INDEX OF SHEETS

SEE SHEET 2 FOR INDEX OF SHEETS

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				001
CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

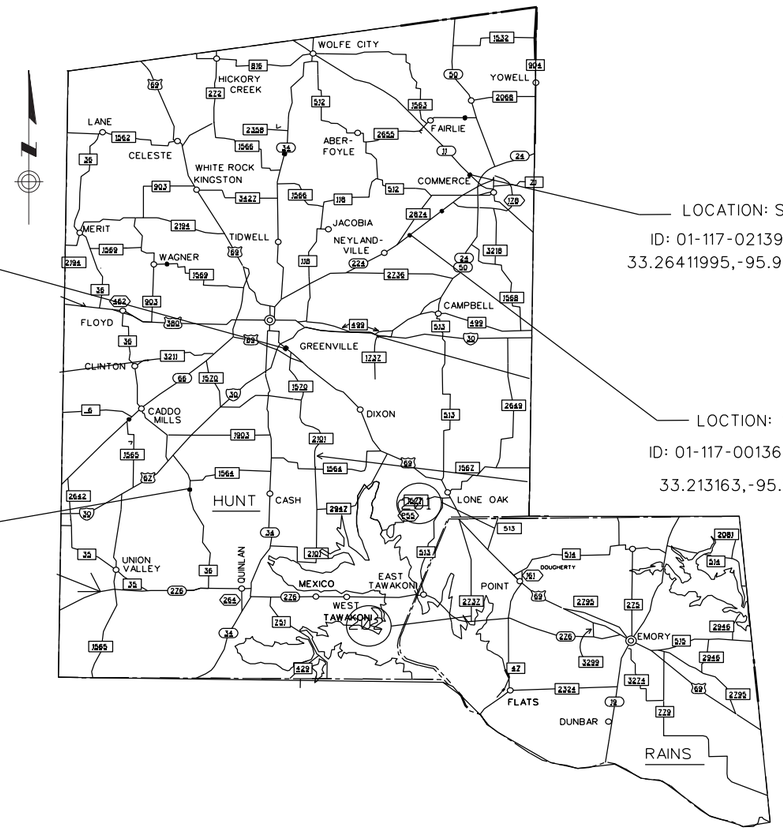
PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

STATE AID PROJECT NO.: C 901-22-128

WINGWALLS REMOVE AND REPLACE

VARIOUS
HUNT & RAINS COUNTY

FOR THE CONSTRUCTION OF: WINGWALLS
EXISTING STRUCTURES
CONSISTING OF: WINGWALL REMOVAL, WINGWALL CONSTRUCTION,
RIPRAP PLACEMENT AND OTHER MINOR STUCTURAL MAINTENANCE.



LOCATION: US 69
ID: 01-117-00203-01-016
33.117367,-96.093569

LOCATION: SH 11
ID: 01-117-02139-04-011
33.26411995,-95.91292085

LOCTION: SH 224
ID: 01-117-00136-01-094
33.213163,-95.984650

LOCATION: FM 36
ID: 01-117-00642-03-010
32.99067121,-96,184632284

EXCEPTIONS: NONE
EQUATIONS: NONE
RAILROAD: NONE

FINAL PLANS

LETTING DATE:
DATE CONTRACTOR BEGIN WORK:
DATE WORK WAS COMPLETED:
DATE WORK WAS ACCEPTED:
ORIGINAL CONTRACT WORKING DAYS:
USED OF WORKING DAYS
NO. OF CHANGE ORDERS:
FINAL CONTRACT COST:
PERCENT OVER/UNDER RUN:

REQUIRED SIGNS SHALL BE IN ACCORDANCE WITH BC (1)- 21 THRU BC (12)- 21 AND THE "TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES".

I CERTIFY THAT THIS PROJECT BUILT IN ACCORDANCE WITH PLANS AND SPECIFICATIONS

AREA ENGINEER DATE

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 SPECIAL LABOR PROVISIONS FOR ALL STATE CONSTRUCTION PROJECTS (000-008)

Texas Department of Transportation

SUBMITTED FOR LETTING: 10/5/2023
DocuSigned by: James Atkins PE
A2C81980FB88444... DESIGN ENGINEER

RECOMMENDED FOR LETTING 10/5/2023
DocuSigned by: James Atkins PE
A2C81980FB88444... AREA ENGINEER

APPROVED FOR LETTING 10/5/2023
DocuSigned by: Noel Paramanantham
AF7AF41AFE6049E... DISTRICT ENGINEER

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STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

THE STANDARD SHEET SPECIFICALLY IDENTIFIED WHTH THE "#" SYMBOL ON THIS SHEET HAVE BEEN ISSUED BY ME AND ARE APPLICABLE TO THIS PROJECT

Tesfai Weldemariam PE — NAME
10/10/23 — DATE

Texas Department of Transportation

VARIOUS

INDEX OF SHEETS

GRAPHICS FILE		SHEET NO.
		002

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

GENERAL NOTES

General:

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

Greenville Area Office
James Atkins II, P.E. – James.Atkins@txdot.gov
Willie Bolden II, P.E. – Willie.Bolden@txdot.gov

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

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.

On Contractor request, earthwork cross sections and construction timelines will be posted to TxDOT's Public FTP at the following Address:
https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting%20Responses/
The site is organized by District, Project Type (Construction or Maintenance), Letting Date, CCSJ/Project Name.

Dispose of waste materials at an approved site. Furnish written approval from the property owner before disposal of waste materials.

Locate equipment a minimum of 30 feet from roadway when possible. Place signs and barricades as approved.

Stockpile sites for construction materials must be approved. Give at least 48 hours notification prior to stockpiling material.

Item 5 Control of the Work:

The responsibility for the construction surveying on this contract will be in accordance with Section 5.9.3, Method C.

Working days will be computed and charged in accordance with Article 8.3.1.4 Standard Work Week.

Right and left are determined based upon the forward direction of stationing in the specific control section.

Per Item 5.11 FINAL CLEANUP, prior to requesting final inspection the Contractor shall leave the work locations in a neat and presentable condition. This may include but is not limited to mowing, trimming and removal litter, debris, objectionable material, temporary structures, excess materials, and equipment from the work locations.

Item 7 Legal Relations and Responsibilities:

No significant traffic generator events identified.

Item 8 Prosecution and Progress:

Before beginning work on this project submit in writing, for approval, a plan of construction operations outlining in detail a sequence of work to be followed.

Provide a Gannt Chart progress schedule for this project.

Roadway widening operations shall only be allowed on one side of the roadway at a time.

Item 9 Measurement and Payment:

Items of work for the Monthly Estimate will be cut off on the 25th of each month. Items of work performed after the 25th will be processed and paid on the following month's estimate. Material on Hand (MOH) will cut off on the 20th of each month. Special circumstances will be considered on a case-by-case basis.

Item 132 Embankment:

Test potential embankment sources using Tex-145-E to determine the presence and concentration of sulfates. Do not bring soil with greater than 3000 ppm sulfates into project.

Embankment sources containing sulfates that meets specification requirement may be used as a fill material provided it is placed with the least one foot of separation from material to be treated with lime, cement or other calcium-based stabilizers. When soils are be placed with less than one foot of separation from material to be treated with lime, cement or other calcium -based stabilizers, process and treat such soils according to the soil sulfates Mitigation General Notes.

Item 162 Sodding for Erosion Control, 166 Fertilizer:

Apply fertilizer with a ratio of 3-1-2 (N-P-K) over the areas to be seeded. This work will not be paid for directly but will be considered subsidiary.

Item 168 Vegetative Watering:

Use water trucks equipped with a sprinkler system adequate to permit coverage of the entire seeded area from the roadbed. This equipment must be available to perform watering throughout the duration of vegetative establishment.

Water all seeded areas the day seed is applied. Thereafter, maintain the seeded areas in a well-watered condition throughout the duration of vegetative establishment.

Item 400 Excavation and Backfill for Structures:

Excavation and backfill for bridge, culvert and Safety End Treatment construction/installation will be subsidiary to Item 466.

Item 402 Trench Excavation Protection:

Submit a trench excavation protection plan to the Engineer a minimum of three weeks prior to use. The excavation support plan shall address excavation/ protection method, work sequencing, traffic control, backfill operations, etc.

Item 403 Temporary Special Shoring:

Submit details and design calculations bearing the seal of a licensed professional engineer before constructing the shoring a minimum of three weeks prior to use. The shoring plan shall address excavation/ protection method, work sequencing, traffic control, backfill operations, etc.

Item 432 Riprap:

The engineer may adjust placement of riprap in the field.
Filter fabric is required for stone riprap.

Item 466 Headwalls and Wingwalls:

Unless shown in the plan to obtain from offsite source, obtain headwall and wingwall backfill from ROW and perform grading to shape ditch to headwall/wingwall, per Engineers directions. this work will be subsidiary to this item.

Riprap apron, between wingwall, will be subsidiary to this Item.

Required excavation, backfill and pipe saw cutting will be subsidiary to this item.

Removed headwalls and wingwalls may be broken into riprap size pieces (12” average diameter) for use as stone riprap on the project. Cut protruding steel reinforcement flush with concrete pieces. Broken concrete and riprap must be stored according to the requirement for material stockpiles indicated on the BC standards.

County: HUNT **Control:** 0901-22-128

Item 502 Barricades, Signs and Traffic Handling:

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.

The following items will be required for flagger on this project:

1. Flaggers are required to wear a white hard hat while performing flagging operations.
2. Flaggers will be required at the intersection of all State maintained roadways.
3. Flaggers may be required at other high traffic generating intersections as deemed necessary by the Area Engineer.

The traffic control plan for this contract consists of the installation and maintenance of warning signs and other traffic control devices shown in the plans, specification data which may be included in the general notes, applicable provisions of the Texas Manual on Uniform Traffic Control Devices (TMUTCD), traffic control plan sheets included in the plans, standard BC sheets and Item 502 of the Standard Specifications.

Do not begin Item 502, Barricades, Signs, and Traffic Handling, on the roadway until both of the following conditions are met:

1. The work schedule is approved.
2. No more than 5 workdays will pass between the beginning of Item 502 and the actual commencement of roadway work bid items.

The final estimate will be withheld until all disturbed areas are covered with at least 70% perennial vegetative cover.

Correct all deficiencies within the time frame noted on the Traffic Control Device Inspection Form 599. Failure to make corrections within time frame specified may result in no payment for this Item for the month of the noted deficiency.

Provide shadow vehicles equipped with Truck Mounted Attenuators (TMA) as shown on Traffic Control Plan (TCP) standards.

Ensure that all travel lanes are open at night.

Provide pilot car during one lane/two-way traffic operations.

Road closures must be approved by the Engineer. Provide a two-week advance notice to the Engineer prior to desired roadway closure period. Begin display of closure information on PCMBs ten days prior to roadway closure.

The total months of barricades includes the number of working days plus the winterization period.

Item 506 Temporary Erosion, Sedimentation & Environmental Controls:

The Temporary Erosion Control measures for this project will consist of using the following items, as directed:

1. Rock Filter Dams: All rock filter dams shall be installed with 6:1 slopes regardless of their location on the project. Failure to do so will result in no payment for the dam.

Silt fences will remain the property of the Contractor upon completion of the project. The final estimate will not be released until all silt fences have been properly removed, or as directed and 70% establishment of vegetative cover is obtained.

Acquire approval for any change to the location of temporary sediment fence, as shown in the plans, prior to installation. Placement of erosion protection devices may be altered, as directed, to satisfy the requirements of the SW3P.

The pay item to remove rock filter dams will require only a partial removal after 70 percent perennial vegetation has been established and approved. When removing the rock filter dams, leave the lower layer of rock adjacent to the ground in place so as not to disturb the soil.

Refer to the SW3P sheet for the total disturbed area for the project.

The disturbed area in this project, all project locations in the Contract, and Contractor project specific locations (PSLs) within one mile of the project limits will further establish the authorization requirements for storm water discharges. The Department will obtain an authorization to discharge storm water from the Texas Commission on Environmental Quality (TCEQ) for the construction activities shown on the plans. Obtain any required authorization from the TCEQ for any Contractor PSLs for construction support activities on or off ROW. When the total area disturbed for all projects in the Contract and PSLs within one mile of the project limits exceeds five acres, provide a copy of the Contractors NOI for PSLs on the ROW (to the appropriate MS4 operator when on an off-system route).

It is the intent of this contract that no disturbance of vegetation occurs as a result of the roadway operations. However, if vegetation is disturbed, treat the disturbed area as follows at no additional costs to the department.

Place temporary sediment control fence, or an alternative material as approved, to minimize and control the amount of sediment that might enter receiving waters from the disturbed area(s). Maintain the sediment controls in a satisfactory manner until the disturbed area(s) is stabilized. After the area(s) has been stabilized, remove the sediment controls. The location and length of the sediment controls will be determined.

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be considered subsidiary to the various bid items.

Item 6001 Portable Changeable Message Board:

Two (2) portable changeable message boards are required for advance warning.

Item 6185 Truck Mounted Attenuators:

Shadow vehicles with truck mounted attenuator (TMA) are required on the traffic control plan and TCP standards for this project. The contractor will be responsible for determining if one or more of these traffic control operations will be ongoing at the same time to determine the total number of TMAs needed for the project.

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0901-22-128 **DISTRICT** Paris **COUNTY** Hunt
HIGHWAY Various

ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL
	132-6001	EMBANKMENT (FINAL)(ORD COMP)(TY A)	CY	3.000	
	162-6002	BLOCK SODDING	SY	1,314.000	
	162-6003	STRAW OR HAY MULCH	SY	2,628.000	
	168-6001	VEGETATIVE WATERING	MG	15.000	
	401-6001	FLOWABLE BACKFILL	CY	61.000	
	403-6001	TEMPORARY SPL SHORING	SF	400.000	
	429-6001	CONC STR REPAIR(CLEAN & COAT WTH EPOXY)	SF	243.000	
	429-6007	CONC STR REPAIR (VERTICAL & OVERHEAD)	SF	544.000	
	429-6009	CONC STR REPAIR (STANDARD)	SF	90.000	
	432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	413.000	
	438-6001	CLEANING AND SEALING EXISTING JOINTS	LF	72.000	
	466-6157	WINGWALL (FW - S) (HW=10 FT)	EA	1.000	
	466-6165	WINGWALL (FW - S) (HW=4 FT)	EA	2.000	
	466-6192	WINGWALL (PW - 2) (HW=3 FT)	EA	2.000	
	466-6197	WINGWALL (PW - 2) (HW=8 FT)	EA	1.000	
	480-6001	CLEAN EXIST CULVERTS	EA	4.000	
	496-6005	REMOV STR (WINGWALL)	EA	4.000	
	496-6042	REMOV STR (SMALL)	EA	3.000	
	500-6001	MOBILIZATION	LS	0.100	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	4.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	56.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	56.000	
	658-6047	INSTL OM ASSM (OM-2Y)(WC)GND	EA	8.000	
	658-6062	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI)	EA	8.000	
	786-6002	CARBON FIBER REINF POLYMER STRENGTHNING	SF	200.000	
	788-6002	CONCRETE BEAM REPAIR (CFRP)	EA	2.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN	EA	2.000	
	6185-6002	TMA (STATIONARY)	DAY	48.000	
	6185-6003	TMA (MOBILE OPERATION)	HR	240.000	
	08	CONTRACTOR FORCE ACCOUNT SAFETY CONTINGENCY (NON-PARTICIPATING)	LS	1.000	
		CONTRACTOR FORCE ACCOUNT EROSION CONTROL MAINTENANCE (NON-PARTICIPATING)	LS	1.000	

SUMMARY OF DRAINAGE (WINGWALLS) ITEMS

	BRIDGE IDENTIFICATION NUMBER	EXISTING STRUCTURE	132 6001 EMBANKMENT (FINAL) (ORD COMP) (TY A) CY	401 6001 FLOWABLE BACKFILL CY	403 6001 TEMPORARY SPL SHORING SF	429 6001 CONC STR REPAIR (CLEAN &COAT WITH EPOXY) SF	429 6007 CONC STR REPAIR (VERTICAL& OVERHEAD) SF	429 6009 CONC STR REPAIR (STANDARD) SF	432 6031 RIPRAP (STONE PROTECTION) (12 IN) CY	438 6001 CLEANING & SEALING EXISTING JOINTS LF	466 6157 WINGWALL (FW-S) (HW=10 FT) EA	466 6165 WINGWALL (FW-S) (HW=4 FT) EA	466 6197 WINGWALL (PW-2) (HW=8 FT) EA	466 6192 WINGWALL (PW-2) (HW=3FT) EA	480 6001 CLEAN EXIST CULVERTS EA	496 6005 REMOV STR (WINGWALL) EA	496 6042 REMOV STR (SMALL) EA	506 6002 ROCK FILTER DAMS (INSTALL) (TY 2) LF	506 6011 ROCK FILTER DAMS (REMOVE) LF	658 6047 INSTL OM ASSM(OM-2Y) (WC)GND EA	658 6062 INSTL DEL ASSM (D-SW) SZ 1(BRF) GF2(BI) EA	786 6002 CARBON FIBER REINF POLYMER STRENGTHNING SF	788 6002 CONCRETE BEAM REPAIR (CFRP) EA
NBI*	01-117-00136-01-094	SH 224	0.8		240	27			21		1				1	1		16	16	2	2		
NBI*	01-117-00203-01-016	BUSINESS 69	0.3		160	30			30				1		1	1		8	8	1	1		
NBI*	01-117-00642-03-010	FM 36	0.8			12			42			2			1	2		32	32	4	4		
NBI*	01-117-02139-04-011	SH 11		10		5								1	1		1						
NBI*	01-117-00009-13-330	IH 30 ML & FR				10				72													1
NBI*	01-117-00009-13-284	SH24 & SH50					12															200	
NBI*	01-117-00009-15-314	US 69					24																
NBI*	01-117-00009-13-297	FM 513					25																
NBI*	01-117-02139--04-080	SH 224					40										1						1
NBI*	01-117-00136-12-013	FM 2874					42																
NBI*	01-117-01463-01-008	FM 1532					15		200														
NBI*	01-117-02193-01-002	FM 2324					75	10															
NBI*	01-190-00203-04-029	US 69				2	15																
NBI*	01-190-00203-04-028	US 69					12	80															
NBI*	01-190-02193-01-003	FM 2324					25																
NBI*	01-190-00108-10-049	SH 19				142	2																
NBI*	01-190-00108-10-048	SH 19				5	80																
NBI*	01-190-00203-04-030	US 69				10																	
NBI*	01-117-00642-03-009	FM 36					16																
NBI*	01-117-00173-06-076	SH 34					50																
NBI*	01-117-00173-06-075	SH 34					75																
NBI*	01-117-00173-06-072	SH 34		36			36																
NBI*	01-117-02035-01-003	FM 2101												1			1						
NBI*	01-117-00009-13-234	IH 30 N FTRG RD		15					120														
	PROJECT TOTALS		3	61	400	243	544	90	413	72	1	2	1	2	4	4	3	56	56	8	8	200	2

SUMMARY OF LANDSCAPING ITEMS

IDENTIFICATION NUMBER	LOCATION	LENGTH	WIDTH	LOCATION	162 6002 BLOCK SODDING SY	162 6003 STRAW OR HAY MULCH SY	168 6001 VEGETATIVE WATERING MG	FERTILIZER 3-1-2* LBS
				LT/RT				
NBI* 01-117-00136-01-094	SH 224	120	28	RT	378	756	5	38
NBI* 01-117-00203-01-016	BUSINESS 69	60	28	RT	189	378	3	19
NBI* 01-117-00642-03-010	FM 36	240	28	LT & RT	747	1494	9	74
NBI* 01-117-02139-04-011	SH 11	0	0	LT & RT	0	0	0	0
PROJECT TOTALS:					1314	2628	15	131

SUMMARY OF TRAFFIC CONTROL PLAN ITEMS

IDENTIFICATION NUMBER	LOCATION	6001 6002 PORTABLE CHANGEABLE MESSAGE SIGN EA	6185 6002 TMA STATIONARY DAY	6185 6003 TMA (MOBILE OPERATION) HR
NBI* 01-117-00136-01-094	SH 224	2	9	12
NBI* 01-117-00203-01-016	BUSINESS 69	2	12	10
NBI* 01-117-00642-03-010	FM 36	2	12	17
NBI* 01-117-02139-04-011	SH 11	2	0	0
PROJECT TOTALS:		2	48	240

*FOR CONTRUCTORS INFORMATION ONLY: 2 CYCLES AT 50 LBS. NITROGEN PER CRE AT 21-7-14(NPK) ANALYSIS= 0.0492LBS/SY/CYCLE

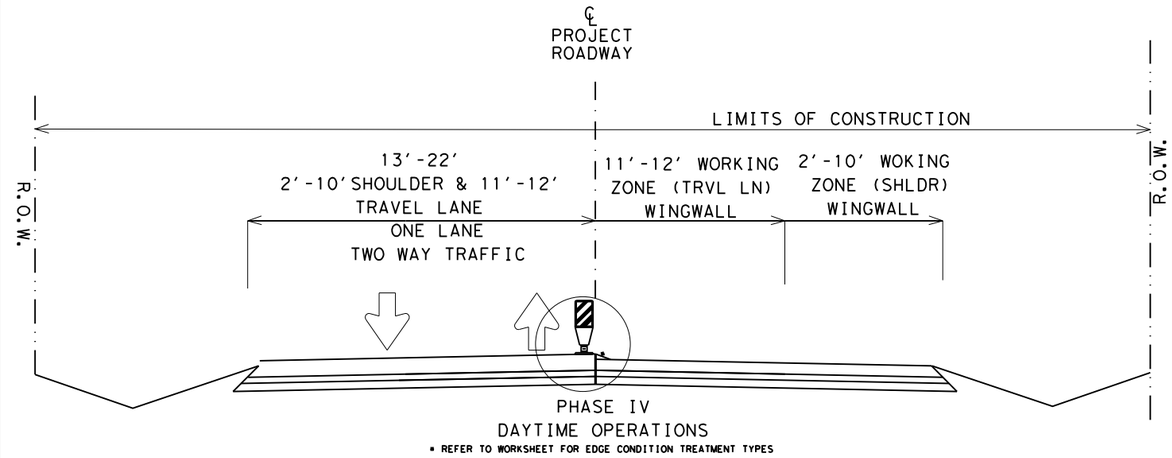
WATERING: BASED ON 2 APPLICATIONS, 05" RAINFALL EQUIVALENT- 0.003 MG/CY/CYCLE.

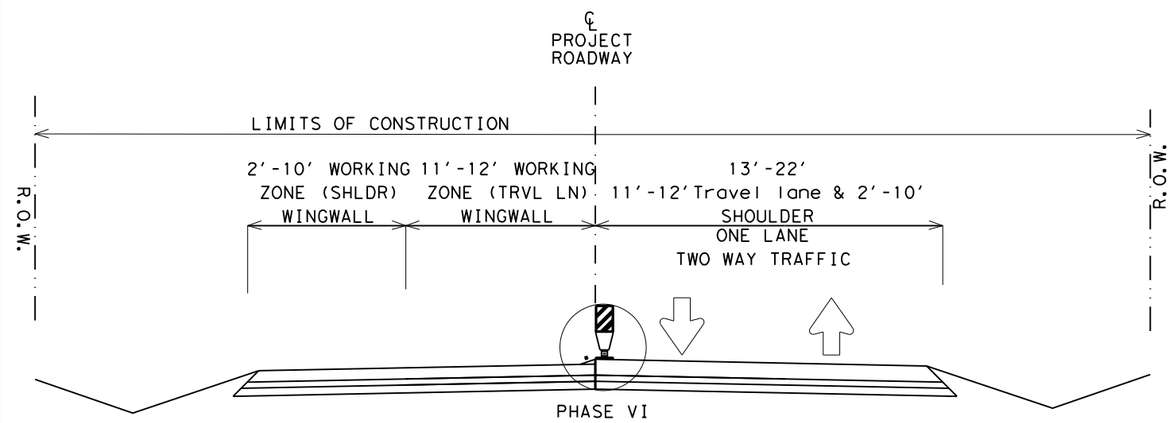
Texas Department of Transportation

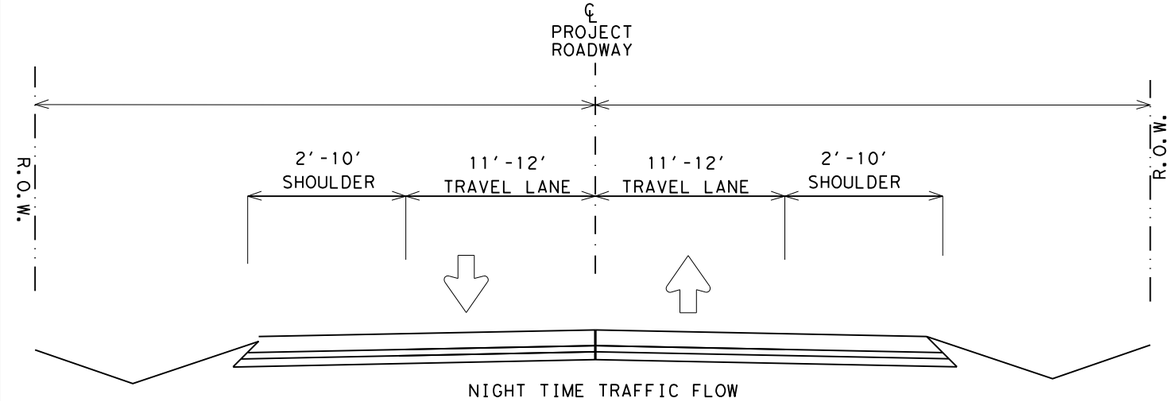
QUANTITY SUMMARIES

GRAPHICS FILE		SHEET NO.
		005

CHECKED	STATE	STATE DIST.	COUNTY	
		PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS







Phase I ~ Initial Traffic Control

Install project limit traffic control devices (TCD) per the BC standard sheets. Utilize the applicable TCP (2-1)-18 or TCP (2-2b)-18 layout for TCD installation.

Phase II ~ Erosion Control

Install erosion control devices utilizing the applicable TCP (2-1)-18 layout or TCP (2-2b)-18.

Phase III - Wingwall Repair,

Utilize TCP (2-2b) -18 with a pilot car as approprait for repair, level, planing and HMA overlay operations. Use PCB/s. Eleven foot minimum travel lane for the open lane.

If incleament weather or other unexpeted warning signs per standard sheet WZ(UL) will be maintained until wingwall repair operation is comoleted.

Prior to advancement to the next wingwall, all backfilling and wingwall reapair must be completed and the setion must be approved by the engineer.

Phase IV ~ Roadway Rehabilitation

Refer to the Traffic Control Plan (TCP) Typical Sections for construction work area and traffic flow. Perform wingwall repair operations and install wingwall repair utilizing TCP(2-2b)-18. Prior to advancement to the next wingwall repair, all shouldering and sodding must be completed as required and the section be approved by the Engineer.

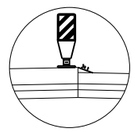
Phase V ~ Backfill, Sign and Sodding Operations

Perform structuaral backfill operations, sign installation and sodding utilizing TCP(2-1)-18.

Phase VI ~ Project Clean Up

Remove erosion control devices, construction debris and waste material utilizing TCP (2-1)-18.

Notes: Prior to a specific construction operation, the traffic control standard specified for the construction phase in this narrative must be evaluated thoroughly for appropriateness. All traffic control operations must adhere to the Texas Manual on Uniform Traffic Control Devices (TMUTCD) and the applicable Traffic Control Standards. Construction phase order may be varied when approved by the Engineer. Submit a Work and Traffic Control Sequence plan to the Engineer for approval. Ensure that both travel lanes are open at night. Provide access to private property and Public Roads at all times. Provide pilot car during one lane/two way traffic operations. Road closures must be approved by the Engineer.



DETAILS A: THE LONGITUDINAL PAVEMENT EDGE IS TO BE BACKFILLED. AT THE DENOTED SLOPE, BEFORE TRAFFIC IS ALLOWED TO TRAVE ON THE PAVEMENT SURFACE.

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

TESFAI WELDEMARIAM PE

10/10/23

VARIOUS
SEQUENCE OF WORK

NOT TO SCALE

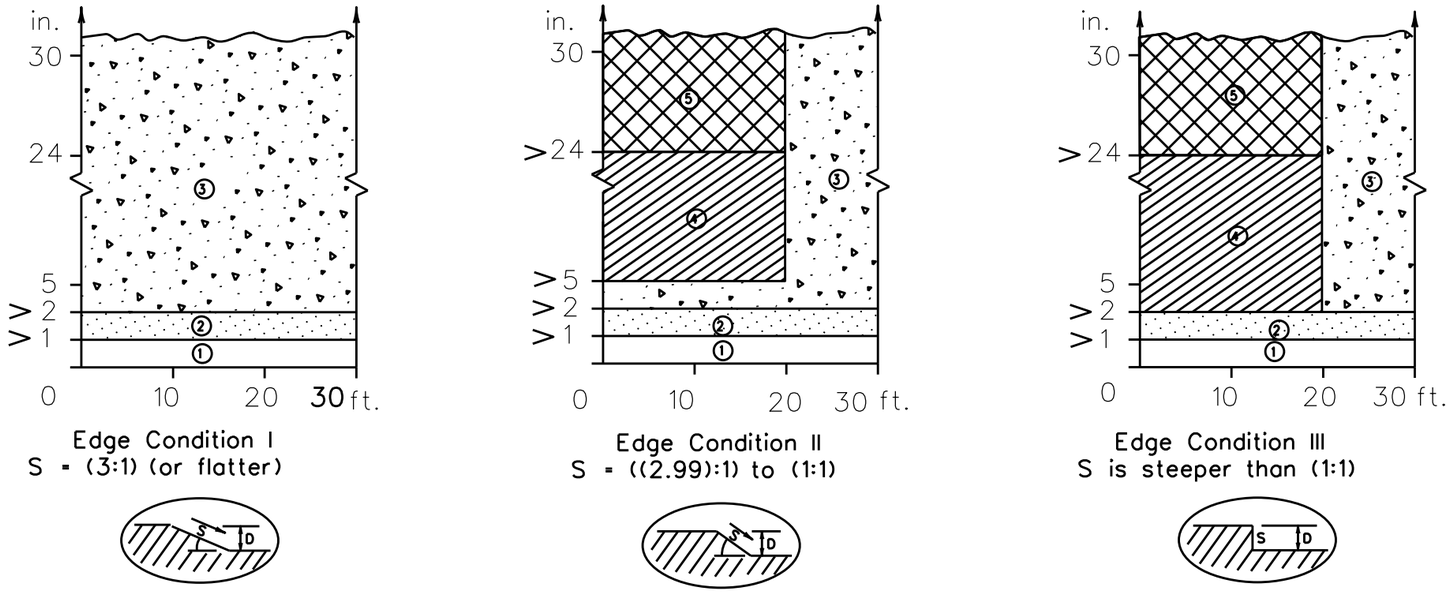
Texas Department of Transportation

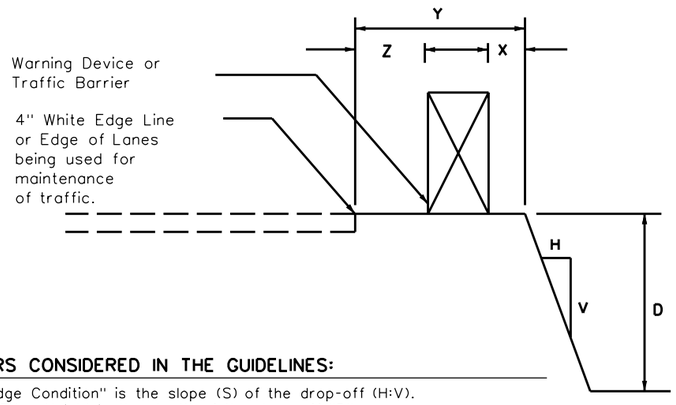
CONT	SECT	JOB	HIGHWAY
0901	22	128	VARIOUS
DIST	COUNTY		SHEET NO.
PAR	HUNT		006

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

DEFINITION OF TREATMENT ZONES FOR VARIOUS EDGE CONDITIONS

Edge Height (D) in Inches versus Lateral Clearance (Y) in Feet





FACTORS CONSIDERED IN THE GUIDELINES:

1. The "Edge Condition" is the slope (S) of the drop-off (H:V). The "Edge Height is the depth of the drop-off "D".

2. Distance "X" is to be the maximum practical under job conditions. Two feet minimum for high speed conditions. Distance "Y" is the lateral clearance from edge of travel lane to edge of dropoff. Distance "Z" does not have a minimum.

3. In addition to the factors considered in the guidelines, each construction zone drop-off situation should be analyzed individually, taking into account other variables, such as: traffic mix, posted speed in the construction zone, horizontal curvature, and the practicality of the treatment options.

4. The conditions for indicating the use of positive or protective barriers are given by Zone-5 and Figure-1. Traffic barriers are primarily applicable for high speed conditions. Urban areas with speeds of 30 mph or less may have a lesser need for signing, delineation, and barriers. Right-angled edges, however, with "D" greater than 2 inches and located within a lateral offset of 6 feet, may indicate a higher level of treatment.

5. If the distance "Y" must be less than 3 feet, the use of a positive barrier may not be feasible. In such a case, consider either: 1) narrowing the lanes to a desired 11 to 12 feet or 10 foot minimum (see CW20-8 sign), or 2) provide an edge slope such as Edge Condition I.

Zone	Treatment Types Guidelines:
①	No treatment
②	CW 8-11 "Uneven Lanes" signs.
③	CW 8-9a Shoulder Drop-Off" or CW 8-11 signs plus vertical panels.
④	CW8-9a or CW 8-11, signs plus drums. Where restricted space precludes the use of drums, use vertical panels. An edge slope to that of the profered Edge Condition I.
⑤	Check indications (Figure-1) for possitive barrier. Where positive barrier is not indicated, the treatment shown above for Zone-4 may be used after consideration of other applicable factors.

Edge Condition Notes:

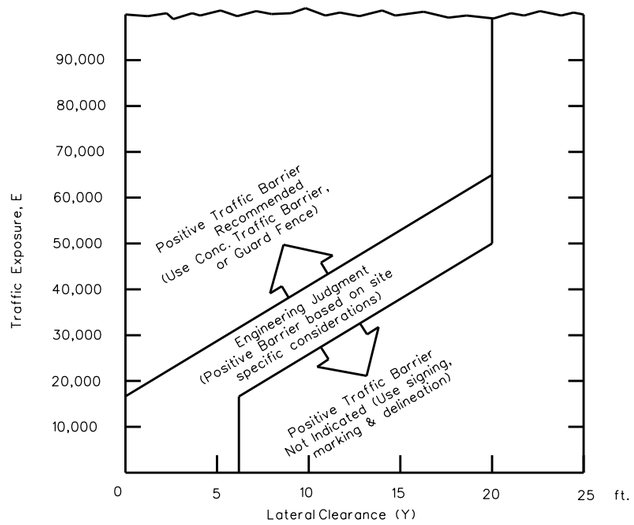
1. Edge Condition I: Most vehicles are able to traverse an edge condition with a slope rate of (3 to 1) or flatter. The slope must be constructed with a compacted material capable of supporting vehicles.

2. Edge Condition II: Most vehicles are able to traverse an edge condition with a slope between (2.99 to 1) and (1 to 1) so long as "D" does not exceed 5 inches. Under-carriage drag on most automobiles will occur when "D" exceeds 6 inches. As "D" exeeds 24 inches, the possibility for rollover is greater in most vehicles.

3. Edge Condition III: When slopes are greater than (1 to 1) and where "D" is greater than 2 inches, a more difficult control factor may exist for some vehicles, if not properly treated. For example, where "D" is greater than 2 inches and up to 24 inches different types of vehicles may experience different steering control at different edge heights. Automobiles might experience more steering control differential when "D" is greater than 2 inches and up to 5 inches. Trucks, particularly those with high loads, have more steering control differential when "D" is greater than 5 inches and up to 24 inches. When "D" exceeds 24 inches, the possibility of rollover is greater for most vehicles.

4. Milling or overlay operations that result in Edge Condition III should not be in place without appropriate warning treatments, and these conditions should not be left in place for extended periods of time.

FIGURE-1: CONDITIONS INDICATING USE OF POSITIVE BARRIER FOR ZONE 5 ( )



1. E = ADT x T
   Where ADT is that portion of the average daily traffic volume traveling within 20 feet (generally two adjacent lanes) of the edge dropoff condition; and, T is the duration time in years of the dropoff condition.

2. Figure-1 provides a practical approach to the use of positive barriers for the protection of vehicles from pavement drop-offs. Other factors, such as the presence of heavy machinery, construction workers, or the mix and volume of traffic may make the use of positive barriers appropriate, even when the edge condition alone may not justify the use of a barrier.

3. An approved end treatment should be provided for any positive barrier end located within the clear zone.

These guidelines apply to temporary traffic control areas or work zones where continuous pavement edges or drop-offs exists parallel and adjacent to a lane used by traffic. The edge conditions may be present between shoulders and travel lanes, between adjacent or opposing travel lanes, or at intermediate points across the width of the paved surface. Due to the variability in construction operations, tolerances in the variables may be allowed by the engineer. These guidelines do not apply to short term operations. These guidelines do not constitute a rigid standard or policy; rather, they are guidance to be used in conjunction with engineering judgement. These guidelines may be updated on the Design Division's on-line manuals.

Engineer's Seal

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Date 10/10/23

Tesfai Weldemariam PE

Texas Department of Transportation

Traffic Safety Division Standard

TREATMENT FOR VARIOUS EDGE CONDITIONS

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© TxDOT August 2000	CONT	SECT	JOB	HIGHWAY
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03-01 08-01 9-21	DIST	COUNTY		SHEET NO.
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BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

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

WORKER SAFETY NOTES:

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

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

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

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

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

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

SHEET 1 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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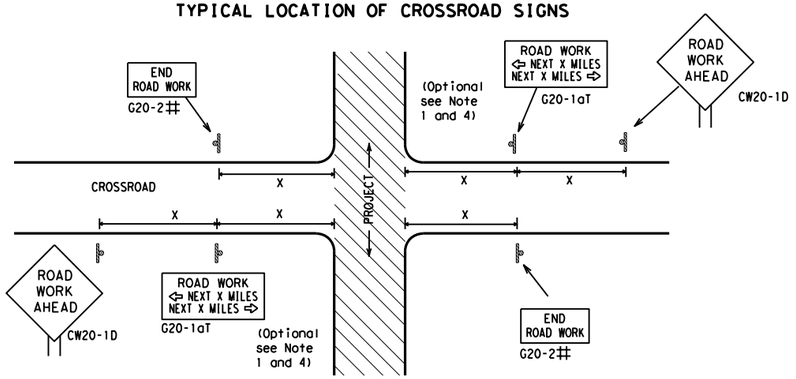
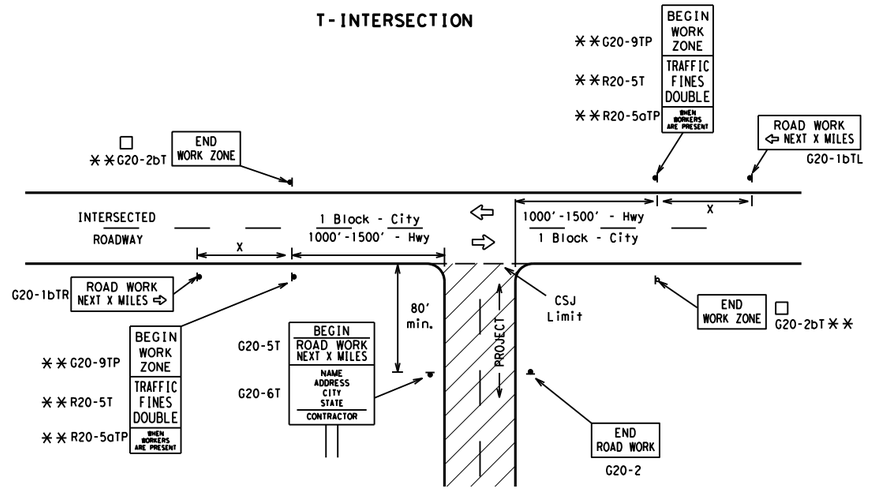
TYPICAL LOCATION OF CROSSROAD SIGNS



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

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

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

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

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

SIZE

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

SPACING

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

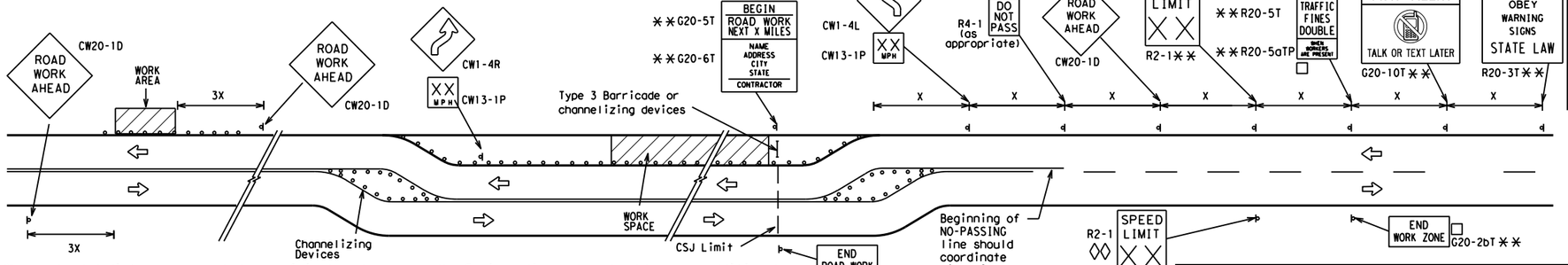
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

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

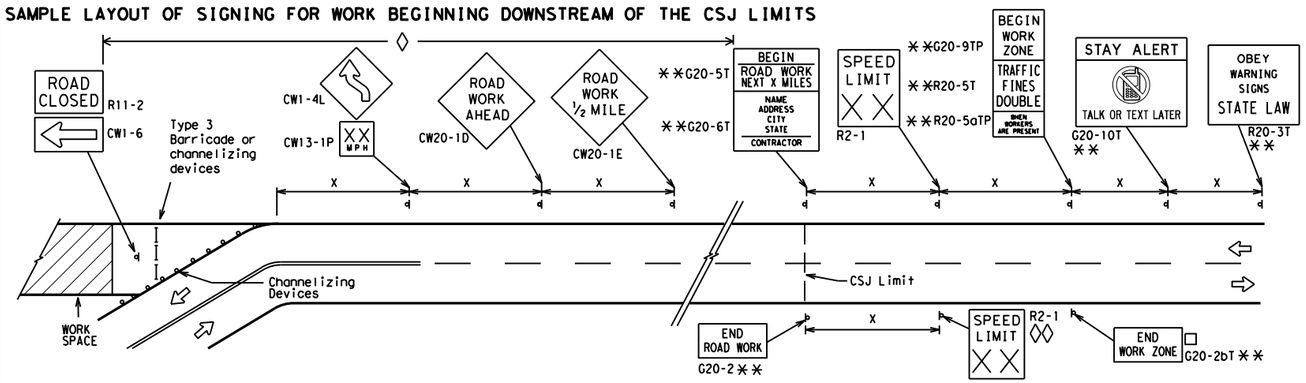
WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS



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

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS

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



NOTES

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

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

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

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9-07 8-14	DIST	COUNTY		SHEET NO.
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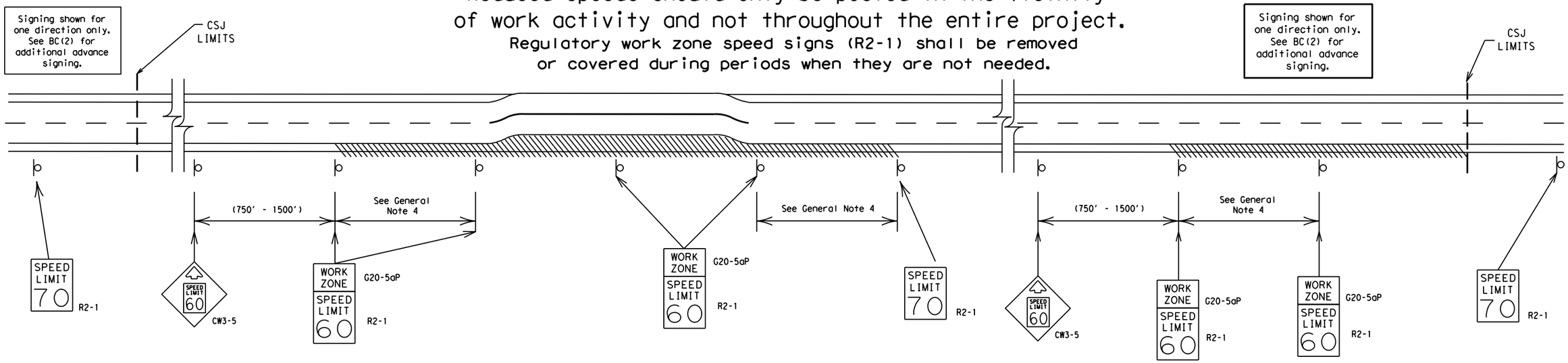
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

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

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



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

a) rough road or damaged pavement surface
b) substantial alteration of roadway geometrics (diversions)
c) construction detours
d) grade
e) width
f) other conditions readily apparent to the driver

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

SHORT TERM WORK ZONE SPEED LIMITS

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

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

GENERAL NOTES

1. Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
2. Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
3. Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
4. Frequency of work zone speed limit signs should be:
   40 mph and greater 0.2 to 2 miles
   35 mph and less 0.2 to 1 mile
5. Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
6. Fabrication, erection and maintenance of the"ADVANCE SPEED LIMIT"(CW3-5)sign, "WORK ZONE"(G20-5aP) plaque and the "SPEED LIMIT"(R2-1)signs shall not be paid for directly, but shall be considered subsidiary to Item 502.
7. Turning signs from view, laying signs over or down will not be allowed, unless as otherwise noted under "REMOVING OR COVERING" on BC(4).
8. Techniques that may help reduce traffic speeds include but are not limited to:
   A. Law enforcement.
   B. Flagger stationed next to sign.
   C. Portable changeable message sign (PCMS).
   D. Low-power (drone) radar transmitter.
   E. Speed monitor trailers or signs.
9. Speeds shown on details above are for illustration only. Work Zone Speed Limits should only be posted as approved for each project.
10. For more specific guidance concerning the type of work, work zone conditions and factors impacting allowable regulatory construction speed zone reduction see TxDOT form #1204 in the TxDOT e-form system.

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

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© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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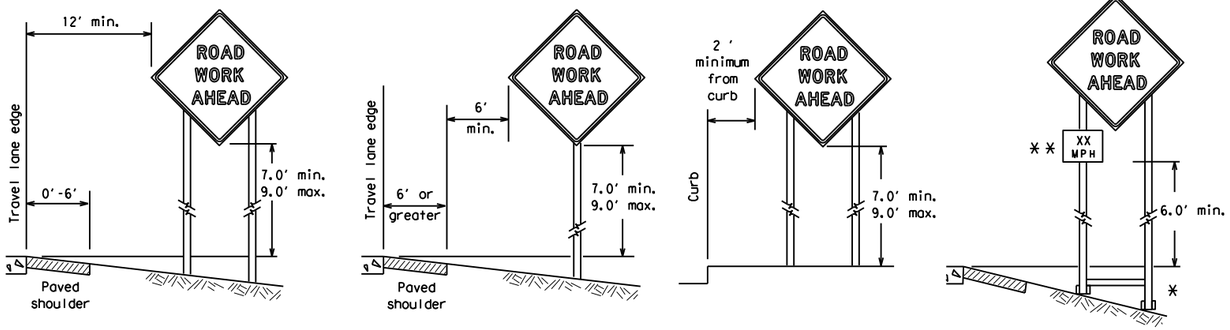
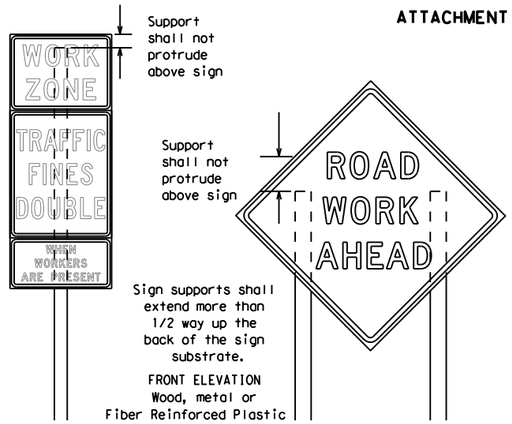
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

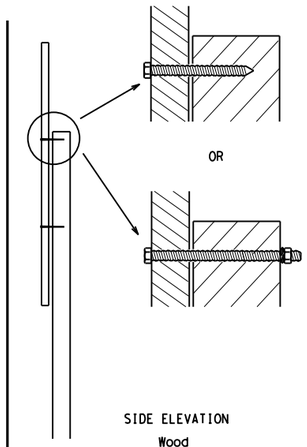


* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

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

ATTACHMENT FOR SIGN SUPPORTS





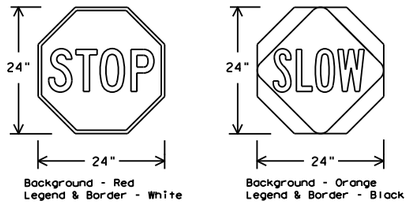
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

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

STOP/SLOW PADDLES

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



SHEETING REQUIREMENTS (WHEN USED AT NIGHT)		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	ORANGE	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND & BORDER	WHITE	TYPE B OR C SHEETING
LEGEND & BORDER	BLACK	ACRYLIC NON-REFLECTIVE FILM

CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

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

GENERAL NOTES FOR WORK ZONE SIGNS

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

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

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

SIGN MOUNTING HEIGHT

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

SIZE OF SIGNS

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

SIGN SUBSTRATES

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

REFLECTIVE SHEETING

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

SIGN LETTERS

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

REMOVING OR COVERING

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

SIGN SUPPORT WEIGHTS

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

FLAGS ON SIGNS

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

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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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7-13 5-21	PAR	HUNT		011

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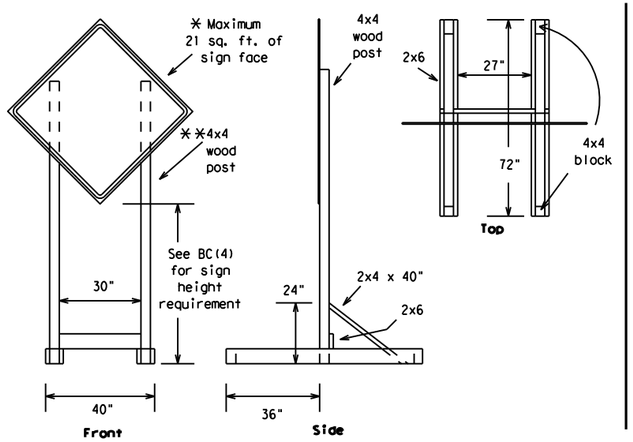
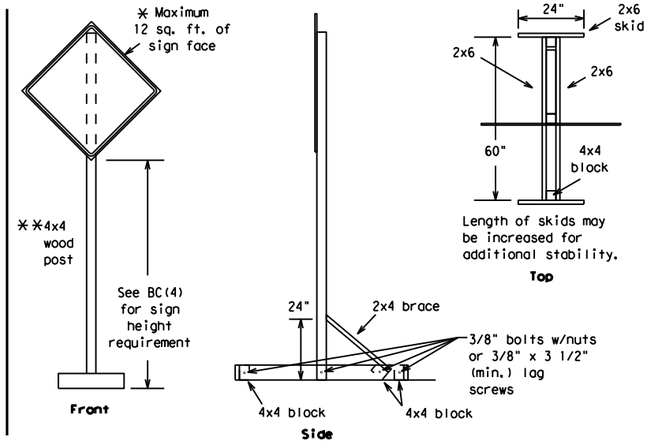
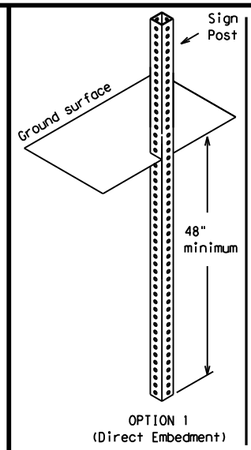
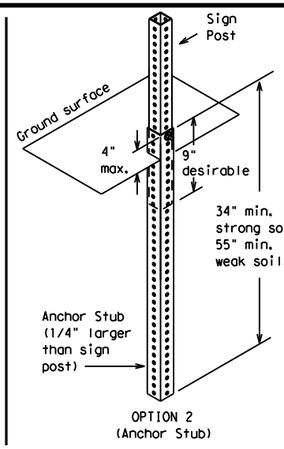


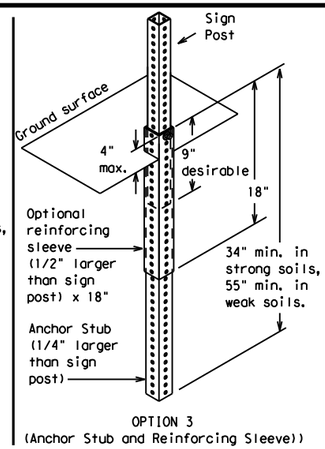


SKID MOUNTED WOOD SIGN SUPPORTS

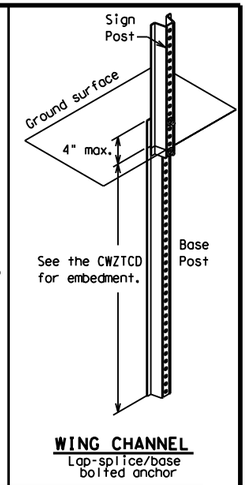
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS







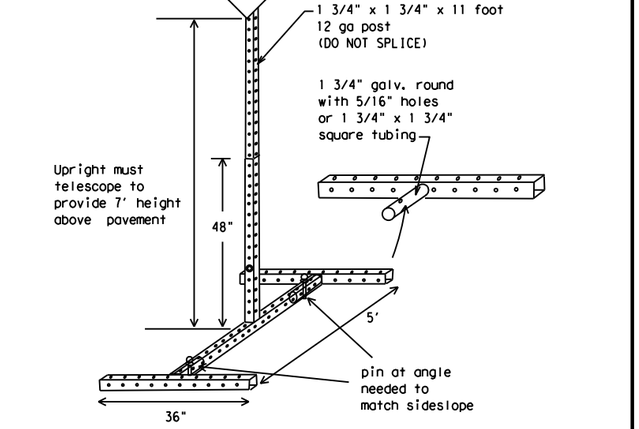
PERFORATED SQUARE METAL TUBING

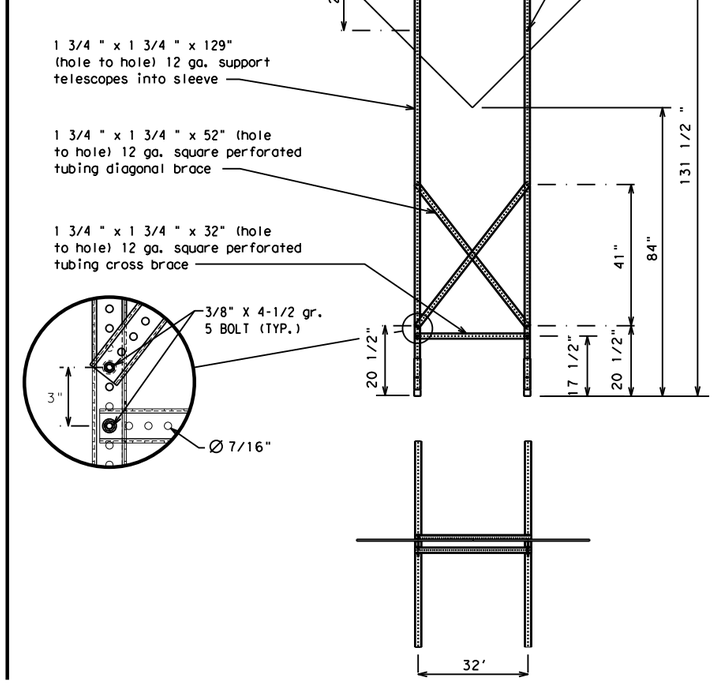


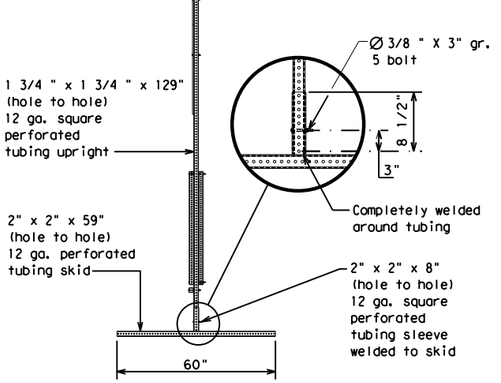
WING CHANNEL
Lap-splice/base bolted anchor

GROUND MOUNTED SIGN SUPPORTS

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







SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

WEDGE ANCHORS

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

OTHER DESIGNS

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

GENERAL NOTES

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

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

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

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

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BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	PAR	HUNT		012

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

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

WORDING ALTERNATIVES

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

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

FULL MATRIX PCMS SIGNS

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

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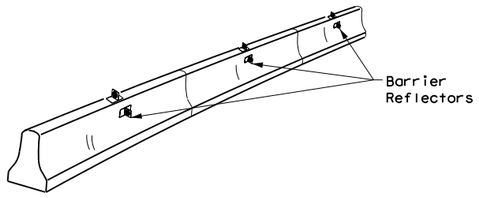
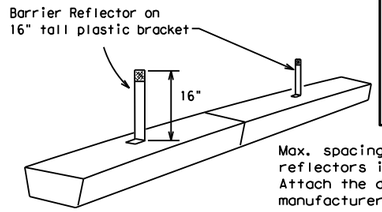
1. Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost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



CONCRETE TRAFFIC BARRIER (CTB)

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

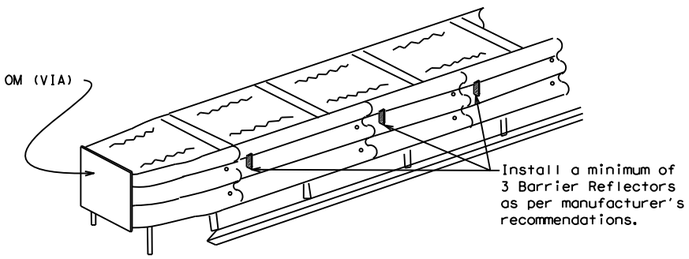


Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

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

LOW PROFILE CONCRETE BARRIER (LPCB)

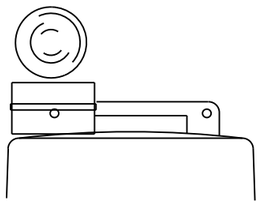


DELINEATION OF END TREATMENTS

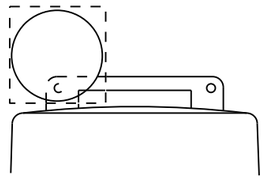
END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



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



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

WARNING LIGHTS

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

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

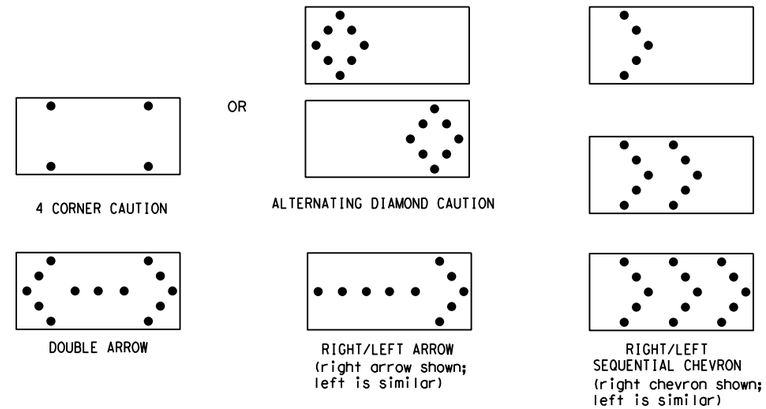
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

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

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

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

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



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	0901	22	128	VARIOUS
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	PAR	HUNT		014

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GENERAL NOTES

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

GENERAL DESIGN REQUIREMENTS

Pre-qualified plastic drums shall meet the following requirements:

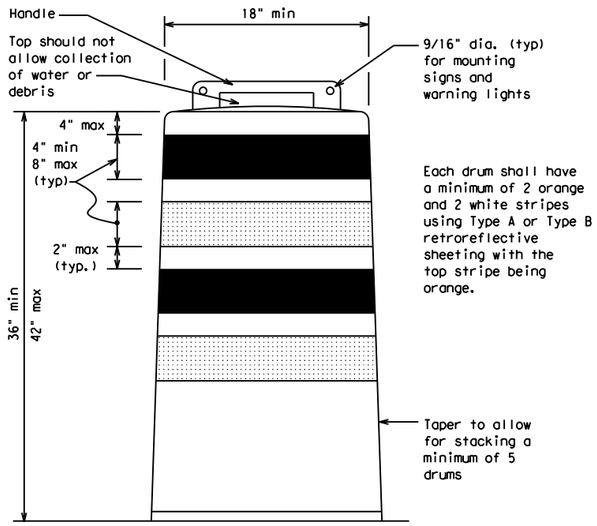
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

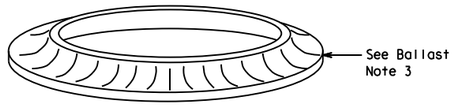
RETROREFLECTIVE SHEETING

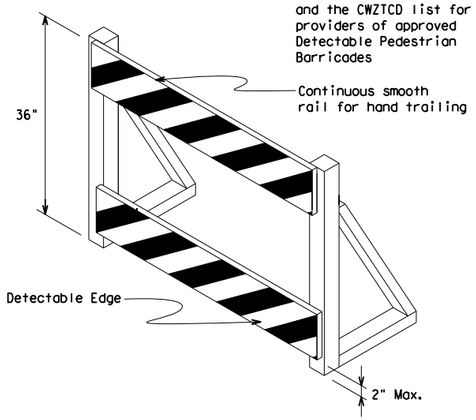
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials," Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall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

BALLAST

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

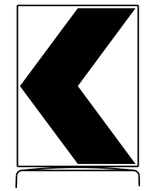




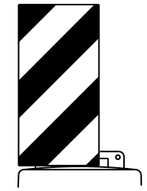


DETECTABLE PEDESTRIAN BARRICADES

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



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



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

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

SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS

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

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(8)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
4-03 8-14	DIST	COUNTY		SHEET NO.
9-07 5-21	PAR	HUNT		015
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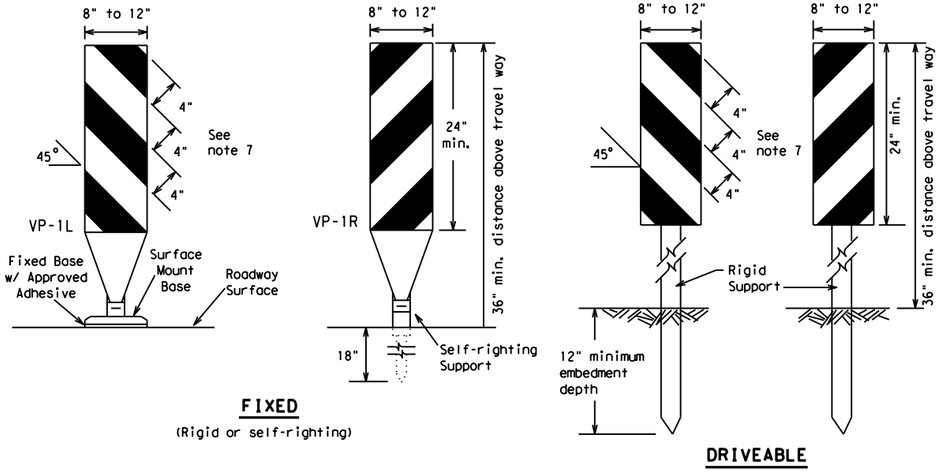
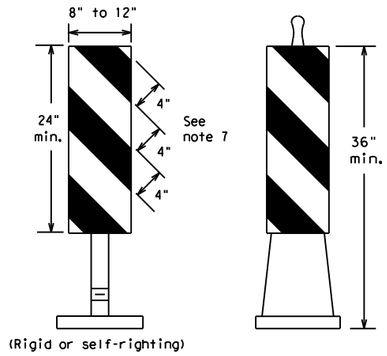


FIXED
(Rigid or self-righting)

DRIVEABLE

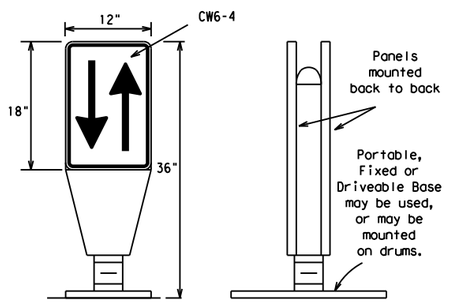


(Rigid or self-righting)

PORTABLE

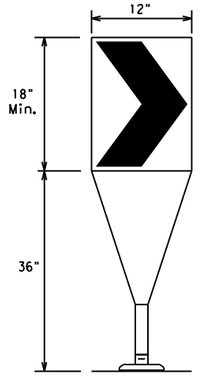
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is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

VERTICAL PANELS (VPs)



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

OPPOSING TRAFFIC LANE DIVIDERS (OTLD)



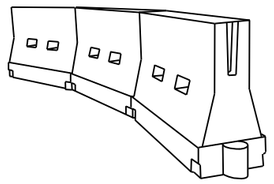
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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

CHEVRONS

GENERAL NOTES

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



LONGITUDINAL CHANNELIZING DEVICES (LCD)

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

WATER BALLASTED SYSTEMS USED AS BARRIERS

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

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

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

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

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

SHEET 9 OF 12

Texas Department of Transportation — Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

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REVISIONS	0901	22	128	VARIOUS
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	PAR	HUNT		016

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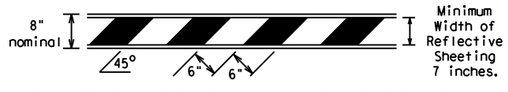
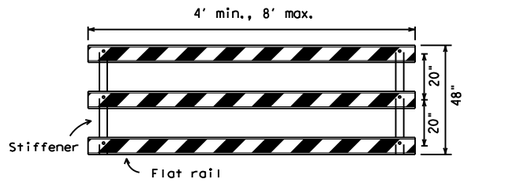
TYPE 3 BARRICADES

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

Barricades shall NOT be used as a sign support.



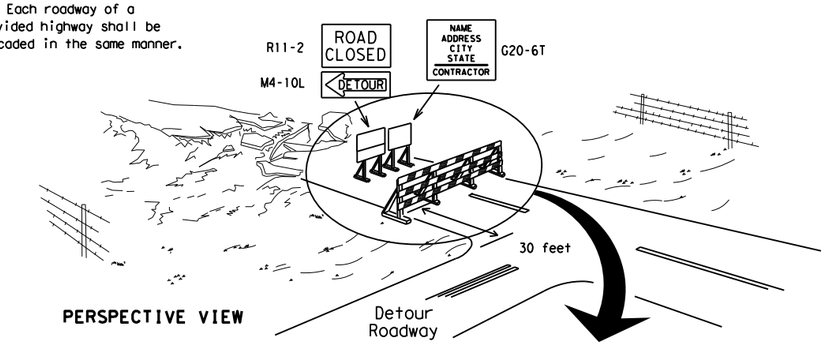
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

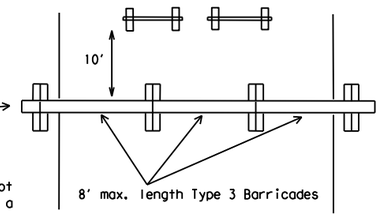
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

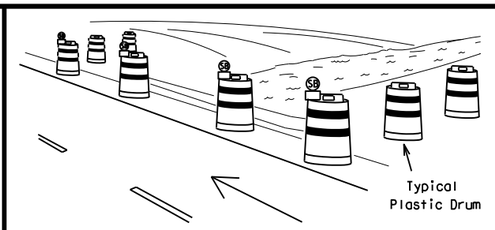
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

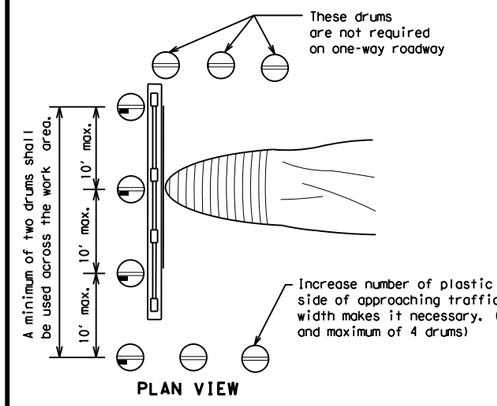
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

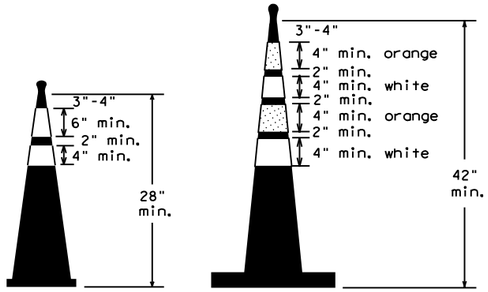
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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



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

PLAN VIEW

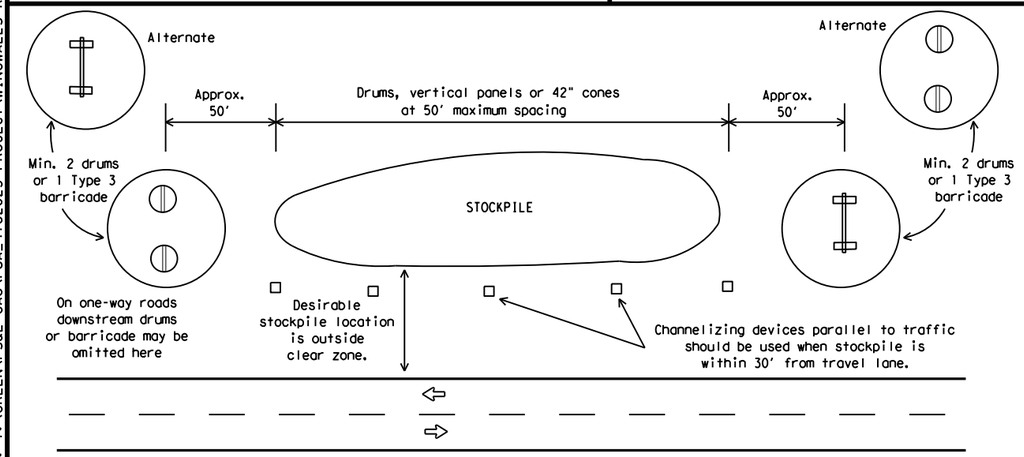
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



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

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

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



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

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	0901	22	128	VARIOUS
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	PAR	HUNT		017

DATE: 10/8/2023 10:12:36 AM
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WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

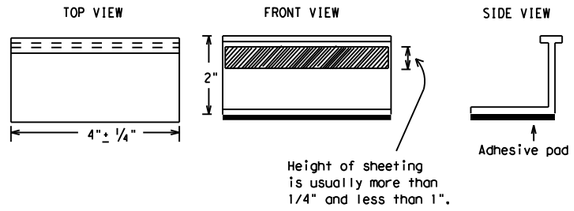
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

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© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
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1-02 7-13	PAR	HUNT		018
11-02 8-14				

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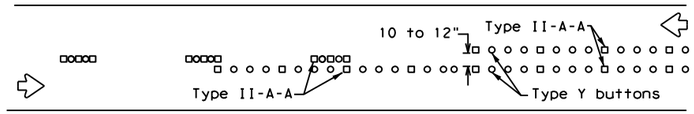
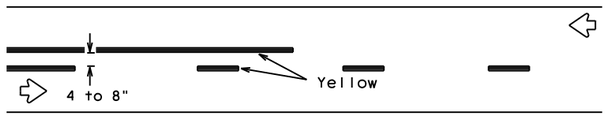
PAVEMENT MARKING PATTERNS

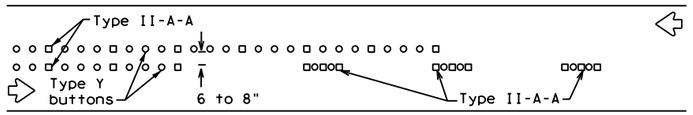
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



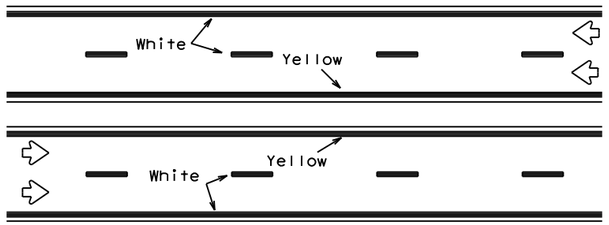
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



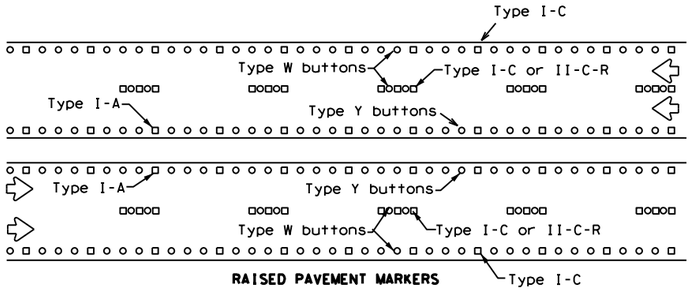
RAISED PAVEMENT MARKERS - PATTERN B

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

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



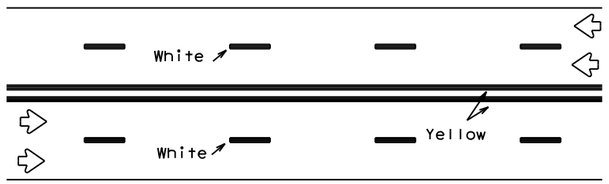
REFLECTORIZED PAVEMENT MARKINGS



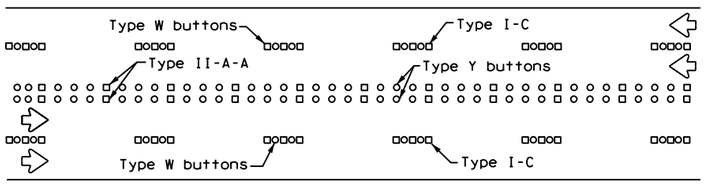
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



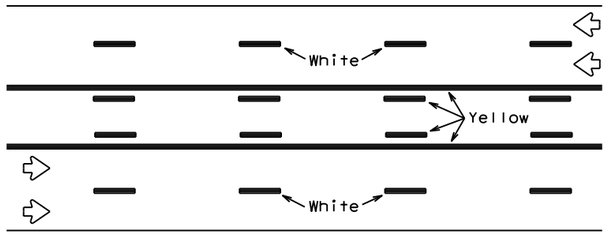
REFLECTORIZED PAVEMENT MARKINGS



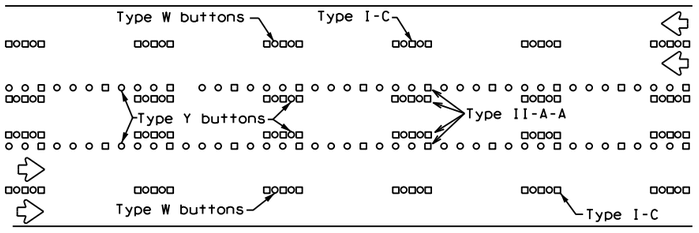
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

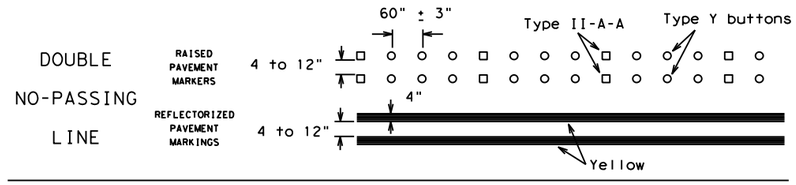
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

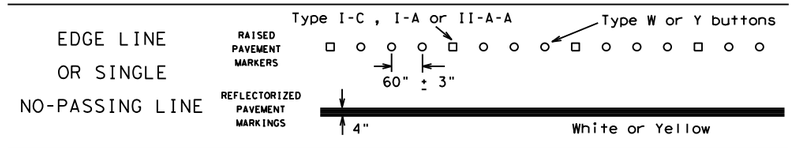
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

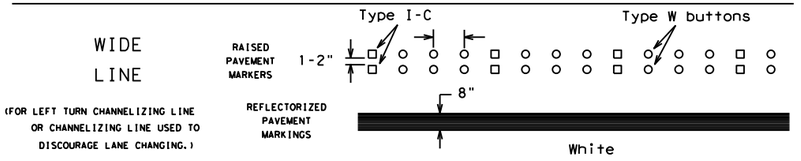


EDGE LINE OR SINGLE NO-PASSING LINE



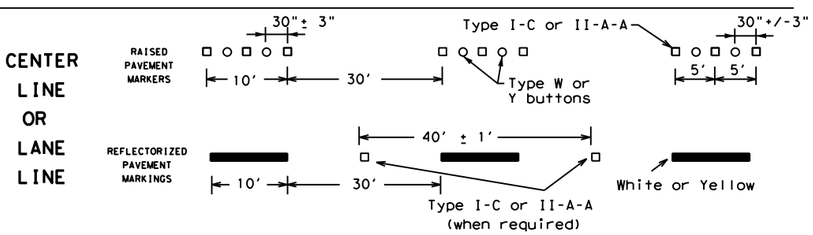
WIDE LINE

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

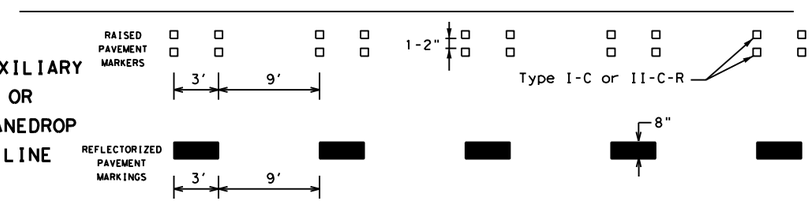


BROKEN LINES

CENTER LINE OR LANE LINE

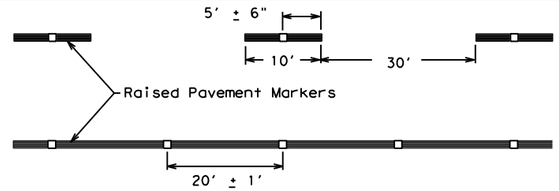


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



Centerline only - not to be used on edge lines

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

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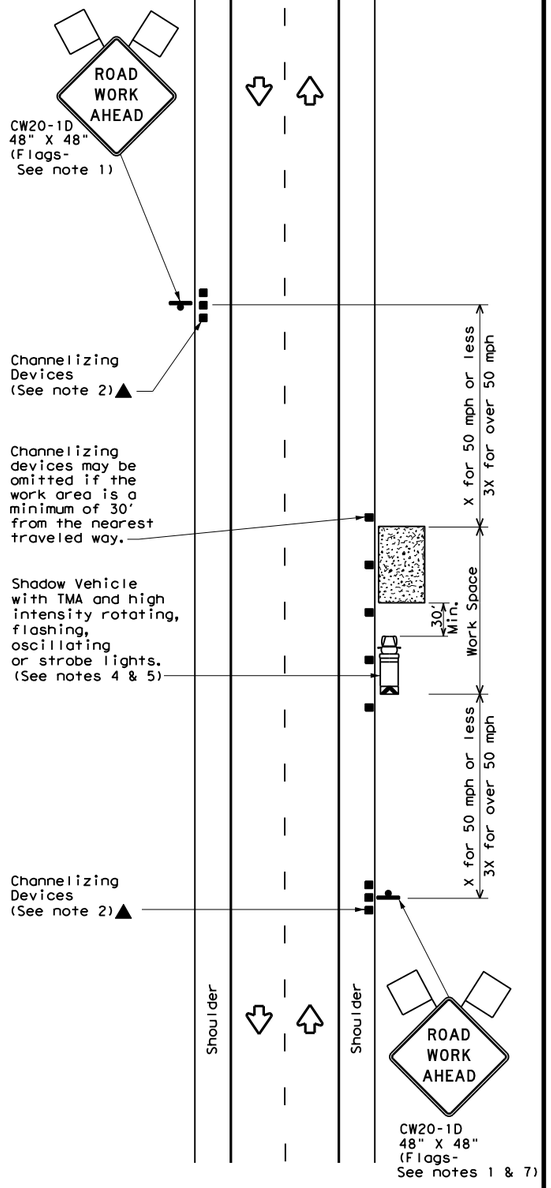
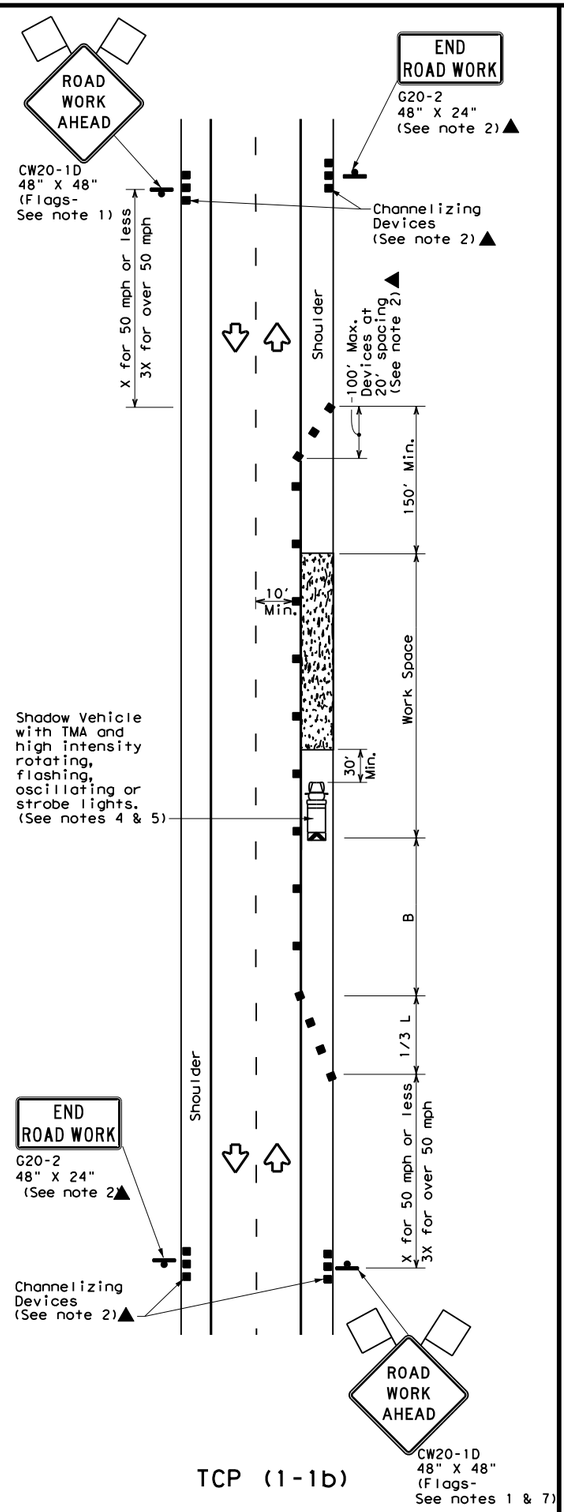


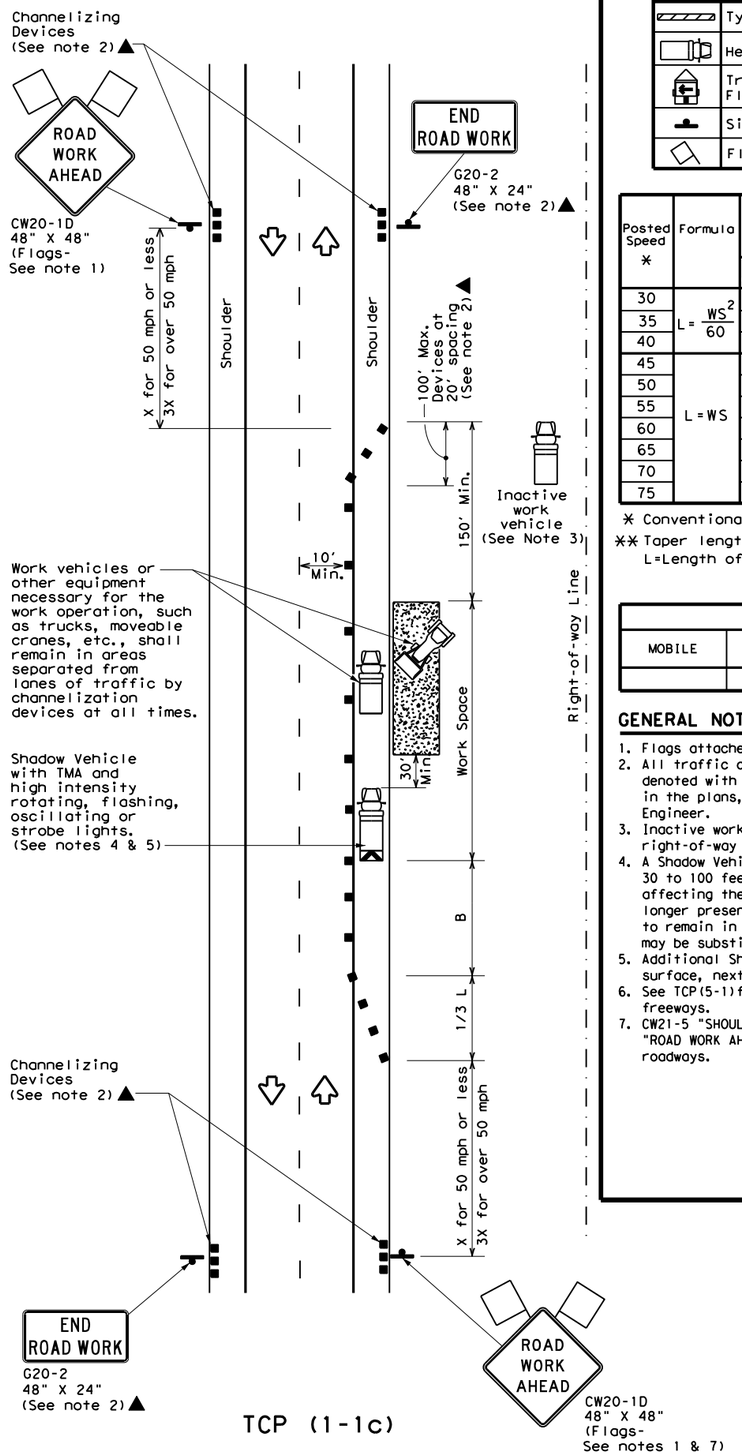
TCP (1-1a)

WORK SPACE NEAR SHOULDER
Conventional Roads



TCP (1-1b)

WORK SPACE ON SHOULDER
Conventional Roads



TCP (1-1c)

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 elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
4. 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 wider work spaces.
6. See TCP(5-1)for shoulder work on divided highways, expressways and freeways.
7. 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(1-1)-18

FILE: tcp1-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 2-12 1-97 2-18	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		020

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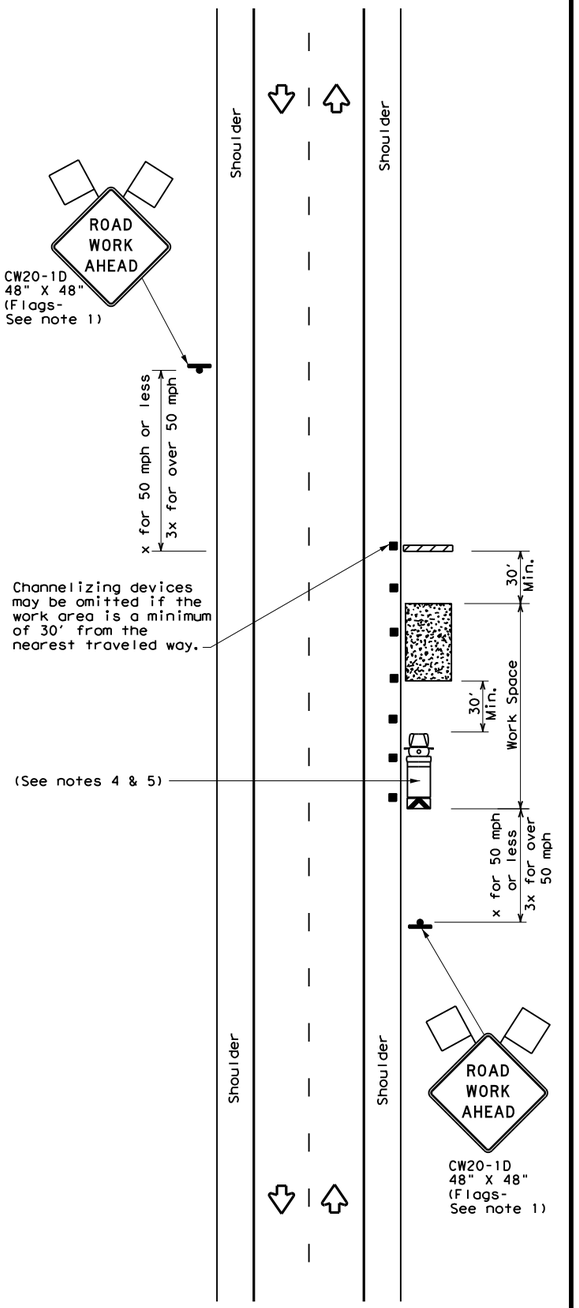
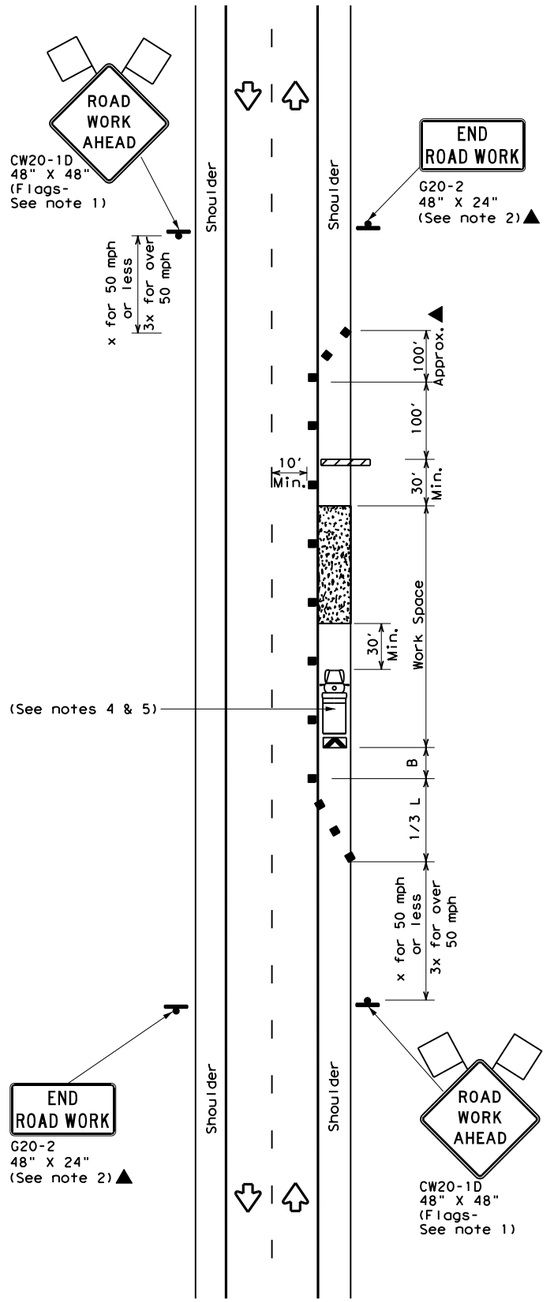


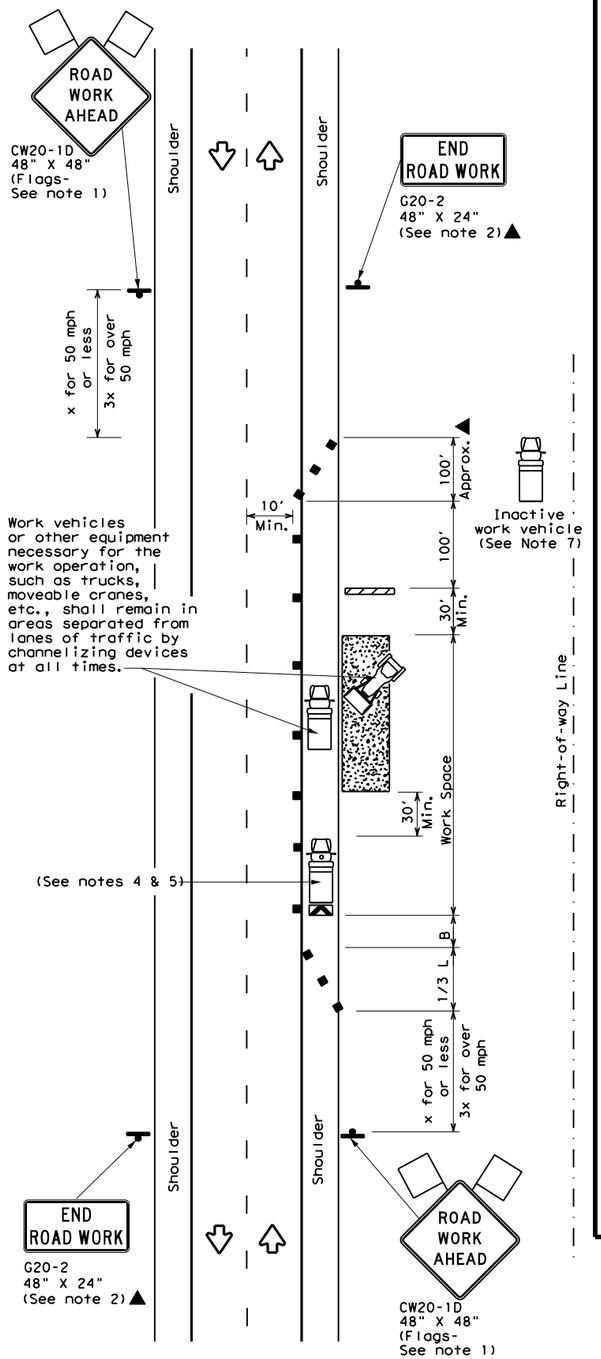
TCP (2-1a)

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

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	PAR	HUNT		021
1-97 2-18				

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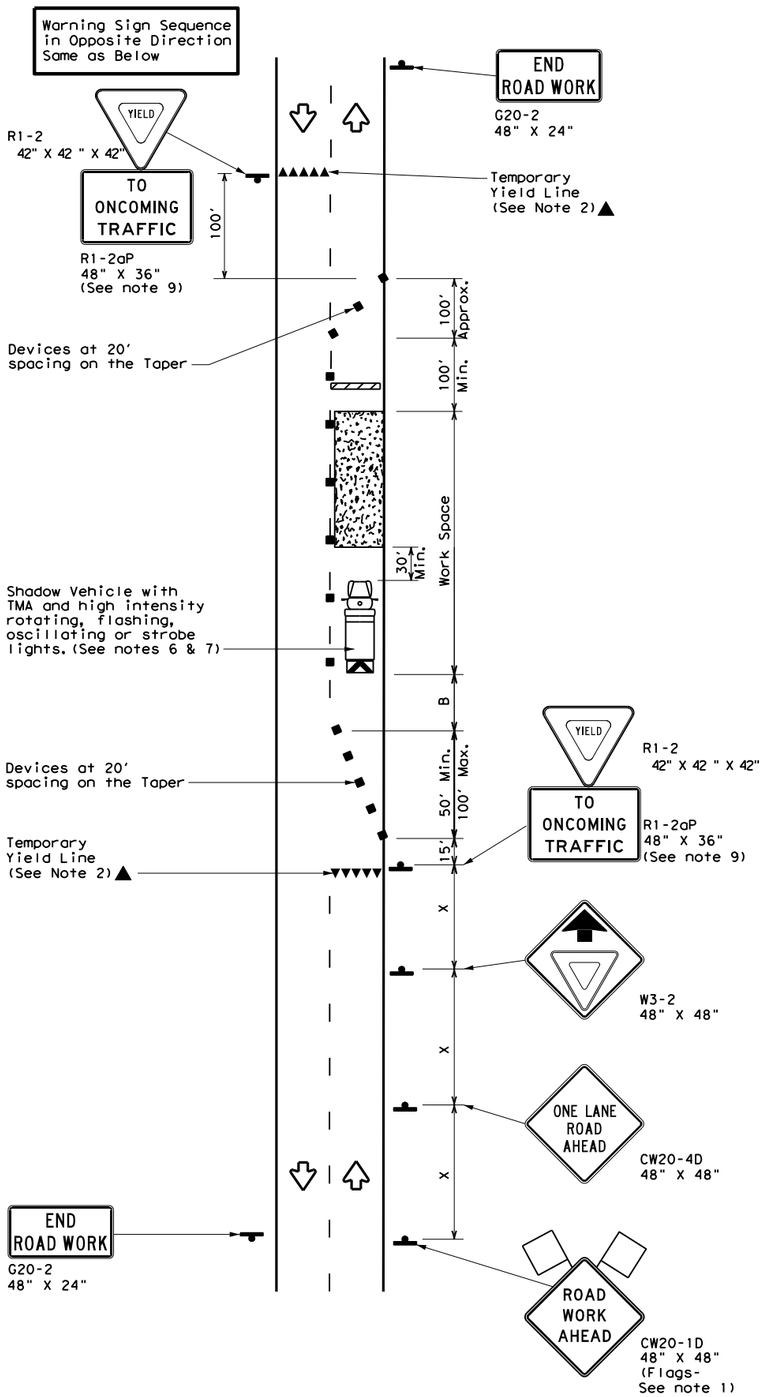
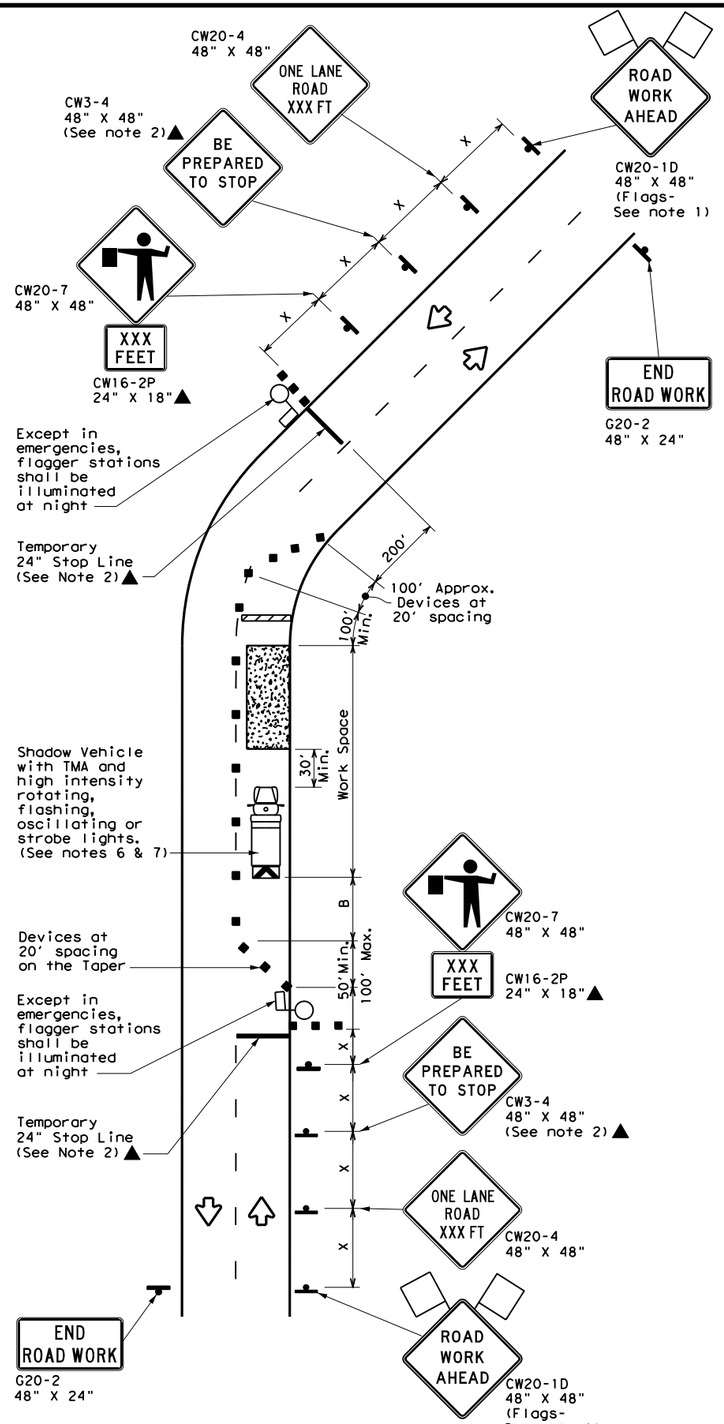


TCP (2-2a)
2-LANE ROADWAY WITHOUT PAVED SHOULDERS
ONE LANE TWO-WAY
CONTROL WITH YIELD SIGNS
(Less than 2000 ADT - See Note 9)



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

LEGEND

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

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©TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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	PAR	HUNT		022

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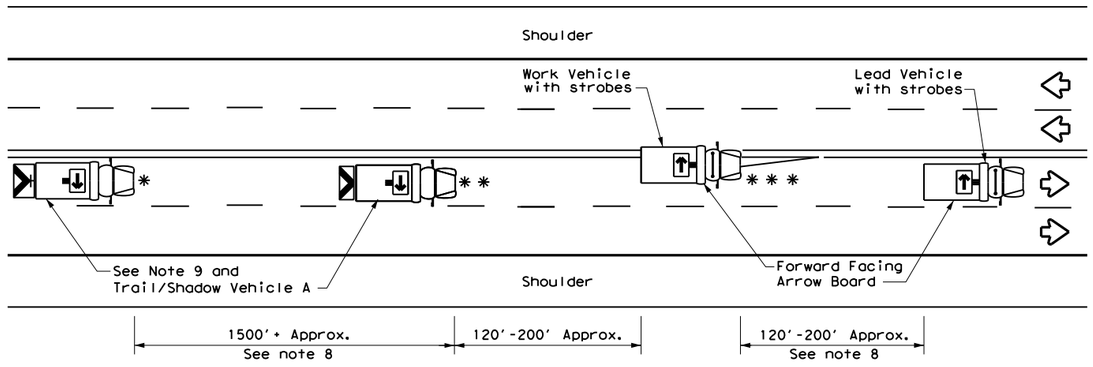
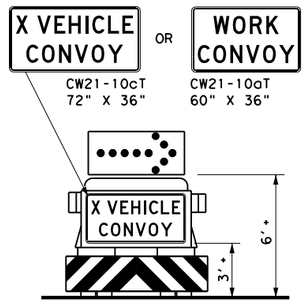


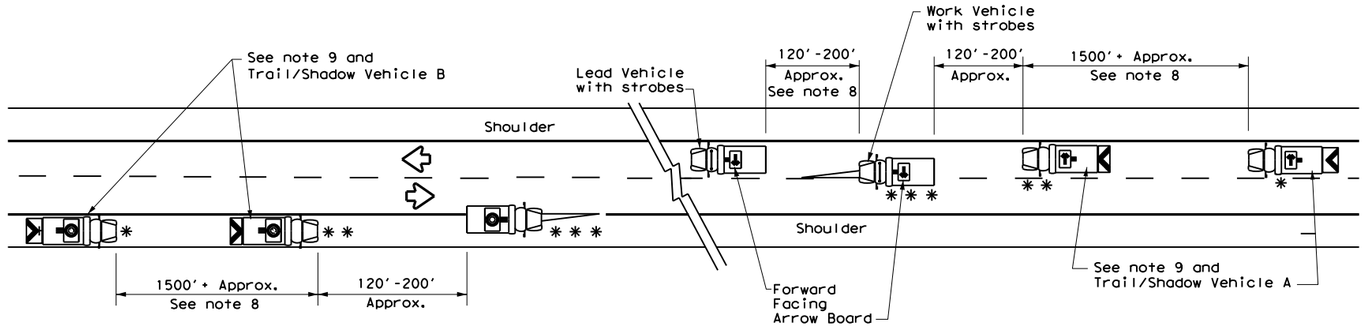
TCP (3-1a)

UNDIVIDED MULTILANE ROADWAY



TRAIL/SHADOW VEHICLE A

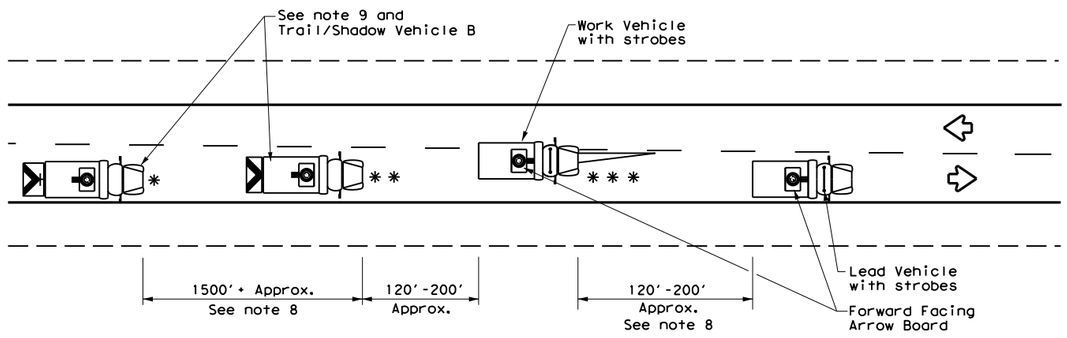
with RIGHT Directional display Flashing Arrow Board



WORK ON SHOULDER — WORK ON TRAVEL LANE

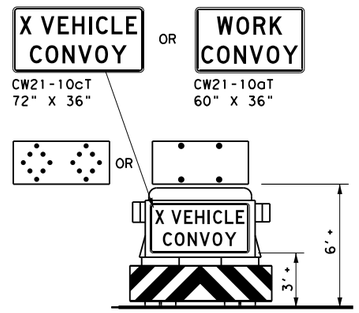
TCP (3-1b)

TWO-WAY ROADWAY WITH PAVED SHOULDERS



TCP (3-1c)

TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS



TRAIL/SHADOW VEHICLE B

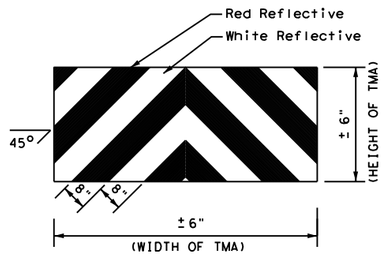
with Flashing Arrow Board in CAUTION display

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

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

GENERAL NOTES

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



STRIPING FOR TMA

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS UNDIVIDED HIGHWAYS

TCP(3-1)-13

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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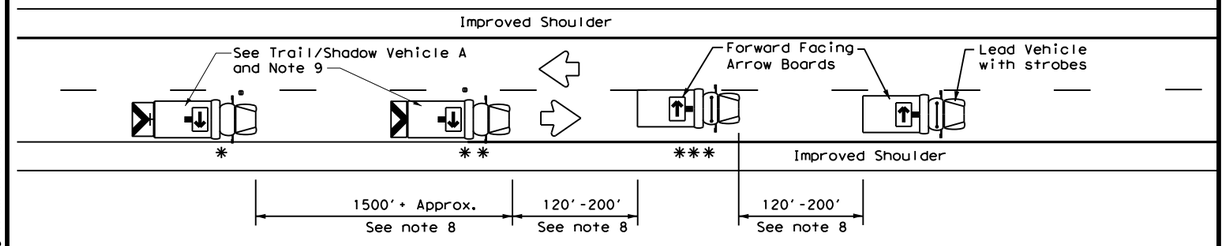
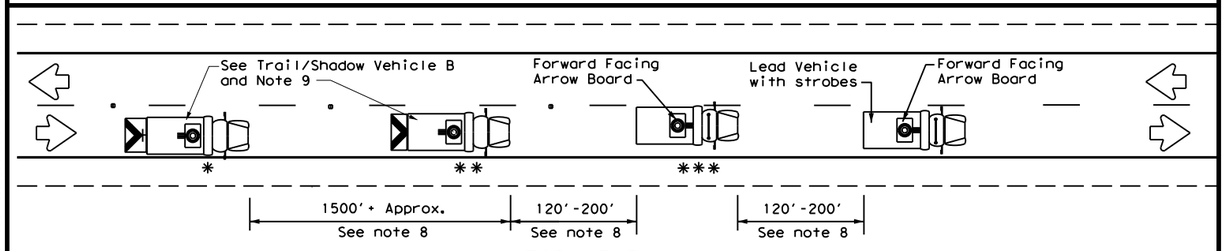


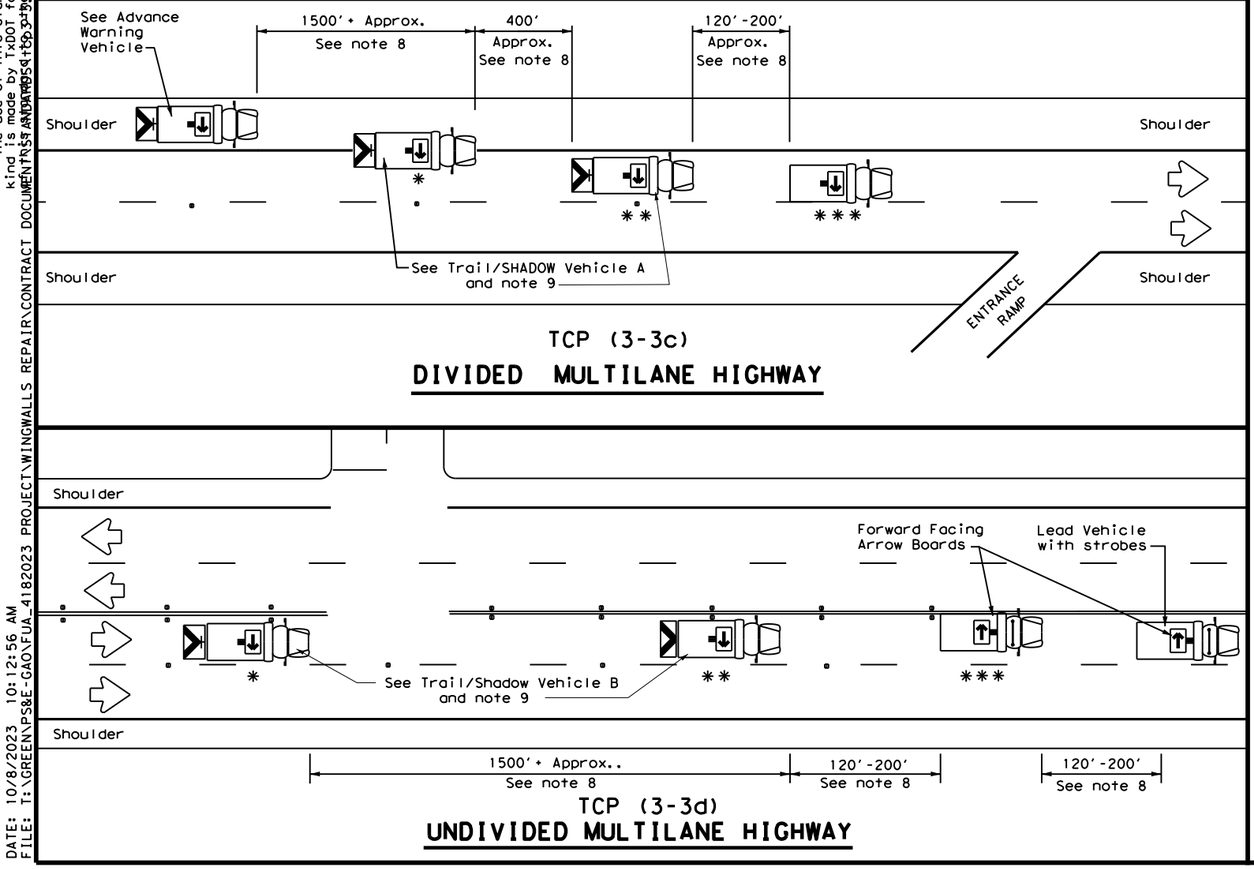
TCP (3-3a)

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



TCP (3-3b)

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

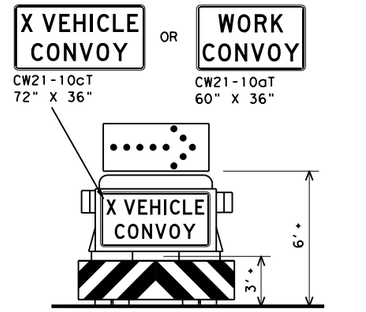


TCP (3-3c)

DIVIDED MULTILANE HIGHWAY

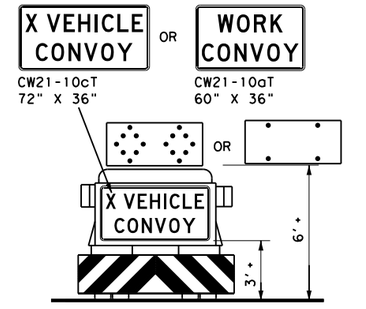
TCP (3-3d)

UNDIVIDED MULTILANE HIGHWAY



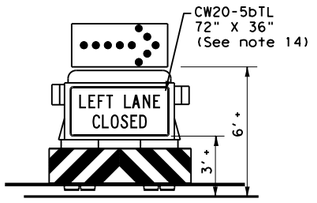
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display
Flashing Arrow Board

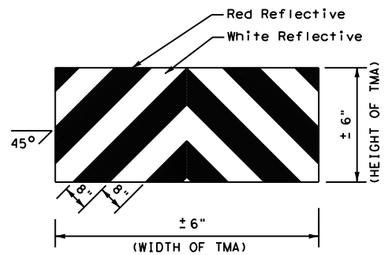


TRAIL/SHADOW VEHICLE B

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

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©TxDOT September 1987	CONT	SECT	JOB	HIGHWAY
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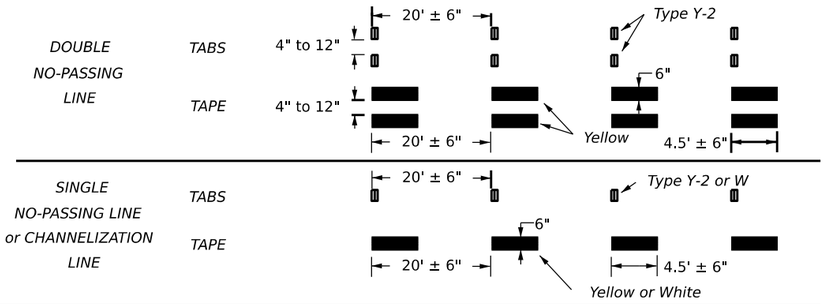
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 7-13	PAR	HUNT		024
1-97 7-14				

WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



NOTES:

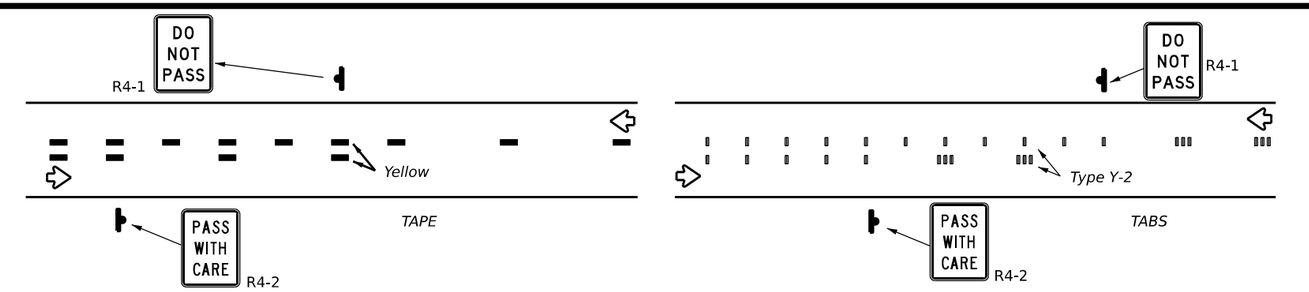
1. Short term pavement markings may be prefabricated markings (stick down tape) or temporary flexible reflective roadway marker tabs unless otherwise specified elsewhere in plans.
2. Short term pavement markings shall NOT be used to simulate edge lines.
3. Dimensions indicated on this sheet are typical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

TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

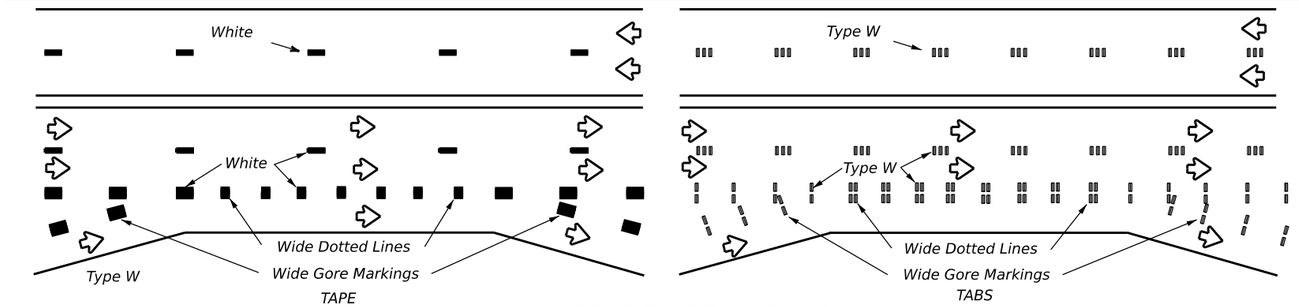
1. Temporary flexible-reflective roadway marker tabs detailed on this sheet will be designated Type Y-2 (two amber reflective surfaces with yellow body); Type Y (one amber reflective surface with yellow body); and Type W (one white or silver reflective surface with white body). Additional details may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

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

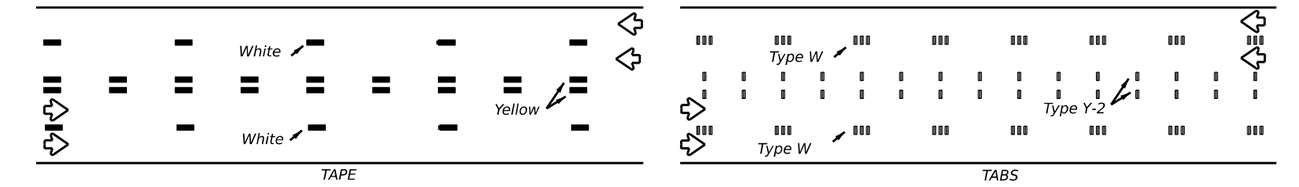
WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



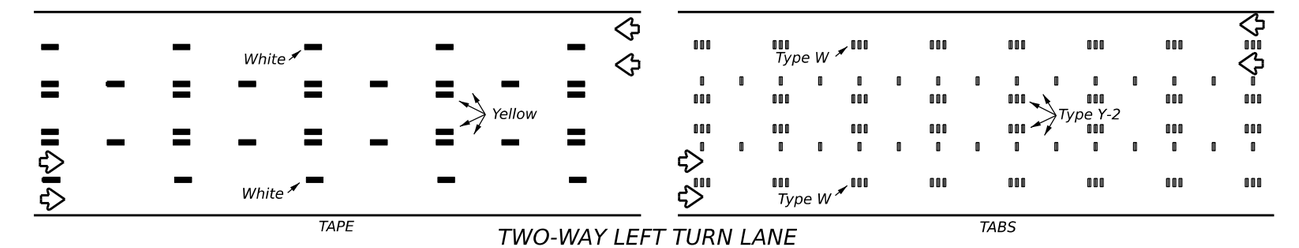
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



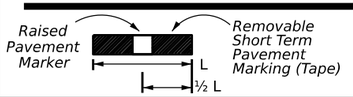
LANE LINES FOR DIVIDED HIGHWAY



LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



TWO-WAY LEFT TURN LANE



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

PREFABRICATED PAVEMENT MARKINGS

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

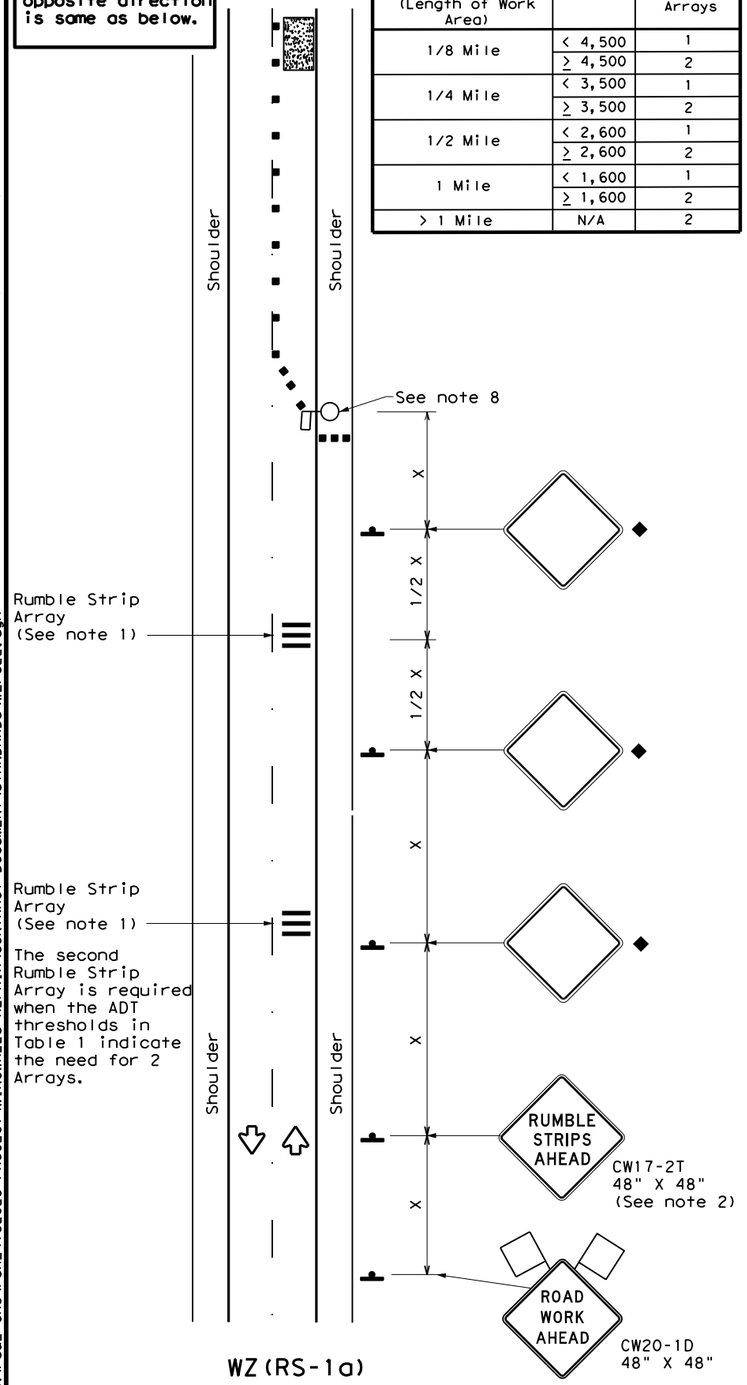
WZ(STPM)-23

FILE: wzstpm-23.dgn	DN:	CK:	DW:	CK:
©TxDOT February 2023	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
4-92 7-13	DIST	COUNTY		SHEET NO.
1-97 2-23	PAR	HUNT		025
3-03				

DATE: 10/8/2023 10:13:05 AM
FILE: I:\GREEN\PS&E-GAO\FUA_418\2023 PROJECT\WINGWALLS REPAIR\CONTRACT DOCUMENTS\STANDARDS\wzrs22.dgn

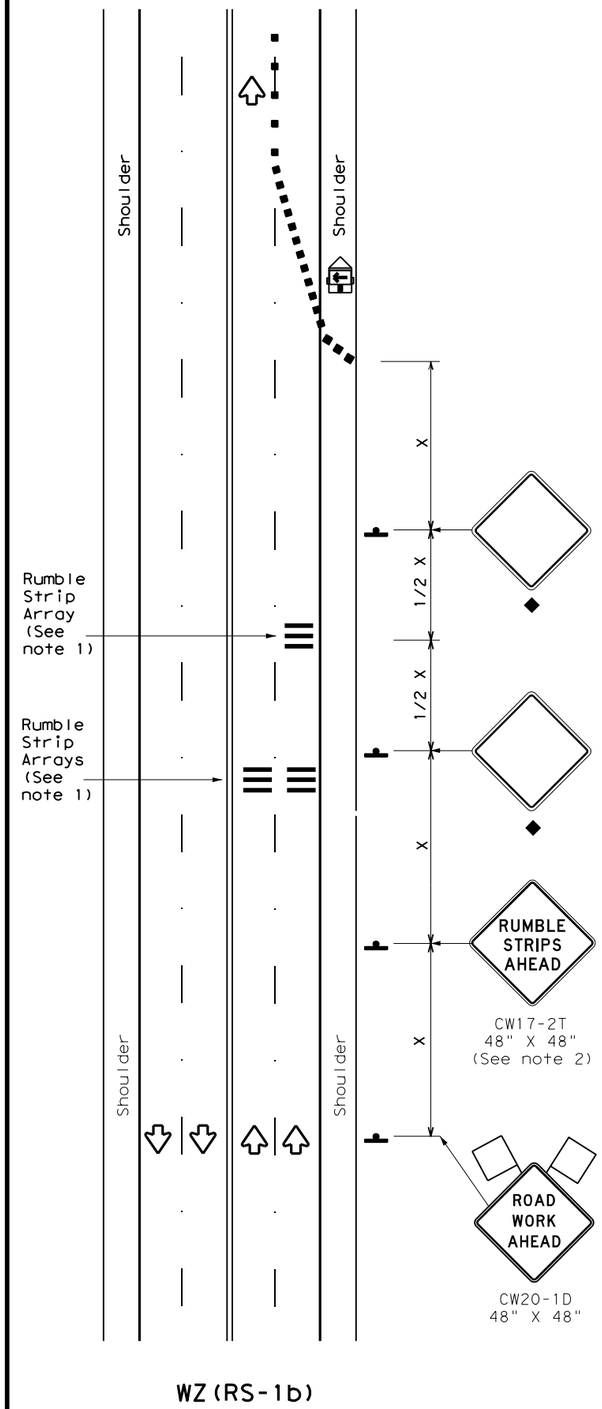
Warning sign and rumble strip sequence in opposite direction is same as below.

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	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		026

DATE: 10/8/2023 10:13:08 AM
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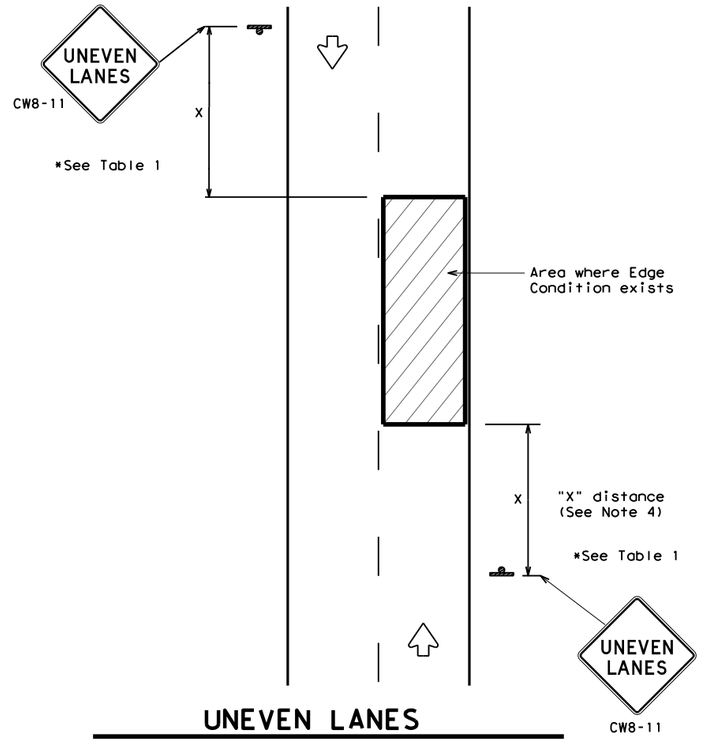
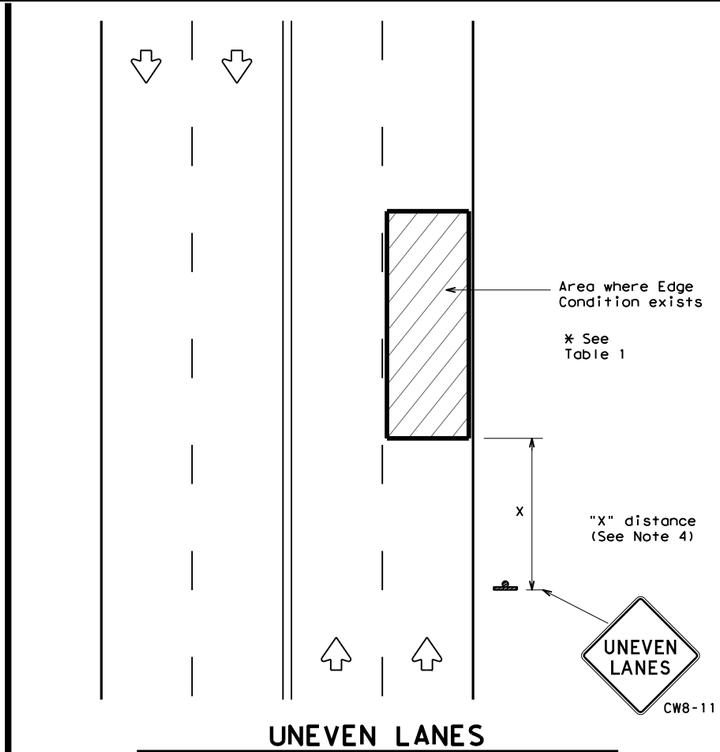
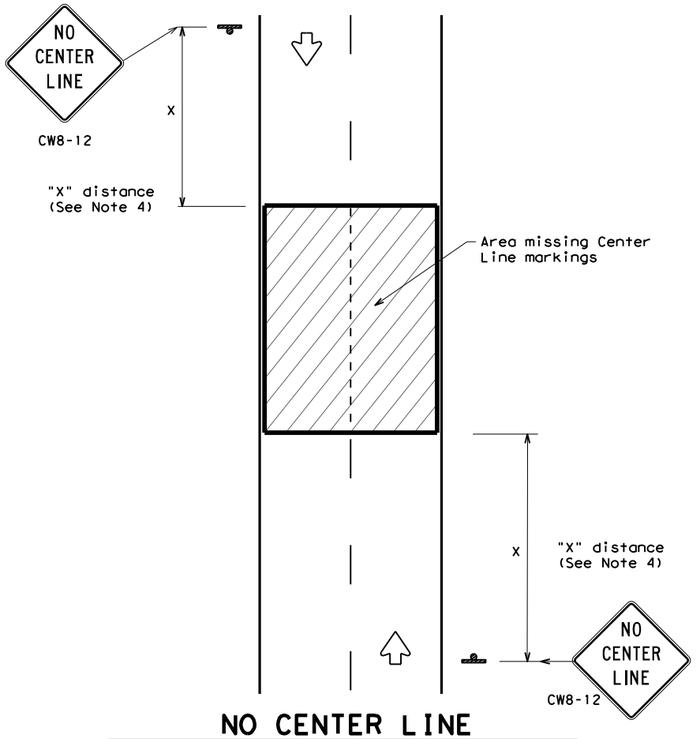


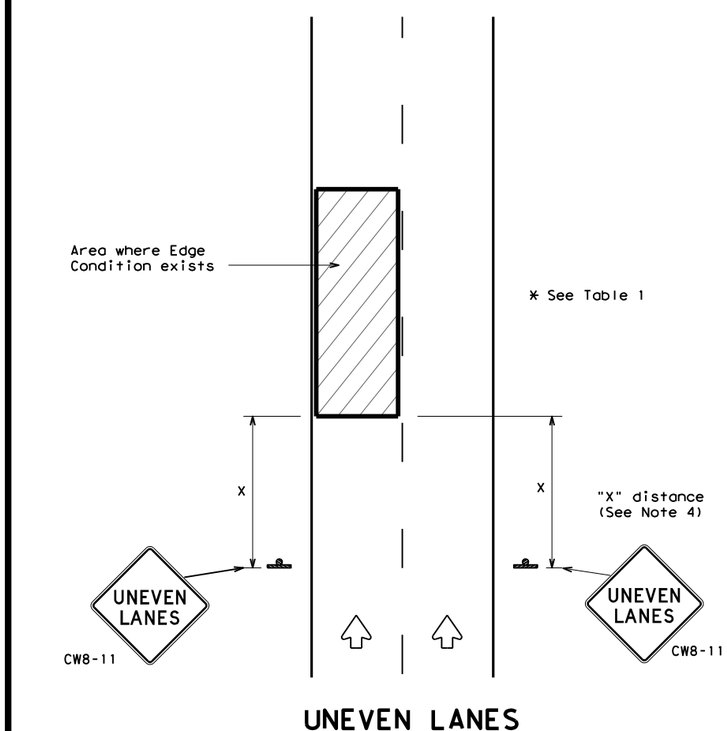
UNEVEN LANES
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
FOUR LANE CONVENTIONAL ROAD



NO CENTER LINE
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
DIVIDED ROADWAY

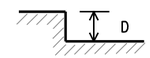
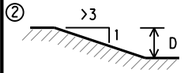
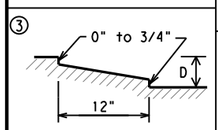
DEPARTMENTAL MATERIAL SPECIFICATIONS	
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY (REMOVABLE) PREFABRICATED PAVEMENT MARKINGS	DMS-8241
SIGN FACE MATERIALS	DMS-8300

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

GENERAL NOTES

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

TABLE 1

Edge Condition	Edge Height (D)	* Warning Devices
① 	Less than or equal to: 1¼" (maximum-planing) 1½" (typical-overlay)	Sign: CW8-11
	Distance "D" may be a maximum of 1 1/4 " for planing operations and 2" for overlay operations if uneven lanes with edge condition 1 are open to traffic after work operations cease.	
② 	Less than or equal to 3"	Sign: CW8-11
③  Notched Wedge Joint	Distance "D" may be a maximum of 3" if uneven lanes with edge condition 2 or 3 are open to traffic after work operations cease. Uneven lanes should not be open to traffic when "D" is greater than 3".	

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

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

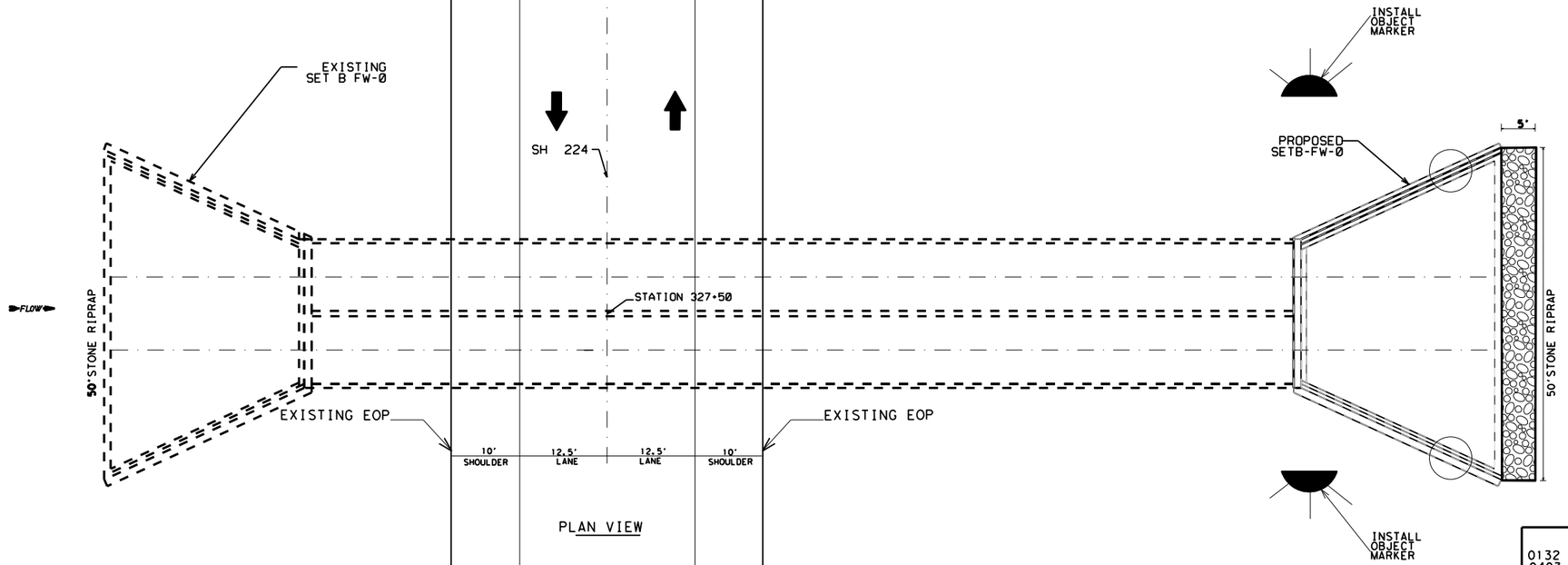
Texas Department of Transportation

Traffic Operations Division Standard

SIGNING FOR UNEVEN LANES

WZ(UL)-13

FILE: wzul-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
8-95 2-98 7-13	DIST	COUNTY		SHEET NO.
1-97 3-03	PAR	HUNT		027



PLAN VIEW

FLOW DIRECTON

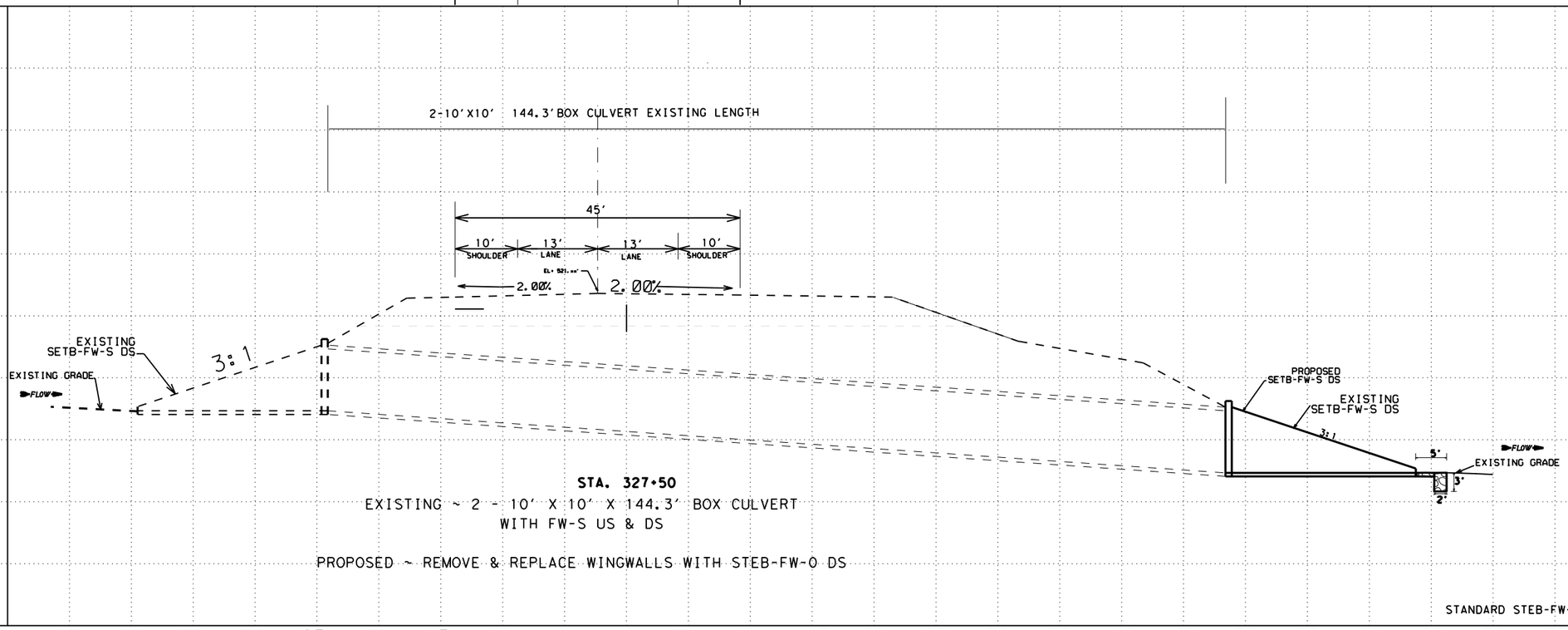
EXISTING WINGWALL

PROPOSED WINGWALL

REMOVE AND REPLACE

ESTIMATED QUANTITIES

0132 6001	EMBANKMENT TYPE A	0.8 CY
0403 6001	TEMPORARY SPL SHORING	240 SF
0429 6001	CONC STRU REPAIR (CLEAN&COAT WITH EPOXY)	27 SF
0432 6031	RIPRAP (STON PROTECTION)	21 CY
0466 6157	WINGWALL (FW-S)(HW=10 FT)	1 EA
0496 6005	REMOVE STR (WINGWALL)(S= 10')(HW= 10')	1 EA
0480 6001	CLEAN EXISTING CULVERTS	1 EA



STA. 327+50

EXISTING ~ 2 - 10' X 10' X 144.3' BOX CULVERT
WITH FW-S US & DS

PROPOSED ~ REMOVE & REPLACE WINGWALLS WITH STEB-FW-0 DS

STANDARD STEB-FW-S

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

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/12/23

CULVERT LAYOUT
SH224
RAYS CRK REL
STA. 327+50
NBI#01-117-00136-01-094

SHEET 1 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0901	22	128	VARIOUS
DIST	COUNTY		SHEET NO.
PAR	HUNT, ETC.		028

DATE: 10/11/2023 04:37 PM
FILE: TxDOT_Sheets_XM.cel

EXISTING WINGWALL PW 2

FLOW

28' STONE RIPRAP

12' LANE | 11' | 12' LANE

PLAN VIEW

INSTALL OBJECT MARKER

REMOVE EXISTING WINGWALL PW 2

28' STONE RIPRAP

FLOW

REMOVE EXISTING WINGWALL

INSTALL OBJECT MARKER

ESTIMATED QUANTITIES

0132	6001	EMBANKEMNT TYPE A	0.3 CY
0403	6001	TEMPORARY SPL SHORING	160 SF
0432	6031	RIPRAP (STON PROTECTION)	30 CY
0429	6001	CONCRETE REPAIR (CLEAN&COAT WITH EPOXY)	30 SF
0466	6197	WINGWALL (PW-2)(HW=8 FT)	1 EA
0496	6005	REMOVE STR (WINGWALL)(S= 10')(HW= 8')	1 EA
0480	6001	CLEAN EXISTING CULVERTS	1 EA
0506	6002	ROCK FILTER DAM (INSTALL)(TY 2)	8 LF
0506	6011	ROCK FILTER DAM (REMOVE)	8 LF
0658	6047	INSTL OM ASSM(OM-2Y)(WC)GND	1 EA
0658	6062	INSTL DEL ASSM (D-SW)SZ1(BRF)GF2(B1)	1 EA

FLOW FLOW DIRECTON

EXISTING WINGWALL

PROPOSED WINGWALL

CRACKS TO FIX

ROMEVE & REPLACE

3-8'X8'X78' BOX CULVERT EXISTING LENGTH

12' LANE | 11' | 12' LANE

EXISTING WINGWALL PW 2

FLOW

9'

3'

2'

PROPOSED WINGWALL PW 2

FLOW

9'

3'

2'

520
515
510
505
500
495
490
485

NBI# 01-117-00203-01-016
EXISTING ~ 3 - 10' X 8' X 78' BOX CULVERT
WITH PW-2 US & DS
PROPOSED ~ REMOVE & REPLACE PARALLEL WINGWALLS WITH PW US N-W WALL ONLY

STANDARD STEB-PW

65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65

DATE:
FILE:

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

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/12/23

CULVERT LAYOUT

BUSINESS 69

HALL BRANCH

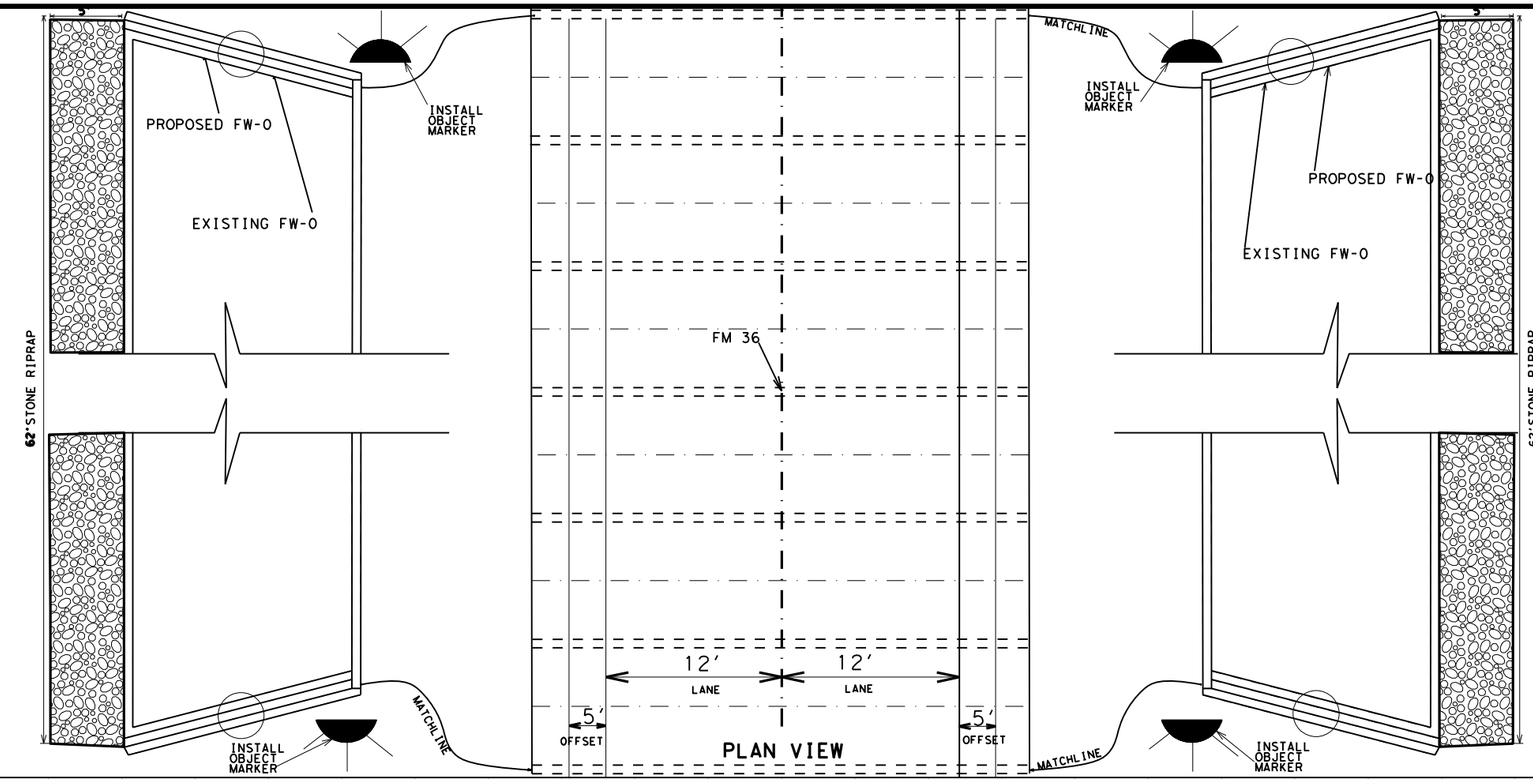
NBI# 01-117-00203-01-016

SHEET 2 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0901	22	128	VARIOUS
DIST	COUNTY		SHEET NO.
PAR	HUNT		029

ESTIMATED QUANTITIES	
0132 6001 EMBANKMENT TYPE A	0.8 CY
029 6001 CONC STR REPAIR (CLEAN &COAT WITH EPOX	12 SF
0432 6031 RIPRAP (STONE PROTECTION)(12 IN)	42 CY
0466 6165 WINGWALL (FW-S)(HW=4 FT)	2 EA
0496 6005 REMOVE STR (WINGWALL)(S= 10')(HW= 4')	2 EA
0480 6001 CLEAN EXISTING CULVERTS	1 EA



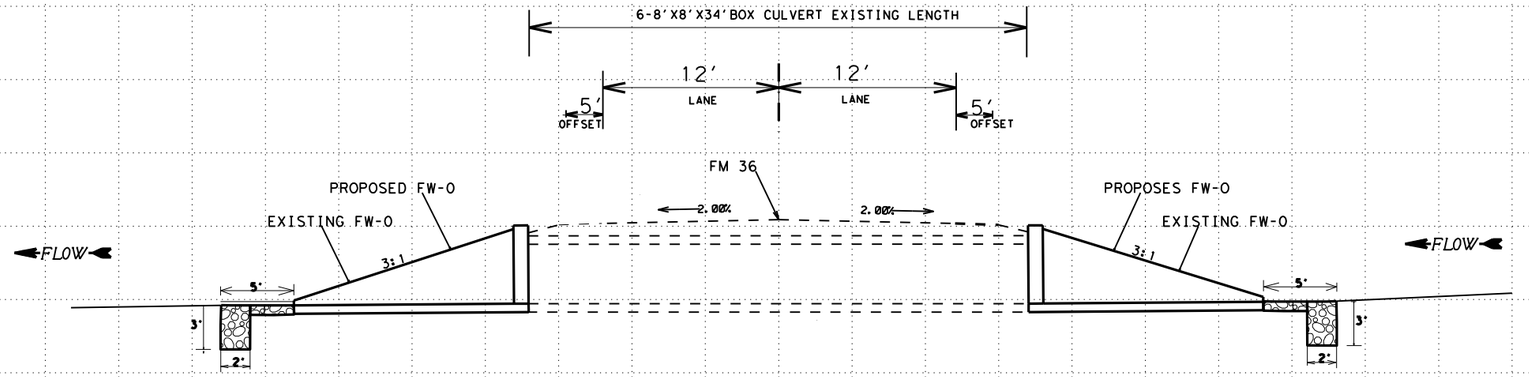
PLAN VIEW

FLOW FLOW DIRECTON

EXISTING WINGWALL

PROPOSED WINGWALL

REMOVE AND REPLACE



NBI#01-117-00642-03-010
EXISTING ~ 6 - 8' X 4' X 34' BOX CULVERT
WITH FW-S US & DS
PROPOSED ~ REMOVE & REPLACE WINGWALLS WITH STEB-FW-0 US & DS

STANDARD STEB-FW-0

520 515 510 505 500 495 490 485

50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60

DATE:
FILE:

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

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/13/23

CULVERT LAYOUT
FM 36
DRAIN

NBI#01-117-00642-03-010

SHEET 3 OF 26

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0901	22	128	VARIOUS
DIST	COUNTY		SHEET NO.
PAR	HUNT		030

UNDERMINING OF SOUTHEAST ABUTMENT AND EXPOSED PILES LOOKING SOUTHEAST

BROKEN AND SEPARATED WEST WINGWALL LOOKING NORTH

SH 11 MIDDLE SULPHUR RELIEF

1. Reconstruct wingwall.
2. Backfill eroded area along Northwest and Southeast bank. Install rock riprap along abutments for erosion protection

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

SUMMARY OF CONCRETE REPAIR

IDENTIFICATION NUMBER	LOCATION	401 6001 FLOWABLE BACKFILL	429 6001 CONC STR REPAIR (CLEAN &COAT WTH EPOXY)	466 6192 WINGWALL (PW-2) (HW-3FT)	496 6042 REMOV STR (SMALL)
		CY	SF	EA	EA
NBI= 01-117-02139-04-011	SH 11	10	5	1	1
PROJECT TOTALS:		10	5	1	1

Tesfai Weldemariam PE
10/11/23

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

BRIDGE LAYOUT
SH 11
(33.26411995,-91292085)

SH 11
MIDDLE SULPHUR RELIEF
01-117-02139-04-011

GRAPHICS FILE		SHEET NO.
		031

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

THE NORTH ABUTMENT JOINT HAS CRACKS LOOKING EAST

MODERATE SPALL WITH EXPOSED REBAR ALONG WEST EXTERIOR BEAM AT SPAN 3 LOOKING SOUTHWEST

1 CLEAN AND RESEAL EXPOSED JOINTS

2 REMOVE UNSOUND CONCRETE, CLEAN & COAT EXPOSED REBAR AND PATCH SPALLS ALONG BEAMS

SUMMARY OF CONCRETE REPAIR				
		429	438	788
		6009	6001	6002
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (STANDARD)	CLEANING AND SEALING EXISTING JOINTS	CONCRETE BEAM REPAIR (CFRP)
		SF	LF	EA
NBI• 01-117-00009-13-330	LAMAR STREET	10	72	1
PROJECT TOTALS:		10	72	1

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT

IH 30 ML & FR

(33.133369,-96.056181)

Texas Department of Transportation

IH 30 ML & FR
(LAMAR STREET)
NBI •01-117-00009-13-330

GRAPHICS FILE		SHEET NO.
		032

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

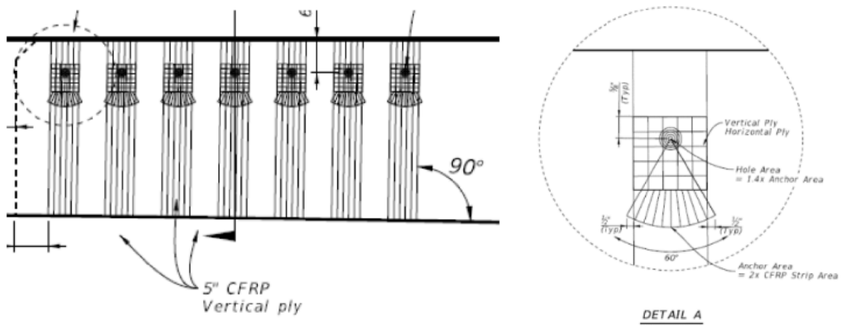
NOTE: 1. The North interior bent cap has a wide diagonal shear crack (approx. 1/4") over the inside face of the East column.

SUMMARY OF CONCRETE REPAIR			
		429	786
		6007	6002
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)	CARBON FIBER REINF POLYMER STRENGTHNING
		SF	SF
NBI* 01-117-00009-13-284	SH24 & SH 50	12	200
PROJECT TOTALS:		12	200

1.REPAIR IMPACT DAMAGES ON DIAPHRAM AND AREAS AT NORTHWEST BEAM ALONG SPAN 2 FROM SOUTH WEST.

2.REMOUVE UNSOUND CONCRETE, CLEAN AND SEAL DIAGONAL CRACKS AT ALL INTERIOR BENT CAPS (3 TOTAL: 200SF).

NOTE: 1. The East exterior column at the center bent has approximately 12 sq. ft. of delaminations and approximately 3 sq. ft. of spalls that are 2" deep with exposed rebar.



INTERIOR BENT CAP REPAIR DETAIL

Figure 6. Proposed CFRP

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
11/06/23
BRIDGE LAYOUT

SH24 & SH50
(33.12945123,-95.99114665)

Texas Department of Transportation

SH24 & SH50
INTERSECTED IH 30
NBI*01-117-00009-13-284

GRAPHICS FILE		SHEET NO.
		033

CHECKED	STATE	STATE DIST.	COUNTY	
		PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

CRACK AND SPALL AT NORTHEAST END OF SOUTHEAST ABUTMENT AND EAST WINGWALL AND HEADWALL INTERFACE LOOKING SOUTH

SUMMARY OF CONCRETE REPAIR		
		429
		6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF
NBI# 01-117-00009-15-314	US 69	24
PROJECT TOTALS:		24

1. REMOVE UNSOUND CONCRETE, CLEAN AND COAT EXPOSED REBAR: PATCH SPALLS AT SOUTHEAST ABUTMENT AT NORTH END

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

Tesfai Weldemariam PE

10/11/23

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

BRIDGE LAYOUT
US 69
(33.113652,-96.094525)

Texas Department of Transportation

US 69
TURTLE CREEK
NBI#01-117-00009-15-314

GRAPHICS FILE		SHEET NO.
		034

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

IMPACT DAMAGE TO SOUTH ABUTMENT GABIONS LOOKING SOUTHWEST

IMPACT SPALLING WITH STRANDS EXPOSED ALONG BEAM 3 FROM WEST IN SPAN 5 FROM THE NORTH LOOKING NORTHEAST

MINOR IMPACT SPALL WITH TWO STRANDS EXPOSED ON WEST BEAM AT SPAN 5 LOOKING NORTHEAST

SEVERAL IMPACT SPALLS WITH STRANDS EXPOSED ALONG EAST BEAM AT SPAN 5 LOOKING NORTHWEST

1. REMOVE UNSOUND CONCRETE, CLEAN AND COAT EXPOSED STRANDS AND PATCH SPALLS ALONG BOTTOM FLANGES 1,3 AND 4 FROM WEST AT SPAN 5
2. REMOVE UNSOUND CONCRETE, CLEAN AND COAT EXPOSED REBAR AND PATCH SPALS ALONGTHE SOFFIT OF BEAM 2 FROM WEST AT SPAN 4 FROM NOTH

SUMMARY OF CONCRETE REPAIR		
		429
		6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF
NBI• 01-117-00009-13-297	FM 513	25
PROJECT TOTALS:		25

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

Tesfai Weldemariam PE
10/11/23

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

BRIDGE LAYOUT
FM 513
(33.13203198,-95.94715318)

Texas Department of Transportation

FM 513
IH 30 ML AND FRS
NBI •01-117-00009-13-297

GRAPHICS FILE		SHEET NO.
		035

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

SOUTHWEST FACE OF CENTER BENT HAS DELAMINATION & CRACKING LOOKING NORTH

WEST WINGWALL IS LEANING AWAY FROM BRIDGE LOOKING NORTH

SUPERSTRUCTURE LOOKING SOUTHWEST

SOUTHEAST EXTERIOR GIRDER STEM OF SPAN 3 HAS SEVERE IMPACT DAMAGE WITH EXPOSED REBAR LOOKING WEST

1. REMOVE UNSOUND CONCRETE, CLEAN & COAT EXPOSED REBAR, AND PATCH SPALLS ALONG THE STEMS.
2. REMOVE UNSOUND CONCRETE AND PATCH SPALLS ALONG WINGWALLS. CONSIDER RECONSTRUCTING SOUTH WINGWALL

SUMMARY OF CONCRETE REPAIR			
		429	788
		6007	6002
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)	CONCRETE BEAM REPAIR (CFRP)
		SF	EA
NBI= 01-117-02139-04-080	SH 224	40	1
PROJECT TOTALS:		40	1

BROKEN BLOCK OUT AT WEST CORNER TRANSITION LOOKING EAST

SOUTHEAST EXTERIOR COLUMN AT BENT 4 HAS MINOR DELAMINATION AND SPALLING AT BASE LOOKING SOUTH

DELAMINATING OF STEM 4 FROM SOUTHEAST ALONG SPAN 3 LOOKING EAST

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT
SH 224
(33.256892,-95.901536)

Texas Department of Transportation

SH 224
INTERSECTED SH 11
NBI•01-117-02139-04-080

GRAPHICS FILE		SHEET NO.
		036

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

SPALLING ALONG PAVEMENT AT EDGE OF DECK LOOKING WEST

MINOR SPALLING WITH EXPOSED REBAR AT SPAN 3 SOUTHEAST SIDE LOOKING NORTHWEST

SPALLING WITH EXPOSED REBAR AT SPAN 2 FROM SOUTHWEST ALONG SOUTHEAST SIDE LOOKING WEST

WEIGHT LIMIT SIGN AT SOUTHWEST END LOOKING NORTHEAST

1. MINOR SPALLING WITH EXPOSED REBAR AT SPAN 3 SOUTHEAST SIDE LOOKING NORTHWEST
2. SPALLING WITH EXPOSED REBAR AT SPAN 2 FROM SOUTHWEST ALONG SOUTHEAST SIDE LOOKING WEST

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

SUMMARY OF CONCRETE REPAIR		
IDENTIFICATION NUMBER	LOCATION	429 6007 CONC STR REPAIR (VERTICAL & OVERHEAD) SF
NBI• 01-117-00136-12-013	FM 2874	42
PROJECT TOTALS:		42

Tesfai Weldemariam PE
10/11/23

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

BRIDGE LAYOUT
FM2874
(33.23896576,-95.96914481)

Texas Department of Transportation

FM2874
SCATTER BRANCH
NBI•01-117-00136-12-013

GRAPHICS FILE		SHEET NO.
		037

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

SPALLS AT EAST END OF SOUTH PARAPET LOOKING NORTH

UNDERMINING OF EAST ABUMENT CAP AND EXPOSED PILES LOOKING EAST

1. SPALLING EAST END OF SOUTH PARAPET LOOKING NORTH

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

SUMMARY OF CONCRETE REPAIR		
		429
		6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF
NBI• 01-117-01463-01-008	FM 1532	15
PROJECT TOTALS:		15

Tesfai Weldemariam PE
10/11/23

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

BRIDGE LAYOUT
FM 1532
(33.384150,-95.865396)

Texas Department of Transportation

FM 1532
JERIGAN CREEK
NBI•01-117-01463-01-008

GRAPHICS FILE			SHEET NO.
			038

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

Moderate drift accumulation at upstream and downstream end of culvert

Upstream end of culvert walls in center barrels have significant voids (up to 2 SF x full width)

Rock riprap has been placed in upstream and downstream channels and has mostly washed away at downstream end of exterior barrels, leaving exposed toewalls (up to 4.5'H)

Upstream end of culvert walls in center barrels have significant spalling (~5'H x 2"D)

1. VOIDS ISOLATED AT BOTTOM SECTION OF CULVERT INTERIOR WALLS.CLEAN VOIDS AND HEAVILY PITTED AREAS ALONG BOTTOM SECTION OF CULVERT WALLS.

SUMMARY OF CONCRETE REPAIR			
		429	429
		6009	6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (STANDARD)	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF	SF
NBI• 01-190-02193-01-002	FM 2324	10	75
PROJECT TOTALS:		10	75

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT
FM 2324
(32.83835833,-95.85661085)

Texas Department of Transportation

REEDER CRK
NBI •01-117-02193-01-002

GRAPHICS FILE		SHEET NO.
		039

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

11 - Voids and deterioration in bottom of walls

SUMMARY OF CONCRETE REPAIR			
		429	429
		6001	6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (CLEAN & COAT WTH EPOXY)	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF	SF
NBI *01-190-00203-04-029	US 69	2	15
PROJECT TOTALS:		2	15

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT

US 69

(32.84520198,-95.71372213)

Texas Department of Transportation

US 69
DRAIN
NBI *01-190-00203-04-029

GRAPHICS FILE		SHEET NO.
		040

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

7 - Crack in concrete on west side at top of wall

9 - Voids at lower section of interior culvert walls

8 - Cracked/Spalled concrete in wingwall

10 - Cracked/Spalled concrete in wingwall

SUMMARY OF CONCRETE REPAIR			
		429 6007	429 6009
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)	CONC STR REPAIR (STANDARD)
		SF	SF
NBI= 01-190-00203-04-028	US 69	12	80
PROJECT TOTALS:		12	80

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT

US 69

(32.82208112,-95.67847517)

Texas Department of Transportation

US 69
BIG CREEK
NBI •01-190-00203-04-028

GRAPHICS FILE		SHEET NO.
		041

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

7 - 2 ft scour at downstream toe

9 - Spalling concrete in top of barrels, exposed rebar

8 - Partial collapse of riprap

10 - Debris located in barrels

SUMMARY OF CONCRETE REPAIR		
		429
		6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF
NBI- 01-190-02193-01-003	FM 2324	25
PROJECT TOTALS:		25

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

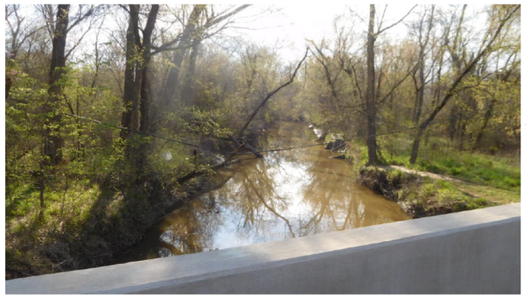
BRIDGE LAYOUT
FM 2324
(32.83845139,-95.87290122)

Texas Department of Transportation

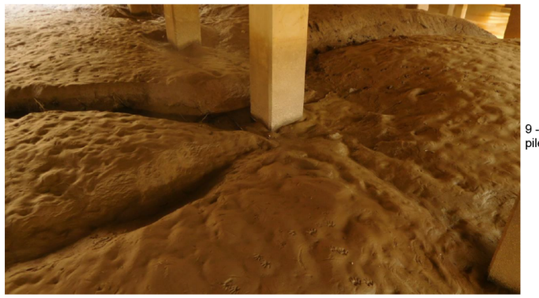
FM 2324
SHUTTLE CREEK
NBI •01-190-02193-01-003

GRAPHICS FILE		SHEET NO.
		042

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS



7 - Downstream looking Southeast



9 - Undermining of piles

8 - Spalling concrete with exposed rebar on bent cap

10 - Uneven slab soffit

SUMMARY OF CONCRETE REPAIR			
IDENTIFICATION NUMBER	LOCATION	429 6001 CONC STR REPAIR (CLEAN & COAT WTH EPOXY)	429 6007 CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF	SF
NBI• 01-190-00108-10-049	SH 19	142	2
PROJECT TOTALS:		142	2

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23
BRIDGE LAYOUT
SH 19
(32.95315374,-95.73259196)

SH 19
GARRETT CREEK
NBI •01-190-00108-10-049

GRAPHICS FILE		SHEET NO.
		043

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

5 - Stream Under looking Northwest

7 - Downstream looking Southeast

6 - Upstream looking Northwest

8 - Spalling concrete with exposed rebar on bent caps

SUMMARY OF CONCRETE REPAIR			
		429	429
		6001	6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (CLEAN & COAT WTH EPOXY)	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF	SF
NBI• 01-190-00108-10-048	SH 19	5	80
PROJECT TOTALS:		5	80

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT

SH 19

(33.95534766,-95.73204993)

Texas Department of Transportation

SH 19
GARRETT CREEK RELIEF
NBI •01-190-00108-10-048

GRAPHICS FILE		SHEET NO.
		044

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

Channel scour has exposed culvert toewall at Southeast Barrel (~1' high) at upstream end and (~3.5' high) with slight undermining (< 1' deep) at downstream end

Moderate abrasion, scaling and pitting along bottom of culvert walls with a few minor to moderate voids (up to 2 SF x 2" D) with exposed and corroded rebar.

SUMMARY OF CONCRETE REPAIR		
		429
		6001
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (CLEAN & COAT WITH EPOXY)
		SF
NBI# 01-190-00203-04-030	BEAR CREEK	10
PROJECT TOTALS:		10

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT

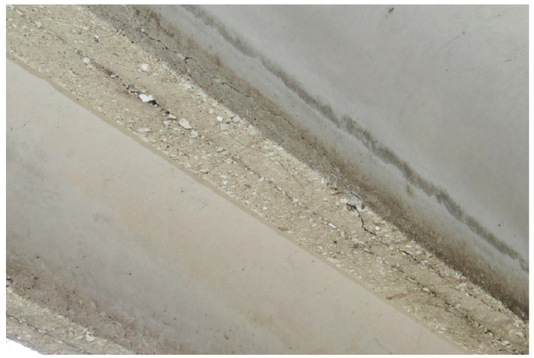
US 69

(32.85816332,-95.73600677)

US 69
BEAR CREEK
NBI# 01-190-00203-04-030

GRAPHICS FILE		SHEET NO.
		045

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS



2ND BEAM FROM WEST AT CENTER SPAN HAS HORIZONTAL CRACKING LOOKING NORTHWEST

MODERATE DELAMINATION AND SPALLING WITH EXPOSED REBAR OF WEST EXTERIOR BEAM OVER BENT 2 LOOKING NORTHWEST

SUMMARY OF CONCRETE REPAIR		
		429
		6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF
NBI= 01-117-00642-03-009	FM 36	16
PROJECT TOTALS:		16

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23
BRIDGE LAYOUT

FM 36
(32.994797,-96.184689)

Texas Department of Transportation

FM 36
W CADDO CRK
NBI= 01-117-00642-03-009

GRAPHICS FILE		SHEET NO.
		046

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

EXPOSED DRILLED SHAFTS AT BENT 8 ARE BELOW WATER LOOKING NORTHEAST

MOST ALL OF NORTH SIDE OF CAP 3 HAS MODERATE DELAMINATIONS & SPALLING LOOKING SOUTHWEST

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

SUMMARY OF CONCRETE REPAIR		
		429
		6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF
NBI# 01-117-00173-06-076	SH 34	50
PROJECT TOTALS:		50

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT

SH 34

(32.861017,-96.148914)

Texas Department of Transportation

SH 34
SO SABINE RIVER
NBI# 01-117-00173-06-076

GRAPHICS FILE		SHEET NO.
		047

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

MODERATE CONTRACTION SCOUR AT BENTS 12 & 13 HAVE EXPOSED DRILLED SHAFTS LOOKING NORTHWEST

MODERATE DELAMINATION AND SPALLING ALONG SOUTH FACE OF CAP 9 LOOKING NORTHWEST

MODERATE DELAMINATION AND SPALLING ALONG SOUTH FACE OF CAP 13 AT WEST END LOOKING NORTHWEST

NORTHWEST CORNER OF RIPRAP AT UPSTREAM SIDE HAS MODERATE SCOUR LOOKING NORTHEAST

SUMMARY OF CONCRETE REPAIR		
		429
		6007
IDENTIFICATION NUMBER	LOCATION	CONC STR REPAIR (VERTICAL & OVERHEAD)
		SF
NBI# 01-117-00173-06-075	FM 34	75
PROJECT TOTALS:		75

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT

SH 34

(32.866458,-96.148639)

Texas Department of Transportation

SH 34
SO SABINE RIVER RELIEF
NBI# 01-117-00173-06-075

GRAPHICS FILE		SHEET NO.
		048

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

NORTHWEST RIRAP HAS MOVED (~4") FROM THE ABUTMENT CAP LOOKING SOUTHEAST

CONTRACTION SCOUR BETWEEN BENTS 7-11. HIGH WATER LEVEL HIDES EXPOSED DRILLED SHAFTS LOOKING NORTHEAST

UPSTREAM END OF BENT CAP 5 HAS MODERATE SPALLS WITH EXPOSED REBAR LOOKING WEST

SUMMARY OF CONCRETE REPAIR

IDENTIFICATION NUMBER	LOCATION	401 6001 FLOWABLE BACKFILL	429 6007 CONC STR REPAIR (VERTICAL & OVERHEAD)
		CY	SF
NBI# 01-117-00173-06-072	SH 34	36	36
PROJECT TOTALS:		36	36

SPALL WITH EXPOSED ANCHOR BOLTS AT SOUTHEAST BRIDGE RAIL (TYP) LOOKING NORTHWEST

SPALLS WITH EXPOSED REBAR ON BENT CAP 5 (TYP AT OTHER BENT CAPS) LOOKING SOUTHWEST

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23
BRIDGE LAYOUT
SH 34
(32.93926272,-96.11196894)

Texas Department of Transportation

SH 34
CADDO CR RELIEF
NBI# 01-117-00173-06-072

GRAPHICS FILE		SHEET NO.
		049

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

SOUTH WINGWALL
LOOKING EAST

NORTH CORNER APPROACH MBGF
LOOKING SOUTHEAST

SUMMARY OF CONCRETE REPAIR			
		466	496
		6192	6042
IDENTIFICATION NUMBER	LOCATION	WINGWALL (PW-2) (HW-3FT)	REMOV STR (SMALL)
		EA	EA
NBI# 01-117-02035-01-003	FM 2101	1	1
PROJECT TOTALS:		1	1

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT

FM 2101

(33.0377695,-96.05529602)

Texas Department of Transportation

FM 2101
CEDAR CREEK
NBI# 01-117-02035-01-003

GRAPHICS FILE		SHEET NO.
		050

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

MODERATE EROSION AT THE NORTH DITCH HAS UNDERMINED THE RIPRAP, ABUTMENT CAP AND WINGWALL LOOKING NORTH

RIPRAP SLAB, ABUTMENT CAP AND WINGWALL ARE UNDERMINED AS MUCH AS 4' BACK DUE TO RIPRAP FAILURE LOOKING SOUTHEAST

SUMMARY OF CONCRETE REPAIR

IDENTIFICATION NUMBER	LOCATION	401 6001 FLOWABLE BACKFILL	432 6031 RIPRAP (STONE PROTECTION) (12 IN)
		CY	CY
NBI# 01-117-00009-13-234	IH 30 N FRTG RD	15	120
PROJECT TOTALS:		15	120

1 REMOVE UNSOUND CONCRETE, CLEAN EXPOSED REBAR, AND PATCH SPALLED AREA ALONG CONCRETE POSTS

2 INSTALL ROCK/RUBBLE AT THE NORTH DITCH TO HELP COUNTER EROSION. CONSIDER REMOVING RIPRAP, FILLING VOIDS AND RECONSTRUCTING CONCRETE RIPRAP

FYI:
AS-BUILT DRAWINGS ARE AVAILABLE ON REQUEST

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/11/23

BRIDGE LAYOUT

IH 30 N FRTG RD

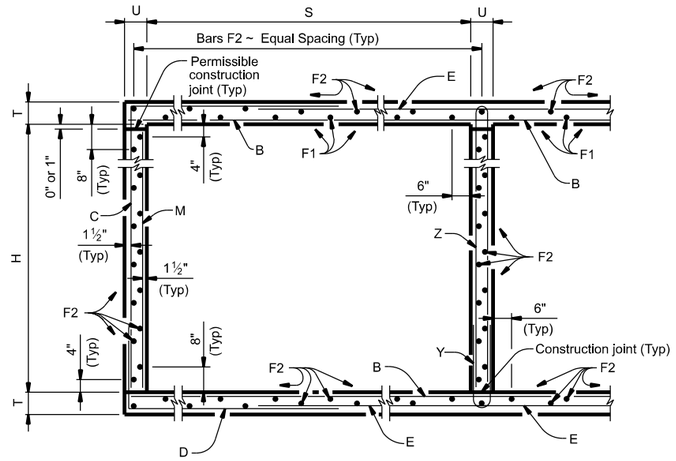
(33.03761104,-96.18480981)

IH 30 N FRTG RD
ELM CREEK
NBI# 01-117-00009-13-234

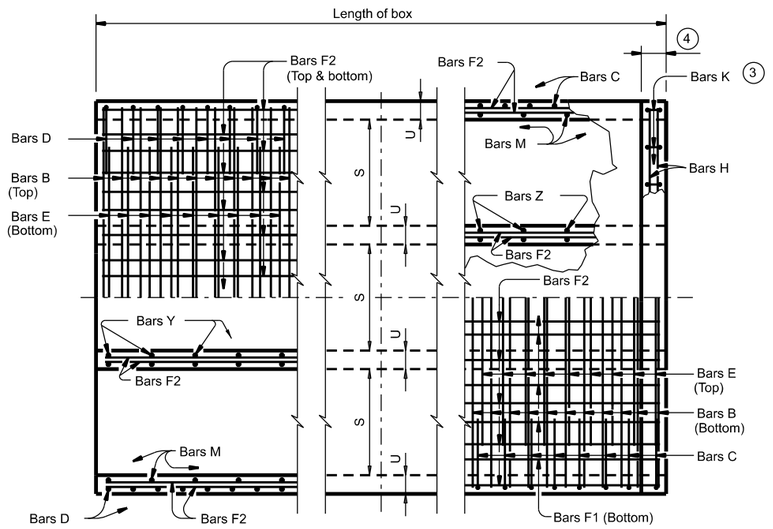
GRAPHICS FILE		SHEET NO.
		051

CHECKED	STATE	STATE DIST.	COUNTY	
	TEXAS	PAR	HUNT	
CHECKED	CONT.	SECT.	JOB	HIGHWAY NO.
	0901	22	128	VARIOUS

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



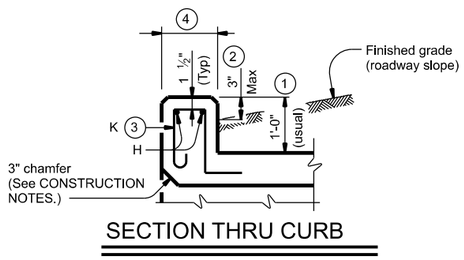
TYPICAL SECTION



BOTTOM SLAB

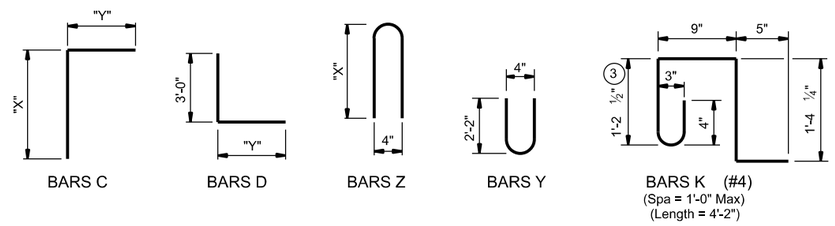
TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
3'-0"	3'-6 ½"	5'-1"
4'-0"	4'-6 ½"	5'-1"
5'-0"	5'-6 ½"	5'-1"
6'-0"	6'-6 ½"	5'-1"
7'-0"	7'-6 ½"	5'-1"
8'-0"	8'-6 ½"	5'-1"



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

2. For vehicle safety, the following requirements must be met:
   · For structures without bridge rail, construct curbs no more than 3" above finished grade.
   · For structures with bridge rail, construct curbs flush with finished grade.
   Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

GENERAL NOTES:

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

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

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

8'-0" SPAN
0' TO 13' FILL

MC-8-13

FILE:	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		052

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

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	8' - 0"	3' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	56	18"	39' - 9"	1,487	108	9"	3' - 0"	216	54	9"	4' - 7"	165	7' - 3"	262	17' - 6"	47	38	106	1.071	313.5	1.3	153	44.2	12,693
3	8' - 0"	3' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	80	18"	39' - 9"	2,124	108	9"	3' - 0"	216	108	9"	4' - 7"	331	7' - 3"	523	26' - 1"	70	56	156	1.560	448.5	1.9	226	64.3	18,167
4	8' - 0"	3' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	104	18"	39' - 9"	2,762	108	9"	3' - 0"	216	162	9"	4' - 7"	496	7' - 3"	785	34' - 8"	93	72	200	2.048	583.5	2.6	293	84.5	23,634
5	8' - 0"	3' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	128	18"	39' - 9"	3,399	108	9"	3' - 0"	216	216	9"	4' - 7"	661	7' - 3"	1,046	43' - 3"	116	90	251	2.537	718.6	3.2	367	104.7	29,109
6	8' - 0"	3' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	152	18"	39' - 9"	4,036	108	9"	3' - 0"	216	270	9"	4' - 7"	827	7' - 3"	1,308	51' - 10"	138	106	295	3.026	853.6	3.8	433	124.9	34,576
2	8' - 0"	4' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	56	18"	39' - 9"	1,487	108	9"	4' - 0"	289	54	9"	4' - 7"	165	9' - 3"	334	17' - 6"	47	38	106	1.136	321.2	1.3	153	46.8	13,000
3	8' - 0"	4' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	80	18"	39' - 9"	2,124	108	9"	4' - 0"	289	108	9"	4' - 7"	331	9' - 3"	667	26' - 1"	70	56	156	1.646	458.0	1.9	226	67.8	18,546
4	8' - 0"	4' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	104	18"	39' - 9"	2,762	108	9"	4' - 0"	289	162	9"	4' - 7"	496	9' - 3"	1,001	34' - 8"	93	72	200	2.156	594.8	2.6	293	88.8	24,085
5	8' - 0"	4' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	128	18"	39' - 9"	3,399	108	9"	4' - 0"	289	216	9"	4' - 7"	661	9' - 3"	1,335	43' - 3"	116	90	251	2.667	731.7	3.2	367	109.9	29,633
6	8' - 0"	4' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	152	18"	39' - 9"	4,036	108	9"	4' - 0"	289	270	9"	4' - 7"	827	9' - 3"	1,668	51' - 10"	138	106	295	3.177	868.5	3.8	433	130.9	35,171
2	8' - 0"	5' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	62	18"	39' - 9"	1,646	108	9"	5' - 0"	361	54	9"	4' - 7"	165	11' - 3"	406	17' - 6"	47	38	106	1.201	332.8	1.3	153	49.4	13,465
3	8' - 0"	5' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	88	18"	39' - 9"	2,337	108	9"	5' - 0"	361	108	9"	4' - 7"	331	11' - 3"	812	26' - 1"	70	56	156	1.733	472.8	1.9	226	71.3	19,138
4	8' - 0"	5' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	114	18"	39' - 9"	3,027	108	9"	5' - 0"	361	162	9"	4' - 7"	496	11' - 3"	1,217	34' - 8"	93	72	200	2.264	612.7	2.6	293	93.1	24,800
5	8' - 0"	5' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	140	18"	39' - 9"	3,717	108	9"	5' - 0"	361	216	9"	4' - 7"	661	11' - 3"	1,623	43' - 3"	116	90	251	2.796	752.7	3.2	367	115.1	30,473
6	8' - 0"	5' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	166	18"	39' - 9"	4,408	108	9"	5' - 0"	361	270	9"	4' - 7"	827	11' - 3"	2,029	51' - 10"	138	106	295	3.328	892.6	3.8	433	137.0	36,138
2	8' - 0"	6' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	68	18"	39' - 9"	1,806	108	9"	6' - 0"	433	54	9"	4' - 7"	165	13' - 3"	478	17' - 6"	47	38	106	1.265	344.5	1.3	153	51.9	13,932
3	8' - 0"	6' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	96	18"	39' - 9"	2,549	108	9"	6' - 0"	433	108	9"	4' - 7"	331	13' - 3"	956	26' - 1"	70	56	156	1.819	487.6	1.9	226	74.7	19,729
4	8' - 0"	6' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	124	18"	39' - 9"	3,293	108	9"	6' - 0"	433	162	9"	4' - 7"	496	13' - 3"	1,434	34' - 8"	93	72	200	2.372	630.6	2.6	293	97.5	25,518
5	8' - 0"	6' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	152	18"	39' - 9"	4,036	108	9"	6' - 0"	433	216	9"	4' - 7"	661	13' - 3"	1,912	43' - 3"	116	90	251	2.926	773.7	3.2	367	120.3	31,316
6	8' - 0"	6' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	180	18"	39' - 9"	4,780	108	9"	6' - 0"	433	270	9"	4' - 7"	827	13' - 3"	2,390	51' - 10"	138	106	295	3.479	916.8	3.8	433	143.0	37,106
2	8' - 0"	7' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	68	18"	39' - 9"	1,806	108	9"	7' - 0"	505	54	9"	4' - 7"	165	15' - 3"	550	17' - 6"	47	38	106	1.330	352.1	1.3	153	54.5	14,238
3	8' - 0"	7' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	96	18"	39' - 9"	2,549	108	9"	7' - 0"	505	108	9"	4' - 7"	331	15' - 3"	1,100	26' - 1"	70	56	156	1.905	497.0	1.9	226	78.1	20,107
4	8' - 0"	7' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	124	18"	39' - 9"	3,293	108	9"	7' - 0"	505	162	9"	4' - 7"	496	15' - 3"	1,650	34' - 8"	93	72	200	2.480	641.9	2.6	293	101.8	25,968
5	8' - 0"	7' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	152	18"	39' - 9"	4,036	108	9"	7' - 0"	505	216	9"	4' - 7"	661	15' - 3"	2,200	43' - 3"	116	90	251	3.056	786.8	3.2	367	125.5	31,838
6	8' - 0"	7' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	180	18"	39' - 9"	4,780	108	9"	7' - 0"	505	270	9"	4' - 7"	827	15' - 3"	2,750	51' - 10"	138	106	295	3.631	931.7	3.8	433	149.1	37,700
2	8' - 0"	8' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	74	18"	39' - 9"	1,965	108	9"	8' - 0"	577	54	9"	4' - 7"	165	17' - 3"	622	17' - 6"	47	38	106	1.395	363.8	1.3	153	57.1	14,703
3	8' - 0"	8' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	104	18"	39' - 9"	2,762	108	9"	8' - 0"	577	108	9"	4' - 7"	331	17' - 3"	1,244	26' - 1"	70	56	156	1.992	511.8	1.9	226	81.6	20,698
4	8' - 0"	8' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	134	18"	39' - 9"	3,558	108	9"	8' - 0"	577	162	9"	4' - 7"	496	17' - 3"	1,867	34' - 8"	93	72	200	2.588	659.8	2.6	293	106.1	26,684
5	8' - 0"	8' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	164	18"	39' - 9"	4,355	108	9"	8' - 0"	577	216	9"	4' - 7"	661	17' - 3"	2,489	43' - 3"	116	90	251	3.185	807.8	3.2	367	130.6	32,680
6	8' - 0"	8' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	194	18"	39' - 9"	5,151	108	9"	8' - 0"	577	270	9"	4' - 7"	827	17' - 3"	3,111	51' - 10"	138	106	295	3.782	955.8	3.8	433	155.1	38,666

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

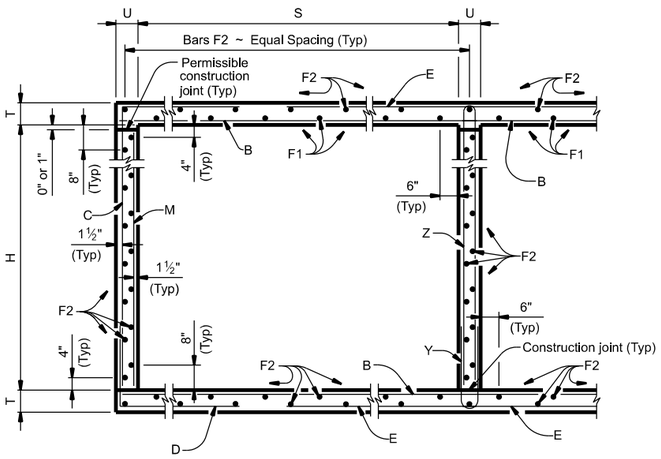
MULTIPLE BOX CULVERTS CAST-IN-PLACE

8'-0" SPAN
0' TO 13' FILL

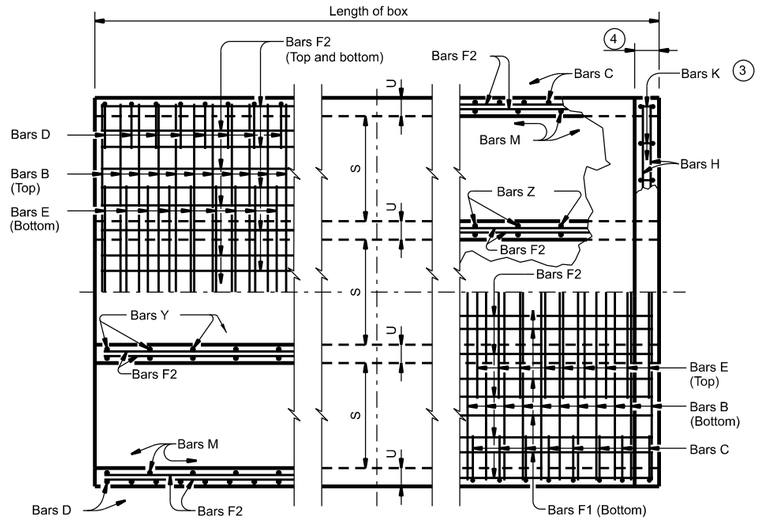
MC-8-13

FILE:	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		053

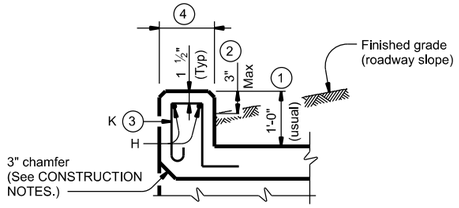
DATE: $DATE$ $TIME$
FILE: $FILE$



TYPICAL SECTION

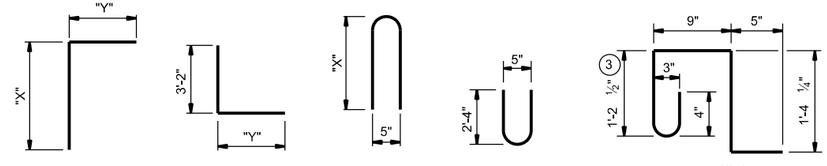


PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
4'-0"	4'-8 ½"	5'-10"
5'-0"	5'-8 ½"	5'-10"
6'-0"	6'-8 ½"	5'-10"
7'-0"	7'-8 ½"	5'-10"
8'-0"	8'-8 ½"	5'-10"
9'-0"	9'-8 ½"	5'-10"
10'-0"	10'-8 ½"	5'-10"



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

GENERAL NOTES:

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

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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation — Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

10'-0" SPAN
2' TO 13' FILL

MC-10-13

FILE:	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		054

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

BILLS OF REINFORCING STEEL (For Box Length = 40 feet)

NUMBER OF SPANS	SECTION DIMENSIONS				Bars B (5)					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4						Bars H 4 ~ #4 (5)		Bars K		QUANTITIES				
													Bars C		Bars D																					Bars Y		Bars Z								Per Foot of Barrel		Curb		Total	
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Length	Wt	Length	Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	Length	Wt	Length	Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	10' - 0"	4' - 0"	10"	8"	162	#6	6"	21' - 9"	5,292	108	#6	9"	10' - 7"	1,717	9' - 1"	1,473	162	#6	6"	9' - 7"	2,332	14	18"	39' - 9"	372	66	18"	39' - 9"	1,752	82	12"	4' - 0"	219	41	12"	5' - 0"	137	9' - 8"	265	21' - 9"	58	46	128	1.654	339.0	1.6	186	67.8	13,745
3	10' - 0"	4' - 0"	10"	8"	162	#6	6"	32' - 5"	7,888	108	#6	9"	10' - 7"	1,717	9' - 1"	1,473	162	#6	6"	19' - 7"	4,765	21	18"	39' - 9"	558	95	18"	39' - 9"	2,523	82	12"	4' - 0"	219	82	12"	5' - 0"	274	9' - 8"	530	32' - 5"	87	68	189	2.412	498.7	2.4	276	98.9	20,223
4	10' - 0"	4' - 0"	10"	8"	162	#6	6"	43' - 1"	10,483	108	#6	9"	10' - 7"	1,717	9' - 1"	1,473	162	#6	6"	29' - 7"	7,198	28	18"	39' - 9"	743	124	18"	39' - 9"	3,293	82	12"	4' - 0"	219	123	12"	5' - 0"	411	9' - 8"	794	43' - 1"	115	90	251	3.169	658.3	3.2	366	130.0	26,697
5	10' - 0"	4' - 0"	10"	8"	162	#6	6"	53' - 9"	13,079	108	#6	9"	10' - 7"	1,717	9' - 1"	1,473	162	#6	6"	39' - 7"	9,632	35	18"	39' - 9"	929	153	18"	39' - 9"	4,063	82	12"	4' - 0"	219	164	12"	5' - 0"	548	9' - 8"	1,059	53' - 9"	144	110	306	3.926	818.0	4.0	450	161.0	33,169
6	10' - 0"	4' - 0"	10"	8"	162	#6	6"	66' - 11"	16,282	108	#6	9"	10' - 7"	1,717	9' - 1"	1,473	162	#6	6"	49' - 7"	12,065	42	18"	39' - 9"	1,115	182	18"	39' - 9"	4,833	82	12"	4' - 0"	219	205	12"	5' - 0"	685	9' - 8"	1,324	66' - 1"	177	132	367	4.683	992.8	4.8	544	192.1	40,257
2	10' - 0"	5' - 0"	10"	8"	162	#6	6"	21' - 9"	5,292	108	#6	9"	11' - 7"	1,879	9' - 1"	1,473	162	#6	6"	9' - 7"	2,332	14	18"	39' - 9"	372	72	18"	39' - 9"	1,912	82	12"	5' - 0"	274	41	12"	5' - 0"	137	11' - 8"	320	21' - 9"	58	46	128	1.728	349.8	1.6	186	70.7	14,177
3	10' - 0"	5' - 0"	10"	8"	162	#6	6"	32' - 5"	7,888	108	#6	9"	11' - 7"	1,879	9' - 1"	1,473	162	#6	6"	19' - 7"	4,765	21	18"	39' - 9"	558	103	18"	39' - 9"	2,735	82	12"	5' - 0"	274	82	12"	5' - 0"	274	11' - 8"	639	32' - 5"	87	68	189	2.510	512.1	2.4	276	102.8	20,761
4	10' - 0"	5' - 0"	10"	8"	162	#6	6"	43' - 1"	10,483	108	#6	9"	11' - 7"	1,879	9' - 1"	1,473	162	#6	6"	29' - 7"	7,198	28	18"	39' - 9"	743	134	18"	39' - 9"	3,558	82	12"	5' - 0"	274	123	12"	5' - 0"	411	11' - 8"	959	43' - 1"	115	90	251	3.292	674.5	3.2	366	134.9	27,344
5	10' - 0"	5' - 0"	10"	8"	162	#6	6"	53' - 9"	13,079	108	#6	9"	11' - 7"	1,879	9' - 1"	1,473	162	#6	6"	39' - 7"	9,632	35	18"	39' - 9"	929	165	18"	39' - 9"	4,381	82	12"	5' - 0"	274	164	12"	5' - 0"	548	11' - 8"	1,278	53' - 9"	144	110	306	4.074	836.8	4.0	450	166.9	33,923
6	10' - 0"	5' - 0"	10"	8"	162	#6	6"	66' - 11"	16,282	108	#6	9"	11' - 7"	1,879	9' - 1"	1,473	162	#6	6"	49' - 7"	12,065	42	18"	39' - 9"	1,115	196	18"	39' - 9"	5,204	82	12"	5' - 0"	274	205	12"	5' - 0"	685	11' - 8"	1,598	66' - 1"	177	132	367	4.856	1,014.4	4.8	544	199.0	41,119
2	10' - 0"	6' - 0"	10"	8"	162	#6	6"	21' - 9"	5,292	108	#6	9"	12' - 7"	2,041	9' - 1"	1,473	162	#6	6"	9' - 7"	2,332	14	18"	39' - 9"	372	78	18"	39' - 9"	2,071	82	12"	6' - 0"	329	41	12"	5' - 0"	137	13' - 8"	374	21' - 9"	58	46	128	1.802	360.5	1.6	186	73.7	14,607
3	10' - 0"	6' - 0"	10"	8"	162	#6	6"	32' - 5"	7,888	108	#6	9"	12' - 7"	2,041	9' - 1"	1,473	162	#6	6"	19' - 7"	4,765	21	18"	39' - 9"	558	111	18"	39' - 9"	2,947	82	12"	6' - 0"	329	82	12"	5' - 0"	274	13' - 8"	749	32' - 5"	87	68	189	2.609	525.6	2.4	276	106.8	21,300
4	10' - 0"	6' - 0"	10"	8"	162	#6	6"	43' - 1"	10,483	108	#6	9"	12' - 7"	2,041	9' - 1"	1,473	162	#6	6"	29' - 7"	7,198	28	18"	39' - 9"	743	144	18"	39' - 9"	3,824	82	12"	6' - 0"	329	123	12"	5' - 0"	411	13' - 8"	1,123	43' - 1"	115	90	251	3.416	690.6	3.2	366	139.8	27,991
5	10' - 0"	6' - 0"	10"	8"	162	#6	6"	53' - 9"	13,079	108	#6	9"	12' - 7"	2,041	9' - 1"	1,473	162	#6	6"	39' - 7"	9,632	35	18"	39' - 9"	929	177	18"	39' - 9"	4,700	82	12"	6' - 0"	329	164	12"	5' - 0"	548	13' - 8"	1,497	53' - 9"	144	110	306	4.222	855.7	4.0	450	172.9	34,678
6	10' - 0"	6' - 0"	10"	8"	162	#6	6"	66' - 11"	16,282	108	#6	9"	12' - 7"	2,041	9' - 1"	1,473	162	#6	6"	49' - 7"	12,065	42	18"	39' - 9"	1,115	210	18"	39' - 9"	5,576	82	12"	6' - 0"	329	205	12"	5' - 0"	685	13' - 8"	1,872	66' - 1"	177	132	367	5.029	1,036.0	4.8	544	205.9	41,982
2	10' - 0"	7' - 0"	10"	8"	162	#6	6"	21' - 9"	5,292	108	#6	9"	13' - 7"	2,203	9' - 1"	1,473	162	#6	6"	9' - 7"	2,332	14	18"	39' - 9"	372	78	18"	39' - 9"	2,071	82	12"	7' - 0"	383	41	12"	5' - 0"	137	15' - 8"	429	21' - 9"	58	46	128	1.877	367.3	1.6	186	76.7	14,878
3	10' - 0"	7' - 0"	10"	8"	162	#6	6"	32' - 5"	7,888	108	#6	9"	13' - 7"	2,203	9' - 1"	1,473	162	#6	6"	19' - 7"	4,765	21	18"	39' - 9"	558	111	18"	39' - 9"	2,947	82	12"	7' - 0"	383	82	12"	5' - 0"	274	15' - 8"	858	32' - 5"	87	68	189	2.708	533.7	2.4	276	110.7	21,625
4	10' - 0"	7' - 0"	10"	8"	162	#6	6"	43' - 1"	10,483	108	#6	9"	13' - 7"	2,203	9' - 1"	1,473	162	#6	6"	29' - 7"	7,198	28	18"	39' - 9"	743	144	18"	39' - 9"	3,824	82	12"	7' - 0"	383	123	12"	5' - 0"	411	15' - 8"	1,287	43' - 1"	115	90	251	3.539	700.1	3.2	366	144.8	28,371
5	10' - 0"	7' - 0"	10"	8"	162	#6	6"	53' - 9"	13,079	108	#6	9"	13' - 7"	2,203	9' - 1"	1,473	162	#6	6"	39' - 7"	9,632	35	18"	39' - 9"	929	177	18"	39' - 9"	4,700	82	12"	7' - 0"	383	164	12"	5' - 0"	548	15' - 8"	1,716	53' - 9"	144	110	306	4.370	866.6	4.0	450	178.8	35,113
6	10' - 0"	7' - 0"	10"	8"	162	#6	6"	66' - 11"	16,282	108	#6	9"	13' - 7"	2,203	9' - 1"	1,473	162	#6	6"	49' - 7"	12,065	42	18"	39' - 9"	1,115	210	18"	39' - 9"	5,576	82	12"	7' - 0"	383	205	12"	5' - 0"	685	15' - 8"	2,145	66' - 1"	177	132	367	5.202	1,048.2	4.8	544	212.9	42,471
2	10' - 0"	8' - 0"	10"	8"	162	#6	6"	21' - 9"	5,292	108	#6	9"	14' - 7"	2,366	9' - 1"	1,473	162	#6	6"	9' - 7"	2,332	14	18"	39' - 9"	372	84	18"	39' - 9"	2,230	82	12"	8' - 0"	438	41	12"	5' - 0"	137	17' - 8"	484	21' - 9"	58	46	128	1.951	378.1	1.6	186	79.7	15,310
3	10' - 0"	8' - 0"	10"	8"	162	#6	6"	32' - 5"	7,888	108	#6	9"	14' - 7"	2,366	9' - 1"	1,473	162	#6	6"	19' - 7"	4,765	21	18"	39' - 9"	558	119	18"	39' - 9"	3,160	82	12"	8' - 0"	438	82	12"	5' - 0"	274	17' - 8"	968	32' - 5"	87	68	189	2.807	547.3	2.4	276	114.7	22,166
4	10' - 0"	8' - 0"	10"	8"	162	#6	6"	43' - 1"	10,483	108	#6	9"	14' - 7"	2,366	9' - 1"	1,473	162	#6	6"	29' - 7"	7,198	28	18"	39' - 9"	743	154	18"	39' - 9"	4,089	82	12"	8' - 0"	438	123	12"	5' - 0"	411	17' - 8"	1,452	43' - 1"	115	90	251	3.663	716.3	3.2	366	149.7	29,019
5	10' - 0"	8' - 0"	10"	8"	162	#6	6"	53' - 9"	13,079	108	#6	9"	14' - 7"	2,366	9' - 1"	1,473	162	#6	6"	39' - 7"	9,632	35	18"	39' - 9"	929	189	18"	39' - 9"	5,019	82	12"	8' - 0"	438	164	12"	5' - 0"	548	17' - 8"	1,935	53' - 9"	144	110	306	4.519	885.5	4.0	450	184.7	35,869
6	10' - 0"	8' - 0"	10"	8"	162	#6	6"	66' - 11"	16,282	108	#6	9"	14' - 7"	2,366	9' - 1"	1,473	162	#6	6"	49' - 7"	12,065	42	18"	39' - 9"	1,115	224	18"	39' - 9"	5,948	82	12"	8' - 0"	438	205	12"	5' - 0"	685	17' - 8"	2,419	66' - 1"	177	132	367	5.374	1,069.8	4.8	544	219.7	43,335
2	10' - 0"	9' - 0"	10"	8"	162	#6	6"	21' - 9"	5,292	162	#6	6"	15' - 7"	3,792	9' - 1"	2,210	162	#6	6"	9' - 7"	2,332	14	18"	39' - 9"	372	90	18"	39' - 9"	2,390	108	9"	9' - 0"	649	41	12"	5' - 0"	137	19' - 8"	539	21' - 9"	58	46	128	2.025	442.8	1.6	186	82.6	17,899
3	10' - 0"	9' - 0"	10"	8"	162	#6	6"	32' - 5"	7,888	162	#6	6"	15' - 7"	3,792	9' - 1"	2,210	162	#6	6"	19' - 7"	4,765	21	18"	39' - 9"	558	127	18"	39' - 9"	3,372	108	9"	9' - 0"	649	82	12"	5' - 0"	274	19' - 8"	1,077	32' - 5"	87	68	189	2.905	614.6	2.4	276	118.6	24,861
4	10' - 0"	9' - 0"	10"	8"	162	#6	6"	43' - 1"	10,483	162	#6	6"	15' - 7"	3,792	9' - 1"	2,210	162	#6	6"	29' - 7"	7,198	28	18"	39' - 9"	743	164	18"	39' - 9"	4,355	108	9"	9' - 0"	649	123	12"	5' - 0"	411	19' - 8"	1,616	43' - 1"	115	90	251	3.786	786.4	3.2	366	154.6	31,823
5	10' - 0"	9' - 0"	10"	8"	162	#6	6"	53' - 9"	13,079	162	#6	6"	15' - 7"	3,792	9' - 1"	2,210	162	#6	6"	39' - 7"	9,632	35	18"	39' - 9"	929	201	18"	39' - 9"	5,337	108	9"	9' - 0"	649	164	12"	5' - 0"	548	19' - 8"	2,155	53' - 9"	144	110	306	4.667	958.3	4.0	450	190.7	38,781
6	10' - 0"	9' - 0"	10"	8"	162	#6	6"	66' - 11"	16,282	162	#6	6"	15' - 7"	3,792	9' - 1"	2,210	162	#6	6"	49' - 7"	12,065	42	18"	39' - 9"	1,115	238	18"	39' - 9"	6,320	108	9"	9' - 0"	649	205	12"	5' - 0"	685	19' - 8"	2,693	66' - 1"	177	132	367	5.547	1,145.3	4.8	544	226.7	46,355
2	10' - 0"	10' - 0"	10"	8"	162	#6	6"	21' - 9"	5,292	162	#6	6"	16' - 7"	4,035	9' - 1"	2,210	162	#6	6"	9' - 7"	2,332	14	18"	39' - 9"	372	90	18"	39' - 9"	2,390	162	6"	10' - 0"	1,082	41	12"	5' - 0"	137	21' - 8"	593	21' - 9"	58	46	128	2.099	461.1	1.6	186	85.6	18,629
3	10' - 0"	10' - 0"	10"	8"	162	#6	6"	32' - 5"	7,888	162	#6	6"	16' - 7"	4,035	9' - 1"	2,210	162	#6	6"	19' - 7"	4,765	21	18"	39' - 9"	558	127	18"	39' - 9"	3,372	162	6"	10' - 0"	1,082	82	12"	5' - 0"	274	21' - 8"	1,187	32' - 5"	87	68	189	3.004	634.3	2.4	276	122.6	25,647
4	10' - 0"	10' - 0"	10"	8"	162	#6	6"	43' - 1"	10,483	162	#6	6"	16' - 7"	4,035	9' - 1"	2,210	162	#6	6"	29' - 7"	7,198	28	18"	39' - 9"	743	164	18"	39' - 9"	4,355	162	6"	10' - 0"	1,082	123	12"	5' - 0"	411	21' - 8"	1,780	43' - 1"	115	90	251	3.909	807.4	3.2	366	159.6	32,663
5	10' - 0"	10' - 0"	10"	8"	162	#6	6"	53' - 9"	13,079	162	#6	6"	16' - 7"	4,035	9' - 1"	2,210	162	#6	6"	39' - 7"	9,632	35	18"	39' - 9"	929	201	18"	39' - 9"	5,337	162	6"	10' - 0"	1,082	164	12"	5' - 0"	548	21' - 8"	2,374	53' - 9"	144	110	306	4.815	980.7	4.0	450	196.6	39,676
6	10' - 0"	10' - 0"	10"	8"	162	#6	6"	66' - 11"	16,282	162	#6	6"	16' - 7"	4,035	9' - 1"	2,210	162	#6	6"	49' - 7"	12,065	42	18"	39' - 9"	1,115	238	18"	39' - 9"	6,320	162	6"	10' - 0"	1,082	205	12"	5' - 0"	685	21' - 8"	2,967	66' - 1"	177	132	367	5.720	1,169.0	4.8	544	233.6	47,305

(5) Bar lengths over 60' include one bar lap; refer to MATERIAL NOTES for minimum lap lengths.

HL93 LOADING SHEET 2 OF 2

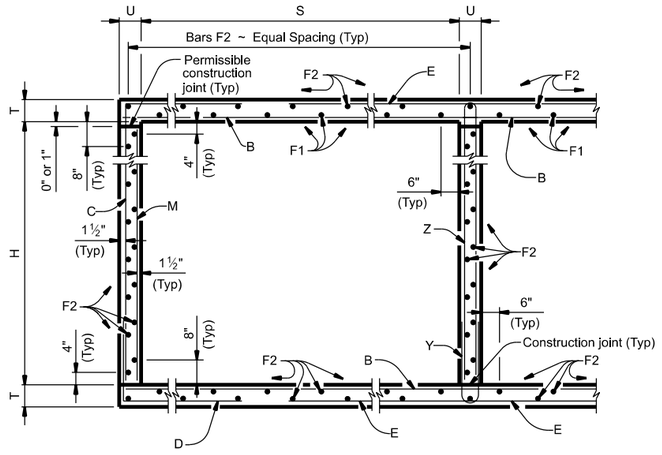
Texas Department of Transportation | Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

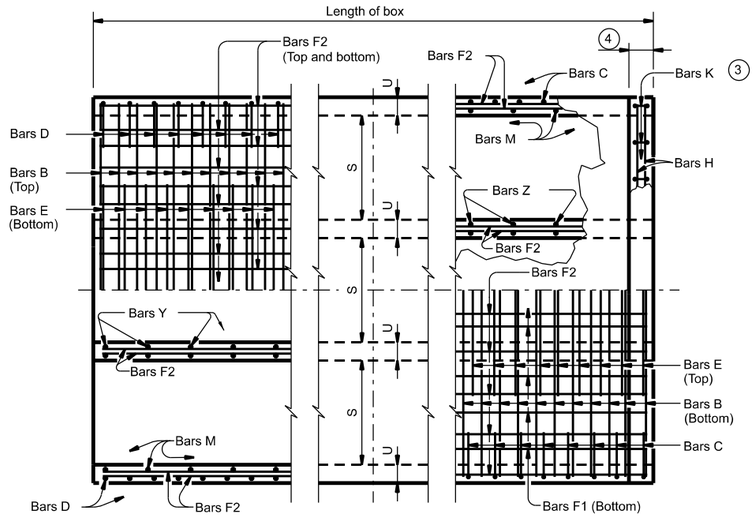
10'-0" SPAN
2' TO 13' FILL

MC-10-13

FILE:	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		055

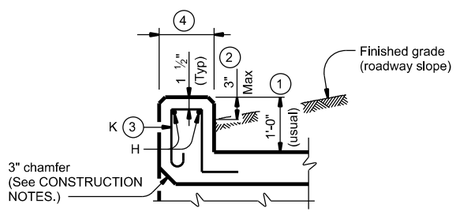


TYPICAL SECTION



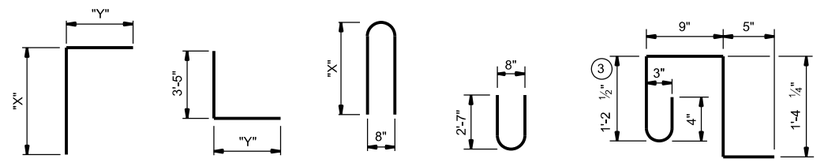
BOTTOM SLAB TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
4'-0"	4'-11 ½"	6'-0 ½"
5'-0"	5'-11 ½"	6'-0 ½"
6'-0"	6'-11 ½"	6'-0 ½"
7'-0"	7'-11 ½"	6'-0 ½"
8'-0"	8'-11 ½"	6'-0 ½"
9'-0"	9'-11 ½"	6'-0 ½"
10'-0"	10'-11 ½"	6'-0 ½"



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

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

2. For vehicle safety, the following requirements must be met:
   · For structures without bridge rail, construct curbs no more than 3" above finished grade.
   · For structures with bridge rail, construct curbs flush with finished grade.
   Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Provide Class C concrete (f'_c = 3,600 psi) for culvert barrel and curb.
Provide bar laps, where required, as follows:
· Uncoated or galvanized ~ #4 = 1'-8" Min
· Uncoated or galvanized ~ #5 = 2'-1" Min
· Uncoated or galvanized ~ #6 = 2'-6" Min

GENERAL NOTES:

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

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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation | Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

10'-0" SPAN
2' TO 23' FILL

MC-10-23

FILE:	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		056

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

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

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																														QUANTITIES					
					Bars B (5)					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4							Bars H 4 ~ #4 (5)		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	10' - 0"	4' - 0"	13"	11"	162	#6	6"	22' - 6"	5,475	108	#6	9"	11' - 0"	1,784	9' - 6"	1,541	162	#6	6"	9' - 10"	2,393	14	18"	39' - 9"	372	66	18"	39' - 9"	1,752	108	9"	4' - 0"	289	54	9"	5' - 7"	201	10' - 3"	370	22' - 6"	60	48	134	2.233	354.4	1.7	194	91.0	14,371
3	10' - 0"	4' - 0"	13"	11"	162	#6	6"	33' - 5"	8,131	108	#6	9"	11' - 0"	1,784	9' - 6"	1,541	162	#6	6"	19' - 10"	4,826	21	18"	39' - 9"	558	95	18"	39' - 9"	2,523	108	9"	4' - 0"	289	108	9"	5' - 7"	403	10' - 3"	739	33' - 5"	89	70	195	3.245	519.9	2.5	284	132.3	21,078
4	10' - 0"	4' - 0"	13"	11"	162	#6	6"	44' - 4"	10,787	108	#6	9"	11' - 0"	1,784	9' - 6"	1,541	162	#6	6"	29' - 10"	7,259	28	18"	39' - 9"	743	124	18"	39' - 9"	3,293	108	9"	4' - 0"	289	162	9"	5' - 7"	604	10' - 3"	1,109	44' - 4"	118	92	256	4.257	685.2	3.3	374	173.6	27,783
5	10' - 0"	4' - 0"	13"	11"	162	#6	6"	55' - 3"	13,444	108	#6	9"	11' - 0"	1,784	9' - 6"	1,541	162	#6	6"	39' - 10"	9,692	35	18"	39' - 9"	929	153	18"	39' - 9"	4,063	108	9"	4' - 0"	289	216	9"	5' - 7"	806	10' - 3"	1,479	55' - 3"	148	114	317	5.269	850.7	4.1	465	214.9	34,492
6	10' - 0"	4' - 0"	13"	11"	162	#6	6"	68' - 8"	16,708	108	#6	9"	11' - 0"	1,784	9' - 6"	1,541	162	#6	6"	49' - 10"	12,126	42	18"	39' - 9"	1,115	182	18"	39' - 9"	4,833	108	9"	4' - 0"	289	270	9"	5' - 7"	1,007	10' - 3"	1,849	67' - 10"	181	136	379	6.280	1,031.3	4.9	560	256.1	41,812
2	10' - 0"	5' - 0"	13"	11"	162	#6	6"	22' - 6"	5,475	108	#6	9"	12' - 0"	1,947	9' - 6"	1,541	162	#6	6"	9' - 10"	2,393	14	18"	39' - 9"	372	72	18"	39' - 9"	1,912	108	9"	5' - 0"	361	54	9"	5' - 7"	201	12' - 3"	442	22' - 6"	60	48	134	2.335	366.1	1.7	194	95.1	14,838
3	10' - 0"	5' - 0"	13"	11"	162	#6	6"	33' - 5"	8,131	108	#6	9"	12' - 0"	1,947	9' - 6"	1,541	162	#6	6"	19' - 10"	4,826	21	18"	39' - 9"	558	103	18"	39' - 9"	2,735	108	9"	5' - 0"	361	108	9"	5' - 7"	403	12' - 3"	884	33' - 5"	89	70	195	3.381	534.7	2.5	284	137.7	21,670
4	10' - 0"	5' - 0"	13"	11"	162	#6	6"	44' - 4"	10,787	108	#6	9"	12' - 0"	1,947	9' - 6"	1,541	162	#6	6"	29' - 10"	7,259	28	18"	39' - 9"	743	134	18"	39' - 9"	3,558	108	9"	5' - 0"	361	162	9"	5' - 7"	604	12' - 3"	1,326	44' - 4"	118	92	256	4.426	703.2	3.3	374	180.3	28,500
5	10' - 0"	5' - 0"	13"	11"	162	#6	6"	55' - 3"	13,444	108	#6	9"	12' - 0"	1,947	9' - 6"	1,541	162	#6	6"	39' - 10"	9,692	35	18"	39' - 9"	929	165	18"	39' - 9"	4,381	108	9"	5' - 0"	361	216	9"	5' - 7"	806	12' - 3"	1,768	55' - 3"	148	114	317	5.472	871.7	4.1	465	223.0	35,334
6	10' - 0"	5' - 0"	13"	11"	162	#6	6"	68' - 8"	16,708	108	#6	9"	12' - 0"	1,947	9' - 6"	1,541	162	#6	6"	49' - 10"	12,126	42	18"	39' - 9"	1,115	196	18"	39' - 9"	5,204	108	9"	5' - 0"	361	270	9"	5' - 7"	1,007	12' - 3"	2,209	67' - 10"	181	136	379	6.518	1,055.5	4.9	560	265.6	42,778
2	10' - 0"	6' - 0"	13"	11"	162	#6	6"	22' - 6"	5,475	108	#6	9"	13' - 0"	2,109	9' - 6"	1,541	162	#6	6"	9' - 10"	2,393	14	18"	39' - 9"	372	78	18"	39' - 9"	2,071	108	9"	6' - 0"	433	54	9"	5' - 7"	201	14' - 3"	514	22' - 6"	60	48	134	2.437	377.7	1.7	194	99.2	15,303
3	10' - 0"	6' - 0"	13"	11"	162	#6	6"	33' - 5"	8,131	108	#6	9"	13' - 0"	2,109	9' - 6"	1,541	162	#6	6"	19' - 10"	4,826	21	18"	39' - 9"	558	111	18"	39' - 9"	2,947	108	9"	6' - 0"	433	108	9"	5' - 7"	403	14' - 3"	1,028	33' - 5"	89	70	195	3.516	549.4	2.5	284	143.1	22,260
4	10' - 0"	6' - 0"	13"	11"	162	#6	6"	44' - 4"	10,787	108	#6	9"	13' - 0"	2,109	9' - 6"	1,541	162	#6	6"	29' - 10"	7,259	28	18"	39' - 9"	743	144	18"	39' - 9"	3,824	108	9"	6' - 0"	433	162	9"	5' - 7"	604	14' - 3"	1,542	44' - 4"	118	92	256	4.596	721.1	3.3	374	187.1	29,216
5	10' - 0"	6' - 0"	13"	11"	162	#6	6"	55' - 3"	13,444	108	#6	9"	13' - 0"	2,109	9' - 6"	1,541	162	#6	6"	39' - 10"	9,692	35	18"	39' - 9"	929	177	18"	39' - 9"	4,700	108	9"	6' - 0"	433	216	9"	5' - 7"	806	14' - 3"	2,056	55' - 3"	148	114	317	5.676	892.8	4.1	465	231.1	36,175
6	10' - 0"	6' - 0"	13"	11"	162	#6	6"	68' - 8"	16,708	108	#6	9"	13' - 0"	2,109	9' - 6"	1,541	162	#6	6"	49' - 10"	12,126	42	18"	39' - 9"	1,115	210	18"	39' - 9"	5,576	108	9"	6' - 0"	433	270	9"	5' - 7"	1,007	14' - 3"	2,570	67' - 10"	181	136	379	6.756	1,079.6	4.9	560	275.1	43,745
2	10' - 0"	7' - 0"	13"	11"	162	#6	6"	22' - 6"	5,475	108	#6	9"	14' - 0"	2,271	9' - 6"	1,541	162	#6	6"	9' - 10"	2,393	14	18"	39' - 9"	372	78	18"	39' - 9"	2,071	108	9"	7' - 0"	505	54	9"	5' - 7"	201	16' - 3"	586	22' - 6"	60	48	134	2.539	385.4	1.7	194	103.2	15,609
3	10' - 0"	7' - 0"	13"	11"	162	#6	6"	33' - 5"	8,131	108	#6	9"	14' - 0"	2,271	9' - 6"	1,541	162	#6	6"	19' - 10"	4,826	21	18"	39' - 9"	558	111	18"	39' - 9"	2,947	108	9"	7' - 0"	505	108	9"	5' - 7"	403	16' - 3"	1,172	33' - 5"	89	70	195	3.652	558.9	2.5	284	148.6	22,638
4	10' - 0"	7' - 0"	13"	11"	162	#6	6"	44' - 4"	10,787	108	#6	9"	14' - 0"	2,271	9' - 6"	1,541	162	#6	6"	29' - 10"	7,259	28	18"	39' - 9"	743	144	18"	39' - 9"	3,824	108	9"	7' - 0"	505	162	9"	5' - 7"	604	16' - 3"	1,759	44' - 4"	118	92	256	4.766	732.3	3.3	374	193.9	29,667
5	10' - 0"	7' - 0"	13"	11"	162	#6	6"	55' - 3"	13,444	108	#6	9"	14' - 0"	2,271	9' - 6"	1,541	162	#6	6"	39' - 10"	9,692	35	18"	39' - 9"	929	177	18"	39' - 9"	4,700	108	9"	7' - 0"	505	216	9"	5' - 7"	806	16' - 3"	2,345	55' - 3"	148	114	317	5.880	905.8	4.1	465	239.3	36,698
6	10' - 0"	7' - 0"	13"	11"	162	#6	6"	68' - 8"	16,708	108	#6	9"	14' - 0"	2,271	9' - 6"	1,541	162	#6	6"	49' - 10"	12,126	42	18"	39' - 9"	1,115	210	18"	39' - 9"	5,576	108	9"	7' - 0"	505	270	9"	5' - 7"	1,007	16' - 3"	2,931	67' - 10"	181	136	379	6.993	1,094.5	4.9	560	284.6	44,340
2	10' - 0"	8' - 0"	13"	11"	162	#6	6"	22' - 6"	5,475	108	#6	9"	15' - 0"	2,433	9' - 6"	1,541	162	#6	6"	9' - 10"	2,393	14	18"	39' - 9"	372	84	18"	39' - 9"	2,230	108	9"	8' - 0"	577	54	9"	5' - 7"	201	18' - 3"	658	22' - 6"	60	48	134	2.640	397.0	1.7	194	107.3	16,074
3	10' - 0"	8' - 0"	13"	11"	162	#6	6"	33' - 5"	8,131	108	#6	9"	15' - 0"	2,433	9' - 6"	1,541	162	#6	6"	19' - 10"	4,826	21	18"	39' - 9"	558	119	18"	39' - 9"	3,160	108	9"	8' - 0"	577	108	9"	5' - 7"	403	18' - 3"	1,317	33' - 5"	89	70	195	3.788	573.7	2.5	284	154.0	23,230
4	10' - 0"	8' - 0"	13"	11"	162	#6	6"	44' - 4"	10,787	108	#6	9"	15' - 0"	2,433	9' - 6"	1,541	162	#6	6"	29' - 10"	7,259	28	18"	39' - 9"	743	154	18"	39' - 9"	4,089	108	9"	8' - 0"	577	162	9"	5' - 7"	604	18' - 3"	1,975	44' - 4"	118	92	256	4.936	750.2	3.3	374	200.7	30,382
5	10' - 0"	8' - 0"	13"	11"	162	#6	6"	55' - 3"	13,444	108	#6	9"	15' - 0"	2,433	9' - 6"	1,541	162	#6	6"	39' - 10"	9,692	35	18"	39' - 9"	929	189	18"	39' - 9"	5,019	108	9"	8' - 0"	577	216	9"	5' - 7"	806	18' - 3"	2,633	55' - 3"	148	114	317	6.083	926.9	4.1	465	247.4	37,539
6	10' - 0"	8' - 0"	13"	11"	162	#6	6"	68' - 8"	16,708	108	#6	9"	15' - 0"	2,433	9' - 6"	1,541	162	#6	6"	49' - 10"	12,126	42	18"	39' - 9"	1,115	224	18"	39' - 9"	5,948	108	9"	8' - 0"	577	270	9"	5' - 7"	1,007	18' - 3"	3,292	67' - 10"	181	136	379	7.231	1,118.7	4.9	560	294.1	45,307
2	10' - 0"	9' - 0"	13"	11"	162	#6	6"	22' - 6"	5,475	162	#6	6"	16' - 0"	3,893	9' - 6"	2,312	162	#6	6"	9' - 10"	2,393	14	18"	39' - 9"	372	90	18"	39' - 9"	2,390	108	9"	9' - 0"	649	54	9"	5' - 7"	201	20' - 3"	730	22' - 6"	60	48	134	2.742	460.4	1.7	194	111.4	18,609
3	10' - 0"	9' - 0"	13"	11"	162	#6	6"	33' - 5"	8,131	162	#6	6"	16' - 0"	3,893	9' - 6"	2,312	162	#6	6"	19' - 10"	4,826	21	18"	39' - 9"	558	127	18"	39' - 9"	3,372	108	9"	9' - 0"	649	108	9"	5' - 7"	403	20' - 3"	1,461	33' - 5"	89	70	195	3.924	640.1	2.5	284	159.4	25,889
4	10' - 0"	9' - 0"	13"	11"	162	#6	6"	44' - 4"	10,787	162	#6	6"	16' - 0"	3,893	9' - 6"	2,312	162	#6	6"	29' - 10"	7,259	28	18"	39' - 9"	743	164	18"	39' - 9"	4,355	108	9"	9' - 0"	649	162	9"	5' - 7"	604	20' - 3"	2,191	44' - 4"	118	92	256	5.105	819.8	3.3	374	207.5	33,167
5	10' - 0"	9' - 0"	13"	11"	162	#6	6"	55' - 3"	13,444	162	#6	6"	16' - 0"	3,893	9' - 6"	2,312	162	#6	6"	39' - 10"	9,692	35	18"	39' - 9"	929	201	18"	39' - 9"	5,337	108	9"	9' - 0"	649	216	9"	5' - 7"	806	20' - 3"	2,922	55' - 3"	148	114	317	6.287	999.6	4.1	465	255.6	40,449
6	10' - 0"	9' - 0"	13"	11"	162	#6	6"	68' - 8"	16,708	162	#6	6"	16' - 0"	3,893	9' - 6"	2,312	162	#6	6"	49' - 10"	12,126	42	18"	39' - 9"	1,115	238	18"	39' - 9"	6,320	108	9"	9' - 0"	649	270	9"	5' - 7"	1,007	20' - 3"	3,652	67' - 10"	181	136	379	7.469	1,194.6	4.9	560	303.7	48,342
2	10' - 0"	10' - 0"	13"	11"	162	#6	6"	22' - 6"	5,475	162	#6	6"	17' - 0"	4,137	9' - 6"	2,312	162	#6	6"	9' - 10"	2,393	14	18"	39' - 9"	372	90	18"	39' - 9"	2,390	162	6"	10' - 0"	1,082	54	9"	5' - 7"	201	22' - 3"	803	22' - 6"	60	48	134	2.844	479.1	1.7	194	115.4	19,359
3	10' - 0"	10' - 0"	13"	11"	162	#6	6"	33' - 5"	8,131	162	#6	6"	17' - 0"	4,137	9' - 6"	2,312	162	#6	6"	19' - 10"	4,826	21	18"	39' - 9"	558	127	18"	39' - 9"	3,372	162	6"	10' - 0"	1,082	108	9"	5' - 7"	403	22' - 3"	1,605	33' - 5"	89	70	195	4.060	660.7	2.5	284	164.9	26,710
4	10' - 0"	10' - 0"	13"	11"	162	#6	6"	44' - 4"	10,787	162	#6	6"	17' - 0"	4,137	9' - 6"	2,312	162	#6	6"	29' - 10"	7,259	28	18"	39' - 9"	743	164	18"	39' - 9"	4,355	162	6"	10' - 0"	1,082	162	9"	5' - 7"	604	22' - 3"	2,408	44' - 4"	118	92	256	5.275	842.2	3.3	374	214.3	34,061
5	10' - 0"	10' - 0"	13"	11"	162	#6	6"	55' - 3"	13,444	162	#6	6"	17' - 0"	4,137	9' - 6"	2,312	162	#6	6"	39' - 10"	9,692	35	18"	39' - 9"	929	201	18"	39' - 9"	5,337	162	6"	10' - 0"	1,082	216	9"	5' - 7"	806	22' - 3"	3,210	55' - 3"	148	114	317	6.491	1,023.7	4.1	465	263.7	41,414
6	10' - 0"	10' - 0"	13"	11"	162	#6	6"	68' - 8"	16,708	162	#6	6"	17' - 0"	4,137	9' - 6"	2,312	162	#6	6"	49' - 10"	12,126	42	18"	39' - 9"	1,115	238	18"	39' - 9"	6,320	162	6"	10' - 0"	1,082	270	9"	5' - 7"	1,007	22' - 3"	4,013	67' - 10"	181	136	379	7.706	1,220.5	4.9	560	313.1	49,380

(5) Bar lengths over 60' include one bar lap; refer to MATERIAL NOTES for minimum lap lengths.

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

10'-0" SPAN
2' TO 23' FILL

MC-10-23

FILE:	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		057

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

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

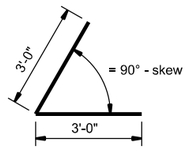
Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing (2~wings) (4)		Estimated Quantities per ft of Toewall (1~toewall)	
Maximum Wingwall Height Hw	W	X	Y	Z	Bars J1		Bars J2					
					Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'-0"	7"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

TABLE OF WINGWALL REINFORCING
(2~wings)

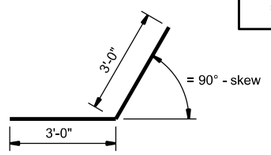
Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

TABLE OF TOEWALL REINFORCING

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



BARS D1



BARS D2

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

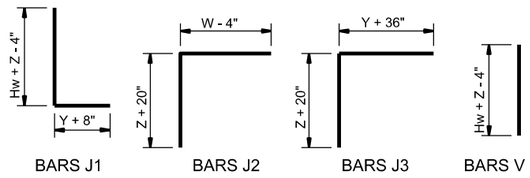
Hw = H + T + C
Lw = (Hw) (SL) ÷ cosine (θ) for Type PW-1
= (Hw - 1') (SL) ÷ cosine (θ) for Type PW-2 and Hw 4' ≥
= (Hw - 0.5') (SL) ÷ cosine (θ) for Type PW-2 and Hw 4' <

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

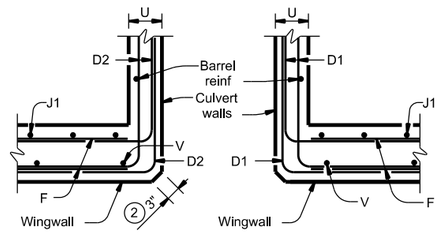
For precast culverts:
Ltw = [(N) (2 U + S) + (N - 1) (0.5')] ÷ cosine (θ)
Total Wingwall Area (two wings ~ SF)
= (2)(Hw)(Lw) for Type PW-1
= (2)(Hw)(Lw) - 6 SF for Type PW-2 and Hw 4' ≥
= (2)(Hw)(Lw) - 1.5 SF for Type PW-2 and Hw 4' <

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

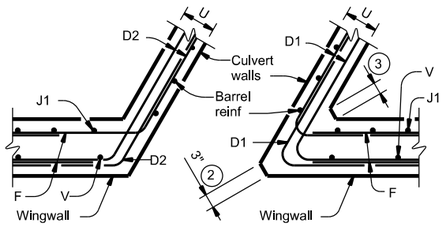
See applicable box culvert standard sheet for S, H, T, and U values.



BARS J1 BARS J2 BARS J3 BARS V



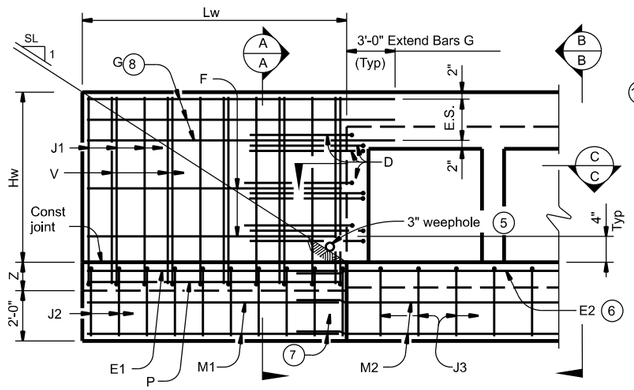
SECTION C-C - PW-1



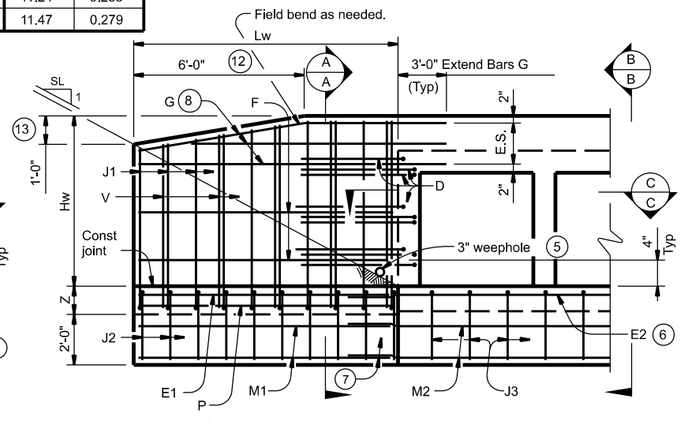
SECTION C-C - PW-2

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

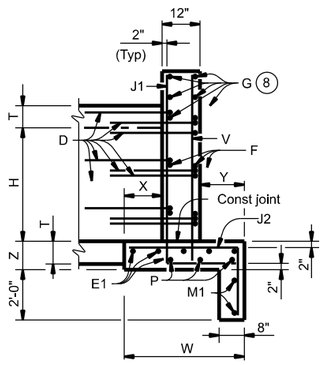
    Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
11. 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elswhere in the plans.
12. 3'-0"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



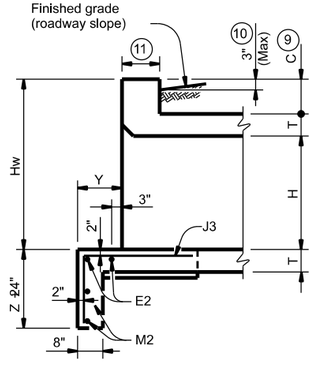
PARTIAL ELEVATION - PW-1



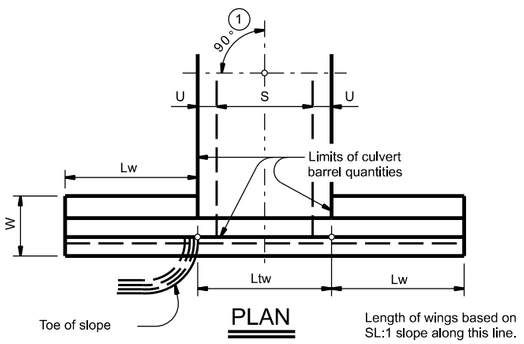
PARTIAL ELEVATION - PW-2



SECTION A-A
(Showing wing reinforcement.)



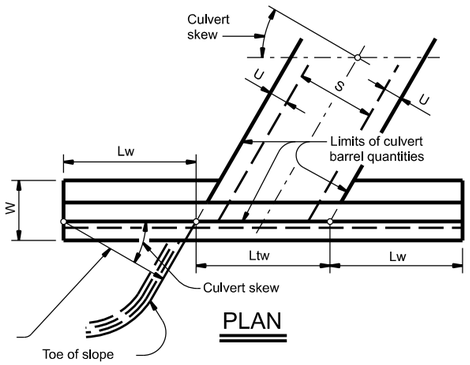
SECTION B-B
(Showing wing reinforcement.)



PLAN

Length of wings based on SL:1 slope along this line.

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

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

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

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

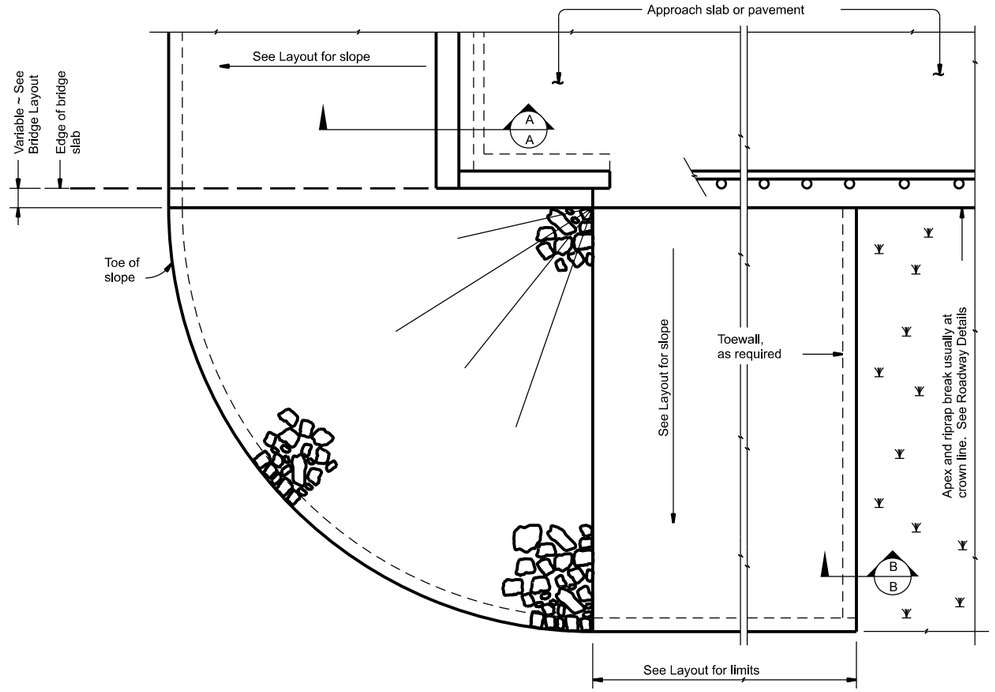
Texas Department of Transportation
Bridge Division Standard

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

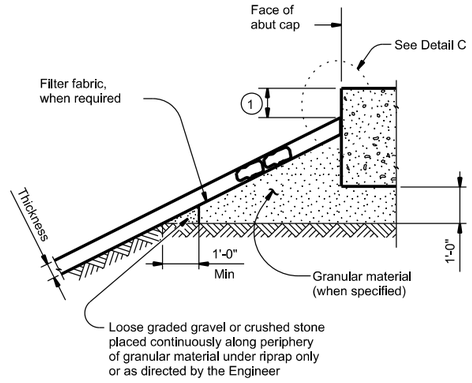
PW

FILE: pwstde01-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		058

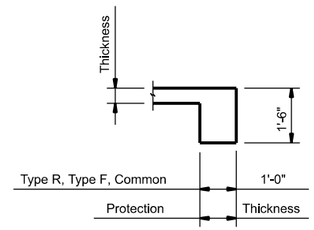
DATE: $DATE$ $TIME$
FILE: $FILE$



PLAN

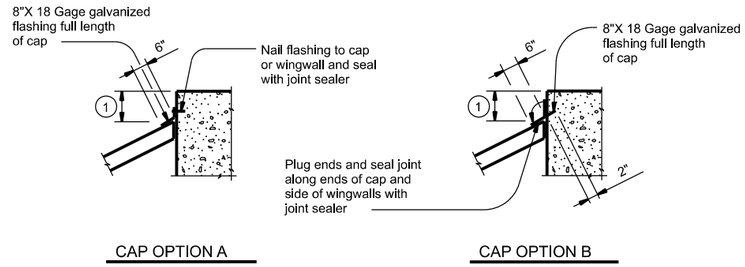


SECTION A-A AT CAP



SECTION B-B

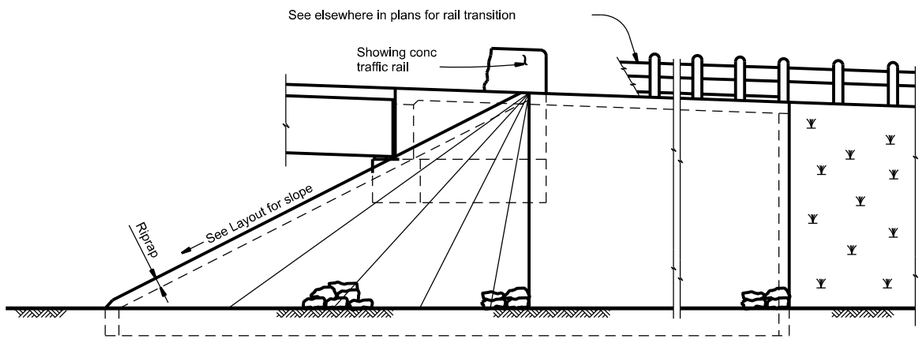
Provide toewall when shoulder drain is located adjacent to limits of stone riprap. Omit toewall when thickness of protection riprap is greater than 18".



CAP OPTION A

CAP OPTION B

DETAIL C



ELEVATION

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

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

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

FILE: srrstde1-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES
©TxDOT Apr 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		059

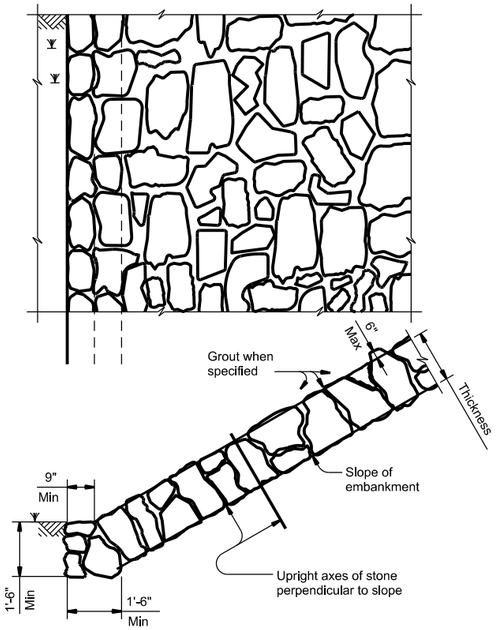


FIGURE 1 ~ TYPE R STONE RIPRAP

dry or grouted

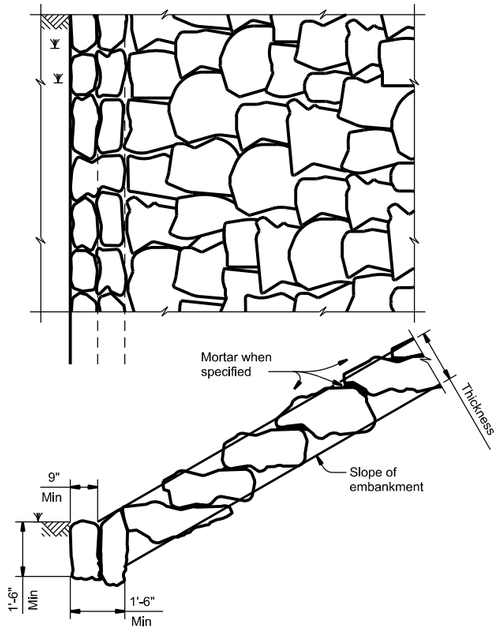


FIGURE 2 ~ TYPE F STONE RIPRAP

dry or mortared

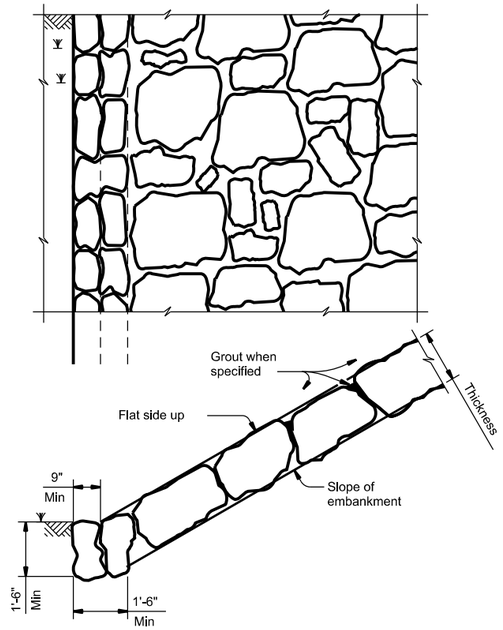


FIGURE 3 ~ TYPE F STONE RIPRAP

grouted

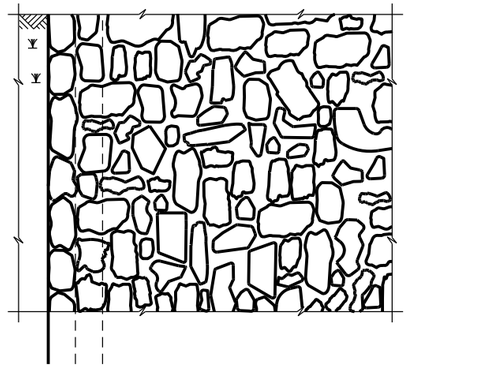


FIGURE 4 ~ COMMON STONE RIPRAP

dry or grouted

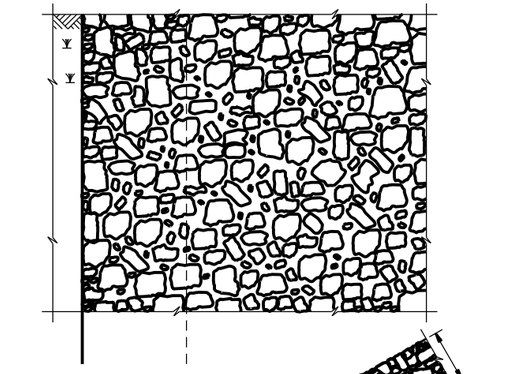


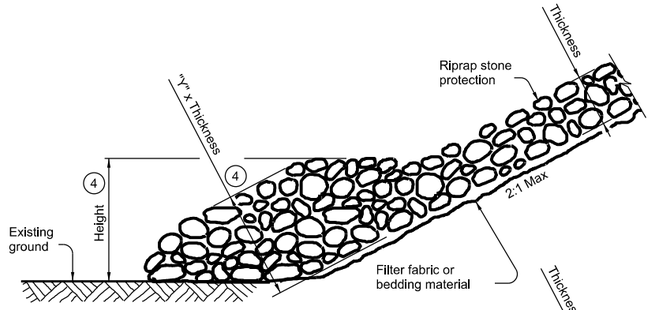
FIGURE 5 ~ PROTECTION STONE RIPRAP 5

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

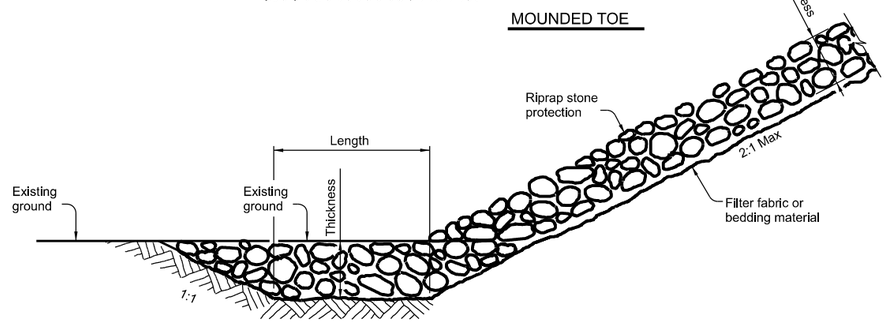
(3) Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.

(4) "Y" and Height need to be defined. See layout or detail sheet for values if this option is used.

(5) List Stone Protection as size (XX inch) and thickness (YY inch) on the layout.
Example: Riprap (Stone Protection) XX inch, Thickness = YY inch.



MOUNDED TOE



EXTENDED ROCK FILLED TRENCH

PROTECTION STONE RIPRAP TOE OPTIONS (5)

SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

FILE: srrstde1-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		060

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

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

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

Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing length (2~wings) (3)	
					Bars J1		Bars J2			
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'-8"	1'-9"	1'-3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'-2"	2'-0"	1'-6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'-8"	2'-3"	1'-9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'-2"	2'-6"	2'-0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'-8"	2'-9"	2'-3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'-2"	3'-0"	2'-6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'-8"	3'-3"	2'-9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'-2"	3'-6"	3'-0"	1'-0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'-8"	4'-0"	3'-0"	1'-1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'-2"	4'-6"	3'-0"	1'-3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING
(2~wings)

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

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

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

Hw = H + T + C - 0.250'
A = (Hw - 0.333') (SL)
B = (A) tangent (30°)
Lw = (A) ÷ cosine (30°)

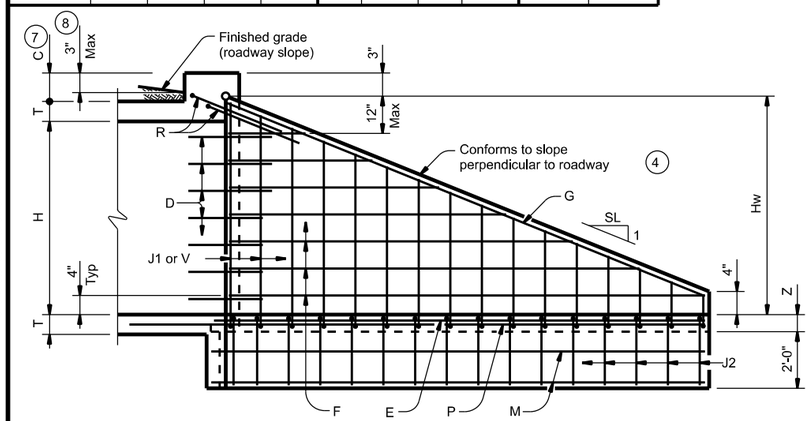
For cast-in-place culverts:
Ltw = (N) (S) + (N + 1) (U)

For precast culverts:
Ltw = (N) (2U + S) + (N - 1) (0.5')

Total wingwall area (two wings ~ SF) = (Hw + 0.333') (Lw)

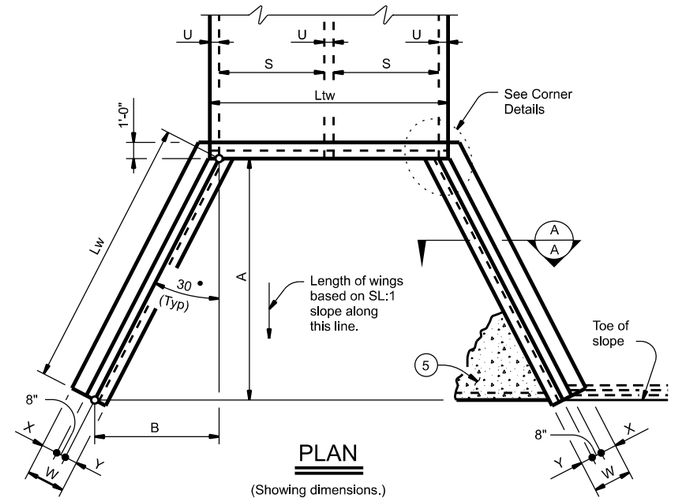
Hw = Height of wingwall
SL:1 = Side slope ratio (horizontal:1 vertical)
Lw = Length of wingwall
Ltw = Culvert toewall length
N = Number of culvert spans

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



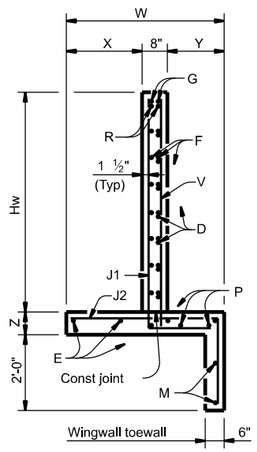
INSIDE ELEVATION

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

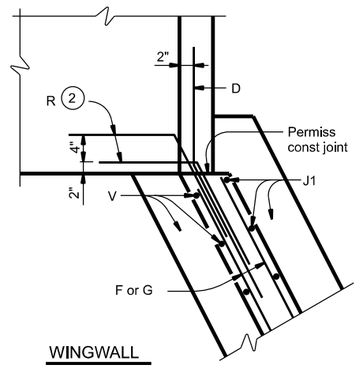


PLAN

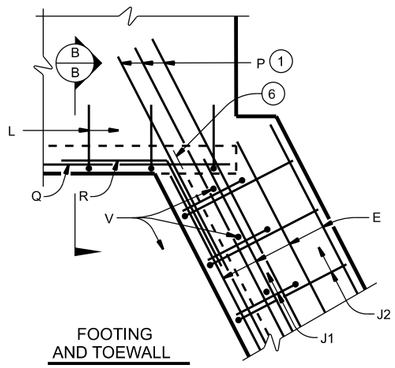
(Showing dimensions.)



SECTION A-A



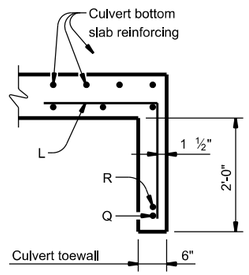
WINGWALL



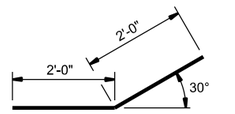
FOOTING AND TOEWALL

CORNER DETAILS

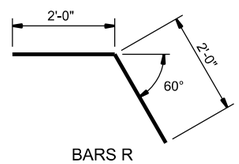
(Culvert and culvert toewall reinforcing not shown for clarity.)



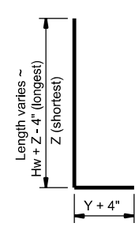
SECTION B-B (5)



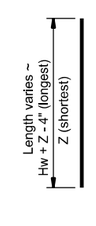
BARS D



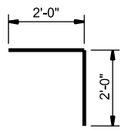
BARS R



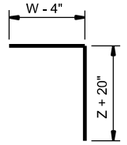
BARS J1



BARS V



BARS L



BARS J2

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

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

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

(4) Recommended values of side slope are: 2:1, 3:1, 4:1, and 6:1.

(5) When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, provide a 6" wide by 1'-6" deep reinforced concrete toewall along all edges of the riprap adjacent to natural ground; reinforce the toewall by extending typical riprap reinforcing into the toewall; and extend construction joints or grooved joints oriented in the direction of flow across the full distance of the riprap at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required.

(6) At Contractor's option, culvert toewall may be ended flush with wingwall toewall. Adjust reinforcing as needed.

(7) 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0, refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.

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

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

MATERIAL NOTES:
Provide Class C concrete (f'c=3,600 psi).
Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
In riprap concrete synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing unless noted otherwise.

GENERAL NOTES:
Designed according to AASHTO LRFD Bridge Design Specifications.
When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.
See Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.
The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

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

Texas Department of Transportation

Bridge Division Standard

CONCRETE WINGWALLS
WITH FLARED WINGS FOR 0° SKEW BOX CULVERTS

FW-0

FILE:	fw-0std-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT	February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS		0901	22	128	VARIOUS
		DIST	COUNTY		SHEET NO.
		PAR	HUNT		061

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

Maximum Wingwall Height Hw	Dimensions W	X	Y	Z	Variable Reinforcing Bars J1 Size	Bars J1 Spa	Bars J2 Size	Bars J2 Spa	Estimated Quantities per ft of wing length (2~wings) ③ Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'-8"	1'-9"	1'-3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'-2"	2'-0"	1'-6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'-8"	2'-3"	1'-9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'-2"	2'-6"	2'-0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'-8"	2'-9"	2'-3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'-2"	3'-0"	2'-6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'-8"	3'-3"	2'-9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'-2"	3'-6"	3'-0"	1'-0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'-8"	4'-0"	3'-0"	1'-1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'-2"	4'-6"	3'-0"	1'-3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING
(2~wings)

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

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

WING DIMENSION FORMULAS:

(All values are in feet.)

Hw = H + T + C - 0.250'
A = (Hw - 0.333')(SL)
B = (A) [tanget (θ + 15°)]
Lw = (A) ÷ [cosine (θ + 15°)]

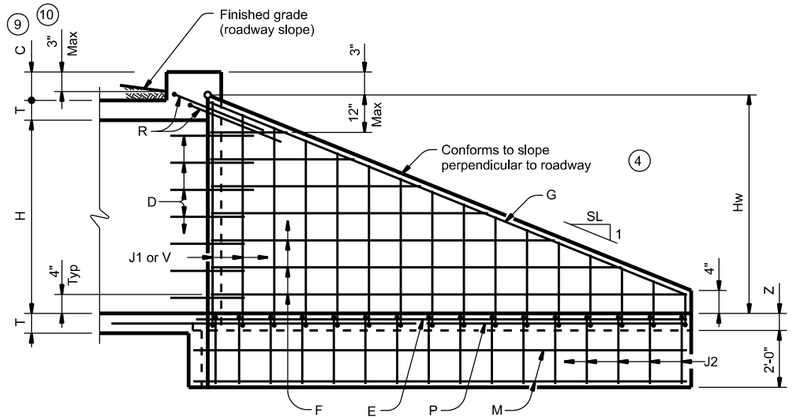
For cast-in-place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ cosine θ

For precast culverts:
Ltw = [(N) (2U + S) + (N - 1) (0.5')] ÷ cosine θ

Total wingwall area (two wings ~ SF) = 0.5 (Hw + 0.333') (Lw + A)

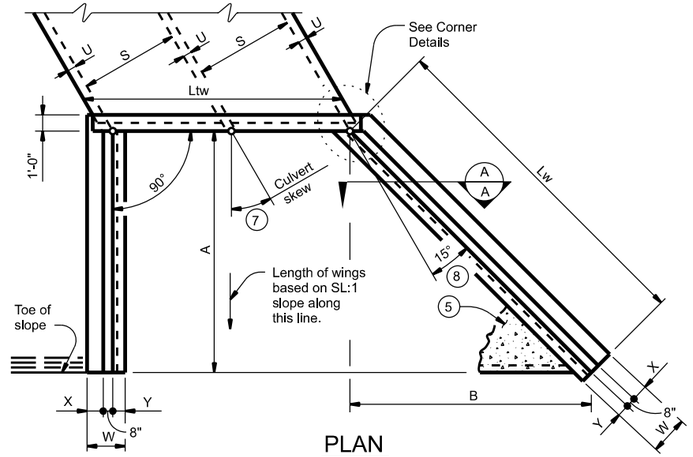
Hw = Height of wingwall
SL:1 = Side slope ratio (horizontal:1 vertical)
A = Length of short wingwalls
Lw = Length of long wingwall
Ltw = Culvert toewall length
N = Number of culvert spans
θ = Culvert skew

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



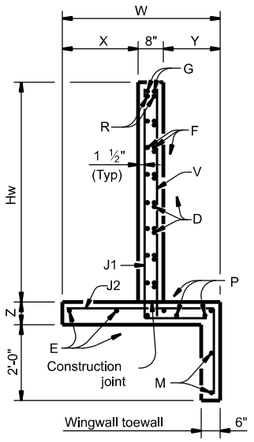
INSIDE ELEVATION

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

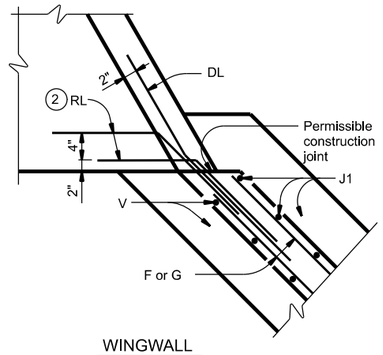


PLAN

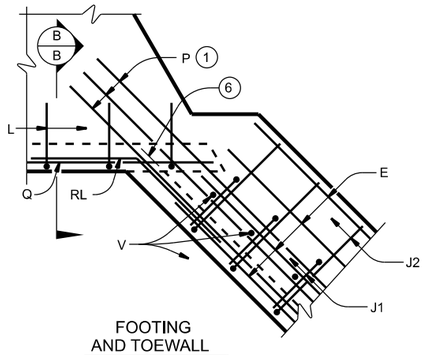
(Showing dimensions and 30° skew.)



SECTION A-A



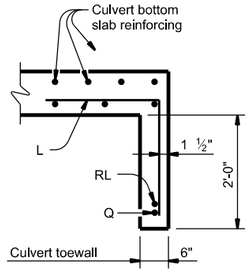
WINGWALL



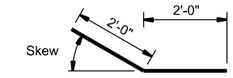
FOOTING AND TOEWALL

CORNER DETAILS

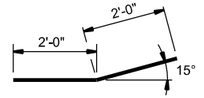
(Culvert and culvert toewall reinforcing not shown for clarity.)



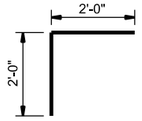
SECTION B-B ⑤



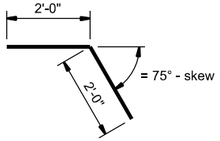
BARS DS
(Short wing)



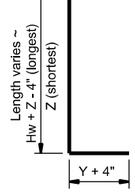
BARS DL
(Long wing)



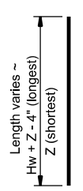
BARS RS
(Short wing)



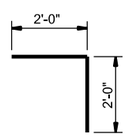
BARS RL
(Long wing)



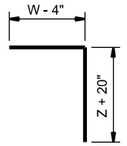
BARS J 1



BARS V



BARS L



BARS J2

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

② Adjust as necessary to maintain 1 1#2" clear cover and 4" minimum between bars.

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

④ Recommended values of side slope are: 2:1, 3:1, 4:1, and 6:1.

⑤ When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, provide a 6" wide by 1'-6" deep reinforced concrete toewall along all edges of the riprap adjacent to natural ground; reinforce the toewall by extending typical riprap reinforcing into the toewall; and extend construction joints or grooved joints oriented in the direction of flow across the full distance of the riprap at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required.

⑥ At Contractor's option, culvert toewall may be ended flush with wingwall toewall. Adjust reinforcing as needed.

⑦ Applicable values of skew are: 15°, 30°, and 45°.

⑧ Typical wingwall angle for all skews.

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

⑩ For vehicle safety, the following requirements must be met:
- For structures without bridge rail, construct curbs no more than 3" above finished grade.
- For structures with bridge rail, construct curbs flush with finished grade.

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

MATERIAL NOTES:

Provide Class C concrete (f'c=3,600 psi).
Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
In riprap concrete, synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.
See Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.
The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

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

Texas Department of Transportation

Bridge Division Standard

CONCRETE WINGWALLS
WITH FLARED WINGS FOR SKEWED BOX CULVERTS

FW-S

FILE: fw-sstde-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		062

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

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)
NBI • 01-117-00136-01-094	2X10X10																		210
NBI • 01-117-00203-01-016	2X10X8																		150
NBI • 01-117-00642-03-010	6X8X4																		40
NBI • 01-117-02139-04-011	BRIDGE																		20

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

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.

SPECIAL NOTE:

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

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

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE — NAME
10/10/23 — DATE

Texas Department of Transportation

Bridge Division Standard

BOX CULVERT SUPPLEMENT
WINGS AND END TREATMENTS

BCS

FILE:	bcsstde1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT	February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS		0901	22	128	VARIOUS
		DIST	COUNTY		SHEET NO.
		PAR	HUNT		063

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

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

Maximum Wingwall Height Hw	Dimensions W	X	Y	Z	Variable Reinforcing Bars J1 Size	Bars J1 Spa	Bars J2 Size	Bars J2 Spa	Estimated Quantities per ft of wing length (2~wings) ③ Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'-8"	1'-9"	1'-3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'-2"	2'-0"	1'-6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'-8"	2'-3"	1'-9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'-2"	2'-6"	2'-0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'-8"	2'-9"	2'-3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'-2"	3'-0"	2'-6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'-8"	3'-3"	2'-9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'-2"	3'-6"	3'-0"	1'-0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'-8"	4'-0"	3'-0"	1'-1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'-2"	4'-6"	3'-0"	1'-3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING
(2~wings)

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

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

WING DIMENSION FORMULAS:

(All values are in feet.)

Hw = H + T + C - 0.250'
Lw = (Hw - 0.333') (SL)

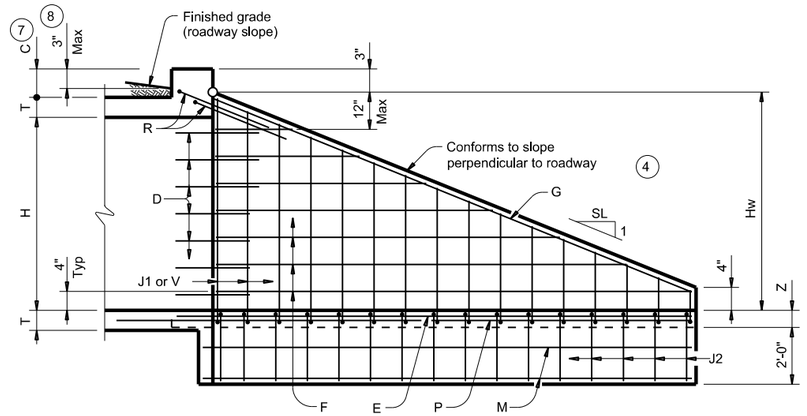
For cast-in-place culverts:
Ltw = (N) (S) + (N + 1) (U)

For precast culverts:
Ltw = (N) (2U + S) + (N - 1) (0.5')

Total Wingwall Area (two wings ~ SF) = (Hw + 0.333') (Lw)

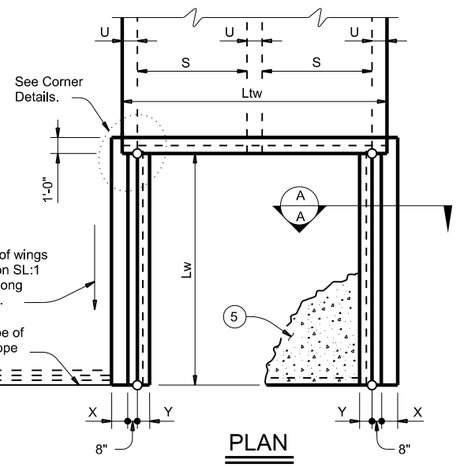
Hw = Height of wingwall
SL:1 = Side slope ratio (horizontal:1 vertical)
Lw = Length of wingwall
Ltw = Culvert toewall length
N = Number of culvert spans

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



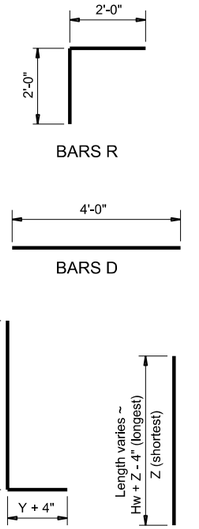
INSIDE ELEVATION

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



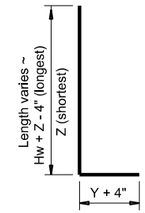
PLAN

(Showing dimensions.)



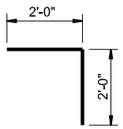
BARS R

BARS D

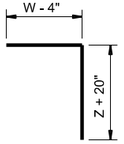


BARS J1

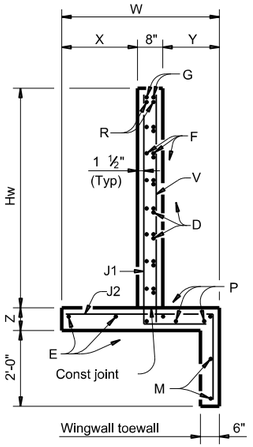
BARS V



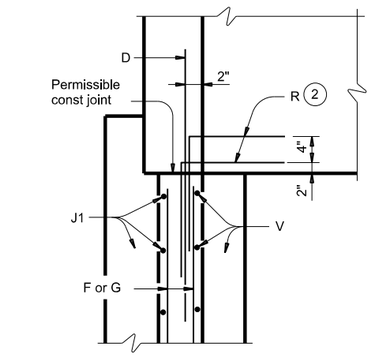
BARS L



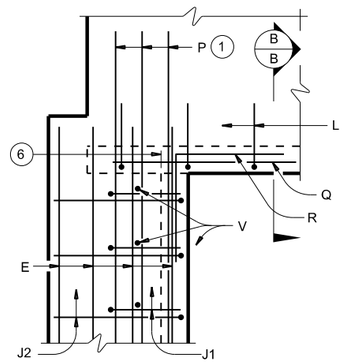
BARS J2



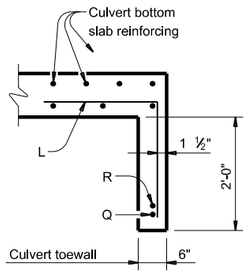
SECTION A-A



WINGWALL



FOOTING AND TOEWALL



SECTION B-B 5

CORNER DETAILS

1. Extend Bars P 3'-0" minimum into bottom slab of box culvert.
2. Adjust as necessary to maintain 1 1#2" clear cover and 4" minimum between bars.
3. Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings, multiply the tabulated values by Lw.
4. Recommended values of side slope are: 2:1, 3:1, 4:1, and 6:1.
5. When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, provide a 6" wide by 1'-6" deep reinforced concrete toewall along all edges of the riprap adjacent to natural ground; reinforce the toewall by extending typical riprap reinforcing into the toewall; and extend construction joints or grooved joints oriented in the direction of flow across the full distance of the riprap at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required.
6. At Contractor's option, culvert toewall may be ended flush with wingwall toewall. Adjust reinforcing as needed.
7. 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0, refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
8. For vehicle safety, the following requirements must be met:
   - For structures without bridge rail, construct curbs no more than 3" above finished grade.
   - For structures with bridge rail, construct curbs flush with finished grade.

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

MATERIAL NOTES:

Provide Class C concrete (f'c=3,600 psi).
Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
In riprap concrete, synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing unless noted otherwise.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.
See Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.
The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

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

Texas Department of Transportation

Bridge Division Standard

CONCRETE WINGWALLS
WITH STRAIGHT WINGS FOR 0° SKEW BOX CULVERTS

SW-O

FILE: sw-0skde-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
	DIST	COUNTY		SHEET NO.
	PAR	HUNT		064

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

REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

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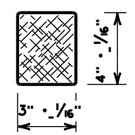
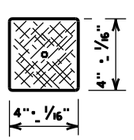
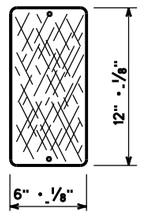
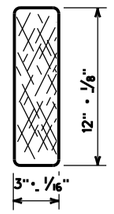
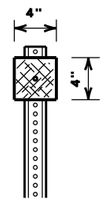
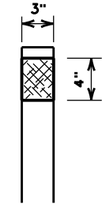
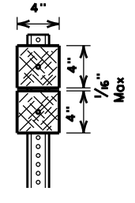
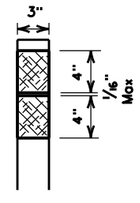
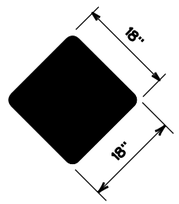
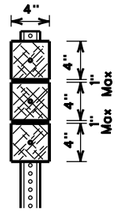
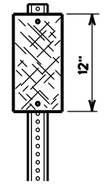
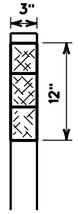
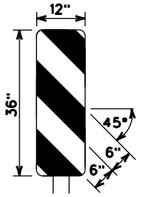
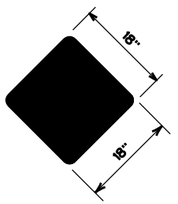
DEVICE				
SHEETING	Yellow, White or Red Type B or C reflective sheeting			

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.

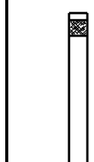
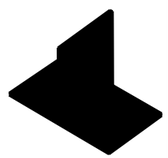
DELINEATORS

	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

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 or C Sheeting	Yellow - Type B or C Sheeting			Alternating acrylic black and retroflective yellow - Type B or C Sheeting			Red -Type B or C Sheeting
POST TYPE	TWT	WC	WC	WFLX	TWT			TWT
MOUNT TYPE	WAS, WAP	GND	GND	GND, SRF	WAS, WAP			WAS, WAP

BARRIER REFLECTORS (BRF)

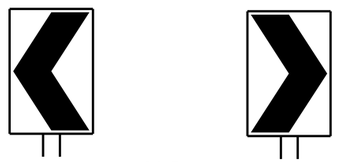
	GF1	GF2	CTB
DEVICE			

1. Barrier reflectors shall meet the requirements of DMS 8600.
2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov.

SHEETING: Yellow, White, Red

NOTE
1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches.

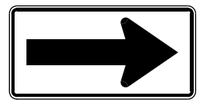
CHEVRONS

DEVICE:  W1-8

SIZE (W x L)	18"x 24" (Conventional)	24"x 30" (Conventional Oversize)	30"x 36" (Expressway)	36" x 48" (Freeway)
MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only	

NOTE
1. CHEVRON (W1-8) signs and ONE DIRECTION LARGE ARROW (W1-6) Signs shall be installed per Sign Mounting Details (SMD) Standard Sheets and paid under Item 644 (Small Roadside Sign Assemblies).
2. When there is a need to increase conspicuity, the Texas version of the ONE DIRECTION LARGE ARROW sign (W1-9T) may be used instead of the ONE DIRECTION LARGE ARROW (W1-6).

ONE DIRECTION LARGE ARROW

DEVICE:  W1-6

SIZE (W x L)	48" x 24" (Conventional)	60" x 30" (Expressway & Freeway)
MOUNTING HEIGHT	7'-0"	

D & OM DESCRIPTIVE CODES

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

NUMBER OF REFLECTORS
- S - Single
- D - Double

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

REFLECTOR UNIT SIZE
- 1 or 2

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

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

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

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

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

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

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

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

DIRECTION
If Required
- BI - Bi-Directional

DEPARTMENTAL MATERIAL SPECIFICATIONS

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

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

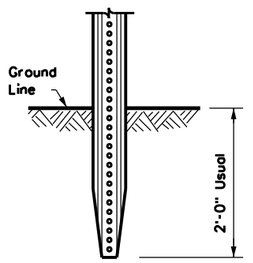
FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	PAR	HUNT		065

20A

POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

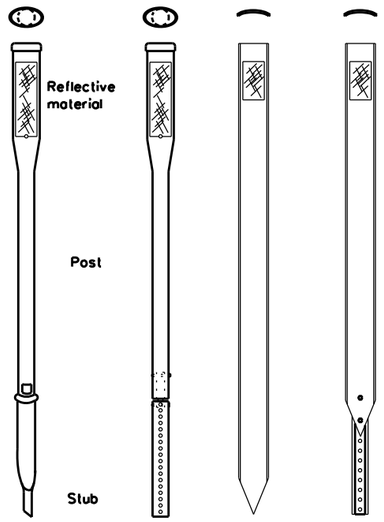


NOTES

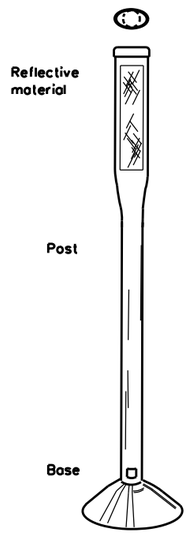
1. Embedded Wing Channel (WC) post option may be used for Type 2 Object Markers and Delineators only.
2. 1.12 lbs/ft steel per ASTM A 1011 SS Gr. 50, or ASTM A499.

FLEXIBLE POSTS (YFLX, WFLX)

GND



SRF



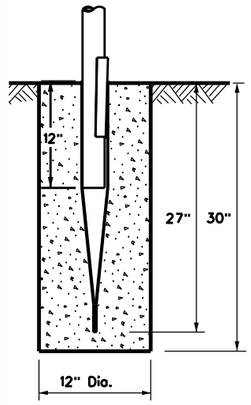
EMBEDDED | SURFACE MOUNT

NOTES

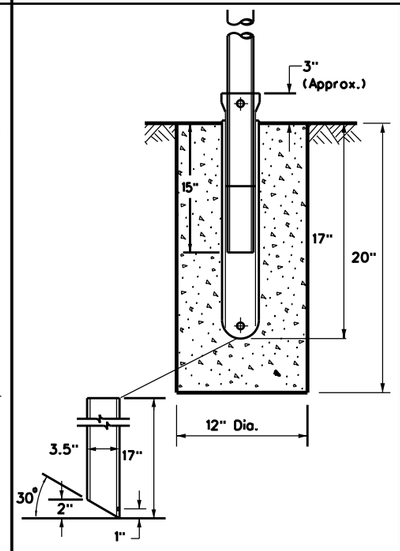
1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices.
2. Install per manufacturer's recommendations.
3. Post length may vary to meet field conditions.
4. When using yellow delineators with flexible posts to separate opposing direction of travel, such as centerline or median use, the flexible posts shall be yellow.

WEDGE ANCHOR SYSTEMS

WAS



WAP



STEEL | PLASTIC

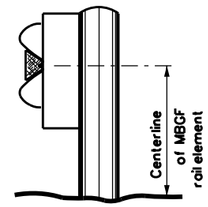
NOTE

1. Install per manufacturer's recommendations.

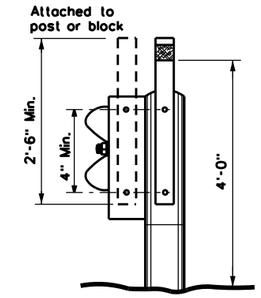
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

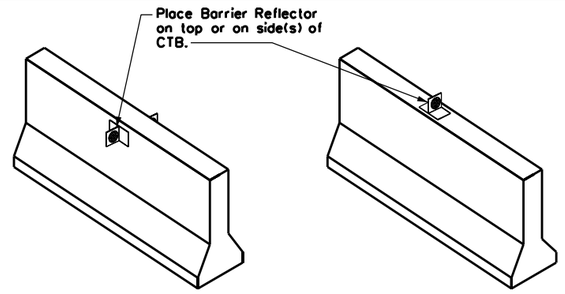
GF1



GF2



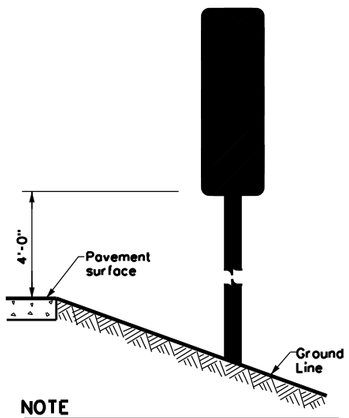
CONCRETE TRAFFIC BARRIER (CTB)



GENERAL NOTES

1. Place delineators on a section of roadway at a consistent distance from the edge of pavement.
2. Where a restriction prevents consistent placement from the pavement edge, place the affected object markers in line with the innermost edge of the obstruction.
3. When Type 2 object markers and delineators are more than 8'-0" from the edge of the pavement, it may not be possible to maintain a height of approximately 4'-0". If this is the case, place the object marker or delineator as close to the desired height as possible.
4. Install all delineators, object markers and barrier reflectors in accordance with the manufacturer's recommendation.
5. Barrier reflectors should be installed a minimum of 18 inches above the edge of the pavement surface.
6. Diagonal stripes on Type 3 object markers shall slope down toward the intended travel lane.

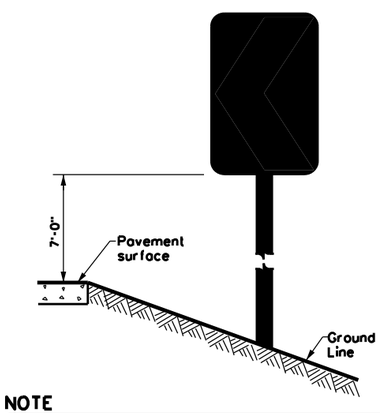
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



NOTE

Mounting at 4 feet to the bottom of the chevron is permitted for chevrons that will not exceed a height of 6'-6" to the top of the chevron (sizes 24" x 30" and smaller)

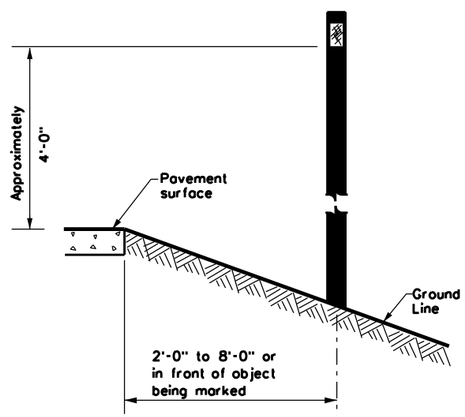
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



NOTE

Chevrons 30" x 36" and larger shall be mounted at a height of 7' to the bottom of the chevron. Chevron sign and ONE DIRECTION LARGE ARROW sign (W1-9T) shall be installed per SMD standard sheets and paid under item 644.

DELINEATORS AND TYPE 2 OBJECT MARKERS



See general notes 1, 2 and 3.

Texas Department of Transportation | Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

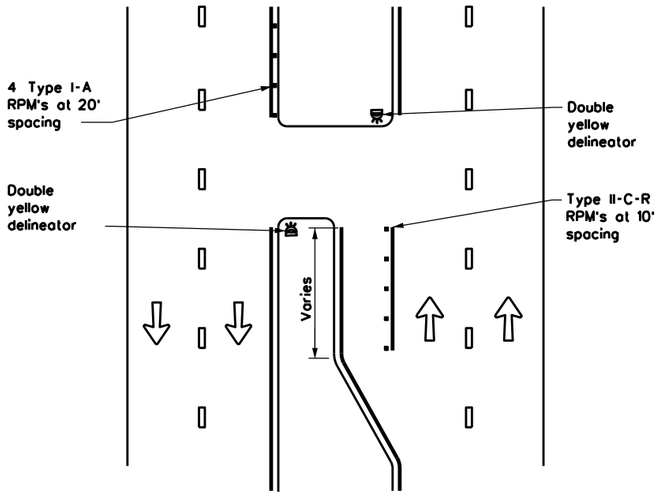
D & OM(2)-20

FILE: dom2-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	PAR	HUNT		066

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

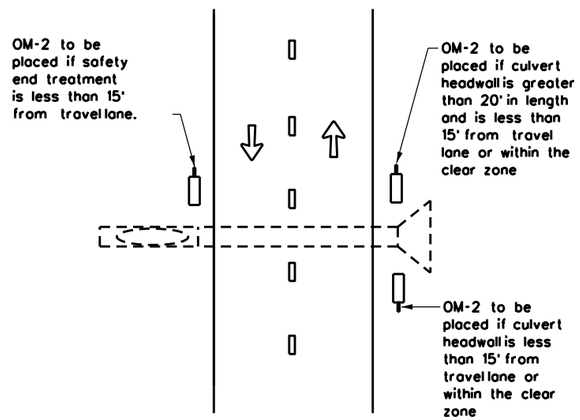
DATE: $DATE$ $TIME$
FILE: $FILE$

CROSSOVERS



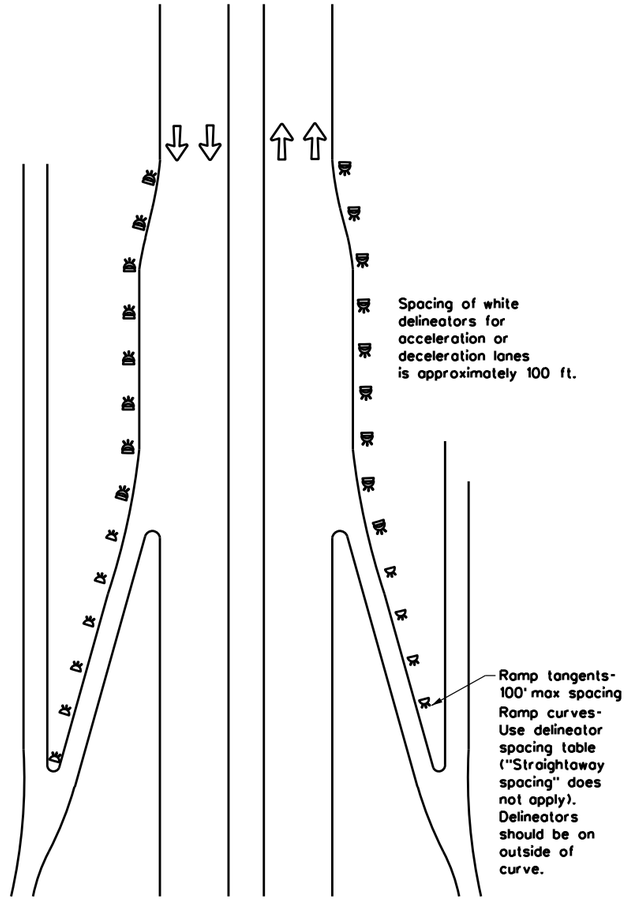
DETAIL 1

FOR CULVERTS WITHOUT MBGF



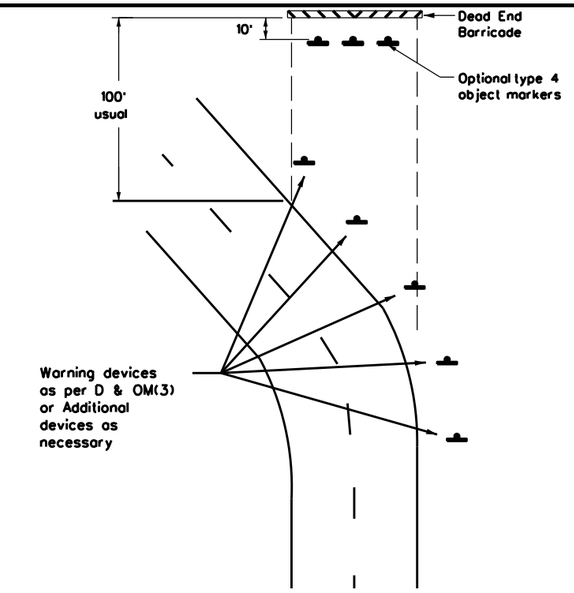
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



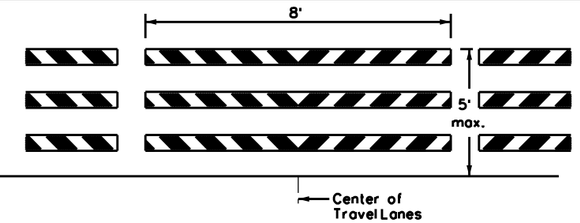
DETAIL 3

TYPICAL APPLICATION OF DEAD END BARRICADE



DETAIL 4

TYPICAL DEAD END BARRICADE INSTALLATION



NOTES

1. Barricade striping shall be red and white reflective sheeting for all permanent road closures.
2. Barricade striping is red and white sloping toward the center of the roadway.
3. Type 3 Barricade Supports should be anchored to soil or pavement as described in compliant Work Zone Traffic Control Devices List, section D.2.f and D.2.g.

DETAIL 5

LEGEND

	Bidirectional Delineator
	Delineator
	OM-3
	Barricade
	Sign
	OM-2
	Double Delineator

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

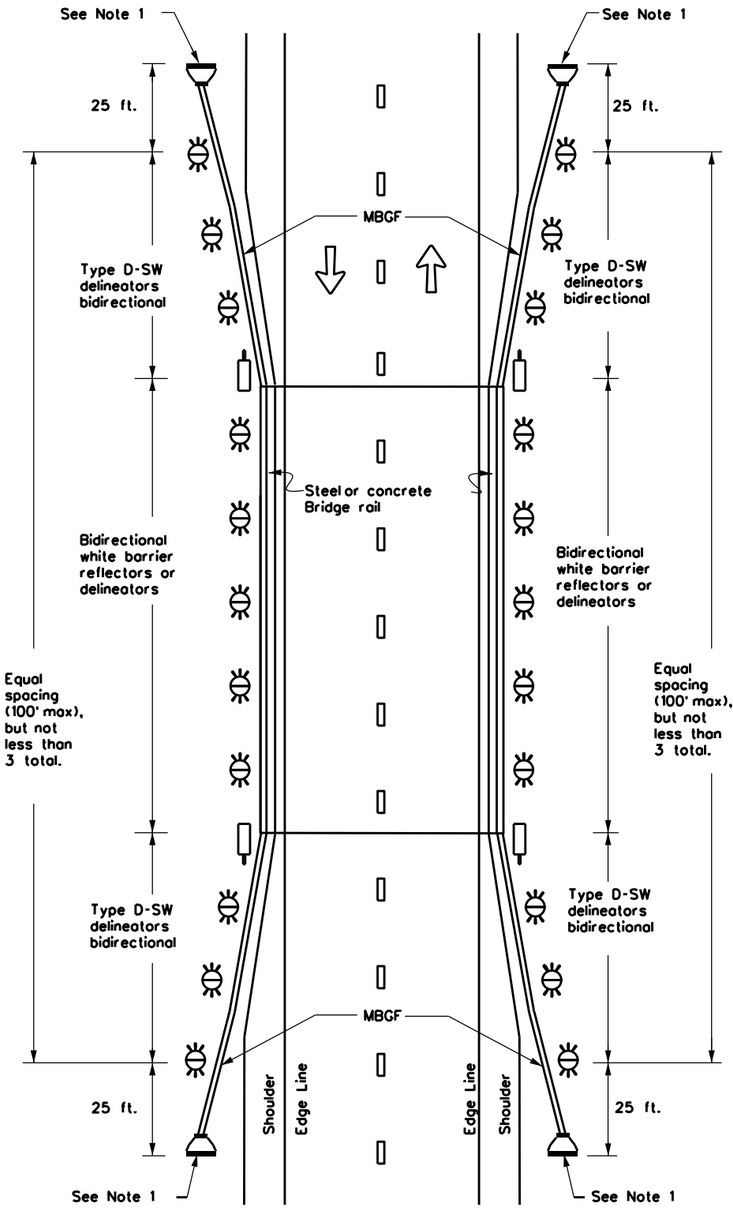
D & OM(4)-20

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
3-15 7-20	DIST	COUNTY		SHEET NO.
	PAR	HUNT		067

20D

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

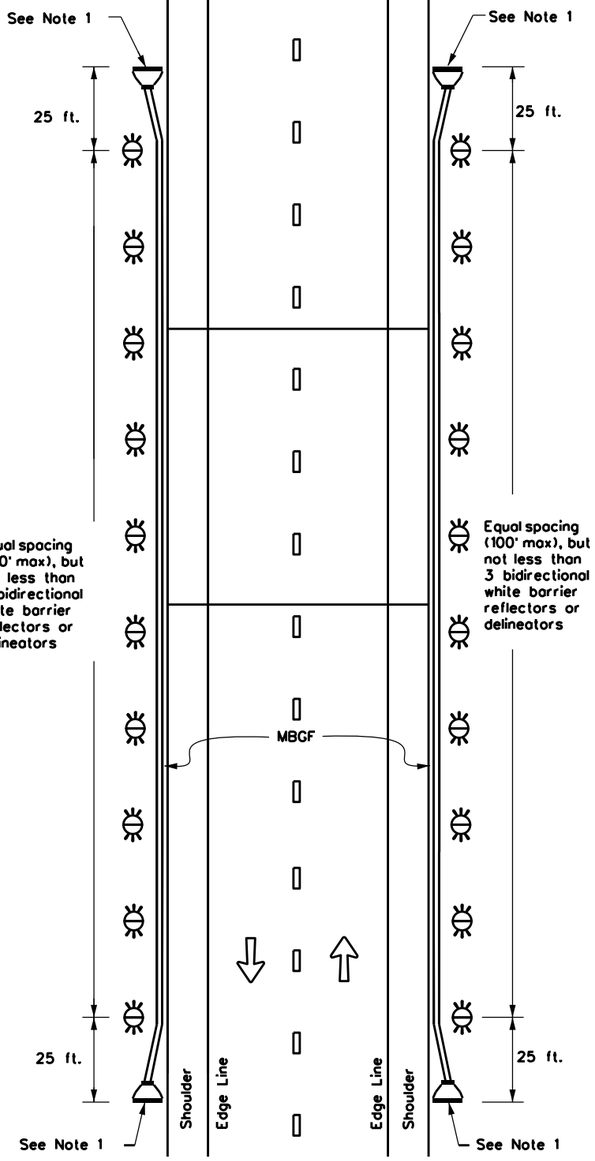
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



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.

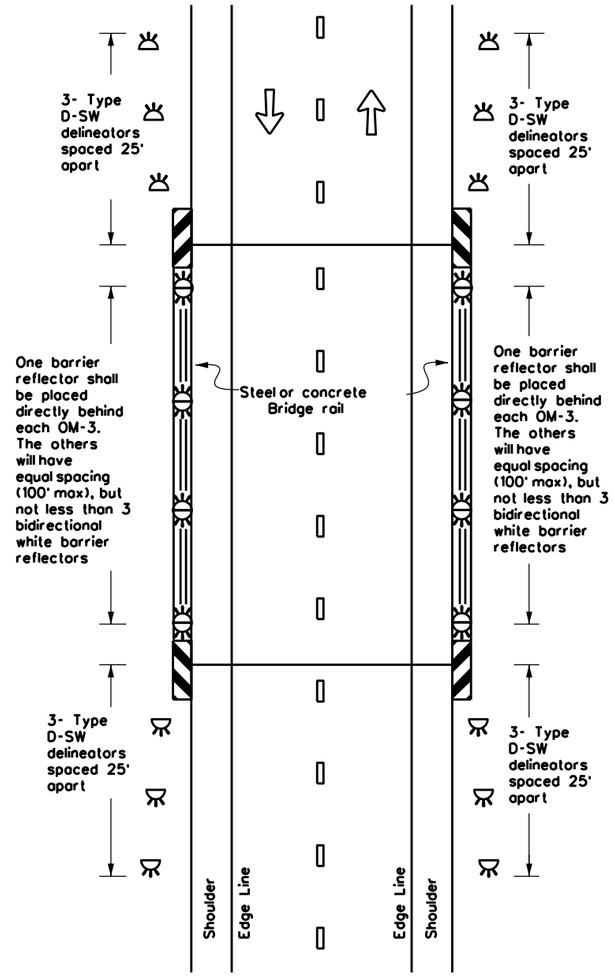
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



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

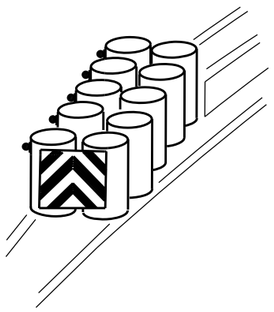
Traffic Safety Division Standard

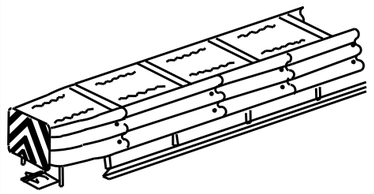
DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

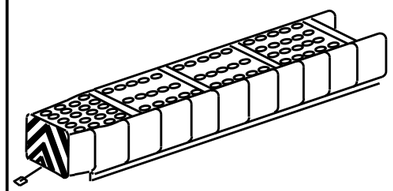
D & OM(5)-20

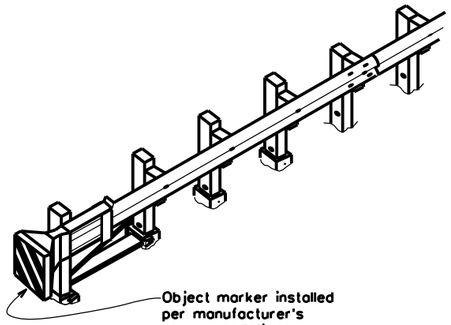
FILE: dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0901	22	128	VARIOUS
7-20	DIST	COUNTY		SHEET NO.
	PAR	HUNT		068

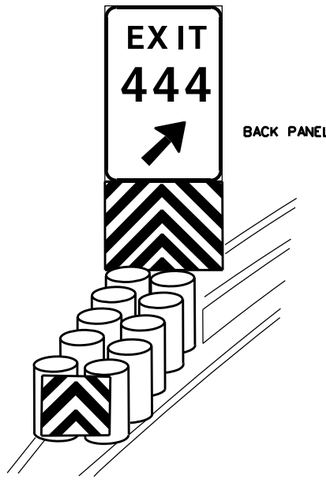
20E

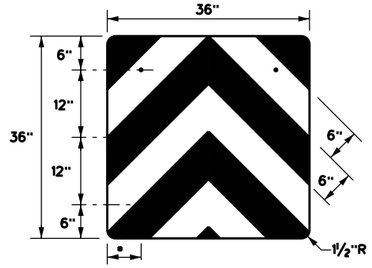


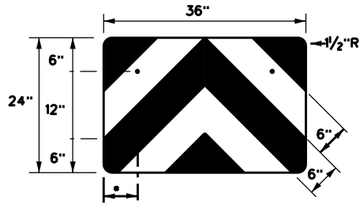




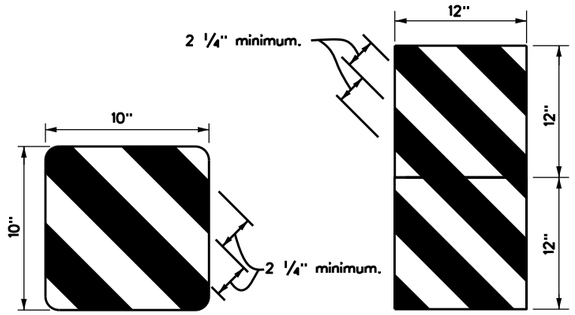




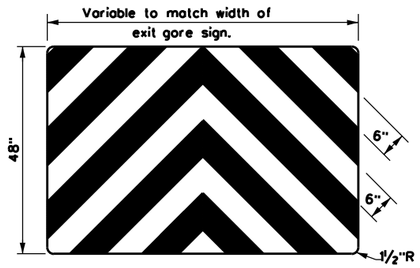


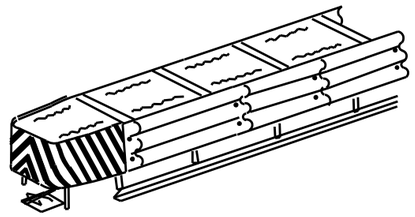


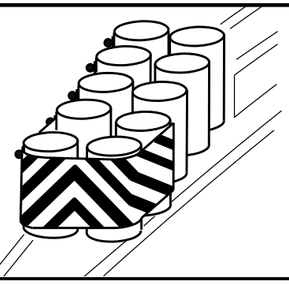
• Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

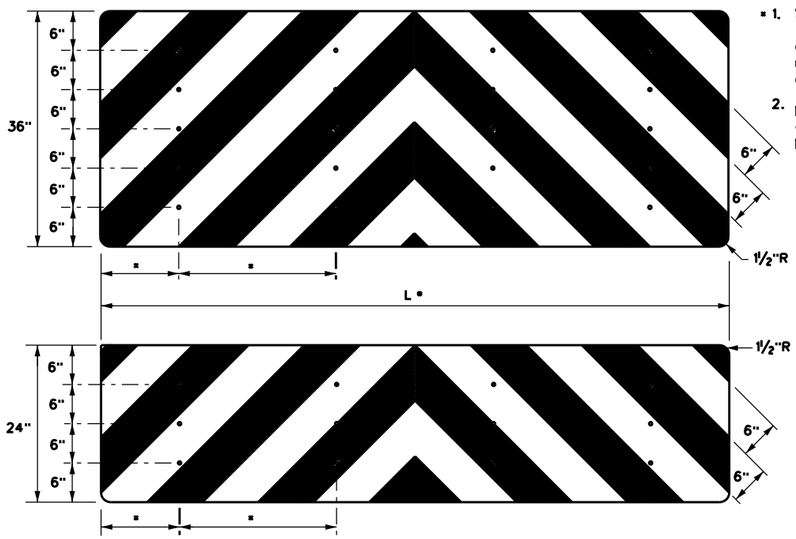


OBJECT MARKERS SMALLER THAN 3 FT^2









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	0901	22	128	VARIOUS
4-92 8-04	DIST	COUNTY		SHEET NO.
8-95 3-15	PAR	HUNT		069
4-98 7-20				

20G

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

STORMWATER POLLUTION PRVENTION PLAN (SWP3):

This SWP3 has been developed in accordance with TxDOT policy for projects disturbing less than 1 acre of soil, and not part of a larger common plan of development.

For projects with less than one acre of soil disturbing activity and 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 project's environmental permits, issues, and commitments (EPICs).

1.0 SITE/PROJECT DESCRIPTION

1.1 PROJECT CONTROL SECTION JOB (CSJ):
N/A

1.2 PROJECT LIMITS:
From: N/A

To: N/A

1.3 PROJECT COORDINATES:
BEGIN: (Lat) N/A ,(Long) N/A

END: (Lat) N/A ,(Long) N/A

1.4 TOTAL PROJECT AREA (Acres): 0.90

1.5 TOTAL AREA TO BE DISTURBED (Acres): 0.50

1.6 NATURE OF CONSTRUCTION ACTIVITY:

1.7 MAJOR SOIL TYPES:

Soil Type	Description

1.8 PROJECT SPECIFIC LOCATIONS (PSLs):

PSLs must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. PSLs may be identified during preconstruction meetings or during the construction process. Please choose from the options below:

☐ PSLs determined during preconstruction meeting
☐ PSLs determined during construction
☐ No PSLs planned for construction

Type	Sheet #s

All off-ROW PSLs required by the Contractor are the Contractor's responsibility. The Contractor shall secure all permits required by local, state, federal laws for off-ROW PSLs. The contractor shall provide diagrams, areas of disturbance, acreage, and BMPs for all off-ROW PSLs within one mile of the project.

1.9 CONSTRUCTION ACTIVITIES:

(Use the following list as a starting point when developing the Construction Activity Schedule and Ceasing Record in Attachment 2.3.)

☒ Mobilization
☒ Install sediment and erosion controls
☐ Blade existing topsoil into windrows, prep ROW, clear and grub
☐ Remove existing pavement
☐ Grading operations, excavation, and embankment
☐ Excavate and prepare subgrade for proposed pavement widening
☐ Remove existing culverts, safety end treatments (SETs)
☐ Remove existing metal beam guard fence (MBGF), bridge rail
☐ Install proposed pavement per plans
☐ Install culverts, culvert extensions, SETs
☐ Install mow strip, MBGF, bridge rail
☐ Place flex base
☐ Rework slopes, grade ditches
☐ Blade windrowed material back across slopes
☐ Revegetation of unpaved areas
☐ Achieve site stabilization and remove sediment and erosion control measures
☒ Other: MINOR CONCRETE REPAIR FOR STUCTURES IN VRIOUS AREAS
☐ Other:
☐ Other:

1.10 POTENTIAL POLLUTANTS AND SOURCES:

☐ Sediment laden stormwater from stormwater conveyance over disturbed area
☒ Fuels, oils, and lubricants from construction vehicles, equipment, and storage
☒ Solvents, paints, adhesives, etc. from various construction activities
☐ Transported soils from offsite vehicle tracking
☒ Construction debris and waste from various construction activities
☐ Contaminated water from excavation or dewatering pump-out water
☐ Sanitary waste from onsite restroom facilities
☒ Trash from various construction activities/receptacles
☐ Long-term stockpiles of material and waste
☒ 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

* Add (*) for impaired waterbodies with pollutant in ().

1.12 ROLES AND RESPONSIBILITIES: TxDOT

☒ Development of plans and specifications
☒ Perform SWP3 inspections
☒ Maintain SWP3 records and update to reflect daily operations
☐ Other:
☐ Other:

1.13 ROLES AND RESPONSIBILITIES: CONTRACTOR

☒ Day To Day Operational Control
☒ Maintain schedule of major construction activities
☒ Install, maintain and modify BMPs
☐ Other:
☐ Other:
☐ Other:

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE
10/10/23

STORMWATER POLLUTION PREVENTION PLAN (SWP3) (Less Than 1 Acre)

July 2023 Sheet 1 of 2

Texas Department of Transportation

FED. RD. DIV. NO.			SHEET NO.
			070
STATE	STATE DIST.	COUNTY	
TEXAS	PAR	HUNT	
CONT.	SECT.	JOB	HIGHWAY NO.
0901	22	128	VARIOUS

STORMWATER POLLUTION PRVENTION 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

- [X] [ ] Protection of Existing Vegetation
- [ ] [ ] Vegetated Buffer Zones
- [ ] [ ] Soil Retention Blankets
- [ ] [ ] Geotextiles
- [ ] [ ] Mulching/ Hydromulching
- [ ] [ ] Soil Surface Treatments
- [ ] [ ] Temporary Seeding
- [X] [ ] Permanent Planting, Sodding or Seeding
- [ ] [ ] Biodegradable Erosion Control Logs
- [X] [ ] Rock Filter Dams/ Rock Check Dams
- [ ] [ ] Vertical Tracking
- [ ] [ ] Interceptor Swale
- [X] [ ] 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
- [X] [ ] 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

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

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
- [X] Concrete and Materials Waste Management
- [ ] Debris and Trash Management
- [ ] Dust Control
- [ ] Sanitary Facilities
- [ ] 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:

- X Fire hydrant flushings
- X Irrigation drainage
- X Pavement washwater (where spills or leaks have not occurred, and detergents are not used)
- X Potable water sources
- X Springs
- X Uncontaminated groundwater
- X Water used to wash vehicles or control dust
- X 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 2.3 of this SWP3 .

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 2.3 of this SWP3.

STATE OF TEXAS
TESFAI WELDEMARIAM
149185
LICENSED
PROFESSIONAL ENGINEER

Tesfai Weldemariam PE 10/10/23

STORMWATER POLLUTION PREVENTION PLAN (SWP3) (Less Than 1 Acre)

July 2023 Sheet 2 of 2

Texas Department of Transportation

FED. RD. DIV. NO.			SHEET NO.
			071
STATE	STATE DIST.	COUNTY	
TEXAS	PAR	HUNT	
CONT.	SECT.	JOB	HIGHWAY NO.
0901	22	128	VARIOUS

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.

2.

☐ No Action Required ☒ Required Action

Action No.

1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000

2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.

3. Post Construction Site Notice (CSN) with SW3P information on or near the site, accessible to the public and TCEQ, EPA or other inspectors.

4. When Contractor project specific locations (PSL's) increase disturbed soil area to 5 acres or more, submit NOI to TCEQ and the Engineer.

II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS CLEAN WATER ACT SECTIONS 401 AND 404

USACE Permit required for filling, dredging, excavating or other work in any water bodies, rivers, creeks, streams, wetlands or wet areas.

The Contractor must adhere to all of the terms and conditions associated with the following permit(s):

☒ No Permit Required

☐ Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)

☐ Nationwide Permit 14 - PCN Required (1/10 to <1/2 acre, 1/3 in tidal waters)

☐ Individual 404 Permit Required

☐ Other Nationwide Permit Required: NWP* _____

Required Actions: List waters of the US permit applies to, location in project and check Best Management Practices planned to control erosion, sedimentation and post-project TSS.

1.

2.

3.

4.

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

Best Management Practices:

Erosion	Sedimentation	Post-Construction TSS
☐ Temporary Vegetation	☐ Silt Fence	☐ Vegetative Filter Strips
☐ Blankets/Matting	☒ Rock Berm	☐ Retention/Irrigation Systems
☒ Mulch	☐ Triangular Filter Dike	☐ Extended Detention Basin
☒ Sodding	☐ Sand Bag Berm	☐ Constructed Wetlands
☐ Interceptor Swale	☐ Straw Bale Dike	☐ Wet Basin
☐ Diversion Dike	☐ Brush Berms	☐ Erosion Control Compost
☐ Erosion Control Compost	☐ Erosion Control Compost	☐ Mulch Filter Berm and Socks
☐ Mulch Filter Berm and Socks	☐ Mulch Filter Berm and Socks	☐ Compost Filter Berm and Socks
☐ Compost Filter Berm and Socks	☐ Compost Filter Berm and Socks	☐ Vegetation Lined Ditches
	☐ Stone Outlet Sediment Traps	☐ Sand Filter Systems
	☐ Sediment Basins	☐ Grassy Swales

III. CULTURAL RESOURCES

Refer to TxDOT Standard Specifications in the event historical issues or archeological artifacts are found during construction. Upon discovery of archeological artifacts (bones, burnt rock, flint, pottery, etc.) cease work in the immediate area and contact the Engineer immediately.

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

IV. VEGETATION RESOURCES

Preserve native vegetation to the extent practical.
Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 193, 506, 730, 751, 752 in order to comply with requirements for invasive species, beneficial landscaping, and tree/brush removal commitments.

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

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

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

If any of the listed species are observed, cease work in the immediate area, do not disturb species or habitat and contact the Engineer immediately. The work may not remove active nests from bridges and other structures during nesting season of the birds associated with the nests. If caves or sinkholes are discovered, cease work in the immediate area, and contact the Engineer immediately.

LIST OF ABBREVIATIONS

BMP:	Best Management Practice	SPCC:	Spill Prevention Control and Countermeasure
CGP:	Construction General Permit	SW3P:	Storm Water Pollution Prevention Plan
DSHS:	Texas Department of State Health Services	PCN:	Pre-Construction Notification
FHWA:	Federal Highway Administration	PSL:	Project Specific Location
MOA:	Memorandum of Agreement	TCEQ:	Texas Commission on Environmental Quality
MOU:	Memorandum of Understanding	TPDES:	Texas Pollutant Discharge Elimination System
MS4:	Municipal Separate Stormwater Sewer System	TPWD:	Texas Parks and Wildlife Department
MBTA:	Migratory Bird Treaty Act	TxDOT:	Texas Department of Transportation
NOT:	Notice of Termination	T&E:	Threatened and Endangered Species
NWP:	Nationwide Permit	USACE:	U.S. Army Corps of Engineers
NOI:	Notice of Intent	USFWS:	U.S. Fish and Wildlife Service

VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

General (applies to all projects):

Comply with the Hazard Communication Act (the Act) for personnel who will be working with hazardous materials by conducting safety meetings prior to beginning construction and making workers aware of potential hazards in the workplace. Ensure that all workers are provided with personal protective equipment appropriate for any hazardous materials used.

Obtain and keep on-site Material Safety Data Sheets (MSDS) for all hazardous products used on the project, which may include, but are not limited to the following categories: Paints, acids, solvents, asphalt products, chemical additives, fuels and concrete curing compounds or additives. Provide protected storage, off bare ground and covered, for products which may be hazardous. Maintain product labelling as required by the Act.

Maintain an adequate supply of on-site spill response materials, as indicated in the MSDS. In the event of a spill, take actions to mitigate the spill as indicated in the MSDS, in accordance with safe work practices, and contact the District Spill Coordinator immediately. The Contractor shall be responsible for the proper containment and cleanup of all product spills.

Contact the Engineer if any of the following are detected:

- Dead or distressed vegetation (not identified as normal)
- Trash piles, drums, canister, barrels, etc.
- Undesirable smells or odors
- Evidence of leaching or seepage of substances

Does the project involve any bridge class structure rehabilitation or replacements (bridge class structures not including box culverts)?

☐ Yes ☒ No

If "No", then no further action is required.
If "Yes", then TxDOT is responsible for completing asbestos assessment/inspection.

Are the results of the asbestos inspection positive (is asbestos present)?

☐ Yes ☒ No

If "Yes", then TxDOT must retain a DSHS licensed asbestos consultant to assist with the notification, develop abatement/mitigation procedures, and perform management activities as necessary. The notification form to DSHS must be postmarked at least 15 working days prior to scheduled demolition.

If "No", then TxDOT is still required to notify DSHS 15 working days prior to any scheduled demolition.

In either case, the Contractor is responsible for providing the date(s) for abatement activities and/or demolition with careful coordination between the Engineer and asbestos consultant in order to minimize construction delays and subsequent claims.

Any other evidence indicating possible hazardous materials or contamination discovered on site. Hazardous Materials or Contamination Issues Specific to this Project:

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

VII. OTHER ENVIRONMENTAL ISSUES

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

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

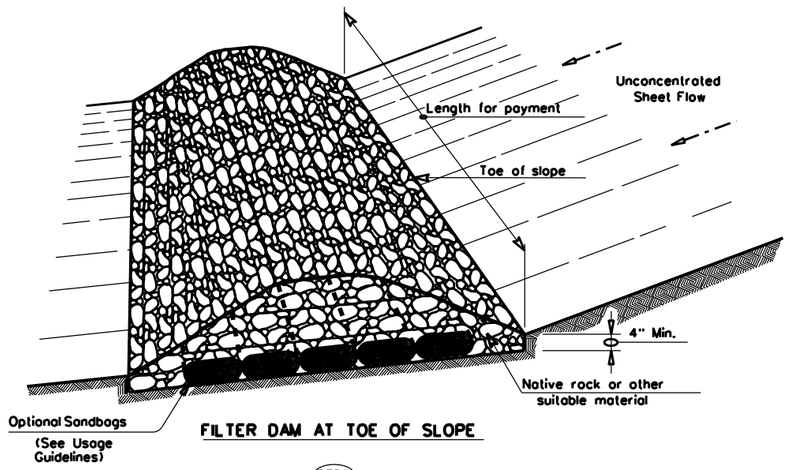
Texas Department of Transportation — Design Division Standard

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

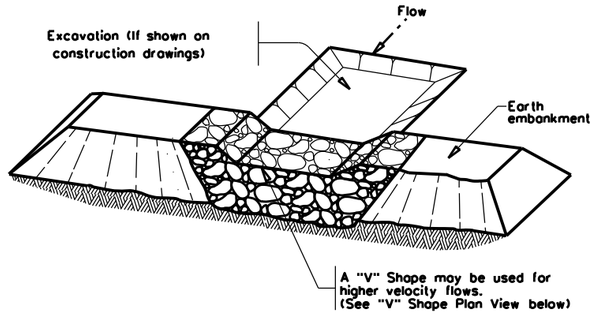
FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR	
©TxDOT: February 2015	CONT	SECT	JOB	HIGHWAY	
REVISIONS 12-12-2011 (DS)	0901	22	128	VARIOUS	
05-07-14 ADDED NOTE SECTION IV. 01-23-2015 SECTION I CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	DIST	COUNTY		SHEET NO.	
	PAR	HUNT		072	

DATE: $DATE$
FILE: $FILE$



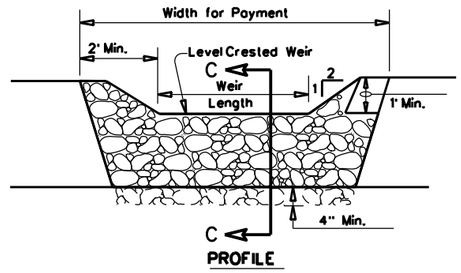
FILTER DAM AT TOE OF SLOPE

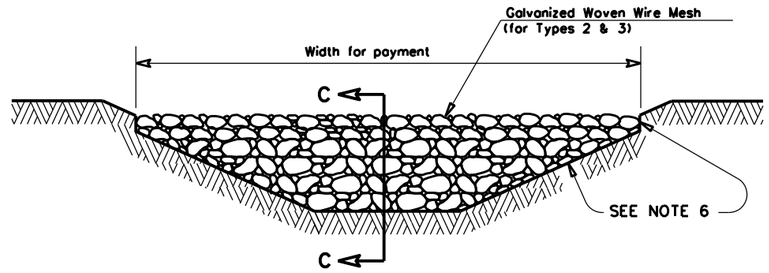
RFD1



FILTER DAM AT SEDIMENT TRAP

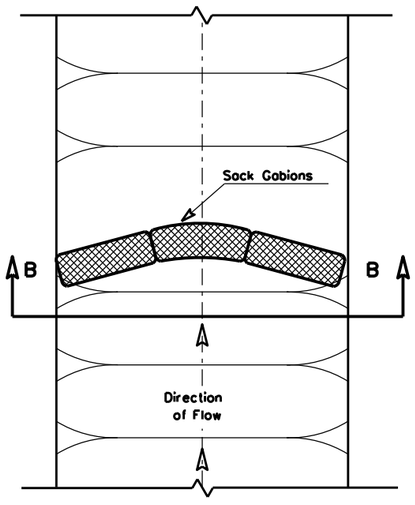
RFD1 OR RFD2



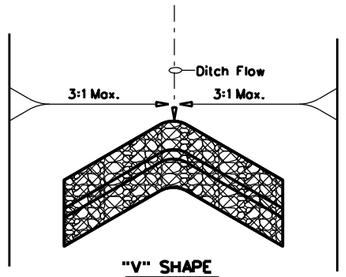


FILTER DAM AT CHANNEL SECTIONS

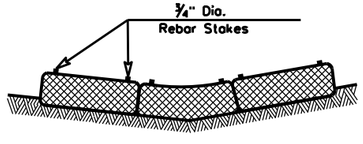
RFD1 OR RFD2 OR RFD3



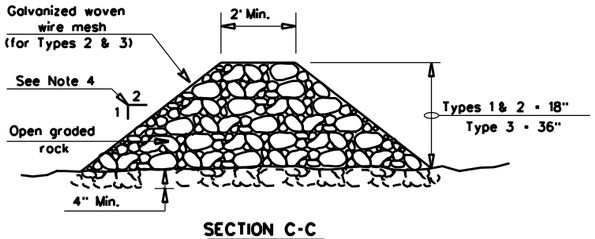
PLAN VIEW



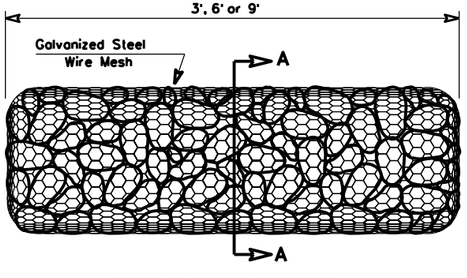
"V" SHAPE PLAN VIEW



SECTION B-B

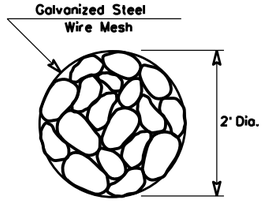


SECTION C-C



TYPE 4 (SACK GABIONS)

RFD4



SECTION A-A

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
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