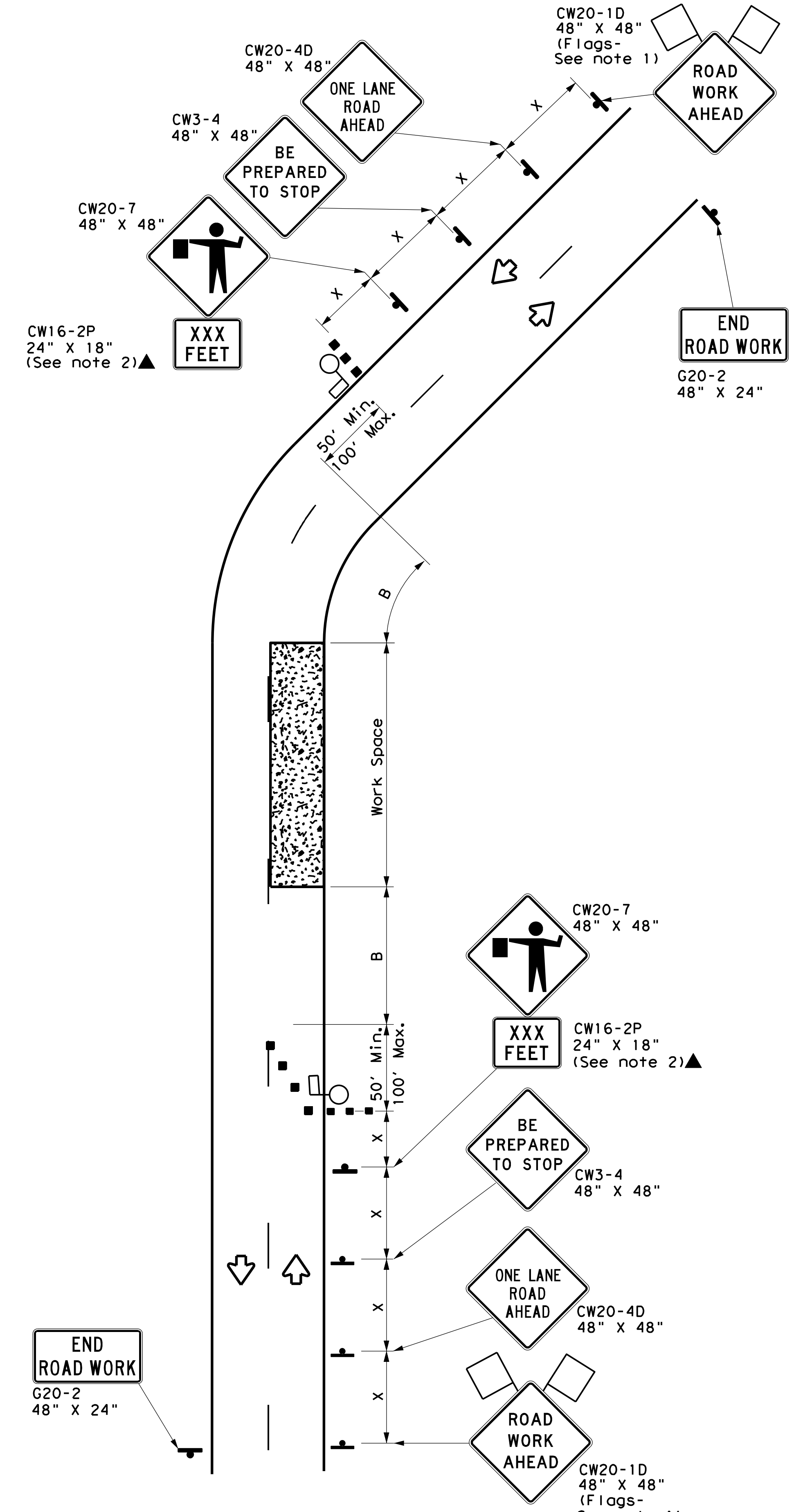
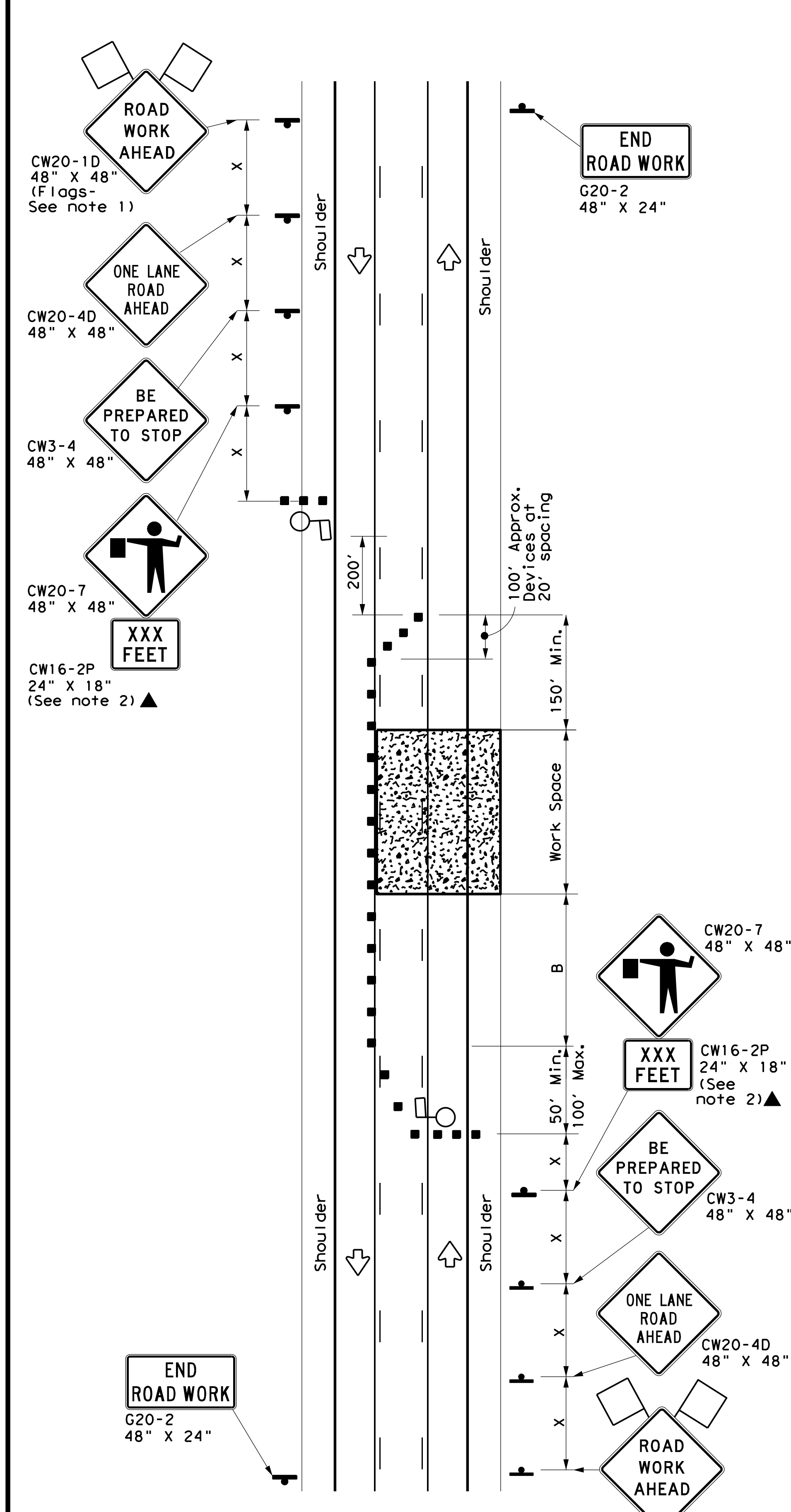


TCP(SC-1a)

ONE LANE TWO-WAY (2 LANES)
CONTROL WITH PILOT VEHICLE



TCP(SC-1b)

ONE LANE TWO-WAY (3 LANES)
CONTROL WITH PILOT VEHICLE
AND CHANNELIZING DEVICES

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	$L=\frac{WS^2}{60}$	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

1. Flags attached to signs where shown are REQUIRED.
2. 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.
3. The CW3-4 "BE PREPARED TO STOP" sign may be installed after the CW20-4D "ONE LANE ROAD AHEAD" sign, but proper sign spacing shall be maintained.
4. Sign spacing may be increased or an additional CW20-1D "ROAD WORK AHEAD" sign may be used if advance warning ahead of the flagger sign is less than 1500 feet.
5. Flaggers should use two-way radios or other methods of communication at all times to control traffic.
6. Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situations.
7. If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain adequate stopping sight distance to the flagger and a queue of stopped vehicles (see table above).
8. If the seal coat operation crosses intersections, traffic in these areas must be controlled, Care must be taken to prevent vehicles from crossing the asphalt before the aggregate is placed. This may require positioning other member of the traffic control crew at the intersection.
9. Temporary rumble strips are not required on seal coat operations.
10. Pilot car is used to guide vehicles through traffic control zone, vehicle shall have an identification name displayed and "PILOT CAR, FOLLOW ME" (G20-4) sign or message board mounted in a conspicuous position on rear.

TCP (SC-1a)

1. Channelizing devices on the center-line may be omitted when a pilot car is leading traffic.

SHEET 1 OF 7

Texas Department of Transportation — Traffic Safety Division Standard

TRAFFIC CONTROL PLAN SEAL COAT OPERATIONS

TCP(SC-1)-21

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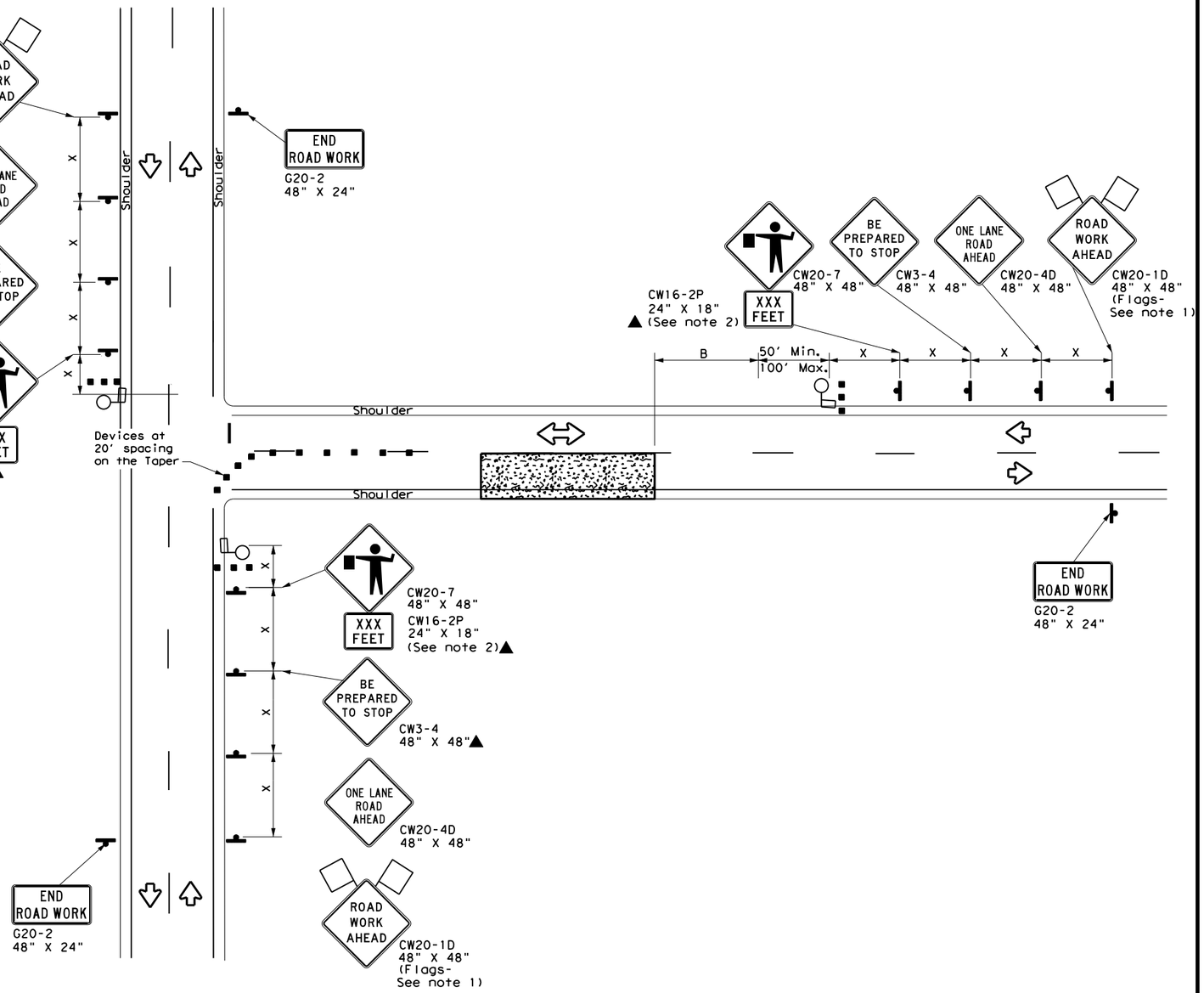

ONE LANE TWO-WAY (T-INTERSECTION) CONTROL WITH PILOT VEHICLE

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 ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent	Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
30	$L=\frac{WS^2}{60}$	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

1. Flags attached to signs where shown are REQUIRED.
2. 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.
3. The CW3-4 "BE PREPARED TO STOP" sign may be installed after the CW20-4D "ONE LANE ROAD AHEAD" sign, but proper sign spacing shall be maintained.
4. Flaggers should use two-way radios or other methods of communication at all times to control traffic.
5. Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situations.
6. If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain adequate stopping sight distance to the flagger and a queue of stopped vehicles (see table above).
7. Temporary rumble strips are not required on seal coat operations.
8. Pilot car is used to guide vehicles through traffic control zone, vehicle shall have an identification name displayed and "PILOT CAR, FOLLOW ME" (G20-4) sign or message board mounted in a conspicuous position on rear.

Texas Department of Transportation | Traffic Safety Division Standard

TRAFFIC CONTROL PLAN SEAL COAT OPERATIONS

TCP(SC-4)-21

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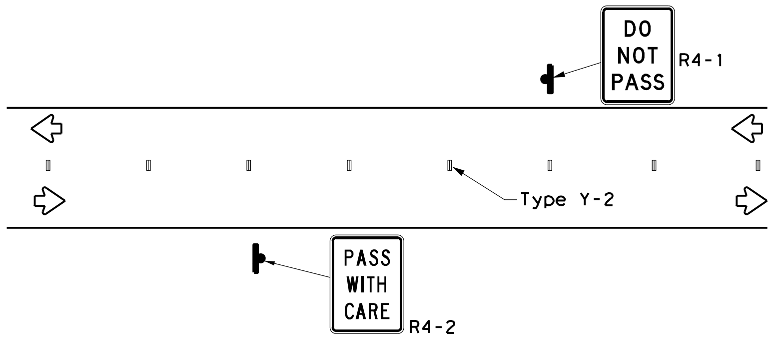
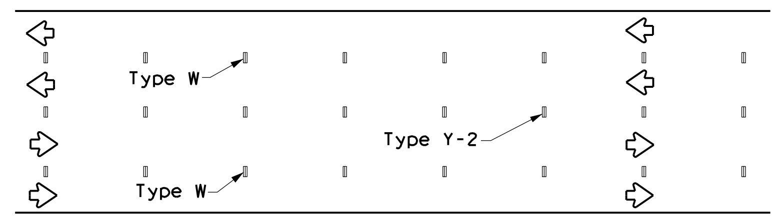
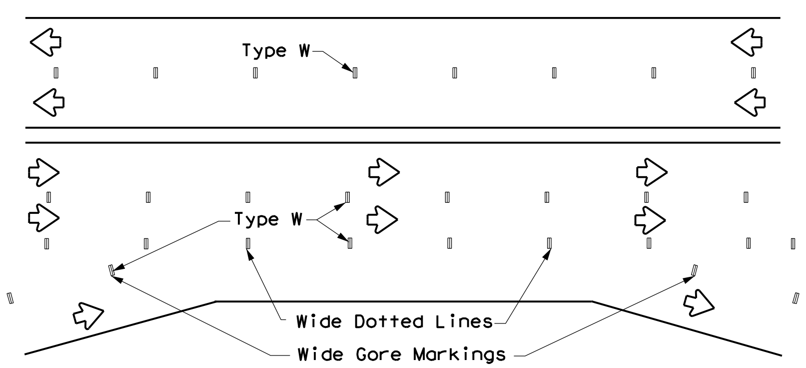
WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS (TABS)



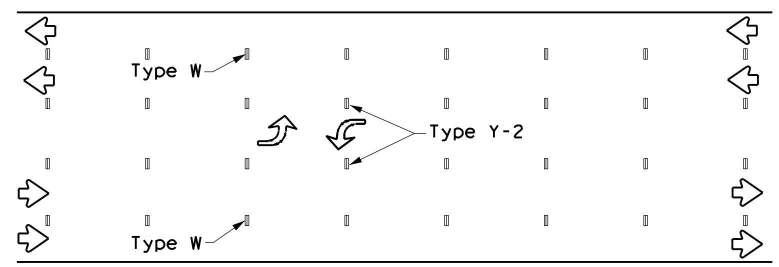
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



LANE LINES FOR DIVIDED HIGHWAY

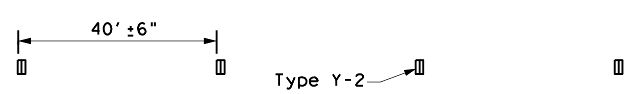


TWO-WAY LEFT TURN LANE

WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS (TABS)

SOLID LINES

DOUBLE NO-PASSING LINE



SINGLE NO-PASSING LINE or CHANNELIZATION LINE

BROKEN LINES
(FOR CENTER LINE OR LANE LINE)

WIDE DOTTED LINES
(FOR LANE DROP LINES)

WIDE GORE MARKINGS

NOTES:

1. Short term pavement markings shall be temporary flexible-reflective roadway marker tabs with protective cover unless otherwise specified elsewhere in plans.
2. Short term pavement markings shall NOT be used to simulate edge lines.
3. Dimensions indicated on this sheet are typical and approximate. Variations in size and height may occur between markers or devices made by manufacturers, by as much as 1/4 inch, unless otherwise noted.
4. Temporary flexible-reflective roadway marker tabs will require normal maintenance replacement when used on roadways with an ADT per lane of up to 7500 vehicles with no more than 10% truck mix. When roadways exceed these values, additional maintenance replacement of devices should be planned.
5. No segment of roadway open to traffic shall remain without permanent pavement markings for a period greater than 14 calendar days. The Contractor will be responsible for maintaining short term pavement markings until permanent pavement markings are in place. When the Contractor is responsible for placement of permanent pavement markings, no segment of roadway shall remain without permanent pavement markings for a period greater than 14 calendar days unless weather conditions prohibit placement. Permanent pavement markings shall be placed as soon as weather permits.
6. For 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)

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

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

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

SHEET 6 OF 7

Texas Department of Transportation
Traffic Safety Division Standard

WORK ZONE SHORT TERM PAVEMENT MARKINGS FOR SEAL COAT OPERATIONS

TCP(SC-6)-21

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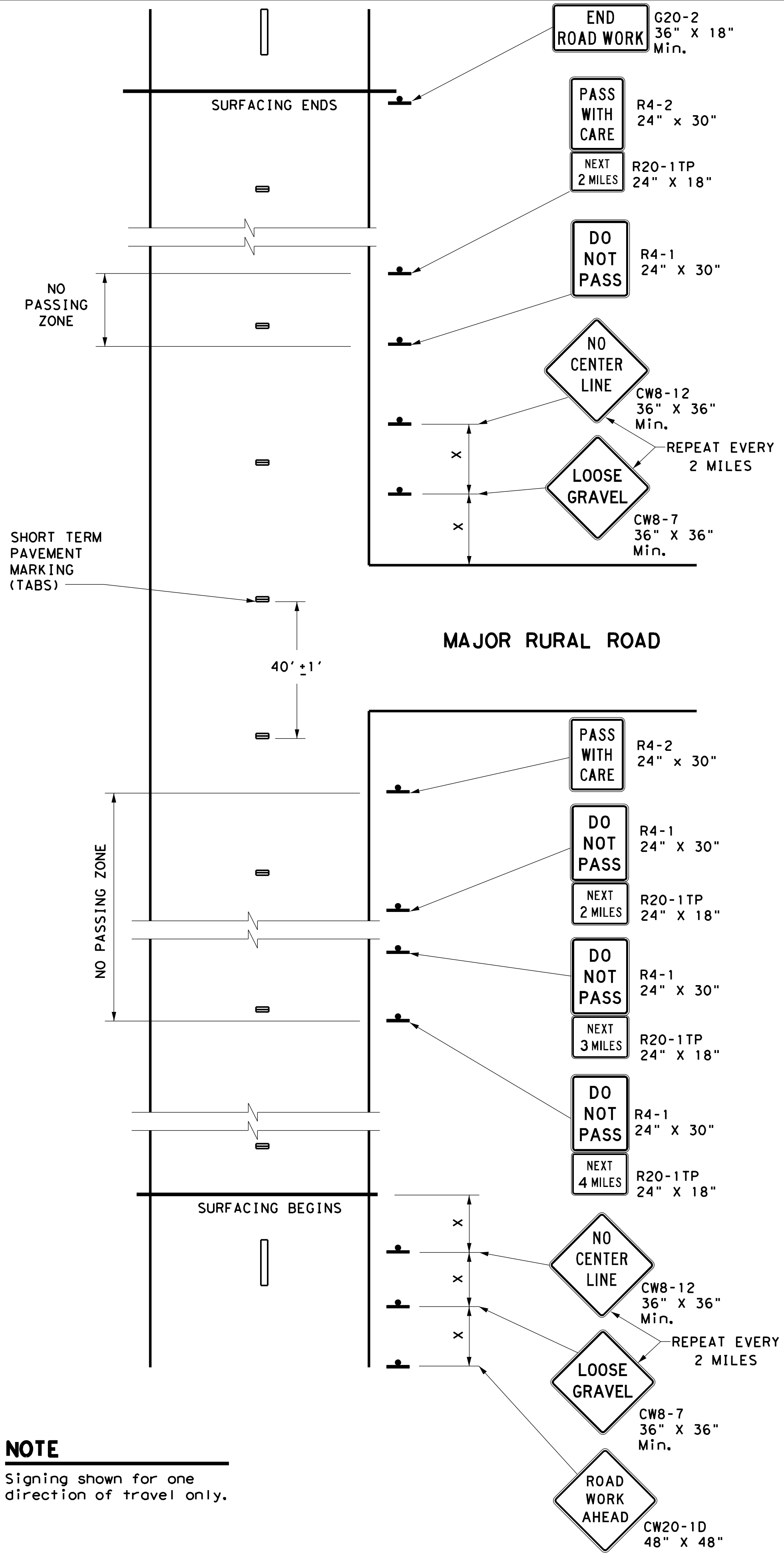
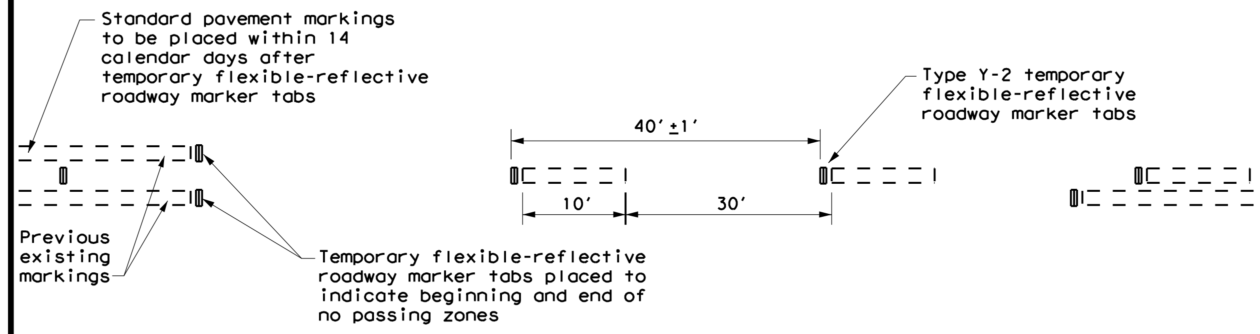


NOTE

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 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.

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 Short Duration / Short Term Stantionary 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.

SHEET 7 OF 7

Texas Department of Transportation — Traffic Safety Division Standard

TRAFFIC CONTROL DETAILS FOR SEAL COAT OPERATIONS

TCP(SC-7)-21

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CCSJ: 2355-01-006 FM 2451 HORIZONTAL ALIGNMENT DATA

Beginning chain 006*ROSSER description
Feature: Geom*Centerline

Point 20 N 6,858,106.6579 E 2,599,754.5245 Sta 49+10.00

Course from 20 to PC 006*ROSSER*3 N 59° 58′ 29.11" E Dist 667.3440

Curve 006*ROSSER*3			Curve Data				
P.I. Station			56+89.55	N	6,858,496.7312	E	2,600,429.4641
Delta	=	90° 06′ 21.99"	(RT)				
Degree	=	51° 09′ 25.01"					
Tangent	=	112.2076					
Length	=	176.1366					
Radius	=	112.0000					
External	=	46.5388					
Long Chord	=	158.5385					
Mid. Ord.	=	32.8774					
P.C. Station			55+77.34	N	6,858,440.5846	E	2,600,332.3142
P.T. Station			57+53.48	N	6,858,399.4775	E	2,600,485.4307
C.C.				N	6,858,343.6144	E	2,600,388.3570
Back	= N	59° 58′ 29.11" E					
Ahead	= S	29° 55′ 08.90" E					
Chord Bear	= S	74° 58′ 19.90" E					

Course from PT 006*ROSSER*3 to PC 006*ROSSER*6 S 29° 55′ 08.90" E Dist 1,775.6276

Curve 006*ROSSER*6			Curve Data				
P.I. Station			80+87.91	N	6,856,376.1604	E	2,601,649.7892
Delta	=	60° 36′ 50.37"	(LT)				
Degree	=	5° 59′ 35.82"					
Tangent	=	558.7979					
Length	=	1,011.3655					
Radius	=	956.0000					
External	=	151.3351					
Long Chord	=	964.8584					
Mid. Ord.	=	130.6528					
P.C. Station			75+29.11	N	6,856,860.4874	E	2,601,371.0735
P.T. Station			85+40.47	N	6,856,381.3599	E	2,602,208.5629
C.C.				N	6,857,337.3185	E	2,602,199.6675
Back	= S	29° 55′ 08.90" E					
Ahead	= N	89° 28′ 00.72" E					
Chord Bear	= S	60° 13′ 34.09" E					

Course from PT 006*ROSSER*6 to PC 006*ROSSER*9 N 89° 28′ 00.72" E Dist 2,217.5981

CCSJ: 2355-01-006 FM 2451 HORIZONTAL ALIGNMENT DATA (CONT.)

Curve 006*ROSSER*9			Curve Data				
P.I. Station			108+03.61	N	6,856,402.4179	E	2,604,471.6011
Delta	=	5° 19′ 15.39"	(RT)				
Degree	=	5° 50′ 47.43"					
Tangent	=	45.5380					
Length	=	91.0106					
Radius	=	980.0000					
External	=	1.0574					
Long Chord	=	90.9779					
Mid. Ord.	=	1.0563					
P.C. Station			107+58.07	N	6,856,401.9942	E	2,604,426.0651
P.T. Station			108+49.08	N	6,856,398.6171	E	2,604,516.9803
C.C.				N	6,855,422.0366	E	2,604,435.1837
Back	= N	89° 28′ 00.72" E					
Ahead	= S	85° 12′ 43.88" E					
Chord Bear	= S	87° 52′ 21.58" E					

Course from PT 006*ROSSER*9 to 21 S 85° 12′ 43.88" E Dist 146.9211

Point 21 N 6,856,386.3542 E 2,604,663.3887 Sta 109+96.00

Ending chain 006*ROSSER description

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FM 2451
ALIGNMENT DATA

SCALE: NTS SHEET 1 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	57
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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CSJ: 2355-02-008 FM 2451 HORIZONTAL ALIGNMENT DATA

Beginning chain 008*FM2451 description
Feature: Geom*Centerline

Point 5 N 6,857,818.6534 E 2,605,660.4749 Sta 128+70.00

Course from 5 to PC 008*FM2451*3 S 55° 11′ 04.80" E Dist 12.9376

Curve 008*FM2451*3						
P.I. Station		130+35.24	N	6,857,724.3119	E	2,605,796.1370
Delta	=	35° 20′ 47.18"	(LT)			
Degree	=	11° 59′ 11.63"				
Tangent	=	152.3031				
Length	=	294.8838				
Radius	=	478.0000				
External	=	23.6774				
Long Chord	=	290.2299				
Mid. Ord.	=	22.5599				
P.C. Station		128+82.94	N	6,857,811.2669	E	2,605,671.0967
P.T. Station		131+77.82	N	6,857,725.7237	E	2,605,948.4336
C.C.			N	6,858,203.7032	E	2,605,944.0028
Back	= S	55° 11′ 04.80" E				
Ahead	= N	89° 28′ 08.02" E				
Chord Bear	= S	72° 51′ 28.39" E				

Course from PT 008*FM2451*3 to PC 008*FM2451*6 N 89° 28′ 08.02" E Dist 3,406.4603

Curve 008*FM2451*6						
P.I. Station		168+71.51	N	6,857,759.9620	E	2,609,641.9594
Delta	=	22° 40′ 59.79"	(LT)			
Degree	=	4° 00′ 03.97"				
Tangent	=	287.2242				
Length	=	566.9257				
Radius	=	1,432.0000				
External	=	28.5211				
Long Chord	=	563.2306				
Mid. Ord.	=	27.9641				
P.C. Station		165+84.28	N	6,857,757.2996	E	2,609,354.7475
P.T. Station		171+51.21	N	6,857,873.1779	E	2,609,905.9289
C.C.			N	6,859,189.2381	E	2,609,341.4737
Back	= N	89° 28′ 08.02" E				
Ahead	= N	66° 47′ 08.23" E				
Chord Bear	= N	78° 07′ 38.12" E				

Course from PT 008*FM2451*6 to PC 008*FM2451*9 N 66° 47′ 08.23" E Dist 337.9654

CSJ: 2355-02-008 FM 2451 HORIZONTAL ALIGNMENT DATA (CONT.)

Curve 008*FM2451*9						
P.I. Station		177+30.72	N	6,858,101.6068	E	2,610,438.5242
Delta	=	19° 08′ 56.51"	(RT)			
Degree	=	4° 00′ 03.97"				
Tangent	=	241.5495				
Length	=	478.5939				
Radius	=	1,432.0000				
External	=	20.2294				
Long Chord	=	476.3696				
Mid. Ord.	=	19.9476				
P.C. Station		174+89.17	N	6,858,006.3946	E	2,610,216.5314
P.T. Station		179+67.77	N	6,858,118.7313	E	2,610,679.4660
C.C.			N	6,856,690.3345	E	2,610,780.9866
Back	= N	66° 47′ 08.23" E				
Ahead	= N	85° 56′ 04.73" E				
Chord Bear	= N	76° 21′ 36.48" E				

Course from PT 008*FM2451*9 to PC 008*FM2451*12 N 85° 56′ 04.73" E Dist 791.5241

Curve 008*FM2451*12						
P.I. Station		196+63.17	N	6,858,238.9260	E	2,612,370.6083
Delta	=	35° 01′ 53.75"	(LT)			
Degree	=	2° 00′ 01.98"				
Tangent	=	903.8840				
Length	=	1,751.0975				
Radius	=	2,864.0000				
External	=	139.2486				
Long Chord	=	1,723.9491				
Mid. Ord.	=	132.7922				
P.C. Station		187+59.29	N	6,858,174.8458	E	2,611,468.9985
P.T. Station		205+10.39	N	6,858,808.9465	E	2,613,072.0946
C.C.			N	6,861,031.6395	E	2,611,265.9574
Back	= N	85° 56′ 04.73" E				
Ahead	= N	50° 54′ 10.98" E				
Chord Bear	= N	68° 25′ 07.86" E				

Course from PT 008*FM2451*12 to PC 008*FM2451*15 N 50° 54′ 10.98" E Dist 1,836.8350

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FM 2451
ALIGNMENT DATA

SCALE: NTS SHEET 2 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	58
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	

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CSJ: 2355-02-008 FM 2451 HORIZONTAL ALIGNMENT DATA (CONT.)

Curve Data

Curve 008*FM2451*15

P.I. Station	228+34.60	N	6,860,274.6775	E	2,614,875.8724
Delta =	37° 35′ 31.31" (RT)				
Degree =	4° 00′ 03.97"				
Tangent =	487.3814				
Length =	939.5419				
Radius =	1,432.0000				
External =	80.6681				
Long Chord =	922.7804				
Mid. Ord. =	76.3662				
P.C. Station	223+47.22	N	6,859,967.3180	E	2,614,497.6254
P.T. Station	232+86.77	N	6,860,287.4775	E	2,615,363.0857
C.C.		N	6,858,855.9714	E	2,615,400.6940
Back = N 50° 54′ 10.98" E					
Ahead = N 88° 29′ 42.29" E					
Chord Bear = N 69° 41′ 56.64" E					

Course from PT 008*FM2451*15 to 6 N 88° 29′ 42.29" E Dist 2,931.2648

Point 6 N 6,860,364.4606 E 2,618,293.3395 Sta 262+18.03

Course from 6 to PC 008*FM2451*20 N 88° 44′ 26.80" E Dist 3,460.0535

Curve Data

Curve 008*FM2451*20

P.I. Station	299+57.07	N	6,860,446.6292	E	2,622,031.4773
Delta =	22° 02′ 56.19" (RT)				
Degree =	4° 00′ 03.97"				
Tangent =	278.9874				
Length =	551.0717				
Radius =	1,432.0000				
External =	26.9236				
Long Chord =	547.6776				
Mid. Ord. =	26.4267				
P.C. Station	296+78.08	N	6,860,440.4982	E	2,621,752.5574
P.T. Station	302+29.16	N	6,860,347.6056	E	2,622,292.2997
C.C.		N	6,859,008.8440	E	2,621,784.0267
Back = N 88° 44′ 26.80" E					
Ahead = S 69° 12′ 37.02" E					
Chord Bear = S 80° 14′ 05.11" E					

Course from PT 008*FM2451*20 to PC 008*FM2451*23 S 69° 12′ 37.02" E Dist 2,443.2955

Curve Data

Curve 008*FM2451*23

P.I. Station	330+77.61	N	6,859,336.5786	E	2,624,955.2867
Delta =	23° 57′ 09.05" (LT)				
Degree =	2° 59′ 59.20"				
Tangent =	405.1559				
Length =	798.4759				
Radius =	1,910.0000				
External =	42.4987				
Long Chord =	792.6742				
Mid. Ord. =	41.5737				
P.C. Station	326+72.45	N	6,859,480.3843	E	2,624,576.5108
P.T. Station	334+70.93	N	6,859,358.9323	E	2,625,359.8254
C.C.		N	6,861,266.0230	E	2,625,254.4446
Back = S 69° 12′ 37.02" E					
Ahead = N 86° 50′ 13.93" E					
Chord Bear = S 81° 11′ 11.54" E					

Course from PT 008*FM2451*23 to PC 008*FM2451*26 N 86° 50′ 13.93" E Dist 2,343.5790

CSJ: 2355-02-008 FM 2451 HORIZONTAL ALIGNMENT DATA (CONT.)

Curve Data

Curve 008*FM2451*26

P.I. Station	360+80.73	N	6,859,502.9233	E	2,627,965.6500
Delta =	10° 37′ 03.21" (RT)				
Degree =	1° 59′ 59.47"				
Tangent =	266.2208				
Length =	530.9171				
Radius =	2,865.0000				
External =	12.3423				
Long Chord =	530.1578				
Mid. Ord. =	12.2893				
P.C. Station	358+14.51	N	6,859,488.2350	E	2,627,699.8347
P.T. Station	363+45.42	N	6,859,468.3829	E	2,628,229.6206
C.C.		N	6,856,627.5990	E	2,627,857.9058
Back = N 86° 50′ 13.93" E					
Ahead = S 82° 32′ 42.85" E					
Chord Bear = S 87° 51′ 14.46" E					

Course from PT 008*FM2451*26 to PC 008*FM2451*29 S 82° 32′ 42.85" E Dist 576.9365

Curve Data

Curve 008*FM2451*29

P.I. Station	371+20.57	N	6,859,367.8129	E	2,628,998.2143
Delta =	7° 54′ 54.60" (LT)				
Degree =	1° 59′ 59.47"				
Tangent =	198.2090				
Length =	395.7874				
Radius =	2,865.0000				
External =	6.8482				
Long Chord =	395.4728				
Mid. Ord. =	6.8318				
P.C. Station	369+22.36	N	6,859,393.5292	E	2,628,801.6807
P.T. Station	373+18.15	N	6,859,369.4056	E	2,629,196.4170
C.C.		N	6,862,234.3131	E	2,629,173.3954
Back = S 82° 32′ 42.85" E					
Ahead = N 89° 32′ 22.55" E					
Chord Bear = S 86° 30′ 10.15" E					

Course from PT 008*FM2451*29 to PC 008*FM2451*32 N 89° 32′ 22.55" E Dist 1,625.7521

Curve Data

Curve 008*FM2451*32

P.I. Station	390+71.69	N	6,859,383.4960	E	2,630,949.9003
Delta =	5° 06′ 27.90" (LT)				
Degree =	1° 59′ 59.47"				
Tangent =	127.7878				
Length =	255.4064				
Radius =	2,865.0000				
External =	2.8484				
Long Chord =	255.3218				
Mid. Ord. =	2.8456				
P.C. Station	389+43.90	N	6,859,382.4692	E	2,630,822.1166
P.T. Station	391+99.31	N	6,859,395.8953	E	2,631,077.0852
C.C.		N	6,862,247.3767	E	2,630,799.0950
Back = N 89° 32′ 22.55" E					
Ahead = N 84° 25′ 54.65" E					
Chord Bear = N 86° 59′ 08.60" E					

Course from PT 008*FM2451*32 to 7 N 84° 25′ 54.65" E Dist 805.4226

Point 7 N 6,859,474.0452 E 2,631,878.7074 Sta 400+04.73

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Ending chain 008*FM2451 description

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FM 2451 ALIGNMENT DATA

SCALE: NTS SHEET 3 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	59
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	

CCSJ: 2355-01-006 FM 2451 VERTICAL PROFILE DATA

Feature: Geom*Centerline

		STATION	ELEV	GRADE	TOTAL L	BACK L	AHEAD L
VPI	1	50+52.00	363.6294				
VPC		51+83.03	364.1148	0.3704	K = 438.5 SSD = 2437.1		
VPI	2	52+84.30	364.4899		202.5392	101.2696	101.2696
High Point		53+45.43	364.4155				
VPT		53+85.56	364.3972	-0.0915			
VPC		54+96.57	364.2956	-0.0915	K = 141.7 SSD = 1416.7		
VPI	3	55+52.78	364.2441		112.4153	56.2076	56.2076
VPT		56+08.99	363.7469	-0.8846			
VPC		56+29.67	363.5639	-0.8846	K = 96.0		
VPI	4	56+84.88	363.0755		110.4159	55.2080	55.2080
Low Point		57+14.60	363.1883				
VPT		57+40.09	363.2221	0.2655			
VPC		58+03.93	363.3917	0.2655	K = 214.1 SSD = 2581.9		
VPI	5	58+49.47	363.5126		91.0735	45.5367	45.5367
High Point		58+60.78	363.4672				
VPT		58+95.01	363.4398	-0.1599			
VPC		76+44.35	360.6433	-0.1599	K = 7121.8		
VPI	6	80+90.12	359.9307		891.5382	445.7691	445.7691
VPT		85+35.89	359.7762	-0.0347			
VPC		94+27.63	359.4670	-0.0347	K = 374.5		
Low Point		94+40.62	359.4647				
VPI	7	98+77.00	359.3112		898.7370	449.3685	449.3685
VPT		103+26.37	369.9400	2.3653			
VPC		105+24.64	374.6297	2.3653	K = 130.0 SSD = 586.1		
VPI	8	106+92.25	378.5941		335.2180	167.6090	167.6090
High Point		108+32.13	378.2662				
VPT		108+59.86	378.2366	-0.2133			
VPI	9	109+75.00	377.9910	-0.2133			

Ending profile 006*PROF description

NOTE:
PROFILE INCLUDED FOR DESIGN CHECK ONLY.
THE PROPOSED GRADE LINE IS CONTROLLED
BY THE TYPICAL SECTIONS.

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FM 2451
ALIGNMENT DATA

SCALE: NTS SHEET 4 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	60
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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CSJ: 2355-02-008 FM 2451 VERTICAL PROFILE DATA

Feature: Geom*Centerline

		STATION	ELEV	GRADE	TOTAL L	BACK L	AHEAD L
VPI	1	128+84.00	383.9249				
VPC		129+48.69	383.9515	0.0412	K = 700.5 SSD = 4531.4		
High Point		129+77.57	383.9575				
VPI	2	130+33.69	383.9866		170.0000	85.0000	85.0000
VPT		131+18.69	383.8154	-0.2014			
VPC		136+79.98	382.6847	-0.2014	K = 1027.4		
Low Point		138+86.94	382.4763				
VPI	3	140+79.98	381.8790		800.0000	400.0000	400.0000
VPT		144+79.98	384.1878	0.5772			
VPC		145+74.77	384.7350	0.5772	K = 608.4 SSD = 1317.3		
VPI	4	149+08.48	386.6612		667.4260	333.7130	333.7130
High Point		149+25.94	385.7485				
VPT		152+42.19	384.9265	-0.5198			
VPC		153+34.03	384.4491	-0.5198	K = 450.1		
VPI	5	154+93.97	383.6176		319.8918	159.9459	159.9459
Low Point		155+67.99	383.8410				
VPT		156+53.92	383.9230	0.1909			
VPC		169+46.31	386.3905	0.1909	K = 800.0 SSD = 4547.1		
VPI	6	170+43.30	386.5757		193.9727	96.9863	96.9863
High Point		170+99.05	386.5363				
VPT		171+40.29	386.5257	-0.0515			
VPC		176+08.87	386.2842	-0.0515	K = 153.0 SSD = 574.6		
VPI	7	179+05.36	386.1313		592.9795	296.4898	296.4898
VPT		182+01.85	374.4860	-3.9277			
VPC		184+84.09	363.4005	-3.9277	K = 125.7		
VPI	8	185+69.09	360.0619		170.0000	85.0000	85.0000
VPT		186+54.09	357.8732	-2.5749			
VPC		186+79.48	357.2194	-2.5749	K = 239.0		
VPI	9	187+91.69	354.3301		224.4174	112.2087	112.2087
VPT		189+03.89	352.4944	-1.6360			
VPC		190+66.02	349.8422	-1.6360	K = 218.1		
VPI	10	193+01.69	345.9866		471.3502	235.6751	235.6751
Low Point		194+22.76	346.9240				
VPT		195+37.37	347.2251	0.5255			
VPC		196+98.47	348.0718	0.5255	K = 96.0		
VPI	11	199+06.30	349.1640		415.6559	207.8279	207.8279
VPT		201+14.13	359.2547	4.8553			
VPC		202+38.07	365.2724	4.8553	K = 116.7 SSD = 502.1		
VPI	12	204+79.61	377.0001		483.0929	241.5465	241.5465
VPT		207+21.16	378.7249	0.7140			
VPC		225+68.13	391.9128	0.7140	K = 1948.5		
VPI	13	228+43.13	393.8764		550.0000	275.0000	275.0000
VPT		231+18.13	396.6163	0.9963			
VPC		235+46.51	400.8842	0.9963	K = 706.7 SSD = 1581.9		
VPI	14	238+43.16	403.8397		593.2942	296.6471	296.6471
VPT		241+39.81	404.3048	0.1568			
VPC		254+89.72	406.4209	0.1568	K = 1751.9		
VPI	15	257+54.50	406.8359		529.5513	264.7756	264.7756
VPT		260+19.27	408.0514	0.4590			

CSJ: 2355-02-008 FM 2451 VERTICAL PROFILE DATA (CONT.)

VPC		270+46.97	412.7689	0.4590	K = 1098.5		
VPI	16	273+03.06	413.9445		512.1911	256.0956	256.0956
VPT		275+59.16	416.3141	0.9253			
VPC		284+26.02	424.3350	0.9253	K = 540.0 SSD = 1167.8		
VPI	17	287+87.18	427.6767		722.3200	361.1600	361.1600
High Point		289+25.67	426.6466				
VPT		291+48.34	426.1875	-0.4123			
VPC		312+52.71	417.5102	-0.4123	K = 4338.7		
Low Point		330+41.76	413.8216				
VPI	18	332+75.49	409.1693		4,045.5591	2,022.7796	2,022.7796
VPT		352+98.27	419.6895	0.5201			
VPC		357+77.20	422.1804	0.5201	K = 600.9 SSD = 2311.3		
VPI	19	359+27.20	422.9605		300.0000	150.0000	150.0000
VPT		360+77.20	422.9918	0.0208			
VPC		367+94.64	423.1413	0.0208	K = 1872.9		
VPI	20	374+76.17	423.2834		1,363.0583	681.5291	681.5291
VPT		381+57.70	428.3854	0.7486			
VPC		389+88.84	434.6075	0.7486	K = 3807.3 SSD = 4655.1		
VPI	21	394+82.42	438.3025		987.1592	493.5796	493.5796
VPT		399+76.00	440.7178	0.4893			

Ending profile 008*VERT description

NOTE:
PROFILE INCLUDED FOR DESIGN CHECK ONLY.
THE PROPOSED GRADE LINE IS CONTROLLED
BY THE TYPICAL SECTIONS.

STATE OF TEXAS
FALON J. RENFROE
131914
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FM 2451
ALIGNMENT DATA

SCALE: NTS SHEET 5 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	61
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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ROAD BORINGS LOCATIONS
CCSJ: 2355-01-006

ROAD BORINGS LOCATIONS
CCSJ: 2355-01-006 (CONT.)

STATE OF TEXAS
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FM 2451
BORING DATA

SCALE: NTS SHEET 1 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	62
CHECK FR	CONTROL	SECTION	JOB	
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ROAD BORINGS
CCSJ: 2355-01-006

Boring#	Pavement Summary		Subgrade Lab Tests					
	Total Pavement Thickness (in)	Pavement Description	Sample Depth (ft)	Moisture Content (%)	Liquid Limit	Plastic Limit	PI	Sulfate Content (ppm)
EB-1	12	2 inch of Asphalt over 10 inch of Base	3-4	8.9	Non-plastic			180
EB-2	12	2 inches of Asphalt over 10 inches of Base	2-3	5.0	Non-plastic			<100
EB-3	12	2 inches of Asphalt over 10 inches of Base	1-2	11.2	Non-plastic			<100
EB-4	12	2 inches of Asphalt over 10 inches of Base	1.5-2.5	10.0	21	12	9	107
EB-5	12	6 inches of Asphalt over 6 inches of Base	1.5-2.5	20.1	45	14	31	200
WB-1	12	2 inches of Asphalt over 10 inches of Base	2-3	8.8	Non-plastic			340
WB-2	12	2 inches of Asphalt over 10 inches of Base	1.5-2	6.2	Non-plastic			<100
WB-3	11	2 inches of Asphalt over 9 inches of Base	1.5-2	11.4	Non-plastic			120
WB-4	12	3 inches of Asphalt over 9 inches of Base	1.5-2.5	19.6	34	13	21	106.7
Total No. of Tests			9	9	9	9	9	9

HVJ ASSOCIATES
8701 John Carpenter Fwy Suite 250
Dallas, TX 75247
214-678-0227 Ph
214-678-0228 Fax

DATE: 6/4/2019	APPROVED BY: RL	PREPARED BY: EH

KAUFMAN COUNTY PAVEMENT CORES
FM 2451 CSJ: 2355-01-006
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO.: DG-16-10279.1.10-3	DRAWING NO.: ATTACHMENT 1

STATE OF TEXAS
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BORING DATA

SCALE: NTS SHEET 2 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	63
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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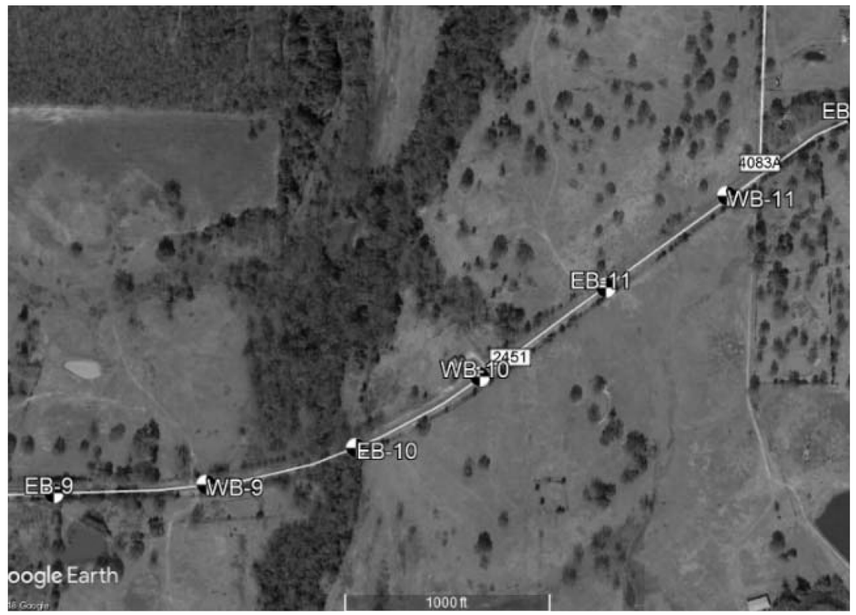
ROAD BORINGS LOCATIONS
CSJ: 2355-02-008

ROAD BORINGS LOCATIONS
CCSJ: 2355-02-008 (CONT.)



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CSJ: 2355-02-008 (CONT.)

ROAD BORINGS LOCATIONS
CCSJ: 2355-02-008 (CONT.)

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BORING DATA

SCALE: NTS SHEET 3 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	64
CHECK	CONTROL	SECTION	JOB	
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ROAD BORINGS LOCATIONS
CSJ: 2355-02-008 (CONT.)

ROAD BORINGS LOCATIONS
CCSJ: 2355-02-008 (CONT.)

STATE OF TEXAS
FALON J. RENFROE
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BORING DATA

SCALE: NTS SHEET 4 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	65
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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ROAD BORINGS
CSJ: 2355-02-008

Boring#	Pavement Summary		Subgrade Lab Tests					
	Total Pavement Thickness (in)	Pavement Description	Sample Depth (ft)	Moisture Content (%)	Liquid Limit	Plastic Limit	PI	Sulfate Content (ppm)
EB-6	14	6 inches of Asphalt over 8 inches of Base	2.5-3.5	18.7	34	14	20	<100
EB-7	11	6 inches of Asphalt over 5 inches of Base	1.5-2.5	16.9	44	13	31	<100
EB-8	9	9 inches of Asphalt	1-2	20.8	21	11	10	<100
EB-9	9	9 inches of Asphalt	1-2	22.6	44	16	18	<100
EB-10	9	4 inches of Asphalt over 5 inches of Base	1-2	14.8	24	12	12	<100
EB-11	9	2.5 inches of Asphalt over 6.5 inches of Base	1.5-2	15.8	40	13	27	<100
EB-12	11	2 inches of Asphalt over 9 inches of Base	2.5-3.5	9.6	16	8	8	100
EB-13	11	0.5 inches of Asphalt over 10.5 inches of Base	2.5-3.5	18.9	42	16	26	<100
EB-14	9	2 inches of Asphalt over 7 inches of Base	1.5-2	9.4	Non-plastic			<100
EB-15	9.75	0.25 inches of Asphalt over 9.5 inches of Base	1.5-2	17.8	55	20	35	167
EB-16	12	0.5 inches of Asphalt over 11.5 inches of Base	1-1.5	18.7	56	21	35	313
EB-17	8	4 inches of Asphalt over 4 inches of Base	1-1.5	17.4	52	17	35	<100
EB-18	6	2 inches of Asphalt over 4 inches of Base	1.5-2	13.1	22	14	8	<100
EB-19	8	3.5 inches of Asphalt over 4.5 inches of Base	1-1.5	15.2	39	14	25	<100
EB-20	9	3.5 inches of Asphalt over 5.5 inches of Base	1-1.5	15.8	26	15	11	<100
EB-21	13	5 inches of Asphalt over 8 inches of Base	1.5-2	17.7	58	20	38	<100
EB-22	9	3 inches of Asphalt over 6 inches of Base	1-1.5	14.8	33	14	19	<100
EB-23	12	5 inches of Asphalt over 7 inches of Base	1-1.5	39.4	88	33	55	100
EB-24	6	2.5 inches of Asphalt over 3.5 inches of Base	1-2.5	14.0	32	15	17	<100
Total No. of Tests			19	19	19	19	19	19

HVJ ASSOCIATES
8701 John Carpenter Fwy Suite 250
Dallas, TX 75247
214-678-0237 Ph
214-678-0238 Fax

DATE: 6/4/2019	APPROVED BY: RL	PREPARED BY: EH

KAUFMAN COUNTY PAVEMENT CORES
FM 2451 CSJ: 2355-01-008
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO.:	DRAWING NO.:
DG-16-10279.1.10-4	ATTACHMENT 1

ROAD BORINGS
CSJ: 2355-02-008 (CONT.)

Boring#	Pavement Summary		Subgrade Lab Tests					
	Total Pavement Thickness (in)	Pavement Description	Sample Depth (ft)	Moisture Content (%)	Liquid Limit	Plastic Limit	PI	Sulfate Content (ppm)
WB-5	8	3 inches of Asphalt over 5 inches of Base	2.5-3.5	18.2	47	16	31	<100
WB-6	12	6 inches of Asphalt over 6 inches of Base	1-1.5	18.7	46	17	29	207
WB-7	9	4 inches of Asphalt over 5 inches of Base	1.5-2.5	16.2	40	12	28	<100
WB-8	7.5	2 inches of Asphalt over 5.5 inches of Base	1-1.5	18.2	46	13	33	<100
WB-9	7	2.5 inches of Asphalt over 4.5 inches of Base	1.5-2	17.3	47	17	30	180
WB-10	11	2.5 inches of Asphalt over 8.5 inches of Base	1-2	8.2	Non-plastic			<100
WB-11	8	3 inches of Asphalt over 5 inches of Base	1-2	21.1	39	14	25	<100
WB-12	9	2 inches of Asphalt over 7 inches of Base	1-1.5	15.2	22	12	10	<100
WB-13	7	3 inches of Asphalt over 4 inches of Base	2-3	13.8	26	13	13	<100
WB-14	10	2.5 inches of Asphalt over 7.5 inches of Base	1.5-2	9.4	46	17	29	<100
WB-15	8	4 inches of Asphalt over 4 inches of Base	2-3	17.3	47	14	33	147
WB-16	11	4 inches of Asphalt over 7 inches of Base	1-2	20.6	33	12	21	<100
WB-17	10.5	2.5 inches of Asphalt over 8 inches of Base	1-1.5	22.1	33	16	17	<100
WB-18	11	2 inches of Asphalt over 9 inches of Base	1-2	17.2	36	16	20	<100
WB-19	9.5	0.25 inches of Asphalt over 9.25 inches of Base	1-1.5	14.3	24	15	9	<100
WB-20	9	2 inches of Asphalt over 7 inches of Base	1-2	12.5	26	17	9	<100
WB-21	9	3 inches of Asphalt over 6 inches of Base	1-1.5	15.1	38	15	23	<100
WB-22	13	6 inches of Asphalt over 7 inches of Base	1-1.5	26.7	63	18	45	213
WB-23	12.5	3.5 inches of Asphalt over 9 inches of Base	1-1.5	18.1	31	16	15	<100
Total No. of Tests			19	19	19	19	19	19

HVJ ASSOCIATES
8701 John Carpenter Fwy Suite 250
Dallas, TX 75247
214-678-0237 Ph
214-678-0238 Fax

DATE: 6/4/2019	APPROVED BY: RL	PREPARED BY: EH

KAUFMAN COUNTY PAVEMENT CORES
FM 2451 CSJ: 2355-01-008
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO.:	DRAWING NO.:
DG-16-10279.1.10-4	ATTACHMENT 2

STATE OF TEXAS
FALON J. RENFROE
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Falon Renfroe, P.E. 10/18/2021
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FM 2451
BORING DATA

SCALE: NTS SHEET 5 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	66
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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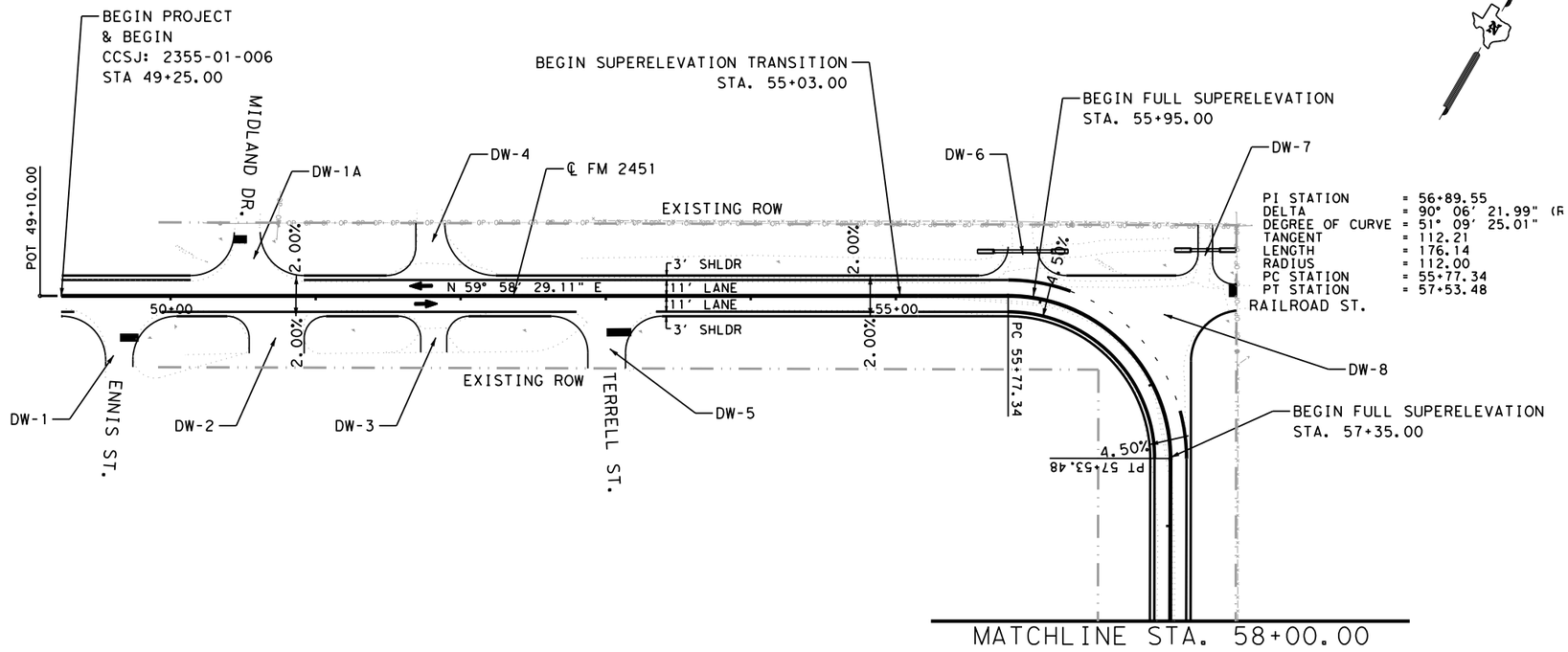

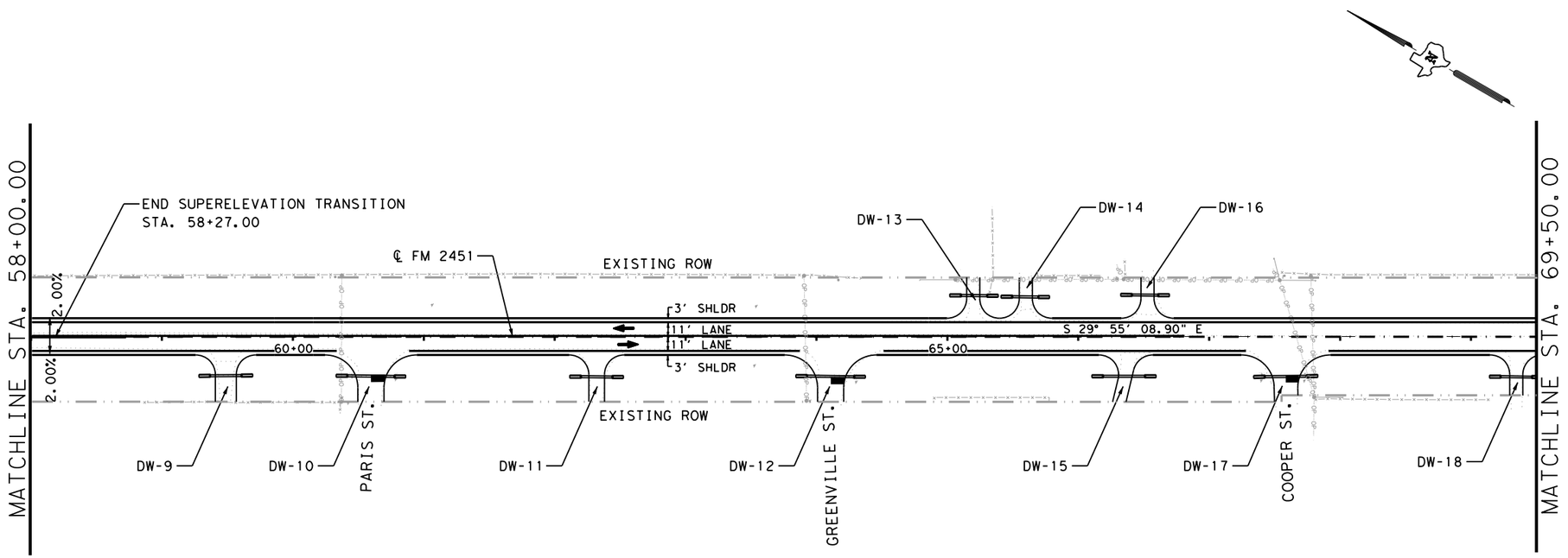

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HORIZ. SCALE IN FEET

NOTE:
1. ALL STATIONS AND OFFSETS ARE TO ℄ FM 2451 UNLESS OTHERWISE NOTED.
2. SEE DRIVEWAY DETAILS AND ROADWAY DETAILS FOR ADDITIONAL INFORMATION.
3. LOCATION OF MIALBOXES WILL BE DETERMINED BY THE ENGINEER IN THE FIELD.

STATE OF TEXAS
FALON J. RENFROE
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Falon Renfroe, P.E. 10/18/2021
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FM 2451
PLAN

SCALE: 1"=100' SHEET 1 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	67
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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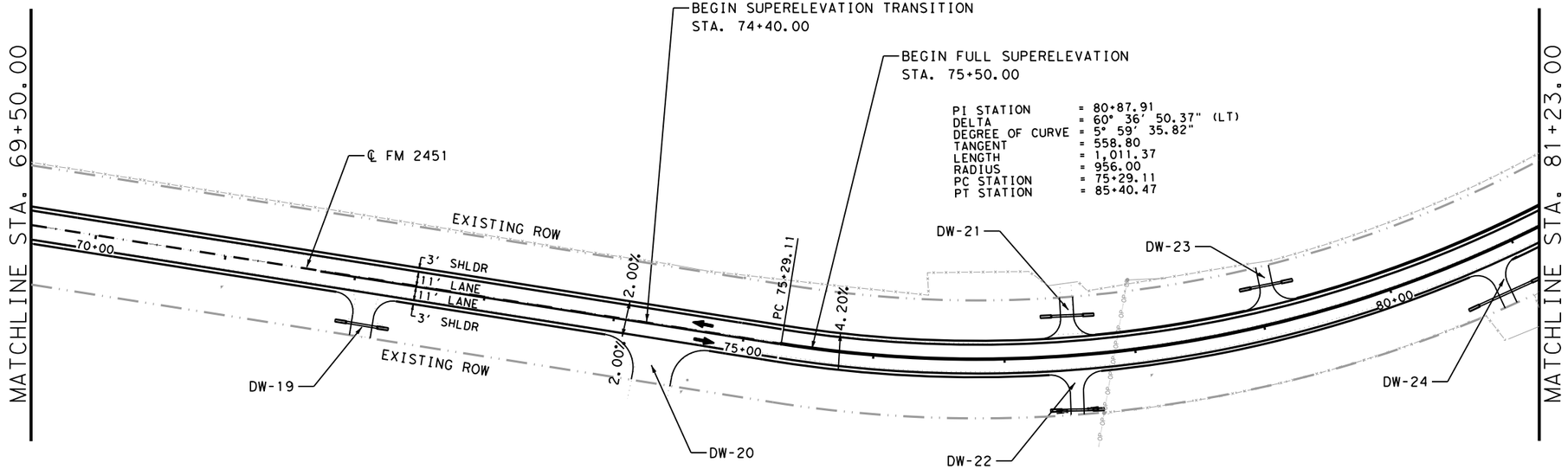

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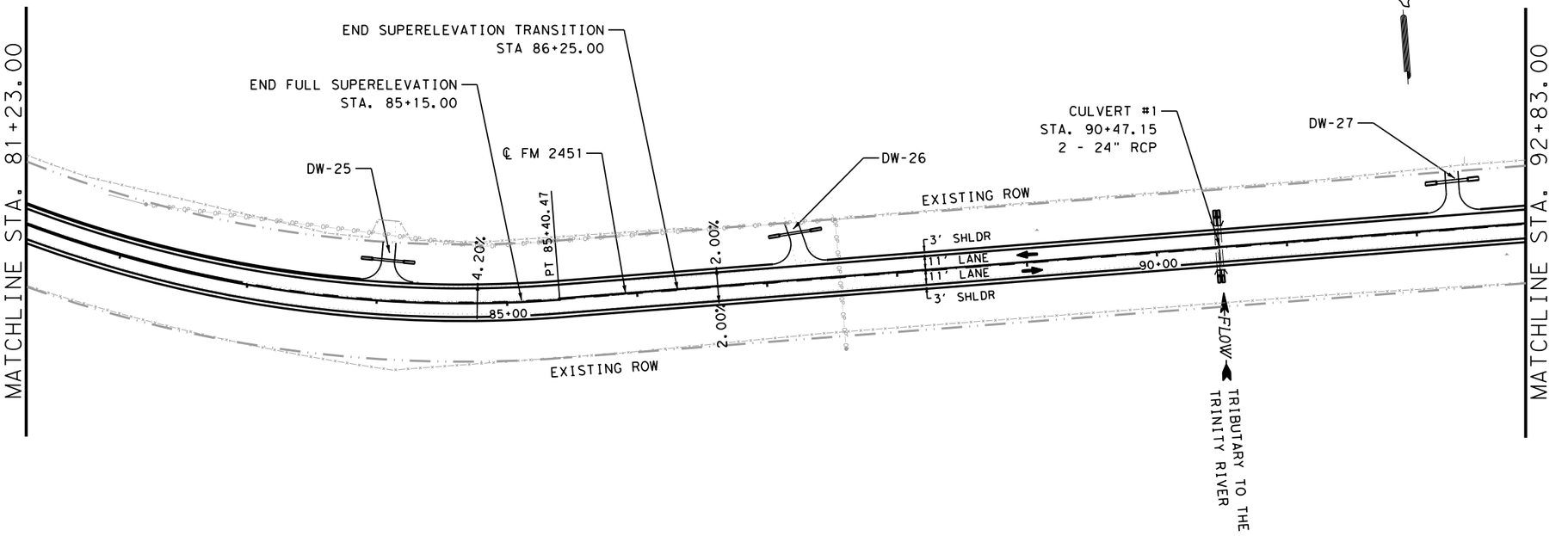
DEGREE OF CURVE = 5° 59' 35.82"
TANGENT = 558.80
LENGTH = 1,011.37
RADIUS = 956.00
PC STATION = 75+29.11
PT STATION = 85+40.47

0 50 100
HORIZ. SCALE IN FEET

NOTE:
1. ALL STATIONS AND OFFSETS ARE TO ℄ FM 2451 UNLESS OTHERWISE NOTED.
2. SEE DRIVEWAY DETAILS AND ROADWAY DETAILS FOR ADDITIONAL INFORMATION.
3. LOCATION OF MIALBOXES WILL BE DETERMINED BY THE ENGINEER IN THE FIELD.



STATE OF TEXAS
FALON J. RENFROE
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FM 2451
PLAN

SCALE: 1"=100' SHEET 2 OF 15

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	68
CHECK	CONTROL	SECTION	JOB	
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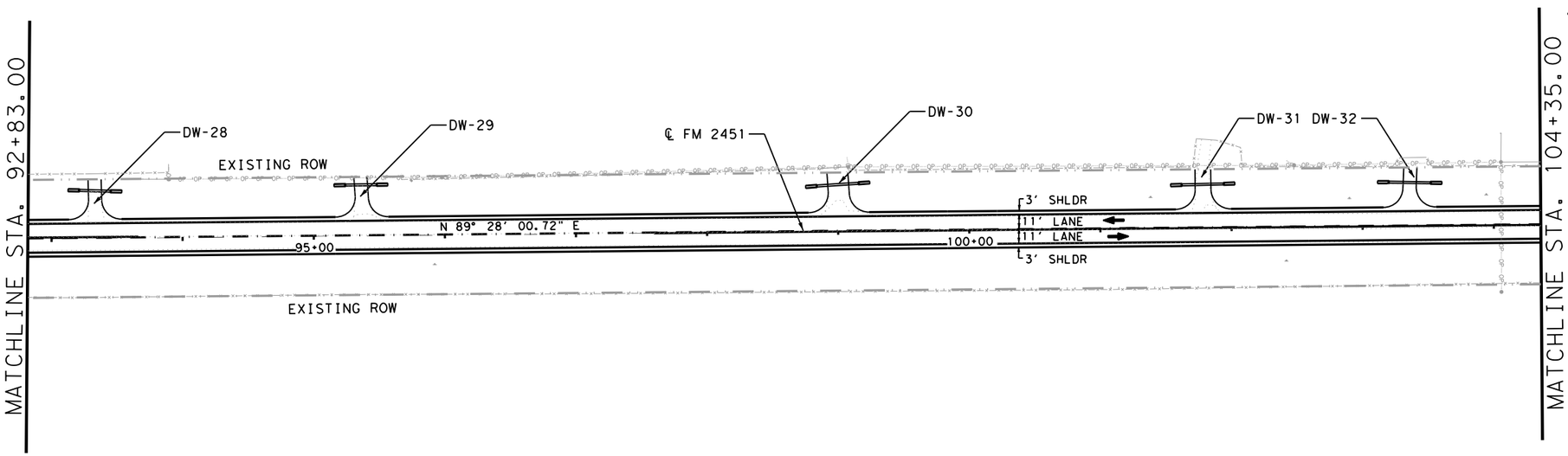
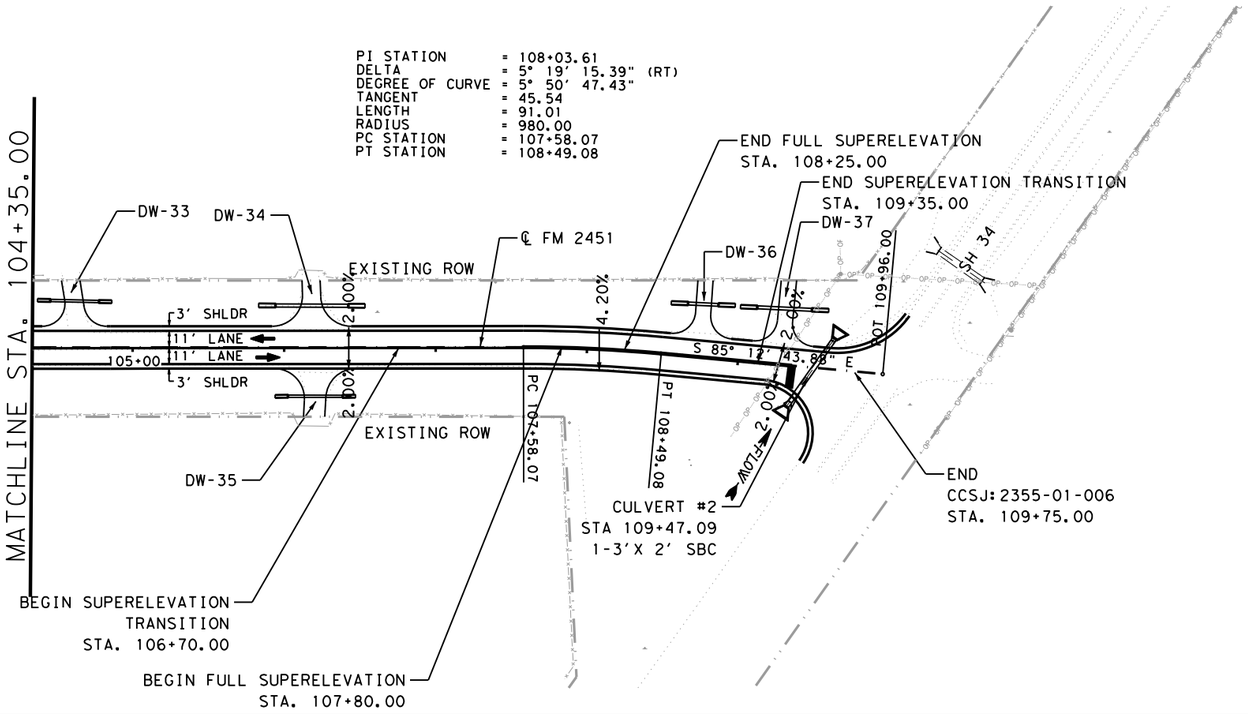


0 50 100

HORIZ. SCALE IN FEET

NOTE:
1. ALL STATIONS AND OFFSETS ARE TO ℄ FM 2451 UNLESS OTHERWISE NOTED.
2. SEE DRIVEWAY DETAILS AND ROADWAY DETAILS FOR ADDITIONAL INFORMATION.
3. LOCATION OF MIALBOXES WILL BE DETERMINED BY THE ENGINEER IN THE FIELD.



STATE OF TEXAS
FALON J. RENFROE
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FM 2451
PLAN

SCALE: 1"=100' SHEET 3 OF 15

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS: SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK: FR	TEXAS	DAL	KAUFMAN	69
CHECK: FR	CONTROL	SECTION	JOB	
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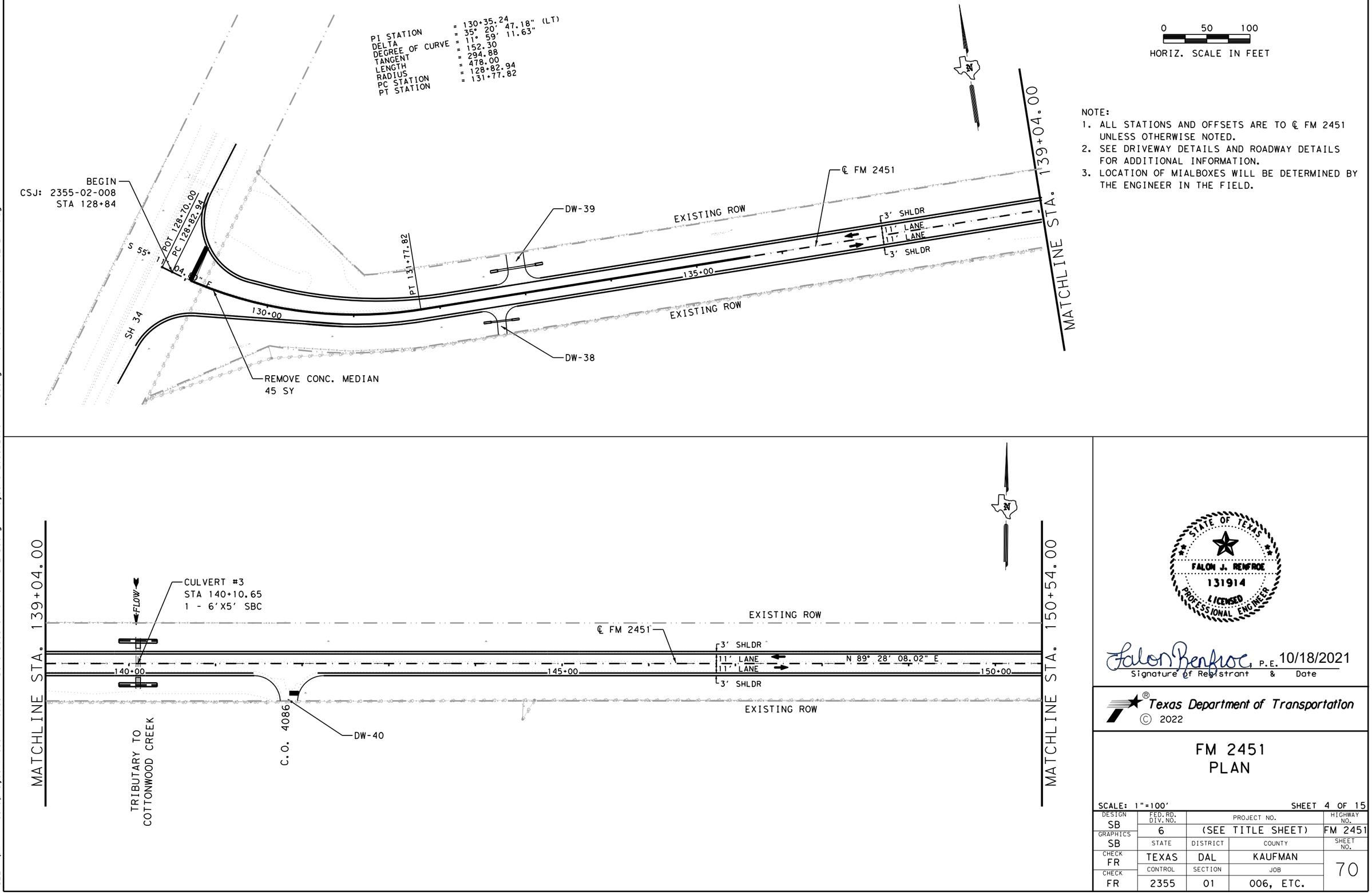

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SCALE: 1"=100' SHEET 4 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	70
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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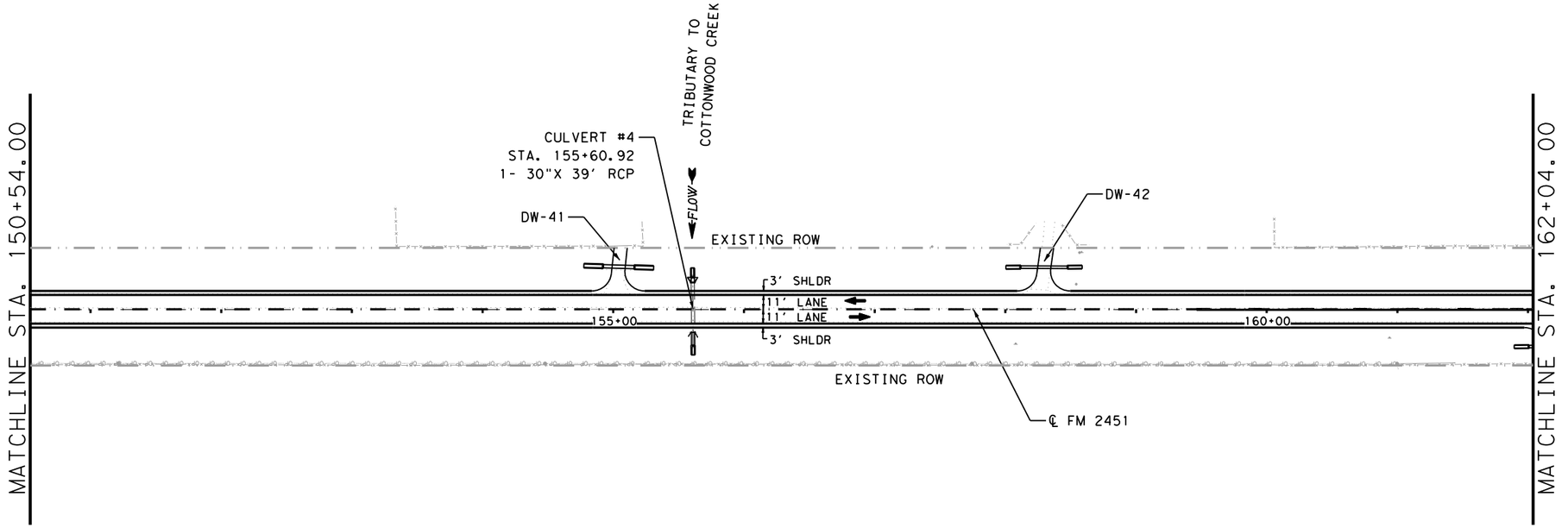
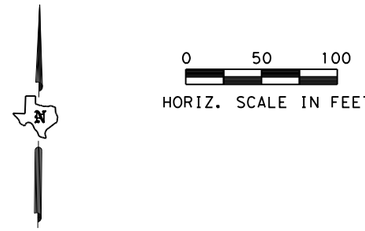
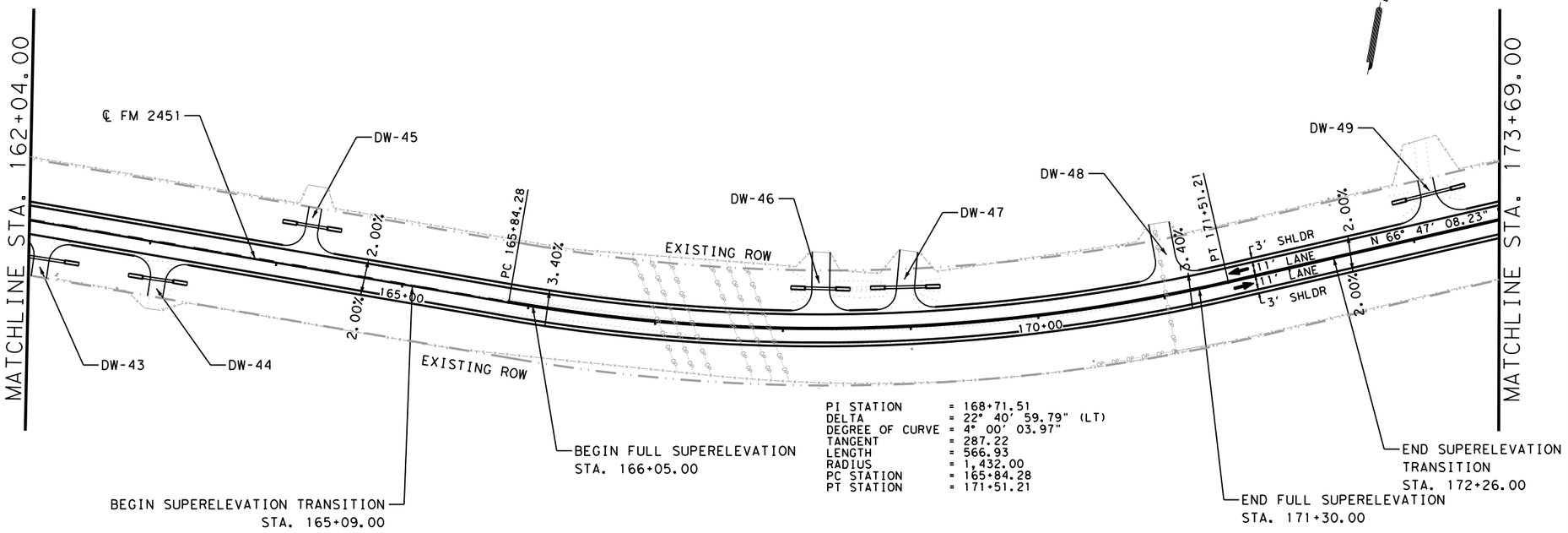




NOTE:
1. ALL STATIONS AND OFFSETS ARE TO ℄ FM 2451 UNLESS OTHERWISE NOTED.
2. SEE DRIVEWAY DETAILS AND ROADWAY DETAILS FOR ADDITIONAL INFORMATION.
3. LOCATION OF MIALBOXES WILL BE DETERMINED BY THE ENGINEER IN THE FIELD.



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TANGENT	= 287.22
LENGTH	= 566.93
RADIUS	= 1,432.00
PC STATION	= 165+84.28
PT STATION	= 171+51.21

STATE OF TEXAS
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PLAN

SCALE: 1"=100' SHEET 5 OF 15

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	71
CHECK	CONTROL	SECTION	JOB	
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CHECK				
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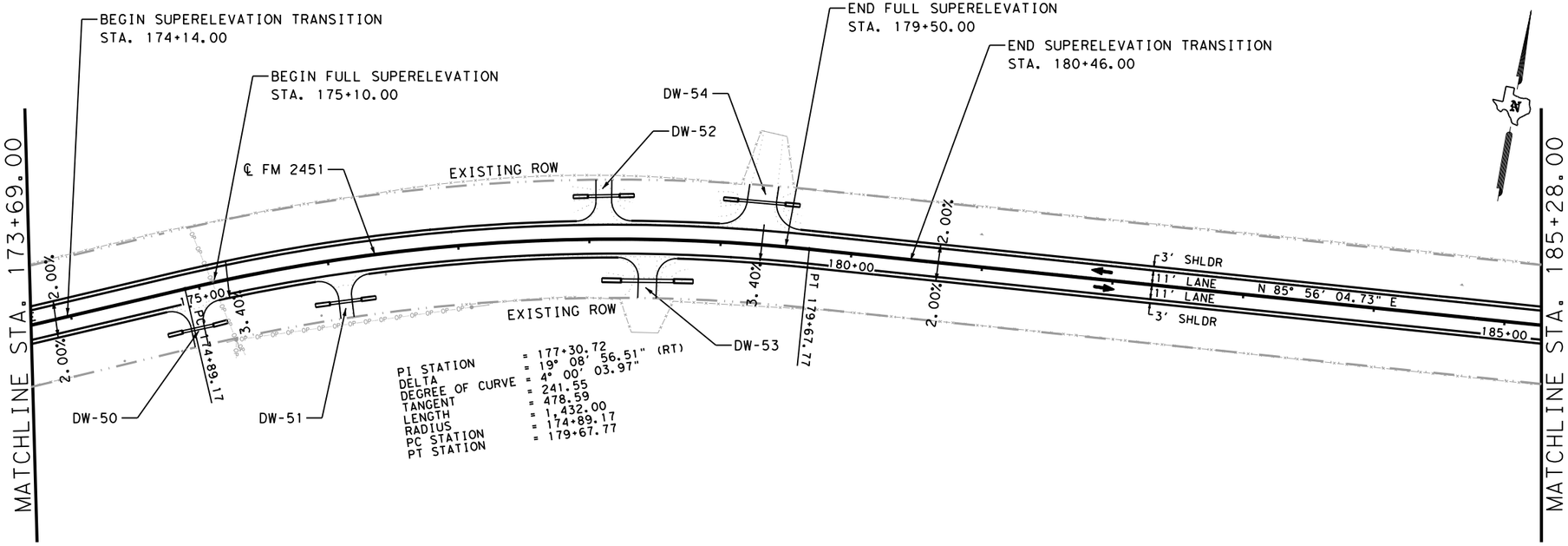

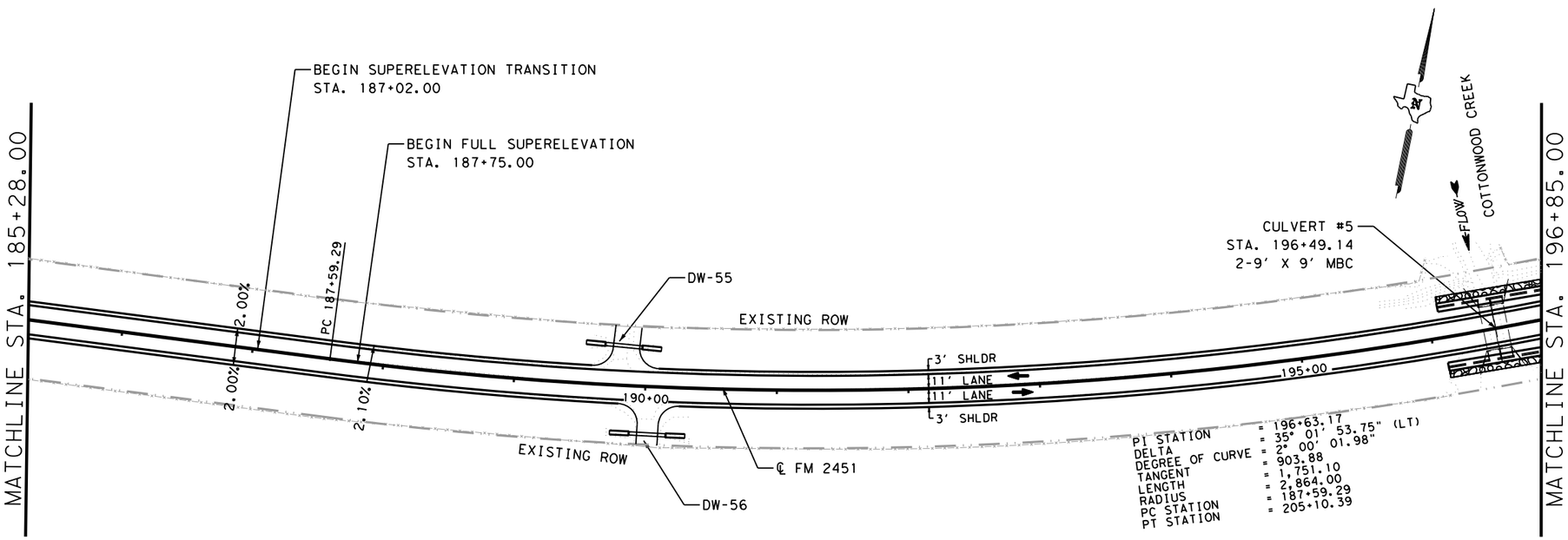

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HORIZ. SCALE IN FEET

NOTE:
1. ALL STATIONS AND OFFSETS ARE TO ℄ FM 2451 UNLESS OTHERWISE NOTED.
2. SEE DRIVEWAY DETAILS AND ROADWAY DETAILS FOR ADDITIONAL INFORMATION.
3. LOCATION OF MIALBOXES WILL BE DETERMINED BY THE ENGINEER IN THE FIELD.

STATE OF TEXAS
FALON J. RENFROE
131914
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SCALE: 1"=100' SHEET 6 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	72
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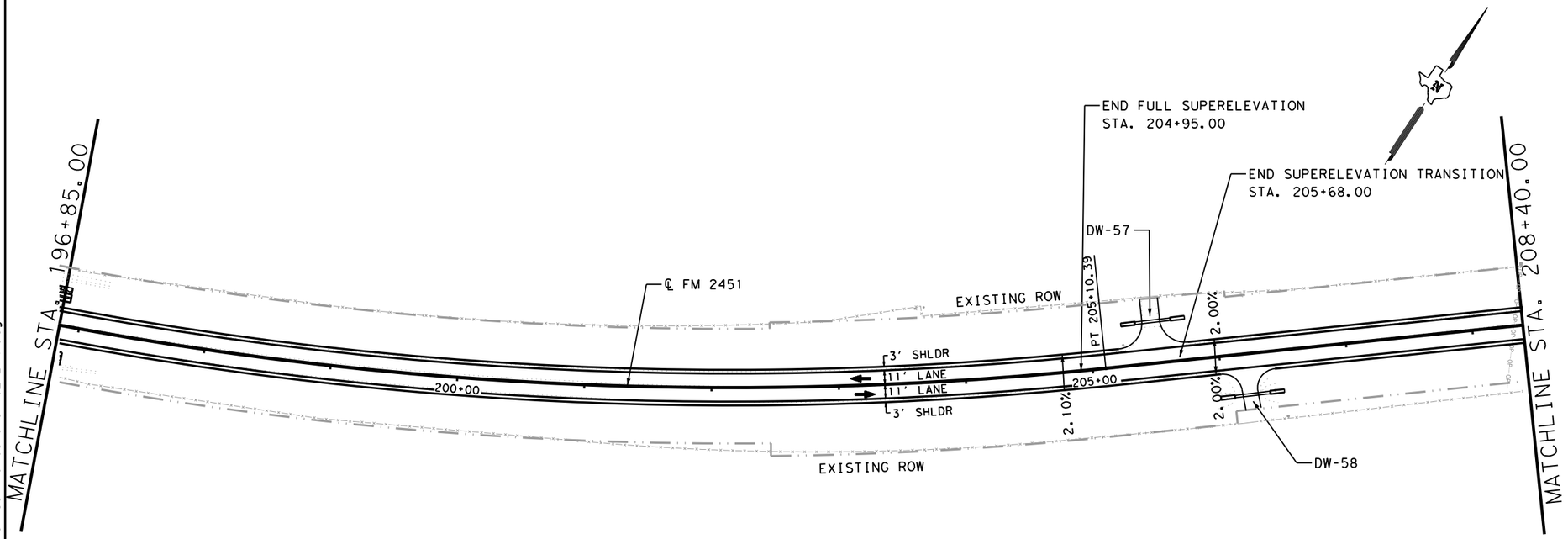

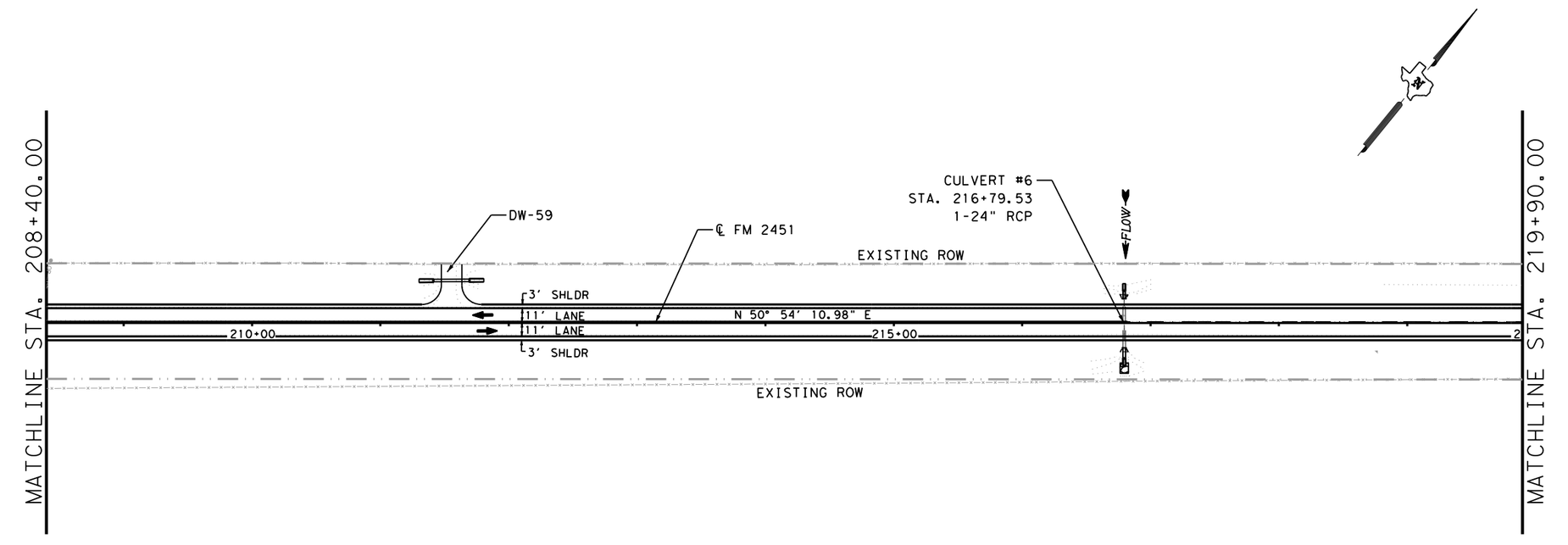

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HORIZ. SCALE IN FEET

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SCALE: 1"=100' SHEET 7 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	73
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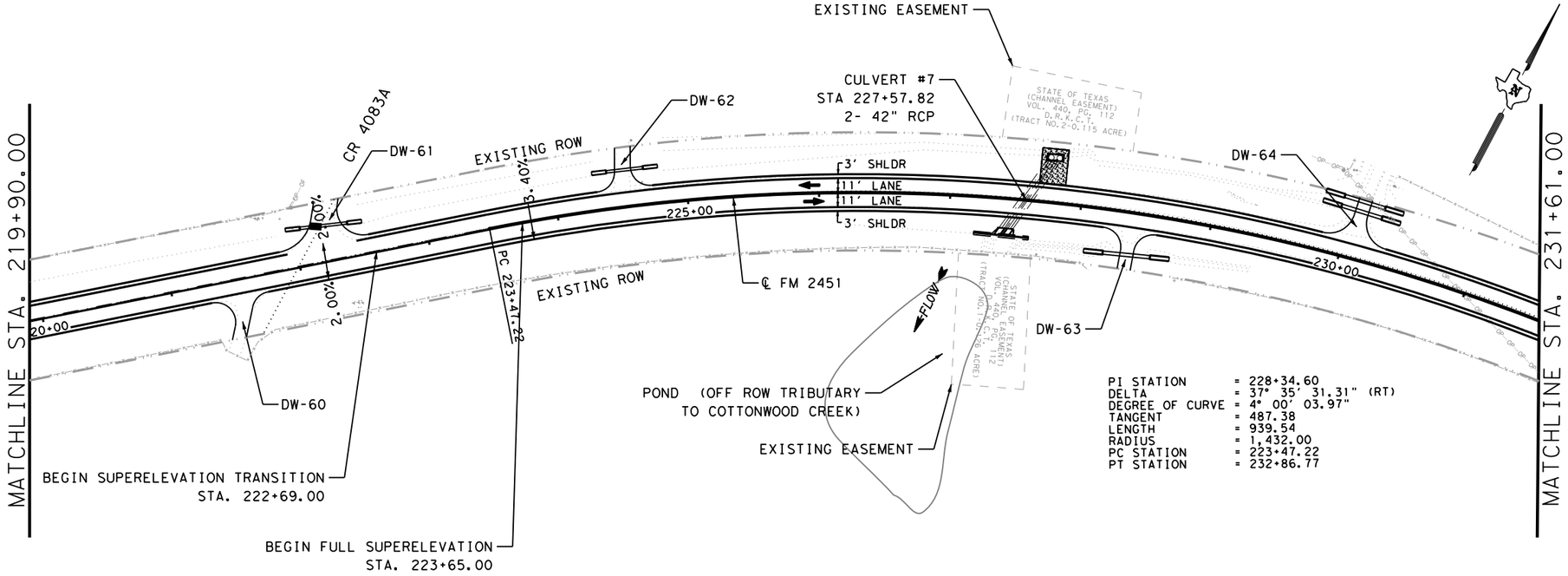

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DELTA = 37° 35' 31.31" (RT)
DEGREE OF CURVE = 4° 00' 03.97"
TANGENT = 487.38
LENGTH = 939.54
RADIUS = 1,432.00
PC STATION = 223+47.22
PT STATION = 232+86.77

NOTE:
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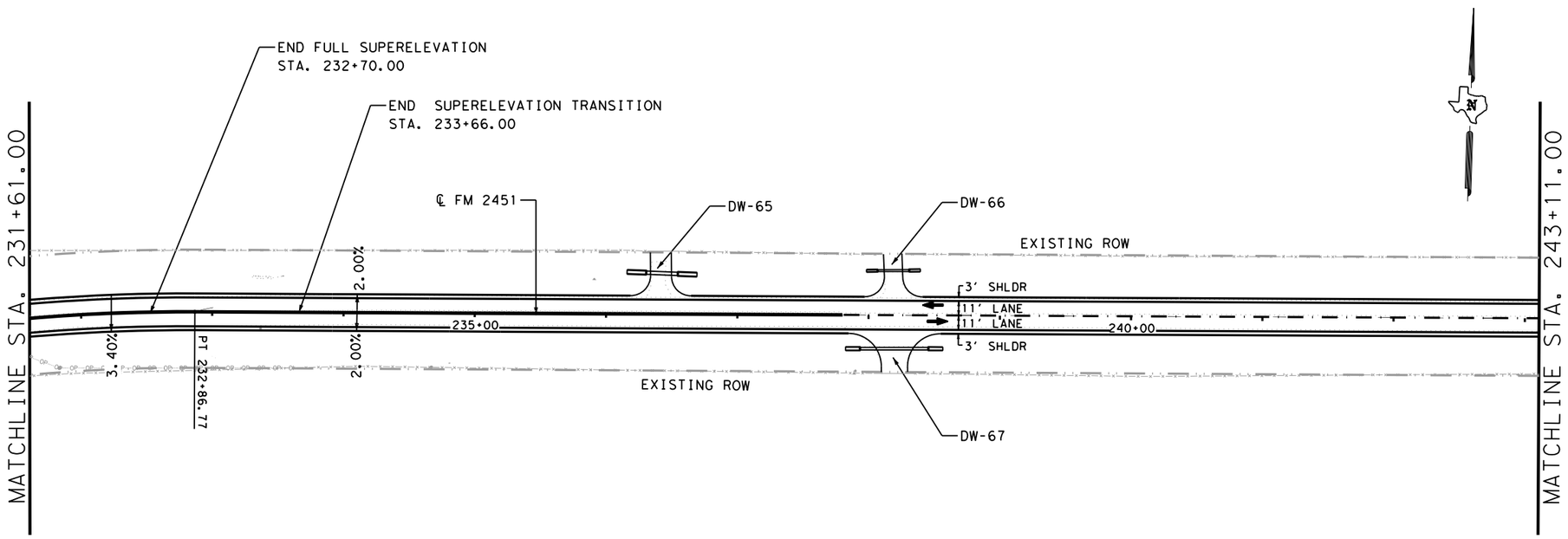

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SCALE: 1"=100' SHEET 8 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	74
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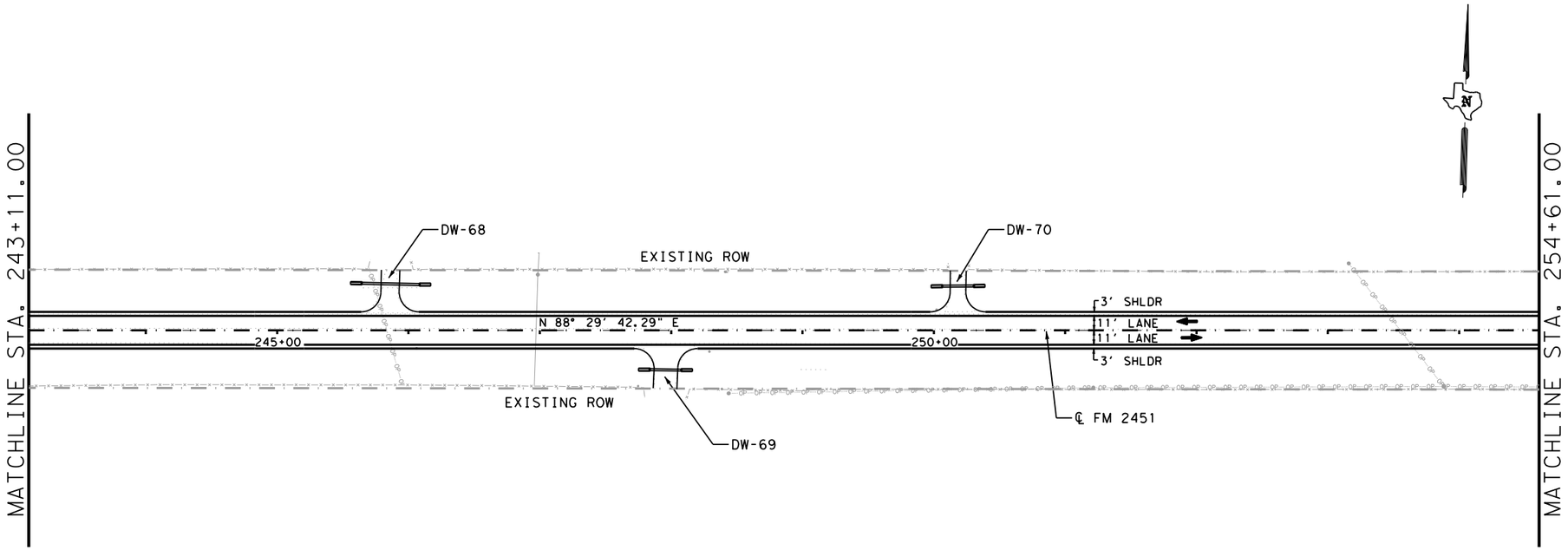

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HORIZ. SCALE IN FEET

NOTE:
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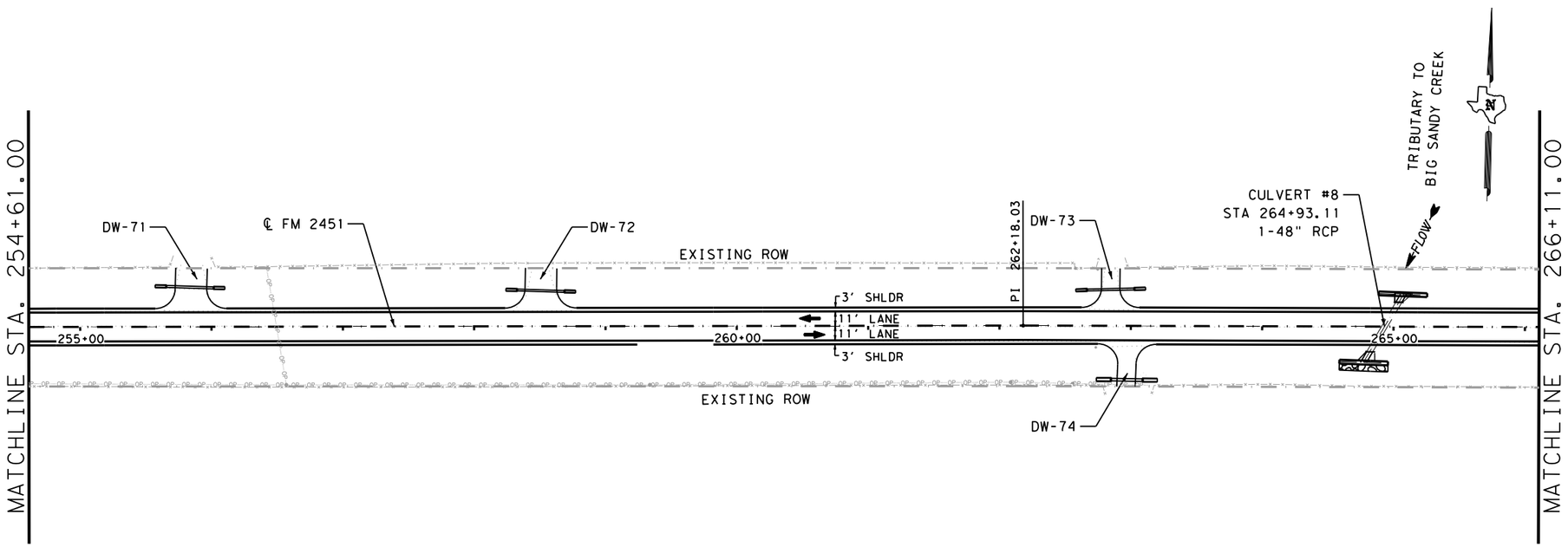
2. SEE DRIVEWAY DETAILS AND ROADWAY DETAILS FOR ADDITIONAL INFORMATION.
3. LOCATION OF MIALBOXES WILL BE DETERMINED BY THE ENGINEER IN THE FIELD.



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SCALE: 1"=100' SHEET 9 OF 15

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	75
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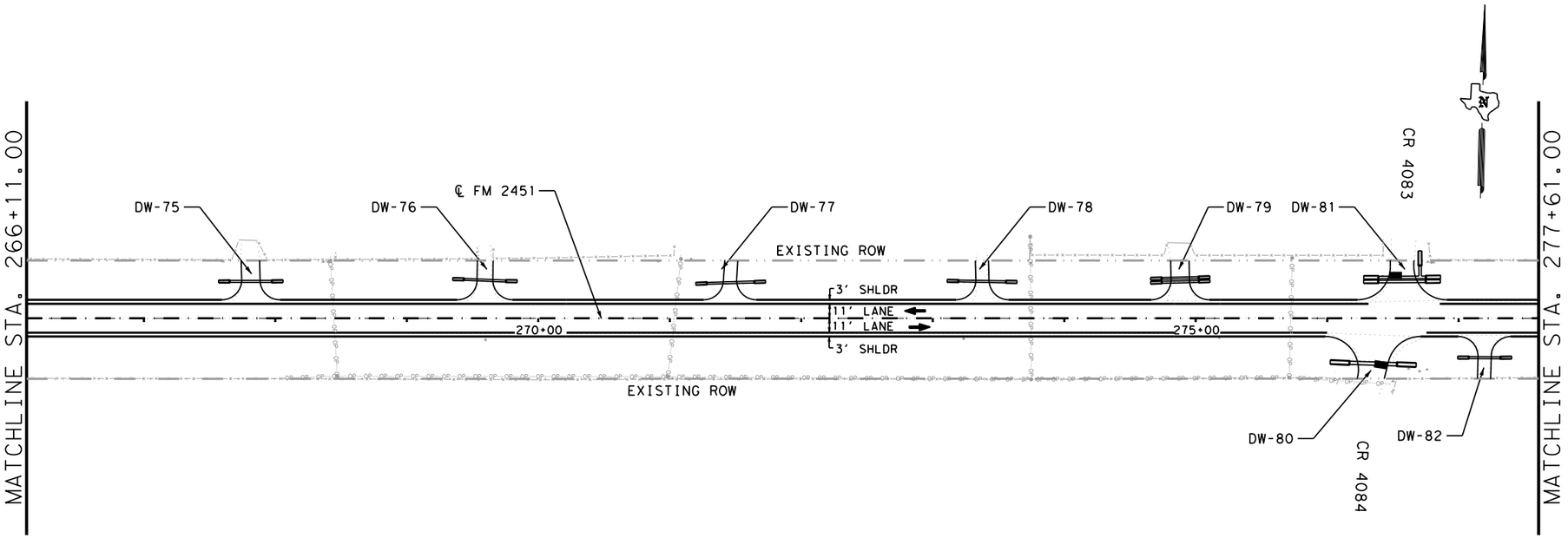

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HORIZ. SCALE IN FEET

NOTE:
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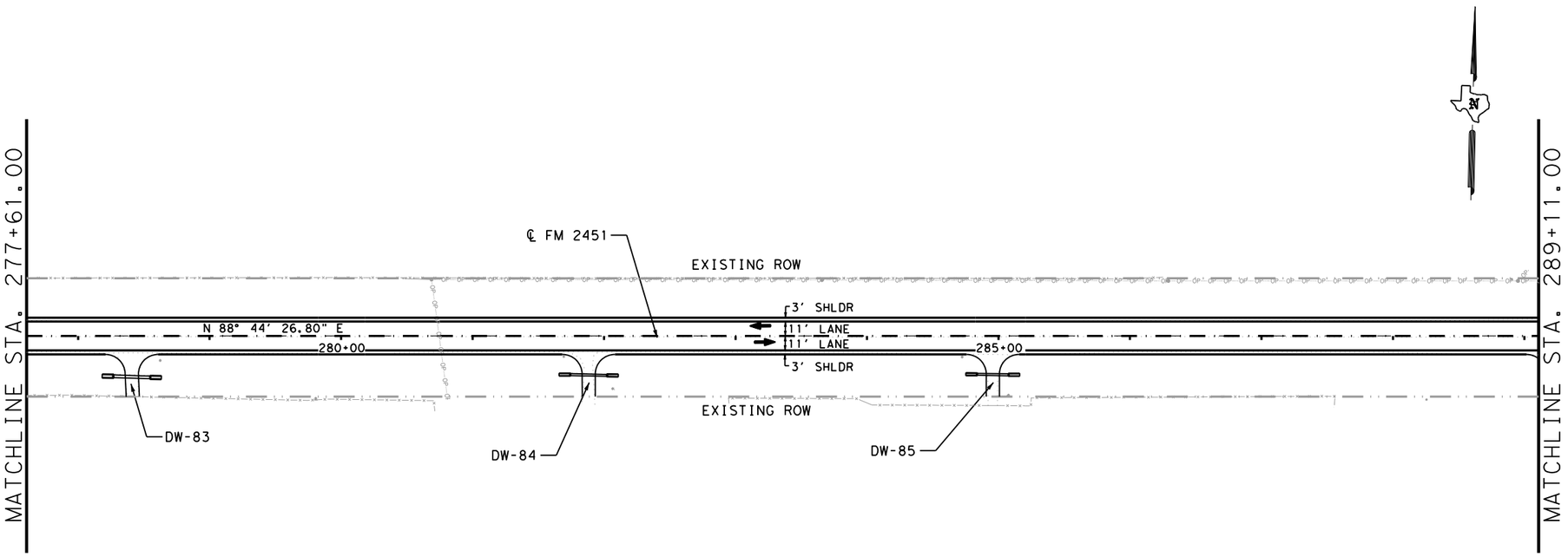
2. SEE DRIVEWAY DETAILS AND ROADWAY DETAILS FOR ADDITIONAL INFORMATION.
3. LOCATION OF MIALBOXES WILL BE DETERMINED BY THE ENGINEER IN THE FIELD.



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SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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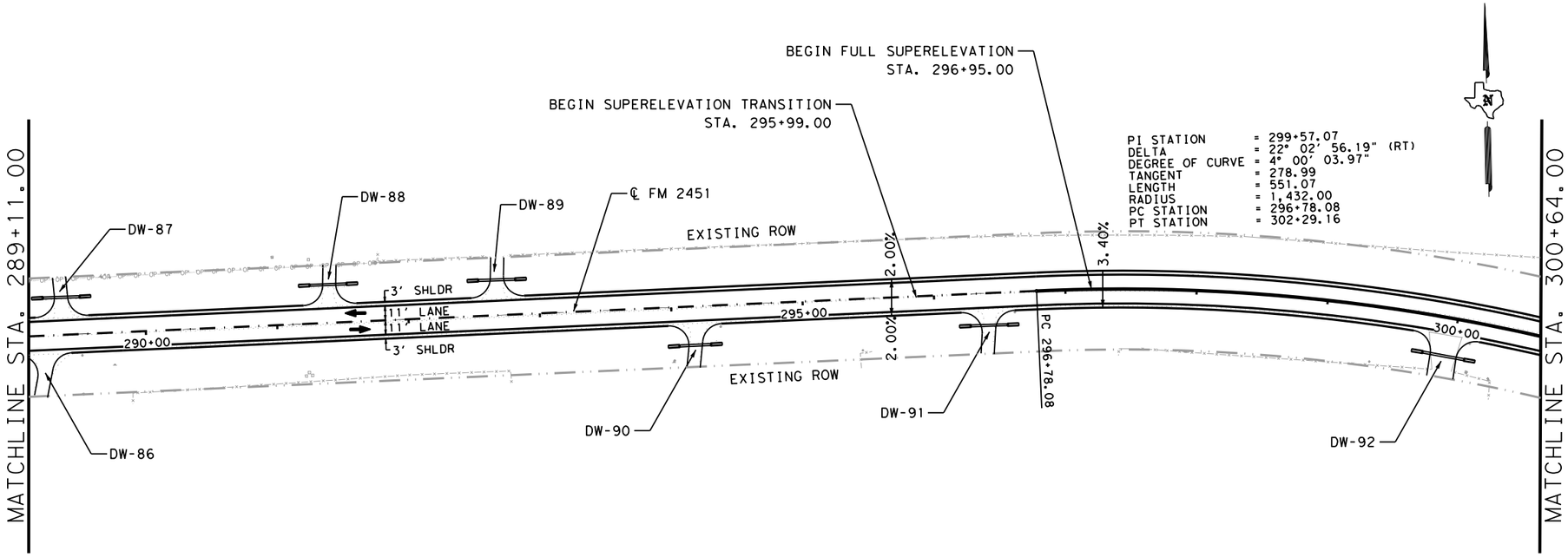

0 50 100
HORIZ. SCALE IN FEET

NOTE:
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2. SEE DRIVEWAY DETAILS AND ROADWAY DETAILS FOR ADDITIONAL INFORMATION.
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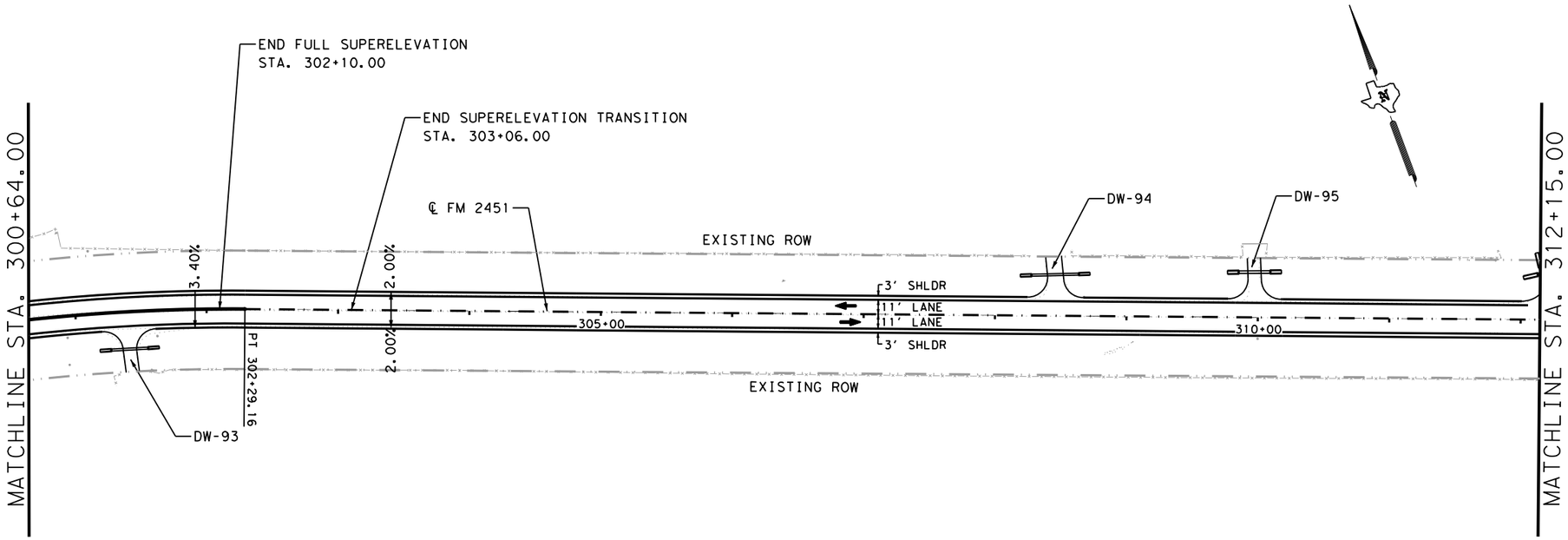

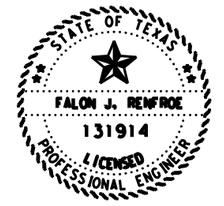

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SCALE: 1"=100' SHEET 11 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	77
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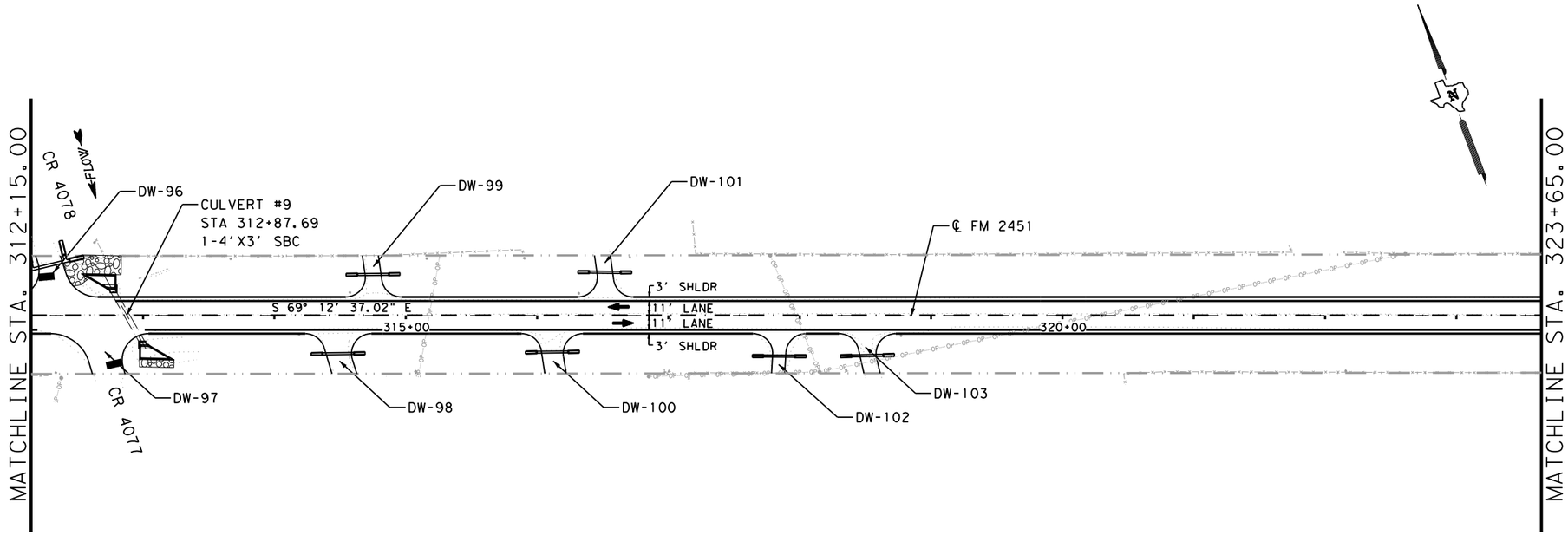

NOTE:
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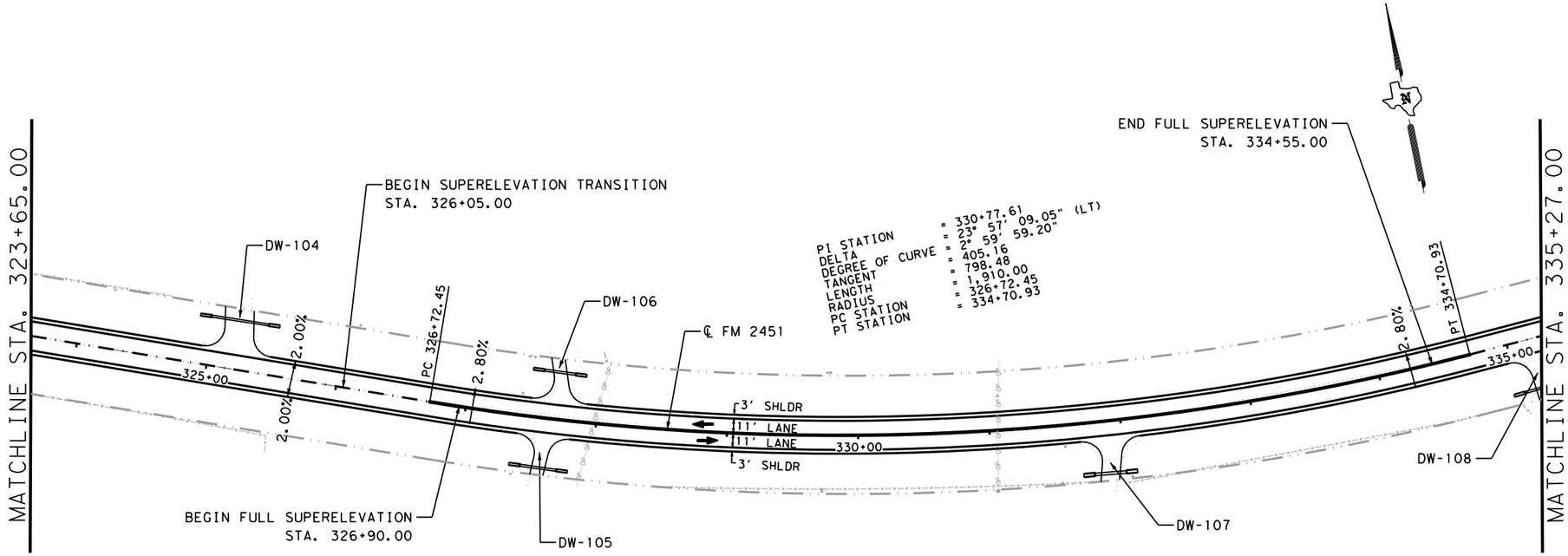

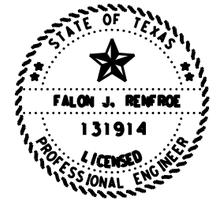

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FM 2451
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SCALE: 1"=100' SHEET 12 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	78
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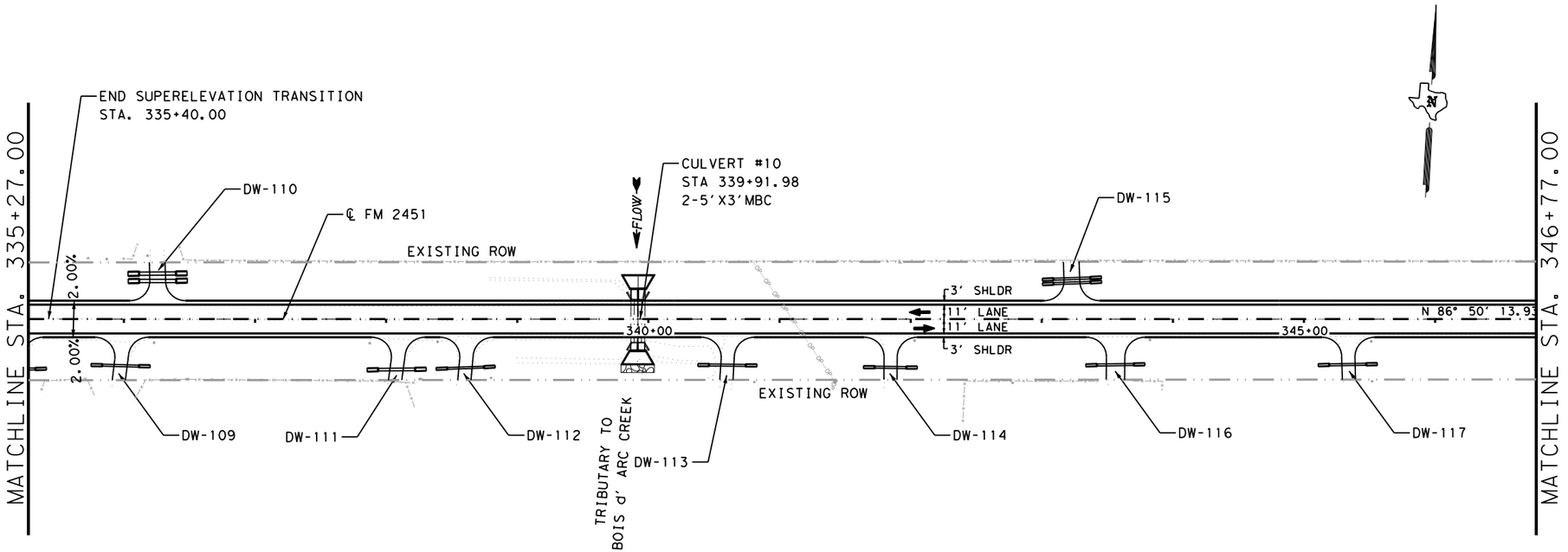

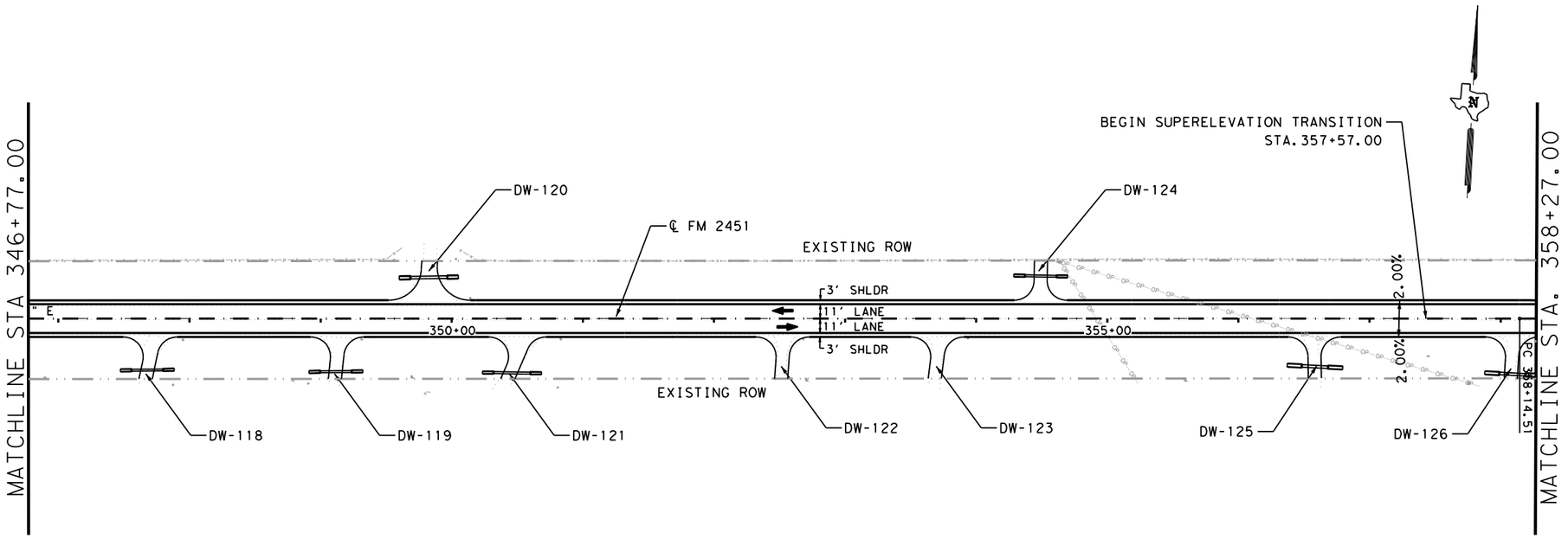

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HORIZ. SCALE IN FEET

NOTE:
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SCALE: 1"=100' SHEET 13 OF 15

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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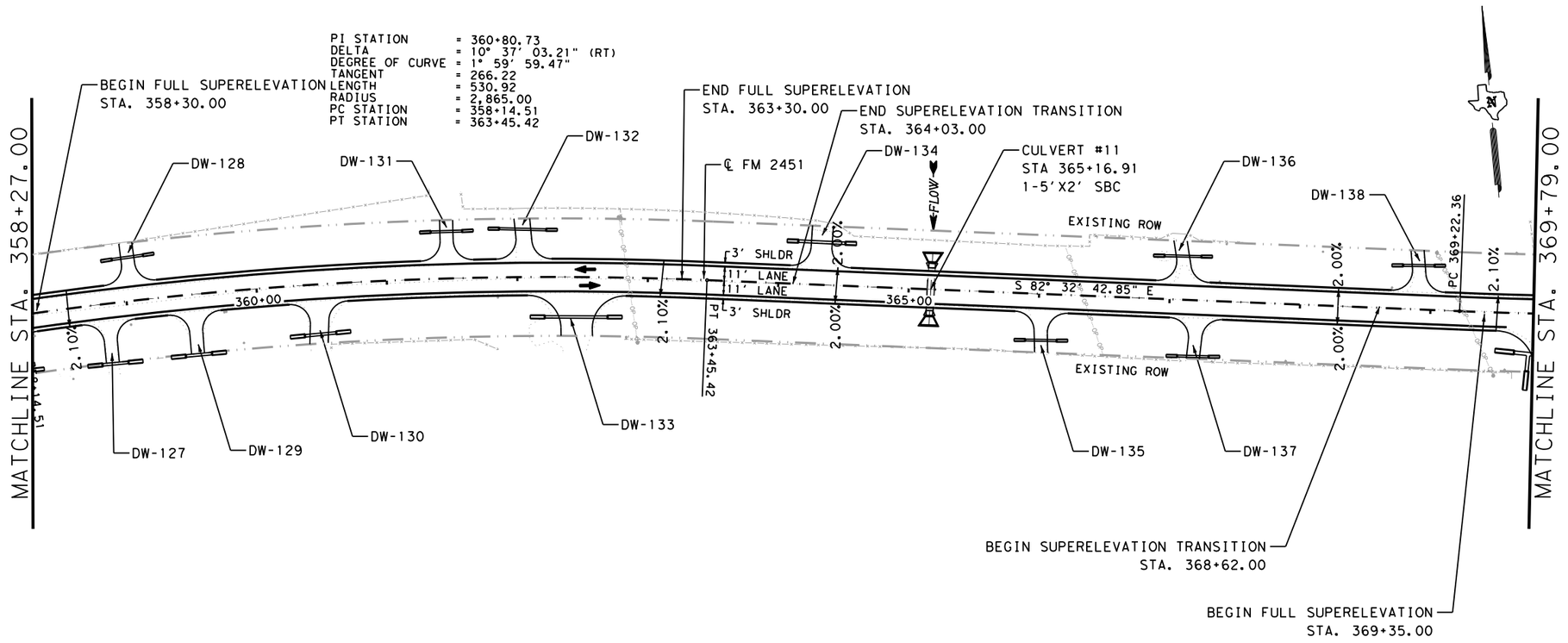

0 50 100
HORIZ. SCALE IN FEET

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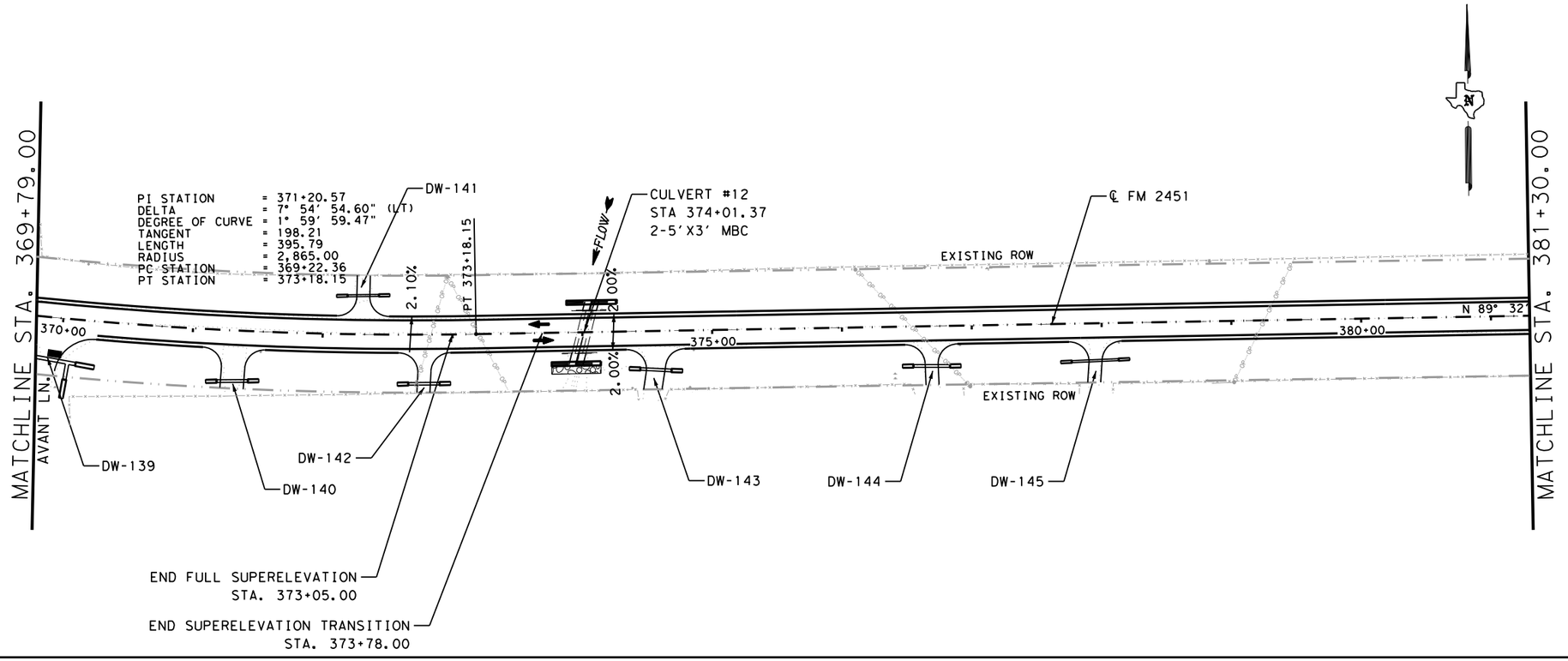

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SCALE: 1"=100' SHEET 14 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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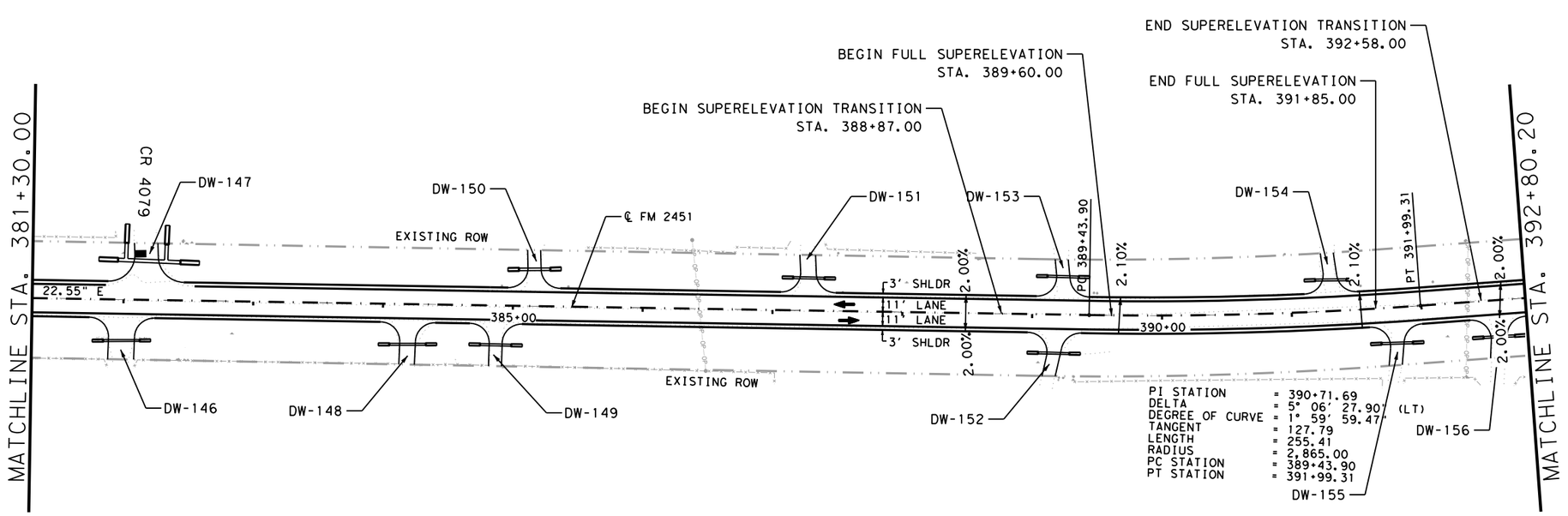

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HORIZ. SCALE IN FEET

NOTE:
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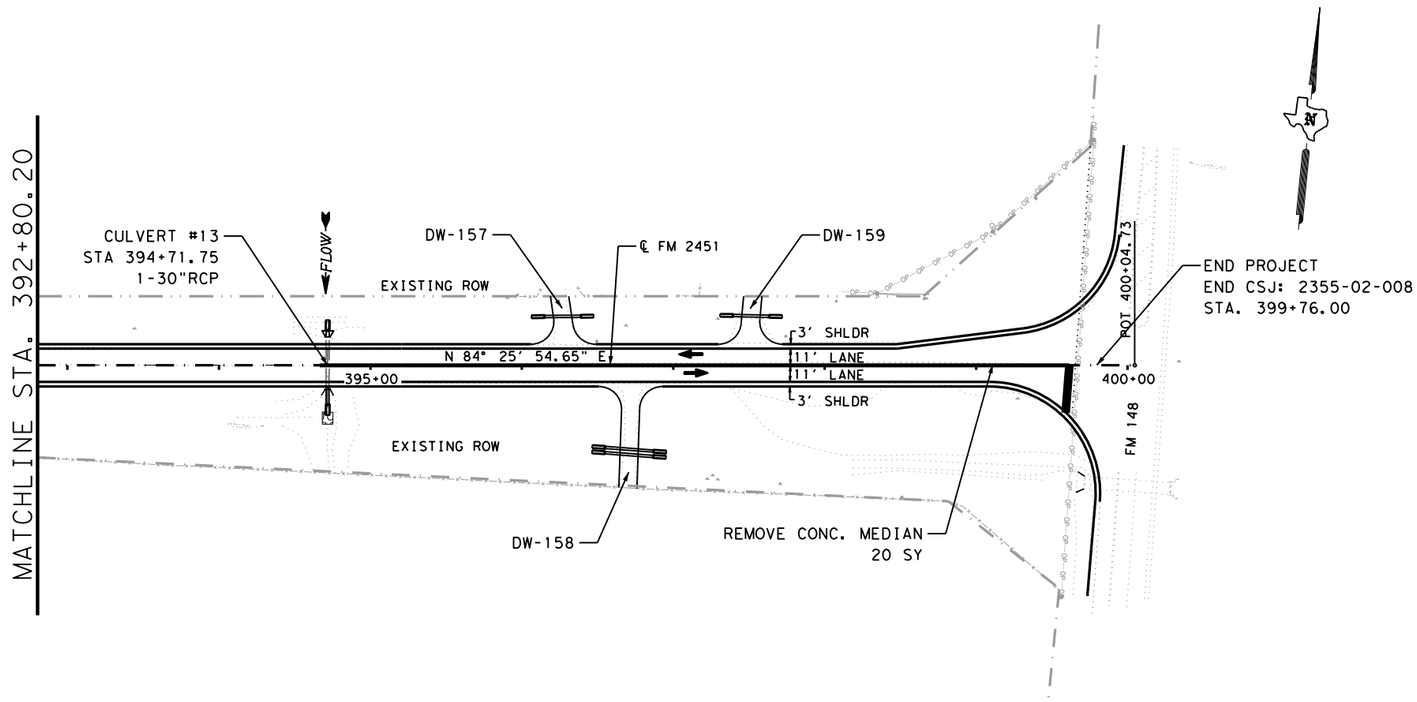

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PLAN

SCALE: 1"=100' SHEET 15 OF 15

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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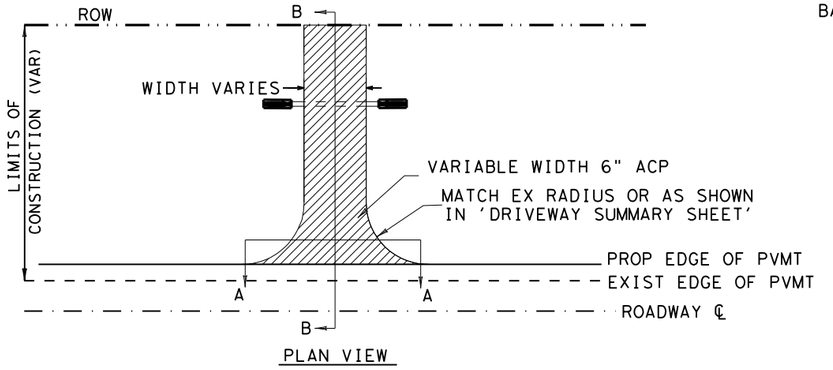
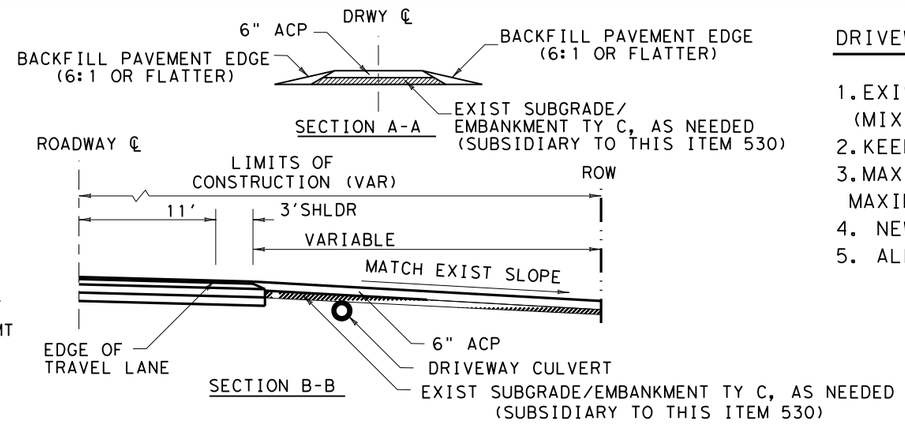


PLAN VIEW

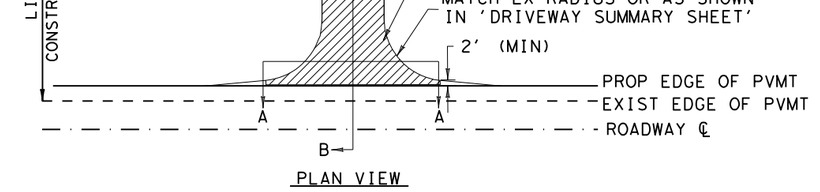


SECTION B-B

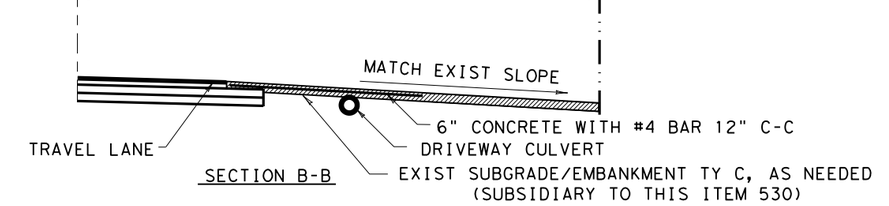
TYPICAL DRIVEWAY/INTERSECTION ASPHALT

DRIVEWAY/INTERSECTION NOTES:

1. EXIST CONC DRIVEWAY - USE 6" HES CONCRETE (MIX DESIGN SHALL BE APPROVED BY ENGINEER).
2. KEEP MINIMUM FILL 6" ON DRIVEWAY CULVERT.
3. MAXIMUM DRIVEWAY SLOPE 12% AND MAXIMUM INTERSECTION SLOPE 10%
4. NEW ACP SHALL BE SP-C SAC-B PG 64-22
5. ALL NEW FLEX BASE SHALL BE TY D GR 1-2

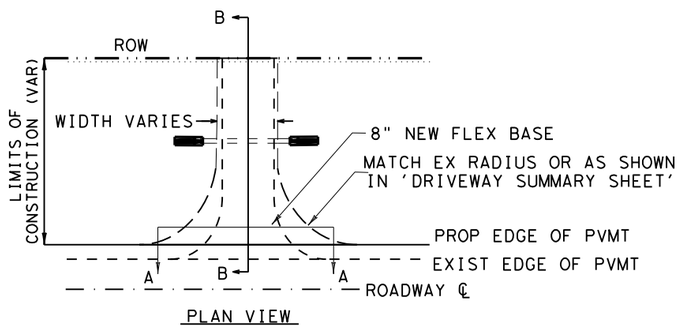


PLAN VIEW

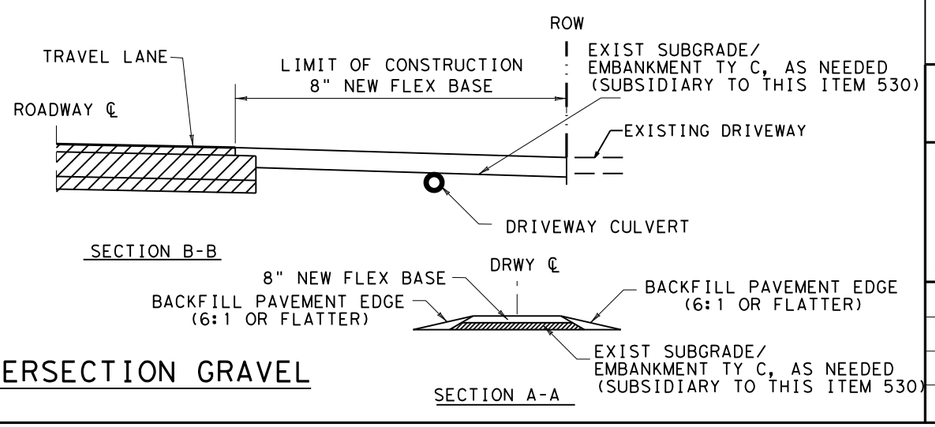


SECTION B-B

TYPICAL DRIVEWAY/INTERSECTION CONCRETE



PLAN VIEW



TYPICAL DRIVEWAY/INTERSECTION GRAVEL

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FM 2451 DRIVEWAY/INTERSECTION DETAILS

SCALE: NTS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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DATE: 10/18/2021 1:42:10 PM
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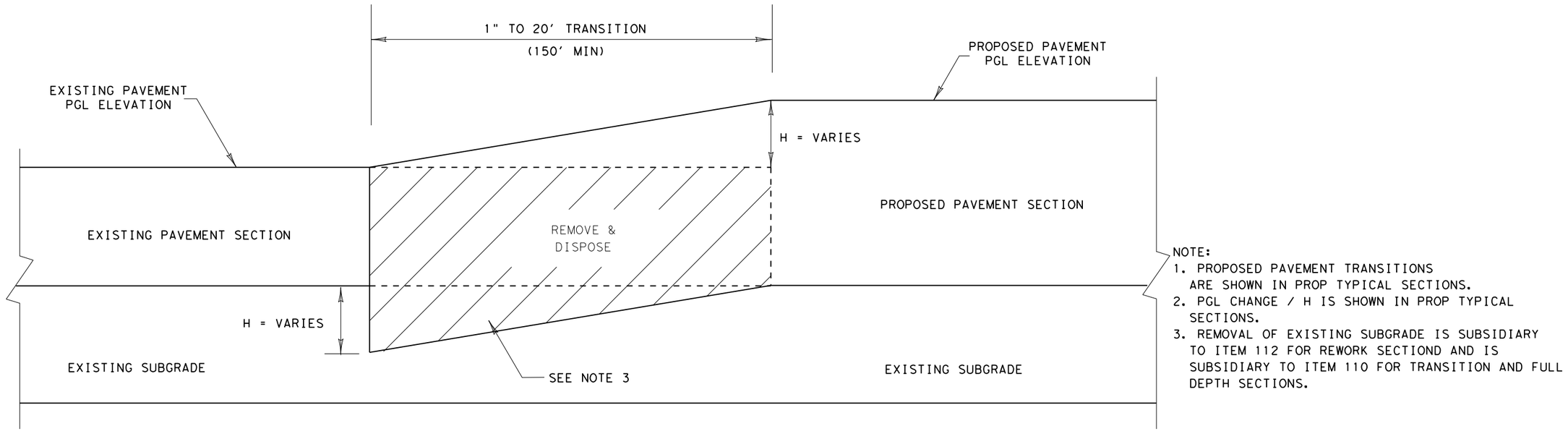
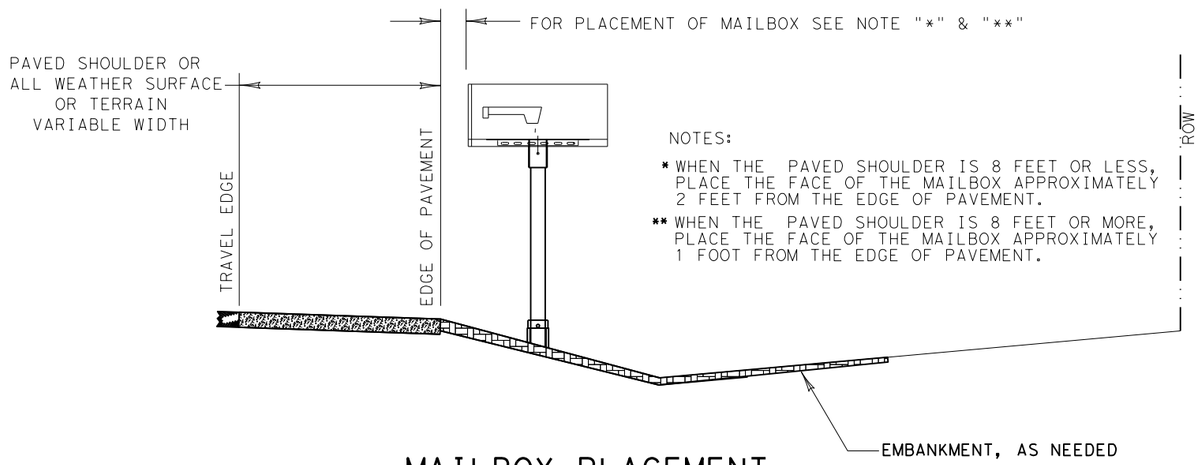


NOTE:
1. PROPOSED PAVEMENT TRANSITIONS ARE SHOWN IN PROP TYPICAL SECTIONS.
2. PGL CHANGE / H IS SHOWN IN PROP TYPICAL SECTIONS.
3. REMOVAL OF EXISTING SUBGRADE IS SUBSIDIARY TO ITEM 112 FOR REWORK SECTIOND AND IS SUBSIDIARY TO ITEM 110 FOR TRANSITION AND FULL DEPTH SECTIONS.

PAVEMENT TRANSITION DETAIL



MAILBOX PLACEMENT

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 11/3/2021
Signature of Registrant & Date

Texas Department of Transportation
© 2022

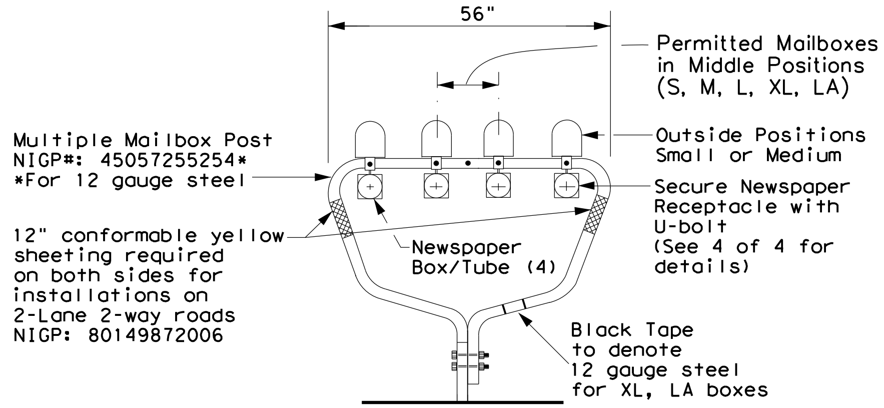
FM 2451
ROADWAY DETAILS
(PVMT TRANSITION & MAILBOX PLACEMENT)

SCALE: NTS

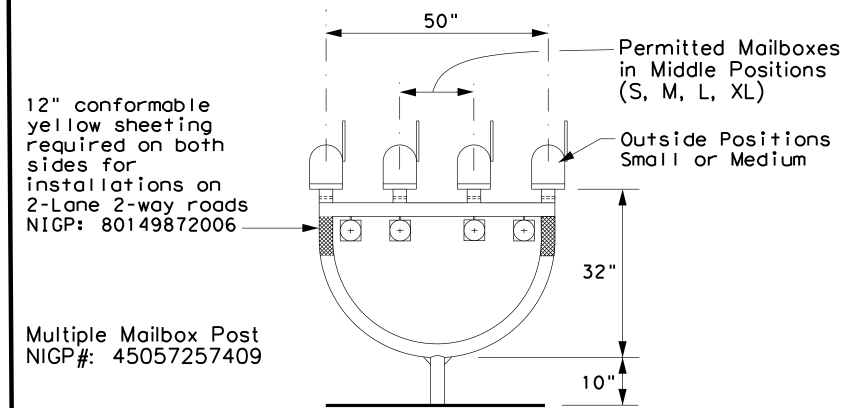
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	83
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

DATE: 11/3/2021 11:30:40 AM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\G03_RDWY MISC DETAIL.dgn

TYPE 1 - MULTIPLE



TYPE 4 - MULTIPLE



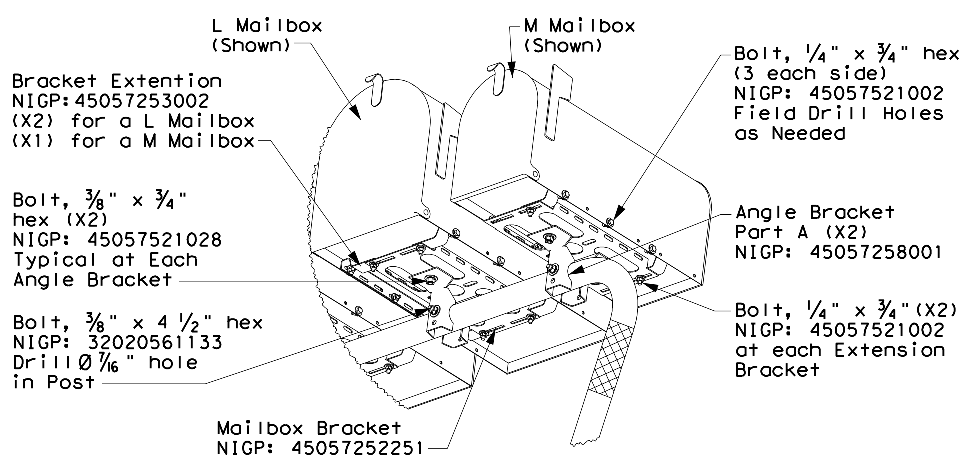
MAILBOX SIZES

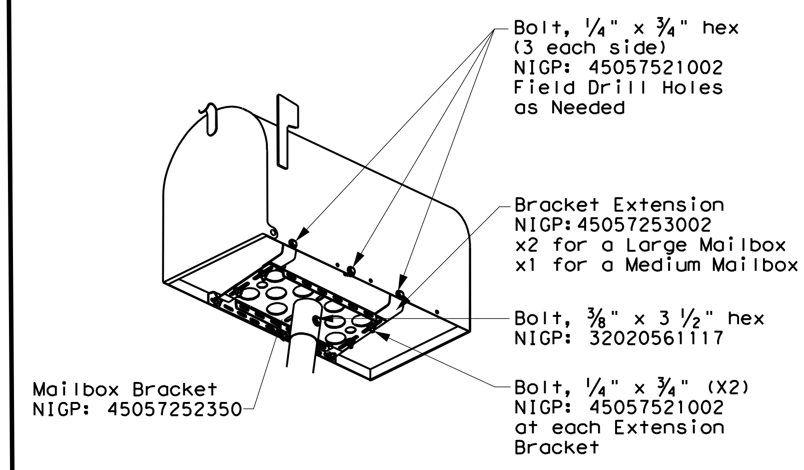
MAILBOX SIZE	TYPICAL DIMENSIONS LENGTH	WIDTH	HEIGHT	MAX ** WEIGHT
SMALL	19 ½"	6"	7"	6 LBS
MEDIUM	22 ½" *	8" *	11 ½" *	8 LBS
LARGE	23 ½"	11 ½"	13 ½"	11 LBS
EXTRA LARGE	18"	14"	12"	13 LBS
LOCKABLE	18"	11 ½"	15"	23 LBS

* See Note 1.
** Excluding Molded Plastic on 4 X 4 Post

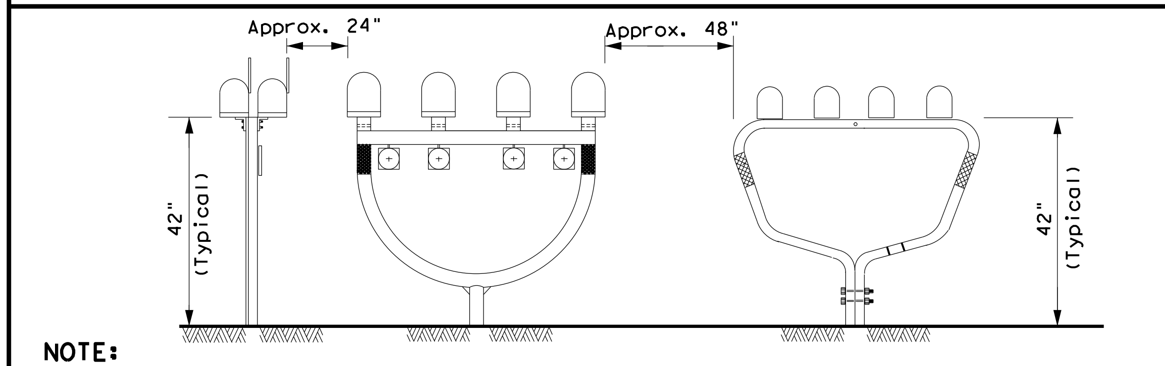
GENERAL NOTES:

1. Dimensions shown (length, width, and height) are typical, not maximums. However, anytime a medium size mailbox is mounted on a single/double mount or on the outside position on a multi mount, the dimensions shown are maximums.
2. Mailboxes shall be made of light weight sheet metal or light weight plastic. Heavy steel, cast iron or decorative mailboxes shall not be used on the state highway system.



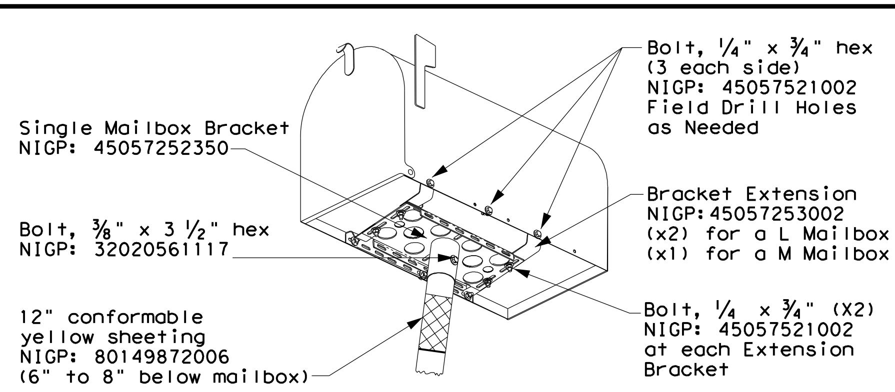


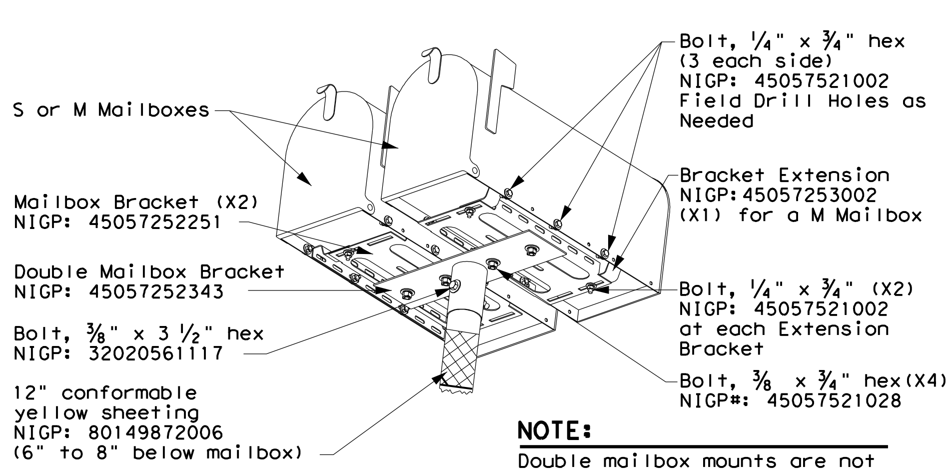
TYPICAL INSTALLATION MEASUREMENTS



NOTE:
Mailbox installations in sidewalk areas shall be in accordance with the latest TxDOT Design Standard sheets PED-Pedestrian Facilities Curb Ramps.

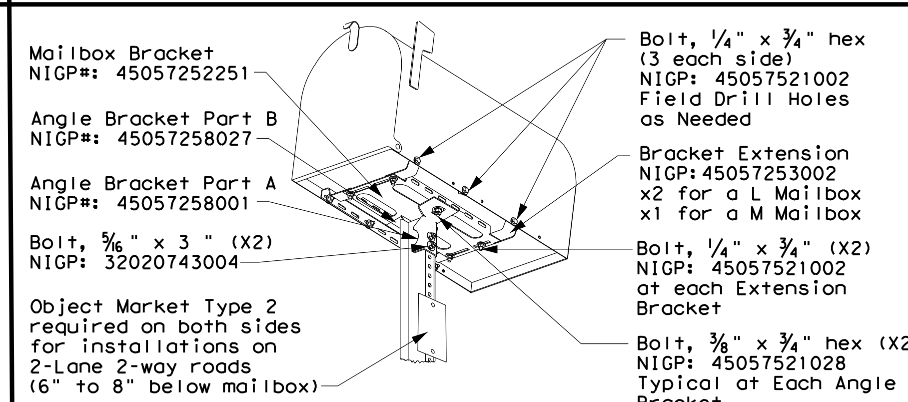
TYPE 2 and 4 - SINGLE/DOUBLE

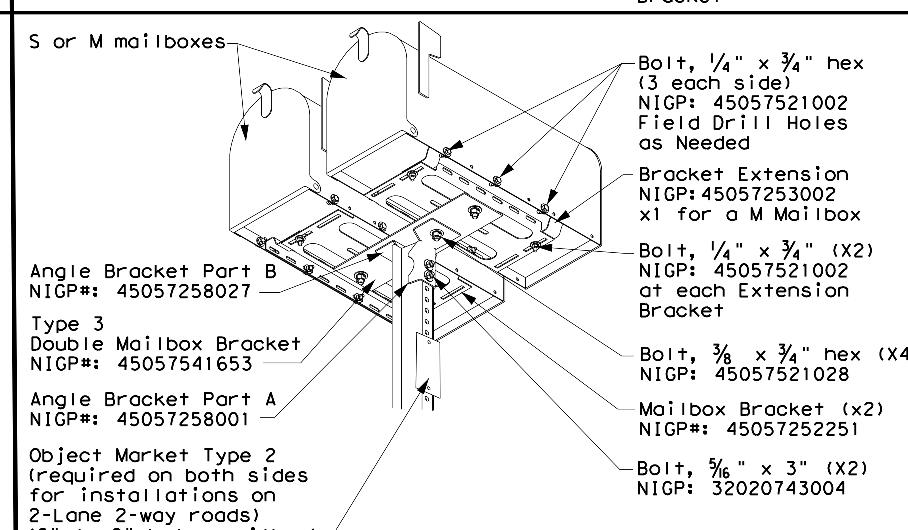




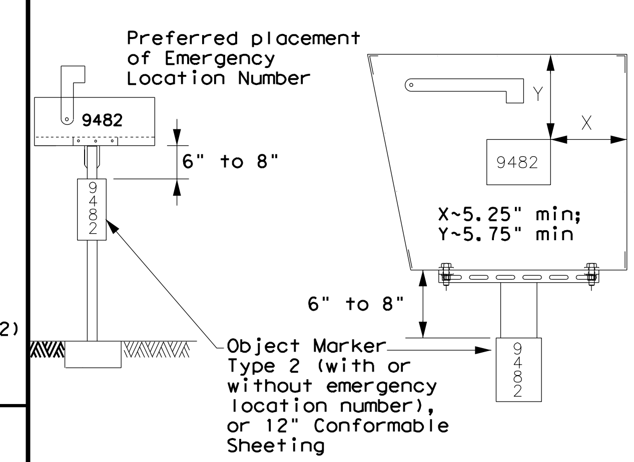
NOTE:
Double mailbox mounts are not allowed with a type 4 multiple mailbox installation

TYPE 3 - SINGLE/DOUBLE





PLACEMENT OF EMERGENCY LOCATION NUMBER

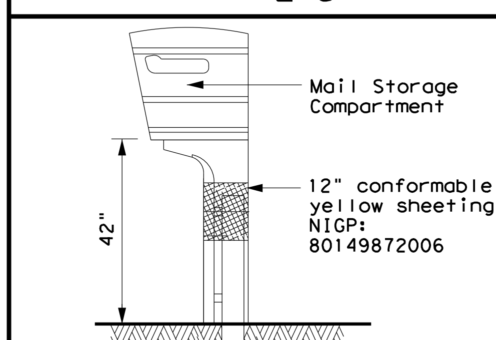


NOTES:

1. Location numbers are provided by homeowner. Minimum size 1" height.
2. Location number is typically placed on the mailbox in a contrasting color.
3. Black numbers may be placed on the Type 2 object marker if the numbers cannot be placed on the mailbox.
4. Alternatively, a green or blue plate with white numbers attached may be mounted below the object marker. Other contrasting color configuration, as approved, may be used.
5. See 3 of 4 for Foundation details.
6. See 4 of 4 for Hardware details.

SHEET 1 OF 4

TYPE 5



Typical Molded Plastic Mailbox

Texas Department of Transportation — Maintenance Division Standard

MAILBOX MOUNTING AND ASSEMBLY

MB(1)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT March 2004	CONT 2355	SECT 01	JOB 006, ETC.	HIGHWAY FM 2451
REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	DIST DAL		COUNTY KAUFMAN	SHEET NO. 84

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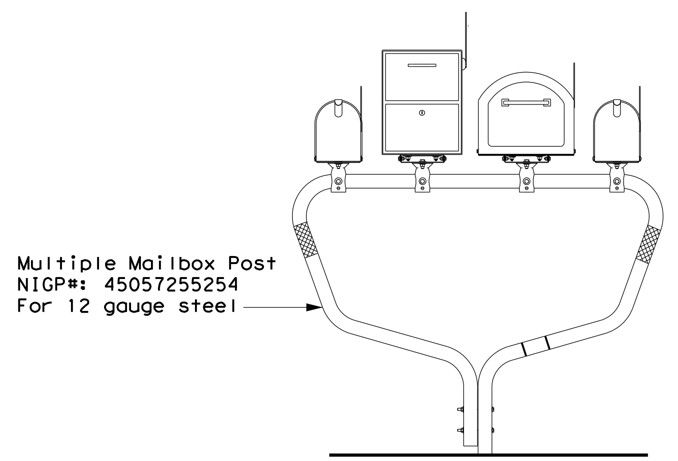
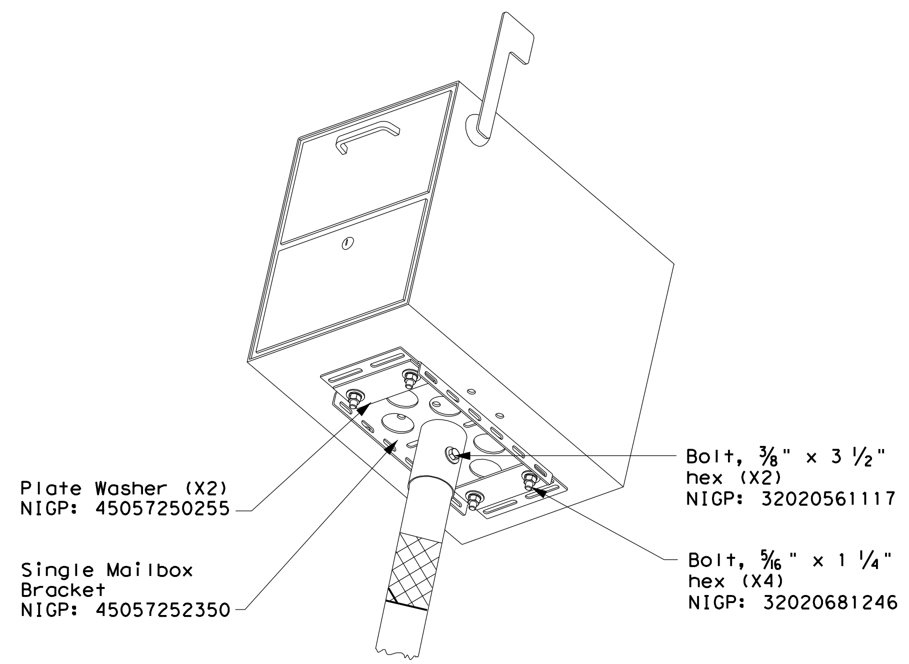
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\

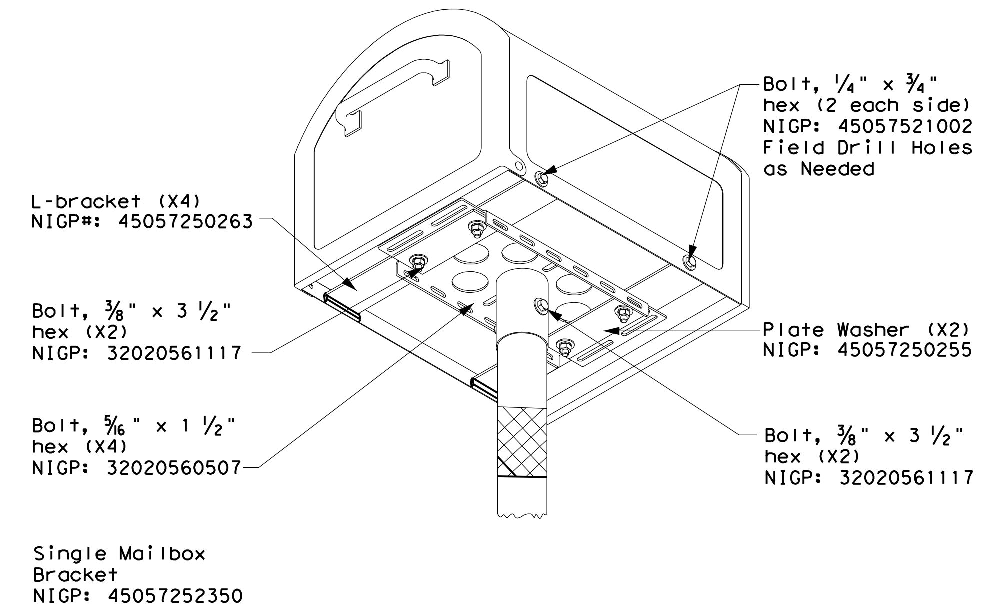
TYPE 1- MULTI LOCKABLE AND XL MAILBOX



TYPE 2/4 - SINGLE LOCKABLE MAILBOX

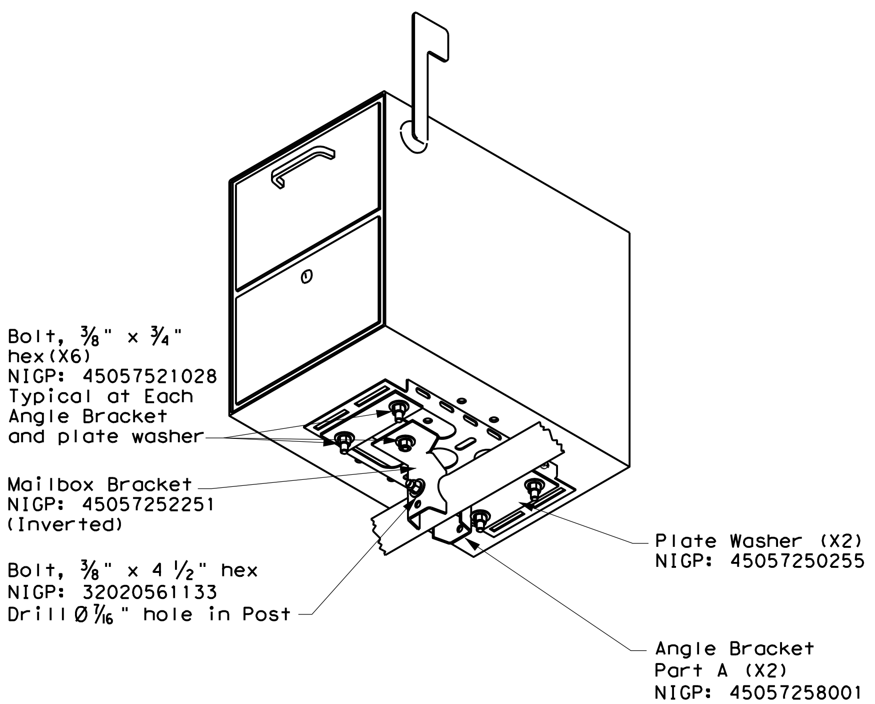


TYPE 2/4 - SINGLE XL MAILBOX

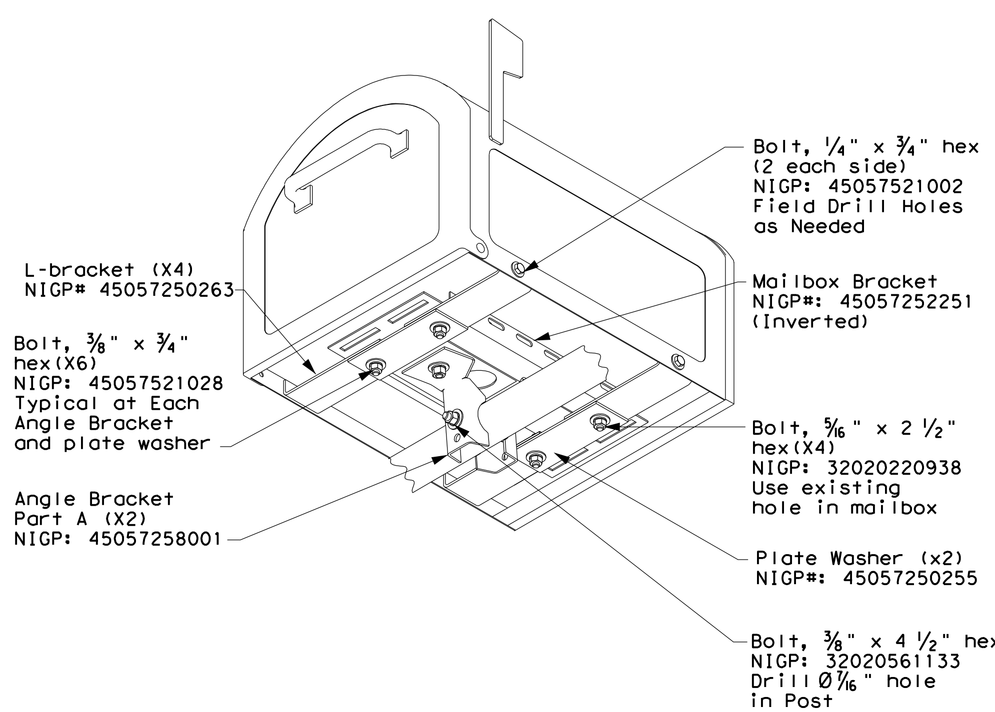


NOTE:
Follow same configuration when mounting an XL mailbox on a Type 4 multi post.

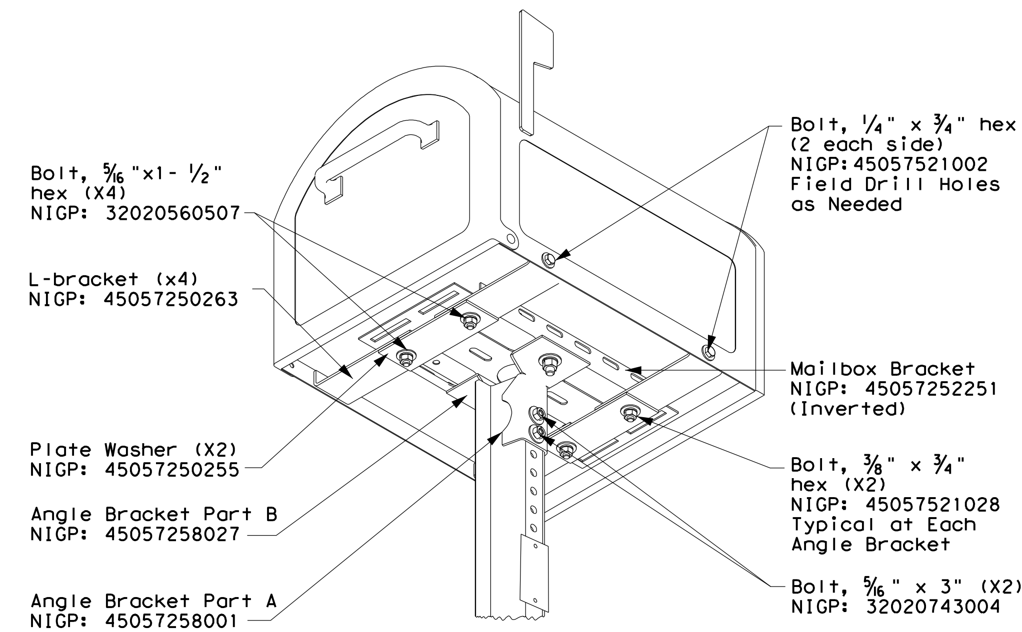
TYPE 1 MULTI - LOCKABLE ARCHITECTURAL (LA)



TYPE 1 MULTI - XL MAILBOX



TYPE 3 - XL MAILBOX MOUNTING



Texas Department of Transportation

Maintenance Division Standard

XL AND LOCKABLE ARCHITECTURAL MAILBOX ASSEMBLY

MB(2)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	2355	01	006, ETC.	FM 2451
	DIST		COUNTY	SHEET NO.
	DAL		KAUFMAN	85

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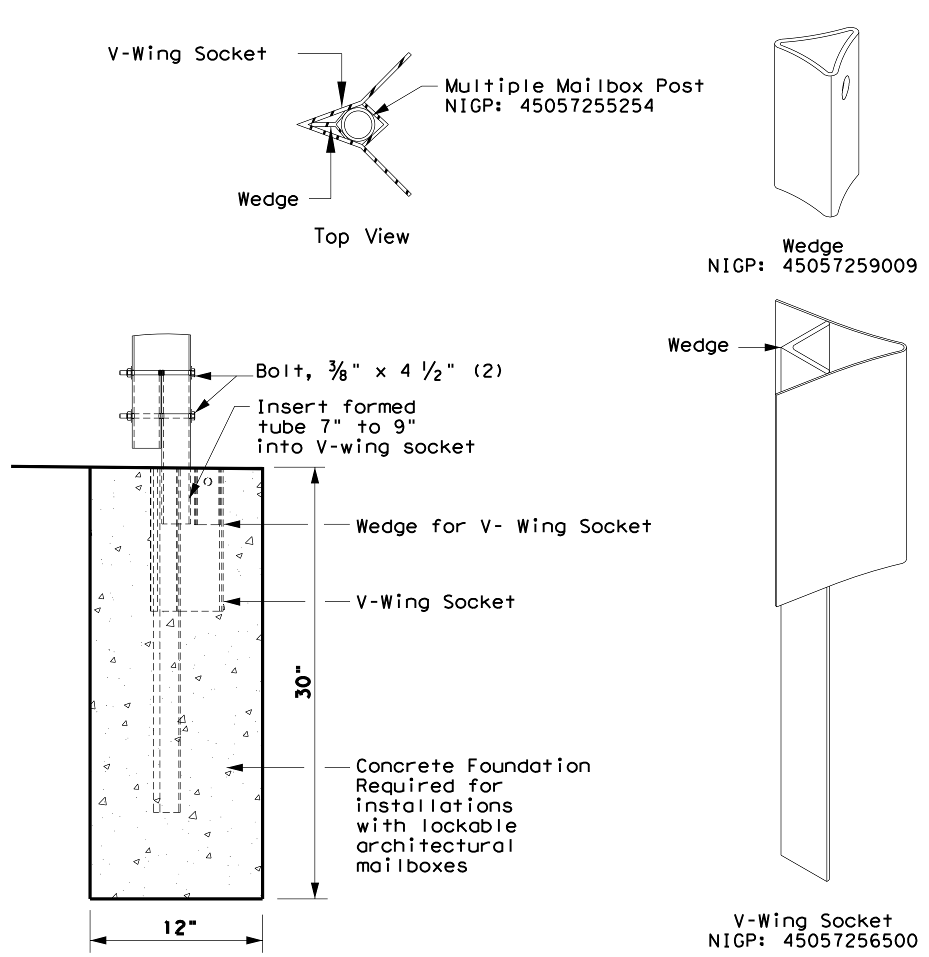
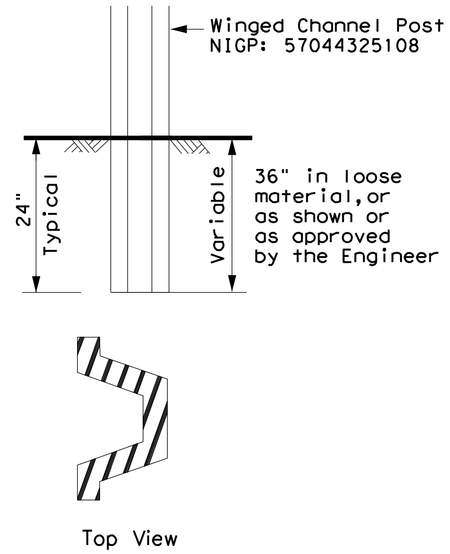
TYPE 1 - SUPPORT/FOUNDATION

Thin Wall Tube w/ V-LOC Anchorage



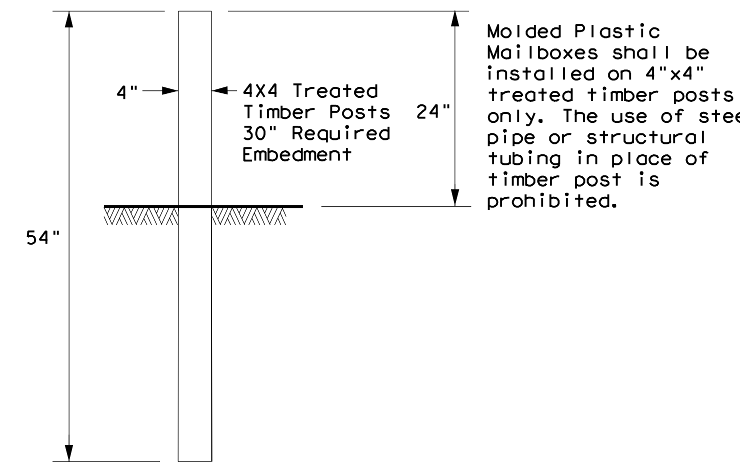
TYPE 3 - SUPPORT/FOUNDATION



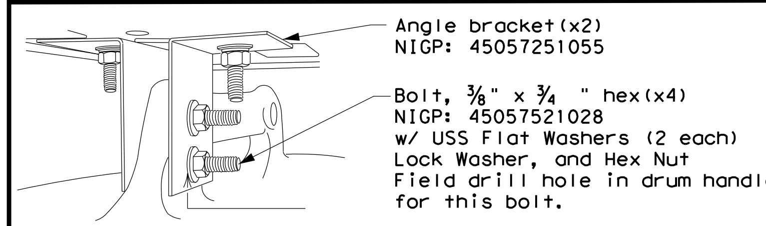
NOTES:

1. Attach Object Marker (OM) facing direction of traffic.
2. OM will also be required on opposite side if installed on a 2-Lane, 2-Way roadway.

TYPE 5 - SUPPORT/FOUNDATION



TYPE 6 - TEMPORARY MAILBOX SUPPORT



Plastic Drum NIGP: 55093383655
Rubber Collar NIGP: 55093387102

NOTES:

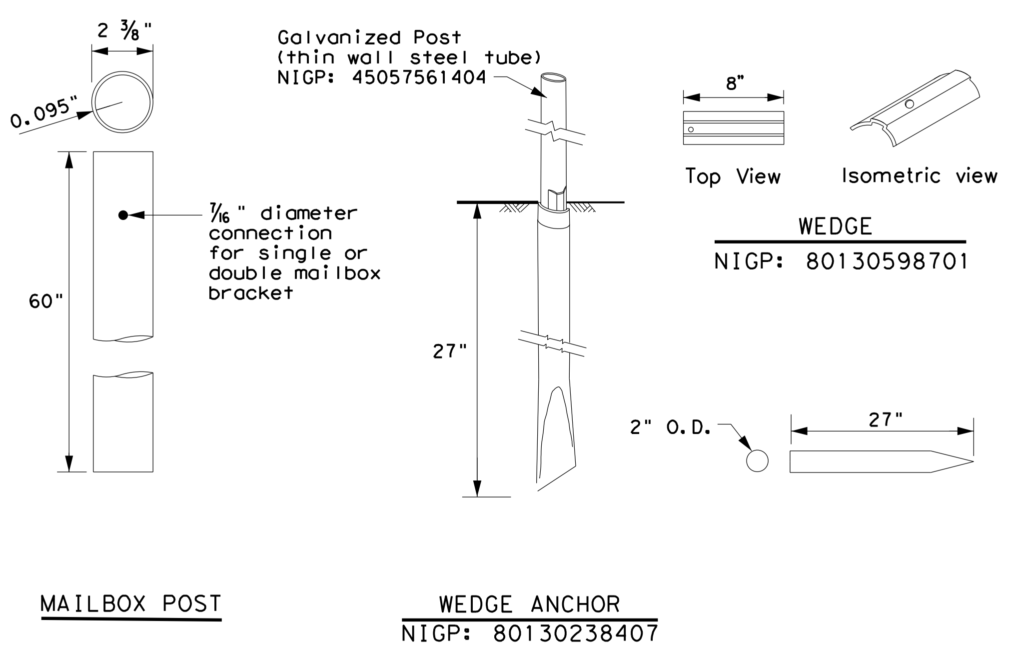
1. Place on approved plastic drum as shown in the Compliant Work Zone Traffic Control Devices (CWZTCD).
2. Existing attachment hardware shall be used unless damaged. Damaged hardware shall be replaced.

GENERAL NOTES:

1. Erect post plumb or vertical.
2. When galvanized part is required galvanize in accordance with Item 445.
3. Use a concrete footing as shown or when directed. Concrete footing will be required when soils do not hold the support/foundations in a stable condition, only on Type 1, Type 2, and Type 4

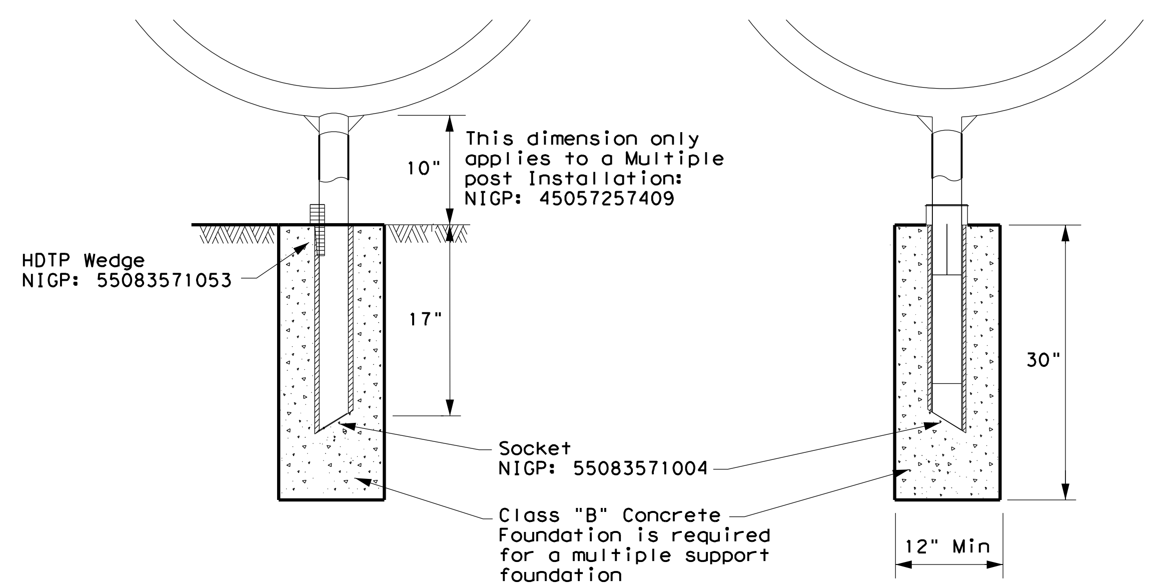
TYPE 2 - SUPPORT/FOUNDATION

Thin Wall Steel Tube w/Wedge Anchor System



TYPE 4 - SUPPORT/FOUNDATION

Whitecoated steel post NIGP: 45057561107
Multiple post NIGP: 45057257409
Recycled Rubber post (RR) NIGP: 45057561057



Texas Department of Transportation

Maintenance Division Standard

MAILBOX SUPPORT AND FOUNDATION

MB(3)-21

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REVISIONS 2/2005 11/2009 4/2015	2355	01	006, ETC.	FM 2451
6/2005 1/2011	DIST	COUNTY		SHEET NO.
11/2006 7/2014	DAL	KAUFMAN		86

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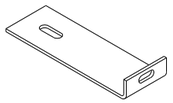
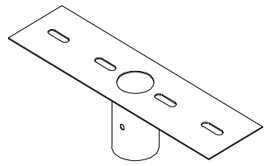
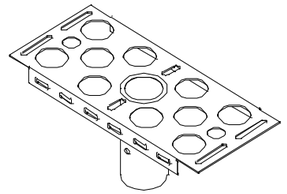
TYPE	TYPE 1	TYPE 2	TYPE 3	TYPE 4			TYPE 5	TYPE 6
Configuration	Multiple	Single or Double	Single or Double	Single	Double	Multiple	Single	Single
Mailbox Size NIGP #	Outside Position: S or M Inside Position: S, M, L, XL, or LA	Single: S, M, L, XL, or LA Double: SS, SM, MM	Single: S, M, L, or XL Double: SS, SM, MM	S, M, L, XL, or LA	SS, SM, or MM	Outside Position: S or M Inside Position: S, M, L, or XL	Molded Plastic	S, or M
Mailbox Post NIGP #	45057255254 (Galvanized Multiple)	45057561404 (Thin Walled Gavanize)	57044325108 (Wing Channel Post)	45057561107 (Thin walled white powder coated) 45057561057 (Recycled Rubber Post: S or M only)	45057561107 (Thin Walled White Powder Coated)	45057257409 (White Powder Coated Multiple)	4x4 Timber	Construction Barrel
Post and Mailbox Hardware NIGP #	45057259009 (Wedge) 45057256500 (V-Wing Socket) 45057253002 (Bracket Extension) 45057252251 (Mailbox Bracket) 45057258001 (Part A Angle Bracket x2) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket for XL x4)	80130598701 (Wedge) 80130238407 (Wedge Anchor) 45057253002 (Bracket Extension) 45057252343 (Double MB Bracket) 45057252350 (S. Mailbox Bracket) 45057252251 (Mailbox Bracket) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket forXL x4)	45057541653 (Type 3 Double Mailbox Bracket) 45057252251 (Mailbox Bracket) 45057253002 (Bracket Extension) 45057258001 (Part A Angle Bracket) 45057258027 (Part B Angle Bracket) 45057250255 (Plate Washer for XL x2) 45057250263 (L-Bracket for XL x4)	55083571053 (Wedge) 55083571004 (Socket) 45057252350 (Single Mailbox Bracket) 45057253002 (Bracket Extension) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket for XL x4)	55083571053 (Wedge) 55083571004 (Socket) 45057253002 (Bracket Extension) 45057252343 (Double Mount Bracket) 45057252251 (Mailbox Bracket x2)	55083571053 (Wedge) 55083571004 (Socket) 45057253002 (Bracket Extension) 45057252350 (Single Mount Bracket) 45057250255 (Plate Washer for XL x2) 45057250263 (L-Bracket for XL x4)	None	45057251055 Angle Bracket (x2)
Foundation Used	Class B Concrete (Required for LA Mailboxes)	Class B Concrete (Required for LA Mailboxes)	None	Class B Concrete (not used with recycled rubber post, required for LA Mailboxes)	Class B Concrete (not required)	Class B Concrete	None	None



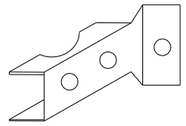
NIGP: 45057250263
L-Bracket x4 for
XL sized mailboxes



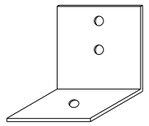
NIGP: 45057252343
Double Mailbox Bracket
For Type 2 and Type 4
double mount



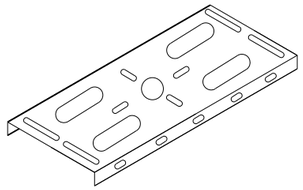
NIGP: 45057252350
Single Mailbox Bracket
For Type 2 single and for
Type 4 single and multi mount



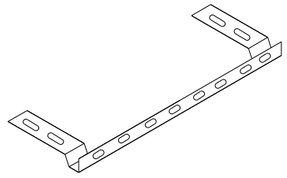
NIGP: 45057258001
Part "A" Angle Bracket
For Type 1 multi (2 per mailbox)
and Type 3 single and double



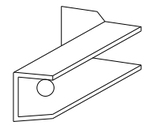
NIGP: 45057251055
Type 6 Angle Bracket
(2 per mailbox)



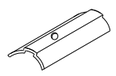
NIGP: 45057252251
Mailbox Bracket
For Type 1 multi and
any double mount (use 2)



NIGP: 45057253002
Bracket Extension
Use 1 for a medium Mailbox
Use 2 for a Large Mailbox



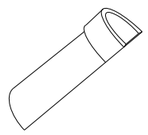
NIGP: 45057258027
Part "B" Angle Bracket
For Type 3 single
and double



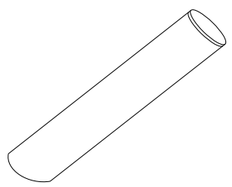
NIGP: 80130598701
Wedge for Type 2

NIGP: 45057250255
Plate Washer for Architecural
and XL Mailboxes

NIGP: 45057541653
Type 3 double mailbox bracket

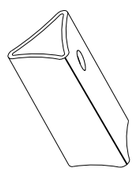


NIGP: 55083571053
Type 4 Mailbox Wedge

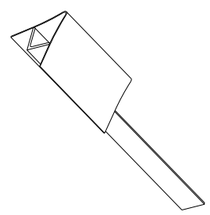


NIGP: 55083571004
Type 4 Mailbox Socket

NIGP: 80130238407
Type 2 Wedge Anchor



NIGP: 45057259009
Wedge for Type 1 V-wing Socket



NIGP: 45057256500
V-wing Socket for
Type 1 Foundation

NIGP #	OBJECT MARKERS AND CONFORMABLE SHEETING
55008311759	Type 2 OM 4"x4" (3 Needed) for Type 3 Wing Channel Post
55008312906	Type 2 OM 6"x12" (1 needed) for Type 3 Wing Channel Post
80149872006	12" Conformable Reflective Yellow Sheeting for Flexible Posts

NOTES:

1. Type 2 object marker in accordance with Traffic Engineering Standard Delineators & Object Markers.
2. A light weight receptacle for newspaper delivery can be attached to mailbox posts if the receptacle does not touch the mailbox, present a hazard to traffic or delivery of the mail, extend beyond the front of the mailbox, or display advertising, except the publication title.

BID CODES FOR CONTRACTS

MB-(X) ASSM TY (XXX) (X)

Type of Mailbox
- S = Single
- D = Double
- M = Multiple
- MP = Molded Plastic

Type of Post
- WC = Winged Channel Post
- RR = Recycled Rubber
- TWW = Thin Walled White Tubing
- TWG = Thin Walled Galvanized Tubing
- TIM = Timber

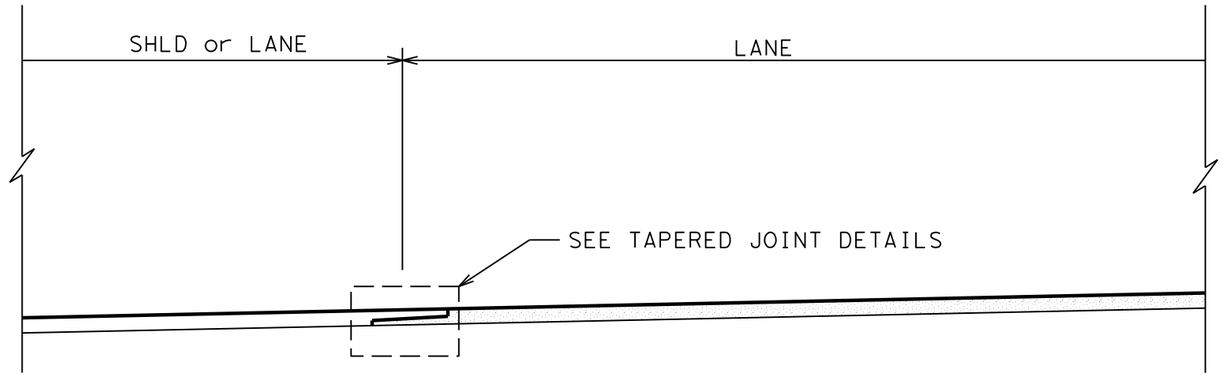
Type of Foundation
- Ty 1 = V-Loc
- Ty 2 = Wedge Anchor Steel System
- Ty 3 = Winged Channel post
- Ty 4 = Wedge Anchor Plastic System
- Ty 5 = 4 X 4 Post

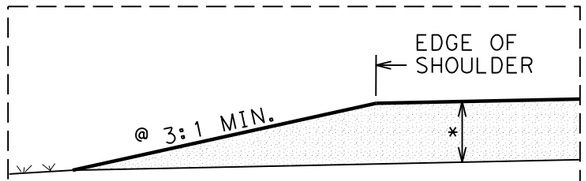
Texas Department of Transportation — Maintenance Division Standard

NIGP PARTS LIST AND COMPATIBILITY

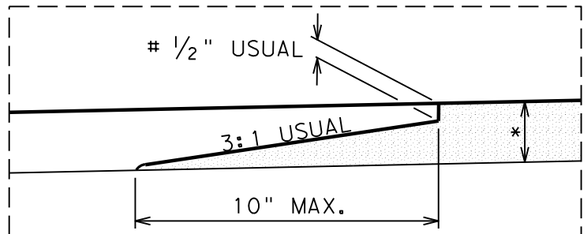
MB(4)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		87

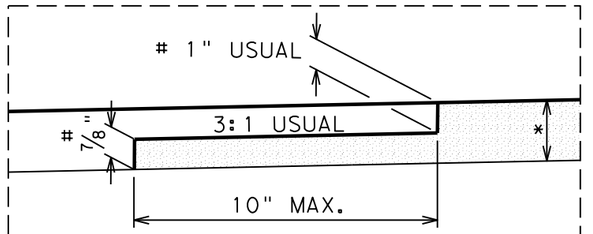




TAPERED OUTSIDE EDGE DETAIL



TAPERED JOINT DETAIL 1.5" TO 4" LIFTS



TAPERED JOINT DETAIL OVER 4" LIFTS

@ 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.

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HOT MIX EDGE AND LONGITUDINAL JOINT DETAILS DALLAS DISTRICT STANDARD

LJD(1-1)-07

FED. RD. DIV. NO.	PROJECT NUMBER		SHEET NUMBER
18	SEE TITLE SHEET		88
STATE	DISTRICT	COUNTY	
TEXAS	DALLAS	KAUFMAN	
CONTROL	SECTION	SECTION	HIGHWAY NUMBER
2355	01	006, ETC.	FM 2451

REVISED ON 9/10/08

FILENAME: pw:\\txdot.projectwiseonline.com:TX00T5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\STANDARDS\ROADWAY\14_Ljd11.dgn

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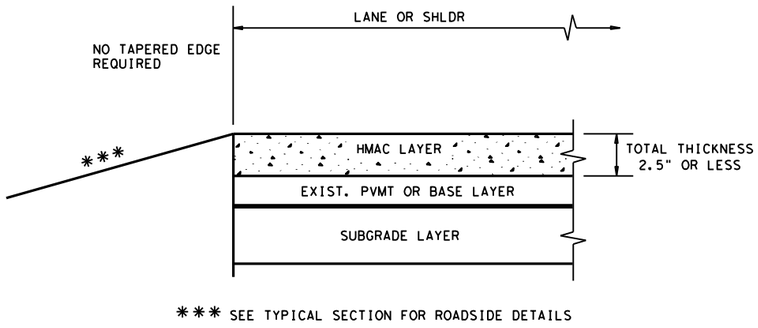
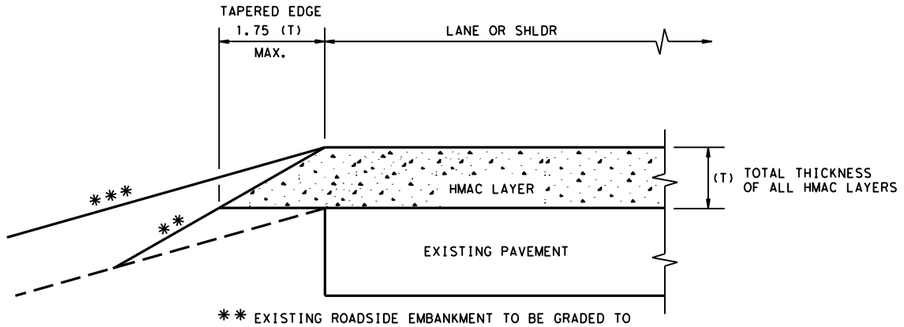
DATE: 10/13/2021
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\STANDARDS\ROADWAY\15.tehmac11.dgn



*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

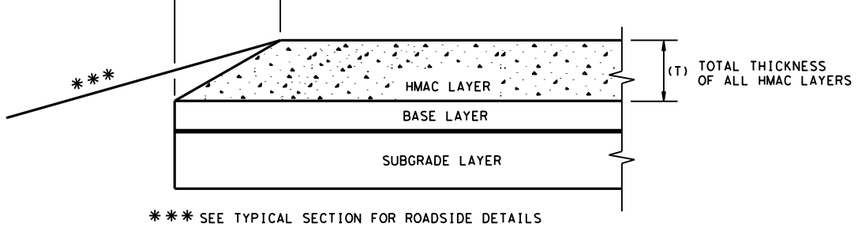
CONDITION - 1
THIN HMAC SURFACES OR HMAC OVERLAY WITH THICKNESS OF 2.5" OR LESS



** 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.

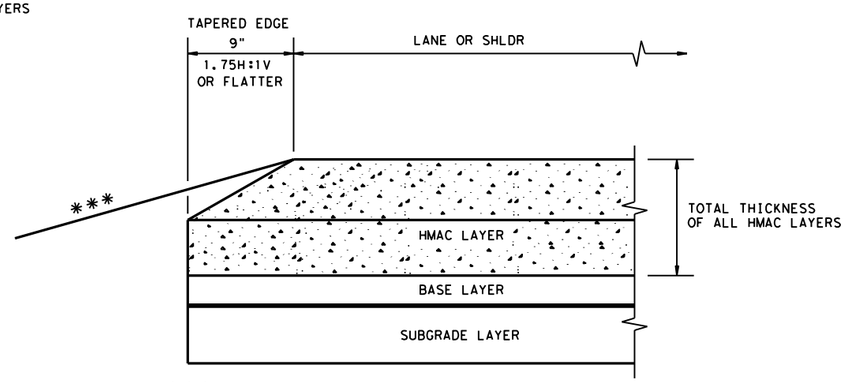
*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

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

(NOT TO SCALE)

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.

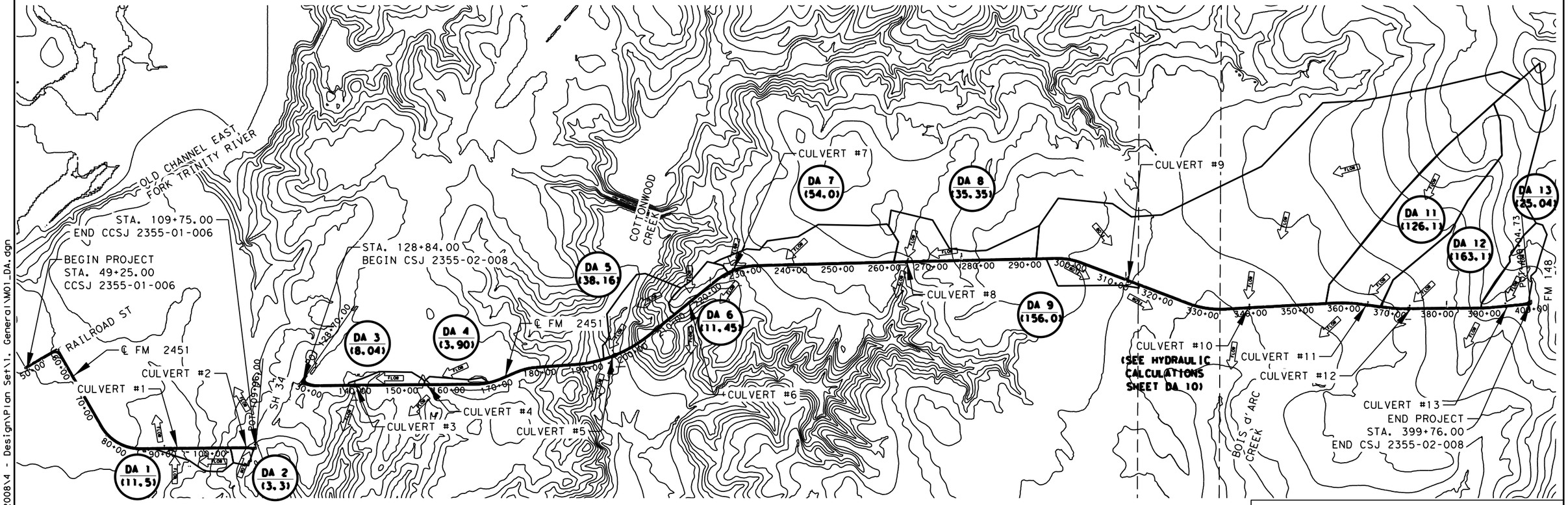
Texas Department of Transportation

Design Division Standard

TAPERED EDGE DETAILS
HMAC PAVEMENT

TE(HMAC)-11

FILE: tehmac11.dgn	DN: TxDOT	CK: RL	DW: KB	CK:
© TxDOT January 2011	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		89



Coeff.	10%		1%
e	0.7741		0.7605
b (in.)	71.2809		103.4628
d (min)	11.0464		12.2819

CULV NO.	COUNTY: KAUFMAN; AREA TYPE: RURAL											10-YEAR		100-YEAR	
	DESCRIPTION	STATION	DA I.D.	Cr *Unimproved Areas*	Ci	Cv *Unimproved Areas*	Cs	C	A (acres)	T_c (min)		I_{10} (in/hr)	Q_{10} (cfs)	I_{100} (in/hr)	Q_{100} (cfs)
1	2-24"x45' RCP PROP	90+47.15	A1	0.08	0.06	0.07	0.07	0.28	11.50	26.0		4.35	**14.01**	6.47	**20.83**
2	1-3'X2'X56' SBC PROP	109+47.09	A2	0.08	0.06	0.07	0.07	0.28	3.30	22.0		4.75	**4.39**	7.04	**6.50**
3	1-6'X5'X51 SBC PROP	140+10.65	A3	0.08	0.06	0.07	0.07	0.28	8.04	35.0		3.68	**8.28**	5.51	**12.40**
4	1-30"X53' RCP PROP	155+60.92	A4	0.08	0.06	0.07	0.04	0.25	3.90	37.0		3.56	**3.47**	5.34	**5.21**
5	2-9'X9'X48' MBC PROP	196+49.14	A5	0.08	0.06	0.07	0.07	0.28	38.16	58.0		2.69	**28.71**	4.08	**43.55**
6	1-24"X53' RCP PROP	216+79.53	A6	0.09	0.06	0.07	0.07	0.29	11.45	24.0		4.54	**15.08**	6.74	**22.38**
7	2-42"X74' RCP PROP	227+57.82	A7	0.075	0.06	0.07	0.07	0.28	54.00	73.0		2.31	**34.27**	3.52	**52.25**
8	1-48"X58' RCP PROP	264+93.11	A8	0.09	0.06	0.07	0.07	0.29	35.35	55.0		2.78	**28.51**	4.21	**43.20**
9	1-4'X3'X51' SBC PROP	312+87.69	A9	0.09	0.07	0.07	0.04	0.27	156.00	83.0		2.12	**89.10**	3.23	**136.22**
10	2-5'X3'X47' MBC PROP	339+91.98	A10	(SEE HYDRAULIC CALCULATIONS SHEET DA 10)											
11	1-5'X2'X41' SBC PROP	365+16.91	A11	0.08	0.07	0.06	0.04	0.25	126.10	110.0		1.74	**54.85**	2.68	**84.33**
12	2-5'X3'X48' MBC PROP	374+01.37	A12	0.09	0.07	0.07	0.04	0.27	163.10	83.0		2.12	**93.16**	3.23	**142.42**
13	1-30"X49' RCP PROP	394+71.75	A13	0.08	0.06	0.07	0.04	0.25	25.04	32.0		3.87	**24.25**	5.79	**36.26**

LEGEND:

FLOW WATER FLOW DIRECTION

DA # / (AC) DRAINAGE ID & AREA

1. TXDOT HYDRAULIC DESIGN MANUAL (SEPT 2019) USED AS REFERENCE.
2. CALCULATIONS ARE BASED ON THE RATIONAL METHOD FOR DRAINAGE AND NRCS METHOD FOR TIME OF CONCENTRATION.
3. USGS MAP 2010 USED FOR DRAINAGE AREA COMPUTAION.
4. FOR RECIEVING WATERS OF THE US, REFERENCE CULVERT LAYOUTS.

0 1050 2100
HORIZ. SCALE IN FEET

STATE OF TEXAS
Jahor L. Roy
83789
LICENSED
PROFESSIONAL ENGINEER

Jahor Roy , P.E. 10/14/21
Signature of Registrant & Date

Texas Department of Transportation
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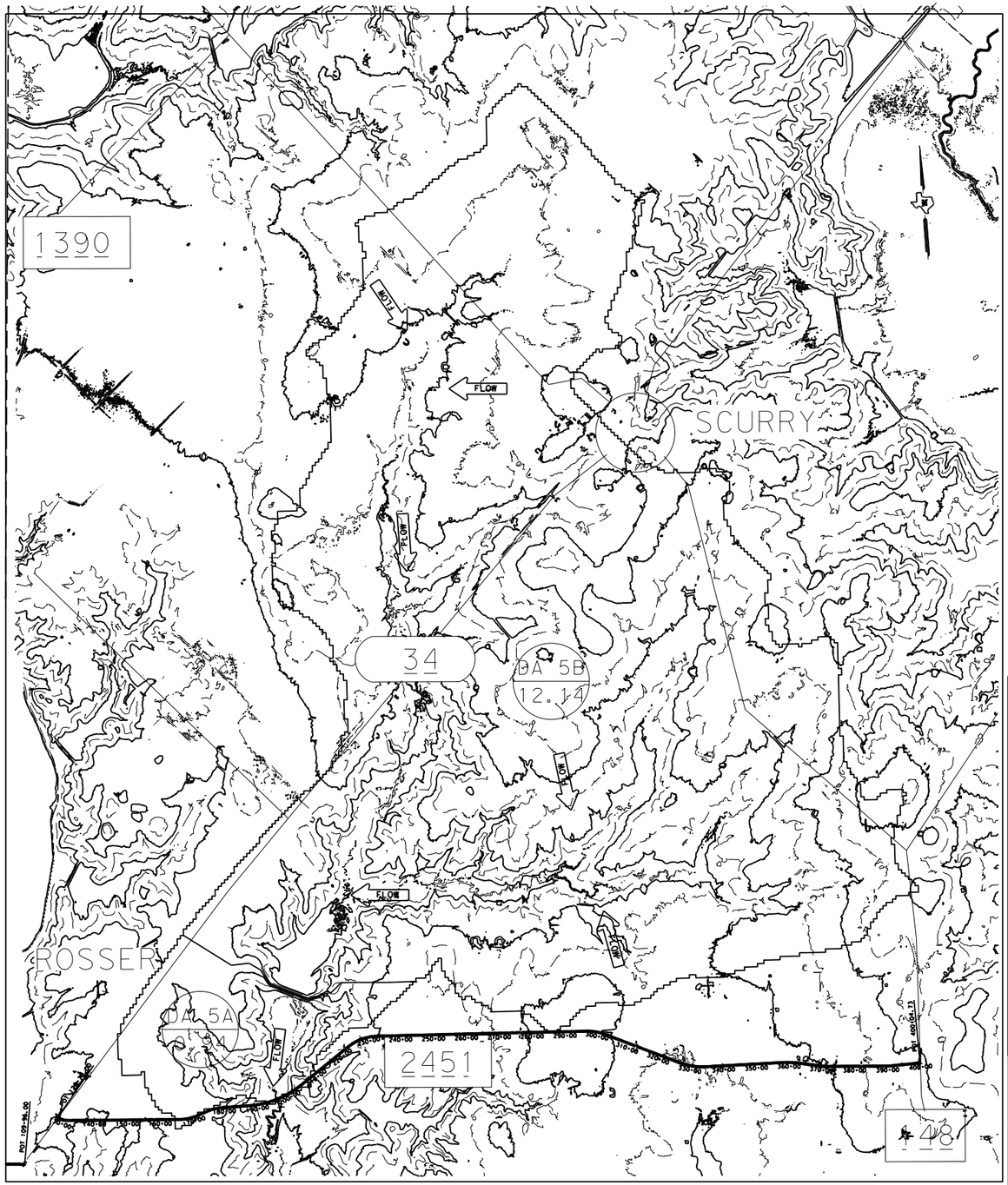
FM 2451
DRAINAGE AREA MAP

SCALE: 1"=2100' SHEET 1 OF 1

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	90
CHECK FR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

DATE: 10/13/2021 9:50:48 AM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\M01_DA.dgn

Note:
DA 5B drains into DA 5A via a 24" circular pipe and Wier located in the Rosser Trinidad Resevoir. The 10YR and 100YR flows are the combined flows from the Resevouir components.



LEGEND:

DA # / (AC) — DRAINAGE ID & AREA

FLOW — WATER FLOW DIRECTION

RUNOFF COMPUTATIONS								
					24 Hour PRECIPITATION		PEAK DISCHARGE	
DA ID	AREA	Tc	LAG TIME	CN	10-YR	100-YR	10-YR	100-YR
	(Sq Mi)	(Min)	(Min)		(in)	(in)	(cfs)	(cfs)
5A	0.94	85	52	79	5.72	9.69	1026.3	1638.6
5B	12.14	276	193	79	5.51	9.29	71.8	1180.3

STATE OF TEXAS
JONATHAN C. STOWE
127957
LICENSED
PROFESSIONAL ENGINEER

Jonathan C. Stowe , P.E. 10/01/2021
Signature of Registrant & Date

Texas Department of Transportation
© 2022

FM 2451
DRAINAGE AREA 5A & 5B MAP

SCALE: NTS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
JS	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS JS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DAL	KAUFMAN	91
CHECK	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

DATE: $DATE$ $TIME$
FILE: $FILE$

CULVERT HYDRAULIC DATA

STATION	ROADWAY	DESCRIPTION	Drainage Area ID	US FL	DS FL	Alloable Headwater (FT)	Q_{10} YEAR (DESIGN)							Q_{100} YEAR (CHECK)							COMMENTS
							Flow Q_{10} (CFS)	HW Elevation (ft)	HW Depth (ft)	TW Elevation (ft)	TW Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)	Flow Q_{100} (CFS)	HW Elevation (ft)	HW Depth (ft)	TW Elevation (ft)	TW Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)	
90+47.15	FM 2451	2-24"X39' RCP EXISTING	A1	354.85	354.76	356.86	14.01	374.43	1.12	355.24	0.48	1.61	2.97	20.83	374.44	1.15	355.35	0.59	1.67	3.32	
90+47.15		2-24"x45' RCP PROP	A1	354.86	354.74	356.86	14.01	374.43	1.11	355.22	0.48	1.59	2.97	20.83	374.44	1.14	355.33	0.59	1.65	3.32	
109+47.09	FM 2451	1-2'X1.7'X50' SBC EXISTING	A2	374.71	373.95	376.76	4.39	375.17	0.46	374.35	0.40	4.63	2.42	6.50	375.29	0.58	374.47	0.52	5.29	2.78	
109+47.09		1-3'X2'X56' SBC PROP	A2	374.76	373.90	376.76	4.39	375.17	0.46	374.30	0.40	4.63	2.42	6.50	375.29	0.58	374.42	0.52	5.29	2.78	
140+10.65	FM 2451	1-6'X5'X35' SBC EXISTING	A3	373.39	372.77	379.53	8.28	373.90	0.51	373.10	0.33	5.06	2.77	12.40	374.04	0.65	373.20	0.43	5.70	3.23	
140+10.65		1-6'X5'X51 SBC PROP	A3	373.53	372.63	379.53	8.28	373.90	0.37	372.96	0.33	4.44	2.77	12.40	374.04	0.51	373.06	0.43	5.07	3.23	
155+60.92	FM 2451	1-30"X39' RCP EXISTING	A4	377.41	376.92	379.96	3.47	378.01	0.61	377.20	0.28	4.43	1.95	5.21	378.15	0.74	377.26	0.34	4.95	2.17	
155+60.92		1-30"X53' RCP PROP	A4	377.46	376.79	379.96	3.47	378.01	0.56	377.07	0.28	4.42	1.95	5.21	378.15	0.69	377.13	0.34	5.01	2.17	
196+49.14	FM 2451	2-9'X9'X34' MBC EXISTING	A5	336.40	335.82	345.50	28.71	336.91	0.51	336.17	0.35	5.04	2.77	43.55	337.05	0.65	336.27	0.45	5.71	3.19	
196+49.14		2-9'X9'X48' MBC PROP	A5	336.50	335.68	345.50	28.71	336.91	0.41	336.03	0.35	6.16	2.77	43.55	337.05	0.55	336.13	0.45	6.16	3.19	
216+79.53	FM 2451	1-24"X39' RCP EXISTING	A6	380.14	378.94	382.32	15.08	382.37	2.23	379.79	0.85	10.22	1.35	22.38	383.03	2.89	379.94	1.00	10.92	1.49	
216+79.53		1-24"X53' RCP PROP	A6	380.32	378.69	382.32	15.08	382.37	0.21	379.54	0.85	9.40	1.35	22.38	383.03	0.71	379.69	1.00	9.43	1.49	
227+57.82	FM 2451	2-42"X66" RCP EXISTING	A7	383.72	383.24	387.22	34.27	384.92	1.20	383.94	0.70	5.72	2.97	52.25	385.22	1.50	384.10	0.86	6.41	3.32	
227+57.82		2-42"X74' RCP PROP	A7	383.72	383.18	387.22	34.27	384.92	1.20	383.88	0.70	5.82	2.97	52.25	385.22	1.50	384.04	0.86	6.51	3.32	
264+93.11	FM 2451	1-48"X44' RCP EXISTING	A8	401.90	401.44	405.96	28.51	403.43	1.53	402.04	0.60	7.02	2.44	43.20	403.81	1.91	402.16	0.72	7.72	2.71	
264+93.11		1-48"X58' RCP PROP	A8	401.96	401.36	405.96	28.51	403.43	1.47	401.96	0.60	7.05	2.44	43.20	403.81	1.85	402.08	0.72	7.80	2.71	
312+87.69	FM 2451	1-4'X3'X43' SBC EXISTING	A9	412.19	412.16	416.19	89.10	414.90	2.65	413.54	1.38	6.91	1.82	136.22	415.79	3.60	413.81	1.65	8.19	2.07	
312+87.69		1-4'X3'X51' SBC PROP	A9	412.19	412.16	416.19	89.10	414.90	2.71	413.54	1.38	7.10	1.86	136.22	415.79	3.60	413.81	1.65	8.19	2.07	
339+91.98	FM 2451	2-5'X3'X33' MBC EXISTING	A10	407.49	406.80	413.49	898.0	413.35	5.86	410.13	3.33	13.09	8.26	1627.0	413.35	6.09	411.05	3.59	13.18	9.59	
339+91.98		2-5'X3'X47' MBC PROP	A10	407.66	406.67	413.49	898.0	414.90	6.43	410.00	3.33	13.94	8.26	1627.0	414.90	6.66	410.92	9.59	14.04	9.59	
365+16.91	FM 2451	1-5'X2'X33' SBC EXISTING	A11	417.60	417.56	422.60	54.85	419.28	1.65	419.63	2.07	5.61	1.60	84.33	419.84	2.23	420.00	2.44	6.48	1.78	
365+16.91		1-5'X2'X41' SBC PROP	A11	417.60	417.56	422.60	54.85	419.28	1.68	419.63	2.07	5.61	1.60	84.33	419.84	2.23	420.00	2.44	6.47	1.78	
374+01.37	FM 2451	2-5'X3'X34' MBC EXISTING	A12	418.44	417.64	423.58	93.16	419.98	1.54	418.89	1.25	9.00	1.22	142.42	420.45	2.01	419.13	1.49	9.93	1.36	
374+01.37		2-5'X3'X48' MBC PROP	A12	418.58	417.45	423.58	93.16	419.93	1.40	418.70	1.25	9.09	1.22	142.42	720.45	1.87	418.94	1.49	10.14	1.36	
394+71.75	FM 2451	1-30"X35' RCP EXISTING	A13	432.78	431.96	435.37	24.25	434.50	1.72	432.61	0.65	8.76	2.59	36.26	434.98	2.20	432.73	0.77	9.47	2.86	
394+71.75		1-30"X49' RCP PROP	A13	432.87	431.73	435.37	24.25	434.50	1.63	432.38	0.65	8.99	2.59	36.26	434.98	2.11	432.50	0.77	9.78	2.86	

CULVERT INPUT DATA (HY-8, V7.5)

STATION	ROADWAY	DESCRIPTION	DRAINAGE AREA ID	INLET STATION (FT)	FL INLET ELEV (FT)	UPPER BREAK STATION (FT)	UPPER BREAK ELEV (FT)	LOWER BREAK STATION (FT)	LOWER BREAK ELEV (FT)	OUTLET STATION (FT)	FL OUTLET ELEV (FT)	TAILWATER DATA
90+47.15	FM 2451	2-24"X39' RCP EXISTING	A1	0+00	354.85					0+35	354.76	S=0.15%, L=1468', Trapizoidal, SS=6:1; b=6'
90+47.15		2-24"x45' RCP PROP	A1	0+00	354.86					0+45	354.74	
109+47.09	FM 2451	1-2'X1.7'X50' SBC EXISTING	A2	0+00	374.71					0+50	373.95	S=0.102%, L=502', Rectangular, n=0.03; b=4.5
109+47.09		1-3'X2'X56' SBC PROP	A2	0+00	374.76					0+56	373.90	
140+10.65	FM 2451	1-6'X5'X35' SBC EXISTING	A3	0+00	373.39					0+35	372.77	S=0.10%, L=1498', Rectangular, n=0.03; b=9'
140+10.65		1-6'X5'X51 SBC PROP	A3	0+00	373.53					0+51	372.63	
155+60.92	FM 2451	1-30"X39' RCP EXISTING	A4	0+00	377.41					0+39	376.92	S=0.15%, L=1280', Trapizoidal, SS=12:1; b=3'
155+60.92		1-30"X53' RCP PROP	A4	0+00	377.46					0+53	376.79	
216+79.53	FM 2451	1-24"X39' RCP EXISTING	A6	0+00	380.14					0+39	378.94	S=0.2%, L=1212', Trapizoidal, SS=12:1; b=3'
216+79.53		1-24"X53' RCP PROP	A6	0+00	380.32					0+53	378.69	
227+57.82	FM 2451	2-42"X66" RCP EXISTING	A7	0+00	383.72					0+66	383.24	S=0.10%, L=3231', Trapizoidal, SS=12:1; b=12'
227+57.82		2-42"X74' RCP PROP	A7	0+00	383.72					0+74	383.18	
264+93.11	FM 2451	1-48"X44' RCP EXISTING	A8	0+00	401.90					0+44	401.44	S=0.10%, L=3274', Trapizoidal, SS=24:1; b=5'
264+93.11		1-48"X58' RCP PROP	A8	0+00	401.96					0+58	401.36	
312+87.69	FM 2451	1-4'X3'X43' SBC EXISTING	A9	0+00	412.19					0+43	412.16	S=0.20%, L=6591', Trapizoidal, SS=20:1; b=7'
312+87.69		1-4'X3'X51' SBC PROP	A9	0+00	412.19					0+51	412.16	
339+91.98	FM 2451	2-5'X3'X33' MBC EXISTING	A10	0+00	407.49					0+33	406.80	S=0.20%, L=7321', Trapizoidal, SS=32:1; b=12'
339+91.98		2-5'X3'X47' MBC PROP	A10	0+00	407.66					0+47	406.67	
365+16.91	FM 2451	1-5'X2'X33' SBC EXISTING	A11	0+00	417.60					0+33	417.56	S=0.10%, L=6584', Trangular, SS=8:1
365+16.91		1-5'X2'X41' SBC PROP	A11	0+00	417.60					0+41	417.56	
374+01.37	FM 2451	2-5'X3'X34' MBC EXISTING	A12	0+00	418.44					0+34	417.64	S=0.10%, L=6591', Trapizoidal, SS=40:1; b=11'
374+01.37		2-5'X3'X48' MBC PROP	A12	0+00	418.58					0+48	417.45	
394+71.75	FM 2451	1-30"X35' RCP EXISTING	A13	0+00	432.78					0+35	431.96	S=0.10%, L=1935', Trapizoidal, SS=16:1; b=4'
394+71.75		1-30"X49' RCP PROP	A13	0+00	432.87					0+49	431.73	

Jahor L. Roy
83789
LICENSED
PROFESSIONAL ENGINEER
STATE OF TEXAS

Jahor Roy, P.E. 10/14/21
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451
HYDRAULIC COMPUTATION

SCALE: NTS SHEET 1 OF 1

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	92
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

DATE: 10/13/2021 11:17:15 AM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\M02_Hydraulic Computations.dgn

Existing

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	4501	10 year	1076.4	339.42	347.17		347.23	0.000794	2.64	617.75	487.52	0.25
Reach 1	4501	100 year	1694.6	339.42	347.98		348.02	0.000461	2.04	1029.78	537.42	0.19
Reach 1	4149	10 year	1076.4	339.71	346.85		346.93	0.000955	2.81	536.27	370.74	0.27
Reach 1	4149	100 year	1694.6	339.71	347.8		347.85	0.000516	2.26	908.17	415.7	0.2
Reach 1	3625	10 year	1076.4	339.44	346.33		346.41	0.000986	2.97	539.9	423.92	0.28
Reach 1	3625	100 year	1694.6	339.44	347.6		347.64	0.000308	1.93	1143.72	561.42	0.16
Reach 1	2772	10 year	1076.4	339.19	345.77		345.82	0.000462	2.22	852.69	661.7	0.19
Reach 1	2772	100 year	1694.6	339.19	347.48		347.49	0.000092	1.25	2106.96	780.19	0.09
Reach 1	2323	10 year	1076.4	339.44	345.32		345.47	0.001283	3.49	452.95	666.98	0.33
Reach 1	2323	100 year	1694.6	339.44	347.39		347.42	0.00025	2.09	1426.67	834.46	0.15
Reach 1	2243	10 year	1076.4	338.37	344.83		345.27	0.003557	5.49	215.09	529.92	0.53
Reach 1	2243	100 year	1694.6	338.37	347.28		347.39	0.000625	3.23	936.39	875.65	0.24
Reach 1	2146	10 year	1076.4	334.35	344.91		345.06	0.000596	3.11	372.4	703.46	0.23
Reach 1	2146	100 year	1694.6	334.35	347.13		347.32	0.000503	3.57	625.65	878.68	0.23
Reach 1	2120	10 year	1076.4	335.2	344.83	339.76	345.04	0.000471	3.66	294.32	579.64	0.23
Reach 1	2120	100 year	1694.6	335.2	346.97	340.81	347.29	0.000542	4.59	394.75	868.43	0.25
Reach 1	2064		Culvert									
Reach 1	2034	10 year	1076.4	332.71	343.63	336.6	343.73	0.000163	2.5	425.78	498.14	0.14
Reach 1	2034	100 year	1694.6	332.71	344.8	337.54	345	0.000278	3.51	476.85	643.6	0.18
Reach 1	2013	10 year	1076.4	332.66	343.63	336.81	343.73	0.000257	2.49	438.45	247.93	0.16
Reach 1	2013	100 year	1694.6	332.66	344.81	337.9	344.98	0.000391	3.37	510.22	591.36	0.2
Reach 1	1947	10 year	1076.4	332.69	343.04	339.76	343.64	0.002907	6.2	173.68	275.84	0.47
Reach 1	1947	100 year	1694.6	332.69	343.75	341.57	344.83	0.00524	8.39	213.84	670.7	0.64
Reach 1	1363	10 year	1076.4	331.71	341.5		341.89	0.002803	5.53	270.65	236.2	0.45
Reach 1	1363	100 year	1694.6	331.71	342.2	341.76	342.49	0.002533	5.27	479.48	352.71	0.43
Reach 1	694	10 year	1076.4	330.83	340.34	338.32	340.49	0.001458	3.92	457.33	553.82	0.33
Reach 1	694	100 year	1694.6	330.83	340.5		340.75	0.002548	5.22	558.2	663.21	0.44
Reach 1	407	10 year	1076.4	330.95	338.75	336.88	339.7	0.005092	7.91	142.63	61.19	0.6
Reach 1	407	100 year	1694.6	330.95	340	339.76	340.16	0.001538	4.5	716.12	696.31	0.34
Reach 1	13	10 year	1076.4	331.74	337.59	335.86	338.03	0.003003	5.26	203.22	66.62	0.48
Reach 1	13	100 year	1694.6	331.74	338.81	336.9	339.27	0.003004	5.68	348.16	307.02	0.49

Proposed

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	4501	10 year	1076.4	339.42	347.17		347.23	0.00079	2.63	619.01	487.78	0.24
Reach 1	4501	100 year	1694.6	339.42	348.07		348.11	0.000401	1.92	1078.61	542.99	0.18
Reach 1	4149	10 year	1076.4	339.71	346.86		346.93	0.000946	2.8	538	370.98	0.27
Reach 1	4149	100 year	1694.6	339.71	347.91		347.96	0.00044	2.12	956.09	418.9	0.19
Reach 1	3625	10 year	1076.4	339.44	346.36		346.44	0.000926	2.89	552.67	426.3	0.27
Reach 1	3625	100 year	1694.6	339.44	347.74		347.78	0.000275	1.87	1223.62	578.85	0.15
Reach 1	2772	10 year	1076.4	339.19	345.89		345.92	0.000372	2.03	929.36	680.4	0.18
Reach 1	2772	100 year	1694.6	339.19	347.64		347.65	0.000079	1.18	2229.75	790.6	0.09
Reach 1	2323	10 year	1076.4	339.44	345.56		345.67	0.000861	2.99	547.85	719.12	0.27
Reach 1	2323	100 year	1694.6	339.44	347.56		347.59	0.000193	1.87	1573.83	840.25	0.14
Reach 1	2243	10 year	1076.4	338.37	345.25		345.54	0.00225	4.5	291.66	719.01	0.43
Reach 1	2243	100 year	1694.6	338.37	347.5		347.57	0.000412	2.69	1131.13	897.82	0.2
Reach 1	2146	10 year	1076.4	334.35	345.28		345.4	0.00046	2.85	407.63	749.52	0.21
Reach 1	2146	100 year	1694.6	334.35	347.38		347.52	0.000372	3.14	852.24	890.49	0.2
Reach 1	2120	10 year	1076.4	335.2	345.19	339.76	345.38	0.000407	3.5	307.38	628.39	0.21
Reach 1	2120	100 year	1694.6	335.2	347.19	340.81	347.49	0.00056	4.43	497.46	895.15	0.25
Reach 1	2064		Culvert									
Reach 1	2034	10 year	1076.4	332.71	343.63	336.6	343.73	0.000163	2.5	425.78	498.14	0.14
Reach 1	2034	100 year	1694.6	332.71	344.8	337.54	345	0.000278	3.51	476.85	643.6	0.18
Reach 1	2013	10 year	1076.4	332.66	343.63	336.81	343.73	0.000257	2.49	438.45	247.93	0.16
Reach 1	2013	100 year	1694.6	332.66	344.81	337.9	344.98	0.000391	3.37	510.22	591.36	0.2
Reach 1	1947	10 year	1076.4	332.69	343.04	339.76	343.64	0.002907	6.2	173.68	275.84	0.47
Reach 1	1947	100 year	1694.6	332.69	343.75	341.57	344.83	0.00524	8.39	213.84	670.7	0.64
Reach 1	1363	10 year	1076.4	331.71	341.5		341.89	0.002803	5.53	270.65	236.2	0.45
Reach 1	1363	100 year	1694.6	331.71	342.2	341.76	342.49	0.002533	5.27	479.48	352.71	0.43
Reach 1	694	10 year	1076.4	330.83	340.34	338.32	340.49	0.001458	3.92	457.33	553.82	0.33
Reach 1	694	100 year	1694.6	330.83	340.5		340.75	0.002548	5.22	558.2	663.21	0.44
Reach 1	407	10 year	1076.4	330.95	338.75	336.88	339.7	0.005092	7.91	142.63	61.19	0.6
Reach 1	407	100 year	1694.6	330.95	340	339.76	340.16	0.001538	4.5	716.12	696.31	0.34
Reach 1	13	10 year	1076.4	331.74	337.59	335.86	338.03	0.003003	5.26	203.22	66.62	0.48
Reach 1	13	100 year	1694.6	331.74	338.81	336.9	339.27	0.003004	5.68	348.16	307.02	0.49

NOTES:

1) CULVERT IS LOCATED AT RS 2064.

2) HEC-RAS VERSION 5.0.7 USED FOR ANALYSIS

3) ALL ELEVATIONS BASED ON THE D NAD 1983 2011 VERTICAL DATUM

4) THIS SITE IS DESIGNATED AS A FEMA ZONE "A" AS SHOWN ON MAP NUMBER 48257C0425D, EFFECTIVE JULY 3, 2012.

STATE OF TEXAS
JONATHAN C. STOWE
127957
LICENSED
PROFESSIONAL ENGINEER

Jonathan C. Stowe , P.E. 10/01/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451
CULVER 5
COTTONWOOD CREEK
HYDRAULIC DATA SHEET

SCALE: NTS SHEET 1 OF 3

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
JS	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS JS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DAL	KAUFMAN	93
CHECK	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

DATE: $DATE$ $TIME$
FILE: $FILE$

Cottonwood Creek Reach 1 RS: 2064			
Q Culv Group (cfs)	1076.4	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	8.68
Q Barrel (cfs)	538.2	Culv Vel DS (ft/s)	7.52
E.G. US. (ft)	345.38	Culv Inv El Up (ft)	336.5
W.S. US. (ft)	345.19	Culv Inv El Dn (ft)	335.68
E.G. DS (ft)	343.73	Culv Frctn Ls (ft)	0.05
W.S. DS (ft)	343.63	Culv Exit Loss (ft)	0.78
Delta EG (ft)	1.65	Culv Entr Loss (ft)	0.82
Delta WS (ft)	1.56	Q Weir (cfs)	
E.G. IC (ft)	344.07	Weir Sta Lft (ft)	
E.G. OC (ft)	345.38	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	343.39	Weir Max Depth (ft)	
Culv WS Outlet (ft)	343.63	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.59	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.81	Min El Weir Flow (ft)	347.1

Cottonwood Creek Reach 1 RS: 2064			
Q Culv Group (cfs)	1076.4	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	8.65
Q Barrel (cfs)	538.2	Culv Vel DS (ft/s)	7.65
E.G. US. (ft)	345.04	Culv Inv El Up (ft)	336.5
W.S. US. (ft)	344.83	Culv Inv El Dn (ft)	335.82
E.G. DS (ft)	343.73	Culv Frctn Ls (ft)	0.03
W.S. DS (ft)	343.63	Culv Exit Loss (ft)	0.81
Delta EG (ft)	1.31	Culv Entr Loss (ft)	0.47
Delta WS (ft)	1.2	Q Weir (cfs)	
E.G. IC (ft)	344.13	Weir Sta Lft (ft)	
E.G. OC (ft)	345.04	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	343.41	Weir Max Depth (ft)	
Culv WS Outlet (ft)	343.63	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.38	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.81	Min El Weir Flow (ft)	347.1

Plan: Prop Cottonwood Creek			
Q Culv Group (cfs)	1529.99	Culv Full Len (ft)	7.5
# Barrels	2	Culv Vel US (ft/s)	10.61
Q Barrel (cfs)	764.99	Culv Vel DS (ft/s)	9.44
E.G. US. (ft)	347.48	Culv Inv El Up (ft)	336.5
W.S. US. (ft)	347.19	Culv Inv El Dn (ft)	335.68
E.G. DS (ft)	345	Culv Frctn Ls (ft)	0.07
W.S. DS (ft)	344.8	Culv Exit Loss (ft)	1.19
Delta EG (ft)	2.49	Culv Entr Loss (ft)	1.23
Delta WS (ft)	2.39	Q Weir (cfs)	164.61
E.G. IC (ft)	346.75	Weir Sta Lft (ft)	483.41
E.G. OC (ft)	347.48	Weir Sta Rgt (ft)	804.68
Culvert Control	Outlet	Weir Submerg	0
Culv WS Inlet (ft)	344.51	Weir Max Depth (ft)	0.4
Culv WS Outlet (ft)	344.68	Weir Avg Depth (ft)	0.33
Culv Nml Depth (ft)	3.33	Weir Flow Area (sq ft)	105.94
Culv Crt Depth (ft)	6.08	Min El Weir Flow (ft)	347.1

Plan: Exist Cottonwood Creek			
Q Culv Group (cfs)	1641.95	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	11.6
Q Barrel (cfs)	820.97	Culv Vel DS (ft/s)	10.16
E.G. US. (ft)	347.29	Culv Inv El Up (ft)	336.5
W.S. US. (ft)	346.97	Culv Inv El Dn (ft)	335.82
E.G. DS (ft)	345	Culv Frctn Ls (ft)	0.05
W.S. DS (ft)	344.8	Culv Exit Loss (ft)	1.41
Delta EG (ft)	2.3	Culv Entr Loss (ft)	0.84
Delta WS (ft)	2.17	Q Weir (cfs)	52.65
E.G. IC (ft)	346.97	Weir Sta Lft (ft)	515.48
E.G. OC (ft)	347.29	Weir Sta Rgt (ft)	785.63
Culvert Control	Outlet	Weir Submerg	0
Culv WS Inlet (ft)	344.37	Weir Max Depth (ft)	0.2
Culv WS Outlet (ft)	344.8	Weir Avg Depth (ft)	0.17
Culv Nml Depth (ft)	3.21	Weir Flow Area (sq ft)	47.15
Culv Crt Depth (ft)	6.37	Min El Weir Flow (ft)	347.1

NOTES:

1) CULVERT IS LOCATED AT RS 2064.
2) HEC-RAS VERSION 5.0.7 USED FOR ANALYSIS
3) ALL ELEVATIONS BASED ON THE D NAD 1983 2011 VERTICAL DATUM
4) THIS SITE IS DESIGNATED AS A FEMA ZONE "A" AS SHOWN ON MAP NUMBER 48257C0425D, EFFECTIVE JULY 3, 2012.

STATE OF TEXAS
JONATHAN C. STOWE
127957
LICENSED
PROFESSIONAL ENGINEER

Jonathan C. Stowe , P.E. 10/01/2021
Signature of Registrant & Date

Texas Department of Transportation
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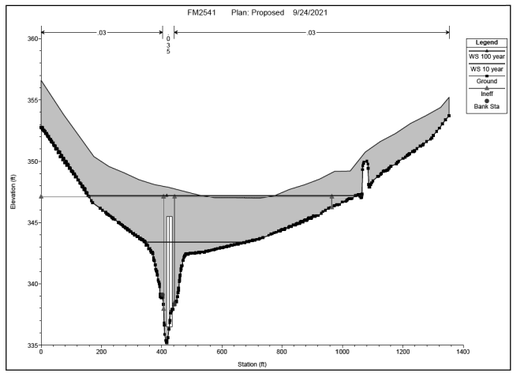
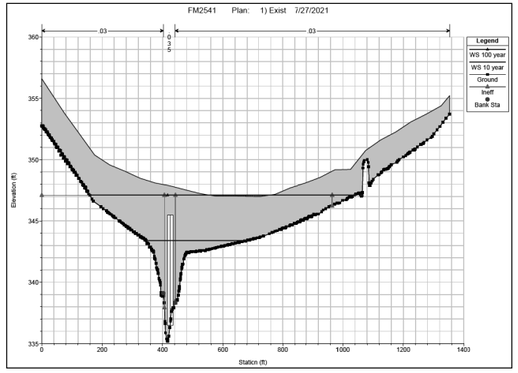
FM 2451
CULVER 5
COTTONWOOD CREEK
HYDRAULIC DATA SHEET

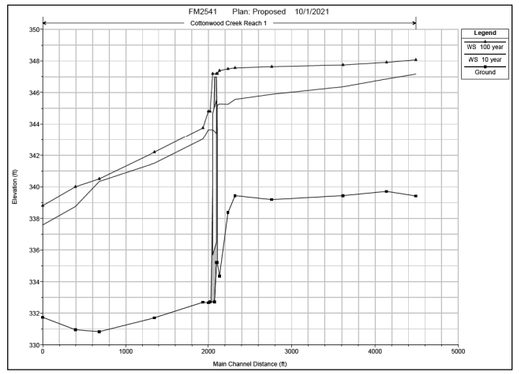
SCALE: NTS SHEET 2 OF 3

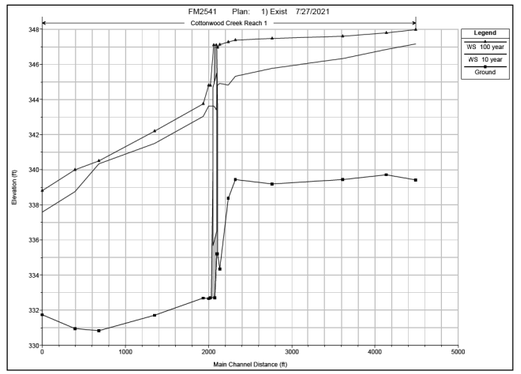
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
JS	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS JS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DAL	KAUFMAN	94
CHECK	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

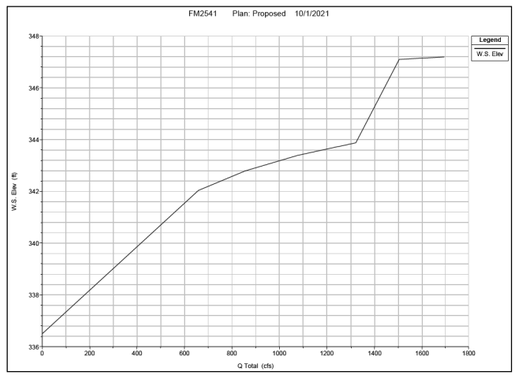
DATE: $DATE$ $TIME$
FILE: $FILE$

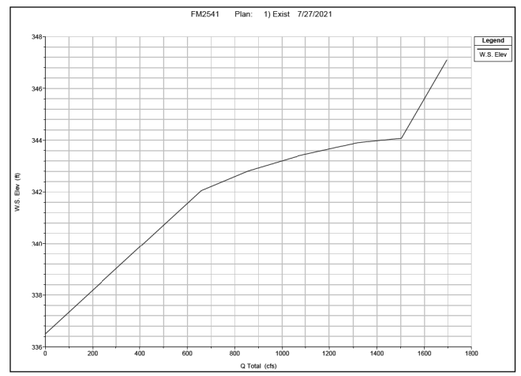












NOTES:

1) CULVERT IS LOCATED AT RS 2064.

2) HEC-RAS VERSION 5.0.7 USED FOR ANALYSIS

3) ALL ELEVATIONS BASED ON THE D NAD 1983 2011 VERTICAL DATUM

4) THIS SITE IS DESIGNATED AS A FEMA ZONE "A" AS SHOWN ON MAP NUMBER 48257C0425D, EFFECTIVE JULY 3, 2012.

STATE OF TEXAS
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FM 2451
CULVER 5
COTTONWOOD CREEK
HYDRAULIC DATA SHEET

SCALE: NTS SHEET 3 OF 3

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
JS	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS JS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DAL	KAUFMAN	95
CHECK	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

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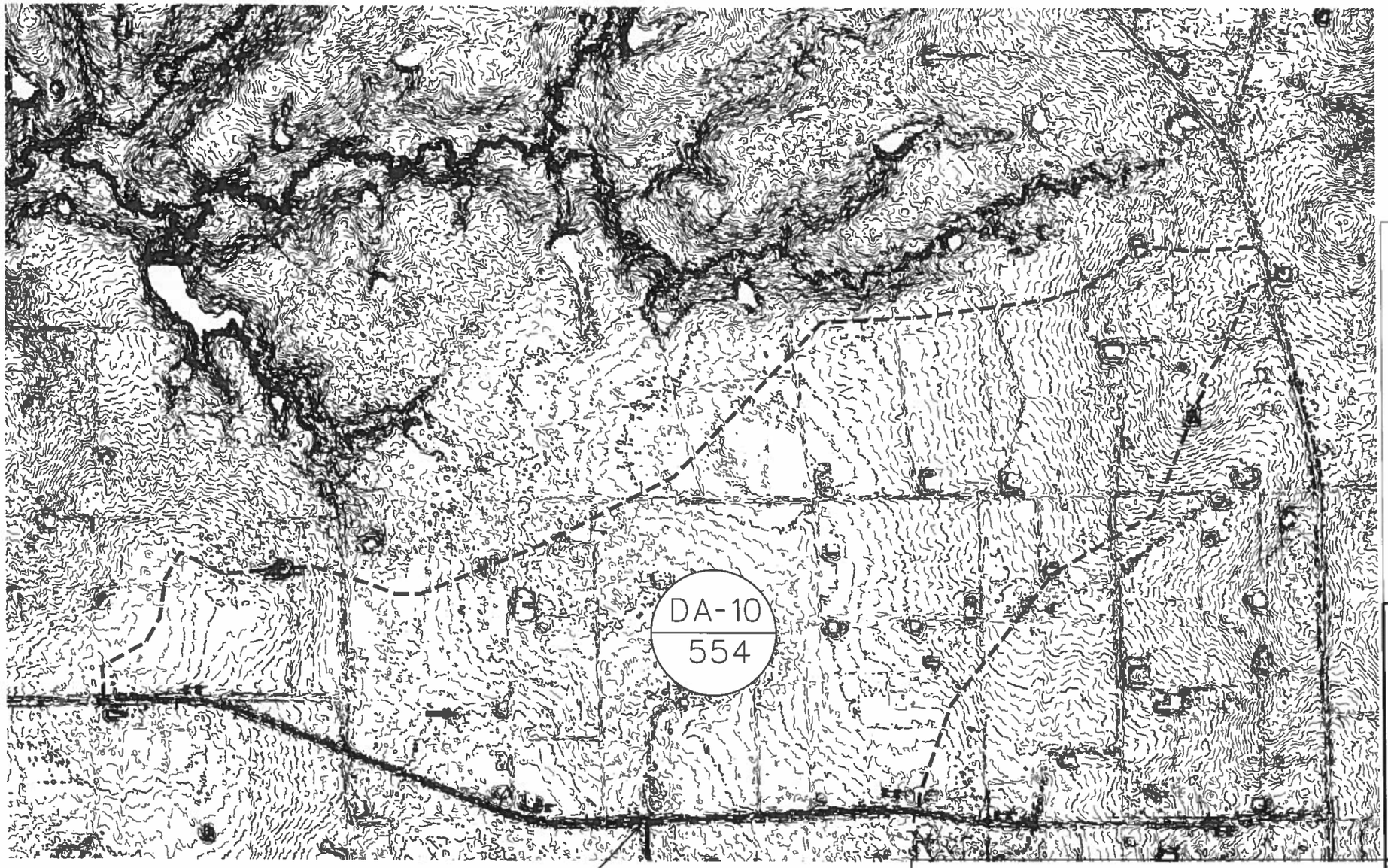
FILE: $FILE$



N

LEGEND

DRAINAGE AREA BOUNDARY

DA / ACRE — DRAINAGE AREA NAME; DRAINAGE AREA, ACRES

STATE OF TEXAS
AZEEM HUSAIN
90178
LICENSED PROFESSIONAL ENGINEER

10/5/21

NRCS DATA	
DRAINAGE AREA (SQ. MI.)	0.86
TIME OF CONCENTRATION (HR.)	1.49
CURVE NUMBER	84
RAINFALL DISTRIBUTION	TYPE III
ACCUMULATED RAINFALL DEPTH (IN) (10-YR)	6.2
ACCUMULATED RAINFALL DEPTH (IN) (100-YR)	10.1
Q(10) (CFS)	898
Q(100) (CFS)	1,627

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FM 2451 HYDRAULIC CALCULATIONS SHEET DA 10

SCALE: 1"=500'

SHEET 1 OF 1

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
CHECK	6	(SEE SHEET TITLE)		FM2451
	STATE	DISTRICT	COUNTY	SHEET NO.
GRAPHICS	TEXAS	DALLAS	KAUFMAN	96
CHECK	CONTROL	SECTION	JOB	
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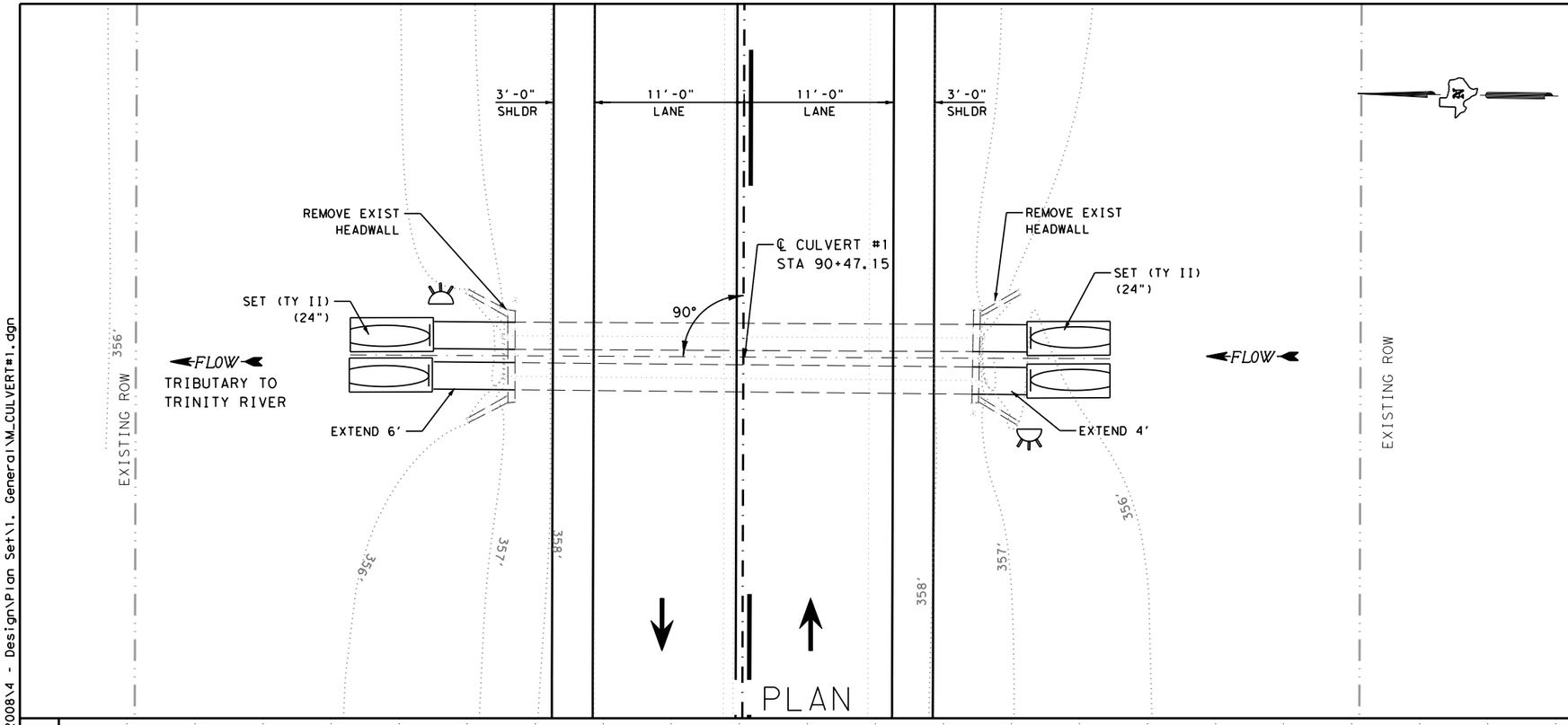


ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
464-6018	RC PIPE (CL IV)(24 IN)	LF	24
467-6388	SET (TY II) (24 IN) (RCP) (3: 1) (C)	EA	4
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6006	REMOV STR (HEADWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	2

LEGEND

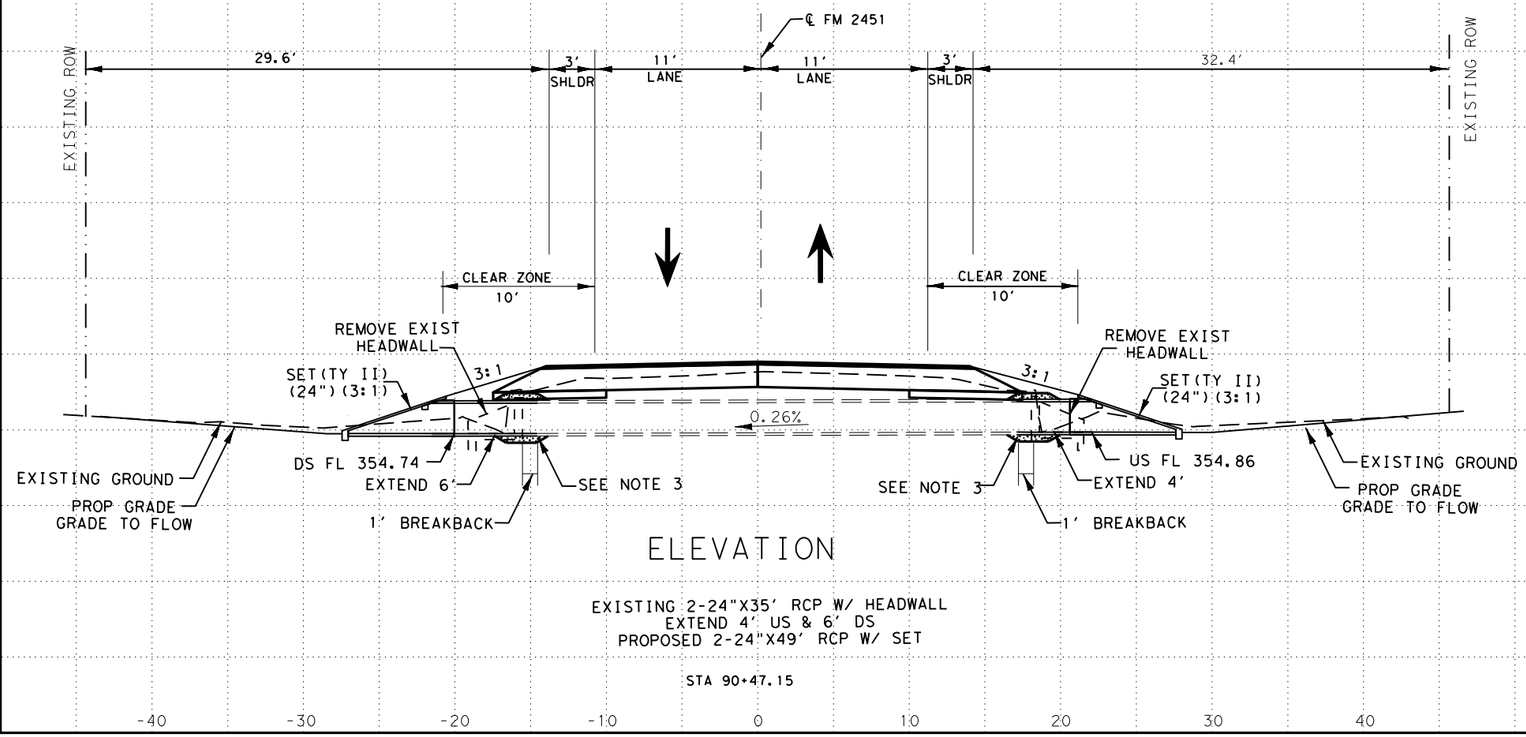
FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. SEE MISC PIPE CONNECTION DETAIL FOR MORE INFORMATION.
4. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=14.01 CFS	Q_{100}	=20.83 CFS
V_{10}	=1.59 F/S	V_{100}	=1.65 F'S
HW_{10}	=374.43	HW_{100}	=374.44
TW_{10}	=355.22	TW_{100}	=355.33



ELEVATION

EXISTING 2-24"X35' RCP W/ HEADWALL
EXTEND 4' US & 6' DS
PROPOSED 2-24"X49' RCP W/ SET

STA 90+47.15

Jahor L. Roy
83789
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

Jahor Roy , P.E. 10/14/21
Signature of Registrant & Date

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FM 2451
CULVERT LAYOUT
(CULV #1)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

SHEET 1 OF 13

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	97
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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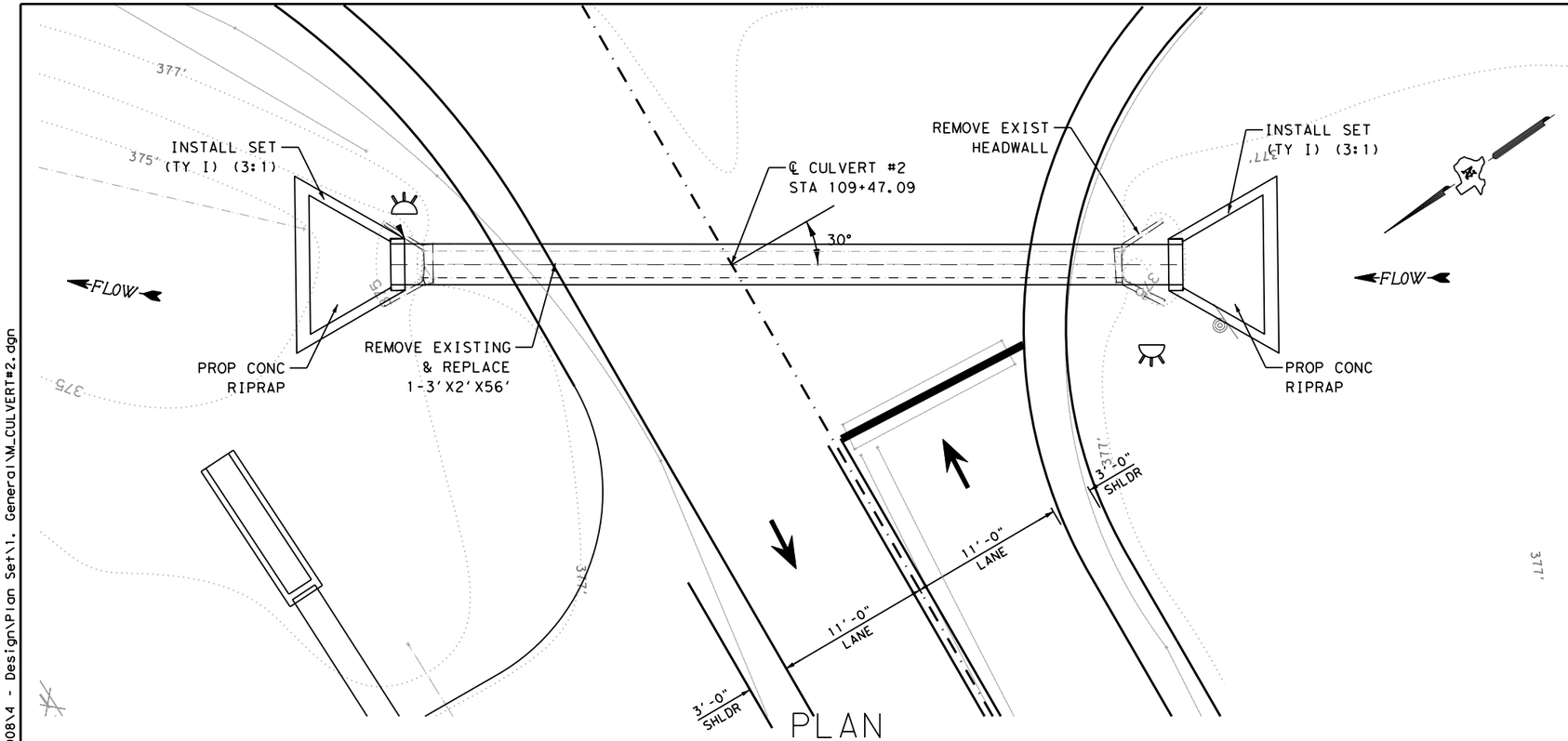


ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
400-6006	CUT & RESTORING PAV	SY	22
432-6002	RIPRAP (CONC)(5 IN)	CY	2.09
462-6001	CONC BOX CULV(3FT X 2FT)	LF	56
467-6105	SET(TY I)(S=3 FT)(HW=3FT)(3:1)	EA	2
496-6005	REMOV STR (WINGWALL)	EA	2
496-6008	REMOV STR (BOX CULVERT)	LF	50
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	2

LEGEND

TEMPORARY SPECIAL SHORING

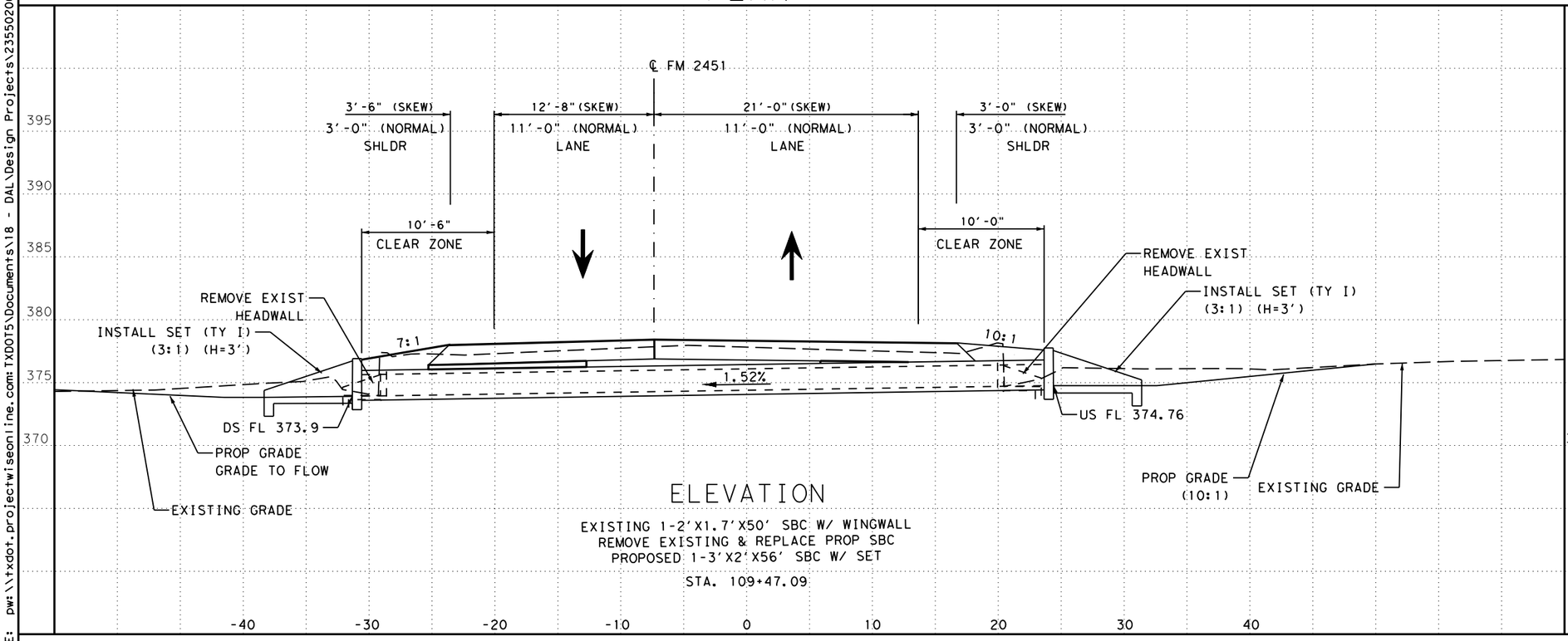
FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. FOR CUT & RESTORE, USE 2" SP-C (SAC B) PG 64-22 & 8" NEW FLBS OVER COMPACTED EXISTING MATERIALS.

HYDRAULIC DATA

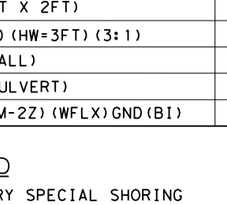
Q_{10}	=4.39 CFS	Q_{100}	=6.50 CFS
V_0	=4.63 F/S	V_{100}	=5.29 F/S
HW_{10}	=375.17	HW_{100}	=375.29
TW_{10}	=374.30	TW_{100}	=374.42



ELEVATION

EXISTING 1-2'X1.7'X50' SBC W/ WINGWALL
REMOVE EXISTING & REPLACE PROP SBC
PROPOSED 1-3'X2'X56' SBC W/ SET

STA. 109+47.09



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Signature of Registrant & Date

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FM 2451
CULVERT LAYOUT
(CULV #2)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

SHEET 2 OF 13

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	98
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
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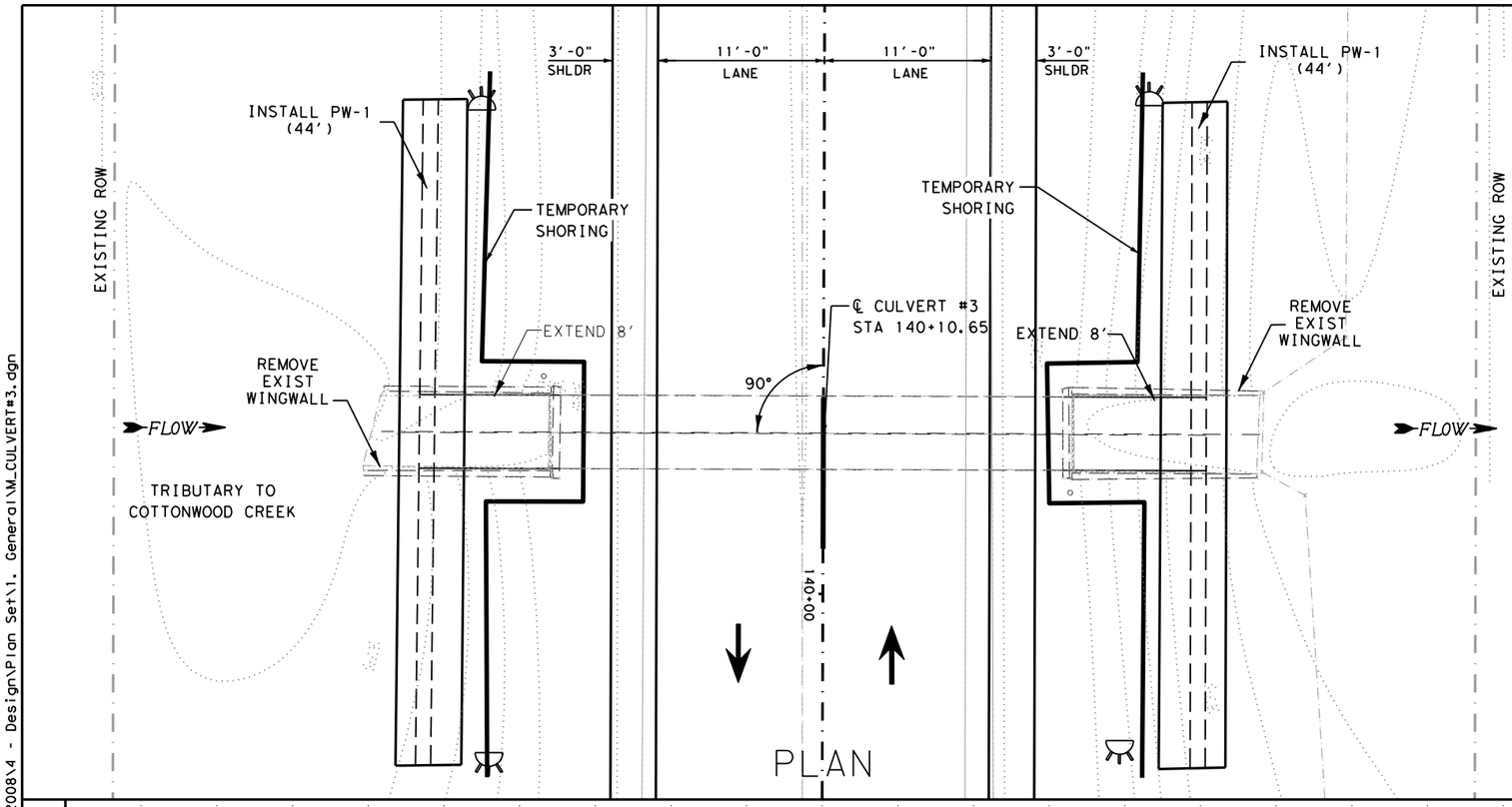

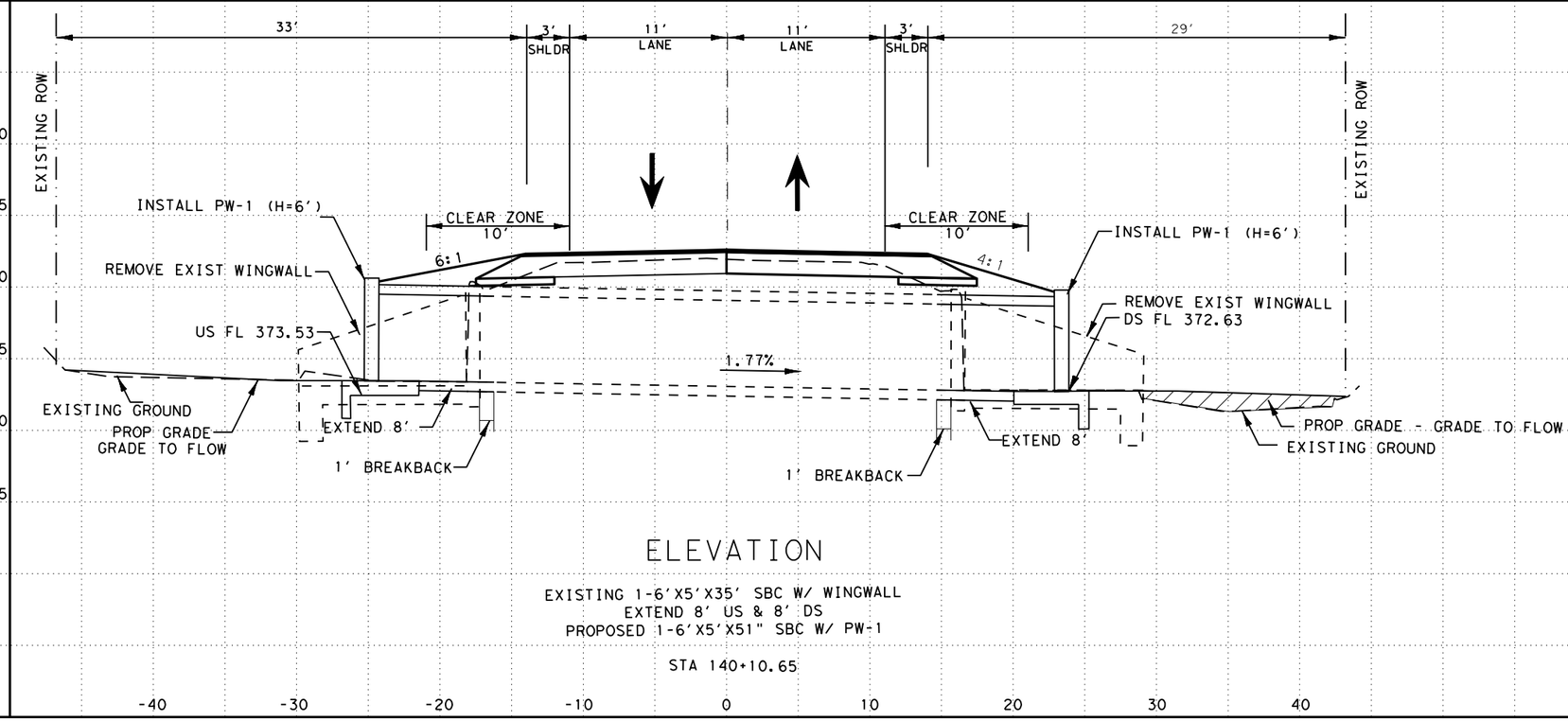

ELEVATION

EXISTING 1-6'X5'X35' SBC W/ WINGWALL
EXTEND 8' US & 8' DS
PROPOSED 1-6'X5'X51" SBC W/ PW-1

STA 140+10.65

ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
403-6001	TEMPORARY SPL SHORING	SF	598
462-6056	CONC BOX CULV(6FT X 5FT)(EXTEND)	LF	18
466-6181	WINGWALL (PW-1)(HW=6FT)	EA	2
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6005	REMOV STR (WINGWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	4

LEGEND

FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=8.28 CFS	Q_{100}	=12.40 CFS
V_{10}	=4.44 F/S	V_{100}	=5.07 F/S
HW_{10}	=373.90	HW_{100}	=374.04
TW_{10}	=372.96	TW_{100}	=373.06

STATE OF TEXAS
Jahor L. Roy
83789
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PROFESSIONAL ENGINEER

Jahor Roy , P.E. 10/14/21
Signature of Registrant & Date

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FM 2451
CULVERT LAYOUT
(CULV #3)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

SHEET 3 OF 13

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	99
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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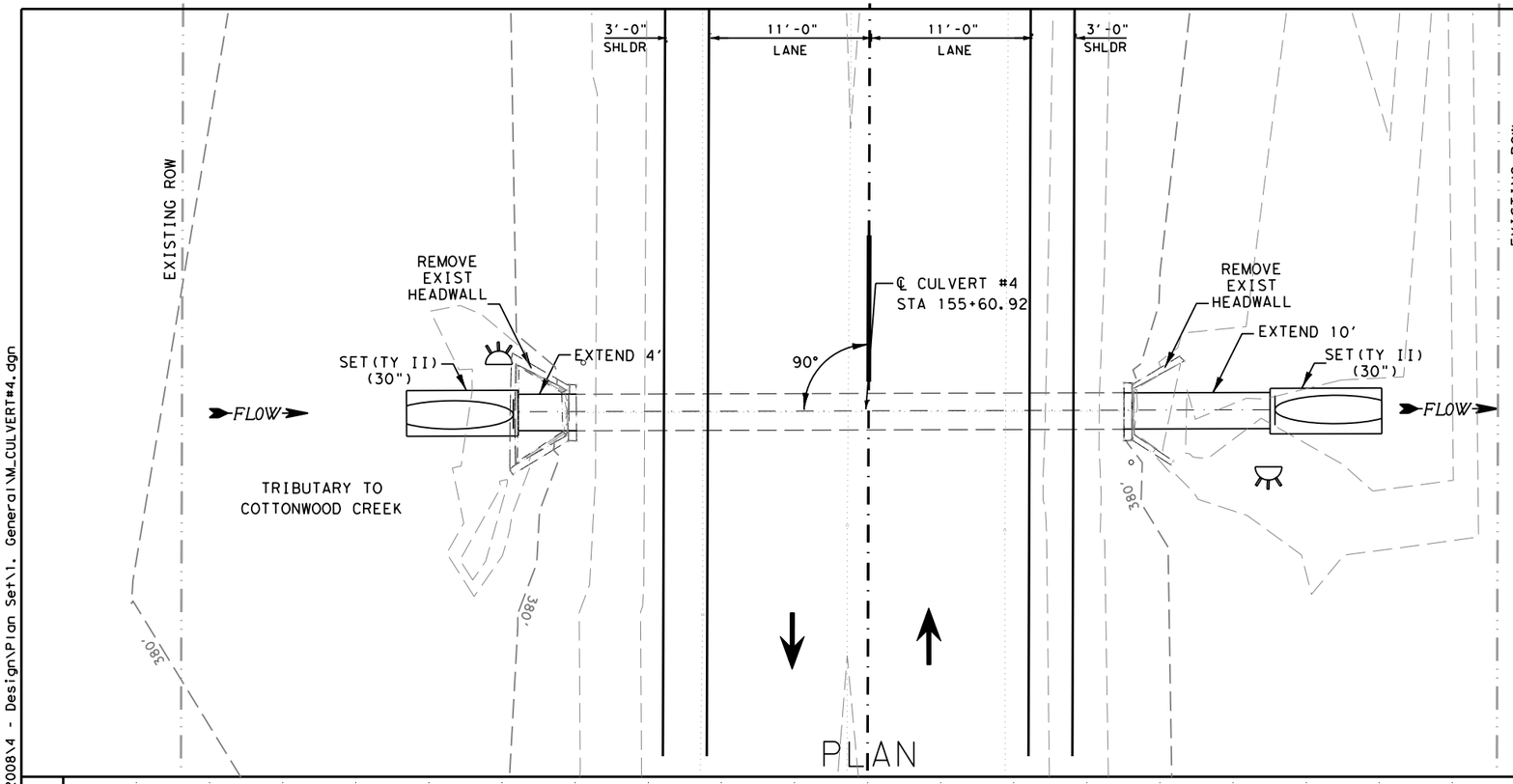

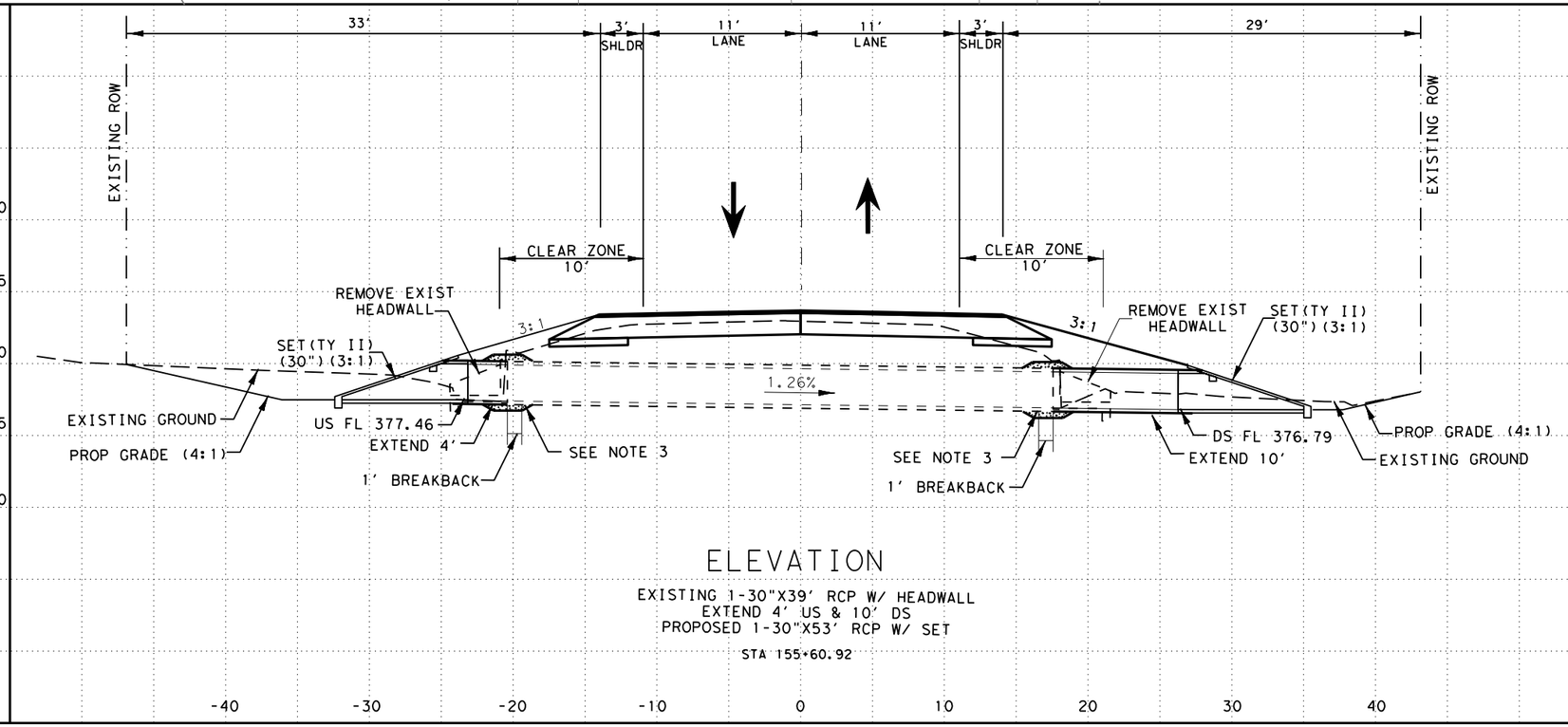

ELEVATION

EXISTING 1-30"X39' RCP W/ HEADWALL
EXTEND 4' US & 10' DS
PROPOSED 1-30"X53' RCP W/ SET

STA 155+60.92

ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
464-6019	RC PIPE (CL IV)(30 IN)	LF	16
467-6417	SET (TY II) (30 IN) (RCP) (3: 1) (C)	EA	2
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6006	REMOV STR (HEADWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	2

LEGEND

FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. SEE MISC PIPE CONNECTION DETAIL FOR MORE INFORMATION.
4. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=3.47 CFS	Q_{100}	=5.21 CFS
V_{10}	=4.42 F/S	V_{100}	=5.01 F/S
HW_{10}	=378.01	HW_{100}	=378.15
TW_{10}	=377.07	TW_{100}	=377.13

STATE OF TEXAS
Jahor L. Roy
83789
LICENSED PROFESSIONAL ENGINEER

Jahor Roy, P.E. 10/14/21
Signature of Registrant & Date

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FM 2451
CULVERT LAYOUT
(CULV #4)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	100
CHECK FR	CONTROL 2355	SECTION 01	JOB 006, ETC.	

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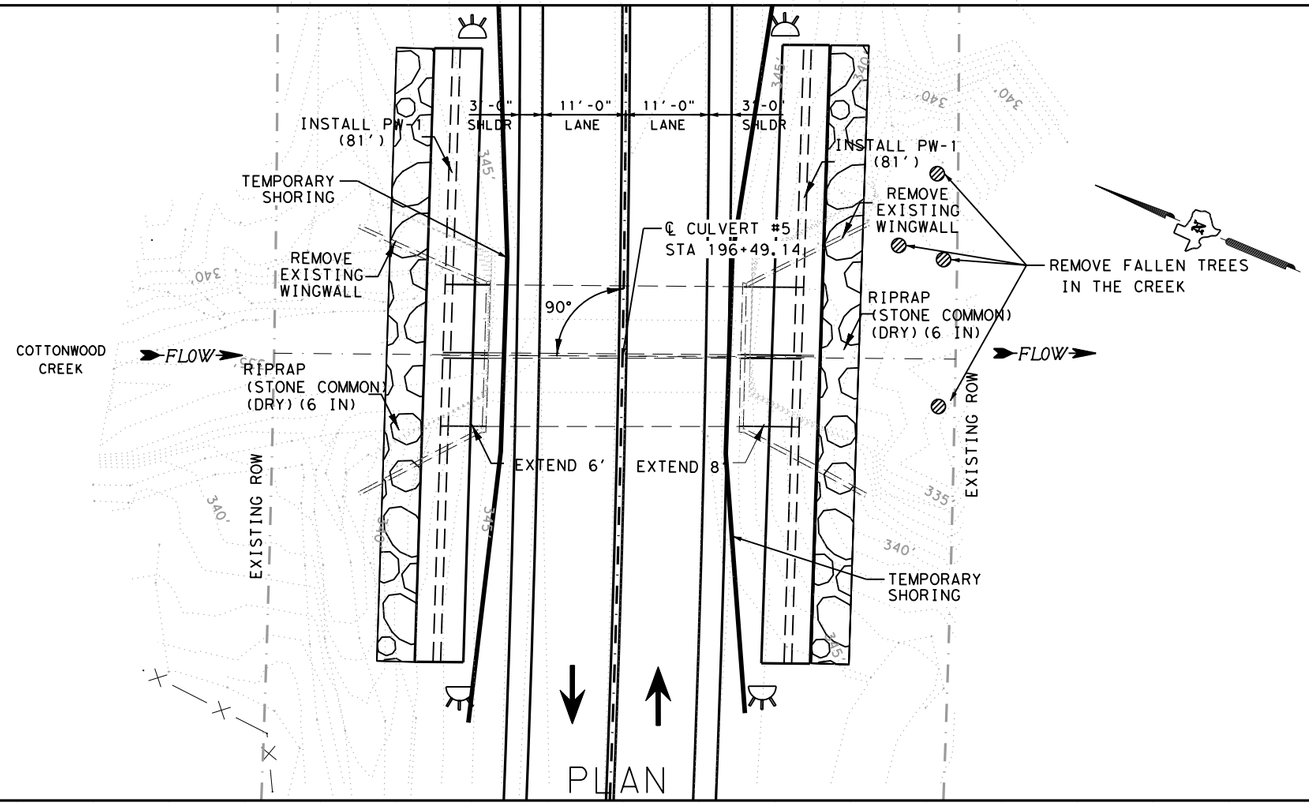

EXISTING 2-9'X9'X30' MBC W/ WINGWALL
EXTEND 6' US & 8' DS
PROPOSED 2-9'X9'X46' MBC W/ PW-1
STA. 196+49.14

ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
100-6012	TREE REMOVAL PREP ROW (TREE)(18'-36" DIA.)	EA	4
403-6001	TEMPORARY SPL SHORING	SF	1,812
432-6022	RIPRAP (STONE COMMON)(DRY)(6 IN)	CY	27.3
462-6072	CONC BOX CULV(9FT X 9FT)(EXTEND)	LF	32
466-6171	WINGWALL (PW-1)(HW=10FT)	EA	2
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6005	REMOV STR (WINGWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	4

LEGEND

FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=28.71 CFS	Q_{100}	=43.55 CFS
V_{10}	=6.16 F/S	V_{100}	=6.16 F/S
HW	=336.91	HW	=337.05
TW	=336.03	TW	=336.13

STATE OF TEXAS
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Signature of Registrant & Date

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FM 2451
CULVERT LAYOUT
(CULV #5)

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=20'

SHEET 5 OF 13

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	101
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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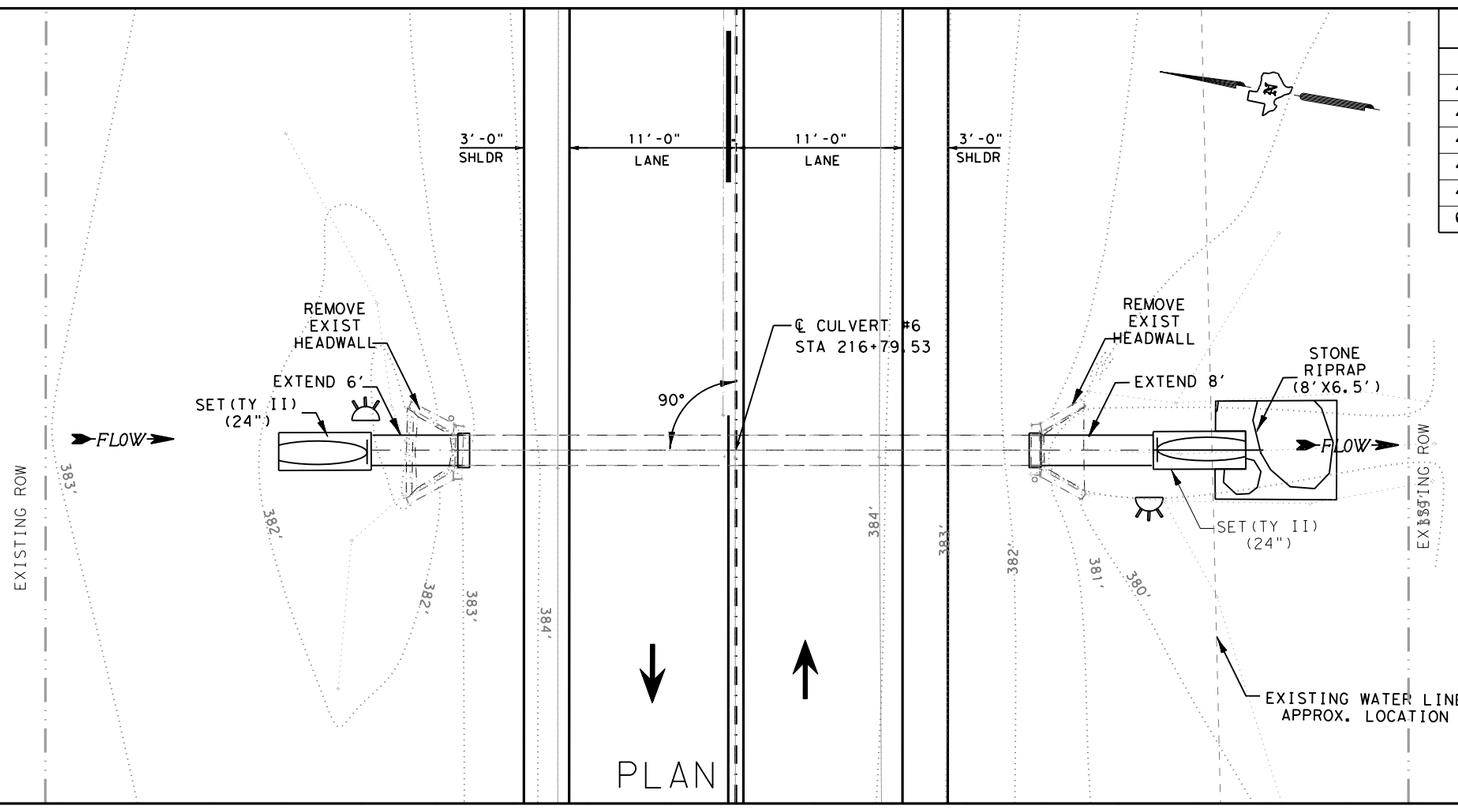
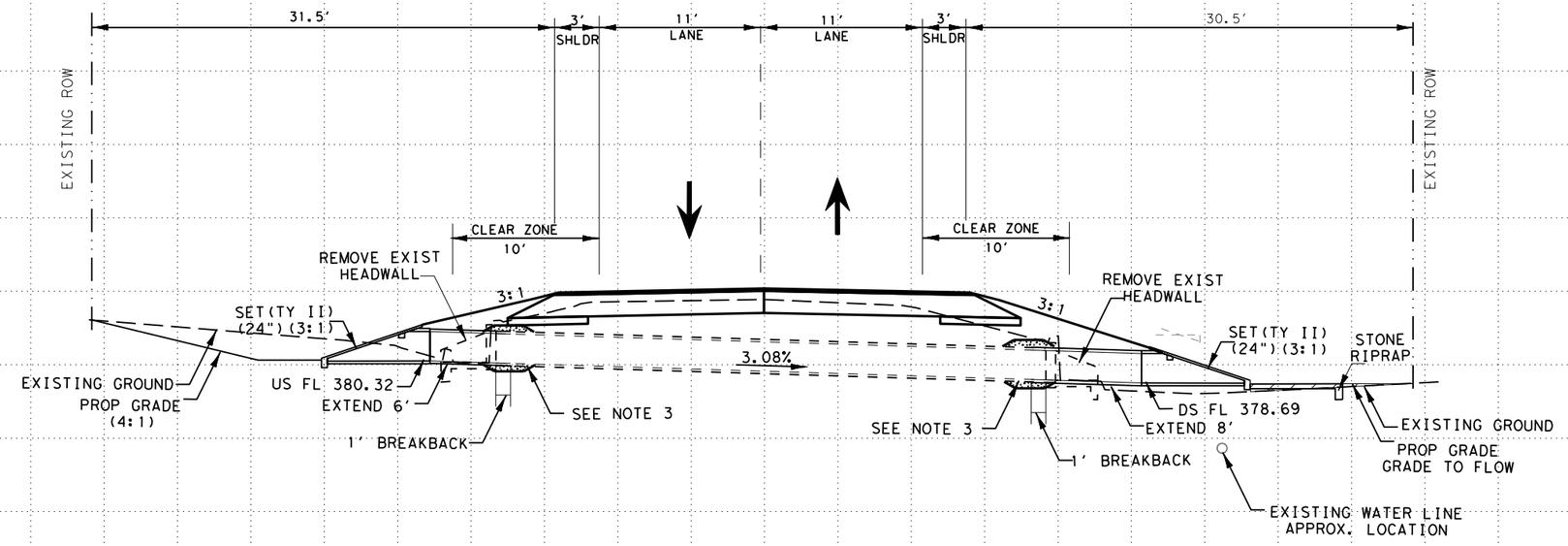
ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
432-6022	RIPRAP (STONE COMMON)(DRY)(6 IN)	CY	1.85
464-6018	RC PIPE (CL IV)(24IN)	LF	16
467-6388	SET (TY II) (24 IN) (RCP) (3: 1) (C)	EA	2
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6006	REMOV STR (HEADWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	2





ELEVATION

EXISTING 1-24"X39' RCP W/ HEADWALL
EXTEND 6' US & 8' DS
PROPOSED 1-24"X53' W/ SET

STA 216+79.53

LEGEND

FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. SEE MISC PIPE CONNECTION DETAIL FOR MORE INFORMATION.
4. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=15.08 CFS	Q_{100}	=22.38 CFS
V_{10}	=9.40 F/S	V_{100}	=9.43 F/S
HW	=382.37	HW	=383.03
TW	=379.54	TW	=379.69

STATE OF TEXAS
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83789
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Jahor Roy, P.E. 10/14/21
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FM 2451
CULVERT LAYOUT
(CULV #6)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

SHEET 6 OF 13

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	102
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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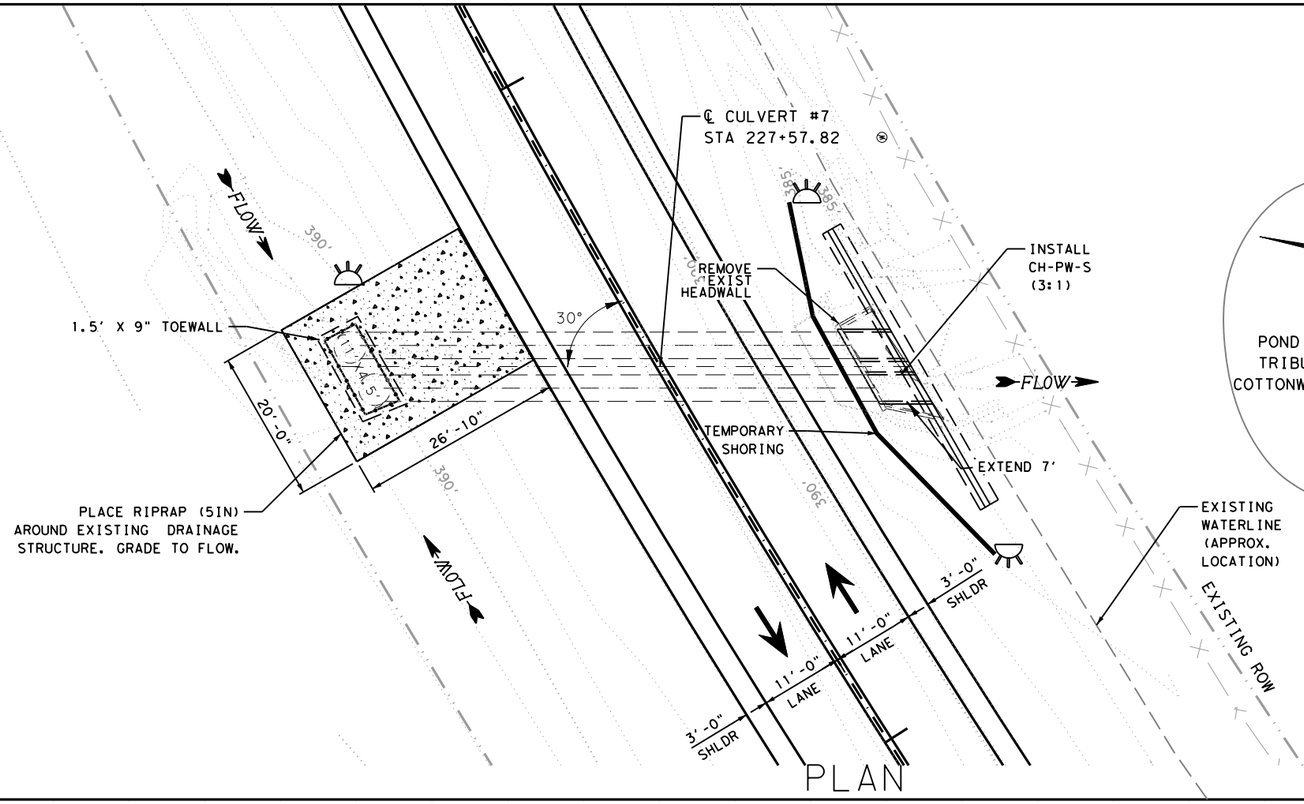
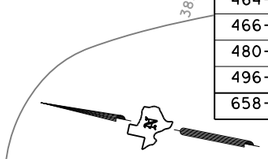




ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
403-6001	TEMPORARY SPL SHORING	SF	291
432-6002	RIPRAP (CONC)(5 IN)	CY	10.0
464-6021	RC PIPE (CL IV)(42 IN)	LF	16
466-6135	HEADWALL (CH-PW-S)(DIA=42 IN)	EA	1
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6006	REMOV STR (HEADWALL)	EA	1
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	3

LEGEND

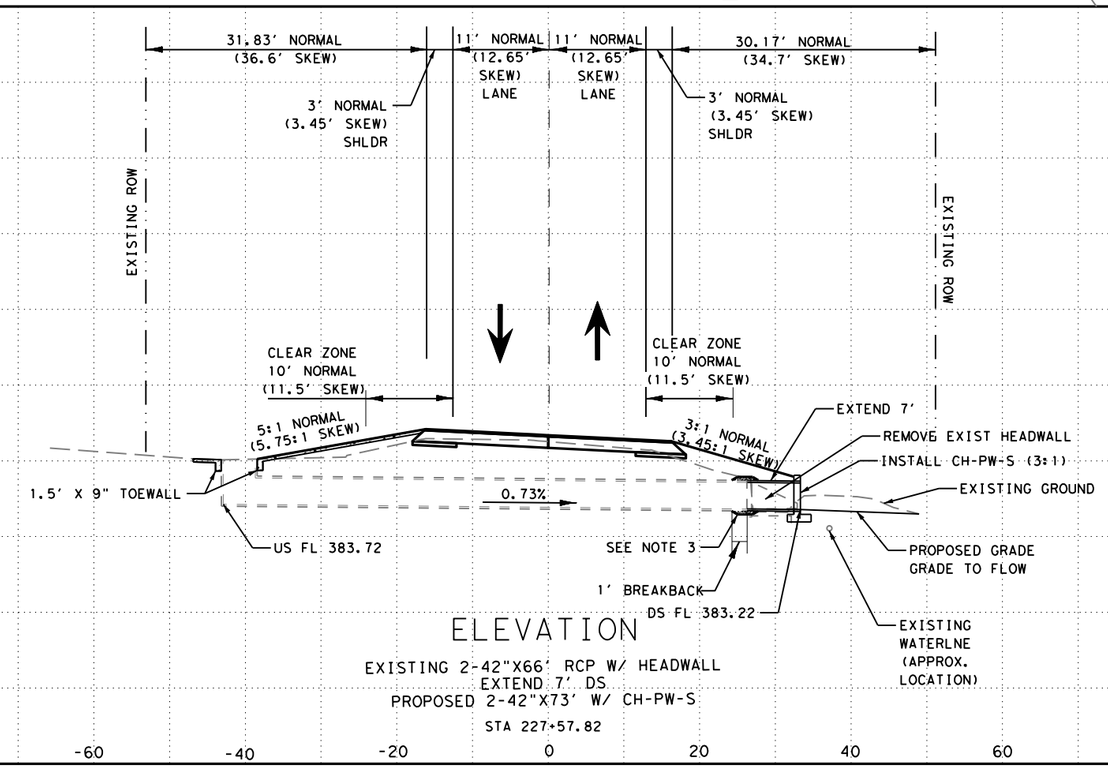
FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. SEE MISC PIPE CONNECTION DETAIL FOR MORE INFORMATION.
4. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

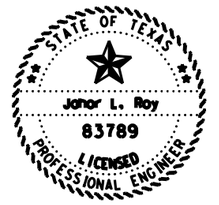
HYDRAULIC DATA

Q_{10}	=34.27 CFS	Q_{100}	=52.25 CFS
V_{10}	=5.82 F/S	V_{100}	=6.51 F/S
HW	=384.92	HW	=385.22
TW	=383.88	TW	=384.04



ELEVATION

EXISTING 2-42"X66' RCP W/ HEADWALL
EXTEND 7' DS
PROPOSED 2-42"X73' W/ CH-PW-S
STA 227+57.82



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Signature of Registrant & Date

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FM 2451
CULVERT LAYOUT
(CULV #7)

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=20'
SHEET 7 OF 13

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	103
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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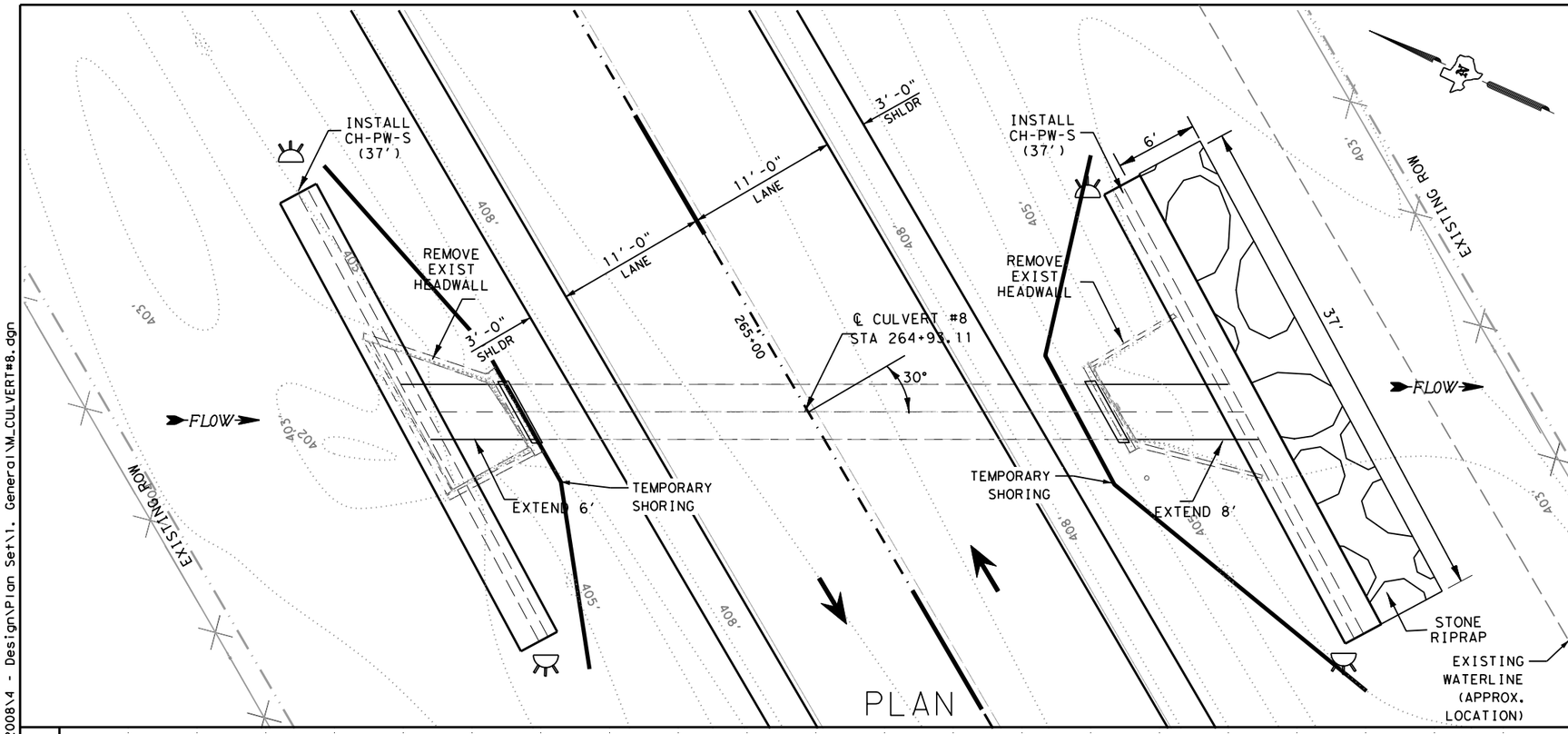


PLAN

ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
403-6001	TEMPORARY SPL SHORING	SF	294
432-6022	RIPRAP (STONE COMMON)(DRY)(6 IN)	CY	4.74
464-6022	RC PIPE (CL IV)(48 IN)	LF	16
466-6136	HEADWALL (CH-PW-S)(DIA=48 IN)	EA	2
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6006	REMOV STR (HEADWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	4

LEGEND

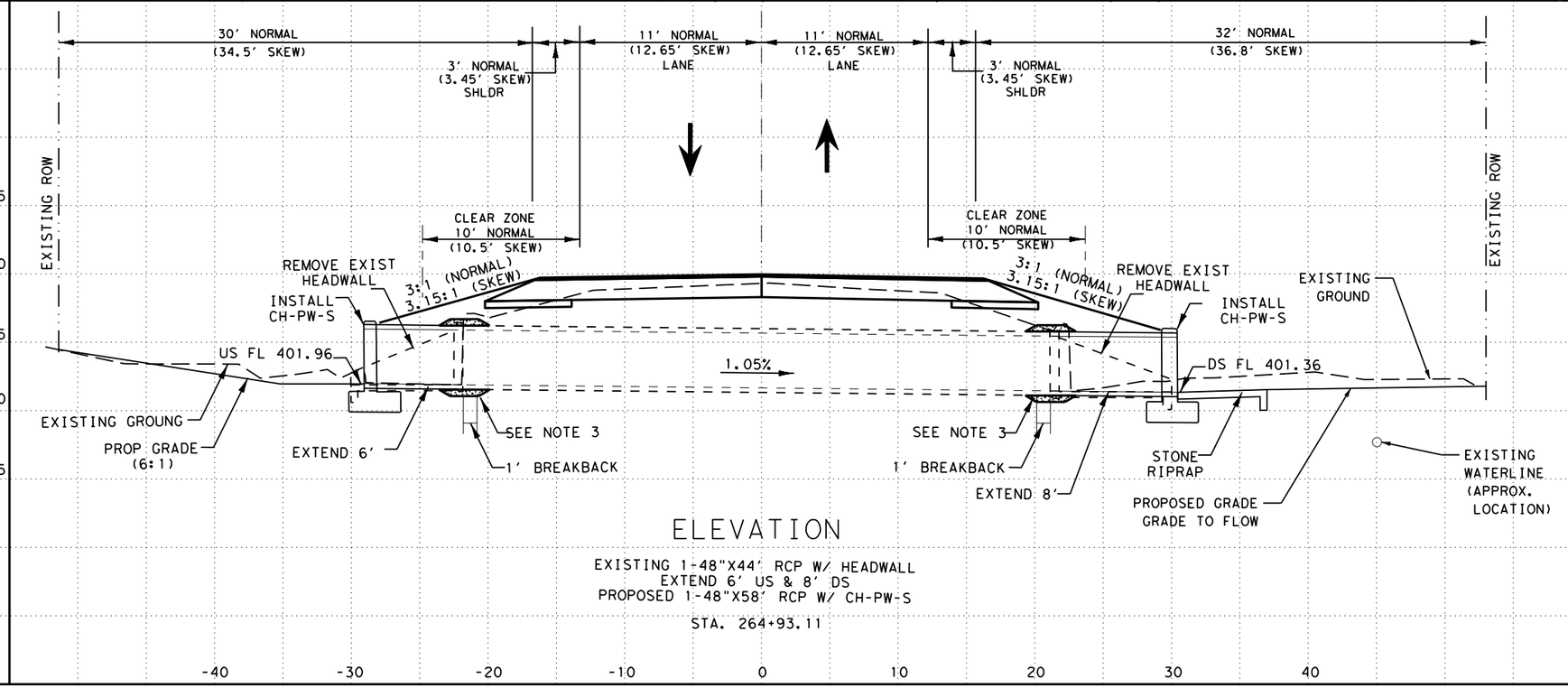
FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. SEE MISC PIPE CONNECTION DETAIL FOR MORE INFORMATION.
4. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=28.51 CFS	Q_{100}	=43.20 CFS
V_{10}	=7.05 F/S	V_{100}	=7.80 F/S
HW	=403.43	HW	=403.81
TW	=401.96	TW	=402.08



ELEVATION

EXISTING 1-48"X44' RCP W/ HEADWALL
EXTEND 6' US & 8' DS
PROPOSED 1-48"X58' RCP W/ CH-PW-S

STA. 264+93.11

Jahor L. Roy
83789
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

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FM 2451
CULVERT LAYOUT
(CULV #8)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	104
CHECK FR	CONTROL 2355	SECTION 01	JOB 006, ETC.	

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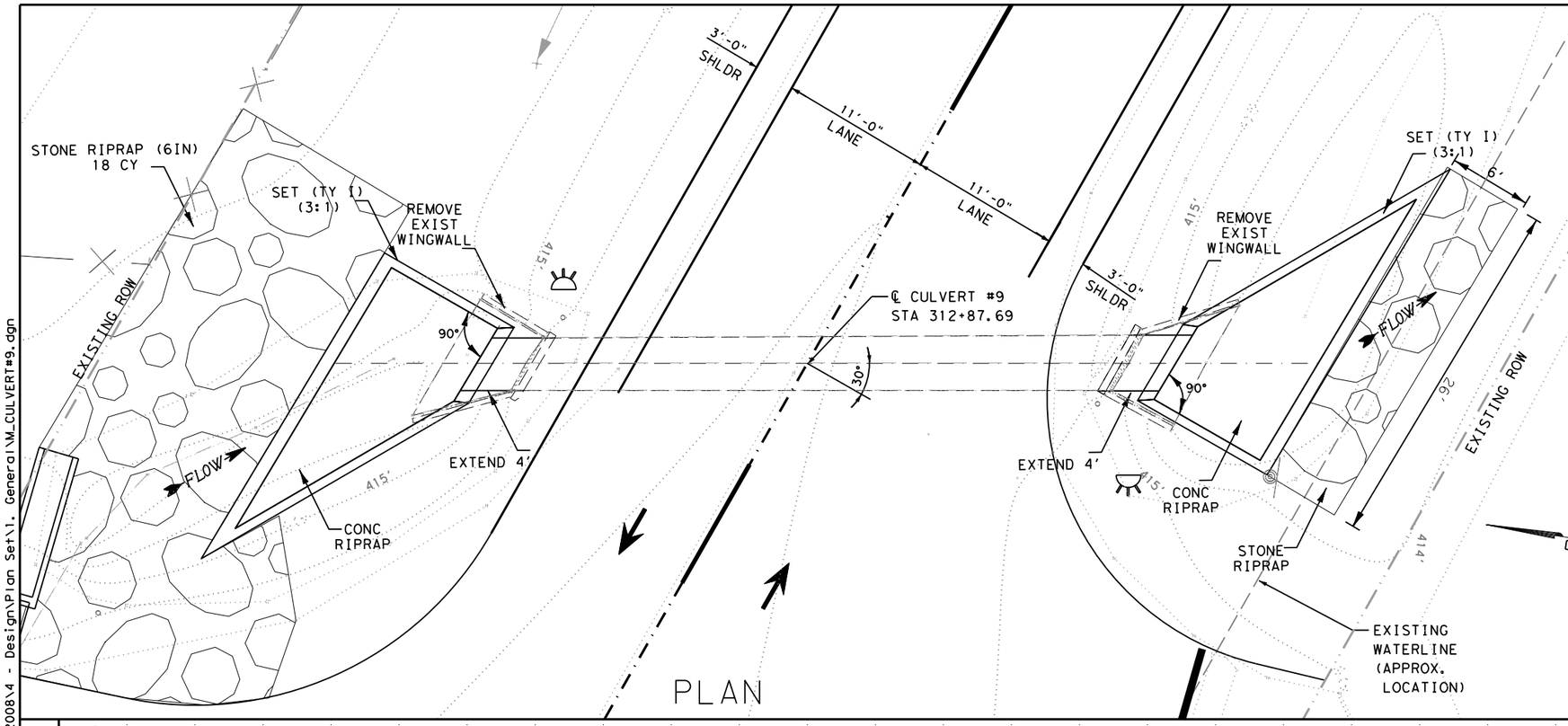


ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
432-6002	RIPRAP (CONC)(5 IN)	CY	4.0
432-6022	RIPRAP (STONE COMMON)(DRY)(6 IN)	CY	21.4
462-6048	CONC BOX CULV(4FT X 3FT)(EXTEND)	LF	10
467-6143	SET(TY I)(S=4FT)(HW=4FT)(3:1)(C)	EA	2
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6005	REMOV STR (WINGWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	2

LEGEND

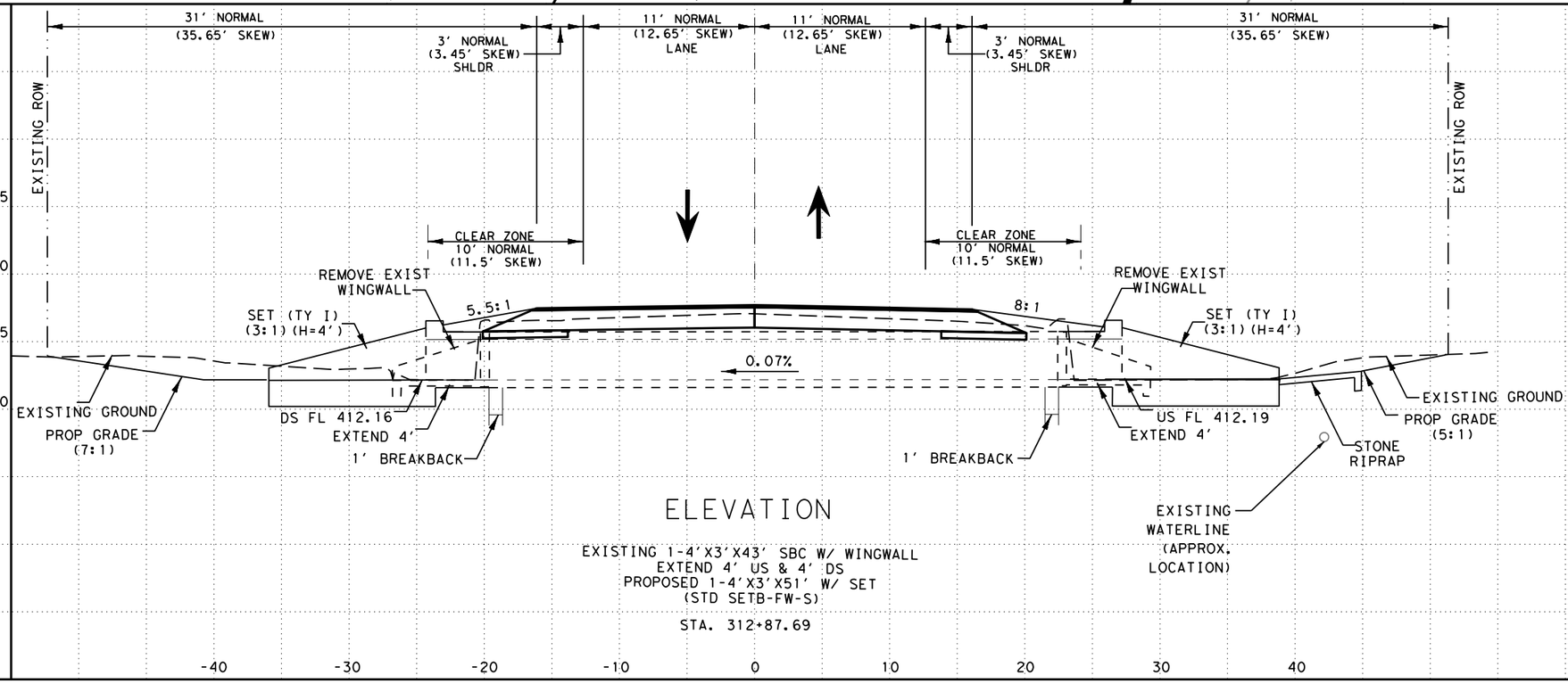
FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=89.10 CFS	Q_{100}	=136.22 CFS
V_{10}	=7.10 F/S	V_{100}	=8.19 F/S
HW	=414.90	HW	=415.79
TW	=413.54	TW	=413.81



ELEVATION

EXISTING 1-4'X3'X43' SBC W/ WINGWALL
EXTEND 4' US & 4' DS
PROPOSED 1-4'X3'X51' W/ SET
(STD SETB-FW-S)

STA. 312+87.69

STATE OF TEXAS
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FM 2451
CULVERT LAYOUT
(CULV #9)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	105
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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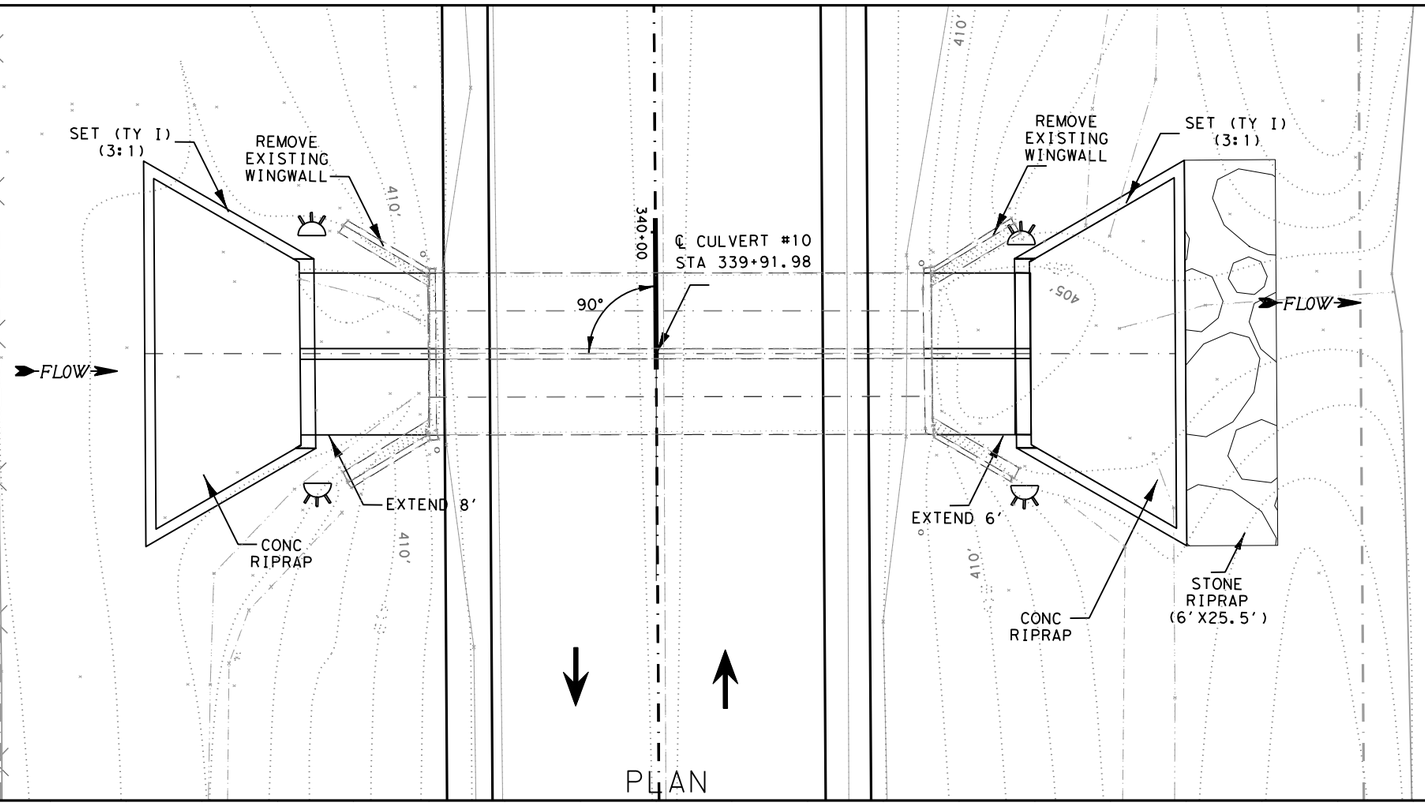


PLAN

ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
432-6002	RIPRAP (CONC) (5 IN)	CY	5.14
432-6022	RIPRAP (STONE COMMON)(DRY)(6 IN)	CY	3.5
462-6048	CONC BOX CULV(4 FT X 3 FT)(EXTEND)	LF	32
467-6175	SET(TY I)(S=5FT)(HW= 4FT)(3:1)(C)	EA	4
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6005	REMOV STR (WINGWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	4

0 5 10
VERT & HZ SCALE IN FT

LEGEND

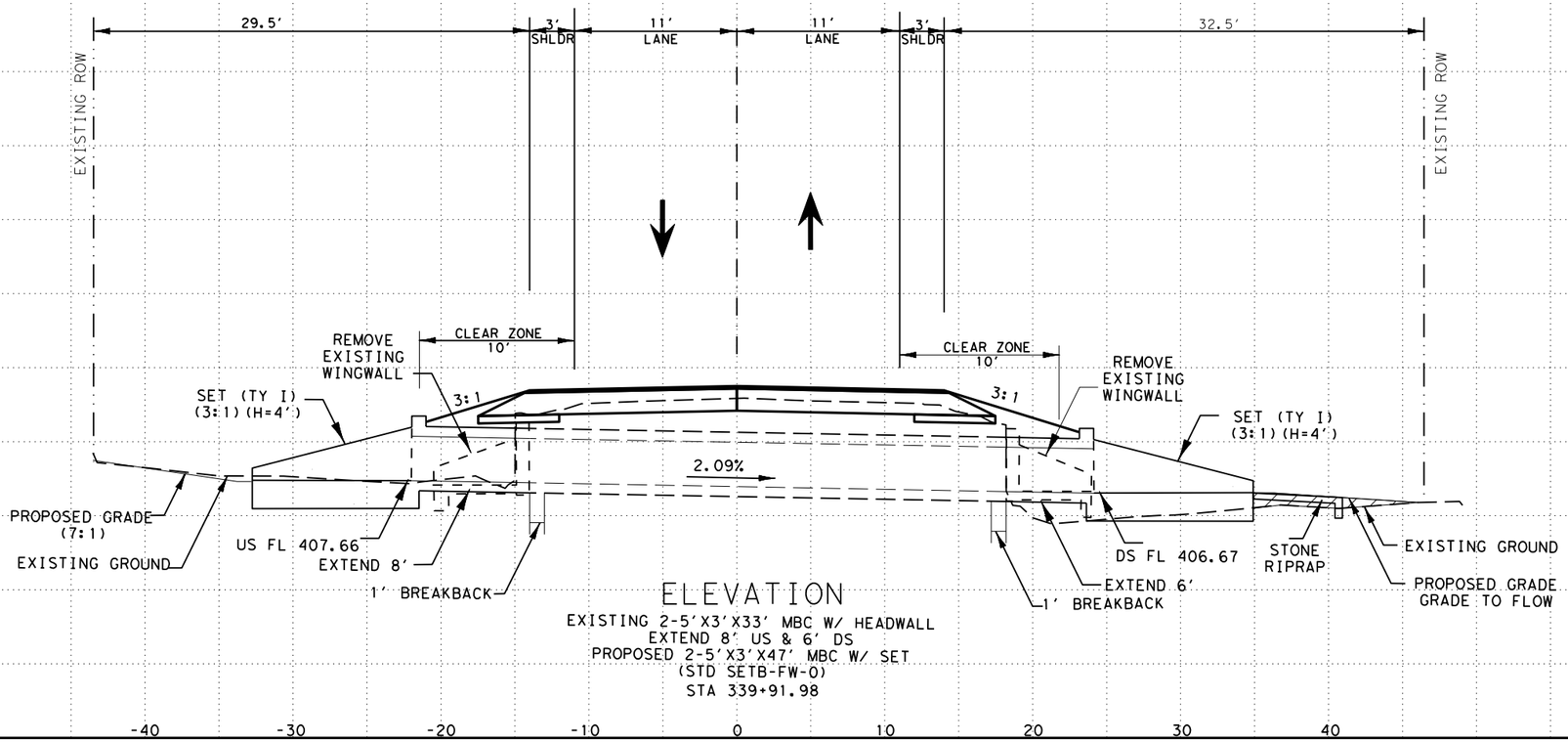
FLOW FLOW DIRECTION

DELINEATOR

NOTE:
1. SEE MC-MD STD FOR CULVERT LENGTHING DETAIL.
2. ANY DAMAGE OF CULVERTS DUE TO CONTRACTOR'S OPERATIONS, CONTRACTOR SHALL REPAIR BY THEIR OWN EXPENSES.
3. BRIDGE DESIGN FOR HL-93 LOADING UNDER 2014 AASHTO LDRF SPECIFICATION AND INTERIM THERETO
4. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=898 CFS	Q_{100}	=1,627 CFS
V_{10}	=13.84 F/S	V_{100}	=14.04 F/S
HW	=414.09	HW	=414.32
TW	=410.13	TW	=410.92



ELEVATION

EXISTING 2-5'X3'X33' MBC W/ HEADWALL
EXTEND 8' US & 6' DS
PROPOSED 2-5'X3'X47' MBC W/ SET
(STD SETB-FW-0)
STA 339+91.98

STATE OF TEXAS
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FM 2451
CULVERT LAYOUT
(CULV #10)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

SHEET 10 OF 13

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	106
CHECK FR	CONTROL 2355	SECTION 01	JOB 006, ETC.	

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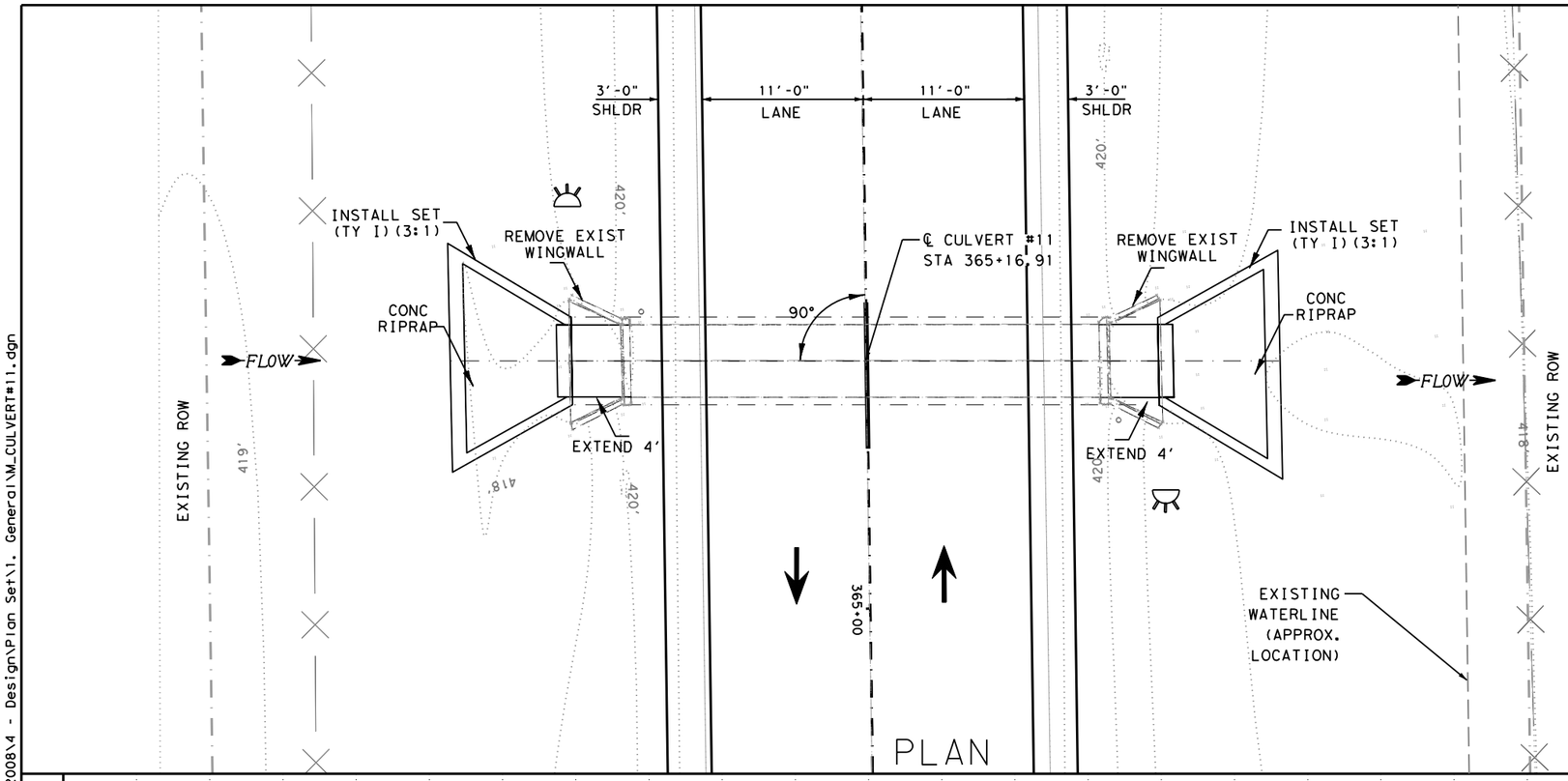
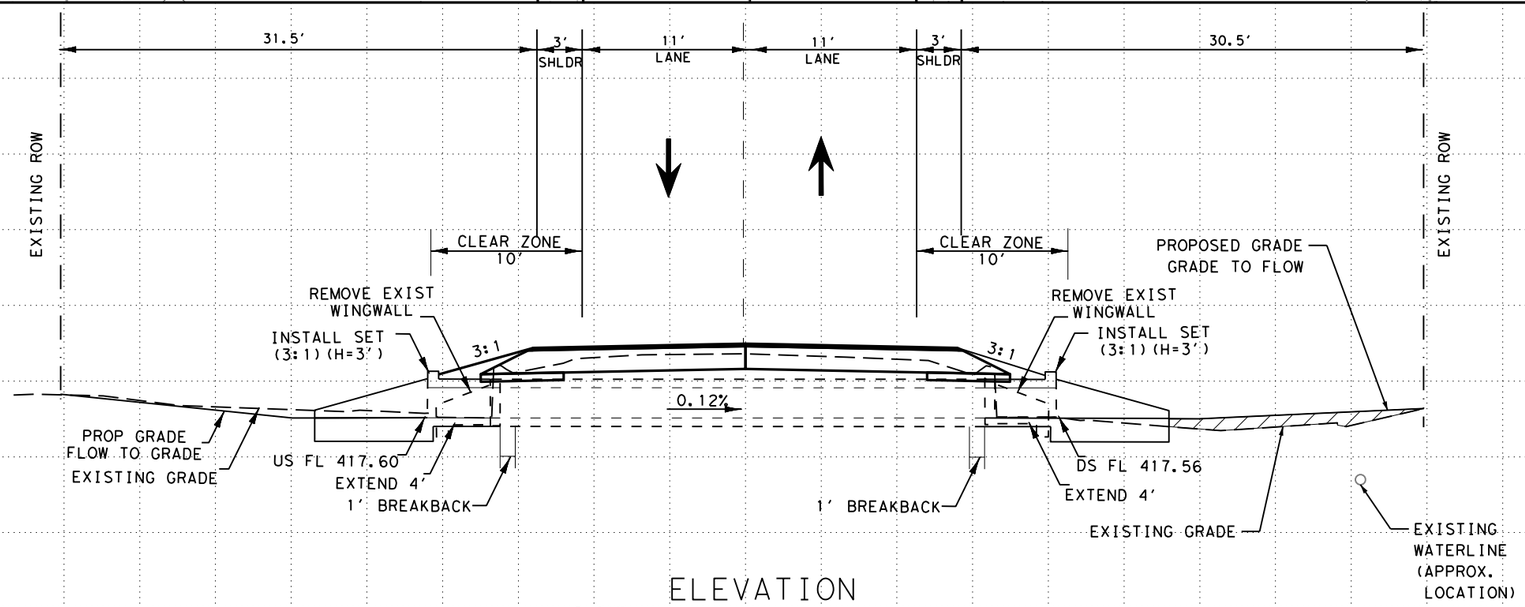
ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
432-6002	RIPRAP (CONC)(5 IN)	CY	2.31
462-6050	CONC BOX CULV(5FT X 2FT)(EXTEND)	LF	10
467-6171	SET(TY I)(S= 5FT)(HW= 3FT)(3:1)(C)	EA	2
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6005	REMOV STR (WINGWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	2



PLAN



ELEVATION

EXISTING 1-5'X2'X33' SBC W/ WINGWALL
EXTEND 4' US & 4' DS
PROPOSED 1-5'X2'X41' SBC W/ SET
(STD SETB-FW-0)
STA 365+16.91

LEGEND

FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=54.85 CFS	Q_{100}	=84.33 CFS
V_{10}	=5.61 F/S	V_{100}	=6.47 F/S
HW	=419.28	HW	=419.84
TW	=419.63	TW	=420.00

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FM 2451
CULVERT LAYOUT
(CULV #11)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

SHEET 11 OF 13

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	107
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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FR				

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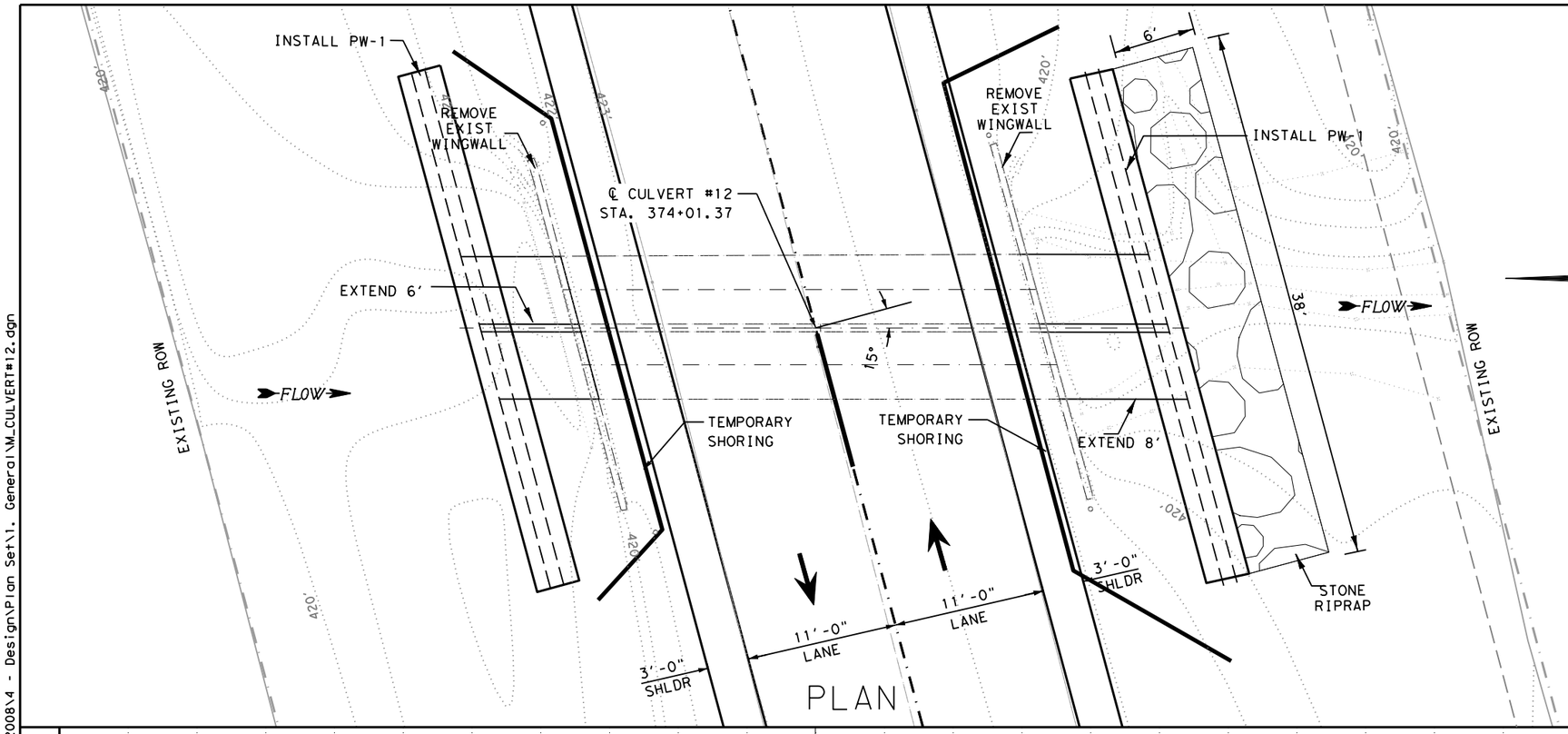

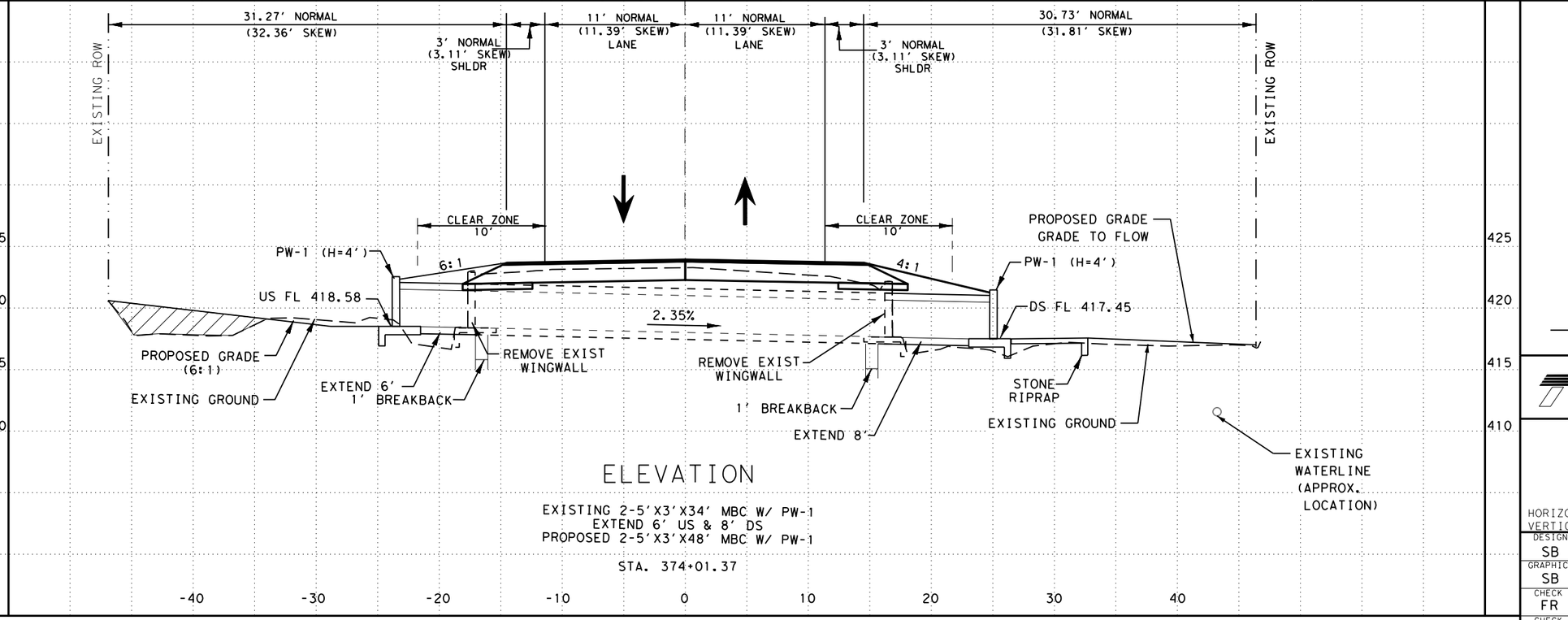

ELEVATION

EXISTING 2-5'X3'X34' MBC W/ PW-1
EXTEND 6' US & 8' DS
PROPOSED 2-5'X3'X48' MBC W/ PW-1

STA. 374+01.37

ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
403-6001	TEMPORARY SPL SHORING	SF	201
432-6022	RIPRAP (STONE COMMON)(DRY)(6 IN)	CY	5.06
462-6051	CONC BOX CULV(5FT X 3FT)(EXTEND)	LF	32
466-6179	WINGWALL (PW-1)(HW=4FT)	EA	2
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6005	REMOV STR (WINGWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	2

LEGEND

FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=93.16 CFS	Q_{100}	=142.42 CFS
V_{10}	=9.09 F/S	V_{100}	=10.14 F/S
HW	=419.93	HW	=420.45
TW	=418.70	TW	=418.94

STATE OF TEXAS
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FM 2451
CULVERT LAYOUT
(CULV #12)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	108
CHECK FR	CONTROL	SECTION	JOB	
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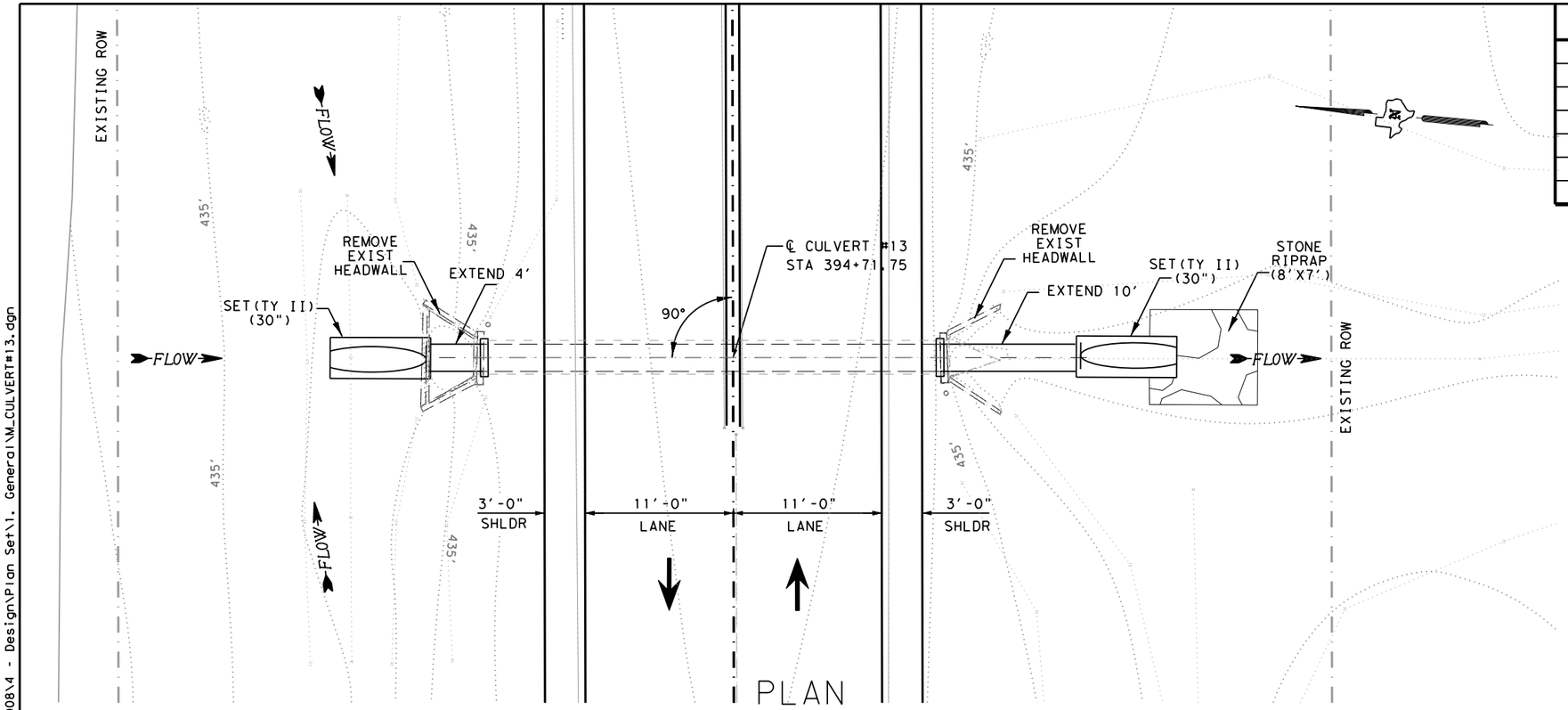
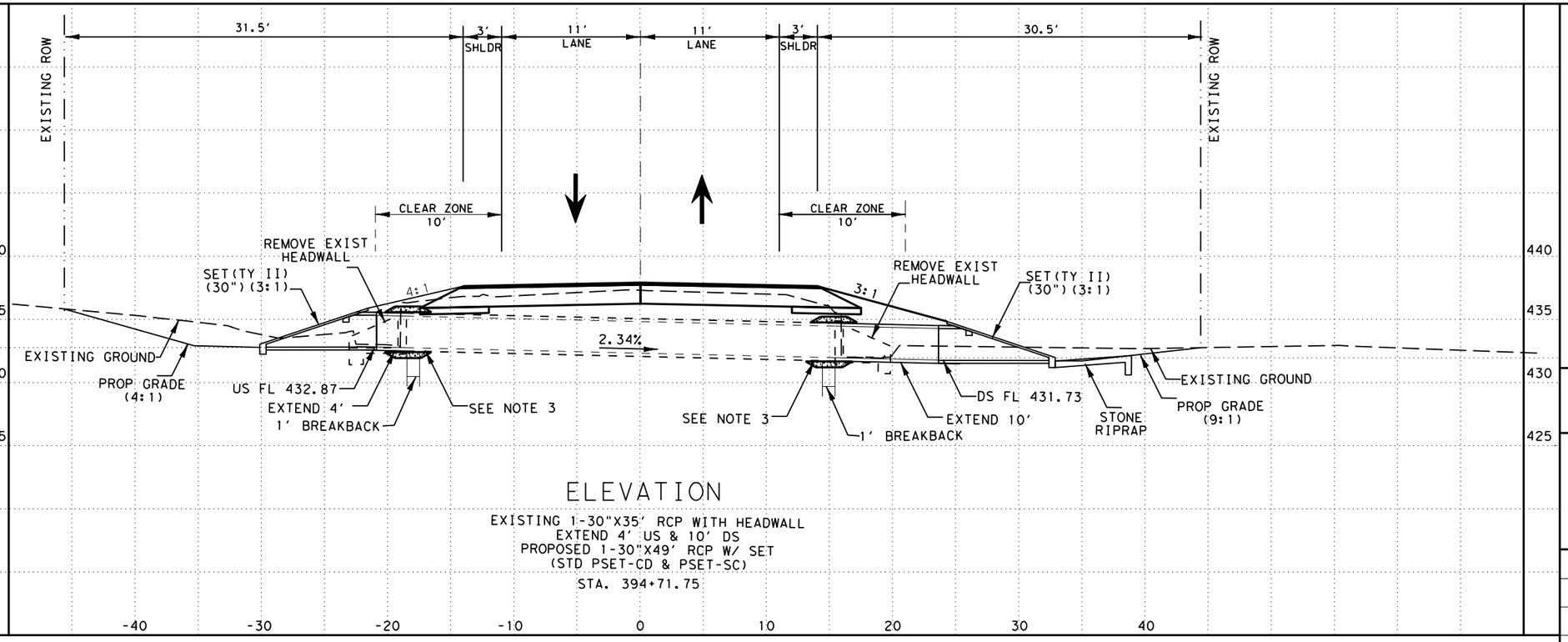


PLAN



ELEVATION

EXISTING 1-30"X35' RCP WITH HEADWALL
EXTEND 4' US & 10' DS
PROPOSED 1-30"X49' RCP W/ SET
(STD PSET-CD & PSET-SC)
STA. 394+71.75

ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUA.
432-6022	RIPRAP (STONE COMMON) (DRY) (6 IN)	CY	1.08
464-6019	RC PIPE (CL IV) (30 IN)	LF	16
467-6417	SET (TY II) (30 IN) (RCP) (3:1) (C)	EA	2
480-6001	CLEAN EXIST CULVERTS	EA	1
496-6006	REMOV STR (HEADWALL)	EA	2
658-6100	INSTL OM ASSM (OM-2Z) (WFLX) GND (BI)	EA	2

LEGEND

FLOW — FLOW DIRECTION

DELINEATOR

NOTES:
1. CULVERT MAY NOT HAVE ENOUGH FILL. ANY DAMAGE TO THE CULVERTS CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
2. PROP EXTENSION WILL MATCH WITH EX CULVERT'S SLOPE.
3. SEE MISC PIPE CONNECTION DETAIL FOR MORE INFORMATION.
4. THE 1' BREAKBACK IS SUBSIDIARY TO ITEM 496.

HYDRAULIC DATA

Q_{10}	=24.25 CFS	Q_{100}	=36.26 CFS
V_{10}	=8.99 F/S	V_{100}	=9.78 F/S
HW	=434.50	HW	=434.98
TW	=432.38	TW	=432.50

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FM 2451
CULVERT LAYOUT
(CULV #13)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

SHEET 13 OF 13

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	109
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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FR				

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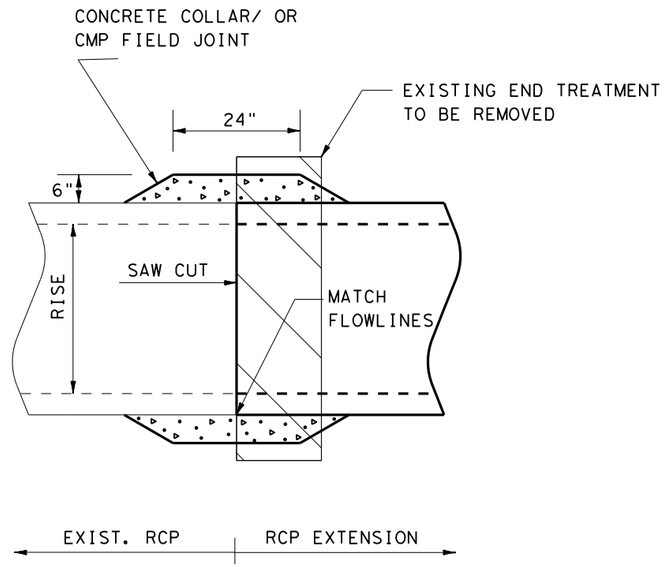
RCP CONNECTION DETAIL



IN LIEU OF CONC. COLLAR THE CONTRACTOR HAS THE OPTION
TO REMOVE THE EXISTING RCP BACK TO FIRST JOINT AND REPLACE
WITH THE NEW PIPE AT CONTRACTOR'S OWN EXPENSE.
COLLAR WILL BE SUBSIDIARY TO ITEM 464.

STATE OF TEXAS
FALON J. RENFROE
131914
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FM 2451
MISC PIPE
CONNECTION DETAILS

SCALE: N/A SHEET 1 OF 1

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	110
CHECK	CONTROL	SECTION	JOB	
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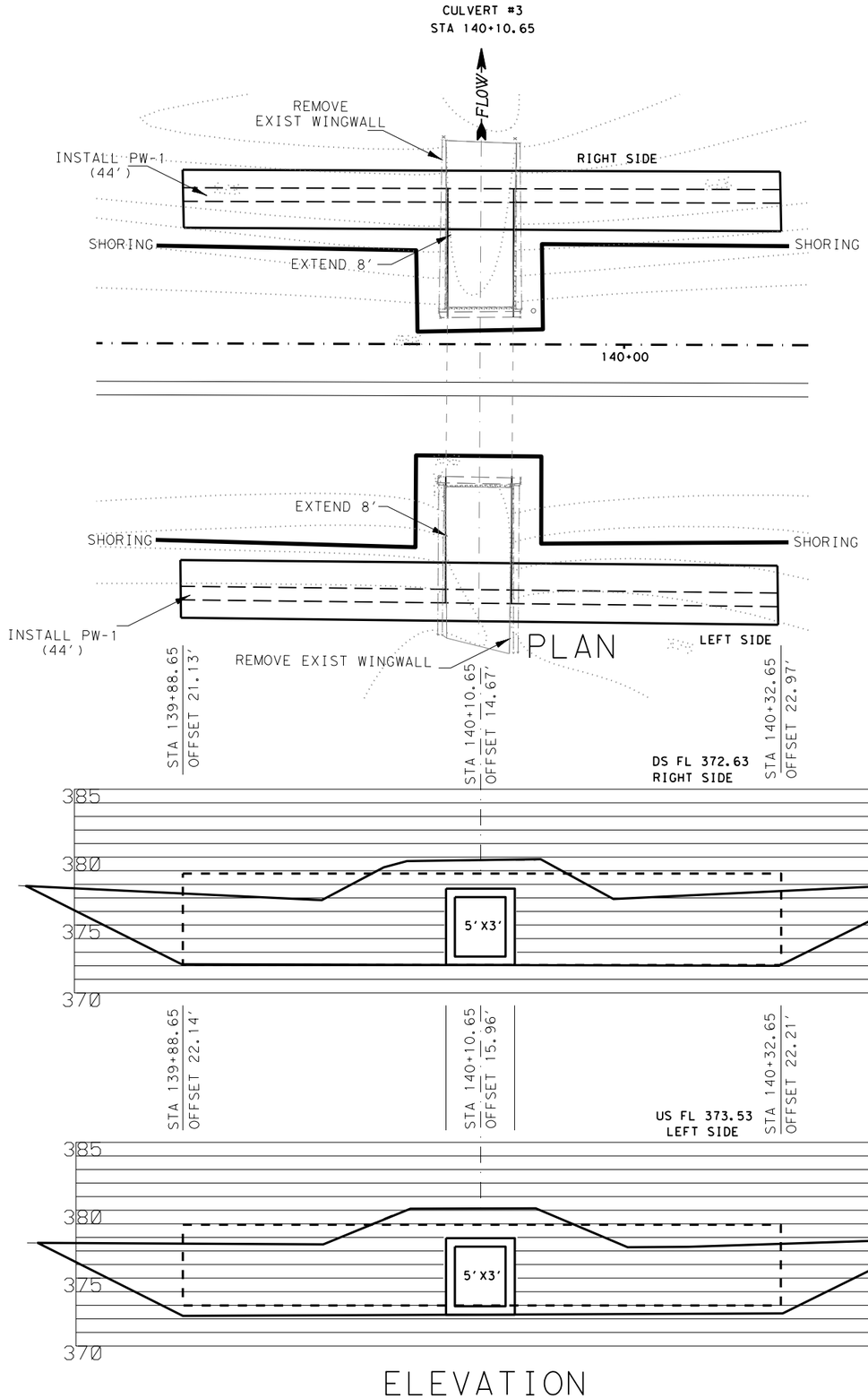

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FM 2451
TEMP SPL SHORING
(CULVERT #3)

SCALE: NTS SHEET 1 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	111
CHECK	CONTROL	SECTION	JOB	
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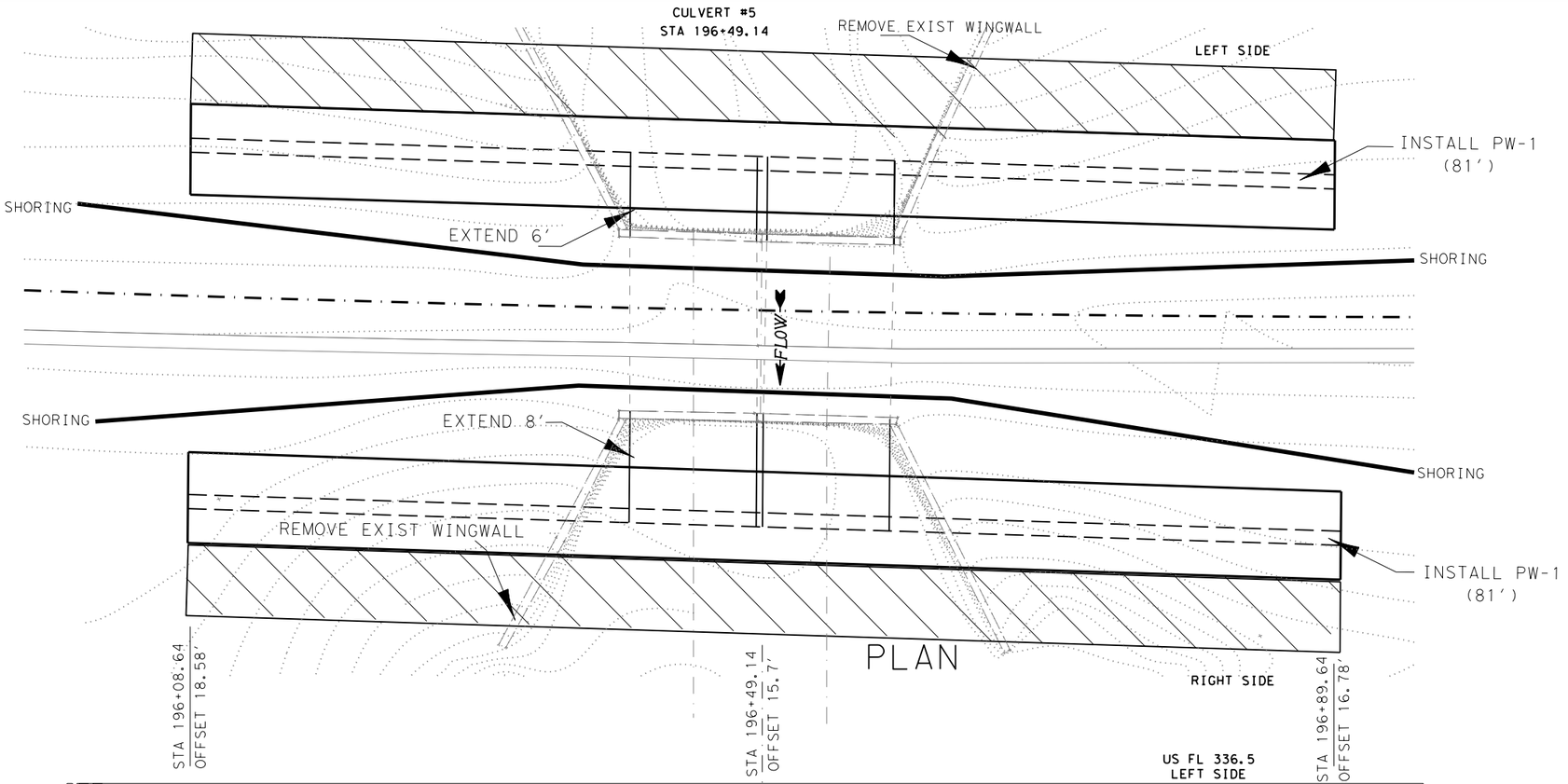
FR				



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FM 2451
TEMP SPL SHORING
(CULVERT #5)

SCALE: NTS SHEET 2 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	112
CHECK	CONTROL	SECTION	JOB	
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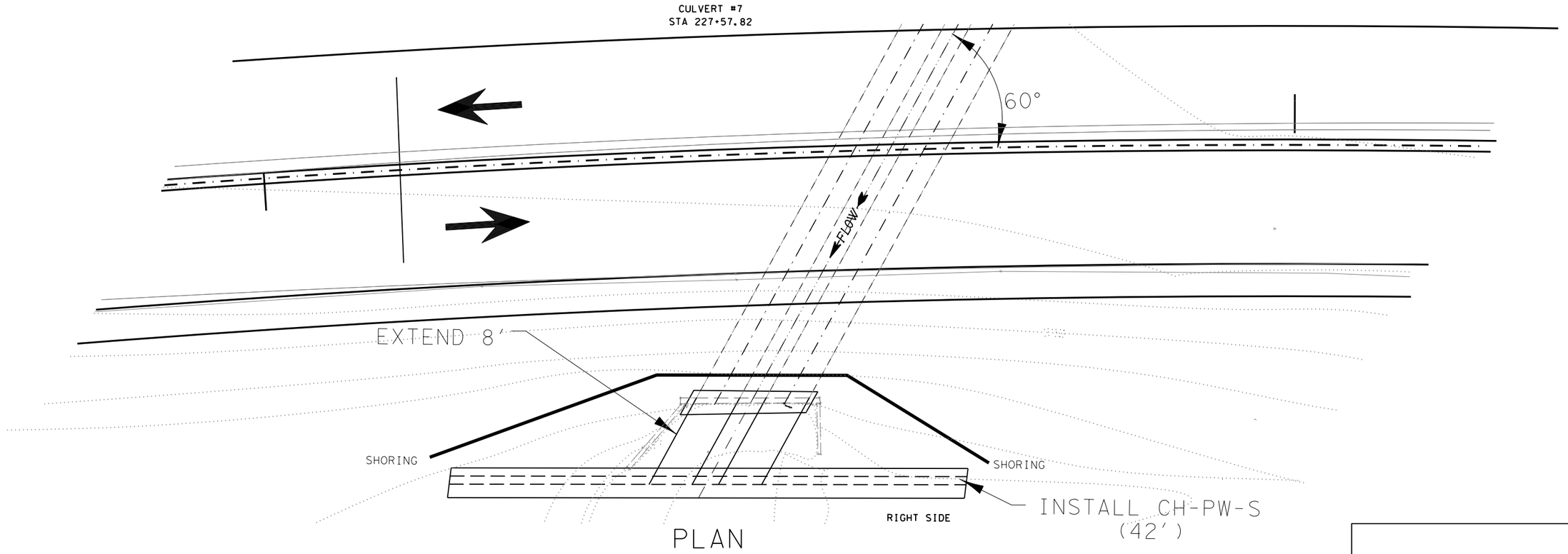
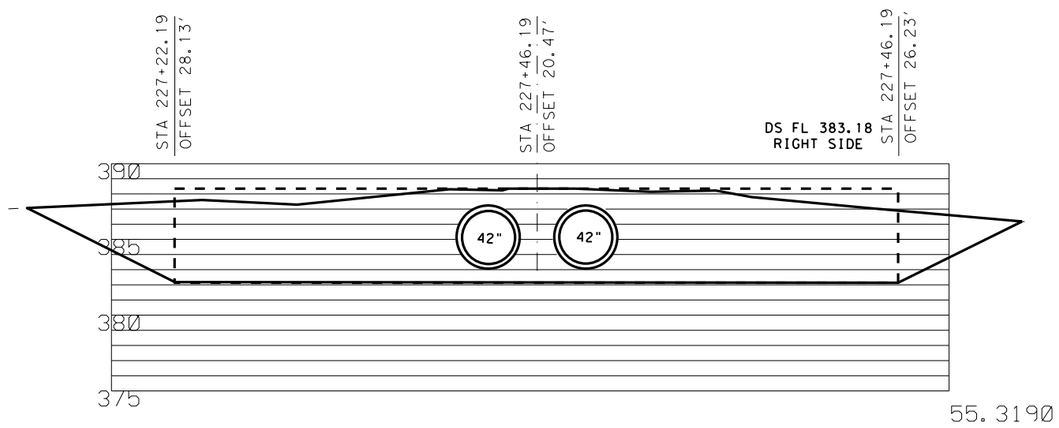
CHECK				
FR				



PLAN



ELEVATION

DATE: 10/13/2021 11:25:29 AM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\M03_Shoring Plan.dgn

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FM 2451
TEMP SPL SHORING
(CULVERT #7)

SCALE: NTS SHEET 3 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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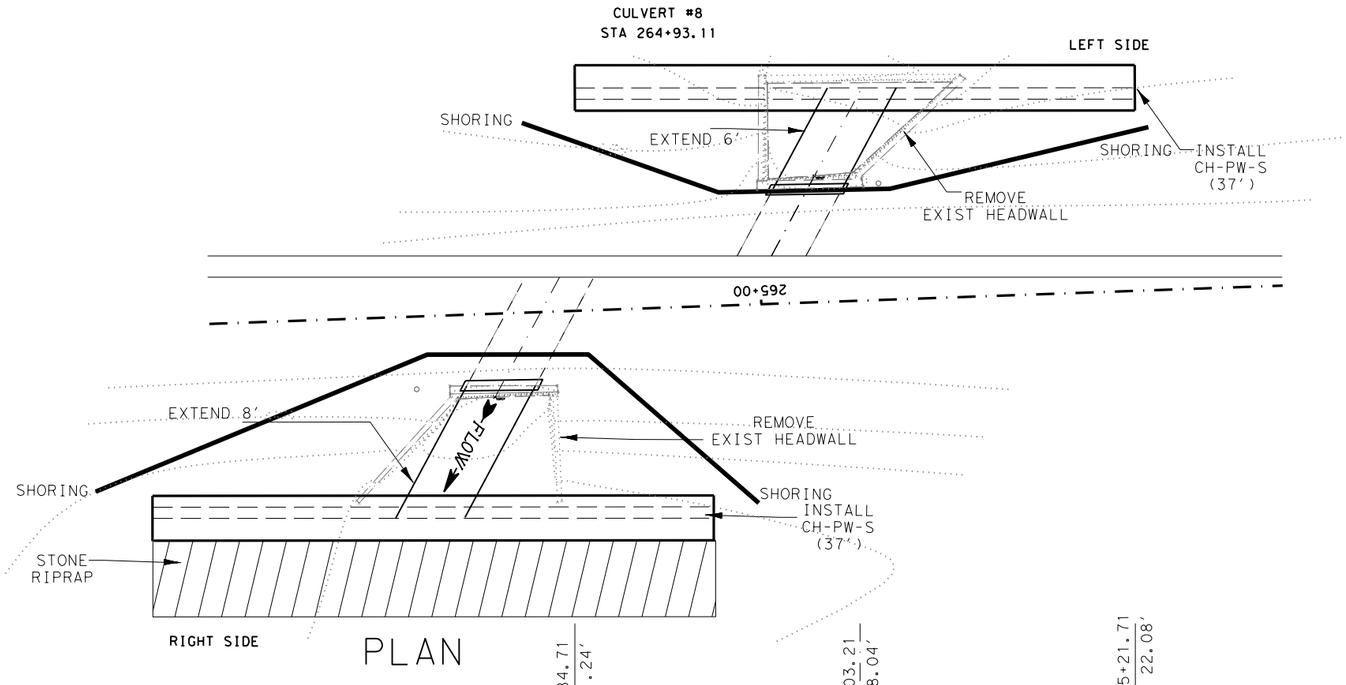
FR				



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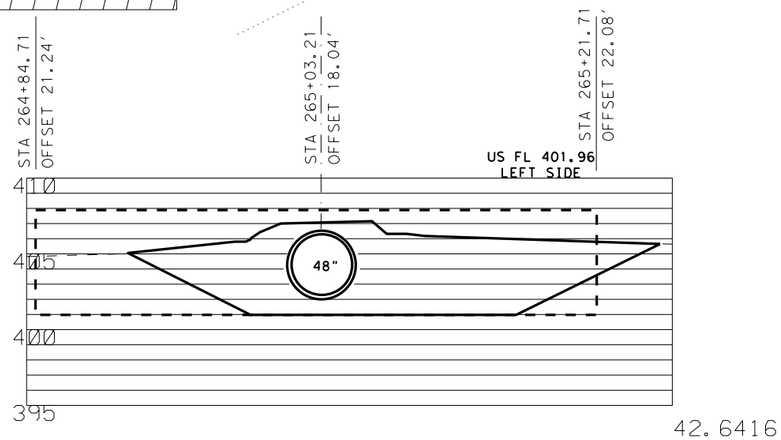

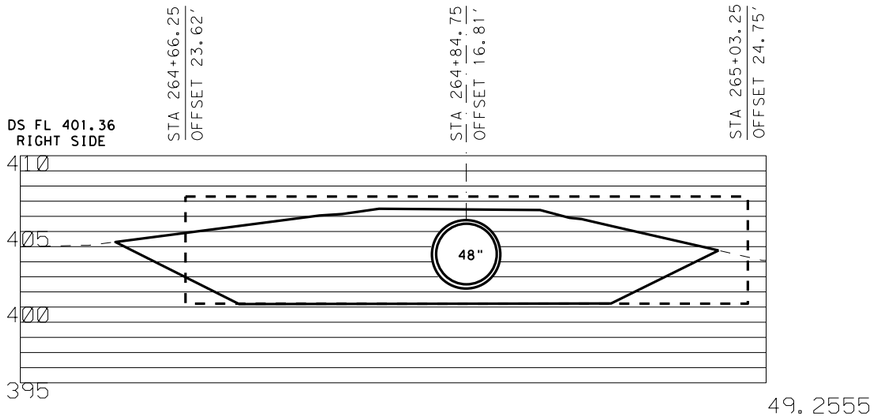

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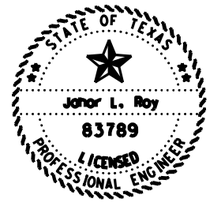

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Signature of Registrant & Date

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FM 2451
TEMP SPL SHORING
(CULVERT #8)

SCALE: NTS SHEET 4 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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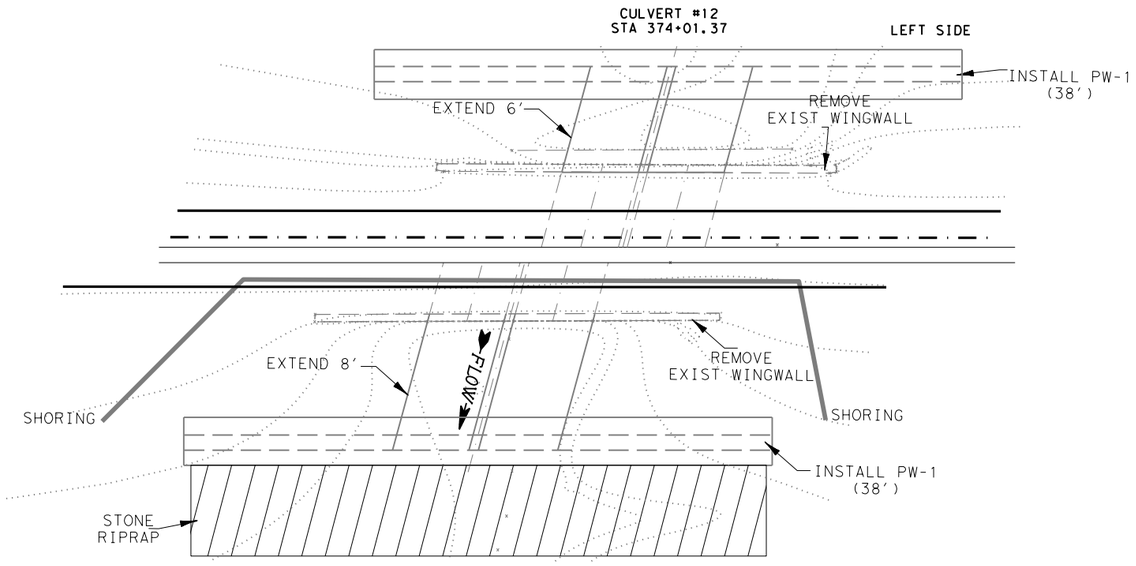

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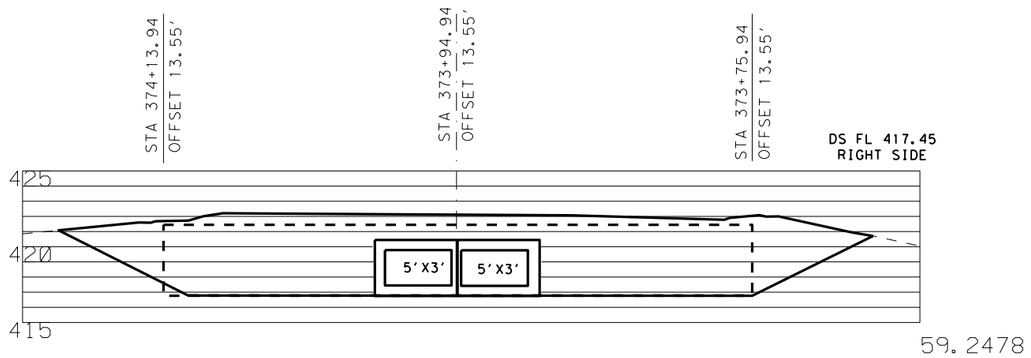

ELEVATION

Jahor L. Roy
83789
LICENSED
PROFESSIONAL ENGINEER

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FM 2451
TEMP SPL SHORING
(CULVERT #12)

SCALE: NTS SHEET 5 OF 5

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
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GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
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BOX CULVERT SUPPLEMENT SHEET ~ WINGS AND END TREATMENTS

© TxDOT September 2000
Revision: 2/3/2020, Bridge Division

Culvert Station and/or Creek Name	Description of Box Culert No.Spans ~ Span X Height	Max Fill Height (ft)	Applicable Box Culvert Standard	Applicable Wingwall or End Treatment Standard	Skew Angle (0°,15°, 30° or 45°)	Side Slope or Channel Slope (SL:1)	T Culvert Top Slab Thick's (in)	U Culvert Wall Thick's (in)	C Estimate Curb Height (ft)	Hw Height of Wing (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 (C.Y.)	Class "C" Conc. (Curb) (CY)	Class "C" Conc. (Wing.) (CY)	Total Wingwall Area (SF)
Culvert #2 - STA 106+47.09 (Lt)	1 ~ 3' X 2'	2'	SCP-3	SETB-FW-0	0	3:1	4"	4"	0.500	2.583	6.750	3.897	7.794	3.667	10.794	1.05	0.1	2.8	N/A
Culvert #2 - STA 106+47.09 (Rt)	1 ~ 3' X 2'	2'	SCP-3	SETB-FW-0	0	3:1	4"	4"	0.500	2.583	6.750	3.897	7.794	3.667	10.794	1.04	0.1	2.8	N/A
Culvert #3 - STA 140+10.65 (Lt)	1 ~ 6' X 5'	3'	SCC-5&6	PW-1	0	3:1	8"	7"	0.500	6.167	N/A	N/A	18.500	7.167	N/A	0.0	0.1	14.8	228
Culvert #3 - STA 140+10.65 (Rt)	1 ~ 6' X 5'	3'	SCC-5&6	PW-1	0	3:1	8"	7"	0.500	6.167	N/A	N/A	18.500	7.167	N/A	0.0	0.1	14.8	228
Culvert #5 - STA 196+49.14 (Lt)	2 ~ 9' X 9'	3'	MC-9-10	PW-1	0	3:1	9"	7"	0.396	10.146	N/A	N/A	30.438	19.750	N/A	0.0	0.3	39.9	618
Culvert #5 - STA 196+49.14 (Rt)	2 ~ 9' X 9'	3'	MC-9-10	PW-1	0	3:1	9"	7"	0.458	10.208	N/A	N/A	30.625	19.750	N/A	0.0	0.3	40.1	625
Culvert #9 - STA 312+87.69 (Lt)	1 ~ 4' X 3'	3'	SCP-4	SETB-FW-S	30	3:1	5"	5"	0.521	3.688	10.063	10.063	14.231	5.581	14.681	2.0	0.1	4.6	N/A
Culvert #9 - STA 312+87.69 (Rt)	1 ~ 4' X 3'	3'	SCP-4	SETB-FW-S	30	3:1	5"	5"	0.500	3.667	10.000	10.000	14.142	5.581	14.619	2.0	0.1	4.6	N/A
Culvert #10 - STA 339+91.98 (Lt)	2 ~ 5' X 3'	4'	SCP-5	SETB-FW-0	0	3:1	6"	6"	0.500	3.750	10.250	5.918	11.836	12.500	23.336	2.57	0.2	5.4	N/A
Culvert #10 - STA 339+91.98 (Rt)	2 ~ 5' X 3'	4'	SCP-5	SETB-FW-0	0	3:1	6"	6"	0.479	3.729	10.188	5.882	11.764	12.500	23.264	2.57	0.2	5.4	N/A
Culvert #11 - STA 365+16.91 (Lt)	1 ~ 5' X 2'	2'	SCP-5	SETB-FW-0	0	3:1	6"	6"	0.500	2.750	7.250	4.186	8.372	6.000	13.372	1.16	0.1	3.3	N/A
Culvert #11 - STA 365+16.91 (Rt)	1 ~ 5' X 2'	2'	SCP-5	SETB-FW-0	0	3:1	6"	6"	0.500	2.750	7.250	4.186	8.372	6.000	13.372	1.15	0.1	3.3	N/A
Culvert #12 - STA 374+01.37 (Lt)	2 ~ 5' X 3'	3'	MC-5-20	PW-1	15	3:1	8"	7"	0.479	4.146	N/A	N/A	12.876	12.164	N/A	2.53	0.2	8.2	107
Culvert #12 - STA 374+01.37 (Rt)	2 ~ 5' X 3'	3'	MC-5-20	PW-1	15	3:1	8"	7"	0.500	4.167	N/A	N/A	12.941	12.164	N/A	2.53	0.2	8.2	108

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.

STATE OF TEXAS
Jahor L. Roy
83789
LICENSED
PROFESSIONAL ENGINEER

Jahor Roy , P.E. 10/14/21
Signature of Registrant & Date

Texas Department of Transportation
Bridge Division Standard

BOX CULVERT SUPPLEMENT
WINGS AND END TREATMENTS

BCS

FILE: bcsstde1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		116

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

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

TABLE OF WING WALL REINFORCING (Two~Wings)

Bar	Size	No.	Spa
D	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
R	#5	6	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

TABLE OF ESTIMATED ANCHOR TOEWALL QUANTITIES

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

(1) Extend Bars P 3'-0" Min into bottom slab of box culvert.

(2) Adjust to fit as necessary to maintain 1 1#2" clear cover and 4" Min between bars.

(3) Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by Lw.

(4) Recommended values of slope are: 3:1, 4:1, and 6:1. Provide 3:1 or flatter slope.

(5) When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, extend construction joints or grooved joints, oriented in the direction of flow, across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B is not required.

(6) At Contractor's option, end the culvert toewall flush with wingwall toewall. Adjust reinforcing as needed.

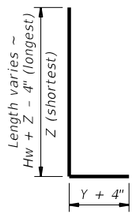
(7) 3" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to the Extend Curb Details (ECD) standard sheet.

(8) For vehicle safety, reduce curb heights, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.

(9) See Table of Maximum Wing Heights for various slopes. Height is limited based on a 33'-6" maximum safety pipe runner length.

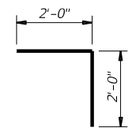
TABLE OF MAXIMUM WING HEIGHTS (9)

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

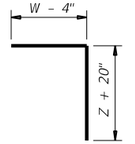


BARS J1

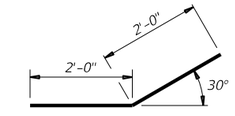
BARS V



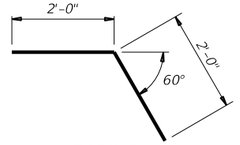
BARS L



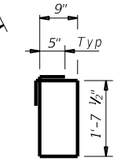
BARS J2



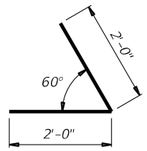
BARS D



BARS R



BARS K
(Length = 5'-5")



BARS OL

WING DIMENSION CALCULATIONS:

Hw = H + T + C - 0.250' (9)
A = (Hw - 0.333') (SL)
B = (A) (tan (30°))
Lw = (A) ÷ cos (30°))

For cast-in-place culverts:
Ltw = (N) (S) + (N + 1) (U)
For precast culverts:
Ltw = (N) (2U + S) + (N - 1) (0.500')

Lc = (Ltw) - (2U)
Atw = (Lc) + (2B)
Total Wingwall Area (two wings ~ SF) = (Hw + 0.333') (Lw)

Hw = Height of wingwall (feet)
Atw = Anchor toewall length (feet)
Lw = Length of wingwall (feet)
N = Number of culvert barrels
SL:1 = Side slope ratio (horizontal : 1 vertical)
Ltw = Culvert toewall length (feet)
Lc = Culvert curb between wings (feet)

See applicable box culvert standard for H, S, T, and U values.
See Table of Maximum Wall Heights for limits on Hw.

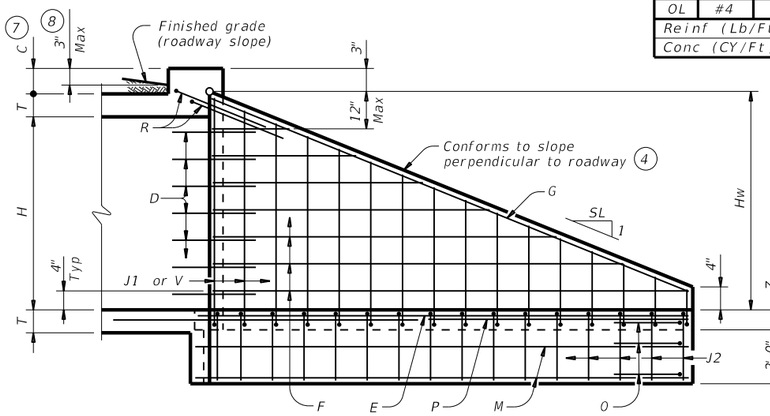
MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.
Provide Class "C" concrete (f`c = 3,600 psi).
Adjust reinforcing as necessary to provide a minimum clear cover of 1 ½".
Provide pipe runners and anchor pipes meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.
Provide ASTM A307 bolts and nuts.
Provide ASTM A36 steel plates.
Galvanize all steel components, except reinforcing unless required elsewhere in the plans, after fabrication.
Repair galvanizing damaged during transport or construction in accordance with the Item 445, "Galvanizing".
For optional adhesive anchors, install adhesive anchorages in accordance with the manufacturer's instructions including hole size, drilling equipment and method, hole cleaning equipment and method, mixing and dispensing adhesive, and anchor insertion. Do not alter the manufacturer's mixing nozzle or dispenser. Provide anchorage rods that are clean and free of grease, oil, or any other foreign material. Demonstrate hole cleaning method to the Engineer for approval and continue the approved process for all anchorage locations. Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

GENERAL NOTES:

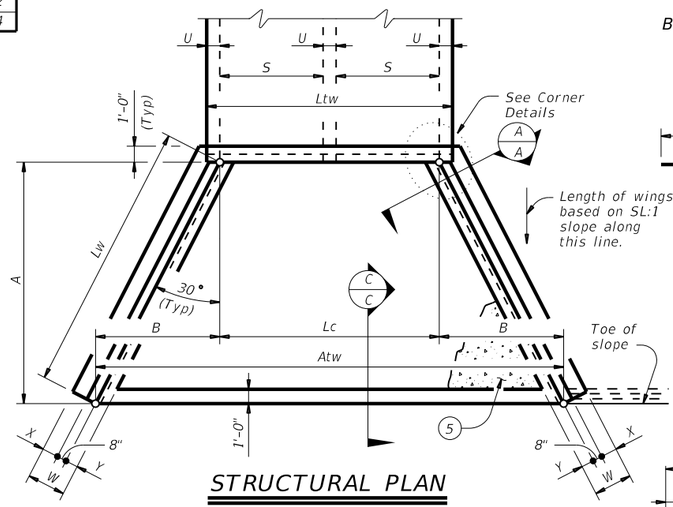
Designed according to AASHTO LRFD Bridge Design Specifications.
The safety end treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.
Pipe runners are designed for a traversing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

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



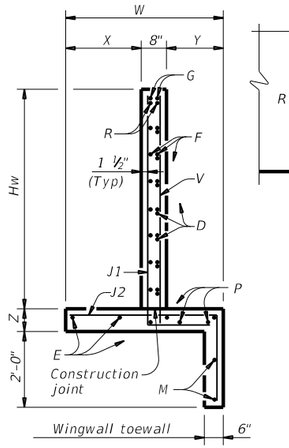
INSIDE ELEVATION OF WINGWALL

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

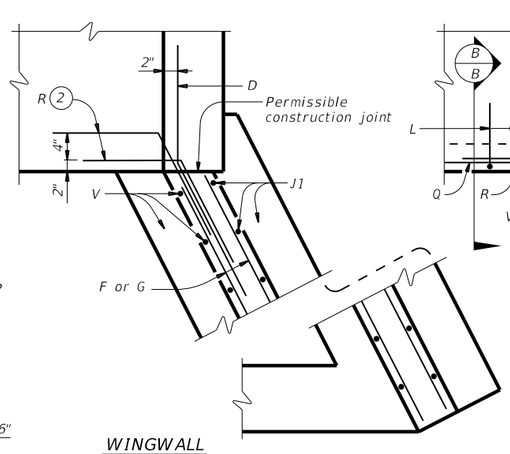


STRUCTURAL PLAN

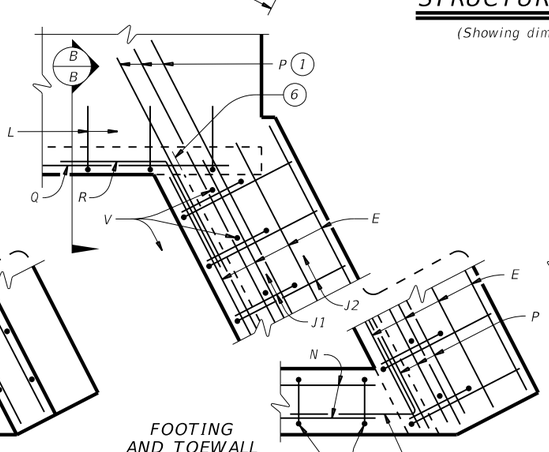
(Showing dimensions.)



SECTION A-A



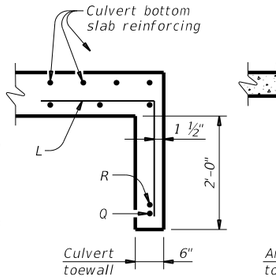
WINGWALL



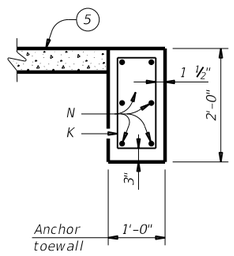
FOOTING AND TOEWALL

CORNER DETAILS

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



SECTION B-B (5)



SECTION C-C

SHEET 1 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-0

FILE: setbf0se-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
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REVISIONS	2355	01	006, ETC.	FM 2451
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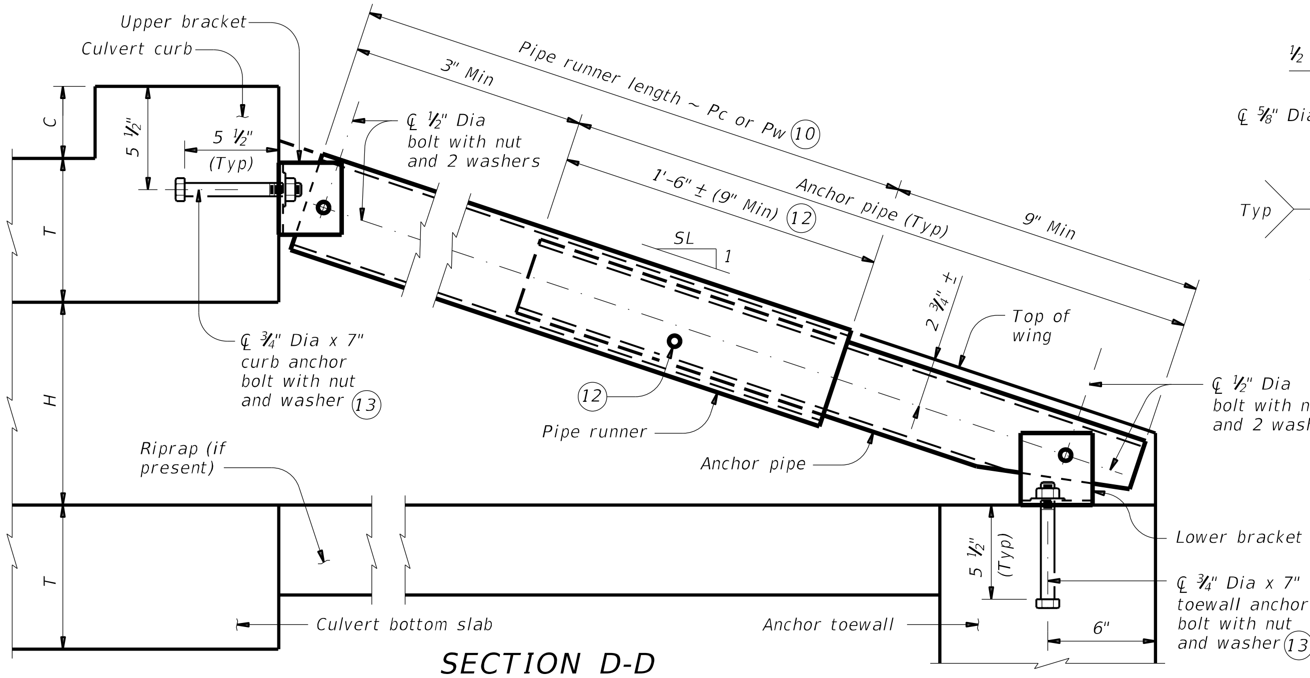
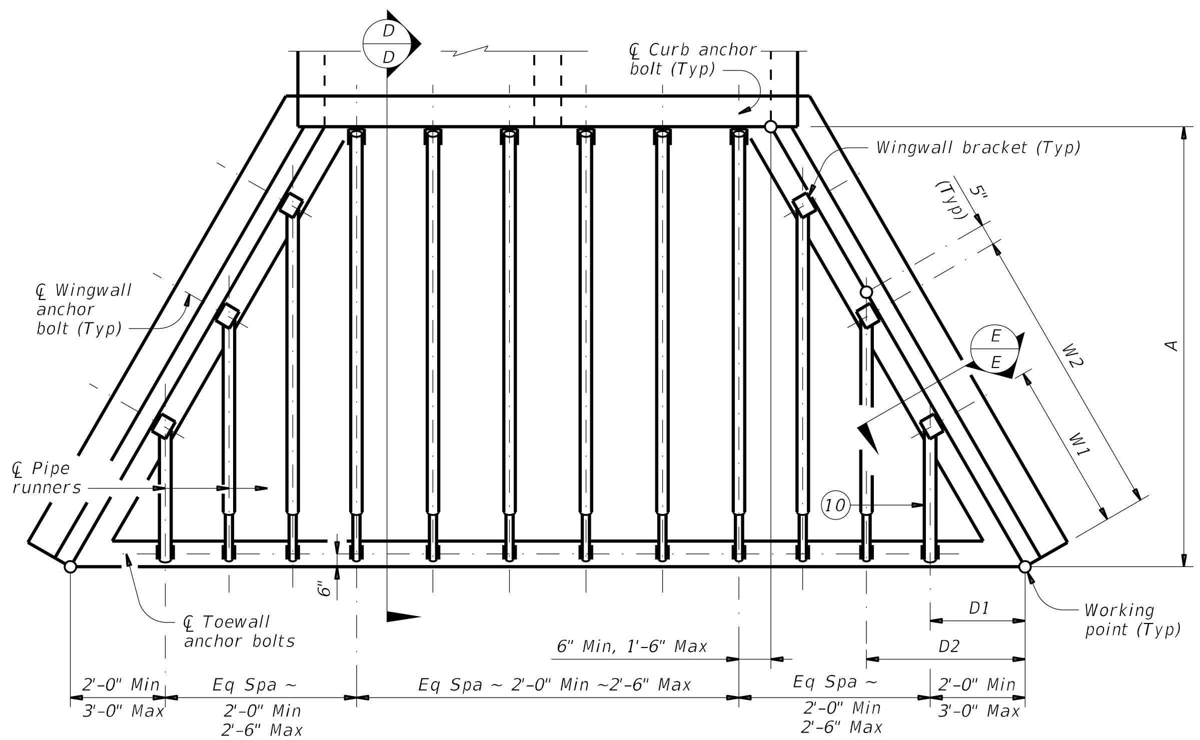
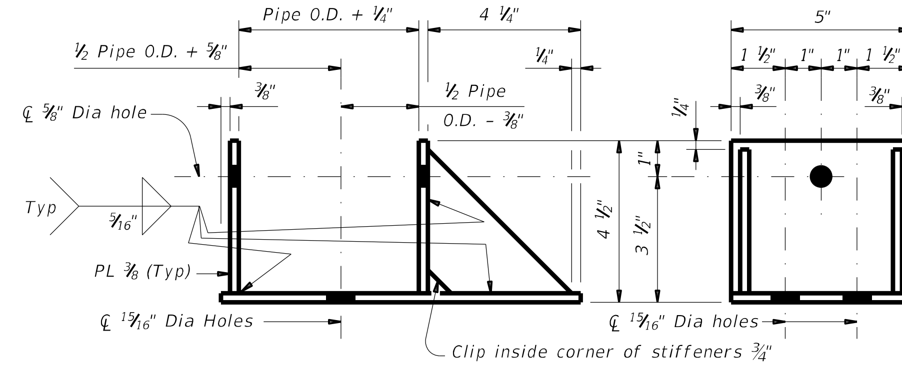


SECTION D-D

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

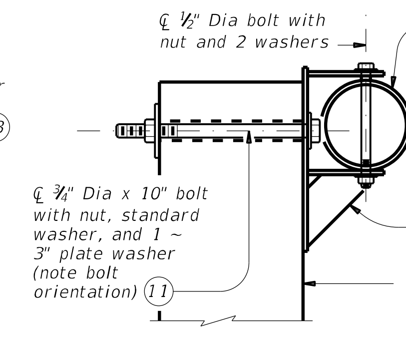


PIPE RUNNER PLAN



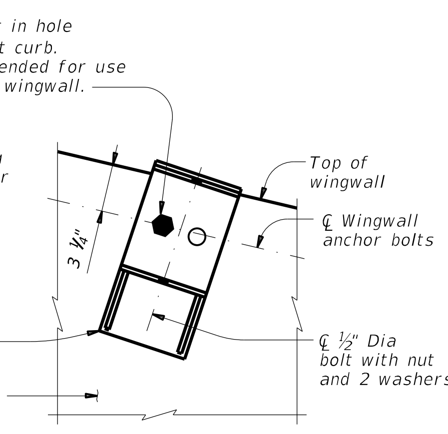
ELEVATION

SIDE VIEW



SECTION E-E

(Showing installed bracket.)

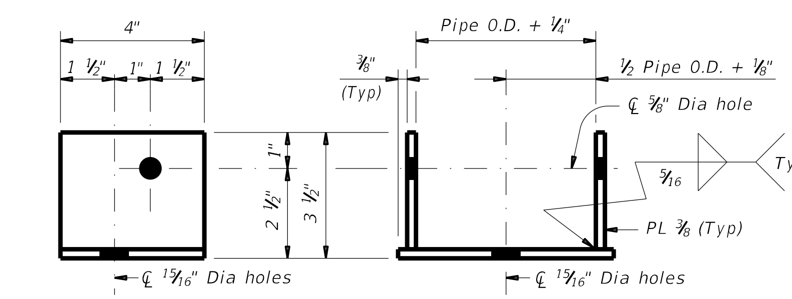


ELEVATION

(Showing installed bracket normal to wall. Pipe not shown for clarity.)

Note: Match wingwall bracket to the upper curb bracket size.

WINGWALL BRACKET DETAILS



SIDE VIEW

ELEVATION

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

UPPER AND LOWER BRACKET DETAILS

MAXIMUM PIPE RUNNER LENGTHS AND REQUIRED PIPE RUNNER SIZES

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

(10) If pipe runner length (Pw) is 1'-9" or less replace the normal pipe runner and anchor pipe with a single non-sliding pipe runner. See Non-Sliding Pipe Runner Details for additional information.

(11) At Contractor's option, 7/8" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

(12) After installation of pipe runner, use the 1/2" inspection hole to ensure that the lap of the anchor pipe with the pipe runner is adequate.

(13) At Contractor's option, an adhesive anchor may be used. Provide 3/4" Dia adhesive anchors that meet the requirements of ASTM A307 Gr A fully threaded rods. Embed threaded rods into curb, wingwalls, and toewall using a Type III, Class C, D, E, or F anchor adhesive. Minimum embedment depth is 5 1/2". Provide anchor adhesive able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use.

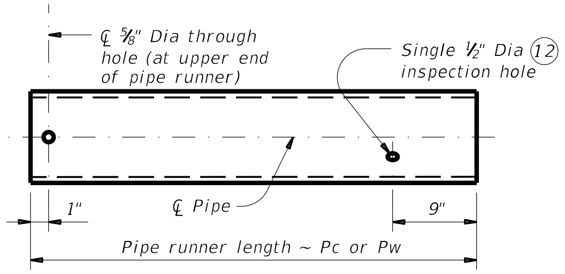
PIPE RUNNER DIMENSION CALCULATIONS:

Wn = (2.000) (Dn) - (0.416')
Pwn = (Dn) (K2) - (2.063')
Pw1 Non-Sliding Pipe Runner (If required) = (D1) (K2) - (0.563')
Pc = (A) (K1) - (1.688')

Wn = Distance from working point to centerline anchor bolt measured along bottom inside face of wing (feet)
Dn = Distance from working point to centerline pipe runner measured along outside face of anchor toewall (feet)
Pw = Wingwall pipe runner length (feet)
Pc = Curb pipe runner length (feet)
K = Constant values for use in formulas

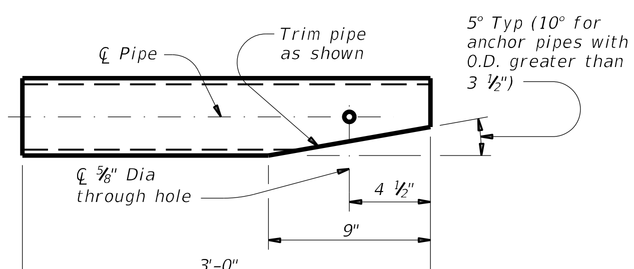
Slope SL:1	K1	K2
3:1	~ 1.054	~ 1.826
4:1	~ 1.031	~ 1.785
6:1	~ 1.014	~ 1.756

n = Wing pipe runner number

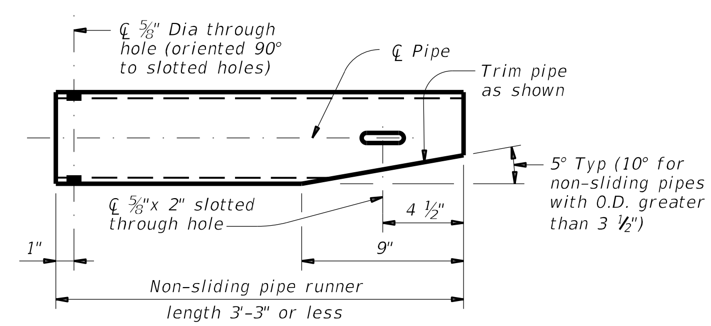


Note: Pipe diameter required for curb pipe runner is also used for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS



Note: Pipe size is the same as required for curb pipe runner. Adjust the corresponding lower bracket accordingly.

NON-SLIDING PIPE RUNNER DETAILS

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-0

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SUMMARY OF SAFETY END TREATMENT PIPE RUNNER INFORMATION FOR SETB-SW-0, SETB-FW-0 AND SETB-FW-S SHEETS

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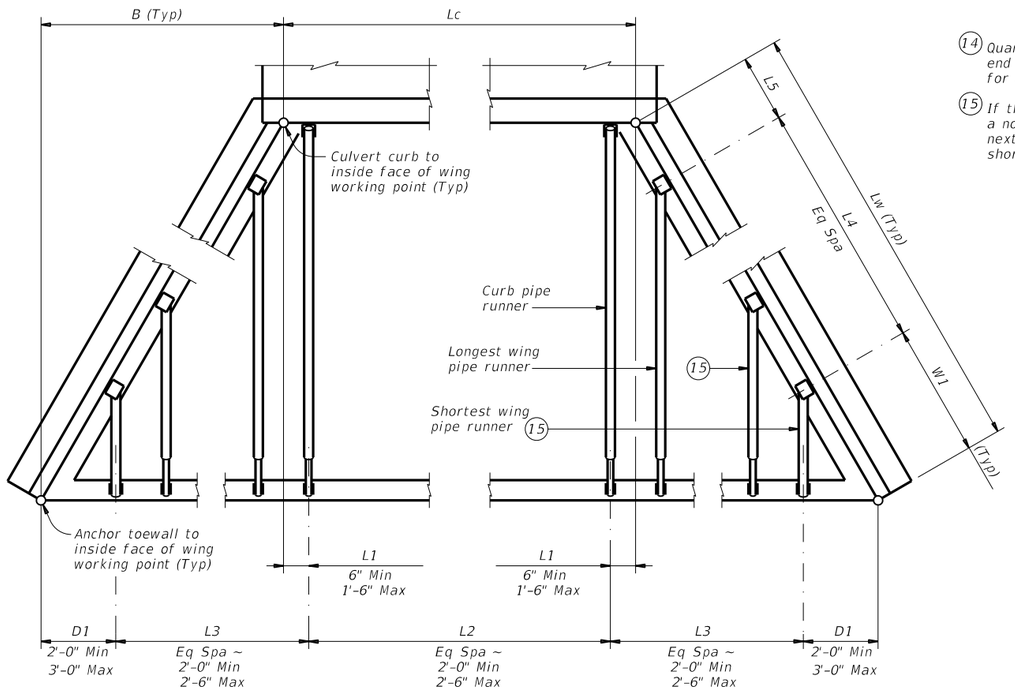
Revision: 2/3/2020, Bridge Division

L1 Not required for SETB-SW-0 D1 Not required for SETB-SW-0

Culvert Station and/or Creek Name (14)	Applicable Wing or End Treatment Standard	Lc	L1	L2			D1	L3			W1	L4			L5	Curb Pipe Runner (Pc)		Longest Wing Pipe Runner (Pw)	Short Pw	non-sliding pipe	Curb, wing &/or Non-Sliding Pipe		3'-0" Anchor Pipe	
				No. Spa	L2 Spa	O'all Lgth		No. Spa	L3 Spa	O'all Lgth		No. Spa	L4 Spa	O'all Lgth		No.	Lgth				Size	Total Lgth (14)	Anchor Pipe Size	Total Lgth (14)
Culvert #2 - STA 106+47.09 (Lt)	SETB-FW-0	3.000	0.500	1	2.000	2.000	3.000	1	1.397	1.397	NG	NG	NG	NG	NG	NG	NG	NG	N/A	NG	NG	NG	NG	NG
Culvert #2 - STA 106+47.09 (Rt)	SETB-FW-0	3.000	0.500	1	2.000	2.000	3.000	1	1.397	1.397	NG	NG	NG	NG	NG	NG	NG	NG	N/A	NG	NG	NG	NG	NG
Culvert #10 - STA 339+91.98 (Lt)	SETB-FW-0	11.500	0.500	5	2.100	10.500	3.000	2	1.709	3.418	NG	NG	NG	NG	NG	NG	NG	NG	N/A	NG	NG	NG	NG	NG
Culvert #10 - STA 339+91.98 (Rt)	SETB-FW-0	11.500	0.500	5	2.100	10.500	3.000	2	1.691	3.382	NG	NG	NG	NG	NG	NG	NG	NG	N/A	NG	NG	NG	NG	NG
Culvert #11 - STA 365+16.91 (Lt)	SETB-FW-0	5.000	0.500	2	2.000	4.000	3.000	1	1.686	1.686	NG	NG	NG	NG	NG	NG	NG	NG	N/A	NG	NG	NG	NG	NG
Culvert #11 - STA 365+16.91 (Rt)	SETB-FW-0	5.000	0.500	2	2.000	4.000	3.000	1	1.686	1.686	NG	NG	NG	NG	NG	NG	NG	NG	N/A	NG	NG	NG	NG	NG



PIPE RUNNER LAYOUT

(14) Quantities shown are for one structure end if Lt or Rt. Quantities shown are for two structure ends if Both.

(15) If the outermost wing pipe runner is a non-sliding pipe runner, consider the next outermost wing pipe runner as the shortest.

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SHEET 3 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-0

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

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

TABLE OF WINGWALL REINFORCING (Two~Wings)

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

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

TABLE OF ESTIMATED ANCHOR TOEWALL QUANTITIES

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

(1) Extend Bars P 3'-0" Min into bottom slab of box culvert.

(2) Adjust to fit as necessary to maintain 11#2" clearcover and 4" Min between bars.

(3) Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by 0.5 (A+Lw).

(4) Recommended values of slope are: 3:1, 4:1, and 6:1. Provide 3:1 or flatter slope.

(5) When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, extend construction joints or grooved joints, oriented in the direction of flow, across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B–B is not required.

(6) At Contractor's option, end the culvert toewall flush with wingwall toewall. Adjust reinforcing as needed.

(7) 3" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet.

(8) For vehicle safety, reduce curb heights, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.

(9) Culvert skew (limit to 15° or 30°)

(10) See Table of Maximum Wing Heights for various slopes. Height is limited based on a 33'-6" maximum safety pipe runner length.

(11) Typical wingwall angle for all skews.

TABLE OF MAXIMUM WING HEIGHTS (10)

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

WING DIMENSION CALCULATIONS:

Formulas:

Hw = H + T + C – 0.250' (10)
A = (Hw – 0.333') (SL)
B = (A) [tan (θ + 15°)]
Lw = (A) ÷ [cos (θ + 15°)]

For cast–in–place culverts:

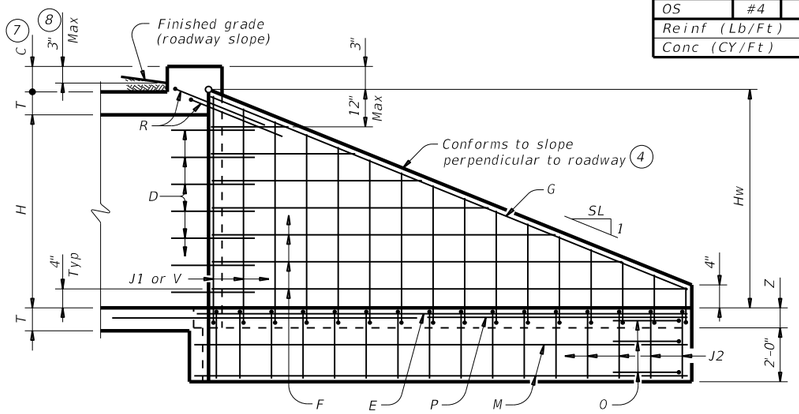
Ltw = [(N) (S) + (N + 1) (U)] ÷ (cos θ)

For precast culverts:

Ltw = [(N) (2U + S) + (N – 1) (0.500')] ÷ (cos θ)

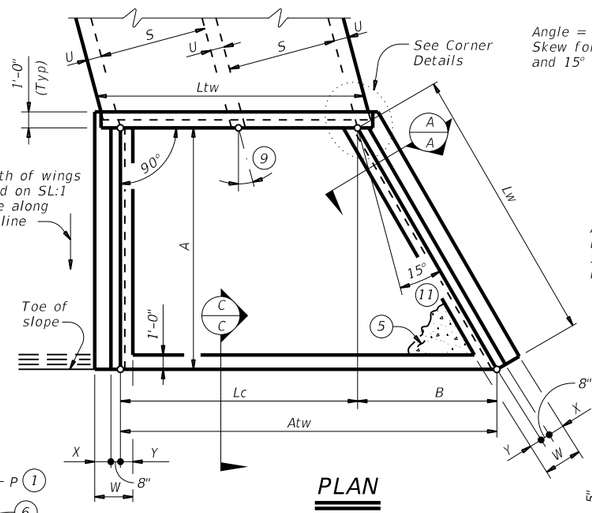
Lc = (Ltw) – (2U) ÷ (cos θ)
Atw = (Lc) + (B)
Total Wingwall Area (two wings ~ S.F.) = (0.5) (Hw + 0.333') (Lw + A)

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



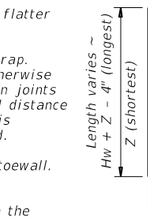
INSIDE ELEVATION OF WINGWALL

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

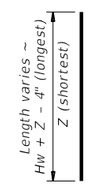


PLAN

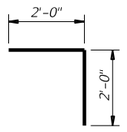
(Showing dimensions and 15° skew.)



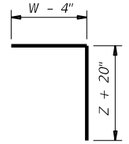
BARS J1



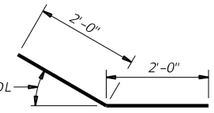
BARS V



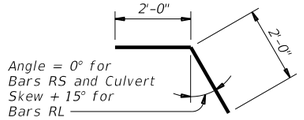
BARS L



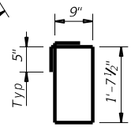
BARS J2



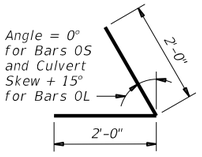
BARS DS and DL
(DS ~ Short wing and DL ~ Long wing)



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



BARS K
(Length = 5'–5")



BARS OS and OL
(OS ~ Short wing and OL ~ Long wing)

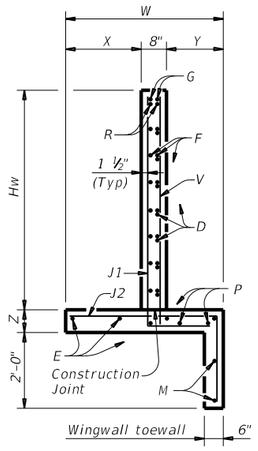
MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.
Provide Class "C" concrete (f`c = 3,600 psi).
Adjust reinforcing as necessary to provide a minimum clear cover of 1 ½".
Provide pipe runners and anchor pipes meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.
Provide ASTM A307 bolts and nuts.
Provide ASTM A36 steel plates.
Galvanize all steel components, except reinforcing unless required elsewherein the plans, after fabrication.
Repair galvanizing damaged during transport or construction in accordance with the Item 445, "Galvanizing".
For optional adhesive anchors, install adhesive anchorages in accordance with the manufacturer's instructions including hole size, drilling equipment and method, hole cleaning equipment and method, mixing and dispensing adhesive, and anchor insertion. Do not alter the manufacturer's mixing nozzle or dispenser. Provide anchorage rods that are clean and free of grease, oil, or any other foreign material. Demonstrate hole cleaning method to the Engineer for approval and continue the approved process for all anchorage locations. Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

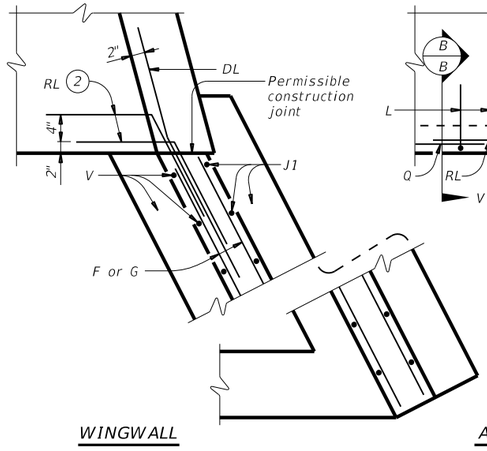
GENERAL NOTES:

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

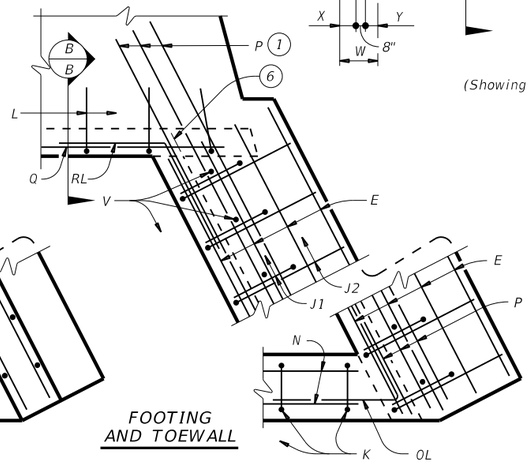
Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing dimensions are out–to–out of bars.



SECTION A-A



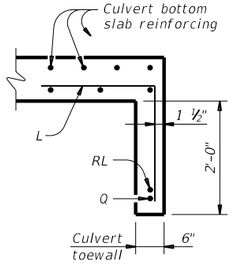
WINGWALL



FOOTING AND TOEWALL

CORNER DETAILS

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



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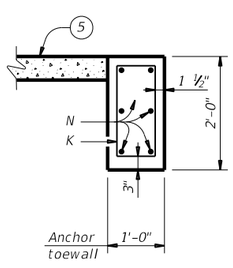


SECTION C-C

SHEET 1 OF 3

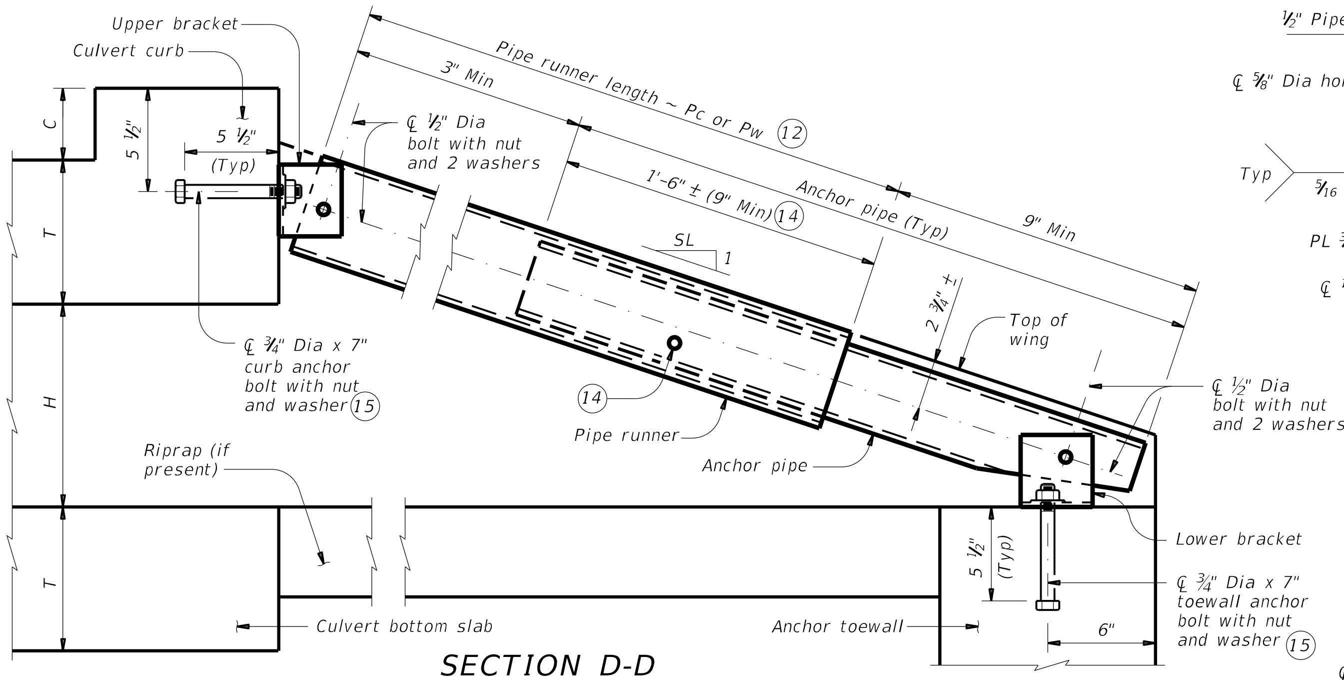
Texas Department of Transportation | Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 15° AND 30° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

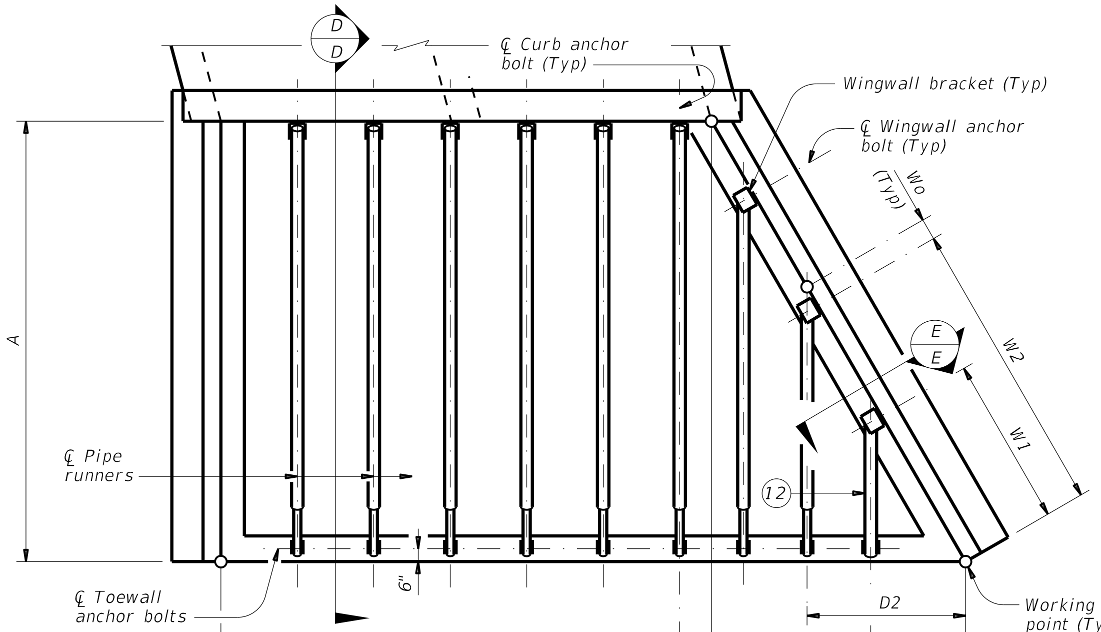
SETB-FW-S

FILE: setbfsse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		120

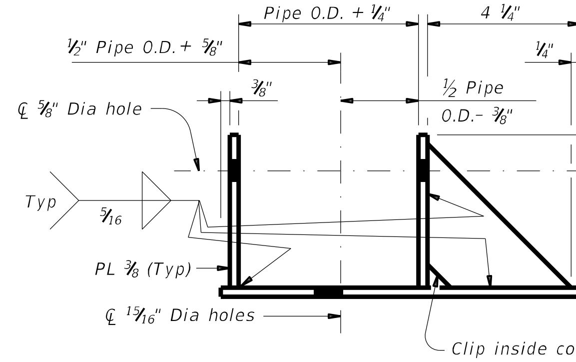


SECTION D-D

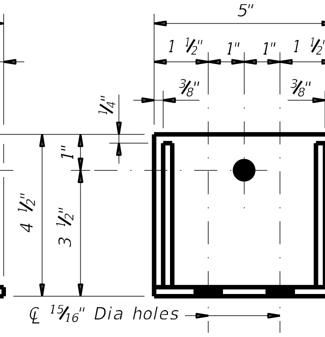
(Showing curb pipe runner. Except for upper bracket, wingwall pipe runners are similar.)



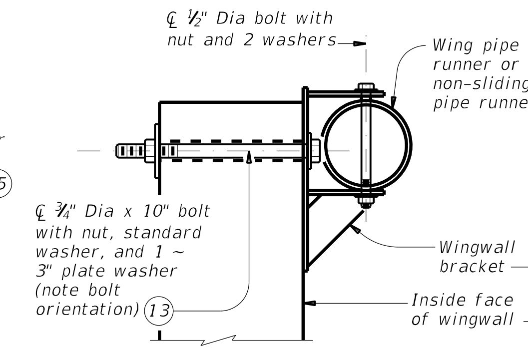
PIPE RUNNER PLAN



ELEVATION

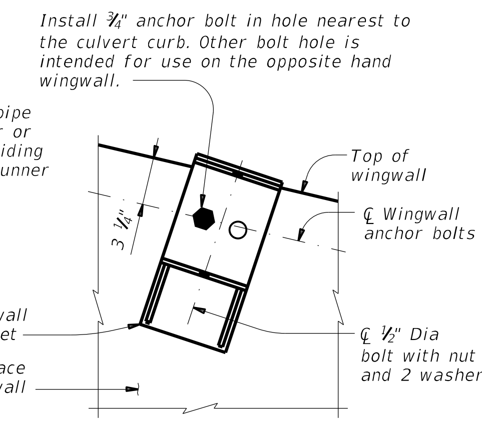


SIDE VIEW



SECTION E-E

(Showing installed bracket.)

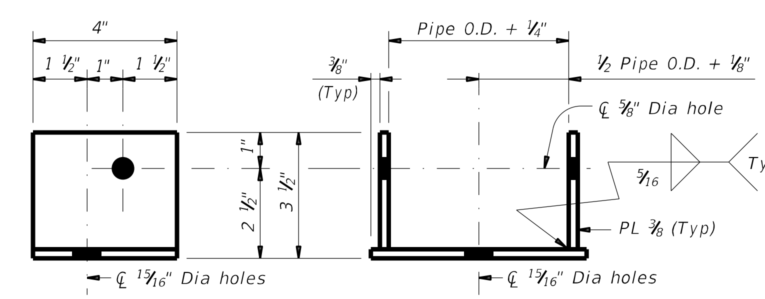


ELEVATION

(Showing installed bracket normal to wall. Pipe not shown for clarity.)

Note: Match wingwall bracket to the upper curb bracket size.

WINGWALL BRACKET DETAILS



SIDE VIEW ELEVATION

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

UPPER AND LOWER BRACKET DETAILS

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

(12) If pipe runner length (Pw) is 1'-9" or less, replace the normal pipe runner and anchor pipe with a single non-sliding pipe runner. See Non-Sliding Pipe Runner Details for additional information.

(13) At Contractor's option, ⅞" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

(14) After installation of pipe runner, use the ½" inspection hole to ensure that the lap of the anchor pipe with the pipe runner is adequate.

(15) At Contractor's option, an adhesive anchor may be used. Provide ¾" Dia adhesive anchors that meet the requirements of ASTM A307, Gr A fully threaded rods. Embed threaded rods into curb, wingwalls, and toewall using a Type III, Class C, D, E, or F anchor adhesive. Minimum embedment depth is 5 ½". Provide anchor adhesive able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use.

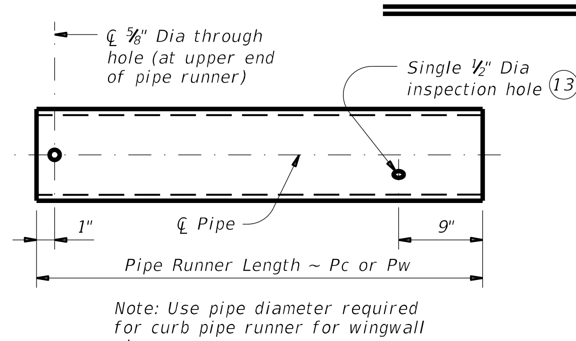
PIPE RUNNER DIMENSION CALCULATIONS:

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

Wn = Distance from working point to centerline anchor bolt measured along bottom inside face of wing (feet)
Dn = Distance from working point to centerline pipe runner measured along outside face of anchor toewall (feet)
Pw = Wingwall pipe runner length (feet)
Pc = Curb pipe runner length (feet)
K = Constant values for use in formulas

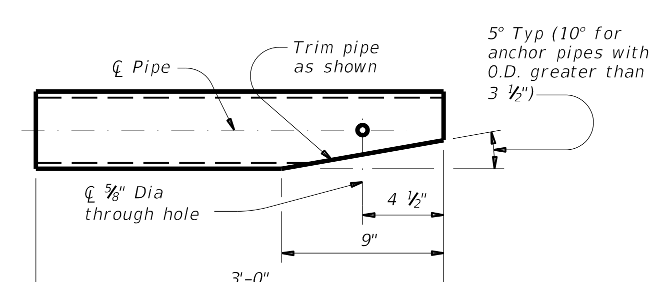
Slope SL:1	K1	K2~15° Skew	K2~30° Skew
3:1	1.054	1.826	1.054
4:1	1.031	1.785	1.031
6:1	1.014	1.756	1.014

K3 = 15° Skew ~ 2.000
30° Skew ~ 1.414
n = Wing pipe runner number
Wo = 15° Skew ~ 5"
30° Skew ~ 2 ½"

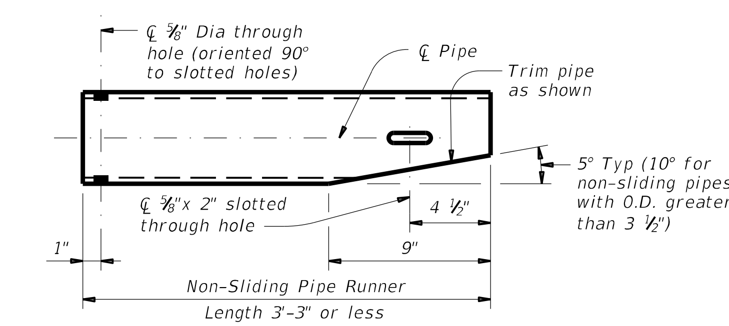


Note: Use pipe diameter required for curb pipe runner for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS



Note: Pipe size is the same as required for curb pipe runner. Adjust the corresponding lower bracket accordingly.

NON-SLIDING PIPE RUNNER DETAILS

SHEET 2 OF 3

Texas Department of Transportation | Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 15° AND 30° SKEW BOX CULVERTS TYPE I ~ CROSS DRAINAGE

SETB-FW-S

FILE: setbfsse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
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REVISIONS	2355	01	006, ETC.	FM 2451
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SUMMARY OF SAFETY END TREATMENT PIPE RUNNER INFORMATION FOR SETB-SW-0, SETB-FW-0 AND SETB-FW-S SHEETS

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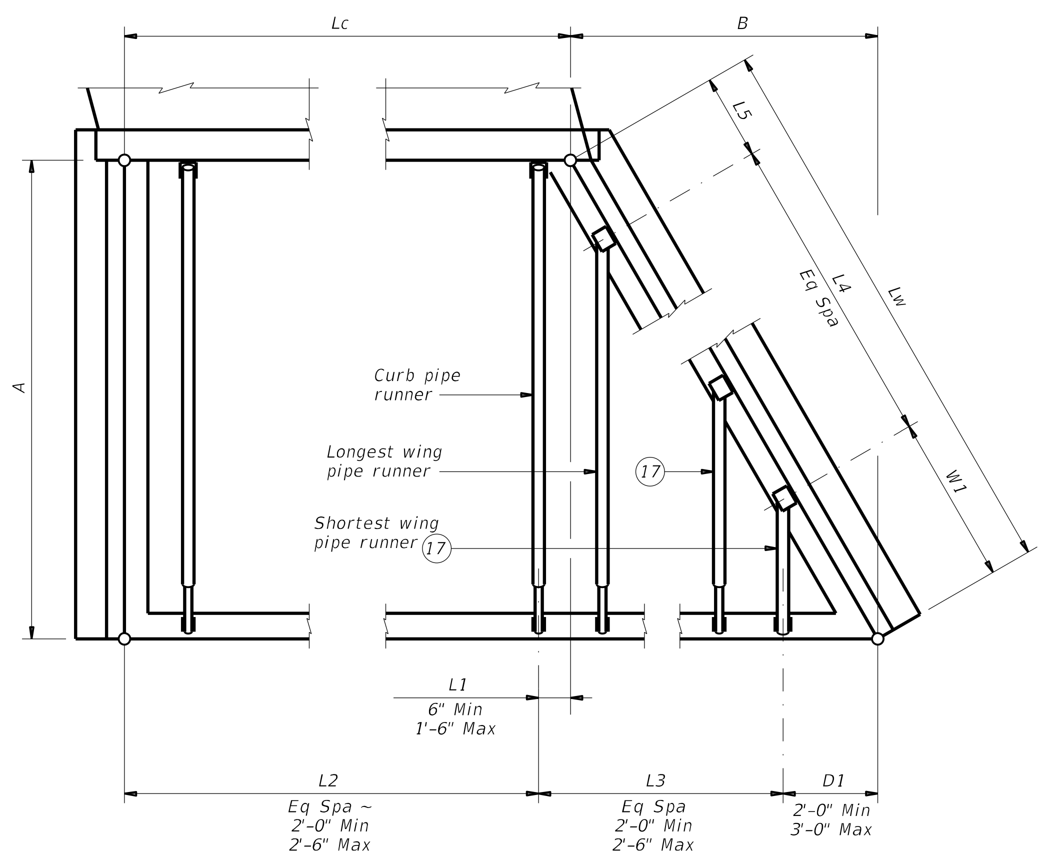
Revision: 2/3/2020, Bridge Division

L1 Not required for SETB-SW-0 D1 Not required for SETB-SW-0

Culvert Station and/or Creek Name (16)	Applicable Wing or End Treatment Standard	Lc	L1	L2			D1	L3			W1	L4			L5	Curb Pipe Runner (Pc)		Longest Wing Pipe Runner (Pw)	Short Pw	non-sliding pipe	Curb, wing &/or Non-Sliding Pipe		3'-0" Anchor Pipe	
				No. Spa	L2 Spa	O'all Lgth		No. Spa	L3 Spa	O'all Lgth		No. Spa	L4 Spa	O'all Lgth		No.	Lgth				Size	Total Lgth (16)	Anchor Pipe Size	Total Lgth (16)
Culvert #9 - STA 312+87.69 (Lt)	SETB-FW-S	4.619	0.500	2	2.059	4.119	3.000	4	1.891	7.563	NG	NG	NG	NG	NG	NG	NG	NG	N/A	NG	NG	NG	NG	NG
Culvert #9 - STA 312+87.69 (Rt)	SETB-FW-S	4.619	0.500	2	2.059	4.119	3.000	3	2.500	7.500	4.034	2	3.535	7.070	3.038	2	8.854	6.375	3.729	2.604	3"	30.417	2"	12.000



PIPE RUNNER LAYOUT

Note: Right forward culvert skew shown, actual culvert skew may be opposite hand.

(16) Quantities shown are for one structure end if Lt or Rt. Quantities shown are for two structure ends if Both.

(17) If the outermost wing pipe runner is a non-sliding pipe runner, consider the next outermost wing pipe runner as the shortest.

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SHEET 3 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 15° AND 30° SKEW BOX CULVERTS TYPE I ~ CROSS DRAINAGE

SETB-FW-S

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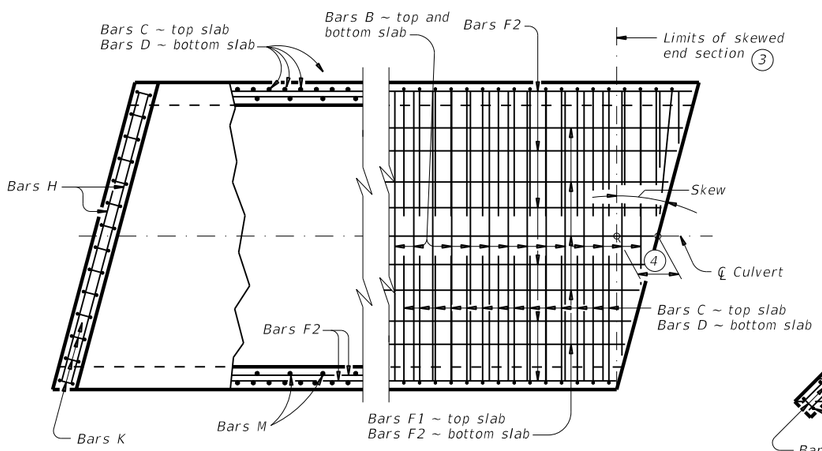
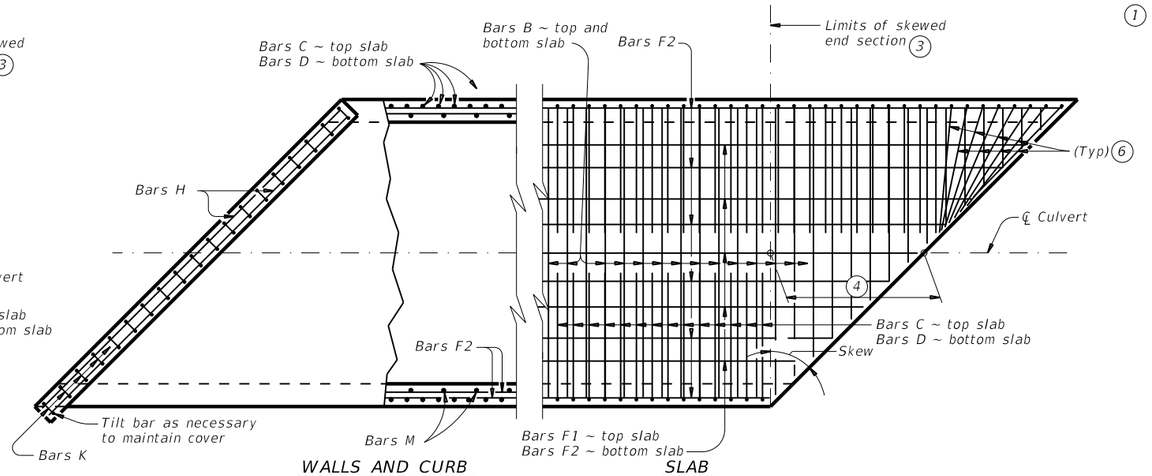
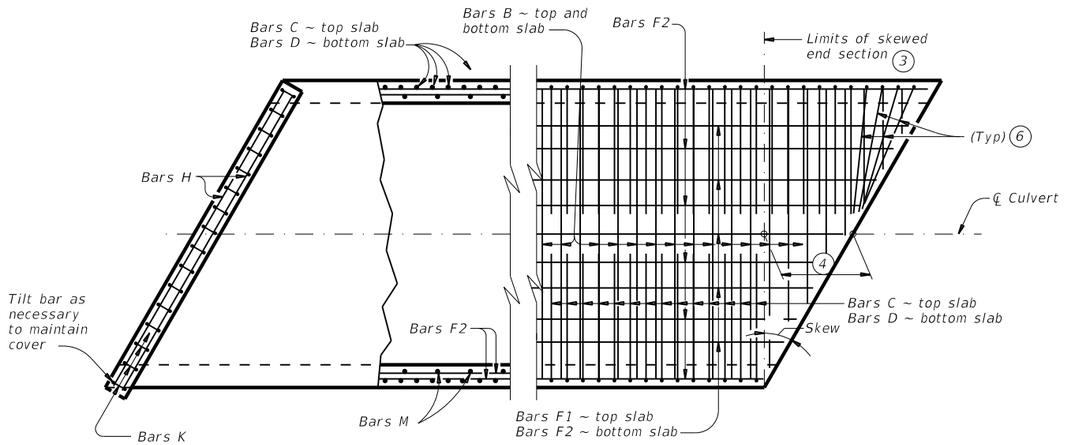


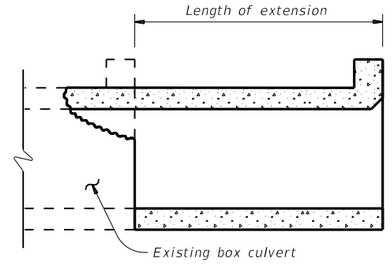
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° (7)



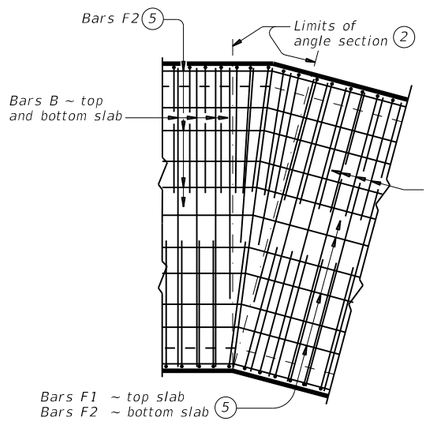
PLAN OF SKEWED ENDS ~ OVER 30° TO 45°



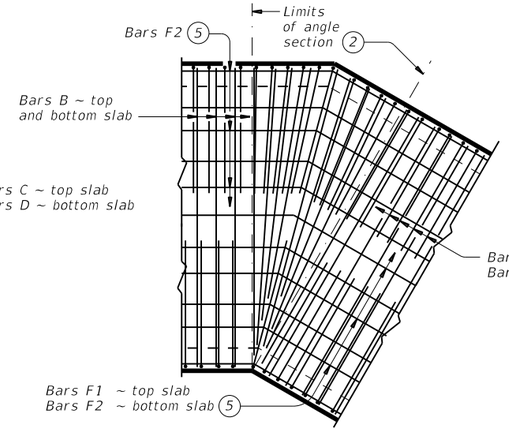
PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



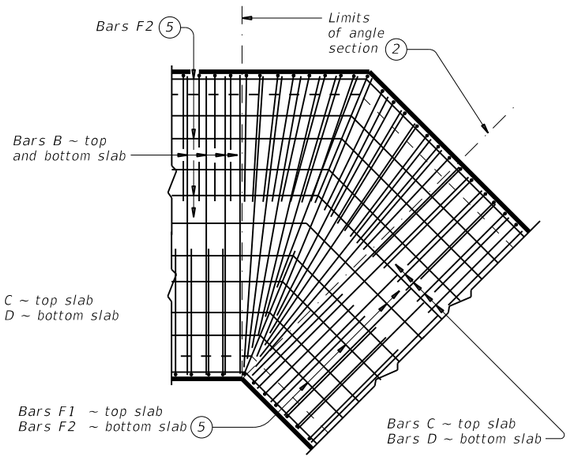
LENGTHENING DETAIL (1)



PLAN OF ANGLE SECTION ~ FROM 0° TO 15°



PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°

(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, C, D , E, or F ancher 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, Nba, 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 becomes less than half of the normal spacing, cut bars to avoid conflict.

(3) The length of Bars B vary in the skewed end sections.

(4) [One half of overall width] x [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 conflictin 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, and D parallel to the skewed end while maintaining spacing along centerline of box. Increase lengths of Bars B shown on the Single Box Culverts Cast-In-Place (SCC) standards sheets to accommodate the skew.

CONSTRUCTION NOTES:

Do not use permanent forms.
When required, lap Bars H 1'-8" for uncoated or galvanized bars.
Provide a minimum of 1 ½" 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 Single Box Culverts Cast-in-Place (SCC) standard sheets for details of straight sections of culvert.

For skewed sections and angle sections, refer to Single Box Culverts Cast-in-Place (SCC) 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 culvert Single Box Culverts Cast-In-Place (SCC) standard sheets by the cosine of the skew angle.

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

SINGLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

SCC-MD

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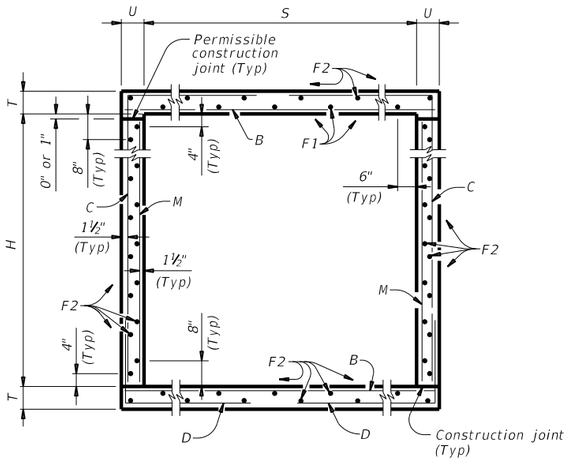

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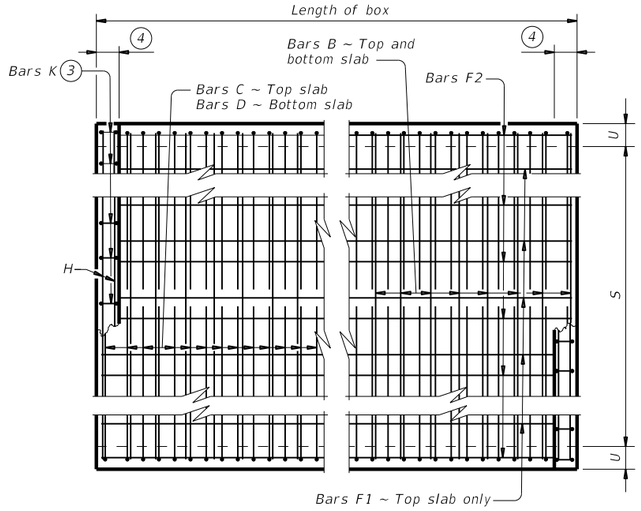


PLAN OF REINF STEEL

(1) 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Rail Anchorage Curb (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.

(2) For vehicle safety, the following requirements must be met:
- For structures without bridge rail, construct curbs no more than 3" above finished grade.
- For structures with bridge rail, construct curbs flush with finished grade.

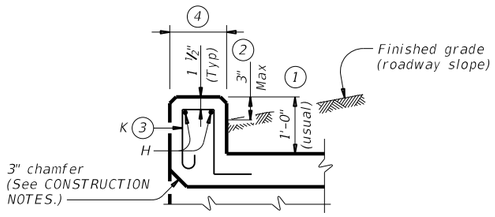
Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(3) For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.

(4) 1'-0" typical. 2'-3" when the Rail Anchorage Curb (RAC) standard sheet is referred to elsewhere in the plans.

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

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



SECTION THRU CURB

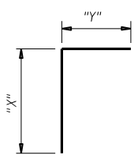
CONSTRUCTION NOTES:
Do not use permanent forms.
Chamfer the bottom edge of the top slab 3" at the entrance.
Optionally, raise construction joints shown at the flow line by a maximum of 6". If this option is taken, Bars M may be cut off or raised, Bars C and D may be reversed.

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

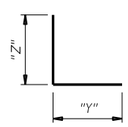
Provide bar laps, where required, as follows:
- Uncoated or galvanized ~ #4 = 1'-8" Min
- Uncoated or galvanized ~ #5 = 2'-1" Min
- Uncoated or galvanized ~ #6 = 2'-6" Min

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

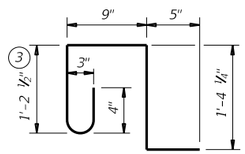
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.



BARS C



BARS D



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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

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

SCC-5 & 6

FILE: scc56ste-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
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	DAL	KAUFMAN		124

SECTION DIMENSIONS				FILL HEIGHT ⑤	BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																										QUANTITIES					
					Bars B					Bars C							Bars D							Bars M ~ #4				Bars F1 ~ #4 at 18" Spa			Bars F2 ~ #4 at 18" Spa			Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
S	H	T	U		No.	Size	Spa	Length	Weight	No.	Size	Spa	Length	Weight	" X "	" Y "	No.	Size	Spa	Length	Weight	" Y "	" Z "	No.	Spa	Length	Weight	No.	Length	Wt	No.	Length	Weight	Length	Wt	No.	Wt	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)
5' – 0"	2' – 0"	8"	7"	26'	108	#6	9"	5' – 11"	960	108	#5	9"	6' – 3"	704	2' – 6"	3' – 9"	108	#5	9"	6' – 5"	723	3' – 9"	2' – 8"	108	9"	2' – 0"	144	4	39' – 9"	106	22	39' – 9"	584	5' – 11"	16	14	39	0.391	80.5	0.5	55	16.1	3,276
5' – 0"	2' – 0"	9"	7"	30'	108	#6	9"	5' – 11"	960	108	#5	9"	6' – 4"	713	2' – 7"	3' – 9"	108	#5	9"	6' – 6"	732	3' – 9"	2' – 9"	108	9"	2' – 0"	144	4	39' – 9"	106	22	39' – 9"	584	5' – 11"	16	14	39	0.429	81.0	0.5	55	17.6	3,294
5' – 0"	3' – 0"	8"	7"	26'	108	#6	9"	5' – 11"	960	108	#5	9"	7' – 3"	817	3' – 6"	3' – 9"	108	#5	9"	6' – 5"	723	3' – 9"	2' – 8"	108	9"	3' – 0"	216	4	39' – 9"	106	26	39' – 9"	690	5' – 11"	16	14	39	0.434	87.8	0.5	55	17.8	3,567
5' – 0"	3' – 0"	9"	7"	30'	108	#6	9"	5' – 11"	960	108	#5	9"	7' – 4"	826	3' – 7"	3' – 9"	108	#5	9"	6' – 6"	732	3' – 9"	2' – 9"	108	9"	3' – 0"	216	4	39' – 9"	106	26	39' – 9"	690	5' – 11"	16	14	39	0.472	88.3	0.5	55	19.3	3,585
5' – 0"	4' – 0"	8"	7"	26'	108	#6	9"	5' – 11"	960	108	#5	9"	8' – 3"	929	4' – 6"	3' – 9"	108	#5	9"	6' – 5"	723	3' – 9"	2' – 8"	108	9"	4' – 0"	289	4	39' – 9"	106	26	39' – 9"	690	5' – 11"	16	14	39	0.477	92.4	0.5	55	19.5	3,752
5' – 0"	4' – 0"	9"	7"	30'	108	#6	9"	5' – 11"	960	108	#5	9"	8' – 4"	939	4' – 7"	3' – 9"	108	#5	9"	6' – 6"	732	3' – 9"	2' – 9"	108	9"	4' – 0"	289	4	39' – 9"	106	26	39' – 9"	690	5' – 11"	16	14	39	0.515	92.9	0.5	55	21.1	3,771
5' – 0"	5' – 0"	8"	7"	26'	108	#6	9"	5' – 11"	960	108	#5	9"	9' – 3"	1,042	5' – 6"	3' – 9"	108	#5	9"	6' – 5"	723	3' – 9"	2' – 8"	108	9"	5' – 0"	361	4	39' – 9"	106	30	39' – 9"	797	5' – 11"	16	14	39	0.521	99.7	0.5	55	21.3	4,044
5' – 0"	5' – 0"	9"	7"	30'	108	#6	9"	5' – 11"	960	108	#5	9"	9' – 4"	1,051	5' – 7"	3' – 9"	108	#5	9"	6' – 6"	732	3' – 9"	2' – 9"	108	9"	5' – 0"	361	4	39' – 9"	106	30	39' – 9"	797	5' – 11"	16	14	39	0.559	100.2	0.5	55	22.8	4,062
6' – 0"	2' – 0"	8"	7"	20'	108	#6	9"	6' – 11"	1,122	108	#5	9"	6' – 7"	742	2' – 6"	4' – 1"	108	#5	9"	6' – 9"	760	4' – 1"	2' – 8"	108	9"	2' – 0"	144	5	39' – 9"	133	25	39' – 9"	664	6' – 11"	18	16	45	0.440	89.1	0.5	63	18.1	3,628
6' – 0"	2' – 0"	9"	7"	26'	108	#6	9"	6' – 11"	1,122	162	#5	6"	6' – 8"	1,126	2' – 7"	4' – 1"	162	#5	6"	6' – 10"	1,155	4' – 1"	2' – 9"	108	9"	2' – 0"	144	5	39' – 9"	133	25	39' – 9"	664	6' – 11"	18	16	45	0.485	108.6	0.5	63	19.9	4,407
6' – 0"	2' – 0"	10"	8"	30'	108	#6	9"	7' – 1"	1,149	162	#5	6"	6' – 10"	1,155	2' – 8"	4' – 2"	162	#5	6"	7' – 0"	1,183	4' – 2"	2' – 10"	82	12"	2' – 0"	110	5	39' – 9"	133	25	39' – 9"	664	7' – 1"	19	18	50	0.551	109.9	0.5	69	22.6	4,463
6' – 0"	3' – 0"	8"	7"	20'	108	#6	9"	6' – 11"	1,122	108	#5	9"	7' – 7"	854	3' – 6"	4' – 1"	108	#5	9"	6' – 9"	760	4' – 1"	2' – 8"	108	9"	3' – 0"	216	5	39' – 9"	133	29	39' – 9"	770	6' – 11"	18	16	45	0.484	96.4	0.5	63	19.9	3,918
6' – 0"	3' – 0"	9"	7"	26'	108	#6	9"	6' – 11"	1,122	162	#5	6"	7' – 8"	1,295	3' – 7"	4' – 1"	162	#5	6"	6' – 10"	1,155	4' – 1"	2' – 9"	108	9"	3' – 0"	216	5	39' – 9"	133	29	39' – 9"	770	6' – 11"	18	16	45	0.528	117.3	0.5	63	21.6	4,754
6' – 0"	3' – 0"	10"	8"	30'	108	#6	9"	7' – 1"	1,149	162	#5	6"	7' – 10"	1,324	3' – 8"	4' – 2"	162	#5	6"	7' – 0"	1,183	4' – 2"	2' – 10"	82	12"	3' – 0"	164	5	39' – 9"	133	29	39' – 9"	770	7' – 1"	19	18	50	0.601	118.1	0.5	69	24.6	4,792
6' – 0"	4' – 0"	8"	7"	20'	108	#6	9"	6' – 11"	1,122	108	#5	9"	8' – 7"	967	4' – 6"	4' – 1"	108	#5	9"	6' – 9"	760	4' – 1"	2' – 8"	108	9"	4' – 0"	289	5	39' – 9"	133	29	39' – 9"	770	6' – 11"	18	16	45	0.527	101.0	0.5	63	21.6	4,104
6' – 0"	4' – 0"	9"	7"	26'	108	#6	9"	6' – 11"	1,122	162	#5	6"	8' – 8"	1,464	4' – 7"	4' – 1"	162	#5	6"	6' – 10"	1,155	4' – 1"	2' – 9"	108	9"	4' – 0"	289	5	39' – 9"	133	29	39' – 9"	770	6' – 11"	18	16	45	0.571	123.3	0.5	63	23.4	4,996
6' – 0"	4' – 0"	10"	8"	30'	108	#6	9"	7' – 1"	1,149	162	#5	6"	8' – 10"	1,493	4' – 8"	4' – 2"	162	#5	6"	7' – 0"	1,183	4' – 2"	2' – 10"	82	12"	4' – 0"	219	5	39' – 9"	133	29	39' – 9"	770	7' – 1"	19	18	50	0.650	123.7	0.5	69	26.5	5,016
6' – 0"	5' – 0"	8"	7"	20'	108	#6	9"	6' – 11"	1,122	108	#5	9"	9' – 7"	1,080	5' – 6"	4' – 1"	108	#5	9"	6' – 9"	760	4' – 1"	2' – 8"	108	9"	5' – 0"	361	5	39' – 9"	133	33	39' – 9"	876	6' – 11"	18	16	45	0.570	108.3	0.5	63	23.3	4,395
6' – 0"	5' – 0"	9"	7"	26'	108	#6	9"	6' – 11"	1,122	162	#5	6"	9' – 8"	1,633	5' – 7"	4' – 1"	162	#5	6"	6' – 10"	1,155	4' – 1"	2' – 9"	108	9"	5' – 0"	361	5	39' – 9"	133	33	39' – 9"	876	6' – 11"	18	16	45	0.614	132.0	0.5	63	25.1	5,343
6' – 0"	5' – 0"	10"	8"	30'	108	#6	9"	7' – 1"	1,149	162	#5	6"	9' – 10"	1,661	5' – 8"	4' – 2"	162	#5	6"	7' – 0"	1,183	4' – 2"	2' – 10"	82	12"	5' – 0"	274	5	39' – 9"	133	33	39' – 9"	876	7' – 1"	19	18	50	0.700	131.9	0.5	69	28.5	5,345
6' – 0"	6' – 0"	8"	7"	20'	108	#6	9"	6' – 11"	1,122	108	#5	9"	10' – 7"	1,192	6' – 6"	4' – 1"	108	#5	9"	6' – 9"	760	4' – 1"	2' – 8"	108	9"	6' – 0"	433	5	39' – 9"	133	37	39' – 9"	982	6' – 11"	18	16	45	0.613	115.6	0.5	63	25.0	4,685
6' – 0"	6' – 0"	9"	7"	26'	108	#6	9"	6' – 11"	1,122	162	#5	6"	10' – 8"	1,802	6' – 7"	4' – 1"	162	#5	6"	6' – 10"	1,155	4' – 1"	2' – 9"	108	9"	6' – 0"	433	5	39' – 9"	133	37	39' – 9"	982	6' – 11"	18	16	45	0.657	140.7	0.5	63	26.8	5,690
6' – 0"	6' – 0"	10"	8"	30'	108	#6	9"	7' – 1"	1,149	162	#5	6"	10' – 10"	1,830	6' – 8"	4' – 2"	162	#5	6"	7' – 0"	1,183	4' – 2"	2' – 10"	82	12"	6' – 0"	329	5	39' – 9"	133	37	39' – 9"	982	7' – 1"	19	18	50	0.749	140.2	0.5	69	30.5	5,675

⑤ For direct traffic culverts (fill height ≤ 2 ft.), identify the required box size and select the option with the minimum fill height.

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

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

SCC-5 & 6

FILE: scc56ste-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		125

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DATE: 10/13/2021 11:30:01 AM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\R4 for Design\STANDARDS\DRAINAGE\scc56ste-21.dgn

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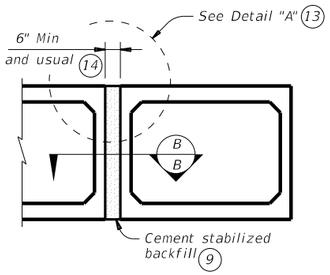
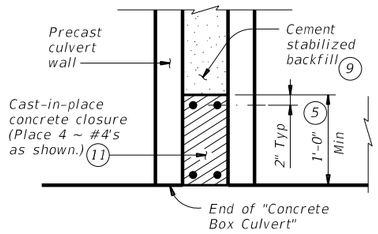
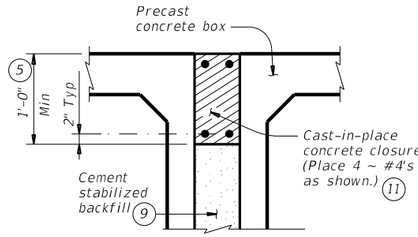


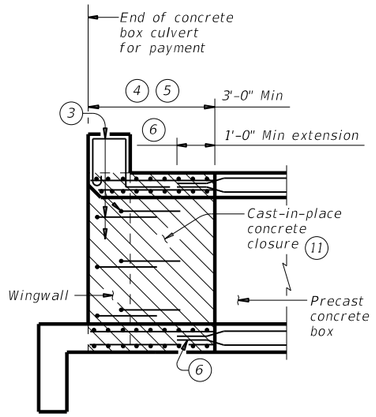
MULTIPLE UNIT PLACEMENT



SECTION B-B

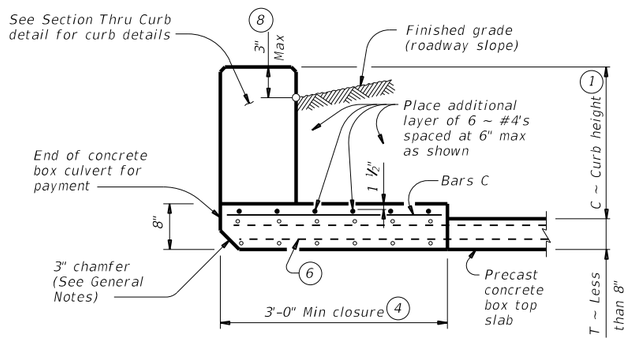


DETAIL "A" (13)

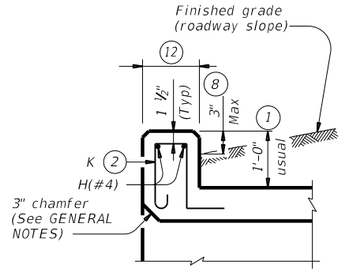


WINGWALL CONNECTION

(Also applies to safety end treatment.)

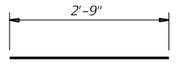


SECTION THRU TOP SLABS LESS THAN 8"

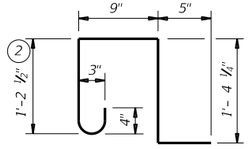


SECTION THRU CURB

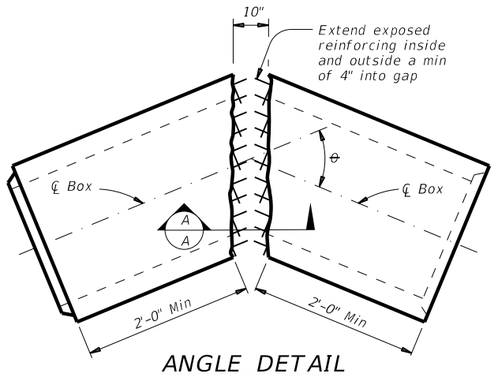
QUANTITIES PER FOOT OF CURB (10)	
Reinforcing Steel	4.12 Lb
Concrete	0.037 CY



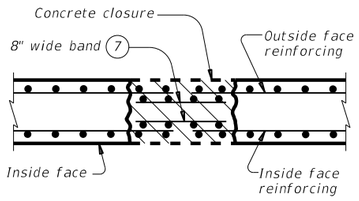
BARS C (#4)
(Spa = 1'-0" Max)



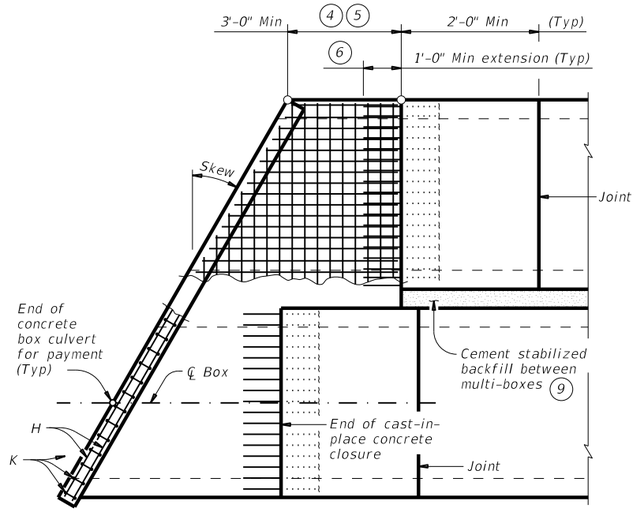
BARS K (#4)
(Spa = 1'-0" Max)
(Length = 4'-2")



ANGLE DETAIL



SECTION A-A



PLAN OF SKEWED ENDS

(Showing multi-box placement.)

(1) 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle 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.

(2) 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.

(3) Extend curb, wingwall, or safety end treatment reinforcing into concrete closure. Bend or trim, as necessary, any reinforcing that does not fit into closure area.

(4) Provide a 3'-0" Min cast-in-place concrete closure. Break back boxes in the field or cast boxes short. Provide bands of reinforcing in the closure that are the same size and spacing as in the precast box section. Provide #4 longitudinal reinforcement spaced at 12 inches Max within the closure. Except where shown otherwise, construct the cast-in-place closure flush with the inside and outside faces of the precast box section.

(5) For multiple unit placements, adjust the length of the closure for the interior walls as necessary. Provide a 3'-0" Min cast-in-place closure in the top slab, bottom slab, and exterior wall. See Section B-B detail when interior walls are cast full length.

(6) Extend precast box reinforcing a minimum of 1'-0" into concrete closure (Typ).

(7) Place bands of reinforcing matching the inside and outside face reinforcing in the gaps of the top and bottom slabs. Place a band matching the outside face reinforcing of the wall in the gaps of the walls (placed in the outside face only). Tack weld the bands to the exposed reinforcing at each point of contact.

(8) 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.

(9) Cement stabilized backfill between boxes is considered part of the box culvert for payment.

(10) All curb concrete and reinforcing is considered part of the box culvert for payment.

(11) Any additional concrete and reinforcing required for the closures will be considered subsidiary to the box culvert for payment.

(12) 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elsewhere in the plans.

(13) For multiple unit placement with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface, provide wall closure as shown in Detail "A".

(14) This dimension may be increased with approval of the Engineer to allow the precast boxes to be tunneled or jacked in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box". No payment will be made for any additional material in the gap between adjacent boxes.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide ASTM A1064 welded wire reinforcement.
Provide Class C concrete (f'c = 3,600 psi) for the closures.
Provide cement stabilized backfill meeting the requirements of Item 400, "Excavation and Backfill for Structures."
Any additional concrete required for the closures will be considered subsidiary to the box culvert.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Refer to the Single Box Culverts Precast (SCP) standard sheets for details and notes not shown.
Chamfer the bottom edge of the top slab closure 3 inches at culvert closure ends.

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

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

BOX CULVERTS PRECAST MISCELLANEOUS DETAILS

SCP-MD

FILE: scpmdsts-20.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
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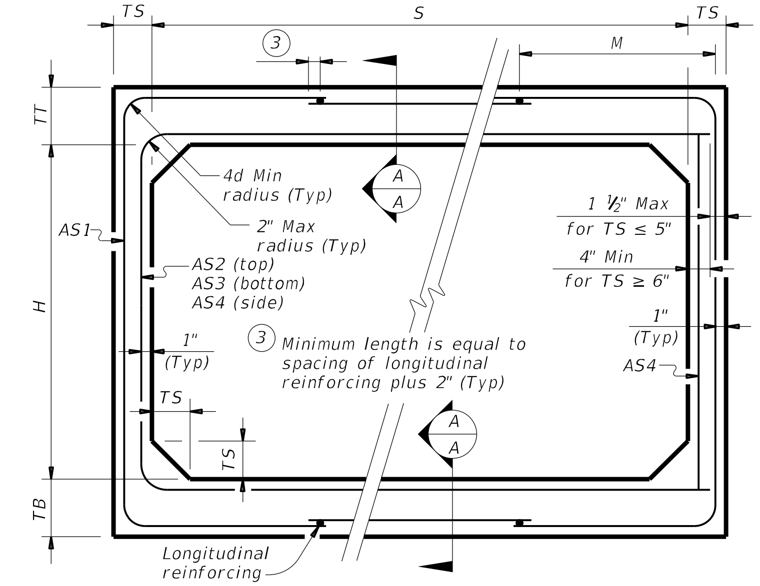
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		126

BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (sq. in. / ft.) (2)							(1) Lift Weight
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)	(ft.)	(in.)	AS1	AS2	AS3	AS4	AS5	AS7	AS8	(tons)
3	2	7	6	4	< 2	–	0.17	0.25	0.16	0.10	0.17	0.17	0.14	3.3
3	2	4	4	4	2 < 3	31	0.13	0.19	0.18	0.10	–	–	–	2.4
3	2	4	4	4	3 – 5	31	0.10	0.11	0.12	0.10	–	–	–	2.4
3	2	4	4	4	10	31	0.10	0.10	0.10	0.10	–	–	–	2.4
3	2	4	4	4	15	31	0.10	0.13	0.13	0.10	–	–	–	2.4
3	2	4	4	4	20	31	0.11	0.17	0.17	0.10	–	–	–	2.4
3	2	4	4	4	25	31	0.14	0.21	0.21	0.10	–	–	–	2.4
3	2	4	4	4	30	31	0.17	0.25	0.25	0.10	–	–	–	2.4
3	2	4	4	4	35	31	0.20	0.29	0.30	0.10	–	–	–	2.4
3	3	7	6	4	< 2	–	0.17	0.27	0.17	0.10	0.17	0.17	0.14	3.7
3	3	4	4	4	2 < 3	31	0.10	0.22	0.21	0.10	–	–	–	2.8
3	3	4	4	4	3 – 5	31	0.10	0.14	0.14	0.10	–	–	–	2.8
3	3	4	4	4	10	31	0.10	0.11	0.11	0.10	–	–	–	2.8
3	3	4	4	4	15	31	0.10	0.14	0.15	0.10	–	–	–	2.8
3	3	4	4	4	20	31	0.10	0.18	0.19	0.10	–	–	–	2.8
3	3	4	4	4	25	31	0.10	0.23	0.23	0.10	–	–	–	2.8
3	3	4	4	4	30	31	0.12	0.27	0.28	0.10	–	–	–	2.8
3	3	4	4	4	35	31	0.14	0.32	0.32	0.10	–	–	–	2.8

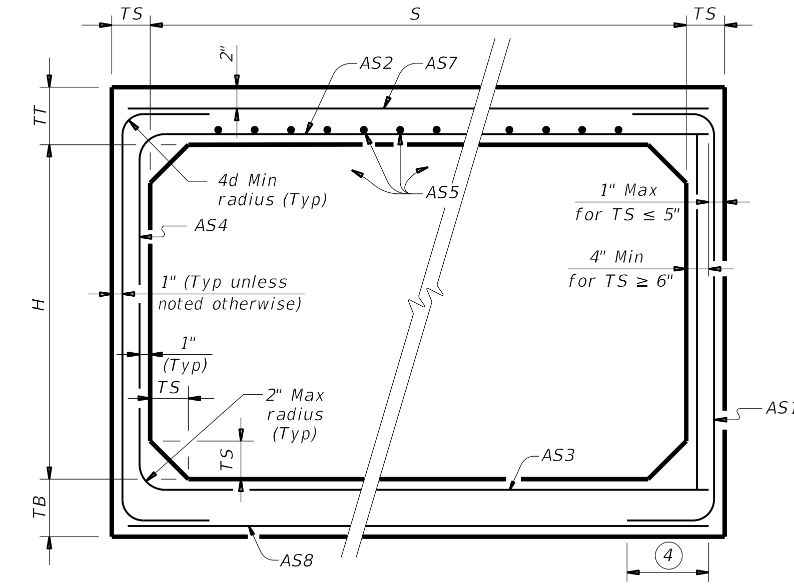
(1) For box length = 8'-0"

(2) AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

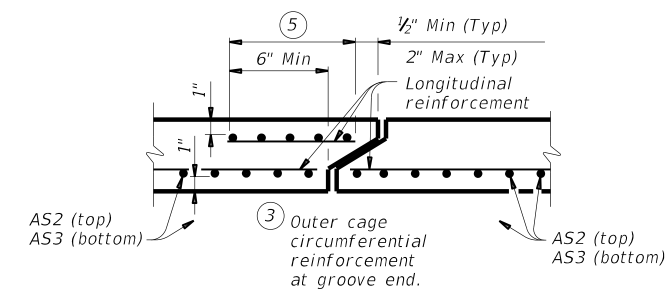
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

(4) Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f'c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.

See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation | Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

3'-0" SPAN

SCP-3

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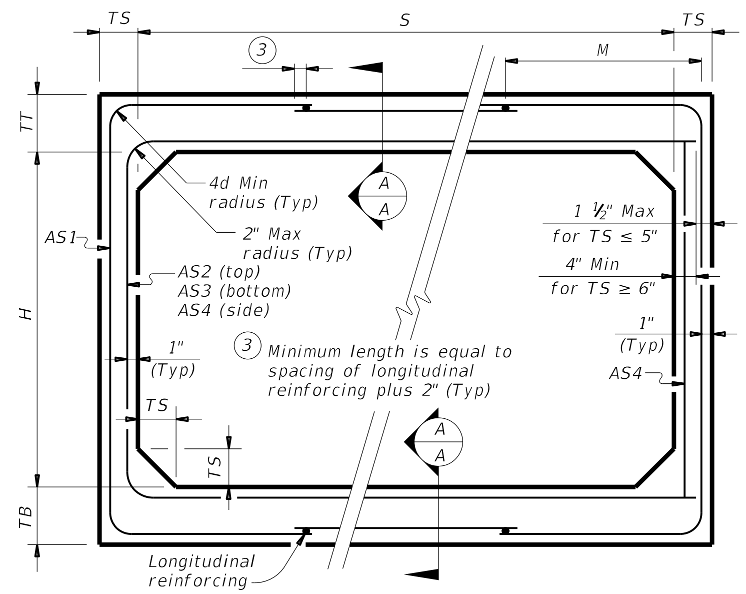
BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (sq. in. / ft.) ②							① Lift Weight
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)	(ft.)	(in.)	AS1	AS2	AS3	AS4	AS5	AS7	AS8	(tons)
4	2	7.5	6	5	< 2	–	0.18	0.27	0.15	0.12	0.18	0.18	0.14	4.5
4	2	5	5	5	2 < 3	38	0.18	0.19	0.17	0.12	–	–	–	3.6
4	2	5	5	5	3 – 5	38	0.13	0.13	0.13	0.12	–	–	–	3.6
4	2	5	5	5	10	38	0.12	0.12	0.12	0.12	–	–	–	3.6
4	2	5	5	5	15	38	0.14	0.16	0.16	0.12	–	–	–	3.6
4	2	5	5	5	20	38	0.18	0.20	0.21	0.12	–	–	–	3.6
4	2	5	5	5	25	38	0.23	0.25	0.25	0.12	–	–	–	3.6
4	2	5	5	5	30	38	0.28	0.30	0.30	0.12	–	–	–	3.6
4	3	7.5	6	5	< 2	–	0.18	0.31	0.18	0.12	0.18	0.18	0.14	5.0
4	3	5	5	5	2 < 3	38	0.15	0.23	0.20	0.12	–	–	–	4.1
4	3	5	5	5	3 – 5	38	0.12	0.16	0.16	0.12	–	–	–	4.1
4	3	5	5	5	10	38	0.12	0.14	0.14	0.12	–	–	–	4.1
4	3	5	5	5	15	38	0.12	0.18	0.18	0.12	–	–	–	4.1
4	3	5	5	5	20	38	0.14	0.23	0.24	0.12	–	–	–	4.1
4	3	5	5	5	25	38	0.17	0.29	0.29	0.12	–	–	–	4.1
4	3	5	5	5	30	38	0.21	0.35	0.35	0.12	–	–	–	4.1
4	4	7.5	6	5	< 2	–	0.18	0.33	0.20	0.12	0.18	0.18	0.14	5.5
4	4	5	5	5	2 < 3	38	0.12	0.26	0.23	0.12	–	–	–	4.6
4	4	5	5	5	3 – 5	38	0.12	0.18	0.18	0.12	–	–	–	4.6
4	4	5	5	5	10	38	0.12	0.15	0.15	0.12	–	–	–	4.6
4	4	5	5	5	15	38	0.12	0.19	0.20	0.12	–	–	–	4.6
4	4	5	5	5	20	38	0.12	0.25	0.25	0.12	–	–	–	4.6
4	4	5	5	5	25	38	0.14	0.31	0.31	0.12	–	–	–	4.6
4	4	5	5	5	30	38	0.17	0.37	0.37	0.12	–	–	–	4.6

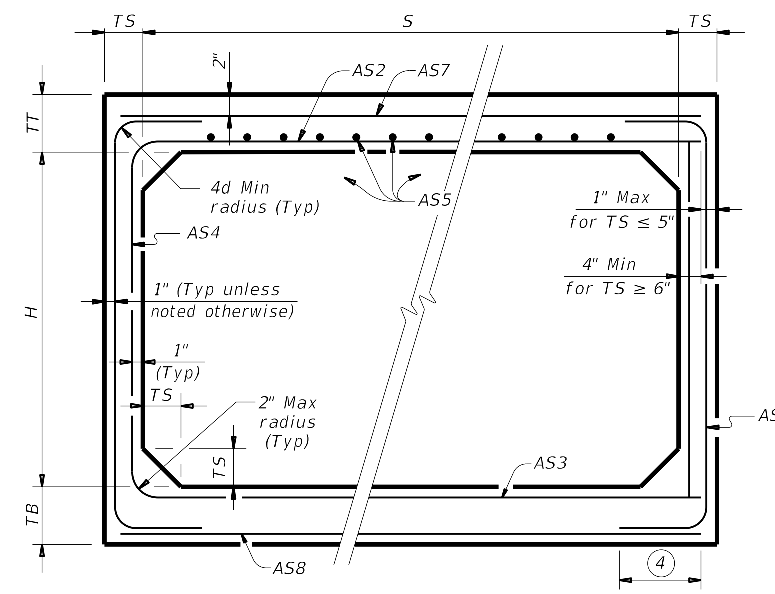
① For box length = 8'-0"

② AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

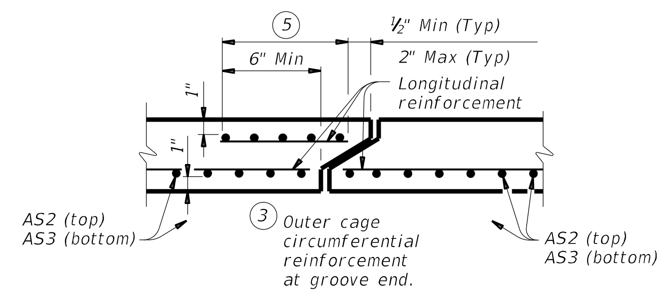
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

④ Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f'c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.

See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation — Bridge Division Standard

SINGLE BOX CULVERTS PRECAST
4'-0" SPAN

SCP-4

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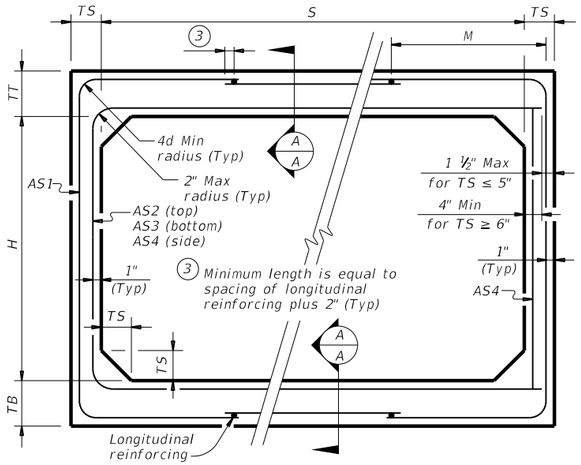
BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (sq. in. / ft.) ②							① Lift Weight
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)	(ft.)	(in.)	AS1	AS2	AS3	AS4	AS5	AS7	AS8	(tons)
5	2	8	7	6	< 2	–	0.19	0.27	0.18	0.14	0.19	0.19	0.17	6.0
5	2	6	6	6	2 < 3	44	0.22	0.20	0.16	0.14	–	–	–	5.1
5	2	6	6	6	3 – 5	44	0.16	0.14	0.14	0.14	–	–	–	5.1
5	2	6	6	6	10	36	0.15	0.14	0.14	0.14	–	–	–	5.1
5	2	6	6	6	15	36	0.20	0.18	0.18	0.14	–	–	–	5.1
5	2	6	6	6	20	36	0.26	0.23	0.24	0.14	–	–	–	5.1
5	2	6	6	6	25	36	0.33	0.29	0.29	0.14	–	–	–	5.1
5	2	6	6	6	30	36	0.39	0.34	0.35	0.14	–	–	–	5.1
5	3	8	7	6	< 2	–	0.19	0.31	0.21	0.14	0.19	0.19	0.17	6.6
5	3	6	6	6	2 < 3	45	0.18	0.24	0.19	0.14	–	–	–	5.7
5	3	6	6	6	3 – 5	36	0.14	0.17	0.16	0.14	–	–	–	5.7
5	3	6	6	6	10	36	0.14	0.16	0.17	0.14	–	–	–	5.7
5	3	6	6	6	15	35	0.16	0.21	0.22	0.14	–	–	–	5.7
5	3	6	6	6	20	35	0.21	0.27	0.28	0.14	–	–	–	5.7
5	3	6	6	6	25	35	0.26	0.34	0.34	0.14	–	–	–	5.7
5	3	6	6	6	30	35	0.31	0.41	0.41	0.14	–	–	–	5.7
5	4	8	7	6	< 2	–	0.19	0.33	0.24	0.14	0.19	0.19	0.17	7.2
5	4	6	6	6	2 < 3	45	0.16	0.27	0.22	0.14	–	–	–	6.3
5	4	6	6	6	3 – 5	45	0.14	0.19	0.18	0.14	–	–	–	6.3
5	4	6	6	6	10	36	0.14	0.18	0.18	0.14	–	–	–	6.3
5	4	6	6	6	15	35	0.14	0.23	0.24	0.14	–	–	–	6.3
5	4	6	6	6	20	35	0.17	0.30	0.31	0.14	–	–	–	6.3
5	4	6	6	6	25	35	0.21	0.37	0.38	0.14	–	–	–	6.3
5	4	6	6	6	30	35	0.25	0.44	0.45	0.14	–	–	–	6.3
5	5	8	7	6	< 2	–	0.19	0.35	0.26	0.14	0.19	0.19	0.17	7.8
5	5	6	6	6	2 < 3	45	0.14	0.29	0.24	0.14	–	–	–	6.9
5	5	6	6	6	3 – 5	45	0.14	0.21	0.20	0.14	–	–	–	6.9
5	5	6	6	6	10	45	0.14	0.19	0.20	0.14	–	–	–	6.9
5	5	6	6	6	15	36	0.14	0.24	0.25	0.14	–	–	–	6.9
5	5	6	6	6	20	35	0.15	0.31	0.32	0.14	–	–	–	6.9
5	5	6	6	6	25	35	0.18	0.38	0.39	0.14	–	–	–	6.9
5	5	6	6	6	30	35	0.21	0.46	0.47	0.14	–	–	–	6.9

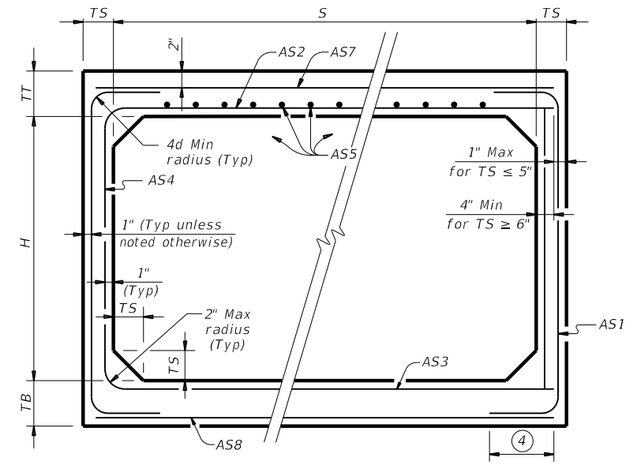
① For box length = 8'-0"

② AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

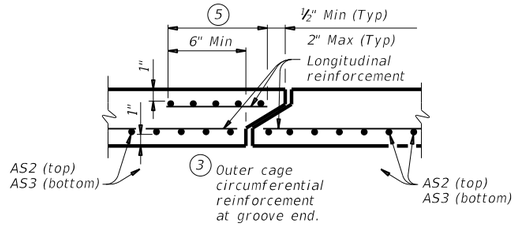
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

④ Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f`c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.

See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

5'-0" SPAN

SCP-5

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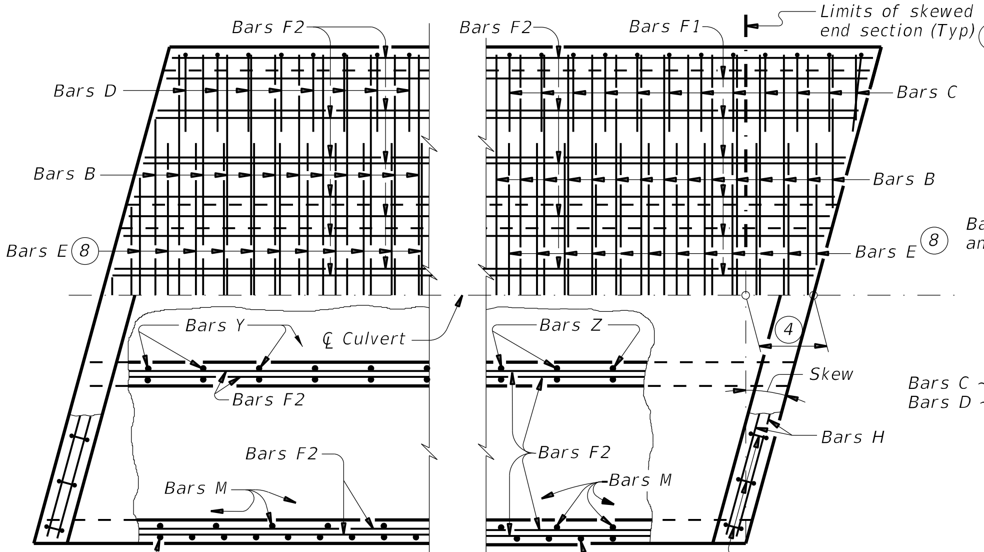
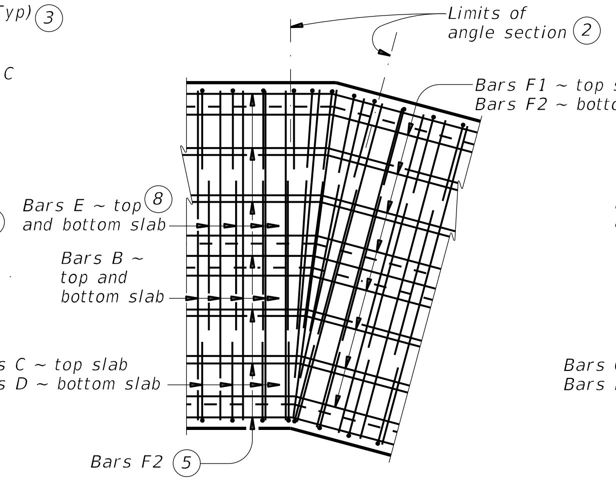
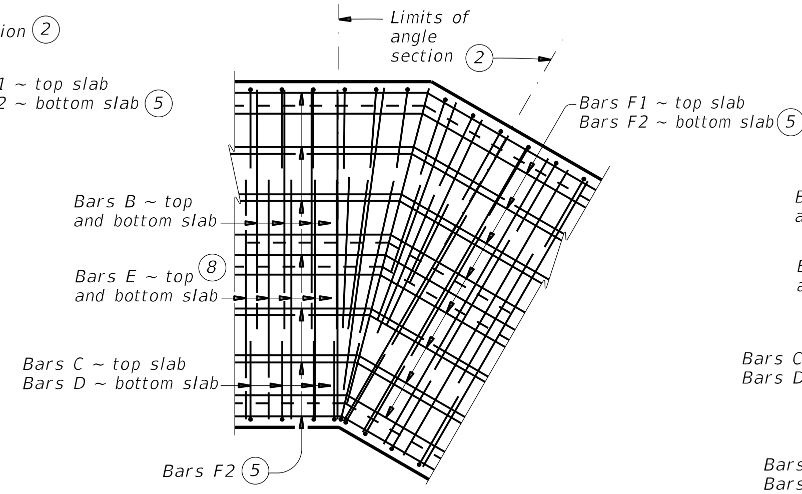
	DAL	KAUFMAN		129



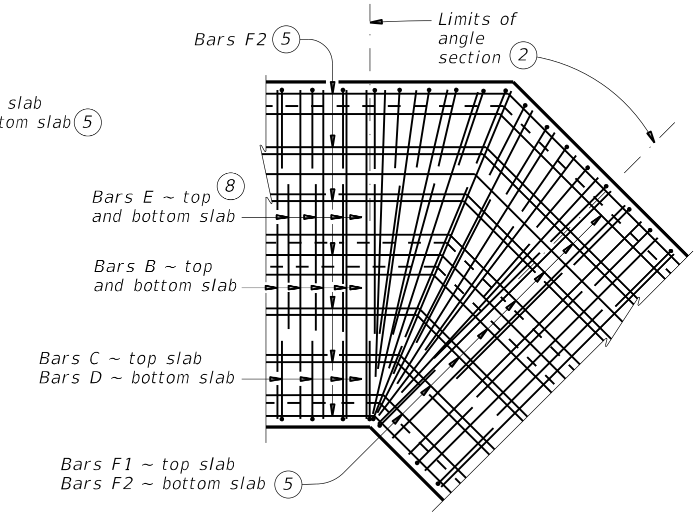
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° 7



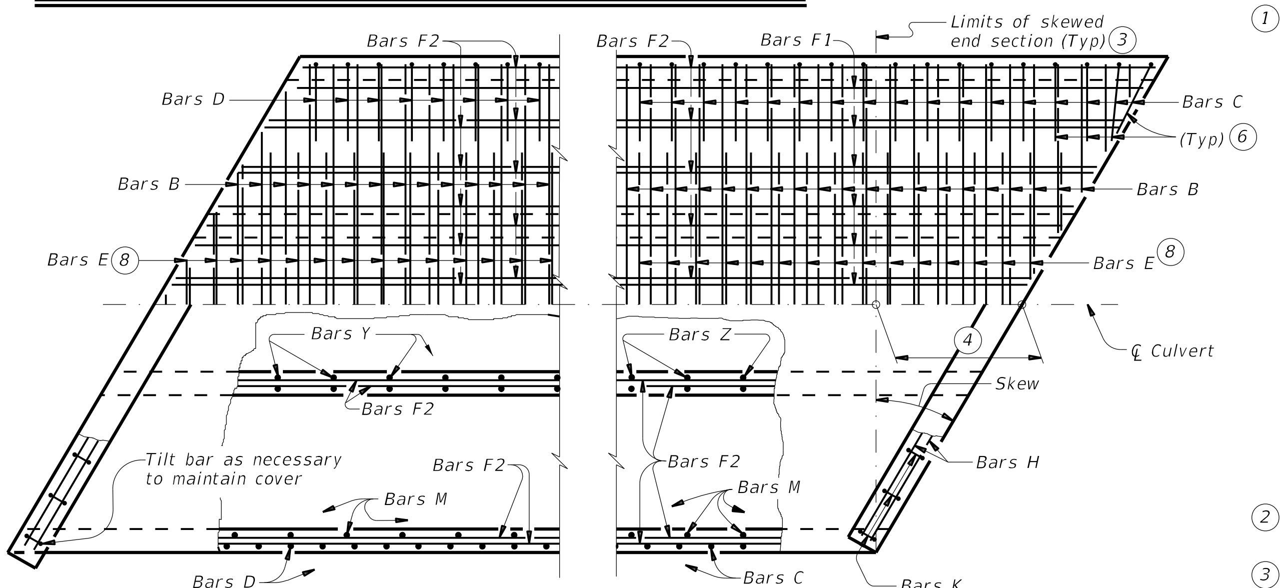
PLAN OF ANGLE SECTION ~ FROM 0° TO 15°



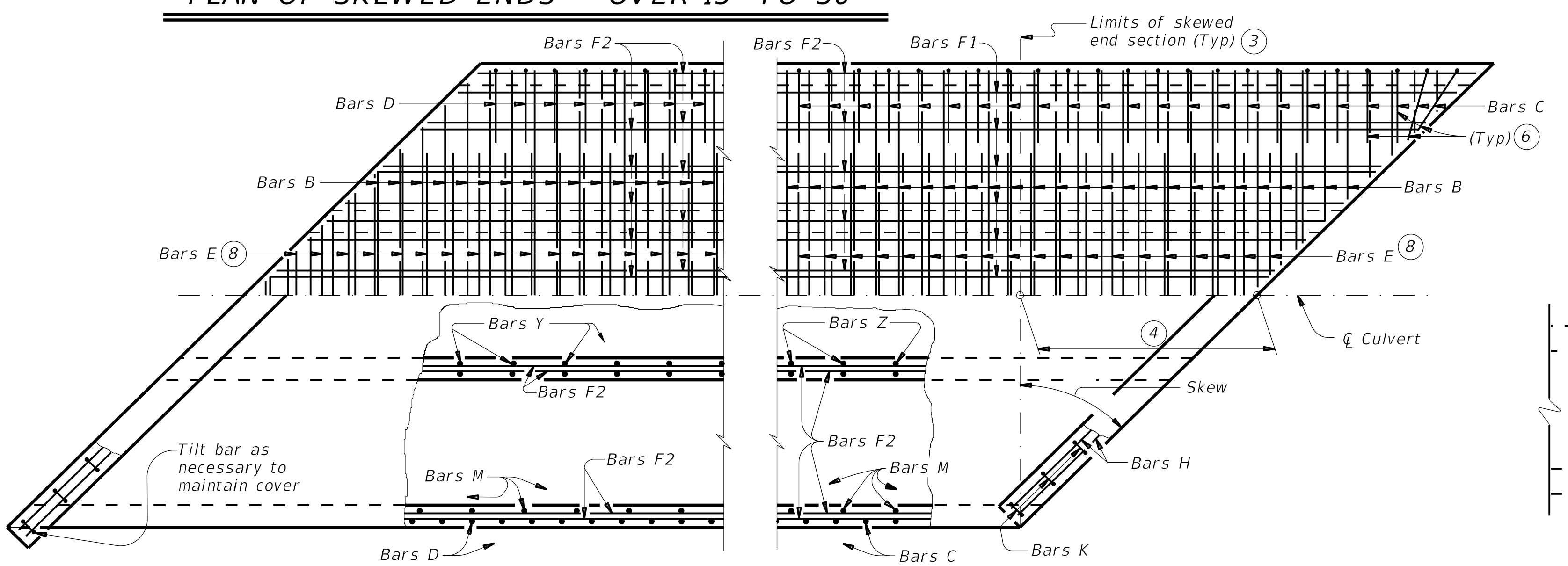
PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°



PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°

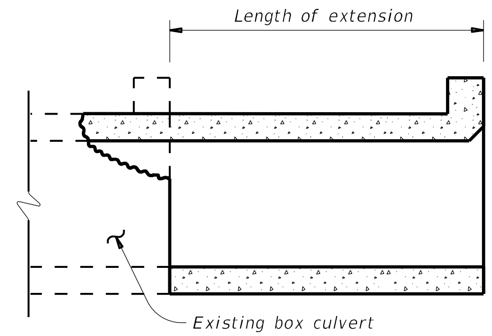
1. For skewed box culverts with less than 2'-0" of fill, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension.
   For non-skewed box culverts with less than 2'-0" of fill and for skewed or non-skewed culverts with a fill 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, Nba, 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. [One half of overall width] x [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 ½" 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.

Cover dimensions are clear dimensions, unless noted otherwise.



LENGTHENING DETAIL 1

HL93 LOADING

Texas Department of Transportation — Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

MC-MD

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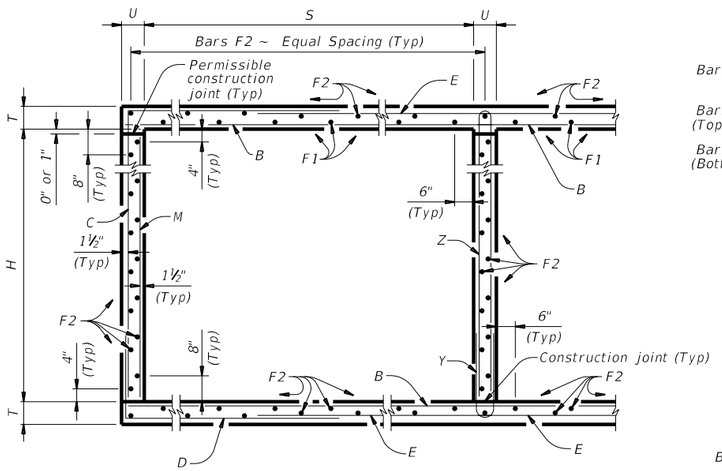
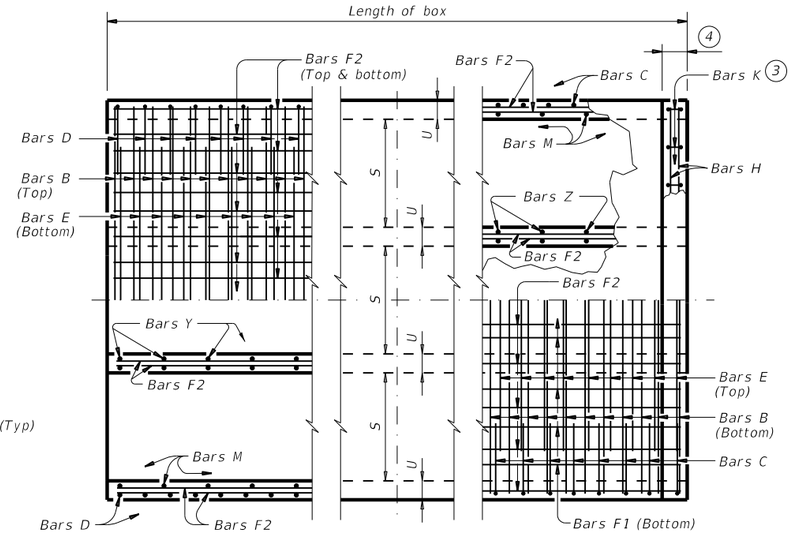
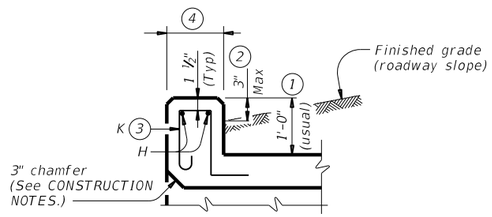


TYPICAL SECTION



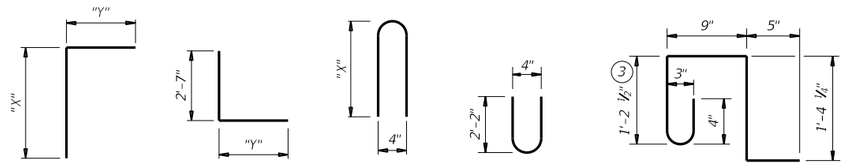
BOTTOM SLAB TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
2'-0"	2'-6 ½"	3'-8 ½"
3'-0"	3'-6 ½"	3'-8 ½"
4'-0"	4'-6 ½"	3'-8 ½"
5'-0"	5'-6 ½"	3'-8 ½"



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

1 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Rail Anchorage Curb (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.

2 For vehicle safety, the following requirements must be met:
- For structures without bridge rail, construct curbs no more than 3" above finished grade.
- For structures with bridge rail, construct curbs flush with finished grade.

Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

3 For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.

4 1'-0" typical. 2'-3" when the Rail Anchorage Curb (RAC) standard sheet is referred to elsewhere in the plans.

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

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

CONSTRUCTION NOTES:

Do not use permanent forms.
Chamfer the bottom edge of the top slab 3" at the entrance.
Optionally, raise construction joints shown at the flow line by a maximum of 6". If this option is taken, Bars M may be cut off or raised, Bars C and D may be reversed, 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
5'-0" SPAN
0' TO 20' FILL

MC-5-20

FILE: mc520ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		131

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	
													Bars C		Bars D																					Bars Y		Bars Z											
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Length	Wt	Length	Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	Length	Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	5' - 0"	2' - 0"	8"	7"	108	#5	9"	11' - 6"	1,295	108	#5	9"	6' - 3"	704	6' - 4"	713	108	#5	9"	8' - 8"	976	8	18"	39' - 9"	212	38	18"	39' - 9"	1,009	108	9"	2' - 0"	144	54	9"	4' - 7"	165	5' - 3"	189	11' - 6"	31	26	72	0.710	135.2	0.9	103	29.3	5,510
3	5' - 0"	2' - 0"	8"	7"	108	#5	9"	17' - 1"	1,924	108	#5	9"	6' - 3"	704	6' - 4"	713	108	#5	9"	14' - 3"	1,605	12	18"	39' - 9"	319	54	18"	39' - 9"	1,434	108	9"	2' - 0"	144	108	9"	4' - 7"	331	5' - 3"	379	17' - 1"	46	38	106	1.029	188.8	1.3	152	42.4	7,705
4	5' - 0"	2' - 0"	8"	7"	108	#5	9"	22' - 8"	2,553	108	#5	9"	6' - 3"	704	6' - 4"	713	108	#5	9"	19' - 10"	2,234	16	18"	39' - 9"	425	70	18"	39' - 9"	1,859	108	9"	2' - 0"	144	162	9"	4' - 7"	496	5' - 3"	568	22' - 8"	61	48	134	1.348	242.4	1.7	195	55.6	9,891
5	5' - 0"	2' - 0"	8"	7"	108	#5	9"	28' - 3"	3,182	108	#5	9"	6' - 3"	704	6' - 4"	713	108	#5	9"	25' - 5"	2,863	20	18"	39' - 9"	531	86	18"	39' - 9"	2,284	108	9"	2' - 0"	144	216	9"	4' - 7"	661	5' - 3"	758	28' - 3"	75	60	167	1.667	296.0	2.1	242	68.8	12,082
6	5' - 0"	2' - 0"	8"	7"	108	#5	9"	33' - 10"	3,811	108	#5	9"	6' - 3"	704	6' - 4"	713	108	#5	9"	31' - 0"	3,492	24	18"	39' - 9"	637	102	18"	39' - 9"	2,708	108	9"	2' - 0"	144	270	9"	4' - 7"	827	5' - 3"	947	33' - 10"	90	70	195	1.986	349.6	2.5	285	82.0	14,268
2	5' - 0"	3' - 0"	8"	7"	108	#6	9"	11' - 6"	1,865	108	#5	9"	7' - 3"	817	6' - 4"	713	108	#5	9"	8' - 8"	976	8	18"	39' - 9"	212	44	18"	39' - 9"	1,168	108	9"	3' - 0"	216	54	9"	4' - 7"	165	7' - 3"	262	11' - 6"	31	26	72	0.775	159.9	0.9	103	31.9	6,497
3	5' - 0"	3' - 0"	8"	7"	108	#6	9"	17' - 1"	2,771	108	#5	9"	7' - 3"	817	6' - 4"	713	108	#5	9"	14' - 3"	1,605	12	18"	39' - 9"	319	62	18"	39' - 9"	1,646	108	9"	3' - 0"	216	108	9"	4' - 7"	331	7' - 3"	523	17' - 1"	46	38	106	1.115	223.5	1.3	152	45.9	9,093
4	5' - 0"	3' - 0"	8"	7"	108	#6	9"	22' - 8"	3,677	108	#5	9"	7' - 3"	817	6' - 4"	713	108	#5	9"	19' - 10"	2,234	16	18"	39' - 9"	425	80	18"	39' - 9"	2,124	108	9"	3' - 0"	216	162	9"	4' - 7"	496	7' - 3"	785	22' - 8"	61	48	134	1.456	287.2	1.7	195	59.9	11,682
5	5' - 0"	3' - 0"	8"	7"	108	#6	9"	28' - 3"	4,583	108	#5	9"	7' - 3"	817	6' - 4"	713	108	#5	9"	25' - 5"	2,863	20	18"	39' - 9"	531	98	18"	39' - 9"	2,602	108	9"	3' - 0"	216	216	9"	4' - 7"	661	7' - 3"	1,046	28' - 3"	75	60	167	1.796	350.8	2.1	242	73.9	14,274
6	5' - 0"	3' - 0"	8"	7"	108	#6	9"	33' - 10"	5,488	108	#5	9"	7' - 3"	817	6' - 4"	713	108	#5	9"	31' - 0"	3,492	24	18"	39' - 9"	637	116	18"	39' - 9"	3,080	108	9"	3' - 0"	216	270	9"	4' - 7"	827	7' - 3"	1,308	33' - 10"	90	70	195	2.137	414.5	2.5	285	88.0	16,863
2	5' - 0"	4' - 0"	8"	7"	108	#6	9"	11' - 6"	1,865	108	#5	9"	8' - 3"	929	6' - 4"	713	108	#5	9"	8' - 8"	976	8	18"	39' - 9"	212	44	18"	39' - 9"	1,168	108	9"	4' - 0"	289	54	9"	4' - 7"	165	9' - 3"	334	11' - 6"	31	26	72	0.840	166.3	0.9	103	34.5	6,754
3	5' - 0"	4' - 0"	8"	7"	108	#6	9"	17' - 1"	2,771	108	#5	9"	8' - 3"	929	6' - 4"	713	108	#5	9"	14' - 3"	1,605	12	18"	39' - 9"	319	62	18"	39' - 9"	1,646	108	9"	4' - 0"	289	108	9"	4' - 7"	331	9' - 3"	667	17' - 1"	46	38	106	1.202	231.8	1.3	152	49.4	9,422
4	5' - 0"	4' - 0"	8"	7"	108	#6	9"	22' - 8"	3,677	108	#5	9"	8' - 3"	929	6' - 4"	713	108	#5	9"	19' - 10"	2,234	16	18"	39' - 9"	425	80	18"	39' - 9"	2,124	108	9"	4' - 0"	289	162	9"	4' - 7"	496	9' - 3"	1,001	22' - 8"	61	48	134	1.564	297.2	1.7	195	64.3	12,083
5	5' - 0"	4' - 0"	8"	7"	108	#6	9"	28' - 3"	4,583	108	#5	9"	8' - 3"	929	6' - 4"	713	108	#5	9"	25' - 5"	2,863	20	18"	39' - 9"	531	98	18"	39' - 9"	2,602	108	9"	4' - 0"	289	216	9"	4' - 7"	661	9' - 3"	1,335	28' - 3"	75	60	167	1.926	362.7	2.1	242	79.1	14,748
6	5' - 0"	4' - 0"	8"	7"	108	#6	9"	33' - 10"	5,488	108	#5	9"	8' - 3"	929	6' - 4"	713	108	#5	9"	31' - 0"	3,492	24	18"	39' - 9"	637	116	18"	39' - 9"	3,080	108	9"	4' - 0"	289	270	9"	4' - 7"	827	9' - 3"	1,668	33' - 10"	90	70	195	2.288	428.1	2.5	285	94.0	17,408
2	5' - 0"	5' - 0"	8"	7"	108	#6	9"	11' - 6"	1,865	108	#5	9"	9' - 3"	1,042	6' - 4"	713	108	#5	9"	8' - 8"	976	8	18"	39' - 9"	212	50	18"	39' - 9"	1,328	108	9"	5' - 0"	361	54	9"	4' - 7"	165	11' - 3"	406	11' - 6"	31	26	72	0.904	176.7	0.9	103	37.0	7,171
3	5' - 0"	5' - 0"	8"	7"	108	#6	9"	17' - 1"	2,771	108	#5	9"	9' - 3"	1,042	6' - 4"	713	108	#5	9"	14' - 3"	1,605	12	18"	39' - 9"	319	70	18"	39' - 9"	1,859	108	9"	5' - 0"	361	108	9"	4' - 7"	331	11' - 3"	812	17' - 1"	46	38	106	1.288	245.3	1.3	152	52.8	9,965
4	5' - 0"	5' - 0"	8"	7"	108	#6	9"	22' - 8"	3,677	108	#5	9"	9' - 3"	1,042	6' - 4"	713	108	#5	9"	19' - 10"	2,234	16	18"	39' - 9"	425	90	18"	39' - 9"	2,390	108	9"	5' - 0"	361	162	9"	4' - 7"	496	11' - 3"	1,217	22' - 8"	61	48	134	1.672	313.9	1.7	195	68.6	12,750
5	5' - 0"	5' - 0"	8"	7"	108	#6	9"	28' - 3"	4,583	108	#5	9"	9' - 3"	1,042	6' - 4"	713	108	#5	9"	25' - 5"	2,863	20	18"	39' - 9"	531	110	18"	39' - 9"	2,921	108	9"	5' - 0"	361	216	9"	4' - 7"	661	11' - 3"	1,623	28' - 3"	75	60	167	2.056	382.5	2.1	242	84.3	15,540
6	5' - 0"	5' - 0"	8"	7"	108	#6	9"	33' - 10"	5,488	108	#5	9"	9' - 3"	1,042	6' - 4"	713	108	#5	9"	31' - 0"	3,492	24	18"	39' - 9"	637	130	18"	39' - 9"	3,452	108	9"	5' - 0"	361	270	9"	4' - 7"	827	11' - 3"	2,029	33' - 10"	90	70	195	2.439	451.0	2.5	285	100.1	18,326

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HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

5'-0" SPAN 0' TO 20' FILL

MC-5-20

FILE: mc520ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		132

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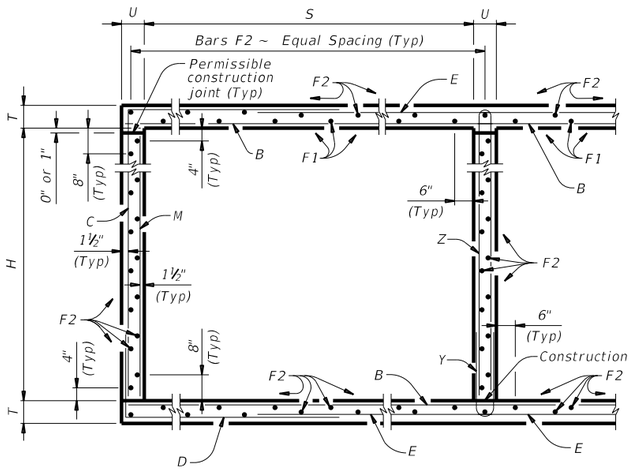
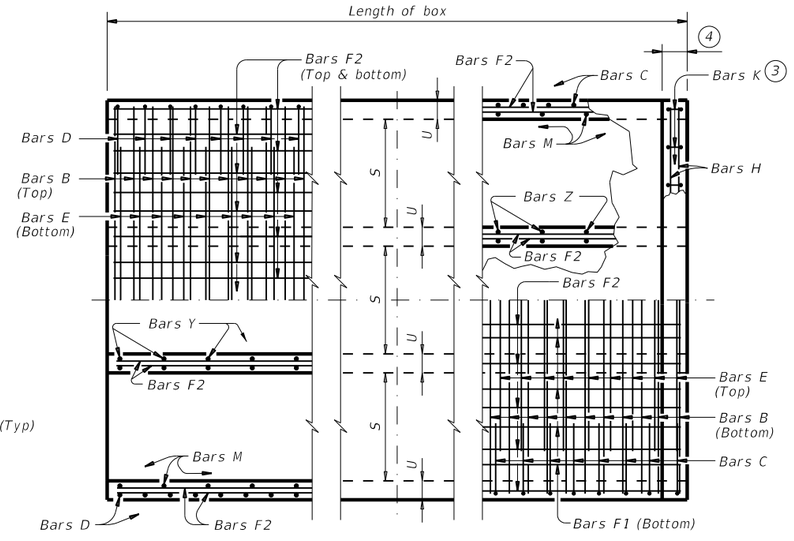
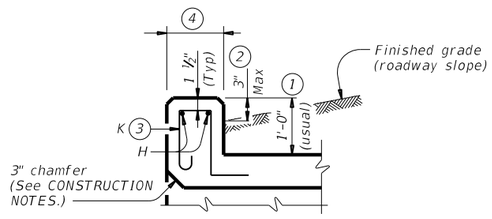


TYPICAL SECTION



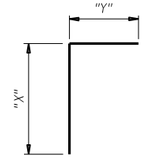
BOTTOM SLAB TOP SLAB

PART PLANS

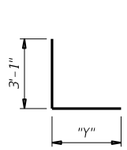


SECTION THRU CURB

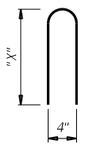
TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
4'-0"	4'-7 ½"	5'-5"
5'-0"	5'-7 ½"	5'-5"
6'-0"	6'-7 ½"	5'-5"
7'-0"	7'-7 ½"	5'-5"
8'-0"	8'-7 ½"	5'-5"
9'-0"	9'-7 ½"	5'-5"



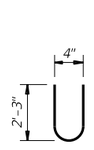
BARS C



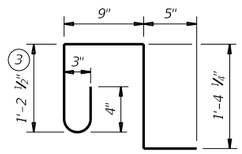
BARS D



BARS Z



BARS Y



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

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

2 For vehicle safety, the following requirements must be met:
- For structures without bridge rail, construct curbs no more than 3" above finished grade.
- For structures with bridge rail, construct curbs flush with finished grade.

Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

3 For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.

4 1'-0" typical. 2'-3" when the Rail Anchorage Curb (RAC) standard sheet is referred to elsewhere in the plans.

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

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

CONSTRUCTION NOTES:

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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation | Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
9'-0" SPAN
0' TO 10' FILL

MC-9-10

FILE: mc910ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		133

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 Length	Bars C Wt	Bars D Length	Bars D Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Bars Y Length	Bars Y Wt	Bars Z Length	Bars Z Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	9' – 0"	4' – 0"	9"	7"	162	#6	6"	19' – 6"	4,745	108	#6	9"	10' – 1"	1,636	8' – 7"	1,392	162	#6	6"	14' – 1"	3,427	14	18"	39' – 9"	372	62	18"	39' – 9"	1,646	108	9"	4' – 0"	289	54	9"	4' – 9"	171	9' – 5"	340	19' – 6"	52	42	117	1.356	350.5	1.5	169	55.7	14,187
3	9' – 0"	4' – 0"	9"	7"	162	#6	6"	29' – 1"	7,077	108	#6	9"	10' – 1"	1,636	8' – 7"	1,392	162	#6	6"	23' – 8"	5,759	21	18"	39' – 9"	558	89	18"	39' – 9"	2,363	108	9"	4' – 0"	289	108	9"	4' – 9"	343	9' – 5"	679	29' – 1"	78	62	173	1.975	502.4	2.2	251	81.2	20,347
4	9' – 0"	4' – 0"	9"	7"	162	#6	6"	38' – 8"	9,409	108	#6	9"	10' – 1"	1,636	8' – 7"	1,392	162	#6	6"	33' – 3"	8,091	28	18"	39' – 9"	743	116	18"	39' – 9"	3,080	108	9"	4' – 0"	289	162	9"	4' – 9"	514	9' – 5"	1,019	38' – 8"	103	80	223	2.594	654.3	2.9	326	106.6	26,499
5	9' – 0"	4' – 0"	9"	7"	162	#6	6"	48' – 3"	11,740	108	#6	9"	10' – 1"	1,636	8' – 7"	1,392	162	#6	6"	42' – 10"	10,422	35	18"	39' – 9"	929	143	18"	39' – 9"	3,797	108	9"	4' – 0"	289	216	9"	4' – 9"	685	9' – 5"	1,359	48' – 3"	129	100	278	3.213	806.2	3.6	407	132.1	32,656
6	9' – 0"	4' – 0"	9"	7"	162	#6	6"	57' – 10"	14,072	108	#6	9"	10' – 1"	1,636	8' – 7"	1,392	162	#6	6"	52' – 5"	12,754	42	18"	39' – 9"	1,115	170	18"	39' – 9"	4,514	108	9"	4' – 0"	289	270	9"	4' – 9"	857	9' – 5"	1,698	57' – 10"	155	118	328	3.832	958.2	4.3	483	157.6	38,810
2	9' – 0"	5' – 0"	9"	7"	162	#6	6"	19' – 6"	4,745	108	#6	9"	11' – 1"	1,798	8' – 7"	1,392	162	#6	6"	14' – 1"	3,427	14	18"	39' – 9"	372	68	18"	39' – 9"	1,806	108	9"	5' – 0"	361	54	9"	4' – 9"	171	11' – 5"	412	19' – 6"	52	42	117	1.421	362.1	1.5	169	58.3	14,653
3	9' – 0"	5' – 0"	9"	7"	162	#6	6"	29' – 1"	7,077	108	#6	9"	11' – 1"	1,798	8' – 7"	1,392	162	#6	6"	23' – 8"	5,759	21	18"	39' – 9"	558	97	18"	39' – 9"	2,576	108	9"	5' – 0"	361	108	9"	4' – 9"	343	11' – 5"	824	29' – 1"	78	62	173	2.062	517.2	2.2	251	84.6	20,939
4	9' – 0"	5' – 0"	9"	7"	162	#6	6"	38' – 8"	9,409	108	#6	9"	11' – 1"	1,798	8' – 7"	1,392	162	#6	6"	33' – 3"	8,091	28	18"	39' – 9"	743	126	18"	39' – 9"	3,346	108	9"	5' – 0"	361	162	9"	4' – 9"	514	11' – 5"	1,235	38' – 8"	103	80	223	2.702	672.2	2.9	326	111.0	27,215
5	9' – 0"	5' – 0"	9"	7"	162	#6	6"	48' – 3"	11,740	108	#6	9"	11' – 1"	1,798	8' – 7"	1,392	162	#6	6"	42' – 10"	10,422	35	18"	39' – 9"	929	155	18"	39' – 9"	4,116	108	9"	5' – 0"	361	216	9"	4' – 9"	685	11' – 5"	1,647	48' – 3"	129	100	278	3.343	827.3	3.6	407	137.3	33,497
6	9' – 0"	5' – 0"	9"	7"	162	#6	6"	57' – 10"	14,072	108	#6	9"	11' – 1"	1,798	8' – 7"	1,392	162	#6	6"	52' – 5"	12,754	42	18"	39' – 9"	1,115	184	18"	39' – 9"	4,886	108	9"	5' – 0"	361	270	9"	4' – 9"	857	11' – 5"	2,059	57' – 10"	155	118	328	3.983	982.4	4.3	483	163.6	39,777
2	9' – 0"	6' – 0"	9"	7"	162	#6	6"	19' – 6"	4,745	108	#6	9"	12' – 1"	1,960	8' – 7"	1,392	162	#6	6"	14' – 1"	3,427	14	18"	39' – 9"	372	74	18"	39' – 9"	1,965	108	9"	6' – 0"	433	54	9"	4' – 9"	171	13' – 5"	484	19' – 6"	52	42	117	1.486	373.7	1.5	169	60.9	15,118
3	9' – 0"	6' – 0"	9"	7"	162	#6	6"	29' – 1"	7,077	108	#6	9"	12' – 1"	1,960	8' – 7"	1,392	162	#6	6"	23' – 8"	5,759	21	18"	39' – 9"	558	105	18"	39' – 9"	2,788	108	9"	6' – 0"	433	108	9"	4' – 9"	343	13' – 5"	968	29' – 1"	78	62	173	2.148	532.0	2.2	251	88.1	21,529
4	9' – 0"	6' – 0"	9"	7"	162	#6	6"	38' – 8"	9,409	108	#6	9"	12' – 1"	1,960	8' – 7"	1,392	162	#6	6"	33' – 3"	8,091	28	18"	39' – 9"	743	136	18"	39' – 9"	3,611	108	9"	6' – 0"	433	162	9"	4' – 9"	514	13' – 5"	1,452	38' – 8"	103	80	223	2.810	690.1	2.9	326	115.3	27,931
5	9' – 0"	6' – 0"	9"	7"	162	#6	6"	48' – 3"	11,740	108	#6	9"	12' – 1"	1,960	8' – 7"	1,392	162	#6	6"	42' – 10"	10,422	35	18"	39' – 9"	929	167	18"	39' – 9"	4,434	108	9"	6' – 0"	433	216	9"	4' – 9"	685	13' – 5"	1,936	48' – 3"	129	100	278	3.472	848.3	3.6	407	142.5	34,338
6	9' – 0"	6' – 0"	9"	7"	162	#6	6"	57' – 10"	14,072	108	#6	9"	12' – 1"	1,960	8' – 7"	1,392	162	#6	6"	52' – 5"	12,754	42	18"	39' – 9"	1,115	198	18"	39' – 9"	5,257	108	9"	6' – 0"	433	270	9"	4' – 9"	857	13' – 5"	2,420	57' – 10"	155	118	328	4.134	1,006.5	4.3	483	169.6	40,743
2	9' – 0"	7' – 0"	9"	7"	162	#6	6"	19' – 6"	4,745	108	#6	9"	13' – 1"	2,122	8' – 7"	1,392	162	#6	6"	14' – 1"	3,427	14	18"	39' – 9"	372	74	18"	39' – 9"	1,965	108	9"	7' – 0"	505	54	9"	4' – 9"	171	15' – 5"	556	19' – 6"	52	42	117	1.551	381.4	1.5	169	63.5	15,424
3	9' – 0"	7' – 0"	9"	7"	162	#6	6"	29' – 1"	7,077	108	#6	9"	13' – 1"	2,122	8' – 7"	1,392	162	#6	6"	23' – 8"	5,759	21	18"	39' – 9"	558	105	18"	39' – 9"	2,788	108	9"	7' – 0"	505	108	9"	4' – 9"	343	15' – 5"	1,112	29' – 1"	78	62	173	2.235	541.4	2.2	251	91.6	21,907
4	9' – 0"	7' – 0"	9"	7"	162	#6	6"	38' – 8"	9,409	108	#6	9"	13' – 1"	2,122	8' – 7"	1,392	162	#6	6"	33' – 3"	8,091	28	18"	39' – 9"	743	136	18"	39' – 9"	3,611	108	9"	7' – 0"	505	162	9"	4' – 9"	514	15' – 5"	1,668	38' – 8"	103	80	223	2.918	701.4	2.9	326	119.6	28,381
5	9' – 0"	7' – 0"	9"	7"	162	#6	6"	48' – 3"	11,740	108	#6	9"	13' – 1"	2,122	8' – 7"	1,392	162	#6	6"	42' – 10"	10,422	35	18"	39' – 9"	929	167	18"	39' – 9"	4,434	108	9"	7' – 0"	505	216	9"	4' – 9"	685	15' – 5"	2,224	48' – 3"	129	100	278	3.602	861.3	3.6	407	147.7	34,860
6	9' – 0"	7' – 0"	9"	7"	162	#6	6"	57' – 10"	14,072	108	#6	9"	13' – 1"	2,122	8' – 7"	1,392	162	#6	6"	52' – 5"	12,754	42	18"	39' – 9"	1,115	198	18"	39' – 9"	5,257	108	9"	7' – 0"	505	270	9"	4' – 9"	857	15' – 5"	2,781	57' – 10"	155	118	328	4.285	1,021.4	4.3	483	175.7	41,338
2	9' – 0"	8' – 0"	9"	7"	162	#6	6"	19' – 6"	4,745	108	#6	9"	14' – 1"	2,285	8' – 7"	1,392	162	#6	6"	14' – 1"	3,427	14	18"	39' – 9"	372	80	18"	39' – 9"	2,124	108	9"	8' – 0"	577	54	9"	4' – 9"	171	17' – 5"	628	19' – 6"	52	42	117	1.616	393.0	1.5	169	66.1	15,890
3	9' – 0"	8' – 0"	9"	7"	162	#6	6"	29' – 1"	7,077	108	#6	9"	14' – 1"	2,285	8' – 7"	1,392	162	#6	6"	23' – 8"	5,759	21	18"	39' – 9"	558	113	18"	39' – 9"	3,000	108	9"	8' – 0"	577	108	9"	4' – 9"	343	17' – 5"	1,257	29' – 1"	78	62	173	2.321	556.2	2.2	251	95.0	22,499
4	9' – 0"	8' – 0"	9"	7"	162	#6	6"	38' – 8"	9,409	108	#6	9"	14' – 1"	2,285	8' – 7"	1,392	162	#6	6"	33' – 3"	8,091	28	18"	39' – 9"	743	146	18"	39' – 9"	3,877	108	9"	8' – 0"	577	162	9"	4' – 9"	514	17' – 5"	1,885	38' – 8"	103	80	223	3.026	719.3	2.9	326	123.9	29,099
5	9' – 0"	8' – 0"	9"	7"	162	#6	6"	48' – 3"	11,740	108	#6	9"	14' – 1"	2,285	8' – 7"	1,392	162	#6	6"	42' – 10"	10,422	35	18"	39' – 9"	929	179	18"	39' – 9"	4,753	108	9"	8' – 0"	577	216	9"	4' – 9"	685	17' – 5"	2,513	48' – 3"	129	100	278	3.731	882.4	3.6	407	152.8	35,703
6	9' – 0"	8' – 0"	9"	7"	162	#6	6"	57' – 10"	14,072	108	#6	9"	14' – 1"	2,285	8' – 7"	1,392	162	#6	6"	52' – 5"	12,754	42	18"	39' – 9"	1,115	212	18"	39' – 9"	5,629	108	9"	8' – 0"	577	270	9"	4' – 9"	857	17' – 5"	3,141	57' – 10"	155	118	328	4.437	1,045.6	4.3	483	181.8	42,305
2	9' – 0"	9' – 0"	9"	7"	162	#6	6"	19' – 6"	4,745	108	#6	9"	15' – 1"	2,447	8' – 7"	1,392	162	#6	6"	14' – 1"	3,427	14	18"	39' – 9"	372	86	18"	39' – 9"	2,284	108	9"	9' – 0"	649	54	9"	4' – 9"	171	19' – 5"	700	19' – 6"	52	42	117	1.681	404.7	1.5	169	68.7	16,356
3	9' – 0"	9' – 0"	9"	7"	162	#6	6"	29' – 1"	7,077	108	#6	9"	15' – 1"	2,447	8' – 7"	1,392	162	#6	6"	23' – 8"	5,759	21	18"	39' – 9"	558	121	18"	39' – 9"	3,213	108	9"	9' – 0"	649	108	9"	4' – 9"	343	19' – 5"	1,401	29' – 1"	78	62	173	2.407	571.0	2.2	251	98.4	23,090
4	9' – 0"	9' – 0"	9"	7"	162	#6	6"	38' – 8"	9,409	108	#6	9"	15' – 1"	2,447	8' – 7"	1,392	162	#6	6"	33' – 3"	8,091	28	18"	39' – 9"	743	156	18"	39' – 9"	4,142	108	9"	9' – 0"	649	162	9"	4' – 9"	514	19' – 5"	2,101	38' – 8"	103	80	223	3.134	737.2	2.9	326	128.2	29,814
5	9' – 0"	9' – 0"	9"	7"	162	#6	6"	48' – 3"	11,740	108	#6	9"	15' – 1"	2,447	8' – 7"	1,392	162	#6	6"	42' – 10"	10,422	35	18"	39' – 9"	929	191	18"	39' – 9"	5,072	108	9"	9' – 0"	649	216	9"	4' – 9"	685	19' – 5"	2,802	48' – 3"	129	100	278	3.861	903.5	3.6	407	158.0	36,545
6	9' – 0"	9' – 0"	9"	7"	162	#6	6"	57' – 10"	14,072	108	#6	9"	15' – 1"	2,447	8' – 7"	1,392	162	#6	6"	52' – 5"	12,754	42	18"	39' – 9"	1,115	226	18"	39' – 9"	6,001	108	9"	9' – 0"	649	270	9"	4' – 9"	857	19' – 5"	3,502	57' – 10"	155	118	328	4.588	1,069.7	4.3	483	187.8	43,272

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HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation — Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
9'-0" SPAN
0' TO 10' FILL

MC-9-10

FILE: mc910ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		134

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

Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing length (2~wings) (3)	
					Bars J1		Bars J2			
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'-8"	1'-9"	1'-3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'-2"	2'-0"	1'-6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'-8"	2'-3"	1'-9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'-2"	2'-6"	2'-0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'-8"	2'-9"	2'-3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'-2"	3'-0"	2'-6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'-8"	3'-3"	2'-9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'-2"	3'-6"	3'-0"	1'-0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'-8"	4'-0"	3'-0"	1'-1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'-2"	4'-6"	3'-0"	1'-3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING
(2~wings)

Bar	Size	No.	Spa
D	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
R	#5	6	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

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

Hw = H + T + C – 0.250'
A = (Hw – 0.333') (SL)
B = (A) tangent (30°)
Lw = (A) ÷ cosine (30°)

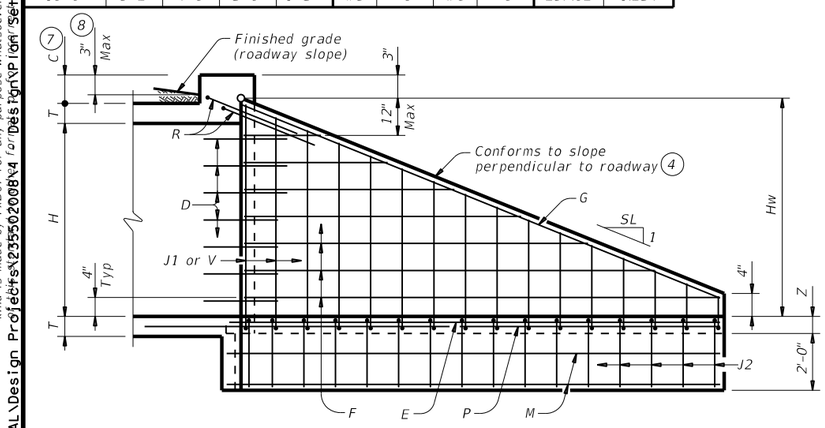
For cast-in-place culverts:
Ltw = (N) (S) + (N + 1) (U)

For precast culverts:
Ltw = (N) (2U + S) + (N – 1) (0.5')

Total wingwall area (two wings ~ SF) = (Hw + 0.333') (Lw)

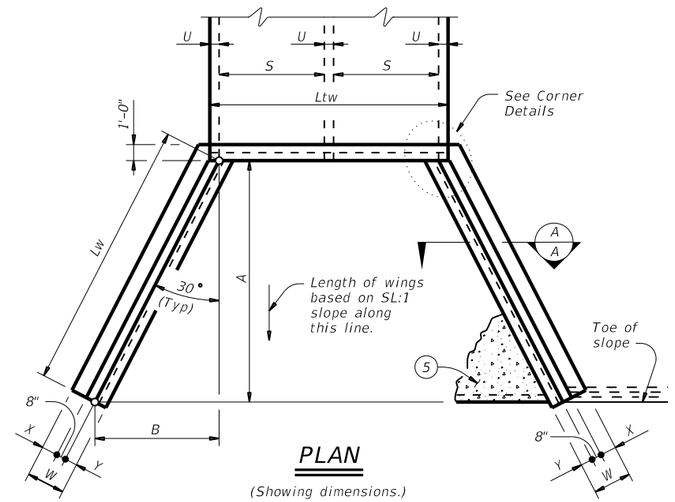
Hw = Height of wingwall
SL:1 = Side slope ratio (horizontal:1 vertical)
Lw = Length of wingwall
Ltw = Culvert toewall length
N = Number of culvert spans

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



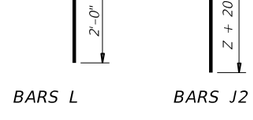
INSIDE ELEVATION

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



PLAN

(Showing dimensions.)

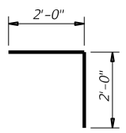


BARS D

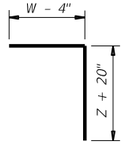
BARS R

BARS J1

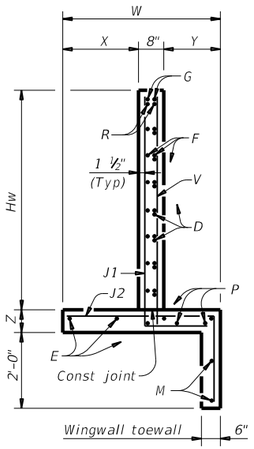
BARS V



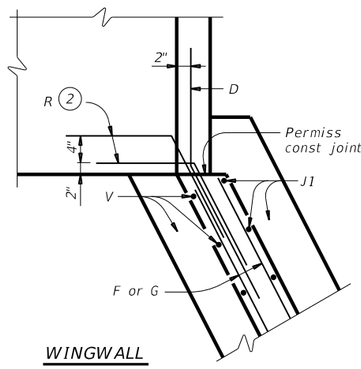
BARS L



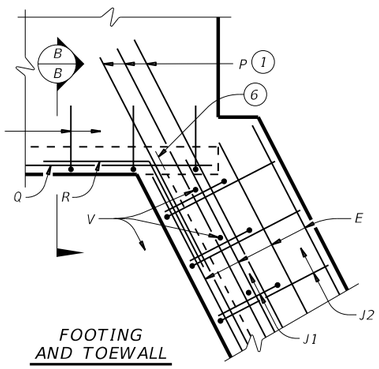
BARS J2



SECTION A-A



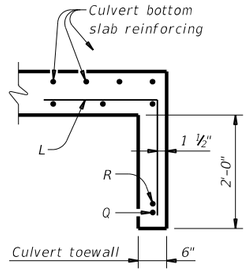
WINGWALL



FOOTING AND TOEWALL

CORNER DETAILS

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



SECTION B-B (5)

(1) Extend Bars P 3'-0" minimum into bottom slab of box culvert.

(2) Adjust as necessary to maintain 1 1#2" clear cover and 4" minimum between bars.

(3) Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings, multiply the tabulated values by Lw.

(4) Recommended values of side slope are: 2:1, 3:1, 4:1, and 6:1.

(5) When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, provide a 6" wide by 1'-6" deep reinforced concrete toewall along all edges of the riprap adjacent to natural ground; reinforce the toewall by extending typical riprap reinforcing into the toewall; and extend construction joints or grooved joints oriented in the direction of flow across the full distance of the riprap at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required.

(6) At Contractor's option, culvert toewall may be ended flush with wingwall toewall. Adjust reinforcing as needed.

(7) 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.

(8) 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.

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

GENERAL NOTES:
Designed according to AASHTO LRFD Bridge Design Specifications.
When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.
See Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.
The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

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

Texas Department of Transportation

Bridge Division Standard

CONCRETE WINGWALLS
WITH FLARED WINGS FOR 0° SKEW BOX CULVERTS

FW-0

FILE: fw-0std-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		135

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

Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing length (2~wings) (3)	
					Bars J1		Bars J2			
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'-8"	1'-9"	1'-3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'-2"	2'-0"	1'-6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'-8"	2'-3"	1'-9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'-2"	2'-6"	2'-0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'-8"	2'-9"	2'-3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'-2"	3'-0"	2'-6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'-8"	3'-3"	2'-9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'-2"	3'-6"	3'-0"	1'-0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'-8"	4'-0"	3'-0"	1'-1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'-2"	4'-6"	3'-0"	1'-3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING
(2~wings)

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

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

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

Hw = H + T + C - 0.250'
A = (Hw - 0.333')(Sc)
B = (A) [tanget (θ + 15°)]
Lw = (A) ÷ [cosine (θ + 15°)]

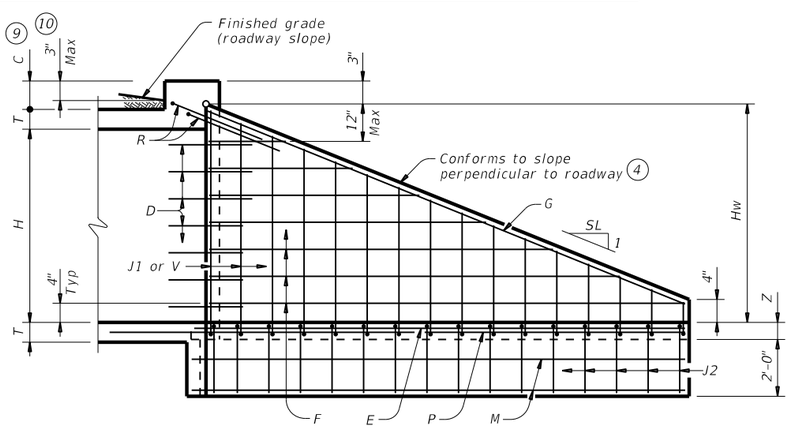
For cast-in-place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ cosine θ

For precast culverts:
Ltw = [(N) (2U + S) + (N - 1) (0.5')] ÷ cosine θ

Total wingwall area (two wings ~ SF) = 0.5 (Hw + 0.333') (Lw + A)

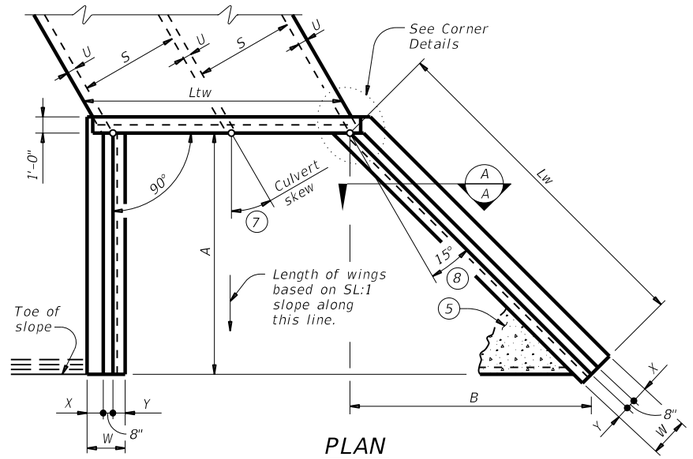
Hw = Height of wingwall
SL:1 = Side slope ratio (horizontal:1 vertical)
A = Length of short wingwalls
Lw = Length of long wingwall
Ltw = Culvert toewall length
N = Number of culvert spans
θ = Culvert skew

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



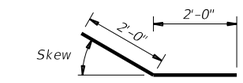
INSIDE ELEVATION

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

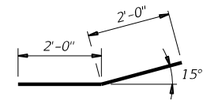


PLAN

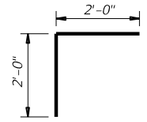
(Showing dimensions and 30° skew.)



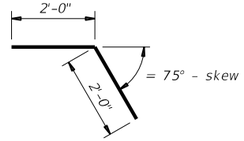
BARS DS
(Short wing)



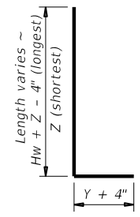
BARS DL
(Long wing)



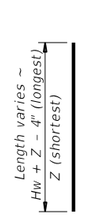
BARS RS
(Short wing)



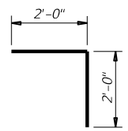
BARS RL
(Long wing)



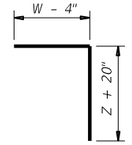
BARS J1



BARS V



BARS L



BARS J2

(1) Extend Bars P 3'-0" minimum into bottom slab of box culvert.

(2) Adjust as necessary to maintain 1 1#2" clear cover and 4" minimum between bars.

(3) Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings, multiply the tabulated values by 0.5 x (A + Lw).

(4) Recommended values of side slope are: 2:1, 3:1, 4:1, and 6:1.

(5) When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, provide a 6" wide by 1'-6" deep reinforced concrete toewall along all edges of the riprap adjacent to natural ground; reinforce the toewall by extending typical riprap reinforcing into the toewall; and extend construction joints or grooved joints oriented in the direction of flow across the full distance of the riprap at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required.

(6) At Contractor's option, culvert toewall may be ended flush with wingwall toewall. Adjust reinforcing as needed.

(7) Applicable values of skew are: 15°, 30°, and 45°.

(8) Typical wingwall angle for all skews.

(9) 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.

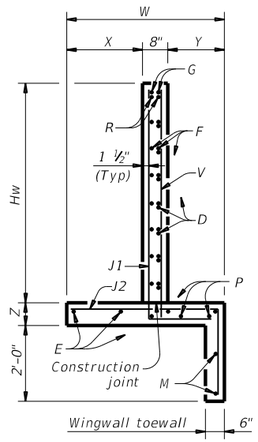
(10) For vehicle safety, the following requirements must be met:
- For structures without bridge rail, construct curbs no more than 3" above finished grade.
- For structures with bridge rail, construct curbs flush with finished grade.

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.

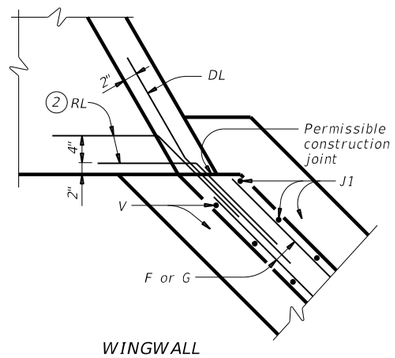
MATERIAL NOTES:
Provide Class C concrete (f'c=3,600 psi).
Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
In riprap concrete, synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

GENERAL NOTES:
Designed according to AASHTO LRFD Bridge Design Specifications.
When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.
See Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.
The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

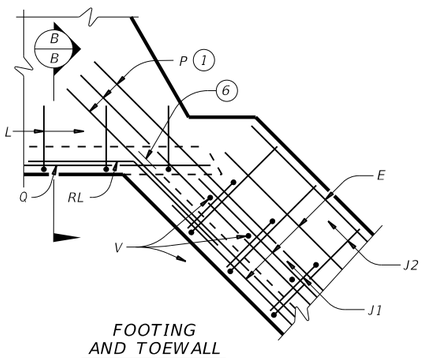
Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing dimensions are out-to-out of bars.



SECTION A-A



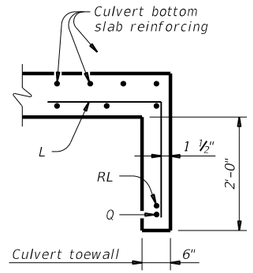
WINGWALL



FOOTING AND TOEWALL

CORNER DETAILS

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



SECTION B-B (5)

Texas Department of Transportation

Bridge Division Standard

CONCRETE WINGWALLS WITH FLARED WINGS FOR SKEWED BOX CULVERTS

FW-S

FILE: fw-sstde-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		136

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

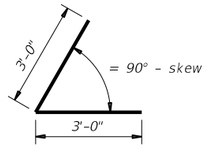
Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing (2~wings) (4)		Estimated Quantities per ft of Toewall (1~toewall)	
					Bars J1		Bars J2					
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'-0"	7"	#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)

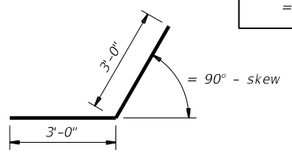
Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

TABLE OF TOEWALL REINFORCING

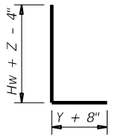
Bar	Size	No.	Spa
J3	#4	~	1'-0"
M2	#4	2	~
E2	#4	~	1'-0"



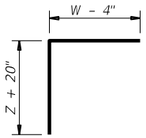
BARS D1



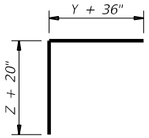
BARS D2



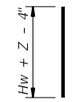
BARS J1



BARS J2



BARS J3



BARS V

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

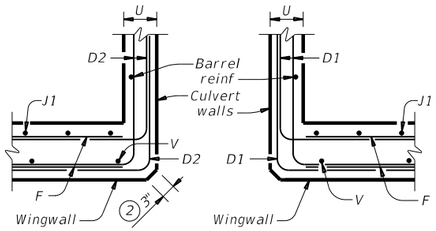
Hw = H + T + C
Lw = (Hw) (SL) ÷ cosine (θ) for Type PW-1
= (Hw - 1') (SL) ÷ cosine (θ) for Type PW-2 and Hw ≥ 4'
= (Hw - 0.5') (SL) ÷ cosine (θ) for Type PW-2 and Hw < 4'

For cast-in-place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ cosine (θ)

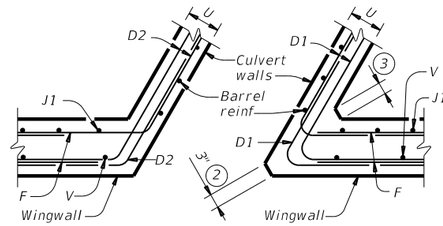
For precast culverts:
Ltw = [(N) (2 U + S) + (N - 1) (0.5')] ÷ cosine (θ)
Total Wingwall Area (two wings ~ SF)
= (2)(Hw)(Lw) for Type PW-1
= (2)(Hw)(Lw) - 6 SF for Type PW-2 and Hw ≥ 4'
= (2)(Hw)(Lw) - 1.5 SF for Type PW-2 and Hw < 4'

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

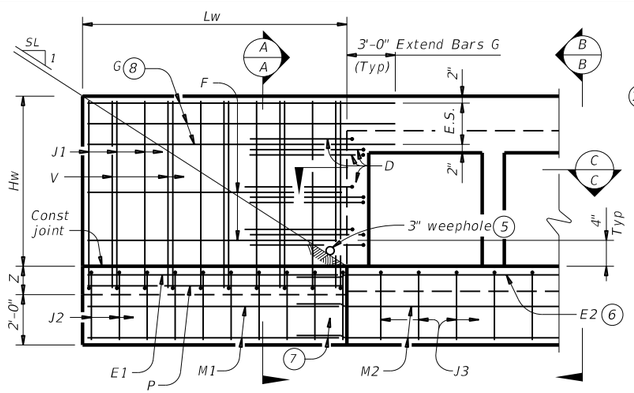
See applicable box culvert standard sheet for S, H, T, and U values.



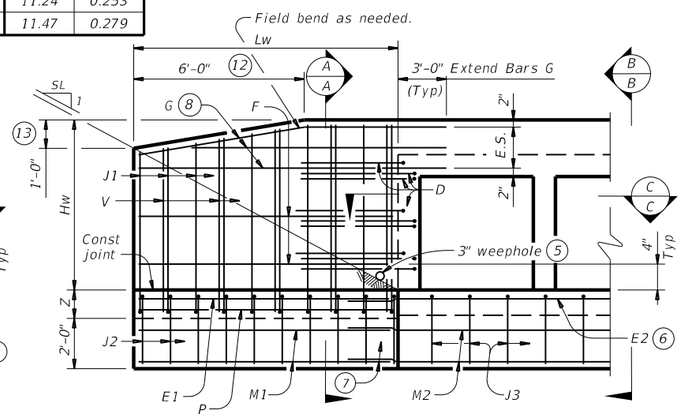
SECTION C-C - PW-1



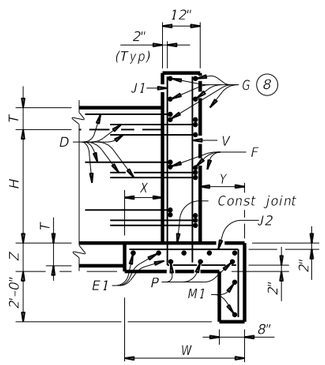
SECTION C-C - PW-2



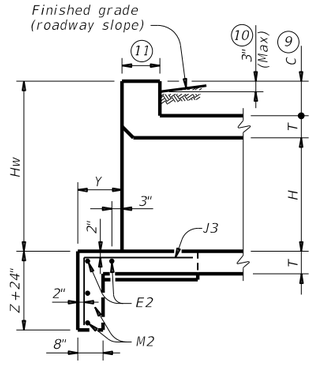
PARTIAL ELEVATION - PW-1



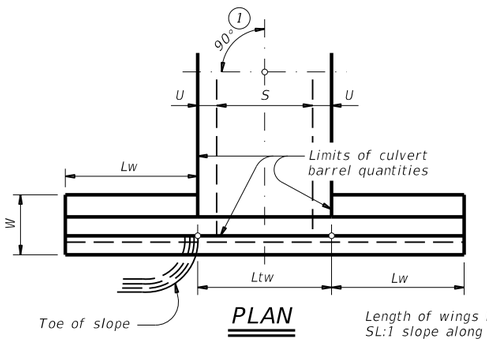
PARTIAL ELEVATION - PW-2



SECTION A-A
(Showing wing reinforcement.)

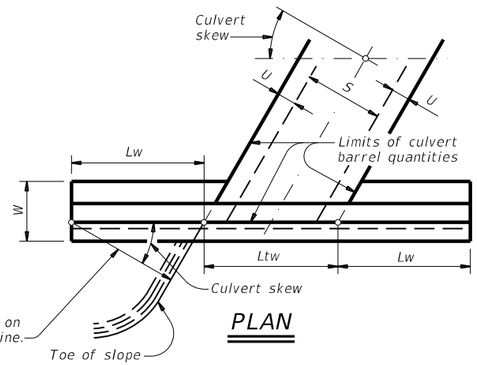


SECTION B-B
(Showing wing reinforcement.)



PLAN

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

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

1. Skew = 0°
2. At discharge end, chamfer may be ¾" minimum.
3. For 15° skew ~ 1"
   For 30° skew ~ 2"
   For 45° skew ~ 3"
4. 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.
5. Provide weepholes for Hw = 5'-0" and greater. Fill around weepholes with coarse gravel.
6. Extend Bars E2 1'-6" minimum into the wingwall footing.
7. Lap Bars M1 1'-6" minimum with Bars M2.
8. Place Bars G as shown, equally spaced at 8" maximum. Provide at least two pairs of Bars G per wing.
9. 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.
10. 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.
11. 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elswhere in the plans.
12. 3'-0" for Hw < 4'.
13. 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 reinforing 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.

Texas Department of Transportation
Bridge Division Standard

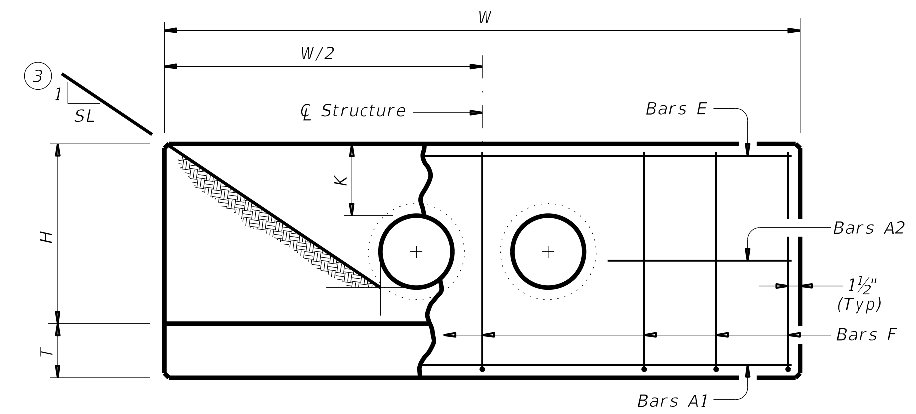
CONCRETE WINGWALLS
WITH PARALLEL WINGS FOR BOX CULVERTS
TYPES PW-1 AND PW-2

PW

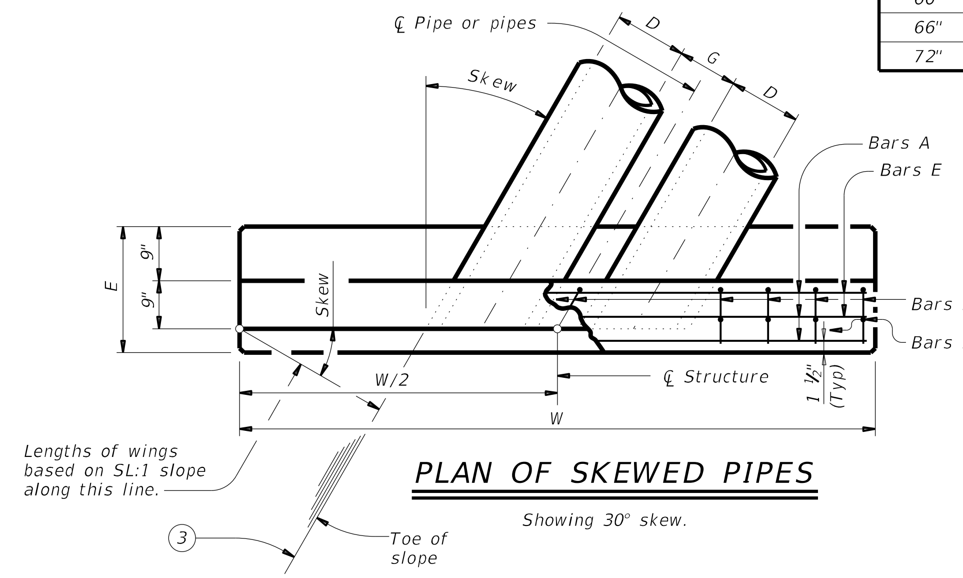
FILE:	pwstde01-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT	February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS		2355	01	006, ETC.	FM 2451
		DIST	COUNTY		SHEET NO.
		DAL	KAUFMAN		137

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

Slope	Dia of Pipe (D)	15° Skew: Values for One Pipe: W	Reinf (Lbs) (1)	Conc (CY) (2)	15° Skew: Values To Be Added for Each Addt'l Pipe: W	Reinf (Lbs) (1)	Conc (CY) (2)	30° Skew: Values for One Pipe: W	Reinf (Lbs) (1)	Conc (CY) (2)	30° Skew: Values To Be Added for Each Addt'l Pipe: W	Reinf (Lbs) (1)	Conc (CY) (2)	45° Skew: Values for One Pipe: W	Reinf (Lbs) (1)	Conc (CY) (2)	45° Skew: Values To Be Added for Each Addt'l Pipe: W	Reinf (Lbs) (1)	Conc (CY) (2)
2:1	12"	9' - 4"	124	1.1	1' - 9 ¾"	15	0.2	10' - 5"	130	1.2	2' - 0"	16	0.2	12' - 9"	159	1.5	2' - 5 ¾"	17	0.3
	15"	10' - 7"	136	1.3	2' - 3"	17	0.2	11' - 10"	159	1.5	2' - 6"	18	0.2	14' - 6"	191	1.8	3' - 0 ¾"	20	0.3
	18"	11' - 11"	165	1.5	2' - 9"	19	0.3	13' - 3"	174	1.7	3' - 1"	29	0.3	16' - 3"	207	2.1	3' - 9 ¼"	33	0.4
	21"	13' - 2"	203	1.9	3' - 2 ¼"	31	0.4	14' - 9"	233	2.1	3' - 6 ¾"	33	0.4	18' - 0"	276	2.6	4' - 4 ¼"	36	0.5
	24"	14' - 6"	240	2.1	3' - 8 ¼"	34	0.4	16' - 2"	251	2.4	4' - 1 ¾"	36	0.5	19' - 10"	318	2.9	5' - 0 ¾"	39	0.6
	27"	15' - 9"	258	2.5	4' - 0 ¾"	38	0.5	17' - 7"	292	2.8	4' - 6 ¼"	39	0.6	21' - 7"	342	3.4	5' - 6 ¼"	44	0.7
	30"	17' - 1"	297	2.8	4' - 5 ¾"	40	0.6	19' - 1"	311	3.1	5' - 0"	42	0.6	23' - 4"	388	3.8	6' - 1 ¾"	47	0.8
	33"	18' - 5"	320	3.3	4' - 9 ¾"	43	0.6	20' - 6"	358	3.6	5' - 4 ¾"	46	0.7	25' - 1"	439	4.4	6' - 7 ¼"	51	0.9
	36"	19' - 8"	401	4.0	5' - 3"	47	0.9	21' - 11"	422	4.5	5' - 10 ¾"	50	0.9	26' - 10"	517	5.5	7' - 2 ¼"	55	1.2
	42"	22' - 3"	476	5.0	6' - 0 ¾"	53	1.1	24' - 10"	528	5.6	6' - 8 ¾"	56	1.2	30' - 5"	634	6.9	8' - 3"	76	1.4
	48"	25' - 11"	577	6.6	6' - 9 ¾"	60	1.3	28' - 10"	637	7.3	7' - 7 ¼"	79	1.5	35' - 4"	791	9.0	9' - 3 ¾"	88	1.8
	54"	28' - 6"	711	7.8	7' - 9"	83	1.6	31' - 9"	781	8.7	8' - 8"	81	1.8	38' - 11"	958	10.7	10' - 7 ¼"	97	2.2
	60"	31' - 1"	805	9.2	8' - 6 ¼"	91	1.9	34' - 8"	881	10.2	9' - 6 ¼"	97	2.1	42' - 5"	1,113	12.5	11' - 8"	124	2.6
	66"	33' - 8"	907	10.6	9' - 0 ¾"	98	2.1	37' - 6"	1,028	11.8	10' - 1 ¼"	102	2.4	46' - 0"	1,235	14.5	12' - 4 ¼"	132	2.9
	72"	36' - 3"	1,071	12.1	9' - 8"	105	2.4	40' - 5"	1,207	13.5	10' - 9 ¼"	110	2.6	49' - 6"	1,446	16.6	13' - 2 ¼"	141	3.2
3:1	12"	13' - 6"	178	1.6	1' - 9 ¾"	15	0.2	15' - 0"	189	1.8	2' - 0"	15	0.2	18' - 5"	237	2.2	2' - 5 ¾"	17	0.2
	15"	15' - 3"	212	1.9	2' - 3"	17	0.2	17' - 0"	223	2.1	2' - 6"	17	0.3	20' - 10"	276	2.6	3' - 0 ¾"	20	0.3
	18"	17' - 1"	231	2.3	2' - 9"	19	0.3	19' - 1"	259	2.5	3' - 1"	29	0.3	23' - 4"	318	3.1	3' - 9 ¼"	32	0.4
	21"	18' - 11"	306	2.7	3' - 2 ¼"	31	0.4	21' - 1"	339	3.0	3' - 6 ¾"	33	0.4	25' - 10"	413	3.7	4' - 4 ¼"	36	0.5
	24"	20' - 8"	345	3.1	3' - 8 ¾"	35	0.4	23' - 1"	384	3.5	4' - 1 ¾"	36	0.5	28' - 3"	462	4.2	5' - 0 ¾"	40	0.6
	27"	22' - 6"	376	3.7	4' - 0 ¾"	38	0.5	25' - 1"	438	4.1	4' - 6 ¼"	39	0.6	30' - 9"	522	5.0	5' - 6 ¼"	44	0.7
	30"	24' - 4"	422	4.1	4' - 5 ¾"	40	0.6	27' - 2"	466	4.6	5' - 0"	42	0.6	33' - 3"	578	5.6	6' - 1 ¾"	47	0.8
	33"	26' - 2"	476	4.8	4' - 10"	43	0.6	29' - 2"	522	5.3	5' - 4 ¾"	46	0.7	35' - 9"	644	6.5	6' - 7 ¼"	51	0.9
	36"	27' - 11"	590	5.9	5' - 3"	47	0.8	31' - 2"	645	6.6	5' - 10 ¾"	50	0.9	38' - 2"	787	8.0	7' - 2 ¼"	56	1.2
	42"	31' - 7"	684	7.3	6' - 0 ¼"	53	1.1	35' - 3"	776	8.2	6' - 8 ¾"	56	1.2	43' - 2"	933	10.0	8' - 3"	79	1.4
	48"	36' - 9"	880	9.6	6' - 9 ¾"	61	1.3	41' - 0"	953	10.7	7' - 7 ¼"	81	1.5	50' - 2"	1,166	13.1	9' - 3 ¾"	88	1.8
	54"	40' - 5"	1,065	11.4	7' - 9"	85	1.6	45' - 0"	1,185	12.7	8' - 8"	89	1.8	55' - 2"	1,435	15.5	10' - 7 ¼"	97	2.2
	60"	44' - 0"	1,224	13.3	8' - 6 ¼"	93	1.9	49' - 1"	1,356	14.8	9' - 6 ¼"	96	2.1	60' - 1"	1,635	18.2	11' - 8"	124	2.6
	66"	47' - 7"	1,357	15.4	9' - 1"	98	2.1	53' - 1"	1,497	17.2	10' - 1 ¼"	103	2.3	65' - 1"	1,892	21.1	12' - 4 ¼"	130	2.9
	72"	51' - 3"	1,624	17.7	9' - 8"	105	2.3	57' - 2"	1,787	19.7	10' - 9 ¼"	109	2.6	70' - 0"	2,218	24.1	13' - 2 ¼"	139	3.2
4:1	12"	17' - 7"	232	2.1	1' - 9 ¾"	15	0.2	19' - 8"	259	2.4	2' - 0"	16	0.2	24' - 0"	314	2.9	2' - 5 ¾"	18	0.2
	15"	19' - 11"	272	2.5	2' - 3"	17	0.2	22' - 3"	301	2.8	2' - 6"	18	0.3	27' - 3"	361	3.5	3' - 0 ¾"	21	0.3
	18"	22' - 3"	313	3.0	2' - 9"	19	0.3	24' - 10"	344	3.3	3' - 1"	29	0.3	30' - 5"	427	4.0	3' - 9 ¼"	32	0.4
	21"	24' - 7"	407	3.6	3' - 2 ¼"	31	0.4	27' - 5"	446	4.0	3' - 6 ¾"	33	0.4	33' - 7"	549	4.9	4' - 4 ¼"	36	0.5
	24"	26' - 11"	455	4.1	3' - 8 ¾"	35	0.4	30' - 0"	499	4.5	4' - 1 ¾"	36	0.5	36' - 9"	609	5.6	5' - 0 ¾"	40	0.6
	27"	29' - 3"	514	4.8	4' - 0 ¾"	38	0.5	32' - 7"	562	5.4	4' - 6 ¼"	40	0.6	39' - 11"	703	6.6	5' - 6 ¼"	43	0.7
	30"	31' - 7"	568	5.4	4' - 5 ¾"	40	0.6	35' - 3"	620	6.0	5' - 0"	42	0.6	43' - 2"	768	7.4	6' - 1 ¾"	49	0.8
	33"	33' - 11"	634	6.2	4' - 10"	43	0.7	37' - 10"	710	7.0	5' - 4 ¾"	46	0.7	46' - 4"	848	8.5	6' - 7 ¼"	52	0.9
	36"	36' - 3"	776	7.7	5' - 3"	48	0.9	40' - 5"	868	8.6	5' - 10 ¾"	49	0.9	49' - 6"	1,058	10.6	7' - 2 ¼"	56	1.1
	42"	40' - 11"	921	9.6	6' - 0 ¼"	53	1.0	45' - 7"	1,022	10.7	6' - 8 ¾"	57	1.2	55' - 10"	1,262	13.1	8' - 3"	78	1.4
	48"	47' - 7"	1,152	12.6	6' - 10"	61	1.3	53' - 1"	1,268	14.0	7' - 7 ¼"	80	1.5	65' - 1"	1,587	17.2	9' - 3 ¾"	86	1.8
	54"	52' - 3"	1,416	14.9	7' - 9 ¼"	86	1.6	58' - 4"	1,589	16.6	8' - 8"	89	1.8	71' - 5"	1,924	20.4	10' - 7 ¼"	95	2.2
	60"	56' - 11"	1,606	17.5	8' - 6 ¾"	92	1.9	63' - 6"	1,806	19.5	9' - 6 ¼"	95	2.1	77' - 9"	2,192	23.9	11' - 8"	122	2.6
	66"	61' - 7"	1,819	20.2	9' - 0 ¾"	97	2.1	68' - 8"	2,019	22.5	10' - 1 ¼"	101	2.4	84' - 2"	2,472	27.6	12' - 4 ¼"	131	2.9
	72"	66' - 3"	2,150	23.2	9' - 8"	104	2.4	73' - 11"	2,379	25.9	10' - 9 ¼"	108	2.6	90' - 6"	2,937	31.7	13' - 2 ¼"	138	3.2
6:1	12"	25' - 11"	342	3.1	1' - 9 ¾"	15	0.2	28' - 10"	374	3.5	2' - 0"	16	0.2	35' - 4"	456	4.3	2' - 5 ¾"	17	0.2
	15"	29' - 3"	390	3.7	2' - 3"	17	0.2	32' - 7"	442	4.2	2' - 6"	18	0.2	39' - 11"	549	5.1	3' - 0 ¾"	20	0.3
	18"	32' - 7"	459	4.4	2' - 9"	20	0.3	36' - 4"	515	4.9	3' - 1"	29	0.3	44' - 7"	629	6.0	3' - 9 ¼"	33	0.4
	21"	36' - 0"	608	5.3	3' - 2 ¼"	31	0.4	40' - 2"	660	5.9	3' - 6 ¾"	33	0.4	49' - 2"	823	7.2	4' - 4 ¼"	38	0.5
	24"	39' - 4"	672	6.0	3' - 8 ¾"	35	0.4	43' - 11"	748	6.7	4' - 1 ¾"	36	0.5	53' - 9"	920	8.2	5' - 0 ¾"	42	0.6
	27"	42' - 8"	770	7.1	4' - 0 ¾"	38	0.5	47' - 8"	852	8.0	4' - 6 ¼"	41	0.5	58' - 4"	1,039	9.7	5' - 6 ¼"	45	0.7
	30"	46' - 1"	839	8.0	4' - 5 ¾"	40	0.6	51' - 5"	949	8.9	5' - 0"	44	0.6	62' - 11"	1,162	10.9	6' - 1 ¾"	48	0.8
	33"	49' - 5"	947	9.2	4' - 10"	45	0.7	55' - 2"	1,040	10.3	5' - 4 ¾"	48	0.7	67' - 6"	1,292	12.6	6' - 7 ¼"	50	0.9
	36"	52' - 10"	1,151	11.4	5' - 3"	49	0.8	58' - 11"	1,287	12.7	5' - 10 ¾"	51	1.0	72' - 1"	1,583	15.6	7' - 2 ¼"	55	1.1
	42"	59' - 6"	1,365	14.2	6' - 0 ¼"	55	1.0	66' - 5"	1,530	15.8	6' - 8 ¾"	57	1.2	81' - 4"	1,875	19.4	8' - 3"	76	1.4
	48"	69' - 4"	1,737	18.5	6' - 10"	59	1.3	77' - 4"	1,942	20.7	7' - 7 ¼"	79	1.5	94' - 9"	2,368	25.3	9' - 3 ¾"	86	1.8
	54"	76' - 1"	2,138	22.0	7' - 9 ¼"	83	1.6	84' - 10"	2,378	24.6	8' - 8"	87	1.8	103' - 11"	2,912	30.1	10' - 7 ¼"	95	2.2
	60"	82' - 10"	2,426	25.8	8' - 6 ¾"	90	1.9	92' - 5"	2,681	28.8	9' - 6 ¼"	94	2.1	113' - 2"	3,294	35.3	11' - 8"	122	2.6
	66"	89' - 7"	2,730	29.9	9' - 0 ¾"	96	2.1	99' - 11"	3,038	33.3	10' - 1 ¼"	101	2.4	122' - 4"	3,697	40.8	12' - 4 ¼"	130	2.9
	72"	96' - 3"	3,218	34.2	9' - 8"	102	2.4	107' - 5"	3,580	38.2	10' - 9 ¼"	108	2.6	131' - 6"	4,372	46.8	13' - 2 ¼"	139	3.2

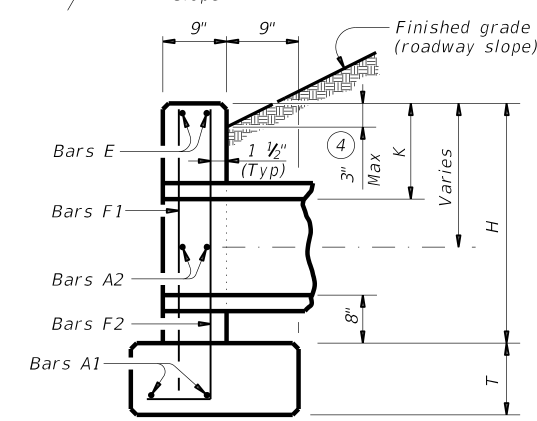


ELEVATION



PLAN OF SKEWED PIPES

Showing 30° skew.



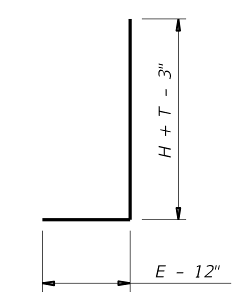
SECTION AT CENTER OF PIPE

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"	~



BARS F2

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.

1. Total quantites 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).

Texas Department of Transportation — Bridge Division Standard

CONCRETE HEADWALLS WITH PARALLEL WINGS FOR SKEWED PIPE CULVERTS

CH-PW-S

FILE: chpwsste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		138

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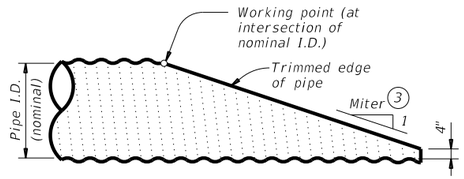
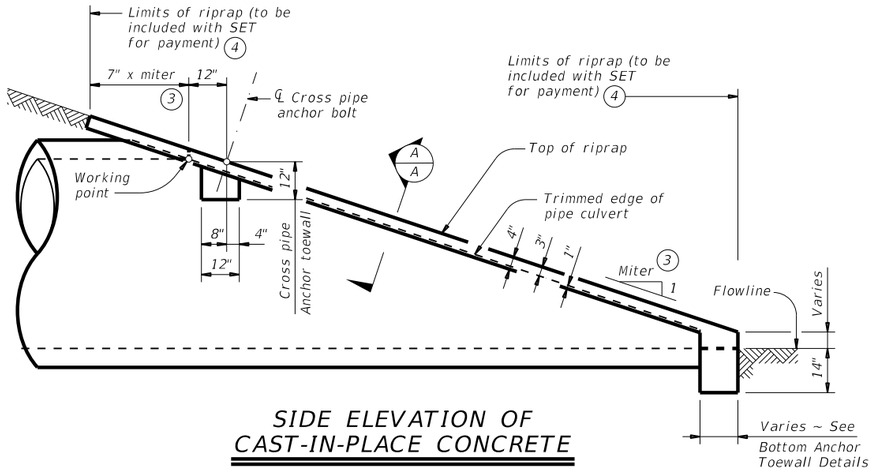


NOTE: All pipe runners, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

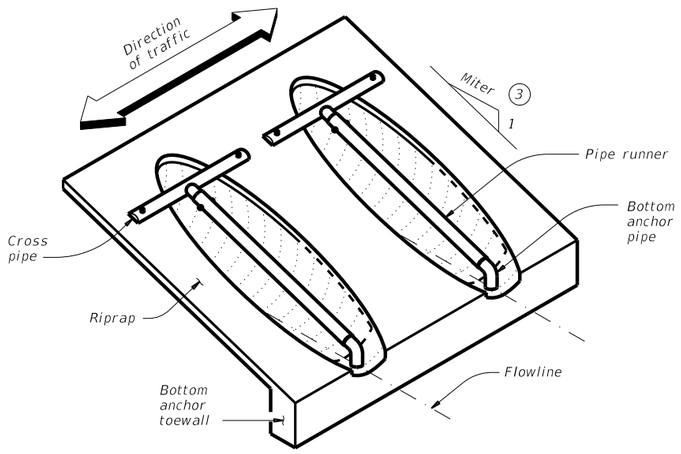
SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

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



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing reinforced concrete pipe (RCP) culvert.
Details of corrugated metal pipe (CMP) culvert
are similar. Pipe runners not shown for clarity)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

(Showing installation with no skew.)

CROSS PIPE LENGTHS AND PIPE RUNNER LENGTHS (1) (2)

Nominal Culvert I.D.	Pipe Culvert Spa ~ G	Cross Pipe Length	Pipe Runner Length											
			3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
			0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
24"	1' - 7"	3' - 5"	N/A	N/A	N/A	5' - 10"	N/A	N/A	N/A	8' - 1"	N/A	N/A	N/A	12' - 9"
27"	1' - 8"	3' - 8"	N/A	N/A	5' - 5"	6' - 11"	N/A	N/A	7' - 7"	9' - 7"	N/A	N/A	11' - 11"	14' - 11"
30"	1' - 10"	3' - 11"	N/A	N/A	6' - 4"	8' - 0"	N/A	N/A	8' - 9"	11' - 0"	N/A	N/A	13' - 8"	17' - 0"
33"	1' - 11"	4' - 2"	6' - 2"	6' - 5"	7' - 3"	9' - 1"	8' - 6"	8' - 10"	10' - 0"	12' - 5"	13' - 3"	13' - 9"	15' - 5"	19' - 2"
36"	2' - 1"	4' - 5"	6' - 11"	7' - 3"	8' - 2"	10' - 2"	9' - 6"	9' - 11"	11' - 2"	13' - 10"	14' - 9"	15' - 3"	17' - 2"	21' - 3"
42"	2' - 4"	4' - 11"	8' - 6"	8' - 10"	9' - 11"	12' - 4"	11' - 7"	12' - 0"	13' - 6"	16' - 8"	17' - 9"	18' - 5"	20' - 8"	25' - 7"
48"	2' - 7"	5' - 5"	10' - 1"	10' - 5"	11' - 9"	N/A	13' - 7"	14' - 2"	15' - 10"	N/A	20' - 9"	21' - 6"	24' - 2"	N/A
54"	3' - 0"	5' - 11"	11' - 8"	12' - 1"	N/A	N/A	15' - 8"	16' - 3"	N/A	N/A	23' - 10"	24' - 8"	N/A	N/A
60"	3' - 3"	6' - 5"	13' - 3"	N/A	N/A	N/A	17' - 9"	N/A	N/A	N/A	26' - 10"	N/A	N/A	N/A

TYPICAL PIPE CULVERT MITERS (3)

Side Slope	0° Skew	15° Skew	30° Skew	45° Skew
3:1	3:1	3.106:1	3.464:1	4.243:1
4:1	4:1	4.141:1	4.619:1	5.657:1
6:1	6:1	6.212:1	6.928:1	8.485:1

CONDITIONS WHERE PIPE RUNNERS ARE NOT REQUIRED (2)

Nominal Culvert I.D.	Single Pipe Culvert	Multiple Pipe Culverts
12" thru 21"	Skews thru 45°	Skews thru 45°
24"	Skews thru 45°	Skews thru 30°
27"	Skews thru 30°	Skews thru 15°
30"	Skews thru 15°	Skews thru 15°
33"	Skews thru 15°	Always required
36"	Normal (no skew)	Always required
42" thru 60"	Always required	Always required

STANDARD PIPE SIZES AND MAX PIPE RUNNER LENGTHS (1)

Pipe Size	Pipe O.D.	Pipe I.D.	Max Pipe Runner Length
2" STD	2.375"	2.067"	N/A
3" STD	3.500"	3.068"	10' - 0"
4" STD	4.500"	4.026"	19' - 8"
5" STD	5.563"	5.047"	34' - 2"

ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) (5)

Nominal Culvert I.D.	3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
12"	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.8
15"	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9
18"	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	1.0
21"	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.2
24"	0.6	0.7	0.7	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.1	1.3
27"	0.7	0.7	0.8	0.9	0.8	0.9	0.9	1.1	1.1	1.1	1.2	1.4
30"	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.2	1.2	1.3	1.6
33"	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.3	1.4	1.5	1.7
36"	0.9	0.9	0.9	1.1	1.1	1.1	1.2	1.4	1.4	1.5	1.6	1.8
42"	1.0	1.0	1.1	1.3	1.2	1.3	1.3	1.6	1.6	1.7	1.8	2.1
48"	1.1	1.1	1.2	N/A	1.4	1.4	1.5	N/A	1.9	1.9	2.1	N/A
54"	1.3	1.3	N/A	N/A	1.6	1.6	N/A	N/A	2.1	2.1	N/A	N/A
60"	1.4	N/A	N/A	N/A	1.7	N/A	N/A	N/A	2.3	N/A	N/A	N/A

(1) Provide pipe runner of the size shown in the tables. Provide cross pipe of the same size as the pipe runner. Provide cross pipe stub out and bottom anchor pipe of the next smaller size pipe as shown in the Standard Pipe Sizes and Max Pipe Runner Lengths table.

(2) This standard allows for the placement of only one pipe runner across each culvert pipe opening. In order to limit the clear opening to be traversed by an errant vehicle, the following conditions must be met:

For 60" culvert pipes, the skew must not exceed 0°.
For 54" culvert pipes, the skew must not exceed 15°.
For 48" culvert pipes, the skew must not exceed 30°.
For all culvert pipe sizes 42" and less, the skew must not exceed 45°.

If the above conditions cannot be met, the designer should consider using a safety end treatment with flared wings. For further information, refer to the TxDOT Roadway Design Manual.

(3) Miter = slope of mitered end of pipe culvert.

(4) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(5) 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.

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA
PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD

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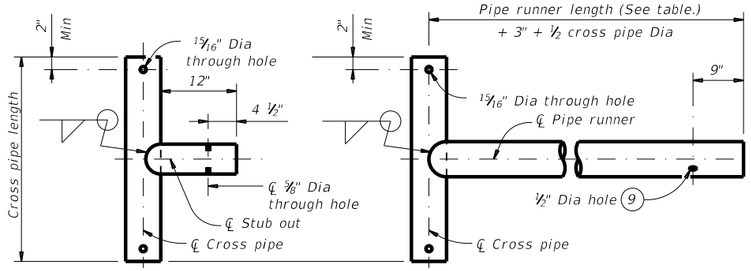
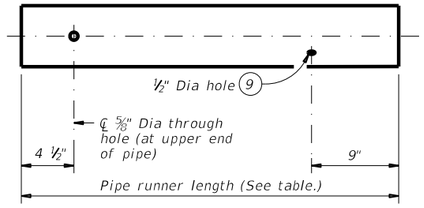


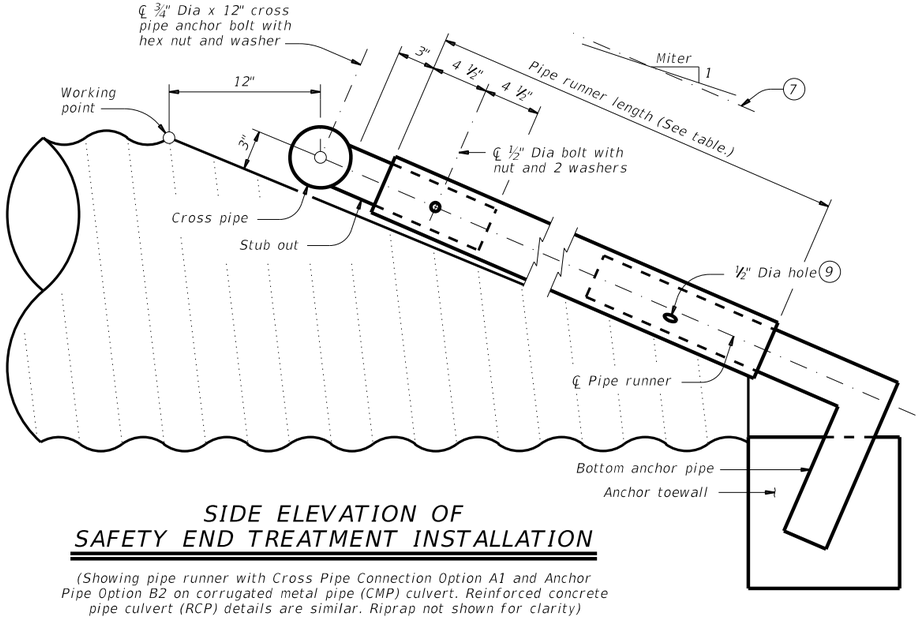
OPTION A1 OPTION A2

CROSS PIPE AND CONNECTIONS DETAILS



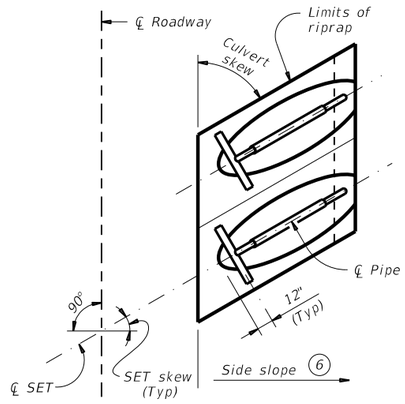
NOTE: The separate pipe runner shown is required when Cross Pipe Connection Option A1 is used.

PIPE RUNNER DETAILS

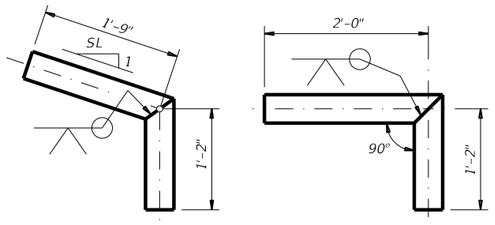


SIDE ELEVATION OF SAFETY END TREATMENT INSTALLATION

(Showing pipe runner with Cross Pipe Connection Option A1 and Anchor Pipe Option B2 on corrugated metal pipe (CMP) culvert. Reinforced concrete pipe culvert (RCP) details are similar. Riprap not shown for clarity)

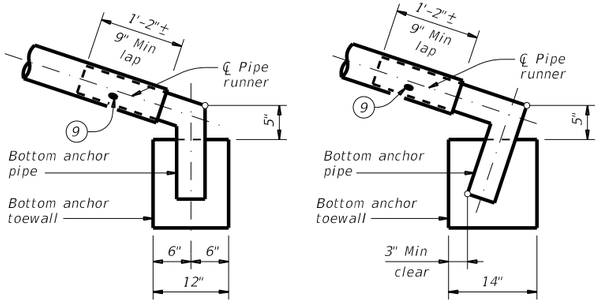


PLAN OF SKEWED INSTALLATION



OPTION B1 OPTION B2

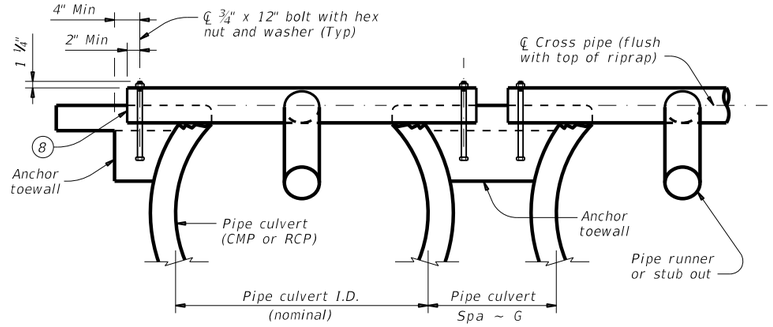
BOTTOM ANCHOR PIPE DETAILS (10)



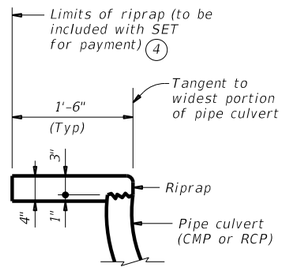
OPTION B1 OPTION B2

BOTTOM ANCHOR TOEWALL DETAILS

(Culvert and riprap not shown for clarity.)



SHOWING CROSS PIPE AND ANCHOR TOEWALL



SHOWING TYPICAL PIPE CULVERT AND RIPRAP

SECTION A-A

(4) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(6) Recommended values of side slope are 3:1, 4:1, and 6:1. All quantities, calculations, and dimensions shown herein are based on these recommended values. Slope of 3:1 or flatter is required for vehicle safety.

(7) Note that actual slope of pipe runner may vary slightly from side slope of riprap and trimmed culvert pipe edge.

(8) Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access.

(9) After installation, inspect the 1/2" hole to ensure that the lap of the pipe runner with the bottom anchor pipe is adequate.

(10) At fabricator's option, a heat bend to a smooth 5" radius or a manufactured elbow (of the same material as the runner) may be substituted for the mitered and welded joint in the bottom anchor pipe.

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, cross pipes, and anchor pipes conforming to 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:

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

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 pipe runners.

Payment for riprap and toewall is included in the price bid for each safety end treatment.

Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD

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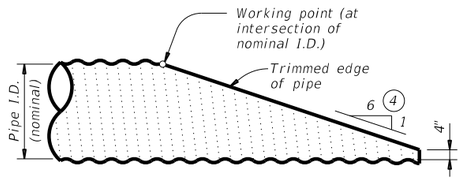
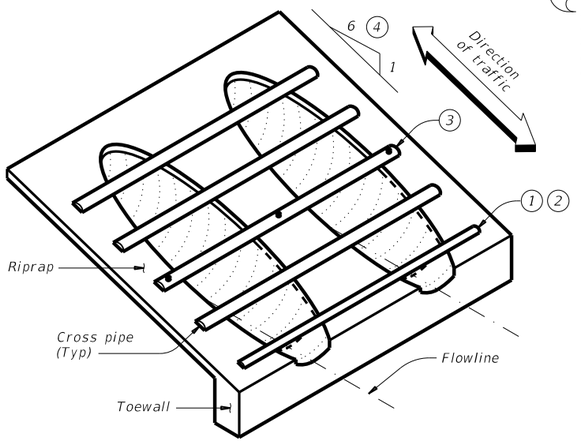


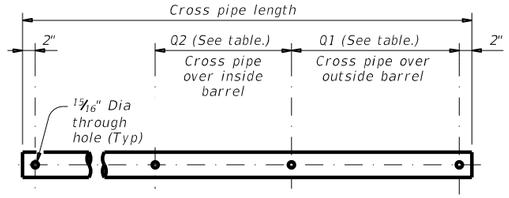
NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

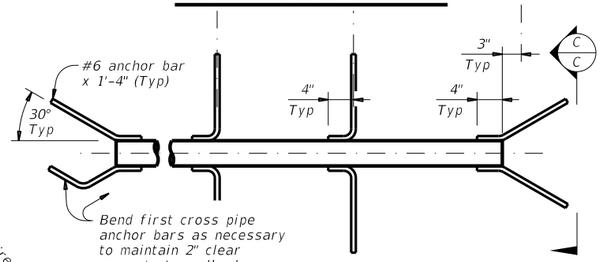
(Showing corrugated metal pipe (CMP) culvert Details at reinforced concrete pipe (RCP) culvert are similar.)



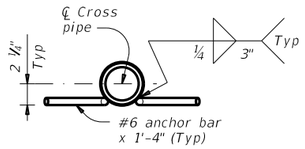
ISOMETRIC VIEW OF TYPICAL INSTALLATION



PIPE WITH BOLTED ANCHOR

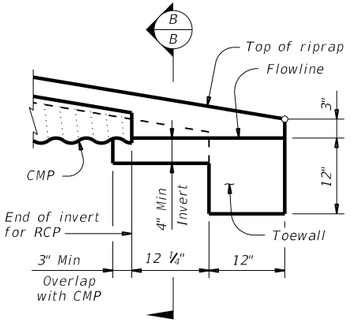


PIPE WITH ANCHOR BARS



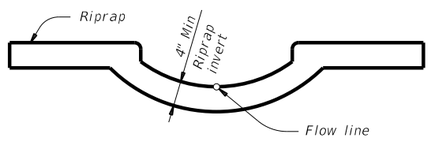
SECTION C-C

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.)

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, AND RIPRAP QUANTITIES (2)

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"		
27"	1.0	1' - 8"	N/A	3' - 10"	3' - 11"	3 or more pipe culverts	3 1/2" Std (4.000" O.D.)
30"	1.1	1' - 10"	N/A	4' - 2"	4' - 4"	2 or more pipe culverts	
33"	1.2	1' - 11"	4' - 2"	4' - 5"	4' - 8"	All pipe culverts	
36"	1.3	2' - 1"	4' - 5"	4' - 9"	5' - 1"	All pipe culverts	4" Std (4.500" O.D.)
42"	1.5	2' - 4"	4' - 11"	5' - 5"	5' - 10"		
48"	1.7	2' - 7"	5' - 5"	6' - 0"	6' - 7"	All pipe culverts	5" Std (5.563" O.D.)
54"	2.0	3' - 0"	5' - 11"	6' - 9"	7' - 6"		
60"	2.2	3' - 3"	6' - 5"	7' - 4"	8' - 3"		
66"	2.4	3' - 3"	6' - 11"	7' - 10"	8' - 9"		
72"	2.7	3' - 4"	7' - 5"	8' - 5"	9' - 4"		

(1) 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 flow line.

(2) 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.

(3) 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.

(4) Match cross slope as shown elsewhere in the plans. Cross slope of 6:1 or flatter is required for vehicle safety.

(5) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(6) 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.

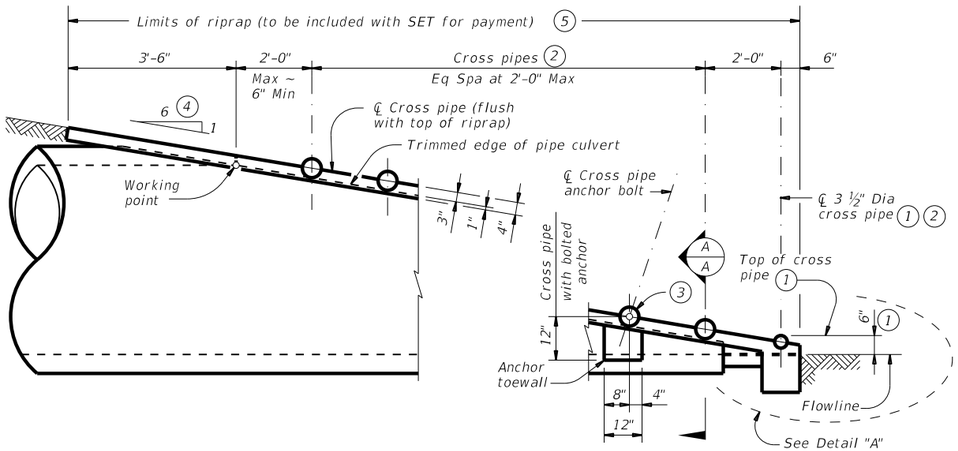
GENERAL NOTES:

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.

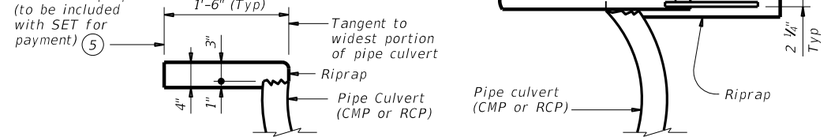
Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.



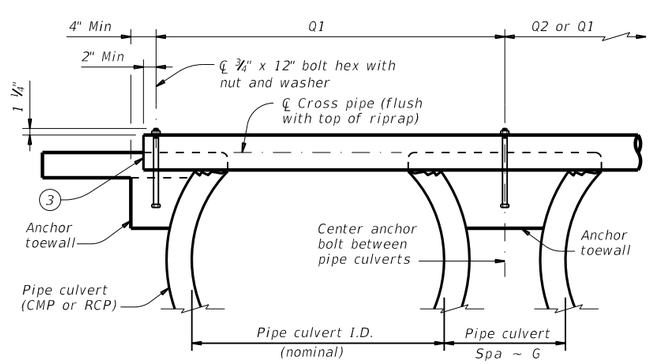
SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

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



SHOWING CROSS PIPE WITH ANCHOR BAR

SHOWING TYPICAL PIPE CULVERT AND RIPRAP



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 72" DIA PIPE CULVERTS
TYPE II ~ PARALLEL DRAINAGE

SETP-PD

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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 Addt'l Pipe		
		W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
3:1	33"	14' – 5 ¾"	4' – 8"	9' – 6"	10' – 11 ¾"	316	3.4	4' – 8"	84	1.2
	36"	15' – 7 ¾"	4' – 11 ½"	10' – 3"	11' – 10"	349	3.8	5' – 1"	96	1.4
	42"	17' – 11 ½"	5' – 6 ½"	11' – 9"	13' – 6 ¾"	430	4.9	5' – 10"	119	1.8
	48"	21' – 1 ¾"	6' – 1 ½"	14' – 0"	16' – 2"	535	6.5	6' – 7"	146	2.4
	54"	23' – 5 ½"	6' – 8 ½"	15' – 6"	17' – 10 ¾"	628	7.8	7' – 6"	186	3.0
	60"	25' – 9 ¼"	7' – 3 ½"	17' – 0"	19' – 7 ½"	717	9.2	8' – 3"	219	3.5
	66"	28' – 1"	7' – 10 ½"	18' – 6"	21' – 4 ¼"	809	10.7	8' – 9"	242	4.0
	72"	30' – 4 ¾"	8' – 5 ½"	20' – 0"	23' – 1 ¼"	922	12.3	9' – 4"	272	4.6
4:1	33"	18' – 1 ¾"	4' – 8"	12' – 8"	14' – 7 ½"	423	4.8	4' – 8"	101	1.5
	36"	19' – 7"	4' – 11 ½"	13' – 8"	15' – 9 ¼"	470	5.5	5' – 1"	115	1.7
	42"	22' – 5 ¾"	5' – 6 ½"	15' – 8"	18' – 1"	581	7.0	5' – 10"	141	2.2
	48"	26' – 6 ¼"	6' – 1 ½"	18' – 8"	21' – 6 ¾"	728	9.4	6' – 7"	175	3.0
	54"	29' – 5"	6' – 8 ½"	20' – 8"	23' – 10 ¼"	873	11.3	7' – 6"	226	3.7
	60"	32' – 3 ¾"	7' – 3 ½"	22' – 8"	26' – 2"	994	13.4	8' – 3"	264	4.4
	66"	35' – 2 ½"	7' – 10 ½"	24' – 8"	28' – 5 ¾"	1,138	15.6	8' – 9"	300	5.0
	72"	38' – 1 ¼"	8' – 5 ½"	26' – 8"	30' – 9 ½"	1,295	18.0	9' – 4"	334	5.7
6:1	33"	25' – 5 ½"	4' – 8"	19' – 0"	21' – 11 ¼"	673	8.3	4' – 8"	127	2.1
	36"	27' – 5 ¾"	4' – 11 ½"	20' – 6"	23' – 8"	733	9.5	5' – 1"	144	2.4
	42"	31' – 6 ¼"	5' – 6 ½"	23' – 6"	27' – 1 ½"	920	12.1	5' – 10"	179	3.1
	48"	37' – 3 ½"	6' – 1 ½"	28' – 0"	32' – 4"	1,189	16.6	6' – 7"	231	4.1
	54"	41' – 4 ¼"	6' – 8 ½"	31' – 0"	35' – 9 ½"	1,422	20.0	7' – 6"	300	5.1
	60"	45' – 4 ¾"	7' – 3 ½"	34' – 0"	39' – 3"	1,629	23.8	8' – 3"	353	6.1

(1) Quantities shown are for concrete pipe and will increase slightly for metal pipe installation.

(2) For vehicle safety, reduce curb heights, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.

(3) Provide a 1'-0" footing as shown where required to maintain 4" minimum cover for pipes.

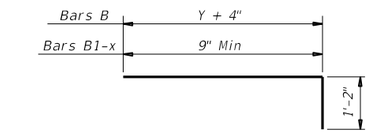
(4) Dimensions shown are usual and maximum.

(5) Quantities shown are for one structure end. (One headwall)

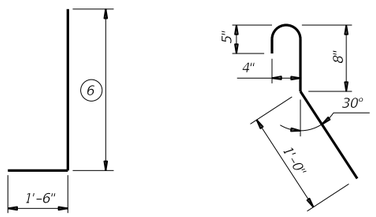
(6) Min Length = $6" + 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = $12 \times H - 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right) - 1"$

(7) Lengths of wings based on SL:1 slope along this line.

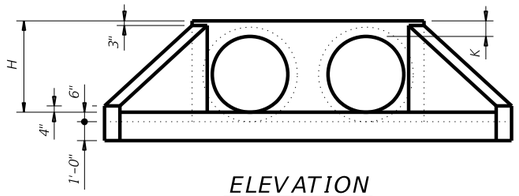


BARS B and B1-x



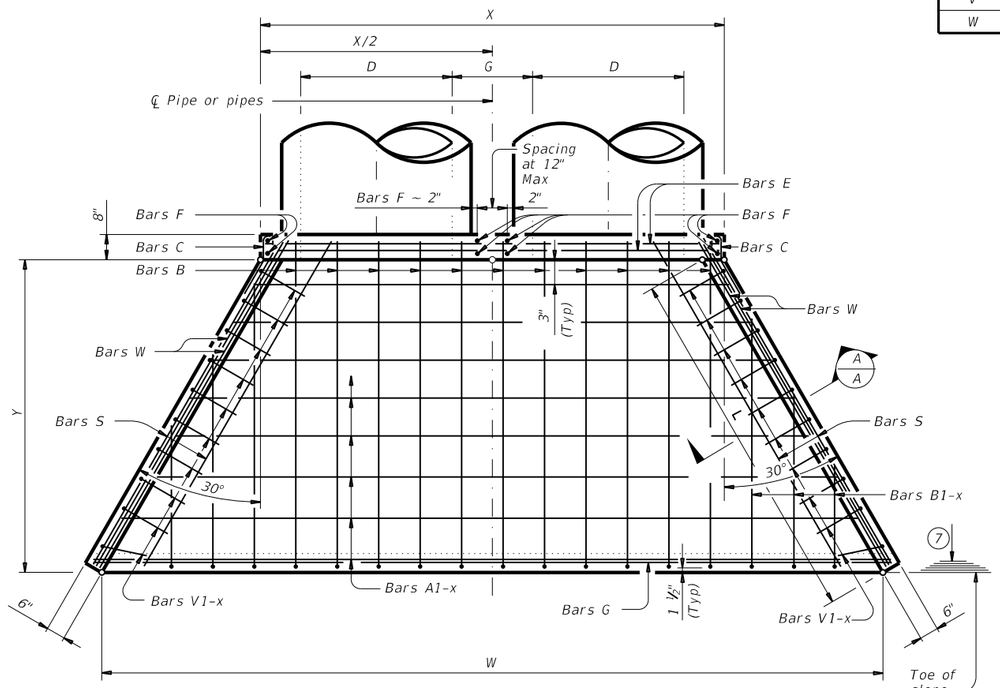
BARS V

BARS C
(Length = 2'-5")

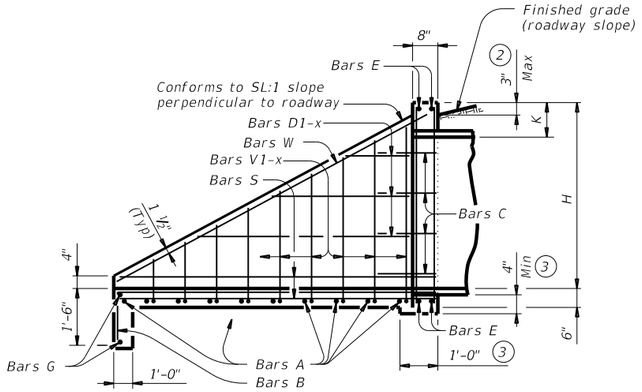


ELEVATION

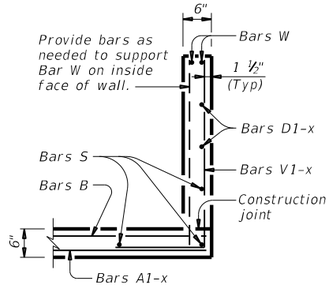
(Showing dimensions.)



PLAN



TYPICAL WING ELEVATION



SECTION A-A

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
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"

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.

Provide galavanized reinforcing steel, if required elsewhere in the plans.

Adjust reinforcing bars, as neccessary, to provide a minimum clear cover of 1 ½".

Provide Class C concrete (f`c= 3,600 psi).

Provide pipe runners 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.

Provide ASTM A36 steel plates.

Galvanize all steel components, except reinforcing unless required elsewhere in the plans, after lubrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

For optional adhesive anchors, install adhesive anchorages in accordance with the manufacturer's instructions including hole size, drilling equipment and method, hole cleaning equipment and method, mixing and dispensing adhesive, and anchor insertion. Do not alter the manufacturer's mixing nozzle or dispenser. Anchorage rods must be clean and free of grease, oil, or any other foreign material. Demonstrate hole cleaning method to the Engineer for approval and continue the approved process for all anchorage locations. Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

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 pipe runners.

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

All bolts, nuts, washers, brackets, angles and pipe runners are considered parts of the safety end treatment for payment.

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

SHEET 1 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-0

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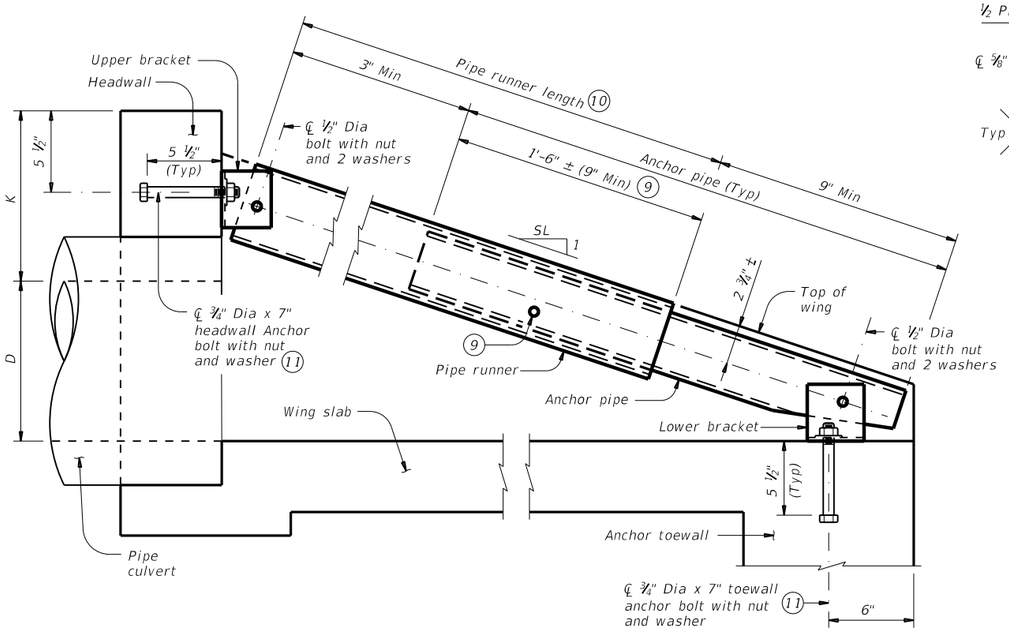
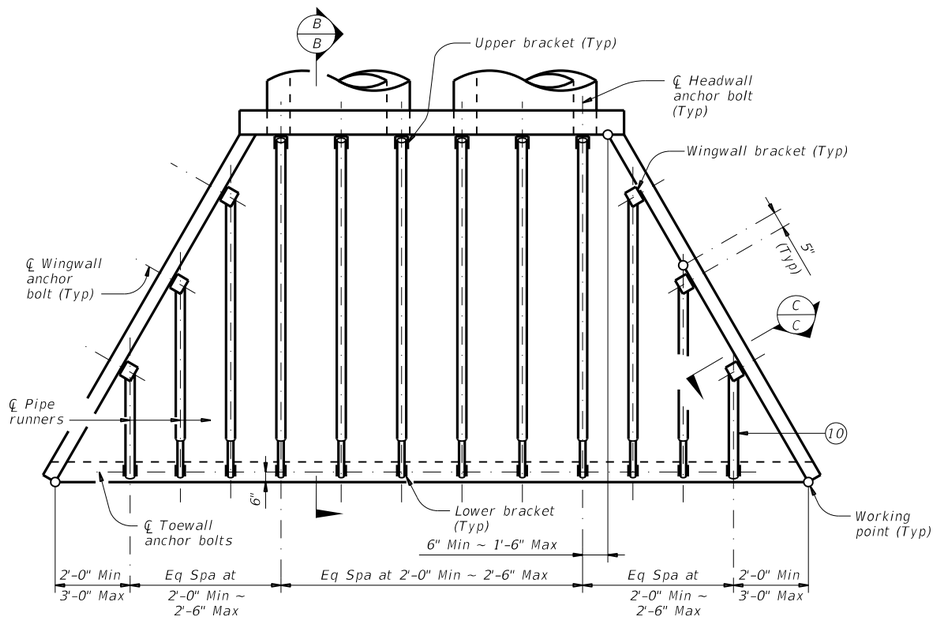
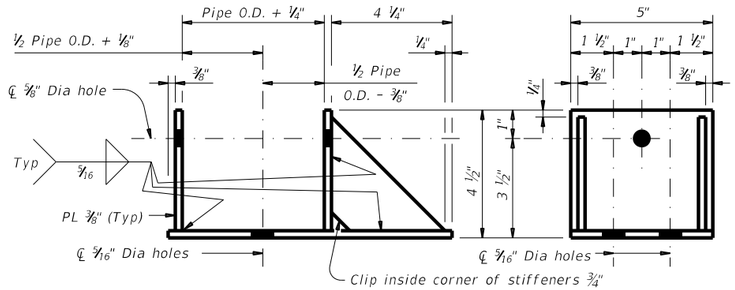


SECTION B-B

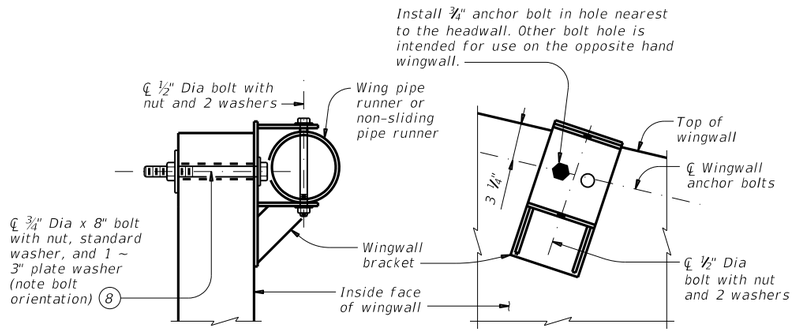
(Showing headwall pipe runner. Except for upper bracket, wingwall pipe runners are similar.)



PIPE RUNNER PLAN



ELEVATION — SIDE VIEW

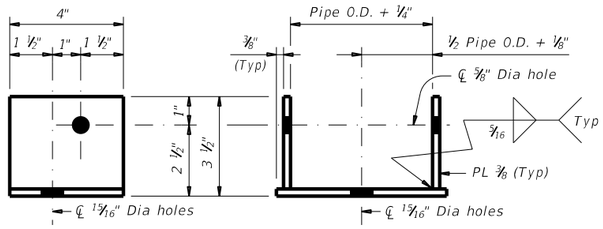


SECTION C-C
(Showing installed bracket.)

ELEVATION
(Showing installed bracket normal to wall. Pipe not shown for clarity.)

NOTE: Match the wingwall bracket to the upper bracket size.

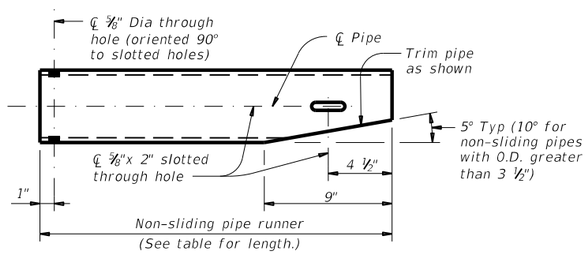
WINGWALL BRACKET DETAILS



SIDE VIEW — ELEVATION

NOTE: Match upper and lower brackets, except for the brackets used with non-sliding pipe runners, with the required pipe diameters as shown in the table.

UPPER AND LOWER BRACKET DETAILS



Note: Pipe size is the same as required for headwall pipe runner. Adjust the corresponding lower bracket accordingly.

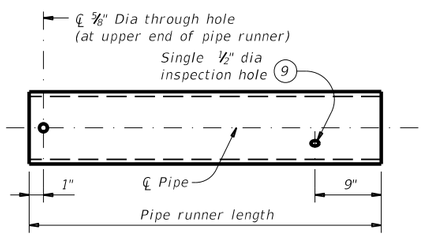
NON-SLIDING PIPE RUNNER DETAILS (10)

(8) At Contractor's option, ⅞" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

(9) After installation of the pipe runner, use the ½" inspection hole to ensure that the lap of the anchor pipe with the pipe runner is adequate.

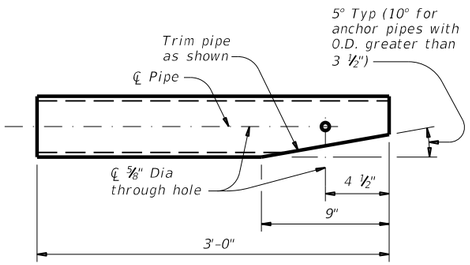
(10) Non-sliding pipe runners are used for those installations that would require pipe runner lengths of 1'-9" or less. The non-sliding pipe runner, when required, replaces the outermost pipe runner and anchor pipe. See table on Sheet 3 of 3 to determine if the non-sliding pipe runner is required.

(11) At Contractor's option, an adhesive anchor may be used. Provide adhesive anchors that are ¾" Dia ASTM A307 Grade A fully threaded rods. Embed threaded rods into curb, wingwalls, and/or toewall using a Type III, Class C, D, E, or F anchor adhesive. Minimum embedment depth is 5 ½". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use.



Note: Use pipe diameter required for headwall pipe runner and for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS

SHEET 2 OF 3

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0 SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-0

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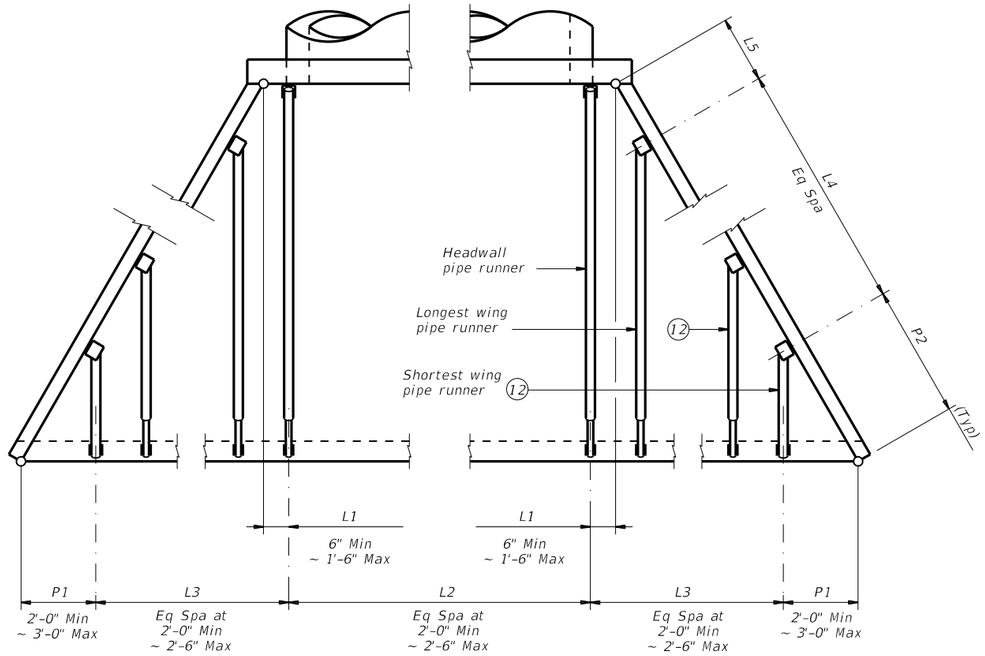
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		143

Side Slope	Pipe Culvert Dia	L1	P1	No. of Spaces in L3	L3 Overall Dimension	P2	No. of Spaces in L4	L4 Overall Dimension	Headwall Pipe Runner Length	No. of Wing Pipes (13)	Longest Wingwall Pipe Runner Length	Shortest Wingwall Pipe Runner Length	Non-Sliding Pipe Length	Pipe Runner Size (14)	Total Length of Wingwall Pipe Runners (13)
3:1	33"	0' – 9"	2' – 0"	2	4' – 2 ¾"	3' – 7"	1	4' – 2 ¾"	8' – 4"	4	5' – 5 ½"	N/A	3' – 1"	3" STD	17' – 1"
	36"	0' – 9"	2' – 0"	2	4' – 8"	3' – 7"	1	4' – 8"	9' – 1 ½"	4	5' – 10 ¼"	N/A	3' – 1"	3" STD	17' – 10 ½"
	42"	1' – 0"	3' – 0"	2	4' – 9 ½"	5' – 7"	1	4' – 9 ½"	10' – 8 ¼"	4	7' – 9 ½"	3' – 5"	N/A	4" STD	22' – 5"
	48"	1' – 3"	2' – 0"	3	7' – 4"	3' – 7"	2	9' – 9 ¼"	13' – 0 ¾"	6	10' – 6 ¼"	6' – 0 ¾"	3' – 1"	4" STD	39' – 4"
	54"	0' – 6"	2' – 0"	3	7' – 5 ½"	3' – 7"	2	9' – 11 ¼"	14' – 7 ¾"	6	10' – 8"	6' – 1 ½"	3' – 1"	4" STD	39' – 9"
	60"	0' – 9"	2' – 0"	4	8' – 6 ¾"	3' – 7"	3	12' – 10 ¼"	16' – 2 ¾"	8	13' – 3 ¾"	5' – 6"	3' – 1"	4" STD	62' – 7 ¼"
	66"	1' – 0"	2' – 0"	4	9' – 8 ¼"	3' – 7"	3	14' – 6 ¼"	17' – 9 ¾"	8	14' – 10 ¼"	6' – 0"	3' – 1"	4" STD	68' – 8 ¾"
	72"	1' – 3"	3' – 0"	4	9' – 9 ½"	5' – 7"	3	14' – 8 ¼"	19' – 4 ¾"	8	16' – 10"	3' – 5"	N/A	5" STD	81' – 0"
4:1	33"	0' – 9"	2' – 0"	3	6' – 0 ¾"	3' – 7"	2	8' – 1"	11' – 4 ½"	6	8' – 8 ¾"	5' – 1 ¼"	3' – 0"	4" STD	33' – 8"
	36"	0' – 9"	2' – 0"	3	6' – 7 ¾"	3' – 7"	2	8' – 10 ¼"	12' – 4 ¾"	6	9' – 5"	5' – 5 ½"	3' – 0"	4" STD	35' – 9"
	42"	1' – 0"	2' – 9"	3	7' – 3 ½"	5' – 1"	2	9' – 8 ¾"	14' – 5 ½"	6	11' – 6 ¼"	2' – 10 ¼"	N/A	4" STD	43' – 1 ½"
	48"	1' – 3"	2' – 3"	4	9' – 9 ¼"	4' – 1"	3	14' – 8"	17' – 6 ¾"	8	15' – 0 ½"	1' – 11 ½"	N/A	4" STD	68' – 0"
	54"	0' – 6"	2' – 6"	4	9' – 11 ¼"	4' – 7"	3	14' – 10 ¾"	19' – 7 ½"	8	15' – 8 ¼"	2' – 4 ¾"	N/A	5" STD	72' – 4"
	60"	0' – 9"	2' – 0"	5	11' – 10"	3' – 7"	4	18' – 11 ¼"	21' – 8 ¼"	10	18' – 5"	5' – 8 ¾"	3' – 0"	5" STD	102' – 7"
	66"	1' – 0"	2' – 9"	5	12' – 6"	5' – 1"	4	19' – 11 ¾"	23' – 9"	10	20' – 8 ¼"	2' – 10 ¼"	N/A	5" STD	117' – 8 ½"
	72"	1' – 3"	2' – 0"	6	14' – 7 ¾"	3' – 7"	5	24' – 5"	25' – 9 ¾"	12	23' – 3 ½"	5' – 10 ¼"	3' – 0"	5" STD	151' – 8 ¾"
6:1	33"	0' – 9"	2' – 0"	4	9' – 8 ¾"	3' – 7"	3	14' – 7"	17' – 7"	8	14' – 3"	5' – 8 ½"	2' – 11 ½"	4" STD	65' – 9 ½"
	36"	0' – 9"	2' – 9"	4	9' – 10"	5' – 1"	3	14' – 9"	19' – 1 ¼"	8	15' – 8 ¾"	2' – 9 ¼"	N/A	5" STD	74' – 0"
	42"	1' – 0"	2' – 3"	5	12' – 3 ¾"	4' – 1"	4	19' – 8 ½"	22' – 1 ¾"	10	19' – 2 ¼"	1' – 10 ¾"	N/A	5" STD	105' – 5"
	48"	1' – 3"	2' – 6"	6	14' – 11"	4' – 7"	5	24' – 10 ¼"	26' – 8 ½"	12	24' – 1 ¾"	2' – 4"	N/A	5" STD	158' – 10 ½"
	54"	0' – 6"	2' – 0"	7	16' – 4 ¾"	3' – 7"	6	28' – 1 ¼"	29' – 9"	14	26' – 1 ½"	5' – 6 ¾"	2' – 11 ½"	5" STD	196' – 0 ½"
	60"	0' – 9"	3' – 0"	7	17' – 4 ½"	5' – 7"	6	29' – 9 ½"	32' – 9 ½"	14	29' – 4 ¼"	3' – 2 ½"	N/A	5" STD	227' – 11 ¼"



PIPE RUNNER LAYOUT

(12) If the outermost wing pipe runner is a non-sliding pipe runner, consider the next outermost wing pipe runner the shortest.

(13) Quantities shown include, if present, the non-sliding pipes.

(14) The anchor pipe size is the next smaller size than the pipe runner size.

STANDARD PIPE RUNNER AND ANCHOR PIPE SIZES (14)

Pipe Size	Pipe O.D.	Pipe I.D.
2" STD	2.375"	2.067"
3" STD	3.500"	3.068"
4" STD	4.500"	4.026"
5" STD	5.563"	5.047"

TOTAL PIPE LENGTHS FORMULAS:

Total Length of All Pipe Runners = Total Length of Wingwall Pipe Runners + (No. of Headwall Pipe Runners) (Headwall Pipe Runner Length)

Total Length of All Anchor Pipes = (3.000') (No. of Wing Pipe Runners + No. of Headwall Pipe Runners – No. of Non-Sliding Pipe Runners)

SPECIAL NOTE:

Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, verify all dimensions in the field prior to fabrication of the safety end treatment components.

Pipe Culvert Dia	No. of Pipe Culverts	No. of L2 Spaces	L2 Overall Dimension	No. of Headwall Pipes
33"	1	1	2' – 0 ¼"	2
	2	3	6' – 8 ¼"	4
	3	5	11' – 4 ¼"	6
	4	7	16' – 0 ¼"	8
	5	9	20' – 8 ¼"	10
	6	11	25' – 4 ¼"	12
36"	1	1	2' – 3 ¾"	2
	2	3	7' – 4 ¾"	4
	3	5	12' – 5 ¾"	6
	4	7	17' – 6 ¾"	8
	5	10	22' – 7 ¾"	11
	6	12	27' – 8 ¾"	13
42"	1	1	2' – 4 ¾"	2
	2	4	8' – 2 ¾"	5
	3	6	14' – 0 ¾"	7
	4	8	19' – 10 ¾"	9
	5	11	25' – 8 ¾"	12
	6	13	31' – 6 ¾"	14
48"	1	1	2' – 5 ¾"	2
	2	4	9' – 0 ¾"	5
	3	7	15' – 7 ¾"	8
	4	9	22' – 2 ¾"	10
	5	12	28' – 9 ¾"	13
	6	15	35' – 4 ¾"	16
54"	1	2	4' – 6 ¾"	3
	2	5	12' – 0 ¾"	6
	3	8	19' – 6 ¾"	9
	4	11	27' – 0 ¾"	12
	5	14	34' – 6 ¾"	15
	6	17	42' – 0 ¾"	18
60"	1	2	4' – 7 ¾"	3
	2	6	12' – 10 ¾"	7
	3	9	21' – 1 ¾"	10
	4	12	29' – 4 ¾"	13
	5	16	37' – 7 ¾"	17
	6	19	45' – 10 ¾"	20
66"	1	2	4' – 8 ¾"	3
	2	6	13' – 5 ¾"	7
	3	9	22' – 2 ¾"	10
	4	13	30' – 11 ¾"	14
	5	16	39' – 8 ¾"	17
	6	20	48' – 5 ¾"	21
72"	1	2	4' – 9 ¾"	3
	2	6	14' – 1 ¾"	7
	3	10	23' – 5 ¾"	11
	4	14	32' – 9 ¾"	15
	5	17	42' – 1 ¾"	18
	6	21	51' – 5 ¾"	22

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-0

FILE: setpf0se-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		144

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

Slope	Dia of Pipe (D)	W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
		Values for One Pipe						Values to be Added for Each Addt'l Pipe		
3:1	24"	10' - 7 ½"	4' - 7"	7' - 3"	10' - 3"	231	2.3	4' - 1 ¾"	65	0.9
	27"	11' - 8 ½"	4' - 11"	8' - 0"	11' - 3 ¾"	259	2.7	4' - 6 ¼"	75	1.0
	30"	12' - 9 ½"	5' - 3"	8' - 9"	12' - 4 ½"	302	3.1	5' - 0"	86	1.2
	33"	13' - 10 ¾"	5' - 7"	9' - 6"	13' - 5 ¼"	328	3.5	5' - 4 ¾"	94	1.4
	36"	14' - 11 ¾"	5' - 11 ¼"	10' - 3"	14' - 6"	361	4.0	5' - 10 ½"	108	1.6
	42"	17' - 1 ¾"	6' - 7 ¼"	11' - 9"	16' - 7 ½"	447	5.0	6' - 8 ¾"	133	2.1
	48"	20' - 0 ¾"	7' - 3 ¼"	14' - 0"	19' - 9 ½"	550	6.6	7' - 7 ¼"	176	2.8
	54"	22' - 3"	7' - 11 ½"	15' - 6"	21' - 11"	636	7.9	8' - 8"	211	3.5
	60"	24' - 5"	8' - 7 ½"	17' - 0"	24' - 0 ½"	735	9.4	9' - 6 ¼"	246	4.1
	66"	26' - 7"	9' - 3 ½"	18' - 6"	26' - 2"	833	10.9	10' - 1 ¼"	274	4.6
	72"	28' - 9 ¼"	9' - 11 ¾"	20' - 0"	28' - 3 ½"	942	12.5	10' - 9 ¼"	309	5.3
4:1	24"	13' - 0 ½"	4' - 7"	9' - 8"	13' - 8"	305	3.1	4' - 1 ¾"	75	1.1
	27"	14' - 4 ½"	4' - 11"	10' - 8"	15' - 1"	343	3.7	4' - 6 ¼"	87	1.3
	30"	15' - 8 ½"	5' - 3"	11' - 8"	16' - 6"	398	4.2	5' - 0"	99	1.5
	33"	17' - 0 ¾"	5' - 7"	12' - 8"	17' - 11"	438	4.9	5' - 4 ¾"	112	1.7
	36"	18' - 4 ¾"	5' - 11 ¼"	13' - 8"	19' - 4"	485	5.5	5' - 10 ½"	128	2.0
	42"	21' - 0 ¾"	6' - 7 ¼"	15' - 8"	22' - 1 ¾"	593	7.0	6' - 8 ¾"	158	2.6
	48"	24' - 8 ¾"	7' - 3 ¼"	18' - 8"	26' - 4 ¾"	746	9.4	7' - 7 ¼"	211	3.4
	54"	27' - 5"	7' - 11 ½"	20' - 8"	29' - 2 ¾"	881	11.3	8' - 8"	257	4.3
	60"	30' - 1"	8' - 7 ½"	22' - 8"	32' - 0 ¾"	1,009	13.3	9' - 6 ¼"	297	5.1
	66"	32' - 9"	9' - 3 ½"	24' - 8"	34' - 10 ½"	1,151	15.6	10' - 1 ¼"	340	5.8
	72"	35' - 5 ¼"	9' - 11 ¾"	26' - 8"	37' - 8 ½"	1,302	18.0	10' - 9 ¼"	378	6.6
6:1	24"	17' - 10 ½"	4' - 7"	14' - 6"	20' - 6"	454	5.1	4' - 1 ¾"	91	1.5
	27"	19' - 8 ½"	4' - 11"	16' - 0"	22' - 7 ½"	523	6.0	4' - 6 ¼"	108	1.7
	30"	21' - 6 ½"	5' - 3"	17' - 6"	24' - 9"	599	7.1	5' - 0"	124	2.0
	33"	23' - 4 ¾"	5' - 7"	19' - 0"	26' - 10 ½"	680	8.2	5' - 4 ¾"	143	2.4
	36"	25' - 2 ¾"	5' - 11 ¼"	20' - 6"	29' - 0"	743	9.3	5' - 10 ½"	162	2.8
	42"	28' - 10 ¾"	6' - 7 ¼"	23' - 6"	33' - 2 ¾"	926	11.9	6' - 8 ¾"	202	3.6
	48"	34' - 0 ¾"	7' - 3 ¼"	28' - 0"	39' - 7 ¼"	1,197	16.2	7' - 7 ¼"	274	4.7

(1) Quantities shown are for concrete pipe and will increase slightly for metal pipe installation.

(2) For vehicle safety, reduce curb heights, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.

(3) Provide a 1'-0" footing as shown where required to maintain 4" minimum cover for pipes.

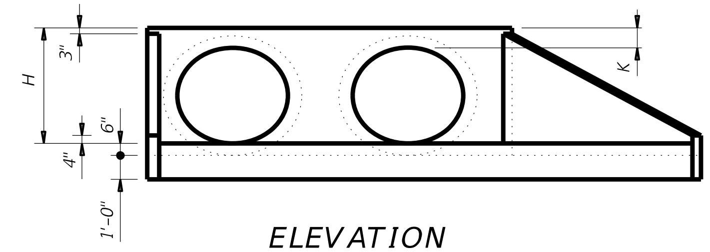
(4) Dimensions shown are usual and maximum.

(5) Quantities shown are for one structure end. (One headwall)

(6) Min Length = 6" + 3" x (12 x H - 7 / 12 x L)

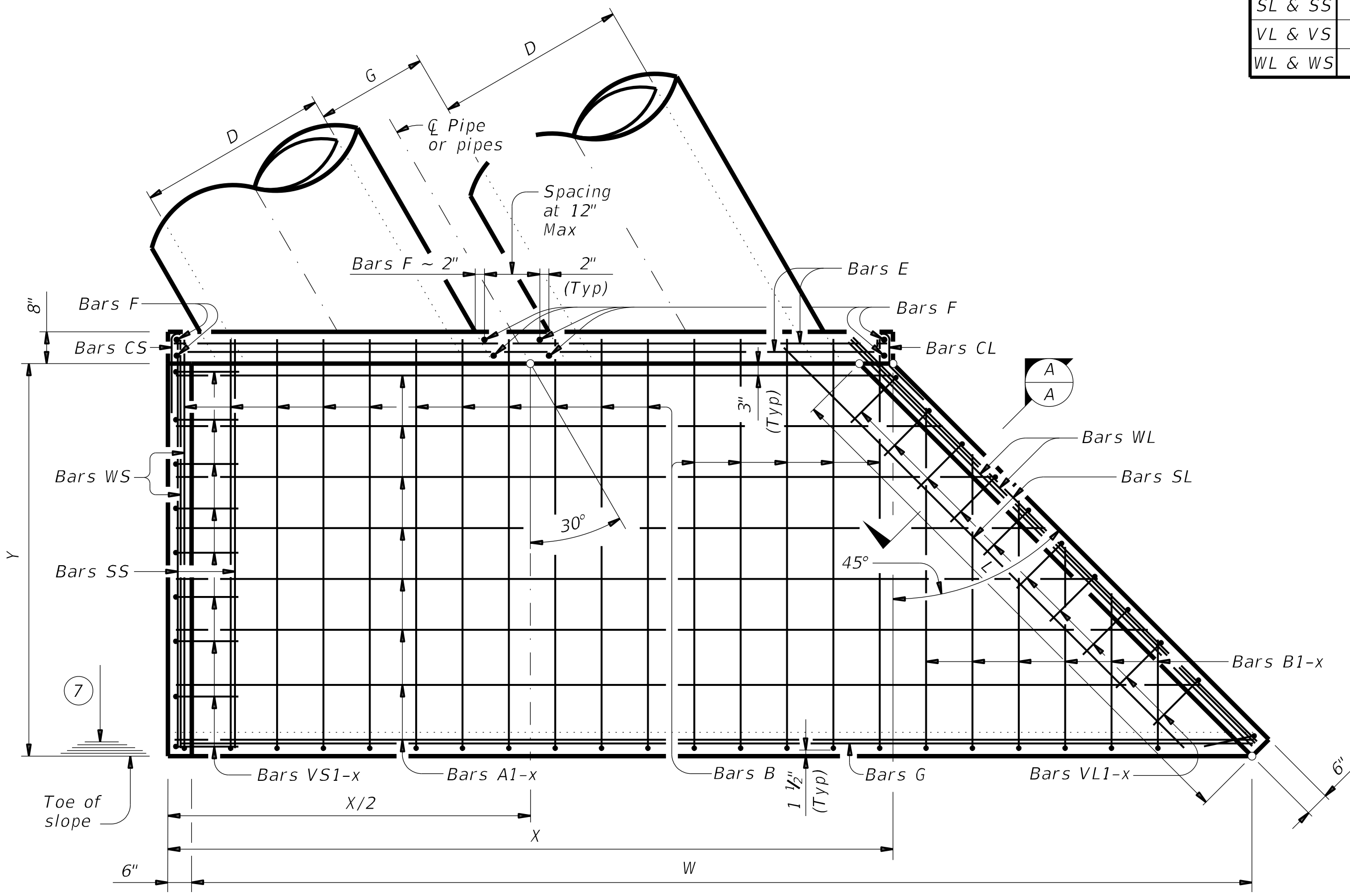
Max Length = 12 x H - 3" x (12 x H - 7 / 12 x L) - 1"

(7) Lengths of wings based on SL:1 slope along this line.



ELEVATION

(Showing dimensions.)



PLAN

TABLE OF REINFORCING STEEL (5)

Bar	Size	Spa	No.
A	#4	1' - 0"	~
B	#3	1' - 6"	~
CL & CS	#4	1' - 0"	~
D	#3	1' - 0"	~
E	#5	~	4
F	#5	~	~
G	#3	~	2
SL & SS	#4	~	6
VL & VS	#4	1' - 0"	~
WL & WS	#5	~	4

TABLE OF CONSTANT DIMENSIONS

Dia of Pipe (D)	G	K (4)	H
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"

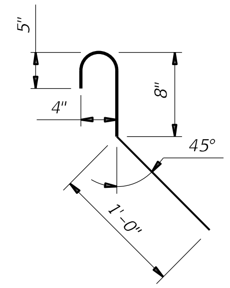
MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galavanized reinforcing steel, if required elsewhere in the plans.
Adjust reinforcing bars, as neccessary, to provide a minimum clear cover of 1 ½".
Provide Class C concrete (f'c= 3,600 psi).
Provide pipe runners 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.
Provide ASTM A36 steel plates.
Galvanize all steel components, except reinforcing unless required elsewhere in the plans, after lubrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.
For optional adhesive anchors, install adhesive anchorages in accordance with the manufacturer's instructions including hole size, drilling equipment and method, hole cleaning equipment and method, mixing and dispensing adhesive, and anchor insertion. Do not alter the manufacturer's mixing nozzle or dispenser. Anchorage rods must be clean and free of grease, oil, or any other foreign material. Demonstrate hole cleaning method to the Engineer for approval and continue the approved process for all anchorage locations. Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

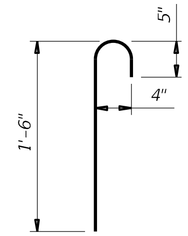
GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
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 pipe runners.
The safety pipe runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.
All bolts, nuts, washers, brackets, angles and pipe runners are considered parts of the safety end treatment for payment.

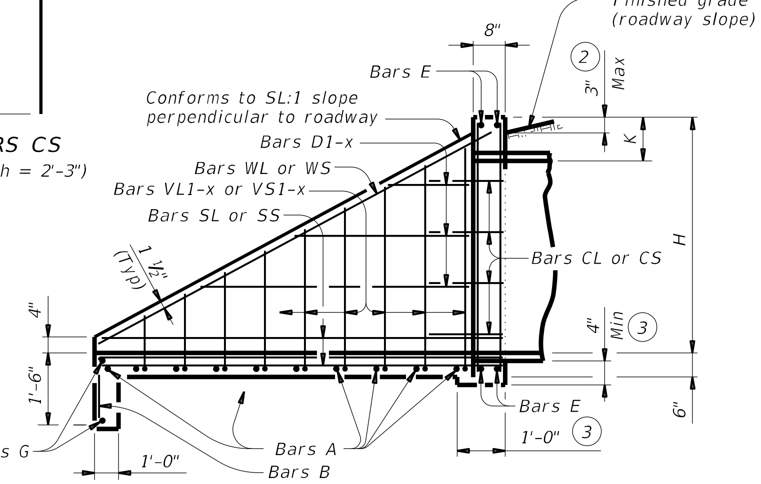
Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing dimensions are out-to-out of bars.



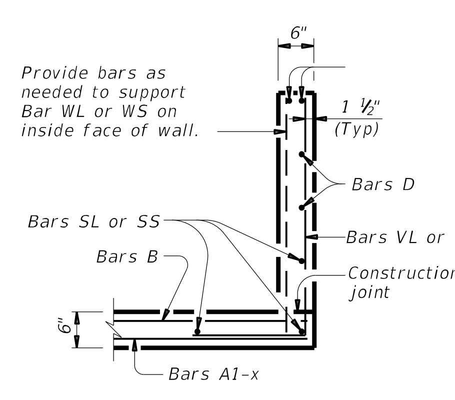
BARS CL
(Length = 2'-5")



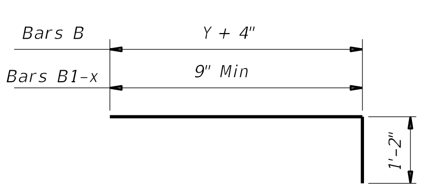
BARS CS
(Length = 2'-3")



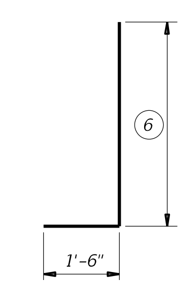
TYPICAL WING ELEVATION



SECTION A-A



BARS B and B1-x



BARS VL and VS

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Texas Department of Transportation | Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 30° SKEW PIPE CULVERTS TYPE I ~ CROSS DRAINAGE

SETP-FW-30

FILE: stpf30se-20.dgn	DN: GAF	CK: CAT	DW: BWH	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST		COUNTY	SHEET NO.
	DAL		KAUFMAN	145

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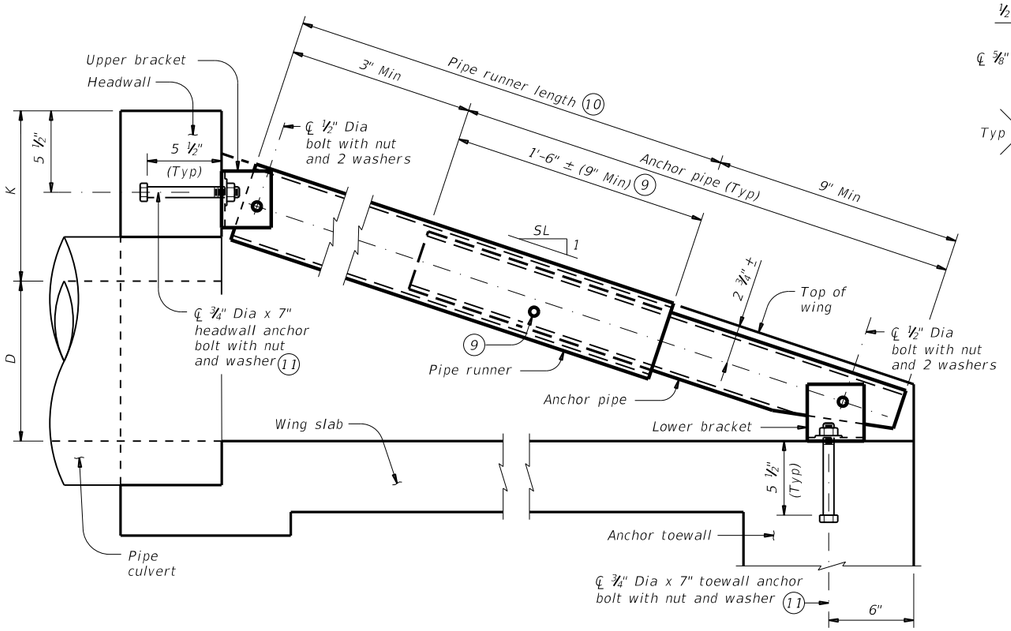
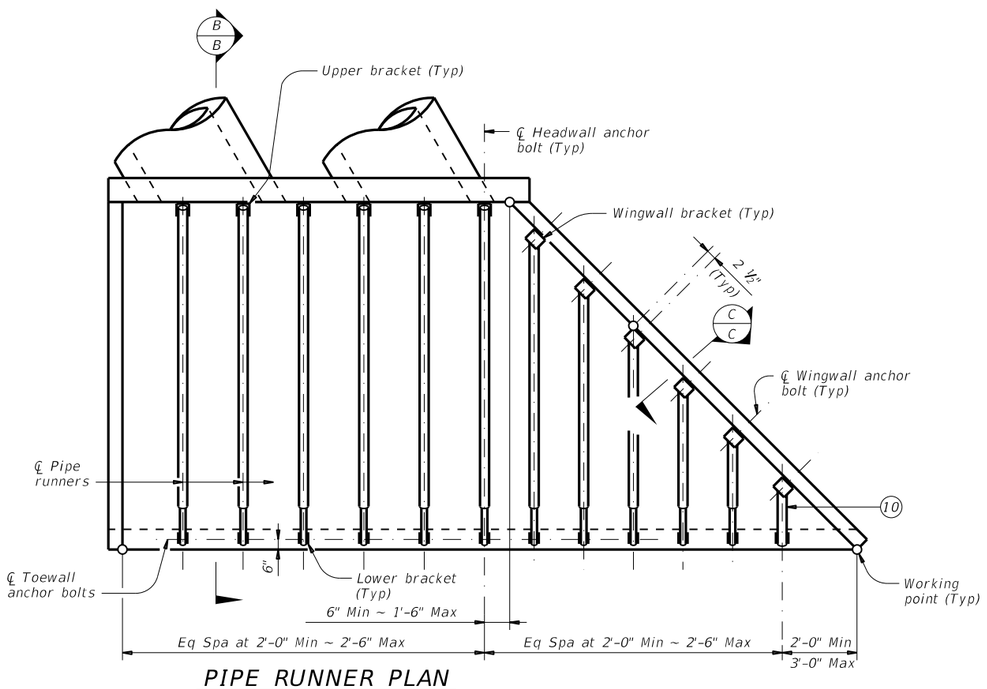
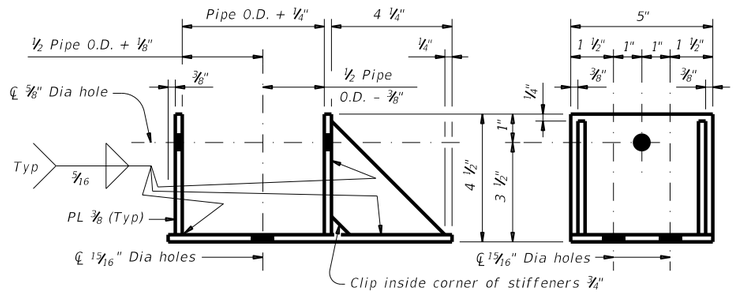


SECTION B-B

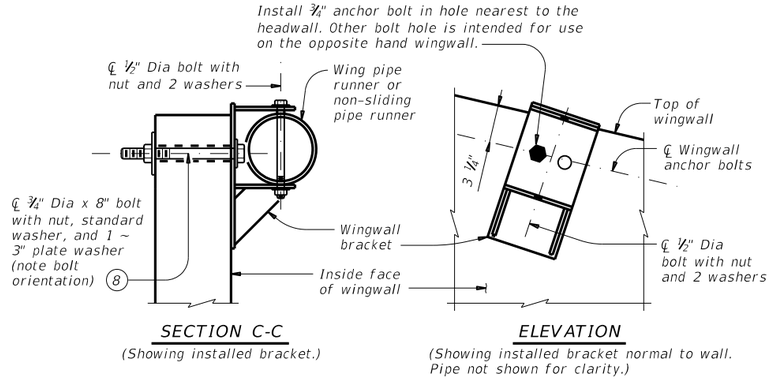
(Showing headwall pipe runner. Except for upper bracket, wingwall pipe runners are similar.)



PIPE RUNNER PLAN



ELEVATION SIDE VIEW

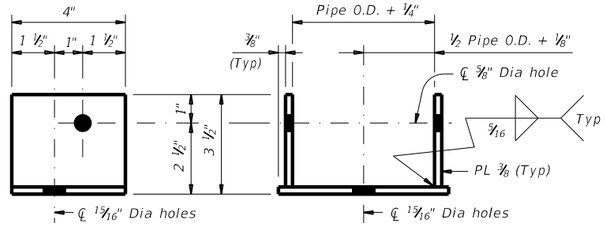


SECTION C-C (Showing installed bracket.)

ELEVATION (Showing installed bracket normal to wall. Pipe not shown for clarity.)

NOTE: Match the wingwall bracket to the upper bracket size.

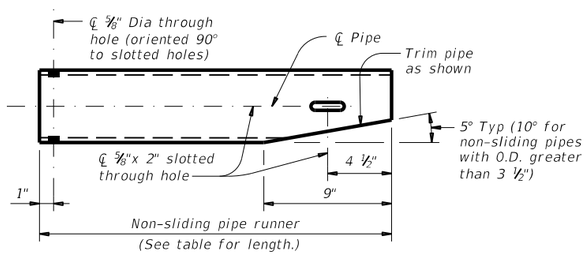
WINGWALL BRACKET DETAILS



SIDE VIEW ELEVATION

NOTE: Match upper and lower brackets, except for the brackets used with non-sliding pipe runners, with the required pipe diameters as shown in the table.

UPPER AND LOWER BRACKET DETAILS



Note: Pipe size is the same as required for headwall pipe runner. Adjust the corresponding lower bracket accordingly.

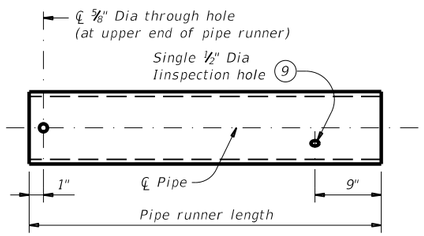
NON-SLIDING PIPE RUNNER DETAILS (10)

(8) At Contractor's option, ⅞" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

(9) After installation of the pipe runner, use the ½" inspection hole to ensure that the lap of the anchor pipe with the pipe runner is adequate.

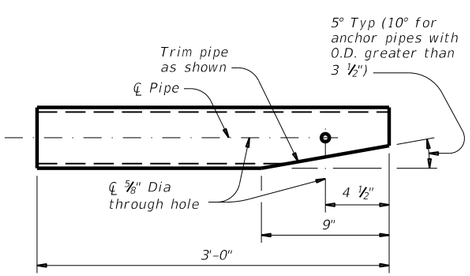
(10) Non-sliding pipe runners are used for those installations that would require pipe runner lengths of 1'-9" or less. The non-sliding pipe runner, when required, replaces the outermost pipe runner and anchor pipe. See table on Sheet 3 of 3 to determine if the non-sliding pipe runner is required.

(11) At Contractor's option, an adhesive anchor may be used. Provide adhesive anchors that are ¾" Dia ASTM A307 Grade A fully threaded rods. Embed threaded rods into curb, wingwalls, and/or toewall using a Type III, Class C, D, E, or F anchor adhesive. Minimum embedment depth is 5 ½". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use.



Note: Use pipe diameter required for headwall pipe runner for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS

SHEET 2 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

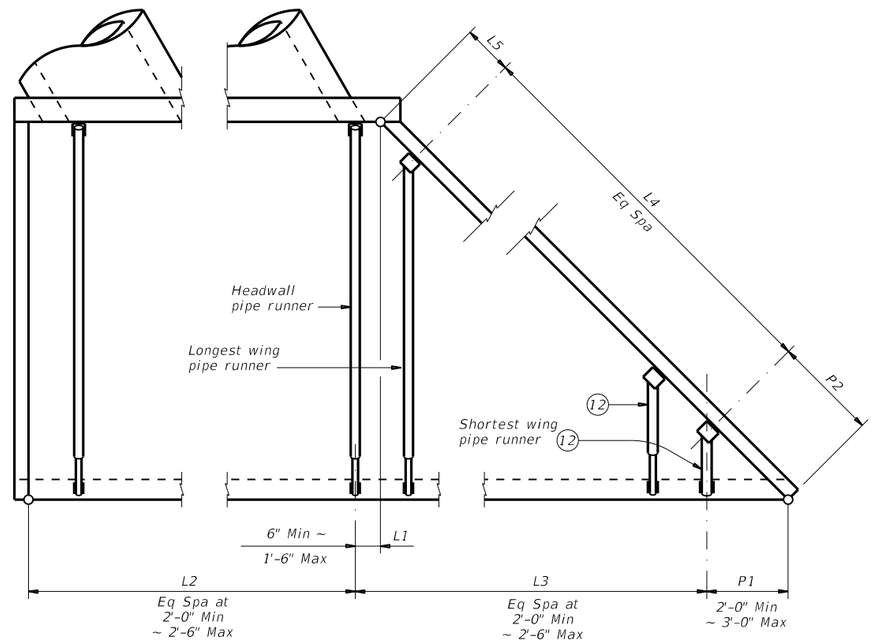
FOR 30° SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-30

FILE: stpf30se-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		146

Pipe Culvert Dia	No. of Pipe Culverts	No. of L2 Spaces	L2 Overall Dimension	No. of Headwall Pipes
24"	1	1	2' – 4 ½"	1
	2	3	6' – 6 ¼"	3
	3	5	10' – 8"	5
	4	6	14' – 9 ¾"	6
	5	8	18' – 11 ½"	8
	6	10	23' – 1 ¼"	10
27"	1	1	2' – 5 ½"	1
	2	3	6' – 11 ¾"	3
	3	5	11' – 6"	5
	4	7	16' – 0 ¼"	7
	5	9	20' – 6 ½"	9
	6	10	25' – 0 ¾"	10
30"	1	1	2' – 6 ½"	1
	2	3	7' – 6 ½"	3
	3	5	12' – 6 ½"	5
	4	7	17' – 6 ½"	7
	5	9	22' – 6 ½"	9
	6	11	27' – 6 ½"	11
33"	1	2	3' – 10 ½"	2
	2	4	9' – 3 ¼"	4
	3	6	14' – 8"	6
	4	9	20' – 0 ¾"	9
	5	11	25' – 5 ½"	11
	6	13	30' – 10 ¼"	13
36"	1	2	3' – 11 ¾"	2
	2	4	9' – 10 ¼"	4
	3	7	15' – 8 ¾"	7
	4	9	21' – 7 ¼"	9
	5	11	27' – 5 ¾"	11
	6	14	33' – 4 ¼"	14
42"	1	2	4' – 10 ¾"	2
	2	5	11' – 7 ½"	5
	3	8	18' – 4 ¼"	8
	4	11	25' – 1"	11
	5	13	31' – 9 ¾"	13
	6	16	38' – 6 ½"	16
48"	1	2	4' – 9 ¾"	2
	2	5	12' – 5"	5
	3	8	20' – 0 ¼"	8
	4	12	27' – 7 ½"	12
	5	15	35' – 2 ¾"	15
	6	18	42' – 10"	18
54"	1	3	6' – 3"	3
	2	6	14' – 11"	6
	3	10	23' – 7"	10
	4	13	32' – 3"	13
	5	17	40' – 11"	17
	6	20	49' – 7"	20
60"	1	3	6' – 11"	3
	2	7	16' – 5 ¼"	7
	3	11	25' – 11 ½"	11
	4	15	35' – 5 ¾"	15
	5	19	45' – 0"	19
	6	22	54' – 6 ¼"	22
66"	1	3	7' – 4"	3
	2	7	17' – 5 ¼"	7
	3	11	27' – 6 ½"	11
	4	16	37' – 7 ¾"	16
	5	20	47' – 9"	20
	6	24	57' – 10 ¼"	24
72"	1	3	7' – 3 ¼"	3
	2	8	18' – 0 ½"	8
	3	12	28' – 9 ¾"	12
	4	16	39' – 7"	16
	5	21	50' – 4 ¼"	21
	6	25	61' – 1 ½"	25

Side Slope	Pipe Culvert Dia	L1	P1	No. of Spaces in L3	L3 Overall Dimension	P2	No. of Spaces in L4	L4 Overall Dimension	Headwall Pipe Runner Length	No. of Wing Pipes (13)	Longest Wingwall Pipe Runner Length	Shortest Wingwall Pipe Runner Length	Non-Sliding Pipe Length	Pipe Runner Size (14)	Total Length of Wingwall Pipe Runners (13)
3:1	24"	1' – 0"	2' – 0"	3	6' – 3"	2' – 7 ½"	2	5' – 10 ¾"	5' – 11 ½"	3	4' – 5 ¼"	2' – 3"	1' – 6 ½"	3" STD	8' – 2 ¾"
	27"	1' – 3"	2' – 0"	3	7' – 3"	2' – 7 ½"	2	6' – 10"	6' – 9"	3	5' – 1 ¾"	2' – 7"	1' – 6 ½"	3" STD	9' – 3 ¼"
	30"	1' – 6"	3' – 0"	3	7' – 3"	4' – 0 ½"	2	6' – 10"	7' – 6 ½"	3	6' – 2 ¼"	3' – 7 ¾"	2' – 7 ¼"	3" STD	12' – 5 ¼"
	33"	0' – 6"	2' – 6"	3	7' – 6"	3' – 4"	2	7' – 0 ¾"	8' – 4"	3	5' – 10"	3' – 2 ½"	2' – 0 ¾"	3" STD	11' – 1 ¼"
	36"	0' – 9"	2' – 0"	4	9' – 0"	2' – 7 ½"	3	9' – 6 ½"	9' – 1 ½"	4	7' – 2"	2' – 5"	1' – 6 ½"	4" STD	15' – 11"
	42"	0' – 6"	2' – 3"	4	10' – 0"	2' – 11 ¾"	3	10' – 7 ¼"	10' – 8 ¼"	4	8' – 2 ½"	2' – 11 ¼"	1 – 9 ¾"	4" STD	18' – 6 ½"
	48"	1' – 3"	2' – 9"	5	12' – 6"	3' – 8 ¼"	4	14' – 1 ¾"	13' – 0 ¾"	5	11' – 4 ½"	3' – 5 ¾"	2' – 4"	4" STD	32' – 0 ½"
	54"	0' – 6"	2' – 0"	6	14' – 0"	2' – 7 ½"	5	16' – 6"	14' – 7 ¾"	6	12' – 4"	2' – 6"	1' – 6 ½"	4" STD	38' – 7 ½"
	60"	0' – 6"	2' – 6"	6	15' – 0"	3' – 4"	5	17' – 8"	16' – 2 ¾"	6	13' – 9"	3' – 2 ½"	2' – 0 ¾"	4" STD	44' – 5 ½"
	66"	0' – 9"	2' – 0"	7	17' – 3"	2' – 7 ½"	6	20' – 11"	17' – 9 ¾"	7	15' – 7 ½"	2' – 7 ¾"	1' – 6 ½"	4" STD	56' – 4 ¼"
	72"	1' – 6"	2' – 0"	8	19' – 6"	2' – 7 ½"	7	24' – 1 ½"	19' – 4 ¾"	8	18' – 0 ¼"	2' – 7 ¼"	1 – 6 ½"	5" STD	73' – 8 ¾"
4:1	24"	1' – 0"	2' – 0"	4	8' – 8"	2' – 7 ½"	3	9' – 2 ¼"	8' – 3 ½"	4	6' – 8 ½"	2' – 2 ¾"	1' – 6"	3" STD	14' – 11"
	27"	1' – 3"	2' – 0"	4	9' – 11"	2' – 7 ½"	3	10' – 6 ¼"	9' – 3 ¾"	4	7' – 8"	2' – 6 ¾"	1' – 6"	4" STD	16' – 10 ¼"
	30"	1' – 6"	2' – 0"	5	11' – 2"	2' – 7 ½"	4	12' – 7 ½"	10' – 4"	5	9' – 2 ½"	2' – 3 ½"	1' – 6"	4" STD	24' – 6"
	33"	0' – 6"	2' – 0"	5	11' – 2"	2' – 7 ½"	4	12' – 7 ½"	11' – 4 ½"	5	9' – 2 ½"	2' – 3 ½"	1' – 6"	4" STD	24' – 6"
	36"	0' – 9"	2' – 0"	5	12' – 5"	2' – 7 ½"	4	14' – 0 ½"	12' – 4 ¾"	5	10' – 3"	2' – 6 ¾"	1' – 6"	4" STD	27' – 1 ½"
	42"	0' – 6"	2' – 0"	6	14' – 2"	2' – 7 ½"	5	16' – 8 ¼"	14' – 5 ½"	6	12' – 2"	2' – 5 ¼"	1 – 6"	4" STD	38' – 0 ¼"
	48"	1' – 3"	2' – 6"	7	17' – 5"	3' – 4"	6	21' – 1 ¼"	17' – 6 ¾"	7	15' – 10 ¾"	3' – 1"	2 – 0 ¼"	4" STD	58' – 11 ½"
	54"	0' – 6"	2' – 0"	8	19' – 2"	2' – 7 ½"	7	23' – 8 ½"	19' – 7 ½"	8	17' – 3 ½"	2' – 5 ¾"	1 – 6"	5" STD	70' – 8 ½"
	60"	0' – 6"	2' – 0"	9	21' – 2"	2' – 7 ½"	8	26' – 7 ¼"	21' – 8 ¼"	9	19' – 4 ¾"	2' – 5"	1' – 6"	5" STD	88' – 9"
	66"	0' – 9"	3' – 0"	9	22' – 5"	4' – 0 ½"	8	28' – 2"	23' – 9"	9	21' – 7"	3' – 7 ¼"	2 – 6 ¼"	5" STD	103' – 3 ¼"
	72"	1' – 6"	2' – 0"	11	26' – 2"	2' – 7 ½"	10	33' – 7 ¾"	25' – 9 ¾"	11	24' – 6 ¼"	2' – 5 ½"	1' – 6"	5" STD	136' – 4 ¾"
6:1	24"	1' – 0"	3' – 0"	5	12' – 6"	4' – 0 ½"	4	14' – 1 ¾"	13' – 0 ¼"	5	11' – 1 ½"	3' – 6 ¼"	2' – 5 ¾"	4" STD	31' – 9 ¼"
	27"	1' – 3"	2' – 3"	6	15' – 0"	2' – 11 ¾"	5	17' – 8"	14' – 6 ½"	6	12' – 10 ¾"	2' – 9"	1' – 8 ½"	4" STD	40' – 10"
	30"	1' – 6"	2' – 0"	7	17' – 0"	2' – 7 ½"	6	20' – 7 ¼"	16' – 0 ¾"	7	14' – 9"	2' – 5 ½"	1' – 5 ½"	4" STD	53' – 0 ¼"
	33"	0' – 6"	2' – 0"	7	17' – 6"	2' – 7 ½"	6	21' – 2 ½"	17' – 7"	7	15' – 2"	2' – 6"	1' – 5 ½"	4" STD	54' – 5 ½"
	36"	0' – 9"	2' – 0"	8	19' – 3"	2' – 7 ½"	7	23' – 9 ¾"	19' – 1 ¼"	8	17' – 0 ½"	2' – 4 ¾"	1 – 5 ½"	5" STD	69' – 6"
	42"	0' – 6"	2' – 0"	9	22' – 0"	2' – 7 ½"	8	27' – 7 ¾"	22' – 1 ¾"	9	19' – 9 ½"	2' – 5 ¼"	1' – 5 ½"	5" STD	90' – 4 ½"
	48"	1' – 3"	2' – 0"	11	27' – 3"	2' – 7 ½"	10	35' – 0 ¼"	26' – 8 ½"	11	25' – 1"	2' – 5 ¾"	1' – 5 ½"	5" STD	139' – 3 ¼"



PIPE RUNNER LAYOUT

Note: Left forward culvert skew shown, actual culvert skew may be opposite hand.

(12) If the outermost wing pipe runner is a non-sliding pipe runner, consider the next outermost wing pipe runner the shortest.

(13) Quantities shown include, if present, the non-sliding pipes.

(14) The anchor pipe size is the next smaller size than the pipe runner size.

SPECIAL NOTE:

Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, verify all dimensions in the field prior to fabrication of the safety end treatment components.

STANDARD PIPE RUNNER AND ANCHOR PIPE SIZES (14)

Pipe Size	Pipe O.D.	Pipe I.D.
2" STD	2.375"	2.067"
3" STD	3.500"	3.068"
4" STD	4.500"	4.026"
5" STD	5.563"	5.047"

TOTAL PIPE LENGTHS FORMULAS:

$$\text{Total Length of All Pipe Runners} = \text{Total Length of Wingwall Pipe Runners} + (\text{No. of Headwall Pipe Runners})(\text{Headwall Pipe Runner Length})$$

$$\text{Total Length of All Anchor Pipes} = (3.000')(\text{No. of Wing Pipe Runners} + \text{No. of Headwall Pipe Runners} - \text{No. of Non-Sliding Pipe Runners})$$

SHEET 3 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 30° SKEW PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-30

FILE: stpf30se-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		147

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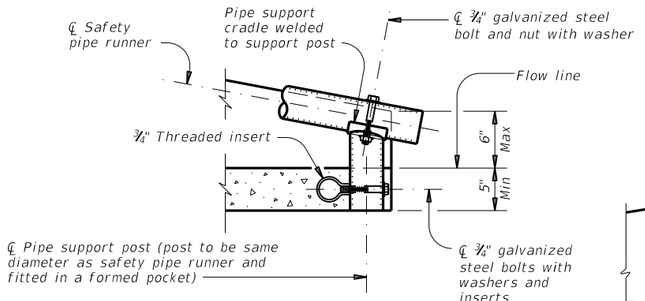
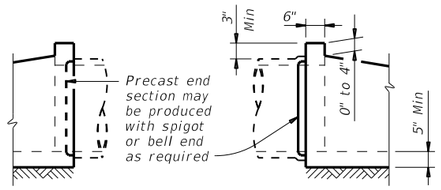
REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (8)	"D" (1)	Slope	Min Length of Unit	Single Pipe Skew	Single Pipe Runners Required	Multiple Pipes Skew	Multiple Pipes Runners Required
12"	2"	1.15"	17.00"	3:1	2' – 11"	≤ 45°	No	≤ 45°	No
				4:1	3' – 6"				
				6:1	4' – 9"				
15"	2 ¼"	1.30"	20.50"	3:1	3' – 8"	≤ 45°	No	≤ 45°	No
				4:1	4' – 7"				
				6:1	6' – 5"				
18"	2 ½"	1.60"	24.00"	3:1	4' – 6"	≤ 45°	No	≤ 45°	No
				4:1	5' – 8"				
				6:1	8' – 0"				
24"	3"	1.95"	31.00"	3:1	6' – 2"	≤ 45°	No	= 30°	No
				4:1	7' – 10"			> 30°	Yes
				6:1	11' – 3"				
30"	3 ½"	2.65"	38.50"	3:1	7' – 10"	= 15°	No	= 15°	No
				4:1	10' – 1"	> 15°	Yes	> 15°	Yes
				6:1	14' – 8"				
36"	4"	2.75"	45.50"	3:1	9' – 5"	= 0°	No	≥ 0°	Yes
				4:1	12' – 3"	> 0°	Yes		
				6:1	17' – 11"				
42"	4 ½"	N/A	52.50"	3:1	11' – 1"	≥ 0°	Yes	≥ 0°	Yes
				4:1	14' – 5"				
				6:1	21' – 2"				



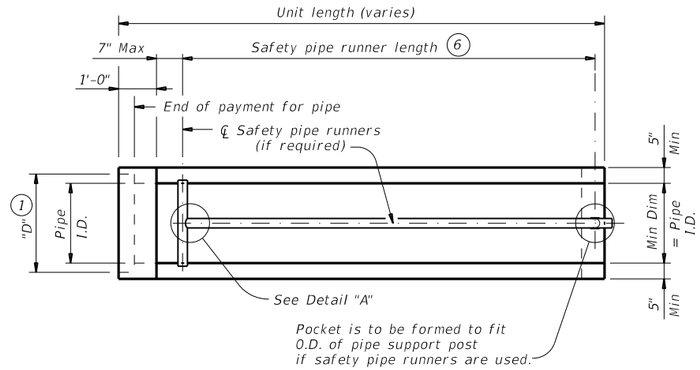
END DETAIL FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)



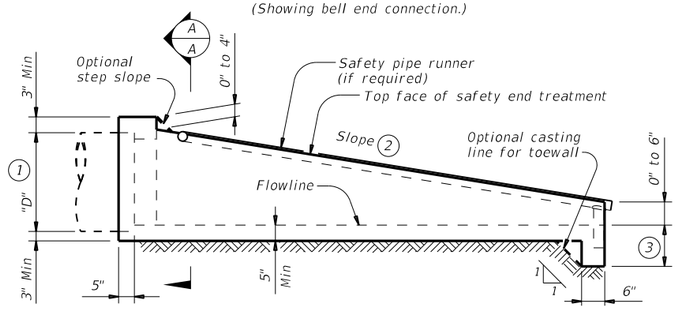
OPTIONAL JOINT FOR RCP

(Showing joint between RCP and precast safety end treatment)



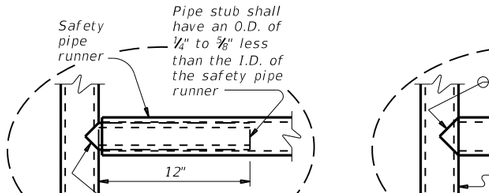
PLAN

(Showing bell end connection.)



LONGITUDINAL ELEVATION

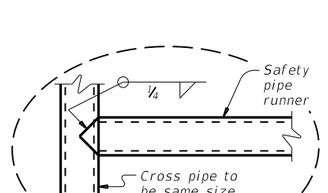
(Showing bell end connection.)



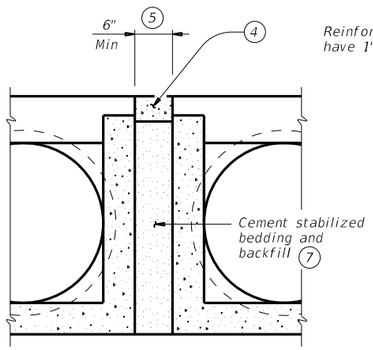
OPTION A

DETAIL A

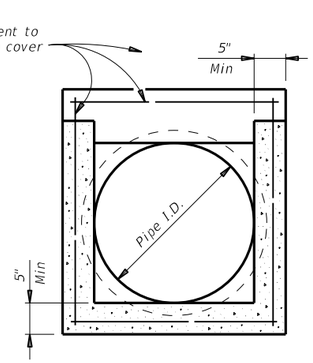
(If required)



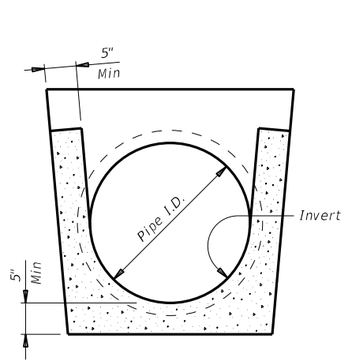
OPTION B



MULTIPLE PIPE INSTALLATION

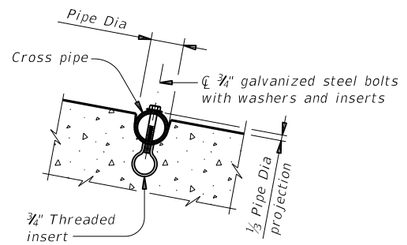


OPTION WITH SQUARE BOTTOM



OPTION WITH INVERT BOTTOM

SECTION A-A



INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)

SAFETY PIPE RUNNER DIMENSIONS

Max Safety Pipe Runner Length	Required Pipe Runner Size: Pipe Size	Pipe O.D.	Pipe I.D.
11' – 2"	3" STD	3.500"	3.068"
15' – 6"	3 ½" STD	4.000"	3.548"
20' – 10"	4" STD	4.500"	4.026"
35' – 4"	5" STD	5.563"	5.047"

(1) Dimension "D" is based on reinforced concrete pipe (RCP) meeting the requirements of ASTM C-76, Class III, (RCP Wall "B" thickness). Adjust "D" for any other wall thickness used. For thermoplastic pipe (TP) take into account the annular space requirements for grouted connections.

(2) Slope as shown elsewhere in plans. Slope of 3:1 or flatter is required for vehicle safety.

(3) Toewall to be used only when dimension is shown elsewhere in the plans.

(4) Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".

(5) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

(6) Measured along slope.

(7) Provide cement stabilized bedding and backfill in accordance with the Item 400, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.

(8) Thermoplastic pipe wall thickness may vary. Adjust accordingly. Thermoplastic pipe requires the safety end treatments to have a bell end for grouted connections.

GENERAL NOTES:

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

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

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

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

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

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

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

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

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

Connect RCP using the Optional Joint for RCP detail shown or in accordance with Item 464 "Reinforced Concrete Pipe". Connect TP by grouting. See 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 ~ CROSS DRAINAGE

PSET-SC

FILE: psetscss-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		148

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DATE: 10/13/2021 11:49:47 AM
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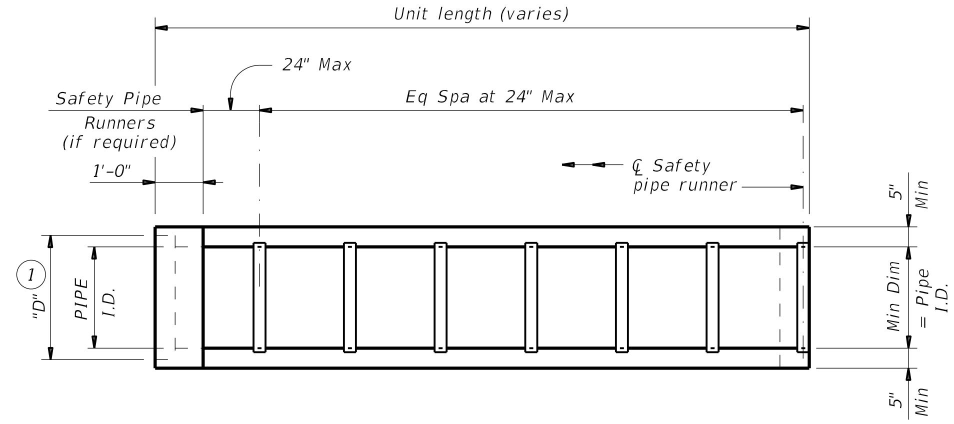
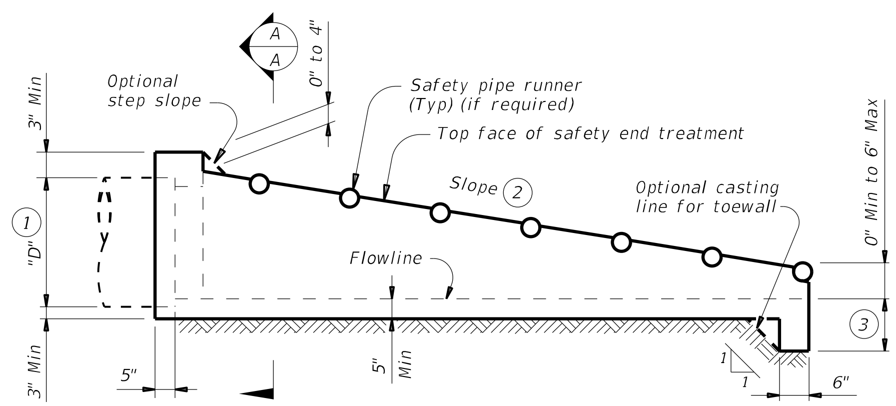


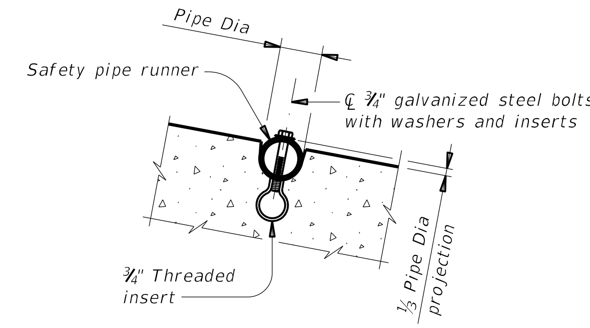
PLAN

(Showing bell end connection.)



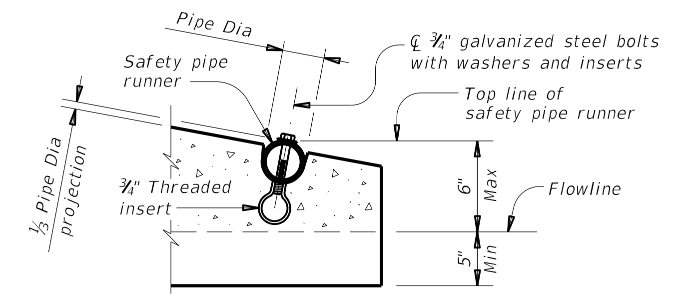
LONGITUDINAL ELEVATION

(Showing bell end connection.)

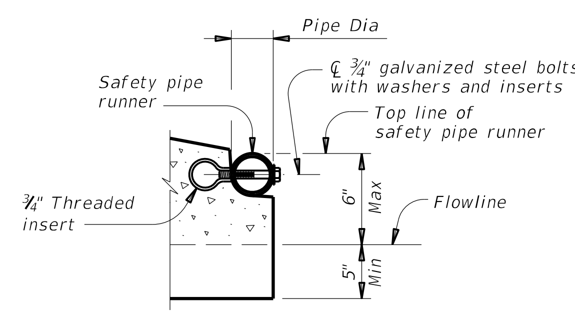


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



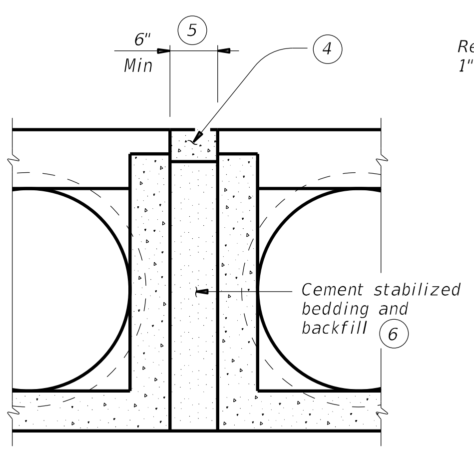
OPTION A



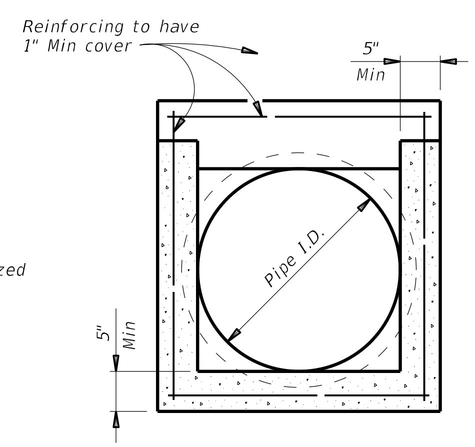
OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

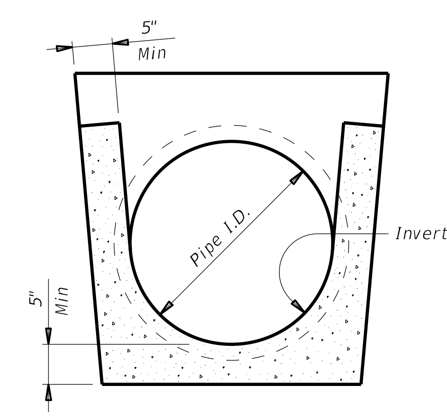
(If required)



MULTIPLE PIPE INSTALLATION

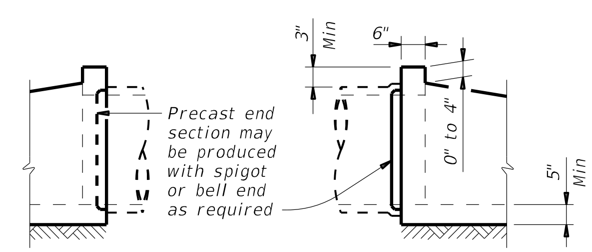


OPTION WITH SQUARE BOTTOM



OPTION WITH INVERT BOTTOM

SECTION A-A



OPTIONAL JOINT FOR RCP

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

REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (7)	"D" (1)	Slope	Min Length	Pipe Runners Required		Required Pipe Runner Size		
						Single Pipe	Multiple Pipe	Nominal Dia.	O.D.	I.D.
12"	2"	1.15"	17.00"	6:1	4' - 9"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
15"	2 ¼"	1.30"	20.50"	6:1	6' - 5"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
18"	2 ½"	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 ½"	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 ½"	N/A	52.50"	6:1	21' - 2"	Yes	Yes	4" STD	4.500"	4.026"

(1) Dimension "D" is based on reinforced concrete pipe (RCP) meeting the requirements of ASTM C-76, Class III, (RCP Wall "B" thickness). Adjust "D" for any other wall thickness used. For thermoplastic pipe (TP) take into account the annular space requirements for grouted connections.

(2) Slope as shown elsewhere in the plans. Slope of 6:1 or flatter is required for vehicle safety.

(3) Toewall to be used only when dimension is shown elsewhere in the plans.

(4) Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".

(5) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

(6) 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.

(7) 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 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: psetspss-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		149

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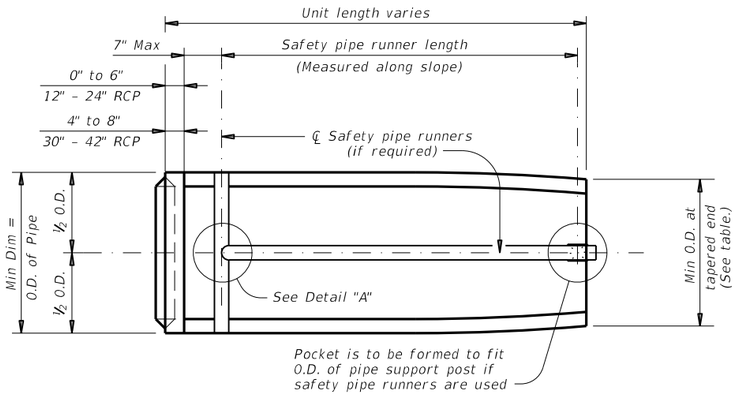
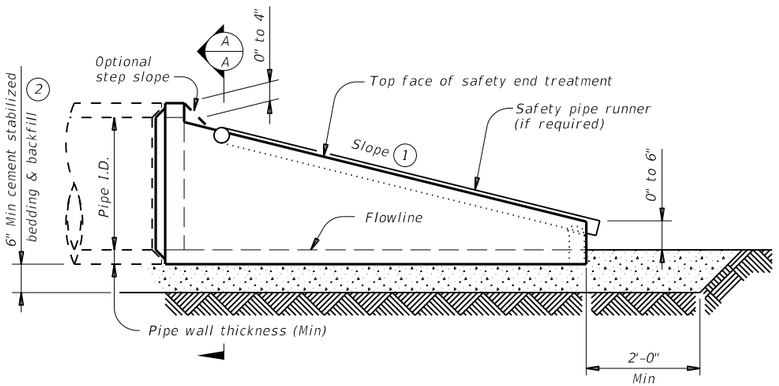


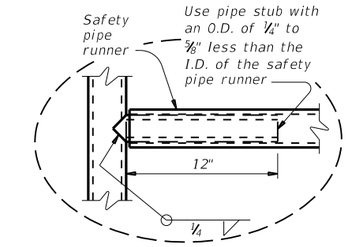
PLAN VIEW

(Showing spigot end connection.)

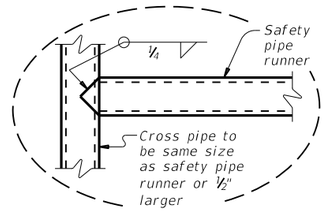


LONGITUDINAL ELEVATION

(Showing spigot end connection.)

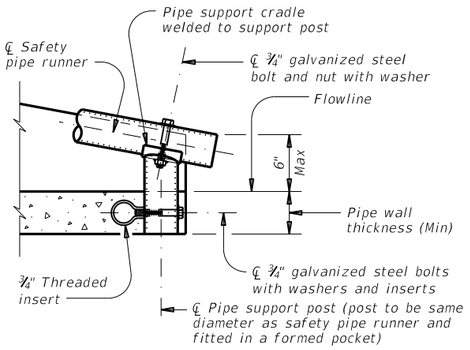


OPTION A



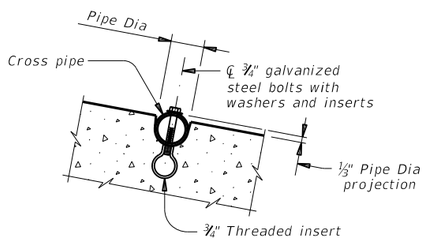
OPTION B

DETAIL A



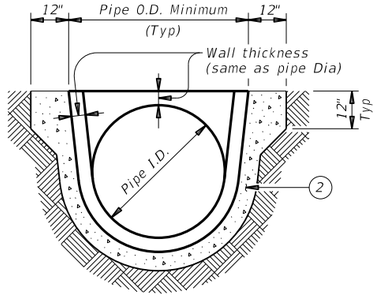
END DETAIL FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)

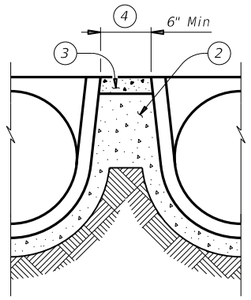


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



SECTION A-A



MULTIPLE PIPE INSTALLATION

MAX SAFETY PIPE RUNNER LENGTHS AND REQUIRED SAFETY PIPE RUNNER SIZES

Max Safety Pipe Runner Length	Required Pipe Runner Size		
	Pipe Size	Pipe O.D.	Pipe I.D.
11' – 2"	3" STD	3.500"	3.068"
15' – 6"	3 ½" STD	4.000"	3.548"
20' – 10"	4" STD	4.500"	4.026"
35' – 4"	5" STD	5.563"	5.047"

(1) Slope as shown elsewhere in the plans. Slope of 3:1 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 "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 be considered subsidiary to the Item "Safety End Treatment".

(4) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

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. / ft. of pipe)	Slope	Minimum Length of Unit	Single Pipe		Multiple Pipe	
							Skew	Pipe Runners Required	Skew	Pipe Runners Required
12"	2"	16"	16"	0.07 Circ.	3:1	2' – 0"	≤ 45°	No	≤ 45°	No
					4:1	2' – 8"				
					6:1	4' – 0"				
15"	2 ¼"	19 ½"	19"	0.07 Circ.	3:1	2' – 10"	≤ 45°	No	≤ 45°	No
					4:1	3' – 9"				
					6:1	5' – 8"				
18"	2 ½"	23"	21 ½"	0.07 Circ.	3:1	3' – 8"	≤ 45°	No	≤ 45°	No
					4:1	4' – 10"				
					6:1	7' – 3"				
24"	3"	30"	27"	0.07 Circ.	3:1	5' – 3"	≤ 45°	No	≤ 30°	No
					4:1	7' – 0"			> 30°	Yes
					6:1	10' – 6"				
30"	3 ½"	37"	31"	0.18 Circ.	3:1	6' – 3"	≤ 15°	No	≤ 15°	No
					4:1	8' – 2"	> 15°	Yes	> 15°	Yes
					6:1	12' – 1"				
36"	4"	44"	36"	0.19 Ellip.	3:1	7' – 10"	= 0°	No	≥ 0°	Yes
					4:1	10' – 4"	> 0°	Yes		
					6:1	15' – 4"				
42"	4 ½"	51"	41 ½"	0.23 Ellip.	3:1	9' – 6"	≥ 0°	Yes	≥ 0°	Yes
					4:1	12' – 6"				
					6:1	18' – 7"				

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

GENERAL NOTES:

Precast safety end treatment for reinforced concrete pipe (CRP) 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 1,800 Lbs at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

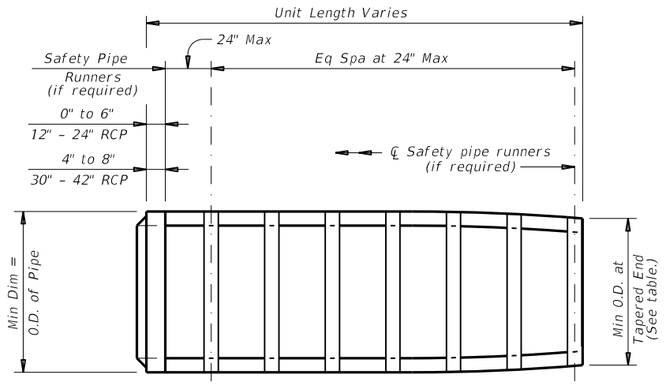
Texas Department of Transportation | Bridge Division Standard

PRECAST SAFETY END TREATMENT

TYPE II ~ CROSS DRAINAGE

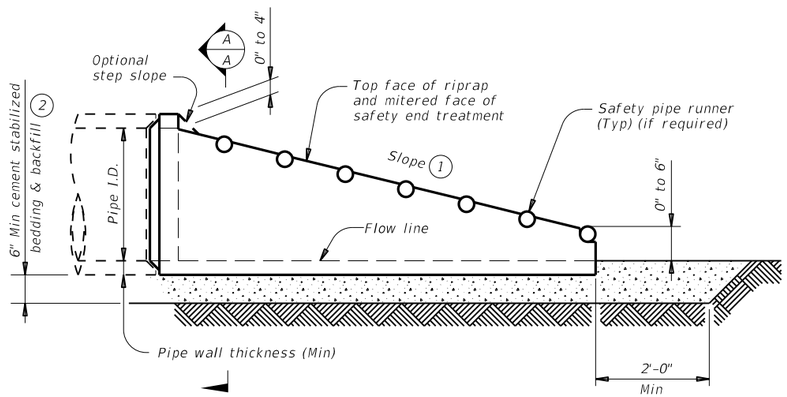
PSET-RC

FILE: psetrcss-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		150



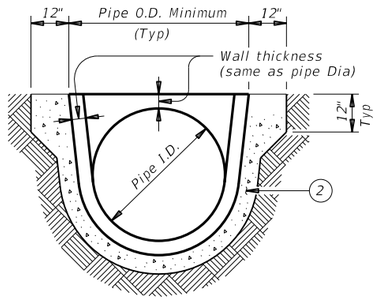
PLAN VIEW – 12" THRU 24"

(Showing spigot end connection.)

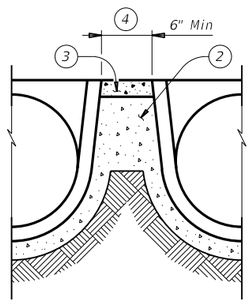


LONGITUDINAL ELEVATION - 12" THRU 24"

(Showing spigot end connection.)



SECTION A-A



MULTIPLE PIPE INSTALLATION

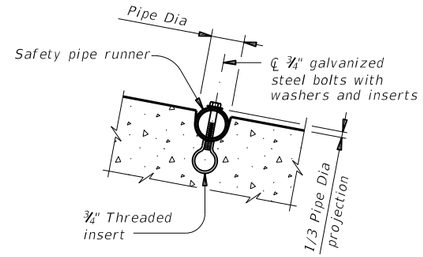
(1) Slope as shown elsewhere in the plans. Slope of 6:1 or flatter is required for vehicle safety.

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".

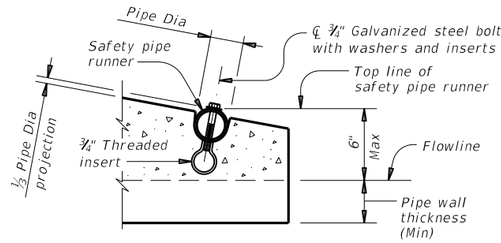
(4) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

(5) Safety pipe runners are required for multiple pipe culverts with more than two pipes.

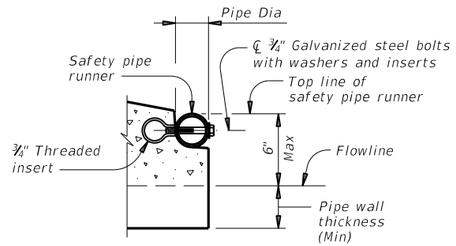


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(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 ¼"	19 ½"	19"	0.07 Circ.	6:1	5'–8"	No	(5)	3" STD	3.500"	3.068"
18"	2 ½"	23"	21 ½"	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 ½"	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 ½"	51"	41 ½"	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.

Texas Department of Transportation

Bridge Division Standard

PRECAST SAFETY END TREATMENT

TYPE II ~ PARALLEL DRAINAGE

PSET-RP

FILE: psetrpss-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		151

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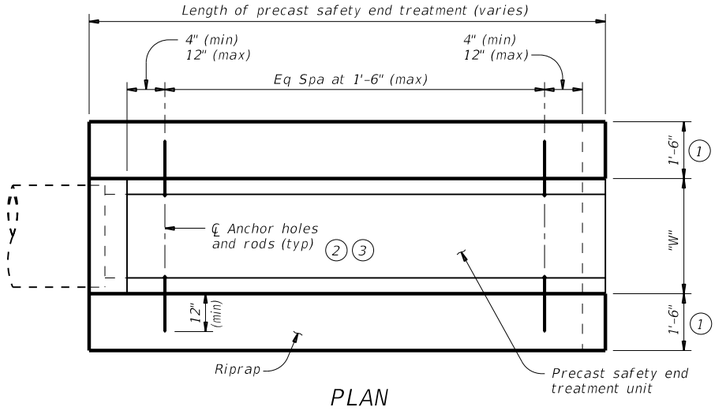
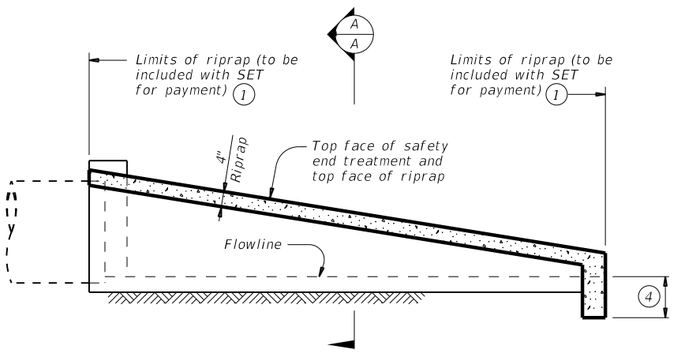


PLAN



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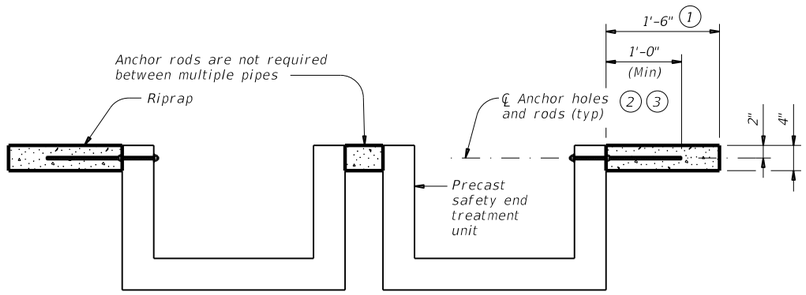
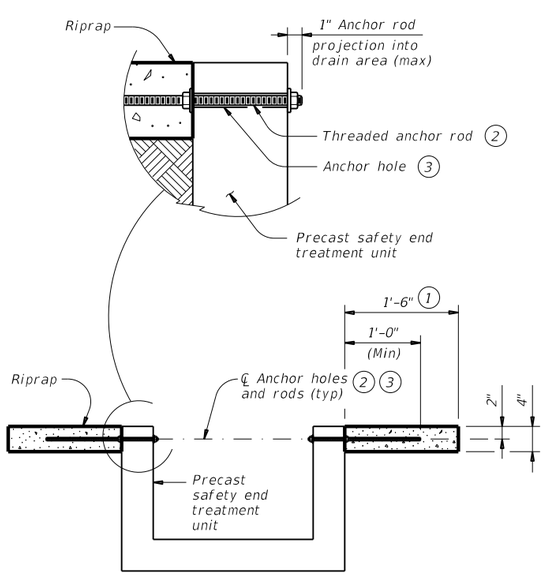


MULTIPLE PIPE INSTALLATION



SINGLE PIPE INSTALLATION

SECTION A-A

ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) 5

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 Saftey 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.lrprecast.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.

Texas Department of Transportation

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	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		152

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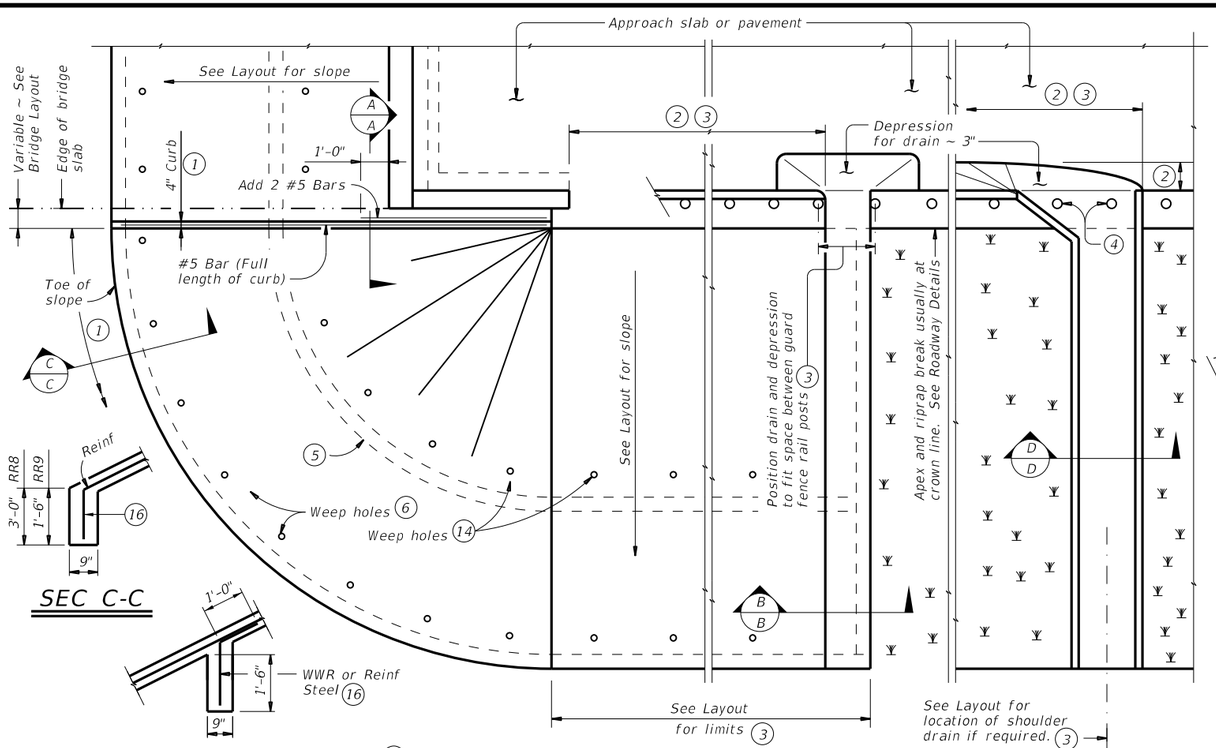
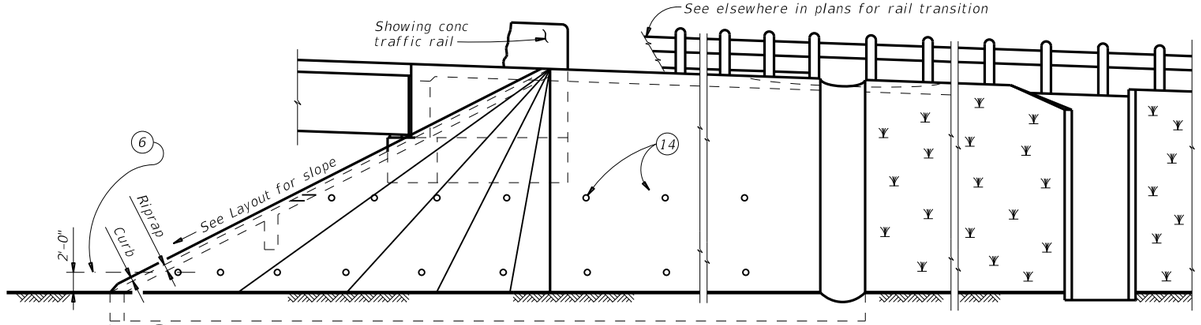
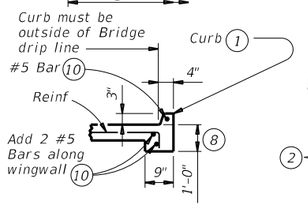
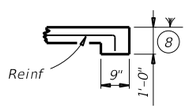
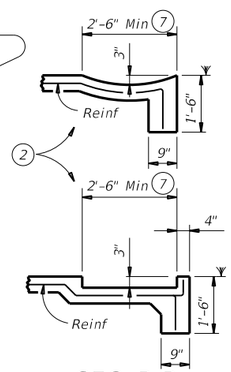
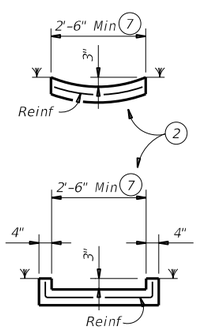


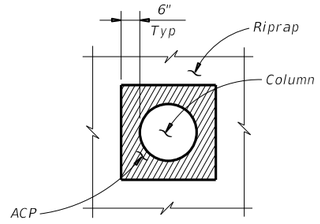






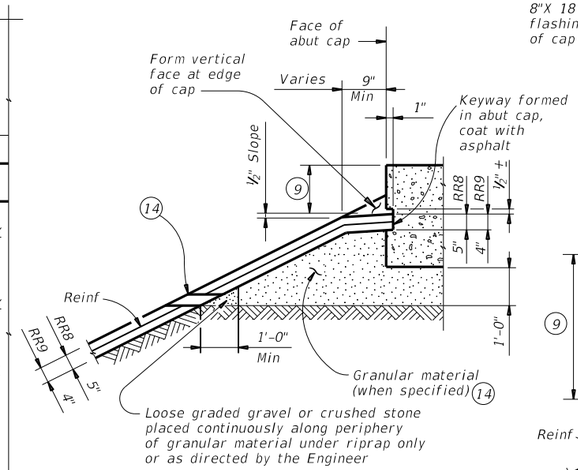




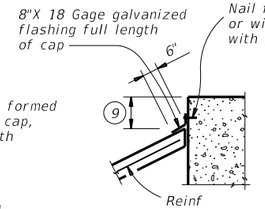


RIPRAP DETAIL AT COLUMNS

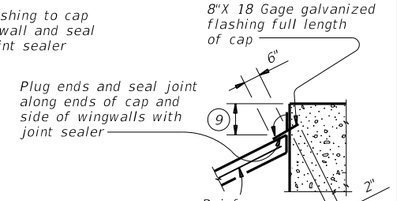
(As directed by the Engineer)



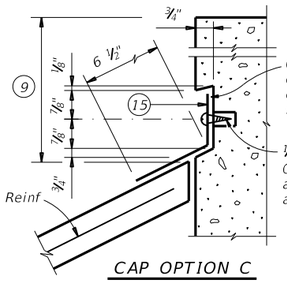
SHOWING KEYWAY OPTION



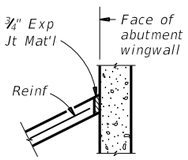
CAP OPTION A



CAP OPTION B

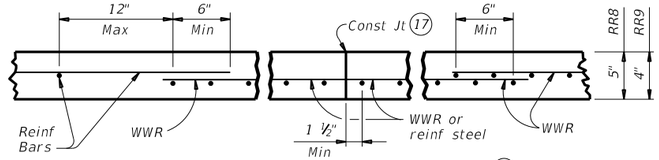


CAP OPTION C



SECT THRU RIPRAP AT WINGWALL (12)

SECTIONS THRU RIPRAP AT CAP (11)



REINFORCEMENT DETAILS (13)

See General Notes for optional synthetic fiber reinforcement.

(1) When riprap is shown extended around header on layout, extend slab and toewall as shown and eliminate 4" curb.

(2) Limits and configuration of drains and depressions are as shown elsewhere in plans or as directed by the Engineer.

(3) Location of shoulder drain must consider limitations imposed by rail transition. Do not locate shoulder drains at expansion joints between approach slab and concrete pavement.

(4) See details elsewhere in plans for installation of guard fence posts through concrete riprap.

(5) Provide intermediate toewall only when designated elsewhere in the plans or included in the specifications.

(6) Provide lower level of 2" Dia weep holes at 10' c-c backed by 1 CF packet of gravel and galvanized hardware cloth at all locations unless directed by the Engineer to eliminate.

(7) Use wider or other drain configurations if shown elsewhere in plans or if directed by the Engineer.

(8) Wall extension may be reduced or modified if approved by the Engineer. Increase wall extension to 1'-6" whenever the optional intermediate toewall is called for in the plans.

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

(10) #5 bars shown are required even when synthetic fiber reinforcing option is selected.

(11) Provide sealing option for joint between the face of cap and riprap as designated by the Engineer or as shown elsewhere on plans.

(12) Flashing (shown in Cap Option A) may be used at wingwall in addition to Exp Jt Mat'l if shown on plans or directed by the Engineer.

(13) Provide #3 reinforcing bars at 18" Spa c-c. Provide Welded Wire Reinforcement (WWR) as 6x6-D2.9xD2.9 or D3xD3. Combinations of WWR and reinforcing bars may be used if both are permitted. Use lap splices of a minimum 6 inches, measured from the transverse wire of WWR, and the ends of reinforcing bars.

(14) If granular material is specified, provide upper level of 2" Dia weep holes at 10' c-c backed by galvanized hardware cloth.

(15) 8" x 18 Gage Galv Sheet Metal

(16) Provide WWR or #3 bars, with 1'-0" extension into slope.

(17) WWR or reinforcing steel is continuous through riprap construction joints. Provide WWR or reinforcing steel that extends 1'-1" minimum into adjacent riprap on each side of construction joint even if synthetic reinforcing fiber is utilized.

FOR CONTRACTOR'S INFORMATION ONLY:
5" of RR8 = 0.015 CY/SF
4" of RR9 = 0.012 CY/SF
#3 Reinf at 18" c-c = 0.501 Lbs/SF
6x6-D3xD3 = 0.408 Lbs/SF

GENERAL NOTES:

Provide Class "B" concrete (f'c = 2,000 psi) unless noted elsewhere in plans.

Provide Grade 60 reinforcing steel.

Provide deformed welded wire reinforcement (WWR) meeting ASTM A1064, unless otherwise shown.

Provide reinforcing bars, deformed WWR, or any suitable combination of both types for riprap reinforcing, unless specified elsewhere in the plans.

Optionally synthetic fibers may be used if approved by the Engineer. Provide synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) in lieu of steel reinforcing in riprap concrete.

Install construction joints or grooved joints extending the full slant slope height at intervals of approximately 20 feet unless otherwise directed by the Engineer.

Hardware cloth, loose grade stone behind weep holes, flashing, or other sealing material are subsidiary to the bid item "Riprap".

See Layout for limits of riprap.

RR8 is to be used on stream crossings.

RR9 is to be used on other embankments.

Texas Department of Transportation

Bridge Division Standard

CONCRETE RIPRAP AND SHOULDER DRAINS
EMBANKMENTS AT BRIDGE ENDS (TYPES RR8 & RR9)

CRR

FILE: crrstde1-19.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		153

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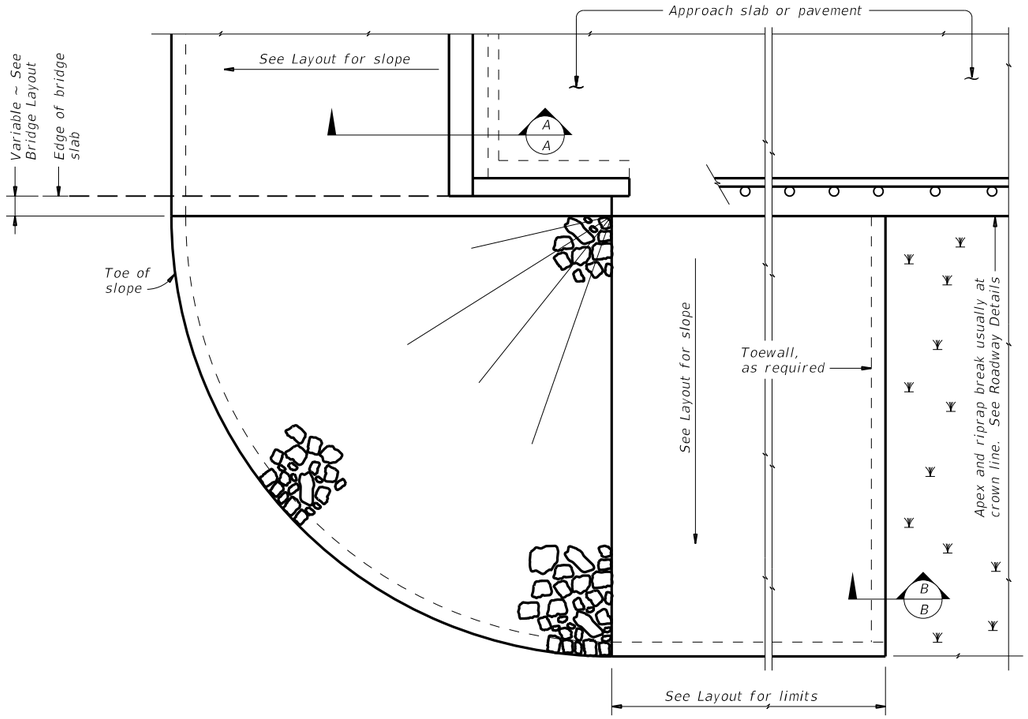
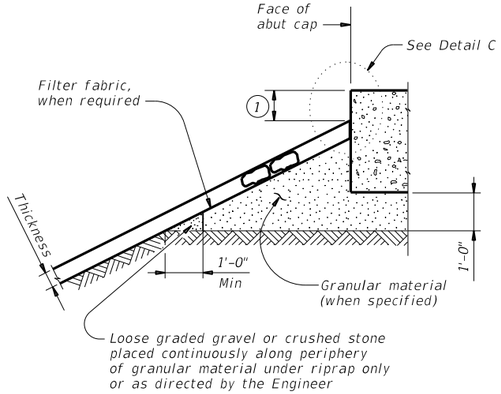
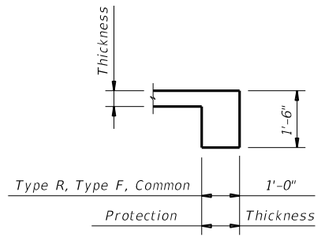


PLAN

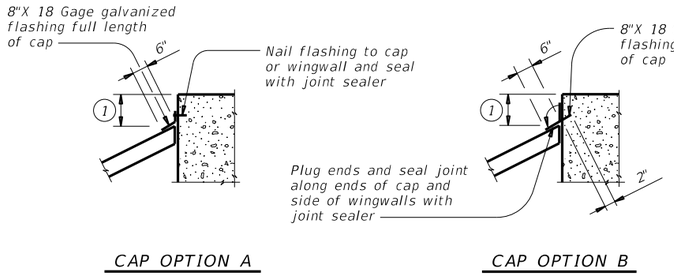


SECTION A-A AT CAP



SECTION B-B

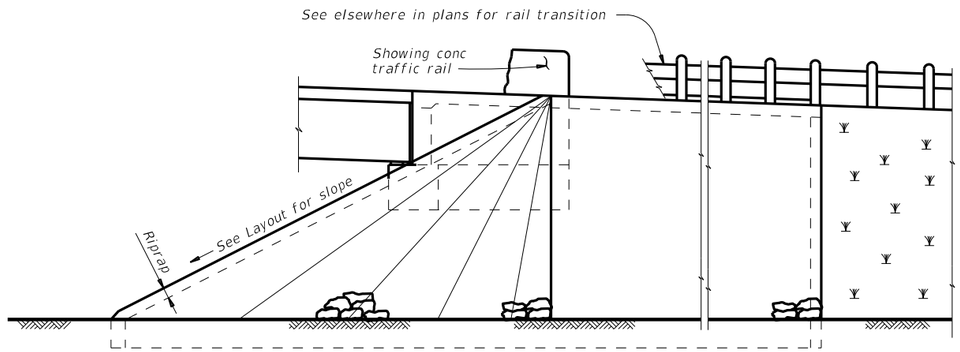
Provide toewall when shoulder drain is located adjacent to limits of stone riprap. Omit toewall when thickness of protection riprap is greater than 18".



CAP OPTION A

CAP OPTION B

DETAIL C



ELEVATION

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.

(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.

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

FILE: srrstde1-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
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	DAL	KAUFMAN		154

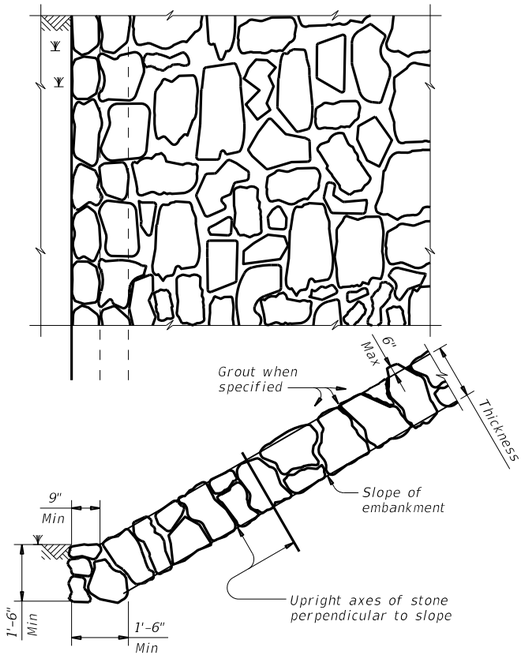


FIGURE 1 ~ TYPE R STONE RIPRAP

dry or grouted

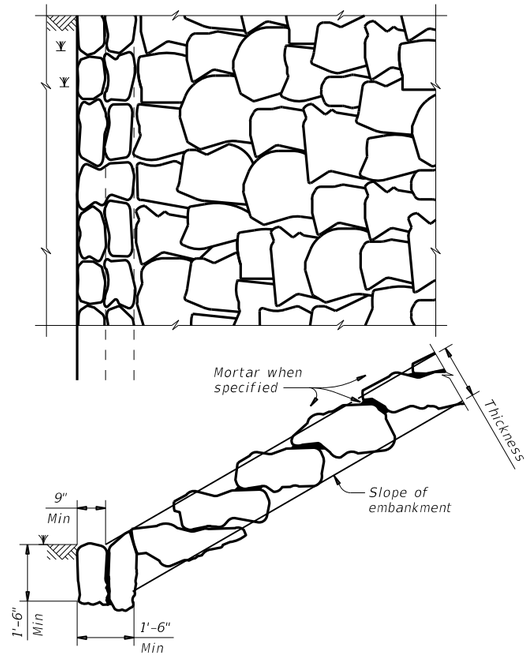


FIGURE 2 ~ TYPE F STONE RIPRAP

dry or mortared

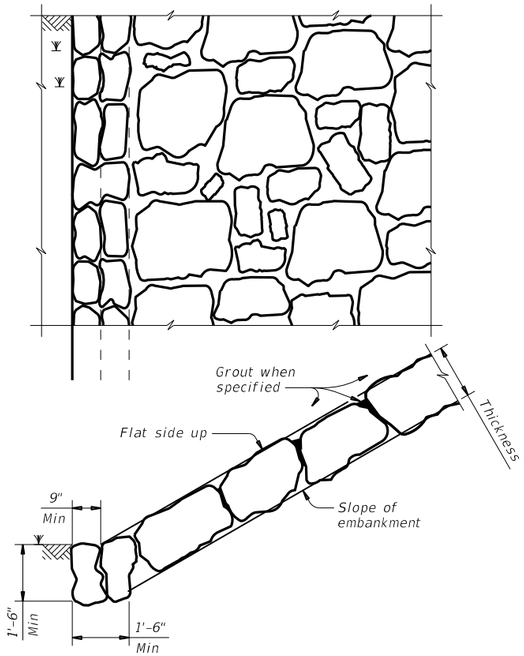


FIGURE 3 ~ TYPE F STONE RIPRAP

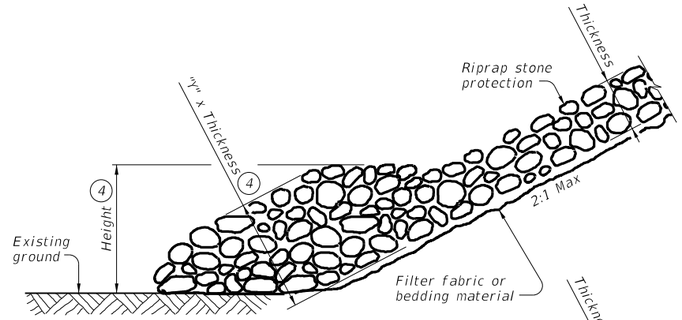
grouted

2 Provide bedding material instead of filter fabric if shown elsewhere in plans. See Layout for thickness of bedding material.

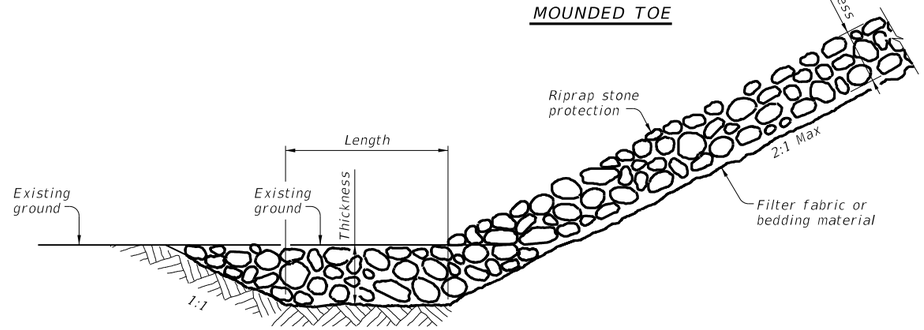
3 Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.

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.



MOUNDED TOE



EXTENDED ROCK FILLED TRENCH

PROTECTION STONE RIPRAP TOE OPTIONS 5

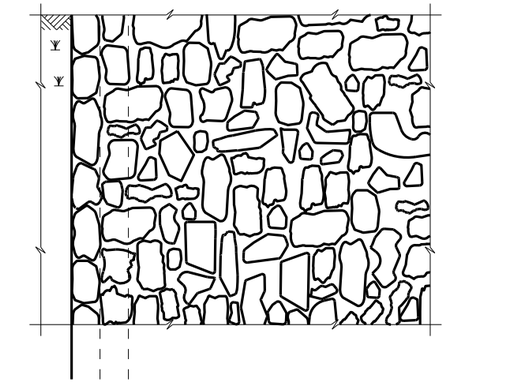


FIGURE 4 ~ COMMON STONE RIPRAP

dry or grouted

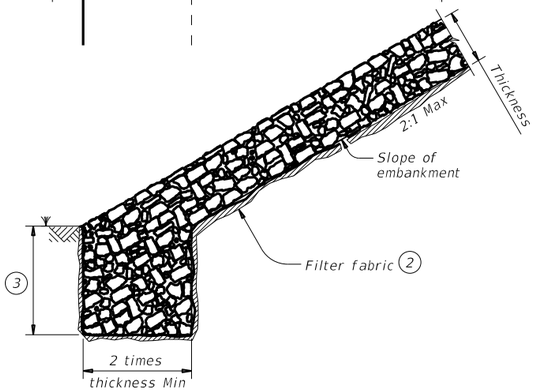


FIGURE 5 ~ PROTECTION STONE RIPRAP 5

SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

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©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		155

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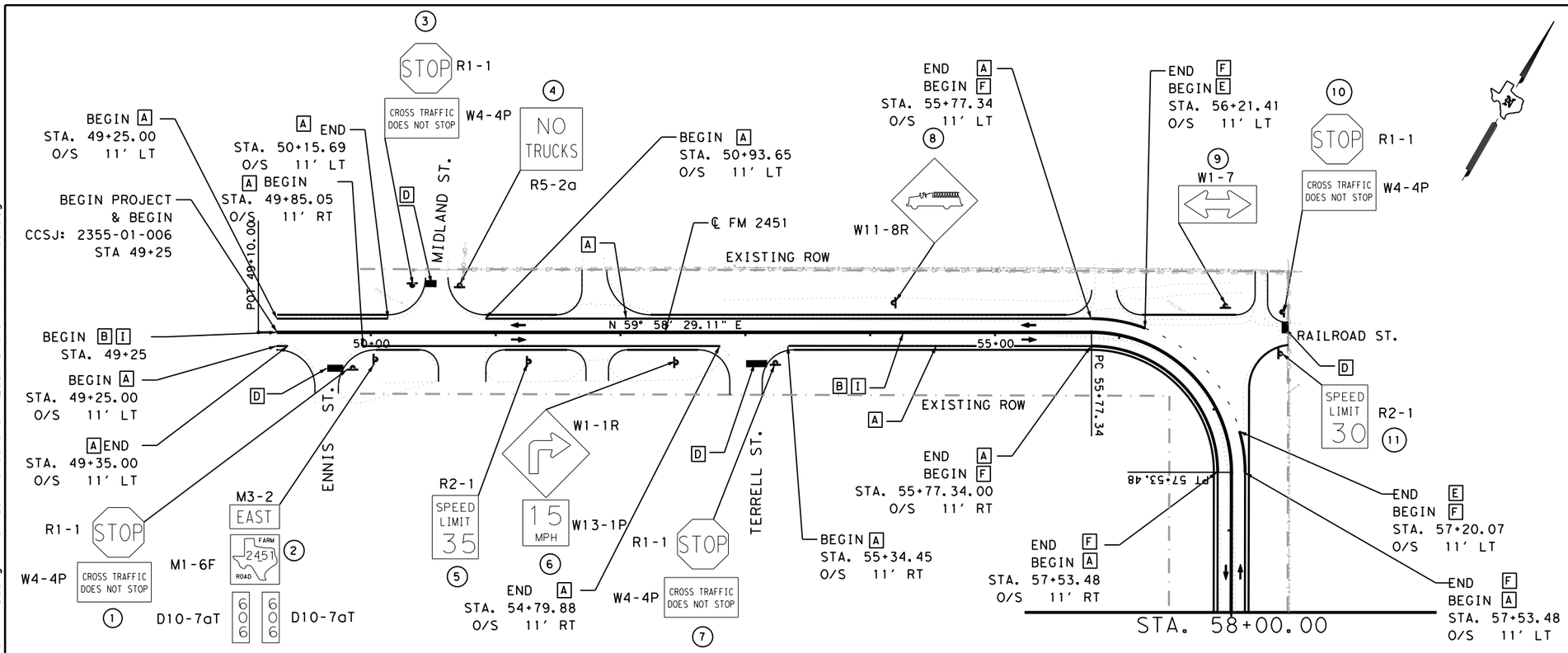


LEGEND:

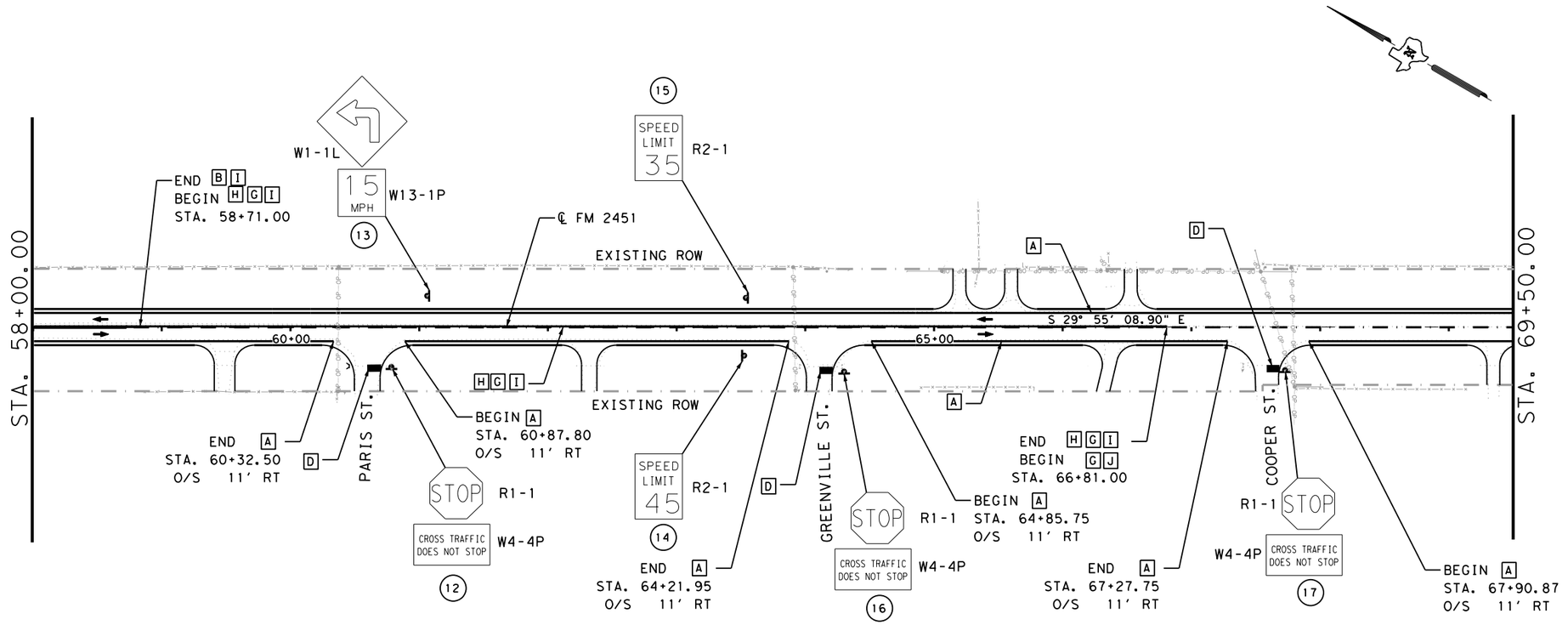
[A]	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
[B]	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
[C]	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
[D]	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
[E]	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
[F]	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
[G]	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
[H]	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
[I]	REFL PAV MRKR TY II-A-A AT 40'
[J]	REFL PAV MRKR TY II-A-A AT 80'
[K]	REFL PAV MRKR TY II-A-A AT 20'
[L]	REFL PAV MRKR TY I-C AT 20'
[M]	REFL PAV MRK TY I (W)(ARROW)
[N]	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

NOTE:
1. LOCATION OF MAILBOX WILL BE DETERMINED IN THE FIELD BY THE ENGINEER.
2. EXISTING STREET NAME SIGNS THAT ARE REMOVED SHALL BE GIVEN TO TXDOT FOR RETURNING TO THE CITY OR COUNTY.



FALON J. RENFROE 131914 LICENSED PROFESSIONAL ENGINEER STATE OF TEXAS

Falon Renfroe, P.E. 10/18/2021
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FM 2451 SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 1 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	156
CHECK FR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

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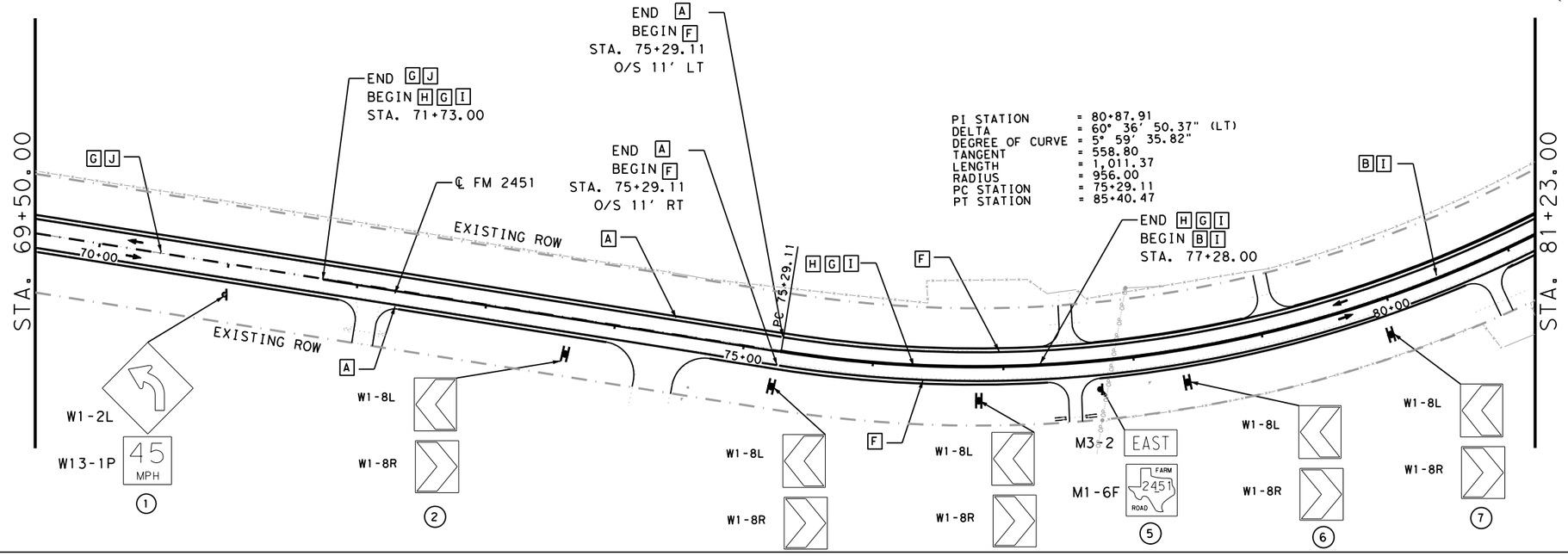

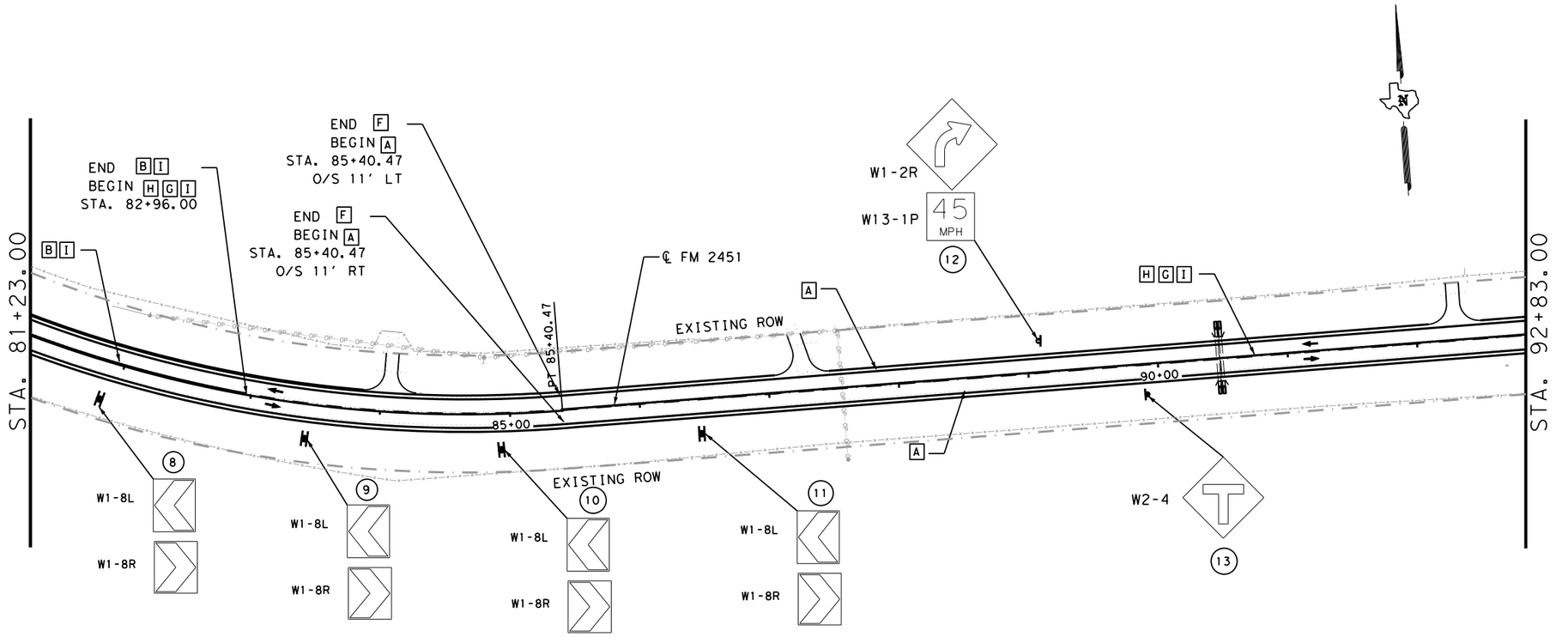

LEGEND:

A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
I	REFL PAV MRKR TY II-A-A AT 40'
J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

NOTE:
1. LOCATION OF MAILBOX WILL BE DETERMINED IN THE FIELD BY THE ENGINEER.
2. EXISTING STREET NAME SIGNS THAT ARE REMOVED SHALL BE GIVEN TO TXDOT FOR RETURNING TO THE CITY OR COUNTY.

STATE OF TEXAS
FALON J. RENFROE
131914
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PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 10/18/2021
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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 2 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	157
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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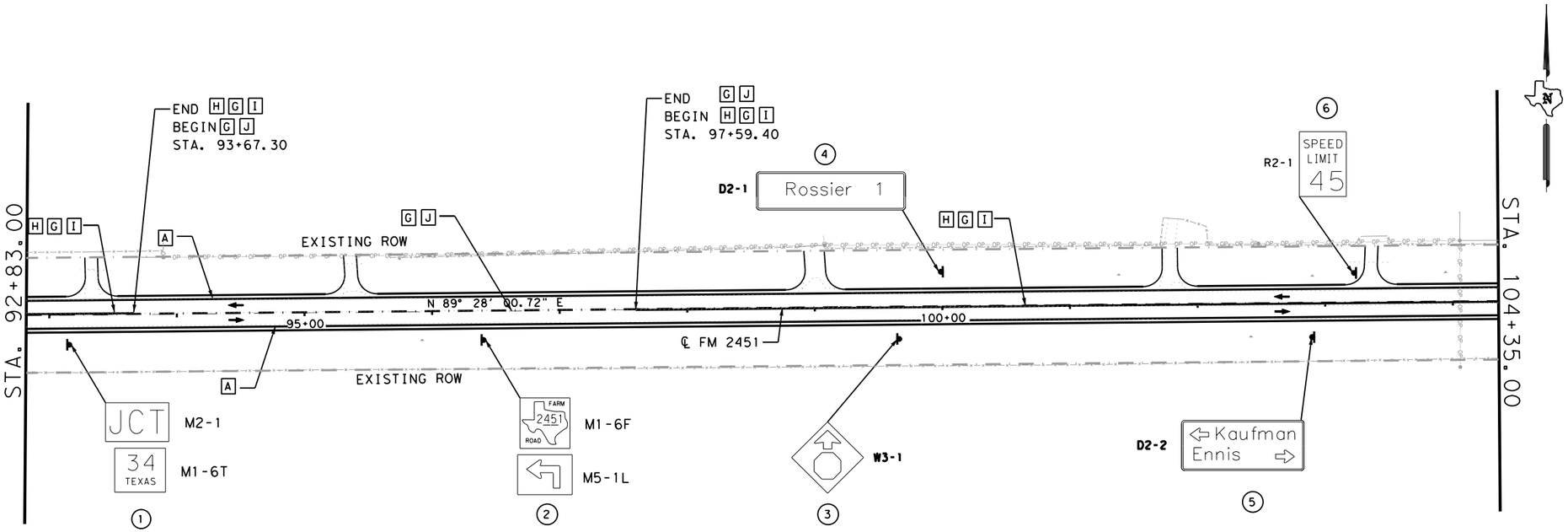

LEGEND:

A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
I	REFL PAV MRKR TY II-A-A AT 40'
J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

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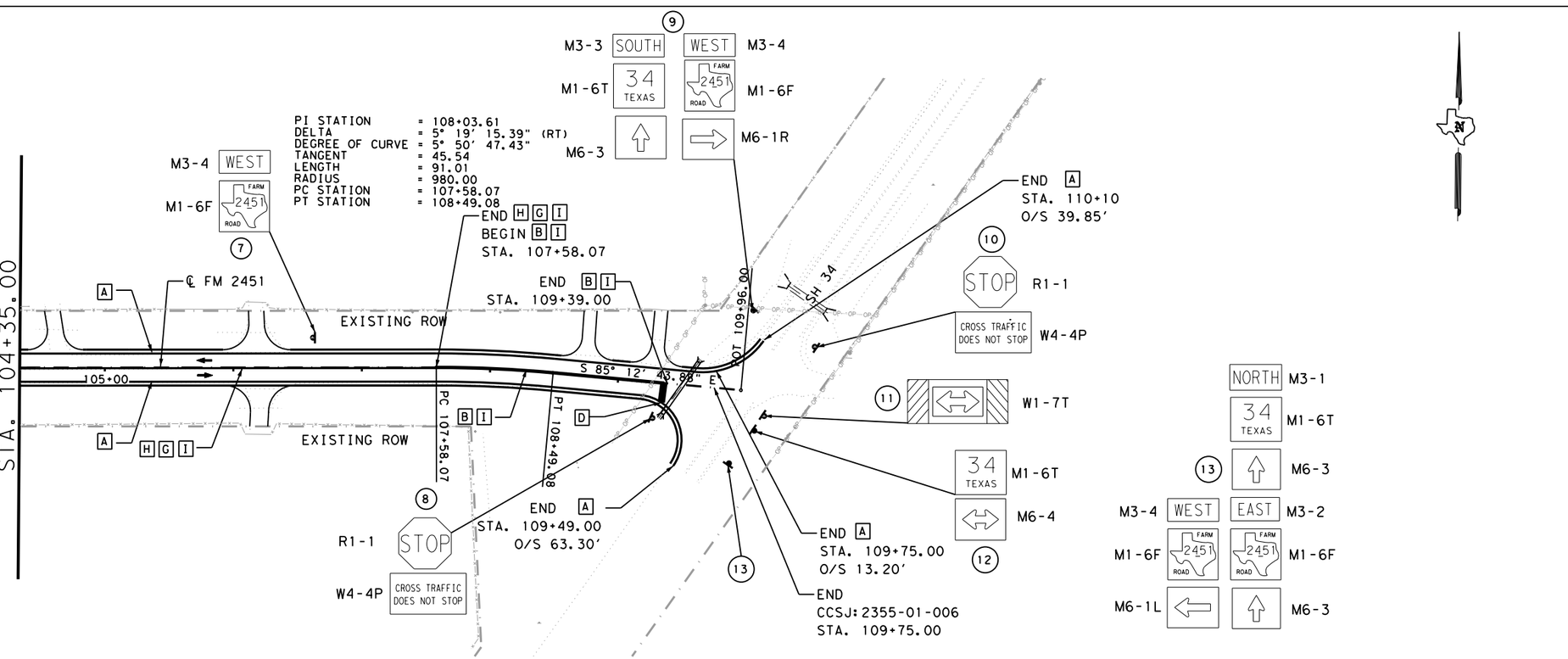

STATE OF TEXAS
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Signature of Registrant & Date

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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 3 OF 15

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	158
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
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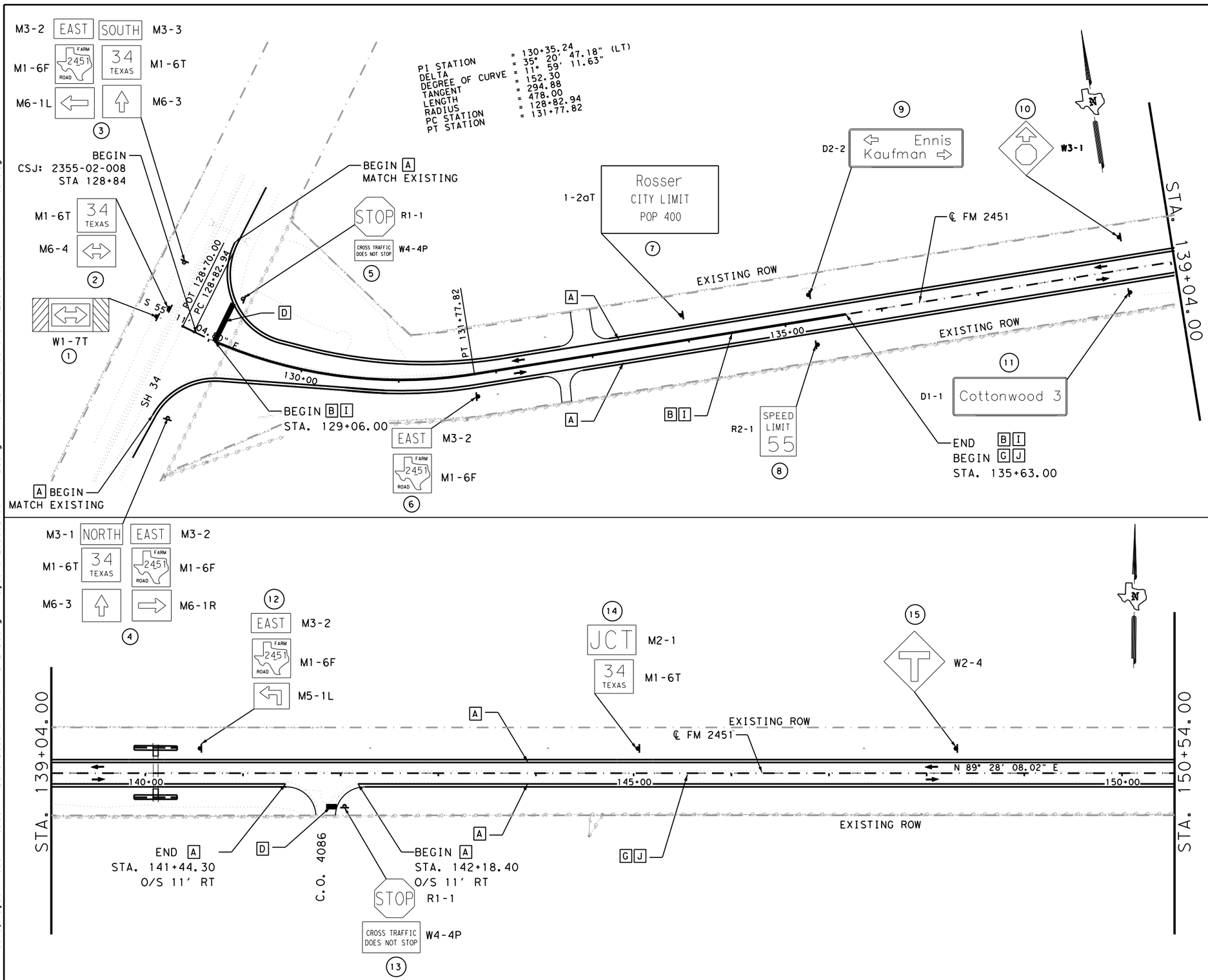

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FM 2451 SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 4 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	159
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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FR				

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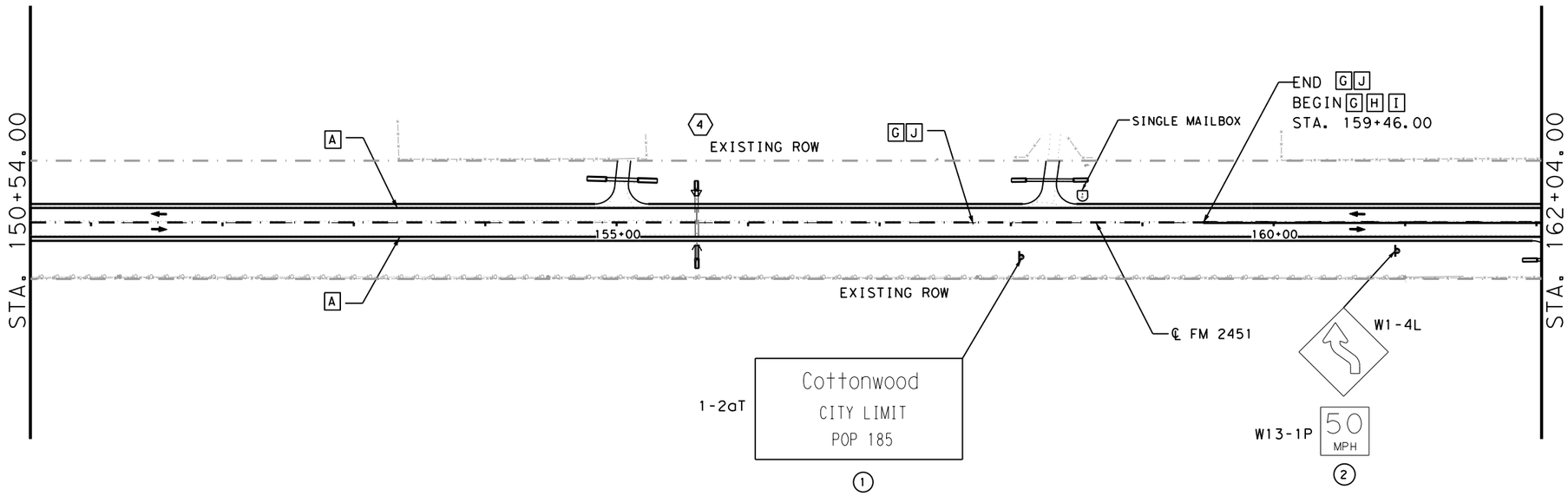

LEGEND:

A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
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J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

NOTE:
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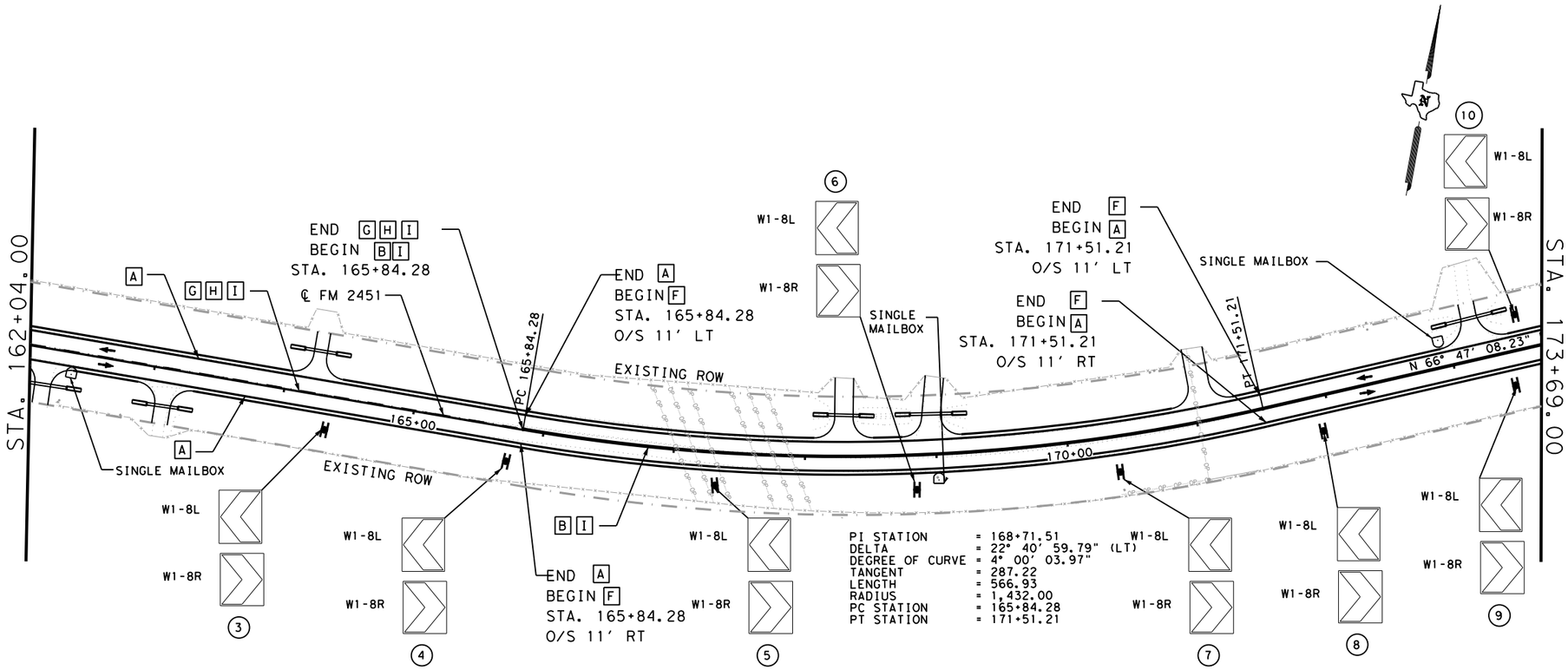

PI STATION = 168+71.51
DELTA = 22° 40' 59.79" (LT)
DEGREE OF CURVE = 4° 00' 03.97"
TANGENT = 287.22
LENGTH = 566.93
RADIUS = 1,432.00
PC STATION = 165+84.28
PT STATION = 171+51.21

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FM 2451 SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 5 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	160
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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FR				

DATE: 10/18/2021 2:15:34 PM
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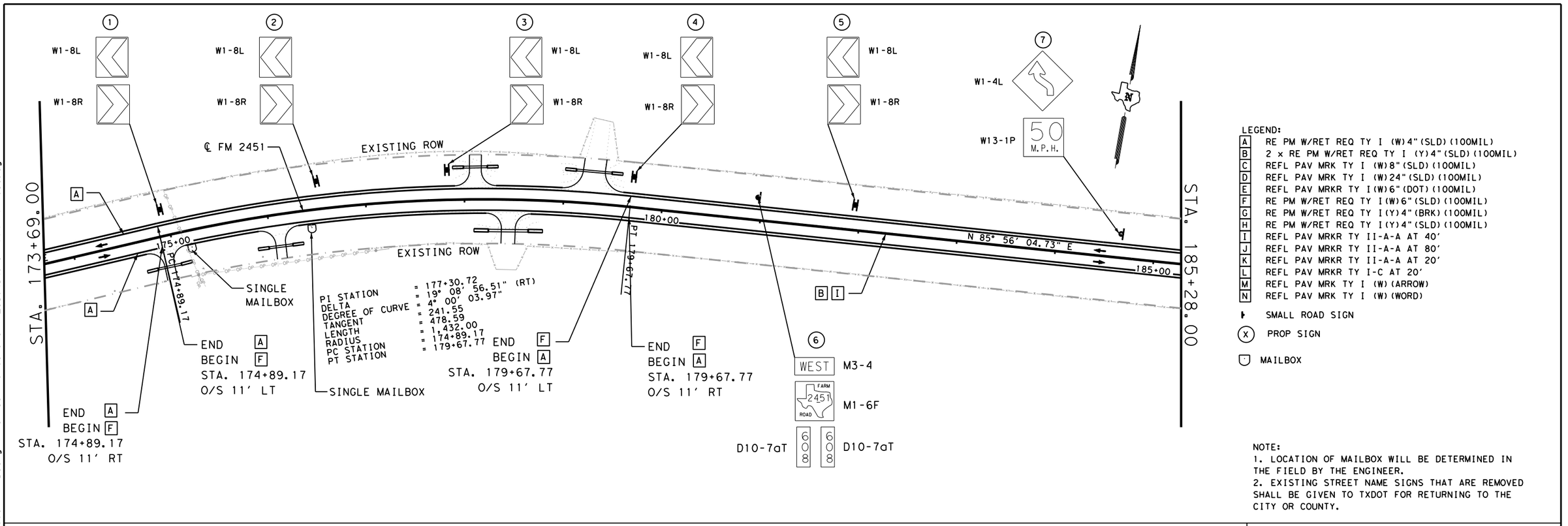

NOTE:
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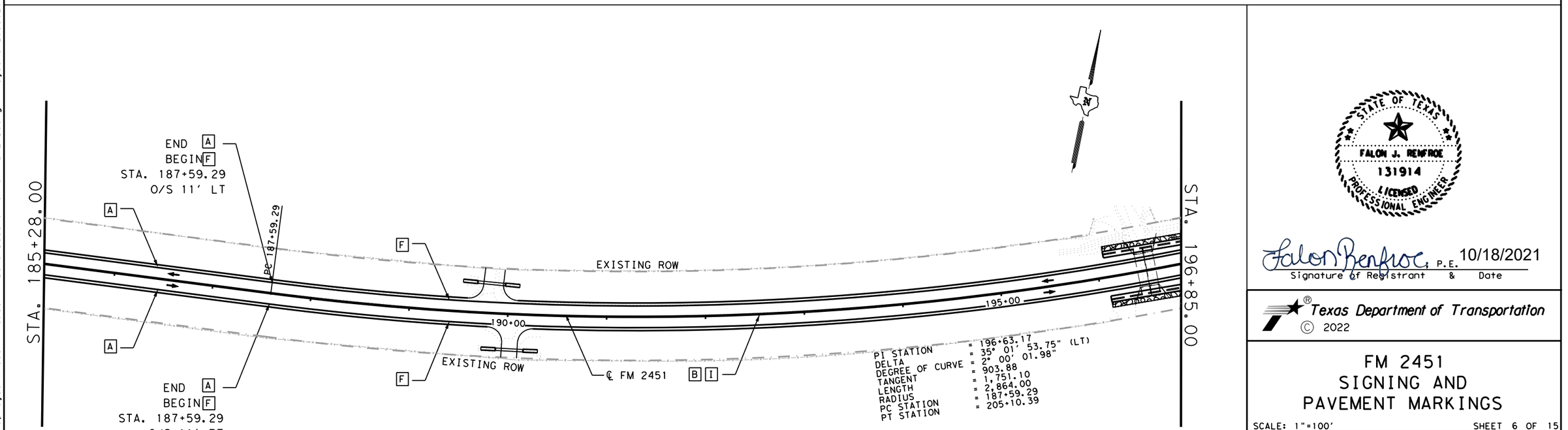

STATE OF TEXAS
FALON J. RENFROE
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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 6 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	161
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

DATE: 10/18/2021 2:19:28 PM
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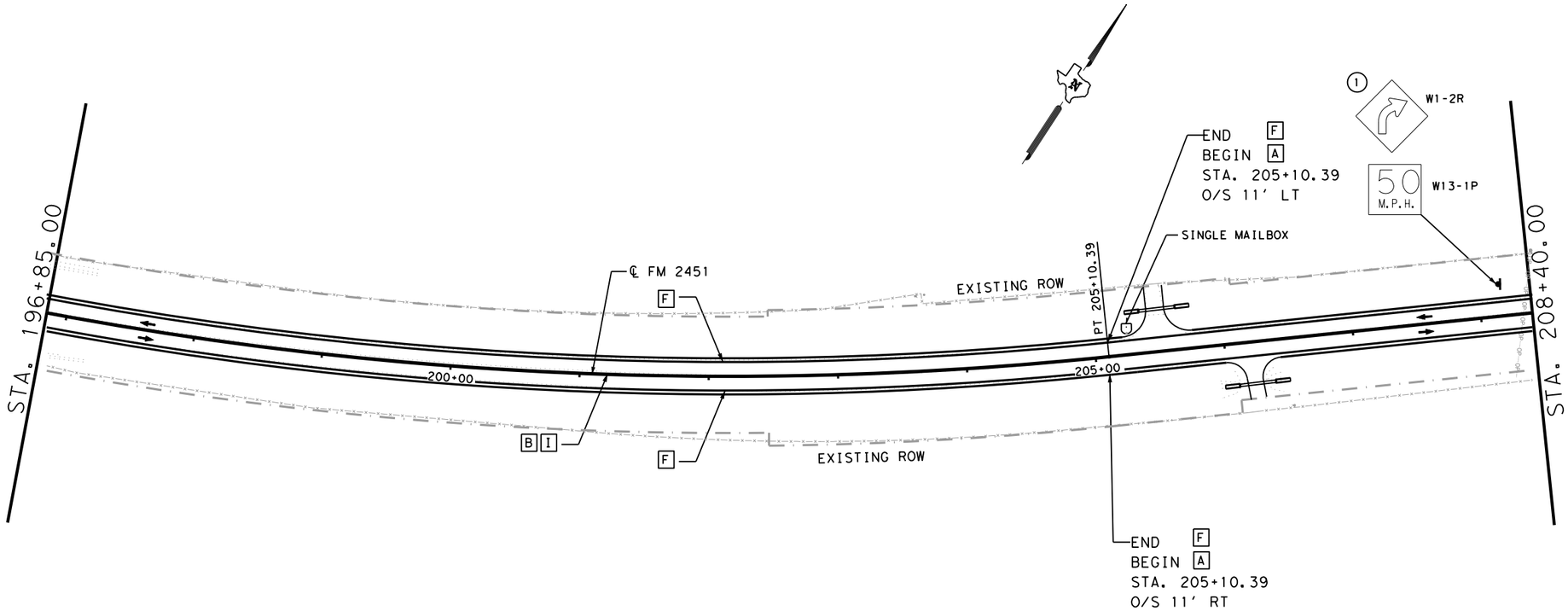

LEGEND:

A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
I	REFL PAV MRKR TY II-A-A AT 40'
J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

NOTE:
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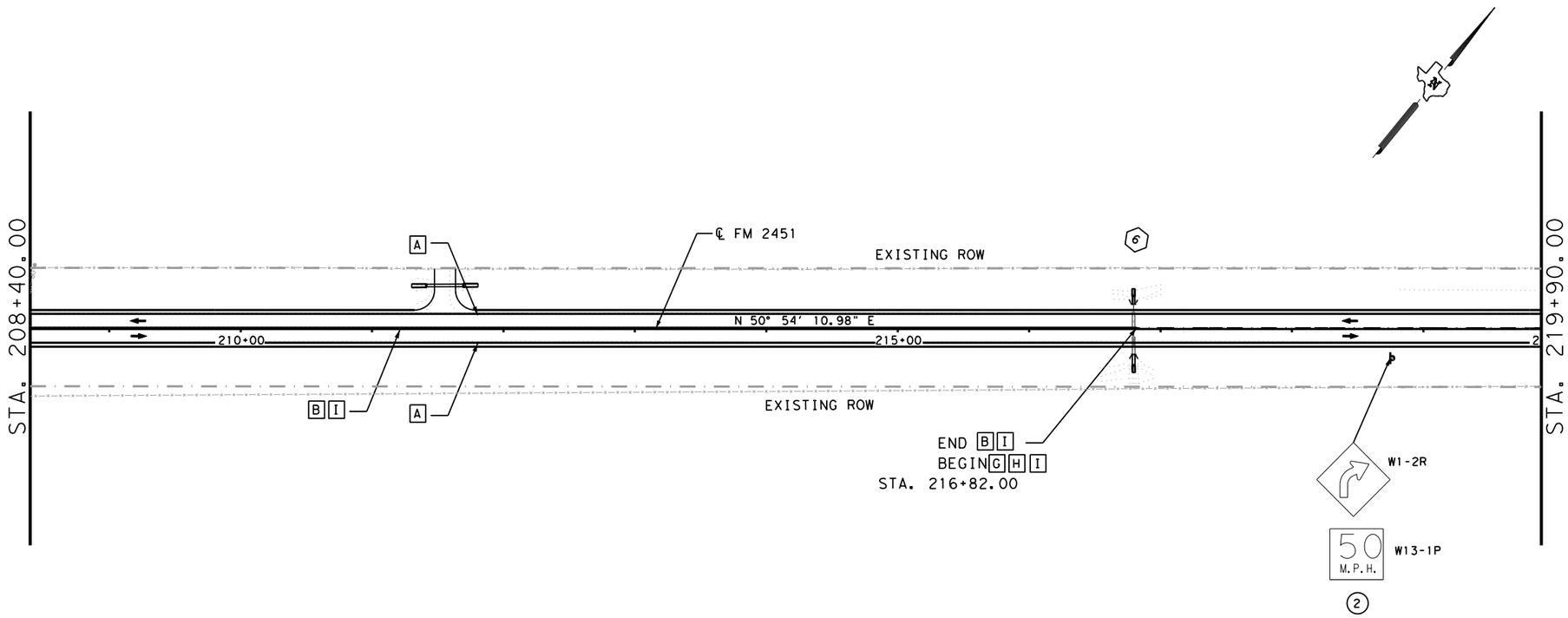

STATE OF TEXAS
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Signature of Registrant & Date

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FM 2451 SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 7 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	162
CHECK FR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

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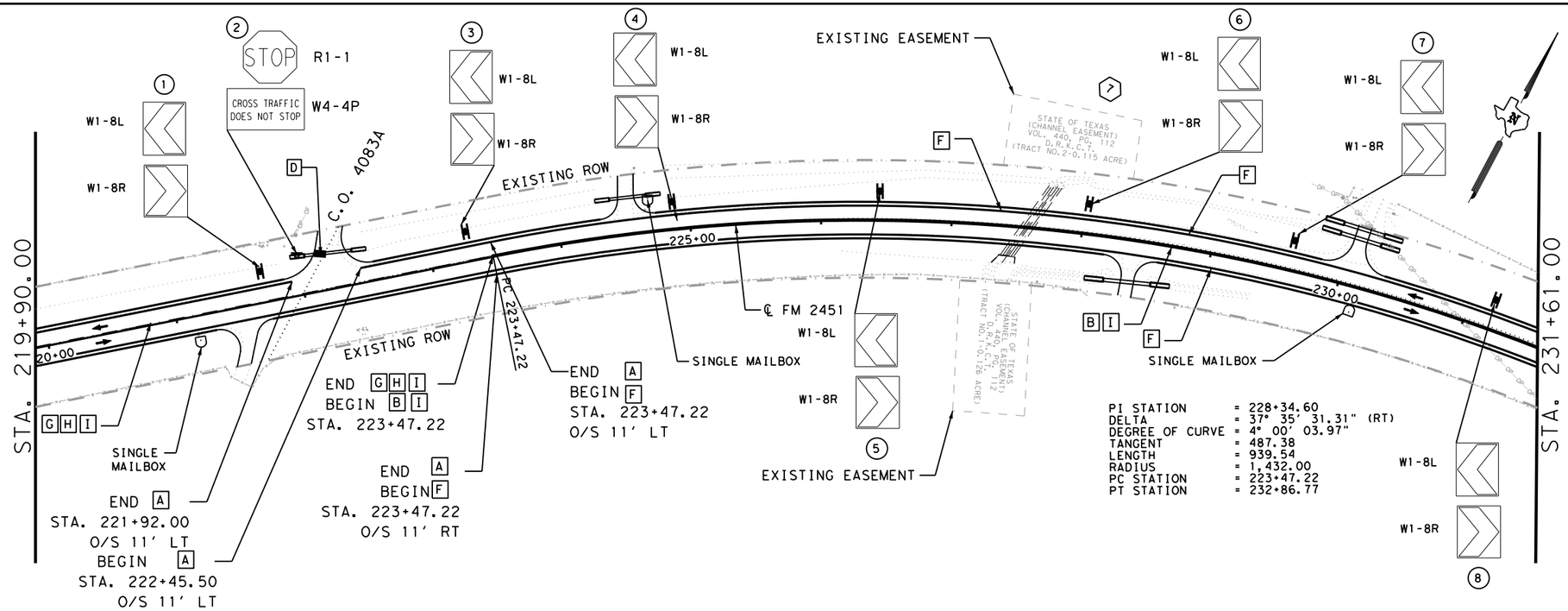

LEGEND:

A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
I	REFL PAV MRKR TY II-A-A AT 40'
J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

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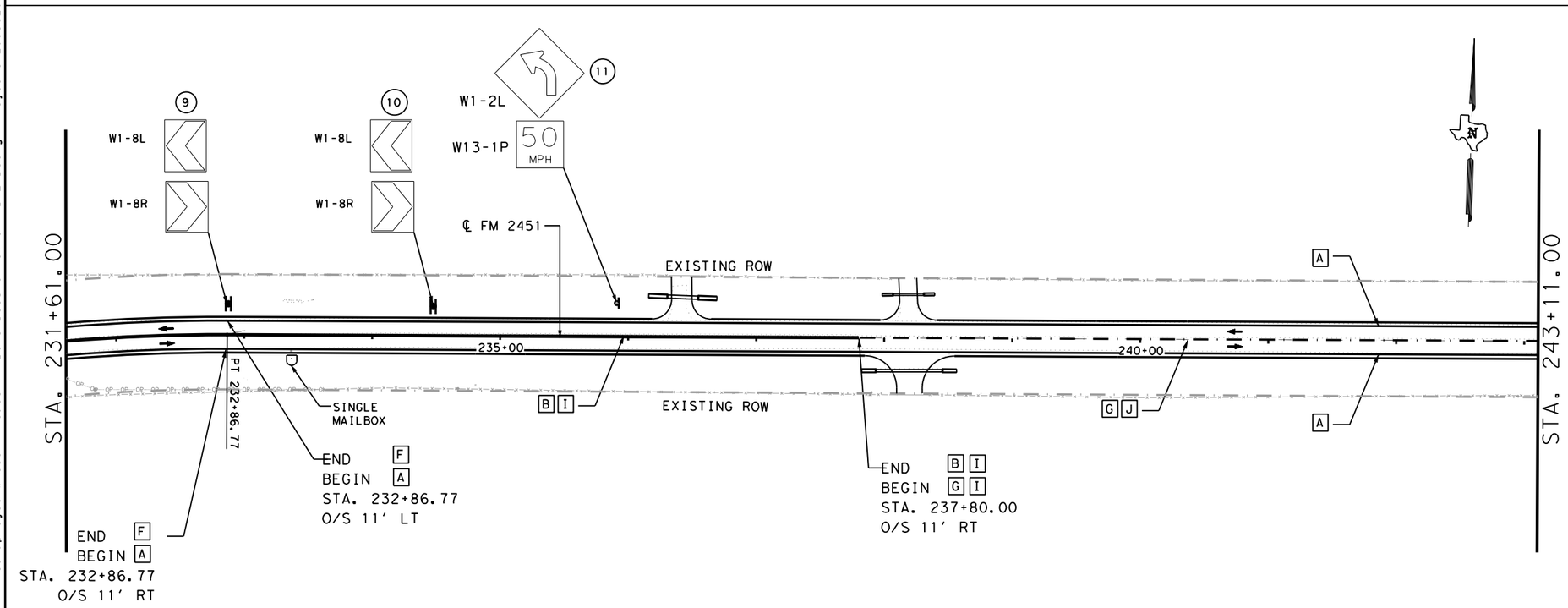

STATE OF TEXAS
FALON J. RENFROE
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Signature of Registrant & Date

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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 8 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	163
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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DATE: 10/18/2021 2:28:20 PM
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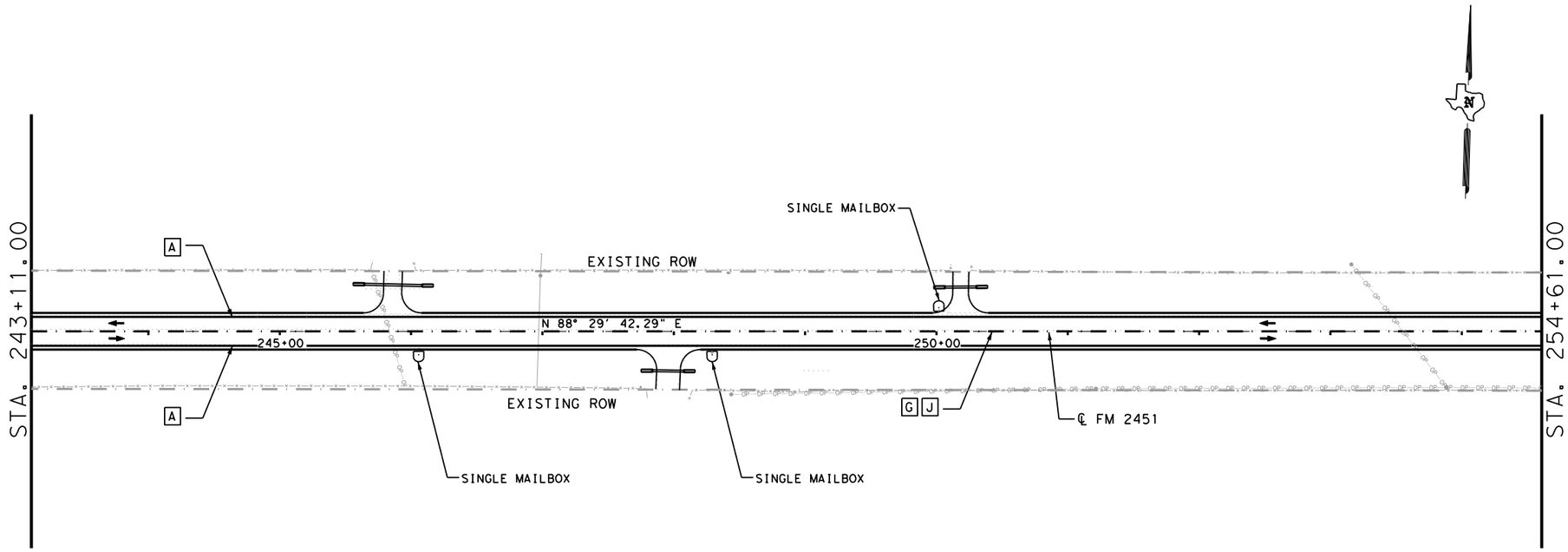

LEGEND:

A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
I	REFL PAV MRKR TY II-A-A AT 40'
J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

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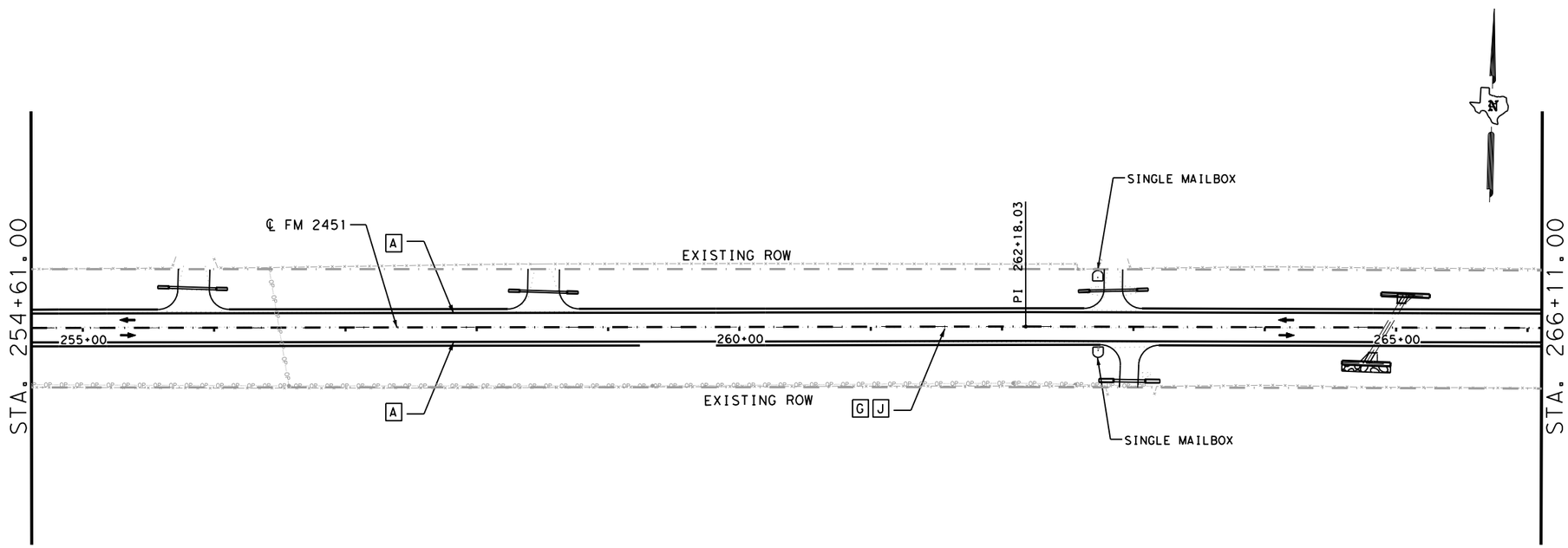

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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 9 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	164
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
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DATE: 10/18/2021 2:33:28 PM
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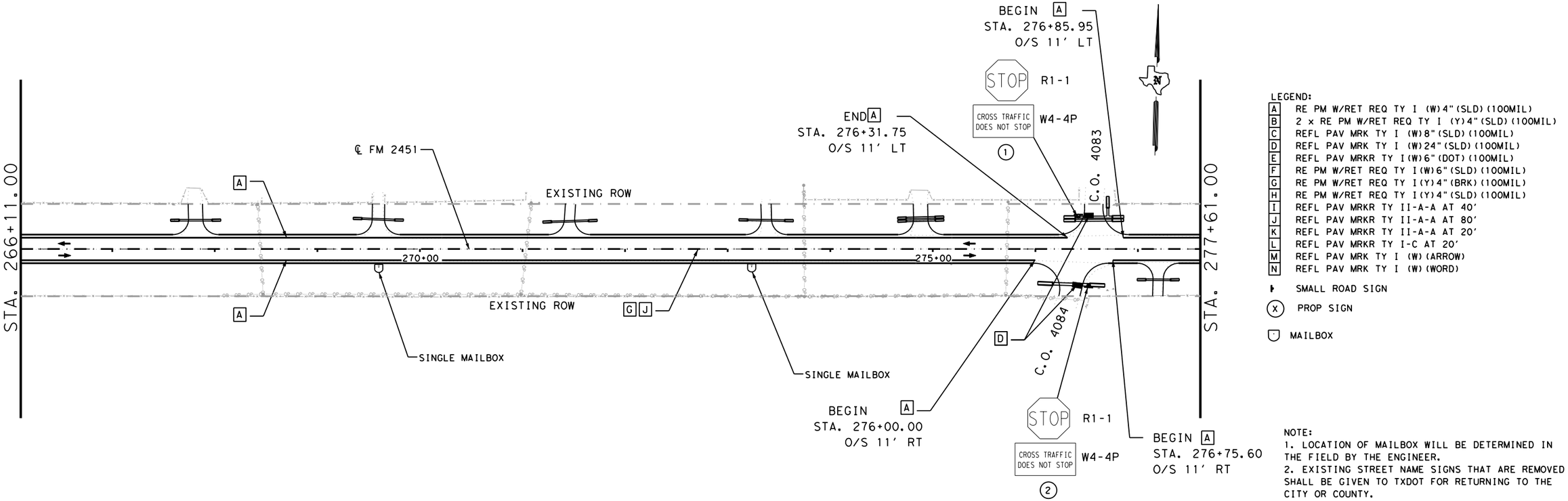

NOTE:
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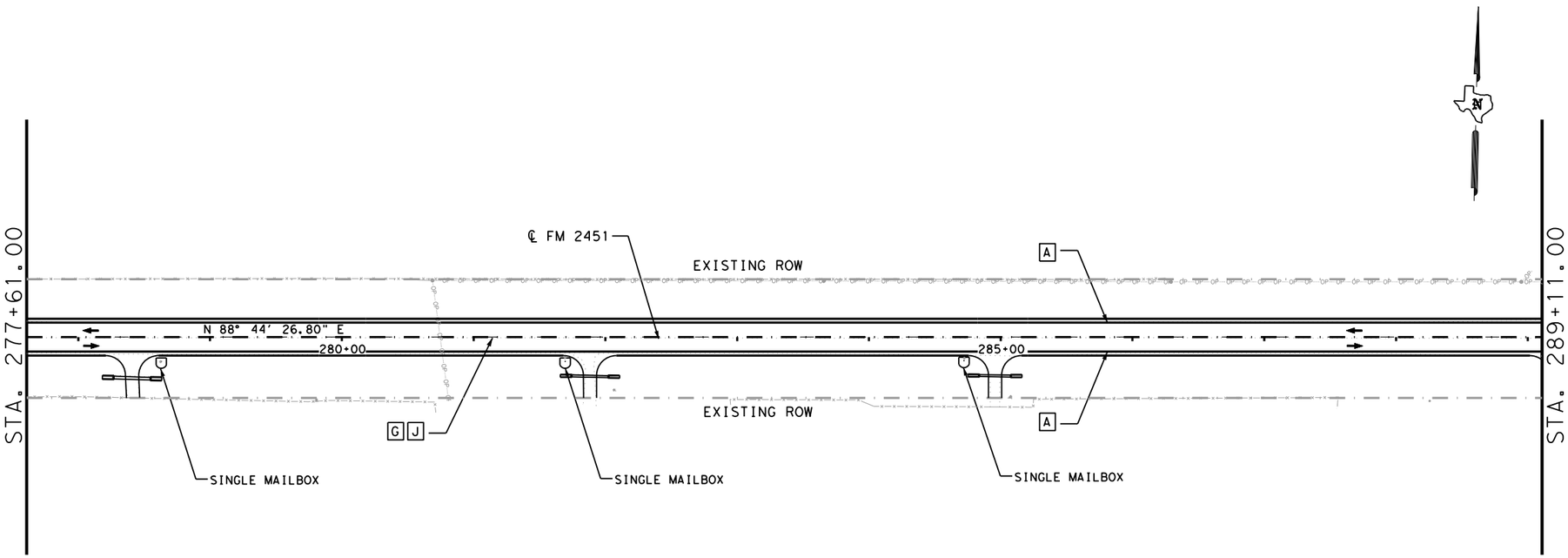

STATE OF TEXAS
FALON J. RENFROE
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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 10 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	165
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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DATE: 10/18/2021 2:38:02 PM
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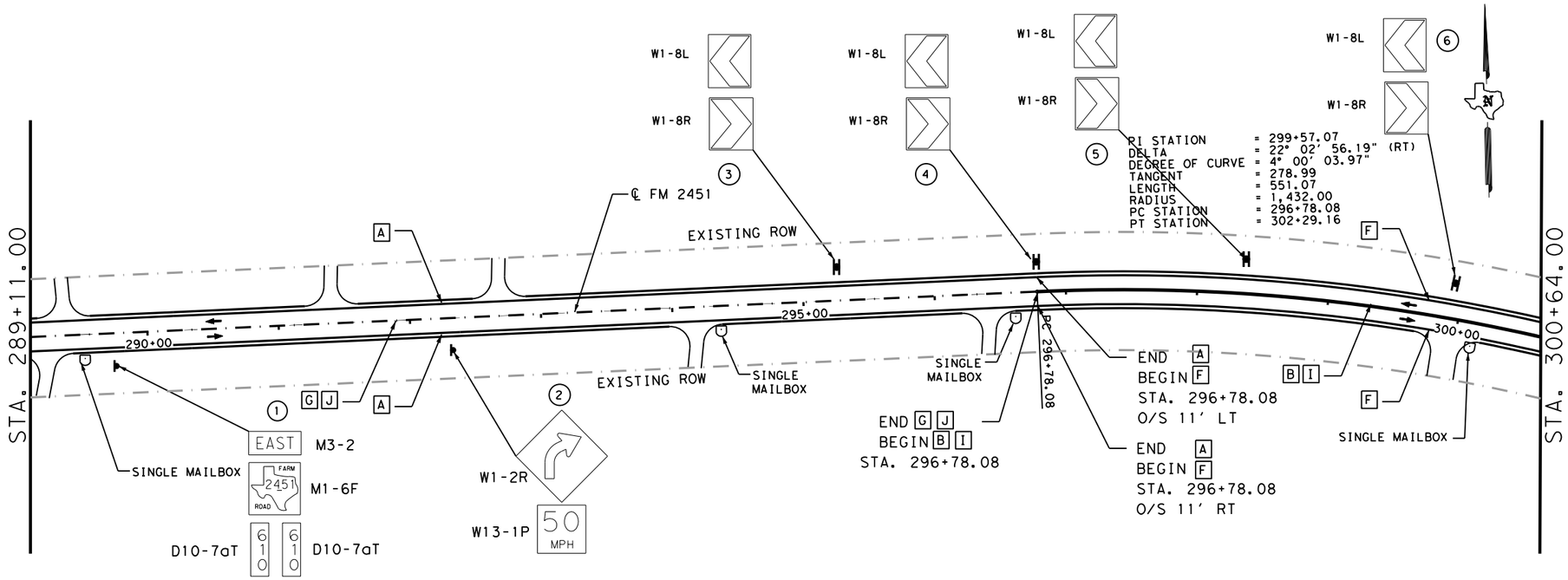


LEGEND:

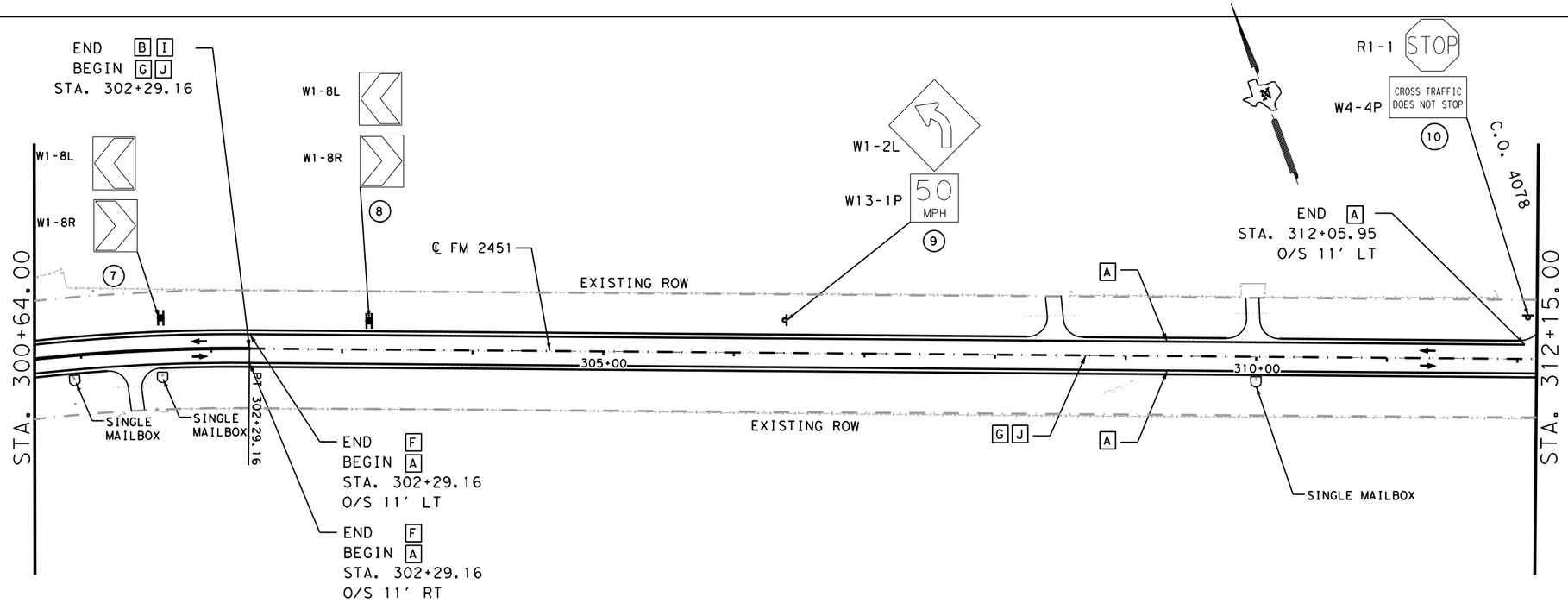
A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
I	REFL PAV MRKR TY II-A-A AT 40'
J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

NOTE:
1. LOCATION OF MAILBOX WILL BE DETERMINED IN THE FIELD BY THE ENGINEER.
2. EXISTING STREET NAME SIGNS THAT ARE REMOVED SHALL BE GIVEN TO TXDOT FOR RETURNING TO THE CITY OR COUNTY.



FALON J. RENFROE
131914
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

Falon Renfroe, P.E. 10/18/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 11 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	166
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	

DATE: 10/18/2021 2:42:48 PM
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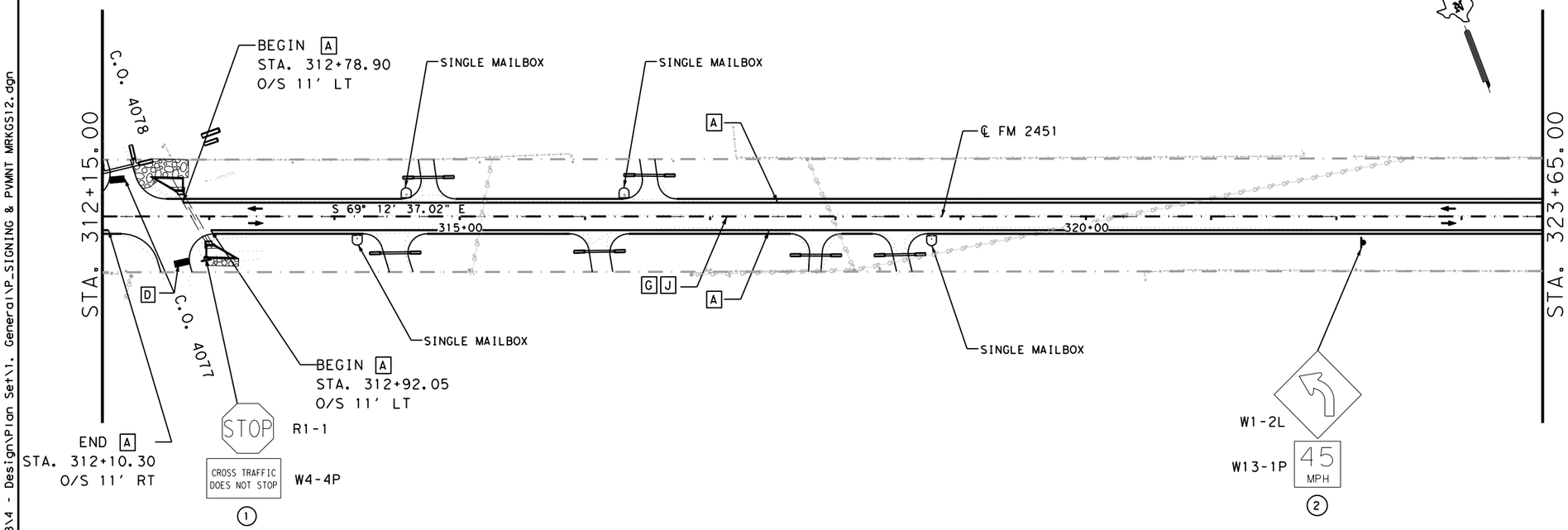


LEGEND:

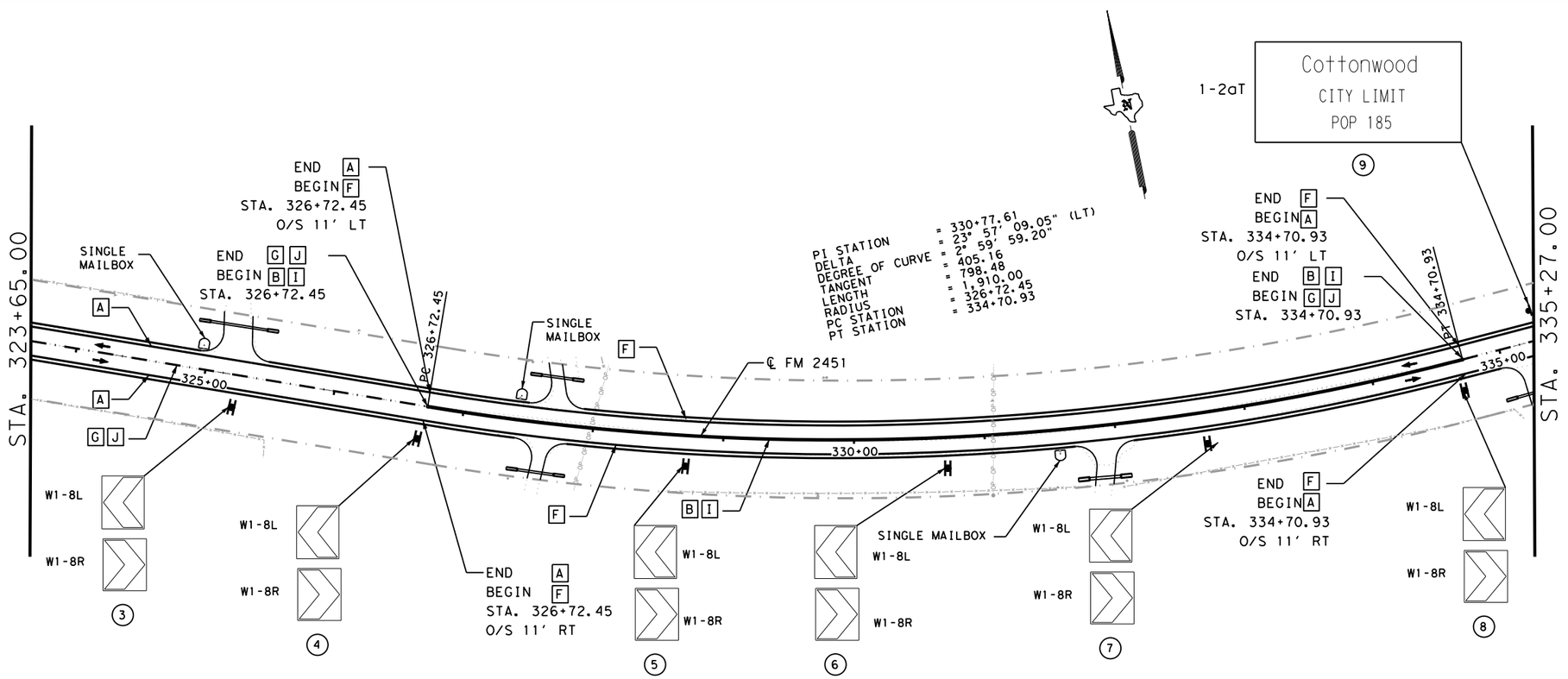
A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
I	REFL PAV MRKR TY II-A-A AT 40'
J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

NOTE:
1. LOCATION OF MAILBOX WILL BE DETERMINED IN THE FIELD BY THE ENGINEER.
2. EXISTING STREET NAME SIGNS THAT ARE REMOVED SHALL BE GIVEN TO TXDOT FOR RETURNING TO THE CITY OR COUNTY.



Falon Renfroe, P.E. 10/18/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 12 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	167
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

DATE: 10/18/2021 2:45:43 PM
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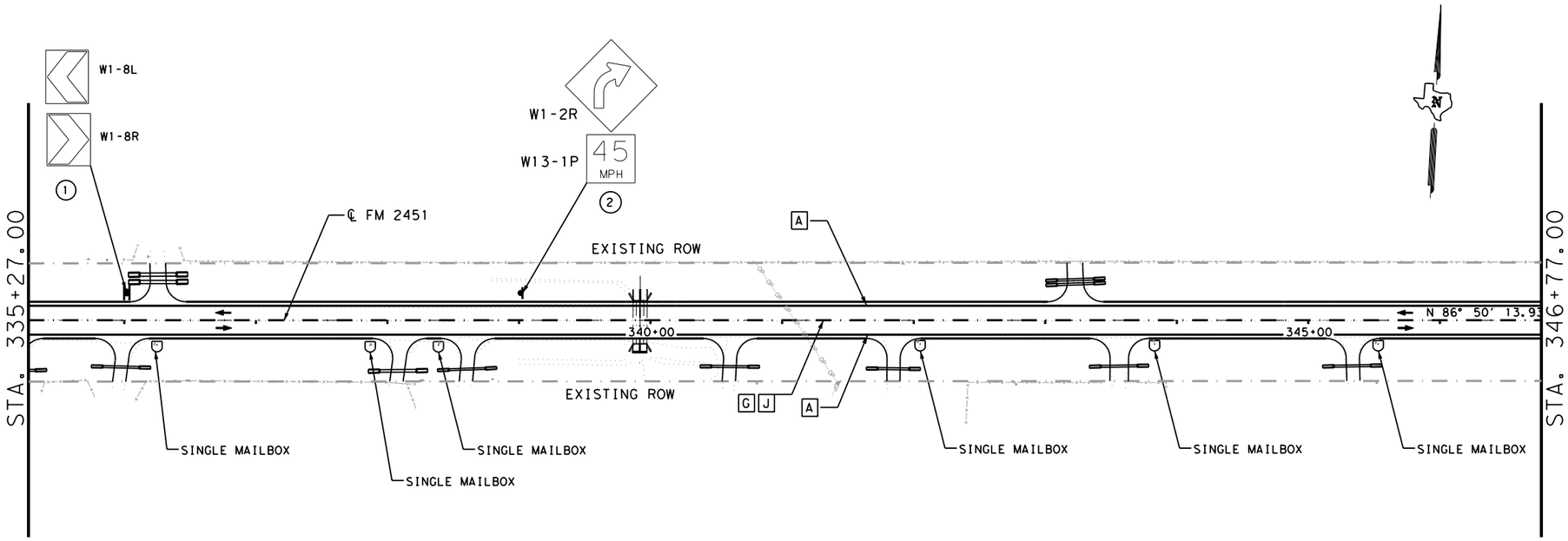


LEGEND:

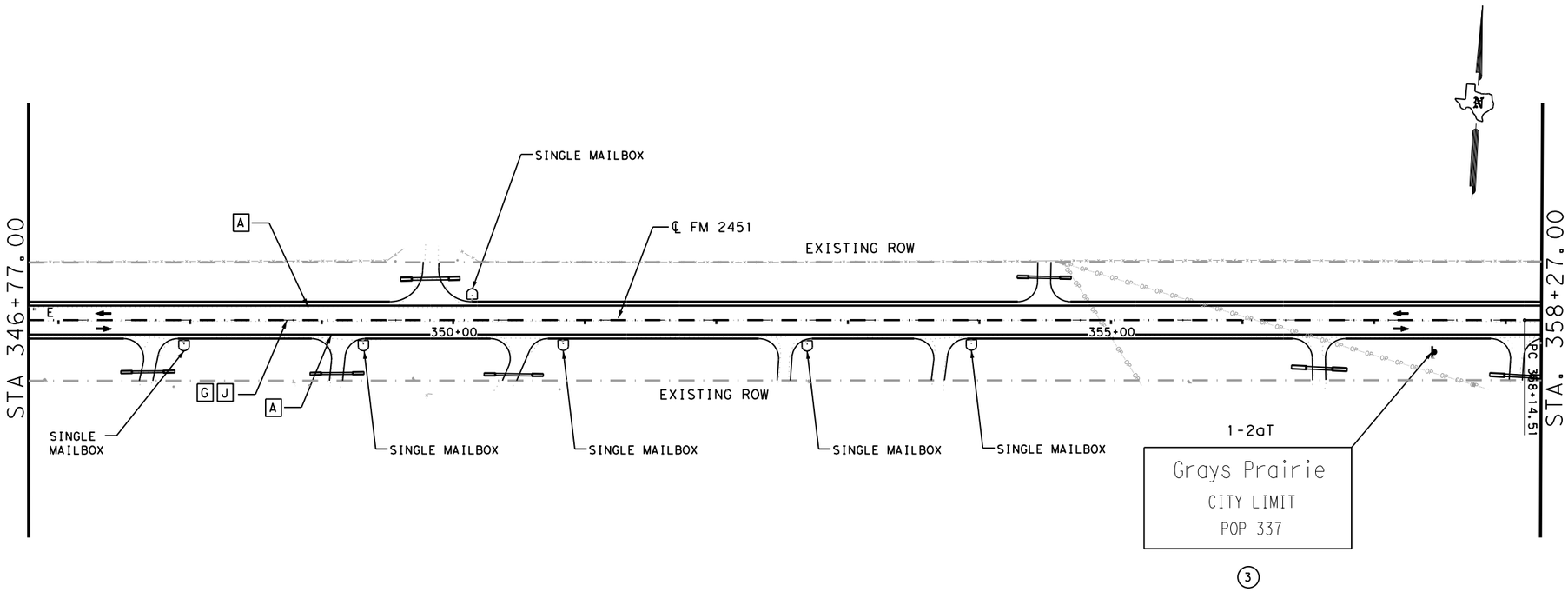
A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
I	REFL PAV MRKR TY II-A-A AT 40'
J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

NOTE:
1. LOCATION OF MAILBOX WILL BE DETERMINED IN THE FIELD BY THE ENGINEER.
2. EXISTING STREET NAME SIGNS THAT ARE REMOVED SHALL BE GIVEN TO TXDOT FOR RETURNING TO THE CITY OR COUNTY.



3

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 10/18/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 13 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	168
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

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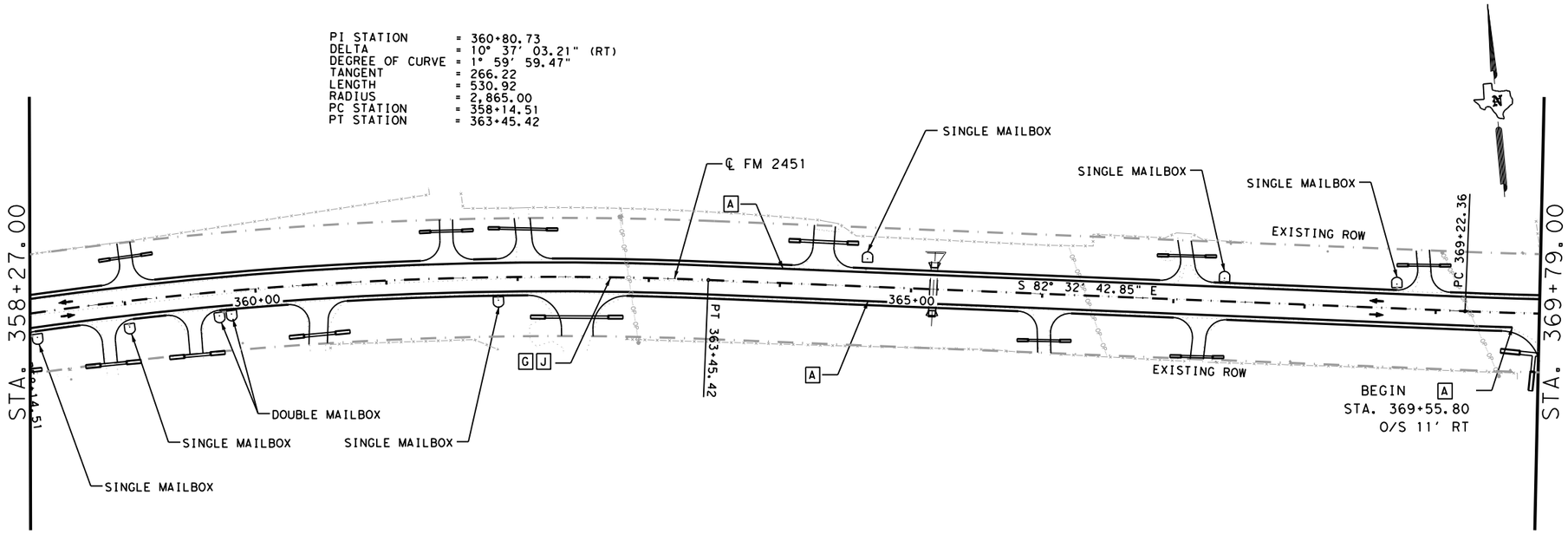

LEGEND:

A	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)
B	2 x RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)
C	REFL PAV MRK TY I (W)8"(SLD)(100MIL)
D	REFL PAV MRK TY I (W)24"(SLD)(100MIL)
E	REFL PAV MRKR TY I(W)6"(DOT)(100MIL)
F	RE PM W/RET REQ TY I(W)6"(SLD)(100MIL)
G	RE PM W/RET REQ TY I(Y)4"(BRK)(100MIL)
H	RE PM W/RET REQ TY I(Y)4"(SLD)(100MIL)
I	REFL PAV MRKR TY II-A-A AT 40'
J	REFL PAV MRKR TY II-A-A AT 80'
K	REFL PAV MRKR TY II-A-A AT 20'
L	REFL PAV MRKR TY I-C AT 20'
M	REFL PAV MRK TY I (W)(ARROW)
N	REFL PAV MRK TY I (W)(WORD)

SMALL ROAD SIGN

(X) PROP SIGN

MAILBOX

NOTE:
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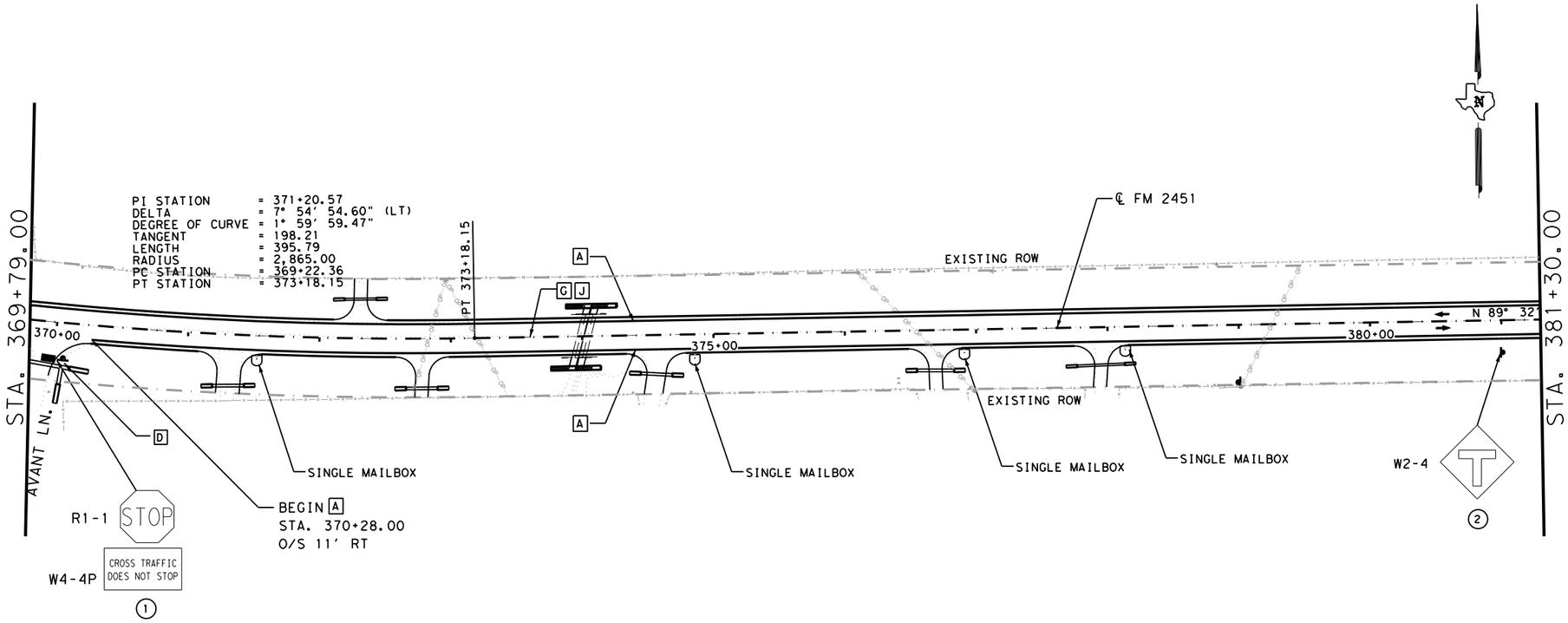

FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 10/18/2021
Signature of Registrant & Date

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FM 2451 SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 14 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	169
CHECK FR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

DATE: 10/18/2021 2:50:15 PM
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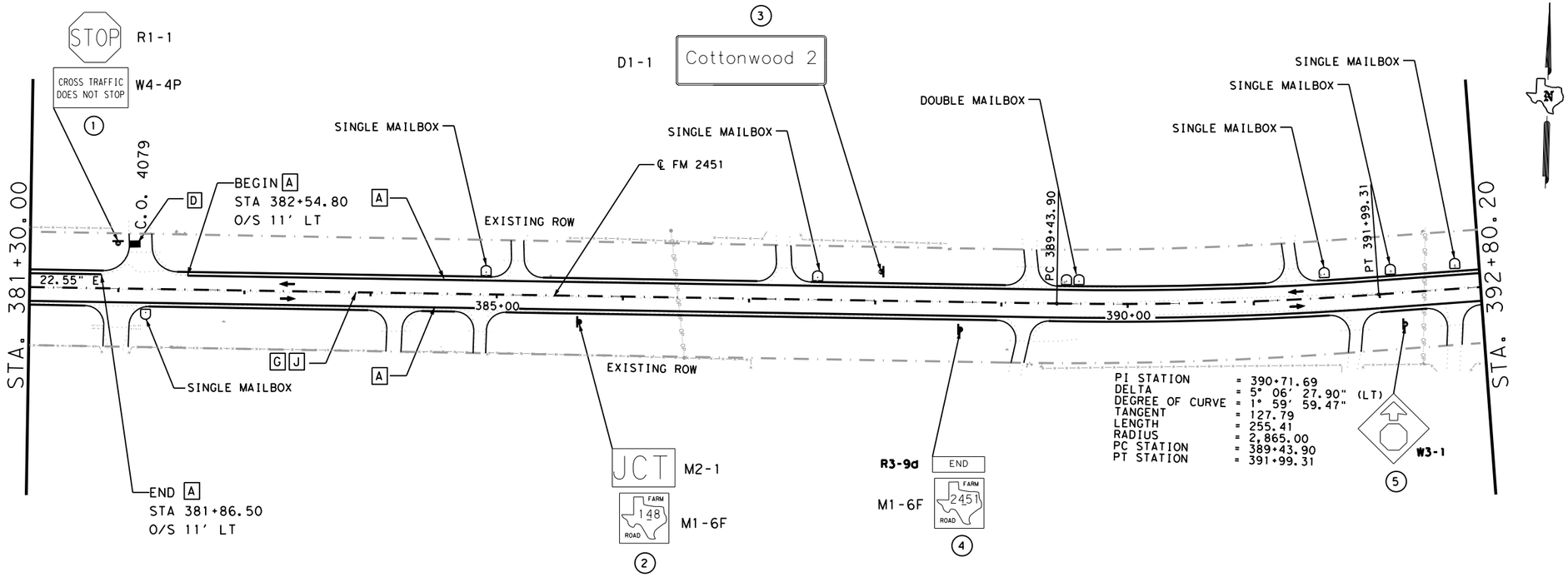

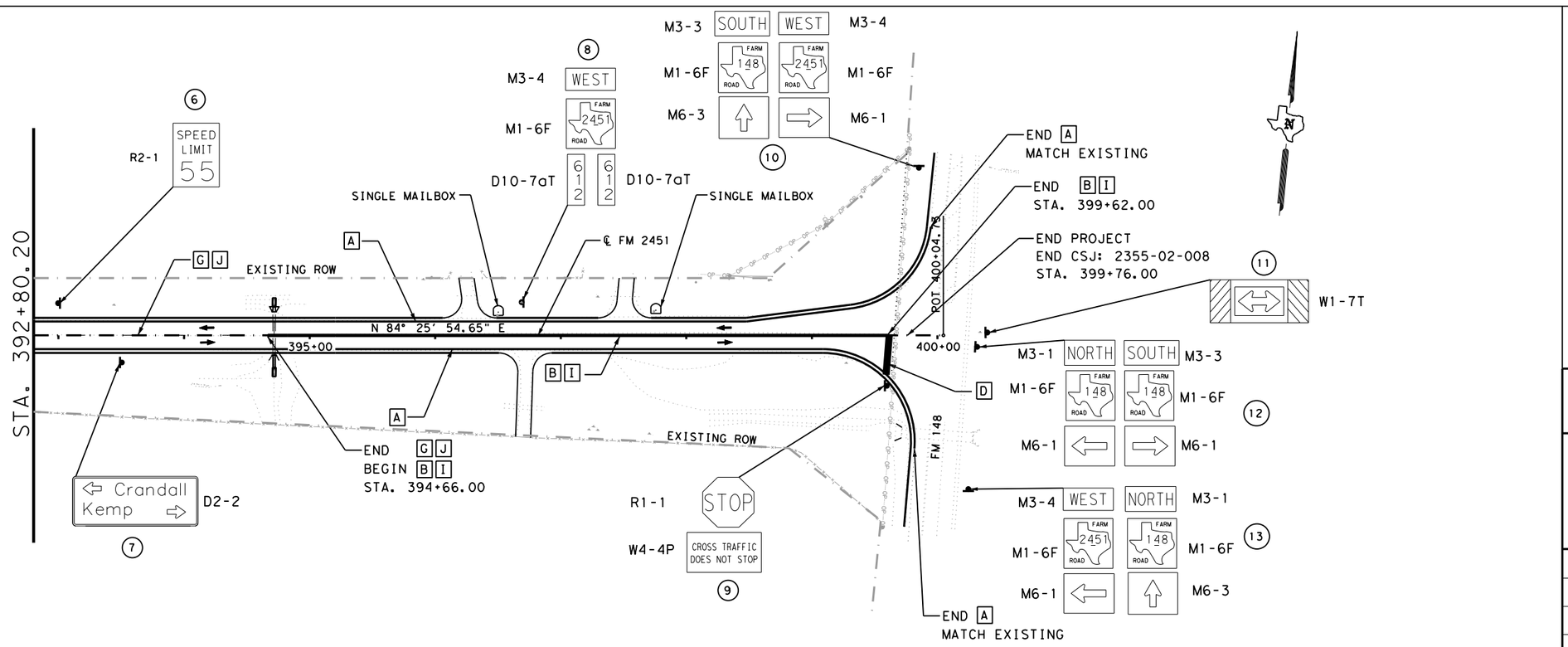

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 10/18/2021
Signature of Registrant & Date

Texas Department of Transportation
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FM 2451
SIGNING AND PAVEMENT MARKINGS

SCALE: 1"=100' SHEET 15 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	170
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
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FR				

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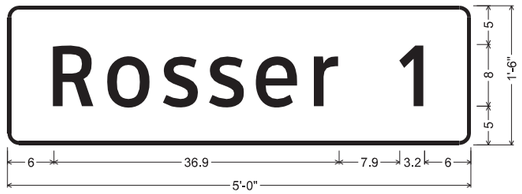
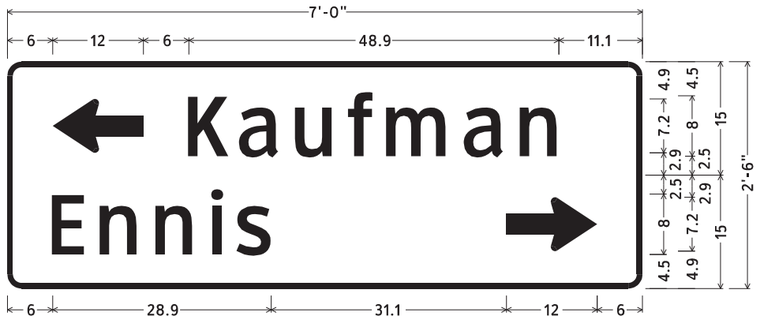


D2-1 8in;
1.5" Radius, 0.5" Border, White on, Green;
"Rosser", ClearviewHwy-3-W; "1", ClearviewHwy-3-W;

SHEET 3 SIGN 4

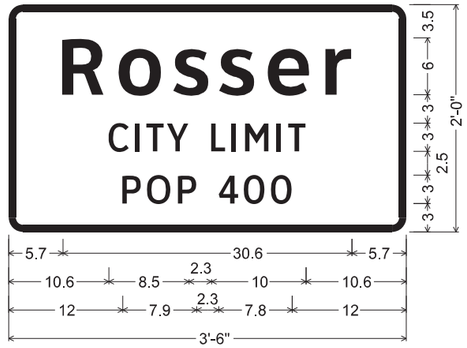


D1-2 8in LT-RT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 12.0" X 7.1" 180'; "Kaufman", ClearviewHwy-3-W;

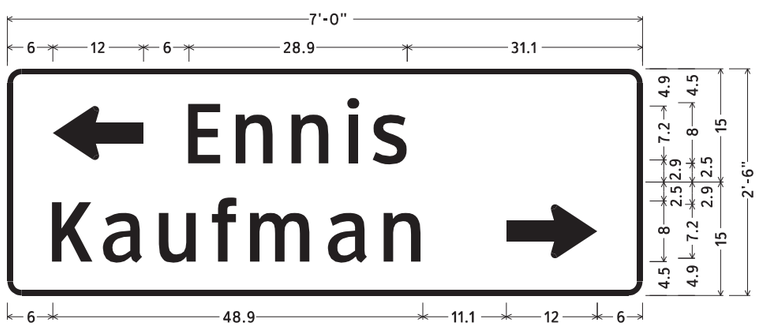
1.9" Radius, 0.8" Border, White on, Green;
"Ennis", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0';

SHEET 3 SIGN 5



I-2aT 6in;
1.5" Radius, 0.8" Border, White on, Green;
"Rosser", ClearviewHwy-5-W-R;
"CITY LIMIT", ClearviewHwy-3-W;
"POP 400", ClearviewHwy-3-W;

SHEET 4 SIGN 7

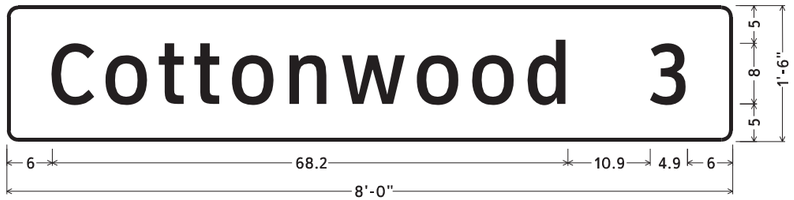


D1-2 8in LT-RT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 12.0" X 7.1" 180'; "Ennis", ClearviewHwy-3-W;

1.9" Radius, 0.8" Border, White on, Green;
"Kaufman", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0';

SHEET 4 SIGN 9



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

SHEET 4 SIGN 11

STATE OF TEXAS
MARK A. ABOSO
112638
LICENSED PROFESSIONAL ENGINEER

Mark A Aboso ,P.E. 05/10/2021
Signature of Registrant Date

Texas Department of Transportation
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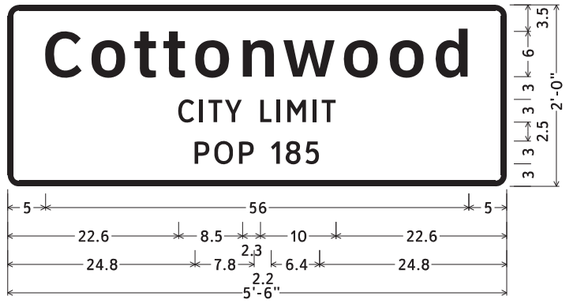
FM 2451

SIGN DETAILS

SHEET 1 OF 2

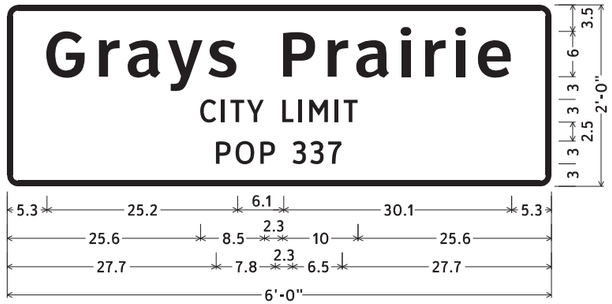
DESIGN	FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ZTF	6	SEE TITLE SHEET		FM 2451
GRAPHICS ZTF	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK BA	TEXAS	DAL	KAUFMAN	171
CHECK FRC	CONTROL	SECTION	JOB	
	2355	01	006	

DATE:5/10/2021 TIME:10:15:43 AM
FILE:C:\Users\MABOSO\Desktop\PROJECTS\ZACH FM 2451 CSJ 2355-02-008\2355-02-008 Sign details.dgn



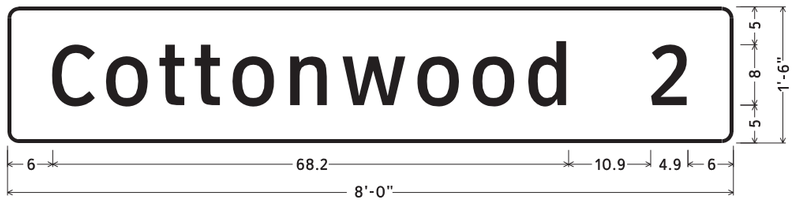
I-2aT 6in;
1.5" Radius, 0.8" Border, White on, Green;
"Cottonwood", ClearviewHwy-5-W-R;
"CITY LIMIT", ClearviewHwy-3-W;
"POP 185", ClearviewHwy-3-W;

SHEET 5 SIGN 1
SHEET 12 SIGN 9



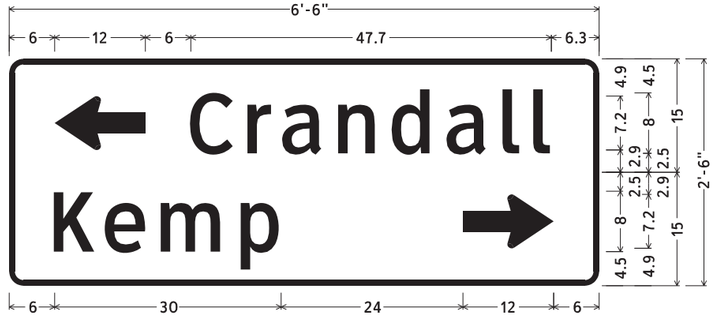
I-2aT 6in;
1.5" Radius, 0.8" Border, White on, Green;
"Grays Prairie", ClearviewHwy-5-W-R;
"CITY LIMIT", ClearviewHwy-3-W; "POP 337", ClearviewHwy-3-W;

SHEET 13 SIGN 3



D2-1 8in;
1.5" Radius, 0.5" Border, White on, Green;
"Cottonwood", ClearviewHwy-3-W; "2", ClearviewHwy-3-W;

SHEET 15 SIGN 3



D1-2 8in LT-RT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 12.0" X 7.1" 180'; "Crandall", ClearviewHwy-3-W;

1.9" Radius, 0.8" Border, White on, Green;
"Kemp", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0';

SHEET 15 SIGN 7

STATE OF TEXAS
MARK A. ABOSO
112638
LICENSED
PROFESSIONAL ENGINEER

Mark A Aboso ,P.E. 05/10/2021
Signature of Registrant Date

Texas Department of Transportation
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FM 2451

SIGN DETAILS

SHEET 2 OF 2

DESIGN	DIV. NO.	FEDERAL AID PROJECT NO.		NO.
ZTF	6	SEE TITLE SHEET		FM 2451
GRAPHICS ZTF	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK BA	TEXAS	DAL	KAUFMAN	172
CHECK FRC	CONTROL	SECTION	JOB	
	2355	01	006	

DATE:5/10/2021 TIME:10:15:44 AM
FILE:C:\Users\MABOSO\Desktop\PROJECTS\ZACH FM 2451 CSJ 2355-02-008\2355-02-008 Sign details.dgn

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DATE: 10/13/2021 12:16:03 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\STANDARDS\TRAFFIC\smdgen.dgn

SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

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

Post Type

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

Number of Posts (1 or 2)

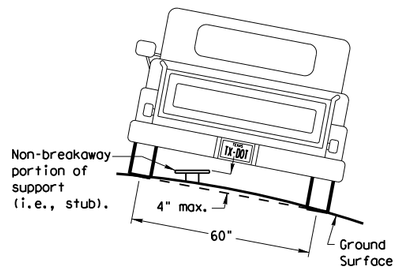
Anchor Type

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

Sign Mounting Designation

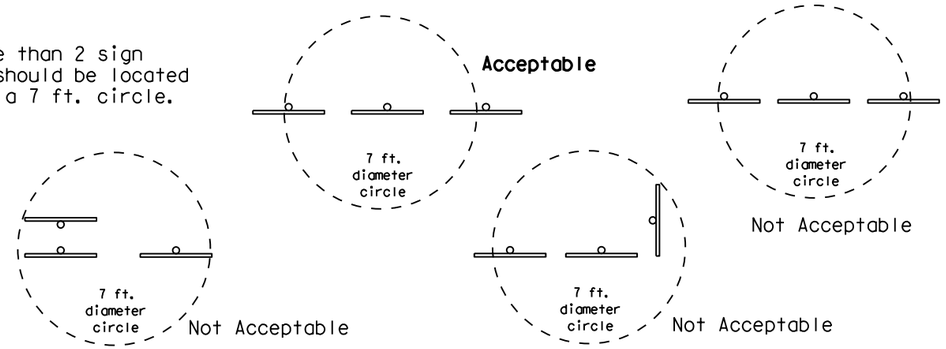
P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))
IF REQUIRED
1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))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

REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



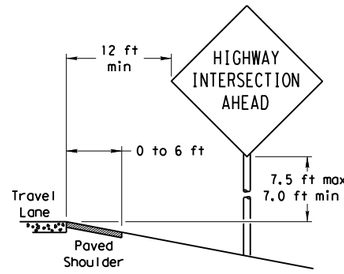
To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

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



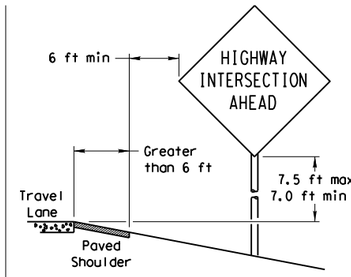
SIGN LOCATION

PAVED SHOULDERS



LESS THAN 6 FT. WIDE

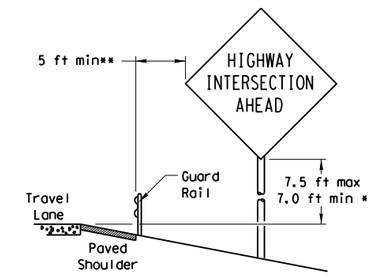
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



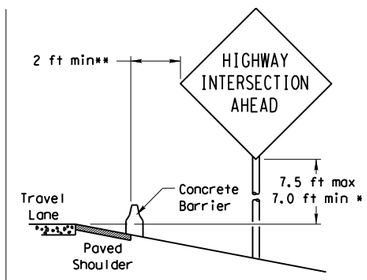
GREATER THAN 6 FT. WIDE

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

BEHIND BARRIER



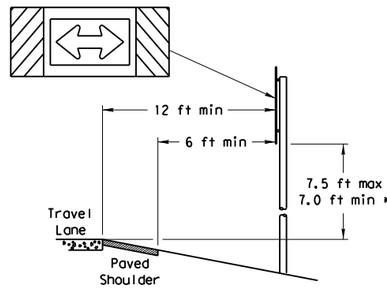
BEHIND GUARDRAIL



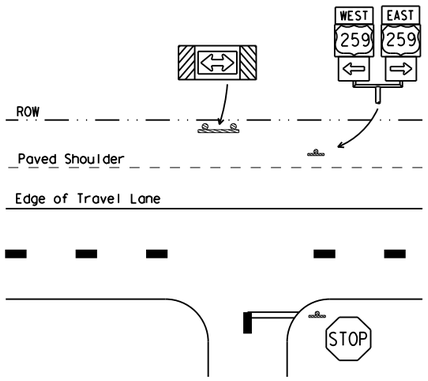
BEHIND CONCRETE BARRIER

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

T-INTERSECTION



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



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

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

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

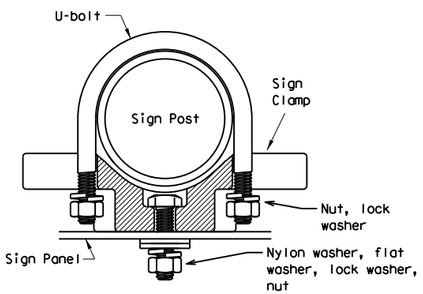
The maximum values may be increased when directed by the Engineer.

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

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

TYPICAL SIGN ATTACHMENT DETAIL

Single Signs

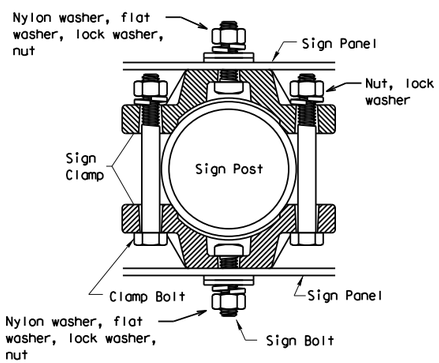


Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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

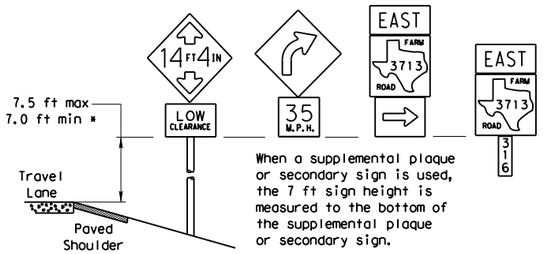
Sign clamps may be either the specific size clamp or the universal clamp.

Back-to-Back Signs



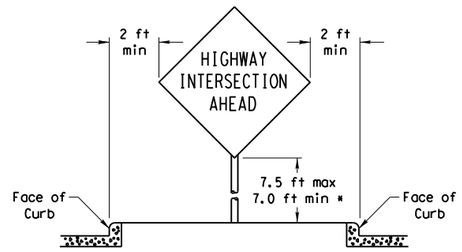
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES



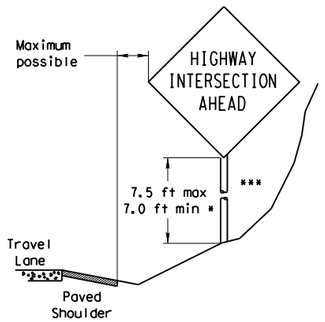
When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

CURB & GUTTER OR RAISED ISLAND



RESTRICTED RIGHT-OF-WAY

(When 6 ft min. is not possible.)



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

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

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

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

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REVISIONS
9-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
2355	01	006, ETC.	FM 2451

DIST	COUNTY	SHEET NO.
DAL	KAUFMAN	173

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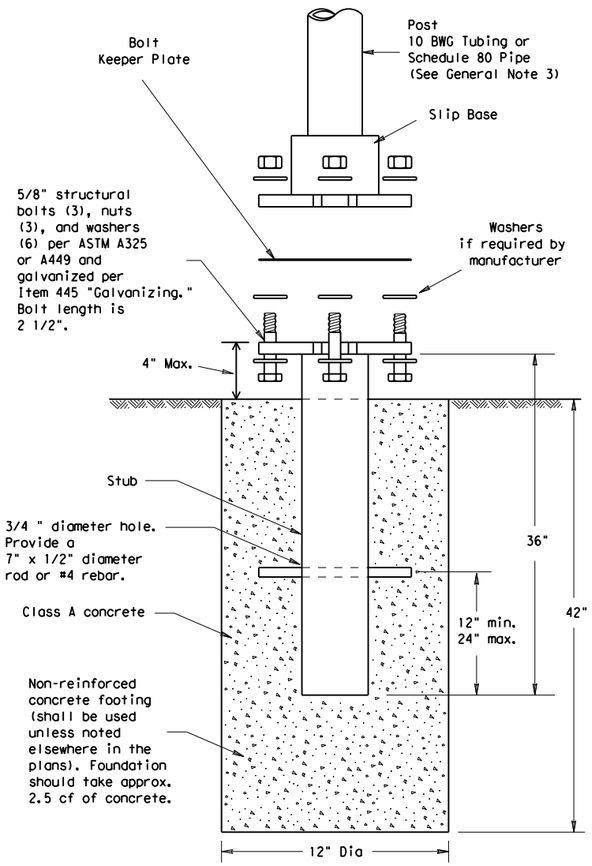
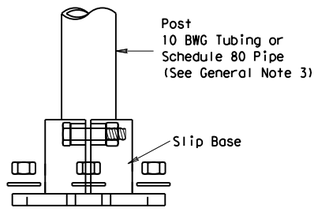
TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS

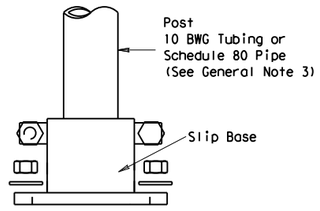


SM RD SGN ASSM TY XXXXX(X)SA(X-XXXX)

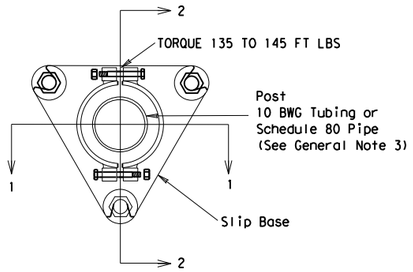
NOTE
The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.



SIDE VIEW 1-1



SIDE VIEW 2-2



TOP VIEW

DETAIL A

GENERAL NOTES:

1. Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
2. Material used as post with this system shall conform to the following specifications:
   10 BWG Tubing (2.875" outside diameter)
   0.134" nominal wall thickness
   Seamless or electric-resistance welded steel tubing or pipe
   Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
   Other steels may be used if they meet the following:
   55,000 PSI minimum yield strength
   70,000 PSI minimum tensile strength
   20% minimum elongation in 2"
   Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
   Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
   Galvanization per ASTM A123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.
   Schedule 80 Pipe (2.875" outside diameter)
   0.276" nominal wall thickness
   Steel tubing per ASTM A500 Gr C
   Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
   46,000 PSI minimum yield strength
   62,000 PSI minimum tensile strength
   21% minimum elongation in 2"
   Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
   Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
   Galvanization per ASTM A123
3. See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is:
   http://www.txdot.gov/publications/traffic.htm
4. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

ASSEMBLY PROCEDURE

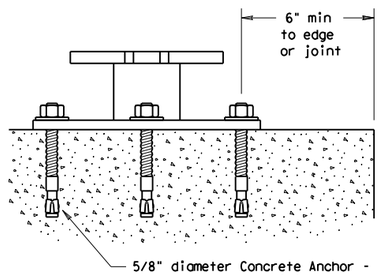
Foundation

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

Support

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

CONCRETE ANCHOR



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

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

ADDED DETAIL A FOR CLAMP BASE

10-2010

Texas Department of Transportation
Dallas District Standard

SIGN MOUNTING DETAILS
SMALL ROADSIDE SIGNS
TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-1)-08(DAL)

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9-08 REVISIONS	CONT	SECT	JOB	HIGHWAY
12-10 (DISTRICT) ADDED CLAMP BASE DETAIL FOR SLIP BASE INSTALLATION	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		174

DATE:
FILE:

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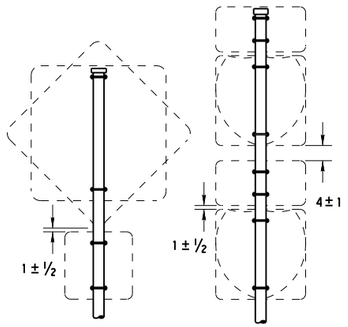
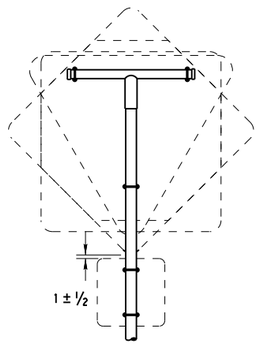


SM RD SGN ASSM TY XXXXX(1)XX(P)



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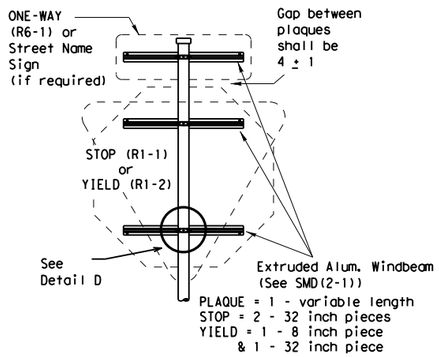
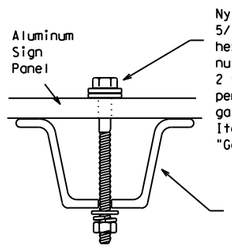
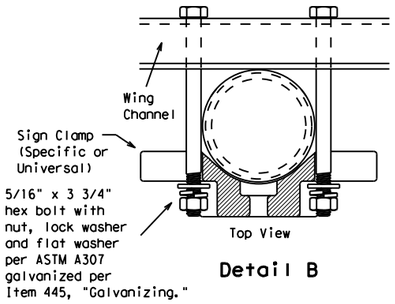


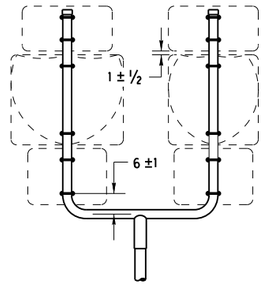
SM RD SGN ASSM TY XXXXX(1)XX(P-BM)



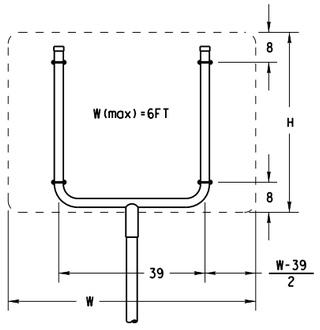
Detail A



Detail B



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



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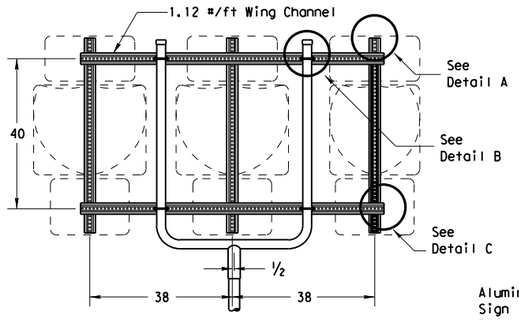
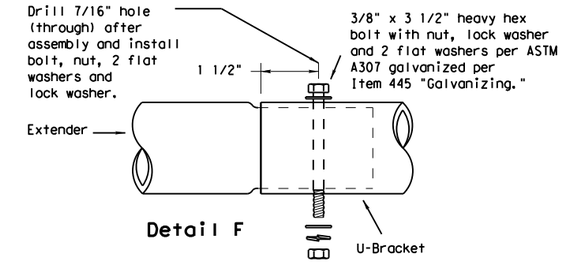
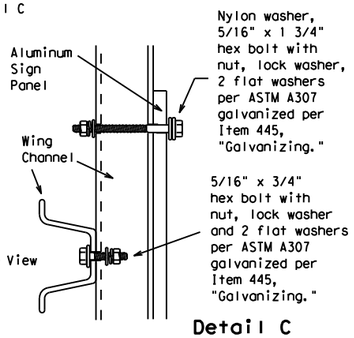


SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)

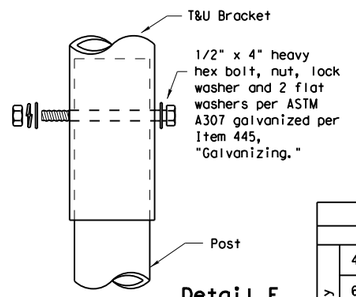


Detail F

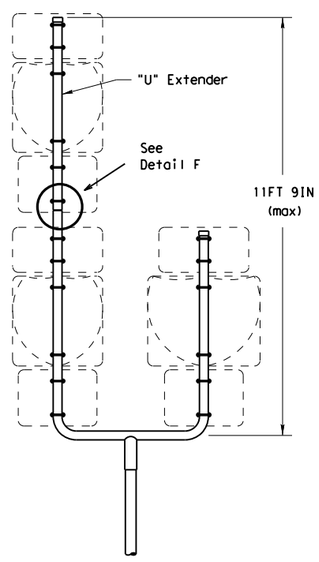
Splices shall only be allowed behind the sign substrate.



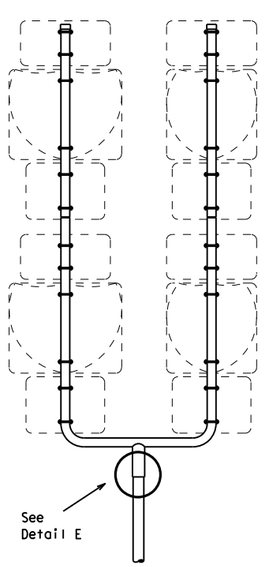
Detail C



Detail E



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



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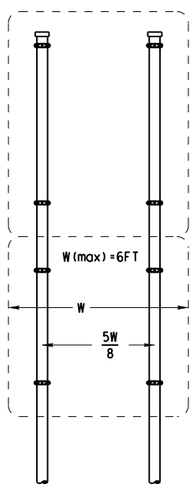
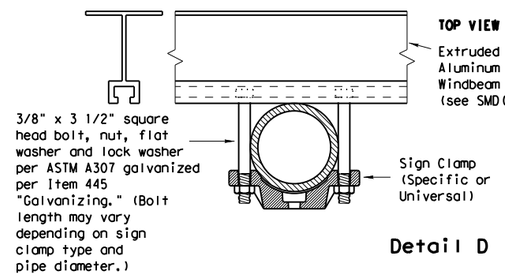
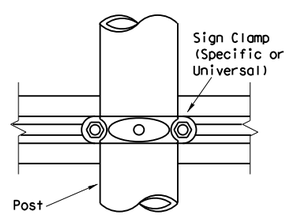


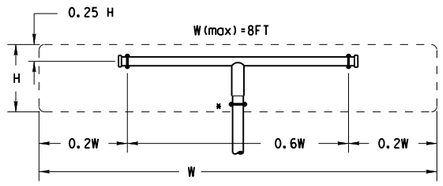
SM RD SGN ASSYM TY XXXXX(2)XX(P)

SIDE VIEW



Detail D

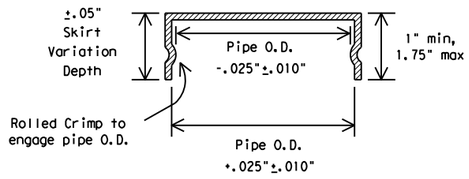




SM RD SGN ASSM TY XXXXX(1)XX(T)
(* - See Note 12)

All dimensions are in english unless detailed otherwise.

FRICTION CAP DETAIL



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

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

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

GENERAL NOTES:

1.

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

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

REQUIRED SUPPORT

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

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-2)-08

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9-08 REVISIONS

CONT	SECT	JOB	HIGHWAY
2355	01	006, ETC.	FM 2451

DIST	COUNTY	SHEET NO.
DAL	KAUFMAN	175

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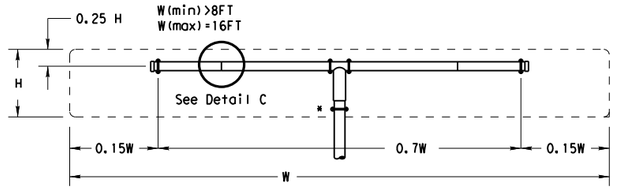
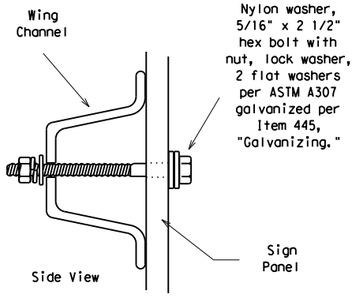
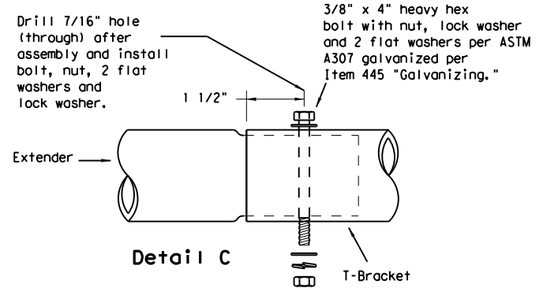


SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)
(* - See Note 12)



Detail B



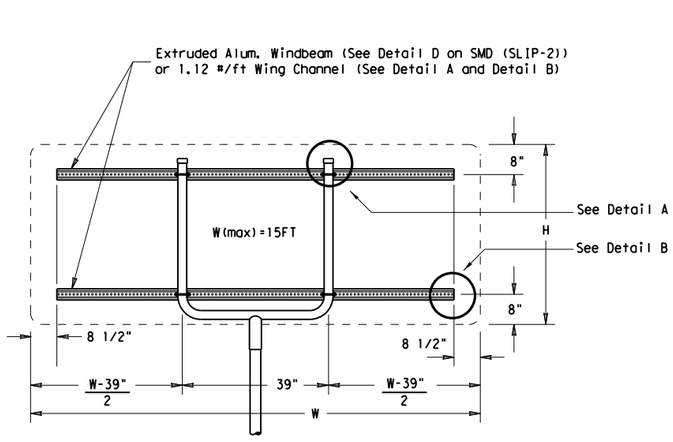
Detail C

Splices shall only be allowed behind the sign substrate.

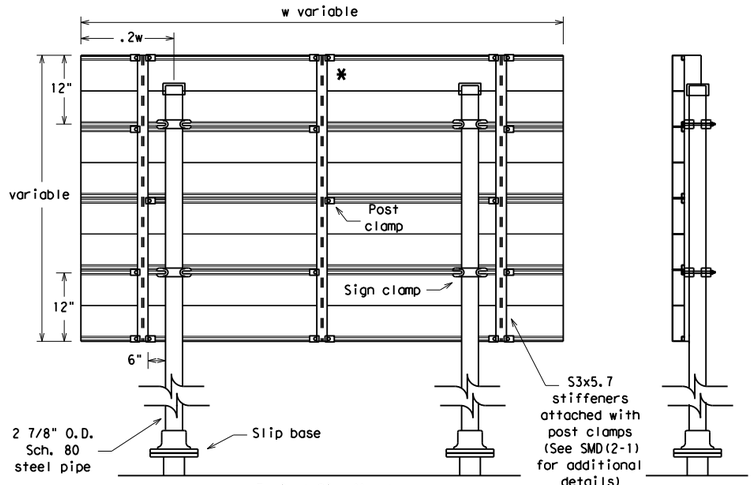
GENERAL NOTES:

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

1. 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.
2. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
3. 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.
4. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
5. 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.
6. 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.
7. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
8. 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."
9. Sign blanks shall be the sizes and shapes shown on the plans.
10. 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.
11. Post open ends shall be fitted with Friction Caps.



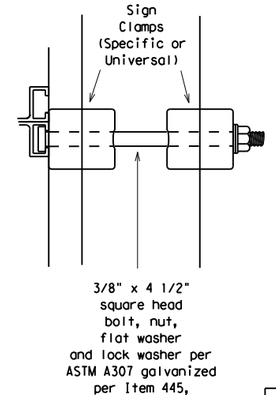
SM RD SGN ASSM TY XXXXX(1)XX(U-XX)



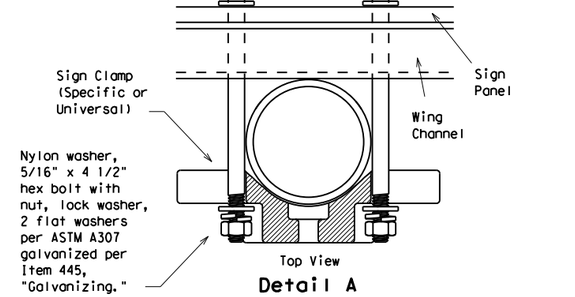
Typical Sign Mount

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

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

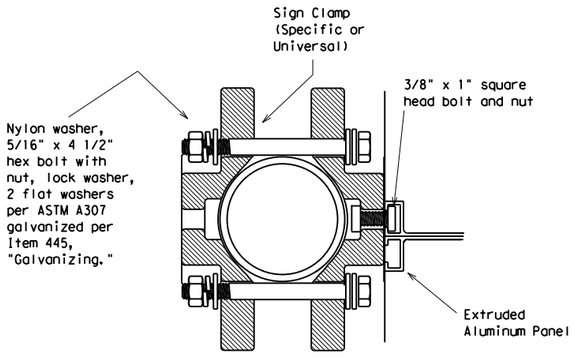


Detail E

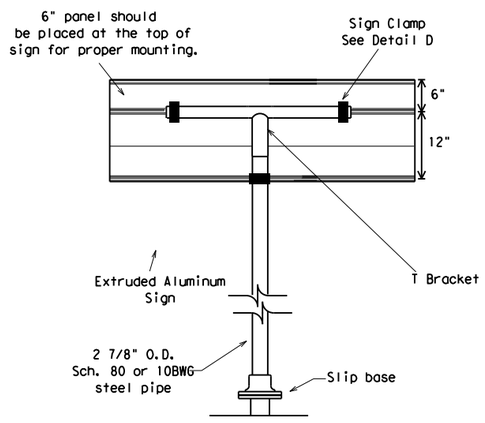


Top View

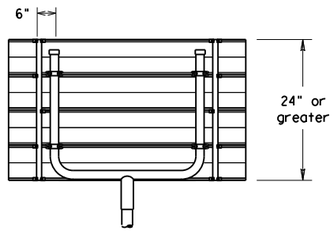
Detail A



Detail D
EXTRUDED ALUMINUM SIGN WITH T BRACKET



Extruded Aluminum Sign
With T Bracket



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

See Detail E
for clamp installation

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

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-3)-08

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REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-08	CONT	SECT	JOB	HIGHWAY
	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		176

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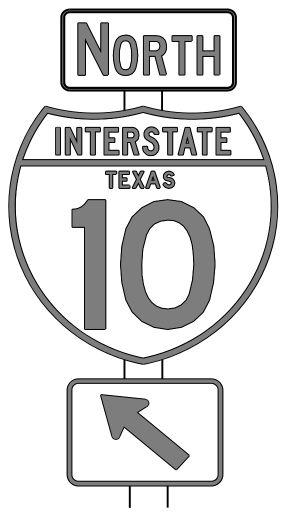
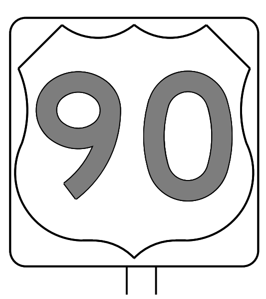
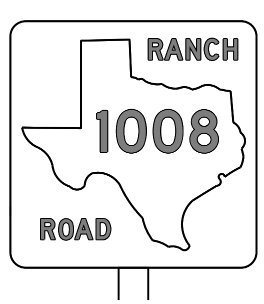
REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

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



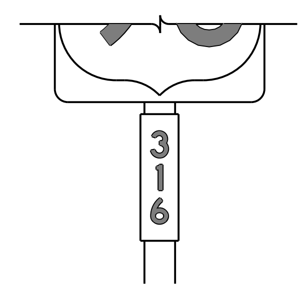


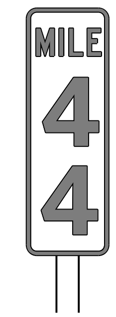


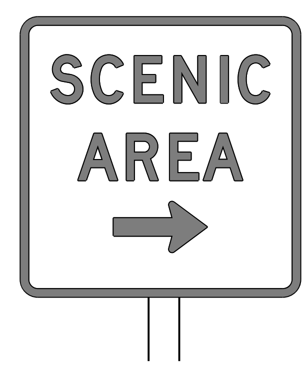
TYPICAL EXAMPLES

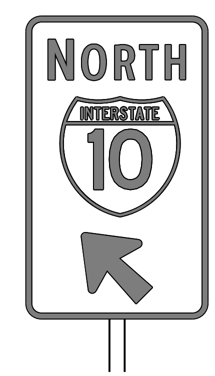
REQUIREMENTS FOR BLUE, BROWN & GREEN D AND I SERIES GUIDE SIGNS

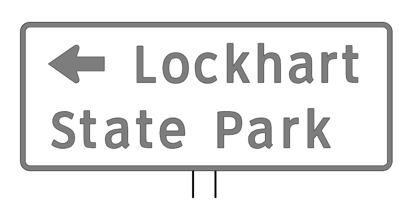
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	ALL	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE D SHEETING
LEGEND, SYMBOLS & BORDERS	ALL OTHERS	TYPE B OR C SHEETING

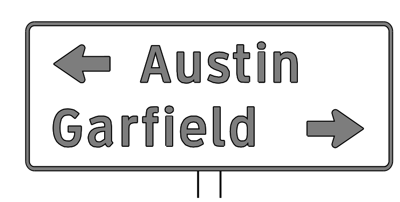












TYPICAL EXAMPLES

GENERAL NOTES

1. 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).

2. 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

3. 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).

4. 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.

5. 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.

6. 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.

7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.

8. Mounting details of roadside signs are shown in the "SMD series" Standard Plan Sheets.

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

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

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

http://www.txdot.gov/

Texas Department of Transportation — Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

TSR(3)-13

FILE: tsr3-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
12-03 7-13	DIST		COUNTY	SHEET NO.
9-08	DAL		KAUFMAN	177

3

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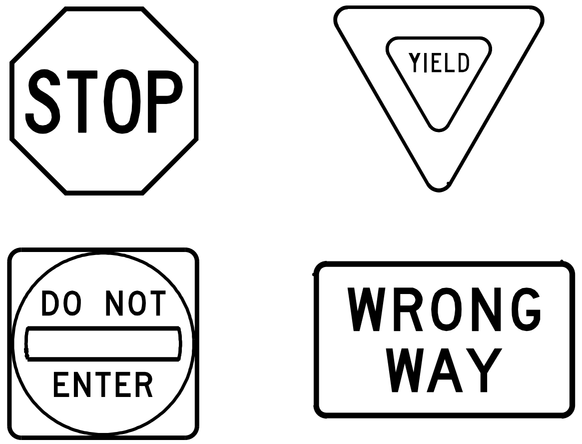
REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS
(STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



REQUIREMENTS FOR FOUR SPECIFIC SIGNS ONLY

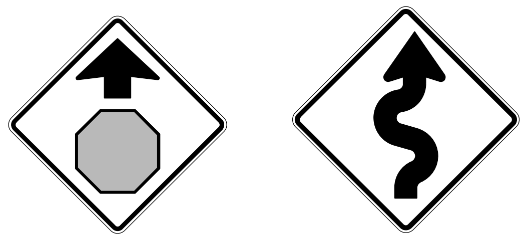
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	WHITE	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE B OR C SHEETING
LEGEND	RED	TYPE B OR C SHEETING

REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS
(EXCLUDING STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)

TYPICAL EXAMPLES

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

REQUIREMENTS FOR WARNING SIGNS



TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLOURESCENT YELLOW	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

REQUIREMENTS FOR SCHOOL SIGNS

TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	FLOURESCENT YELLOW GREEN	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
SYMBOLS	RED	TYPE B OR C SHEETING

GENERAL NOTES

1. 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).
2. Sign legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod or F).
3. 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.
4. Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
6. Colored legend shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to background sheeting, or combination thereof.
7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
8. Mounting details for roadside mounted signs are shown in the "SMD series" Standard Plan Sheets.

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

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

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

Texas Department of Transportation — Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

TSR(4)-13

FILE: tsr4-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2003	CONT 2355	SECT 01	JOB 006, ETC.	HIGHWAY FM 2451
REVISIONS 12-03 7-13 9-08	DIST DAL	COUNTY KAUFMAN		SHEET NO. 178

4

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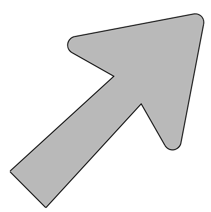
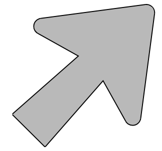
ARROW DETAILS

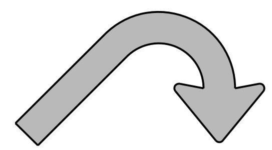
for Large Ground-Mounted and Overhead Guide Signs



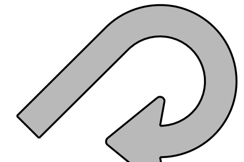
Type A



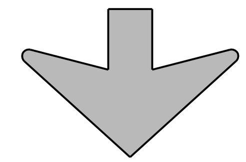
Type B



E-3



E-4



Down Arrow

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

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

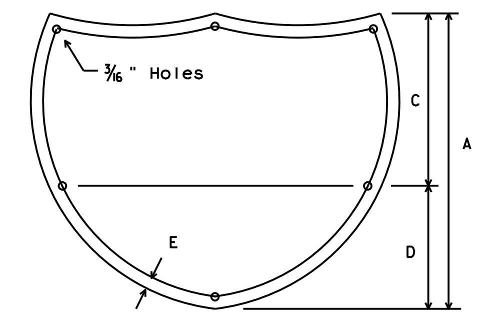
NOTE

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

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

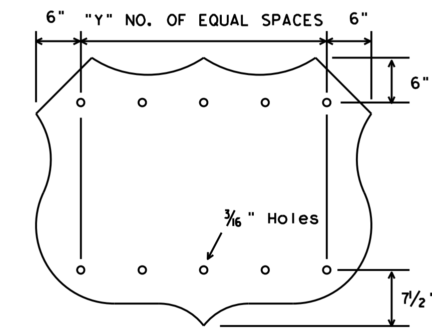
http://www.txdot.gov/

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



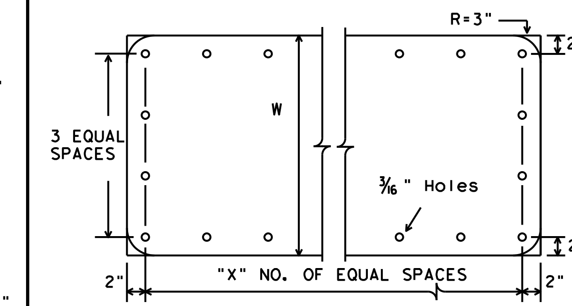
INTERSTATE ROUTE MARKERS

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



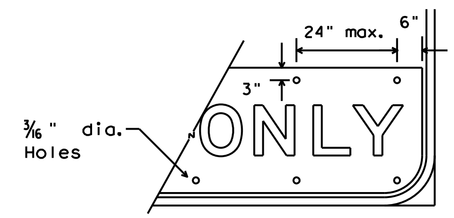
U.S. ROUTE MARKERS

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



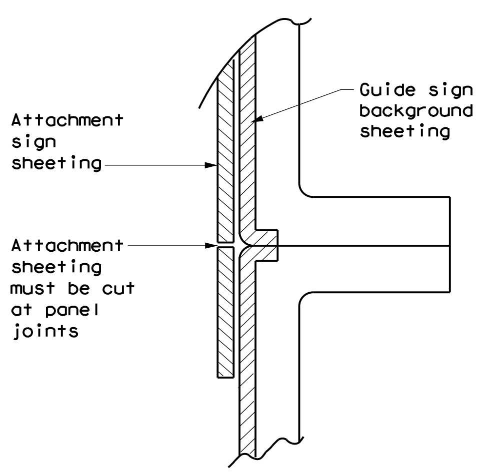
STATE ROUTE MARKERS

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

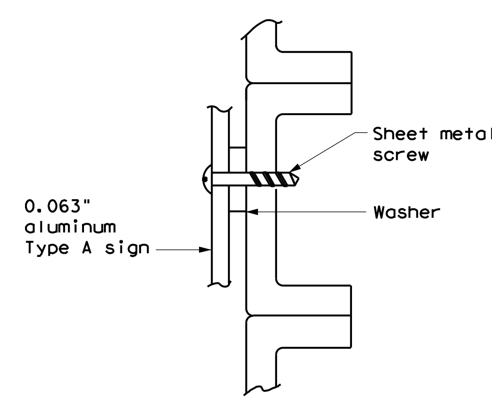


EXIT ONLY PANEL

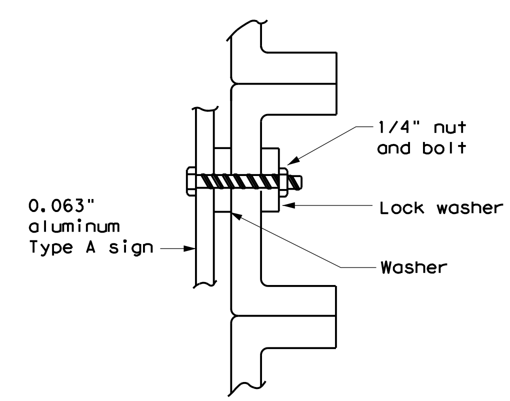
MOUNTING DETAILS OF ATTACHMENTS TO GUIDE SIGN FACE ("EXIT ONLY" AND "LEFT EXIT" PANELS, ROUTE MARKERS AND OTHER ATTACHMENTS)



DIRECT APPLIED ATTACHMENT



SCREW ATTACHMENT



NUT/BOLT ATTACHMENT

NOTE:

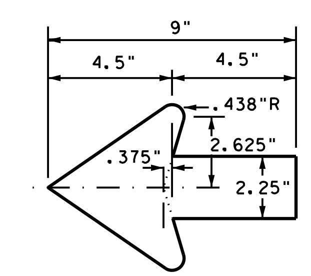
1. Sheeting for legend, symbols, and borders must be cut at panel joints.
2. Direct applied attachment signs will be subsidiary to "Aluminum Signs" or "Fiberglass Signs".

NOTE:

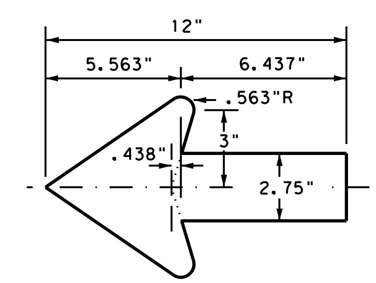
Furnish Type A aluminum sign attachments only when specified in the plans. These signs will be paid for under "Aluminum Signs".

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.

Texas Department of Transportation

Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

TSR(5)-13

FILE:	tsr5-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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12-03 7-13 9-08		DIST		COUNTY	SHEET NO.
		DAL		KAUFMAN	179

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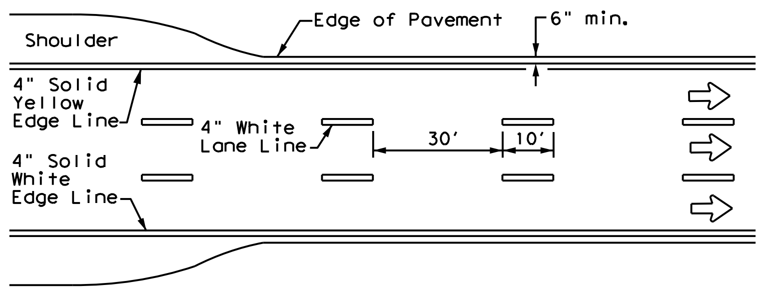
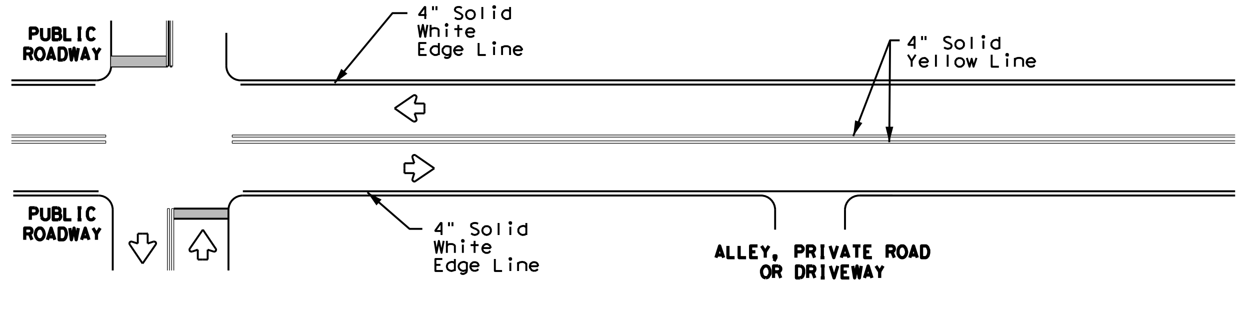
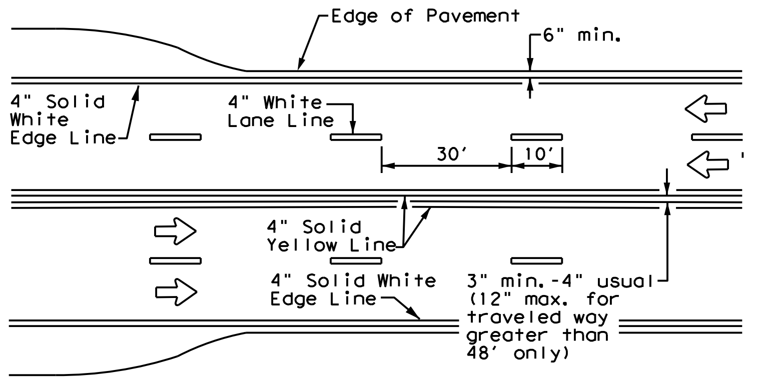


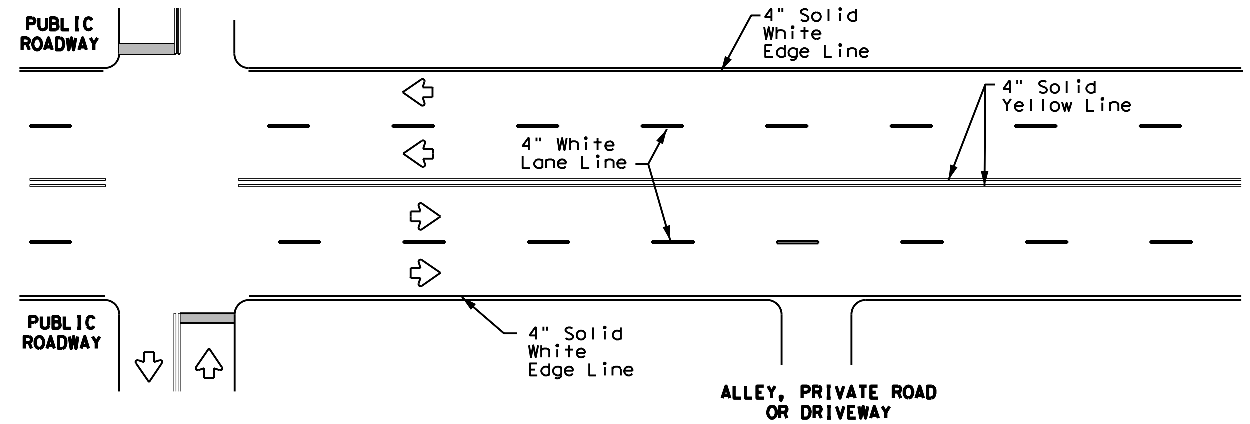
EDGE LINE AND LANE LINES
ONE-WAY ROADWAY
WITH OR WITHOUT SHOULDERS



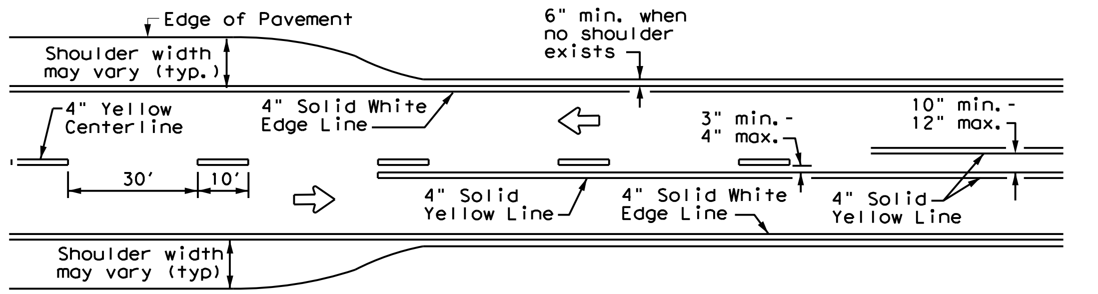
TYPICAL TWO-LANE, TWO-WAY PAVEMENT
MARKINGS THROUGH INTERSECTIONS



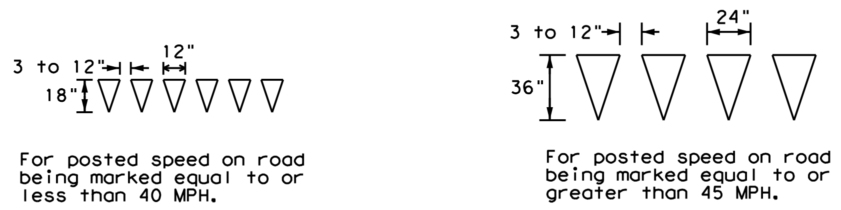
CENTERLINE AND LANE LINES
FOUR LANE TWO-WAY ROADWAY
WITH OR WITHOUT SHOULDERS



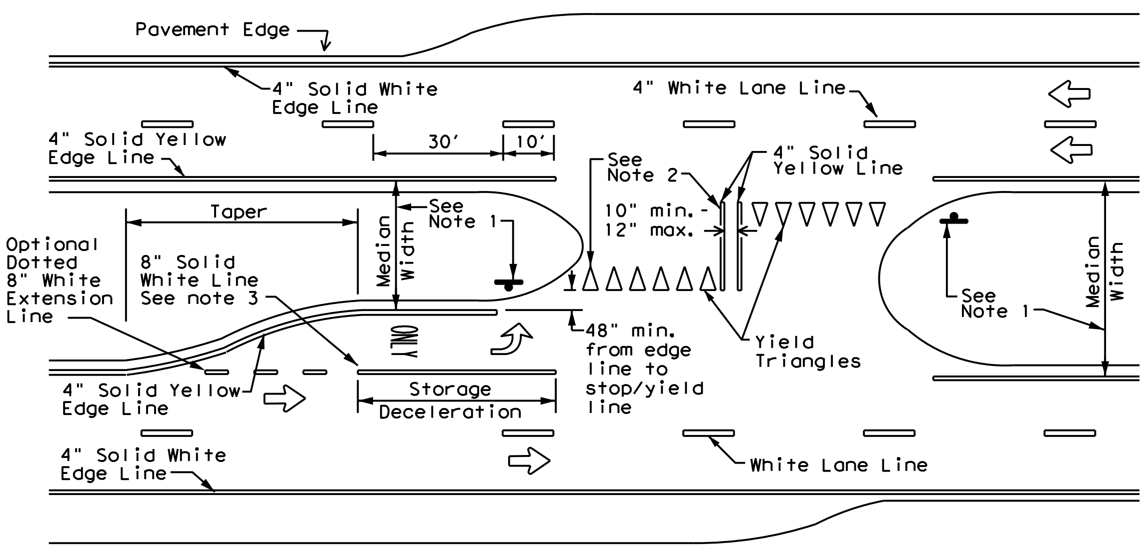
TYPICAL MULTI-LANE, TWO-WAY PAVEMENT
MARKINGS THROUGH INTERSECTIONS



TWO LANE TWO-WAY ROADWAY
WITH OR WITHOUT SHOULDERS



YIELD LINES



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

1. Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs are optional as determined by the Engineer.

2. Install median striping (double yellow centerlines and stop bars/yield triangles) when a 50' or greater median centerline can be placed. Stop bars shall only be used with stop signs. Yield traingles shall only be used with yield signs.

3. Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

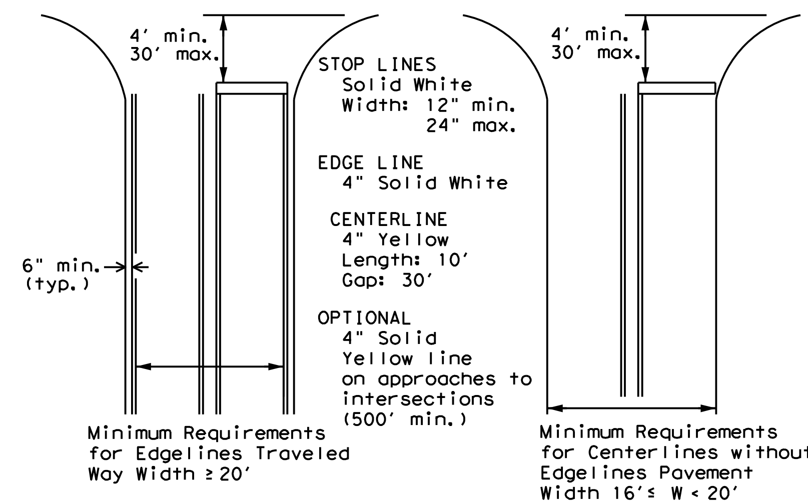
GENERAL NOTES

1. Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should not be placed less less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edgelines are not required in curb and gutter sections of roadways.

2. The traveled way includes only that portion of the roadway used for vehicular travel. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to the inside of edgeline of a two lane roadway.

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

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



GUIDE FOR PLACEMENT OF STOP LINES,
EDGE LINE & CENTERLINE
Based on Traveled Way and Pavement Widths for Undivided Highways

Texas Department of Transportation | Traffic Safety Division Standard

TYPICAL STANDARD PAVEMENT MARKINGS

PM(1)-20

FILE: pm1-20.dgn	DN:	CK:	DW:	CK:
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	DIST		COUNTY	SHEET NO.
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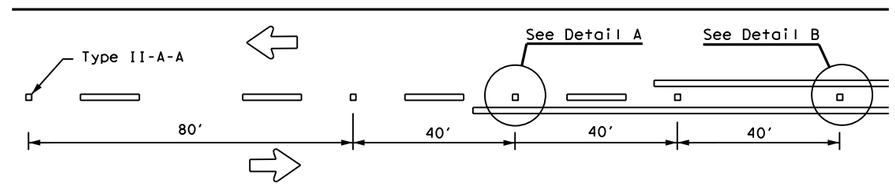
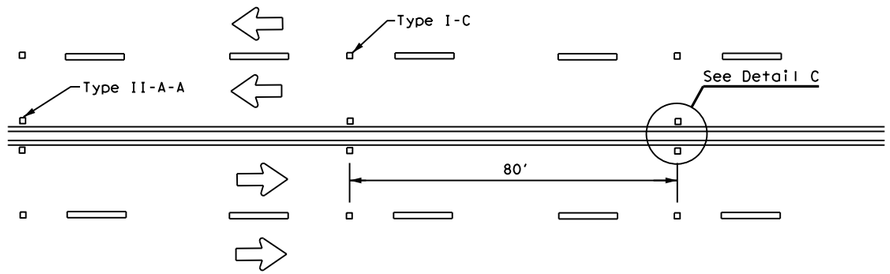
22A

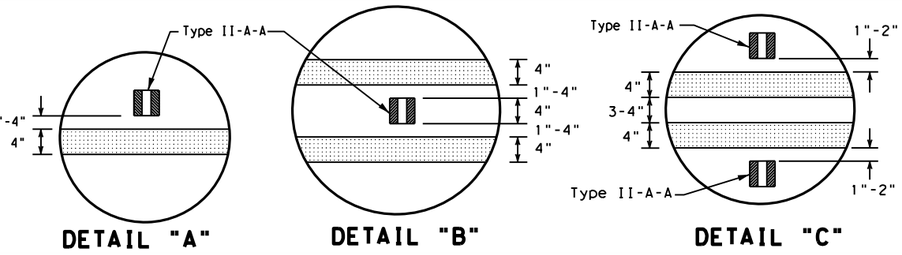
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE



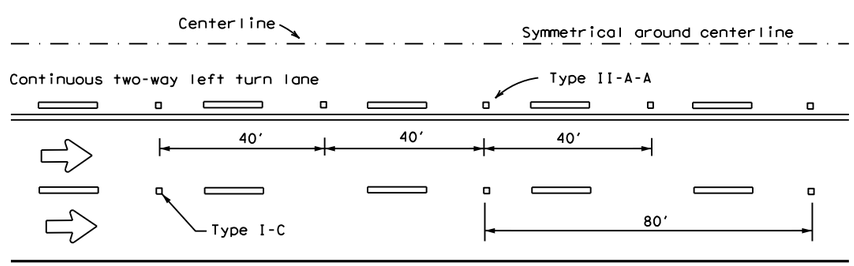
CENTERLINE FOR ALL TWO LANE ROADWAYS



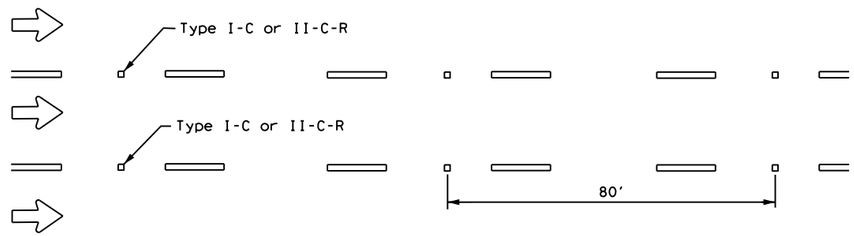
CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY HIGHWAYS



DETAIL "A" **DETAIL "B"** **DETAIL "C"**

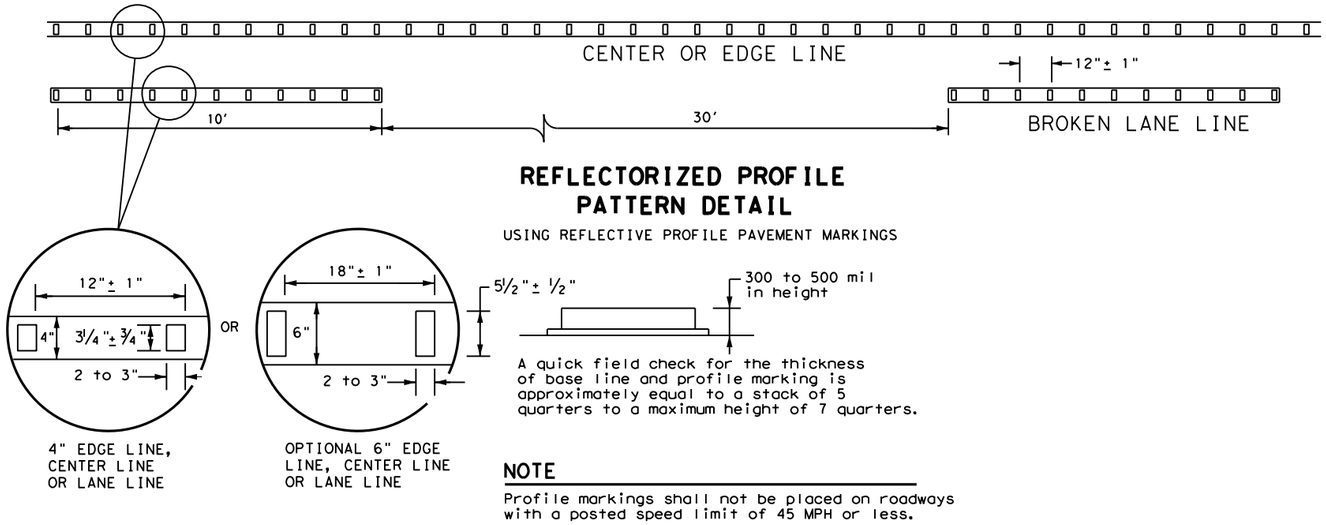


CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



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

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

4" EDGE LINE, CENTER LINE OR LANE LINE

OPTIONAL 6" EDGE LINE, CENTER LINE OR LANE LINE

NOTE

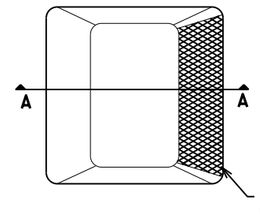
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

GENERAL NOTES

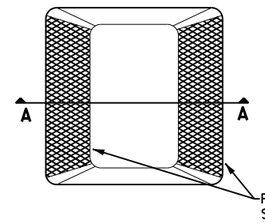
1. All raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.

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

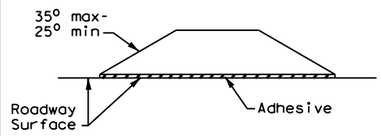
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)



Type II (Top View)



SECTION A

RAISED PAVEMENT MARKERS

Texas Department of Transportation

Traffic Safety Division Standard

POSITION GUIDANCE USING RAISED MARKERS RELECTORIZED PROFILE MARKINGS PM(2)-20

FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
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REVISIONS 4-92 2-10 5-00 2-12 8-00 6-20	2355	01	006, ETC.	FM 2451
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	DAL	KAUFMAN		181

22B

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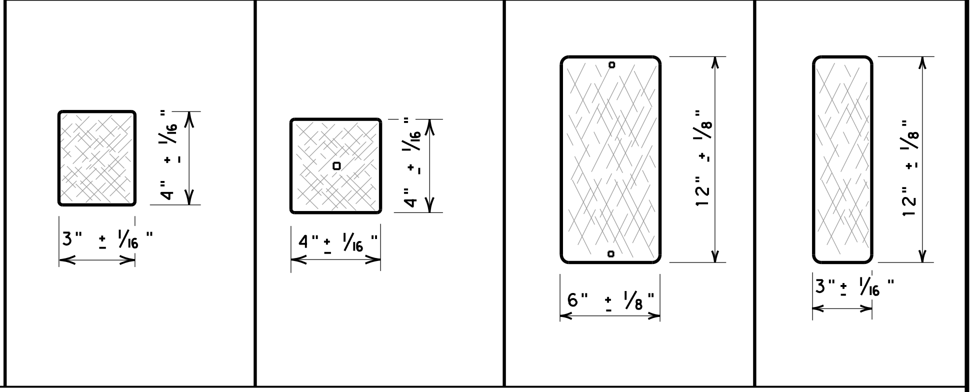
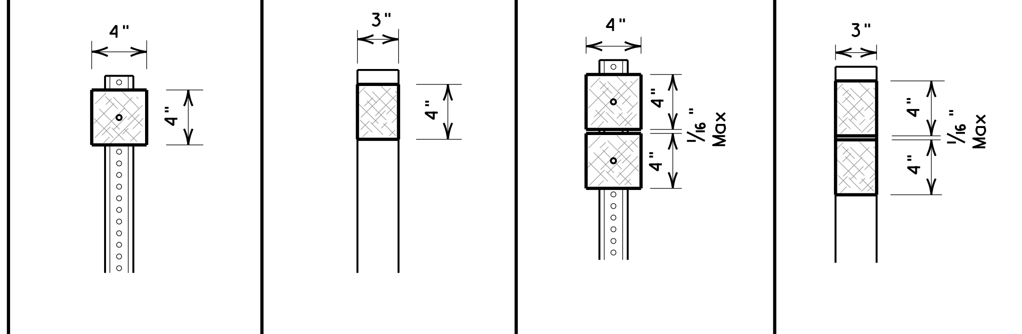
REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

	SIZE 1	SIZE 2	SIZE 3	SIZE 4
DEVICE				
SHEETING	Yellow, White or Red Type B or C reflective sheeting			
NOTE	1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (flx). 2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.			

DELINEATORS

	SINGLE		DOUBLE	
DEVICE				
	1-Size 2 reflector unit	1-Size 1 reflector unit	2-Size 2 reflector units	2-Size 1 reflector units
SHEETING	Yellow, White or Red Type B or C Reflective Sheeting			
POST TYPE	WC	YFLX, WFLX	WC	YFLX, WFLX
MOUNT TYPE	GND	GND, SRF	GND	GND, SRF

D & OM DESCRIPTIVE CODES

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

DIRECTION
If Required
BI = Bi-Directional
BR = Bi-Directional with red on back

INSTL OM ASSM (OM-XX) (XXXX)XXX(XX)

TYPE OF OBJECT MARKER
1, 2, 3, or 4

NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (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)

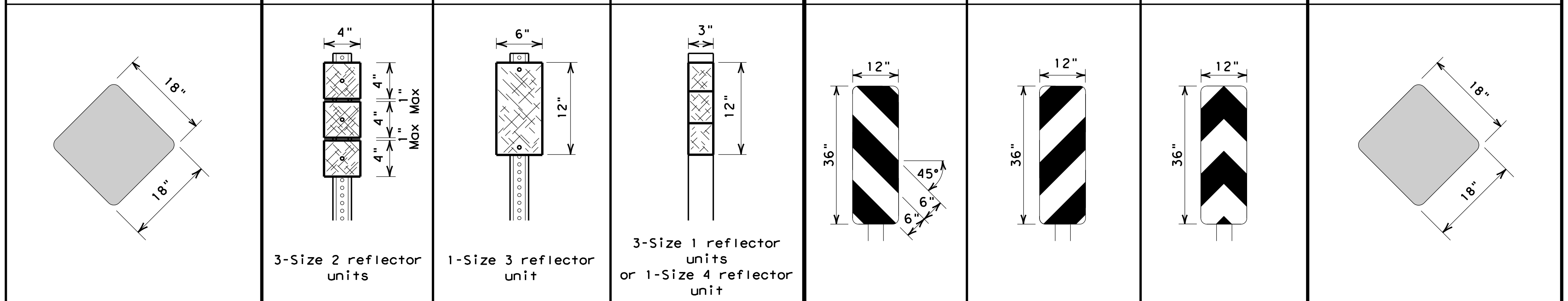
TYPE OF POST
WC = Wing Channel Post
WFLX = White Flexible Post
TWT = Thin Walled Tubing

TYPE OF MOUNT
GND = Embedded (drivable)
SRF = Surface Mount
WAS = Wedge Anchor Steel
WAP = Wedge Anchor Plastic

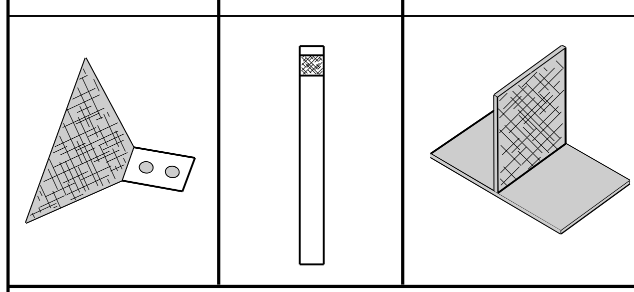
DIRECTION
If Required
BI = Bi-Directional

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

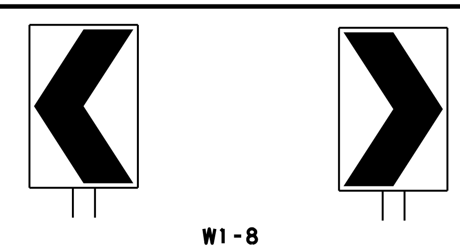
OBJECT MARKERS

	Type 1 (OM-1)	Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)
	OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4
DEVICE								
		3-Size 2 reflector units	1-Size 3 reflector unit	3-Size 1 reflector units or 1-Size 4 reflector unit				
SHEETING	Yellow-Type B_{FL} or C_{FL} Sheeting	Yellow - Type B or C Sheeting			Alternating acrylic black and retroflective yellow - Type B_{FL} or C_{FL} Sheeting			Red -Type B_{FL} or C_{FL} Sheeting
POST TYPE	TWT	WC	WC	WFLX	TWT			TWT
MOUNT TYPE	WAS, WAP	GND	GND	GND, SRF	WAS, WAP			WAS, WAP

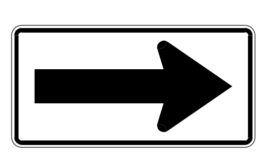
BARRIER REFLECTORS (BRF)

	GF1	GF2	CTB
DEVICE			
	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.		
SHEETING	Yellow, White, Red		
NOTE	1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches.		

CHEVRONS

DEVICE				
	W1-8			
SIZE (W x L)	18"x 24" (Conventional)	24"x 30" (Conventional Oversize)	30"x 36" (Expressway)	36" x 48" (Freeway)
MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only	

ONE DIRECTION LARGE ARROW

DEVICE		
	W1-6	
SIZE (W x L)	48" x 24" (Conventional)	60" x 30" (Expressway & Freeway)
MOUNTING HEIGHT	7'-0"	

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).

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.

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

D & OM(1)-20

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	DAL		KAUFMAN	182

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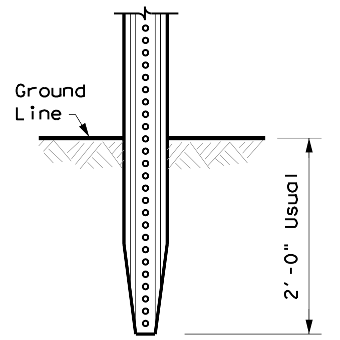
POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

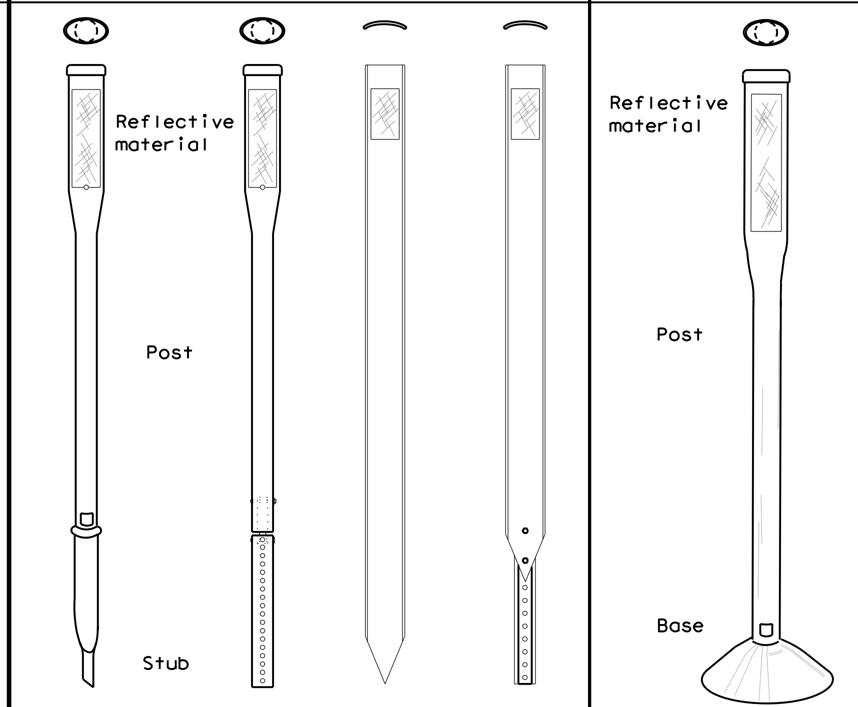


NOTES

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.

FLEXIBLE POSTS (YFLX, WFLX)

GND | SRF



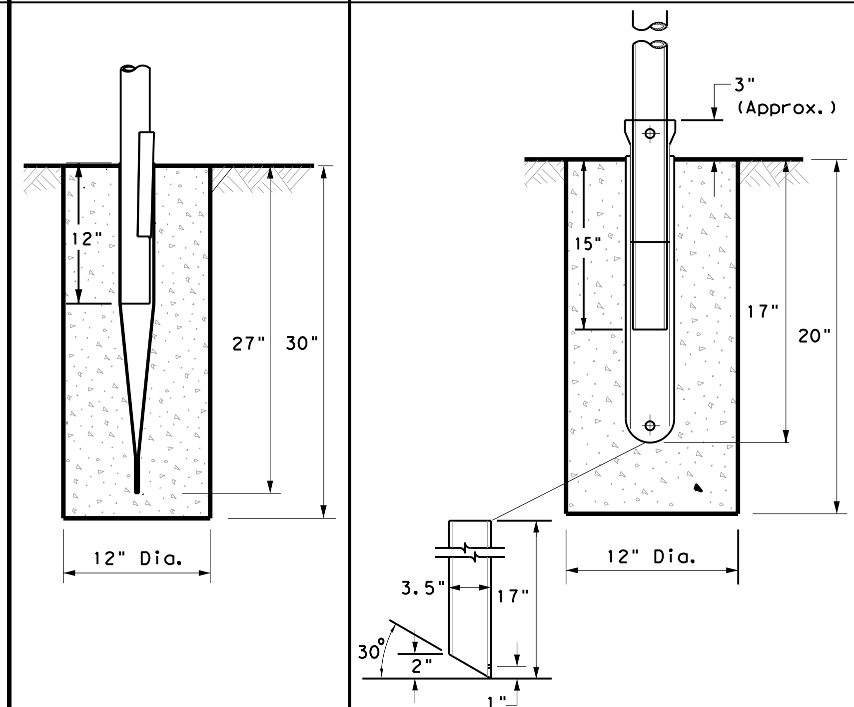
EMBEDDED | SURFACE MOUNT

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.

WEDGE ANCHOR SYSTEMS

WAS | WAP



STEEL | PLASTIC

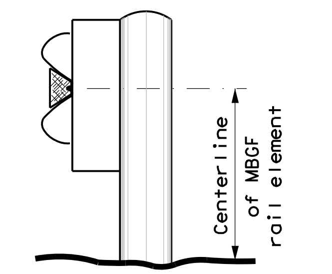
NOTE

1. Install per manufacturer's recommendations.

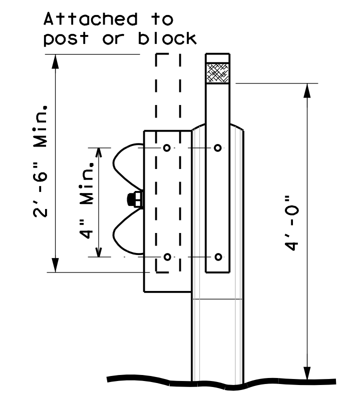
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

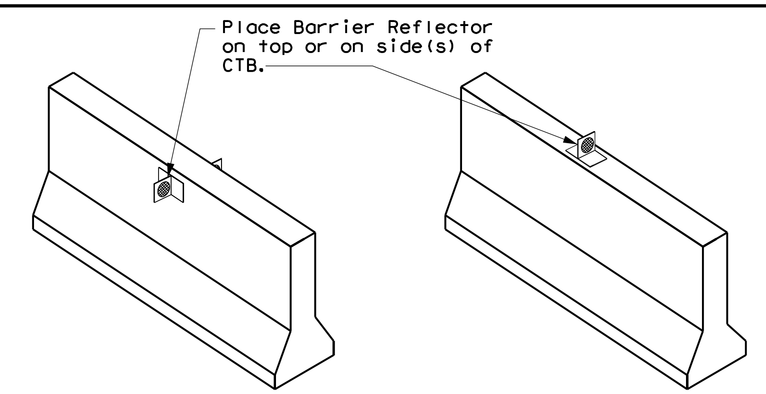
GF1



GF2



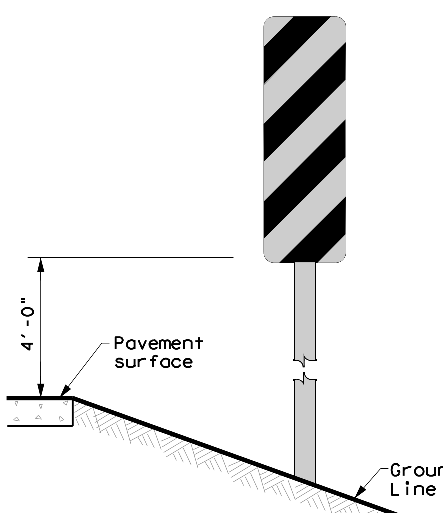
CONCRETE TRAFFIC BARRIER (CTB)



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.

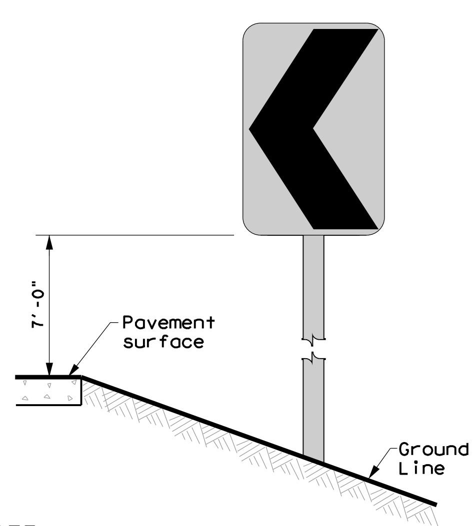
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



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)

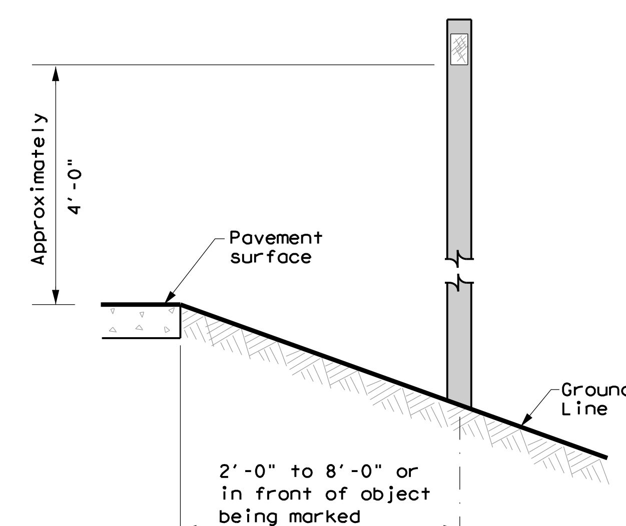
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



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.

DELINEATORS AND TYPE 2 OBJECT MARKERS



See general notes 1, 2 and 3.

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DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

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20B

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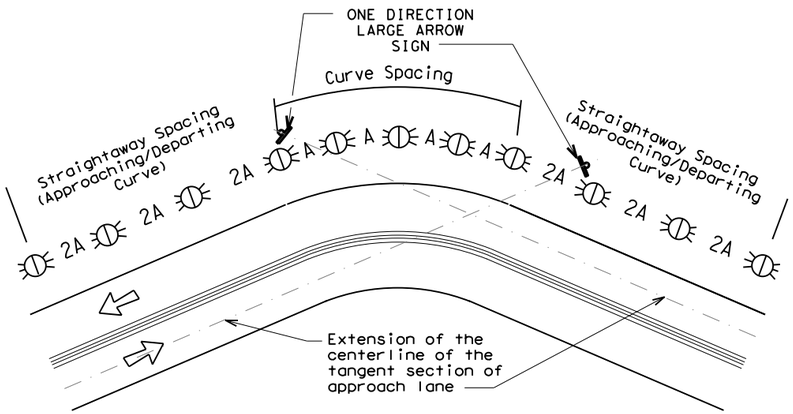
MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

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

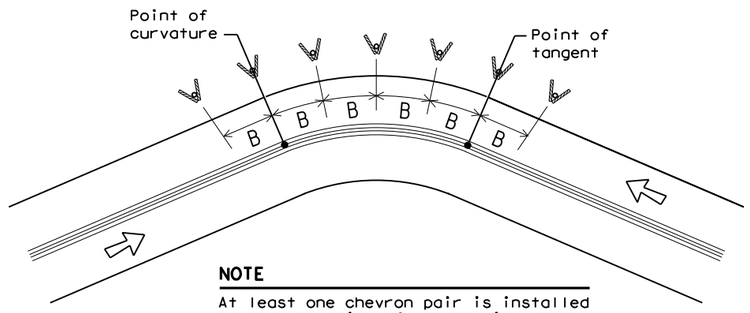
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



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

1. 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.
2. Barrier reflectors may be used to replace required delineators.
3. Single red delineators may be mounted on the back side of delineator posts for wrong way driver applications

LEGEND

	Bi-directional Delineator
	Delineator
	Sign

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(3)-20

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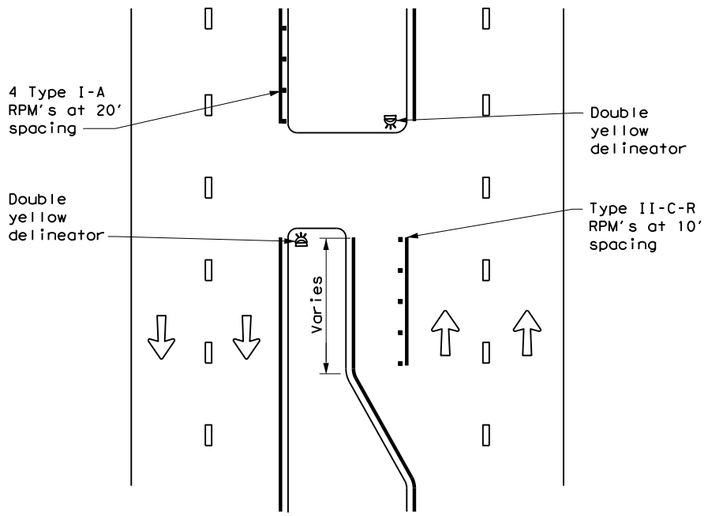
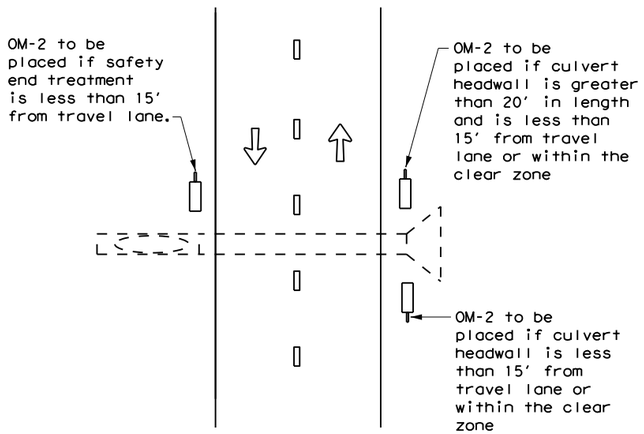
CROSSOVERS



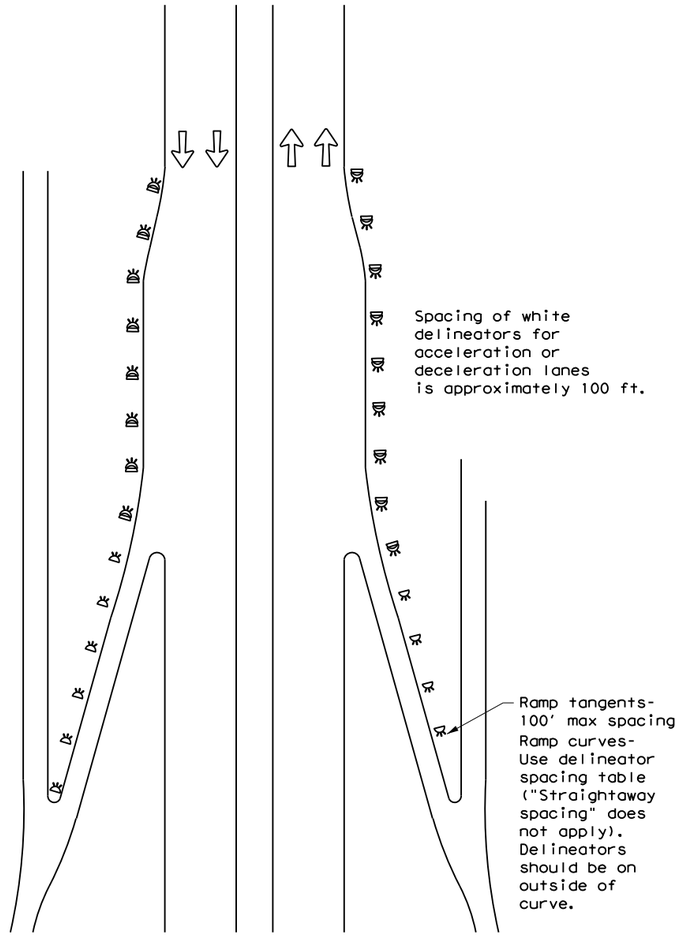
DETAIL 1

FOR CULVERTS WITHOUT MBGF



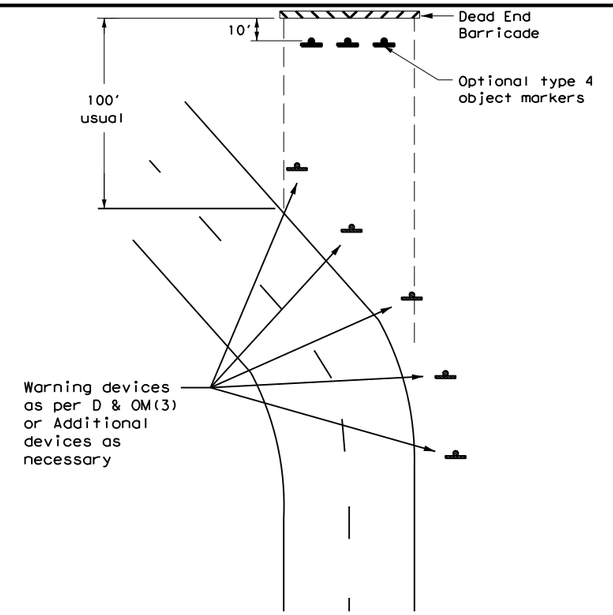
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



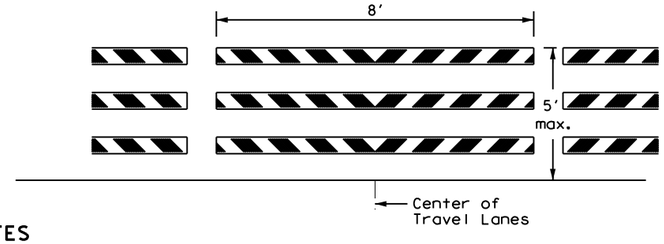
DETAIL 3

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(4)-20

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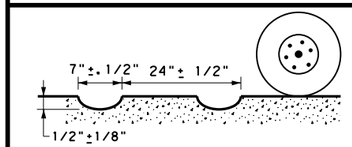
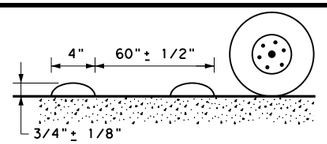
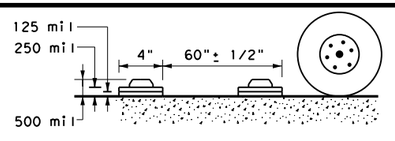
CENTERLINE RUMBLE STRIPS



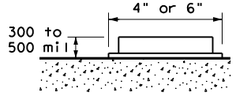
MILLED RUMBLE STRIPS



RAISED TRAFFIC BUTTONS

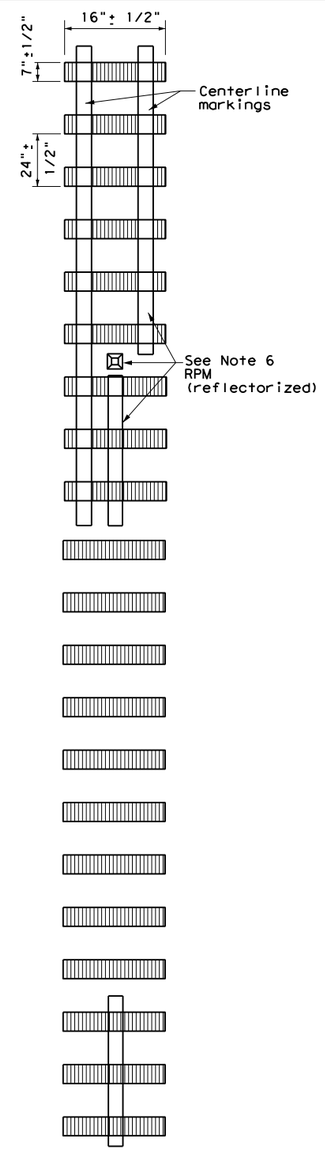


PREFORMED THERMOPLASTIC STRIPS



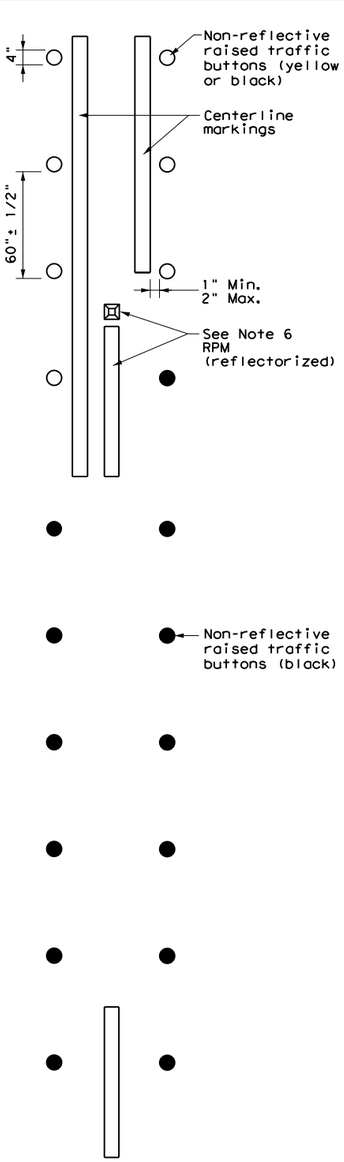
PROFILE MARKINGS

PROFILE VIEW



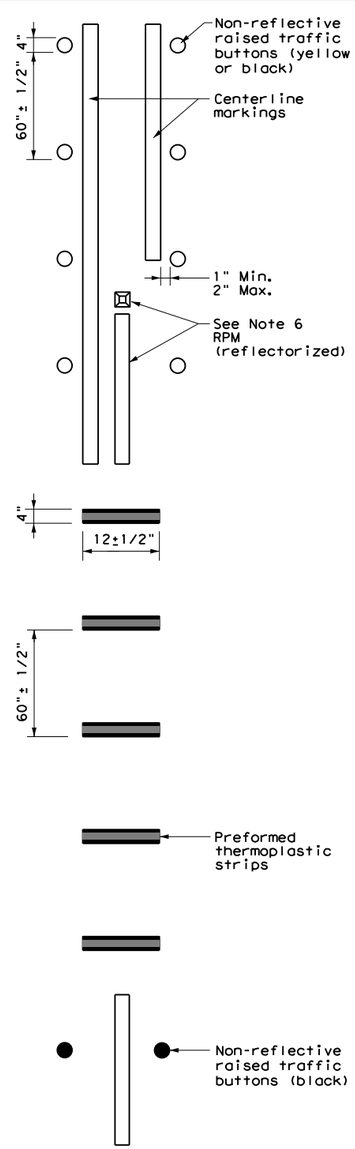
PLAN VIEW
OPTION 1

MILLED CENTERLINE RUMBLE STRIPS



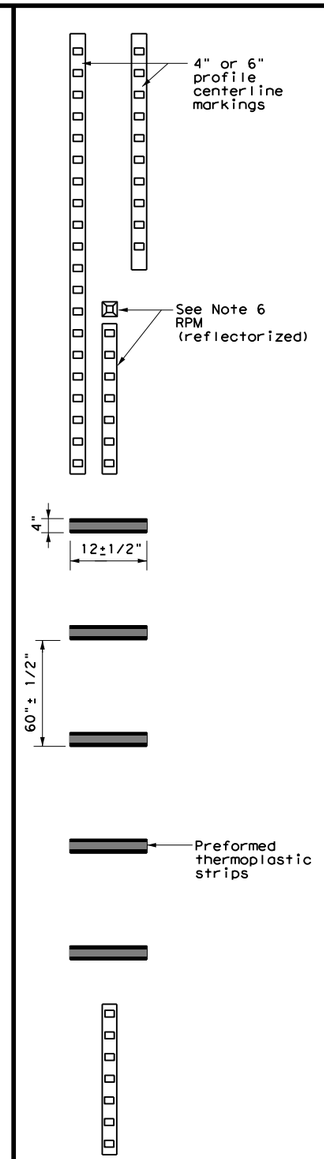
PLAN VIEW
OPTION 2

RAISED CENTERLINE RUMBLE STRIPS



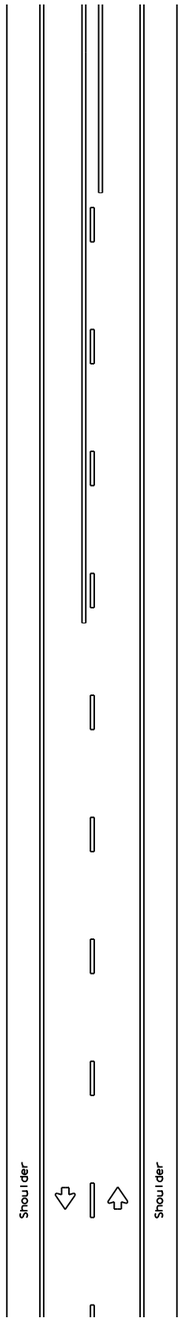
PLAN VIEW
OPTION 3

RAISED CENTERLINE RUMBLE STRIPS AND PREFORMED THERMOPLASTIC STRIPS



PLAN VIEW
OPTION 4

PROFILE CENTERLINE MARKINGS AND PREFORMED THERMOPLASTIC STRIPS



TWO LANE TWO-WAY ROADWAYS

GENERAL NOTES

1. This standard sheet provides guidelines for installing centerline rumble strips on two-lane highways with or without shoulders.
2. Centerline and edgeline rumble strips or profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
3. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
4. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
5. Breaks in milled centerline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks.
6. Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, and dimensions pavement markings and profile markings.
7. Consideration should be given to noise levels when centerline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inch depth of milled rumble strip may be considered in these areas.
8. Pavement markings must be applied over milled centerline rumble strips.

WHEN INSTALLING CENTERLINE RUMBLE STRIPS:

9. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per manufacturer's recommendations.
10. When using non-reflective raised traffic buttons as a centerline rumble strip, the button shall be placed adjacent to the pavement marking delineating the centerline. The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
11. The color of the button should be yellow for a continuous no passing roadway. Black buttons should be used in areas where passing is allowed.

WHEN INSTALLING EDGELINE RUMBLE STRIPS WITH OR WITHOUT CENTERLINE RUMBLE STRIPS ON UNDIVIDED HIGHWAYS:

12. See standard sheet RS(4).

Texas Department of Transportation®
Traffic Operations Division Standard

CENTERLINE RUMBLE STRIPS ON TWO LANE TWO-WAY HIGHWAYS

RS(3)-13

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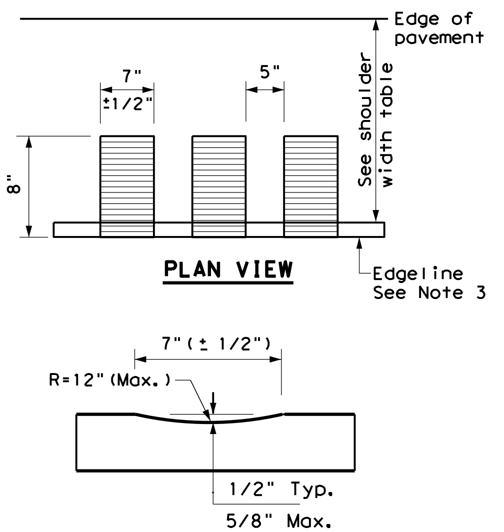
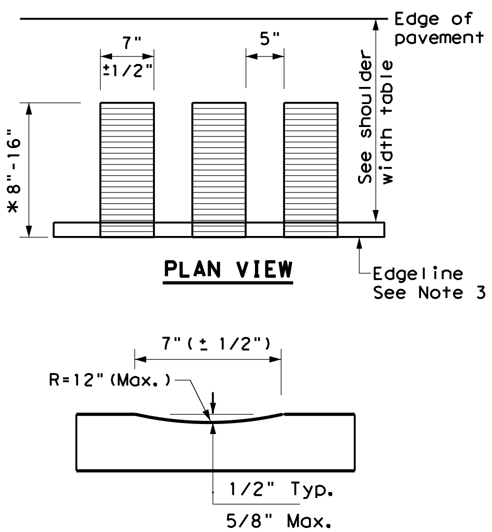


PROFILE VIEW
OPTION 1

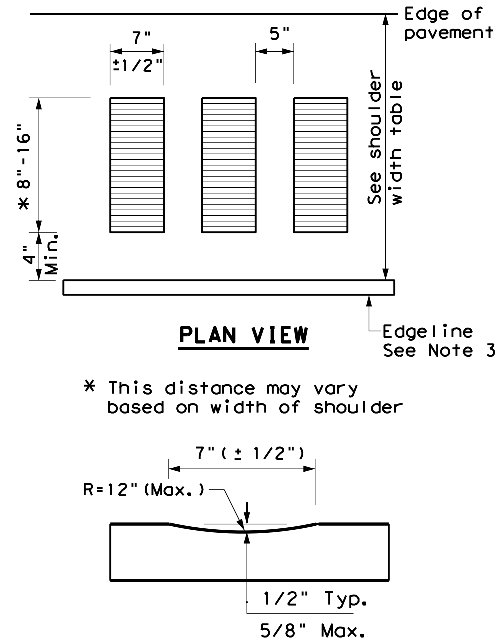
CONTINUOUS MILLED DEPRESSIONS
(Rumble Stripes)



* This distance may vary based on width of shoulder

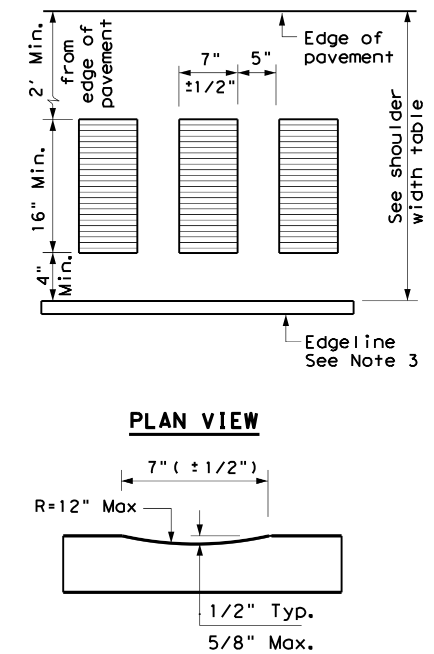
PROFILE VIEW
OPTION 2

CONTINUOUS MILLED DEPRESSIONS
(Rumble Stripes)



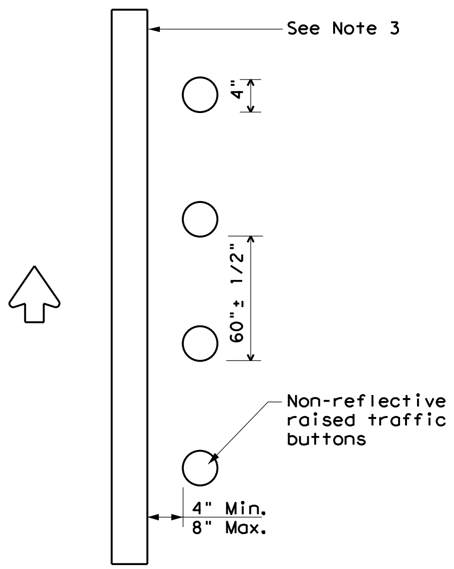
PROFILE VIEW
OPTION 3

CONTINUOUS MILLED DEPRESSIONS
(Rumble Strips)



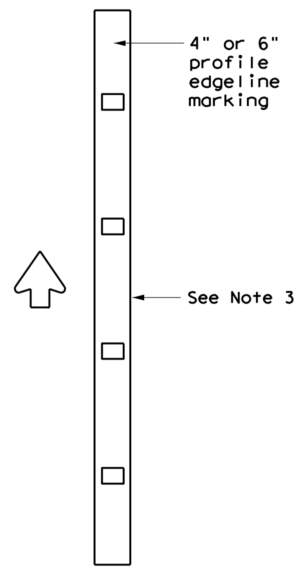
PROFILE VIEW
OPTION 4

CONTINUOUS MILLED DEPRESSIONS
(Rumble Strips)



PLAN VIEW
OPTION 5

RAISED EDGELINE RUMBLE STRIPS



PLAN VIEW
OPTION 6

PROFILE EDGELINE MARKINGS

SHOULDER WIDTH TABLE		
EQUAL TO OR LESS THAN 2 FEET	GREATER THAN 2 FEET LESS THAN 4 FEET	EQUAL TO OR GREATER THAN 4 FEET
Option 1, 5 OR 6	Option 1, 2, 3 5 OR 6	Option 2, 4, 5 OR 6

GENERAL NOTES

1. Rumble strips and profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
2. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
3. Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings, and profile markings.
4. See the table below for determining what options may be used for edgeline rumble strips.

WHEN INSTALLING MILLED DEPRESSION EDGELINE RUMBLE STRIPS:

5. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
6. Pavement markings can be applied over milled shoulder rumble strips to create an edgeline rumble stripe.
7. Breaks in edgeline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks when installed on conventional highways.
8. Rumble strips shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
9. Consideration should be given to noise levels when edgeline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inches depth of milled rumble strip may be considered in these areas.
10. On roadways with high bicycle activity, consideration should be given before the installation of edgeline rumble strips. Things to consider include size of rumble strips, rumble strip material and location of rumble strips on the shoulder. If the designer determines that gaps are needed in the rumble strips due to bicycle use of the road, then follow the requirement shown in FHWA Technical Advisory T5040.39, or latest version. A detail of the spacing shall be included in the plans.

WHEN INSTALLING RAISED OR PROFILE EDGELINE RUMBLE STRIPS:

11. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per the manufacturer's recommendations.
12. Non-reflective traffic buttons shall be placed adjacent to the pavement marking delineating the edgeline when used as a rumble strip. The color of the button should match the color of the adjacent edgeline marking (white or yellow). The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
13. Non-reflective traffic buttons shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
14. Breaks in edgeline rumble strips using raised traffic buttons shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossing, intersections and driveways with high usage of large trucks when installed on conventional highways.
15. The minimum distance between the edgeline and the buttons should be used if the shoulder is less than 8 feet in width.
16. Raised profile thermoplastic markings used as edgelines may substitute for buttons.

Texas Department of Transportation
Traffic Operations Division Standard

EDGELINE RUMBLE STRIPS ON UNDIVIDED OR TWO LANE HIGHWAYS
RS(4)-13

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		DAL		KAUFMAN	187

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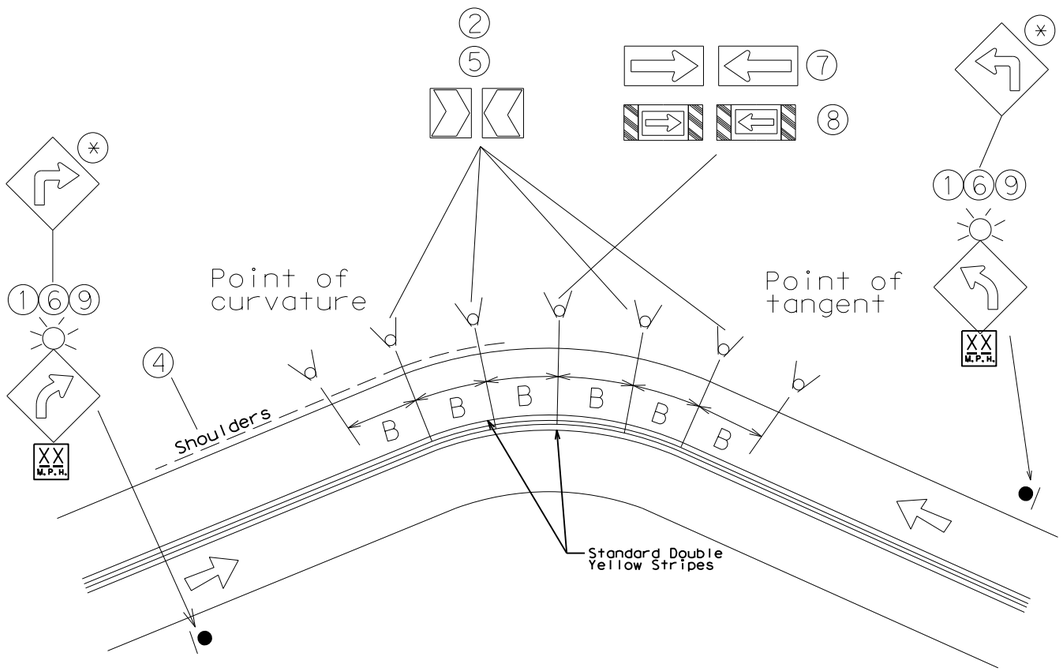
Dallas District Standard for Two-Lane Highway Curve Signing/Markings



Curve Safety Sequence

Applicable Minimum Measures

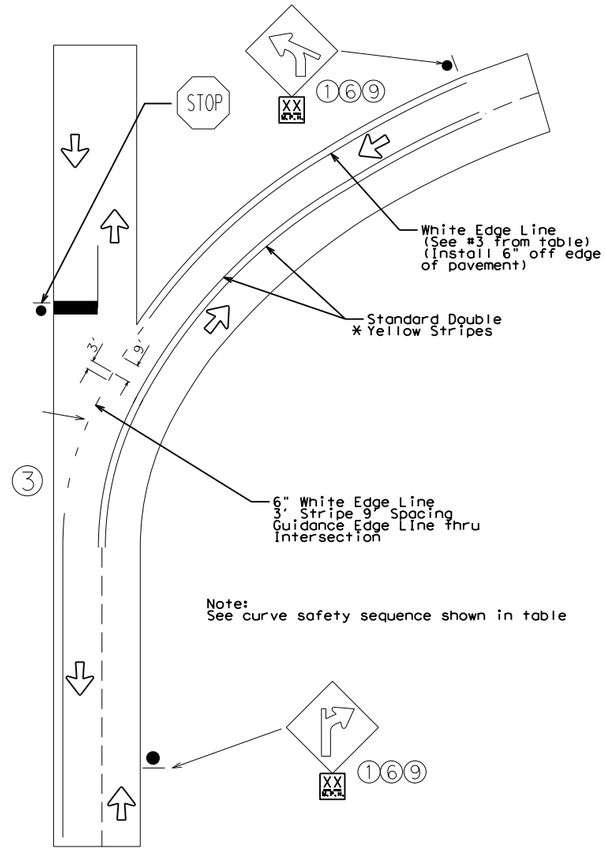
Advisory Speed 55 mph or higher	Advisory Speed 40-50 mph	Advisory speed 35 mph or less		Curve signing, delineation and pavement markings (listed in order from minimum to maximum level of treatment as needed)
+	+	+	1	Advance warning (36" x 36") and advisory mph (18" x 18")
+	+	+	2	Chevron alignment signs if advisory speed is 15 mph or greater than posted speed
	+	+	3	Edge lines
			3a	Pavement width 24' or greater 6" solid white edge line
			3b	Pavement width 20' - 24' 4" solid white edge line
			3c	Pavement width 20' or less no edge line
		Supplemental Measures		
		#	4	Add shoulders and edge line (see #3a)
		#	5	Yellow high intensity flourescent chevron alignment signs - add reflective sheeting to sign support from bottom edge of sign
#	#	#	6	Large advance warning (48" x 48") and advisory mph (30" x 30")
#	#	#	7	Arrow sign (48" x 24")
		#	8	Large arrow sign with diagonals (96" x 36")
		#	9	Add flashers to advance warning signs
#	#	#	10	Surface treatment to improve friction
			**	The W1-1R or L sign shall only be used when the advisory speed is
				30 mph or less

\+ = required
\# = optional

Applications 4 - 10 are additional supplemental applications which may be added as directed by the Area Engineer.

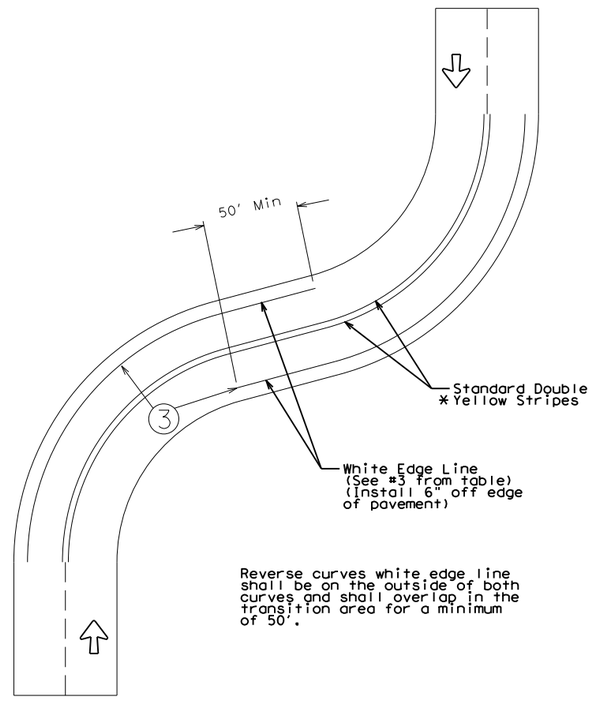
Note:
"B" - Chevron Spacing referenced from D&OM(3)-15B

Typical Curve Treatment with Intersection



Note:
See curve safety sequence shown in table

Typical Reverse Curve Edge Line Treatment



Reverse curves white edge line shall be on the outside of both curves and shall overlap in the transition area for a minimum of 50'.

* Standard Double Yellow Stripes shall be dropped through a non-signalized intersection within the city limit. Outside the city limit, the Standard Double Yellow Strip shall be carried through all non-signalized intersections.

Notes:
1. Two methods will be used to determine the appropriate advisory speed for curves, the GPS Method(existing curves) and the Design Method (new curves).
2. Notify the Traffic Engineering Section for all requests on advisory speeds for existing curves.

OCT-2014 UPDATED NOTES
JAN-2016 NOTE ADDED
SEPT-2016 NOTE ADDED FOR STRIPING IN CURVE
MAR-2017 REMOVED REFERENCE TO DELINEATORS
MAY-2019 MODIFIED SIGN SIZE

Texas Department of Transportation
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TWO-LANE HIGHWAY CURVE SIGNING & MARKINGS

DALLAS DISTRICT STANDARD

SCALE: NTS SHEET 1 OF 1

DESIGN/CK	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
BLS	6	(SEE TITLE SHEET)		FM 2451
CHECK BLS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FRC	TEXAS	DAL	KAUFMAN	188
CHECK ARO	CONTROL 2355	SECTION 01	JOB 006, ETC.	

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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. Kaufman County Phase II MS 4 - Contact Kathy Morris

☐ 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 sream 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. Cottonwood Creek Sta 227+57.82 Stream Impact NWP # 14 NRP

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
☒ Temporary Vegetation	☒ Silt Fence	☐ Vegetative Filter Strips
☐ Blankets/Matting	☐ Rock Berm	☐ Retention/Irrigation Systems
☐ Mulch	☐ Triangular Filter Dike	☐ Extended Detention Basin
☐ Sodding	☐ Sand Bag Berm	☐ Constructed Wetlands
☐ Interceptor Swale	☐ Straw Bale Dike	☐ Wet Basin
☐ Diversion Dike	☐ Brush Berms	☐ Erosion Control Compost
☐ Erosion Control Compost	☐ Erosion Control Compost	☐ Mulch Filter Berm and Socks
☐ Mulch Filter Berm and Socks	☐ Mulch Filter Berm and Socks	☐ Compost Filter Berm and Socks
☐ Compost Filter Berm and Socks	☐ Compost Filter Berm and Socks	☒ Vegetation Lined Ditches
	☐ Stone Outlet Sediment Traps	☐ Sand Filter Systems
	☐ Sediment Basins	☐ 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.

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.

3.

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. Wood Stork - Bird BMPs:
a. Prior to construction, perform daytime surveys for nests including under bridges and in culverts to determine if they are active before removal. Nests that are active should not be disturbed.
b. Do not disturb, destroy, or remove active nests, including ground nesting birds, during the nesting season.
c. Avoid the removal of unoccupied, inactive nests, as practicable.
d. Prevent the establishment of active nests during the nesting season on TxDOT owned and operated facilities and structures proposed for replacement or repair. e. Do not collect, capture, relocate, or transport birds, eggs, young, or active nests without a permit.

REFER TO EPIC SHEET 2 OF 2 FOR CONTINUATION OF SECTION V

Special Note: 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 Material Safety Data Sheets (MSDS) for all hazardous products used on the project, which may include, but are not limited to the following categories: Paints, acids, solvents, asphalt products, chemical additives, fuels and concrete curing compounds or additives. Provide protected storage, off bare ground and covered, for products which may be hazardous. Maintain product labelling as required by the Act. Maintain an adequate supply of on-site spill response materials, as indicated in the MSDS. In the event of a spill, take actions to mitigate the spill as indicated in the MSDS, in accordance with safe work practices, and contact the District Spill Coordinator immediately. The Contractor shall be responsible for the proper containment and cleanup of all product spills.

Contact the Engineer if any of the following are detected:
* Dead or distressed vegetation (not identified as normal)
* Trash piles, drums, 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 notifiy 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:

VII. OTHER ENVIRONMENTAL ISSUES

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

☒ No Action Required ☐ Required Action

Action Number:

1.

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.

LAST REVISION: 1/15/15

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Dallas District

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS (EPIC)

SHEET 1 OF 2

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
6	SEE TITLE SHEET		FM 2451
STATE	DISTRICT	COUNTY	
TEXAS	DALLAS	Kaufman	
CONTROL	SECTION	JOB	SHEET NO.
2355	01	006 Etc.	189

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:

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Filled Out: xx/xx/xxxx
Prepared By:

V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRD TREATY ACT.- CONTINUATION FROM PAGE 1.

2. Southern crawfish frog - 1) Minimize impact to wetland habitats including isolated ephemeral pools, 2) Water Quality BMPs, 3) Amphibian BMPs (see below).

3. Water Quality BMPs: In addition to BMPs required for a TCEQ Storm Water Pollution Prevention Plan and/or 401 water quality permit:
a. Minimize the use of equipment in streams and riparian areas during construction. When possible, equipment access should be from banks, bridges, or barges.
b. When temporary stream crossings are unavoidable, remove stream crossings once they are no longer needed and stabilize banks and soils around the crossing.

4. Woodhouse's Toad and Strecker's chrous frog- Amphibian BMPs:
a) Contractors will be advised of potential occurrence in the project area, and to avoid harming the species if encountered. b) Minimize the impacts to wetland, temporary and permanent open water features, including depressions, and riverine habitats. c) Maintain hydrologic regime and connections between wetlands and other aquatic features. d) N/A e).Apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas where feasible. If hydromulching and/or hydroseeding are not feasible due to site conditions, using erosion control blankets or mats that contain no netting, or only contain loosely woven natural fiber netting is preferred. Plastic netting should be avoided to the extent practicable. f). Project specific locations (PSLs) proposed within state-owned ROW should be located in uplands away from aquatic features. g). When work is directly adjacent to the water, minimize impacts to shoreline basking sites (e.g., downed trees, sand bars, exposed bedrock) and overwinter sites (e.g., brush and debris piles, crayfish burrows) where feasible. h). Avoid or minimize disturbing or removing downed trees, rotting stumps, and leaf litter, which may be refugia for terrestrial amphibians, where feasible.
i). N/A

5. Eastern spotted skunk, long-tailed weasel, and swamp rabbit - Contractors will be advised of potential occurrence in the project area, and to avoid harming the species if encountered and avoid unnecessary impacts to dens.

6. Eastern Box Turtle, slender glass lizard, and western box turtle, - Terrestrial Reptile BMPs:
a) Apply hydromulching and/or hydroseeding in areas for soil stabilization and or revegetation of disturbed areas where feasible. If hydromulching and/or hydroseeding are not feasible due to site conditions, utilize erosion control blankets or mats that contain no netting or contain loosely woven, natural fiber netting is preferred. Plastic netting should be avoided to the extent practicable. b) For open trenches and excavation pits, install escape ramps at an angle of less than 45 degrees (1:1) in areas left uncovered. Visually inspect excavation areas for trapped wildlife prior to backfilling. c) Inform contractors that if reptiles are found on the project site, allow species to safely leave the project area.
d) Avoid or minimize disturbing or removing downed trees, rotting stumps, and leaf litter where feasible. e) Contractors will be advised of potential occurrence in the proejct area and to avoid harming the species if encountered.

7. Shinner's sedge - Contractors will be advised of potential occurrence in the project area, and to avoid harming the species if encountered.

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LAST REVISION: 1/15/15

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ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS (EPIC)

SHEET 2 OF 2

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
6	SEE TITLE SHEET		FM 2451
STATE	DISTRICT	COUNTY	
TEXAS	DALLAS	Kaufman	
CONTROL	SECTION	JOB	SHEET NO.
2355	01	006 Etc.	190

A. GENERAL SITE DATA

1. PROJECT LIMITS: *FM 2451: FROM MIDLAND DR TO SH 34 & SH 34 TO FM 148*

Begin Project Coordinates : Latitude (N): 32.4625463 Longitude (W): -96.4539176
End Project Coordinates : Latitude (N): 32.4644398 Longitude (W): -96.3499721

2. PROJECT SITE MAPS:

- *Project Location Map: The Title Sheet and Project Layout (Sheet 1 & Sheet 3)*
- *Drainage Patterns: Drainage Area Maps (Sheet 90-91)*
- *Slopes Anticipated After Major Gradings or Areas of Soil Disturbance: Typical Sections (Sheets 4-7)*
- *Location of Erosion and Sediment Controls: SW3P Site Maps (Sheets 192-206)*
- *Surface Waters and Discharge Locations: Drainage and Culvert Layouts (Sheets 90-122)*
- *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:
RECONSTRUCT EXISTING PAVEMENT AND ADD SHOULDERS

4. MAJOR SOIL DISTURBING ACTIVITIES:
PAVEMENT WIDENING (VARIES, AS SHOWN IN TYPICAL SECTION) AND CULVERT EXTENSION, REGRADE DITCHES, EMBANKMENT, BACKFILL AND SEEDING

5. EXISTING CONDITION OF SOIL & VEGETATIVE COVER AND % OF EXISTING VEGETATIVE COVER:
SOIL IS WELL DRAINED. GENTLY SLOPING TO MODERATE STEEP. CLAYEY AND SANDY LOAMY SOILS THAT HAVE MODERATE AND VERY SLOW PERMEABILITY. THE GENERAL AREA AROUND THE PROJECT HAS APPROXIMATELY 95% VEGETATION COVER OF MAINTANED ROW GRASSES.

6. TOTAL PROJECT AREA: *71.97* Acres

7. TOTAL AREA TO BE DISTURBED: *60.45* Acres (84%)

8. WEIGHTED RUNOFF COEFFICIENT

BEFORE CONSTRUCTION: *0.84*
AFTER CONSTRUCTION: *0.85*

9. NAME OF RECEIVING WATERS:
PROJECT AREA DRAIN TO A TRIBUTARY TO TRINITY RIVER, COTTONWOOD CREEK; AND TRIBUTARIES TO EACH: COTTONWOOD CREEK, BIG SANDY CREEK & BOIS 'D ARC CREEK. THEN IT FLOWS TO THE UPPER TRINITY RIVER [SEGMENT 0805] ; WATER QUALITY IMPAIRED BY BACTERIA IN WATER (RECREATION USE), AND BY DIOXIN AND PCBS IN EDIBLE TISSUE].

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 Checklist(s) (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)

T	TEMPORARY SEEDING	P	PRESERVATION OF NATURAL RESOURCES
___	MULCHING (Hay or Straw)	___	FLEXIBLE CHANNEL LINER
___	BUFFER ZONES	___	RIGID CHANNEL LINER
___	PLANTING	___	SOIL RETENTION BLANKET
P	SEEDING	P	COMPOST MANUFACTURED TOPSOIL
___	SODDING	T	VERTICAL TRACKING
		___	OTHER:

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

T	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
___	VELOCITY CONTROL DEVICES
___	OTHER:

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:

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 feasiable on this project due to limitted room within the TXDOT ROW. Alternate BMPs have been included in the SW3P to provide equivalent sedimentation control.

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

SEE CONSTRUCTION PROGRESS SCHEDULE (CONTRACT TIME DETERMINATION - CTD) FOR SCHEDULE AND DURATIONS OF RELEVANT SOIL DISTURBANCE AND STABILIZATION ACTIVITIES.
1. THE CONTRACTOR WILL PLACE BARRICADES AND SIGNS, AND PLACE SW3P MEASURES WHERE CONTRACTOR WILL START WORKING. INSTALL SW3P CONTROL DEVICES (BMPS) TO PROTECT RECEIVING WATERS, DOWNSLOPE PARIMETERS, AND ACTIVE ROADWAYS PRIOR TO SOIL DISTURBANCE AND CONSTRUCTION ACTIVITIES IN THE VICINITY PER SW3P SITE MAP AS APPROPRIATE, AND AS DIRECTED BY THE ENGINEER. DO NOT INSTALL BMPS MORE THAN TWO WEEKS PRIOR TO THE ACTIVITIES IN THEIR WORK AREA.
2. TO THE EXTENT PRACTICABLE, PRESERVE EXISTING VEGETATION, MAINTAIN A VEGATATIVE BUFFER ALONG RECEIVING WATERS, AND PHASE CONSTRUCTION ACTIVITIES TO MINIMIZE EXPOSURE OF DISTURBED SOILS.
3. AVOID STORING PORTABLE SANITARY UNITS, CONCRETE WASHOUTS OR CHEMICALS WITHIN 50 FEET UPGRADIENT OF A RECEIVING WATER OR DRAINAGE CONVEYANCE WITHOUT ADEQUATE POLLUTION CONTROLS.
4. THE CONTRACTOR WILL EXTEND THE CULVERT WITH PROPER SW3P MEASURES PRESENCE.
5. START WIDENING AS SHOWN IN PLANS, ONE SIDE AT A TIME.
6. PLACE EMBANKMENT, BACKFILL AND SIGNS, AND REGRADE DITCHES.
7. WHERE WORK HAS TEMPORARILY CEASED IN A DISTURBED AREA (I.E., WILL EXCEED 14 DAYS BEFORE NEXT SOIL DISTURBANCE ACTIVITY OR INITIATION OF FINAL STABILIZATION MEASURES), TEMPORARILY STABILIZE SOILS PER TXR150000, WITH VERTICAL TRACKING, TEMPORARY SEEDING AND/OR OTHER SOIL COVER, AND VELOCITY AND DOWNSLOPE PERIMETER CONTROLS, AS APPROPRIATE AND/OR AS DIRECTED BY ENGINEER.
8. RE-VEGETATE DISTURBED SOILS IN COMPLETED PROJECT AREAS AS SOON AS PRACTICABLE OR AS DIRECTED BY ENGINEER.
9. WHEN CONSTRUCTION ACTIVITY IS COMPLETE, PROJECT AREA IS STABILIZED, AND AS DIRECTED OR AUTHORIZED BY ENGINEER, REMOVE ALL TEMPORARY SW3P CONTROLS.
10. FINAL PROJECT SITE CLEANUP AS DIRECTED BY THE ENGINEER.

5. 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.

STATE OF TEXAS
FALON J. RENFROE
131914
LICENSED
PROFESSIONAL ENGINEER

Falon Renfroe 10/19/2021
Signature of Registrant & Date P.E.

Texas Department of Transportation
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DALLAS DISTRICT ENVIRONMENTAL

STORM WATER POLLUTION PREVENTION PLAN (SW3P)

TEMPLATE REVISION DATE: 02/07/18

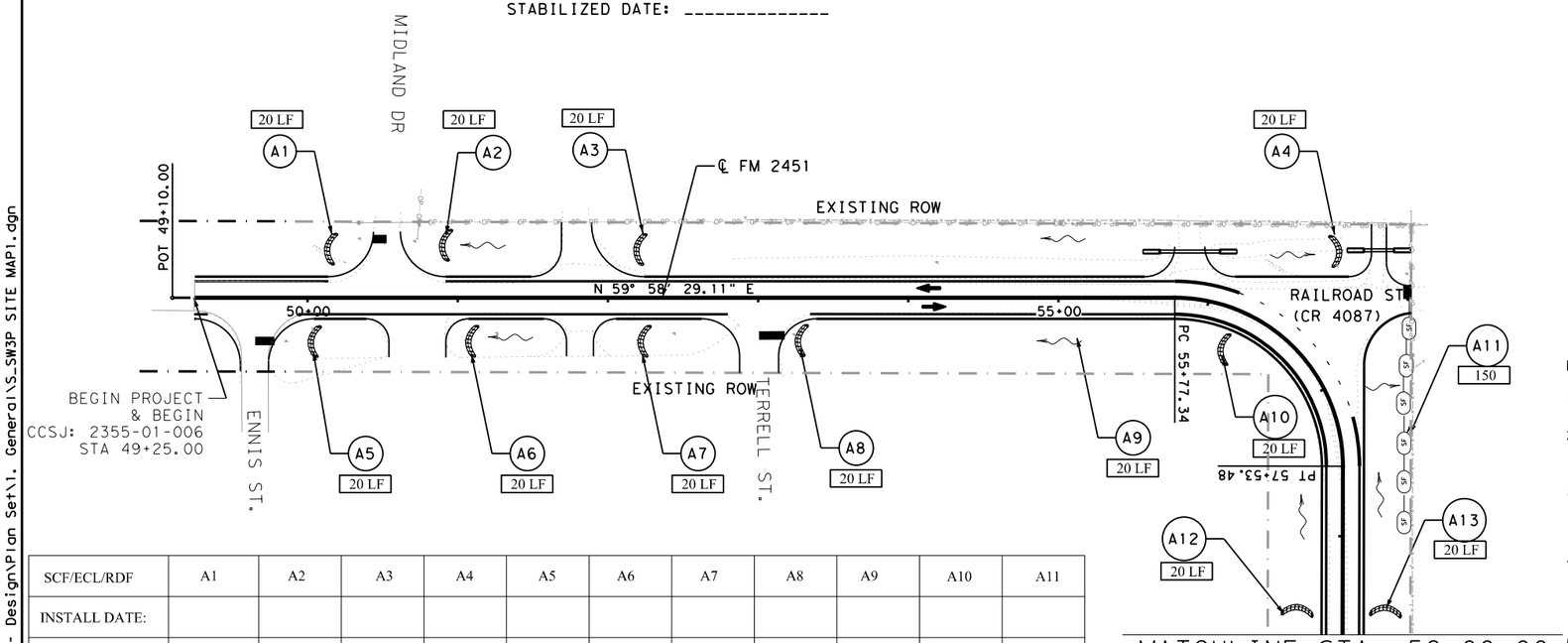
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
FR	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS FR	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DALLAS	KAUFMAN	191
CHECK JR	CONTROL 2355	SECTION 01	JOB 006, ETC.	

FILE NAME
DATE
DESIGNER

AREA A

DISTURBED DATE: _____

STABILIZED DATE: _____



SCF/ECL/RDF	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
INSTALL DATE:											
REMOVE DATE:											

0 50 100

HORIZ. SCALE IN FEET

LEGEND:

- TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- DISTURBED AREA
- BMP INSTALLATION
- CONSTRUCTION EXIT

NOTES:

1) CONSTRUCTION EXITS TO BE PLACED AT LOCATIONS APPROVED BY THE ENGINEER
2) CONTRACTOR TO PLACE AND MAINTAIN SWPPP MEASURES APPLICABLE TO EACH PHASE OF CONSTRUCTION.
3) EXACT LOCATION OF ROCK FILTER DAM AND TEMPORARY SEDIMENT CONTROL FENCE TO BE DETERMINED BY THE ENGINEER IN THE FIELD.
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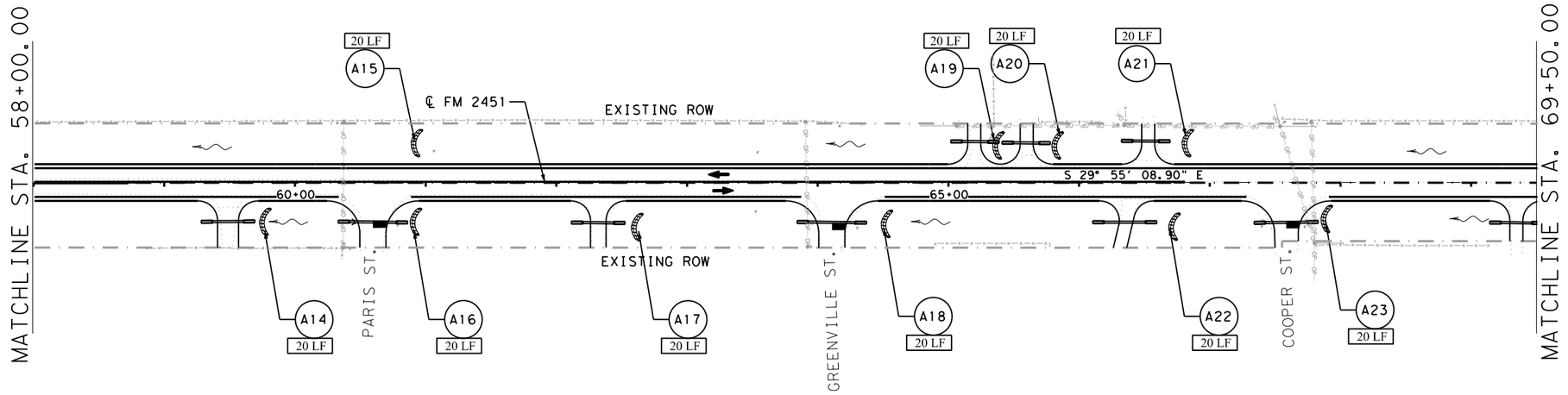
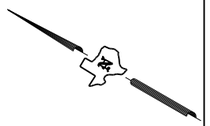
6) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.
7) BMPS SHALL NOT BE INSTALLED IN THEIR CONTROL AREA ANY SOONER THAN TWO WEEKS PRIOR TO SOIL DISTURBANING ACTIVITIES IN THAT AREA.
8) PROTECT TREES AND THEIR ROOTS, IF ALL POSSIBLE. PRESERVE CREEKSIDE VEGETATION TO THE EXTENT PRACTICABLE.

SCF/ECL/RDF	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23
INSTALL DATE:												
REMOVE DATE:												





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Signature of Registrant & Date

10/19/2021

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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 1 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	192
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

DATE: 10/13/2021 12:20:44 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP1.dgn

NOTES:

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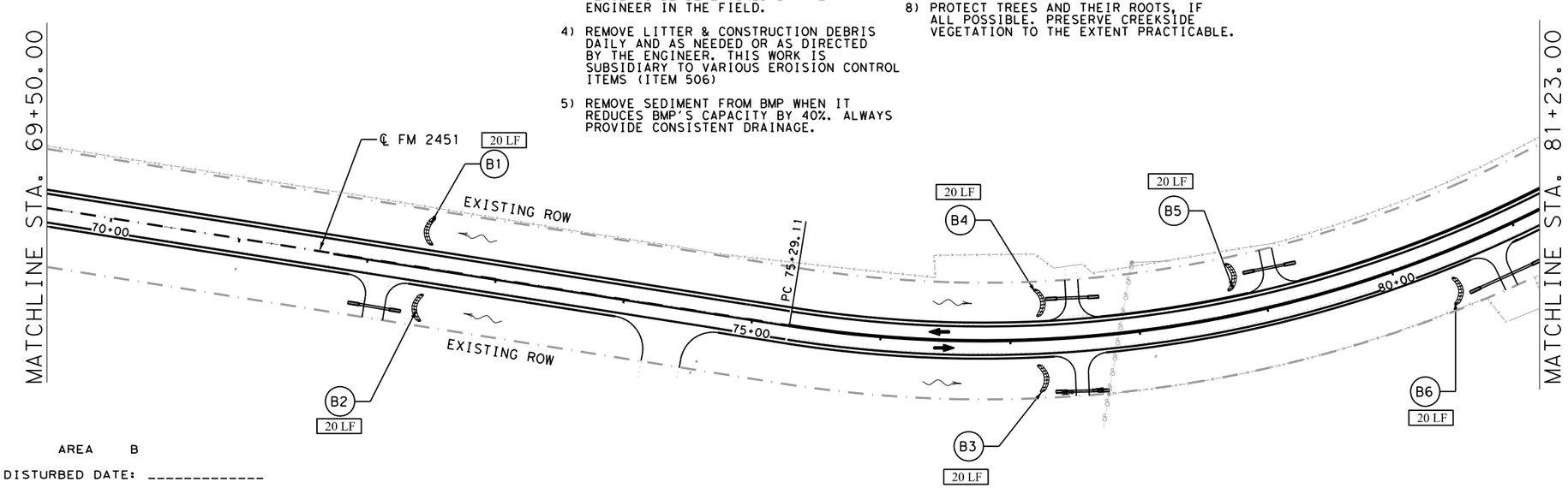


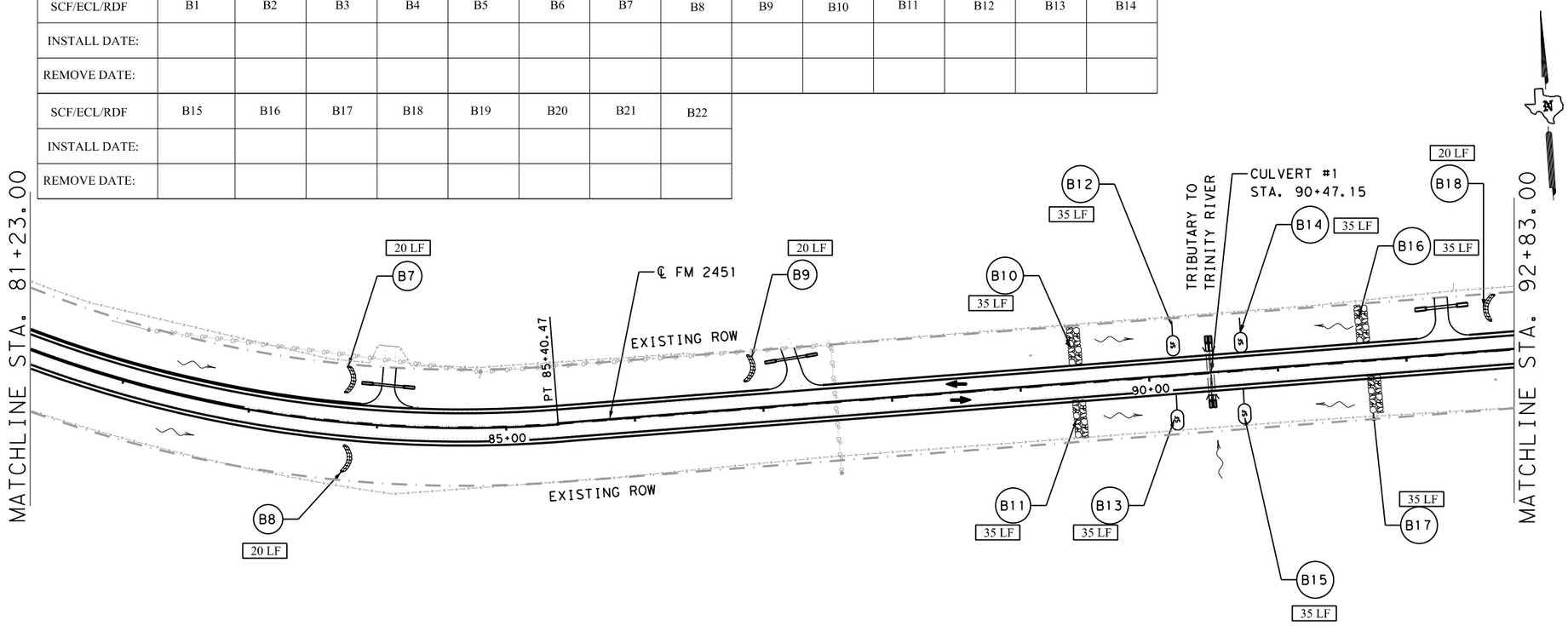
AREA B

DISTURBED DATE: _____

STABILIZED DATE: _____

SCF/ECL/RDF	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14
INSTALL DATE:														
REMOVE DATE:														

SCF/ECL/RDF	B15	B16	B17	B18	B19	B20	B21	B22
INSTALL DATE:								
REMOVE DATE:								



0 50 100

HORIZ. SCALE IN FEET

LEGEND:

- TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- XXX DISTURBED AREA
- XX BMP INSTALLATION
- CONSTRUCTION EXIT

STATE OF TEXAS
FALON J. RENFROE
131914
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PROFESSIONAL ENGINEER

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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 2 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	193
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

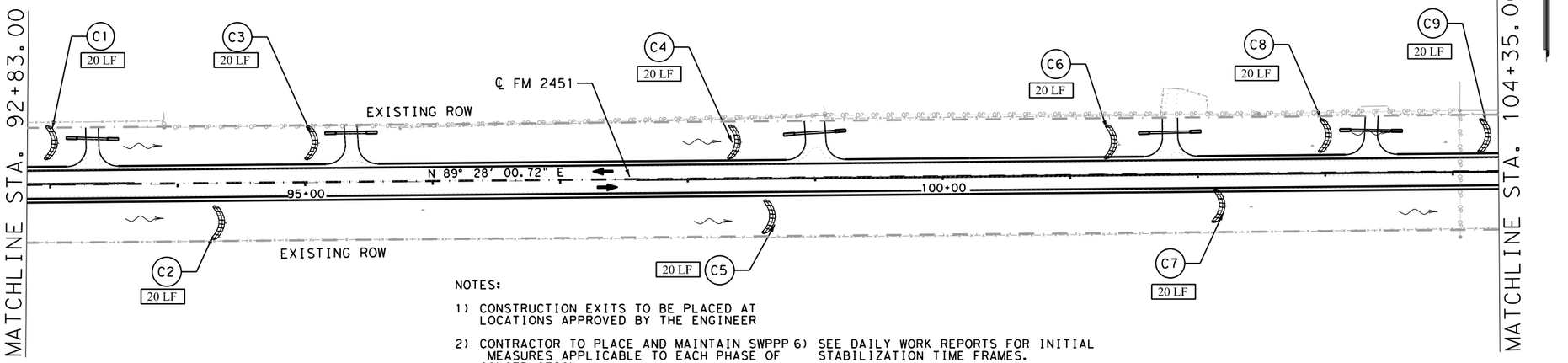
DATE: 10/13/2021 12:21:28 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP2.dgn

AREA C

DISTURBED DATE: _____

STABILIZED DATE: _____

SCF/ECL/RDF	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
INSTALL DATE:														
REMOVE DATE:														



NOTES:

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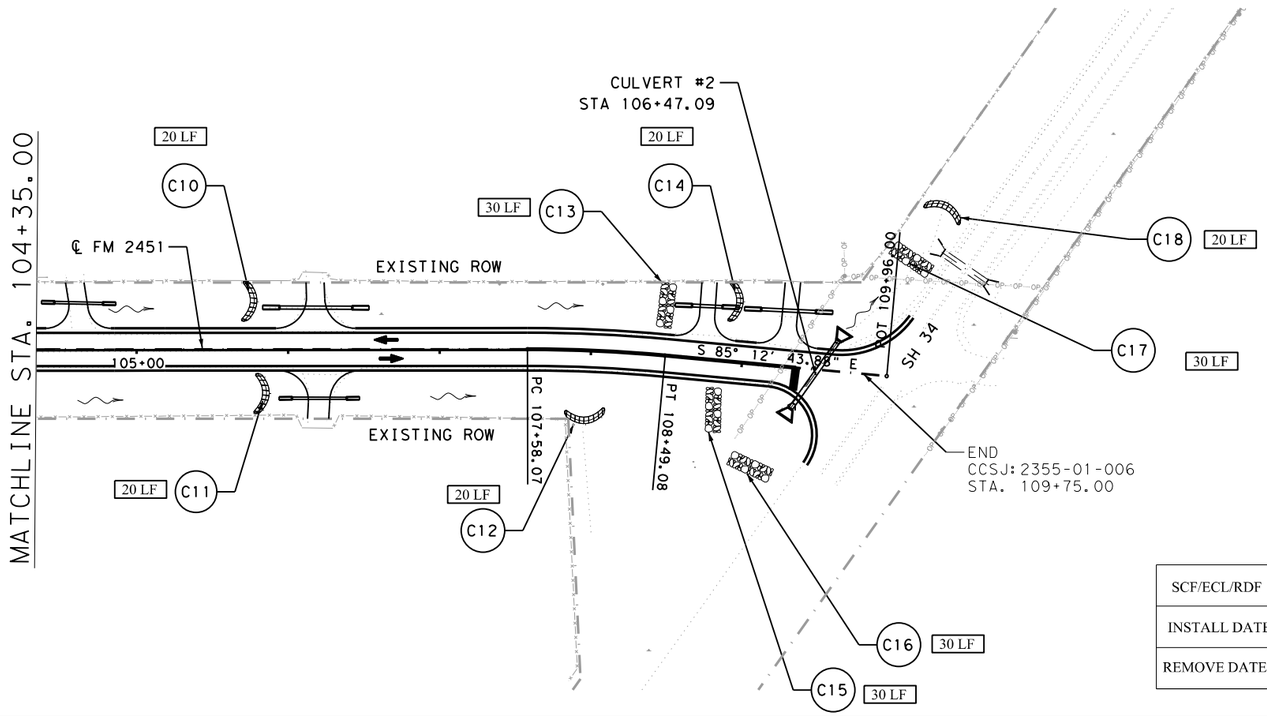

SCF/ECL/RDF	C15	C16	C17	C18
INSTALL DATE:				
REMOVE DATE:				

0 50 100

HORIZ. SCALE IN FEET

LEGEND:

- TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- XXX DISTURBED AREA
- XX BMP INSTALLATION
- CONSTRUCTION EXIT

STATE OF TEXAS
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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 3 OF 15

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	194
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

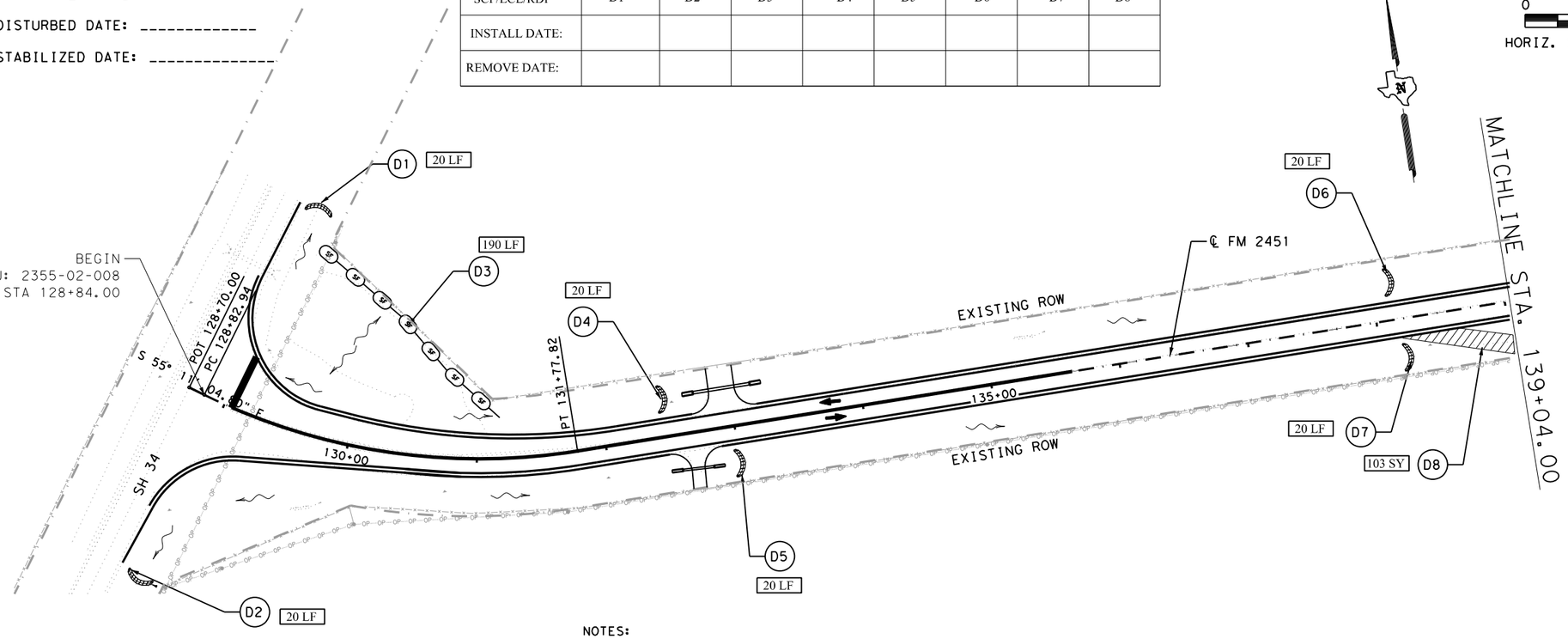
DATE: 10/13/2021 12:21:55 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP3.dgn

AREA D

DISTURBED DATE: _____

STABILIZED DATE: _____

SCF/ECL/RDF	D1	D2	D3	D4	D5	D6	D7	D8
INSTALL DATE:								
REMOVE DATE:								



LEGEND:

- TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- XXX DISTURBED AREA
- XX BMP INSTALLATION
- CONSTRUCTION EXIT

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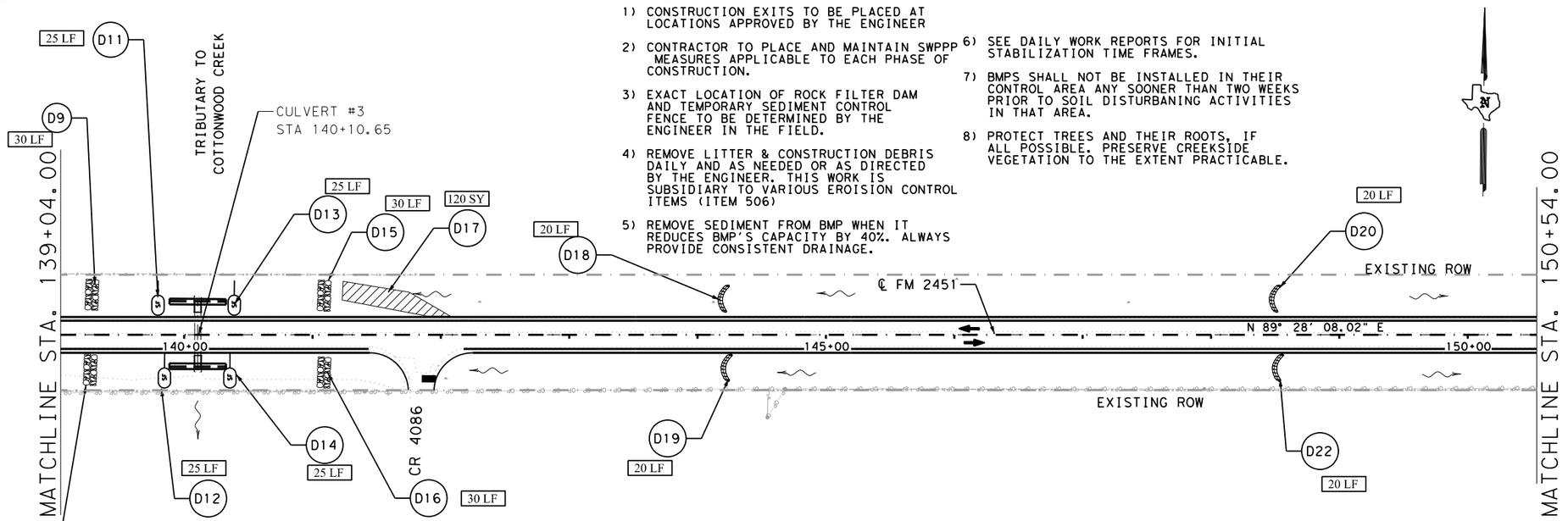

SCF/ECL/RDF	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22
INSTALL DATE:														
REMOVE DATE:														

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FM 2451
SW3P SITE MAP

SCALE: NTS SHEET 4 OF 15

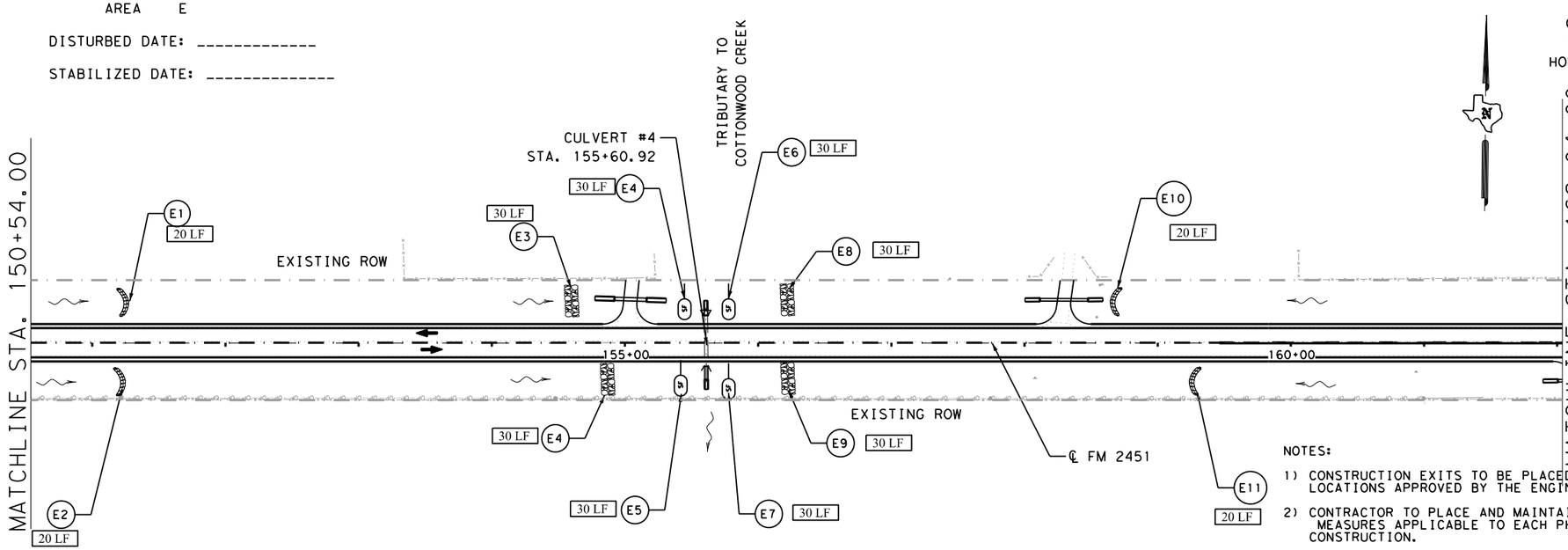
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	195
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

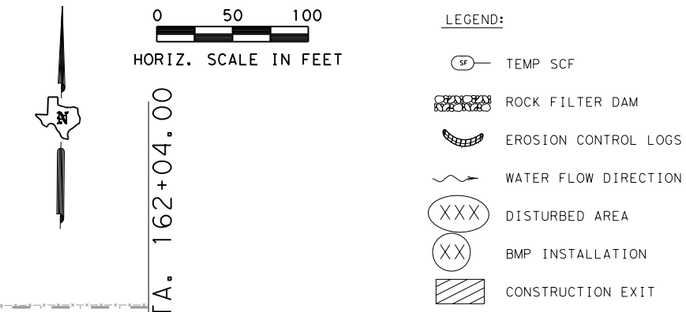
DATE: 10/13/2021 12:22:08 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP4.dgn

AREA E

DISTURBED DATE: _____

STABILIZED DATE: _____





SCF/ECL/RDF	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16
INSTALL DATE:																
REMOVE DATE:																

SCF/ECL/RDF	E17	E18
INSTALL DATE:		
REMOVE DATE:		

NOTES:

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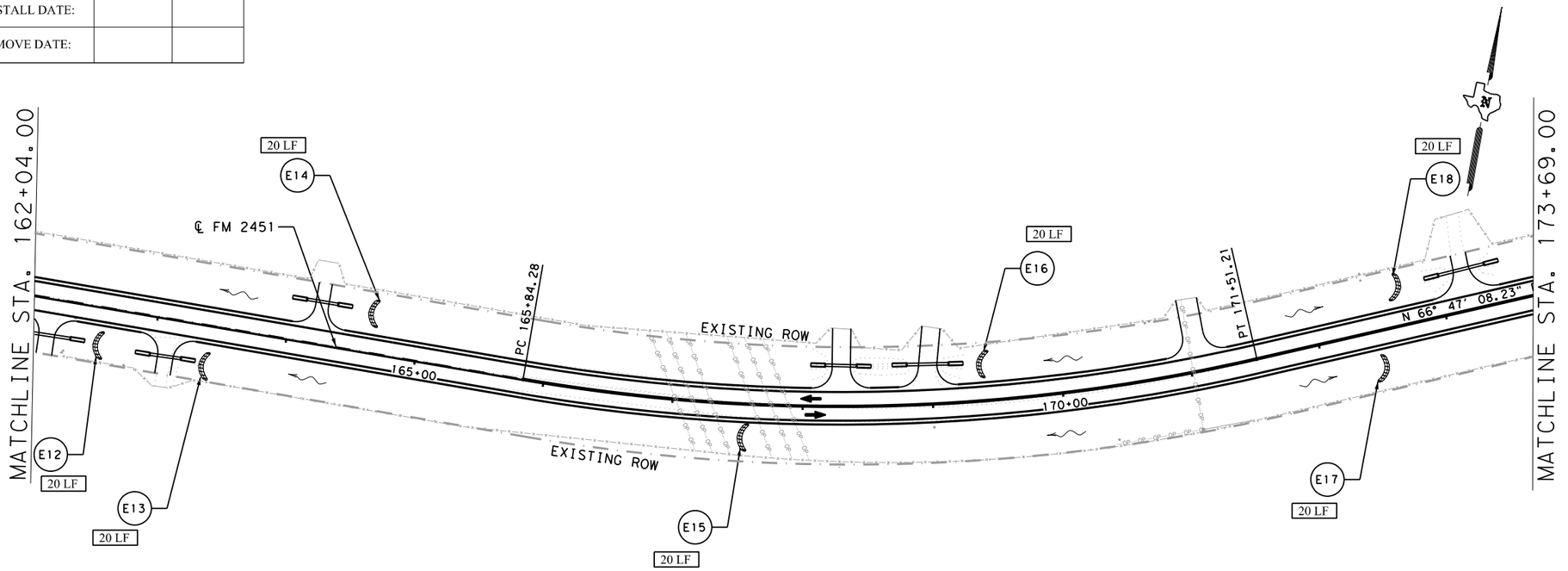

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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 5 OF 15

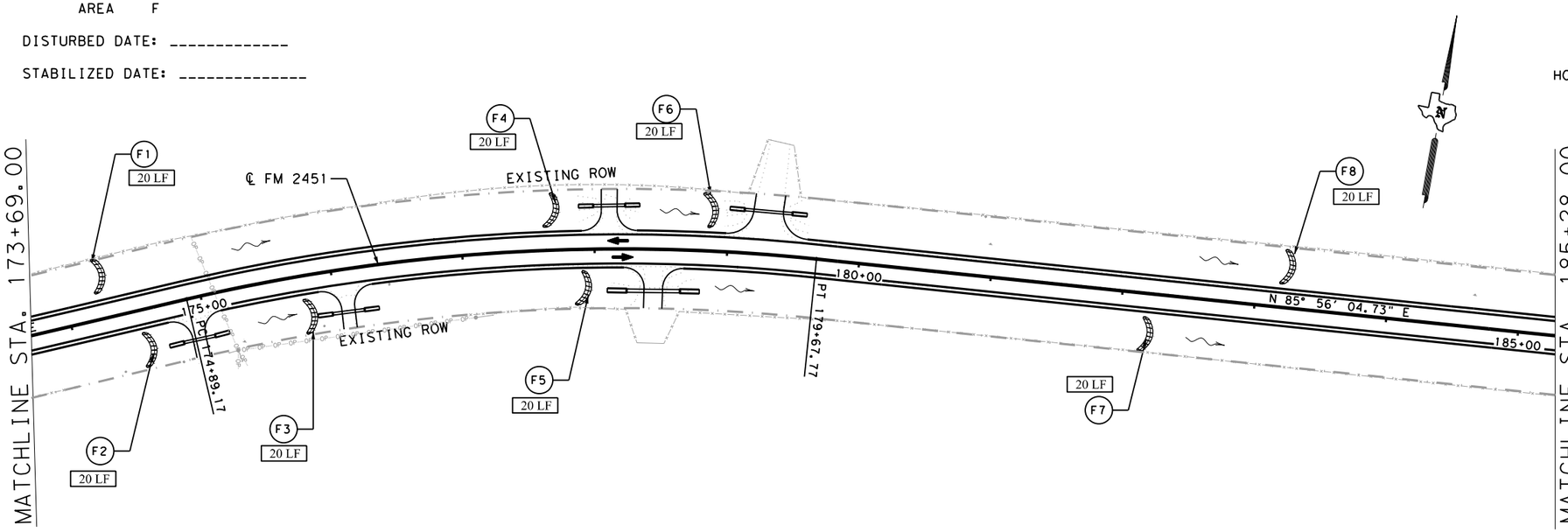
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	196
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	

DATE: 10/13/2021 12:22:21 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP5.dgn

AREA F

DISTURBED DATE: _____

STABILIZED DATE: _____



0 50 100

HORIZ. SCALE IN FEET

LEGEND:

- TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- XXX DISTURBED AREA
- XX BMP INSTALLATION
- CONSTRUCTION EXIT

SCF/ECL/RDF	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19
INSTALL DATE:																			
REMOVE DATE:																			

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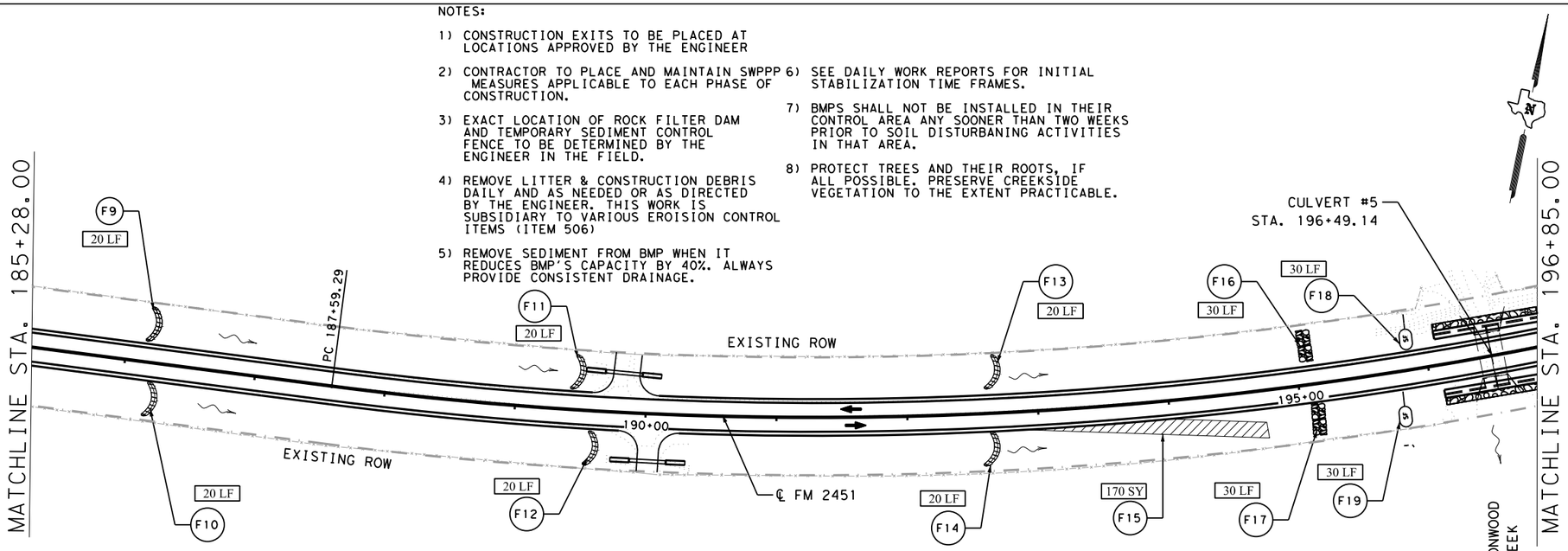

STATE OF TEXAS
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SW3P SITE MAP

SCALE: 1"=100' SHEET 6 OF 15

DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	197
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

DATE: 10/13/2021 12:22:34 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP6.dgn

AREA G

DISTURBED DATE: _____

STABILIZED DATE: _____

NOTES:

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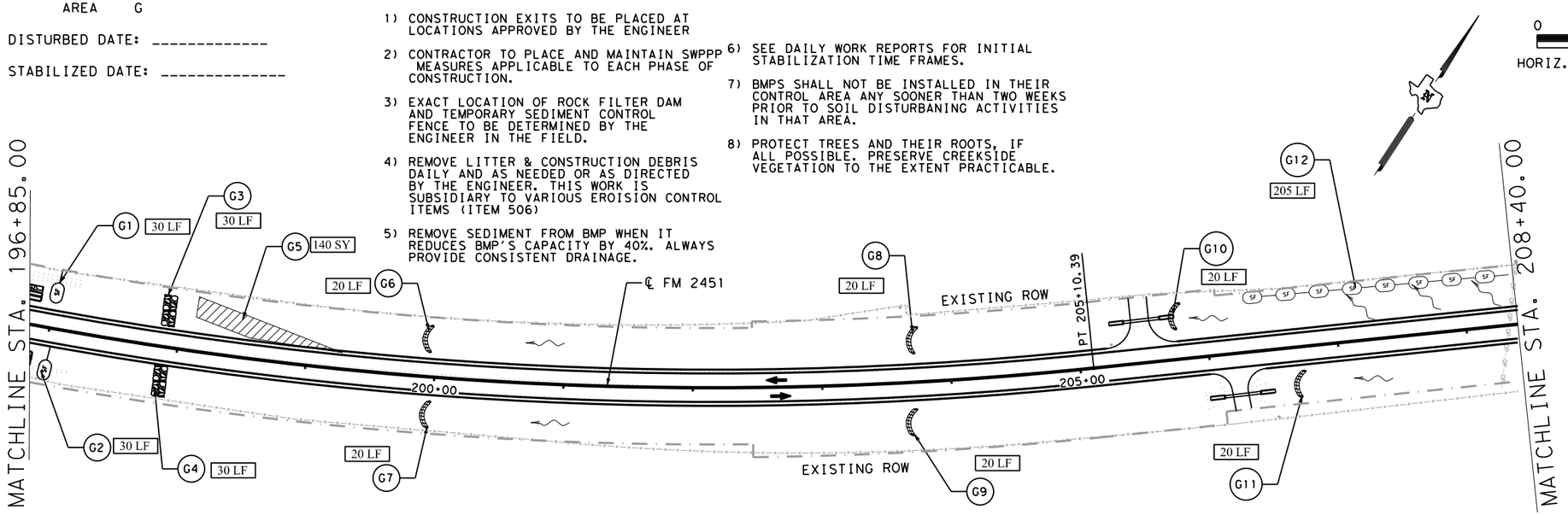
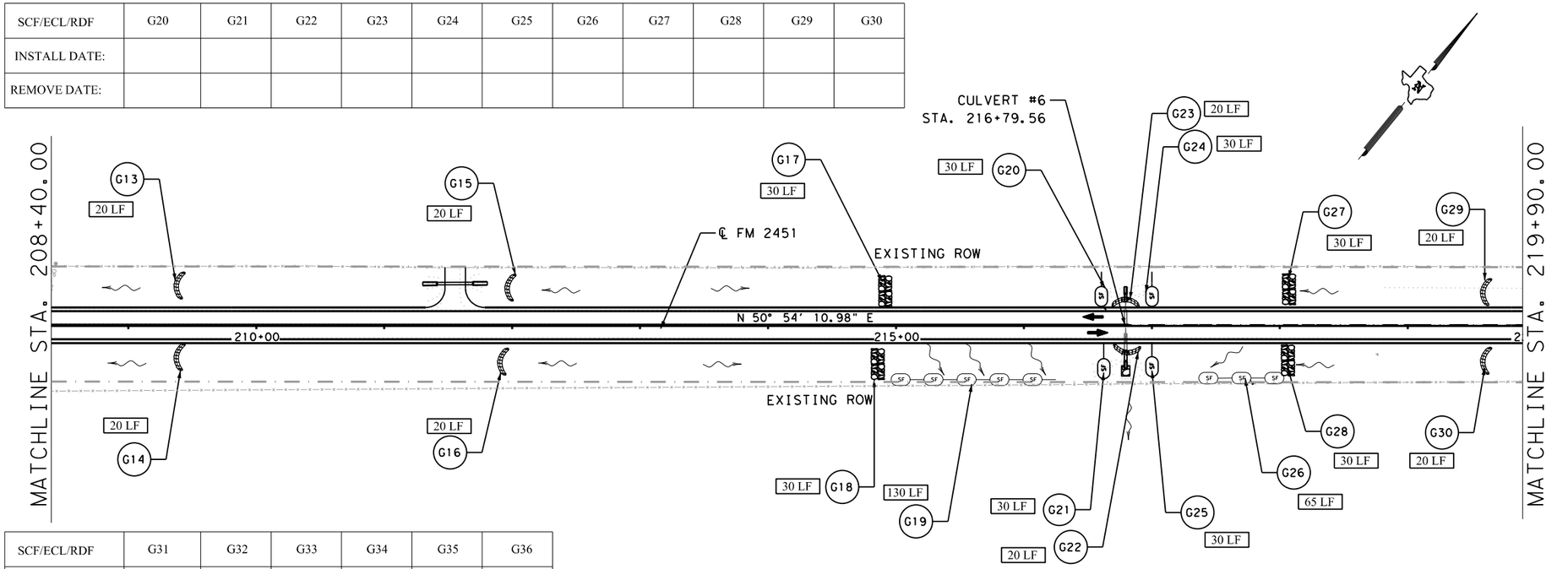


0 50 100
HORIZ. SCALE IN FEET

LEGEND:
- TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- XXX DISTURBED AREA
- XX BMP INSTALLATION
- CONSTRUCTION EXIT

SCF/ECL/RDF	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	G16	G17	G18	G19
INSTALL DATE:																			
REMOVE DATE:																			

SCF/ECL/RDF	G20	G21	G22	G23	G24	G25	G26	G27	G28	G29	G30
INSTALL DATE:											
REMOVE DATE:											



SCF/ECL/RDF	G31	G32	G33	G34	G35	G36
INSTALL DATE:						
REMOVE DATE:						

STATE OF TEXAS
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SW3P SITE MAP

SCALE: 1"=100' SHEET 7 OF 15

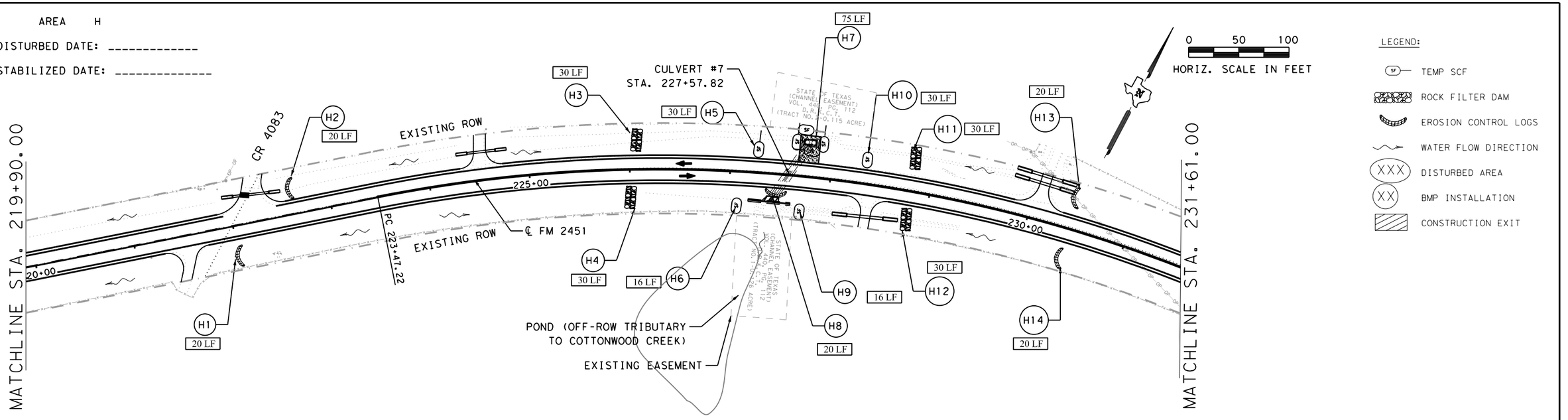
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	198
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

DATE: 10/13/2021 12:22:47 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP7.dgn

AREA H

DISTURBED DATE: _____

STABILIZED DATE: _____



SCF/ECL/RDF	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14	H15	H16	H17	H18	H19	H20
INSTALL DATE:																				
REMOVE DATE:																				

NOTES:

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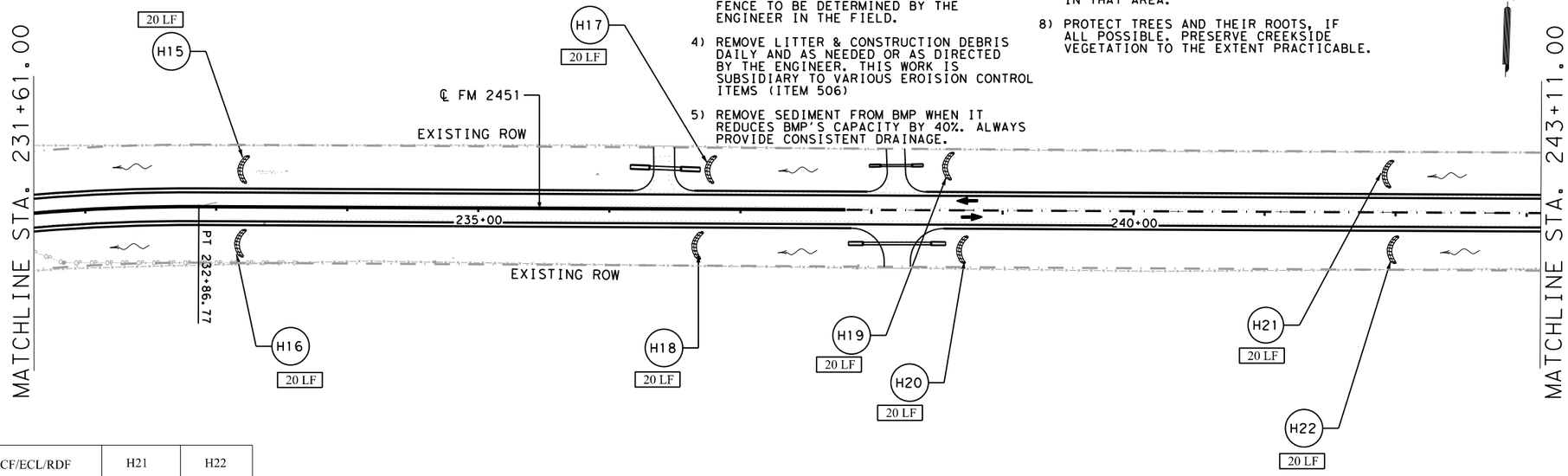
7) BMPS SHALL NOT BE INSTALLED IN THEIR CONTROL AREA ANY SOONER THAN TWO WEEKS PRIOR TO SOIL DISTURBANING ACTIVITIES IN THAT AREA.
8) PROTECT TREES AND THEIR ROOTS, IF ALL POSSIBLE. PRESERVE CREEKSIDE VEGETATION TO THE EXTENT PRACTICABLE.



SCF/ECL/RDF	H21	H22
INSTALL DATE:		
REMOVE DATE:		

FALON J. RENFROE
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PROFESSIONAL ENGINEER

Falon Renfroe, P.E. 10/19/2021
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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 8 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	199
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

DATE: 10/13/2021 12:23:00 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP8.dgn

AREA I

DISTURBED DATE: _____

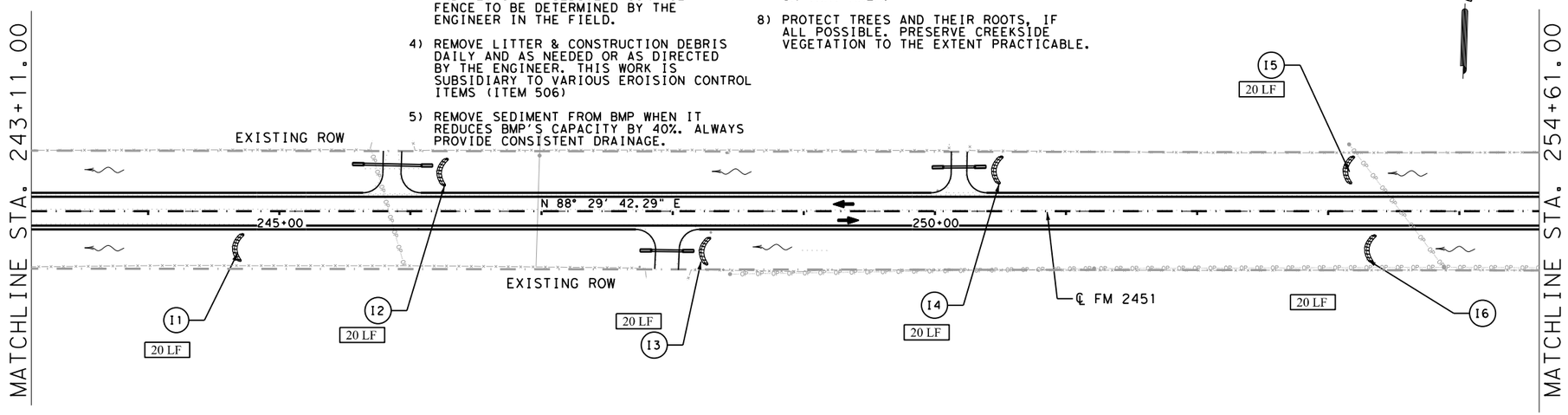
STABILIZED DATE: _____

NOTES:

1) CONSTRUCTION EXITS TO BE PLACED AT LOCATIONS APPROVED BY THE ENGINEER
2) CONTRACTOR TO PLACE AND MAINTAIN SWPPP MEASURES APPLICABLE TO EACH PHASE OF CONSTRUCTION.
3) EXACT LOCATION OF ROCK FILTER DAM AND TEMPORARY SEDIMENT CONTROL FENCE TO BE DETERMINED BY THE ENGINEER IN THE FIELD.
4) REMOVE LITTER & CONSTRUCTION DEBRIS DAILY AND AS NEEDED OR AS DIRECTED BY THE ENGINEER. THIS WORK IS SUBSIDIARY TO VARIOUS EROISION CONTROL ITEMS (ITEM 506)
5) REMOVE SEDIMENT FROM BMP WHEN IT REDUCES BMP'S CAPACITY BY 40%. ALWAYS PROVIDE CONSISTENT DRAINAGE.
6) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.
7) BMPS SHALL NOT BE INSTALLED IN THEIR CONTROL AREA ANY SOONER THAN TWO WEEKS PRIOR TO SOIL DISTURBANING ACTIVITIES IN THAT AREA.
8) PROTECT TREES AND THEIR ROOTS, IF ALL POSSIBLE. PRESERVE CREEKSIDE VEGETATION TO THE EXTENT PRACTICABLE.

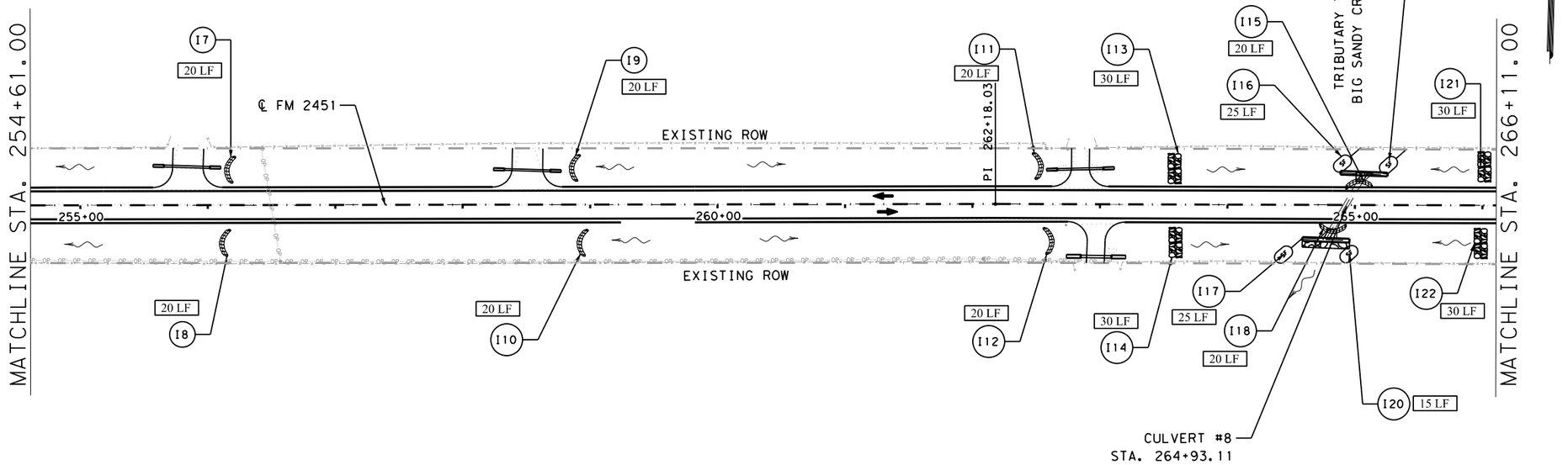
0 50 100
HORIZ. SCALE IN FEET

LEGEND:
- SF — TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- XXX DISTURBED AREA
- XX BMP INSTALLATION
- CONSTRUCTION EXIT



SCF/ECL/RDF	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15	I16	I17	I18	I19	I20
INSTALL DATE:																				
REMOVE DATE:																				

SCF/ECL/RDF	I21	I22	I23	I24
INSTALL DATE:				
REMOVE DATE:				



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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 9 OF 15

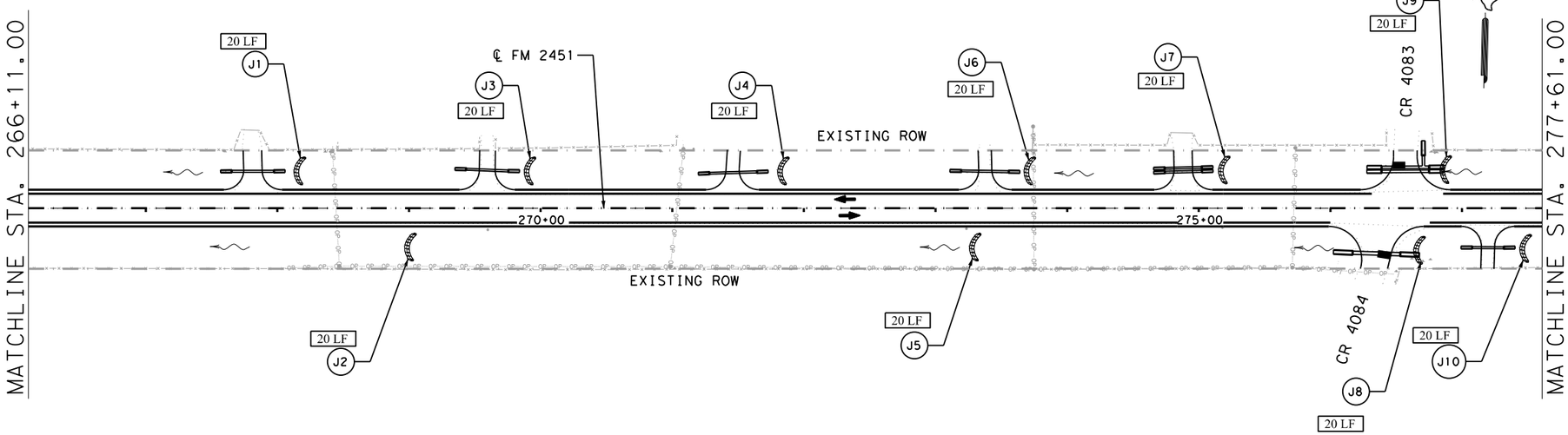
DESIGN	FED. RD. DIV. NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS: SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK: FR	TEXAS	DAL	KAUFMAN	200
CHECK: FR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

DATE: 10/13/2021 12:23:14 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP9.dgn

AREA J

DISTURBED DATE: _____

STABILIZED DATE: _____



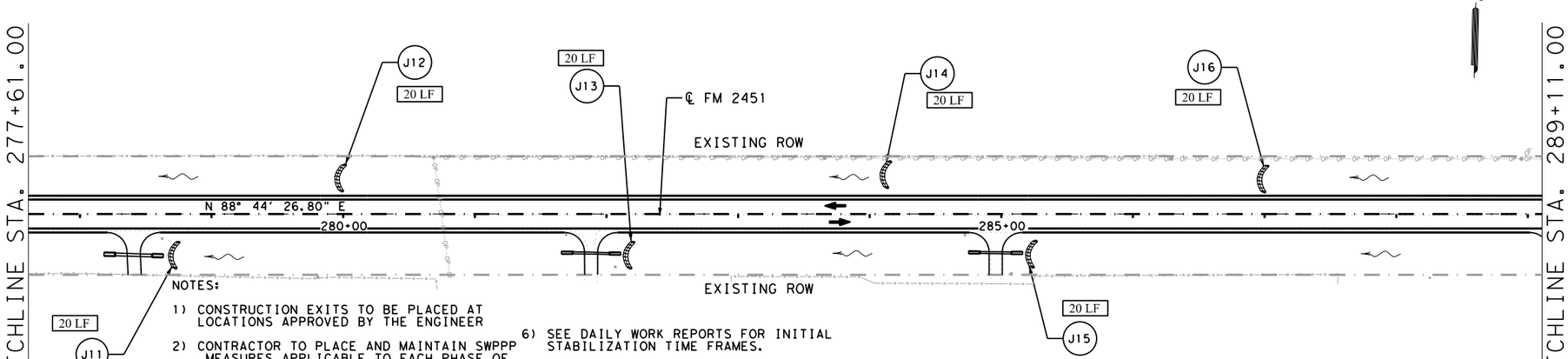
0 50 100

HORIZ. SCALE IN FEET

LEGEND:

- SF — TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- XXX — DISTURBED AREA
- XX — BMP INSTALLATION
- CONSTRUCTION EXIT

SCF/ECL/RDF	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16
INSTALL DATE:																
REMOVE DATE:																



NOTES:

1) CONSTRUCTION EXITS TO BE PLACED AT LOCATIONS APPROVED BY THE ENGINEER
2) CONTRACTOR TO PLACE AND MAINTAIN SWPPP MEASURES APPLICABLE TO EACH PHASE OF CONSTRUCTION.
3) EXACT LOCATION OF ROCK FILTER DAM AND TEMPORARY SEDIMENT CONTROL FENCE TO BE DETERMINED BY THE ENGINEER IN THE FIELD.
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6) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.
7) BMPS SHALL NOT BE INSTALLED IN THEIR CONTROL AREA ANY SOONER THAN TWO WEEKS PRIOR TO SOIL DISTURBANING ACTIVITIES IN THAT AREA.
8) PROTECT TREES AND THEIR ROOTS, IF ALL POSSIBLE. PRESERVE CREEKSIDE VEGETATION TO THE EXTENT PRACTICABLE.

STATE OF TEXAS
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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 10 OF 15

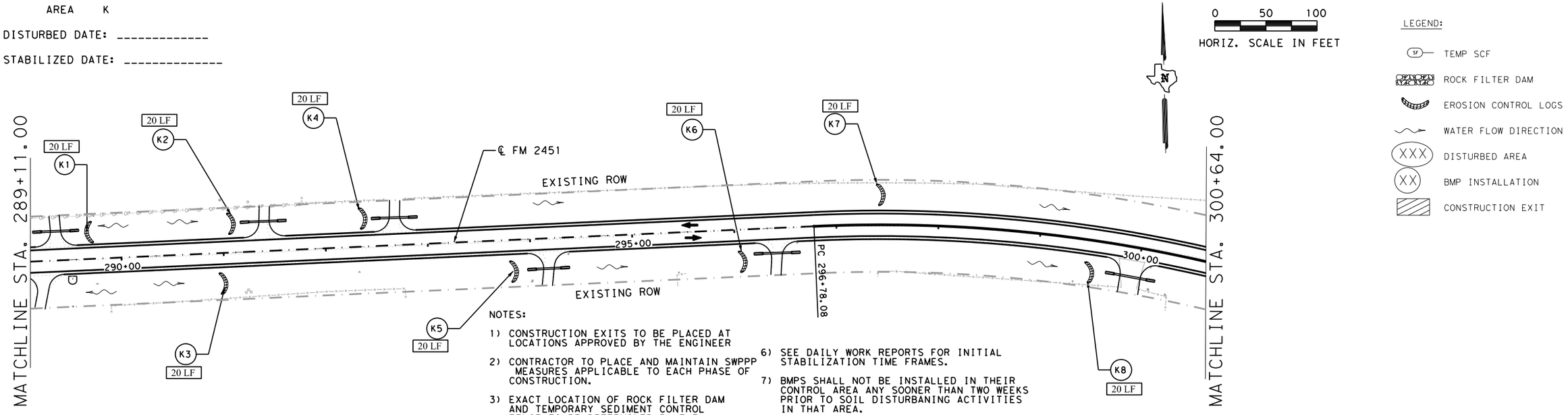
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS: SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK: FR	TEXAS	DAL	KAUFMAN	201
CHECK: FR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

DATE: 10/13/2021 12:23:27 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP10.dgn

AREA K

DISTURBED DATE: _____

STABILIZED DATE: _____



NOTES:

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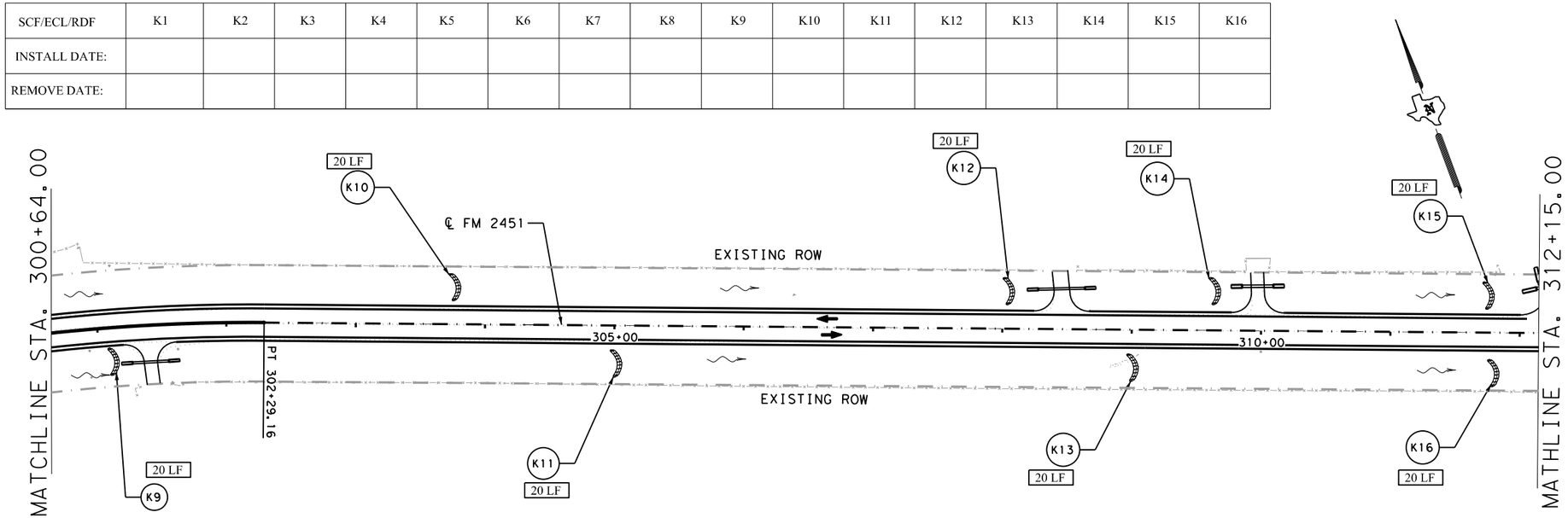
SCF/ECL/RDF	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16
INSTALL DATE:																
REMOVE DATE:																



STATE OF TEXAS
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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 11 OF 15

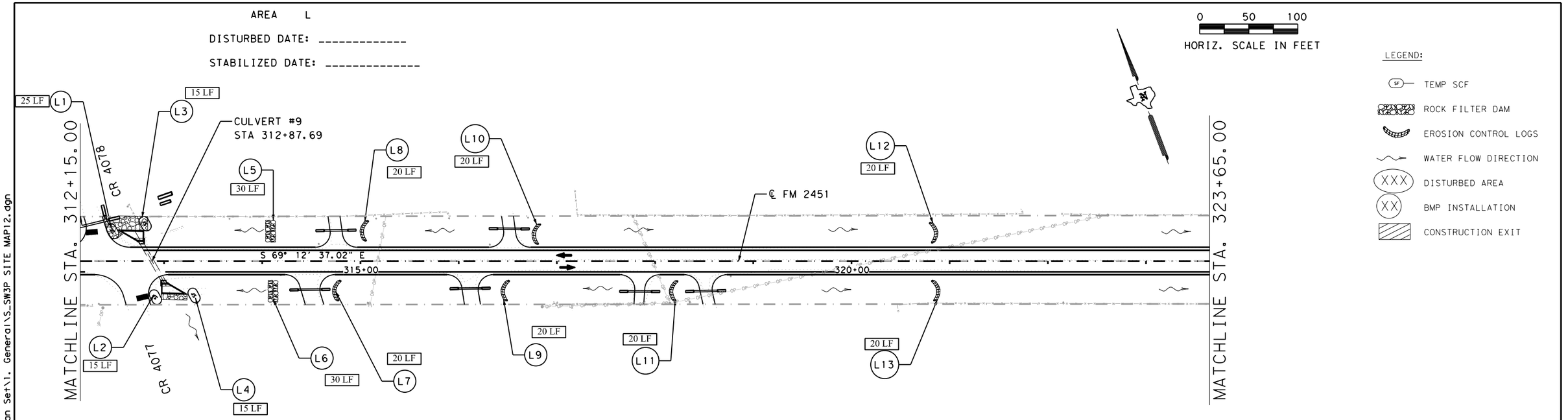
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK FR	TEXAS	DAL	KAUFMAN	202
CHECK FR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

DATE: 10/13/2021 12:23:40 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP11.dgn

AREA L

DISTURBED DATE: _____

STABILIZED DATE: _____



SCF/ECL/RDF	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17
INSTALL DATE:																	
REMOVE DATE:																	

NOTES:

1) CONSTRUCTION EXITS TO BE PLACED AT LOCATIONS APPROVED BY THE ENGINEER
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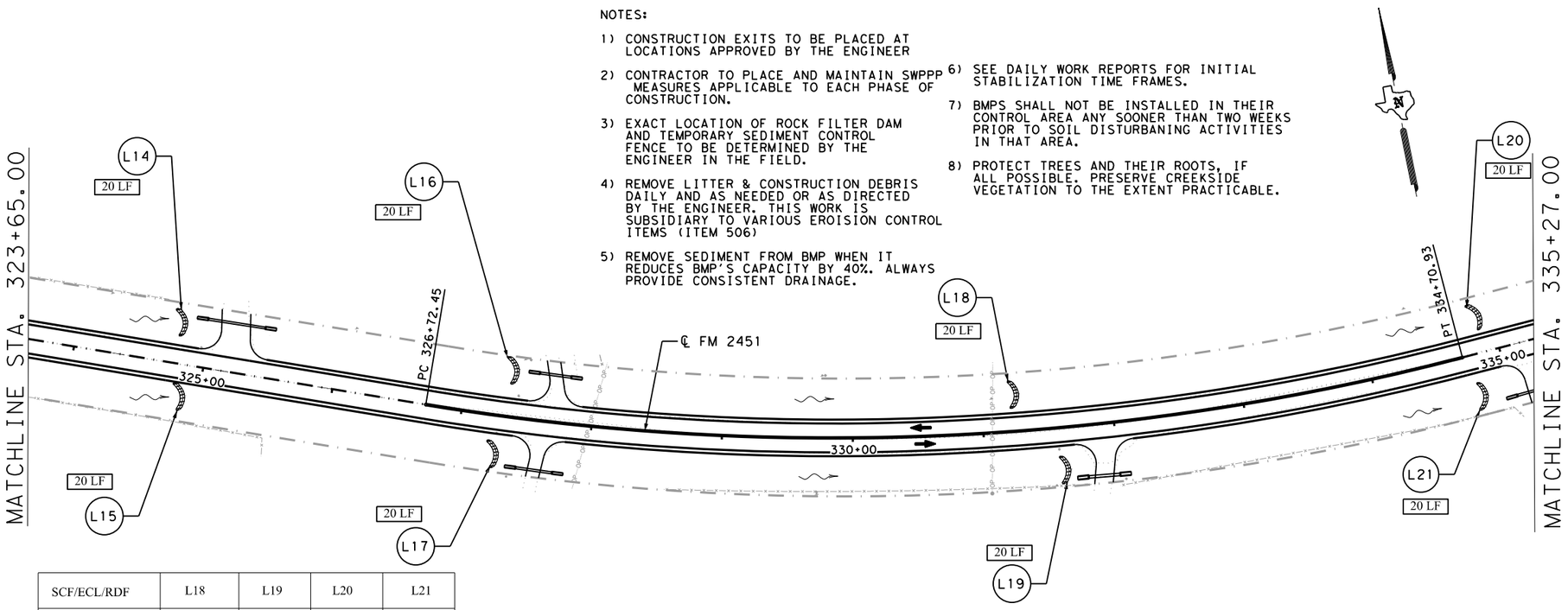
6) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.
7) BMPS SHALL NOT BE INSTALLED IN THEIR CONTROL AREA ANY SOONER THAN TWO WEEKS PRIOR TO SOIL DISTURBANING ACTIVITIES IN THAT AREA.
8) PROTECT TREES AND THEIR ROOTS, IF ALL POSSIBLE. PRESERVE CREEKSIDE VEGETATION TO THE EXTENT PRACTICABLE.



SCF/ECL/RDF	L18	L19	L20	L21
INSTALL DATE:				
REMOVE DATE:				

STATE OF TEXAS
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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 12 OF 15

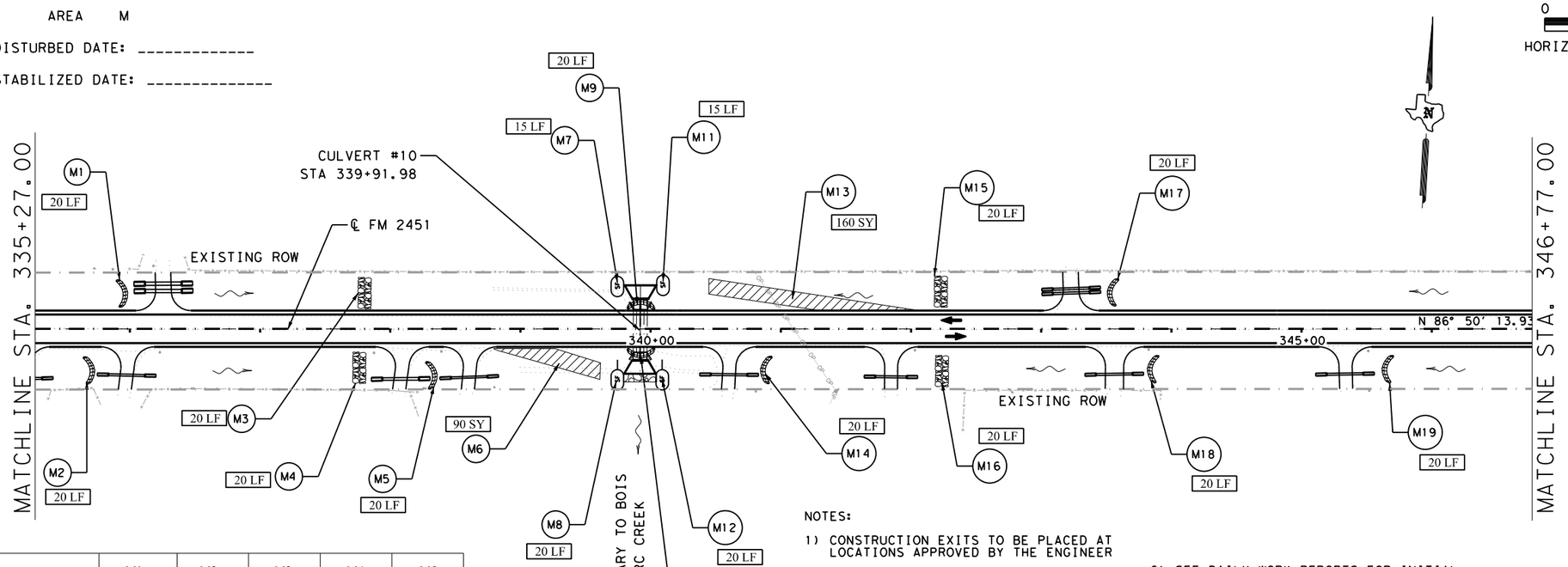
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	203
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

DATE: 10/13/2021 12:23:53 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP12.dgn

AREA M

DISTURBED DATE: _____

STABILIZED DATE: _____



0 50 100

HORIZ. SCALE IN FEET

LEGEND:

- SF — TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- XXX DISTURBED AREA
- XX BMP INSTALLATION
- CONSTRUCTION EXIT

SCF/ECL/RDF	M1	M2	M3	M4	M5
INSTALL DATE:					
REMOVE DATE:					

SCF/ECL/RDF	M6	M7	M8	M9	M10	M11	M12	M13	M14
INSTALL DATE:									
REMOVE DATE:									

NOTES:

1) CONSTRUCTION EXITS TO BE PLACED AT LOCATIONS APPROVED BY THE ENGINEER
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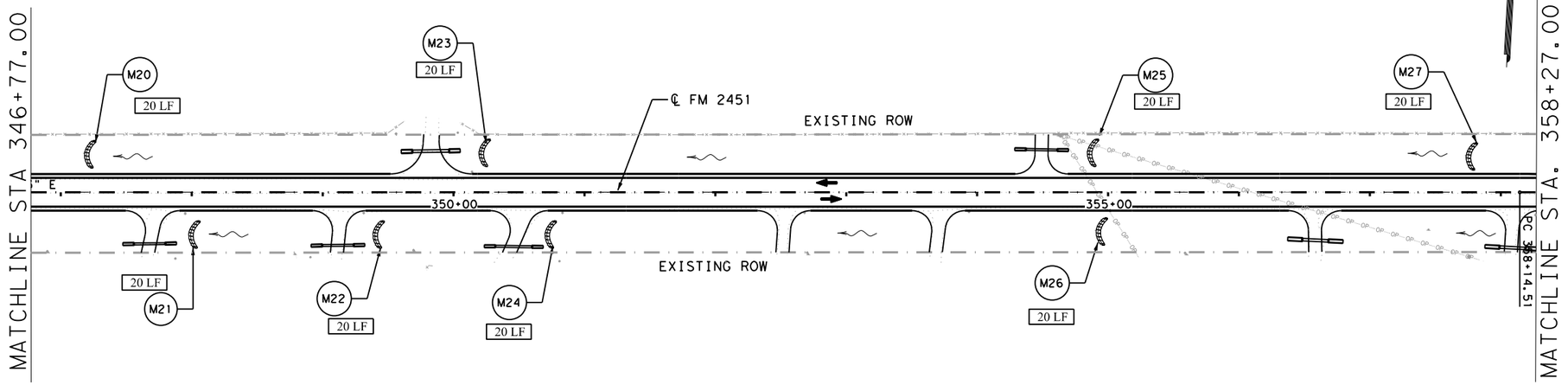

SCF/ECL/RDF	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31
INSTALL DATE:																	
REMOVE DATE:																	

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SW3P SITE MAP

SCALE: 1"=100' SHEET 13 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
SB	TEXAS	DAL	KAUFMAN	204
CHECK	CONTROL	SECTION	JOB	
FR	2355	01	006, ETC.	
CHECK				
FR				

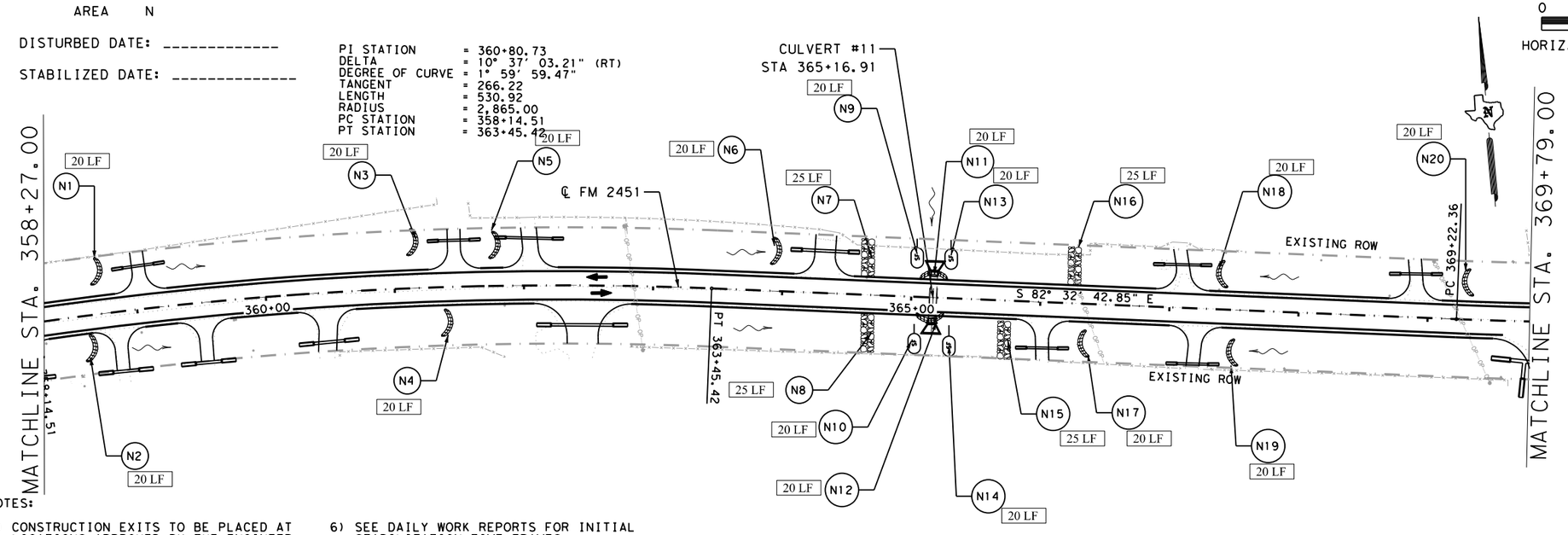
DATE: 10/13/2021 12:24:06 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP13.dgn

AREA N

DISTURBED DATE: _____

STABILIZED DATE: _____

PI STATION	= 360+80.73
DELTA	= 10° 37' 03.21" (RT)
DEGREE OF CURVE	= 1° 59' 59.47"
TANGENT	= 266.22
LENGTH	= 530.92
RADIUS	= 2,865.00
PC STATION	= 358+14.51
PT STATION	= 363+45.42



0 50 100

HORIZ. SCALE IN FEET

LEGEND:

- SF — TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- XXX — DISTURBED AREA
- XX — BMP INSTALLATION
- CONSTRUCTION EXIT

NOTES:

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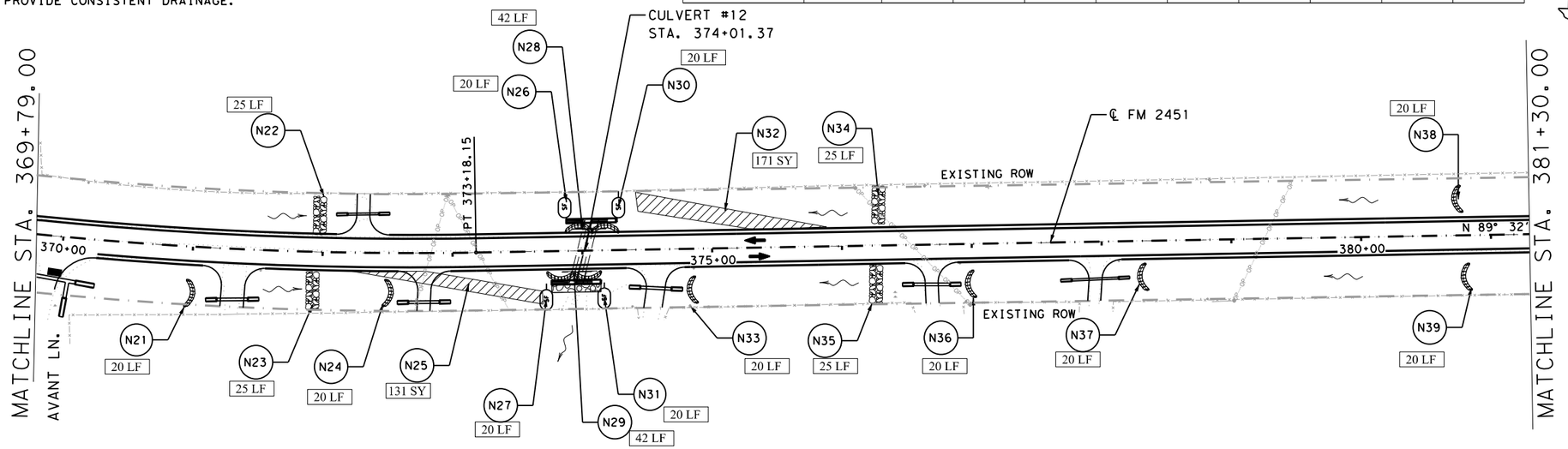
SCF/ECL/RDF	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17
INSTALL DATE:																	
REMOVE DATE:																	

SCF/ECL/RDF	N18	N19	N20	N21	N22	N23	N24	N25	N26	N27
INSTALL DATE:										
REMOVE DATE:										



SCF/ECL/RDF	N28	N29	N30	N31	N32	N33	N34	N35	N36	N37	N38	N39
INSTALL DATE:												
REMOVE DATE:												

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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 14 OF 15

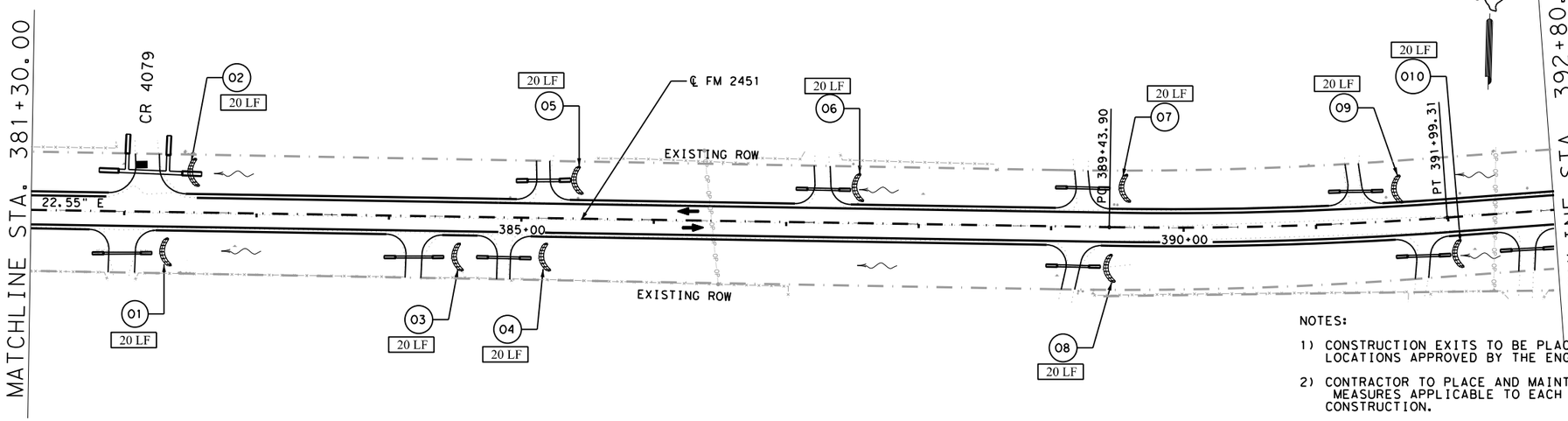
DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS: SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK: FR	TEXAS	DAL	KAUFMAN	205
CHECK: FR	CONTROL	SECTION	JOB	
	2355	01	006, ETC.	

DATE: 10/13/2021 12:24:20 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\S_SW3P SITE MAP14.dgn

AREA O

DISTURBED DATE: _____

STABILIZED DATE: _____



SCF/ECL/RDF	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	O13	O14	O15
INSTALL DATE:															
REMOVE DATE:															

0 50 100

HORIZ. SCALE IN FEET

LEGEND:

- TEMP SCF
- ROCK FILTER DAM
- EROSION CONTROL LOGS
- WATER FLOW DIRECTION
- DISTURBED AREA
- BMP INSTALLATION
- CONSTRUCTION EXIT

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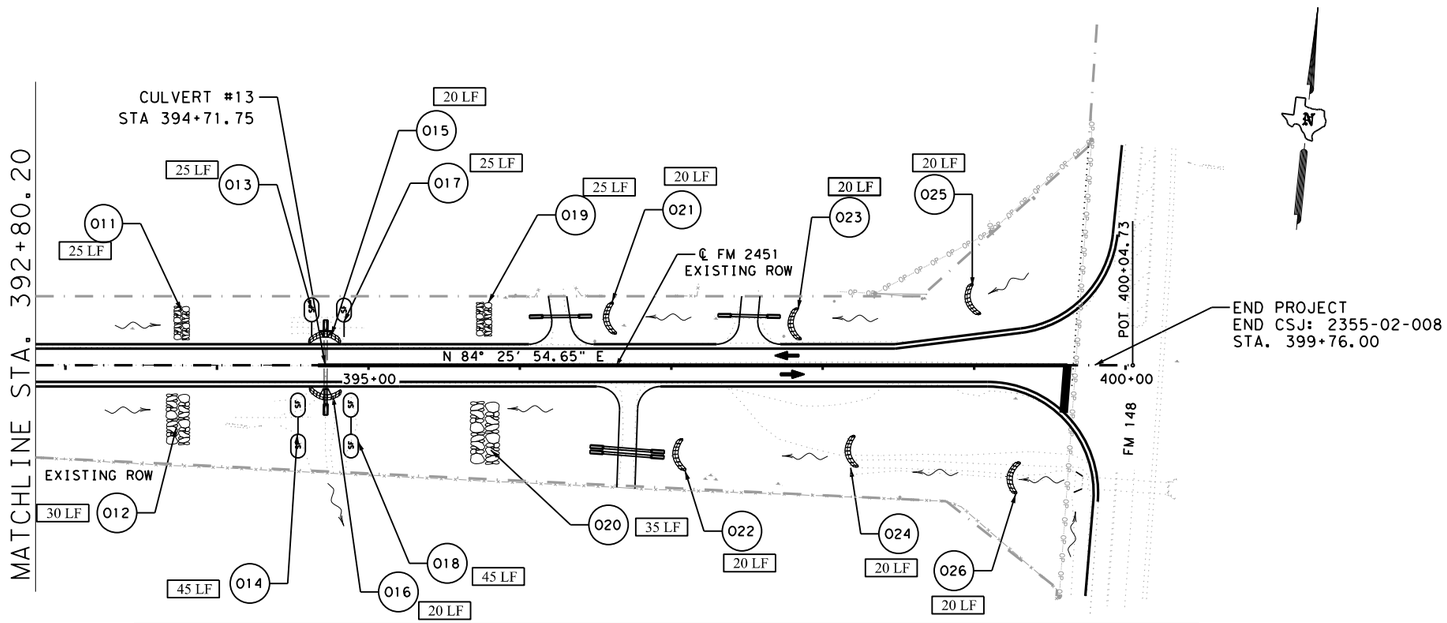
8) PROTECT TREES AND THEIR ROOTS, IF ALL POSSIBLE. PRESERVE CREEKSIDE VEGETATION TO THE EXTENT PRACTICABLE.
9) INSTALL AND ADJUST PLACEMENT OF WILDLIFE BARRIER FENCING AS NEEDED TO MEET EPIC SHEET SECTION V REQUIREMNETS, VARIABLE SITE CONDITIONS, AND APPLICABLE CONSTRUCTION ACTIVITIES.



SCF/ECL/RDF	O16	O17	O18	O19	O20	O21	O22	O23	O24	O25	O26
INSTALL DATE:											
REMOVE DATE:											

STATE OF TEXAS
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FM 2451
SW3P SITE MAP

SCALE: 1"=100' SHEET 15 OF 15

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
SB	6	(SEE TITLE SHEET)		FM 2451
GRAPHICS: SB	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK: FR	TEXAS	DAL	KAUFMAN	206
CHECK: FR	CONTROL	SECTION	JOB	
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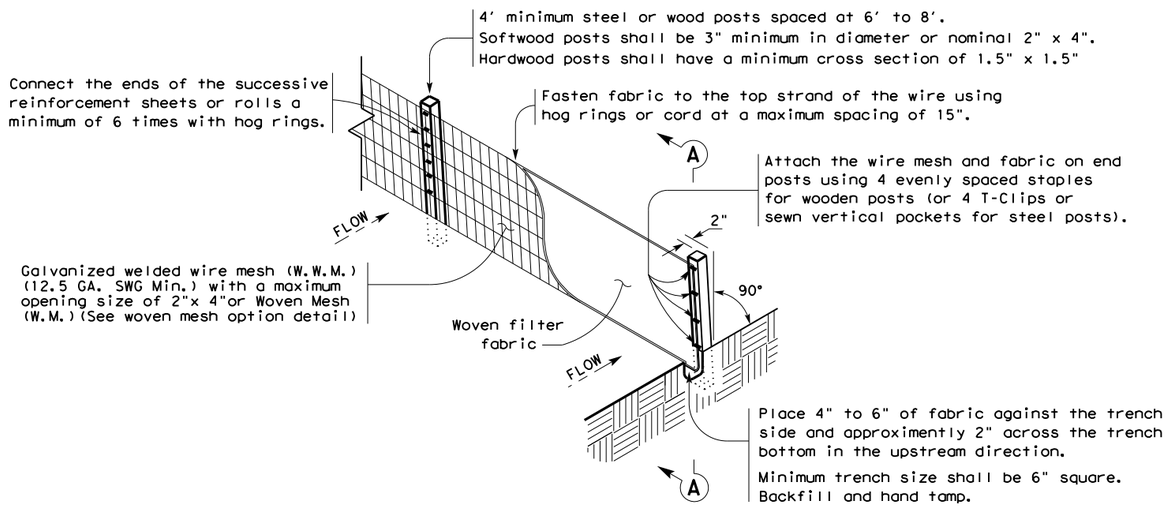
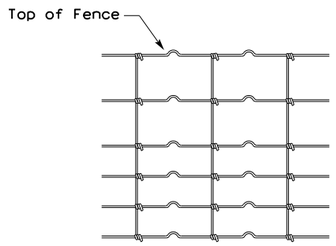
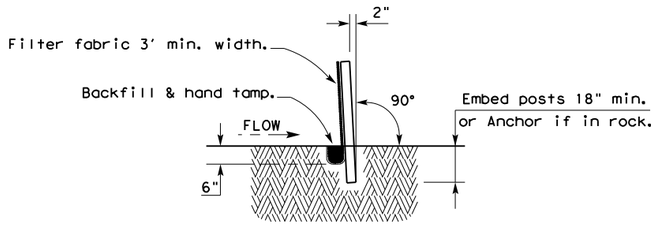


TEMPORARY SEDIMENT CONTROL FENCE

SCF





SECTION A-A

HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL

Galvanized hinge joint knot woven mesh (12.5 GA.SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

SEDIMENT CONTROL FENCE USAGE GUIDELINES

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

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

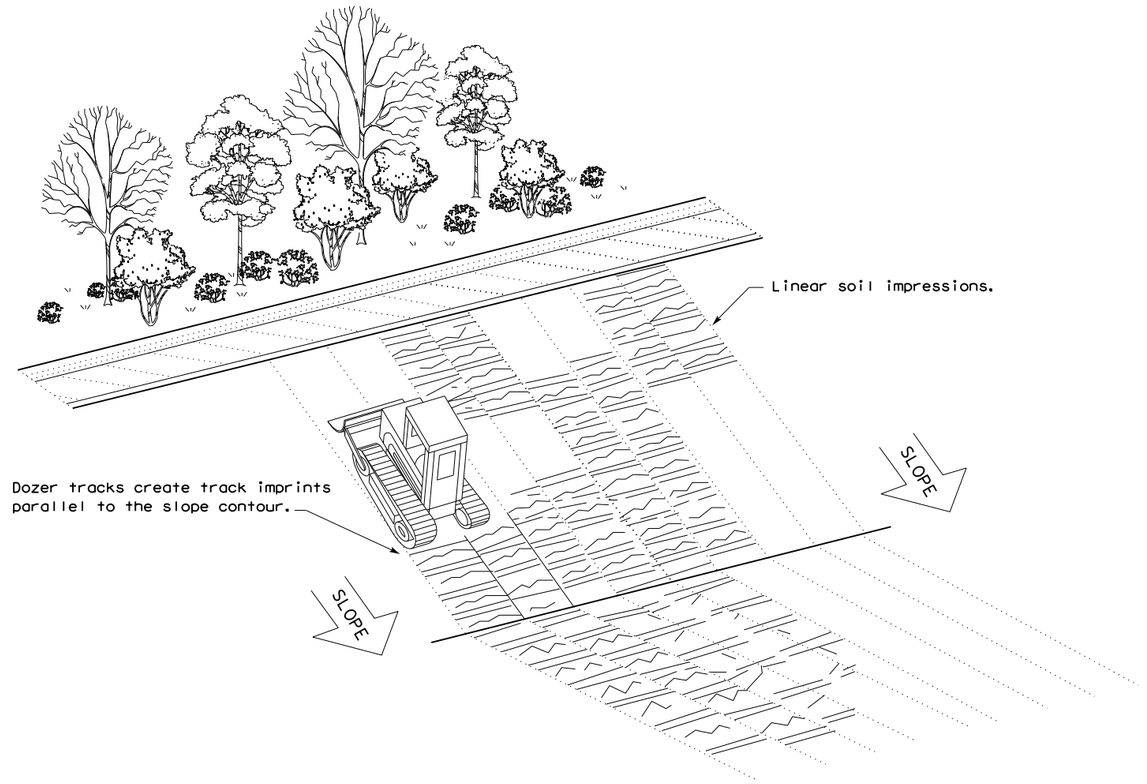
LEGEND

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 continous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.



VERTICAL TRACKING

Texas Department of Transportation

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	2355	01	006, ETC.	FM 2451
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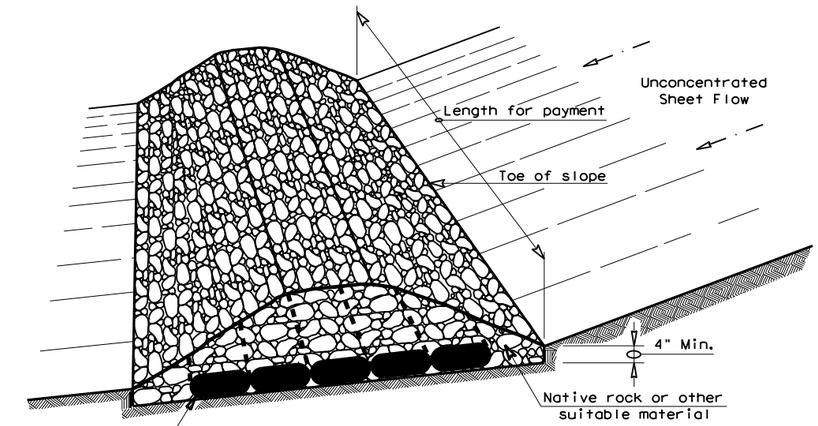
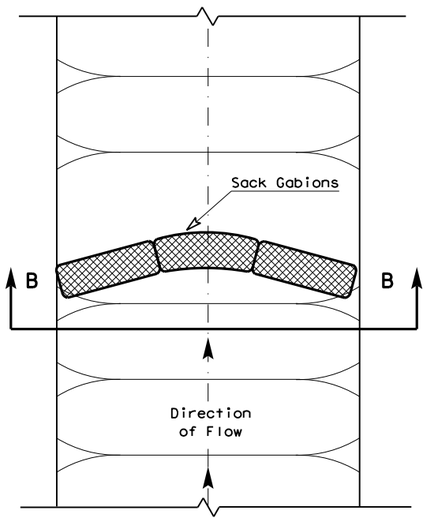
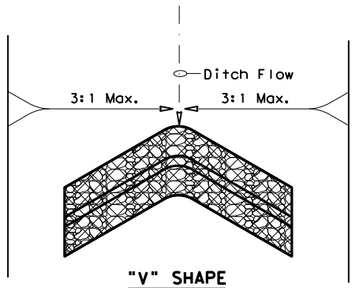


FILTER DAM AT TOE OF SLOPE

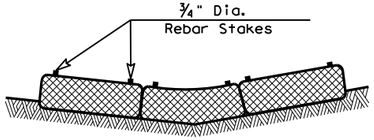
RFD1



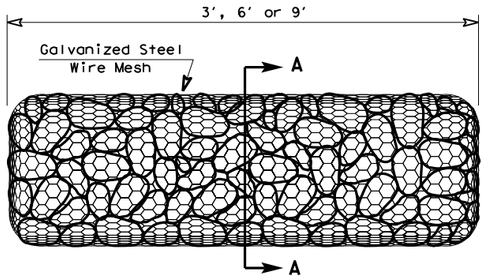
PLAN VIEW



"V" SHAPE PLAN VIEW

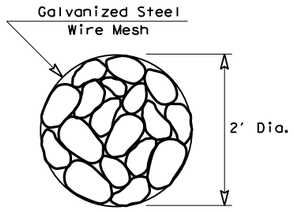


SECTION B-B

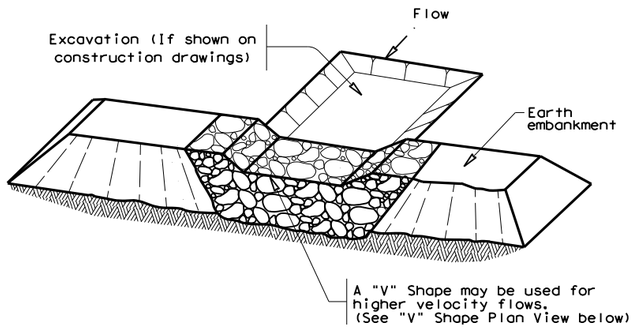


TYPE 4 (SACK GABIONS)

RFD4

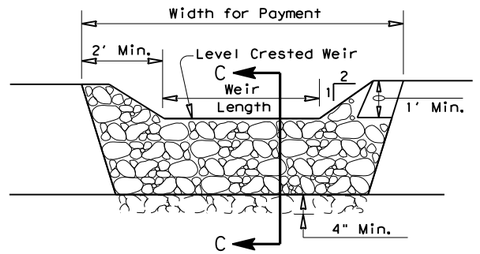


SECTION A-A



FILTER DAM AT SEDIMENT TRAP

RFD1 — OR — RFD2



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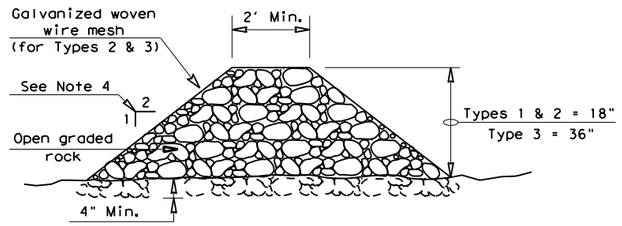


SECTION C-C

ROCK FILTER DAM USAGE GUIDELINES

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

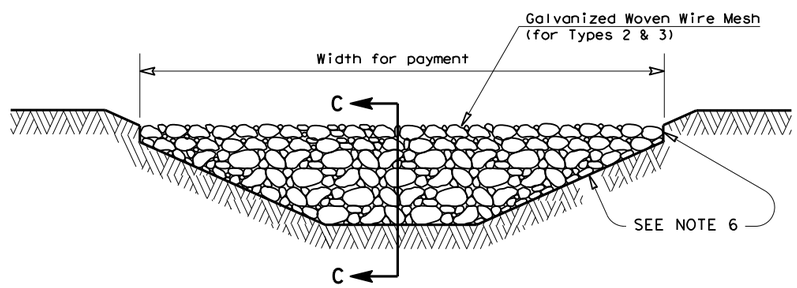
Type 1 (18" high with no wire mesh) (3" to 6" aggregate): Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approximently 8 Ft/Sec or more) in which aggregate wash out may occur. Sandbags may be used at the embedded foundation (4" deep min.) for better filtering efficiency of low flows if called for on the plans or directed by the Engineer.

Type 2 (18" high with wire mesh) (3" to 6" aggregate): Type 2 may be used in ditches and at dike or swale outlets.

Type 3 (36" high with wire mesh) (4" to 8" aggregate): Type 3 may be used in stream flow and should be secured to the stream bed.

Type 4 (Sack gabions) (3" to 6" aggregate): Type 4 May be used in ditches and smaller channels to form an erosion control dam.

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



FILTER DAM AT CHANNEL SECTIONS

RFD1 — OR — RFD2 — OR — RFD3

GENERAL NOTES

1. If shown on the plans or directed by the Engineer, filter dams should be placed near the toe of slopes where erosion is anticipated, upstream and/or downstream at drainage structures, and in roadway ditches and channels to collect sediment.
2. Materials (aggregate, wire mesh, sandbags, etc.) shall be as indicated by the specification for "Rock Filter Dams for Erosion and Sedimentation Control".
3. The rock filter dam dimensions shall be as indicated on the SW3P plans.
4. Side slopes should be 2:1 or flatter. Dams within the safety zone shall have sideslopes of 6:1 or flatter.
5. Maintain a minimum of 1' between top of rock filter dam weir and top of embankment for filter dams at sediment traps.
6. Filter dams should be embedded a minimum of 4" into existing ground.
7. The sediment trap for ponding of sediment laden runoff shall be of the dimensions shown on the plans.
8. Rock filter dam types 2 & 3 shall be secured with 20 gauge galvanized woven wire mesh with 1" diameter hexagonal openings. The aggregate shall be placed on the mesh to the height & slopes specified. The mesh shall be folded at the upstream side over the aggregate and tightly secured to itself on the downstream side using wire ties or hog rings. For in stream use, the mesh should be secured or staked to the stream bed prior to aggregate placement.
9. Sack Gabions should be staked down with ¾" dia. rebar stakes, and have a double-twisted hexagonal weave with a nominal mesh opening of 2 ½" x 3 ¼"
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

Texas Department of Transportation — Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

ROCK FILTER DAMS

EC(2)-16

FILE: ec216	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
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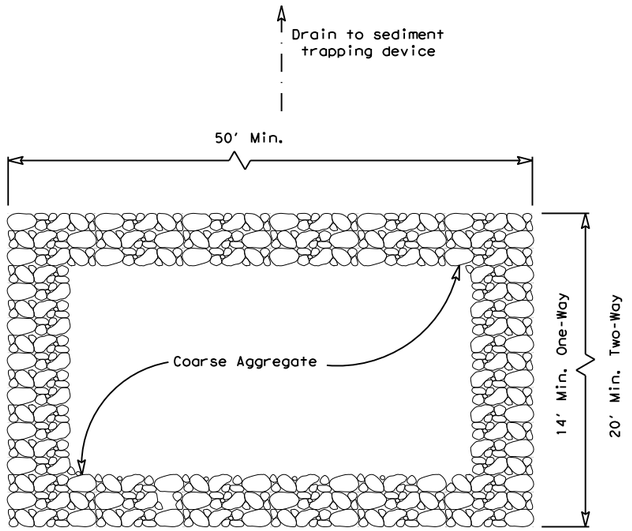

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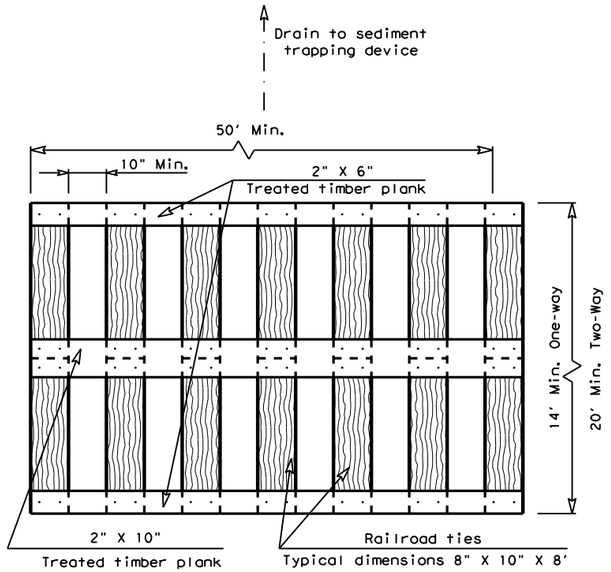

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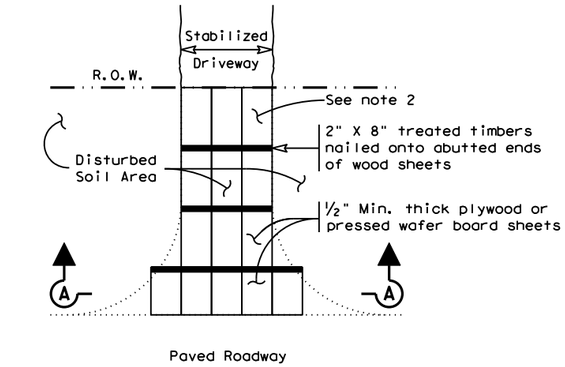

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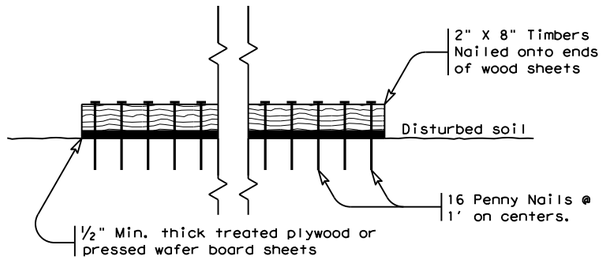
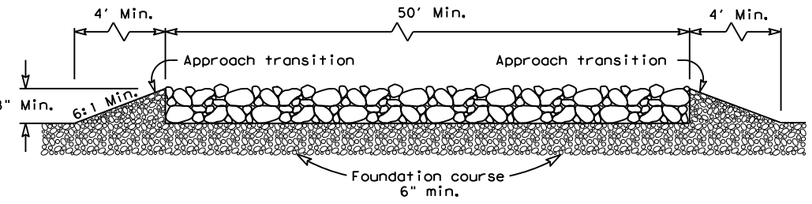


SECTION A-A

CONSTRUCTION EXIT (TYPE 3)

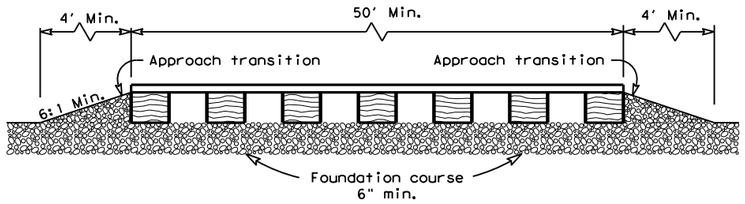
SHORT TERM



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 materialas 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 ½"x 6" min. lag bolts. Other fasteners may be used as approved by the Engineer.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The approach transitions shall be no steeper than 6:1 and constructed as directed by the Engineer.
5. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
6. The construction exit should be graded to allow drainage to a sediment trapping device.
7. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
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.

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

CONSTRUCTION EXITS

EC(3)-16

FILE: ec316	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
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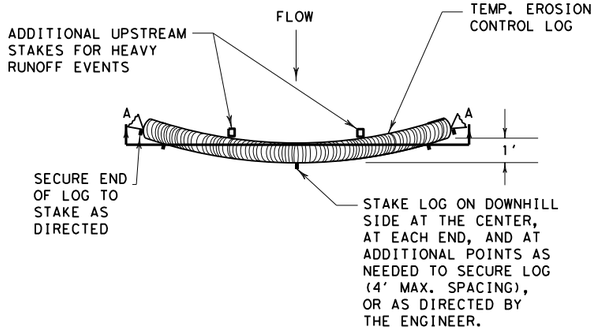

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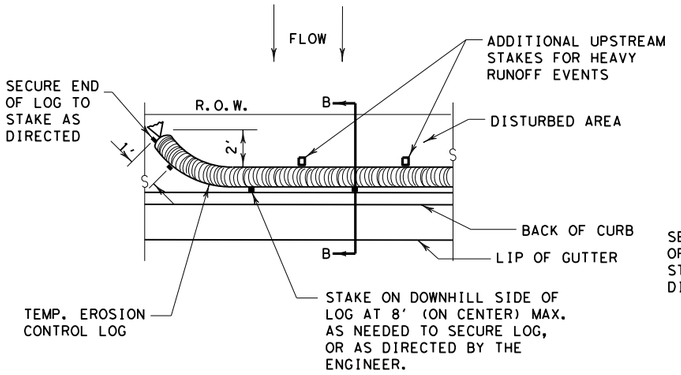

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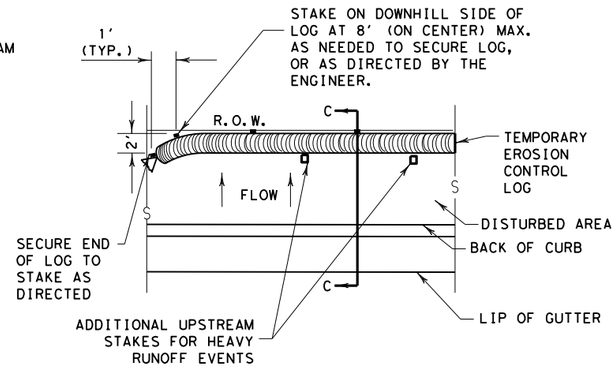

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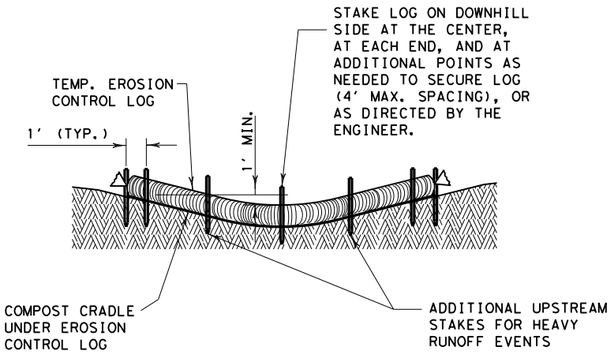
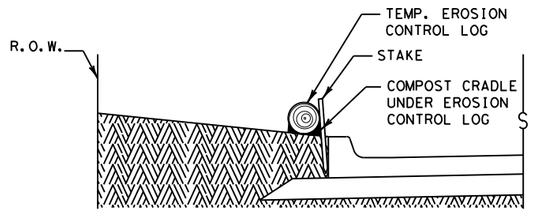


SECTION A-A

EROSION CONTROL LOG DAM

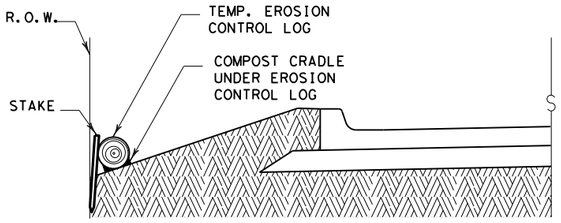
CL-D



SECTION B-B

EROSION CONTROL LOG AT BACK OF CURB

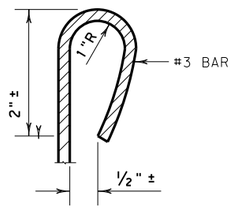
CL-BOC



SECTION C-C

EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY

CL-ROW



REBAR STAKE DETAIL

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

GENERAL NOTES:

1. EROSION CONTROL LOGS SHALL BE INSTALLED IN ACCORDANCE WITH MANFACTURER'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.

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.

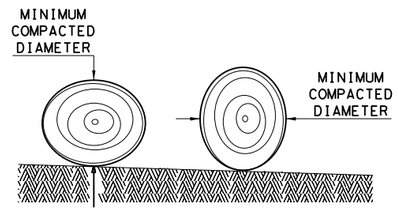
Log Traps: The drainage area for a sediment trap should not exceed 5 acres. The trap capacity should be 1800 CF/Acre (0.5" over the drainage area).

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.



DIAMETER MEASUREMENTS OF EROSION CONTROL LOGS SPECIFIED IN PLANS

Texas Department of Transportation

Design Division Standard

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
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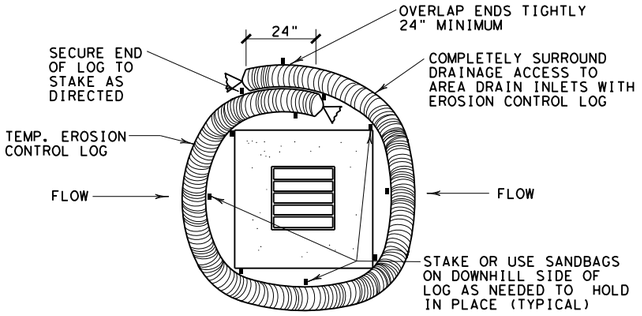
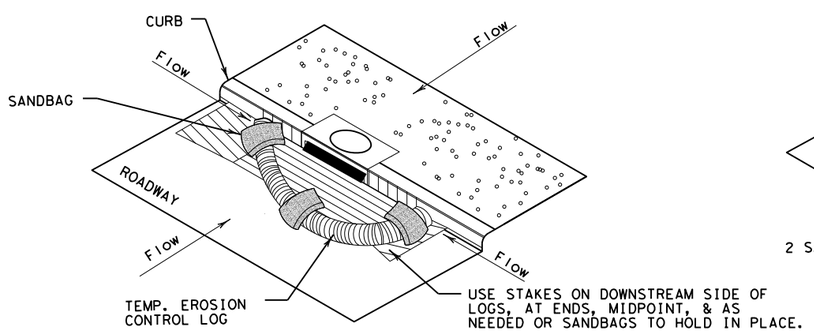


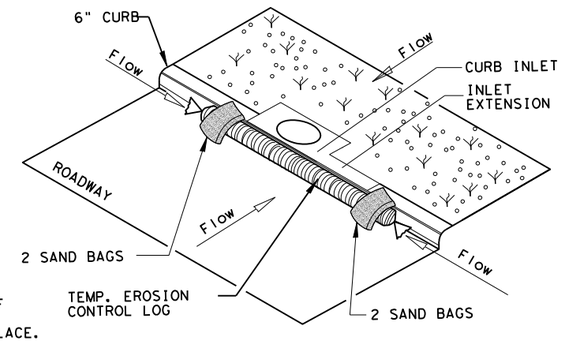
EROSION CONTROL LOG AT DROP INLET

CL-DI



EROSION CONTROL LOG AT CURB INLET

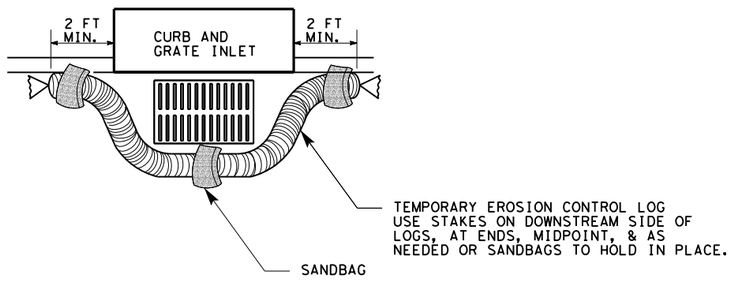
CL-CI



EROSION CONTROL LOG AT CURB INLET

CL-CI

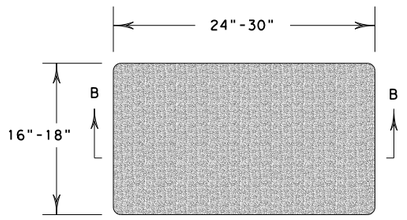
NOTE:
EROSION CONTROL LOGS USED AT CURB INLETS SHOULD ONLY BE USED IF THEY WILL NOT IMPEDE TRAFFIC OR FLOOD THE ROADWAY OR WHEN THE STORM SEWER SYSTEM IS NOT FULLY FUNCTIONAL.



EROSION CONTROL LOG AT CURB & GRADE INLET

CL-GI

SECTION B-B



SANDBAG DETAIL

SHEET 3 OF 3

Texas Department of Transportation

Design Division Standard

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	2355	01	006, ETC.		FM 2451	
	DIST	COUNTY			SHEET NO.	
	DAL	KAUFMAN			211	

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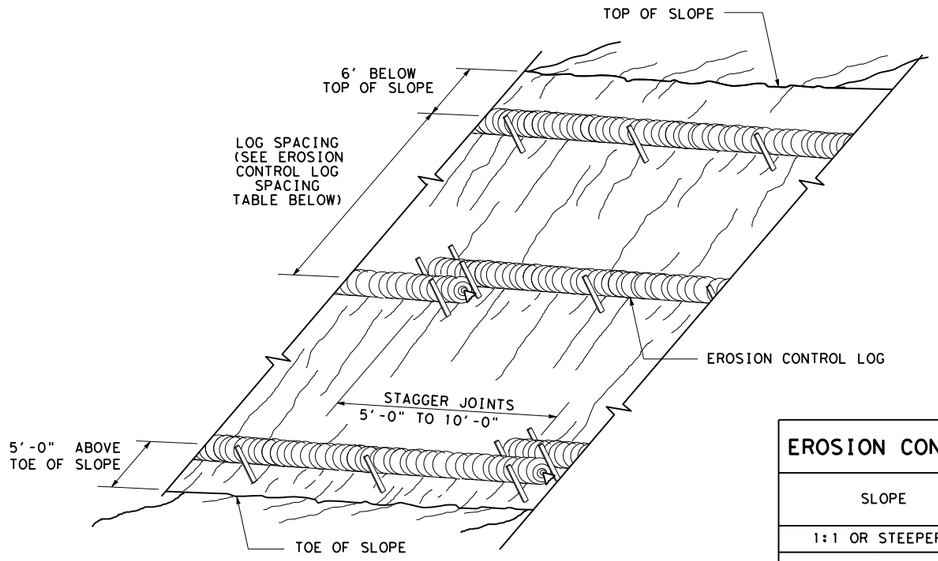
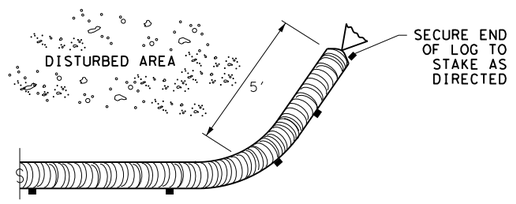
DATE: 10/13/2021
FILE: pw:\\txdot.projectwiseonline.com:TXDOT5\Documents\18 - DAL\Design Projects\235502008\4 - Design\Plan Set\1. General\STANDARDS\ENVIRONMENTAL\ec916.dgn



EROSION CONTROL LOGS ON SLOPES
STAKE AND TRENCHING ANCHORING

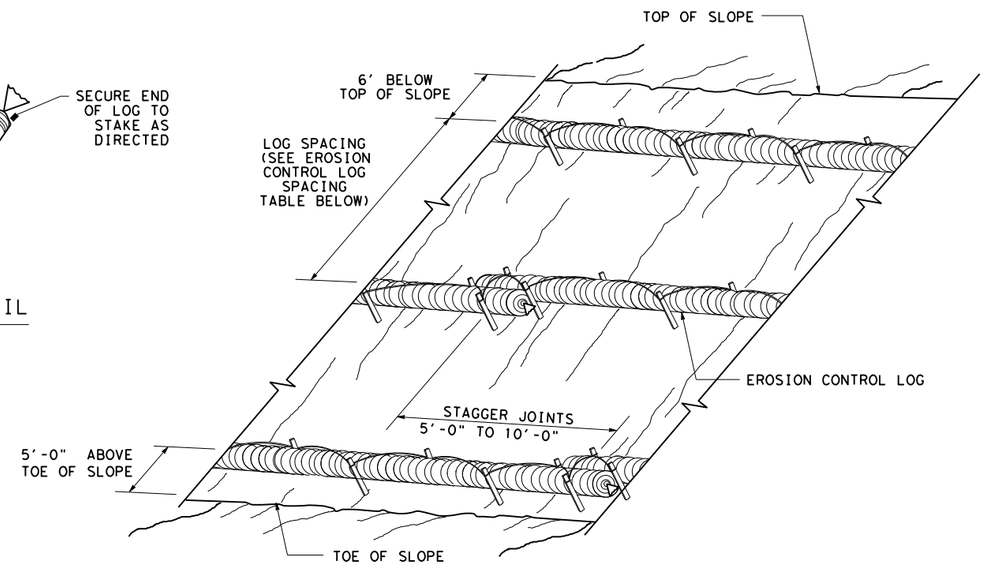
CL-SST



END SECTION RAP DETAIL

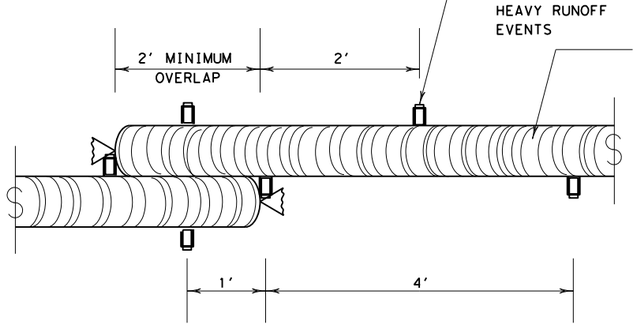
EROSION CONTROL LOG SPACING TABLE				
SLOPE	LOG DIAMETER			
	6"	8"	12"	18"
1:1 OR STEEPER	5'	10'	15'	20'
2:1	10'	20'	30'	40'
3:1	15'	30'	45'	60'
4:1 OR FLATTER	20'	40'	60'	80'

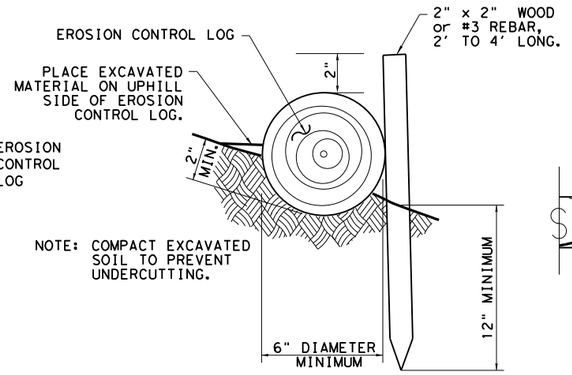
* ADJUSTMENTS CAN BE MADE FOR SOIL TYPE:
SOFT, LOAMY SOILS-ADJUST ROWS CLOSER TOGETHER;
HARD, ROCKY SOILS- ADJUST ROWS FARTHER APART



EROSION CONTROL LOGS ON SLOPES
STAKE AND LASHING ANCHORING

CL-SSL

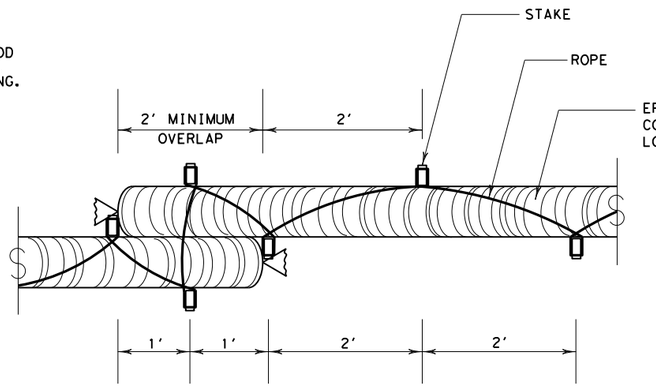


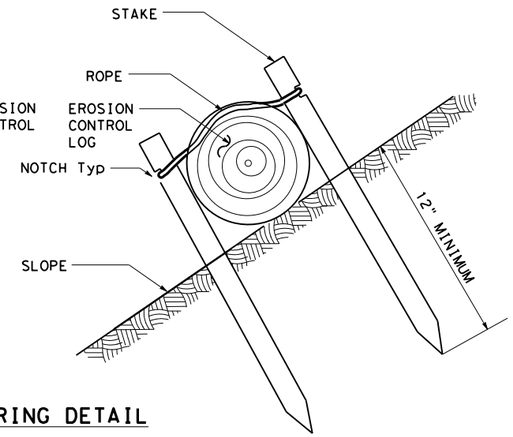


STAKE AND TRENCHING ANCHORING DETAIL

CL-SST

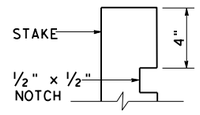
TRENCH DEPTH TABLE	
LOG DIAMETER	DEPTH
6"	2"
8"	3"
12"	4"
18"	5"





STAKE AND LASHING ANCHORING DETAIL

CL-SSL



STAKE NOTCH DETAIL

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

EROSION CONTROL LOG

EC(9)-16

FILE: ec116	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	2355	01	006, ETC.	FM 2451
	DIST	COUNTY		SHEET NO.
	DAL	KAUFMAN		212

USER ID

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:
1. 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.
2. Topsoil shall include only the top 6 inches of its native surface, and be easily cultivated, fertile, erosion-resistant and free of objectionable materials.
3. Topsoil obtained from sites outside of the ROW must come from approved sources and have a pH between 5.5 and 8.5 su.
4. 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:
1. 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.
2. Contractor shall provide tickets/invoices that document material type, quantity and placement for all compost delivered.
3. 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:
1. 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.
2. Apply fertilizer BEFORE seeding, or AFTER placing sod.
3. 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.
4. 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.
5. Apply fertilizer uniformly, as a dry, granular material, essentially dust-free, and do not mix with water for application as a slurry.
6. 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)	Pure Live Seed Rate**	PERMANENT URBAN SEED MIX ITEM 164 - DRILL SEEDING (PERM) (URBAN)(CLAY)	Pure Live Seed Rate**	TEMPORARY DRILL SEED MIX ITEM 164 - DRILL SEEDING (TEMP) (WARM OR COOL)	Pure Live Seed Rate**
WARM SEASON Mar.15th, April, May, June, July, August, Sept. 15th	Green Sprangletop (Van Horn)	- 1.0 lbs/AC	Green Sprangletop (Leptochloa dubia)	- 0.3 lbs/AC	Foxtail Millet (Setaria italica)	- 34 lbs/AC
	Sideoats Grama (Haskell)	- 1.0 lbs/AC	Sideoats Grama (El Reno)(Bouteloua curtipendula)	- 3.6 lbs/AC		
	Texas Grama (Atascosa)	- 1.0 lbs/AC	Buffalograss (Texoka)(Buchloe dactyloides)	- 1.6 lbs/AC		
	Hairy Grama (Chaparral)	- 0.4 lbs/AC	Bermudagrass (Cynodon dactylon)	- 2.4 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)	- 0.75lbs/AC				
	Illinois Bundleflower	- 1.3 lbs/AC				
	Awnless Bushsunflower (Plateau)	- 0.2 lbs/AC				
COOL SEASON Sept 16th, Oct, Nov, Dec, Jan, Feb, Mar 14th					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

SEEDING NOTES:
1. 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.
2. Conduct seeding upon completion of each applicable construction stage (dependent upon planting season requirements), without compensation for additional move-ins.
3. Place seed AFTER preparing planting area surface. Refer to Surface Preparation detail 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. Hydroseeding may be allowed, when specified or Engineer concurs.
9. 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:
1. 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.
2. 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.
3. Place sod only AFTER soil surface preparation is complete as detailed in this sheet. Dry soil may require pre-watering.
4. 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.
5. 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.
6. Place fertilizer promptly AFTER sodding operation is complete in each area.
7. Water sod immediately following placement, and continue Vegetative Watering per Item 168.

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

WATERING SCHEDULE

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:
1. 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.
2. Use clean water free of industrial waste and other substances harmful to vegetation growth, per Item 168.2.
3. 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.
4. For sod, water immediately.
5. 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.
6. 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.
7. Do not water between the hours of 12:00 p.m. and 6:00 p.m. when daytime temperatures exceed 95 degrees F.
8. 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.
9. 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.)
10. 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.

**Note: The amount of Pure Live Seed (PLS) in one pound of bulk seed is based on three factors: % Purity, % Germination, and % Dormant. Use the following formula to calculate PLS in bulk seed: PLS = % Purity X (% Germination + % Dormant) Ensure that the specified amount of pure live seed is placed.

ROADSIDE MOWING ITEM 730* PROJECT MAINTENANCE AC

MOWING NOTES:
1. During project construction, once seed is established, use mowing to promote permanent grasses by mowing any remaining temporary grasses.
2. Also mow established turf and ROW grasses in designated areas of project limits as specified or directed by Engineer.
3. Remove litter and debris prior to mowing.
4. Do not mow on wet ground when soil rutting can occur.
5. Hand-trim around obstructions and stormwater control devices as needed.
6. 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	FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
CPB	6	(See Title Sheet)		FM 245
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
XXX	TEXAS	DALLAS	KAUFMAN	
CHECK	CONTROL	SECTION	JOB	213
XXX	2355	01	006, ETC.	
CHECK				
XXX				

DATE

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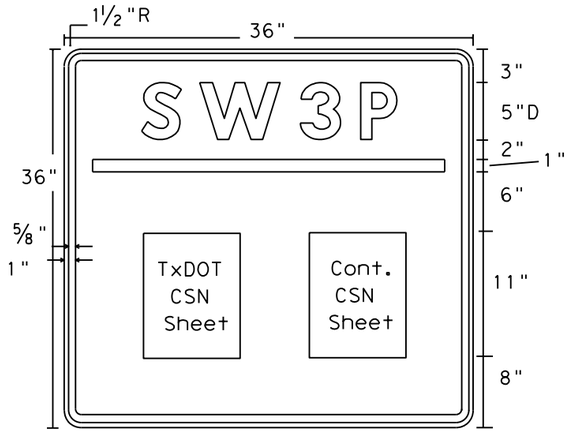


SW3P SIGN

TxDOT & Contractor Construction Site Note (CSN)

Sign Dimensions

36" X 36"

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

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.

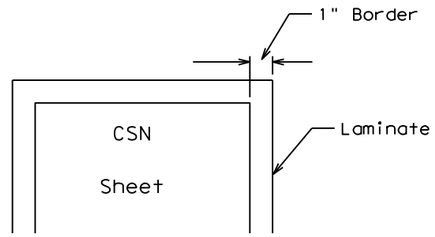
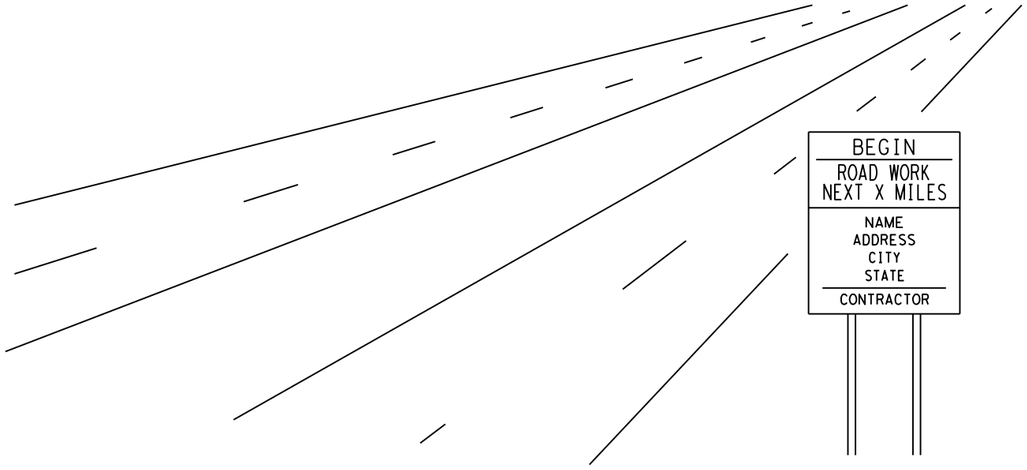
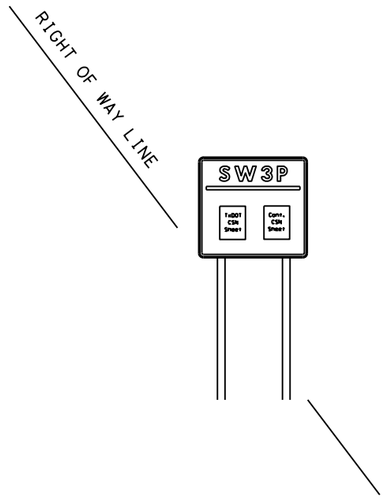


Figure 1





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	CK:	DW:	CK:
©TxDOT 2022	DISTRICT	FEDERAL AID PROJECT		SHEET
	18	(SEE TITLE SHEET)		214
REVISION DATE: 10-16-15	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	KAUFMAN	2355	01 006, ET	CEM 2451

LEVELS DISPLAYED
PATH: