SEE SHEET 2 FOR INDEX OF SHEETS

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

PROJECT NO. F 2024(613), ETC.

SH 21
HOUSTON COUNTY

CSJ	ROADWAY	
	FT.	MI.
0118-02-036	88,750.00	16.809
0118-01-024	13,705.62	2.596
0118-01-022	27,831.38	5.271
NET LENGTH OF PROJECT	130,287.00	24.676

LIMITS: FROM 2.56 MILES WEST OF FM 1733 TO CHEROKEE COUNTY LINE, ETC.

FOR THE CONSTRUCTION OF WIDEN NON-FREEWAY, ETC.

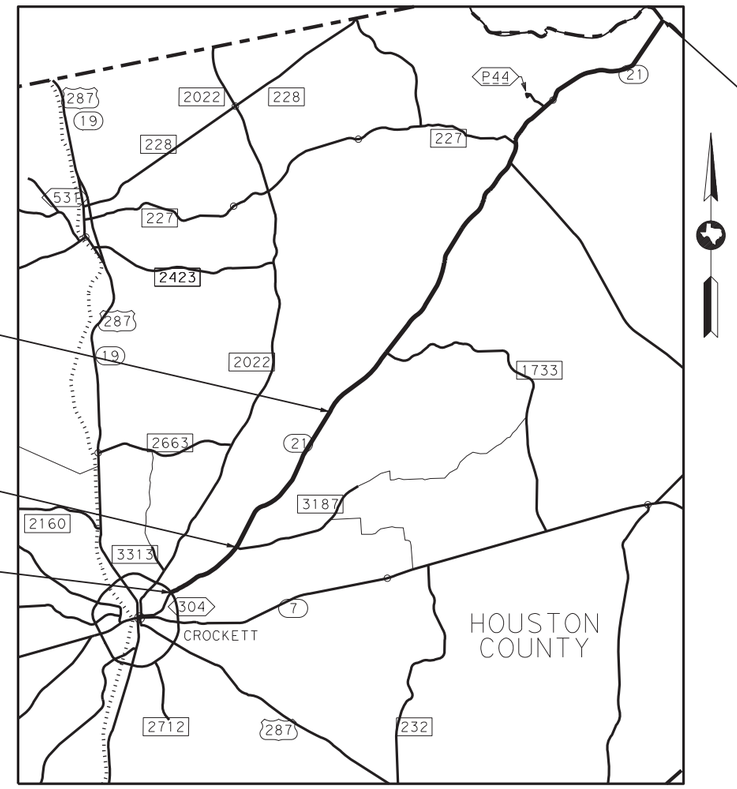
CONSISTING OF WIDEN TO NON-FREEWAY (ADD SHOULDERS), ETC

(CSJ 0118-01-024: SL 304 TO FM 3187)
FUNCTIONAL CLASS: MINOR ARTERIAL
DESIGN SPEED = 40 MPH
A.D.T. (2021)= 2446
A.D.T. (2041)= 3,033

(CSJ 0118-01-022: FM 3187 TO CR 1535)
FUNCTIONAL CLASS: MINOR ARTERIAL
DESIGN SPEED = 40 MPH
A.D.T. (2021)= 1,554
A.D.T. (2041)= 2,207

(CSJ 0118-02-036: CR 1535 TO CHEROKEE C/L)
FUNCTIONAL CLASS: MINOR ARTERIAL
DESIGN SPEED = 40 MPH
A.D.T. (2026)= 1,346
A.D.T. (2046)= 1,992

PROJECT NO.			
F 2024(613), ETC.			
CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		1



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END CSJ 0118-01-022
STA 451+27.00

BEGIN CSJ 0118-02-036
STA 0+00.00

END CSJ 0118-01-024

BEGIN CSJ 0118-01-022
STA 172+95.62

BEGIN PROJECT
CSJ 0118-01-024
STA 35+90.00
REF MRK 720+0.416
LAT: 31.328499°
LONG: -95.439914°

PREVIOUS PROJECT TIE
PROJECT NO. STP 90(35)R
CSJ 0118-01-012
TIE-IN STA 35+00

END PROJECT
CSJ 0118-02-036
STA 887+50.00
REF MRK 744+1.215
LAT: 31.54889722°
LONG: -95.22429444°

PREVIOUS PROJECT TIE
PROJECT NO. C 118-02-24
CSJ 0118-02-024
TIE-IN STA 887+50.00

EXCEPTIONS: NONE
EQUATIONS: STA 451+27.00 (BK) = STA 0+00.00 (FWD) = 45,127.00'
RAILROAD CROSSINGS: NONE

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Richard B. Klatt 11/1/2023
4692CB9B5B43454...

FINAL PLANS

LETTING DATE: _____

DATE CONTRACTOR BEGAN WORK: _____

DATE WORK WAS COMPLETED: _____

DATE WORK WAS ACCEPTED: _____

FINAL CONTRACT COST: $ _____

CONTRACTOR : _____

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

_____ DATE _____

BARRICADES AND WARNING SIGNS

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

Texas Department of Transportation

RECOMMENDED FOR LETTING: 11/2/2023

DocuSigned by:
Jennifer H. Adams
CE1DDBE07C00426...
DISTRICT ADVANCE TRANSPORTATION PLANNING DIRECTOR

APPROVED FOR LETTING: 11/2/2023

DocuSigned by:
Kelly O. Morris, P.E.
F044211639424B4...
DISTRICT ENGINEER

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL-AID CONSTRUCTION CONTRACTS (FORM FHWA 1273, OCTOBER 23, 2023)

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GENERAL

	SHEET NO.	DESCRIPTION
	1	TITLE SHEET
	2	INDEX OF SHEETS
	3 - 8	TYPICAL SECTIONS
	9, 9A-9H	GENERAL NOTES
	10, 10A - 10B	ESTIMATE & QUANTITY SHEET
	11 - 26	QUANTITY SUMMARIES
	27 - 34	SUMMARY OF SMALL SIGNS

TRAFFIC CONTROL PLAN

	SHEET NO.	DESCRIPTION
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#	47	TCP(2-1)-18
#	48	TCP(2-2)-18
#	49	TCP(3-1)-13
#	50	TCP(3-3)-14
#	51	TCP(S-1)-08A
#	52	TCP(S-2)-08A
#	53	TCP(S-2c)-10
#	54	WZ (BRK)-13
#	55	WZ (RS)-22
#	56	WZ(STPM)-23

ROADWAY DETAILS

	SHEET NO.	DESCRIPTION
	57	SUPERELEVATION DATA
	58	MISCELLANEOUS DETAILS
	59	DRIVEWAY & SIDE ROAD DETAILS
	60 - 61	ROADWAY, DRIVEWAY, & SIDE ROAD DETAILS
	62	REHAB TAPER DETAIL
#	63 - 66	MB(1)-21 THRU MB(4)-21
#	67	MBP(1)-22
#	68	MBP(2)-22
#	69	TE(HMAC)-11

DRAINAGE DETAILS

	SHEET NO.	DESCRIPTION
	70 - 75	CULVERT LAYOUTS
	76 - 78	DRAINAGE AREA MAP AND HYDRAULIC DATA SHEETS
	79	CUT & RESTORE DETAILS
	80	STONE RIPRAP DRAINAGE DETAILS
	81	BCS
#	82	ECD
#	83	MC-MD
#	84 - 85	MC-3-23
#	86 - 87	MC-4-23
#	88	PSET-SC
#	89	PSET-SP
#	90	PW
#	91	SCC-MD
#	92 - 93	SCC-3 & 4

TRAFFIC ITEMS

	SHEET NO.	DESCRIPTION
	94 - 95	SIGN DETAILS
#	96 - 101	D & OM(1)-20 THRU D & OM(6)-20
#	102	D & OM(VIA)-20
#	103 - 105	PM(1)-22 THRU PM(3)-22
#	106	RS(2)-23
#	107	RS(4)-23
#	108	SMD(GEN)-08
#	109	SMD(TWT)-08
#	110 - 112	SMD(SLIP-1)-08 THRU SMD(SLIP-3)-08
#	113	SMD(2-1)-08
#	114 - 116	TSR(3)-13 THRU TSR(5)-13

ENVIRONMENTAL ISSUES

	SHEET NO.	DESCRIPTION
	117 - 118	STORMWATER POLLUTION PREVENTION PLAN (SWP3)
	119 - 142	ENVIRONMENTAL LAYOUT SHEETS
	143 - 144	EPIC
	145	BLOCK SOD DETAILS
	146	TREE REMOVAL AND TRIMMING DETAILS
#	147 - 149	EC(1)-16 THRU EC(3)-16

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

THIS STANDARD SHEETS SPECIFICALLY IDENTIFIED WITH A "#" HAVE BEEN ISSUED BY ME AND ARE APPLICABLE TO THIS PROJECT.

DocuSigned by:
Richard B. Klatt
RICHARD B. KLATT, P.E. 11/2/2023

LOCHNER

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INDEX OF SHEETS

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21

DIST	COUNTY	SHEET NO.
LFK	HOUSTON	2

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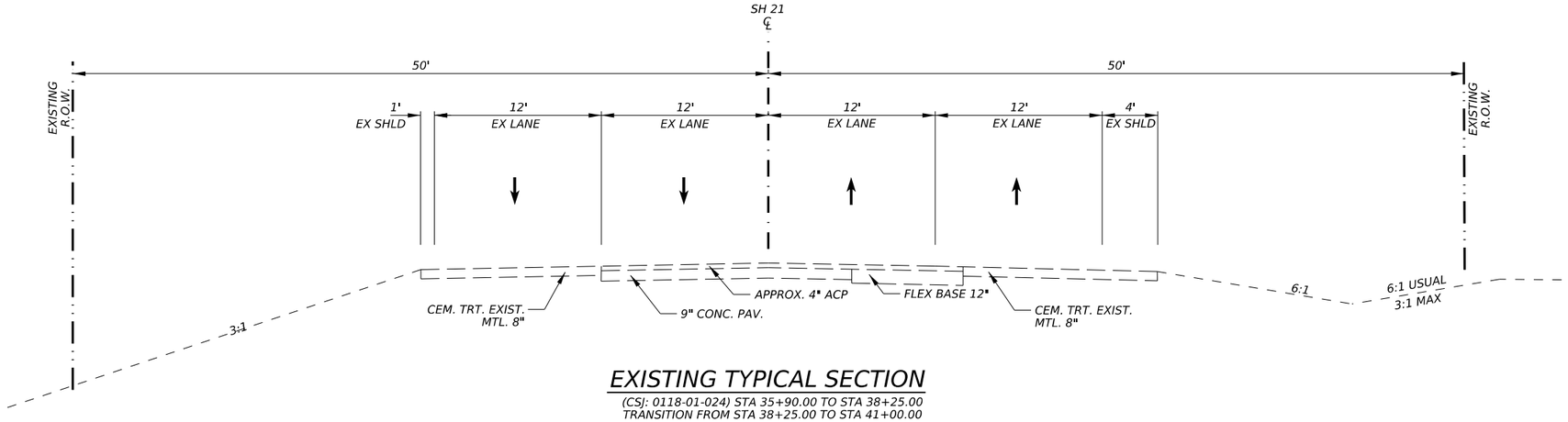
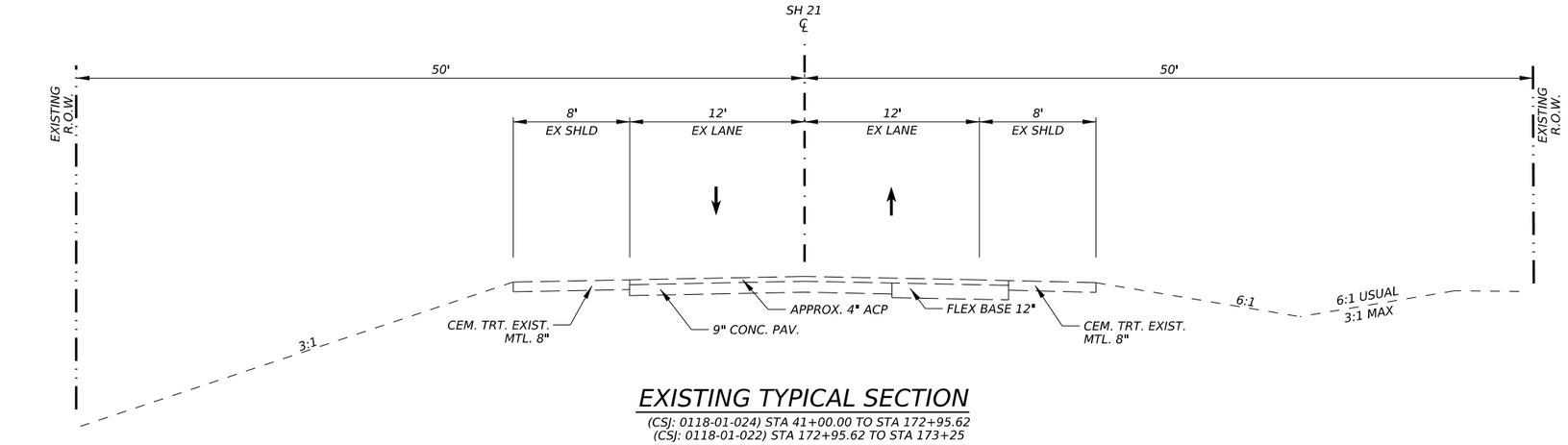


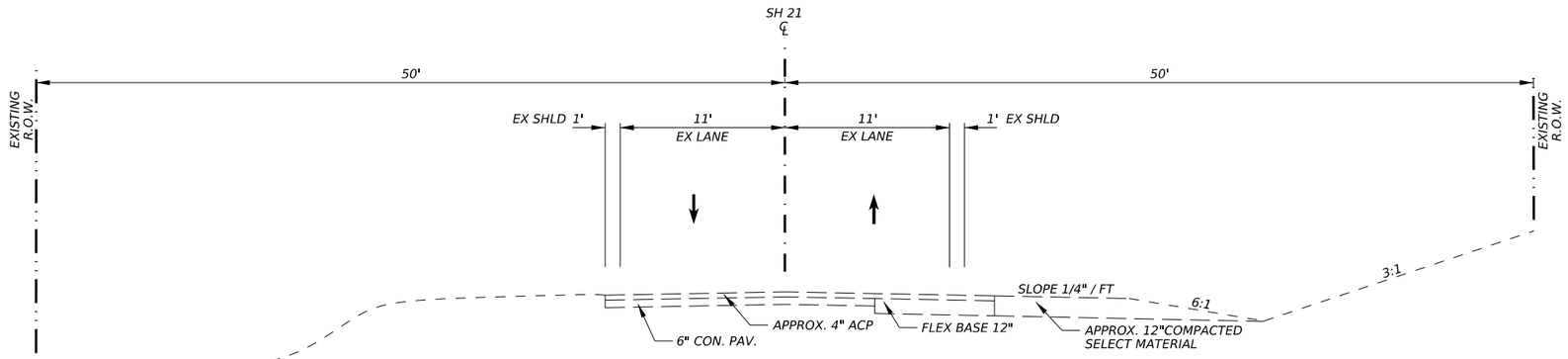
EXISTING TYPICAL SECTION

(CSJ: 0118-01-024) STA 35+90.00 TO STA 38+25.00
TRANSITION FROM STA 38+25.00 TO STA 41+00.00



EXISTING TYPICAL SECTION

(CSJ: 0118-01-024) STA 41+00.00 TO STA 172+95.62
(CSJ: 0118-01-022) STA 172+95.62 TO STA 173+25



EXISTING TYPICAL SECTION

(CSJ: 0118-01-022)
STA 173+25 TO STA 183+00
STA 192+00 TO STA 219+00
STA 238+00 TO STA 246+00
STA 257+00 TO STA 261+00
STA 296+00 TO STA 355+00
STA 385+00 TO STA 395+00
STA 404+00 TO STA 408+00
STA 414+00 TO STA 451+27

SCALE 1" = 10'

0 5 10

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
10/27/2023

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

TYPICAL SECTIONS

SHEET 1 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		3

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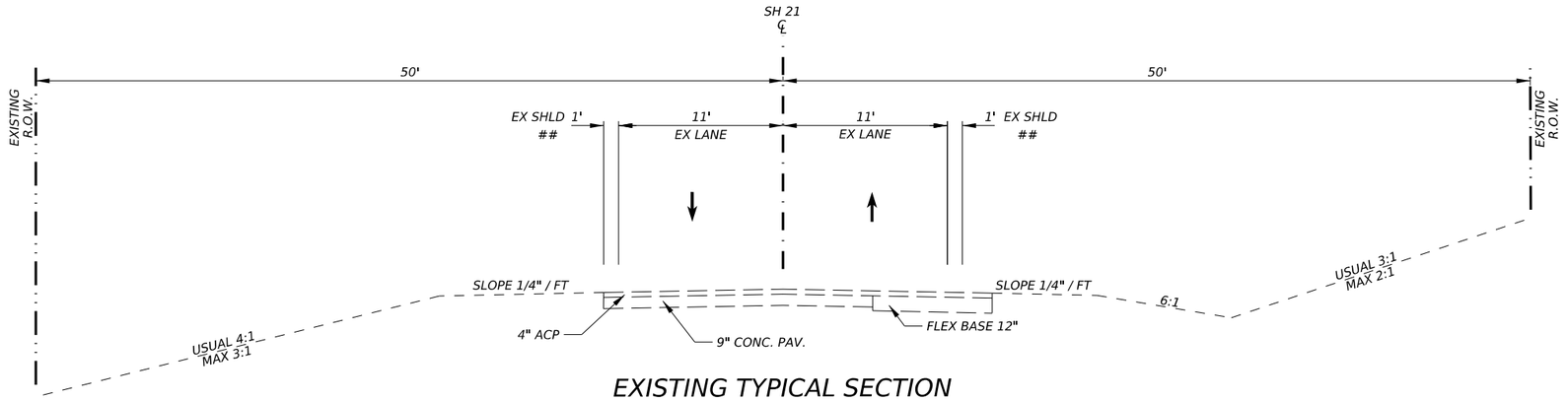
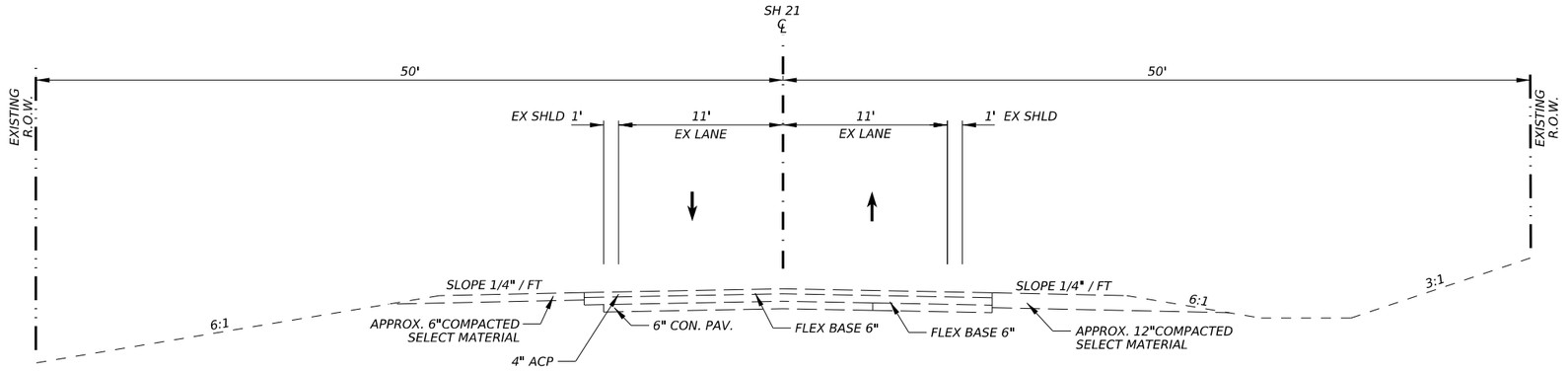


EXISTING TYPICAL SECTION

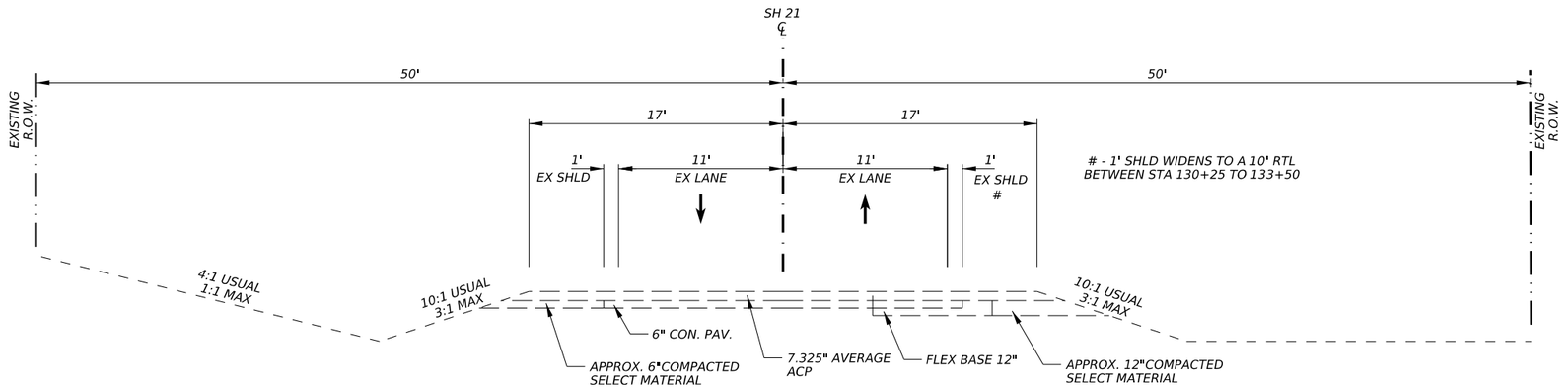
(CSJ: 0118-01-022)
STA 183+00 TO STA 192+00
STA 219+00 TO STA 238+00
STA 246+00 TO STA 257+00
STA 261+00 TO STA 296+00
STA 395+00 TO STA 404+00
STA 408+00 TO STA 414+00

- 9' EXISTING SHOULDERS STA 228+20 TO STA 231+80
(AT HURRICANE BAYOU)



EXISTING TYPICAL SECTION

(CSJ: 0118-01-022) STA 355+00 TO STA 385+00



EXISTING TYPICAL SECTION

(CSJ: 0118-02-036) STA 0+00 TO STA 133+22.26
STA 133+22.26 TO STA 513+00

SCALE 1" = 10'

0 5 10

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
10/27/2023

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86961
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LOCHNER

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TYPICAL SECTIONS

SHEET 2 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		4

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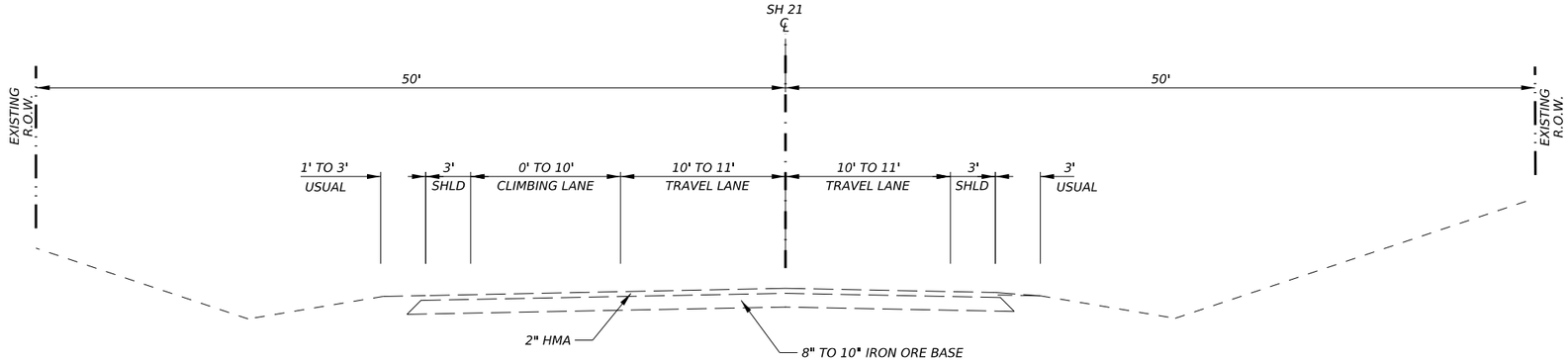
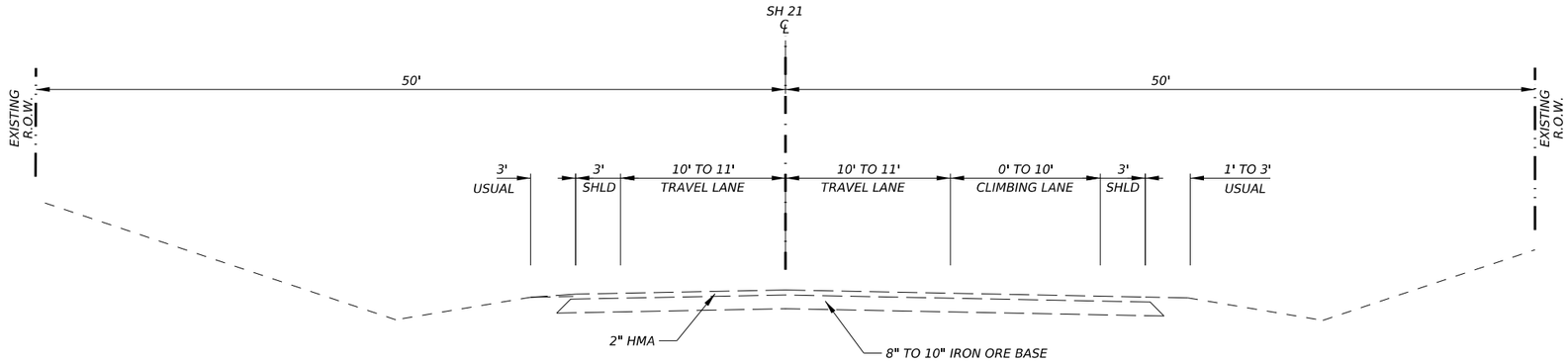


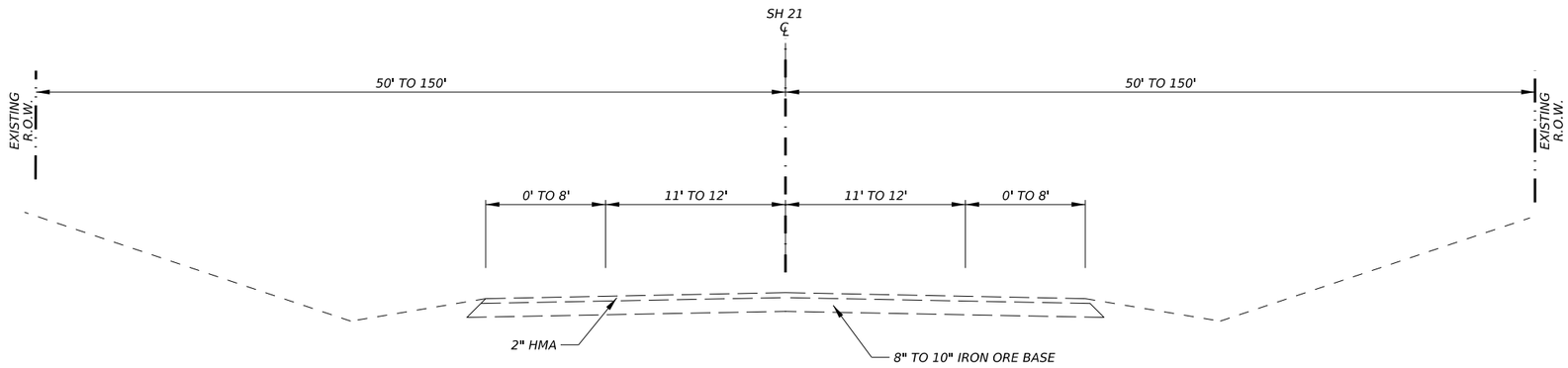
EXISTING TYPICAL SECTION

(CSJ: 0118-02-036) STA 513+00 TO STA 563+00
STA 765+00 TO STA 864+20



EXISTING TYPICAL SECTION

(CSJ: 0118-02-036) STA 563+00 TO STA 765+00



EXISTING TYPICAL SECTION

(CSJ: 0118-02-036) STA 864+20.00 TO STA 887+50.00

SCALE 1" = 10'

0 5 10

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
10/27/2023

STATE OF TEXAS
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TYPICAL SECTIONS

SHEET 3 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		5

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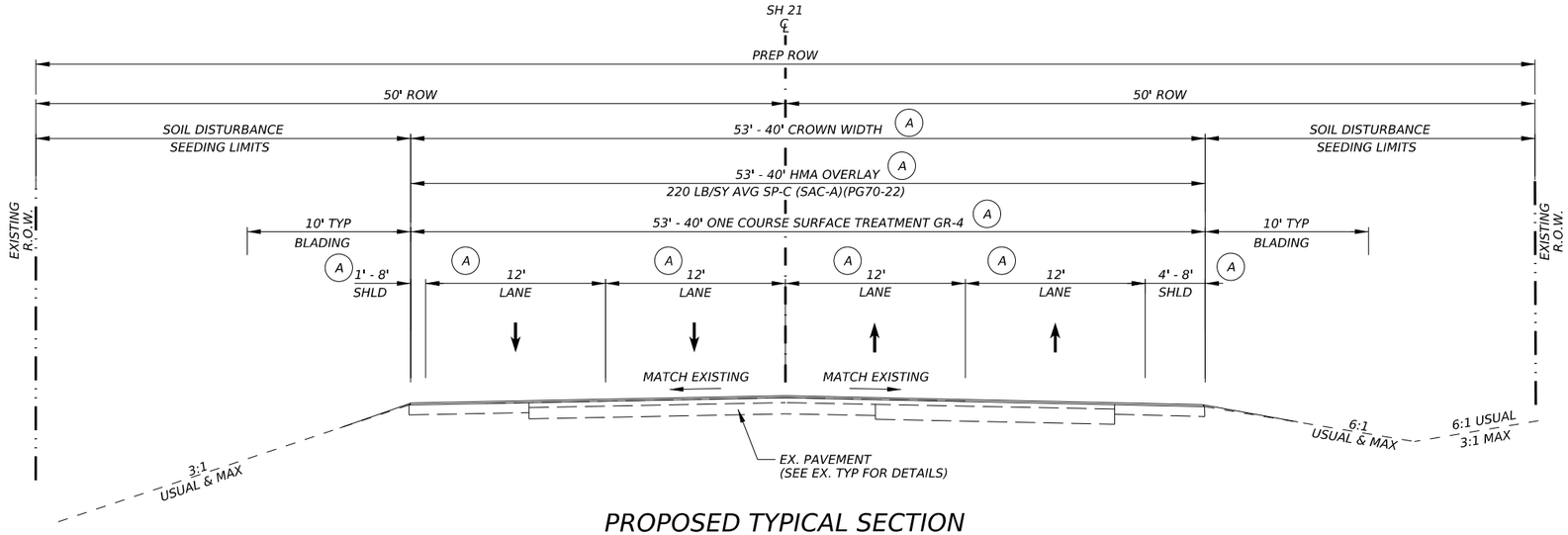
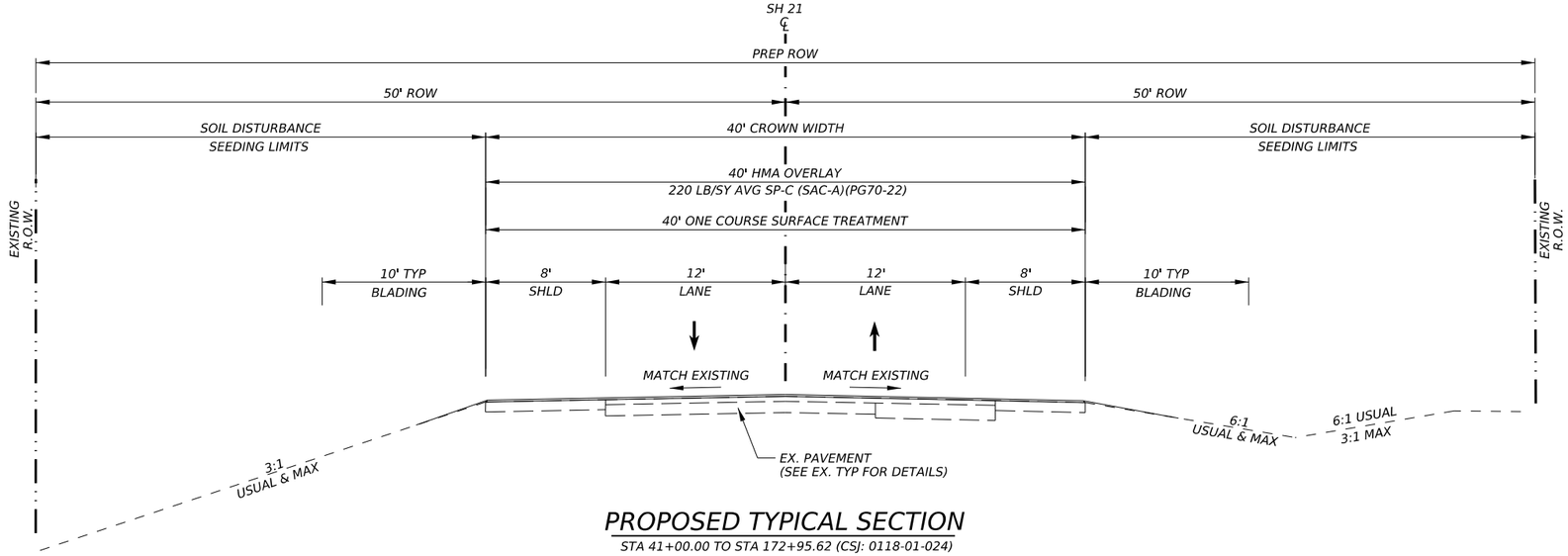


PROPOSED TYPICAL SECTION

STA 35+90.00 TO STA 41+00.00 (CSJ: 0118-01-024)

(A) PAVING WIDTH IS 53' FROM STA 35+90.00 TO STA 38+25.00
PAVING WIDTH TRANSITIONS FROM 53' AT STA 38+25.00 TO 40' AT STA 41+00.00
(SEE EXISTING TYPICAL SECTION FOR ADDITIONAL INFORMATION)



PROPOSED TYPICAL SECTION

STA 41+00.00 TO STA 172+95.62 (CSJ: 0118-01-024)

NOTE:

1. USE CARE WHEN WIDENING OVER CROSS-DRAINAGE STRUCTURES. DEPTH OF WIDENING MAY NEED TO BE REDUCED TO ACCOMMODATE DRAINAGE FEATURES.
2. BLADE 6" OF EXISTING TOPSOIL AND WINDROW OUTSIDE WORK AREA, THEN RETURN SLOPES UPON COMPLETION OF ROADWAY WORK. THIS OPERATION WILL BE PAID FOR ONCE UNDER ITEM 150, BLADING. IF ADDITIONAL MATERIAL IS NEEDED TO RETURN SLOPES, THIS WILL BE PAID FOR UNDER ITEM 132, EMBANKMENT (VEH) (ORD COMP) (TY B) (CY) AS DIRECTED.
3. REMOVAL OF EXISTING SURFACE AND/OR BASE WILL BE SUBSIDARY TO ITEM 112 "SUBGRADE WIDENING".
4. D-GR HMA TY-B (64-22) (12") MAY BE USED AT THE OPTION OF THE CONTRACTOR IN LIEU OF CEM TRT (PLNT MX) (CL N) (TY D) (GR 3 TY A). PLACE IN 2 LIFTS UNLESS OTHERWISE APPROVED.
5. TRIM OVERHANGING LIMBS TO A HEIGHT OF 60'. SEE TREE REMOVAL AND TRIMMING DETAILS FOR MORE INFORMATION.
6. MAINTAIN CROSS SLOPE AND RIDE QUALITY FOR THE DURATION UNTIL FINAL ACCEPTANCE.
7. EXISTING CONCRETE TO REMAIN IN PLACE IN WIDENING AREAS.

SEQUENCE OF CONSTRUCTION

1. PLACE PAVEMENT MARKING (REFL PAV MRK TY II).
   STA 35+90 TO STA 451+27.00 & STA 0+00 TO STA 134+00
2. PREP ROW / CONSTRUCTION CULVERT EXTENSIONS.
3. FLEXIBLE PAVEMENT STRUCTURAL REPAIR.
4. WIDEN SUBGRADE LT & RT.
   STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00
5. PLACE PROPOSED CEM TRT BASE.
   STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00
6. APPLY STRIP SEAL.
   STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00
7. APPLY SEED & FERTILIZER.
   STA 35+90 TO STA 451+27.00 & STA 0+00 TO STA 134+00
8. OCST UNDERSEAL GR-4. STA 35+90.00 TO STA 172+95.62
9. HMA OVERLAY SP-C (SAC-A). STA 35+90.00 TO STA 172+95.62
10. OVERLAY / LEVEL UP SURFACE WITH SP-C (SAC-A) TO MEET CROSS SLOPES AS SHOWN ON TYPICAL SECTIONS AND SUPERELEVATION DATA SHEET.
    STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00
11. OCST SURFACE TREATMENT (SAC-A) GR-4.
    STA 172+95.62 TO STA 887+50
12. PLACE FINAL PAVEMENT MARKINGS AND MARKERS.

SCALE 1" = 10'

0 5 10

DocuSigned by:
Richard B. Klatt 11/1/2023
4692CB9B5B43454...

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

TYPICAL SECTIONS

SHEET 4 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		6

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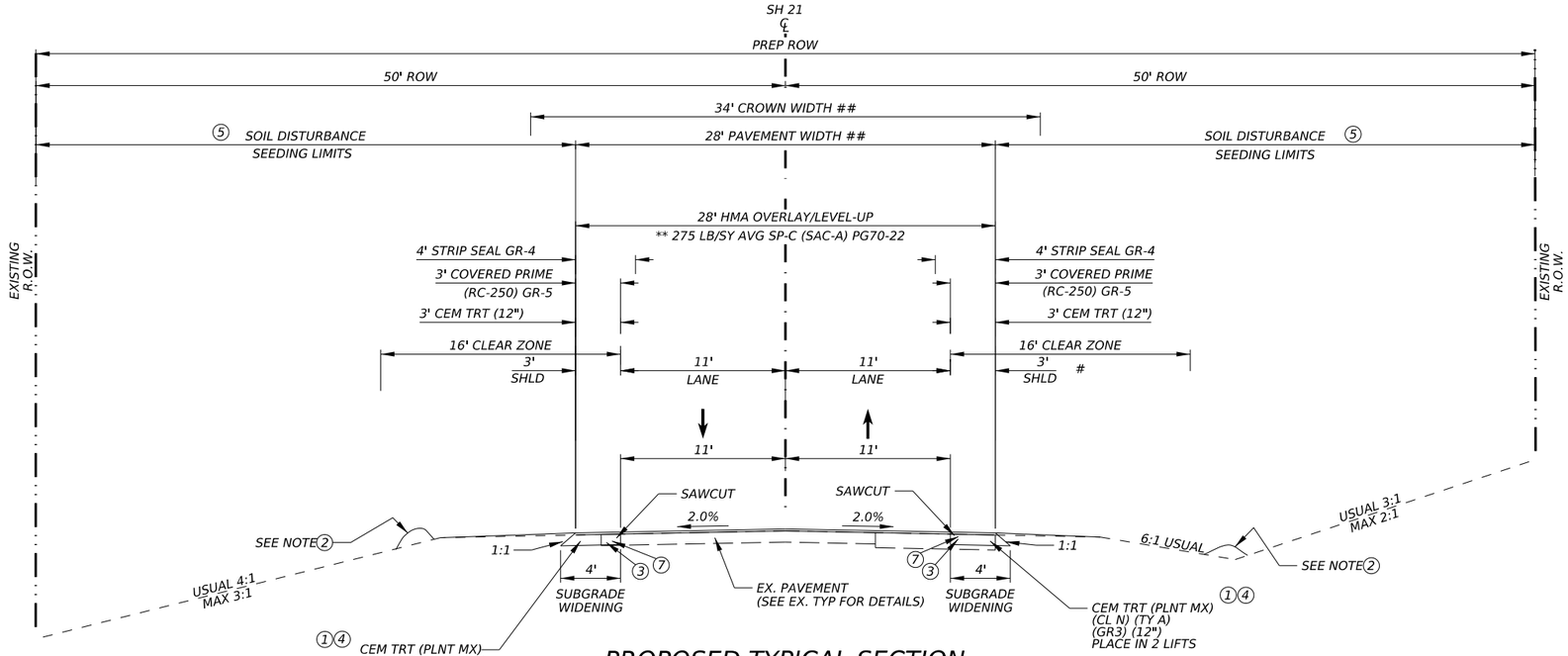


PROPOSED TYPICAL SECTION

STA 172+95.62 TO STA 451+27.00 (CSJ: 0118-01-022)
*WIDENING EXCEPTION: STA 227+10.83 RT TO STA 231+54.11 RT (AT HURRICANE BAYOU)
*WIDENING EXCEPTION: STA 228+16.11 LT TO STA 232+37.06 LT (AT HURRICANE BAYOU)

STA 0+00 TO STA 134+00 (CSJ: 0118-02-036)

** AVERAGE RATE INCLUDES SUPERELEVATION AND PAVEMENT CROSS SLOPE CORRECTIONS OVER RETAINED PAVEMENT AND 165 LB/SY OVER NEW PAVEMENT WIDENING

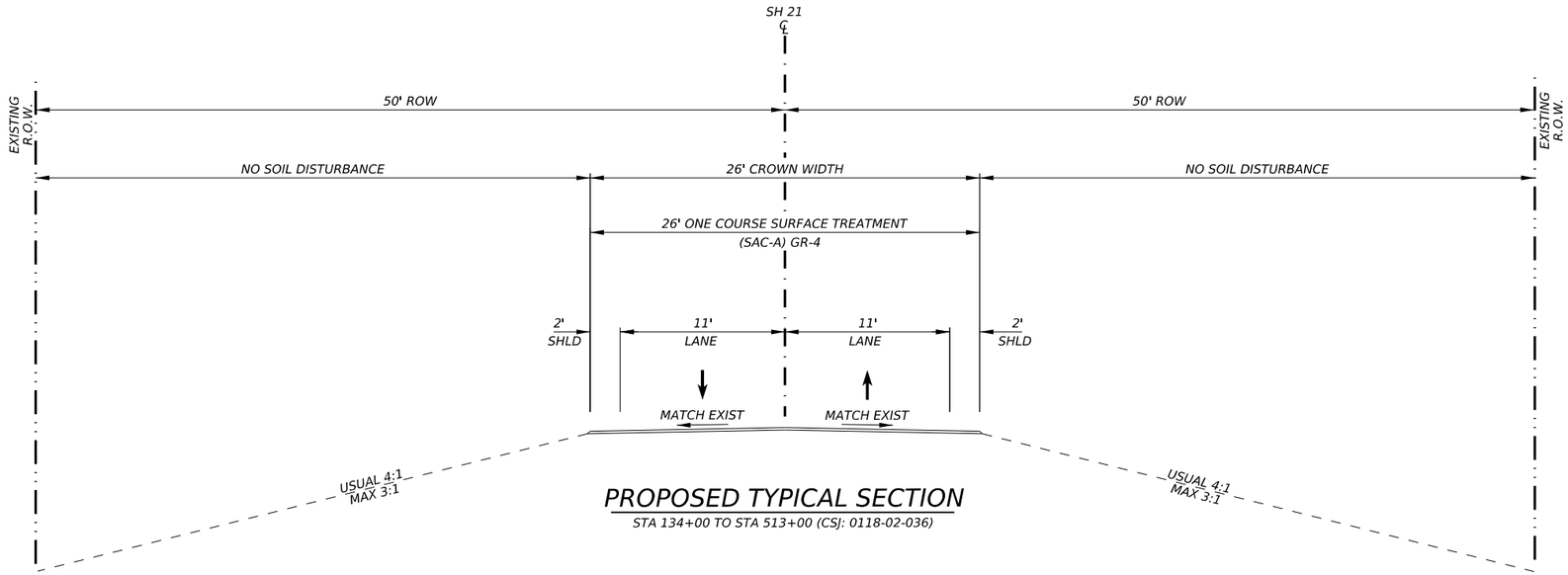
- 3' SHLD WIDENS TO A 11' RTL WITH 1' SHLD BETWEEN STA 130+25 TO STA 133+50 (CSJ: 0118-02-036) WITH PROPOSED WIDENING.
- 40' EXISTING ROADWAY & CROWN STA 228+50 TO STA 231+88 (AT HURRICANE BAYOU). OMIT WIDENING RELATED WORK.
PLACE HMA OVERLAY AND OCST ON EXISTING ROADWAY.

NOTE:

① USE CARE WHEN WIDENING OVER CROSS-DRAINAGE STRUCTURES. DEPTH OF WIDENING MAY NEED TO BE REDUCED TO ACCOMMODATE DRAINAGE FEATURES.
② BLADE 6" OF EXISTING TOPSOIL AND WINDROW OUTSIDE WORK AREA, THEN RETURN SLOPES UPON COMPLETION OF ROADWAY WORK. THIS OPERATION WILL BE PAID FOR ONCE UNDER ITEM 150, BLADING. IF ADDITIONAL MATERIAL IS NEEDED TO RETURN SLOPES, THIS WILL BE PAID FOR UNDER ITEM 132, EMBANKMENT (VEH) (ORD COMP) (TY B) (CY) AS DIRECTED.
③ REMOVAL OF EXISTING SURFACE AND/OR BASE WILL BE SUBSIDARY TO ITEM 112 "SUBGRADE WIDENING".
④ SP-B-GR HMA TY-B (64-22) (12") MAY BE USED AT THE OPTION OF THE CONTRACTOR IN LIEU OF CEM TRT (PLNT MX) (CL N) (TY D) (GR 3 TY A) AND THE COVERED PRIME. PLACE IN 2 LIFTS UNLESS OTHERWISE APPROVED.
⑤ TRIM OVERHANGING LIMBS TO A HEIGHT OF 60'. SEE TREE REMOVAL AND TRIMMING DETAILS FOR MORE INFORMATION.
⑥ MAINTAIN CROSS SLOPE AND RIDE QUALITY FOR THE DURATION UNTIL FINAL ACCEPTANCE.
⑦ EXISTING CONCRETE TO REMAIN IN PLACE IN WIDENING AREAS.

SEQUENCE OF CONSTRUCTION

1. PLACE PAVEMENT MARKING (REFL PAV MRK TY II). STA 35+90 TO STA 451+27.00 & STA 0+00 TO STA 134+00
2. PREP ROW / CONSTRUCTION CULVERT EXTENSIONS.
3. FLEXIBLE PAVEMENT STRUCTURAL REPAIR.
4. WIDEN SUBGRADE LT & RT. STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00
5. PLACE PROPOSED CEM TRT BASE. STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00
6. APPLY STRIP SEAL. STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00
7. APPLY SEED & FERTILIZER. STA 35+90 TO STA 451+27.00 & STA 0+00 TO STA 134+00
8. OCST UNDERSEAL GR-4. STA 35+90.00 TO STA 172+95.62
9. HMA OVERLAY SP-C (SAC-A). STA 35+90.00 TO STA 172+95.62
10. OVERLAY / LEVEL UP SURFACE WITH SP-C (SAC-A) TO MEET CROSS SLOPES AS SHOWN ON TYPICAL SECTIONS AND SUPERELEVATION DATA SHEET. STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00
11. OCST SURFACE TREATMENT (SAC-A) GR-4. STA 172+95.62 TO STA 887+50
12. PLACE FINAL PAVEMENT MARKINGS AND MARKERS.



PROPOSED TYPICAL SECTION

STA 134+00 TO STA 513+00 (CSJ: 0118-02-036)

SCALE 1" = 10'

0 5 10

DocuSigned by:
Richard B. Klatt
4692CB9B5B4345...
11/1/2023

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

TYPICAL SECTIONS

SHEET 5 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		7

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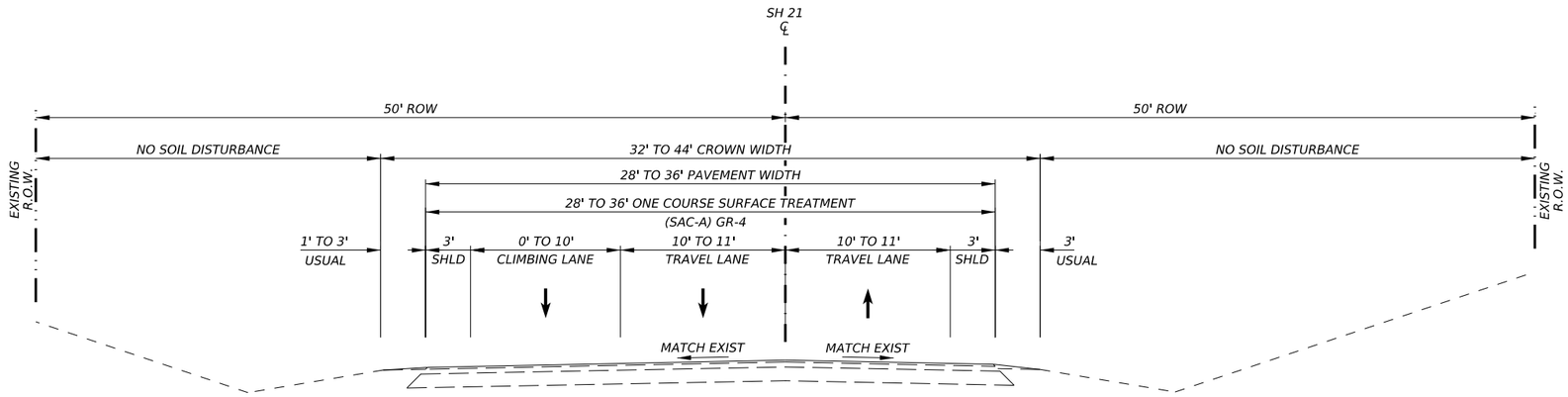
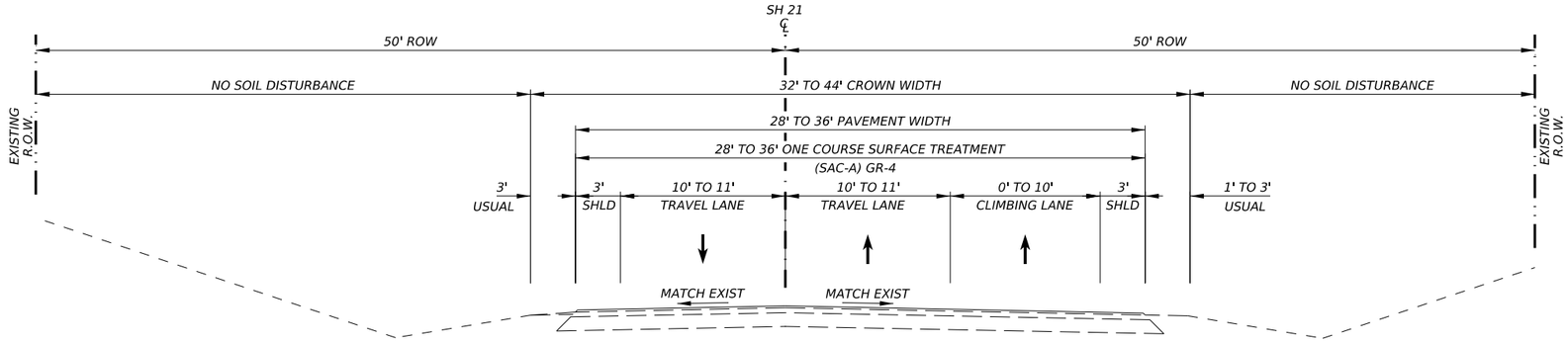


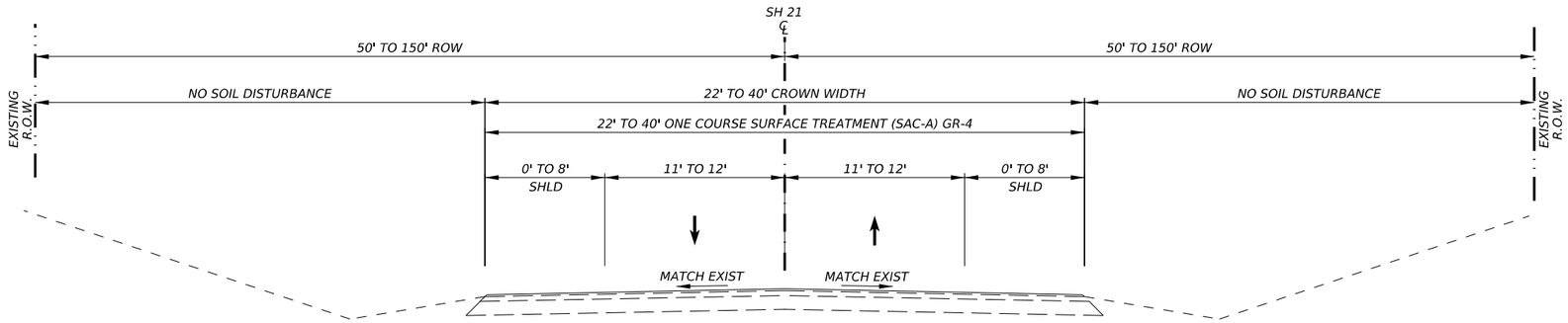
PROPOSED TYPICAL SECTION

(CSJ: 0118-02-036) STA 513+00 TO STA 563+00
STA 765+00 TO STA 864+20



PROPOSED TYPICAL SECTION

(CSJ: 0118-02-036) STA 563+00 TO STA 765+00



PROPOSED TYPICAL SECTION

(CSJ: 0118-02-036) STA 864+20.00 TO STA 887+50.00

NOTE:

1. *USE CARE WHEN WIDENING OVER CROSS-DRAINAGE STRUCTURES. DEPTH OF WIDENING MAY NEED TO BE REDUCED TO ACCOMMODATE DRAINAGE FEATURES.*
2. *BLADE 6" OF EXISTING TOPSOIL AND WINDROW OUTSIDE WORK AREA, THEN RETURN SLOPES UPON COMPLETION OF ROADWAY WORK. THIS OPERATION WILL BE PAID FOR ONCE UNDER ITEM 150, BLADING. IF ADDITIONAL MATERIAL IS NEEDED TO RETURN SLOPES, THIS WILL BE PAID FOR UNDER ITEM 132, EMBANKMENT (VEH) (ORD COMP) (TY B) (CY) AS DIRECTED.*
3. *REMOVAL OF EXISTING SURFACE AND/OR BASE WILL BE SUBSIDARY TO ITEM 112 "SUBGRADE WIDENING".*
4. *SP-B-GR HMA TY-B (64-22) (12*) MAY BE USED AT THE OPTION OF THE CONTRACTOR IN LIEU OF CEM TRT (PLNT MX) (CL N) (TY D) (GR 3 TY A) AND THE COVERED PRIME. PLACE IN 2 LIFTS UNLESS OTHERWISE APPROVED.*
5. *TRIM OVERHANGING LIMBS TO A HEIGHT OF 60'. SEE TREE REMOVAL AND TRIMMING DETAILS FOR MORE INFORMATION.*
6. *MAINTAIN CROSS SLOPE AND RIDE QUALITY FOR THE DURATION UNTIL FINAL ACCEPTANCE.*
7. *EXISTING CONCRETE TO REMAIN IN PLACE IN WIDENING AREAS.*

SEQUENCE OF CONSTRUCTION

1. *PLACE PAVEMENT MARKING (REFL PAV MRK TY II). STA 35+90 TO STA 451+27.00 & STA 0+00 TO STA 134+00*
2. *PREP ROW / CONSTRUCTION CULVERT EXTENSIONS.*
3. *FLEXIBLE PAVEMENT STRUCTURAL REPAIR.*
4. *WIDEN SUBGRADE LT & RT. STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00*
5. *PLACE PROPOSED CEM TRT BASE. STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00*
6. *APPLY STRIP SEAL. STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00*
7. *APPLY SEED & FERTILIZER. STA 35+90 TO STA 451+27.00 & STA 0+00 TO STA 134+00*
8. *OCST UNDERSEAL GR-4. STA 35+90.00 TO STA 172+95.62*
9. *HMA OVERLAY SP-C (SAC-A). STA 35+90.00 TO STA 172+95.62*
10. *OVERLAY / LEVEL UP SURFACE WITH SP-C (SAC-A) TO MEET CROSS SLOPES AS SHOWN ON TYPICAL SECTIONS AND SUPERELEVATION DATA SHEET. STA 172+95.62 to STA 451+27.00 & STA 0+00 TO STA 134+00*
11. *OCST SURFACE TREATMENT (SAC-A) GR-4. STA 172+95.62 TO STA 887+50*
12. *PLACE FINAL PAVEMENT MARKINGS AND MARKERS.*

SCALE 1" = 10'

0 5 10

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
11/1/2023

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

TYPICAL SECTIONS

SHEET 6 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		8

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GENERAL NOTES:

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

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

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

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

Roadway cross slopes shall conform approximately to the existing surface, unless otherwise directed.

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

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

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

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:

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

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.

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

Project Mowing

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

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

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

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

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

Litter Pickup

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

The equipment used for litter pickup shall be approved.

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

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

Item 5: Control of the Work

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

ONEOK to be contacted prior to starting construction. Contact Bart Richey at (936) 544-6337.

Electronic files (pdf only) containing cross-sections will be available upon request.

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

Item 6: Control of Materials

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: Legal Relations and Responsibilities

Roadway closures during the following key dates and/or special events are prohibited and shall be verified by the Contractor:

Houston County	Crockett	All roads into Crockett & SL 304	2nd Weekend of May (Thursday thru Saturday)	Davy Crockett Music & Art Festival
Houston County	Crockett	All roads into Crockett & SL 304	Saturday before Thanksgiving	Christmas in Crockett

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

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

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

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

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

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

Item 8: Prosecution and Progress

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

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

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

A 90-day delay has been included for Contractor mobilization.

Item 100: Preparing Right of Way

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

Prep ROW shall be maintained until project acceptance.

Prep ROW has to be done prior to placing any final surface.

Remove vegetation necessary to conduct culvert work permissible, but vegetation removal and ground disturbing activities need to be outside of MBTA season.

Item 132: Embankment

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

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

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

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

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

Embankment with greater than 3,000 ppm sulfates from a borrow source shall not be brought to the project.

Item 150: Blading

Use blading to reshape slopes and ditches as directed.

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

Item 158: Specialized Excavation Work

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

Item 162: Sodding for Erosion Control

Provide Bermuda block sod unless St. Augustine is the prevailing grass cover at particular placement locations. Provide St. Augustine block sod at those locations.

Item 166: Fertilizer

Fertilize all seeded or sodded areas.

Item 168: Vegetative Watering

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

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

Item 276: Cement Treatment (Plant-Mixed)

Cure with a mixture of emulsified asphalt and water as approved.

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

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

Item 302: Aggregates for Surface Treatments

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

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

Aggregate stockpile locations shall be approved prior to stockpiling.

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

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

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

The target asphalt content for pre-coating will be 1.0%.

Item 314: Emulsified Asphalt Treatment

Use MS-2 or SS-1, unless otherwise approved, mixed with water and applied at approved rates.

Before application, dilute the emulsion with water up to a maximum dilution of 50% at a distribution rate of 0.30 gal. per sq. yd.

Item 316: Seal Coat

Apply the covered prime weekly.

Open season for asphalt placement is from May 1 thru August 31. Do not place asphalt outside the open season without written approval. Asphalt underseals may be placed through October 1 weather permitting with the approval of the engineer.

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

Resurface county road turnouts and intersection areas as directed.

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

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

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

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

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

Use precoated aggregate with AC-15P or AC-20XP, and use non-precoated aggregate with RC-250 and CRS-2P.

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

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

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

Item 354: Planing and Texturing Pavement

Complete planing operations in adjacent lanes and shoulders to the same point at the end of each day.

Stockpile salvaged material at *Houston County Maintenance Facility, 1123 East Loop 304, Crockett, TX 75835.*

Cut the existing shoulder pavement to drain water away from planed travel lanes. This work will be subsidiary to various bid items.

Use an approved ski device to control longitudinal grade.

Where the underlying flexible base is exposed during the planing operation, prime exposed area with asphalt at the rate directed and patch with an approved HMA material at the end of the day's operation in which it occurs. These items of work will not be paid for directly but will be subsidiary to Item 354.

Item 400: Excavation and Backfill for Structures

When cutting an existing roadway open to traffic, complete all operations including structural excavation, laying pipe and backfilling within daylight hours the day they are initiated.

Replace excavated material deemed unsuitable for backfilling with material approved by the Engineer, paid for under the pertinent bid items or as extra work. This provision does not apply to excavated materials that are too wet and are replaced for the contractor's convenience to expedite the work.

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

Item 420: Concrete Substructures

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

Item 421: Hydraulic Cement Concrete

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

Item 427: Surface Finishes for Concrete

Provide a rub finish for Surface Area I.

Item 432: Riprap

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

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

Item 462: Concrete Box Culverts and Drains

Provide cast-in-place box culverts.

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

Item 464: Reinforced Concrete Pipe

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

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

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

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

Item 466: Headwalls and Wingwalls

Provide cast-in-place headwalls and wingwalls.

Item 467: Safety End Treatment

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

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

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

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

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

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

Item 480: Cleaning Existing Culverts

Certain box culverts will require cleaning to remove silt and other debris. Waters carried by these box culverts have been determined to be waters of the United States and are under jurisdiction of the U.S. Army Corps of Engineers. Silt and other debris removal shall be immediately hauled to an upland location for dumping. Material will not be side cast into either the water channel or its banks. Removal of the sediment is limited to the minimum necessary to restore the waterway to its configuration when the structure was built. No work will be allowed outside of the right-of-way.

Item 502: Barricades, Signs, and Traffic Handling

Traffic Control Plan (TCP):

Ensure the Contractor's Responsible Person (CRP) or their alternate for Barricades, Signs and Traffic Handling is available at all times and able to receive instructions from the Engineer or authorized Department representative. The CRP shall be a person that is usually at the project site during normal working hours.

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

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

This project requires speed reduction signs during construction. Fabricate, provide and maintain speed limit signs (XX mph) as shown on the applicable BC standards. Remove or cover regulatory (black and white) speed limit signs, when not applicable. These signs are required for both lanes of travel on divided highways regardless of the location of work.

Furnishing, erecting, relocating and removing temporary speed zone signs is subsidiary to Item 502.

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

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

In general, restrict construction work to single lane widths. Control traffic in accordance with standard drawings WZ(BTS-1) "Traffic Signal Installation Typical Details"; WZ(BTS-2) "Traffic Signal Installation Barricades and Signs"; and, Part VI of the "Texas Manual on

Uniform Traffic Control Devices for Streets and Highways". Unless otherwise approved, use an advance warning, flashing arrow panel in addition to the necessary signs, barricades, or other traffic control devices at the work area.

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

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

Lane closure lengths can exclude the end tapers.

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

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

Provide temporary rumble strips as shown on work zone rumble strip standards. Temporary rumble strips shall be a product listed on the Compliant Work Zone Traffic Control Devices and shall be a two-piece rumble strip that hinges in the middle.

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

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

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

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

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

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

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

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

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

when the equipment is in the work zone. On all other equipment such as automobiles, trailers, etc. use emergency flashers while within the work zone.

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

Install "Slow Down on Wet Road" (CW8-5aT), "Shoulder Drop-Off" (CW8-17), “Uneven Lanes” (CW8-11), “Bump” (CW8-1) and "Soft Shoulder" (CW8-4) signs during construction at one-half mile spacings as the hot mix asphalt is placed, unless otherwise directed. Maintain signs until the condition is eliminated.

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

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

Notify the Engineer prior to placing any materials or equipment on the right of way. Locate equipment, stockpiles or other materials not in use as far as possible from the driving lanes and in no case closer than 30 ft. unless otherwise authorized. Any equipment, stockpiles, or materials placed within 30 ft. of the driving lane must have adequate signs, barricades or other warning devices as approved. As a minimum place an 8 ft. wide TY III Barricade or barrels on the approach side of each site that is within 30 ft. of the driving lane. Use TY III Barricade or barrels for the site similarly on the departure side if the location is within 30 ft. of the opposing traffic lane.

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

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

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

Provide an illuminated flagger station when nighttime work is performed.

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

Item 504: Field Office and Laboratory

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

Item 506: Temporary Erosion, Sedimentation, and Environmental Controls

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

Item 530: Intersections, Driveways, and Turnouts

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

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

Item 560: Mailbox Assemblies

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

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

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

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

Item 585: Ride Quality for Pavement Surfaces

Use Surface Test Type B pay adjustment schedule 3.

Item 644: Small Roadside Sign Assemblies

Install adjacent signs with bottom edges at equal heights.

Sign placement shall be in accordance with the “Sign Crew Field Book” and as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where

necessary to secure a more desirable location or to avoid conflict with utilities. Stake all sign support locations for verification and approval.

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

Salvage all sign blanks to be removed and deliver the same day to TxDOT’s facility at Houston County Maintenance Facility, 1123 East Loop 304, Crockett, TX 75835.

Place relocated signs as close as feasible to existing signs, unless placement conflicts with the Sign Crew Field Book.

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

Wrap red retroreflective tape (NIGP Code 801-49-87-1008) around the support post of all STOP, YIELD, and DO NOT ENTER signs. Tape shall be placed approximately 4 feet above the surface of the edge of the roadway adjacent to the sign and shall be wrapped to a height of 12 inches. The tape and the placement of the tape on the sign posts shall be subsidiary to the sign assembly.

Item 658: Delineator and Object Marker Assemblies

Install delineators on the departure side of the posts when mounting to metal beam guard fence and guardrail end treatments.

Install CTB barrier reflectors on top of concrete bridge rail and concrete barriers.

Install D-SW delineators on the departure side of steel bridge rail posts.

Surface mount object markers shall be bolted to the concrete surface with galvanized lag bolts, 2 lag bolts minimum. Drilling may be necessary. Plastic shims shall be used as necessary to ensure posts are plum. This work will be subsidiary to Item 658, Object Markers.

For Surface Mount Flexible Delineator and Object Marker Posts, the following manufactures, for the post type as indicated in the TxDOT Material Producer List, are approved for district use:

Safe-Hit a division of Energy Absorption Systems

Impact Recovery Systems, Inc.

FlexStake, Inc.

Shur-Tite Products

Item 662: Work Zone Pavement Markings

Place standard work zone pavement markings before traffic is routed over detours.

Install standard work zone pavement markings on the level-up course of the overlay.

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

Install short term pavement markings (removable) on the hot mix asphalt immediately following final rolling.

Install short term pavement markings (removable) on the finish course of the overlay immediately following final rolling, offset from lane lines so there will be no conflict with permanent stripes.

Place short term pavement markings on the level-up course of the hot mix asphalt and the existing pavement after planing.

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

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

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

Item 666: Reflectorized Pavement Markings

Remove loose aggregate immediately prior to placing pavement markings.

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

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

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

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

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

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

Item 672: Raised Pavement Markers

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

signal shop at 1805 North Timberland Drive in Lufkin. Neatly stockpile these materials.

Item 3077: Superpave Mixtures

No Department-owned RAP is available.

Add hydrated lime to all HMA mixtures at a minimum rate of 1.0% by weight of the total aggregate, except for those mixtures containing RAP and/or RAS. Mixtures that contain RAP and/or RAS shall be designed at a minimum rate of 0.5 % of lime by weight and the test results will be evaluated by the engineer to determine if lime or a liquid anti-strip additive will be used. The hydrated lime shall meet the requirements of DMS-6350, "Lime and Lime Slurry". The hydrated lime shall be added in accordance with the construction method in Item 301, "Asphalt Antistripping Agents". This lime will be subsidiary to this item.

Trial batches may be required whenever the design has not been produced in the previous 12 months. Trial batches will be subsidiary to the bid item.

Provide a tack that meets the requirements of Item 300, Table 3A or Table 10A, unless otherwise approved by the engineer.

Cover each load of mixture with waterproof tarpaulins.

Operate the spreading and finishing machine at a uniform forward speed consistent with the plant production rate, hauling capability, and roller train capacity to result in a continuous operation. The speed shall be slow enough so that stopping between trucks is not ordinarily required. If, in the opinion of the Engineer, sporadic delivery of material is adversely affecting the HMA placement, the Engineer may require paving operations to cease until acceptable methods are employed to minimize starting and stopping of the paver.

A material transfer vehicle (MTV) will be required for all courses of HMA on this project. An MTV is defined as a self-propelled, wheel-mounted vehicle capable of receiving HMA from the haul trucks separate from the paver. The MTV shall have a minimum storage capacity of approximately 25 tons and shall be equipped with a pivoting discharge conveyor and a means of completely remixing the HMA prior to placement. The Engineer may approve an alternative device as long as it is capable of receiving HMA separate from the paver.

Remove and properly dispose of any piles of asphaltic concrete and all other debris left on the right of way daily.

On Table 1 under 3077.2.1.3, the Sand equivalent, %, Min is void and not replaced. The minimum percent for the sand equivalent shall be 45 for the combined aggregate.

Class B aggregate meeting all other requirements in Table 1 may be blended with a Class A aggregate to meet requirements for Class A materials. Ensure that at least 60% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source when blending Class A and B aggregates to meet a Class A requirement. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300.

Coarse aggregate from RAP and Recycled Asphalt Shingles (RAS) will be considered as Class B aggregate for blending purposes.

The Engineer may perform tests at any time during production, when the Contractor blends Class A and B aggregates to meet a Class A requirement, to ensure that at least 60% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source. The Engineer will use the Department's mix design template, when electing to verify conformance, to calculate the percent of Class A aggregate retained on the No. 4 sieve by inputting the bin percentages shown from readouts in the control room at the time of production and stockpile gradations measured at the time of production. The Engineer may determine the gradations based on either washed or dry sieve analysis from samples obtained from individual aggregate cold feed bins or aggregate stockpiles. The Engineer may perform spot checks using the gradations supplied by the Contractor on the mixture design report as an input for the template; however, a failing spot check will require confirmation with a stockpile gradation determined by the Engineer.

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

One (1) TMAs (stationary) will be required for this project. The contractor will be responsible for determining if multiple operations will be ongoing at the same time to determine the total number of TMAs needed for the project.

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

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 0118-02-036 **DISTRICT** Lufkin **COUNTY** Houston
HIGHWAY SH 21

				0118-01-022		0118-01-024		0118-02-036		TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB									
		PROJECT ID		A00066913		A00132863		A00066914			
		COUNTY		Houston		Houston		Houston			
		HIGHWAY		SH 21		SH 21		SH 21			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	100-6002	PREPARING ROW	STA	275.000		138.000		134.000		547.000	
	104-6001	REMOVING CONC (PAV)	SY	105.000						105.000	
	112-6001	SUBGRADE WIDENING (ORD COMP)	STA	277.000				134.000		411.000	
	132-6019	EMBANKMENT (VEHICLE)(ORD COMP)(TY B)	CY	5,370.000				2,820.000		8,190.000	
	150-6001	BLADING	STA	278.000		138.000		134.000		550.000	
	158-6003	SPEC EXCAV WORK (HYD EXCAVATOR)	HR	17.000				32.000		49.000	
	162-6002	BLOCK SODDING	SY	504.000				1,006.000		1,510.000	
	164-6009	BROADCAST SEED (TEMP) (WARM)	SY	61,848.000		15,179.000		29,606.000		106,633.000	
	164-6011	BROADCAST SEED (TEMP) (COOL)	SY	61,848.000		15,179.000		29,606.000		106,633.000	
	164-6054	BOND FBR MTRX SEED (PERM)(RURAL)(SAND)	SY	123,696.000		30,357.000		59,211.000		213,264.000	
	168-6001	VEGETATIVE WATERING	MG	4,958.800		1,215.000		2,388.200		8,562.000	
	204-6003	SPRINKLING (DUST CONTROL)	MG	857.000				424.000		1,281.000	
	276-6313	CEM TRT (PLNT MX)(CL N)(TY A)(GR3)(12")	SY	18,324.000				8,935.000		27,259.000	
	314-6010	EMULS ASPH (EROSN CONT)(SS-1)	GAL	6,185.000		3,036.000		2,961.000		12,182.000	
	316-6060	ASPH (RC-250)	TON	21.000				11.000		32.000	
	316-6416	AGGR (TY E OR L, PE OR PL GR 4)	CY	182.000				90.000		272.000	
	316-6417	AGGR (TY E OR L GR 5)	CY	132.000				65.000		197.000	
	316-6530	ASPH (AC-15P OR CRS-2P)	TON	45.000		111.000		476.000		632.000	
	316-6535	AGGR (TY E OR L, PE OR PL GR 4) (SAC-A)	CY					1,856.000		1,856.000	
	351-6008	FLEXIBLE PAVEMENT STRUCTURE REPAIR(12")	SY	1,200.000		1,200.000		600.000		3,000.000	
	354-6021	PLANE ASPH CONC PAV(0" TO 2")	SY	446.000		740.000		217.000		1,403.000	
	354-6045	PLANE ASPH CONC PAV (2")	SY	1,637.000		1,309.000				2,946.000	
	400-6005	CEM STABIL BKFL	CY					2.000		2.000	
	400-6007	CUT & RESTORE CONC PAVING	SY	5.000						5.000	
	403-6001	TEMPORARY SPL SHORING	SF					264.000		264.000	
	432-6026	RIPRAP (STONE COMMON)(DRY)(18 IN)	CY					12.000		12.000	
	462-6045	CONC BOX CULV (3 FT X 2 FT)(EXTEND)	LF					18.000		18.000	
	462-6046	CONC BOX CULV (3 FT X 3 FT)(EXTEND)	LF					10.000		10.000	
	464-6003	RC PIPE (CL III)(18 IN)	LF	594.000				814.000		1,408.000	
	466-6192	WINGWALL (PW - 2) (HW=3 FT)	EA					1.000		1.000	
	466-6193	WINGWALL (PW - 2) (HW=4 FT)	EA					1.000		1.000	
	466-6194	WINGWALL (PW - 2) (HW=5 FT)	EA					1.000		1.000	
	467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	37.000				64.000		101.000	
	480-6001	CLEAN EXIST CULVERTS	EA					5.000		5.000	
	496-6016	REMOV STR (PIPE)	EA	18.000				32.000		50.000	
	500-6001	MOBILIZATION	LS	0.469		0.148		0.383		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO					26.000		26.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0118-02-036 **DISTRICT** Lufkin **COUNTY** Houston
HIGHWAY SH 21

				0118-01-022		0118-01-024		0118-02-036		TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB									
		PROJECT ID		A00066913		A00132863		A00066914			
		COUNTY		Houston		Houston		Houston			
		HIGHWAY		SH 21		SH 21		SH 21			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	936.000				648.000		1,584.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	936.000				648.000		1,584.000	
	506-6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	125.000				125.000		250.000	
	506-6024	CONSTRUCTION EXITS (REMOVE)	SY	125.000				125.000		250.000	
	506-6034	CONSTRUCTION PERIMETER FENCE	LF	120.000				60.000		180.000	
	530-6004	DRIVEWAYS (CONC)	SY	159.000						159.000	
	530-6005	DRIVEWAYS (ACP)	SY	5,073.000				4,665.000		9,738.000	
	530-6009	TURNOUTS (SURF TREAT)	SY	701.000				731.000		1,432.000	
	533-6002	RUMBLE STRIPS (CENTERLINE)	LF	27,854.000		13,606.000		88,750.000		130,210.000	
	542-6006	MTL BM GD FEN (REMOVE & REINSTALL)	LF	50.000						50.000	
	560-6003	MAILBOX INSTALL-M (TWG-POST) TY 1	EA	4.000				1.000		5.000	
	560-6007	MAILBOX INSTALL-S (WC-POST) TY 3	EA	23.000				26.000		49.000	
	560-6008	MAILBOX INSTALL-D (WC-POST) TY 3	EA	4.000				3.000		7.000	
	644-6007	IN SM RD SN SUP&AM TY10BWG(1)SA(U)	EA	6.000		9.000		3.000		18.000	
	644-6033	IN SM RD SN SUP&AM TYS80(1)SA(U)	EA			1.000				1.000	
	644-6060	IN SM RD SN SUP&AM TYTWT(1)WS(P)	EA	19.000		27.000		21.000		67.000	
	644-6061	IN SM RD SN SUP&AM TYTWT(1)WS(T)	EA	1.000		4.000		1.000		6.000	
	644-6076	REMOVE SM RD SN SUP&AM	EA	26.000		41.000		25.000		92.000	
	658-6101	INSTL OM ASSM (OM-2Z)(WFLX)SRF)SRF	EA	12.000				12.000		24.000	
	662-6008	WK ZN PAV MRK NON-REMOV (W)6"(SLD)	LF	111,326.000		27,411.000		53,290.000		192,027.000	
	662-6037	WK ZN PAV MRK NON-REMOV (Y)6"(SLD)	LF	111,326.000		27,411.000		53,290.000		192,027.000	
	662-6109	WK ZN PAV MRK SHT TERM (TAB)TY W	EA			27.000		7,544.000		7,571.000	
	662-6111	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	EA	5,568.000		1,368.000		17,756.000		24,692.000	
	666-6035	REFL PAV MRK TY I (W)8"(SLD)(090MIL)	LF			820.000				820.000	
	666-6171	REFL PAV MRK TY II (W) 6" (BRK)	LF			120.000				120.000	
	666-6174	REFL PAV MRK TY II (W) 6" (SLD)	LF	55,707.000		27,411.000		26,800.000		109,918.000	
	666-6178	REFL PAV MRK TY II (W) 8" (SLD)	LF					122.000		122.000	
	666-6208	REFL PAV MRK TY II (Y) 6" (BRK)	LF	2,850.000		1,400.000		1,460.000		5,710.000	
	666-6210	REFL PAV MRK TY II (Y) 6" (SLD)	LF	42,692.000		21,002.000		18,642.000		82,336.000	
	666-6305	RE PM W/RET REQ TY I (W)6"(BRK)(090MIL)	LF			90.000				90.000	
	666-6306	RE PM W/RET REQ TY I (W)6"(BRK)(100MIL)	LF					2,310.000		2,310.000	
	666-6308	RE PM W/RET REQ TY I (W)6"(SLD)(090MIL)	LF			26,134.000				26,134.000	
	666-6318	RE PM W/RET REQ TY I (Y)6"(BRK)(100MIL)	LF	3,640.000				5,760.000		9,400.000	
	666-6320	RE PM W/RET REQ TY I (Y)6"(SLD)(090MIL)	LF			27,154.000				27,154.000	
	666-6343	REF PROF PAV MRK TY I(W)6"(SLD)(100MIL)	LF	55,571.000				174,127.000		229,698.000	
	666-6347	REF PROF PAV MRK TY I(Y)6"(SLD)(100MIL)	LF	349.000				137,276.000		137,625.000	
	668-6076	PREFAB PAV MRK TY C (W) (24") (SLD)	LF			39.000				39.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0118-02-036 **DISTRICT** Lufkin **COUNTY** Houston
HIGHWAY SH 21

			CONTROL SECTION JOB	**0118-01-022**		**0118-01-024**		**0118-02-036**		TOTAL EST.	TOTAL FINAL
			PROJECT ID	**A00066913**		**A00132863**		**A00066914**			
			COUNTY	**Houston**		**Houston**		**Houston**			
			HIGHWAY	**SH 21**		**SH 21**		**SH 21**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	672-6007	REFL PAV MRKR TY I-C	EA			8.000				8.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	350.000		388.000		2,006.000		2,744.000	
	3077-6022	SP MIXES SP-C SAC-A PG70-22	TON	15,341.000		6,762.000		7,037.000		29,140.000	
	3084-6001	BONDING COURSE	GAL	4,345.000		3,075.000		2,114.000		9,534.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN	EA	1.000				1.000		2.000	
	6185-6002	TMA (STATIONARY)	DAY	215.000		70.000		155.000		440.000	
	6185-6005	TMA (MOBILE OPERATION)	DAY	20.000		10.000		25.000		55.000	
	18	SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS					1.000		1.000	
		EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS					1.000		1.000	

CK:
DW:
CK:
DW:

ROADWAY SUMMARY

STATION TO STATION	LENGTH	AVERAGE WIDTH	AREA	COVER PRIME AREA	STRIP SEAL AREA	ITEM	ITEM	ITEM	ITEM	ITEM	ITEM	ITEM	ITEM	ITEM	ITEM	ITEM	ITEM	ITEM
						112 6001	150 6001	132 6019	204 6003	276 6313	316 6060	#	316 6417	316 6530	#	316 6416	316 6530	#
								(1)		(2)	COVERED PRIME (5)			STRIP SEAL			ONE CRSE SURF TRT FOR SP-C (5) (UNDERSEAL)	
						SUBGRADE WIDENING (ORD COMP)	BLADING	EMBANKMENT (VEHICLE) (ORD COMP) (TY B)	SPRINKLING (DUST CONTROL)	CEM TRT (PLNT MX)(CL N)(TY A)(GR3)(12")	ASPH (RC-250)	ASPH (RC-250)	AGGR (TY E OR L GR 5)	ASPH (AC-15P OR CRS-2P)	ASPH (AC-15P OR CRS-2P)	AGGR (TY E OR L, PE OR PL GR 4)	ASPH (AC-15P OR CRS-2P)	ASPH (AC-15P OR CRS-2P)
									10 GAL/SY			0.25 GAL/SY	1 CY/140 SY		0.42 GAL/SY	1 CY/135 SY		0.42 GAL/SY
	LF	LF	SY	SY	SY	STA	STA	CY	MG	SY	TON	GAL	CY	TON	GAL	CY	TON	GAL
CSJ: 0118-01-024																		
STA 35+90 TO STA 38+25	235.00	53.00	1383.89				3										3	582
STA 38+25 TO STA 41+00	275.00	46.50	1420.83				3										3	597
STA 41+00 TO STA 172+95.62	13195.62	40.00	58647.20				132										105	24632
0118-01-024 TOTALS			**61452**	**0**	**0**	**0**	**138**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**111**	**25811**
CSJ: 0118-01-022																		
STA 172+95.62 TO STA 227+10.83	5415.21	28.00	16847.32	3611	4814	55	55	964	169	3611	4	903	26	9	2022	36		
STA 227+10.83 TO STA 228+16.11	105.28	28.00	327.54	36	47	1	1	10	2	36	1	5	1	1	10	1		
STA 228+16.11 TO STA 231+54.11	338.00	28.00	1051.56				1	480										
STA 231+54.11 TO STA 232+37.06	82.95	28.00	258.07	28	37	1	1	8	2	28	1	4	1	1	8	1		
STA 232+37.06 TO STA 451+27.00	21972.89	28.00	68360.10	14649	19532	220	220	3905	684	14649	16	3663	105	35	8204	145		
0118-01-022 TOTALS			**86845**	**18324**	**24430**	**277**	**278**	**5370**	**857**	**18324**	**21**	**4574**	**132**	**45**	**10244**	**182**	**0**	**0**
CSJ: 0118-02-036																		
STA 0+00.00 TO STA 129+25.54	12925.54	28.00	40212.79	8618	11490.00	129	129	2300	403	8618	10	2155	62	21	4826	86		
STA 129+25.54 TO STA 134+00	474.46	39.00	2055.99	317	422.00	5	5	88	21	317	1	80	3	1	178	4		
STA 134+00 TO STA 513+00	37900.00	26.00	109488.89															
STA 513+00 TO STA 864+20	35120.00	32.00	124871.11															
STA 864+20 TO STA 887+50	2330.00	31.00	8025.56															
MAILBOX AND HISTORICAL MARKER TURNOUT, AND SIDE ROAD																		
0118-02-036 TOTALS			**284654**	**8935**	**11912**	**134**	**134**	**2388**	**424**	**8935**	**11**	**2235**	**65**	**22**	**5004**	**90**	**0**	**0**
* SUPERELEVATION CORRECTION 0118-02-022																		
* SUPERELEVATION CORRECTION 0118-02-036																		
PROJECTS TOTALS			**432951**	**27259**	**36342**	**411**	**550**	**7758**	**1281**	**27259**	**32**	**6809**	**197**	**67**	**15248**	**272**	**111**	**25811**

** SEE SUPERELEVATION SHEET FOR ADDITIONAL INFORMATION*
 # FOR CONTRACTOR'S INFORMATION ONLY
(1) USE AS DIRECTED FOR CONSTRUCTING FRONT SLOPE.
(2) 3% CEMENT IS ESTIMATED. ACTUAL PERCENTAGE OF CEMENT TO BE DETERMINED FROM BLENDED SAMPLE.
(5) USE PRECOATED AGGREGATE WITH AC-15P, AND USE NON-PRECOATED AGGREGATE WITH RC-250 AND CRS-2P.
(6) ASPHALTS ESTIMATED USING THE FOLLOWING EQUATIONS/ASSUMPTIONS:

*TONS = (RATE * (SGA) * SY) / 2000*

SPECIFIC GRAVITY OF ASPHALT
*(SGA) ESTIMATED AT 1.02 * 8.34*

MBGF ADJUSTMENT SUMMARY

LOCATION	ITEM	
	542 6006	
	MTL BM GD FEN (REMOVE & REINSTALL)	
	LF	
CSJ: 0118-01-022		
HURRICANE BAYOU: STA 231+00 (RT)	50	
PROJECT TOTALS	**50**	

DATE: 11/1/2023 1:50:52 PM
FILE: c:\pw working\lochner-pw-01\dms72485\SH21 SUMMARY.dgn

LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		11

CK:
DW:
CK:
DW:

ROADWAY SUMMARY (CONT.)

STATION TO STATION	ITEM 316 6530	ITEM #	ITEM 316 6535	ITEM 351 6008	ITEM #	ITEM #	ITEM 354-6045	ITEM 354-6021	ITEM 3077 6022	ITEM 3077 6022	ITEM 3084 6001
	OCST (5) (FINISH SURFACE)			FLEX PAV REPAIR QUANTITIES							
	ASPH (AC-15P OR CRS-2P)	ASPH (AC-15P OR CRS-2P)	AGGR (TY E OR L, PE OR PL GR 4) (SAC A)	FLEXIBLE PAVEMENT STRUCTURE REPAIR(12")	SP MIXES SP-B SAC-B PG64-22	AGGR (TY E OR L, PE OR PL GR 4)	PLANE ASPH CONC PAV (2")	PLANE ASPH CONC PAV (0"TO 2")	SP MIXES SP-C SAC-A PG70-22	SP MIXES SP-C SAC-A PG70-22	BONDING COURSE
		0.42 GAL/SY	1 CY/135 SY		1320 LB/SY	1 CY/135 SY			220 LB/SY	275 LB/SY	0.05 GAL/SY
	TON	GAL	CY	SY	TON	CY	SY	SY	TON	TON	GAL
CSJ: 0118-01-024											
STA 35+90 TO STA 38+25				60				295	153		70
STA 38+25 TO STA 41+00				10					157		72
STA 41+00 TO STA 172+95.62				1130			1309	445	6452		2933
0118-01-024 TOTALS	**0**	**0**	**0**	**1200**	**0**	**0**	**1309**	**740**	**6762**	**0**	**3075**
CSJ: 0118-01-022											
STA 172+95.62 TO STA 227+10.83				240	159	2				2317	843
STA 227+10.83 TO STA 228+16.11							328	223		46	17
STA 228+16.11 TO STA 231+54.11				20	14	1	1052			145	53
STA 231+54.11 TO STA 232+37.06							258	223		36	13
STA 232+37.06 TO STA 451+27.00				940	621	8				9400	3419
0118-01-022 TOTALS	**0**	**0**	**0**	**1200**	**794**	**11**	**1637**	**446**	**0**	**11944**	**4345**
CSJ: 0118-02-036											
STA 0+00.00 TO STA 129+25.54				580	383	5				5530	2011
STA 129+25.54 TO STA 134+00				20	14	1		217		283	103
STA 134+00 TO STA 513+00	198	45986	812								
STA 513+00 TO STA 864+20	226	52446	925								
STA 864+20 TO STA 887+50	15	3371	60								
MAILBOX AND HISTORICAL MARKER TURNOUT, AND SIDE ROAD	15	3302	59								
0118-02-036 TOTALS	**454**	**105105**	**1856**	**600**	**397**	**6**	**0**	**217**	**0**	**5813**	**2114**
* SUPERELEVATION CORRECTION 0118-02-022										**3397**	
* SUPERELEVATION CORRECTION 0118-02-036										**1224**	
PROJECTS TOTALS	**454**	**105105**	**1856**	**3000**	**1191**	**17**	**2946**	**1403**	**6762**	**22378**	**9534**

* SEE SUPERELEVATION SHEET FOR ADDITIONALINFORMATION
# FOR CONTRACTOR'S INFORMATION ONLY
(1) USE AS DIRECTED FOR CONSTRUCTING FRONT SLOPE.
(2) 3% CEMENT IS ESTIMATED. ACTUAL PERCENTAGE OF CEMENT TO BE DETERMINED FROM BLENDED SAMPLE.
(5) USE PRECOATED AGGREGATE WITH AC-15P, AND USE NON-PRECOATED AGGREGATE WITH RC-250 AND CRS-2P.
(6) ASPHALTS ESTIMATED USING THE FOLLOWING EQUATIONS/ASSUMPTIONS:

TONS = (RATE * (SGA) * SY) / 2000

SPECIFIC GRAVITY OF ASPHALT
(SGA) ESTIMATED AT 1.02 * 8.34

REFLECTOR TO BE INSTALLED ON BOTH SIDES OF POST

TRUCK MOUNTED ATTENUATOR SUMMARY

STATION TO STATION	ITEM 6185 6002 TMA (STATIONARY) DAY	ITEM 6185 6005 TMA (MOBILE OPERATION) DAY
CSJ: 0118-01-024		
STA 35+90.00 TO STA 172+95.62	70	10
0118-01-024 TOTALS	**70**	**10**
CSJ: 0118-01-022		
STA 172+95.62 TO STA 451+27.00	215	20
0118-01-022 TOTALS	**215**	**20**
CSJ: 0118-02-036		
STA 0+00.00 TO STA 887+50.00	155	25
0118-02-036 TOTALS	**155**	**25**
PROJECTS TOTALS	**440**	**55**

PREP ROW SUMMARY

STATION TO STATION	ITEM 100 6002 PREPARING ROW STA
CSJ: 0118-01-024	
STA 35+90.00 TO STA 172+95.62	138
CSJ: 0118-01-022	
STA 172+95.62 TO STA 451+27.00	275
CSJ: 0118-02-036	
STA 0+00.00 TO STA 134+00.00	134
PROJECT TOTALS	**547**

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0118	02	036, etc.	SH 21
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LFK	HOUSTON		12

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MAILBOX SUMMARY

LOCATION			ITEM 530 6009 TURNOUTS (SURF TREAT) SY	ITEM 560 6003 MAILBOX INSTALL-M (TWG-POST) TY 1 EA	ITEM 560 6007 MAILBOX INSTALL-S (WC-POST) TY 3 EA	ITEM 560 6008 MAILBOX INSTALL-D (WC-POST) TY 3 EA
CSJ: 0118-01-022						
STA	181+16	LT	23			1
STA	196+30	LT	27			1
STA	198+56	LT	17		1	
STA	210+55	LT	23		1	
STA	221+20	LT	23		1	
STA	243+37	LT	21		1	
STA	244+69	LT	23		1	
STA	253+45	LT	23		1	
STA	259+87	LT	23	1		
STA	265+31	LT	23		1	
STA	288+42	LT	23		1	
STA	301+32	LT	23		1	
STA	310+08	LT	23	1		
STA	332+03	LT	23		1	
STA	342+79	LT	23		1	
STA	346+07	LT	23			1
STA	358+55	LT	62	1	2	
STA	362+89	LT	23		1	
STA	366+58	LT	23	1		
STA	370+36	LT	23		1	
STA	377+51	LT	23		1	
STA	379+56	LT	23		1	
STA	381+48	LT	22		1	
STA	396+95	LT	23		1	
STA	403+30	LT	23		1	
STA	407+49	LT	23			1
STA	409+47	LT	23		1	
STA	417+06	LT	23		1	
STA	441+98	LT	23		1	
CSJ: 0118-01-022 TOTALS			**701**	**4**	**23**	**4**

MAILBOX TURNOUTS ARE TO BE CONSTRUCTED WITH 6" CEMENT TREATED FLEX BASE (3% CEMENT) W/ COVERED PRIME (RC-250 (0.25 GAL/SY))(AGGR GR 5 TY E OR L (1 CY/140 SY)) AND ONE COURSE SURFACE TREATMENT (ASPH (AC-15P OR CRS-2P (0.42 GAL/SY)) (AGGR GR 4 TY PE, PL, E, OR L (1 CY/135 SY) NO SAC REQUIREMENT). ITEM 3077, SP-B PG64-22 (5") MAY BE USED AT THE OPTION OF THE CONTRACTOR IN LIEU OF CEMENT TREAT, FLEX BASE, COVERED PRIME AND SURFACE TREATMENT. THIS WORK IS SUBSIDIARY TO THE ITEM 530, TURNOUTS (SURF TREAT).

MAILBOX SUMMARY (CONT.)

LOCATION			ITEM 530 6009 TURNOUTS (SURF TREAT) SY	ITEM 560 6003 MAILBOX INSTALL-M (TWG-POST) TY 1 EA	ITEM 560 6007 MAILBOX INSTALL-S (WC-POST) TY 3 EA	ITEM 560 6008 MAILBOX INSTALL-D (WC-POST) TY 3 EA
CSJ: 0118-02-036						
STA	0+91	LT	23		1	
STA	12+52	LT	67		2	
STA	15+37	LT	23		1	
STA	19+78	LT	23		1	
STA	29+45	LT	23		1	
STA	36+95	LT	23		1	
STA	39+08	LT	23		1	
STA	40+09	LT	23		1	
STA	41+90	LT	23		1	
STA	44+09	LT	23			1
STA	52+73	LT	23		1	
STA	55+74	LT	23		1	
STA	63+68	LT	20		1	
STA	65+30	LT	23		1	
STA	68+18	LT	23		1	
STA	69+34	LT	23		1	
STA	85+43	LT	23		1	
STA	90+24	LT	18		1	
STA	95+06	LT	23		1	
STA	96+79	LT	23			1
STA	108+55	LT	23		1	
STA	115+75	LT	49		2	
STA	118+27	LT	67		2	
STA	120+20	LT	23	1		
STA	121+35	LT	23		1	
STA	125+36	LT	23		1	
STA	127+85	LT	27			1
CSJ: 0118-02-036 TOTALS			**731**	**1**	**26**	**3**
PROJECT TOTALS			**1432**	**5**	**49**	**7**

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0118	02	036, ETC.	SH 21
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LFK	HOUSTON		13

CK:
DW:
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EROSION CONTROL SUMMARY (8)

STATION TO STATION	ITEM 164 6009 BROADCAST SEED (TEMP) (WARM) SY	ITEM 164 6011 BROADCAST SEED (TEMP) (COOL) SY	ITEM 164 6054 BOND FBR MTRX SEED (PERM)(RURAL)(SAND) SY	ITEM 168 6001 (9) VEGETATIVE WATERING MG	ITEM 314 6010 (10) EMULS ASPH (EROSN CONT) (SS-1) GAL	ITEM 506 6002 ROCK FILTER DAMS (INSTALL) (TY 2) LF	ITEM 506 6011 ROCK FILTER DAMS (REMOVE) LF	ITEM 506 6020 CONSTRUCTION EXITS (INSTALL) (TY 1) SY	ITEM 506 6024 CONSTRUCTION EXITS (REMOVE) SY	ITEM 506 6034 CONSTRUCTION PERIMETER FENCE LF
CSJ: 0118-01-024										
STA 35+90.00 TO STA 172+95.62	15179	15179	30357	1215	3036					
0118-01-024 TOTALS	**15179**	**15179**	**30357**	**1215**	**3036**	**0**	**0**	**0**	**0**	**0**
CSJ: 0118-01-022										
STA 172+95.62 TO STA 451+27.00	61848	61848	123696	4948	6185	936	936	125	125	120
0118-01-022 TOTALS	**61848**	**61848**	**123696**	**4948**	**6185**	**936**	**936**	**125**	**125**	**120**
CSJ: 0118-02-036										
STA 0+00.00 TO STA 134+00	29606	29606	59211	2369	2961	648	648	125	125	60
0118-02-036 TOTALS	**29606**	**29606**	**59211**	**2369**	**2961**	**648**	**648**	**125**	**125**	**60**
PROJECTS TOTALS	**106633**	**106633**	**213264**	**8532**	**12182**	**1584**	**1584**	**250**	**250**	**180**

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

(9) 2 APPLICATIONS AT 10 GAL/SY PER APPLICATION

(10) 1 APPLICATION AT 0.1 GAL/SY PER APPLICATION. MS-2 MAY BE USED FOR EMULSIFIED ASPHALT TREATMENT. EMULSIFIED ASPHALT TO BE APPLIED TO THE LIMITS OF 10' ON EACH SIDE OF EDGE OF PAVEMENT OR AS DIRECTED BY THE ENGINEER.

PAVEMENT MARKING SUMMARY

STATION TO STATION	LENGTH LF	ITEM 666 6035 REFL PAV MRK TY I (W)8"(SLD) (090MIL) LF	ITEM 666 6305 RE PM W/RET REQ TY I (W)6"(BRK) (090MIL) LF	ITEM 666 6306 RE PM W/RET REQ TY I (W)6"(BRK) (100MIL) LF	ITEM 666 6308 RE PM W/RET REQ TY I (W)6"(SLD) (090MIL) LF	ITEM 666 6343 REF PROF PAV MRK TY I (W)6"(SLD) (100MIL) LF	ITEM 666 6318 RE PM W/RET REQ TY I (Y)6"(BRK) (100MIL) LF	ITEM 666 6320 RE PM W/RET REQ TY I (Y)6"(SLD) (090MIL) LF	ITEM 666 6347 REF PROF PAV MRK TY I (Y)6"(SLD) (100MIL) LF	ITEM 668 6076 PREFAB PAV MRK TY C (W) (24") (SLD) LF	ITEM 672 6007 REFL PAV MRKR TY I-C EA	ITEM 672 6009 (11) REFL PAV MRKR TY II-A-A EA	ITEM 533 6002 RUMBLE STRIPS (CENTERLINE) LF
CSJ: 0118-01-024													
STA 35+90.00 TO STA 41+00.00	510	820	90					1020			8	60	410
STA 41+00.00 TO STA 172+95.62	13196				26134			26134		39		328	13196
0118-01-024 TOTALS	**13706**	**820**	**90**	**0**	**26134**	**0**	**0**	**27154**	**0**	**39**	**8**	**388**	**13606**
CSJ: 0118-01-022													
STA 172+95.62 TO STA 451+49.22	27854					55571	3640		349			350	27854
0118-01-022 TOTALS	**27854**	**0**	**0**	**0**	**0**	**55571**	**3640**	**0**	**349**	**0**	**0**	**350**	**27854**
CSJ: 0118-02-036													
STA 0+00 TO STA 134+00.00	13400					26287	1440		19949			322	13400
STA 134+00.00 TO STA 887+50.00	75350			2310		147840	4320		117327			1684	75350
0118-02-036 TOTALS	88750	**0**	**0**	**2310**	**0**	**174127**	**5760**	**0**	**137276**	**0**	**0**	**2006**	**88750**
PROJECT TOTALS	**130309**	**820**	**90**	**2310**	**26134**	**229698**	**9400**	**27154**	**137625**	**39**	**8**	**2744**	**130210**

(11) BASED ON 1 EVERY 40' FOR NO PASS ZONES AND 1 EVERY 80' FOR PASSING ZONES.

PAVEMENT MARKING SUMMARY (CONT.)

STATION TO STATION	LENGTH LF	ITEM 666 6171 REFL PAV MRK TY II (W) 6" (BRK) LF	ITEM 666 6174 REFL PAV MRK TY II (W) 6" (SLD) LF	ITEM 666 6178 REFL PAV MRK TY II (W) 8" (SLD) LF	ITEM 666 6208 REFL PAV MRK TY II (Y) 6" (BRK) LF	ITEM 666 6210 REFL PAV MRK TY II (Y) 6" (SLD) LF
CSJ: 0118-01-024						
STA 35+90.00 TO STA 41+00.00	510	120	1020			783
STA 41+00.00 TO STA 172+95.62	13196		26391		1400	20219
0118-01-024 TOTALS	**13706**	**120**	**27411**	**0**	**1400**	**21002**
CSJ: 0118-01-022						
STA 172+95.62 TO STA 451+49.22	27854		55707		2850	42692
0118-01-022 TOTALS	**27854**	**0**	**55707**	**0**	**2850**	**42692**
CSJ: 0118-02-036						
STA 0+00 TO STA 134+00.00	13400		26800	122	1460	18642
0118-02-036 TOTALS	**13400**	**0**	**26800**	**122**	**1460**	**18642**
PROJECT TOTALS	**54959**	**120**	**109918**	**122**	**5710**	**82336**

SMALL SIGN SUMMARY

STATION TO STATION	ITEM 644 6007 IN SM RD SN SUP&AM TY10BWG(1)SA(U) EA	ITEM 644 6033 IN SM RD SN SUP&AM TYS80(1)SA(U) EA	ITEM 644 6060 IN SM RD SN SUP&AM TYTWT(1)WS(P) EA	ITEM 644 6061 IN SM RD SN SUP&AM TYTWT(1)WS(T) EA	ITEM 644 6076 REMOVE SM RD SN SUP&AM EA
CSJ: 0118-01-024					
STA 35+90.00 TO STA 172+95.62	9	1	27	4	41
CSJ: 0118-01-024 TOTALS	**9**	**1**	**27**	**4**	**41**
CSJ: 0118-01-022					
STA 172+95.62 TO STA 451+27.00	6		19	1	26
CSJ: 0118-01-022 TOTALS	**6**	**0**	**19**	**1**	**26**
CSJ: 0118-02-036					
STA 0+00.00 TO STA 134+00.00	3		21	1	25
CSJ: 0118-02-036 TOTALS	**3**	**0**	**21**	**1**	**25**
PROJECT TOTALS	**18**	**1**	**67**	**6**	**92**

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QUANTITY SUMMARIES

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LFK	HOUSTON		14

CK:
DW:
CK:
DN:

ROADWAY CULVERT SUMMARY

STA	DESCRIPTION	ITEM 132 2019 EMBANKMENT (VEHICLE) (ORD COMP) (TY B) CY	ITEM 162 6002 BLOCK SODDING SY	ITEM 400 6005 CEM STABIL BKFL CY	ITEM 403 6001 TEMPORARY SPL SHORING SF	ITEM 432 6026 RIPRAP (STONE COMMON)(DRY) (18 IN) CY	ITEM 462 6045 CONC BOX CULV (3 FT X 2 FT) (EXTEND) LF	ITEM 462 6046 CONC BOX CULV (3 FT X 3 FT) (EXTEND) LF	ITEM 466 6192 WINGWALL (PW - 2) (HW=3 FT) EA	ITEM 466 6193 WINGWALL (PW - 2) (HW=4 FT) EA	ITEM 466 6194 WINGWALL (PW - 2) (HW=5 FT) EA	ITEM 480 6001 CLEAN EXIST CULVERTS EA	ITEM 658 6101 INSTL OM ASSM (OM-2Z) (WFLX)SRF)SRF EA
CSJ: 0118-01-022													
247+70	EXISTING 3'X3'X45'-9" SBC W/ SETB-CD LT & RT (LT) NO WORK (RT) NO WORK												2
257+12	EXISTING 3 - 4'X4'X57'-6" MBC W/ PW-2 LT & RT (LT) NO WORK (RT) NO WORK												2
294+58.50	EXISTING 3'X3'X43'-9" SBC W/ SETB-CD LT & RT (LT) NO WORK (RT) NO WORK												2
318+34	EXISTING 3 - 4'X4'X57'-9" MBC W/ PW-2 LT & RT (LT) NO WORK (RT) NO WORK												2
400+38	EXISTING 3 - 4'X4'X56'-9" MBC W/ PW-2 LT & RT (LT) NO WORK (RT) NO WORK												2
430+41.80	EXISTING 3 - 6'X6'X57'-9" MBC W/ PW-2 LT & RT (LT) NO WORK (RT) NO WORK												2
CSJ: 0118-01-022 TOTALS		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**
CSJ: 0118-02-036													
1+90	EXISTING 3'X3'X39'-6" SBC W/ SETB-CD LT & RT (LT) NO WORK (RT) REMOVE SETB-CD, EXTEND 10' W/ SCC- 3 & 4 (3 FT X 3 FT), ADD WINGWALL (PW-2)(HW=4 FT), ADD TEMP SPL SHORING, ADD CSB, ADD ROCK RIPRAP CLEAN CULVERT	69	22	2	96	7		10		1		1	2
34+50	EXISTING 3' X 2' X 39'-9" SBC W/ SETB-CD LT & RT (LT) NO WORK (RT) ADD ROCK RIPRAP CLEAN CULVERT	113	22			5						1	2
82+00	EXISTING 3' X 2' X 39'-9" SBC W/ SETB-CD LT & RT (LT) NO WORK (RT) NO WORK	34	22										2
91+50	EXISTING 3' X 2' X 39'-6" SBC W/ SETB-CD LT & RT (LT) NO WORK (RT) REMOVE SETB-CD, EXTEND 9' W/ SCC- 3 & 4 (3 FT X 2 FT), ADD PW-2(HW = 3 FT), ADD TEMP SPL SHORING CLEAN CULVERT	61	22		72		9		1			1	2
104+00	EXISTING 3' X 2' X 39'-6" SBC W/ SETB-CD LT & RT (LT) REMOVE SETB-CD, EXTEND 9' W/ SCC- 3 & 4 (3 FT X 2 FT), ADD WINGWALL (PW - 2)(HW = 5 FT), ADD TEMP SPL SHORING (RT) NO WORK CLEAN CULVERT	135	22		96		9				1	1	2
123+50	EXISTING 3' X 2' X 40' SBC W/ SETB-CD LT & RT (LT) NO WORK (RT) NO WORK CLEAN CULVERT	20										1	2
CSJ: 0118-02-036 TOTALS		**432**	**110**	**2**	**264**	**12**	**18**	**10**	**1**	**1**	**1**	**5**	**12**
PROJECT TOTALS		**432**	**110**	**2**	**264**	**12**	**18**	**10**	**1**	**1**	**1**	**5**	**24**

THERE IS NO HISTORICAL DATA OF OVERTOPPING EVENTS FOR ANY CULVERT LOCATION IN THIS PROJECT.
CULVERTS REQUIRING HYDRAULIC ANALYSIS WERE ANALYZED AT A 5, 10, AND 100 YEAR FREQUENCY.
DUE CONSIDERATION HAS BEEN GIVEN TO THE EFFECTS OF HEADWATER AND VELOCITIES WITH THESE STRUCTURES.
ADDITIONAL STUDIES NOT JUSTIFIED.

TRAFFIC CONTROL SUMMARY

STATION TO STATION	LENGTH	ITEM 662 6008 (12) WK ZN PAV MRK NON-REMOV (W)6"(SLD) LF	ITEM 662 6037 (12) WK ZN PAV MRK NON-REMOV (Y)6"(SLD) LF	ITEM 662 6109 (13) WK ZN PAV MRK SHT TERM (TAB)TY W EA	ITEM 662 6111 (13) WK ZN PAV MRK SHT TERM (TAB)TY Y-2 EA	ITEM 6001 6002 PORTABLE CHANGEABLE MESSAGE SIGN EA
CSJ: 0118-01-024				(ONE APPLICATION FOR 0118-01-024)		
STA 35+90.00 TO STA 172+95.62	13706	27411	27411	27	1368	
0118-01-024 TOTALS	**13706**	**27411**	**27411**	**27**	**1368**	**0**
CSJ: 0118-01-022						
STA 172+95.62 TO STA 451+27.00	27831	111326	111326		5568	1
0118-01-022 TOTALS	**27831**	**111326**	**111326**	**0**	**5568**	**1**
CSJ: 0118-02-036						
STA 0+00.00 TO STA 134+00.00	13400	53290	53290		2668	1
STA 134+00.00 TO STA 887+50.00	75350			7544	15088	
0118-02-036 TOTALS	**88750**	**53290**	**53290**	**7544**	**17756**	**1**
PROJECTS TOTALS	**130287**	**192027**	**192027**	**7571**	**24692**	**2**

(12) 2 APPLICATIONS (13) 3 APPLICATIONS

WORK ZONE APPLICATIONS
0118-01-024: 1 APPLICATION OF TABS FOR SEAL COAT
1 APPLICATION OF NON REMOV FOR SEAL COAT
1 APPLICATION OF TAPE FOR SURFACE
0118-01-022/02-036: 1 APPLICATION OF TAPE FOR LEVEL UP
1 APPLICATION OF NON REMOV FOR LEVEL UP
1 APPLICATION OF TABS FOR SEAL COAT SURFACE

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
4/28/2023

LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

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0118	02	036, ETC.	SH 21
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LFK	HOUSTON		15

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DATE: $DATE$
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DRIVEWAY SUMMARY

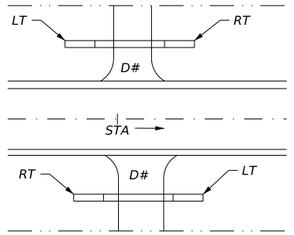
DRWY ID	STA	O/S	EXIST MATERIAL	R C S	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4"	DRIVEWAYS (ACP) 6"
														10 GAL/SY/2 APPS						440 LBS/SY	660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-01-024																					
D1 - D94																					
CSJ: 0118-01-022																					
D95	175+66	LT	DIRT	R	11	36	15	EXISTING 18" X 42' RCP NO STRUCTURE WORK	20											56	
D96	178+47	RT	DIRT	R	16	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	27											77	
D97	178+94	LT	DIRT	R	13	36	15	EXISTING 24" X 34' RCP NO STRUCTURE WORK	29											64	
D98	179+99	RT	DIRT	R	28	36	15	EXISTING 18" X 42' RCP NO STRUCTURE WORK	29											126	
D99	181+43	RT	DIRT	R	16	36	15	EXISTING 18" X 42' RCP NO STRUCTURE WORK	30											76	
D100	181+67	LT	DIRT	R	12	36	15	EXISTING 18" X 34' RCP NO STRUCTURE WORK	27											61	
D101	182+79	RT	DIRT	R	14	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	32											70	
D102	184+14	LT	DIRT	R	14	36	15	EXISTING 18" X 30' RCP NO STRUCTURE WORK	30											71	
D103	190+11	LT	DIRT	R	11	36	15	EXISTING 15" X 22' RCP REMOVE EXISTING AND REPLACE WITH 18" X 24' RCP	31	31		1	28	0.6		24	2	1		59	
D104	196+86	LT	GRAVEL/DIRT	R	12.5	36	15	NO STRUCTURE												68	
D105	198+27	LT	GRAVEL/DIRT	R	11	36	15	NO STRUCTURE												69	
D106	199+01	LT	CONCRETE	R	10	36	15	EXISTING 15" X 30' RCP REMOVE EXISTING AND REPLACE WITH 18" X 30" RCP	35	35		1	28	0.6	5	30	2	1	54		
D107	206+25	RT	DIRT	C	10	36	15	EXISTING 18" X 34' RCP NO STRUCTURE WORK	32											54	
CSJ: 0118-01-022 SHEET TOTALS											**0**	**2**	**56**	**1.2**	**5**	**54**	**4**	**2**	**54**	**851**	**0**

R = Residential C = Commercial S = Street

1) PROVIDE 12" DEEP TOEWALL FOR ALL SETS.

2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
30"	16



DRIVEWAYS

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LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 6 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		16

CK:
DW:
CK:
DN:

DRIVEWAY SUMMARY (CONT.)

DRWY ID	STA	O/S	EXIST MATERIAL	R C S	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING 10 GAL/SY/2 APPS	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4" 440 LBS/SY	DRIVEWAYS (ACP) 6" 660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-01-022																					
D108	209+37	RT	GRAVEL/DIRT	R	12.8	36	15R/20L	NO STRUCTURE												121	
D109	210+01	LT	DIRT	R	16	36	15	EXISTING 18" X 34' W/ SET FROM GOOGLE EARTH. NO SRUCTURE WORK	30											75	
D110	215+79	LT	DIRT	R	11.2	36	15	EXISTING 18" X 22' RCP NO STRUCTURE WORK	37											60	
D111	220+46	RT	DIRT	R	9	36	15	NO STRUCTURE												44	
D112	220+66	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 18" X 52' RCP NO STUCTURE WORK	36											62	
D113	223+16	RT	GRAVEL	R	13	36	15	NO STRUCTURE												65	
D114	224+58	RT	GRAVEL	R	9	36	15	EXISTING 15" X 26' REMOVE EXISTING AND REPLACE WITH 18" X 26' RCP	40	40		1	28	0.6		26	2	1		51	
D115	224+88	LT	GRAVEL	R	12	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	41											53	
D116	225+58	LT	GRAVEL	R	42	36	15	NO STRUCTURE												60	
D117	239+52	LT	GRAVEL	S	17	36	30	NO STRUCTURE													116
D118	242+82	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXISTING AND REPLACE WITH 18" X 22' RCP	35			1	28	0.6		22	2	1		52	
D119	245+18	LT	GRAVEL/DIRT	R	9	36	15	NO STRUCTURE	22											48	
D120	248+54	RT	GRAVEL/DIRT	R	15	36	15	NO STRUCTURE												82	
D121	249+04	RT	GRAVEL/DIRT	R	10	36	15	NO STRUCTURE												59	
D122	249+64	LT	GRAVEL/DIRT	R	16	36	15	NO STRUCTURE												78	
CSJ: 0118-01-022 SHEET TOTALS											**0**	**2**	**56**	**1.2**	**0**	**48**	**4**	**2**	**0**	**910**	**116**

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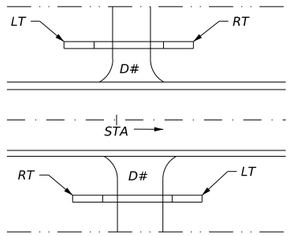
2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
30"	16



DRIVEWAYS

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LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 7 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		17

CK:
DW:
CK:
DN:

DRIVEWAY SUMMARY (CONT.)

DRWY ID	STA	O/S	EXIST MATERIAL	R C S	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING 10 GAL/SY/2 APPS	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4" 440 LBS/SY	DRIVEWAYS (ACP) 6" 660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-01-022																					
D123	252+90	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 18" X 30' RCP NO STRUCTURE WORK	31											62	
D124	259+26	LT	CONCRETE	C	16	36	15	EXISTING 2-36" X 34' RCP NO STRUCTURE WORK	32		105								105	105	
D125	265+81	LT	DIRT	R	9	36	15	EXISTING 2- 24" X 30' RCP NO STRUCTURE WORK	30											50	
D126	269+21	LT	DIRT	R	10	36	15	EXISTING 2-15" X 48' RCP REMOVE EXIST AND REPLACE WITH 2-18" X 48' RCP	36	36		1	28	0.6		96	4	2		83	
D127	269+67	RT	GRAVEL	R	13	36	15	NO STRUCTURE												68	
D128	288+90	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 40' RCP REMOVE EXIST AND REPLACE WITH 18" X 40' RCP	28	28		1	28	0.6		40	2	1		54	
D129	289+97	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	30	30		1	28	0.6		22	2	1		49	
D130	291+03	LT	GRAVEL/DIRT	R	11	36	15	EXISTING 15" X 50' RCP REMOVE EXIST AND REPLACE WITH 18" X 50' RCP	30	30		1	28	0.6		50	2	1		61	
D131	301+82	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 18" X 39' RCP NO STRUCTURE WORK	35											48	
D132	309+08	RT	GRAVEL/DIRT	R	12	36	15	EXISTING 18" X 28' RCP NO STRUCTURE WORK	35											66	
D133	310+65	LT	GRAVEL/DIRT	R	16	36	15	EXISTING 18" X 50' RCP NO STRUCTURE WORK	35											86	
D134	331+87	RT	GRAVEL/DIRT	R	13	36	15	EXISTING 2-24" X 32' RCP NO STRUCTURE WORK	34											66	
D135	342+78	RT	GRAVEL	R	10	36	15	EXISTING 2-15" X 38' RCP REMOVE EXIST AND REPLACE WITH 2-18" X 44' RCP	34	34		1	56	1.2		88	4	2		78	
D136	346+59	LT	GRAVEL/CONC	R	16	36	15	EXISTING 3-24" X 50' RCP NO STRUCTURE WORK	36											37	
D137	351+03	LT	DIRT	R	10	36	15	EXISTING 2-18" X 30' RCP NO STRUCTURE WORK	34											54	
CSJ: 0118-01-022 SHEET TOTALS											**105**	**5**	**168**	**3.6**	**0**	**296**	**14**	**7**	**105**	**967**	**0**

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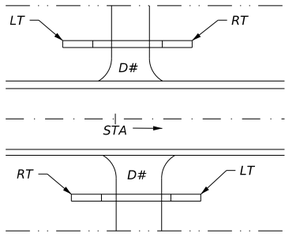
1) PROVIDE 12" DEEP TOEWALL FOR ALL SETS.

2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
30"	16



DRIVEWAYS

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LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 8 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		18

CK:
DW:
CK:
DN:

DRIVEWAY SUMMARY (CONT.)

DRWY ID	STA	O/S	EXIST MATERIAL	R C S	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING 10 GAL/SY/2 APPS	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4" 440 LBS/SY	DRIVEWAYS (ACP) 6" 660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-01-022																					
D138	354+41	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 2-18" X 38' RCP NO STRUCTURE WORK	33											57	
D139	355+12	RT	GRAVEL/DIRT	R	12	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	40											72	
D140	355+85	LT	GRAVEL/DIRT	R	13	36	15	EXISTING 2-18" X 42' RCP NO STRUCTURE WORK	32											66	
D141	356+50	RT	GRAVEL	R	12	36	15	EXISTING 15" X 30' RCP REMOVE EXIST AND REPLACE WITH 18" X 30' RCP	24	24		1	28	0.6		30	2	1		60	
D142	357+63	RT	GRAVEL/DIRT	R	18	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	34											82	
D143	357+68	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 3-18" X 26' RCP NO STRUCTURE WORK	32											59	
D144	358+57	RT	GRAVEL	C	28	36	30	EXISTING 18" X 55' RCP NO STRUCTURE WORK	36											168	
D145	363+43	LT	CONCRETE	R	12	36	15	EXISTING 3-18" X 34' RCP NO STRUCTURE WORK	34											77	
D146	367+17	LT	GRAVEL/DIRT	S	16	36	20	NO STRUCTURE													95
D147	370+92	LT	ASPHALT	R	14	36	15	EXISTING 2-18" X 34' RCP NO STRUCTURE WORK	35											94	
D148	371+70	RT	GRAVEL	R	13	36	15	EXISTING 15" X 32' RCP REMOVE EXIST AND REPLACE WITH 18" X 32' RCP	32	32		1	28	0.6		32	2	1		80	
D149	377+71	RT	ASPHALT	R	20	36	30	NO STRUCTURE												124	
D150	378+02	LT	GRAVEL/DIRT	R	11	36	15	EXISTING 15" X 30' RCP REMOVE EXIST AND REPLACE WITH 18" X 30' RCP	36	36		1	28	0.6		30	2	1		57	
D151	380+06	LT	GRAVEL/DIRT	R	12	36	15	EXISTING 15" X 32' RCP REMOVE EXIST AND REPLACE WITH 18" X 32' RCP	32	32		1	28	0.6		32	2	1		56	
D152	382+02	LT	GRAVEL	R	11	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	35	35										59	
CSJ: 0118-01-022 SHEET TOTALS											**0**	**4**	**112**	**2.4**	**0**	**124**	**8**	**4**	**0**	**1111**	**95**

R = Residential C = Commercial S = Street

1) PROVIDE 12" DEEP TOEWALL FOR ALL SETS.

2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
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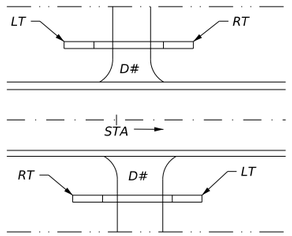
30"	16



DRIVEWAYS

LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 9 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		19

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DRIVEWAY SUMMARY (CONT.)

DRWY ID	STA	O/S	EXIST MATERIAL	R C S	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING 10 GAL/SY/2 APPS	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4" 440 LBS/SY	DRIVEWAYS (ACP) 6" 660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-01-022																					
D153	386+21	RT	GRAVEL/DIRT	R	10	36	20	NO STRUCTURE												57	
D154	397+52	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 2-24" X 34' RCP NO STRUCTURE WORK	34											60	
D155	397+62	RT	GRAVEL	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	30	30		1	28	0.6		22	2	1		49	
D156	403+41	LT	GRAVEL/DIRT	R	10	36	15	NO STRUCTURE												58	
D157	407+38	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 20' RCP REMOVE EXIST AND REPLACE WITH 18" X 20' RCP	38	38		1	28	0.6		20	2	1		49	
D158	408+24	LT	GRAVEL/DIRT	R	14	36	20	NO STRUCTURE												59	
D159	409+72	RT	GRAVEL/DIRT	R	11	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	34											56	
D160	416+90	RT	DIRT	R	12	36	15	NO STRUCTURE												59	
D161	417+27	RT	DIRT	R	10	36	15	NO STRUCTURE												52	
D162	417+63	LT	GRAVEL/DIRT	R	13	36	20	NO STRUCTURE												71	
D163	425+02	LT	DIRT	R	18	36	15L/30R	NO STRUCTURE												121	
D164	425+64	RT	DIRT	R	10	36	15	NO STRUCTURE												57	
D165	434+25	LT	DIRT	R	10	36	15	EXISTING 18" X 38' RCP NO STRUCTURE WORK	32											60	
D166	440+96	LT	GRAVEL	R	10	36	15	EXISTING 24" X 32' CMP NO STRUCTURE WORK	35											49	
D167	440+98	RT	GRAVEL/DIRT	R	13	36	15	EXISTING 18" X 32' RCP EXTEND PIPE 4FT LT	34	34		1	28	0.6		4	1			58	
CSJ: 0118-01-022 SHEET TOTALS											**0**	**3**	**84**	**1.8**	**0**	**46**	**5**	**2**	**0**	**915**	**0**

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1) PROVIDE 12" DEEP TOEWALL FOR ALL SETS.

2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
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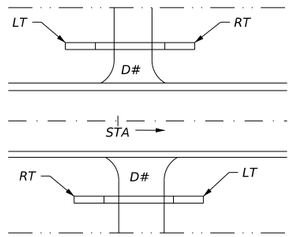

DRIVEWAYS

LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 10 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		20

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DRIVEWAY SUMMARY (CONT.)

DRWY ID	STA	O/S	EXIST MATERIAL	R C S	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING 10 GAL/SY/2 APPS	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4" 440 LBS/SY	DRIVEWAYS (ACP) 6" 660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-01-022																					
D168	442+48	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 18" X 30 RCP NO STRUCTURE WORK	33											48	
D169	447+80	LT	GRAVEL/DIRT	R	11	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	29	29		1	28	0.6		26	2	1		55	
CSJ: 0118-01-022 SHEET TOTALS											**0**	**1**	**28**	**0.6**	**0**	**26**	**2**	**1**	**0**	**108**	**0**
CSJ: 0118-01-022 TOTALS											**105**	**17**	**504**	**10.8**	**5**	**594**	**37**	**18**	**159**	**4862**	**211**

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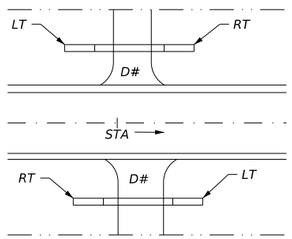
2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
30"	16



DRIVEWAYS

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LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 11 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		21

CK:
DW:
CK:
DN:

DRIVEWAY SUMMARY (CONT.)

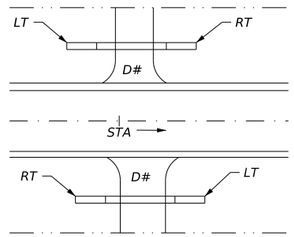
DRWY ID	STA	O/S	EXIST MATERIAL	R C S	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING 10 GAL/SY/2 APPS	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4" 440 LBS/SY	DRIVEWAYS (ACP) 6" 660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-02-036																					
D170	0+02	LT	GRAVEL	S	18	36	30	NO STRUCTURE													116
D171	0+43	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	36	36		1	28	0.6		26	2	1		61	
D172	3+19	RT	GRAVEL	R	10	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	32											68	
D173	11+90	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 14' RCP REMOVE EXIST AND REPLACE WITH 18" X 16' RCP	30	30		1	28	0.6		16	2	1		39	
D174	12+38	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 30' RCP REMOVE EXIST AND REPLACE WITH 18" X 30' RCP	30	30		1	28	0.6		30	2	1		47	
D175	15+35	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 18" X 32' RCP NO STRUCTURE WORK	29											46	
D176	16+50	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	30	30		1	28	0.6		26	2	1		47	
D177	20+27	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 2-18" X 32' RCP NO STRUCTURE WORK	30											51	
D178	28+96	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 24" X 34' RCP NO STRUCTURE WORK	27											42	
D179	29+23	RT	GRAVEL/DIRT	R	12	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	28	28		1	28	0.6		26	2	1		61	
D180	29+90	RT	GRAVEL/DIRT	R	13	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 28' RCP	27	27		1	28	0.6		28	2	1		64	
D181	32+03	RT	GRAVEL	R	12	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	30	30		1	28	0.6		26	2	1		76	
D182	33+58	RT	GRAVEL	C	27	36	20	EXISTING 18" X 54' RCP NO STRUCTURE WORK	34											127	
D183	35+20	LT	GRAVEL/DIRT	C	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	34	34		1	28	0.6		22	2	1		46	
D184	37+45	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	29	29		1	28	0.6		22	2	1		44	
CSJ: 0118-02-036 SHEET TOTALS											**0**	**9**	**252**	**5.4**	**0**	**222**	**18**	**9**	**0**	**819**	**116**

R = Residential C = Commercial S = Street

1) PROVIDE 12" DEEP TOEWALL FOR ALL SETS.

2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
30"	16



DRIVEWAYS

LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 12 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		22

DATE: 11/2/2023 1:45:50 PM
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CK:
DW:
CK:
DN:

DRIVEWAY SUMMARY (CONT.)

DRWY ID	STA	O/S	EXIST MATERIAL	R C S	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING 10 GAL/SY/2 APPS	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4" 440 LBS/SY	DRIVEWAYS (ACP) 6" 660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-02-036																					
D185	39+57	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	28	28		1	28	0.6		22	2	1		51	
D186	40+60	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	29	29		1	28	0.6		26	2	1		56	
D187	42+47	RT	GRAVEL/DIRT	R	24	36	15	NO STRUCTURE												131	
D188	42+39	LT	GRAVEL/DIRT	R	20	36	15	NO STRUCTURE												91	
D189	43+07	LT	GRAVEL/DIRT	R	20	36	15	NO STRUCTURE												91	
D190	43+56	LT	GRAVEL/DIRT	R	20	36	15	NO STRUCTURE												91	
D191	48+00	RT	GRAVEL/DIRT	R	14	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	28	28		1	28	0.6		26	2	1		69	
D192	48+49	LT	GRAVEL/DIRT	R	16	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	26	26		1	28	0.6		26	2	1		82	
D193	52+25	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 34' RCP REMOVE EXIST AND REPLACE WITH 18" X 34' RCP	32	32		1	28	0.6		34	2	1		50	
D194	53+24	LT	GRAVEL	R	12	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	32	32		1	28	0.6		26	2	1		58	
D195	54+87	LT	GRAVEL	S	22	36	30	NO STRUCTURE													140
D196	56+24	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 18" X 30' RCP NO STRUCTURE WORK	29											48	
D197	56+52	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 18" X 46' RCP NO STRUCTURE WORK	33											49	
D198	60+40	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	32	32		1	28	0.6		22	2	1		49	
D199	63+18	LT	GRAVEL	R	21	36	15	EXISTING 18" X 38' RCP NO STRUCTURE WORK	27											101	
CSJ: 0118-02-036 SHEET TOTALS											**0**	**7**	**196**	**4.2**	**0**	**182**	**14**	**7**	**0**	**1017**	**140**

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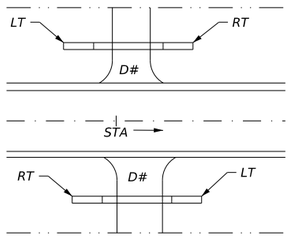
1) PROVIDE 12" DEEP TOEWALL FOR ALL SETS.

2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
30"	16



DRIVEWAYS

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LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 13 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		23

CK:
DW:
CK:
DW:

DRIVEWAY SUMMARY (CONT.)

DRWY ID	STA	O/S	EXIST MATERIAL	RCS	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING 10 GAL/SY/2 APPS	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4" 440 LBS/SY	DRIVEWAYS (ACP) 6" 660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-02-036																					
D200	64+01	LT	GRAVEL	R	16	36	15	EXISTING 18" X 38' RCP NO STRUCTURE WORK	26											77	
D201	64+96	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	27											59	
D202	67+47	LT	GRAVEL/DIRT	R	49	36	15	NO STRUCTURE												209	
D203	68+68	LT	DIRT	R	10	36	15	NO STRUCTURE												49	
D204	69+28	RT	ASPHALT/CONC	R	10	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	34											68	
D205	73+52	LT	GRAVEL	R	11	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	30	30		1	28	0.6		22	2	1		55	
D206	73+91	RT	GRAVEL	R	22	36	30	EXISTING 15' X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	32	32		1	28	0.6		22	2	1		67	
D207	80+31	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	29	29		1	28	0.6		26	2	1		47	
D208	84+41	RT	GRAVEL	R	12	36	15	EXISTING 15" X 34' RCP REMOVE EXIST AND REPLACE WITH 18" X 34' RCP	29	29		1	28	0.6		34	2	1		59	
D209	85+24	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	29	29		1	28	0.6		26	2	1		52	
D210	87+41	RT	GRAVEL	R	12	36	15	NO STRUCTURE												59	
D211	89+70	LT	GRAVEL	R	10	36	20L/15R	NO STRUCTURE												56	
D212	90+45	LT	DIRT	R	10	36	15	NO STRUCTURE												47	
D213	90+47	RT	GRAVEL	R	12	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	28	28		1	28	0.6		26	2	1		59	
D214	90+93	RT	ASPHALT	R	10	36	15	NO STRUCTURE												51	
CSJ: 0118-02-036 SHEET TOTALS											**0**	**6**	**168**	**3.6**	**0**	**156**	**12**	**6**	**0**	**1014**	**0**

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1) PROVIDE 12" DEEP TOEWALL FOR ALL SETS.

2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
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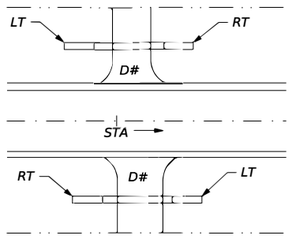

DRIVEWAYS

LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 14 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		24

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DRIVEWAY SUMMARY (CONT.)

DRWY ID	STA	O/S	EXIST MATERIAL	RCS	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
									EXIST	PROP	REMOVING CONC (PAV)	SPEC EXCAV WORK (HYD EXCAVATOR)	BLOCK SODDING	VEGETATIVE WATERING 10 GAL/SY/2 APPS	CUT & RESTORE CONC PAVING	RC PIPE (CL III) (18 IN)	SET (TY II) (18 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP) 4" 440 LBS/SY	DRIVEWAYS (ACP) 6" 660 LBS/SY
									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-02-036																					
D215	93+53	LT	DIRT	R	10	36	15	NO STRUCTURE												49	
D216	94+55	LT	DIRT	R	10	36	15	NO STRUCTURE												50	
D217	95+00	RT	GRAVEL/DIRT	R	12	36	15	EXISTING 15' X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 30' RCP	27	27		1	28	0.6		30	2	1		56	
D218	95+70	LT	DIRT	R	13	36	15	NO STRUCTURE												65	
D219	97+28	LT	DIRT	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	25	25		1	28	0.6		22	2	1		43	
D220	98+17	RT	ASPHALT	S	18	36	50R/30L	NO STRUCTURE													134
D221	98+98	LT	GRAVEL	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	23	23		1	28	0.6		22	2	1		38	
D222	106+36	LT	DIRT	C	11	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	32	32		1	28	0.6		26	2	1		57	
D223	108+25	RT	GRAVEL/DIRT	R	13	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	28	28		1	28	0.6		26	2	1		62	
D224	113+31	LT	DIRT	R	13	36	15	NO STRUCTURE												61	
D225	114+47	LT	GRAVEL/DIRT	R	10	36	15	NO STRUCTURE												53	
D226	114+96	LT	GRAVEL/DIRT	R	10	36	15L/40R	NO STRUCTURE												81	
D227	115+24	RT	GRAVEL/DIRT	R	10	36	15	NO STRUCTURE												43	
D228	116+66	LT	GRAVEL/DIRT	R	20	36	15	NO STRUCTURE												102	
D229	118+01	RT	GRAVEL/DIRT	R	10	36	15	NO STRUCTURE												50	
CSJ: 0118-02-036 SHEET TOTALS											**0**	**5**	**140**	**3**	**0**	**126**	**10**	**5**	**0**	**810**	**134**

R = Residential C = Commercial S = Street

1) PROVIDE 12" DEEP TOEWALL FOR ALL SETS.

2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
15"	10
18"	11
24"	13
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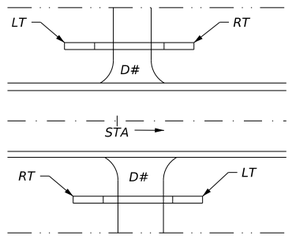

DRIVEWAYS

LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 15 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		25

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DW:
CK:
DN:

DRIVEWAY SUMMARY (CONT.)

DRWY ID	STA	O/S	EXIST MATERIAL	R C S	AVG WIDTH	LENGTH	RADIUS	DESCRIPTION OF WORK	OFFSET FROM CL		ITEM 104 6001	ITEM 158 6003	ITEM 162 6002 (2)	ITEM 168 6001	ITEM 400 6007	ITEM 464 6003	ITEM 467 6363 (1)	ITEM 496 6016	ITEM 530 6004	ITEM 530 6005	ITEM 530 6005
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									FT	FT	SY	HR	SY	MG	SY	LF	EA	EA	SY	SY	SY
CSJ: 0118-02-036																					
D230	120+15	RT	GRAVEL/DIRT	R	12	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	28											73	
D231	120+60	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	28	28		1	28	0.6		22	2	1		45	
D232	120+70	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 34' RCP REMOVE EXIST AND REPLACE WITH 18" X 34' RCP	25	25		1	28	0.6		34	2	1		54	
D233	122+43	LT	GRAVEL/DIRT	R	11	36	15	NO STRUCTURE												68	
D234	122+60	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 22' RCP	32	32		1	28	0.6		22	2	1		55	
D235	125+48	RT	GRAVEL/DIRT	R	11	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	30											52	
D236	127+06	RT	GRAVEL/DIRT	R	10	36	15	EXISTING 15" X 26' RCP REMOVE EXIST AND REPLACE WITH 18" X 26' RCP	30	30		1	28	0.6		26	2	1		53	
D237	127+30	LT	GRAVEL/DIRT	R	10	36	15	EXISTING 18" X 26' RCP NO STRUCTURE WORK	28											53	
D238	129+05	RT	GRAVEL/DIRT	R	12	36	15	EXISTING 15" X 22' RCP REMOVE EXIST AND REPLACE WITH 18" X 24' RCP	28	28		1	28	0.6		24	2	1		59	
D239	132+88	LT	GRAVEL/DIRT	R	10	36	15	NO STRUCTURE												103	
CSJ: 0118-02-036 SHEET TOTALS											**0**	**5**	**140**	**3**	**0**	**128**	**10**	**5**	**0**	**615**	**0**
CSJ 0118-02-022 TOTALS											**105**	**17**	**504**	**10.8**	**5**	**594**	**37**	**18**	**159**	**4862**	**211**
CSJ: 0118-02-036 TOTALS											**0**	**32**	**896**	**19.2**	**0**	**814**	**64**	**32**	**0**	**4275**	**390**
PROJECT TOTALS											**105**	**49**	**1400**	**30**	**5**	**1408**	**101**	**50**	**159**	**9137**	**601**

R = Residential C = Commercial S = Street

1) PROVIDE 12" DEEP TOEWALL FOR ALL SETS.

2)

REQUIRED BLOCK SOD AT EACH SET END	
CULVERT SIZE	SY
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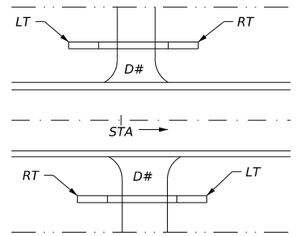
24"	13
30"	16



DRIVEWAYS

LOCHNER

Texas Department of Transportation

QUANTITY SUMMARIES

SHEET 16 OF 16

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		26

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

SUMMARY OF SMALL SIGNS

ENV LAYOUT SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX) POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION PREFABRICATED	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
							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"		TY N TY S
1	S1	R1-1	STOP	36 X 36			TWT	1	WS	T		
		R1-3P	ALL WAY	18 X 6								
		M1-6T	(ROUTE *) TEXAS (SH 21)	24 X 24								
1	S2						TWT	1	WS	P		
		M6-1	<ARROW - HORIZ. STRGHT><AUXILLARY SIGN>	21 X 15								
		M1-6T	(ROUTE *) TEXAS (SH 21)	24 X 24								
1	S93						TWT	1	WS	P		
		M6-1	<ARROW - HORIZ. STRGHT><AUXILLARY SIGN>	21 X 15								
1	S3	R1-1	STOP	36 X 36			TWT	1	WS	T		
		R1-3P	ALL WAY	18 X 6								
		M3-2	EAST <AUXILIARY SIGN>	24 X 24								
		M1-6T	(ROUTE *) TEXAS (SH 21)	21 X 15								
1	S4	M6-3	<ARROW - HORIZ. STRGHT><AUXILLARY SIGN>	21 X 15			10BWG	1	SA	U		
		M1-6L	LOOP (NUMBER)(304)	24 X 24								
		M6-4	<ARROW - DUAL LEFT & RIGHT><AUX. SIGN>	21 X 15								
		D9-2	HOSPITAL	24 X 24								
1	S5						TWT	1	WS	P		
		M6-1B	<ARROW - LEFT><AUX. SIGN>	21 X 15								
		M1-6T	EAST <AUXILIARY SIGN>	24 X 24								
1	S6						TWT	1	WS	P		
		M3-2	(ROUTE *) TEXAS (SH 21)	24 X 12								
1	S7	R2-1	SPEED LIMIT (SPEED) (55 MPH)	30 X 36			TWT	1	WS	P		
1	S8	D7-6aTL	HISTORICAL MARKER (NUMBER) (1539)(XLT)	48 X 48			10BWG	1	SA	U		
1	S9	W3-1	SYMBOL - STOP AHEAD	36 X 36			TWT	1	WS	T		
		M2-1	JCT <AUXILIARY SIGN>	21 X 15								
1	S11						TWT	1	WS	P		
		M1-6L	LOOP (NUMBER)(304) (304)	24 X 24								

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

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Texas Department of Transportation

Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

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FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	0118	02	036, ETC.	SH 21
4-16	DIST	COUNTY		SHEET NO.
8-16	LFK	HOUSTON		27

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SUMMARY OF SMALL SIGNS

ENV LAYOUT SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX) POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION PREFABRICATED	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
							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"		TY N TY S
1	S12	D2-2	*(ALTO 32)* *(NACOGDOCHES 58)*	84 X 24			10BWG	1	SA	T		
2	S13	R2-1	*SPEED LIMIT (SPEED)* *(55 MPH)*	30 X 36			TWT	1	WS	P		
2	S14	R2-1	*SPEED LIMIT (SPEED)* *(60 MPH)*	30 X 36			TWT	1	WS	P		
2	S15	I-2aT	*CITY LIMIT SIGN* *(CROCKETT)*	54 X 24			TWT	1	WS	T		
			CITY LIMIT SIGN *(CROCKETT)*									
2	S16	R1-1	*STOP*	36 X 36			TWT	1	WS	P		
3	S18	D20-1TL	*COUNTY ROAD (NUMBER)* *(1500XLT)*	24 X 24			TWT	1	WS	P		
3	S20	R1-1	*STOP*	36 X 36			TWT	1	WS	P		
3	S21	R1-1	*STOP*	36 X 36			TWT	1	WS	P		
3	S24	D7-7aTL	*HISTORICAL MARKER (NUMBER)* *(1539IXLT)*	48 X 48			10BWG	1	SA	U		
3	S24	D7-7aTR	*HISTORICAL MARKER (NUMBER)* *(1539IXRT)*	48 X 48			10BWG	1	SA	U		

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

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Traffic Operations Division Standard

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4-16	DIST	COUNTY		SHEET NO.
8-16	LFK	HOUSTON		28

SUMMARY OF SMALL SIGNS

ENV LAYOUT SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX) POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION PREFABRICATED	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
							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"		TY N TY S
3	S25	R2-1	*SPEED LIMIT (SPEED)*	30 X 36			TWT	1	WS	P		
			(70 MPH)									
3	S26	R2-1	*SPEED LIMIT (SPEED)*	30 X 36			TWT	1	WS	P		
			(60 MPH)									
3	S27	D20-1TR	*COUNTY ROAD (NUMBER)*	24 X 24			TWT	1	WS	P		
			(1500)(RT)									
4	S28	W3-5	*(SPEED) MPH <SPEED LIMIT SLOWS>*	30 X 36			TWT	1	WS	P		
			(60 MPH)									
		M1-6T	*(ROUTE *) TEXAS*	24 X 24								
			(SH 21)									
		D10-7aT	*<3 DIGIT VERTICAL NUMBER>*	3 X 10								
4	S29		*-722*				TWT	1	WS	P		
		M1-6T	*(ROUTE *) TEXAS*	24 X 24								
			(SH 21)									
		D10-7aT	*<3 DIGIT VERTICAL NUMBER>*	3 X 10								
			-722									
5	S30	I-3	*(CEDAR CREEK)*	36 X 18			TWT	1	WS	T		
5	S31	I-3	*(CEDAR CREEK)*	36 X 18			TWT	1	WS	T		
5	S32	W11-10L	*SYMBOL - TRUCK CROSSING (LT)*	36 X 36			TWT	1	WS	P		
5	S33	D7-6aTR	*HISTORICAL MARKER (NUMBER)*	48 X 48			10BWG	1	SA	U		
			(1539)(RT)									
		M2-1	*JCT <AUXILIARY SIGN>*	21 X 15								
6	S34						TWT	1	WS	P		
		M1-6F	*<FM SHEILD> FARM ROAD (ROUTE *)*	24 X 24								
			(FM 3187)									
6	S35	D7-6aTL	*HISTORICAL MARKER (NUMBER)*	48 X 48			10BWG	1	SA	U		
			(8809.7039)(LT)									

ALUMINUM SIGN BLANKS THICKNESS	
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7.5 to 15	0.100"
Greater than 15	0.125"

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8-16		LFK	HOUSTON		29

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SUMMARY OF SMALL SIGNS

ENV LAYOUT SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX) POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION PREFABRICATED	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
							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"		TY N TY S
6	S36	R2-1	SPEED LIMIT (SPEED)	30 X 36			TWT	1	WS	P		
			(70 MPH)									
6	S37	W11-10R	SYMBOL - TRUCK CROSSING (RT)	36 X 36			TWT	1	WS	P		
		M3-4	WEST <AUXILLARY SIGN>	24 X 12								
6	S38						TWT	1	WS	P		
		M1-6T	(ROUTE *) TEXAS (SH 21)	24 X 24								
		M3-3	SOUTH <AUXILLARY SIGN>									
		M1-6F	<FM SHEILD> FARM ROAD (ROUTE *)	24 X 24								
6	S39		(FM 3187)				TWT	1	WS	P		
		M6-1	<ARROW - HORIZ. STRGHT><AUXILLARY SIGN>	21 X 15								
6	S40	W1-7T	<BI-DIRECTIONAL LRG ARROW w/CHEVRONS>	96 X 36			S80	1	SA	U	WC	
		M1-6T	(ROUTE *) TEXAS (SH 21)	24 X 24								
		M6-4	<ARROW - DUAL LEFT & RIGHT><AUX. SIGN>	21 X 15								
6	S41	M3-3	SOUTH <AUXILLARY SIGN>	24 X 12			10BWG	1	SA	U		
		M1-6F	<FM SHEILD> FARM ROAD (ROUTE *)(FM 3187)	24 X 24								
		M6-1	<ARROW - HORIZ. STRGHT><AUXILLARY SIGN>	21 X 15								
6	S42	R1-1	STOP	36 X 36			10BWG	1	SA	P		
		W4-4P	CROSS TRAFFIC DOES NOT STOP	24 X 12								
		M3-2	EAST <AUXILLARY SIGN>	24 X 12								
6	S43						TWT	1	WS	P		
		M1-6T	(ROUTE *) TEXAS (SH 21)	24 X 24								
7	S44	R2-1	SPEED LIMIT (SPEED)	30 X 36			TWT	1	WS	P		
			(70 MPH)									
		M2-1	JCT <AUXILIARY SIGN>	21 X 15								
7	S45						TWT	1	WS	P		
		M1-6F	<FM SHEILD> FARM ROAD (ROUTE *)	24 X 24								
			(FM 3187)									
		D7-7aTL	HISTORICAL MARKER (NUMBER)	48 X 48								
			(8809.7039XLT)									
8	S46						10BWG	1	SA	U		
		D7-7aTR	HISTORICAL MARKER (NUMBER)	48 X 48								
			(8809.7039XRT)									
		M1-6T	(ROUTE *) TEXAS	24 X 24								
8	S47		(SH 21)				TWT	1	WS	P		
		D10-7aT	<3 DIGIT VERTICAL NUMBER>	3 X 10								
			-724									
		D10-7aT	<3 DIGIT VERTICAL NUMBER>	3 X 10								
			-724									

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

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Texas Department of Transportation

Traffic Operations Division Standard

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4-16	DIST	COUNTY		SHEET NO.
8-16	LFK	HOUSTON		30

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SUMMARY OF SMALL SIGNS

ENV LAYOUT SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX) POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION PREFABRICATED	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
							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"		TY N TY S
		W1-2R	*SYMBOL - HORIZ. CURVE RIGHT*	30 X 30								
8	S48						10BWG	1	SA	P		
		W13-1P	*(SPEED) MPH <ADVISORY SPEED PAQUE>*	18 X 18								
			(60 MPH)									
8	S49	W8-13aT	*BRIDGE MAY ICE IN COLD WEATHER*	36 X 36			TWT	1	WS	P		
9	S50	I-3	*HURRICANE BAYOU*	48 X 18			TWT	1	WA	T		
9	S51	I-3	*HURRICANE BAYOU*	48 X 18			TWT	1	WA	T		
9	S52	W8-13aT	*BRIDGE MAY ICE IN COLD WEATHER*	36 X 36			TWT	1	WS	P		
				24 X 24			TWT	1	WS	P		
9	S53	D20-1TL	*COUNTY ROAD (NUMBER)*									
			(CR 1515XLT)									
9	S54	R1-1	*STOP*	36 X 36			TWT	1	WS	P		
				24 X 24			TWT	1	WS	P		
9	S55	D20-1TR	*COUNTY ROAD (NUMBER)*									
			(CR 1515XRT)									
		W1-2L	*SYMBOL - HORIZ. CURVE LEFT*	30 X 30								
10	S56						10BWG	1	SA	P		
		W13-1P	*(SPEED) MPH <ADVISORY SPEED PAQUE>*	18 X 18								
			(60 MPH)									
10	S57	D7-6aTL	*HISTORICAL MARKER (NUMBER)*	48 X 48			10BWG	1	SA	U		
			(1539IXLT)									
10	S58	D7-6aTR	*HISTORICAL MARKER (NUMBER)*	48 X 48			10BWG	1	SA	U		
			(8809.7039XRT)									
12	S59	D7-7aTL	*HISTORICAL MARKER (NUMBER)*	48 X 48								
			(1539IXLT)				10BWG	1	SA	U		
		D7-7aTR	*HISTORICAL MARKER (NUMBER)*	48 X 48								
			(1539IXRT)									

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ALUMINUM SIGN BLANKS THICKNESS	
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SUMMARY OF SMALL SIGNS

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		M1-6T	(ROUTE *) TEXAS	24 X 24								
13	S60		(SH 21)									
		D10-7aT	<3 DIGIT VERTICAL NUMBER>	3 X 10								
			726									
		M1-6T	(ROUTE *) TEXAS	24 X 24			TWT	1	WS	P		
			(SH 21)									
		D10-7aT	<3 DIGIT VERTICAL NUMBER>	3 X 10								
			726									
14	S61	D20-1TL	COUNTY ROAD (NUMBER)	24 X 24			TWT	1	WS	P		
			(CR 1525)(LT)									
14	S62	D7-6aTR	HISTORICAL MARKER (NUMBER)	48 X 48			10BWG	1	SA	U		
			(1539)(RT)									
14	S63	R1-1	STOP	36 X 36			TWT	1	WS	P		
15	S64	D20-1TR	COUNTY ROAD (NUMBER)	24 X 24			TWT	1	WS	P		
			(1525)(RT)									
		M1-6T	(ROUTE *) TEXAS	24 X 24								
17	S65		(SH 21)									
		D10-7aT	<3 DIGIT VERTICAL NUMBER>	3 X 10								
			-728									
		M1-6T	(ROUTE *) TEXAS	24 X 24			TWT	1	WS	P		
			(SH 21)									
		D10-7aT	<3 DIGIT VERTICAL NUMBER>	3 X 10								
			-728									
18	S66	D20-1TL	COUNTY ROAD (NUMBER)	24 X 24			TWT	1	WS	P		
			(1535)(LT)									
18	S67	I-2cT	(BELOTT)	42 X 12			TWT	1	WS	P		
18	S68	R1-1	STOP	36 X 36			TWT	1	WS	P		
		D3-3bTL	MANNING CEMETERY	54 X 36								
18	S69		(LT)				10BWG	1	SA	U		
		D3-3bTR	MANNING CEMETERY	54 X 36								
			(RT)									
18	S70	D20-1TR	COUNTY ROAD (NUMBER)	24 X 24			TWT	1	WS	P		
			(1535)(RT)									
18	S71	W17-15T	WATCH FOR MUD ON ROAD	36 X 36			TWT	1	WS	P		

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ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080"
7.5 to 15	0.100"
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8-16		LFK	HOUSTON		32

SUMMARY OF SMALL SIGNS

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19	S72	W17-15T	*WATCH FOR MUD ON ROAD*	36 X 36			TWT	1	WS	P		
20	S73	D20-1TL	*COUNTY ROAD (NUMBER)*	24 X 24			TWT	1	WS	P		
			(1545XLT)									
20	S74	W11-8L	*EMERGENCY VEHICLE (FIRETRUCK)*	36 X 36			TWT	1	WS	P		
20	S75	R1-1	*STOP*	36 X 36			TWT	1	WS	P		
20	S76	D3-3bTL	*(PARKER CEMETERY)*	54 X 36			10BWG	1	SA	U		
		D3-3bTR	*(PARKER CEMETERY)*	54 X 36								
20	S77	D20-1TR	*COUNTY ROAD (NUMBER)*	24 X 24			TWT	1	WS	P		
			(1545XRT)									
21	S78	W11-8L	*EMERGENCY VEHICLE (FIRETRUCK)*	36 X 36			TWT	1	WS	P		
		M1-6T	*(ROUTE *) TEXAS*	24 X 24								
21	S79		*(SH 21)*									
		D10-7aT	*<3 DIGIT VERTICAL NUMBER>*	3 X 10								
			-730									
		M1-6T	*(ROUTE *) TEXAS*	24 X 24			TWT	1	WS	P		
			(SH 21)									
		D10-7aT	*<3 DIGIT VERTICAL NUMBER>*	3 X 10								
			-730									
21	S80	D7-6aTL	*HISTORICAL MARKER (NUMBER)*	48 X 48			10BWG	1	SA	U		
			(1539IXLT)									
22	S81	D20-1TR	*COUNTY ROAD (NUMBER)*	24 X 24			TWT	1	WS	P		
			(1050IXRT)									
22	S82	R1-1	*STOP*	36 X 36			TWT	1	WS	P		
22	S83	D20-1TL	*COUNTY ROAD (NUMBER)*	24 X 24			TWT	1	WS	P		
			(1050IXLT)									

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

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4-16	DIST	COUNTY		SHEET NO.
8-16	LFK	HOUSTON		33

TB

SUMMARY OF SMALL SIGNS

ENV LAYOUT SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX) POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION PREFABRICATED	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
		M1-6F	*JCT <AUXILIARY SIGN>*	24 X 24								
23	S84		*(FM 1733)*				TWT	1	WS	P		
		M2-1	*<FM SHEILD> FARM ROAD (ROUTE *)*	21 X 15								
23	S85	D2-2	*CROCKETT 12*	78 X 24			10BWG	1	SA	U		
			MADISONVILLE 51									
23	S86	R2-1	*SPEED LIMIT (SPEED)*	30 X 36			TWT	1	WS	P		
			(70 MPH)									
		M1-6T	*WEST<AUXILIARY SIGN>*	24 X 24								
23	S87		*(SH 21)*				TWT	1	WS	P		
		M3-4	*(ROUTE *) TEXAS*	24 X 12								
		M3-3	*SOUTH <AUXILIARY SIGN>*	24 X 12								
		M1-6F	*<FM SHEILD> FARM ROAD (ROUTE *)*	24 X 24								
23	S88		*(FM 1733)*				TWT	1	WS	P		
		M6-1	*<ARROW - HORIZ. STRGHT><AUXILLARY SIGN>*	21 X 15								
23	S89	W1-7T	*<BI-DIRECTIONAL LRG ARROW w/CHEVRONS>*	96 X 36			S80	1	SA	U	WC	
		M1-6T	*(ROUTE *) TEXAS*	24 X 24								
23	S90		*(SH 21)*				TWT	1	WS	P		
		M6-4	*<ARROW - DUAL LEFT & RIGHT><AUX. SIGN>*	21 X 15								
23	S91	R1-1	*STOP*	36 X 36			TWT	1	WS	P		
		W4-4P	*CROSS TRAFFIC DOES NOT STOP*	24 X 12								
		M3-3	*SOUTH <AUXILIARY SIGN>*	24 X 12								
		M1-6F	*<FM SHEILD> FARM ROAD (ROUTE *)*	24 X 24								
23	S92		*(FM 1733)*				TWT	1	WS	P		
		M6-1	*<ARROW - HORIZ. STRGHT><AUXILLARY SIGN>*	21 X 15								

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

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

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

http://www.txdot.gov/

NOTE:

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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

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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

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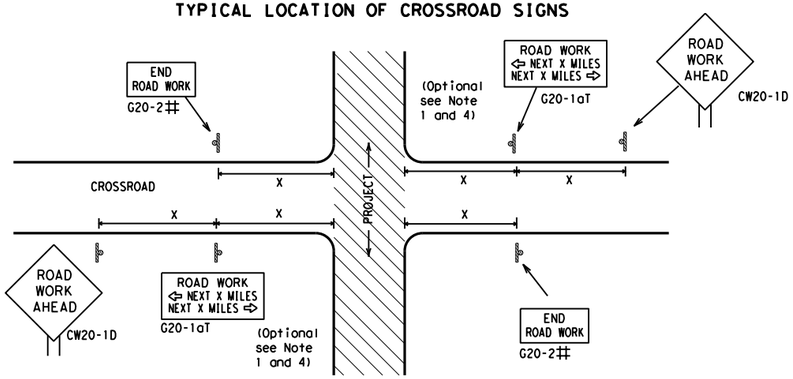
	LFK	HOUSTON		35

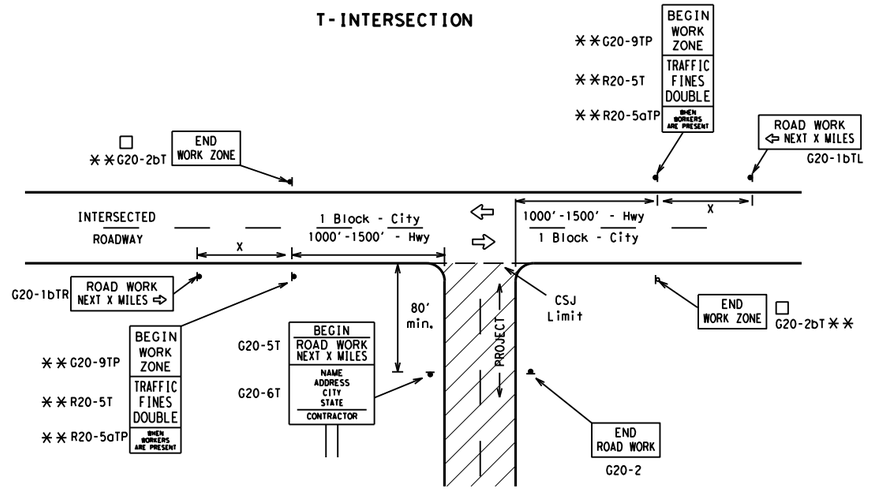
TYPICAL LOCATION OF CROSSROAD SIGNS



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

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

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

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

TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING[1,5,6]

SIZE

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

SPACING

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

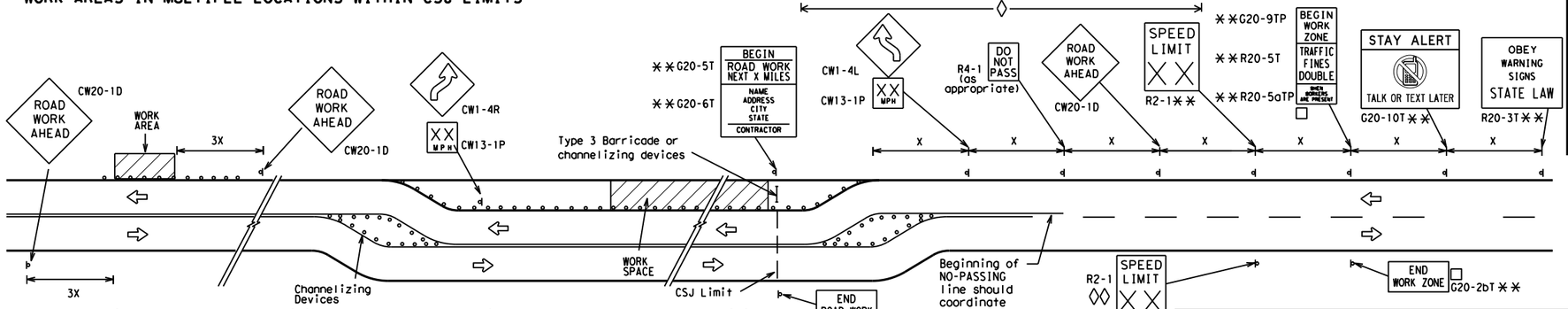
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have 1/2 mile or more advance warning.
4. 36" x 36" "ROAD WORK AHEAD" (CW20-1D)signs may be used on low volume crossroads at the discretion of the Engineer as per TMUTCD Part 5. See Note 2 under "Typical Location of Crossroad Signs".
5. Only diamond shaped warning sign sizes are indicated.
6. See sign size listing in "TMUTCD", Sign Appendix or the "Standard Highway Sign Designs for Texas" manual for complete list of available sign design sizes.

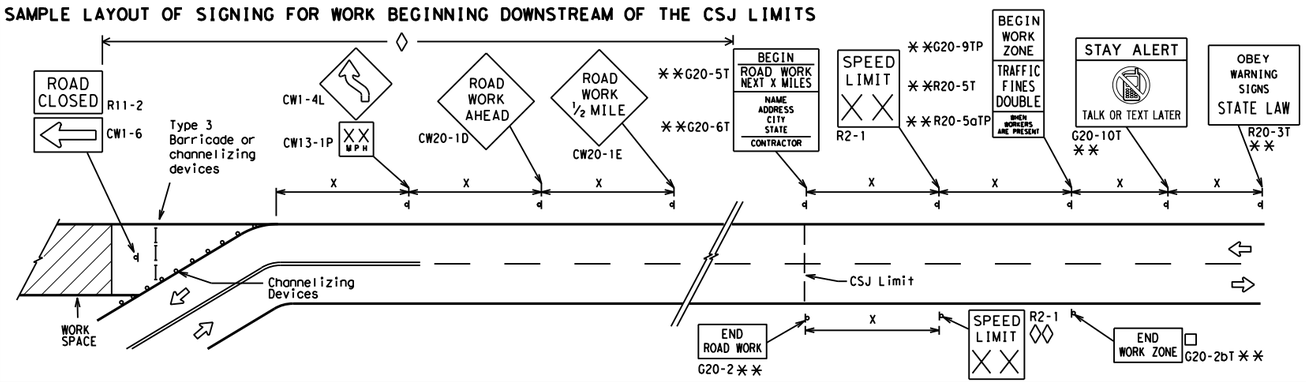
WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS



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

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS

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



NOTES

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

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

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

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7-13 5-21	LFK	HOUSTON		36

DATE:
FILE:

DATE:
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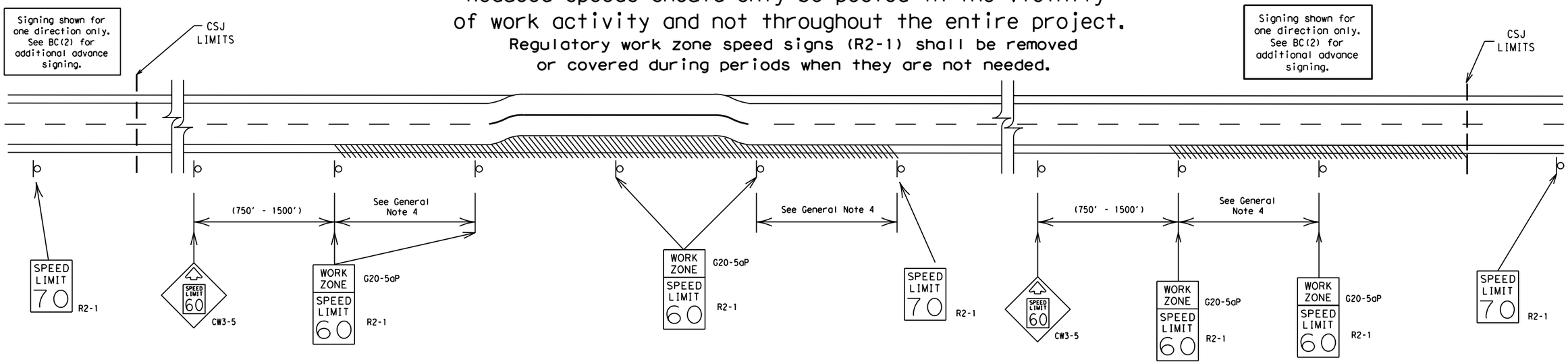
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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.

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Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

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	LFK	HOUSTON		37

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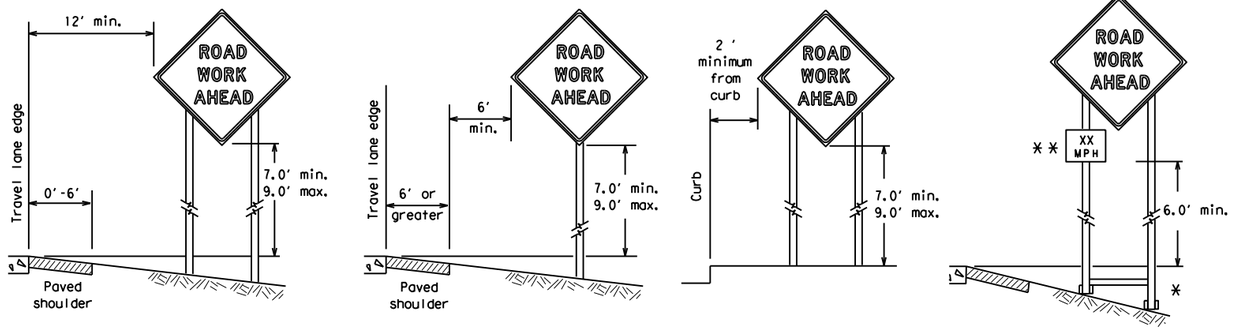
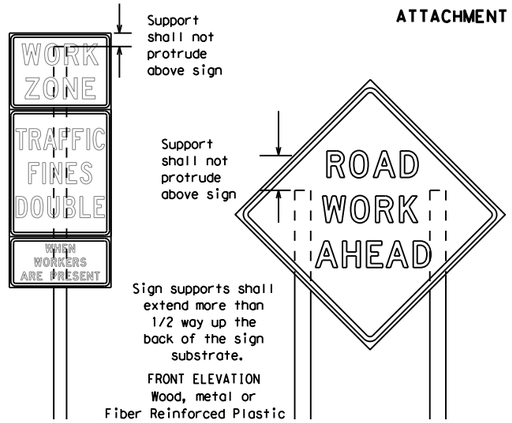
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

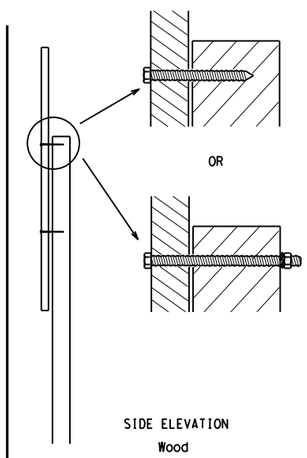


* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

** 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





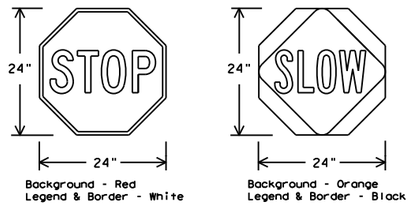
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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.



Background - Red
Legend & Border - White

Background - Orange
Legend & Border - Black

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

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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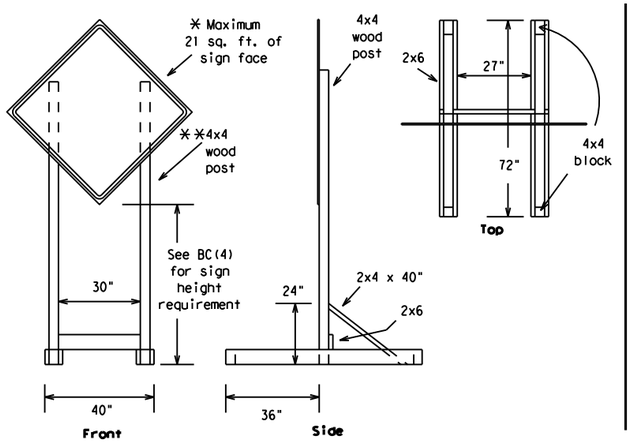
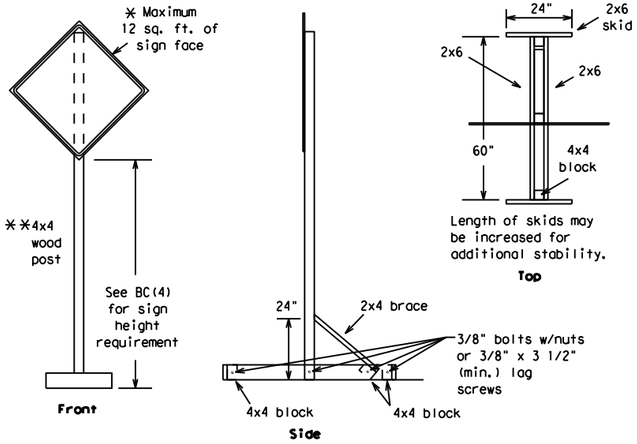
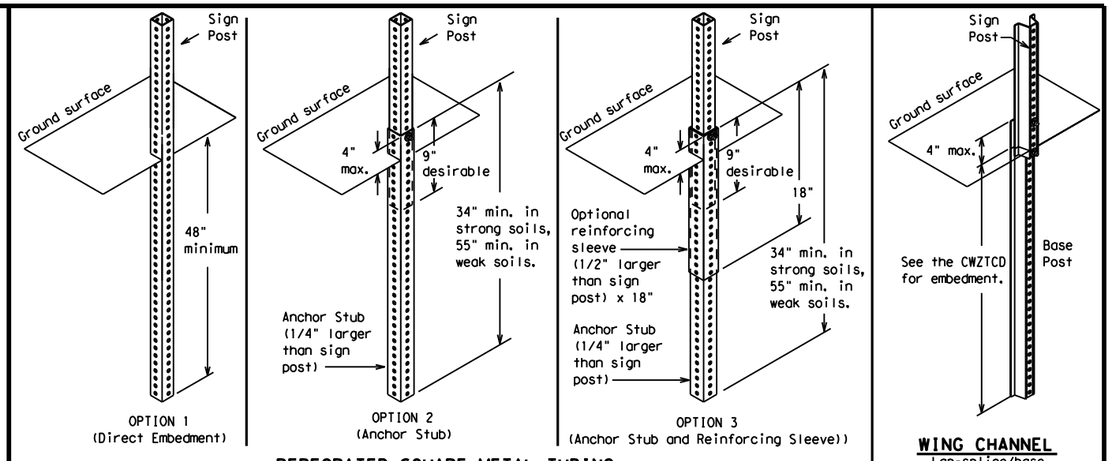




SKID MOUNTED WOOD SIGN SUPPORTS

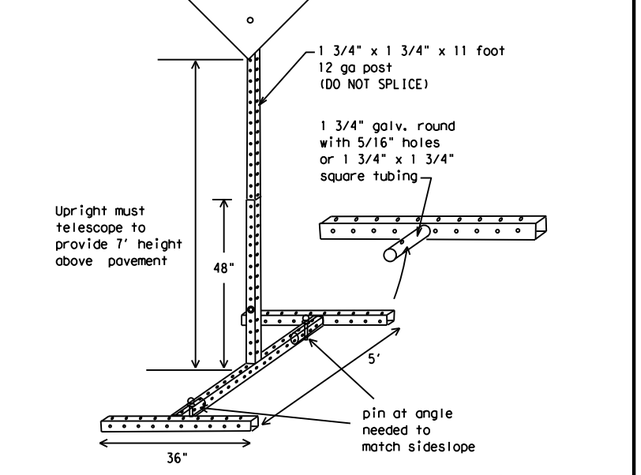
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS

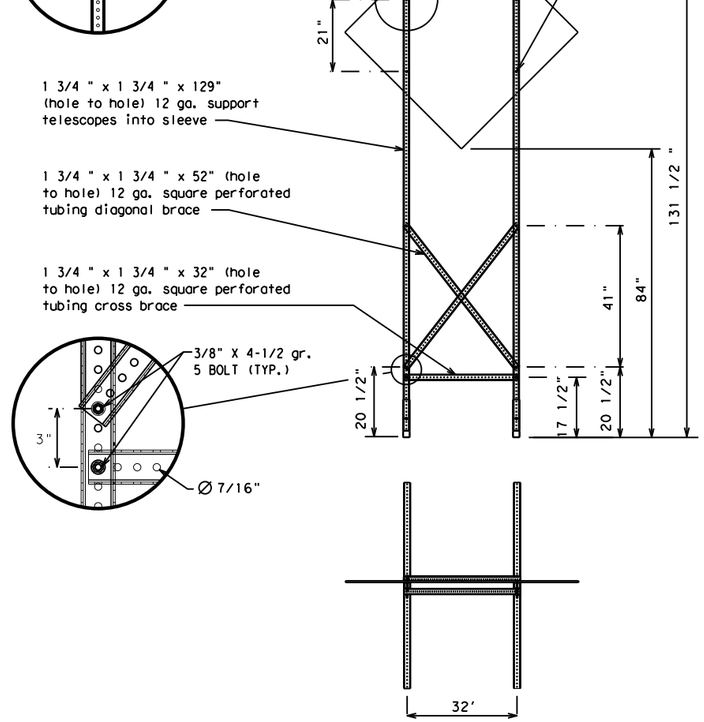


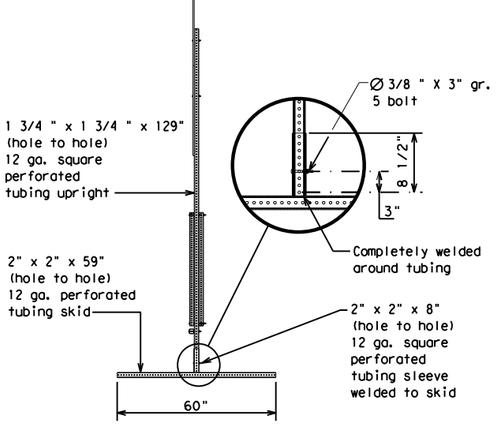
PERFORATED SQUARE METAL TUBING

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.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

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

PORTABLE CHANGEABLE MESSAGE SIGNS

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

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

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

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

- 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

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

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

WORDING ALTERNATIVES

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

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

FULL MATRIX PCMS SIGNS

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

FILE:	bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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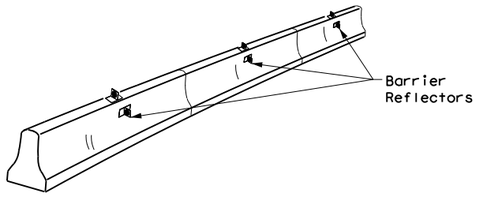
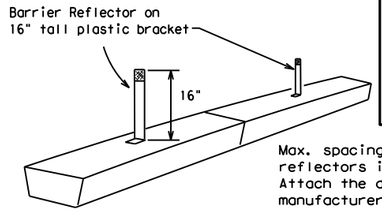
1. Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 512.



CONCRETE TRAFFIC BARRIER (CTB)

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

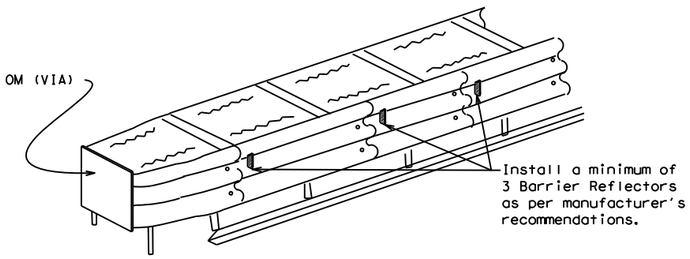


Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

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

LOW PROFILE CONCRETE BARRIER (LPCB)

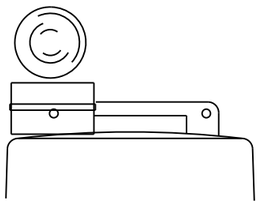


DELINEATION OF END TREATMENTS

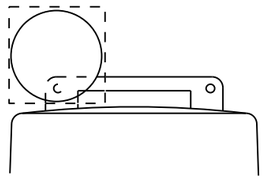
END TREATMENTS FOR CTB'S USED IN WORK ZONES

End treatments used on CTB's in work zones shall meet the apppropriate crashworthy standards as defined in the Manual for Assessing Safety Hardware (MASH). Refer to the CWZTCD List for approved end treatments and manufacturers.

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



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



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

WARNING LIGHTS

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

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

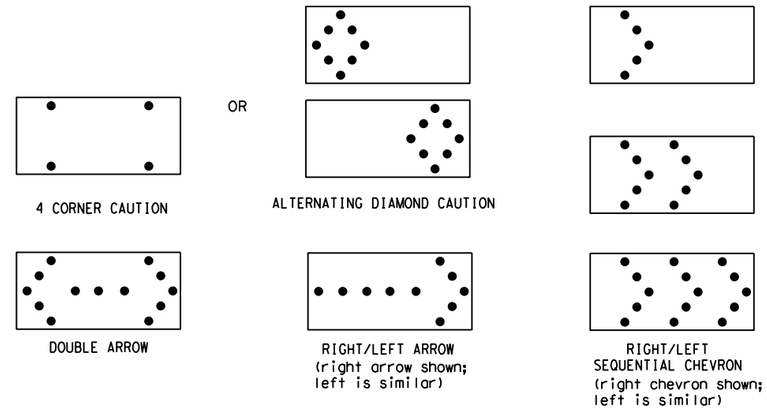
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

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

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

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

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



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	0118	02	036, ETC.	SH 21
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	LFK	HOUSTON		41

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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:

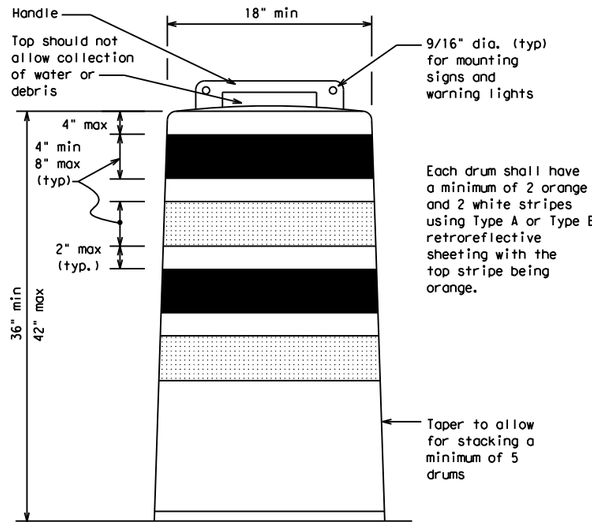
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

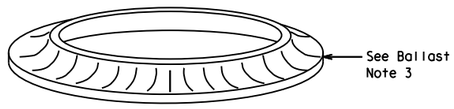
RETROREFLECTIVE SHEETING

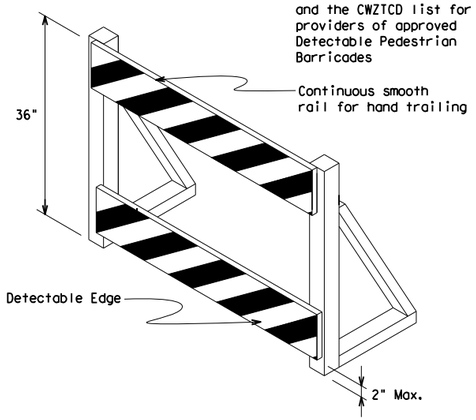
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials." Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall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

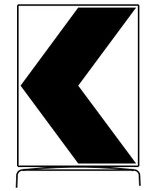




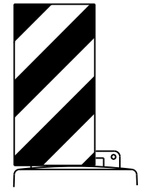


DETECTABLE PEDESTRIAN BARRICADES

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.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(8)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	0118	02	036, ETC.	SH 21
4-03 8-14	DIST	COUNTY		SHEET NO.
9-07 5-21	LFK	HOUSTON		42
7-13				

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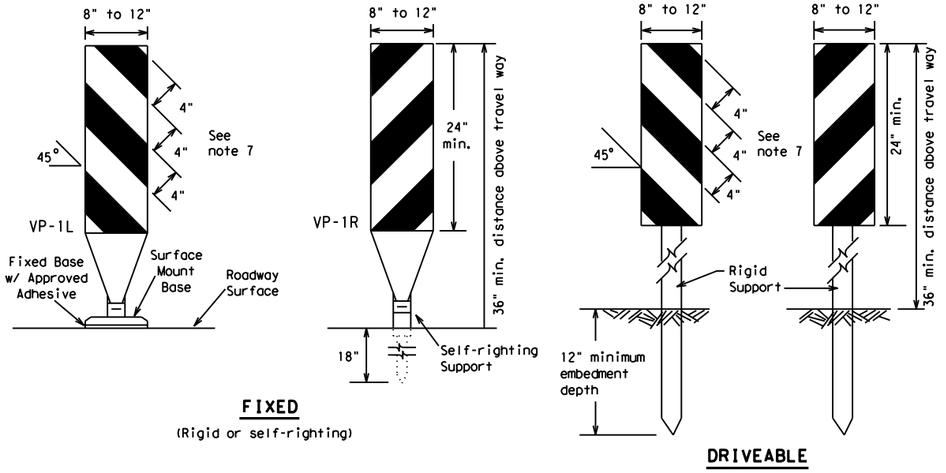
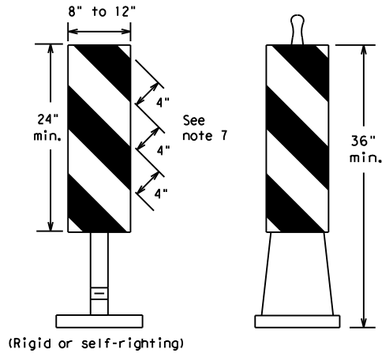


FIXED
(Rigid or self-righting)

DRIVEABLE

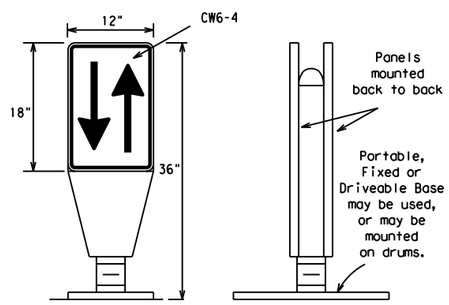


(Rigid or self-righting)

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)

DATE:
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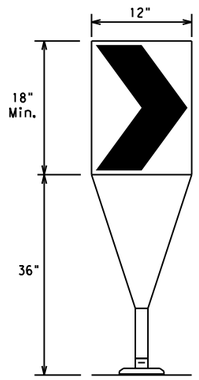


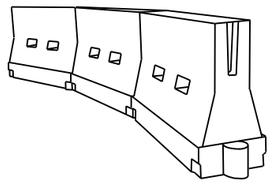
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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

CHEVRONS

GENERAL NOTES

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



LONGITUDINAL CHANNELIZING DEVICES (LCD)

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

WATER BALLASTED SYSTEMS USED AS BARRIERS

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

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

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

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

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

SHEET 9 OF 12

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	0118	02	036, ETC.	SH 21
9-07 8-14	DIST	COUNTY		SHEET NO.
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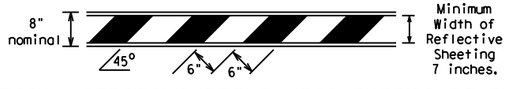
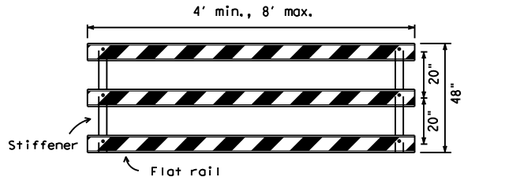
TYPE 3 BARRICADES

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.



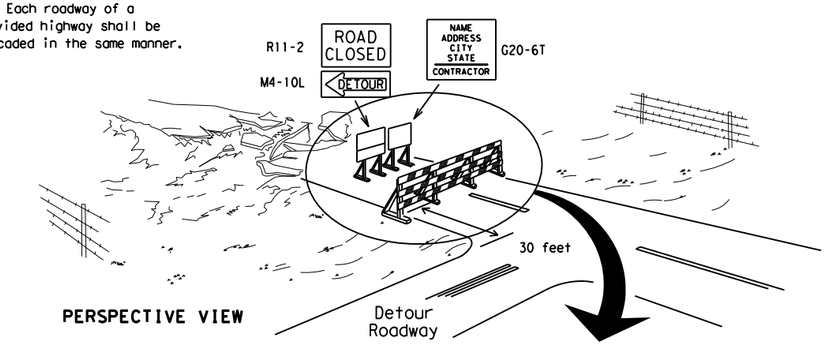
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

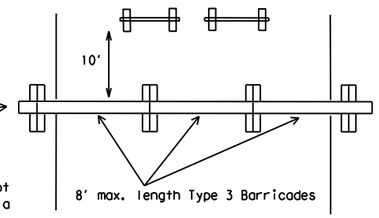
Each roadway of a divided highway shall be barricaded in the same manner.



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.

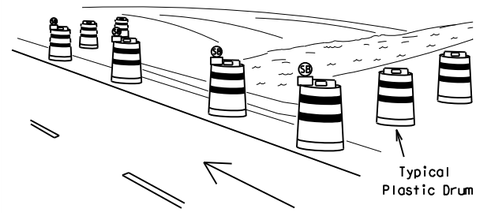
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

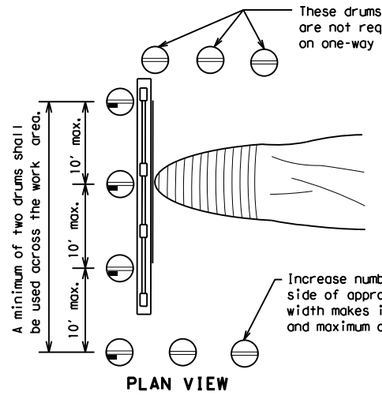
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

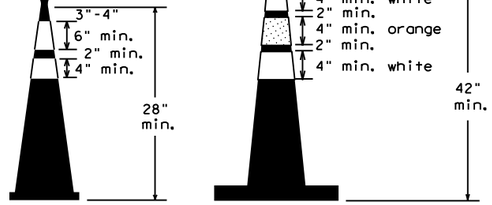
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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



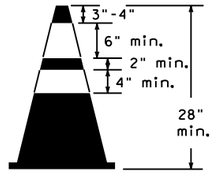
LEGEND	
	Plastic drum
	Plastic drum with steady burn light or yellow warning reflector
SB	Steady burn warning light or yellow warning reflector

PLAN VIEW

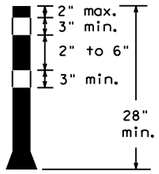
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



Two-Piece cones



One-Piece cones

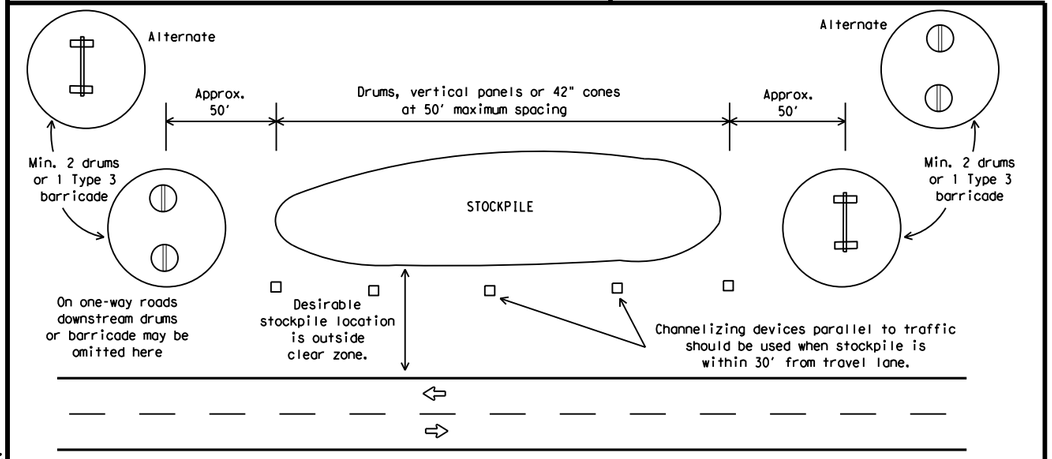


Tubular Marker

28" Cones shall have a minimum weight of 9 1/2 lbs.

42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

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



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

DATE:
FILE:

SHEET 10 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	LFK	HOUSTON		44

104

DATE:
FILE:

WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

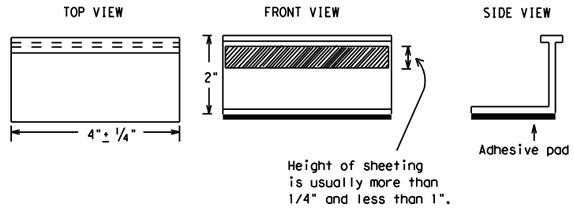
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-98 9-07 5-21 1-02 7-13 11-02 8-14	0118	02	036, ETC.	SH 21
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	LFK	HOUSTON		45

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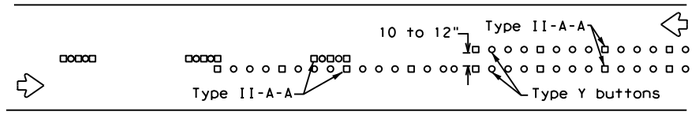
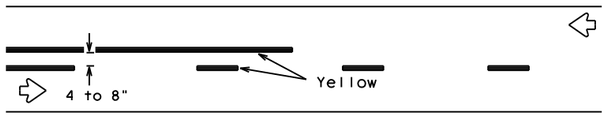
PAVEMENT MARKING PATTERNS

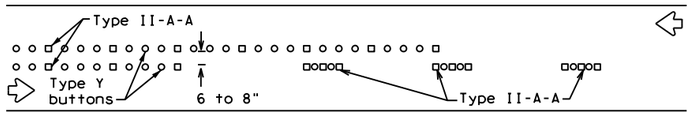
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



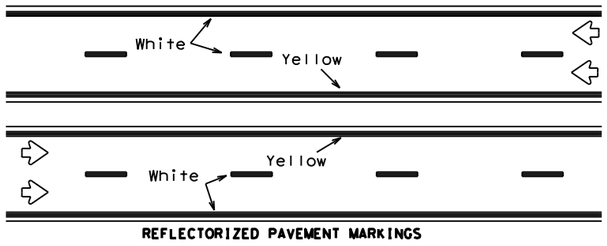
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



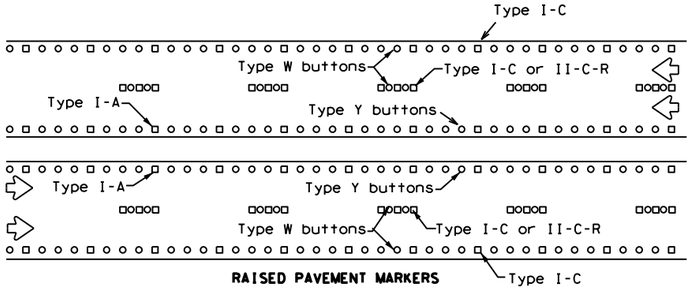
RAISED PAVEMENT MARKERS - PATTERN B

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

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



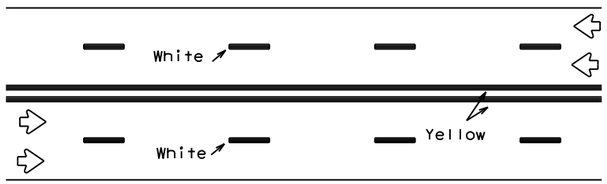
REFLECTORIZED PAVEMENT MARKINGS



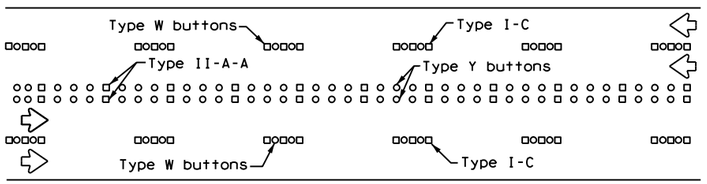
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



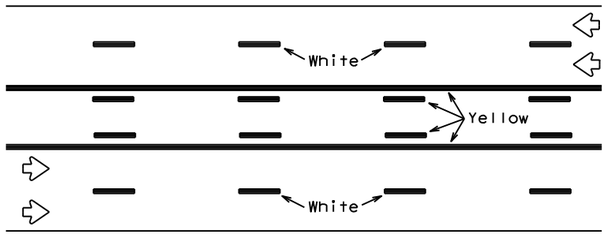
REFLECTORIZED PAVEMENT MARKINGS



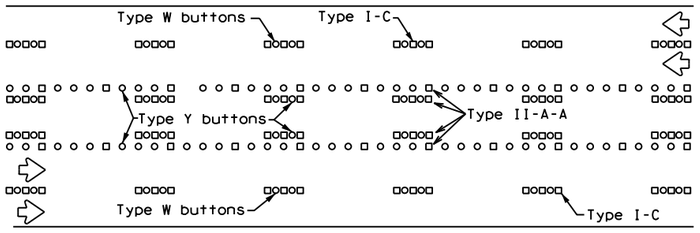
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

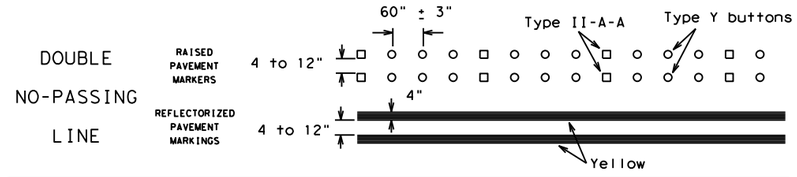
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

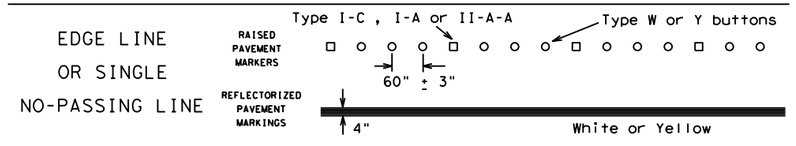
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

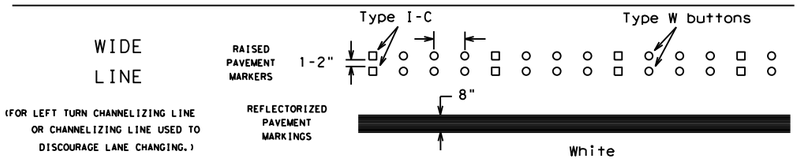


EDGE LINE OR SINGLE NO-PASSING LINE



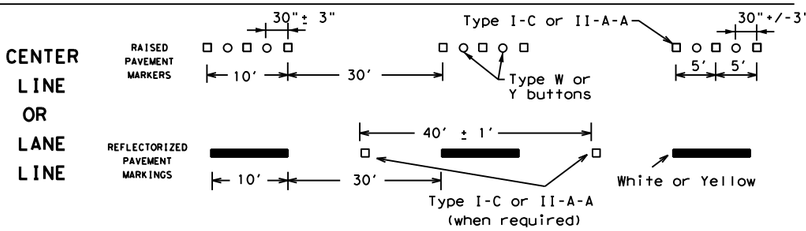
WIDE LINE

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

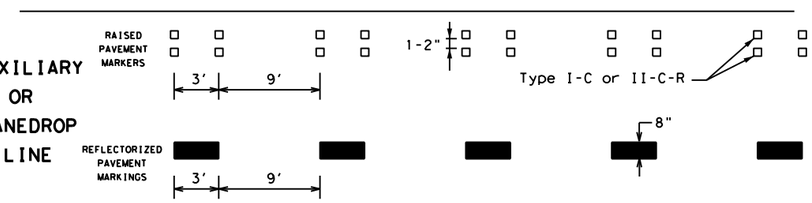


BROKEN LINES

CENTER LINE OR LANE LINE

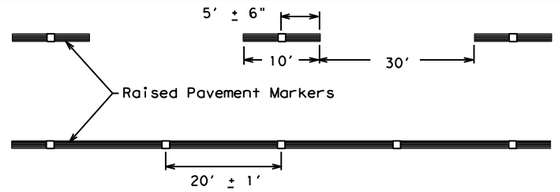


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



Centerline only - not to be used on edge lines

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

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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
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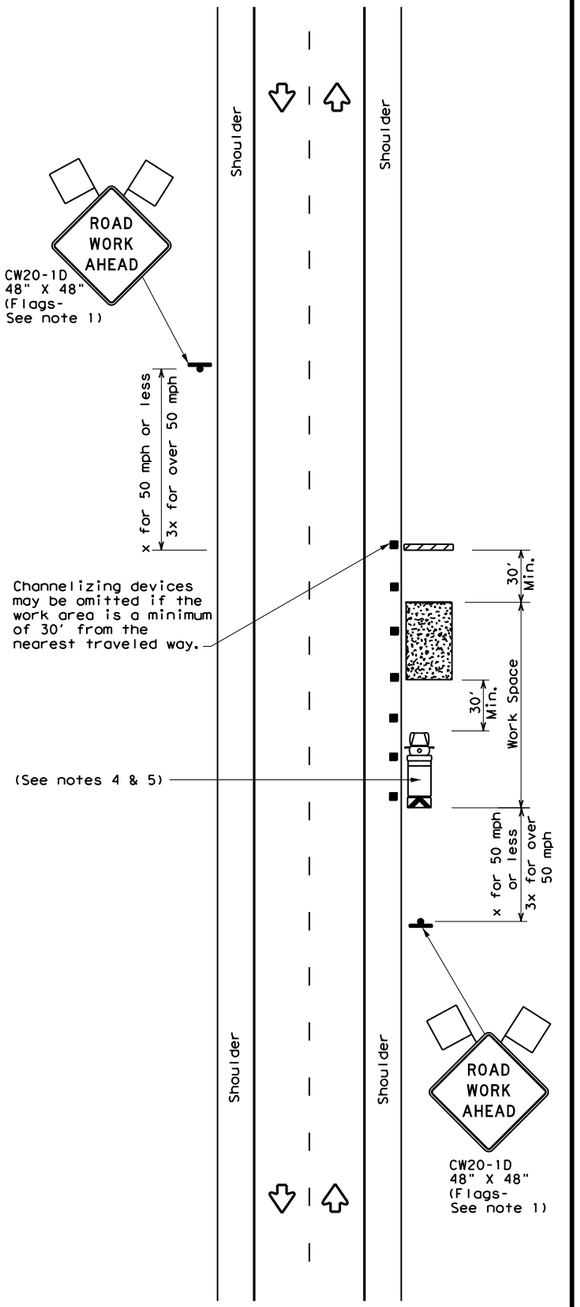
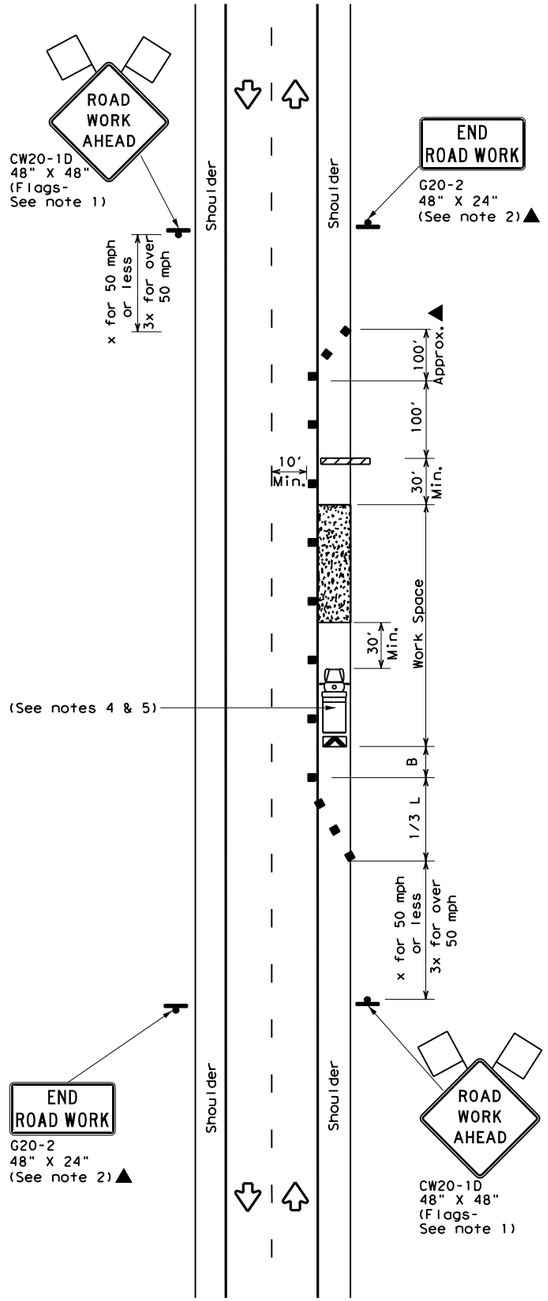


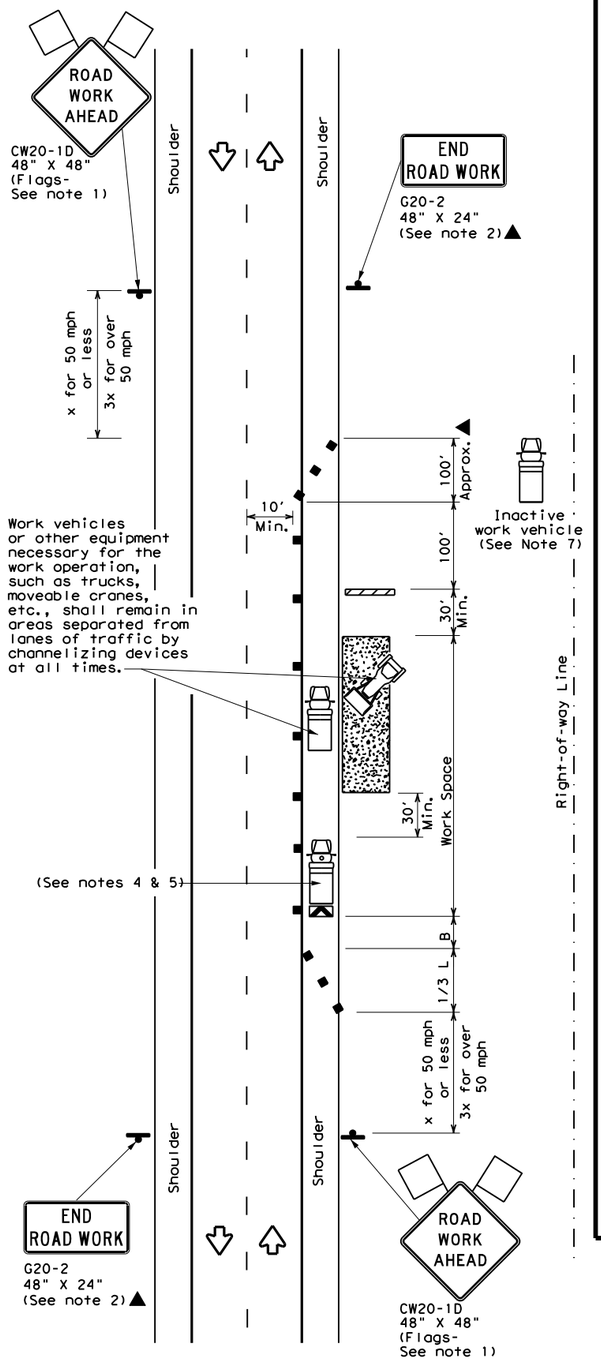
TCP (2-1a)

WORK SPACE NEAR SHOULDER
Conventional Roads



TCP (2-1b)

WORK SPACE ON SHOULDER
Conventional Roads



TCP (2-1c)

WORK VEHICLES ON SHOULDER
Conventional Roads

LEGEND			
	Type 3 Barricade	■ ■	Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board	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:
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REVISIONS	0118	02	036, ETC.	SH 21
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	LFK	HOUSTON		47
1-97 2-18				

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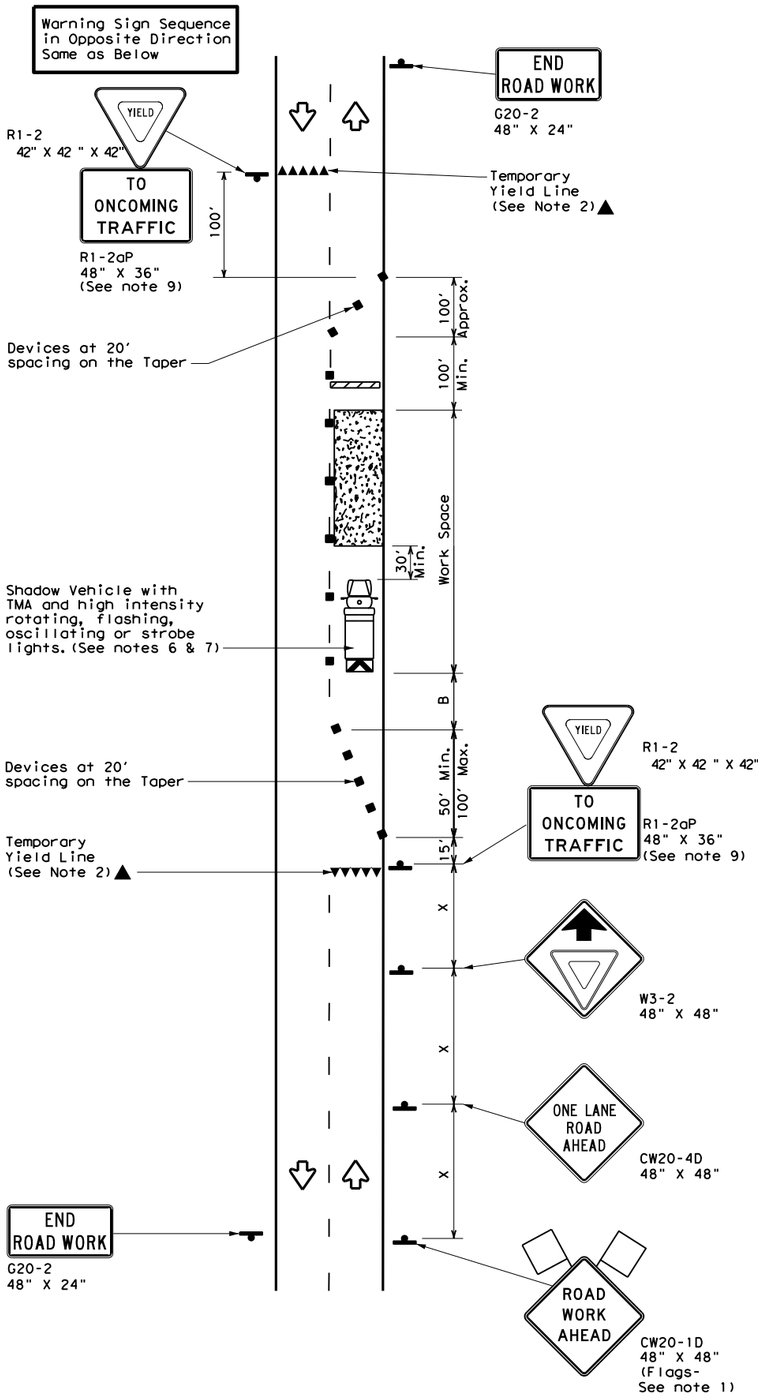
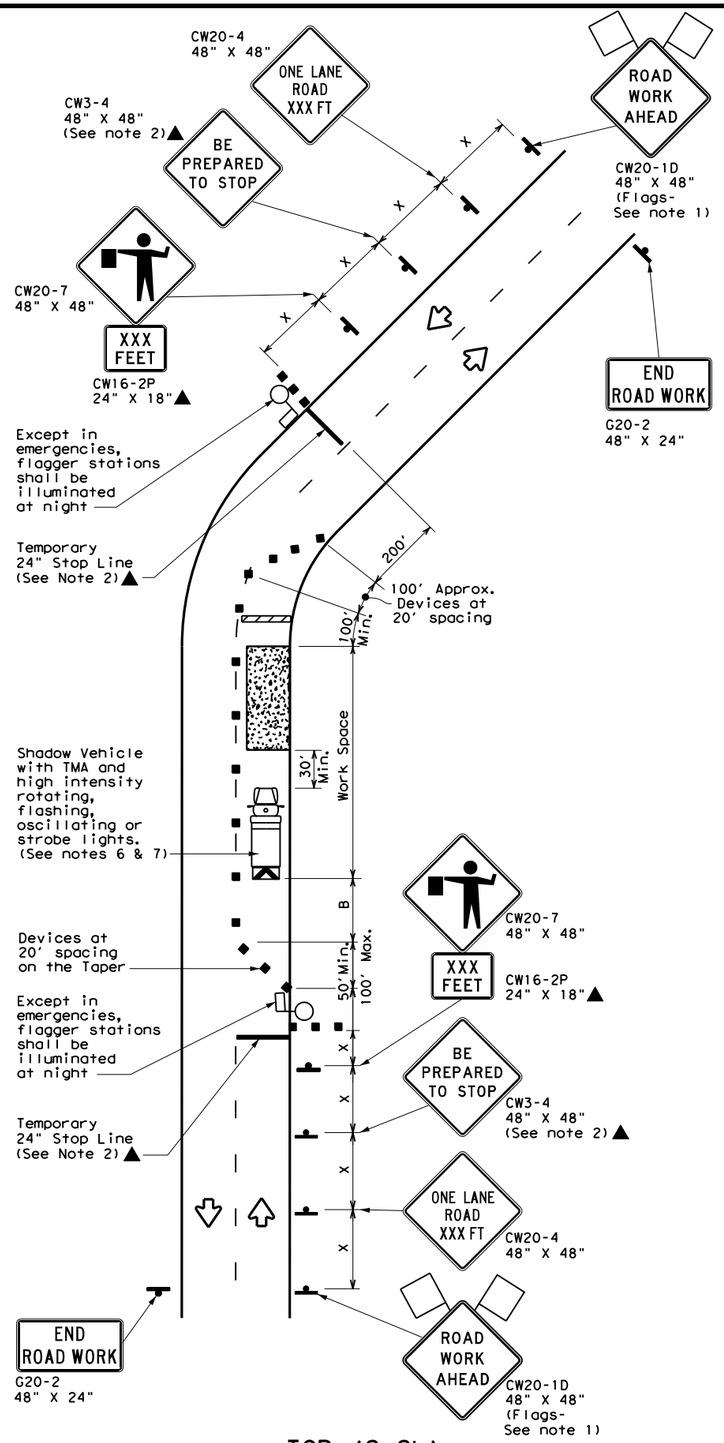
DATE:
FILE:



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.

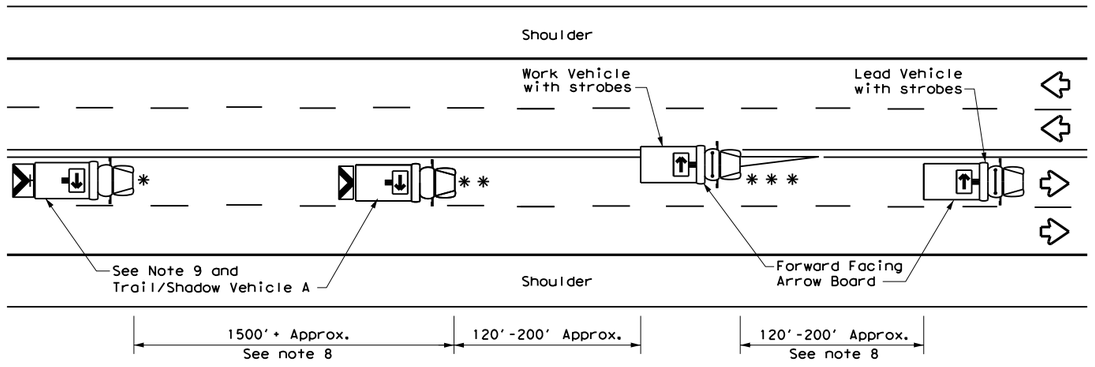
Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
ONE-LANE TWO-WAY
TRAFFIC CONTROL

TCP(2-2)-18

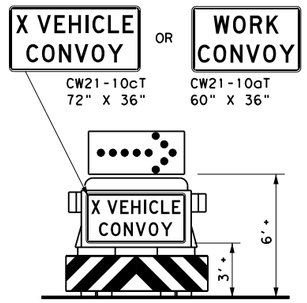
FILE: tcp2-2-18.dgn	DN:	CK:	DW:	CK:
©TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03 1-97 2-12 4-98 2-18	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		48

DATE:
FILE:



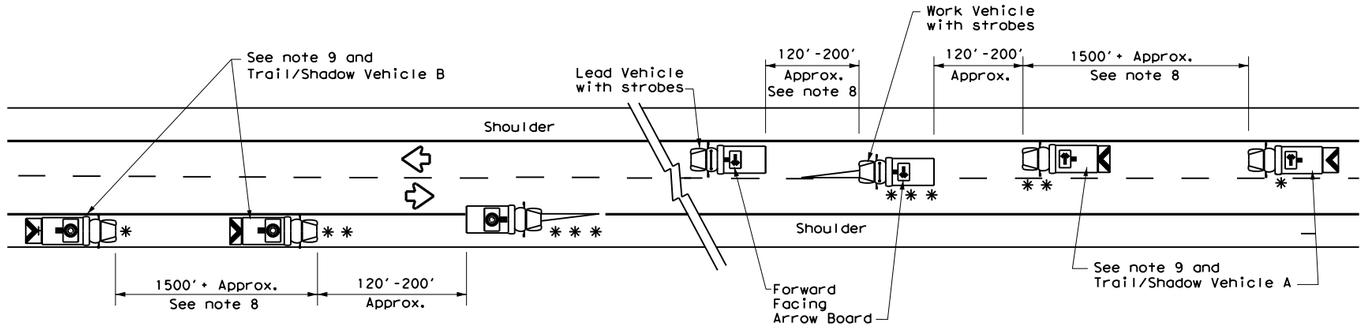
TCP (3-1a)

UNDIVIDED MULTILANE ROADWAY



TRAIL/SHADOW VEHICLE A

with RIGHT Directional display Flashing Arrow Board

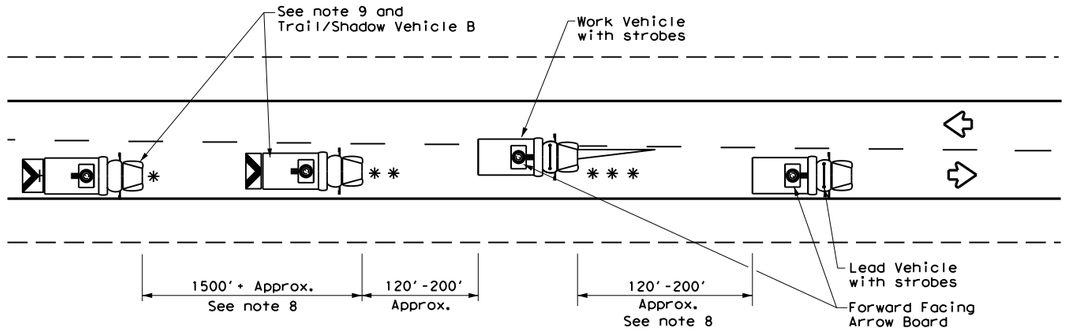


WORK ON SHOULDER

WORK ON TRAVEL LANE

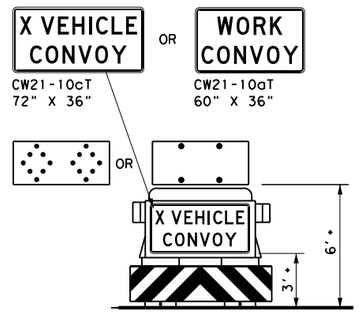
TCP (3-1b)

TWO-WAY ROADWAY WITH PAVED SHOULDERS



TCP (3-1c)

TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS



TRAIL/SHADOW VEHICLE B

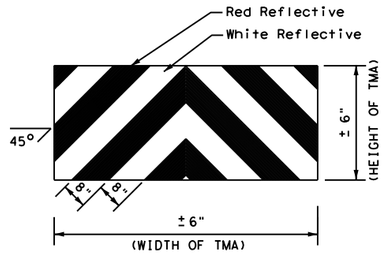
with Flashing Arrow Board in CAUTION display

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
REVISIONS 2-94 4-98 8-95 7-13 1-97	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		49

DATE:
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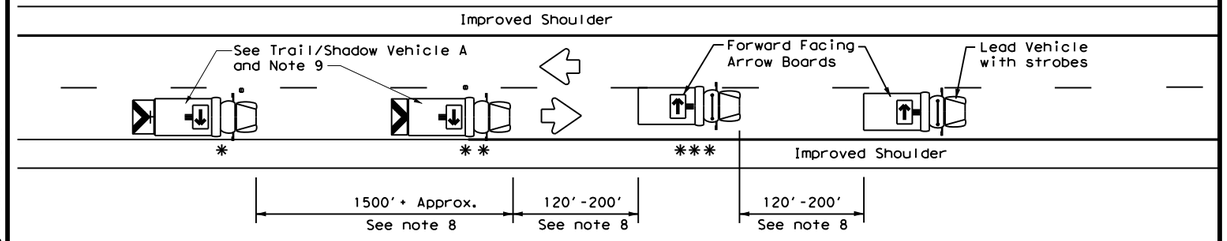
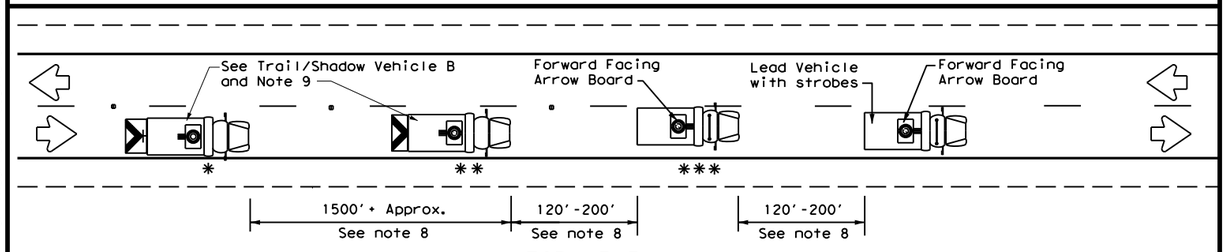


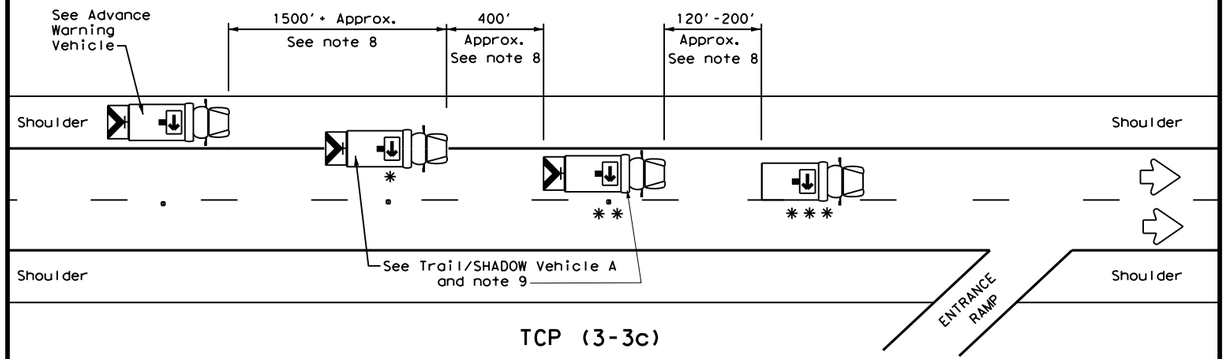
TCP (3-3a)

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



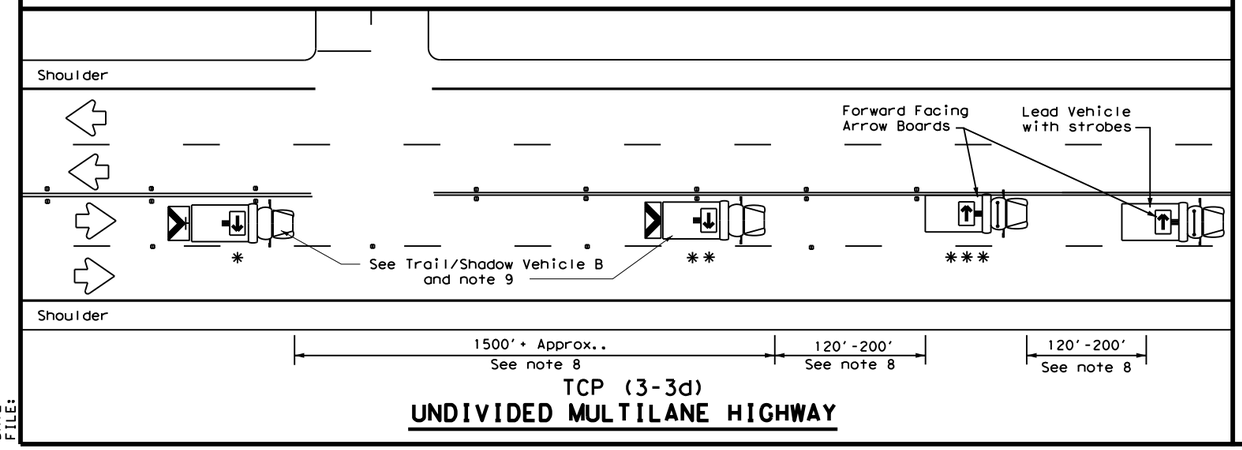
TCP (3-3b)

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



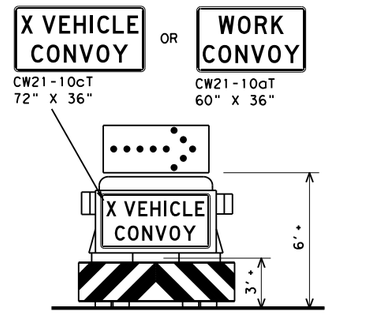
TCP (3-3c)

DIVIDED MULTILANE HIGHWAY



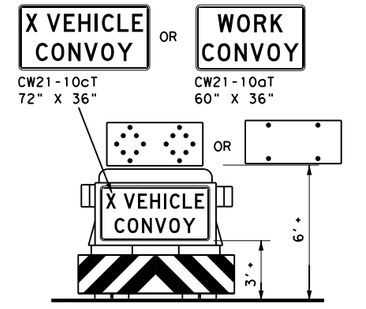
TCP (3-3d)

UNDIVIDED MULTILANE HIGHWAY



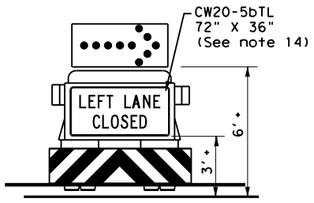
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display
Flashing Arrow Board

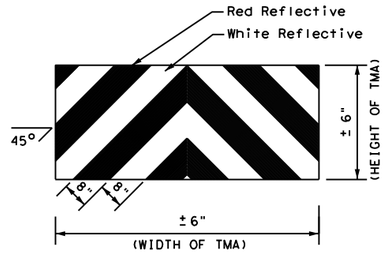


TRAIL/SHADOW VEHICLE B

with Flashing Arrow Board
in Caution Mode



ADVANCE WARNING VEHICLE



STRIPING FOR TMA

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

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

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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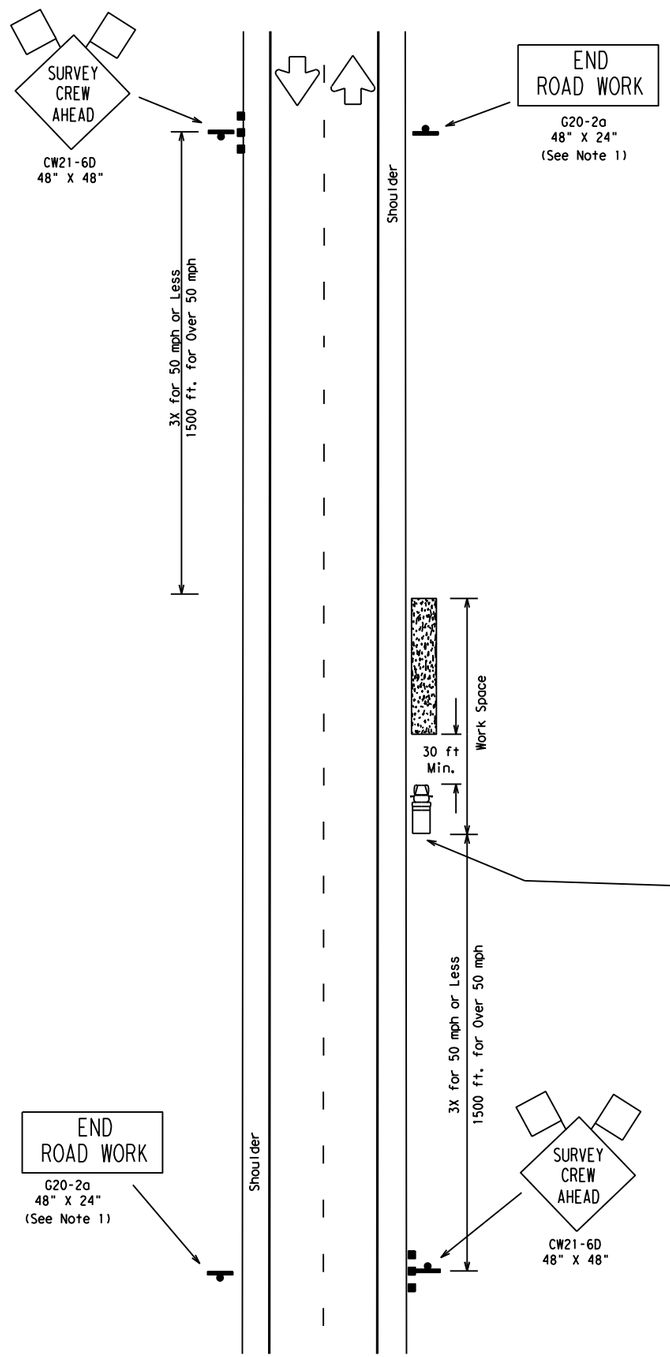
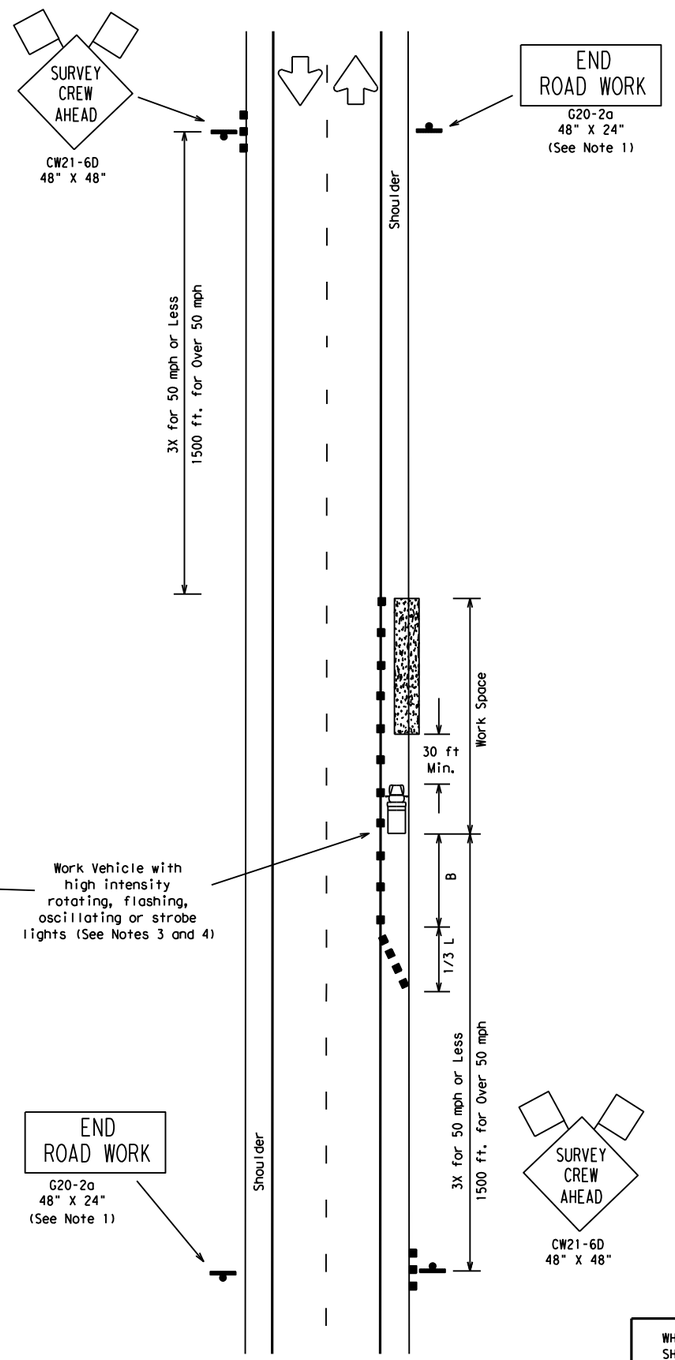
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 7-13	LFK	HOUSTON		50
1-97 7-14				



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



TCP (S-1b)
WORK ON SHOULDER

LEGEND

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

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

✳ Conventional Roads Only

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

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

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

GENERAL NOTES:

1. The G20-2a "END ROAD WORK" sign may be placed on the back of the CW21-6D "SURVEY CREW AHEAD" sign or may be omitted for short duration (less than 1 hour) work.
2. Channelizing devices on the shoulder taper and tangent section may be omitted for short duration (less than 1 hour) work.
3. If line-of-sight requirements for surveying operations will preclude the placement of the Work Vehicle to protect workers, the channelizing devices mentioned in Note 2 are required.
4. ⚠1 A Shadow Vehicle with a Truck Mounted Attenuator and flashing warning lights/arrow panel in caution mode may be used in lieu of the Work Vehicle to protect the work space.
5. The CW20-1D "ROAD WORK AHEAD" sign may be substituted for the CW21-6D "SURVEY CREW AHEAD" sign.
6. This plan may also be used for shoulder work or off shoulder work for multilane undivided roadways.
7. The CW21-6D "SURVEY CREW AHEAD" sign for low volume intersecting side roads is desirable, but is not required when working less than 15 minutes in area of the side road, as determined by the Engineer.

TCP(S-1a)

8. Cones may be placed at edge of pavement adjacent to the work space to enhance safety.

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

8-18-08 Revision
⚠1 Corrected misspelling.

Texas Department of Transportation
Traffic Operations Division

TRAFFIC CONTROL PLAN FOR SURVEYING OPERATIONS

TCP(S-1)-08A

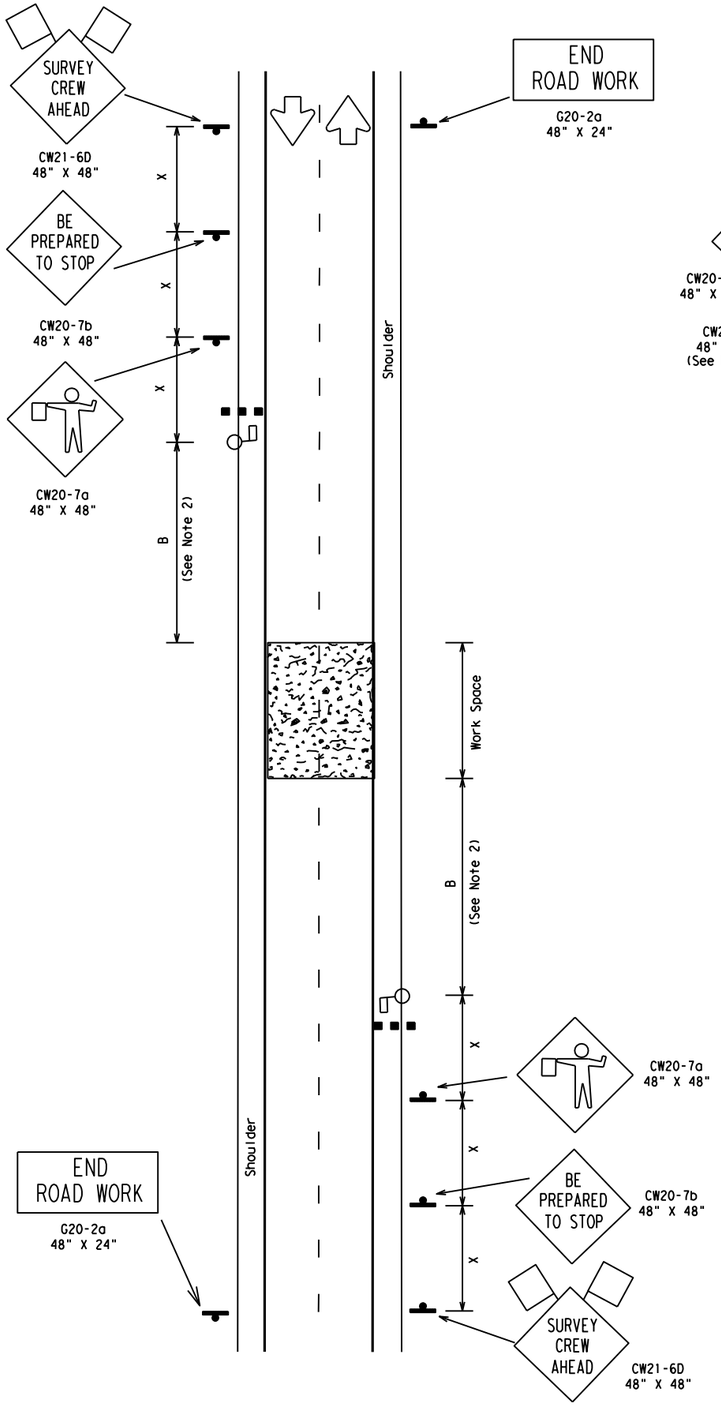
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
8-08

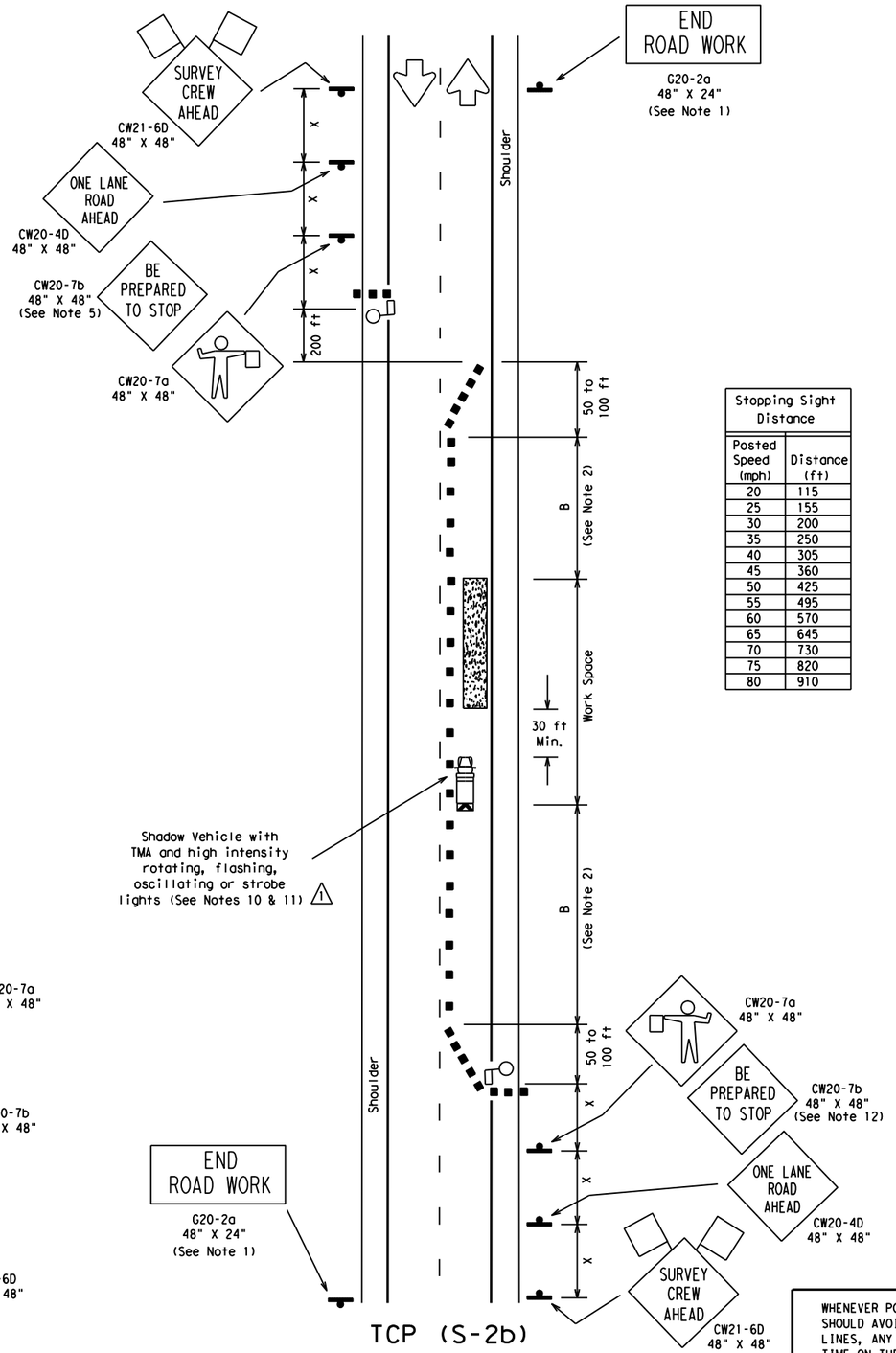
CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		51

DATE:
FILE:

DATE:
FILE:



TCP (S-2a)
ROAD CLOSED FOR LESS THAN 20 MINUTES -
OFF PEAK TRAFFIC HOURS
WITH OR WITHOUT SHOULDERS



TCP (S-2b)
WORK IN ROADWAY
OFF PEAK TRAFFIC HOURS
WITH OR WITHOUT SHOULDERS

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

LEGEND

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

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

✳ Conventional Roads Only

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

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

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

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

TCP(S-2a)

7. Road closures shall be less than 20 minutes. Closures less than 5 minutes are desirable.
8. Sign spacing should be increased if traffic repeatedly queues past the CW20-7b "BE PREPARED TO STOP" sign.
9. The surveying instrument should not be located on the paved surface.

TCP (S-2B)

10. For short duration work the Shadow Vehicle with a TMA may be replaced by another Work Vehicle with high intensity rotating, flashing or strobe lights.
11. Shadow Vehicles with a TMA are desirable when workers or equipment are in the work space. When approved by the engineer, Type III barricades or other channelizing devices may be substituted for the Shadow Vehicle.
12. The CW20-7b "BE PREPARED TO STOP" sign is optional. When used, it should be installed after the CW20-4D "ONE LANE ROAD AHEAD" sign.

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

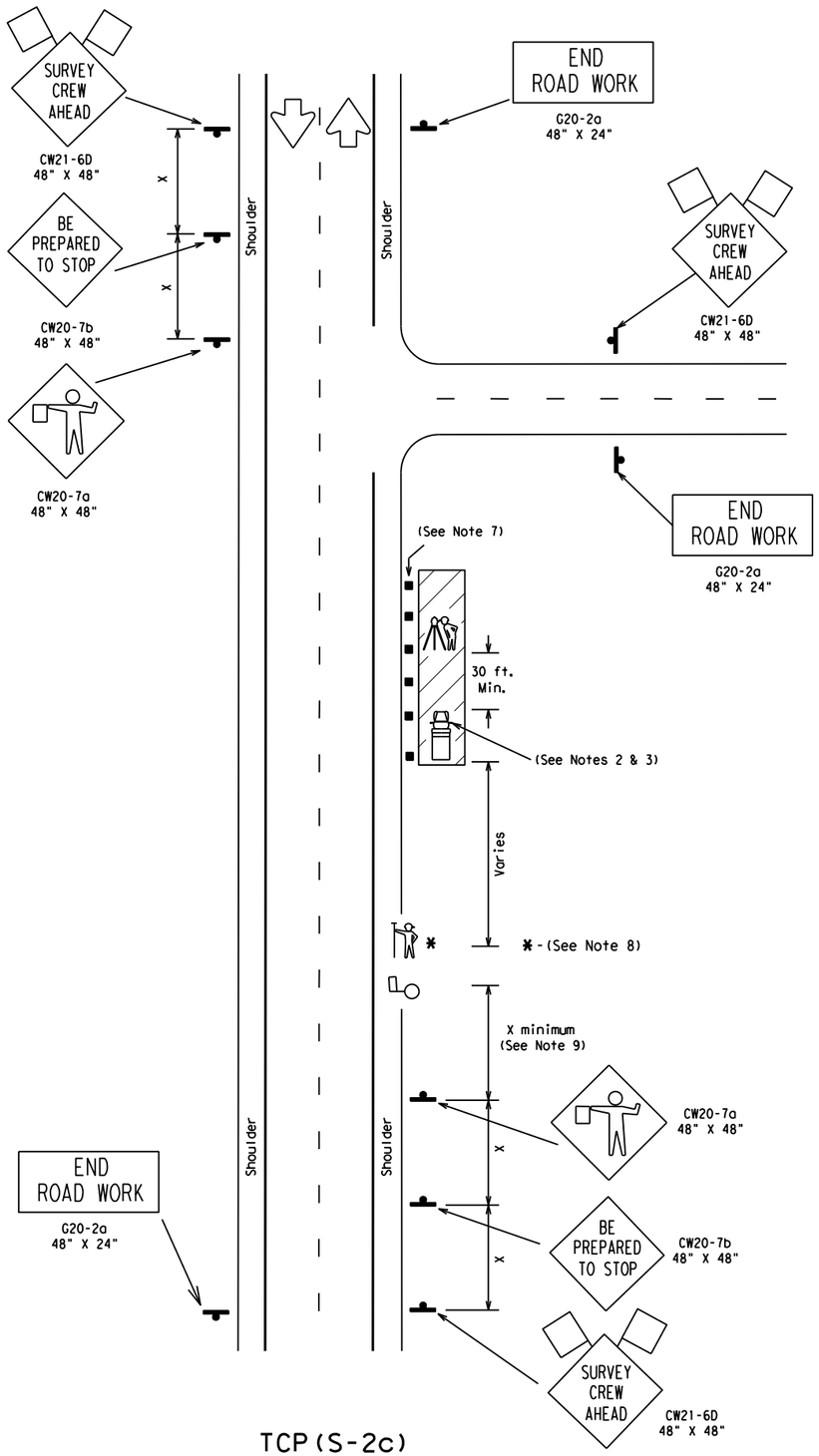
8-18-08 Revision
1 Corrected referrence to notes.

Texas Department of Transportation
Traffic Operations Division

TRAFFIC CONTROL PLAN FOR SURVEYING OPERATIONS

TCP(S-2)-08A

REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
8-08	CONT	SECT	JOB	HIGHWAY
	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		52



TCP(S-2c)

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

LEGEND

Type III Barricade ■ ■ Channelizing Devices Flag

Work Vehicle Truck Mounted Attenuator (TMA)

Flagger Sign Post Survey Rodman Instrument Person

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

* Conventional Roads Only

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

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

DEFINITIONS:

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

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

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

GENERAL NOTES:

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

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

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

Texas Department of Transportation
Traffic Operations Division

TRAFFIC CONTROL PLAN FOR SURVEYING OPERATIONS

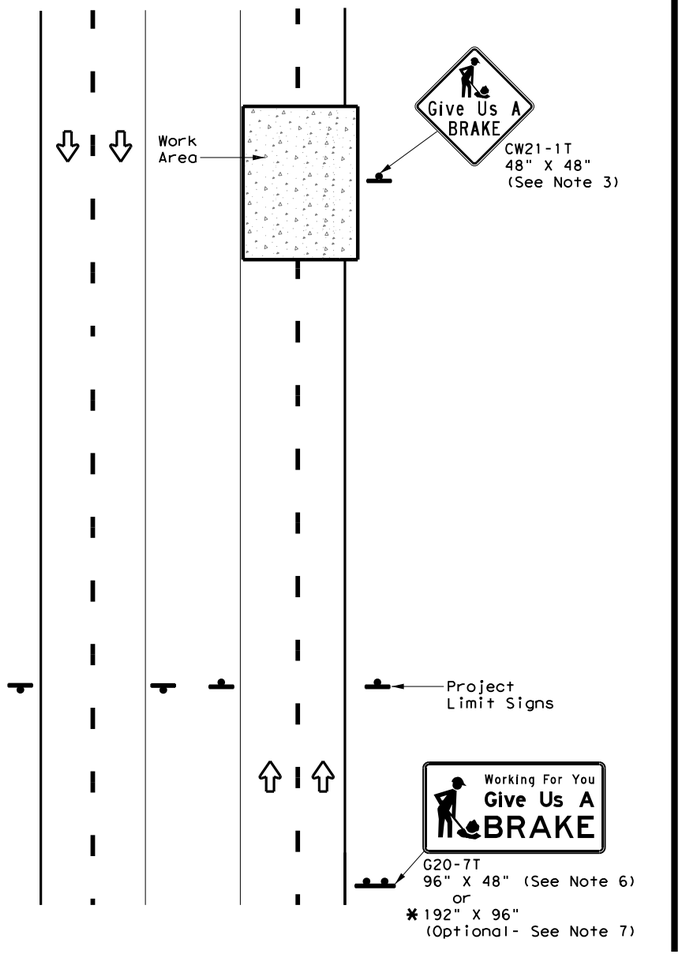
TCP(S-2c)-10

REVISIONS

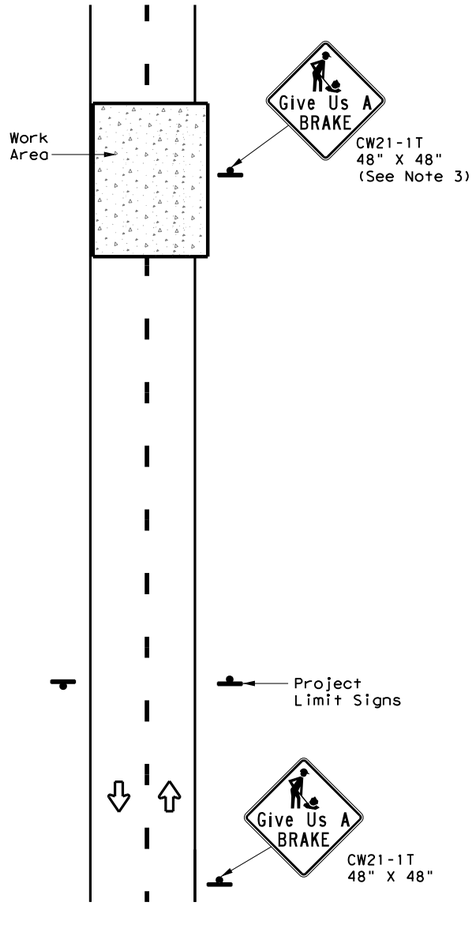
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		53

212A

DATE:
FILE:



DIVIDED HIGHWAY



UNDIVIDED HIGHWAY

SIGNS ARE SHOWN FOR ONE DIRECTION OF TRAVEL

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

DATE:
FILE:

SUMMARY OF LARGE SIGNS

BACKGROUND COLOR	SIGN DESIGNATION	SIGN	SIGN DIMENSIONS	REFLECTIVE SHEETING	SQ FT	GALVANIZED STRUCTURAL STEEL			DRILLED SHAFT 24" DIA. (LF)
						Size	(LF) ①	(LF) ②	
Orange	G20-7T	Working For You Give Us A BRAKE	96" X 48"	Type B_{FL} or C_{FL}	32	▲	▲	▲	▲
Orange	G20-7T	Working For You Give Us A BRAKE	192" X 96"	Type B_{FL} or C_{FL}	128	W8x18	16	17	12

▲ See Note 6 Below

LEGEND	
	Sign
	Large Sign
	Traffic Flow

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

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B_{FL} OR TYPE C_{FL}
BLACK	LEGEND & BORDERS	NON-REFLECTIVE ACRYLIC FILM

GENERAL NOTES

1. See BC and SMD sheets for additional sign support details.
2. Sign locations shall be approved by the Engineer.
3. For projects more than two miles in length, Give Us a BRAKE signs should be repeated halfway through the project. The Give Us a Brake (CW21-1T) may be used for this purpose.
4. Work zone speed limits are sometimes used in conjunction with GIVE US A BRAKE signing. See BC(3) for location and spacing of construction speed zone signing when required.
5. Give Us a Brake (CW21-1T) signs and supports shall be considered subsidiary to Item 502, "Barricades, Signs and Traffic Handling."
6. The 96" X 48" Working For You Give Us A BRAKE (G20-7T) may use a 1/2" or 5/8" plywood substrate or 0.125" aluminum sheeting substrate and may be supported by two 4" x 6" wood posts with drilled holes for breakaway as per BC(5) and will be subsidiary to Item 502.
7. The Working For You Give Us A BRAKE (G20-7T) 192" X 96" sign shall be paid for under the following specification items:
   Item 636 - Aluminum Signs
   Item 647 - Large Roadside Sign Supports and Assemblies.
   Item 416 - Drilled Shaft Foundations
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.

Texas Department of Transportation

Traffic Operations Division Standard

WORK ZONE "GIVE US A BRAKE" SIGNS

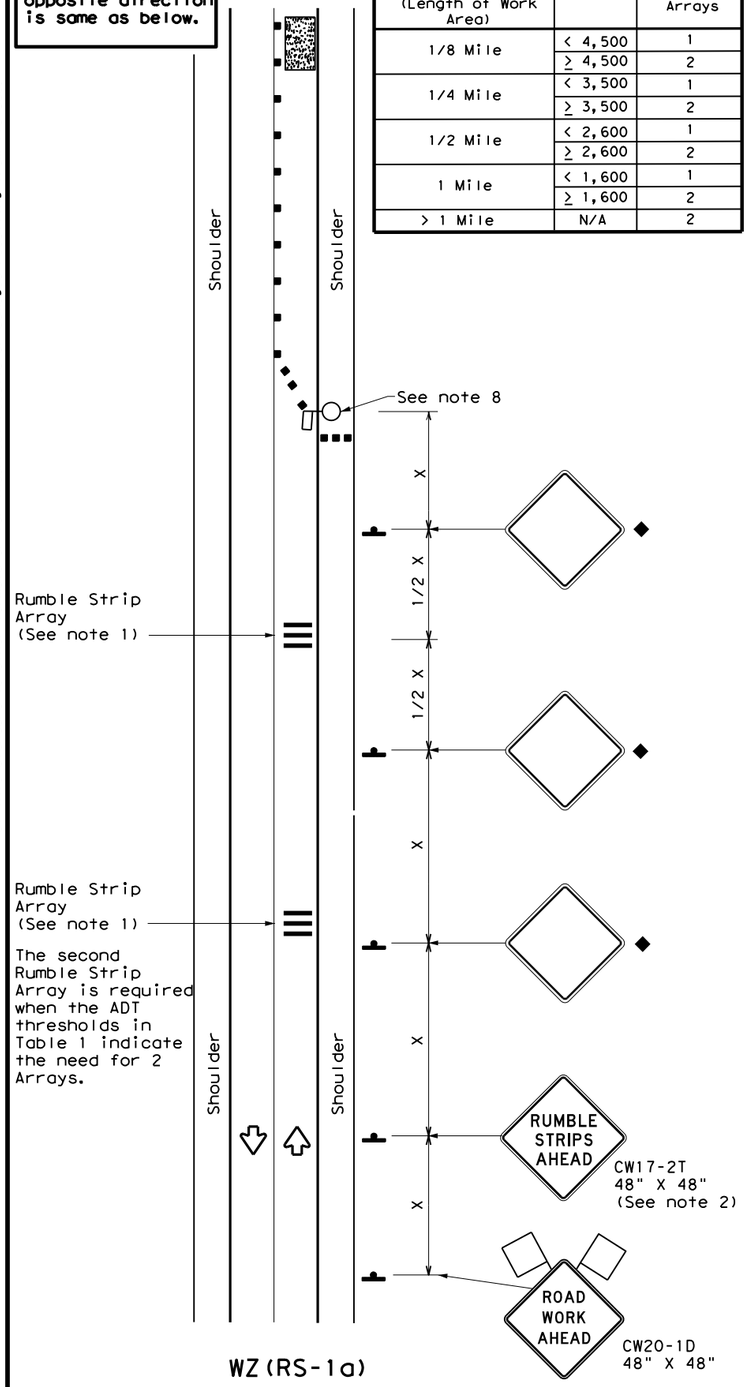
WZ(BRK)-13

FILE: wzbrk-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 1995	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
6-96 5-98 7-13	DIST	COUNTY		SHEET NO.
8-96 3-03	LFK	HOUSTON		54

116

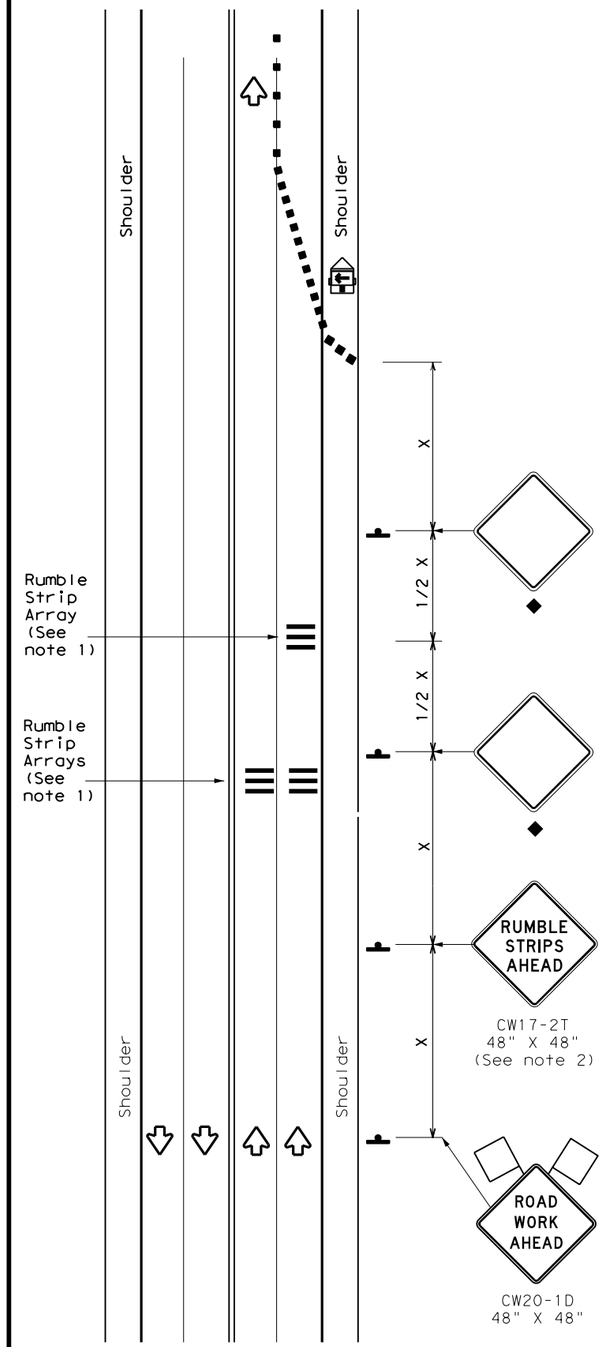
Warning sign and rumble strip sequence in opposite direction is same as below.

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

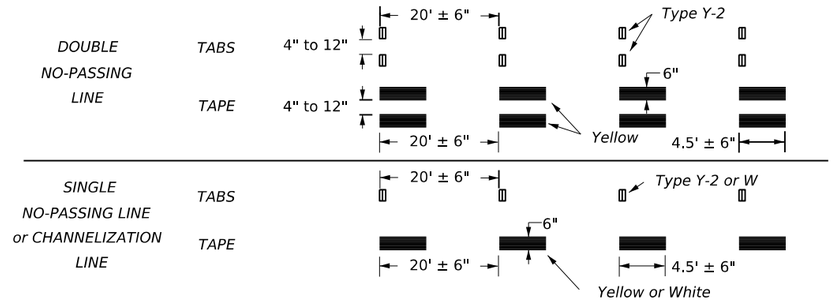
TEMPORARY RUMBLE STRIPS

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	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		55

DATE:
FILE:

WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



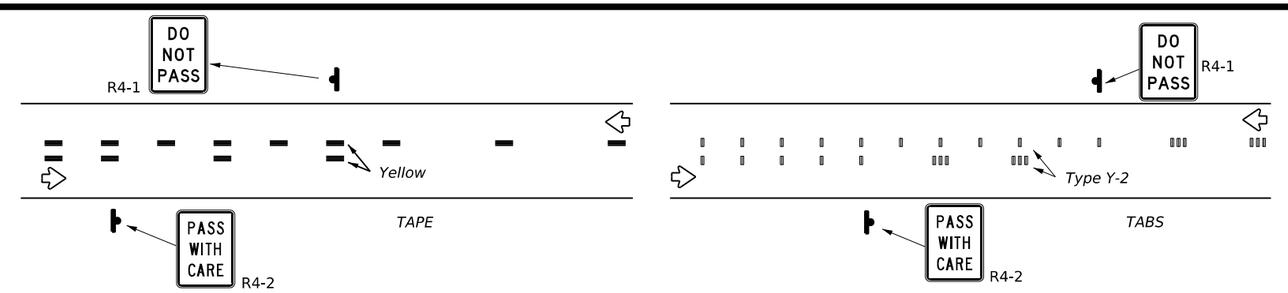
NOTES:

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.

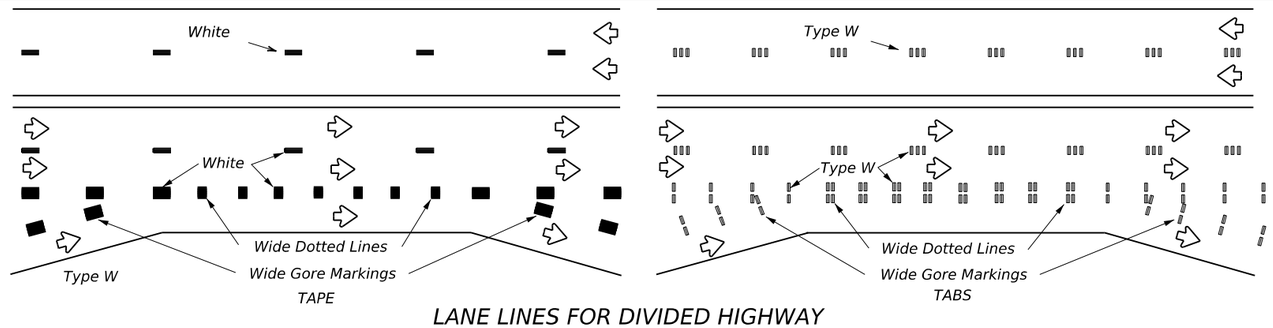
TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

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.

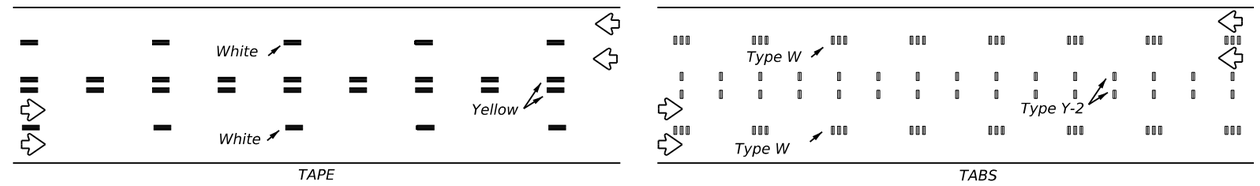
WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



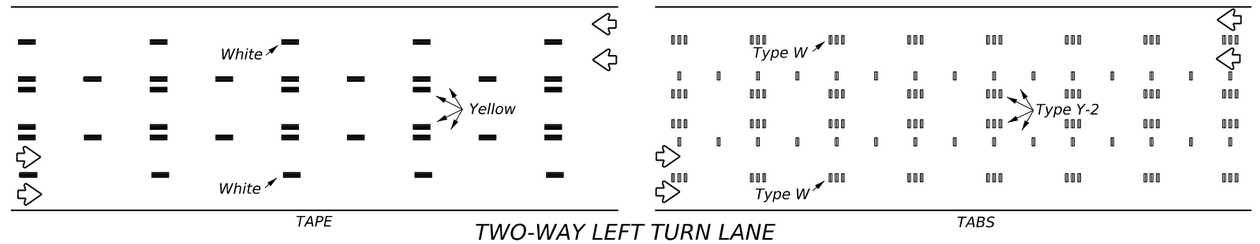
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



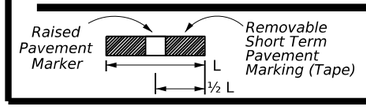
LANE LINES FOR DIVIDED HIGHWAY



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

FILE: wzstpm-23.dgn	DN:	CK:	DW:	CK:
©TxDOT February 2023	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
4-92 7-13	DIST	COUNTY		SHEET NO.
1-97 2-23	LFK	HOUSTON		56
3-03				

DATE:
FILE:

SH 21 SUPERELEVATION DATA (0118-01-022)

STATION			TRAVEL LANE CROSS SLOPE LEFT (%)	TRAVEL LANE CROSS SLOPE RIGHT (%)	ADDITIONAL HOT MIX (TONS)
BEGIN CSJ 0118-01-022					
		>	-3.40%	3.40%	227.00
SUPERELEVATION TRANSITION					
172+95.62	IN FS / IN CURVE				
178+50	END FS				
SUPERELEVATION TRANSITION					
180+12	BEGIN NC				
		>	-2.00%	-2.00%	
230+76	END NC				
SUPERELEVATION TRANSITION					
233+16	BEGIN FS				
		>	6.00%	-6.00%	612.00
245+89	END FS				
SUPERELEVATION TRANSITION					
248+29	BEGIN NC				
		>	-2.00%	-2.00%	
255+26	END NC				
SUPERELEVATION TRANSITION					
257+48	BEGIN FS				
		>	-5.40%	5.40%	423.00
263+39	END FS				
SUPERELEVATION TRANSITION					
265+61	BEGIN NC				
		>	-2.00%	-2.00%	
276+01	END NC				
SUPERELEVATION TRANSITION					
278+23	BEGIN FS				
		>	-5.40%	5.40%	312.00
283+94	END FS				
SUPERELEVATION TRANSITION					
286+16	BEGIN NC				
		>	-2.00%	-2.00%	
311+53	END NC				
SUPERELEVATION TRANSITION					
313+75	BEGIN FS				
		>	-5.40%	5.40%	391.00
319+21	END FS				
SUPERELEVATION TRANSITION					
321+43	BEGIN NC				
		>	-2.00%	-2.00%	
335+55	END NC				
SUPERELEVATION TRANSITION					
337+77	BEGIN FS				
		>	-5.40%	5.40%	277.00
340+81	END FS				
SUPERELEVATION TRANSITION					
343+03	BEGIN NC				
		>	-2.00%	-2.00%	
				CSJ SUB TOTAL	2242.00

SH 21 SUPERELEVATION DATA (0118-01-022) (CONT)

STATION			TRAVEL LANE CROSS SLOPE LEFT (%)	TRAVEL LANE CROSS SLOPE RIGHT (%)	ADDITIONAL HOT MIX (TONS)
CONTINUE CSJ 0118-01-022					
		>	-2.00%	-2.00%	
352+40	END NC				
SUPERELEVATION TRANSITION					
354+62	BEGIN FS				
		>	5.40%	-5.40%	166.21
357+37	END FS				
SUPERELEVATION TRANSITION					
359+59	BEGIN NC				
		>	-2.00%	-2.00%	
388+51	END NC				
SUPERELEVATION TRANSITION					
390+13	BEGIN FS				
		>	3.40%	-3.40%	540.00
394+66	END FS				
SUPERELEVATION TRANSITION					
396+28	BEGIN NC				
		>	-2.00%	-2.00%	
437+50	END NC				
SUPERELEVATION TRANSITION					
439+72	BEGIN FS				
		>	-5.40%	5.40%	448.00
444+26	END FS				
SUPERELEVATION TRANSITION					
446+48	BEGIN NC				
		>	-2.00%	-2.00%	
	END NC				
SUPERELEVATION TRANSITION					
	BEGIN FS				
		>			
	END FS				
SUPERELEVATION TRANSITION					
	BEGIN NC				
		>			
	END NC				
SUPERELEVATION TRANSITION					
	BEGIN FS				
		>			
	END FS				
SUPERELEVATION TRANSITION					
	BEGIN NC				
		>			
END CSJ 0118-01-022					
				CSJ TOTAL	3396.21

SH 21 SUPERELEVATION DATA (0118-02-036)

STATION			TRAVEL LANE CROSS SLOPE LEFT (%)	TRAVEL LANE CROSS SLOPE RIGHT (%)	ADDITIONAL HOT MIX (TONS)
BEGIN CSJ 0118-02-036 (0+00.00)					
		>	2.00%	2.00%	
2+15	END NC				
SUPERELEVATION TRANSITION					
4+37	BEGIN FS				
		>	5.40%	-5.40%	359.00
12+17	END FS				
SUPERELEVATION TRANSITION					
14+39	BEGIN NC				
		>	-2.00%	-2.00%	
28+03	END NC				
SUPERELEVATION TRANSITION					
30+25	BEGIN FS				
		>	5.40%	-5.40%	326.00
33+54	END FS				
SUPERELEVATION TRANSITION					
35+76	BEGIN NC				
		>	-2.00%	-2.00%	
87+66	END NC				
SUPERELEVATION TRANSITION					
89+88	BEGIN FS				
		>	-5.40%	5.40%	410.00
95+23	END FS				
SUPERELEVATION TRANSITION					
97+45	BEGIN NC				
		>	-2.00%	-2.00%	
108+57	END NC				
SUPERELEVATION TRANSITION					
110+19	BEGIN FS				
		>	-3.40%	3.40%	129.00
111+11	END FS				
SUPERELEVATION TRANSITION					
112+73	BEGIN NC				
		>	-2.00%	-2.00%	
	END NC				
SUPERELEVATION TRANSITION					
	BEGIN FS				
		>			
	END FS				
SUPERELEVATION TRANSITION					
	BEGIN NC				
		>			
	END NC				
SUPERELEVATION TRANSITION					
	BEGIN FS				
		>			
	END FS				
SUPERELEVATION TRANSITION					
	BEGIN NC				
		>			
END CSJ 0118-02-036					
				CSJ TOTAL	1224.00
				PROJECT TOTAL	4620.21

NC = NORMAL CROWN
FS = FULL SUPERELEVATION

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Richard B. Klatt 10/27/2023
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LOCHNER

Texas Department of Transportation

SUPERELEVATION DATA

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		57

DATE: 10/27/2023 3:36:07 PM
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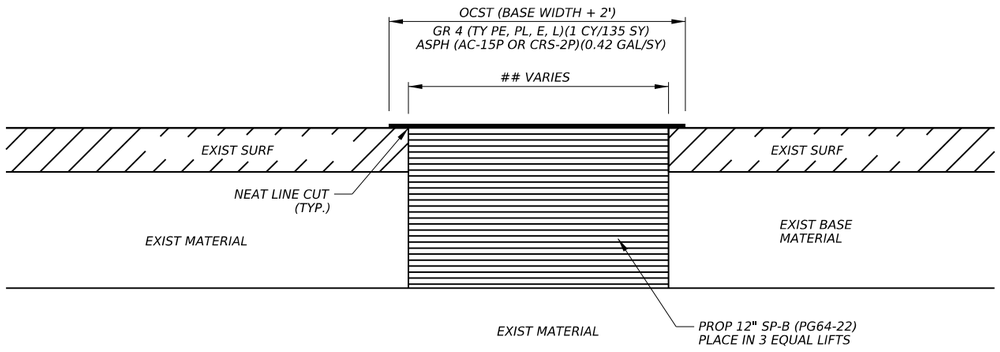
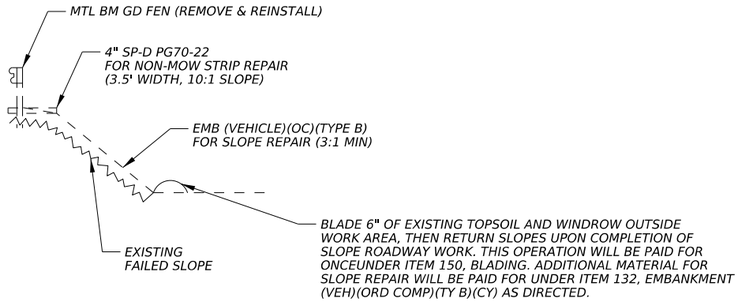
DW:
CK:
DN:



ITEM 351 BASE REPAIR DETAIL

LOCATIONS AS DIRECTED

MINIMUM DIMENSIONS 6' WIDTH X 25' LENGTH



MBGF SLOPE REPAIR DETAIL
HURRICANE BAYOU

N.T.S.

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Richard B. Klatt 11/1/2023
4692CB9B5B4345C...

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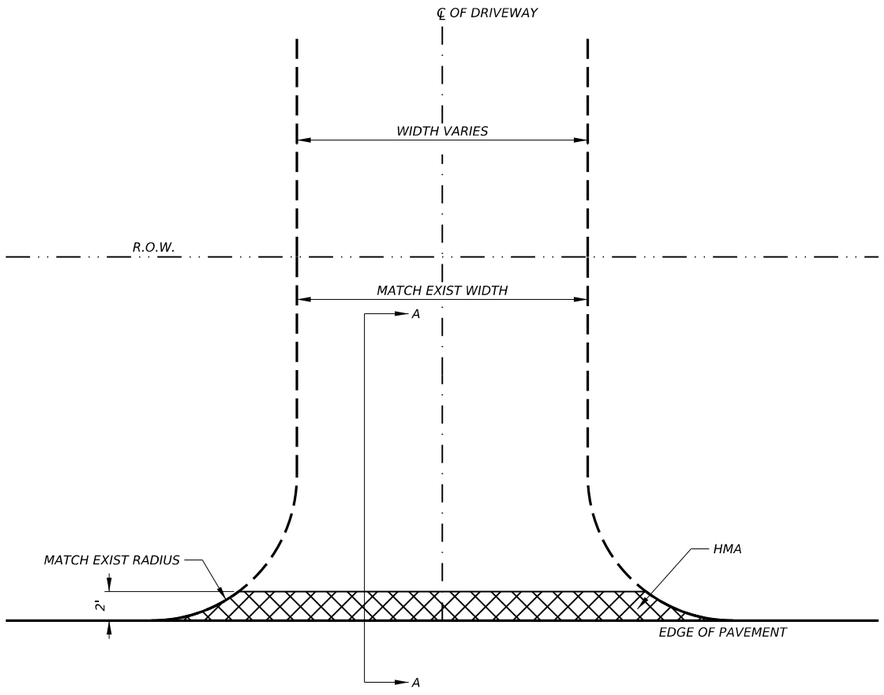
MISCELLANEOUS DETAILS

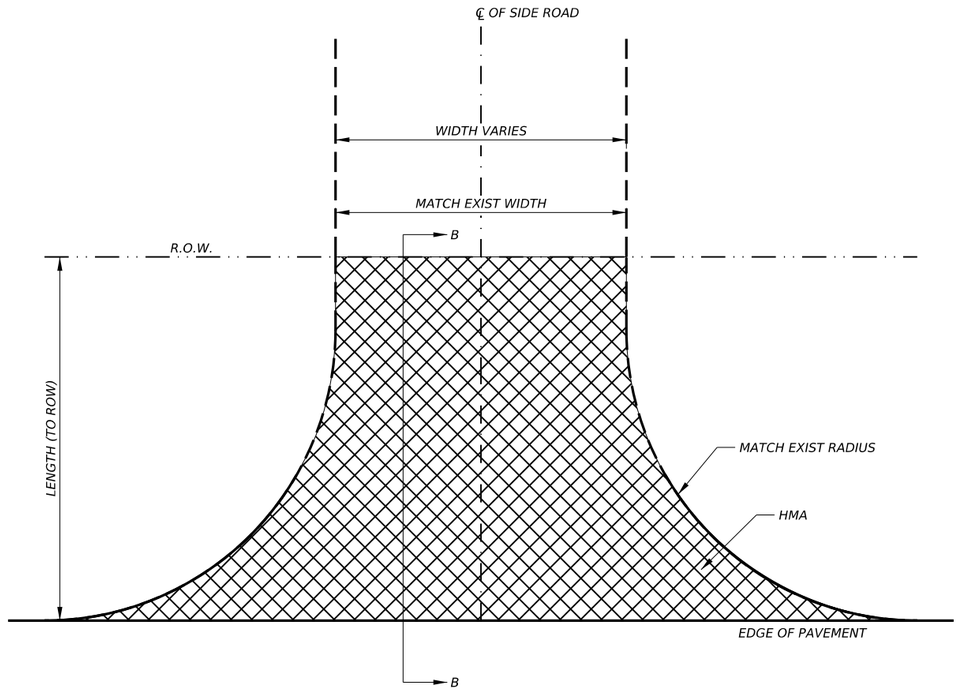
CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		58

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



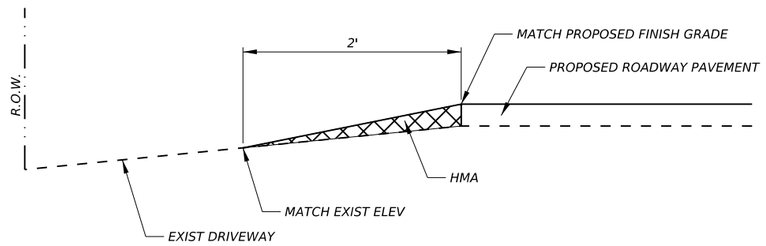
TYPICAL PLAN VIEW OF DRIVEWAY

(USE AS DIRECTED)



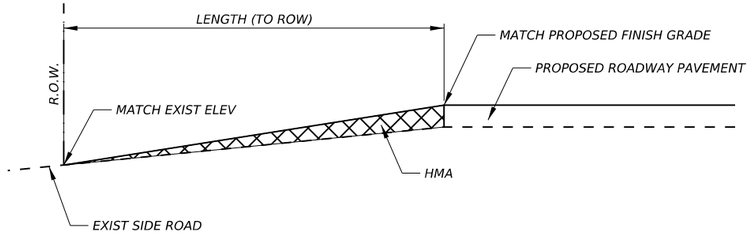
TYPICAL PLAN VIEW OF SIDE ROAD

(USE AS DIRECTED)



SECTION A-A

NO SCALE



SECTION B-B

NO SCALE

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DRIVEWAY & SIDE ROAD DETAILS (OVERLAY PROJECTS)

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		59

DATE: 10/27/2023 1:38:59 PM
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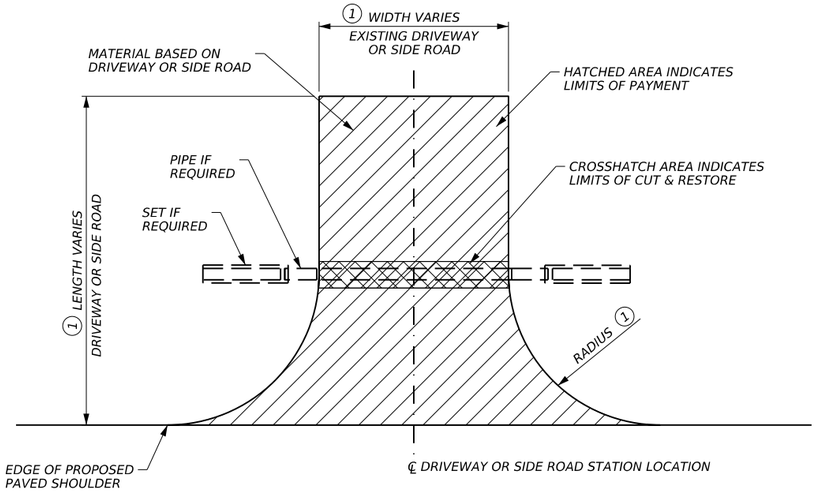
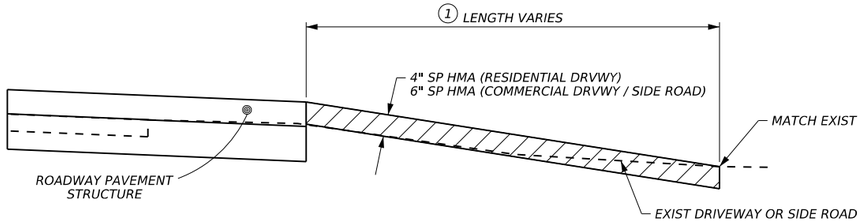


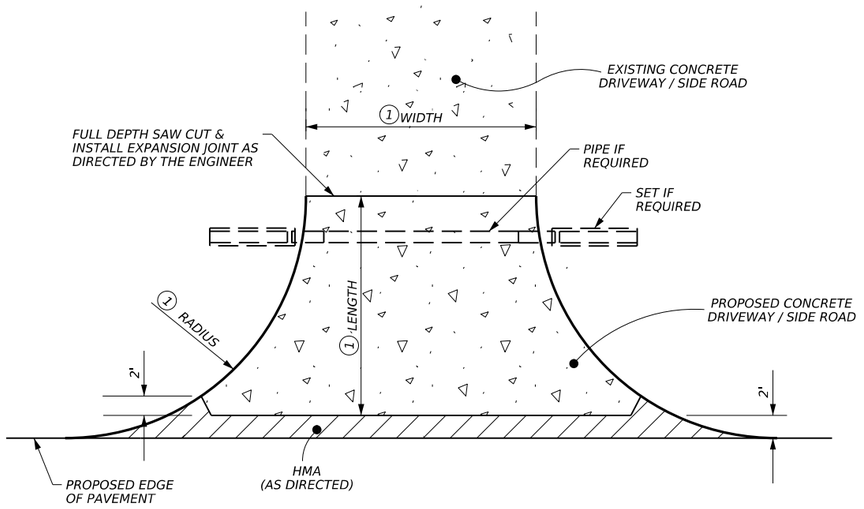
TYPICAL PLAN VIEW OF NON-CONC DRIVEWAY & SIDE ROAD



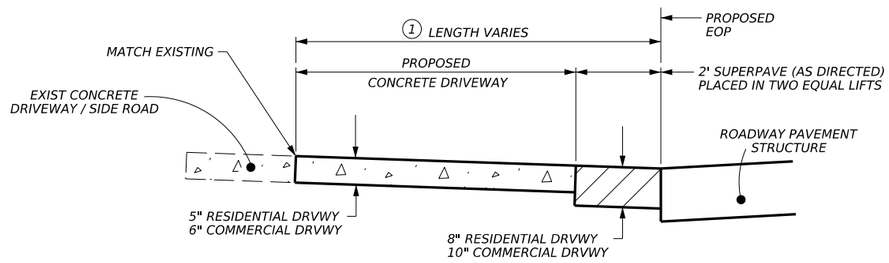
PROFILE (NON-CONCRETE)

DETAIL NOTES:

1. SEE SUMMARY ELSEWHERE IN PLANS FOR LENGTH, WIDTH, AND RADIUS



TYPICAL PLAN VIEW OF CONCRETE DRIVEWAY & SIDE ROAD



PROFILE (CONCRETE)

NOT TO SCALE

GENERAL NOTES:

1. CONCRETE SURFACE - USE REINFORCING STEEL CONSISTING OF NO. 3 OR 4 BARS MEETING THE REQUIREMENTS OF GRADE 60 REINFORCING STEEL. PLACE BARS ON 12 INCH CENTERS IN EACH DIRECTION, SUPPORTED ON REINFORCING CHAIRS.
2. CONCRETE SURFACE - WELDED WIRE FABRIC WILL NOT BE ALLOWED FOR REINFORCING.
3. CONCRETE SURFACE - UNLESS OTHERWISE DIRECTED, INSTALL 1/2 INCH PREMOLDED EXPANSION JOINT MATERIAL BETWEEN EXISTING CONCRETE AND NEW CONCRETE.
4. PREPARATION AND CONSTRUCTION OF DRIVEWAYS / SIDE ROADS SHALL BE PAID FOR UNDER ITEM 530 INTERSECTIONS, DRIVEWAYS, AND TURNOUTS. NO ADDITIONAL PAYMENT WILL BE MADE FOR REMOVAL OF EXISTING HMA, BASE, GRAVEL AND DIRT DRIVEWAYS. THE NECESSARY EXCAVATION, GRADING, COMPACTION, HMA AND INCIDENTALS WILL BE CONSIDERED SUBSIDIARY TO ITEM 530.
5. ESTABLISH AND MAINTAIN 6:1 SLOPE ALONG SIDES OF DRIVEWAYS AND SIDE ROADS. ADDITIONAL EMBANKMENT REQUIRED WILL BE PAID FOR UNDER ITEM 132, EMBANKMENT (VEHICLE).

DocuSigned by:
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LOCHNER

Texas Department of Transportation

ROADWAY, DRIVEWAY, & SIDE ROAD DETAILS (REHAB & WIDENING PROJECTS)

SHEET 1 OF 2

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		60

DATE: 10/27/2023 1:39:06 PM
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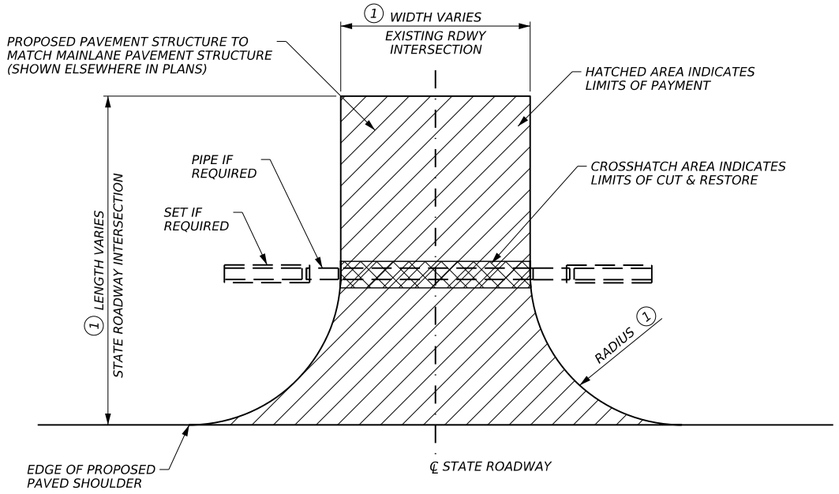
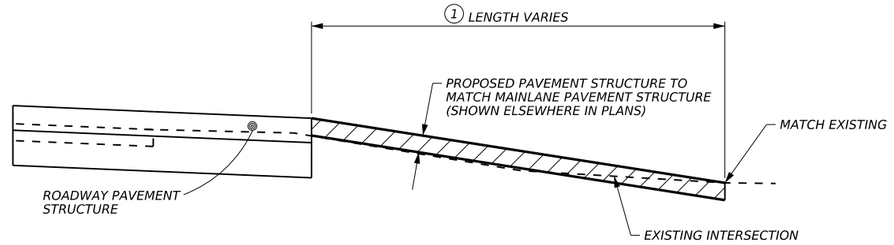


TYPICAL PLAN VIEW OF STATE ROADWAY INTERSECTIONS



PROFILE (STATE ROADWAY INTERSECTIONS)

DETAIL NOTES:

1 SEE SUMMARY ELSEWHERE IN PLANS FOR LENGTH, WIDTH, AND RADIUS

NOT TO SCALE

GENERAL NOTES:

1. CONCRETE SURFACE - USE REINFORCING STEEL CONSISTING OF NO. 3 OR 4 BARS MEETING THE REQUIREMENTS OF GRADE 60 REINFORCING STEEL. PLACE BARS ON 12 INCH CENTERS IN EACH DIRECTION, SUPPORTED ON REINFORCING CHAIRS.
2. CONCRETE SURFACE - WELDED WIRE FABRIC WILL NOT BE ALLOWED FOR REINFORCING.
3. CONCRETE SURFACE - UNLESS OTHERWISE DIRECTED, INSTALL 1/2 INCH PREMOLDED EXPANSION JOINT MATERIAL BETWEEN EXISTING CONCRETE AND NEW CONCRETE.
4. PREPARATION AND CONSTRUCTION OF DRIVEWAYS / SIDE ROADS SHALL BE PAID FOR UNDER ITEM 530 INTERSECTIONS, DRIVEWAYS, AND TURNOUTS. NO ADDITIONAL PAYMENT WILL BE MADE FOR REMOVAL OF EXISTING HMA, BASE, GRAVEL AND DIRT DRIVEWAYS. THE NECESSARY EXCAVATION, GRADING, COMPACTION, HMA AND INCIDENTALS WILL BE CONSIDERED SUBSIDIARY TO ITEM 530.
5. ESTABLISH AND MAINTAIN 6:1 SLOPE ALONG SIDES OF DRIVEWAYS AND SIDE ROADS. ADDITIONAL EMBANKMENT REQUIRED WILL BE PAID FOR UNDER ITEM 132, EMBANKMENT (VEHICLE).

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
10/27/2023

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PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

ROADWAY, DRIVEWAY, & SIDE ROAD DETAILS (REHAB & WIDENING PROJECTS)

SHEET 2 OF 2

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		61

DATE: 10/27/2023 1:39:07 PM
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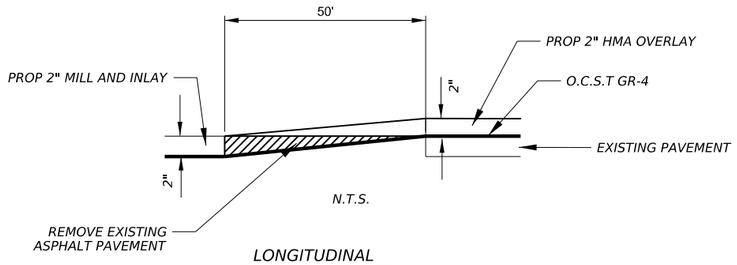
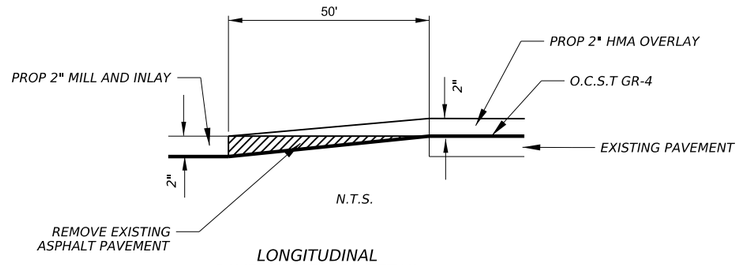
CK:
DN:



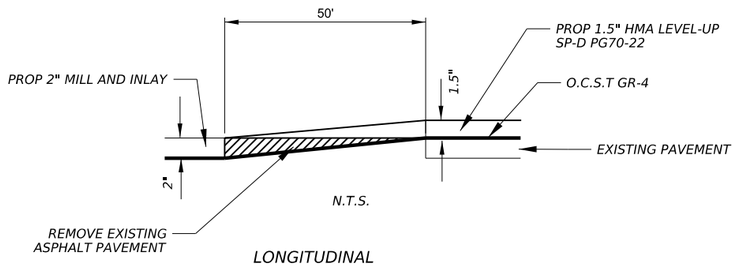
LONGITUDINAL
PAVEMENT TAPER DETAIL
@ CEDAR CREEK

CSJ: 0118-02-024 STA 129+92 TO STA 130+42
STA 133+36 TO STA 133+86



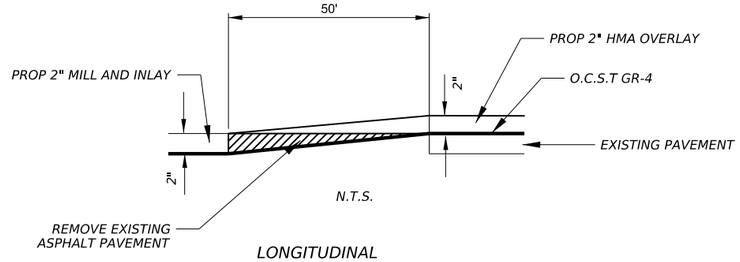
LONGITUDINAL
PAVEMENT TAPER DETAIL
@ BEGINNING OF PROJECT

FROM 35+90.00 TO STA 36+40.00



LONGITUDINAL
PAVEMENT TAPER DETAIL
@ HURRICANE BAYOU

CSJ: 0118-02-022 STA 270+10 TO STA 269+60
STA 232+37 TO STA 232+87



LONGITUDINAL
PAVEMENT TAPER DETAIL
@ END OF PROJECT

FROM STA 133+50.00 TO STA 134+00.00

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Richard B. Klatt 10/27/2023
4692CB9B5B43454...

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RICHARD B. KLATT
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LOCHNER

Texas Department of Transportation

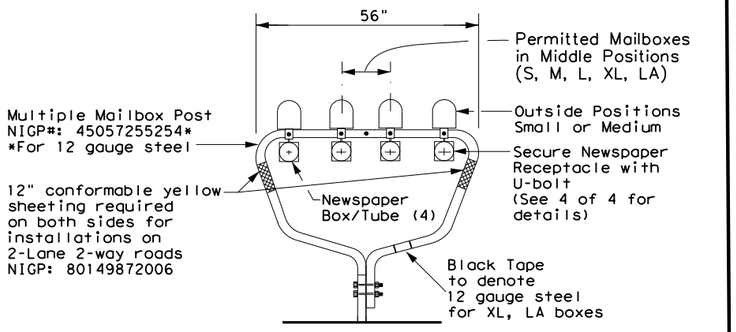
REHAB TAPER DETAIL

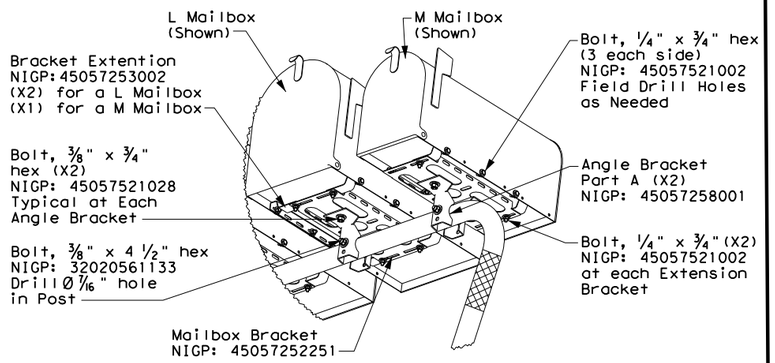
CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		62

DATE: 10/27/2023 1:39:14 PM
FILE: c:\pw_working\lochner-pw-01\dms78273\Rehab Taper.dgn

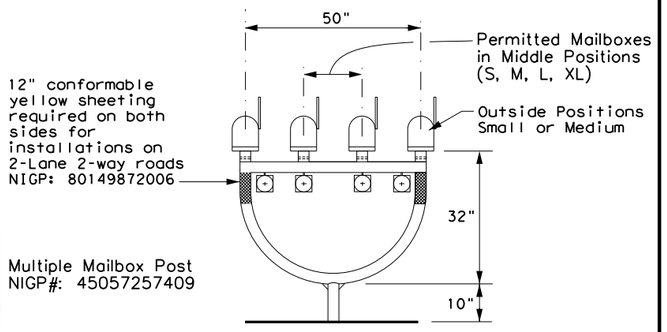
DATE:
FILE:

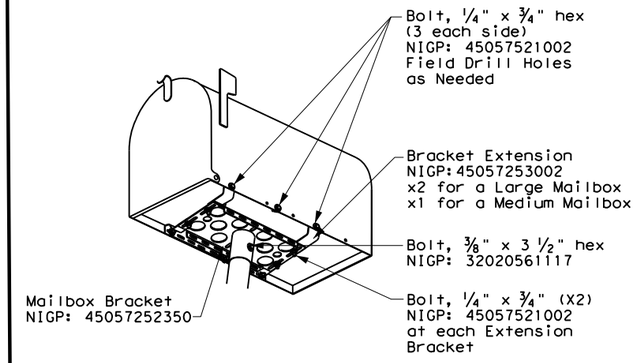
TYPE 1 - MULTIPLE





TYPE 4 - MULTIPLE





MAILBOX SIZES

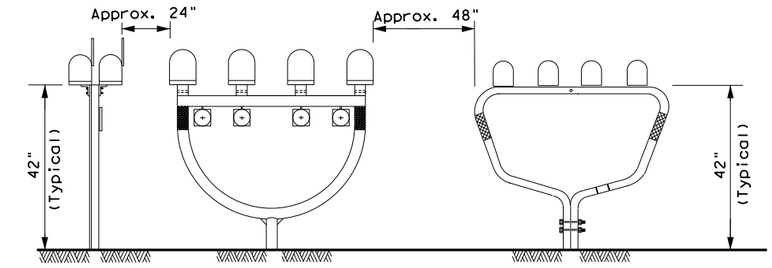
MAILBOX SIZE	TYPICAL DIMENSIONS			MAX **
	LENGTH	WIDTH	HEIGHT	WEIGHT
SMALL	19 1/2"	6"	7"	6 LBS
MEDIUM	22 1/2" *	8" *	11 1/2" *	8 LBS
LARGE	23 1/2"	11 1/2"	13 1/2"	11 LBS
EXTRA LARGE	18"	14"	12"	13 LBS
LOCKABLE	18"	11 1/2"	15"	23 LBS

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

GENERAL NOTES:

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

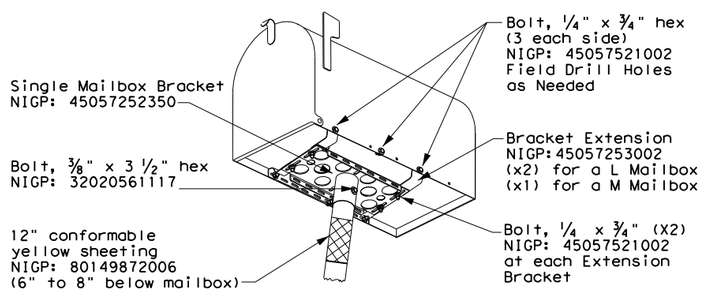
TYPICAL INSTALLATION MEASUREMENTS

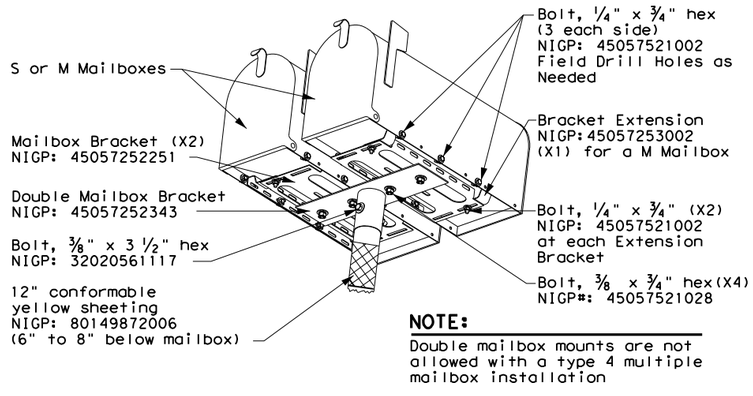


NOTE:

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

TYPE 2 and 4 - SINGLE/DOUBLE

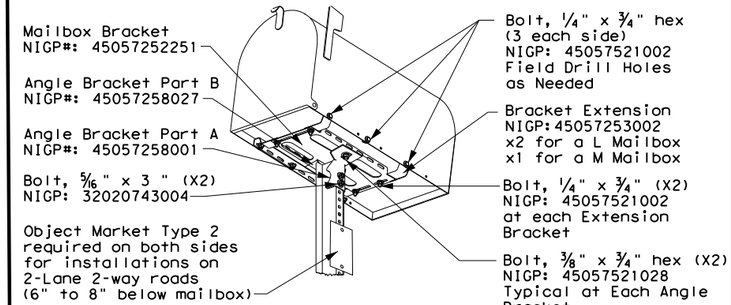


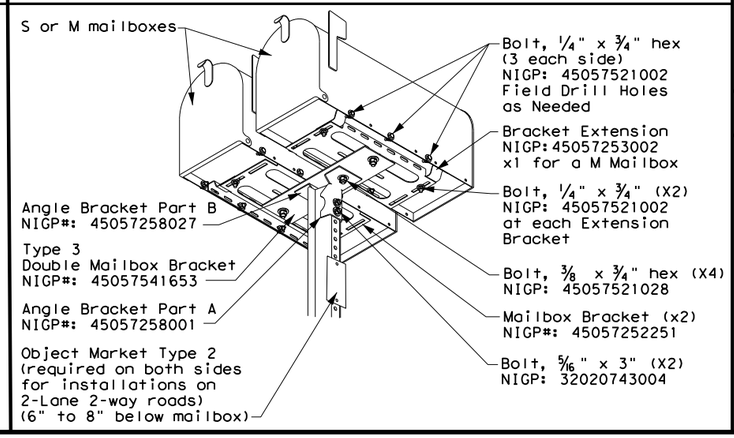


NOTE:

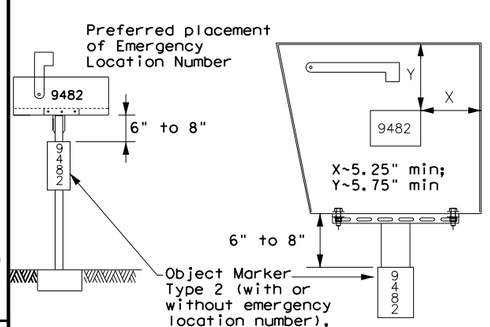
Double mailbox mounts are not allowed with a type 4 multiple mailbox installation

TYPE 3 - SINGLE/DOUBLE





PLACEMENT OF EMERGENCY LOCATION NUMBER

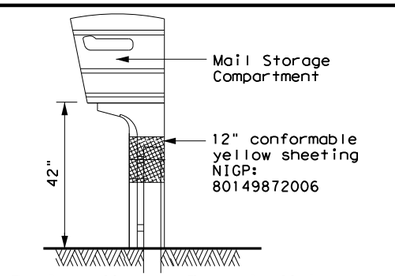


NOTES:

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

SHEET 1 OF 4

TYPE 5



Typical Molded Plastic Mailbox

Texas Department of Transportation

Maintenance Division Standard

MAILBOX MOUNTING AND ASSEMBLY

MB(1)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		63

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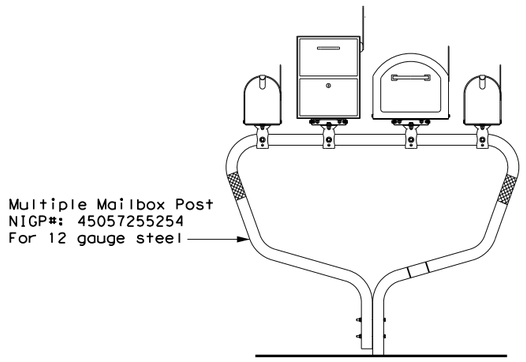
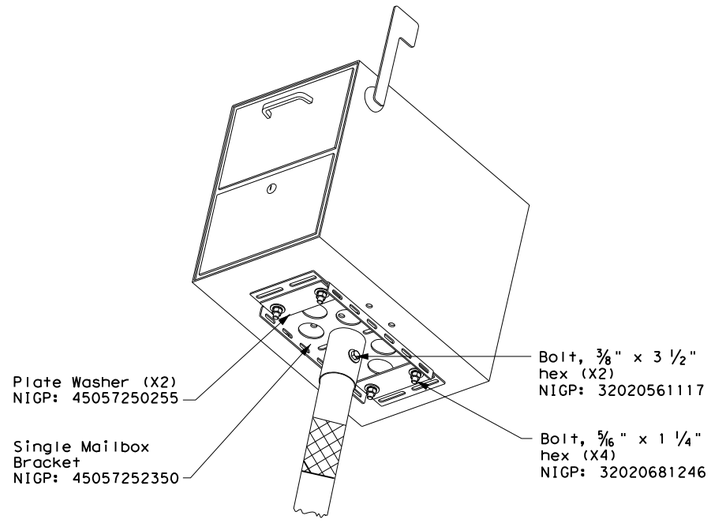
DATE:
FILE:

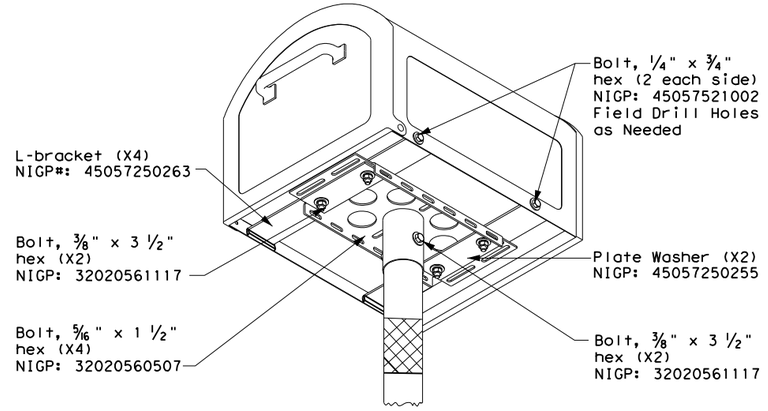
TYPE 1- MULTI LOCKABLE AND XL MAILBOX



TYPE 2/4 - SINGLE LOCKABLE MAILBOX

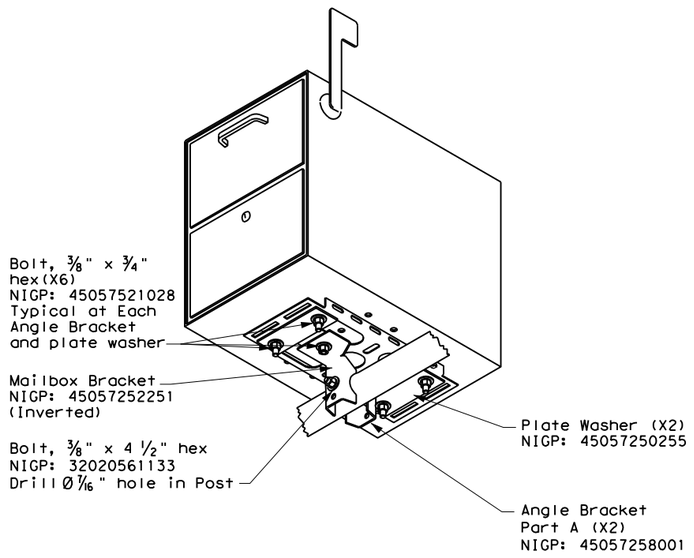


TYPE 2/4 - SINGLE XL MAILBOX

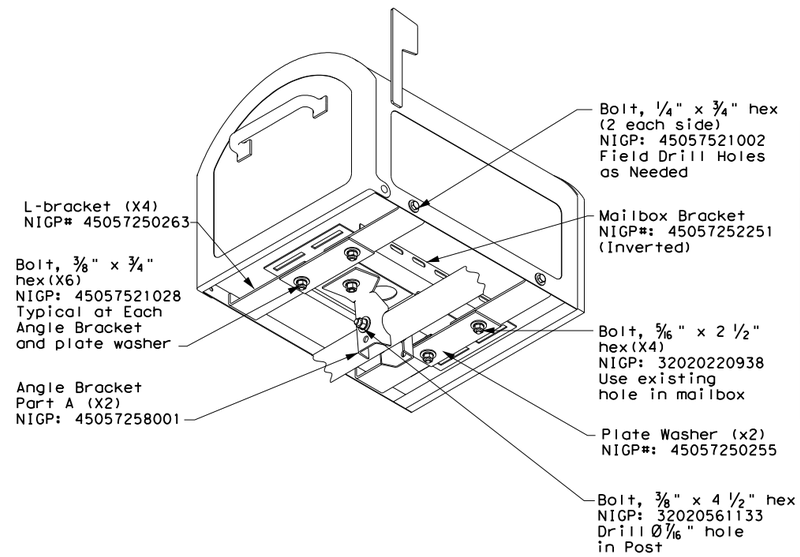


NOTE:
Follow same configuration when mounting an XL mailbox on a Type 4 multi post.

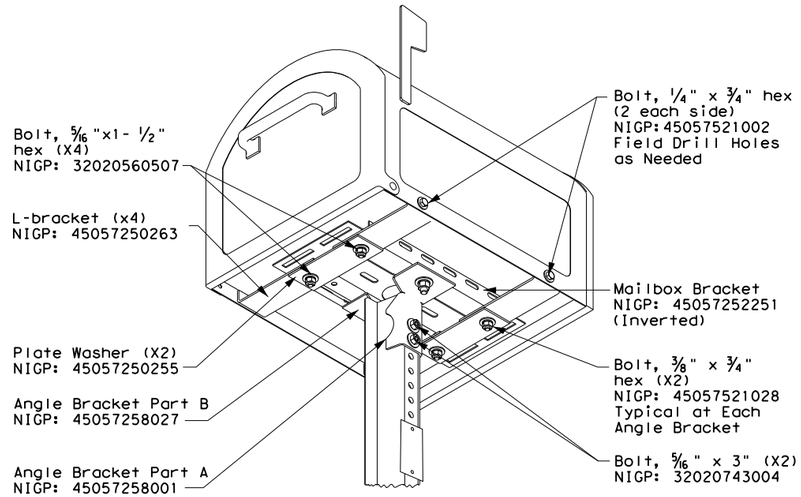
TYPE 1 MULTI – LOCKABLE ARCHITECTURAL (LA)



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

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	0118	02	036, ETC.	SH 21
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	LFK	HOUSTON		64

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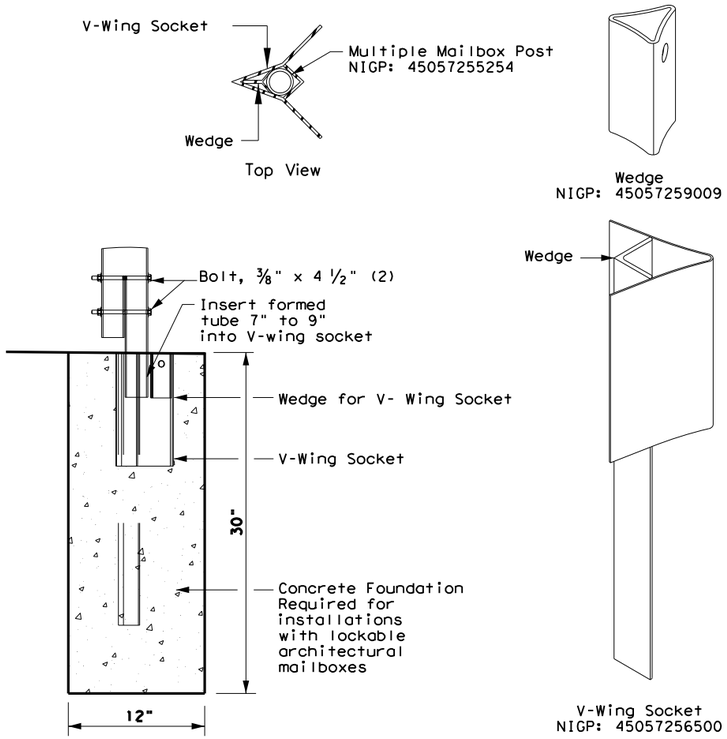
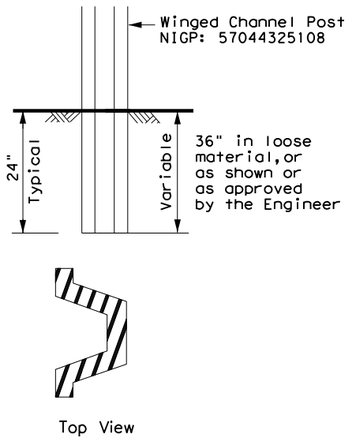
DATE:
FILE:

TYPE 1 - SUPPORT/FOUNDATION

Thin Wall Tube w/ V-LOC Anchorage



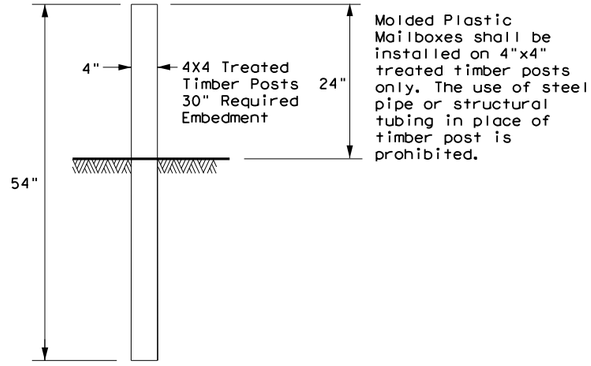
TYPE 3 - SUPPORT/FOUNDATION



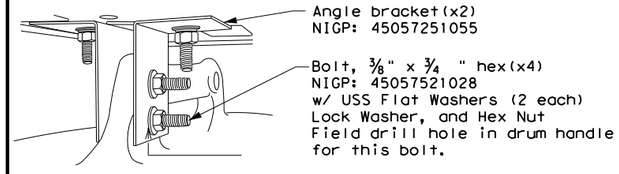
NOTES:

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



TYPE 6 - TEMPORARY MAILBOX SUPPORT



Plastic Drum NIGP: 55093383655
Rubber Collar NIGP: 55093387102

NOTES:

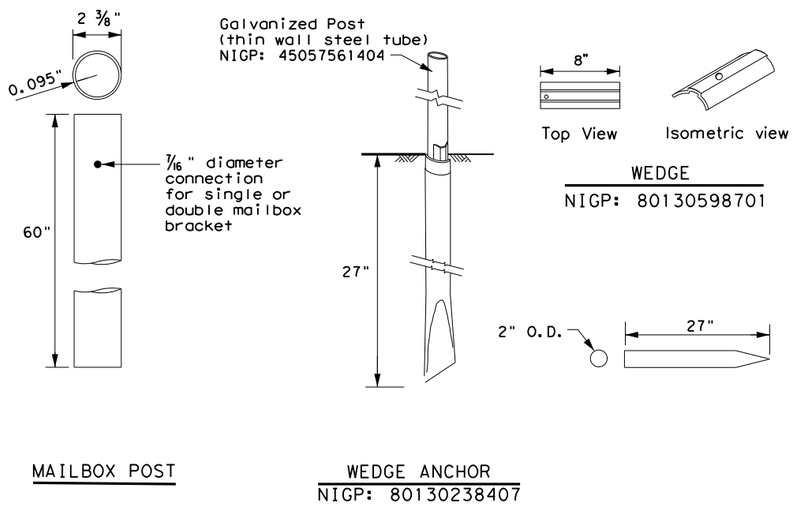
1. Place on approved plastic drum as shown in the Compliant Work Zone Traffic Control Devices (CWZTCD).
2. Existing attachment hardware shall be used unless damaged. Damaged hardware shall be replaced.

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

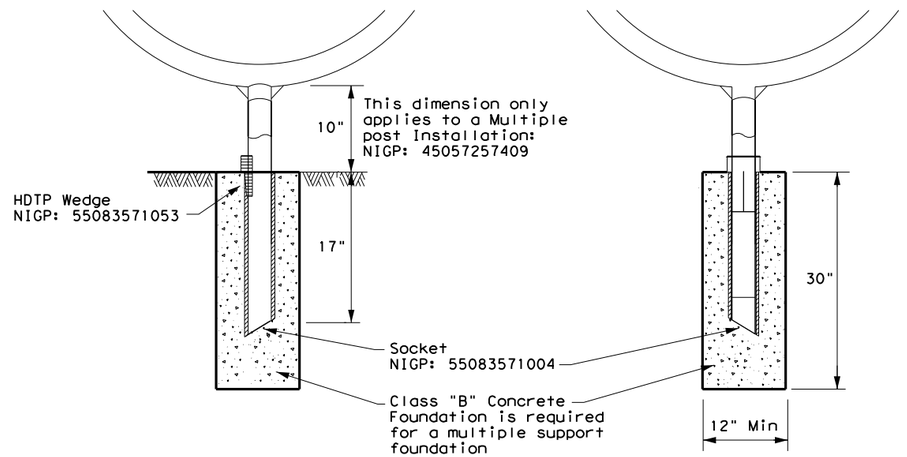


MAILBOX POST

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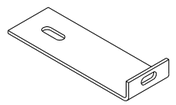
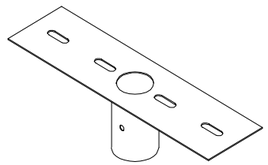
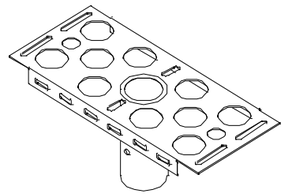
TYPE	TYPE 1	TYPE 2	TYPE 3	TYPE 4			TYPE 5	TYPE 6
Configuration	Multiple	Single or Double	Single or Double	Single	Double	Multiple	Single	Single
Mailbox Size NIGP #	Outside Position: S or M Inside Position: S, M, L, XL, or LA	Single: S, M, L, XL, or LA Double: SS, SM, MM	Single: S, M, L, or XL Double: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



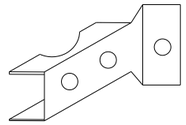
NIGP: 45057250263
L-Bracket x4 for
XL sized mailboxes



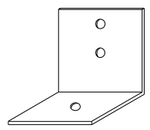
NIGP: 45057252343
Double Mailbox Bracket
For Type 2 and Type 4
double mount



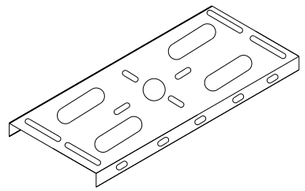
NIGP: 45057252350
Single Mailbox Bracket
For Type 2 single and for
Type 4 single and multi mount



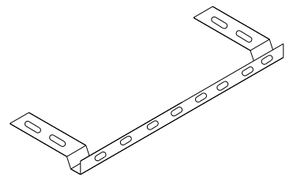
NIGP: 45057258001
Part "A" Angle Bracket
For Type 1 multi (2 per mailbox)
and Type 3 single and double



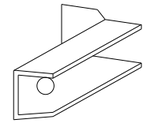
NIGP: 45057251055
Type 6 Angle Bracket
(2 per mailbox)



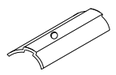
NIGP: 45057252251
Mailbox Bracket
For Type 1 multi and
any double mount (use 2)



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



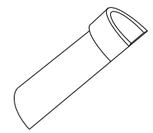
NIGP: 45057258027
Part "B" Angle Bracket
For Type 3 single
and double



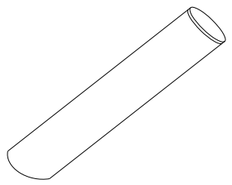
NIGP: 80130598701
Wedge for Type 2

NIGP: 45057250255
Plate Washer for Architecural
and XL Mailboxes

NIGP: 45057541653
Type 3 double mailbox bracket

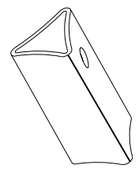


NIGP: 55083571053
Type 4 Mailbox Wedge

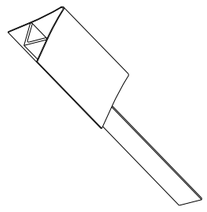


NIGP: 55083571004
Type 4 Mailbox Socket

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

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Maintenance Division Standard

NIGP PARTS LIST AND COMPATIBILITY

MB(4)-21

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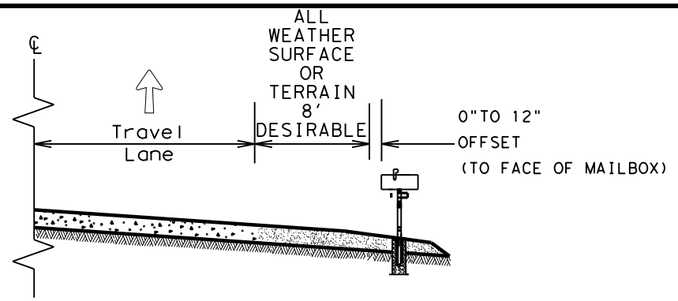
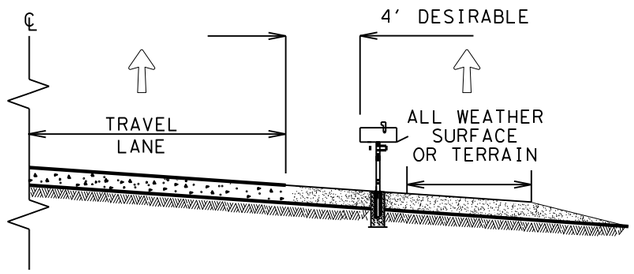
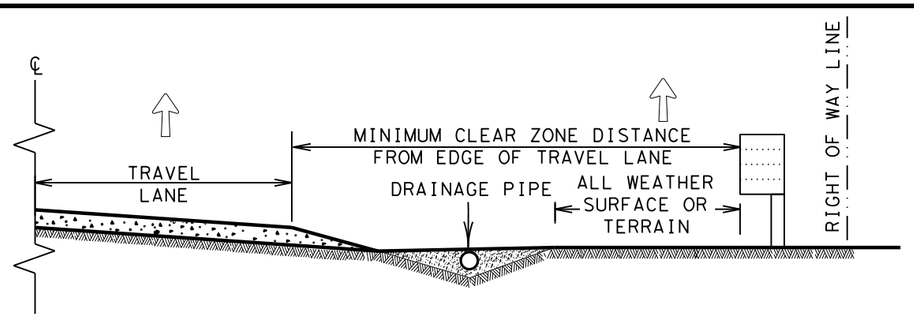
	LFK	HOUSTON		66



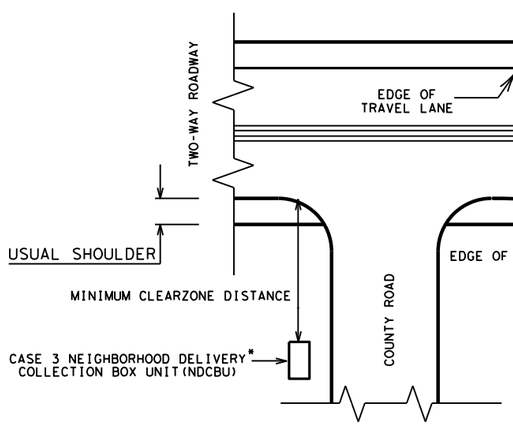
CASE 1. OFF TRAVEL WAY DELIVERY

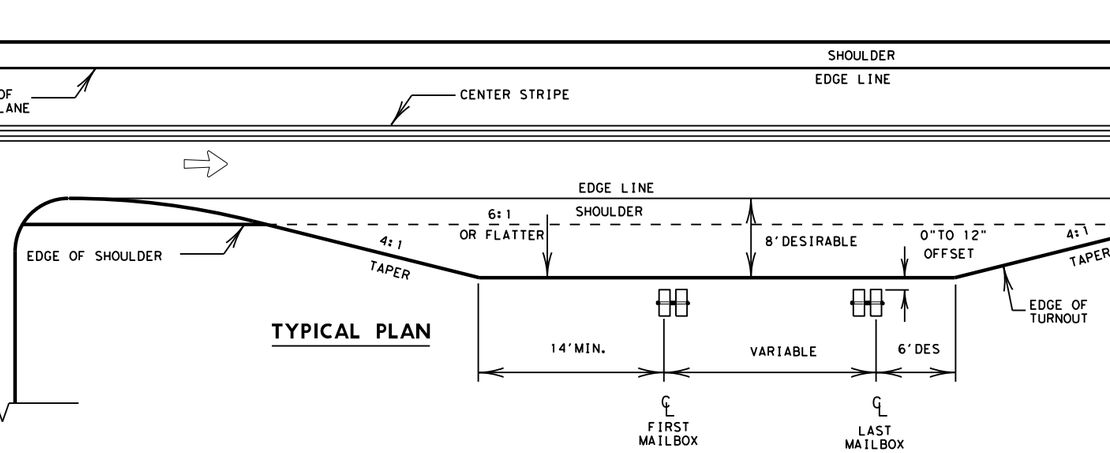


CASE 2. BACK SIDE DELIVERY

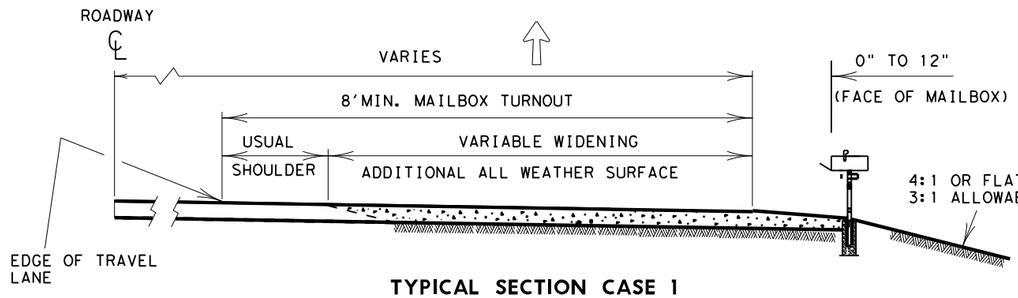


CASE 3. DELIVERY NEAR RIGHT OF WAY LINE





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

DATE:
FILE:

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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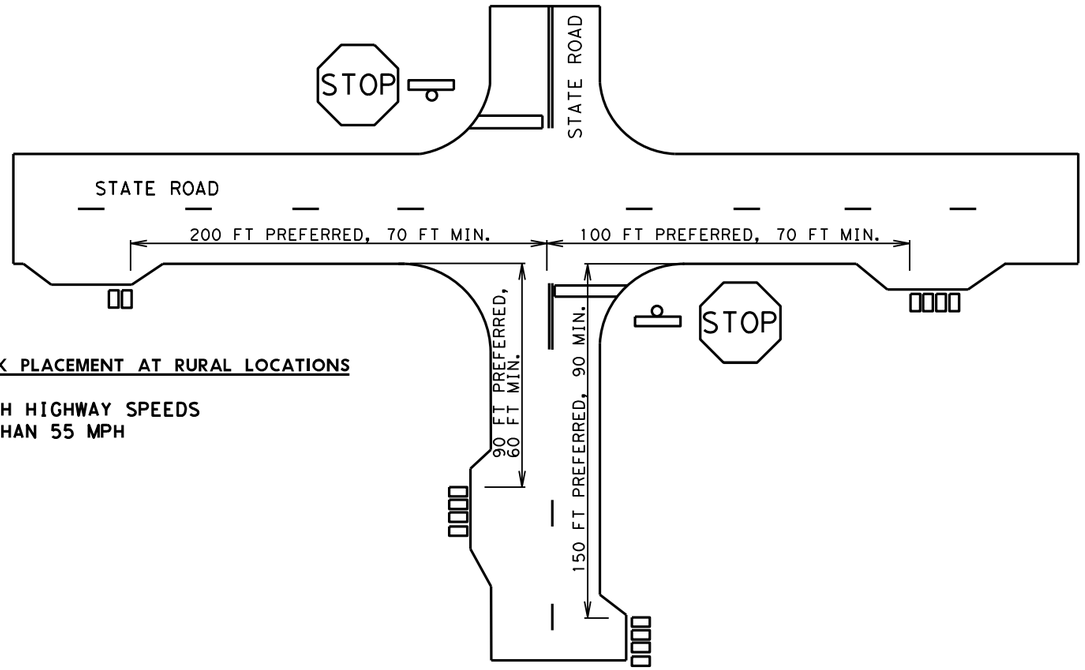
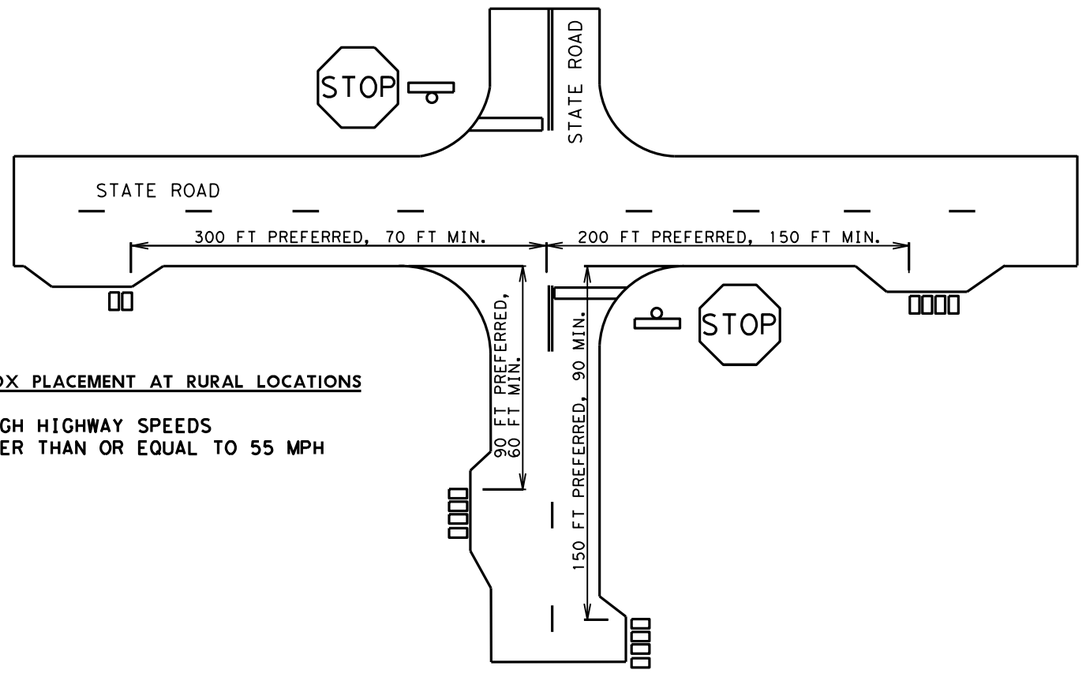
	LFK	HOUSTON		67

DATE:
FILE:



MAILBOX PLACEMENT AT RURAL LOCATIONS

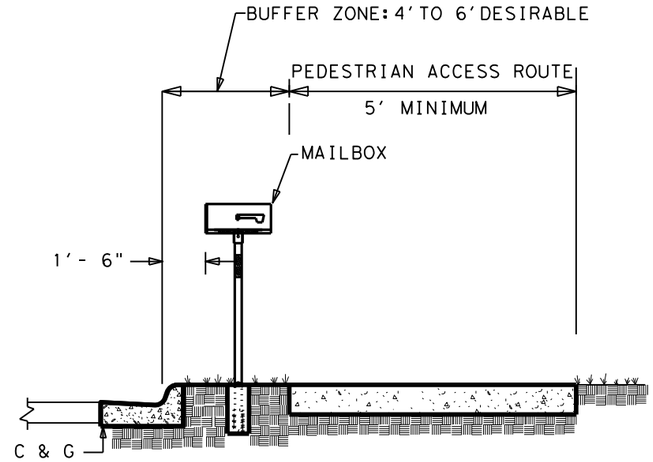
THROUGH HIGHWAY SPEEDS
LESS THAN 55 MPH



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

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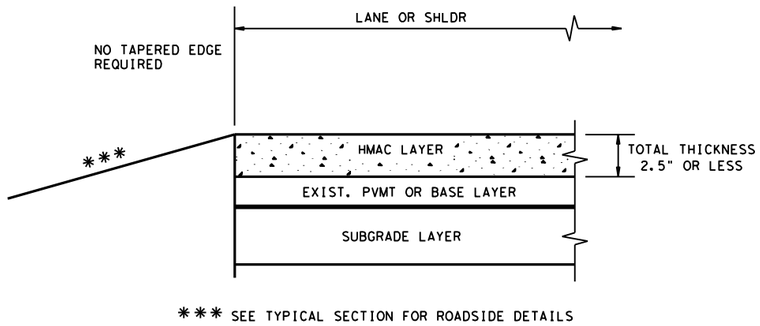
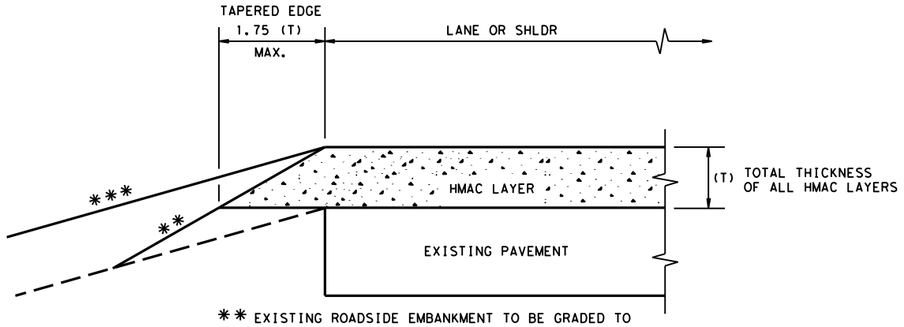
FILE:



*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

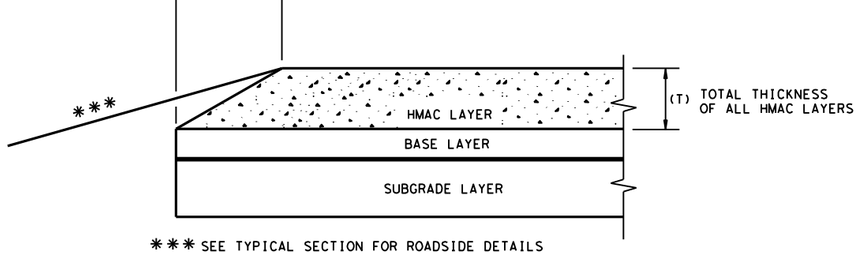
CONDITION - 1
THIN HMAC SURFACES OR HMAC OVERLAY WITH THICKNESS OF 2.5" OR LESS



** 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.

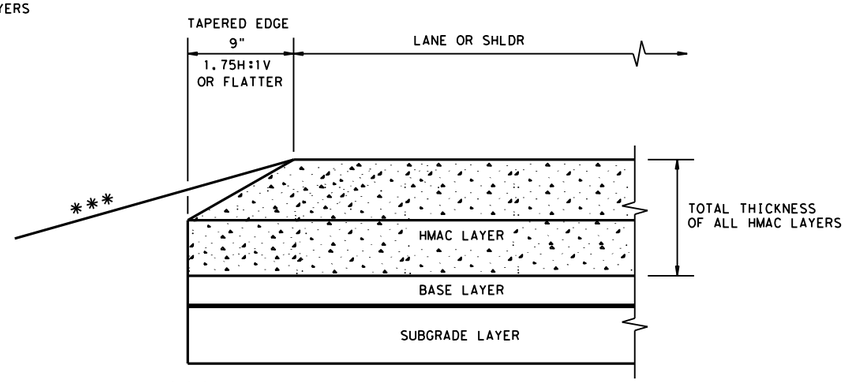
*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

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.

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Design Division Standard

TAPERED EDGE DETAILS HMAC PAVEMENT

TE(HMAC)-11

FILE: tehmac11.dgn	DN: TxDOT	CK: RL	DW: KB	CK:
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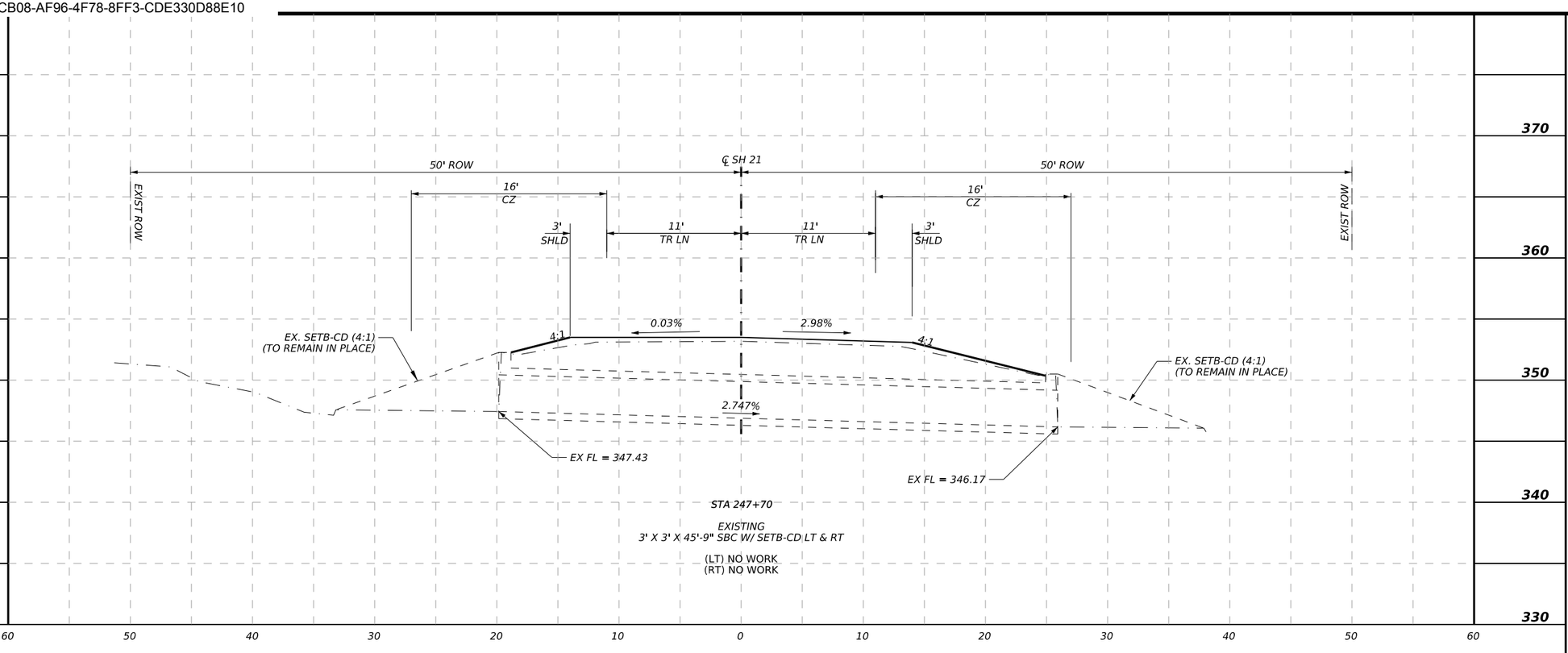
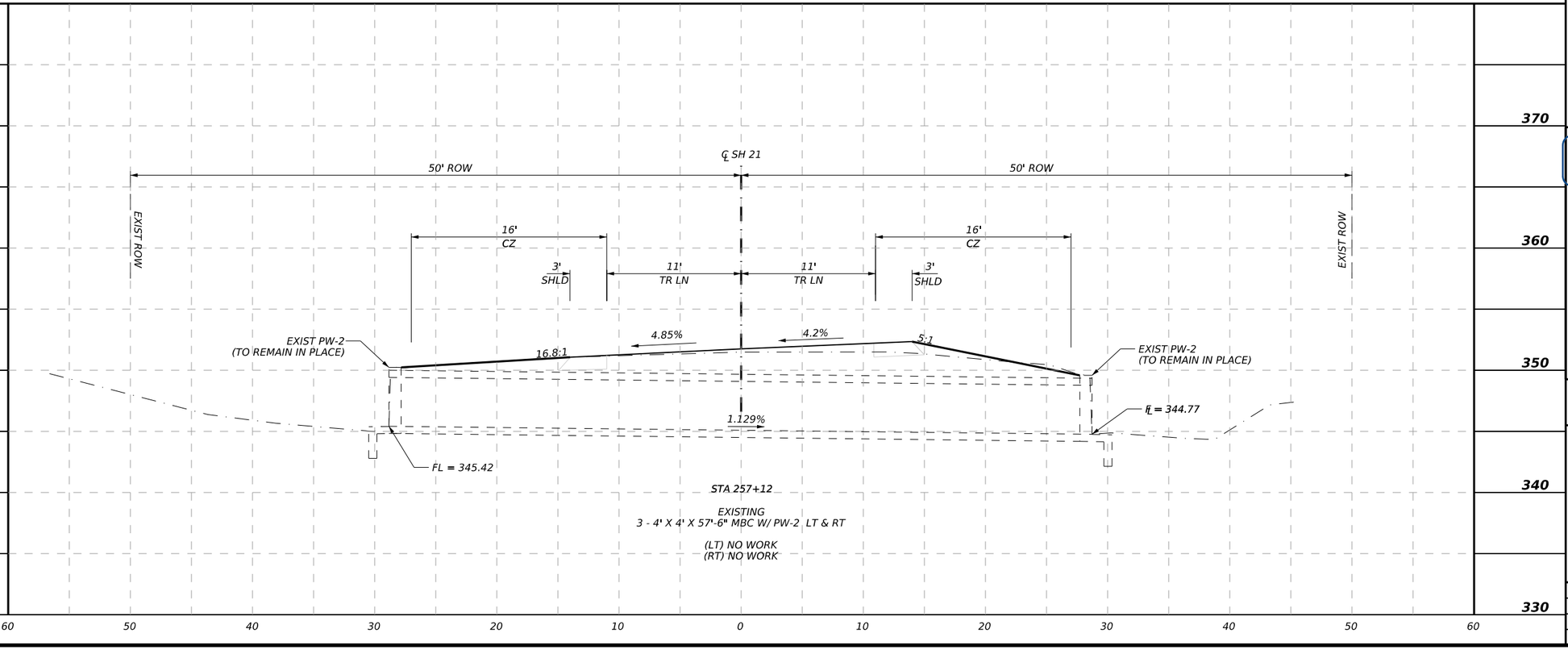
REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		69



STA 247+70

EXISTING
3' X 3' X 45'-9" SBC W/ SETB-CD LT & RT

(LT) NO WORK
(RT) NO WORK



STA 257+12

EXISTING
3 - 4' X 4' X 57'-6" MBC W/ PW-2 LT & RT

(LT) NO WORK
(RT) NO WORK

SCALE 1" = 10'

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10/27/2023

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CULVERT LAYOUTS

SHEET 1 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		70

DATE: 10/27/2023 1:39:49 PM
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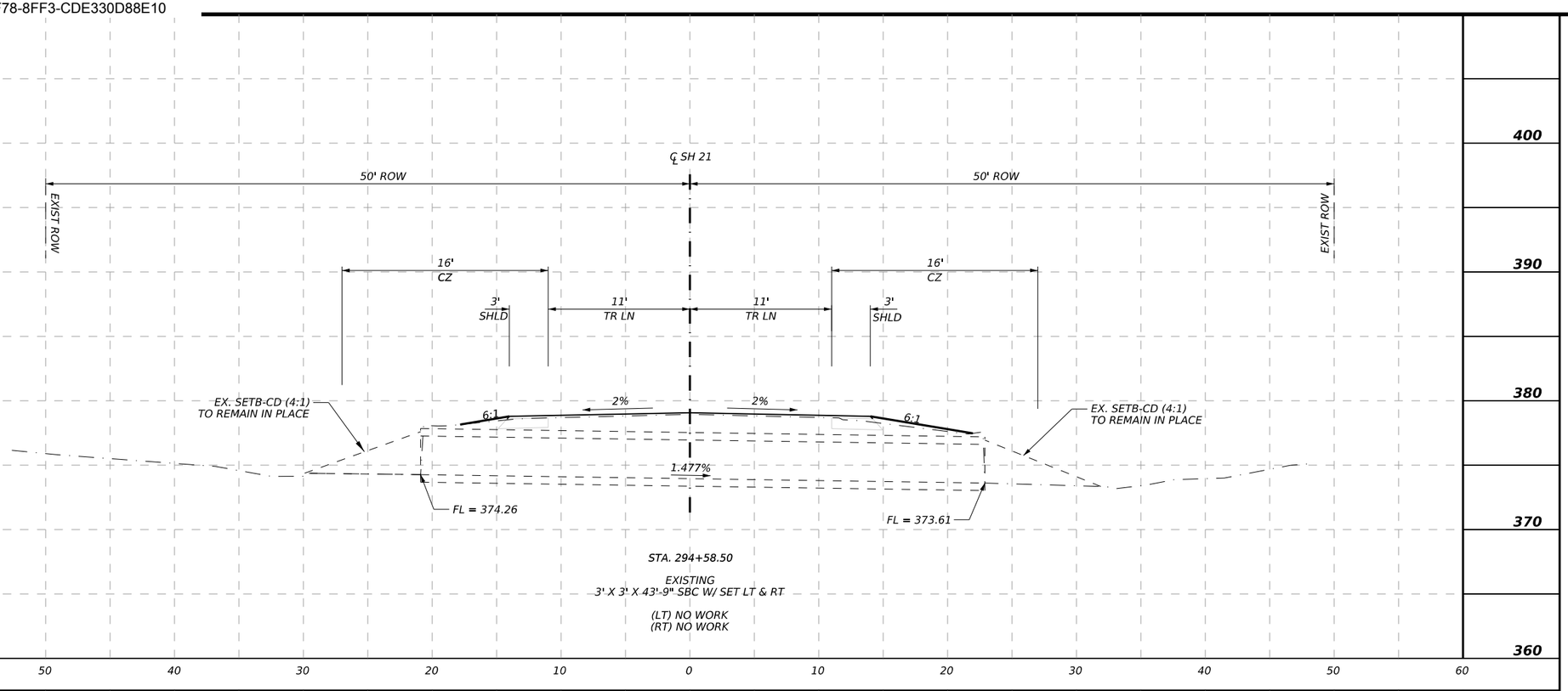

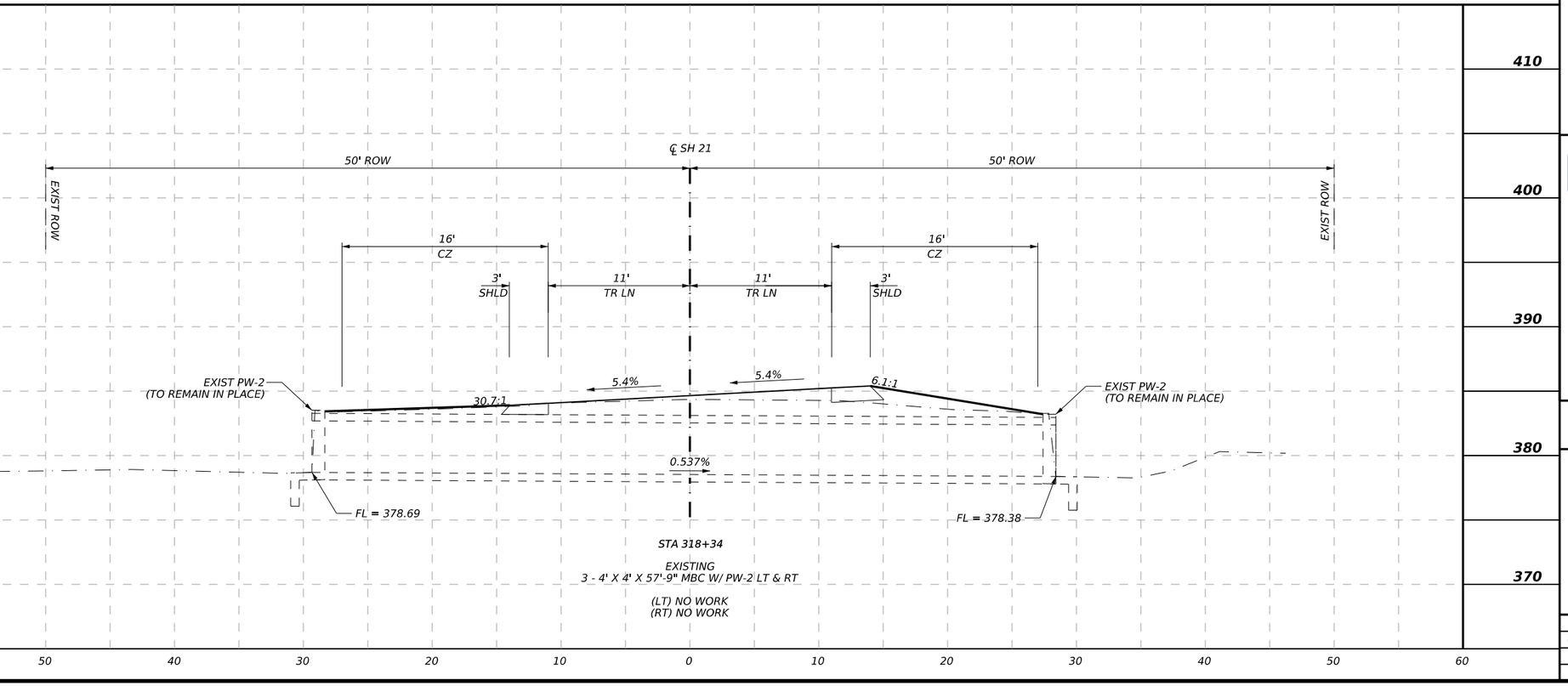

SCALE 1" = 10'

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CULVERT LAYOUTS

SHEET 2 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		71

DATE: 10/27/2023 1:39:57 PM
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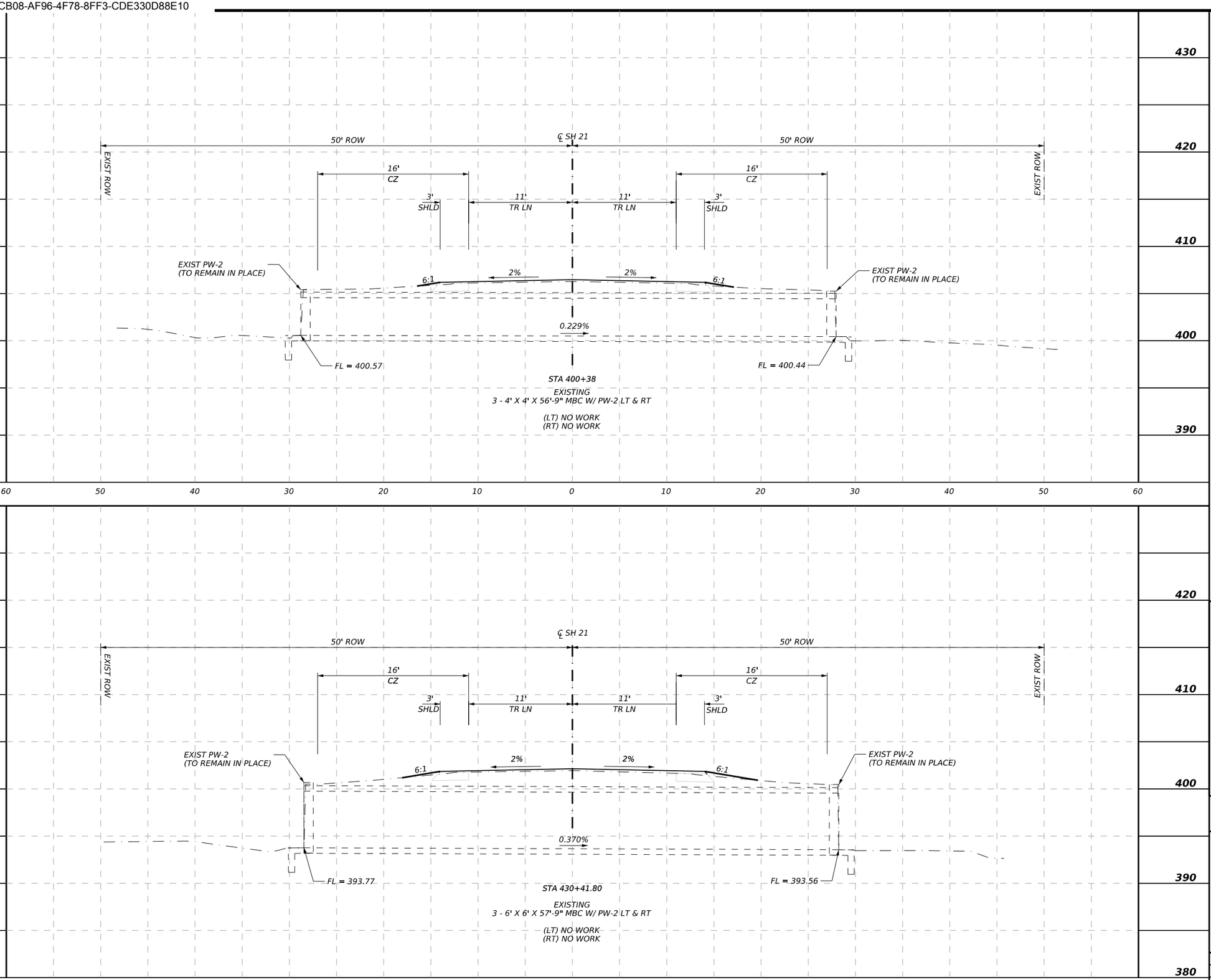

SCALE 1" = 10'

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CULVERT LAYOUTS

SHEET 3 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		72

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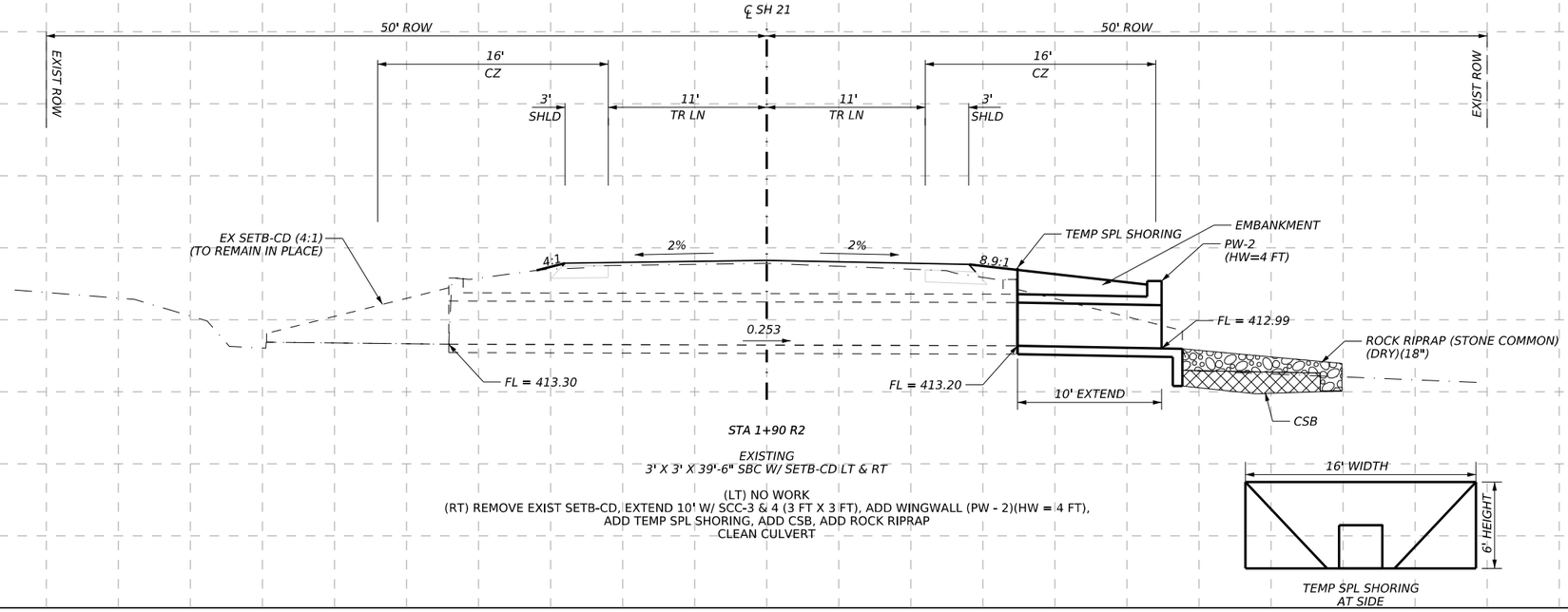

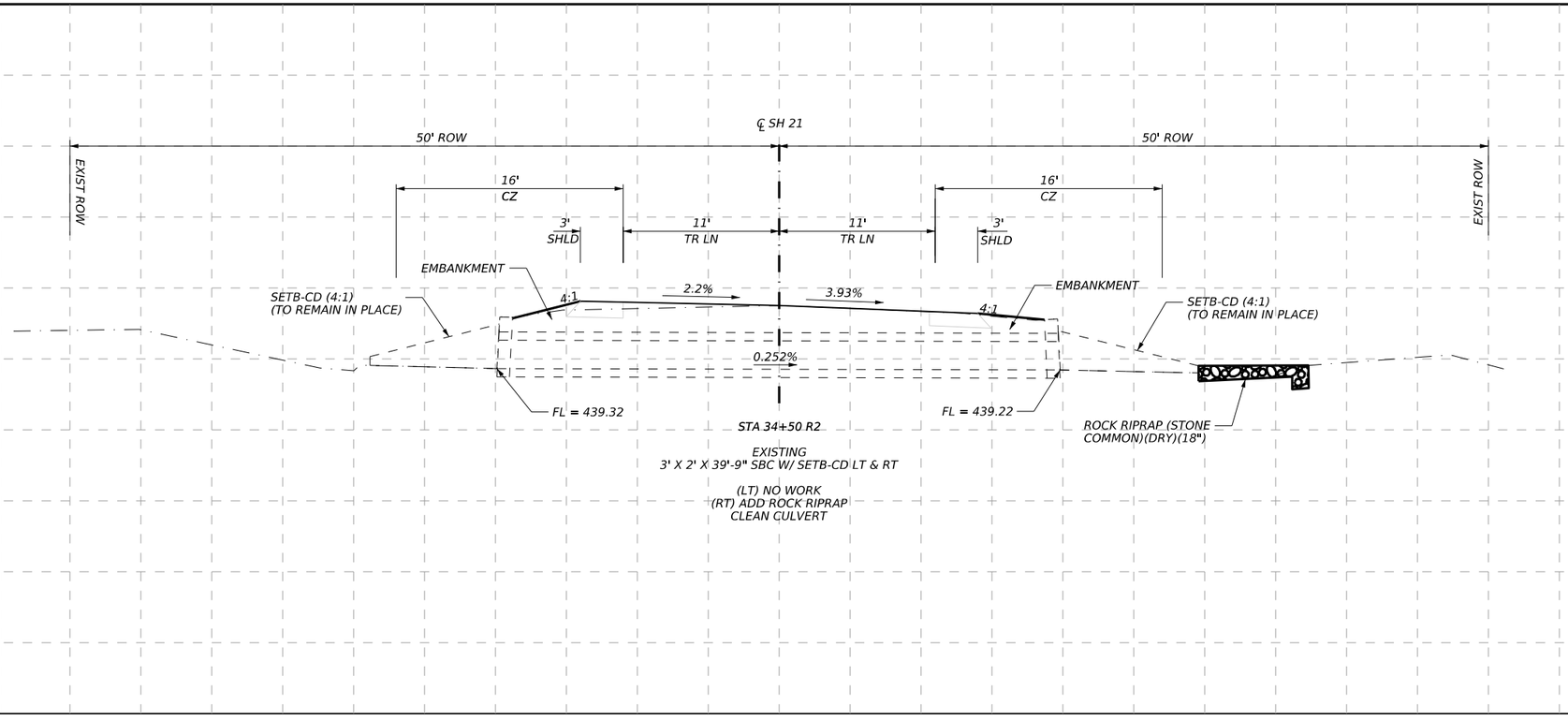

SCALE 1" = 10'

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CULVERT LAYOUTS

SHEET 4 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		73

DATE: 10/27/2023 1:40:12 PM
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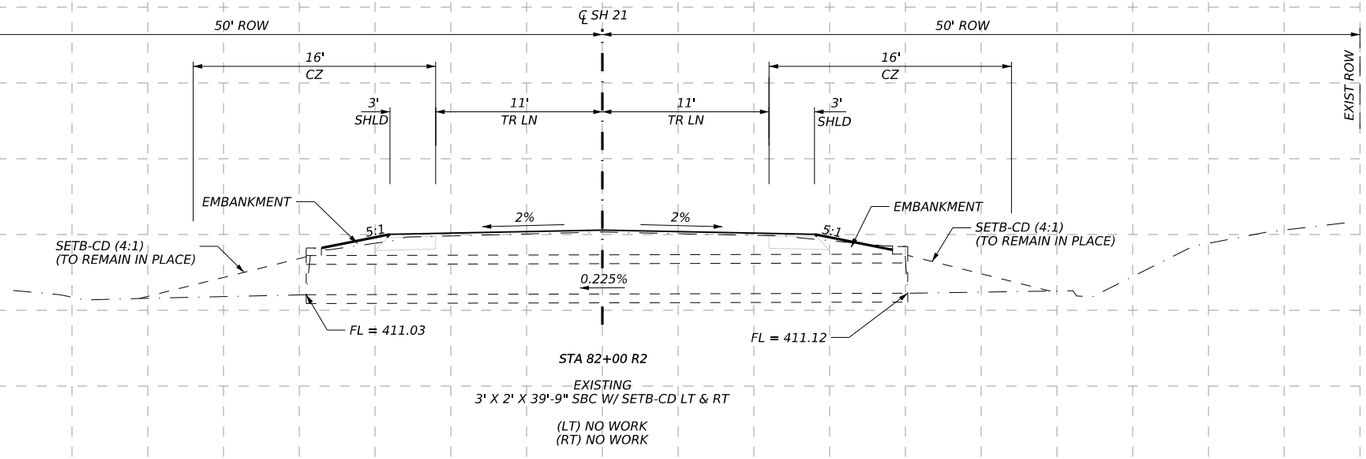

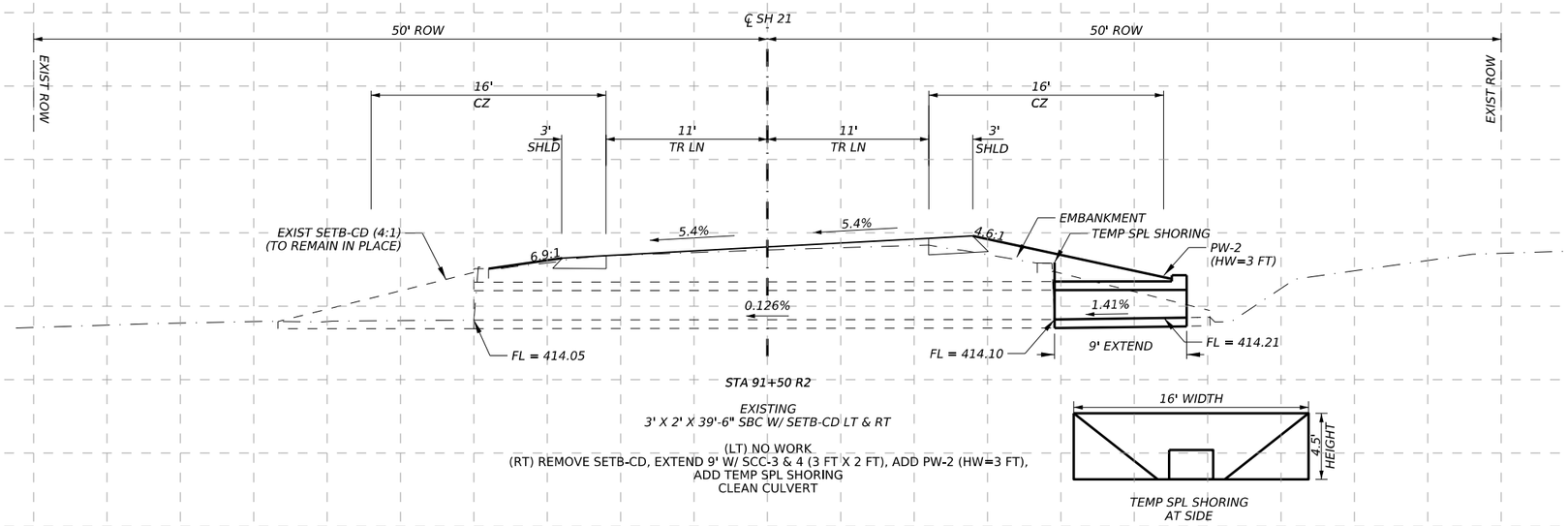

SCALE 1" = 10'

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CULVERT LAYOUTS

SHEET 5 OF 6

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		74

DATE: 11/2/2023 2:25:43 PM
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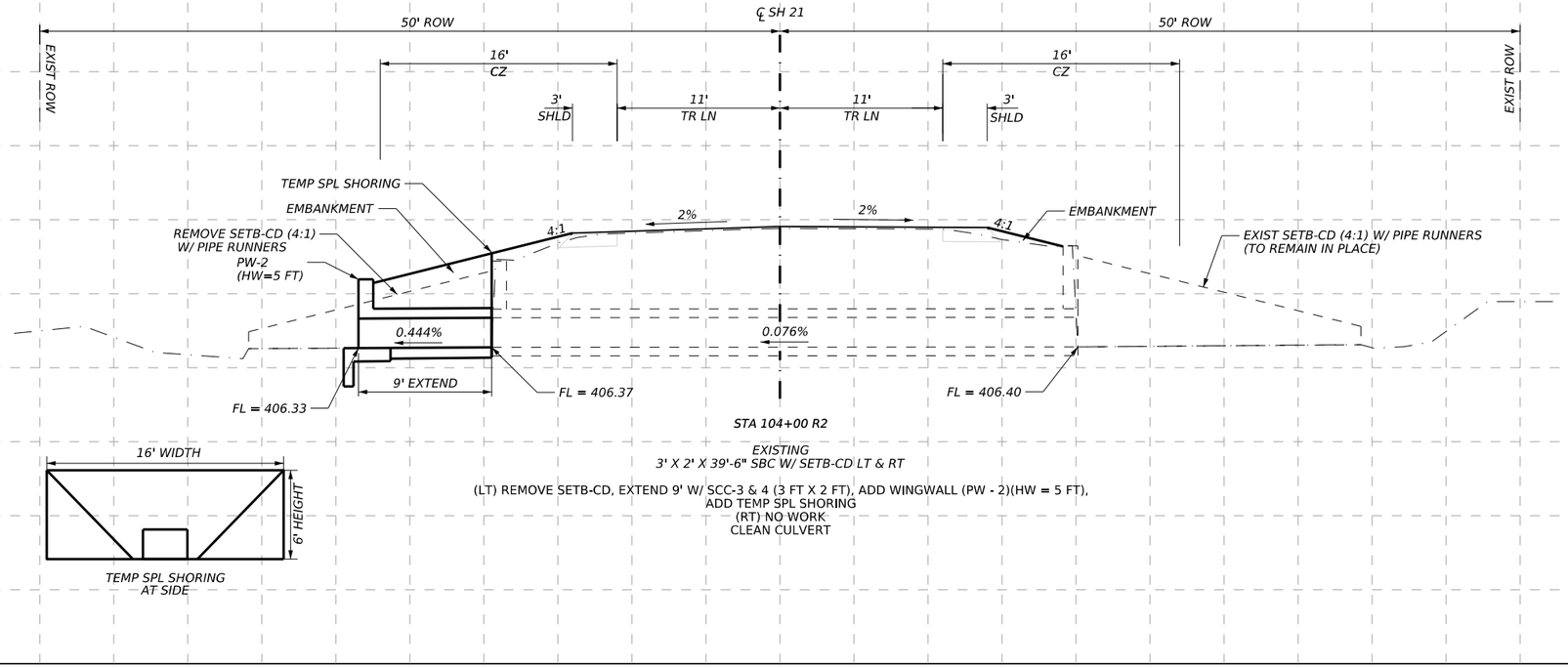

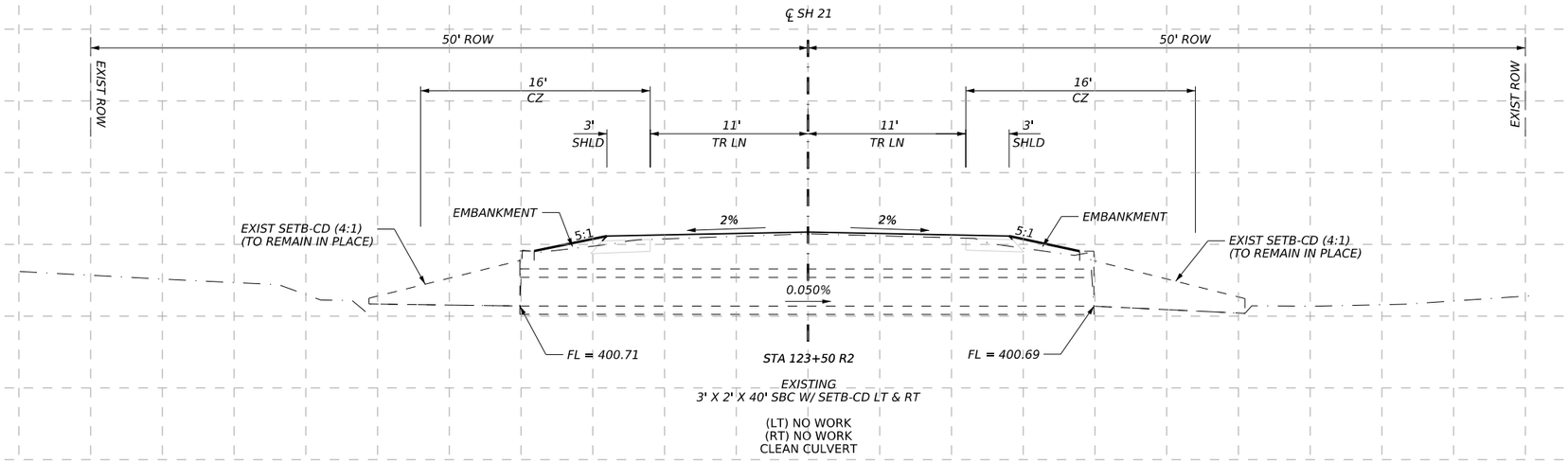

SCALE 1" = 10'

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CULVERT LAYOUTS

SHEET 6 OF 6

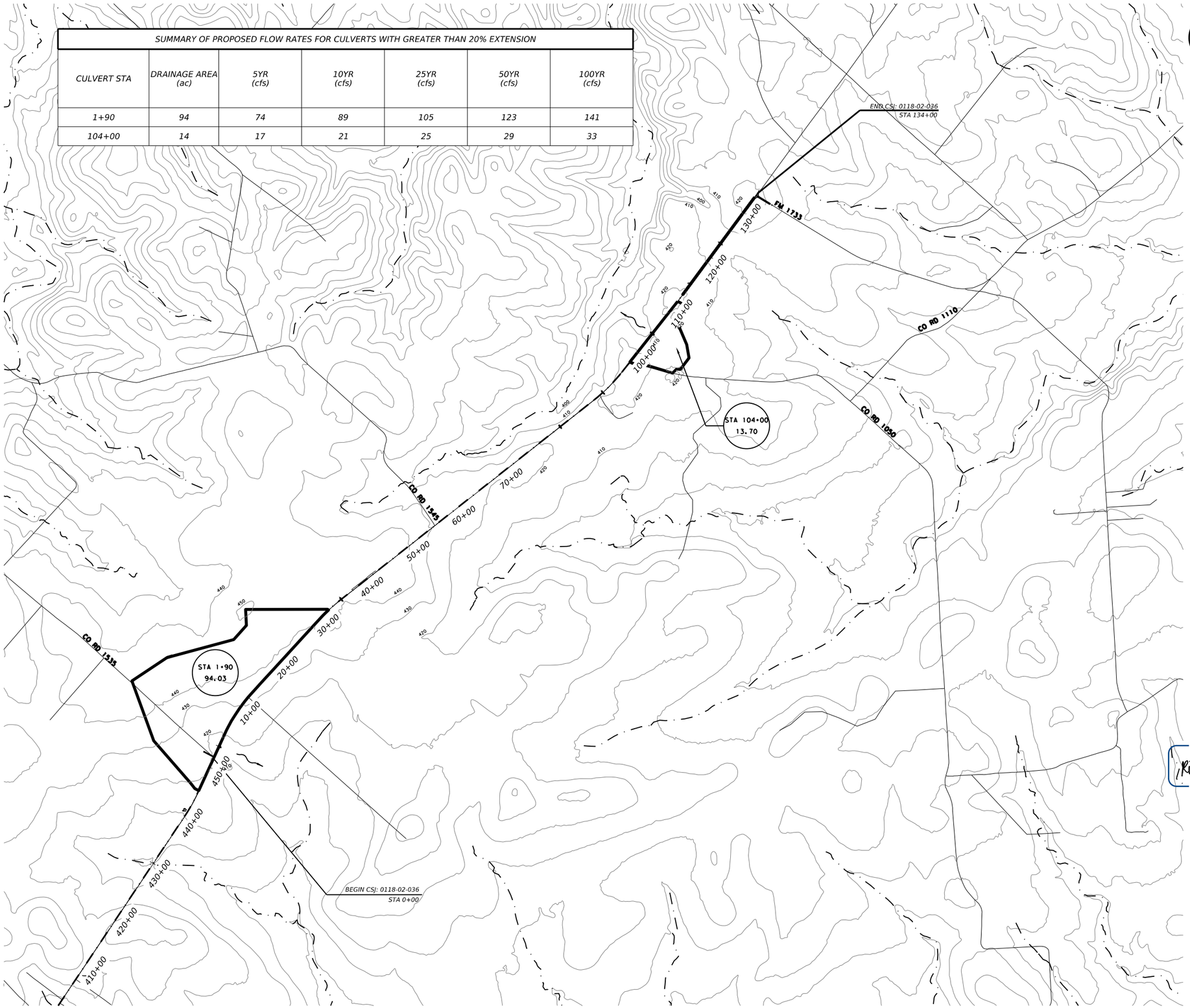
CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		75

DATE: 10/27/2023 1:40:27 PM
FILE: c:\pw working\lochner-pw-01\dms72492\CUL PROFILES 6.dgn

CK:
DW:
CK:
DW:

SUMMARY OF PROPOSED FLOW RATES FOR CULVERTS WITH GREATER THAN 20% EXTENSION

CULVERT STA	DRAINAGE AREA (ac)	5YR (cfs)	10YR (cfs)	25YR (cfs)	50YR (cfs)	100YR (cfs)
1+90	94	74	89	105	123	141
104+00	14	17	21	25	29	33



N

LEGEND

- *DRAINAGE AREA BOUNDARY*
- *FLOW LINE*
- *DRAINAGE FLOW*
- *CULVERT STA / DA (ac)*

NOTE: CONTOURS GENERATED FROM USGS TOPOGRAPHY MAPS OF HOUSTON COUNTY.

SCALE 1" = 1545'

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DRAINAGE AREA MAP AND HYDRAULIC DATA SHEETS

SHEET 1 OF 3

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		76

DATE: 10/27/2023 1:40:43 PM
FILE: c:\pw_working\lochner-pw-01\dms72492\SH21_DAM Sheet.dgn

CULVERT 7 Station 1+90

HY-8 Culvert Analysis Report

Site Data

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 413.30 ft
Outlet Station: 49.50 ft
Outlet Elevation: 412.99 ft
Number of Barrels: 1

Culvert Data Summary

Barrel Shape: Concrete Box
Barrel Span: 3.00 ft
Barrel Rise: 3.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall (Ke=0.5)

Tailwater Channel Data

Tailwater Channel Option: Rectangular Channel
Bottom Width: 6.00 ft
Channel Slope: 0.1360
Channel Manning's n: 0.0400
Channel Invert Elevation: 412.99 ft

Roadway Data for Crossing: STA 1+90

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 100.00 ft
Crest Elevation: 419.12 ft
Roadway Surface: Paved
Roadway Top Width: 28.00 ft

Table 1 - Culvert Summary Table: STA 1+90

Storm Frequency (yr)	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5 year	73.66	73.66	418.33	5.03	4.39	5-S2n	2.59	2.66	2.59	0.92	9.49	8.26
10 year	88.57	84.47	419.18	5.88	5.11	5-S2n	2.89	2.91	2.89	1.01	9.74	8.70
100 year	140.97	87.50	419.44	6.14	5.34	7-M2c	3.00	2.98	2.98	1.28	9.79	9.89

****

Inlet Elevation (invert): 413.30 ft, Outlet Elevation (invert): 412.99 ft

Culvert Length: 49.50 ft, Culvert Slope: 0.0253

****

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DRAINAGE AREA MAP
AND
HYDRAULIC DATA
SHEETS

SHEET 2 OF 3

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		77

DATE: 10/27/2023 1:40:50 PM
FILE: c:\pw_working\lochner-pw-01\dms72492\SH21 CUL 1+90 HYDRAULIC DATA.dgn

CULVERT 11 Station 104+00

HY-8 Culvert Analysis Report

Site Data

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 406.40 ft
Outlet Station: 48.50 ft
Outlet Elevation: 406.33 ft
Number of Barrels: 1

Culvert Data Summary

Barrel Shape: Concrete Box
Barrel Span: 3.00 ft
Barrel Rise: 2.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall (Ke=0.5)
Inlet Depression: None

Tailwater Channel Data

Tailwater Channel Option: Rectangular Channel
Bottom Width: 6.00 ft
Channel Slope: 0.0867
Channel Manning's n: 0.0400
Channel Invert Elevation: 406.33 ft

Roadway Data for Crossing: STA 104+00

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 100.00 ft
Crest Elevation: 414.55 ft
Roadway Surface: Paved
Roadway Top Width: 28.00 ft

Table 1 - Culvert Summary Table: STA 104+00

Storm Frequency (yr)	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5 year	17.19	17.19	408.14	1.7	1.738	2-M2c	1.48	1.01	1.01	0.47	5.69	6.03
10 year	20.66	20.66	408.36	1.93	1.964	2-M2c	1.7	1.14	1.14	0.53	6.05	6.45
100 year	32.77	32.77	409.15	2.75	2.669	7-M2c	2	1.55	1.55	0.72	7.06	7.6

****

Inlet Elevation (invert): 406.40 ft, Outlet Elevation (invert): 406.33 ft

Culvert Length: 48.50 ft, Culvert Slope: 0.0076

****

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DRAINAGE AREA MAP
AND
HYDRAULIC DATA
SHEETS

SHEET 3 OF 3

CONT.	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		78

DATE: 10/27/2023 1:40:58 PM
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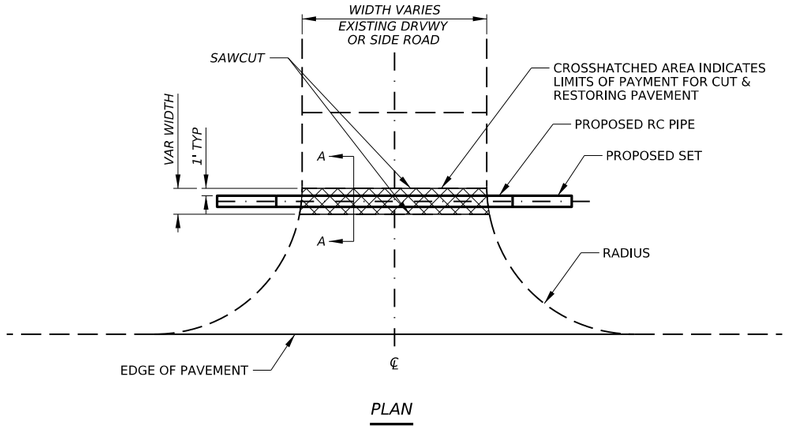
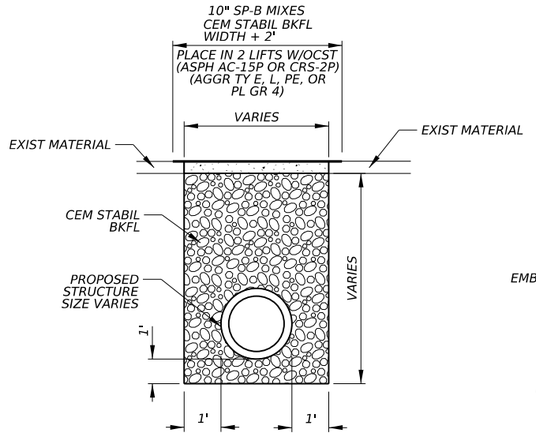
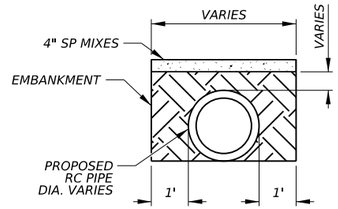


PLAN



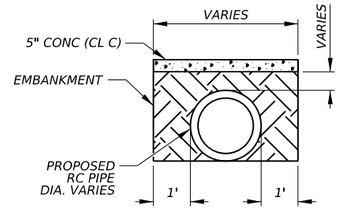
SECTION A-A

STATE ROADWAY
CUT & RESTORE PAV



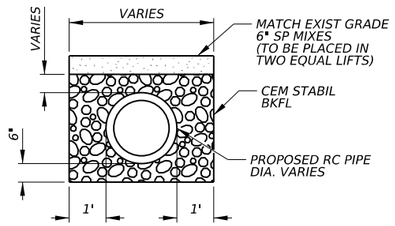
SECTION A-A

DRIVEWAYS (ASPH)
CUT & RESTORE PAV



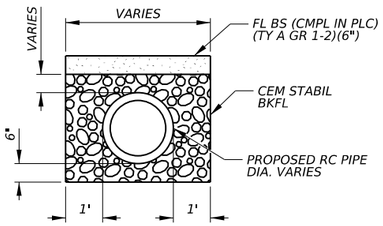
SECTION A-A

DRIVEWAYS (CONC)
CUT & RESTORE PAV



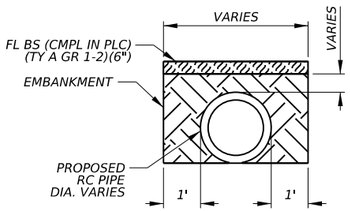
SECTION A-A

SIDE ROADS (ASPH)
CUT & RESTORE PAV
W/ CEM STABIL BKFL



SECTION A-A

SIDE ROADS (GRAVEL)
CUT & RESTORE PAV
W/ CEM STABIL BKFL



SECTION A-A

DRIVEWAYS
(GRAVEL/DIRT)

CULVERT NOTES:

1. *PLACE FULL LENGTH CULVERT REPLACEMENTS SYMMETRICAL ABOUT DRIVEWAY/SIDE ROAD CENTERED & AT THE SAME HORIZONTAL OFFSET AS THE ORIGINAL PIPE UNLESS OTHERWISE DIRECTED.*
2. *IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO CONSTRUCT THE PROPOSED PARALLEL SETs IN SUCH A MANNER AS TO PROVIDE A MINIMUM SIDE SLOPE OF 6:1 BETWEEN THE EDGE OF THE DRIVEWAY OR SIDE ROAD PAVEMENT AND THE TOP OF THE SET HEADWALL. ADDITIONAL PIPE NEEDED TO ACQUIRE 6:1 MIN SLOPE WILL BE PAID FOR UNDER ITEM 464.*
3. *FOR DEPTHS GREATER THAN 5', ANY QUANTITY OF CUT & RESTORE OVER 1' OUTSIDE OF THE CULVERT WILL BE CONSIDERED SUBSIDIARY TO ITEM 402, TRENCH EXCAVATION PROTECTION.*

CONCRETE DRIVEWAY OR SIDE ROADS:

1. *USE REINFORCING STEEL CONSISTING OF NO. 3 OR 4 BARS MEETING THE REQUIREMENTS OF GRADE 60 REINFORCING STEEL. PLACE BARS ON 12 INCH CENTERS IN EACH DIRECTION, SUPPORTED ON REINFORCING CHAIRS, INSTALL DOWELS SIX INCHES INTO EXISTING CONCRETE USING AN APPROVED EPOXY GROUT.*
2. *WELDED WIRE FABRIC WILL NOT BE ALLOWED FOR REINFORCING.*
3. *UNLESS OTHERWISE DIRECTED, INSTALL 1/2 INCH PREMOLDED EXPANSION JOINT MATERIAL BETWEEN EXISTING CONCRETE AND NEW CONCRETE.*
4. *UNLESS OTHERWISE DIRECTED, CUT & RESTORE CONCRETE DRIVEWAYS AND SIDE ROADS AS SHOWN OR TO THE NEAREST JOINT.*

N.T.S.

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CUT & RESTORE DETAILS

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		79

DATE: 11/1/2023 1:55:12 PM
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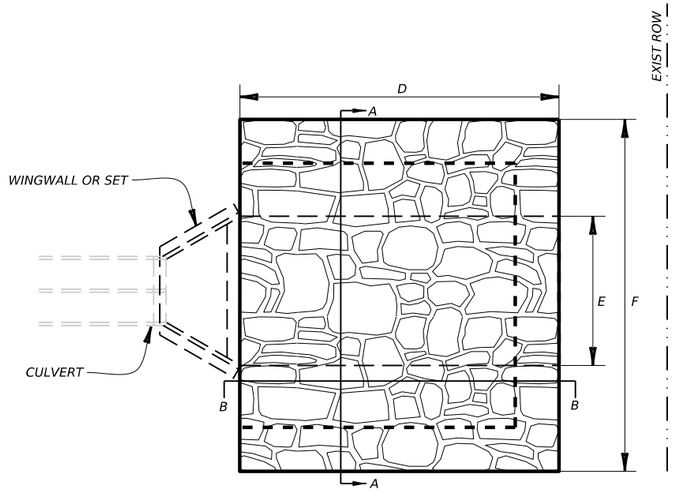
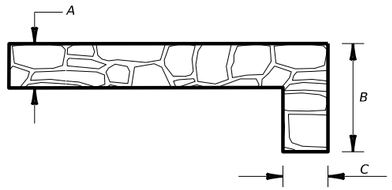


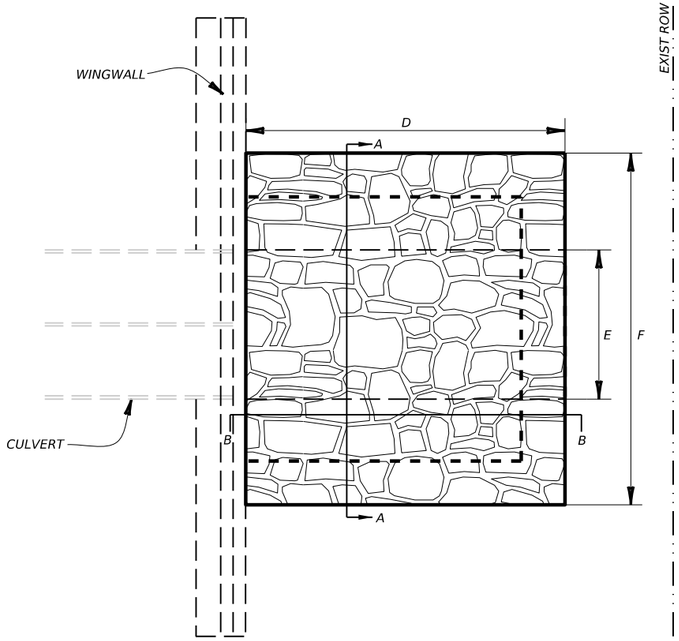
PLAN VIEW (FLARED WING OR SET)



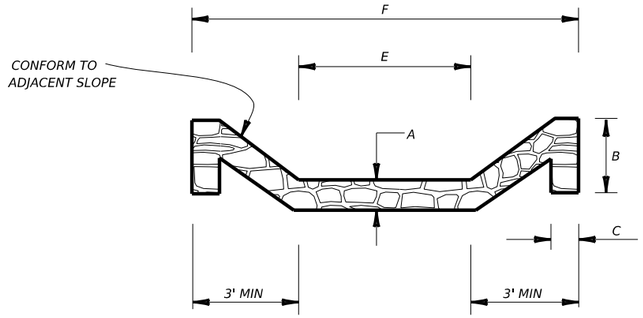
SECTION B-B

ELEVATION VIEW (FLARED WING OR SET)

RIPRAP DIMENSIONS (FT)								
LOCATION	O/S	A	B	C	D	E	F	ITEM 432 6026 RIPRAP (STONE COMMON)(DRY) (18 IN) CY
CSJ: 0118-02-036								
STA 1+90	RT	1.5	2	1	11.16	4.17	10.0	7
STA 34+50	RT	1.5	2	1	7.75	4.17	10.0	5
							PROJECT TOTALS	12



PLAN VIEW (PARALLEL WING)



SECTION A-A

ELEVATION VIEW (PARALLEL WING)

NOTE: CEMENT STABILIZE BACKFILL AS DIRECTED

N.T.S.

DocuSigned by:
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STONE RIPRAP DRAINAGE DETAILS

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		80

DATE: 11/1/2023 1:55:19 PM
FILE: c:\pw_working\lochner-pw-01\dms782741\StoneRiprapDetails.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 Height of Wingwall (1) (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 1+90 R2, Rt	1 ~ 3 X 3	1.7	SCC-3&4	PW-2	0°	3:1	8	7	1.085	4.00	N/A	N/A	9.00	4.167	N/A	7.0	0.161	4.79	72
STA 91+50 R2, Rt	1 ~ 3 X 2	1.3	SCC-3&4	PW-2	0°	3:1	8	7	0.404	3.50	N/A	N/A	9.00	4.167	N/A	0.0	0.140	4.32	63
STA 104+00 R2, Lt	1 ~ 3 X 2	3.8	SCC-3&4	PW-2	0°	3:1	8	7	2.000	5.00	N/A	N/A	12.00	4.167	N/A	0.0	0.393	7.58	120

DATE:
FILE:

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
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
11/1/2023

Texas Department of Transportation

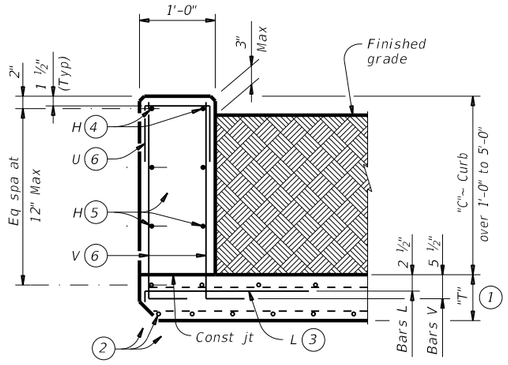
Bridge Division Standard

BOX CULVERT SUPPLEMENT
WINGS AND END TREATMENTS

BCS

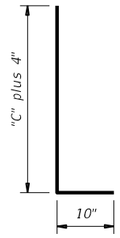
FILE: bcsstde1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		81

DATE:
FILE:

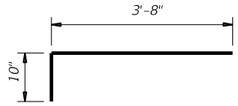


TYPICAL SECTION

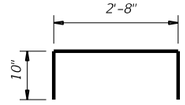
Used for curbs over 1'–0" to 5'–0"



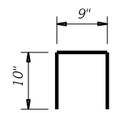
BARS V (#5) (6)
Spaced at 12" Max



BARS L (#5) (3)
Spaced at 12" Max



OPTIONAL BARS L (#5) (3) (7)
Spaced at 12" Max



BARS U (#4) (6)
Spaced at 12" Max

(1) "T" is equal to the culvert top slab thickness. For precast boxes with slabs less than 8" thick, see SCP-MD standard for additional details.

(2) Adjust normal culvert slab bars as necessary to clear obstructions.

(3) Place bars L as shown. Tilt hook as necessary to maintain cover.

(4) Place normal culvert curb bars H(#4) as shown. Adjust as necessary to clear obstructions.

(5) Additional bars H(#4) as required to maintain 12" Max spacing.

(6) Replace normal culvert curb bars K with one bar U and two bars V as shown spaced at 12" Max. Adjust length of bars V as necessary to maintain clear cover.

(7) Optional bars L are to be used only for precast box culverts with 3'–0" closure pour.

(8) Quantities shown are for Contractor's information only. Quantities are per linear foot of curb length. The value in table can be interpolated for intermediate values of curb height, "C". Quantity includes bars K (when applicable).

TABLE OF ESTIMATED CURB QUANTITIES (8)

Curb Height "C"	Conc (CY/LF)	Reinf Steel (Lb/LF)
1'–0"	0.037	10.4
1'–6"	0.056	14.5
2'–0"	0.074	15.6
2'–6"	0.093	18.0
3'–0"	0.111	19.0
3'–6"	0.130	21.3
4'–0"	0.148	22.4
4'–6"	0.167	24.8
5'–0"	0.185	25.9

CONSTRUCTION NOTES:

Adjust reinforcing steel as necessary to provide 1 ¼" cover.

For vehicle safety, top of the curb must not project more than 3" above the finished grade.

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) minimum for curbs.

Provide bar laps, where required, as follows:

- Uncoated or galvanized ~ #4 = 1'–8" Min

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

These extended curb details have sufficient strength to allow for future retrofit of Type T631 or T631LS railing. These details are suitable for use with PR11, PR22 and PR3 type rails. These details are not suitable for the mounting of other rail types. For new construction using T631 or T631LS railing, use the T631-CM standard.

This Curb is considered as part of the Box Culvert for payment.

Cover dimensions are clear dimensions, unless noted otherwise.

Reinforcing bar dimensions shown are out-to-out of bar.

Texas Department of Transportation

Bridge Division Standard

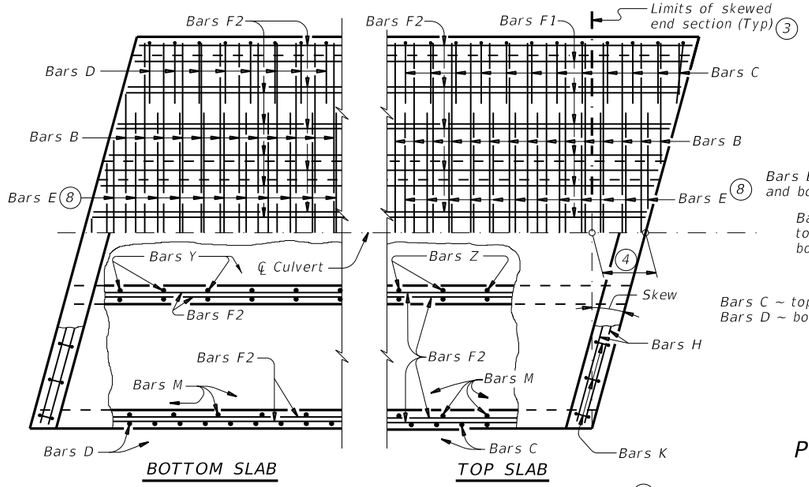
EXTENDED CURB DETAILS

FOR BOX CULVERTS WITH CURBS OVER 1'-0" TO 5'-0" TALL

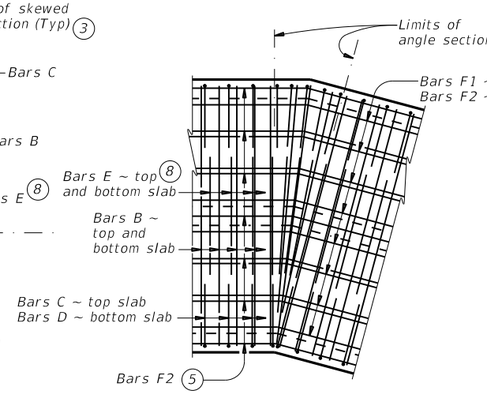
ECD

FILE: ecdstde1-20.dgn	DN: GAF	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		82

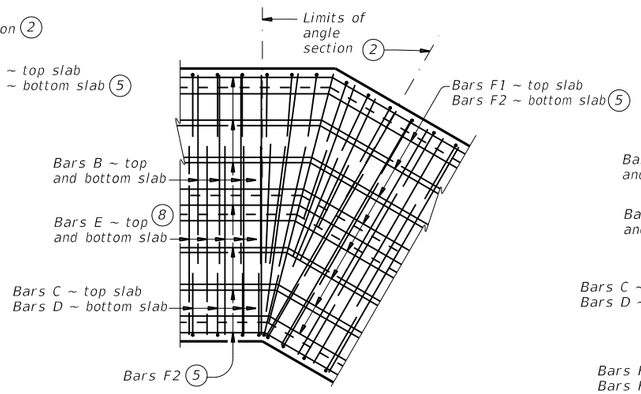
DATE:
FILE:



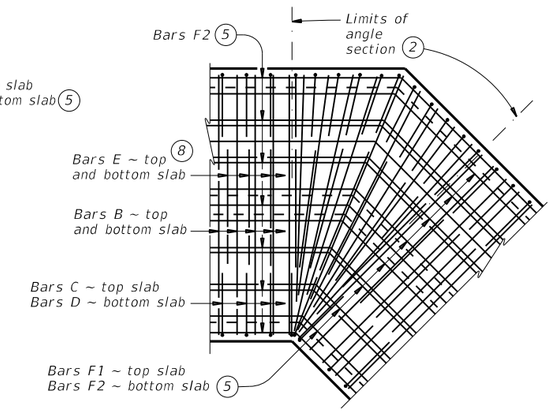
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° 7



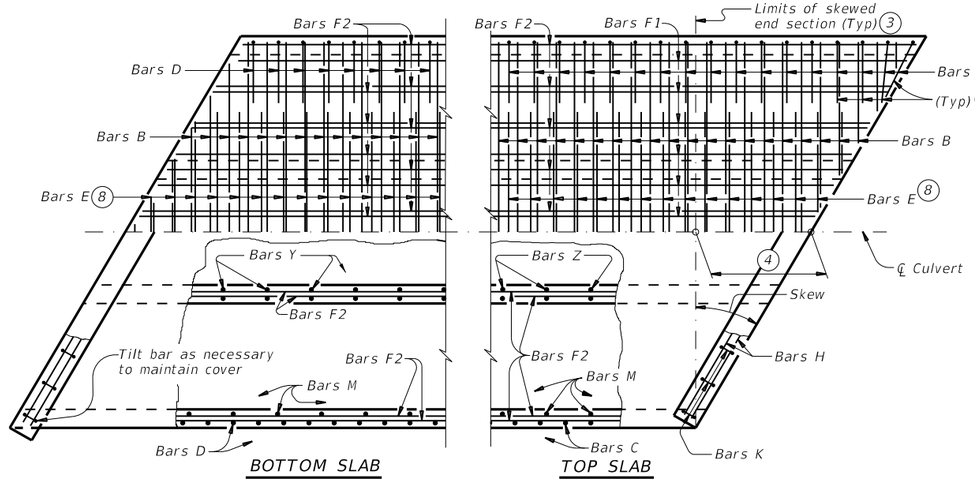
PLAN OF ANGLE SECTION ~ FROM 0° TO 15°



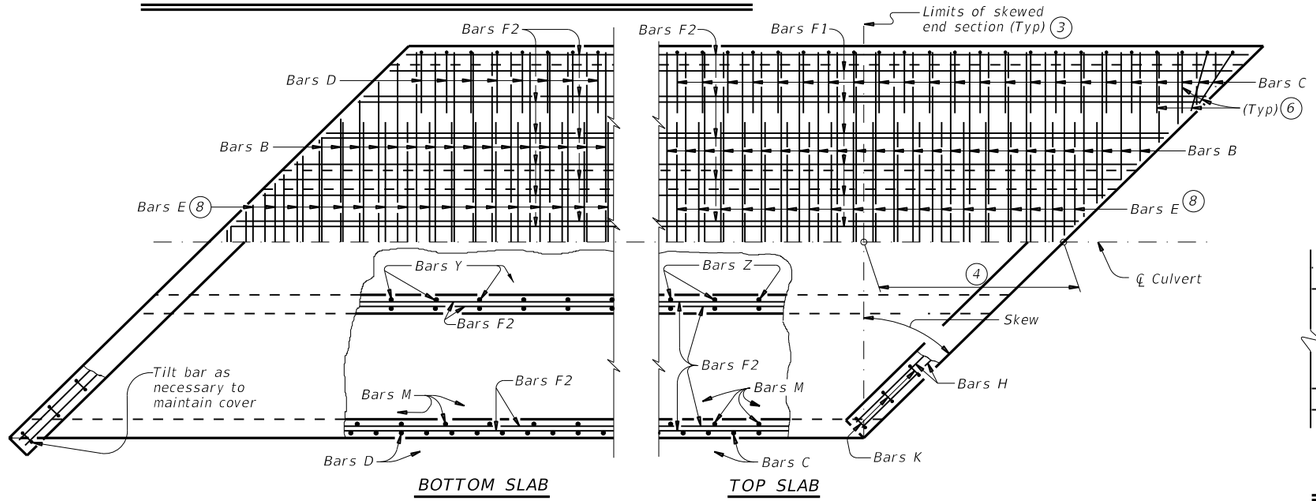
PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°



PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°

(1) For skewed box culverts with less than 2'-0" of fill, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension.

For non-skewed box culverts with less than 2'-0" of fill and for skewed or non-skewed culverts with a fill depth of 2'-0" or greater, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension. Alternatively, if the box is non-skewed, embed #6 anchor bars with a Type III, Class C, D, E, or F anchor adhesive into the existing walls, top and bottom slab at 1'-6" center-to-center spacing. Minimum embedment depth is 8". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 26.4 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing." Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

Break back wings and apron as necessary to install the extension. Clean and extend the exposed wingwall and apron reinforcing into the extension. When lengthening existing box culverts with dimensions different than current standard dimensions, form horizontal and vertical transitions as directed by the Engineer. Match bottom slabs to maintain an uninterrupted flow line. Field bend existing and new reinforcing into transitions and maintain specified cover requirements. For top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface, adjust the "H" dimension to provide a smooth riding surface.

(2) When the spacing between Bars B or Bars E becomes less than half of the normal spacing, cut bars to avoid conflict.

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

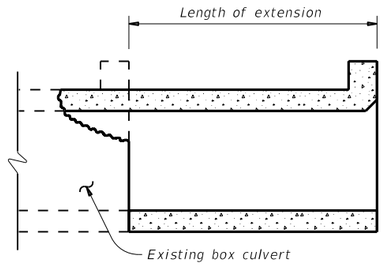
(4) [One half of overall width] x [tangent of the skew angle]

(5) Place Bars F1 and F2 continuously through the angle section. Bend Bars F1 and F2 to remain parallel to the walls of the box culvert.

(6) When necessary to avoid conflict in acute corners, shorten the slab extension leg of Bars C and Bars D to a minimum of 1'-6" for skews of 30° thru 45°.

(7) At the Contractor's option, for skews of 15° or less, place Bars B, C, D, and E parallel to the skewed end while maintaining spacing along centerline of box. Increase lengths of Bars B and Bars E shown on the Multiple Box Culverts Cast-In-Place (MC) standard sheets to accommodate the skew.

(8) Extend Bars E as shown on the MC standard sheet for direct traffic culverts.



LENGTHENING DETAIL (1)

CONSTRUCTION NOTES:

Do not use permanent forms.
When required, lap Bars H 1'-8" for uncoated or galvanized bars.
Provide a minimum of 1 ½" clear cover.

MATERIAL NOTES:

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

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets for details of straight sections of culvert.
For skewed sections and angle sections, refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets for slab and wall dimensions, bar sizes, maximum bar spacing, and any other details not shown.
For skewed ends with curbs, adjust length of Bars H, number of Bars K, curb concrete volume, and reinforcing steel weight by dividing the values shown on the Multiple Box Culverts Cast-In-Place (MC) standard sheets by the cosine of the skew angle.

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

MC-MD

FILE: mc-mdste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		83

DATE:
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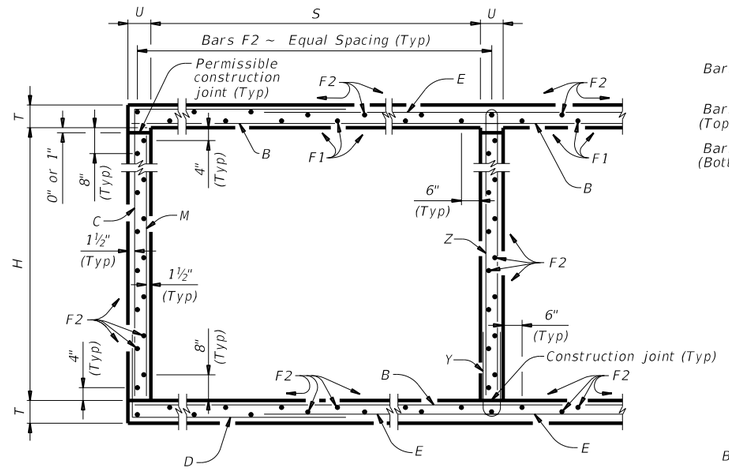
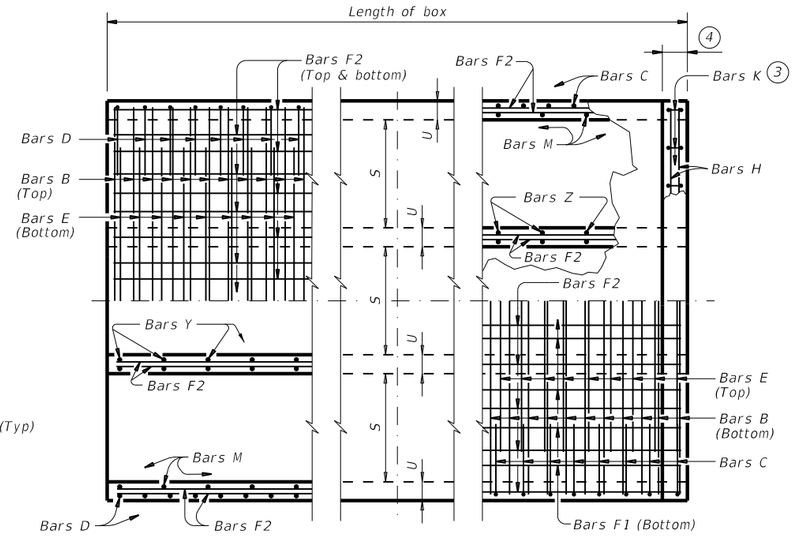
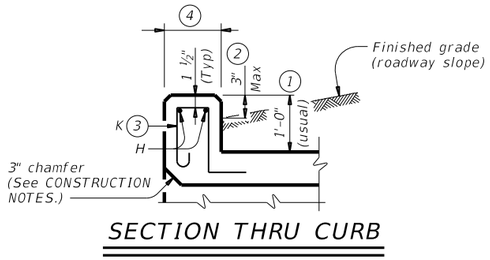


TYPICAL SECTION



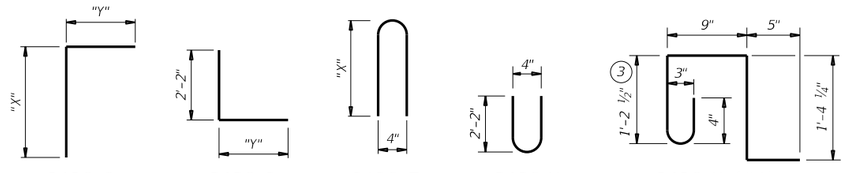
BOTTOM SLAB TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
2'-0"	2'-6 ½"	2'-8"
3'-0"	3'-6 ½"	3'-8"



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

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

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

GENERAL NOTES:

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

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

Use this standard only when lengthening existing multiple box culverts.

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

3'-0" SPAN
0' TO 23' FILL
FOR LENGTHENING ONLY
MC-3-23

FILE: mc323ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
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REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		84

DATE:
FILE:

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																														QUANTITIES					
					Bars B					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4							Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Bars C Length	Bars C Wt	Bars D Length	Bars D Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Bars Y Length	Bars Y Wt	Bars Z Length	Bars Z Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	3' – 0"	2' – 0"	8"	7"	108	#5	9"	7' – 6"	845	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	5' – 11"	427	6	18"	39' – 9"	159	32	18"	39' – 9"	850	108	9"	2' – 0"	144	54	9"	4' – 7"	165	5' – 3"	189	7' – 6"	20	18	50	0.512	88.1	0.6	70	21.1	3,595
3	3' – 0"	2' – 0"	8"	7"	108	#5	9"	11' – 1"	1,248	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	9' – 6"	685	9	18"	39' – 9"	239	45	18"	39' – 9"	1,195	108	9"	2' – 0"	144	108	9"	4' – 7"	331	5' – 3"	379	11' – 1"	30	26	72	0.733	124.2	0.8	102	30.2	5,069
4	3' – 0"	2' – 0"	8"	7"	108	#5	9"	14' – 8"	1,652	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	13' – 1"	944	12	18"	39' – 9"	319	58	18"	39' – 9"	1,540	108	9"	2' – 0"	144	162	9"	4' – 7"	496	5' – 3"	568	14' – 8"	39	32	89	0.953	160.2	1.1	128	39.2	6,537
5	3' – 0"	2' – 0"	8"	7"	108	#5	9"	18' – 3"	2,056	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	16' – 8"	1,202	15	18"	39' – 9"	398	71	18"	39' – 9"	1,885	108	9"	2' – 0"	144	216	9"	4' – 7"	661	5' – 3"	758	18' – 3"	49	40	111	1.173	196.3	1.4	160	48.3	8,010
6	3' – 0"	2' – 0"	8"	7"	108	#5	9"	21' – 10"	2,459	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	20' – 3"	1,461	18	18"	39' – 9"	478	84	18"	39' – 9"	2,230	108	9"	2' – 0"	144	270	9"	4' – 7"	827	5' – 3"	947	21' – 10"	58	46	128	1.393	232.3	1.6	186	57.4	9,478
2	3' – 0"	3' – 0"	8"	7"	108	#5	9"	7' – 6"	845	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	5' – 11"	427	6	18"	39' – 9"	159	38	18"	39' – 9"	1,009	108	9"	3' – 0"	216	54	9"	4' – 7"	165	7' – 3"	262	7' – 6"	20	18	50	0.577	97.5	0.6	70	23.7	3,971
3	3' – 0"	3' – 0"	8"	7"	108	#5	9"	11' – 1"	1,248	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	9' – 6"	685	9	18"	39' – 9"	239	53	18"	39' – 9"	1,407	108	9"	3' – 0"	216	108	9"	4' – 7"	331	7' – 3"	523	11' – 1"	30	26	72	0.819	136.7	0.8	102	33.6	5,569
4	3' – 0"	3' – 0"	8"	7"	108	#5	9"	14' – 8"	1,652	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	13' – 1"	944	12	18"	39' – 9"	319	68	18"	39' – 9"	1,806	108	9"	3' – 0"	216	162	9"	4' – 7"	496	7' – 3"	785	14' – 8"	39	32	89	1.061	175.9	1.1	128	43.5	7,164
5	3' – 0"	3' – 0"	8"	7"	108	#5	9"	18' – 3"	2,056	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	16' – 8"	1,202	15	18"	39' – 9"	398	83	18"	39' – 9"	2,204	108	9"	3' – 0"	216	216	9"	4' – 7"	661	7' – 3"	1,046	18' – 3"	49	40	111	1.302	215.0	1.4	160	53.4	8,761
6	3' – 0"	3' – 0"	8"	7"	108	#5	9"	21' – 10"	2,459	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	20' – 3"	1,461	18	18"	39' – 9"	478	98	18"	39' – 9"	2,602	108	9"	3' – 0"	216	270	9"	4' – 7"	827	7' – 3"	1,308	21' – 10"	58	46	128	1.544	254.2	1.6	186	63.4	10,355

Use this standard only when lengthening existing multiple box culverts.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS
CAST-IN-PLACE
3'-0" SPAN
0' TO 23' FILL
FOR LENGTHENING ONLY
MC-3-23

FILE: mc323ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
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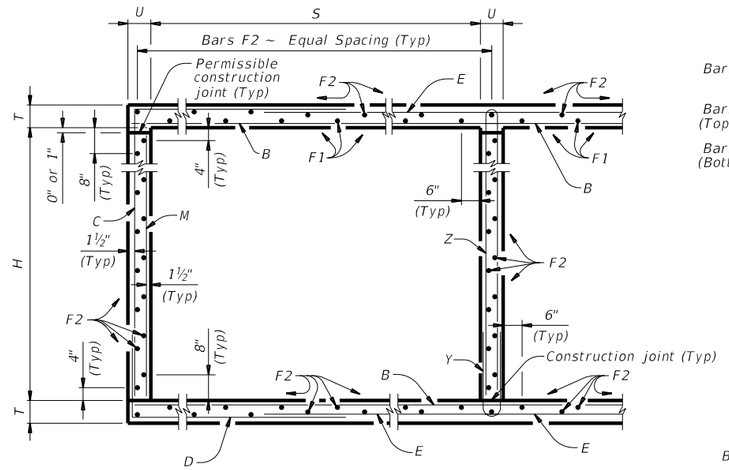
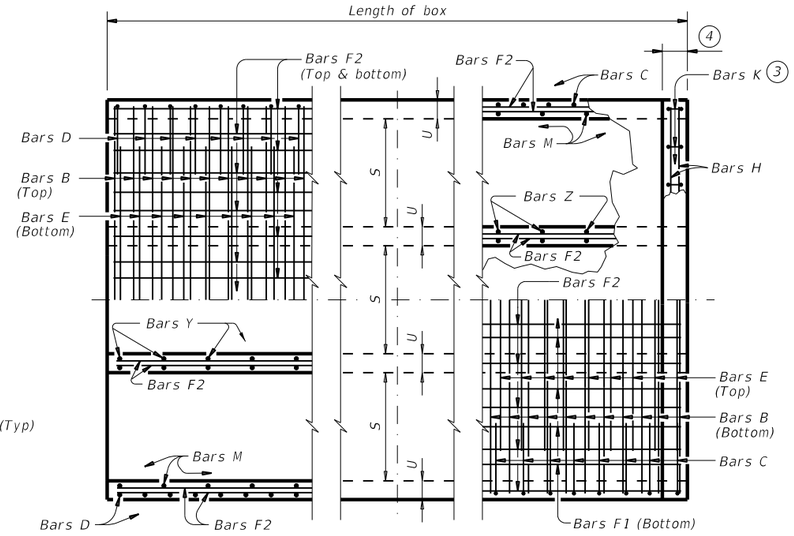
REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		85

DATE:
FILE:



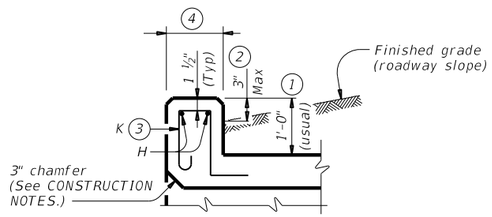
TYPICAL SECTION



BOTTOM SLAB

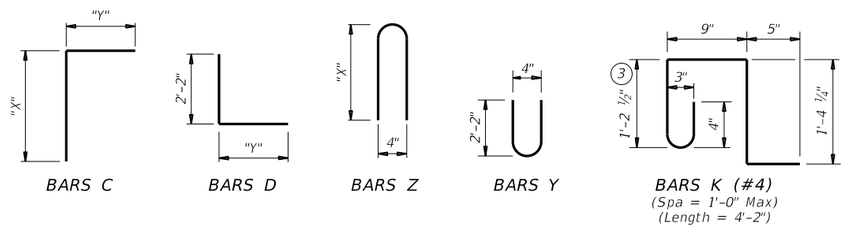
TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
2'-0"	2'-6 ½"	3'-0"
3'-0"	3'-6 ½"	3'-0"
4'-0"	4'-0 ½"	3'-0"



BARS C | BARS D | BARS Z | BARS Y | BARS K (#4)
(Spa = 1'-0" Max)
(Length = 4'-2")

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

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

GENERAL NOTES:

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

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

Use this standard only when lengthening existing multiple box culverts.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
4'-0" SPAN
0' TO 23' FILL
FOR LENGTHENING ONLY
MC-4-23

FILE: mc423ste-20.dgn	DN: TBE	CK: TAR	DW: TxDOT	CK: TxDOT
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REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		86

DATE:
FILE:

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																														QUANTITIES					
					Bars B					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4						Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Bars C Length	Bars C Wt	Bars D Length	Bars D Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Bars Y Length	Bars Y Wt	Bars Z Length	Bars Z Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	4' – 0"	2' – 0"	8"	7"	108	#5	9"	9' – 6"	1,070	162	#4	6"	5' – 8"	613	5' – 4"	577	108	#5	9"	7' – 4"	826	6	18"	39' – 9"	159	36	18"	39' – 9"	956	108	9"	2' – 0"	144	54	9"	4' – 7"	165	5' – 3"	189	9' – 6"	25	22	61	0.611	117.5	0.7	86	25.2	4,785
3	4' – 0"	2' – 0"	8"	7"	108	#5	9"	14' – 1"	1,586	162	#4	6"	5' – 8"	613	5' – 4"	577	108	#5	9"	11' – 11"	1,342	9	18"	39' – 9"	239	51	18"	39' – 9"	1,354	108	9"	2' – 0"	144	108	9"	4' – 7"	331	5' – 3"	379	14' – 1"	38	32	89	0.881	164.1	1.1	127	36.3	6,692
4	4' – 0"	2' – 0"	8"	7"	108	#5	9"	18' – 8"	2,103	162	#4	6"	5' – 8"	613	5' – 4"	577	108	#5	9"	16' – 6"	1,859	12	18"	39' – 9"	319	66	18"	39' – 9"	1,752	108	9"	2' – 0"	144	162	9"	4' – 7"	496	5' – 3"	568	18' – 8"	50	40	111	1.150	210.8	1.4	161	47.4	8,592
5	4' – 0"	2' – 0"	8"	7"	108	#5	9"	23' – 3"	2,619	162	#4	6"	5' – 8"	613	5' – 4"	577	108	#5	9"	21' – 1"	2,375	15	18"	39' – 9"	398	81	18"	39' – 9"	2,151	108	9"	2' – 0"	144	216	9"	4' – 7"	661	5' – 3"	758	23' – 3"	62	50	139	1.420	257.4	1.7	201	58.5	10,497
6	4' – 0"	2' – 0"	8"	7"	108	#5	9"	27' – 10"	3,135	162	#4	6"	5' – 8"	613	5' – 4"	577	108	#5	9"	25' – 8"	2,891	18	18"	39' – 9"	478	96	18"	39' – 9"	2,549	108	9"	2' – 0"	144	270	9"	4' – 7"	827	5' – 3"	947	27' – 10"	74	58	161	1.689	304.0	2.1	235	69.6	12,396
2	4' – 0"	3' – 0"	8"	7"	108	#5	9"	9' – 6"	1,070	162	#4	6"	6' – 8"	721	5' – 4"	577	108	#5	9"	7' – 4"	826	6	18"	39' – 9"	159	42	18"	39' – 9"	1,115	108	9"	3' – 0"	216	54	9"	4' – 7"	165	7' – 3"	262	9' – 6"	25	22	61	0.676	127.8	0.7	86	27.8	5,197
3	4' – 0"	3' – 0"	8"	7"	108	#5	9"	14' – 1"	1,586	162	#4	6"	6' – 8"	721	5' – 4"	577	108	#5	9"	11' – 11"	1,342	9	18"	39' – 9"	239	59	18"	39' – 9"	1,567	108	9"	3' – 0"	216	108	9"	4' – 7"	331	7' – 3"	523	14' – 1"	38	32	89	0.967	177.6	1.1	127	39.7	7,229
4	4' – 0"	3' – 0"	8"	7"	108	#5	9"	18' – 8"	2,103	162	#4	6"	6' – 8"	721	5' – 4"	577	108	#5	9"	16' – 6"	1,859	12	18"	39' – 9"	319	76	18"	39' – 9"	2,018	108	9"	3' – 0"	216	162	9"	4' – 7"	496	7' – 3"	785	18' – 8"	50	40	111	1.258	227.4	1.4	161	51.7	9,255
5	4' – 0"	3' – 0"	8"	7"	108	#5	9"	23' – 3"	2,619	162	#4	6"	6' – 8"	721	5' – 4"	577	108	#5	9"	21' – 1"	2,375	15	18"	39' – 9"	398	93	18"	39' – 9"	2,469	108	9"	3' – 0"	216	216	9"	4' – 7"	661	7' – 3"	1,046	23' – 3"	62	50	139	1.549	277.1	1.7	201	63.7	11,283
6	4' – 0"	3' – 0"	8"	7"	108	#5	9"	27' – 10"	3,135	162	#4	6"	6' – 8"	721	5' – 4"	577	108	#5	9"	25' – 8"	2,891	18	18"	39' – 9"	478	110	18"	39' – 9"	2,921	108	9"	3' – 0"	216	270	9"	4' – 7"	827	7' – 3"	1,308	27' – 10"	74	58	161	1.841	326.9	2.1	235	75.7	13,309
2	4' – 0"	4' – 0"	8"	7"	108	#5	9"	9' – 6"	1,070	162	#4	6"	7' – 8"	830	5' – 4"	577	108	#5	9"	7' – 4"	826	6	18"	39' – 9"	159	42	18"	39' – 9"	1,115	108	9"	4' – 0"	289	54	9"	4' – 7"	165	9' – 3"	334	9' – 6"	25	22	61	0.741	134.1	0.7	86	30.4	5,451
3	4' – 0"	4' – 0"	8"	7"	108	#5	9"	14' – 1"	1,586	162	#4	6"	7' – 8"	830	5' – 4"	577	108	#5	9"	11' – 11"	1,342	9	18"	39' – 9"	239	59	18"	39' – 9"	1,567	108	9"	4' – 0"	289	108	9"	4' – 7"	331	9' – 3"	667	14' – 1"	38	32	89	1.053	185.7	1.1	127	43.2	7,555
4	4' – 0"	4' – 0"	8"	7"	108	#5	9"	18' – 8"	2,103	162	#4	6"	7' – 8"	830	5' – 4"	577	108	#5	9"	16' – 6"	1,859	12	18"	39' – 9"	319	76	18"	39' – 9"	2,018	108	9"	4' – 0"	289	162	9"	4' – 7"	496	9' – 3"	1,001	18' – 8"	50	40	111	1.366	237.3	1.4	161	56.0	9,653
5	4' – 0"	4' – 0"	8"	7"	108	#5	9"	23' – 3"	2,619	162	#4	6"	7' – 8"	830	5' – 4"	577	108	#5	9"	21' – 1"	2,375	15	18"	39' – 9"	398	93	18"	39' – 9"	2,469	108	9"	4' – 0"	289	216	9"	4' – 7"	661	9' – 3"	1,335	23' – 3"	62	50	139	1.679	288.8	1.7	201	68.9	11,754
6	4' – 0"	4' – 0"	8"	7"	108	#5	9"	27' – 10"	3,135	162	#4	6"	7' – 8"	830	5' – 4"	577	108	#5	9"	25' – 8"	2,891	18	18"	39' – 9"	478	110	18"	39' – 9"	2,921	108	9"	4' – 0"	289	270	9"	4' – 7"	827	9' – 3"	1,668	27' – 10"	74	58	161	1.992	340.4	2.1	235	81.8	13,851

Use this standard only when lengthening existing multiple box culverts.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE 4'-0" SPAN 0' TO 23' FILL FOR LENGTHENING ONLY

MC-4-23

FILE: mc423ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
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REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		87

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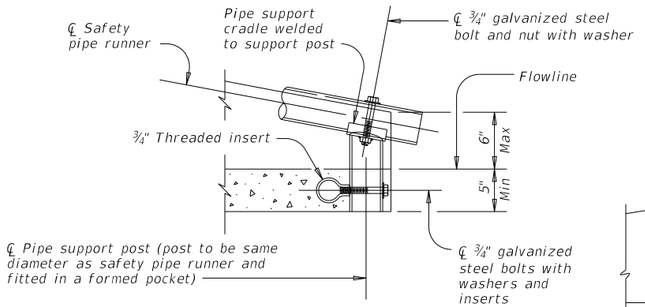
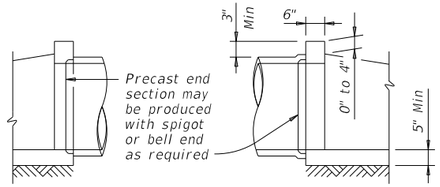
REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (8)	"D" (1)	Slope	Min Length of Unit	Single Pipe		Multiple Pipes	
						Skew	Pipe Runners Required	Skew	Pipe Runners Required
12"	2"	1.15"	17.00"	3:1	2' – 11"	≤ 45°	No	≤ 45°	No
				4:1	3' – 6"				
				6:1	4' – 9"				
15"	2 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"				



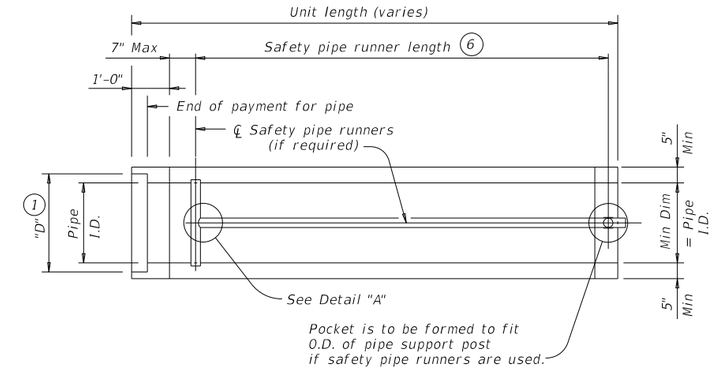
END DETAIL FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)



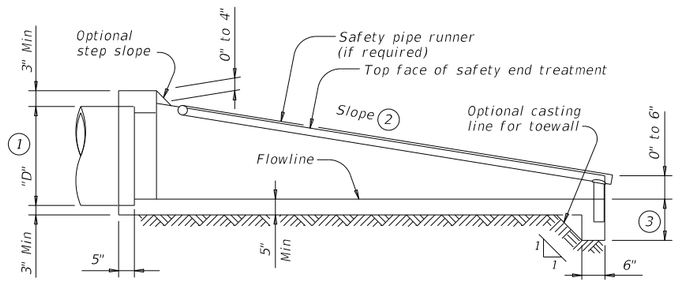
OPTIONAL JOINT FOR RCP

(Showing joint between RCP and precast safety end treatment)



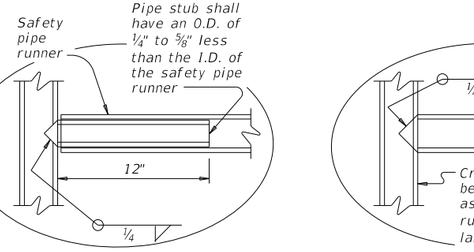
PLAN

(Showing bell end connection.)



LONGITUDINAL ELEVATION

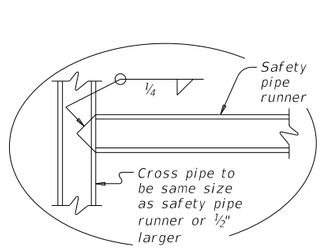
(Showing bell end connection.)



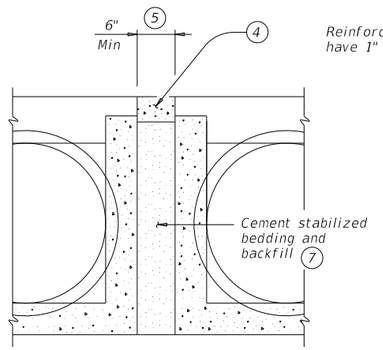
OPTION A

DETAIL A

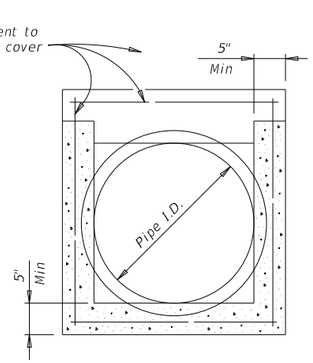
(If required)



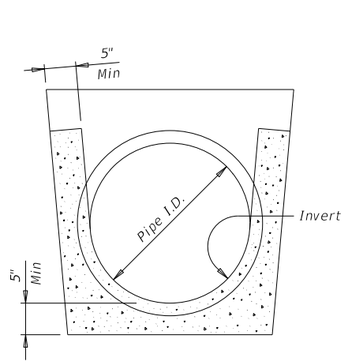
OPTION B



MULTIPLE PIPE INSTALLATION

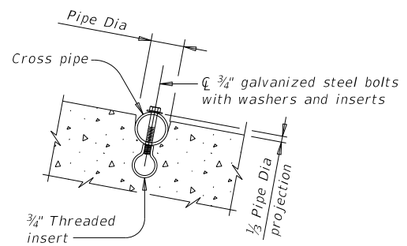


OPTION WITH SQUARE BOTTOM



OPTION WITH INVERT BOTTOM

SECTION A-A



INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)

SAFETY PIPE RUNNER DIMENSIONS

Max Safety Pipe Runner Length	Required Pipe Runner Size		
	Pipe Size	Pipe O.D.	Pipe I.D.
11' – 2"	3" STD	3.500"	3.068"
15' – 6"	3 ½" STD	4.000"	3.548"
20' – 10"	4" STD	4.500"	4.026"
35' – 4"	5" STD	5.563"	5.047"

(1) Dimension "D" is based on reinforced concrete pipe (RCP) meeting the requirements of ASTM C-76, Class III, (RCP Wall "B" thickness). Adjust "D" for any other wall thickness used. For thermoplastic pipe (TP) take into account the annular space requirements for grouted connections.

(2) Slope as shown elsewhere in plans. Slope of 3:1 or flatter is required for vehicle safety.

(3) Toewall to be used only when dimension is shown elsewhere in the plans.

(4) Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".

(5) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

(6) Measured along slope.

(7) Provide cement stabilized bedding and backfill in accordance with the Item 400, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.

(8) Thermoplastic pipe wall thickness may vary. Adjust accordingly. Thermoplastic pipe requires the safety end treatments to have a bell end for grouted connections.

GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

Texas Department of Transportation

Bridge Division Standard

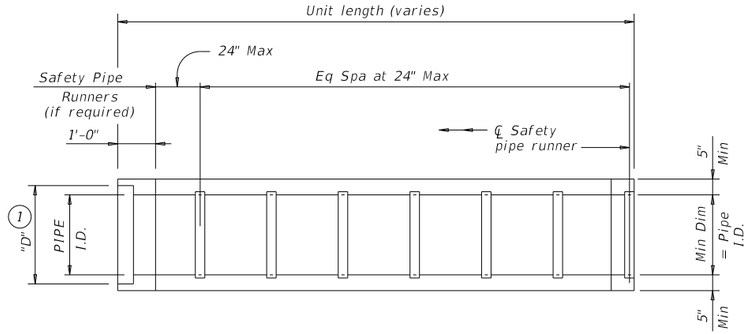
PRECAST SAFETY END TREATMENT

TYPE II ~ CROSS DRAINAGE

PSET-SC

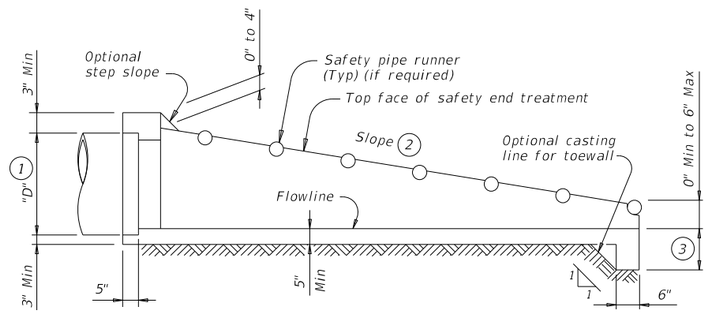
FILE: psetscss-21.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: Added 42" TP	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		88

DATE:
FILE:



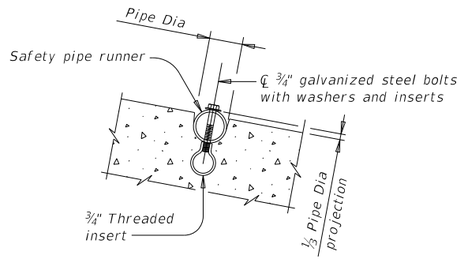
PLAN

(Showing bell end connection.)



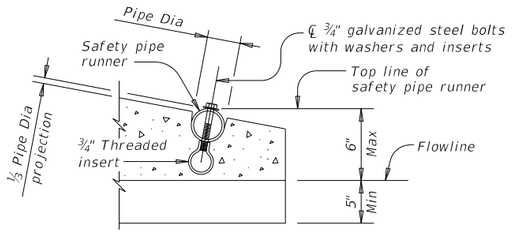
LONGITUDINAL ELEVATION

(Showing bell end connection.)

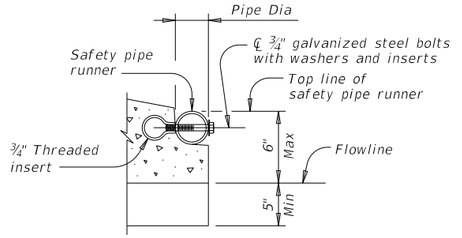


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



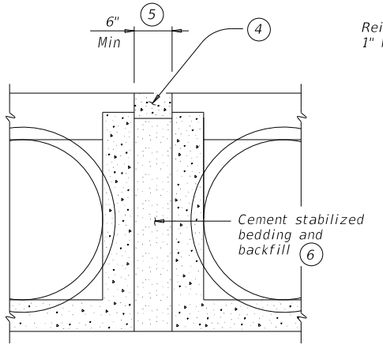
OPTION A



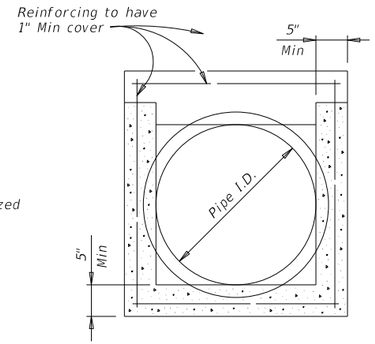
OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

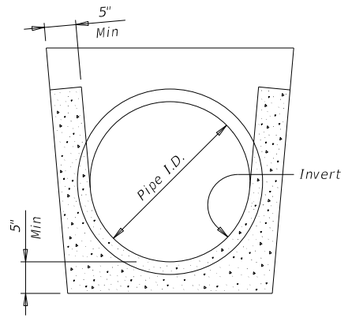
(If required)



MULTIPLE PIPE INSTALLATION

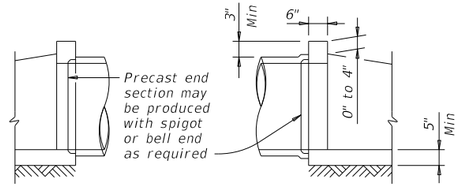


OPTION WITH SQUARE BOTTOM



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: psetspss-21.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: Added 42" TP	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		89

DATE:
FILE:

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

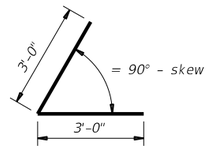
Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing (2~wings) (4)		Estimated Quantities per ft of Toewall (1~toewall)	
					Bars J1		Bars J2					
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'-0"	7"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

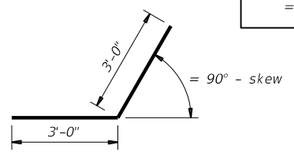
Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

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.)

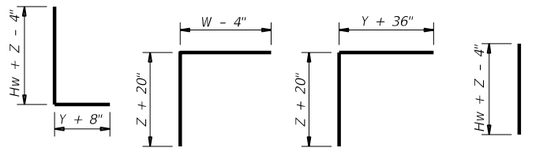
Hw = H + T + C
Lw = (Hw) (SL) ÷ cosine (θ) for Type PW-1
= (Hw - 1') (SL) ÷ cosine (θ) for Type PW-2 and Hw ≥ 4'
= (Hw - 0.5') (SL) ÷ cosine (θ) for Type PW-2 and Hw < 4'

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

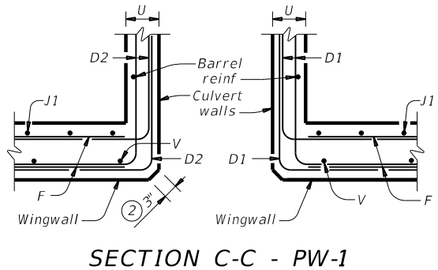
For precast culverts:
Ltw = [(N) (2 U + S) + (N - 1) (0.5')] ÷ cosine (θ)
Total Wingwall Area (two wings ~ SF)
= (2)(Hw)(Lw) for Type PW-1
= (2)(Hw)(Lw) - 6 SF for Type PW-2 and Hw ≥ 4'
= (2)(Hw)(Lw) - 1.5 SF for Type PW-2 and Hw < 4'

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

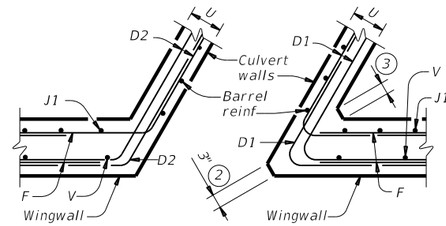
See applicable box culvert standard sheet for S, H, T, and U values.



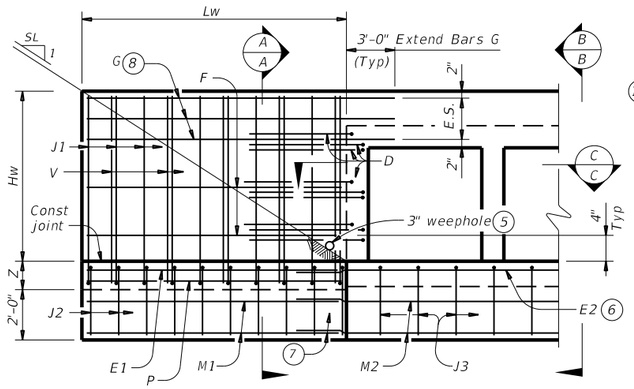
BARS J1 BARS J2 BARS J3 BARS V



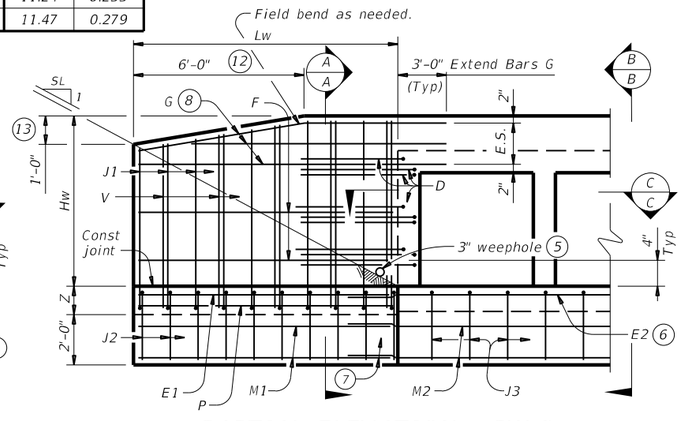
SECTION C-C - PW-1



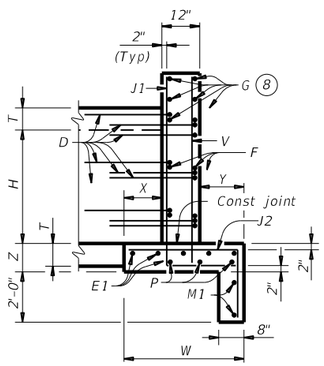
SECTION C-C - PW-2



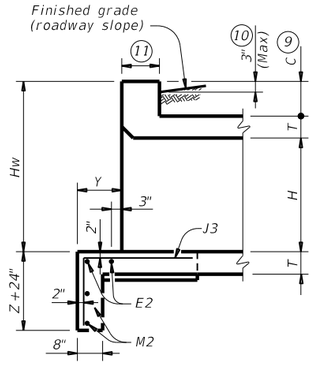
PARTIAL ELEVATION - PW-1



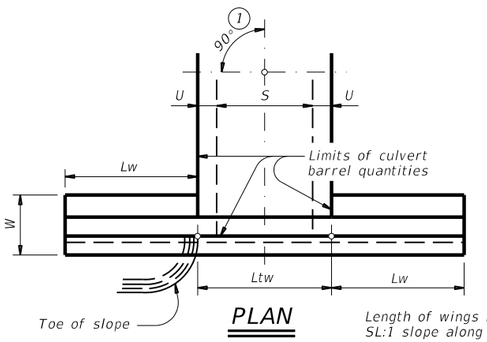
PARTIAL ELEVATION - PW-2



SECTION A-A
(Showing wing reinforcement.)

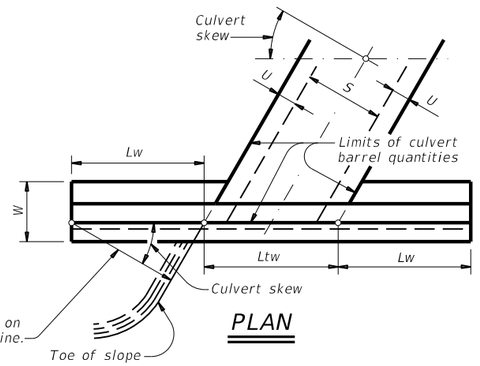


SECTION B-B
(Showing wing reinforcement.)



PLAN

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

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

1. Skew = 0°
2. At discharge end, chamfer may be ¾" minimum.
3. For 15° skew ~ 1"
   For 30° skew ~ 2"
   For 45° skew ~ 3"
4. Quantities shown are for two Type PW-1 wings. Adjust concrete volume for Type PW-2 wings. To determine estimated quantities for two wings, multiply the tabulated values by Lw. Quantities shown do not include weight of Bars D.
5. Provide weepholes for Hw = 5'-0" and greater. Fill around weepholes with coarse gravel.
6. Extend Bars E2 1'-6" minimum into the wingwall footing.
7. Lap Bars M1 1'-6" minimum with Bars M2.
8. Place Bars G as shown, equally spaced at 8" maximum. Provide at least two pairs of Bars G per wing.
9. 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0, refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
10. For vehicle safety, the following requirements must be met:
    - For structures without bridge rail, construct curbs no more than 3" above finished grade.
    - For structures with bridge rail, construct curbs flush with finished grade.

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

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

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

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

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

Texas Department of Transportation

Bridge Division Standard

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

PW

FILE: pwstde01-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		90

DATE:
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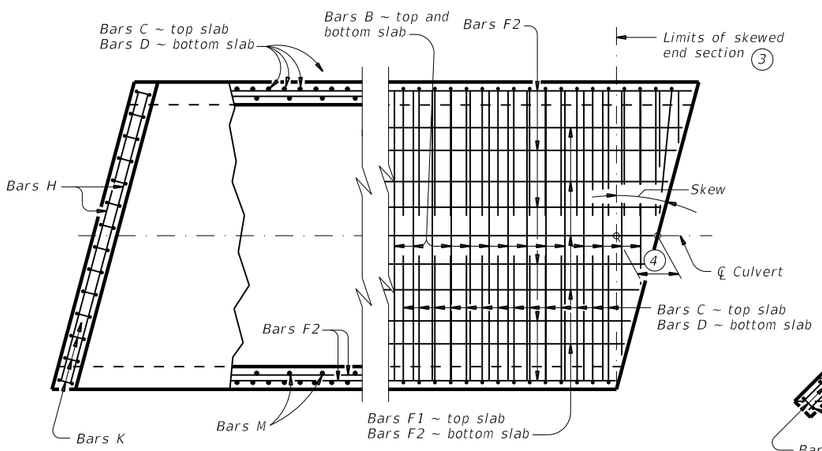
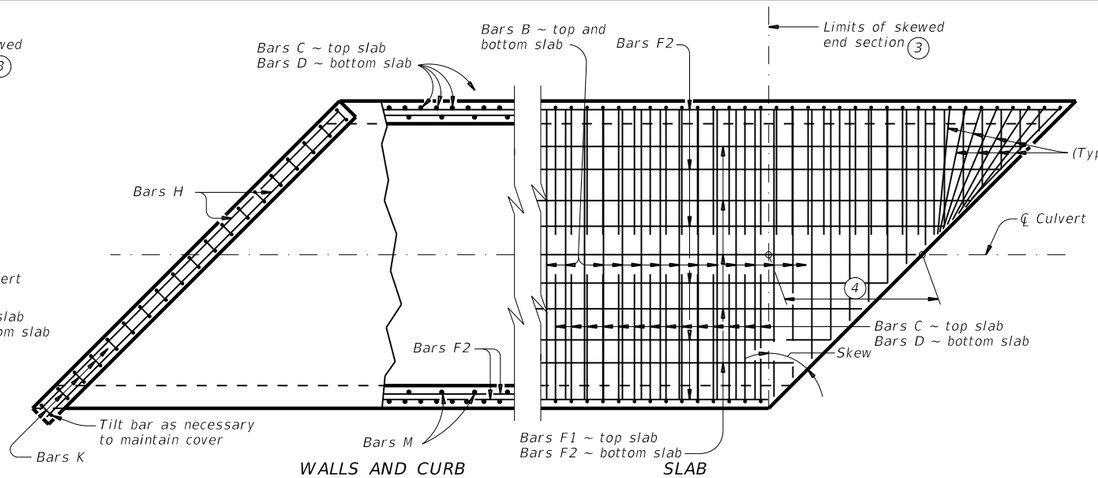
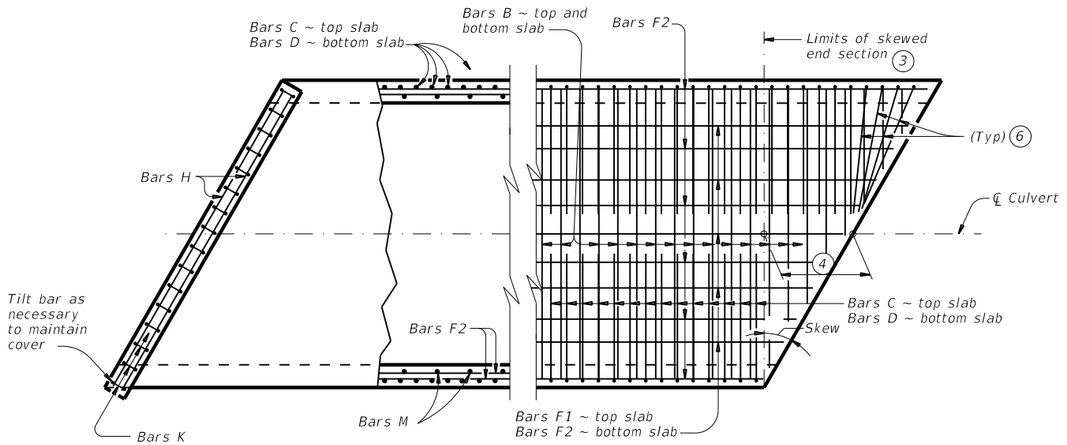


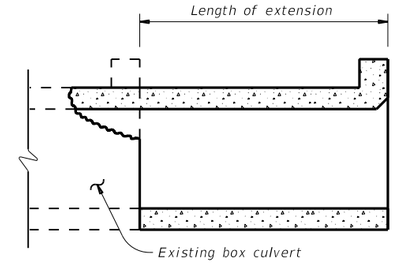
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° (7)



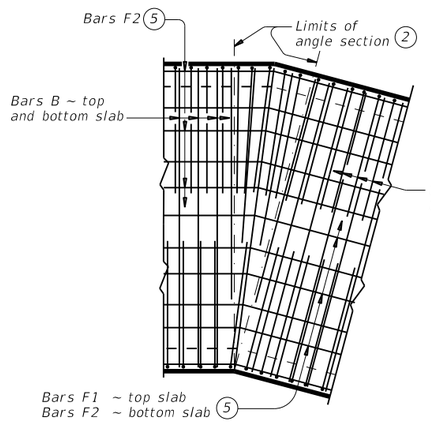
PLAN OF SKEWED ENDS ~ OVER 30° TO 45°



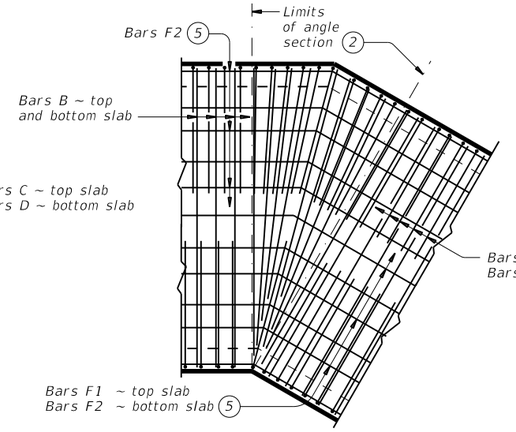
PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



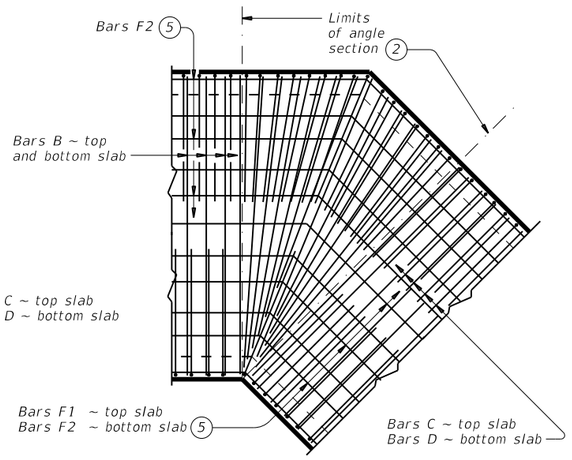
LENGTHENING DETAIL (1)



PLAN OF ANGLE SECTION ~ FROM 0° TO 15°



PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°

(1) For skewed box culverts with less than 2'-0" of fill, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension.

For non-skewed box culverts with less than 2'-0" of fill and for skewed or non-skewed culverts with a fill depth of 2'-0" or greater, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension. Alternatively, if the box is non-skewed, embed #6 anchor bars with a Type III, C, D , E, or F 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

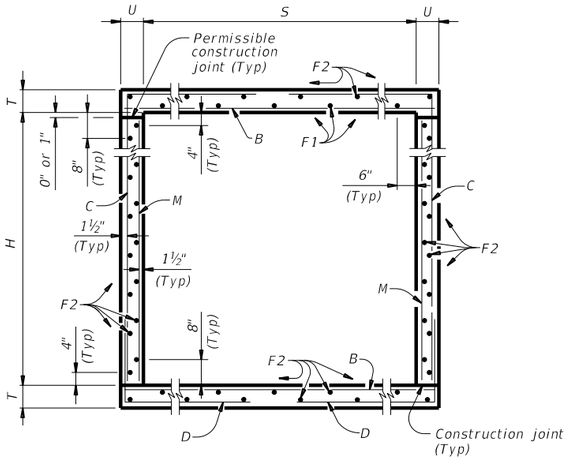
Bridge Division Standard

SINGLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

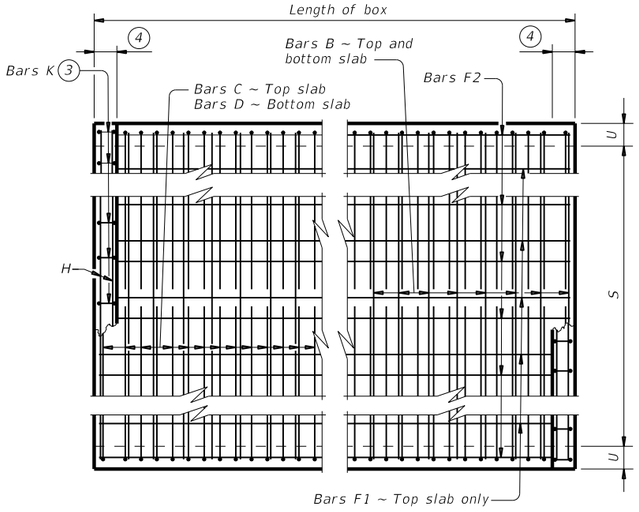
SCC-MD

FILE: sccmdste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		91

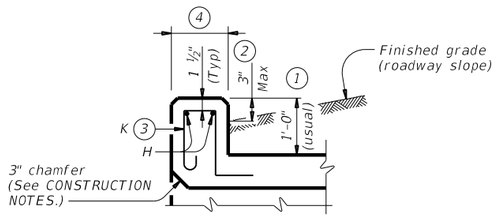
DATE:
FILE:



TYPICAL SECTION



PLAN OF REINF STEEL



SECTION THRU CURB

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

Do not use permanent forms.

Chamfer the bottom edge of the top slab 3" at the entrance.

Optionally, raise construction joints shown at the flow line by a maximum of 6". If this option is taken, Bars M may be cut off or raised, Bars C and D may be reversed.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.

Provide galvanized reinforcing steel if required elsewhere in the plans.

Provide Class C concrete (f'c = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of:

- culverts with overlay,
- culverts with 1-to-2 course surface treatment, or
- culverts with the top slab as the final riding surface.

Provide bar laps, where required, as follows:

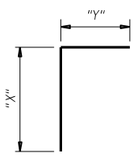
- Uncoated or galvanized ~ #4 = 1'-8" Min
- Uncoated or galvanized ~ #5 = 2'-1" Min

GENERAL NOTES:

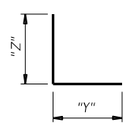
Designed according to AASHTO LRFD Bridge Design Specifications for the range of fill heights shown.

See the Single Box Culverts Cast-In-Place Miscellaneous Detail (SCC-MD) standard sheet for details pertaining to skewed ends, angle sections, and lengthening.

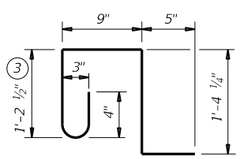
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.



BARS C



BARS D



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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

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

SCC-3 & 4

FILE: scc34ste-21.dgn	DN: TBE	CK: BNP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		92

SECTION DIMENSIONS				FILL HEIGHT (5)	BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																										QUANTITIES					
					Bars B					Bars C							Bars D							Bars M ~ #4				Bars F1 ~ #4 at 18" Spa			Bars F2 ~ #4 at 18" Spa			Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
S	H	T	U		No.	Size	Spa	Length	Weight	No.	Size	Spa	Length	Weight	" X "	" Y "	No.	Size	Spa	Length	Weight	" Y "	" Z "	No.	Spa	Length	Weight	No.	Length	Wt	No.	Length	Weight	Length	Wt	No.	Wt	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)
3' – 0"	2' – 0"	8"	7"	30'	108	#5	9"	3' – 11"	441	108	#4	9"	5' – 4"	385	2' – 6"	2' – 10"	108	#4	9"	5' – 1"	367	2' – 10"	2' – 3"	108	9"	2' – 0"	144	3	39' – 9"	80	19	39' – 9"	505	3' – 11"	10	10	28	0.292	48.1	0.3	38	12.0	1,960
3' – 0"	3' – 0"	8"	7"	30'	108	#5	9"	3' – 11"	441	108	#4	9"	6' – 4"	457	3' – 6"	2' – 10"	108	#4	9"	5' – 1"	367	2' – 10"	2' – 3"	108	9"	3' – 0"	216	3	39' – 9"	80	23	39' – 9"	611	3' – 11"	10	10	28	0.335	54.3	0.3	38	13.7	2,210
4' – 0"	2' – 0"	8"	7"	30'	108	#5	9"	4' – 11"	554	162	#4	6"	5' – 8"	613	2' – 6"	3' – 2"	162	#4	6"	5' – 5"	586	3' – 2"	2' – 3"	108	9"	2' – 0"	144	3	39' – 9"	80	21	39' – 9"	558	4' – 11"	13	12	33	0.342	63.4	0.4	46	14.1	2,581
4' – 0"	3' – 0"	8"	7"	30'	108	#5	9"	4' – 11"	554	162	#4	6"	6' – 8"	721	3' – 6"	3' – 2"	162	#4	6"	5' – 5"	586	3' – 2"	2' – 3"	108	9"	3' – 0"	216	3	39' – 9"	80	25	39' – 9"	664	4' – 11"	13	12	33	0.385	70.5	0.4	46	15.8	2,867
4' – 0"	4' – 0"	8"	7"	30'	108	#5	9"	4' – 11"	554	162	#4	6"	7' – 8"	830	4' – 6"	3' – 2"	162	#4	6"	5' – 5"	586	3' – 2"	2' – 3"	108	9"	4' – 0"	289	3	39' – 9"	80	25	39' – 9"	664	4' – 11"	13	12	33	0.428	75.1	0.4	46	17.5	3,049

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

DATE:
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HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

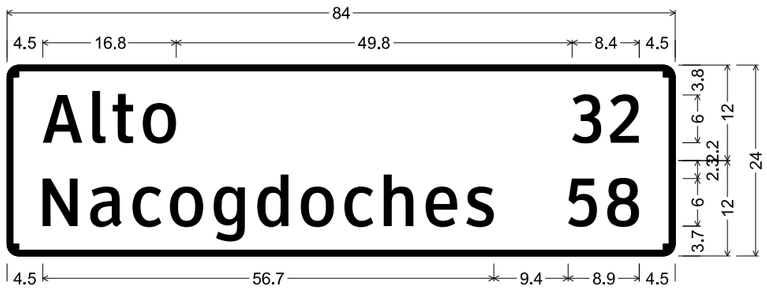
Bridge Division Standard

SINGLE BOX CULVERTS CAST-IN-PLACE

0' TO 30' FILL

SCC-3 & 4

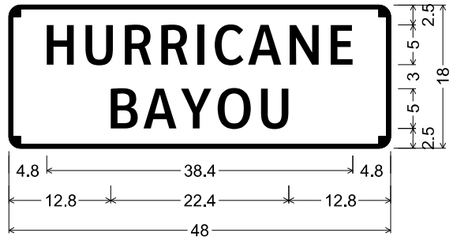
FILE: scc34ste-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		93



D2-2 6in;

1.5" Radius, 0.8" Border, White on Green;
"Alto", ClearviewHwy-3-W; "32", ClearviewHwy-3-W;

1.5" Radius, 0.8" Border, White on Green;
"Nacogdocges", ClearviewHwy-3-W; "58", ClearviewHwy-3-W;



I-3 5in;
1.5" Radius, 0.5" Border, White on Green;
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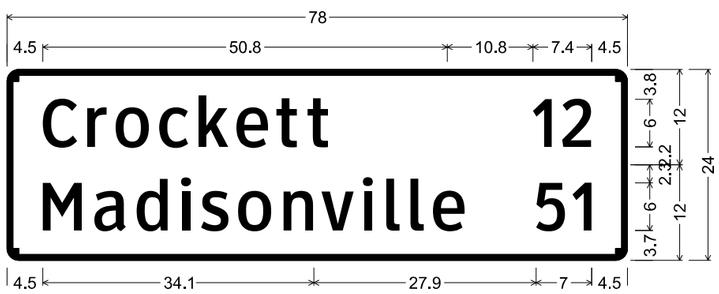
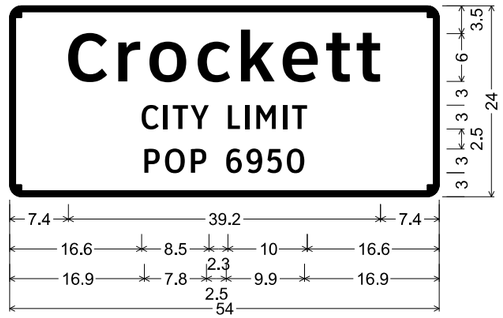
"BAYOU", ClearviewHwy-3-W;



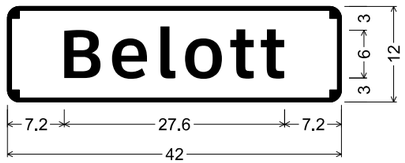
D2-2 6in;

1.5" Radius, 0.8" Border, White on Green;
"Crocketville", ClearviewHwy-3-W; "12", ClearviewHwy-3-W;

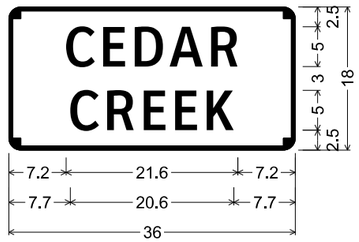
1.5" Radius, 0.8" Border, White on Green;
"Madison", ClearviewHwy-3-W; "51", ClearviewHwy-3-W;



I-2aT 6in;
1.5" Radius, 0.8" Border, White on Green;
"Crockett", ClearviewHwy-5-W-R;
"CITY LIMIT", ClearviewHwy-3-W;
"POP 6950", ClearviewHwy-3-W;



I-2cT 6in;
1.5" Radius, 0.5" Border, White on Green;
"Belott", ClearviewHwy-5-W-R;



I-3 5in;
1.5" Radius, 0.5" Border, White on Green;
"CEDAR", ClearviewHwy-3-W;
"CREEK", ClearviewHwy-3-W;

NOT TO SCALE

DocuSigned by:
Richard B. Klatt
4692CB9B5B4345...
11/1/2023

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

SIGN DETAILS

Sheet 1 of 2

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		94

DATE: 11/1/2023 1:56:45 PM
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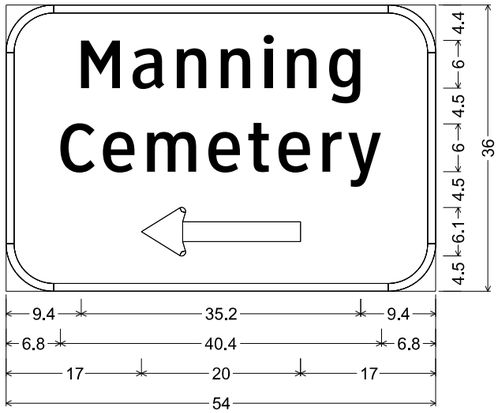

6.0" Radius, 1.0" Border, White on Green;
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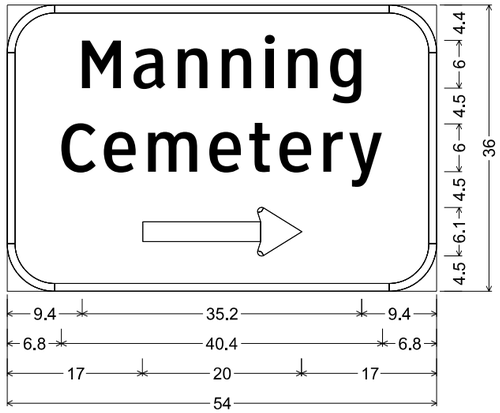
"Cemetery", ClearviewHwy-3-W;
Standard Arrow Custom 20.0" X 6.1" 180°;



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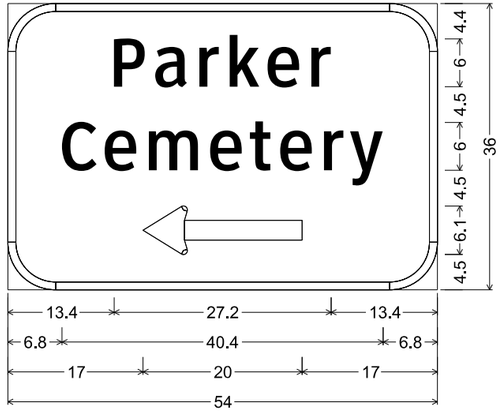
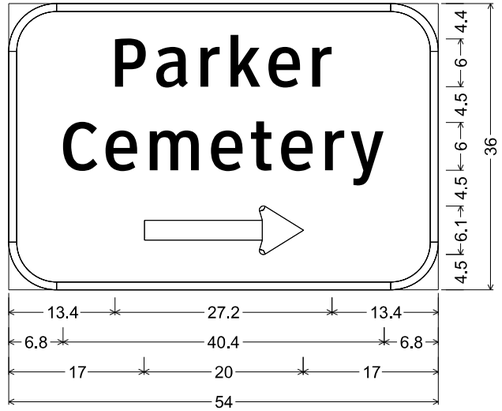
"Cemetery", ClearviewHwy-3-W;
Standard Arrow Custom 20.0" X 6.1" 0°;



6.0" Radius, 1.0" Border, White on Green;
"Parker", ClearviewHwy-3-W;
"Cemetery", ClearviewHwy-3-W;
Standard Arrow Custom 20.0" X 6.1" 180°;



6.0" Radius, 1.0" Border, White on Green;
"Parker", ClearviewHwy-3-W;
"Cemetery", ClearviewHwy-3-W;
Standard Arrow Custom 20.0" X 6.1" 0°;

NOT TO SCALE

DocuSigned by:
Richard B. Klatt
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11/1/2023

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

SIGN DETAILS

Sheet 2 of 2

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		95

DATE: 11/1/2023 1:56:46 PM
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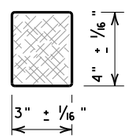
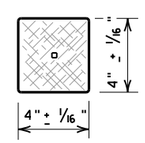
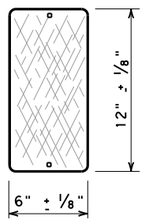
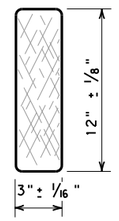
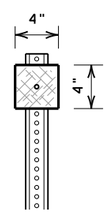
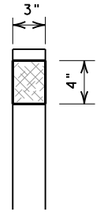
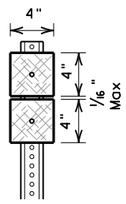
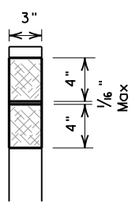
REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

	SIZE 1	SIZE 2	SIZE 3	SIZE 4
DEVICE				
SHEETING	Yellow, White or Red Type B or C reflective sheeting			
NOTE	1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (flx). 2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.			

DELINEATORS

	SINGLE		DOUBLE	
DEVICE				
	1-Size 2 reflector unit	1-Size 1 reflector unit	2-Size 2 reflector units	2-Size 1 reflector units
SHEETING	Yellow, White or Red Type B or C Reflective Sheeting			
POST TYPE	WC	YFLX, WFLX	WC	YFLX, WFLX
MOUNT TYPE	GND	GND, SRF	GND	GND, SRF

D & OM DESCRIPTIVE CODES

INSTL DEL ASSM (D-XX)SZ X (XXXX)XXX(XX)

NUMBER OF REFLECTORS
S = Single
D = Double

COLOR OF REFLECTORS
W = White
Y = Yellow
R = Red

REFLECTOR UNIT SIZE
1 or 2

TYPE OF POST OR DELINEATOR
WC = Wing Channel Post
YFLX = Yellow Flexible Post
WFLX = White Flexible Post
BRF = Barrier Reflector

TYPE OF MOUNT
GND = Embedded (drivable or set in concrete)
CTB = Concrete Barrier Mount
GF1 or GF2 = Guard Fence Attachment
SRF = Surface Mount

DIRECTION
If Required
BI = Bi-Directional
BR = Bi-Directional with red on back

INSTL OM ASSM (OM-XX) (XXXX)XXX(XX)

TYPE OF OBJECT MARKER
1, 2, 3, or 4

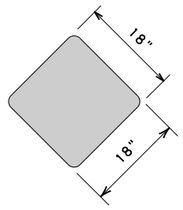
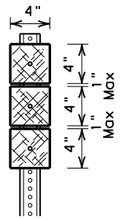
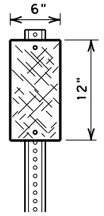
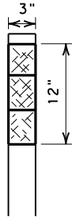
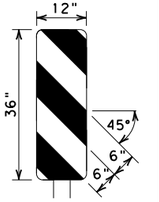
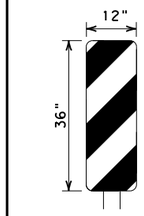
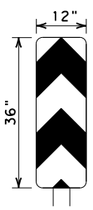
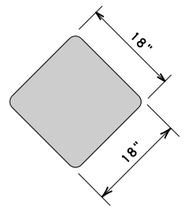
NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s) (Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

TYPE OF POST
WC = Wing Channel Post
WFLX = White Flexible Post
TWT = Thin Walled Tubing

TYPE OF MOUNT
GND = Embedded (drivable)
SRF = Surface Mount
WAS = Wedge Anchor Steel
WAP = Wedge Anchor Plastic

DIRECTION
If Required
BI = Bi-Directional

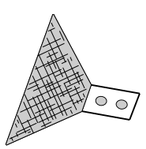
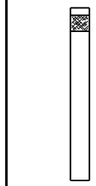
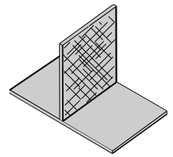
OBJECT MARKERS

	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

DEPARTMENTAL MATERIAL SPECIFICATIONS

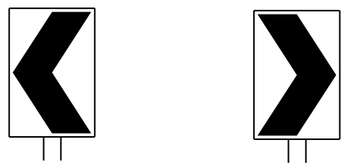
FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES)	DMS-4400
SIGN FACE MATERIALS	DMS-8300
DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS	DMS-8600

BARRIER REFLECTORS (BRF)

	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



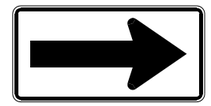
W1-8

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.

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	0118	02	036, ETC.	SH 21
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	LFK	HOUSTON		96

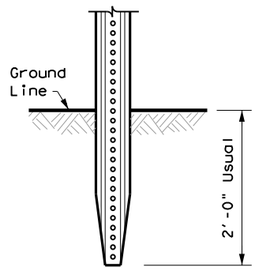
20A

DATE:
FILE:

POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

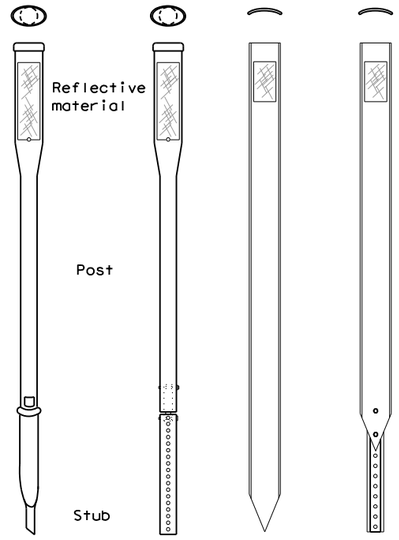


NOTES

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.

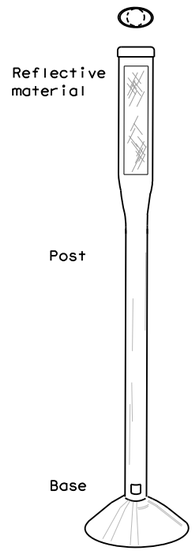
FLEXIBLE POSTS (YFLX, WFLX)

GND



EMBEDDED

SRF



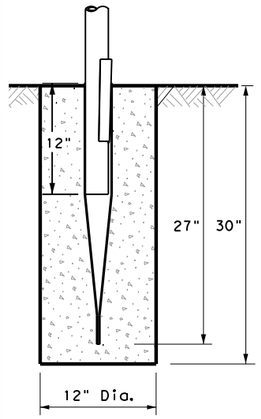
SURFACE MOUNT

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.

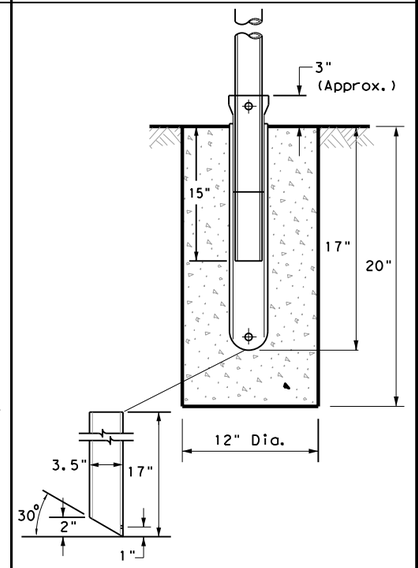
WEDGE ANCHOR SYSTEMS

WAS



STEEL

WAP



PLASTIC

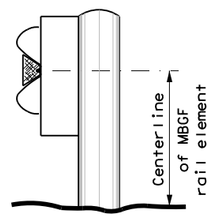
NOTE

1. Install per manufacturer's recommendations.

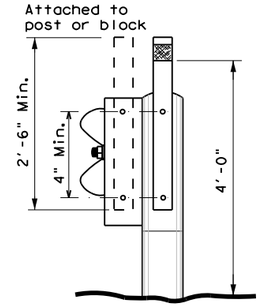
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

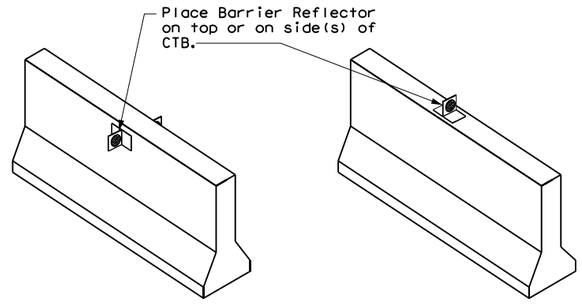
GF1



GF2



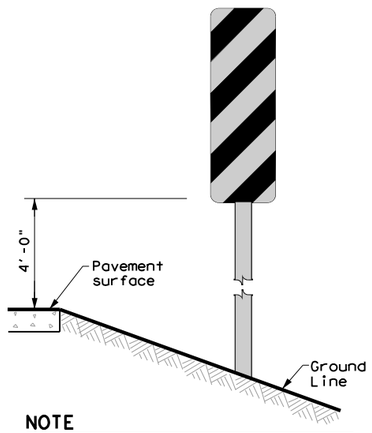
CONCRETE TRAFFIC BARRIER (CTB)



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.

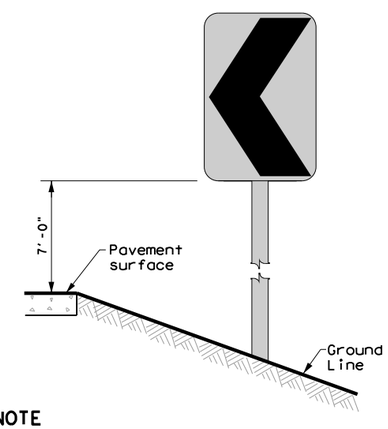
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



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)

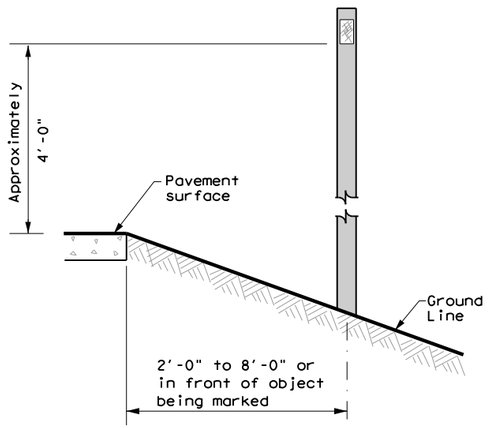
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



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	0118	02	036, ETC.	SH 21
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	LFK	HOUSTON		97

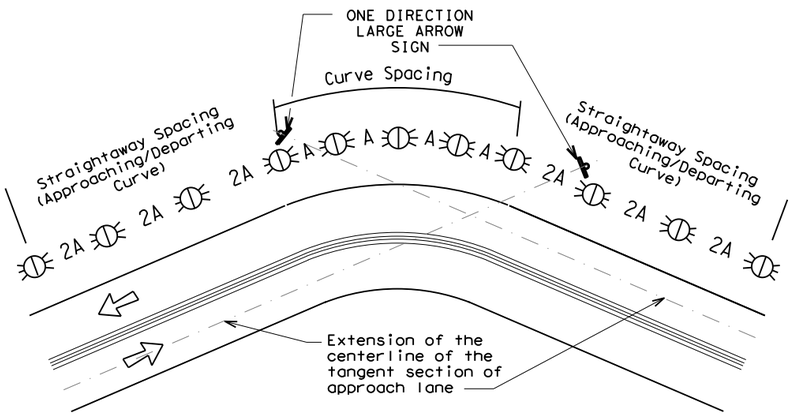
20B

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

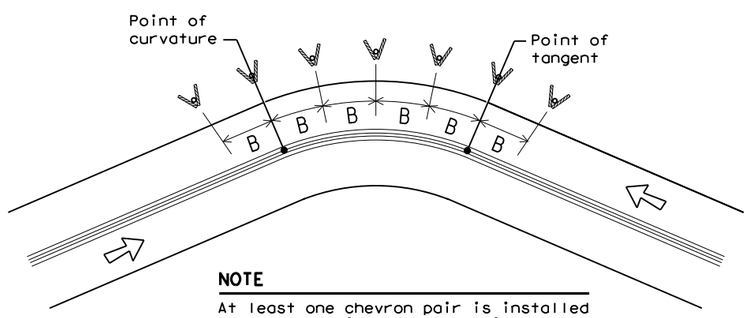
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



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.

DATE:
FILE:

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

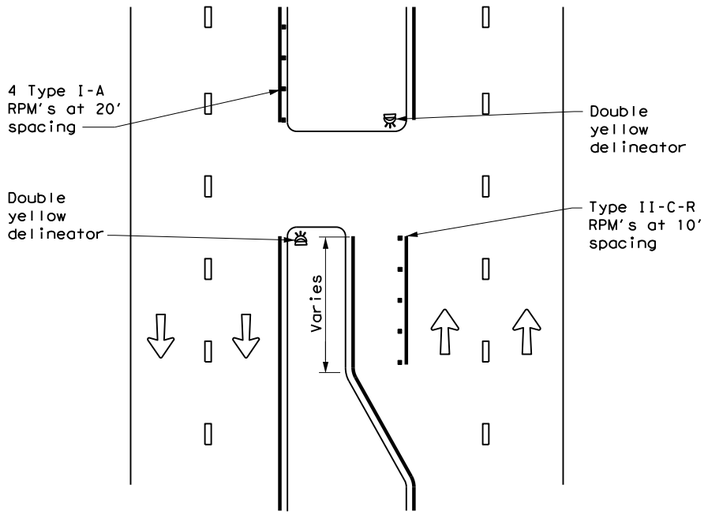
DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(3)-20

FILE: dom3-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
3-15 8-15	DIST	COUNTY		SHEET NO.
8-15 7-20	LFK	HOUSTON		98

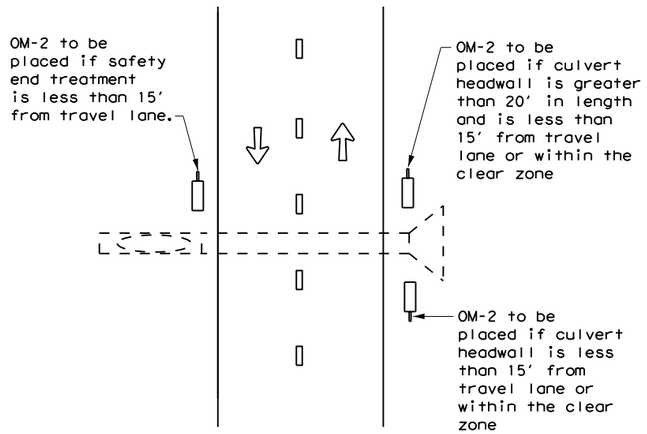
20C

CROSSOVERS



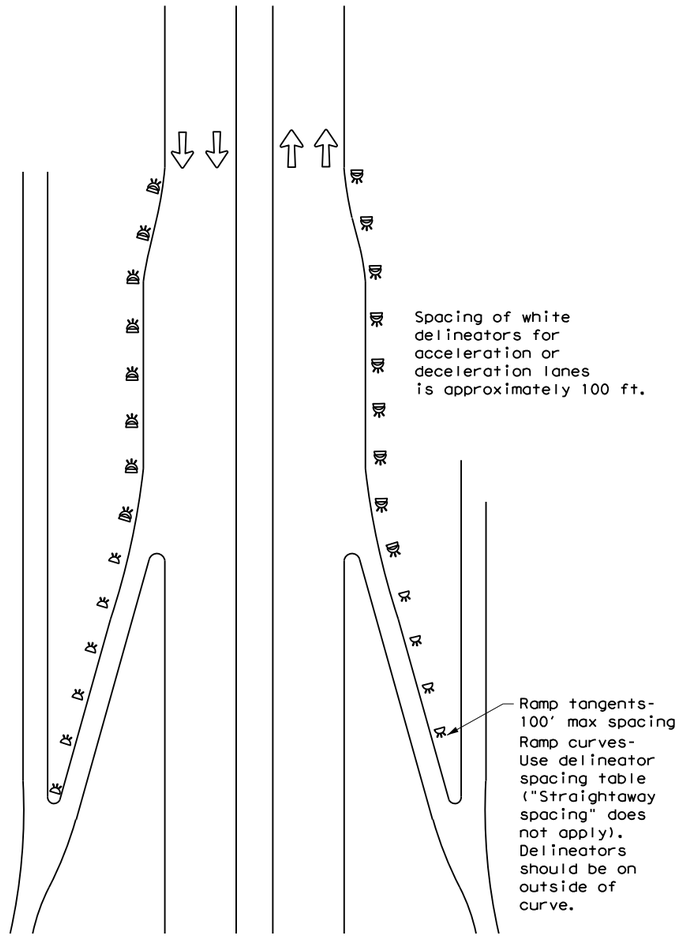
DETAIL 1

FOR CULVERTS WITHOUT MBGF



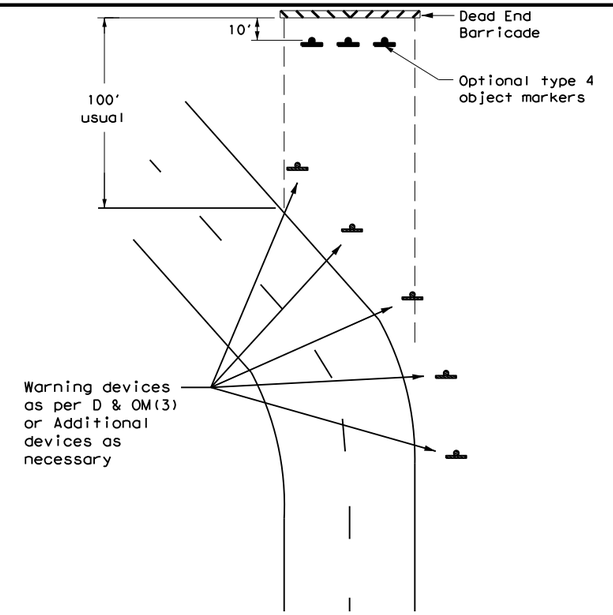
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



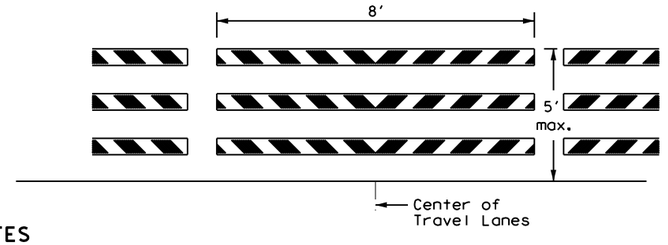
DETAIL 3

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

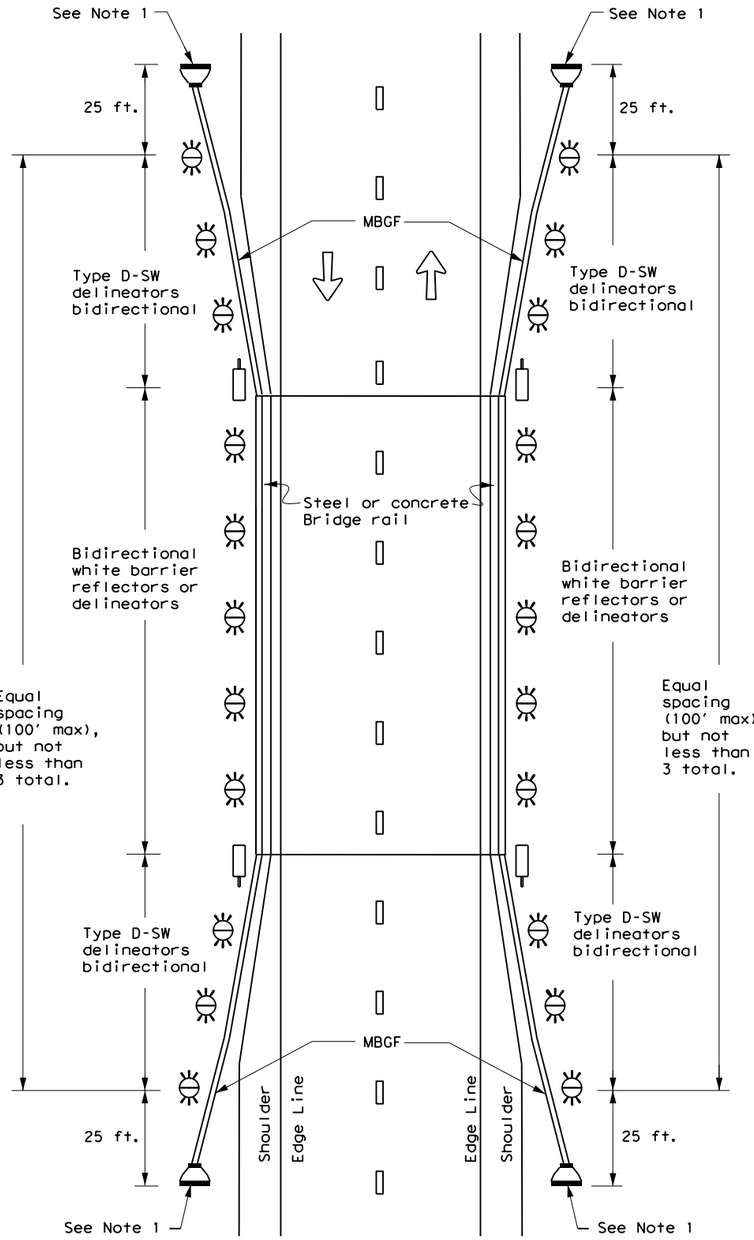
FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
3-15	DIST	COUNTY		SHEET NO.
7-20	LFK	HOUSTON		99

DATE:
FILE:

20D

DATE:
FILE:

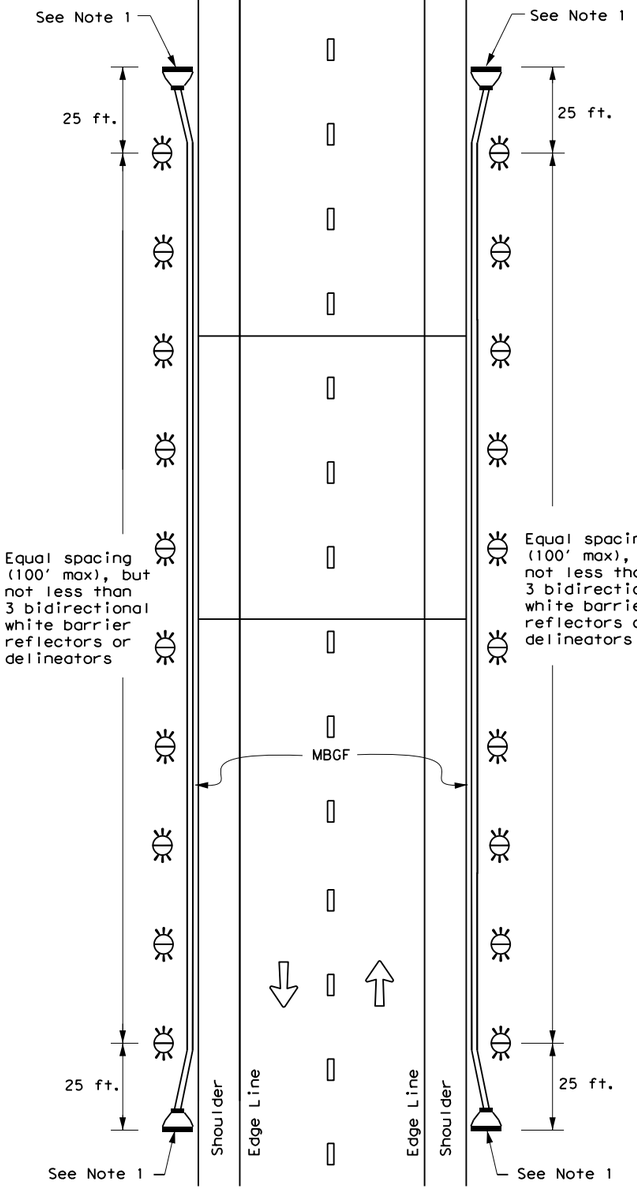
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



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.

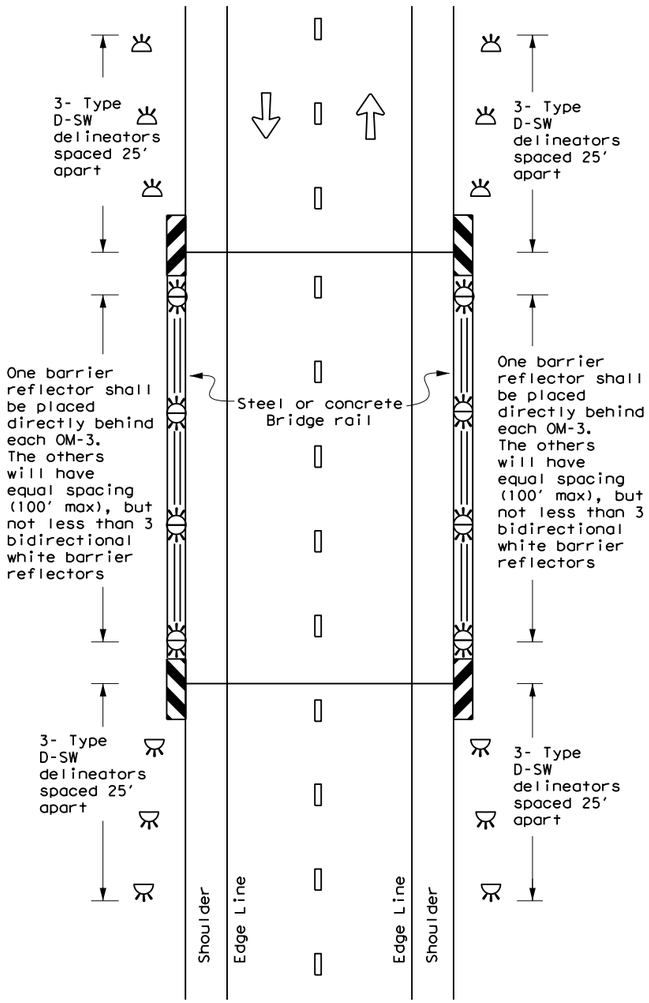
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



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

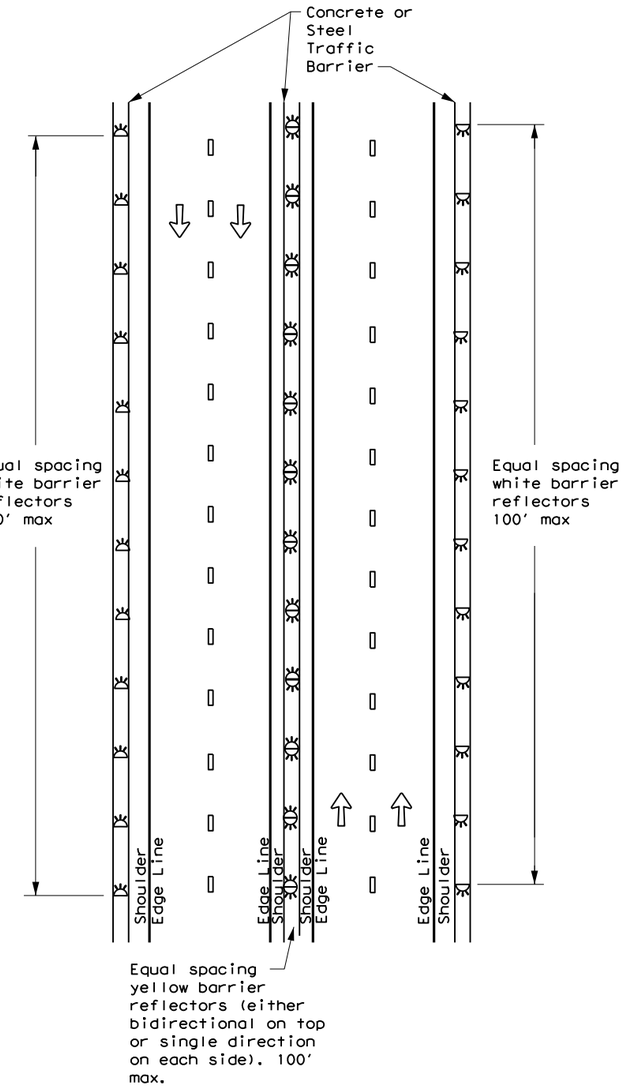
D & OM(5)-20

FILE: dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
7-20	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		100

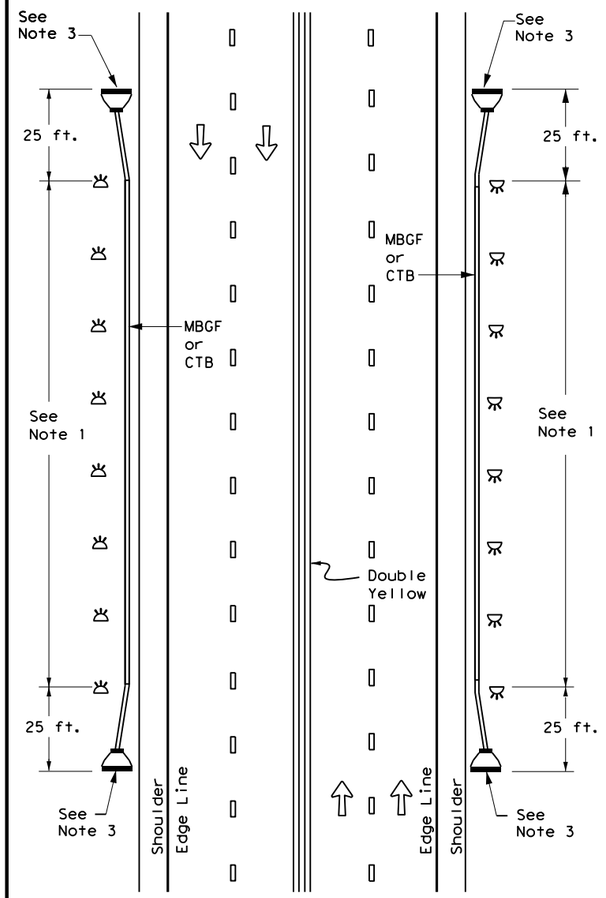
20E

DATE:
FILE:

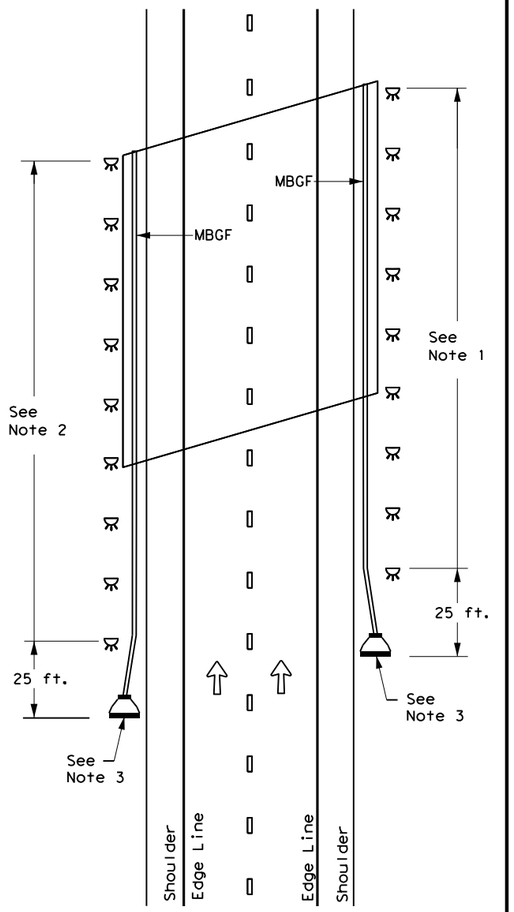
CONTINUOUS CONCRETE OR STEEL BARRIER



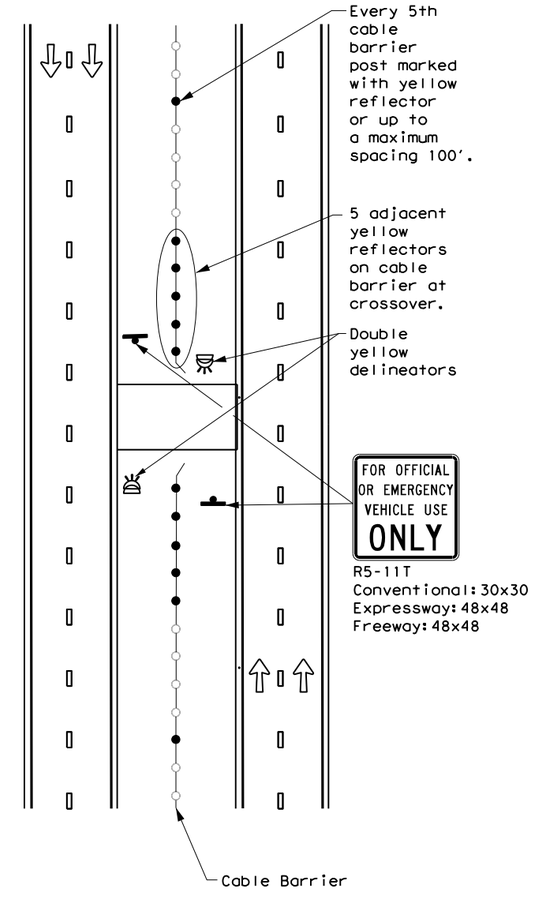
MULTI-LANE UNDIVIDED, TWO-WAY ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



DIVIDED ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



EMERGENCY CROSSOVER



NOTES

1. Equal spacing (100′ max), but not less than 3 single directional white barrier reflectors or delineators. On Continuos Barrier, equal spacing (100′ max.)
2. Equal spacing (100′ max), but not less than 3 single directional yellow barrier reflectors or delineators.
3. 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.

LEGEND

	Bidirectional Delineator
	Delineator
	OM-3
	OM-2
	Terminal End
	Traffic Flow

Texas Department of Transportation

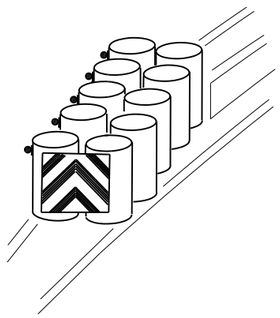
Traffic Safety Division Standard

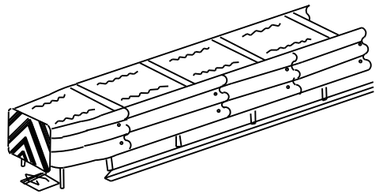
DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

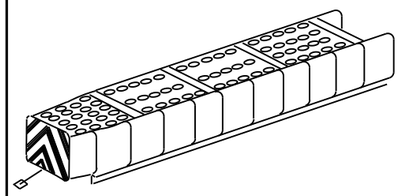
D & OM(6)-20

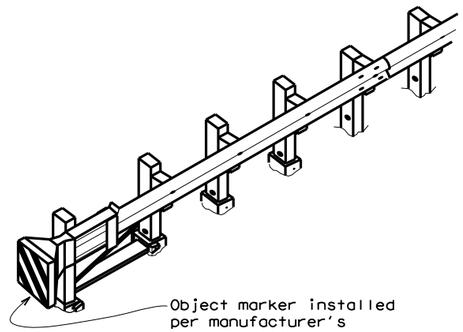
FILE: dom6-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
7-20	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		101

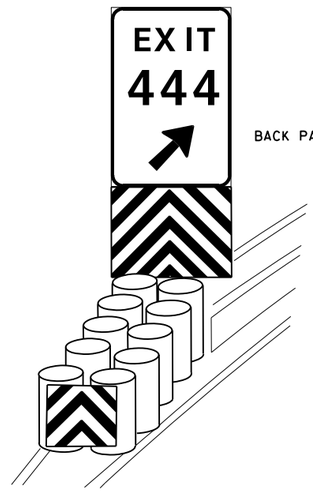
DATE:
FILE:

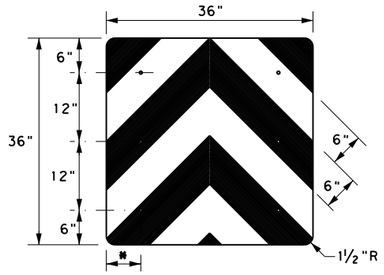


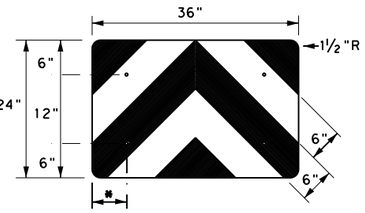




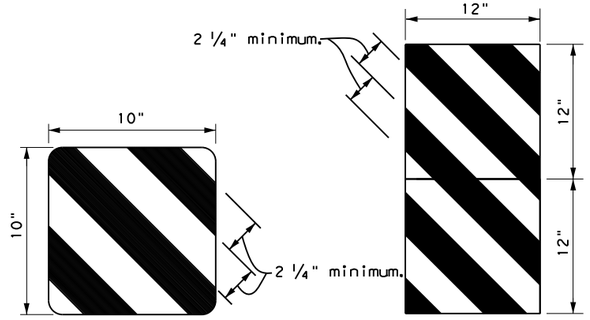




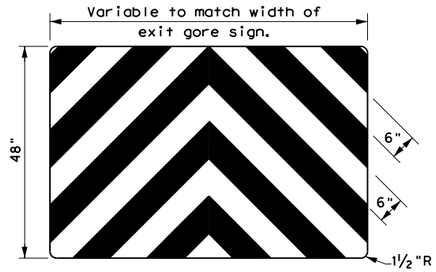


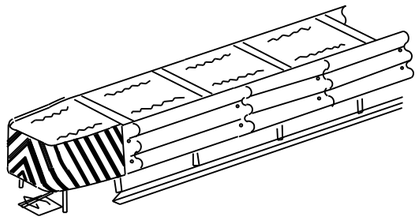


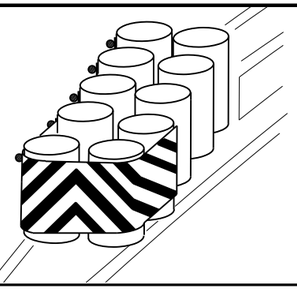
* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

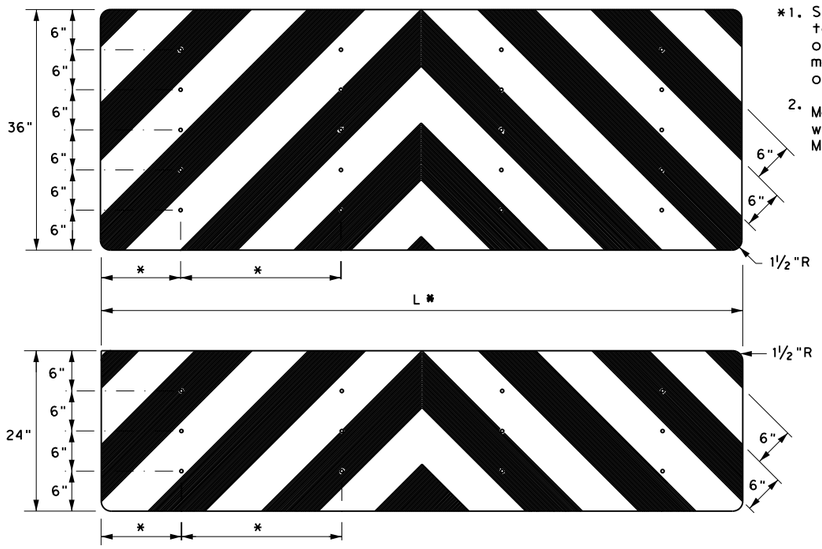


OBJECT MARKERS SMALLER THAN 3 FT^2









NOTES

*1. Spacing should be adjusted to attach through centerline of drum, per attenuator manufacturers recommendation, or as directed by the Engineer.

2. Mounting should be flush with top of attenuator. Minimum size 96" x 24".

NOTES

1. Object Markers shall conform to the Texas MUTCD and meet the color and reflectivity requirement of Department Material Specification DMS 8300. Background shall be yellow reflective sheeting (Type B or C) and Chevron shall be black.

2. Object Markers may be fabricated from adhesive backed reflective sheeting applied directly to guardrail end treatment, or applied directly to an "end cap" as per the manufacturer's recommendation. Direct applied sheeting shall provide a smooth surface and have no wrinkles, air bubbles, cuts or tears. A radius at the corners is not required for direct applied sheeting.

3. Object Marker size may be reduced to fit smaller devices. Width of alternating black and yellow stripes are typically 6". Object Markers smaller than 3ft may have reduced width stripes of a minimum of 2 ¼".

4. Pop rivets, screws, or nuts and bolts may be used to attach object markers and reflectors. Holes, slots or other openings may be cut or drilled through object markers to allow cable or other attachments.

5. Object Marker at nose of attenuator is subsidiary to the attenuator.

6. See D & OM (1-4) for required barrier reflectors.

Texas Department of Transportation

Traffic Safety Division Standard

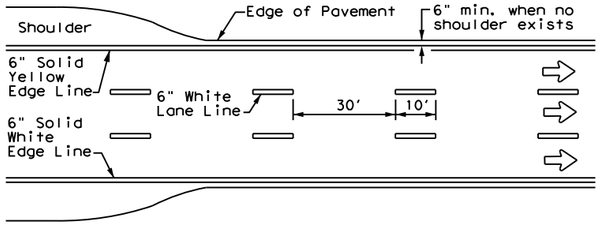
DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS

D & OM(VIA)-20

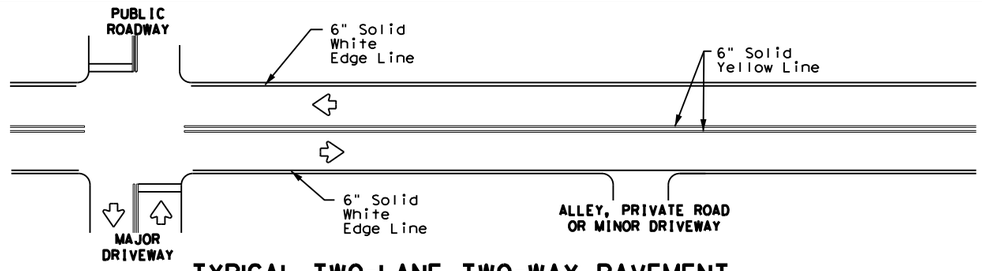
FILE: domvia20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT December 1989	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
4-92 8-04	DIST	COUNTY		SHEET NO.
8-95 3-15	LFK	HOUSTON		102
4-98 7-20				

20G

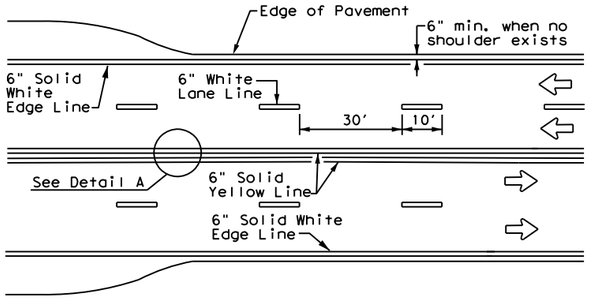
DATE:
FILE:

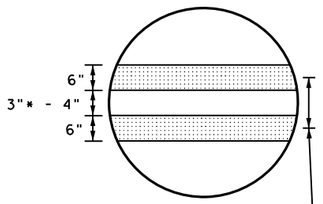


EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



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





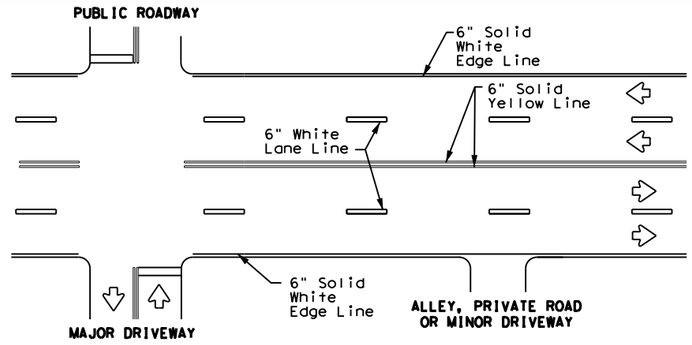
DETAIL "A"

9"** min. - 10" typ.
(18" max. for traveled way greater than 48' only)

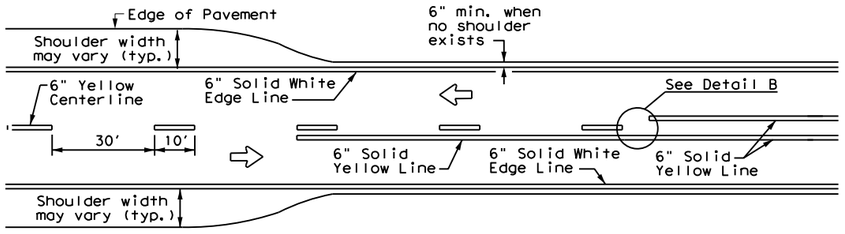
CENTERLINE AND LANE LINES FOUR LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS

* 2" minimum for restripe projects when approved by the Engineer.

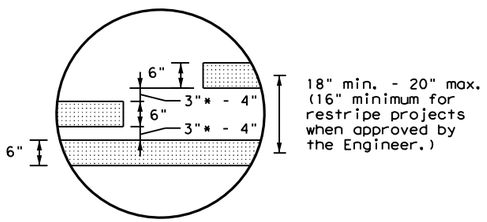
** 8" minimum for restripe projects when approved by the Engineer.



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

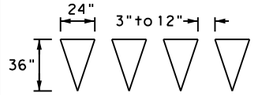


TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS



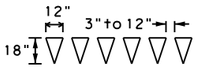
DETAIL "B"

* 2" minimum for restripe projects when approved by the Engineer.

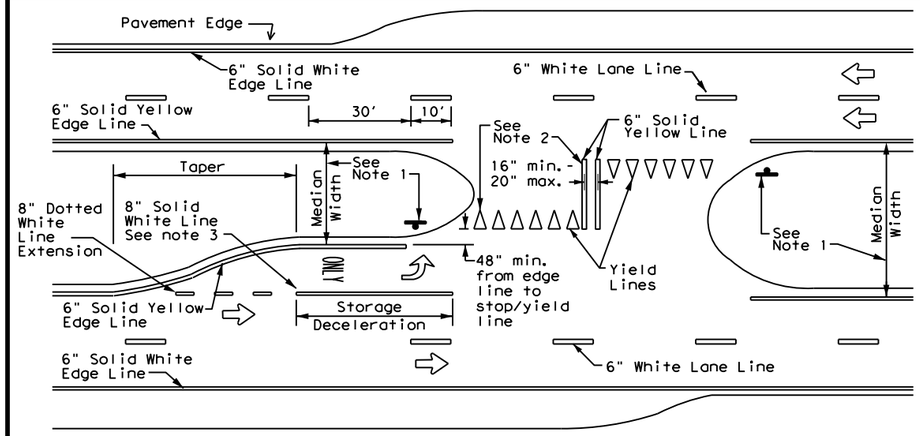


For posted speed on road being marked equal to or greater than 45 MPH.

YIELD LINES



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



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

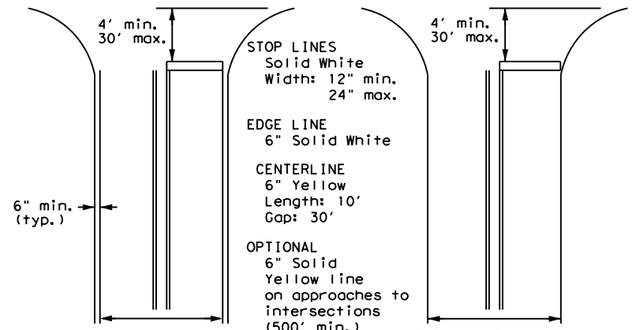
1. Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections.
   Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling 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

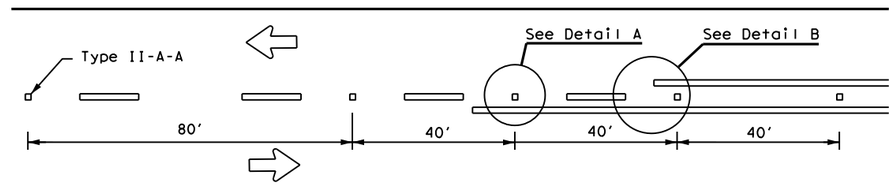
TYPICAL STANDARD PAVEMENT MARKINGS

PM(1)-22

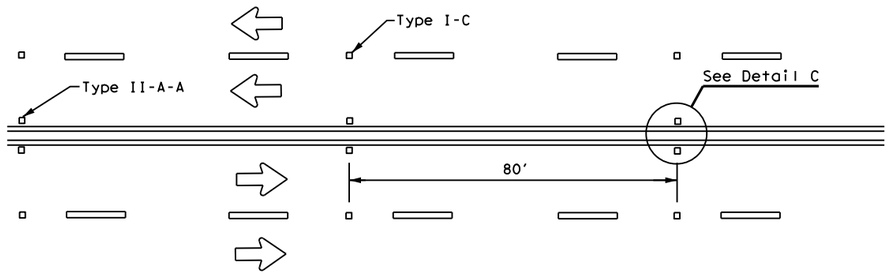
FILE: pm1-22.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
11-78 8-00 6-20	DIST	COUNTY		SHEET NO.
8-95 3-03 12-22	LFK	HOUSTON		103
5-00 2-12				

22A

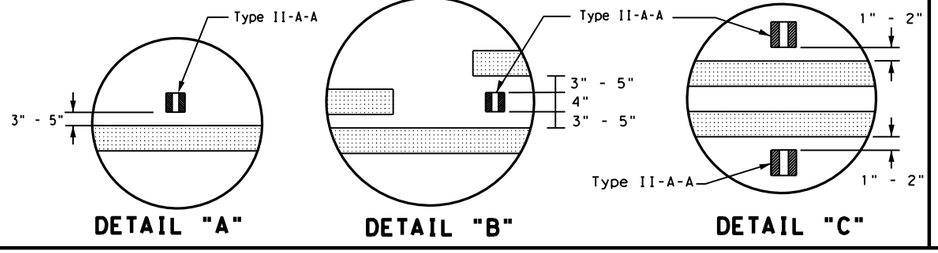
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE

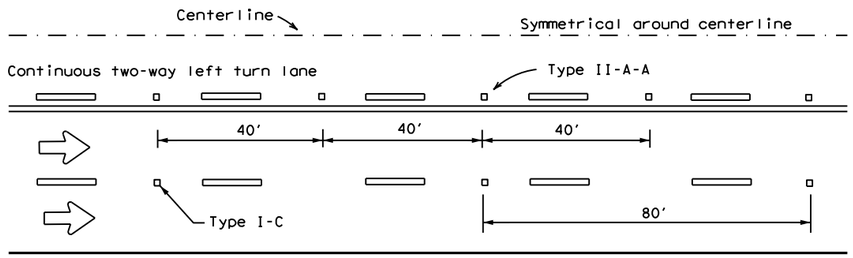


CENTERLINE FOR ALL TWO LANE TWO-WAY ROADWAYS

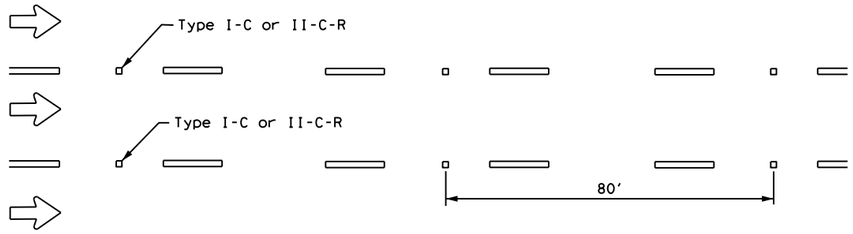


CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY ROADWAYS





CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



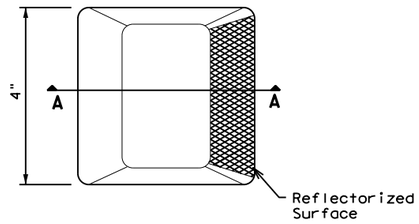
LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

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

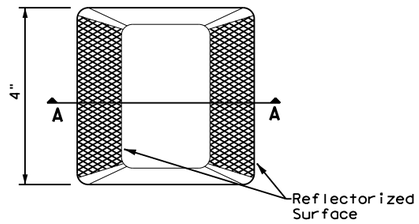
See Note 3.

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

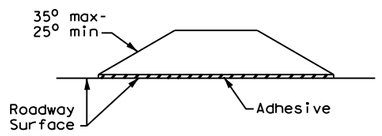
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)

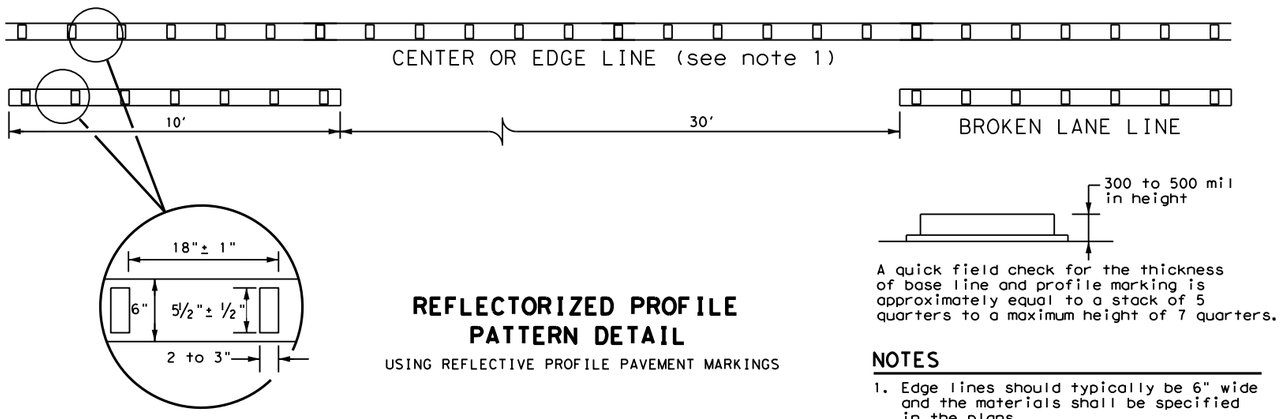


Type II (Top View)



SECTION A

RAISED PAVEMENT MARKERS



REFLECTORIZED PROFILE PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS

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.

Texas Department of Transportation

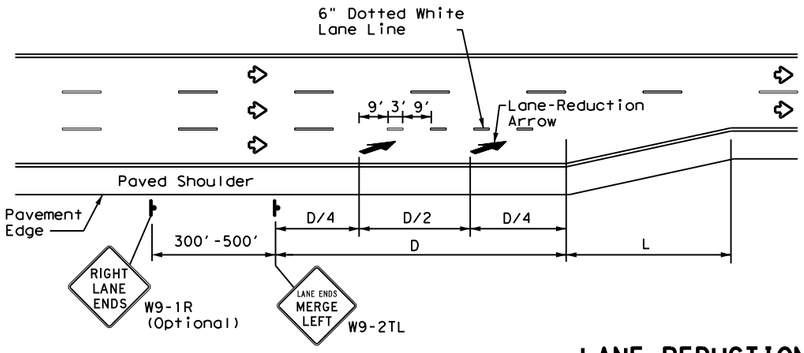
Traffic Safety Division Standard

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	0118	02	036, ETC.	SH 21
4-77 8-00 6-20	DIST	COUNTY		SHEET NO.
4-92 2-10 12-22	LFK	HOUSTON		104
5-00 2-12				

22B

DATE:
FILE:

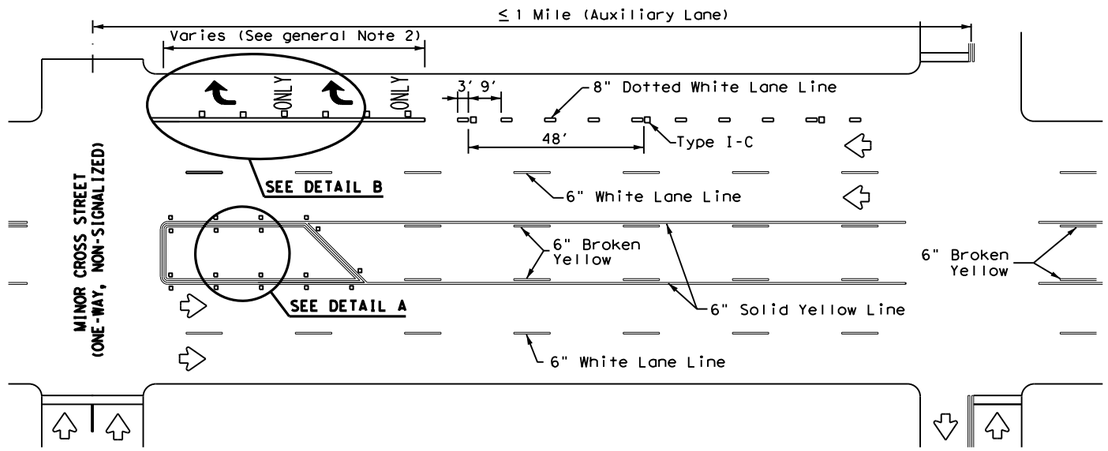


LANE REDUCTION

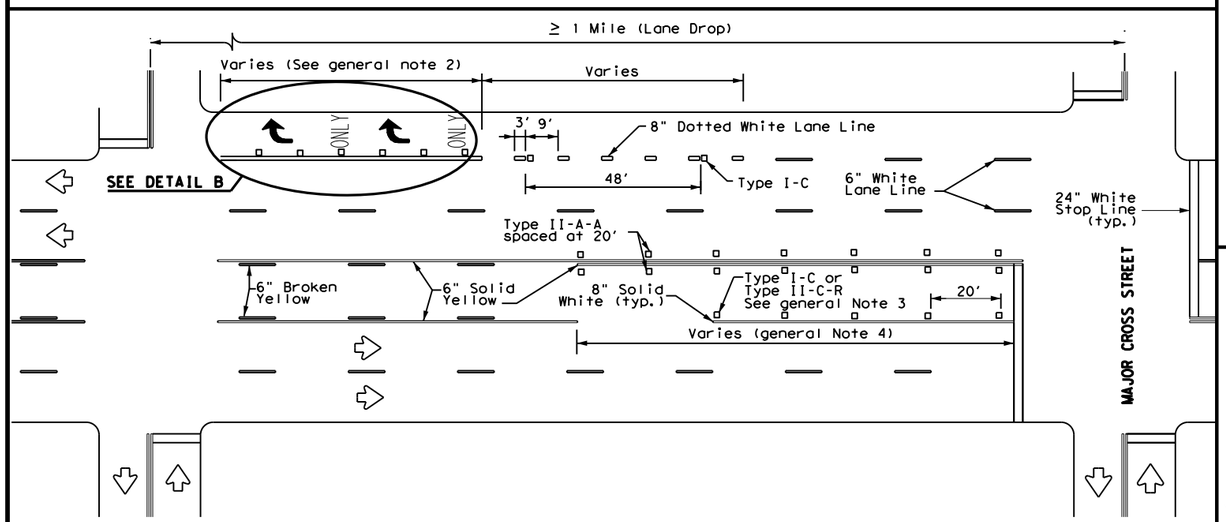
NOTES

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.

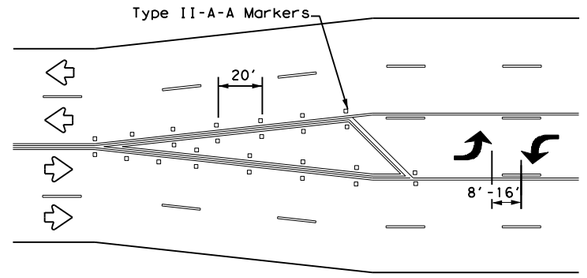
ADVANCED WARNING SIGN DISTANCE (D)		
Posted Speed	D (ft)	L (ft)
30 MPH	460	$L = \frac{WS^2}{60}$
35 MPH	565	
40 MPH	670	
45 MPH	775	L=WS
50 MPH	885	
55 MPH	990	
60 MPH	1,100	
65 MPH	1,200	
70 MPH	1,250	
75 MPH	1,350	



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

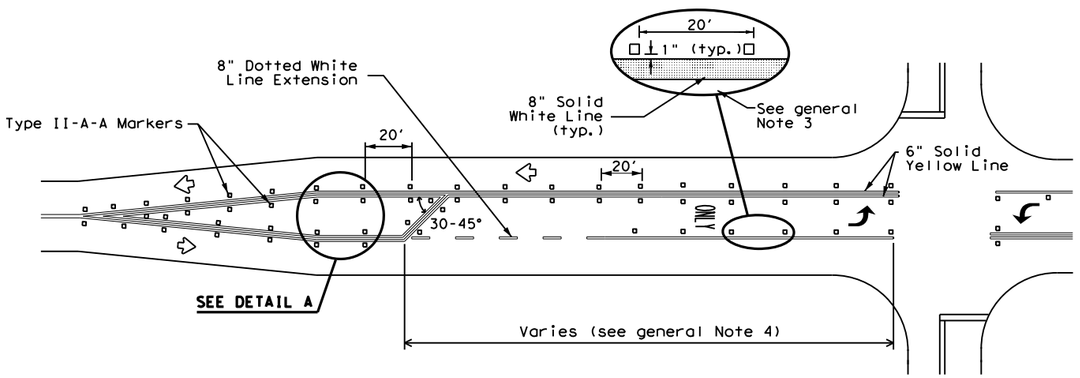


TYPICAL TWLTL AT TWO-WAY CROSS STREET AND RIGHT TURN LANE DROP



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



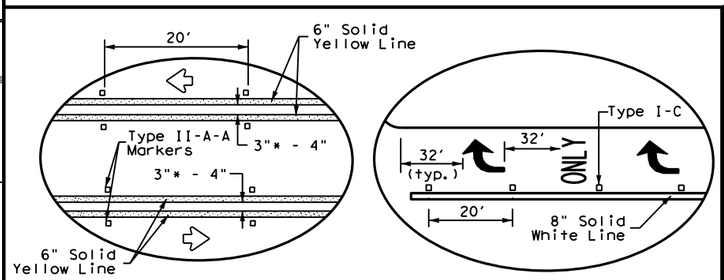
TYPICAL TWO-LANE ROADWAY INTERSECTION WITH LEFT TURN BAYS

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.



* 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 4-98 3-03 6-20 5-00 2-10 12-22 8-00 2-12	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		105

22C

DATE:
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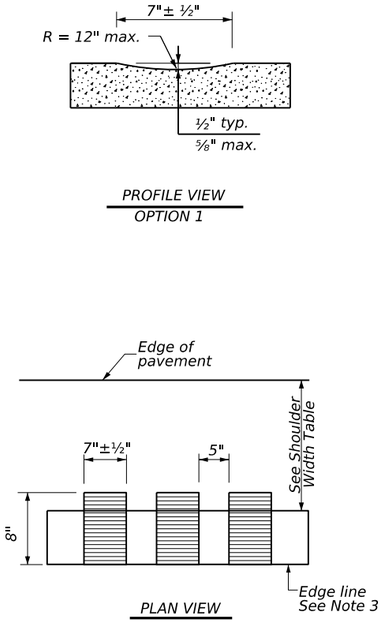
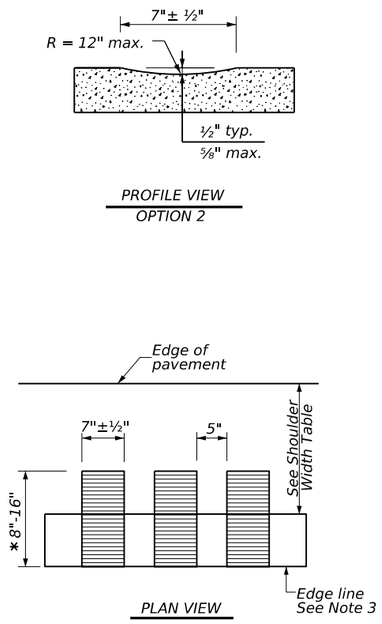
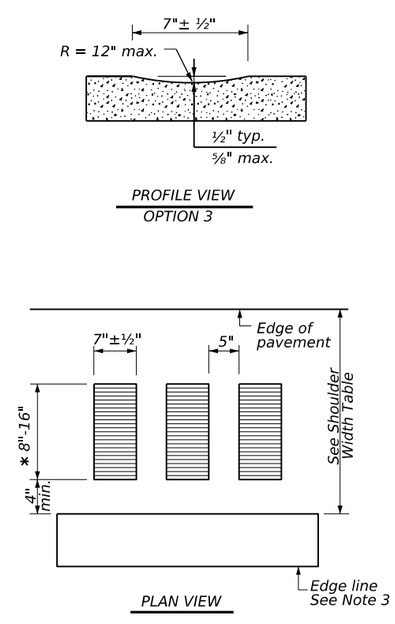


CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



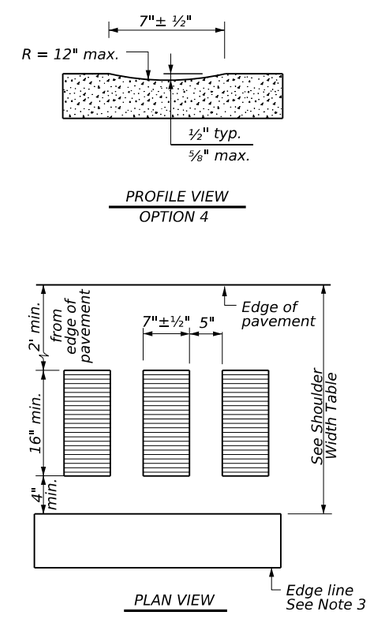
∗ This distance may vary based on width of shoulder

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

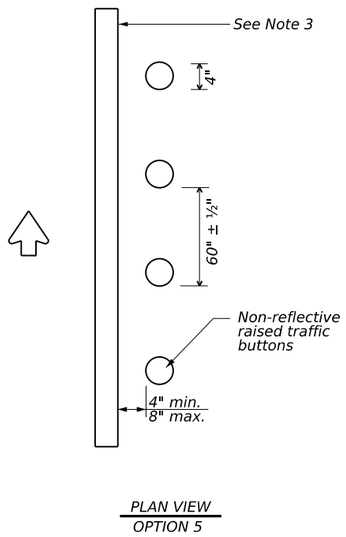


∗ This distance may vary based on width of shoulder

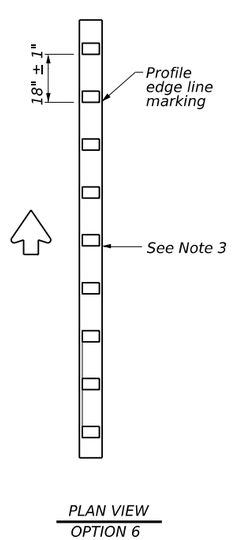
CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



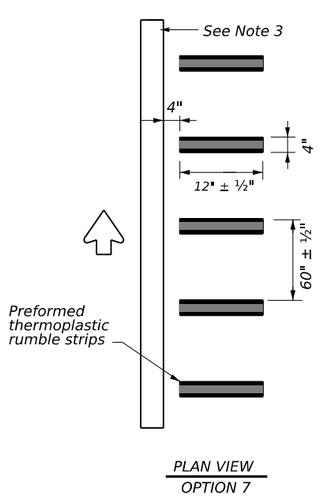
CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



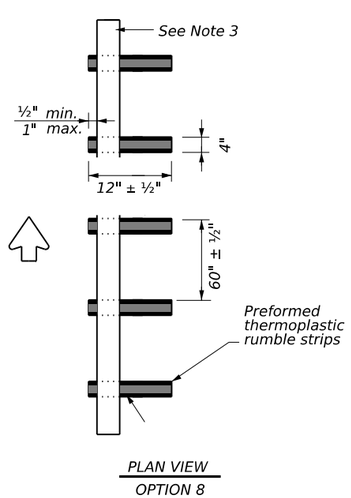
RAISED EDGE LINE (Rumble Strips)



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	0118	02	036, ETC.	SH 21
10-13 1-23	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		106

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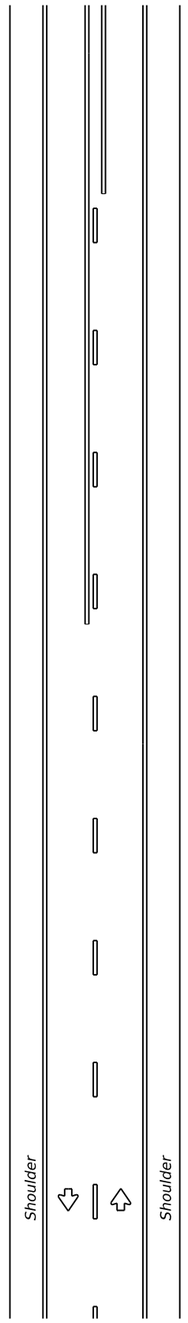
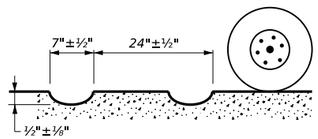
DATE:
FILE:

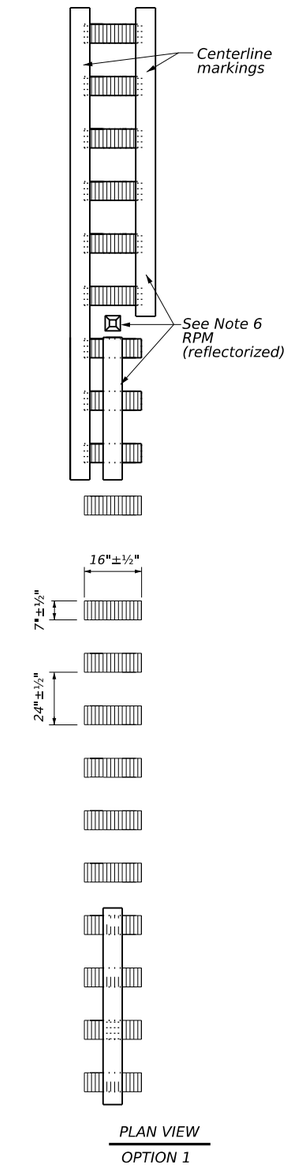
CENTERLINE RUMBLE STRIPS



TWO LANE TWO-WAY HIGHWAYS

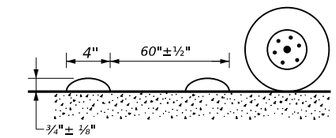


PROFILE VIEW

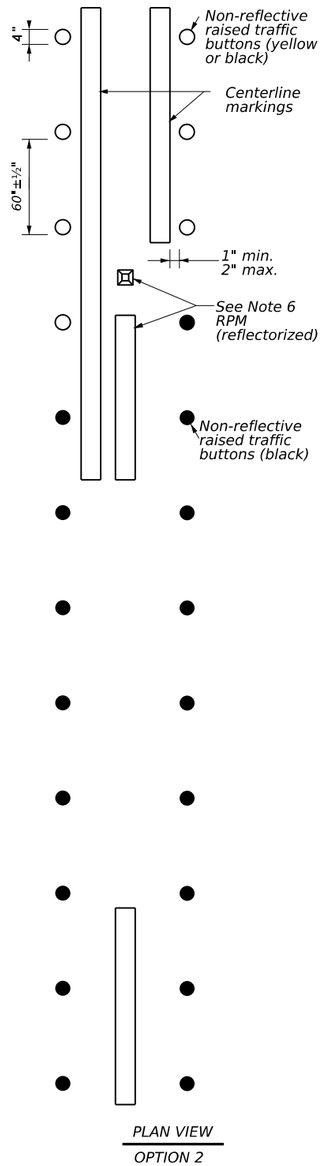


PLAN VIEW
OPTION 1

MILLED CENTERLINE RUMBLE STRIPS

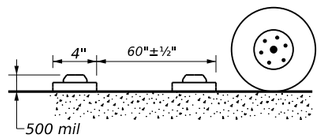


PROFILE VIEW

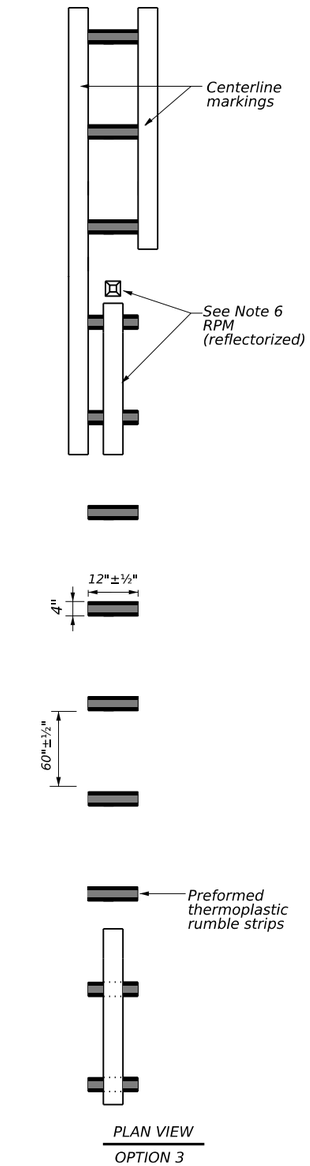


PLAN VIEW
OPTION 2

RAISED CENTERLINE RUMBLE STRIPS

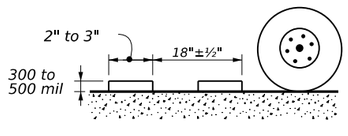


PROFILE VIEW

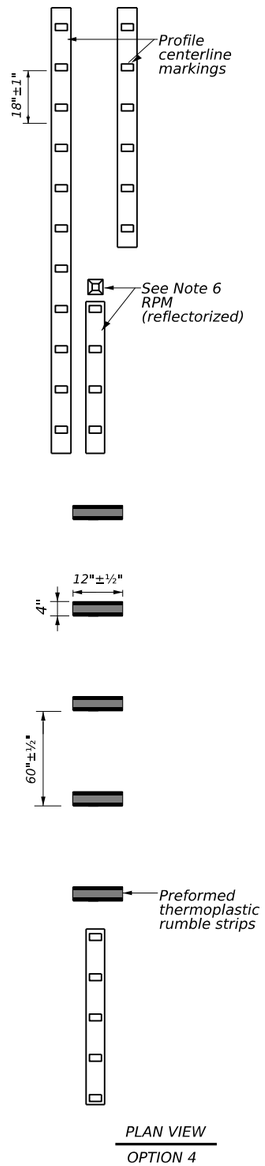


PLAN VIEW
OPTION 3

PREFORMED THERMOPLASTIC RUMBLE STRIPS



PROFILE VIEW



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).

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	0118	02	036, ETC.	SH 21
10-13 1-23	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		107

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)

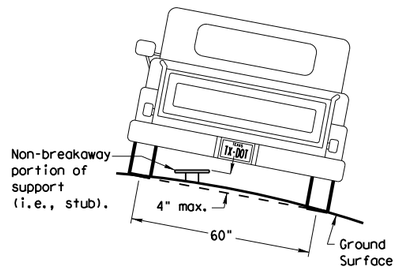
Anchor Type

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))

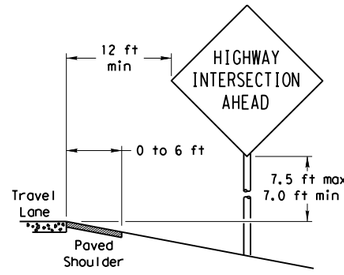
REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



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).

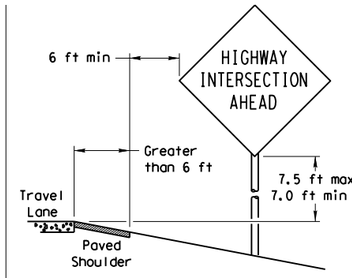
SIGN LOCATION

PAVED SHOULDERS



LESS THAN 6 FT. WIDE

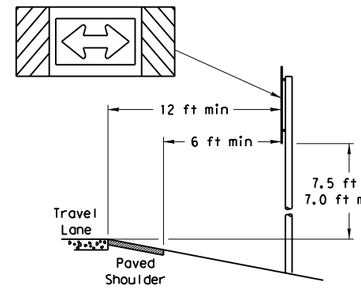
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



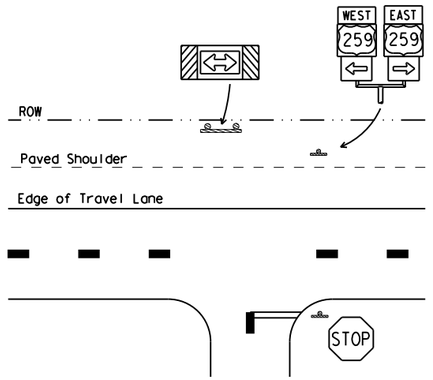
GREATER THAN 6 FT. WIDE

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.

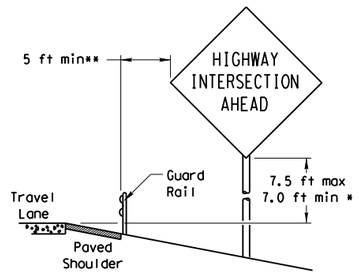
T-INTERSECTION



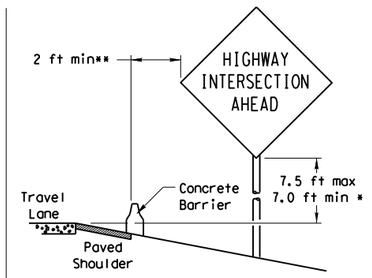
When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.



BEHIND BARRIER



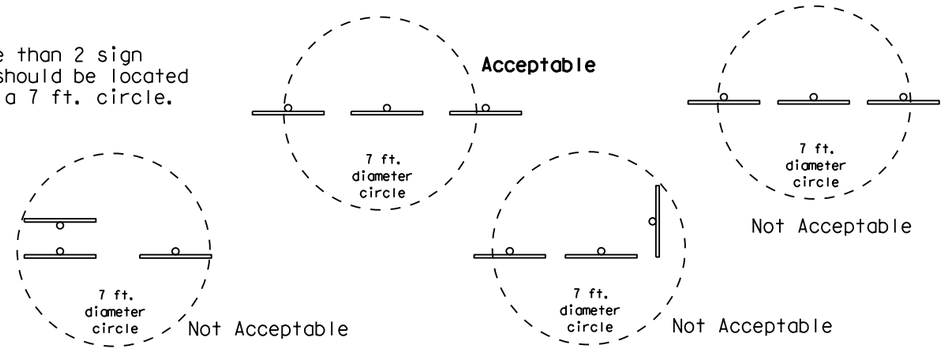
BEHIND GUARDRAIL



BEHIND CONCRETE BARRIER

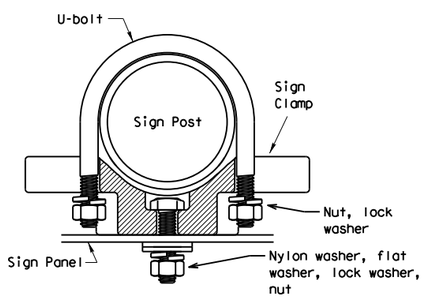
**Sign clearance based on distance required for proper guard rail or concrete barrier performance.

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



TYPICAL SIGN ATTACHMENT DETAIL

Single Signs

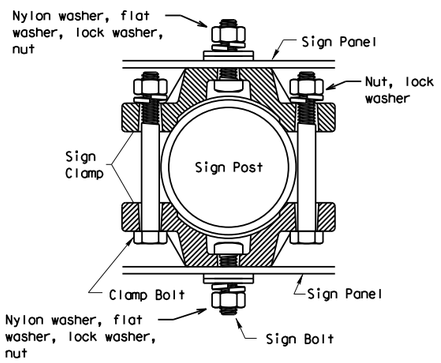


Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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.

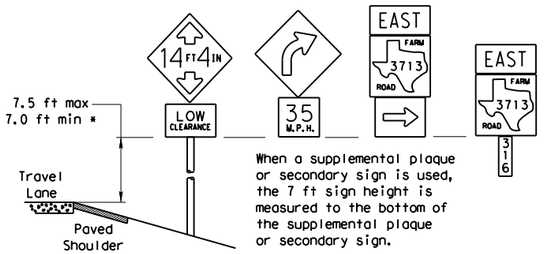
Sign clamps may be either the specific size clamp or the universal clamp.

Back-to-Back Signs



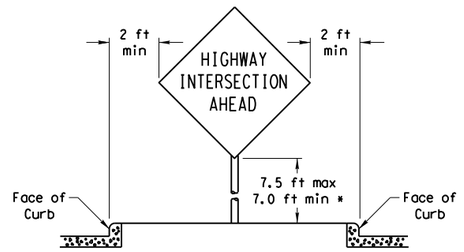
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES



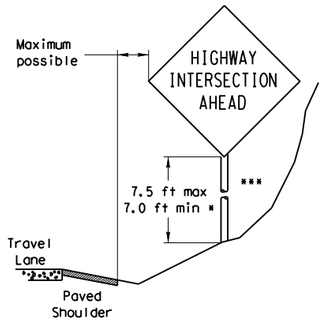
When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

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.

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

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

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

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

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

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

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

REVISIONS
9-08

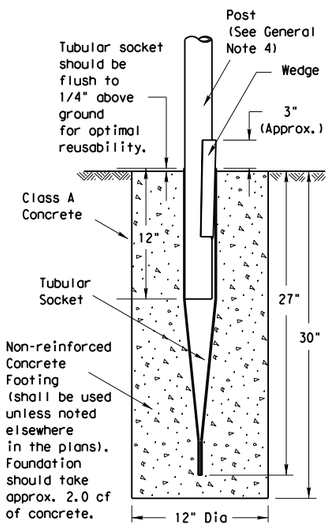
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		108

DATE:
FILE:

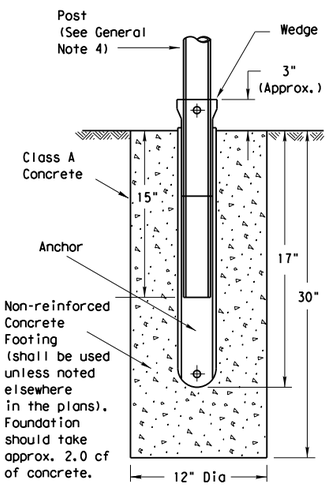
DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

Wedge Anchor Steel System



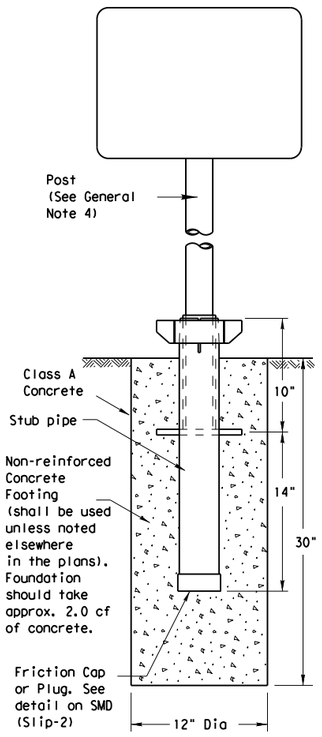
SM RD SGN ASSM TY TWT(X)WS(X)

Wedge Anchor High Density Polyethylene (HDPE) System

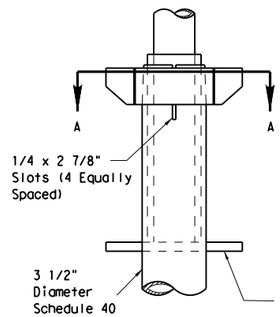


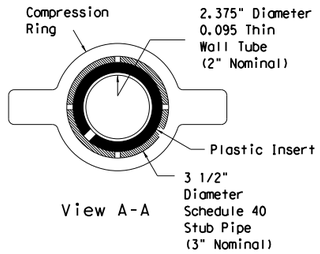
SMD RD SGN ASSM TY TWT(X)WP(X)

Universal Anchor System with Thin-Walled Tubing Post



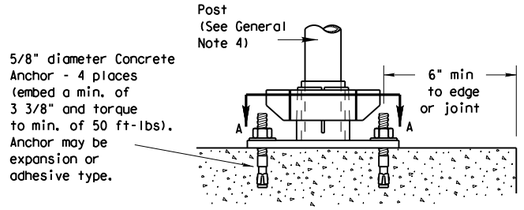
SM RD SGN ASSM TY TWT(X)UA(P)



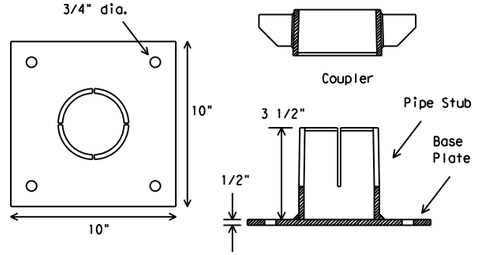


View A-A

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

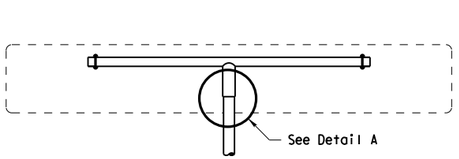


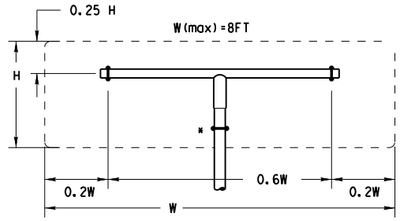
Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. A heavy hex nut per ASTM A563 and hardened washer per ASTM F436. The stud bolt shall have minimum yield and ultimate tensile strengths of 50 and 75 ksi, respectively. Nuts, bolts and washers shall be galvanized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



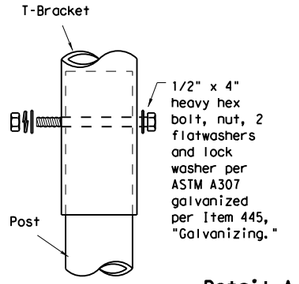
SM RD SGN ASSM TY TWT(X)UB(P)

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





SM RD SGN ASSM TY TWT(X)XX(T)
(* - See General Note 6)



Detail A

9/16" hole may need to be drilled through post to accommodate bolt.

NOTE

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

GENERAL NOTES:

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

WEDGE ANCHOR SYSTEM INSTALLATION PROCEDURE

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

UNIVERSAL ANCHOR SYSTEM INSTALLATION PROCEDURE

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

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS WEDGE & UNIVERSAL ANCHOR WITH THIN WALL TUBING POST

SMD(TWT)-08

DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT

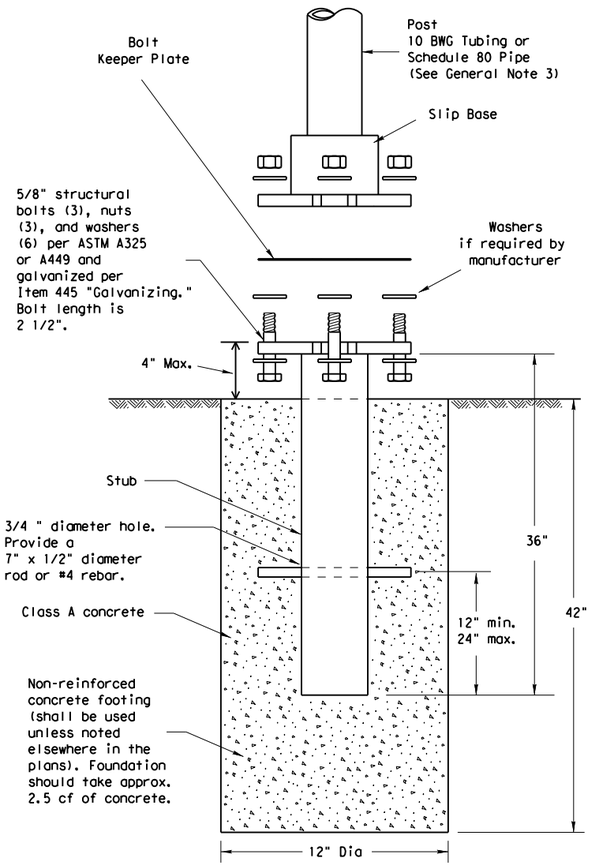
CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		109

9-08 REVISIONS

DATE:
FILE:

26E

TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



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

NOTE

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

GENERAL NOTES:

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

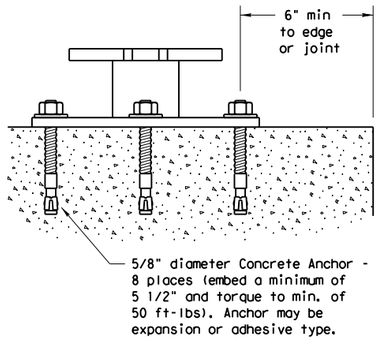
   Schedule 80 Pipe (2.875" outside diameter)
   - 0.276" nominal wall thickness
   - Steel tubing per ASTM A500 Gr C
   - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
     - 46,000 PSI minimum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

ASSEMBLY PROCEDURE

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

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

CONCRETE ANCHOR



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

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

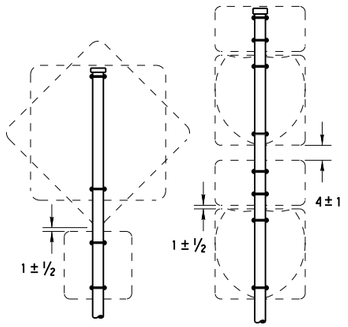
Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-1)-08

© TxDOT July 2002	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS	CONT	SECT	JOB	HIGHWAY
9-08	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		110

DATE:
FILE:



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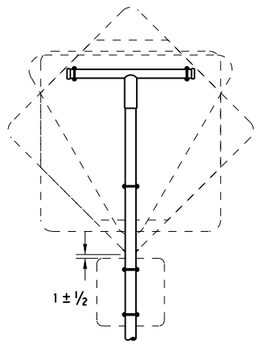

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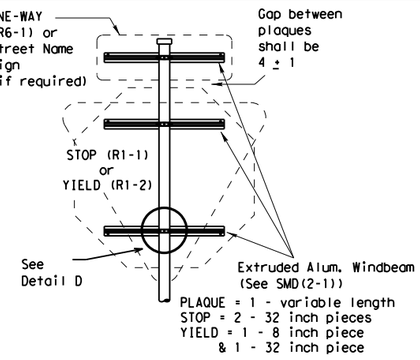

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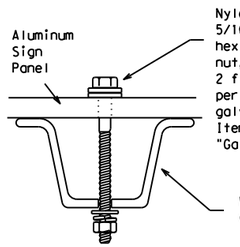
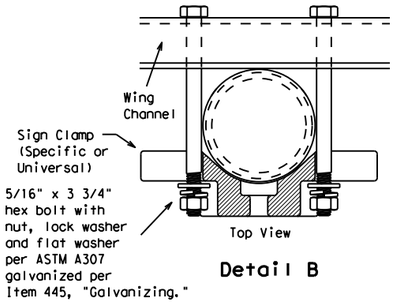
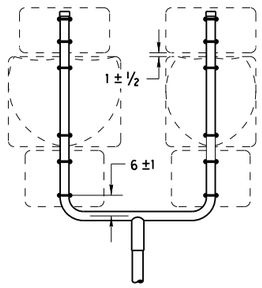


Detail A



Detail B



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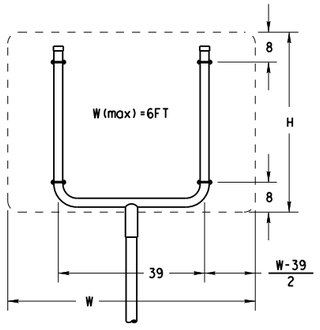

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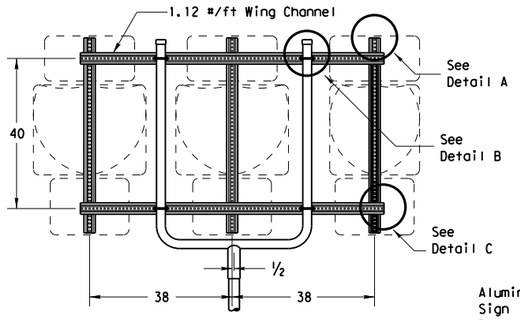
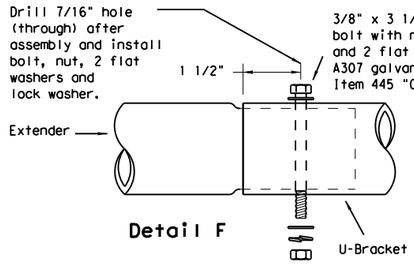
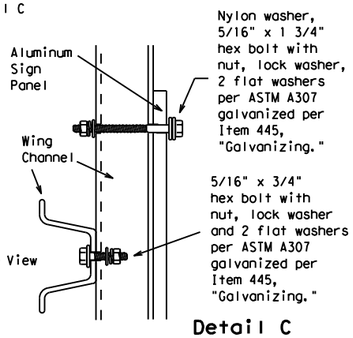


SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)

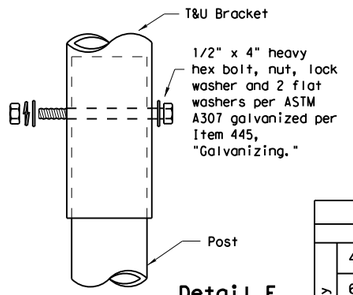


Detail F

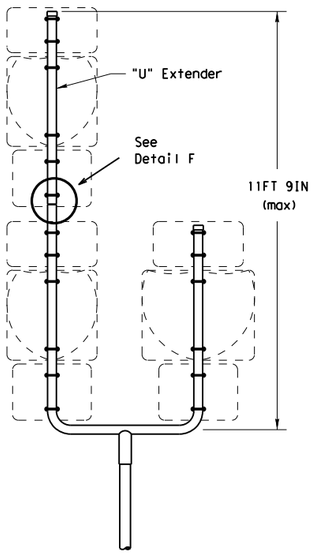
Splices shall only be allowed behind the sign substrate.



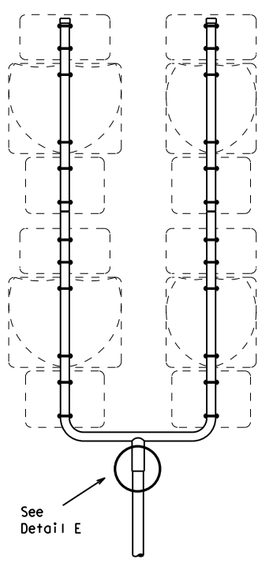
Detail C



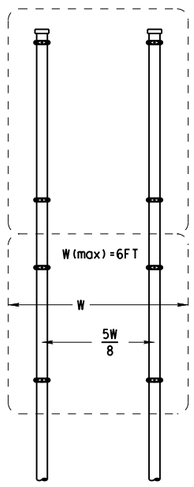
Detail E



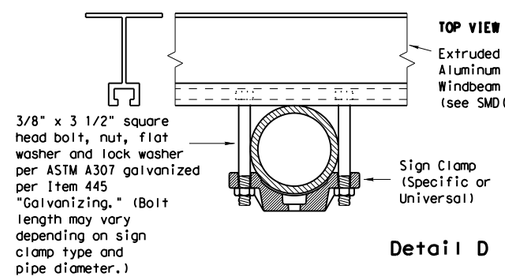
SM RD SGN ASSM TY S80(1)XX(U-1EXT)



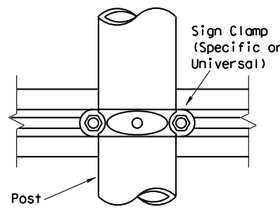
SM RD SGN ASSM TY S80(1)XX(U-2EXT)



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



Detail D



GENERAL NOTES:

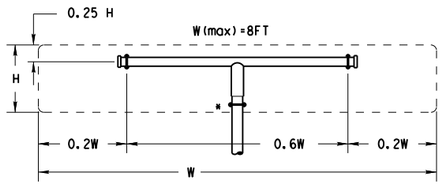
1.

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

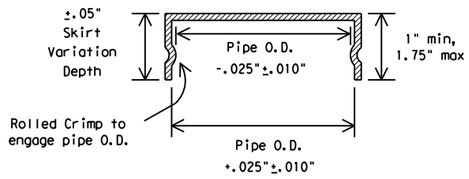
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	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

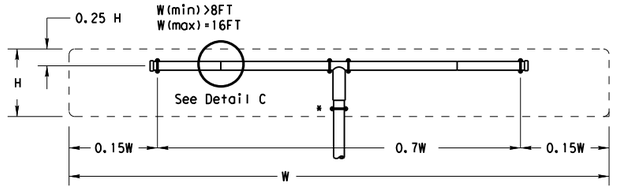
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21

DIST	COUNTY	SHEET NO.
LFK	HOUSTON	111

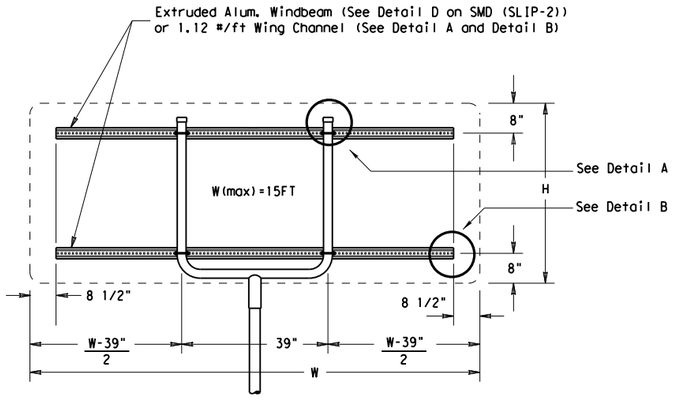
9-08 REVISIONS

DATE:
FILE:

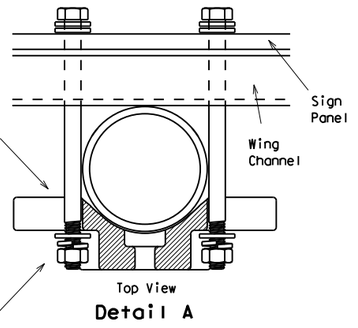


SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)

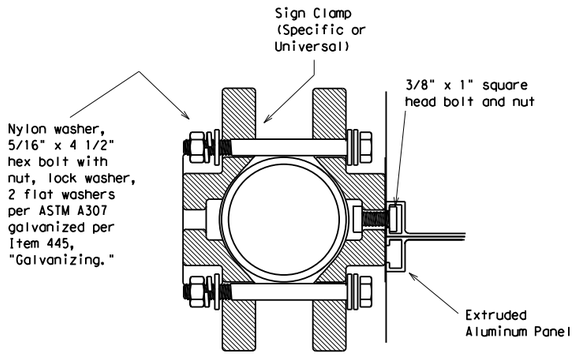
(* - See Note 12)



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

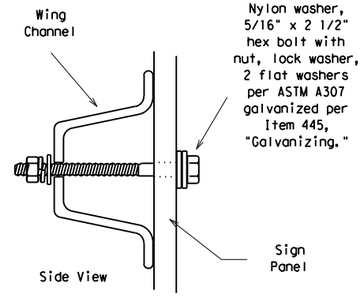


Detail A

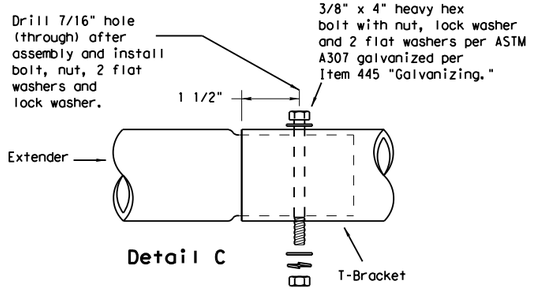


Detail D

EXTRUDED ALUMINUM SIGN WITH T BRACKET

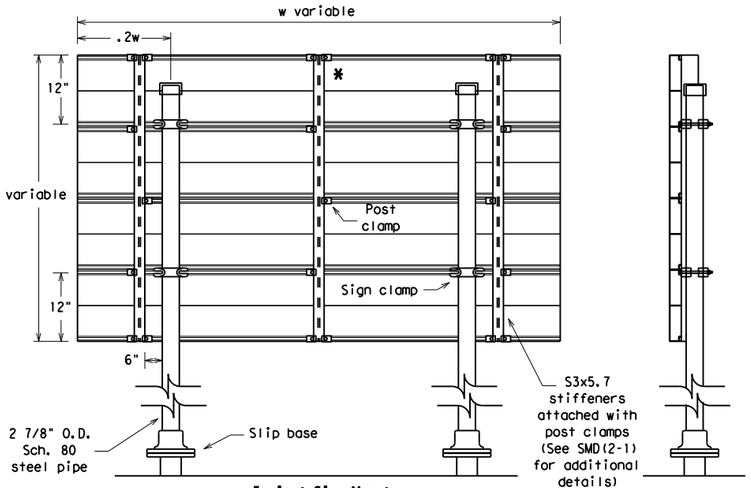


Detail B



Detail C

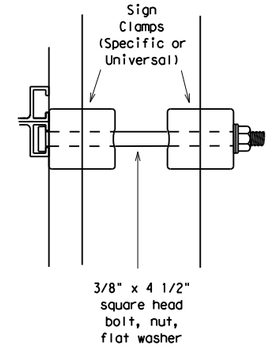
Splices shall only be allowed behind the sign substrate.



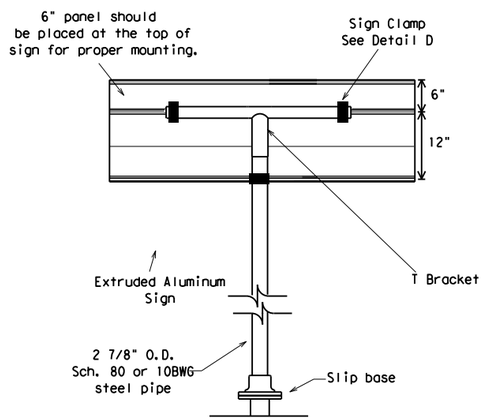
Typical Sign Mount

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

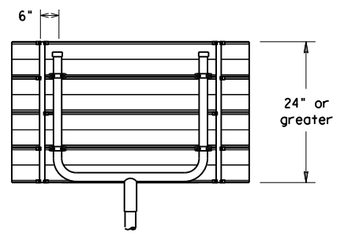
* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.



Detail E



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

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

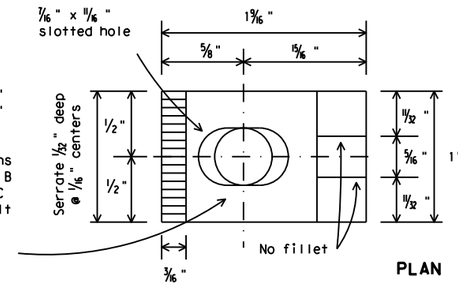
9-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		112

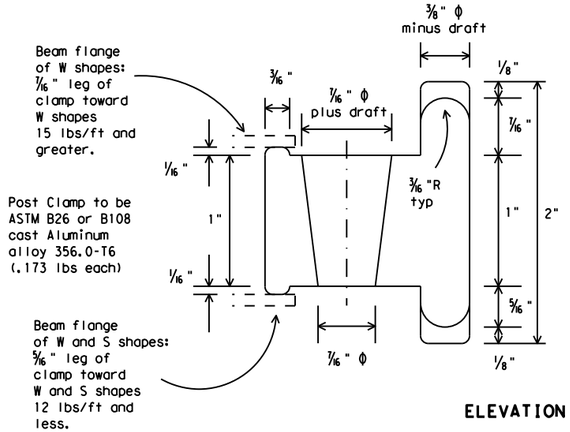
DATE:
FILE:

DATE:
FILE:



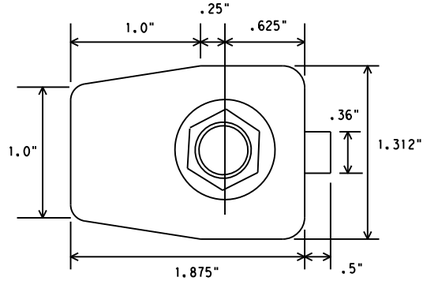
NOTE: centerline of hole for 3/8" diameter squarehead bolt x 2 1/4" long with a flat washer and self-locking nut, or lock washer and hex. nut. Bolt head dimensions shall be in accordance with ANSI B 18.2.1 as referred to in the AISC Manual of steel construction. Bolt assembly shall be galvanized.

PLAN

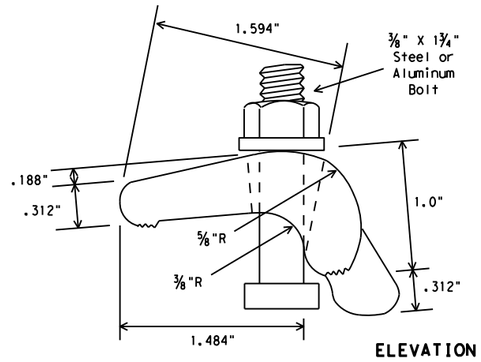


ELEVATION

POST CLAMP DETAIL

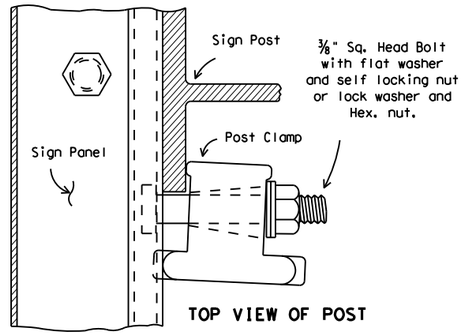


PLAN

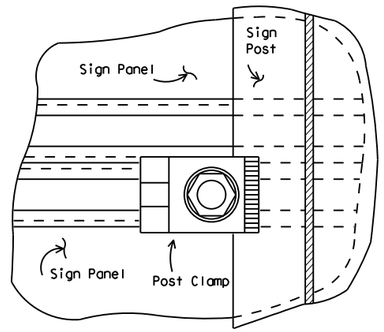


ELEVATION

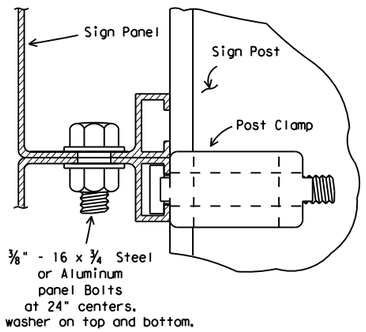
ALTERNATE POST CLAMP DETAIL



TOP VIEW OF POST

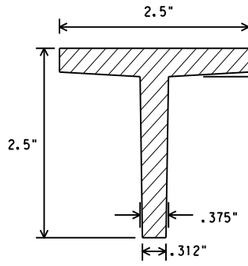


TOP VIEW OF CLAMP



SIDE VIEW OF PANELS

CONNECTION DETAILS

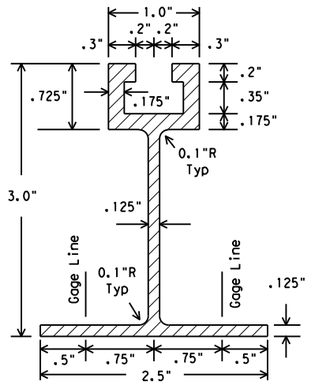


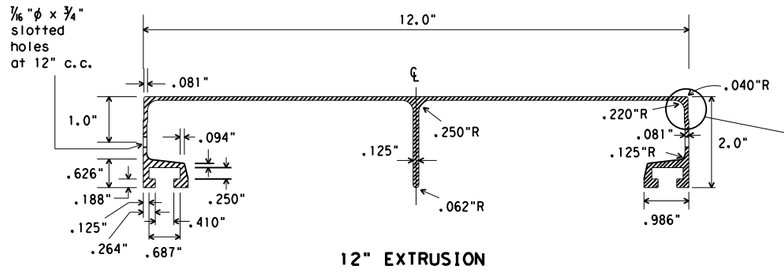
1.912 lbs/ft

ALUMINUM T SECTION OR APPROVED ALTERNATIVE

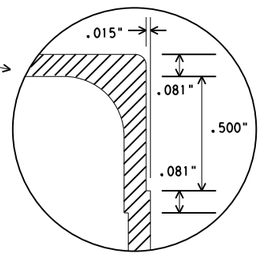
WINDBEAM CROSS SECTION

Windbeam to be extruded aluminum (1.175 lbs/ft) or approved alternative

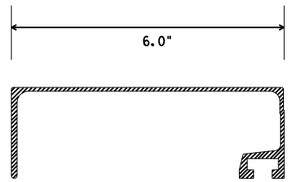




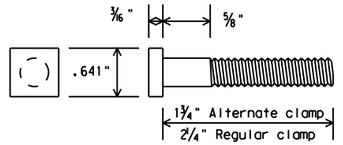
12" EXTRUSION



ALUMINUM SIGN PANEL EXTRUSION DETAILS



6" EXTRUSION



POST CLAMP BOLT DETAIL

DEPARTMENTAL MATERIAL SPECIFICATIONS

SIGN HARDWARE	DMS-7120

GENERAL NOTES:

1. Design conforms with AASHTO Specifications for the design and construction of structural supports for highway signs.
2. Materials and fabrication shall conform to the requirements of the Department material specifications.
3. Structural steel shall be "low-alloy steel" for non-bridge structures per Item 442, "Metal For Structures."
4. For fiberglass substrate connection details, see manufacturer's recommendations.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS- EXTRUDED ALUMINUM SIGN PANELS & HARDWARE

SMD(2-1)-08

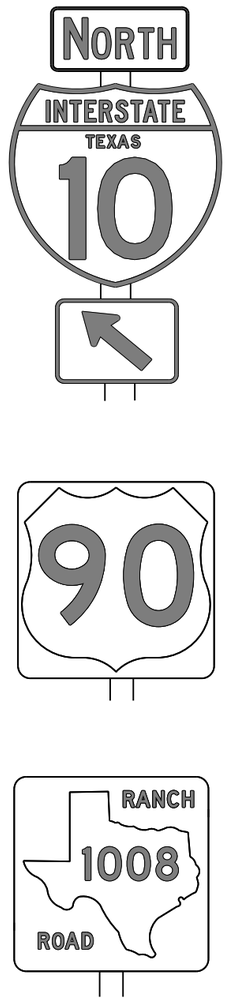
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS	CONT	SECT	JOB	HIGHWAY
9-08	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		113

DATE:
FILE:

REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

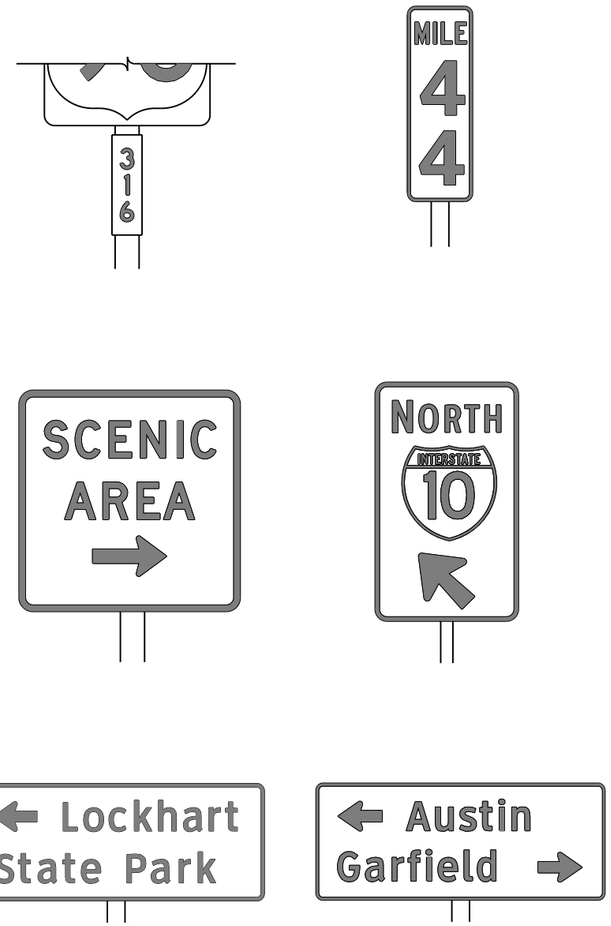
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE A SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B or C SHEETING



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

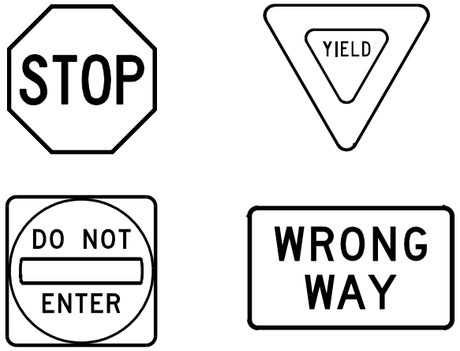
TSR(3)-13

FILE:	tsr3-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT	October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS		0118	02	036, ETC.	SH 21
12-03 7-13		DIST	COUNTY		SHEET NO.
9-08		LFK	HOUSTON		114

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

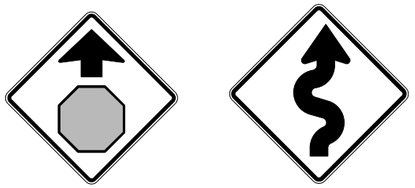
REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS

(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

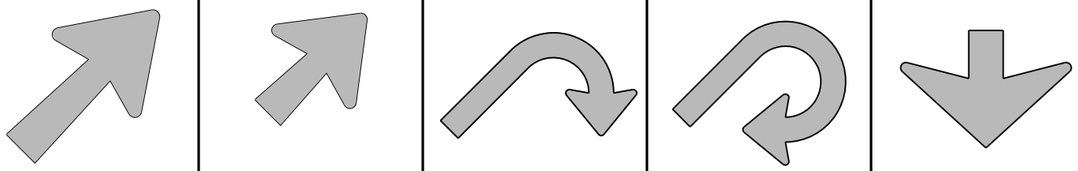
TSR(4)-13

FILE: tsr4-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, etc.	SH 21
12-03 7-13 9-08	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		115

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

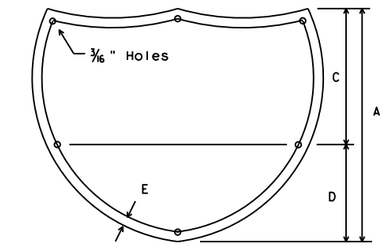
NOTE

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.

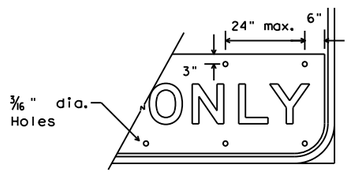
http://www.txdot.gov/

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

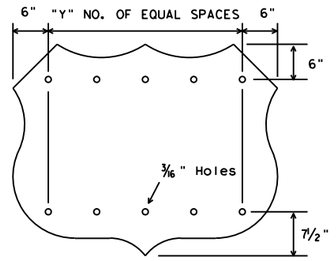


INTERSTATE ROUTE MARKERS

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

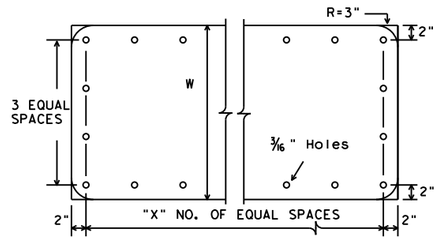


EXIT ONLY PANEL



U.S. ROUTE MARKERS

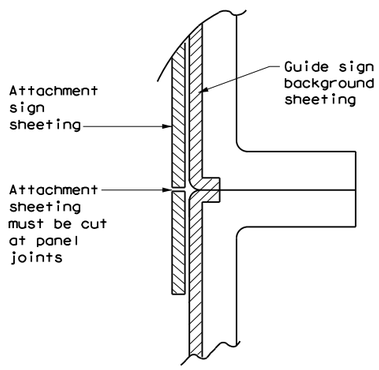
Sign Size	"Y"
24x24	2
30x24	3
36x36	3
45x36	4
48x48	4
60x48	5



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

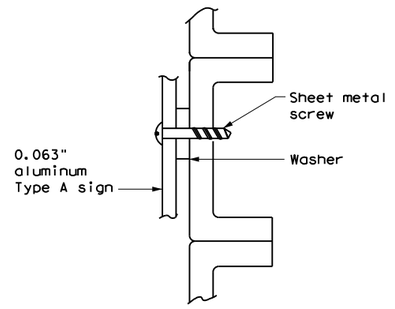
MOUNTING DETAILS OF ATTACHMENTS TO GUIDE SIGN FACE ("EXIT ONLY" AND "LEFT EXIT" PANELS, ROUTE MARKERS AND OTHER ATTACHMENTS)



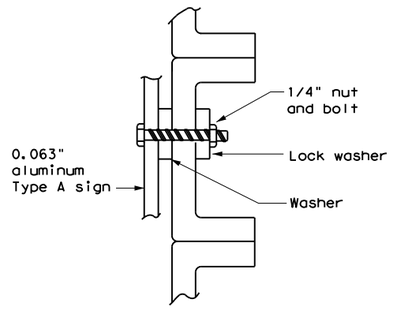
DIRECT APPLIED ATTACHMENT

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



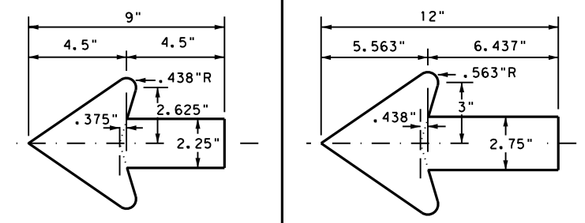
NUT/BOLT ATTACHMENT

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	0118	02	036, ETC.	SH 21
12-03 7-13	DIST	COUNTY		SHEET NO.
9-08	LFK	HOUSTON		116

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):

0118-02-036, ETC

1.2 PROJECT LIMITS:

From: *2.56 MILES WEST OF FM 1733*

To: *FM 1733, ETC.*

1.3 PROJECT COORDINATES:

BEGIN: (Lat) *31.328499°* ,(Long) *-95.439914°*

END: (Lat) *31.433558°* ,(Long) *-95.320314°*

1.4 TOTAL PROJECT AREA (Acres): _____

1.5 TOTAL AREA TO BE DISTURBED (Acres): _____

1.6 NATURE OF CONSTRUCTION ACTIVITY:

FOR THE CONSTRUCTION OF WIDEN NON-FREEWAY, ETC.

CONSISTING OF WIDEN TO NON-FREEWAY (ADD SHOULDERS), ETC.

1.7 MAJOR SOIL TYPES:

Soil Type	Description
AaB—Alazan very fine sandy loam	Slope: 0 to 2 percent, Runoff class: Low Drainage class: Moderately well drained 0 to 4 inches: very fine sandy loam, 4 to 10 inches: very fine sandy loam, 10 to 80 inches: sandy clay loam
AbA—Alazan-Besner complex	Slope: 0 to 2 percent, Runoff class: Low Drainage class: Moderately well drained 0 to 12 inches: very fine sandy loam, 12 to 80 inches: sandy clay loam
AfB—Alto fine sandy loam	Slope: 1 to 3 percent, Runoff class: Medium Drainage class: Moderately well drained 0 to 4 inches: fine sandy loam, 4 to 16 inches: sandy clay loam, 16 to 74 inches: clay loam
AnB—Annona loam	Slope: 1 to 3 percent, Runoff class: Very high Drainage class: Moderately well drained 0 to 10 inches: loam, 10 to 82 inches: clay
BaB—Bernaldo fine sandy loam	Slope: 0 to 3 percent, Runoff class: Low Drainage class: Well drained 0 to 15 inches: fine sandy loam, 15 to 80 inches: sandy clay loam
ChA—Chireno loam	Slope: 0 to 1 percent, Runoff class: Low Drainage class: Moderately well drained 0 to 12 inches: loam, 12 to 80 inches: clay loam
EtB—Etoile loam	Slope: 1 to 3 percent, Runoff class: Very high Drainage class: Moderately well drained 0 to 4 inches: loam, 4 to 80 inches: clay

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:

X PSLs determined during preconstruction meeting
X 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.)

X Mobilization
X Install sediment and erosion controls
X Blade existing topsoil into windrows, prep ROW, clear and grub
☐ Remove existing pavement
X Grading operations, excavation, and embankment
X Excavate and prepare subgrade for proposed pavement widening
X Remove existing culverts, safety end treatments (SETs)
☐ Remove existing metal beam guard fence (MBGF), bridge rail
X Install proposed pavement per plans
X Install culverts, culvert extensions, SETs
☐ Install mow strip, MBGF, bridge rail
☐ Place flex base
X Rework slopes, grade ditches
☐ Blade windrowed material back across slopes
X Revegetation of unpaved areas
X Achieve site stabilization and remove sediment and erosion control measures
☐ Other: _____
☐ Other: _____
☐ Other: _____

1.10 POTENTIAL POLLUTANTS AND SOURCES:

X Sediment laden stormwater from stormwater conveyance over disturbed area
X Fuels, oils, and lubricants from construction vehicles, equipment, and storage
X Solvents, paints, adhesives, etc. from various construction activities
X Transported soils from offsite vehicle tracking
X Construction debris and waste from various construction activities
☐ Contaminated water from excavation or dewatering pump-out water
X Sanitary waste from onsite restroom facilities
X Trash from various construction activities/receptacles
X Long-term stockpiles of material and waste
☐ Discharges from concrete washout activities, runoff from concrete cutting activities, and other concrete related activities.
☐ Other: _____
☐ 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
VARIOUS UNNAMED STREAMS	

* Add (*) for impaired waterbodies with pollutant in ().

1.12 ROLES AND RESPONSIBILITIES: TxDOT

X Development of plans and specifications
X Submit Notice of Intent (NOI) to TCEQ (≥5 acres)
X Post Construction Site Notice
X Submit NOI/CSN to local MS4
X Perform SWP3 inspections
X Maintain SWP3 records and update to reflect daily operations
X Complete and submit Notice of Termination to TCEQ
X Maintain SWP3 records for 3 years
☐ Other: _____
☐ Other: _____
☐ Other: _____

1.13 ROLES AND RESPONSIBILITIES: CONTRACTOR

X Day To Day Operational Control
X Submit Notice of Intent (NOI) to TCEQ (≥5 acres)
X Post Construction Site Notice
X Submit NOI/CSN to local MS4
X Maintain schedule of major construction activities
X Install, maintain and modify BMPs
X Complete and submit Notice of Termination to TCEQ
X 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
RICHARD B. KLATT
86961
LICENSED PROFESSIONAL ENGINEER

DocuSigned by:
Richard B. Klatt
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10/27/2023

STORMWATER POLLUTION PREVENTION PLAN (SWP3)

July 2023 Sheet 1 of 2

Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
			117
STATE	STATE DIST.	COUNTY	
TEXAS	LFK	HOUSTON	
CONT.	SECT.	JOB	HIGHWAY NO.
0118	02	036, ETC.	SH 21

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: _____
- ☐ ☐ 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: _____

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
BLOCK SODDING		
RIPRAP		

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: _____
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

2.5 POLLUTION PREVENTION MEASURES:

- ☒ Chemical Management
- ☒ Concrete and Materials Waste Management
- ☒ Debris and Trash Management
- ☐ Dust Control
- ☒ Sanitary Facilities
- ☐ Other: _____
- ☐ 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
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Richard B. Klatt
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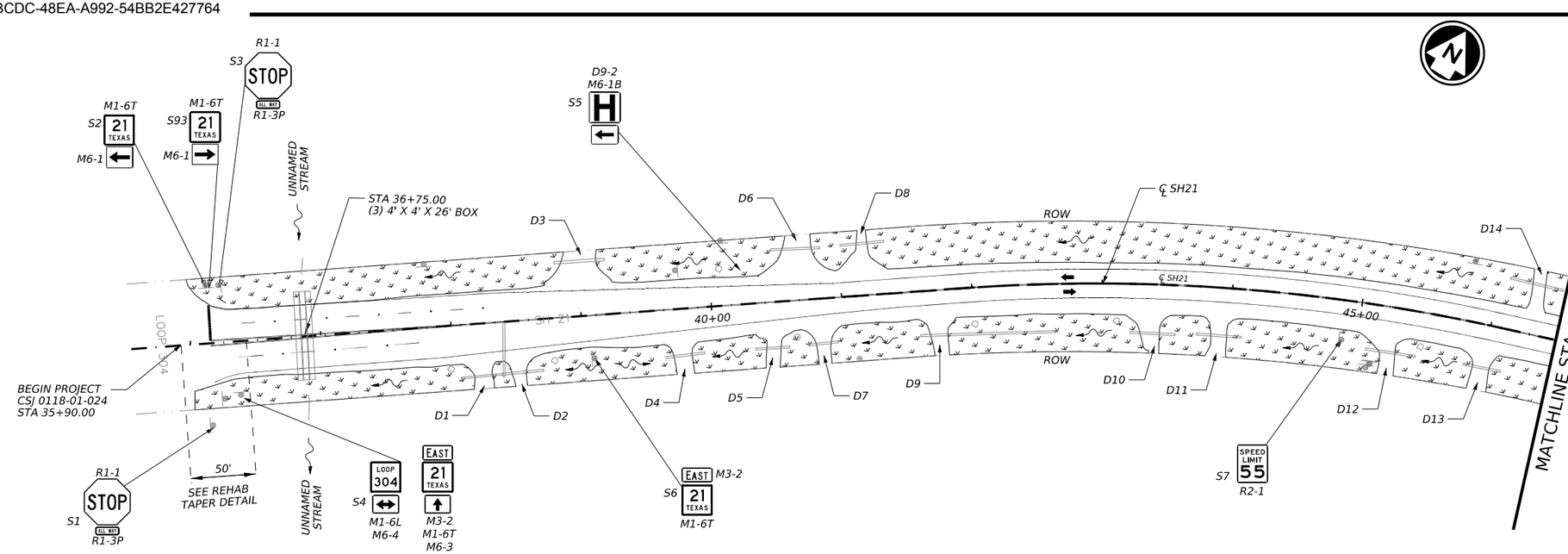
10/27/2023

STORMWATER POLLUTION PREVENTION PLAN (SWP3)

July 2023 Sheet 2 of 2

Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
			118
STATE	STATE DIST.	COUNTY	
TEXAS	LFK	HOUSTON	
CONT.	SECT.	JOB	HIGHWAY NO.
0118	02	036, ETC.	SH 21



LEGEND

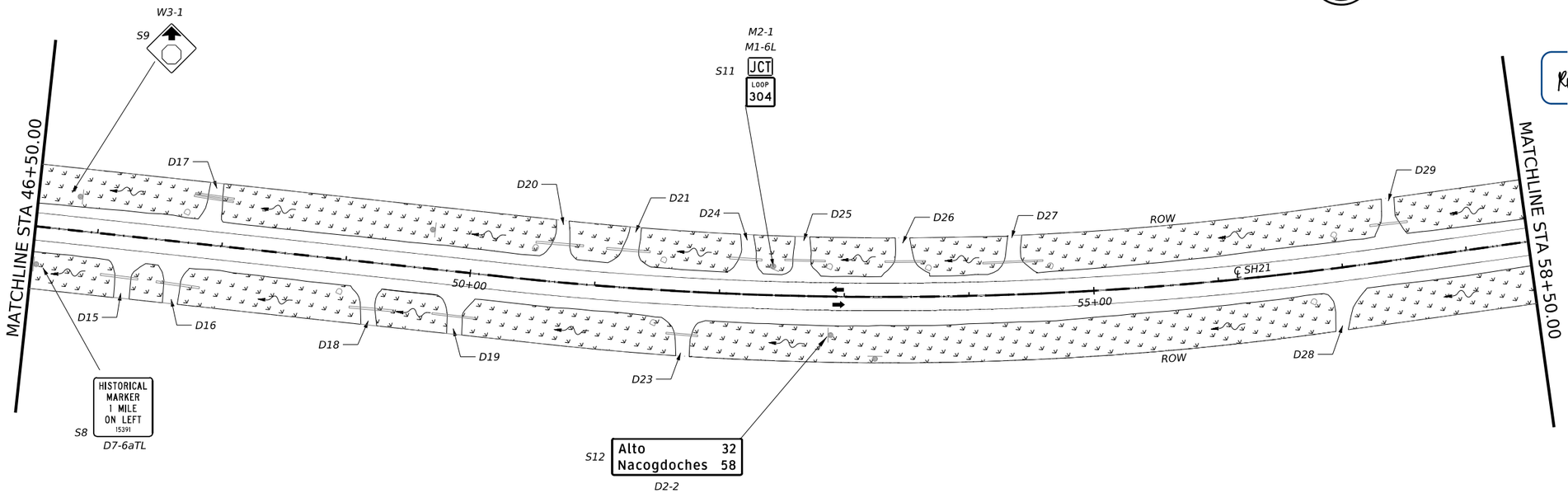
- DIRECTION OF TRAFFIC ARROW
- SCF — SEDIMENT CONT FENCE
- RFD2 — ROCK FILTER DAM (TY II)
- FLOW DIRECTION
- EXIST ROW
- LIMITS OF SEEDING/ AREA OF DISTURBANCE/PREP ROW
- MAIL BOX
- D## — DRIVEWAY ID
- S## — SIDE ROAD ID
- R## — SIGN ID
- CONSTRUCTION EXIT

NOTE:
1. LOCATIONS OF CONSTRUCTION EXITS MAY BE ADJUSTED IN THE FIELD AS DIRECTED BY THE ENGINEER.

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

3. ONEOK TO BE CONTACTED PRIOR TO STARTING CONSTRUCTION. CONTACT BART RICHEY AT (936) 544-6337.

4. HISTORICAL MARKERS TO REMAIN DURING CONSTRUCTION. FENCING SHALL BE PLACED AROUND THE MARKER AND NO WORK OR EQUIPMENT SHALL BE ALLOWED INSIDE THE FENCE IN ORDER TO PROTECT THE MONUMENT.



SCALE 1" = 100'

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
10/27/2023

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

ENVIRONMENTAL LAYOUT SHEETS

SHEET 1 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		119

DATE: 10/27/2023 3:05:20 PM
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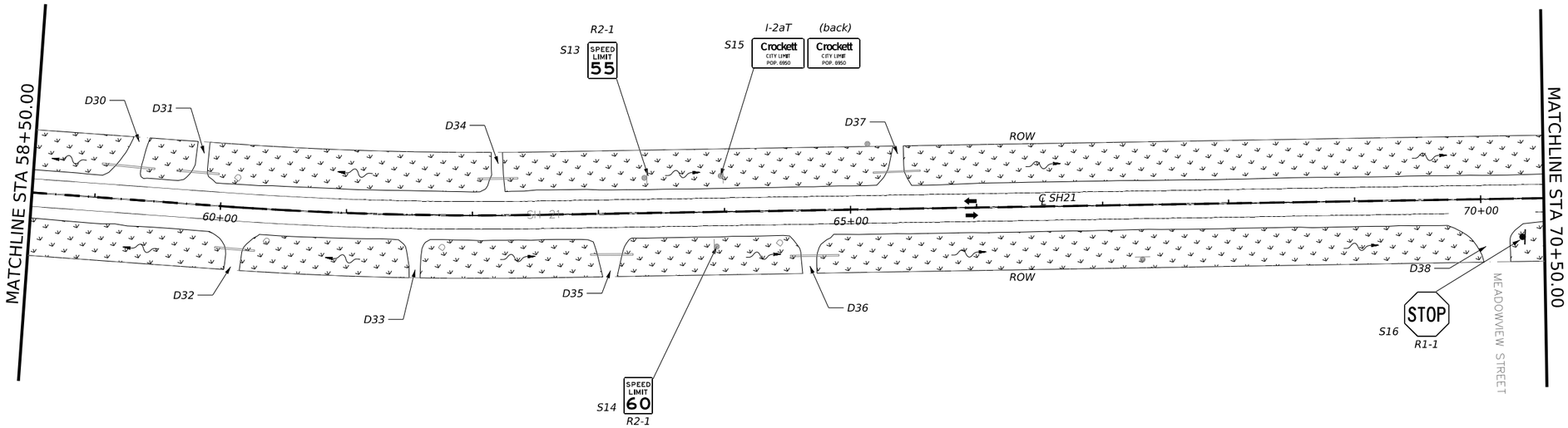

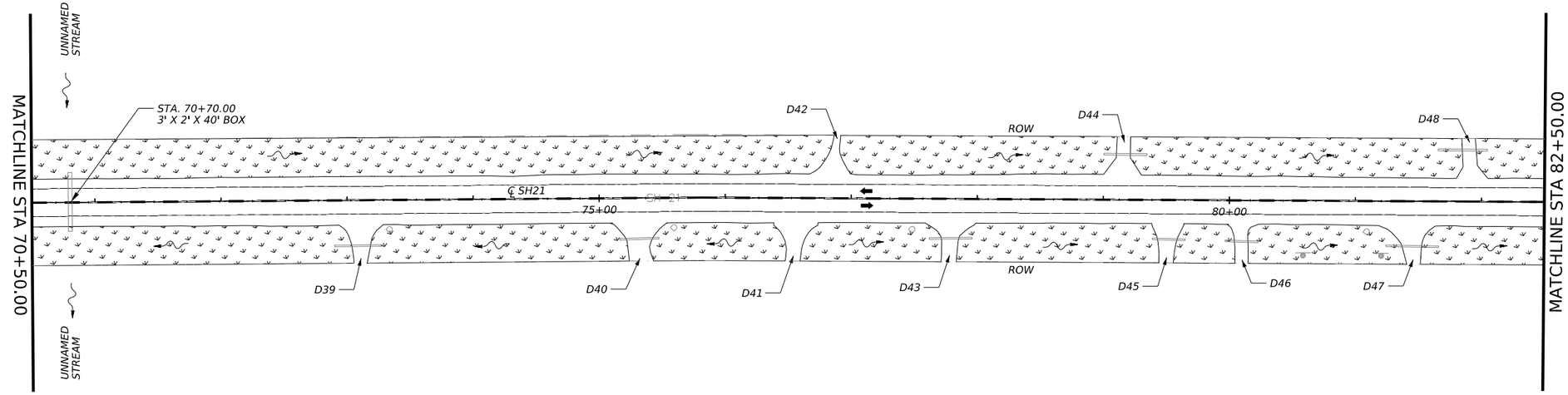

LEGEND

- DIRECTION OF TRAFFIC ARROW
- SCF — SEDIMENT CONT FENCE
- RFD2 — ROCK FILTER DAM (TY II)
- FLOW DIRECTION
- EXIST ROW
- LIMITS OF SEEDING/ AREA OF DISTURBANCE/PREP ROW
- MAIL BOX
- D## — DRIVEWAY ID
- S## — SIDE ROAD ID
- R## — SIGN ID
- CONSTRUCTION EXIT

NOTE:
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SCALE 1" = 100'

DocuSigned by:
Richard B. Klatt
4692CB9B5B4345...
10/27/2023

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

ENVIRONMENTAL LAYOUT SHEETS

SHEET 2 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		120

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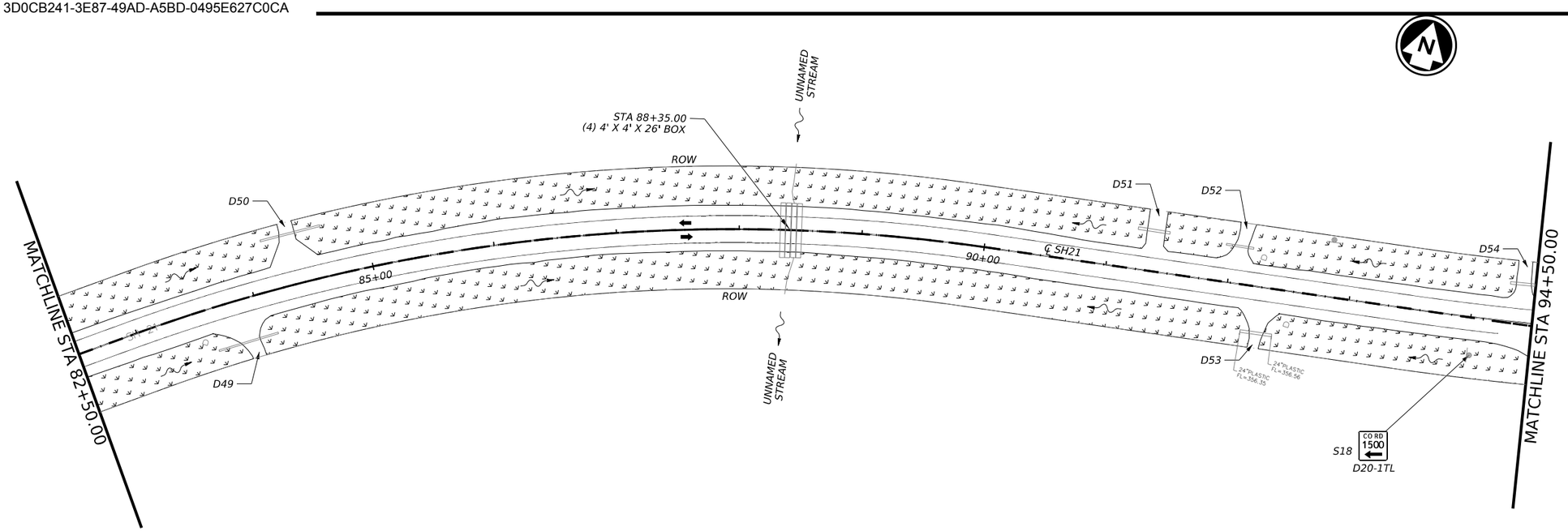

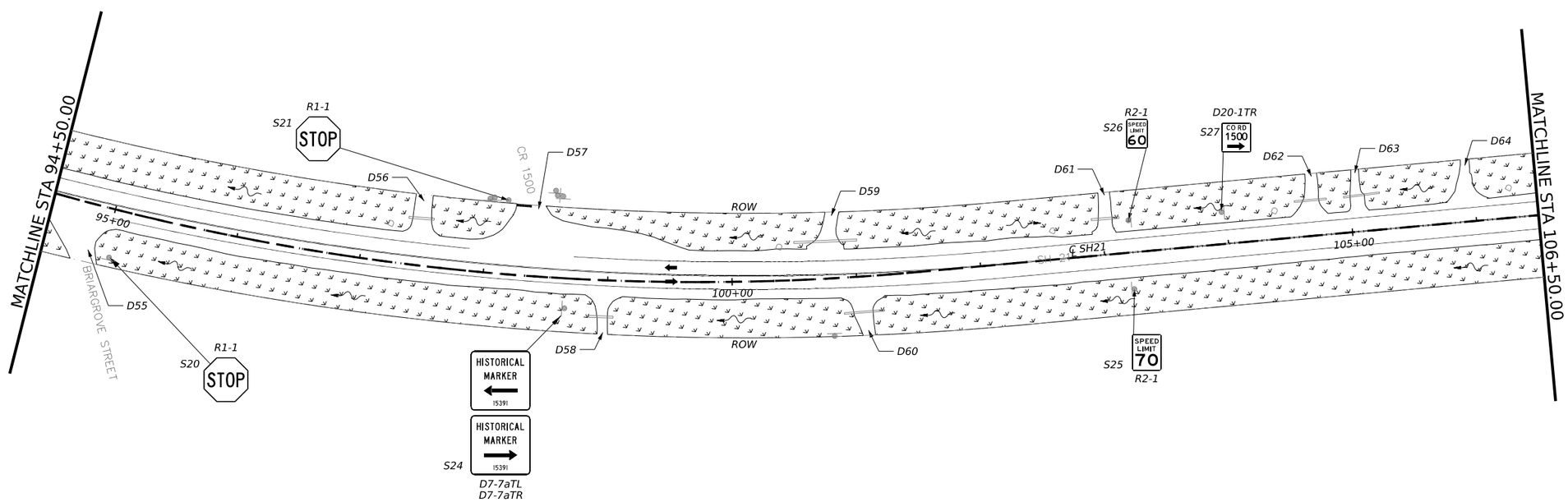

LEGEND

- DIRECTION OF TRAFFIC ARROW
- SCF — SEDIMENT CONT FENCE
- RFD2 — ROCK FILTER DAM (TY II)
- FLOW DIRECTION
- EXIST ROW
- LIMITS OF SEEDING/ AREA OF DISTURBANCE/PREP ROW
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ENVIRONMENTAL LAYOUT SHEETS

SHEET 3 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		121

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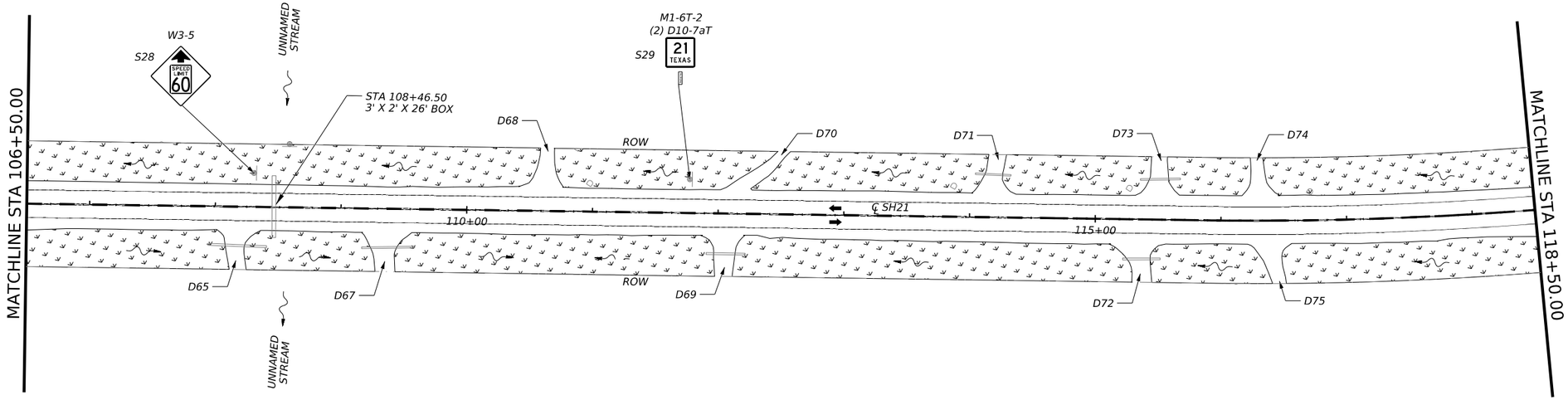

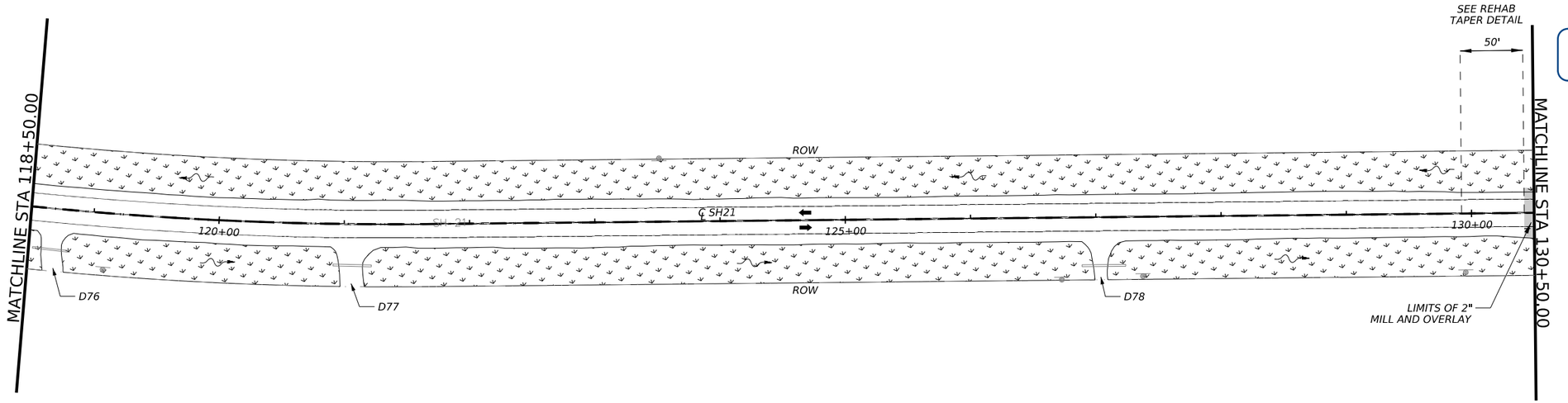

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 4 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		122

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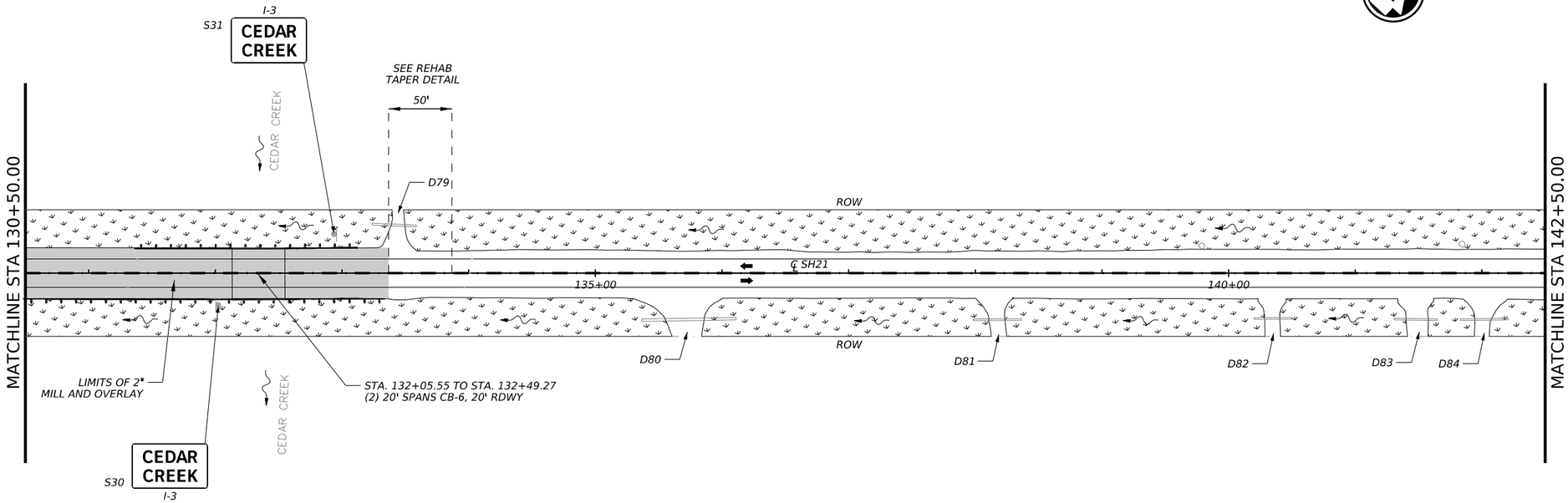

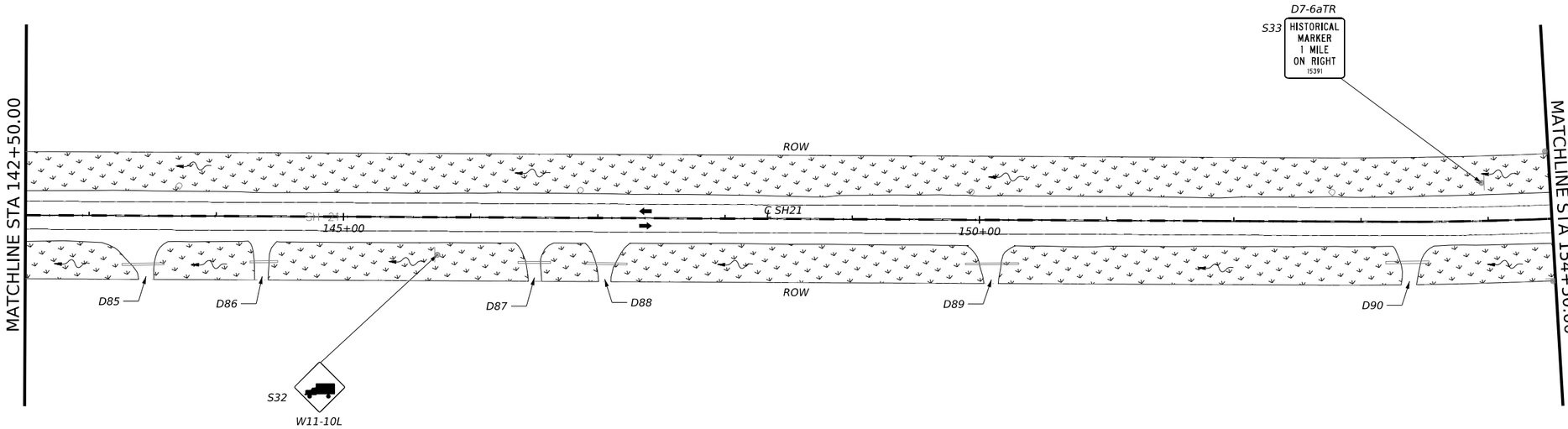

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 5 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		123

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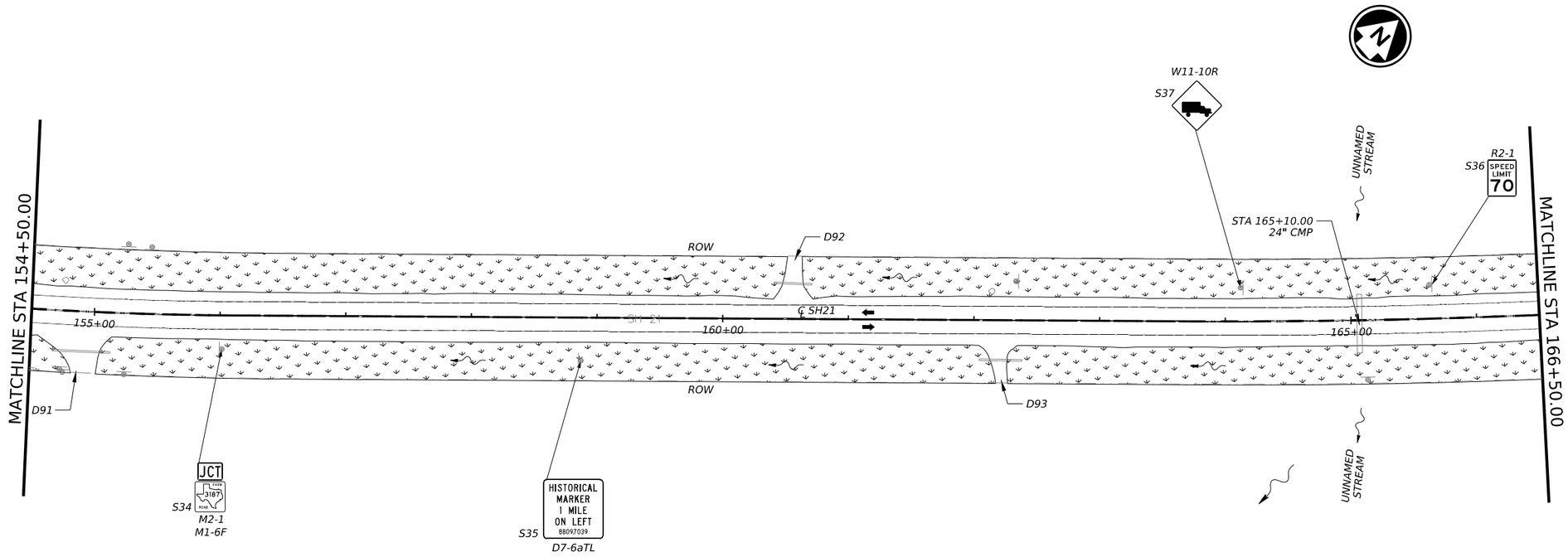

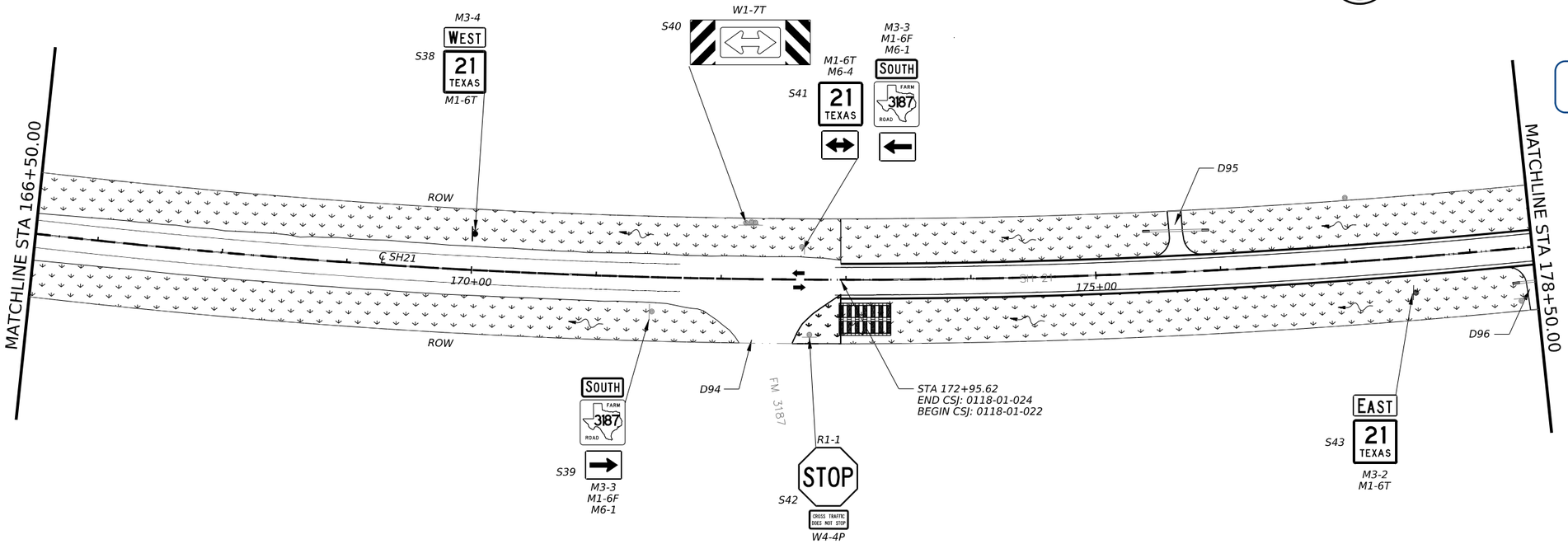

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 6 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		124

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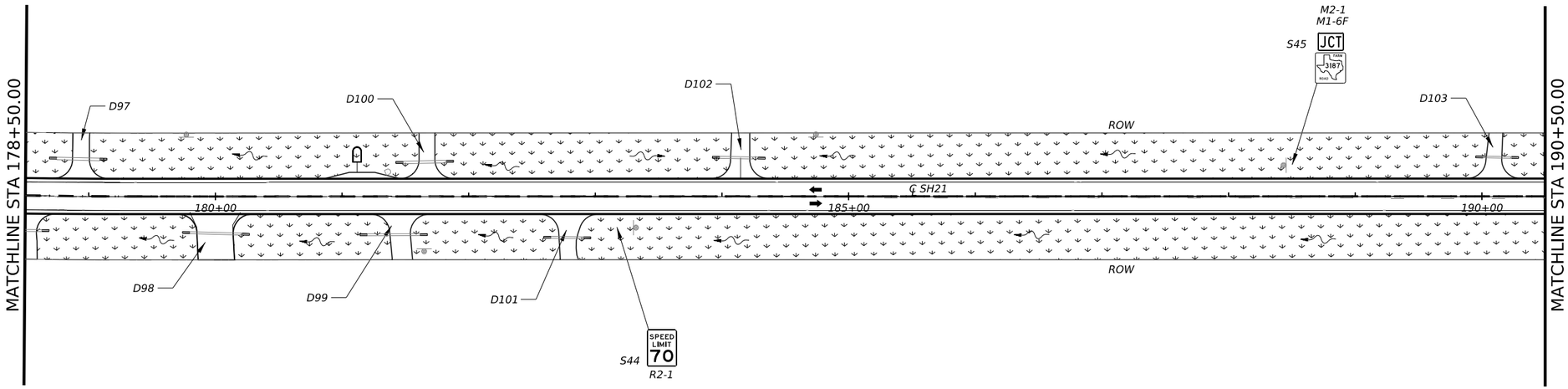

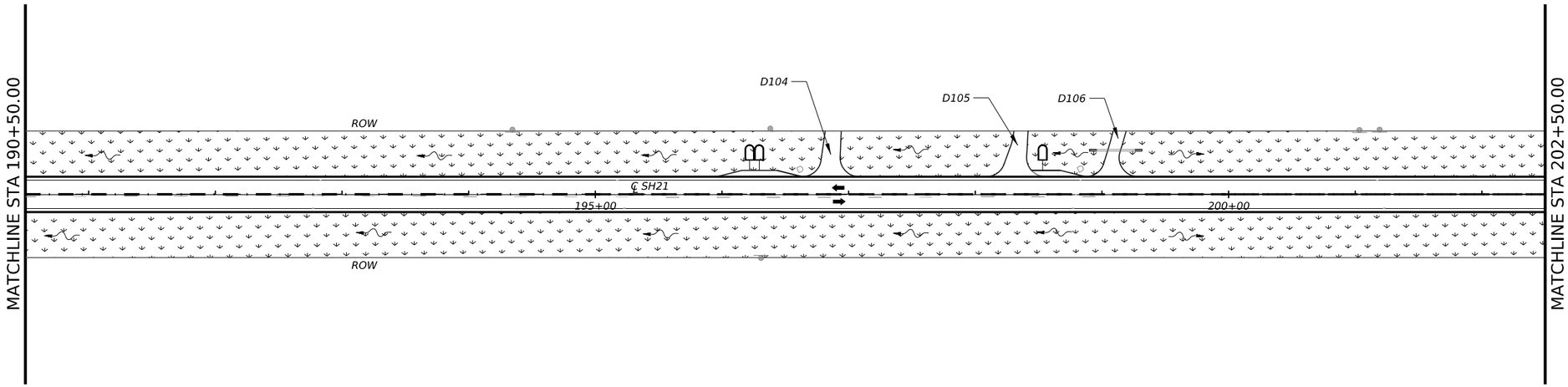

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 7 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		125

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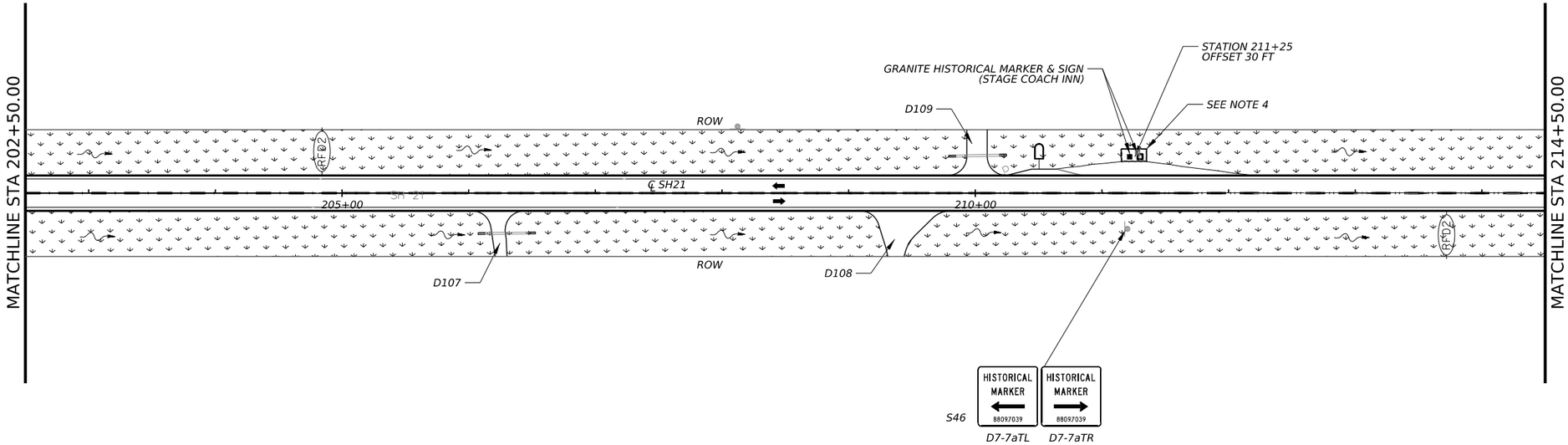

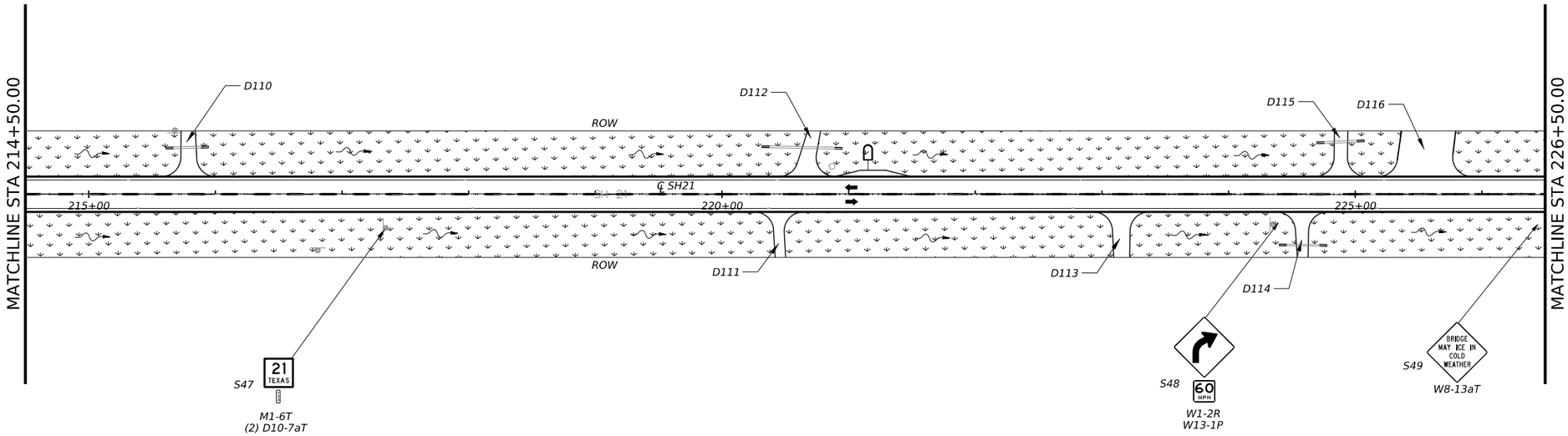

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 8 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		126

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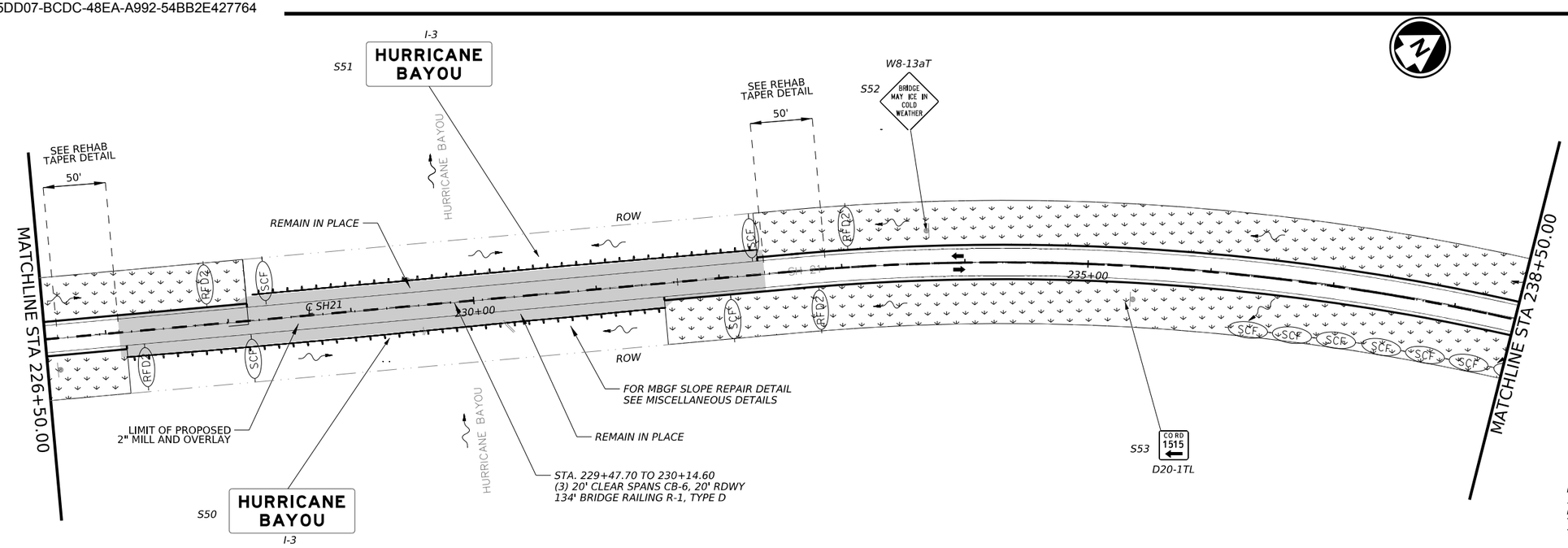

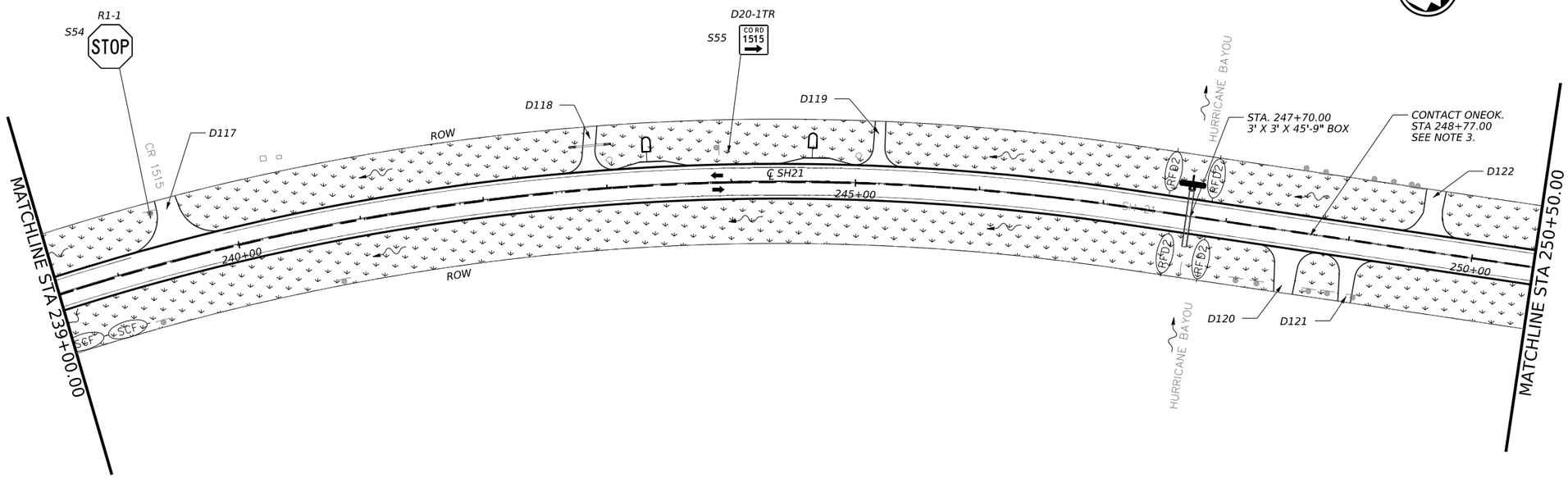

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 9 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		127

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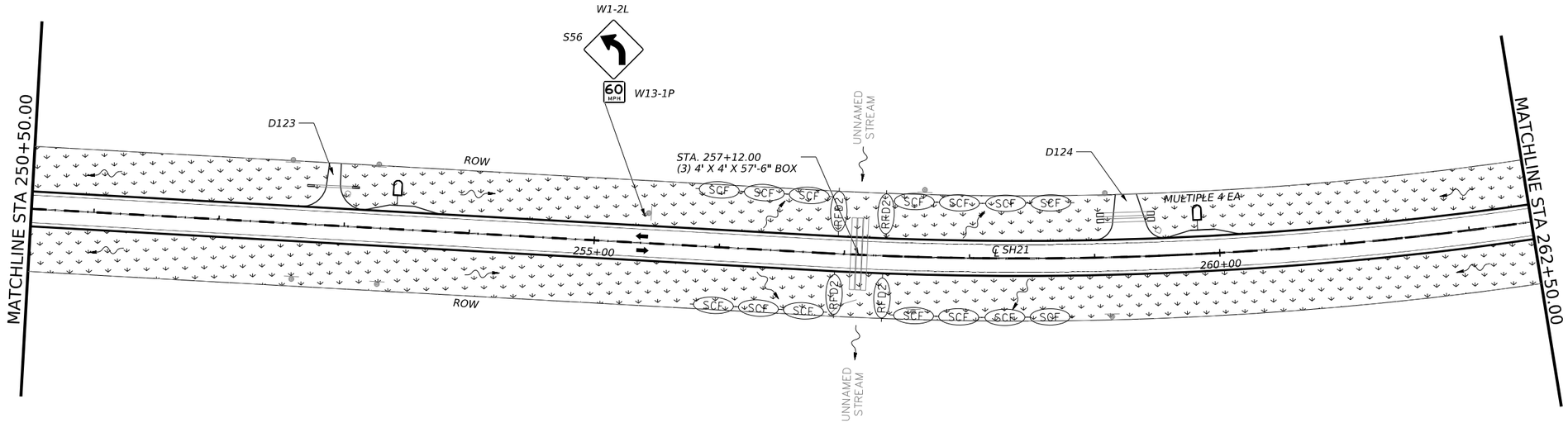

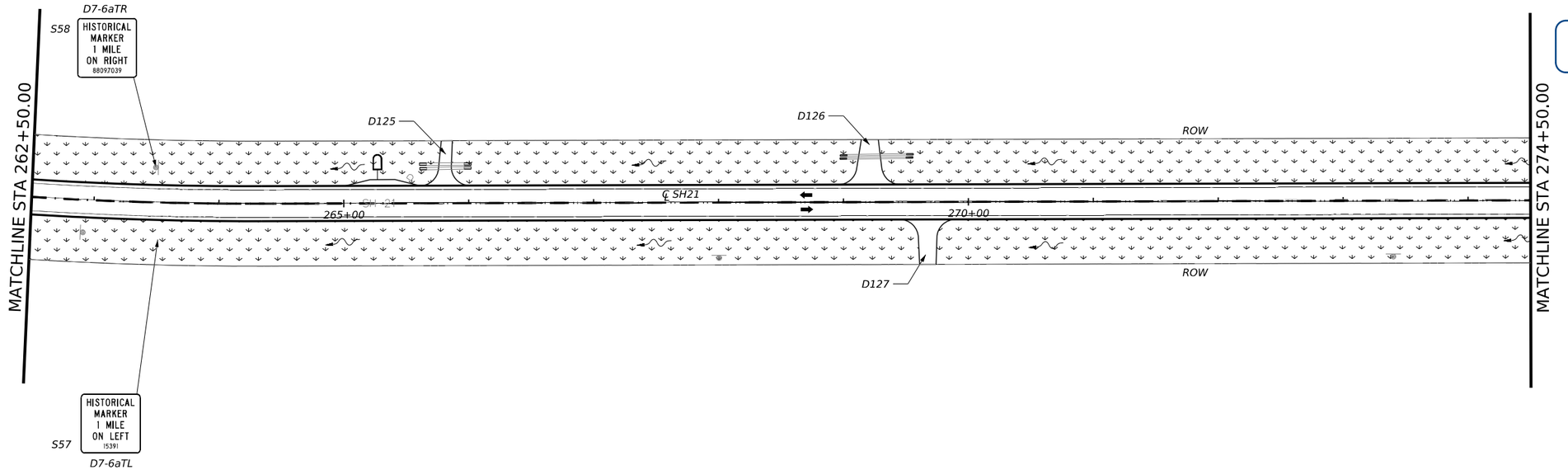

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SHEET 10 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		128

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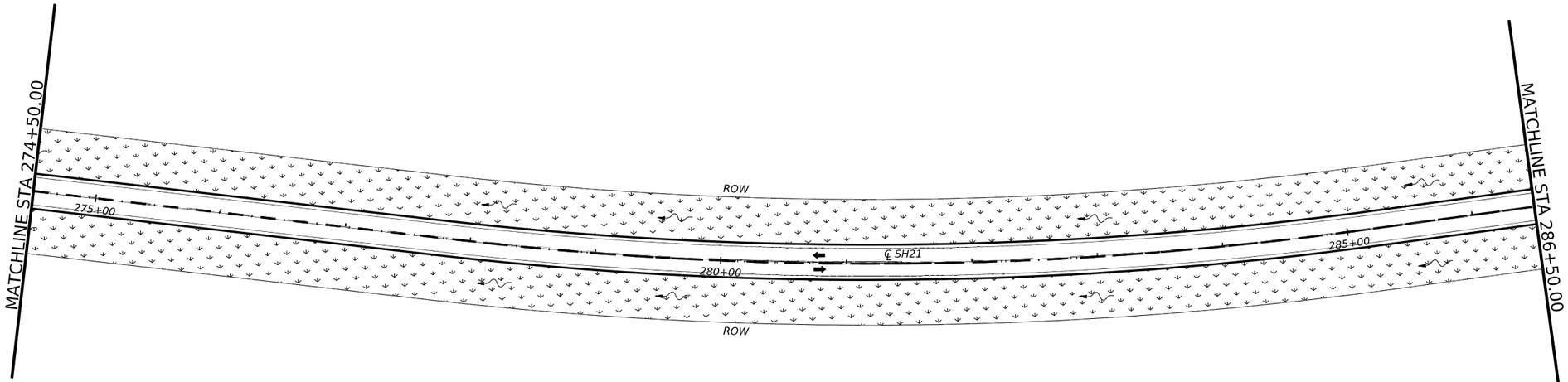

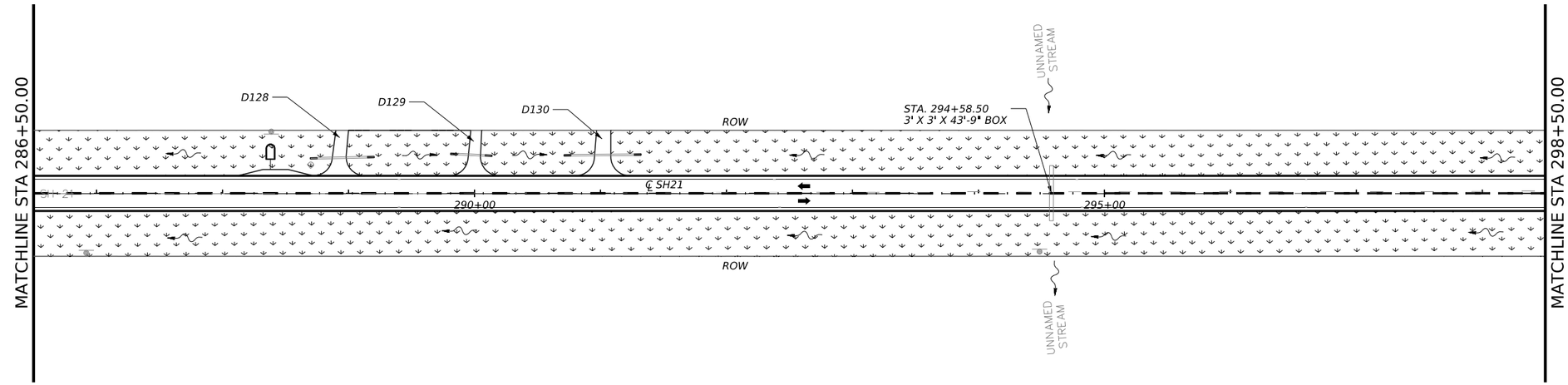

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 11 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		129

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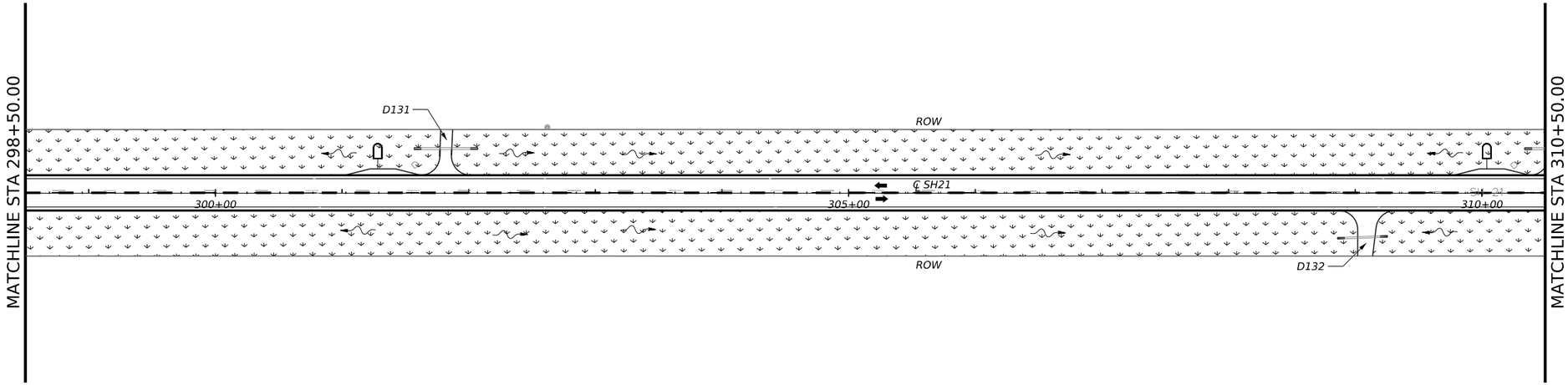

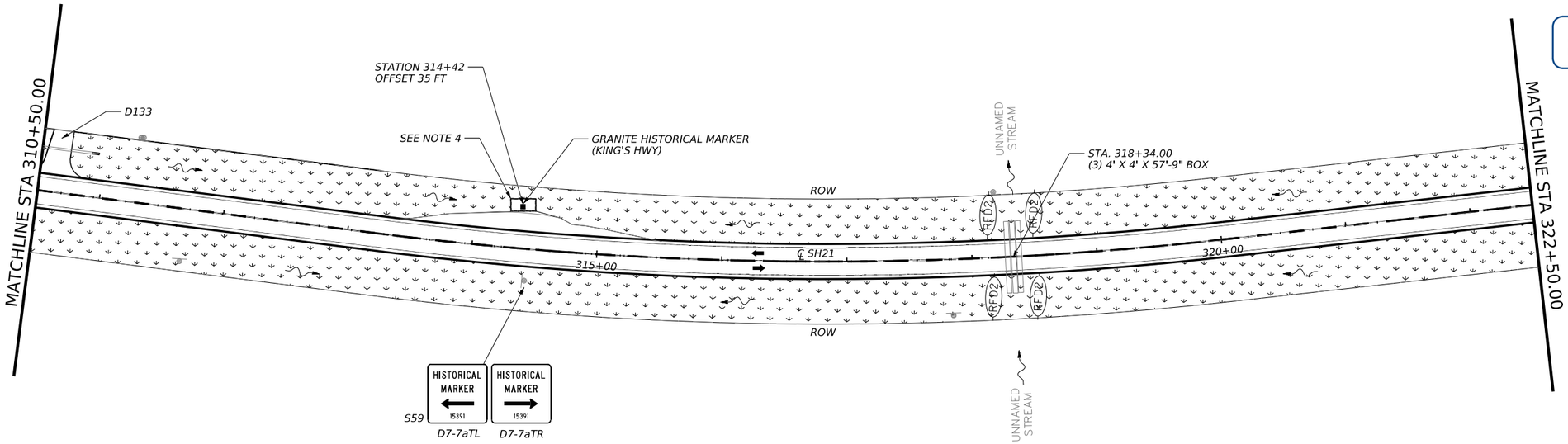

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- D## — DRIVEWAY ID
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NOTE:
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SCALE 1" = 100'

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
10/27/2023

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

ENVIRONMENTAL LAYOUT SHEETS

SHEET 12 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		130

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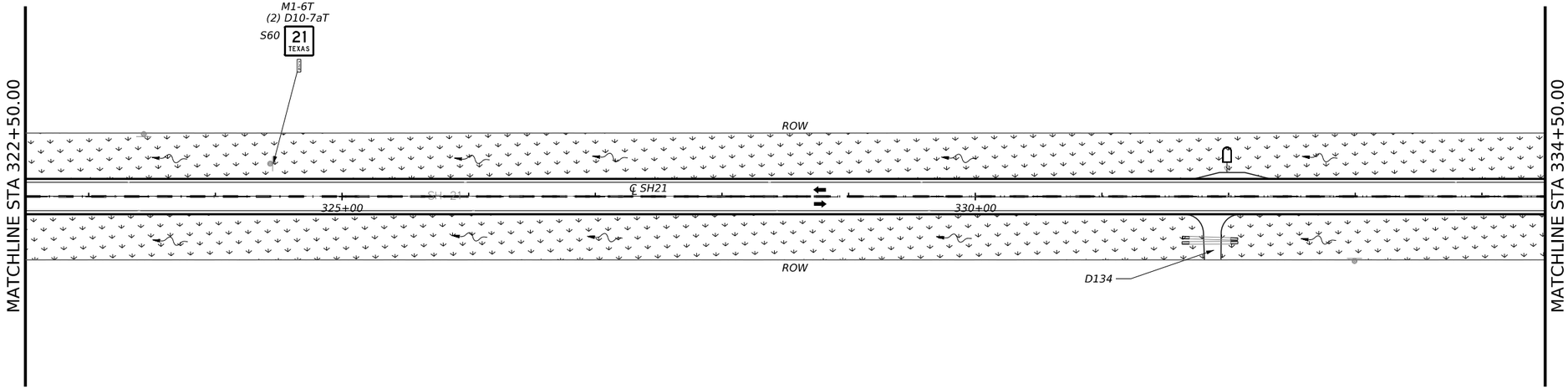

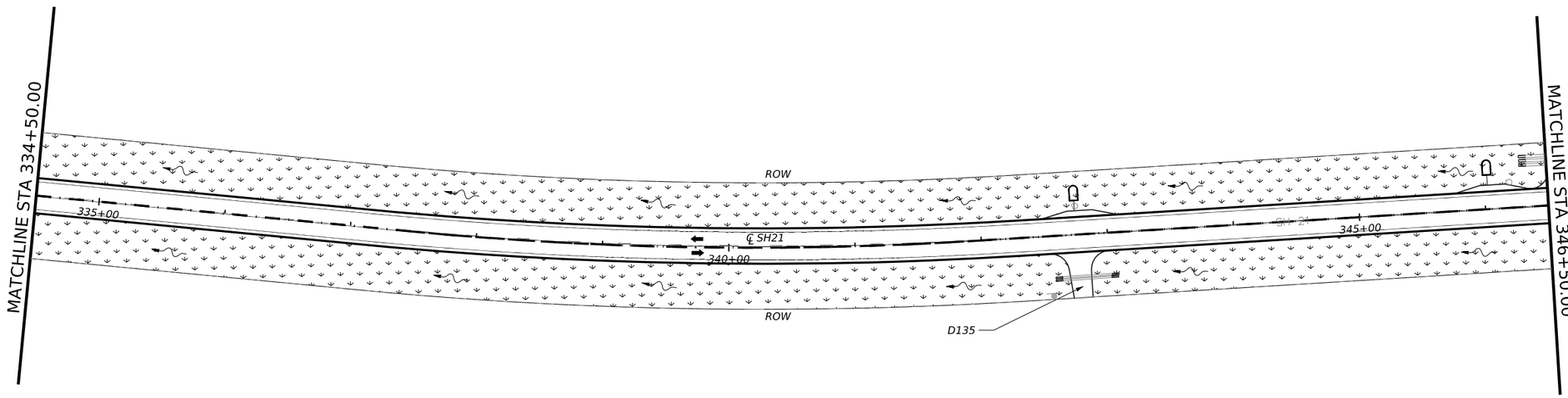

LEGEND

- DIRECTION OF TRAFFIC ARROW
- SCF — SEDIMENT CONT FENCE
- RFD2 — ROCK FILTER DAM (TY II)
- FLOW DIRECTION
- EXIST ROW
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ENVIRONMENTAL LAYOUT SHEETS

SHEET 13 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		131

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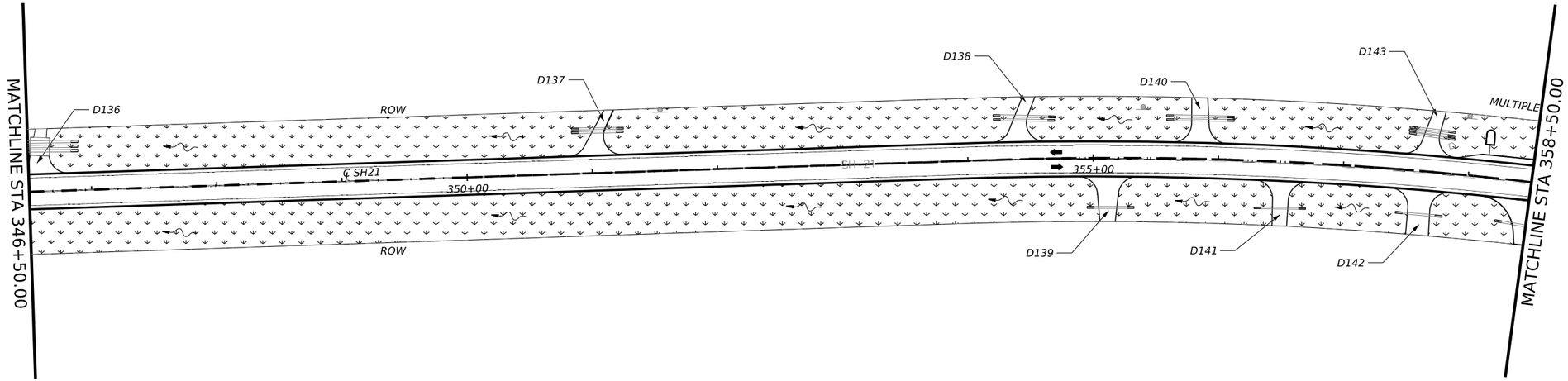

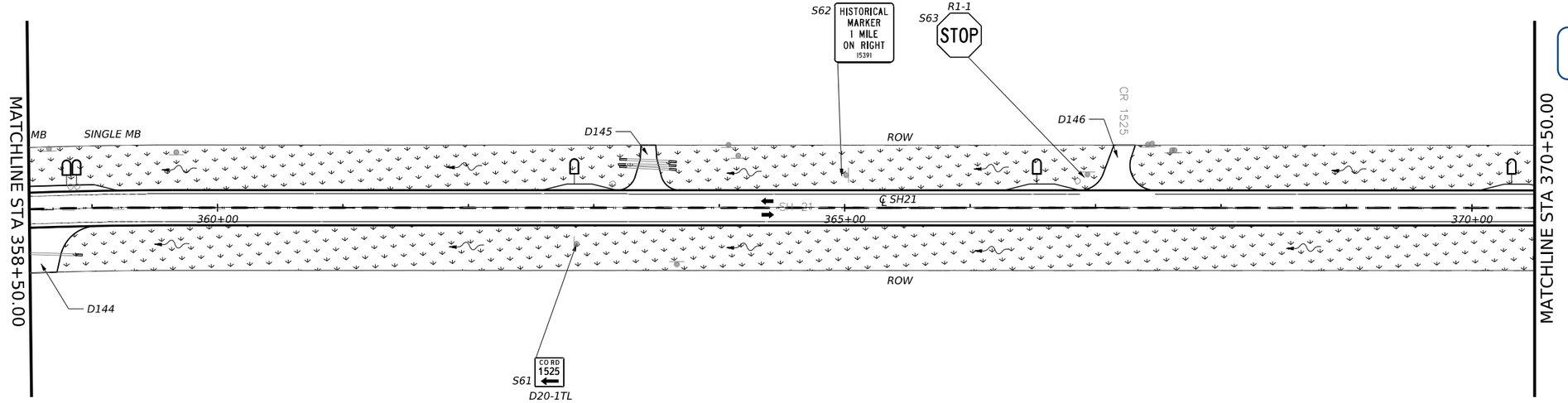

LEGEND

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 14 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		132

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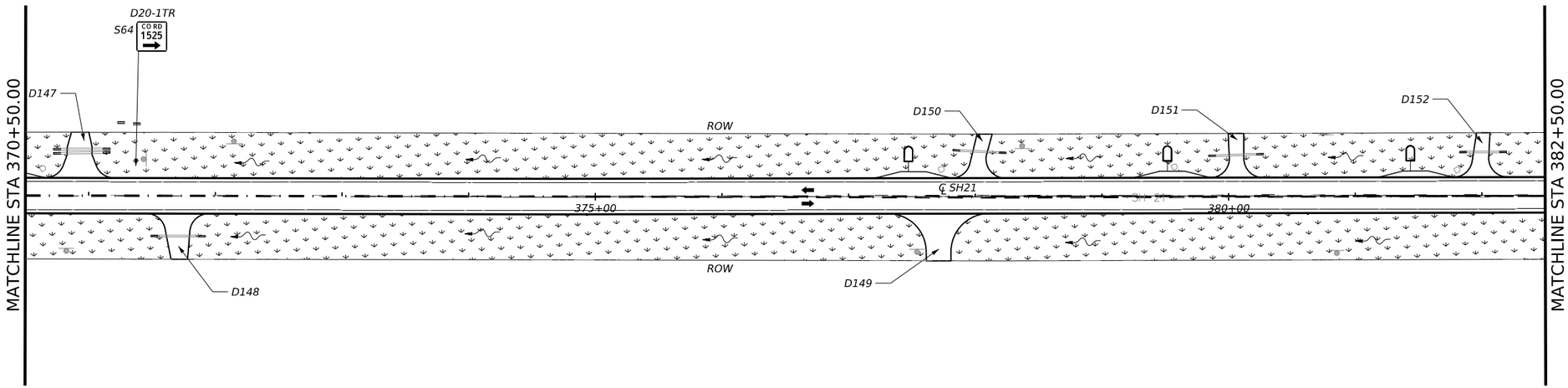

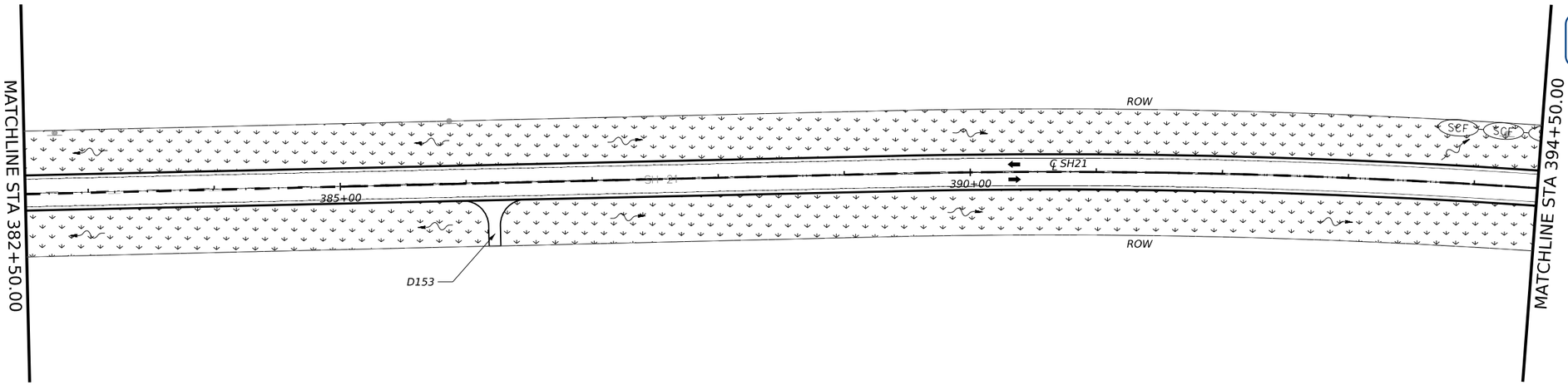

LEGEND

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 15 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		133

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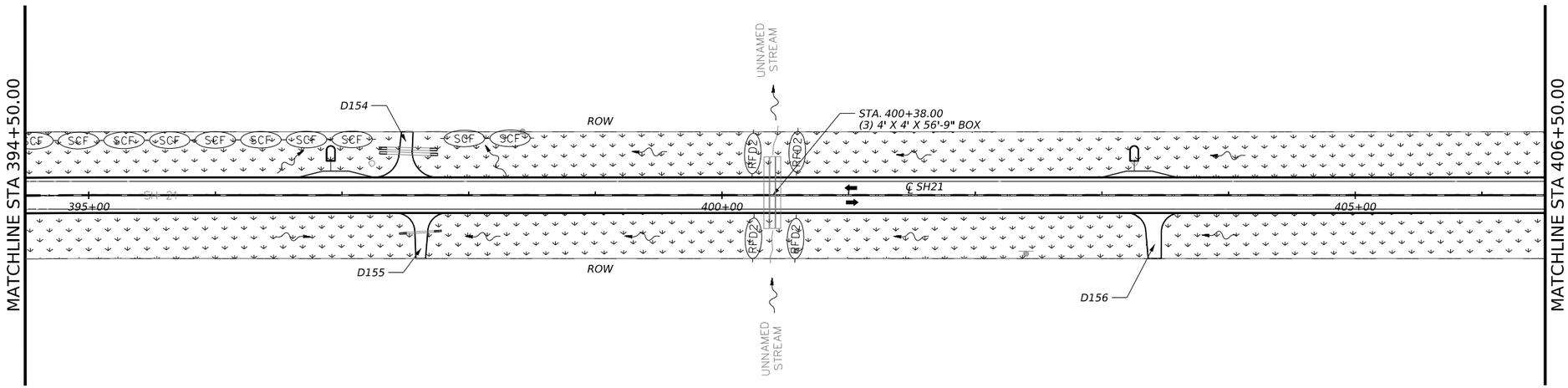

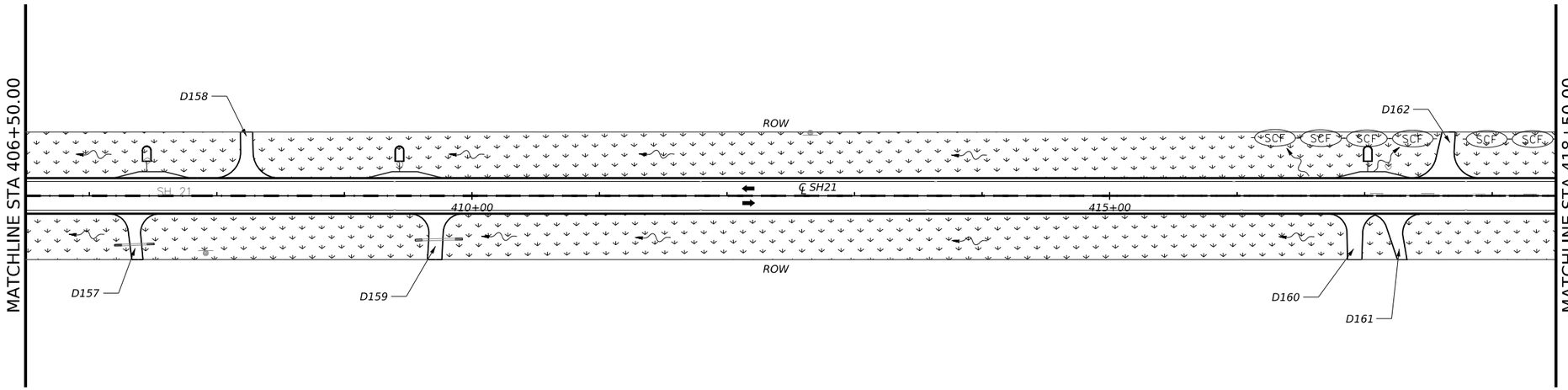

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 16 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		134

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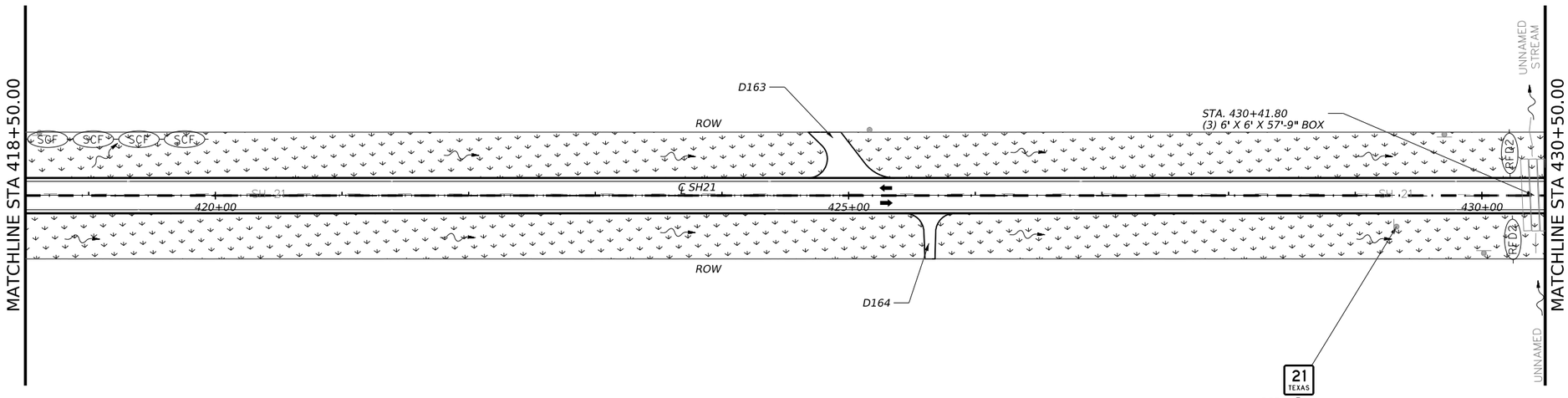

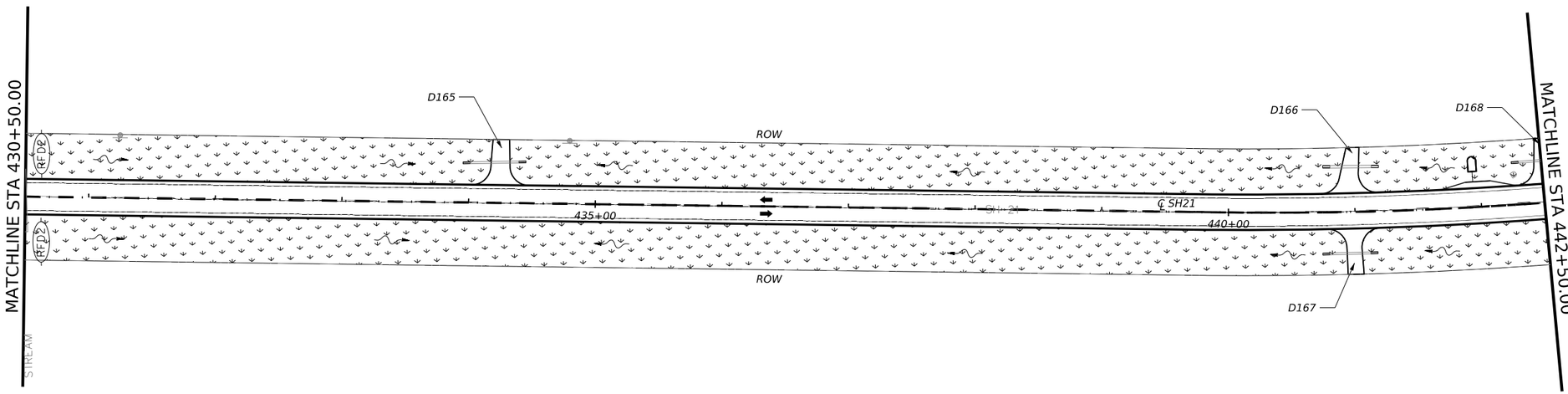

LEGEND

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 17 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		135

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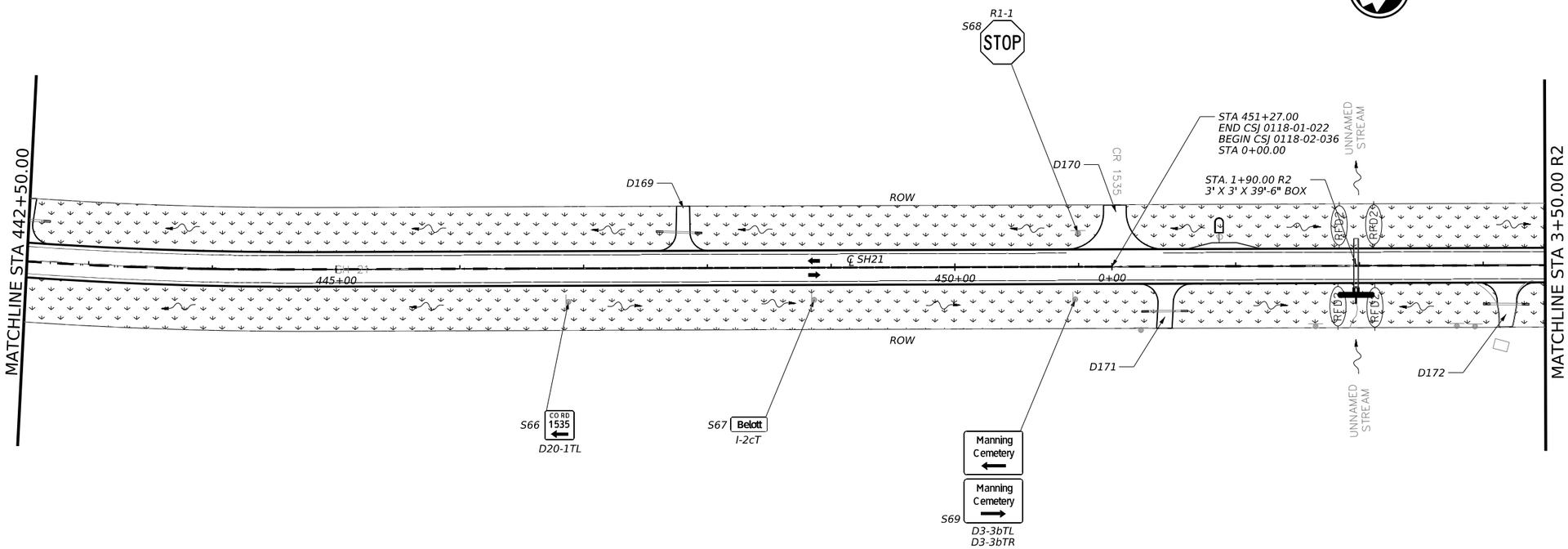

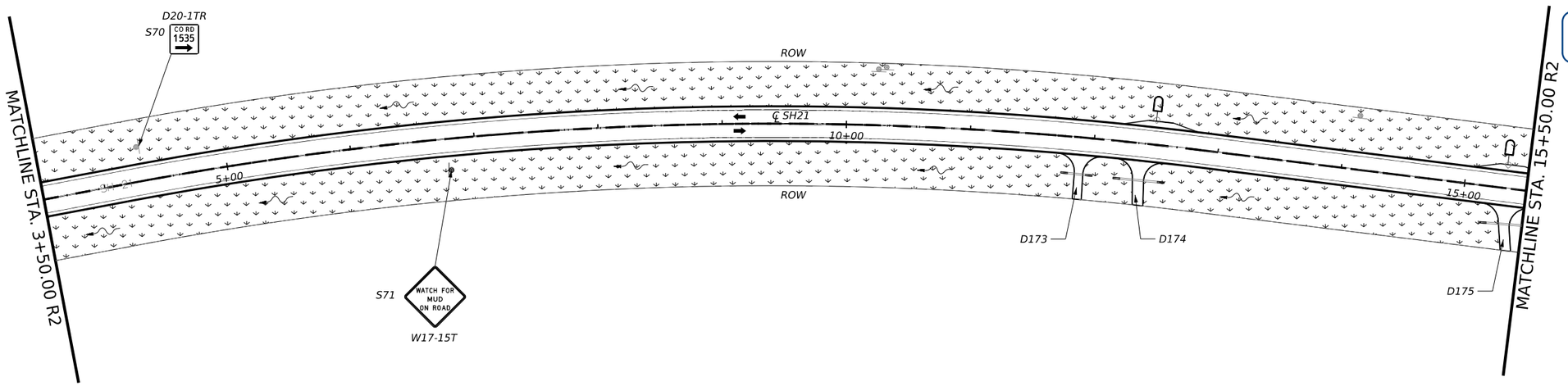

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 18 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		136

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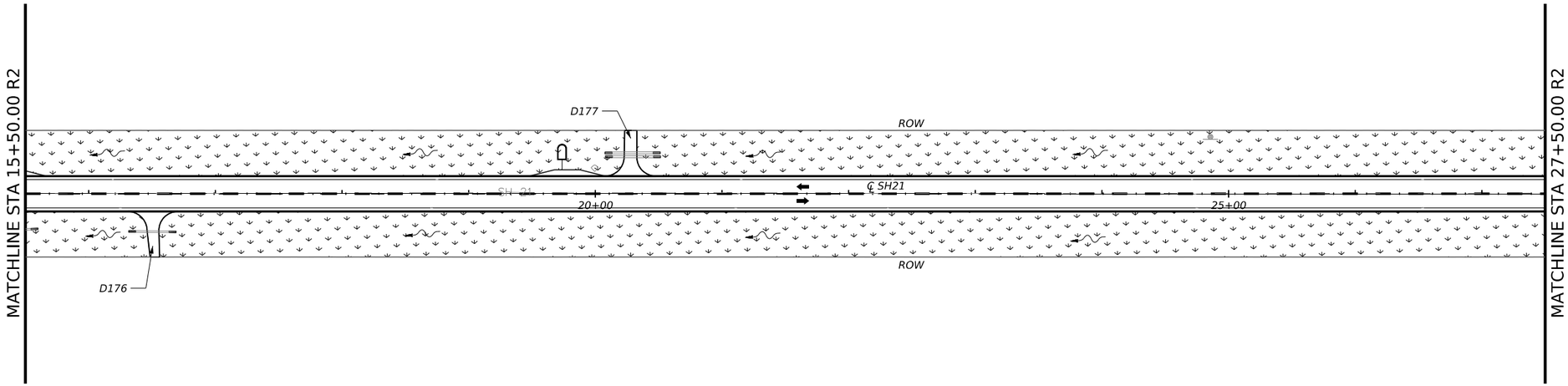

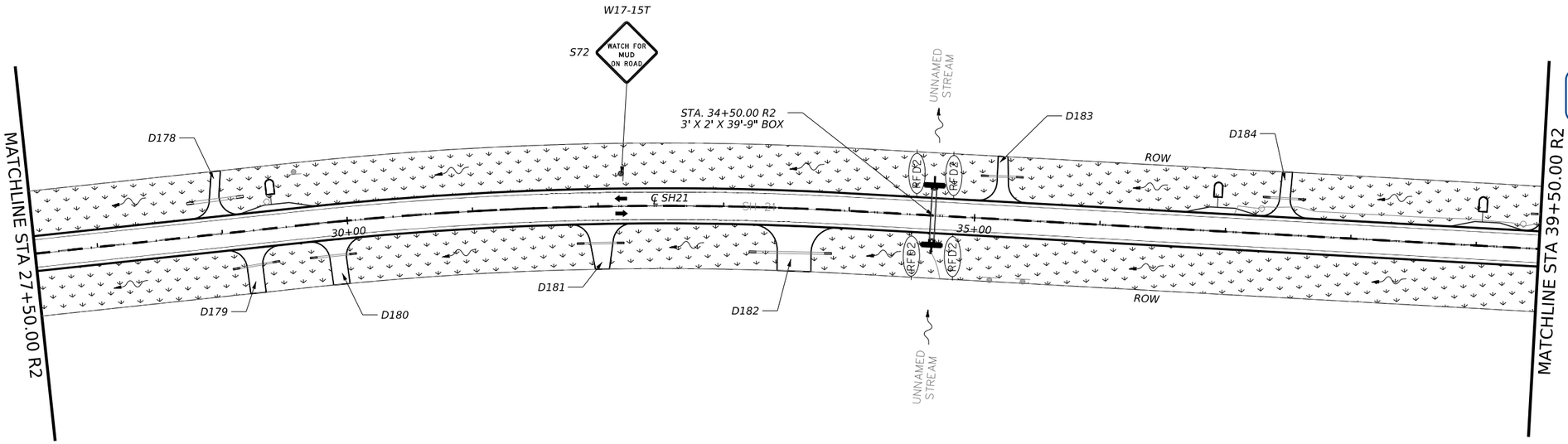

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 19 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		137

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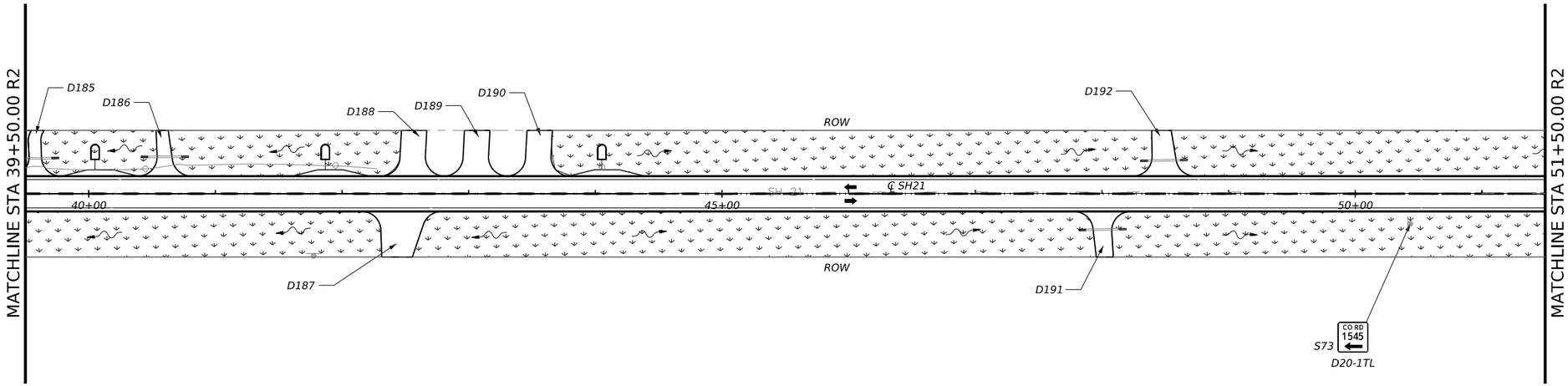

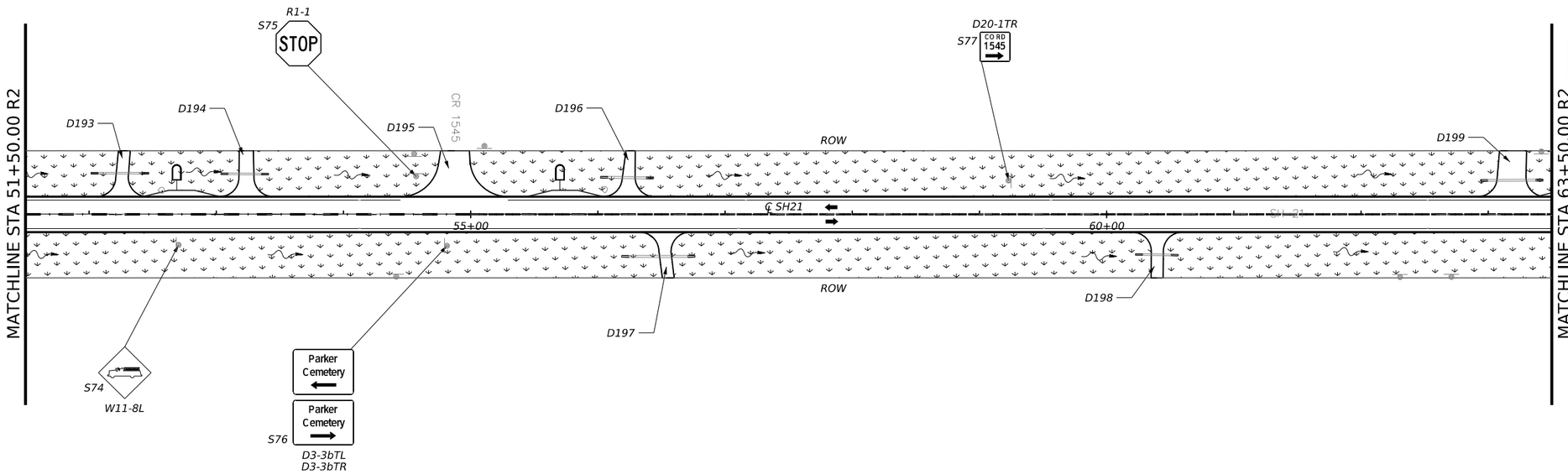

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SHEET 20 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		138

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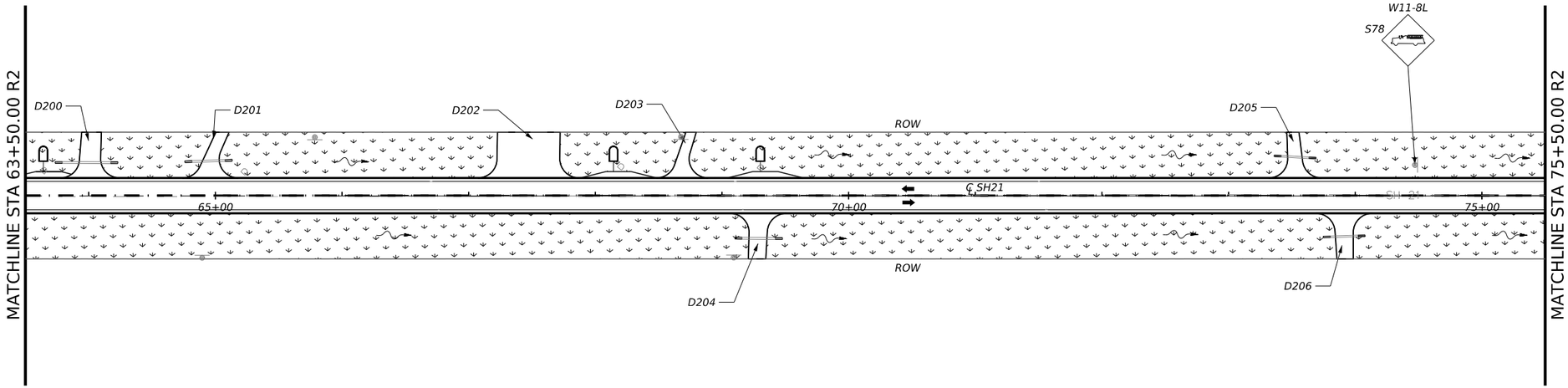

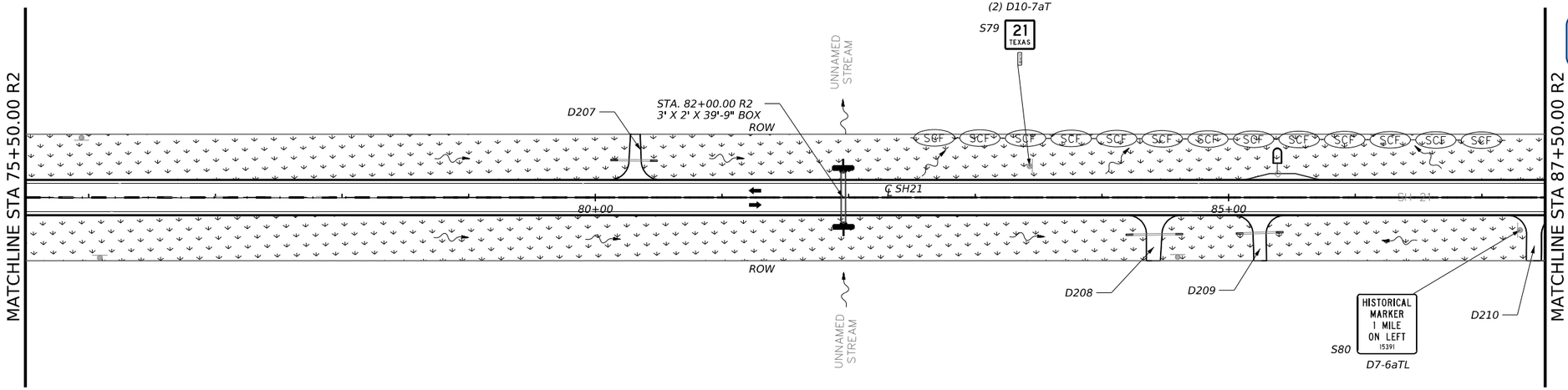

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 21 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		139

DATE: 10/27/2023 3:07:58 PM
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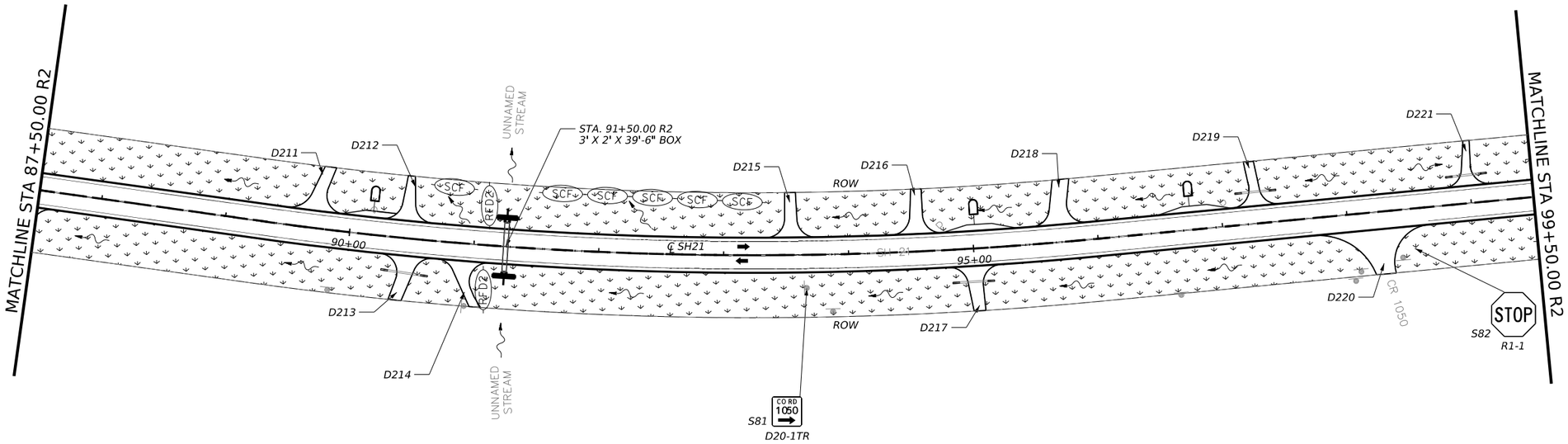

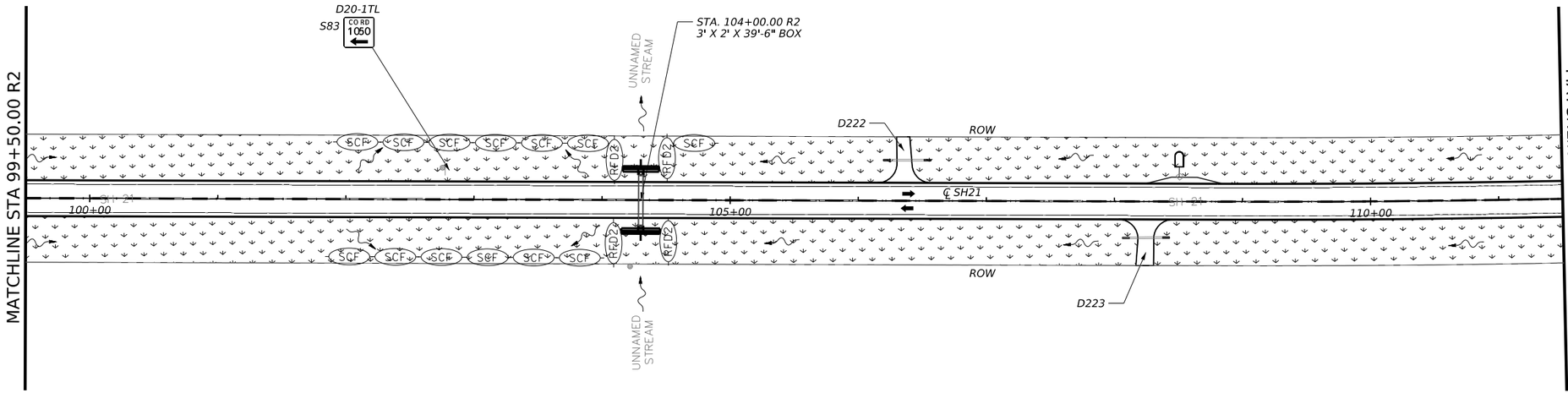

LEGEND

- DIRECTION OF TRAFFIC ARROW
- SCF — SEDIMENT CONT FENCE
- RFD2 — ROCK FILTER DAM (TY II)
- FLOW DIRECTION
- EXIST ROW
- LIMITS OF SEEDING/ AREA OF DISTURBANCE/PREP ROW
- MAIL BOX
- D## — DRIVEWAY ID
- S## — SIDE ROAD ID
- R## — SIGN ID
- CONSTRUCTION EXIT

NOTE:
1. LOCATIONS OF CONSTRUCTION EXITS MAY BE ADJUSTED IN THE FIELD AS DIRECTED BY THE ENGINEER.

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

3. ONEOK TO BE CONTACTED PRIOR TO STARTING CONSTRUCTION. CONTACT BART RICHEY AT (936) 544-6337.

4. HISTORICAL MARKERS TO REMAIN DURING CONSTRUCTION. FENCING SHALL BE PLACED AROUND THE MARKER AND NO WORK OR EQUIPMENT SHALL BE ALLOWED INSIDE THE FENCE IN ORDER TO PROTECT THE MONUMENT.

SCALE 1" = 100'

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
10/27/2023

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

LOCHNER

Texas Department of Transportation

ENVIRONMENTAL LAYOUT SHEETS

SHEET 22 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		140

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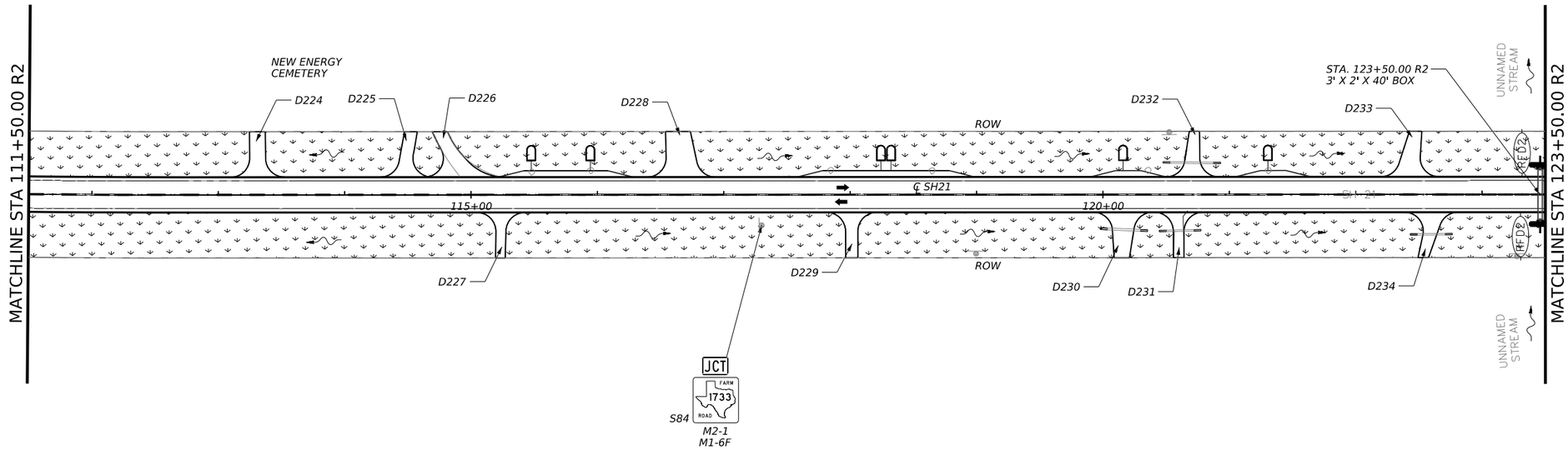

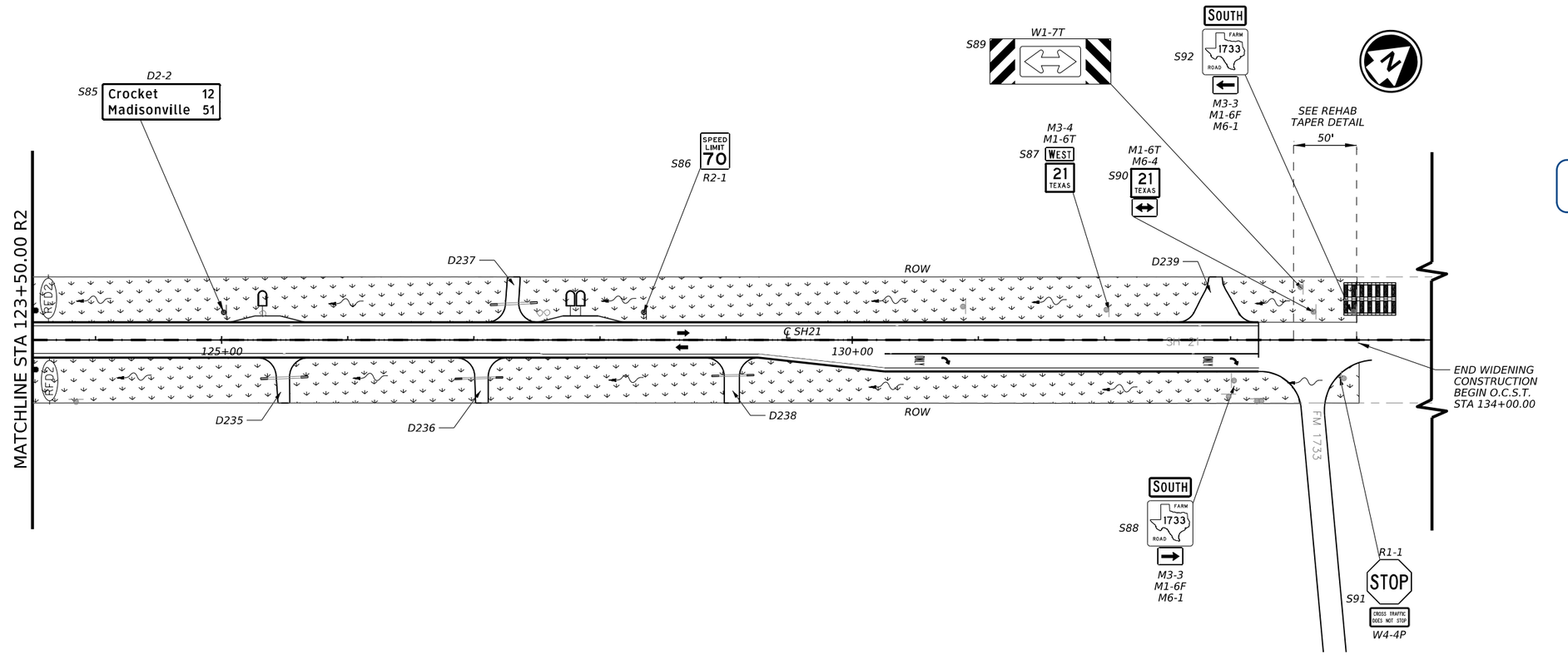

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ENVIRONMENTAL LAYOUT SHEETS

SHEET 23 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		141

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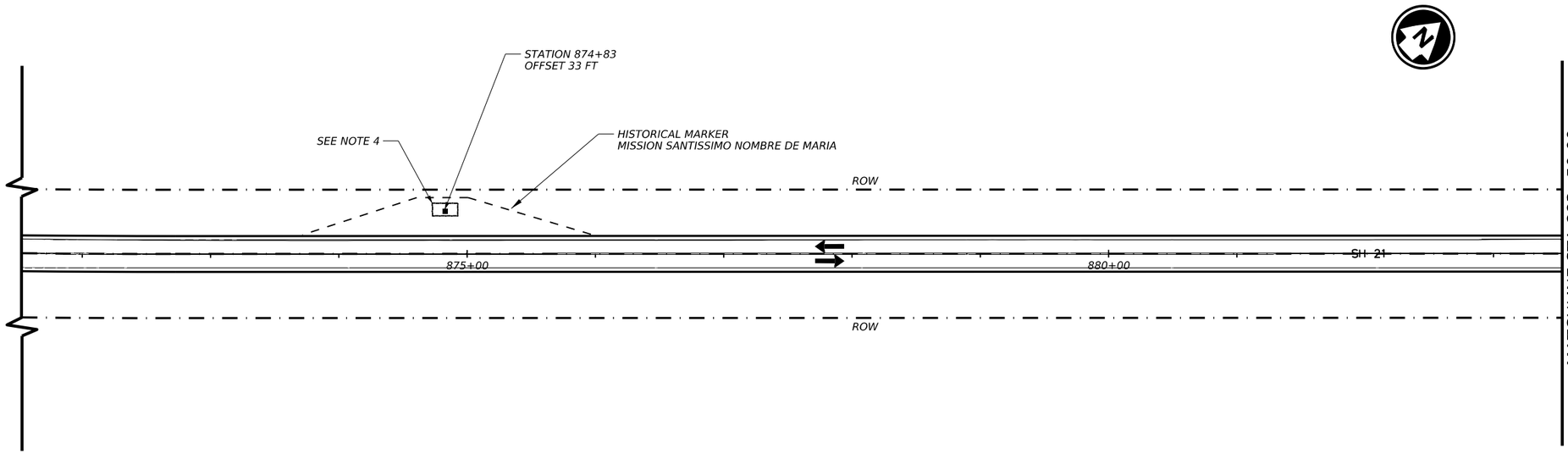

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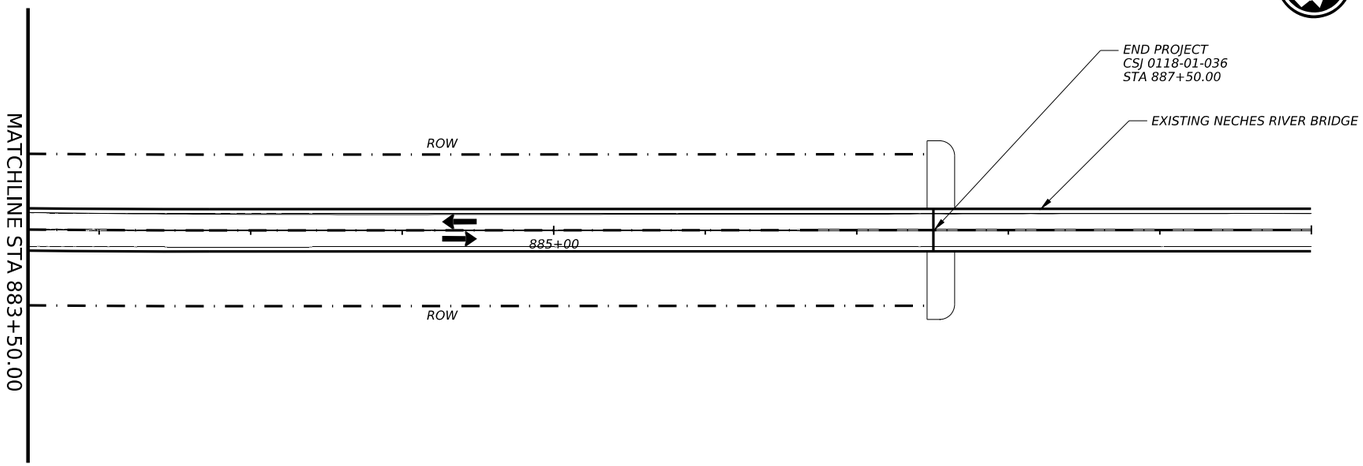

SCALE 1" = 100'

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10/27/2023

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Texas Department of Transportation

ENVIRONMENTAL LAYOUT SHEETS

SHEET 24 OF 24

CONT	SECT	JOB	HIGHWAY
0118	02	036, etc.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		142

DATE: 10/27/2023 3:08:23 PM
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DATE:
FILE:

I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

1. N/A

☐ *No Action Required* ☒ *Required Action*

Action No.

This project disturbs more than 5 acres of soil
1. *Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000*
2. *Comply with the SWP3 and revise when necessary to control pollution or required by the Engineer.*
3. *Project requires that a NOI and Large Site Notice be posted on or near the site, accessible to the public and TCEQ, EPA or other inspectors.*
4. *NOT must be filed with TCEQ for the project when final stabilization has been achieved.*

II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS CLEAN WATER ACT SECTIONS 401 AND 404

USACE Permit required for filling, dredging, excavating or other work in any water bodies, rivers, creeks, streams, wetlands or wet areas.

The Contractor must adhere to all of the terms and conditions associated with the following permit(s):

☐ *No Permit Required*
☒ *Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)*
☐ *Nationwide Permit 14 - PCN Required (1/10th to < 1/2 acre, 1/3 in tidal waters)*
☐ *Individual 404 Permit Required*
☐ *Other Nationwide Permit Required: NWP # _____*

Required Actions: List waters of the US permit applies to, location in project and check Best Management Practices planned to control erosion, sedimentation and post-project TSS.

1. Hurricane Bayou
2. Various un-named creeks and streams

Best Management Practices:

Erosion	*Sedimentation*	*Post-Cconstruction 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.

There is a granite historical marker and sign located at Station 211+00.

☐ *No Action Required* ☒ *Required Action*

Action No.

1. Historical Markers to remain during construction. Fencing shall be placed around the marker and no work or equipment shall be allowed inside the fence in order to protect the monument.

2. Contractor to repair or replace in kind, at his own expense, any historic materials damaged (buildings, historical markers, etc.) in the course of executing the work. Contractor is responsible for locating replacement source for historic materials damaged in the course of the work. TxDOT-Environmental Affairs Division is to be informed of proposed repairs to facilitate consultation with Texas Historical Commission prior to execution of repairs.

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*

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

☐ *No Action Required* ☒ *Required Action*

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.

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

LIST OF ABBREVIATIONS

BMP:	*Best Management Practice*	*SPCC:*	*Spill Prevention Control and Countermeasure*
CGP:	*Construction General Permit*	*SWP3:*	*Storm Water Pollution Prevention Plan*
DSHS:	*Texas Department of State Health Services*	*PCN:*	*Pre-Construction Notification*
FHWA:	*Federal Highway Administration*	*PSL:*	*Project Specific Location*
MOA:	*Memorandum of Agreement*	*TCEQ:*	*Texas Commission on Environmental Quality*
MOU:	*Memorandum of Understanding*	*TPDES:*	*Texas Pollutant Discharge Elimination System*
MS4:	*Municipal Separate Stormwater Sewer System*	*TPWD:*	*Texas Parks and Wildlife Department*
MBTA:	*Migratory Bird Treat Act*	*TxDOT:*	*Texas Department of Transportation*
NOT:	*Notice of Termination*	*T&E:*	*Threatened and Endangered Species*
NWP:	*Nationwide Permit*	*USACE:*	*U. S. Army Corps of Engineers*
NOI:	*Notice of Intent*	*USFWS:*	*U. S. Fish and Wildlife Service*

VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

General (applies to all projects):

Comply with the Hazard Communication Act (the Act) for personnel who will be working with hazardous materials by conducting safety meetings prior to beginning construction and making workers aware of potential hazards in the workplace. Ensure that all workers are provided with personal protective equipment appropriate for any hazardous materials used.

Obtain and keep on-site Material Safety Data Sheets (MSDS) for all hazardous products used on the project, which may include, but are not limited to the following categories: Paints, acids, solvents, asphalt products, chemical additives, fuels and concrete curing compounds or additives. Provide protected storage, off bare ground and covered, for products which may be hazardous. Maintain product labelling as required by the Act.

Maintain an adequate supply of on-site spill response materials, as indicated in the MSDS. In the event of a spill, take actions to mitigate the spill as indicated in the MSDS, in accordance with safe work practices, and contact the District Spill Coordinator immediately. The Contractor shall be responsible for the proper containment and cleanup of all product spills.

Contact the Engineer if any of the following are detected:
- ** Dead or distressed vegetation (not identified as normal)*
- ** Trash piles, drums, canister, barrels, etc.*
- ** Undesirable smells or odors*
- ** Evidence of leaching or seepage of substances*

Does the project involve any bridge class structure rehabilitation or replacements (bridge class structures not including box culverts)?

☐ *Yes* ☒ *No*

If "No", then no further action is rquired.
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.

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*

VII. OTHER ENVIRONMENTAL ISSUES

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

☒ *No Action Required* ☐ *Required Action*

Texas Department of Transportation — Design Division Standard

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR		
© TxDOT: February 2015	CONT	SECT	JOB		HIGHWAY	
REVISIONS	0118	02	036, ETC.		SH 21	
12-12-2011 (DS)	DIST	COUNTY			SHEET NO.	
05-07-14 ADDED NOTE SECTION IV.	LFK	HOUSTON			143	
01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.						

DATE:
FILE:

NWP GENERAL CONDITIONS

AS APPLICABLE TO
THIS PROJECT

2. AQUATIC LIFE MOVEMENTS. NO ACTIVITY MAY SUBSTANTIALLY DISRUPT THE NECESSARY LIFE CYCLE MOVEMENTS OF THOSE SPECIES OF AQUATIC LIFE INDIGENOUS TO THE WATERBODY, INCLUDING THOSE SPECIES THAT NORMALLY MIGRATE THROUGH THE AREA, UNLESS THE ACTIVITY'S PRIMARY PURPOSE IS TO IMPOUND WATER.

3. SPAWNING AREAS. ACTIVITIES IN SPAWNING AREAS DURING SPAWNING SEASONS MUST BE AVOIDED TO THE MAXIMUM EXTENT PRACTICABLE. ACTIVITIES THAT RESULT IN THE PHYSICAL DESTRUCTION (E.G., THROUGH EXCAVATION, FILL, OR DOWNSTREAM SMOTHERING BY SUBSTANTIAL TURBIDITY) OF AN IMPORTANT SPAWNING AREA ARE NOT AUTHORIZED.

6. SUITABLE MATERIAL. NO ACTIVITY MAY USE UNSUITABLE MATERIAL (E.G., TRASH, DEBRIS, CAR BODIES, ASPHALT, ETC.). MATERIAL USED FOR CONSTRUCTION OR DISCHARGED MUST BE FREE FROM TOXIC POLLUTANTS IN TOXIC AMOUNTS (SEE SECTION 307 OF THE CLEAN WATER ACT).

8. ADVERSE EFFECTS FROM IMPOUNDMENTS. IF THE ACTIVITY CREATES AN IMPOUNDMENT OF WATER, ADVERSE EFFECTS TO THE AQUATIC SYSTEM DUE TO ACCELERATING THE PASSAGE OF WATER, AND/OR RESTRICTING ITS FLOW MUST BE MINIMIZED TO THE MAXIMUM EXTENT PRACTICABLE.

9. MANAGEMENT OF WATER FLOWS. TO THE MAXIMUM EXTENT PRACTICABLE, THE PRE-CONSTRUCTION COURSE, CONDITION, CAPACITY, AND LOCATION OF OPEN WATERS MUST BE MAINTAINED FOR EACH ACTIVITY, INCLUDING STREAM CHANNELIZATION AND STORM WATER MANAGEMENT ACTIVITIES, EXCEPT AS PROVIDED BELOW. THE ACTIVITY MUST BE CONSTRUCTED TO WITHSTAND EXPECTED HIGH FLOWS. THE ACTIVITY MUST NOT RESTRICT OR IMPEDE THE PASSAGE OF NORMAL OR HIGH FLOWS, UNLESS THE PRIMARY PURPOSE OF THE ACTIVITY IS TO IMPOUND WATER OR MANAGE HIGH FLOWS. THE ACTIVITY MAY ALTER THE PRE-CONSTRUCTION COURSE, CONDITION, CAPACITY, AND LOCATION OF OPEN WATERS IF IT BENEFITS THE AQUATIC ENVIRONMENT (E.G., STREAM RESTORATION OR RELOCATION ACTIVITIES).

11. EQUIPMENT. HEAVY EQUIPMENT WORKING IN WETLANDS OR MUD FLATS MUST BE PLACED ON MATS, OR OTHER MEASURES MUST BE TAKEN TO MINIMIZE SOIL DISTURBANCE.

12. SOIL EROSION AND SEDIMENT CONTROLS. APPROPRIATE SOIL EROSION AND SEDIMENT CONTROLS MUST BE USED AND MAINTAINED IN EFFECTIVE OPERATING CONDITION DURING CONSTRUCTION, AND ALL EXPOSED SOIL AND OTHER FILLS, AS WELL AS ANY WORK BELOW THE ORDINARY HIGH WATER MARK OR HIGH TIDE LINE, MUST BE PERMANENTLY STABILIZED AT THE EARLIEST PRACTICABLE DATE. PERMITTEES ARE ENCOURAGED TO PERFORM WORK WITHIN WATERS OF THE UNITED STATES DURING PERIODS OF LOW-FLOW OR NO-FLOW.

13. REMOVAL OF TEMPORARY FILLS. TEMPORARY FILLS MUST BE REMOVED IN THEIR ENTIRETY AND THE AFFECTED AREAS RETURNED TO PRE-CONSTRUCTION ELEVATIONS. THE AFFECTED AREAS MUST BE REVEGETATED, AS APPROPRIATE.

14. PROPER MAINTENANCE. ANY AUTHORIZED STRUCTURE OR FILL SHALL BE PROPERLY MAINTAINED, INCLUDING MAINTENANCE TO ENSURE PUBLIC SAFETY AND COMPLIANCE WITH APPLICABLE NWP GENERAL CONDITIONS, AS WELL AS ANY ACTIVITY-SPECIFIC CONDITIONS ADDED BY THE DISTRICT ENGINEER TO AN NWP AUTHORIZATION.

23. MITIGATION. THE DISTRICT ENGINEER WILL CONSIDER SEVERAL FACTORS WHEN DETERMINING APPROPRIATE AND PRACTICABLE MITIGATION NECESSARY TO ENSURE THAT ADVERSE EFFECTS ON THE AQUATIC ENVIRONMENT ARE MINIMAL.

25. WATER QUALITY. WHERE STATES AND AUTHORIZED TRIBES, OR EPA WHERE APPLICABLE, HAVE NOT PREVIOUSLY CERTIFIED COMPLIANCE OF AN NWP WITH CWA SECTION 401, INDIVIDUAL 401 WATER QUALITY CERTIFICATION MUST BE OBTAINED OR WAIVED (SEE 33 CFR 330.4(C)). THE DISTRICT ENGINEER OR STATE OR TRIBE MAY REQUIRE ADDITIONAL WATER QUALITY MANAGEMENT MEASURES TO ENSURE THAT THE AUTHORIZED ACTIVITY DOES NOT RESULT IN MORE THAN MINIMAL DEGRADATION OR WATER QUALITY.

27. REGIONAL AND CASE-BY-CASE CONDITIONS. THE ACTIVITY MUST COMPLY WITH ANY REGIONAL CONDITIONS THAT MAY HAVE BEEN ADDED BY THE DIVISION ENGINEER (SEE 33 CFR 330.4(E)) AND WITH ANY CASE SPECIFIC CONDITIONS ADDED BY THE CORPS OR BY THE STATE, INDIAN TRIBE, OR U.S. EPA IN ITS SECTION 401 WATER QUALITY CERTIFICATION, OR BY THE STATE IN ITS COASTAL ZONE MANAGEMENT ACT CONSISTENCY DETERMINATION.

FOR A COMPLETE LIST OF GENERAL CONDITIONS GO TO:

http://www.swf.usace.army.mil/Missions/Regulatory/Permitting/NationwideGeneralPermits.aspx

USACE - PERMIT #14

AS APPLICABLE TO
THIS PROJECT

ACTIVITIES REQUIRED FOR CROSSINGS OF WATERS OF THE UNITED STATES ASSOCIATED WITH THE CONSTRUCTION, EXPANSION, MODIFICATION, OR IMPROVEMENT OF LINEAR TRANSPORTATION PROJECTS (E.G., ROADS, HIGHWAYS, RAILWAYS, TRAILS, AIRPORT RUNWAYS, AND TAXIWAYS) IN WATERS OF THE U.S. FOR LINEAR TRANSPORTATION PROJECTS IN NON-TIDAL WATERS, THE DISCHARGE CANNOT CAUSE THE LOSS OF GREATER THAN 1/2-ACRE OF WATERS OF THE U.S. ANY STREAM CHANNEL MODIFICATION, INCLUDING BANK STABILIZATION, IS LIMITED TO THE MINIMUM NECESSARY TO CONSTRUCT OR PROTECT THE LINEAR TRANSPORTATION PROJECT; SUCH MODIFICATIONS MUST BE IN THE IMMEDIATE VICINITY OF THE PROJECT.

THIS NWP ALSO AUTHORIZES TEMPORARY STRUCTURES, FILLS, AND WORK NECESSARY TO CONSTRUCT THE LINEAR TRANSPORTATION PROJECT. APPROPRIATE MEASURES MUST BE TAKEN TO MAINTAIN DOWNSTREAM FLOWS AND MINIMIZE FLOODING TO THE MAXIMUM EXTENT PRACTICABLE, WHEN TEMPORARY STRUCTURES, WORK, AND DISCHARGES, INCLUDING COFFERDAMS, ARE NECESSARY FOR CONSTRUCTION ACTIVITIES, ACCESS FILLS, OR DEWATERING OF CONSTRUCTION SITES. TEMPORARY FILLS MUST CONSIST OF MATERIALS, AND BE PLACED IN A MANNER THAT WILL NOT BE ERODED BY EXPECTED HIGH FLOWS. TEMPORARY FILLS MUST BE REMOVED IN THEIR ENTIRETY AND THE AFFECTED AREAS RETURNED TO PRE-CONSTRUCTION ELEVATIONS. THE AREAS AFFECTED BY TEMPORARY FILLS MUST BE REVEGETATED, AS APPROPRIATE.

THIS NWP CANNOT BE USED TO AUTHORIZE NON-LINEAR FEATURES COMMONLY ASSOCIATED WITH TRANSPORTATION PROJECTS, SUCH AS VEHICLE MAINTENANCE OR STORAGE BUILDINGS, PARKING LOTS, TRAIN STATIONS, OR AIRCRAFT HANGARS.

NOTIFICATION: THE PERMITTEE MUST SUBMIT A PRE-CONSTRUCTION NOTIFICATION (PCN) TO THE DISTRICT ENGINEER PRIOR TO COMMENCING THE ACTIVITY IF: (1) THE LOSS OF WATERS OF THE U.S. EXCEEDS 1/10-ACRE; OR (2) THERE IS A DISCHARGE IN A SPECIAL AQUATIC SITE, INCLUDING WETLANDS.

NOTE:

THE PROJECT CROSSES JURISDICTIONAL WATERS OF THE U.S. A NWP #14 WITH PCN HAS BEEN OBTAINED BECAUSE IMPACTS WILL EXCEEDED THE ABOVE CRITERIA. THIS PERMIT AUTHORIZES THE ACTIVITIES WHICH WILL IMPACT WATERS OF THE U.S. THE NWP GENERAL CONDITIONS AND THE NWP #14 LIMITS MUST BE FOLLOWED IN ORDER TO MAINTAIN COMPLIANCE WITH THE NWP. PROJECT PLANS PROVIDE THE EXTENT OF WORK AUTHORIZED BY THE USACE. ANY CHANGES AT WATERS OF THE U.S. WILL REQUIRE COORDINATION WITH THE USACE. IF COORDINATION MAY BE NEEDED, CONTACT THE TXDOT LUFKIN DISTRICT ENVIRONMENTAL SECTION AT 1-800-687-8087.

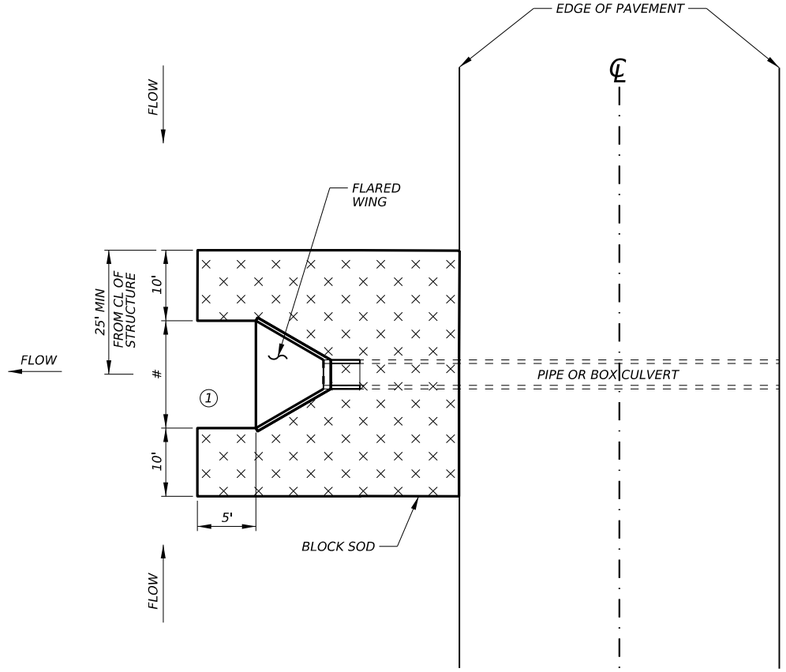
ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS (EPIC)

USACE

Texas Department of Transportation | Design Division Standard

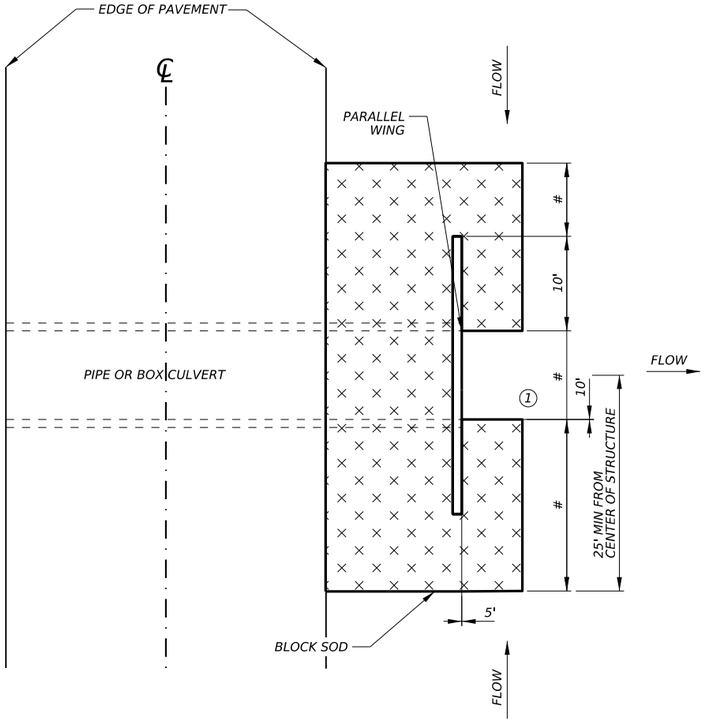
ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS EPIC

FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR
©TxDOT: February 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
12-12-2011 (DS)	DIST	COUNTY		SHEET NO.
05-07-14 ADDED NOTE SECTION IV. 01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	LFK	HOUSTON		144



CROSSROAD CULVERT W/FLARED WING

PLACE AT ALL FLARED WING CROSS
DRAINAGE STRUCTURE WORK IS PROPOSED



CROSSROAD CULVERT W/PARALLEL WING

PLACE AT ALL PARALLEL WING CROSS
DRAINAGE STRUCTURE WORK IS PROPOSED

SYMBOL	DESCRIPTION
	BLOCK SODDING

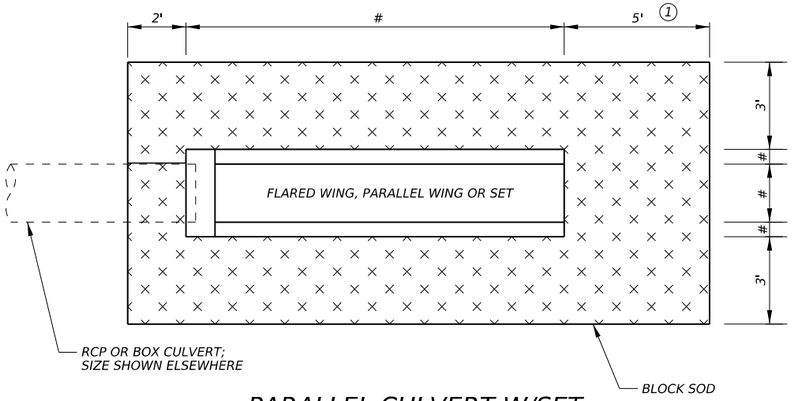
GENERAL NOTES:

PLACE BLOCK SOD IMMEDIATELY UPON COMPLETION OF WORK AT A STRUCTURE OR AT AN END OF A STRUCTURE.

(1) DO NOT PLACE BLOCK SOD WHERE RIPRAP IS INSTALLED.

DIMENSION VARIES

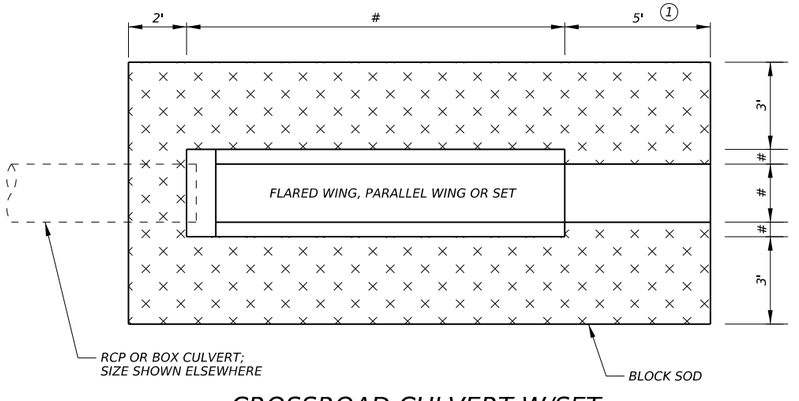
N.T.S.



PARALLEL CULVERT W/SET

PLACE AT ALL PARALLEL CULVERTS
WHERE WORK IS PROPOSED.

MIN REQUIRED SOD AREA	
SET SIZE	SY
15"	13
18"	14
24"	17
30"	20
36"	22



CROSSROAD CULVERT W/SET

PLACE AT ALL CROSSROAD CULVERTS
WHERE WORK IS PROPOSED.
DO NOT PLACE SOD DIRECTLY IN
THE CHANNEL.

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
10/27/2023

Texas Department of Transportation

BLOCK SOD DETAILS

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		145

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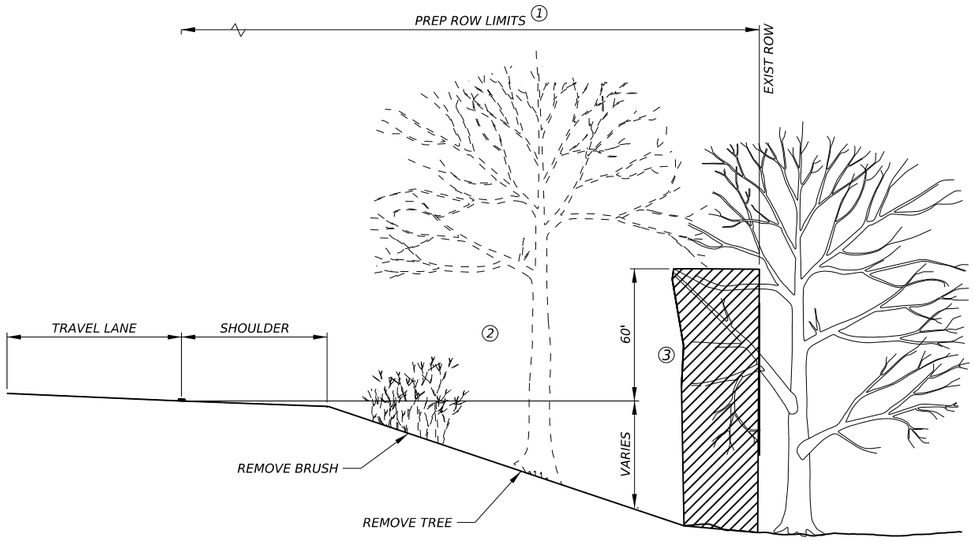

TYPICAL REMOVAL AND TRIM DETAIL

NOTES:

① REMOVE ALL TREES AND BRUSH WITHIN ROW.

② REMOVE TREE AND ROOT SYSTEM IF ANY PART OF THE TRUNK IS WITHIN THE ROW.

③ TRIM TREE LIMBS INSIDE PREP ROW LIMITS FROM NATURAL GROUND UP TO A MINIMUM HEIGHT OF 60' FROM THE OUTSIDE EDGE OF TRAVEL LANE.

GENERAL NOTES:

1. PREP ROW SHALL BE MAINTAINED UNTIL FINAL ACCEPTANCE.

NOT TO SCALE

STATE OF TEXAS
RICHARD B. KLATT
86961
LICENSED
PROFESSIONAL ENGINEER

DocuSigned by:
Richard B. Klatt
4692CB9B5B43454...
10/27/2023

Texas Department of Transportation

TREE REMOVAL AND TRIMMING DETAILS

CONT	SECT	JOB	HIGHWAY
0118	02	036, ETC.	SH 21
DIST	COUNTY		SHEET NO.
LFK	HOUSTON		146

DATE: 10/27/2023 1:49:24 PM
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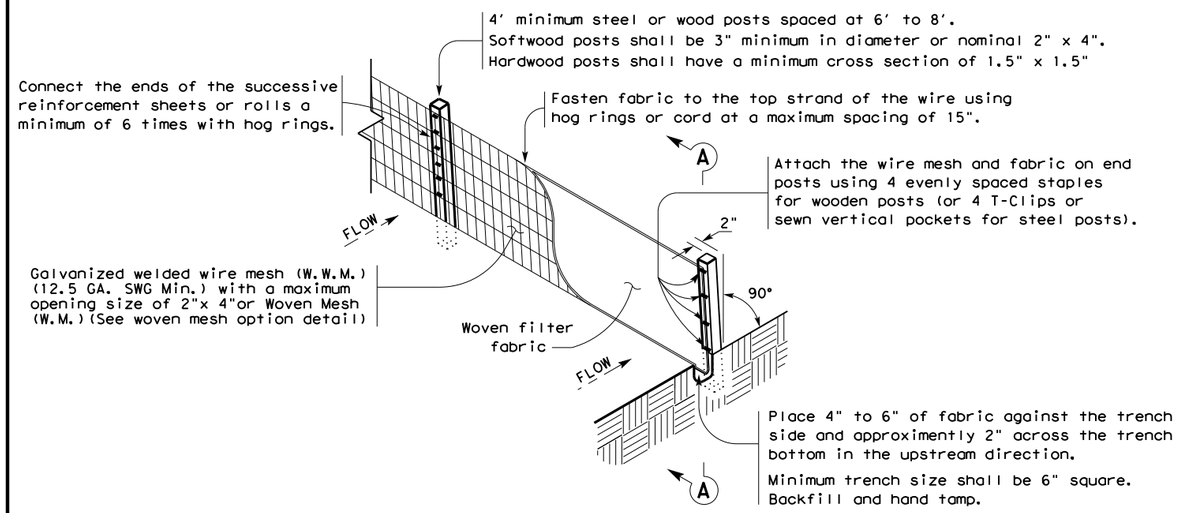
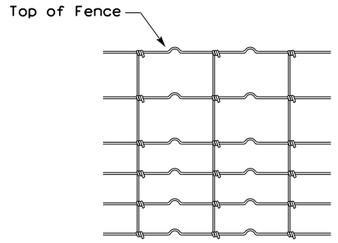
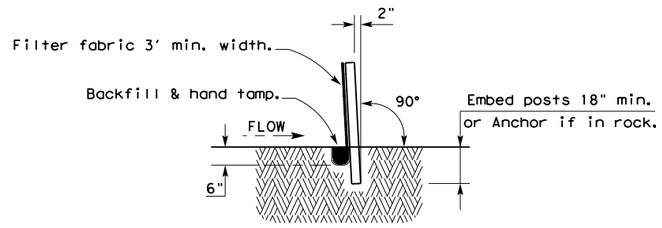


TEMPORARY SEDIMENT CONTROL FENCE

SCF





SECTION A-A

HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL

Galvanized hinge joint knot woven mesh (12.5 GA.SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

SEDIMENT CONTROL FENCE USAGE GUIDELINES

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

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

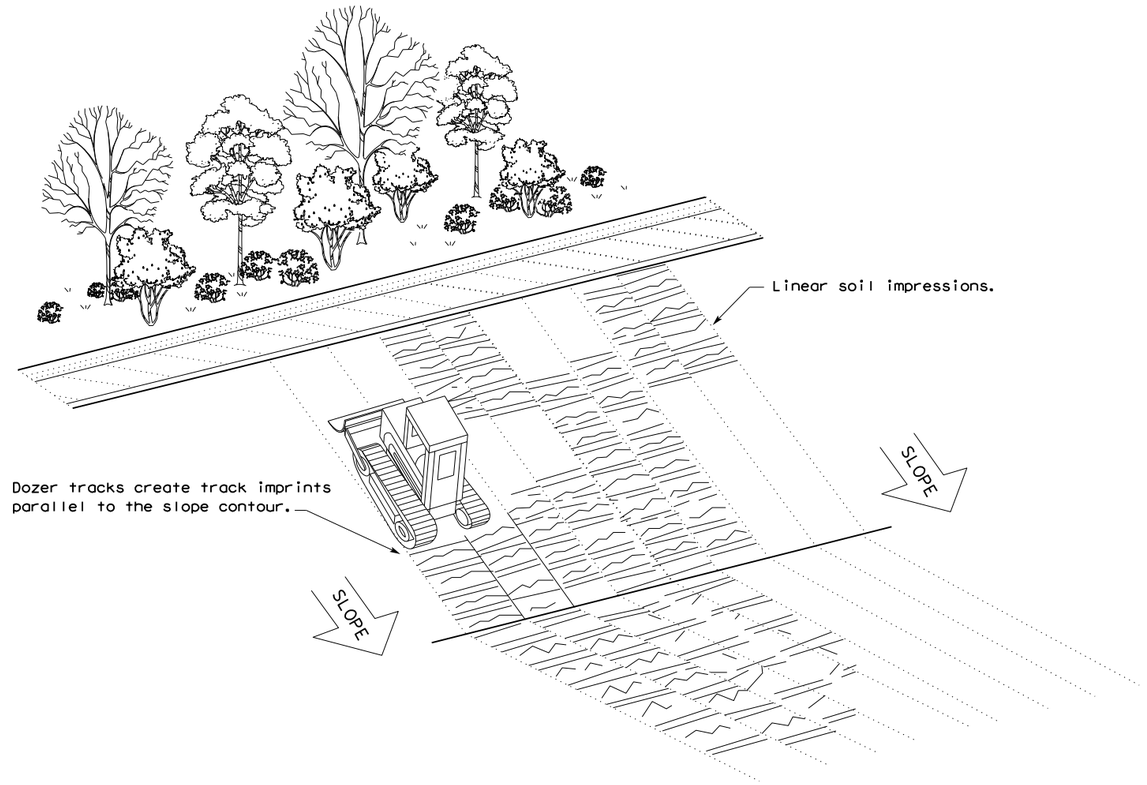
LEGEND

Sediment Control Fence

SCF

GENERAL NOTES

1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.



VERTICAL TRACKING

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

FENCE & VERTICAL TRACKING

EC(1)-16

FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0118	02	036, ETC.	SH 21	
	DIST	COUNTY		SHEET NO.	
	LFK	HOUSTON		147	

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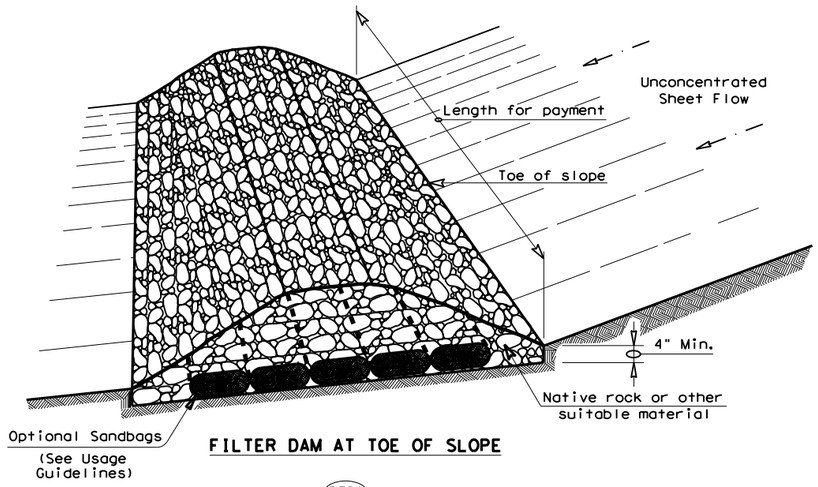
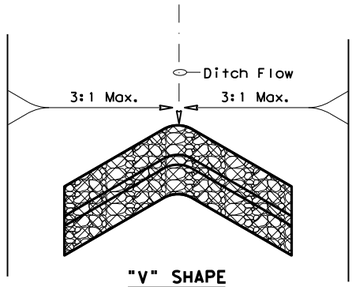
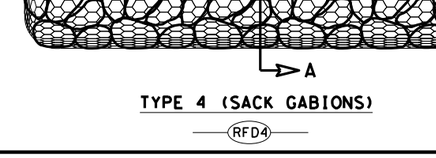


FILTER DAM AT TOE OF SLOPE

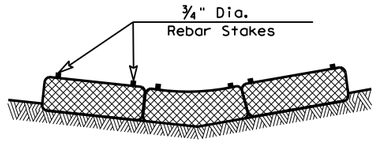
RFD1



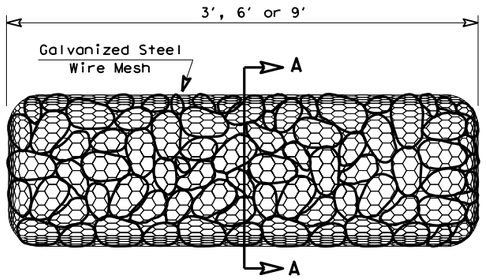
"V" SHAPE PLAN VIEW



PLAN VIEW

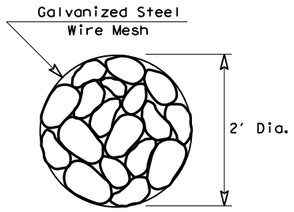


SECTION B-B

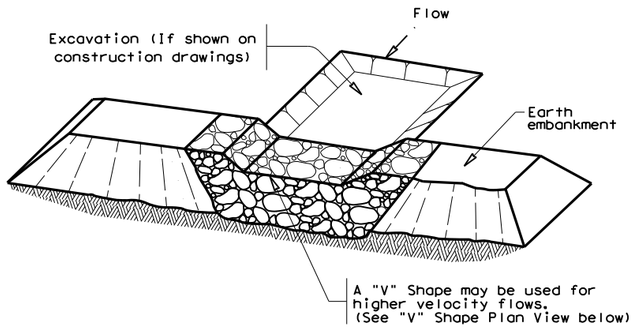


TYPE 4 (SACK GABIONS)

RFD4

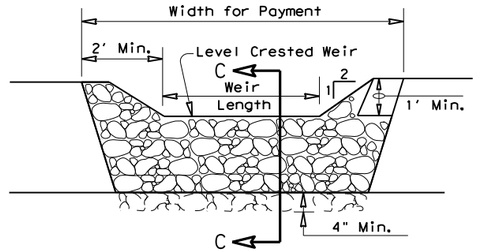


SECTION A-A

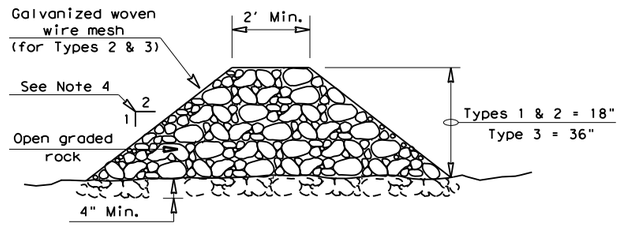


FILTER DAM AT SEDIMENT TRAP

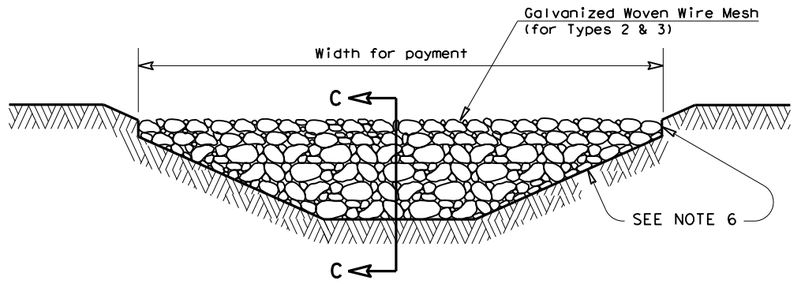
RFD1 — OR — RFD2



PROFILE



SECTION C-C



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	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		148

DATE:
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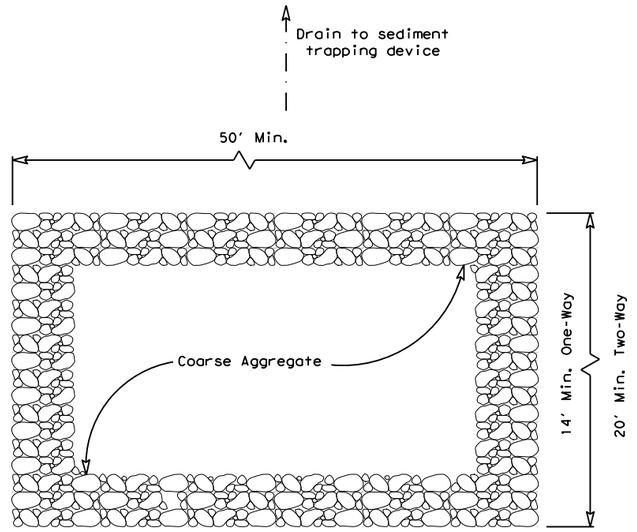
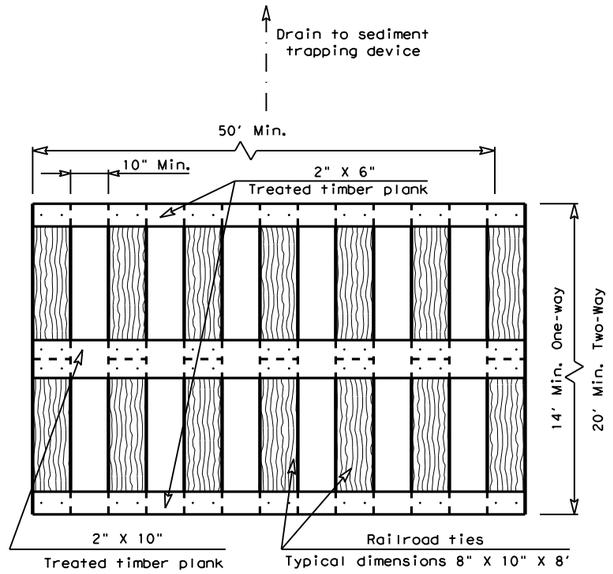


PLAN VIEW



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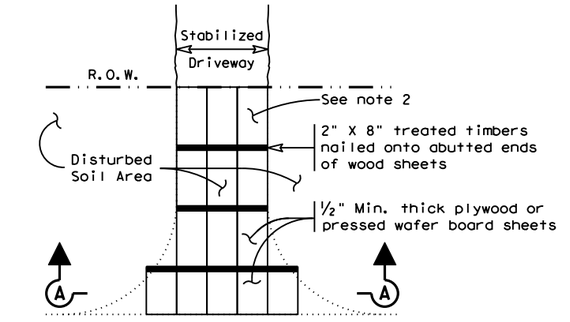

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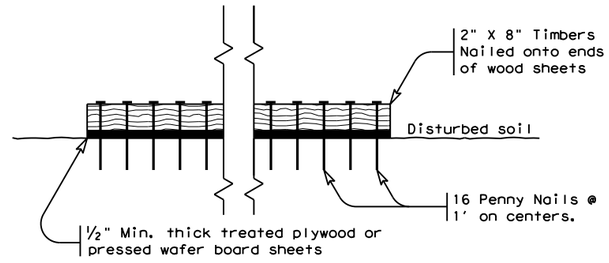
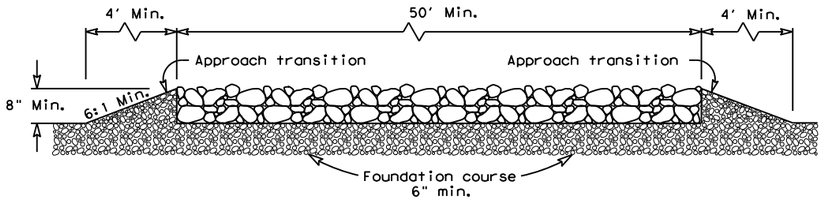


SECTION A-A

CONSTRUCTION EXIT (TYPE 3)

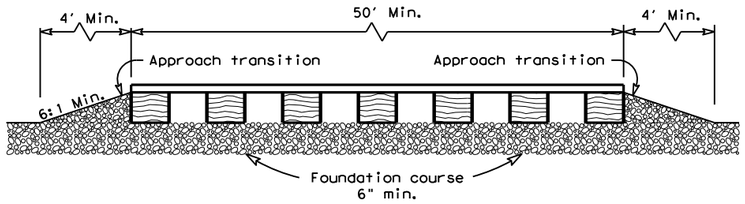
SHORT TERM



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 1)

ROCK CONSTRUCTION (LONG TERM)



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 2)

TIMBER CONSTRUCTION (LONG TERM)

GENERAL NOTES (TYPE 1)

1. The length of the type 1 construction exit shall be as indicated on the plans, but not less than 50'.
2. The coarse aggregate should be open graded with a size of 4" to 8".
3. The approach transitions should be no steeper than 6:1 and constructed as directed by the Engineer.
4. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other materialas approved by the Engineer.
5. The construction exit shall be graded to allow drainage to a sediment trapping device.
6. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
7. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.

GENERAL NOTES (TYPE 2)

1. The length of the type 2 construction exit shall be as indicated on the plans, but not less than 50'.
2. The treated timber planks shall be attached to the railroad ties with ½"x 6" min. lag bolts. Other fasteners may be used as approved by the Engineer.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The approach transitions shall be no steeper than 6:1 and constructed as directed by the Engineer.
5. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
6. The construction exit should be graded to allow drainage to a sediment trapping device.
7. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
8. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.

GENERAL NOTES (TYPE 3)

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

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

CONSTRUCTION EXITS

EC(3)-16

FILE: ec316	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
©TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0118	02	036, ETC.	SH 21
	DIST	COUNTY		SHEET NO.
	LFK	HOUSTON		149