STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

FEDERAL AID PROJECT NO.			
STP 2B24(017) HRR			
CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		1

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

FEDERAL AID PROJECT
STP 2B24(017)HRR
CSJ: 2353-02-028

FM 2450
DENTON COUNTY

DESIGN SPEED = 40 MPH
A.D.T. (2024)= 3,500
A.D.T. (2054)= 5,450
FUNCTIONAL CLASSIFICATION = RURAL MAJOR COLLECTOR

LIMITS: FROM FM 455
TO FM 156

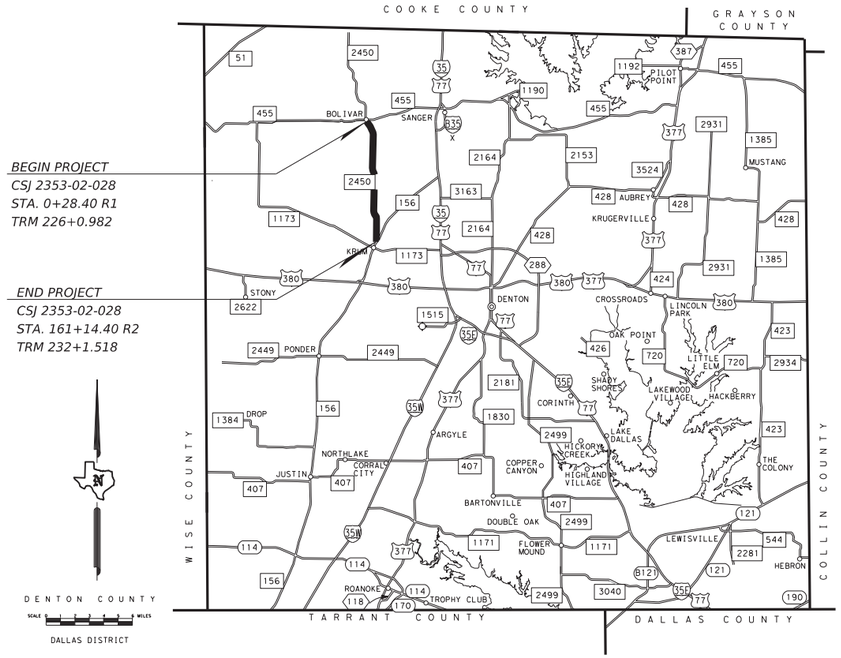
TOTAL LENGTH OF PROJECT =

ROADWAY = 34315.00	FT.= 6.499	MI.
BRIDGE = 355.00	FT.= 0.067	MI.
TOTAL = 34670.00	FT.= 6.566	MI.

FOR THE CONSTRUCTION OF SAFETY IMPROVEMENT PROJECTS CONSISTING OF SAFETY TREAT FIXED OBJECTS, PROFILE MARKINGS, PROVIDE ADDITIONAL PAVED SURFACE WIDTH.

BEGIN PROJECT
CSJ 2353-02-028
STA. 0+28.40 R1
TRM 226+0.982

END PROJECT
CSJ 2353-02-028
STA. 161+14.40 R2
TRM 232+1.518



EXCEPTIONS: NONE
EQUATIONS: STA. 185+84.00 R1 (BK)= STA. 0+00.00 R2 (AH)
RAILROAD CROSSINGS: NONE

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: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL-AID CONSTRUCTION CONTRACTS (FORM FHWA 1273,OCTOBER 23,2023)

FINAL PLANS

NAME OF CONTRACTOR: _____

DATE OF LETTING: _____

DATE WORK BEGAN: _____

DATE WORK COMPLETED: _____

DATE WORK ACCEPTED: _____

WORK WAS COMPLETED ACCORDING TO THE PLAN AND CONTRACT.

P.E.

Signature of Registrant & Date

Texas Department of Transportation

SUBMITTED FOR LETTING: 2/27/2024

DocuSigned by: Hram Mang
7E66E4980AEB4E4...
, P.E.
ENGINEER

DocuSigned by: James P. Campbell
98671C109B6A4C3...
2/27/2024
, P.E.
PORTATION PLANNING AND DEVELOPMENT

DocuSigned by:
01F881A42AA240C...
2/27/2024
, P.E.

APPROVED FOR LETTING: 2/27/2024

DocuSigned by: Cesson Clemens
A879E0D10CD6464...
, P.E.
IEER

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X. MISCELLANEOUS ITEMS

NONE

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...

2/27/2024

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

, P.E.
Signature of Registrant & Date

Texas Department of Transportation

FM 2450

INDEX OF SHEETS

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CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		2

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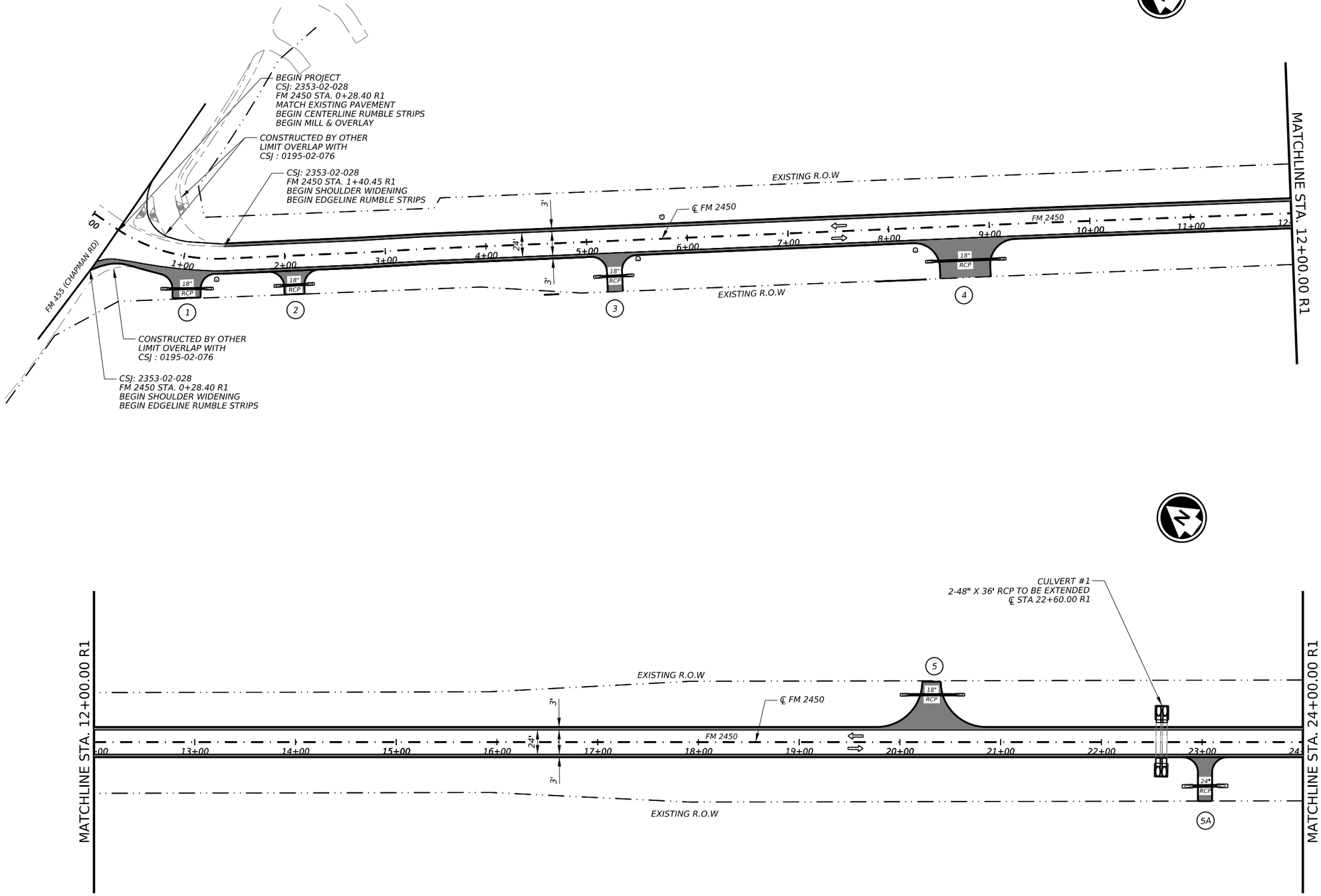

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DocuSigned by:
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2/22/2024

Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 0+00.00 R1
TO
STA. 24+00.00 R1

2024 SHEET 1 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		3

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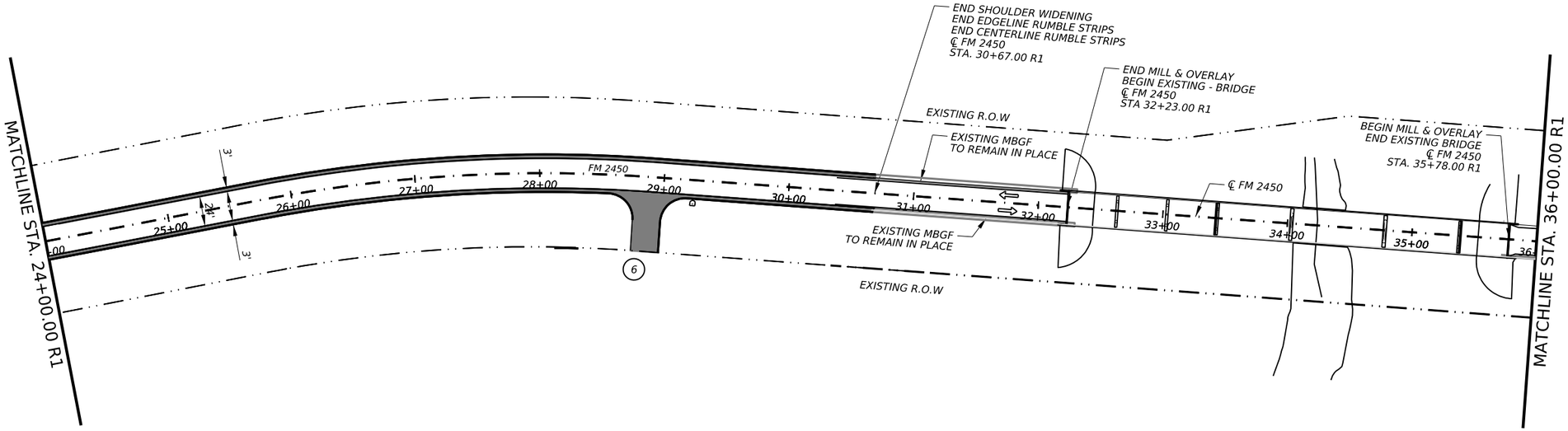

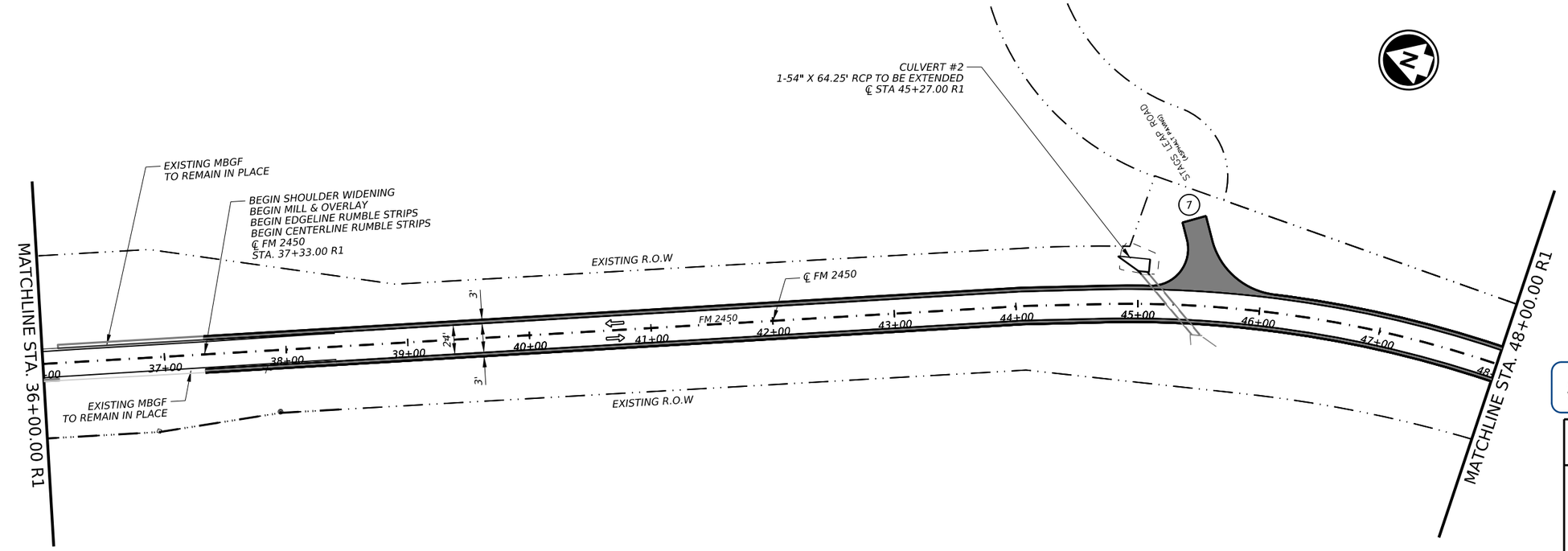

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SCALE IN FEET

PROPOSED CONSTRUCTION

STATE OF TEXAS
HRAM MANG
141660
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PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
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2/28/2024

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FM 2450

PROJECT LAYOUT
STA. 24+00.00 R1
TO
STA. 48+00.00 R1

2024 SHEET 2 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
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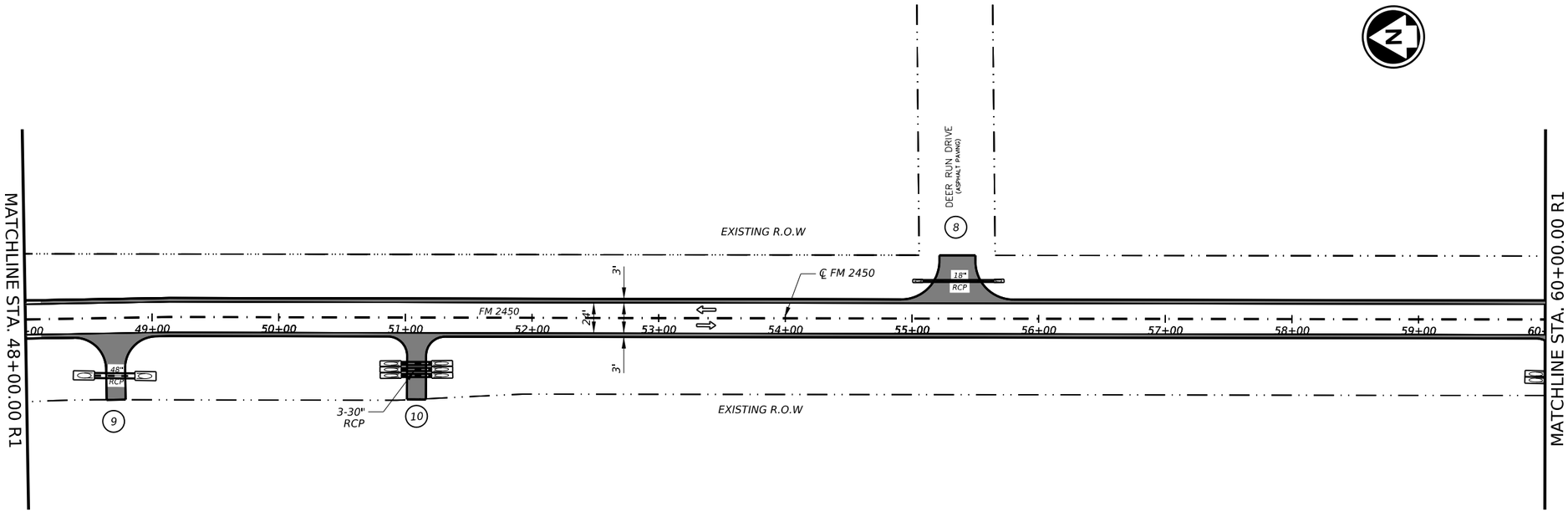

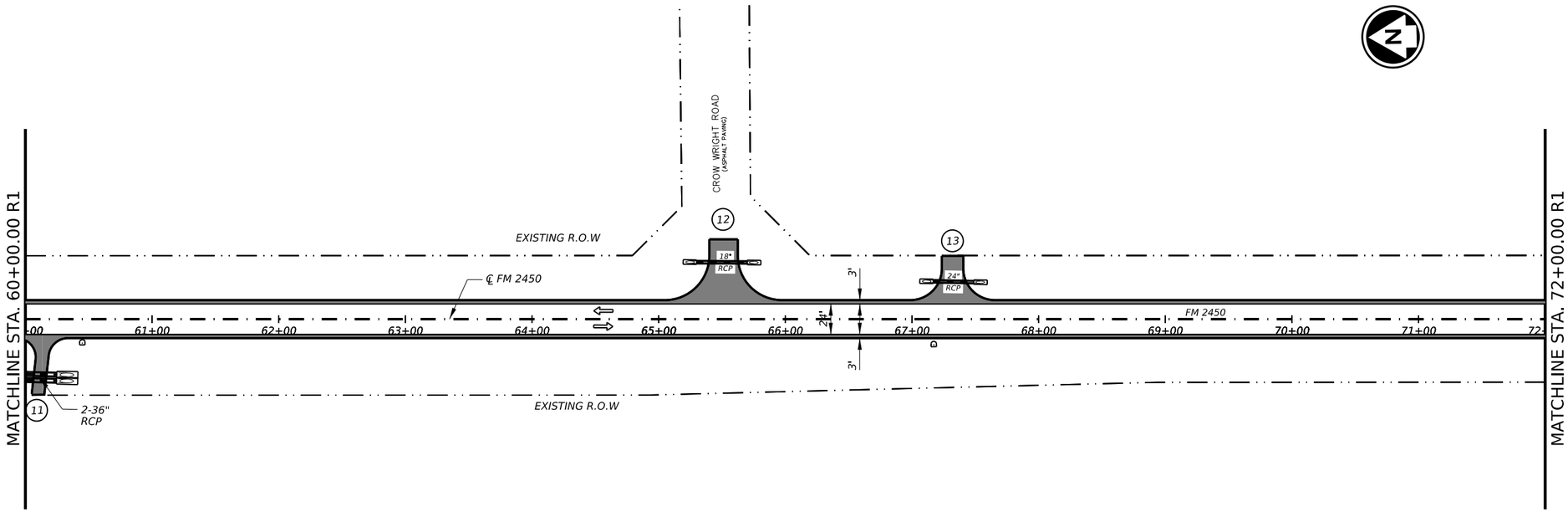

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SCALE IN FEET

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STATE OF TEXAS
HRAM MANG
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DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 48+00.00 R1
TO
STA. 72+00.00 R1

2024 SHEET 3 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
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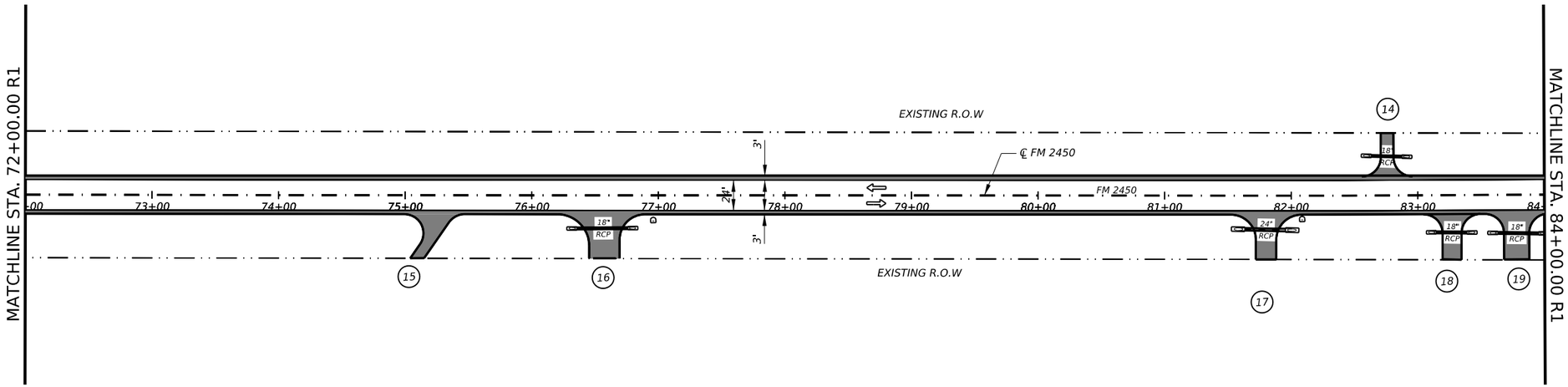

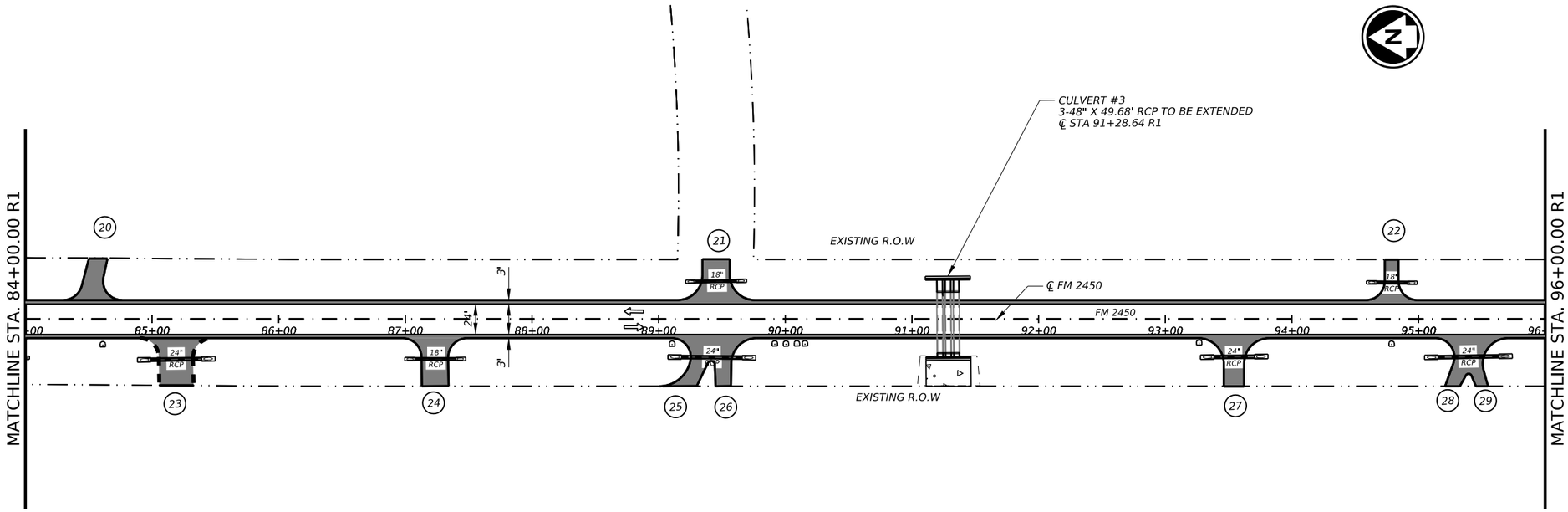

PROPOSED CONSTRUCTION

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STATE OF TEXAS
HRAM MANG
141660
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DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 72+00.00 R1
TO
STA. 96+00.00 R1

2024 SHEET 4 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		6

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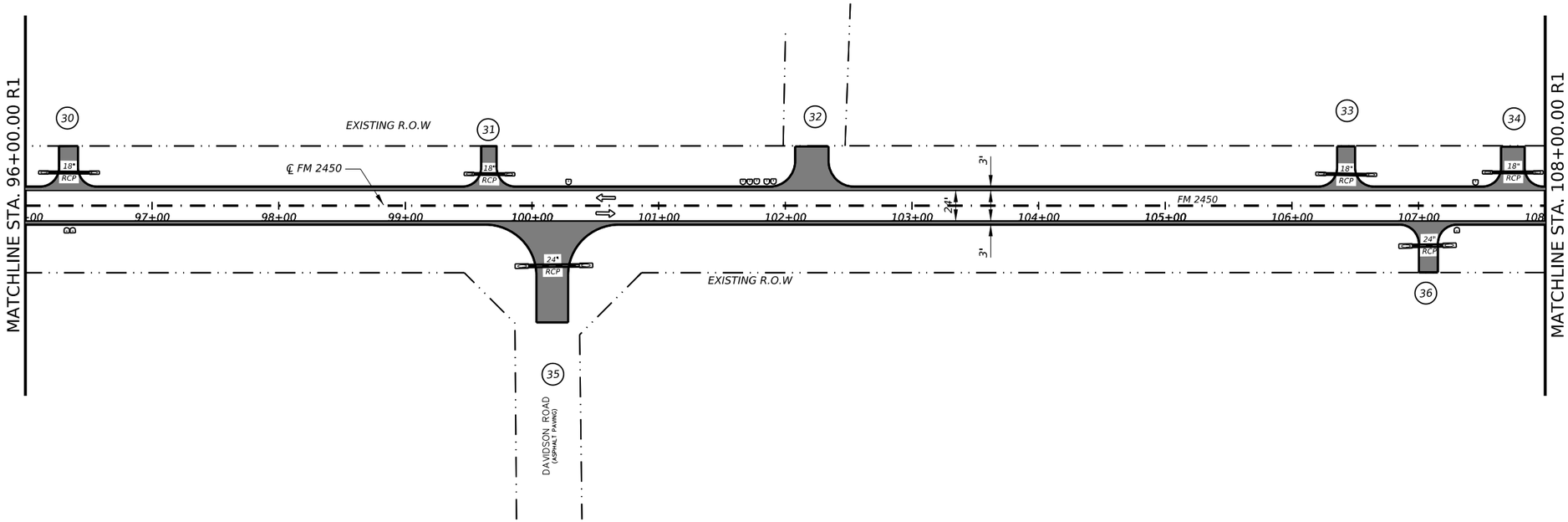

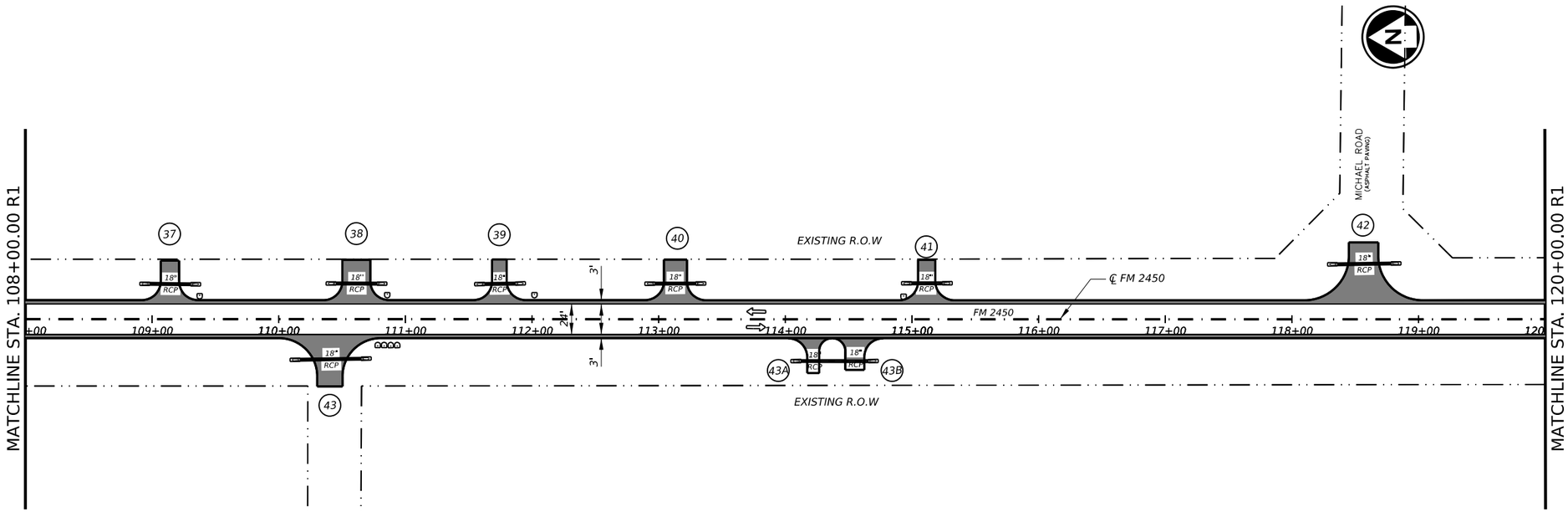

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SCALE IN FEET

PROPOSED CONSTRUCTION

STATE OF TEXAS
HRAM MANG
141660
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DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 96+00.00 R1
TO
STA. 120+00.00 R1

2024 SHEET 5 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		7

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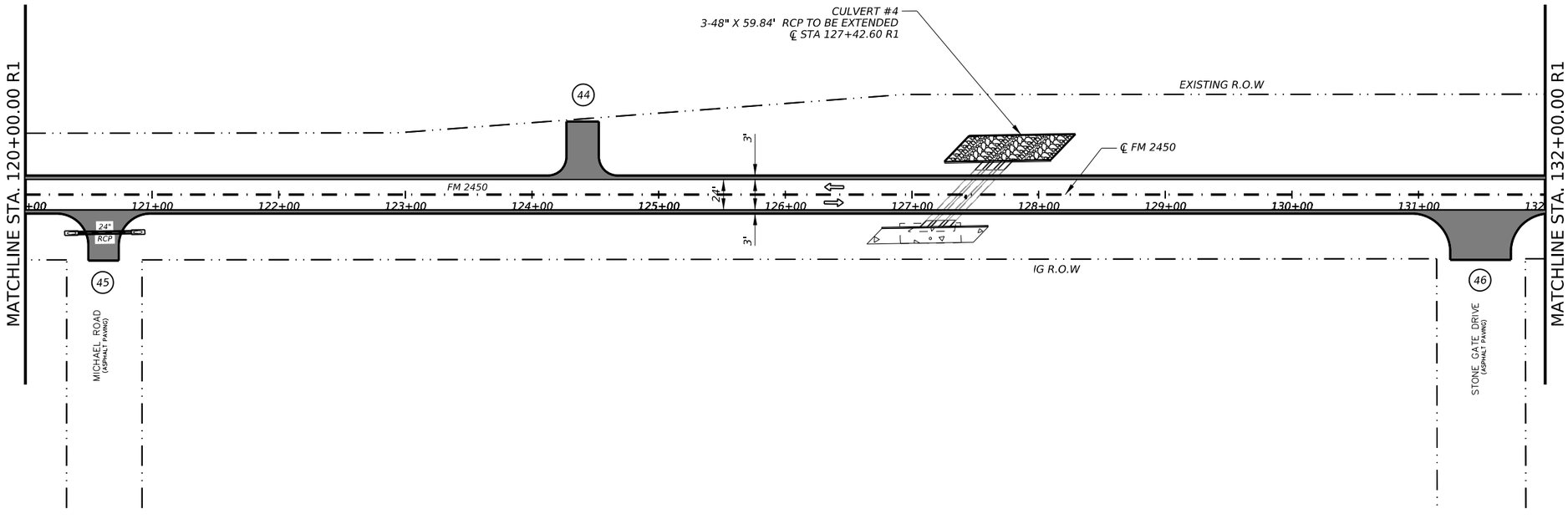

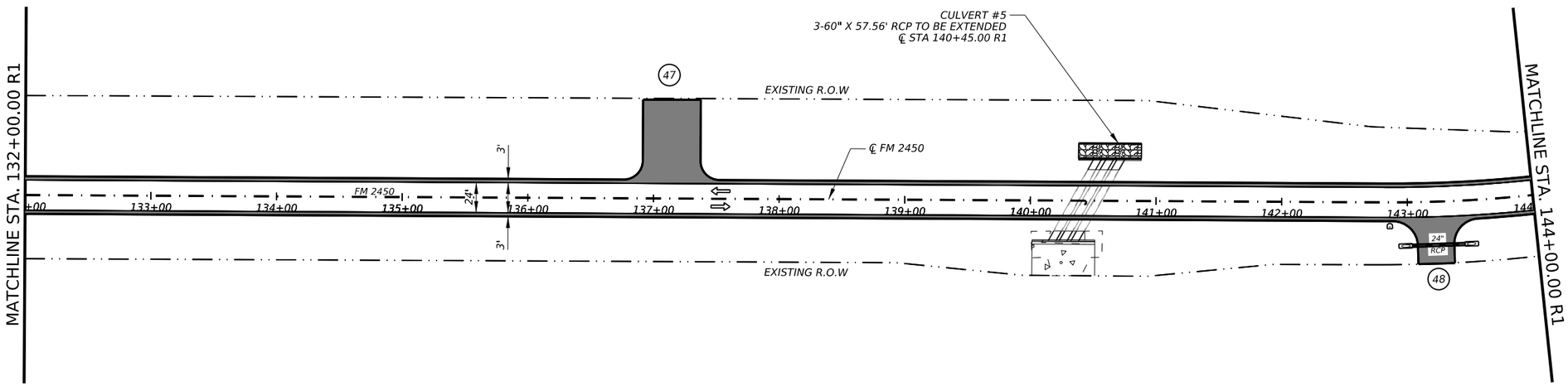

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SCALE IN FEET

PROPOSED CONSTRUCTION

STATE OF TEXAS
HRAM MANG
141660
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PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...

2/22/2024

Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 120+00.00 R1
TO
STA. 144+00.00 R1

2024 SHEET 6 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		8

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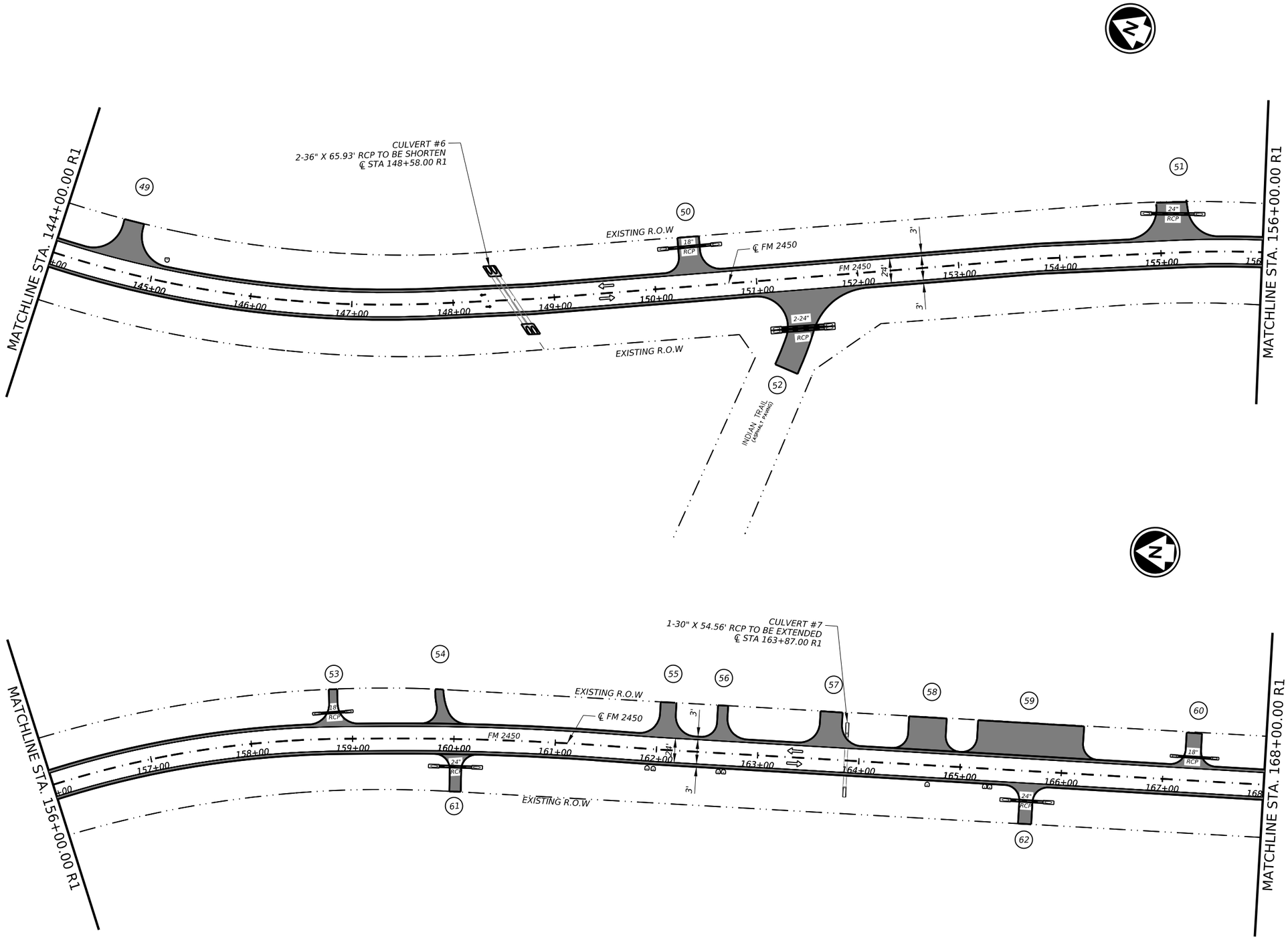

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2/27/2024

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PROJECT LAYOUT
STA. 144+00.00 R1
TO
STA. 168+00.00 R1

2024 SHEET 7 OF 15

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2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
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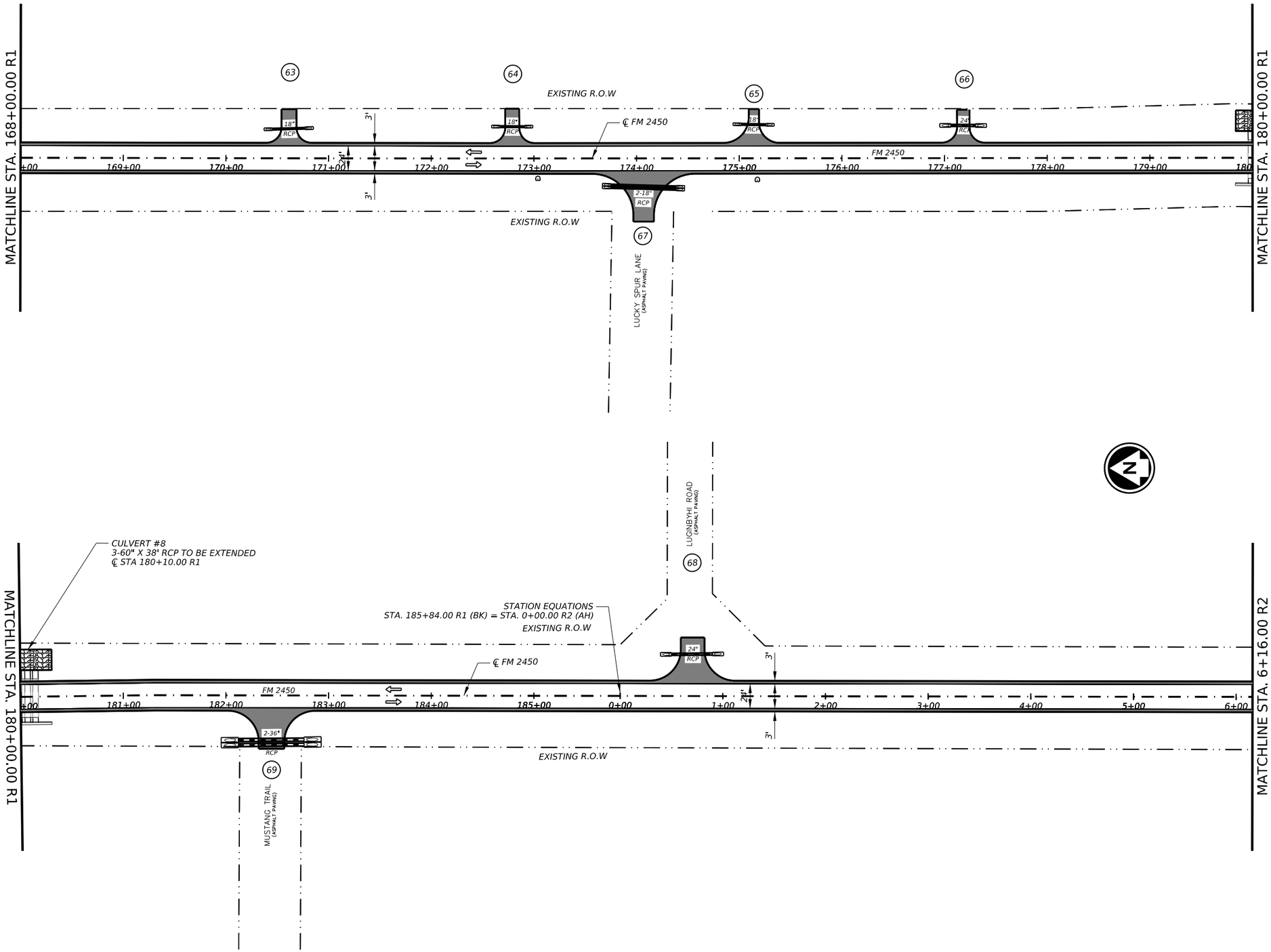

STATE OF TEXAS
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Hram Mang 2/22/2024
7E66E4980AEB4E4...

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FM 2450

PROJECT LAYOUT
STA. 168+00.00 R1
TO
STA. 6+16.00 R2

2024 SHEET 8 OF 15

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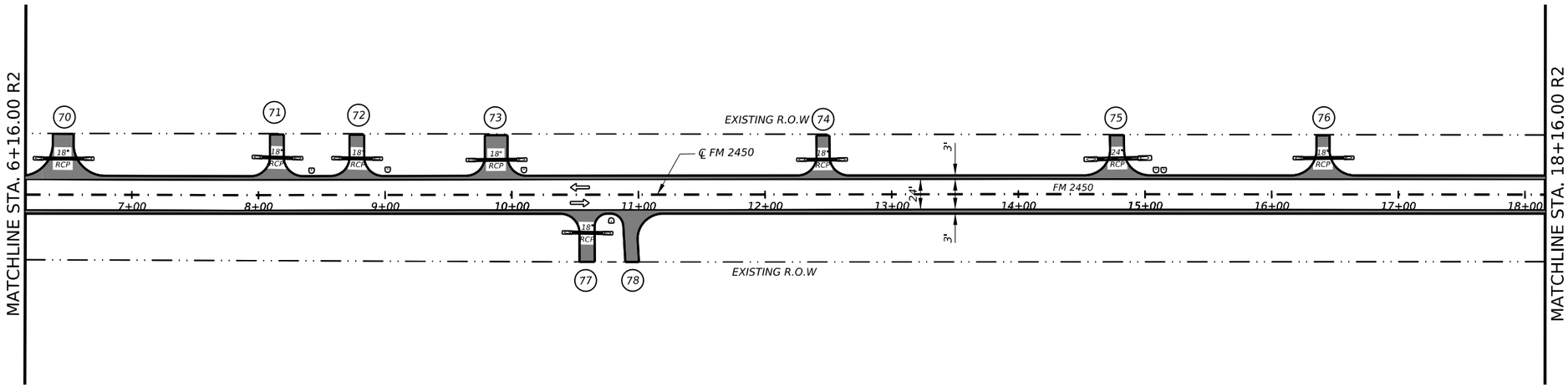

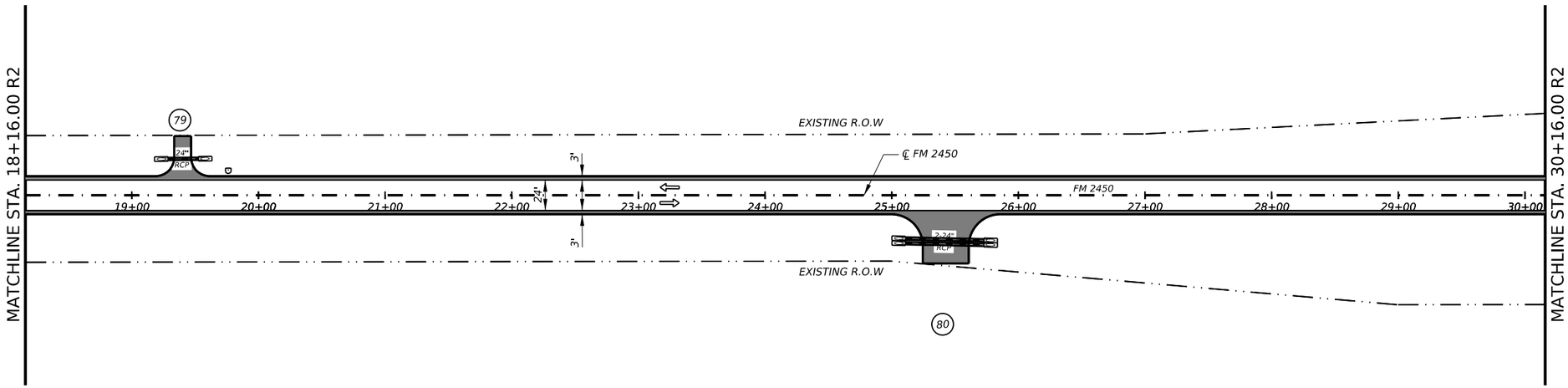

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SCALE IN FEET

PROPOSED CONSTRUCTION

STATE OF TEXAS
HRAM MANG
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7E66E4980AFB4E4...
2/22/2024

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FM 2450

PROJECT LAYOUT
STA. 6+16.00 R2
TO
STA. 30+16.00 R2

2024 SHEET 9 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		11

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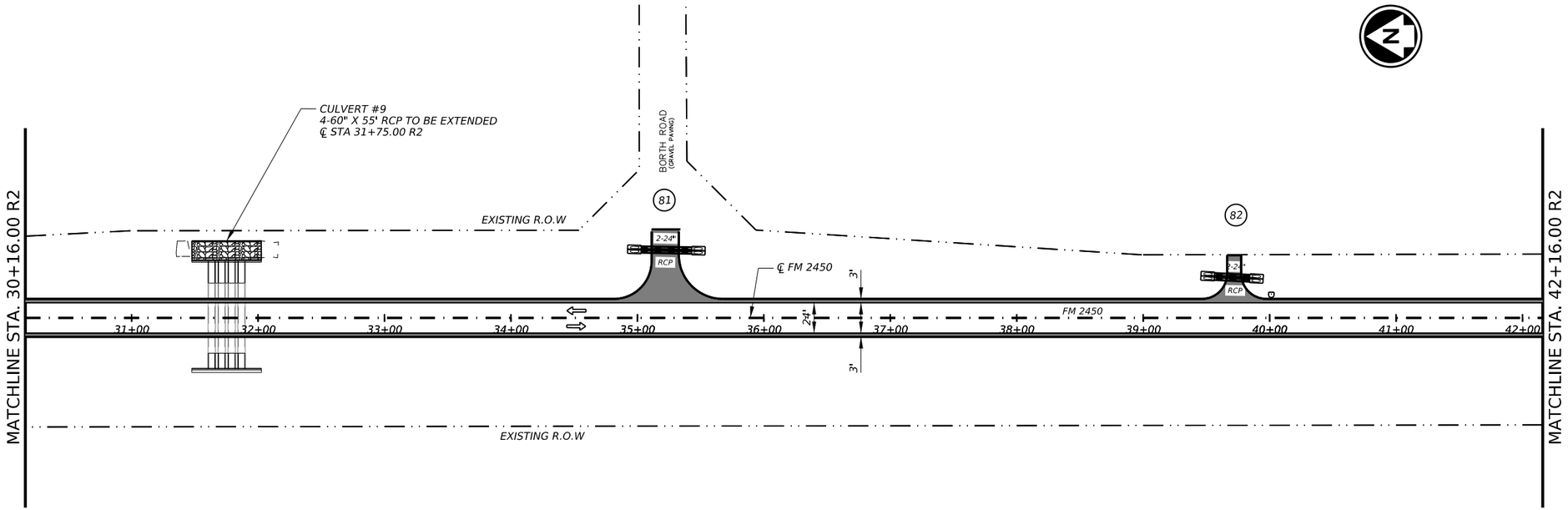

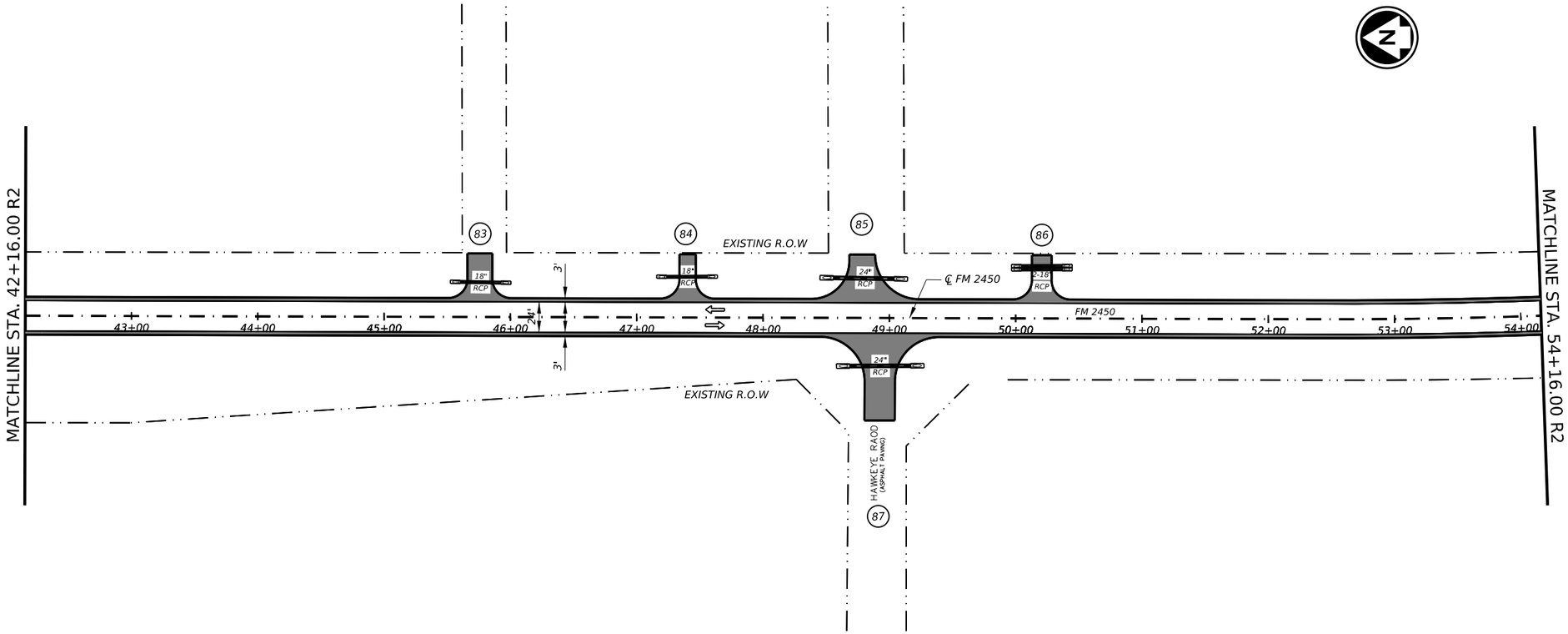

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SCALE IN FEET

PROPOSED CONSTRUCTION

STATE OF TEXAS
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PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E08E4988AED4E4...

Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 30+16.00 R2
TO
STA. 54+16.00 R2

2024 SHEET 10 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		12

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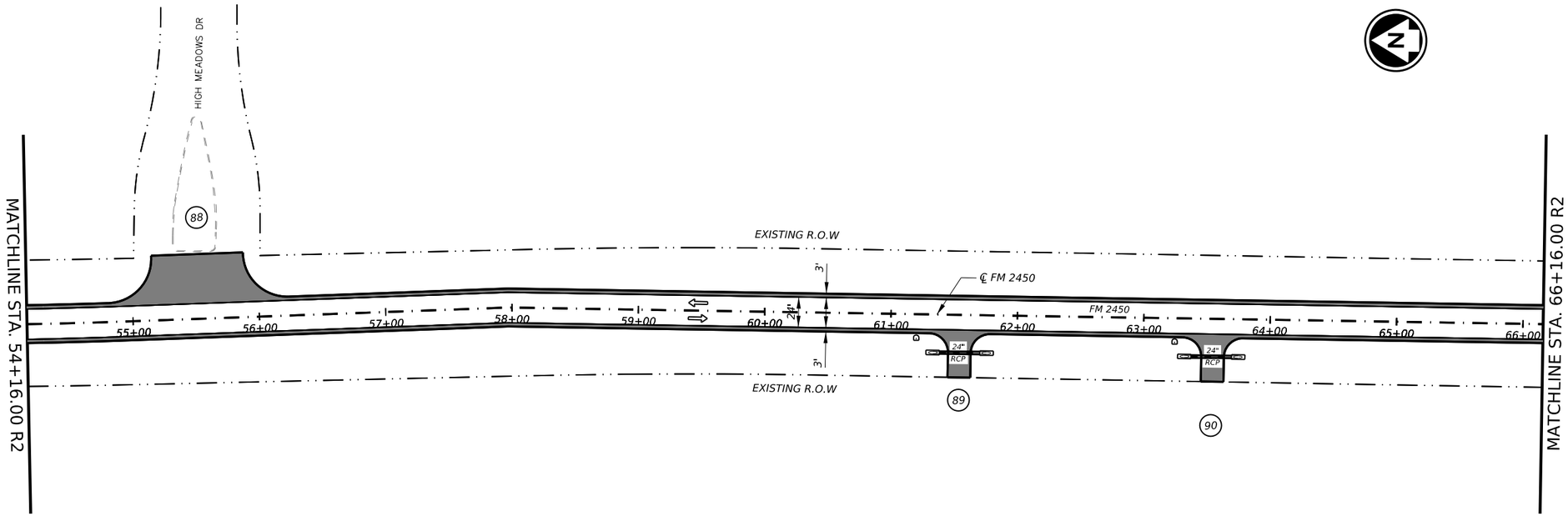

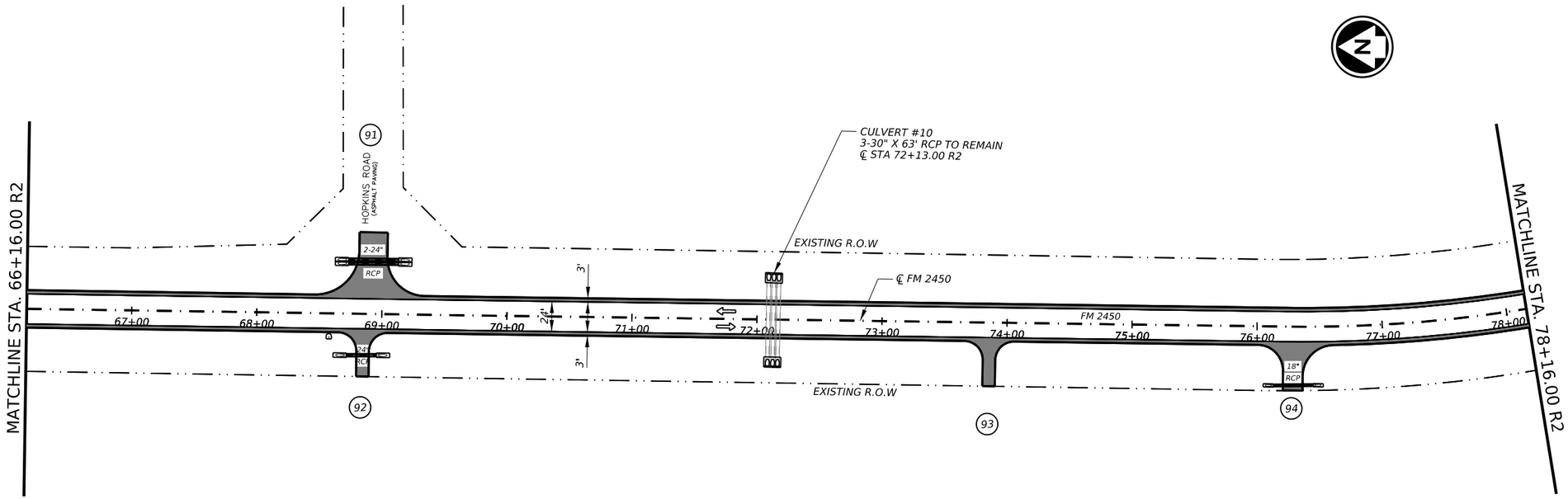

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SCALE IN FEET

PROPOSED CONSTRUCTION

STATE OF TEXAS
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7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 54+16.00 R2
TO
STA. 78+16.00 R2

2024 SHEET 11 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		13

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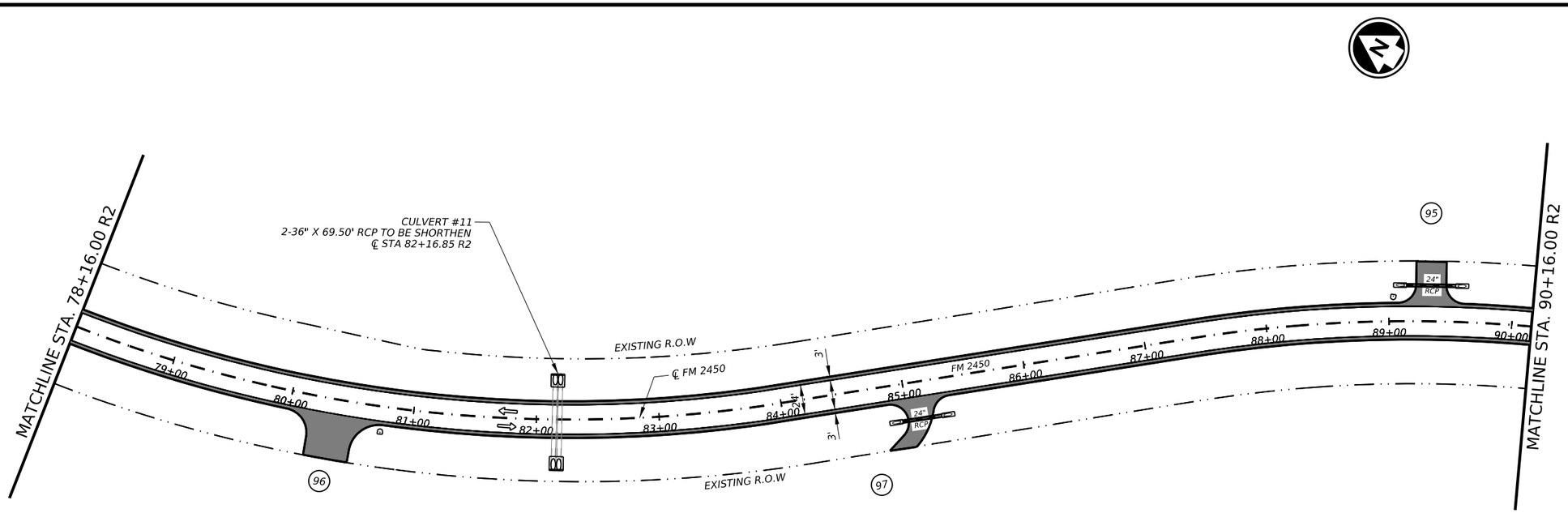

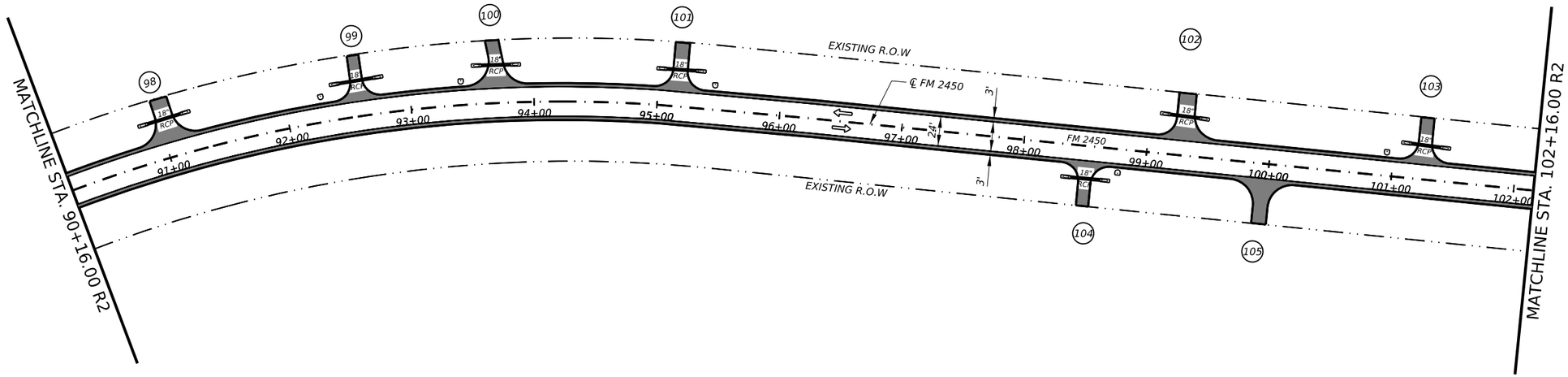

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SCALE IN FEET

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DocuSigned by:
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7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 78+16.00 R2
TO
STA. 102+16.00 R2

2024 SHEET 12 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		14

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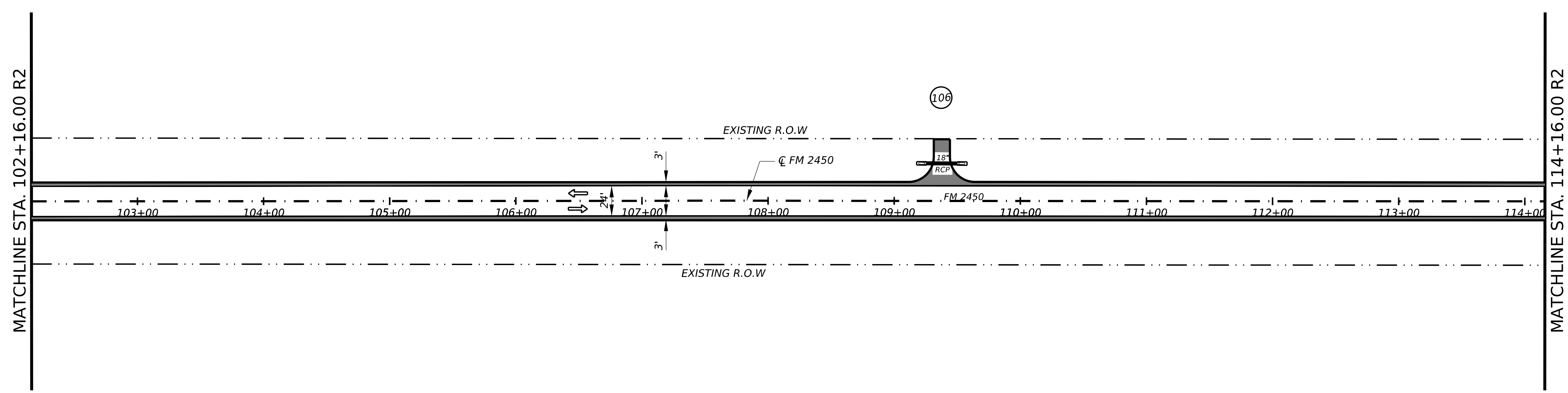

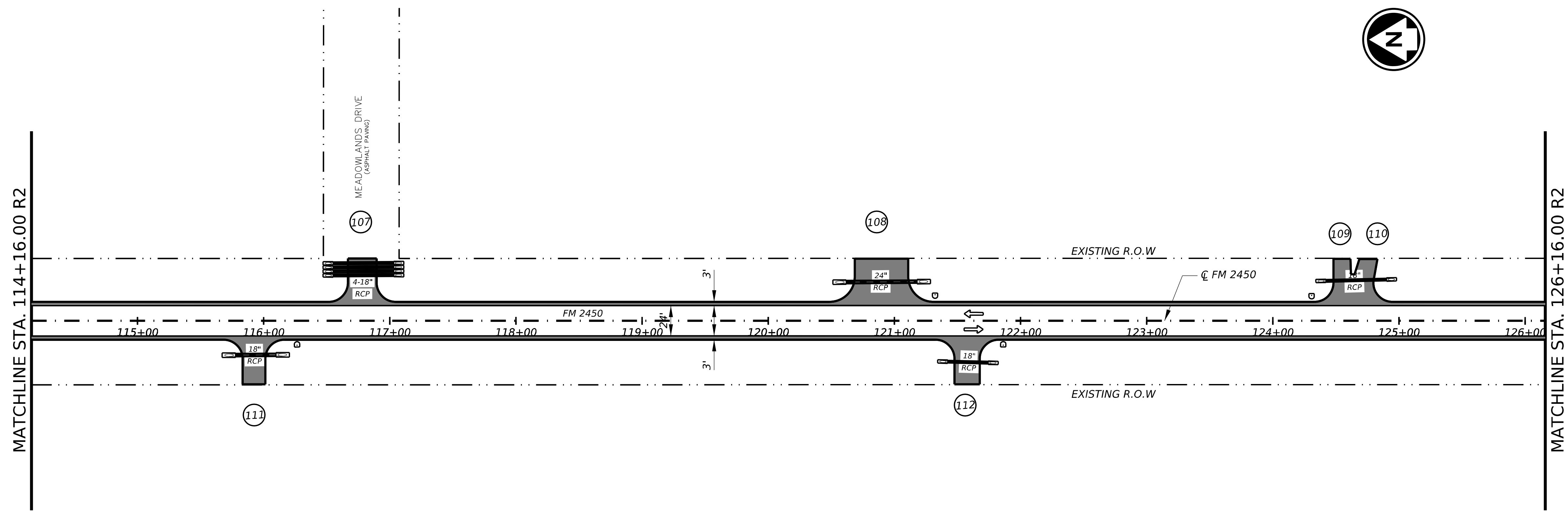

PROPOSED CONSTRUCTION

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
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Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 102+16.00 R2
TO
STA. 126+16.00 R2

2024 SHEET 13 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		15

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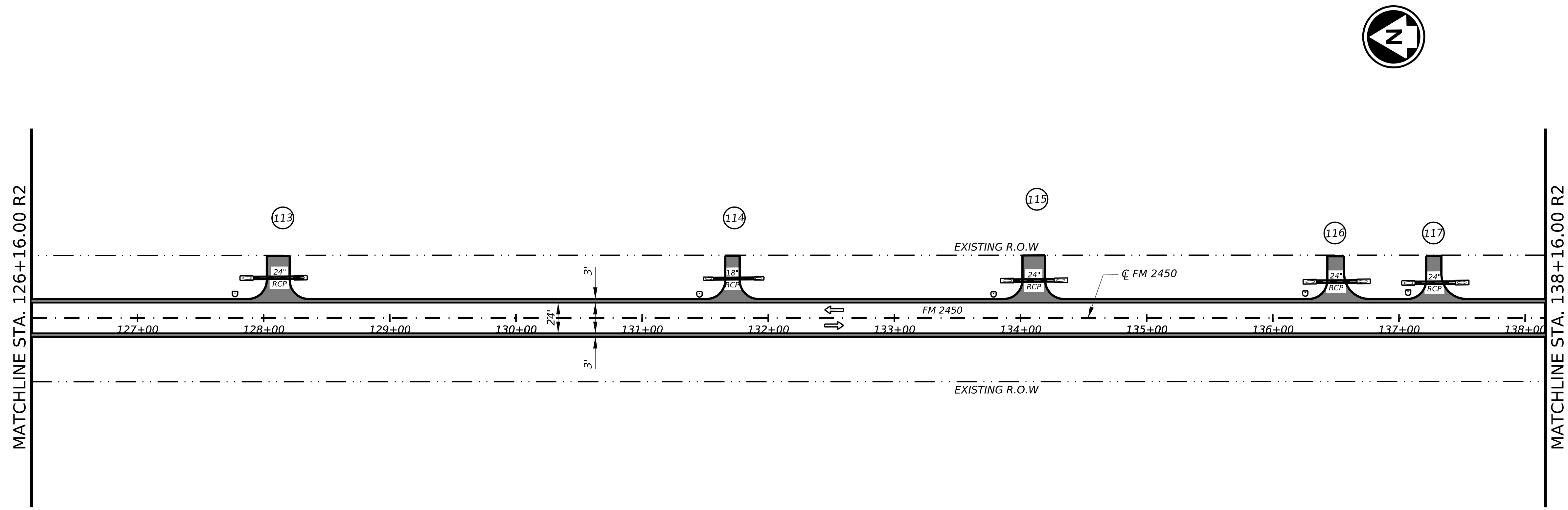

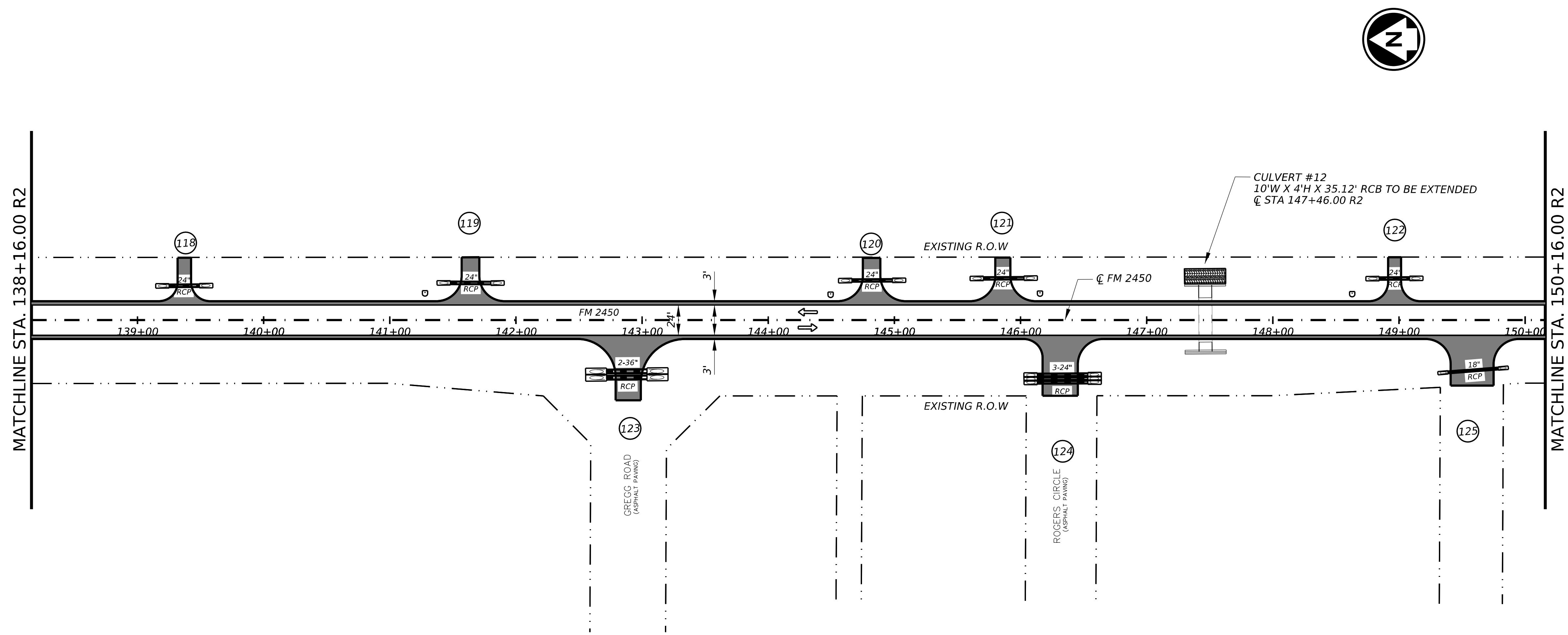

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PROPOSED CONSTRUCTION

STATE OF TEXAS
HRAM MANG
141660
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PROFESSIONAL ENGINEER

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Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 126+16.00 R2
TO
STA. 150+16.00 R2

2024 SHEET 14 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST		COUNTY	SHEET NO.
DAL		DENTON	16

DATE: 2/22/2024 1:48:22 PM
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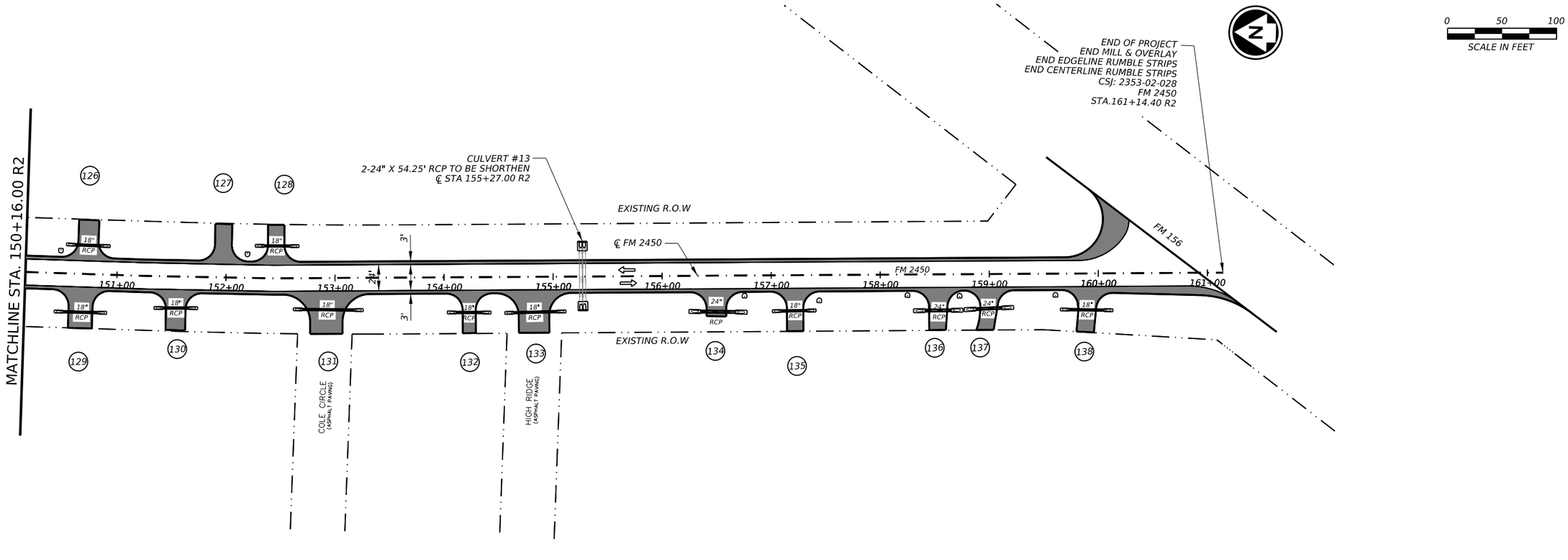

PROPOSED CONSTRUCTION

STATE OF TEXAS
HRAM MANG
141660
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PROFESSIONAL ENGINEER

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2/28/2024

Texas Department of Transportation

FM 2450

PROJECT LAYOUT
STA. 150+16.00 R2
TO
STA 161+14.41 R2

2024 SHEET 15 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		17

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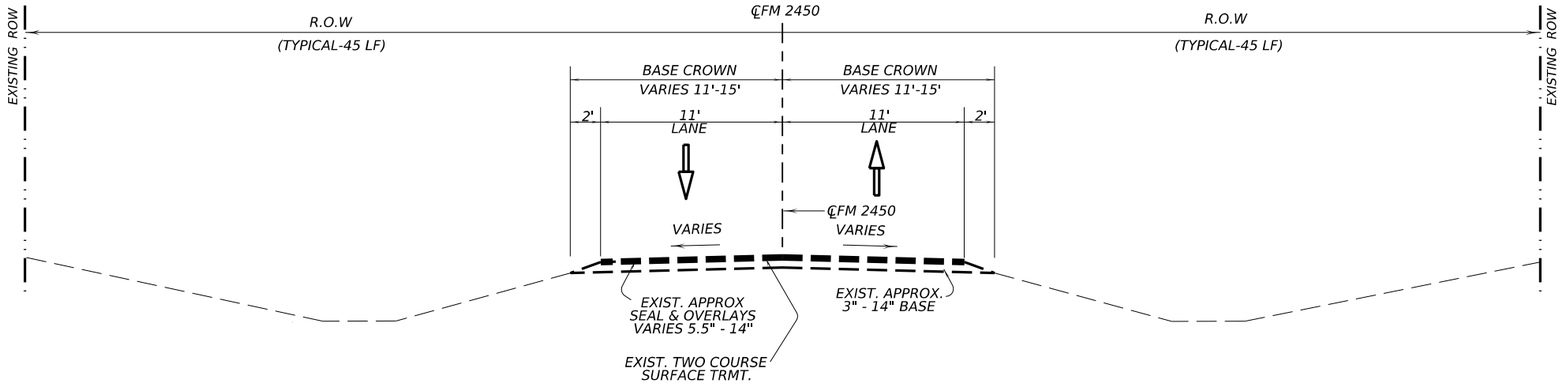
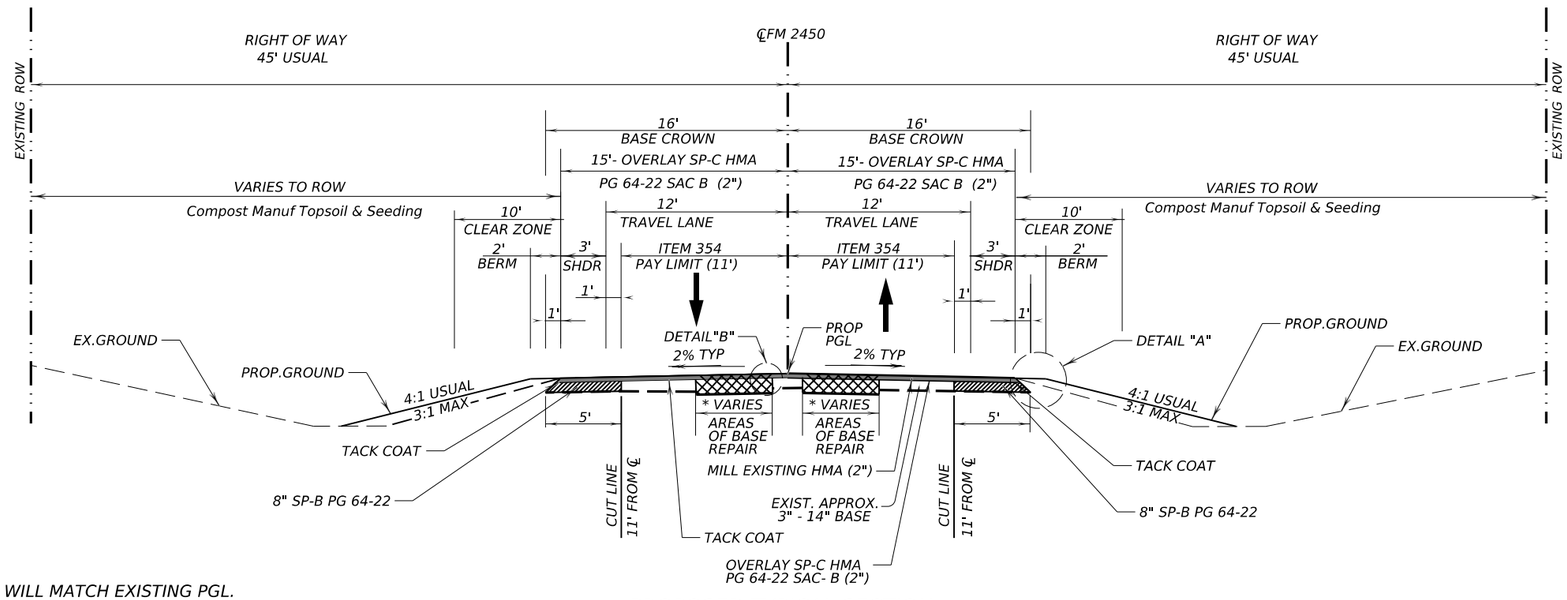


EXISTING TYPICAL SECTION

FM 455 TO FM 156
FROM STA. 0+28.40 R1 TO STA. 161+14.40 R2



PROPOSED TYPICAL SECTION

FM 455 TO FM 156
FROM STA. 0+28.40 R1 TO STA. 32+23.00 R1
FROM STA. 35+78.00 R1 TO STA. 161+14.40 R2

NOTES:

(1) PROPOSED PGL WILL MATCH EXISTING PGL.

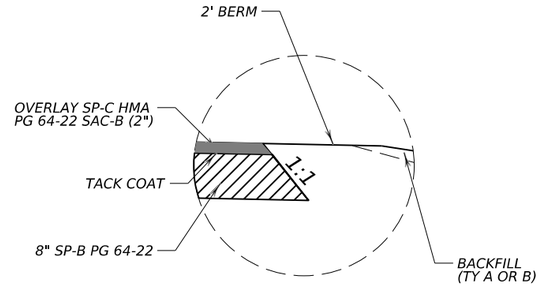
(2) SAW CUT 11 FT FROM CENTER FOR SHOULDER WIDENING.

(3) SEE PROJECT LAYOUTS FOR SHOULDER WIDENING.

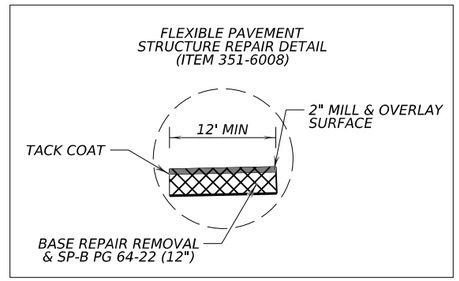
(4) RESTRIPE PAVEMENT MARKING FROM STA. 0+28.40 R1 TO STA.161+14.40 R2.

(5) CROSS SLOPE MAY VARY IN SUPERELEVATED SECTIONS.

(6) *BASE REPAIR LOCATIONS TO BE DETERMINED BY THE ENGINEER.



DETAIL "A"



DETAIL "B"

STATE OF TEXAS
HRAM MANG
141660
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PROFESSIONAL ENGINEER

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4/5/2024

Texas Department of Transportation

FM 2450

TYPICAL SECTIONS

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		18

DATE: 4/5/2024 5:09:14 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/2353020028/4 - Design/Plan Set/1. General/Typical Section.dgn

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Core No.	Latitude	Longitude	Date Drilled	Concrete * (in.)	Asphalt * (in.)	Flexible Base (in.)
P-1	33.26586°	-97.23568°	11/18/2019	-	10.0	5.0
P-2	33.26988°	-97.23574°	11/19/2019	-	12.0	14.0
P-3	33.274000°	-97.23562°	11/18/2019	-	8.0	6.0
P-4	33.278116°	-97.23556°	11/19/2019	-	10.0	7.0
P-5	33.282237°	-97.23545°	11/18/2019	-	9.0	3.0
P-6	33.286066°	-97.23663°	11/19/2019	-	10.0	4.0
P-7	33.289924°	-97.23775°	11/18/2019	-	8.0	3.0
P-8	33.294045°	-97.23775°	11/19/2019	-	13.0	6.0
P-9	33.298155°	-97.23766°	11/21/2019	-	8.0	9.0
P-10	33.30226°	-97.23760°	11/19/2019	-	14.0	7.0
P-11	33.30637°	-97.23747°	11/25/2019	-	3.0	8.5
P-12	33.31050°	-97.23740°	11/21/2019	-	10.0	6.0
P-13	33.31463°	-97.23733°	11/25/2019	-	13.0	7.5
P-14	33.31859°	-97.23816°	12/9/2019	-	12.0	6.0
P-15	33.32257°	-97.23899°	11/25/2019	-	5.5	8.0
P-16	33.32670°	-97.23890°	12/9/2019	-	9.0	5.0
P-17	33.33081°	-97.23874°	11/25/2019	-	12.5	5.0
P-18	33.33493°	-97.23862°	12/9/2019	-	10.0	6.0
P-19	33.33905°	-97.23845°	11/25/2019	-	12.5	6.0
P-20	33.34316°	-97.23831°	12/9/2019	-	10.0	6.0
P-21	33.34728°	-97.23814°	11/25/2019	-	9.0	6.0

* Refer to core pictures for the top and bottom section

FUGRO USA LAND, INC.	PAVEMENT CORE	PLATE
2880 Virgo Lane	FM 2450 CSJ 2353-02-026	C1
Dallas, TX 75229	Denton County, Texas	
1/23/2020	Project No. 04.40191087	

DocuSign Envelope ID: 2CE2DA67-B4EF-40C1-BA39-914E6E8CEC10

Core No.	Latitude	Longitude	Date Drilled	Concrete (in.)	Asphalt (in.)	Flexible Base (in.)
P-22	33.35116°	-97.23984°	11/26/2019	-	7.0	6.0
P-23	33.35465°	-97.24236°	11/25/2019	-	13.0	6.0
P-24	33.35796°	-97.24527°	11/18/2019	-	9.0	7.0
P-25	33.36210°	-97.24537°	11/26/2019	-	6.0	6.0
P-26	33.36621°	-97.24529°	11/18/2019	-	12.0	6.0
P-27	33.37018°	-97.24604°	11/26/2019	-	13.0	7.0
P-28	33.37182°	-97.25044°	11/18/2019	-	10.0	6.0
P-29	33.37532°	-97.25277°	11/26/2019	-	15.0	7.0
P-30	33.37932°	-97.25375°	11/18/2019	-	10.0	7.0
P-31	33.38344°	-97.25357°	11/26/2019	-	9.0	6.0
P-32	33.38738°	-97.25439°	11/18/2019	-	8.0	6.0
P-33	33.39091°	-97.25641°	11/26/2019	-	14.0	2.0
P-34	33.39498°	-97.25675°	11/18/2019	-	5.0	6.0
P-35	33.39772°	-97.26032°	11/26/2019	-	5.5	6.0
P-36	33.40173°	-97.26092°	11/18/2019	-	9.0	7.0
P-37	33.40584°	-97.26082°	11/26/2019	-	12.0	4.0
P-38	33.40997°	-97.26076°	12/12/2019	-	6.0	5.0
P-39	33.41409°	-97.26064°	12/12/2019	-	7.0	4.0
P-40	33.41821°	-97.26058°	12/12/2019	-	10.0	4.0
P-41	33.42233°	-97.26053°	12/12/2019	-	6.5	6.0
P-42	33.42422°	-97.26051°	12/12/2019	-	11.0	4.0

* Refer to core pictures for the top and bottom section

FUGRO USA LAND, INC.	PAVEMENT CORE	PLATE
2880 Virgo Lane	FM 2450 CSJ 2353-02-026	C2
Dallas, TX 75229	Denton County, Texas	
1/23/2020	Project No. 04.40191087	

STATE OF TEXAS
HRAM MANG
141660
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Hram Mang
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2/22/2024

Texas Department of Transportation

FM 2450

CORE DATA

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		19

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FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Plan Set/1. General/FM2450_COREDATA.dgn

SPECIFICATION DATA

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

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

Table 2: Basis of Estimate for Permanent Construction					
Item	Description	Thickness	Rate		Quantity
162	Block Sod	N/A	See Specifications		11903 SY
164	Drill Seed (Perm) (R) (C)	N/A	See Specifications		257851 SY
166 *	Fertilizer (12-6-6)	N/A	500	Lbs./Ac	14 Ton
168	Vegetative Watering (Warm)**	N/A	12	MG/Ac/Day	40125 MG
3077	SP MIXES	See Plans	110	Lbs./SY/In	27727 Ton
3077	Tack Coat (Undiluted Application Rate)	Milled HMA	0.11	Gal/SY	16519 Gal
*For contractor's information only **Use Summer rate for calculation, adjust for actual field conditions/temperatures as necessary. See Vegetation Establishment Plan Sheet for estimated daily rates.					
Note: (1) Base material weight based on 1.50 Ton/CY (dry- compacted) (2) Asphalt weight based on 110 Lbs./SY/In (3) Subgrade weight based on 1.5 Ton/CY (dry-compacted)					

Table 3: Basis of Estimate for Temporary Erosion Control Items				
Item	Description	Rate		Quantity
164	Drill Seeding (Temp) (Warm or Cool)	See Specifications		128926 SY
166*	Fertilizer (12-6-6)	500	Lb/Ac	7 Ton
168	Vegetative Watering (Warm)**	12	MG/Ac/Day	20063 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 55.73 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 permits with environmental resources agencies. 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.

Questions may be submitted via the Letting Pre-Bid Q&A web page. This webpage can be accessed from the Notice to Contractors dashboard located at the following Address:

CSJ:2353-02-028

County: DENTON

Highway: FM 2450

https://tableau.txdot.gov/views/ProjectInformationDashboard/NoticetoContractors

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

Amanda Miller *Amanda.Miller@txdot.gov*
Christopher Rocha *Christopher.Rocha@txdot.gov*

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

All contractor questions will be reviewed by the Engineer. All questions and any corresponding responses that are generated will be posted through the same Letting Pre-Bid Q&A web page.

The Letting Pre-Bid Q&A web page for each project can be accessed by using the dashboard to navigate to the project you are interested in by scrolling or filtering the dashboard using the controls on the left. Hover over the blue hyperlink for the project you want to view the Q&A for and click on the link in the window that pops up.

Cross sections may be requested by posting a question to the above Letting Pre-Bid Q&A web page. 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.

CSJ:2353-02-028

County: DENTON

Highway: FM 2450

Item 6:

To comply with the latest provisions of Build America, Buy America Act (BABA Act) of the Bipartisan Infrastructure Law, the contractor must submit an original of the TxDOT Construction Material Buy America Certification Form for all items classified as construction materials. This form is not required for materials classified as a manufactured product.

Refer to the Buy America Material Classification Sheet for clarification on material categorization.

The Buy America Material Classification Sheet is located at the below link. https://www.txdot.gov/business/resources/materials/buy-america-material-classification-sheet.html for clarification on material categorization.

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).

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

Lane and ramp closures during the following key dates and/or special events are prohibited and other dates as directed:

This is a list the dates and/or events lane and ramp closures will be prohibited:

Events		Dates
1	Texas Motor Speedway- NASCAR Series Races	April and November
2	Texas Motor Speedway- INDY Series Races	June and September

Item 8:

This Project will be a Standard Workweek

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

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

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

Item 100:

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

The limits of preparing right of way will be measured from Sta. 0+28.40 R1 to Sta. 161+14.40 R2 along the centerline of construction.

Item 104:

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

Items 105,354:

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

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

Properly dispose of unsalvageable material at your own expense.

Item 110:

Excavated shale is not an acceptable material for embankment.

Items 110 and 132:

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

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

Item 132:

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

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

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

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

Item 134:

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

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

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:2353-02-028

County: DENTON

Highway: FM 2450

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 301:

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

Item 320:

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

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

Item 354:

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

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

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

CSJ:2353-02-028

County: DENTON

Highway: FM 2450

Item 400:

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

Item 420:

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

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

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

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

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

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

Item 421:

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

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

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

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

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

Item 464:

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

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

Item 500:

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

Item 502:

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

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

Provide 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.

Limit lane closures along FM 2450 to the hours between 9:00 am and 3:30 pm. Work in other areas of the project is not restricted to this time frame.

Traffic Control Plans with Lane Closures causing back-ups of 8 minutes or greater in duration will be modified by the Engineer up to and including removal of the lane closure.

Additional lanes may be closed, started earlier, or extended later with written permission of the Engineer.

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 3 on the service roads.

Item 644:

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

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

Item 662 and 672:

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

Item 730:

At the discretion of the Engineer, mow non-paved areas within the project prior to placement of permanent vegetation. Mow up to two (2) 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-B and SP-C.

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
(1-6)-18		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.

The TMA/TA used for installation/removal of traffic control for a work area will be subsidiary to the TMA/TA used to perform the work.

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 2353-02-028 **DISTRICT** Dallas **COUNTY** Denton
HIGHWAY FM 2450

						TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB		**2353-02-028**			
		PROJECT ID		**A00176134**			
		COUNTY		**Denton**			
		HIGHWAY		**FM 2450**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	100-6002	PREPARING ROW	STA	340.040		340.040	
	104-6009	REMOVING CONC (RIPRAP)	SY	419.000		419.000	
	104-6017	REMOVING CONC (DRIVEWAYS)	SY	1,904.000		1,904.000	
	105-6043	REMOVING STAB BASE & ASPH PAV (0-6")	SY	13,990.000		13,990.000	
	105-6046	REMOVING STAB BASE & ASPH PAV (0"-10")	SY	7,557.000		7,557.000	
	110-6001	EXCAVATION (ROADWAY)	CY	14,941.000		14,941.000	
	132-6006	EMBANKMENT (FINAL)(DENS CONT)(TY C)	CY	20,200.000		20,200.000	
	134-6004	BACKFILL (TY A OR B)	STA	340.040		340.040	
	161-6017	COMPOST MANUF TOPSOIL (4")	SY	269,754.000		269,754.000	
	162-6002	BLOCK SODDING	SY	11,903.000		11,903.000	
	164-6035	DRILL SEEDING (PERM) (RURAL) (CLAY)	SY	257,851.000		257,851.000	
	164-6051	DRILL SEED (TEMP)(WARM OR COOL)	SY	128,926.000		128,926.000	
	168-6001	VEGETATIVE WATERING	MG	60,188.000		60,188.000	
	351-6008	FLEXIBLE PAVEMENT STRUCTURE REPAIR(12")	SY	2,000.000		2,000.000	
	354-6045	PLANE ASPH CONC PAV (2")	SY	91,688.000		91,688.000	
	403-6001	TEMPORARY SPL SHORING	SF	1,632.000		1,632.000	
	432-6001	RIPRAP (CONC)(4 IN)	CY	41.000		41.000	
	432-6051	RIPRAP (STONE COMMON)(GROUT)(18 IN)	CY	287.000		287.000	
	462-6101	CONC BOX CULV (10 FT X 4 FT)	LF	22.000		22.000	
	464-6003	RC PIPE (CL III)(18 IN)	LF	2,413.000		2,413.000	
	464-6005	RC PIPE (CL III)(24 IN)	LF	1,846.000		1,846.000	
	464-6007	RC PIPE (CL III)(30 IN)	LF	76.000		76.000	
	464-6008	RC PIPE (CL III)(36 IN)	LF	240.000		240.000	
	464-6010	RC PIPE (CL III)(48 IN)	LF	152.000		152.000	
	464-6011	RC PIPE (CL III)(54 IN)	LF	3.000		3.000	
	464-6012	RC PIPE (CL III)(60 IN)	LF	238.000		238.000	
	466-6057	HEADWALL (CH - FW - 45) (DIA= 54 IN)	EA	1.000		1.000	
	466-6103	HEADWALL (CH - PW - 0) (DIA= 48 IN)	EA	2.000		2.000	
	466-6105	HEADWALL (CH - PW - 0) (DIA= 60 IN)	EA	4.000		4.000	
	466-6136	HEADWALL (CH - PW - S) (DIA= 48 IN)	EA	2.000		2.000	
	466-6138	HEADWALL (CH - PW - S) (DIA= 60 IN)	EA	2.000		2.000	
	466-6195	WINGWALL (PW - 2) (HW=6 FT)	EA	2.000		2.000	
	467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	140.000		140.000	
	467-6388	SET (TY II) (24 IN) (RCP) (3: 1) (C)	EA	2.000		2.000	
	467-6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)	EA	106.000		106.000	
	467-6417	SET (TY II) (30 IN) (RCP) (3: 1) (C)	EA	2.000		2.000	
	467-6419	SET (TY II) (30 IN) (RCP) (4: 1) (C)	EA	2.000		2.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 2353-02-028 **DISTRICT** Dallas **COUNTY** Denton
HIGHWAY FM 2450

			CONTROL SECTION JOB		**2353-02-028**	TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00176134**		
			COUNTY		**Denton**		
			HIGHWAY		**FM 2450**		
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	467-6423	SET (TY II) (30 IN) (RCP) (6: 1) (P)	EA	6.000		6.000	
	467-6448	SET (TY II) (36 IN) (RCP) (3: 1) (C)	EA	4.000		4.000	
	467-6454	SET (TY II) (36 IN) (RCP) (6: 1) (P)	EA	12.000		12.000	
	467-6474	SET (TY II) (48 IN) (RCP) (3: 1) (C)	EA	4.000		4.000	
	467-6480	SET (TY II) (48 IN) (RCP) (6: 1) (P)	EA	2.000		2.000	
	480-6001	CLEAN EXIST CULVERTS	EA	13.000		13.000	
	496-6004	REMOV STR (SET)	EA	120.000		120.000	
	496-6005	REMOV STR (WINGWALL)	EA	2.000		2.000	
	496-6006	REMOV STR (HEADWALL)	EA	13.000		13.000	
	496-6007	REMOV STR (PIPE)	LF	4,257.000		4,257.000	
	496-6008	REMOV STR (BOX CULVERT)	LF	2.000		2.000	
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	11.000		11.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	1,415.000		1,415.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	1,415.000		1,415.000	
	506-6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	78.000		78.000	
	506-6024	CONSTRUCTION EXITS (REMOVE)	SY	78.000		78.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	3,900.000		3,900.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	3,900.000		3,900.000	
	506-6041	BIODEG EROSN CONT LOGS (INSTL) (12")	LF	4,163.000		4,163.000	
	506-6043	BIODEG EROSN CONT LOGS (REMOVE)	LF	4,163.000		4,163.000	
	530-6005	DRIVEWAYS (ACP)	SY	12,829.000		12,829.000	
	530-6017	DRIVEWAYS (CONC) (HES)	SY	1,587.000		1,587.000	
	533-6001	RUMBLE STRIPS (SHOULDER)	LF	61,630.000		61,630.000	
	533-6002	RUMBLE STRIPS (CENTERLINE)	LF	34,315.000		34,315.000	
	560-6011	MAILBOX INSTALL-S (TWW-POST) TY 4	EA	58.000		58.000	
	560-6013	MAILBOX INSTALL-M (TWW-POST) TY 4	EA	7.000		7.000	
	644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	33.000		33.000	
	644-6004	IN SM RD SN SUP&AM TY10BWG(1)SA(T)	EA	5.000		5.000	
	644-6033	IN SM RD SN SUP&AM TYS80(1)SA(U)	EA	7.000		7.000	
	658-6099	INSTL OM ASSM (OM-2Z)(WFLX)GND	EA	26.000		26.000	
	662-6111	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	EA	6,806.000		6,806.000	
	666-6018	REFL PAV MRK TY I (W)6"(DOT)(100MIL)	LF	27.000		27.000	
	666-6048	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	LF	311.000		311.000	
	666-6225	PAVEMENT SEALER 6"	LF	1,420.000		1,420.000	
	666-6309	RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)	LF	96,560.000		96,560.000	
	666-6318	RE PM W/RET REQ TY I (Y)6"(BRK)(100MIL)	LF	6,560.000		6,560.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 2353-02-028 **DISTRICT** Dallas **COUNTY** Denton
HIGHWAY FM 2450

						TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB		**2353-02-028**			
		PROJECT ID		**A00176134**			
		COUNTY		**Denton**			
		HIGHWAY		**FM 2450**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	666-6321	RE PM W/RET REQ TY I (Y)6"(SLD)(100MIL)	LF	30,622.000		30,622.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	713.000		713.000	
	677-6001	ELIM EXT PAV MRK & MRKS (4")	LF	1,420.000		1,420.000	
	678-6002	PAV SURF PREP FOR MRK (6")	LF	1,420.000		1,420.000	
	730-6107	FULL - WIDTH MOWING	CYC	2.000		2.000	
	3077-6001	SP MIXES SP-B PG64-22	TON	14,943.000		14,943.000	
	3077-6013	SP MIXES SP-C SAC-B PG64-22	TON	12,784.000		12,784.000	
	3077-6075	TACK COAT	GAL	16,519.000		16,519.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN	EA	2.000		2.000	
	6185-6002	TMA (STATIONARY)	DAY	250.000		250.000	
	6185-6003	TMA (MOBILE OPERATION)	HR	200.000		200.000	
	18	EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000		1.000	
		SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000	

CK:
DW:
CK:
DW:

SUMMARY OF ROADWAY ITEMS

LOCATION	100 6002	105 6046	110 6001	132 6006	134 6004	351 6008	354 6045	533 6001	533 6002	560 6011	560 6013	3077 6001	3077 6013	3077 6075
	PREPARING ROW	REMOVING STAB BASE & ASPH PAV (0"-10")	EXCAVATION (ROADWAY)	EMBANKMENT (FINAL)(DENS CONT)(TY C)	BACKFILL (TY A OR B)	FLEXIBLE PAVEMENT STRUCTURE REPAIR(12")	PLANE ASPH CONC PAV (2")	RUMBLE STRIPS (SHOULDER)	RUMBLE STRIPS (CENTERLINE)	MAILBOX INSTALL-S (TWW-POST) TY 4	MAILBOX INSTALL-M (TWW-POST) TY 4	SP MIXES SP-B PG64-22	SP MIXES SP-C SAC-B PG64-22	TACK COAT
	STA	SY	CY	CY	STA	SY	SY	LF	LF	EA	EA	TON	TON	GAL
FM 2450	340.04	7557	14941	20200	340.04	2000	91688	61630	34315	58	7	14943	12784	16519
PROJECT TOTALS	**340.04**	**7557**	**14941**	**20200**	**340.04**	**2000**	**91688**	**61630**	**34315**	**58**	**7**	**14943**	**12784**	**16519**

SUMMARY OF EROSION CONTROL ITEMS

LOCATION	161 6017	162 6002	164 6035	164 6051	168 6001	506 6002	506 6011	506 6020	506 6024	506 6038	506 6039	506 6041	506 6043	730 6107
	COMPOST MANUF TOPSOIL (4")	BLOCK SODDING	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	SY	MG	LF	LF	SY	SY	LF	LF	LF	LF	CYC
FM 2450	269754	11903	257851	128926	60188	1415	1415	78	78	3900	3900	4163	4163	2
PROJECT TOTALS	**269754**	**11903**	**257851**	**128926**	**60188**	**1415**	**1415**	**78**	**78**	**3900**	**3900**	**4163**	**4163**	**2**

SUMMARY OF SIGNING AND PAVEMENT MARKING ITEMS

LOCATION	644 6001	644 6004	644 6033	658 6099	666 6018	666 6048	666 6225	666 6309	666 6318	666 6321	672 6009	677 6001	678 6002
	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 TYS80(1)SA(U)	INSTL OM ASSM (OM-2Z)(WFLX)GND	REFL PAV MRK TY I (W)6"(DOT)(100MIL)	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	PAVEMENT SEALER 6"	RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)	RE PM W/RET REQ TY I (Y)6"(BRK)(100MIL)	RE PM W/RET REQ TY I (Y)6"(SLD)(100MIL)	REFL PAV MRKR TY II-A-A	ELIM EXT PAV MRK & MRKS (4")	PAV SURF PREP FOR MRK (6")
	EA	EA	EA	EA	LF	LF	LF	LF	LF	LF	EA	LF	LF
FM 2450	33	5	7	26	27	311	1420	96560	6560	30622	713	1420	1420
PROJECT TOTAL	**33**	**5**	**7**	**26**	**27**	**311**	**1420**	**96560**	**6560**	**30622**	**713**	**1420**	**1420**

SUMMARY OF WORKZONE TRAFFIC CONTROL ITEMS

LOCATION	502 6001	662 6111	6001 6002	6185 6002	6185 6003
	BARRICADES, SIGNS AND TRAFFIC HANDLING	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	PORTABLE CHANGEABLE MESSAGE SIGN	TMA (STATIONARY)	TMA (MOBILE OPERATION)
	MO	EA	EA	DAY	HR
FM 2450	11	6806	2	250	200
PROJECT TOTALS	**11**	**6806**	**2**	**250**	**200**

Texas Department of Transportation

FM 2450

ROADWAY SUMMARY SHEET

2024 *SHEET 1 OF 1*

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		23

DATE: 4/4/2024 2:29:55 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/2353028/4 - Design/Plan Set/1. General/FM2450_SUMMARY SHEETS.dgn

SUMMARY OF DRAINAGE ITEMS

LOCATION	104 6009	403 6001	432 6001	432 6051	462 6101	464 6007	464 6010	464 6011	464 6012	466 6057	466 6103	466 6105	466 6136	466 6138	466 6195	467 6388	467 6417	467 6419
	REMOVING CONC (RIPRAP)	TEMPORARY SPL SHORING	RIPRAP (CONC)(4 IN)	RIPRAP (STONE COMMON)(GROUT)(18 IN)	CONC BOX CULV (10 FT X 4 FT)	RC PIPE (CL III)(30 IN)	RC PIPE (CL III)(48 IN)	RC PIPE (CL III)(54 IN)	RC PIPE (CL III)(60 IN)	HEADWALL (CH - FW - 45) (DIA= 54 IN)	HEADWALL (CH - PW - 0) (DIA= 48 IN)	HEADWALL (CH - PW - 0) (DIA= 60 IN)	HEADWALL (CH - PW - S) (DIA= 48 IN)	HEADWALL (CH - PW - S) (DIA= 60 IN)	WINGWALL (PW - 2) (HW=6 FT)	SET (TY II) (24 IN) (RCP) (3: 1) (C)	SET (TY II) (30 IN) (RCP) (3: 1) (C)	SET (TY II) (30 IN) (RCP) (4: 1) (C)
	SY	SF	CY	CY	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA
CULVERT 1							24											
CULVERT 2	57							3		1								
CULVERT 3	108		10				42				2							
CULVERT 4	61		17	131			54						2					
CULVERT 5	145	408	16	34					72					2				
CULVERT 6																		
CULVERT 7						4												2
CULVERT 8		374		53					42			2						
CULVERT 9	48	520		47					124			2						
CULVERT 10																	2	
CULVERT 11																		
CULVERT 12		330		22	22										2			
CULVERT 13																2		
PROJECT TOTALS	**419**	**1632**	**43**	**287**	**22**	**4**	**120**	**3**	**238**	**1**	**2**	**4**	**2**	**2**	**2**	**2**	**2**	**2**

SUMMARY OF DRAINAGE ITEMS

LOCATION	*467 6448*	*467 6474*	*480 6001*	*496 6005*	*496 6006*	*496 6007*	*496 6008*
	SET (TY II) (36 IN) (RCP) (3: 1) (C)	*SET (TY II) (48 IN) (RCP) (3: 1) (C)*	*CLEAN EXIST CULVERTS*	*REMOV STR (WINGWALL)*	*REMOV STR (HEADWALL)*	*REMOV STR (PIPE)*	*REMOV STR (BOX CULVERT)*
	EA	*EA*	*EA*	*EA*	*EA*	*LF*	*LF*
CULVERT 1		*4*	*1*		*2*	*6*	
CULVERT 2			*1*		*1*	*1*	
CULVERT 3			*1*		*2*	*9*	
CULVERT 4			*1*		*2*	*9*	
CULVERT 5			*1*		*2*	*18*	
CULVERT 6	*2*		*1*			*8*	
CULVERT 7			*1*			*2*	
CULVERT 8			*1*		*2*	*9*	
CULVERT 9			*1*		*2*	*8*	
CULVERT 10			*1*				
CULVERT 11	*2*		*1*			*20*	
CULVERT 12			*1*	*2*			*2*
CULVERT 13			*1*			*6*	
PROJECT TOTALS	*4*	*4*	*13*	*2*	*13*	*96*	*2*

Texas Department of Transportation

FM 2450

DRAINAGE SUMMARY SHEET

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		24

DATE: 4/4/2024 2:29:57 PM
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CK: DW: CK: DW:

CSJ 2353-02-028	SUMMARY OF DRIVEWAY ITEMS					104	105	464	464	464	464	464	467	467	467	467	467	496	496	530	530
						6017	6043	6003	6005	6007	6008	6010	6363	6395	6423	6454	6480	6004	6007	6005	6017
DRIVEWAY NO	PLAN SHEET NO.	EXISTING MATERIAL/ TYPE	THROAT WIDTH	R (1)	R (2)	REMOVING CONC (DRIVEWAYS)	REMOVING STAB BASE & ASPH PAV (0-6")	RC PIPE (CL III)(18 IN)	RC PIPE (CL III)(24 IN)	RC PIPE (CL III)(30 IN)	RC PIPE (CL III)(36 IN)	RC PIPE (CL III)(48 IN)	SET (TY II) (18 IN) (RCP) (6: 1) (P)	SET (TY II) (24 IN) (RCP) (6: 1) (P)	SET (TY II) (30 IN) (RCP) (6: 1) (P)	SET (TY II) (36 IN) (RCP) (6: 1) (P)	SET (TY II) (48 IN) (RCP) (6: 1) (P)	REMOV STR (SET)	REMOV STR (PIPE)	DRIVEWAYS (ACP)	DRIVEWAYS (CONC) (HES)
			FT	FT	FT	SY	SY	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	LF	SY	SY
1	1	ASPHALT PAVEMENT	28	15	15		87	36					2							83.8	
2	1	ASPHALT PAVEMENT	20	15	15		59.7	24					2						26	62.6	
3	1	ASPHALT PAVEMENT	15	15	15		86.6	24					2						20	69.8	
4	1	ASPHALT PAVEMENT	50	25	25		252.1	64					2					2	51	231.2	
5	1	ASPHALT PAVEMENT	18.4	45	45		181.4	48					2					2	53	188.6	
5A	1	ASPHALT PAVEMENT	14	15	15		78.5		24					2					34	78.5	
6	2	ASPHALT PAVEMENT	22.1	20	20		129.6													128.8	
7 STAGS LEAP RD	2	ASPHALT PAVEMENT	20	30	60		227.3													205.2	
8 DEER RUN DRIVE	3	CONCRETE PAVEMENT	28.5	30	30	195.3		56					2					2	52		153.3
9	3	ASPHALT PAVEMENT	15	25	25		144.6					32					2		30	112.3	
10	3	ASPHALT PAVEMENT	15	15	15		87.4			72					6				72	93.1	
11	3	ASPHALT PAVEMENT	10	15	15		70.3				48					4			50	61	
12 CROW WRIGHT ROAD	3	ASPHALT PAVEMENT	22.5	35	35		223.6	40					2						37	178.2	
13	3	ASPHALT PAVEMENT	16.9	25	25		107.2		32					2				2	27	95.5	
14	4	ASPHALT PAVEMENT	10	15	15		48.6	24					2						23	48.8	
15	4	ASPHALT PAVEMENT	11	15	15		46.9													64	
16	4	ASPHALT PAVEMENT	24	25	20		121.6	40					2					2	36	117.2	
17	4	ASPHALT PAVEMENT	16	20	20		85.3		32					2				2	22	82.1	
18	4	ASPHALT PAVEMENT	15	15	15		81.1	24					2					2	20	70.6	
19	4	ASPHALT PAVEMENT	20	15	15		109.1	32					2					2	26	90.9	
20	4	ASPHALT PAVEMENT	14.7	15	15		80.1													67.9	
21	4	ASPHALT PAVEMENT	21.5	20	20		113.2	32					2						27	96.3	
22	4	ASPHALT PAVEMENT	10.9	15	15		55.8	24					2						20	49.4	
23	4	ASPHALT PAVEMENT	27	15	15		19.1		40					2					32	122.3	
24	4	ASPHALT PAVEMENT	21	15	15		105	32					2					2	33	99	
25	4	ASPHALT PAVEMENT	29.5	15	3		80.9		48					2				2	44	73.9	
26	4	ASPHALT PAVEMENT	12	3	20		78.3													68.2	
27	4	ASPHALT PAVEMENT	16	20	20		119.4		32					2				2	31	86.4	
28	4	ASPHALT PAVEMENT	11.7	15	2.5		83.6		48					2				2	44	56.7	
29	4	ASPHALT PAVEMENT	9.6	2.5	20		21.9													55.8	
30	5	CONCRETE PAVEMENT	15	15	15	143.7		32					2						27		64.2
31	5	ASPHALT PAVEMENT	12.2	15	15		64.3	24					2						24	64.3	
32	5	ASPHALT PAVEMENT	26.5	20	20		133.4													112.6	
33	5	ASPHALT PAVEMENT	14.1	15	15		77.6	32					2						27	60.6	
34	5	ASPHALT PAVEMENT	18.5	15	15		78.2	32					2						24	75.8	
35 DAVIDSON ROAD	5	ASPHALT PAVEMENT	25	40	40		320.9		40					2					37	329	
36	5	ASPHALT PAVEMENT	15	15	15		56.8		24					2					25	73.5	
37	5	ASPHALT PAVEMENT	14.4	15	15		64.3	32					2						24	60.9	
38	5	ASPHALT PAVEMENT	22	15	15		79.7	32					2					2	24	88.7	
39	5	ASPHALT PAVEMENT	11.5	15	15		62.3	24					2						25	51.9	
40	5	ASPHALT PAVEMENT	18.2	15	15		88.9	32					2						24	75.3	
41	5	ASPHALT PAVEMENT	13.5	15	15		65.4	24					2						21	58.7	
42	5	ASPHALT PAVEMENT	23.2	35	35		195.7	42					2						36	175.9	
43	5	ASPHALT PAVEMENT	20	30	30		122.5	48					2						45	127.3	
43A	5	ASPHALT PAVEMENT	9.4	15	10		37.2	53					2						21	36.6	
43B	5	ASPHALT PAVEMENT	15	10	15		49.3												21	49.3	

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Texas Department of Transportation

FM 2450

DRIVEWAY SUMMARY SHEET

2024 SHEET 1 OF 3

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		25

CSJ 2353-02-028	SUMMARY OF DRIVEWAY ITEMS					104	105	464	464	464	464	464	467	467	467	467	467	496	496	530	530
						6017	6043	6003	6005	6007	6008	6010	6363	6395	6423	6454	6480	6004	6007	6005	6017
DRIVEWAY NO	PLAN SHEET NO.	EXISTING MATERIAL/ TYPE	THROAT WIDTH	R (1)	R (2)	REMOVING CONC (DRIVEWAYS)	REMOVING STAB BASE & ASPH PAV (0-6")	RC PIPE (CL III)(18 IN)	RC PIPE (CL III)(24 IN)	RC PIPE (CL III)(30 IN)	RC PIPE (CL III)(36 IN)	RC PIPE (CL III)(48 IN)	SET (TY II) (18 IN) (RCP) (6: 1) (P)	SET (TY II) (24 IN) (RCP) (6: 1) (P)	SET (TY II) (30 IN) (RCP) (6: 1) (P)	SET (TY II) (36 IN) (RCP) (6: 1) (P)	SET (TY II) (48 IN) (RCP) (6: 1) (P)	REMOV STR (SET)	REMOV STR (PIPE)	DRIVEWAYS (ACP)	DRIVEWAYS (CONC) (HES)
44	6	ASPHALT PAVEMENT	25.5	15	15		131.9													131.9	
45 MICHAEL ROAD	6	ASPHALT PAVEMENT	24	25	25		134.7		42					2				2	35	135.3	
46 STONE GATE DRIVE	6	ASPHALT PAVEMENT	48	30	30		252.8													237.5	
47	6	ASPHALT PAVEMENT	45.9	15	15		335.5													335.48	
48	6	ASPHALT PAVEMENT	29	20	20		171.6		42					2				2	41	131.3	
49	7	ASPHALT PAVEMENT	20	30	30		135.4													121.4	
50	7	ASPHALT PAVEMENT	21.3	15	20		118	42					2					2	30	95.1	
51	7	ASPHALT PAVEMENT	29.9	30	30		179.7		42					2				2	36	162.5	
52	7	ASPHALT PAVEMENT	24	30	60		342.1		84					4					82	298.5	
53	7	ASPHALT PAVEMENT	8.3	20	20		72.6	24					2						25	50.8	
54	7	ASPHALT PAVEMENT	12.7	15	20		55.2													48.8	
55	7	ASPHALT PAVEMENT	15.6	20	20		97.9													74.4	
56	7	ASPHALT PAVEMENT	10	15	20		68.4													50.5	
57	7	ASPHALT PAVEMENT	21.9	20	20		104.1													96.8	
58	7	ASPHALT PAVEMENT	37	15	15		238.9													143.5	
59	7	ASPHALT PAVEMENT	105	15	15		453.6													385.2	
60	7	ASPHALT PAVEMENT	15.3	15	15		71	32					2						26	64.8	
61	7	ASPHALT PAVEMENT	11.2	15	15		71.2		32					2					32	56.9	
62	7	ASPHALT PAVEMENT	13	15	15		73.14		32					2				2	27	64.6	
63	8	ASPHALT PAVEMENT	14.5	15	15		98.5	32					2						31	63.6	
64	8	ASPHALT PAVEMENT	13.7	15	15		88.4	24					2						25	61.8	
65	8	ASPHALT PAVEMENT	10	25	20		63.2	24					2						25	61	
66	8	ASPHALT PAVEMENT	12.1	15	15		67.5		24					2					25	54.2	
67 LUCKY SPUR LANE	8	ASPHALT PAVEMENT	20	40	40		172.6	128						4				2	124	179.8	
68 LUGINBYHI ROAD	8	ASPHALT PAVEMENT	23.2	30	30		296.2		40					2					36	289.3	
69 MUSTANF TRAIL	8	ASPHALT PAVEMENT	25	30	30		156.5				128					4		4	130	161.4	
70	9	ASPHALT PAVEMENT	16.5	25	25		116	32					2					2	33	90.6	
71	9	ASPHALT PAVEMENT	11	15	15		67.3	24					2						27	50.9	
72	9	ASPHALT PAVEMENT	11.5	15	15		50.7	24					2						26	52.5	
73	9	ASPHALT PAVEMENT	17.9	15	15		55.9	32					2						27	74.8	
74	9	ASPHALT PAVEMENT	10.3	15	15		58.6	24					2						25	46.8	
75	9	ASPHALT PAVEMENT	11	20	20		78.5		32					2				2	33	57.9	
76	9	ASPHALT PAVEMENT	10.3	20	20		78.7	32					2						30	55.2	
77	9	ASPHALT PAVEMENT	12	15	10		53.7	24					2						25	58.4	
78	9	ASPHALT PAVEMENT	10.7	10	20		85.7													58.4	
79	9	ASPHALT PAVEMENT	13.2	15	15		65.2		24					2				2	25	57.4	
80	9	CONCRETE PAVEMENT	36.2	25	25	235.6			124					4				4	124		186.2
81 BORTH ROAD	10	ASPHALT PAVEMENT	21.4	30	35		176.3		80					4					74	181.7	
82	10	ASPHALT PAVEMENT	11	20	20		58.8		56					4					22	112.3	
83	10	ASPHALT PAVEMENT	19.7	15	15		92.7	32					2						25	87.9	
84	10	ASPHALT PAVEMENT	12.9	15	15		55.5	32					2						42	61.1	
85	10	ASPHALT PAVEMENT	20.3	30	35		143.6		48					2					47	130.2	
86	10	ASPHALT PAVEMENT	15.6	15	15		59.6	64					4					2	46	71.4	
87 HAWKEYE ROAD	10	ASPHALT PAVEMENT	24	35	35		264.5		48					2					41	234.7	
88	11	ASPHALT PAVEMENT	72.6	35	35		437.1													350.9	
89	11	ASPHALT PAVEMENT	18	15	15		98.2		32					2				2	22	79.9	
90	11	ASPHALT PAVEMENT	18	15	15		81.3		32					2				2	18	80.1	
91 HOPKINS ROAD	11	ASPHALT PAVEMENT	22.6	35	30		183		80					4					74	177	
92	11	ASPHALT PAVEMENT	10	15	15		56.9		24					2				2	23	49.8	

Texas Department of Transportation

FM 2450

DRIVEWAY SUMMARY SHEET

2024 SHEET 2 OF 3

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		26

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DW: CK: DW: CK:

CSJ 2353-02-028	SUMMARY OF DRIVEWAY ITEMS					104	105	464	464	464	464	464	467	467	467	467	467	496	496	530	530
						6017	6043	6003	6005	6007	6008	6010	6363	6395	6423	6454	6480	6004	6007	6005	6017
DRIVEWAY NO	PLAN SHEET NO.	EXISTING MATERIAL/ TYPE	THROAT WIDTH	R (1)	R (2)	REMOVING CONC (DRIVEWAYS)	REMOVING STAB BASE & ASPH PAV (0-6")	RC PIPE (CL III)(18 IN)	RC PIPE (CL III)(24 IN)	RC PIPE (CL III)(30 IN)	RC PIPE (CL III)(36 IN)	RC PIPE (CL III)(48 IN)	SET (TY II) (18 IN) (RCP) (6: 1) (P)	SET (TY II) (24 IN) (RCP) (6: 1) (P)	SET (TY II) (30 IN) (RCP) (6: 1) (P)	SET (TY II) (36 IN) (RCP) (6: 1) (P)	SET (TY II) (48 IN) (RCP) (6: 1) (P)	REMOV STR (SET)	REMOV STR (PIPE)	DRIVEWAYS (ACP)	DRIVEWAYS (CONC) (HES)
93	11	ASPHALT PAVEMENT	10	15	15		56.8													50.7	
94	11	ASPHALT PAVEMENT	16	20	25		118.2	32					2					2	33	88.5	
95	12	CONCRETE PAVEMENT	24.6	15	15	100.6			40					2				2	33		103.4
96	12	CONCRETE PAVEMENT	36.2	20	25	211.6												2	44		165.1
97	12	ASPHALT PAVEMENT	22.1	15	15		89.2		32					2					20	93.7	
98	12	ASPHALT PAVEMENT	14.1	20	20		80.2	28					2						22	72.9	
99	12	ASPHALT PAVEMENT	9.6	15	15		76	28					2						27	48.2	
100	12	ASPHALT PAVEMENT	11	20	20		83.7	24					2						26	64.7	
101	12	ASPHALT PAVEMENT	11.7	15	15		61	24					2						23	58.9	
102	12	ASPHALT PAVEMENT	14.1	15	20		75.6	24					2						10	71	
103	12	ASPHALT PAVEMENT	10.9	15	15		67.1	24					2						23	53.2	
104	12	ASPHALT PAVEMENT	10	15	15		56.8	24					2						25	48.4	
105	12	ASPHALT PAVEMENT	12	20	20		88.3													64.5	
106	13	ASPHALT PAVEMENT	12.7	20	20		83.5	24					2						21	66.8	
107 MEADOWLAND DRIVE	13	CONCRETE PAVEMENT	22.8	15	15	117		192					8					8	184		102.1
108	13	ASPHALT PAVEMENT	42.3	20	20		206.5		56					2				2	51	179.5	
109	13	CONCRETE PAVEMENT	13.5	15	0	68.1		48					2					2	32		61.2
110	13	CONCRETE PAVEMENT	14.4	0	15	84.9															65.9
111	13	ASPHALT PAVEMENT	18	15	15		92.8	32					2					2	21	81.2	
112	13	CONCRETE PAVEMENT	20	15	15	122.3		32					2						23		89.1
113	14	ASPHALT PAVEMENT	18.2	15	15		96.1		40					2				2	30	79.9	
114	14	ASPHALT PAVEMENT	11.4	15	15		76.8	32					2					2	30	54.3	
115	14	CONCRETE PAVEMENT	18	15	15	88.6			32					2				2	23		80
116	14	ASPHALT PAVEMENT	13.3	15	20		85.3		32					2				2	27	65.1	
117	14	ASPHALT PAVEMENT	12.1	15	20		60.6		32					2				2	26	61	
118	14	ASPHALT PAVEMENT	10.7	15	15		50.6		24					2				2	23	51.8	
119	14	ASPHALT PAVEMENT	14	20	20		94.7		32					2				2	33	73.3	
120	14	ASPHALT PAVEMENT	13.8	20	20		59.3		32					2				2	23	71.8	
121	14	ASPHALT PAVEMENT	11.8	20	20		52.8		32					2				2	27	64.7	
122	14	ASPHALT PAVEMENT	10.4	15	15		66		24					2				2	27	50.9	
123 GREGG ROAD	14	ASPHALT PAVEMENT	20	30	35		189.6				64					4			72	158.8	
124 ROGERS CIRCLE	14	ASPHALT PAVEMENT	27.9	15	20		154.4		120					6					108	180.6	
125 FINLEY CIRCLE	14	ASPHALT PAVEMENT	34	20	20		231.5	40					2						38	220.1	
126	15	ASPHALT PAVEMENT	18.5	15	15		75.3	24					2					2	21	81.9	
127	15	ASPHALT PAVEMENT	15.5	15	15		54.3													69.1	
128	15	ASPHALT PAVEMENT	15	15	15		61.6	24					2						22	67.1	
129	15	CONCRETE PAVEMENT	22	15	15	102.9		32					2					2	27		95.9
130	15	CONCRETE PAVEMENT	18	15	15	76.3		24					2					2	19		79.3
131	15	ASPHALT PAVEMENT	29.7	25	25		182.8	48					2					2	37	168.2	
132	15	CONCRETE PAVEMENT	11.9	15	15	83.3		24					2					2	17		58.9
133 HIGH RIDGE	15	ASPHALT PAVEMENT	28.1	20	20		146.3	40					2					2	32	142.8	
134	15	CONCRETE PAVEMENT	18	15	15	55.1			32					2				2	23		55.1
135	15	ASPHALT PAVEMENT	15	15	15		65.8	24					2						25	71.1	
136	15	CONCRETE PAVEMENT	15.3	15	15	73.7			24					2				2	23		76.2
137	15	CONCRETE PAVEMENT	15.9	15	15	69			24					2				2	23		72.6
138	15	CONCRETE PAVEMENT	16	15	15	75.9		32					2					2	33		78
		CSJ TOTALS				1904	13990	2413	1846	72	240	32	140	106	6	12	2	120	4161	12829	1587

Texas Department of Transportation

FM 2450

DRIVEWAY SUMMARY SHEET

2024 SHEET 3 OF 3

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		27

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EARTHWORK SUMMARY		
2353-02-028	110-6001	132-6006
STATION	EXCAVATION (CY)	EMBANKMENT (FINAL)(DENSCONTROL)(TY-C)(CY)
0+00.000 R1	0	0
1+00.000 R1	16.479	9.721
2+00.000 R1	37.182	17.402
3+00.000 R1	38.748	38.118
4+00.000 R1	39.177	54.556
5+00.000 R1	41.415	51.215
5+73.198 R1	43.404	48.018
6+00.000 R1	44.132	46.848
6+09.829 R1	44.701	46.422
7+00.000 R1	49.922	42.517
8+00.000 R1	49.505	49.768
9+00.000 R1	46.446	43.687
10+00.000 R1	47.313	34.745
11+00.000 R1	47.081	37.686
12+00.000 R1	42.359	41.376
13+00.000 R1	44.322	37.762
14+00.000 R1	49.222	23.486
15+00.000 R1	46.234	13.169
16+00.000 R1	45.537	10.409
17+00.000 R1	51.403	5.304
18+00.000 R1	54.322	1.583
19+00.000 R1	52.157	3.187
20+00.000 R1	45.728	10.263
21+00.000 R1	41.74	18.306
22+00.000 R1	44.356	16.284
23+00.000 R1	47.167	10.627
24+00.000 R1	45.036	25.654
25+00.000 R1	43.897	40.517
26+00.000 R1	43.636	36.52
27+00.000 R1	44.674	32.099
28+00.000 R1	46.896	65.682
29+00.000 R1	36.536	76.567
30+00.000 R1	37.822	121.178
31+00.000 R1	42.544	232.97
31+73.391 R1	42.13	206.583
32+00.000 R1	41.98	197.016
33+00.000 R1	23.44	59.316
34+00.000 R1	0	0
35+00.000 R1	0	0
36+00.000 R1	11.846	196.382
37+00.000 R1	23.747	290.137
38+00.000 R1	26.216	155.635
39+00.000 R1	38.173	67.53
40+00.000 R1	53.198	8.783
41+00.000 R1	56.731	8.523
42+00.000 R1	56.098	11.975
43+00.000 R1	56.076	12.732
44+00.000 R1	45.193	38.439
45+00.000 R1	29.206	244.351
46+00.000 R1	24.458	272.696
47+00.000 R1	28.492	87.975
48+00.000 R1	30.011	90.887
49+00.000 R1	36.207	85.853
50+00.000 R1	44.572	89.744
51+00.000 R1	42.419	84.798
52+00.000 R1	37.703	63.846
53+00.000 R1	37.304	75.855
54+00.000 R1	36.254	58.07
55+00.000 R1	37.252	78.996
56+00.000 R1	39.889	91.422
57+00.000 R1	42.567	82.044
58+00.000 R1	41.501	78.485
59+00.000 R1	37.921	71.567
60+00.000 R1	39.096	47.188
61+00.000 R1	37.102	33.183
62+00.000 R1	38.688	42.963
63+00.000 R1	39.704	48.156
64+00.000 R1	38.334	51.947
65+00.000 R1	45.818	44.434
66+00.000 R1	46.167	44.051
67+00.000 R1	43.959	47.764
68+00.000 R1	47.573	44.779
69+00.000 R1	47.642	50.403
70+00.000 R1	46.189	57.52
71+00.000 R1	44.076	58.345
72+00.000 R1	43.285	52.494
73+00.000 R1	41.9	52.818
74+00.000 R1	40.949	60.322
75+00.000 R1	40.925	60.971
76+00.000 R1	43.424	50.612
77+00.000 R1	47.175	38.875
78+00.000 R1	46.278	34.798
79+00.000 R1	44.677	36.694
80+00.000 R1	43.686	38.171
81+00.000 R1	43.179	46.992
82+00.000 R1	46.219	53.906
83+00.000 R1	49.473	48.061
84+00.000 R1	53.701	25.628
85+00.000 R1	54.786	15.772
86+00.000 R1	49.403	28.13
87+00.000 R1	47.366	36.637
88+00.000 R1	45.925	43.255
89+00.000 R1	49.95	33.753
90+00.000 R1	52.932	20.042
91+00.000 R1	44.302	75.479
92+00.000 R1	35.565	142.144
93+00.000 R1	30.848	127.075
94+00.000 R1	33.132	85.404
95+00.000 R1	38.468	59.304
96+00.000 R1	44.428	49.245
97+00.000 R1	48.529	43.838
98+00.000 R1	48.728	41.659
99+00.000 R1	52.201	40.836
100+00.000 R1	55.603	37.249
101+00.000 R1	54.347	35.321
102+00.000 R1	52.001	26.438
103+00.000 R1	48.825	33.611
104+00.000 R1	45.999	43.847
105+00.000 R1	46.541	38.824
106+00.000 R1	46.239	41.056
107+00.000 R1	48.21	40.59
108+00.000 R1	50.469	41.586
109+00.000 R1	52.814	40.968
110+00.000 R1	51.422	40.941
111+00.000 R1	45.66	43.22
112+00.000 R1	48.211	40.495
113+00.000 R1	56.419	23.622
114+00.000 R1	55.527	18.036
115+00.000 R1	53.529	26.662
116+00.000 R1	50.887	31.14
117+00.000 R1	45.652	39.778
118+00.000 R1	45.775	51.194
119+00.000 R1	40.486	68.399
120+00.000 R1	34.244	75.294
121+00.000 R1	34.784	76.862
122+00.000 R1	39.484	71.515
123+00.000 R1	40.235	54.016
124+00.000 R1	37.861	46.338
125+00.000 R1	41.94	58.234
126+00.000 R1	41.892	74.286
127+00.000 R1	35.17	148.767
128+00.000 R1	33.088	157.772
129+00.000 R1	34.133	83.994
130+00.000 R1	34.775	72.86
131+00.000 R1	35.68	58.109
132+00.000 R1	37.548	40.378
133+00.000 R1	35.932	55.002
134+00.000 R1	36.43	65.376
135+00.000 R1	39.645	60.319
136+00.000 R1	39.251	58.024
137+00.000 R1	36.115	65.568
138+00.000 R1	33.768	88.288
139+00.000 R1	32.392	92.079
140+00.000 R1	30.759	134.099
141+00.000 R1	30.532	157.894
142+00.000 R1	26.45	137.987
143+00.000 R1	27.375	116.15
144+00.000 R1	32.032	93.234
145+00.000 R1	32.201	71.545
146+00.000 R1	32.594	56.7
147+00.000 R1	32.365	67.977
148+00.000 R1	33.295	66.104
149+00.000 R1	34.346	88.82
150+00.000 R1	43.893	78.467
151+00.000 R1	57.693	40.255
152+00.000 R1	62.211	19.269
153+00.000 R1	52.832	24.115
154+00.000 R1	46.411	43.045
155+00.000 R1	46.756	36.785
156+00.000 R1	43.031	30.415
157+00.000 R1	42.147	35.778
158+00.000 R1	47.51	37.653
159+00.000 R1	49.84	37.362
160+00.000 R1	44.364	26.762
161+00.000 R1	37.08	23.889
162+00.000 R1	33.444	45.303
163+00.000 R1	34.123	58.868
164+00.000 R1	34.474	66.217
165+00.000 R1	41.707	42.592
166+00.000 R1	49.224	23.772
167+00.000 R1	44.334	44.07
168+00.000 R1	38.177	48.491
169+00.000 R1	38.523	38.919
170+00.000 R1	40.698	39.046
171+00.000 R1	44.133	43.986
172+00.000 R1	46.526	47.346
173+00.000 R1	41.816	43.786
174+00.000 R1	37.426	44.662
175+00.000 R1	34.89	56.637
176+00.000 R1	28.084	84.991
177+00.000 R1	27.952	96.961
178+00.000 R1	26.917	112.83
179+00.000 R1	26.442	157.474
180+00.000 R1	28.354	416.041
181+00.000 R1	28.037	405.313
182+00.000 R1	30.238	118.485

Texas Department of Transportation

FM 2450

EARTHWORK SUMMARY SHEET

2024 SHEET 1 OF 2

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		28

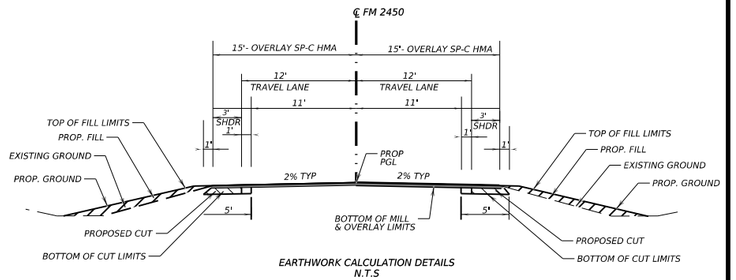
DATE: 4/4/2024 2:30:03 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/2353020284 - Design/Plan Set/1. General/FM2450_SUMMARY SHEETS.dgn

183+00.000 R1	26.953	95.915
184+00.000 R1	27.877	99.388
185+00.000 R1	34.598	78.926
0+00.000 R2	33.402	57.668
1+00.000 R2	44.09	63.789
2+00.000 R2	40.543	66.435
3+00.000 R2	36.052	71.553
4+00.000 R2	36.61	68.568
5+00.000 R2	37.66	62.771
6+00.000 R2	36.517	66.95
7+00.000 R2	35.166	70.538
8+00.000 R2	39.136	50.971
9+00.000 R2	42.425	39.559
10+00.000 R2	43.579	31.631
11+00.000 R2	43.308	27.217
12+00.000 R2	42.09	42.857
13+00.000 R2	45.915	47.51
14+00.000 R2	46.484	45.224
15+00.000 R2	45.419	43.265
16+00.000 R2	48.185	57.27
17+00.000 R2	45.869	82.527
18+00.000 R2	43.638	85.693
19+00.000 R2	45.809	80.278
20+00.000 R2	45.33	81.63
21+00.000 R2	41.275	96.854
22+00.000 R2	38.951	101.144
23+00.000 R2	40.327	84.123
24+00.000 R2	45.184	58.07
25+00.000 R2	50.159	38.835
26+00.000 R2	51.31	40.282
27+00.000 R2	52.639	39.631
28+00.000 R2	53.769	40.386
29+00.000 R2	52.21	43.924
30+00.000 R2	49.955	41.554
31+00.000 R2	48.727	55.336
32+00.000 R2	42.167	197.921
33+00.000 R2	40.316	207.364
34+00.000 R2	45.87	74.22
35+00.000 R2	50.378	34.31
36+00.000 R2	47.431	32.204
37+00.000 R2	41.209	48.199
38+00.000 R2	42.788	39.178
39+00.000 R2	43.253	40.858
40+00.000 R2	44.363	48.618
41+00.000 R2	41.947	56.647
42+00.000 R2	42.434	55.615
43+00.000 R2	45.666	53.69
44+00.000 R2	44.973	53.936
45+00.000 R2	47.482	41.464
46+00.000 R2	48.225	39.227
47+00.000 R2	50.754	41.626

48+00.000 R2	57.331	29.165
49+00.000 R2	63.741	11.167
50+00.000 R2	61.646	29.955
51+00.000 R2	57.999	46.234
52+00.000 R2	54.281	42.86
53+00.000 R2	44.284	45.278
54+00.000 R2	52.518	27.681
55+00.000 R2	65.567	18.482
56+00.000 R2	68.266	16.239
57+00.000 R2	58.105	26.176
58+00.000 R2	42.265	39.179
59+00.000 R2	41.311	47.601
60+00.000 R2	44.665	59.505
61+00.000 R2	44.379	67.324
62+00.000 R2	42.361	71.745
63+00.000 R2	45.074	64.798
64+00.000 R2	42.053	54.063
65+00.000 R2	31.426	53.936
66+00.000 R2	37.263	37.899
67+00.000 R2	47.443	18.07
68+00.000 R2	41.511	18.76
69+00.000 R2	47.924	17.091
70+00.000 R2	46.782	38.557
71+00.000 R2	35.958	67.622
72+00.000 R2	40.264	85.009
73+00.000 R2	42.648	62.523
74+00.000 R2	48.599	30.727
75+00.000 R2	48.139	48.765
76+00.000 R2	41.175	61.644
77+00.000 R2	39.086	72.975
78+00.000 R2	38.811	97.579
79+00.000 R2	36.223	152.972
80+00.000 R2	35.254	130.812
81+00.000 R2	38.65	91.335
82+00.000 R2	41.223	113.929
83+00.000 R2	41.632	82.434
84+00.000 R2	44.623	48.344
85+00.000 R2	50.598	32.521
86+00.000 R2	48.79	21.067
87+00.000 R2	41.412	21.683
88+00.000 R2	35.158	30.682
89+00.000 R2	40.586	30.582
90+00.000 R2	44.266	30.955
91+00.000 R2	44.827	29.408
92+00.000 R2	43.638	35.363
93+00.000 R2	38.86	42.962
94+00.000 R2	40.015	35.651
95+00.000 R2	43.745	28.442
96+00.000 R2	43.901	34.499
97+00.000 R2	45.297	41.521

98+00.000 R2	50.549	36.118
99+00.000 R2	54.55	34.593
100+00.000 R2	60.149	26.371
101+00.000 R2	54.324	36.39
102+00.000 R2	42.323	61.183
103+00.000 R2	41.825	61.929
104+00.000 R2	40.482	61.449
105+00.000 R2	30.562	87.413
106+00.000 R2	25.738	105.225
107+00.000 R2	26.021	100.411
108+00.000 R2	28.854	91.325
109+00.000 R2	38.617	72.093
110+00.000 R2	44.853	60.243
111+00.000 R2	42.728	51.706
112+00.000 R2	43.261	42.738
113+00.000 R2	45.597	46.679
114+00.000 R2	42.433	50.498
115+00.000 R2	37.718	52.712
116+00.000 R2	41.093	43.321
117+00.000 R2	46.93	27.591
118+00.000 R2	41.086	33.835
119+00.000 R2	35.872	43.934
120+00.000 R2	35.657	49.388
121+00.000 R2	40.882	37.344
122+00.000 R2	46.313	29.282
123+00.000 R2	39.585	48.651
124+00.000 R2	35.169	67.201
125+00.000 R2	36.035	71.111
126+00.000 R2	39.935	63.116
127+00.000 R2	43.926	54.872
128+00.000 R2	50.208	31.835
129+00.000 R2	49.788	25.165
130+00.000 R2	51.993	25.991
131+00.000 R2	56.599	17.218
132+00.000 R2	52.763	21.262
133+00.000 R2	51.867	24.273
134+00.000 R2	53.758	15.812
135+00.000 R2	51.426	19.777
136+00.000 R2	44.741	33.385
137+00.000 R2	41.792	36.282
138+00.000 R2	44.984	43.357
139+00.000 R2	51.936	54.802
140+00.000 R2	47.569	61.292
141+00.000 R2	41.066	59.191
142+00.000 R2	43.924	56.148
143+00.000 R2	54.22	45.121
144+00.000 R2	51.745	41.295
145+00.000 R2	43.617	40
146+00.000 R2	49.013	28.03
147+00.000 R2	49.434	63.466

148+00.000 R2	48.585	98.376
149+00.000 R2	54.098	52.725
150+00.000 R2	54.575	30.388
151+00.000 R2	51.372	42.505
152+00.000 R2	58.268	20.978
153+00.000 R2	64.023	18.253
154+00.000 R2	54.502	39.94
155+00.000 R2	48.889	47.241
156+00.000 R2	52.243	56.874
157+00.000 R2	50.082	61.963
158+00.000 R2	50.35	45.9
159+00.000 R2	50.204	25.34
160+00.000 R2	48.373	7.069
161+00.000 R2	60.209	0.138
161+14.402 R2	10.07	0
Grand Total:	**14940.788**	**20199.292**



EARTHWORK CALCULATION DETAILS
N.T.S

EXCAVATION (CUT)

EMBANKMENT (FILL)

MILL & OVERLAY (0*- 2*)

Texas Department of Transportation

FM 2450

EARTHWORK
SUMMERY SHEET

2024 SHEET 2 OF 2

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		29

DATE: 4/4/2024 2:30:04 PM
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DW: CK: DW: CK:

SUMMARY OF SMALL SIGNS

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

POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION: PREFABRICATED	MOUNTING DESIGNATION	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2)
FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	1 or 2	UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	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	TY = TYPE TY N TY S

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE	POSTS	ANCHOR TYPE	PREFABRICATED	MOUNTING DESIGNATION	BRIDGE MOUNT CLEARANCE SIGNS
1	1	M3-1	NORTH <AUXILIARY SIGN>	24 x 12	X		S80	1	SA	U		
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	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 (ROUTE #)	24 x 24	X							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	X							
	2	R1-1	STOP	36 x 36	X		10BWG	1	SA	P		
		R1-3P	ALL WAY	18 x 6	X							
	3	D1-2	FORESTBURG(LEFT ARROW) SANGER(RIGHT ARROW)	96x30	X		S80	1	SA	U		
	4	R2-1	SPEED LIMIT (SPEED)	36X36	X		10BWG	1	SA	P		
	5	W3-1	SYMBOL - STOP AHEAD	36X36	X		10BWG	1	SA	P		
	6	M3-2	EAST <AUXILIARY SIGN>	24 x 12	X		S80	1	SA	U		
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	24 x 24	X							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	X							
		M3-4	WEST <AUXILIARY SIGN>	24 x 12	X							
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	24 x 24	X							
		M6-1	<ARROW - HORIZ. STRGHT> <AUXILIARY SIGN>	21 x 15	X							
	7	R12-6BT	LOAD ZONED ROAD (MI) MILES AHD (DESCRIP)	102X30	X		S80	1	SA	U		
	8	R12-1T	WEIGHT LIMIT/GROSS (WEIGHT) LBS	24 x 36	X		10BWG	1	SA	P		
	9	R7-1D	NO PARKING ANY TIME <BI-DIRECTNAL ARRW>	12 x 18	X		10BWG	1	SA	P		
	10	M3-3	SOUTH <AUXILIARY SIGN>	24 x 12	X		10BWG	1	SA	P		
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	24 x 24	X							
	11	R7-1R	NO PARKING ANY TIME <ARROW RIGHT>	12 x 18	X		10BWG	1	SA	P		
	12	R2-1	SPEED LIMIT (SPEED)	30 x 36	X		10BWG	1	SA	P		
	13	D2-1	KRUM 7	54X18	X		10BWG	1	SA	T		
	14	W3-5	<SYMBOL - REDUCED SPEED AHD> (SPEED)	36 x 36	X		10BWG	1	SA	P		
	15	M2-1	JCT <AUXILIARY SIGN>	21 x 15	X		10BWG	1	SA	P		
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	24 x 24	X							
	16	W1-2R	SYMBOL - HORIZ CURVE RIGHT	36 x 36	X		10BWG	1	SA	P		
		W13-1P	(SPEED) MPH <ADVISORY SPEED PLAQUE>	18 x 18	X							
2	1	W1-2L	SYMBOL - HORIZ CURVE LEFT	36 x 36	X		10BWG	1	SA	P		
		W13-1P	(SPEED) MPH <ADVISORY SPEED PLAQUE>	18 x 18	X							
	2	R12-8AT	WT LIMT (4 LINE DESCRIP OF VEH TYPES/WTS)	78 x 36	X		S80	1	SA	U		
	3	R12-8AT	WT LIMT (4 LINE DESCRIP OF VEH TYPES/WTS)	78 x 36	X		S80	1	SA	U		
	4	R2-1	SPEED LIMIT (SPEED)	30 x 36	X		10BWG	1	SA	P		
	5	W1-2R	SYMBOL - HORIZ CURVE RIGHT	36 x 36	X		10BWG	1	SA	P		
		W13-1P	(SPEED) 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"

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).

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 4-16 8-16	2353	02	028	FM 2450
	DIST		COUNTY	SHEET NO.
	DAL		DENTON	30

DATE: 2/22/2024 1:49:45 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/...

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	1	M3-1	NORTH <AUXILIARY SIGN>	24 x 12	X		10BWG	1	SA	P		
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	24 x 24	X							
		D10-7AT	MILE MARKER 228	3 x 10	X							
		D10-7AT	MILE MARKER 228	3 x 10	X							
	2	W1-2L	SYMBOL - HORIZ CURVE LEFT	36 x 36	X		10BWG	1	SA	P		
		W13-1P	(SPEED) MPH <ADVISORY SPEED PLAQUE>	18 x 18	X							
6	1	W1-4L	SYMBOL - REVERSE CURVE LEFT	36 x 36	X		10BWG	1	SA	P		
		W13-1P	(SPEED) MPH <ADVISORY SPEED PLAQUE>	18 x 18	X							
7	1	M3-2	EAST <AUXILIARY SIGN>	24 x 12	X		10BWG	1	SA	P		
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	24 x 24	X							
		D10-7AT	MILE MARKER 230	3 x 10	X							
		D10-7AT	MILE MARKER 230	3 x 10	X							
	2	R2-1	SPEED LIMIT (SPEED)	30 x 36	X		10BWG	1	SA	P		
8	1	W1-4L	SYMBOL - REVERSE CURVE LEFT	36 x 36	X		10BWG	1	SA	P		
		W13-1P	(SPEED) MPH <ADVISORY SPEED PLAQUE>	18 x 18	X							
10	1	D14-4T	ADOPT A HWY NEXT (MI) MILES (GROUP NAME)	48 x 48	X		10BWG	1	SA	T		
11	1	R2-1	SPEED LIMIT (SPEED)	30 x 36	X		10BWG	1	SA	P		
	2	W1-4L	SYMBOL - REVERSE CURVE LEFT	36 x 36	X		10BWG	1	SA	P		
		W13-1P	(SPEED) MPH <ADVISORY SPEED PLAQUE>	18 x 18	X							
12	1	M3-1	NORTH <AUXILIARY SIGN>	24 x 12	X		10BWG	1	SA	P		
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	24 x 24	X							
		D10-7AT	MILE MARKER 232	3 x 10	X							
		D10-7AT	MILE MARKER 232	3 x 10	X							
13	1	W1-4L	SYMBOL - REVERSE CURVE LEFT	36 x 36	X		10BWG	1	SA	P		
		W13-1P	(SPEED) MPH <ADVISORY SPEED PLAQUE>	18 x 18	X							
14	1	W3-5	<SYMBOL - REDUCED SPEED AHD> (SPEED)	36 x 36	X		10BWG	1	SA	P		
	2	R2-1	SPEED LIMIT (SPEED)	30 x 36	X		10BWG	1	SA	P		
	3	D2-1	BOLIVAR 7	66X18	X		10BWG	1	SA	T		
	4	R2-1	SPEED LIMIT (SPEED)	30 x 36	X		10BWG	1	SA	P		
	5	I-2AT	KRUM CITY LIMIT	42X34	X		10BWG	1	SA	P		
	6	M2-1	JCT <AUXILIARY SIGN>	21 x 15	X		10BWG	1	SA	P		
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	24 x 24	X							
15	1	R2-1	SPEED LIMIT (SPEED)	30 x 36	X		10BWG	1	SA	P		
	2	M3-1	NORTH <AUXILIARY SIGN>	24 x 12	X		10BWG	1	SA	P		
		M1-6F	<FM SHIELD> FARM ROAD (ROUTE #)	24 x 24	X							
		D10-7AT	MILE MARKER 234	3 x 10	X							
		D10-7AT	MILE MARKER 234	3 x 10	X							
	3	D14-4T	ADOPT A HWY NEXT (MI) MILES (GROUP NAME)	48 x 48	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.
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).

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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
© TxDOT May 1987	CONT 2353	SECT 02	JOB 028	HIGHWAY FM 2450
REVISIONS 4-16, 8-16	DIST DAL	COUNTY DENTON		SHEET NO. 31

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
	4	R12-1T	WEIGHT LIMIT/GROSS (WEIGHT) LBS	24 x 36	X		10BWG	1	SA	P		
	5	R12-6BT	LOAD ZONED ROAD (MI) MILES AHD (DESCRIP)	102X30	X		S80	1	SA	U		
	6	D1-1	FT WORTH (RIGHT ARROW)	84X18	X		10BWG	1	SA	T		
	7	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:

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).

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 DENTON		SHEET NO. 32

18

DW: DW: CK: CK:

GENERAL SEQUENCE OF WORK:

1.) ERECT PROJECT LIMIT AND ADVANCE WARNING SIGNS AS SHOWN IN THE PLANS, BC, TCP, AND WZ STANDARDS AND AS DIRECTED BY THE ENGINEER.

2.) PLACE AND MAINTAIN SW3P DEVICES AS SHOWN IN THE PLANS AND AS DIRECTED BY THE ENGINEER. TEMPORARY SW3P EROSION CONTROL MEASURES SHALL ONLY BE PLACED IN AREAS WHERE SOIL DISTRUBANCE OR OTHER POTENTIAL POLLUTANT-GENERATING ACTIVITIES ARE EXPECTED TO OCCUR WITHIN TWO WEEKS.

3.) USING DAILY LANE CLOSURES, PERFORM CULVERT EXTENSIONS IN ACCORDANCE WITH TCP (2-2)-18 AND BC(10)-21.

4.) SAW CUT AND REMOVE 1' OF EXISTING PAVEMENT AND CONSTRUCT SHOULDER WIDENING AS SHOWN IN THE TYPICAL SECTIONS. A 3:1 OR FLATTER SLOPE AT THE PAVEMENT EDGES IS TO BE INTACT AT THE END OF EACH DAY'S OPERATIONS.

5.) CONSTRUCT DRIVEWAYS AND DRIVEWAY DRAINAGE STRUCTURES DURING CONSTRUCTION PHASE OF OPERATION AS ADJACENT ROADWAY PAVEMENT.

6.) BACKFILL/EMBANK EDGES AND GRADE TO DRAIN IN ACCORDANCE WITH CROSS-SECTIONS AND THE EXISTING TOPOGRAPHY. PULL TOPSOIL BACK UP TO THE SLOPE.

7.) MILL 2" OF ROADWAY FOR THE FULL WIDTH OF THE ROAD.

8.) CONSTRUCT FLEXIBLE PAVEMENT STRUCTURE REPAIR AS DIRECTED BY THE ENGINEER.
(NOTE- IF REPAIRS ARE NEEDED BEFORE MILLING, THERE WILL BE A SCARIFICE OF 2" TO BRING BACK TO EXISTING PROFILE GRADE.)

9.) OVERLAY 2" TY C SUPERPAVE MIXTURES. (NOTE: 7-9 WILL BE COMPLETED IN ONE MILE SECTION OR AS APPROVED BY THE ENGINEER)

10.) PLACE AND MAINTAIN TEMPORARY PAVEMENT MARKINGS (TABS) FOR SECTION OF ROADWAY BEING WORKED, AND MAINTAIN AS DIRECTED.

11.) ERECT PERMANENT SIGNS.

12.) ESTABLISH PERMANENT VEGETATION IN DISTURBED AREAS, OR AS DIRECTED BY THE ENGINEER PER THE SWPPP.

13.) PLACE PERMANENT PAVEMENT MARKINGS AND RUMBLE STRIPS.

14.) TEMPORARY SW3P EROSION CONTROL MEASURES SHALL BE REMOVED WITHIN TWO WEEKS OF VEGETATION ESTABLISHMENT IN THEIR CONTROL AREA OR AS APPROVED BY THE ENGINEER.

15.) PERFORM FINAL SITE CLEAN UP AS DIRECTED BY THE ENGINEER AND REMOVE PROJECT LIMIT/ADVANCE WARNING SIGNS.

TCP GENERAL NOTES:

1.) THE CONTRACTOR WILL PROVIDE AND MAINTAIN SKILLED FLAGGERS EQUIPPED WITH TWO-WAY RADIOS TO HANDLE TRAFFIC THROUGH THE WORK AREAS FOR THE SAFETY AND CONVENIENCE OF THE TRAVELING PRUBLIC AND CONTRACTOR PERSONNEL. PAY ATTENTION FOR OVERHEAD UTILITIES.

2.) COMPLY WITH TCP(7-1)-13 WHICH INCLUDES PROVISIONS FOR CERTAIN SIGNS TO BE INSTALLED AND TO REMAIN UNTIL PERMANENT PAVEMENT MARKINGS ARE IN PLACE. THESE SIGNS ARE IN ADDITION TO SIGNS THAT MAY BE REQUIRED BY THE VARIOUS TCP AND BC STANDARDS.

3.) MAINTAIN DRIVEWAY AND SIDE STREET ACCESS AT ALL TIMES.

4.) MAINTAIN POSITIVE DRAINAGE DURING CONSTRUCTION.

5.) ALL TCP DEVICES AND SIGNS SHOWN ON TCP PLAN ARE CONSIDERED MINIMUM, ADDITIONAL DEVICES AND SIGNS MAY BE NECESSARY AND WILL BE SUBSIDIARY TO ITEM 502.

6.) ALL TRAFFIC CONTROL SHALL CONFROM TO THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, ALL APPLICABLE TXDOT STANDARDS AND AS DIRECTED BY THE ENGINEER.

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
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Texas Department of Transportation

FM 2450

TRAFFIC CONTROL PLAN
SEQUENCE OF WORK

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		33

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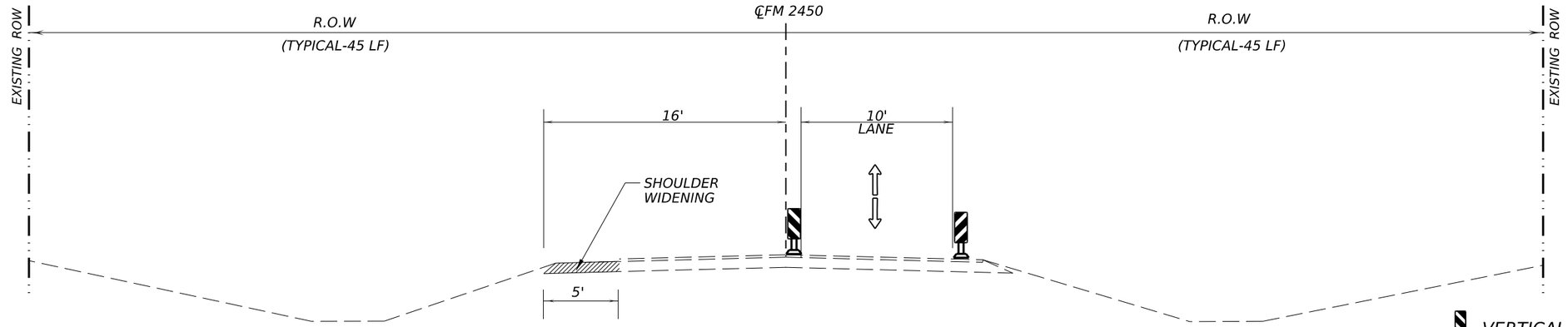


STEP - 1
CONSTRUCTION OPERATION (PRESENT)

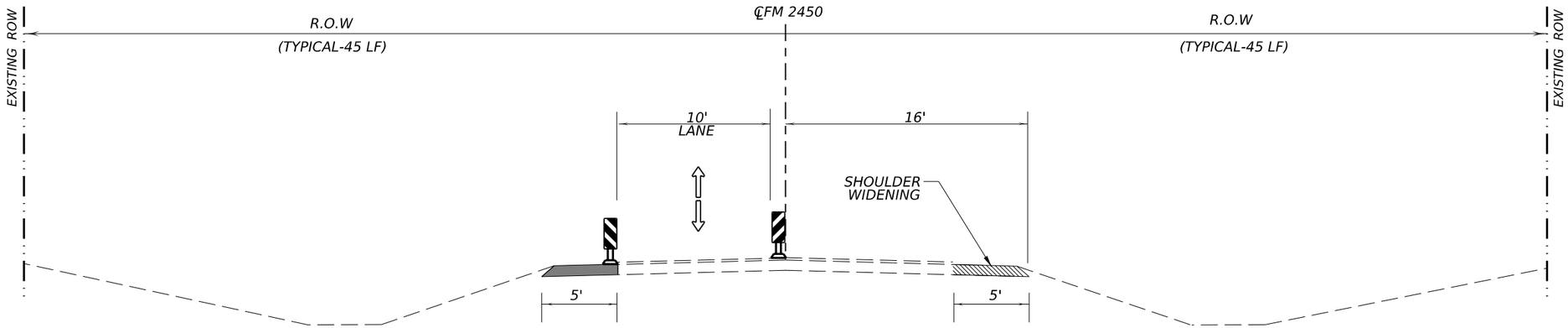
VERTICAL PANEL

PROPOSED CONSTRUCTION

CONSTRUCTED IN PREVIOUS STEP

NOTES:

1. TWO WAY TRAFFIC SHALL BE ESTABLISHED AT THE END OF EACH WORK DAY.
2. SEE CULVERT LAYOUTS FOR ADDITIONAL DETAIL.



STEP - 2
CONSTRUCTION OPERATION (PRESENT)

STATE OF TEXAS
HRAM MANG
141660
PROFESSIONAL ENGINEER

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Hram Mang
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2/22/2024

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FM 2450

TRAFFIC CONTROL PLAN
TYPICAL SECTION

2024 SHEET 1 OF 2

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		34

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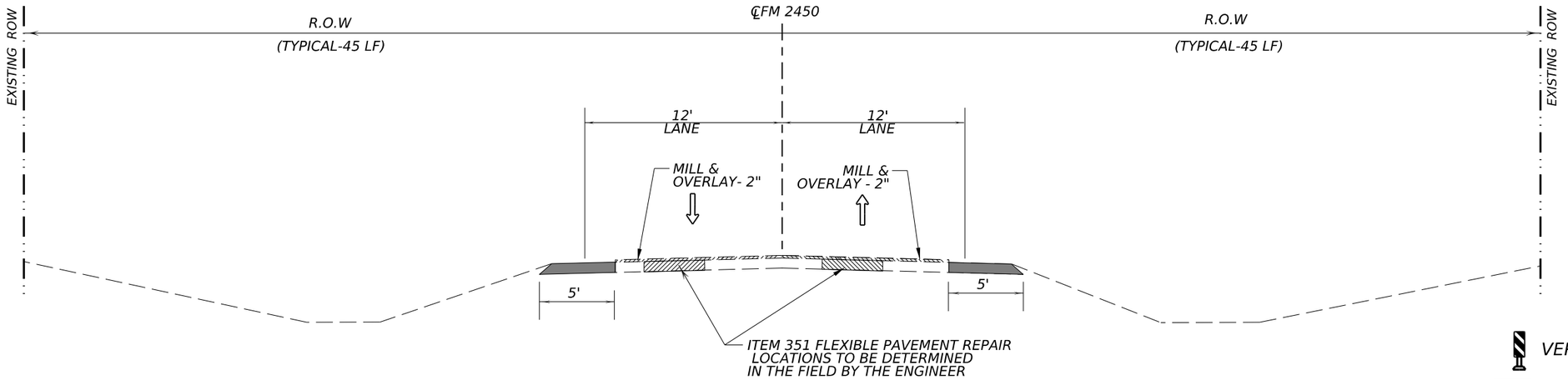


STEP - 3
CONSTRUCTION OPERATION (PRESENT)

VERTICAL PANEL

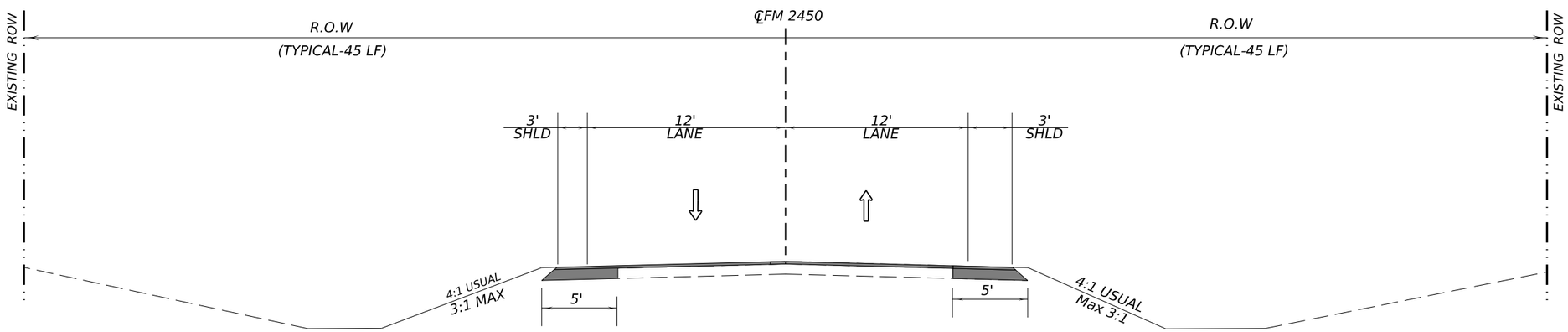
PROPOSED CONSTRUCTION

CONSTRUCTED IN PREVIOUS STEP

NOTES:

1. TWO WAY TRAFFIC SHALL BE ESTABLISHED AT THE END OF EACH WORK DAY.

2. SEE CULVERT LAYOUTS FOR ADDITIONAL DETAIL.



STEP - 4
CONSTRUCTION OPERATION (NOT PRESENT)

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
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2/22/2024

Texas Department of Transportation

FM 2450

TRAFFIC CONTROL PLAN
TYPICAL SECTION

2024 SHEET 2 OF 2

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		35

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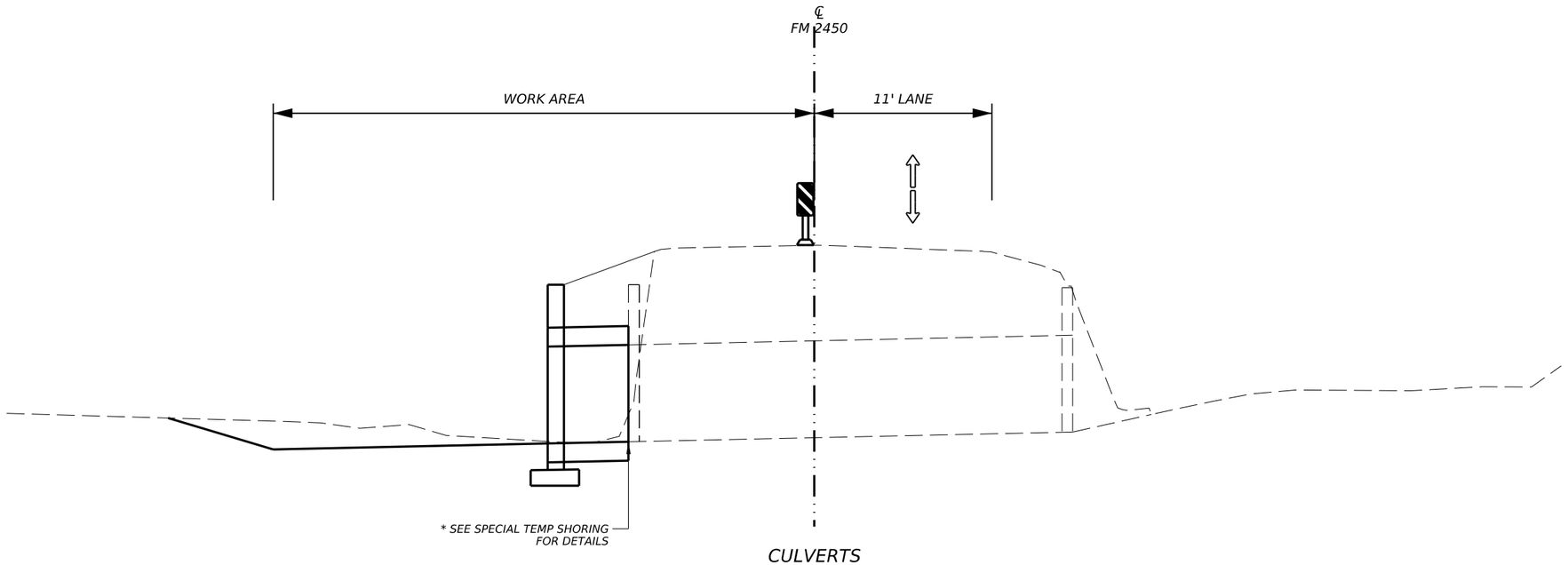
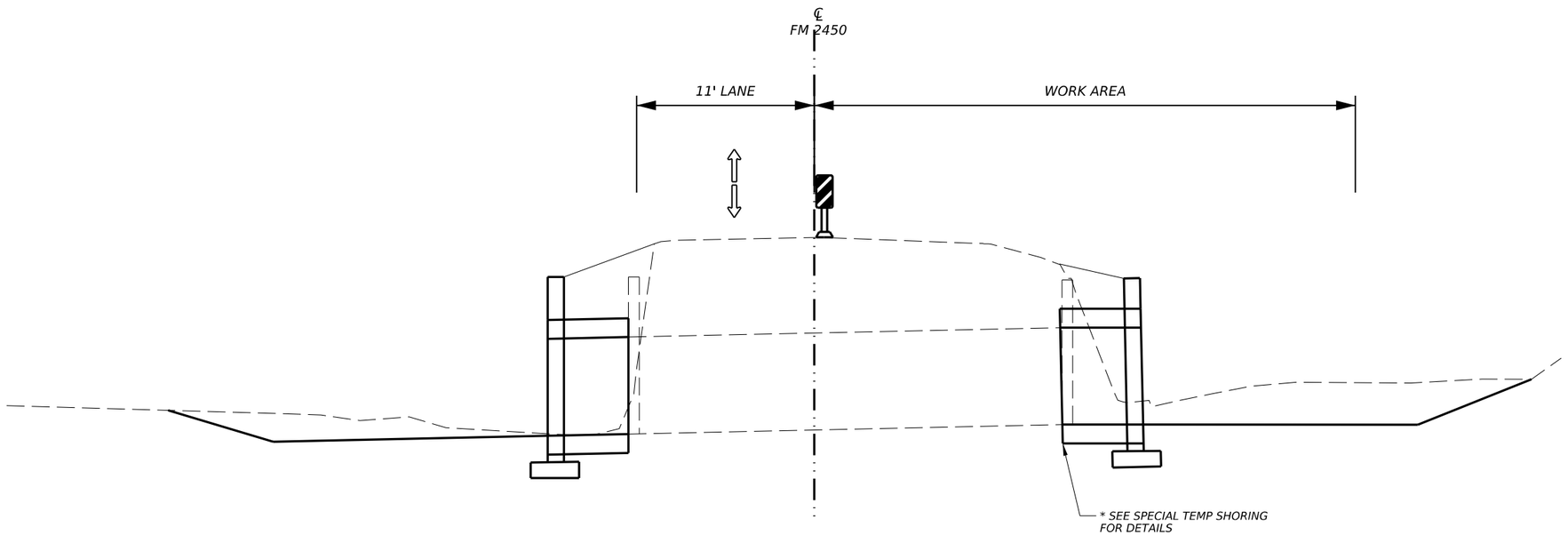


CULVERTS
PHASE 1



CULVERTS
PHASE 2

VERTICAL PANEL

NOTES:

1. TWO WAY TRAFFIC SHALL BE ESTABLISHED AT THE END OF EACH WORK DAY.

2. SEE CULVERT LAYOUTS FOR ADDITIONAL DETAIL.

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PROFESSIONAL ENGINEER

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Hram Mang
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Texas Department of Transportation

FM 2450

CULVERT EXTENSION TYPICAL SECTION

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		36

CK:
DW:
CK:
DW:

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DATE:
FILE:

BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

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

WORKER SAFETY NOTES:

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

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

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

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

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

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

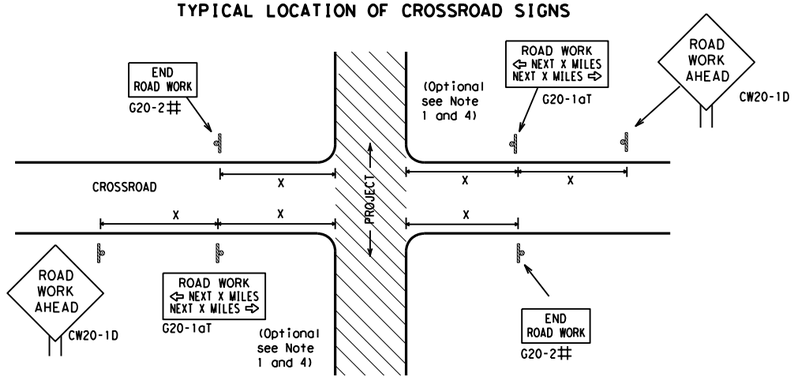
BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

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 9-07 8-14 5-10 5-21	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		37

DATE:
FILE:

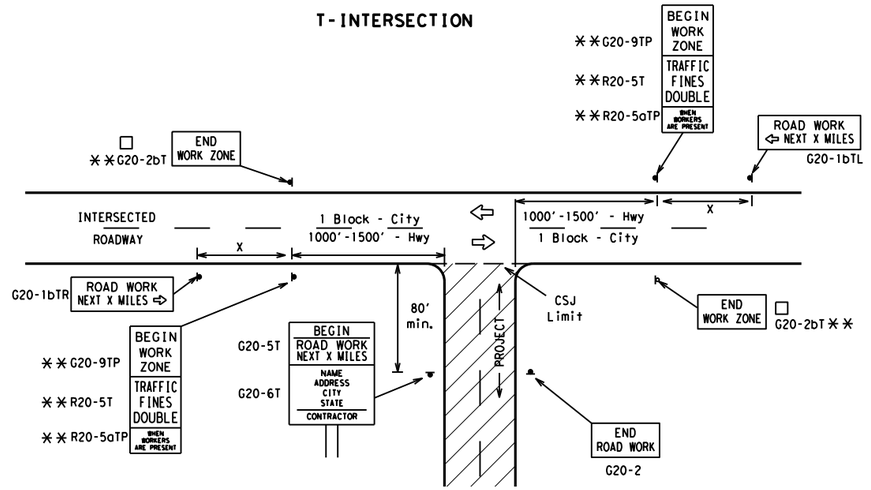
TYPICAL LOCATION OF CROSSROAD SIGNS



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]

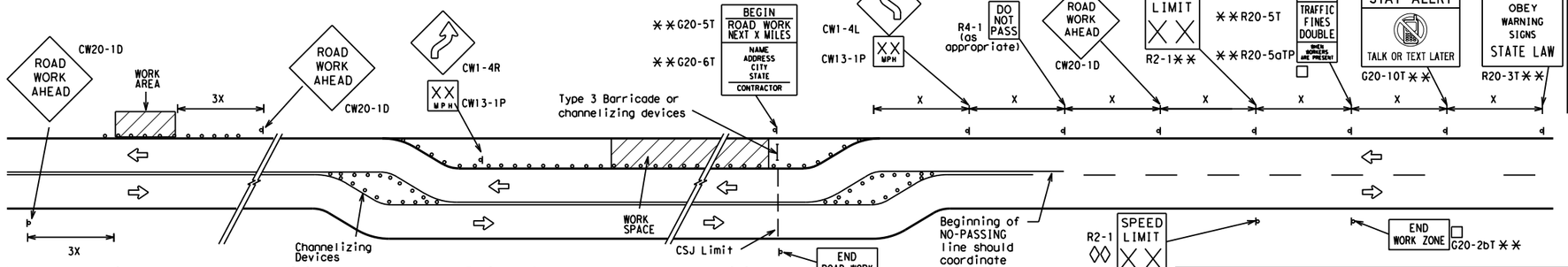
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

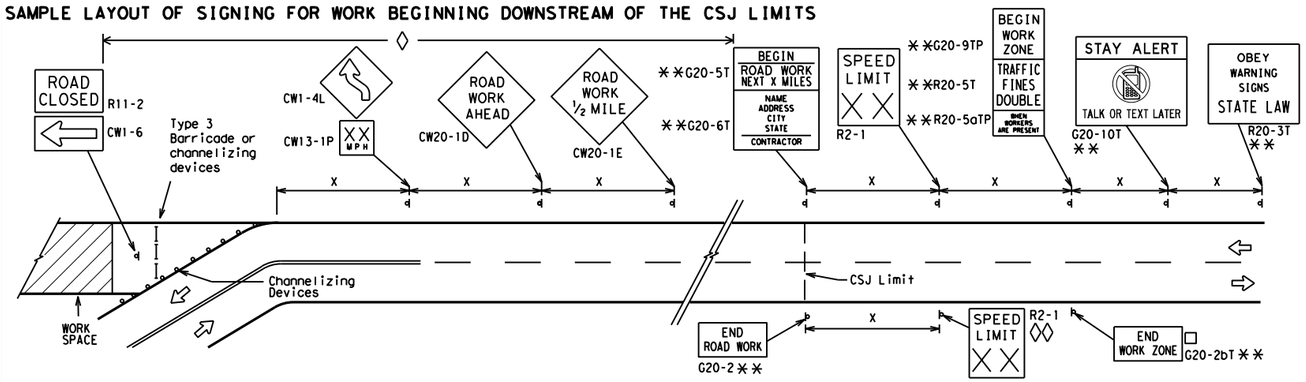
1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have 1/2 mile or more advance warning.
4. 36" x 36" "ROAD WORK AHEAD" (CW20-1D)signs may 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 DOWNSTREAM OF THE CSJ LIMITS



SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS

NOTES

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

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

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

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

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

LEGEND

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

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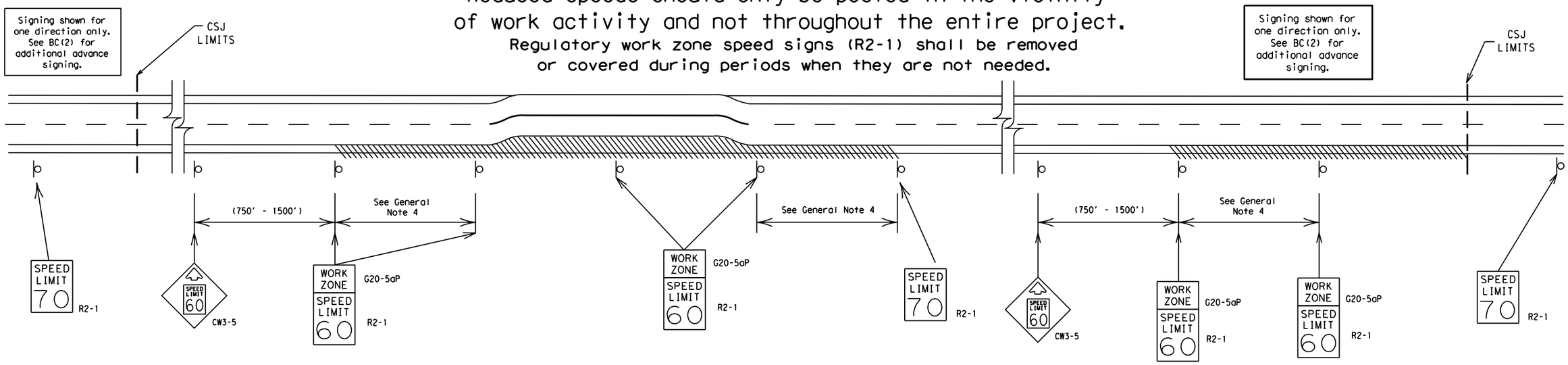
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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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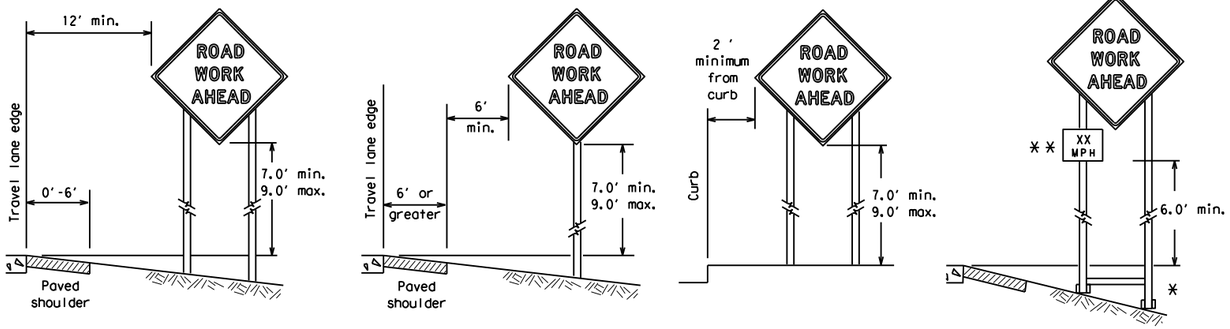
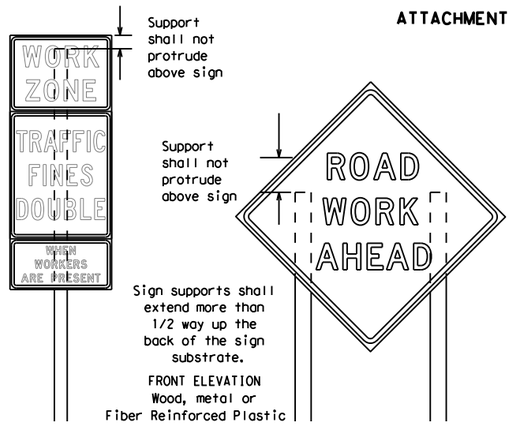
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

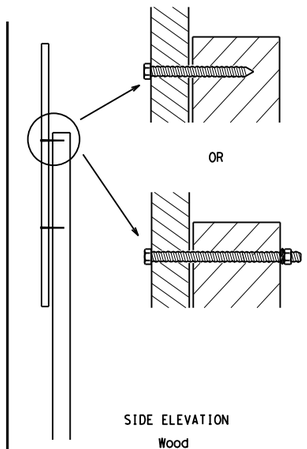


* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

** 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





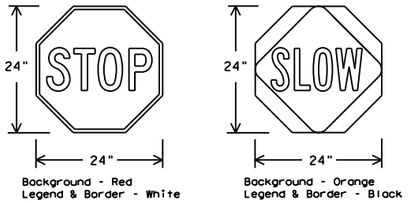
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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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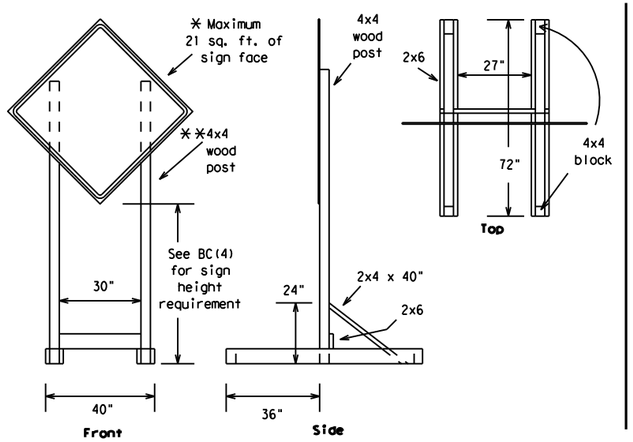
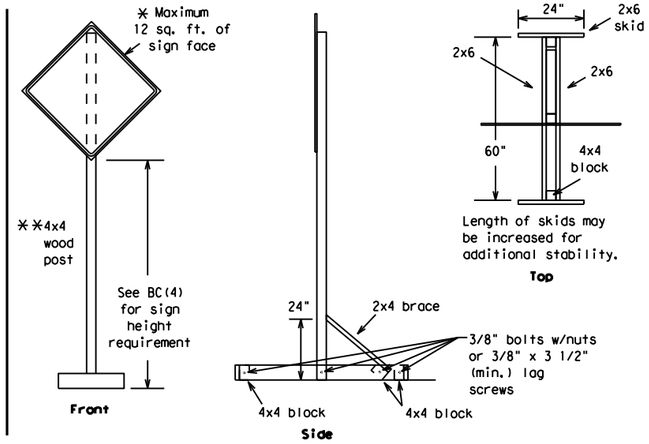
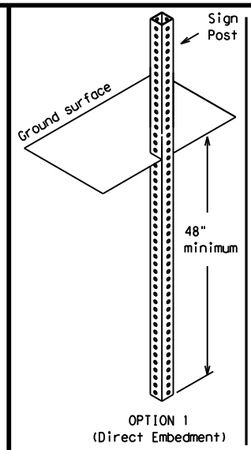
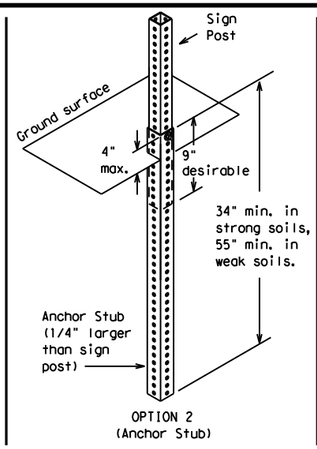


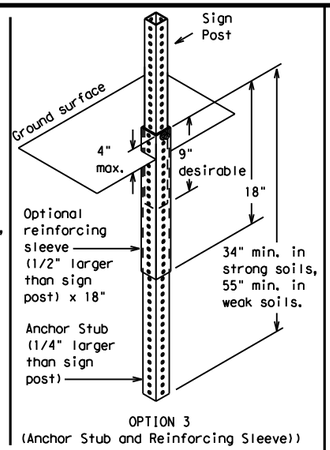


SKID MOUNTED WOOD SIGN SUPPORTS

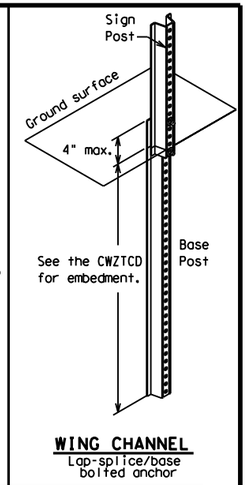
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS







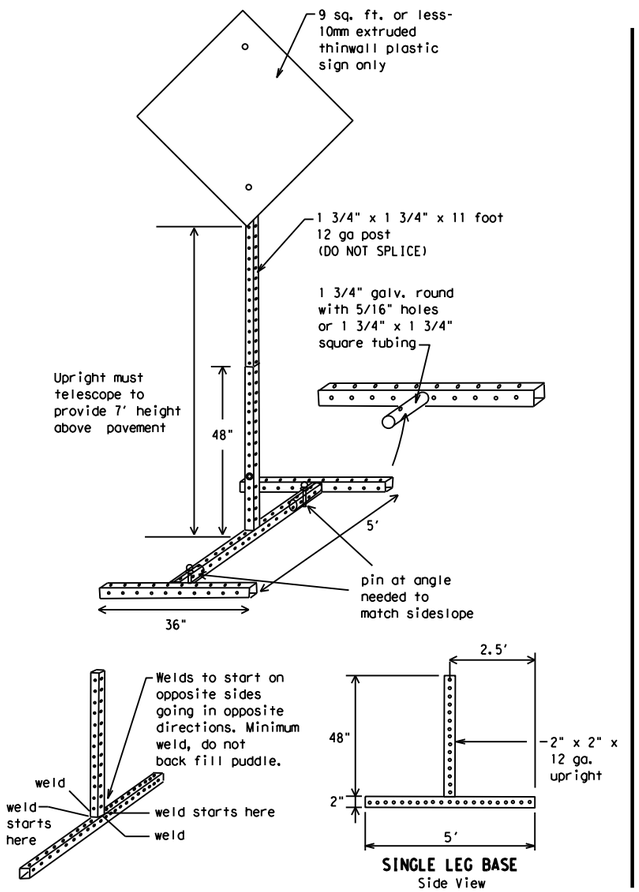
PERFORATED SQUARE METAL TUBING

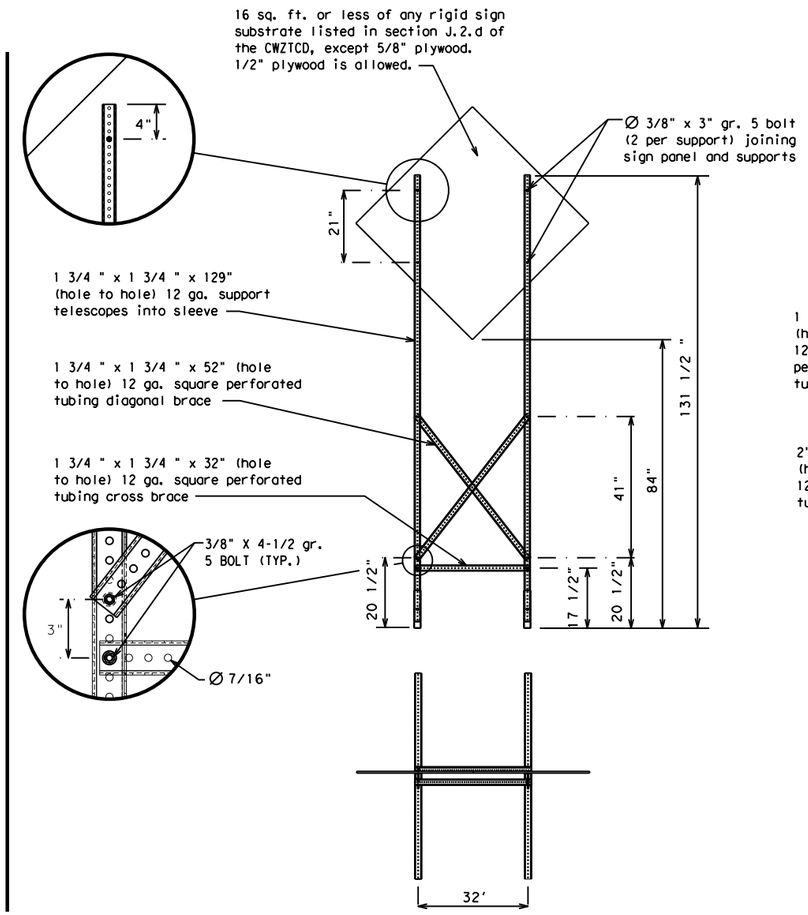


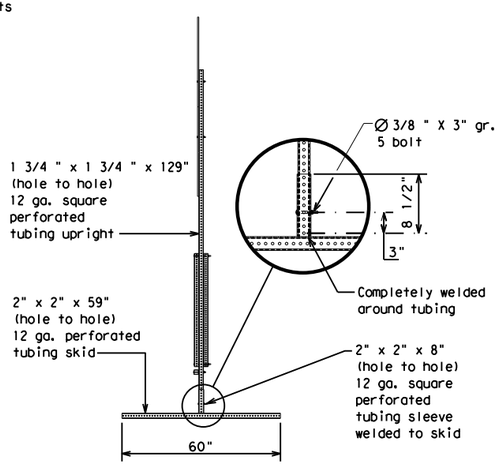
WING CHANNEL
Lap-splice/base bolted anchor

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
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

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

Other Condition List

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

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

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

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

Location List

- AT FM XXXX
- BEFORE RAILROAD CROSSING
- NEXT X MILES
- PAST US XXX EXIT
- XXXXXXX TO XXXXXXX
- US XXX TO FM XXXX

Warning List

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

** Advance Notice List

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

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

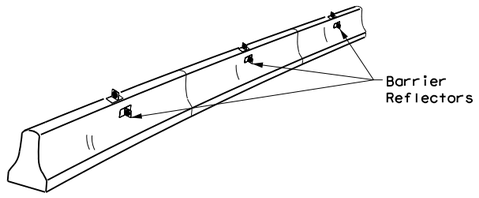
BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	DAL	DENTON		42

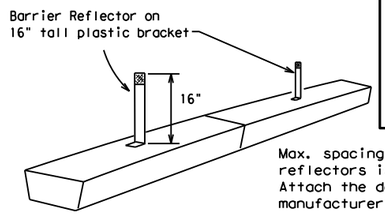
DATE:
FILE:

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.



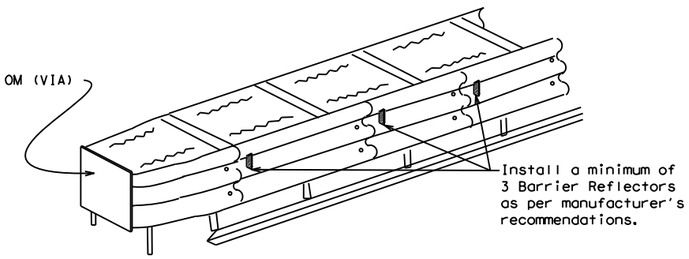
CONCRETE TRAFFIC BARRIER (CTB)

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)



DELINEATION OF END TREATMENTS

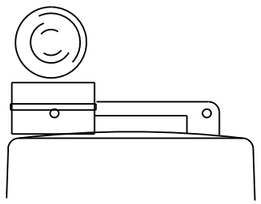
LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

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

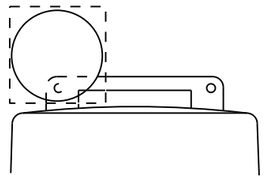
END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

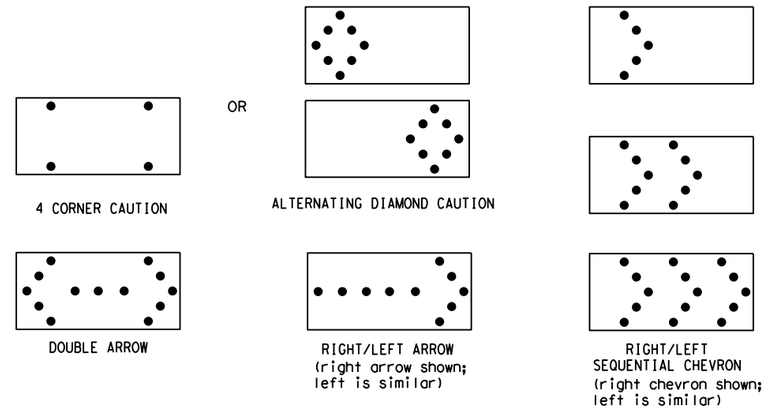
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing 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:



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	2353	02	028	FM 2450
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	DAL	DENTON		43

101

DATE:
FILE:

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:

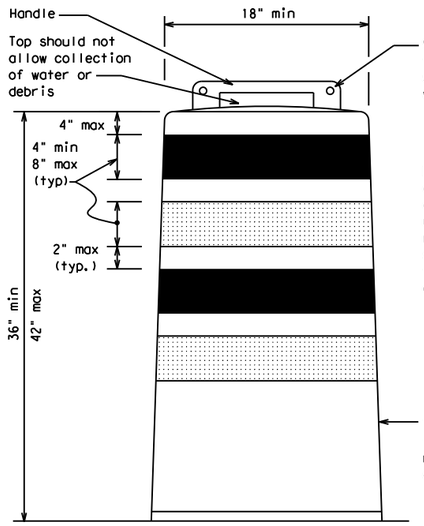
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents 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.

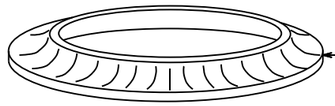
RETROREFLECTIVE SHEETING

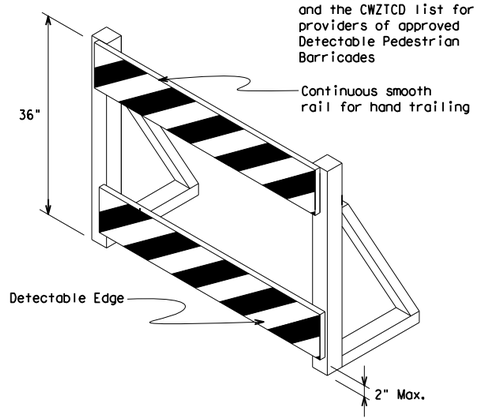
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials," Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall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

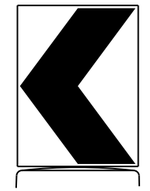




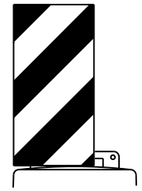


DETECTABLE PEDESTRIAN BARRICADES

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.

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(8)-21

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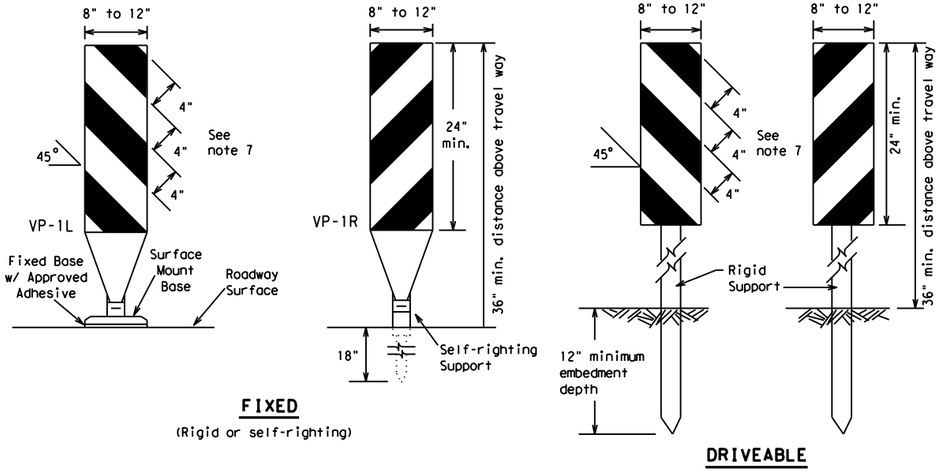
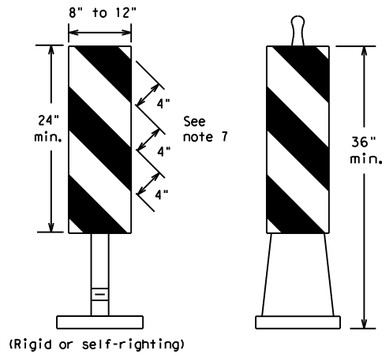


FIXED
(Rigid or self-righting)

DRIVEABLE

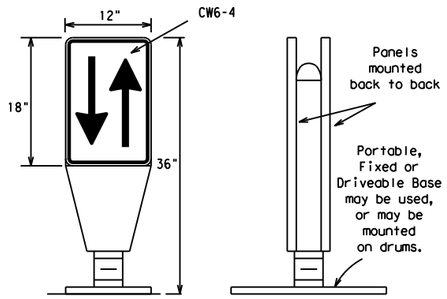


(Rigid or self-righting)

PORTABLE

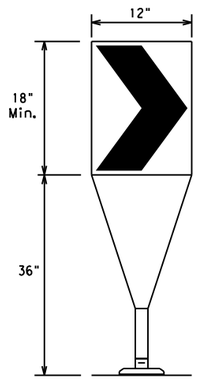
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is 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)



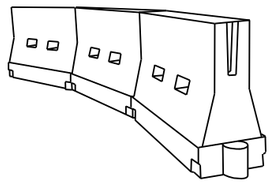
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

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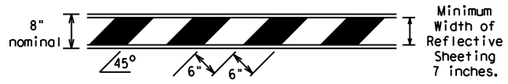
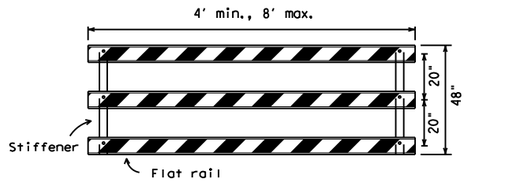
TYPE 3 BARRICADES

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.



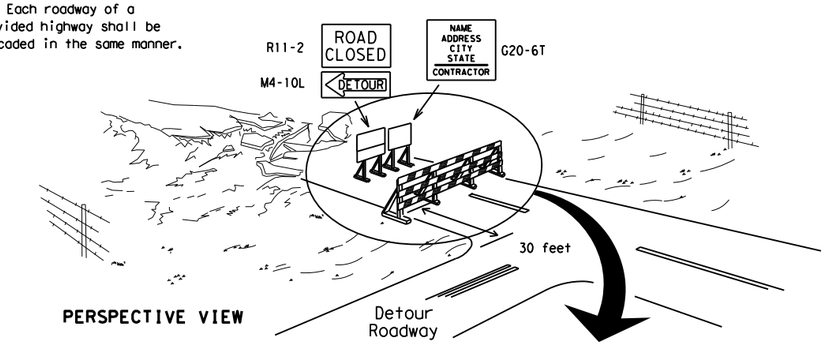
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

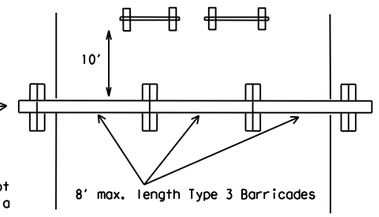
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

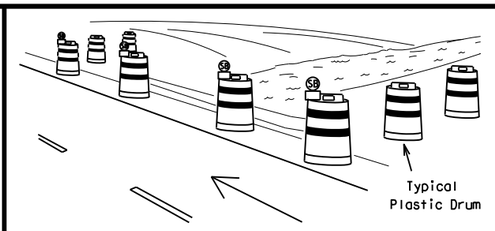
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

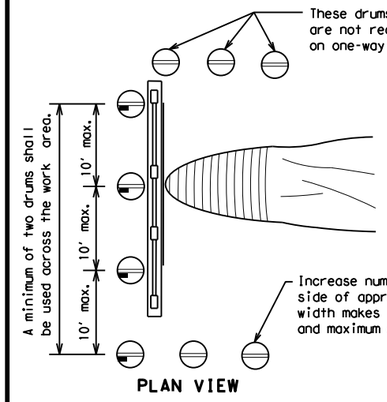
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

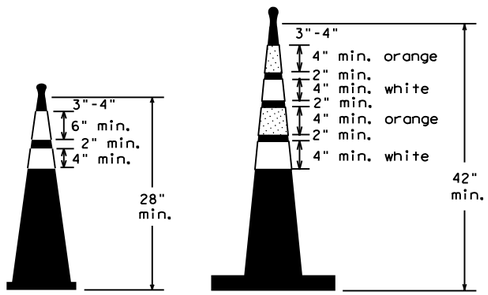
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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

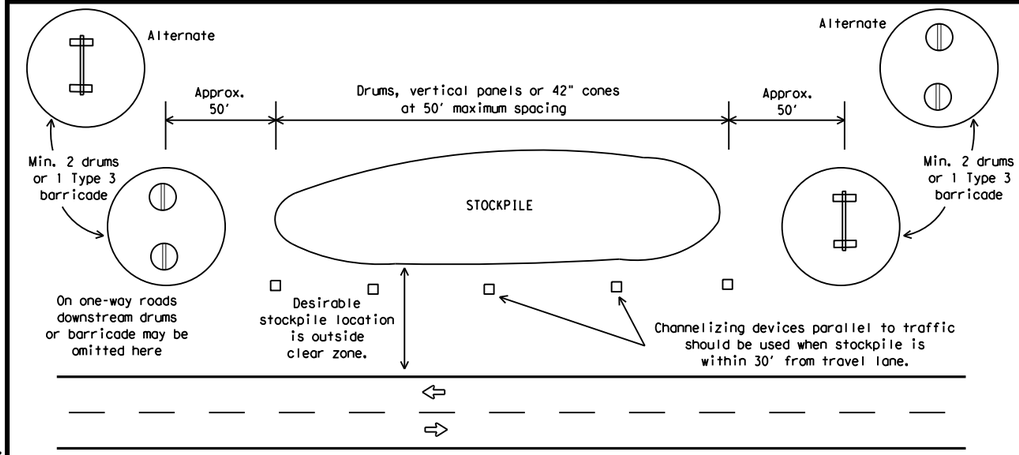
PLAN VIEW

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

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

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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.

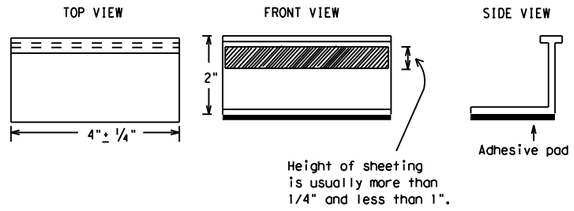
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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).

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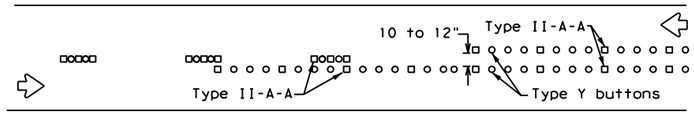
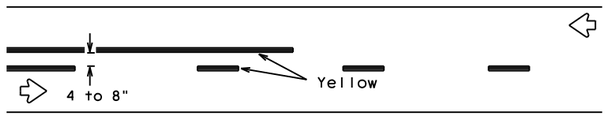
PAVEMENT MARKING PATTERNS

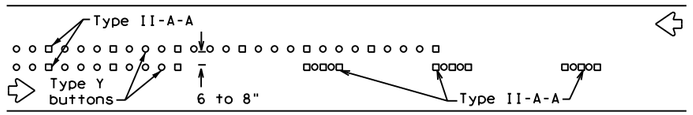
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



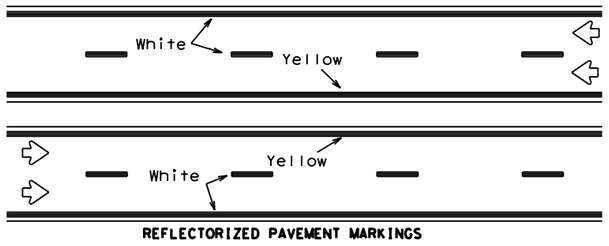
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



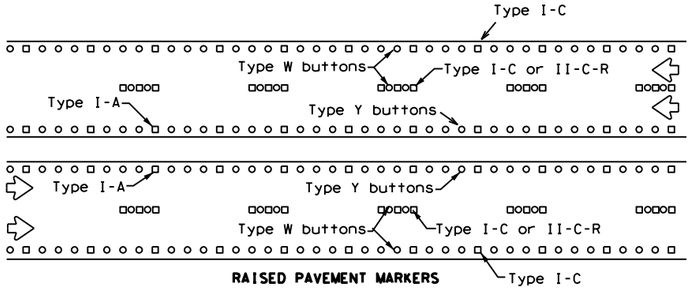
RAISED PAVEMENT MARKERS - PATTERN B

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



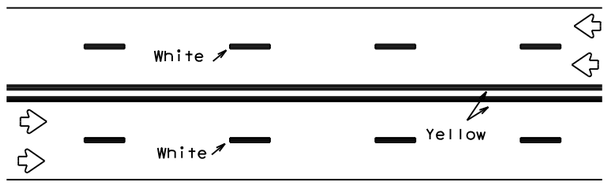
REFLECTORIZED PAVEMENT MARKINGS



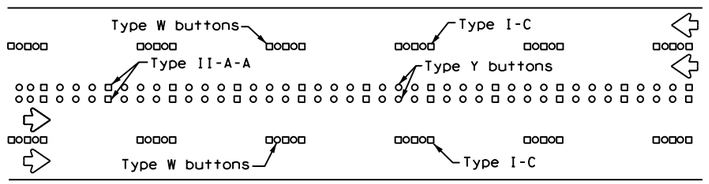
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



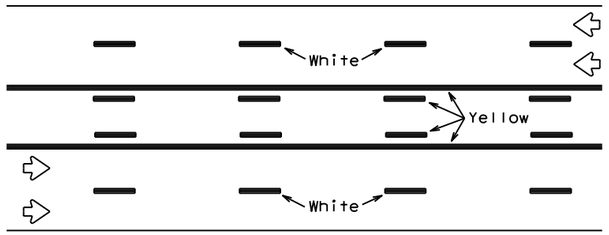
REFLECTORIZED PAVEMENT MARKINGS



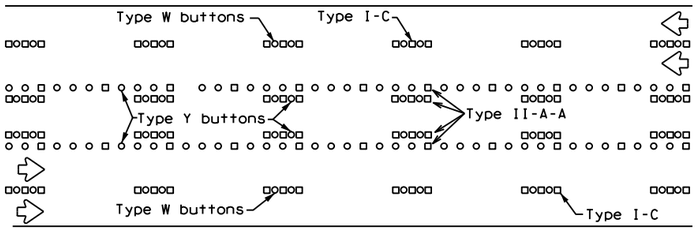
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

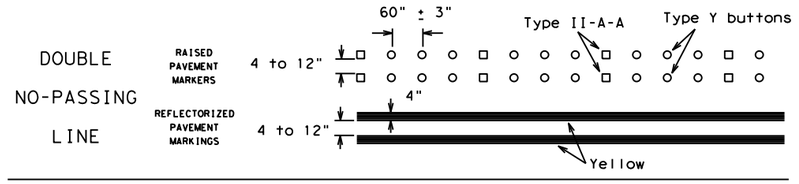
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

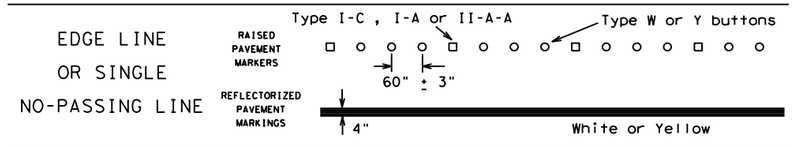
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

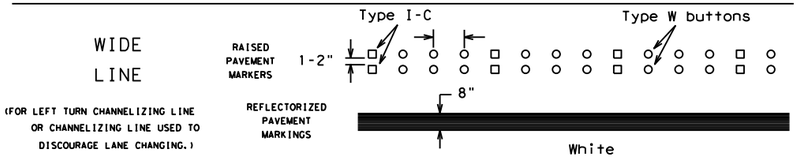


EDGE LINE OR SINGLE NO-PASSING LINE



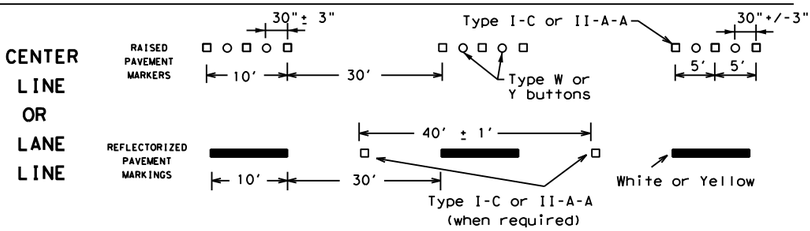
WIDE LINE

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

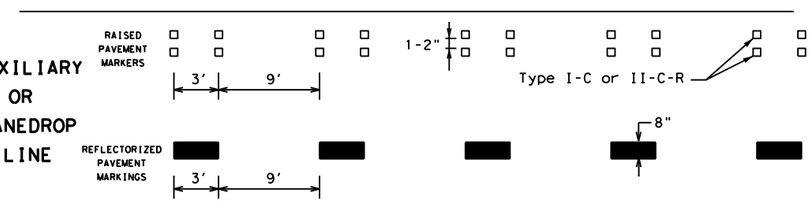


BROKEN LINES

CENTER LINE OR LANE LINE

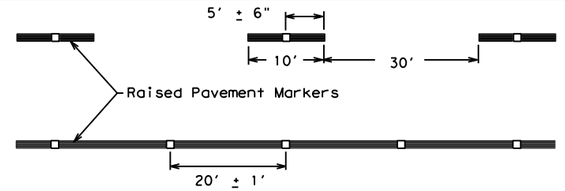


AUXILIARY OR LANEDROP LINE



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."

Texas Department of Transportation

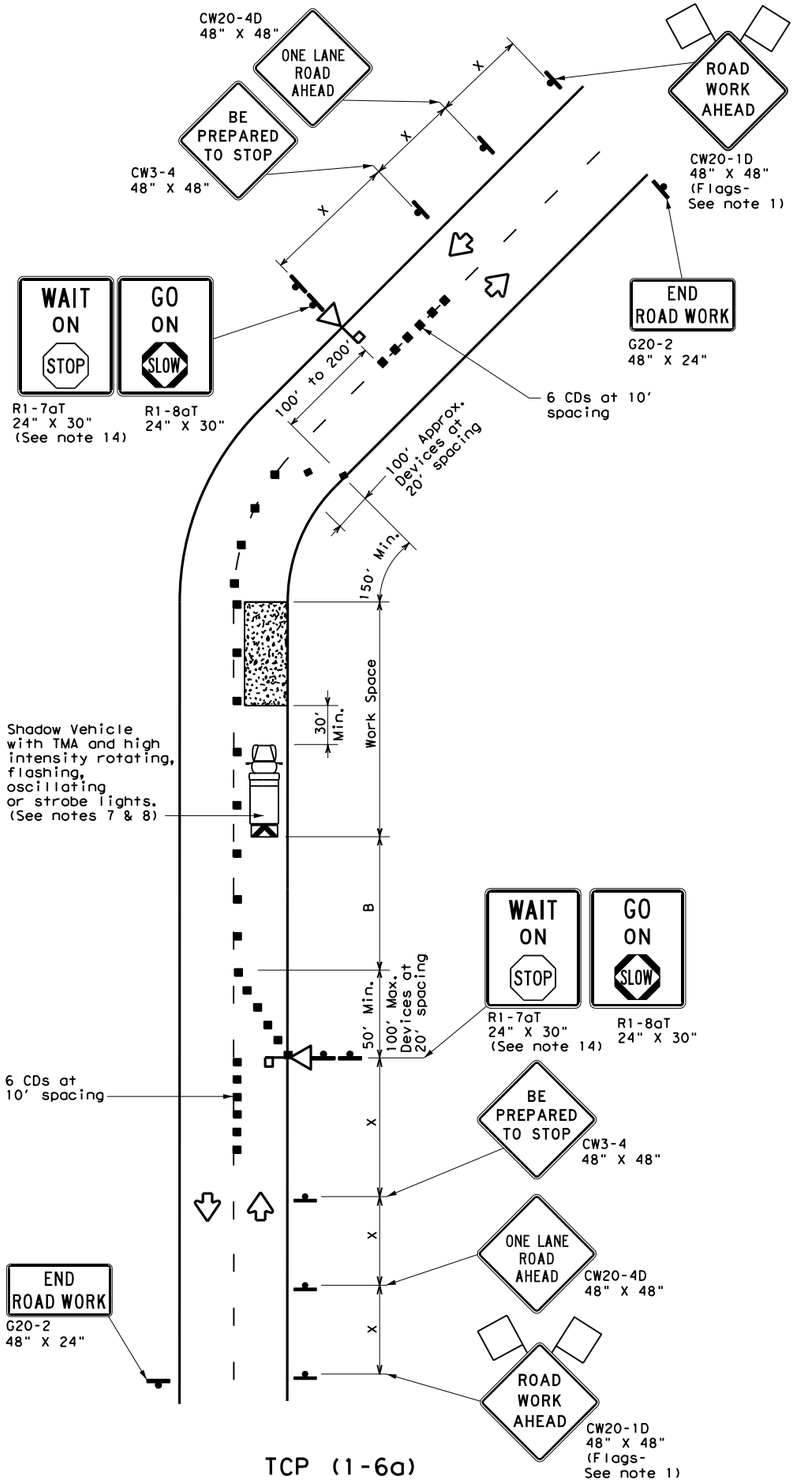
Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

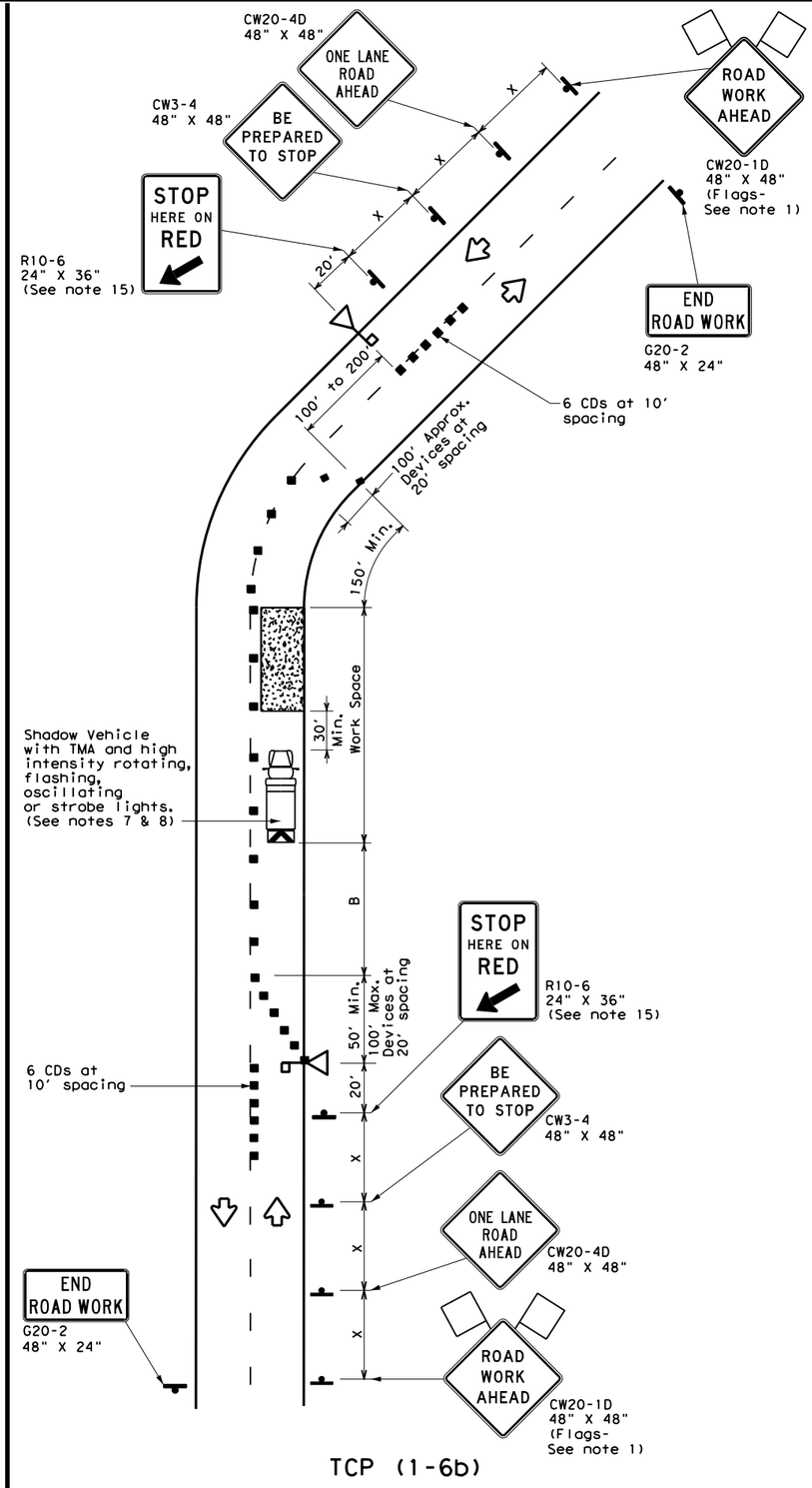
FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 1-97 9-07 5-21 2-98 7-13 11-02 8-14	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		48

DATE:
FILE:



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

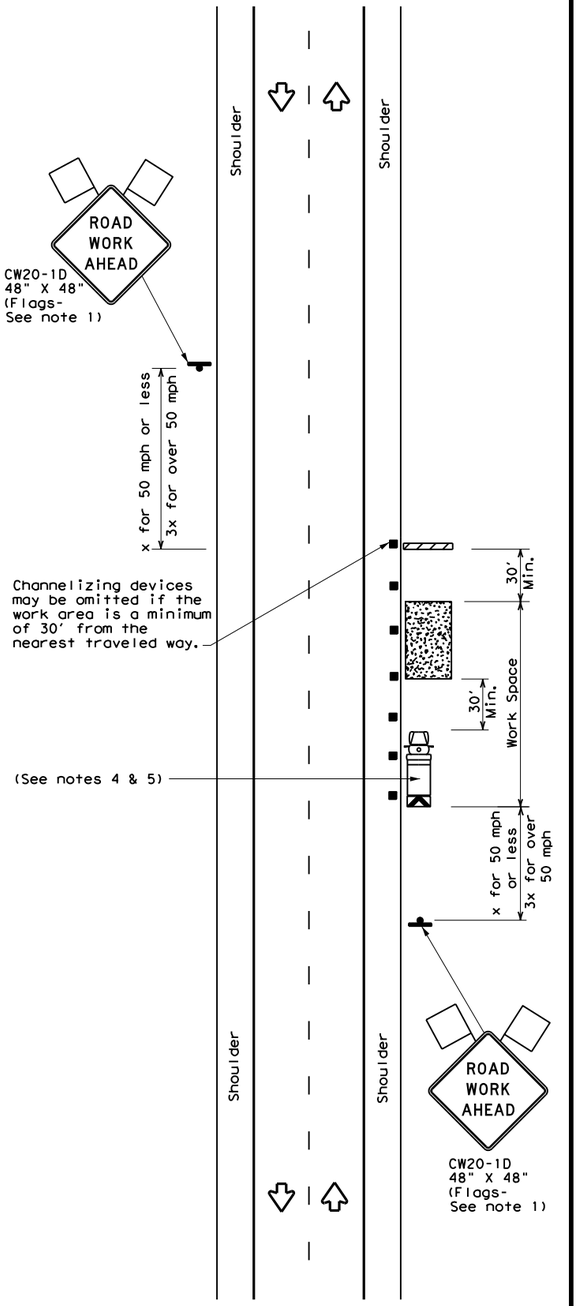
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
AUTOMATED FLAGGER ASSISTANCE DEVICES (AFADS)

TCP(1-6)-18

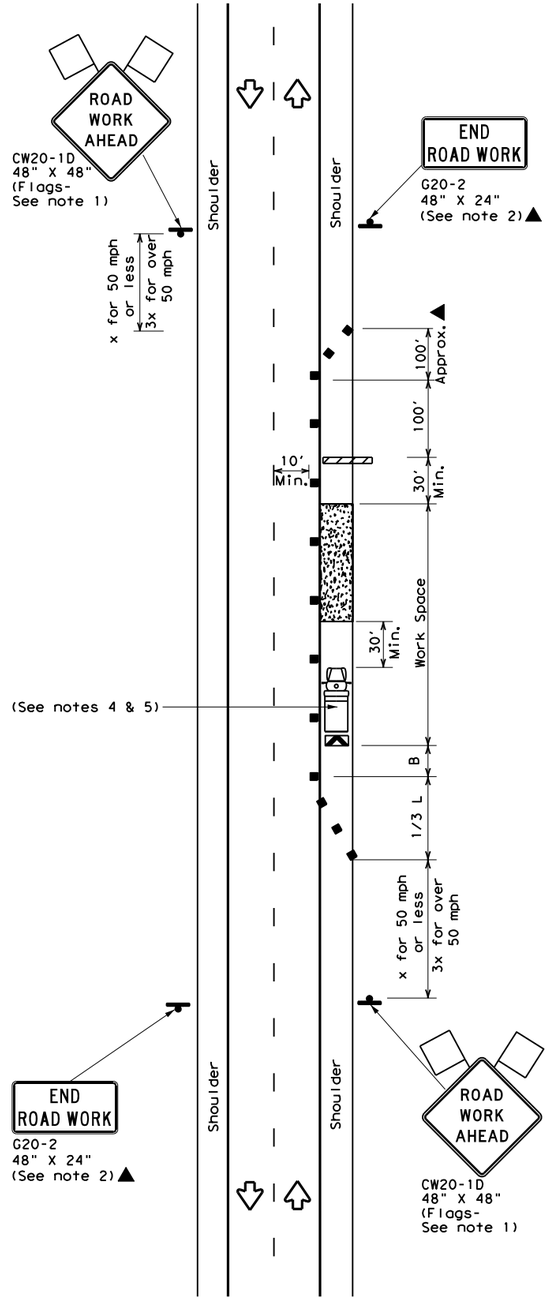
FILE: tcp1-6-18.dgn	DN:	CK:	DW:	CK:
© TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
2-18	DIST	COUNTY		SHEET NO.
	DAL	DENTON		49

DATE:
FILE:



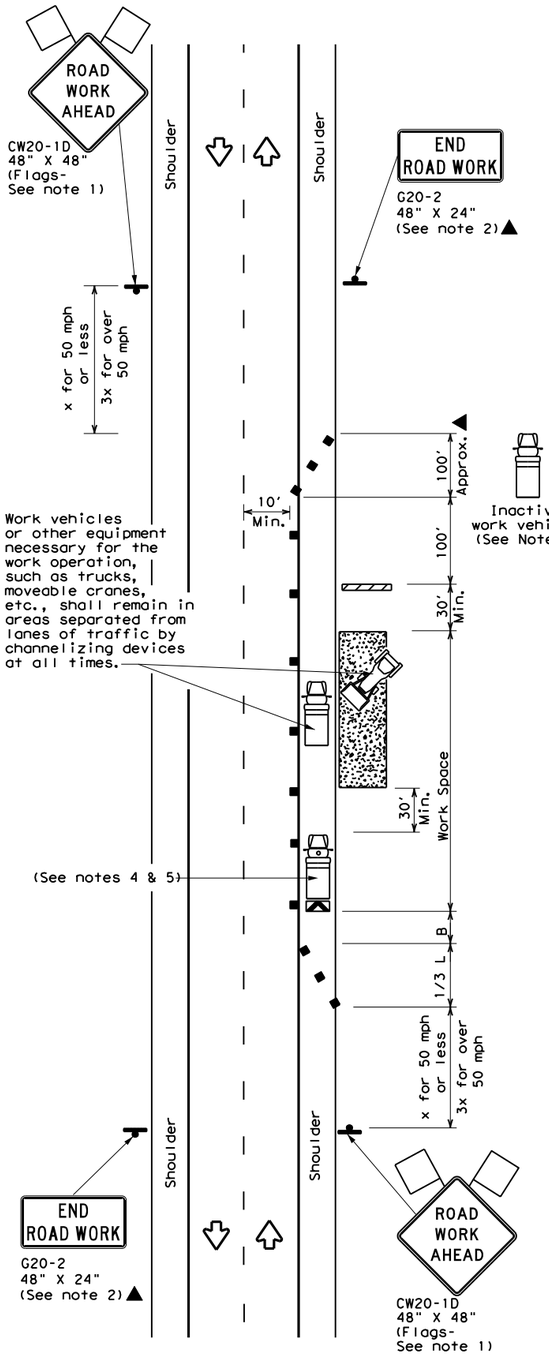
TCP (2-1a)

WORK SPACE NEAR SHOULDER
Conventional Roads



TCP (2-1b)

WORK SPACE ON SHOULDER
Conventional Roads



TCP (2-1c)

WORK VEHICLES ON SHOULDER
Conventional Roads

LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board	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
	✓	✓	✓	✓

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

FILE: tcp2-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	DAL	DENTON		50
1-97 2-18				

DATE:
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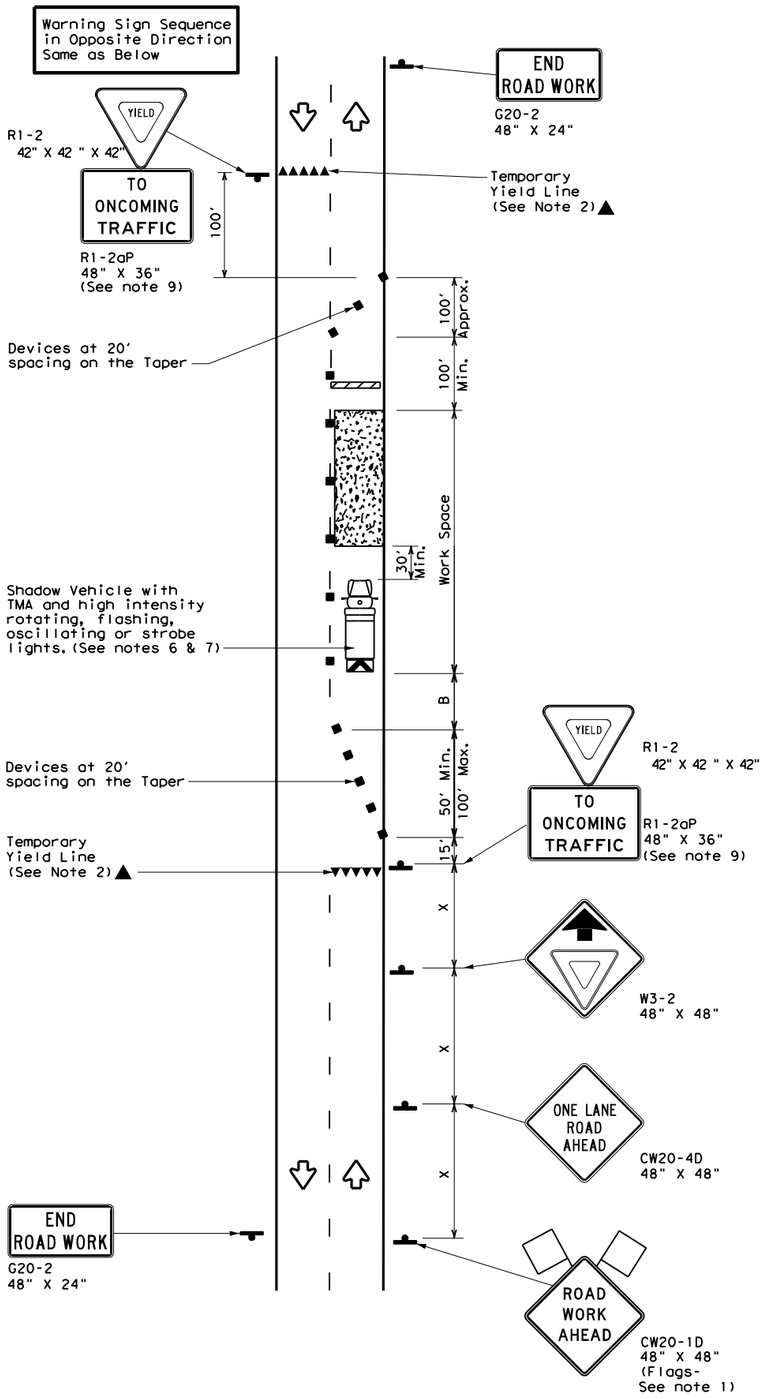
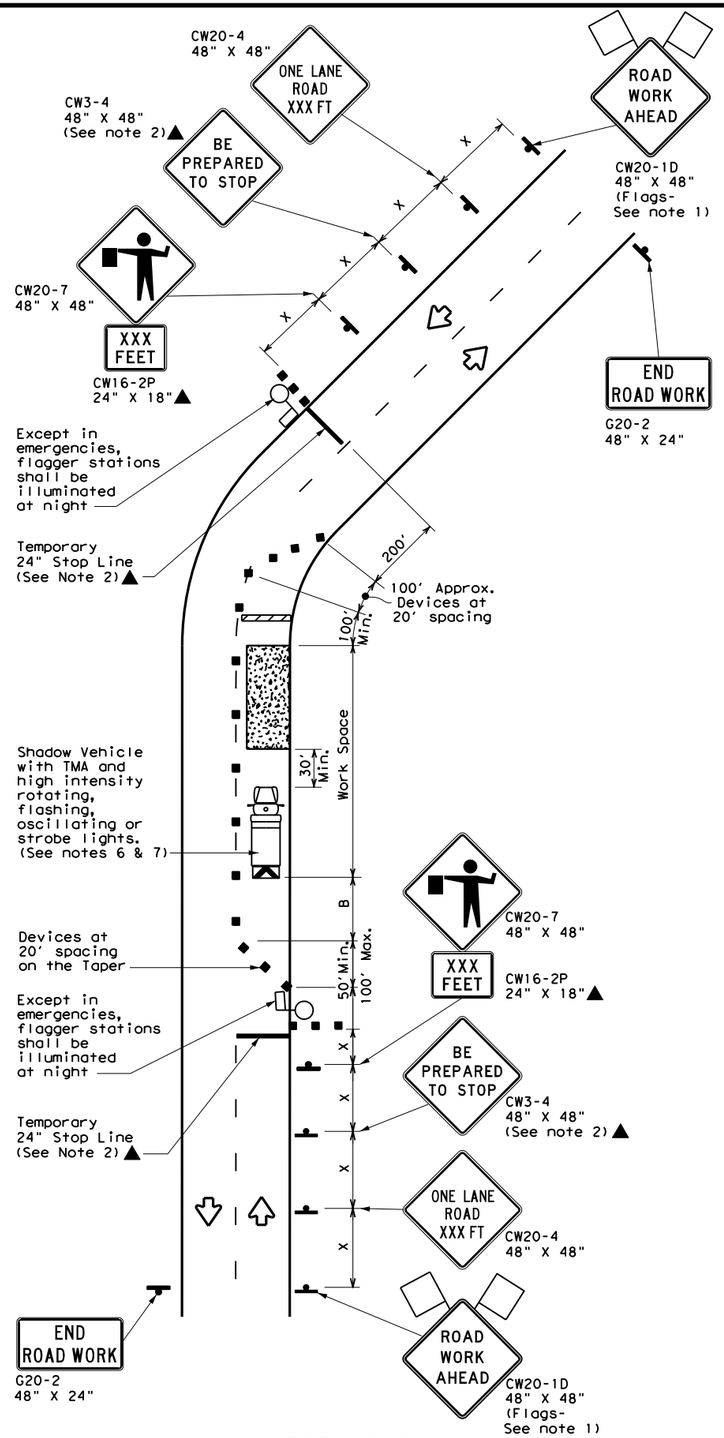


TCP (2-2a)
2-LANE ROADWAY WITHOUT PAVED SHOULDERS
ONE LANE TWO-WAY
CONTROL WITH YIELD SIGNS
(Less than 2000 ADT - See Note 9)



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

LEGEND

	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board	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. 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	2353	02	028	FM 2450
8-95 3-03	DIST	COUNTY		SHEET NO.
1-97 2-12	DAL	DENTON		51
4-98 2-18				

DATE:
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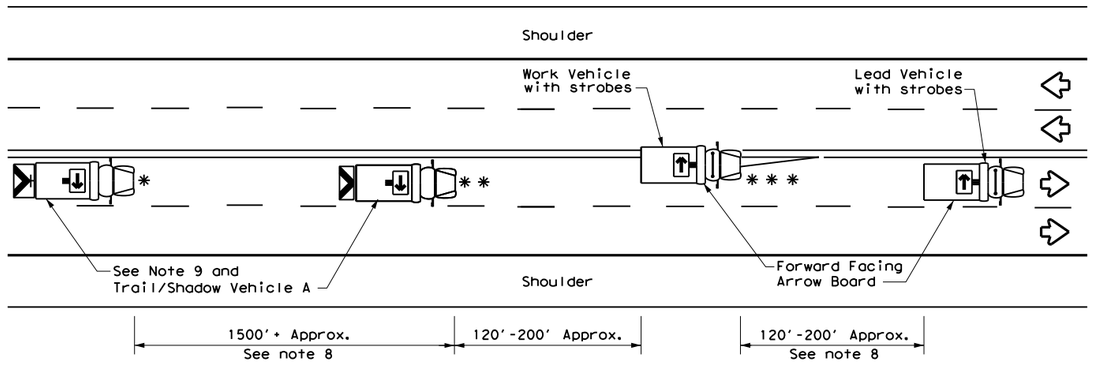
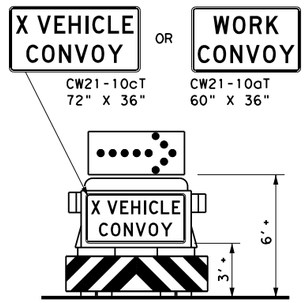


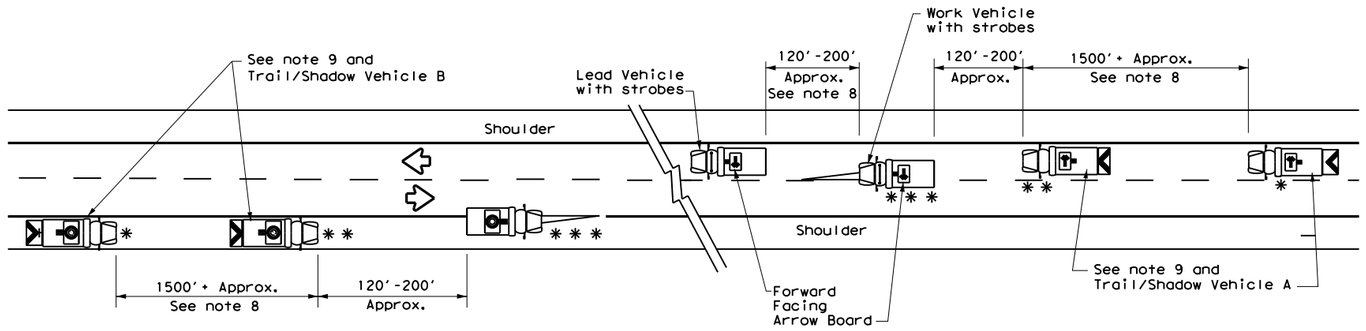
TCP (3-1a)

UNDIVIDED MULTILANE ROADWAY



TRAIL/SHADOW VEHICLE A

with RIGHT Directional display Flashing Arrow Board

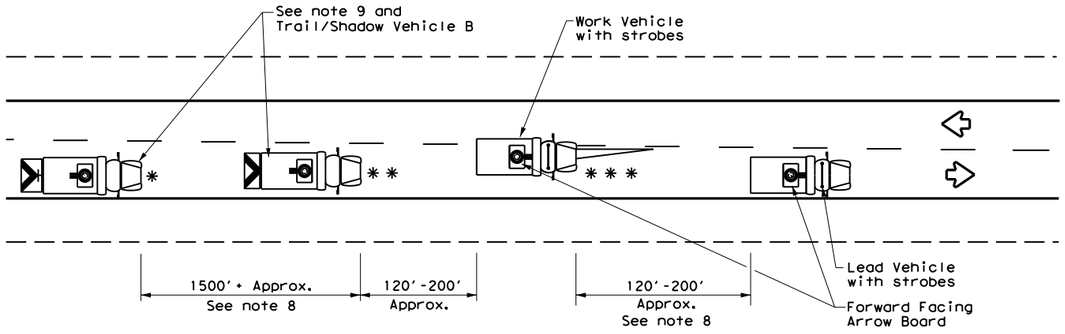


WORK ON SHOULDER

WORK ON TRAVEL LANE

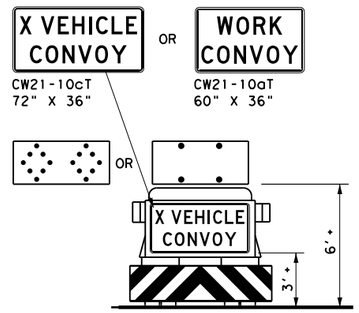
TCP (3-1b)

TWO-WAY ROADWAY WITH PAVED SHOULDERS



TCP (3-1c)

TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS



TRAIL/SHADOW VEHICLE B

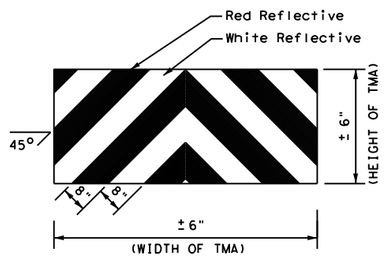
with Flashing Arrow Board in CAUTION display

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

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

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

FILE: tcp3-1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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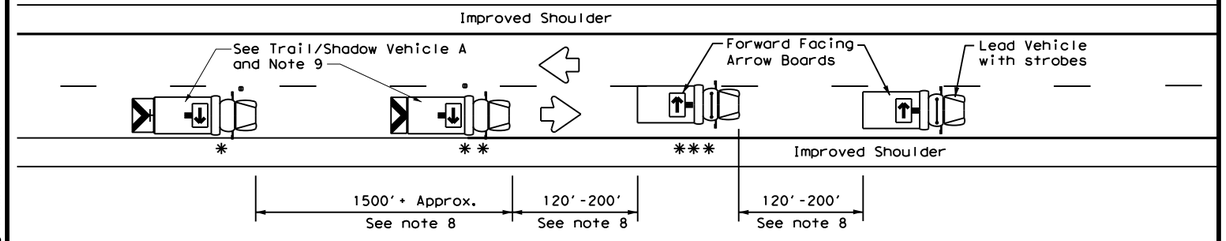
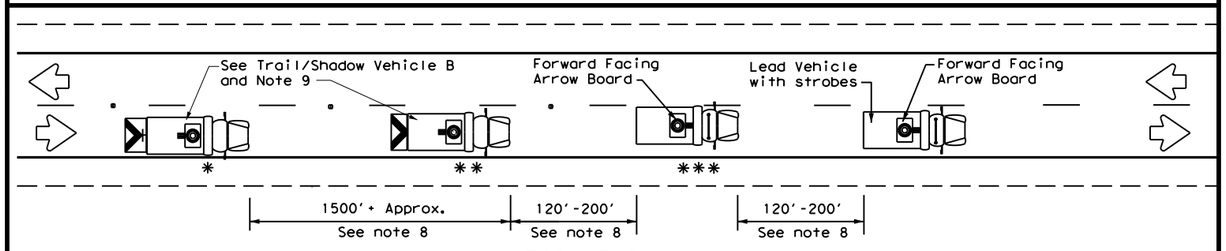


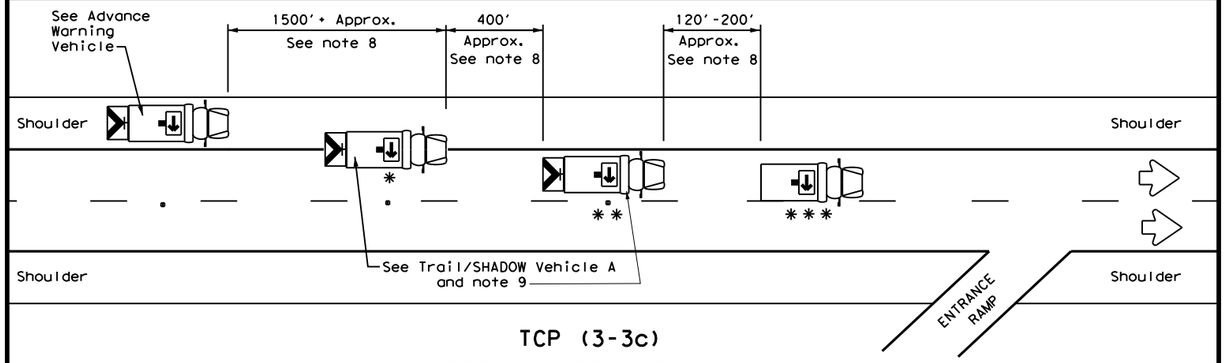
TCP (3-3a)

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



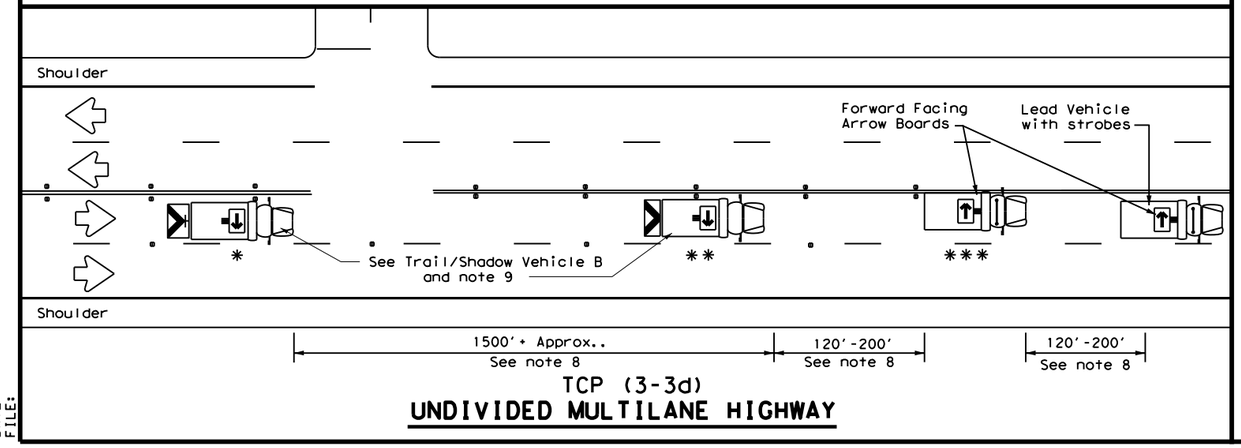
TCP (3-3b)

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



TCP (3-3c)

DIVIDED MULTILANE HIGHWAY



TCP (3-3d)

UNDIVIDED MULTILANE HIGHWAY

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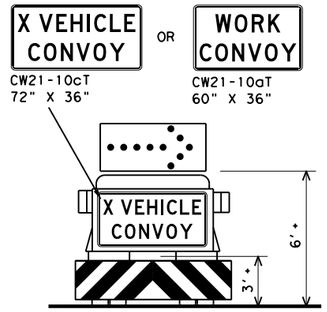
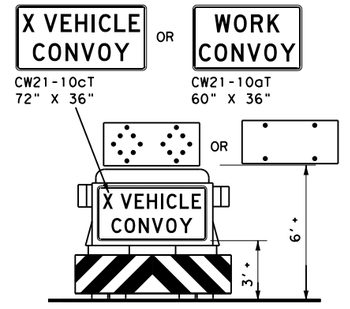


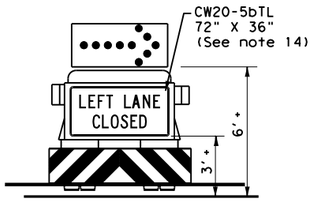
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display
Flashing Arrow Board

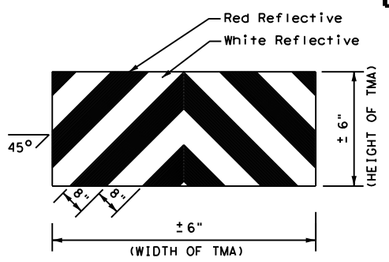


TRAIL/SHADOW VEHICLE B

with Flashing Arrow Board
in Caution Mode



ADVANCE WARNING VEHICLE



STRIPING FOR TMA

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

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

FILE: tcp3-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT September 1987	CONT	SECT	JOB	HIGHWAY
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8-95 7-13	DAL	DENTON		53
1-97 7-14				

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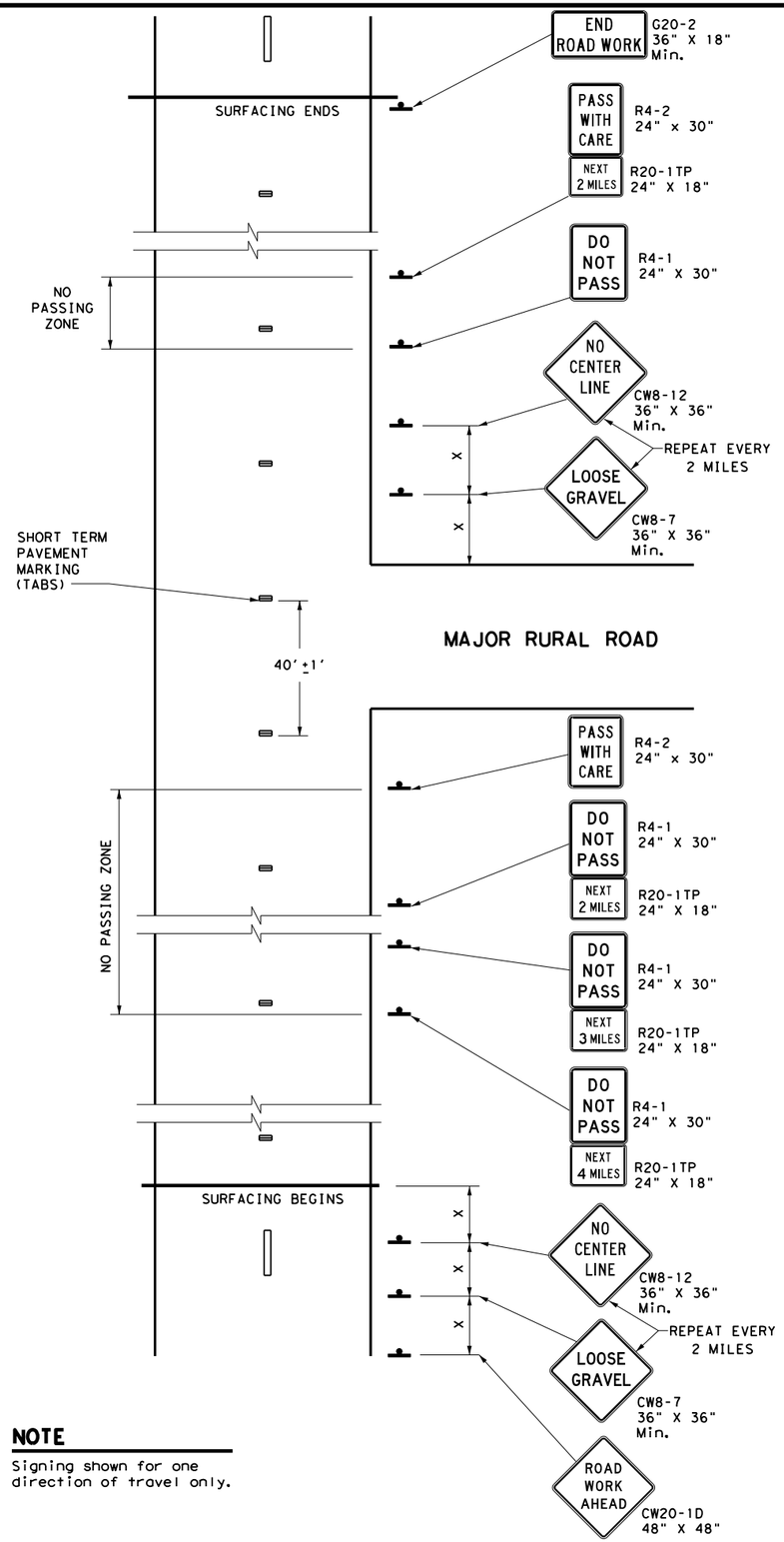
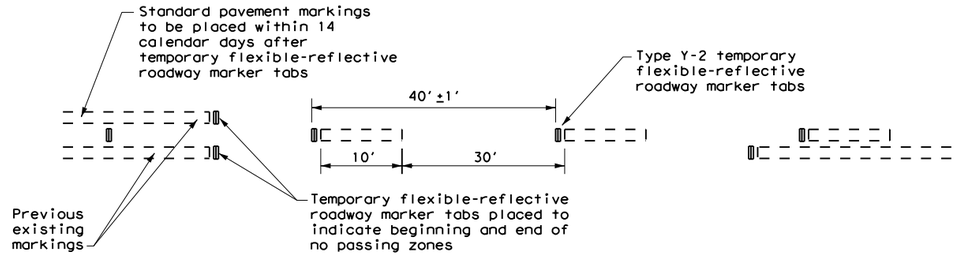


NOTE

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

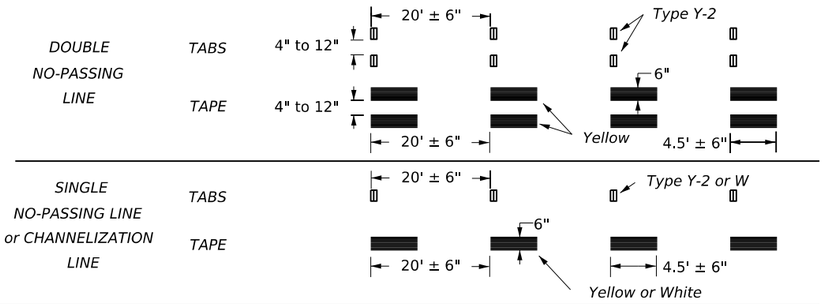
TRAFFIC CONTROL DETAILS FOR SURFACING OPERATIONS

TCP(7-1)-13

FILE: tcp7-1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT March 1991	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
4-92 4-98	DIST	COUNTY		SHEET NO.
1-97 7-13	DAL	DENTON		54

210

WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



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.

DATE:
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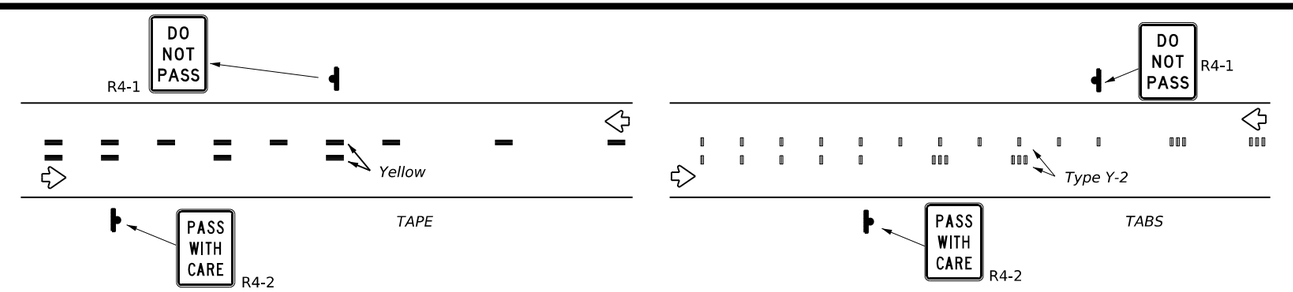
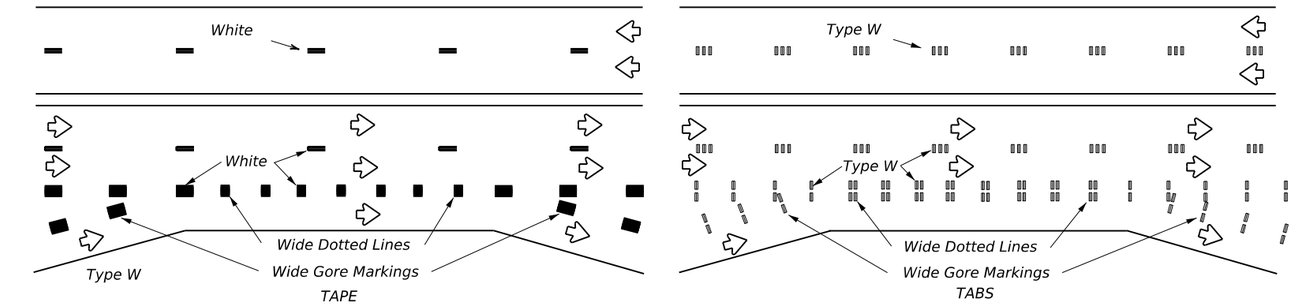
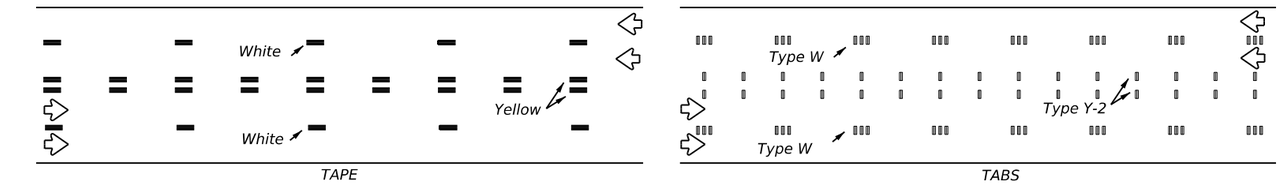
WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



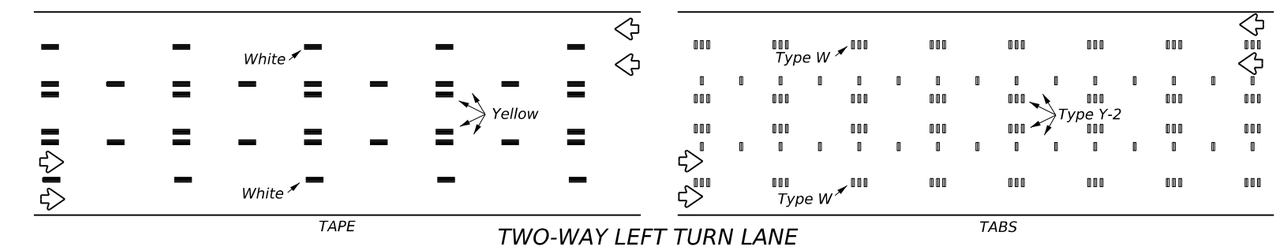
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



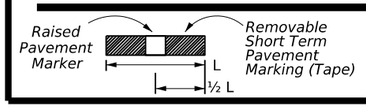
LANE LINES FOR DIVIDED HIGHWAY



LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



TWO-WAY LEFT TURN LANE



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

PREFABRICATED PAVEMENT MARKINGS

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 Safety Division Standard

WORK ZONE SHORT TERM PAVEMENT MARKINGS

WZ(STPM)-23

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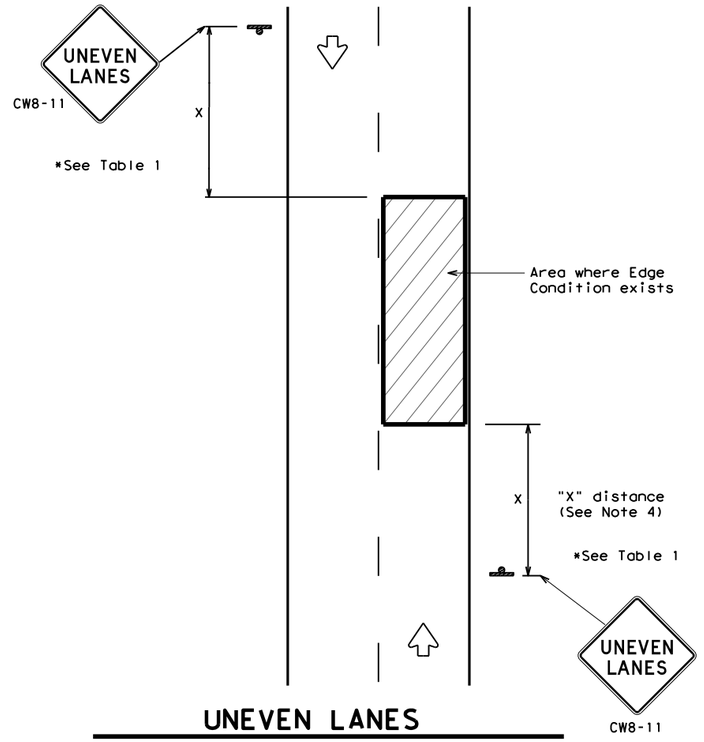
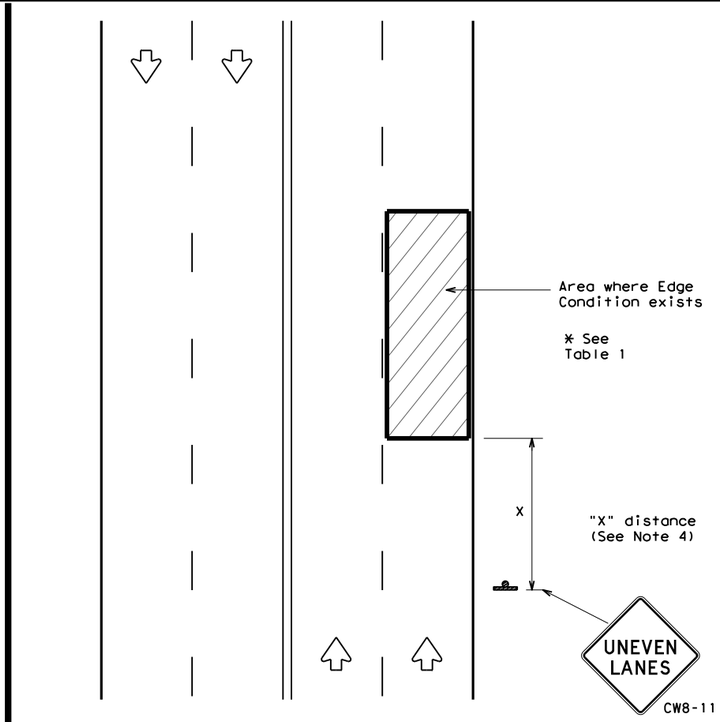
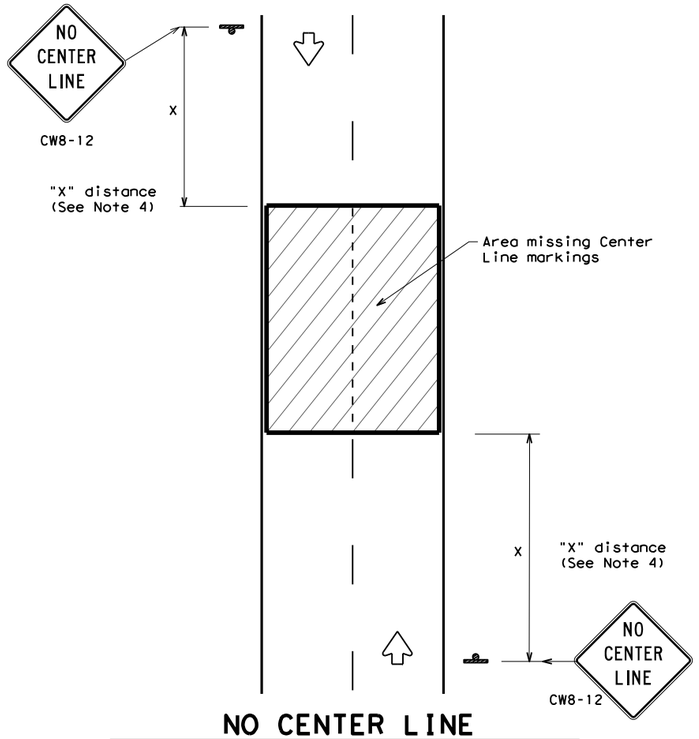


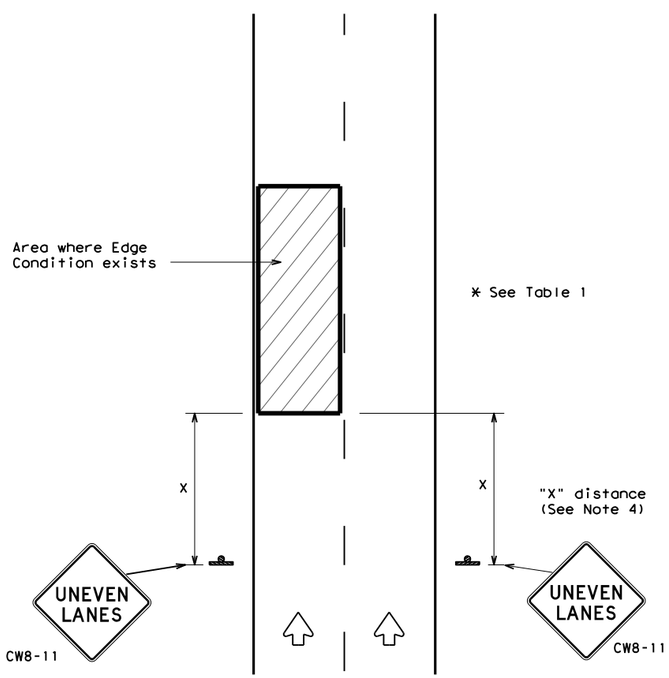
UNEVEN LANES
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
FOUR LANE CONVENTIONAL ROAD



NO CENTER LINE
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
DIVIDED ROADWAY

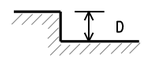
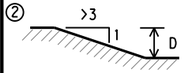
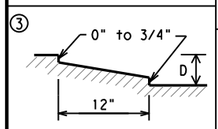
DEPARTMENTAL MATERIAL SPECIFICATIONS	
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY (REMOVABLE) PREFABRICATED PAVEMENT MARKINGS	DMS-8241
SIGN FACE MATERIALS	DMS-8300

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 	Less than or equal to: 1¼" (maximum-planing) 1½" (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 	Less than or equal to 3"	Sign: CW8-11
③  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

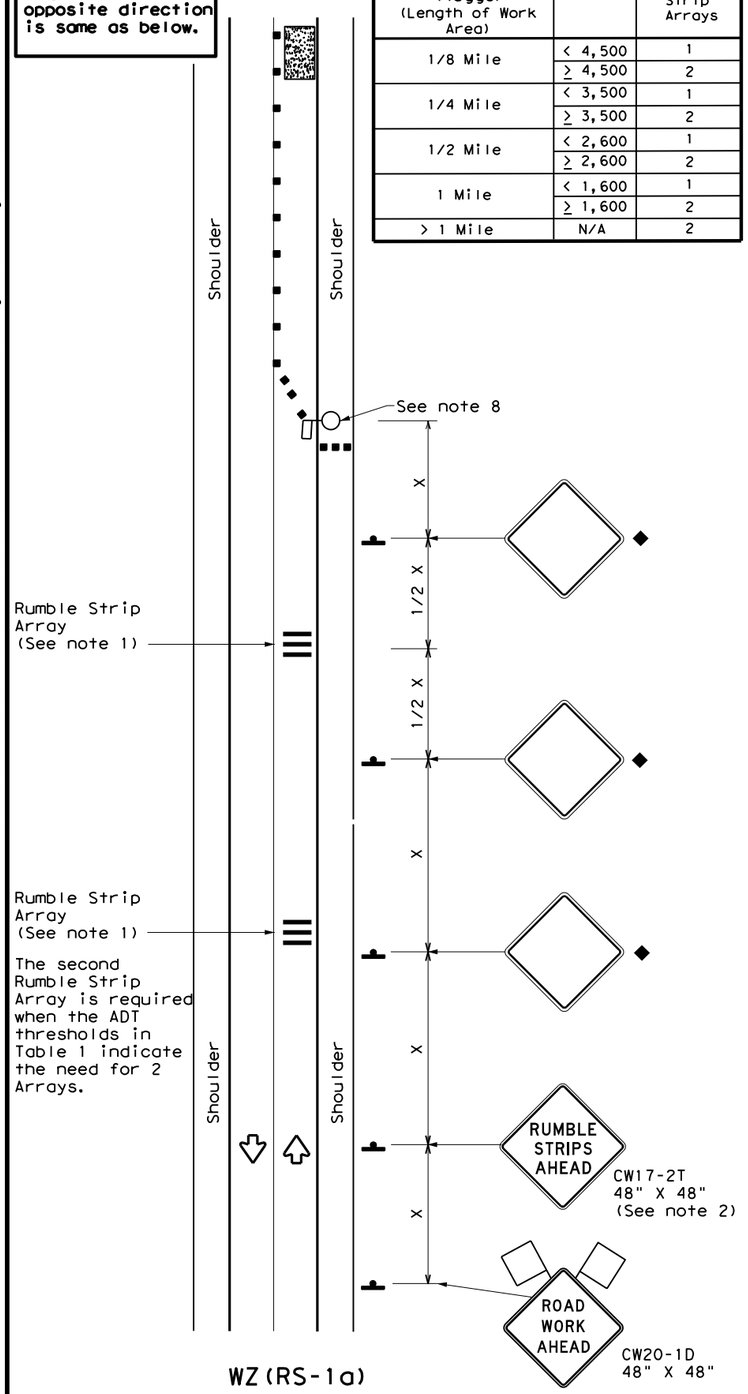
WZ(UL)-13

FILE: wzul-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
8-95 2-98 7-13	DIST	COUNTY		SHEET NO.
1-97 3-03	DAL	DENTON		56

DATE:
FILE:

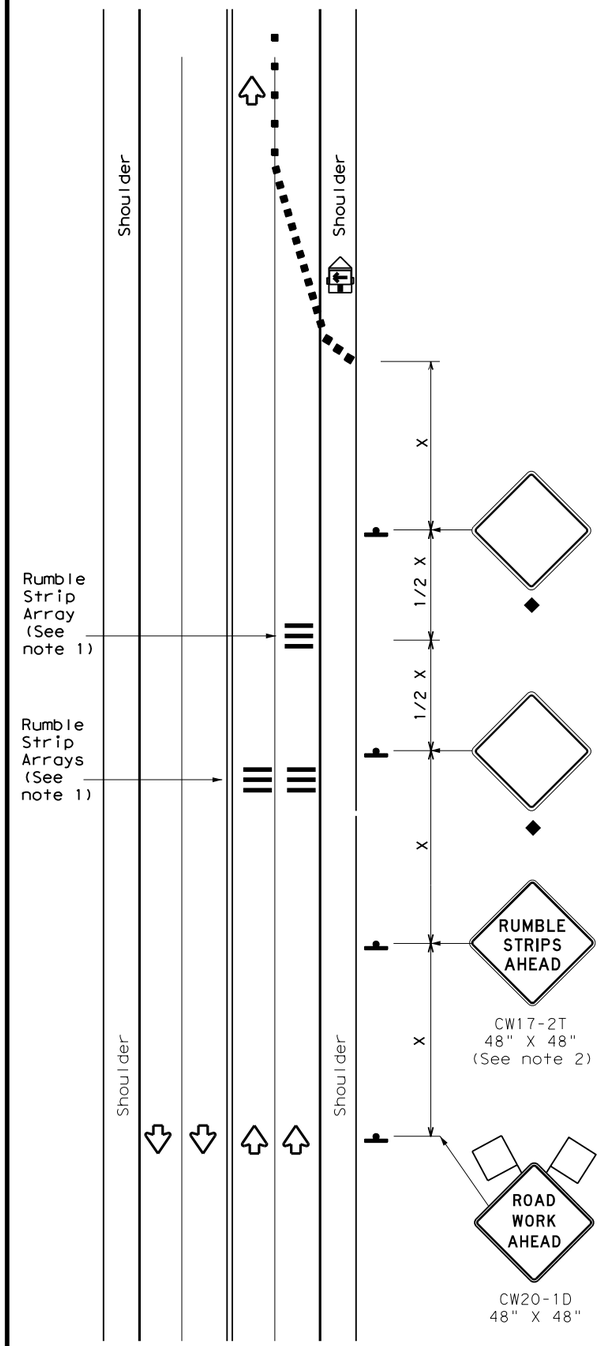
Warning sign and rumble strip sequence in opposite direction is same as below.

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)

RUMBLE STRIPS ON ONE-LANE TWO-WAY APPLICATION



WZ(RS-1b)

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. Remove Temporary Rumble Strips before removing the advanced 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 Automated Flagger Assistance Device (AFAD) or a Portable Traffic Signal (PTS).
9. Replace defective Temporary Rumble Strips as directed by the Engineer.
10. Temporary Rumble Strips may be used on freeways or expressways based on engineering judgment and written direction from the Engineer.

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.

* For posted speeds in excess of 65 MPH, it is recommended that spacing is increased as speed limits increase. Increasing space between rumble strips will improve effectiveness.

TABLE 2	
Speed	Approximate distance between strips in an array
≤ 40 MPH	10'
> 40 MPH & ≤ 55 MPH	15'
= 60 MPH	20'
≥ 65 MPH	* 35' +

Texas Department of Transportation

Traffic Safety Division Standard

TEMPORARY RUMBLE STRIPS

WZ(RS)-22

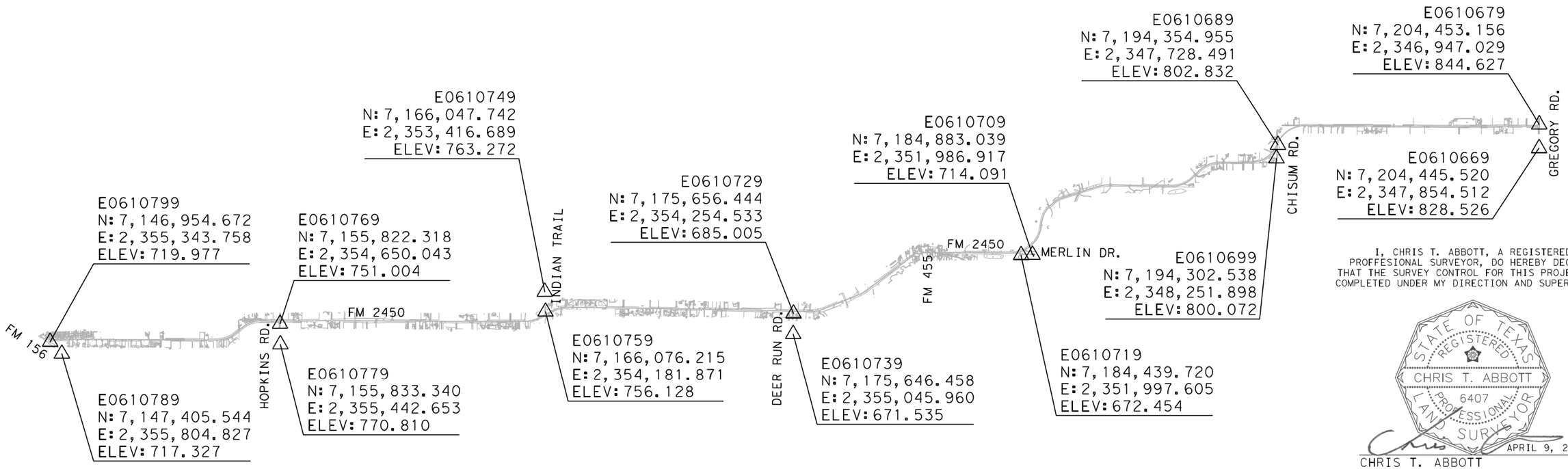
FILE: wzrs22.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-14 1-22 4-16	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		57

117

GRAPHIC SCALE

0' 2000' 4000' 8000' 12000'

22"x34" SCALE: 1" = 2000'
11"x17" SCALE: 1" = 4000'



I, CHRIS T. ABBOTT, A REGISTERED PROFFESIONAL SURVEYOR, DO HEREBY DECLARE THAT THE SURVEY CONTROL FOR THIS PROJECT WAS COMPLETED UNDER MY DIRECTION AND SUPERVISION.

STATE OF TEXAS
REGISTERED
CHRIS T. ABBOTT
6407
PROFESSIONAL
LAND SURVEYOR

APRIL 9, 2020

CHRIS T. ABBOTT
REGISTERED PROFESSIONAL LAND SURVEYOR
NO. 6407 TEXAS FIRM No. 10106900

SURVEYED DATE: DECEMBER 2019

GORRONDONA & ASSOC., INC.
7524 JACK NEWELL BLVD. SO.
FORT WORTH, TEXAS 76118
TEXAS FIRM NO. 10106900

NOTES:

1. COORDINATES ARE US SURVEY FEET ADJUSTED TO SURFACE VALUES USING A SURFACE ADJUSTMENT FACTOR OF 1.000150630.

2. HORIZONTAL CONTROL IS BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, NAD-83 NA2011 (EPOCH 2010.00) NORTH CENTRAL ZONE (4202).

3. ALL ELEVATIONS ARE BASED ON GPS DERIVED ELLIPSOID HEIGHTS AND ADJUSTED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) ELEVATIONS USING GEOID 12B.

FM 2450
SURVEY CONTROL INDEX SHEET

DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
CHECK	6	SEE TITLE SHEET		FM 2450
	STATE	DISTRICT	COUNTY	SHEET NO.
DETAIL	TEXAS	DALLAS	DENTON	58
CHECK	CONTROL	SECTION	JOB	
	2353	02	028	

CK:
DW:
CK:
DN:

DATE: 2/22/2024 1:54:33 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Plan Set/1. General/FM2450_HORIZONTAL ALIGNMENT.dgn

HORIZONTAL ALIGNMENT REPORT

Alignment name: BL CL-54
Alignment description:
Report Created: Sunday, October 15, 2023
Time: 2:25:52 PM

	STATION	X	Y
POT	0+00.000 R1	2351891.937	7180518.184
PC	0+23.852 R1	2351891.935	7180494.332

Tangential Direction: S0.005°W
Tangential Length: 23.852

PC	0+23.852 R1	2351891.935	7180494.332
PI	0+84.070 R1	2351891.929	7180434.114
CC		2352071.935	7180494.315
PT	1+40.075 R1	2351928.161	7180386.015

Radius: 180.000
Delta: 36.995° Left
Degree of Curvature(Arc): 31.831°
Length: 116.223
Tangent: 60.218
Chord: 114.214
Middle Ordinate: 9.299
External: 9.806
Tangent Back Direction: S0.005°W
Radial Direction: N89.995°W
Chord Direction: S18.492°E
Radial Direction: S53.011°W
Tangent Ahead Direction: S36.989°E

PT	1+40.075 R1	2351928.161	7180386.015
PC	2+67.232 R1	2352004.667	7180284.449

Tangential Direction: S36.989°E
Tangential Length: 127.157

PC	2+67.232 R1	2352004.667	7180284.449
PI	2+72.842 R1	2352008.042	7180279.967
CC		2352643.665	7180765.782
PT	2+78.452 R1	2352011.480	7180275.534

Radius: 800.000
Delta: 0.804° Left
Degree of Curvature(Arc): 7.162°
Length: 11.220
Tangent: 5.610
Chord: 11.220
Middle Ordinate: 0.020
External: 0.020
Tangent Back Direction: S36.989°E
Radial Direction: S53.011°W
Chord Direction: S37.391°E
Radial Direction: S52.207°W
Tangent Ahead Direction: S37.793°E

PT	2+78.452 R1	2352011.480	7180275.534
PI	3+41.516 R1	2352050.127	7180225.699

Tangential Direction: S37.793°E
Tangential Length: 63.064

PI	3+41.516 R1	2352050.127	7180225.699
PI	9+33.170 R1	2352405.574	7179752.717

Tangential Direction: S36.925°E
Tangential Length: 591.654

PI	9+33.170 R1	2352405.574	7179752.717
PC	25+73.503 R1	2353385.109	7178436.965

Tangential Direction: S36.667°E
Tangential Length: 1640.333

PC	25+73.503 R1	2353385.109	7178436.965
PI	27+33.963 R1	2353480.929	7178308.257
CC		2352412.584	7177712.951
PT	28+92.568 R1	2353539.968	7178159.053

Radius: 1212.436
Delta: 15.078° Right
Degree of Curvature(Arc): 4.726°
Length: 319.065
Tangent: 160.460
Chord: 318.145
Middle Ordinate: 10.481
External: 10.572
Tangent Back Direction: S36.667°E
Radial Direction: S53.333°W
Chord Direction: S29.128°E
Radial Direction: S68.411°W
Tangent Ahead Direction: S21.589°E

PT	28+92.568 R1	2353539.968	7178159.053
PI	30+39.509 R1	2353594.033	7178022.420

Tangential Direction: S21.589°E
Tangential Length: 146.941

PI	30+39.509 R1	2353594.033	7178022.420
PI	44+04.916 R1	2354097.186	7176753.100

Tangential Direction: S21.623°E
Tangential Length: 1365.407

PI	119+69.830 R2	2355266.086	7150933.553
PI	151+25.793 R2	2355246.649	7147777.649

Tangential Direction: S0.353°W
Tangential Length: 3155.963

PC	44+69.014 R1	2354118.765	7176692.744
PI	46+34.974 R1	2354174.636	7176536.472
CC		2353227.229	7176373.998
PT	47+97.595 R1	2354174.025	7176370.513

Radius: 946.803
Delta: 19.884° Right
Degree of Curvature(Arc): 6.051°
Length: 328.581
Tangent: 165.960
Chord: 326.935
Middle Ordinate: 14.218
External: 14.435
Tangent Back Direction: S19.673°E
Radial Direction: S70.327°W
Chord Direction: S9.731°E
Radial Direction: N89.789°W
Tangent Ahead Direction: S0.211°W

PT	47+97.595 R1	2354174.025	7176370.513
PI	49+13.912 R1	2354173.602	7176254.197

Tangential Direction: S0.208°W
Tangential Length: 116.317

PI	49+13.912 R1	2354173.602	7176254.197
PI	51+60.386 R1	2354167.991	7176007.788

Tangential Direction: S1.305°W
Tangential Length: 246.473

PI	51+60.386 R1	2354167.991	7176007.788
PI	74+15.242 R1	2354117.786	7173753.490

Tangential Direction: S1.276°W
Tangential Length: 2254.856

PI	74+15.242 R1	2354117.786	7173753.490
PI	82+43.749 R1	2354100.294	7172925.168

Tangential Direction: S1.210°W
Tangential Length: 828.507

PI	82+43.749 R1	2354100.294	7172925.168
PI	119+58.961 R1	2354041.967	7169210.414

Tangential Direction: S0.900°W
Tangential Length: 3715.212

PI	119+58.961 R1	2354041.967	7169210.414
PC	142+82.857 R1	2354009.264	7166886.747

Tangential Direction: S0.806°W
Tangential Length: 2323.896

PC	142+82.857 R1	2354009.264	7166886.747
PI	145+37.984 R1	2354005.674	7166631.646
CC		2355079.158	7166871.690
PT	147+83.757 R1	2354117.576	7166402.371

Radius: 1070.000
Delta: 26.822° Left
Degree of Curvature(Arc): 5.355°
Length: 500.900
Tangent: 255.126
Chord: 496.339
Middle Ordinate: 29.177
External: 29.995
Tangent Back Direction: S0.806°W
Radial Direction: N89.194°W
Chord Direction: S12.605°E
Radial Direction: S63.984°W
Tangent Ahead Direction: S26.016°E

PT	147+83.757 R1	2354117.576	7166402.371
PI	148+78.270 R1	2354159.031	7166317.435

Tangential Direction: S26.016°E
Tangential Length: 94.512

PI	148+78.270 R1	2354159.031	7166317.435
PI	153+79.061 R1	2354393.350	7165874.845

Tangential Direction: S27.898°E
Tangential Length: 500.791

PI	153+79.061 R1	2354393.350	7165874.845
PC	155+16.641 R1	2354453.522	7165751.120

Tangential Direction: S25.935°E
Tangential Length: 137.580

PC	155+16.641 R1	2354453.522	7165751.120
PI	157+06.257 R1	2354536.452	7165580.601
CC		2353577.024	7165324.847
PT	158+91.194 R1	2354549.405	7165391.428

Radius: 974.658
Delta: 22.018° Right
Degree of Curvature(Arc): 5.879°
Length: 374.553
Tangent: 189.616
Chord: 372.252
Middle Ordinate: 17.937
External: 18.273
Tangent Back Direction: S25.935°E
Radial Direction: S64.065°W
Chord Direction: S14.926°E
Radial Direction: S86.083°W
Tangent Ahead Direction: S3.917°E

PC	159+28.988 R1	2354551.987	7165353.723
PI	160+37.611 R1	2354559.407	7165245.354
CC		2351777.725	7165163.762
PT	161+46.124 R1	2354558.351	7165136.736

Radius: 2780.758
Delta: 4.474° Right
Degree of Curvature(Arc): 2.060°
Length: 217.136
Tangent: 108.623
Chord: 217.081
Middle Ordinate: 2.119
External: 2.121
Tangent Back Direction: S3.917°E
Radial Direction: S86.083°W
Chord Direction: S1.680°E
Radial Direction: N89.443°W
Tangent Ahead Direction: S0.557°W

PT	161+46.124 R1	2354558.351	7165136.736
PI	162+01.198 R1	2354557.816	7165081.664

Tangential Direction: S0.557°W
Tangential Length: 55.074

PI	162+01.198 R1	2354557.816	7165081.664
PI	172+61.916 R1	2354560.992	7164020.951

Tangential Direction: S0.172°E
Tangential Length: 1060.719

PI	172+61.916 R1	2354560.992	7164020.951
PI	181+31.249 R1	2354565.752	7163151.631

Tangential Direction: S0.314°E
Tangential Length: 869.332

PI	181+31.249 R1	2354565.752	7163151.631
EQNBK	185+84.000 R1	2354561.806	7162698.897
EQNAHD	0+00.000 R2	2354561.806	7162698.897
PI	7+80.352 R2	2354555.004	7161918.574

Tangential Direction: S0.499°W
Tangential Length: 1233.104

PI	7+80.352 R2	2354555.004	7161918.574
PI	14+06.088 R2	2354551.845	7161292.847

Tangential Direction: S0.289°W
Tangential Length: 625.735

PI	14+06.088 R2	2354551.845	7161292.847
PC	52+47.356 R2	2354523.865	7157451.681

Tangential Direction: S0.417°W
Tangential Length: 3841.268

PC	52+47.356 R2	2354523.865	7157451.681
PI	53+70.535 R2	2354522.967	7157328.505
CC		2359023.745	7157418.902
PT	54+93.652 R2	2354528.810	7157205.465

Radius: 4500.000
Delta: 3.136° Left
Degree of Curvature(Arc): 1.273°
Length: 246.296
Tangent: 123.179
Chord: 246.265
Middle Ordinate: 1.685
External: 1.686
Tangent Back Direction: S0.417°W
Radial Direction: N89.583°W
Chord Direction: S1.151°E
Radial Direction: S87.281°W
Tangent Ahead Direction: S2.719°E

PT	54+93.652 R2	2354528.810	7157205.465
PI	57+96.939 R2	2354543.195	7156902.519

Tangential Direction: S2.719°E
Tangential Length: 303.287

PI	57+96.939 R2	2354543.195	7156902.519
PI	69+71.435 R2	2354537.193	7155728.038

Tangential Direction: S0.293°W
Tangential Length: 1174.496

PI	69+71.435 R2	2354537.193	7155728.038
PC	76+23.044 R2	2354534.442	7155076.435

Tangential Direction: S0.242°W
Tangential Length: 651.609

PC	76+23.044 R2	2354534.442	7155076.435
PI	80+19.086 R2	2354532.771	7154680.397
CC		2355640.141	7155071.768
PT	83+83.645 R2	2354782.926	7154373.360

Radius: 1105.709
Delta: 39.413° Left
Degree of Curvature(Arc): 5.182°
Length: 760.601
Tangent: 396.042
Chord: 745.693
Middle Ordinate: 64.759
External: 68.787
Tangent Back Direction: S0.242°W
Radial Direction: N89.758°W
Chord Direction: S19.465°E
Radial Direction: S50.829°W
Tangent Ahead Direction: S39.171°E

PT	83+83.645 R2	2354782.926	7154373.360
PC	87+39.494 R2	2355011.903	7154100.967

Tangential Direction: S40.051°E
Tangential Length: 355.849

PC	87+39.494 R2	2355011.903	7154100.967
PI	91+35.936 R2	2355267.000	7153797.501
CC		2354145.303	7153372.492
PT	95+02.162 R2	2355277.048	7153401.187

Radius: 1132.109
Delta: 38.598° Right
Degree of Curvature(Arc): 5.061°
Length: 762.667
Tangent: 396.441
Chord: 748.327
Middle Ordinate: 63.618
External: 67.406
Tangent Back Direction: S40.051°E
Radial Direction: S49.949°W
Chord Direction: S20.752°E
Radial Direction: S88.548°W
Tangent Ahead Direction: S1.452°E

PT	95+02.162 R2	2355277.048	7153401.187
PI	96+29.221 R2	2355277.866	7153274.131

Tangential Direction: S0.369°E
Tangential Length: 127.059

PI	96+29.221 R2	2355277.866	7153274.131
PI	107+60.977 R2	2355273.297	7152142.384

Tangential Direction: S0.231°W
Tangential Length: 1131.756

PI	107+60.977 R2	2355273.297	7152142.384
PI	119+69.830 R2	2355266.086	7150933.553

Tangential Direction: S0.342°W
Tangential Length: 1208.853

PI	119+69.830 R2	2355266.086	7150933.553
PI	151+25.793 R2	2355246.649	7147777.649

Tangential Direction: S0.353°W
Tangential Length: 3155.963

PI	151+25.793 R2	2355246.649	7147777.649
PI	152+43.117 R2	2355247.402	7147660.328

Tangential Direction: S0.368°E
Tangential Length: 117.324

PI	152+43.117 R2	2355247.402	7147660.328
POT	161+14.402 R2	2355275.097	7146789.483

Tangential Direction: S1.822°E
Tangential Length: 871.285

NOTES:

(1) HORIZONTAL DATA SHOWN ON THIS PAGE IS FOR DESIGN PURPOSE ONLY.

(2) DO NOT USE THIS INFORMATION FOR CONSTRUCTION

(3) PERFORM WIDENING OF THE PROJECT ACCORDING TO THE TYPICAL SECTIONS.

(4) TO VERIFY THE GEOMETRIC DATA SEE AS-BUILT PROJECT.

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

HORIZONTAL ALIGNMENT DATA

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		59

CK:
DW:
CK:
DW:

DATE: 2/22/2024 1:54:36 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/2353020028/4 - Design/Plan Set/1. General/FM2450_HORIZONTAL ALIGNMENT.dgn

VERTICAL ALIGNMENT REPORT

Alignment name: BL CL-28
Alignment description:
Report Created: Sunday, October 15, 2023
Time: 4:08:32 PM

	STATION	ELEVATION
POT	-0+10.580 R1	677.796
VPC	0+30.221 R1	677.892
Tangent Grade:	0.002	
Tangent Length:	40.801	
VPC	0+30.221 R1	677.892
VPI	1+21.993 R1	678.110
VPT	2+13.764 R1	674.874
VHP	0+41.784 R1	677.906
Length:	183.543	
Entrance Grade:	0.002	
Exit Grade:	-0.035	
K Value =:	48.769	
Middle Ordinate (E):	-0.863	
VPT	2+13.764 R1	674.874
VPC	5+16.169 R1	664.209
Tangent Grade:	-0.035	
Tangent Length:	302.404	
VPC	5+16.169 R1	664.209
VPI	6+66.169 R1	658.920
VPT	8+16.169 R1	657.797
Length:	300.000	
Entrance Grade:	-0.035	
Exit Grade:	-0.007	
K Value =:	107.993	
Middle Ordinate (E):	1.042	
VPT	8+16.169 R1	657.797
VPC	16+65.295 R1	651.441
Tangent Grade:	-0.007	
Tangent Length:	849.126	
VPC	16+65.295 R1	651.441
VPI	20+85.475 R1	648.296
PVCC	25+05.655 R1	652.373
VLP	20+31.280 R1	650.072
Length:	840.360	
Entrance Grade:	-0.007	
Exit Grade:	0.010	
K Value =:	488.966	
Middle Ordinate (E):	1.805	
PVCC	25+05.655 R1	652.373
VPI	27+30.088 R1	654.550
PVRC	29+54.522 R1	658.719
Length:	448.866	
Entrance Grade:	0.010	
Exit Grade:	0.019	
K Value =:	505.954	
Middle Ordinate (E):	0.498	
PVRC	29+54.522 R1	658.719
VPI	31+34.499 R1	662.061
VPT	33+14.476 R1	662.823
Length:	359.954	
Entrance Grade:	0.019	
Exit Grade:	0.004	
K Value =:	250.986	
Middle Ordinate (E):	-0.645	
VPT	33+14.476 R1	662.823
VPC	38+59.583 R1	665.130
Tangent Grade:	0.004	
Tangent Length:	545.107	
VPC	38+59.583 R1	665.130
VPI	39+02.172 R1	665.310
VPT	39+44.761 R1	666.561
Length:	85.178	
Entrance Grade:	0.004	
Exit Grade:	0.029	
K Value =:	33.882	
Middle Ordinate (E):	0.268	
VPT	39+44.761 R1	666.561
VPC	42+07.922 R1	674.290
Tangent Grade:	0.029	
Tangent Length:	263.161	
VPC	42+07.922 R1	674.290
VPI	44+78.893 R1	682.249
VPT	47+49.864 R1	682.771
Length:	541.942	
Entrance Grade:	0.029	
Exit Grade:	0.002	
K Value =:	197.468	
Middle Ordinate (E):	-1.859	
VPT	47+49.864 R1	682.771
VPC	52+08.079 R1	683.654
Tangent Grade:	0.002	
Tangent Length:	458.215	
VPC	52+08.079 R1	683.654
VPI	55+70.853 R1	684.353
VPT	59+33.626 R1	690.316
Length:	725.547	
Entrance Grade:	0.002	
Exit Grade:	0.016	
K Value =:	500.053	
Middle Ordinate (E):	1.316	
VPT	59+33.626 R1	690.316
VPC	83+11.331 R1	729.396
Tangent Grade:	0.016	
Tangent Length:	2377.704	
VPC	83+11.331 R1	729.396
VPI	84+69.045 R1	731.988
VPT	86+26.759 R1	727.936
VHP	84+34.388 R1	730.407
Length:	315.428	
Entrance Grade:	0.016	
Exit Grade:	-0.026	
K Value =:	74.870	
Middle Ordinate (E):	-1.661	
VPT	86+26.759 R1	727.936
VPC	90+69.664 R1	716.556
Tangent Grade:	-0.026	
Tangent Length:	442.906	
VPC	90+69.664 R1	716.556
VPI	92+49.282 R1	711.941
VPT	94+28.899 R1	717.124
VLP	92+38.860 R1	714.382
Length:	359.235	
Entrance Grade:	-0.026	
Exit Grade:	0.029	
K Value =:	65.851	
Middle Ordinate (E):	2.450	
VPT	94+28.899 R1	717.124
VPC	97+03.417 R1	725.047
Tangent Grade:	0.029	
Tangent Length:	274.518	
VPC	97+03.417 R1	725.047
VPI	100+34.118 R1	734.590
VPT	103+64.819 R1	734.956
Length:	661.402	
Entrance Grade:	0.029	
Exit Grade:	0.001	
K Value =:	238.305	
Middle Ordinate (E):	-2.295	
VPT	103+64.819 R1	734.956
VPC	103+86.672 R1	734.980
Tangent Grade:	0.001	
Tangent Length:	21.853	
VPC	103+86.672 R1	734.980
VPI	104+86.672 R1	735.090
VPT	105+86.672 R1	738.357
Length:	200.000	
Entrance Grade:	0.001	
Exit Grade:	0.033	
K Value =:	63.363	
Middle Ordinate (E):	0.789	
VPT	105+86.672 R1	738.357
VPC	113+15.702 R1	762.174
Tangent Grade:	0.033	
Tangent Length:	729.031	
VPC	113+15.702 R1	762.174
VPI	114+89.040 R1	767.837
VPT	116+62.378 R1	765.602
VHP	115+64.265 R1	766.234
Length:	346.676	
Entrance Grade:	0.033	
Exit Grade:	-0.013	
K Value =:	76.085	
Middle Ordinate (E):	-1.974	
VPT	116+62.378 R1	765.602
VPC	120+59.473 R1	760.481
Tangent Grade:	-0.013	
Tangent Length:	397.094	
VPC	120+59.473 R1	760.481
VPI	126+60.027 R1	752.737
VPT	132+60.580 R1	753.776
VLP	131+18.450 R1	753.653
Length:	1201.108	
Entrance Grade:	-0.013	
Exit Grade:	0.002	
K Value =:	821.222	
Middle Ordinate (E):	2.196	
VPT	132+60.580 R1	753.776
EQNBK	185+84.000 R1	
EQNAHD	0+00.000 R2	
VPC	5+26.191 R2	763.900
Tangent Grade:	0.002	
Tangent Length:	5849.611	
VPC	5+26.191 R2	763.900
VPI	12+26.191 R2	765.112
VPT	19+26.191 R2	756.624
VHP	7+01.061 R2	764.051
Length:	1400.000	
Entrance Grade:	0.002	
Exit Grade:	-0.012	
K Value =:	1010.392	
Middle Ordinate (E):	-2.425	
VPT	19+26.191 R2	756.624
VPC	25+37.700 R2	749.209
Tangent Grade:	-0.012	
Tangent Length:	611.509	
VPC	25+37.700 R2	749.209
VPI	30+12.700 R2	743.450
VPT	34+87.700 R2	749.622
VLP	29+96.262 R2	746.429
Length:	950.000	
Entrance Grade:	-0.012	
Exit Grade:	0.013	
K Value =:	378.186	
Middle Ordinate (E):	2.983	
VPT	34+87.700 R2	749.622
VPC	52+81.461 R2	772.931
Tangent Grade:	0.013	
Tangent Length:	1793.761	
VPC	52+81.461 R2	772.931
VPI	56+06.461 R2	777.155
VPT	59+31.461 R2	770.114
VHP	55+25.177 R2	774.515
Length:	650.000	
Entrance Grade:	0.013	
Exit Grade:	-0.022	
K Value =:	187.552	
Middle Ordinate (E):	-2.816	
VPT	59+31.461 R2	770.114
VPC	62+10.045 R2	764.080
Tangent Grade:	-0.022	
Tangent Length:	278.584	
VPC	62+10.045 R2	764.080
VPI	68+66.700 R2	749.855
VPT	75+23.355 R2	749.182
Length:	1313.310	
Entrance Grade:	-0.022	
Exit Grade:	-0.001	
K Value =:	636.344	
Middle Ordinate (E):	3.388	
VPT	75+23.355 R2	749.182
VPC	83+57.526 R2	748.328
Tangent Grade:	-0.001	
Tangent Length:	834.171	
VPC	83+57.526 R2	748.328
VPI	88+32.526 R2	747.842
VPT	93+07.526 R2	759.213
VLP	83+96.497 R2	748.308
Length:	950.000	
Entrance Grade:	-0.001	
Exit Grade:	0.024	
K Value =:	380.551	
Middle Ordinate (E):	2.964	
VPT	93+07.526 R2	759.213
VPC	94+23.713 R2	761.994
Tangent Grade:	0.024	
Tangent Length:	116.187	
VPC	94+23.713 R2	761.994
VPI	100+77.234 R2	777.640
VPT	107+30.754 R2	765.890
VHP	101+70.151 R2	770.929
Length:	1307.041	
Entrance Grade:	0.024	
Exit Grade:	-0.018	
K Value =:	311.799	
Middle Ordinate (E):	-6.849	
VPT	107+30.754 R2	765.890
VPC	112+32.252 R2	756.873
Tangent Grade:	-0.018	
Tangent Length:	501.498	
VPC	112+32.252 R2	756.873
VPI	117+32.252 R2	747.883
VPT	122+32.252 R2	743.995
Length:	1000.000	
Entrance Grade:	-0.018	
Exit Grade:	-0.008	
K Value =:	980.008	
Middle Ordinate (E):	1.276	
VPT	122+32.252 R2	743.995
VPC	144+33.350 R2	726.880
Tangent Grade:	-0.008	
Tangent Length:	2201.098	
VPC	144+33.350 R2	726.880
VPI	149+33.350 R2	722.992

NOTES:

(1) VERTICAL DATA SHOWN ON THIS PAGE IS FOR DESIGN PURPOSE ONLY.

(2) DO NOT USE THIS INFORMATION FOR CONSTRUCTION.

(3) PERFORM WIDENING OF THE PROJECT ACCORDING TO THE TYPICAL SECTIONS.

(4) TO VERIFY THE GEOMETRIC DATA SEE AS-BUILT PROJECT.

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

VERTICAL ALIGNMENT DATA

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		60

	Superelevation : LT			Superelevation : RT		
CURVE NO	Point Type	STATION	Cross Slope	Point Type	Station	Cross Slope
1	Start Point	0+00.000 R1	-0.04	Start Point	0+00.000 R1	0.04
	Full Super	0+59.642 R1	-0.06	Full Super	0+59.642 R1	0.06
	Full Super	1+04.285 R1	-0.06	Full Super	1+04.285 R1	0.06
	End Point	1+67.468 R1	-0.039	End Point	1+67.468 R1	0.039
2	Normal Crown	24+00.000 R1	-0.02	Normal Crown	24+00.000 R1	-0.02
	Normal Crown	24+09.826 R1	-0.02	Normal Crown	24+09.826 R1	-0.02
	Level Crown	24+69.475 R1	0	Full Super	25+99.510 R1	-0.044
	Reverse Crown	25+29.125 R1	0.02	Full Super	28+66.561 R1	-0.044
	Full Super	25+99.510 R1	0.044	Normal Crown	30+56.245 R1	-0.02
	Full Super	28+66.561 R1	0.044	Normal Crown	31+00.000 R1	-0.02
	Reverse Crown	29+36.947 R1	0.02			
	Level Crown	29+96.596 R1	0			
	Normal Crown	30+56.245 R1	-0.02			
	Normal Crown	31+00.000 R1	-0.02			
3	Normal Crown	41+00.000 R1	-0.02	Normal Crown	41+00.000 R1	-0.02
	Normal Crown	42+92.214 R1	-0.02	Normal Crown	44+11.513 R1	-0.02
	Level Crown	43+51.863 R1	0	Full Super	44+98.302 R1	-0.049
	Reverse Crown	44+11.513 R1	0.02	Full Super	47+68.308 R1	-0.049
	Full Super	44+98.302 R1	0.049	Normal Crown	48+55.097 R1	-0.02
	Full Super	47+68.308 R1	0.049	Normal Crown	51+00.000 R1	-0.02
	Reverse Crown	48+55.097 R1	0.02			
	Level Crown	49+14.746 R1	0			
	Normal Crown	49+74.395 R1	-0.02			
	Normal Crown	51+00.000 R1	-0.02			

	Superelevation : LT			Superelevation : RT		
4	Normal Crown	140+00.000 R1	-0.02	Normal Crown	140+00.000 R1	-0.02
	Normal Crown	141+12.500 R1	-0.02	Normal Crown	141+12.500 R1	-0.02
	Full Super	143+10.535 R1	-0.046	Level Crown	141+72.149 R1	0
	Full Super	147+56.080 R1	-0.046	Reverse Crown	142+31.798 R1	0.02
	Normal Crown	149+54.115 R1	-0.02	Full Super	143+10.535 R1	0.046
	Normal Crown	153+41.273 R1	-0.02	Full Super	147+56.080 R1	0.046
	Level Crown	154+00.922 R1	0	Reverse Crown	148+34.817 R1	0.02
	Reverse Crown	154+60.571 R1	0.02	Level Crown	148+94.466 R1	0
	Full Super	155+45.571 R1	0.049	Normal Crown	149+54.115 R1	-0.02
	Normal Crown	158+08.020 R1	-0.02	Normal Crown	153+41.273 R1	-0.02
	Full Super	158+62.264 R1	0.049	Full Super	155+45.571 R1	-0.049
	Level Crown	158+67.669 R1	0	Normal Crown	158+08.020 R1	-0.02
	Reverse Crown	159+27.318 R1	0.02	Full Super	158+62.264 R1	-0.049
	Full Super	159+44.318 R1	0.026	Full Super	159+44.318 R1	-0.026
	Reverse Crown	159+47.264 R1	0.02	Normal Crown	160+66.563 R1	-0.02
	Level Crown	160+06.914 R1	0	Full Super	161+30.794 R1	-0.026
	Normal Crown	160+66.563 R1	-0.02	Normal Crown	162+67.092 R1	-0.02
	Full Super	161+30.794 R1	0.026	Normal Crown	163+00.000 R1	-0.02
	Reverse Crown	161+47.794 R1	0.02			
	Level Crown	162+07.443 R1	0			
	Normal Crown	162+67.092 R1	-0.02			
	Normal Crown	163+00.000 R1	-0.02			
5	Start Point	75+00.000 R2	0.005	Start Point	75+00.000 R2	-0.005
	Full Super	76+50.304 R2	-0.046	Level Crown	75+14.006 R2	0
	Full Super	83+56.385 R2	-0.046	Reverse Crown	75+73.655 R2	0.02
	Normal Crown	85+52.333 R2	-0.02	Full Super	76+50.304 R2	0.046
	Normal Crown	85+72.000 R2	-0.02	Full Super	83+56.385 R2	0.046
	Level Crown	86+31.649 R2	0	Reverse Crown	84+33.034 R2	0.02
	Reverse Crown	86+91.298 R2	0.02	Level Crown	84+92.684 R2	0
	Full Super	87+66.456 R2	0.045	Normal Crown	85+52.333 R2	-0.02
	Full Super	94+75.200 R2	0.045	Normal Crown	85+72.000 R2	-0.02
	Reverse Crown	95+50.358 R2	0.02	Full Super	87+66.456 R2	-0.045
	Level Crown	96+10.007 R2	0	Full Super	94+75.200 R2	-0.045
	Normal Crown	96+69.656 R2	-0.02	Normal Crown	96+69.656 R2	-0.02
	Normal Crown	97+00.000 R2	-0.02	Normal Crown	97+00.000 R2	-0.02

NOTES:

(1) SUPERELEVATION DATA SHOWN ON THIS PAGE IS FOR DESIGN PURPOSE ONLY.

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(3) PERFORM WIDENING OF THE PROJECT ACCORDING TO THE TYPICAL SECTIONS.

(4) TO VERIFY THE GEOMETRIC DATA SEE AS-BUILT PROJECT.

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

SUPERELEVATION DATA

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		61

DATE: 2/22/2024 1:54:57 PM
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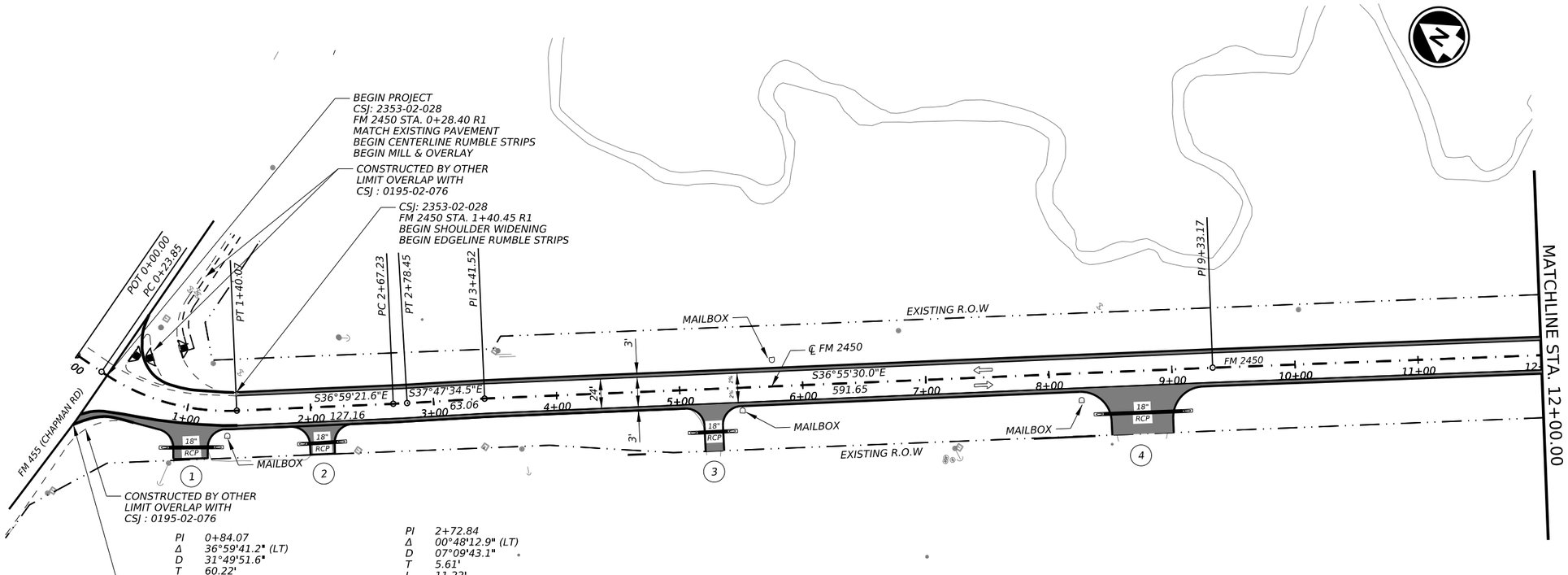
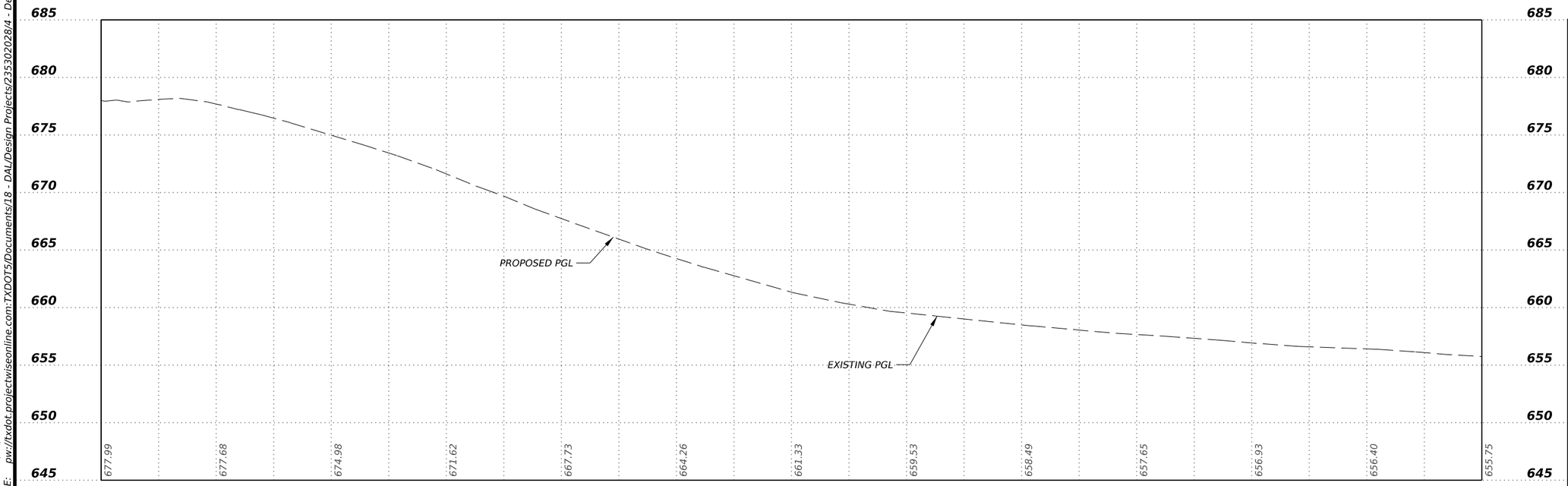


NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



HORIZ SCALE
0 50 100
SCALE IN FEET

VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

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FM 2450

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2024 SHEET 1 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		62

DATE: 2/22/2024 1:55:23 PM
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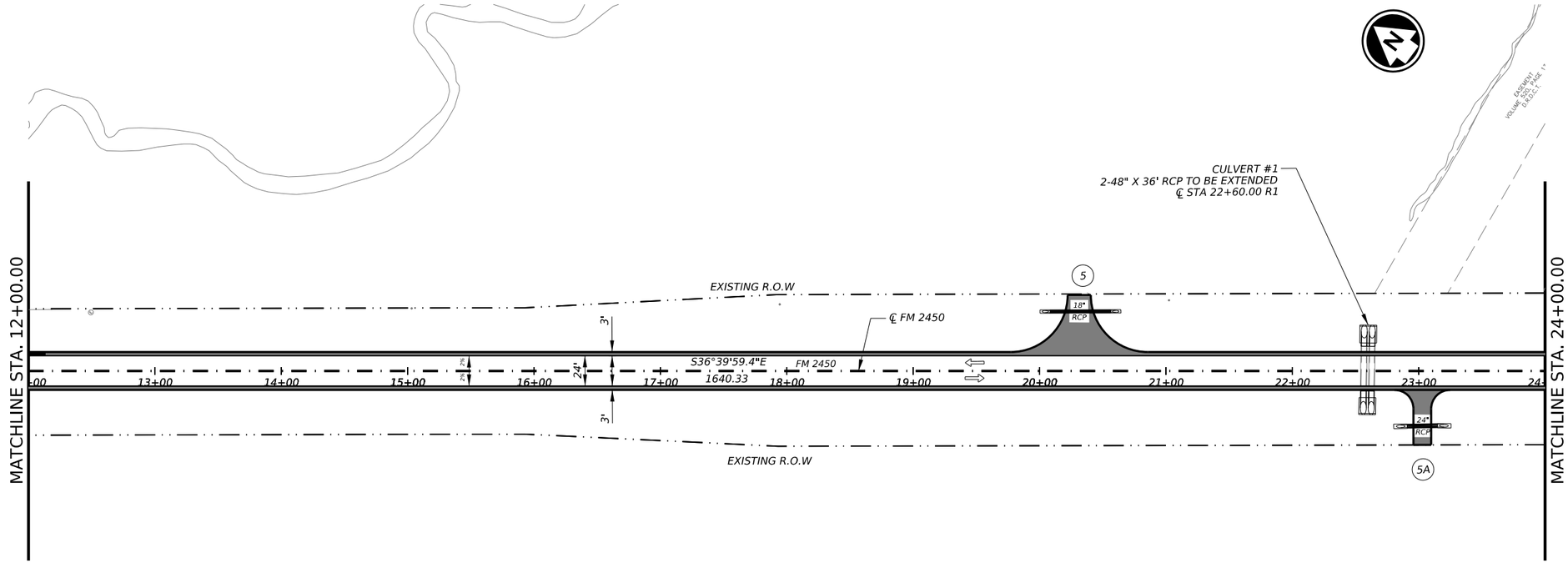

HORIZ SCALE

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SCALE IN FEET

VERT SCALE

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SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
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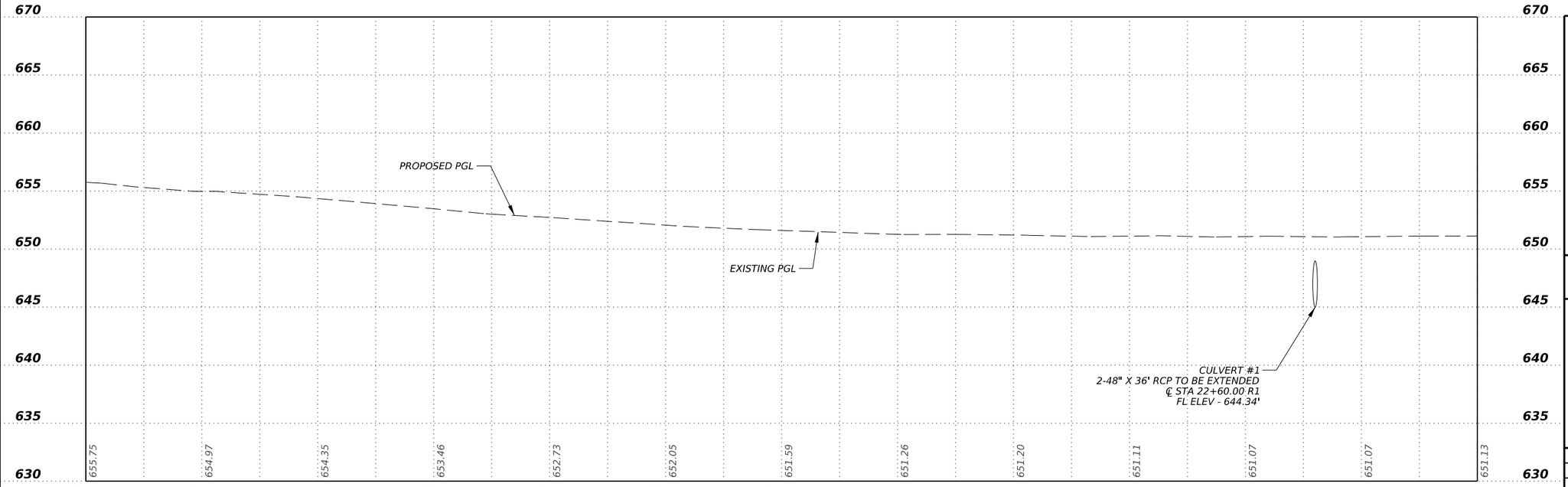
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



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Texas Department of Transportation

FM 2450

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2024 SHEET 2 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		63

DATE: 2/22/2024 1:55:24 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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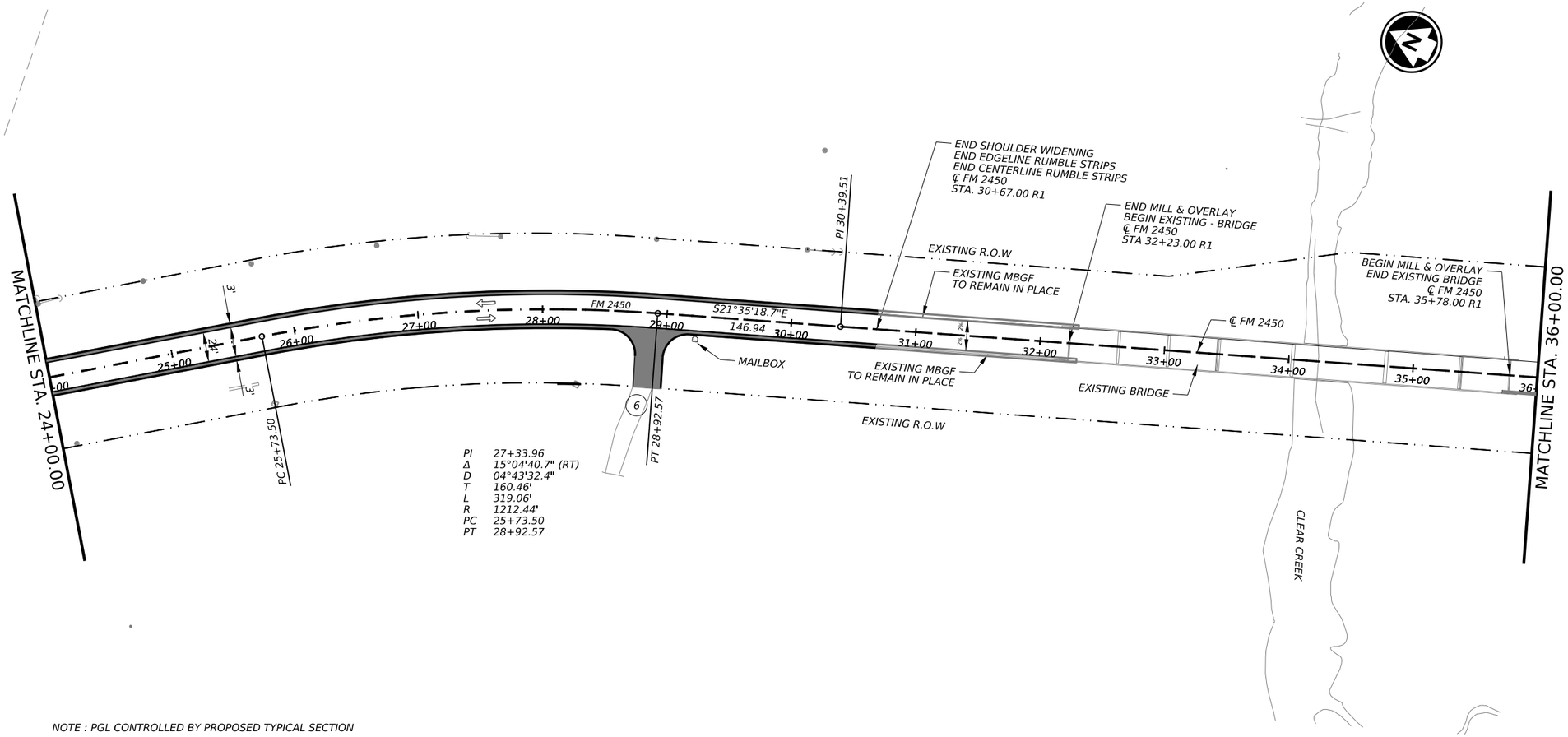


HORIZ SCALE
0 50 100
SCALE IN FEET

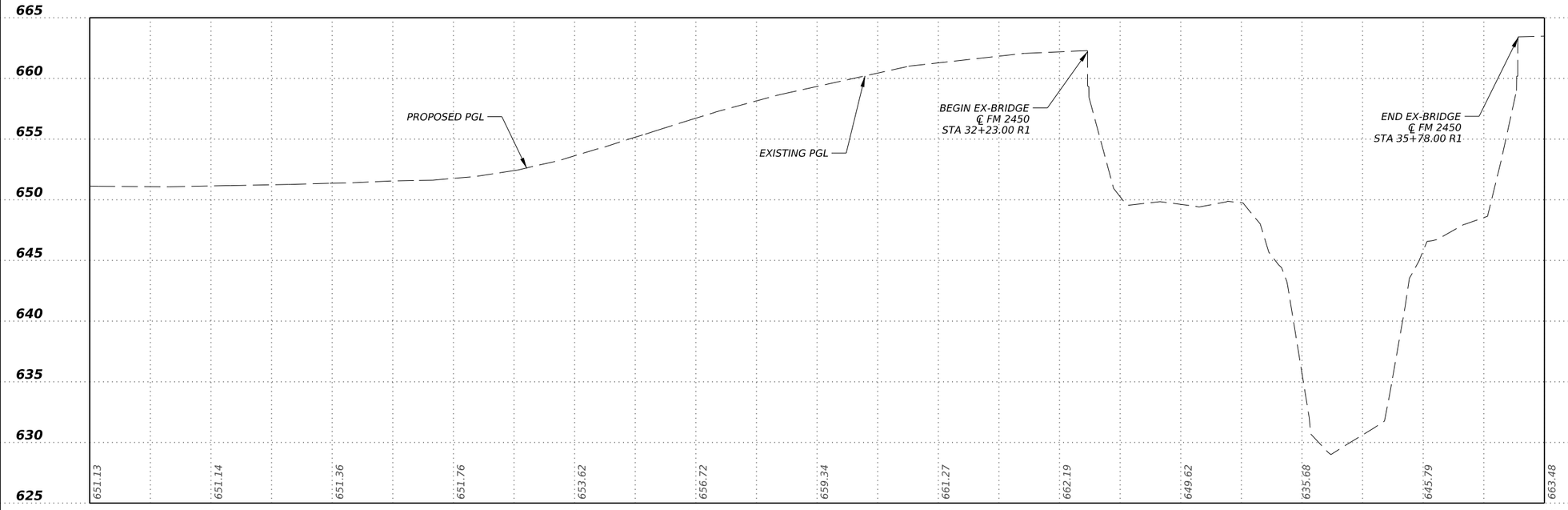
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
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2/28/2024

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
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TO
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2024 SHEET 3 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		64

DATE: 2/28/2024 10:38:20 AM
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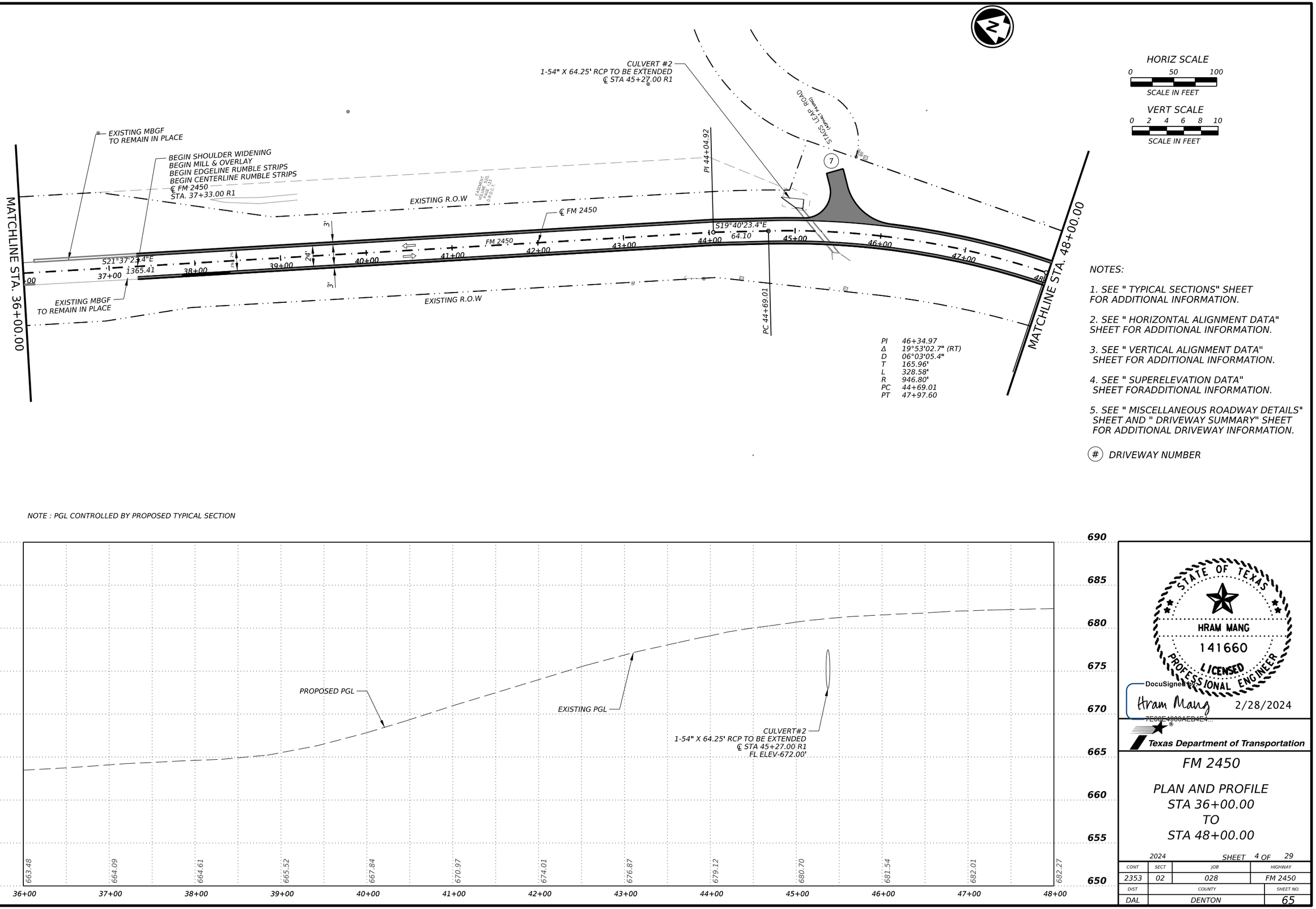

HORIZ SCALE
0 50 100
SCALE IN FEET

VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

PI	46+34.97
Δ	19°53'02.7" (RT)
D	06°03'05.4"
T	165.96'
L	328.58'
R	946.80'
PC	44+69.01
PT	47+97.60

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION

STATE OF TEXAS
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PROFESSIONAL ENGINEER
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7E88E4988AED4E4...

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 36+00.00
TO
STA 48+00.00

2024 SHEET 4 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		65

DATE: 2/28/2024 10:38:53 AM
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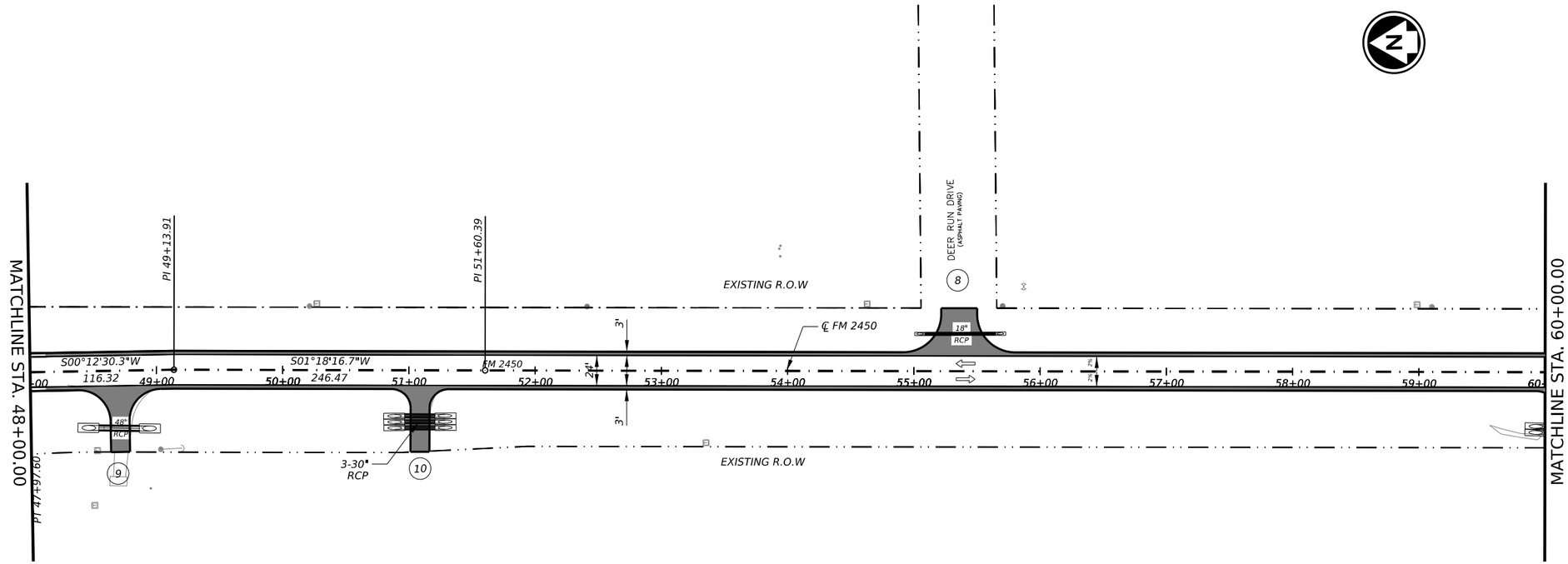


HORIZ SCALE
0 50 100
SCALE IN FEET

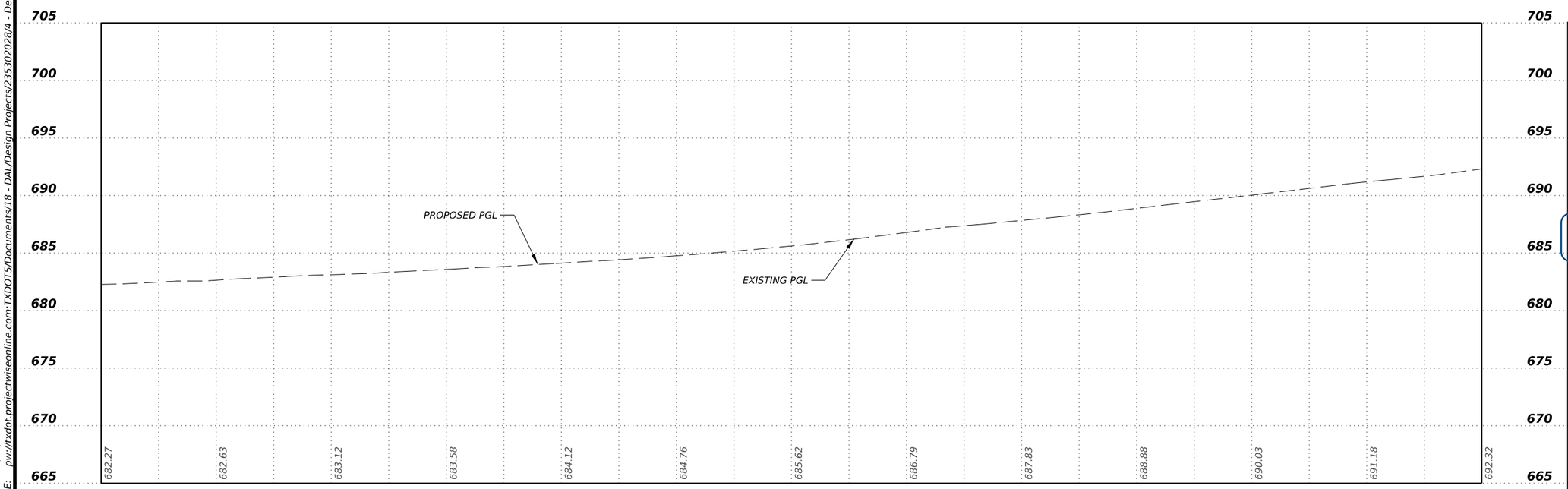
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E00E4900AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 48+00.00
TO
STA 60+00.00

2024 SHEET 5 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		66

DATE: 2/22/2024 1:55:27 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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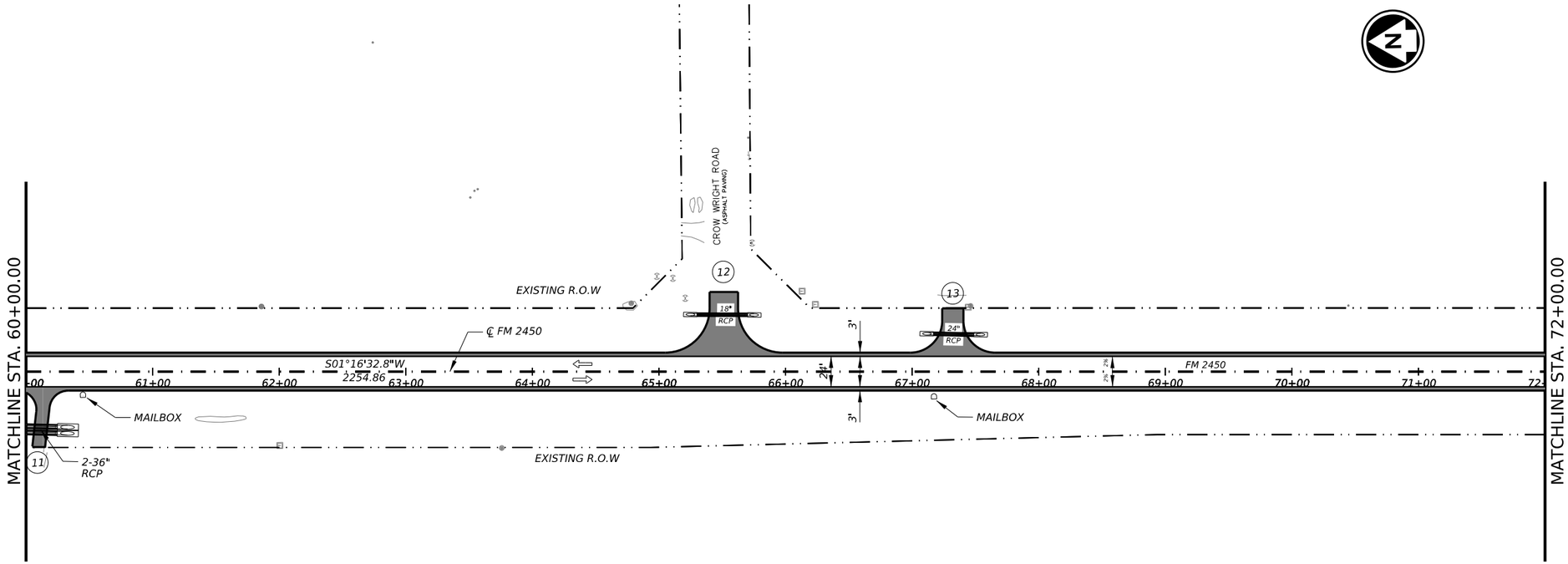


HORIZ SCALE
0 50 100
SCALE IN FEET

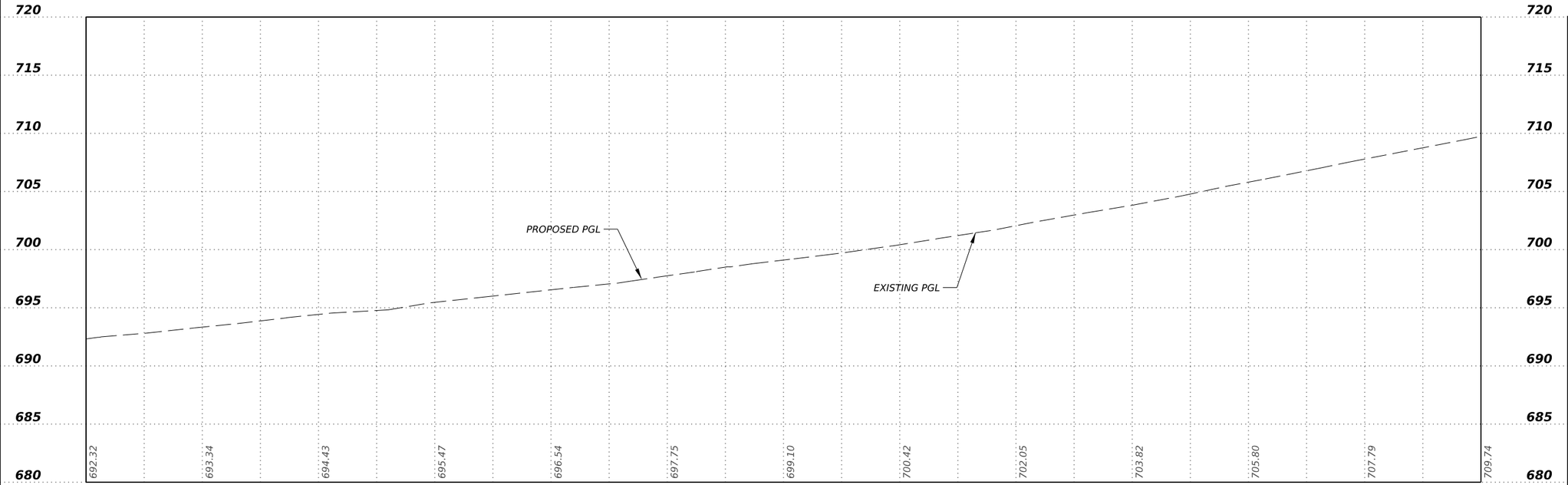
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
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PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang 2/22/2024
7E66E1980AEB4E4...

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 60+00.00
TO
STA 72+00.00

2024 SHEET 6 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		67

DATE: 2/22/2024 1:55:28 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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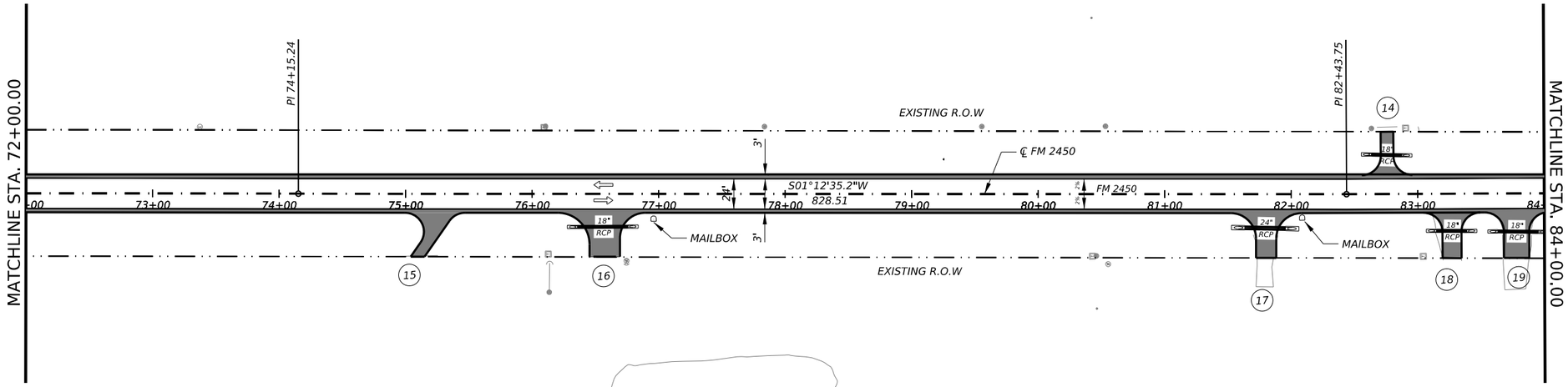
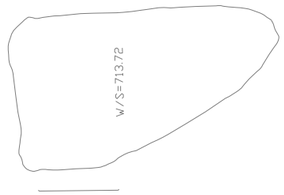




HORIZ SCALE

0 50 100

SCALE IN FEET

VERT SCALE

0 2 4 6 8 10

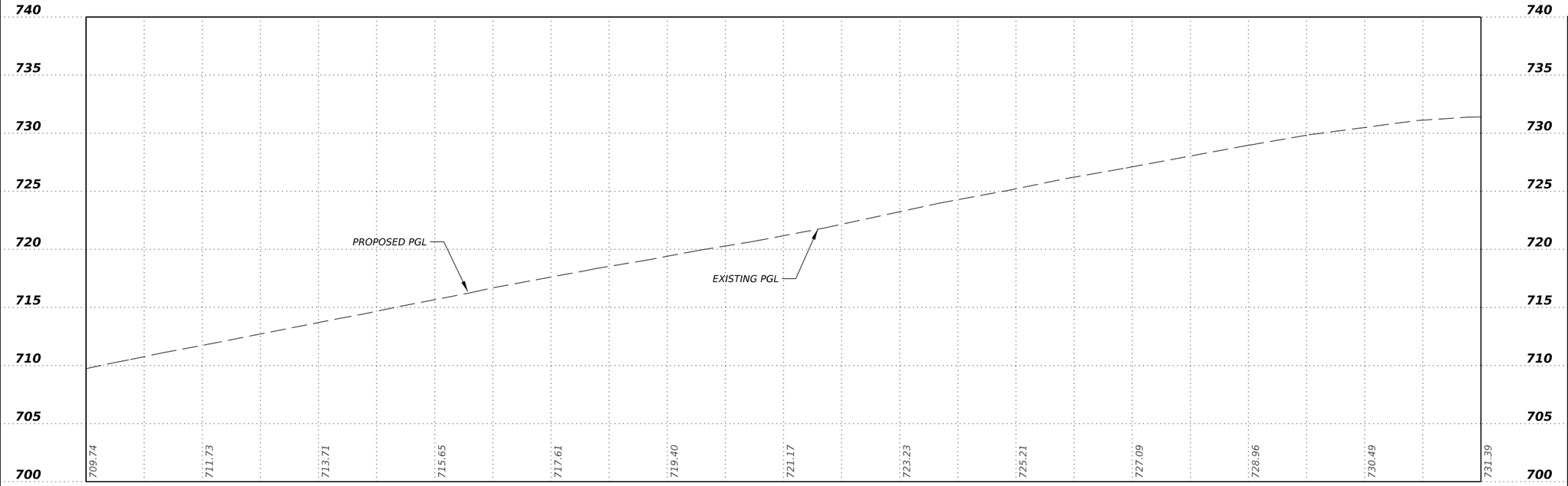
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
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FM 2450

PLAN AND PROFILE STA 72+00.00 TO STA 84+00.00

2024 SHEET 7 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		68

DATE: 2/22/2024 1:55:28 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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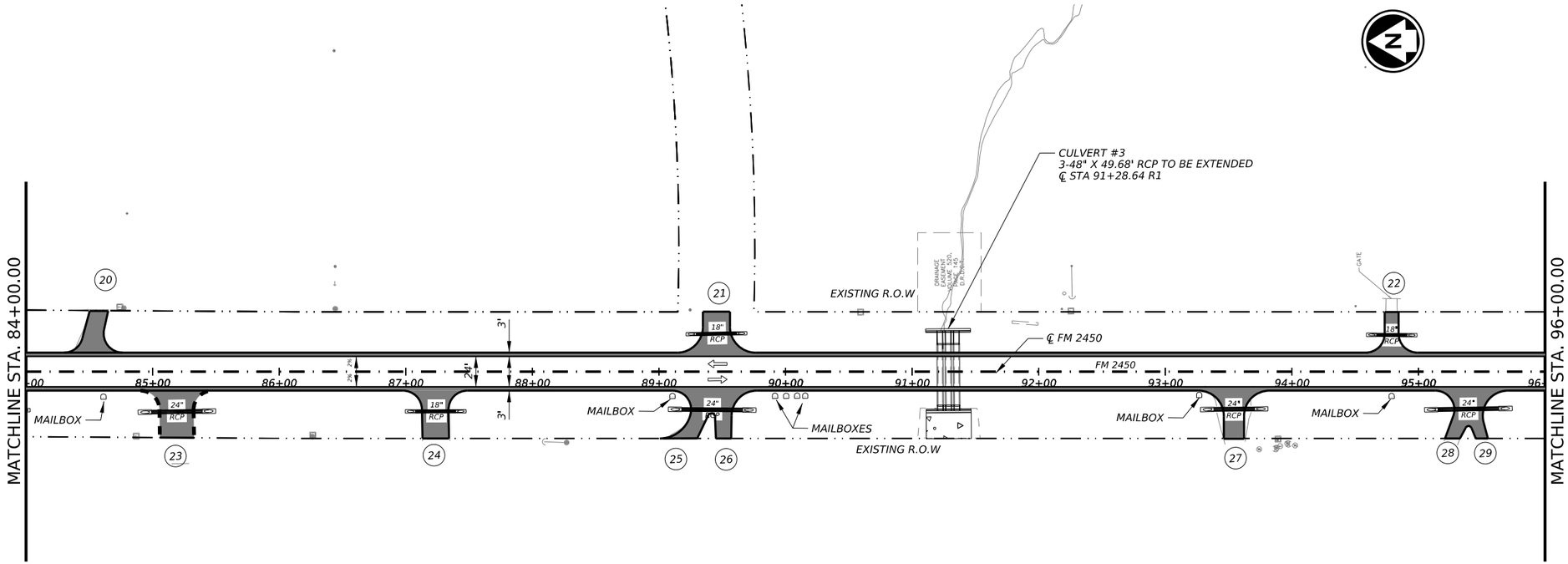


HORIZ SCALE
0 50 100
SCALE IN FEET

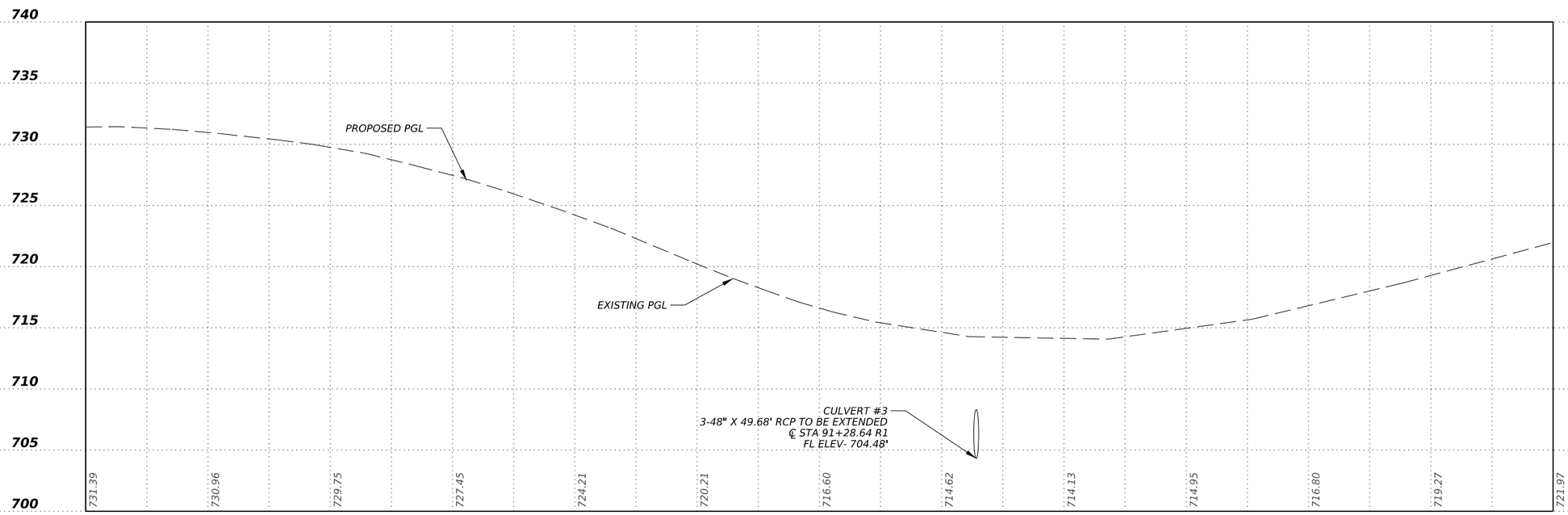
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



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FM 2450

PLAN AND PROFILE
STA 84+00.00
TO
STA 96+00.00

2024 SHEET 8 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		69

DATE: 2/22/2024 1:55:29 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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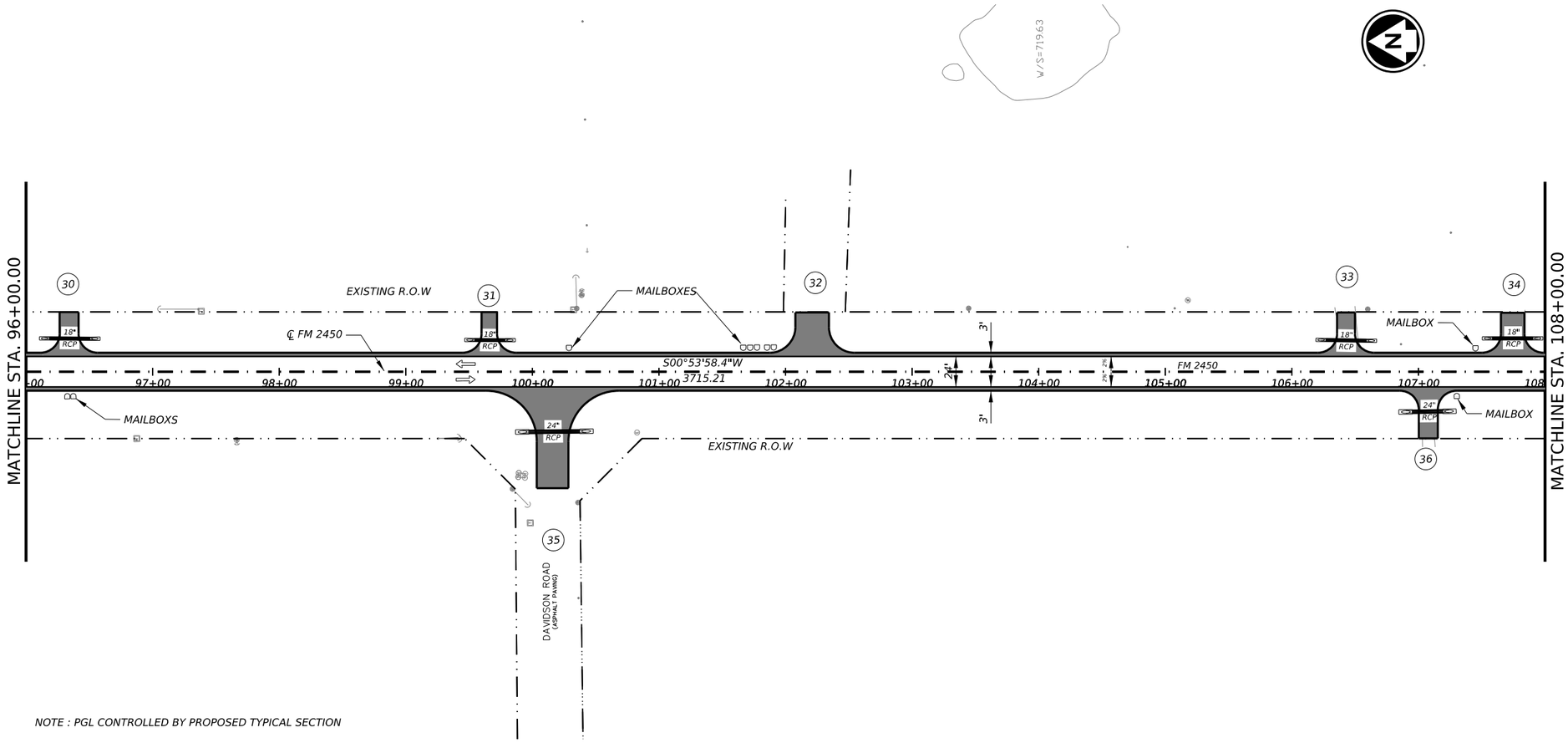
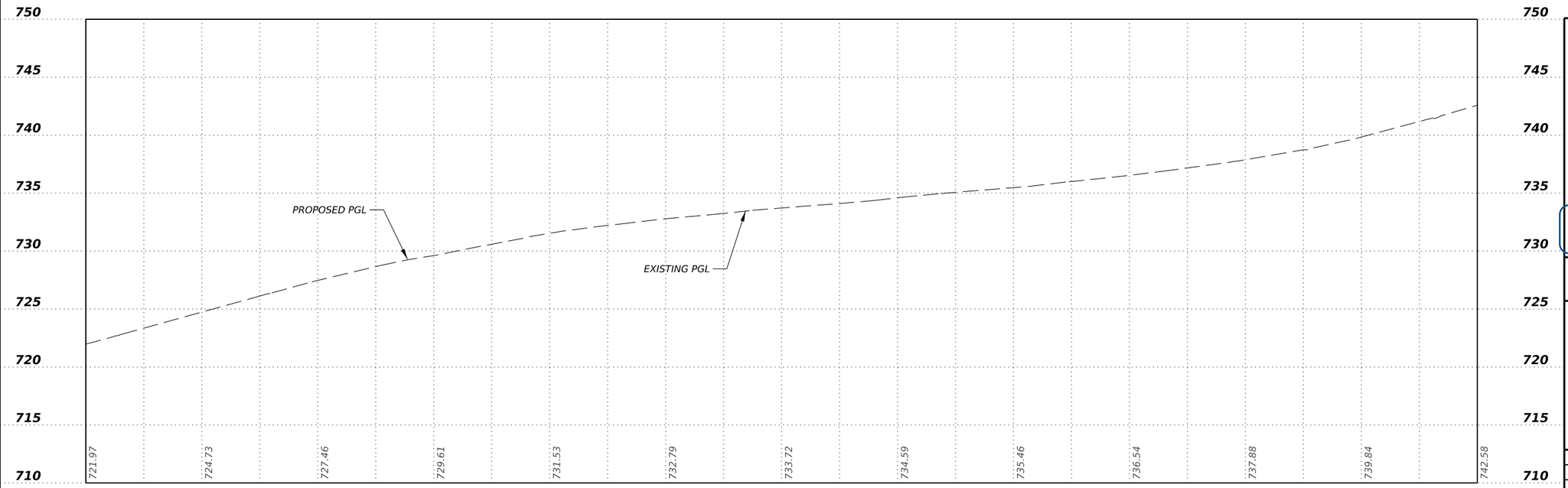


NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



HORIZ SCALE
0 50 100
SCALE IN FEET

VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

STATE OF TEXAS
HRAM MANG
141660
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PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang
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2/22/2024

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 96+00.00
TO
STA 108+00.00

2024 SHEET 9 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		70

DATE: 2/22/2024 1:55:30 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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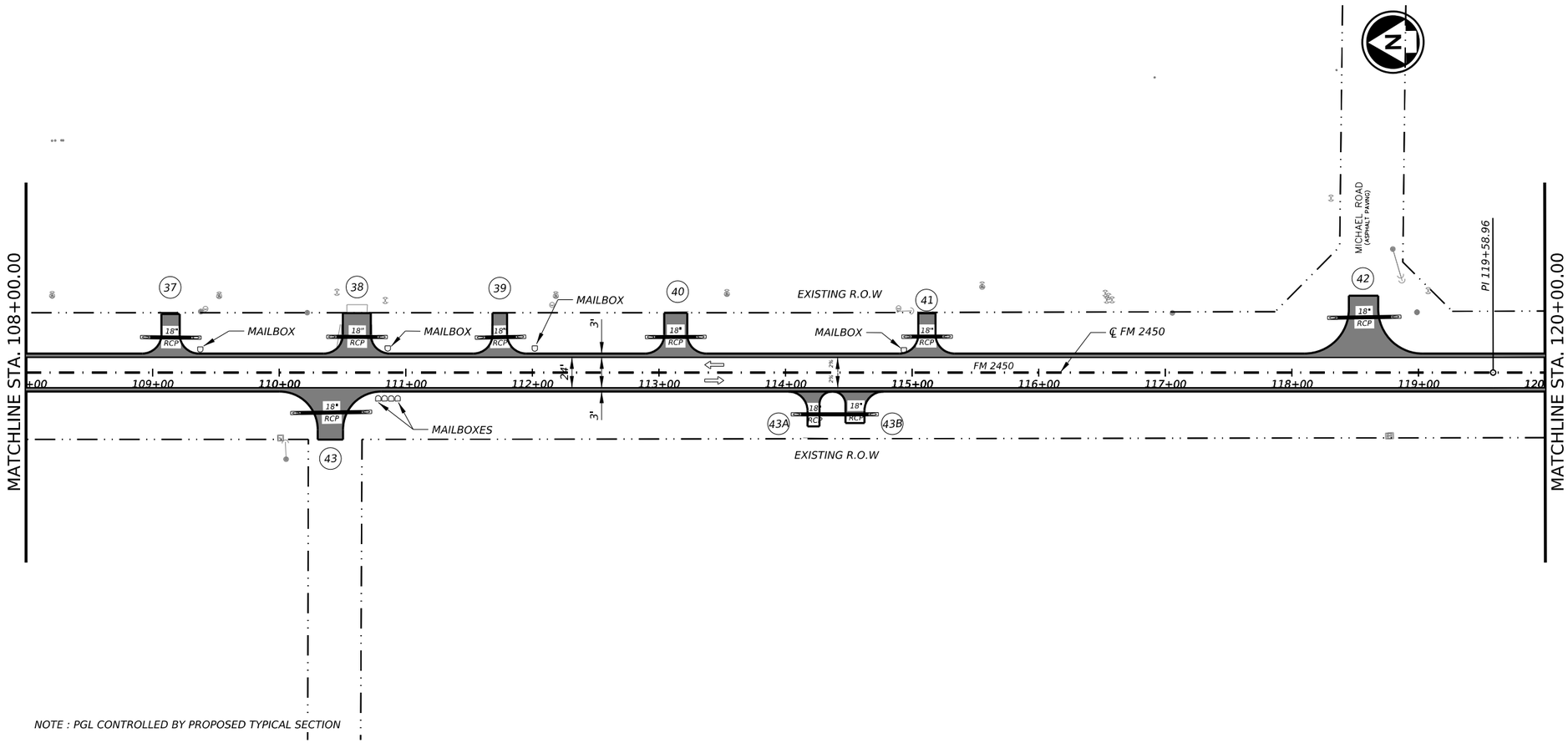


HORIZ SCALE

0 50 100

SCALE IN FEET

VERT SCALE

0 2 4 6 8 10

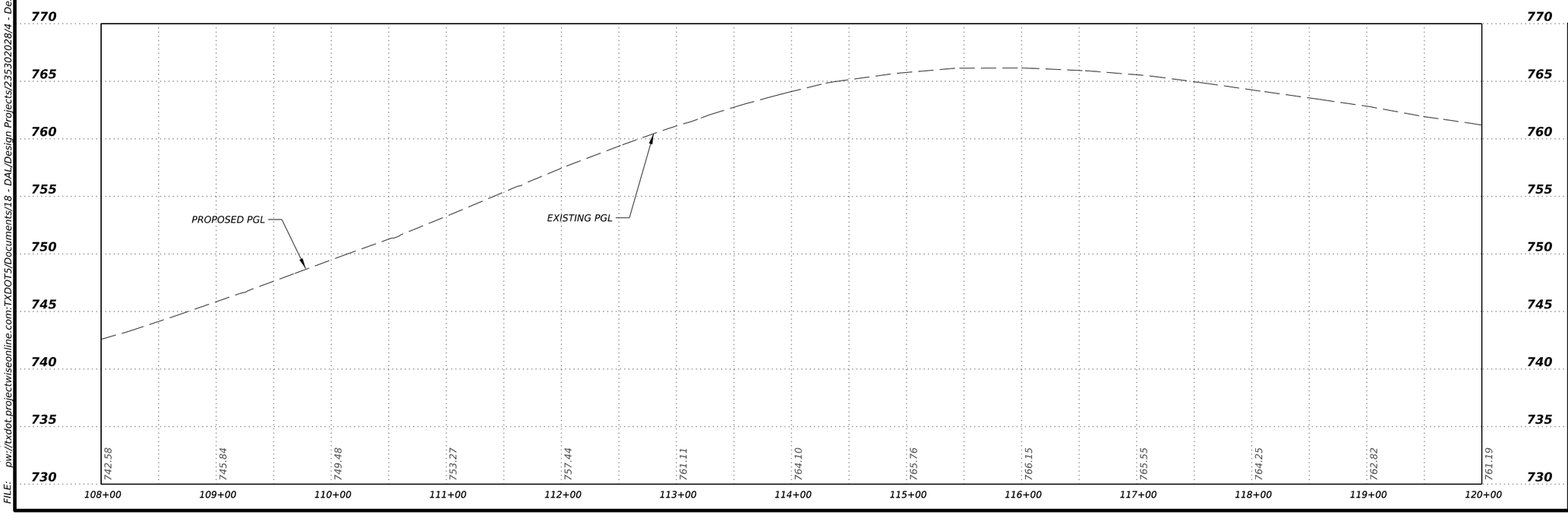
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
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PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E69...980AEB4E4...

Texas Department of Transportation

FM 2450

PLAN AND PROFILE STA 108+00.00 TO STA 120+00.00

2024 SHEET 10 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		71

DATE: 2/22/2024 1:55:31 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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CK:
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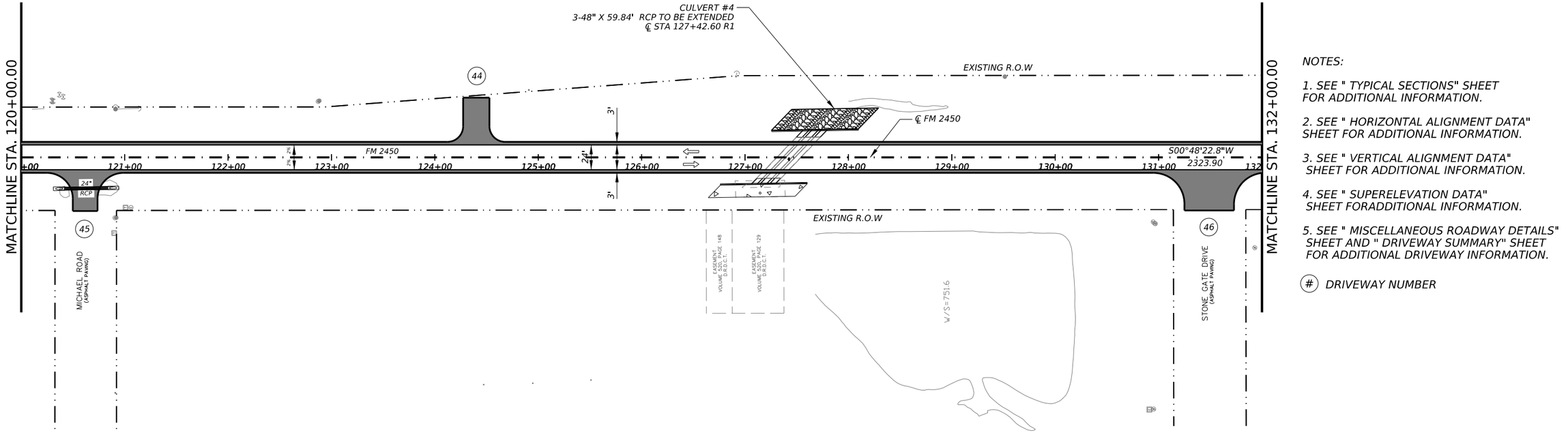
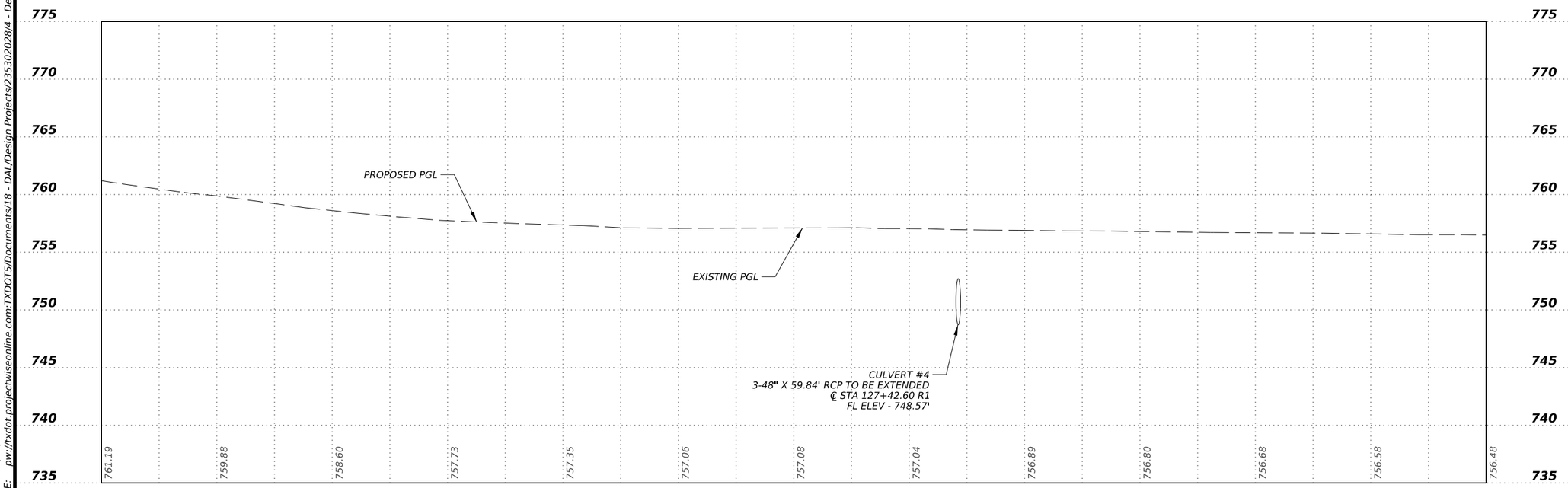
CK:
DW:



NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



HORIZ SCALE
0 50 100
SCALE IN FEET

VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

STATE OF TEXAS
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2/22/2024

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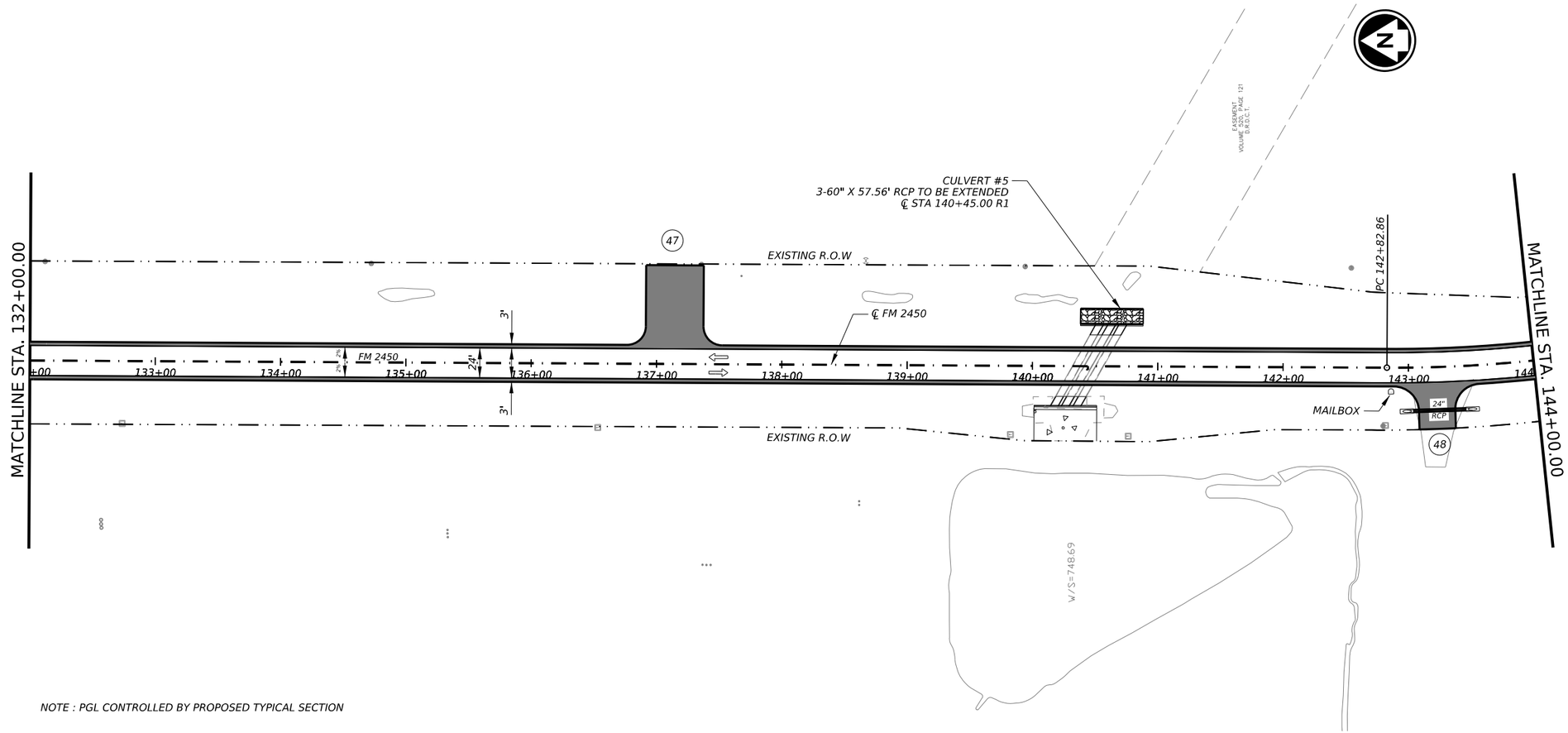
FM 2450

PLAN AND PROFILE
STA 120+00.00
TO
STA 132+00.00

2024 SHEET 11 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		72

DATE: 2/22/2024 1:55:32 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn



HORIZ SCALE
0 50 100
SCALE IN FEET

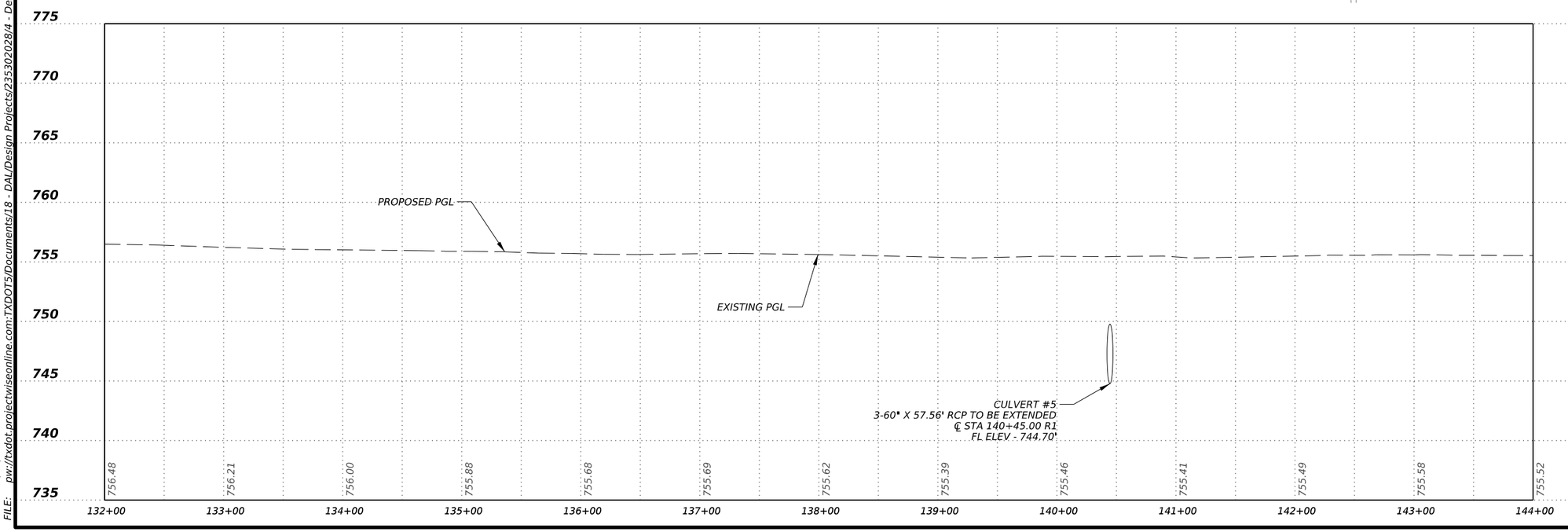
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
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PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang 2/22/2024
7E08E4988AEB4E4...

Texas Department of Transportation

FM 2450

PLAN AND PROFILE STA 132+00.00 TO STA 144+00.00

2024 SHEET 12 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		73

DATE: 2/22/2024 1:55:33 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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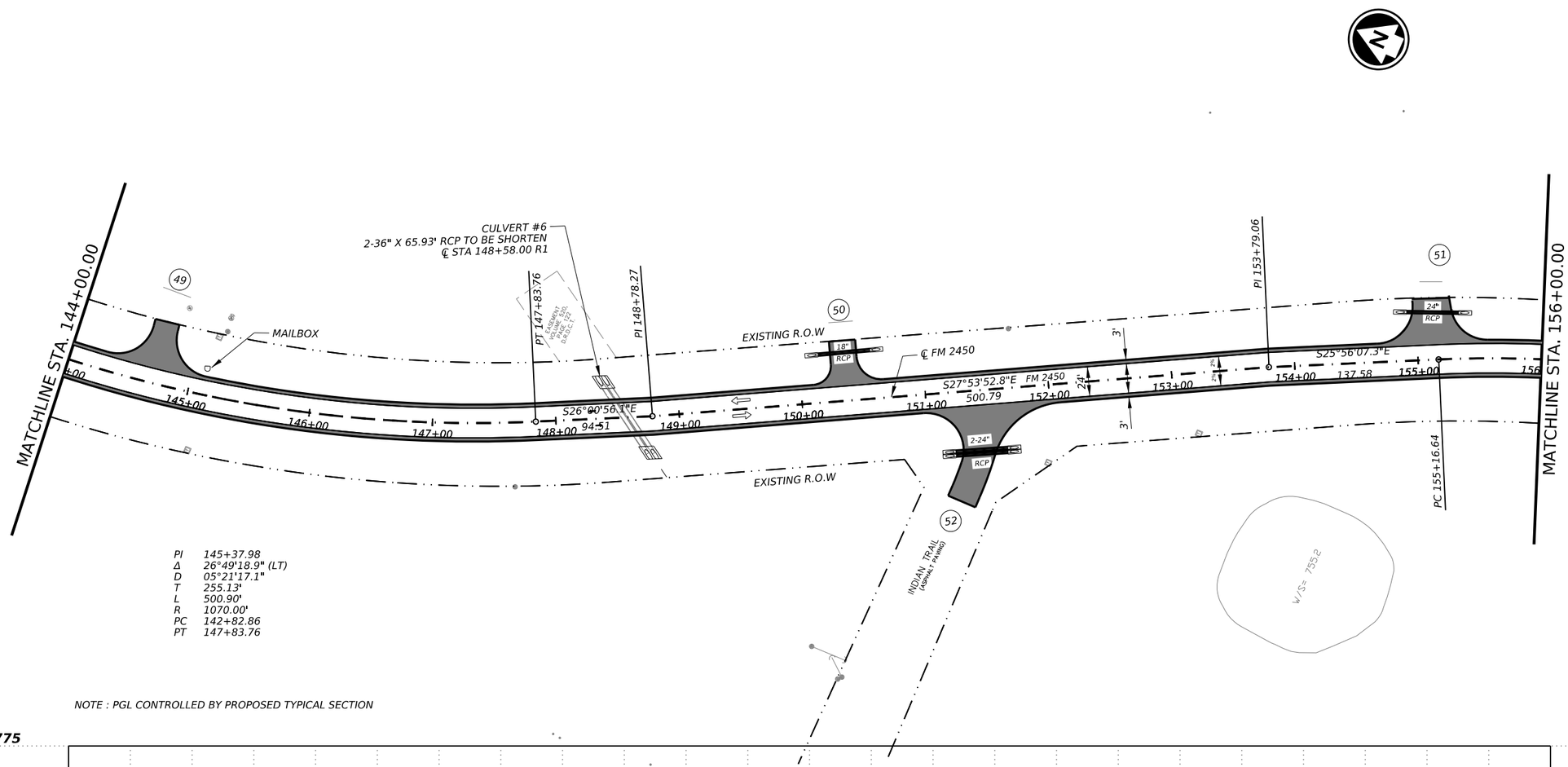


PI	145+37.98
Δ	26°49'18.9" (LT)
D	05°21'17.1"
T	255.13'
L	500.90'
R	1070.00'
PC	142+82.86
PT	147+83.76

HORIZ SCALE
0 50 100
SCALE IN FEET

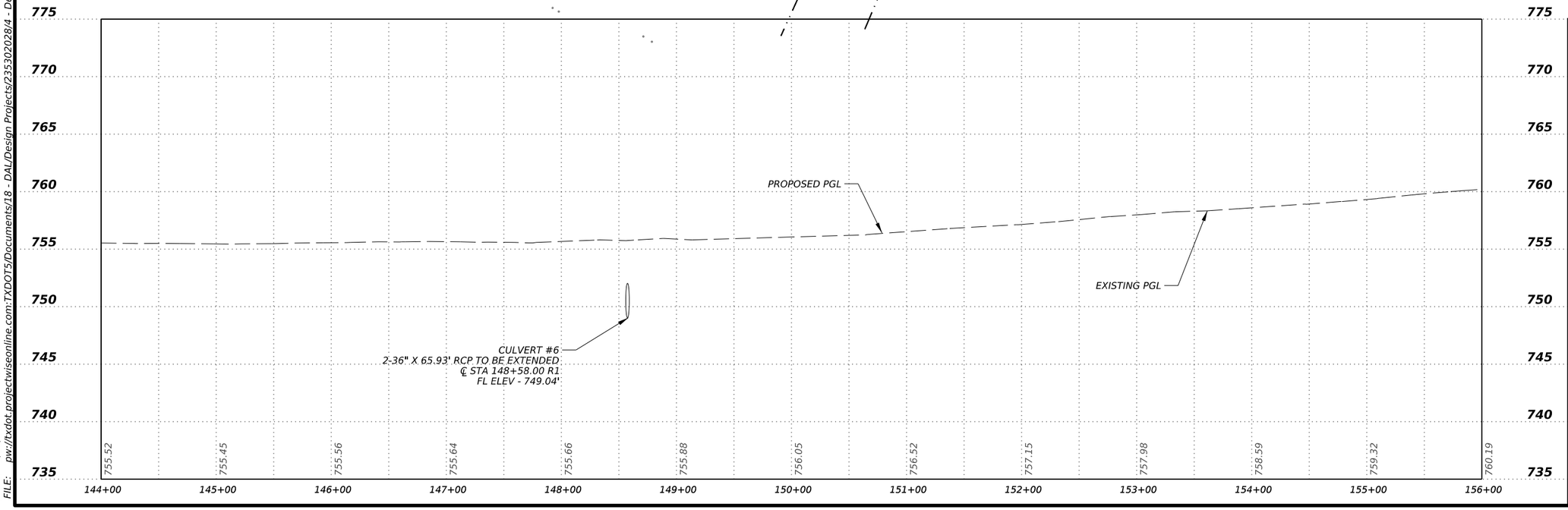
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
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LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang 2/22/2024
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Texas Department of Transportation

FM 2450

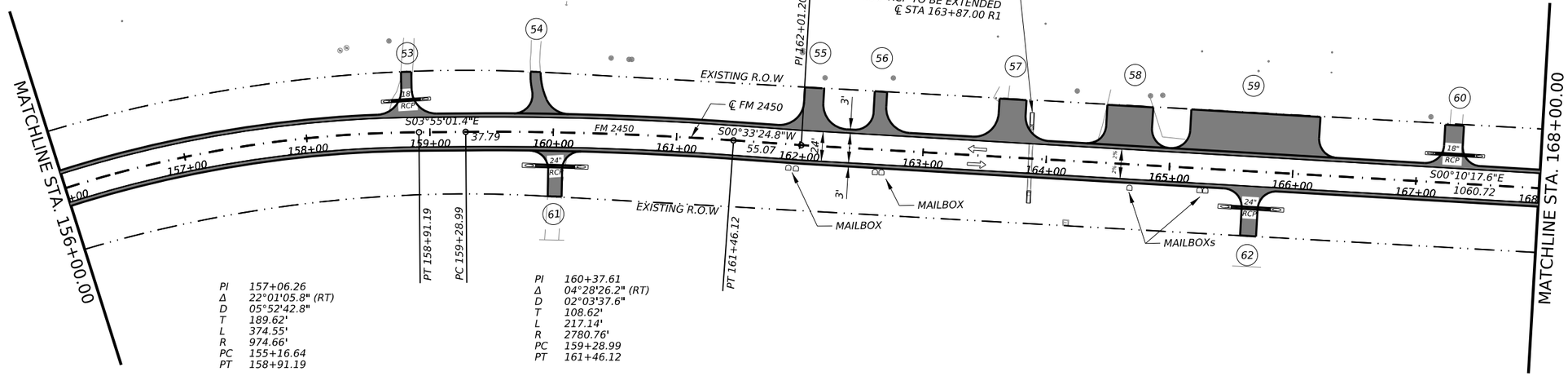
PLAN AND PROFILE
STA 144+00.00
TO
STA 156+00.00

2024 SHEET 13 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		74

DATE: 2/22/2024 1:55:34 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

CK: DW: CK: DW:



PI	157+06.26
Δ	22°01'05.8" (RT)
D	05°52'42.8"
T	189.62'
L	374.55'
R	974.66'
PC	155+16.64
PT	158+91.19

PI	160+37.61
Δ	04°28'26.2" (RT)
D	02°03'37.6"
T	108.62'
L	217.14'
R	2780.76'
PC	159+28.99
PT	161+46.12

HORIZ SCALE
0 50 100
SCALE IN FEET

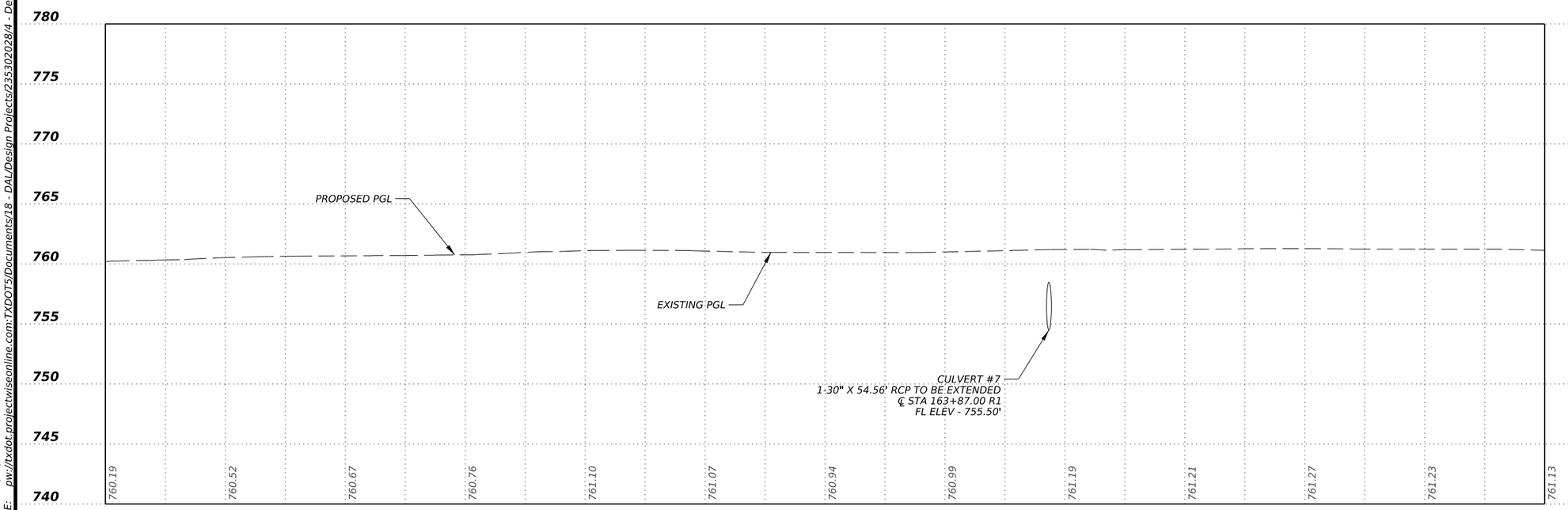
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
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141660
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PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

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FM 2450

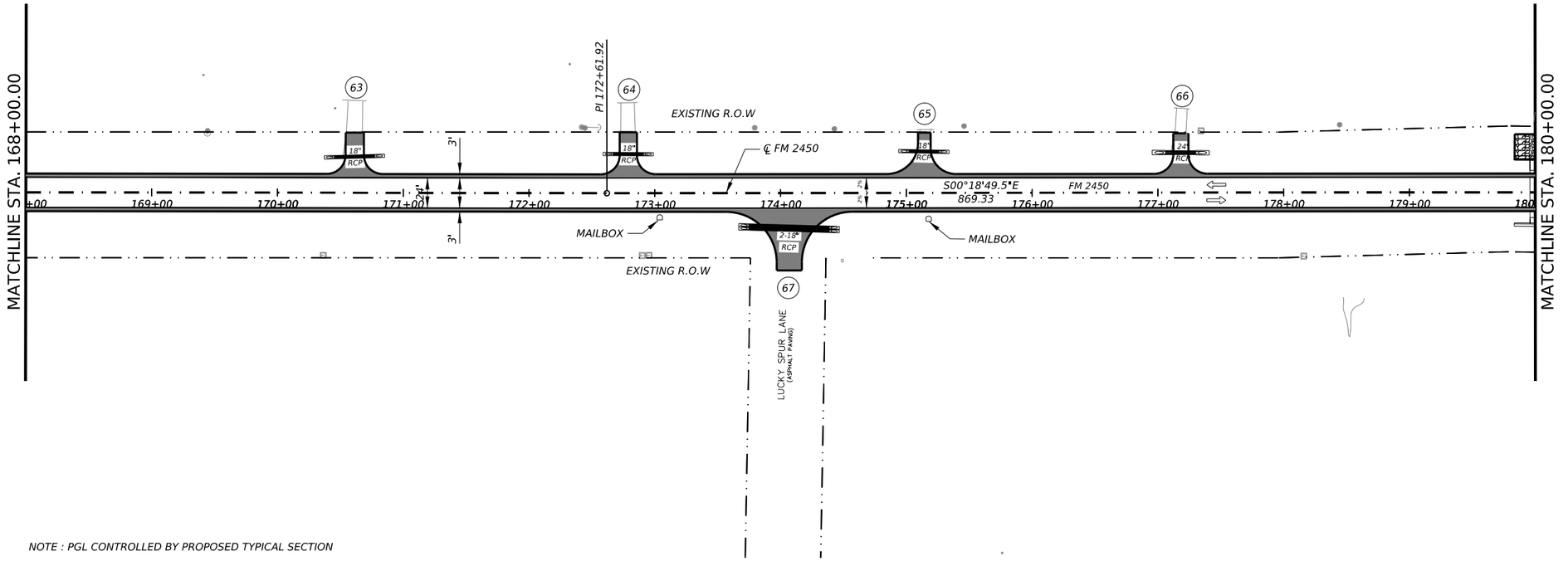
PLAN AND PROFILE
STA 156+00.00
TO
STA 168+00.00

2024 SHEET 14 OF 29

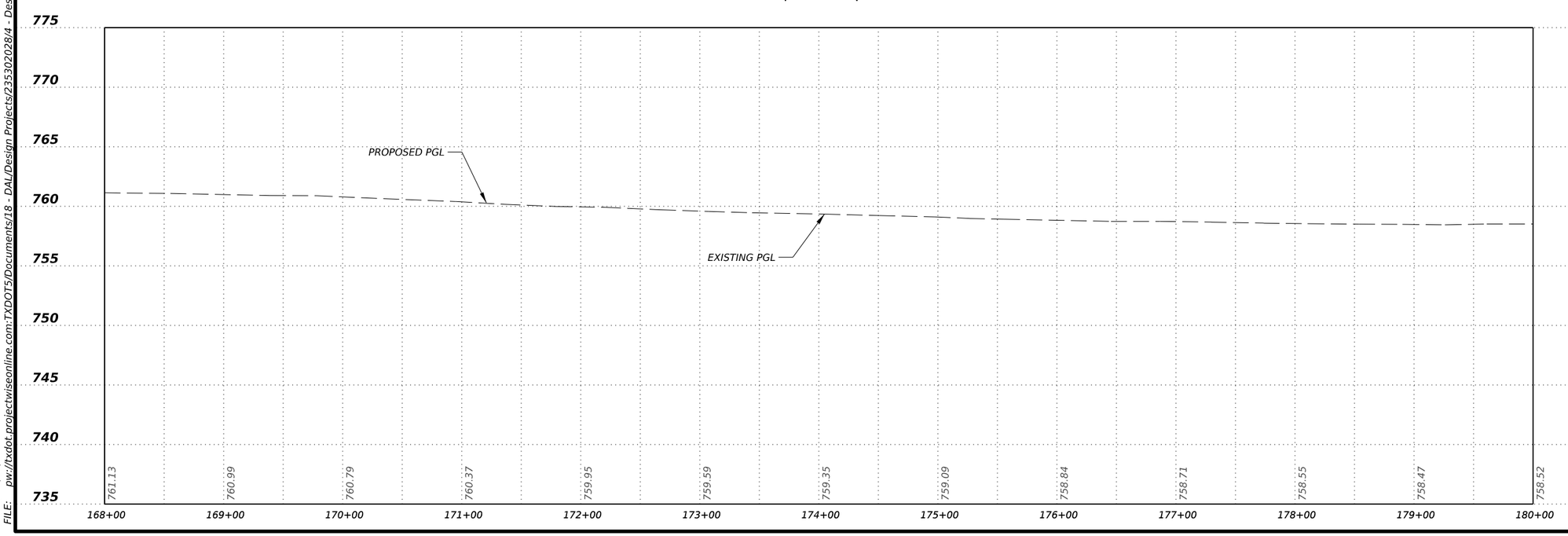
CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		75

DATE: 2/22/2024 1:55:34 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

DW: CK: DW: CK:



NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



HORIZ SCALE
0 50 100
SCALE IN FEET

VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E66E4980AEB4E4...

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 168+00.00
TO
STA 180+00.00

2024 SHEET 15 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		76

DATE: 2/22/2024 1:55:35 PM
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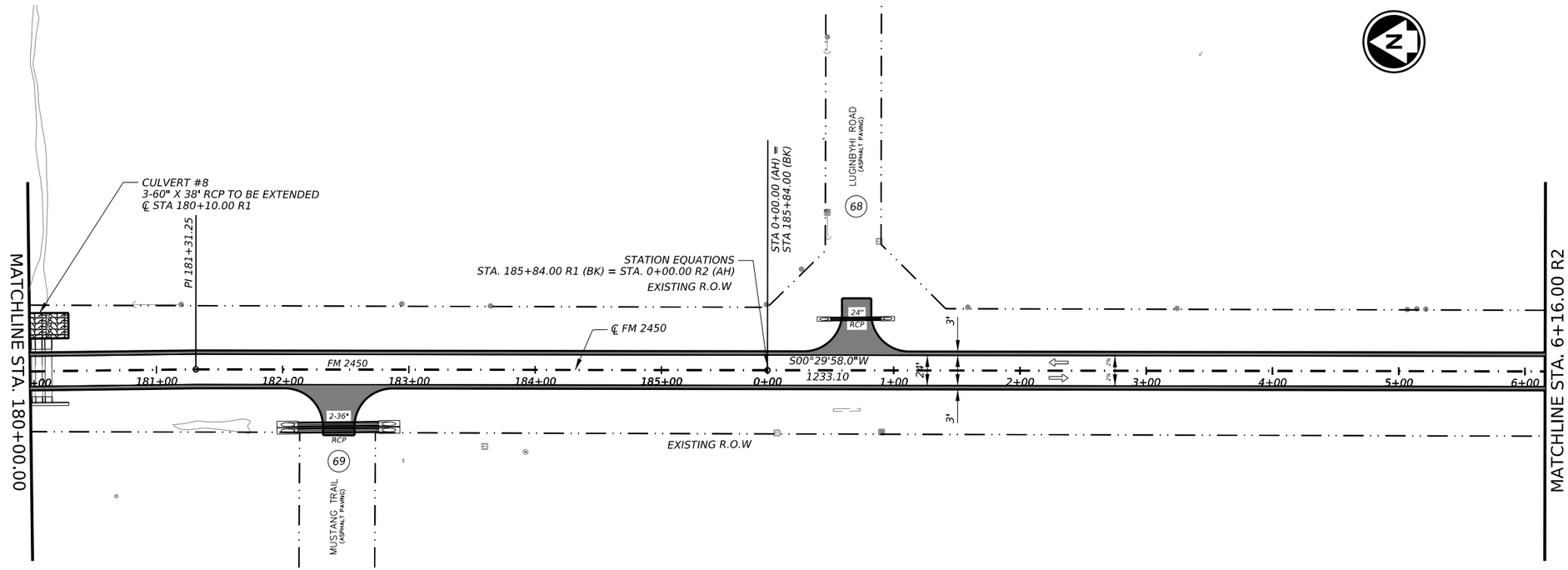


HORIZ SCALE
0 50 100
SCALE IN FEET

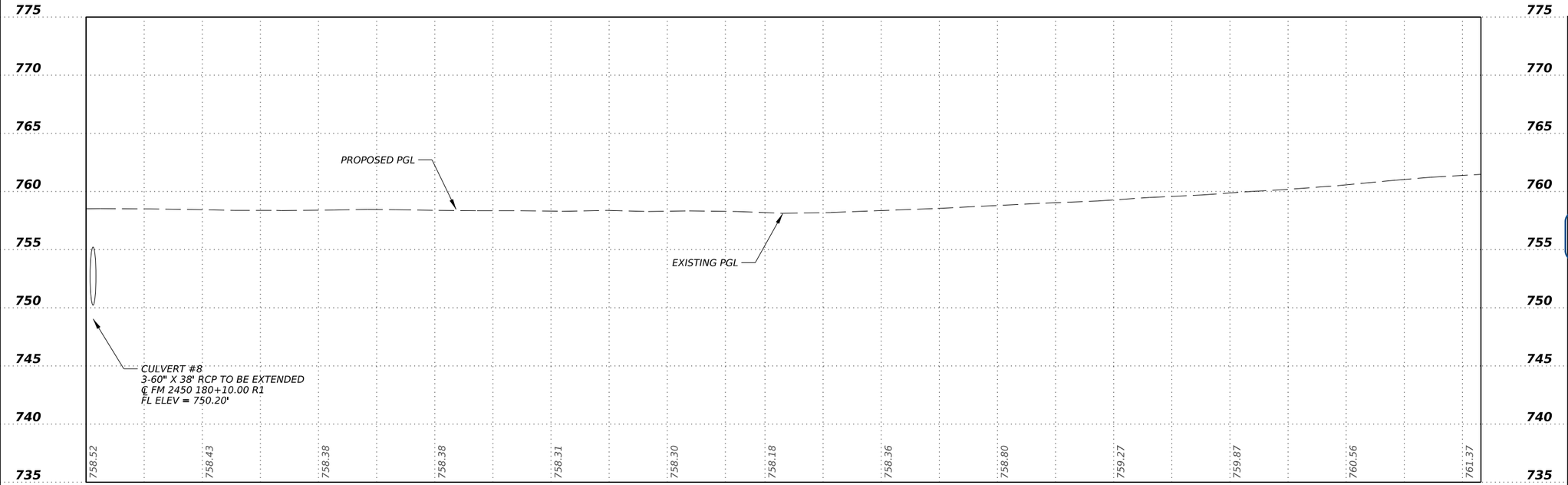
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E66E4080AEB4E4...

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 180+00
TO
STA 6+16.00 R2

2024 SHEET 16 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		77

DATE: 2/22/2024 3:20:10 PM
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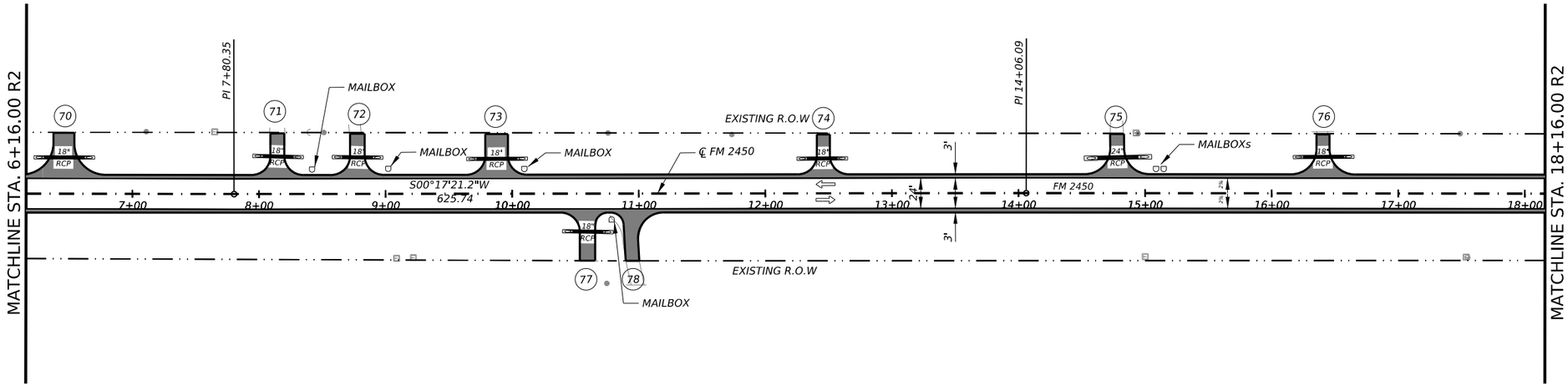
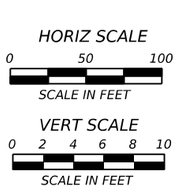


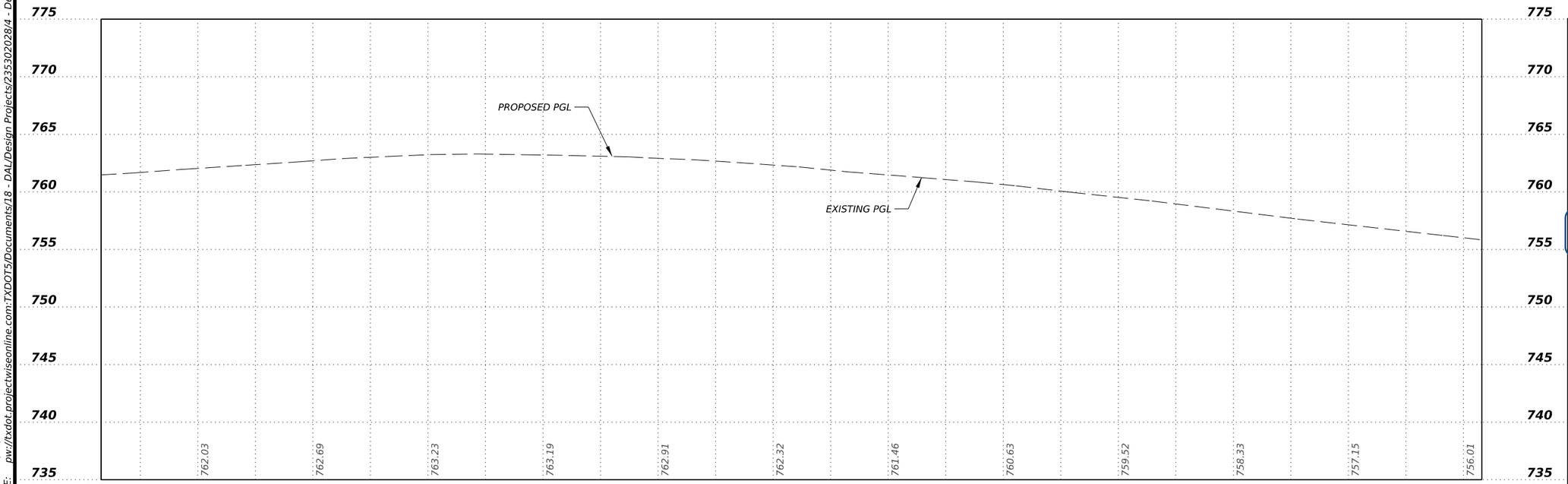


NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E08E4988AED4E4...

Texas Department of Transportation

FM 2450

PLAN AND PRODILE
STA 6+16.00 R2
TO
STA 18+16.00 R2

2024 SHEET 17 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		78

DATE: 2/22/2024 1:55:37 PM
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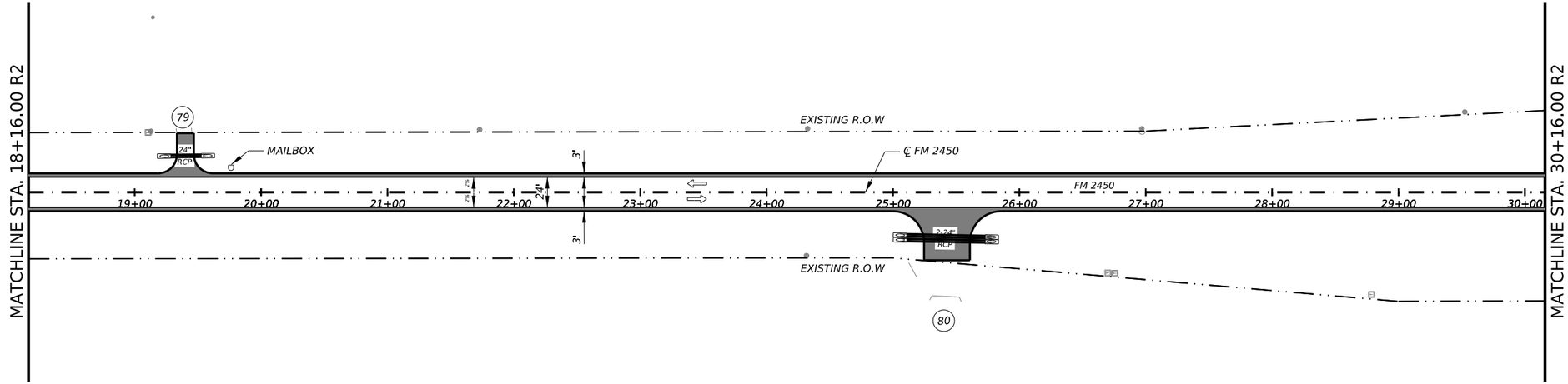


HORIZ SCALE

0 50 100

SCALE IN FEET

VERT SCALE

0 2 4 6 8 10

SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.

2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.

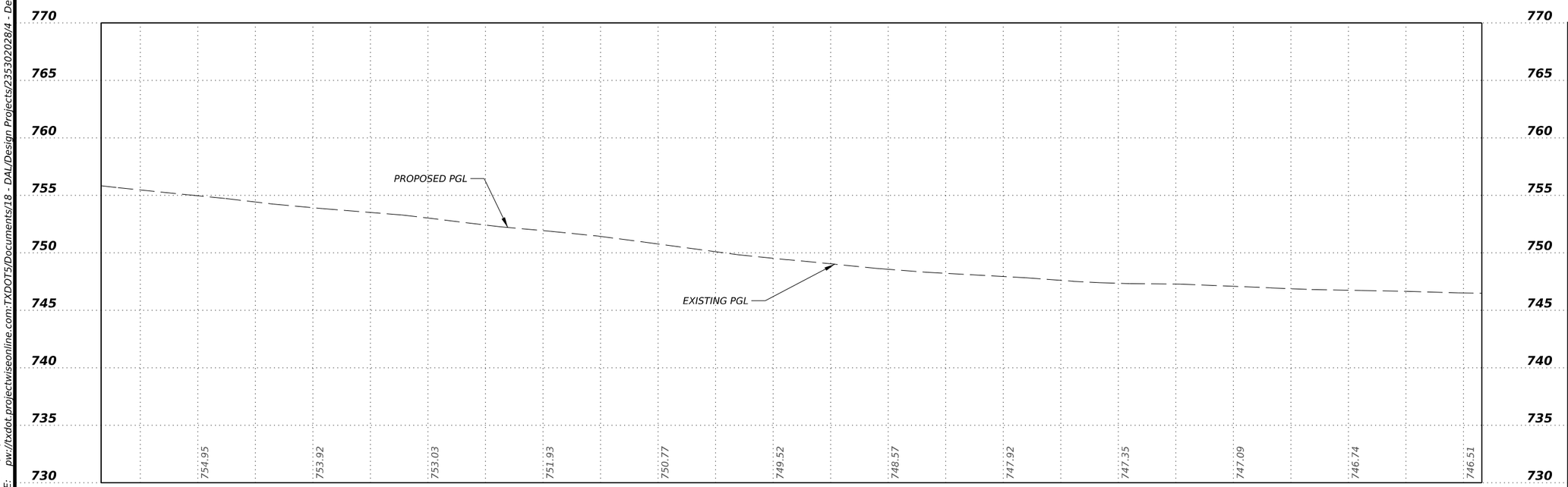
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.

4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.

5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E6C...4980AEB4E4...

Texas Department of Transportation

FM 2450

PLAN AND PROFILE STA 18+16.00 R2 TO STA 30+16.00 R2

2024 SHEET 18 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		79

DATE: 2/22/2024 1:55:38 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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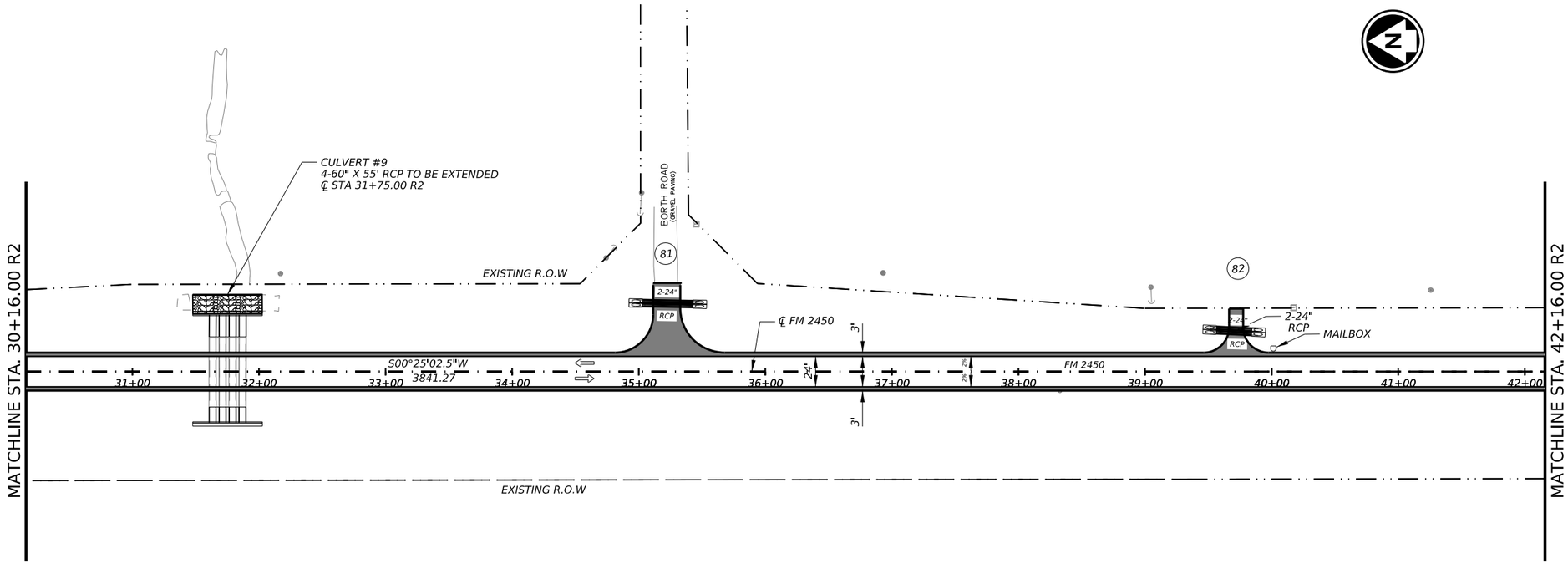


HORIZ SCALE

0 50 100

SCALE IN FEET

VERT SCALE

0 2 4 6 8 10

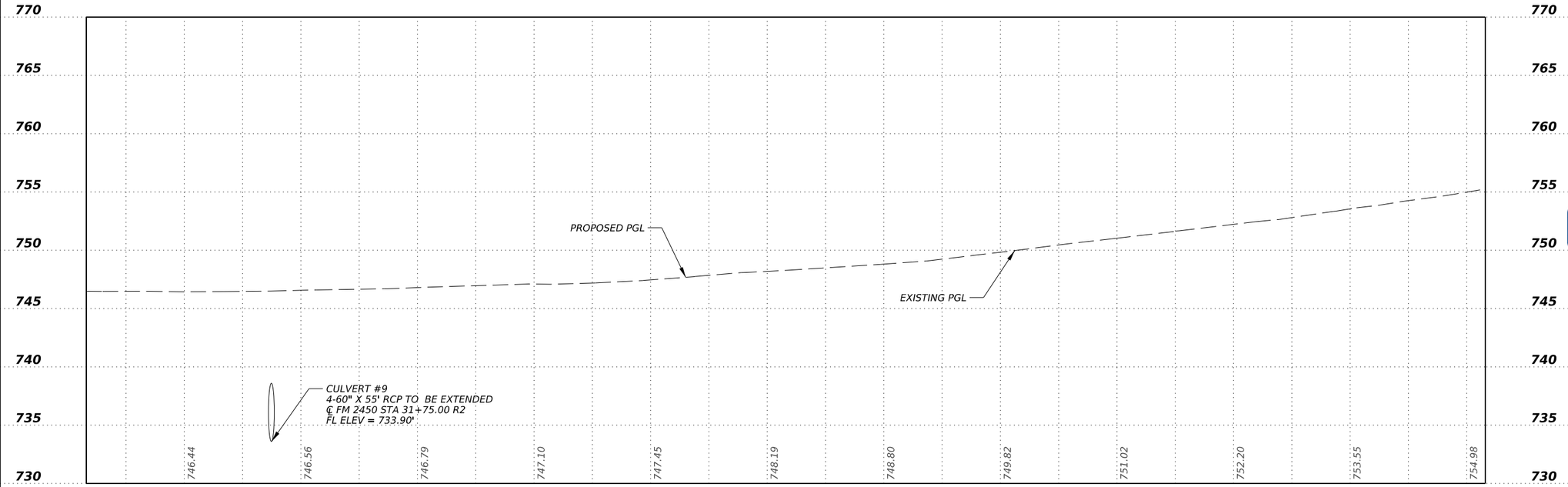
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 30+16.00 R2
TO
STA 42+16.00 R2

2024 SHEET 19 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		80

DATE: 2/22/2024 1:55:39 PM
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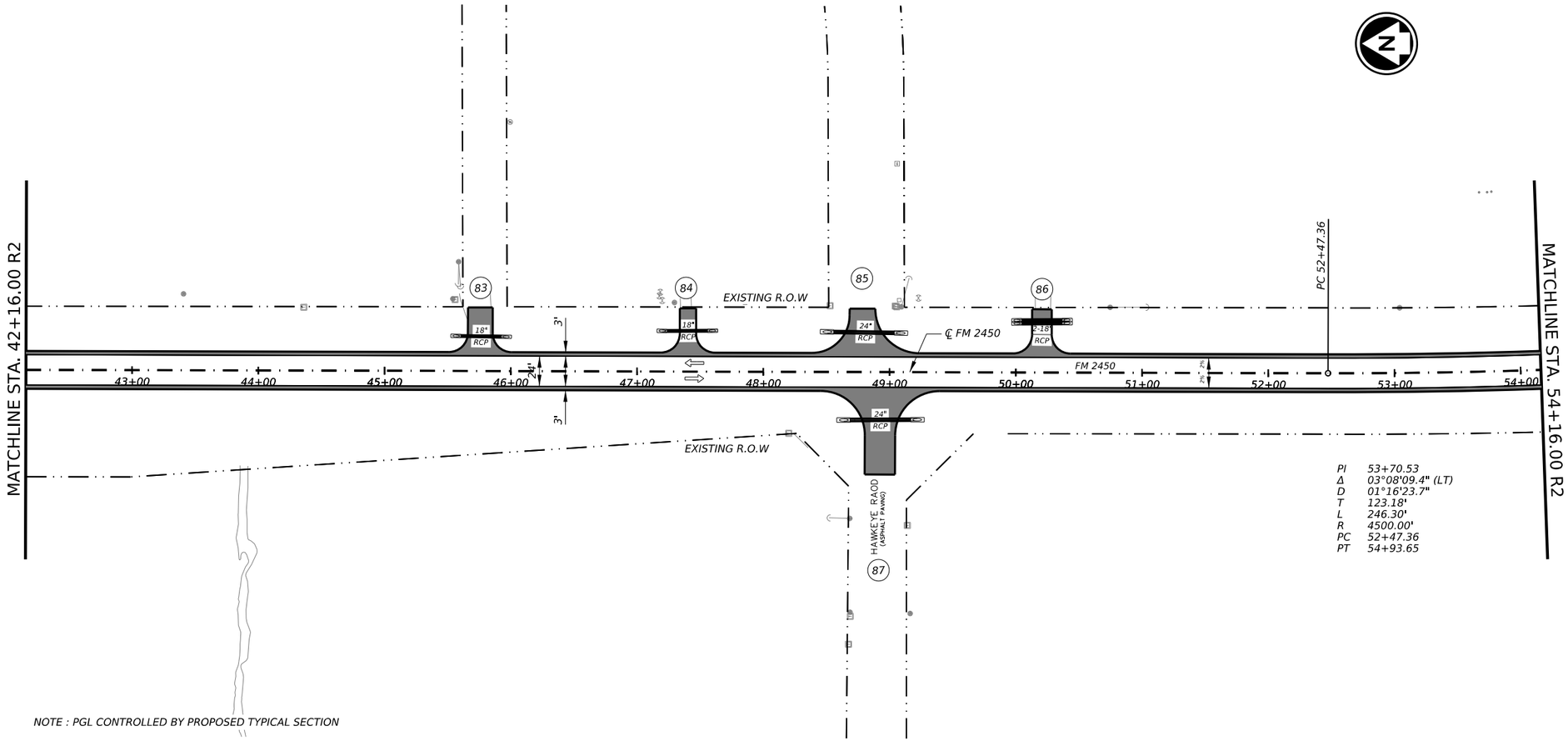

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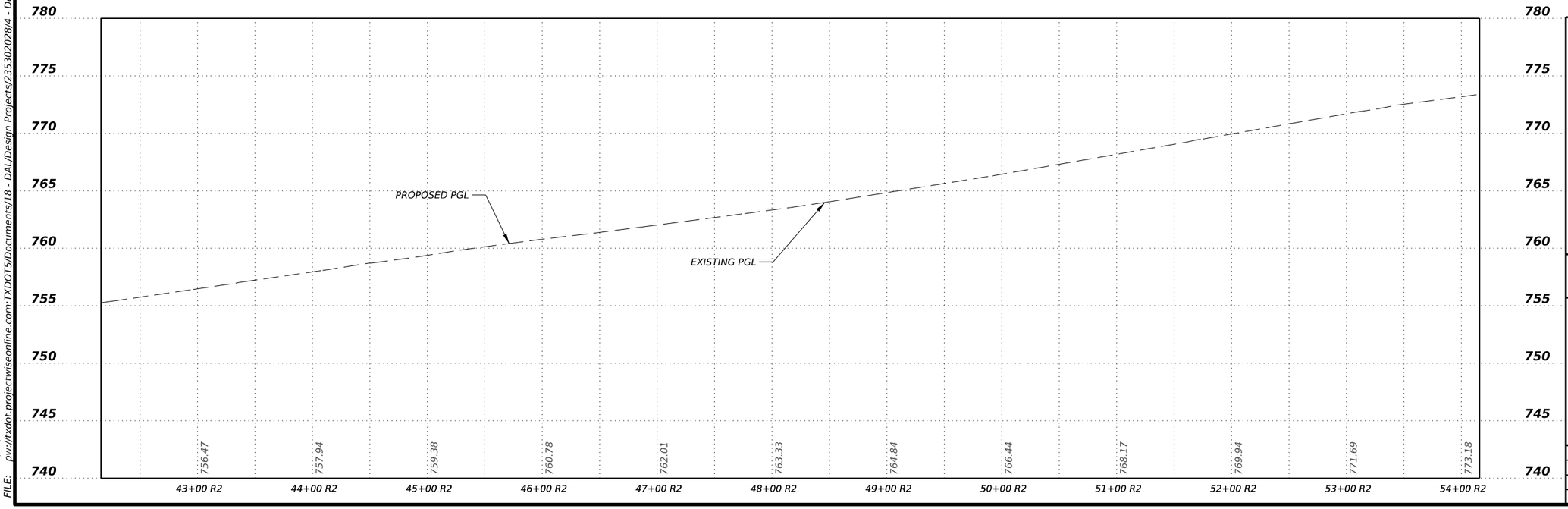

HORIZ SCALE
0 50 100
SCALE IN FEET

VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang
7F66F4980AFB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 42+16.00 R2
TO
STA 54+16.00 R2

2024 SHEET 20 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		81

DATE: 2/22/2024 1:55:40 PM
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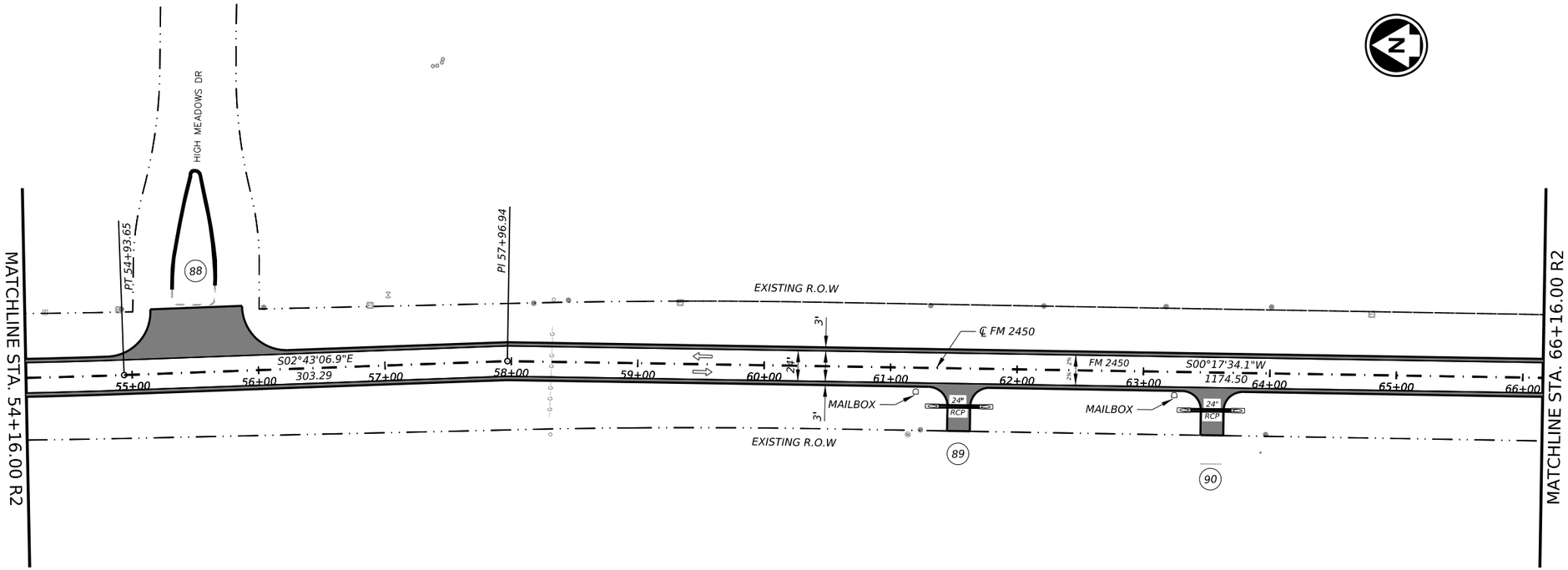


HORIZ SCALE
0 50 100
SCALE IN FEET

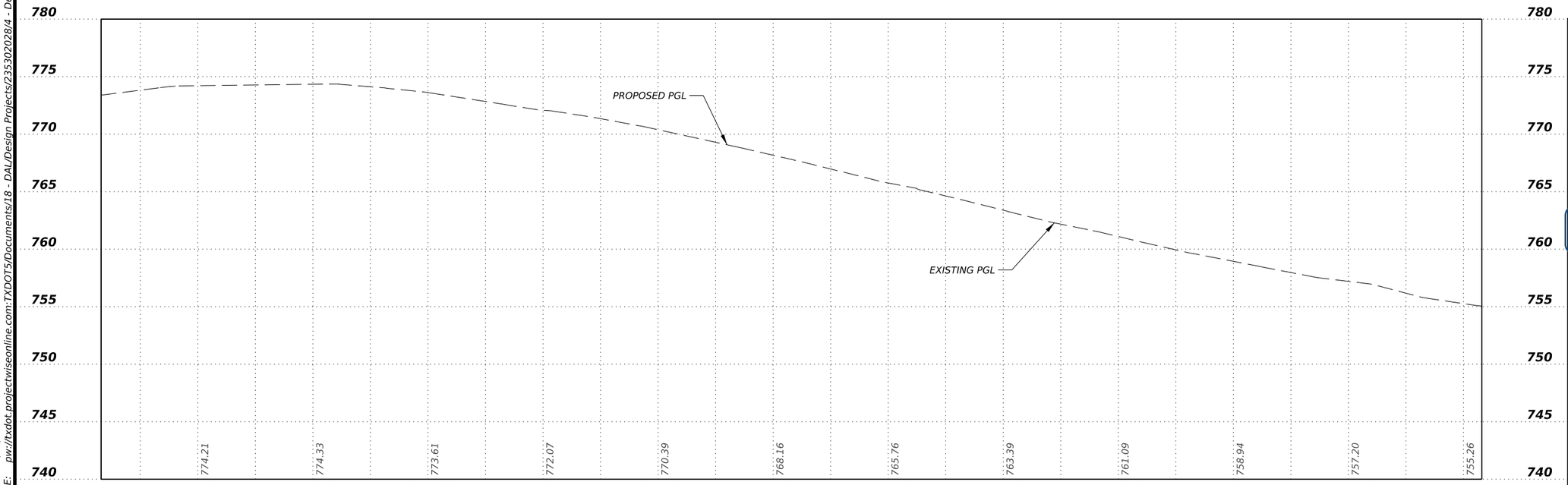
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 54+16.00 R2
TO
STA 66+16.00 R2

2024 SHEET 21 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		82

DATE: 2/22/2024 1:55:41 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

DW: CK: DW: CK:

HORIZ SCALE
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SCALE IN FEET

VERT SCALE
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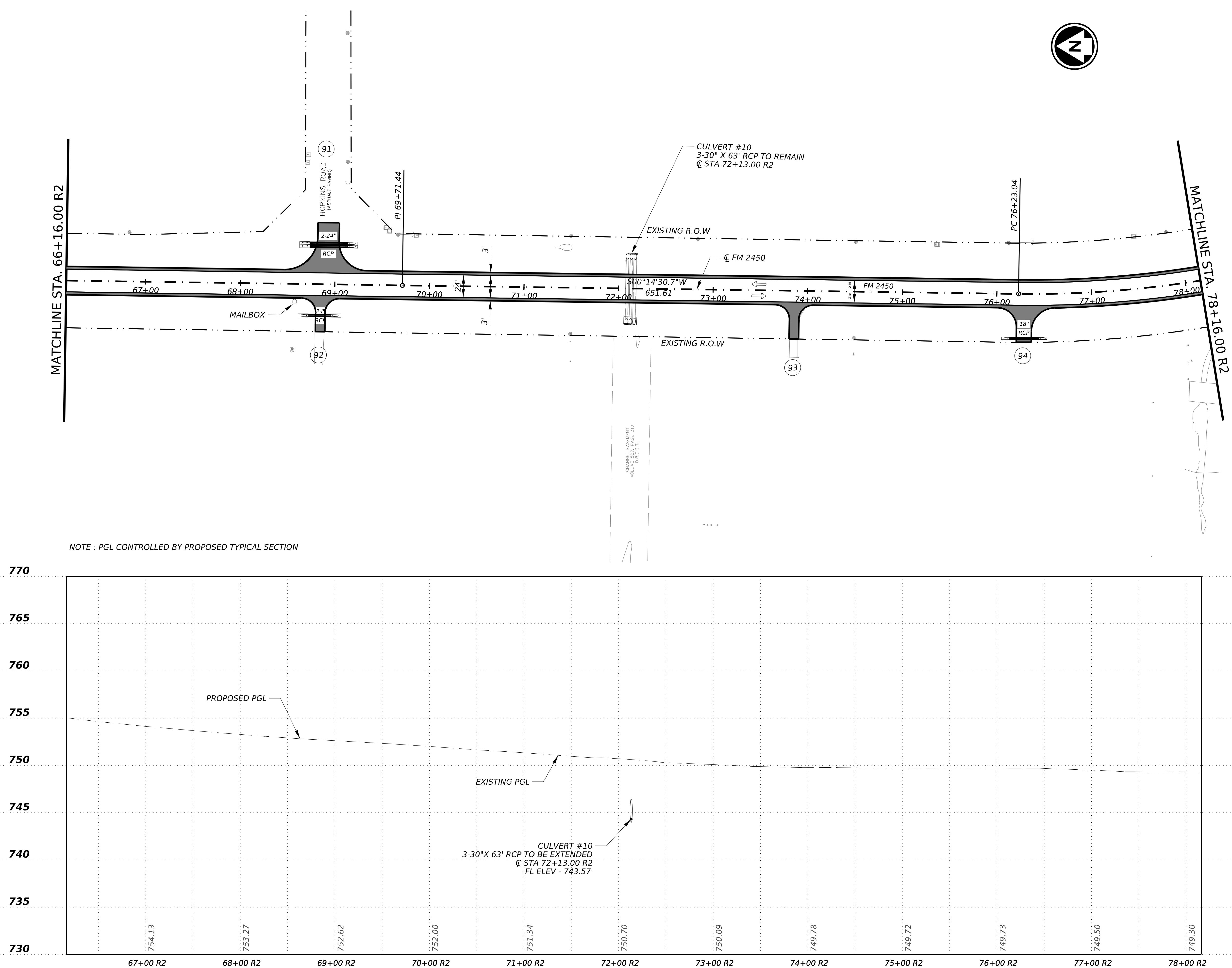
SCALE IN FEET



NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.

2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.

3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.

4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.

5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

\# DRIVEWAY NUMBER

STATE OF TEXAS
HRAM MANG
141660
LICENSED PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
2/22/2024

Texas Department of Transportation

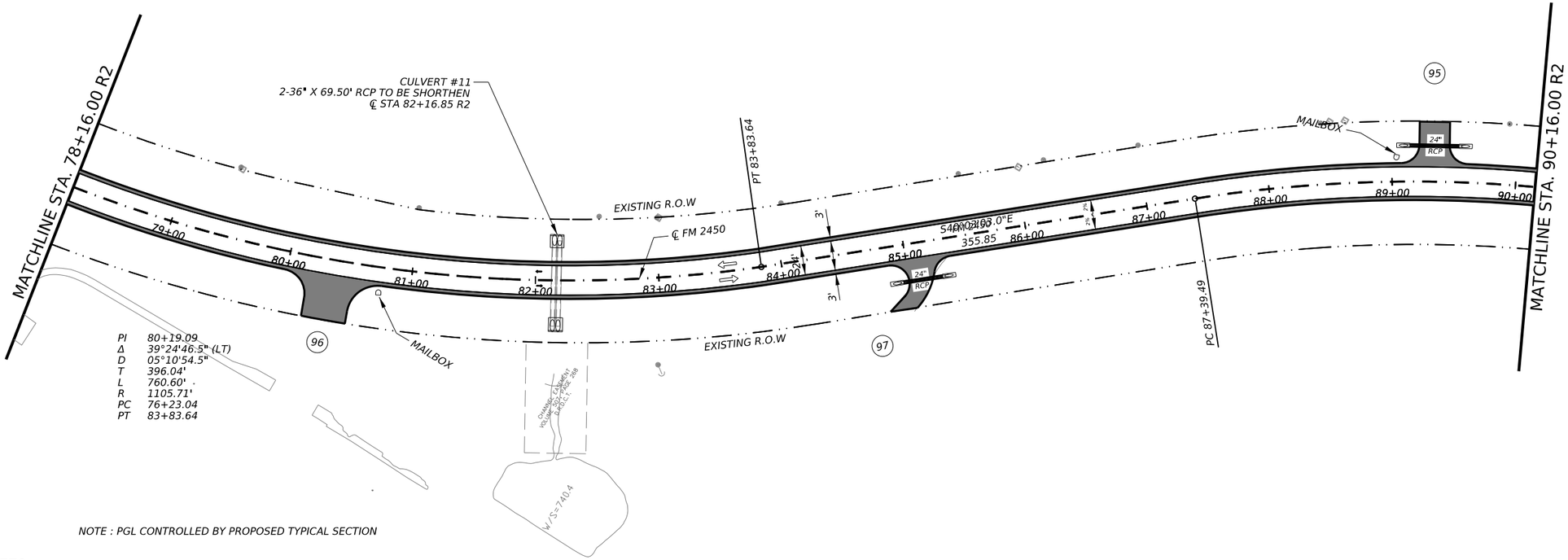
FM 2450

PLAN AND PROFILE
STA 66+16.00 R2
TO
STA 78+16.00 R2

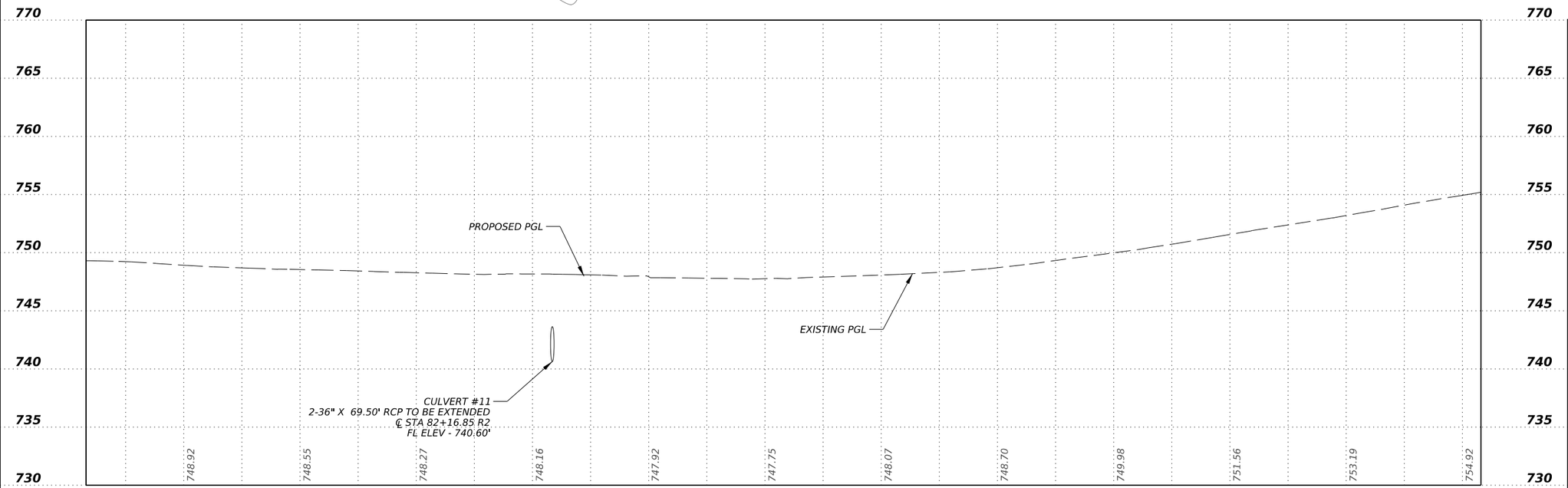
2024 SHEET 22 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST		COUNTY	SHEET NO.
DAL		DENTON	83

DATE: 2/22/2024 1:55:41 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn



NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



HORIZ SCALE
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SCALE IN FEET

VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang 2/22/2024
7E66F4980AEB4E4...

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 78+16.00 R2
TO
STA 90+16.00 R2

2024 SHEET 23 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		84

DATE: 2/22/2024 1:55:42 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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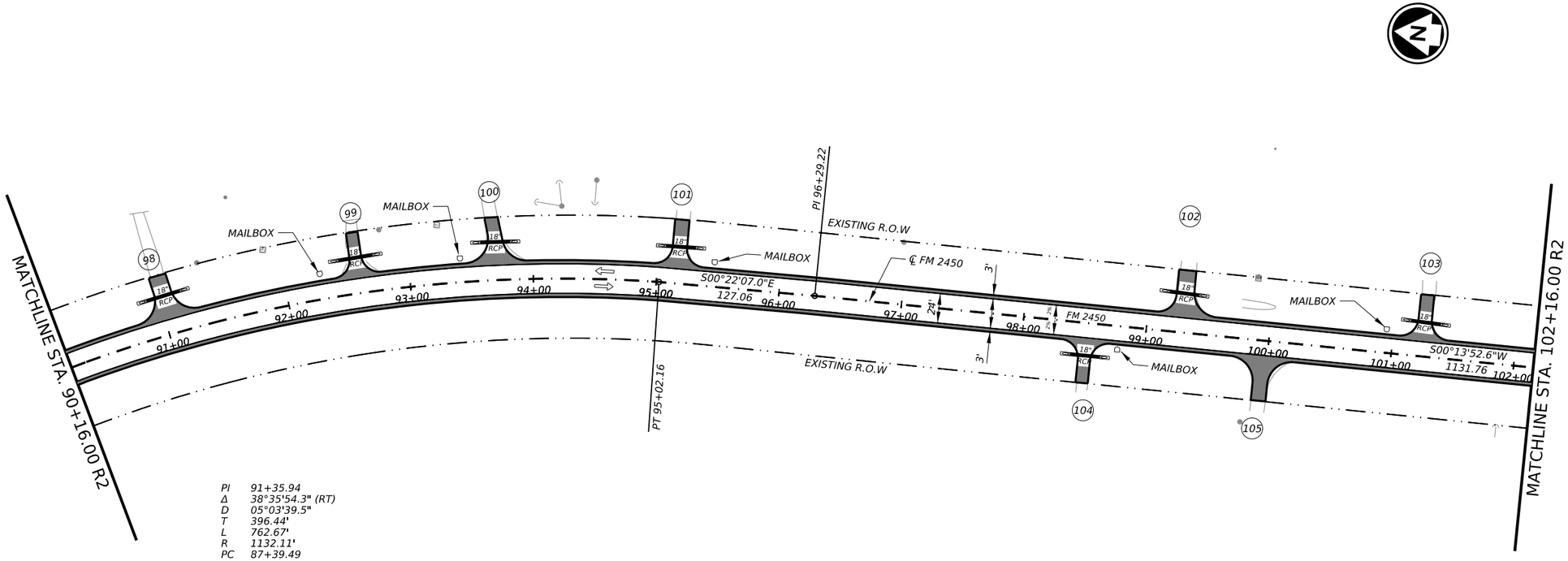


PI 91+35.94
Δ 38°35'54.3" (RT)
D 05°03'39.5"
T 396.44'
L 762.67'
R 1132.11'
PC 87+39.49
PT 95+02.16

HORIZ SCALE
0 50 100
SCALE IN FEET

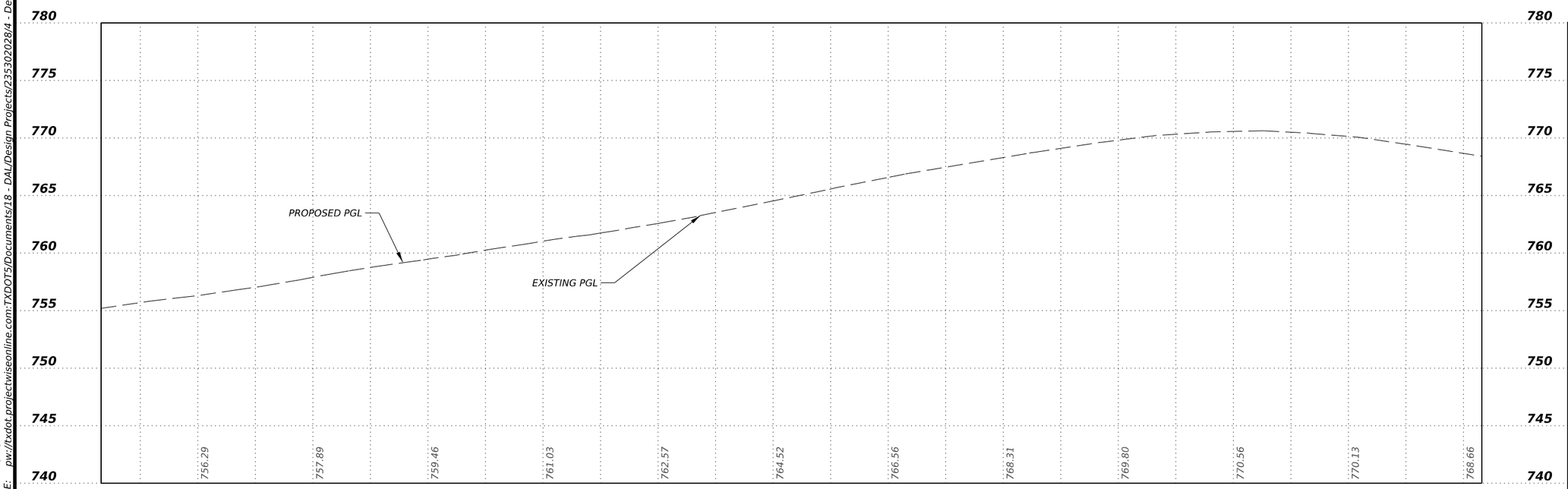
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang 2/22/2024
7E66F1980AEB4E4...

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 90+16.00 R2
TO
STA 102+16.00 R2

2024 SHEET 24 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		85

DATE: 2/22/2024 1:55:43 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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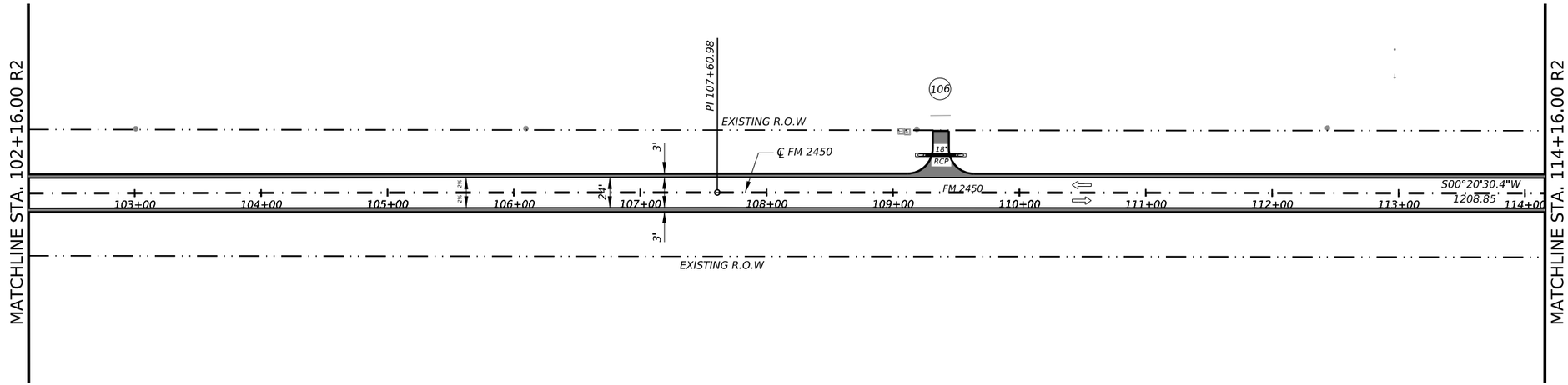


HORIZ SCALE
0 50 100
SCALE IN FEET

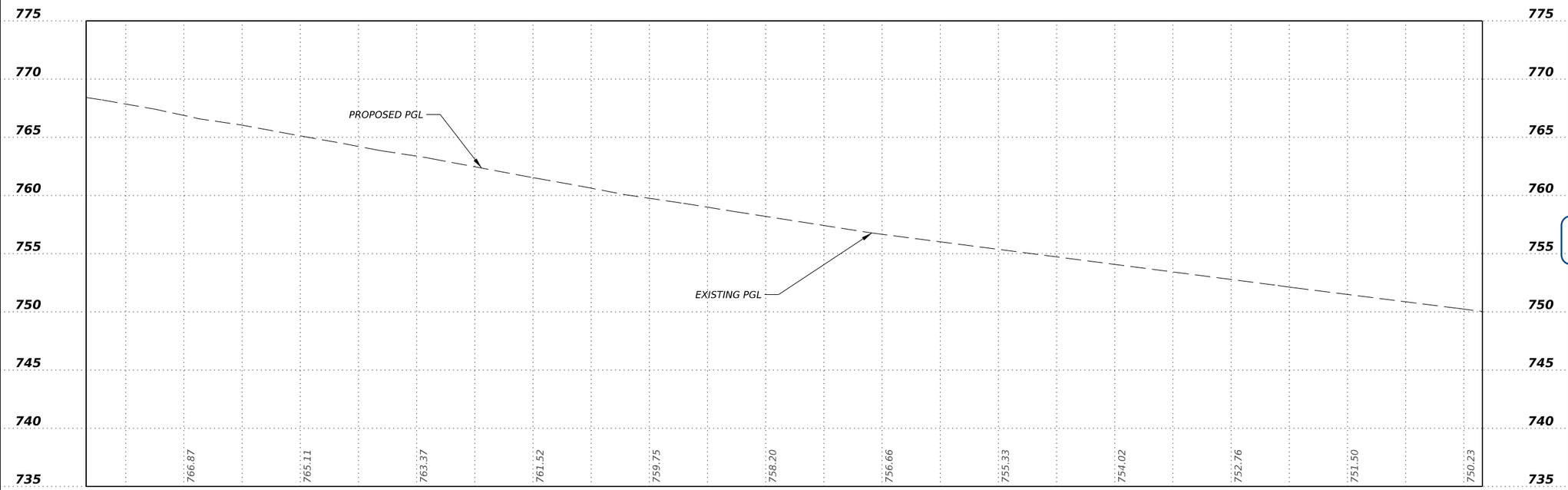
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4920AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 102+16.00 R2
TO
STA 114+16.00 R2

2024 SHEET 25 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		86

DATE: 2/22/2024 1:55:44 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450PP01.dgn

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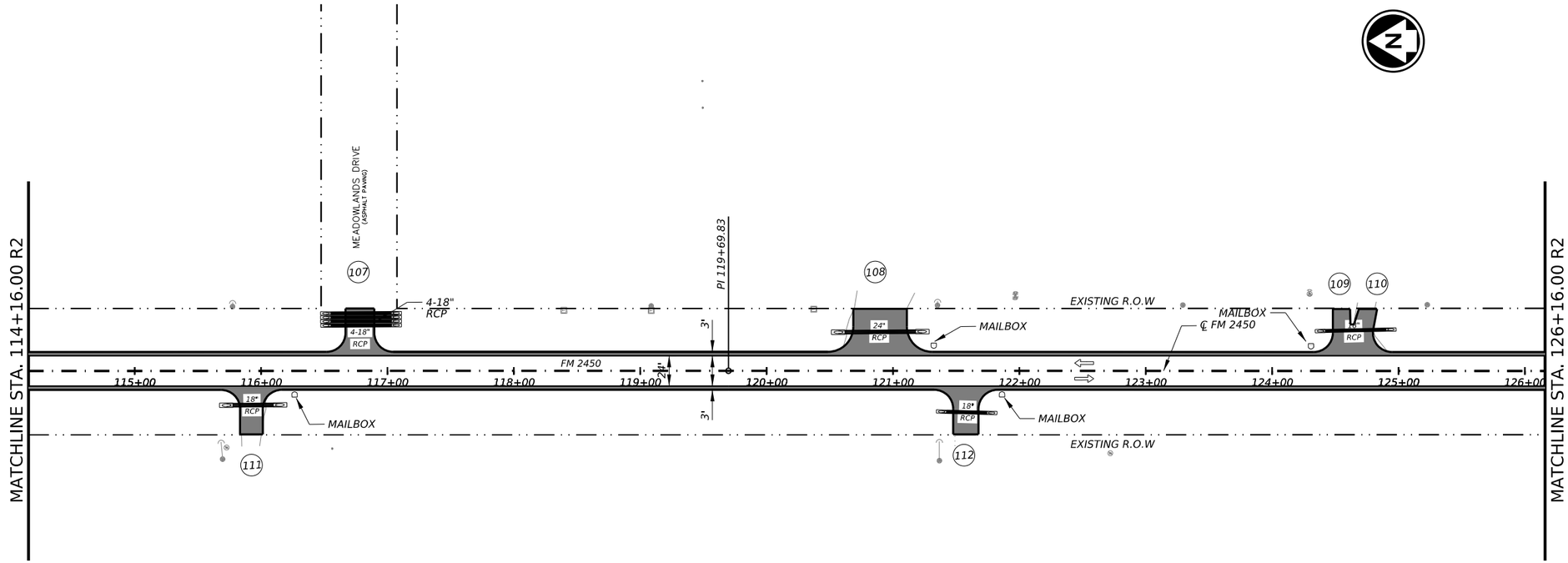


HORIZ SCALE
0 50 100
SCALE IN FEET

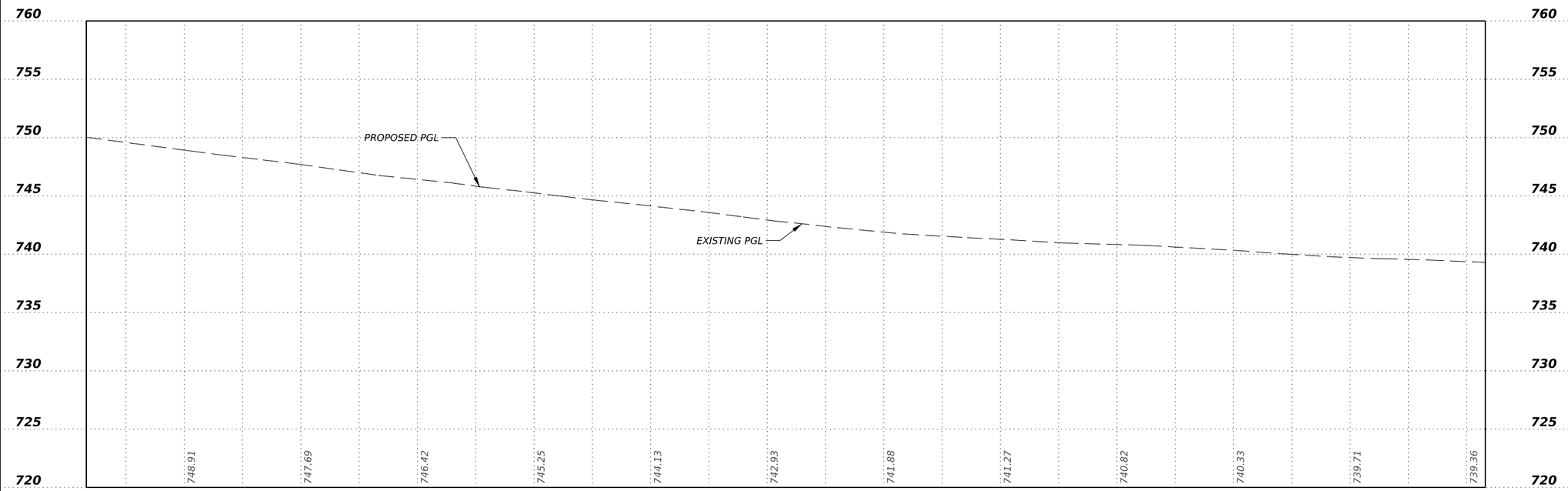
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang
7E66F4080AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 114+16.00 R2
TO
STA 126+16.00 R2

2024 SHEET 26 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		87

DATE: 2/22/2024 1:55:45 PM
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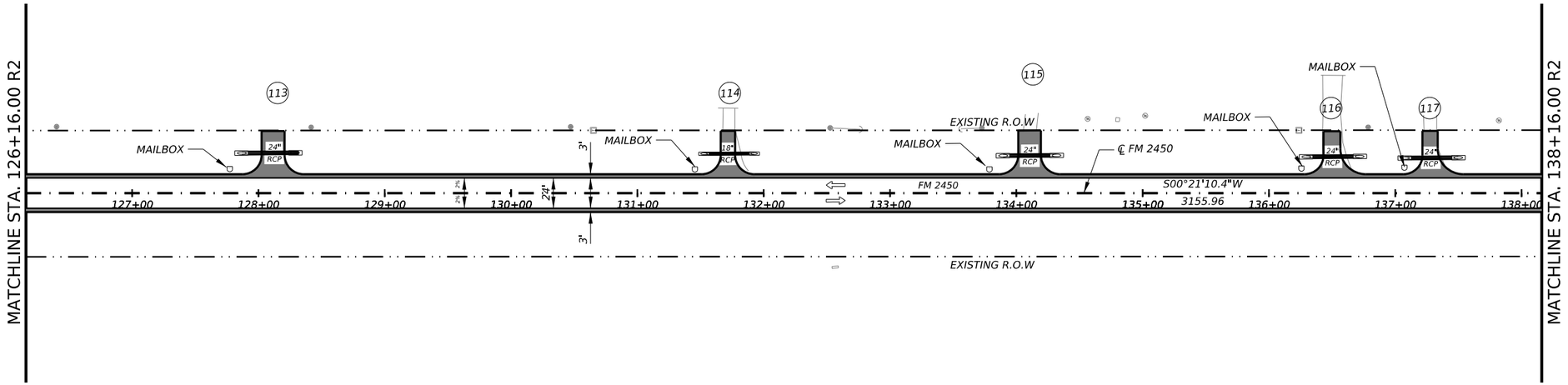

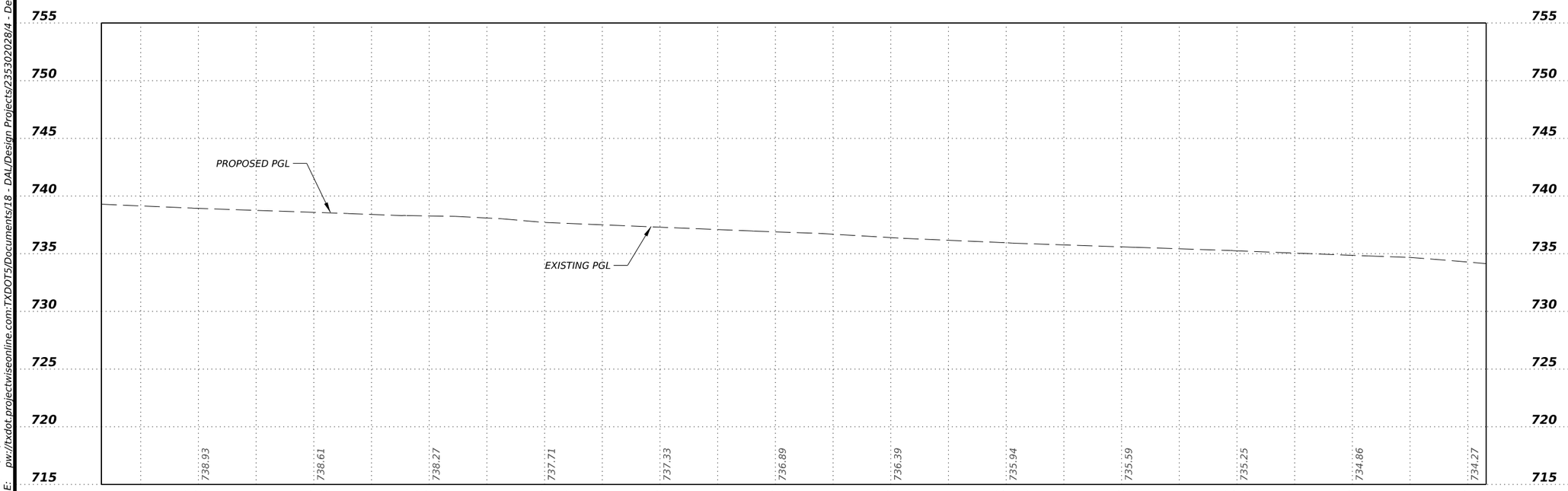

HORIZ SCALE
0 50 100
SCALE IN FEET

VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

STATE OF TEXAS
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Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 126+16.00 R2
TO
STA 138+16.00 R2

2024 SHEET 27 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		88

DATE: 2/22/2024 1:55:46 PM
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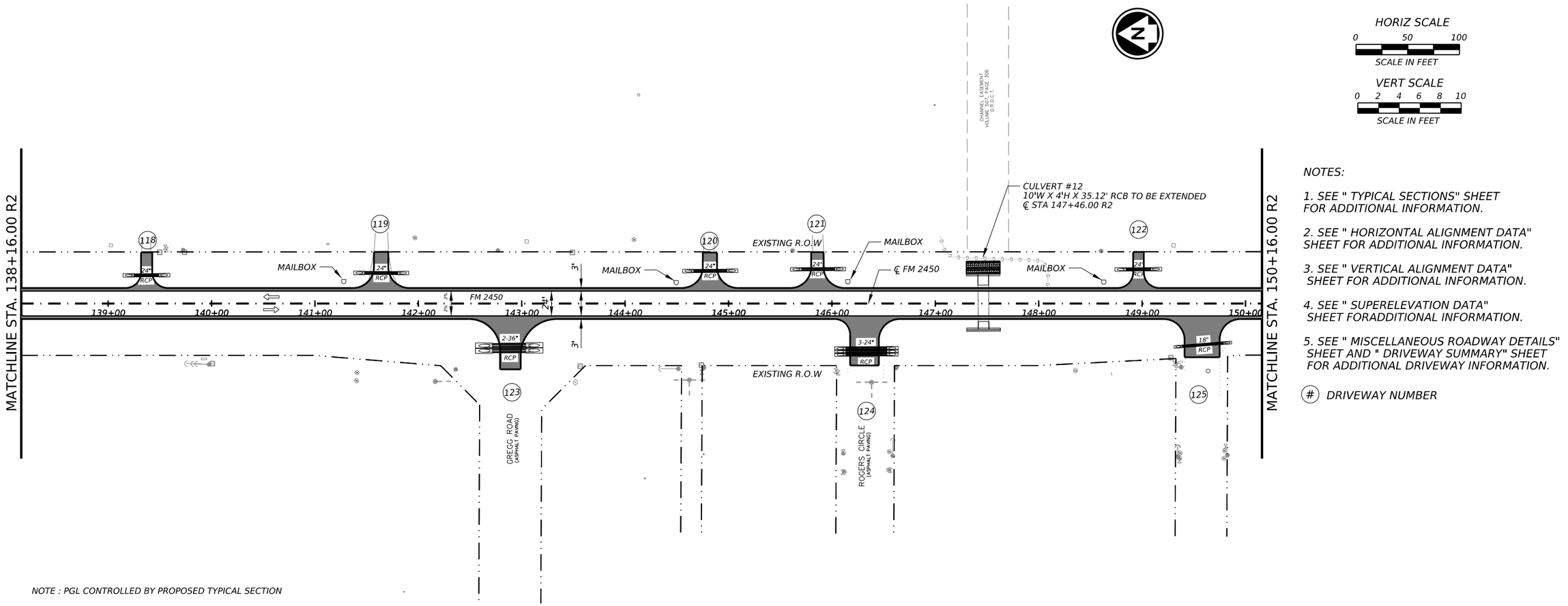

HORIZ SCALE
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SCALE IN FEET

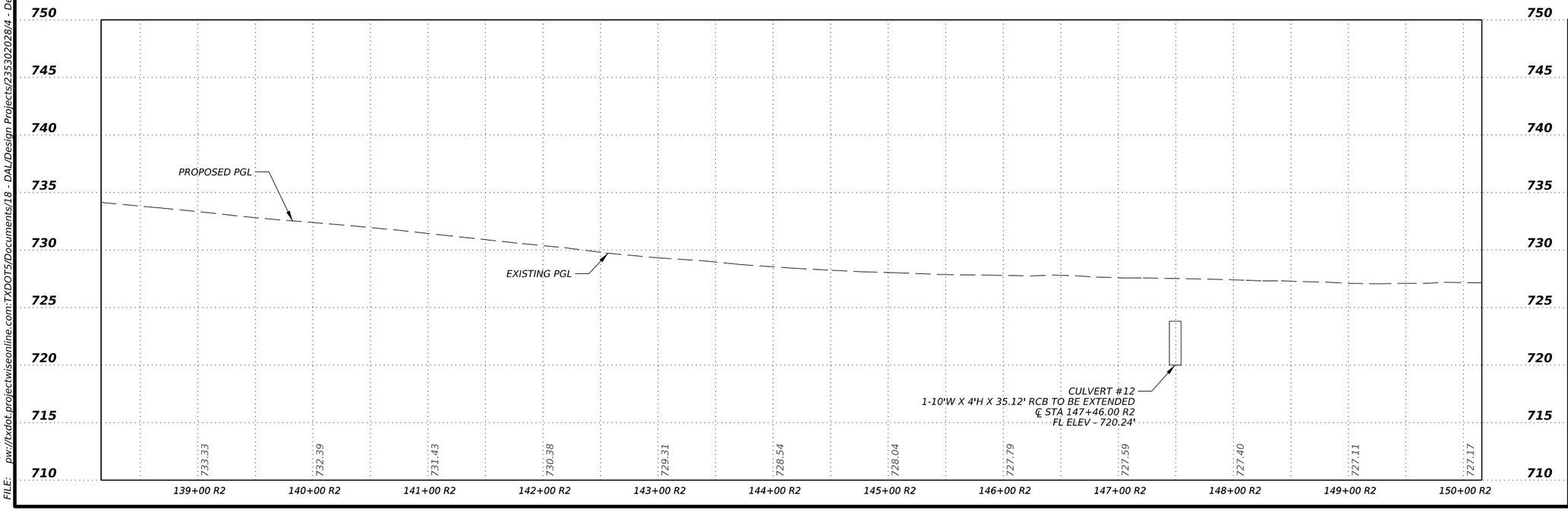
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



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Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 138+16.00 R2
TO
STA 150+16.00 R2

2024 SHEET 28 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		89

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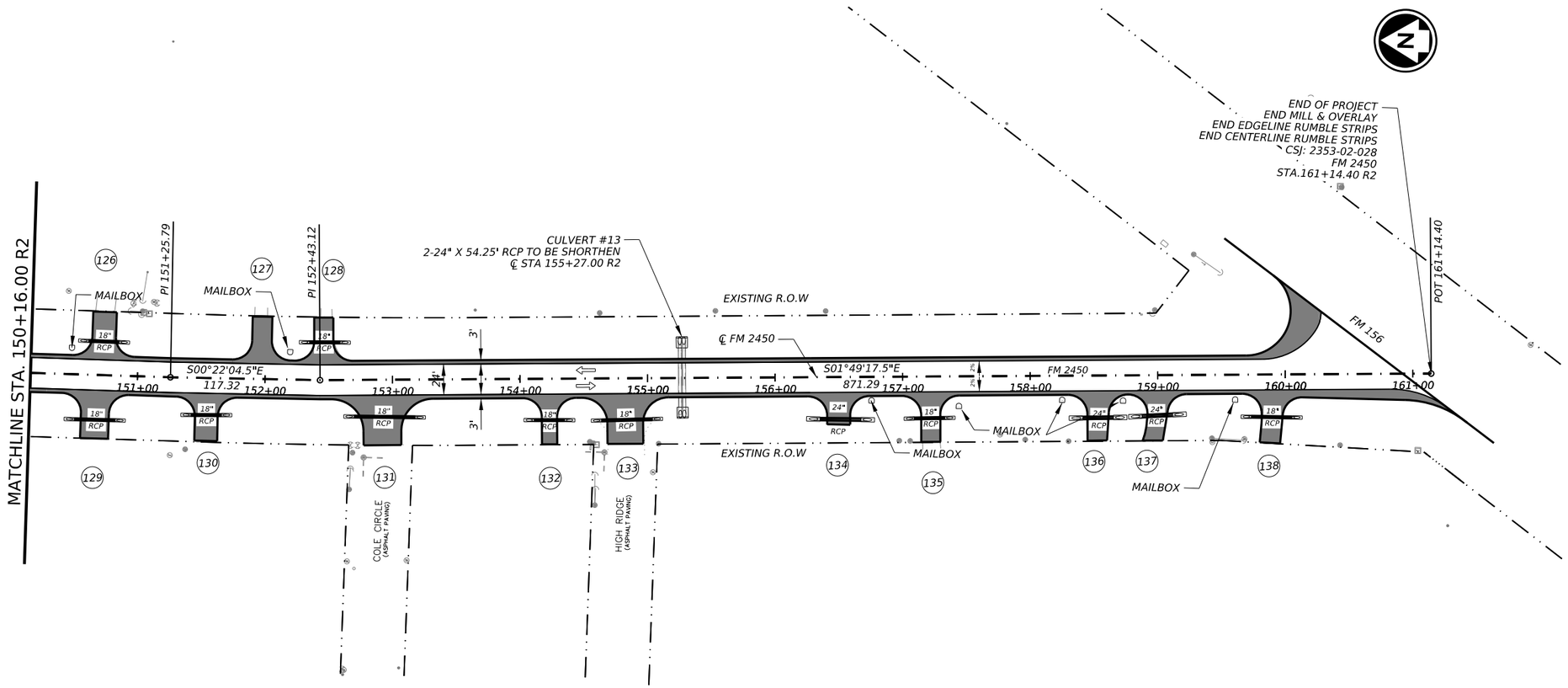


HORIZ SCALE
0 50 100
SCALE IN FEET

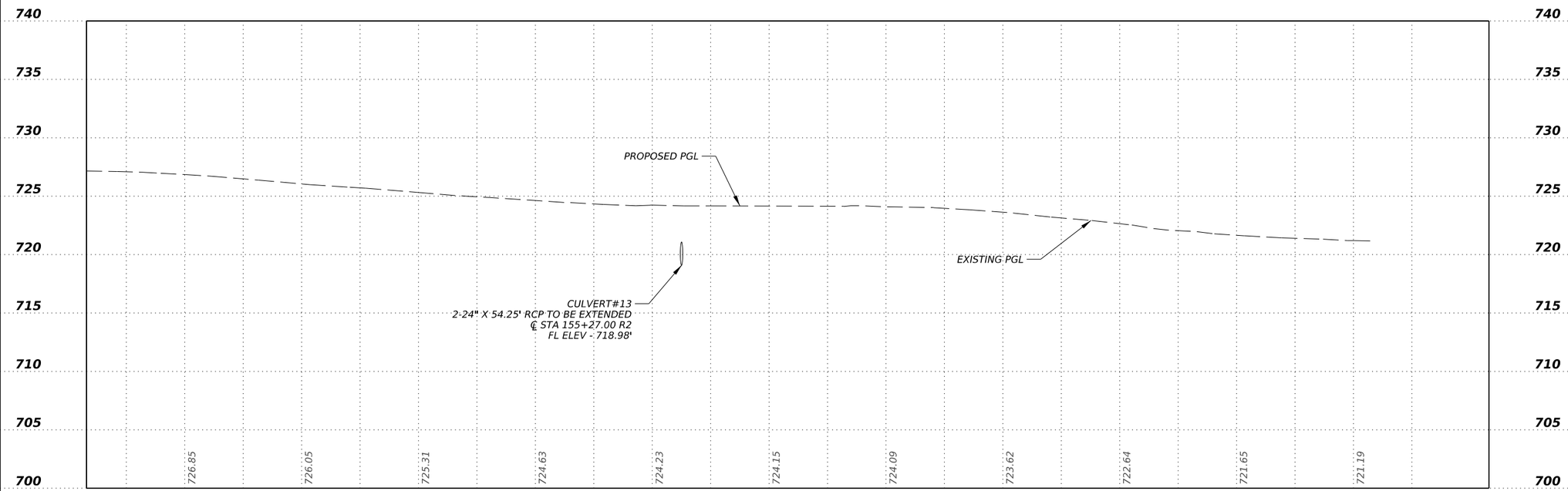
VERT SCALE
0 2 4 6 8 10
SCALE IN FEET

NOTES:

1. SEE " TYPICAL SECTIONS" SHEET FOR ADDITIONAL INFORMATION.
2. SEE " HORIZONTAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
3. SEE " VERTICAL ALIGNMENT DATA" SHEET FOR ADDITIONAL INFORMATION.
4. SEE " SUPERELEVATION DATA" SHEET FORADDITIONAL INFORMATION.
5. SEE " MISCELLANEOUS ROADWAY DETAILS" SHEET AND " DRIVEWAY SUMMARY" SHEET FOR ADDITIONAL DRIVEWAY INFORMATION.

(#) DRIVEWAY NUMBER

NOTE : PGL CONTROLLED BY PROPOSED TYPICAL SECTION



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2/28/2024

Texas Department of Transportation

FM 2450

PLAN AND PROFILE
STA 150+16.00 R2
TO
STA 161+14.40 R2

2024 SHEET 29 OF 29

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		90

DATE: 2/28/2024 11:03:53 AM
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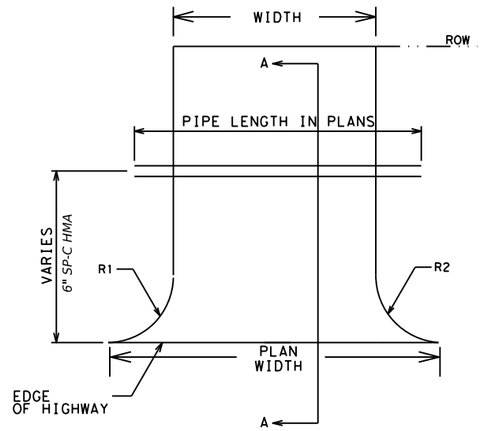
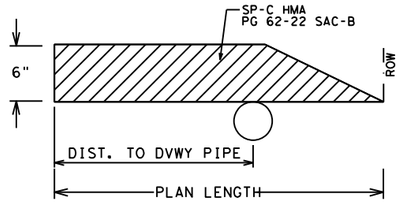
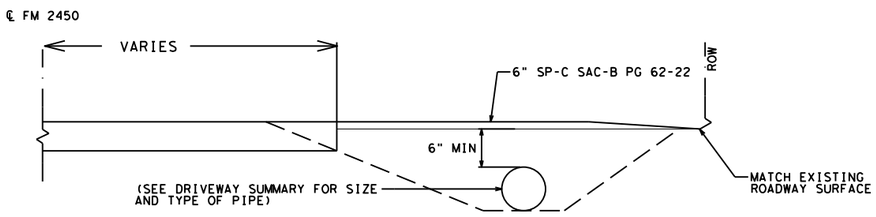
ASPHALT CONCRETE DRIVEWAY PAVEMENT
COUNTY, CITY, OR STATE ROAD
W/PIPE REPLACEMENT
OVERLAY DETAIL



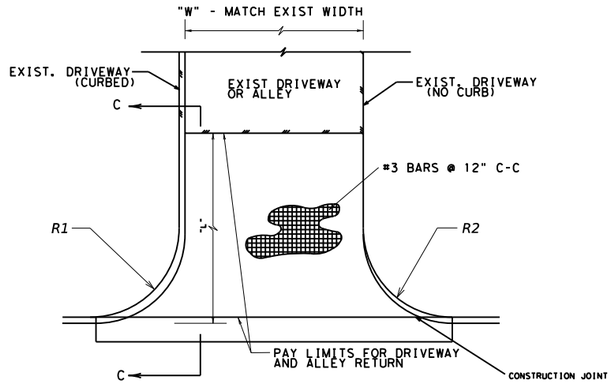
PLAN VIEW



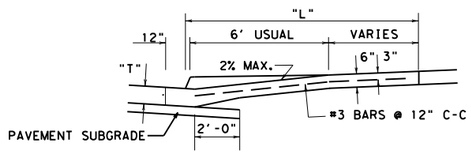
SECTION A-A



CROSS SECTION DRIVEWAY WITH PIPE



PLAN



SECTION C-C

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

STATE OF TEXAS
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PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
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2/22/2024

Texas Department of Transportation

FM 2450

MISCELLANEOUS ROADWAY DETAILS

SHEET 1 OF 2

CONT	SECT	JOB	HIGHWAY
2353	02	28	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		91

DATE: 2/22/2024 1:56:06 PM
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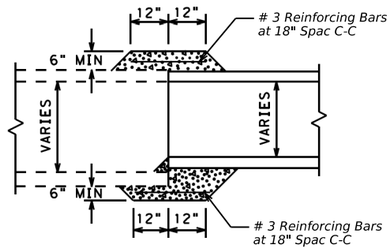

CONCRETE COLLAR FOR PIPE CONNECTION DETAIL

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

NOTES:

1. *SEE THE TxDOT BARRICADE AND CONSTRUCTION AND TRAFFIC CONTROL PLAN STANDARDS FOR ADDITIONAL INFORMATION.*
2. *SEE CULVERT LAYOUTS FOR ADDITIONAL INFORMATION.*
3. *CULVERTS SHALL BE CONSTRUCTED FROM DOWNSTREAM TO UPSTREAM.*
4. *MAINTAIN POSITIVE DRAINAGE DURING CULVERT CONSTRUCTION.*
5. *MATCH EXISTING CROSS SLOPES AND ELEVATIONS.*
6. *PROVIDE DAYTIME ONE-WAY TRAFFIC CONTROL AS NECESSARY FOR PHASED CONSTRUCTION.*

STATE OF TEXAS
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DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

MISCELLANEOUS ROADWAY DETAILS

SHEET 2 OF 2

CONT	SECT	JOB	HIGHWAY
2353	2	28	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		92

DW: CK: DW: CK:

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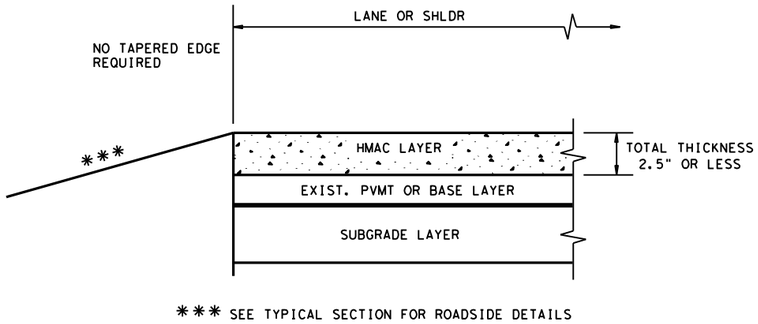
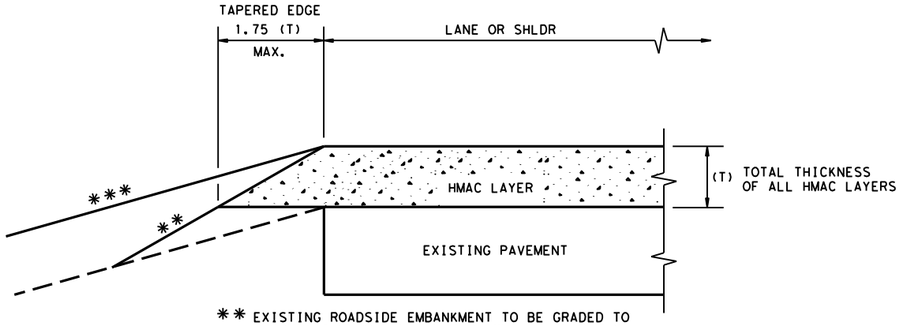


*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

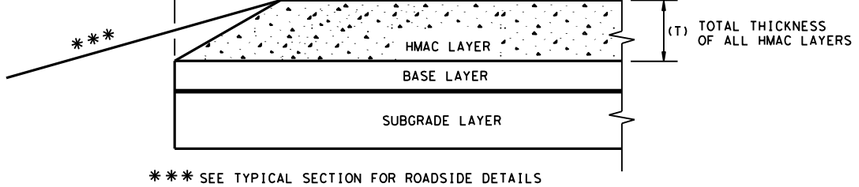
CONDITION - 1
THIN HMAC SURFACES OR HMAC OVERLAY WITH THICKNESS OF 2.5" OR LESS



** 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.

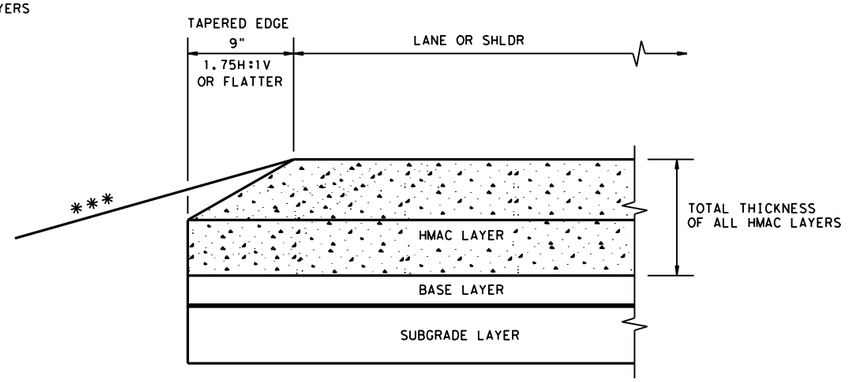
*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

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.

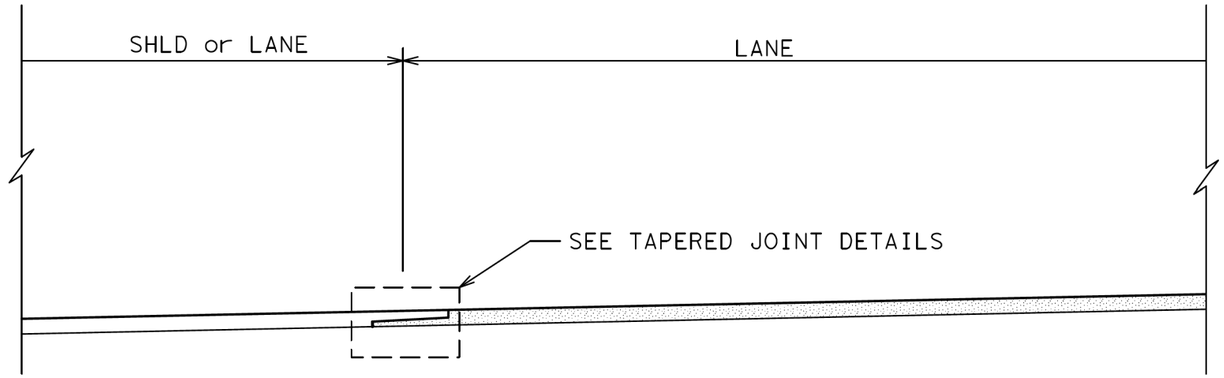
Texas Department of Transportation

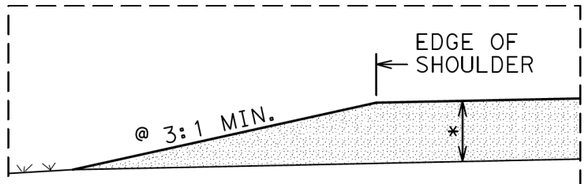
Design Division Standard

TAPERED EDGE DETAILS HMAC PAVEMENT

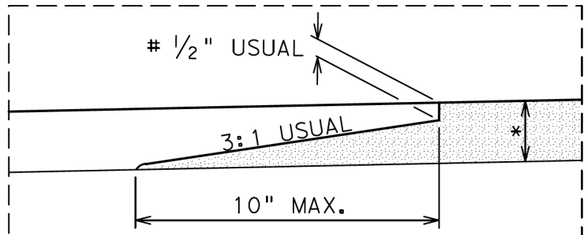
TE(HMAC)-11

FILE: tehmac11.dgn	DN: TxDOT	CK: RL	DW: KB	CK:		
© TxDOT January 2011	CONT	SECT	JOB	HIGHWAY		
REVISIONS	2353	02	028	HWY		
	DIST	COUNTY		SHEET NO.		
	DAL	DAL		93		

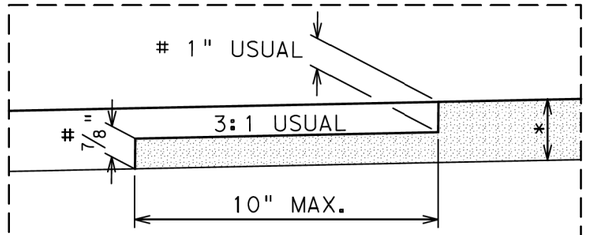




TAPERED OUTSIDE EDGE DETAIL



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.

HOT MIX EDGE AND LONGITUDINAL JOINT DETAILS DALLAS DISTRICT STANDARD

LJD(1-1)-07

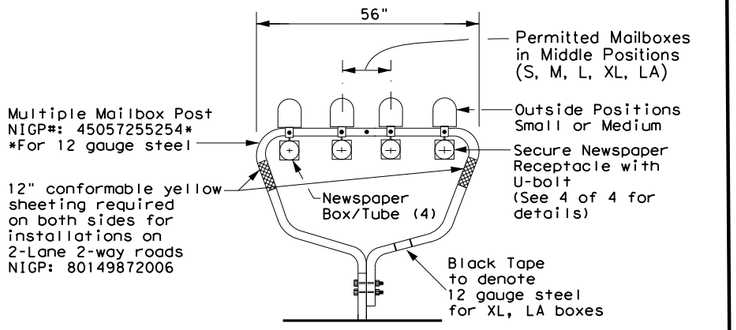
FED. RD. DIV. NO.	PROJECT NUMBER		SHEET NUMBER
18	SEE TITLE SHEET		94
STATE	DISTRICT	COUNTY	
TEXAS	DALLAS	DALLAS	
CONTROL	SECTION	SECTION	HIGHWAY NUMBER
2353	02	028	FM 2450

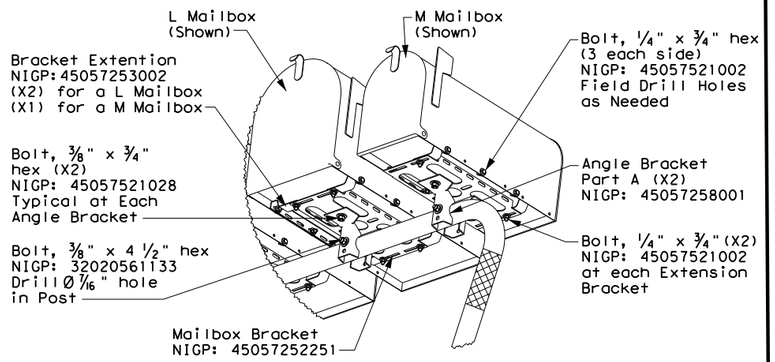
REVISED ON 9/10/08

FILENAME: sFILE$

DATE:
FILE:

TYPE 1 - MULTIPLE





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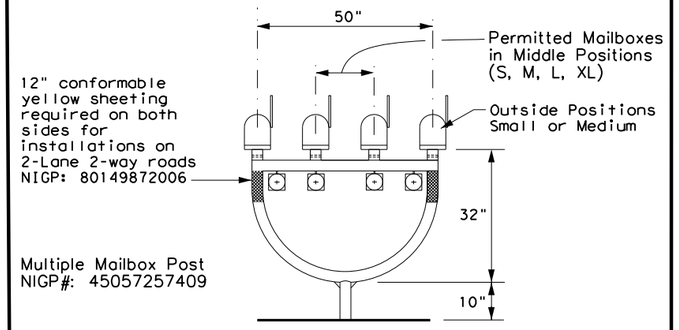
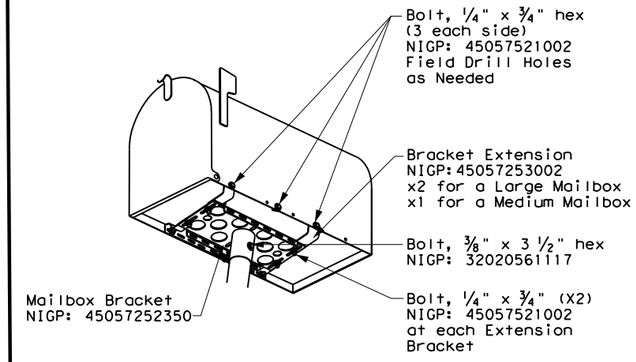




MAILBOX SIZES

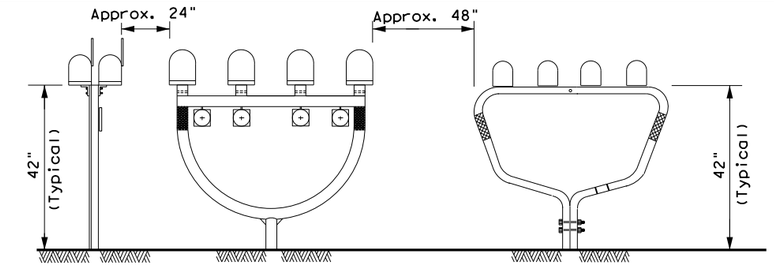
MAILBOX SIZE	TYPICAL DIMENSIONS			MAX **
	LENGTH	WIDTH	HEIGHT	WEIGHT
SMALL	19 1/2"	6"	7"	6 LBS
MEDIUM	22 1/2" *	8" *	11 1/2" *	8 LBS
LARGE	23 1/2"	11 1/2"	13 1/2"	11 LBS
EXTRA LARGE	18"	14"	12"	13 LBS
LOCKABLE	18"	11 1/2"	15"	23 LBS

* 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.

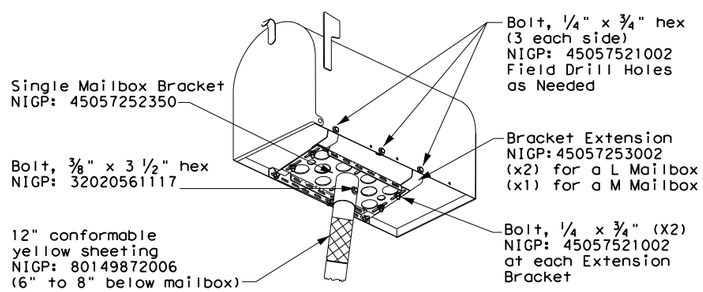
TYPICAL INSTALLATION MEASUREMENTS

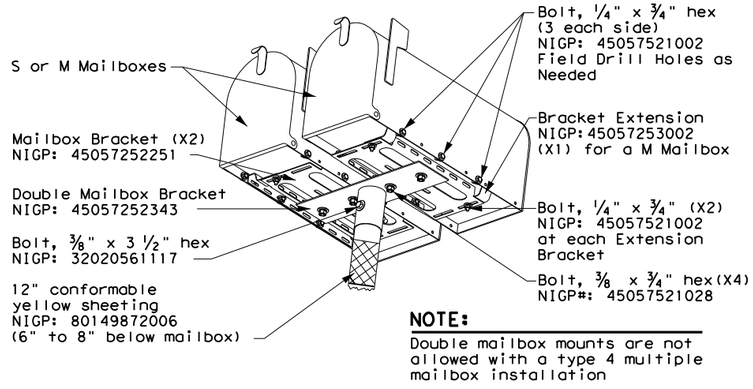


NOTE:

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

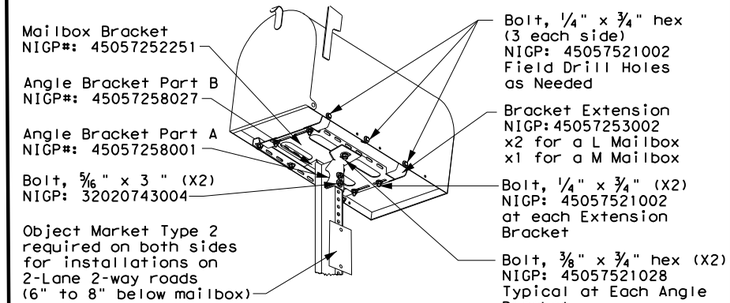


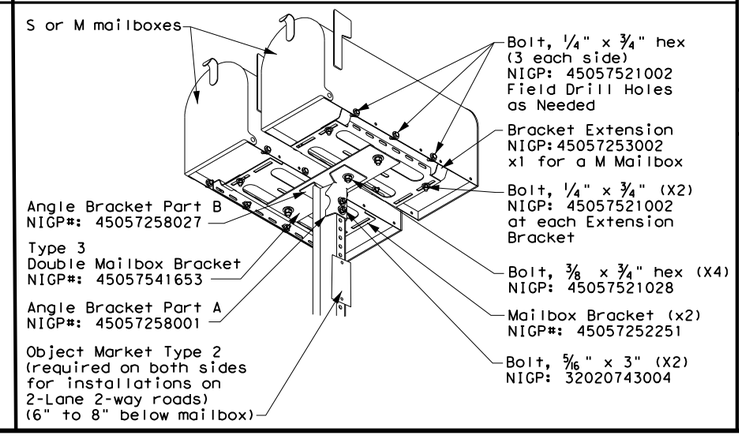


NOTE:

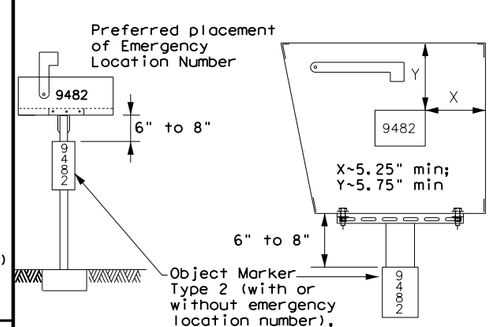
Double mailbox mounts are not allowed with a type 4 multiple mailbox installation

TYPE 3 - SINGLE/DOUBLE





PLACEMENT OF EMERGENCY LOCATION NUMBER

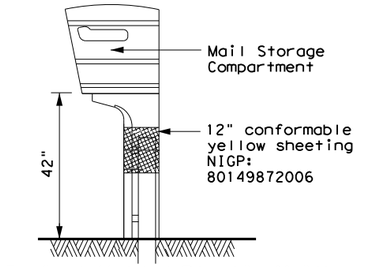


NOTES:

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
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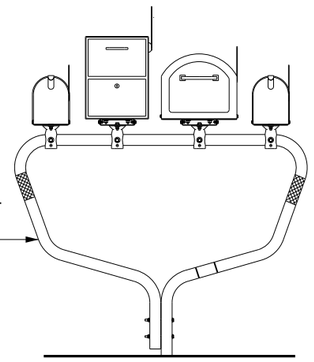
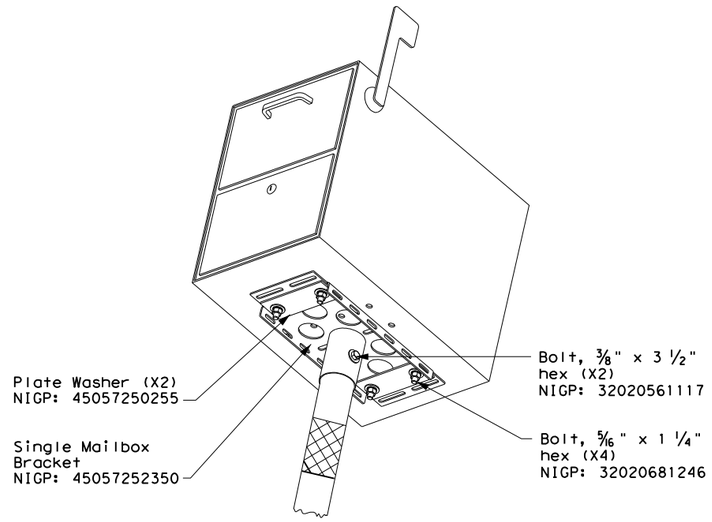
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		95

DATE:
FILE:

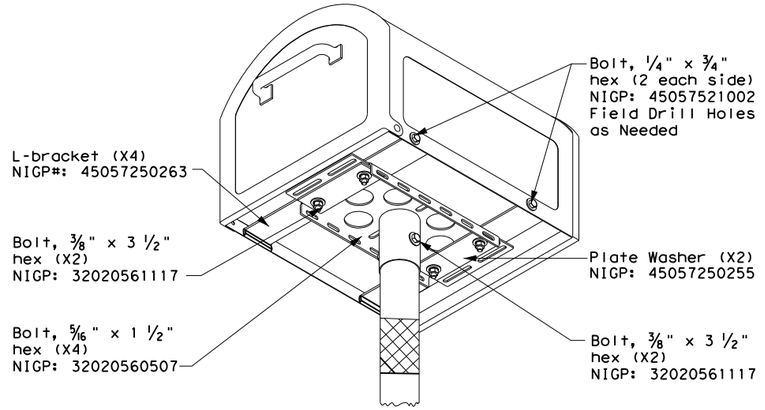
TYPE 1- MULTI LOCKABLE AND XL MAILBOX



TYPE 2/4 - SINGLE LOCKABLE MAILBOX

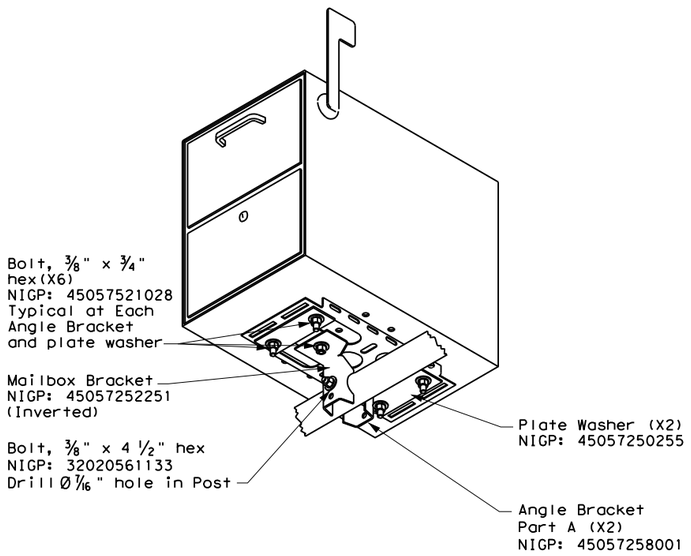


TYPE 2/4 - SINGLE XL MAILBOX

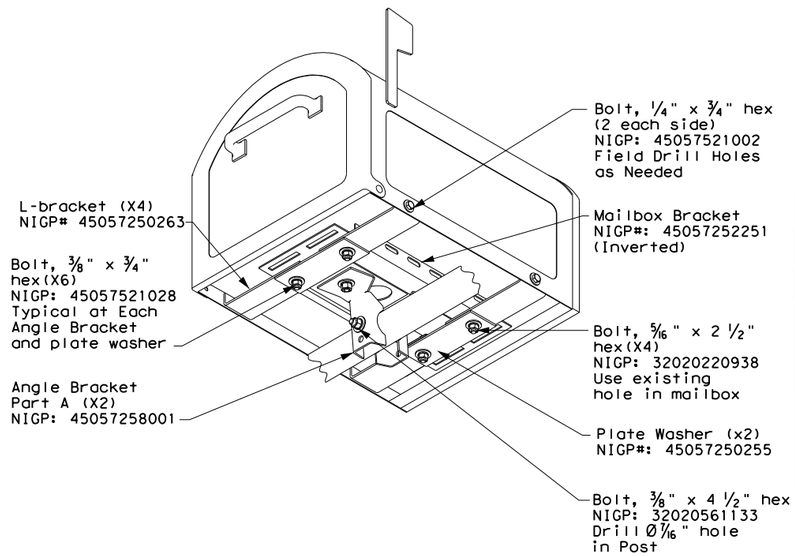


NOTE:
Follow same configuration when mounting an XL mailbox on a Type 4 multi post.

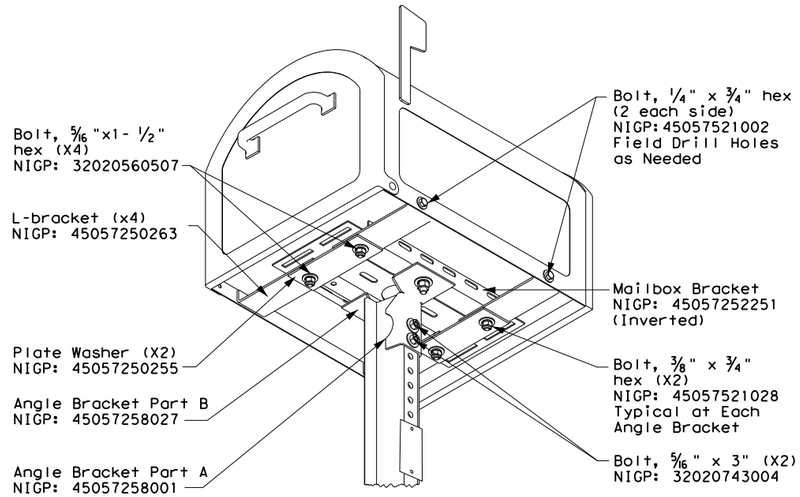
TYPE 1 MULTI – LOCKABLE ARCHITECTURAL (LA)



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

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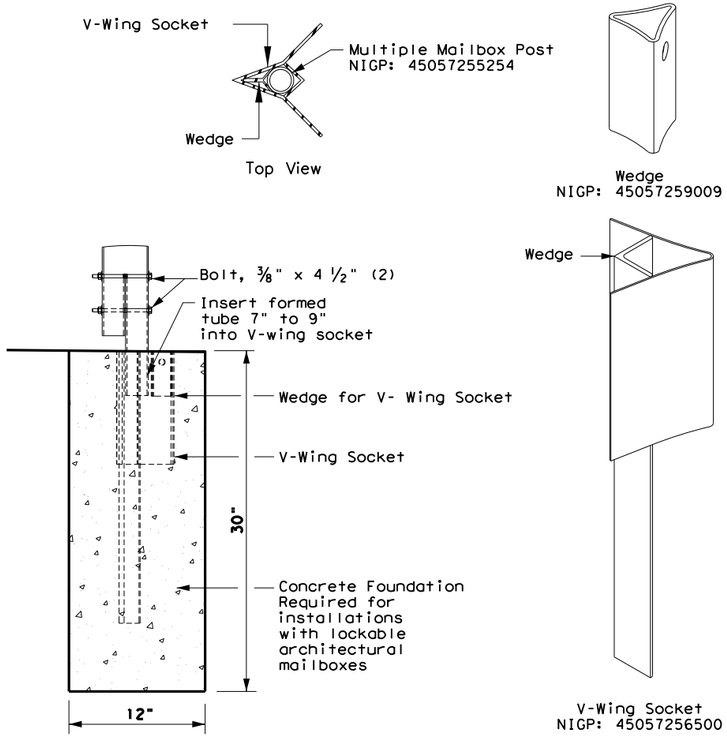
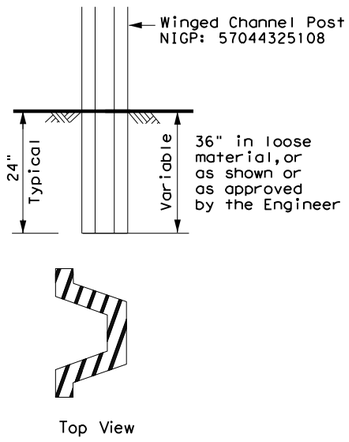
	DAL	DENTON		96

DATE:
FILE:

TYPE 1 - SUPPORT/FOUNDATION
Thin Wall Tube w/ V-LOC Anchorage

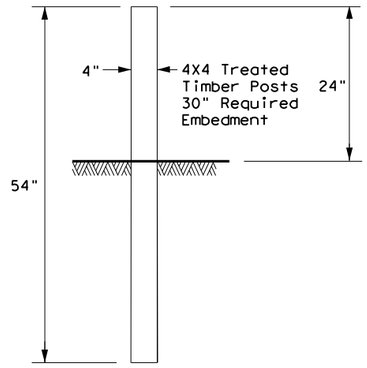


TYPE 3 - SUPPORT/FOUNDATION



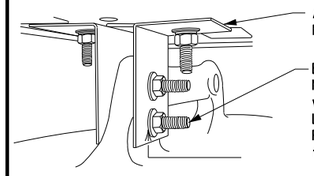
NOTES:
1. Attach Object Marker (OM) facing direction of traffic.
2. OM will also be required on opposite side if installed on a 2-Lane, 2-Way roadway.

TYPE 5 - SUPPORT/FOUNDATION



Molded Plastic Mailboxes shall be installed on 4"x4" treated timber posts only. The use of steel pipe or structural tubing in place of timber post is prohibited.

TYPE 6 - TEMPORARY MAILBOX SUPPORT

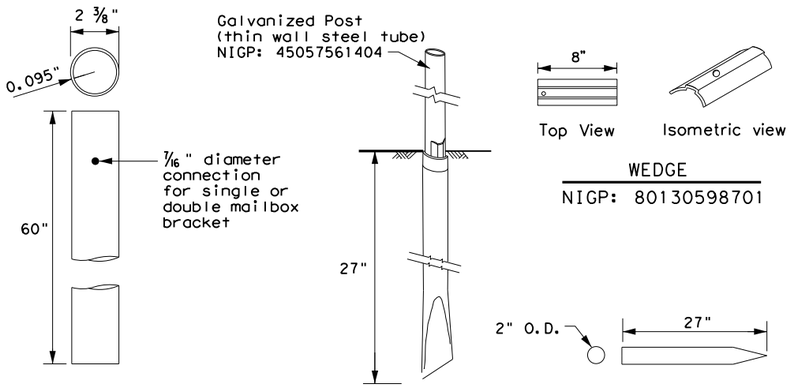


Plastic Drum NIGP: 55093383655
Rubber Collar NIGP: 55093387102

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

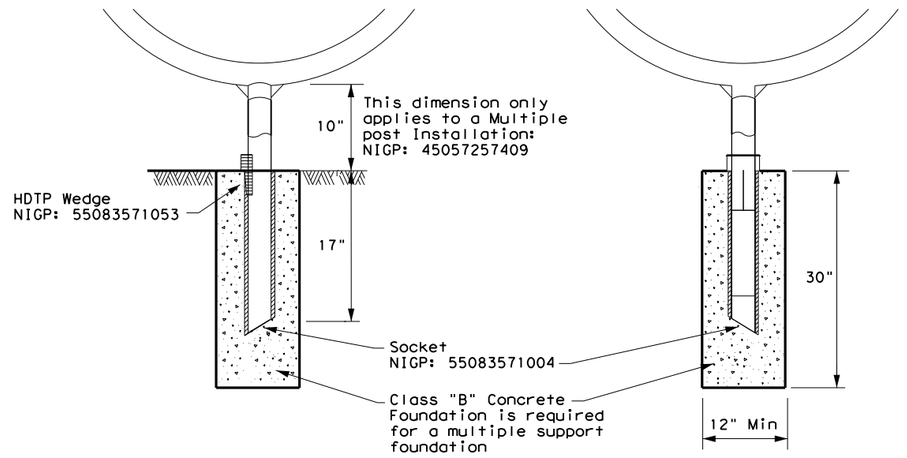
TYPE 2 - SUPPORT/FOUNDATION
Thin Wall Steel Tube w/Wedge Anchor System



MAILBOX POST

WEDGE ANCHOR
NIGP: 80130238407

TYPE 4 - SUPPORT/FOUNDATION
Whitecoated steel post NIGP: 45057561107
Multiple post NIGP: 45057257409
Recycled Rubber post (RR) NIGP: 45057561057



SHEET 3 OF 4

Texas Department of Transportation

Maintenance Division Standard

MAILBOX SUPPORT AND FOUNDATION

MB(3)-21

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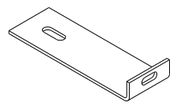
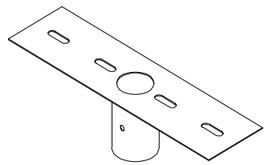
DATE:
FILE:

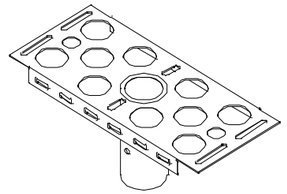
TYPE	TYPE 1	TYPE 2	TYPE 3	TYPE 4			TYPE 5	TYPE 6
Configuration	Multiple	Single or Double	Single or Double	Single	Double	Multiple	Single	Single
Mailbox Size NIGP #	Outside Position: S or M Inside Position: S, M, L, XL, or LA	Single: S, M, L, XL, or LA Double: SS, SM, MM	Single: S, M, L, or XL Double: 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



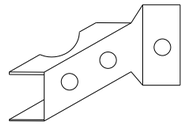
NIGP: 45057250263
L-Bracket x4 for
XL sized mailboxes



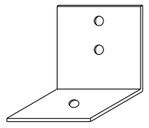
NIGP: 45057252343
Double Mailbox Bracket
For Type 2 and Type 4
double mount



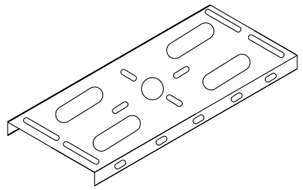
NIGP: 45057252350
Single Mailbox Bracket
For Type 2 single and for
Type 4 single and multi mount



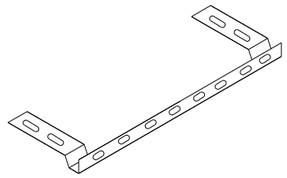
NIGP: 45057258001
Part "A" Angle Bracket
For Type 1 multi (2 per mailbox)
and Type 3 single and double



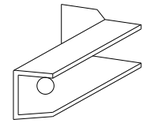
NIGP: 45057251055
Type 6 Angle Bracket
(2 per mailbox)



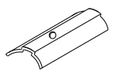
NIGP: 45057252251
Mailbox Bracket
For Type 1 multi and
any double mount (use 2)



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



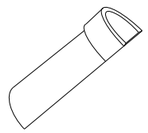
NIGP: 45057258027
Part "B" Angle Bracket
For Type 3 single
and double



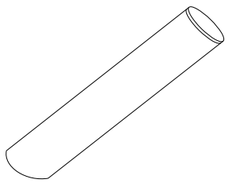
NIGP: 80130598701
Wedge for Type 2

NIGP: 45057250255
Plate Washer for Architecural
and XL Mailboxes

NIGP: 45057541653
Type 3 double mailbox bracket

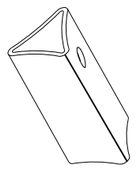


NIGP: 55083571053
Type 4 Mailbox Wedge

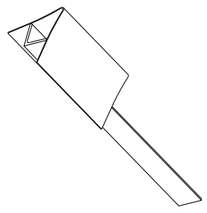


NIGP: 55083571004
Type 4 Mailbox Socket

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

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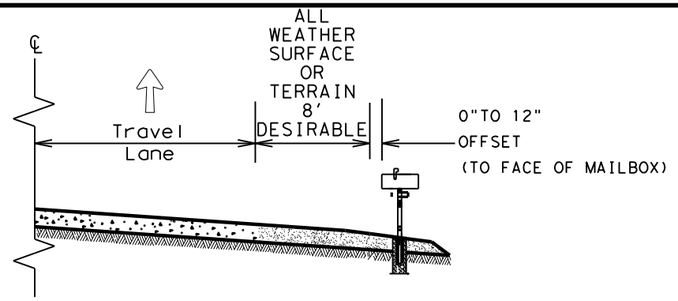
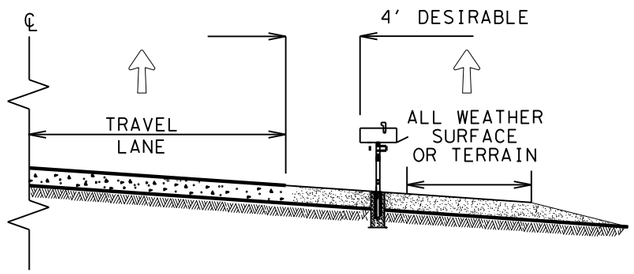
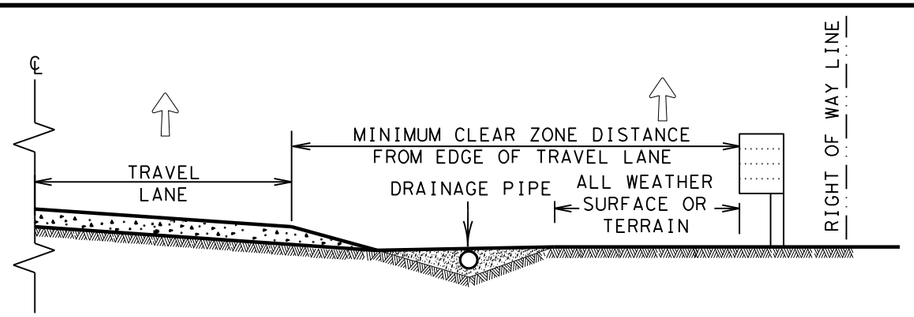
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		98



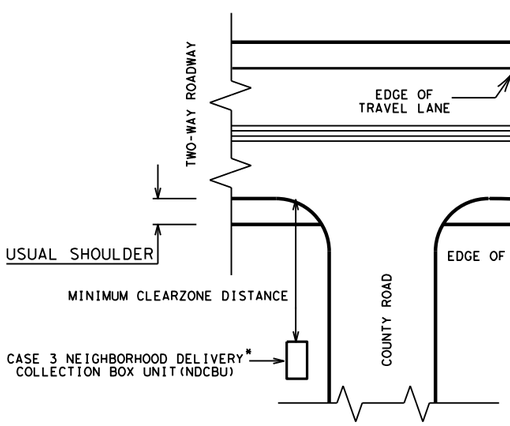
CASE 1. OFF TRAVEL WAY DELIVERY

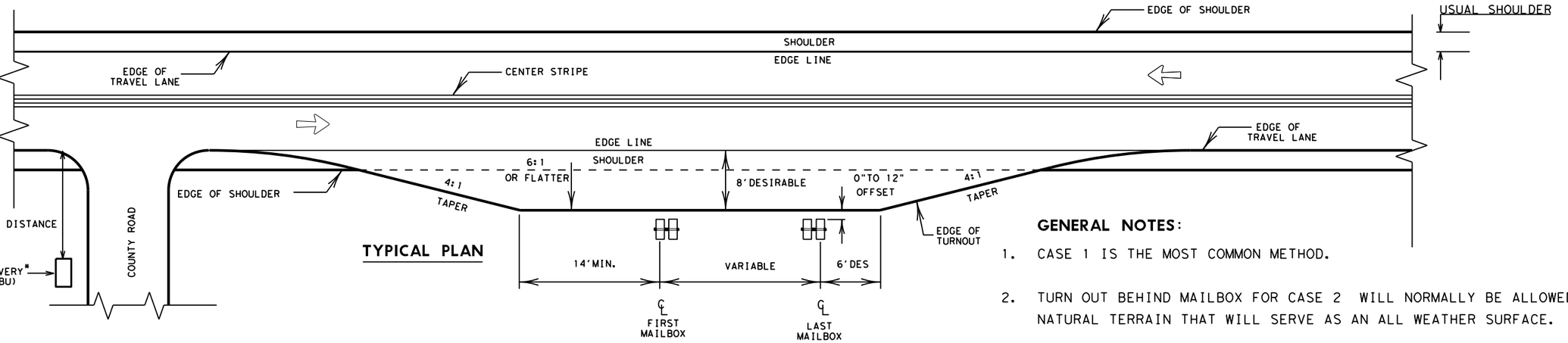


CASE 2. BACK SIDE DELIVERY

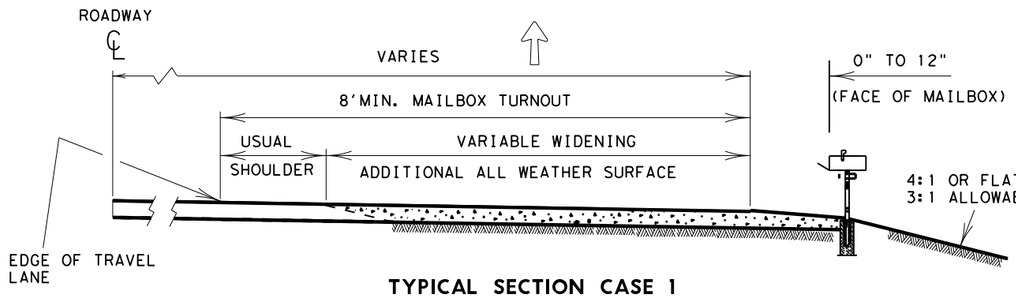


CASE 3. DELIVERY NEAR RIGHT OF WAY LINE





TYPICAL PLAN



TYPICAL SECTION CASE 1

GENERAL NOTES:

1. CASE 1 IS THE MOST COMMON METHOD.
2. TURN OUT BEHIND MAILBOX FOR CASE 2 WILL NORMALLY BE ALLOWED FOR NATURAL TERRAIN THAT WILL SERVE AS AN ALL WEATHER SURFACE.
3. ALL WEATHER DRIVEWAYS FOR CASE 3 MAILBOXES LOCATED AT THE RIGHT OF WAY LINE SHOULD NORMALLY BE PLACED IN CONJUNCTION WITH COUNTY ROADS OR OTHER CONNECTING COMMUNITY ROADS OR STREETS. WHEN 3 OR MORE MULTI-RACKS ARE ANTICIPATED, THE USE OF AN NDCBU IS RECOMMENDED. ONLY RURAL PATRONS LOCATED ON STATE MAINTAINED HIGHWAYS MAY HAVE A MAILBOX OR NDCBU SLOT ON TXDOT RIGHT OF WAY.

* NDCBU MAY BE INSTALLED ON COUNTY ROAD ROW WITH APPROVAL OF COUNTY.

MAIL DELIVERY VEHICLE TRAVEL DIRECTION

Texas Department of Transportation | Maintenance Division Standard

Guideline

MAILBOX SIDE ROAD PLACEMENT AND TURNOUTS

MBP(1)-22

FILE: MBP-22.DGN	DN: VS		CK:	DW: VS		CK:
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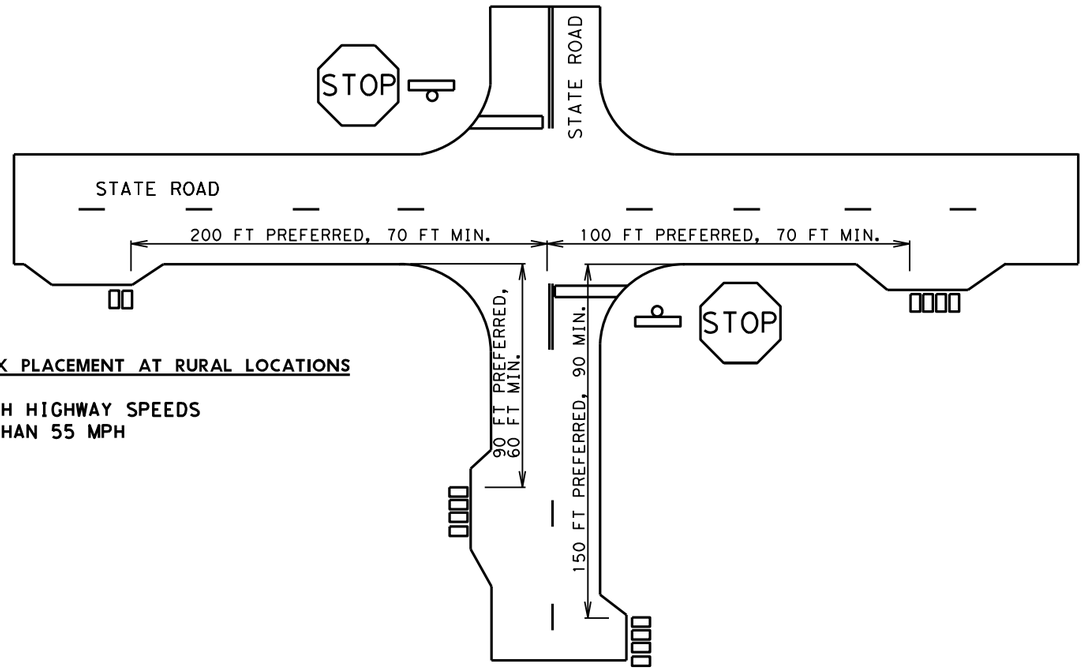
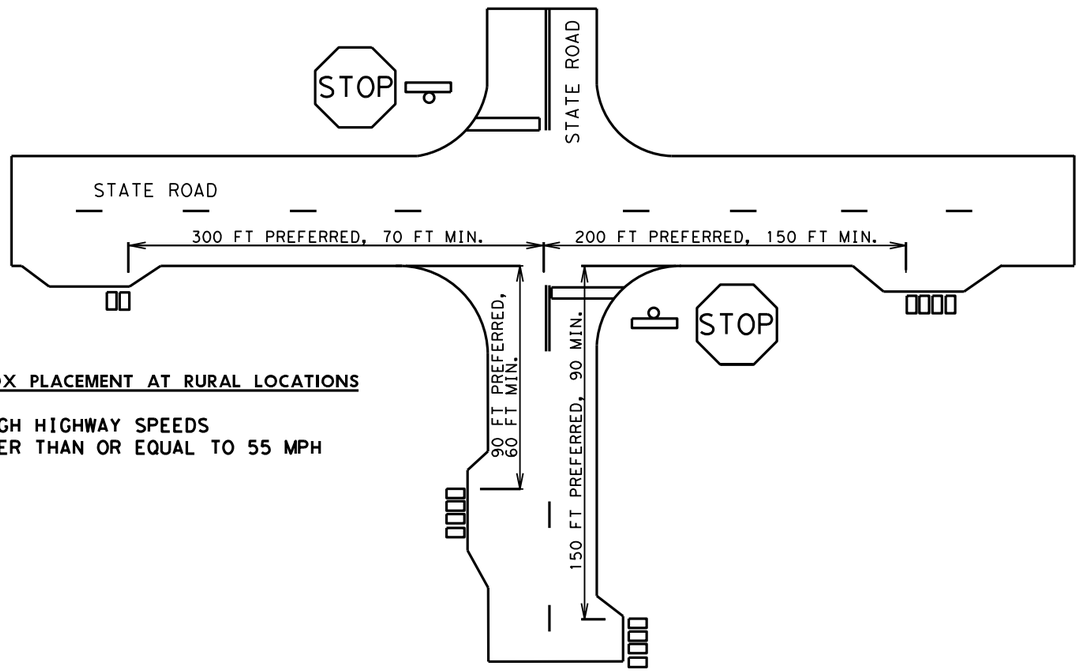
DATE:
FILE:

DATE:
FILE:



MAILBOX PLACEMENT AT RURAL LOCATIONS

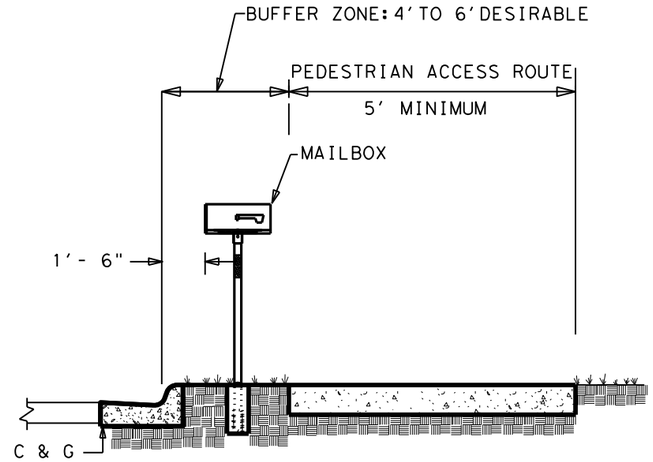
THROUGH HIGHWAY SPEEDS
LESS THAN 55 MPH



MAILBOX PLACEMENT AT RURAL LOCATIONS

THROUGH HIGHWAY SPEEDS
GREATER THAN OR EQUAL TO 55 MPH

CURB AND GUTTER MAILBOX INSTALLATION



NOTES:
1. A NON-TRAVERSABLE SURFACE MUST BE INSTALLED NEAR THE MAILBOX (NATURAL VEGETATION OR OTHER) IN THE BUFFER ZONE. ALTERNATIVELY, A BASE WITH A MINIMUM HEIGHT OF 2.5 INCHES MAY BE INSTALLED SO THAT THE EDGE OF THE MAILBOX DOES NOT EXTEND OUT MORE THAN 4 INCHES HORIZONTALLY BEYOND THE BASE.

2. THE SIDEWALK WIDTH MAY BE REDUCED TO 4 FOOT FOR SHORT DISTANCES AROUND THE MAILBOX IF NEEDED.

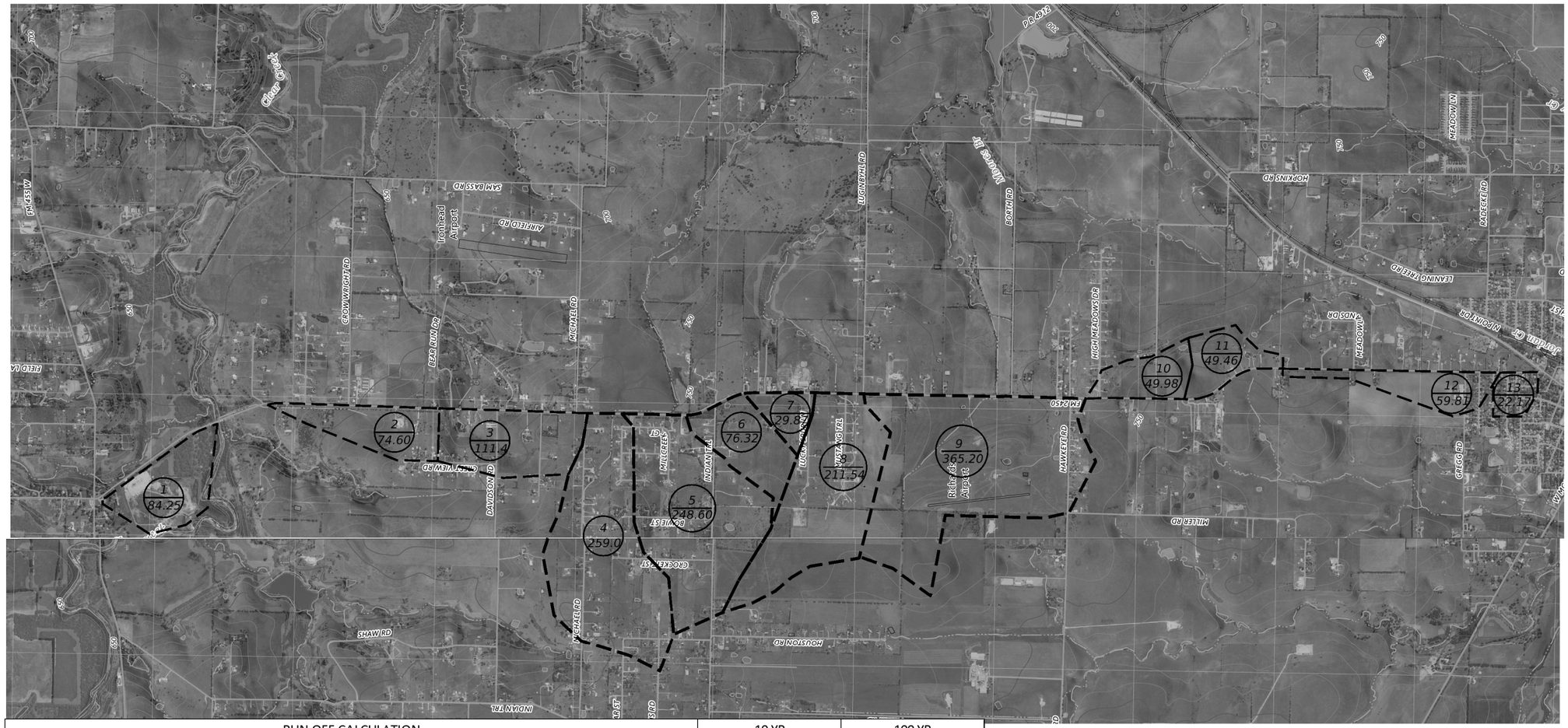
3. MAINTAIN A MINIMUM OF 5 FEET BETWEEN OBSTRUCTIONS IN THE PEDESTRIAN ACCESS ROUTE.

Texas Department of Transportation | Maintenance Division Standard

MAILBOX PLACEMENT CURBS & INTERSECTIONS

MBP(2)-22

FILE: MBP-22.DGN	DN: VS	CK:	DW: VS	CK:
© TxDOT OCTOBER 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS 12/2012 5/2014	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		100



RUN OFF CALCULATION								10 YR		100 YR	
CULVERT	DA	STA	METHOD	AREA (Acres)	CURVE NO	C	TC	I	Q	I	Q
1	1	22+60.00 R1	NRCS	84.3	N/A	0.45	30	3.97	150.49	5.99	227.02
2	2	45+27.00 R1	NRCS	74.6	N/A	0.66	46	3.04	149.7	4.60	226.48
3	3	91+28.64 R1	NRCS	111.4	N/A	0.57	33	3.75	237.96	5.66	359.18
**4	4	127+42.60 R1	**	259	75	N/A	N/A	N/A	311	N/A	565.00
**5	5	140+45.00 R1	**	248.6	86	N/A	N/A	N/A	426	N/A	681.00
6	6	148+50.00 R1	NRCS	76.32	N/A	0.42	32	3.82	122.39	5.76	184.70
7	7	163+87.00 R1	NRCS	29.87	N/A	0.31	27	4.22	39.11	6.37	58.97
**8	8	180+10.00 R1	**	211.54	79	N/A	N/A	N/A	288	N/A	497.00
**9	9	31+75.00 R2	**	365.2	80	N/A	N/A	N/A	488	N/A	839.00
10	10	72+13.00 R2	NRCS	49.98	N/A	0.54	31	3.89	105.05	5.87	158.49
11	11	82+16.85 R2	NRCS	49.46	N/A	0.52	30	3.97	102.09	5.99	154.00
12	12	147+46.00 R2	NRCS	59.81	N/A	0.52	40	3.33	107.40	5.03	162.31
13	13	155+27.00 R2	NRCS	22.17	N/A	0.52	30	3.97	47.52	5.99	71.69

** SEE NOTE FOR CALCULATION DETAILS

NOTES:

1. RUNOFF COMPUTATIONS PERFORMED AND VERIFIED BY HEC-HMS 4.2 AND OMEGA EM REGRESSION EQUATION ANALYSIS.

2. SOURCE OF TOPOGRAPHY DATA : USGS

3. RAINFALL DEPTHS WERE OBTAINED FROM THE USGS REPORT 2004-5041 ATLAS OF DEPTH-DURATION FREQUENCY OF PRECIPITATION ANNUAL MAXIMA FOR TEXAS.

4. RUNOFF VOLUME WAS COMPUTED USING THE SCS CURVE NUMBER LOSS MODEL WITH CLIMATIC ADJUSTMENT.

5. THE SCS UNIT HYDROGRAPH METHOD WAS USED TO DEVELOP DISCHARGE HYRDROGRAPH.

6. THE TIME OF CONCENTRATON (TC) WAS COMPUTED USING THE KERBY-KERPICH METHOD. LAG TIME = 0.7 = TC

STATE OF TEXAS
GAURAB ADHIKARI
140607
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Gaurab Adhikari 2/22/2024
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STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
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Texas Department of Transportation

FM 2450

DRAINAGE AREA MAP

N.T.S SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		101

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

DW: | CK: | DW: | CK:

CULVERT HYDRAULIC DATA

STATION	Culvert #	ROADWAY	DESCRIPTION		DRAINAGE AREA ID	Watershed Area	ALLOWABLE HEADWATER (FT)	10 YEAR (DESIGN)							100 YEAR (CHECK)							COMMENTS
								FLOW "Q" (CFS)	HW ELEV (FT)	HW DEPTH (FT)	TW ELEV (FT)	TW DEPTH (FT)	OUTLET VEL (FT/S)	TW VEL (FT/S)	FLOW "Q" (CFS)	HW ELEV (FT)	HW DEPTH (FT)	TW ELEV (FT)	TW DEPTH (FT)	OUTLET VEL (FT/S)	TW VEL (FT/S)	
22+60 R1	Culvert #1	FM 2450	EXISTING	2 - 48" X 36' RCP	DA-1	84	650.53	148.38	648.66	4.05	646.66	2.59	11.26	3.63	223.83	650.40	5.79	647.23	3.16	12.69	4.05	Straight
			PROPOSED	2 - 48" X 47.47' RCP		84.3		150.49	648.75	4.09	647.11	3.07	11.61	3.71	227.02	650.02	5.87	647.71	3.67	13.06	4.12	Straight
45+27 R1	Culvert #2	FM 2450	EXISTING	1-54"X64.28' RCP	DA-2	72	679.90	148.86	678.07	5.86	673.27	1.58	12.31	10.82	225.21	679.85	8.16	673.61	1.92	13.38	12.06	Straight
			PROPOSED	1-54"X68' RCP		74.6		149.70	678.10	5.89	673.17	1.48	12.33	10.73	226.48	680.39	8.18	673.50	1.81	13.39	11.99	Straight
91+28.64 R1	Culvert #3	FM 2450	EXISTING	3-48"X49.68' RCP	DA-3	97	713.38	234.87	709.10	4.40	706.37	2.02	10.04	11.53	354.30	711.63	6.93	706.79	2.44	11.32	12.48	Straight
			PROPOSED	3-48"X63.33' RCP		111.4		237.96	709.01	4.27	706.29	2.04	10.80	11.57	359.18	710.98	6.24	706.71	2.46	12.23	12.86	Straight
127+42.60 R1	Culvert #4	FM 2450	EXISTING	3-48" X 59.84' RCP	DA-4	205	755.98	290.86	753.77	5.09	751.62	3.17	9.07	4.26	440.92	756.75	8.07	752.35	3.90	11.77	4.77	Straight
			PROPOSED	3-48" X 73' RCP		259		311.00	754.11	5.38	751.68	3.28	9.40	4.34	565.00	758.00	9.27	752.80	4.40	12.91	5.09	Straight
140+45 R1	Culvert #5	FM 2450	EXISTING	3-60" X 57.56' RCP	DA-5	304	754.35	464.06	750.71	5.97	748.33	3.72	9.88	4.77	703.39	753.71	8.97	749.19	4.58	12.44	5.35	Straight
			PROPOSED	3-60" X 76' RCP		248.6		426.00	750.41	5.63	748.14	3.56	9.50	4.66	681.00	753.39	8.61	749.09	4.51	12.18	5.30	Straight
148+58 R1	Culvert #6	FM 2450	EXISTING	2-36" X 65.93' RCP	DA-6	53	754.42	105.19	753.11	3.82	751.29	2.22	8.83	4.45	158.68	755.19	6.06	751.74	2.67	11.65	4.95	Straight
			EXISTING	2-36" X 62.07' RCP		76.32		122.39	754.71	5.63	751.19	2.38	9.65	4.63	184.70	756.38	7.30	751.67	2.86	10.98	5.14	Straight
163+87 R1	Culvert #7	FM 2450	EXISTING	1-30" X 54.56' RCP	DA-7	11	760.21	29.69	758.52	2.88	756.14	0.85	8.11	5.32	44.79	759.99	4.35	756.34	1.05	9.72	5.97	Straight
			EXISTING	1-30" X 54' RCP		29.87		39.11	759.39	3.72	756.10	0.98	9.93	5.75	58.97	761.33	5.66	756.32	1.20	11.42	6.43	Straight
180+10 R1	Culvert #8	FM 2450	EXISTING	3-60" X 38' RCP	DA-8	270	757.41	413.81	755.63	5.33	753.62	3.51	10.54	4.62	626.84	758.11	7.81	754.43	4.32	11.58	5.18	Straight
			PROPOSED	3-60" X 52' RCP		211.54		288.00	754.50	4.18	752.98	3.21	10.03	4.40	497.00	756.51	6.19	753.92	3.85	11.09	4.86	Straight
31+75 R2	Culvert #9	FM 2450	EXISTING	4-60" X 55' RCP	DA-9	354	744.54	647.42	743.36	9.22	737.42	3.96	14.48	5.12	978.47	13.89	748.03	738.36	4.90	16.72	5.75	Straight
			PROPOSED	4-60" X 86.70' RCP		365.2		488.00	740.84	6.37	736.88	3.77	14.44	4.98	839.00	747.18	10.82	737.99	4.53	15.88	5.51	Straight
72+13 R2	Culvert #10	FM 2450	EXISTING	3-30" X 62' RCP	DA-10	47	749.60	108.21	747.21	3.58	744.98	1.47	8.42	8.75	163.23	749.26	5.63	745.30	1.79	11.37	9.75	Straight
			PROPOSED	3-30" X 62' RCP		49.98		105.05	747.33	3.70	744.96	1.45	8.28	8.68	158.49	749.89	6.26	745.27	1.76	11.08	9.67	Straight
82+16.85 R2	Culvert #11	FM 2450	EXISTING	2-36" X 69.50' RCP	DA-11	49	747.00	101.14	744.51	3.69	742.09	1.59	8.65	7.28	152.57	746.55	5.75	742.43	1.93	11.29	8.11	Straight
			PROPOSED	2-36" X 60.11' RCP		49.46		102.09	744.51	4.58	742.13	1.59	8.69	7.30	154.00	746.49	5.83	742.47	1.93	11.37	8.12	Straight
147+46 R2	Culvert #12	FM 2450	EXISTING	1-10'X4'-35.12 ' BOX	DA-12	59	726.30	105.74	723.03	2.89	721.11	1.12	9.79	12.91	159.82	723.83	3.35	721.36	1.37	10.88	14.43	Straight
			PROPOSED	1-10'X4'-54.87' BOX		59.81		107.40	723.17	2.56	720.96	1.12	11.36	13.65	162.31	723.97	3.36	721.22	1.38	11.96	14.49	Straight
155+27 R2	Culvert #13	FM 2450	EXISTING	2-24" X 54.25' RCP	DA-13	22	723.00	47.16	722.29	3.22	719.85	0.97	8.19	7.03	71.14	724.23	5.16	720.07	1.19	11.12	7.87	Straight
			PROPOSED	2-24" X 52.43' RCP		22.17		47.52	722.33	3.26	719.85	0.97	8.23	7.05	71.69	724.24	5.17	720.08	1.20	11.16	7.89	Straight

STATE OF TEXAS
HRAM MANG
141660
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PROFESSIONAL ENGINEER

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2/22/2024

Texas Department of Transportation

FM 2450

HYDRAULIC DATA SHEET

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		102

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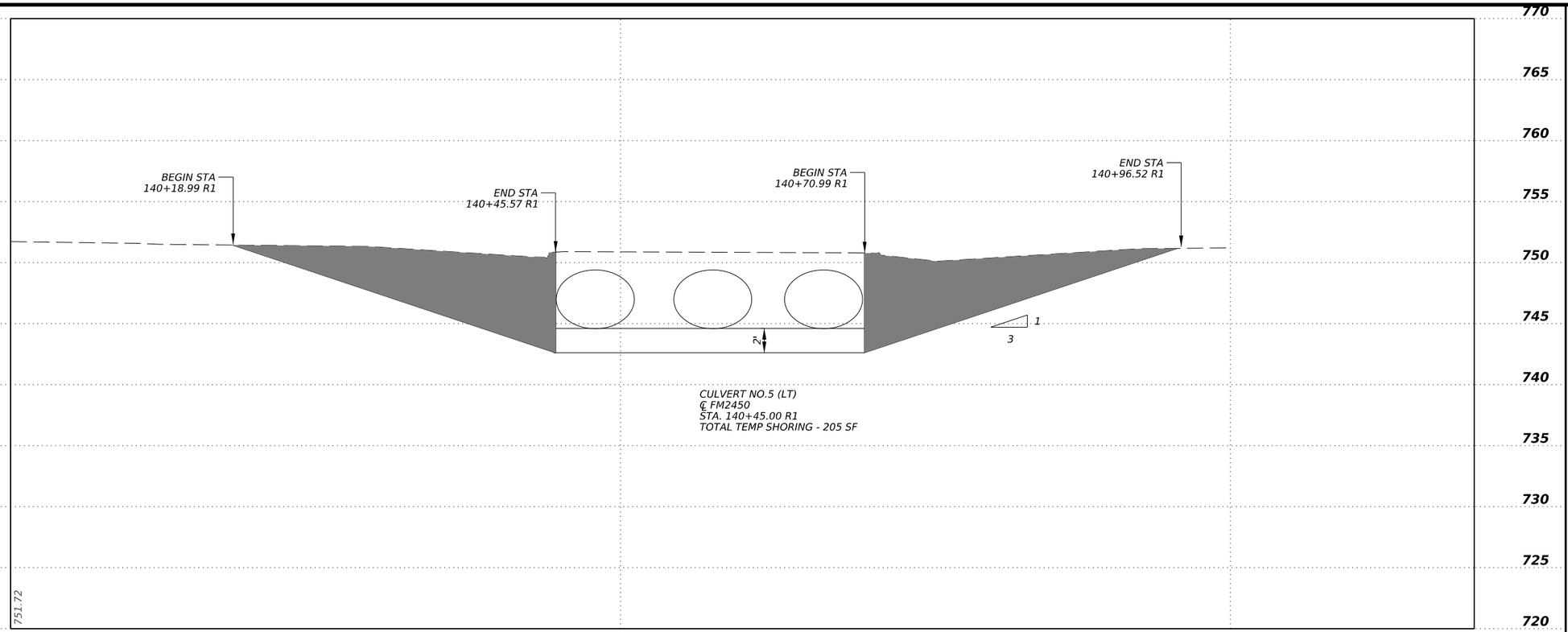
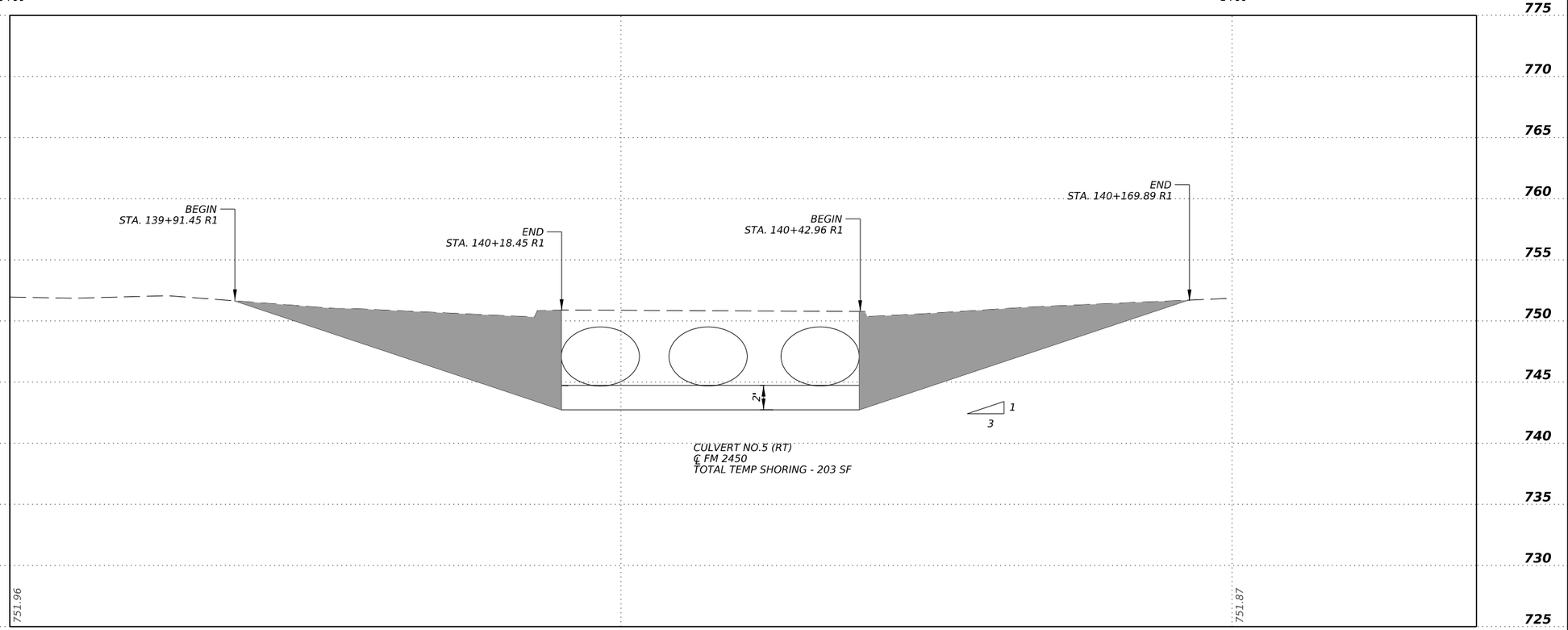


CULVERT NO.5 (LT)
℄ FM2450
STA. 140+45.00 R1
TOTAL TEMP SHORING - 205 SF



CULVERT NO.5 (RT)
℄ FM 2450
TOTAL TEMP SHORING - 203 SF

0 2 4 6 8 10
SCALE IN FEET

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FM 2450

SPECIAL
TEMPORARY SHORING
CULVERT NO.5

2024 SHEET 1 OF 4

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		103

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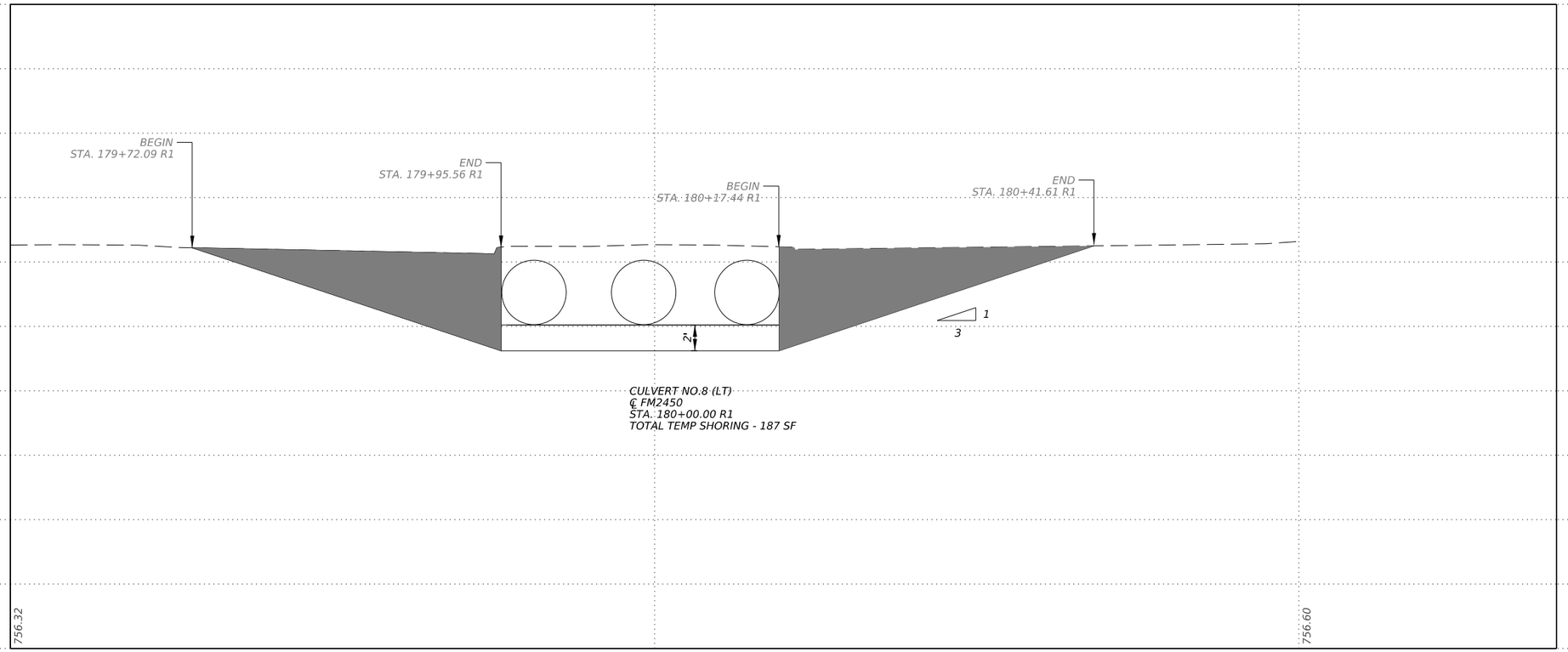
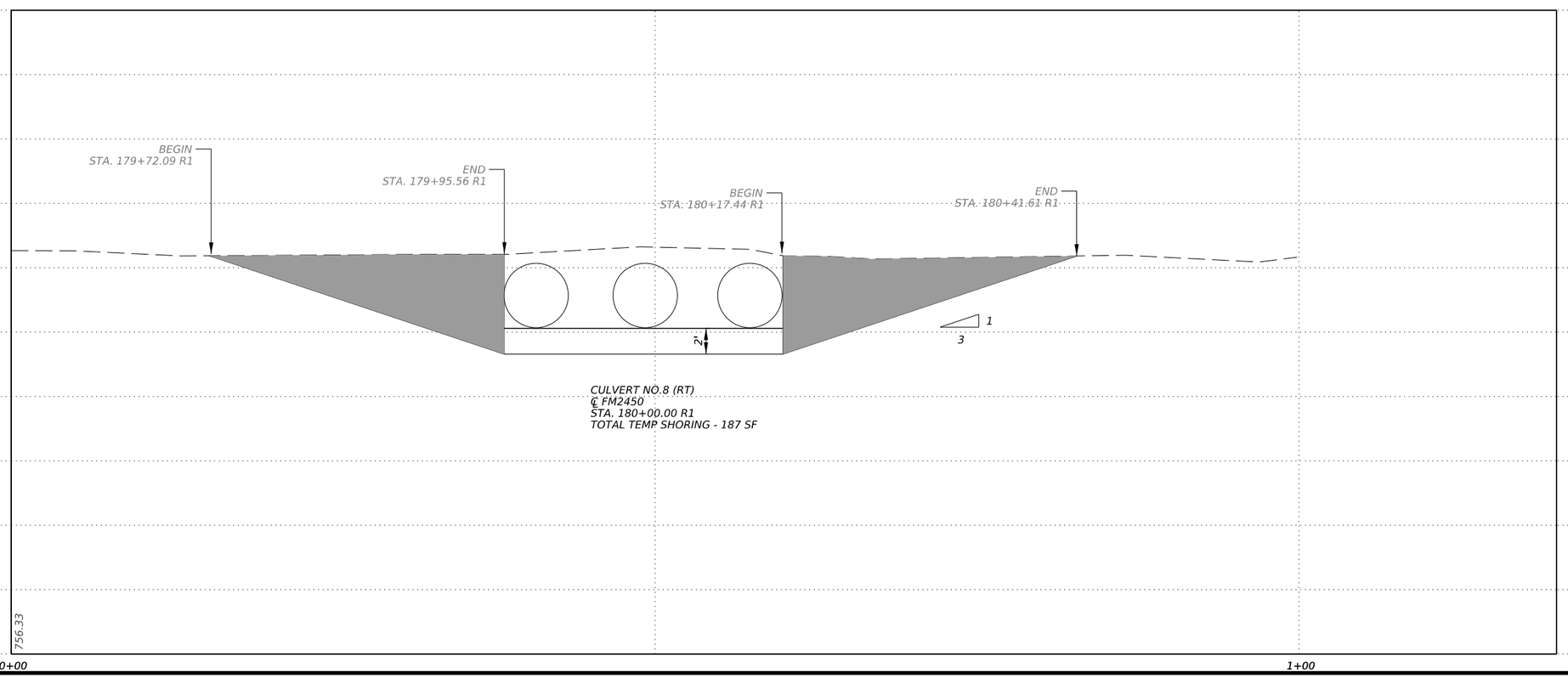


CULVERT NO.8 (LT)
℄ FM2450
STA. 180+00.00 R1
TOTAL TEMP SHORING - 187 SF



CULVERT NO.8 (RT)
℄ FM2450
STA. 180+00.00 R1
TOTAL TEMP SHORING - 187 SF

0 2 4 6 8 10
SCALE IN FEET

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141660
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PROFESSIONAL ENGINEER

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Hram Mang
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2/22/2024

Texas Department of Transportation

FM 2450

SPECIAL
TEMPORARY SHORING
CULVERT NO.8

2024 SHEET 2 OF 4

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		104

DATE: 2/22/2024 1:58:36 PM
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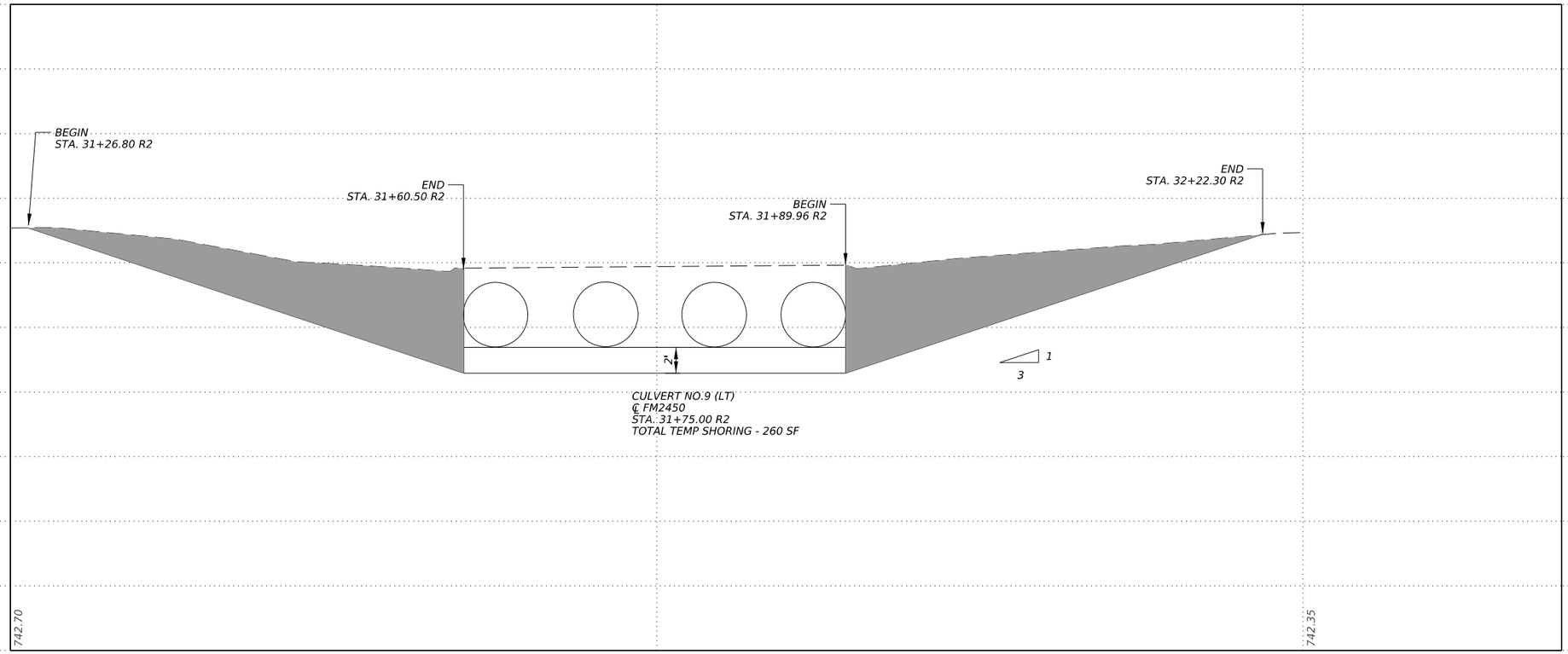

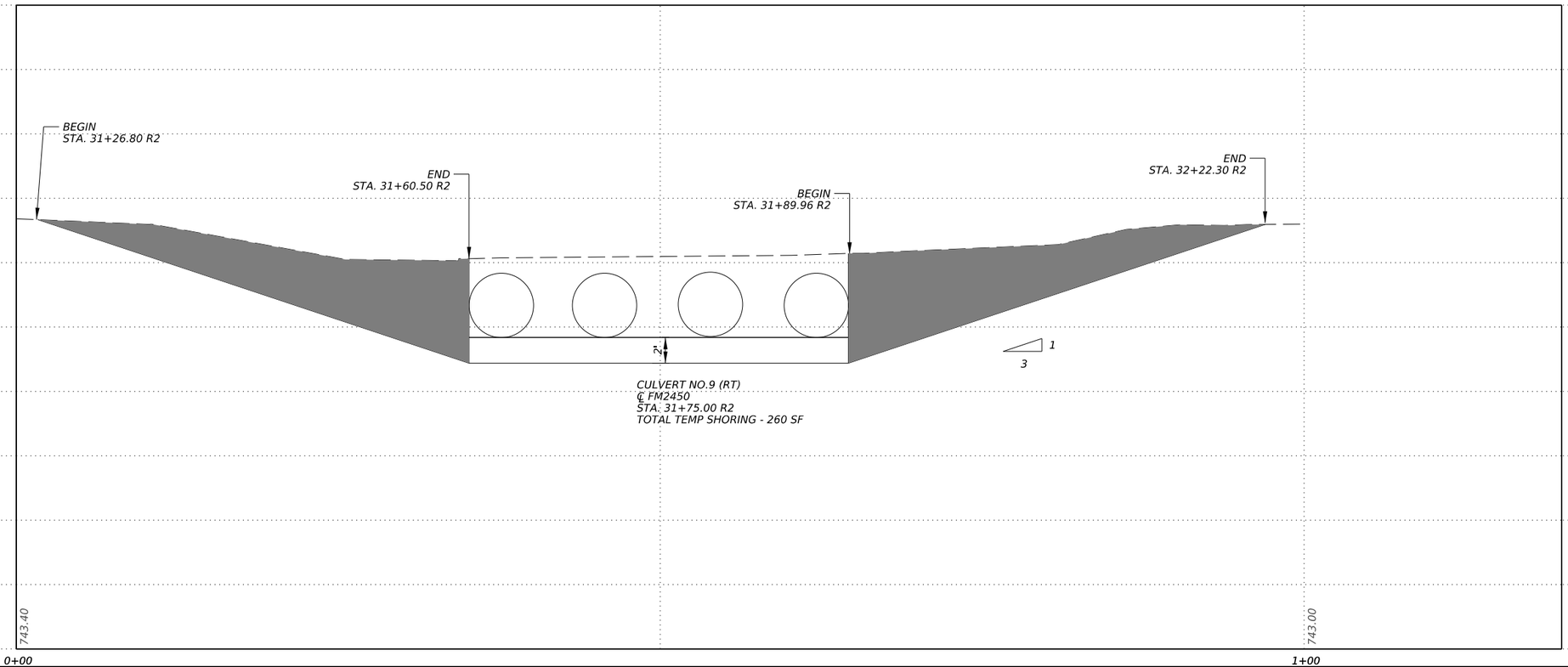

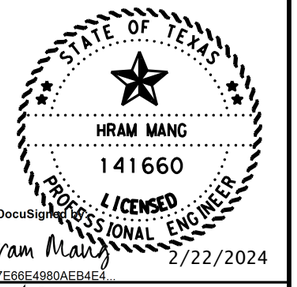

Texas Department of Transportation

FM 2450

SPECIAL TEMPORARY SHORING CULVERT NO.9

2024 SHEET 3 OF 4

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		105

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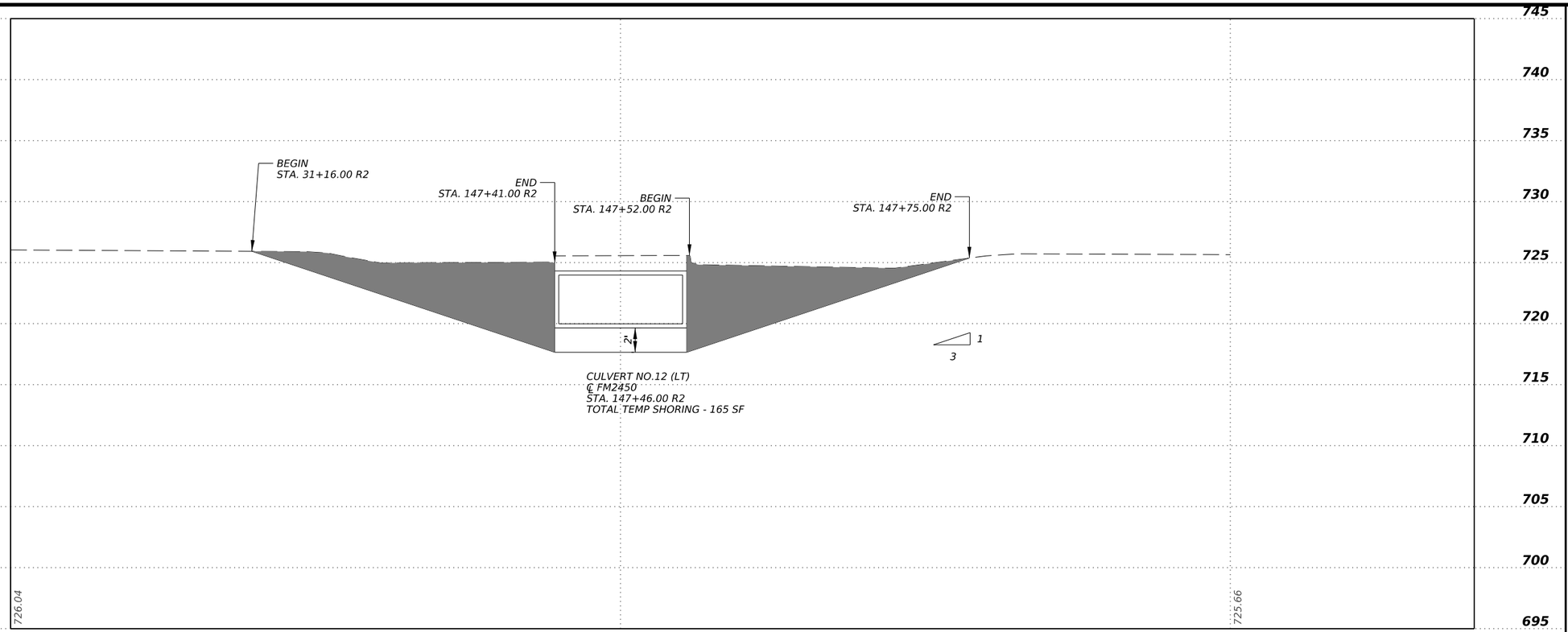

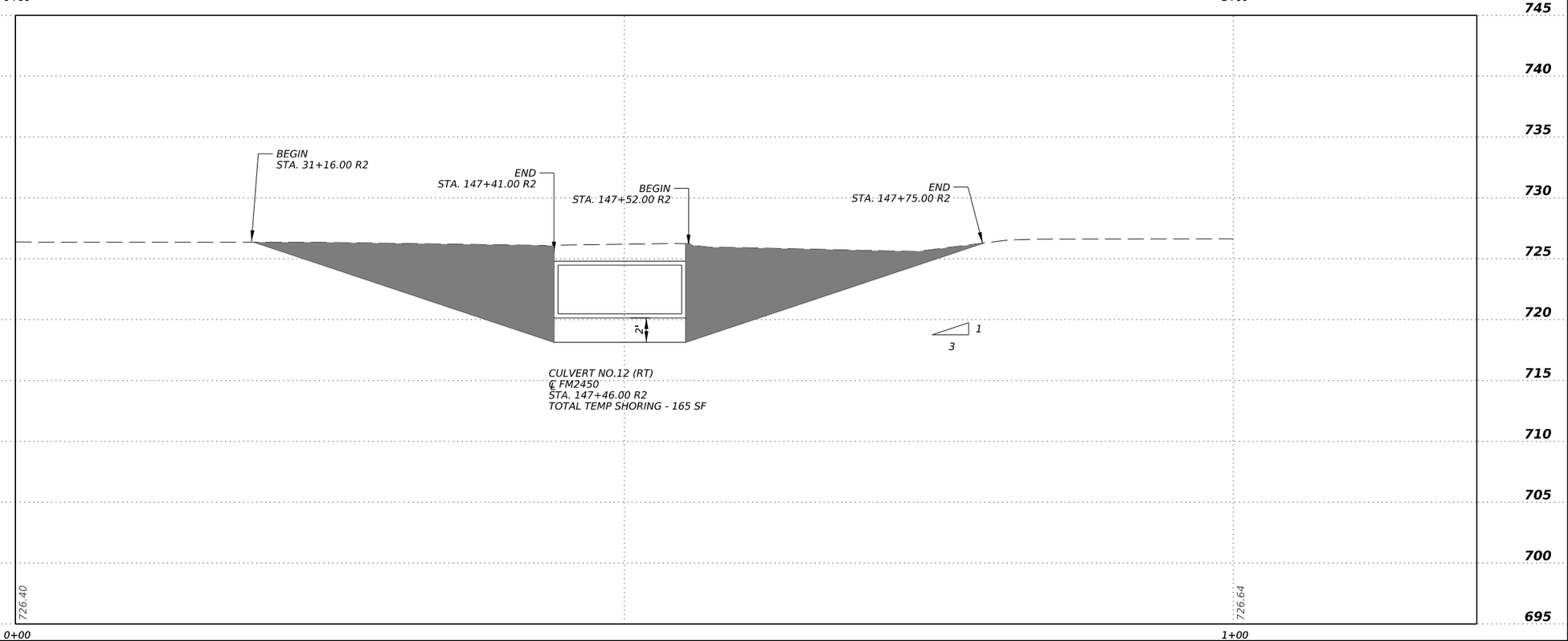

0 2 4 6 8 10
SCALE IN FEET

STATE OF TEXAS
HRAM MANG
141660
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FM 2450

SPECIAL
TEMPORARY SHORING
CULVERT NO.12

2024 SHEET OF

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		106

DATE: 3/12/2024 4:11:05 PM
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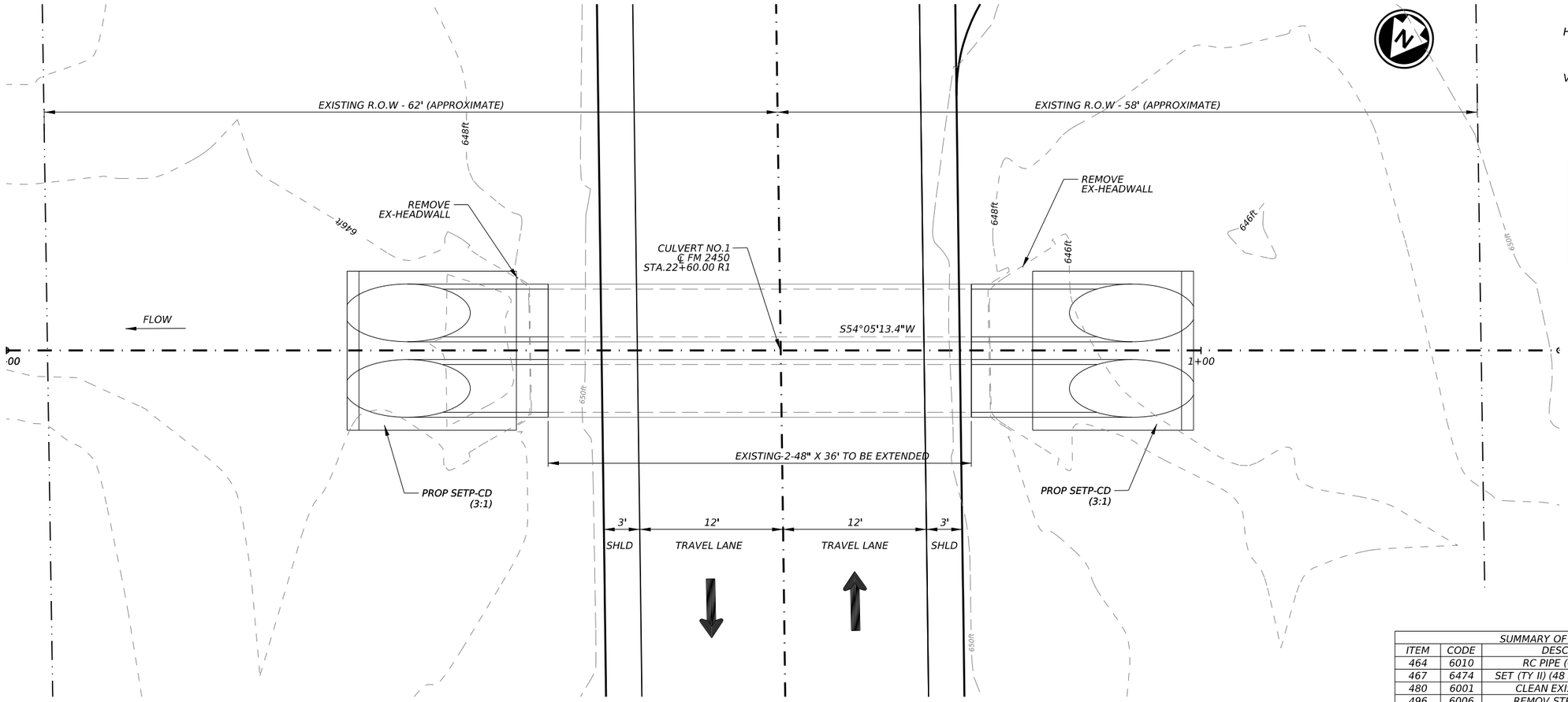
DW: CK: DW: CK:

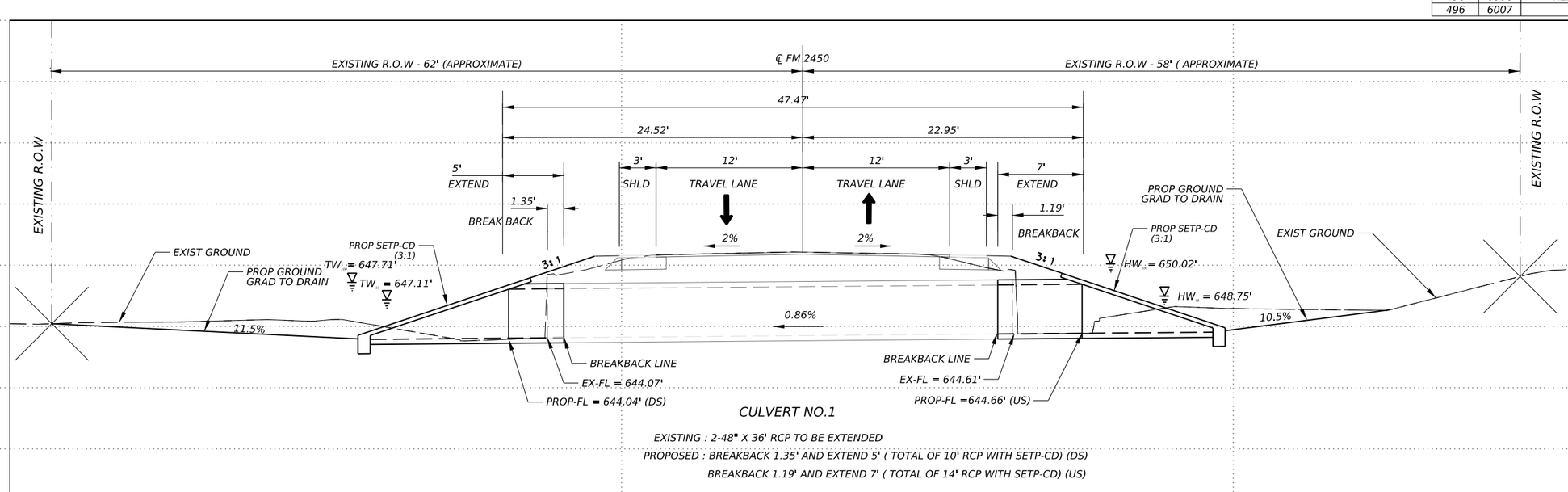
DW: CK: DW: CK:



HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #1	
Drainage Area = 84.3 Acres	
Q_{10} = 150.49 cfs	Q_{100} = 227.02 cfs
HW_{10} = 648.75 ft	HW_{100} = 650.02 ft
TW_{10} = 647.11 ft	TW_{100} = 647.71 ft
V_{10} = 11.61 fps	V_{100} = 13 fps



CULVERT NO.1

EXISTING : 2-48" X 36' RCP TO BE EXTENDED

PROPOSED : BREAKBACK 1.35' AND EXTEND 5' (TOTAL OF 10' RCP WITH SETP-CD) (DS)

BREAKBACK 1.19' AND EXTEND 7' (TOTAL OF 14' RCP WITH SETP-CD) (US)

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
464	6010	RC PIPE (CL III)(48 IN)	LF	24
467	6474	SET (TY II) (48 IN) (RCP) (3:1) (C)	EA	4
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6006	REMOV STR (HEADWALL)	EA	2
496	6007	REMOV STR (PIPE)	LF	6

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141660
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FM 2450

CULVERT NO.1 LAYOUT AT STA. 22+60.00 R1

2024 SHEET 1 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		107

DATE: 4/4/2024 2:19:45 PM
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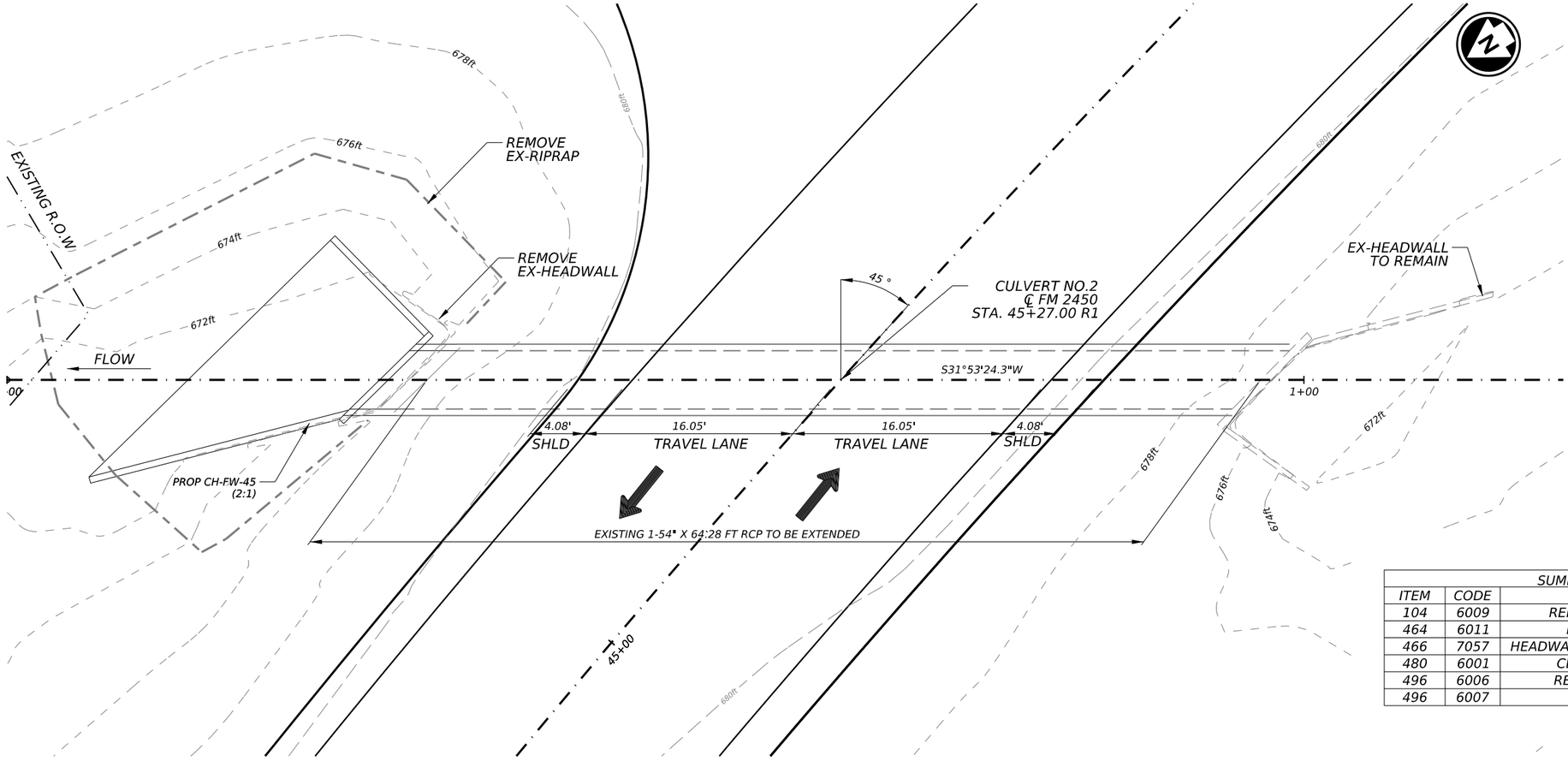

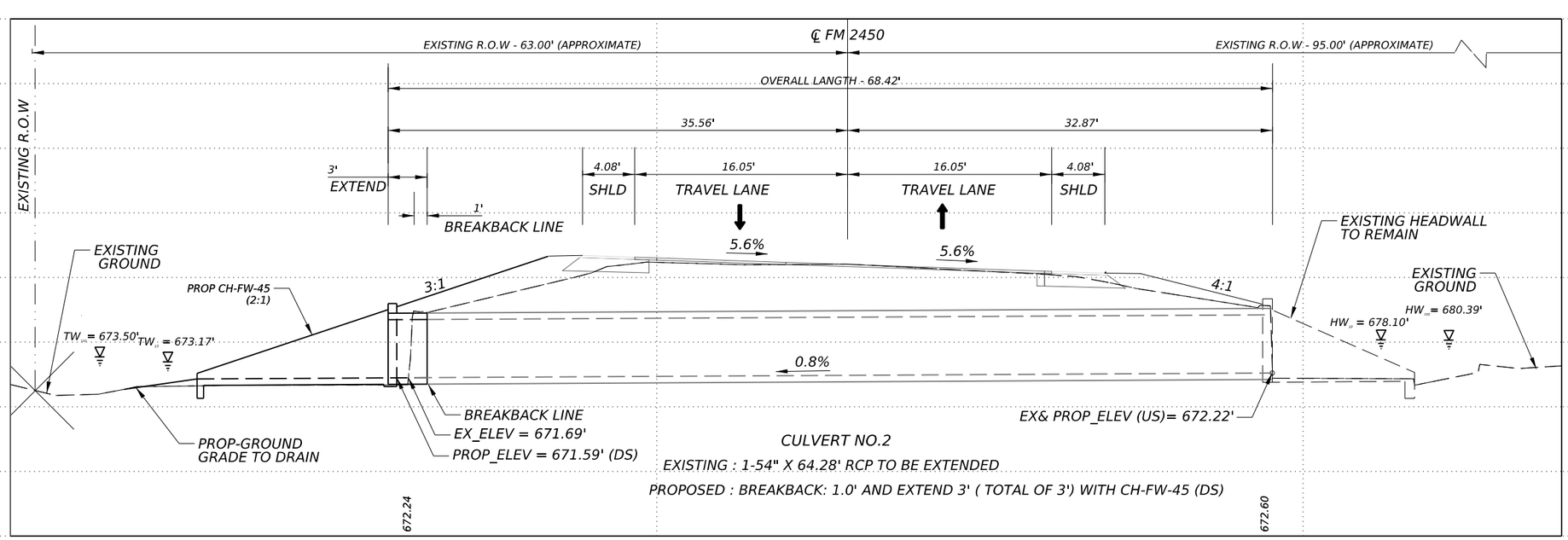

HORIZ SCALE 0 10 20 SCALE IN FEET

VERT SCALE 0 10 20 SCALE IN FEET

HYDRAULIC DATA CULVERT #2	
Drainage Area = 74.60 Acres	
Q_{10} = 149.70 cfs	Q_{100} = 201.76 cfs
HW_{10} = 678.10 ft	HW_{100} = 680.39 ft
TW_{10} = 673.17 ft	TW_{100} = 673.50 ft
V_{10} = 10.73 fps	V_{100} = 11.99 fps

SUMMARY OF ESTIMATED QUANTITES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
104	6009	REMOVING CONC (RIPRAP)	SY	57
464	6011	RC PIPE (CL III)(54 IN)	LF	3
466	7057	HEADWALL (CH - FW - 45) (DIA= 54 IN)	EA	1
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6006	REMOV STR (HEADWALL)	EA	1
496	6007	REMOV STR (PIPE)	LF	1

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 4/4/2024
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Texas Department of Transportation

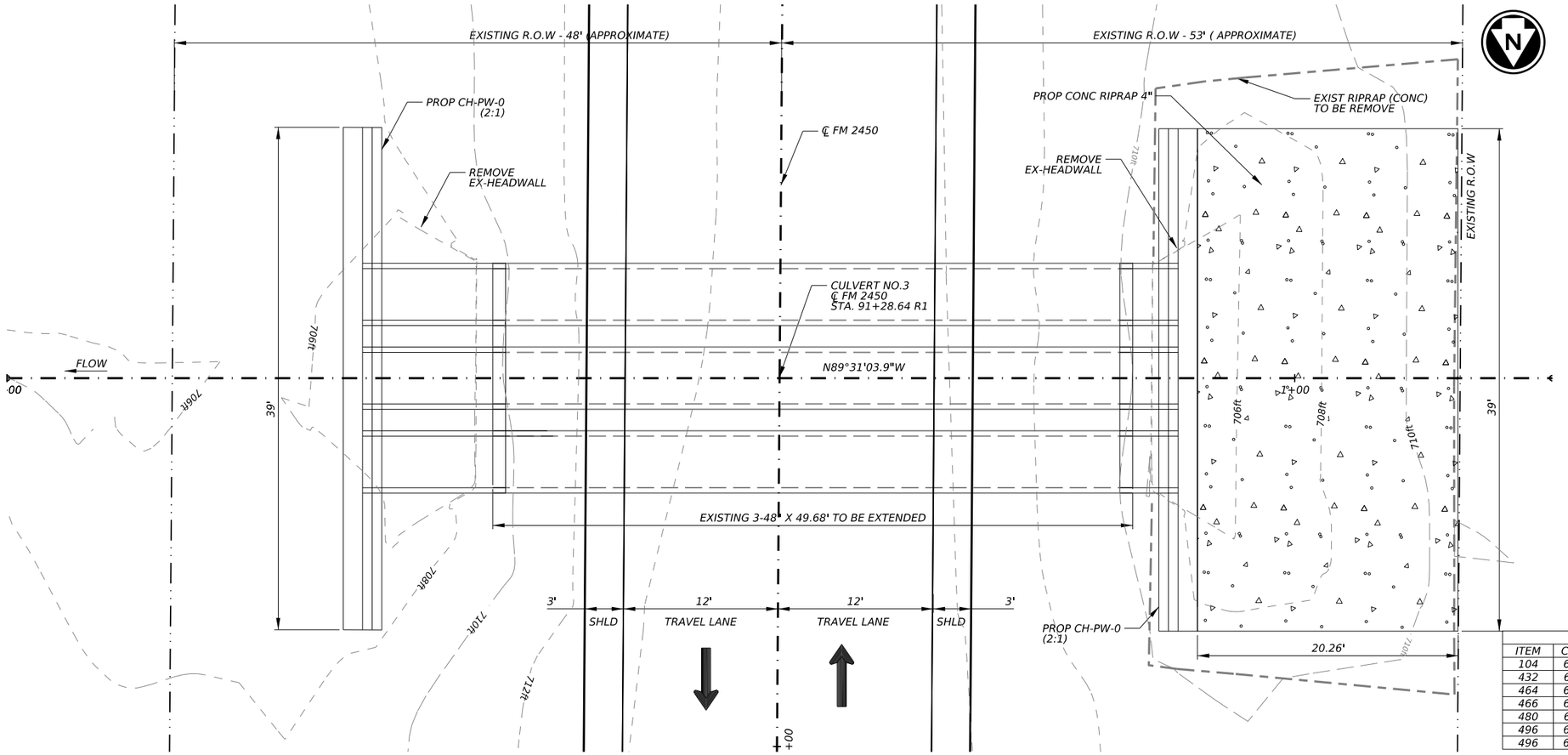
FM 2450

CULVERT NO.2 LAYOUT AT STA. 45+27.00 R1

2024 SHEET 2 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		108

DATE: 4/4/2024 2:19:47 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Drainage/Drainage/Models/FM2450_Drainage_1_2_3_Kareem.dgn



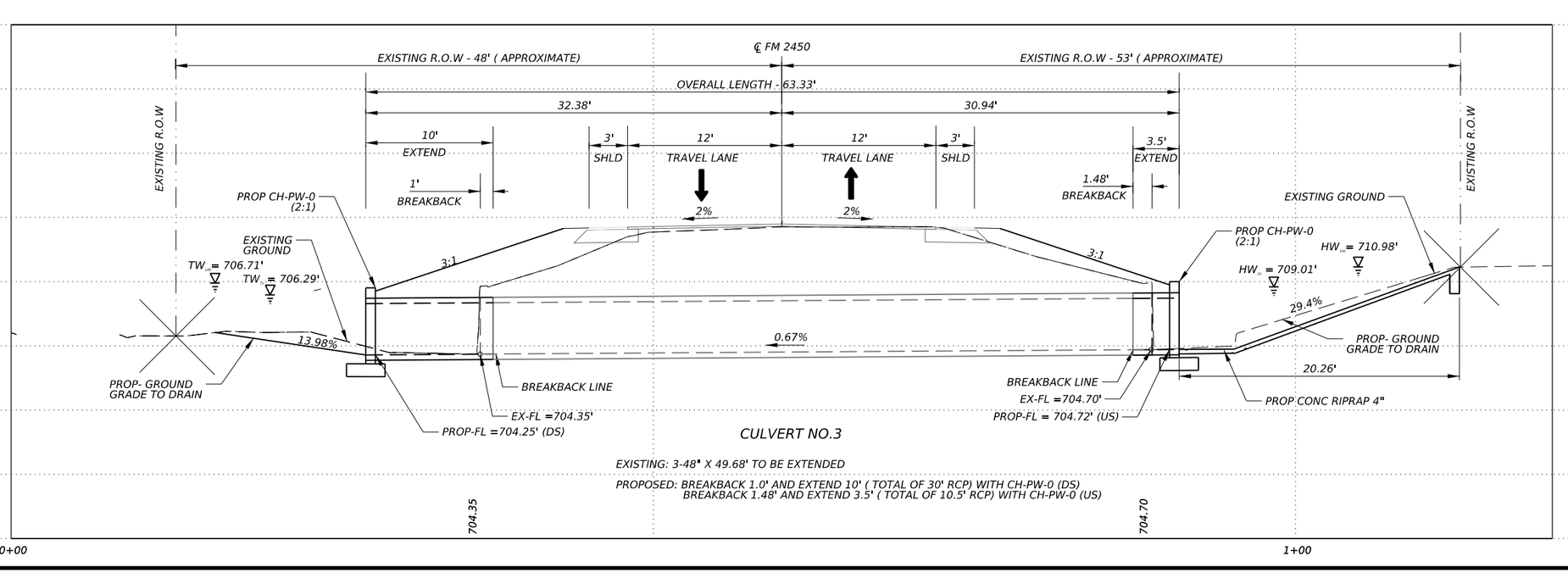
HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #3	
Drainage Area = 111.40 Acres	
Q_{10} = 237.96 cfs	Q_{100} = 359.16 cfs
HW_{10} = 709.01 ft	HW_{100} = 710.98 ft
TW_{10} = 706.29 ft	TW_{100} = 706.71 ft
V_{10} = 10.80 fps	V_{100} = 12.23 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
104	6009	REMOVING CONC (RIPRAP)	SY	108
432	6001	RIPRAP (CONC)(4 IN)	CY	10
464	6010	RC PIPE (CL III)(48 IN)	LF	42
466	6103	HEADWALL (CH - PW - 0) (DIA= 48 IN)	EA	2
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6006	REMOV STR (HEADWALL)	EA	2
496	6007	REMOV STR (PIPE)	LF	9



CULVERT NO.3

EXISTING: 3-48" X 49.68' TO BE EXTENDED

PROPOSED: BREAKBACK 1.0' AND EXTEND 10' (TOTAL OF 30' RCP) WITH CH-PW-0 (DS)
BREAKBACK 1.48' AND EXTEND 3.5' (TOTAL OF 10.5' RCP) WITH CH-PW-0 (US)

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
4/5/2024

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FM 2450

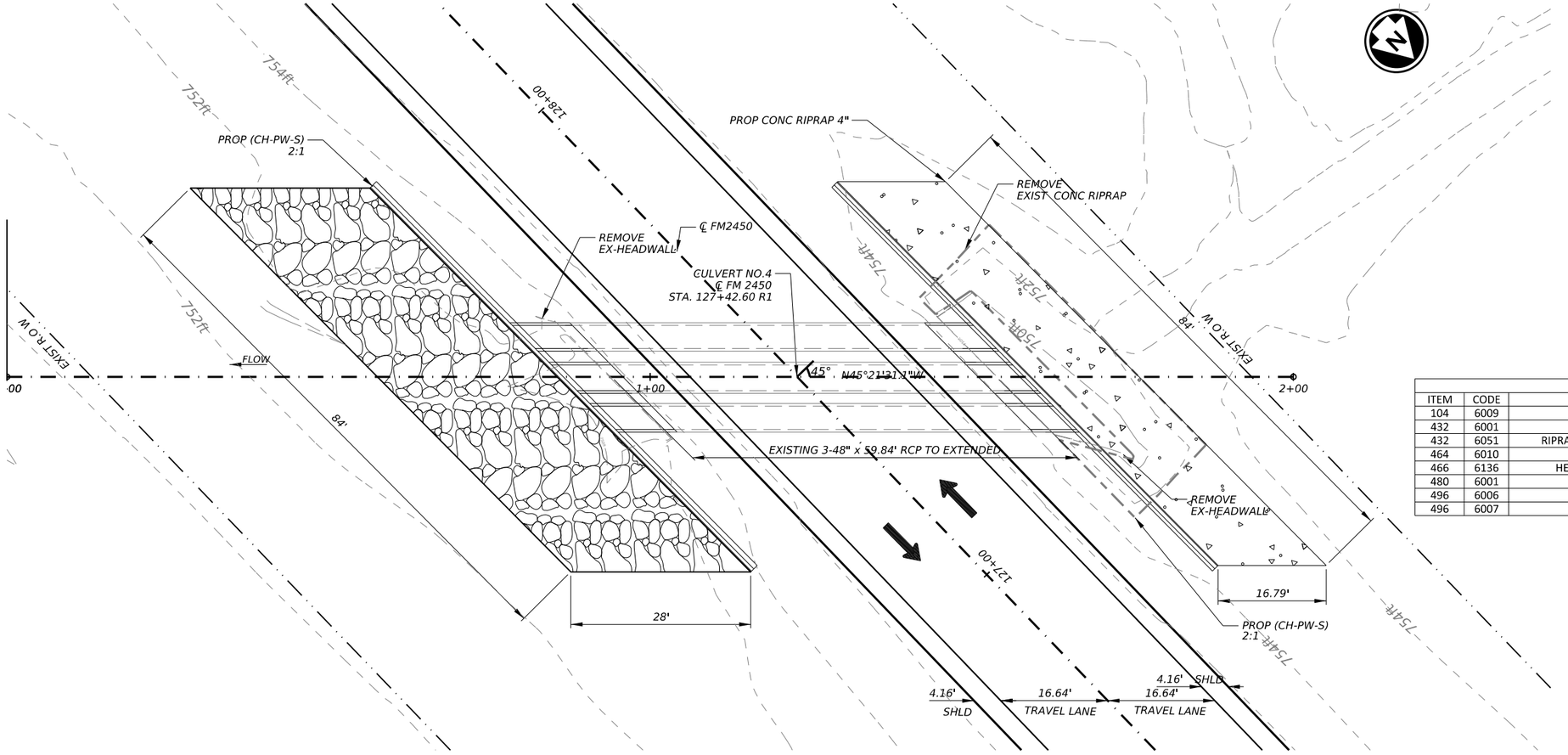
CULVERT NO.3 LAYOUT AT STA. 91+28.64 R1

2024 SHEET 3 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		109

DATE: 4/5/2024 11:57:53 AM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Drainage/Models/FM2450 Drainage 1_2_3 Kareem.dgn

CK: DW: CK: DW:



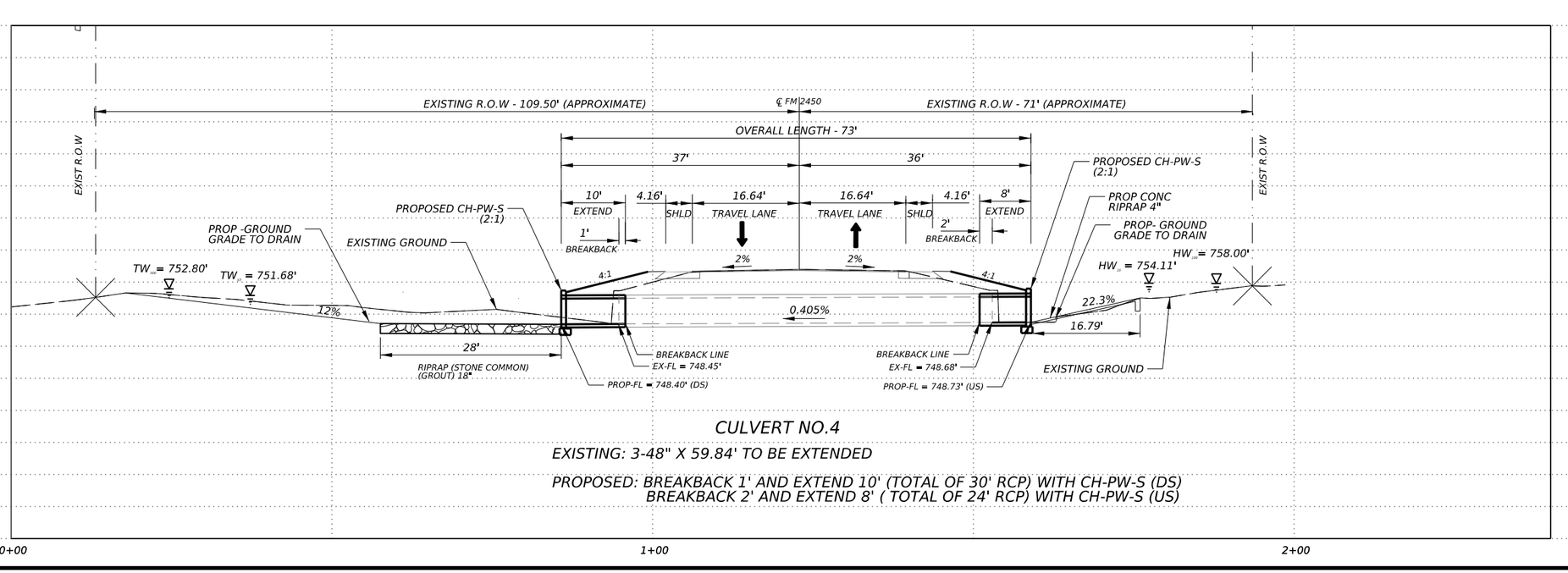
HORIZ SCALE 0 10 20
SCALE IN FEET

VERT SCALE 0 10 20
SCALE IN FEET

HYDRAULIC DATA CULVERT #4	
Drainage Area = 259 Acres	
Q_{10} = 311 cfs	Q_{100} = 565 cfs
HW_{10} = 754.11 ft	HW_{100} = 758 ft
TW_{10} = 751.68 ft	TW_{100} = 752.80 ft
V_{10} = 4.34 fps	V_{100} = 5.09 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
104	6009	REMOVING CONC (RIPRAP)	SY	61
432	6001	RIPRAP (CONC)(4 IN)	CY	17
432	6051	RIPRAP (STONE COMMON)(GROUT)(18 IN)	CY	131
464	6010	RC PIPE (CL III)(48 IN)	LF	54
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
496	6007	REMOV STR (PIPE)	LF	9



CULVERT NO.4

EXISTING: 3-48" X 59.84' TO BE EXTENDED

PROPOSED: BREAKBACK 1' AND EXTEND 10' (TOTAL OF 30' RCP) WITH CH-PW-S (DS)
BREAKBACK 2' AND EXTEND 8' (TOTAL OF 24' RCP) WITH CH-PW-S (US)

STATE OF TEXAS
GAURAB ADHIKARI, P.E
140607
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Gaurab Adhikari 4/5/2024
7200AF00B33740A...

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang 4/4/2024
7E66E4980AEB4E4...

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FM 2450

CULVERT NO.4 LAYOUT
AT
STA. 127+42.60 R1

2024 SHEET 4 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		110

DATE: 4/4/2024 2:20:11 PM
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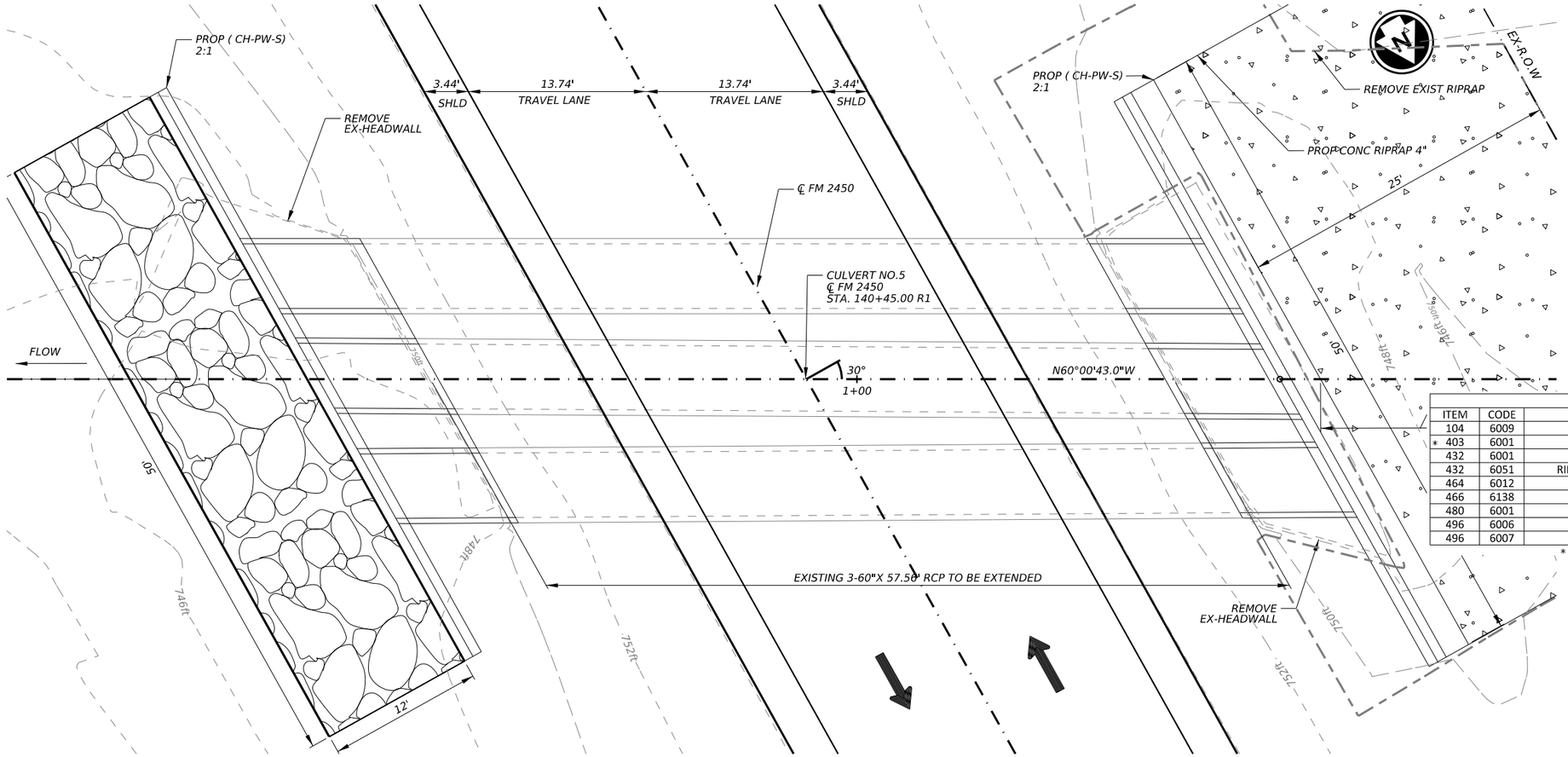


HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

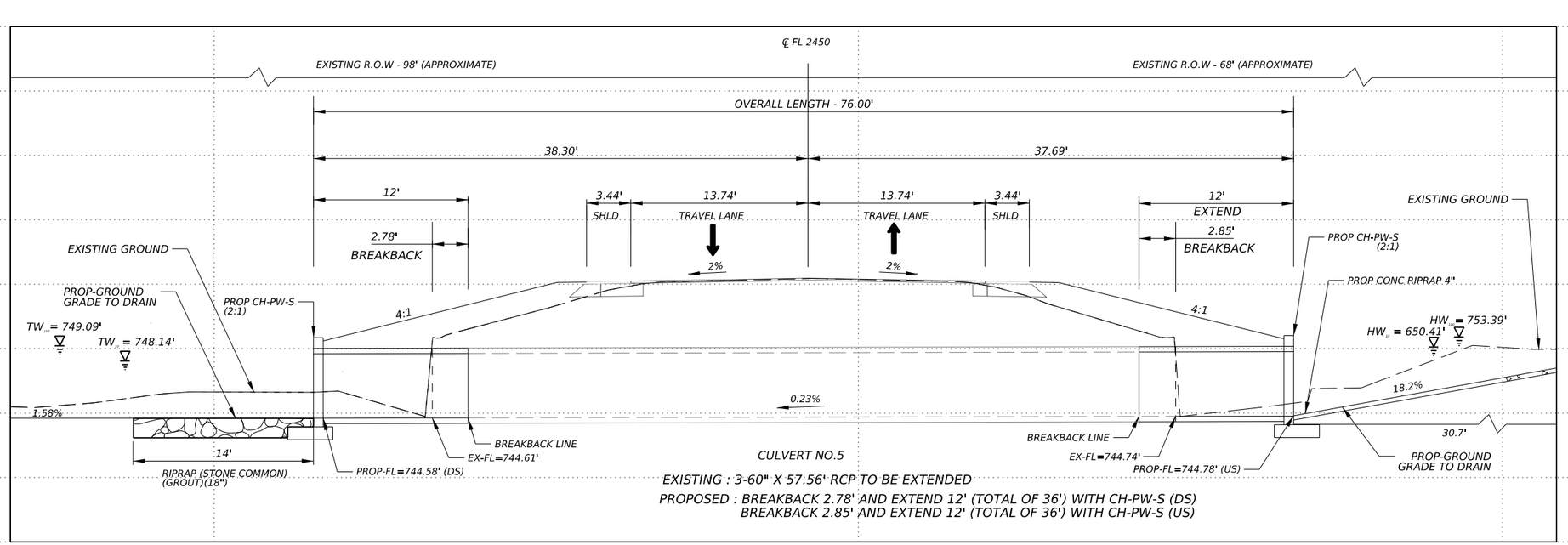
VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #5	
Drainage Area = 248.60 Acres	
Q_{10} = 426 cfs	Q_{100} = 681 cfs
HW_{10} = 750.41 ft	HW_{100} = 753.39 ft
TW_{10} = 748.14 ft	TW_{100} = 749.09 ft
V_{10} = 9.56 fps	V_{100} = 12.18 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
104	6009	REMOVING CONC (RIPRAP)	SY	145
* 403	6001	TEMPORARY SPL SHORING	SF	408
432	6001	RIPRAP (CONC)(4 IN)	CY	16
432	6051	RIPRAP (STONE COMMON)(GROUT)(18 IN)	CY	34
464	6012	RC PIPE (CL III)(60 IN)	LF	72
466	6138	HEADWALL (CH - PW - S) (DIA= 60 IN)	EA	2
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6006	REMOV STR (HEADWALL)	EA	2
496	6007	REMOV STR (PIPE)	LF	18

* SEE SHORING SHEET FOR DETAILS.



CULVERT NO.5

EXISTING : 3-60" X 57.56' RCP TO BE EXTENDED

PROPOSED : BREAKBACK 2.78' AND EXTEND 12' (TOTAL OF 36') WITH CH-PW-S (DS)
BREAKBACK 2.85' AND EXTEND 12' (TOTAL OF 36') WITH CH-PW-S (US)

STATE OF TEXAS
GAURAB ADHIKARI, P.E
140607
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Gaurab Adhikari 4/4/2024
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STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Hram Mang 4/4/2024
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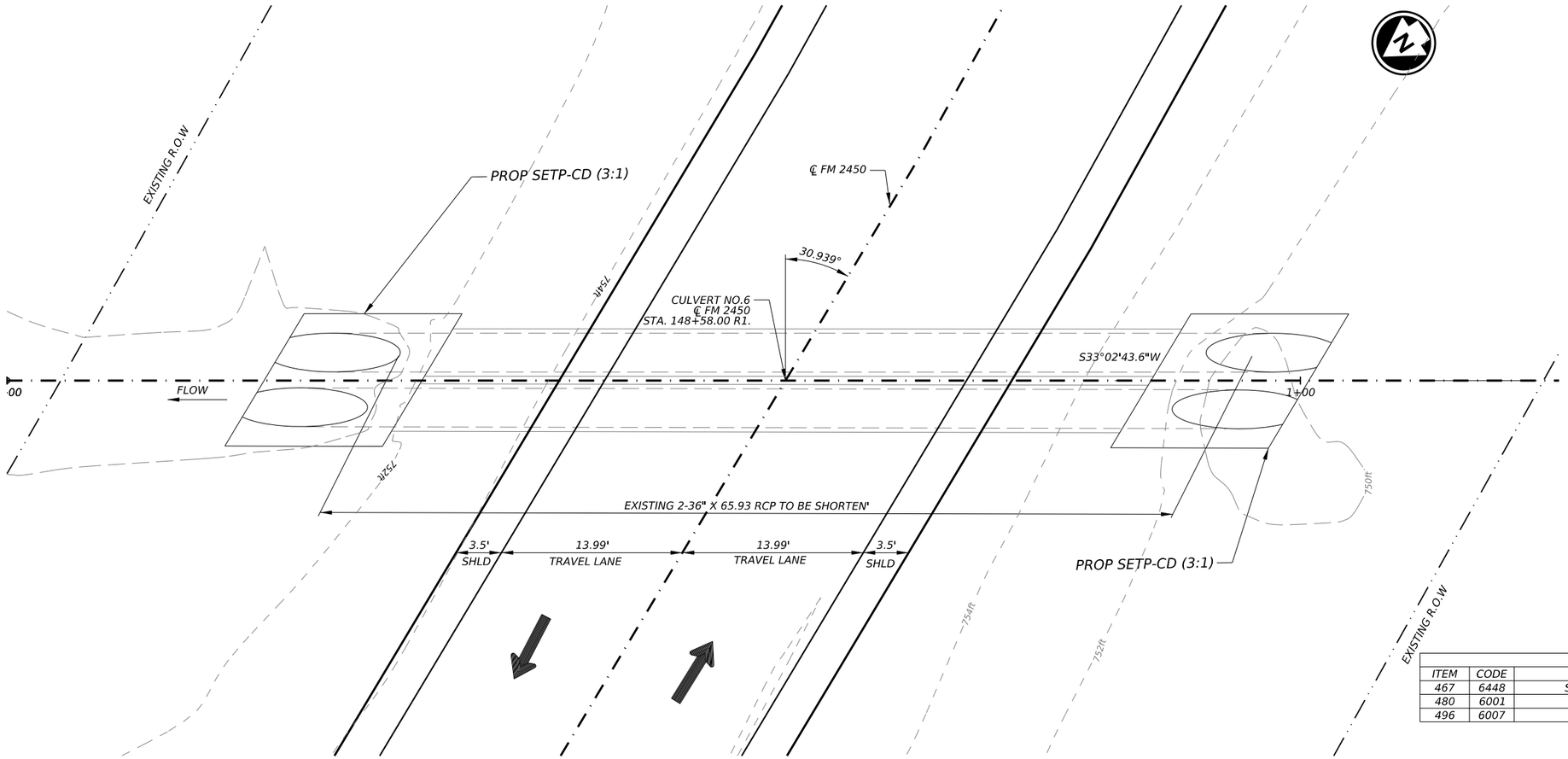
FM 2450

CULVERT NO.5 LAYOUT
AT
STA.140+45.00 R1

2024 SHEET 5 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		111

DATE: 4/4/2024 2:20:13 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/3D Corridor Modeling/Geometry/FM2450_Drainage.dgn



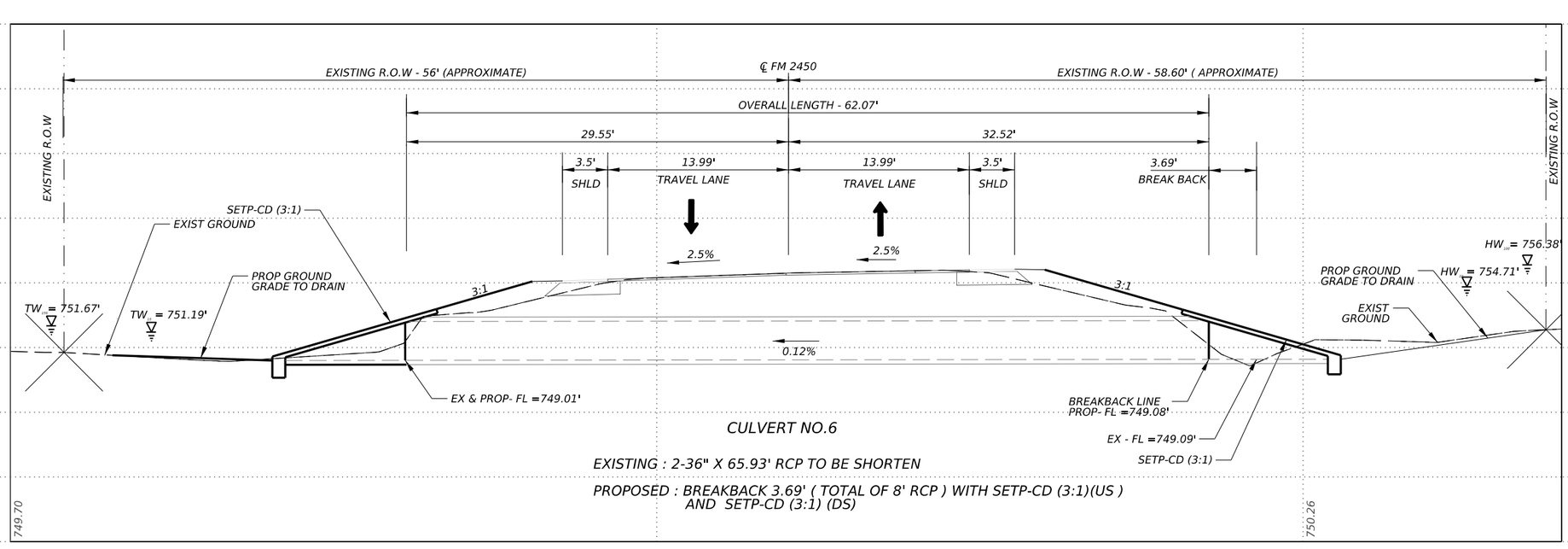
HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #6	
Drainage Area = 76.32 Acres	
Q_{10} =122.39 cfs	Q_{100} = 184.70 cfs
HW_{10} =754.71 ft	HW_{100} = 756.38ft
TW_{10} = 751.19 ft	TW_{100} = 751.67 ft
V_{10} = 9.65 fps	V_{100} = 10.98 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
467	6448	SET (TY II) (36 IN) (RCP) (3: 1) (C)	EA	2
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6007	REMOV STR (PIPE)	LF	8



CULVERT NO.6

EXISTING : 2-36" X 65.93' RCP TO BE SHORTEN

PROPOSED : BREAKBACK 3.69' (TOTAL OF 8' RCP) WITH SETP-CD (3:1)(US) AND SETP-CD (3:1) (DS)

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HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

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Hram Mang 4/4/2024
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FM 2450

CULVERT NO.6 LAYOUT AT STA. 148+58.00 R1

2024 SHEET 6 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		112

DATE: 4/4/2024 2:20:36 PM
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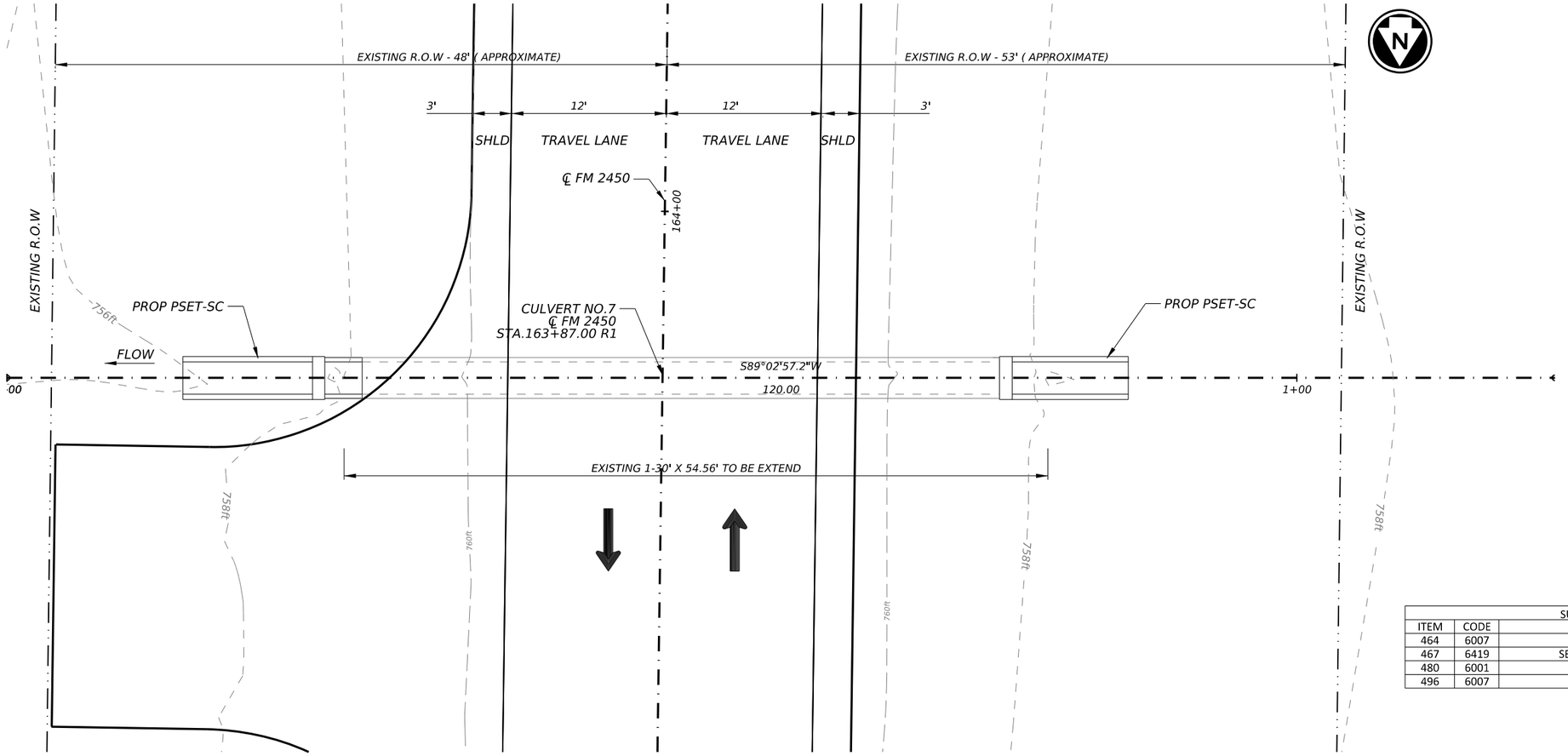


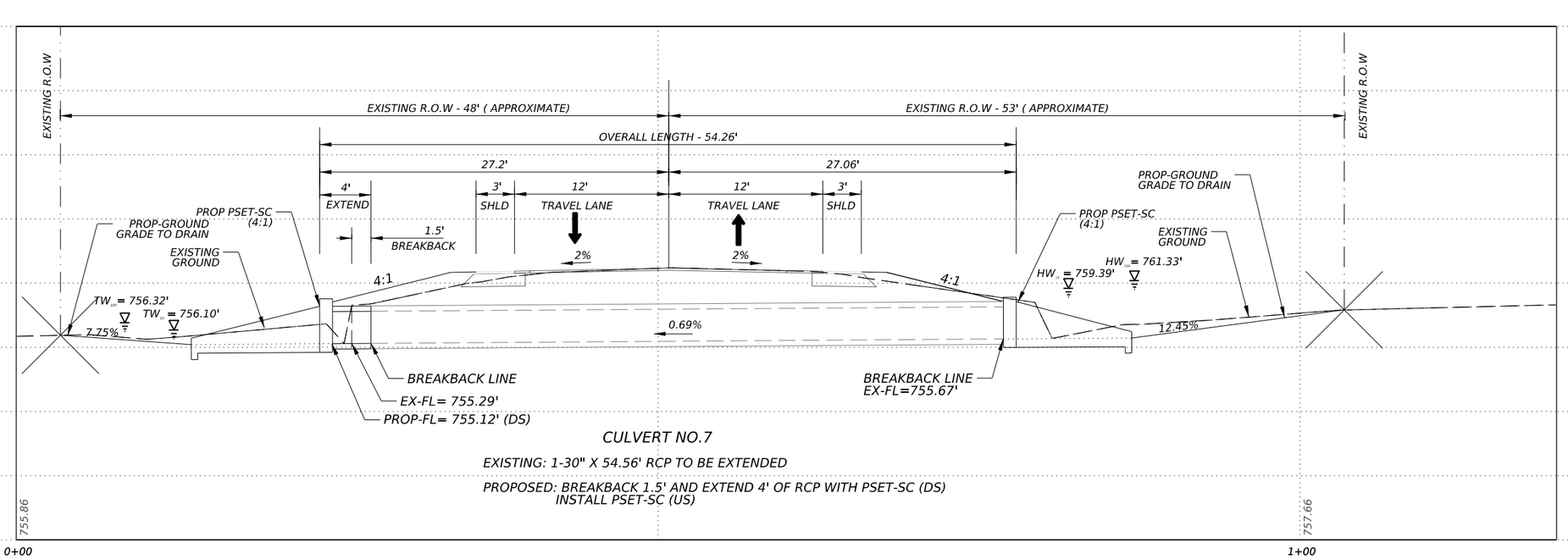
HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #7	
Drainage Area = 29.87 Acres	
Q_{10} = 39.11 cfs	Q_{100} = 58.97 cfs
HW_{10} = 759.39 ft	HW_{100} = 761.33 ft
TW_{10} = 756.10 ft	TW_{100} = 756.32 ft
V_{10} = 9.93 fps	V_{100} = 11.42 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
464	6007	RC PIPE (CL III)(30 IN)	LF	4
467	6419	SET (TY II) (30 IN) (RCP) (4:1) (C)	EA	2
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6007	REMOV STR (PIPE)	LF	2



CULVERT NO.7

EXISTING: 1-30" X 54.56' RCP TO BE EXTENDED

PROPOSED: BREAKBACK 1.5' AND EXTEND 4' OF RCP WITH PSET-SC (DS)
INSTALL PSET-SC (US)

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HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER
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Hram Mang 4/4/2024
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FM 2450

CULVERT NO.7 LAYOUT AT STA. 163+87.00 R1

2024 SHEET 7 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		113

DATE: 4/4/2024 2:21:00 PM
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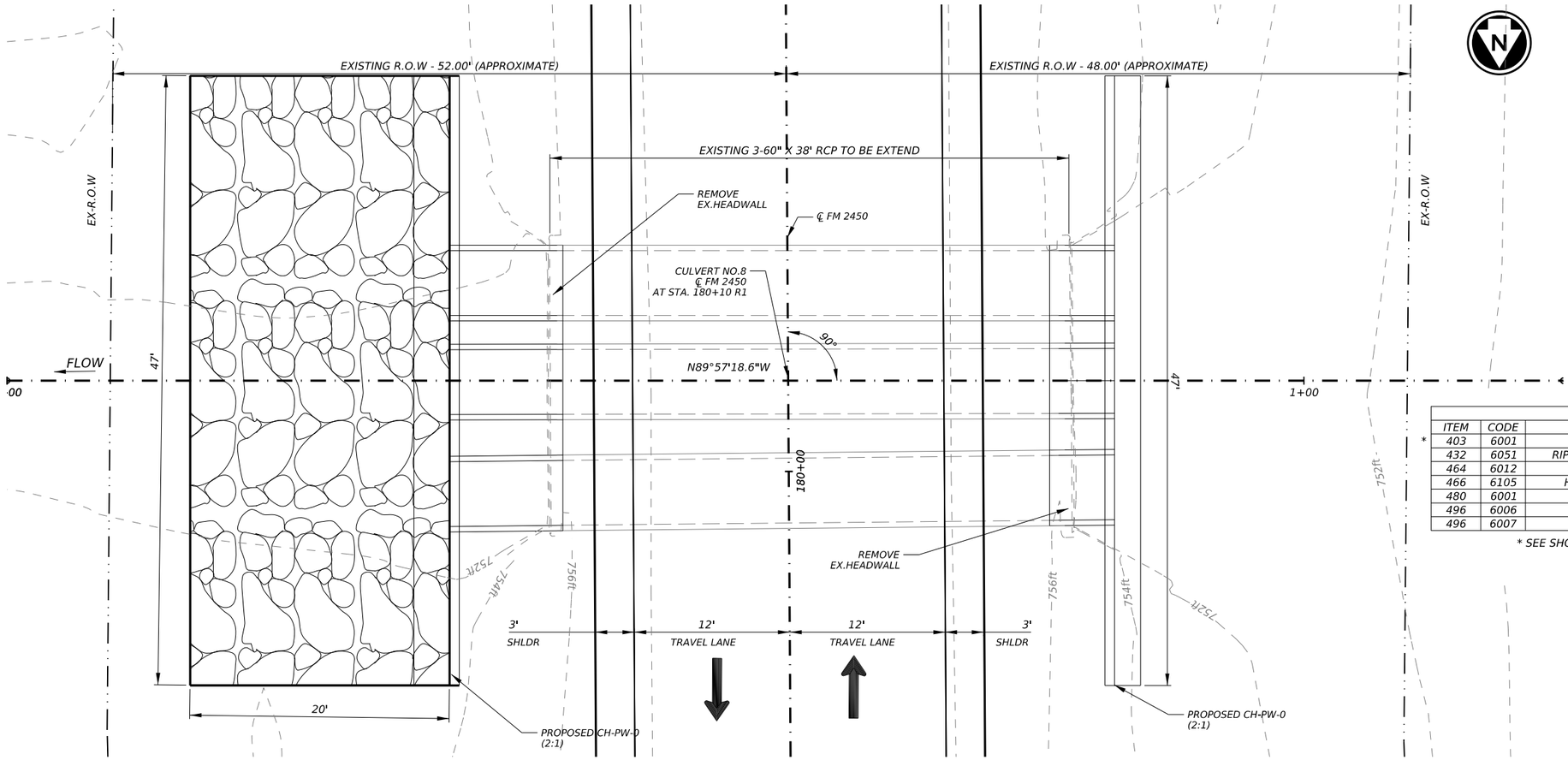


HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

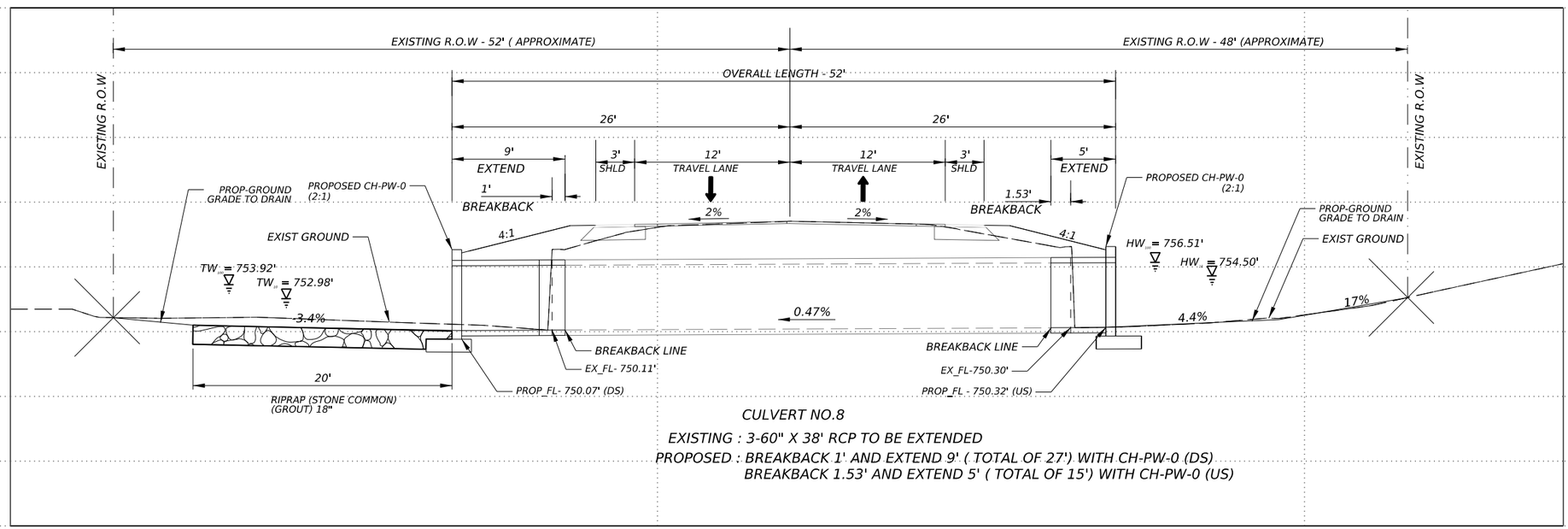
VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #8	
Drainage Area = 211.54 Acres	
Q_{10} = 288 cfs	Q_{100} = 497 cfs
HW_{10} = 754.50 ft	HW_{100} = 756.51 ft
TW_{10} = 752.98 ft	TW_{100} = 753.92 ft
V_{10} = 9.51 fps	V_{100} = 11.09 fps

SUMMARY OF ESTIMATED QUANTITIES

	ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
*	403	6001	TEMPORARY SPL SHORING	SF	374
	432	6051	RIPRAP (STONE COMMON)(GROUT)(18 IN)	CY	53
	464	6012	RC PIPE (CL III)(60 IN)	LF	42
	466	6105	HEADWALL (CH - PW - 0) (DIA= 60 IN)	EA	2
	480	6001	CLEAN EXIST CULVERTS	EA	1
	496	6006	REMOV STR (HEADWALL)	EA	2
	496	6007	REMOV STR (PIPE)	LF	9

* SEE SHORING SHEET FOR DETAILS.



CULVERT NO.8

EXISTING : 3-60" X 38' RCP TO BE EXTENDED

PROPOSED : BREAKBACK 1' AND EXTEND 9' (TOTAL OF 27') WITH CH-PW-0 (DS)
BREAKBACK 1.53' AND EXTEND 5' (TOTAL OF 15') WITH CH-PW-0 (US)

GAURAB ADHIKARI, P.E
140607
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

DocuSigned by:
Gaurab Adhikari 4/5/2024
7299AE09B33740A...

HRAM MANG
141660
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

DocuSigned by:
Hram Mang 4/4/2024
7E00E4800AEB4E4...

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FM 2450

CULVERT NO.8 LAYOUT AT STA.180+10.00 R1

2024 SHEET 8 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		114

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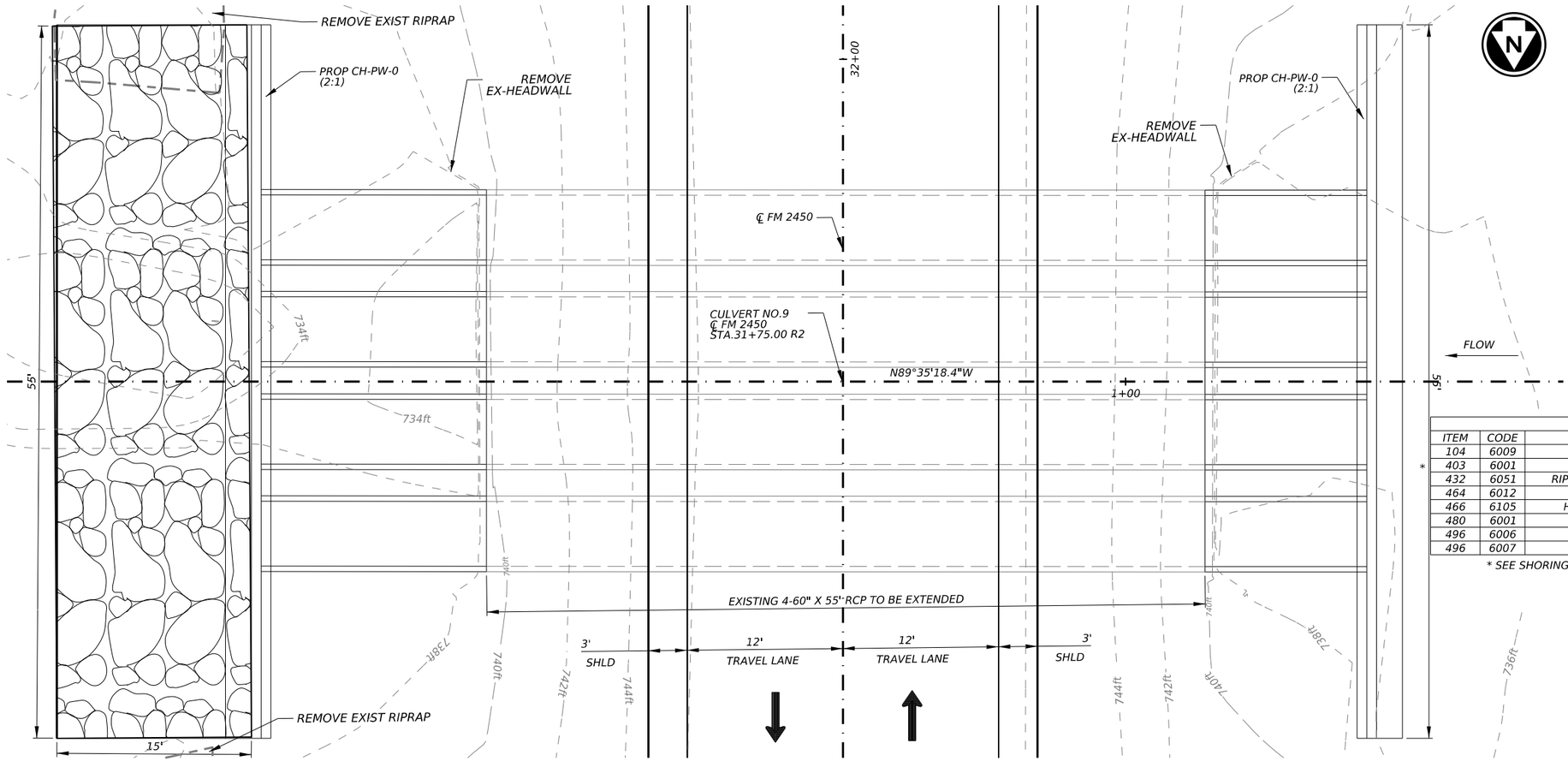

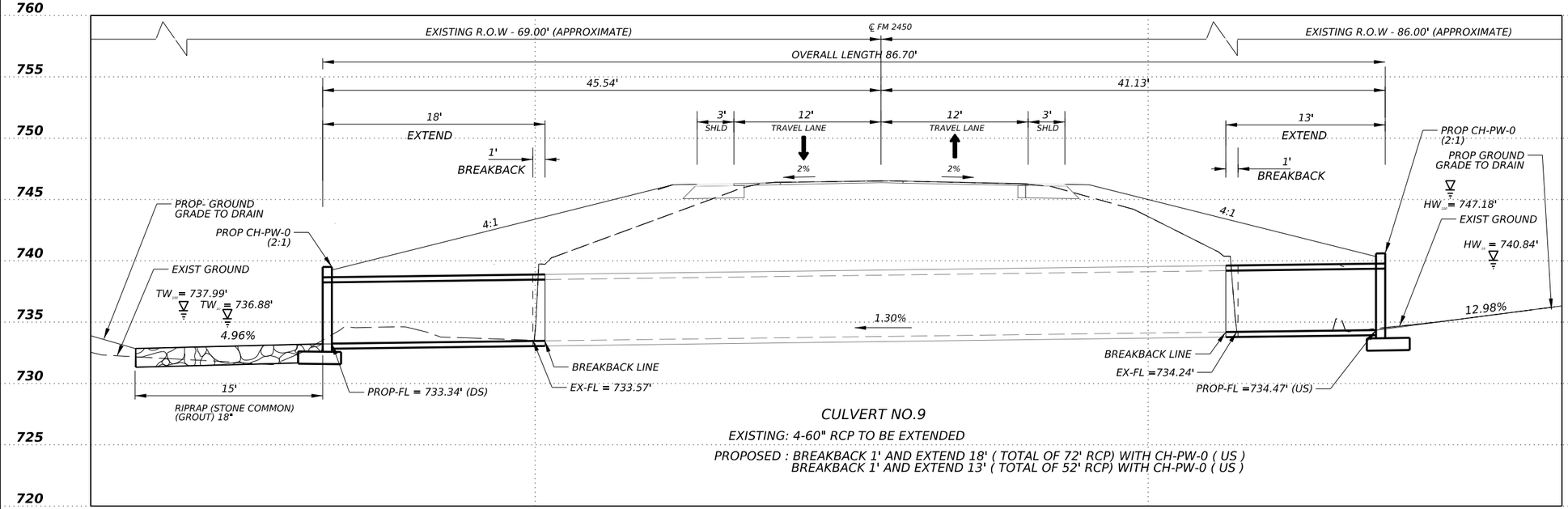

CULVERT NO.9

EXISTING: 4-60" RCP TO BE EXTENDED

PROPOSED : BREAKBACK 1' AND EXTEND 18' (TOTAL OF 72' RCP) WITH CH-PW-0 (US)
BREAKBACK 1' AND EXTEND 13' (TOTAL OF 52' RCP) WITH CH-PW-0 (US)

HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #9	
Drainage Area = 365.20 Acres	
Q_{10} = 488 cfs	Q_{100} = 839 cfs
HW_{10} = 740.84 ft	HW_{100} = 747.18 ft
TW_{10} = 736.88 ft	TW_{100} = 737.99 ft
V_{10} = 4.72 fps	V_{100} = 5.51 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
104	6009	REMOVING CONC (RIPRAP)	SY	48
403	6001	TEMPORARY SPL SHORING	SF	520
432	6051	RIPRAP (STONE COMMON)(GROUT)(18 IN)	CY	47
464	6012	RC PIPE (CL III)(60 IN)	LF	124
466	6105	HEADWALL (CH - PW - 0) (DIA= 60 IN)	EA	2
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6006	REMOV STR (HEADWALL)	EA	2
496	6007	REMOV STR (PIPE)	LF	6

* SEE SHORING SHEET FOR SHORING DETAILS.

STATE OF TEXAS
GAURAB ADHIKARI, P.E
140607
LICENSED PROFESSIONAL ENGINEER

DocuSigned by:
Gaurab Adhikari 4/4/2024
7299AF09B33740A...

STATE OF TEXAS
HRAM MANG
141660
LICENSED PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 4/4/2024
7E88E4200AEB4E7...

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FM 2450

CULVERT NO.9 LAYOUT
AT
STA. 31+75.00 R2

2024 SHEET 9 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		115

DATE: 4/4/2024 2:21:03 PM
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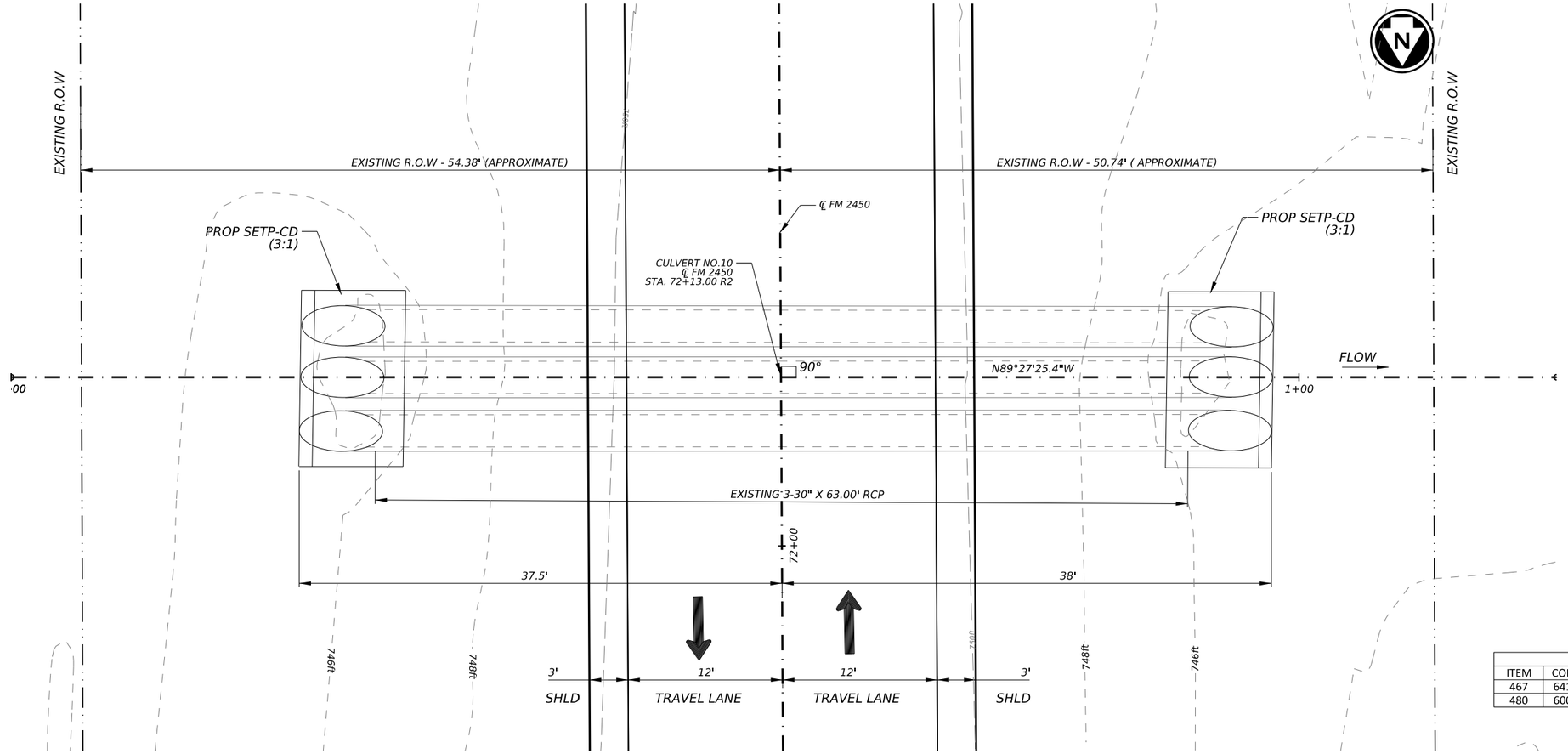


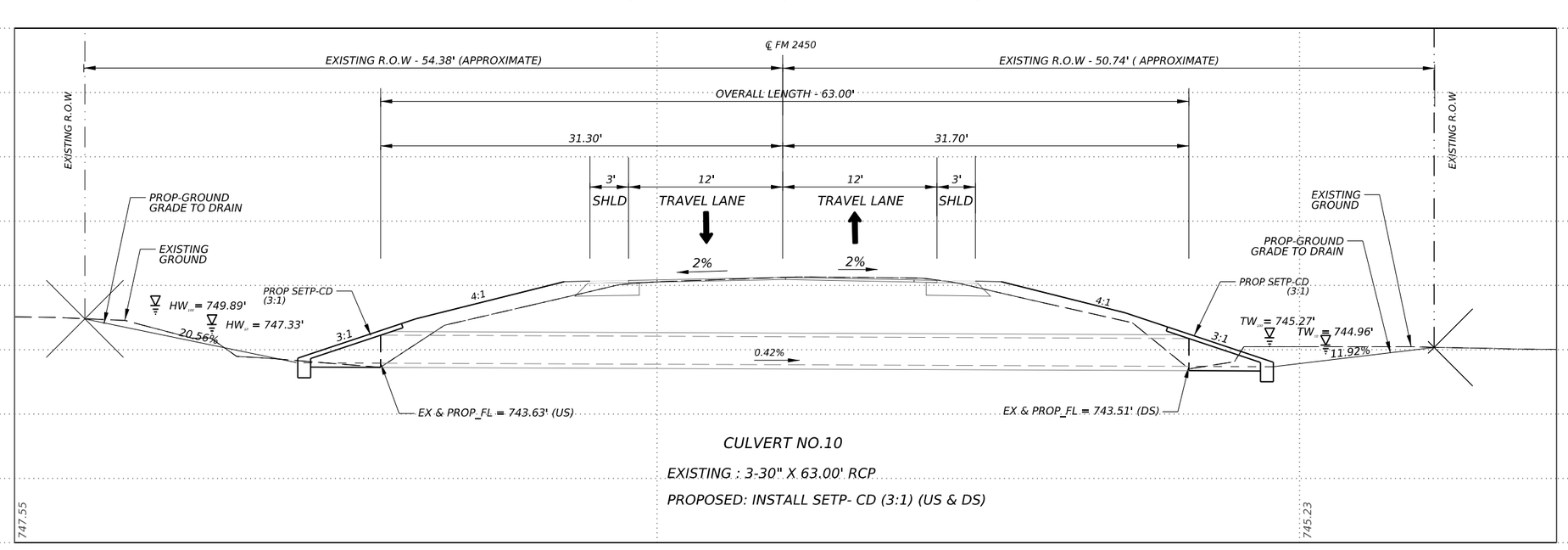
HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #10	
Drainage Area = 49.98 Acres	
Q_{10} = 105.05 cfs	Q_{100} = 158.49 cfs
HW_{10} = 747.33 ft	HW_{100} = 749.89 ft
TW_{10} = 744.96 ft	TW_{100} = 745.27 ft
V_{10} = 8.28 fps	V_{100} = 11.08 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
467	6417	SET (TY II) (30 IN) (RCP) (3: 1) (C)	EA	2
480	6001	CLEAN EXIST CULVERTS	EA	1



CULVERT NO.10

EXISTING : 3-30" X 63.00' RCP

PROPOSED: INSTALL SETP- CD (3:1) (US & DS)

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HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
4/4/2024

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CULVERT NO.10 LAYOUT AT STA. 72+13.00 R2

2024 SHEET 10 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		116

DATE: 4/4/2024 2:21:23 PM
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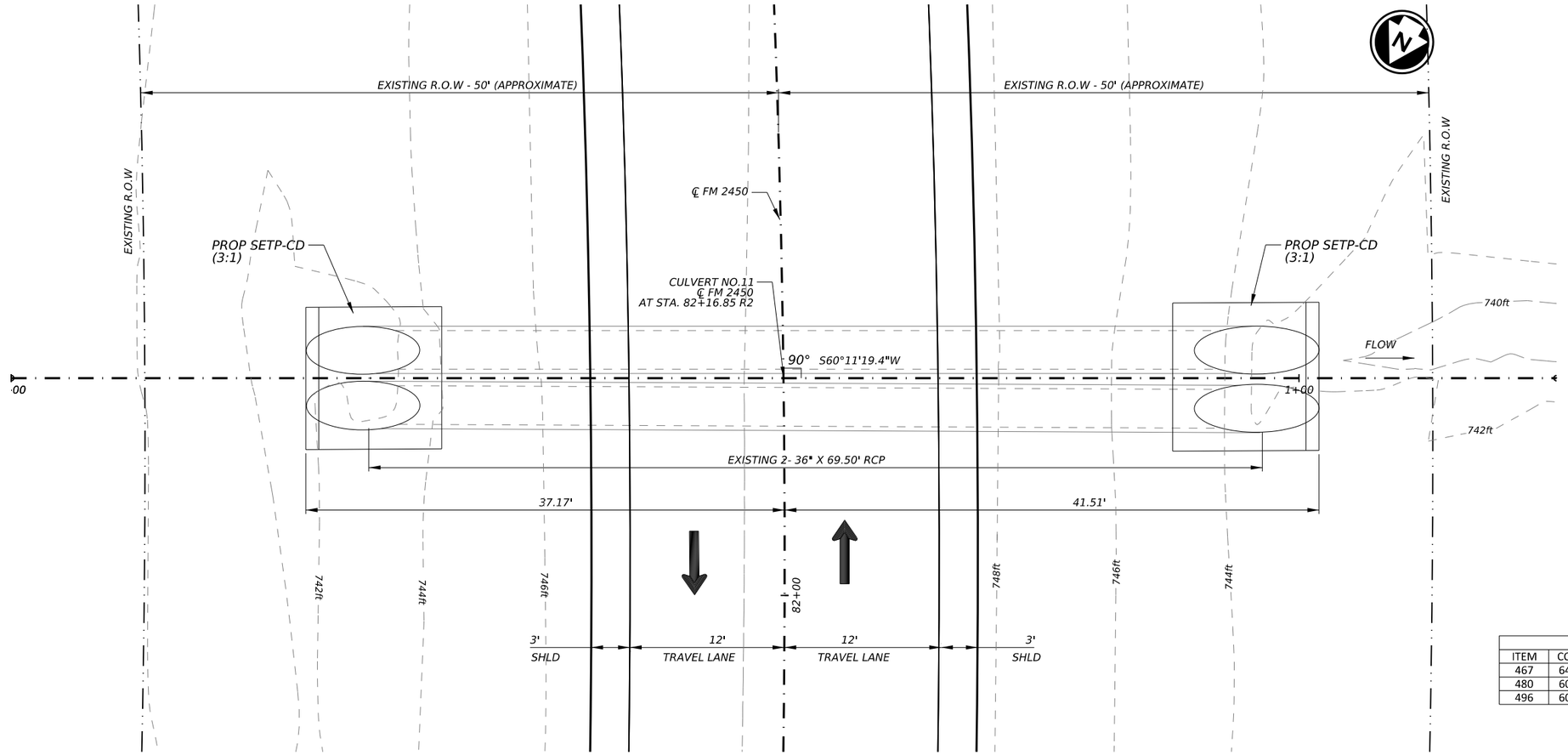


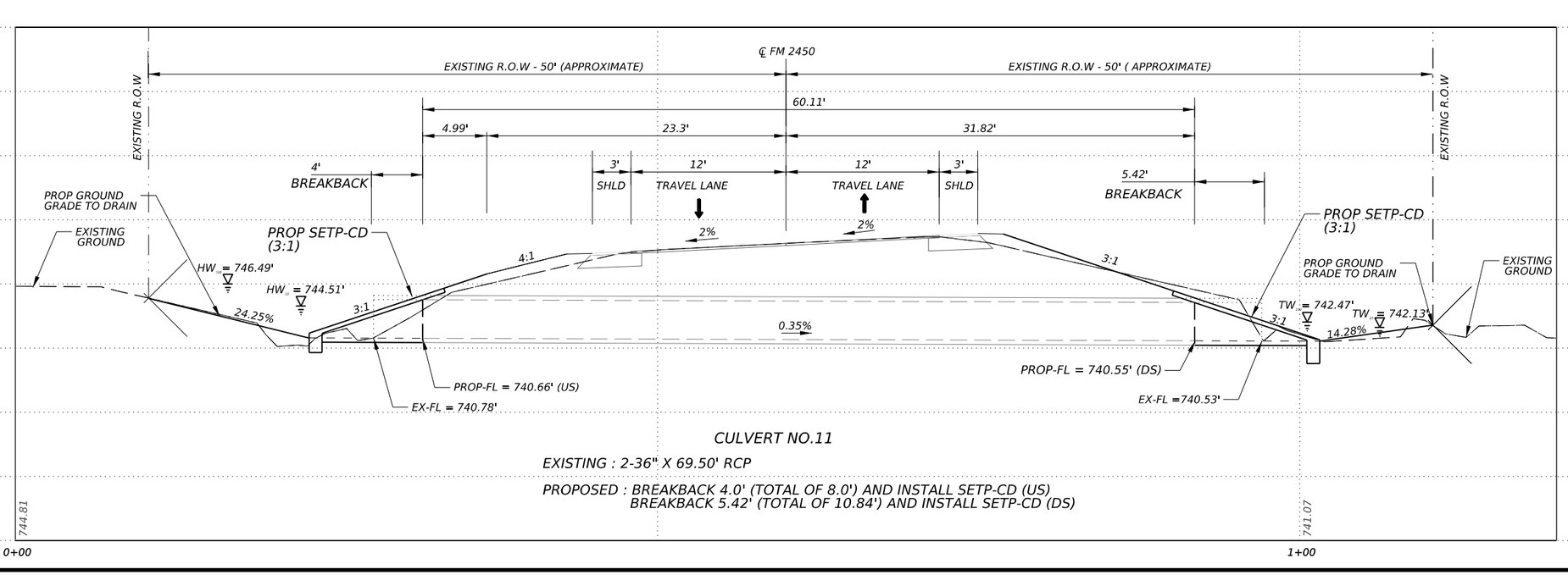
HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #11	
Drainage Area = 49.46 Acres	
Q_{10} = 102.09 cfs	Q_{100} = 154 cfs
HW_{10} = 744.51 ft	HW_{100} = 746.49 ft
TW_{10} = 742.13 ft	TW_{100} = 742.47 ft
V_{10} = 8.69 fps	V_{100} = 11.37 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
467	6448	SET (TY II) (36 IN) (RCP) (3: 1) (C)	EA	2
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6007	REMOV STR (PIPE)	LF	20



CULVERT NO.11

EXISTING : 2-36" X 69.50' RCP

PROPOSED : BREAKBACK 4.0' (TOTAL OF 8.0') AND INSTALL SETP-CD (US)
BREAKBACK 5.42' (TOTAL OF 10.84') AND INSTALL SETP-CD (DS)

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HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER
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Hram Mang
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Texas Department of Transportation

FM 2450

CULVERT NO.11 LAYOUT AT STA. 82+16.85 R2

2024 SHEET 11 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		117

DATE: 4/4/2024 2:21:25 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Drainage/Models/FM2450 Drainage 10-13 Hram.dgn

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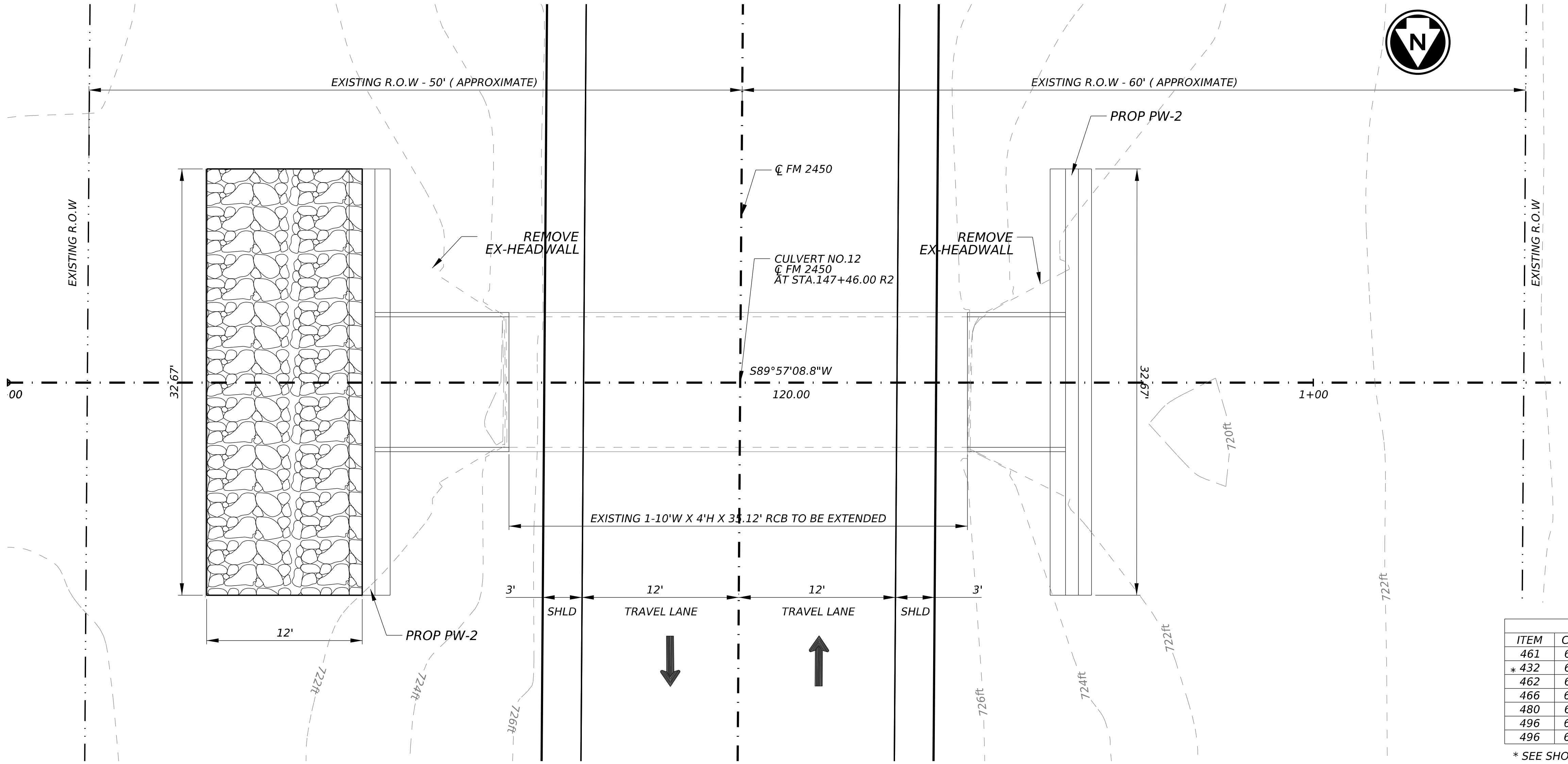


HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

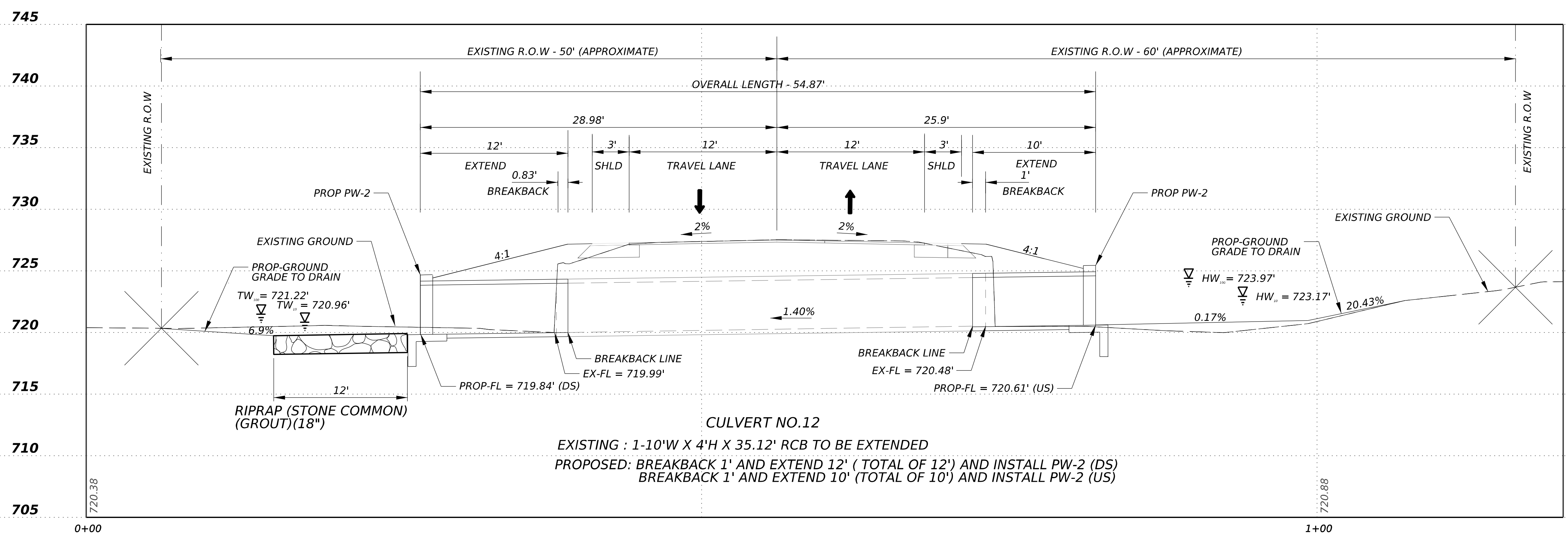
VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #12	
Drainage Area = 59.81 Acres	
Q_{10} = 107.40cfs	Q_{100} = 162.31 cfs
HW_{10} = 723.17 ft	HW_{100} = 723.97 ft
TW_{10} = 720.96 ft	TW_{100} = 721.22 ft
V_{10} = 10.87 fps	V_{100} = 11.96 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
461	6001	TEMPORARY SPL SHORING	SF	330
* 432	6051	RIPRAP (STONE COMMON)(GROUT)(18 IN)	CY	22
462	6101	CONC BOX CULV (10 FT X 4 FT)	LF	22
466	6195	WINGWALL (PW - 2) (HW=6 FT)	EA	2
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6005	REMOV STR (WINGWALL)	EA	2
496	6008	REMOV STR (BOX CULVERT)	LF	2

* SEE SHORING SHEET FOR SHORING DETAILS



CULVERT NO.12

EXISTING : 1-10'W X 4'H X 35.12' RCB TO BE EXTENDED

PROPOSED: BREAKBACK 1' AND EXTEND 12' (TOTAL OF 12') AND INSTALL PW-2 (DS)
BREAKBACK 1' AND EXTEND 10' (TOTAL OF 10') AND INSTALL PW-2 (US)

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HRAM MANG
141660
LICENSED PROFESSIONAL ENGINEER

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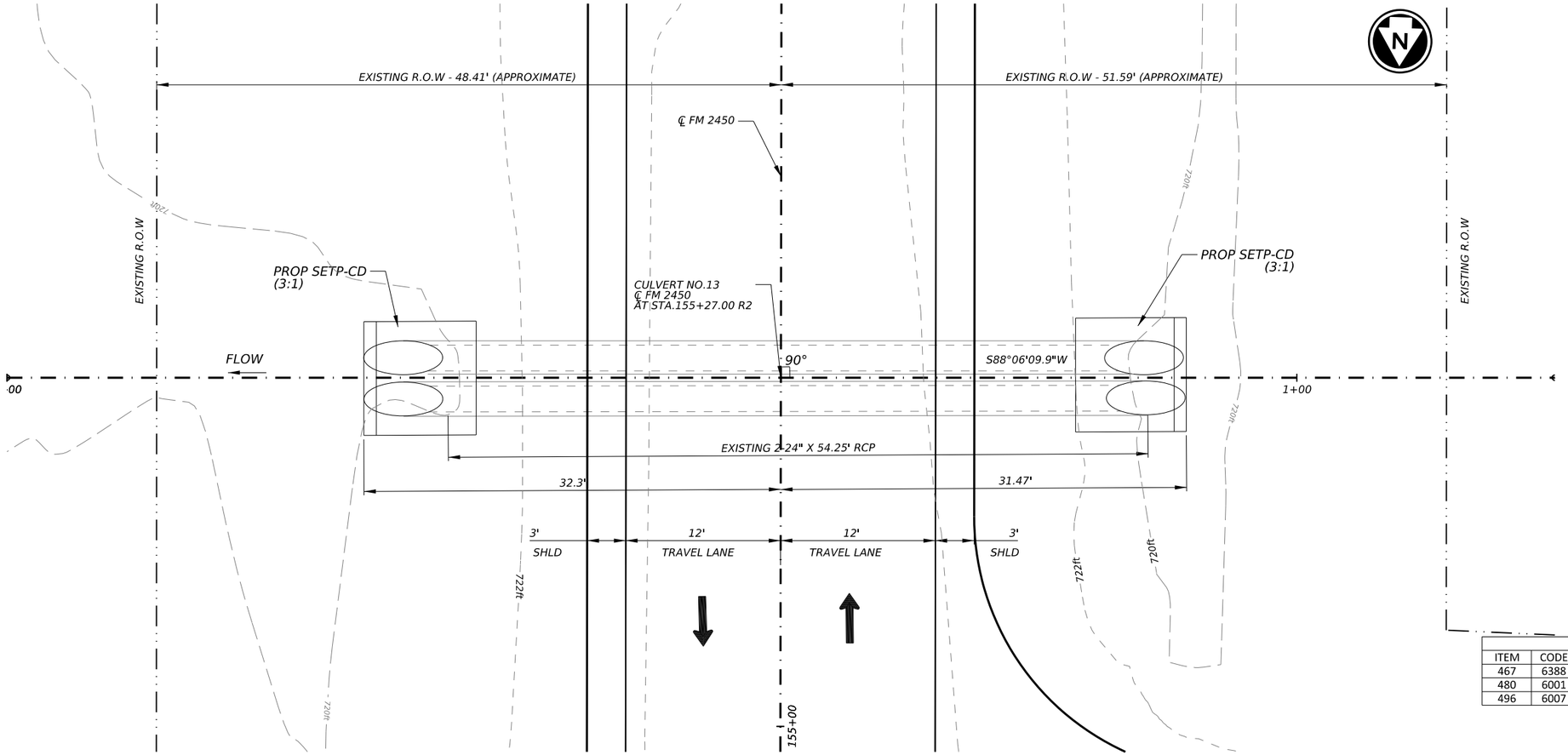
FM 2450

CULVERT NO.12 LAYOUT AT STA. 147+46.00 R2

2024 SHEET 12 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST		COUNTY	SHEET NO.
DAL		DENTON	118

DATE: 4/4/2024 2:21:45 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/2353020284 - Design/3D Corridor Modeling/Geometry/FM2450_Drainage.dgn



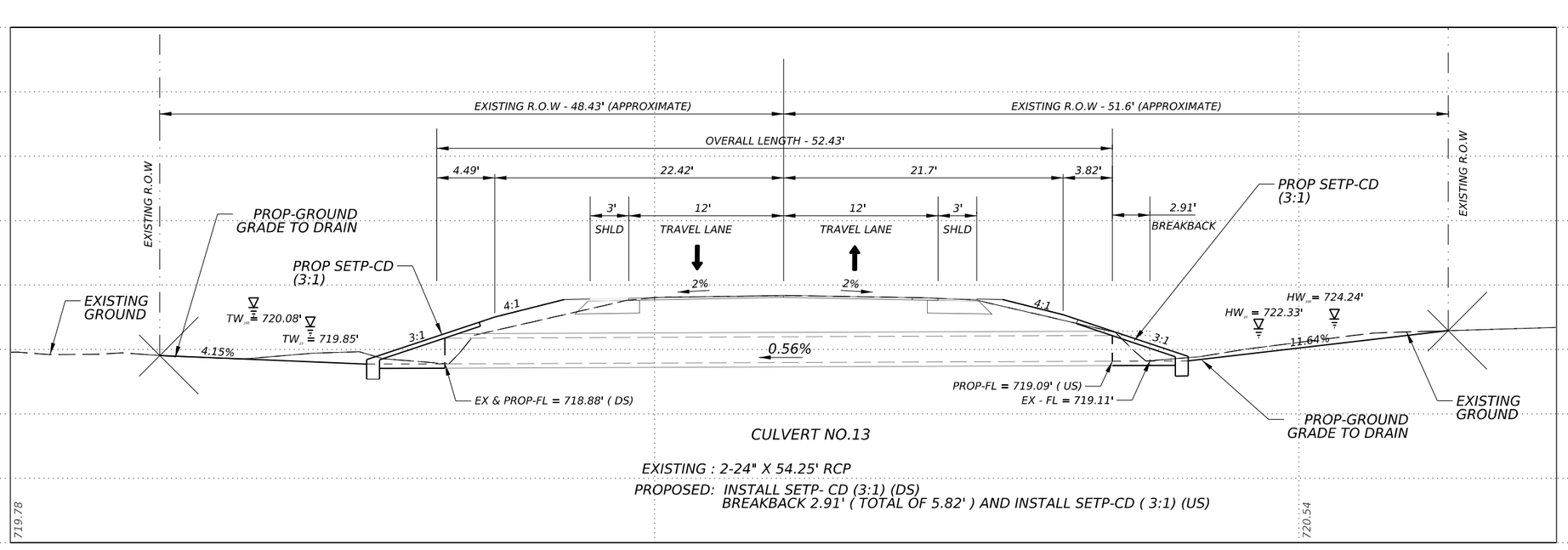
HORIZ SCALE 0 2 4 6 8 10 SCALE IN FEET

VERT SCALE 0 2 4 6 8 10 SCALE IN FEET

HYDRAULIC DATA CULVERT #13	
Drainage Area = 22.17 Acres	
Q_{10} = 47.52 cfs	Q_{100} = 71.69 cfs
HW_{10} = 722.33 ft	HW_{100} = 724.24 ft
TW_{10} = 719.85 ft	TW_{100} = 720.08 ft
V_{10} = 8.23 fps	V_{100} = 11.16 fps

SUMMARY OF ESTIMATED QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
467	6388	SET (TY II) (24 IN) (RCP) (3:1) (C)	EA	2
480	6001	CLEAN EXIST CULVERTS	EA	1
496	6007	REMOV STR (PIPE)	LF	6



CULVERT NO.13

EXISTING : 2-24" X 54.25' RCP

PROPOSED: INSTALL SETP- CD (3:1) (DS)
BREAKBACK 2.91' (TOTAL OF 5.82') AND INSTALL SETP-CD (3:1) (US)

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HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

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Hram Mang 4/4/2024
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FM 2450

CULVERT NO.13 LAYOUT AT STA. 155+27.00 R2

2024 SHEET 13 OF 13

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		119

DATE: 4/4/2024 2:22:07 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Drainage/Models/FM2450 Drainage 10-13 Hram.dgn

Culvert Station and/or Creek Name followed by applicable end (Lt, Rt or Both)	Description of Box Culvert No. Spans ~ Span X Height	Max Fill Height (Ft)	Applicable Box Culvert Standard (4)	Applicable Wingwall or End Treatment Standard	Skew Angle (0°,15°, 30° or 45°)	Side Slope or Channel Slope Ratio (SL:1)	T Culvert Top Slab Thickness (In)	U Culvert Wall Thickness (In)	C Estimated Curb Height (Ft)	Hw (1) Height of Wingwall (Ft)	A Curb to End of Wingwall (Ft)	B Offset of End of Wingwall (Ft)	Lw Length of Longest Wingwall (Ft)	Ltw Culvert Toewall Length (Ft)	Atw Anchor Toewall Length (Ft)	Riprap Apron (CY)	Class "C" Conc (Curb) (2) (CY)	Class "C" Conc (Wingwall) (3) (CY)	Total Wingwall Area (SF)
STA 147+46.00 R2 (CUL-12) (Both)	1 ~10'x 4'	3.5'	SCC-10	PW-2	0°	2:1	8"	7"	1.000'	5.667'	N/A	N/A	9.333'	11.167'	N/A	0.0	0.8	15.0	200

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
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
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SPECIAL NOTE:

This sheet is a supplement to the box culvert standards. It is to be filled out by the culvert specifier and provides dimensions for the construction of the box culvert wingwalls and safety end treatments.

An Excel 2010 spreadsheet to assist in completing this table can be downloaded from the Bridge Standards (English) web page on the TxDOT web site. The completed sheet must be signed, sealed, and dated by a licensed Professional Engineer.

Texas Department of Transportation

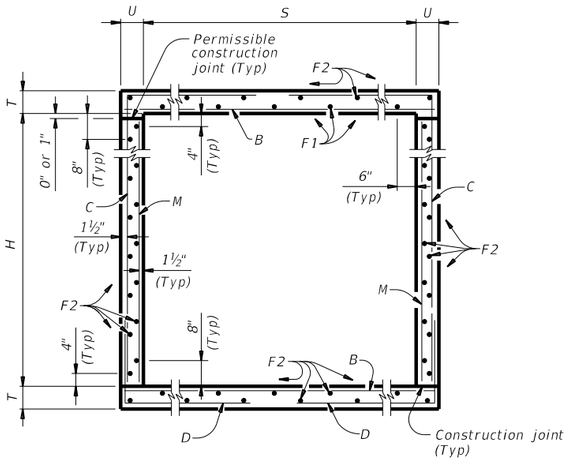
Bridge Division Standard

BOX CULVERT SUPPLEMENT
WINGS AND END TREATMENTS

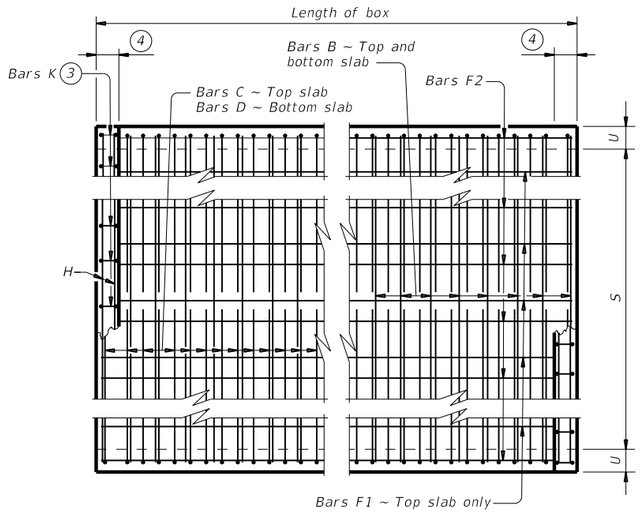
BCS

FILE: CD-BCS-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020 REVISIONS	CONT	SECT	JOB	HIGHWAY
	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		120

DATE: 2/22/2024 4:17:51 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302824 - Design/Plan Set/5. Drainage/CD-BCS-20.dgn



TYPICAL SECTION



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.

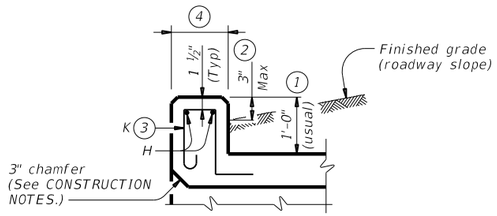
Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(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

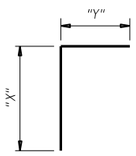
CONSTRUCTION NOTES:
Do not use permanent forms.
Chamfer the bottom edge of the top slab 3" at the entrance.
Optionally, raise construction joints shown at the flow line by a maximum of 6". If this option is taken, Bars M may be cut off or raised, Bars C and D may be reversed.

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.

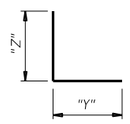
Provide bar laps, where required, as follows:
- Uncoated or galvanized ~ #4 = 1'-8" Min
- Uncoated or galvanized ~ #5 = 2'-1" Min
- Uncoated or galvanized ~ #6 = 2'-6" Min
- Uncoated or galvanized ~ #7 = 3'-3" Min

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.

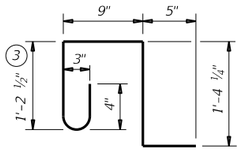
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.



BARS C



BARS D



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

HL93 LOADING SHEET 1 OF 3

Texas Department of Transportation | Bridge Division Standard

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

SCC-10

FILE: CD-SCC10-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
04/2021 Updated 'X' values.	DIST	COUNTY		SHEET NO.
	DAL	DENTON		121

DATE: 2/20/2024 5:01:52 PM
FILE: DOCUMENT NAME

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	Wt	No.	Length	Wt	No.	Length	Weight	Length	Wt	No.	Wt	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)
10' – 0"	4' – 0"	8"	7"	7'	162	#6	6"	10' – 11"	2,656	162	#6	6"	10' – 4"	2,514	4' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	4' – 0"	289	7	39' – 9"	186	37	39' – 9"	982	10' – 11"	29	24	67	0.724	219.9	0.8	96	29.8	8,893
10' – 0"	4' – 0"	9"	7"	10'	162	#6	6"	10' – 11"	2,656	162	#6	6"	10' – 5"	2,535	4' – 7"	5' – 10"	162	#6	6"	9' – 0"	2,190	5' – 10"	3' – 2"	108	9"	4' – 0"	289	7	39' – 9"	186	37	39' – 9"	982	10' – 11"	29	24	67	0.793	221.0	0.8	96	32.5	8,934
10' – 0"	4' – 0"	10"	8"	13'	162	#6	6"	11' – 1"	2,697	162	#6	6"	10' – 7"	2,575	4' – 8"	5' – 11"	162	#6	6"	9' – 2"	2,230	5' – 11"	3' – 3"	82	12"	4' – 0"	219	7	39' – 9"	186	37	39' – 9"	982	11' – 1"	30	26	72	0.897	222.2	0.8	102	36.7	8,991
10' – 0"	4' – 0"	11"	8"	16'	162	#6	6"	11' – 1"	2,697	162	#6	6"	10' – 8"	2,595	4' – 9"	5' – 11"	162	#6	6"	9' – 3"	2,251	5' – 11"	3' – 4"	82	12"	4' – 0"	219	7	39' – 9"	186	37	39' – 9"	982	11' – 1"	30	26	72	0.967	223.3	0.8	102	39.5	9,032
10' – 0"	4' – 0"	12"	9"	20'	162	#6	6"	11' – 3"	2,737	162	#6	6"	10' – 10"	2,636	4' – 10"	6' – 0"	162	#6	6"	9' – 5"	2,291	6' – 0"	3' – 5"	108	9"	4' – 0"	289	7	39' – 9"	186	37	39' – 9"	982	11' – 3"	30	26	72	1.074	228.0	0.8	102	43.8	9,223
10' – 0"	4' – 0"	13"	10"	23'	162	#6	6"	11' – 5"	2,778	162	#6	6"	10' – 11"	2,656	4' – 11"	6' – 0"	162	#6	6"	9' – 6"	2,312	6' – 0"	3' – 6"	108	9"	4' – 0"	289	7	39' – 9"	186	37	39' – 9"	982	11' – 5"	31	26	72	1.183	230.1	0.9	103	48.2	9,306
10' – 0"	4' – 0"	14"	11"	26'	162	#6	6"	11' – 7"	2,819	162	#6	6"	11' – 1"	2,697	5' – 0"	6' – 1"	162	#6	6"	9' – 8"	2,352	6' – 1"	3' – 7"	108	9"	4' – 0"	289	7	39' – 9"	186	37	39' – 9"	982	11' – 7"	31	26	72	1.294	233.1	0.9	103	52.6	9,428
10' – 0"	4' – 0"	15"	12"	30'	162	#6	6"	11' – 9"	2,859	162	#6	6"	11' – 3"	2,737	5' – 1"	6' – 2"	162	#6	6"	9' – 10"	2,393	6' – 2"	3' – 8"	108	9"	4' – 0"	289	7	39' – 9"	186	37	39' – 9"	982	11' – 9"	31	26	72	1.407	236.2	0.9	103	57.2	9,549
10' – 0"	5' – 0"	8"	7"	7'	162	#6	6"	10' – 11"	2,656	162	#6	6"	11' – 4"	2,758	5' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	5' – 0"	361	7	39' – 9"	186	41	39' – 9"	1,089	10' – 11"	29	24	67	0.767	230.5	0.8	96	31.5	9,316
10' – 0"	5' – 0"	9"	7"	10'	162	#6	6"	10' – 11"	2,656	162	#6	6"	11' – 5"	2,778	5' – 7"	5' – 10"	162	#6	6"	9' – 0"	2,190	5' – 10"	3' – 2"	108	9"	5' – 0"	361	7	39' – 9"	186	41	39' – 9"	1,089	10' – 11"	29	24	67	0.836	231.5	0.8	96	34.3	9,356
10' – 0"	5' – 0"	10"	8"	13'	162	#6	6"	11' – 1"	2,697	162	#6	6"	11' – 7"	2,819	5' – 8"	5' – 11"	162	#6	6"	9' – 2"	2,230	5' – 11"	3' – 3"	82	12"	5' – 0"	274	7	39' – 9"	186	41	39' – 9"	1,089	11' – 1"	30	26	72	0.947	232.4	0.8	102	38.7	9,397
10' – 0"	5' – 0"	11"	8"	16'	162	#6	6"	11' – 1"	2,697	162	#6	6"	11' – 8"	2,839	5' – 9"	5' – 11"	162	#6	6"	9' – 3"	2,251	5' – 11"	3' – 4"	82	12"	5' – 0"	274	7	39' – 9"	186	41	39' – 9"	1,089	11' – 1"	30	26	72	1.016	233.4	0.8	102	41.5	9,438
10' – 0"	5' – 0"	12"	9"	20'	162	#6	6"	11' – 3"	2,737	162	#6	6"	11' – 10"	2,879	5' – 10"	6' – 0"	162	#6	6"	9' – 5"	2,291	6' – 0"	3' – 5"	108	9"	5' – 0"	361	7	39' – 9"	186	41	39' – 9"	1,089	11' – 3"	30	26	72	1.130	238.6	0.8	102	46.0	9,645
10' – 0"	5' – 0"	13"	10"	23'	162	#6	6"	11' – 5"	2,778	162	#6	6"	11' – 11"	2,900	5' – 11"	6' – 0"	162	#6	6"	9' – 6"	2,312	6' – 0"	3' – 6"	108	9"	5' – 0"	361	7	39' – 9"	186	41	39' – 9"	1,089	11' – 5"	31	26	72	1.245	240.7	0.9	103	50.7	9,729
10' – 0"	5' – 0"	14"	11"	26'	162	#6	6"	11' – 7"	2,819	162	#6	6"	12' – 1"	2,940	6' – 0"	6' – 1"	162	#6	6"	9' – 8"	2,352	6' – 1"	3' – 7"	108	9"	5' – 0"	361	7	39' – 9"	186	41	39' – 9"	1,089	11' – 7"	31	26	72	1.362	243.7	0.9	103	55.4	9,850
10' – 0"	5' – 0"	15"	12"	30'	162	#7	6"	11' – 9"	3,891	162	#6	6"	12' – 3"	2,981	6' – 1"	6' – 2"	162	#6	6"	9' – 10"	2,393	6' – 2"	3' – 8"	108	9"	5' – 0"	361	7	39' – 9"	186	41	39' – 9"	1,089	11' – 9"	31	26	72	1.481	272.5	0.9	103	60.1	11,004
10' – 0"	6' – 0"	8"	7"	7'	162	#6	6"	10' – 11"	2,656	162	#6	6"	12' – 4"	3,001	6' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	6' – 0"	433	7	39' – 9"	186	45	39' – 9"	1,195	10' – 11"	29	24	67	0.811	241.0	0.8	96	33.3	9,737
10' – 0"	6' – 0"	8"	7"	10'	162	#6	6"	10' – 11"	2,656	162	#6	6"	12' – 4"	3,001	6' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	6' – 0"	433	7	39' – 9"	186	45	39' – 9"	1,195	10' – 11"	29	24	67	0.811	241.0	0.8	96	33.3	9,737
10' – 0"	6' – 0"	9"	8"	13'	162	#6	6"	11' – 1"	2,697	162	#6	6"	12' – 6"	3,042	6' – 7"	5' – 11"	162	#6	6"	9' – 1"	2,210	5' – 11"	3' – 2"	82	12"	6' – 0"	329	7	39' – 9"	186	45	39' – 9"	1,195	11' – 1"	30	26	72	0.926	241.5	0.8	102	37.9	9,761
10' – 0"	6' – 0"	10"	8"	16'	162	#6	6"	11' – 1"	2,697	162	#6	6"	12' – 7"	3,062	6' – 8"	5' – 11"	162	#6	6"	9' – 2"	2,230	5' – 11"	3' – 3"	82	12"	6' – 0"	329	7	39' – 9"	186	45	39' – 9"	1,195	11' – 1"	30	26	72	0.996	242.5	0.8	102	40.7	9,801
10' – 0"	6' – 0"	12"	9"	20'	162	#6	6"	11' – 3"	2,737	162	#6	6"	12' – 10"	3,123	6' – 10"	6' – 0"	162	#6	6"	9' – 5"	2,291	6' – 0"	3' – 5"	108	9"	6' – 0"	433	7	39' – 9"	186	45	39' – 9"	1,195	11' – 3"	30	26	72	1.185	249.1	0.8	102	48.2	10,067
10' – 0"	6' – 0"	13"	10"	23'	162	#6	6"	11' – 5"	2,778	162	#6	6"	12' – 11"	3,143	6' – 11"	6' – 0"	162	#6	6"	9' – 6"	2,312	6' – 0"	3' – 6"	108	9"	6' – 0"	433	7	39' – 9"	186	45	39' – 9"	1,195	11' – 5"	31	26	72	1.307	251.2	0.9	103	53.1	10,150
10' – 0"	6' – 0"	14"	11"	26'	162	#6	6"	11' – 7"	2,819	162	#6	6"	13' – 1"	3,183	7' – 0"	6' – 1"	162	#6	6"	9' – 8"	2,352	6' – 1"	3' – 7"	108	9"	6' – 0"	433	7	39' – 9"	186	45	39' – 9"	1,195	11' – 7"	31	26	72	1.430	254.2	0.9	103	58.1	10,271
10' – 0"	6' – 0"	15"	12"	30'	162	#7	6"	11' – 9"	3,891	162	#6	6"	13' – 3"	3,224	7' – 1"	6' – 2"	162	#6	6"	9' – 10"	2,393	6' – 2"	3' – 8"	108	9"	6' – 0"	433	7	39' – 9"	186	45	39' – 9"	1,195	11' – 9"	31	26	72	1.556	283.1	0.9	103	63.1	11,425
10' – 0"	7' – 0"	8"	7"	7'	162	#6	6"	10' – 11"	2,656	162	#6	6"	13' – 4"	3,244	7' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	7' – 0"	505	7	39' – 9"	186	45	39' – 9"	1,195	10' – 11"	29	24	67	0.854	248.9	0.8	96	35.0	10,052
10' – 0"	7' – 0"	8"	7"	10'	162	#6	6"	10' – 11"	2,656	162	#6	6"	13' – 4"	3,244	7' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	7' – 0"	505	7	39' – 9"	186	45	39' – 9"	1,195	10' – 11"	29	24	67	0.854	248.9	0.8	96	35.0	10,052
10' – 0"	7' – 0"	9"	8"	13'	162	#6	6"	11' – 1"	2,697	162	#6	6"	13' – 6"	3,285	7' – 7"	5' – 11"	162	#6	6"	9' – 1"	2,210	5' – 11"	3' – 2"	82	12"	7' – 0"	383	7	39' – 9"	186	45	39' – 9"	1,195	11' – 1"	30	26	72	0.975	248.9	0.8	102	39.8	10,058
10' – 0"	7' – 0"	10"	8"	16'	162	#6	6"	11' – 1"	2,697	162	#6	6"	13' – 7"	3,305	7' – 8"	5' – 11"	162	#6	6"	9' – 2"	2,230	5' – 11"	3' – 3"	82	12"	7' – 0"	383	7	39' – 9"	186	45	39' – 9"	1,195	11' – 1"	30	26	72	1.045	249.9	0.8	102	42.6	10,098
10' – 0"	7' – 0"	12"	9"	20'	162	#6	6"	11' – 3"	2,737	162	#6	6"	13' – 10"	3,366	7' – 10"	6' – 0"	162	#6	6"	9' – 5"	2,291	6' – 0"	3' – 5"	108	9"	7' – 0"	505	7	39' – 9"	186	45	39' – 9"	1,195	11' – 3"	30	26	72	1.241	257.0	0.8	102	50.5	10,382
10' – 0"	7' – 0"	13"	10"	23'	162	#6	6"	11' – 5"	2,778	162	#6	6"	13' – 11"	3,386	7' – 11"	6' – 0"	162	#6	6"	9' – 6"	2,312	6' – 0"	3' – 6"	108	9"	7' – 0"	505	7	39' – 9"	186	45	39' – 9"	1,195	11' – 5"	31	26	72	1.368	259.1	0.9	103	55.6	10,465
10' – 0"	7' – 0"	14"	11"	26'	162	#6	6"	11' – 7"	2,819	162	#6	6"	14' – 1"	3,427	8' – 0"	6' – 1"	162	#6	6"	9' – 8"	2,352	6' – 1"	3' – 7"	108	9"	7' – 0"	505	7	39' – 9"	186	45	39' – 9"	1,195	11' – 7"	31	26	72	1.498	262.1	0.9	103	60.8	10,587
10' – 0"	7' – 0"	15"	12"	30'	162	#7	6"	11' – 9"	3,891	162	#6	6"	14' – 3"	3,467	8' – 1"	6' – 2"	162	#6	6"	9' – 10"	2,393	6' – 2"	3' – 8"	108	9"	7' – 0"	505	7	39' – 9"	186	45	39' – 9"	1,195	11' – 9"	31	26	72	1.630	290.9	0.9	103	66.1	11,740
10' – 0"	8' – 0"	8"	7"	7'	162	#6	6"	10' – 11"	2,656	162	#6	6"	14' – 4"	3,488	8' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	8' – 0"	577	7	39' – 9"	186	49	39' – 9"	1,301	10' – 11"	29	24	67	0.897	259.5	0.8	96	36.7	10,474
10' – 0"	8' – 0"	8"	7"	10'	162	#6	6"	10' – 11"	2,656	162	#6	6"	14' – 4"	3,488	8' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	8' – 0"	577	7	39' – 9"	186	49	39' – 9"	1,301	10' – 11"	29	24	67	0.897	259.5	0.8	96	36.7	10,474
10' – 0"	8' – 0"	9"	8"	13'	162	#6	6"	11' – 1"	2,697	162	#6	6"	14' – 6"	3,528	8' – 7"	5' – 11"	162	#6	6"	9' – 1"	2,210	5' – 11"	3' – 2"	82	12"	8' – 0"	438	7	39' – 9"	186	49	39' – 9"	1,301	11' – 1"	30	26	72	1.025	259.0	0.8	102	41.8	10,462
10' – 0"	8' – 0"	10"	8"	16'	162	#6	6"	11' – 1"	2,697	162	#6	6"	14' – 7"	3,548	8' – 8"	5' – 11"	162	#6	6"	9' – 2"	2,230	5' – 11"	3' – 3"	82	12"	8' – 0"	438	7	39' – 9"	186	49	39' – 9"	1,301	11' – 1"	30	26	72	1.095	260.0	0.8	102	44.6	10,502
10' – 0"	8' – 0"	12"	9"	20'	162	#6	6"	11' – 3"	2,737	162	#6	6"	14' – 10"	3,609	8' – 10"	6' – 0"	162	#6	6"	9' – 5"	2,291	6' – 0"	3' – 5"	108	9"	8' – 0"	577	7	39' – 9"	186	49	39' – 9"	1,301	11' – 3"	30	26	72	1.296	267.5	0.8	102	52.7	10,803
10' – 0"	8' – 0"	13"	10"	23'	162	#6	6"	11' – 5"	2,778	162	#6	6"	14' – 11"	3,630	8' – 11"	6' – 0"	162	#6	6"	9' – 6"	2,312	6' – 0"	3' – 6"	108	9"	8' – 0"	577	7	39' – 9"	186	49	39' – 9"	1,301	11' – 5"	31	26	72	1.430	269.6	0.9	103	58.1	10,887
10' – 0"	8' – 0"	14"	11"	26'	162	#6	6"	11' – 7"	2,819	162	#6	6"	15' – 1"	3,670	9' – 0"	6' – 1"	162	#6	6"	9' – 8"	2,352	6' – 1"	3' – 7"	108	9"	8' – 0"	577	7	39' – 9"	186	49	39' – 9"	1,301	11' – 7"	31	26	72	1.566	272.6	0.9	103	63.5	11,008
10' – 0"	8' – 0"	15"	12"	30'	162	#7	6"	11' – 9"	3,891	162	#6	6"	15' – 3"	3,711	9' – 1"	6' – 2"	162	#6	6"	9' – 10"	2,393	6' – 2"	3' – 8"	108	9"	8' – 0"	577	7	39' – 9"	186	49	39' – 9"	1,301	11' – 9"	31	26	72	1.704	301.5	0.9	103	69.0	12,162

(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 3

Texas Department of Transportation

Bridge Division Standard

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

SCC-10

FILE: CD-SCC10-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	DAL	DENTON		122

DATE: 2/21/2024 4:29:07 PM
FILE: DOCUMENT NAME

SECTION DIMENSIONS				(5) FILL HEIGHT	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	Wt	No.	Size	Spa	Length	Wt	" X "	" Y "	No.	Size	Spa	Length	Wt	" Y "	" Z "	No.	Spa	Length	Wt	No.	Length	Wt	No.	Length	Wt	Length	Wt	No.	Wt	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)
10' – 0"	9' – 0"	8"	7"	7'	162	#6	6"	10' – 11"	2,656	162	#6	6"	15' – 4"	3,731	9' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	9' – 0"	649	7	39' – 9"	186	53	39' – 9"	1,407	10' – 11"	29	24	67	0.940	270.0	0.8	96	38.4	10,895
10' – 0"	9' – 0"	8"	7"	10'	162	#6	6"	10' – 11"	2,656	162	#6	6"	15' – 4"	3,731	9' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	108	9"	9' – 0"	649	7	39' – 9"	186	53	39' – 9"	1,407	10' – 11"	29	24	67	0.940	270.0	0.8	96	38.4	10,895
10' – 0"	9' – 0"	9"	8"	13'	162	#6	6"	11' – 1"	2,697	162	#6	6"	15' – 6"	3,772	9' – 7"	5' – 11"	162	#6	6"	9' – 1"	2,210	5' – 11"	3' – 2"	108	9"	9' – 0"	649	7	39' – 9"	186	53	39' – 9"	1,407	11' – 1"	30	26	72	1.074	273.0	0.8	102	43.8	11,023
10' – 0"	9' – 0"	10"	8"	16'	162	#6	6"	11' – 1"	2,697	162	#6	6"	15' – 7"	3,792	9' – 8"	5' – 11"	162	#6	6"	9' – 2"	2,230	5' – 11"	3' – 3"	162	6"	9' – 0"	974	7	39' – 9"	186	53	39' – 9"	1,407	11' – 1"	30	26	72	1.144	282.2	0.8	102	46.6	11,388
10' – 0"	9' – 0"	12"	9"	20'	162	#6	6"	11' – 3"	2,737	162	#6	6"	15' – 10"	3,853	9' – 10"	6' – 0"	162	#6	6"	9' – 5"	2,291	6' – 0"	3' – 5"	162	6"	9' – 0"	974	7	39' – 9"	186	53	39' – 9"	1,407	11' – 3"	30	26	72	1.352	286.2	0.8	102	54.9	11,550
10' – 0"	9' – 0"	13"	10"	23'	162	#6	6"	11' – 5"	2,778	162	#6	6"	15' – 11"	3,873	9' – 11"	6' – 0"	162	#6	6"	9' – 6"	2,312	6' – 0"	3' – 6"	162	6"	9' – 0"	974	7	39' – 9"	186	53	39' – 9"	1,407	11' – 5"	31	26	72	1.492	288.3	0.9	103	60.5	11,633
10' – 0"	9' – 0"	14"	11"	26'	162	#6	6"	11' – 7"	2,819	162	#6	6"	16' – 1"	3,913	10' – 0"	6' – 1"	162	#6	6"	9' – 8"	2,352	6' – 1"	3' – 7"	162	6"	9' – 0"	974	7	39' – 9"	186	53	39' – 9"	1,407	11' – 7"	31	26	72	1.634	291.3	0.9	103	66.2	11,754
10' – 0"	9' – 0"	15"	12"	30'	162	#7	6"	11' – 9"	3,891	162	#6	6"	16' – 3"	3,954	10' – 1"	6' – 2"	162	#6	6"	9' – 10"	2,393	6' – 2"	3' – 8"	162	6"	9' – 0"	974	7	39' – 9"	186	53	39' – 9"	1,407	11' – 9"	31	26	72	1.778	320.1	0.9	103	72.0	12,908
10' – 0"	10' – 0"	8"	7"	7'	162	#6	6"	10' – 11"	2,656	162	#6	6"	16' – 4"	3,974	10' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	162	6"	10' – 0"	1,082	7	39' – 9"	186	53	39' – 9"	1,407	10' – 11"	29	24	67	0.984	286.9	0.8	96	40.2	11,571
10' – 0"	10' – 0"	8"	7"	10'	162	#6	6"	10' – 11"	2,656	162	#6	6"	16' – 4"	3,974	10' – 6"	5' – 10"	162	#6	6"	8' – 11"	2,170	5' – 10"	3' – 1"	162	6"	10' – 0"	1,082	7	39' – 9"	186	53	39' – 9"	1,407	10' – 11"	29	24	67	0.984	286.9	0.8	96	40.2	11,571
10' – 0"	10' – 0"	9"	8"	13'	162	#6	6"	11' – 1"	2,697	162	#6	6"	16' – 6"	4,015	10' – 7"	5' – 11"	162	#6	6"	9' – 1"	2,210	5' – 11"	3' – 2"	162	6"	10' – 0"	1,082	7	39' – 9"	186	53	39' – 9"	1,407	11' – 1"	30	26	72	1.123	289.9	0.8	102	45.8	11,699
10' – 0"	10' – 0"	10"	8"	16'	162	#6	6"	11' – 1"	2,697	162	#6	6"	16' – 7"	4,035	10' – 8"	5' – 11"	162	#6	6"	9' – 2"	2,230	5' – 11"	3' – 3"	162	6"	10' – 0"	1,082	7	39' – 9"	186	53	39' – 9"	1,407	11' – 1"	30	26	72	1.193	290.9	0.8	102	48.6	11,739
10' – 0"	10' – 0"	12"	9"	20'	162	#6	6"	11' – 3"	2,737	162	#6	6"	16' – 10"	4,096	10' – 10"	6' – 0"	162	#6	6"	9' – 5"	2,291	6' – 0"	3' – 5"	162	6"	10' – 0"	1,082	7	39' – 9"	186	53	39' – 9"	1,407	11' – 3"	30	26	72	1.407	295.0	0.8	102	57.1	11,901
10' – 0"	10' – 0"	13"	10"	23'	162	#6	6"	11' – 5"	2,778	162	#6	6"	16' – 11"	4,116	10' – 11"	6' – 0"	162	#6	6"	9' – 6"	2,312	6' – 0"	3' – 6"	162	6"	10' – 0"	1,082	7	39' – 9"	186	53	39' – 9"	1,407	11' – 5"	31	26	72	1.553	297.0	0.9	103	63.0	11,984
10' – 0"	10' – 0"	14"	11"	26'	162	#6	6"	11' – 7"	2,819	162	#6	6"	17' – 1"	4,157	11' – 0"	6' – 1"	162	#6	6"	9' – 8"	2,352	6' – 1"	3' – 7"	162	6"	10' – 0"	1,082	7	39' – 9"	186	53	39' – 9"	1,407	11' – 7"	31	26	72	1.702	300.1	0.9	103	69.0	12,106
10' – 0"	10' – 0"	15"	12"	30'	162	#7	6"	11' – 9"	3,891	162	#6	6"	17' – 3"	4,197	11' – 1"	6' – 2"	162	#6	6"	9' – 10"	2,393	6' – 2"	3' – 8"	162	6"	10' – 0"	1,082	7	39' – 9"	186	53	39' – 9"	1,407	11' – 9"	31	26	72	1.852	328.9	0.9	103	75.0	13,259

(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

Texas Department of Transportation

Bridge Division Standard

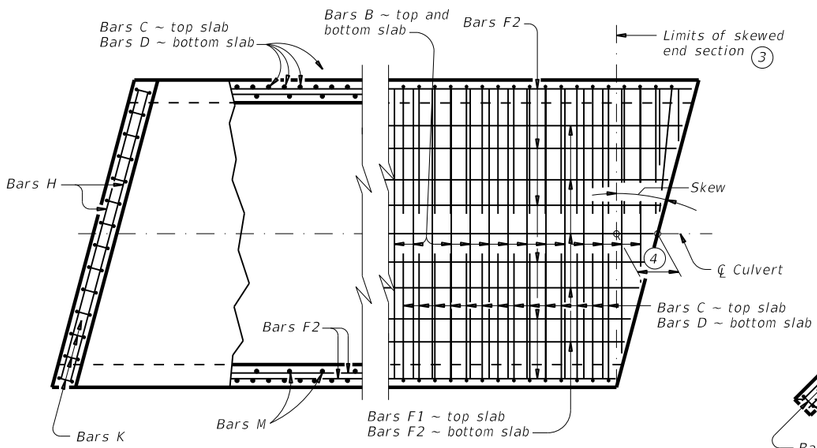
SINGLE BOX CULVERTS CAST-IN-PLACE 0' TO 30' FILL

SCC-10

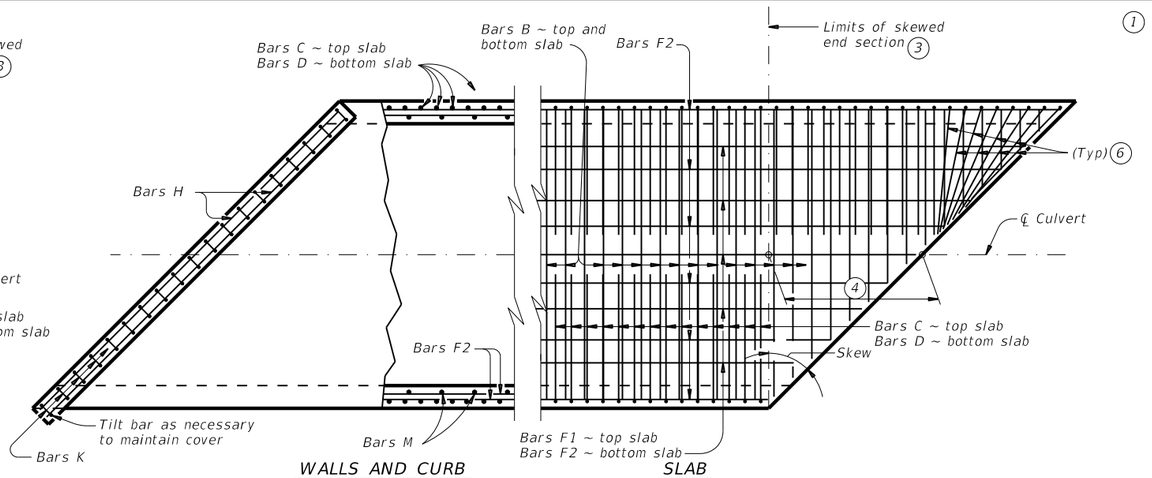
FILE: CD-SCC10-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	DAL	DENTON		123

DATE: 2/21/2024 4:29:56 PM
FILE: DOCUMENT NAME

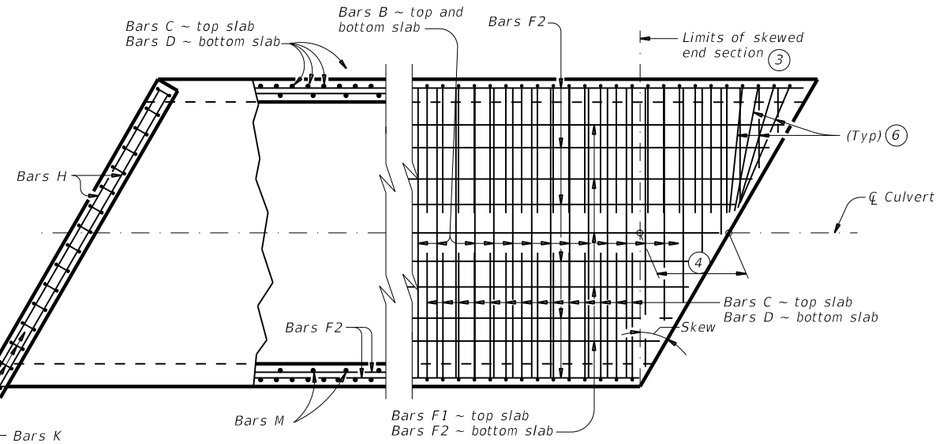
DATE:
FILE:



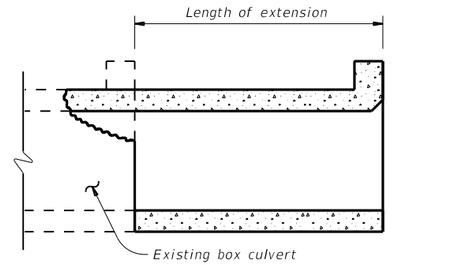
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° (7)



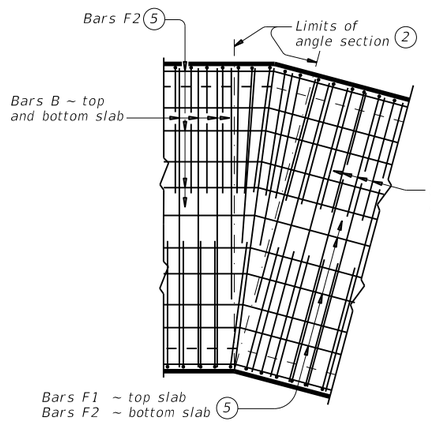
PLAN OF SKEWED ENDS ~ OVER 30° TO 45°



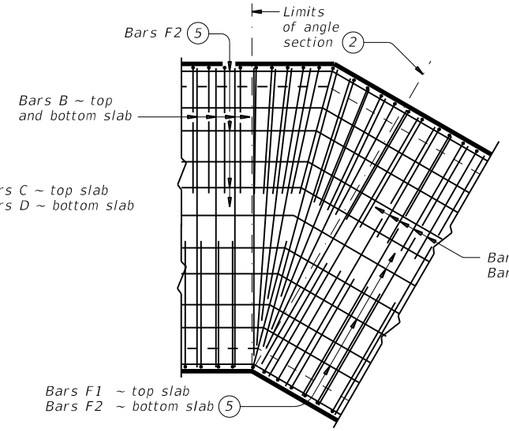
PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



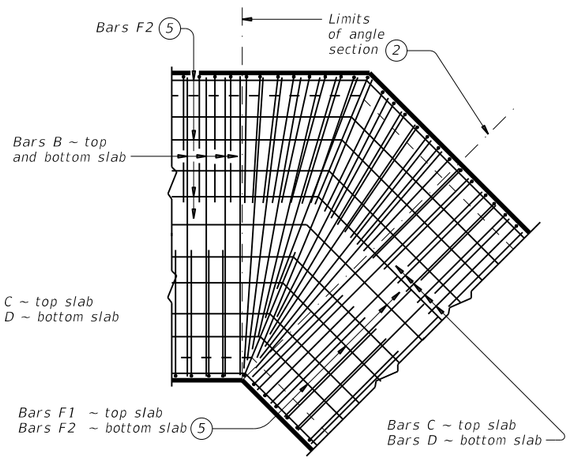
LENGTHENING DETAIL (1)



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 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 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 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, 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

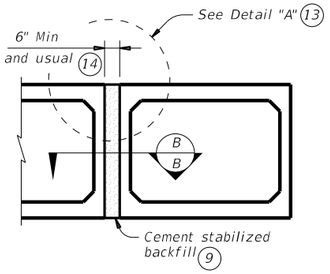
Bridge Division Standard

SINGLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

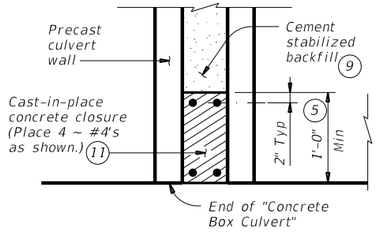
SCC-MD

FILE: CD-SCC-MD-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		124

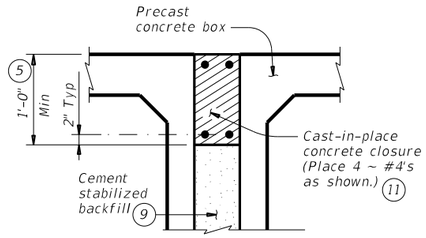
DATE:
FILE:



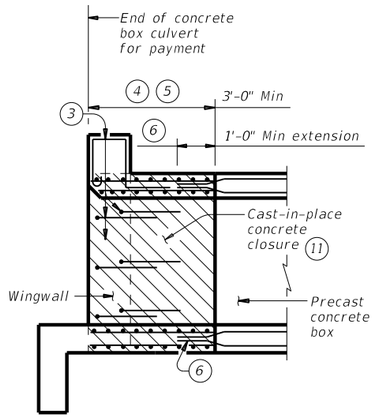
MULTIPLE UNIT PLACEMENT



SECTION B-B

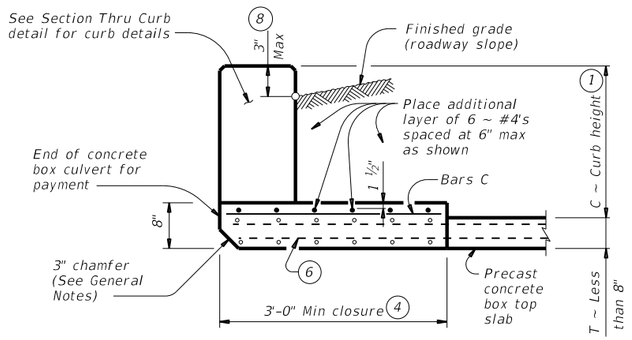


DETAIL "A" (13)

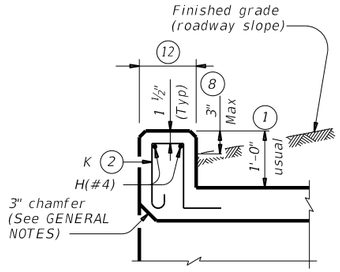


WINGWALL CONNECTION

(Also applies to safety end treatment.)

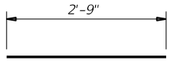


SECTION THRU TOP SLABS LESS THAN 8"



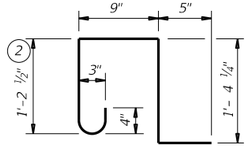
SECTION THRU CURB

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



BARS C (#4)

(Spa = 1'-0" Max)

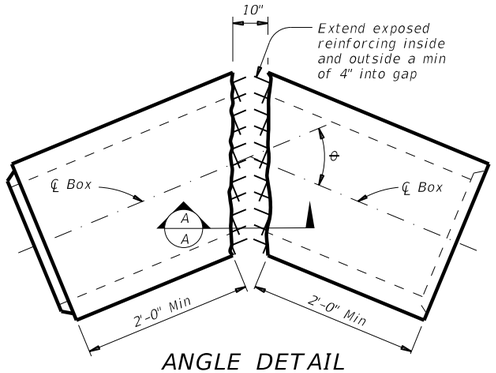


BARS K (#4)

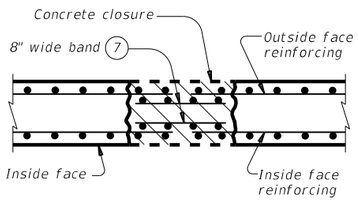
(Spa = 1'-0" Max)
(Length = 4'-2")

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.

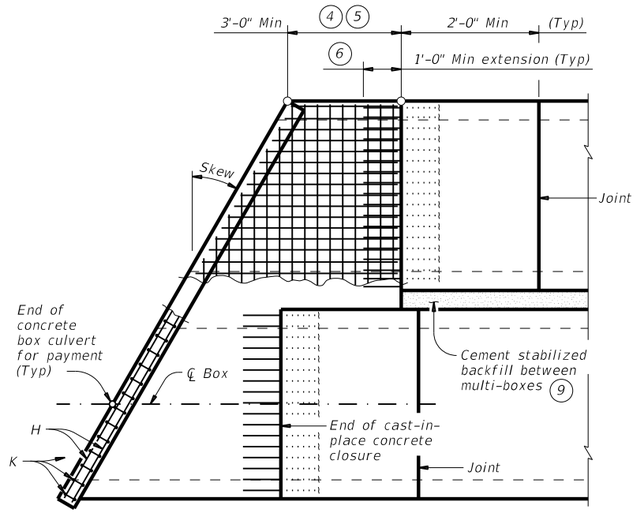
   Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
9. Cement stabilized backfill between boxes is considered part of the box culvert for payment.
10. All curb concrete and reinforcing is 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.



ANGLE DETAIL



SECTION A-A



PLAN OF SKEWED ENDS

(Showing multi-box placement.)

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: CD-SCP-MD-20.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		125

DATE:
FILE:

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

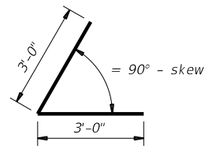
Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing (2~wings) (4)		Estimated Quantities per ft of Toewall (1~toewall)	
					Bars J1		Bars J2					
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'-0"	7"	#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)

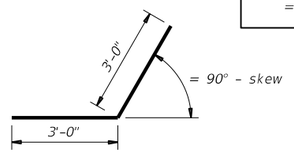
Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

TABLE OF TOEWALL REINFORCING

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



BARS D1



BARS D2

WING DIMENSION FORMULAS:

(All values are in feet.)

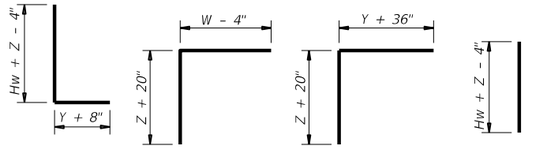
Hw = H + T + C
Lw = (Hw) (SL) ÷ cosine (θ) for Type PW-1
= (Hw - 1') (SL) ÷ cosine (θ) for Type PW-2 and Hw ≥ 4'
= (Hw - 0.5') (SL) ÷ cosine (θ) for Type PW-2 and Hw < 4'

For cast-in-place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ cosine (θ)

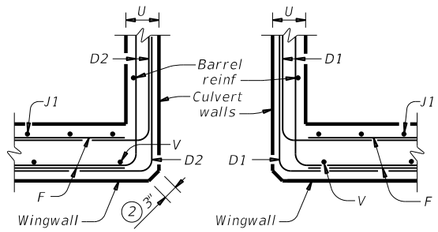
For precast culverts:
Ltw = [(N) (2 U + S) + (N - 1) (0.5')] ÷ cosine (θ)
Total Wingwall Area (two wings ~ SF)
= (2)(Hw)(Lw) for Type PW-1
= (2)(Hw)(Lw) - 6 SF for Type PW-2 and Hw ≥ 4'
= (2)(Hw)(Lw) - 1.5 SF for Type PW-2 and Hw < 4'

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

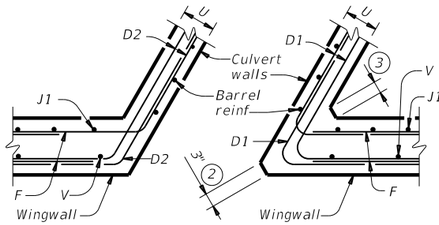
See applicable box culvert standard sheet for S, H, T, and U values.



BARS J1 BARS J2 BARS J3 BARS V



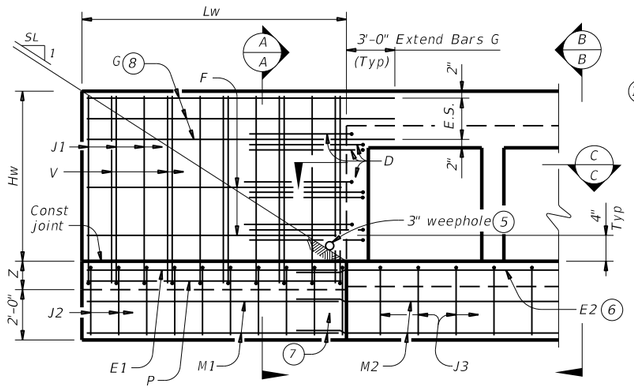
SECTION C-C - PW-1



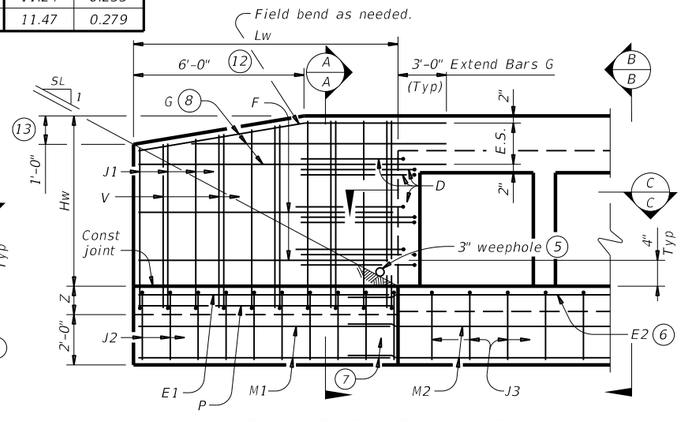
SECTION C-C - PW-2

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.

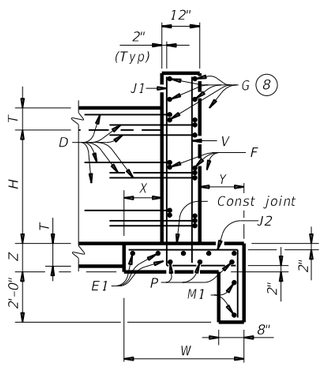
    Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
11. 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elsewhere in the plans.
12. 3'-0" for Hw < 4'.
13. 6" for Hw < 4'.



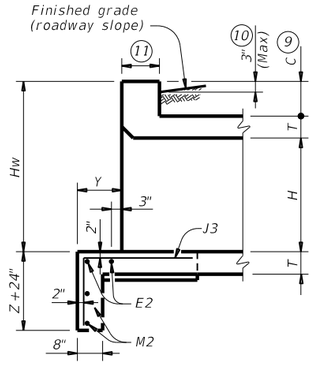
PARTIAL ELEVATION - PW-1



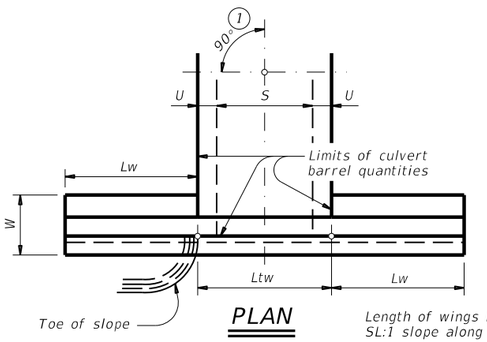
PARTIAL ELEVATION - PW-2



SECTION A-A
(Showing wing reinforcement.)

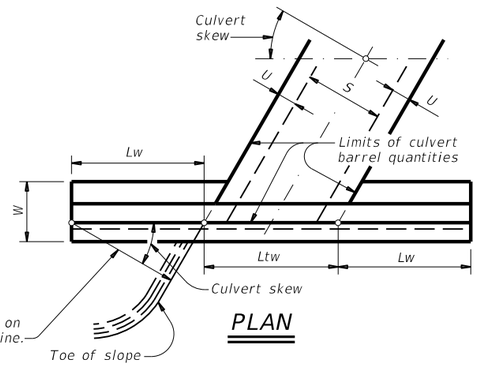


SECTION B-B
(Showing wing reinforcement.)



PLAN

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

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

DESIGNER NOTES:

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

MATERIAL NOTES:

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

GENERAL NOTES:

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

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

Texas Department of Transportation

Bridge Division Standard

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

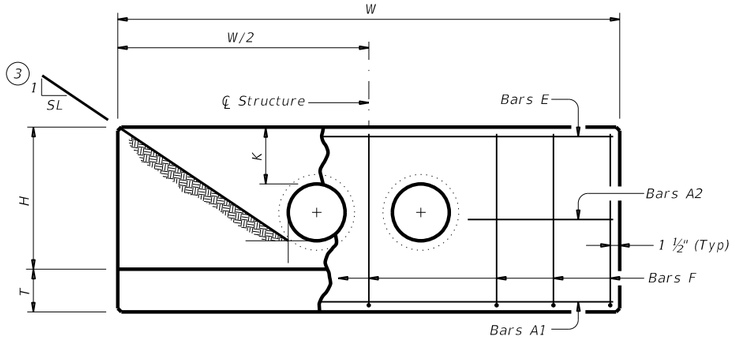
PW

FILE: CD-PW-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		126

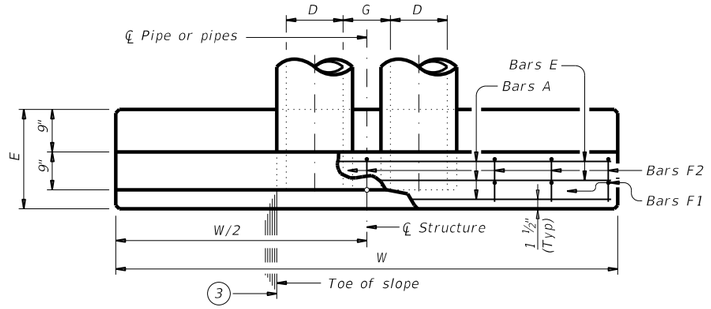
DATE:
FILE:

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

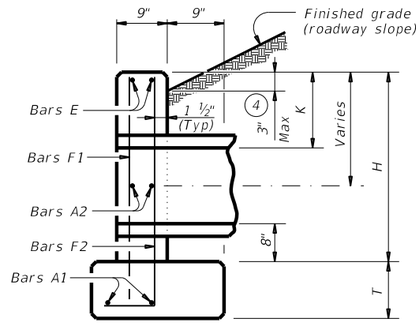
Slope	Dia of Pipe (D)	Values for One Pipe			Values To Be Added for Each Addt'l Pipe		
		W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)
2:1	12"	9' – 0"	122	1.1	1' – 9"	15	0.2
	15"	10' – 3"	136	1.3	2' – 2"	16	0.2
	18"	11' – 6"	163	1.5	2' – 8"	19	0.3
	21"	12' – 9"	200	1.8	3' – 1"	31	0.4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



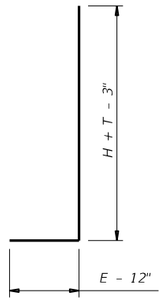
ELEVATION



PLAN OF NON-SKEWED PIPES



SECTION AT CENTER OF PIPE



BARS F2

(1) Total quantities include one 3'–1" lap for bars over 60' in length.

(2) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(3) Indicated slope is perpendicular to centerline pipe or pipes.

(4) For vehicle safety, construct curbs no more than 3" above finished grade. Reduce curb heights, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(5) Dimensions shown are usual and maximum.

(6) Quantities shown are for one structure end only (one headwall).

TABLE OF CONSTANT DIMENSIONS

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

TABLE OF REINFORCING STEEL (6)

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

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

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

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

Texas Department of Transportation

Bridge Division Standard

CONCRETE HEADWALLS
WITH PARALLEL WINGS FOR NON-SKEWED PIPE CULVERTS

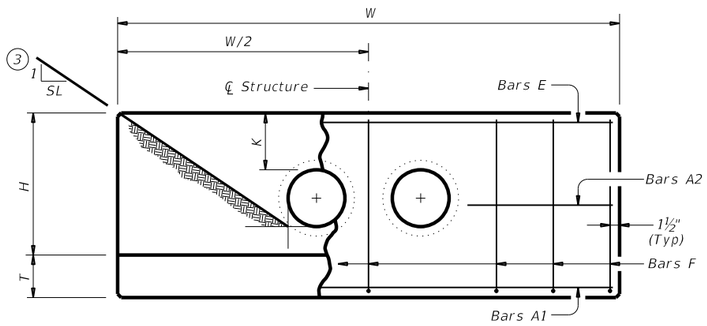
CH-PW-0

FILE: CD-CH-PW0-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		127

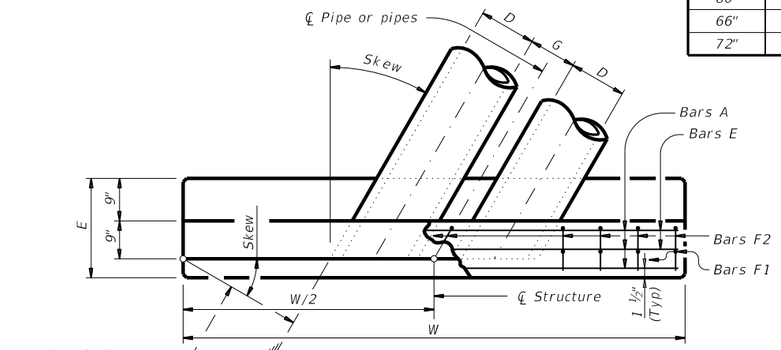
DATE:

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

Slope	Dia of Pipe (D)	15° Skew						30° Skew						45° Skew					
		Values for One Pipe			Values To Be Added for Each Addt'l Pipe			Values for One Pipe			Values To Be Added for Each Addt'l Pipe			Values for One Pipe			Values To Be Added for Each Addt'l Pipe		
		W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)
2:1	12"	9' – 4"	124	1.1	1' – 9 3/4"	15	0.2	10' – 5"	130	1.2	2' – 0"	16	0.2	12' – 9"	159	1.5	2' – 5 3/4"	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 3/4"	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 1/4"	33	0.4
	21"	13' – 2"	203	1.9	3' – 2 1/4"	31	0.4	14' – 9"	233	2.1	3' – 6 3/4"	33	0.4	18' – 0"	276	2.6	4' – 4 1/4"	36	0.5
	24"	14' – 6"	240	2.1	3' – 8 1/4"	34	0.4	16' – 2"	251	2.4	4' – 1 3/4"	36	0.5	19' – 10"	318	2.9	5' – 0 3/4"	39	0.6
	27"	15' – 9"	258	2.5	4' – 0 3/4"	38	0.5	17' – 7"	292	2.8	4' – 6 1/4"	39	0.6	21' – 7"	342	3.4	5' – 6 1/4"	44	0.7
	30"	17' – 1"	297	2.8	4' – 5 3/4"	40	0.6	19' – 1"	311	3.1	5' – 0"	42	0.6	23' – 4"	388	3.8	6' – 1 3/4"	47	0.8
	33"	18' – 5"	320	3.3	4' – 9 3/4"	43	0.6	20' – 6"	358	3.6	5' – 4 3/4"	46	0.7	25' – 1"	439	4.4	6' – 7 1/4"	51	0.9
	36"	19' – 8"	401	4.0	5' – 3"	47	0.9	21' – 11"	422	4.5	5' – 10 3/4"	50	0.9	26' – 10"	517	5.5	7' – 2 1/4"	55	1.2
	42"	22' – 3"	476	5.0	6' – 0 3/4"	53	1.1	24' – 10"	528	5.6	6' – 8 3/4"	56	1.2	30' – 5"	634	6.9	8' – 3"	76	1.4
	48"	25' – 11"	577	6.6	6' – 9 3/4"	60	1.3	28' – 10"	637	7.3	7' – 7 1/4"	79	1.5	35' – 4"	791	9.0	9' – 3 3/4"	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 1/4"	97	2.2
	60"	31' – 1"	805	9.2	8' – 6 1/4"	91	1.9	34' – 8"	881	10.2	9' – 6 1/4"	97	2.1	42' – 5"	1,113	12.5	11' – 8"	124	2.6
	66"	33' – 8"	907	10.6	9' – 0 3/4"	98	2.1	37' – 6"	1,028	11.8	10' – 1 1/4"	102	2.4	46' – 0"	1,235	14.5	12' – 4 1/4"	132	2.9
	72"	36' – 3"	1,071	12.1	9' – 8"	105	2.4	40' – 5"	1,207	13.5	10' – 9 1/4"	110	2.6	49' – 6"	1,446	16.6	13' – 2 1/4"	141	3.2
3:1	12"	13' – 6"	178	1.6	1' – 9 3/4"	15	0.2	15' – 0"	189	1.8	2' – 0"	15	0.2	18' – 5"	237	2.2	2' – 5 3/4"	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 3/4"	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 1/4"	32	0.4
	21"	18' – 11"	306	2.7	3' – 2 1/4"	31	0.4	21' – 1"	339	3.0	3' – 6 3/4"	33	0.4	25' – 10"	413	3.7	4' – 4 1/4"	36	0.5
	24"	20' – 8"	345	3.1	3' – 8 3/4"	35	0.4	23' – 1"	384	3.5	4' – 1 3/4"	36	0.5	28' – 3"	462	4.2	5' – 0 3/4"	40	0.6
	27"	22' – 6"	376	3.7	4' – 0 3/4"	38	0.5	25' – 1"	438	4.1	4' – 6 1/4"	39	0.6	30' – 9"	522	5.0	5' – 6 1/4"	44	0.7
	30"	24' – 4"	422	4.1	4' – 5 3/4"	40	0.6	27' – 2"	466	4.6	5' – 0"	42	0.6	33' – 3"	578	5.6	6' – 1 3/4"	47	0.8
	33"	26' – 2"	476	4.8	4' – 10"	43	0.6	29' – 2"	522	5.3	5' – 4 3/4"	46	0.7	35' – 9"	644	6.5	6' – 7 1/4"	51	0.9
	36"	27' – 11"	590	5.9	5' – 3"	47	0.8	31' – 2"	645	6.6	5' – 10 3/4"	50	0.9	38' – 2"	787	8.0	7' – 2 1/4"	56	1.2
	42"	31' – 7"	684	7.3	6' – 0 1/4"	53	1.1	35' – 3"	776	8.2	6' – 8 3/4"	56	1.2	43' – 2"	933	10.0	8' – 3"	79	1.4
	48"	36' – 9"	880	9.6	6' – 9 3/4"	61	1.3	41' – 0"	953	10.7	7' – 7 1/4"	81	1.5	50' – 2"	1,166	13.1	9' – 3 3/4"	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 1/4"	97	2.2
	60"	44' – 0"	1,224	13.3	8' – 6 1/4"	93	1.9	49' – 1"	1,356	14.8	9' – 6 1/4"	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 1/4"	103	2.3	65' – 1"	1,892	21.1	12' – 4 1/4"	130	2.9
	72"	51' – 3"	1,624	17.7	9' – 8"	105	2.3	57' – 2"	1,787	19.7	10' – 9 1/4"	109	2.6	70' – 0"	2,218	24.1	13' – 2 1/4"	139	3.2
4:1	12"	17' – 7"	232	2.1	1' – 9 3/4"	15	0.2	19' – 8"	259	2.4	2' – 0"	16	0.2	24' – 0"	314	2.9	2' – 5 3/4"	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 3/4"	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 1/4"	32	0.4
	21"	24' – 7"	407	3.6	3' – 2 1/4"	31	0.4	27' – 5"	446	4.0	3' – 6 3/4"	33	0.4	33' – 7"	549	4.9	4' – 4 1/4"	36	0.5
	24"	26' – 11"	455	4.1	3' – 8 3/4"	35	0.4	30' – 0"	499	4.5	4' – 1 3/4"	36	0.5	36' – 9"	609	5.6	5' – 0 3/4"	40	0.6
	27"	29' – 3"	514	4.8	4' – 0 3/4"	38	0.5	32' – 7"	562	5.4	4' – 6 1/4"	40	0.6	39' – 11"	703	6.6	5' – 6 1/4"	43	0.7
	30"	31' – 7"	568	5.4	4' – 5 3/4"	40	0.6	35' – 3"	620	6.0	5' – 0"	42	0.6	43' – 2"	768	7.4	6' – 1 3/4"	49	0.8
	33"	33' – 11"	634	6.2	4' – 10"	43	0.7	37' – 10"	710	7.0	5' – 4 3/4"	46	0.7	46' – 4"	848	8.5	6' – 7 1/4"	52	0.9
	36"	36' – 3"	776	7.7	5' – 3"	48	0.9	40' – 5"	868	8.6	5' – 10 3/4"	49	0.9	49' – 6"	1,058	10.6	7' – 2 1/4"	56	1.1
	42"	40' – 11"	921	9.6	6' – 0 1/4"	53	1.0	45' – 7"	1,022	10.7	6' – 8 3/4"	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 1/4"	80	1.5	65' – 1"	1,587	17.2	9' – 3 3/4"	86	1.8
	54"	52' – 3"	1,416	14.9	7' – 9 1/4"	86	1.6	58' – 4"	1,589	16.6	8' – 8"	89	1.8	71' – 5"	1,924	20.4	10' – 7 1/4"	95	2.2
	60"	56' – 11"	1,606	17.5	8' – 6 3/4"	92	1.9	63' – 6"	1,806	19.5	9' – 6 1/4"	95	2.1	77' – 9"	2,192	23.9	11' – 8"	122	2.6
	66"	61' – 7"	1,819	20.2	9' – 0 3/4"	97	2.1	68' – 8"	2,019	22.5	10' – 1 1/4"	101	2.4	84' – 2"	2,472	27.6	12' – 4 1/4"	131	2.9
	72"	66' – 3"	2,150	23.2	9' – 8"	104	2.4	73' – 11"	2,379	25.9	10' – 9 1/4"	108	2.6	90' – 6"	2,937	31.7	13' – 2 1/4"	138	3.2
6:1	12"	25' – 11"	342	3.1	1' – 9 3/4"	15	0.2	28' – 10"	374	3.5	2' – 0"	16	0.2	35' – 4"	456	4.3	2' – 5 3/4"	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 3/4"	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 1/4"	33	0.4
	21"	36' – 0"	608	5.3	3' – 2 1/4"	31	0.4	40' – 2"	660	5.9	3' – 6 3/4"	33	0.4	49' – 2"	823	7.2	4' – 4 1/4"	38	0.5
	24"	39' – 4"	672	6.0	3' – 8 3/4"	35	0.4	43' – 11"	748	6.7	4' – 1 3/4"	36	0.5	53' – 9"	920	8.2	5' – 0 3/4"	42	0.6
	27"	42' – 8"	770	7.1	4' – 0 3/4"	38	0.5	47' – 8"	852	8.0	4' – 6 1/4"	41	0.5	58' – 4"	1,039	9.7	5' – 6 1/4"	45	0.7
	30"	46' – 1"	839	8.0	4' – 5 3/4"	40	0.6	51' – 5"	949	8.9	5' – 0"	44	0.6	62' – 11"	1,162	10.9	6' – 1 3/4"	48	0.8
	33"	49' – 5"	947	9.2	4' – 10"	45	0.7	55' – 2"	1,040	10.3	5' – 4 3/4"	48	0.7	67' – 6"	1,292	12.6	6' – 7 1/4"	50	0.9
	36"	52' – 10"	1,151	11.4	5' – 3"	49	0.8	58' – 11"	1,287	12.7	5' – 10 3/4"	51	1.0	72' – 1"	1,583	15.6	7' – 2 1/4"	55	1.1
	42"	59' – 6"	1,365	14.2	6' – 0 1/4"	55	1.0	66' – 5"	1,530	15.8	6' – 8 3/4"	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 1/4"	79	1.5	94' – 9"	2,368	25.3	9' – 3 3/4"	86	1.8
	54"	76' – 1"	2,138	22.0	7' – 9 1/4"	83	1.6	84' – 10"	2,378	24.6	8' – 8"	87	1.8	103' – 11"	2,912	30.1	10' – 7 1/4"	95	2.2
	60"	82' – 10"	2,426	25.8	8' – 6 3/4"	90	1.9	92' – 5"	2,681	28.8	9' – 6 1/4"	94	2.1	113' – 2"	3,294	35.3	11' – 8"	122	2.6
	66"	89' – 7"	2,730	29.9	9' – 0 3/4"	96	2.1	99' – 11"	3,038	33.3	10' – 1 1/4"	101	2.4	122' – 4"	3,697	40.8	12' – 4 1/4"	130	2.9
	72"	96' – 3"	3,218	34.2	9' – 8"	102	2.4	107' – 5"	3,580	38.2	10' – 9 1/4"	108	2.6	131' – 6"	4,372	46.8	13' – 2 1/4"	139	3.2

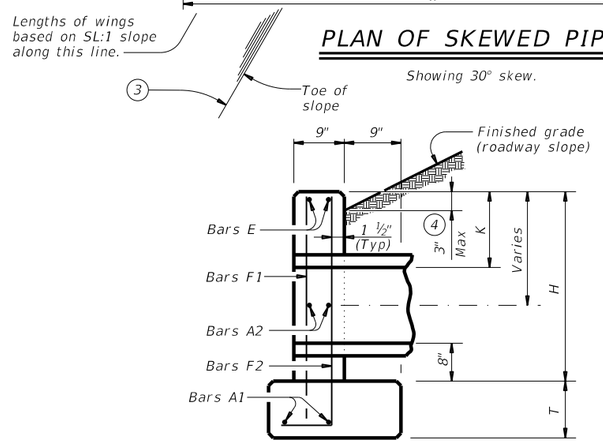


ELEVATION



PLAN OF SKEWED PIPES

Showing 30° skew.



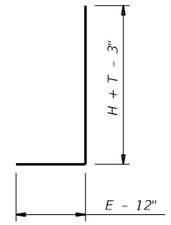
SECTION AT CENTER OF PIPE

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 (6) REINFORCING STEEL

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 quantities include one 3'-1" lap for bars over 60' in length.

(2) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(3) Indicated slope is perpendicular to centerline pipe or pipes.

(4) For vehicle safety, construct curbs no more than 3" above finished grade. Reduce curb heights, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(5) Dimensions shown are usual and maximum.

(6) Quantities shown are for one structure end only (one headwall).

Texas Department of Transportation

Bridge Division Standard

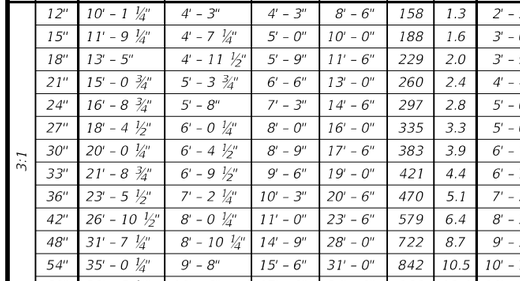
CONCRETE HEADWALLS
WITH PARALLEL WINGS FOR SKEWED PIPE CULVERTS

CH-PW-S

FILE: CD-CH-PWS-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		128

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)
2:1	12"	7' - 7 3/4"	4' - 3"	2' - 10"	5' - 8"	119	0.9	2' - 5 3/4"	26	0.3
	15"	8' - 10 1/2"	4' - 7 1/4"	3' - 4"	6' - 8"	135	1.1	3' - 0 3/4"	32	0.4
	18"	10' - 1 1/4"	4' - 11 1/2"	3' - 10"	7' - 8"	167	1.3	3' - 9 1/4"	48	0.5
	21"	11' - 3 3/4"	5' - 3 3/4"	4' - 4"	8' - 8"	187	1.6	4' - 4 1/4"	54	0.6
	24"	12' - 6 1/2"	5' - 8"	4' - 10"	9' - 8"	214	1.8	5' - 0 3/4"	67	0.8
	27"	13' - 9"	6' - 0 1/4"	5' - 4"	10' - 8"	231	2.1	5' - 6 1/2"	73	0.9
	30"	14' - 11 3/4"	6' - 4 1/2"	5' - 10"	11' - 8"	265	2.5	6' - 1 1/2"	86	1.1
	33"	16' - 3"	6' - 9 1/2"	6' - 4"	12' - 8"	292	2.8	6' - 7 1/4"	92	1.2
	36"	17' - 6 1/4"	7' - 2 1/4"	6' - 10"	13' - 8"	324	3.2	7' - 2 1/4"	107	1.4
	42"	20' - 1"	8' - 0 1/2"	7' - 10"	15' - 8"	391	4.0	8' - 3"	138	1.8
	48"	23' - 6"	8' - 10 1/4"	9' - 4"	18' - 8"	478	5.4	9' - 3 3/4"	167	2.4
	54"	26' - 0 3/4"	9' - 8"	10' - 4"	20' - 8"	561	6.4	10' - 7 1/4"	198	3.0
	60"	28' - 7 1/2"	10' - 6"	11' - 4"	22' - 8"	632	7.5	11' - 8"	243	3.6
	66"	31' - 2 1/4"	11' - 3 3/4"	12' - 4"	24' - 8"	724	8.8	12' - 4 1/2"	269	4.0
	72"	33' - 8 3/4"	12' - 1 3/4"	13' - 4"	26' - 8"	803	10.1	13' - 2 1/2"	303	4.6
3:1	12"	10' - 1 1/4"	4' - 3"	4' - 3"	8' - 6"	158	1.3	2' - 5 3/4"	28	0.3
	15"	11' - 9 1/4"	4' - 7 1/4"	5' - 0"	10' - 0"	188	1.6	3' - 0 3/4"	37	0.5
	18"	13' - 5"	4' - 11 1/2"	5' - 9"	11' - 6"	229	2.0	3' - 9 1/4"	55	0.6
	21"	15' - 0 3/4"	5' - 3 3/4"	6' - 6"	13' - 0"	260	2.4	4' - 4 1/4"	62	0.8
	24"	16' - 8 3/4"	5' - 8"	7' - 3"	14' - 6"	297	2.8	5' - 0 3/4"	77	1.0
	27"	18' - 4 1/2"	6' - 0 1/4"	8' - 0"	16' - 0"	335	3.3	5' - 6 1/2"	88	1.2
	30"	20' - 0 1/4"	6' - 4 1/2"	8' - 9"	17' - 6"	383	3.9	6' - 1 1/2"	103	1.4
	33"	21' - 8 3/4"	6' - 9 1/2"	9' - 6"	19' - 0"	421	4.4	6' - 7 1/4"	111	1.6
	36"	23' - 5 1/2"	7' - 2 1/4"	10' - 3"	20' - 6"	470	5.1	7' - 2 1/4"	126	1.9
	42"	26' - 10 1/2"	8' - 0 1/4"	11' - 0"	23' - 6"	579	6.4	8' - 3"	168	2.4
	48"	31' - 7 1/4"	8' - 10 1/4"	14' - 9"	28' - 0"	722	8.7	9' - 3 3/4"	210	3.2
	54"	35' - 0 1/4"	9' - 8"	15' - 6"	31' - 0"	842	10.5	10' - 7 1/4"	249	4.0
	60"	38' - 5 1/4"	10' - 6"	17' - 0"	34' - 0"	966	12.4	11' - 8"	306	4.8
	66"	41' - 10 1/4"	11' - 3 3/4"	18' - 6"	37' - 0"	1,106	14.5	12' - 4 1/2"	338	5.5
4:1	12"	12' - 6 3/4"	4' - 3"	5' - 8"	11' - 4"	207	1.7	2' - 5 3/4"	32	0.4
	15"	14' - 7 3/4"	4' - 7 1/4"	6' - 8"	13' - 4"	246	2.2	3' - 0 3/4"	43	0.6
	18"	16' - 8 3/4"	4' - 11 1/2"	7' - 8"	15' - 4"	300	2.8	3' - 9 1/4"	61	0.8
	21"	18' - 9 3/4"	5' - 3 3/4"	8' - 8"	17' - 4"	349	3.4	4' - 4 1/4"	73	1.0
	24"	20' - 10 3/4"	5' - 8"	9' - 8"	19' - 4"	400	4.0	5' - 0 3/4"	90	1.3
	27"	23' - 0"	6' - 0 1/4"	10' - 8"	21' - 4"	451	4.8	5' - 6 1/2"	103	1.5
	30"	25' - 1"	6' - 4 1/2"	11' - 8"	23' - 4"	516	5.5	6' - 1 1/2"	120	1.8
	33"	27' - 2 3/4"	6' - 9 1/2"	12' - 8"	25' - 4"	580	6.4	6' - 7 1/4"	134	2.0
	36"	29' - 4 1/2"	7' - 2 1/4"	13' - 8"	27' - 4"	639	7.3	7' - 2 1/4"	152	2.4
	42"	33' - 8"	8' - 0 1/4"	15' - 8"	31' - 4"	789	9.4	8' - 3"	198	3.0
	48"	39' - 8"	8' - 10 1/4"	18' - 8"	37' - 4"	1,001	12.8	9' - 3 3/4"	255	4.0
6:1	12"	17' - 5 3/4"	4' - 3"	8' - 6"	17' - 0"	299	2.9	2' - 5 3/4"	38	0.5
	15"	20' - 5"	4' - 7 1/4"	10' - 0"	20' - 0"	371	3.7	3' - 0 3/4"	51	0.8
	18"	23' - 4 1/2"	4' - 11 1/2"	11' - 6"	23' - 0"	449	4.7	3' - 9 1/4"	73	1.0
	21"	26' - 4"	5' - 3 3/4"	13' - 0"	26' - 0"	537	5.8	4' - 4 1/4"	89	1.3
	24"	29' - 3 1/4"	5' - 8"	14' - 6"	29' - 0"	611	7.0	5' - 0 3/4"	110	1.7
	27"	32' - 2 3/4"	6' - 0 1/4"	16' - 0"	32' - 0"	708	8.3	5' - 6 1/2"	129	2.0
	30"	35' - 2 1/4"	6' - 4 1/2"	17' - 6"	35' - 0"	807	9.7	6' - 1 1/2"	150	2.4
	33"	38' - 2 1/4"	6' - 9 1/2"	19' - 0"	38' - 0"	921	11.3	6' - 7 1/4"	170	2.8

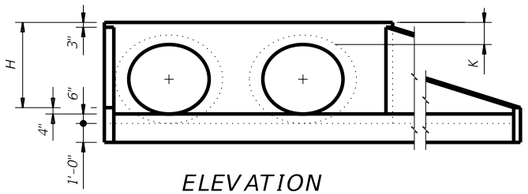


BARS CL (Length = 2'-5 1/4")

BARS VL and VS

BARS CS (Length = 2'-3")

BARS B and B1-x



ELEVATION

(Showing dimensions.)

1. Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.
2. 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.
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 only (one headwall).
6. Min Length = $6" + 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right)$

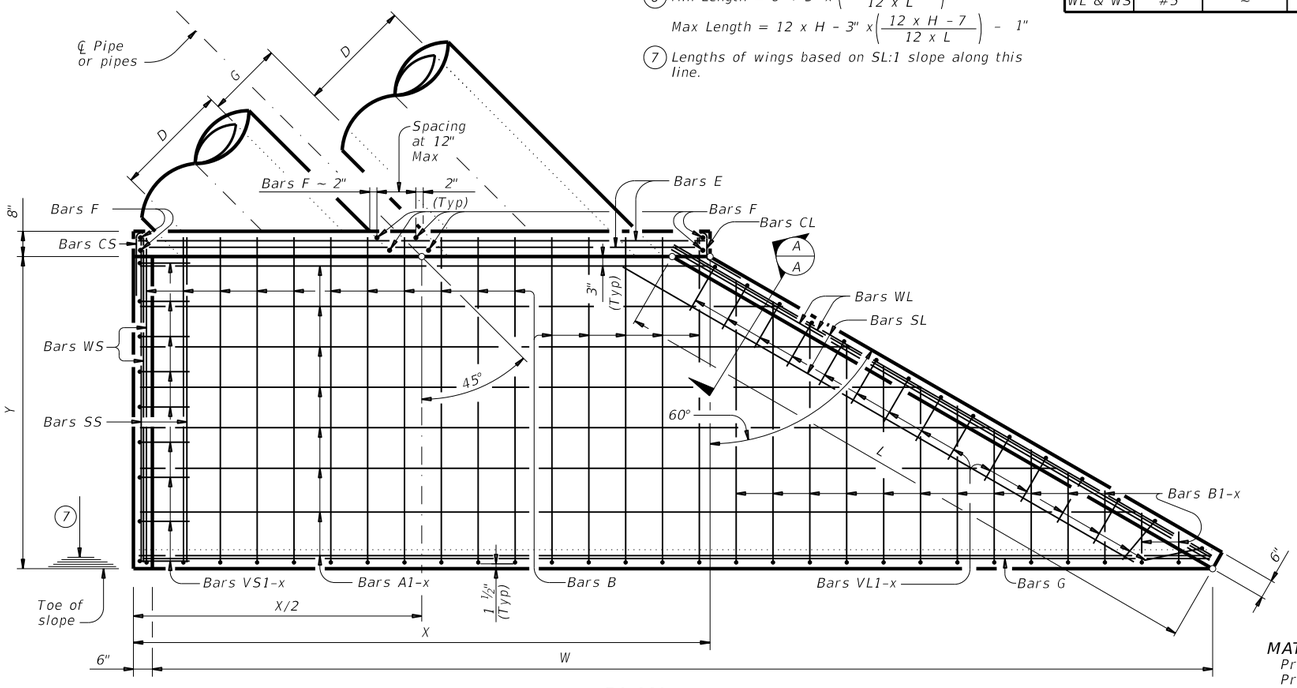
   Max Length = $12 \times H - 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right) - 1"$
7. Lengths of wings based on SL:1 slope along this line.

TABLE OF (5) REINFORCING STEEL

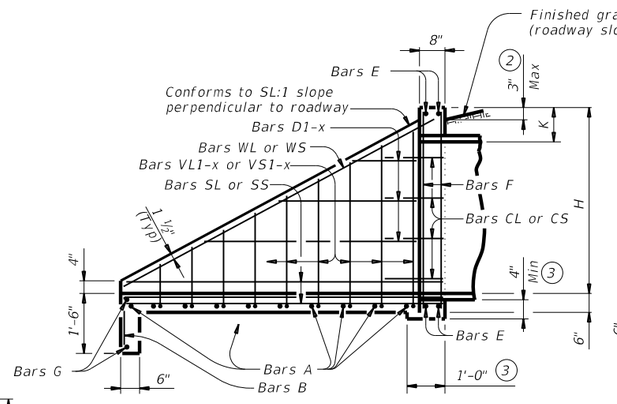
Bar	Size	Spa	No.
A	#4	1' - 0"	~
B	#3	1' - 6"	~
CL & CS	#4	1' - 0"	~
D	#3	1' - 0"	~
E	#5	~	4
F	#5	~	~
G	#3	~	2
SL & SS	#4	~	6
VL & VS	#4	1' - 0"	~
WL & WS	#5	~	4

TABLE OF CONSTANT DIMENSIONS

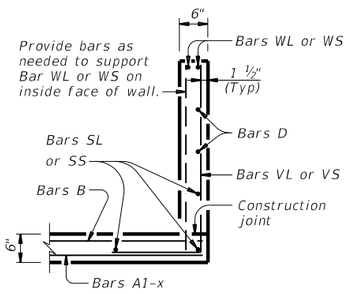
Dia of Pipe (D)	G	K (4)	H
12"	0' - 9"	1' - 0"	2' - 0"
15"	0' - 11"	1' - 0"	2' - 3"
18"	1' - 2"	1' - 0"	2' - 6"
21"	1' - 4"	1' - 0"	2' - 9"
24"	1' - 7"	1' - 0"	3' - 0"
27"	1' - 8"	1' - 0"	3' - 3"
30"	1' - 10"	1' - 0"	3' - 6"
33"	1' - 11"	1' - 0"	3' - 9"
36"	2' - 1"	1' - 0"	4' - 0"
42"	2' - 4"	1' - 0"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



PLAN



TYPICAL WING ELEVATION



SECTION A-A

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.

Texas Department of Transportation

Bridge Division Standard

CONCRETE HEADWALLS WITH FLARED WINGS FOR 45° SKEW PIPE CULVERTS

CH-FW-45

FILE: CD-CH-FW45-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
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	DAL	DENTON		129

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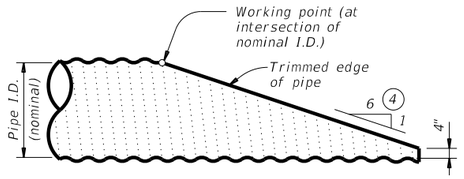
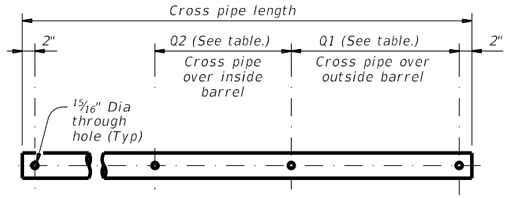


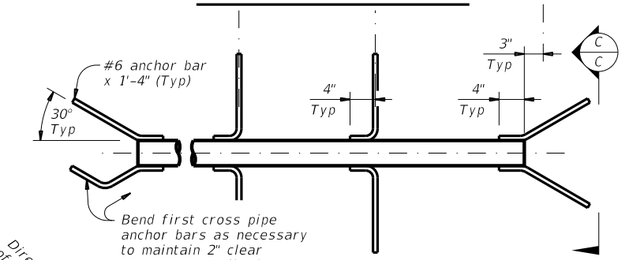
NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

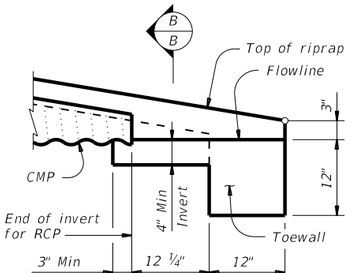
(Showing corrugated metal pipe (CMP) culvert Details at reinforced concrete pipe (RCP) culvert are similar.)



PIPE WITH BOLTED ANCHOR

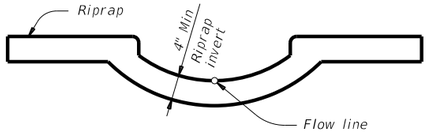


PIPE WITH ANCHOR BARS



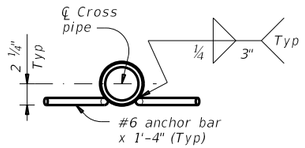
DETAIL "A"

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



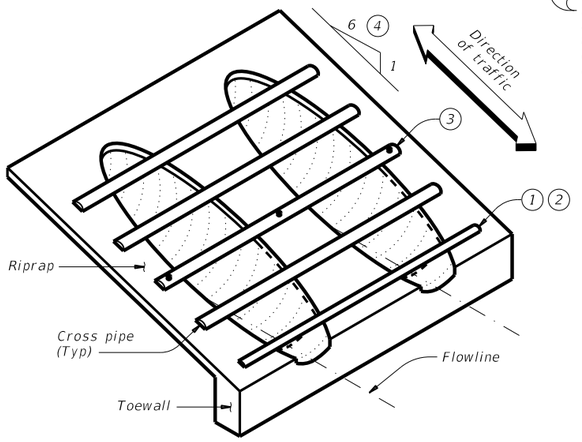
SECTION B-B

(Cross pipes not shown for clarity.)

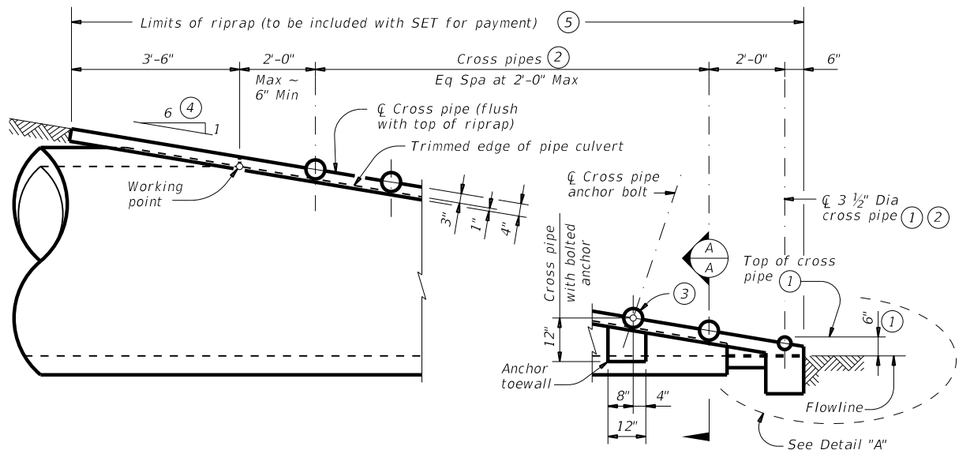


SECTION C-C

CROSS PIPE DETAILS

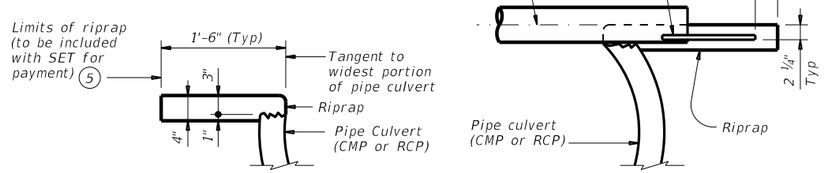


ISOMETRIC VIEW OF TYPICAL INSTALLATION



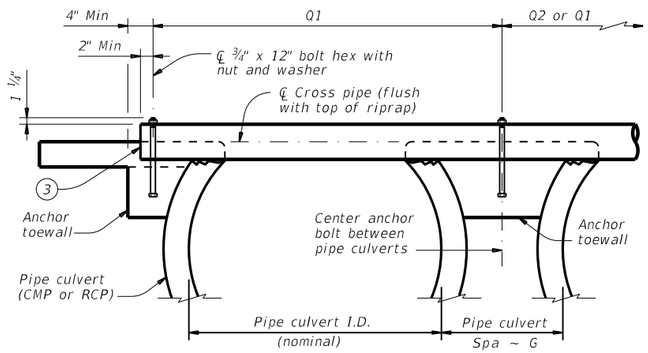
SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

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



SHOWING TYPICAL PIPE CULVERT AND RIPRAP

SHOWING CROSS PIPE WITH ANCHOR BAR



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, AND RIPRAP QUANTITIES (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.

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT
FOR 12" DIA TO 72" DIA PIPE CULVERTS
TYPE II ~ PARALLEL DRAINAGE
SETP-PD

FILE: CD-SETP-PD-20.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
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	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		130

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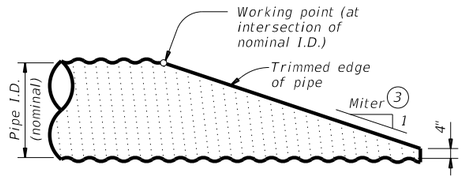
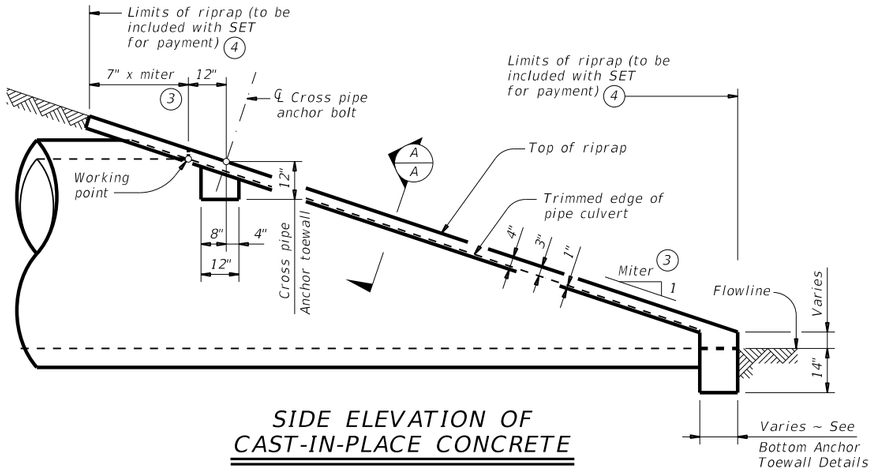


NOTE: All pipe runners, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

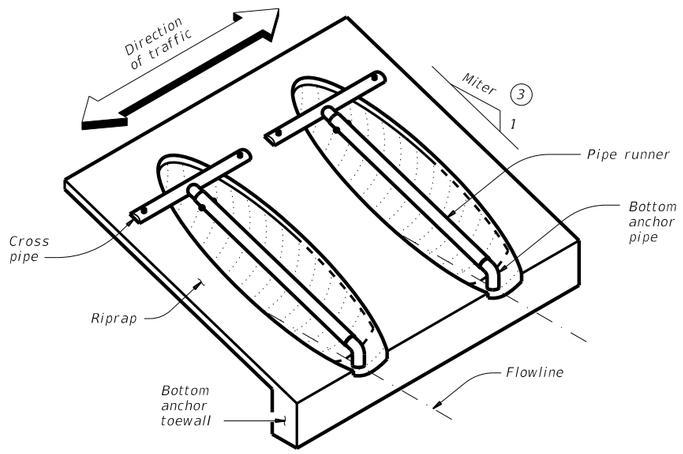
SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

(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 Span ~ 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

FILE: CD-SETP-CD-20.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
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REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		131

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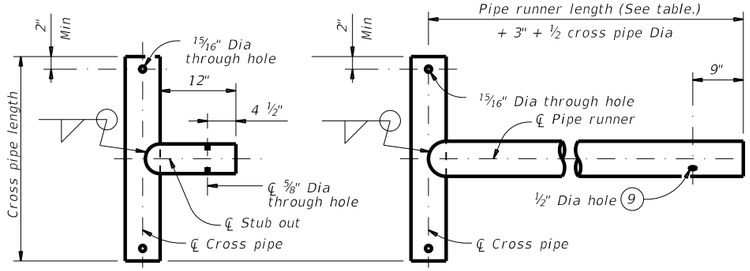
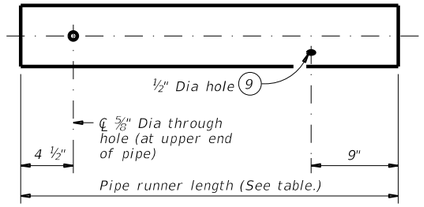


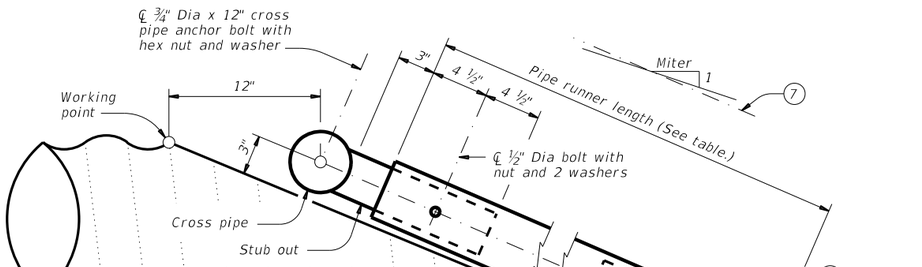
OPTION A1 OPTION A2

CROSS PIPE AND CONNECTIONS DETAILS



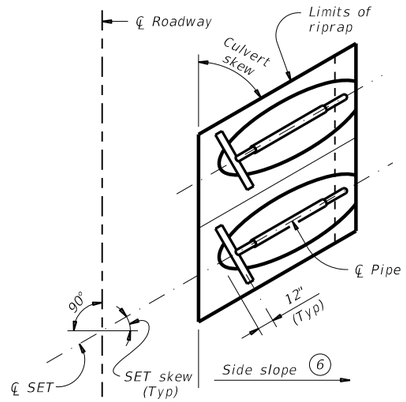
NOTE: The separate pipe runner shown is required when Cross Pipe Connection Option A1 is used.

PIPE RUNNER DETAILS

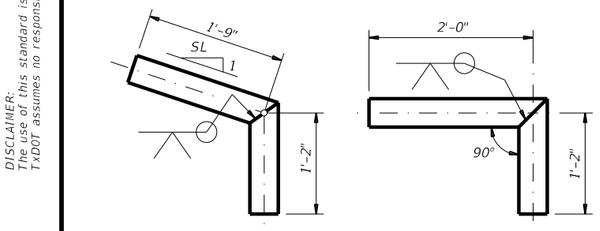


SIDE ELEVATION OF SAFETY END TREATMENT INSTALLATION

(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)

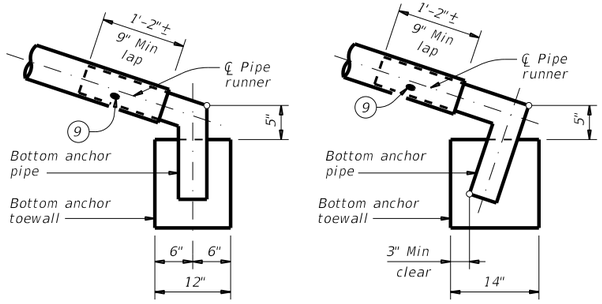


PLAN OF SKEWED INSTALLATION



OPTION B1 OPTION B2

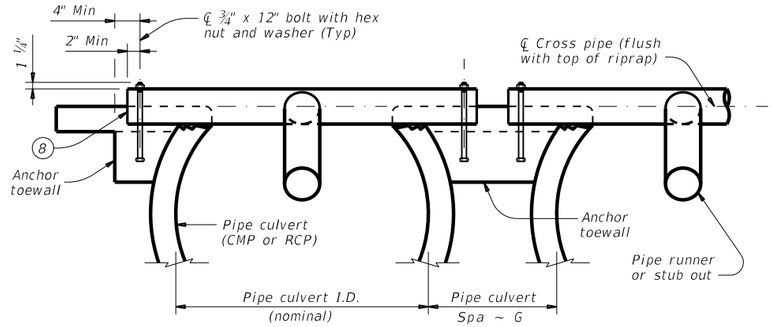
BOTTOM ANCHOR PIPE DETAILS (10)



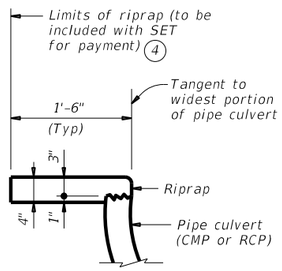
OPTION B1 OPTION B2

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

FILE: CD-SETP-CD-20.dgn		DN: GAF	CK: CAT	DW: JRP	CK: GAF		
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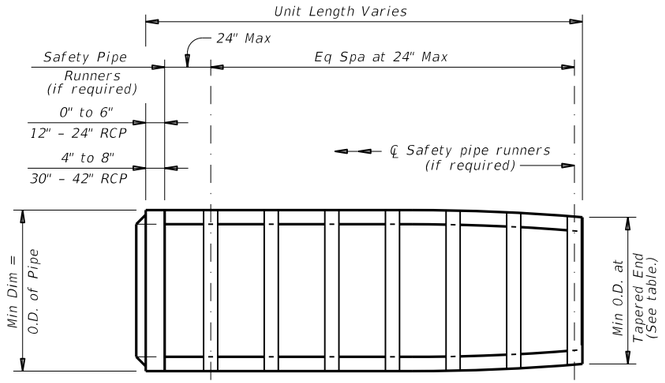
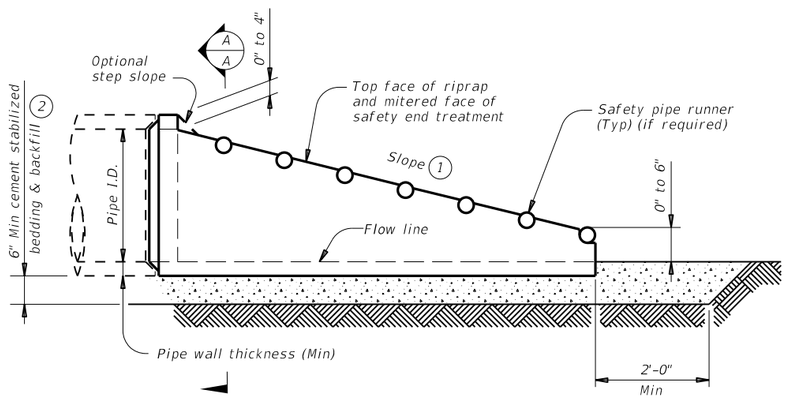
REVISIONS		2353	02	028		FM 2450	
		DIST	COUNTY			SHEET NO.	
		5DIST	DENTON			132	



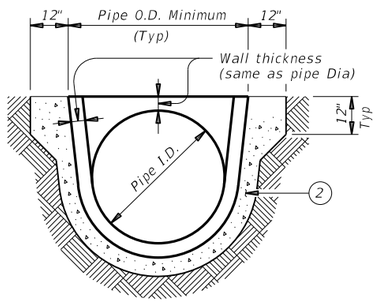
PLAN VIEW – 12" THRU 24"

(Showing spigot end connection.)

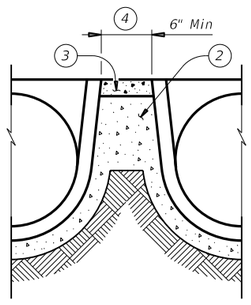


LONGITUDINAL ELEVATION - 12" THRU 24"

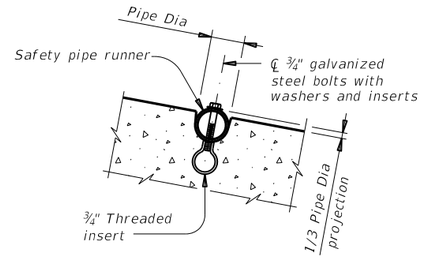
(Showing spigot end connection.)



SECTION A-A

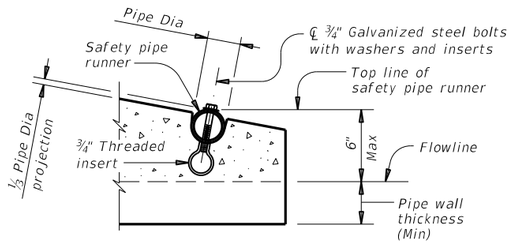


MULTIPLE PIPE INSTALLATION

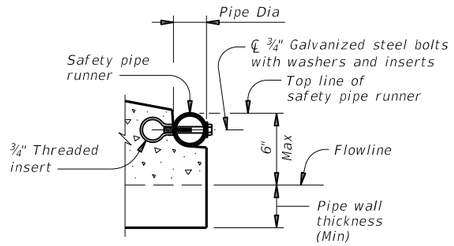


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



OPTION A



OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)

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

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

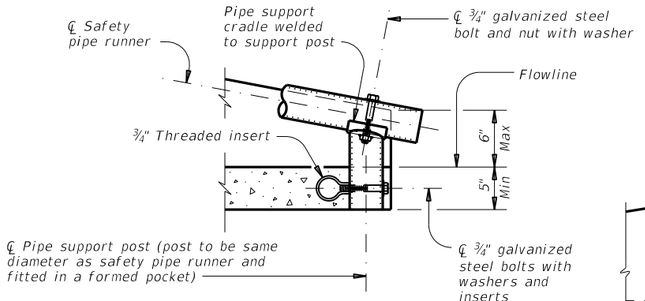
PSET-RP

FILE: CD-PSET-RP-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		133

DATE:
FILE:

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 Pipe Runners Required	Multiple Pipes Skew	Multiple Pipes Pipe Runners Required
12"	2"	1.15"	17.00"	3:1	2' – 11"	≤ 45°	No	≤ 45°	No
				4:1	3' – 6"				
				6:1	4' – 9"				
15"	2 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"	2.7"	52.50"	3:1	11' – 1"	≥ 0°	Yes	≥ 0°	Yes
				4:1	14' – 5"				
				6:1	21' – 2"				

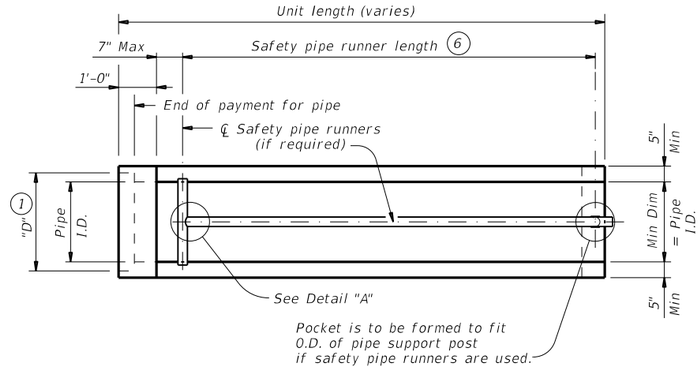


END DETAIL FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)

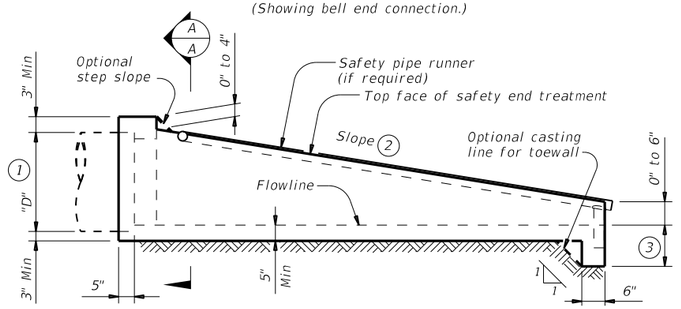
OPTIONAL JOINT FOR RCP

(Showing joint between RCP and precast safety end treatment)



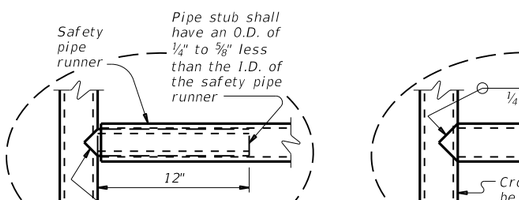
PLAN

(Showing bell end connection.)

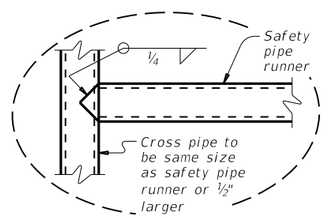


LONGITUDINAL ELEVATION

(Showing bell end connection.)



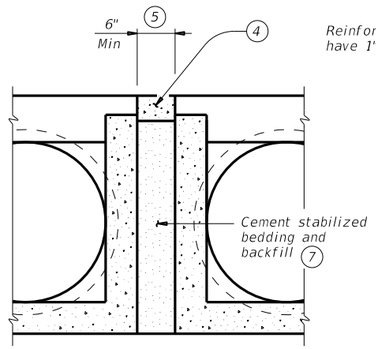
OPTION A



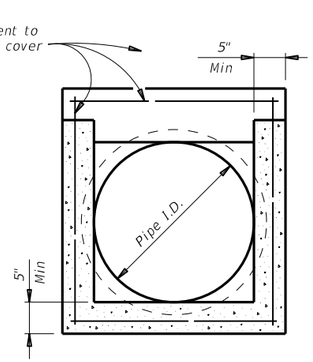
OPTION B

DETAIL A

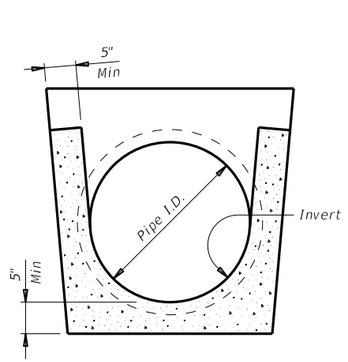
(If required)



MULTIPLE PIPE INSTALLATION

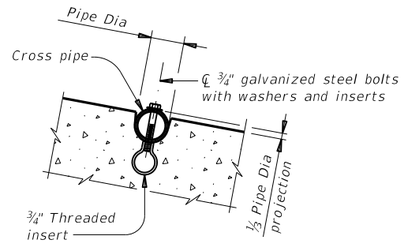


OPTION WITH SQUARE BOTTOM



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 Pipe and Box Grouted Connections (PBGC) standard for grouted connections with TP and precast safety end treatment.

Texas Department of Transportation

Bridge Division Standard

PRECAST SAFETY END TREATMENT

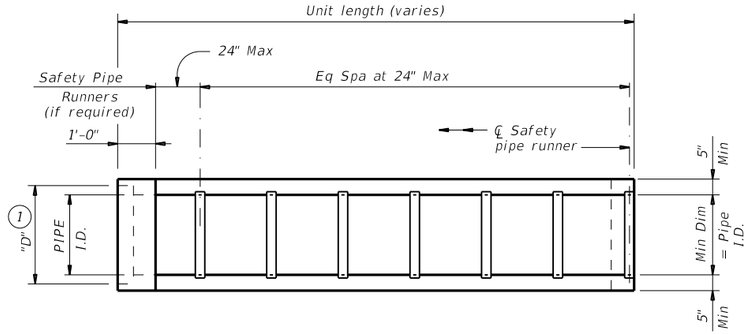
TYPE II ~ CROSS DRAINAGE

PSET-SC

FILE: CD-PSET-SC-21.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: Added 42" TP	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		134

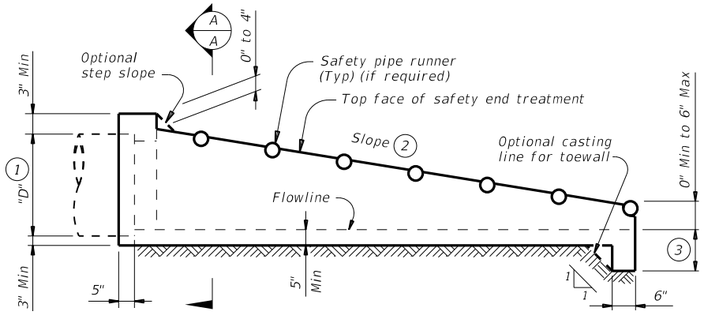
DATE:
FILE:

DATE:
FILE:



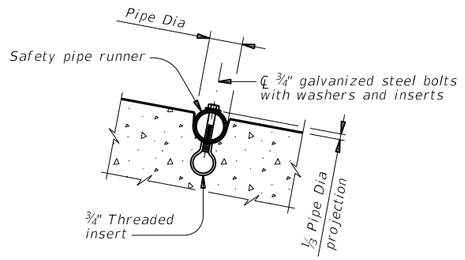
PLAN

(Showing bell end connection.)



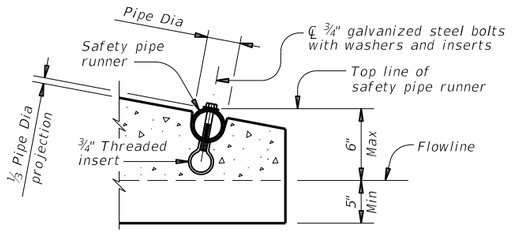
LONGITUDINAL ELEVATION

(Showing bell end connection.)

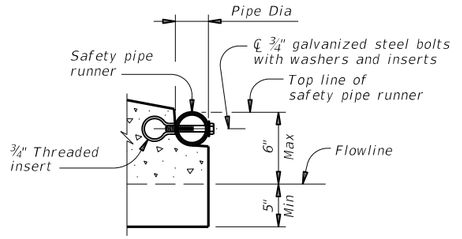


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



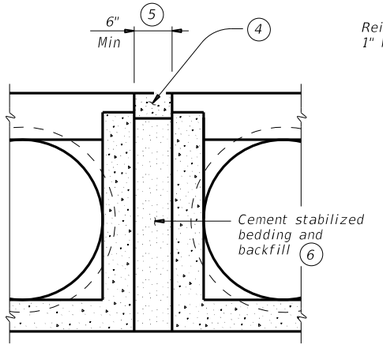
OPTION A



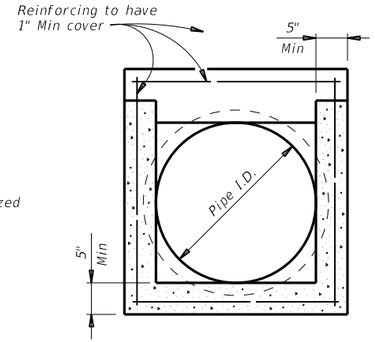
OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

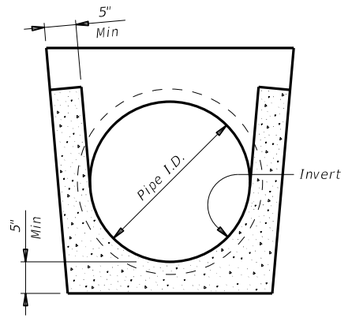
(If required)



MULTIPLE PIPE INSTALLATION

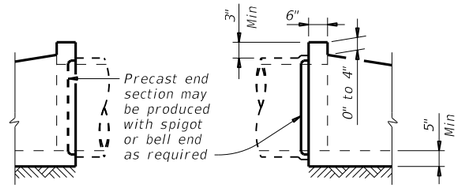


OPTION WITH SQUARE BOTTOM



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"	2.7"	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 Pipe and Box Grouted Connections (PBGC) standard for grouted connections with TP and precast safety end treatment.

Texas Department of Transportation

Bridge Division Standard

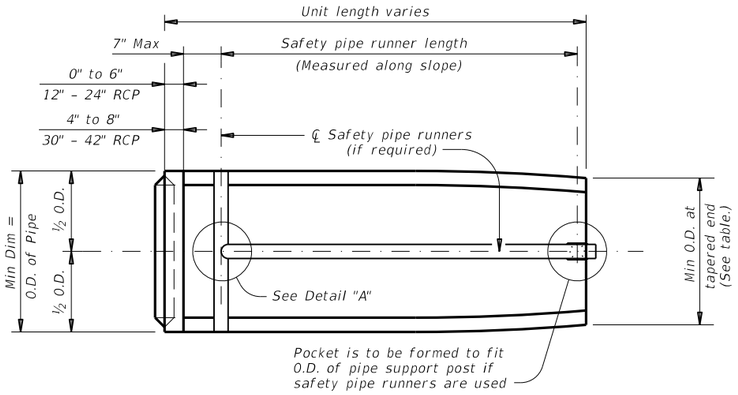
PRECAST SAFETY END TREATMENT

TYPE II ~ PARALLEL DRAINAGE

PSET-SP

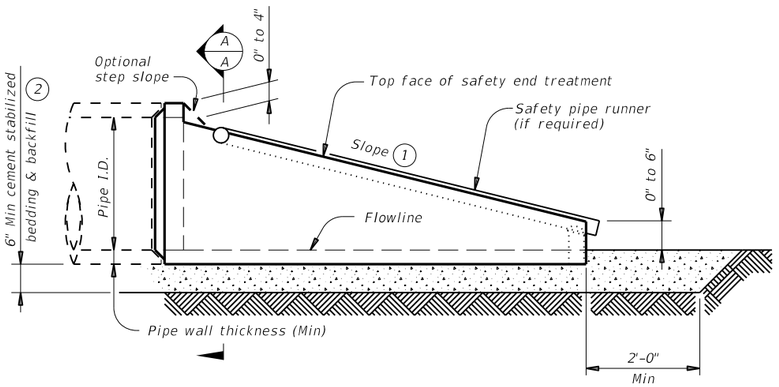
FILE: CD-PSET-SP-21.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: Added 42" TP	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		135

DATE:
FILE:



PLAN VIEW

(Showing spigot end connection.)



LONGITUDINAL ELEVATION

(Showing spigot end connection.)

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.

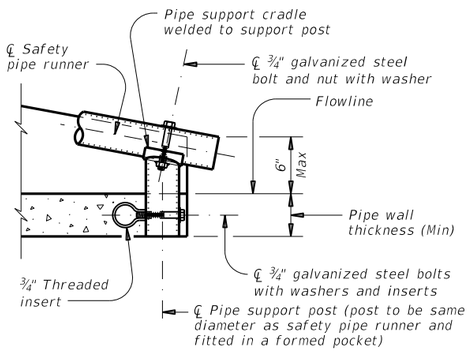
REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

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"				

OPTION A

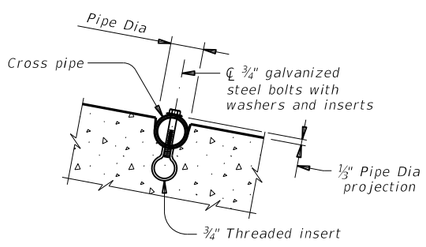
OPTION B

DETAIL A



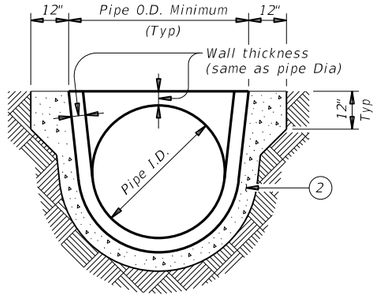
END DETAIL FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)

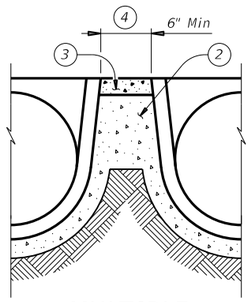


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



SECTION A-A



MULTIPLE PIPE INSTALLATION

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

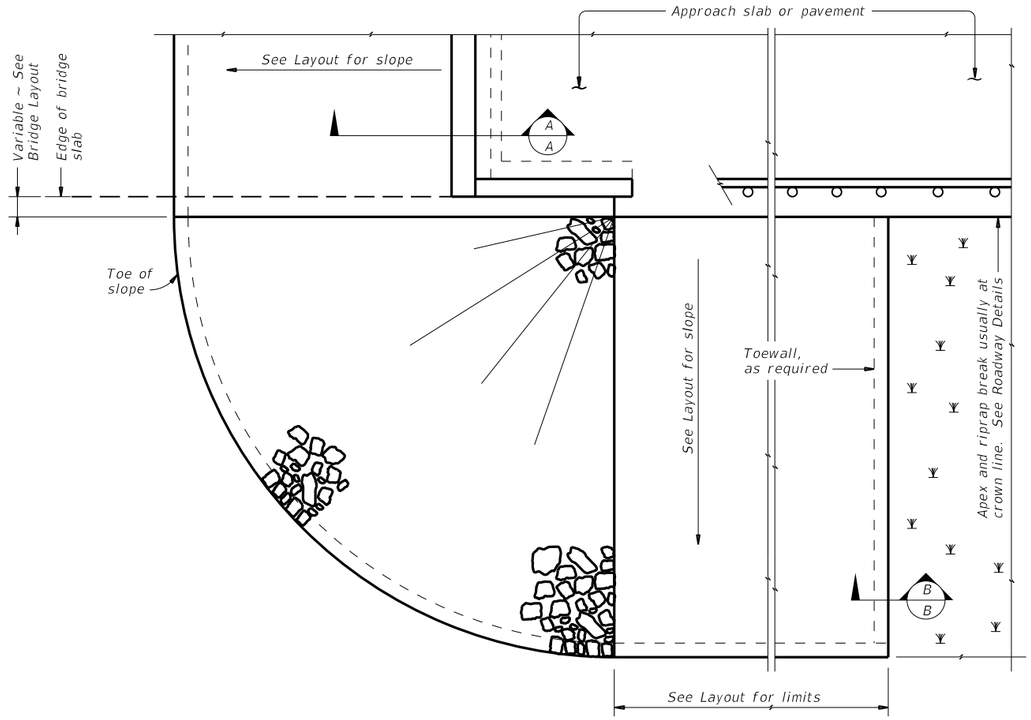
PRECAST SAFETY END TREATMENT

TYPE II ~ CROSS DRAINAGE

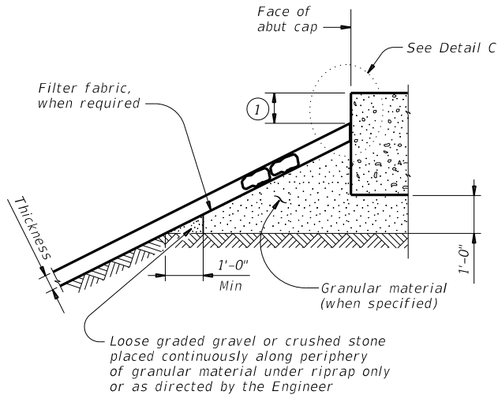
PSET-RC

FILE: CD-PSET-RC-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		136

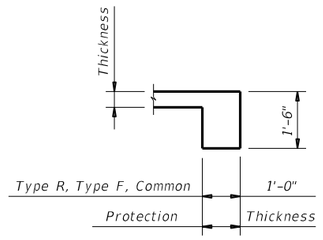
DATE:
FILE:



PLAN

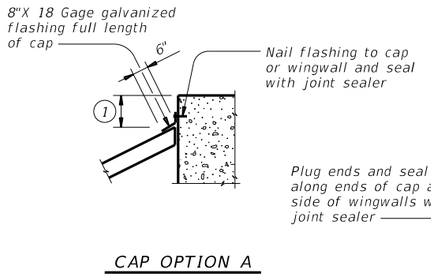


SECTION A-A AT CAP

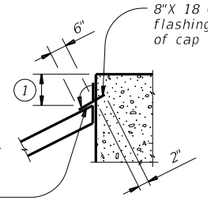


SECTION B-B

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

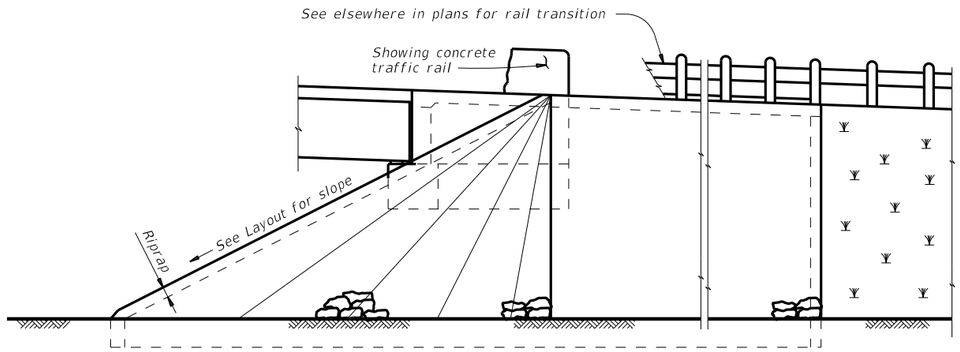


CAP OPTION A



CAP OPTION B

DETAIL C



ELEVATION

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

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

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

FILE: MS-SRR-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		137

DATE:
FILE:

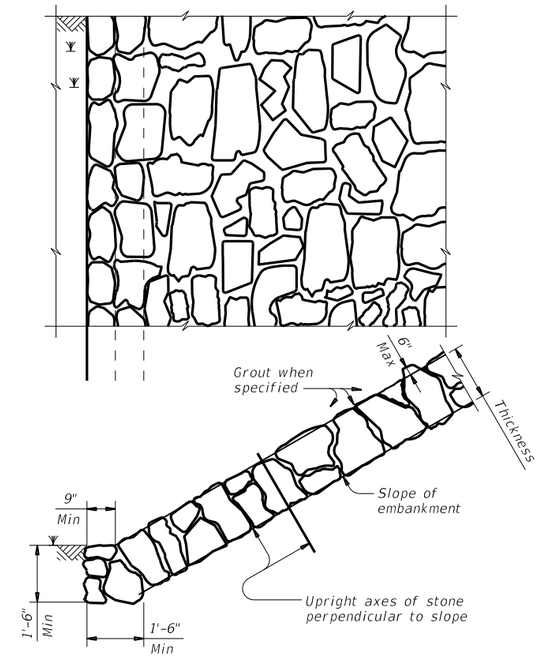


FIGURE 1 ~ TYPE R STONE RIPRAP

dry or grouted

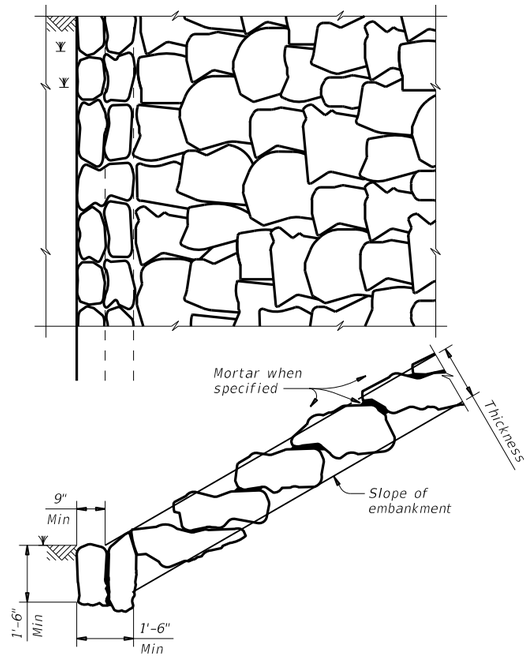


FIGURE 2 ~ TYPE F STONE RIPRAP

dry or mortared

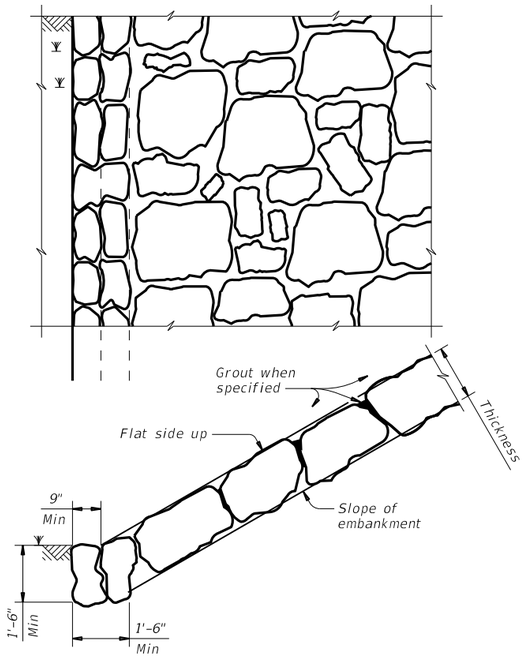


FIGURE 3 ~ TYPE F STONE RIPRAP

grouted

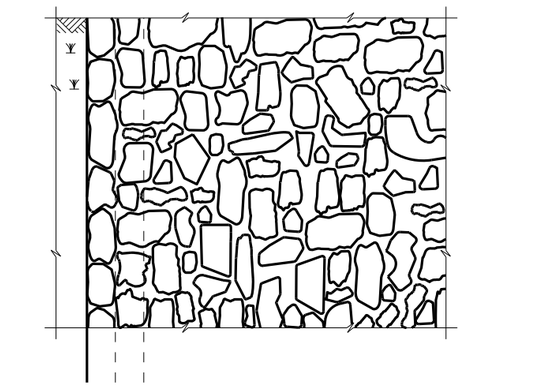


FIGURE 4 ~ COMMON STONE RIPRAP

dry or grouted

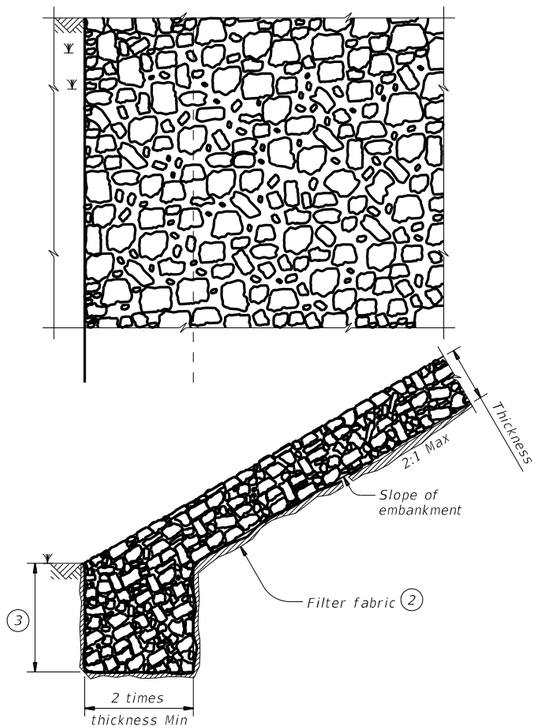


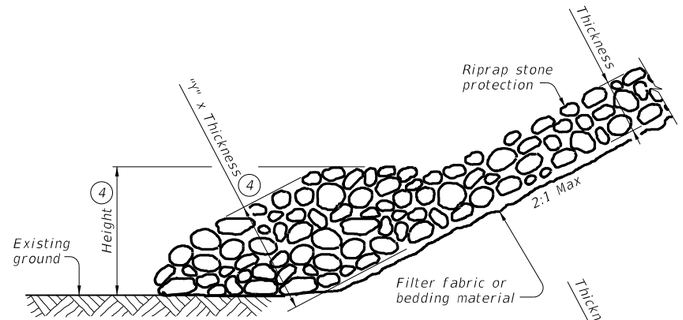
FIGURE 5 ~ PROTECTION STONE RIPRAP (5)

(2) Provide bedding material instead of filter fabric if shown elsewhere in plans. See Layout for thickness of bedding material.

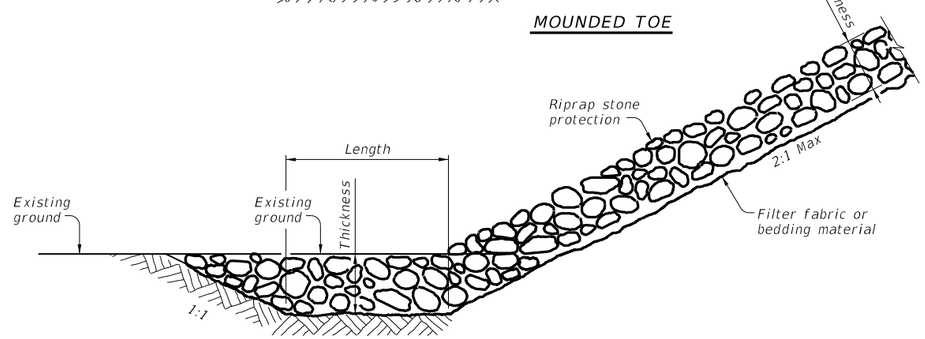
(3) Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.

(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)

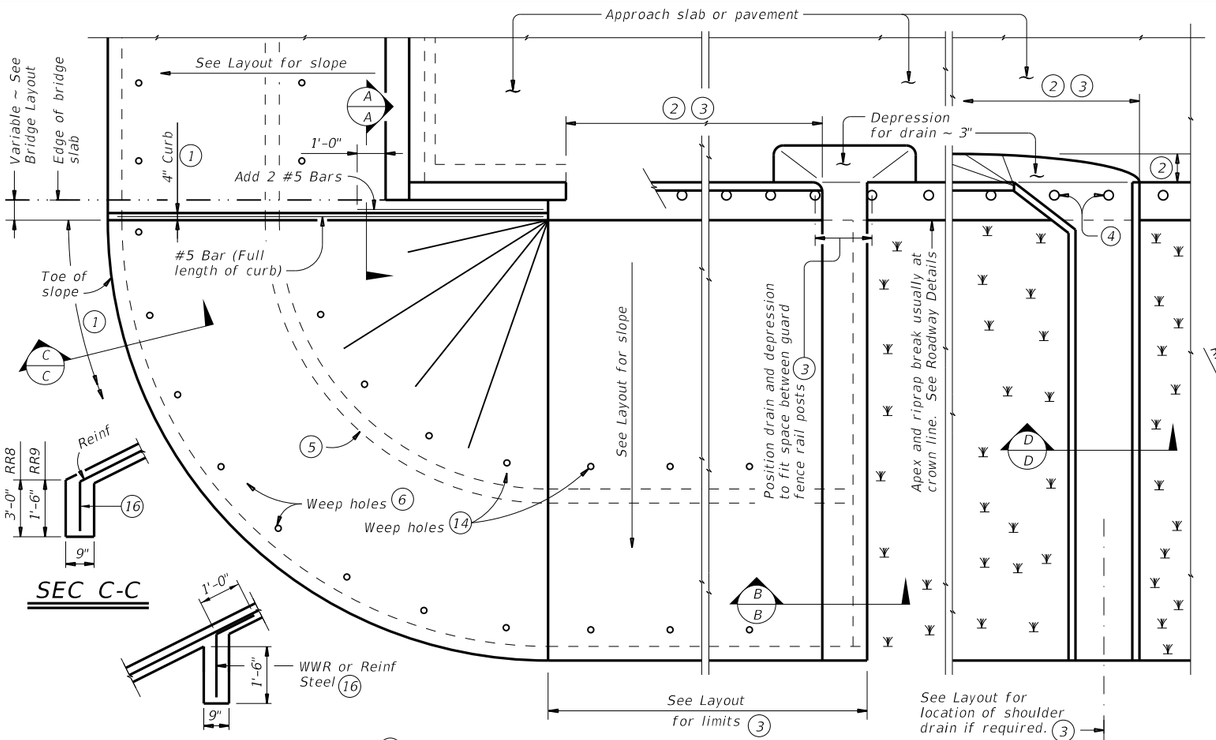
Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

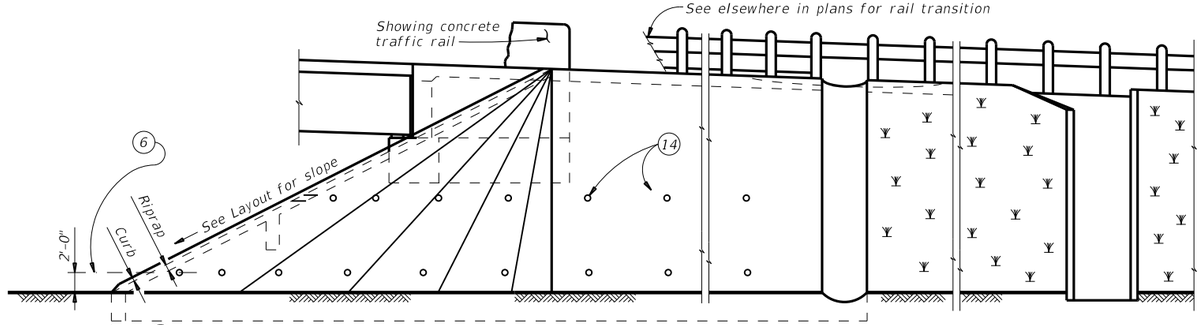
FILE: MS-SRR-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES		
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY		
REVISIONS	2353	02	028	FM 2450		
	DIST	COUNTY		SHEET NO.		
	DAL	DENTON		138		



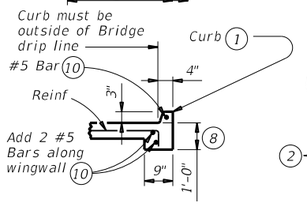
PLAN

SEC C-C

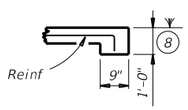
INTERMEDIATE TOEWALL (5)



ELEVATION

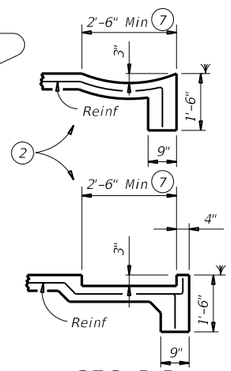


SEC A-A



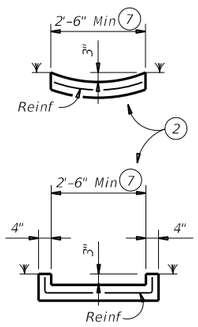
SEC B-B

(No drain)



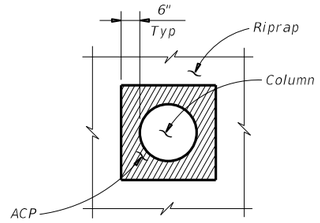
SEC B-B

(Shoulder drain integral with riprap)



SEC D-D

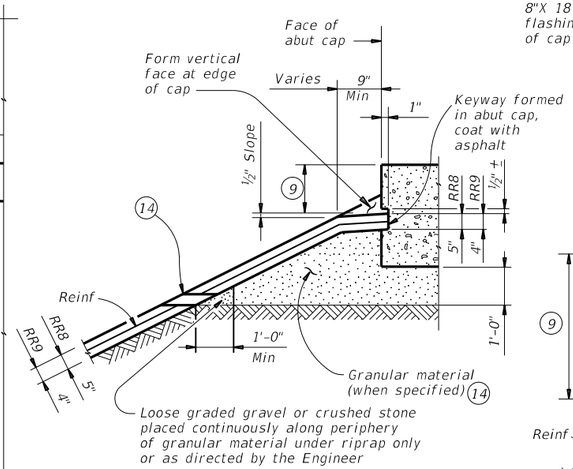
(Shoulder drain)



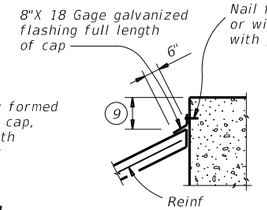
Riprap blockout to be filled with ACP. (Subsidiary to riprap)

RIPRAP DETAIL AT COLUMNS

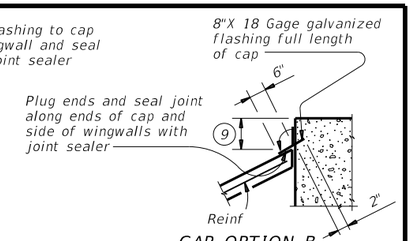
(As directed by the Engineer)



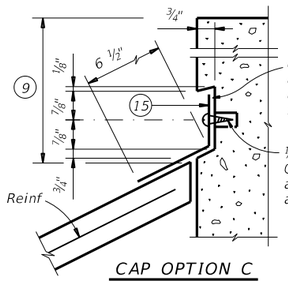
SHOWING KEYWAY OPTION



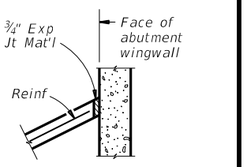
CAP OPTION A



CAP OPTION B

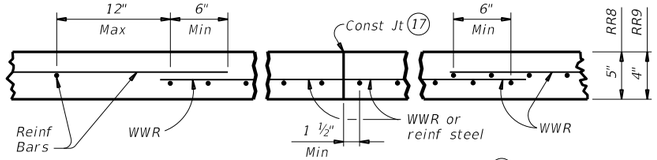


CAP OPTION C



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: MS-CRR-19.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
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	DAL	DENTON		139

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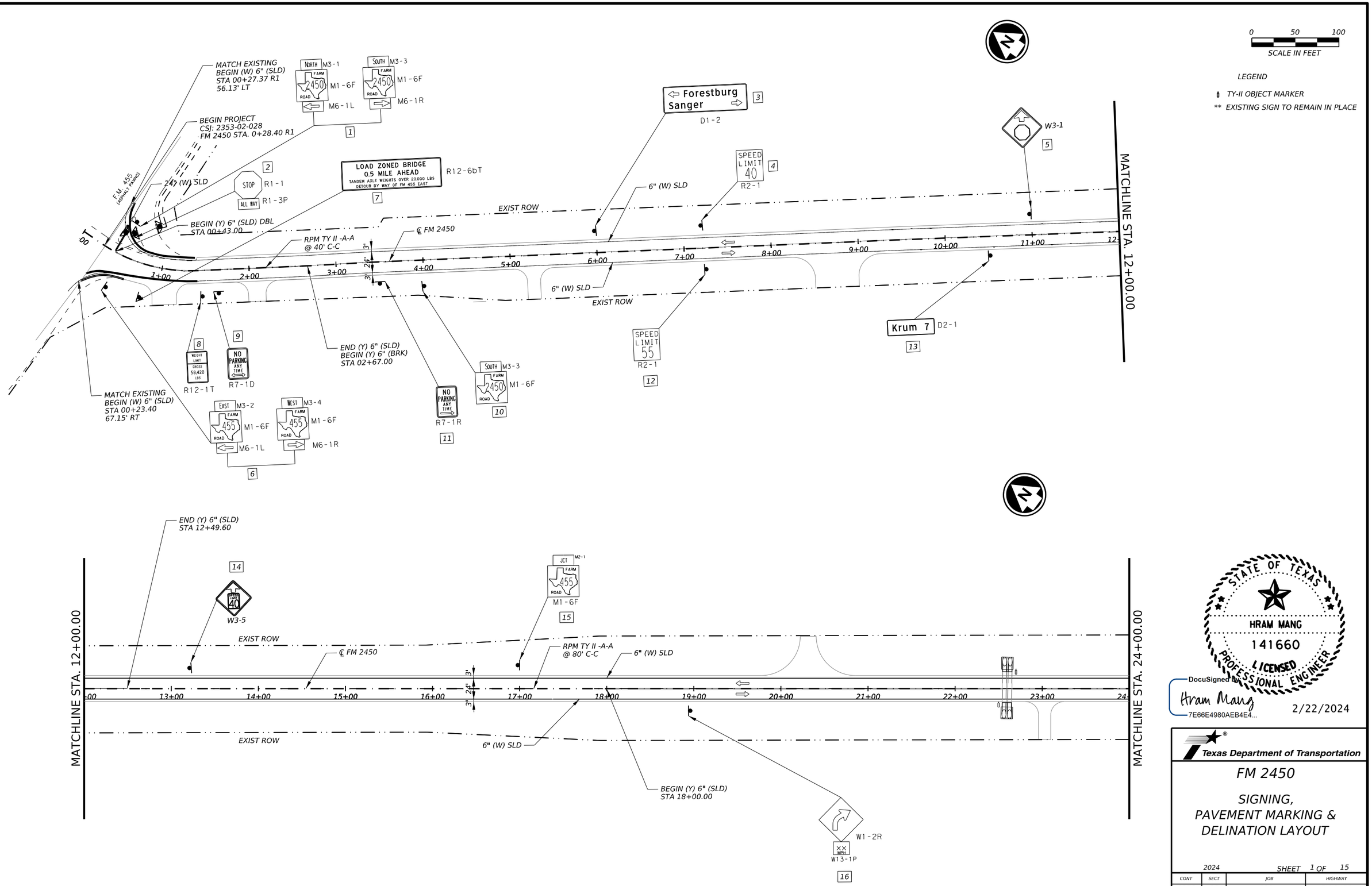

DocuSigned by:
Hram Mang
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2/22/2024

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

Texas Department of Transportation

FM 2450

SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 1 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		140

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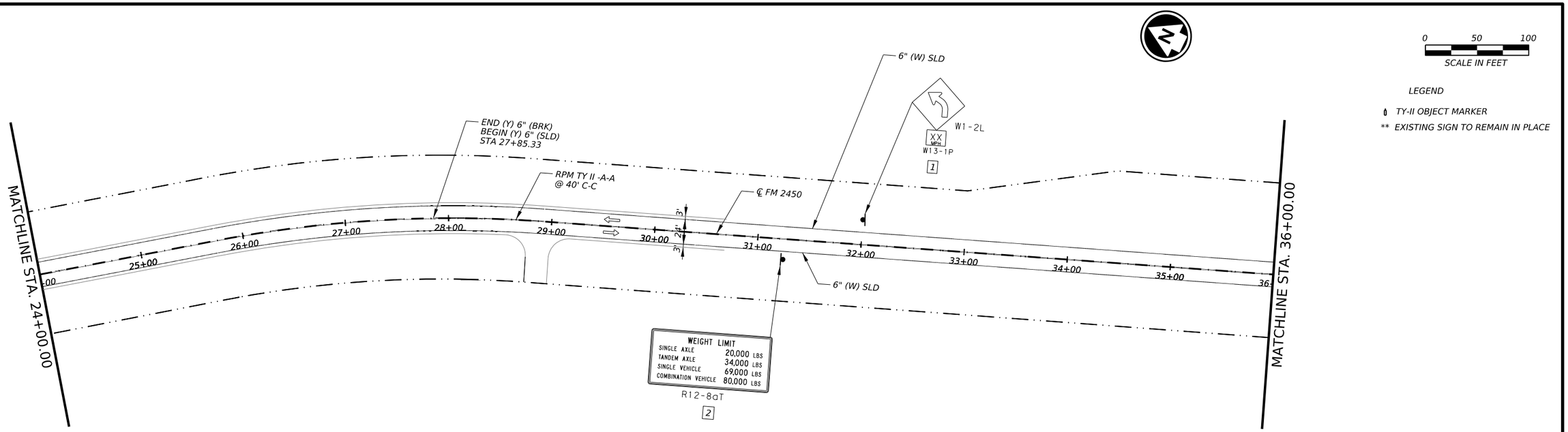

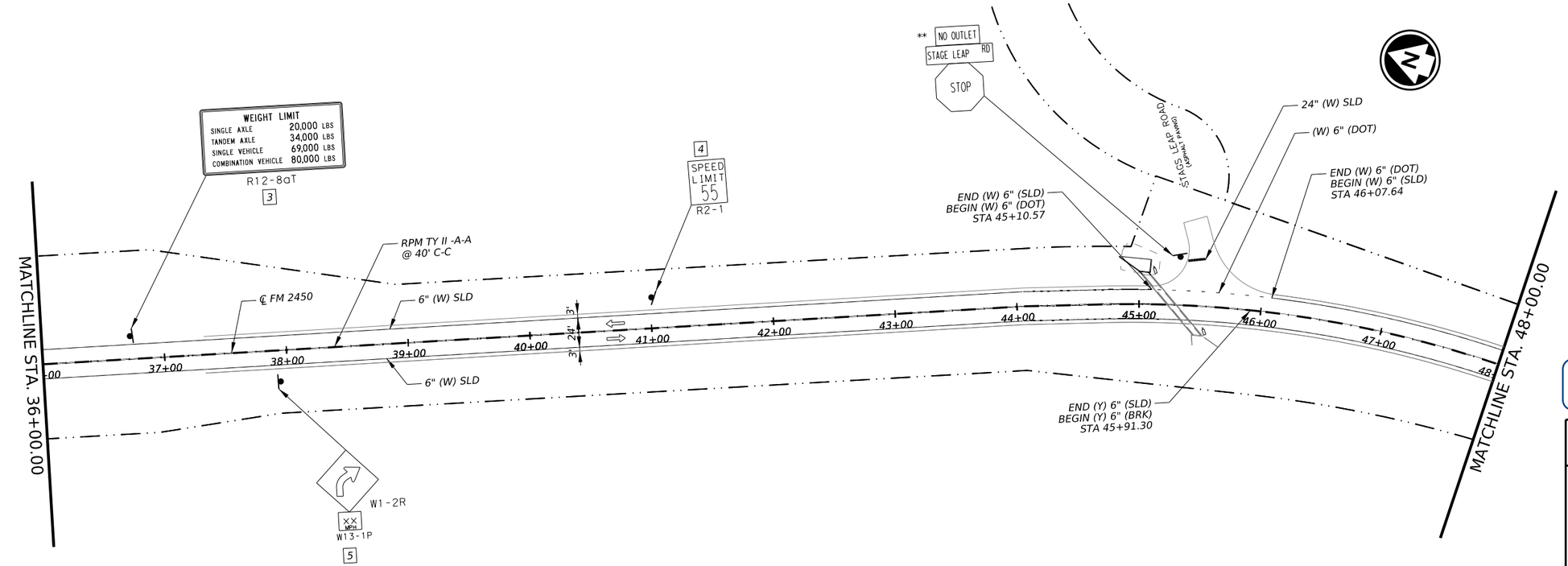

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141660
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PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
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Texas Department of Transportation

FM 2450

SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 2 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO
DAL	DENTON		141

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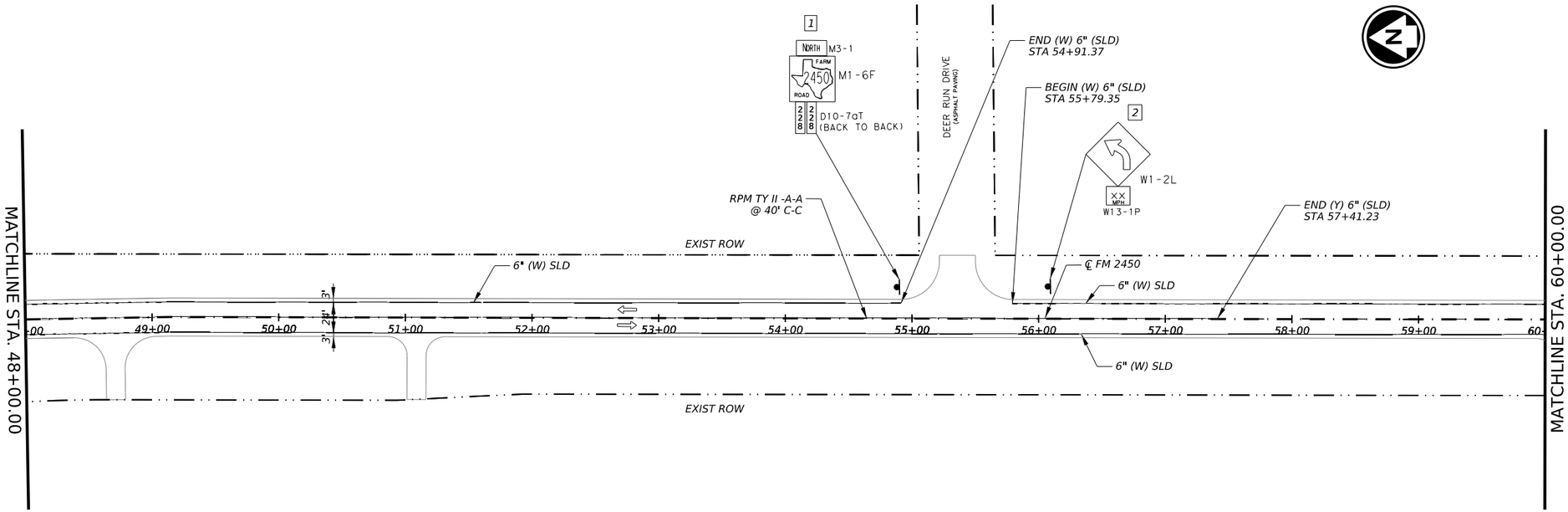

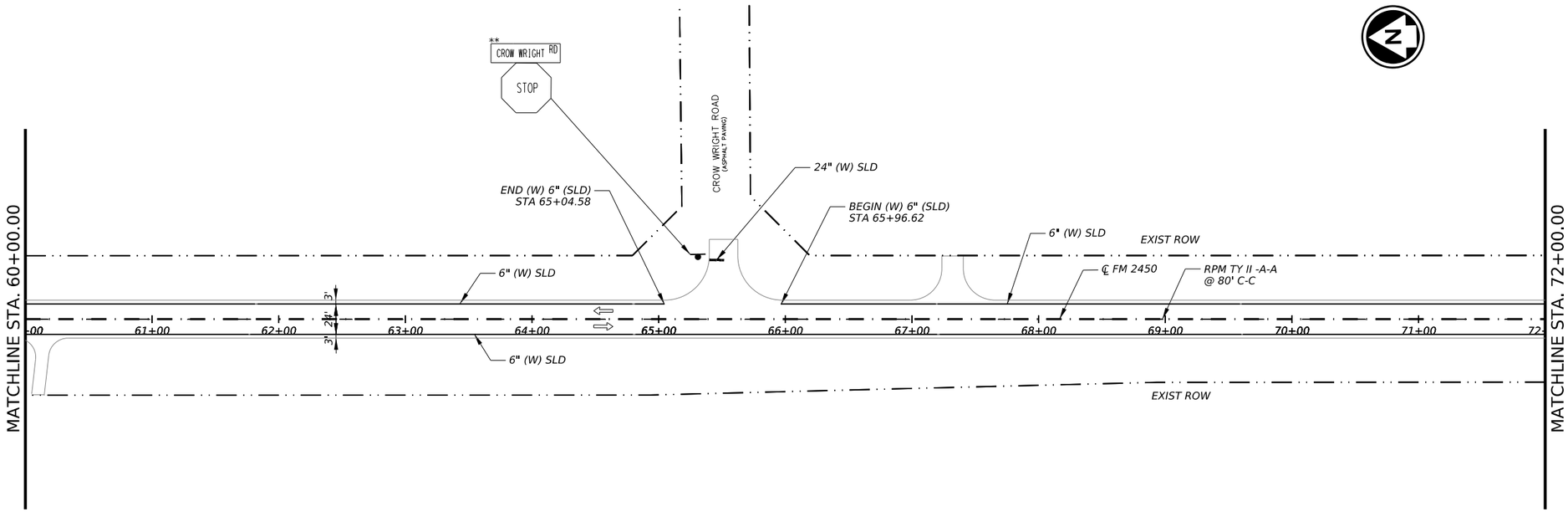

0 50 100
SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

** EXISTING SIGN TO REMAIN IN PLACE

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E66E4980AEB4E4...

Texas Department of Transportation

FM 2450

SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 3 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450

DIST	COUNTY	SHEET NO.
DAL	DENTON	142

DATE: 2/22/2024 2:06:18 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450_Striping.dgn

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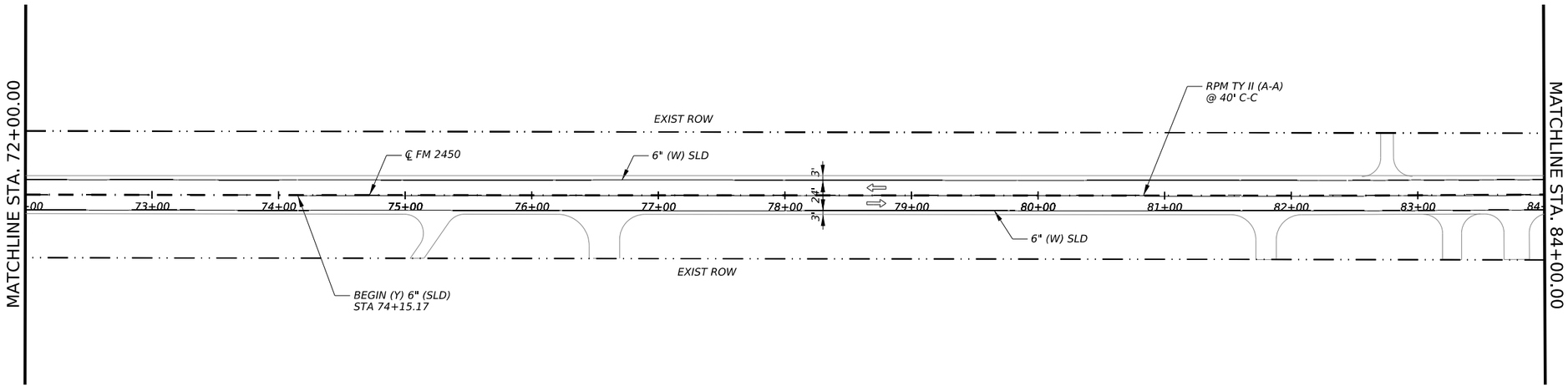

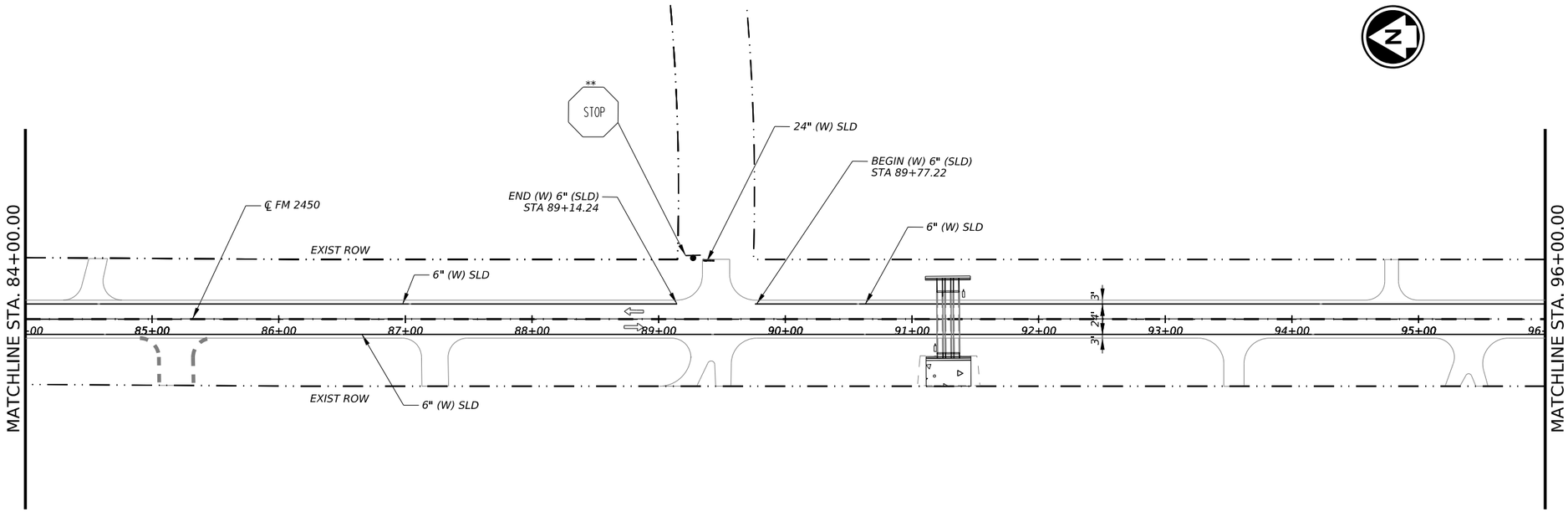

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SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

** EXISTING SIGN TO REMAIN IN PLACE

STATE OF TEXAS
HRAM MANG
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SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 4 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		143

DATE: 2/22/2024 2:06:19 PM
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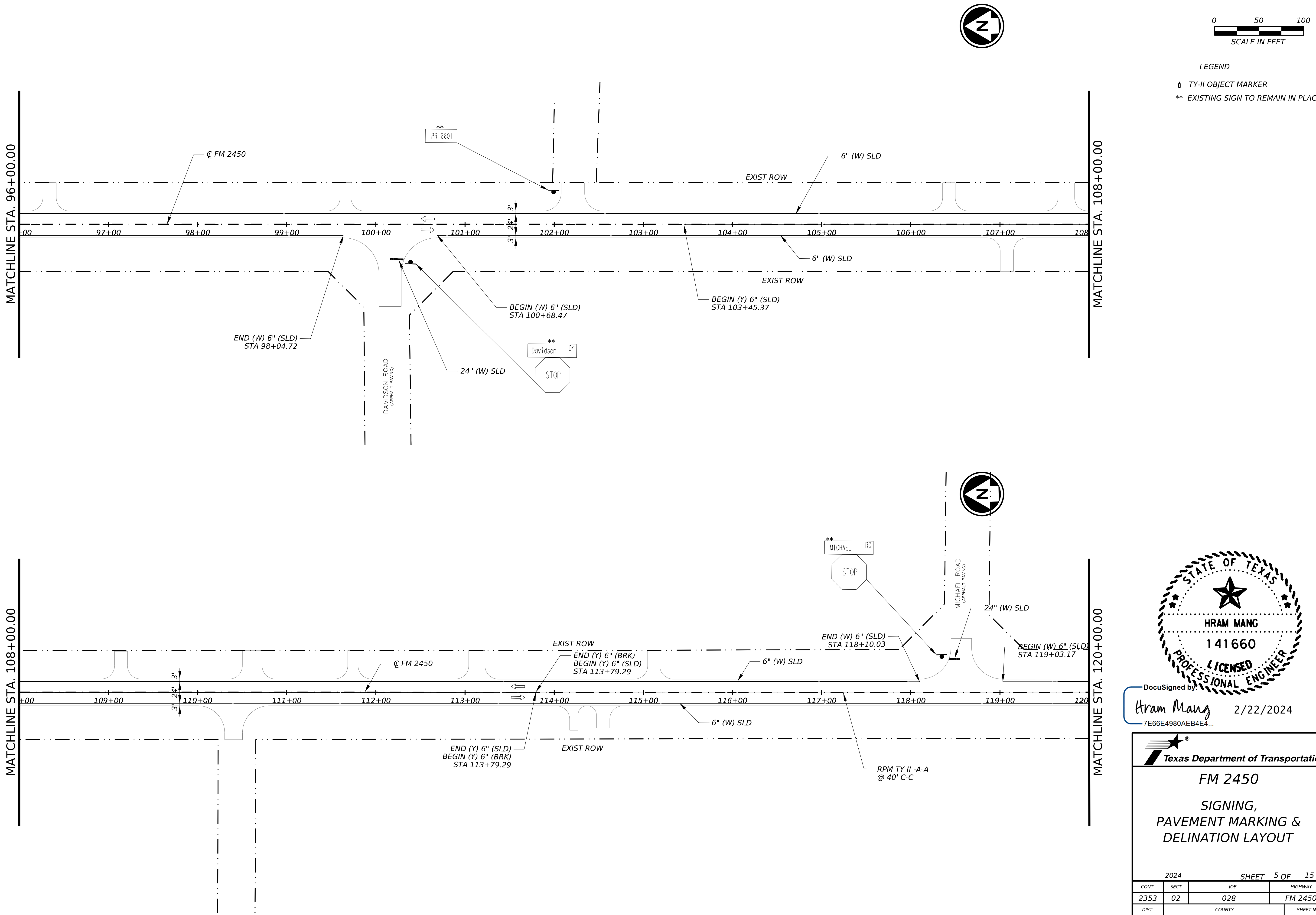

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SIGNING,
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DELINATION LAYOUT

2024 SHEET 5 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		144

DATE: 2/22/2024 2:06:20 PM
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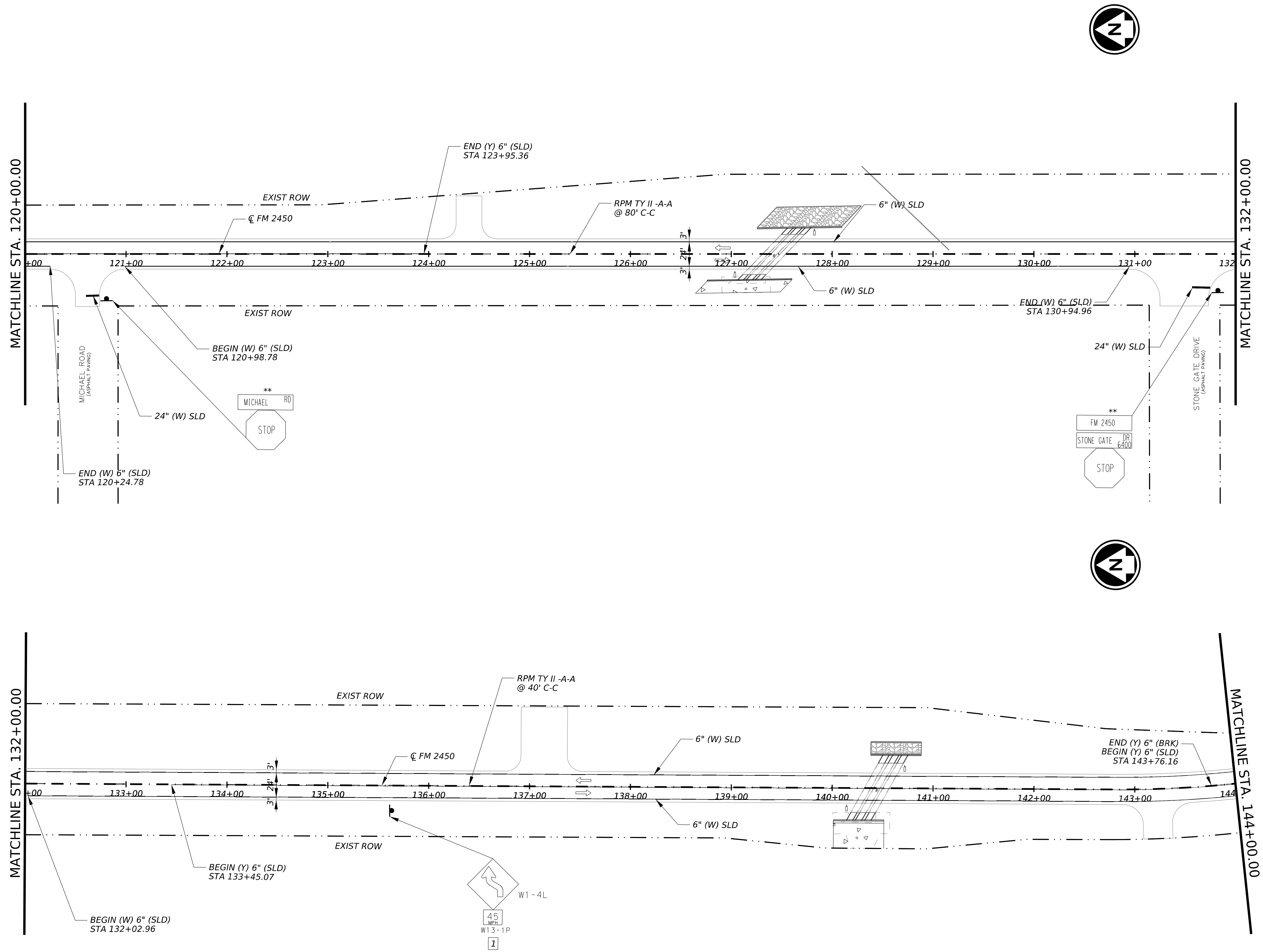

0 50 100
SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

** EXISTING SIGN TO REMAIN IN PLACE

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FM 2450

SIGNING,
PAVEMENT MARKING &
DELINATION LAYOUT

2024 SHEET 6 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		145

DATE: 2/22/2024 2:06:21 PM
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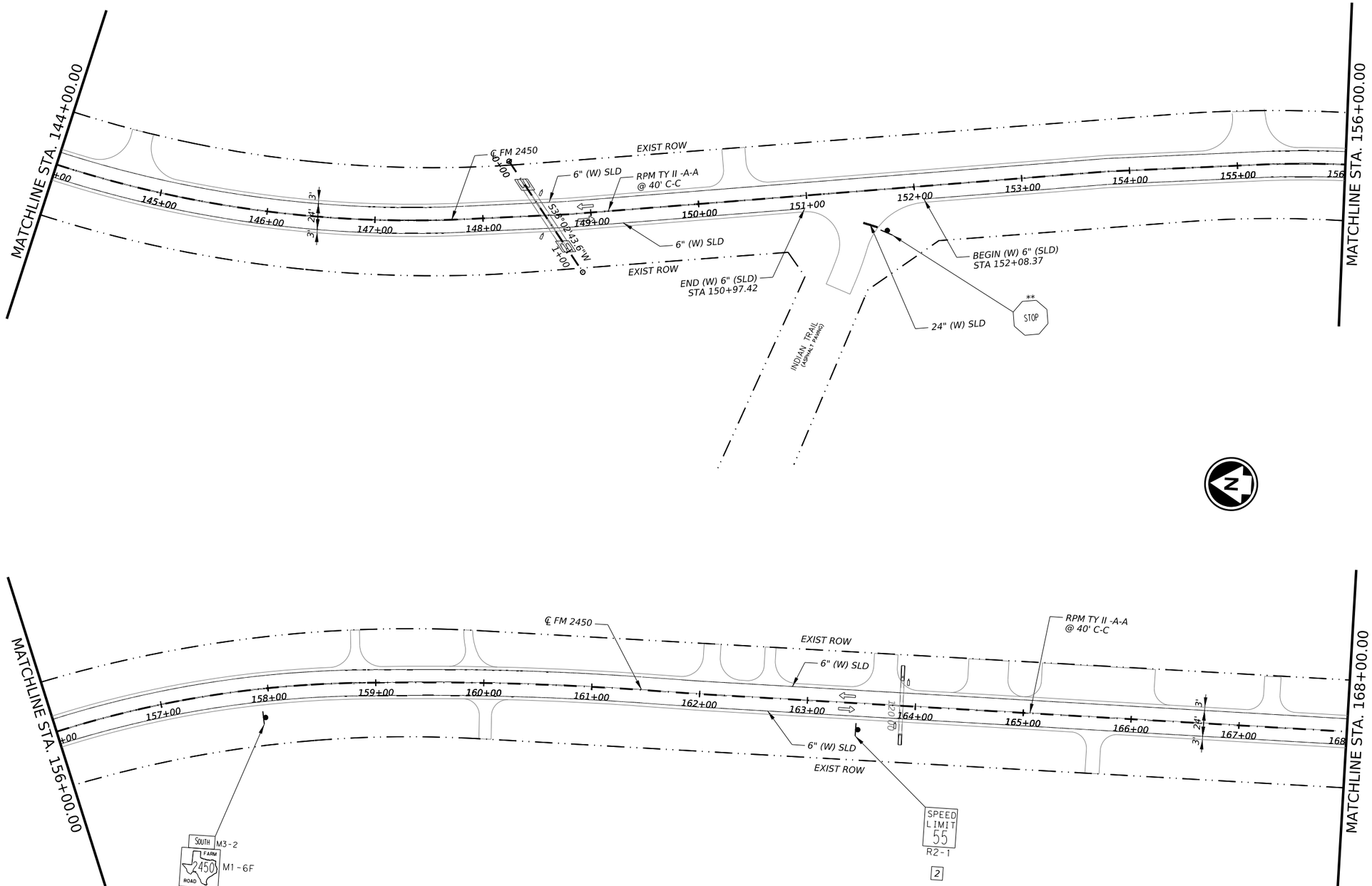

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SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

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SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 7 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		146

DATE: 2/22/2024 2:06:22 PM
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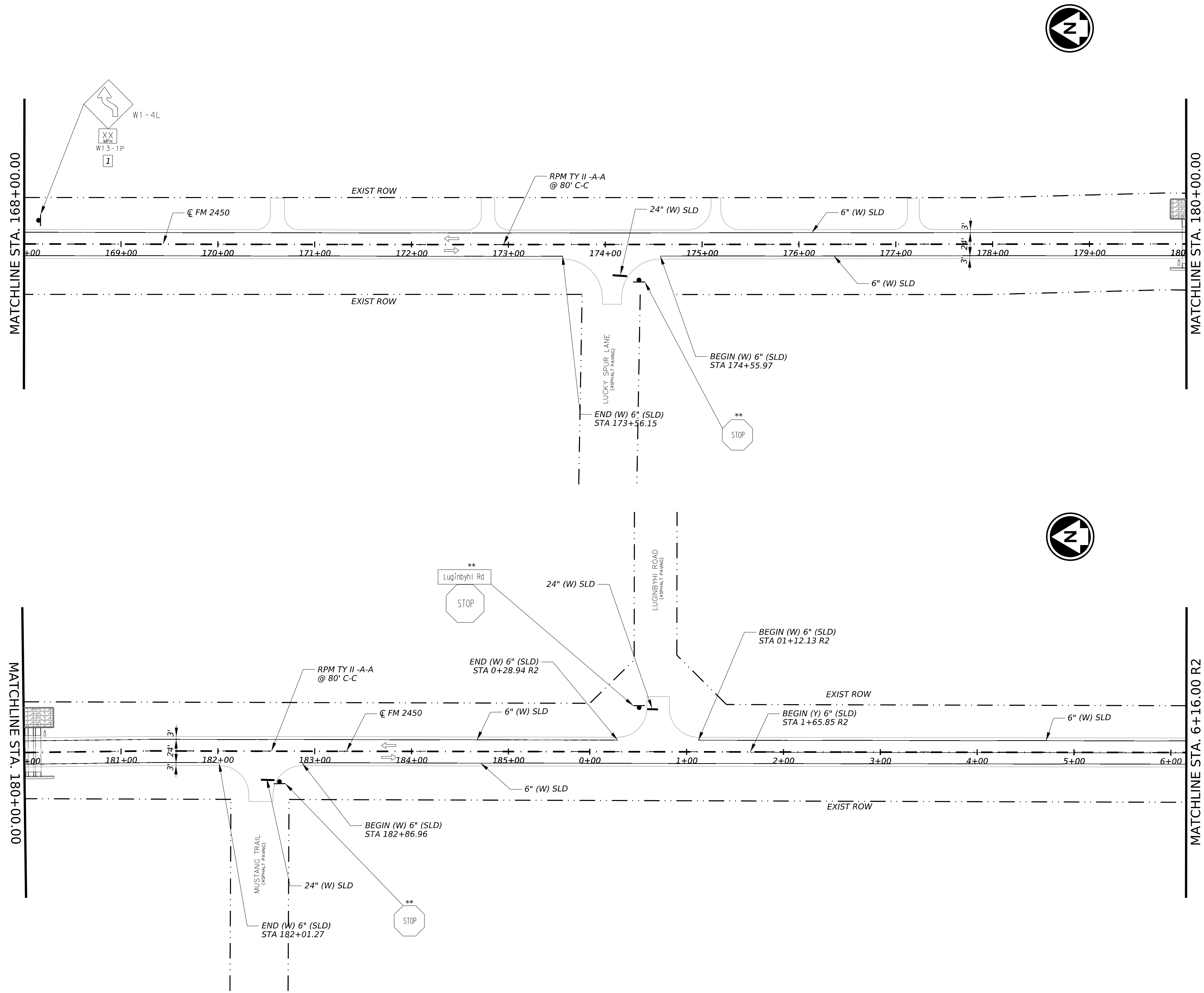

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SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

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SIGNING,
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2024 SHEET 8 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		147

DATE: 2/22/2024 2:06:22 PM
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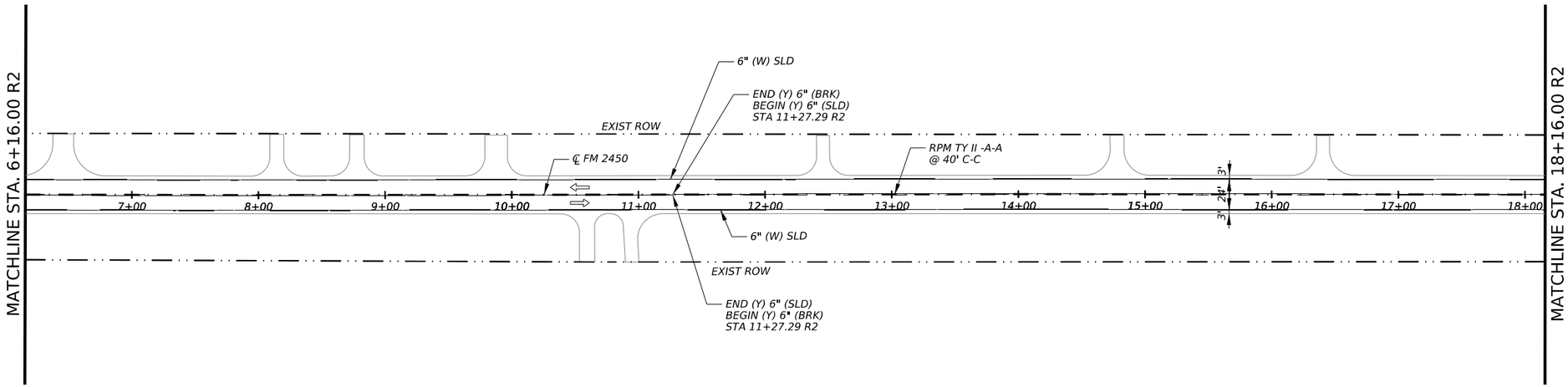

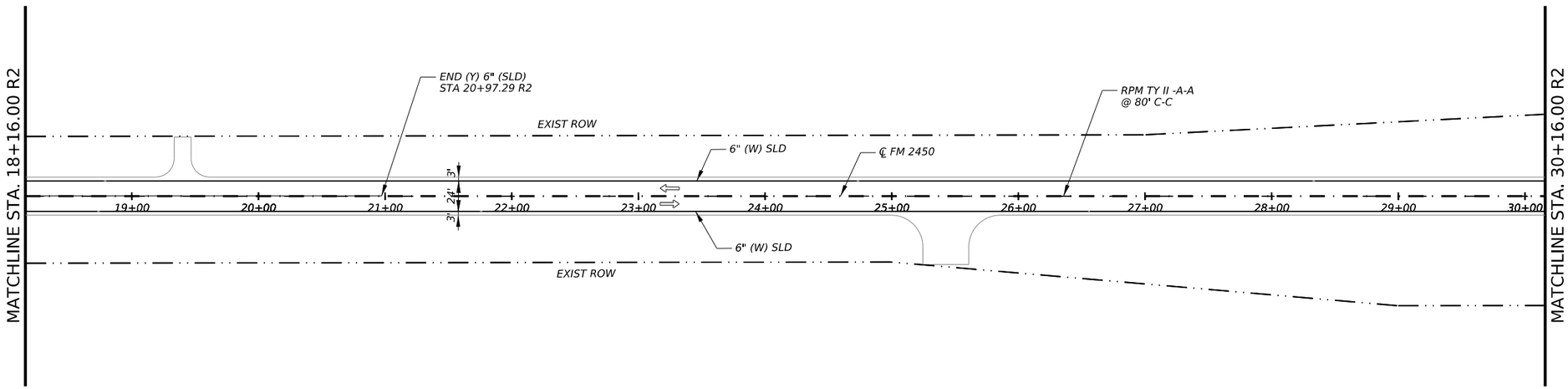

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SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

** EXISTING SIGN TO REMAIN IN PLACE

STATE OF TEXAS
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SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 9 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		148

DATE: 2/22/2024 2:06:23 PM
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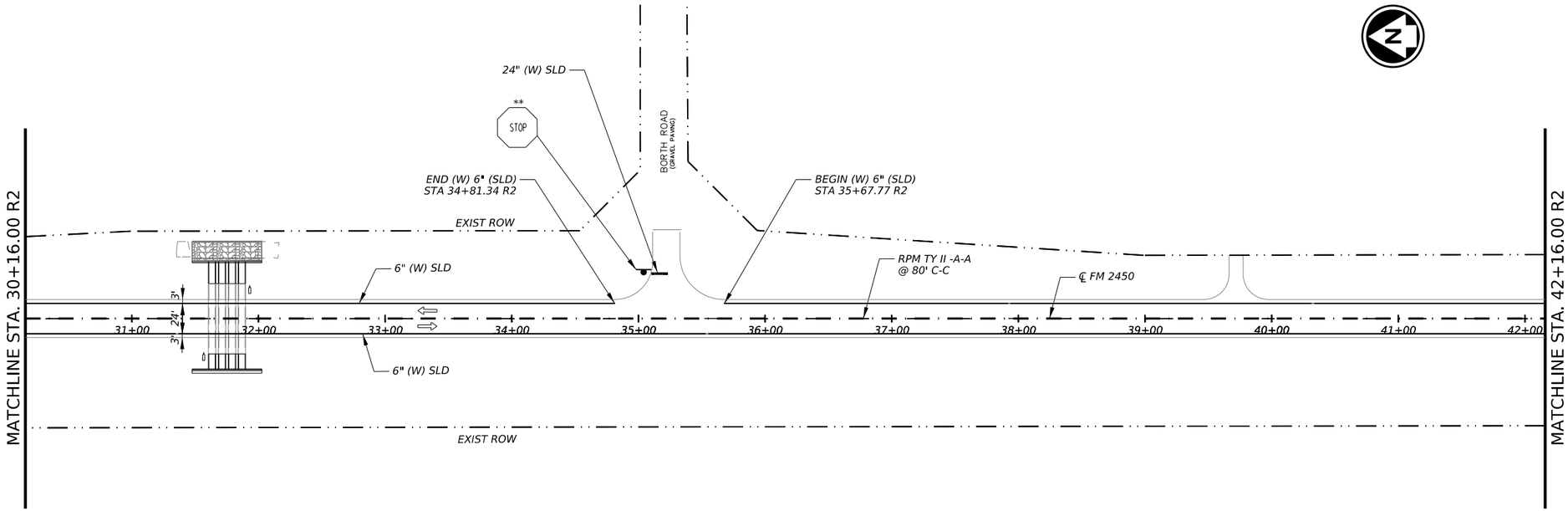

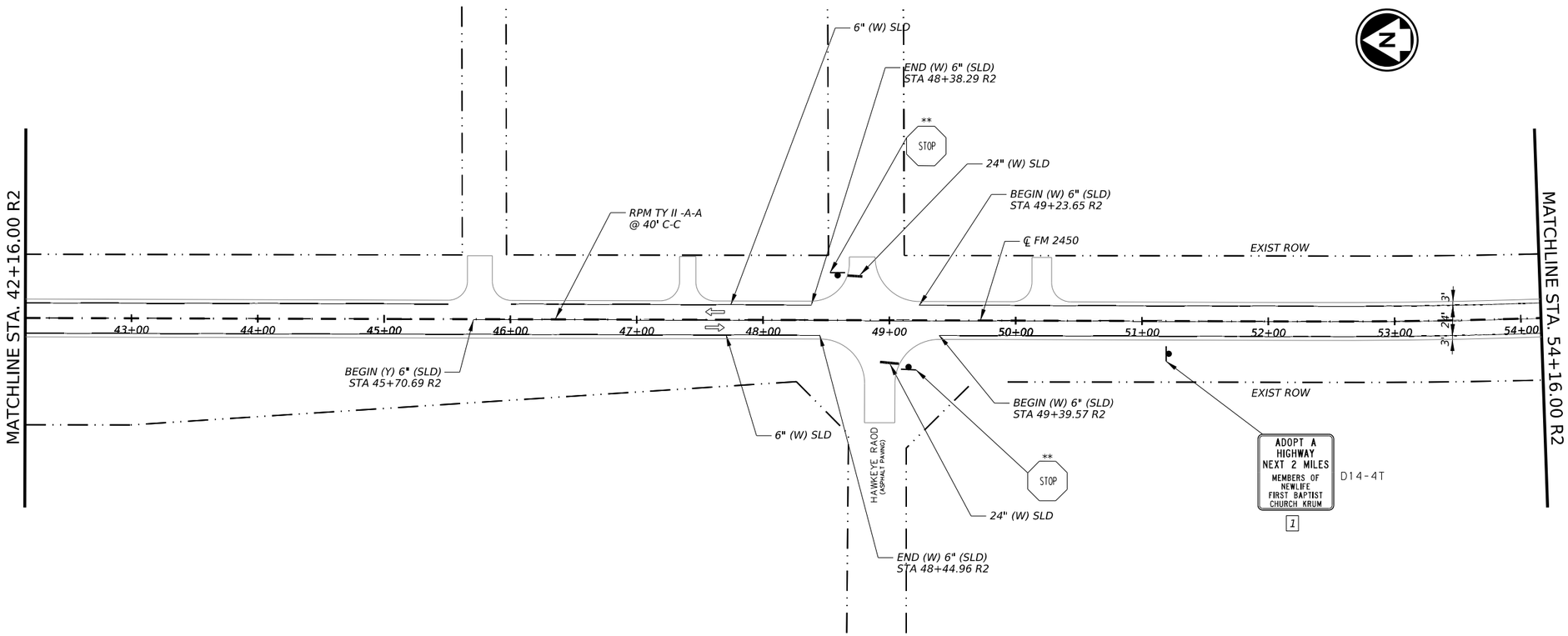

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SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

** EXISTING SIGN TO REMAIN IN PLACE

STATE OF TEXAS
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DocuSigned by:
Hram Mang 2/22/2024
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FM 2450

SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 10 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		149

DATE: 2/22/2024 2:06:24 PM
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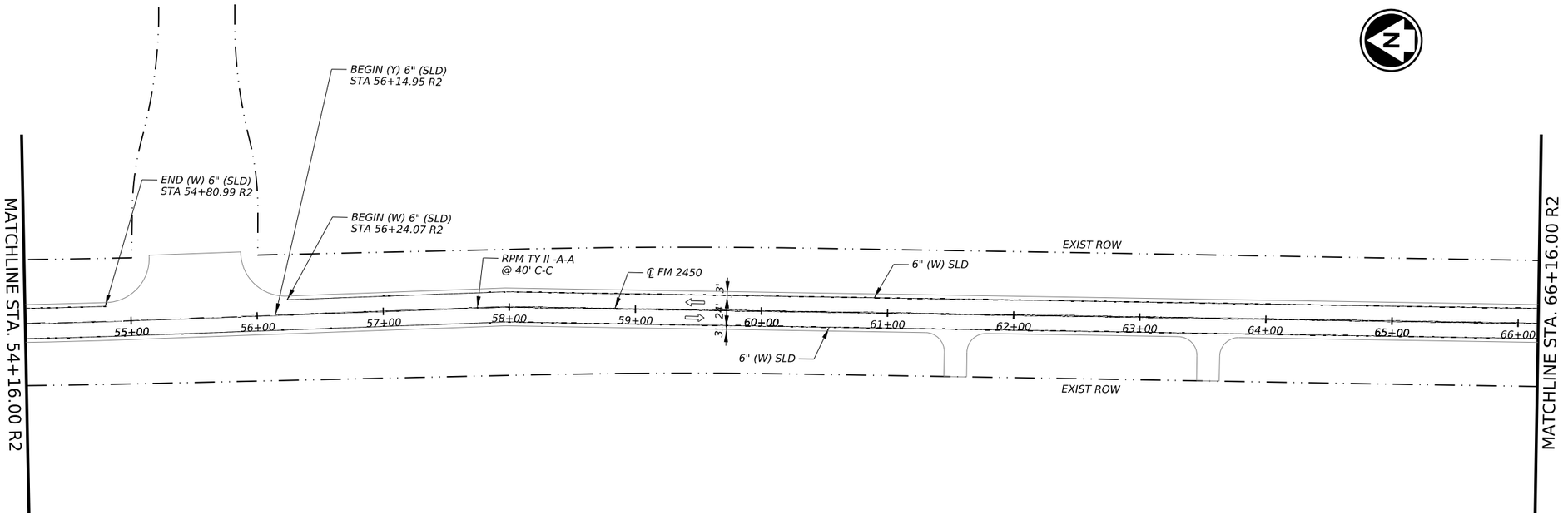

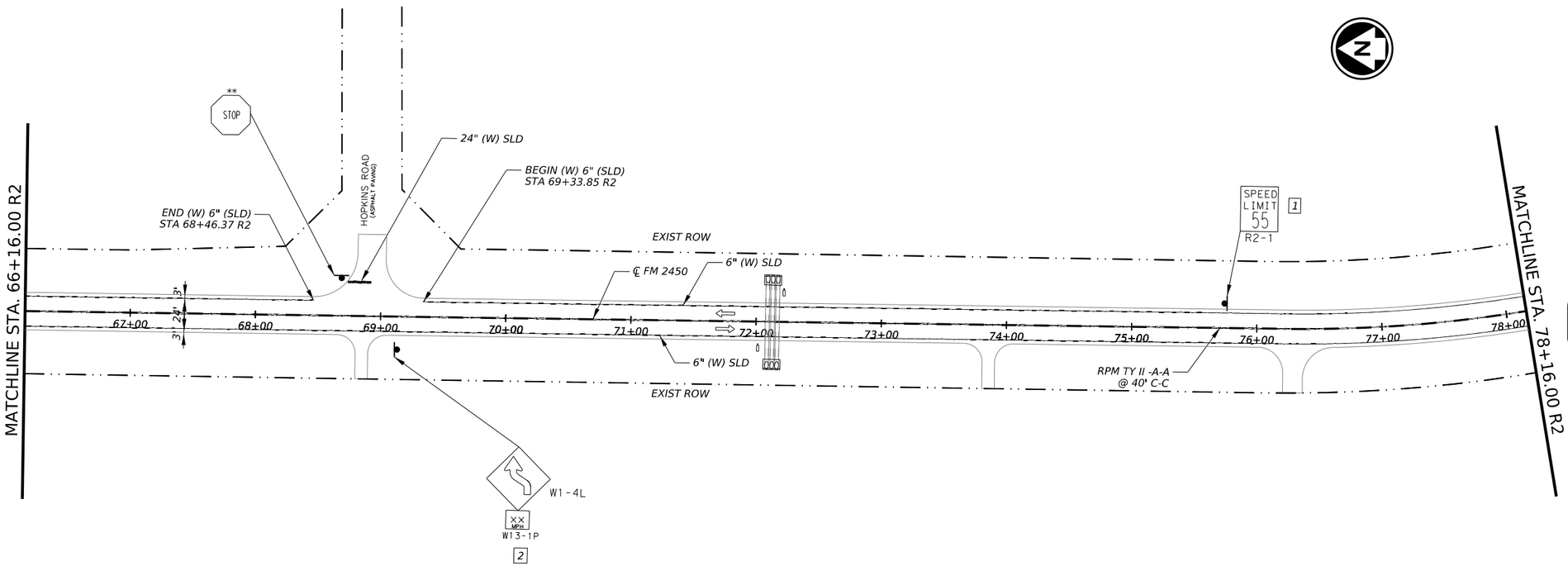

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SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

** EXISTING SIGN TO REMAIN IN PLACE

STATE OF TEXAS
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SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 11 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		150

DATE: 2/22/2024 2:06:25 PM
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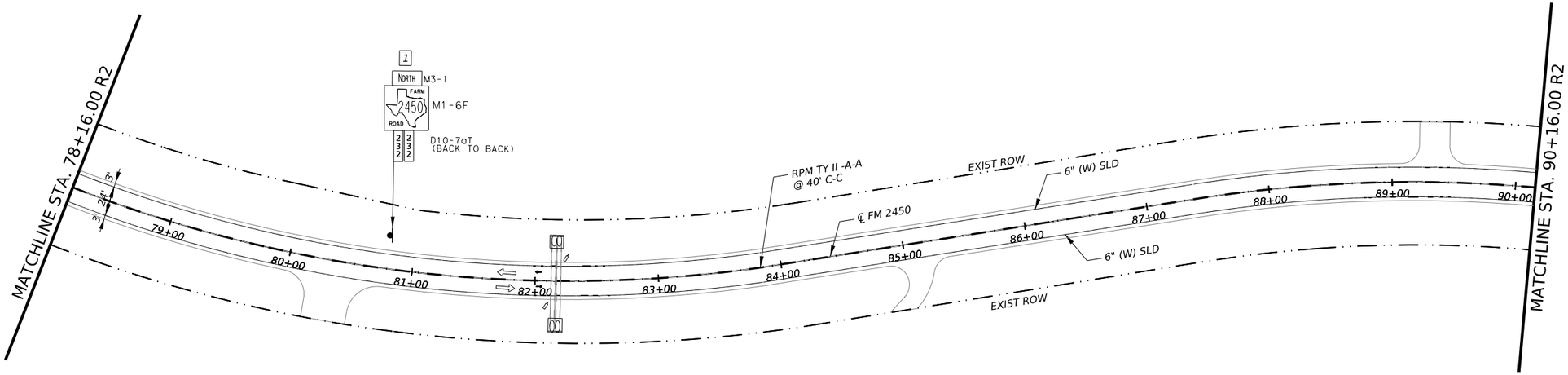

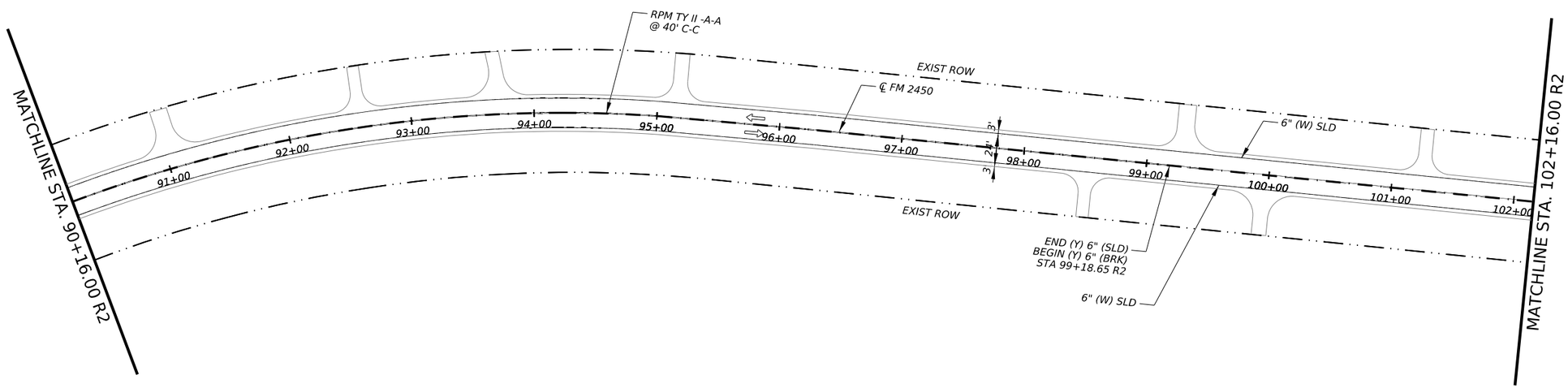

0 50 100
SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

** EXISTING SIGN TO REMAIN IN PLACE

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

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Hram Mang
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SIGNING,
PAVEMENT MARKING &
DELINATION LAYOUT

2024 SHEET 12 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		151

DATE: 2/22/2024 2:06:26 PM
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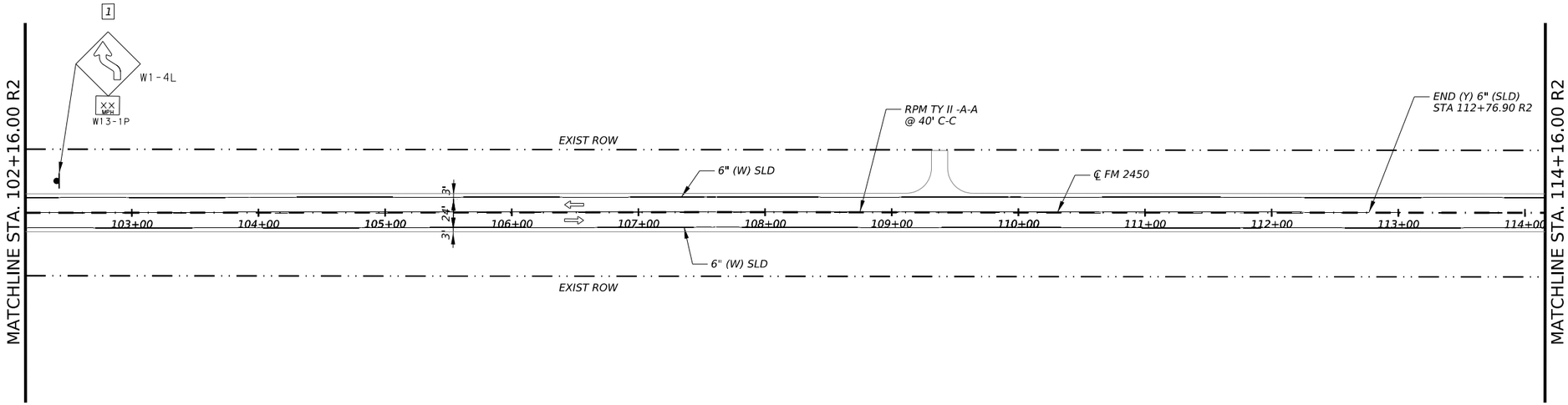

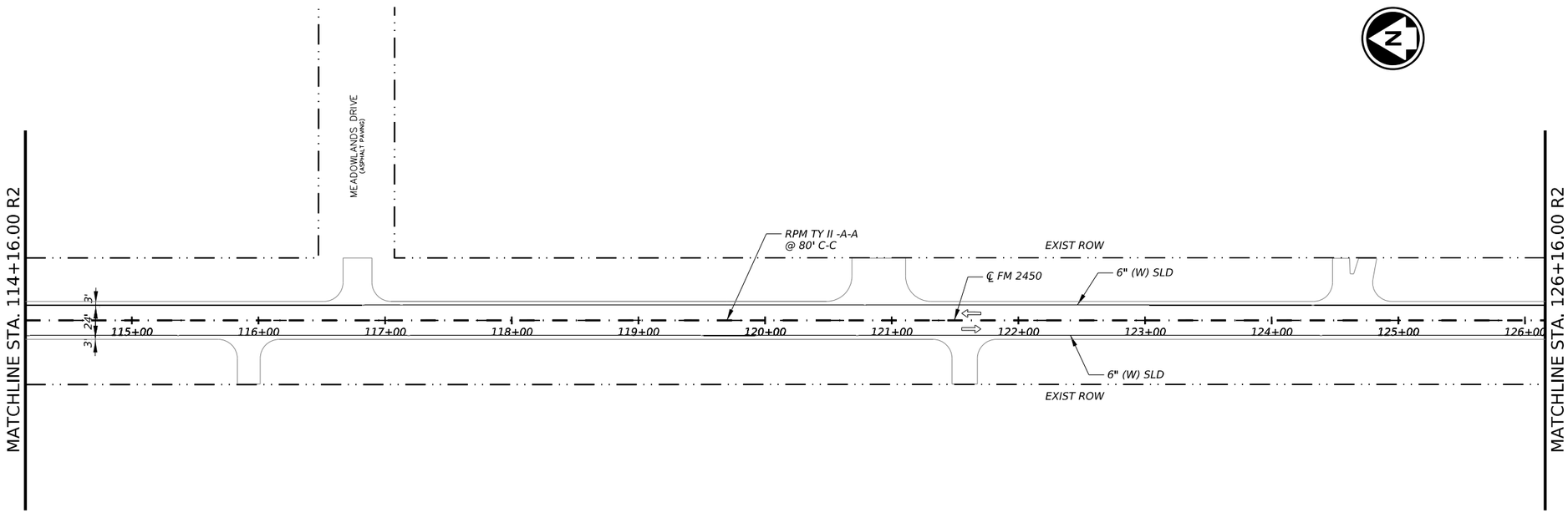

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SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

** EXISTING SIGN TO REMAIN IN PLACE

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E66E4980AEB4E4...

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FM 2450

SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 13 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		152

DATE: 2/22/2024 2:06:27 PM
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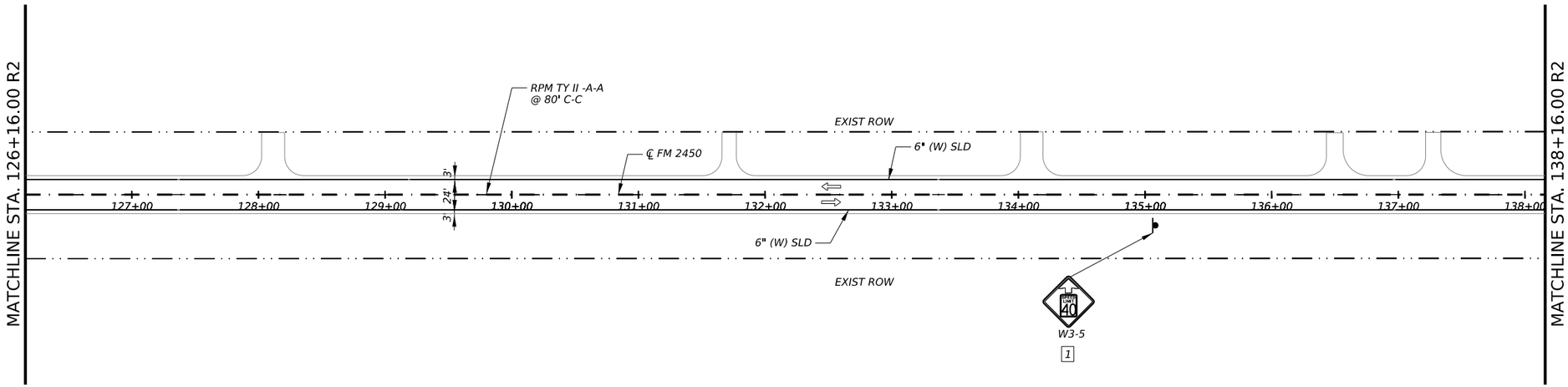

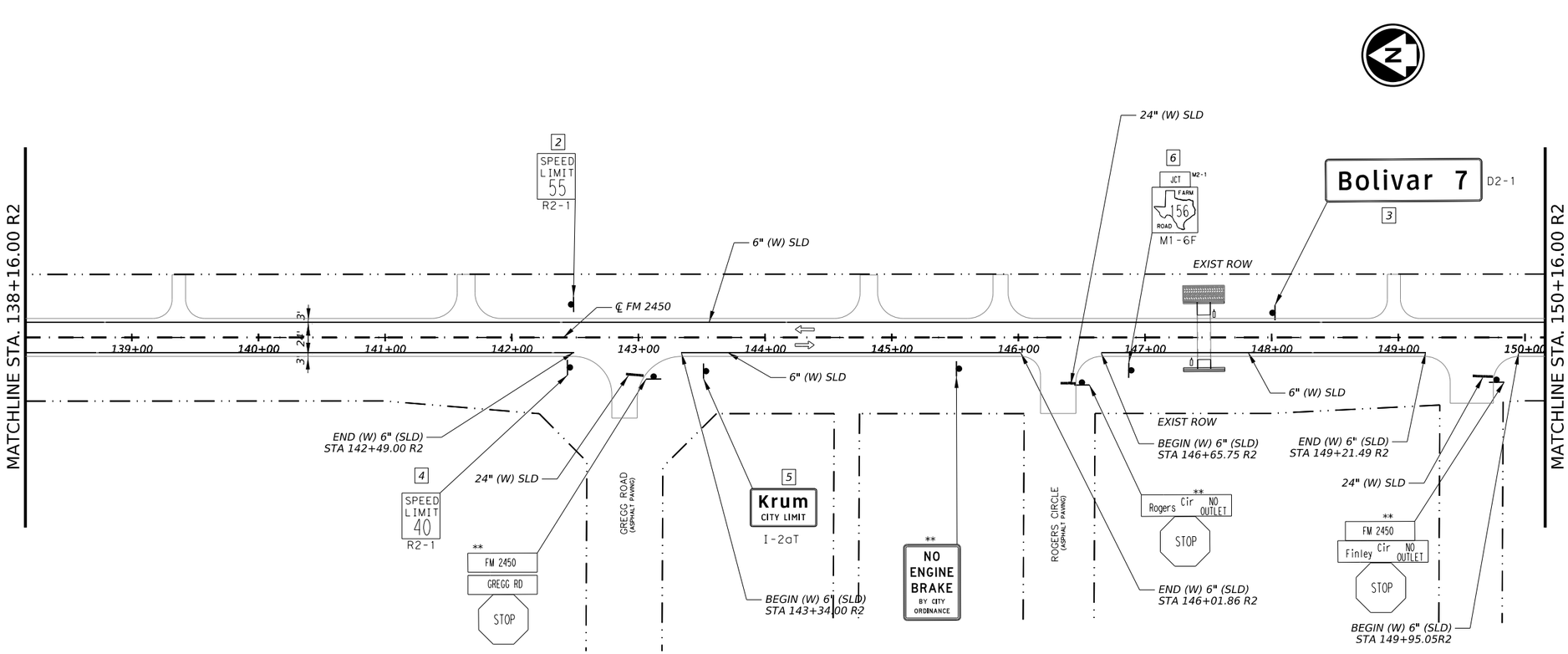

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SCALE IN FEET

LEGEND

TY-II OBJECT MARKER

** EXISTING SIGN TO REMAIN IN PLACE

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

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2/22/2024

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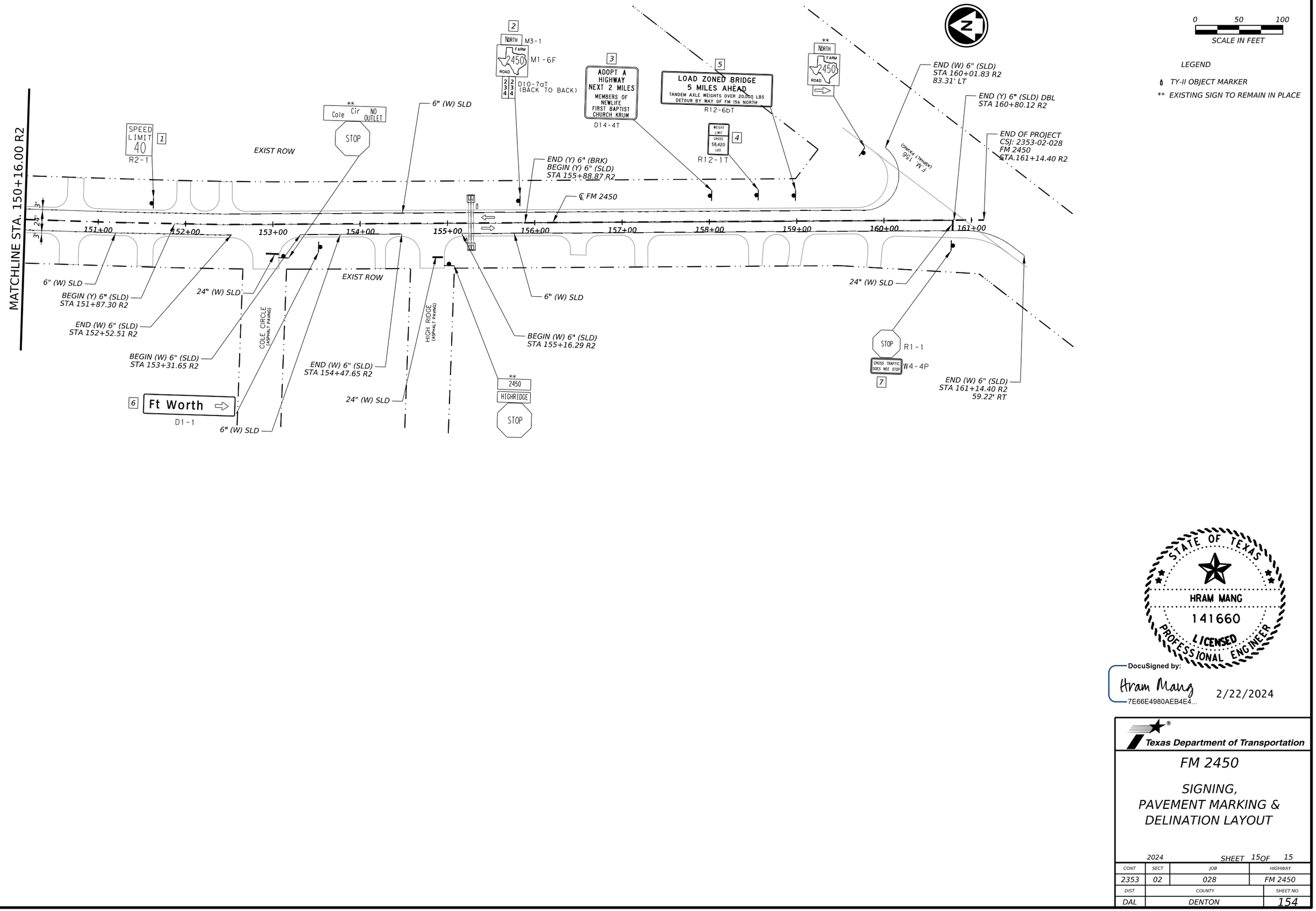
FM 2450

SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 14 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		153



STATE OF TEXAS
HRAM MANG
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7E66E4980AEB4E4...
2/22/2024

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FM 2450

SIGNING, PAVEMENT MARKING & DELINATION LAYOUT

2024 SHEET 15 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		154

DATE: 2/22/2024 2:06:29 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/2353028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450_Striping.dgn

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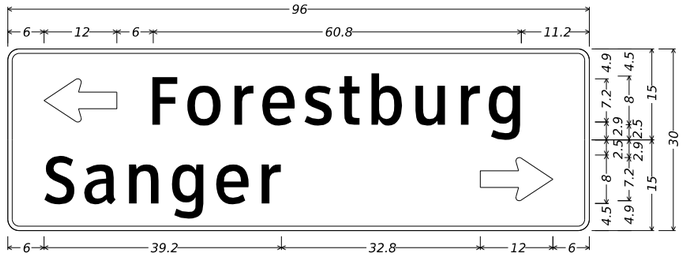
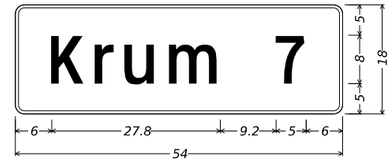


D1-2 8in LT-RT;

1.9" Radius, 0.8" Border, White on Green;
Standard Arrow Custom 12.0" X 7.1" 180°; "Forestburg", ClearviewHwy-3-W;

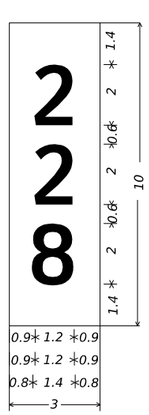
1.9" Radius, 0.8" Border, White on Green;
"Sanger", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0°;

SIGN 3 (SHEET 1 OF 15)



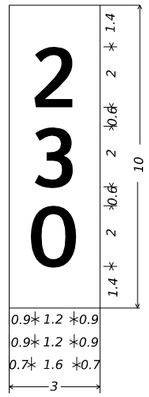
D2-1 8in;
1.5" Radius, 0.5" Border, White on Green;
"Krum", ClearviewHwy-3-W; "7", ClearviewHwy-3-W;

SIGN 13 (SHEET 1 OF 15)



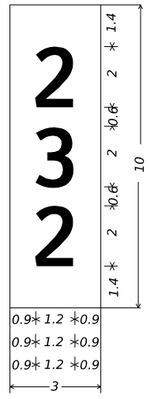
D10-7aT 3in;
No border, White on Green;
"2", ClearviewHwy-4-W;
"2", ClearviewHwy-4-W;
"8", ClearviewHwy-4-W;

SIGN 1 (SHEET 3 OF 15)



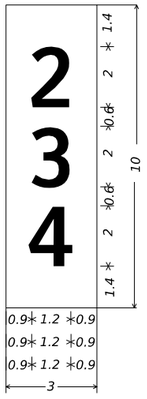
D10-7aT 3in;
No border, White on Green;
"2", ClearviewHwy-4-W;
"3", ClearviewHwy-4-W;
"0", ClearviewHwy-4-W;

SIGN 1 (SHEET 7 OF 15)



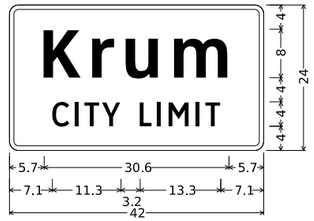
D10-7aT 3in;
No border, White on Green;
"2", ClearviewHwy-4-W;
"3", ClearviewHwy-4-W;
"2", ClearviewHwy-4-W;

SIGN 1 (SHEET 12 OF 15)



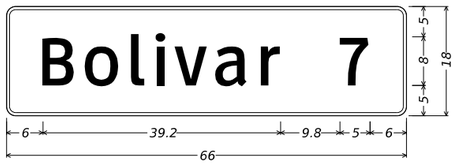
D10-7aT 3in;
No border, White on Green;
"2", ClearviewHwy-4-W;
"3", ClearviewHwy-4-W;
"4", ClearviewHwy-4-W;

SIGN 2 (SHEET 15 OF 15)



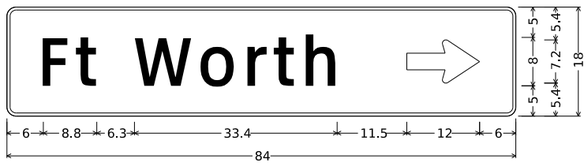
I-2aT 8in;
1.5" Radius, 0.8" Border, White on Green;
"Krum", ClearviewHwy-5-W-R;
"CITY LIMIT", ClearviewHwy-3-W;

SIGN 5 (SHEET 14 OF 15)



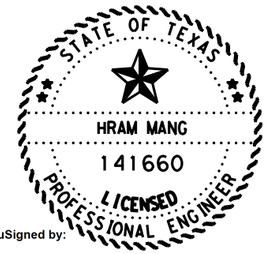
D2-1 8in;
1.5" Radius, 0.5" Border, White on Green;
"Bolivar", ClearviewHwy-3-W; "7", ClearviewHwy-3-W;

SIGN 3 (SHEET 14 OF 15)



D1-1 8in RT;
1.5" Radius, 0.5" Border, White on Green;
"Ft Worth", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0°;

SIGN 6 (SHEET 15 OF 15)



DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

SCALE: NTS

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GUIDE SIGN DETAILS

2024 SHEET 1 OF 1

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		155

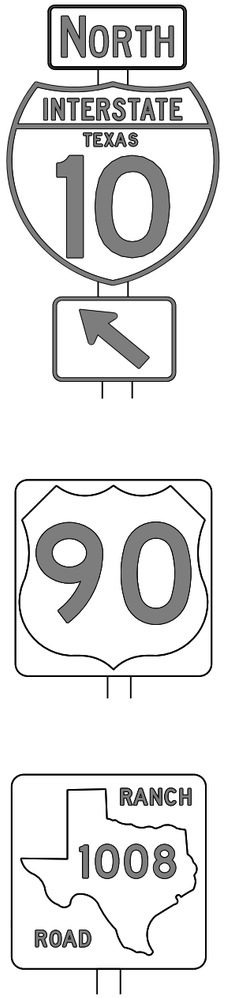
DATE: 2/22/2024 2:06:47 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Plan Set/8. Traffic/FM 2450 Small sign Detail

CK DW CK DW

DATE:
FILE:

REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

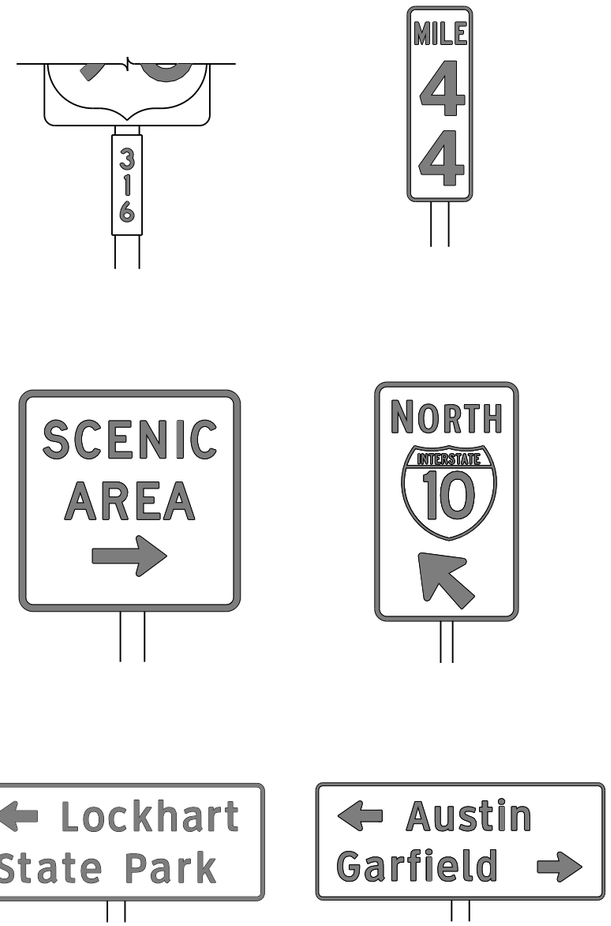
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE A SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B or C SHEETING



TYPICAL EXAMPLES

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

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



TYPICAL EXAMPLES

GENERAL NOTES

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

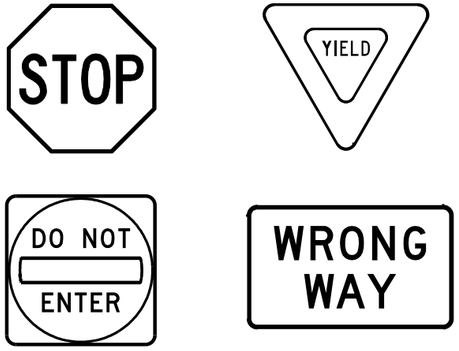
TSR(3)-13

FILE:	tsr3-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT	October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS		235302	028		FM 2450
12-03 7-13		DIST	COUNTY		SHEET NO.
9-08		DAL	DENTON		156

DATE:
FILE:

REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS

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



REQUIREMENTS FOR FOUR SPECIFIC SIGNS ONLY

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

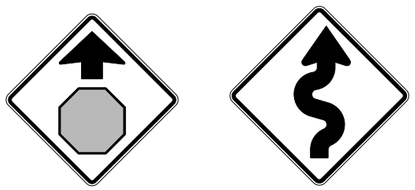
REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS

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

TYPICAL EXAMPLES

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

REQUIREMENTS FOR WARNING SIGNS



TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLOURESCENT YELLOW	TYPE B_{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	SECT	JOB	HIGHWAY
REVISIONS	235302	028		FM 2450
12-03 7-13	DIST	COUNTY		SHEET NO.
9-08	DAL	DENTON		157

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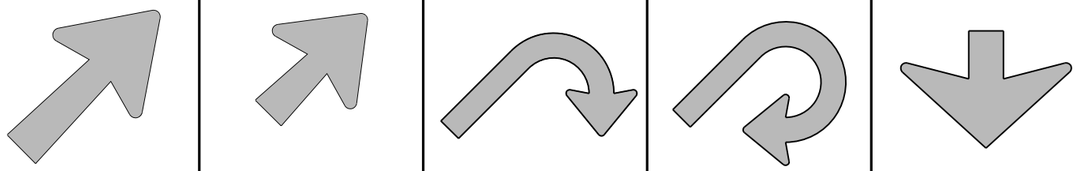
DATE:
FILE:

ARROW DETAILS

for Large Ground-Mounted and Overhead Guide Signs



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

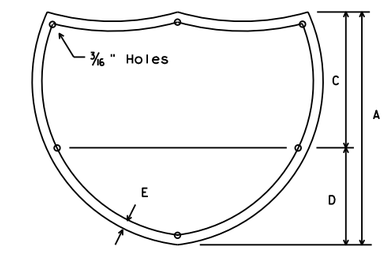
NOTE

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.

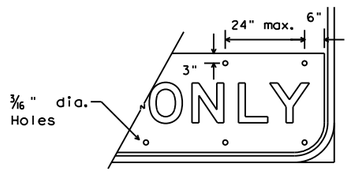
http://www.txdot.gov/

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

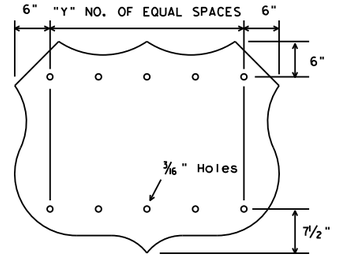


INTERSTATE ROUTE MARKERS

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

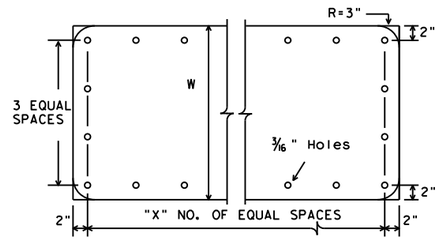


EXIT ONLY PANEL



U.S. ROUTE MARKERS

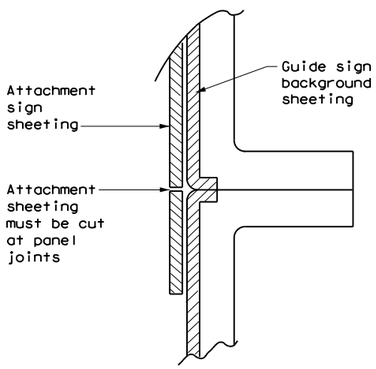
Sign Size	"Y"
24x24	2
30x24	3
36x36	3
45x36	4
48x48	4
60x48	5



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

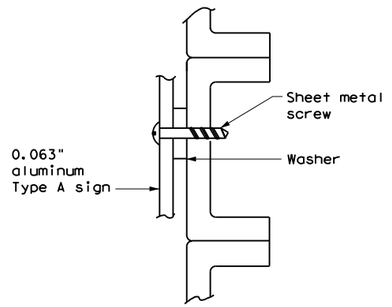
MOUNTING DETAILS OF ATTACHMENTS TO GUIDE SIGN FACE ("EXIT ONLY" AND "LEFT EXIT" PANELS, ROUTE MARKERS AND OTHER ATTACHMENTS)



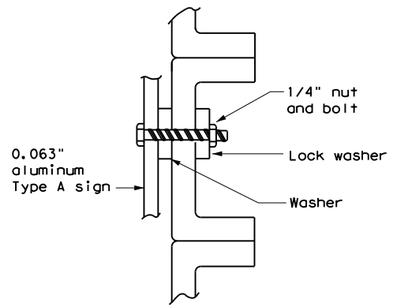
DIRECT APPLIED ATTACHMENT

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".



SCREW ATTACHMENT



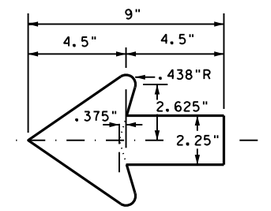
NUT/BOLT ATTACHMENT

NOTE:

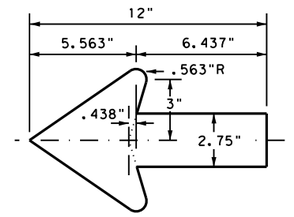
Furnish Type A aluminum sign attachments only when specified in the plans. These signs will be paid for under "Aluminum Signs".

ARROW DETAILS

for Destination Signs (Type D)



Standard arrow to be used with 6 inch letters.



Standard arrow to be used with 8 inch letters.

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
© TxDOT	October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS		235302		028	FM 2450
12-03 7-13		DIST	COUNTY		SHEET NO.
9-08		DAL	DENTON		158

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SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

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

Post Type

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

Number of Posts (1 or 2)

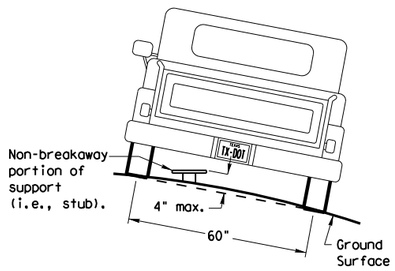
Anchor Type

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

Sign Mounting Designation

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

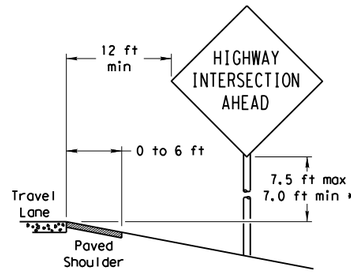
REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



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

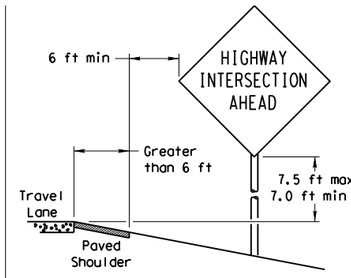
SIGN LOCATION

PAVED SHOULDERS



LESS THAN 6 FT. WIDE

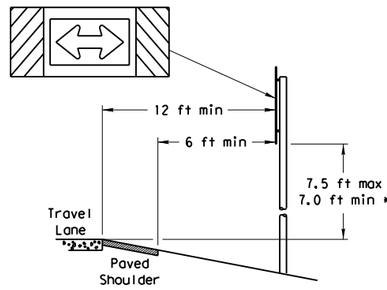
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



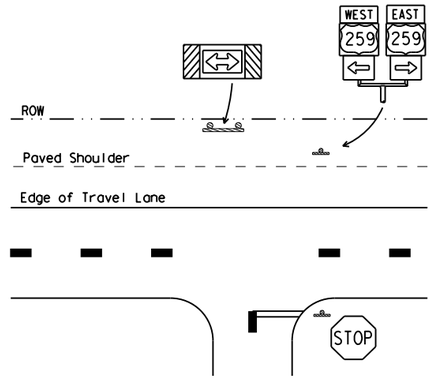
GREATER THAN 6 FT. WIDE

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

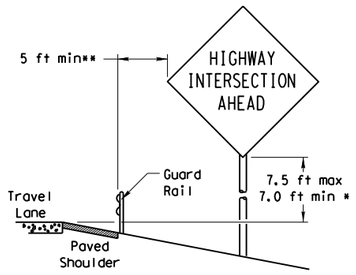
T-INTERSECTION



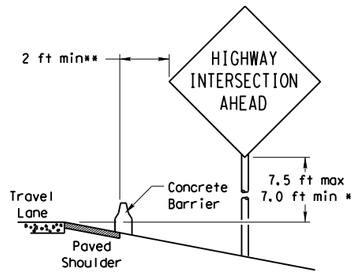
When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.



BEHIND BARRIER



BEHIND GUARDRAIL



BEHIND CONCRETE BARRIER

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

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

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

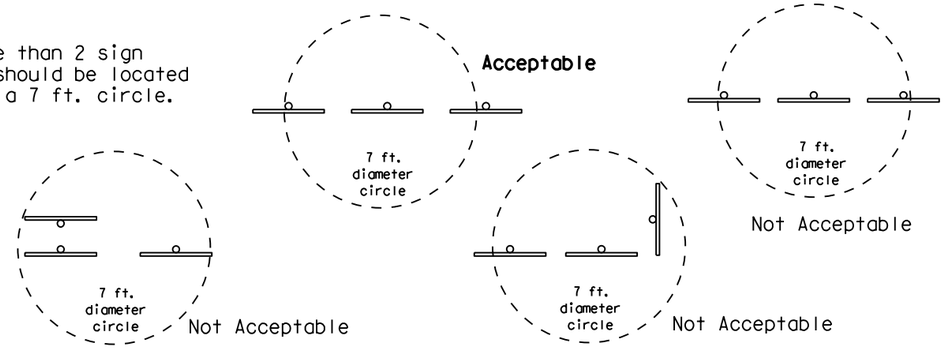
(2) a minimum of 7 to a maximum of 7.5 feet above the grade at the base of the support when sign is installed on the backslope.

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

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

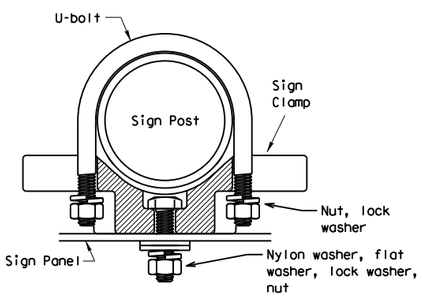
The website address is:
http://www.txdot.gov/publications/traffic.htm

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



TYPICAL SIGN ATTACHMENT DETAIL

Single Signs

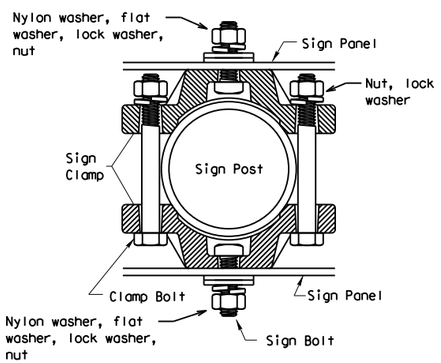


Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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

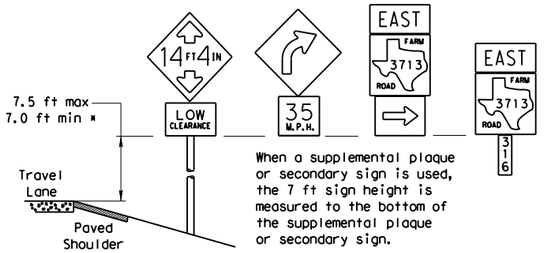
Sign clamps may be either the specific size clamp or the universal clamp.

Back-to-Back Signs



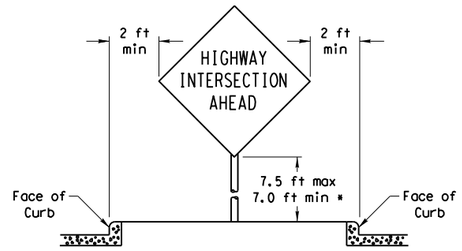
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES



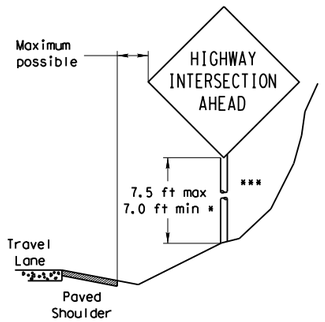
When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

CURB & GUTTER OR RAISED ISLAND



RESTRICTED RIGHT-OF-WAY

(When 6 ft min. is not possible.)



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

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

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

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

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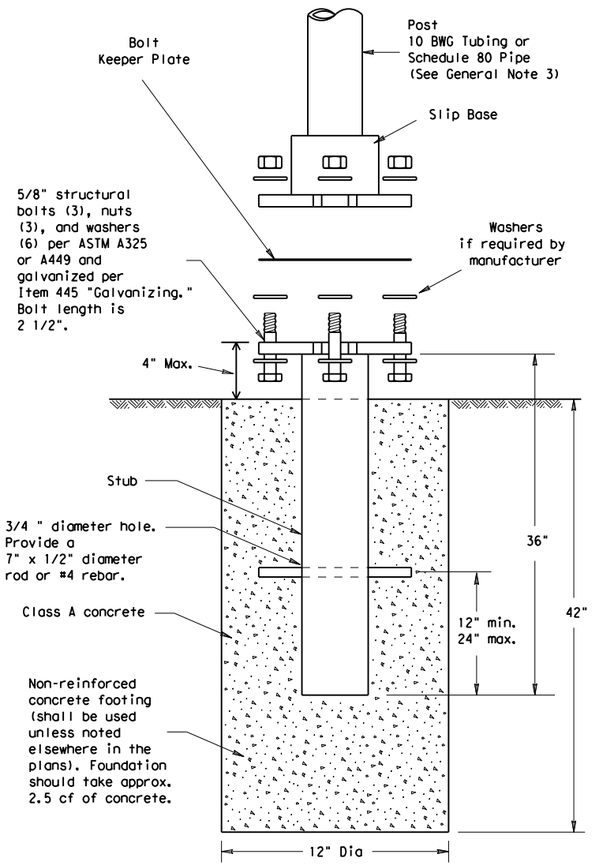
9-08 REVISIONS	CONT	SECT	JOB	HIGHWAY
	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		159

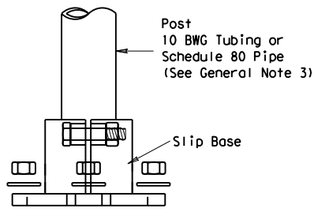
DATE:
FILE:

TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS

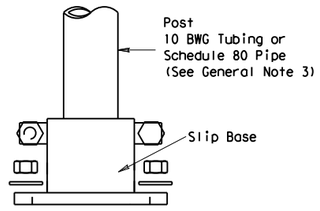


SM RD SGN ASSM TY XXXXX(X)SA(X-XXXX)

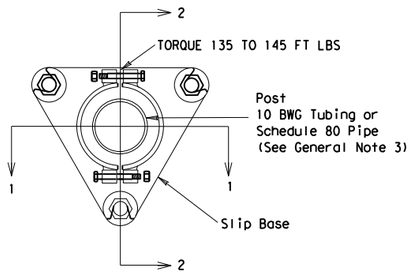
NOTE
The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.



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

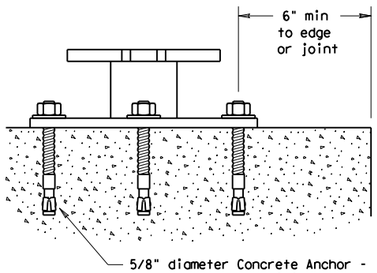
Foundation

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

DATE:
FILE:

Texas Department of Transportation
Dallas District Standard

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

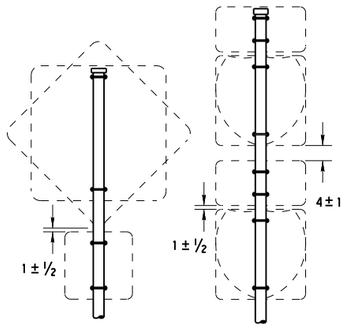
SMD(SLIP-1)-08(DAL)

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

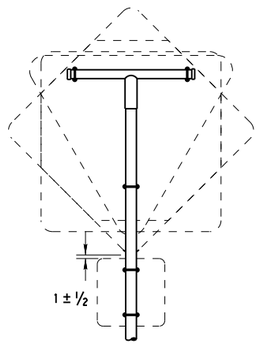
9-08 REVISIONS
12-10 (DISTRICT) ADDED CLAMP BASE DETAIL FOR SLIP BASE INSTALLATION

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		160

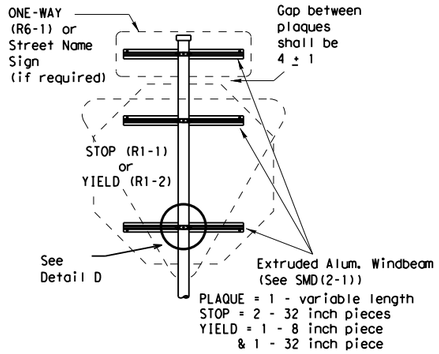
26B



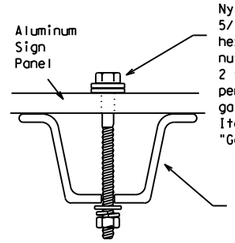
SM RD SGN ASSM TY XXXXX(1)XX(P)



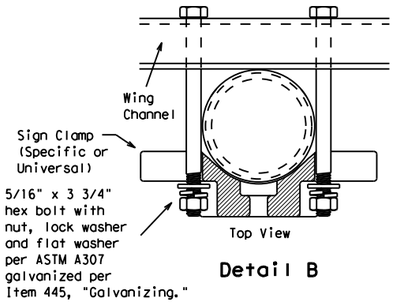
SM RD SGN ASSM TY XXXXX(1)XX(T)



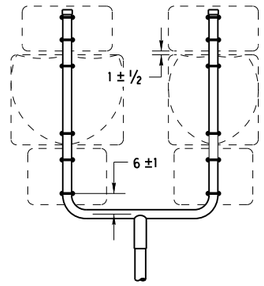
SM RD SGN ASSM TY XXXXX(1)XX(P-BM)



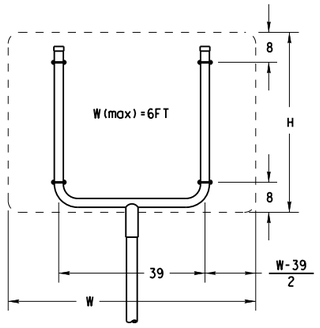
Detail A



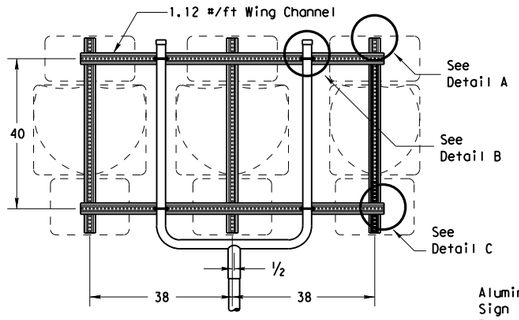
Detail B



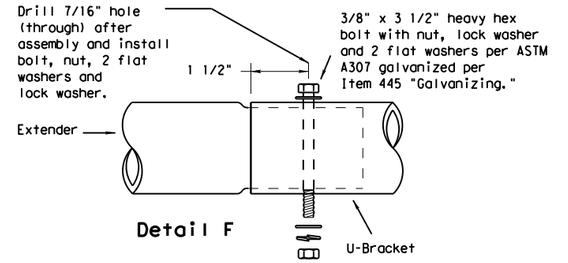
SM RD SGN ASSM TY XXXXX(1)XX(U)



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

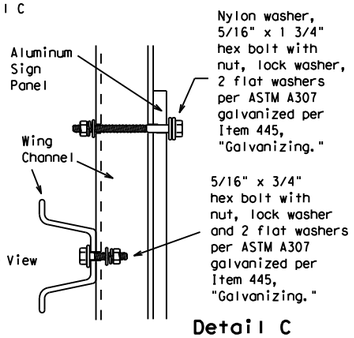


SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)

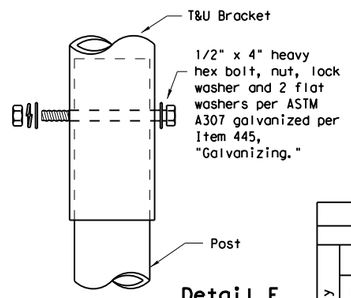


Detail F

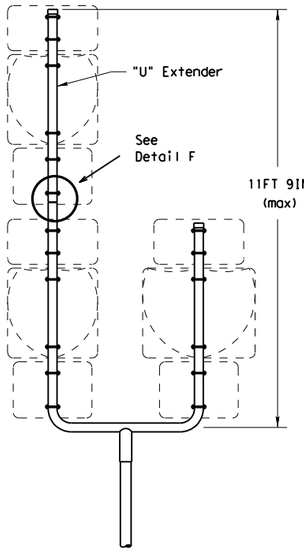
Splices shall only be allowed behind the sign substrate.



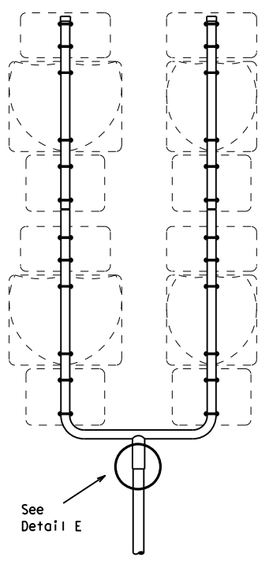
Detail C



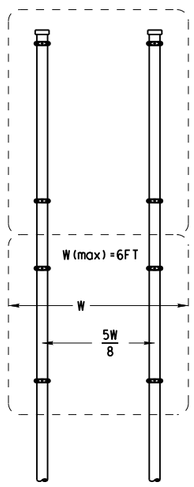
Detail E



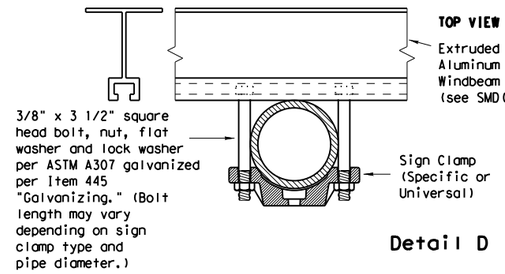
SM RD SGN ASSM TY S80(1)XX(U-1EXT)



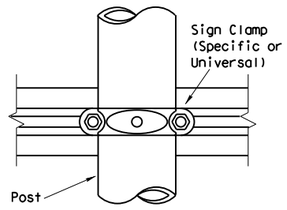
SM RD SGN ASSM TY S80(1)XX(U-2EXT)



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



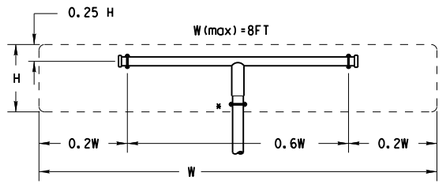
Detail D



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.

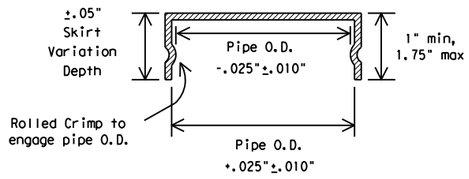
REQUIRED SUPPORT		
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	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)



All dimensions are in english unless detailed otherwise.

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

FRICTION CAP DETAIL



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

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

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

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

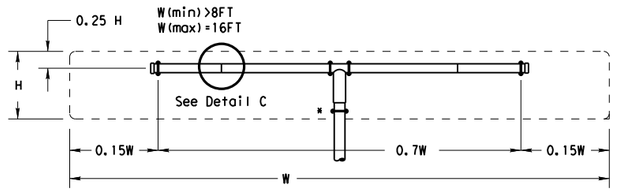
SMD(SLIP-2)-08

DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		161

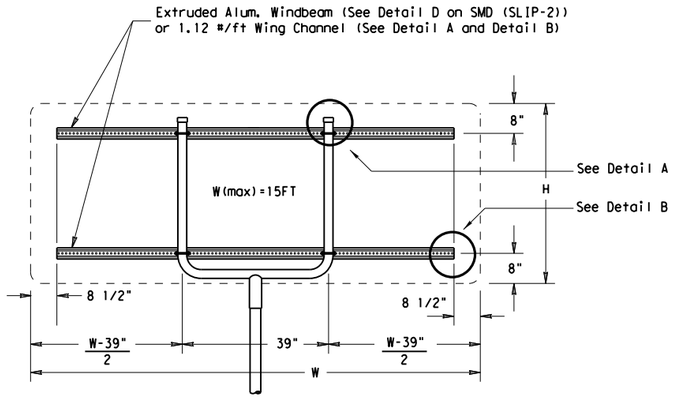
9-08 REVISIONS

DATE:
FILE:

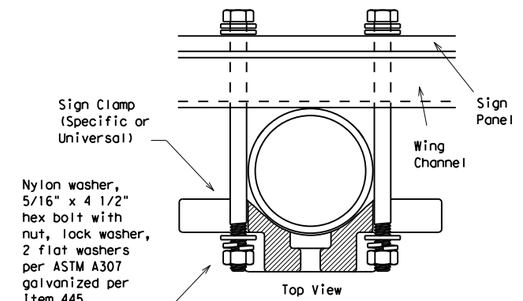
DATE:
FILE:



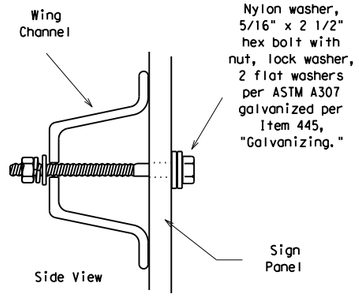
SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)
(* - See Note 12)



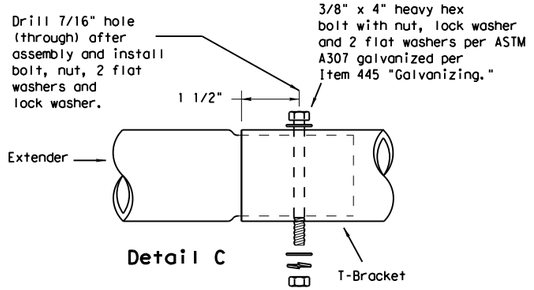
SM RD SGN ASSM TY XXXXX(1)XX(U-XX)



Detail A

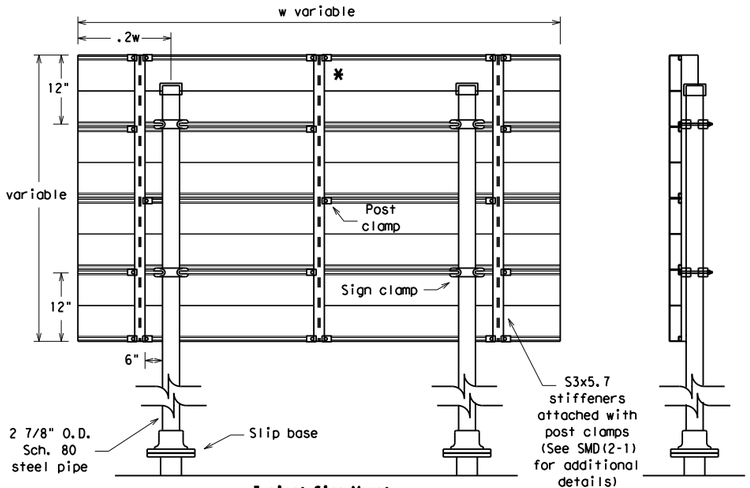


Detail B



Detail C

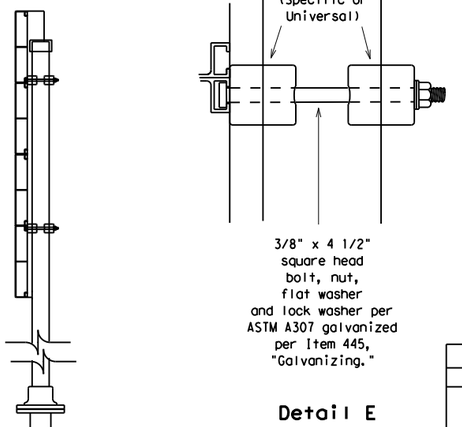
Splices shall only be allowed behind the sign substrate.

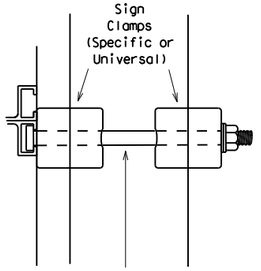


Typical Sign Mount

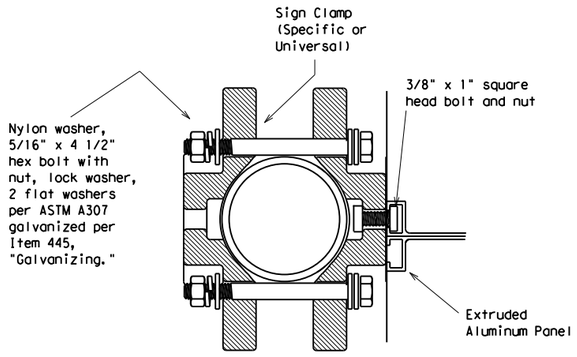
SM RD SGN ASSM TY S80(2)XX(P-EXAL)

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

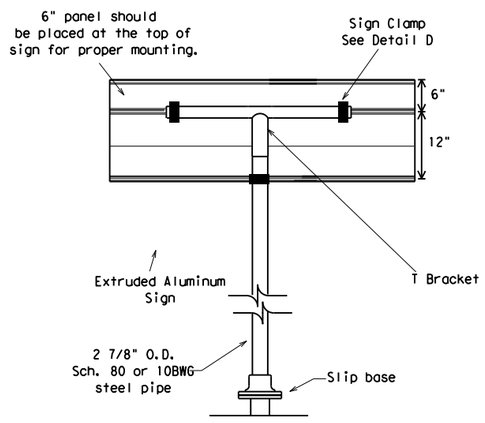




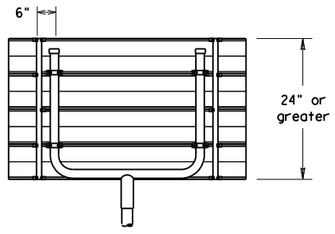
Detail E



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

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

REQUIRED SUPPORT

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

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS
SMALL ROADSIDE SIGNS
TRIANGULAR SLIPBASE SYSTEM

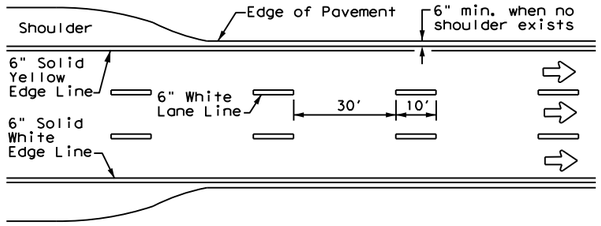
SMD(SLIP-3)-08

REVISIONS
9-08

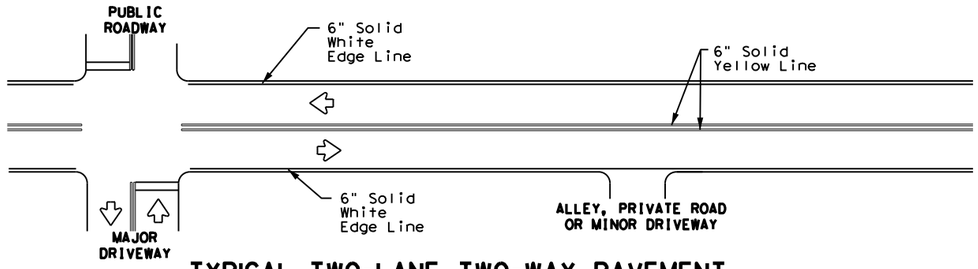
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450

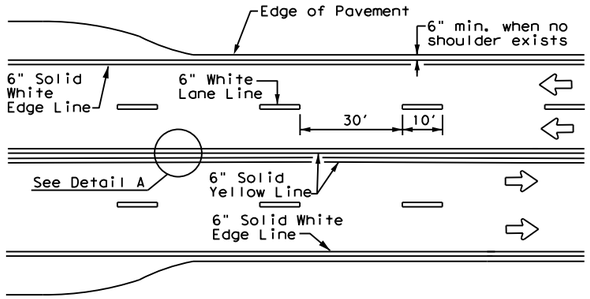
DIST	COUNTY	SHEET NO.
DAL	DENTON	162

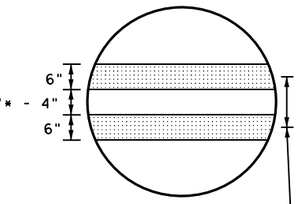


EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



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





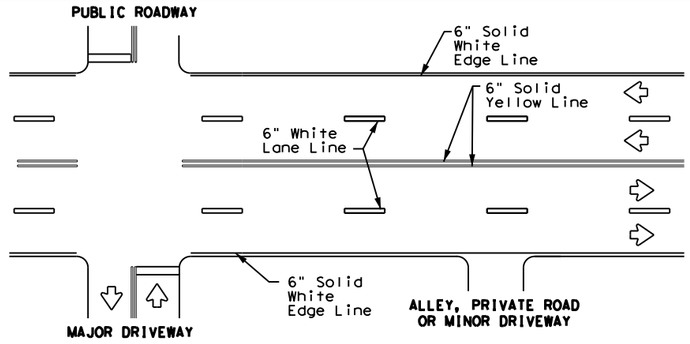
DETAIL "A"

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

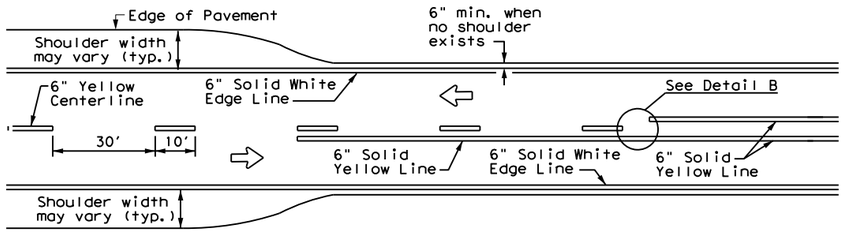
CENTERLINE AND LANE LINES FOUR LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS

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

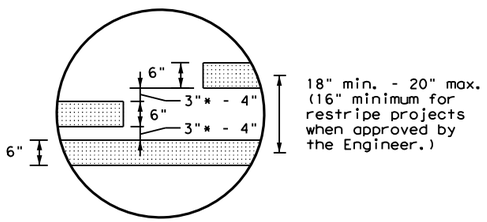
** 8" minimum for restripe projects when approved by the Engineer.



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

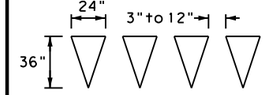


TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS



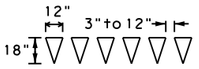
DETAIL "B"

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

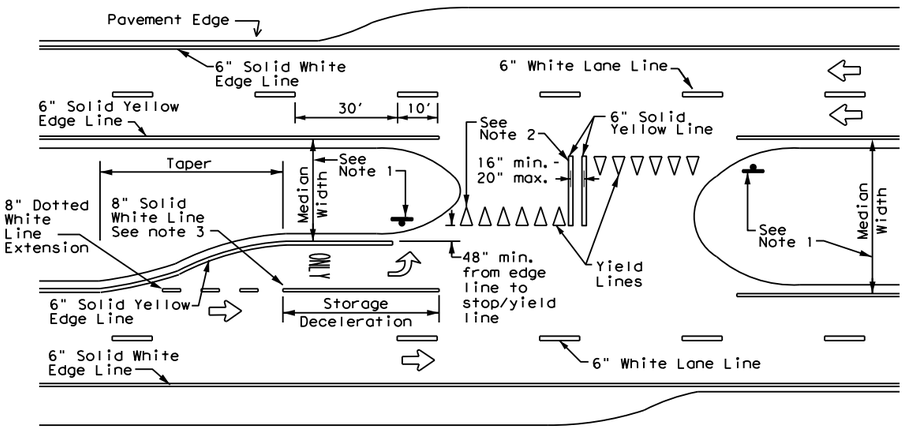


For posted speed on road being marked equal to or greater than 45 MPH.

YIELD LINES



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



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

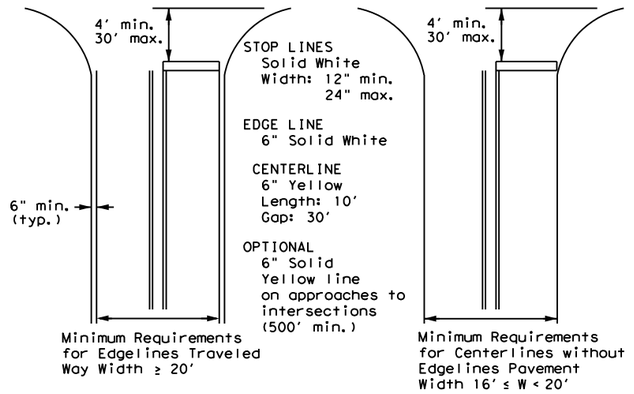
1. Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections.
   Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs and stop bars are optional as determined by the Engineer.
2. Install median striping (double yellow centerlines and stop lines/yield lines) when a 50' or greater median centerline can be placed. Stop lines shall only be used with stop signs. Yield lines shall only be used with yield signs.
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. Edge line striping shall be as shown in the plans or as directed by the Engineer. The edge line should not be placed less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edge lines are not required in curb and gutter sections of roadways.
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 center of edge line to the center of edge line of a two lane roadway.

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

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



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

GUIDE FOR PLACEMENT OF STOP LINES, EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths for Undivided Roadways

Texas Department of Transportation

Traffic Safety Division Standard

TYPICAL STANDARD PAVEMENT MARKINGS

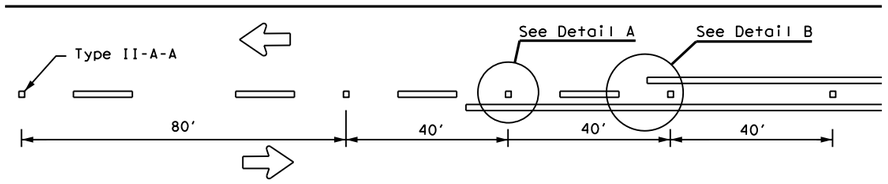
PM(1)-22

FILE: pm1-22.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
11-78 8-00 6-20	DIST	COUNTY		SHEET NO.
8-95 3-03 12-22	DAL	DENTON		163
5-00 2-12				

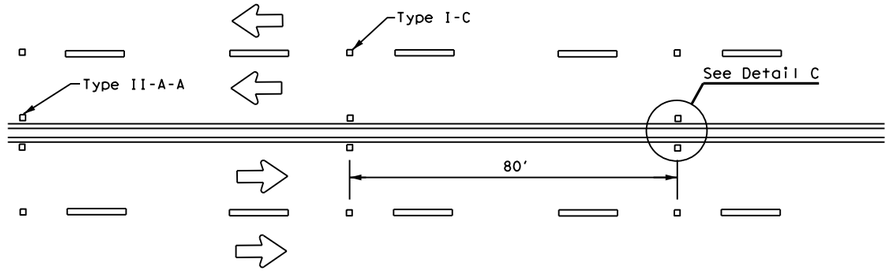
22A

DATE:
FILE:

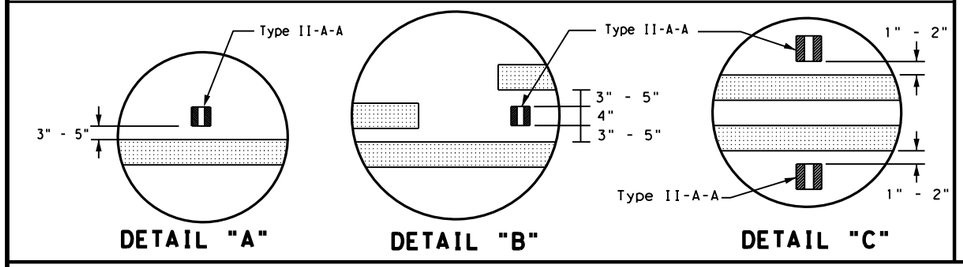
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE

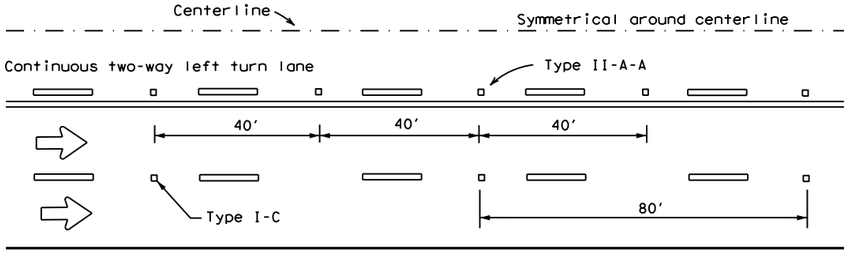


CENTERLINE FOR ALL TWO LANE TWO-WAY ROADWAYS

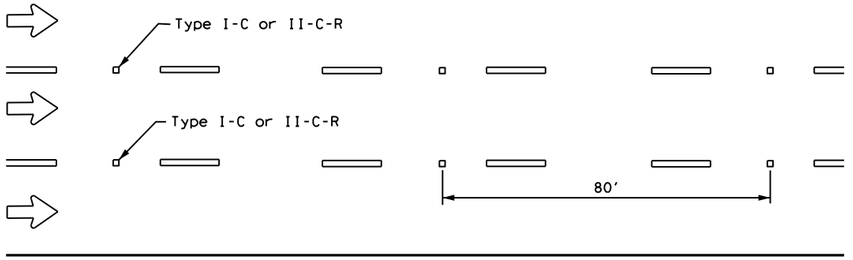


CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY ROADWAYS





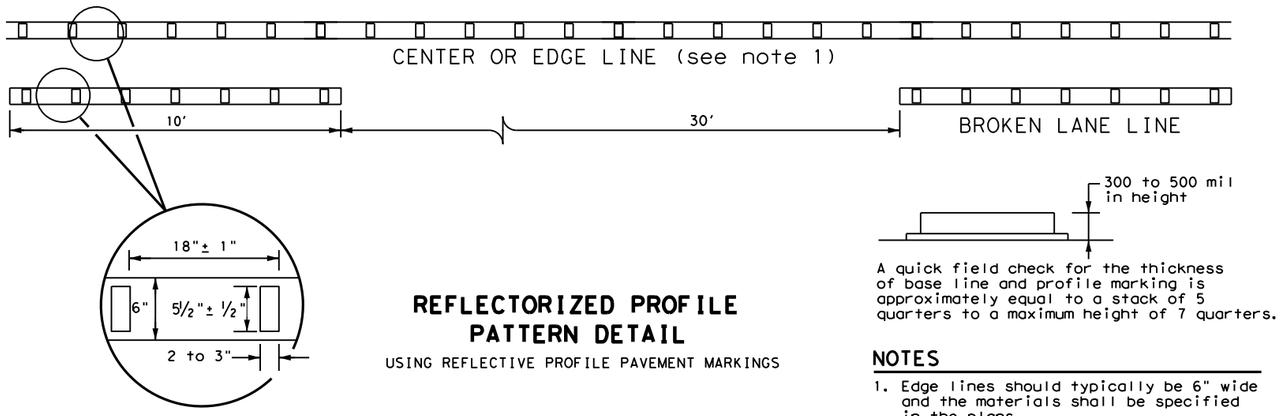
CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



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

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

See Note 3.



REFLECTORIZED PROFILE PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS

NOTES

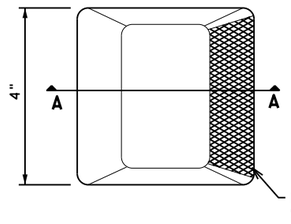
1. Edge lines should typically be 6" wide and the materials shall be specified in the plans.
2. Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

GENERAL NOTES

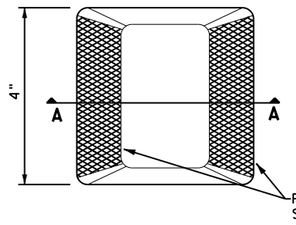
1. All raised pavement markers placed along broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.
3. Use raised pavement marker Type I-C with undivided roadways, flush medians and two way left turn lanes. Use raised pavement marker Type II-C-R with divided highways and raised medians.

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

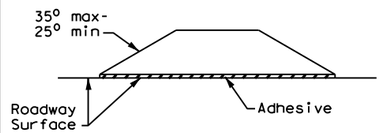
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



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)-22

FILE: pm2-22.dgn	DN:	CK:	DW:	CK:
©TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
4-77 8-00 6-20	DIST	COUNTY		SHEET NO.
4-92 2-10 12-22	DAL	DENTON		164
5-00 2-12				

22B

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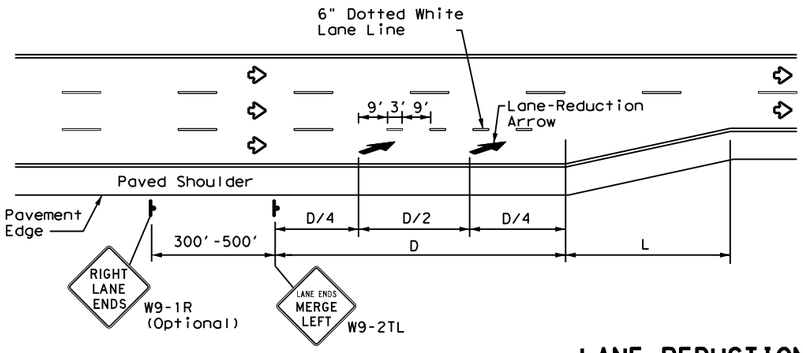
DATE:
FILE:

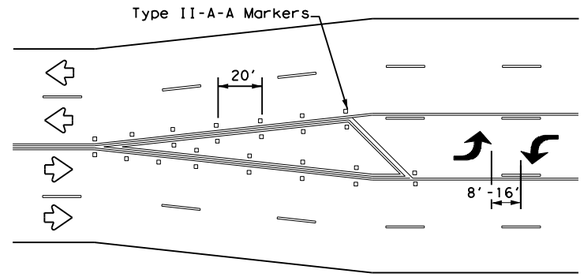


LANE REDUCTION

NOTES

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

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



A two-way left-turn (TWLT) lane-use arrow pavement marking should be used at or just downstream from the beginning of a two-way left-turn lane within a corridor. Repeating the marking after each intersection or dedicated turn bay is not required unless stated elsewhere in the plans.

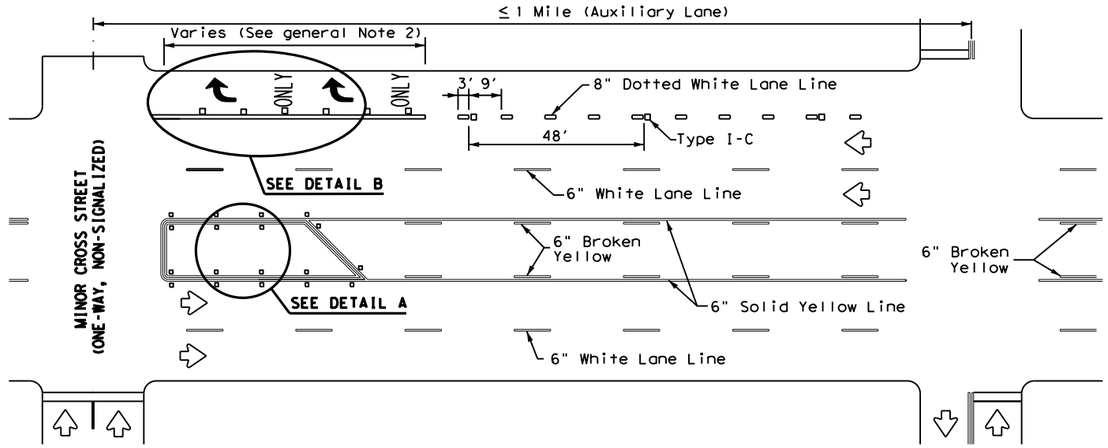
TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY

GENERAL NOTES

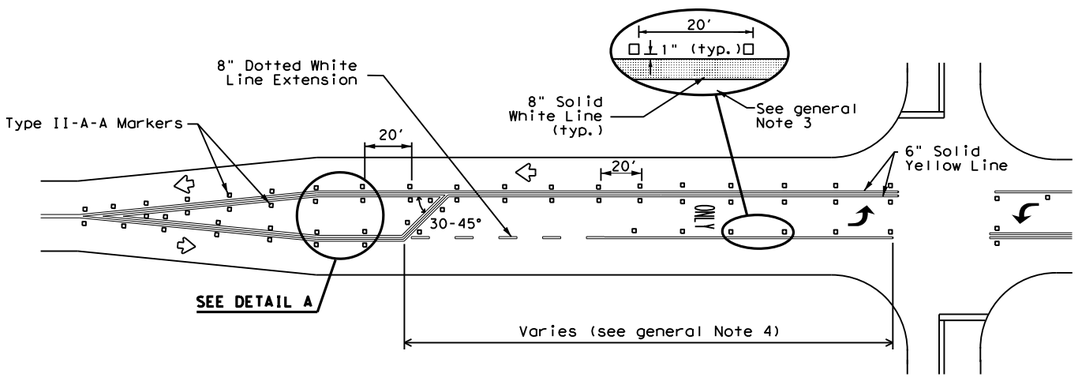
1. Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn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

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

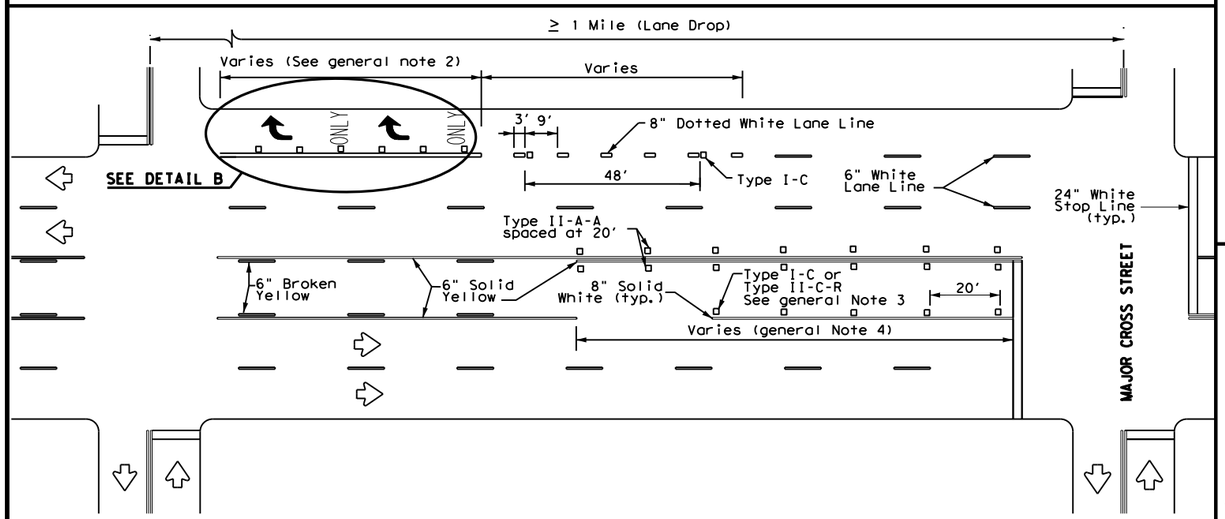
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



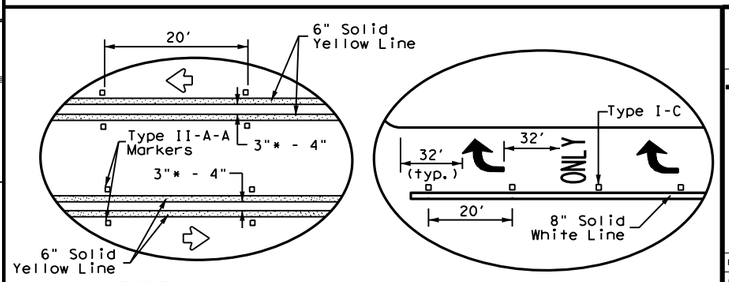
TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE



TYPICAL TWO-LANE ROADWAY INTERSECTION WITH LEFT TURN BAYS



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



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

Texas Department of Transportation

Traffic Safety Division Standard

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

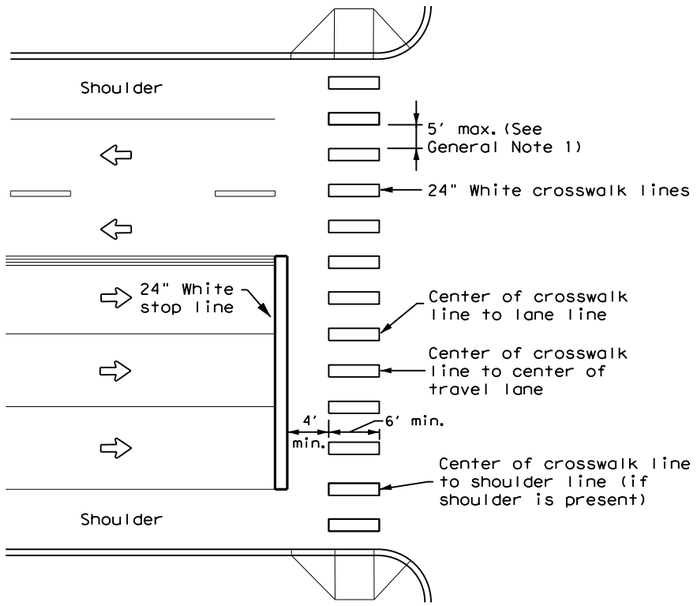
PM(3)-22

FILE: pm3-22.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
4-98 3-03 6-20	DIST	COUNTY		SHEET NO.
5-00 2-10 12-22	DAL	DENTON		165
8-00 2-12				

22C

DATE:
FILE:

DATE:
FILE:



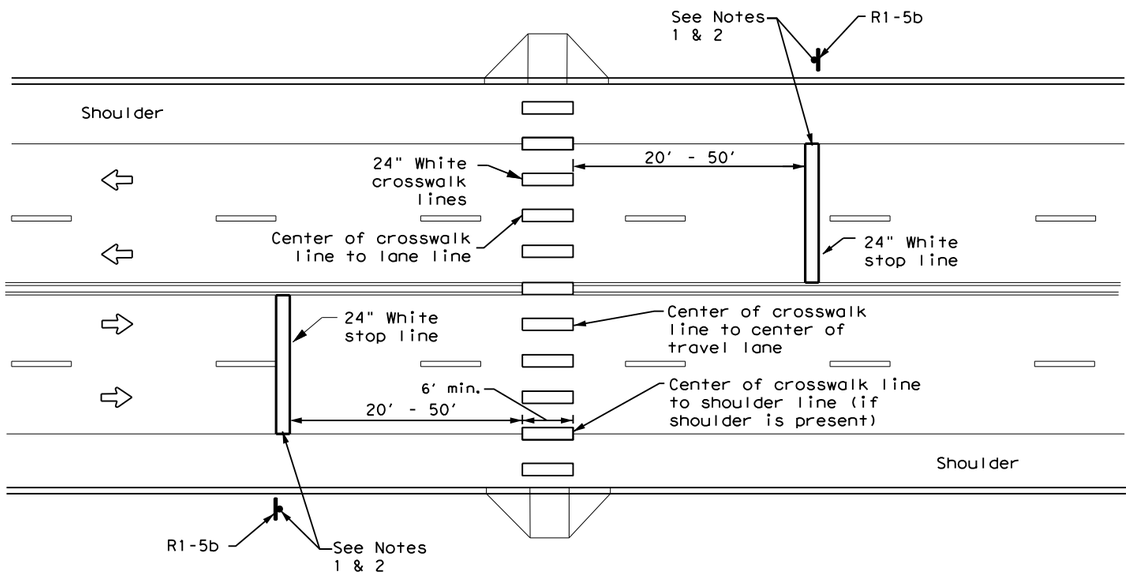
HIGH-VISIBILITY LONGITUDINAL CROSSWALK AT CONTROLLED APPROACH

GENERAL NOTES

1. Longitudinal crosswalk lines should not be placed in the wheel path of vehicles. Center the crosswalk lines on travel lanes, lane lines, and shoulder lines (if present).
2. A minimum 6" clear distance shall be provided to the curb face. If the last crosswalk line falls into this distance it must be omitted.
3. For divided roadways, adjustments in spacing of the crosswalk lines should be made in the median so that the crosswalk lines are maintained in their proper location across the travel portion of the roadway.
4. At skewed crosswalks, the crosswalk lines are to remain parallel to the lane lines.
5. Each crosswalk shall be a minimum of 6' wide.
6. The High-Visibility Longitudinal Crosswalk is the preferred crosswalk pattern on State Highways. Other crosswalk patterns as shown in the "Texas Manual on Uniform Traffic Control Devices" may be used. All crosswalk designs and dimension shall comply with the "Texas Manual on Uniform Traffic Control Devices."
7. Final placement of Stop Bar and Crosswalk shall be approved by the Engineer in the field.

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.



UNSIGNALIZED MIDBLOCK HIGH-VISIBILITY LONGITUDINAL CROSSWALK

NOTES:

1. Use stop bars with Stop Here For Pedestrians (R1-5b) signs at unsignalized midblock cross walks.
2. Use stop bars with STOP HERE ON RED (R10-6 or R10-6a) signs at mid block crosswalks controlled by traffic signals or pedestrian hybrid beacons.

Texas Department of Transportation

Traffic Safety Division Standard

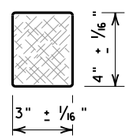
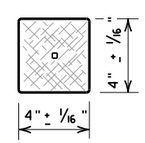
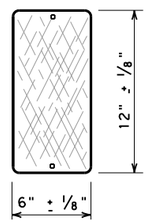
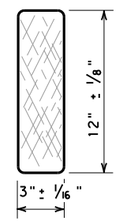
CROSSWALK PAVEMENT MARKINGS

PM(4)-22A

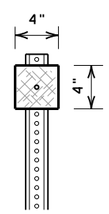
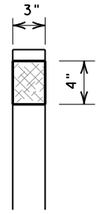
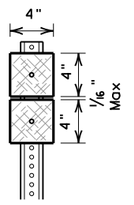
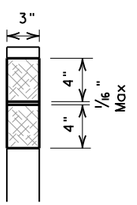
FILE: pm4-22a.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
6-20	DIST	COUNTY		SHEET NO.
6-22	DAL	DENTON		166
12-22				

22D

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

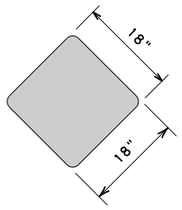
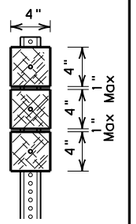
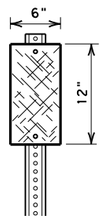
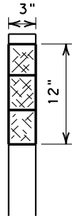
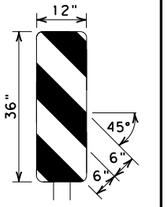
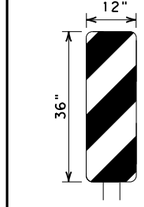
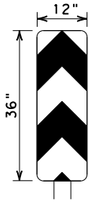
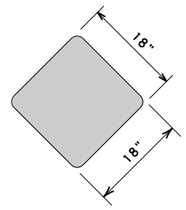
NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

TYPE OF POST
WC = Wing Channel Post
WFLX = White Flexible Post
TWT = Thin Walled Tubing

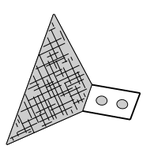
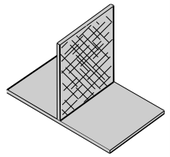
TYPE OF MOUNT
GND = Embedded (drivable)
SRF = Surface Mount
WAS = Wedge Anchor Steel
WAP = Wedge Anchor Plastic

DIRECTION
If Required
BI = Bi-Directional

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)

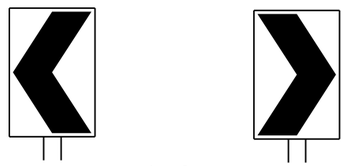
	GF1	GF2	CTB
DEVICE			

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.

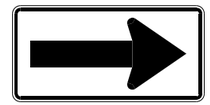
CHEVRONS

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	

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).

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:

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.

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

D & OM(1)-20

FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	DAL	DENTON		167

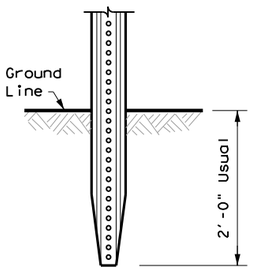
20A

DATE:
FILE:

POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

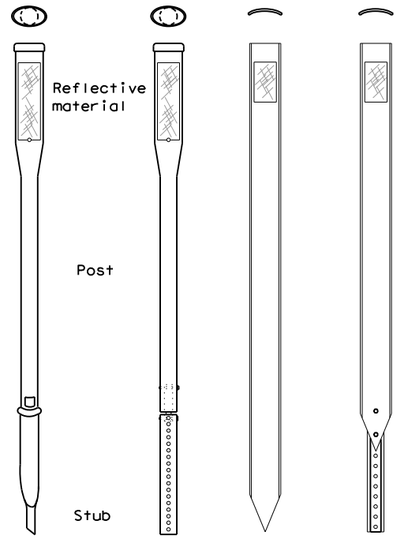


NOTES

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.

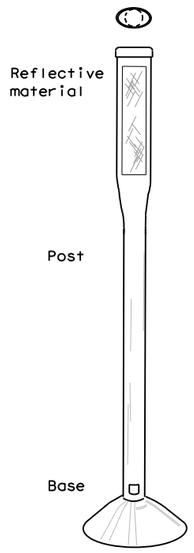
FLEXIBLE POSTS (YFLX, WFLX)

GND



EMBEDDED

SRF



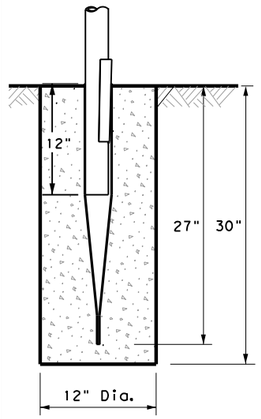
SURFACE MOUNT

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.

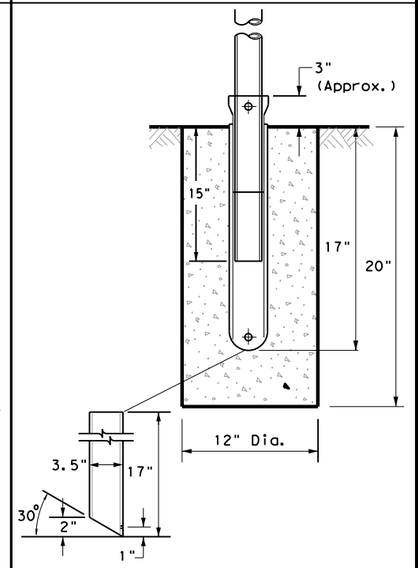
WEDGE ANCHOR SYSTEMS

WAS



STEEL

WAP



PLASTIC

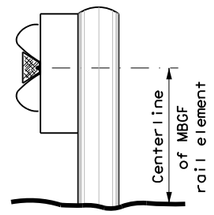
NOTE

1. Install per manufacturer's recommendations.

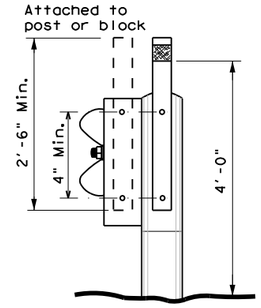
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

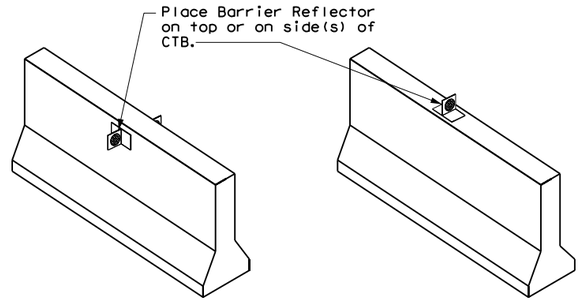
GF1



GF2



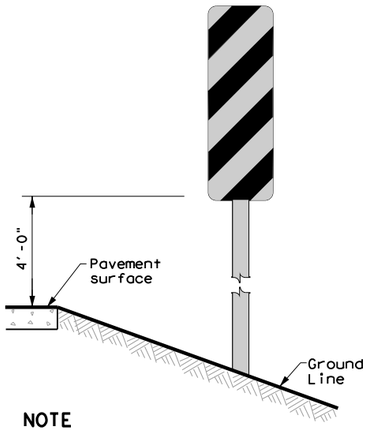
CONCRETE TRAFFIC BARRIER (CTB)



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.

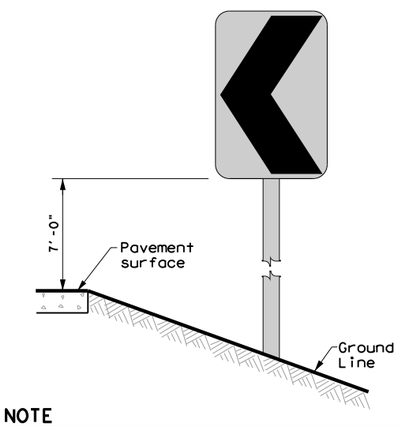
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



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)

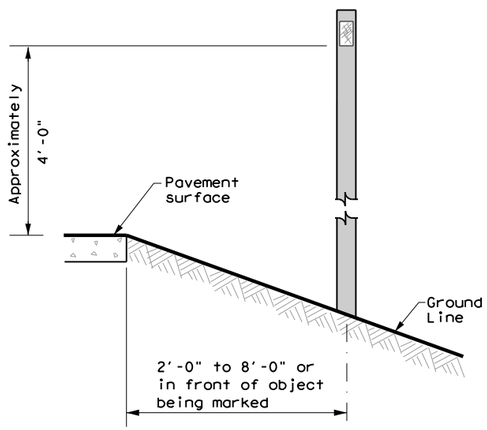
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



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.

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

FILE: dom2-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	DAL	DENTON		168

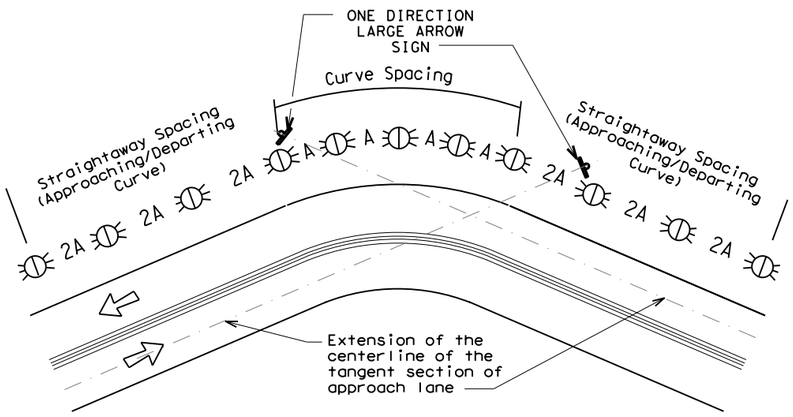
20B

DATE:
FILE:

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

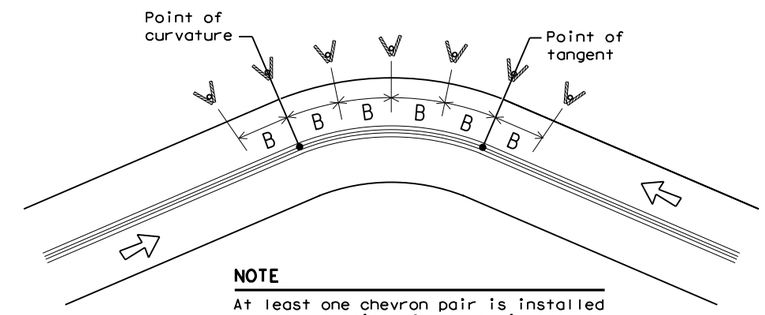
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



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

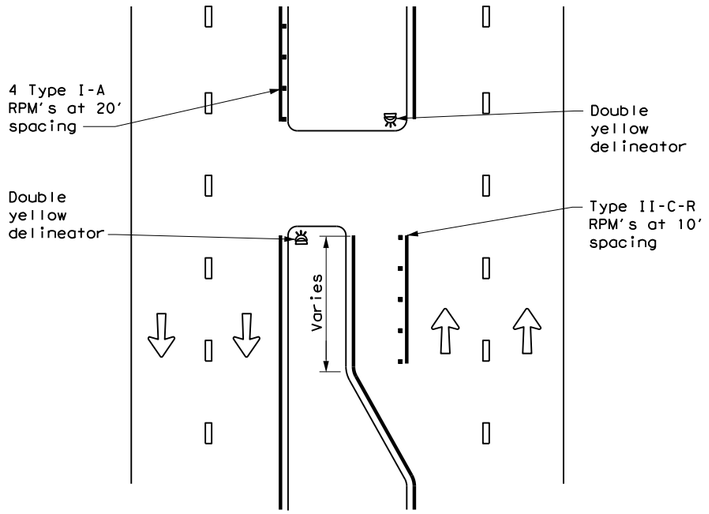
D & OM(3)-20

FILE: dom3-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
3-15 8-15	DIST	COUNTY		SHEET NO.
8-15 7-20	DAL	DENTON		169

20C

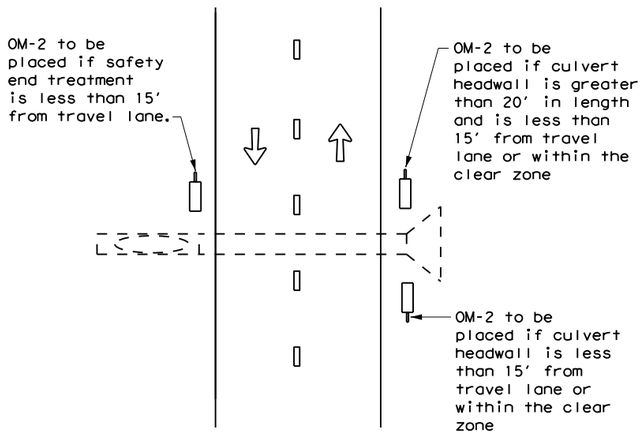
DATE:
FILE:

CROSSOVERS



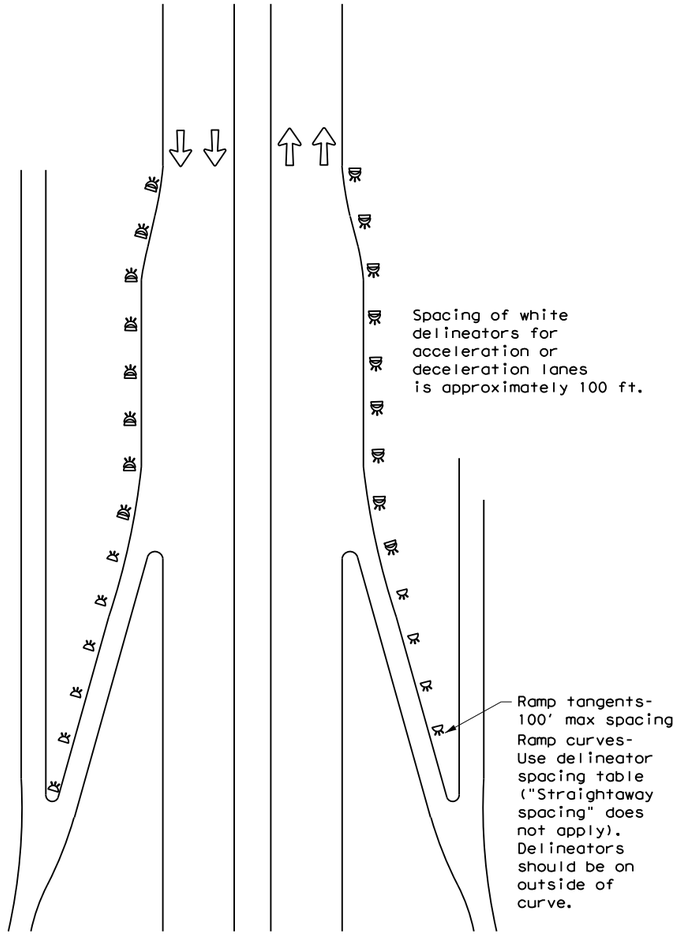
DETAIL 1

FOR CULVERTS WITHOUT MBGF



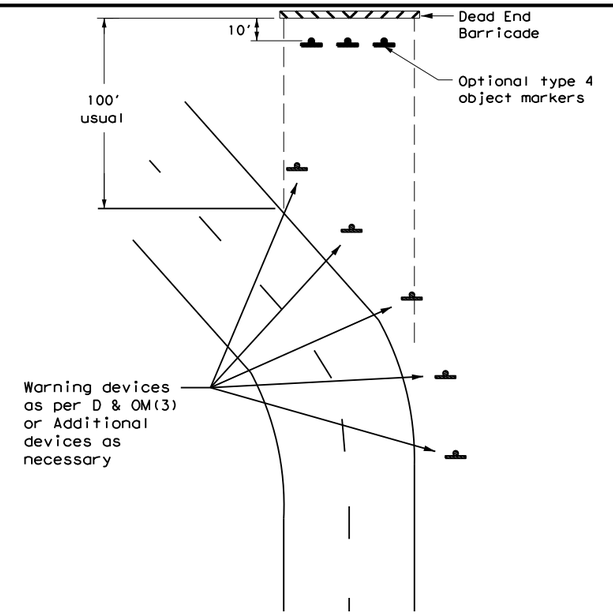
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



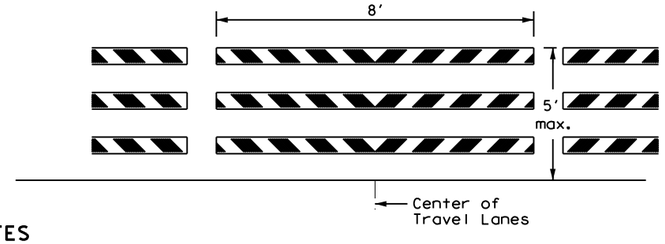
DETAIL 3

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

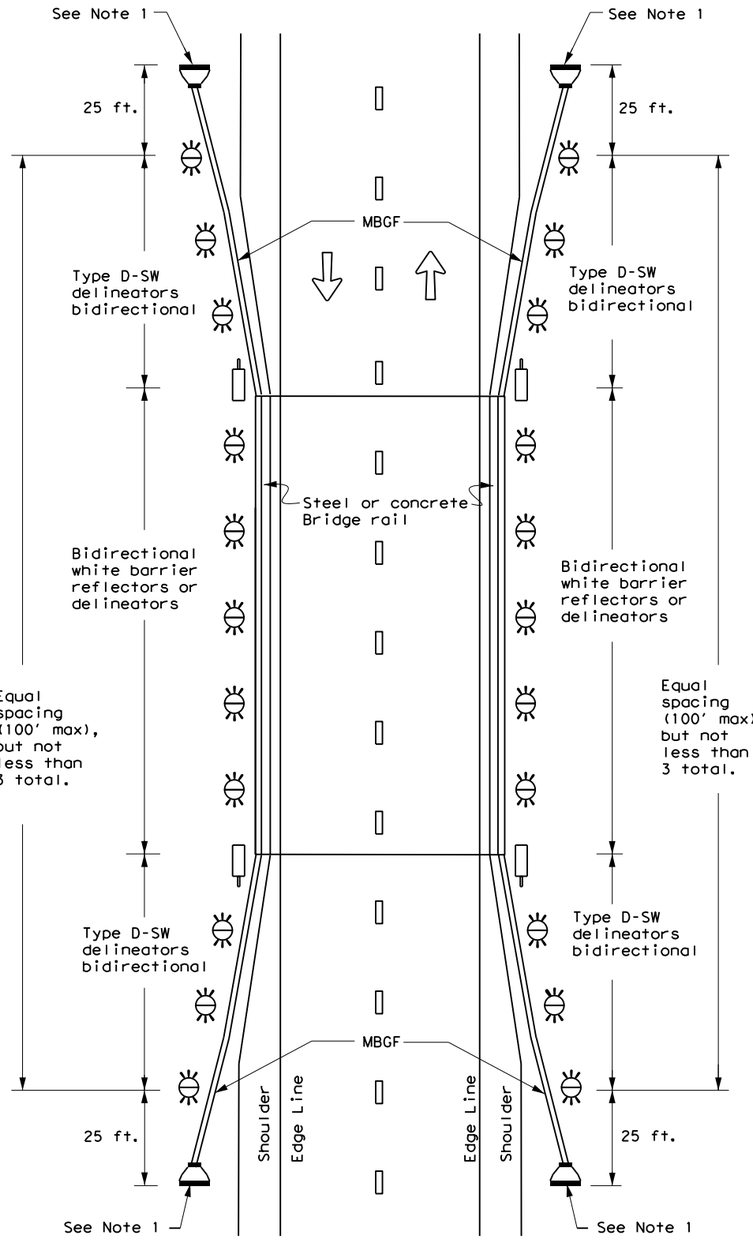
FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
3-15	DIST	COUNTY		SHEET NO.
7-20	DAL	DENTON		170

DATE:
FILE:

20D

DATE:
FILE:

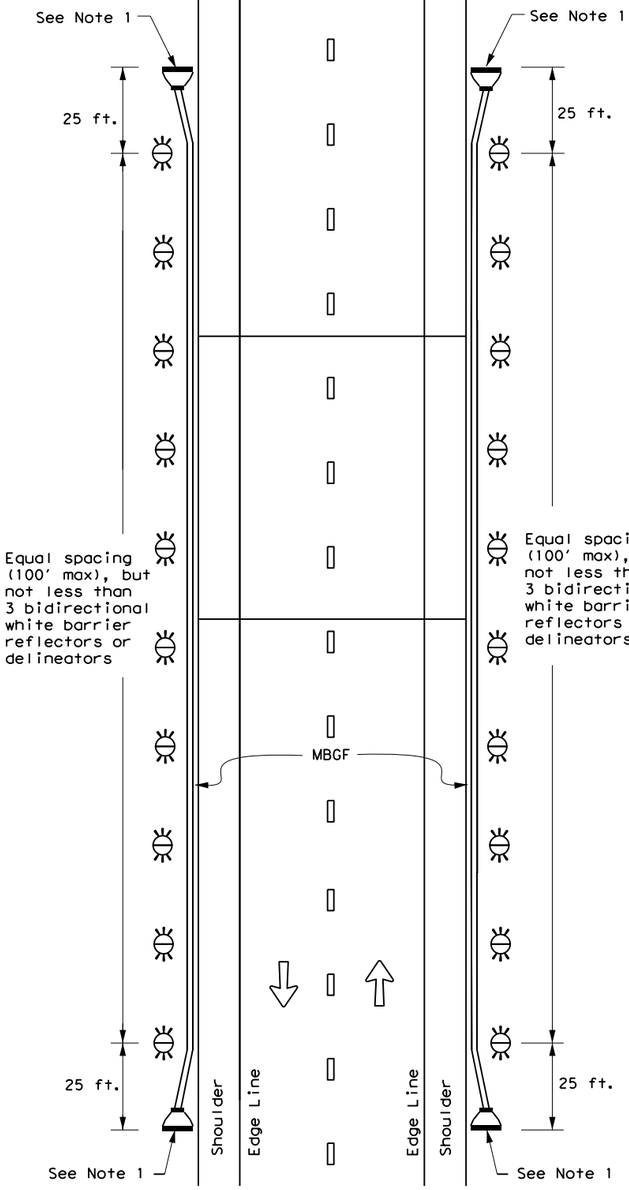
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

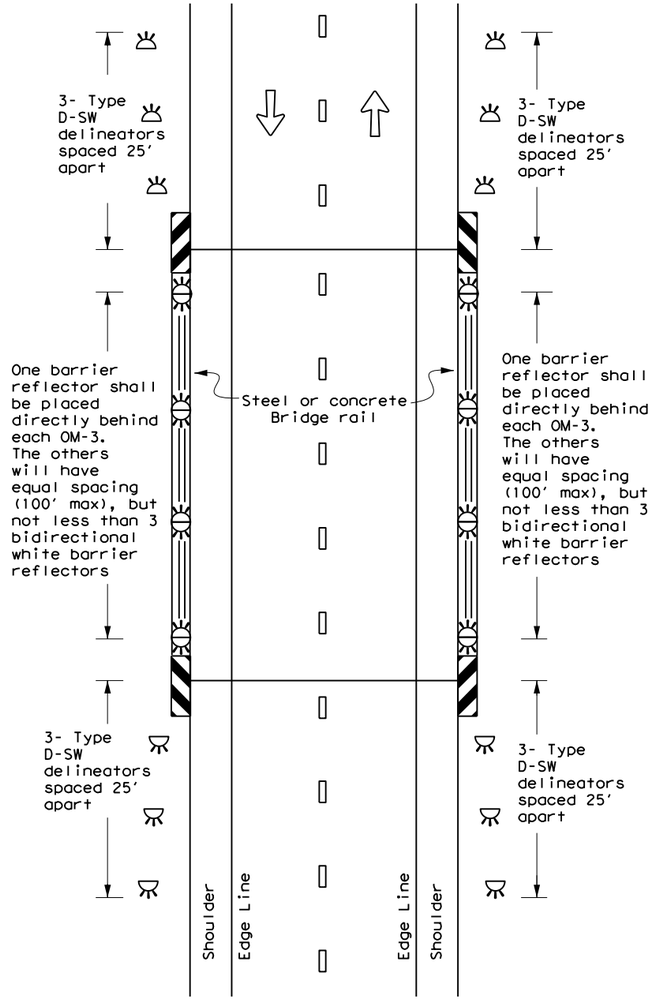
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

TWO-WAY, TWO LANE ROADWAY BRIDGE WITH NO APPROACH RAIL



LEGEND

	Bidirectional Delineator
	Delineator
	OM-3
	OM-2
	Terminal End
	Traffic Flow

Texas Department of Transportation

Traffic Safety Division Standard

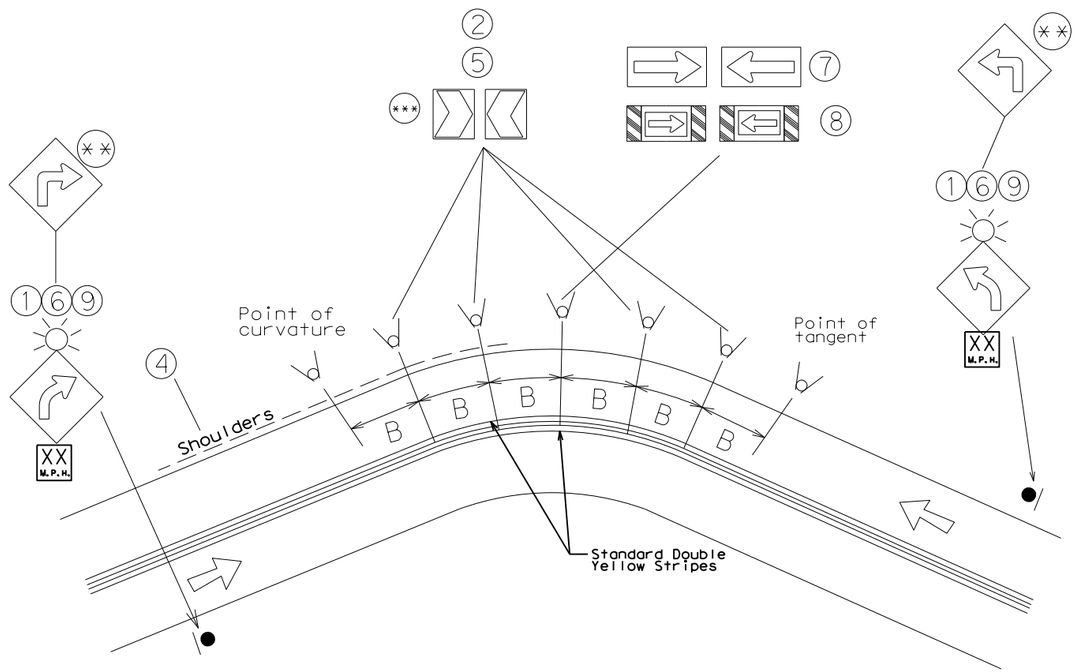
DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(5)-20

FILE: dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
7-20	DIST	COUNTY		SHEET NO.
	DAL	DENTON		171

20E

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 less than posted speed
+	+	+	3a	Pavement width 20' or greater 6" solid white edge line
+	+	+	3c	Pavement width less than 20', 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
			***	Chevron size minimum is 24" x 30"

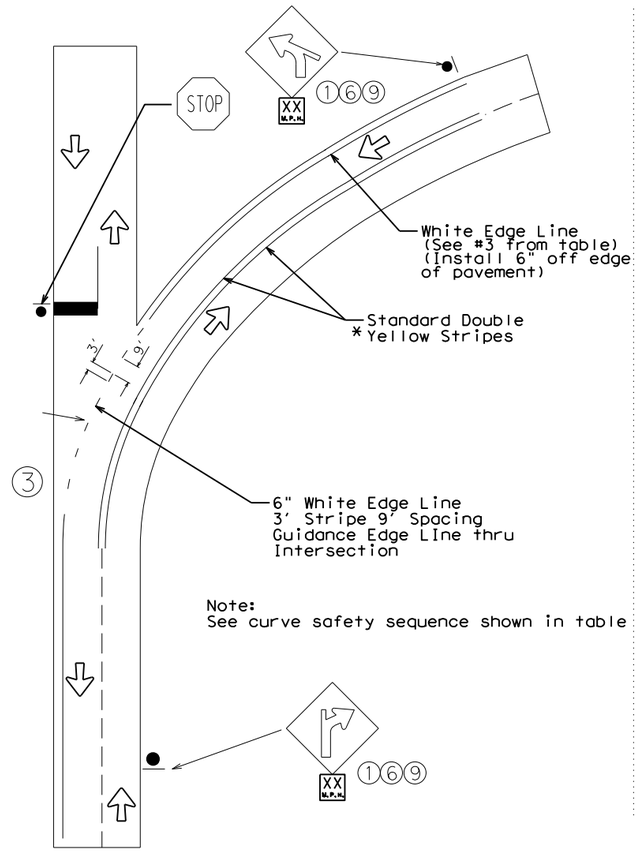
+ = required
# = optional

Applications 4 - 10 are additional supplemental applications which may be added as directed by the Area Engineer.

Note:
"B" - Chevron Spacing referenced from latest version of the D&OM(3) standard

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.

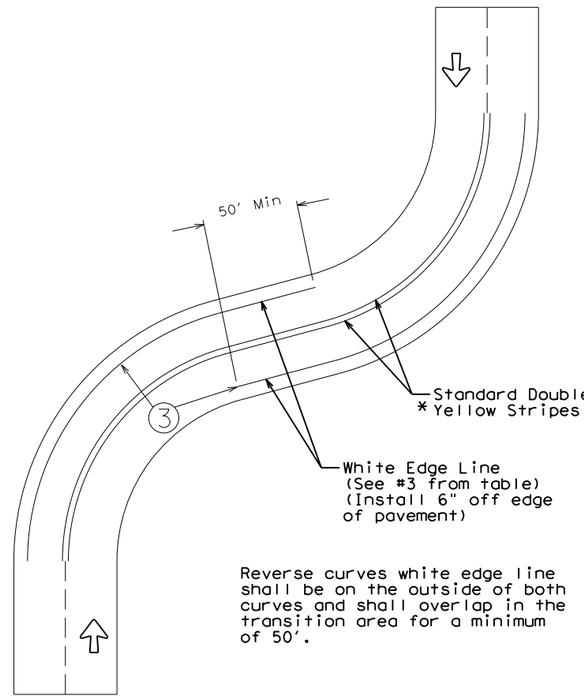
Typical Curve Treatment witn Intersection



Note:
See curve safety sequence shown in table

* 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.

Typical Reverse Curve Edge Line Treatment



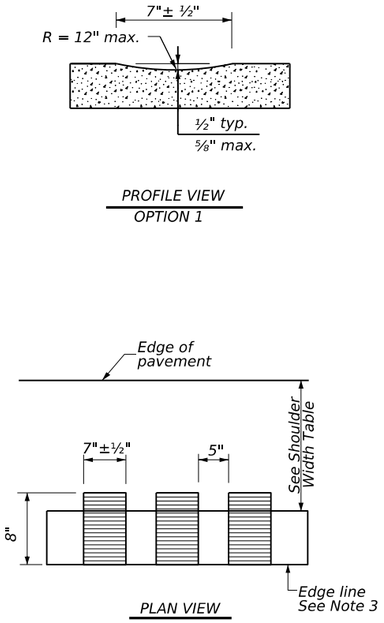
Reverse curves white edge line shall be on the outside of both curves and shall overlap in the transition area for a minimum of 50'.

TWO-LANE HIGHWAY CURVE SIGNING & MARKINGS

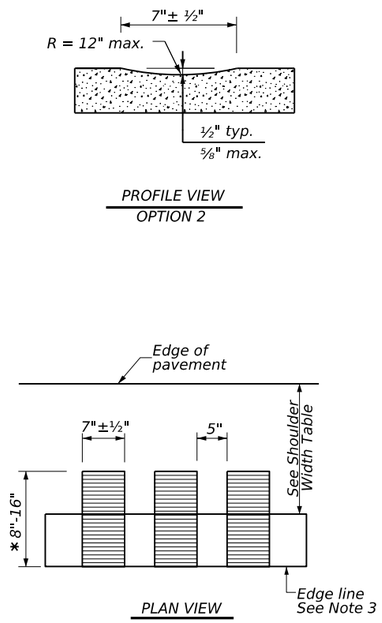
DALLAS DISTRICT STANDARD

SCALE: NTS SHEET 1 OF 1

DESIGN/CK	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
BLS	6	SEE TITLE SHEET		FM 2450
CHECK MA	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK BA	TEXAS	DALLAS	DENTON	172
CHECK BB	CONTROL	SECTION	JOB	
	2353	02	028	

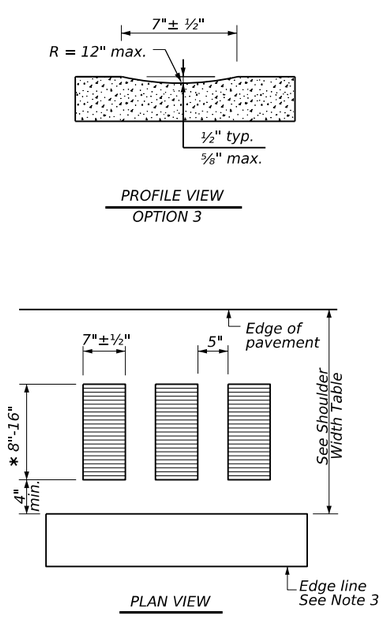


CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



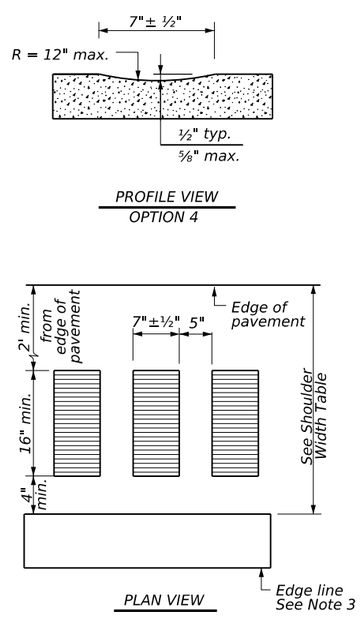
∗ This distance may vary based on width of shoulder

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

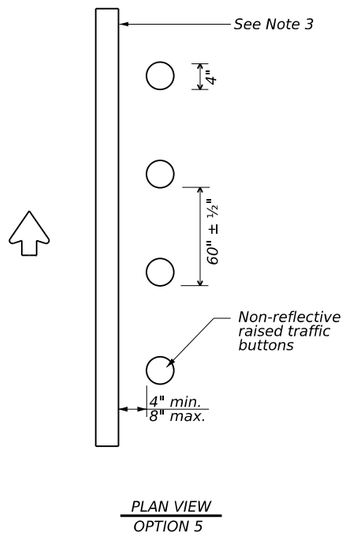


∗ This distance may vary based on width of shoulder

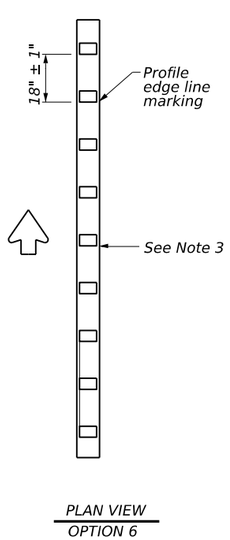
CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



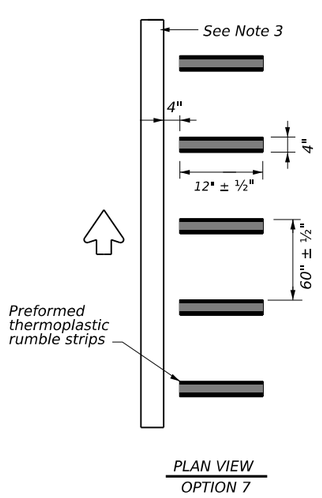
CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



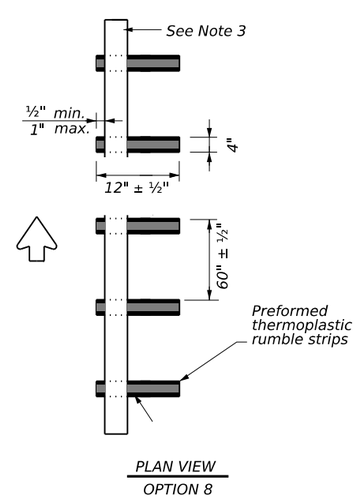
RAISED EDGE LINE (Rumble Strips)



PROFILE EDGE LINE MARKINGS (Rumble Strips)



PREFORMED THERMOPLASTIC EDGE LINE (Rumble Strips)



PREFORMED THERMOPLASTIC EDGE LINE (Rumble Strips)

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, 6 or 8	Option 1, 2, 3 5, 6 or 7	Option 2, 4, 5 6 or 7

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) and FPM(1) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings, and profile markings.
4. See the Shoulder Width Table below for determining what options may be used for edge line rumble strips.
5. Breaks in edge line rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections, or driveways with high usage of large trucks when installed on conventional highways.
6. Rumble strips shall not be placed across exit or entrance ramps, acceleration or deceleration lanes, crossovers, gore areas, or intersections with other roadways.
7. Consideration should be given to noise levels when edgeline rumble strips are to be installed near residential areas, schools, churches, etc. A 3/8 inch deep (minimum) milled rumble strip may be considered in these areas.
8. Consideration shall be given to bicyclists. See RS(6).

WHEN INSTALLING MILLED DEPRESSION EDGE LINE RUMBLE STRIPS:

9. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Safety Division.
10. Pavement markings can be applied over milled shoulder rumble strips to create an edge line rumble strip.

WHEN INSTALLING RAISED OR PROFILE EDGE LINE 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 edge line when used as a rumble strip. The color of the button should match the color of the adjacent edge line 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. The minimum distance between the edge line and the buttons should be used if the shoulder is less than 8 feet in width.
15. Raised profile thermoplastic markings used as edge lines may substitute for buttons.

Texas Department of Transportation

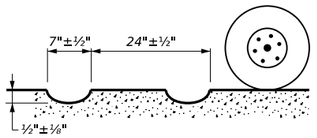
Traffic Safety Division Standard

EDGE LINE RUMBLE STRIPS ON UNDIVIDED OR TWO LANE HIGHWAYS RS(2)-23

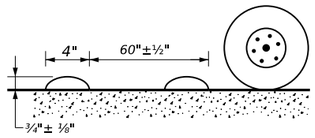
FILE: rs(2)-23.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT January 2023	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
10-13 1-23	DIST	COUNTY		SHEET NO.
	DAL	DENTON		173

DATE:
FILE:

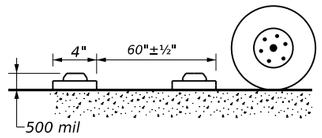
CENTERLINE RUMBLE STRIPS



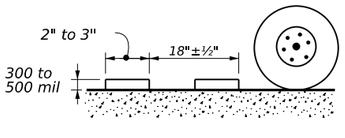
PROFILE VIEW



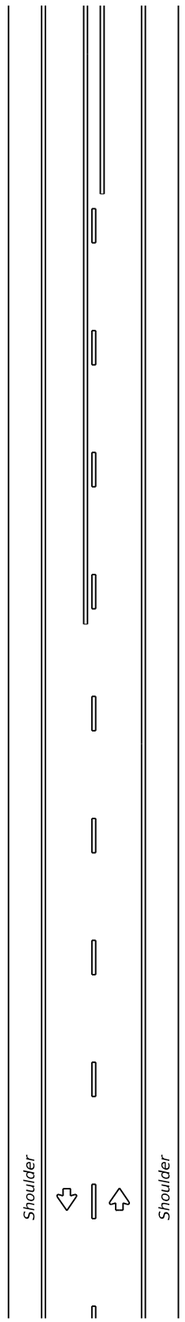
PROFILE VIEW



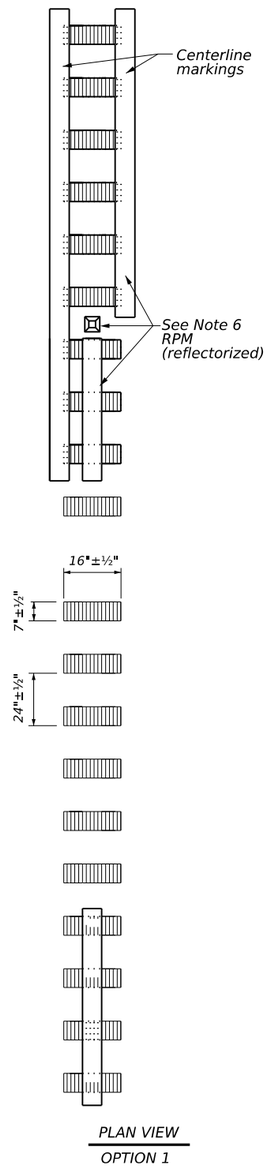
PROFILE VIEW



PROFILE VIEW

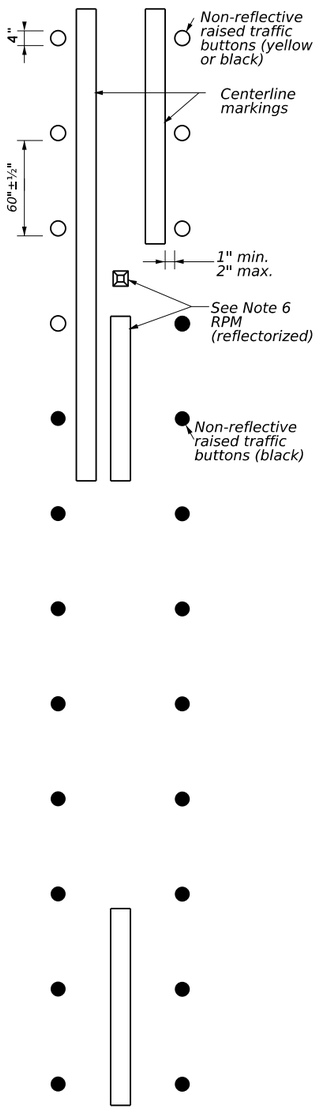


TWO LANE TWO-WAY HIGHWAYS



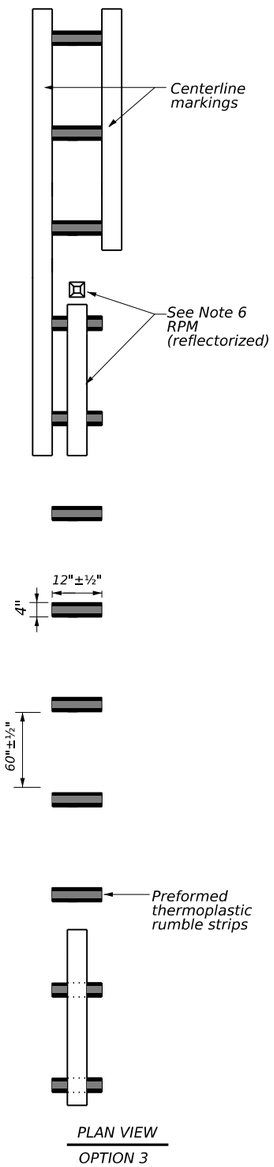
PLAN VIEW
OPTION 1

MILLED CENTERLINE RUMBLE STRIPS



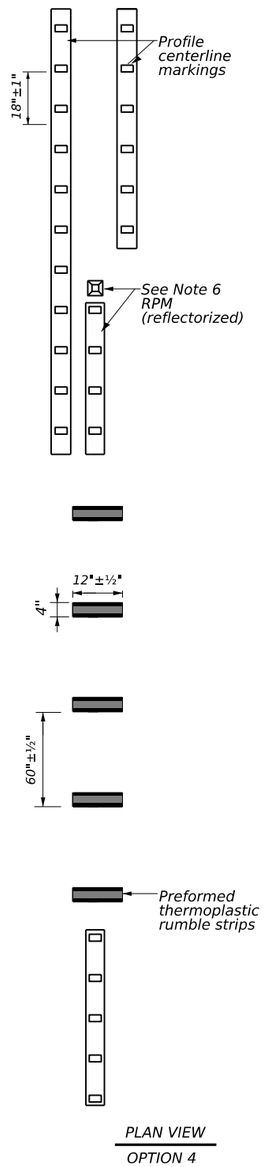
PLAN VIEW
OPTION 2

RAISED CENTERLINE RUMBLE STRIPS



PLAN VIEW
OPTION 3

PREFORMED THERMOPLASTIC RUMBLE STRIPS



PLAN VIEW
OPTION 4

PROFILE CENTERLINE MARKINGS AND PREFORMED THERMOPLASTIC RUMBLE STRIPS

GENERAL NOTES

1. This standard sheet provides guidelines for installing centerline rumble strips on two-lane highways with or without shoulders.
2. Centerline and edge line 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 Safety 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 or driveways with high usage of large trucks.
6. Use standard sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings and profile markings.
7. Consideration should be given to noise levels when centerline rumble strips are to be installed near residential areas, schools, churches, etc. A 3/8 inch deep (minimum) 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.
12. Consideration shall be given to bicyclists. See RS(6).

WHEN INSTALLING EDGE LINE RUMBLE STRIPS WITH OR WITHOUT CENTERLINE RUMBLE STRIPS ON UNDIVIDED HIGHWAYS:

13. See standard sheet RS(2).

DATE:
FILE:

Texas Department of Transportation

Traffic Safety Division Standard

CENTERLINE RUMBLE STRIPS ON TWO LANE TWO-WAY HIGHWAYS RS(4)-23

FILE: rs(4)-23.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT January 2023	CONT	SECT	JOB	HIGHWAY
REVISIONS 10-13 1-23	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		174

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

Filled Out: XX/XX/XXXX
Prepared By: Name/Section

I. STORMWATER POLLUTION PREVENTION PLAN-CLEAN WATER ACT SECTION 402

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.
List adjacent MS 4 Operator(s) that receive discharges from this project. They need to be notified prior to construction activities.
(Note: Leave blank only if no adjacent MS 4 Operator(s) are affected.)

1. DENTON COUNTY PHASE II MS4 - CONTACT STEPHEN BELKNAP

☐ 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.

Action Number:

Non-reportable crossings authorized under NWP 14:

1. Culvert- STA 91+36 tributary to Clear Creek Stream Impacts
2. Culvert- STA 140+25 tributary to Morres Branch Stream Impacts
3. Culvert- STA 180+00 tributary to Morres Branch Stream Impacts

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.
2.

IV. VEGETATION RESOURCES

Preserve native vegetation to the extent practical.
Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 193, 506, 730, 751 & 752 in order to comply with requirements for invasive species, beneficial landscaping and tree/brush removal commitments.

☒ No Action Required ☐ Required Action

Action Number:

1.
2.

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

☐ No Action Required ☒ Required Action

Action Number:

1. The following species could occur in the project area: Strecker's chorus frog, Woodhouse's toad, American bumblebee, Monarch butterfly, Arethaea ambulator, muskrat, eastern spotted skunk, long-tailed weasel, swamp rabbit, western hog-nosed skunk, eastern box turtle, slender glass lizard, prairie skink, Texas garter snake, timber (canebrake) rattlesnake, and western box turtle. Follow the special note on the EPIC sheet and the BMPs listed below to protect these species.

2. Contractor to implement the following BMPs from Beneficial Management Practices: Avoiding, Minimizing, and Mitigating Impacts of Transportation Projects on State Natural Resources available at:
https://ftp.txdot.gov/pub/txdot-info/env/toolkit/300-01-bmp.pdf.

a) Section 1.2 Vegetation BMP
b) Section 1.4 Water Quality BMP
c) Section 2.4.4 Insect Pollinator BMP
d) Section 2.6.1 Aquatic Amphibian and Reptile BMP
(barrier fencing not required)
e) Section 2.6.2 Terrestrial Amphibian and Reptile BMP

Special Notes:

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

LIST OF ABBREVIATIONS

BMP:	Best Management Practice	SPCC:	Spill Prevention Control and Countermeasure
CGP:	Construction General Permit	SW3P:	Storm Water Pollution Prevention Plan
DSHS:	Texas Department of State Health Services	PCN:	Pre-Construction Notification
FHWA:	Federal Highway Administration	PSL:	Project Specific Location
MOA:	Memorandum of Agreement	TCEQ:	Texas Commission on Environmental Quality
MOU:	Memorandum of Understanding	TPDES:	Texas Pollutant Discharge Elimination System
MS4:	Municipal Separate Stormwater Sewer System	TPWD:	Texas Parks and Wildlife Department
MBTA:	Migratory Bird Treaty Act	TxDOT:	Texas Department of Transportation
NOT:	Notice of Termination	T&E:	Threatened and Endangered Species
NWP:	Nationwide Permit	USACE:	U.S. Army Corp of Engineers
NOI:	Notice of Intent	USFWS:	U.S. Fish and Wildlife Service

VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

General (applies to all projects):
Comply with the Hazard Communication Act (the Act) for personnel who will be working with hazardous materials by conducting safety meetings prior to beginning construction and making workers aware of potential hazards in the workplace. Ensure that all workers are provided with personal protective equipment appropriate for any hazardous materials used.

Obtain and keep on-site Safety Data Sheets (SDS) for all hazardous products used on the project, which may include, but are not limited to the following categories: Paints, acids, solvents, asphalt products, chemical additives, fuels and concrete curing compounds or additives. Provide protected storage, off bare ground and covered, for products which may be hazardous. Maintain product labelling as required by the Act. Maintain an adequate supply of on-site spill response materials, as indicated in the SDS. In the event of a spill, take actions to mitigate the spill as indicated in the SDS, in accordance with safe work practices, and contact the District Spill Coordinator immediately. The Contractor shall be responsible for the proper containment and cleanup of all product spills.

Contact the Engineer if any of the following are detected:
* Dead or distressed vegetation (not identified as normal)
* Trash piles, drums, canisters, barrels, etc.
* Undesirable smells or odors
* Evidence of leaching or seepage of substances

Does the project involve any bridge class structure rehabilitation(s) or replacement(s) (bridge class structures not including box culverts)?

☐ Yes ☒ No

If "No", then no further action is required.
If "Yes", then TxDOT is responsible for completing asbestos assessment/inspection.

Are the results of the asbestos inspection positive (is asbestos present)?

☐ Yes ☒ No

If "Yes", then TxDOT must retain a DSHS licensed asbestos consultant to assist with the notification, develop abatement/mitigation procedures, and perform management activities as necessary. The notification form to DSHS must be postmarked at least 15 working days prior to scheduled demolition.

If "No", then TxDOT is still required to notify DSHS 15 working days prior to any scheduled demolition.

In either case, the Contractor is responsible for providing the date(s) for abatement activities and/or demolition with careful coordination between the Engineer and asbestos consultant in order to minimize construction delays and subsequent claims.

Any other evidence indicating possible hazardous materials or contamination discovered on site. Hazardous Materials or Contamination Issues Specific to this Project:

☒ No Action Required ☐ Required Action

Action Number:

1.

2.

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

 Texas Department of Transportation
Dallas District

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS (EPIC)

FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
6	SEE TITLE SHEET		FM2450
STATE	DISTRICT	COUNTY	
TEXAS	DALLAS	DENTON	
CONTROL	SECTION	JOB	SHEET NO.
2353	02	028	175

STORMWATER POLLUTION PREVENTION PLAN (SWP3):

This SWP3 has been developed in accordance with the TPDES Construction General Permit TXR150000 (CGP). The Texas Department of Transportation (TxDOT) ensures that project specifications include adequate best management practices (BMPs) for this project.

For all projects with soil disturbing activity and for projects that have Environmental, Permits, Issues, and Commitments (EPICs) dependent on stormwater controls and water quality measures TxDOT will maintain a SWP3 with all pertinent records, correspondence, environmental documents, etc. at the project field office, Area Office, or electronically.

This SWP3 is consistent with requirements specified in applicable stormwater plans and the projects environmental permits, issues, and commitments (EPICs). A copy of the CGP is included in Attachment 2.12 of the SWP3 binder.

1.0 SITE/PROJECT DESCRIPTION

1.1 PROJECT CONTROL SECTION JOB (CSJ):
2353-02-028 (FM 2450)

1.2 PROJECT LIMITS:

From: **FM 455**

To: **FM 156**

1.3 PROJECT COORDINATES:

BEGIN: (Lat) **33.35835** ,(Long) **-97.24544**

END: (Lat) **33.265696** ,(Long) **-97.235689**

1.4 TOTAL PROJECT AREA (Acres): **65**

1.5 TOTAL AREA TO BE DISTURBED (Acres): **55.73**

1.6 NATURE OF CONSTRUCTION ACTIVITY:

SAFETY TREAT FIXED OBJECTS,
PROFILE EDGELINE MARKINGS,
PROVIDE ADDITIONAL PAVED SURFACE WIDTH,
PROFILE CENTERLINE MARKINGS

1.7 MAJOR SOIL TYPES:

Soil Type	Description
CLAY	LIGHT BROWN CLAY SAND W/ROCK
CLAY	MEDIUM STIFF, DARK BROWN W/ CRUSH STONE

1.8 PROJECT SPECIFIC LOCATIONS (PSLs):

PSLs must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. PSLs may be identified during preconstruction meetings or during the construction process. Please choose from the options below:

☒ PSLs determined during preconstruction meeting
☐ PSLs determined during construction
☐ No PSLs planned for construction

Type	Sheet #s

All off-ROW PSLs required by the Contractor are the Contractor's responsibility. The Contractor shall secure all permits required by local, state, federal laws for off-ROW PSLs. The contractor shall provide diagrams, areas of disturbance, acreage, and BMPs for all off-ROW PSLs within one mile of the project.

1.9 CONSTRUCTION ACTIVITIES:

(Use the following list as a starting point when developing the Construction Activity Schedule and Ceasing Record in Attachment 2.5.)

☒ Mobilization
☒ Install sediment and erosion controls
☒ Blade existing topsoil into windrows, prep ROW, clear and grub
☒ Remove existing pavement
☒ Grading operations, excavation, and embankment
☒ Excavate and prepare subgrade for proposed pavement widening
☒ Remove existing culverts, safety end treatments (SETs)
☐ Remove existing metal beam guard fence (MBGF), bridge rail
☒ Install proposed pavement per plans
☒ Install culverts, culvert extensions, SETs
☐ Install mow strip, MBGF, bridge rail
☐ Place flex base
☒ Rework slopes, grade ditches
☐ Blade windrowed material back across slopes
☐ Revegetation of unpaved areas
☒ Achieve site stabilization and remove sediment and erosion control measures
☐ Other: _____
☐ Other: _____
☐ Other: _____

1.10 POTENTIAL POLLUTANTS AND SOURCES:

☒ Sediment laden stormwater from stormwater conveyance over disturbed area
☒ Fuels, oils, and lubricants from construction vehicles, equipment, and storage
☒ Solvents, paints, adhesives, etc. from various construction activities
☒ Transported soils from offsite vehicle tracking
☒ Construction debris and waste from various construction activities
☒ Contaminated water from excavation or dewatering pump-out water
☒ Sanitary waste from onsite restroom facilities
☒ Trash from various construction activities/receptacles
☐ Long-term stockpiles of material and waste
☒
☒ Other: CONCRETE WASHOUT
☐ Other: _____
☐ Other: _____

1.11 RECEIVING WATERS:

Receiving waters must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. Include Segment # for receiving waters.

Tributaries	Classified Waterbody

* Add (*) for impaired waterbodies with pollutant in ().

1.12 ROLES AND RESPONSIBILITIES: TxDOT

☒ Development of plans and specifications
☒ Submit Notice of Intent (NOI) to TCEQ (≥5 acres)
☒ Post Construction Site Notice
☒ Submit NOI/CSN to local MS4
☒ Perform SWP3 inspections
☒ Maintain SWP3 records and update to reflect daily operations
☒ Complete and submit Notice of Termination to TCEQ
☒ Maintain SWP3 records for 3 years
☐ Other: _____
☐ Other: _____
☐ Other: _____

1.13 ROLES AND RESPONSIBILITIES: CONTRACTOR

☒ Day To Day Operational Control
☒ Submit Notice of Intent (NOI) to TCEQ (≥5 acres)
☒ Post Construction Site Notice
☒ Submit NOI/CSN to local MS4
☒ Maintain schedule of major construction activities
☒ Install, maintain and modify BMPs
☒ Complete and submit Notice of Termination to TCEQ
☒ Maintain SWP3 records for 3 years
☐ Other: _____
☐ Other: _____
☐ Other: _____

1.14 LOCAL MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) OPERATOR COORDINATION:

MS4 Entity

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

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Hram Mang
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2/22/2024

STORMWATER POLLUTION PREVENTION PLAN (SWP3)

July 2023 Sheet 1 of 2

Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6	(SEE TITLE SHEET)		176
STATE	STATE DIST.	COUNTY	
TEXAS	DAL	DENTON	
CONT.	SECT.	JOB	HIGHWAY NO.
2353	02	028	FM 2450

STORMWATER POLLUTION PREVENTION PLAN (SWP3):

2.0 BEST MANAGEMENT PRACTICES (BMPs) AND CONTROLS, INSPECTION, AND MAINTENANCE

The Contractor shall be the responsible party for implementing the BMPs described herein and for complying with the SWP3 for control of erosion and sedimentation during day-to-day operations. The Contractor shall implement changes to this SWP3 approved by TxDOT within the times specified in this SWP3 or the CGP.

2.1 EROSION CONTROL AND SOIL STABILIZATION BMPs:

T / P

- ☐ ☒ Protection of Existing Vegetation
- ☐ ☐ Vegetated Buffer Zones
- ☐ ☐ Soil Retention Blankets
- ☐ ☐ Geotextiles
- ☐ ☐ Mulching/ Hydromulching
- ☐ ☐ Soil Surface Treatments
- ☒ ☐ Temporary Seeding
- ☐ ☒ Permanent Planting, Sodding or Seeding
- ☒ ☐ Biodegradable Erosion Control Logs
- ☒ ☐ Rock Filter Dams/ Rock Check Dams
- ☒ ☐ Vertical Tracking
- ☐ ☐ Interceptor Swale
- ☐ ☒ Riprap
- ☐ ☐ Diversion Dike
- ☐ ☐ Temporary Pipe Slope Drain
- ☐ ☐ Embankment for Erosion Control
- ☐ ☐ Paved Flumes
- ☐ ☒ Other: VEGETATION LINED DITCHES (PERMANENT)
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____

2.2 SEDIMENT CONTROL BMPs:

T / P

- ☒ ☐ Biodegradable Erosion Control Logs
- ☒ ☐ Dewatering Controls
- ☐ ☐ Inlet Protection
- ☒ ☐ Rock Filter Dams/ Rock Check Dams
- ☐ ☐ Sandbag Berms
- ☒ ☐ Sediment Control Fence
- ☒ ☐ Stabilized Construction Exit
- ☐ ☐ Floating Turbidity Barrier
- ☐ ☐ Vegetated Buffer Zones
- ☐ ☐ Vegetated Filter Strips
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

Sediment control BMPs requiring design capacity calculations (See SWP3 Attachment 1.3.):

T / P

- ☐ ☐ Sediment Trap
  - ☐ Calculated volume runoff from 2-year, 24-hour storm for each acre of disturbed area
  - ☐ 3,600 cubic feet of storage per acre drained
- ☐ ☐ Sedimentation Basin
  - ☐ Not required (<10 acres disturbed)
  - ☐ Required (>10 acres) and implemented.
    - ☐ Calculated volume runoff from 2-year, 24-hour storm for each acre of disturbed area
    - ☐ 3,600 cubic feet of storage per acre drained
  - ☒ Required (>10 acres), but not feasible due to:
    - ☒ Available area/Site geometry
    - ☐ Site slope/Drainage patterns
    - ☐ Site soils/Geotechnical factors
    - ☐ Public safety
    - ☒ Other: Alternate BMPs are provided in SW3p for equivalent sedimentation control

2.3 PERMANENT CONTROLS:

(Coordinate post-construction BMPs with appropriate TxDOT maintenance sections.)

BMPs To Be Left In Place Post Construction:

Type	Stationing	
	From	To
No Permanent Controls are planned		

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

2.4 OFFSITE VEHICLE TRACKING CONTROLS:

- ☒ Excess dirt/mud on road removed daily
- ☐ Haul roads dampened for dust control
- ☒ Loaded haul trucks to be covered with tarpaulin
- ☒ Stabilized construction exit
- ☐ Daily street sweeping
- ☐ Other: Dampen Distrubed Soil as needed for dust control
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

2.5 POLLUTION PREVENTION MEASURES:

- ☒ Chemical Management
- ☒ Concrete and Materials Waste Management
- ☒ Debris and Trash Management
- ☒ Dust Control
- ☐ Sanitary Facilities
- ☒ Other: Maintain Paved Surface free of Project sedimentation and debris
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

2.6 VEGETATED BUFFER ZONES:

Natural vegetated buffers shall be maintained as feasible to protect adjacent surface waters. If vegetated natural buffer zones are not feasible due to site geometry, the appropriate additional sediment control measures have been incorporated into this SWP3.

Type	Stationing	
	From	To

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

2.7 ALLOWABLE NON-STORMWATER DISCHARGES:

- ☒ Fire hydrant flushings
- ☒ Irrigation drainage
- ☒ Pavement washwater (where spills or leaks have not occurred, and detergents are not used)
- ☒ Potable water sources
- ☒ Springs
- ☒ Uncontaminated groundwater
- ☒ Water used to wash vehicles or control dust
- ☒ Other allowable non-stormwater discharges as allowed by TPDES GP TXR150000.

2.8 DEWATERING:

Dewatering discharges of accumulated stormwater, groundwater, and surface water including discharges from dewatering of trenches, excavations, foundations, vaults, and other points of accumulation are prohibited unless managed by appropriate controls to prevent and minimize the offsite discharge of sediment and other pollutants.

2.9 INSPECTIONS:

All disturbed areas and erosion and sediment control devices shall be inspected at least once every seven (7) days. Inspections shall be performed by TxDOT as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.5 of this SWP3.

When dewatering activities are present, a daily inspection will be conducted once per day during those activities and documented in accordance with CGP and TxDOT requirements.

2.10 MAINTENANCE:

Control measures shall be properly installed according to specifications. If it is determined that a BMP or control measure is not operating effectively, maintenance must be accomplished as soon as possible and before the next anticipated rain event, but in no case later than 7 calendar days after being able to access the site. Maintenance shall be performed by the Contractor as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.5 of this SWP3.

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

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Hram Mang
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2/22/2024

STORMWATER POLLUTION PREVENTION PLAN (SWP3)

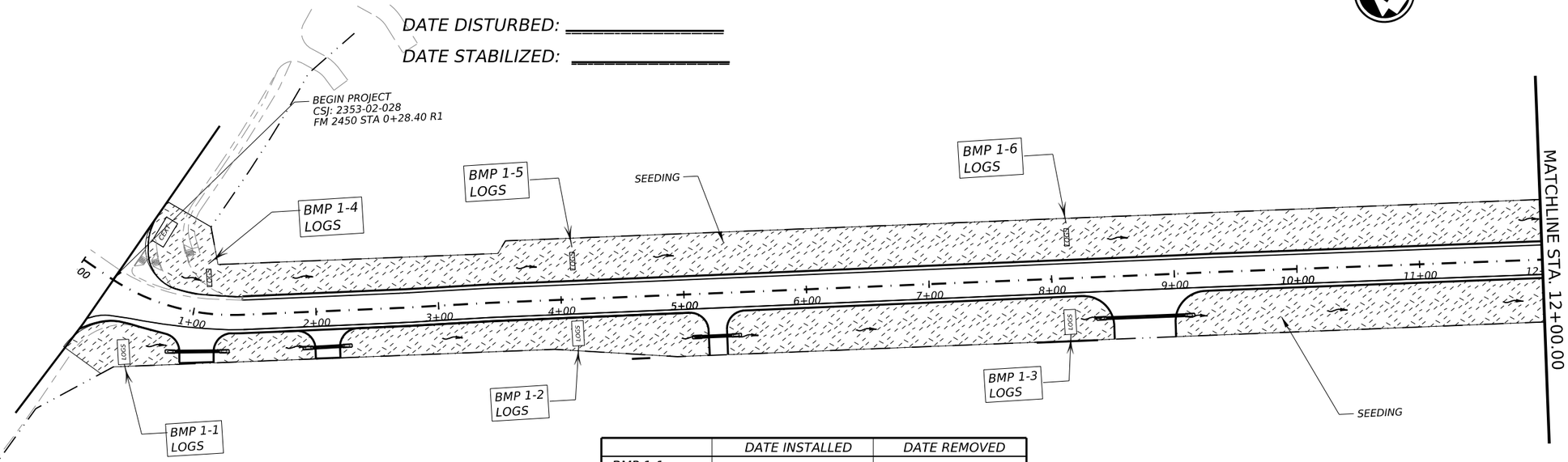
July 2023 Sheet 2 of 2

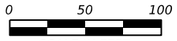
Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6	(SEE TITLE SHEET)		177
STATE	STATE DIST.	COUNTY	
TEXAS	DAL	DENTON	
CONT.	SECT.	JOB	HIGHWAY NO.
2353	02	028	FM 2450

DATE DISTURBED: _____

DATE STABILIZED: _____





LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

NOTES:

1) BMP LOCATIONS MAY BE ADJUSTED AS NEEDED, AS AUTHORIZED OR DIRECTED BY THE ENGINEER

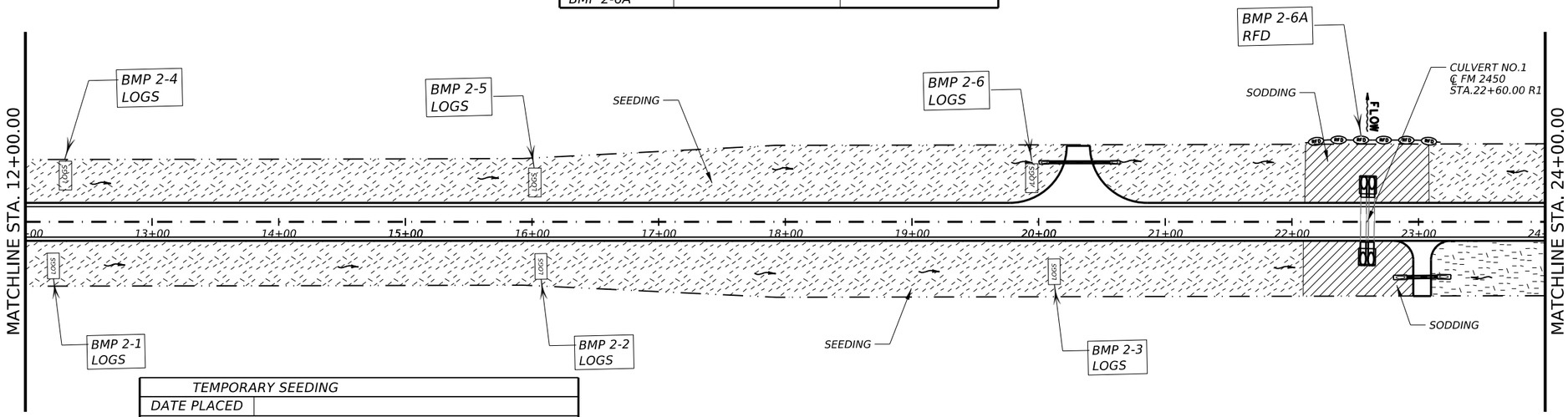
2) BMP'S SHALL BE INSTALLED IN THEIR CONTROL AREA NO SOONER THAN 2 WEEKS PRIOR TO SOIL DISTURBANCE OR POTENTIAL POLLUTANT-GENERATING ACTIVITIES IN THE CONTROL AREA.

3) 10 LF OF BIODEGRADABLE EROSION CONTROL LOGS TO BE PLACED IN ACCORDANCE WITH TXDOT ENVIRONMENTAL STANDARD EC(9)-16, EROSION CONTROL LOG SPACING TABLE.

4) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.

5) SEDIMENT CONTROL FENCE MAY BE USED IN LIEU OF OTHER STORMWATER BMP'S WHERE CONDITIONS WARRANT. AS AUTHORIZED OR DIRECTED BY THE ENGINEER.

	DATE INSTALLED	DATE REMOVED
BMP 1-1		
BMP 1-2		
BMP 1-3		
BMP 1-4		
BMP 1-5		
BMP 1-6		
BMP 2-1		
BMP 2-2		
BMP 2-3		
BMP 2-4		
BMP 2-5		
BMP 2-6		
BMP 2-6A		



TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

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Hram Mang
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2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.00+28.40 R1
TO
STA.24+00.00 R1

2024 SHEET 1 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		178

DATE: 2/22/2024 2:13:34 PM
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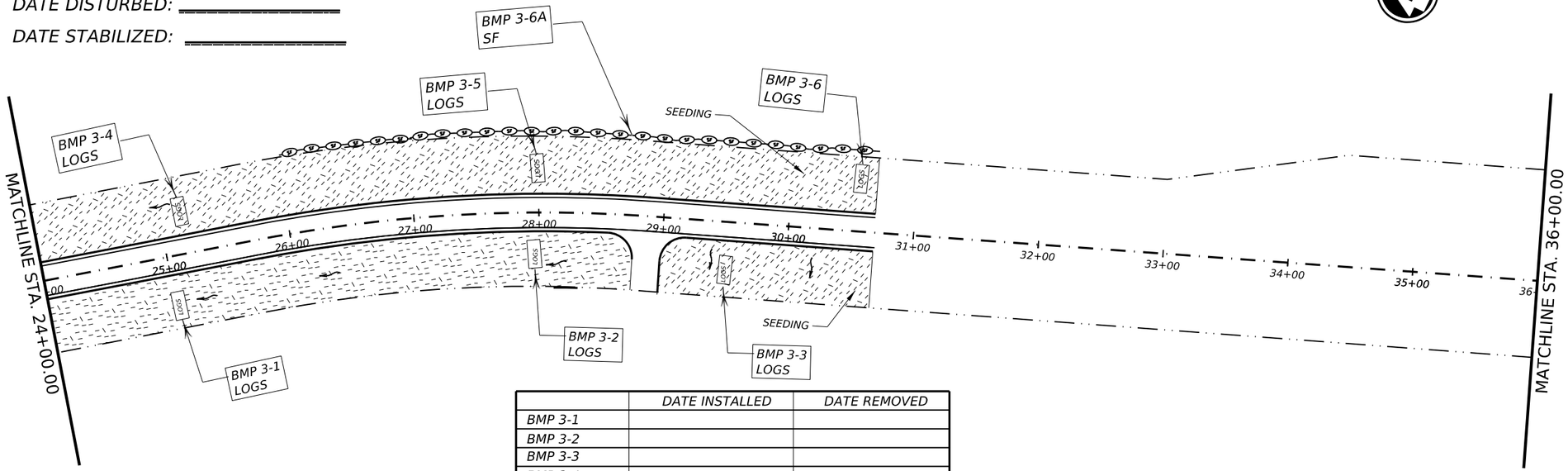
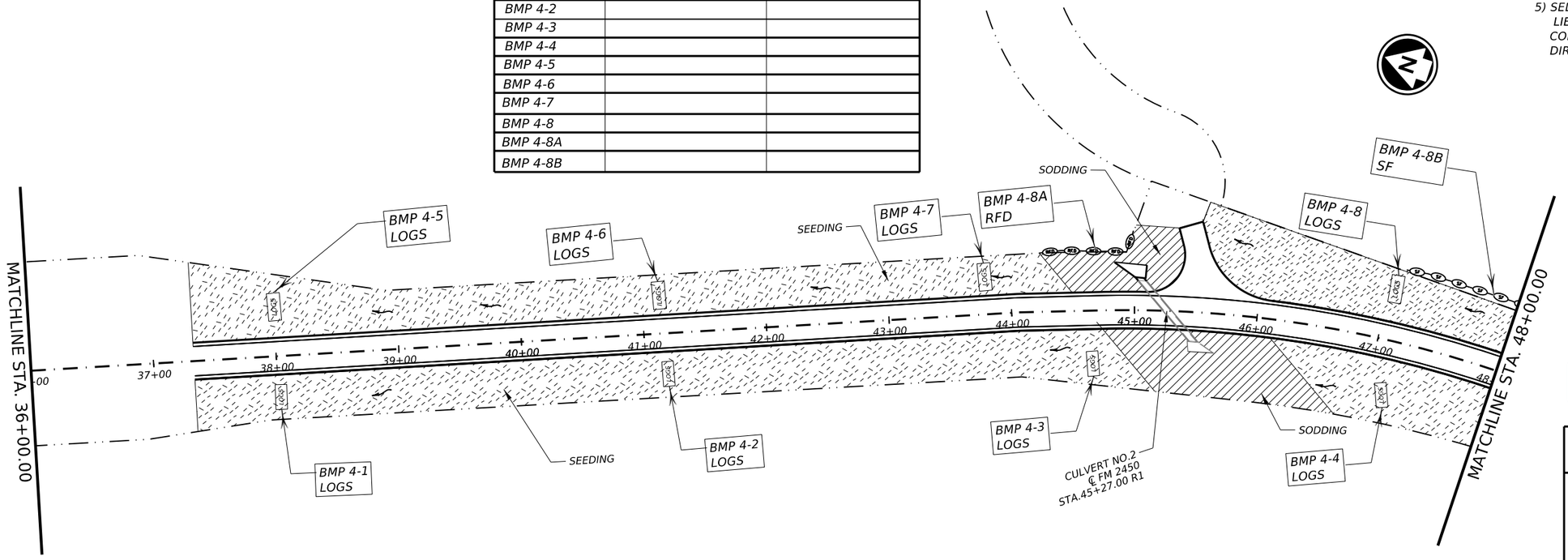
DN: CK: DW: CK:

DATE DISTURBED: _____

DATE STABILIZED: _____



	DATE INSTALLED	DATE REMOVED
BMP 3-1		
BMP 3-2		
BMP 3-3		
BMP 3-4		
BMP 3-5		
BMP 3-6		
BMP 3-6A		
BMP 4-1		
BMP 4-2		
BMP 4-3		
BMP 4-4		
BMP 4-5		
BMP 4-6		
BMP 4-7		
BMP 4-8		
BMP 4-8A		
BMP 4-8B		



TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

NOTES:

1) BMP LOCATIONS MAY BE ADJUSTED AS NEEDED, AS AUTHORIZED OR DIRECTED BY THE ENGINEER

2) BMP'S SHALL BE INSTALLED IN THEIR CONTROL AREA NO SOONER THAN 2 WEEKS PRIOR TO SOIL DISTURBANCE OR POTENTIAL POLLUTANT-GENERATING ACTIVITIES IN THE CONTROL AREA.

3) 10 LF OF BIODEGRADABLE EROSION CONTROL LOGS TO BE PLACED IN ACCORDANCE WITH TXDOT ENVIRONMENTAL STANDARD EC(9)-16, EROSION CONTROL LOG SPACING TABLE.

4) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.

5) SEDIMENT CONTROL FENCE MAY BE USED IN LIEU OF OTHER STORMWATER BMP'S WHERE CONDITIONS WARRANT. AS AUTHORIZED OR DIRECTED BY THE ENGINEER.

STATE OF TEXAS
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141660
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PROFESSIONAL ENGINEER

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Hram Mang 2/22/2024
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Texas Department of Transportation

FM 2450

SW3P SITE MAP
ST.24+00.00 R1
TO
STA.48+00.00 R1

2024 SHEET 2 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		179

DATE: 2/22/2024 2:13:35 PM
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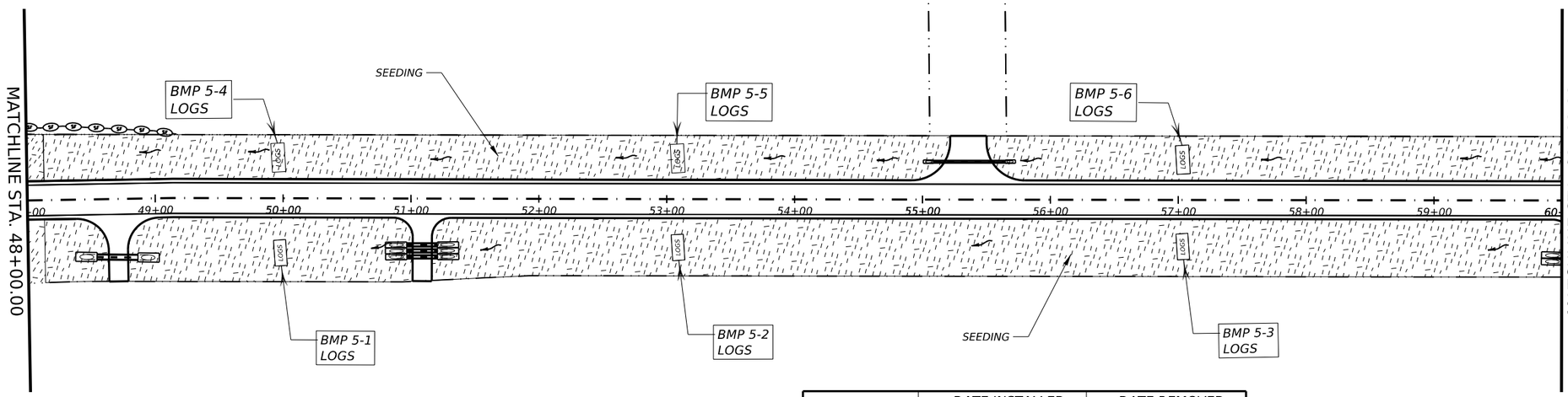
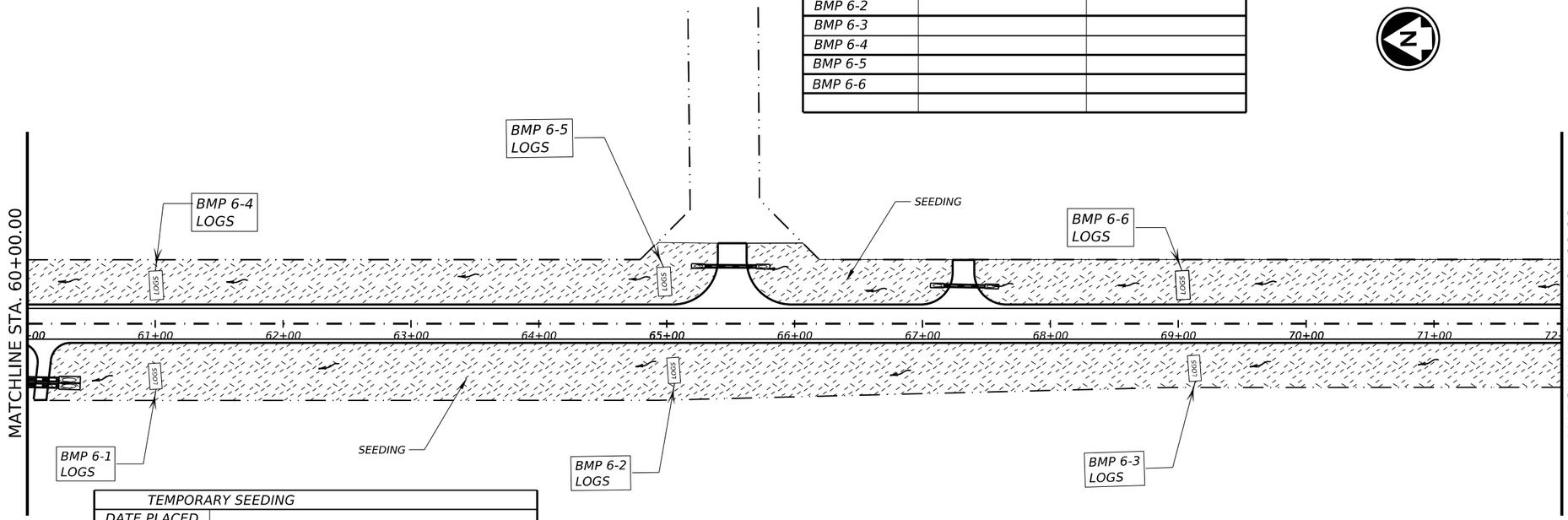
DATE DISTURBED: _____

DATE STABILIZED: _____



	DATE INSTALLED	DATE REMOVED
BMP 5-1		
BMP 5-2		
BMP 5-3		
BMP 5-4		
BMP 5-5		
BMP 5-6		
BMP 6-1		
BMP 6-2		
BMP 6-3		
BMP 6-4		
BMP 6-5		
BMP 6-6		



TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

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CEXT CONSTRUCTION EXIT

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1) BMP LOCATIONS MAY BE ADJUSTED AS NEEDED, AS AUTHORIZED OR DIRECTED BY THE ENGINEER

2) BMP'S SHALL BE INSTALLED IN THEIR CONTROL AREA NO SOONER THAN 2 WEEKS PRIOR TO SOIL DISTURBANCE OR POTENTIAL POLLUTANT-GENERATING ACTIVITIES IN THE CONTROL AREA.

3) 10 LF OF BIODEGRADABLE EROSION CONTROL LOGS TO BE PLACED IN ACCORDANCE WITH TXDOT ENVIRONMENTAL STANDARD EC(9)-16, EROSION CONTROL LOG SPACING TABLE.

4) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.

5) SEDIMENT CONTROL FENCE MAY BE USED IN LIEU OF OTHER STORMWATER BMP'S WHERE CONDITIONS WARRANT. AS AUTHORIZED OR DIRECTED BY THE ENGINEER.

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.48+00.00 R1
TO
STA.72+00.00 R1

2024 SHEET 3 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		180

DATE: 2/22/2024 2:13:36 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450_SW3P.dgn

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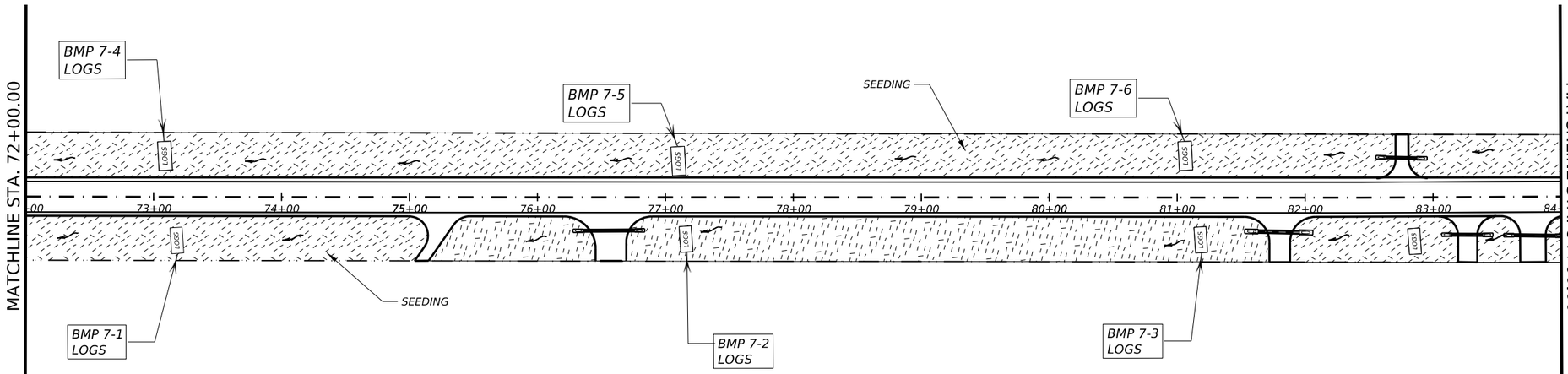
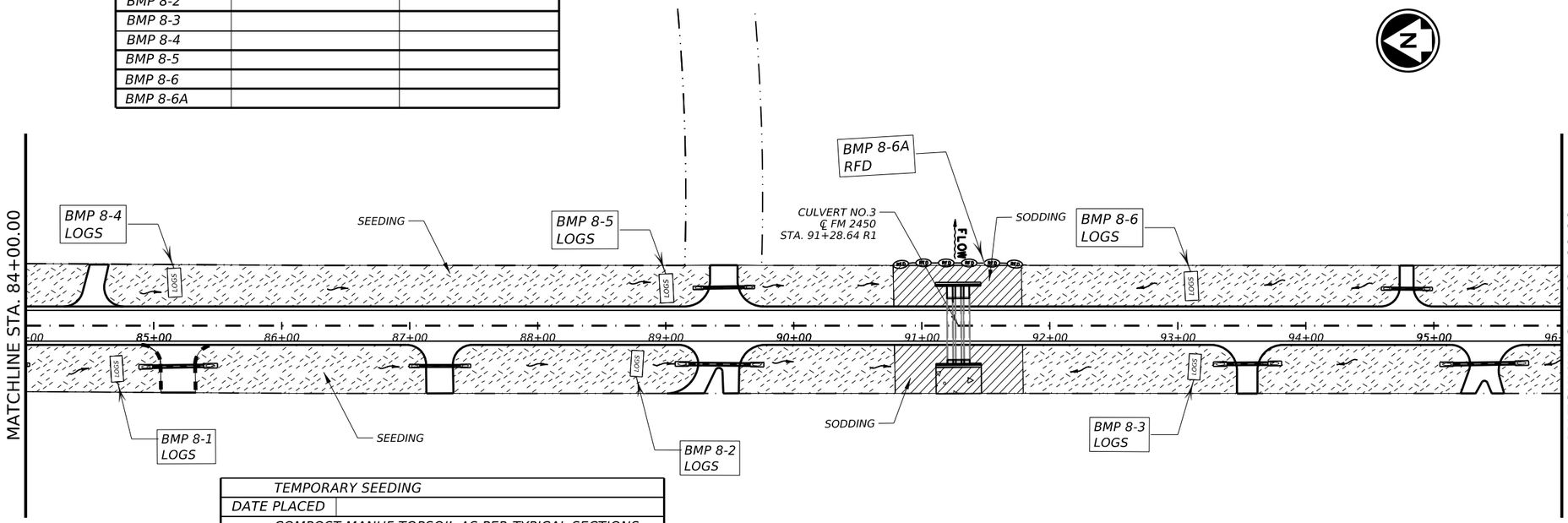
DATE DISTURBED: _____

DATE STABILIZED: _____





	DATE INSTALLED	DATE REMOVED
BMP 7-1		
BMP 7-2		
BMP 7-3		
BMP 7-4		
BMP 7-5		
BMP 7-6		
BMP 8-1		
BMP 8-2		
BMP 8-3		
BMP 8-4		
BMP 8-5		
BMP 8-6		
BMP 8-6A		

TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

NOTES:

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3) 10 LF OF BIODEGRADABLE EROSION CONTROL LOGS TO BE PLACED IN ACCORDANCE WITH TXDOT ENVIRONMENTAL STANDARD EC(9)-16, EROSION CONTROL LOG SPACING TABLE.

4) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.

5) SEDIMENT CONTROL FENCE MAY BE USED IN LIEU OF OTHER STORMWATER BMP'S WHERE CONDITIONS WARRANT. AS AUTHORIZED OR DIRECTED BY THE ENGINEER.

STATE OF TEXAS
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DocuSigned by:
Hram Mang 2/22/2024
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Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.72+00.00 R1
TO
STA.96+00.00 R1

2024 SHEET 4 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		181

DATE: 2/22/2024 2:13:37 PM
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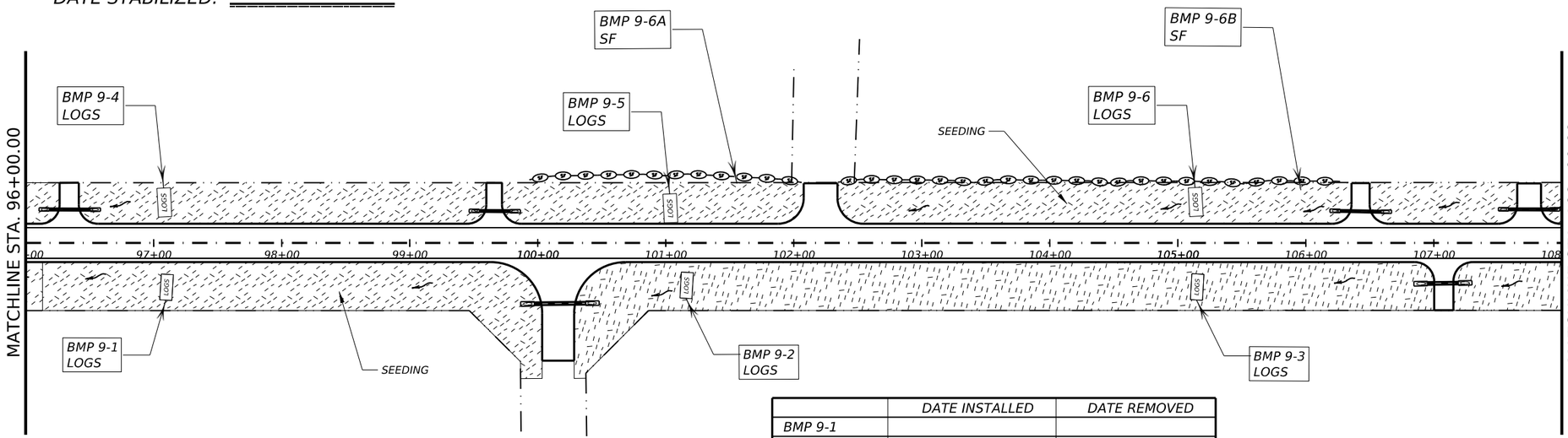
DATE STABILIZED: _____



	DATE INSTALLED	DATE REMOVED
BMP 9-1		
BMP 9-2		
BMP 9-3		
BMP 9-4		
BMP 9-5		
BMP 9-6		
BMP 9-6A		
BMP 9-6B		
BMP 10-1		
BMP 10-2		
BMP 10-3		
BMP 10-4		
BMP 10-5		
BMP 10-6		
BMP 10-7		

TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

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DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.96+00.00 R1
TO
STA.120+00.00 R1

2024 SHEET 5 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		182

DATE: 2/22/2024 2:13:38 PM
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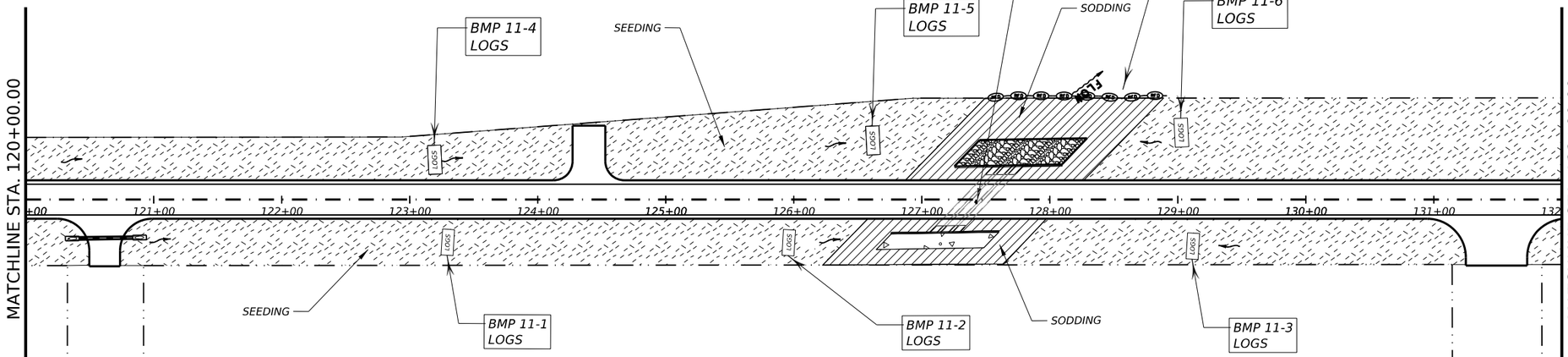
CK:
DW:
CK:
DW:

DATE DISTURBED: _____

DATE STABILIZED: _____



0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

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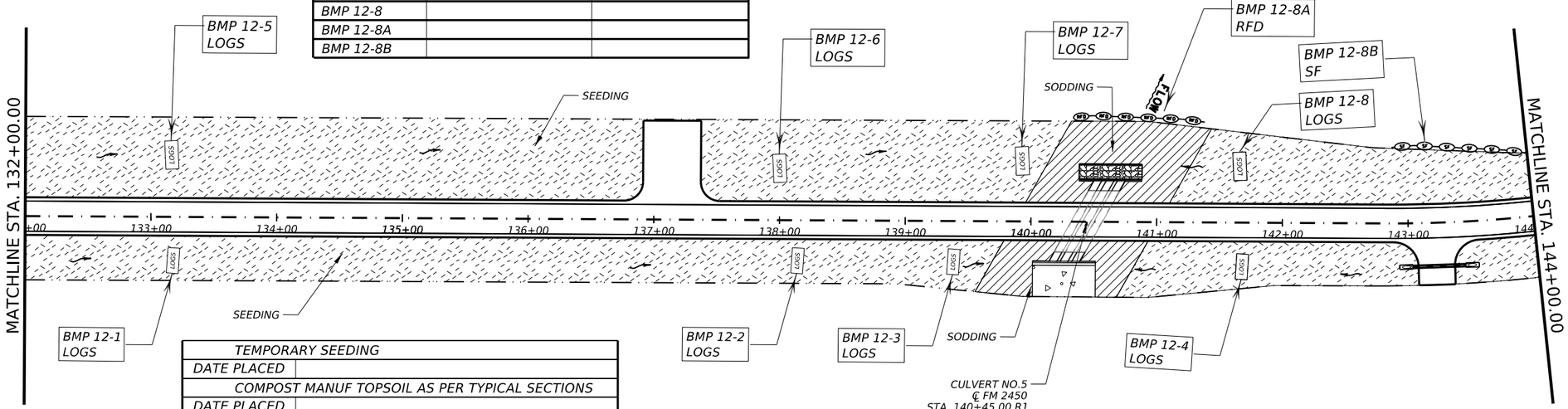
5) SEDIMENT CONTROL FENCE MAY BE USED IN LIEU OF OTHER STORMWATER BMP'S WHERE CONDITIONS WARRANT. AS AUTHORIZED OR DIRECTED BY THE ENGINEER.

	DATE INSTALLED	DATE REMOVED
BMP 11-1		
BMP 11-2		
BMP 11-3		
BMP 11-4		
BMP 11-5		
BMP 11-6		
BMP 11-6A		
BMP 12-1		
BMP 12-2		
BMP 12-3		
BMP 12-4		
BMP 12-5		
BMP 12-6		
BMP 12-7		
BMP 12-8		
BMP 12-8A		
BMP 12-8B		



TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...

2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.120+00.00 R1
TO
STA.144+00

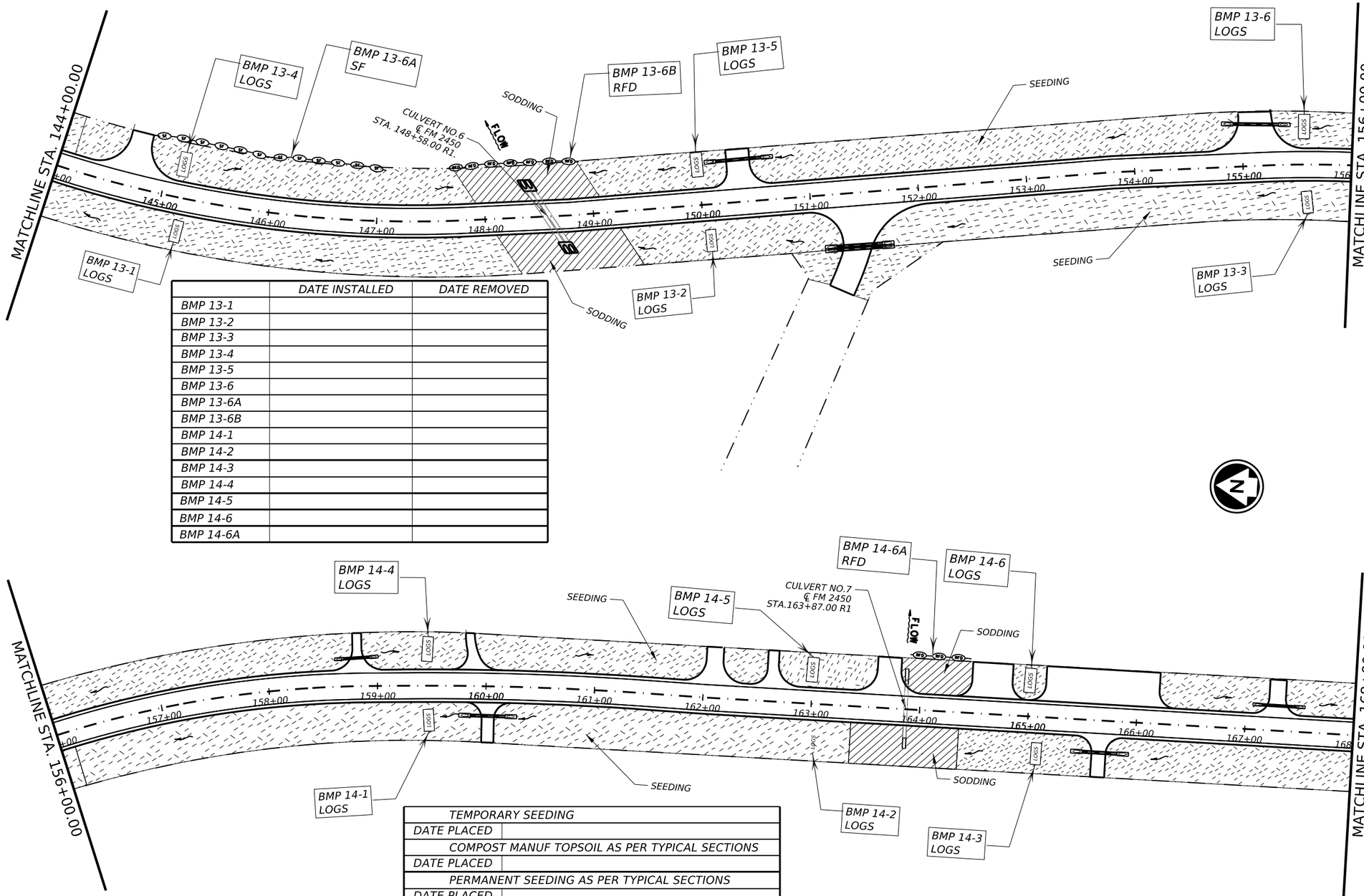
2024 SHEET 6 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		183

DATE: 2/22/2024 2:13:39 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450_SW3P.dgn

DATE DISTURBED: _____

DATE STABILIZED: _____



	DATE INSTALLED	DATE REMOVED
BMP 13-1		
BMP 13-2		
BMP 13-3		
BMP 13-4		
BMP 13-5		
BMP 13-6		
BMP 13-6A		
BMP 13-6B		
BMP 14-1		
BMP 14-2		
BMP 14-3		
BMP 14-4		
BMP 14-5		
BMP 14-6		
BMP 14-6A		

TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

NOTES:

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Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.144+00.00 R1
TO
STA.168+00.00 R1

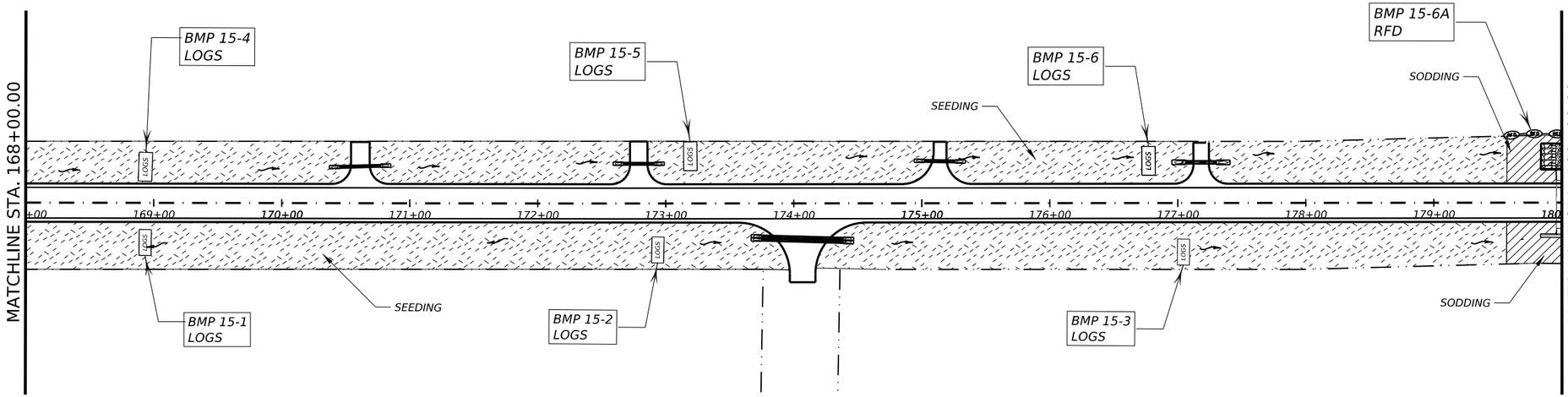
2024 SHEET 7 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		184

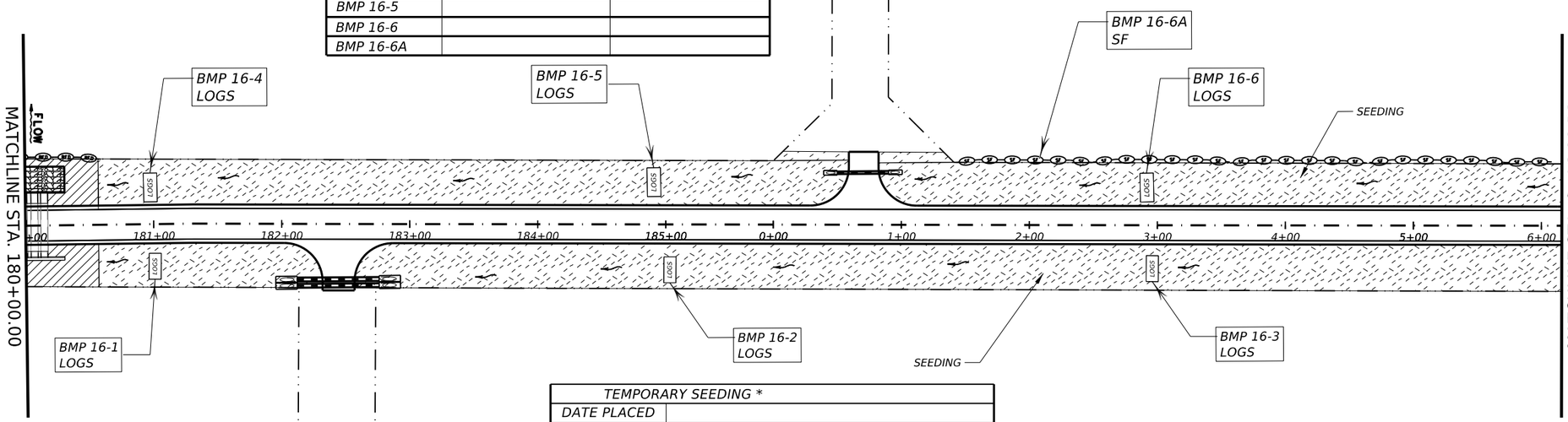
DATE: 2/22/2024 2:13:40 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/2353028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450_SW3P.dgn

DATE DISTURBED: _____

DATE STABILIZED: _____



	DATE INSTALLED	DATE REMOVED
BMP 15-1		
BMP 15-2		
BMP 15-3		
BMP 15-4		
BMP 15-5		
BMP 15-6		
BMP 15-6A		
BMP 16-1		
BMP 16-2		
BMP 16-3		
BMP 16-4		
BMP 15-5		
BMP 16-6		
BMP 16-6A		



TEMPORARY SEEDING *	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS *	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

NOTES:

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4) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.

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STATE OF TEXAS
HRAM MANG
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7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.168+00.00 R1
TO
STA.6+16.00 R2

2024 SHEET 8 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		185

DATE: 2/22/2024 2:13:41 PM
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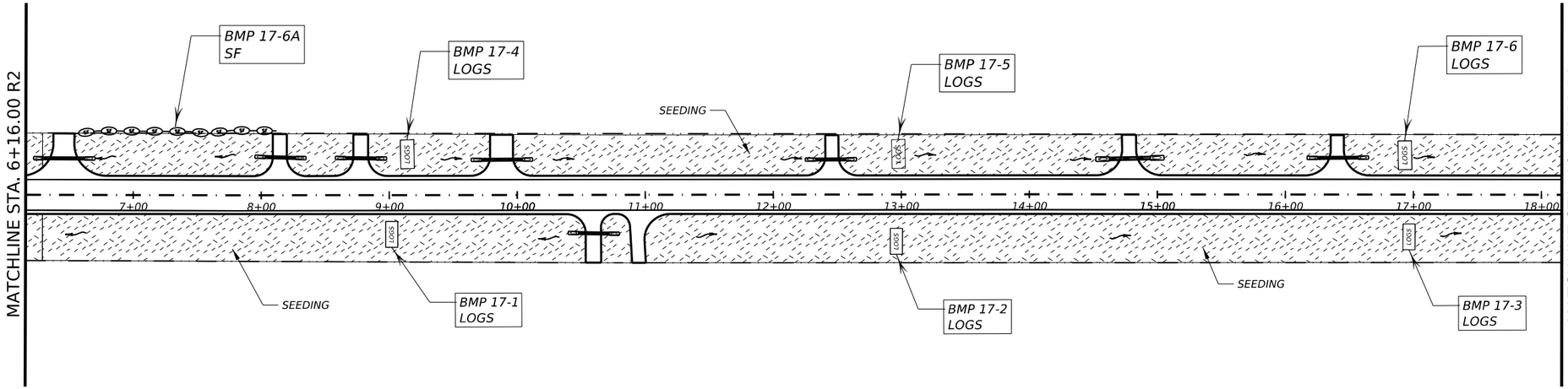
DATE DISTURBED: _____

DATE STABILIZED: _____



	DATE INSTALLED	DATE REMOVED
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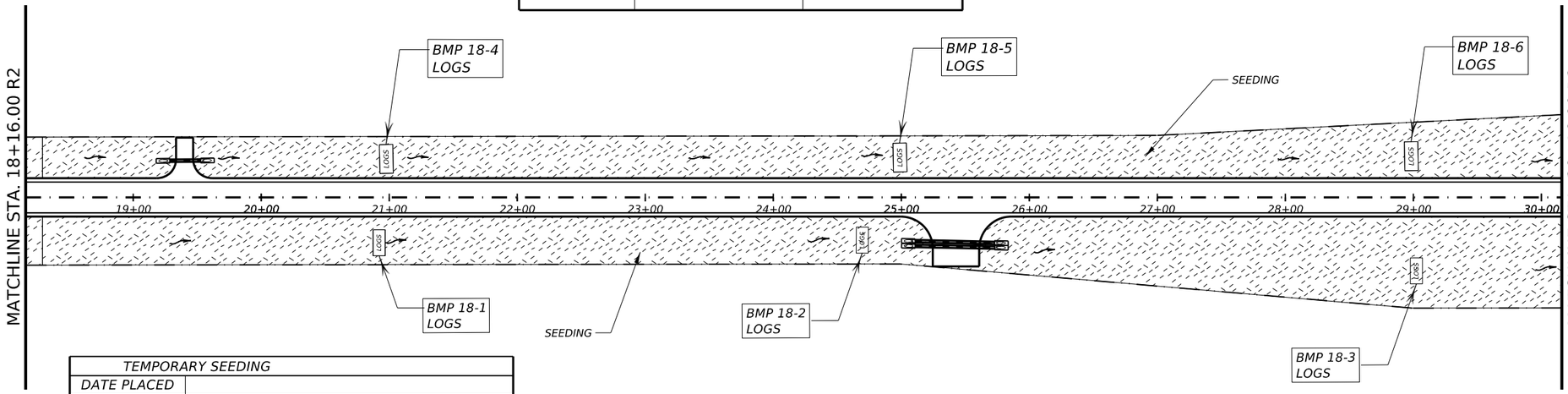
BMP 17-2		
BMP 17-3		
BMP 17-4		
BMP 17-5		
BMP 17-6		
BMP 18-1		
BMP 18-2		
BMP 18-3		
BMP 18-4		
BMP 18-5		
BMP 18-6		



TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100
SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS
SF SEDIMENT CONTROL FENCE
RFD ROCK FILTER DAM
CEXT CONSTRUCTION EXIT

NOTES:

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STATE OF TEXAS
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DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.6+16.00 R2
TO
STA.30+16.00 R2

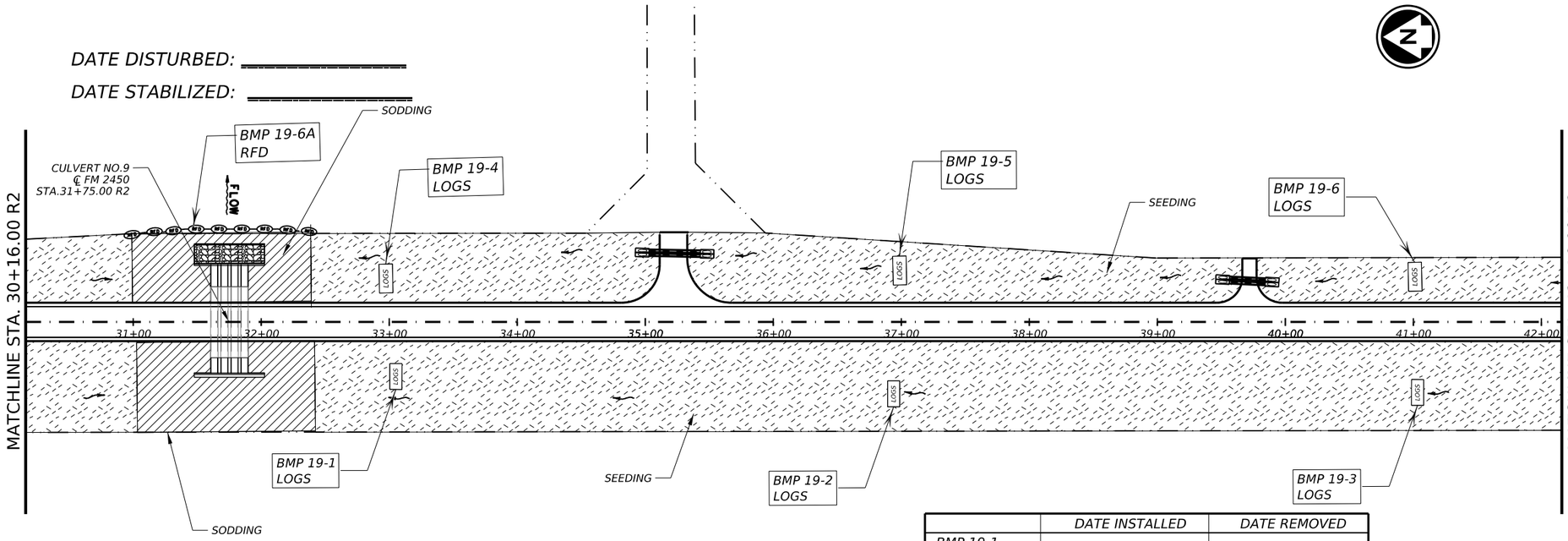
2024 SHEET 9 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		186

DATE: 2/22/2024 2:13:42 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Master Design Files/Sheet Boundary Container/FM2450_SW3P.dgn

DATE DISTURBED: _____

DATE STABILIZED: _____



	DATE INSTALLED	DATE REMOVED
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BMP 19-2		
BMP 19-3		
BMP 19-4		
BMP 19-5		
BMP 19-6		
BMP 19-6A		
BMP 20-1		
BMP 20-2		
BMP 20-3		
BMP 20-4		
BMP 20-5		
BMP 20-6		
BMP 20-6A		

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

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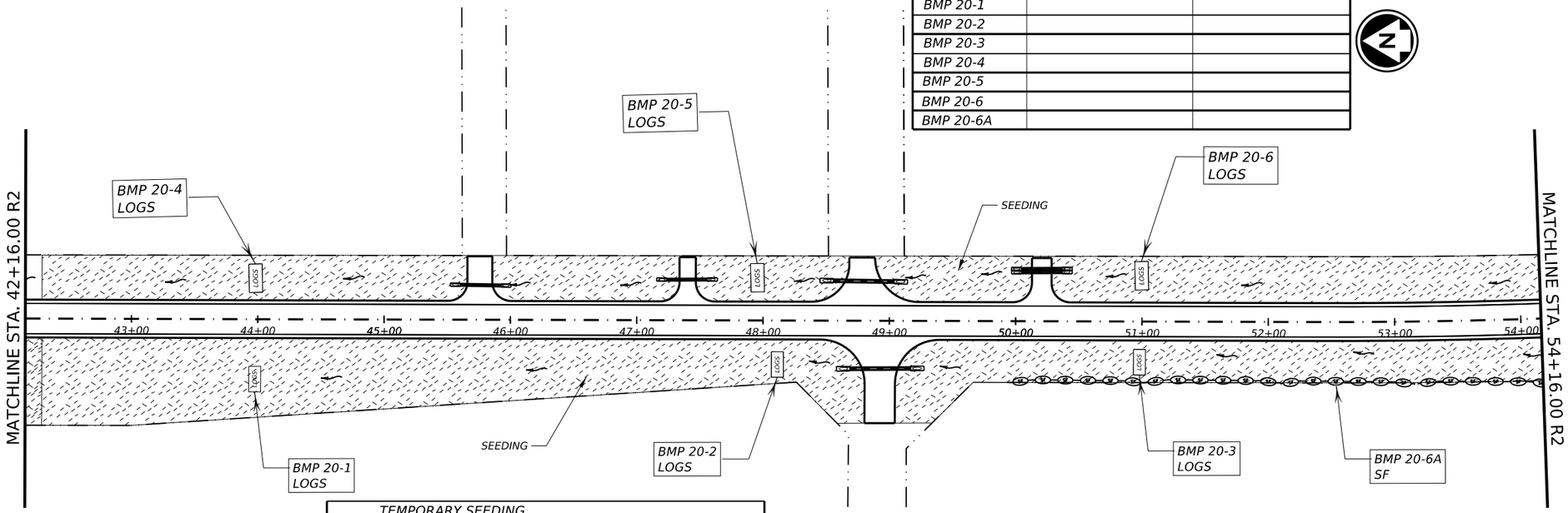
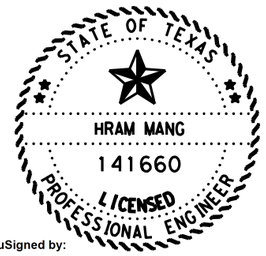


TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	



DocuSigned by:
Hram Mang
7E66E4980AEB4E4...

2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.30+16.00 R2
TO
STA.54+16.00 R2

2024 SHEET 10 OF 15

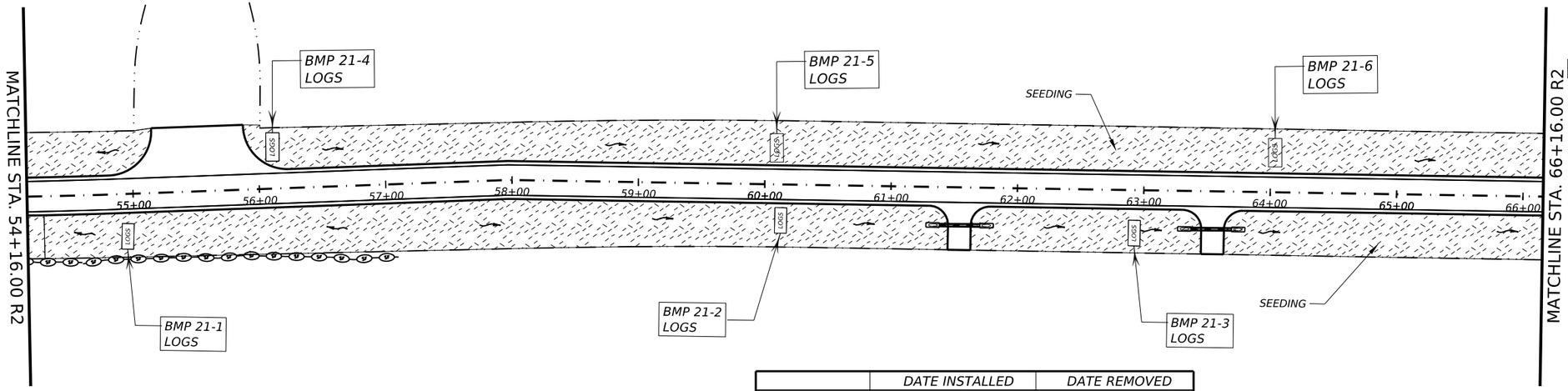
CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		187

DATE: 2/22/2024 2:13:43 PM
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/2353020284 - Design/Master Design Files/Sheet Boundary Container/FM2450_SW3P.dgn

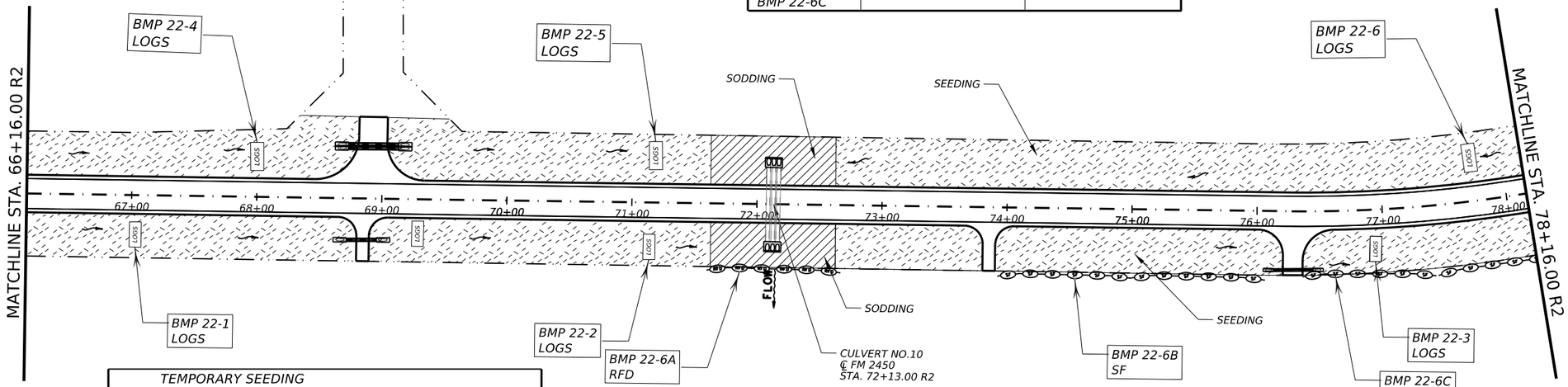
DW: CK: DW: CK: DW: CK:

DATE DISTURBED: _____

DATE STABILIZED: _____



	DATE INSTALLED	DATE REMOVED
BMP 21-1		
BMP 21-2		
BMP 21-3		
BMP 21-4		
BMP 21-5		
BMP 21-6		
BMP 22-1		
BMP 22-2		
BMP 22-3		
BMP 22-4		
BMP 22-5		
BMP 22-6		
BMP 22-6A		
BMP 22-6B		
BMP 22-6C		



TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

NOTES:

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3) 10 LF OF BIODEGRADABLE EROSION CONTROL LOGS TO BE PLACED IN ACCORDANCE WITH TXDOT ENVIRONMENTAL STANDARD EC(9)-16, EROSION CONTROL LOG SPACING TABLE.

4) SEE DAILY WORK REPORTS FOR INITIAL STABILIZATION TIME FRAMES.

5) SEDIMENT CONTROL FENCE MAY BE USED IN LIEU OF OTHER STORMWATER BMP'S WHERE CONDITIONS WARRANT. AS AUTHORIZED OR DIRECTED BY THE ENGINEER.

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E66E4980AEB4E4...

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.54+16.00 R2
TO
STA.78+16.00 R2

2024 SHEET 11 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		188

DATE: 2/22/2024 2:13:44 PM
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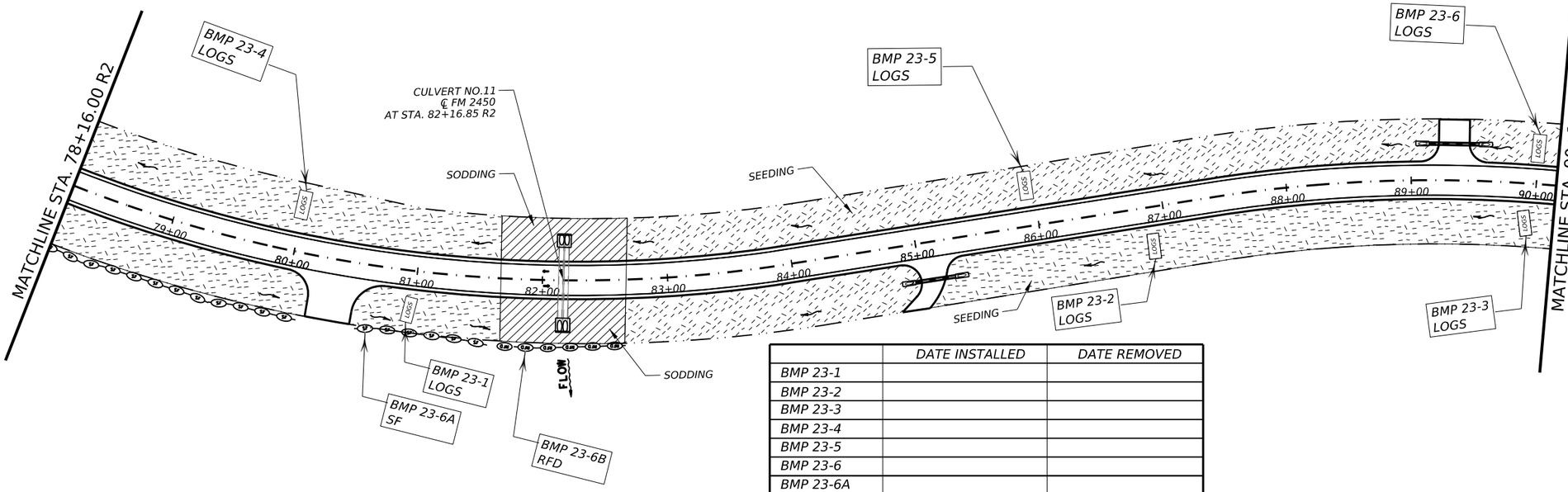
DATE STABILIZED: _____



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BMP 23-2		
BMP 23-3		
BMP 23-4		
BMP 23-5		
BMP 23-6		
BMP 23-6A		
BMP 23-6B		
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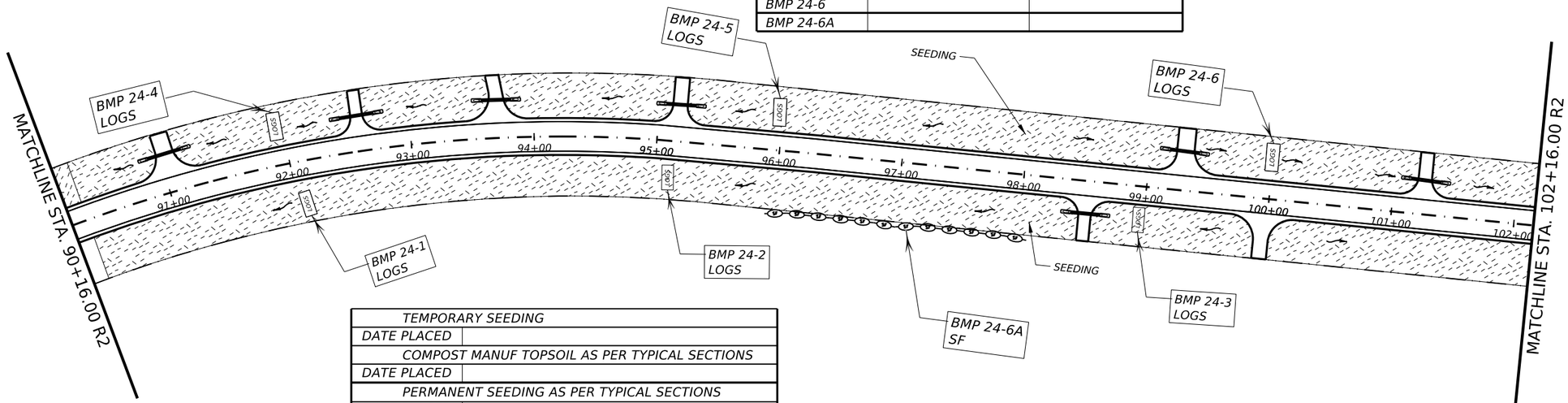
BMP 24-4		
BMP 24-5		
BMP 24-6		
BMP 24-6A		



TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

NOTES:

1) BMP LOCATIONS MAY BE ADJUSTED AS NEEDED, AS AUTHORIZED OR DIRECTED BY THE ENGINEER

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Hram Mang
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2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.78+16.00 R2
TO
STA.102+16.00 R2

2024 SHEET 12 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		189

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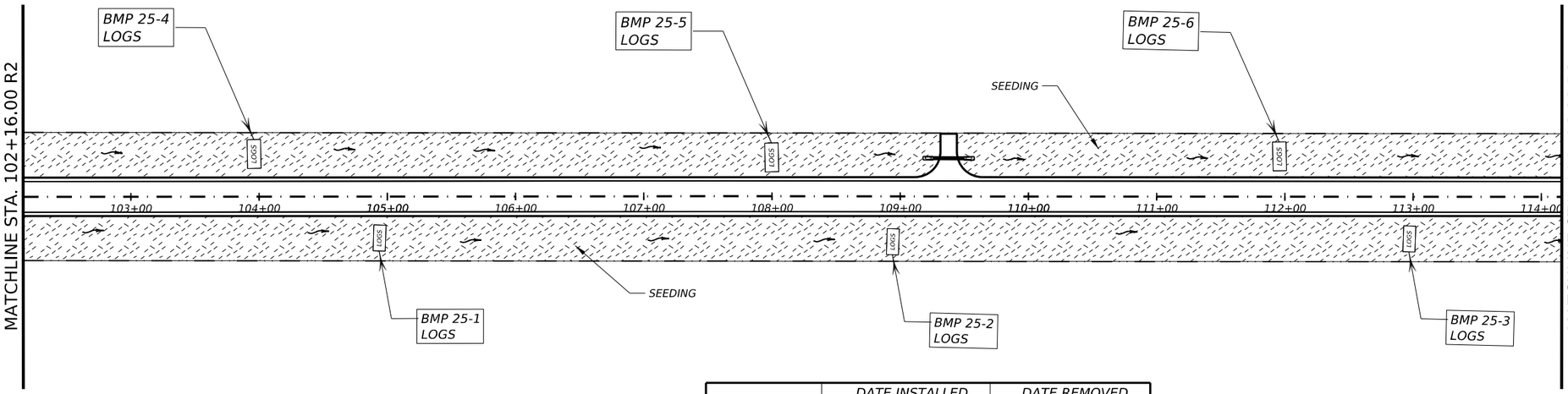
DATE DISTURBED: _____

DATE STABILIZED: _____



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BMP 25-2		
BMP 25-3		
BMP 25-4		
BMP 25-5		
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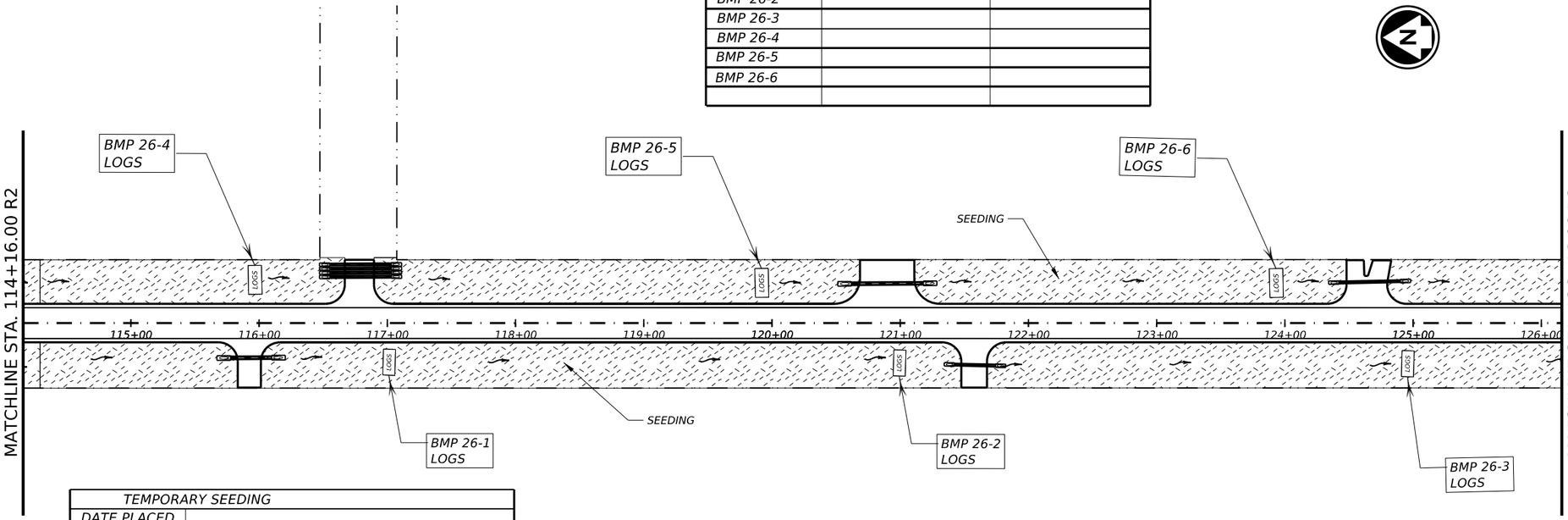
BMP 26-6		



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DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

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PROFESSIONAL ENGINEER

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Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.102+16.00 R2
TO
STA.126+16.00 R2

2024 SHEET 13 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		190

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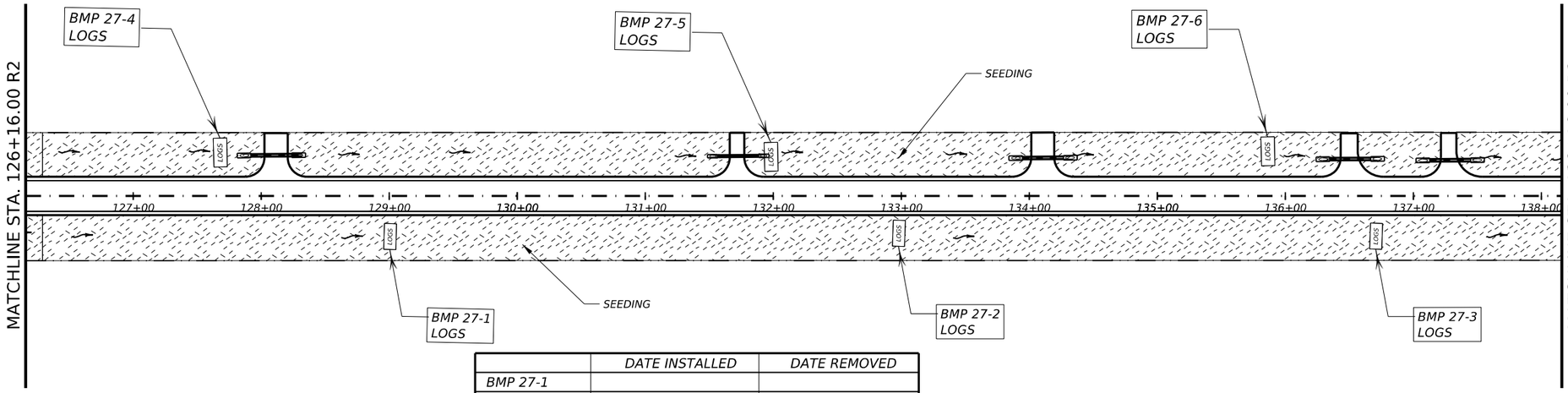
DATE STABILIZED: _____



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BMP 27-2		
BMP 27-3		
BMP 27-4		
BMP 27-5		
BMP 27-6		
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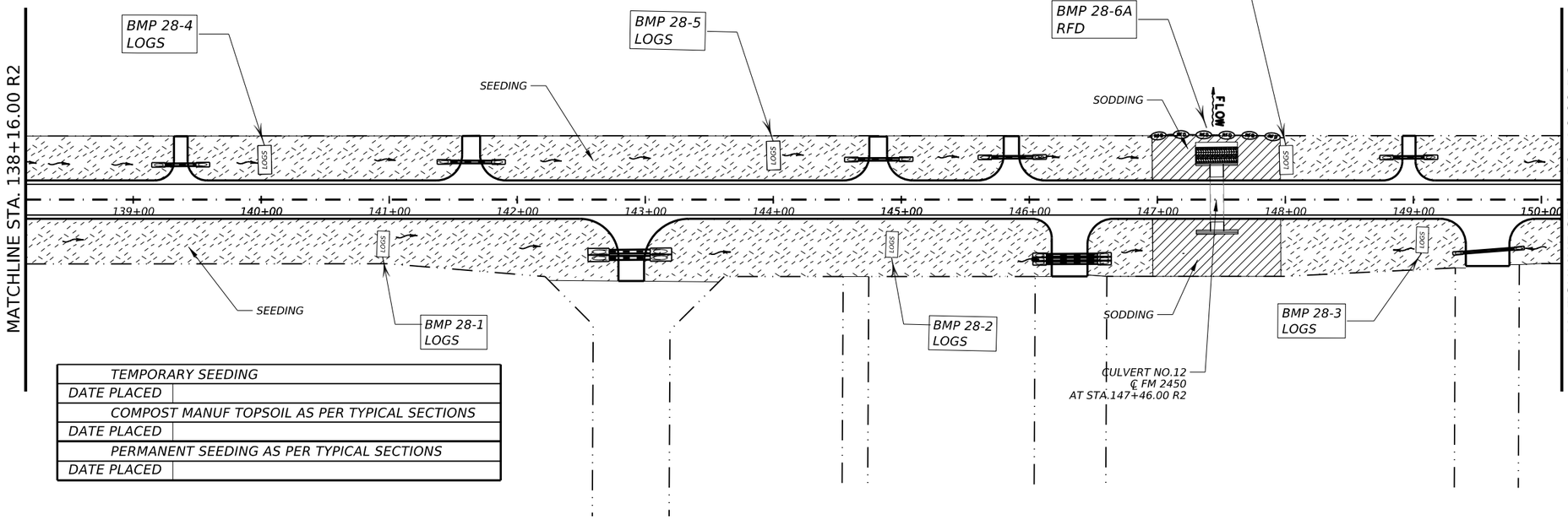
BMP 28-3		
BMP 28-4		
BMP 28-5		
BMP 28-6		
BMP 28-6A		



TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

CEXT CONSTRUCTION EXIT

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STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang 2/22/2024
7E66E4980AEB4E4...

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.126+16.00 R2
TO
STA.150+16.00 R2

2024 SHEET 14 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		191

DATE: 2/22/2024 2:13:47 PM
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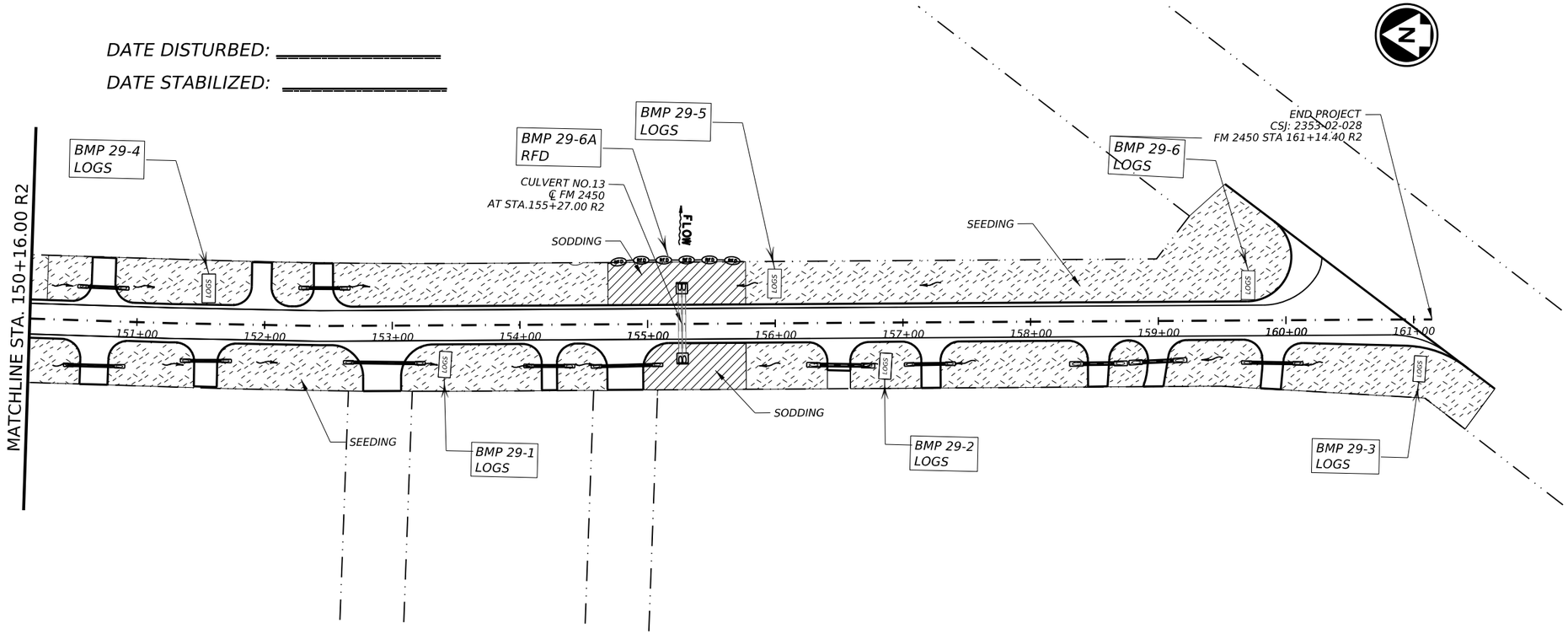

0 50 100

SCALE IN FEET

LEGENDS

SEEDING

SODDING

DIRECTION OF FLOW

LOGS BIODEGRADABLE EROSION CONTROL LOGS

SF SEDIMENT CONTROL FENCE

RFD ROCK FILTER DAM

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	DATE INSTALLED	DATE REMOVED
BMP 29-1		
BMP 29-2		
BMP 29-3		
BMP 29-4		
BMP 29-5		
BMP 29-6		
BMP 29-6A		

TEMPORARY SEEDING	
DATE PLACED	
COMPOST MANUF TOPSOIL AS PER TYPICAL SECTIONS	
DATE PLACED	
PERMANENT SEEDING AS PER TYPICAL SECTIONS	
DATE PLACED	

STATE OF TEXAS
HRAM MANG
141660
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Hram Mang
7E66E4980AEB4E4...
2/22/2024

Texas Department of Transportation

FM 2450

SW3P SITE MAP
STA.150+16.00 R2
TO
STA.161+14.40 R2

2024 SHEET 15 OF 15

CONT	SECT	JOB	HIGHWAY
2353	02	028	FM 2450
DIST	COUNTY		SHEET NO.
DAL	DENTON		192

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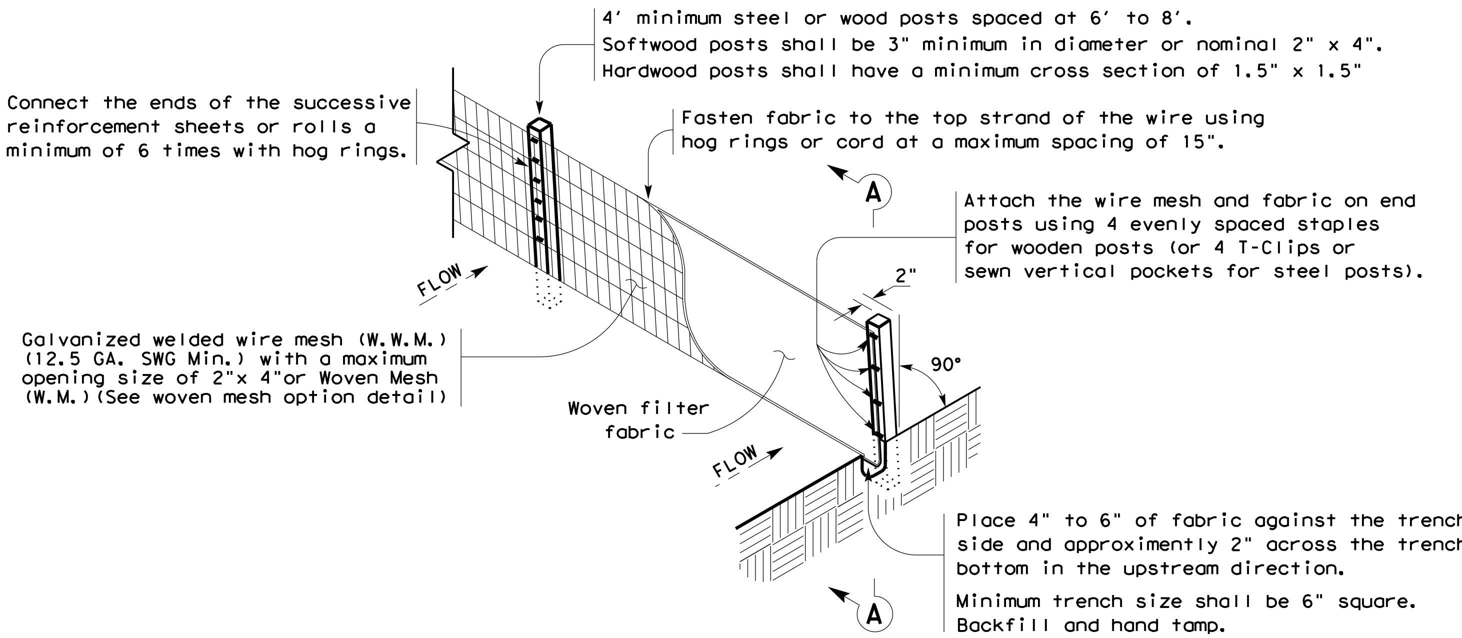
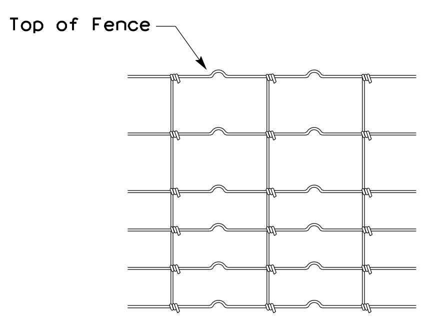
pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/2353020284 - Design/Plan Set/1. General/EC116.dgn



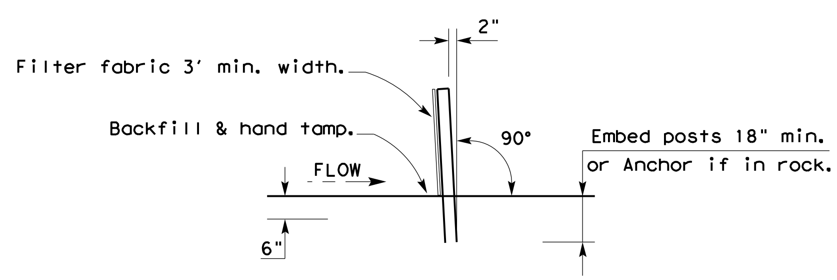
TEMPORARY SEDIMENT CONTROL FENCE

SCF



HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL

Galvanized hinge joint knot woven mesh (12.5 GA.SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.



SECTION A-A

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.

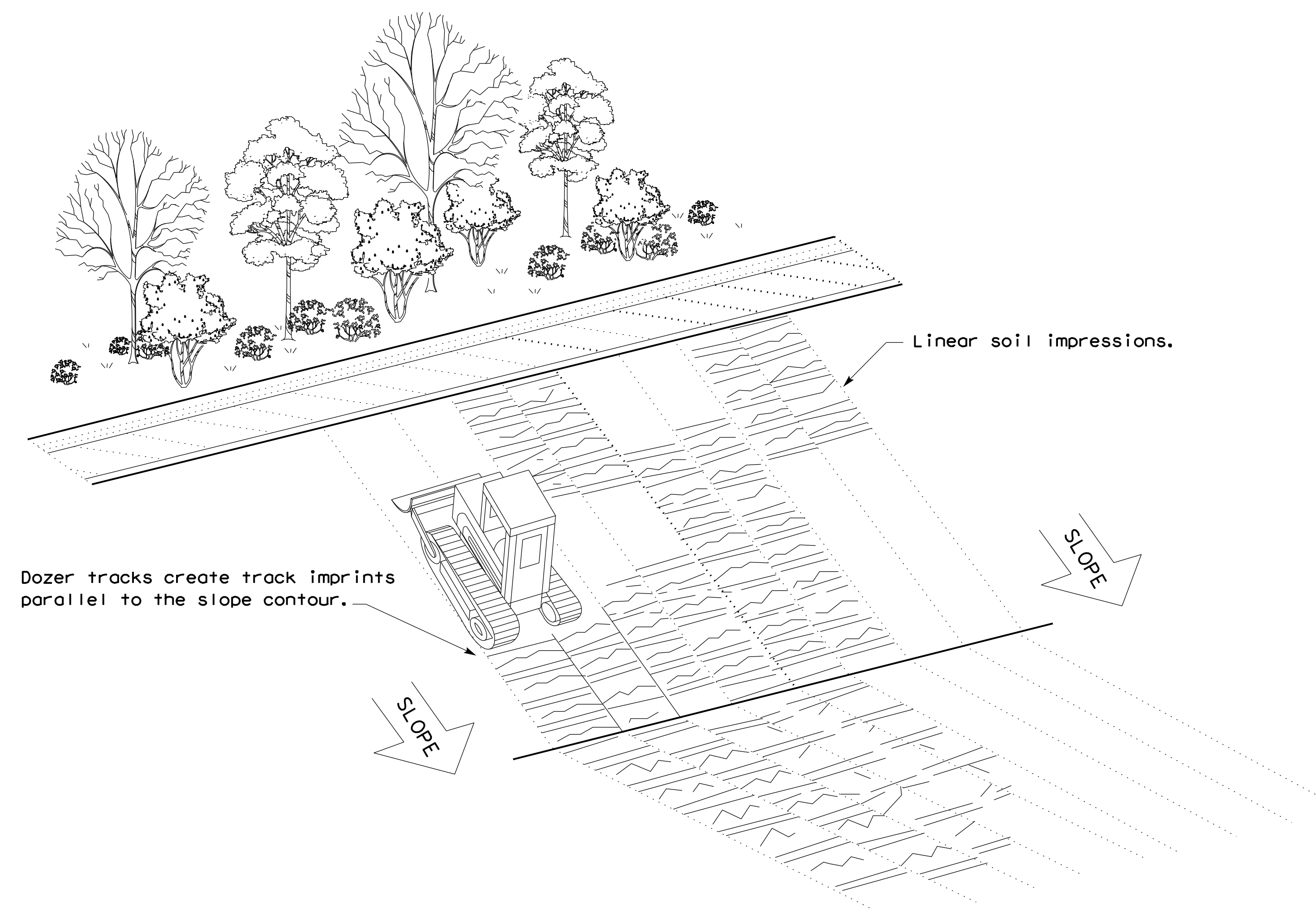
LEGEND

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

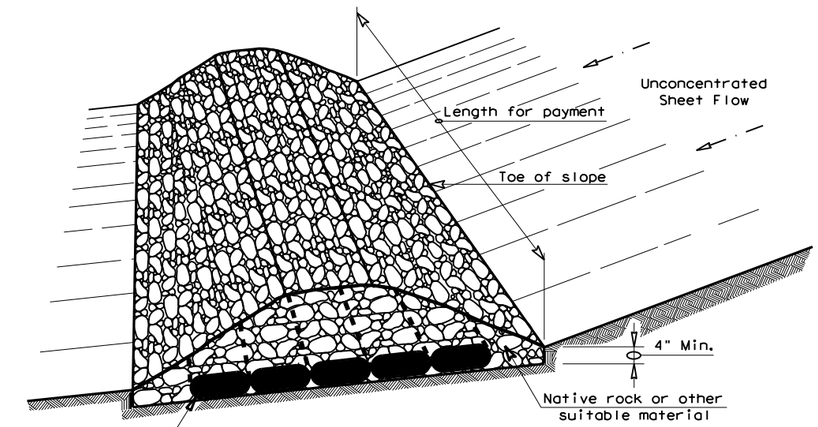
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

FENCE & VERTICAL TRACKING

EC(1)-16

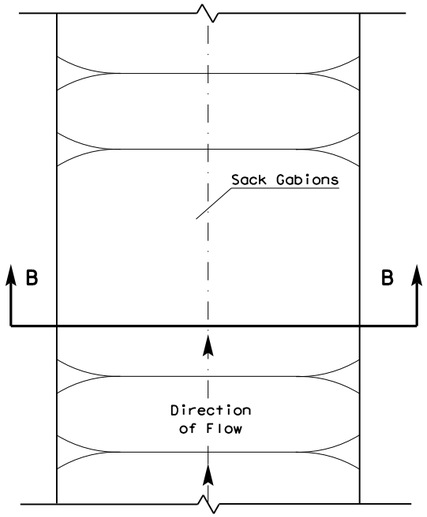
FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST		COUNTY	SHEET NO.
	DAL		DENTON	193

DATE: 2/22/2024
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Plan Set/1. General/EC216.dgn

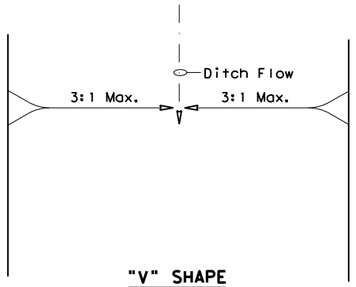


FILTER DAM AT TOE OF SLOPE

RFD1

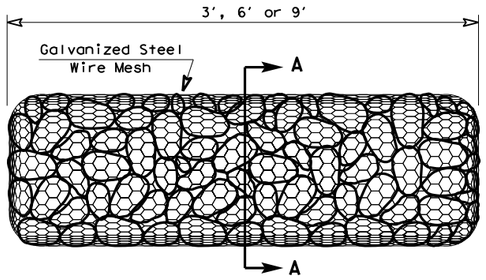


PLAN VIEW



"V" SHAPE PLAN VIEW

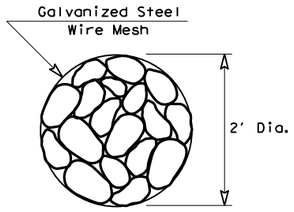
¾" Dia.
Rebar Stakes



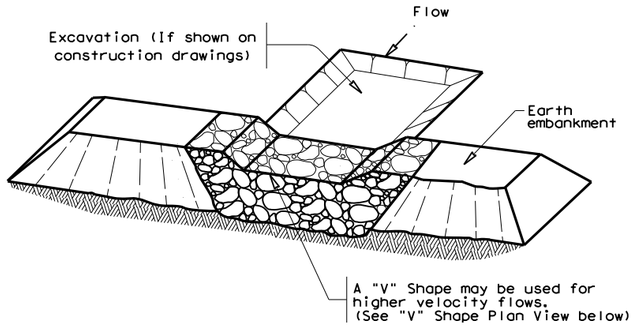
TYPE 4 (SACK GABIONS)

RFD4

SECTION B-B

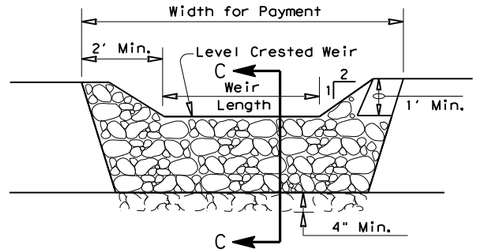


SECTION A-A

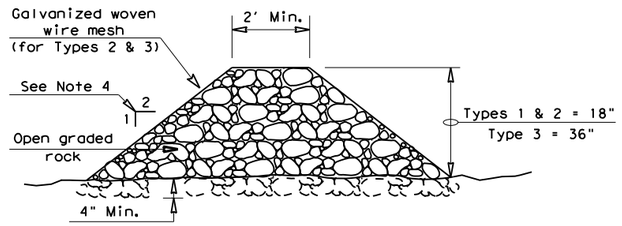


FILTER DAM AT SEDIMENT TRAP

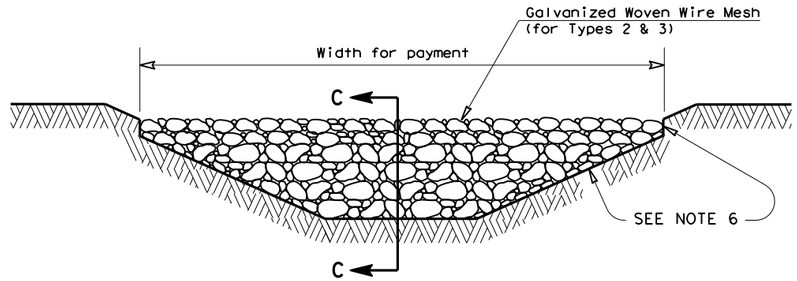
RFD1 — OR — RFD2



PROFILE



SECTION C-C



FILTER DAM AT CHANNEL SECTIONS

RFD1 — OR — RFD2 — OR — RFD3

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.

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

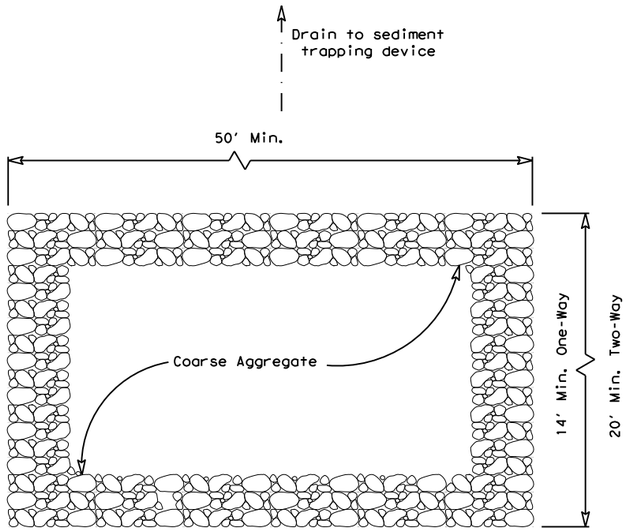
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

ROCK FILTER DAMS

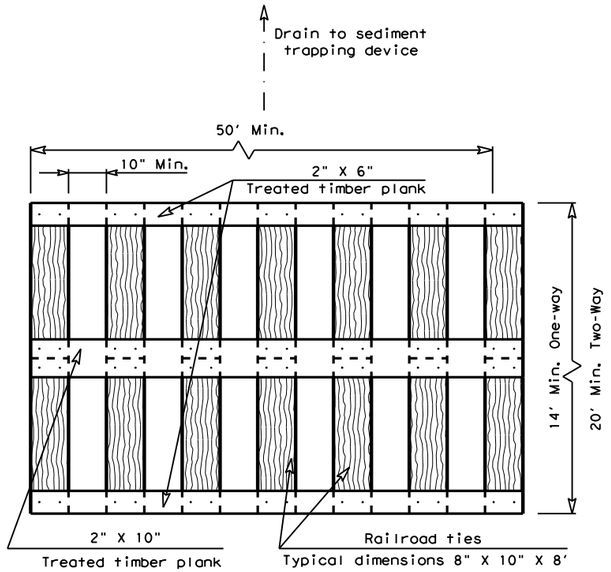
EC(2)-16

FILE: ec216	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		194

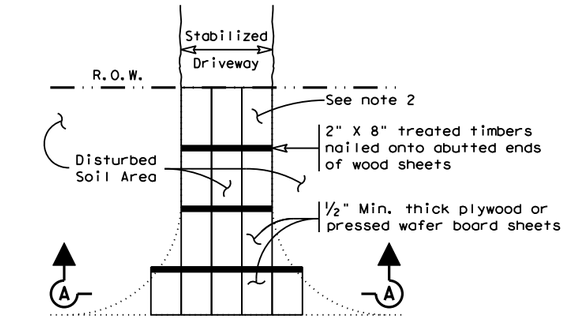
DATE: 2/22/2024
FILE: pw://txdot.projectwiseonline.com:TXDOT5/Documents/18 - DAL/Design Projects/235302028/4 - Design/Plan Set/1. General/EC316.dgn



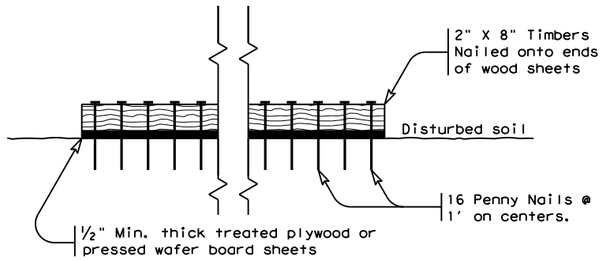
PLAN VIEW



PLAN VIEW



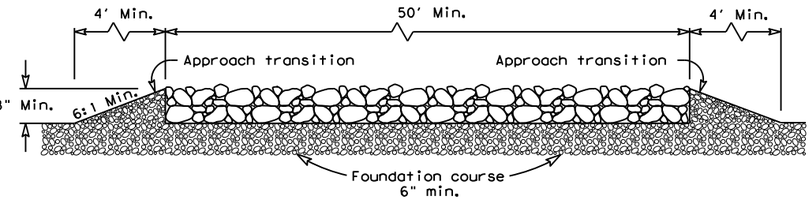
PLAN VIEW



SECTION A-A

CONSTRUCTION EXIT (TYPE 3)

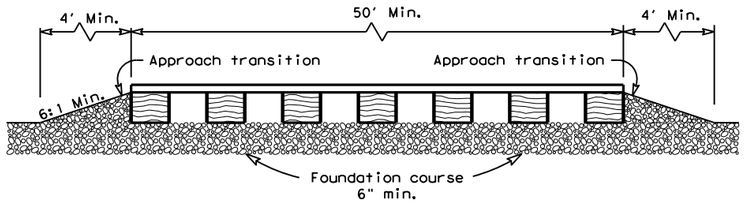
SHORT TERM



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 1)

ROCK CONSTRUCTION (LONG TERM)



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 2)

TIMBER CONSTRUCTION (LONG TERM)

GENERAL NOTES (TYPE 1)

1. The length of the type 1 construction exit shall be as indicated on the plans, but not less than 50'.
2. The coarse aggregate should be open graded with a size of 4" to 8".
3. The approach transitions should be no steeper than 6:1 and constructed as directed by the Engineer.
4. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other 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

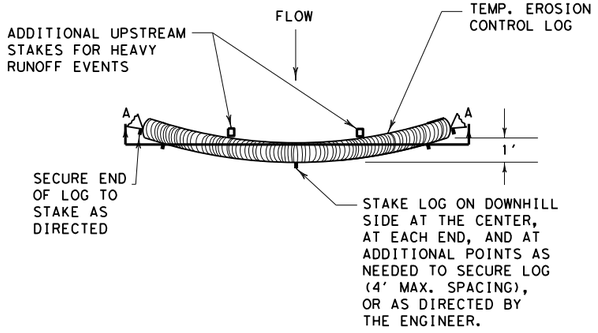
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

CONSTRUCTION EXITS

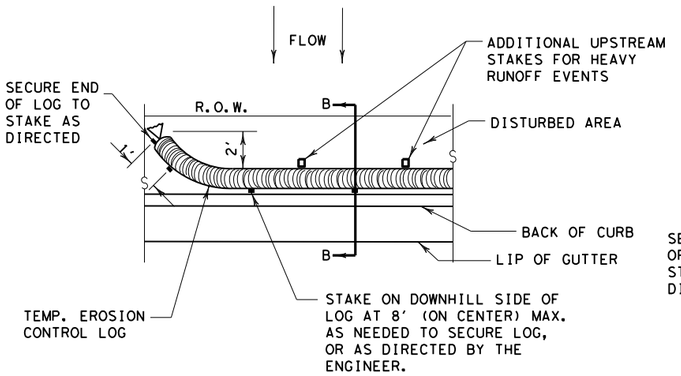
EC(3)-16

FILE: ec316	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
	CONT	SECT	JOB	HIGHWAY
REVISIONS	2353	02	028	FM 2450
	DIST	COUNTY		SHEET NO.
	DAL	DENTON		195

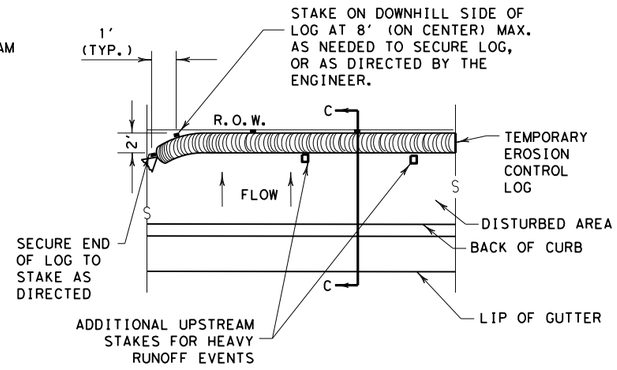
DATE:
FILE:



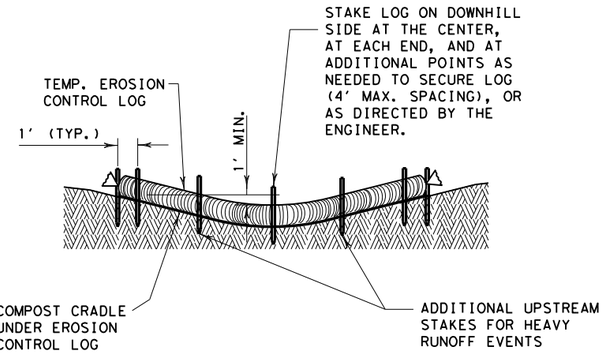
PLAN VIEW



PLAN VIEW



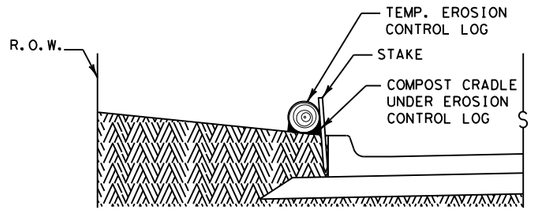
PLAN VIEW



SECTION A-A

EROSION CONTROL LOG DAM

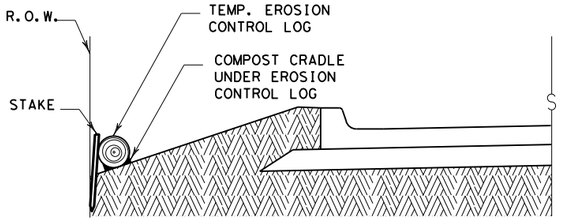
CL-D



SECTION B-B

EROSION CONTROL LOG AT BACK OF CURB

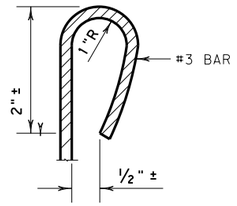
CL-BOC



SECTION C-C

EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY

CL-ROW



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.

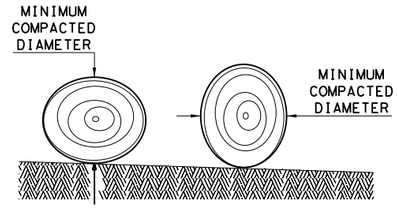
Log Traps: The drainage area for a sediment trap should not exceed 5 acres. The trap capacity should be 1800 CF/Acre (0.5" over the drainage area).

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

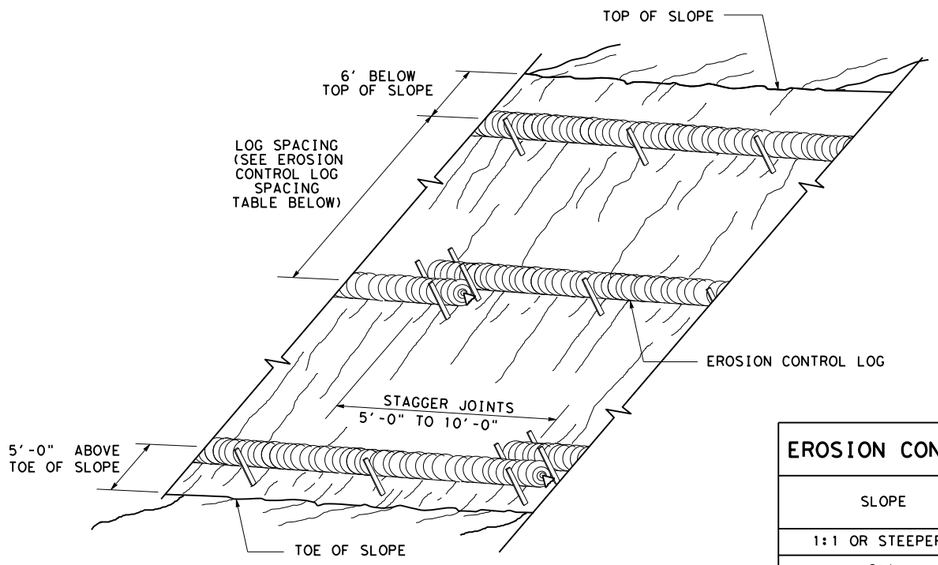
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

EROSION CONTROL LOG

EC(9)-16

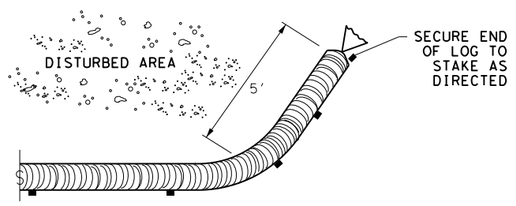
FILE: ec916	DN: TxDOT		CK: KM	DW: LS/PT	CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY
REVISIONS	2353	02	028		FM 2450
	DIST	COUNTY			SHEET NO.
	DAL	DENTON			196

DATE:
FILE:



EROSION CONTROL LOGS ON SLOPES
STAKE AND TRENCHING ANCHORING

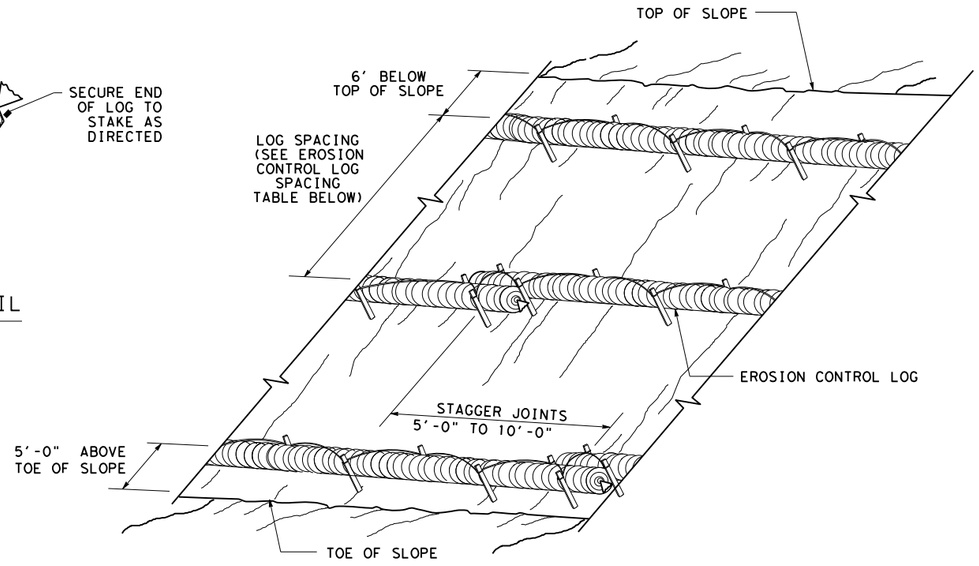
CL-SST



END SECTION RAP DETAIL

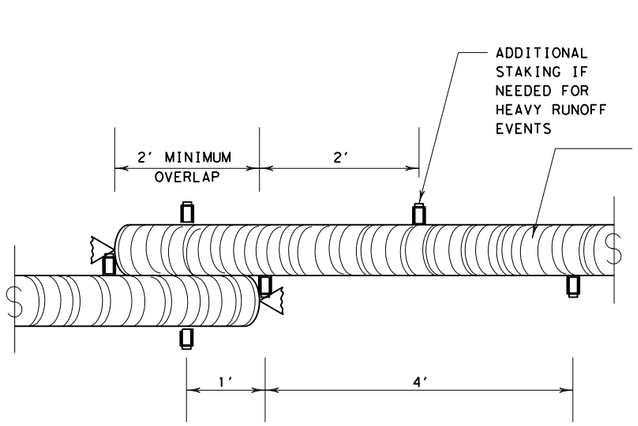
EROSION CONTROL LOG SPACING TABLE				
SLOPE	LOG DIAMETER			
	6"	8"	12"	18"
1:1 OR STEEPER	5'	10'	15'	20'
2:1	10'	20'	30'	40'
3:1	15'	30'	45'	60'
4:1 OR FLATTER	20'	40'	60'	80'

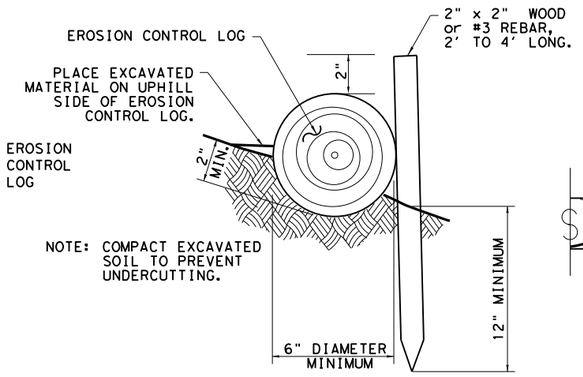
* ADJUSTMENTS CAN BE MADE FOR SOIL TYPE:
SOFT, LOAMY SOILS-ADJUST ROWS CLOSER TOGETHER;
HARD, ROCKY SOILS- ADJUST ROWS FARTHER APART



EROSION CONTROL LOGS ON SLOPES
STAKE AND LASHING ANCHORING

CL-SSL

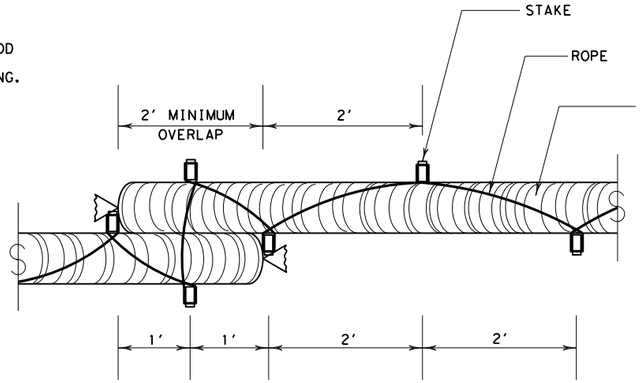


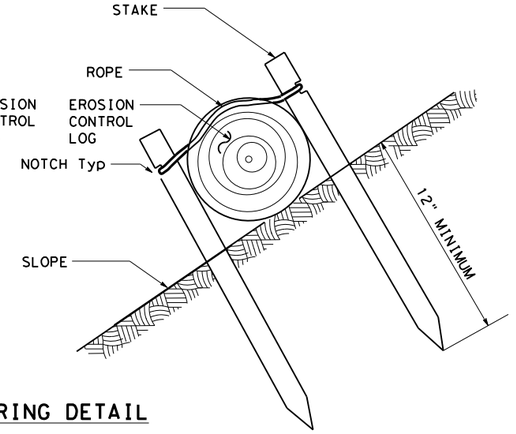


STAKE AND TRENCHING ANCHORING DETAIL

CL-SST

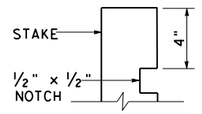
TRENCH DEPTH TABLE	
LOG DIAMETER	DEPTH
6"	2"
8"	3"
12"	4"
18"	5"





STAKE AND LASHING ANCHORING DETAIL

CL-SSL



STAKE NOTCH DETAIL

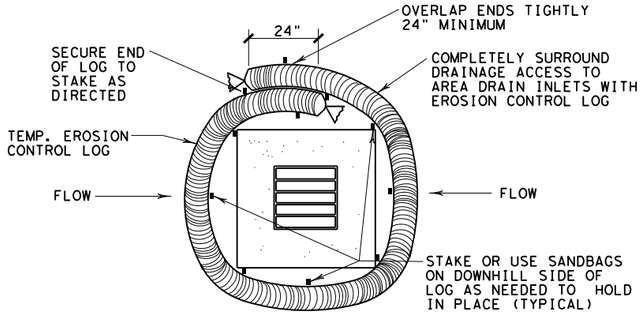
Texas Department of Transportation

Design Division Standard

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

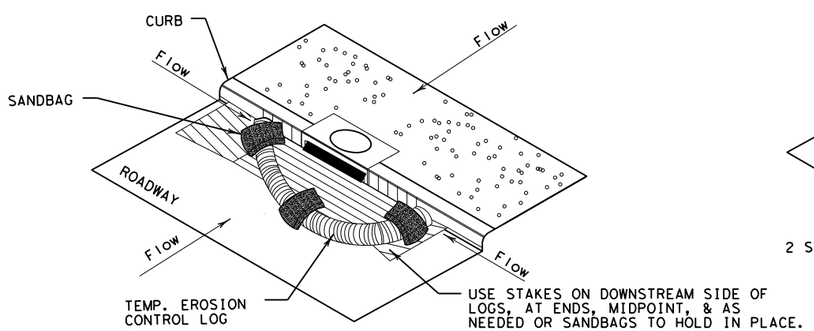
FILE: ec116	DN: TxDOT		CK: KM		DW: LS/PT	CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY	
REVISIONS	2353	02	028		FM 2450	
	DIST	COUNTY			SHEET NO.	
	DAL	DENTON			197	

DATE:
FILE:



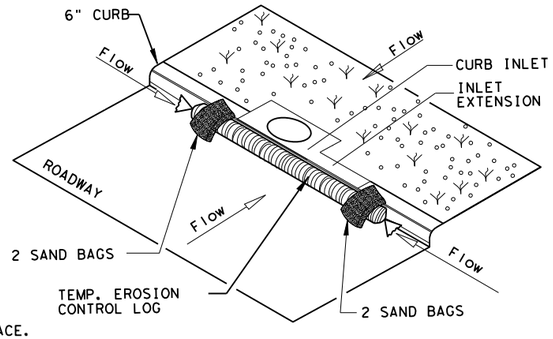
EROSION CONTROL LOG AT DROP INLET

CL-DI



EROSION CONTROL LOG AT CURB INLET

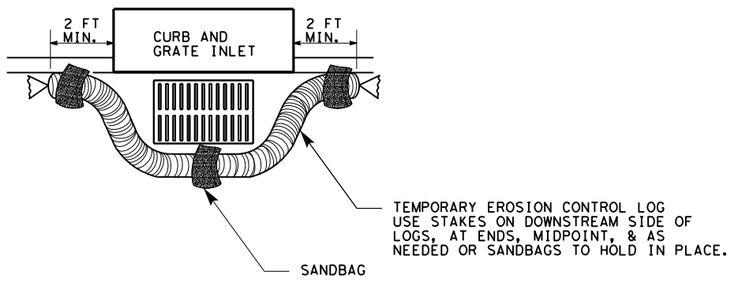
CL-CI



EROSION CONTROL LOG AT CURB INLET

CL-CI

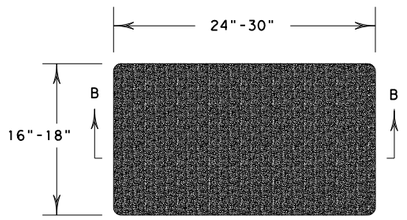
NOTE:
EROSION CONTROL LOGS USED AT CURB INLETS SHOULD ONLY BE USED IF THEY WILL NOT IMPEDE TRAFFIC OR FLOOD THE ROADWAY OR WHEN THE STORM SEWER SYSTEM IS NOT FULLY FUNCTIONAL.



EROSION CONTROL LOG AT CURB & GRADE INLET

CL-GI

SECTION B-B



SANDBAG DETAIL

SHEET 3 OF 3

Texas Department of Transportation

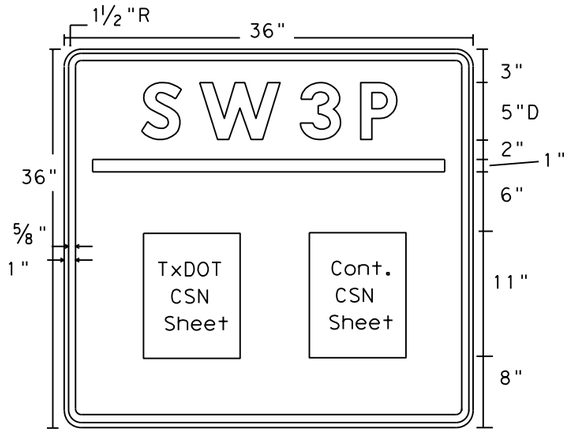
Design Division Standard

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	2353	02	028		FM 2450	
	DIST	COUNTY			SHEET NO.	
	DAL	DENTON			198	



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.

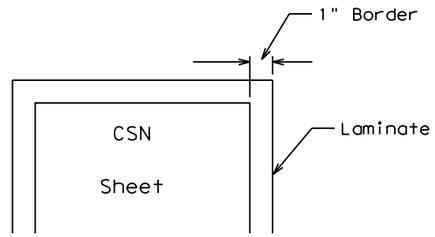
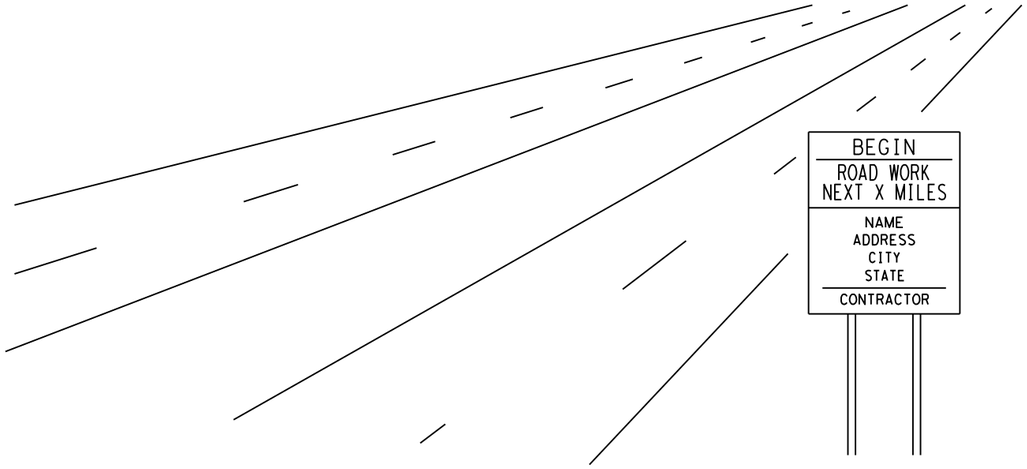
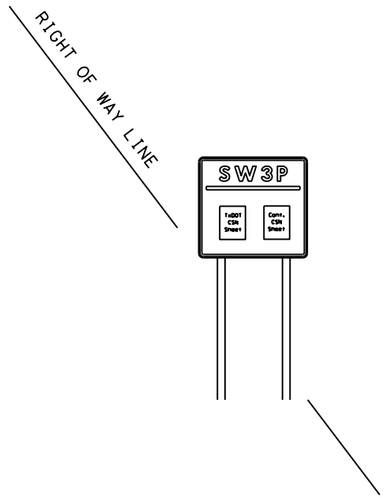


Figure 1





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:	
	DISTRICT	PROJECT NO			SHEET
REVISION DATE: 10-16-15	18	SEE TITLE SHEET			199
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	DENTON		2353	02	028	FM 2450

LEVELS DISPLAYED
PATH:

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.

****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.

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.

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

VEGETATION ESTABLISHMENT SHEET

(DALLAS DISTRICT)

TEMPLATE REVISION DATE: 02/21/19

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
CPB	8	(See Title Sheet)		FM 2450
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	DALLAS	DENTON	200
CHECK	CONTROL	SECTION	JOB	
	2353	02	028	

DATE