DESIGN	FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		SHEET NO.
GRAPHICS	6	STP 2022(886)HES		1
	STATE	STATE DIST.	COUNTY	
CHECKED	TEXAS	WACO	HILL	
	CONT.	SECT.	JOB	HIGHWAY NO.
CHECKED	0019	03	028,Etc	SH 171

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

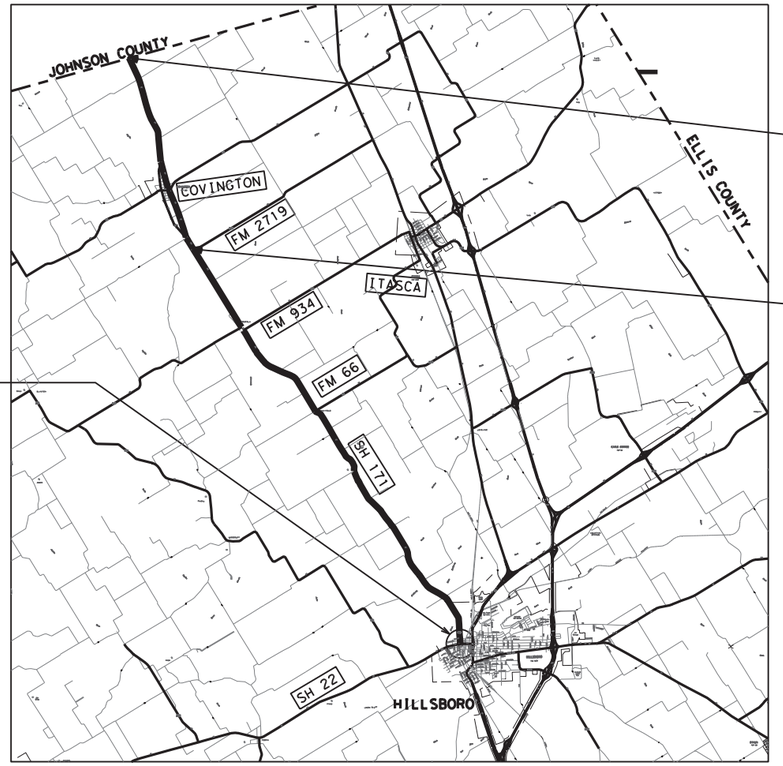
FEDERAL AID PROJECT: STP 2022(886)HES

HILL COUNTY

SH 171, CSJ 0019-03-028, ETC.

CSJ	ROADWAY (FT)	ROADWAY (MI)	BRIDGE (FT)	BRIDGE (MI)	TOTAL (FT)	TOTAL (MI)
0019-03-028	26,775.00	5.071	0.00	0.00	26,775.00	5.071
0418-03-025	64,015.00	12.124	435.00	0.082	64,450.00	12.206
TOTAL PROJECT	90,790.00	17.195	435.00	0.082	91,225.00	17.277

LIMITS: CSJ 0019-03-028: FROM JOHNSON COUNTY LINE TO FM 2719
CSJ 0418-03-025: FROM FM 2719 TO SH 22
FOR THE CONSTRUCTION OF SAFETY, CONSISTING OF SAFETY TREAT FIXED OBJECTS.



BEGIN PROJECT
BEGIN CSJ: 0019-03-028
BEGIN STA 932+25
REF. MRKR. 322+00.00

BEGIN CSJ: 0418-03-025
END CSJ 0019-03-028
BEGIN STA 664+50
REF. MRKR. 326+1.053

END PROJECT
END PROJECT CSJ 0418-03-025
END STA 20+00.00
REF. MRKR. 338+1.304

EXCEPTIONS: NONE
EQUATIONS: NONE
RAILROAD CROSSINGS: NONE

SCALE: 1": 20,000'

DESIGN SPEED = MEEC

ADT	YEAR
3600	2022
5000	2042

INDEX OF SHEETS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	INDEX OF SHEETS

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL-AID CONSTRUCTION CONTRACTS (FORM FHWA 1273, MAY 2012).

TEXAS DEPARTMENT OF TRANSPORTATION

RECOMMENDED FOR LETTING 5/31/2022
DocuSigned by: Josh Voiles
AC8604F84EC2483...
AREA ENGINEER

RECOMMENDED FOR LETTING 06/01/2022
DIRECTOR OF TRANSPORTATION PLANNING & DEVELOPMENT

APPROVED FOR LETTING 6/1/2022
DocuSigned by: Stanley Swiatek
B69BD796DD564C9...
DISTRICT ENGINEER

FILE LOCATION AND NAME

LEVELS DISPLAYED
1

PROJ. NO.
LETTING DATE
COUNTY
HWY. NO.
DATE ACCEPTED

INDEX OF SHEETS

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	9, 9A-9G	GENERAL NOTES
	10, 10A-10D	ESTIMATE & QUANTITY
	11-22	CONSOLIDATED SUMMARIES
	23	CRASH CUSHION SUMMARY SHEET
	24	TRAFFIC CONTROL AND SEQUENCE OF OPERATION

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#	132	MC-MD
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* THE STANDARD SHEETS SPECIFICALLY IDENTIFIED ABOVE HAVE BEEN SELECTED BY ME OR UNDER MY DIRECT SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/31/2022

SIGNATURE OF REGISTRANT & DATE

INDEX OF SHEETS

SHEET 1 OF 1

FED. RD. DIV. NO.	STATE	CONT	SECT	JOB	HIGHWAY
6	TEXAS	0019	03	028 Etc.	SH 171
		DIST	COUNTY		SHEET NO.
		WAC	HILL		2

NOTES:

LEGEND

(##) DRIVEWAY NUMBER. SEE DRIVEWAY SUMMARIES FOR MORE INFORMATION.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

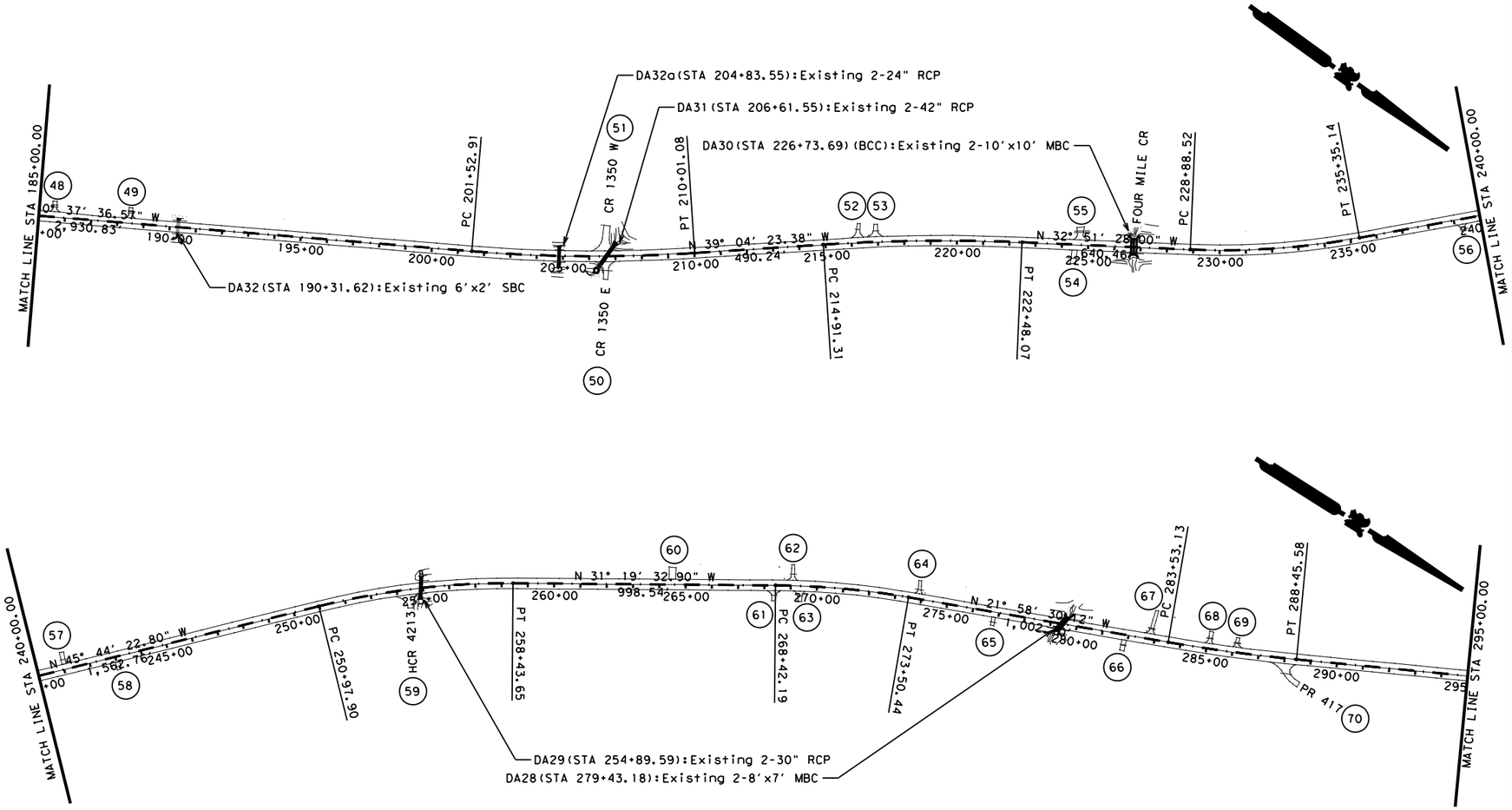
Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

PROJECT LAYOUT

SHEET 1 OF 6 1" = 500' HORIZ.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		3



NOTES:

LEGEND

(##) DRIVEWAY NUMBER. SEE DRIVEWAY SUMMARIES FOR MORE INFORMATION.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

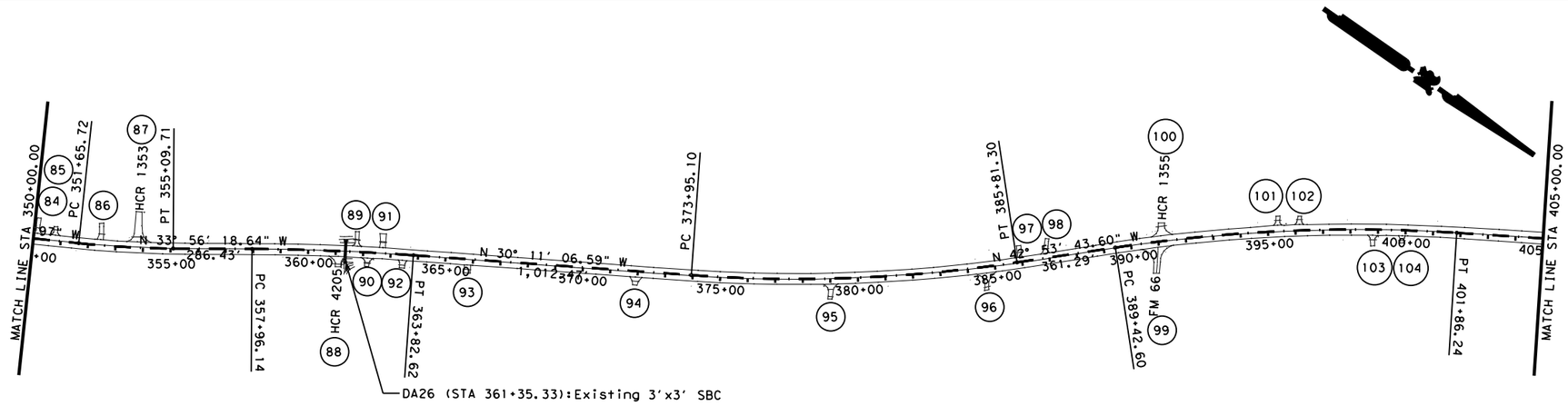
Chris J. Mashek, P.E. 5/19/2022

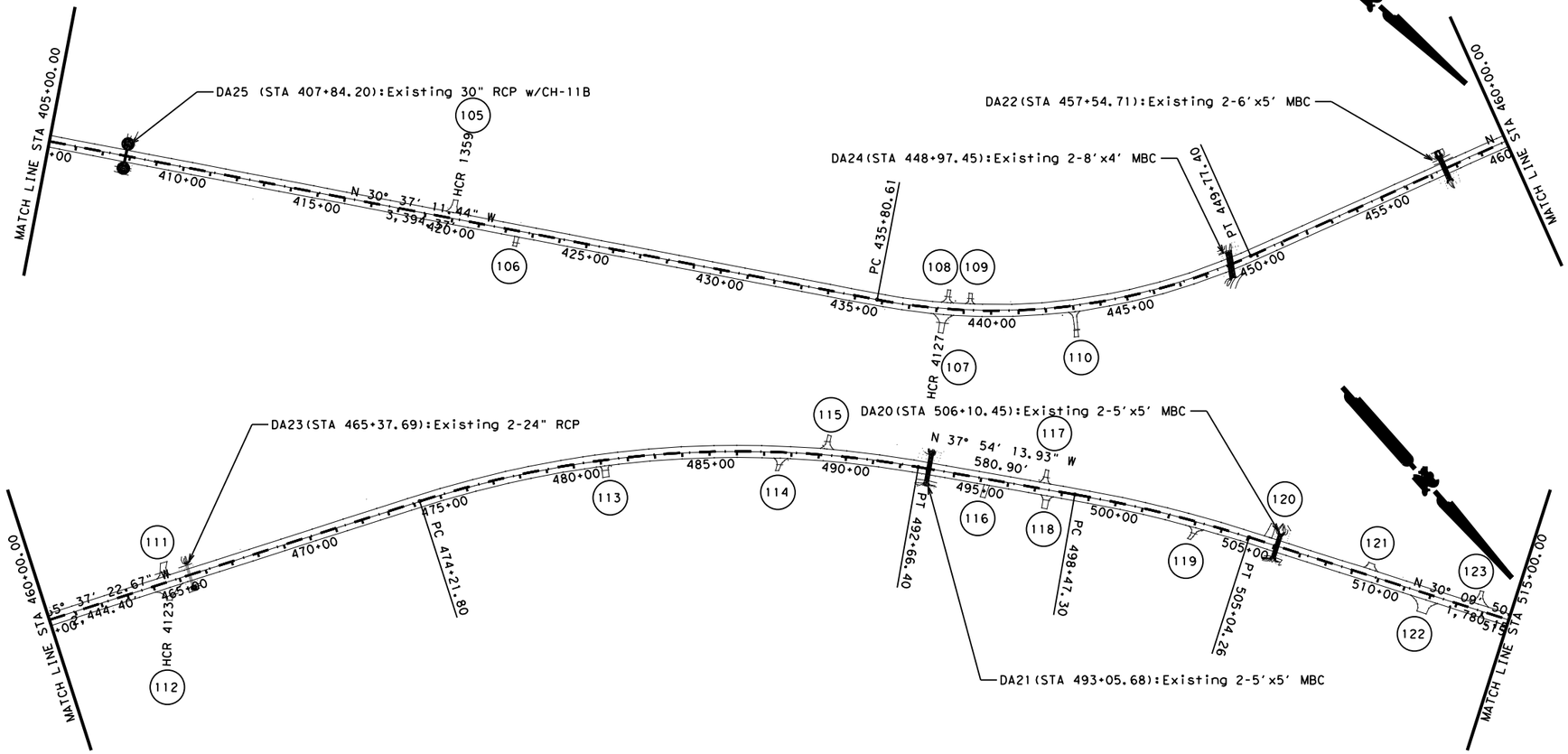
SIGNATURE OF REGISTRANT & DATE

PROJECT LAYOUT

SHEET 2 OF 6 1" = 500' HORIZ.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		4





NOTES:

LEGEND

(##) DRIVEWAY NUMBER. SEE DRIVEWAY SUMMARIES FOR MORE INFORMATION.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

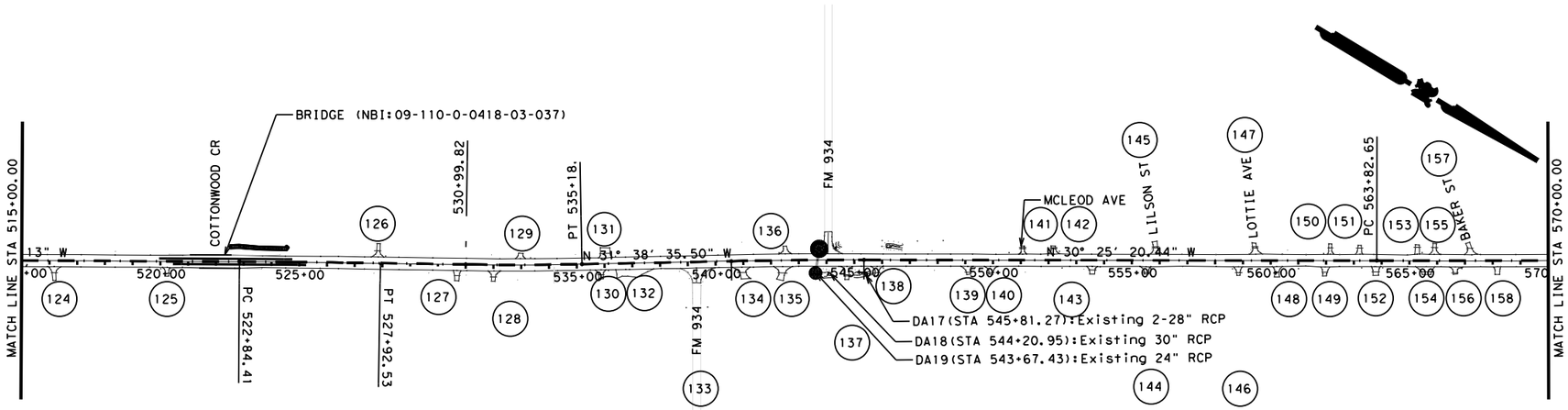
Chris J. Mashek, P.E. 5/19/2022

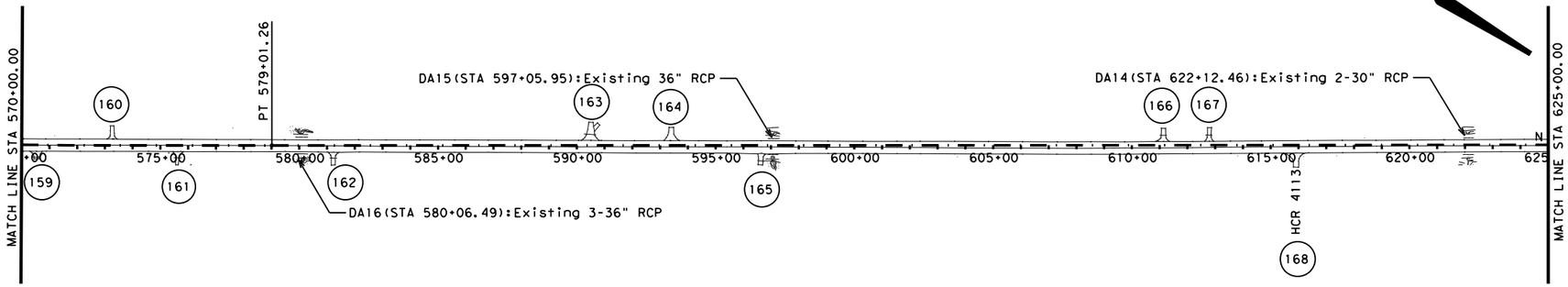
SIGNATURE OF REGISTRANT & DATE

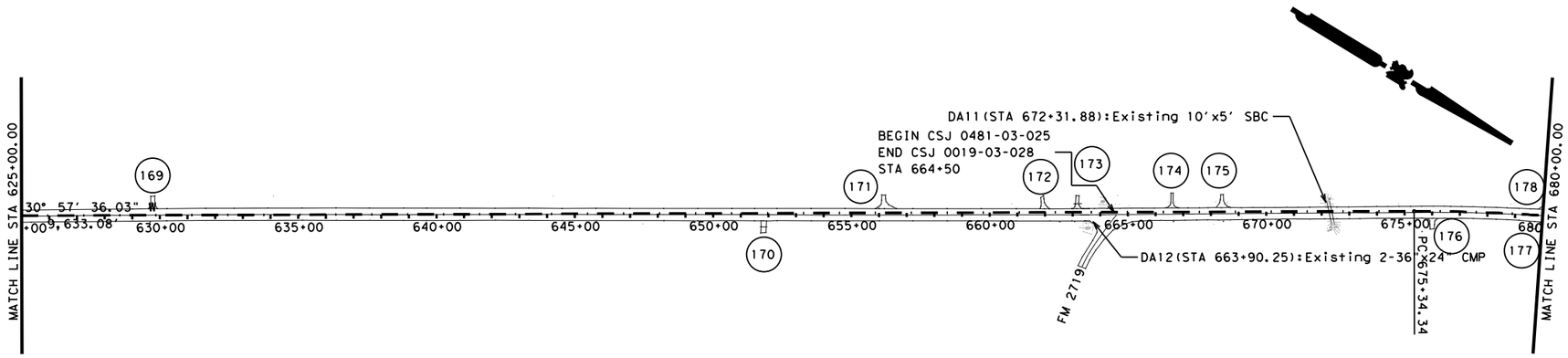
PROJECT LAYOUT

SHEET 3 OF 6 1" = 500' HORIZ.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		5







NOTES:

1. REFER TO SUMMARIES FOR STRIPING QUANTITIES
2. REFER TO SUMMARY OF SMALL SIGNS FOR ADDITIONAL SIGN DETAILS

LEGEND

(##) DRIVEWAY NUMBER. SEE DRIVEWAY SUMMARIES FOR MORE INFORMATION.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

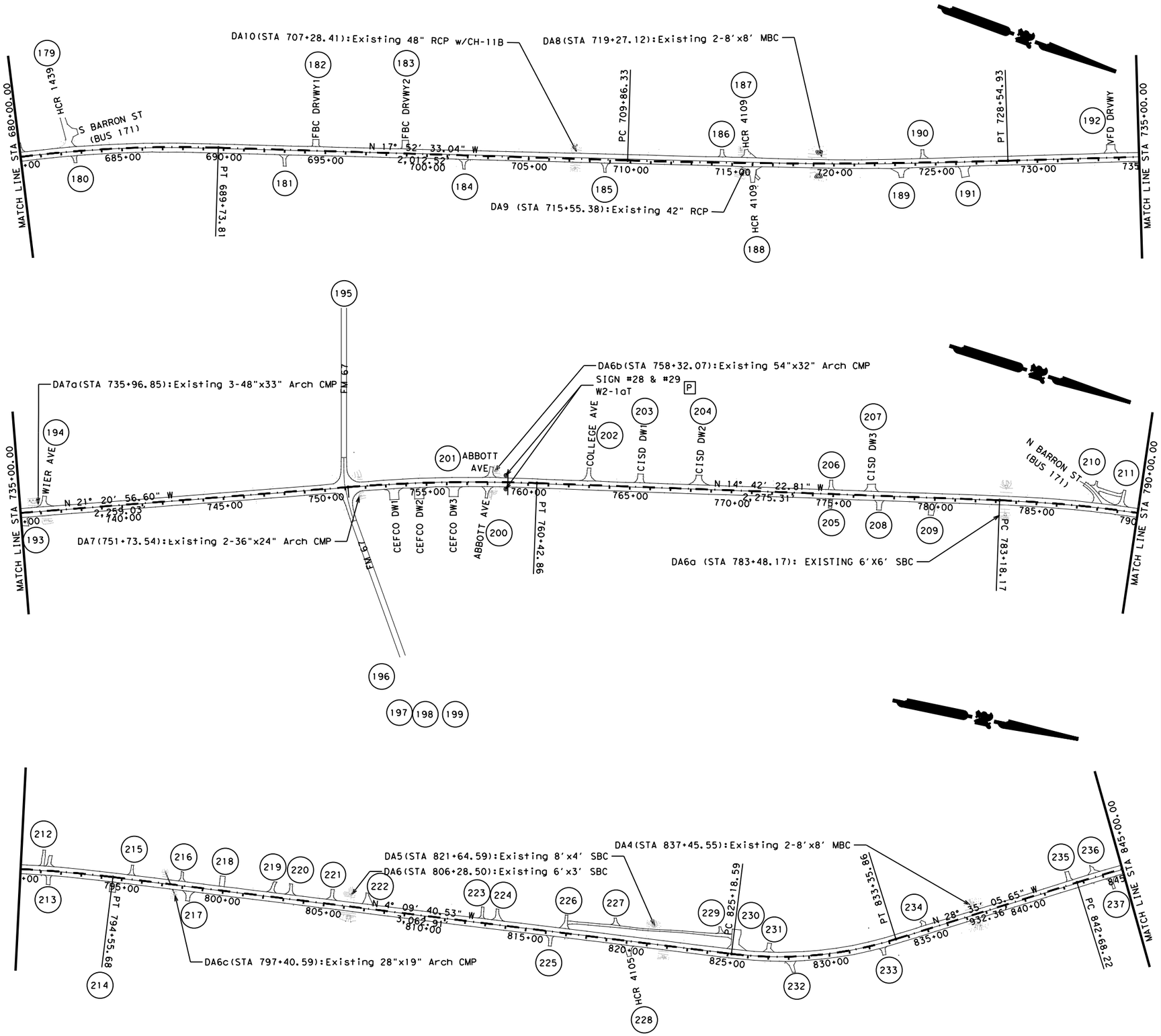
Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

PROJECT LAYOUT

SHEET 4 OF 6 1" = 500' HORIZ.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		6



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1. REFER TO SUMMARIES FOR STRIPING QUANTITIES
2. REFER TO SUMMARY OF SMALL SIGNS FOR ADDITIONAL SIGN DETAILS

LEGEND

(##) DRIVEWAY NUMBER. SEE DRIVEWAY SUMMARIES FOR MORE INFORMATION.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

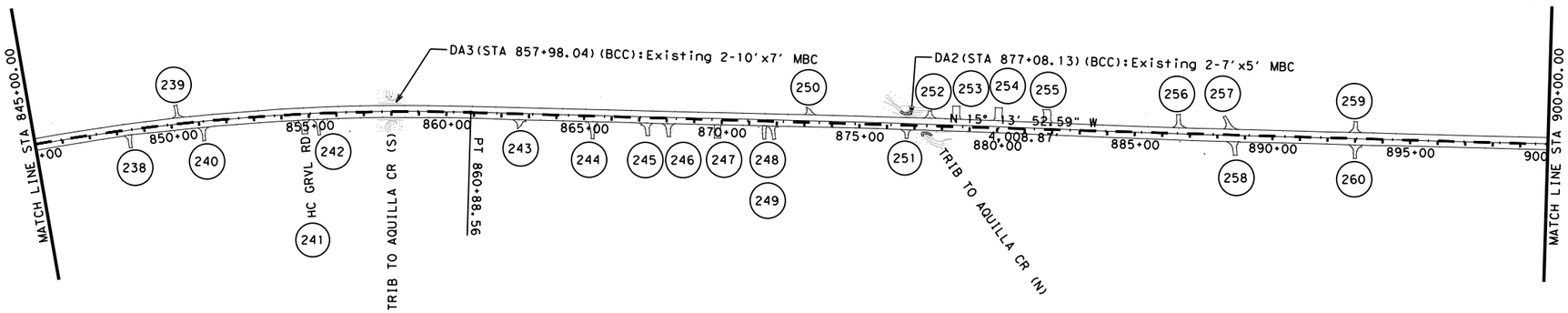
Chris J. Mashek, P.E. 5/19/2022

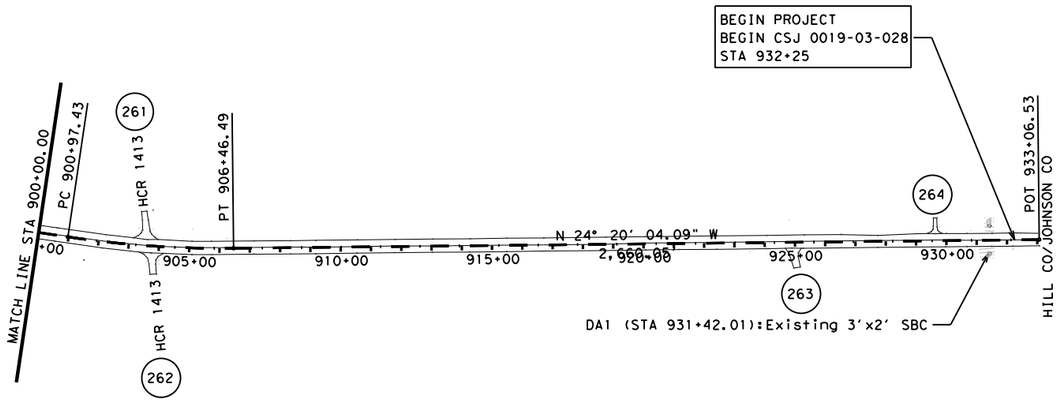
SIGNATURE OF REGISTRANT & DATE

PROJECT LAYOUT

SHEET 5 OF 6 1" = 500' HORIZ.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		7





NOTES:

LEGEND

(##) DRIVEWAY NUMBER. SEE DRIVEWAY SUMMARIES FOR MORE INFORMATION.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

PROJECT LAYOUT

SHEET 6 OF 6 1" = 500' HORIZ.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		8

BASIS OF ESTIMATE TABLES

Table 1: Basis of Estimate for Erosion Control Items				
Item	**Description**	**Rate**	**Basis**	**Quantities**
*166	FERTILIZER			
	FERTILIZER (20-10-10) (PERMANENT)	300 LBS / AC	2.35 AC	0.36 TON
	FERTILIZER (20-10-10) (TEMPORARY)	300 LBS / AC	2.35 AC	0.36 TON
168	VEGETATIVE WATERING			
	(3 APPLICATIONS - PERM)	13,100 GAL/AC/APP	2.35 AC	93 MG
	(3 APPLICATIONS - TEMP)	13,100 GAL/AC/APP	2.35 AC	93 MG

Table 8: Basis of Estimate for Roadside Maintenance				
Item	**Description**	**Rate**	**Basis**	**Quantities**
730	ROADSIDE MOWING	201.1 AC / CYCLE	2 CYC / YR	6**04** AC
734	LITTER REMOVAL	1 CYC / 3 MONTH	1**8** MO	6 CYC
735	DEBRIS REMOVAL			
	(CENTER MEDIANS / MAINLANES)			
	YEAR AROUND	4 CYC /MONTH	1**8** MO	7**2** CYC
738	CLEANING AND SWEEPING HIGHWAYS			
	(OUTSIDE MAINLANE)	1 CYC /1 MONTH	1**8** MO	1**8** CYC

GENERAL

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

The disturbed area for this project, as shown on the plans is 2.35 acres. However, the Total Disturbed Area (TDA) will establish the required authorization for storm water discharges. The TDA of this project will be determined by the sum of the disturbed area in all project locations in the contract, and all disturbed area on all Project-Specific Locations (PSL) located in the project limits and/or within 1 mile of the project limits. The department will obtain an authorization to discharge storm water from the Texas Commission on Environmental Quality (TCEQ) for the construction site as shown on the plans, according to the TDA of the project. The contractor will obtain any required authorization from the TCEQ for the discharge of storm water from any PSL for construction support activities on or off of the project row according to the TDA of the project. When the TDA for the project exceeds 1 acre, provide a copy of the appropriate application of

permit (NOI, or Construction Site Notice) to the engineer, for any PSL located in the project limits or within 1 mile of the project limits. Follow the directives and adhere to all requirements set forth in the TCEQ, Texas Pollution Discharge Elimination System, Construction General Permit (TPDES, CGP).

There is a high probability that an environmentally sensitive area could be encountered on the contractor designated Project-Specific Locations (PSL) for this project (haul roads, equipment staging areas, borrow pits, disposal sites, field offices, storage areas, parking areas, etc.). Item 7.6 “Project-Specific Locations”, provides a listing of regulatory agencies that may need to be contacted regarding this project.

Contractor questions on this project are to be emailed to the Waco District at the following address:

Bill Compton - Wacoprebid@txdot.gov, 254-867-2707, 100 S. Loop Dr., Waco, TX
Carmen Chau - Wacoprebid@txdot.gov, 254-867-2794, 100 S. Loop Dr., Waco, TX

Or Via phone or in person to the following individual(s):
Area Engineer’s: Josh Voiles 254-582-5432
Assistant Area Engineer’s: Anel Rivera Rosado 254-582-5432

All contractor questions will be reviewed by the Area Engineer or Assistant Area Engineer. Once a response is developed, it will be posted to TxDOT’s Public FTP at the following Address:
https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting%20Responses/

All questions submitted that generate a response will be posted through this site. The site is organized by District, Project Type (Construction or Maintenance), Letting Date, CCSJ/Project Name.

GENERAL NOTES

ITEM 5: CONTROL OF THE WORK

Submit all fabrication and shop drawings per TxDOT’s online shop drawing submittal system and copy the Area Engineer on the email submittal, unless otherwise directed.

Where a precast or cast-in-place concrete element is shown in the plans, Contractor may submit a precast concrete alternate in accordance with “Standard Operating Procedure for Alternate Precast Proposal Submission” found online at:
https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/publications/bridge.html#design.
Acceptance or denial of an alternate is at the sole discretion of the Department. Contractor is responsible for impacts to the project schedule and cost resulting from the use of alternates.

Underground utilities owned by the Texas Department of Transportation may be present within the Right-Of-Way on this project. For signal, illumination, surveillance, and communications & control maintained by TxDOT, call the TxDOT Traffic Signal Office (254)867-2808 for locates a minimum of 48 hours in advance of excavation. For irrigation systems, call TxDOT Landscape Office (254)867-2726 for locates a minimum of 48 hours in advance of excavation. If city or town owned irrigation facilities are present, call the appropriate department of the local city or town a minimum of 48 hours in advance of excavation. The Contractor is liable for all damages when utilities are damaged due to Contractor's negligence including, but not limited to, repair or replacement at the Contractor's expense.

For the solar powered LED embedded signs, contractor shall submit and receive TxDOT approval of the equipment prior to installation.

ITEM 6: CONTROL OF MATERIALS

References to manufacturer's trade name or catalog numbers are for the purpose of identification only and the contractor will be permitted to furnish like materials of other manufacturers provided they are of equal quality and comply with specifications for this project.

This project has structure with surface coatings which contain hazardous constituent on Cottonwood Creek bridge which contains lead in silver paint on steel I-beams, cross bars, bearings and guardrails. Contractor is responsible for the health and safety of his employees and compliance with all OSHA standards and regulations.

ITEM 7: LEGAL RELATIONS AND RESPONSIBILITIES

No significant traffic generator events identified.

If utilizing private property for waste disposal sites, field office sites, equipment storage sites or for any other purpose involved with this project, provide to the Engineer written proof of the property owner's approval of the use of this property. This proof may be in the form of a letter or agreement signed by the property owner or other documents acceptable to the Engineer.

Personal vehicles of the contractor's employees will not be parked within the right of way at any time including any section closed to public traffic, unless the vehicle is being utilized for construction procedures. However, the contractor's employees may park on the right of way at the sites where the contractor has his office, equipment and materials storage yard.

The contractor is alerted to the possible presence of swallows under the existing bridges or culverts. Because the migratory bird treaty act prohibits harm to swallows, their eggs or their nestlings, the contractor will not begin potentially disturbing activities on or near the bridge until the birds have abandoned any occupied nests (approximately September 1). Active nests may not be removed regardless of the date.

Prior to the swallows returning to the nests (approximately March 1), abandoned nests will be removed from the bridge. The contractor will prevent the establishment of new nests on any portion of the structure. Methods for preventing the establishment of new nests must be approved by the project Engineer. Examples of acceptable nest prevention methods are bird-deterrent netting and bird-repelling sprays and/or gels to be applied to the structure. This work will not be paid for directly but will be subsidiary to the various bid items.

The Contractor will submit detailed site-specific plans for work in each "water of the United States" designated on the EPIC sheet. These plans must be approved by the TxDOT Engineer prior to starting any work in these areas. The plans must also describe facilities and work activities adjacent the Ordinary High-Water Marks. The plan must show actual dimensions and materials for:

- Proposed construction roads and work areas leading to or in close proximity to the Ordinary High-Water Marks
- Temporary material or equipment storage areas in close proximity to the Ordinary High-Water Marks
- Locations of proposed sediment and erosion control devices
- Identification of construction equipment and construction techniques to accomplish the work

Once this drawing and supporting information is reviewed and approved by TxDOT, all construction workers should be made aware of the limits designated on the drawings by the Contractor's supervision. Work in all waters of the US will be limited to the minimum necessary required to construct the bridge, culvert or roadway fills. Work will also include all activities needed for bridge and culvert demolitions. Working or disturbing soil in the stream channel outside the limits of the work plan will not be allowed. Orange fencing will be provided and maintained to establish the TxDOT approved boundaries in which work may be conducted between the Ordinary High-Water Marks. Orange fencing will not be paid for but will be considered subsidiary to Item 502, "Barricades, Signs and Traffic Handling".

ITEM 8: PROSECUTION AND PROGRESS

This Project will be a Standard Workweek in accordance with Article 8.3.1.4.

Meet bi-weekly or at intervals as agreed upon with the engineer to notify him or her of planned work for the upcoming 3-week period.

For this project, provide a Bar Chart progress schedule.

ITEM 100: PREPARING RIGHT OF WAY

The limits of preparing right of way will be measured as shown on the culvert layout sheets.

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

Remove all trees within the right of way where designated for Preparing Right of Way unless designated for preservation or as directed by the engineer.

Tree trimming and tree removal are subsidiary to preparing right of way.

Trees to be removed near gas lines shall be cut and ground 2' below grade.

The Contractor will take precautions to avoid harm to any wildlife encountered during the project; this includes active nests or burrows.

All Oak Tree Species:

1. To avoid the spread of Oak Wilt or other disease, all species of oak trees that are damaged or cut (branches, roots and/or stumps) for any reason during this contract, must be treated with a commercial wound dressing within 20 minutes of causing the damage or cut.

2. To prevent the spread of infection from tree to tree when pruning oak trees (all species), the Contractor must disinfect all pruning tools with a solution of 70% isopropyl alcohol after all cutting is complete on each oak tree.

3. Potentially dangerous trees or limbs will be removed as soon as possible.

4. The Engineer can stop all Work operations if the dressing, cut and removal requirements are not followed.

5. Pruning shall be in accordance with ANSI A300 pruning standard.

The Contractor will be responsible for leaving the project site clean and neat in appearance upon completion and before final acceptance by the Engineer.

Limits as shown in the plans are approximate. Actual limits may vary.

Remove and dispose of cuttings within five (5) calendar days after cutting.

Material will be disposed of in accordance with federal, state, and local regulations. No material will be placed on private property unless otherwise approved in writing by the Engineer. The Contractor will provide sufficient documentation to verify proper disposal.

Wood chips may be left on the right of way no deeper than two (2) inches. Do not trespass on private property while perform work on this contract. Do not cut or damage timber outside the right-of-way lines.

Remove all fallen parts of trees, damaged limbs, and dead limbs. This work will not be paid for directly, but will be considered subsidiary to this item.

Tree Trimming: Contractor may use a buzzbar type saw for trimming trees. If using a buzzbar type saw, branches may protrude from the truck. The use of a brushax will not be allowed.

Trees will be trimmed to a clearance height as follows:
2. 18 feet above pavement (includes shoulders and travel lanes)

Stump removal is subsidiary to this bid item for trees removed by Contractor.

ITEM 104: REMOVING CONCRETE

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

ITEM 110: EXCAVATION

In a cut section, when soils are encountered at subgrade depths that are unstable and are deemed unsuitable by the Engineer, undercut this material for a minimum depth of one (1.0) foot below the maximum depth as determined and replace with a material having a plasticity index less than 25 and a liquid limit of less than 50.

ITEMS 110 & 132: EXCAVATION & EMBANKMENT

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

In those cases where fixed features require, the governing slopes indicated herein may be varied between the limits and to the extent determined.

ITEM 132: EMBANKMENT

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

ITEM 150: BLADING

The limits of blading and grading operations will be to the minimum width and length necessary to accomplish the required work. The Contractor will limit the removal of permanent grass that is already established at the proper lines and grades.

ITEM 164: SEEDING FOR EROSION CONTROL

Temporary seeding mixtures (cool and warm) will also include three (3) lbs of Bermuda grass seed per acre, with all seeds being planted concurrently.

Contractor will mow or disc wheat and or oats in spring prior to vegetation going to seed.

Permanent seed mixes for both urban and rural projects including sand or clay soils in the Waco District will be bid and installed to include a minimum of one & one-half (1.5) pounds per acre Green Sprangletop seed and four (4) pounds per acre Bermudagrass seed, with other seed types also being included and quantities remaining unchanged.

ITEM 169: SOIL RETENTION BLANKETS

Hydraulically apply Flexterra FGM, CocoFlex ET-FGM, Earth Guard or other spray applied soil retention as approved by the Engineer for erosion control on the specified slopes or areas in the construction plan. Apply as required per manufacturer's recommendations.

Use Tables under Item 164 to determine type of seeds to be used. Water for application, seeding, labor, equipment, tools, supplies, materials, fertilizer and incidentals will not be paid for directly but will be subsidiary to this Item.

ITEM 400: EXCAVATION AND BACKFILL OF STRUCTURES

Aggregate for cement stabilized backfill will be coarse aggregates, GRADE 3, 4 or 5 and fine aggregate, as shown in Item 421, "Hydraulic Cement Concrete". The ratio of course aggregate to sand should not contain more than sixty percent (60%) sand unless otherwise approved.

CLASS B bedding is required if rock is encountered.

ITEM 421: HYDRAULIC CEMENT CONCRETE

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

Provide sulfate resistant concrete for box culverts.

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

ITEM 432: RIPRAP

Weep holes and granular material, are required and locations will be determined prior to placement of concrete riprap at bridge abutments.

Tie existing concrete aprons at culverts to proposed concrete with No. 4 – 24" rebars spaced at a maximum of 18 in.

ITEM 440: REINFORCEMENT FOR CONCRETE

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

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

ITEM 451: RETROFIT RAILING

Refinish the outside face of the concrete slabs and curbs on the underpasses where railing is removed in such a manner as to leave a neat surface. Grind existing anchor bolts flush with the concrete. Paint the ends of the anchor bolts with two coats of zinc dust-zinc rich oxide paint as described under Item 450, "Railing". This work will not be paid for directly, but will be subsidiary to Item 451, "Retrofit Railing".

ITEM 462: CONCRETE BOX CULVERTS AND DRAINS

Joints between pre-cast concrete box culverts will be pre-formed flexible joint sealants as described in Section 464.3.3, "Jointing".

For this contract the contractor may use either pre-cast or cast in place culvert construction.

Reshape embankment side slopes, provide embankment as required, and add topsoil to achieve a smooth uniform finish around the installation of the safety end treatments and culvert extensions as directed. Finishing and reshaping work will be subsidiary to Items 132, "Embankment", Item 162, "Sodding for Erosion Control", and Item 467, "Safety End Treatment".

Provide and install pneumatically placed concrete on the ditch bottom and side slopes between temporary terminations between old and new culverts. Pnuematically placed concrete will be placed to the height of the largest culvert on the ditch side slopes; and to a limit 10 feet outside the location of BMPs along the ditch bottom. Cement stabilized sand may be substituted for pneumatically placed concrete, with Engineer approval.

ITEM 464: REINFORCED CONCRETE PIPE

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

ITEM 467: SAFETY END TREATMENT

Precast SET units are required for Item 4122 Thermoplastic Pipe.

ITEM 500: MOBILIZATION

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

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.

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

A meeting between the contractor and Engineer to discuss upcoming changes in construction phasing and traffic switches is required at least fourteen (14) days prior to the phase change. Items to be discussed at this meeting include temporary signing, traffic control, pavement markings, the processes necessary for the phase change and subcontractor scheduling.

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

When excavation is required next to a pavement lane carrying traffic and the widening is not completed by the end of the work day, backfill against the edge of the pavement with at least a 3:1 slope using an acceptable material to support vehicular traffic. Carefully remove and dispose of

this material when work resumes. Backfilling pavement edges, and the materials required for the work will be subsidiary to this item.

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

The Contractor Responsible Person(s) (CRP) for Work Zone Traffic Controls will inspect and ensure any deficiencies are corrected each and every day throughout the duration of this contract. Any misaligned or damaged traffic control devices will be repaired as soon as practical after deficiency is discovered.

In addition to providing a Contractor's Responsible Person and a phone number for emergency contact, have an employee(s) available to respond on the project for emergencies and for taking corrective measures within One (1) Hour.

Limit lane closures along SH 171 to the hours between 9:00 am and 3:30 pm. Work in other areas of the project is not restricted to this time frame.

ITEM 506: TEMPROARY EROSION, SEDIMENTATION AND ENVIRONMENTAL CONTROLS

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

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

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

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

No soil disturbing activities will begin on any section of TxDOT ROW without adequate sedimentation controls first being installed and functioning at adjacent drainage outfalls. Begin and continuously prosecute the repairs, additions and maintenance of erosion and sedimentation control devices within seven days after the Contractor receives each Form 2118, Field Inspection and Maintenance Report, from the Engineer. Failure of the Contractor to fulfill either of the above requirements places TxDOT in potential non-compliance with permit requirements and may result in withholding estimates or stopping work or both until all environmental permit requirements are fulfilled.

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

Cleaning and sweeping of open roadways due to material spillage or loss from Contractor equipment or tires will be the responsibility of the Contractor at no cost to TxDOT. This work will not be charged as Item 738, “Cleaning and Sweeping Highways”. Cleaning and sweeping of roadways will be completed as directed, including multiple times per day if necessary, to maintain acceptable roadways for the traveling public and to meet environmental regulations. Construction activities will cease when material deposited on the roadway is not properly removed or when equipment is not available as needed. Adequate construction exits will be planned, constructed and maintained by the Contractor per Item 506, “Temporary Erosion, Sedimentation, and Environmental Controls”.

ITEM 512: PORTABLE TRAFFIC BARRIER:

Department-furnished concrete traffic barrier units are at a TxDOT yard near the project location or other locations within fifty (50) miles of the project as directed. Barrier provided by TxDOT will be single slope. The Contractor will furnish equipment necessary to load the units at the stockpile locations.

The current locations for barrier are:

HCR 3102

Provide necessary hardware for connecting the portable concrete traffic barrier. For designated source portable barrier, the Department will provide the connection hardware. Should adequate hardware not be available, the Contractor will acquire the hardware, provide to the Department and be reimbursed via force account.

Upon completion of the project, all barrier will remain property of the Department and stockpiled at a TxDOT yard near the project location or other locations within fifty (50) miles of the project as directed. The Contractor will furnish equipment necessary to load and unload the units at the

stockpile locations. When stockpiling, separate damaged barriers from salvaged barriers as directed.

Stockpiling of portable concrete traffic barriers will not be permitted to be stockpiled (stacked) more than three (3) barriers high in any direction.

Portable concrete traffic barrier that is determined unusable will become property of contractor and will not be returned to TxDOT stockpile location. This work will be considered subsidiary to this item.

All hardware will become the property of the Department and will be returned to the TxDOT Maintenance yard within fifty (50) miles of the project as directed. Place hardware in fifty-five (55) gallon barrels with holes in bottom to allow drainage.

ITEM 540: METAL BEAM GUARD FENCE

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

Wooden block out will not be allowed.

ITEMS 542 & 544: REMOVING METAL BEAM GUARD FENCE & GUARDRAIL END TREATMENTS

W-Beam elements, steel posts and composite material blockouts will become the property of the contractor.

ITEM 544: GUARDRAIL END TREATMENTS
The use of wooden block-outs will not be allowed.

ITEM 545: CRASH CUSHON ATTENUATORS
Stockpile crash cushion attenuators at the SH 81/SP 579 split in Hillsboro.

ITEM 636: SIGNS

Verify all dimensions at the actual proposed sign location in order to maintain dimensions as shown on the Sign Mounting Details.

Stake the location of the new signs to be approved.

ITEM 644: SMALL ROADSIDE SIGN ASSEMBLIES

Bolt Clamp type will be used on Texas Triangular Slip Base System.

As practical with new construction, leave the existing sign assemblies in place until the proposed foundation, post and sign are in installed, and then remove the old sign assemblies.

Do not leave any sign foundation holes open overnight. Ensure all holes drilled are at least the minimum required depth with no loose material remaining in the hole.

Stake proposed sign locations and receive approval before installation of sign foundations.

Existing Mile Markers Signs are to be relocated to their original location(s) as they were prior to the beginning of the project.

Expanded foam foundations are not permitted.

Cut the bottom of all posts square.

For sign types which design details are not shown on these plans, fabricate according to the "STANDARD HIGHWAY SIGN DESIGNS FOR TEXAS".

Removed material that is deemed salvageable (signs and posts) will be the property of TxDOT. Deliver salvageable material to the TxDOT Maintenance Office. Remove unsalvageable material.

The Contractor will relocate the existing double sided street name signs and furnish the post mounted brackets for the street name signs to be paid for as part of the proposed Stop Signs (R1-1). Existing street name signs will be mounted above Stop signs. If damaged while being relocated, the Contractor will furnish new double sided street name sign at their own expense.

ITEM 658: DELINEATOR AND OBJECT MARKER ASSEMBLIES

All flexible and GF2 delineators will have a tubular body.

ITEM 666: RETROREFLECTORIZED PAVEMENT MARKINGS

The Contractor will layout the proposed striping in accordance with TxDOT Traffic Control Plan Standards and latest version Texas Manual on Uniform Traffic Control Devices (TMUTCD) and project striping layout sheets. The Engineer will verify proposed striping layout prior to the beginning of striping operations.

The Contractor will locate the beginning and ending points of No Pass Zones.

ITEM 668: PREFABRICATED PAVEMENT MARKINGS

Use Type C prefabricated pavement markings.

ITEM 672: RAISED PAVEMENT MARKERS

Existing raised pavement markers to be replaced will be removed at the same time that the new markers are placed (i.e. remove and replace in one operation). Existing raised pavement markers replaced by new markers will be removed in accordance with Item 677, "Eliminating Existing Pavement Markings and Markers". Immediately fill the damaged area in the pavement due to the removal of existing markers with an approved bituminous material. This removal and backfill work will not be paid for directly, but will be subsidiary to Item 672, "Raised Pavement Markers".

ITEM 677: ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS

Water blasting method will be used on all final pavement surfaces for removal of temporary or permanent pavement markings.

The following are considered acceptable Pavement Marking Removal methods on this project for non-final pavement surfaces:

Provide 2' wide strip seals
Water blasting
Mechanical Method

ITEM 730: ROADSIDE MOWING

Throughout the course of the project, when in the opinion of the Engineer, tall grass and weeds affect the safety of the public by restricting visibility, interfere with normal traffic flow or appear unsightly, the contractor will be required to mow same. Final cleanup will include mowing of grass and weeds. This work will be paid by the acre.

Mowing cycles will coincide with adjoining construction projects and adjoining segments maintained by contracted maintenance.

At the discretion of the Engineer, mow non-paved areas within the project prior to placement of permanent vegetation. The Contractor will plan and schedule to perform the full width mowing cycle work under this Item as follows:

RURAL AREAS
- At least two (2) times per year
- June 1 to July 15 and late October to late November

URBAN AREAS
- At least four (4) times per year
- Prior to March 1, June 1 to July 15, September and late October to late November

The Engineer will approve the actual beginning time of work for each cycle of work performed. The Contractor will provide the Engineer two weeks advance notice before beginning actual work for each cycle.

ITEM 734: LITTER REMOVAL:

Litter shall be picked up within **48 hours** of the completion of a mowing cycle.

Contractor shall pickup and dispose of litter on the roadways designated in the plans for litter pickup. Disposal shall conform to all applicable regulations and laws.

The Department will issue a written notice to begin a litter cycle. In the notice the Contractor will be given the number of acres required for litter pickup, the number of working days allowed to complete the cycle, and the date when time charges for the cycle will start. Liquidated damages will be assessed for any working day charged beyond the authorized time. Cycles for litter removal and disposal will be scheduled by the Maintenance Supervisor. Once work has started on a cycle, the Contractor will proceed in an expeditious manner satisfactory to the Engineer until all work on the cycle is satisfactorily completed.

ITEM 738: CLEANING AND SWEEPING HIGHWAYS

For sweeping operations, a vacuum pickup type broom will be utilized.

Regular sweeping of dirt or mud due to construction operations from the travel ways will not be paid for directly but will be subsidiary to the various bid items.

ITEM 6001: PORTABLE CHANGEABLE MESSAGE SIGN

This project will require “full matrix” type portable changeable message signs.

Ensure that the Contractor’s Responsible Person for traffic control can revise messages within thirty (30) minutes of notification.

Supply portable changeable message sign(s) in accordance with the Traffic Control Plan standard sheets and Article 6f.55 of the Texas Manual on Uniform Traffic Control Devices for Streets and Highways Part VI.

ITEM 6185: TRUCK MOUNTED ATTENUATORS

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

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

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

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

Shadow vehicles equipped for truck mounted attenuators (TMA) for stationary operations will be paid for by the day and must be available for use at any time as determined by the Engineer.

Mobile operations will be paid for by the hour, per specifications. For mobile operations, payment will be made only while the TMA is in use.

For mobile operations requiring multiple TMA’s, judgement may be applied in lower speed, urban / in town traffic environments to reduce the numbers of TMA in use where the added TMA may pose a hazard for traffic entering and exiting driveways, side streets, etc.

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

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0019-03-028 **DISTRICT** Waco **COUNTY** Hill
HIGHWAY SH 171

			CONTROL SECTION JOB		**0019-03-028**		**0418-03-025**		TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00004920**		**A00004918**			
			COUNTY		**Hill**		**Hill**			
			HIGHWAY		**SH 171**		**SH 171**			
ALT	**BID CODE**	**DESCRIPTION**		**UNIT**	EST.	FINAL	EST.	FINAL		
	100-6002	PREPARING ROW		STA	4.000		4.300		8.300	
	104-6009	REMOVING CONC (RIPRAP)		SY			73.600		73.600	
	104-6010	REMOVING CONC (RIPRAP)		CY			4.000		4.000	
	104-6054	REMOVING CONCRETE(MOW STRIP)		LF			500.000		500.000	
	110-6002	EXCAVATION (CHANNEL)		CY	20.000		99.000		119.000	
	132-6001	EMBANKMENT (FINAL)(ORD COMP)(TY A)		CY	6.000				6.000	
	132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)		CY	95.000		323.800		418.800	
	150-6001	BLADING		STA	18.000		14.000		32.000	
	164-6003	BROADCAST SEED (PERM) (RURAL) (CLAY)		SY	4,170.000		7,228.000		11,398.000	
	164-6071	BROADCAST SEED (TEMP)(WARM OR COOL)		SY	4,170.000		7,228.000		11,398.000	
	168-6001	VEGETATIVE WATERING		MG	68.000		117.000		185.000	
	169-6003	SOIL RETENTION BLANKETS (CL 1) (TY C)		SY	2,085.000		3,614.000		5,699.000	
	400-6005	CEM STABIL BKFL		CY	314.800		62.350		377.150	
	400-6006	CUT & RESTORING PAV		SY	594.000		566.000		1,160.000	
	402-6001	TRENCH EXCAVATION PROTECTION		LF	318.000		85.000		403.000	
	403-6001	TEMPORARY SPL SHORING		SF	2,533.000		2,642.000		5,175.000	
	420-6070	CL C CONC (PILE ENCASEMENT)		CY			2.700		2.700	
	429-6005	CONC STR REPAIR(DECK REP (FULL DEPTH))		SF			6.000		6.000	
	432-6002	RIPRAP (CONC)(5 IN)		CY	60.200		86.850		147.050	
	432-6030	RIPRAP (STONE COMMON)(GROUT)(12 IN)		CY			119.000		119.000	
	432-6031	RIPRAP (STONE PROTECTION)(12 IN)		CY	90.000		125.000		215.000	
	432-6033	RIPRAP (STONE PROTECTION)(18 IN)		CY	682.400		846.000		1,528.400	
	432-6035	RIPRAP (STONE PROTECTION)(24 IN)		CY			81.000		81.000	
	432-6045	RIPRAP (MOW STRIP)(4 IN)		CY	30.500		199.600		230.100	
	432-6051	RIPRAP (STONE COMMON)(GROUT)(18 IN)		CY			2.250		2.250	
	438-6003	CLEANING AND SEALING EXIST JOINTS(CL5)		LF			116.000		116.000	
	451-6019	RETROFIT RAIL (TY T631)		LF			251.500		251.500	
	462-6004	CONC BOX CULV (4 FT X 3 FT)		LF	90.000				90.000	
	462-6006	CONC BOX CULV (5 FT X 2 FT)		LF	389.000		184.000		573.000	
	462-6008	CONC BOX CULV (5 FT X 4 FT)		LF			104.000		104.000	
	462-6010	CONC BOX CULV (6 FT X 3 FT)		LF			348.000		348.000	
	462-6030	CONC BOX CULV (10 FT X 6 FT)		LF	88.000				88.000	
	462-6045	CONC BOX CULV (3 FT X 2 FT)(EXTEND)		LF	4.000				4.000	
	462-6046	CONC BOX CULV (3 FT X 3 FT)(EXTEND)		LF			18.000		18.000	
	462-6053	CONC BOX CULV (5 FT X 5 FT)(EXTEND)		LF			4.000		4.000	
	462-6056	CONC BOX CULV (6 FT X 5 FT)(EXTEND)		LF			8.000		8.000	
	462-6060	CONC BOX CULV (7 FT X 5 FT)(EXTEND)		LF	8.000				8.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0019-03-028 **DISTRICT** Waco **COUNTY** Hill
HIGHWAY SH 171

			CONTROL SECTION JOB		**0019-03-028**		**0418-03-025**		TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00004920**		**A00004918**			
			COUNTY		**Hill**		**Hill**			
			HIGHWAY		**SH 171**		**SH 171**			
ALT	**BID CODE**	**DESCRIPTION**		**UNIT**	EST.	FINAL	EST.	FINAL		
	462-6063	CONC BOX CULV (8 FT X 4 FT)(EXTEND)		LF			8.000		8.000	
	462-6066	CONC BOX CULV (8 FT X 7 FT)(EXTEND)		LF			8.000		8.000	
	462-6067	CONC BOX CULV (8 FT X 8 FT)(EXTEND)		LF	8.000				8.000	
	462-6075	CONC BOX CULV (10 FT X 7 FT)(EXTEND)		LF	8.000				8.000	
	462-6078	CONC BOX CULV (10 FT X 10 FT)(EXTEND)		LF			24.000		24.000	
	462-6095	CONC BOX CULV (6 FT X 2 FT) (EXTEND)		LF			4.000		4.000	
	464-6009	RC PIPE (CL III)(42 IN)		LF	4.000		36.000		40.000	
	464-6010	RC PIPE (CL III)(48 IN)		LF	20.000		4.000		24.000	
	466-6144	WINGWALL (FW - 0) (HW=12 FT)		EA			3.000		3.000	
	466-6153	WINGWALL (FW - 0) (HW=6 FT)		EA			3.000		3.000	
	466-6154	WINGWALL (FW - 0) (HW=7 FT)		EA			1.000		1.000	
	466-6155	WINGWALL (FW - 0) (HW=8 FT)		EA	1.000				1.000	
	466-6157	WINGWALL (FW - S) (HW=10 FT)		EA	1.000				1.000	
	466-6166	WINGWALL (FW - S) (HW=5 FT)		EA			1.000		1.000	
	466-6167	WINGWALL (FW - S) (HW=6 FT)		EA			1.000		1.000	
	466-6168	WINGWALL (FW - S) (HW=7 FT)		EA	4.000				4.000	
	466-6170	WINGWALL (FW - S) (HW=9 FT)		EA			2.000		2.000	
	466-6171	WINGWALL (PW - 1) (HW=10 FT)		EA	2.000				2.000	
	466-6173	WINGWALL (PW - 1) (HW=12 FT)		EA			1.000		1.000	
	466-6182	WINGWALL (PW - 1) (HW=7 FT)		EA	2.000				2.000	
	467-6105	SET (TY I)(S=3 FT)(HW=3FT)(3:1)(C)		EA	2.000				2.000	
	467-6111	SET (TY I)(S=3 FT)(HW= 4 FT)(3:1)(C)		EA			2.000		2.000	
	467-6143	SET (TY I)(S= 4 FT)(HW= 4 FT)(3:1) (C)		EA	2.000				2.000	
	467-6171	SET (TY I)(S= 5 FT)(HW= 3 FT)(3:1) (C)		EA			4.000		4.000	
	467-6172	SET (TY I)(S= 5 FT)(HW= 3 FT)(4:1) (C)		EA	8.000				8.000	
	467-6184	SET (TY I)(S= 5 FT)(HW= 5 FT)(6:1) (P)		EA			4.000		4.000	
	467-6205	SET (TY I)(S= 6 FT)(HW= 3 FT)(4:1) (C)		EA			2.000		2.000	
	467-6215	SET (TY I)(S= 6 FT)(HW= 4 FT)(6:1) (P)		EA			10.000		10.000	
	467-6217	SET (TY I)(S= 6 FT)(HW= 5 FT)(3:1) (C)		EA	2.000				2.000	
	467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)		EA	44.000		127.000		171.000	
	467-6388	SET (TY II) (24 IN) (RCP) (3: 1) (C)		EA			4.000		4.000	
	467-6394	SET (TY II) (24 IN) (RCP) (6: 1) (C)		EA	2.000				2.000	
	467-6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)		EA	66.000		78.000		144.000	
	467-6417	SET (TY II) (30 IN) (RCP) (3: 1) (C)		EA			3.000		3.000	
	467-6419	SET (TY II) (30 IN) (RCP) (4: 1) (C)		EA			11.000		11.000	
	467-6423	SET (TY II) (30 IN) (RCP) (6: 1) (P)		EA	22.000		36.000		58.000	
	467-6448	SET (TY II) (36 IN) (RCP) (3: 1) (C)		EA			4.000		4.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0019-03-028 **DISTRICT** Waco **COUNTY** Hill
HIGHWAY SH 171

			CONTROL SECTION JOB		**0019-03-028**		**0418-03-025**		TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00004920**		**A00004918**			
			COUNTY		**Hill**		**Hill**			
			HIGHWAY		**SH 171**		**SH 171**			
ALT	**BID CODE**	**DESCRIPTION**		**UNIT**	EST.	FINAL	EST.	FINAL		
	467-6450	SET (TY II) (36 IN) (RCP) (4: 1) (C)		EA			8.000		8.000	
	467-6454	SET (TY II) (36 IN) (RCP) (6: 1) (P)		EA	6.000		4.000		10.000	
	467-6461	SET (TY II) (42 IN) (RCP) (3: 1) (C)		EA	2.000				2.000	
	467-6463	SET (TY II) (42 IN) (RCP) (4: 1) (C)		EA			2.000		2.000	
	467-6466	SET (TY II) (42 IN) (RCP) (6: 1) (P)		EA			2.000		2.000	
	467-6474	SET (TY II) (48 IN) (RCP) (3: 1) (C)		EA	2.000				2.000	
	467-6477	SET (TY II) (48 IN) (RCP) (4: 1) (C)		EA			2.000		2.000	
	467-6480	SET (TY II) (48 IN) (RCP) (6: 1) (P)		EA	4.000				4.000	
	480-6001	CLEAN EXIST CULVERTS		EA	53.000		103.000		156.000	
	496-6004	REMOV STR (SET)		EA	44.000		6.000		50.000	
	496-6005	REMOV STR (WINGWALL)		EA	16.000		16.000		32.000	
	496-6006	REMOV STR (HEADWALL)		EA	10.000		26.000		36.000	
	496-6007	REMOV STR (PIPE)		LF	1,680.000		2,075.500		3,755.500	
	496-6008	REMOV STR (BOX CULVERT)		LF	150.000		58.000		208.000	
	496-6018	REMOVE STR (CONC)		EA			1.000		1.000	
	500-6001	MOBILIZATION		LS	0.700		0.300		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING		MO	18.000				18.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)		LF	300.000		520.000		820.000	
	506-6011	ROCK FILTER DAMS (REMOVE)		LF	300.000		520.000		820.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)		LF	1,500.000		2,600.000		4,100.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)		LF	1,500.000		2,600.000		4,100.000	
	512-6013	PORT CTB (DES SOURCE)(SGL SLP)(TY 1)		LF			420.000		420.000	
	512-6025	PORT CTB (MOVE)(SGL SLP)(TY 1)		LF			420.000		420.000	
	512-6037	PORT CTB (STKPL)(SGL SLP)(TY 1)		LF			420.000		420.000	
	533-6001	RUMBLE STRIPS (SHOULDER)		LF	52,385.000		125,967.000		178,352.000	
	533-6002	RUMBLE STRIPS (CENTERLINE)		LF	26,193.000		62,984.000		89,177.000	
	540-6002	MTL W-BEAM GD FEN (STEEL POST)		LF	237.500		1,437.500		1,675.000	
	540-6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)		EA			15.000		15.000	
	540-6014	SHORT RADIUS		LF	30.000		70.000		100.000	
	540-6015	DRIVEWAY TERMINAL ANCHOR SECTION		EA	2.000				2.000	
	540-6020	MTL W - BEAM GD FEN (LOW FILL CULVERT)		LF	100.000		225.000		325.000	
	540-6035	MTL BM GD FEN TRANS (31"-28")		EA	2.000		2.000		4.000	
	542-6001	REMOVE METAL BEAM GUARD FENCE		LF			1,157.500		1,157.500	
	542-6002	REMOVE TERMINAL ANCHOR SECTION		EA			1.000		1.000	
	542-6004	RM MTL BM GD FENCE TRANS (THRIE-BEAM)		EA			15.000		15.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)		EA	6.000		35.000		41.000	
	544-6003	GUARDRAIL END TREATMENT (REMOVE)		EA			19.000		19.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0019-03-028 **DISTRICT** Waco **COUNTY** Hill
HIGHWAY SH 171

			CONTROL SECTION JOB		**0019-03-028**		**0418-03-025**		TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00004920**		**A00004918**			
			COUNTY		**Hill**		**Hill**			
			HIGHWAY		**SH 171**		**SH 171**			
ALT	**BID CODE**	**DESCRIPTION**		**UNIT**	EST.	FINAL	EST.	FINAL		
	545-6003	CRASH CUSH ATTEN (MOVE & RESET)		EA			2.000		2.000	
	545-6004	CRASH CUSH ATTEN (STKPL)		EA			2.000		2.000	
	545-6019	CRASH CUSH ATTEN (INSTL)(S)(N)(TL3)		EA			2.000		2.000	
	644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)		EA	7.000		9.000		16.000	
	644-6004	IN SM RD SN SUP&AM TY10BWG(1)SA(T)		EA	4.000		9.000		13.000	
	644-6030	IN SM RD SN SUP&AM TYS80(1)SA(T)		EA	4.000		2.000		6.000	
	644-6033	IN SM RD SN SUP&AM TYS80(1)SA(U)		EA			4.000		4.000	
	644-6051	IN SM RD SN SUP&AM TYS80(2)SA(P-EXAL)		EA			2.000		2.000	
	644-6076	REMOVE SM RD SN SUP&AM		EA	14.000		19.000		33.000	
	644-6094	ISRSA TY10BWG(1)SA(T) (EXCLUDING SIGN)		EA	8.000		8.000		16.000	
	658-6046	INSTL OM ASSM (OM-2X)(WC)GND		EA	28.000		46.000		74.000	
	658-6062	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI)		EA	12.000		78.000		90.000	
	662-6111	WK ZN PAV MRK SHT TERM (TAB)TY Y-2		EA	2,680.000		6,470.000		9,150.000	
	666-6030	REFL PAV MRK TY I (W)8"(DOT)(100MIL)		LF			44.000		44.000	
	666-6036	REFL PAV MRK TY I (W)8"(SLD)(100MIL)		LF			106.000		106.000	
	666-6048	REFL PAV MRK TY I (W)24"(SLD)(100MIL)		LF	96.000		14.000		110.000	
	666-6303	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)		LF	52,385.000		125,967.000		178,352.000	
	666-6312	RE PM W/RET REQ TY I (Y)4"(BRK)(100MIL)		LF	5,302.000		12,602.000		17,904.000	
	666-6315	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)		LF	17,585.000		65,840.000		83,425.000	
	668-6077	PREFAB PAV MRK TY C (W) (ARROW)		EA			1.000		1.000	
	668-6085	PREFAB PAV MRK TY C (W) (WORD)		EA			1.000		1.000	
	672-6007	REFL PAV MRKR TY I-C		EA			10.000		10.000	
	672-6009	REFL PAV MRKR TY II-A-A		EA	487.000		1,454.000		1,941.000	
	677-6012	ELIM EXT PAV MRK & MRKS (WORD)		EA			2.000		2.000	
	677-6028	ELIM EXT PV MRK & MRKS (RUMBLE STRIP)		LF			80.000		80.000	
	730-6002	FULL - WIDTH MOWING		AC	181.000		423.000		604.000	
	734-6002	LITTER REMOVAL		CYC	2.000		4.000		6.000	
	735-6001	DEBRIS REMOVAL (CNTR MEDIANS/MAINLANES)		CYC	22.000		50.000		72.000	
	738-6003	CLEANING / SWEEPING (OUTSIDE MAIN LANE)		CYC	6.000		12.000		18.000	
	6001-6001	PORTABLE CHANGEABLE MESSAGE SIGN		DAY	20.000		20.000		40.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN		EA	2.000		2.000		4.000	
	6056-6001	PREFORMED IN-LANE(TRANS) RUMBLE STRIP		LF			160.000		160.000	
	6185-6002	TMA (STATIONARY)		DAY	40.000		60.000		100.000	
	6185-6003	TMA (MOBILE OPERATION)		HR	60.000		100.000		160.000	
	6368-6001	SOLAR POWERED LED SIGN		EA	8.000		8.000		16.000	
	18	EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)		LS	1.000				1.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0019-03-028 **DISTRICT** Waco **COUNTY** Hill
HIGHWAY SH 171

								TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB		**0019-03-028**		**0418-03-025**			
		PROJECT ID		**A00004920**		**A00004918**			
		COUNTY		**Hill**		**Hill**			
		HIGHWAY		**SH 171**		**SH 171**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL	EST.	FINAL		
	18	SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000				1.000	
1	464-6003	RC PIPE (CL III)(18 IN)	LF	200.000		600.000		800.000	
	4122-6014	THERMOPLASTIC PIPE(18 IN)(PP)(TYPE III)	LF	132.000		164.000		296.000	
1A	464-6003	RC PIPE (CL III)(18 IN)	LF	332.000		764.000		1,096.000	
2	464-6005	RC PIPE (CL III)(24 IN)	LF	268.000		244.000		512.000	
	4122-6010	THERMOPLASTIC PIPE(24 IN)(PP)(TYPE III)	LF	416.000		412.000		828.000	
2A	464-6005	RC PIPE (CL III)(24 IN)	LF	684.000		656.000		1,340.000	
3	464-6007	RC PIPE (CL III)(30 IN)	LF			88.000		88.000	
	4122-6008	THERMOPLASTIC PIPE(30 IN)(PP)(TYPE III)	LF	296.000		388.000		684.000	
3A	464-6007	RC PIPE (CL III)(30 IN)	LF	296.000		476.000		772.000	
4	464-6008	RC PIPE (CL III)(36 IN)	LF			48.000		48.000	
	4122-6015	THERMOPLASTIC PIPE(36")(PP) (TYPE III)	LF	72.000				72.000	
4A	464-6008	RC PIPE (CL III)(36 IN)	LF	72.000		48.000		120.000	

SUMMARY OF DRAINAGE ITEMS

LOCATION	100 6002	104 6009	104 6010	110 6002	132 6001	132 6003	150 6001	400 6005	400 6006	402 6001	403 6001	432 6002	432 6031	432 6033	432 6051	462 6004	462 6006	462 6030	462 6045	462 6046	462 6053	462 6056	462 6060	462 6063	462 6066
	PREPARING ROW	REMOVING CONC (RIPRAP)	REMOVING CONC (RIPRAP)	EXCAVATION (CHANNEL)	EMBANKMENT (FINAL)(ORD COMP)(TY A)	EMBANKMENT (FINAL)(ORD COMP)(TY B)	BLADING	CEM STABIL BKFL	CUT & RESTORING PAV	TRENCH EXCAVATION PROTECTION	TEMPORARY SPL SHORING	RIPRAP (CONC)(5 IN)	RIPRAP (STONE PROTECTION)(12 IN)	RIPRAP (STONE PROTECTION)(18 IN)	RIPRAP (STONE COMMON)(GROUT)(18 IN)	CONC BOX CULV (4 FT X 3 FT)	CONC BOX CULV (5 FT X 2 FT)	CONC BOX CULV (10 FT X 6 FT)	CONC BOX CULV (3 FT X 2 FT)(EXTEND)	CONC BOX CULV (3 FT X 3 FT)(EXTEND)	CONC BOX CULV (5 FT X 5 FT)(EXTEND)	CONC BOX CULV (6 FT X 5 FT)(EXTEND)	CONC BOX CULV (7 FT X 5 FT)(EXTEND)	CONC BOX CULV (8 FT X 4 FT)(EXTEND)	CONC BOX CULV (8 FT X 7 FT)(EXTEND)
	STA	SY	CY	CY	CY	CY	STA	CY	SY	LF	SF	CY	CY	CY	CY	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF
CSJ 0418-03-025																									
37 - NBI 091100041803042				20		10					936	5		177											
36 - NBI 091100041803041		42		20		10					936	9		149											
35		2.8		6			1						13												
34		9										3	9												
33													5												
32a													8												
32							1					3		23											
30 - NBI 091100041803036				22								15		128											
31						63.8							10												
29		3.8											6												
28							1					13		87											8
27 - NBI 091100041803038														51											
26						10	1					2.6		12						18					
25												0.25	4												
24				31			1				359	7		58										8	
23							1	21.7	49	44		2		23			84								
22								2.25			411	7		32	2.25							8			
21	1		4									4		23											
20							1					6		63							4				
19																									
18																									
17						10	1					2	8												
16							1						9												
15						6	1						4												
14							1						8												
12							1	38.4	54	41		2	41				100								
CSJ 0418-03-025 TOTAL	1	57.6	4	99		109.8	12	62.35	103	85	2642	80.85	125	826	2.25		184			18	4	8		8	8
CSJ 0019-03-028																									
11	1						1	88.7	79	88		6		70				88							
10					6		1						9.9												
9							1						6.3												
8	1						1				1093			164.4											
7a							1	65.2	127	25		8.2	29.2				300								
7							1	32.6	50	33			9.7				89								
6c							1	88	38	96			4.6												
6b							1	40.3	45	76		2	30.3			90									
6a	1											4		27.8											
6							1					4		40.3											
5	1						1				321			79.4											
4				20								11		27.7											
3 - NBI 091100001903039						12					782	12		122											
2 - NBI 091100001903038						12					337	12		115.8									8		
1						7						1		35					4						
CSJ 0019-03-028 TOTAL	4			20	6	31	10	314.8	339	318	2533	60.2	90	682.4		90	389	88	4				8		
PROJECT TOTALS	**5**	**57.6**	**4**	**119**	**6**	**140.8**	**22**	**377.15**	**442**	**403**	**5175**	**141.05**	**215**	**1508.4**	**2.25**	**90**	**573**	**88**	**4**	**18**	**4**	**8**	**8**	**8**	**8**

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		11

SUMMARY OF DRAINAGE ITEMS

LOCATION	462 6067	462 6075	462 6078	462 6095	* 464 6003	* 464 6005	* 464 6007	* 464 6008	* 464 6009	464 6010	466 6144	466 6153	466 6154	466 6155	466 6157	466 6166	466 6167	466 6168	466 6170	466 6171	466 6173	466 6182	467 6105	467 6111	467 6143
	CONC BOX CULV (8 FT X 8 FT)(EXTEND)	CONC BOX CULV (10 FT X 7 FT)(EXTEND)	CONC BOX CULV (10 FT X 10 FT)(EXTEND)	CONC BOX CULV (6 FT X 2 FT) (EXTEND)	RC PIPE (CL III)(18 IN)	RC PIPE (CL III)(24 IN)	RC PIPE (CL III)(30 IN)	RC PIPE (CL III)(36 IN)	RC PIPE (CL III)(42 IN)	RC PIPE (CL III)(48 IN)	WINGWALL (FW - 0) (HW=12 FT)	WINGWALL (FW - 0) (HW=6 FT)	WINGWALL (FW - 0) (HW=7 FT)	WINGWALL (FW - 0) (HW=8 FT)	WINGWALL (FW - S) (HW=10 FT)	WINGWALL (FW - S) (HW=5 FT)	WINGWALL (FW - S) (HW=6 FT)	WINGWALL (FW - S) (HW=7 FT)	WINGWALL (FW - S) (HW=9 FT)	WINGWALL (PW - 1) (HW=10 FT)	WINGWALL (PW - 1) (HW=12 FT)	WINGWALL (PW - 1) (HW=7 FT)	SET (TY I)(S=3 FT)(HW=3FT) (3:1)(C)	SET (TY I)(S=3 FT)(HW= 4 FT)(3:1)(C)	SET (TY I)(S= 4 FT)(HW= 4 FT)(3:1) (C)
	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
CSJ 0418-03-025																									
37 - NBI 091100041803042			12								1										1				
36 - NBI 091100041803041			12								2														
35										4															
34							8																		
33								4																	
32a						8																			
32				4																					
30 - NBI 091100041803036																									
31									36																
29							8																		
28																			2						
27 - NBI 091100041803038																									
26					52																			2	
25							2																		
24																1	1								
23																									
22												1	1												
21																									
20												2													
19																									
18																									
17							32																		
16																									
15							6																		
14																									
12																									
CSJ 0418-03-025 TOTAL			24	4	52	8	56	4	36	4	3	3	1			1	1		2		1			2	
CSJ 0019-03-028																									
11																		2							
10										4															
9									4																
8	8																			2					
7a																									
7																									
6c						96																			
6b																									2
6a																									
6																									
5																						2			
4																									
3 - NBI 091100001903039		8												1	1										
2 - NBI 091100001903038																		2							
1																							2		
CSJ 0019-03-028 TOTAL	8	8				96			4	4				1	1			4		2		2	2		2
PROJECT TOTALS	**8**	**8**	**24**	**4**	**52**	**104**	**56**	**4**	**40**	**8**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**4**	**2**	**2**	**1**	**2**	**2**	**2**	**2**

*QUANTITIES ARE SHOWN IN THE ESTIMATE AS BASE BID AND ALT BID.

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		12

SUMMARY OF DRAINAGE ITEMS

LOCATION	467 6171	467 6172	467 6205	467 6217	467 6363	467 6388	467 6394	467 6417	467 6419	467 6423	467 6448	467 6450	467 6461	467 6463	467 6466	467 6474	467 6477	480 6001	496 6005	496 6006	496 6007	496 6008	496 6018	658 6046
	SET (TY I)(S=5 FT)(HW=3 FT)(3:1) (C)	SET (TY I)(S=5 FT)(HW=3 FT)(4:1) (C)	SET (TY I)(S=6 FT)(HW=3 FT)(4:1) (C)	SET (TY I)(S=6 FT)(HW=5 FT)(3:1) (C)	SET (TY II) (18 IN) (RCP) (6: 1) (P)	SET (TY II) (24 IN) (RCP) (3: 1) (C)	SET (TY II) (24 IN) (RCP) (6: 1) (C)	SET (TY II) (30 IN) (RCP) (3: 1) (C)	SET (TY II) (30 IN) (RCP) (4: 1) (C)	SET (TY II) (30 IN) (RCP) (6: 1) (P)	SET (TY II) (36 IN) (RCP) (3: 1) (C)	SET (TY II) (36 IN) (RCP) (4: 1) (C)	SET (TY II) (42 IN) (RCP) (3: 1) (C)	SET (TY II) (42 IN) (RCP) (4: 1) (C)	SET (TY II) (42 IN) (RCP) (6: 1) (P)	SET (TY II) (48 IN) (RCP) (3: 1) (C)	SET (TY II) (48 IN) (RCP) (4: 1) (C)	CLEAN EXIST CULVERTS	REMOV STR (WINGWALL)	REMOV STR (HEADWALL)	REMOV STR (PIPE)	REMOV STR (BOX CULVERT)	REMOVE STR (CONC)	INSTL OM ASSM (OM-2X)(WC)GND
	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF	LF	EA	EA
CSJ 0418-03-025																								
37 - NBI 091100041803042																		1	2			12		
36 - NBI 091100041803041																		1	2			12		
35																	2	1		2	4			4
34											4							1		2	8			2
33												2						1		2	4			2
32a						4												1		2	8			2
32			2															1	2			4		2
30 - NBI 091100041803036																		1						
31														2	2			1		2	4			2
29									4									1		2	8			2
28																		1	2			8		2
27 - NBI 091100041803038																		1						
26					3													1	2			2		2
25								2										1		2	4.5			2
24																		1	2			8		2
23	2																			2	178		1	2
22																		1	2			8		2
21																		1						2
20																		1	2			4		2
19																		1						2
18																		1						2
17									2	2								1		2	30			2
16												6						1		2	36			2
15								1	1									1		2	12			2
14									4									1		2	28			2
12	2																			2	208			2
CSJ 0418-03-025 TOTAL	4		2		3	4		3	11	2	4	8		2	2		2	24	16	26	532.5	58	1	46
CSJ 0019-03-028																								
11																			2			92		2
10																2		1		2	4			2
9													2					1		2	4			2
8																		1	2			8		2
7a		6																	2		309			2
7		2																		2	178			2
6c							2													2	120			2
6b																				2	99			2
6a																		1						4
6				2														1	2			18		2
5																		1	2			12		2
4																		1						2
3 - NBI 091100001903039																		1	2			8		
2 - NBI 091100001903038																		1	2			8		
1																		1	2			4		2
CSJ 0019-03-028 TOTAL		8		2			2						2			2		10	16	10	714	150		28
PROJECT TOTALS	**4**	**8**	**2**	**2**	**3**	**4**	**2**	**3**	**11**	**2**	**4**	**8**	**2**	**2**	**2**	**2**	**2**	**34**	**32**	**36**	**1246,5**	**208**	**1**	**74**

SUMMARY OF MBGF ITEMS

LOCATION	104 6054	132 6003	432 6030	432 6045	512 6013	512 6025	512 6037	540 6002	540 6006	540 6014	540 6015	540 6020	540 6035	542 6001	542 6002	542 6004	544 6001	544 6003	545 6003	545 6004	545 6019	658 6062
	REMOVING CONCRETE(MOW STRIP)	EMBANKMENT (FINAL)(ORD COMP)(TY B)	RIPRAP (STONE COMMON)(GROUT)(12 IN)	RIPRAP (MOW STRIP)(4 IN)	PORT CTB (DES SOURCE)(SGL SLP)(TY 1)	PORT CTB (MOVE)(SGL SLP)(TY 1)	PORT CTB (STKPL)(SGL SLP)(TY 1)	MTL W-BEAM GD FEN (STEEL POST)	MTL BEAM GD FEN TRANS (THRIE-BEAM)	SHORT RADIUS	DRIVEWAY TERMINAL ANCHOR SECTION	MTL W - BEAM GD FEN (LOW FILL CULVERT)	MTL BM GD FEN TRANS (31"-28")	REMOVE METAL BEAM GUARD FENCE	REMOVE TERMINAL ANCHOR SECTION	RM MTL BM GD FENCE TRANS (THRIE-BEAM)	GUARDRAIL END TREATMENT (INSTALL)	GUARDRAIL END TREATMENT (REMOVE)	CRASH CUSH ATTEN (MOVE & RESET)	CRASH CUSH ATTEN (STKPL)	CRASH CUSH ATTEN (INSTL)(S)(N)(TL3)	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI)
	LF	CY	CY	CY	LF	LF	LF	LF	EA	LF	EA	LF	EA	LF	EA	EA	EA	EA	EA	EA	EA	EA
CSJ 0481-03-025																						
Sheet 1 of 6	500	12		10.8				162.5	2					162.5	1	2	6	6				12
Sheet 2 of 6		102		41.8				175				125					8					12
Sheet 3 of 6				70.3				750	8					750		8	8	8				26
Sheet 4 of 6		96		41.7				200				100					8					12
Sheet 5 of 6		4	119	35	420	420	420	150	5	70			2	245		5	5	5	2	2	2	16
CSJ 0481-03-025 TOTAL	500	214	119	199.6	420	420	420	1437.5	15	70		225	2	1157.5	1	15	35	19	2	2	2	78
CSJ 0019-03-028																						
Sheet 6 of 6		64		30.5				237.5		30	2	100	2				6					12
CSJ 0019-03-028 TOTAL		64		30.5				237.5		30	2	100	2				6					12
PROJECT TOTALS	**500**	**278**	**119**	**230.1**	**420**	**420**	**420**	**1675**	**15**	**100**	**2**	**325**	**4**	**1157.5**	**1**	**15**	**41**	**19**	**2**	**2**	**2**	**90**

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		13

SUMMARY OF EROSION CONTROL ITEMS							
LOCATION	164	164	169	506	506	506	506
	6003	6071	6003	6002	6011	6038	6039
	BROADCAST SEED (PERM) (RURAL) (CLAY)	BROADCAST SEED (TEMP) (WARM OR COOL)	SOIL RETENTION BLANKETS (CL 1) (TY C)	ROCK FILTER DAMS (INSTALL) (TY 2)	ROCK FILTER DAMS (REMOVE)	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)
	SY	SY	SY	LF	LF	LF	LF
CSJ 0481-03-025							
37 - NBI 091100041803042	278	278	139	20	20	100	100
36 - NBI 091100041803041	278	278	139	20	20	100	100
35	278	278	139	20	20	100	100
34	278	278	139	20	20	100	100
33	278	278	139	20	20	100	100
32	278	278	139	20	20	100	100
32a	278	278	139	20	20	100	100
30 - NBI 091100041803036	278	278	139	20	20	100	100
31	278	278	139	20	20	100	100
29	278	278	139	20	20	100	100
28	278	278	139	20	20	100	100
27 - NBI 091100041803038	278	278	139	20	20	100	100
26	278	278	139	20	20	100	100
25	278	278	139	20	20	100	100
24	278	278	139	20	20	100	100
23	278	278	139	20	20	100	100
22	278	278	139	20	20	100	100
21	278	278	139	20	20	100	100
20	278	278	139	20	20	100	100
19	278	278	139	20	20	100	100
18	278	278	139	20	20	100	100
17	278	278	139	20	20	100	100
16	278	278	139	20	20	100	100
15	278	278	139	20	20	100	100
14	278	278	139	20	20	100	100
12	278	278	139	20	20	100	100
CSJ 0481-03-025 TOTAL	7228	7228	3614	520	520	2600	2600
CSJ 0019-03-028							
11	278	278	139	20	20	100	100
10	278	278	139	20	20	100	100
9	278	278	139	20	20	100	100
8	278	278	139	20	20	100	100
7a	278	278	139	20	20	100	100
7	278	278	139	20	20	100	100
6c	278	278	139	20	20	100	100
6b	278	278	139	20	20	100	100
6a	278	278	139	20	20	100	100
6	278	278	139	20	20	100	100
5	278	278	139	20	20	100	100
4	278	278	139	20	20	100	100
3 - NBI 091100001903039	278	278	139	20	20	100	100
2 - NBI 091100001903038	278	278	139	20	20	100	100
1	278	278	139	20	20	100	100
CSJ 0019-03-028 TOTAL	4170	4170	2085	300	300	1500	1500
PROJECT TOTALS	11398	11398	5699	820	820	4100	4100

SEEDING AND WATERING IS TO BE DONE AT CROSS CULVERTS ONLY UNLESS OTHERWISE DIRECTED BY TXDOT

SUMMARY OF WORKZONE TRAFFIC CONTROL ITEMS					
LOCATION	662	6001	6001	6185	6185
	6111	6001	6002	6002	6003
	WK ZN PAV MRK SHT TERM (TAB) TY Y-2	PORTABLE CHANGEABLE MESSAGE SIGN	PORTABLE CHANGEABLE MESSAGE SIGN	TMA (STATIONARY)	TMA (MOBILE OPERATION)
	EA	DAY	EA	DAY	HR
CSJ 0418-03-025	6470	20	2	60	100
CSJ 0019-03-028	2680	20	2	40	60
PROJECT TOTALS	9150	40	4	100	160

SUMMARY OF PAVEMENT MARKING ITEMS												
LOCATION	533	533	666	666	666	666	666	666	668	668	672	672
	6001	6002	6030	6036	6048	6303	6312	6315	6077	6085	6007	6009
	RUMBLE STRIPS (SHOULDER)	RUMBLE STRIPS (CENTER LINE)	REFL PAV MRK TY I (W)8"(DOT)(100MIL)	REFL PAV MRK TY I (W)8"(SLD)(100MIL)	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	RE PM W/RET REQ TY I (Y)4"(BRK)(100MIL)	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	PREFAB PAV MRK TY C (W) (ARROW)	PREFAB PAV MRK TY C (W) (WORD)	REFL PAV MRKR TY I-C	REFL PAV MRKR TY II-A-A
	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA
CSJ 0418-03-025	125967	62984	44	106	14	125967	12602	65840	1	1	10	1454
CSJ 0019-03-028	52385	26193			96	52385	5302	17585				487
PROJECT TOTALS	178352	89177	44	106	110	178352	17904	83425	1	1	10	1941

SUMMARY OF BRIDGES									
LOCATION	100	104	420	429	432	432	432	438	451
	6002	6009	6070	6005	6002	6033	6035	6003	6019
	PREPARING ROW	REMOVING CONC (RIPRAP)	CL C CONC (PILE ENCASEMENT)	CONC STR REPAIR(DECK REP (FULL DEPTH))	RIPRAP (CONC) (5 IN)	RIPRAP (STONE PROTECTION) (18 IN)	RIPRAP (STONE PROTECTION) (24 IN)	CLEANING AND SEALING EXIST JOINTS(CL5)	RETROFIT RAIL (TY T631)
	STA	SY	CY	SF	CY	CY	CY	LF	LF
CSJ 0418-03-025									
STR. #040 LITTLE HACKBERRY CREEK	1	8			2			40	
STR. #039 HACKBERRY CREEK	2.3	8			1.5			40	
STR. #037 COTTONWOOD CREEK			2.7	6	2.5	20	81	36	251.5
CSJ 0418-03-025 TOTALS	3.3	16	2.7	6	6	20	81	116	251.5
PROJECT TOTALS	3.3	16	2.7	6	6	20	81	116	251.5

SUMMARY OF SIGNING ITEMS											
LOCATION	644	644	644	644	644	644	644	677	677	6056	6368
	6001	6004	6030	6033	6051	6076	6094	6012	6028	6001	6001
	IN SM RD SN SUP&AM TY10BWG (1)SA(P)	IN SM RD SN SUP&AM TY10BWG (1)SA(T)	IN SM RD SN SUP&AM TYS80(1)SA(T)	IN SM RD SN SUP&AM TYS80(1)SA(U)	IN SM RD SN SUP&AM TYS80(2)SA(P-EXAL)	REMOVE SM RD SN SUP&AM	ISRSA TY10BWG (1)SA(T) (EXCLUDING SIGN)	ELIM EXT PAV MRK & MRKS (WORD)	ELIM EXT PV MRK & MRKS (RUMBLE STRIP)	PREFORMED IN-LANE (TRANS) RUMBLE STRIP	SOLAR POWERED LED SIGN
	EA	EA	EA	EA	EA	EA	EA	EA	LF	LF	EA
CSJ 0481-03-025											
SIGN LAYOUT 1	9	9	2	4	2	19	8	2	80	160	8
CSJ 0481-03-025 TOTAL	9	9	2	4	2	19	8	2	80	160	8
CSJ 0019-03-028											
SIGN LAYOUT 2	7	4	4			14	8				8
CSJ 0019-03-028 TOTAL	7	4	4			14	8				8
PROJECT TOTALS	16	13	6	4	2	33	16	2	80	160	16

SUMMARY OF MAINTENANCE ITEMS				
LOCATION	730	734	735	738
	6002	6002	6001	6003
	FULL - WIDTH MOWING	LITTER REMOVAL	DEBRIS REMOVAL (CNTR MEDIANS /MAINLANES)	CLEANING / SWEEPING (OUTSIDE MAIN LANE)
	AC	CYC	CYC	CYC
CSJ 0418-03-025	423	4	50	12
CSJ 0019-03-028	181	2	22	6
PROJECT TOTALS	604	6	72	18

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		14

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	150	247	3076	400	462	462	464	464	464	464	464	4122	4122	4122	4122	467	467	467	467	467	467	467	480	496	496
									REPLACE		BASE BID EXTEND					BASE BID REPLACE												
					6001	(1)	(1)	6006	6008	6010	6003	6005	6007	6008	6010	6008	6010	6014	6015	6184	6215	6363	6395	6423	6454	6480	6001	6004	6007
					BLADING	FL BS (CMP IN PLC) (TY D GR 4) (FINAL POS)	D-GR HMA TY-C SAC-B PG64-22	CUT & RESTORING PAV	CONC BOX CULV (5 FT X 4 FT)	CONC BOX CULV (6 FT X 3 FT)	RC PIPE (CL III) (18 IN)	RC PIPE (CL III) (24 IN)	RC PIPE (CL III) (30 IN)	RC PIPE (CL III) (36 IN)	RC PIPE (CL III) (48 IN)	THERMOPLASTIC PIPE(30 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(24 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(18 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(36")(PP) (TYPE III)	SET (TY I)(S= 5 FT)(HW= 5 FT)(6:1) (P)	SET (TY I)(S= 6 FT)(HW= 4 FT)(6:1) (P) EA	SET (TY II) (18 IN) (RCP) (6:1) (P)	SET (TY II) (24 IN) (RCP) (6:1) (P)	SET (TY II) (30 IN) (RCP) (6:1) (P)	SET (TY II) (36 IN) (RCP) (6:1) (P)	SET (TY II) (48 IN) (RCP) (6:1) (P)	CLEAN EXIST CULVERTS	REMOV STR (SET)	REMOV STR (PIPE)
					STA	CY	TON	SY	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF
CSJ 0481-03-025																												
1	20+35	RT																										
2	20+45	LT																										
3	20+95	RT																										
4	21+25	LT																										
5	21+90	LT																										
6	22+50	RT																										
7	22+75	LT																										
8	23+30 FRANKLIN	RT																										
9	23+45 FRANKLIN	LT																										
10	24+00	RT																										
11	25+70	LT																										
12	26+00	RT																										
13	33+85	LT																										
14	38+75	LT	11.3	1							4											2					1		4
15	50+30	LT	14.4	2							16											4					1		8
16	53+95	LT	11.9	1								24											2				1		4
17	56+35	RT	12.3	1								4											2				1		4
18	60+00	LT	12.8	1								8											2				1		4
19	60+45	RT	14	1		1.2		7.0										24				2							24
20	68+05	LT	27	1							4											2					1		4
21	68+45	RT	12.8	1							8											2					1		4
22	69+85	RT	32.8	1							4											2					1		4
23	87+00 HCR 1343E	RT	20.8	1			2.8	13.0								32								2					31
24	87+40 HCR 1343W	LT	26.7	1										4											2		1		4
25	92+35	LT	11.7	1							24											2					1		4
26	97+35	RT	11.8	1							4											2					1		4
27	100+70	LT	13.4	1							4											2					1		4
28	110+05	LT																										
29	110+35	RT																										
30	123+25	RT	16.6	1								36											2				1		4
31	123+40	LT																										
32	131+75	RT	17.8	1																								
33	131+80	LT	12.6	1										40											2		1		4
34	141+30	LT	12.2	2								16											4				1		8
35	154+30	LT	13.8	1							44											2					1		4
36	155+50	RT	10.2	1							12											2					1		4
37	156+10	RT	11.8	1																							1		4
38	164+10	LT	21	1							8											2					1		4
39	167+30	RT																										
40	168+30	LT	14.3	1							16											2					1		4
41	168+40	RT	14.9	1																								
42	168+80	RT	9.52	1																								
43	178+10	LT	14.1	2		4.4		26.0		76											2							46
44	180+20	LT	14	2			5.7	26.0		64											2							48
45	181+20	RT	14.9	2			5.3	25.0	52											2								50
46	182+60	RT	14.8	2			5.3	24.0	52											2								50
47	183+20	LT	14.2	2			5.8	27.0		60											2							48
48	185+60	LT	15.3	2			6.2	29.0		76											2							48
49	188+50	LT	14.3	2			5.8	27.0		72											2							48
50	206+60*	RT	19.5	1									28											2			1		4
51	206+70																											
52	216+20	LT	12.4	1																							1		4
53	216+90	LT	16	1							12											2					1		4
54	224+50	RT	18.6	1								20											2				1		4
55	224+75	LT	24.7	2																								
56	239+30	RT	16	1							4											2					1		4
57	241+00	LT	15	1							4											2					1		4
58	243+00	RT	15	1							4											2					1		4
59	254+40	RT																										
60	264+50	LT																										
SHEET TOTALS						5.6	36.9	204.0	104.0	348.0	172.0	108.0	28.0	44.0		32.0		24.0		4.0	10.0	36.0	14.0	4.0	4.0		27.0		509.0

(1) - FOR CONTRACTORS INFORMATION ONLY

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		15

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	150	247	3076	400	REPLACE 462	REPLACE 462	BASE BID EXTEND 464	BASE BID EXTEND 464	BASE BID EXTEND 464	BASE BID EXTEND 464	464	BASE BID REPLACE 4122	BASE BID REPLACE 4122	BASE BID REPLACE 4122	BASE BID REPLACE 4122	467	467	467	467	467	467	467	480	496	496
					6001	(1)	(1)	6006	6008	6010	6003	6005	6007	6008	6010	6008	6010	6014	6015	6184	6215	6363	6395	6423	6454	6480	6001	6004	6007
					BLADING	FL BS (CMP IN PLC) (TY D GR 4) (FINAL POS)	D-GR HMA TY-C SAC-B PG64-22	CUT & RESTORING PAV	CONC BOX CULV (5 FT X 4 FT)	CONC BOX CULV (6 FT X 3 FT)	RC PIPE (CL III) (18 IN)	RC PIPE (CL III) (24 IN)	RC PIPE (CL III) (30 IN)	RC PIPE (CL III) (36 IN)	RC PIPE (CL III) (48 IN)	THERMOPLASTIC PIPE(30 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(24 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(18 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(36")(PP) (TYPE III)	SET (TY I)(S= 5 FT)(HW= 5 FT)(6:1) (P)	SET (TY I)(S= 6 FT)(HW= 4 FT)(6:1) (P) EA	SET (TY II) (18 IN) (RCP) (6:1) (P)	SET (TY II) (24 IN) (RCP) (6:1) (P)	SET (TY II) (30 IN) (RCP) (6:1) (P)	SET (TY II) (36 IN) (RCP) (6:1) (P)	SET (TY II) (48 IN) (RCP) (6:1) (P)	CLEAN EXIST CULVERTS	REMOV STR (SET)	REMOV STR (PIPE)
					STA	CY	TON	SY	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF
CSJ 0481-03-025																													
61	268+40	RT	16	1							20											2					1		4
62	269+10	LT	12.1	1							28											2					1		4
63	269+40	RT	15.5	1							12											2					1		4
64	273+90	LT	11.3	1																									
65	276+80	RT	12.9	1							16											2					1		4
66	281+90	RT	15.6	2							8											4					1		8
67	282+80	LT	13	2																									
68	285+10	LT	12.4	2							16											4					1		8
69	286+10	LT	12.4	2							16											4					1		8
70	288+10	RT	26.5	1								8											2				1		4
71	296+60	LT																											
72	316+00	RT	24.3	1								4											2				1		4
73	319+30	LT	11.1	1								4											2				1		4
74	328+20	RT	23.6	1							20											2					1		4
75	338+70	RT	13.6	1							12											2					1		4
76	340+40	LT	16.9	1							8											2					1		4
77	341+40	RT	13	1							4											2					1		4
78	342+00	RT	12.1	1							4											2					1		4
79	342+30	RT	19.1	1							8											2					1		4
80	343+22	RT	18.8	1							8											2					1		4
81	343+90	RT	13.2	1							8											2					1		4
82	344+30	RT	17.7	1							4											2					1		4
83	342+25	RT	14.1	1							4											2					1		4
84	350+10	LT	11.8	1							4											2					1		4
85	350+80	LT	12.9	1							12											2					1		4
86	352+50	LT	14.9	1							8											2					1		4
87	353+80	LT	39.2	1							20											2					1		4
88	361+10	RT	20.3	1							16											2					1		4
89	361+70	LT	12.3	2								40											4				1		8
90	362+20	RT	16.9	2			3.6	16.0									48						4						48
91	362+70	LT	19.2	2								24											4				1		8
92	363+40	RT	18.2	1								8											2				1		4
93	365+80	RT	23.1	1									4											2			1		4
94	371+90	RT	23.1	1																									
95	379+00	RT	18.8	2																			4				1		8
96	384+60	RT	13.4	1																									
97	385+90	LT	14.5	1								4											2				1		4
98	386+90	LT	14.4	1								4											2				1		4
99	390+90	RT																											
100	391+20	LT	23.1	1			2.9	13.0									44						2						41
101	395+40	LT	14	1			1.6	7.0										28				2							25
102	396+20	LT	14.9	1			1.7	8.0										24				2							24
103	398+80	RT	15.6	1							12											2					1		4
104	399+90	RT	13.8	1							4											2					1		4
105	420+00	LT																											
106	422+50	RT	13.6	1							4											2					1		4
107	438+30	RT	19.3	1		1.8		11.0									48						2						46
108	438+40	LT	18.9	1		1.6		10.0										40				2							27
109	439+20	LT	12	1			1.5	7.0									28						2						25
110	443+00	RT	12.4	2																									
111	464+40	LT	23.4	1																									
112	464+50	RT	30.97	1								4											2				1		4
113	481+10	RT	22.1	1																									
114	487+60	RT	13.6	1								8											2				1		4
115	489+30	LT	12.8	1								4											2				1		4
116	495+20	RT																											
117	497+30	LT	13.2	1								4											2				1		4
118	497+50	RT	21.2	1																									
119	503+10	RT	14.4	1								4											2				1		4
120	505+80	LT																											
SHEET TOTAL						3.4	11.3	72.0			276.0	120.0	4.0				168.0	92.0				62.0	44.0	2.0			40.0		420.0

(1) - FOR CONTRACTORS INFORMATION ONLY

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		16

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	150	247	3076	400	REPLACE 462	REPLACE 462	BASE BID EXTEND 464	464	464	464	464	BASE BID REPLACE 4122	4122	4122	4122	467	467	467	467	467	467	467	480	496	496
					6001	(1)	(1)	6006	6008	6010	6003	6005	6007	6008	6010	6008	6010	6014	6015	6184	6215	6363	6395	6423	6454	6480	6001	6004	6007
					BLADING	FL BS (CMP IN PLC) (TY D GR 4) (FINAL POS)	D-GR HMA TY-C SAC-B PG64-22	CUT & RESTORING PAV	CONC BOX CULV (5 FT X 4 FT)	CONC BOX CULV (6 FT X 3 FT)	RC PIPE (CL III) (18 IN)	RC PIPE (CL III) (24 IN)	RC PIPE (CL III) (30 IN)	RC PIPE (CL III) (36 IN)	RC PIPE (CL III) (48 IN)	THERMOPLASTIC PIPE(30 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(24 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(18 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(36")(PP) (TYPE III)	SET (TY I)(S= 5 FT)(HW= 5 FT)(6:1) (P)	SET (TY I)(S= 6 FT)(HW= 4 FT)(6:1) (P) EA	SET (TY II) (18 IN) (RCP) (6:1) (P)	SET (TY II) (24 IN) (RCP) (6:1) (P)	SET (TY II) (30 IN) (RCP) (6:1) (P)	SET (TY II) (36 IN) (RCP) (6:1) (P)	SET (TY II) (48 IN) (RCP) (6:1) (P)	CLEAN EXIST CULVERTS	REMOV STR (SET)	REMOV STR (PIPE)
					STA	CY	TON	SY	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF
CSJ 0481-03-025																													
121	509+60	LT																											
122	511+90	RT																											
123	513+80	LT																											
124	516+20	RT	13.5	1							16											2					1		4
125	520+25	RT	12.4	1								8											2				1		4
126	527+80	LT	11.5	1							8											2					1		4
127	530+70	RT	17	1		1.5		9.0										24				2						2	23
128	532+00	RT	14.3	1							4											2					1		4
129	533+00	LT																											
130	535+90	RT	15.2	1		1.3		8.0										24				2							24
131	536+00	LT	34.7	1																									
132	537+00	RT																											
133	539+30	RT																											
134	541+00	RT	23.4	1																							1		4
135	542+40	RT	22.4	1							16											2					1		4
136	542+50	LT																											
**137	544+80	RT	13.7	2	1																			4					
138	545+80	RT	13.1	1			1.7	8.0									28						2						25
139	549+10	RT	14.7	1		1.4		9.0									24						2						24
140	549+90	RT	15.1	1			1.9	9.0									24						2						24
141	551+10	LT	11.2	2			2.7	12.0								56								4					50
142	552+20	LT	14.8	2		2.7		16.0								56								4					48
143	553+60	RT	19.7	1																									
144	555+50	RT	16.3	1			2.0	10.0									24						2						24
145	555+90	LT	14.8	2		2.7		16.0								64								4					50
146	558+90	RT	12.4	1		1.2		7.0									28						2						25
147	559+40	LT	15.1	2		2.7		16.0								56								4					48
148	560+20	RT	15.6	1																									
**149	562+00	RT	17.2	1	1																	2							
150	562+20	LT	11.1	1		1.1		7.0									24						2					2	23
151	563+20	LT	13.1	1			1.7	8.0									36						2						25
152	563+80	RT	20.5	1																									
153	565+30	LT	14.2	1		1.5		9.0								32								2					25
154	565+60	RT	35.7	1																									
155	565+90	LT	12.5	1			1.7	8.0								32								2					25
156	566+60	RT	14.6	1			1.8	9.0									24						2						24
157	567+20	LT	14.8	1		1.6		10.0								32								2					25
158	568+20	RT																											
159	570+50	RT	19.9	1							4											2					1		4
160	573+30	LT																											
161	575+60	RT	12	1							4											2					1		4
162	581+20	RT	14.5	1		1.5		9.0								28								2					25
163	590+50	LT	28.7	1																									
164	593+40	LT																											
165	596+60	RT	16.2	N/A																									
166	611+10	LT	16.4	1							12											2					1		4
167	612+80	LT	13.2	1							16											2					1		4
168	615+90	RT																											
169	629+70	LT	17.9	1							8											2					1		4
170	651+80	RT	18	1							12											2					1		4
171	656+20	LT																											
172	661+90	LT																											
173	663+20	LT	12.5	1		1.2		7.0									32						2					2	29
SHEET TOTAL					2.0	20.4	13.5	187.0			100.0	8.0				356.0	244.0	48.0				26.0	20.0	28.0			12.0	6.0	614.0
CSJ 0481-03-025 TOTAL					2.0	29.4	61.7	463.0	104.0	348.0	548.0	236.0	32.0	44.0		388.0	412.0	164.0		4.0	10.0	124.0	78.0	34.0	4.0		79.0	6.0	1543.0

(1) - FOR CONTRACTORS INFORMATION ONLY

**CONTRACTOR TO GRADE DRAINAGE DITCH AT CULVERT INLET AND OUTLET, TO ENSURE POSITIVE DRAINAGE.
**CONTRACTOR TO SAWCUT EXISTING SET FROM CONCRETE DRIVEWAY. THIS WORK IS CONSIDERED SUBSIDIARY TO ITEM 496-6004 "REMOVE STR (SET)". ANY DAMAGE TO THE DRIVEWAY CONCRETE WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		17

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	150	247	3076	400	REPLACE 462	REPLACE 462	BASE BID EXTEND 464	EXTEND 464	EXTEND 464	EXTEND 464	464	BASE BID REPLACE 4122	REPLACE 4122	REPLACE 4122	REPLACE 4122	467	467	467	467	467	467	467	480	496	496
					6001	(1)	(1)	6006	6008	6010	6003	6005	6007	6008	6010	6008	6010	6014	6015	6184	6215	6363	6395	6423	6454	6480	6001	6004	6007
					BLADING	FL BS (CMP IN PLC) (TY D GR 4) (FINAL POS)	D-GR HMA TY-C SAC-B PG64-22	CUT & RESTORING PAV	CONC BOX CULV (5 FT X 4 FT)	CONC BOX CULV (6 FT X 3 FT)	RC PIPE (CL III) (18 IN)	RC PIPE (CL III) (24 IN)	RC PIPE (CL III) (30 IN)	RC PIPE (CL III) (36 IN)	RC PIPE (CL III) (48 IN)	THERMOPLASTIC PIPE(30 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(24 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(18 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(36")(PP) (TYPE III)	SET (TY I)(S= 5 FT)(HW= 5 FT)(6:1) (P)	SET (TY I)(S= 6 FT)(HW= 4 FT)(6:1) (P) EA	SET (TY II) (18 IN) (RCP) (6:1) (P)	SET (TY II) (24 IN) (RCP) (6:1) (P)	SET (TY II) (30 IN) (RCP) (6:1) (P)	SET (TY II) (36 IN) (RCP) (6:1) (P)	SET (TY II) (48 IN) (RCP) (6:1) (P)	CLEAN EXIST CULVERTS	REMOV STR (SET)	REMOV STR (PIPE)
					STA	CY	TON	SY	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF
CSJ 0019-03-028																													
174	666+60	LT	7.9	2								40											4				1		8
175	668+40	LT	15.8	2		2.8		17.0								88								4				2	86
176	676+00	RT	16.2	2							16											4					1		8
177	679+70	RT	13.4	1								12											2				1		4
178	680+00	LT	12.4	1								4											2				1		4
179	682+40	LT	30.9	1								4											2				1		4
180	682+60	RT	14.6	1								12											2				1		4
181	693+00	RT	14.3	1							4											2					1		4
182	694+50	LT	30.2	1																									
183	698+90	LT	30.2	1																									
184	701+80	RT	15.1	1							12											2					1		4
185	708+80	RT	11	1		1.0		6.0										16				2							16
186	714+50	LT	24.2	1																							1		4
187	715+70	LT																											
188	716+00	RT																											
189	723+30	RT	28.1	1		2.7		16.0									36						2					2	30
190	724+40	LT	14.4	1								4											2				1		4
191	726+50	RT	36.6	2																									
192	733+60	LT	41.5	2																									
**193	735+10	RT	40.9	1	1																	2					1	2	
194	736+20	LT	19.1	1								16											2				1	2	4
195	751+00 Gathings	LT																											
196	751+30 FM 67	RT																											
**197	753+40	RT	44.7	1	1																	2					1	2	
**198	754+60	RT	44.8	1	1																	2					1	2	
**199	756+30	RT	44.6	1	1																	2					1	2	
200	757+90	RT	12.4	1							8											2					1		4
201	758+20	LT																											
202	763+00	LT																											
203	765+50	LT	28.4	1																									
204	768+40	LT	33.2	1			3.7	17.0										44				2						2	44
205	774+90	RT	16.4	1								8											2				1		4
206	774+90	LT	16.3	1								8											2				1		4
207	776+90	LT	39	1			4.8	22.0									44						2					2	43
208	777+30	RT	23.6	1		2.5		15.0								36								2				2	36
209	779+80	RT	32.4	1		3.0		18.0									52						2					2	50
210	788+00	LT	37.9	1								8											2				1		4
211	789+10	LT	18	1																									
212	791+20	LT	47.3	1																									
213	791+40	RT	17.5	1							16											2					1		4
214	794+60	RT	29.9	1																									
215	795+40	LT	11.3	1																									
216	797+90	LT	10.5	2			2.2	10.0									40						4						34
217	798+33	RT																											
218	799+90	LT																											
219	802+40	LT	14	1			1.8	8.0									28						2						25
220	803+30	LT	12.5	1								8											2				1		4
221	805+40	LT	15.4	1								4											2				1		4
222	807+10	LT																											
223	812+80	LT																											
224	813+50	LT																											
225	816+30	RT	15.4	1							16											2					1		4
226	816+90	LT	12.4	1							28											2					1		4
227	819+30	LT																											
228	820+20	RT	22.9	1		2.0		12.0										72				2							56
229	824+50	LT																											
230	825+30	LT																											
231	827+00	LT	18.9	1							8											2					1		4
232	828+20	RT	21.2	1							8											2					1		4
233	832+60	RT	16.8	1							8											2					1		4
234	834+90	LT	19.5	1							24											2					1		4
SHEET TOTAL					4.0	14.0	12.5	141.0			148.0	128.0				124.0	200.0	132.0				38.0	38.0	6.0			28.0	22.0	524.0

(1) - FOR CONTRACTORS INFORMATION ONLY

**CONTRACTOR TO GRADE DRAINAGE DITCH AT CULVERT INLET AND OUTLET, TO ENSURE POSITIVE DRAINAGE.
**CONTRACTOR TO SAWCUT EXISTING SET FROM CONCRETE DRIVEWAY. THIS WORK IS CONSIDERED SUBSIDIARY TO ITEM 496-6004 "REMOVE STR (SET)". ANY DAMAGE TO THE DRIVEWAY CONCRETE WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		18

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	150	247	3076	400	REPLACE 462	REPLACE 462	BASE BID EXTEND 464	464	464	464	464	BASE BID REPLACE 4122	4122	4122	4122	467	467	467	467	467	467	467	480	496	496
					6001	(1)	(1)	6006	6008	6010	6003	6005	6007	6008	6010	6008	6010	6014	6015	6184	6215	6363	6395	6423	6454	6480	6001	6004	6007
					BLADING	FL BS (CMP IN PLC) (TY D GR 4) (FINAL POS)	D-GR HMA TY-C SAC-B PG64-22	CUT & RESTORING PAV	CONC BOX CULV (5 FT X 4 FT)	CONC BOX CULV (6 FT X 3 FT)	RC PIPE (CL III) (18 IN)	RC PIPE (CL III) (24 IN)	RC PIPE (CL III) (30 IN)	RC PIPE (CL III) (36 IN)	RC PIPE (CL III) (48 IN)	THERMOPLASTIC PIPE(30 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(24 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(18 IN)(PP)(TYPE III)	THERMOPLASTIC PIPE(36")(PP) (TYPE III)	SET (TY I)(S= 5 FT)(HW= 5 FT)(6:1) (P)	SET (TY I)(S= 6 FT)(HW= 4 FT)(6:1) (P) EA	SET (TY II) (18 IN) (RCP) (6:1) (P)	SET (TY II) (24 IN) (RCP) (6:1) (P)	SET (TY II) (30 IN) (RCP) (6:1) (P)	SET (TY II) (36 IN) (RCP) (6:1) (P)	SET (TY II) (48 IN) (RCP) (6:1) (P)	CLEAN EXIST CULVERTS	REMOV STR (SET)	REMOV STR (PIPE)
					STA	CY	TON	SY	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF
CSJ 0019-03-028																												
235	842+40	LT	19.3	1							8											2					1		4
236	843+60	LT																											
237	844+33	RT	11.4	1							32											2					1		4
238	848+40	RT	10.9	1								4											2				1		4
239	850+20	LT	10.5	1							8											2					1		4
240	851+10	RT	11.5	1								8											2				1		4
241	854+80	RT	19.1	1								20											2				1		4
242	855+31	RT	9.1	1								4											2				1		4
243	862+70	RT	12.8	3			4.7	22.0											72					6					69
**244	865+30	RT	18.7	2	1																		4				1	4	
245	867+30	RT	14.2	2											16										4		1		8
246	868+10	RT	15.1	2			3.2	15.0									72						4					4	54
247	869+90	RT	22.3	2																									
*248	871+60	RT	12.3	2																								2	
*249	871+90	RT	11.1	2			2.4	11.0									72												42
250	873+10	LT	3.1	1								4											2				1		4
251	876+70	RT																											
252	877+50	LT	5.5	3		1.3		8.0									72						6					6	63
**253	878+50	LT	25.9	1	1																		2				1	2	
**254	880+00	LT	25.8	1	1																		2				1	2	
**255	881+80	LT	26.3	1	1																		2				1	2	
256	886+60	LT	13.2	1			1.8	9.0								24								2					24
257	888+40	LT	13.6	1			1.9	9.0								28								2					25
258	888+70	RT	14.3	1			2.0	9.0								28								2					25
259	893+00	LT	13.1	1			1.8	9.0								24								2					24
260	893+00	RT	12.1	1			1.7	8.0								24								2					24
261	903+40	LT	23.6	1								4											2				1		4
262	903+90	RT	22.8	1			3.1	14.0								44								2					44
263	925+10	RT																											
264	929+60	LT	12.1	1							4																1		4
SHEET TOTAL					4.0	1.3	22.6	114.0			52.0	44.0			16.0	172.0	216.0		72.0			6.0	28.0	16.0	6.0	4.0	15.0	22.0	442.0
CSJ 0019-03-028 TOTAL					8.0	15.3	35.1	255.0			200.0	172.0			16.0	296.0	416.0	132.0	72.0			44.0	66.0	22.0	6.0	4.0	43.0	44.0	966.0
PROJECT TOTAL					10.00	44.70	96.80	718.00	104.00	348.00	748.00	408.00	32.00	44.00	16.00	684.00	828.00	296.00	72.00	4.00	10.00	168.00	144.00	56.00	10.00	4.00	122.00	50.00	2509.00

(1) - FOR CONTRACTORS INFORMATION ONLY

*MOVE EXISTING TWO SETs (LT ONLY) ON DRIVEWAY 248 AND PLACE AT THE LT END OF THE NEW CULVERTS FOR DRIVEWAY 249. EXTEND THE NEW CULVERT FOR DRIVEWAY 249 TO TIE-IN TO THE EXISTING CMP CULVERT FOR DRIVEWAY 248.

**CONTRACTOR TO GRADE DRAINAGE DITCH AT CULVERT INLET AND OUTLET, TO ENSURE POSITIVE DRAINAGE.
**CONTRACTOR TO SAWCUT EXISTING SET FROM CONCRETE DRIVEWAY. THIS WORK IS CONSIDERED SUBSIDIARY TO ITEM 496-6004 "REMOVE STR (SET)". ANY DAMAGE TO THE DRIVEWAY CONCRETE WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		19

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE
					464		464		464		464	
					6003		6005		6007		6008	
					RC PIPE (CL III) (18 IN)		RC PIPE (CL III) (24 IN)		RC PIPE (CL III) (30 IN)		RC PIPE (CL III) (36 IN)	
					LF		LF		LF		LF	
CSJ 0481-03-025												
1	20+35	RT										
2	20+45	LT										
3	20+95	RT										
4	21+25	LT										
5	21+90	LT										
6	22+50	RT										
7	22+75	LT										
8	23+30 FRANKLIN	RT										
9	23+45 FRANKLIN	LT										
10	24+00	RT										
11	25+70	LT										
12	26+00	RT										
13	33+85	LT										
14	38+75	LT	11.3	1	4							
15	50+30	LT	14.4	2	16							
16	53+95	LT	11.9	1			24					
17	56+35	RT	12.3	1			4					
18	60+00	LT	12.8	1			8					
19	60+45	RT	14	1		24						
20	68+05	LT	27	1	4							
21	68+45	RT	12.8	1	8							
22	69+85	RT	32.8	1	4							
23	87+00 HCR 1343E	RT	20.8	1						32		
24	87+40 HCR 1343W	LT	26.7	1							4	
25	92+35	LT	11.7	1	24							
26	97+35	RT	11.8	1	4							
27	100+70	LT	13.4	1	4							
28	110+05	LT										
29	110+35	RT										
30	123+25	RT	16.6	1			36					
31	123+40	LT										
32	131+75	RT	17.8	1								
33	131+80	LT	12.6	1							40	
34	141+30	LT	12.2	2			16					
35	154+30	LT	13.8	1	44							
36	155+50	RT	10.2	1	12							
37	156+10	RT	11.8	1								
38	164+10	LT	21	1	8							
39	167+30	RT										
40	168+30	LT	14.3	1	16							
41	168+40	RT	14.9	1								
42	168+80	RT	9.52	1								
43	178+10	LT	14.1	2								
44	180+20	LT	14	2								
45	181+20	RT	14.9	2								
46	182+60	RT	14.8	2								
47	183+20	LT	14.2	2								
48	185+60	LT	15.3	2								
49	188+50	LT	14.3	2								
50	206+60*	RT	19.5	1					28			
51	206+70											
52	216+20	LT	12.4	1								
53	216+90	LT	16	1	12							
54	224+50	RT	18.6	1			20					
55	224+75	LT	24.7	2								
56	239+30	RT	16	1	4							
57	241+00	LT	15	1	4							
58	243+00	RT	15	1	4							
59	254+40	RT										
60	264+50	LT										
SUBTOTAL					172	24	108		28	32	44	

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE
					464		464		464		464	
					6003		6005		6007		6008	
					RC PIPE (CL III) (18 IN)		RC PIPE (CL III) (24 IN)		RC PIPE (CL III) (30 IN)		RC PIPE (CL III) (36 IN)	
					LF		LF		LF		LF	
CSJ 0481-03-025												
61	268+40	RT	16	1	20							
62	269+10	LT	12.1	1	28							
63	269+40	RT	15.5	1	12							
64	273+90	LT	11.3	1								
65	276+80	RT	12.9	1	16							
66	281+90	RT	15.6	2	8							
67	282+80	LT	13	2								
68	285+10	LT	12.4	2	16							
69	286+10	LT	12.4	2	16							
70	288+10	RT	26.5	1			8					
71	296+60	LT										
72	316+00	RT	24.3	1			4					
73	319+30	LT	11.1	1			4					
74	328+20	RT	23.6	1	20							
75	338+70	RT	13.6	1	12							
76	340+40	LT	16.9	1	8							
77	341+40	RT	13	1	4							
78	342+00	RT	12.1	1	4							
79	342+30	RT	19.1	1	8							
80	343+22	RT	18.8	1	8							
81	343+90	RT	13.2	1	8							
82	344+30	RT	17.7	1	4							
83	342+25	RT	14.1	1	4							
84	350+10	LT	11.8	1	4							
85	350+80	LT	12.9	1	12							
86	352+50	LT	14.9	1	8							
87	353+80	LT	39.2	1	20							
88	361+10	RT	20.3	1	16							
89	361+70	LT	12.3	2			40					
90	362+20	RT	16.9	2				48				
91	362+70	LT	19.2	2			24					
92	363+40	RT	18.2	1			8					
93	365+80	RT	23.1	1					4			
94	371+90	RT	23.1	1								
95	379+00	RT	18.8	2								
96	384+60	RT	13.4	1								
97	385+90	LT	14.5	1			4					
98	386+90	LT	14.4	1			4					
99	390+90	RT										
100	391+20	LT	23.1	1				44				
101	395+40	LT	14	1		28						
102	396+20	LT	14.9	1		24						
103	398+80	RT	15.6	1	12							
104	399+90	RT	13.8	1	4							
105	420+00	LT										
106	422+50	RT	13.6	1	4							
107	438+30	RT	19.3	1				48				
108	438+40	LT	18.9	1		40						
109	439+20	LT	12	1				28				
110	443+00	RT	12.4	2								
111	464+40	LT	23.4	1								
112	464+50	RT	30.97	1			4					
113	481+10	RT	22.1	1								
114	487+60	RT	13.6	1			8					
115	489+30	LT	12.8	1			4					
116	495+20	RT										
117	497+30	LT	13.2	1			4					
118	497+50	RT	21.2	1								
119	503+10	RT	14.4	1			4					
120	505+80	LT										
SUBTOTAL					276.0	92.0	120.0	168.0	4.0			

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		20

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE
					464		464		464		464	
					6003		6005		6007		6008	
					RC PIPE (CL III) (18 IN)		RC PIPE (CL III) (24 IN)		RC PIPE (CL III) (30 IN)		RC PIPE (CL III) (36 IN)	
					LF		LF		LF		LF	
CSJ 0481-03-025												
121	509+60	LT										
122	511+90	RT										
123	513+80	LT										
124	516+20	RT	13.5	1	16							
125	520+25	RT	12.4	1			8					
126	527+80	LT	11.5	1	8							
127	530+70	RT	17	1		24						
128	532+00	RT	14.3	1	4							
129	533+00	LT										
130	535+90	RT	15.2	1		24						
131	536+00	LT	34.7	1								
132	537+00	RT										
133	539+30	RT										
134	541+00	RT	23.4	1								
135	542+40	RT	22.4	1	16							
136	542+50	LT										
137	544+80	RT	13.7	2								
138	545+80	RT	13.1	1				28				
139	549+10	RT	14.7	1				24				
140	549+90	RT	15.1	1				24				
141	551+10	LT	11.2	2						56		
142	552+20	LT	14.8	2						56		
143	553+60	RT	19.7	1								
144	555+50	RT	16.3	1				24				
145	555+90	LT	14.8	2						64		
146	558+90	RT	12.4	1				28				
147	559+40	LT	15.1	2						56		
148	560+20	RT	15.6	1								
149	562+00	RT	17.2	1								
150	562+20	LT	11.1	1				24				
151	563+20	LT	13.1	1				36				
152	563+80	RT	20.5	1								
153	565+30	LT	14.2	1						32		
154	565+60	RT	35.7	1								
155	565+90	LT	12.5	1						32		
156	566+60	RT	14.6	1				24				
157	567+20	LT	14.8	1						32		
158	568+20	RT										
159	570+50	RT	19.9	1	4							
160	573+30	LT										
161	575+60	RT	12	1	4							
162	581+20	RT	14.5	1						28		
163	590+50	LT	28.7	1								
164	593+40	LT										
165	596+60	RT	16.2	N/A								
166	611+10	LT	16.4	1	12							
167	612+80	LT	13.2	1	16							
168	615+90	RT										
169	629+70	LT	17.9	1	8							
170	651+80	RT	18	1	12							
171	656+20	LT										
172	661+90	LT										
173	663+20	LT	12.5	1				32				
SUBTOTAL					100.0	48.0	8.0	244.0		356.0		
CSJ 0481-03-025 TOTAL					548.0	164.0	236.0	412.0	32.0	388.0	44.0	

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE	ALT BID EXTEND	ALT BID REPLACE
					464		464		464		464	
					6003		6005		6007		6008	
					RC PIPE (CL III) (18 IN)		RC PIPE (CL III) (24 IN)		RC PIPE (CL III) (30 IN)		RC PIPE (CL III) (36 IN)	
					LF		LF		LF		LF	
CSJ 0019-03-028												
174	666+60	LT	7.9	2			40					
175	668+40	LT	15.8	2						88		
176	676+00	RT	16.2	2	16							
177	679+70	RT	13.4	1			12					
178	680+00	LT	12.4	1			4					
179	682+40	LT	30.9	1			4					
180	682+60	RT	14.6	1			12					
181	693+00	RT	14.3	1	4							
182	694+50	LT	30.2	1								
183	698+90	LT	30.2	1								
184	701+80	RT	15.1	1	12							
185	708+80	RT	11	1		16						
186	714+50	LT	24.2	1								
187	715+70	LT										
188	716+00	RT										
189	723+30	RT	28.1	1				36				
190	724+40	LT	14.4	1			4					
191	726+50	RT	36.6	2								
192	733+60	LT	41.5	2								
193	735+10	RT	40.9	1								
194	736+20	LT	19.1	1			16					
195	751+00 Gathings	LT										
196	751+30 FM 67	RT										
197	753+40	RT	44.7	1								
198	754+60	RT	44.8	1								
199	756+30	RT	44.6	1								
200	757+90	RT	12.4	1	8							
201	758+20	LT										
202	763+00	LT										
203	765+50	LT	28.4	1								
204	768+40	LT	33.2	1		44						
205	774+90	RT	16.4	1			8					
206	774+90	LT	16.3	1			8					
207	776+90	LT	39	1				44				
208	777+30	RT	23.6	1						36		
209	779+80	RT	32.4	1				52				
210	788+00	LT	37.9	1			8					
211	789+10	LT	18	1								
212	791+20	LT	47.3	1								
213	791+40	RT	17.5	1	16							
214	794+60	RT	29.9	1								
215	795+40	LT	11.3	1								
216	797+90	LT	10.5	2				40				
217	798+33	RT										
218	799+90	LT										
219	802+40	LT	14	1				28				
220	803+30	LT	12.5	1			8					
221	805+40	LT	15.4	1			4					
222	807+10	LT										
223	812+80	LT										
224	813+50	LT										
225	816+30	RT	15.4	1	16							
226	816+90	LT	12.4	1	28							
227	819+30	LT										
228	820+20	RT	22.9	1		72						
229	824+50	LT										
230	825+30	LT										
231	827+00	LT	18.9	1	8							
232	828+20	RT	21.2	1	8							
233	832+60	RT	16.8	1	8							
234	834+90	LT	19.5	1	24							
SUBTOTAL					148.0	132.0	128.0	200.0		124.0		

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		21

SUMMARY OF DRIVEWAYS

Driveway Number	Station & Offset		Existing Driveway Width (ft)	Existing Driveway No. of Barrells	ALT BID							
					EXTEND	REPLACE	EXTEND	REPLACE	EXTEND	REPLACE	EXTEND	REPLACE
					464		464		464		464	
					6003		6005		6007		6008	
					RC PIPE (CL III) (18 IN)		RC PIPE (CL III) (24 IN)		RC PIPE (CL III) (30 IN)		RC PIPE (CL III) (36 IN)	
					LF		LF		LF		LF	
CSJ 0019-03-028												
235	842+40	LT	19.3	1	8							
236	843+60	LT										
237	844+33	RT	11.4	1	32							
238	848+40	RT	10.9	1			4					
239	850+20	LT	10.5	1	8							
240	851+10	RT	11.5	1			8					
241	854+80	RT	19.1	1			20					
242	855+31	RT	9.1	1			4					
243	862+70	RT	12.8	3								72
244	865+30	RT	18.7	2								
245	867+30	RT	14.2	2								
246	868+10	RT	15.1	2				72				
247	869+90	RT	22.3	2								
*248	871+60	RT	12.3	2								
*249	871+90	RT	11.1	2				72				
250	873+10	LT	3.1	1			4					
251	876+70	RT										
252	877+50	LT	5.5	3				72				
253	878+50	LT	25.8	1								
254	880+00	LT	25.8	1								
255	881+80	LT	26.3	1								
256	886+60	LT	13.2	1						24		
257	888+40	LT	13.6	1						28		
258	888+70	RT	14.3	1						28		
259	893+00	LT	13.1	1						24		
260	893+00	RT	12.1	1						24		
261	903+40	LT	23.6	1			4					
262	903+90	RT	22.8	1						44		
263	925+10	RT										
264	929+60	LT	12.1	1	4							
SUBTOTAL					52.0		44.0	216.0		172.0		72.0
CSJ 0019-03-028 TOTAL					200.0	132.0	172.0	416.0		296.0		72.0
PROJECT TOTAL					748.00	296.00	408.00	828.00	32.00	684.00	44.00	72.00
PROJECT TOTAL (EXTEND + REPLACE)					1044.00		1236.00		716.00		116.00	

*MOVE EXISTING TWO SETs (LT ONLY) ON DRIVEWAY 248 AND PLACE AT THE LT END OF THE NEW CULVERTS FOR DRIVEWAY 249. EXTEND THE NEW CULVERT FOR DRIVEWAY 249 TO TIE-IN TO THE EXISTING CMP CULVERT FOR DRIVEWAY 248.

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		22

LOC NO.	TCP PHASE	PLAN SHEET NUMBER	LOCATION	STA	TEST LEVEL	DIRECTION OF TRAFFIC (UNI/BI)	FOUNDATION PAD		BACKUP SUPPORT			AVAILABLE SITE LENGTH	CRASH CUSHION									
															MOVE / RESET		L	L	R	R	S	S
							PROPOSED MATERIAL	PROPOSED THICKNESS	DESCRIPTION	WIDTH	HEIGHT		INSTALL	REMOVE	MOVE/ RESET	FROM LOC. #	N	W	N	W	N	W
A	PHASE 1	57	WEST COTTONWOOD CREEK BRIDGE	STA 522+26	TL-3	BI	N/A	N/A	SINGLE SLOPE CONCRETE BARRIER	24"	42"	AS NEEDED	2								X	
B	PHASE 2	57	EAST COTTONWOOD CREEK BRIDGE	STA 522+26	TL-3	BI	N/A	N/A	SINGLE SLOPE CONCRETE BARRIER	24"	42"	AS NEEDED			2	A					X	
B	PHASE 2	57	EAST COTTONWOOD CREEK BRIDGE	STA 522+26	TL-3	BI	N/A	N/A	SINGLE SLOPE CONCRETE BARRIER	24"	42"	AS NEEDED		2							X	
												TOTALS	2	2	2							

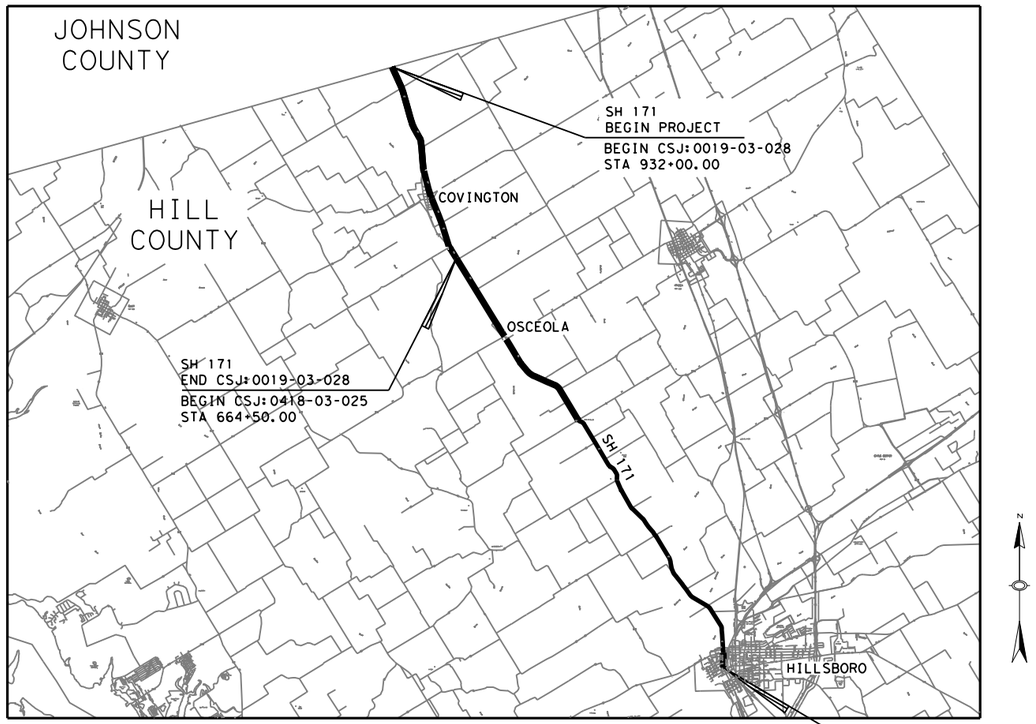
LEGEND:

L=LOW MAINTENANCE
R=REUSABLE
S=SACRIFICIAL
N=NARROW
W=WIDE

FOR DEFINITIONS SEE THE "CRASH CUSHION CATEGORIZATION CHART.PDF" AT THE DESIGN DIVISION (ROADWAY STANDARDS) WEBSITE. USE QUICK LINKS TO ACCESS ATTENUATORS / CRASH CUSHIONS SECTION.
http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/standard/rdwylse.htm

CRASH CUSHION SUMMARY SHEET

FILE: ccss.dgn	DN: TxDOT	CK:	CK:
© TxDOT	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY	
	WAC	HILL	
	FEDERAL AID PROJECT		SHEET NO.
			23



NTS

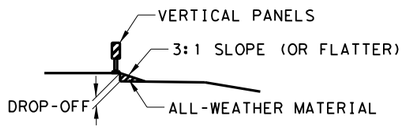
VICINITY MAP

SIGNS G20-1bTR, G20-1bTL or G20-5T, G20-6T, G20-2, G20-2bT, CW20-1D, R20-3T, G20-10T, R20-5T, G20-9TP AND R20-5aTP WILL BE REQUIRED AT PROJECT LIMITS.

CW20-1D AND G20-2 WILL BE REQUIRED AT ALL CROSSROADS.

G20-1a WILL BE REQUIRED AT ALL MAJOR CROSSROADS.

SIGNAGE LEGEND
G20-1bTR or G20-1bTL (48X18) - ROAD WORK NEXT X MILES or G20-5T (48X24)- BEGIN ROAD WORK NEXT X MILES
G20-6T (48X30)- NAME, ADDRESS, CITY, STATE, CONTRACTOR
G20-9TP (36X30) - BEGIN WORK ZONE
G20-2bT (36X18) - END WORK ZONE
R20-3T (48X42)- OBEY WARNING SIGNS STATE LAW
G20-1aT (72X36)- ROAD WORK NEXT X MILES NEXT X MILES
CW20-1D (48X48)- ROAD WORK AHEAD
R20-5T (36X36)- TRAFFIC FINES DOUBLE
R20-5aTP (36X18) - WHEN WORKERS ARE PRESENT
G20-2 (48X24) - END ROAD WORK
G20-10T (60X48) - STAY ALERT TALK OR TEXT LATER
G20-5aP (24X18) - WORK ZONE



PAVEMENT EDGE DROP-OFF DETAIL

1. LESS THAN 2 INCHES: CW 8-11 SIGNS ARE REQUIRED.
2. GREATER THAN 2 INCHES: VERTICAL PANELS AND EITHER CW 8-9a OR CW 8-11 SIGNS ARE REQUIRED.
3. THE SAFETY SLOPE SHALL BE CONSTRUCTED WITH AN ALL-WEATHER MATERIAL SUCH AS RAP, WHICH IS CLEAN AND FREE OF DEBRIS AND LARGE ROCKS.

NOTE:

ALL TRAFFIC CONTROL DEVICES WILL CONFORM WITH THE TEXAS "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS" (TMUTCD), AND WILL BE MAINTAINED AS DIRECTED. ADDITIONAL GUIDELINES FOR TRAFFIC CONTROL DEVICES MAY BE FOUND IN THE TMUTCD.

FOR CHANNELING DEVICE PLACEMENT AND SPACING FOR ALL PHASES, REFER TO THE TCP STANDARDS.

GENERAL

A. INSTALL ALL SIGNS, BARRICADES AND TRAFFIC CONTROL DEVICES AS SHOWN AND IN ACCORDANCE WITH THE STANDARD BC SHEETS AND AS DIRECTED.

B. ADDITIONAL SIGNS, BARRICADES OR TRAFFIC CONTROL DEVICES OTHER THAN THOSE SPECIFIED MAY BE REQUIRED FOR THE SAFE MOVEMENT OF TRAFFIC THROUGH THE PROJECT. PAYMENT FOR ALL SUCH SIGNS, BARRICADES OR TRAFFIC CONTROL DEVICES SHALL BE CONSIDERED AS SUBSIDIARY TO THE ITEM 502, "BARRICADES, SIGNS AND TRAFFIC HANDLING".

C. WORK SITES SHOULD BE CAREFULLY MONITORED TO ENSURE THAT TRAFFIC CONTROL MEASURES ARE OPERATING EFFECTIVELY AND THAT ALL DEVICES USED ARE CLEARLY VISIBLE, CLEAN AND IN GOOD REPAIR.

D. THE CONTRACTOR WILL PROVIDE SAFE ACCESS TO AND FROM ALL PRIVATE PROPERTY AT ALL TIMES AND IN ALL WEATHER CONDITIONS.

E. THE CONTRACTOR WILL BE REQUIRED TO SUBMIT A DETAILED SCHEDULE OF WORK TO THE PROJECT ENGINEER PRIOR TO THE BEGINNING OF CONSTRUCTION WHICH GENERALLY CONFORMS TO THE SEQUENCE SHOWN ON THE TCP SEQUENCE OF OPERATION.

F. COMPLETE ALL WORK ON PROJECT AS SHOWN ON THE VARIOUS PLAN SHEETS AND IN COMPLIANCE WITH THE GENERAL NOTES OF THIS CONTRACT.

G. ANY REQUEST TO ALTER THE SEQUENCE OF OPERATION OR TRAFFIC CONTROL PLAN WILL BE SUBMITTED TO THE ENGINEER FOR HIS WRITTEN APPROVAL.

SEQUENCE OF OPERATION

A. SCHEDULE PROPOSED WORK ON ONLY ONE SIDE AT A TIME. THERE WILL BE NO WORK PERFORMED ON MORE THAN ONE SIDE AT A TIME.

B. FINISH PROPOSED WORK IN EACH WORK AREA BEFORE PROCEEDING TO PERFORM WORK IN ANOTHER WORK AREA. AT A MINIMUM, ALL SAFETY END TREATMENTS FOR ONE SIDE OF ROAD AND CROSS DRAINAGE WILL BE COMPLETE AND IN PLACE. OBTAIN APPROVAL BEFORE PROCEEDING TO BEGIN WORK IN ANOTHER WORK AREA.

C. THE CONTRACTOR WILL BE REQUIRED TO SUBMIT A DETAILED SCHEDULE OF WORK TO THE AREA ENGINEER PRIOR TO THE BEGINNING OF CONSTRUCTION, WHICH GENERALLY CONFORMS TO THE FOLLOWING SEQUENCE:

1. INSTALL PROJECT LIMIT SIGNAGE AND BARRICADES PRIOR TO ANY OTHER WORK.
2. INSTALL SW3P MEASURES AS DIRECTED.
3. CONSTRUCT CULVERT WIDENINGS, REPLACEMENTS, DRIVEWAY SAFETY TREATMENTS, AND BRIDGE WORK AS SHOWN.

   FOR CULVERT REPLACEMENT AND BRIDGE WORK, REFER TO THE TRAFFIC CONTROL STANDARDS. CULVERT REPLACEMENTS WILL CONSIST OF ONE-LANE TWO-WAY TRAFFIC CONTROL. ONLY ONE FULL REPLACEMENT STRUCTURE WILL BE WORKED ON AT A TIME. BOTH LANES WILL BE OPEN AT THE CONCLUSION OF EACH DAYS WORK. COTTONWOOD CREEK BRIDGE RAIL AND GUARDRAIL WILL CONSIST OF TWO-LANE TWO-WAY TRAFFIC CONTROL WITH BARRIER. WORK ON ONE SIDE AT A TIME.
4. INSTALL NEW MBGF (NOT COVERED IN STEP 3) AS SHOWN.
5. INSTALL SIGNING.
6. CONSTRUCT MILLED CENTERLINE AND EDGELINE RUMBLE STRIPS.
7. INSTALL SHORT TERM, WORKZONE PAVEMENT MRKER TABS.
8. PLACE PERMANENT PAVEMENT MARKINGS.
9. CLEAN UP PROJECT LIMITS.
10. REMOVE PROJECT SIGNAGE AND BARRICADES AS DIRECTED.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

TRAFFIC CONTROL AND SEQUENCE OF OPERATION

FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		SHEET NO.
6			24
STATE	DIST.	COUNTY	
TEXAS	WACO	HILL	
CONT.	SECT.	JOB	HIGHWAY NO.
0019	03	028 Etc.	SH 171

BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

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

WORKER SAFETY NOTES:

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

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

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-03 7-13 9-07 8-14 5-10 5-21	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		25

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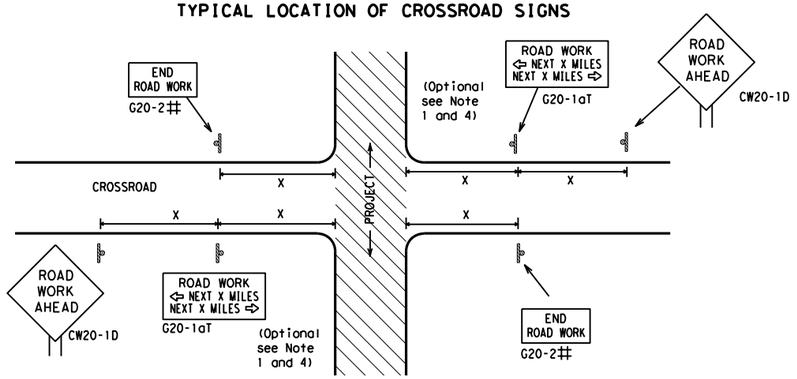
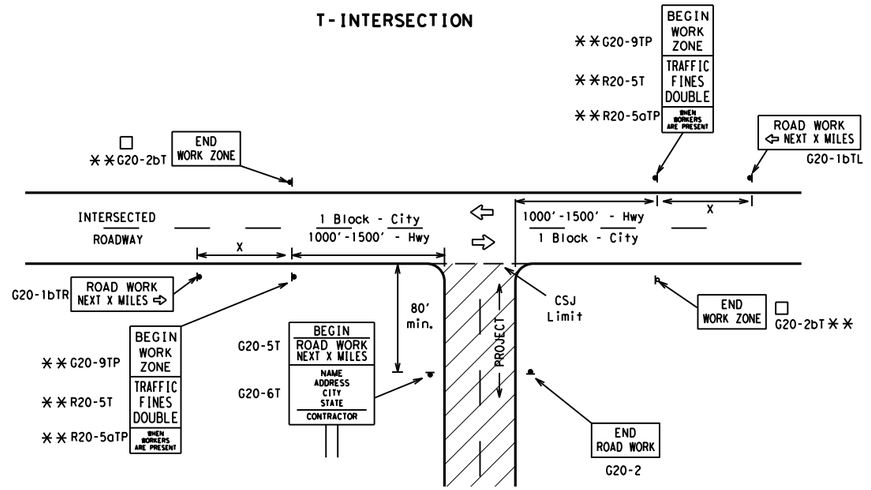
TYPICAL LOCATION OF CROSSROAD SIGNS



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]

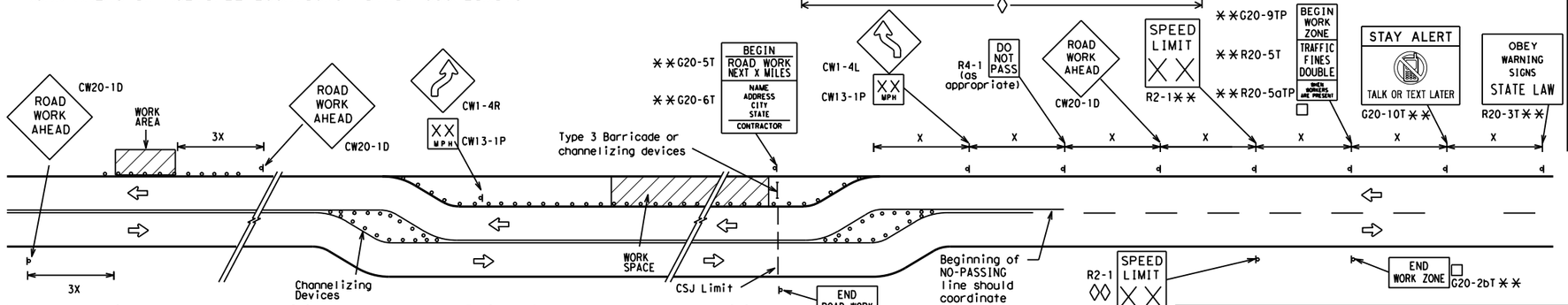
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

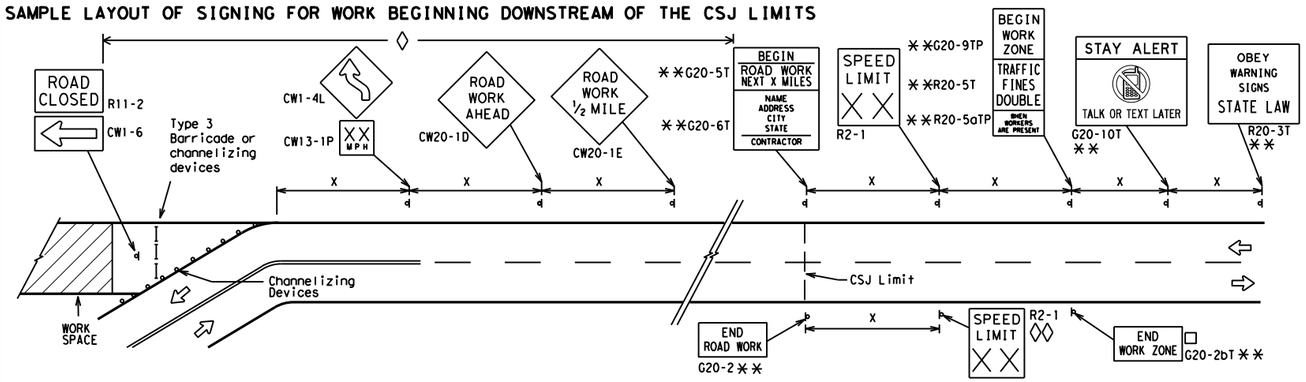
1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have 1/2 mile or more advance warning.
4. 36" x 36" "ROAD WORK AHEAD" (CW20-1D)signs may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



SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS

NOTES

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

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

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

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

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

LEGEND

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

SHEET 2 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

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REVISIONS	0019	03	028 Etc.	SH 171
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WAC	HILL		26

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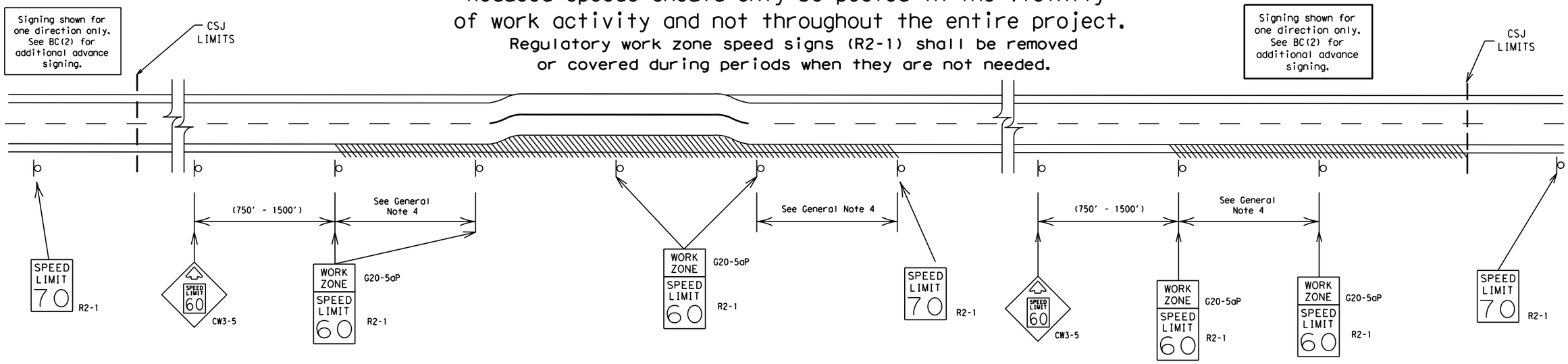
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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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9-07 8-14	DIST	COUNTY		SHEET NO.
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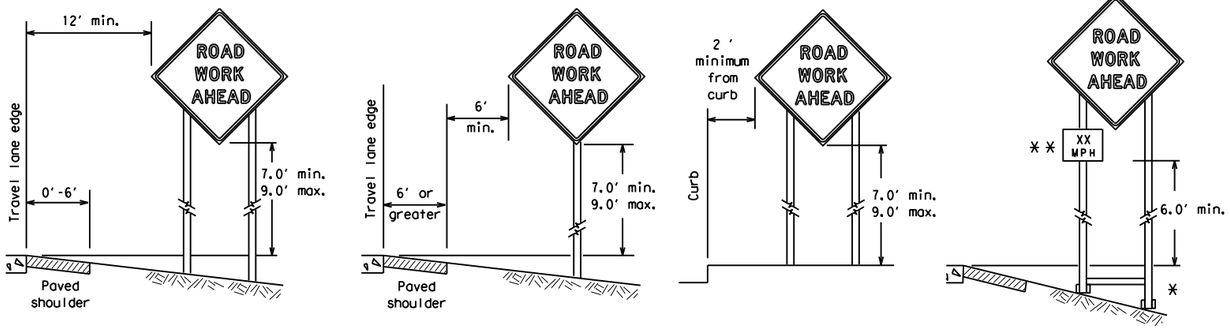
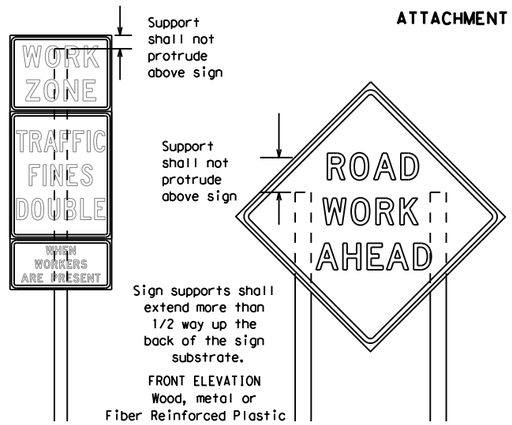
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

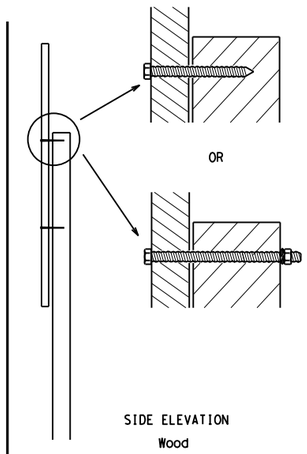


* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

** 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





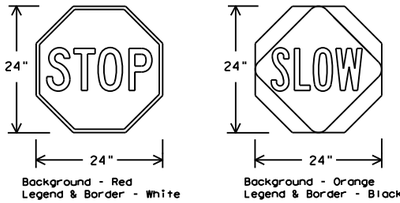
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

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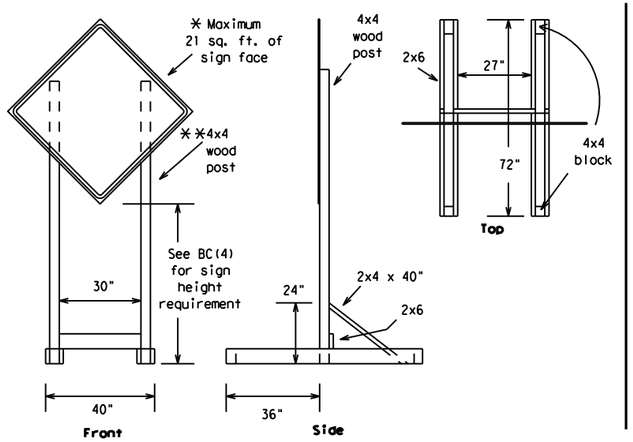
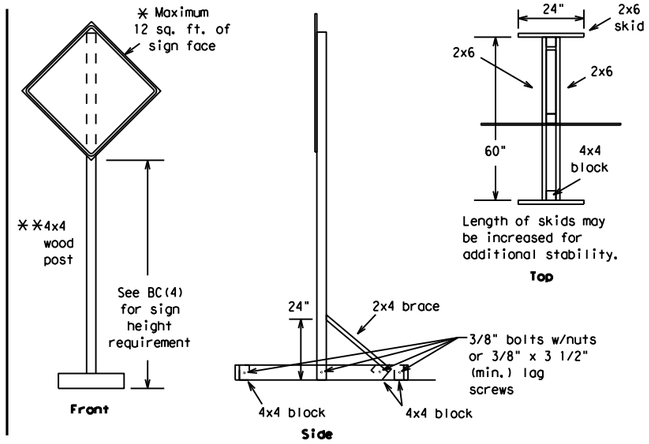
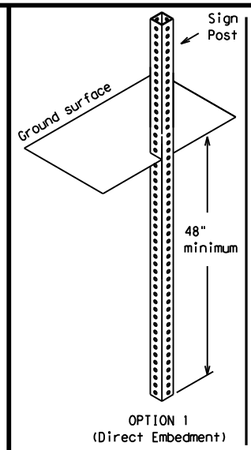
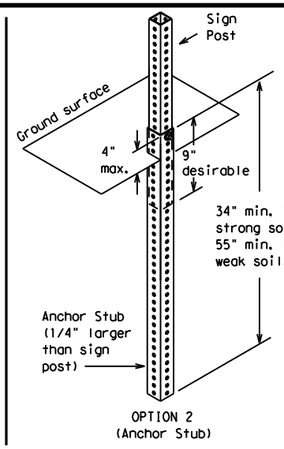


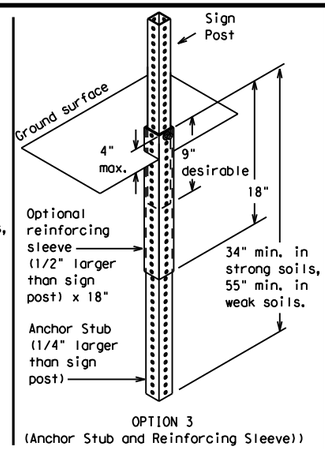


SKID MOUNTED WOOD SIGN SUPPORTS

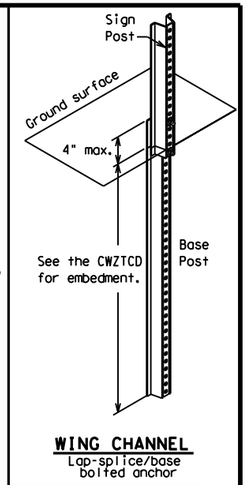
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS







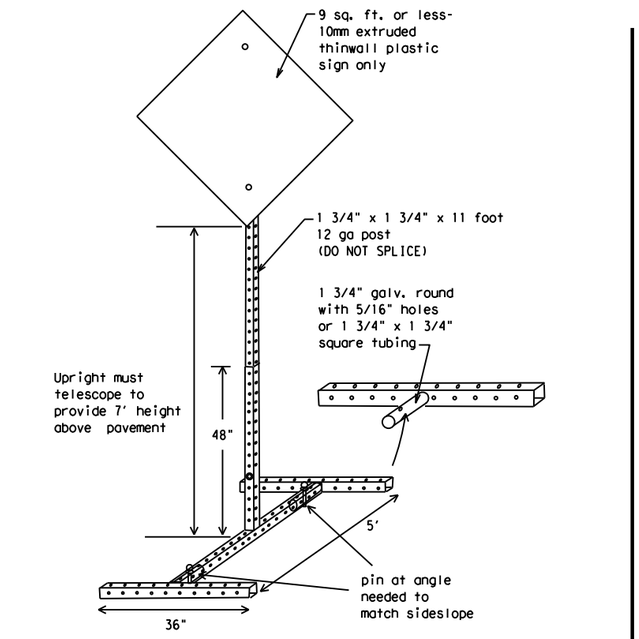
PERFORATED SQUARE METAL TUBING

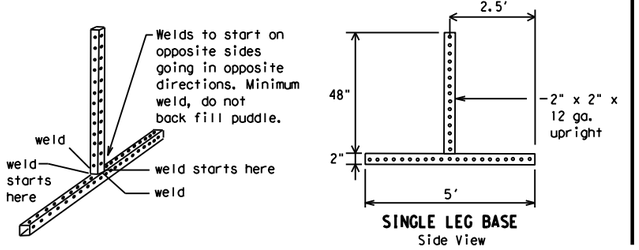


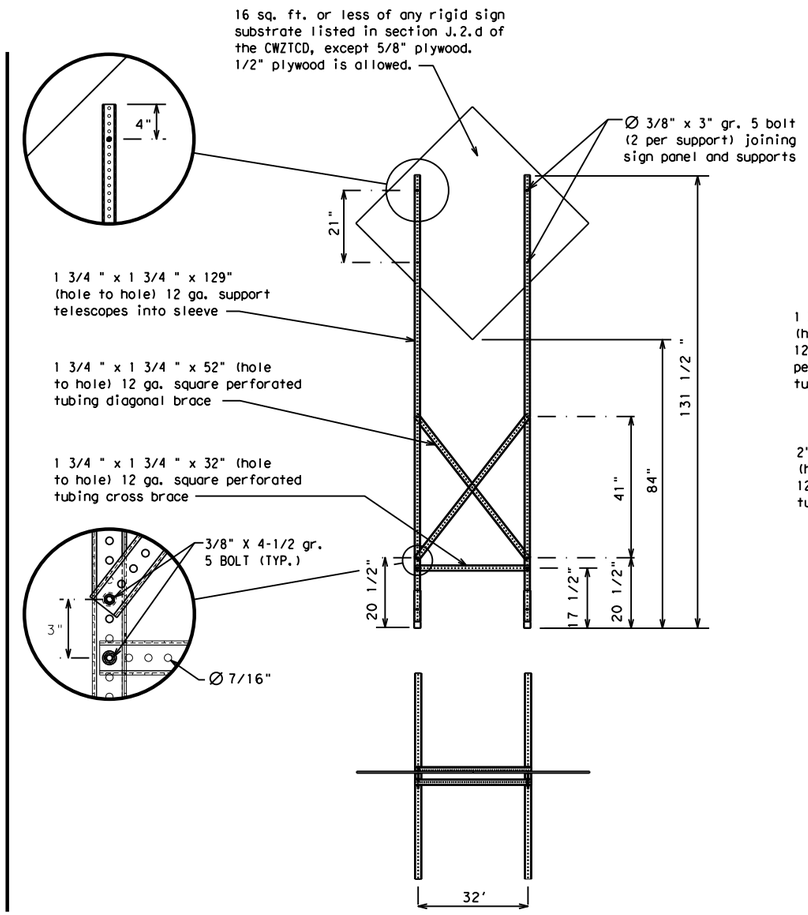
WING CHANNEL
Lap-splice/base bolted anchor

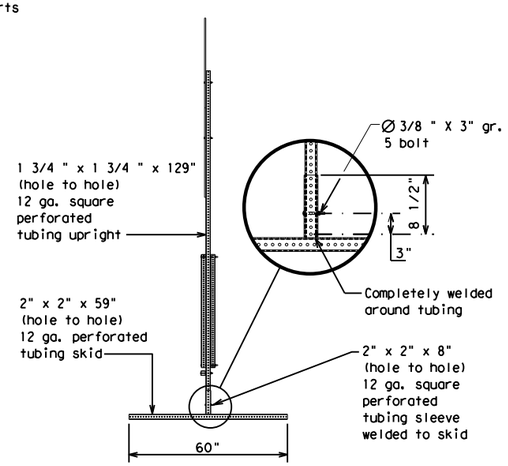
GROUND MOUNTED SIGN SUPPORTS

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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Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

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

PORTABLE CHANGEABLE MESSAGE SIGNS

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

WORD OR PHRASE	ABBREVIATION
Access Road	ACCS RD
Alternate	ALT
Avenue	AVE
Best Route	BEST RTE
Boulevard	BLVD
Bridge	BRDG
Cannot	CANT
Center	CTR
Construction Ahead	CONST AHD
CROSSING	XING
Detour Route	DETOUR RTE
Do Not	DONT
East	E
Eastbound	(route) E
Emergency	EMER
Emergency Vehicle	EMER VEH
Entrance, Enter	ENT
Express Lane	EXP LN
Expressway	EXPWY
XXXX Feet	XXXX FT
Fog Ahead	FOG AHD
Freeway	FRWY, FWY
Freeway Blocked	FWY BLKD
Friday	FRI
Hazardous Driving	HAZ DRIVING
Hazardous Material	HAZMAT
High-Occupancy	HOV
Vehicle Highway	HWY
Hour(s)	HR, HRS
Information	INFO
It Is	ITS
Junction	JCT
Left	LFT
Left Lane	LFT LN
Lane Closed	LN CLOSED
Lower Level	LWR LEVEL
Maintenance	MAINT
Major	MAJ
Miles	MI
Miles Per Hour	MPH
Minor	MNR
Monday	MON
Normal	NORM
North	N
Northbound	(route) N
Parking	PKING
Road	RD
Right Lane	RT LN
Saturday	SAT
Service Road	SERV RD
Shoulder	SHLDR
Slippery	SLIP
South	S
Southbound	(route) S
Speed	SPD
Street	ST
Sunday	SUN
Telephone	PHONE
Temporary	TEMP
Thursday	THURS
To Downtown	TO DWNTN
Traffic	TRAF
Travelers	TRVLRS
Tuesday	TUES
Time Minutes	TIME MIN
Upper Level	UPR LEVEL
Vehicles (s)	VEH, VEHS
Warning	WARN
Wednesday	WED
Weight Limit	WT LIMIT
West	W
Westbound	(route) W
Wet Pavement	WET PVMT
Will Not	WONT

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

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

Other Condition List

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

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

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

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

Location List

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

Warning List

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

** Advance Notice List

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

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

WORDING ALTERNATIVES

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

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

FULL MATRIX PCMS SIGNS

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

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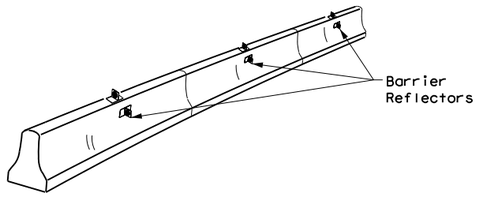
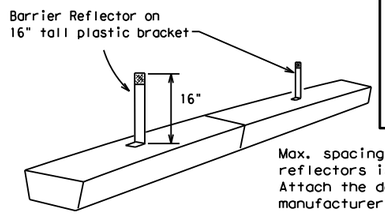
100

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



CONCRETE TRAFFIC BARRIER (CTB)

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

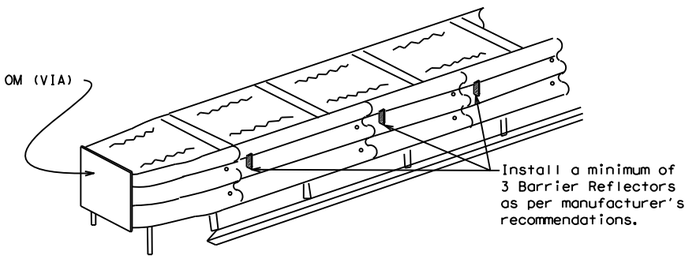


Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

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

LOW PROFILE CONCRETE BARRIER (LPCB)

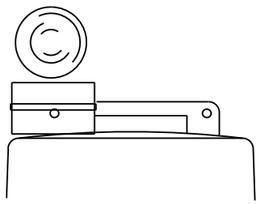


DELINEATION OF END TREATMENTS

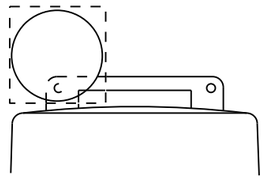
END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



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



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

WARNING LIGHTS

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

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

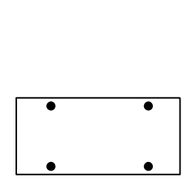
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

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

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

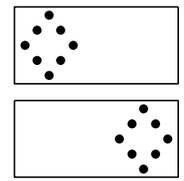
Arrow Boards may be located behind channelizing devices in place for a shoulder taper or merging taper, otherwise they shall be delineated with four (4) channelizing devices placed perpendicular to traffic on the upstream side of traffic.

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

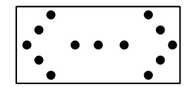


4 CORNER CAUTION

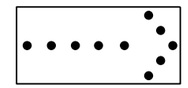
OR



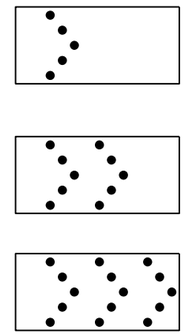
ALTERNATING DIAMOND CAUTION



DOUBLE ARROW



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



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

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

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

ATTENTION

Flashing Arrow Boards shall be equipped with automatic dimming devices.

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

FLASHING ARROW BOARDS

TRUCK-MOUNTED ATTENUATORS

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

Texas Department of Transportation

Traffic Safety Division Standard

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

BC(7)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WAC	HILL		31

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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:

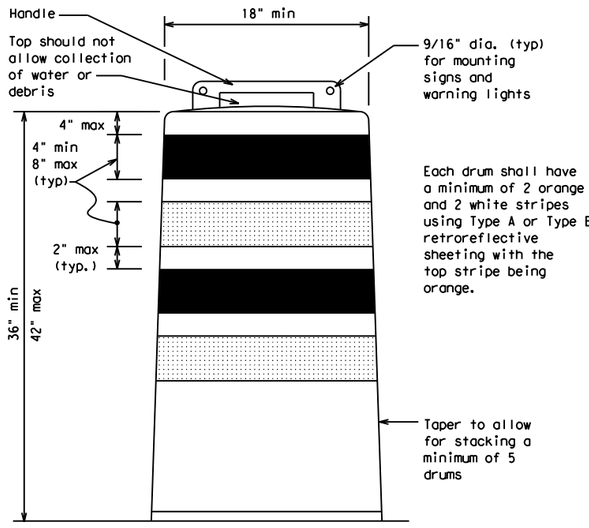
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

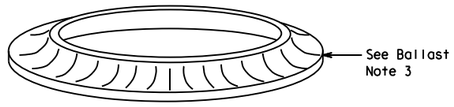
RETROREFLECTIVE SHEETING

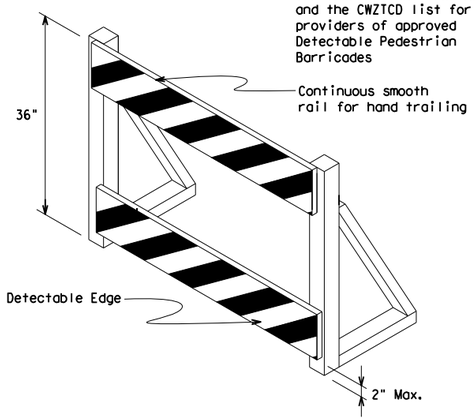
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials." Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall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

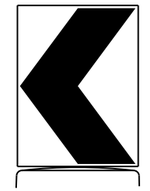




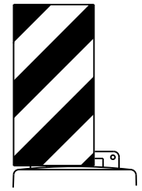


DETECTABLE PEDESTRIAN BARRICADES

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	0019	03	028 Etc.	SH 171
4-03 8-14	DIST	COUNTY		SHEET NO.
9-07 5-21	WAC	HILL		32
7-13				

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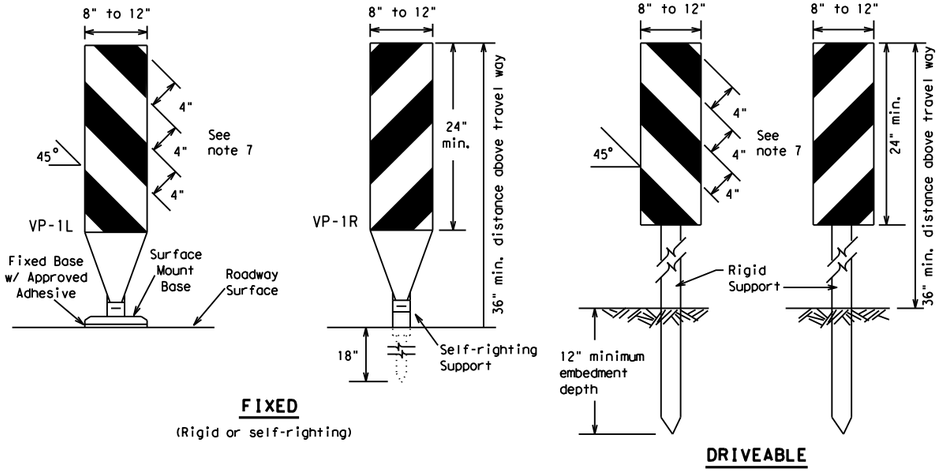
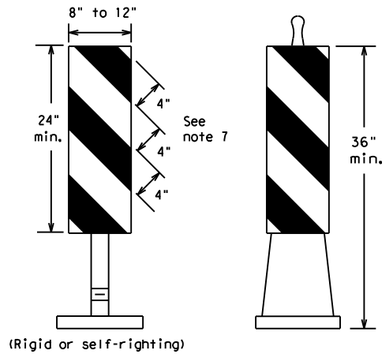
DATE: 03/28/2022 09:16 AM
FILE: DOCUMENT NAME



FIXED
(Rigid or self-righting)

DRIVEABLE

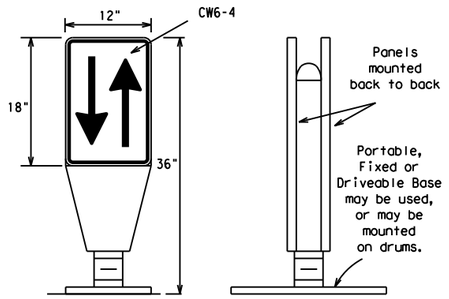


(Rigid or self-righting)

PORTABLE

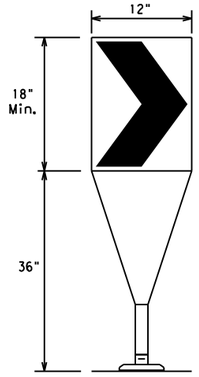
VERTICAL PANELS (VPs)

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.



OPPOSING TRAFFIC LANE DIVIDERS (OTLD)

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.



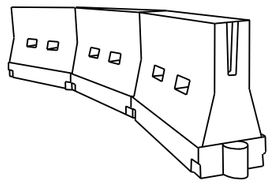
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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

CHEVRONS

GENERAL NOTES

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



LONGITUDINAL CHANNELIZING DEVICES (LCD)

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

WATER BALLASTED SYSTEMS USED AS BARRIERS

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

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

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

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

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

SHEET 9 OF 12

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	0019	03	028 Etc.	SH 171
9-07 8-14	DIST	COUNTY		SHEET NO.
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DATE: 03/28/2022 09:16 AM
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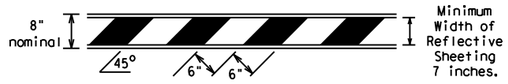
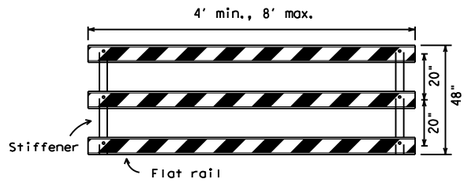
TYPE 3 BARRICADES

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.



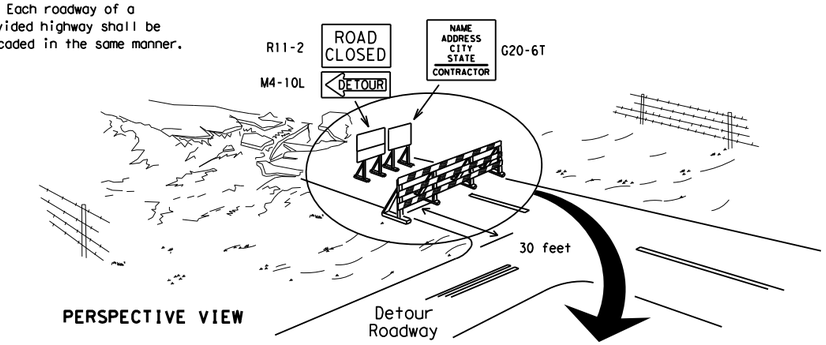
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

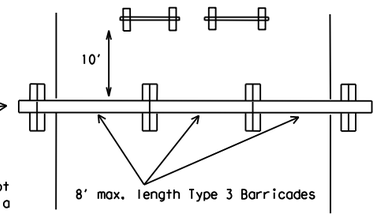
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

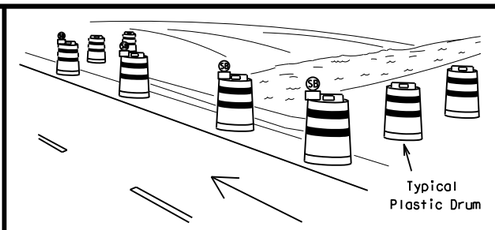
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

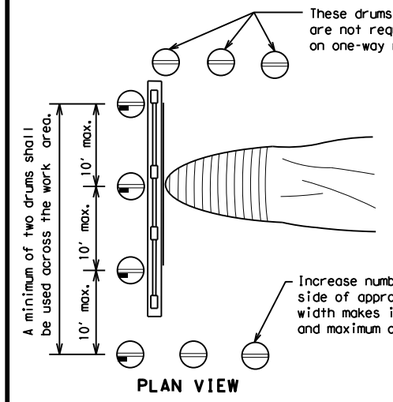
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

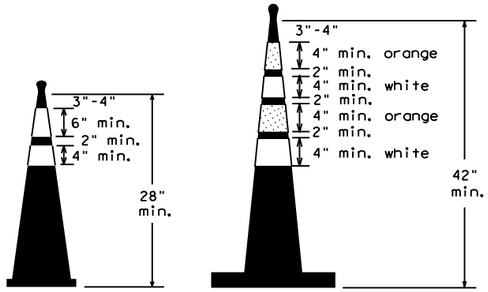
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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

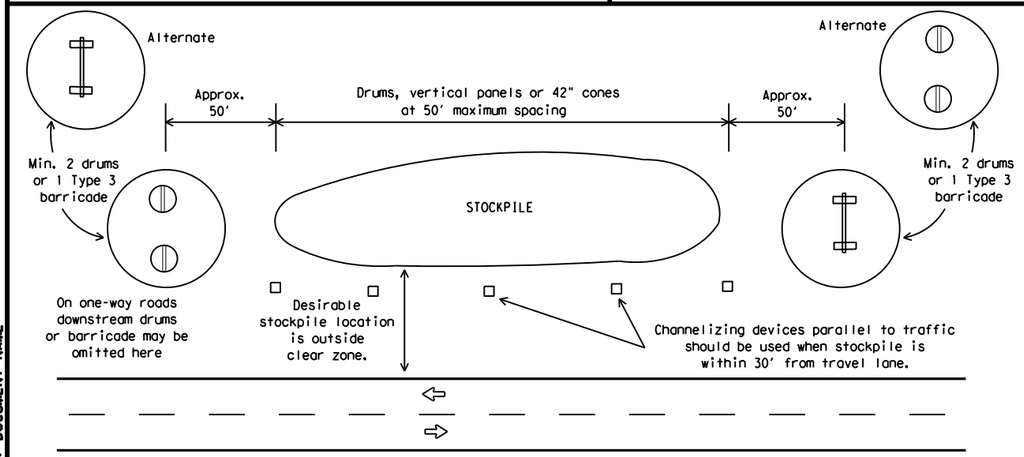
PLAN VIEW

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	0019	03	028 Etc.	SH 171
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WAC	HILL		34

104

DATE: 03/28/2022 09:16 AM
FILE: DOCUMENT NAME

WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

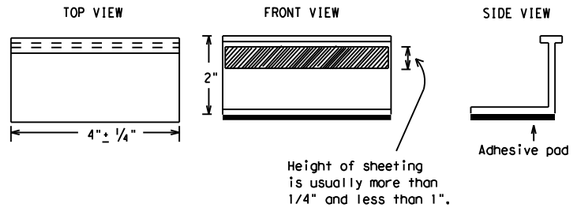
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
2-98 9-07 5-21	DIST	COUNTY		SHEET NO.
1-02 7-13	WAC	HILL		35
11-02 8-14				

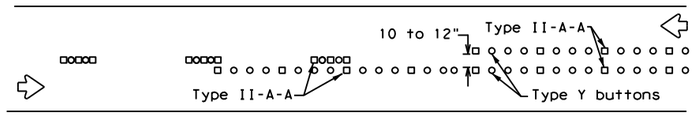
105

DATE: 03/28/2022 09:16 AM
FILE: DOCUMENT NAME

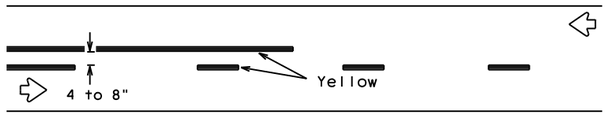
DATE: 03/28/2022 09:16 AM
FILE: DOCUMENT NAME

PAVEMENT MARKING PATTERNS

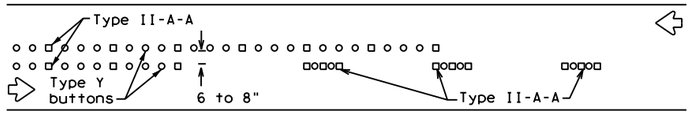
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



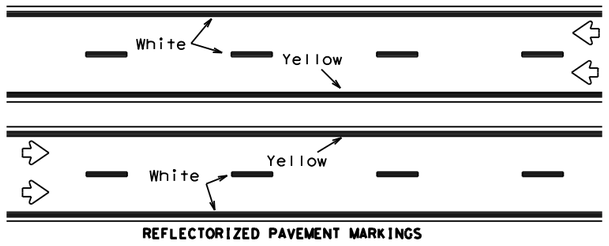
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



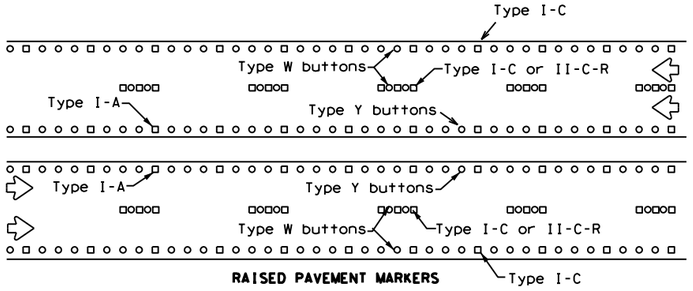
RAISED PAVEMENT MARKERS - PATTERN B

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

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



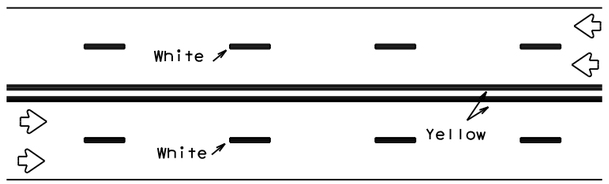
REFLECTORIZED PAVEMENT MARKINGS



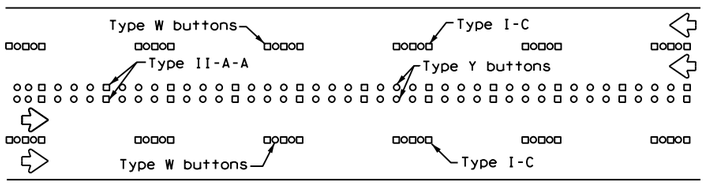
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



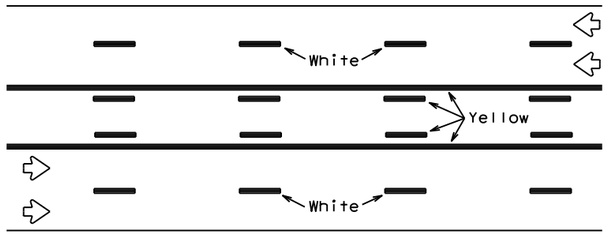
REFLECTORIZED PAVEMENT MARKINGS



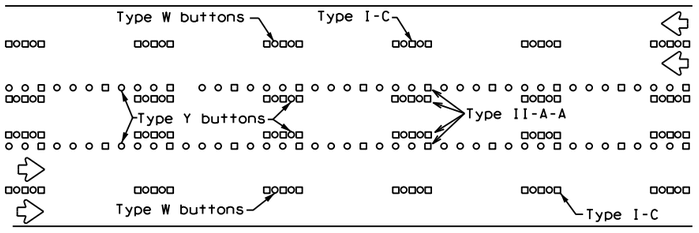
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

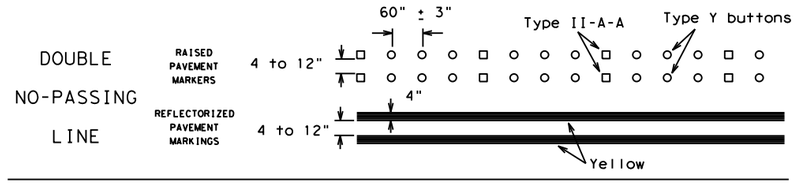
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

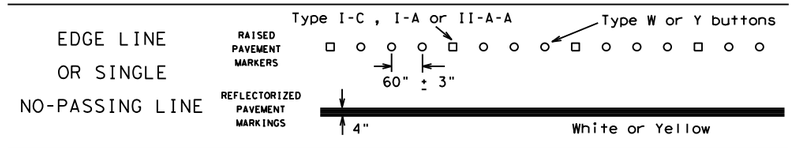
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

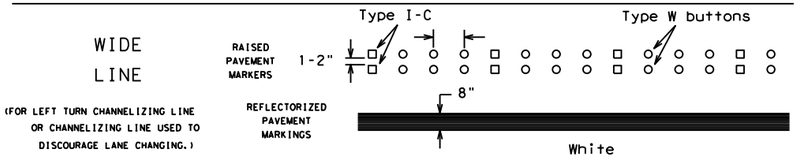


EDGE LINE OR SINGLE NO-PASSING LINE



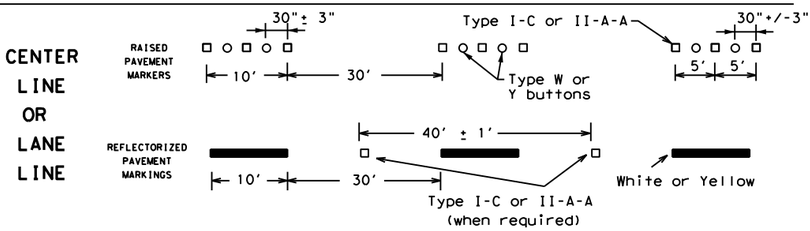
WIDE LINE

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

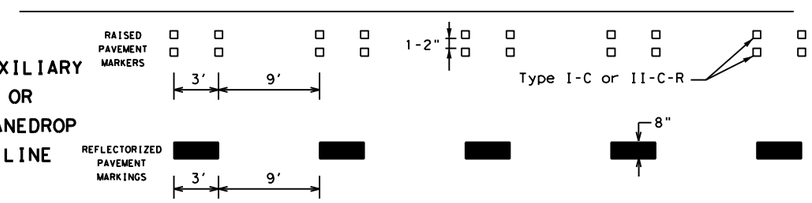


BROKEN LINES

CENTER LINE OR LANE LINE

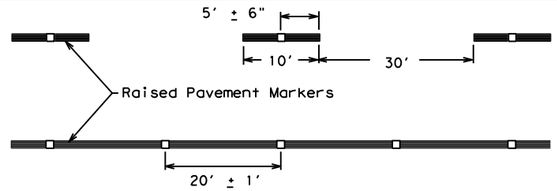


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



Centerline only - not to be used on edge lines

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS 1-97 9-07 5-21 2-98 7-13 11-02 8-14	0019	03	028 Etc.	SH 171
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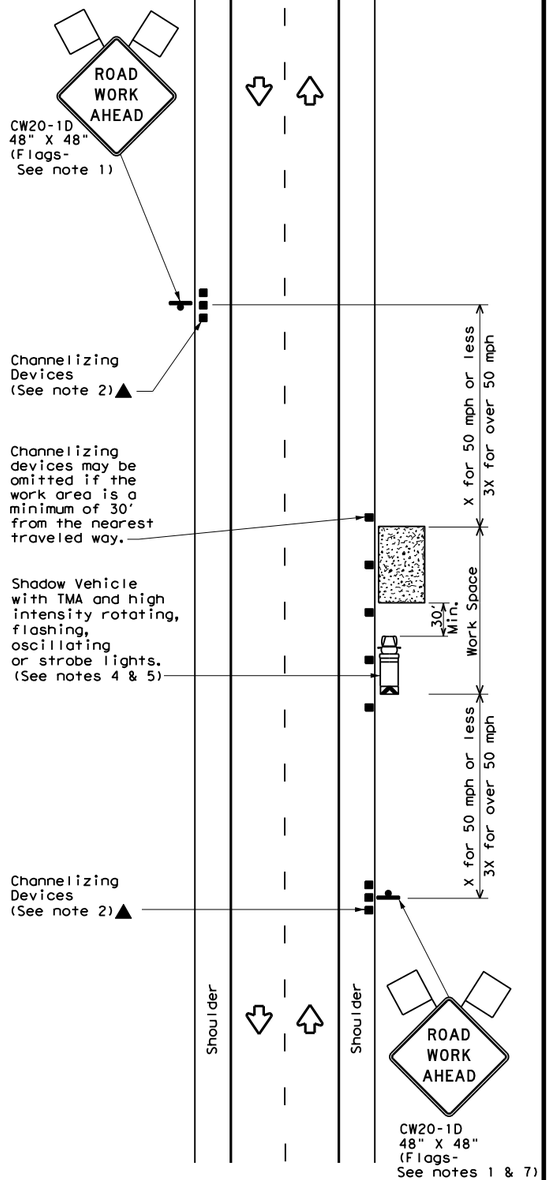
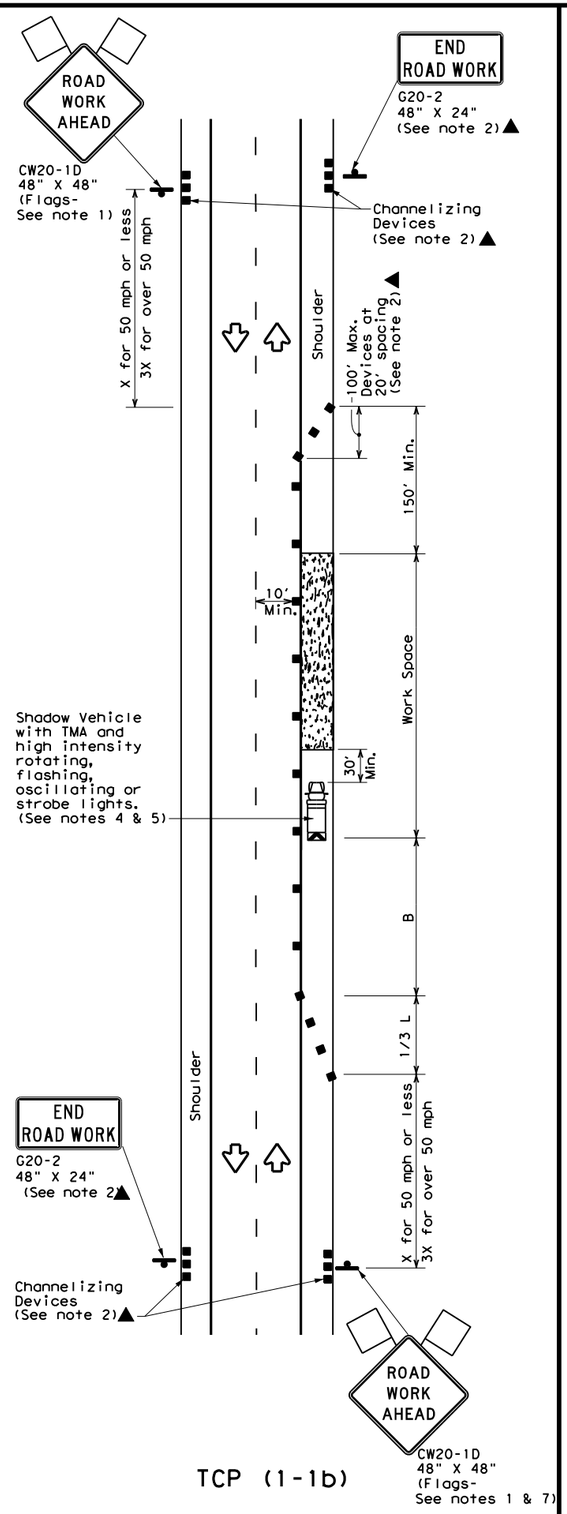


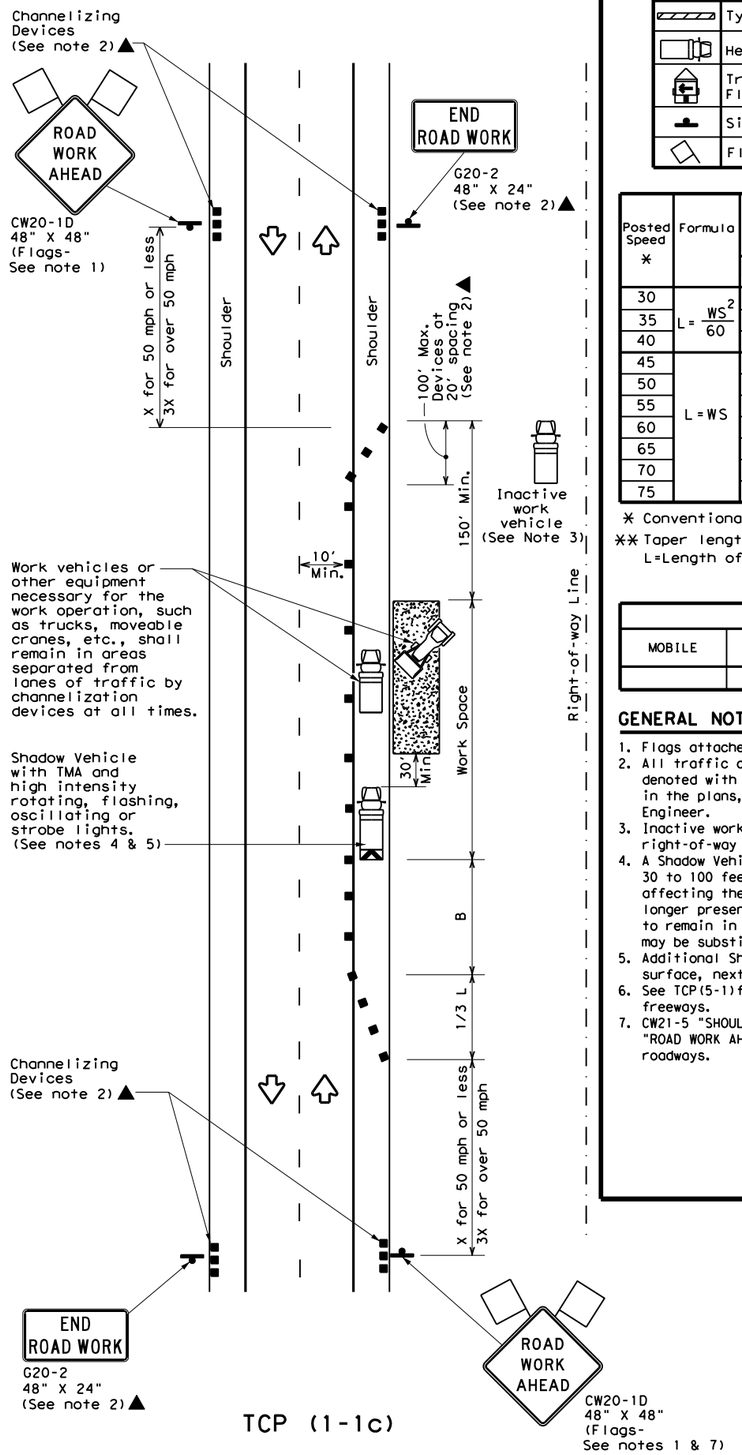
TCP (1-1a)

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
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2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	WAC	HILL		37
1-97 2-18				

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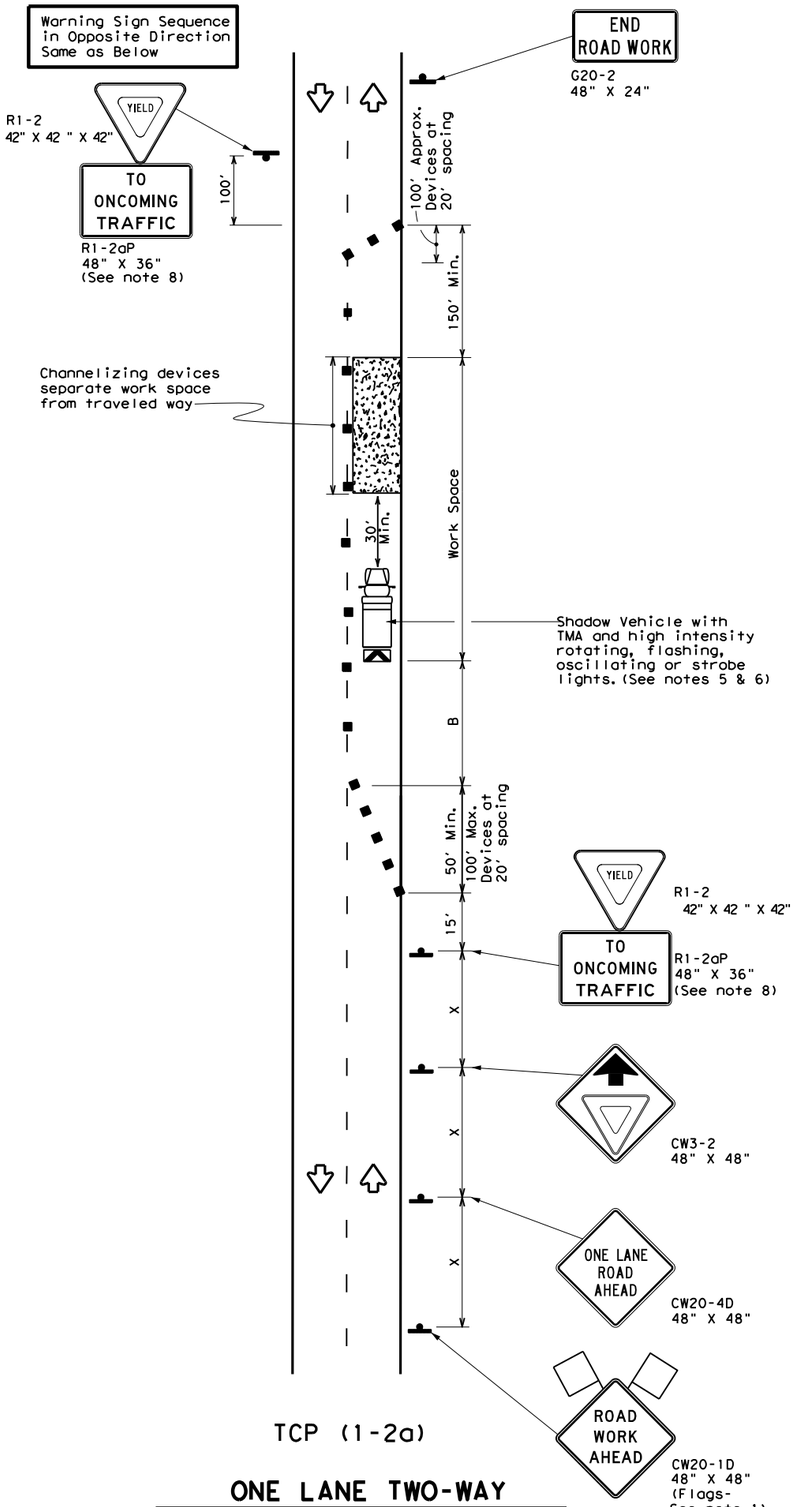
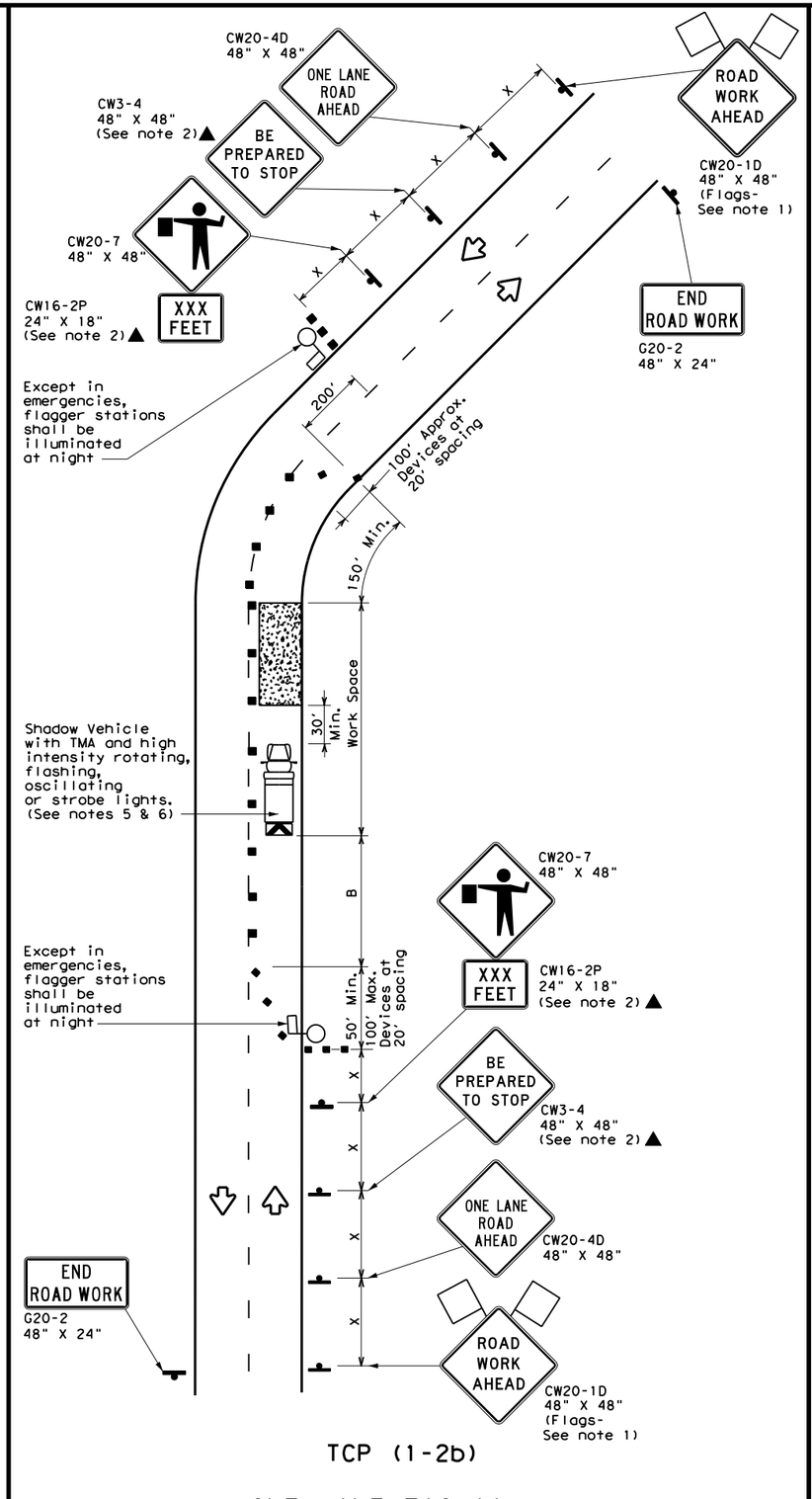


TCP (1-2a)

ONE LANE TWO-WAY
CONTROL WITH YIELD SIGNS
(Less than 2000 ADT - See note 7)



TCP (1-2b)

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 CW20-4D "ONE LANE ROAD AHEAD" sign, but proper sign spacing shall be maintained.
4. Sign spacing may be increased or an additional CW20-1D "ROAD WORK AHEAD" sign may be used if advance warning ahead of the flagger or R1-2 "YIELD" sign is less than 1500 feet.
5. 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.
6. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.

TCP (1-2a)

7. R1-2 "YIELD" sign traffic control may be used on projects with approaches that have adequate sight distance. For projects in urban areas, work spaces should be no longer than one half city block. In rural areas on roadways with less than 2000 ADT, work spaces should be no longer than 400 feet.
8. R1-2 "YIELD" sign with R1-2aP "TO ONCOMING TRAFFIC" plaque shall be placed on a support at a 7 foot minimum mounting height.

TCP (1-2b)

9. Flaggers should use two-way radios or other methods of communication to control traffic.
10. Length of work space should be based on the ability of flaggers to communicate.
11. If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain adequate stopping sight distance to the flagger and a queue of stopped vehicles (see table above).
12. Channelizing devices on the center-line may be omitted when a pilot car is leading traffic and approved by the Engineer.
13. Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situations.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
ONE-LANE TWO-WAY
TRAFFIC CONTROL

TCP(1-2)-18

FILE: tcp1-2-18.dgn	DN:	CK:	DW:	CK:
©TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-90 4-98	0019	03	028 Etc.	SH 171
2-94 2-12	DIST	COUNTY		SHEET NO.
1-97 2-18	WAC	HILL		38

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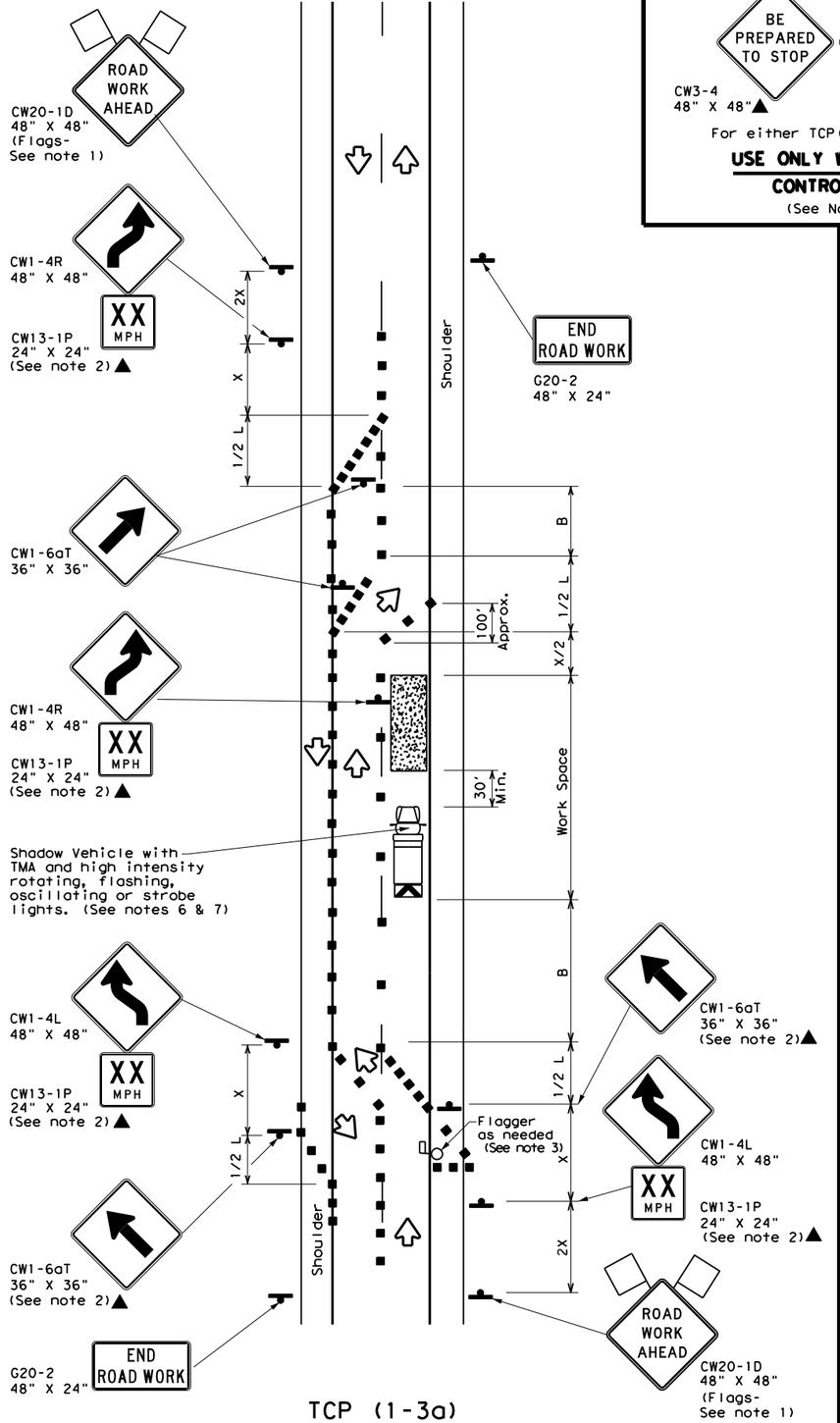
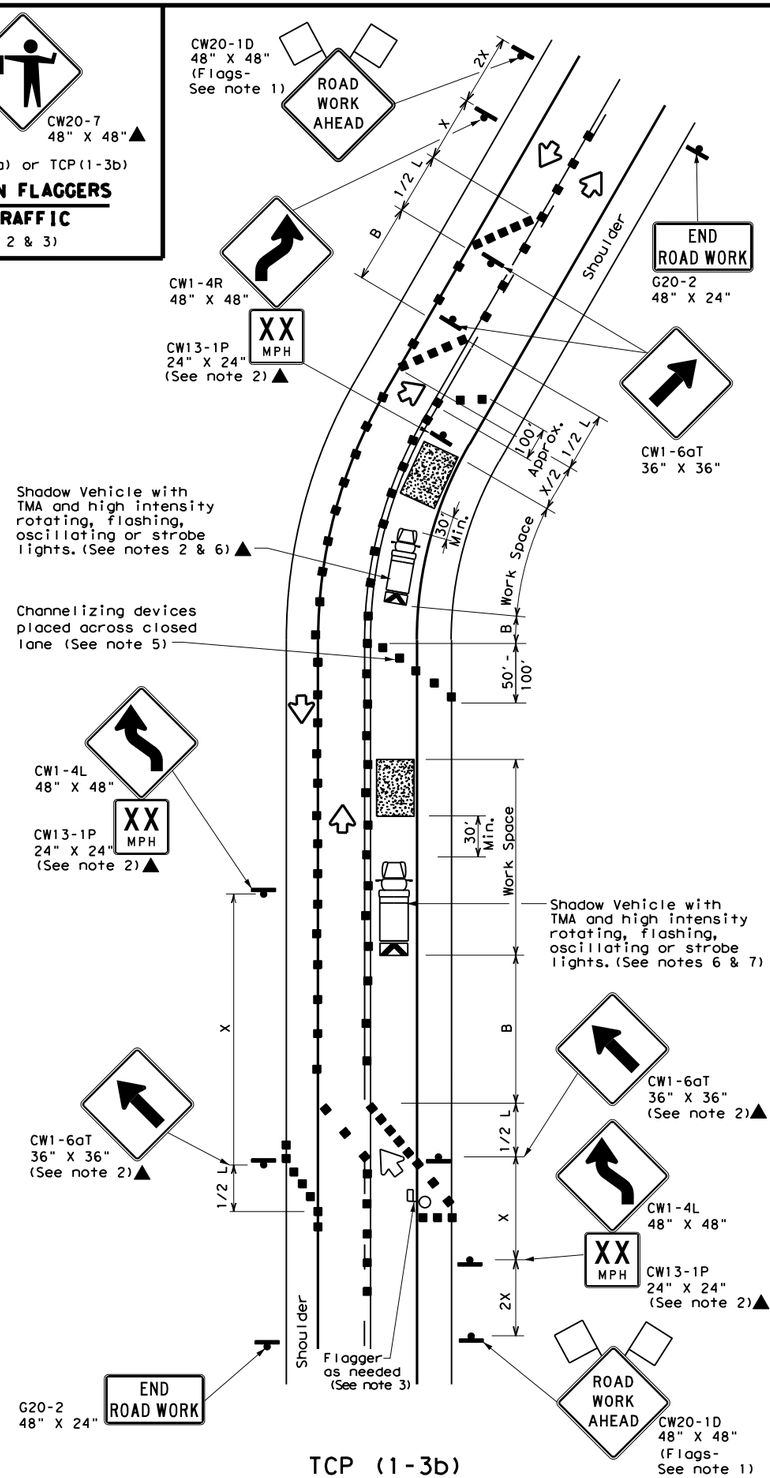


TCP (1-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS

ONE LANE CLOSED
ADEQUATE FIELD OF VIEW

BE PREPARED TO STOP
CW3-4 48" X 48"
CW20-7 48" X 48"
For either TCP(1-3a) or TCP(1-3b)
USE ONLY WHEN FLAGGERS CONTROL TRAFFIC
(See Notes 2 & 3)



TCP (1-3b)
2-LANE ROADWAY WITH PAVED SHOULDERS

ONE LANE CLOSED
INADEQUATE FIELD OF VIEW

LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board	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. Flagger control should NOT be used unless roadway conditions or heavy traffic volume require additional emphasis to safely control traffic. Additional flaggers may be positioned in advance of traffic queues to alert traffic to reduce speed.
4. DO NOT PASS, PASS WITH CARE and construction regulatory speed zone signs may be installed downstream of the ROAD WORK AHEAD signs.
5. When the work zone is made up of several work spaces, channelizing devices should be placed laterally across the closed lane to re-emphasize closure. Laterally placed channelizing devices should be repeated every 500 to 1000 feet in urban areas and every 1/4 to 1/2 mile in rural areas.
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 wider work spaces.
8. Where traffic is directed over a yellow centerline, channelizing devices which separate two-way traffic should be spaced on tapers at 20', or 15' if posted speed are 35 mph or slower, and for tangent sections, at 1/2S where S is the speed in mph. This tighter device spacing is intended for the area of conflicting markings not the entire work zone.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN TRAFFIC SHIFTS ON TWO LANE ROADS

TCP(1-3)-18

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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8-95 2-12	WAC	HILL		39
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153

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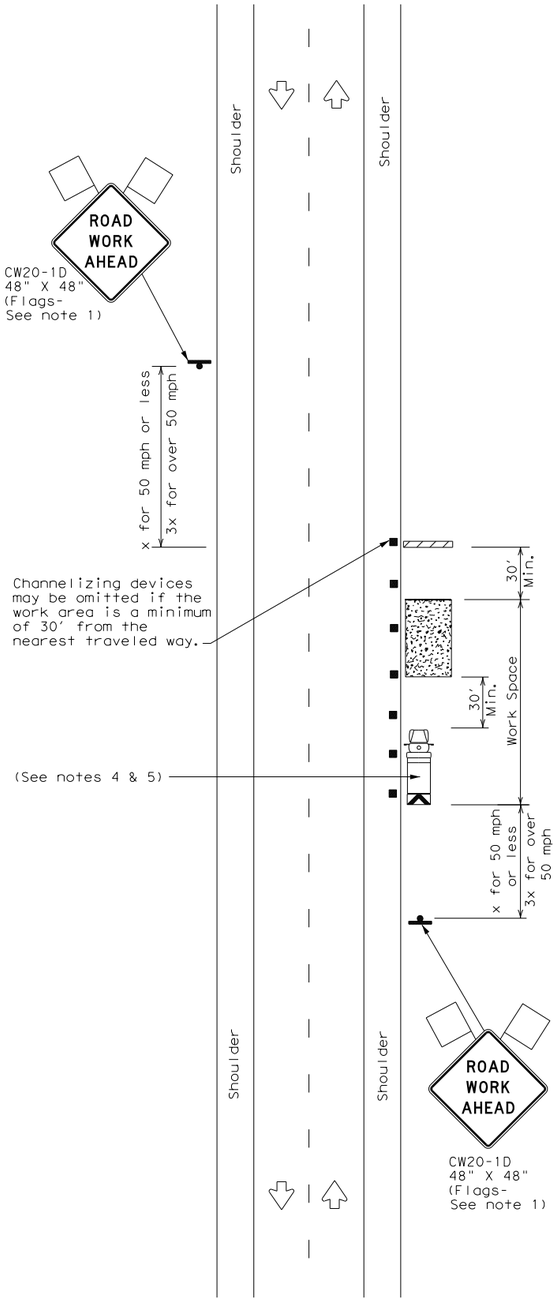
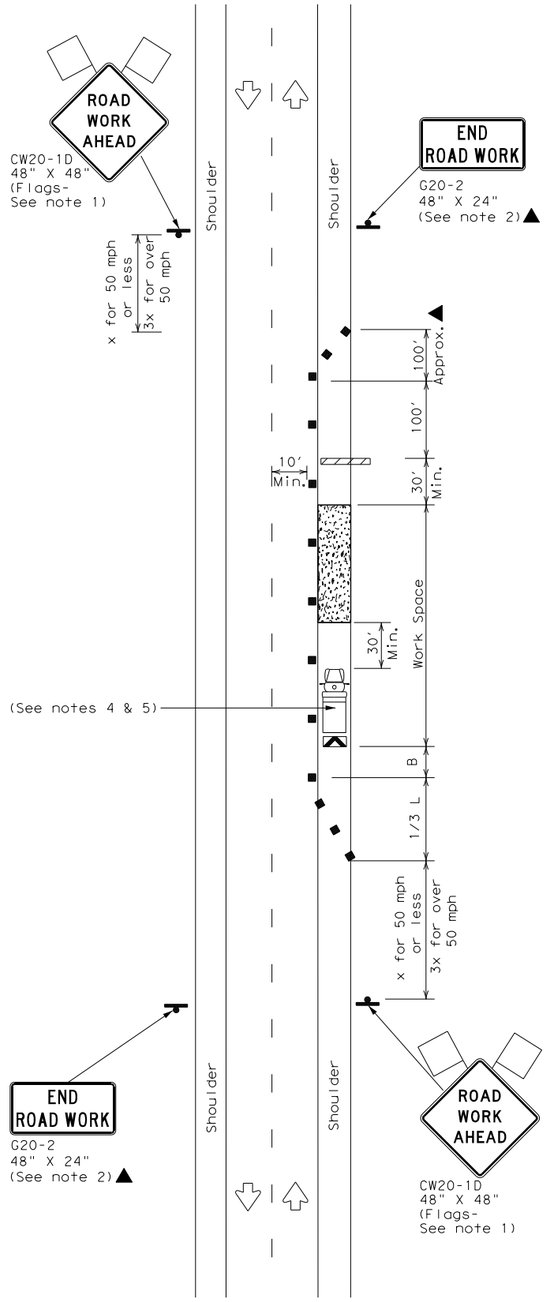


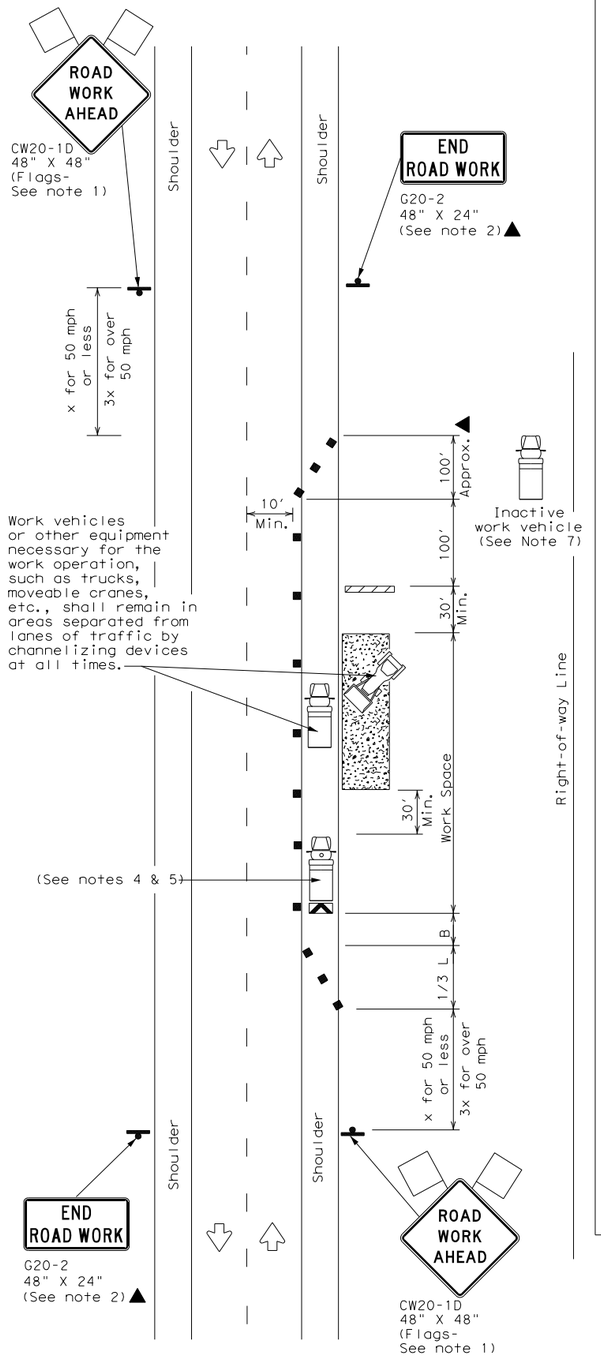
TCP (2-1a)

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
REVISIONS 2-94 4-98 8-95 2-12 1-97 2-18	0019	03	028 Etc.	SH 171
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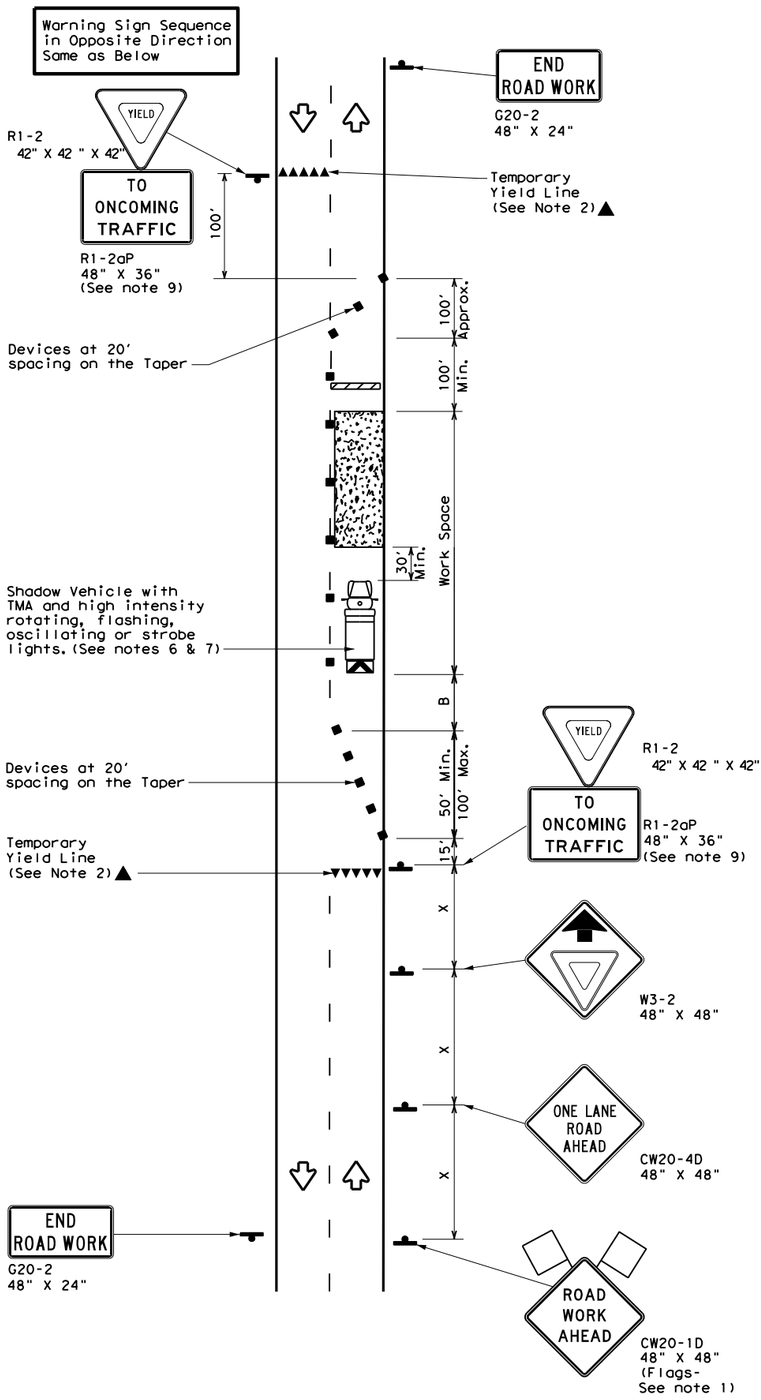
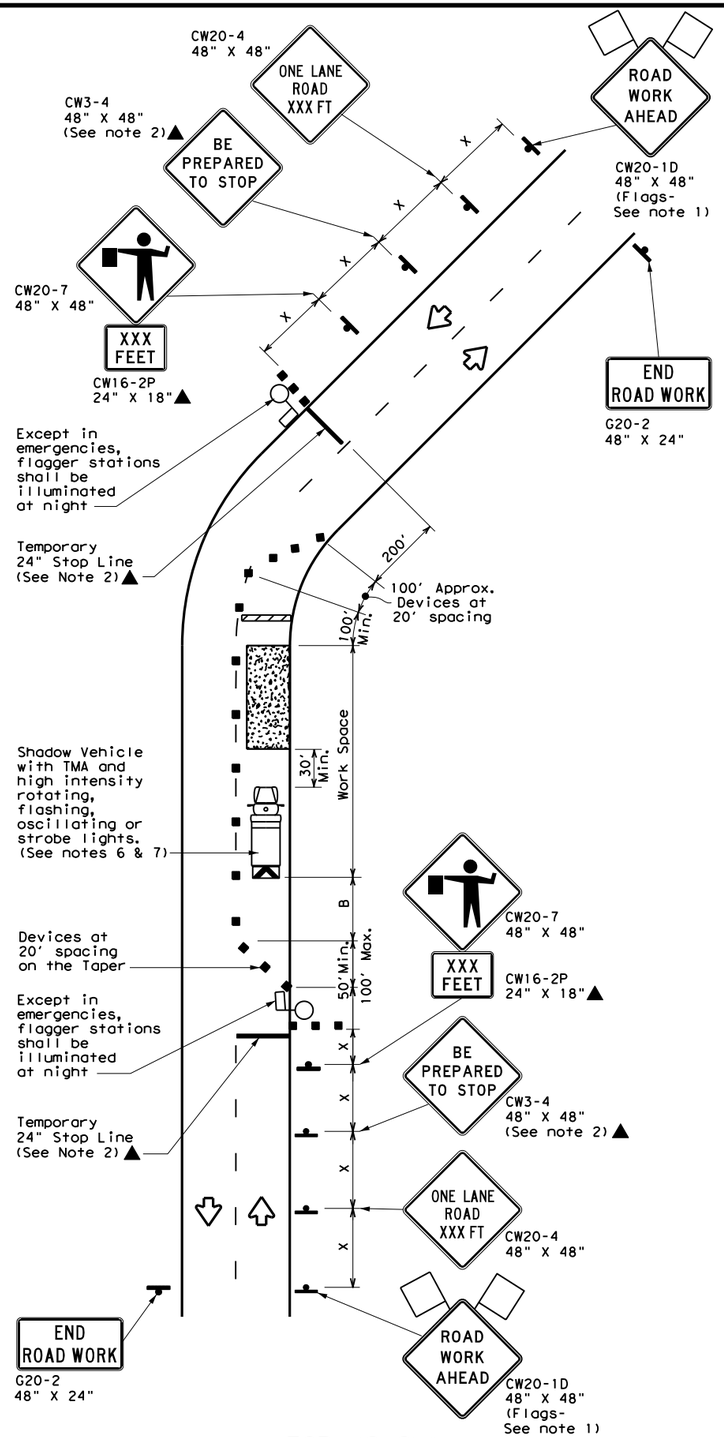


TCP (2-2a)
2-LANE ROADWAY WITHOUT PAVED SHOULDERS
ONE LANE TWO-WAY
CONTROL WITH YIELD SIGNS
(Less than 2000 ADT - See Note 9)



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
REVISIONS 8-95 3-03 1-97 2-12 4-98 2-18	0019	03	028 Etc.	SH 171
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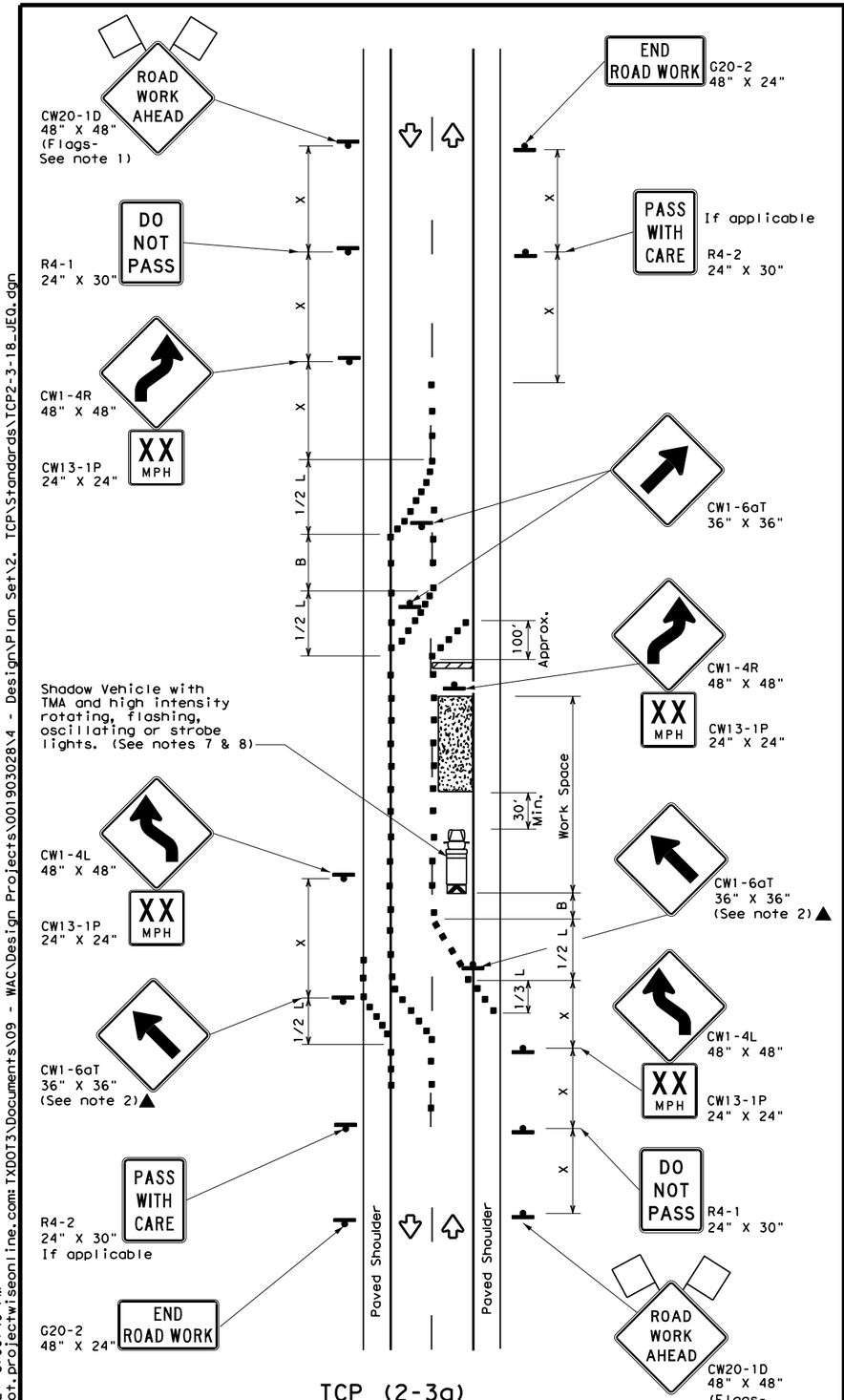
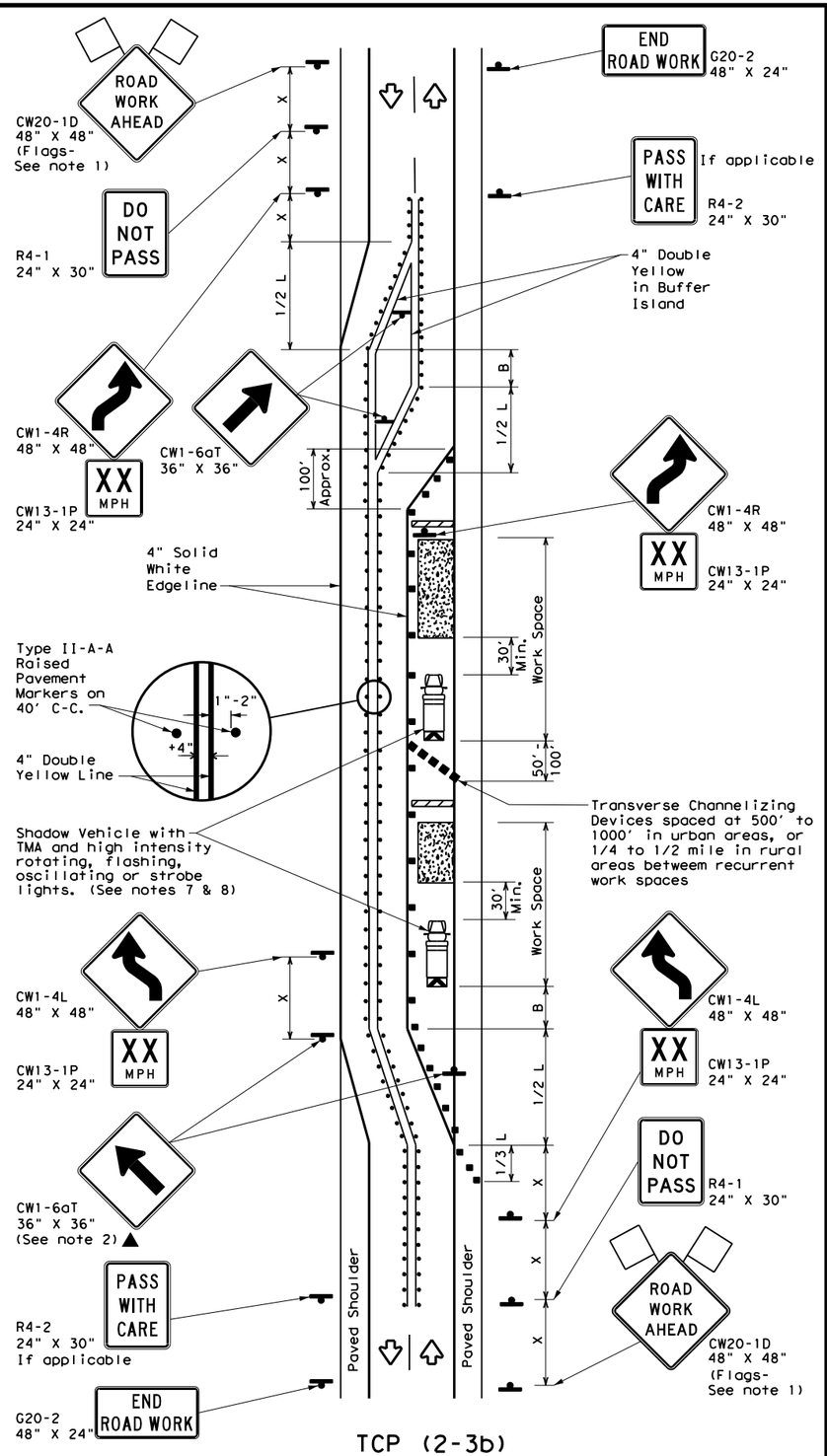


TCP (2-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS

ONE LANE CLOSED
ADEQUATE FIELD OF VIEW



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

ONE LANE CLOSED
INADEQUATE FIELD OF VIEW

LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board		Raised Pavement Markers Ty II-AA
	Sign		Traffic Flow
	Flag		Flagger

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

* Conventional Roads Only

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
				TCP(2-3b)ONLY
			✓	✓

GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. When work space will be in place less than three days existing pavement markings may remain in place. Channelizing devices shall be used to separate traffic.
4. Flagger control should NOT be used unless roadway conditions or heavy traffic volume require additional emphasis to safely control traffic. Flagger should be positioned at end of traffic queue.
5. The R4-1 "DO NOT PASS," R4-2 " PASS WITH CARE" and construction regulatory speed zone signs may be installed within CW20-1D "ROAD WORK AHEAD" signs. Proper spacing of signs shall be maintained.
6. Conflicting pavement marking shall be removed for long term projects.
7. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted.
8. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.

TCP (2-3a)

9. Conflicting pavement markings shall be removed for long-term projects. For shorter durations where traffic is directed over a yellow centerline, channelizing devices which separate two-way traffic should be spaced on tapers at 20' or 15' if posted speeds are 35 mph or slower, and for tangent sections, at 1/2(S) where S is the speed in mph. This tighter device spacing is intended for the area of the conflicting markings, not the entire work zone.

Texas Department of Transportation — Traffic Operations Division Standard

TRAFFIC CONTROL PLAN TRAFFIC SHIFTS ON TWO-LANE ROADS

TCP(2-3)-18

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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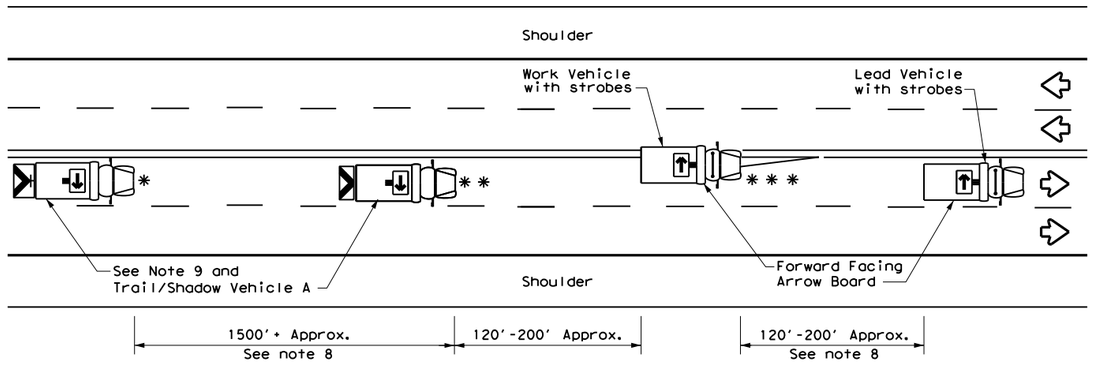
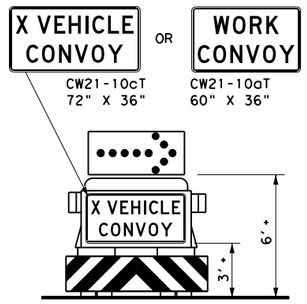


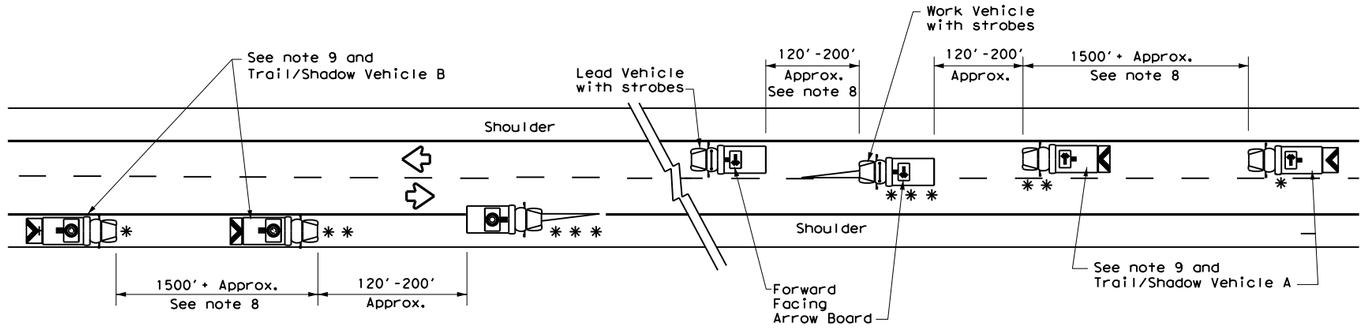
TCP (3-1a)

UNDIVIDED MULTILANE ROADWAY



TRAIL/SHADOW VEHICLE A

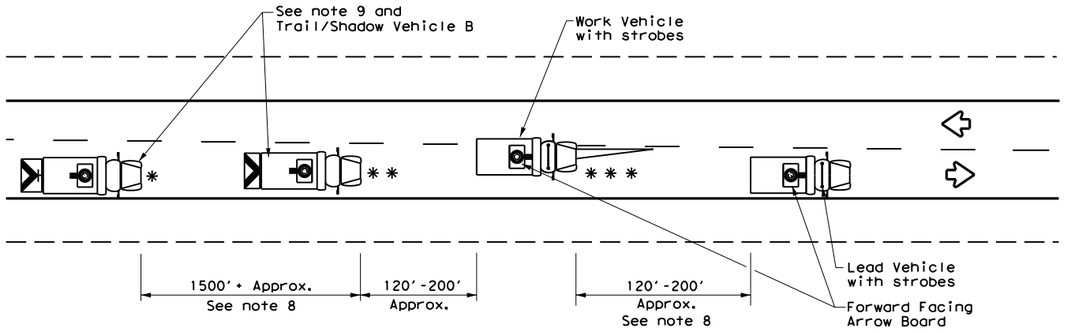
with RIGHT Directional display Flashing Arrow Board



WORK ON SHOULDER — WORK ON TRAVEL LANE

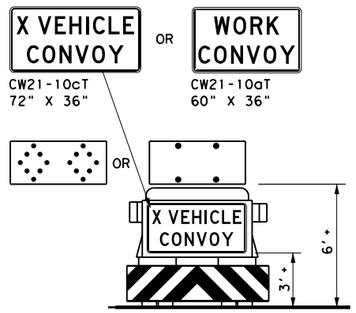
TCP (3-1b)

TWO-WAY ROADWAY WITH PAVED SHOULDERS



TCP (3-1c)

TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS



TRAIL/SHADOW VEHICLE B

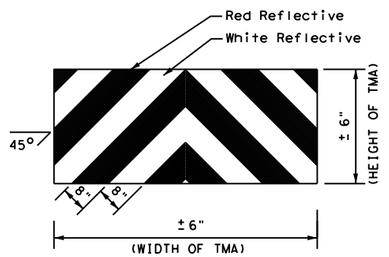
with Flashing Arrow Board in CAUTION display

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

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

GENERAL NOTES

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



STRIPING FOR TMA

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS UNDIVIDED HIGHWAYS

TCP(3-1)-13

FILE: tcp3-1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 7-13 1-97	0019	03	028 Etc.	SH 171
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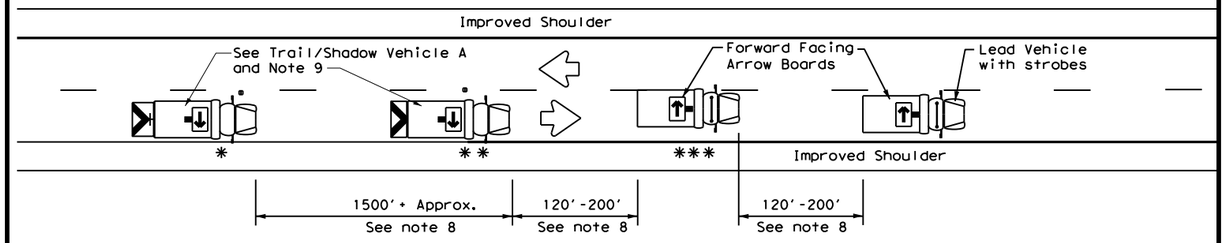
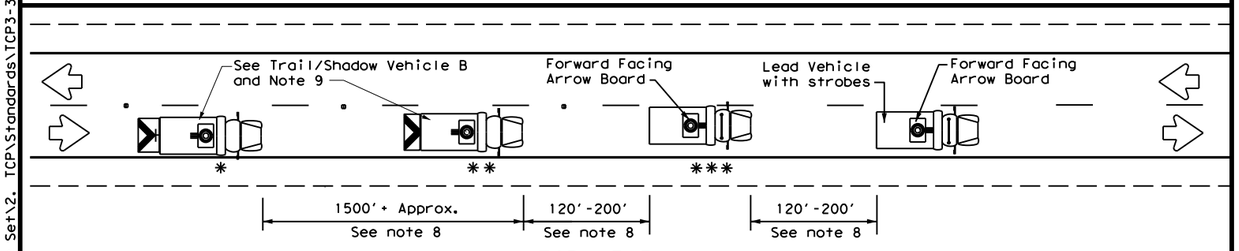
	WAC	HILL		44



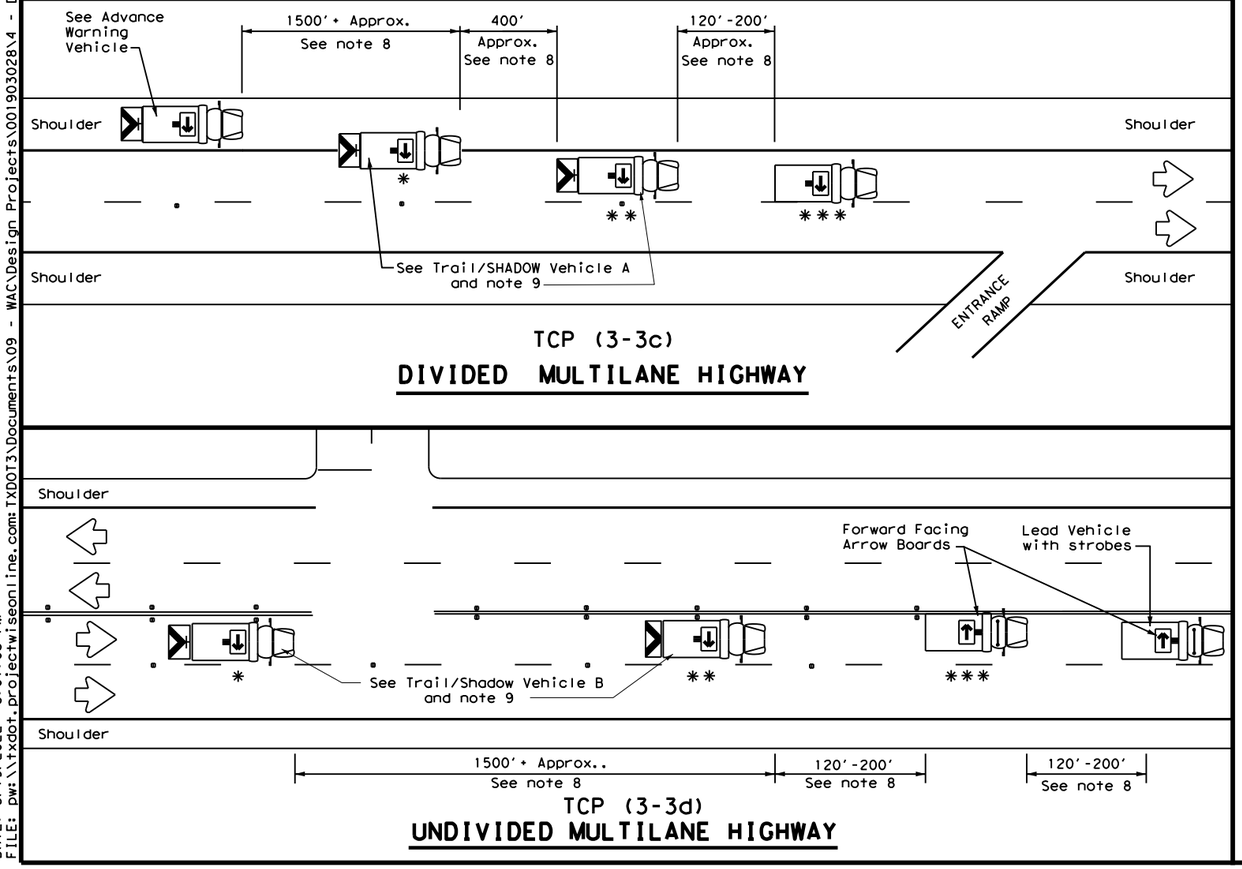
TCP (3-3a)

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



TCP (3-3b)

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

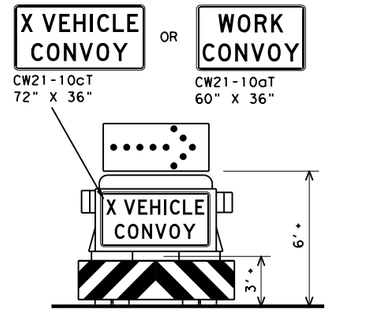


TCP (3-3c)

DIVIDED MULTILANE HIGHWAY

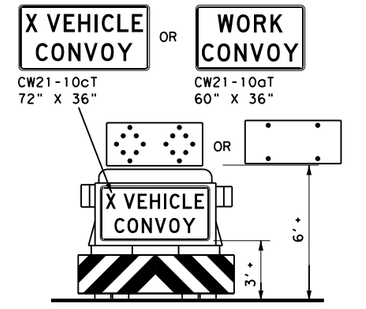
TCP (3-3d)

UNDIVIDED MULTILANE HIGHWAY



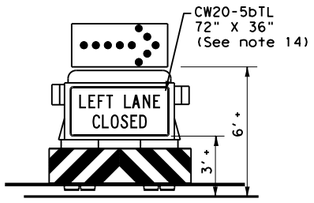
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display
Flashing Arrow Board

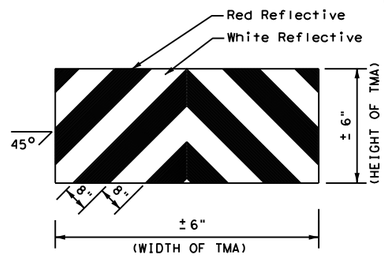


TRAIL/SHADOW VEHICLE B

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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8-95 7-13	WAC	HILL		45
1-97 7-14				

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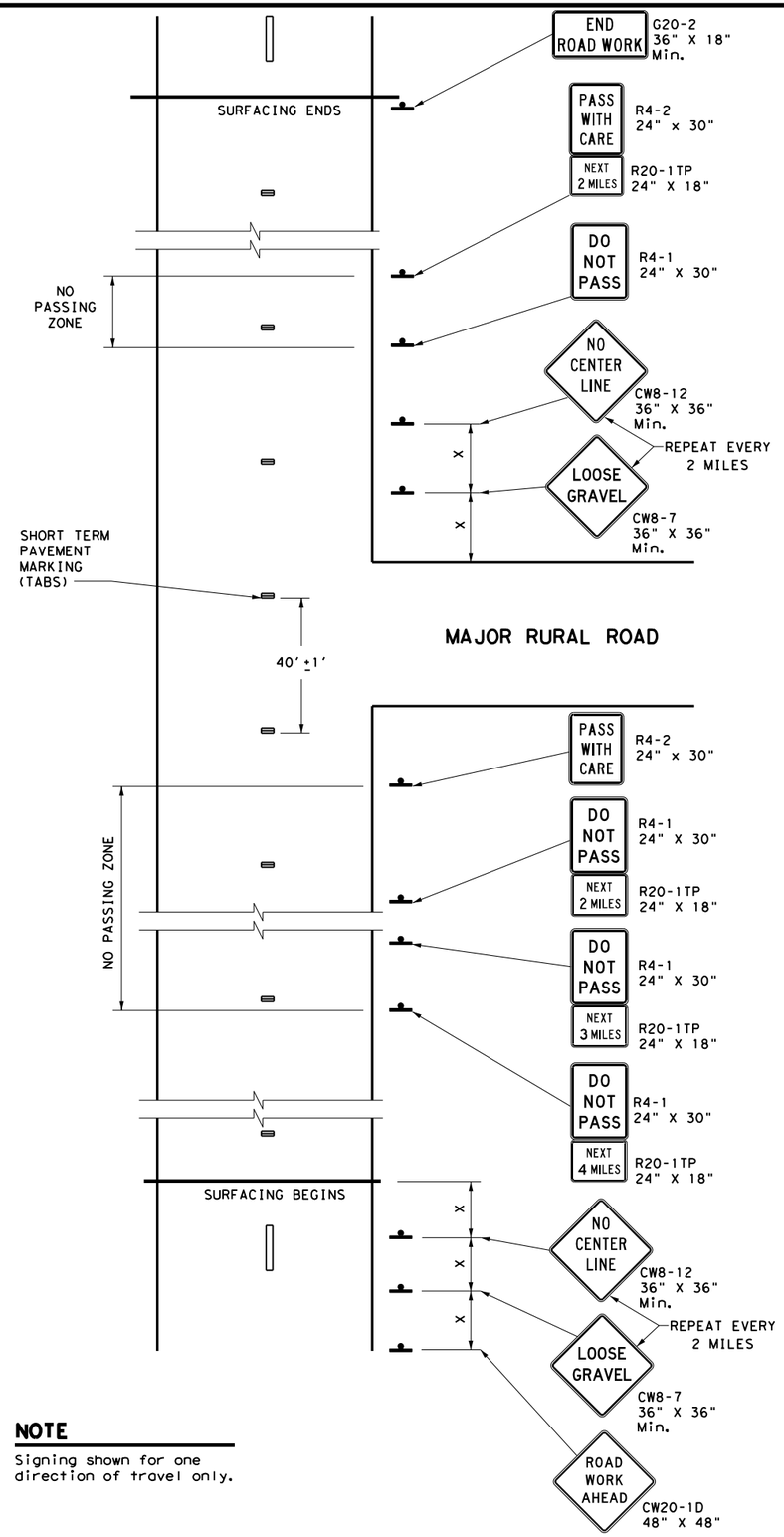
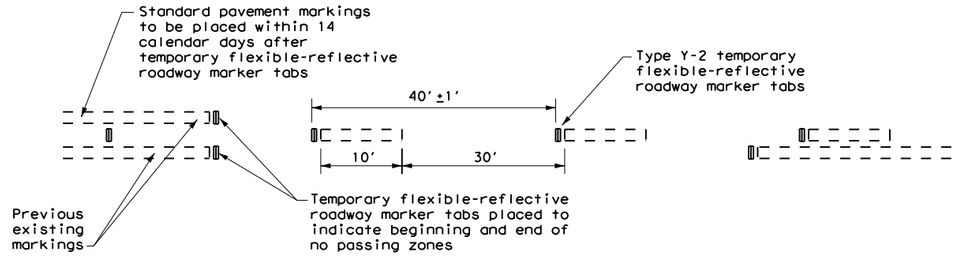


NOTE

Signing shown for one direction of travel only.

NO PASSING ZONES ON TWO-LANE TWO-WAY ROADS



TABS ON CENTERLINES OF TWO-LANE TWO-WAY ROADS

For seal coat, micro-surface or similar operations

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

A. Prior to the beginning of construction, all currently striped no-passing zones shall be signed with the DO NOT PASS (R4-1) signs and PASS WITH CARE (R4-2) signs placed at the beginning and end of each zone for each direction of travel except as otherwise provided herein. Signs marking these individual no-passing zones need not be covered prior to construction if the signs supplement the existing pavement markings.

B. At the discretion of the Engineer, in areas of numerous no-passing zones, several zones may be combined as a single zone. If passing is to be prohibited over one or more lengthy sections, a DO NOT PASS sign and a NEXT XX MILES (R20-1TP) plaque may be used at the beginning of such zones. The DO NOT PASS sign and the NEXT XX MILES plaque should be repeated every mile to the end of the no-passing zone. In areas where there is considerable distance between no-passing zones, the end of the no-passing zone may be signed with a PASS WITH CARE sign and a NEXT XX MILES plaque.

C. Depending on traffic volumes and length of sections, it may be desirable to prohibit passing throughout the project to prevent damage to windshield and lights. The DO NOT PASS sign and NEXT XX MILES plaque should be used and repeated as often as necessary for this purpose. Where several existing zones are to be combined into one individual no-passing zone, the sign at the beginning of the zone should be covered until the surfacing operation has passed this location so as not to have the DO NOT PASS sign conflict with the existing pavement markings. Also, unless one days operation completes the entire length of such combined zones, appropriate DO NOT PASS and PASS WITH CARE signs should be placed at the beginning and end of the no-passing zones where the surfacing operation has stopped for the day.

D. R4-1 and R4-2 are to remain in place until standard pavement markings are installed.

"NO CENTER LINE" SIGN (CW8-12)

A. Center line markings are yellow pavement markings that delineate the separation of travel lanes that have opposite directions of travel on a roadway. Divided highways do not typically have center line markings.

B. At the time construction activity obliterates the existing center line markings(low volume roads may not have an existing centerline), a NO CENTER LINE (CW8-12) sign should be erected at the beginning of the work area, at approximately 2 mile intervals within the work area, beyond major intersections and other locations deemed necessary by the Engineer.

C. The NO CENTER LINE signs are to remain in place until standard pavement markings are installed.

"LOOSE GRAVEL" SIGN (CW8-7)

A. When construction begins, a LOOSE GRAVEL (CW8-7) sign should be erected at each end of the work area and repeated at intervals of approximately 2 miles in rural areas and closer in urban areas.

B. The LOOSE GRAVEL signs are to remain in place until the condition no longer exists.

PAVEMENT MARKINGS

A. Temporary markings for surfacing projects shall be Temporary Flexible-reflective Roadway Marker Tabs unless otherwise approved by the Engineer. Tabs are to be installed to provide true alignment for striping crews or as directed by the Engineer. Tabs will be placed at the spacing indicated. Tabs should be applied to the pavement
no more than two (2) days before the surfacing is applied. After the surfacing is rolled and swept, the cover over the reflective strip shall be removed.

B. Tabs shall not be used to simulate edge lines.

C. Tab placement for overlay/inlay operations shall be as shown on the WZ(STPM) standard sheet.

COORDINATION OF SIGN LOCATIONS

A. The location of warning signs at the beginning and end of a work area are to be coordinated with other signing typically shown on the Barricade and Construction Standards for project limits to ensure adequate sign spacing.

B. Where possible the ROAD WORK AHEAD (CW20-1D), LOOSE GRAVEL (CW8-7), and NO CENTER LINE (CW8-12) signs should be placed in the sequence shown following the OBEY WARNING SIGNS STATE LAW (R20-3T) and the TRAFFIC FINES DOUBLE (R20-5T) sign, and one "X" sign spacing prior to the CONTRACTOR (G20-6T)sign typically located at or near the limits of surfacing. LOOSE GRAVEL and NO CENTER LINE signs will then be repeated as described above.

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

* Conventional Roads Only

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL DETAILS FOR SURFACING OPERATIONS

TCP(7-1)-13

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© TxDOT March 1991	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-92 4-98 1-97 7-13	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
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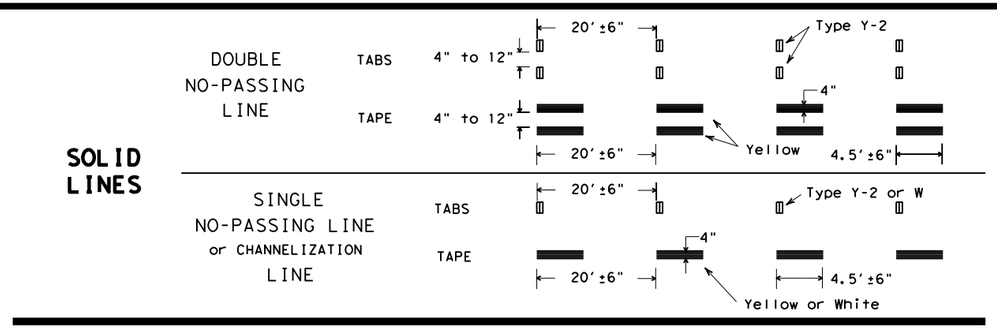
WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



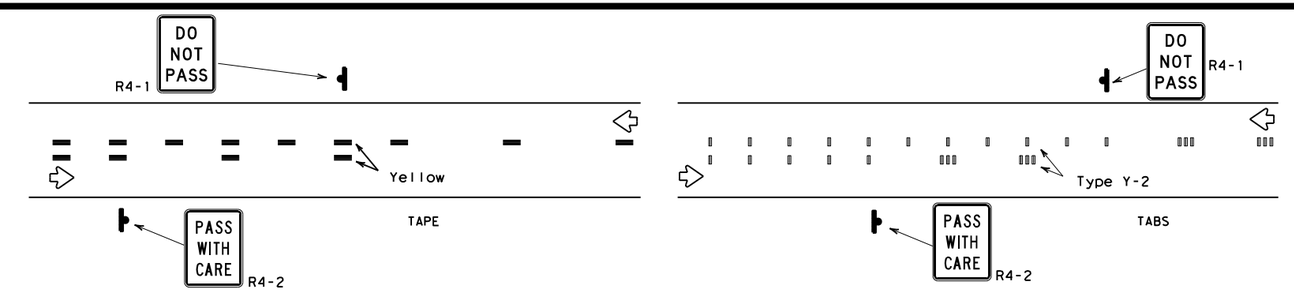
NOTES:

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

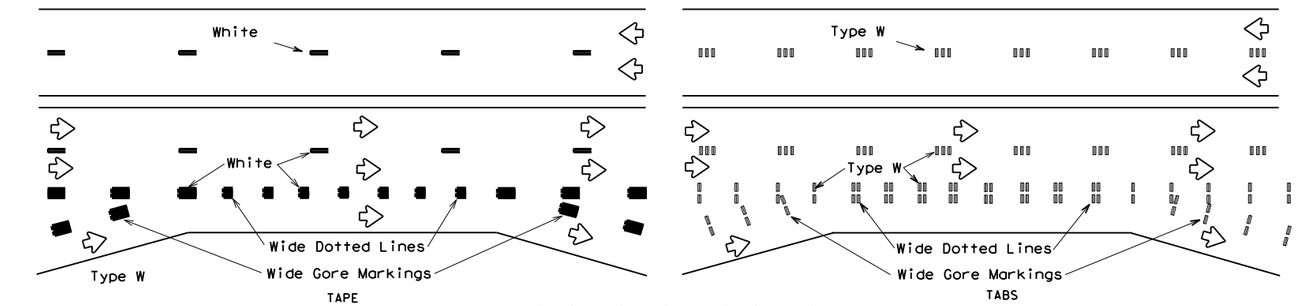
TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

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

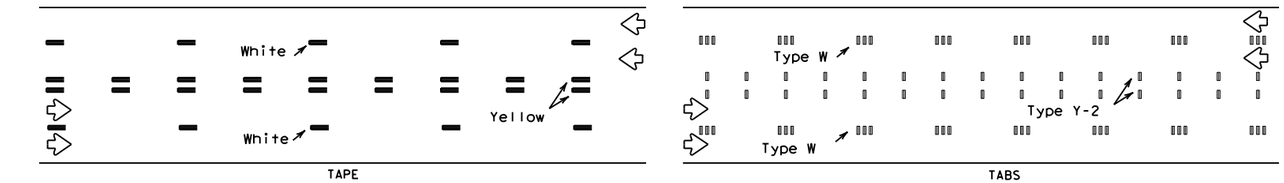
WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



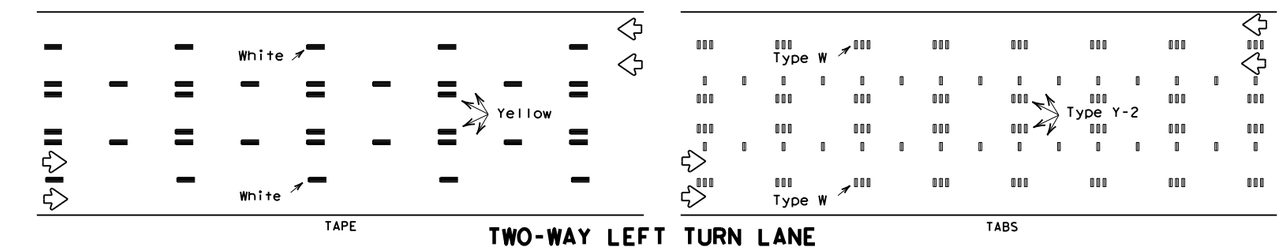
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



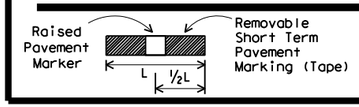
LANE LINES FOR DIVIDED HIGHWAY



LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



TWO-WAY LEFT TURN LANE



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

PREFABRICATED PAVEMENT MARKINGS

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

RAISED PAVEMENT MARKERS

1. All raised pavement markers used for work zone markings shall meet the requirements of Item 672, "RAISED PAVEMENT MARKERS" and DMS-4200.

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

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

Texas Department of Transportation

Traffic Operations Division Standard

WORK ZONE SHORT TERM PAVEMENT MARKINGS

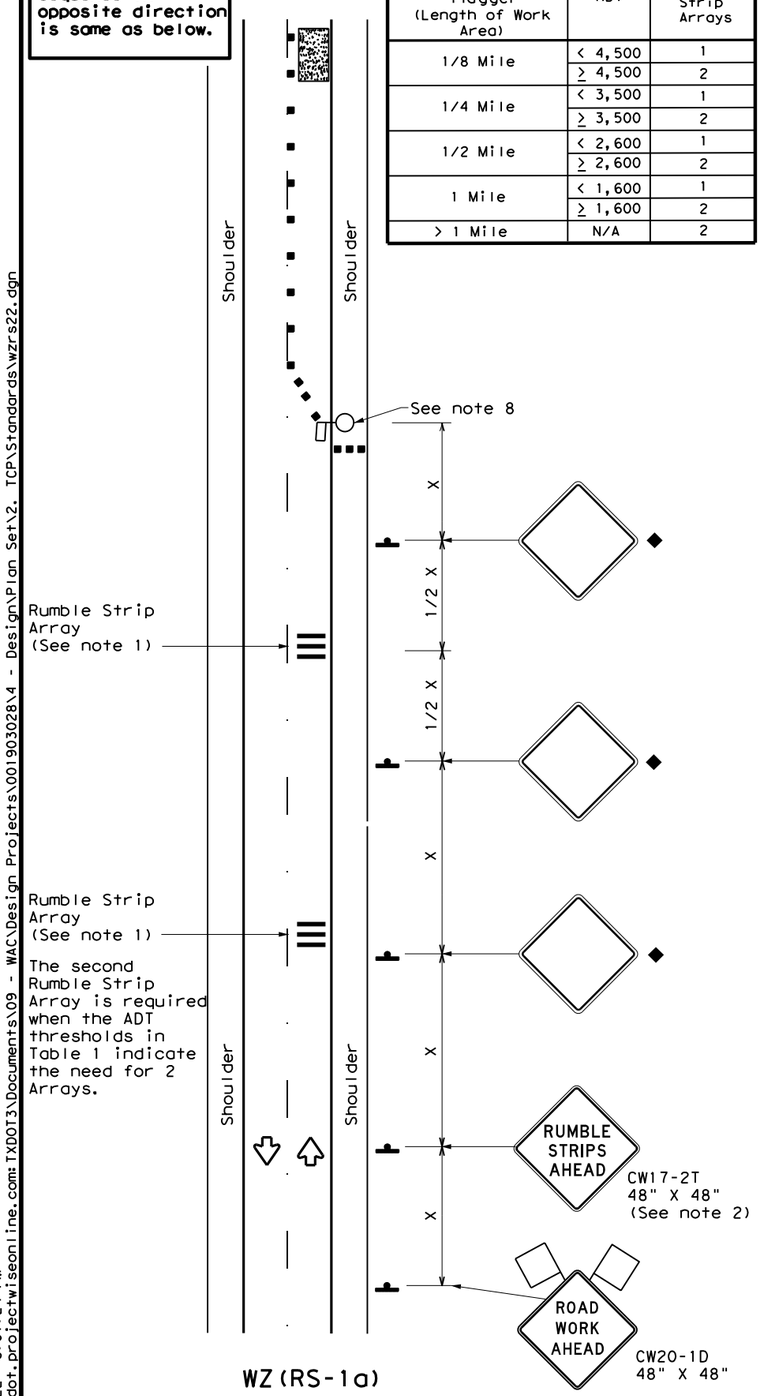
WZ(STPM)-13

FILE:	wzstpm-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT	April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS		0019	03	028 Etc.	SH 171
1-97		DIST	COUNTY		SHEET NO.
3-03		WAC	HILL		47
7-13					

DATE: 5/19/2022 6:01:24 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\001903028\4 - Design\Plan Set\2. TCP\Standards\wzrs22.dgn

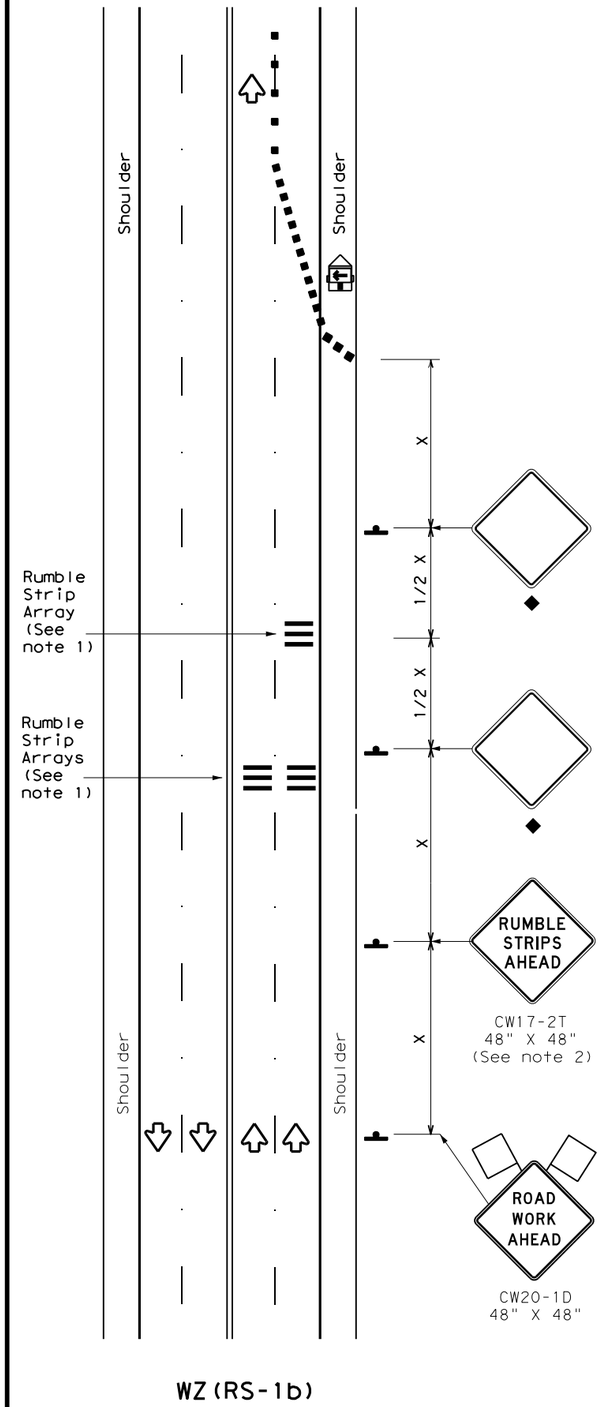
Warning sign and rumble strip sequence in opposite direction is same as below.

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

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REVISIONS 2-14 1-22 4-16	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		48

117

DATE: 5/19/2022
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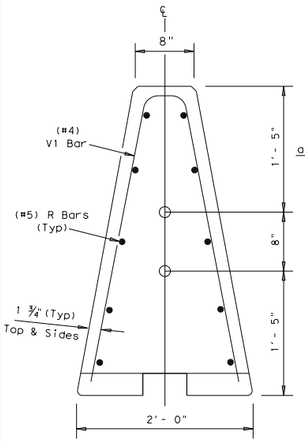
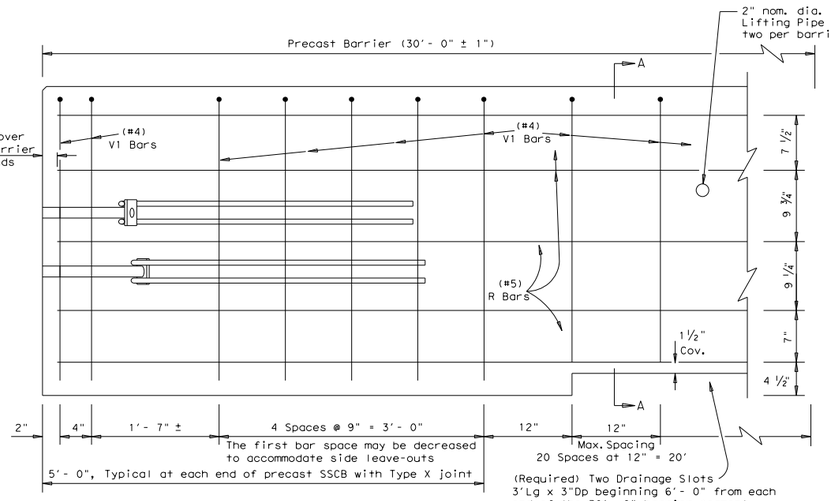


End View
Precast Barrier

Pipe locations for Joint
Type X connection

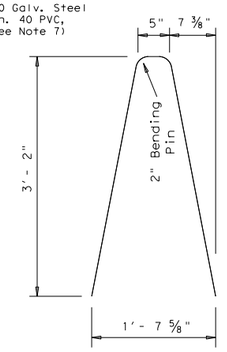


The first bar space may be decreased to accommodate side leave-outs

(Required) Two Drainage Slots 3"Lg x 3"Dp beginning 6'- 0" from each end of the 30'- 0" barrier segment.

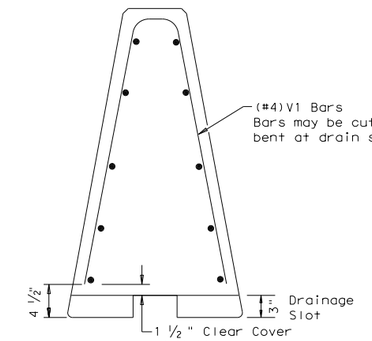
Reinforcement for Precast (SSCB)
Single Slope Concrete Barrier (Type 1)

Showing reinforcement for Joint Connection (Type X)



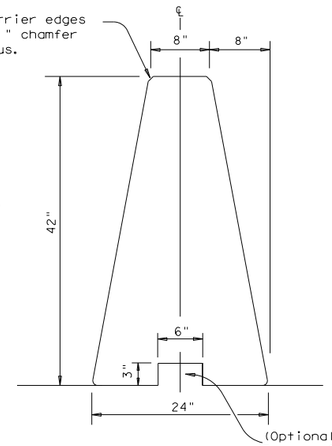
V1 Bar
#4 Rebar

Note:
V1 Bars above the drainage slots may bent to accomadate 1 ½" clear cover as directed by the Engineer.



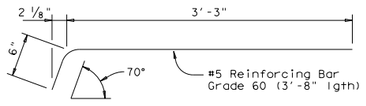
Section A-A
Steel Placement at
(Required) Drainage Slots

All precast barrier edges shall have a ¾" chamfer or tooled radius.



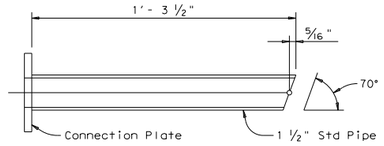
Single Slope Concrete Traffic Barrier

Precast SSCB barrier may be connected to cast-in-place SSBC. The joint connection "Types" may be used in the cast-in-place barrier, to match the precast barrier connection.



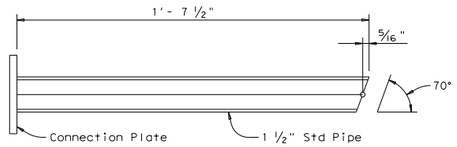
DEFORMED BAR ANCHOR DETAILS

Two (2) Bars required per assembly.
Eight (8) required per Joint.



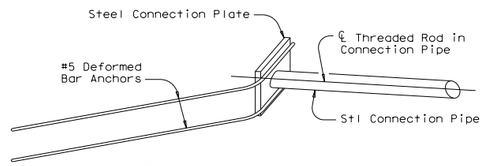
UPPER CONNECTION PIPE DETAILS

One (1) Steel Pipe required per Upper Assembly.
Two (2) required per Joint.



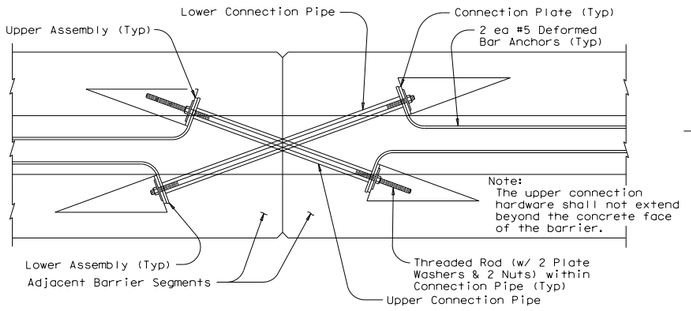
LOWER CONNECTION PIPE DETAILS

One (1) Steel Pipe required per Lower Assembly.
Two (2) required per Joint.



ISOMETRIC OF
TYPICAL WELDED ASSEMBLY

Four (4) [2 Upper & 2 Lower]
Assemblies required per Joint.



TYPE X JOINT INSTALLATION DETAIL

Barrier reinforcing and Type X Joint Leave-Out
dimensions not shown for clarity.

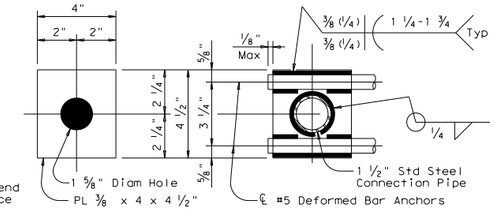
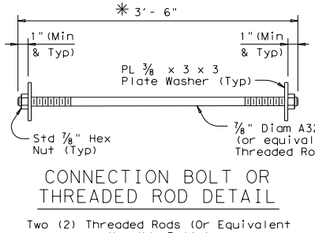


PLATE DIMENSIONS WELDING DETAILS

CONNECTION PLATE DETAILS

One (1) Plate required per assembly.
Four (4) required per Joint. All steel fittings for joint Type X shall be galvanized after fabrication in accordance with Item 445.



✳ The connection hardware shall not extend beyond the concrete face of the barrier. Hex head bolts may be provided. The proper length of all hardware should be verified.

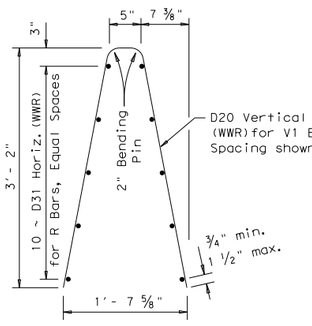
CONNECTION BOLT OR
THREADED ROD DETAIL

Two (2) Threaded Rods (Or Equivalent Hex Hd. Bolts)
(w/ Two (2) PL ⅜ x 3 x 3
Plate Washers & Two (2) Std Hex Nuts)
required per Joint.

Weight of one precast 30 ft.
(SSCB) segment = Approx. 10.5 Tons
or 717 lbs per ft.

General Notes

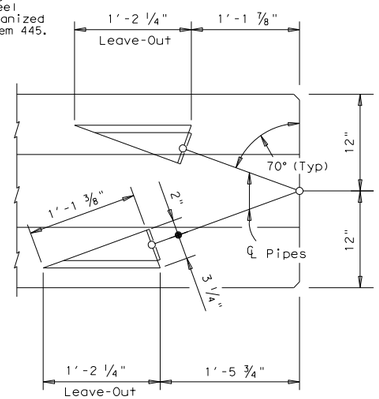
1. Concrete shall be Class H with a minimum compressive strength of 3,600 psi.
2. Where used, rebar reinforcement shall be Grade 60 and conform to ASTM A615.
3. Precast barrier length shall be 30 ft. unless otherwise specified on the plans.
4. All precast barrier edges shall have a ¾" chamfer or a tooled radius.
5. All concrete, reinforcement, joint connection systems, grout etc. as shown, are considered as part of the barrier payment.
6. Conduit trough when required shall be shown elsewhere on the plans, or as directed by the Engineer.
7. Regardless of the method of handling, barrier lifting points shall be approx. 7.5 feet from the ends of the barrier. Lifting devices and attachments to barrier sections shall be approved by the Engineer.
8. Surface finishing and grouting (where required) shall be two parts sand one part cement with enough water to make the mixture plastic. Grouting shall be done in a manner that will assure a smooth surface. Surface finishing shall be considered subsidiary to the various bid items.
9. All steel assemblies shall be galvanized after fabrication in accordance with Item 445, "Galvanizing."



Welded Wire Reinforcement (WWR) Option for Bars R and V1

(WWR) General Notes

1. Deformed Welded Wire Reinforcement (WWR) shall conform to ASTM A497.
2. Welded wire cage may be cut or bent to accommodate the Type X joint connection and drainage slots, as directed by the Engineer.
3. All reinforcement shall comply with Item 440, "Reinforcing Steel."
4. Combinations of reinforcing steel and WWR will be permitted, as directed by the Engineer. The dimension from the end of the barrier section to the first wire shall not exceed 3".



BARRIER PLAN AT JOINT

SHEET 1 OF 2

Texas Department of Transportation

Design Division Standard

SINGLE SLOPE CONCRETE BARRIER

PRECAST BARRIER (TYPE 1)

SSCB(2)-10

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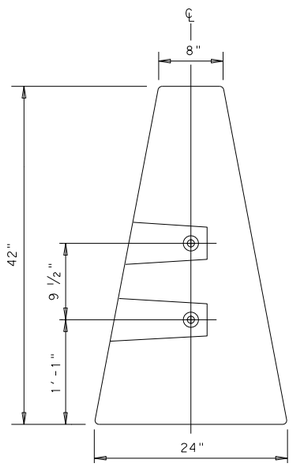
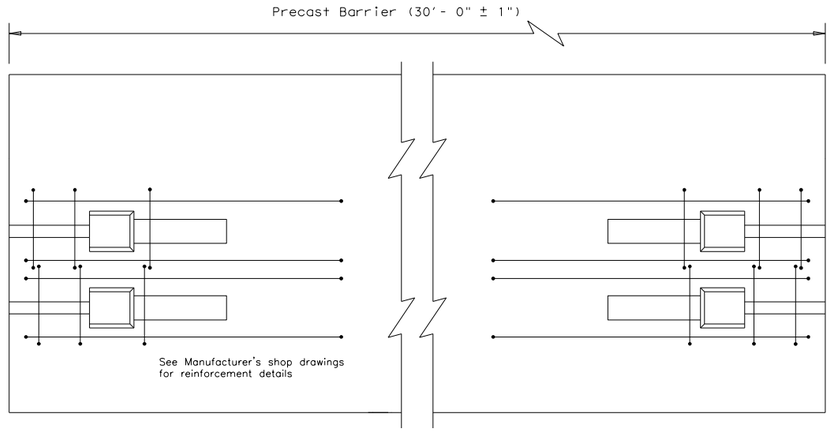
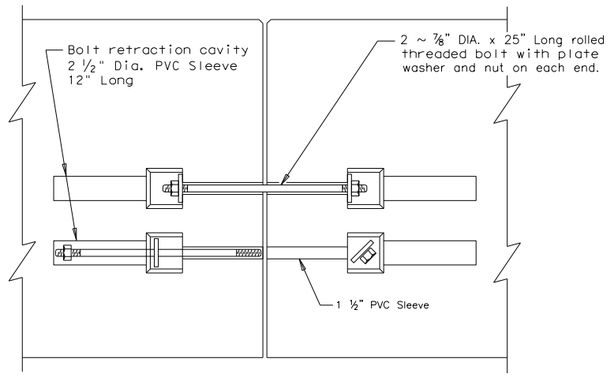


END VIEW
"QUICK-BOLT" POCKET LOCATIONS

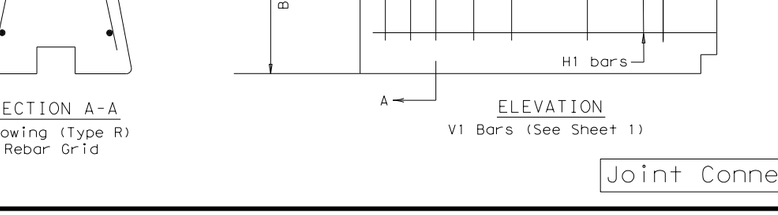


ELEVATION VIEW
"QUICK-BOLT" (SSCB)
See Manufacturer's shop drawing for additional details

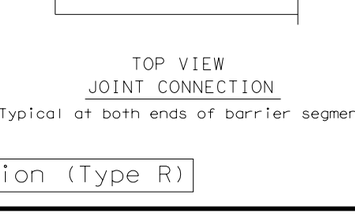


ELEVATION VIEW SHOWING JOINT CONNECTION
"QUICK-BOLT"

Joint Connection (Type Q)



TOP VIEW
PRECAST (SSCB) WITH J-J HOOKS
See Manufacturer's shop drawing for additional details



VIEW FROM ABOVE
J-J HOOK CONNECTION

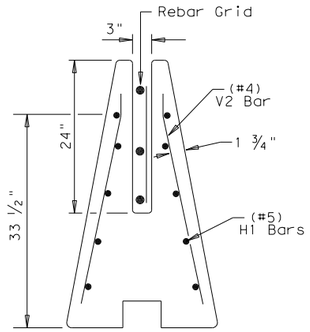
END VIEW

Proprietary Joint Connections (SSCB)

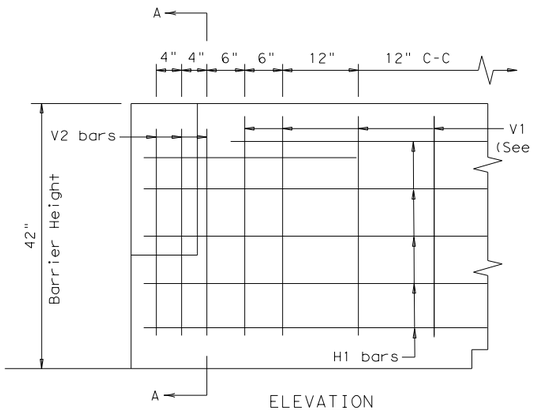
Two proprietary joint connections are acceptable as alternates to the (Type X) connection shown, here on. These joint connections types are:

J-J Hooks by Easi-Set Industries, (800)547-4045
Quick-Bolt by Bexar Concrete, (210)497-3773

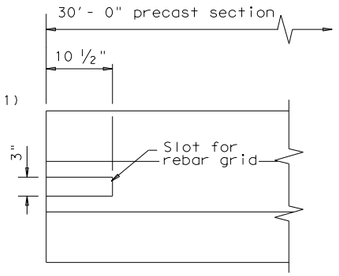
If one of these connection systems are exclusively specified in the plans, prior approval for sole source use must be obtained. Details of the connection components and barrier reinforcement for these systems, will be shown on the manufacturer's shop drawing(s) furnished to the Engineer.



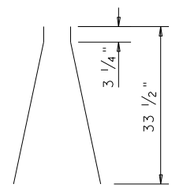
SECTION A-A
Showing (Type R) Rebar Grid



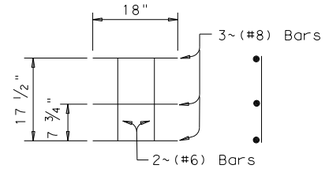
ELEVATION
V1 Bars (See Sheet 1)



TOP VIEW
JOINT CONNECTION
Typical at both ends of barrier segment



(#4) V2 BARS
6 ~ two piece bars per barrier segment



WELDED REBAR GRID

Joint Connection (Type R)

SHEET 2 OF 2

Texas Department of Transportation — Design Division Standard

SINGLE SLOPE CONCRETE BARRIER

PRECAST BARRIER (TYPE 1)

SSCB(2)-10

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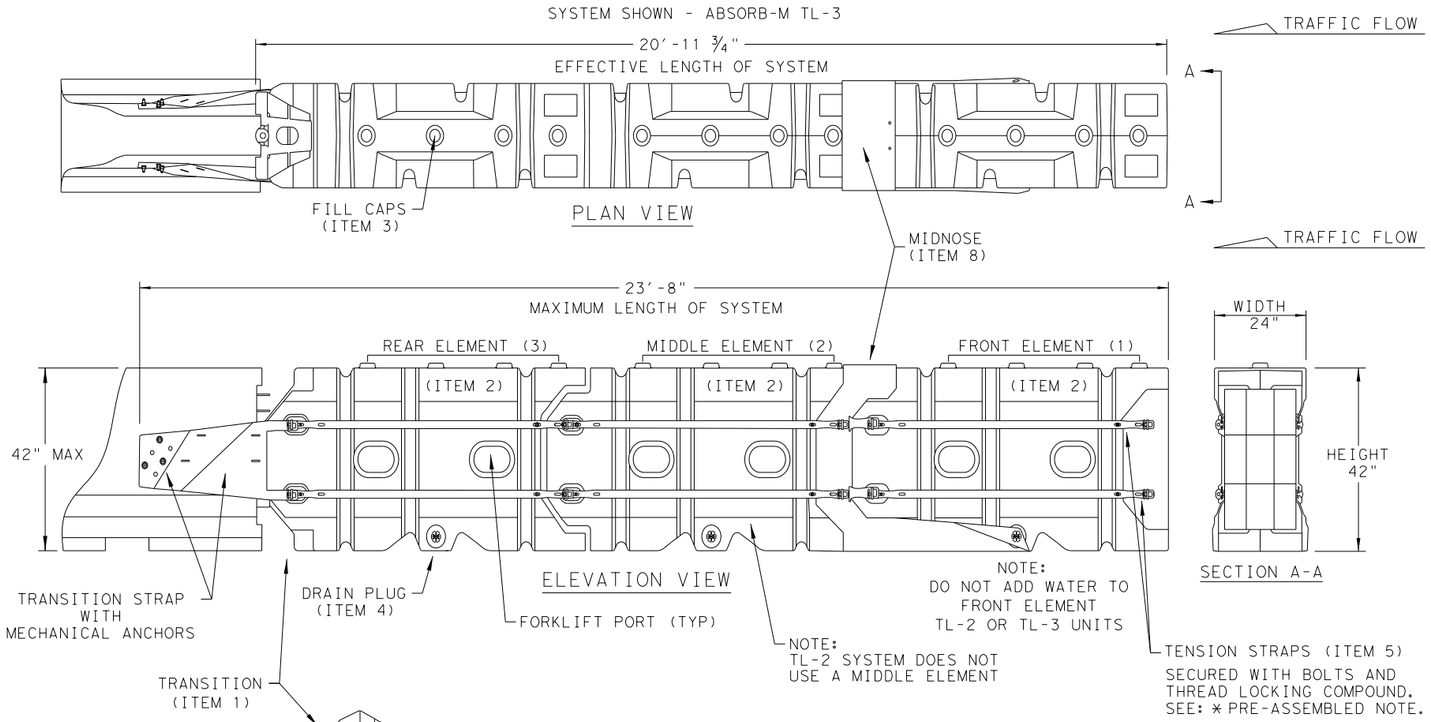
SYSTEM SHOWN - ABSORB-M TL-3



THE ABSORB-M IS A NON-REDIRECTIVE, GATING, CRASH CUSHION DESIGNED TO MEET THE LATEST TL-3 & TL-2 MASH REQUIREMENTS.

THE SYSTEM IS DESIGNED TO ACCOMMODATE A VARIETY OF F-SHAPE AND SINGLE SLOPE CONCRETE BARRIERS. CONTACT THE MANUFACTURER FOR GUIDANCE REGARDING OTHER ALLOWABLE SHAPES.

TEST LEVEL	NUMBER OF ELEMENTS	EFFECTIVE LENGTH	MAXIMUM LENGTH
TL-2	2	14'- 7 3/4"	17'- 4"
TL-3	3	20'- 11 3/4"	23'- 8"

NOTE:
CROSS SLOPES OF UP TO 8% (OR 1:12 SLOPE) CAN BE ACCOMMODATED WITH STANDARD HARDWARE SHOWN WITHIN THE INSTRUCTIONS MANUAL. FOR SLOPES WITH EXCESS OF 8% (OR 1:12) CONTACT, LINDSAY TRANSPORTATION SOLUTIONS.

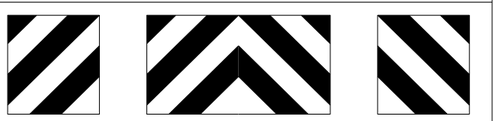
GENERAL NOTES

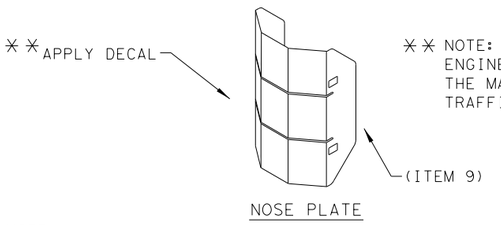
1. FOR SPECIFIC INFORMATION REGARDING THE INSTALLATION AND TECHNICAL GUIDANCE, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800. 180 RIVER ROAD, RIO VISTA, CA 94571
2. THE ABSORB-M SYSTEM IS ONLY APPROVED FOR USE IN (TEMPORARY WORK ZONE) LOCATIONS.
3. THE ABSORB-M IS A WATER FILLED NON-REDIRECTIVE, GATING CRASH CUSHION THAT DOES NOT NEED TO BE ATTACHED TO A FOUNDATION AND CAN BE INSTALLED ON TOP OF CONCRETE, ASPHALT, OR ANY SURFACE CAPABLE OF BEARING THE WEIGHT OF THE SYSTEM.
4. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
5. THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
6. THE ABSORB-M SHOULD BE LOCATED APPROXIMATELY PARALLEL WITH THE BARRIER.
7. THE USE OF THE ABSORB-M IS RESTRICTED TO A BARRIER HEIGHT OF UP TO 42 INCHES.
8. DO NOT ADD WATER TO FRONT ELEMENT (TL-2 OR TL-3 UNIT).

BILL OF MATERIALS (BOM) ABSORB-M TL-3 & TL-2 SYSTEMS			QTY	QTY
ITEM #	PART NUMBER	PART DESCRIPTION	TL-2 SYSTEM	TL-3 SYSTEM
1	BSI-1809036-00	TRANSITION-(GALV)	1	1
* 2	BSI-1808002-00	PRE-ASSEMBLED ABSORBING (ELEMENTS)	2	3
* 3	BSI-4004598	FILL CAPS	8	12
* 4	BSI-4004599	DRAIN PLUGS	2	3
* 5	BSI-1809053-00	TENSION STRAP-(GALV)	8	12
* 6	BSI-2001998	C-SCR FH 3/8-16 X 1 1/2 GR5 PLT	8	12
* 7	BSI-2001999	C-SCR FH 3/8-16 X 1 GR5 PLT	8	12
8	BSI-1809035-00	MIDNOSE-(GALV)	1	1
9	BSI-1808014-00	NOSE PLATE	1	1
10	BSI-1809037-00	TRANSITION STRAP (LEFT-HAND)-(GALV)	1	1
11	BSI-1809038-00	TRANSITION STRAP (RIGHT-HAND)-(GALV)	1	1
12	BSI-1808005-00	PIN ASSEMBLY	8	10
13	BSI-2002001	ANC MECH 5/8-11X5 (GALV)	6	6
14	ABSORB-M	INSTALLATION AND INSTRUCTIONS MANUAL	1	1

*COMPONENTS PRE-ASSEMBLED WITH ELEMENT ASSEMBLY

DELINEATION DECAL PLACEMENT GUIDE





** NOTE: (PROVIDED BY OTHERS)
ENGINEER OR CONTRACTOR SHALL COORDINATE WITH THE MANUFACTURER FOR THE CORRECT DECAL PER TRAFFIC FLOW, LEFT, RIGHT OR BOTH-SIDES.

NOTE:
APPLY A HIGH REFLECTIVE DECAL TO THE NOSE PLATE. DELINEATION DECAL ORIENTATION IS SHOWN ON THE CONSTRUCTION PLAN SET AND SHALL BE IN ACCORDANCE WITH THE TEXAS MUTCD FOR (TRAFFIC CONTROL DEVICES). DECALs ARE AVAILABLE FOR TRAFFIC FLOW ON THE LEFT-SIDE, BOTH -SIDES AND RIGHT-SIDE.

NOTE:
THIS STANDARD IS A BASIC REPRESENTATION OF THE ABSORB-M, IT IS NOT INTENDED TO REPLACE THE INSTALLATION INSTRUCTIONS MANUAL.

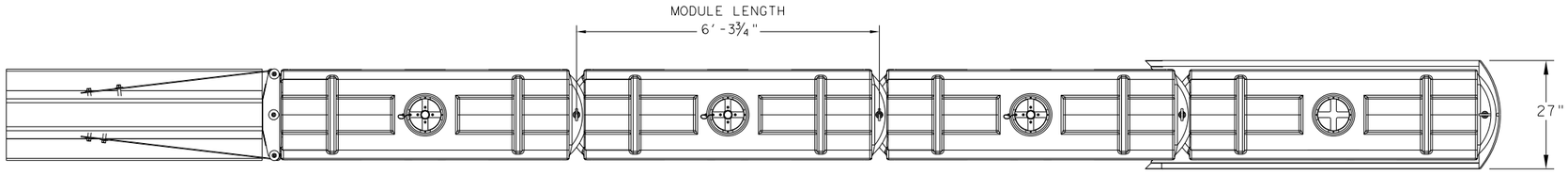
SACRIFICIAL

Texas Department of Transportation — Design Division Standard

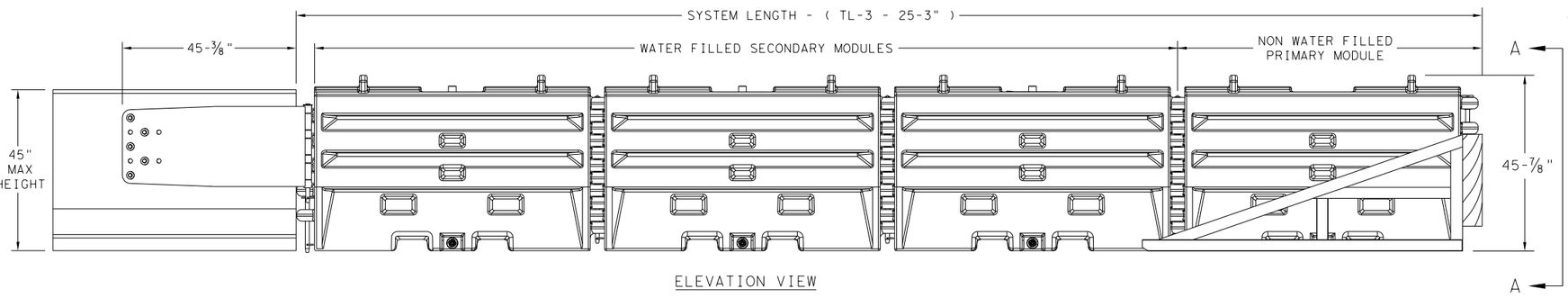
LINDSAY TRANSPORTATION SOLUTIONS
CRASH CUSHION
(MASH TL-3 & TL-2)
TEMPORARY - WORK ZONE
ABSORB(M)-19

FILE: absorbm19	DN: TxDOT	CK: KM	DW: VP	CK:
	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		51

DATE: 5/19/2022
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\001903028\4 - Design\Plan Set\2. TCP\Standards\sled19.dgn



PLAN VIEW



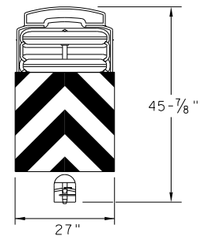
ELEVATION VIEW

GENERAL NOTES

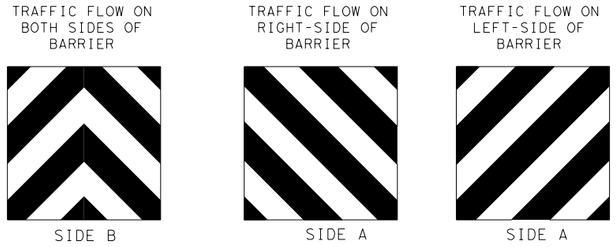
1. REFER TO THE INSTALLATION MANUAL FOR SPECIFIC SYSTEM ASSEMBLY AND MODULE ORIENTATION. FOR ADDITIONAL INFORMATION, CONTACT TRAFFIX, INC. AT (949) 361-5663.
2. THE SLED SYSTEM IS A MASH APPROVED TEST LEVEL 3 (TL-3) CRASH CUSHION APPROVED FOR USE IN TEMPORARY WORK ZONES. THE SLED SYSTEM IS A NON-REDIRECTIVE, GATING CRASH CUSHION THAT DOES NOT NEED TO BE ATTACHED TO THE GROUND AND CAN BE INSTALLED ON CONCRETE, ASPHALT, GRAVEL OR COMPACTED SOIL.
3. MAXIMUM PERMISSIBLE CROSS SLOPE IS 8° (DEGREES) (14%).
4. THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
5. THE SLED SYSTEM CAN BE ATTACHED TO:

- CONCRETE BARRIER, TEMPORARY OR PERMANENT, 45" MAXIMUM HEIGHT
- STEEL BARRIER
- PLASTIC BARRIER
- CONCRETE BRIDGE ABUTMENTS
- W-BEAM GUARD RAIL
- THRIE BEAM GUARD RAIL

TEST LEVEL	NUMBER OF SECONDARY MODULES	SYSTEM LENGTH
TL-3	3	25' 3"

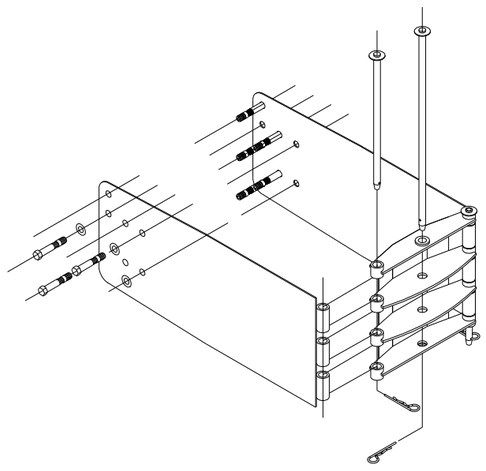


SECTION A-A



NOSE SHEETING PANEL DELINEATION

NOTE:
SEE INSTALLATION MANUAL FOR CUSTOMIZED DELINEATION NOSE SHEETING FOR DECAL PLACEMENT.



SLED TRANSITION COMPONENTS FOR ATTACHMENT TO CMB

NOTE:
SEE MANUFACTURER'S INSTALLATION MANUAL FOR FURTHER DETAILS.

TRANSITION OPTIONS
SLED TRANSITION TO CONCRETE TRAFFIC BARRIER (TEMPORARY OR PERMANENT)
SLED TRANSITION TO STEEL TRAFFIC BARRIER (CONTACT MFGR FOR PROPER TRANSITION)
SLED TRANSITION TO PLASTIC TRAFFIC BARRIER (CONTACT MFGR FOR PROPER TRANSITION)
SLED TRANSITION TO W-BEAM OR THRIE BEAM GUARD RAIL (CONTACT MFGR FOR PROPER TRANSITION)
SLED TRANSITION TO CONCRETE BRIDGE ABUTMENT

NOTE:
THIS STANDARD IS A BASIC REPRESENTATION OF THE SLED, IT IS NOT INTENDED TO REPLACE THE INSTALLATION INSTRUCTIONS MANUAL.

SACRIFICIAL

BILL OF MATERIAL

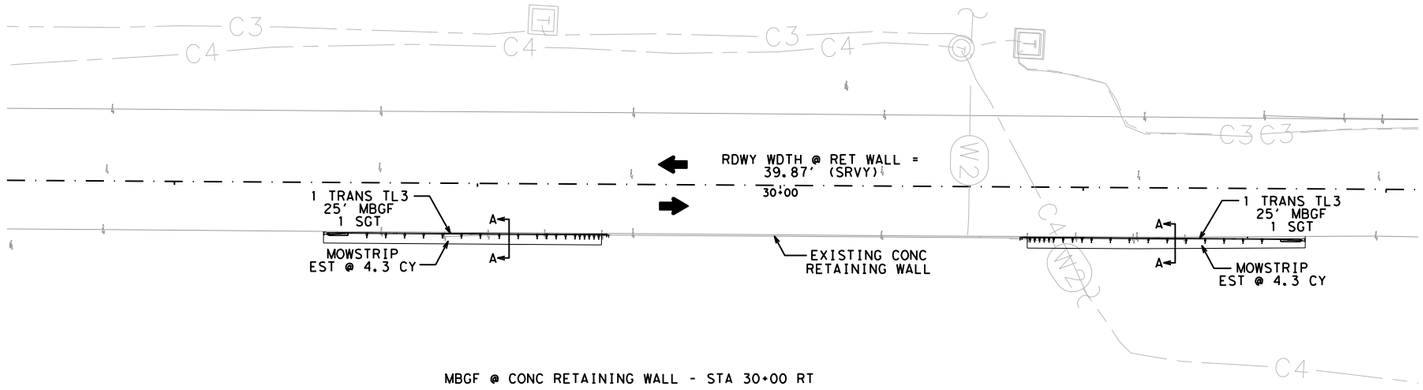
PART NUMBER	DESCRIPTION	QTY: TL-3
45131	TRANSITION FRAME, GALVANIZED	1
45150	TRANSITION PANEL, GALVANIZED	2
45147-CP	TRANSITION SHORT DROP PIN W/ KEEPER PIN, GALVANIZED	2
45148-CP	TRANSITION LONG DROP PIN W/ KEEPER PIN, GALVANIZED	1
45050	ANCHOR BOLTS	9
12060	WASHER, 3/4" ID X 2" OD	9
45044-Y	SLED YELLOW WATER FILLED MODULE	3
45044-YH	SLED YELLOW "NO FILL" MODULE	1
45044-S	CIS (CONTAINMENT IMPACT SLED), GALVANIZED	1
45043-CP	T-PIN W/ KEEPER PIN	4
18009-B-I	FILL CAP W/ "DRIVE BY" FLOAT INDICATOR	3
45033-RC-B	DRAIN PLUG	3
45032-DPT	DRAIN PLUG REMOVAL TOOL	1

Texas Department of Transportation — Design Division Standard

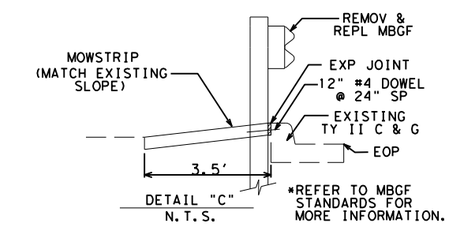
SLED
CRASH CUSHION
TL-3 MASH COMPLIANT
(TEMPORARY, WORK ZONE)
SLED-19

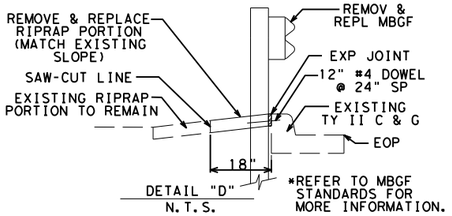
FILE: sled19.dgn	DN: TxDOT	CK: KM	DW: VP	CK:
©TxDOT: DECEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		52

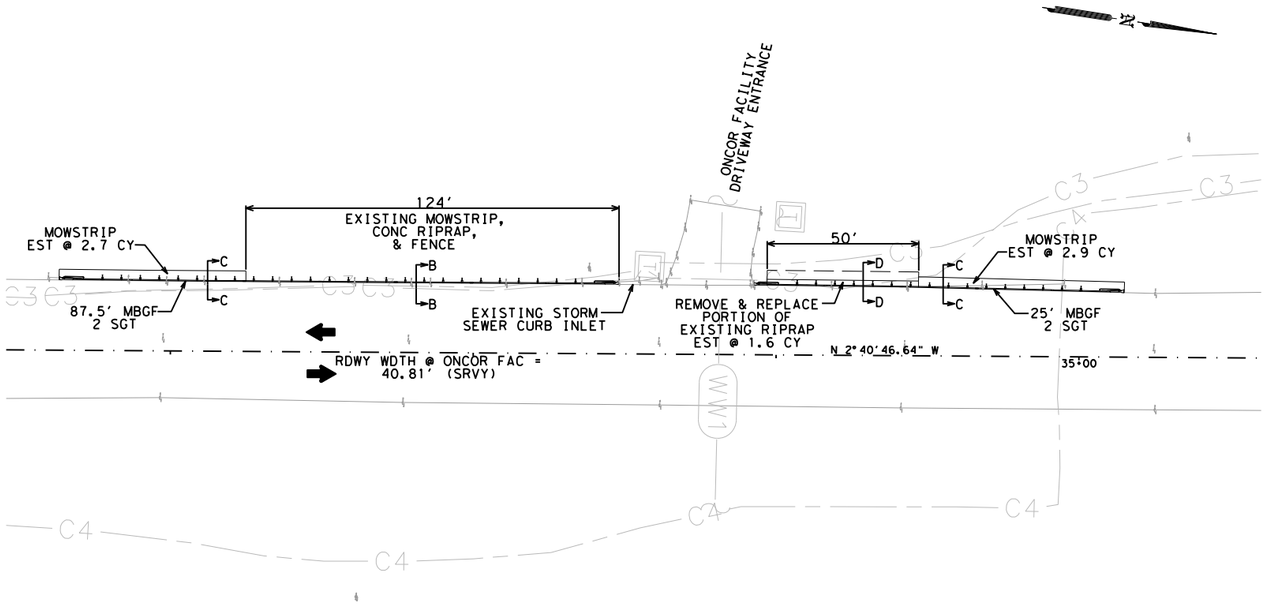
1. ALL MBGF WILL BE 31" UNLESS OTHERWISE NOTED. ALL 28" AND 31" MBGF IS PAID FOR UNDER ITEM 540-6002.



MBGF @ CONC RETAINING WALL - STA 30+00 RT

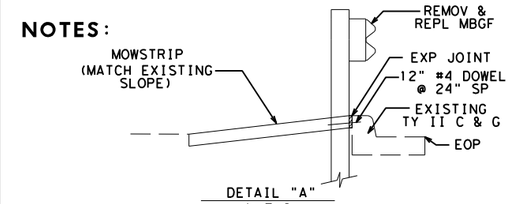


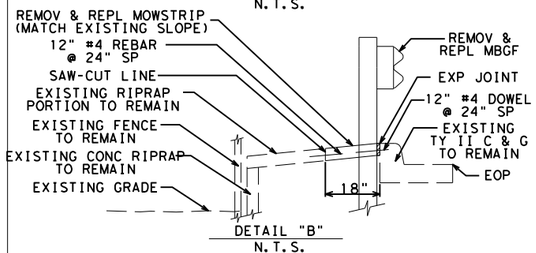




MBGF @ ONCOR FACILITY & ENTRANCE - STA 34+00 LT

NOTES:





ITEM	DESCRIPTION	UNIT	QTY
0104 6054	REMOVING CONCRETE (MOW STRIP)	LF	500
0132 6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	12
0432 6045	RIPRAP(MOW STRIP)(4 IN)	CY	10.8
0540 6002	MTL THRIE-BEAM GD FEN (STEEL POST)	LF	162.5
0540 6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	2
0542 6001	REMOVE METAL BEAM GUARD FENCE	LF	162.5
0542 6002	REMOVE TERMINAL ANCHOR SECTION	EA	1
0542 6004	RM MTL BM GD FENCE TRANS(THRIE-BEAM)	EA	2
0544 6001	GUARDRAIL END TREATMENT(INSTALL)	EA	6
0544 6003	GUARDRAIL END TREATMENT(REMOVE)	EA	6
0658 6062	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI)	EA	12

Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

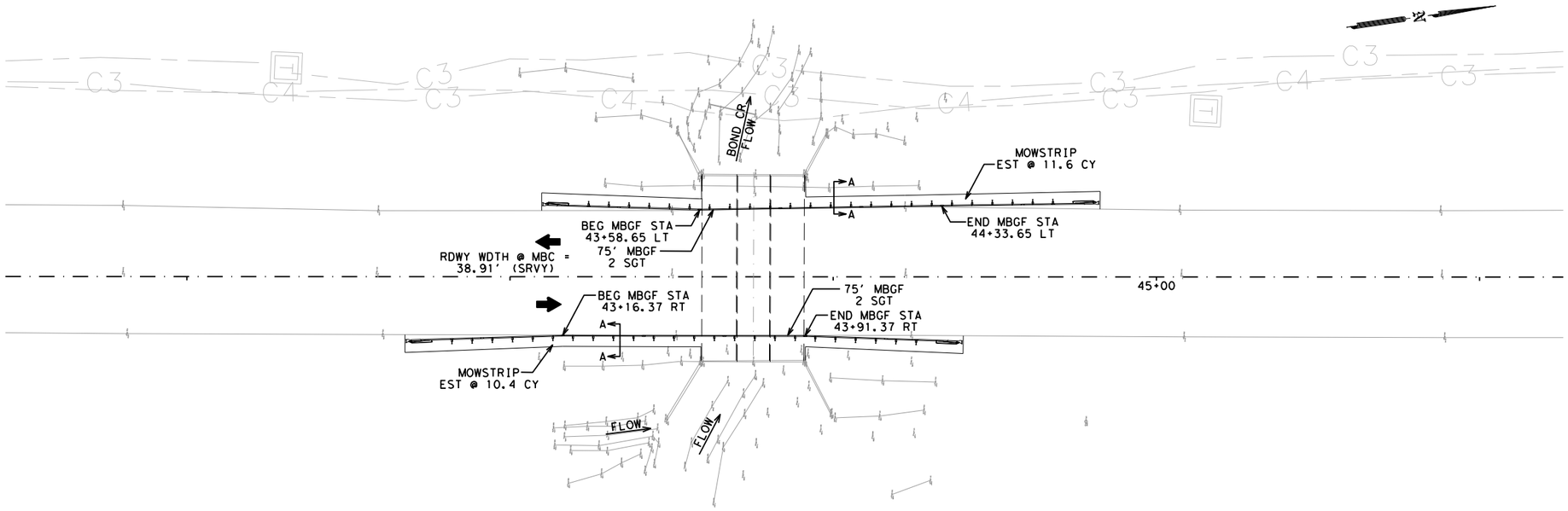
MBGF LAYOUTS

SCALE: FEET

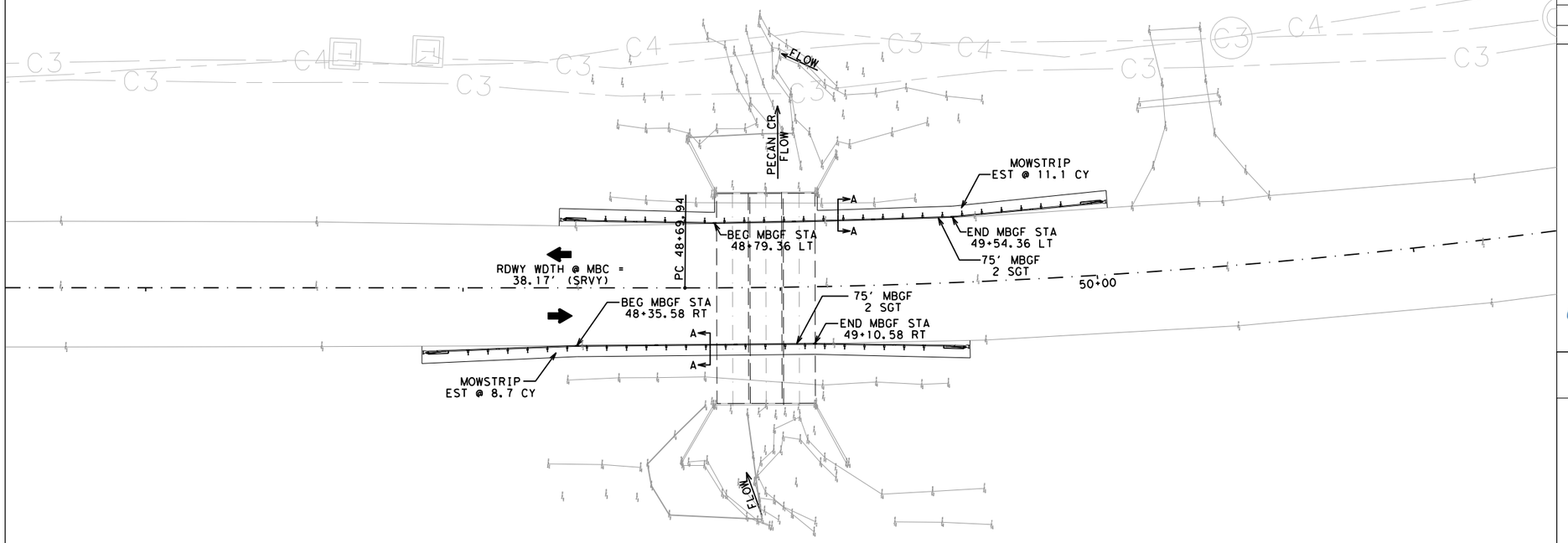
SCALE: 1" = 50'

SHEET 1 OF 6

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		53

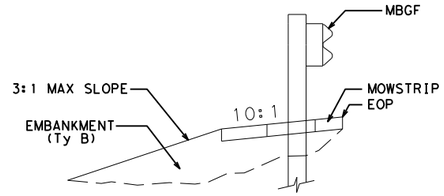


CULVERT 37 @ BOND CREEK: EXISTING 3 ~ 10'X10' MBC (BRIDGE CLASS); STA 43+75.37 (NBI: 091100041803042)



CULVERT 36 @ PECAN CREEK: EXISTING 3 ~ 10'X10' MBC (BRIDGE CLASS); STA 48+95.46 (NBI: 091100041803041)

NOTES:



DETAIL "A"
N.T.S.

1. ALL MBGF WILL BE 31" UNLESS OTHERWISE NOTED. ALL 28" AND 31" MBGF IS PAID FOR UNDER ITEM 540-6002.

ITEM	DESCRIPTION	UNIT	QTY
	CULVERT 37 @ BOND CR (STA 43+75.37):		
	CULVERT 36 @ PECAN CR (STA 48+95.46):		
0540 6002	MTL W-BEAM GD FEN (STEEL POST)	LF	175
0544 6001	GUARDRAIL END TREATMENT (INSTALL)	EA	8
0132 6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	102
0432 6045	RIPRAP (MOW STRIP)(4 IN)	CY	41.8
0658 6062	INSTL DEL ASSM(D-SW)SZ 1(BRF)GF2(BI)	LF	12
0540 6020	MTL W-BEAM GD FEN (LOW FILL CULVERT)	LF	125

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/19/2022

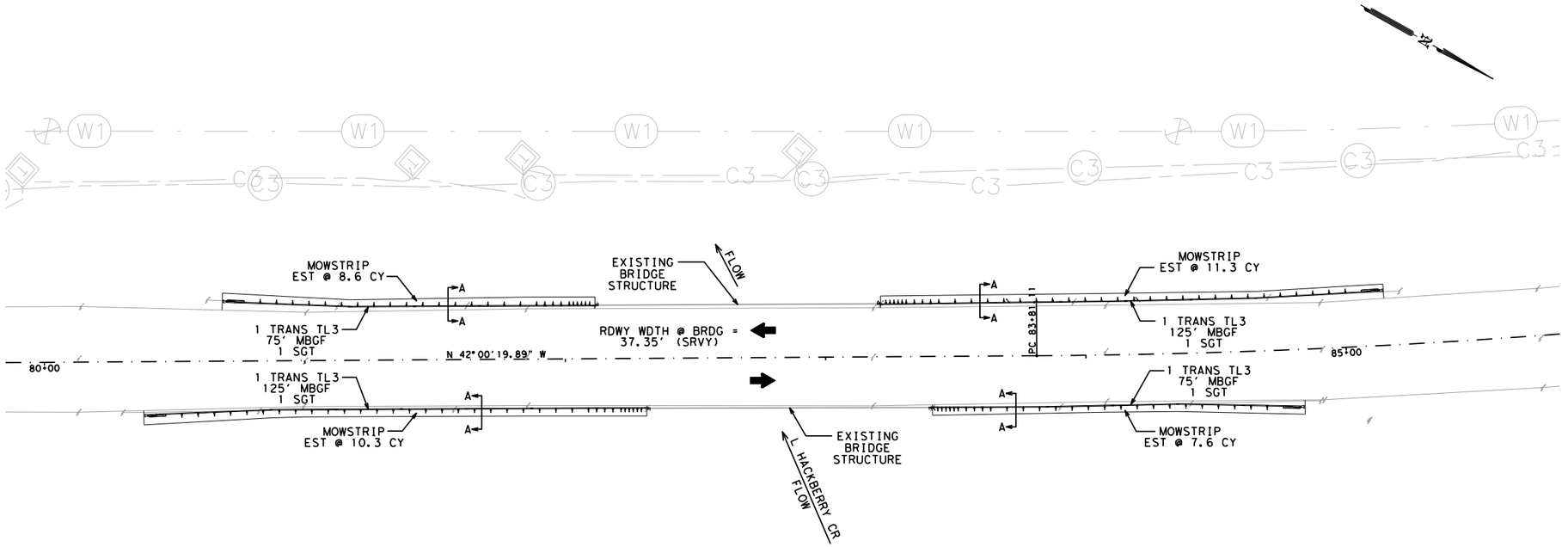
SIGNATURE OF REGISTRANT & DATE

MBGF LAYOUTS

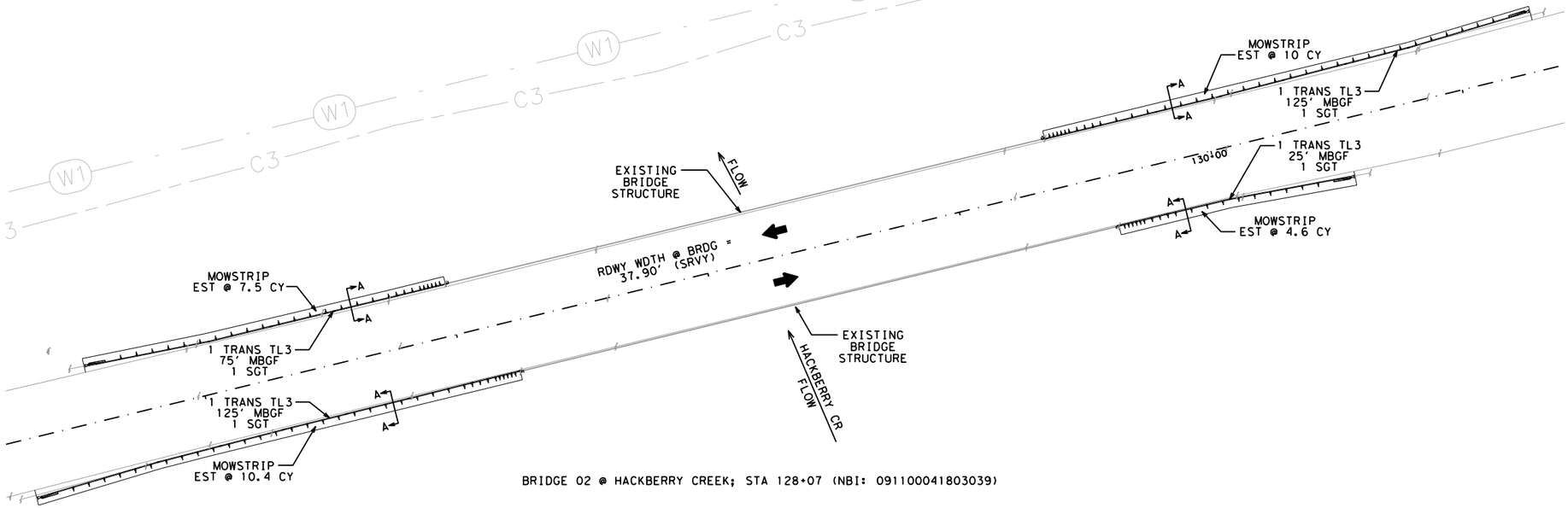
SCALE: FEET

SCALE: 1" = 40'

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		54

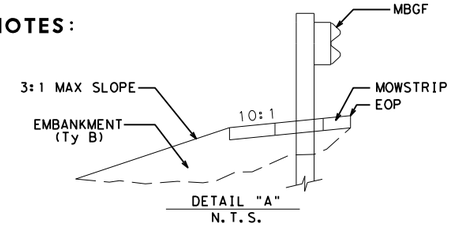


BRIDGE 03 @ LITTLE HACKBERRY CREEK; STA 82+86 (NBI: 091100041803040)



BRIDGE 02 @ HACKBERRY CREEK; STA 128+07 (NBI: 091100041803039)

NOTES:



1. ALL MBGF WILL BE 31" UNLESS OTHERWISE NOTED. ALL 28" AND 31" MBGF IS PAID FOR UNDER ITEM 540-6002.

ITEM	DESCRIPTION	UNIT	QTY
	(LOCATIONS COMBINED)		
0432 6045	RIPRAP (MOW STRIP) (4 IN)	CY	70.3
0512 6013	PORT CTB (DES SOURCE) (SGL SLP) (TY 1)	LF	0
0512 6025	PORT CTB (MOVE) (SGL SLP) (TY 1)	LF	0
0512 6037	PORT CTB (STKPL) (SGL SLP) (TY 1)	LF	0
0540 6002	MTL THRIE-BEAM GD FEN (STEEL POST)	LF	750
0540 6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	8
0542 6001	REMOVE METAL BEAM GUARD FENCE	LF	750
0542 6004	RM MTL BM GD FENCE TRANS (THRIE-BEAM)	EA	8
0544 6001	GUARDRAIL END TREATMENT (INSTALL)	EA	8
0544 6003	GUARDRAIL END TREATMENT (REMOVE)	EA	8
0545 6003	CRASH CUSH ATTEN (MOVE & RESET)	EA	0
0545 6004	CRASH CUSH ATTEN (STKPL)	EA	0
0545 6019	CRASH CUSH ATTEN (INSTL) (S) (N) (TL3)	EA	0
0658 6062	INSTL DEL ASSM (D-SW) SZ 1 (BRF) GF2 (BI)	EA	26

Chris J. Mashek, P.E. 5/19/2022

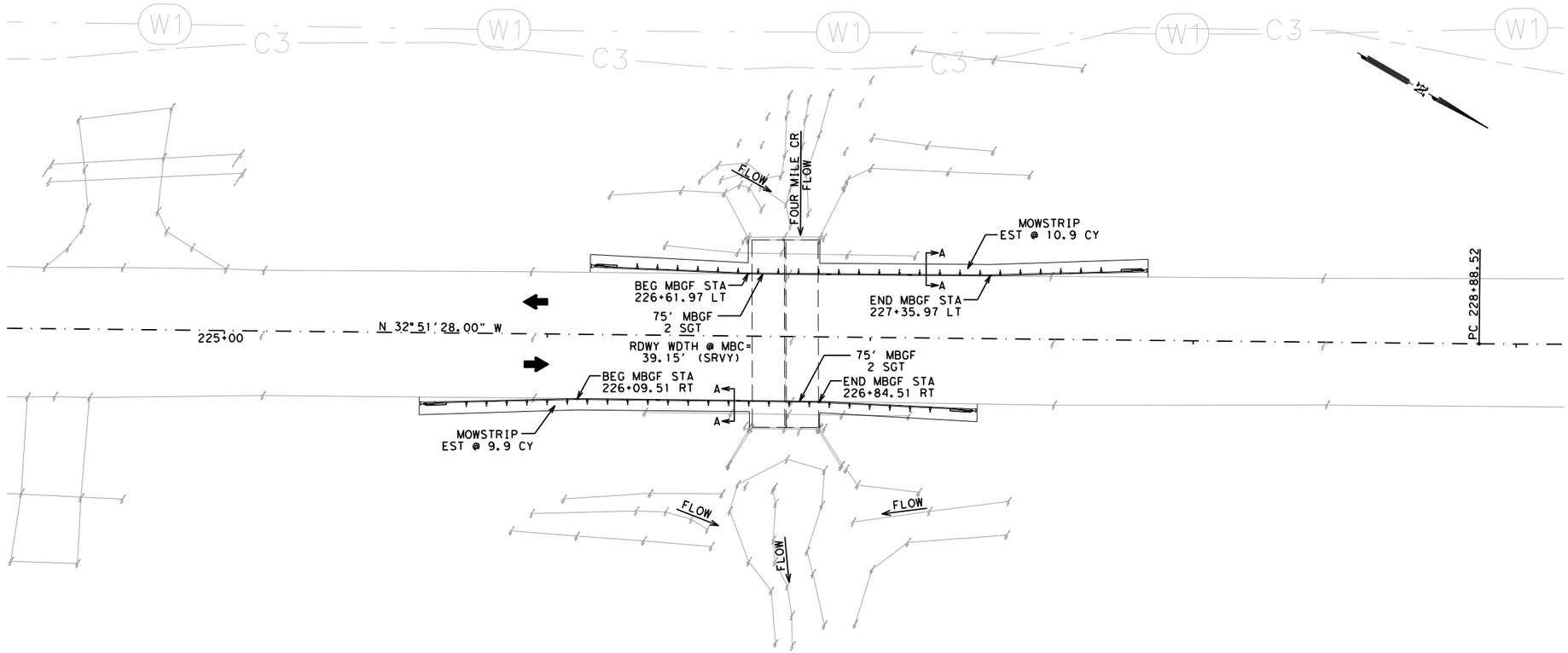
SIGNATURE OF REGISTRANT & DATE

MBGF LAYOUTS

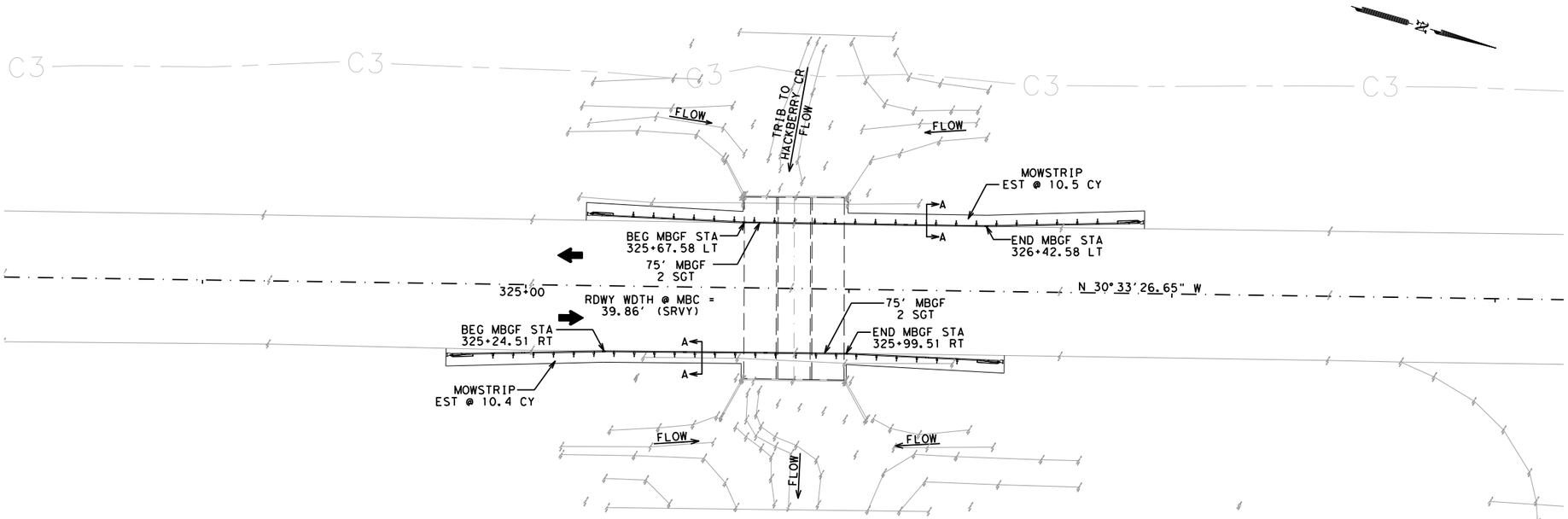
SCALE: FEET

SCALE: 1" = 50'

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		55

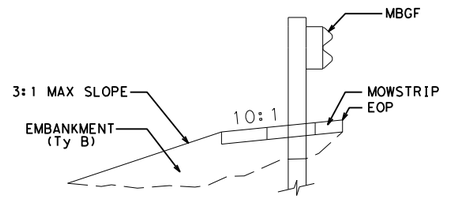


CULVERT 30 @ FOUR MILE CREEK: EXISTING 2 ~ 10' X 10' MBC (BRIDGE CLASS); STA 226+73.69 (NBI: 091100041803036)



CULVERT 27 @ TRIB. TO HACKBERRY CREEK: EXISTING 3 ~ 10' X 8' MBC (BRIDGE CLASS); STA 325+83.08 (NBI: 091100041803038)

NOTES:



DETAIL "A"
N.T.S.

1. ALL MBGF WILL BE 31" UNLESS OTHERWISE NOTED. ALL 28" AND 31" MBGF IS PAID FOR UNDER ITEM 540-6002.

ITEM	DESCRIPTION	UNIT	QTY
CULVERT 30 @ FOUR MILE CR (STA 226+73.69):			
CULVERT 36 @ TRIB TO HACKBERRY CR (STA 325+83.08):			
0540 6002	MTL W-BEAM GD FEN (STEEL POST)	LF	200
0544 6001	GUARDRAIL END TREATMENT (INSTALL)	EA	8
0132 6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	96
0432 6045	RIPRAP (MOW STRIP)(4 IN)	CY	41.7
0658 6062	INSTL DEL ASSM(D-SW)SZ 1(BRF)GF2(BI)	LF	12
0540 6020	MTL W-BEAM GD FEN (LOW FILL CULVERT)	LF	100

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

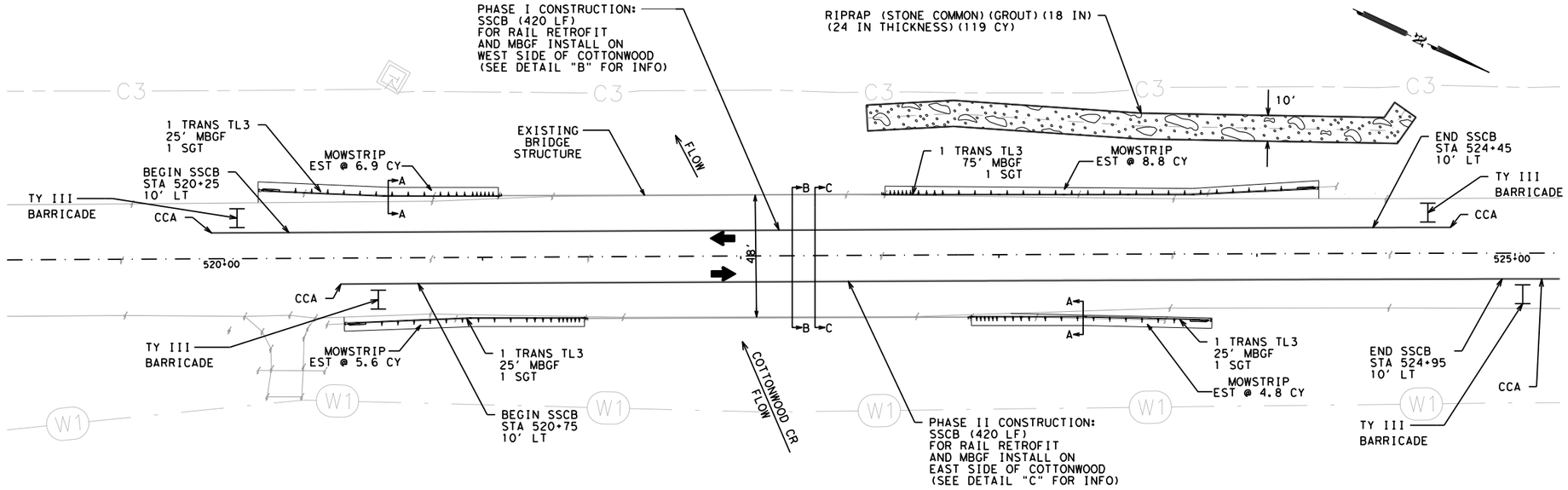
Chris J. Mashek, P.E. 5/19/2022
SIGNATURE OF REGISTRANT & DATE

MBGF LAYOUTS

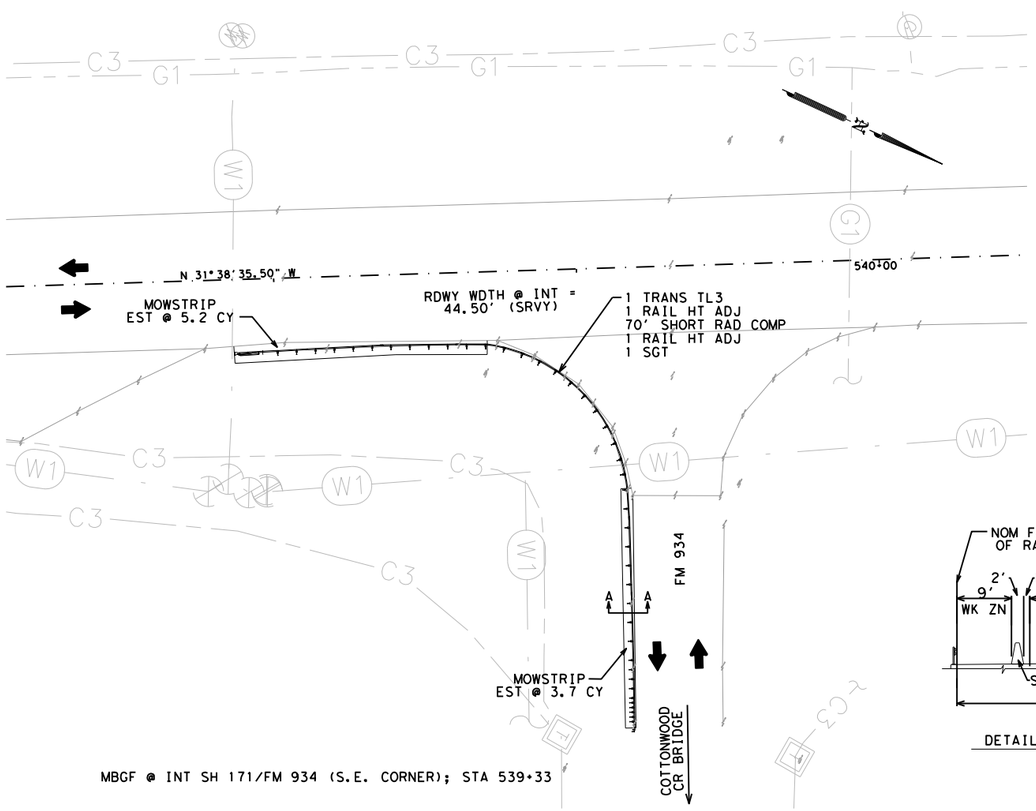
SCALE: FEET

SCALE: 1" = 40'

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		56



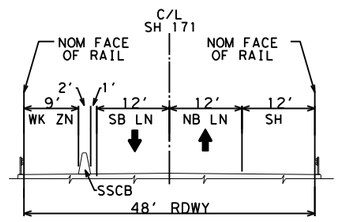
BRIDGE 01 @ COTTONWOOD CREEK; STA 522+26 (NBI: 091100041803037)



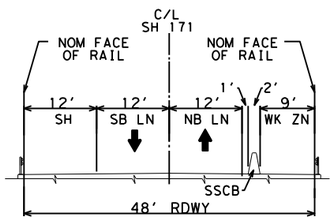
MBGF @ INT SH 171/FM 934 (S.E. CORNER); STA 539+33

*FOR MBGF @ INT SH 171 & FM 934:

ITEM	DESCRIPTION	UNIT	QTY
0432 6045	RIPRAP (MOW STRIP) (4 IN)	CY	8.9
0542 6001	REMOVE METAL BEAM GUARD FENCE	LF	120
0542 6004	RM MTL BM GD FENCE TRANS (THRIE-BEAM)	EA	1
0544 6003	GUARDRAIL END TREATMENT (REMOVE)	EA	1
0544 6001	GUARDRAIL END TREATMENT (INSTALL)	EA	1
0540 6035	MTL BM GD FEN TRANS (31"-28")	EA	2
0540 6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	1
0540 6014	SHORT RADIUS	LF	70
0658 6062	INSTL DEL ASSM (D-SW) SZ 1 (BRF) GF2 (BI)	EA	6

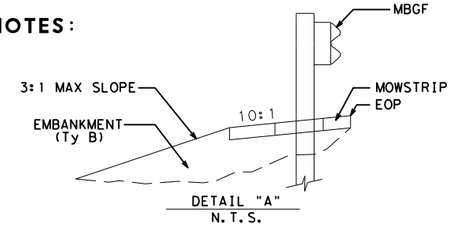


DETAIL "B" - PHASE I CONSTR
NTS



DETAIL "C" - PHASE II CONSTR
NTS

NOTES:



DETAIL "A"
N.T.S.

1. ALL MBGF WILL BE 31" UNLESS OTHERWISE NOTED. ALL 28" AND 31" MBGF IS PAID FOR UNDER ITEM 540-6002.

*FOR BRIDGE @ COTTONWOOD CREEK:

ITEM	DESCRIPTION	UNIT	QTY
0432 6051	RIPRAP (STONE COMMON) (GROUT) (18 IN)	CY	119
0432 6045	RIPRAP (MOW STRIP) (4 IN)	CY	26.1
0512 6013	PORT CTB (DES SOURCE) (SGL SLP) (TY 1)	LF	420
0512 6025	PORT CTB (MOVE) (SGL SLP) (TY 1)	LF	420
0512 6037	PORT CTB (STKPL) (SGL SLP) (TY 1)	LF	420
0540 6002	MTL THRIE-BEAM GD FEN (STEEL POST)	LF	150
0540 6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	4
0542 6001	REMOVE METAL BEAM GUARD FENCE	LF	125
0542 6004	RM MTL BM GD FENCE TRANS (THRIE-BEAM)	EA	4
0544 6001	GUARDRAIL END TREATMENT (INSTALL)	EA	4
0544 6003	GUARDRAIL END TREATMENT (REMOVE)	EA	4
0545 6003	CRASH CUSH ATTEN (MOVE & RESET)	EA	2
0545 6004	CRASH CUSH ATTEN (STKPL)	EA	2
0545 6019	CRASH CUSH ATTEN (INSTL) (S) (N) (TL3)	EA	2
0658 6062	INSTL DEL ASSM (D-SW) SZ 1 (BRF) GF2 (BI)	EA	10
0132 6003	EMBANKMENT (FINAL) (ORD COMP) (TY B)	CY	4

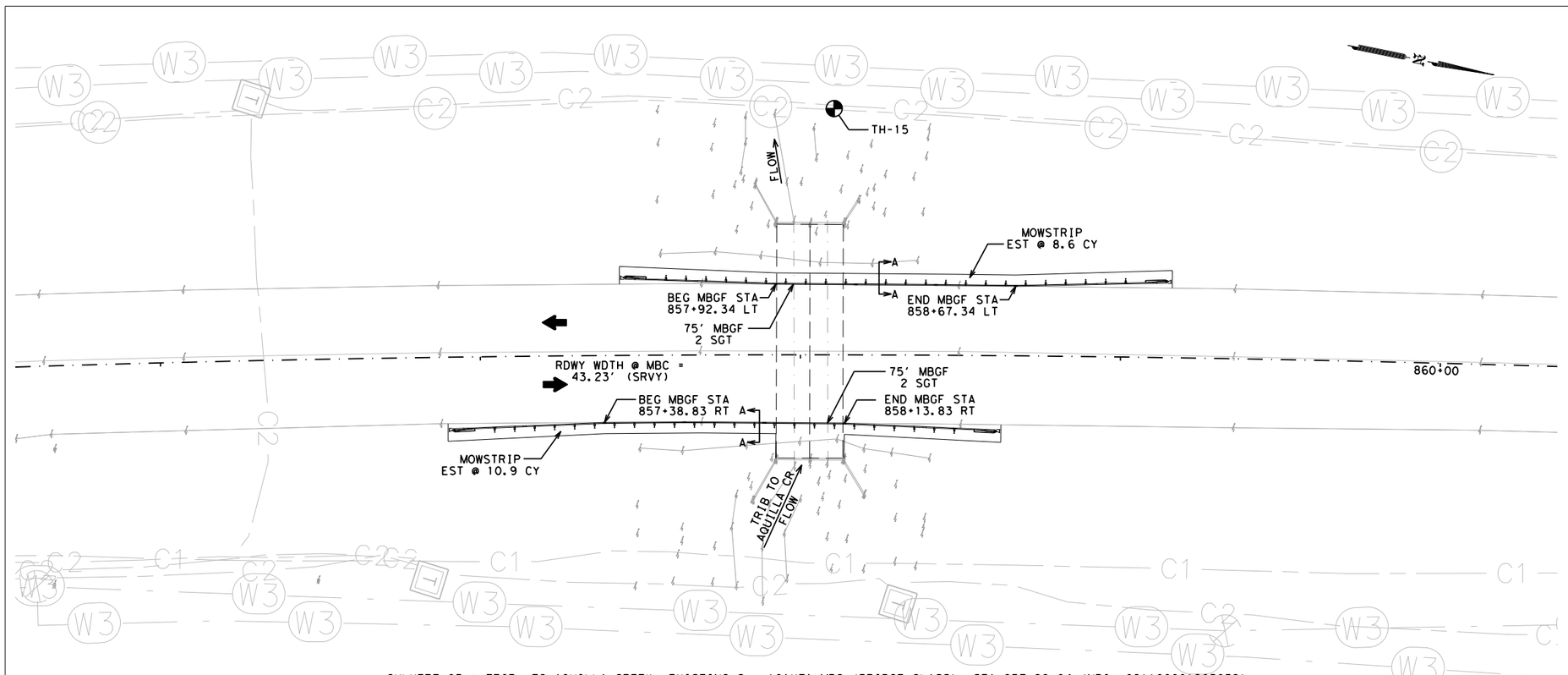
Chris J. Mashek, P.E. 6/1/2022

SIGNATURE OF REGISTRANT & DATE

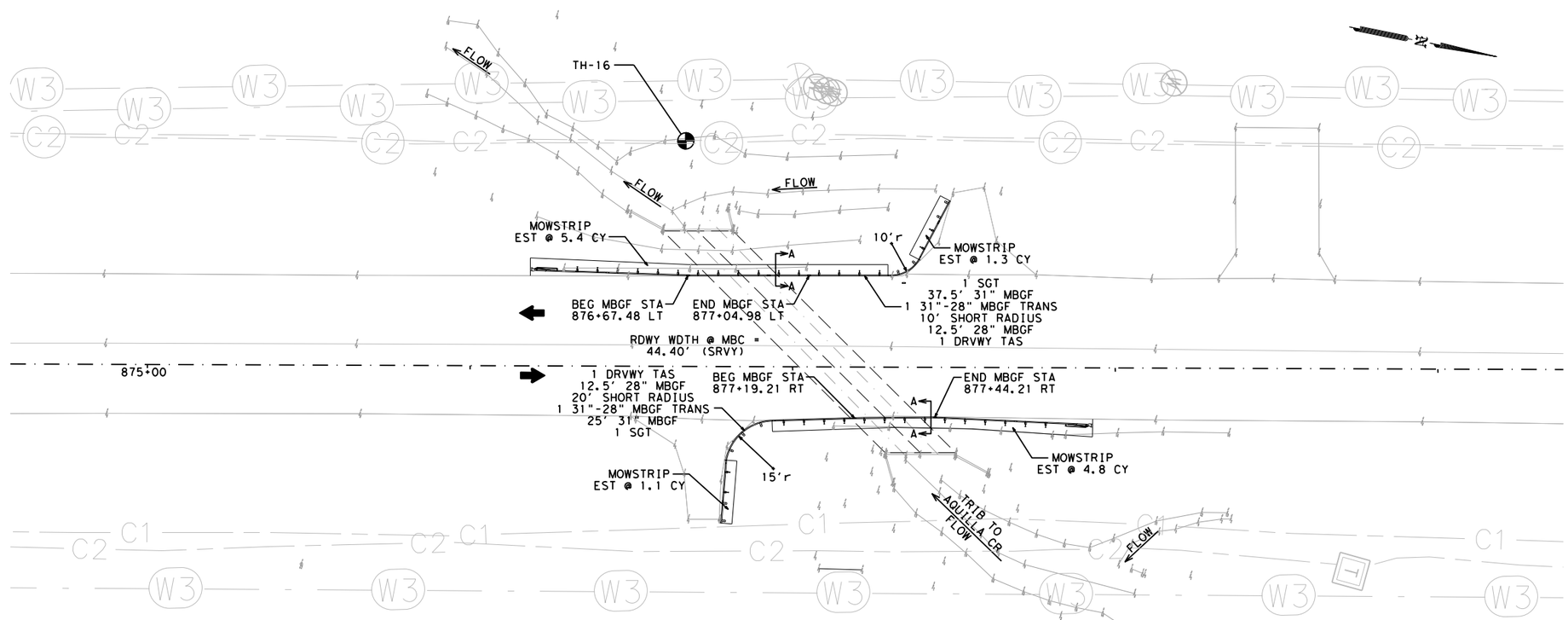
MBGF LAYOUTS

SCALE: FEET
SCALE: 1" = 50'

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		57

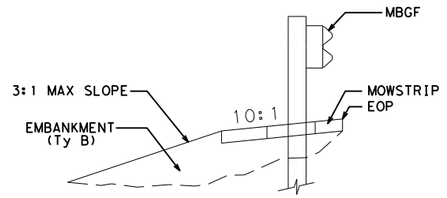


CULVERT 03 @ TRIB. TO AQUILLA CREEK: EXISTING 2 ~ 10'X7' MBC (BRIDGE CLASS); STA 857+98.04 (NBI: 091100001903039)



CULVERT 02 @ TRIB. TO AQUILLA CREEK: EXISTING 2 ~ 7'X5' MBC (BRIDGE CLASS); STA 877+08.13 (NBI: 091100001903038)

NOTES:



DETAIL "A"
N.T.S.

1. ALL MBGF WILL BE 31" UNLESS OTHERWISE NOTED. ALL 28" AND 31" MBGF IS PAID FOR UNDER ITEM 540-6002.

ITEM	DESCRIPTION	UNIT	QTY
	(LOCATIONS COMBINED)		
	CULVERT 03 @ TRIB TO AQUILLA CR (STA 857+98.04) &		
	CULVERT 02 @ TRIB TO AQUILLA CR (STA 877+08.13):		
0540 6002	MTL W-BEAM GD FEN (STEEL POST)	LF	237.5
0544 6001	GUARDRAIL END TREATMENT (INSTALL)	EA	6
0132 6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	66
0432 6045	RIPRAP (MOW STRIP)(4 IN)	CY	30.5
0540 6035	MTL BM GD FEN TRANS (31" - 28")	EA	2
0540 6014	SHORT RADIUS	LF	30
0540 6015	DRIVEWAY TERMINAL ANCHOR SECTION	EA	2
0658 6062	INSTL DEL ASSM(D-SW)SZ 1(BRF)GF2(BI)	LF	12
0540 6020	MTL W-BEAM GD FEN (LOW FILL CULVERT)	LF	100

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/19/2022
SIGNATURE OF REGISTRANT & DATE

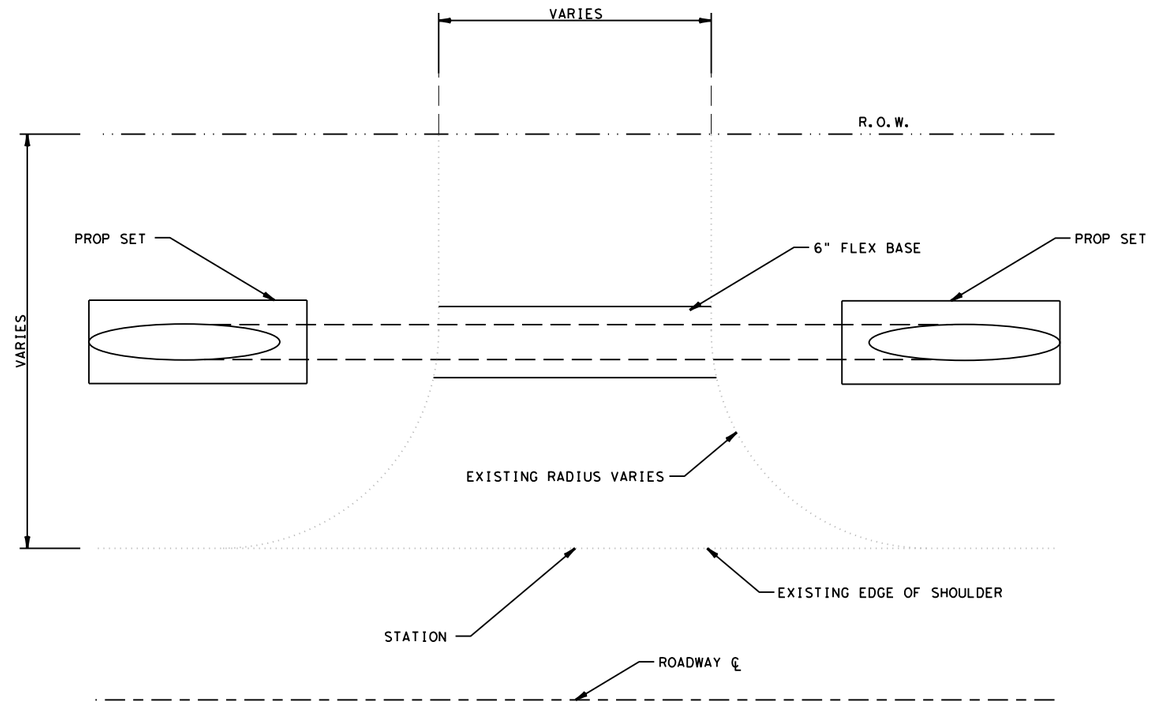
MBGF LAYOUTS

SCALE: FEET
SCALE: 1" = 40'

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		58

NOTES:
1. IF ITEM 4122 (THERMOPLASTIC PIPE) IS USED THEN PRECAST SETS ARE REQUIRED.

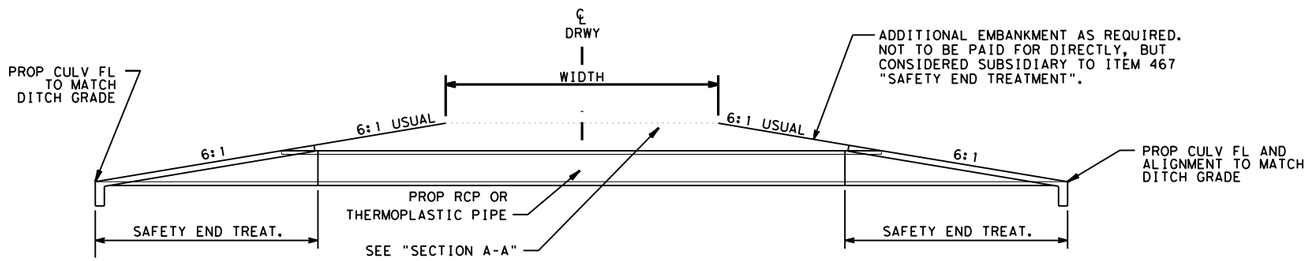
2. SEE DRIVEWAY SUMMARIES FOR MATERIAL INFORMATION AT EACH DRIVEWAY.



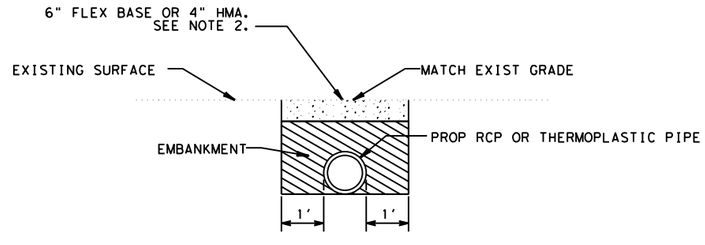
DRIVEWAYS
(NOT TO SCALE)

DRIVEWAYS WILL CONSIST OF: CUTTING TO REMOVE EXISTING CMP PIPE TO REPLACE WITH THERMOPLASTIC PIPE OR RCP. MATCH EXISTING GRADES ON ALL EXISTING DRIVEWAYS FOR SURFACE ELEVATIONS. THE CONTRACTOR WILL MAINTAIN A MINIMUM OF SIX (6") COVER FOR PROPOSED THERMOPLASTIC PIPE OR RCP.

PLACE SIX (6") OF FLEX BASE AS SHOWN FOR DRIVEWAYS WHERE PIPE WILL BE REPLACED.



DRIVEWAY TYPICAL SECTION
(NOT TO SCALE)



SECTION A-A
(NOT TO SCALE)

STATE OF TEXAS
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PROFESSIONAL ENGINEER

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DRIVEWAY DETAILS

SHEET 1 OF 1

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	HILL		59

DATE: 5/19/2022
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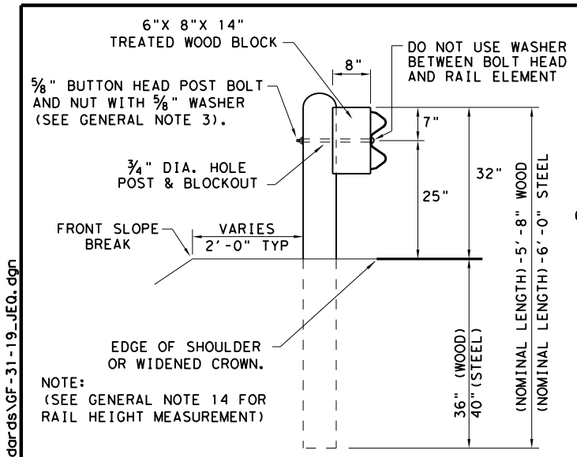
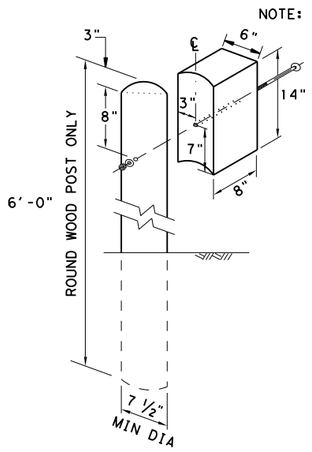
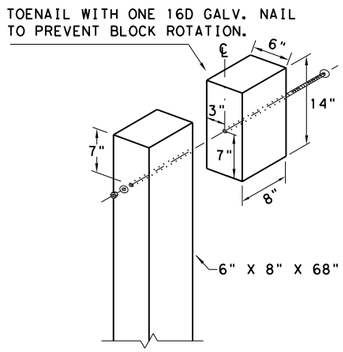


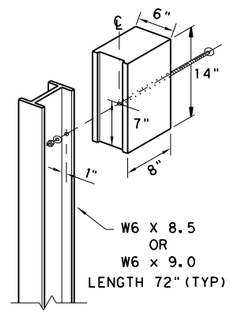
TYPICAL POST PLACEMENT



WOOD BLOCK TO ROUND WOOD POST

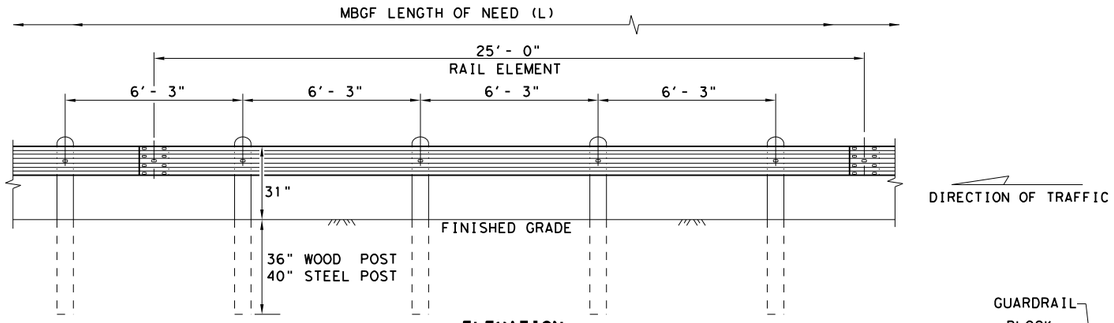


WOOD BLOCK TO RECTANGULAR WOOD POST



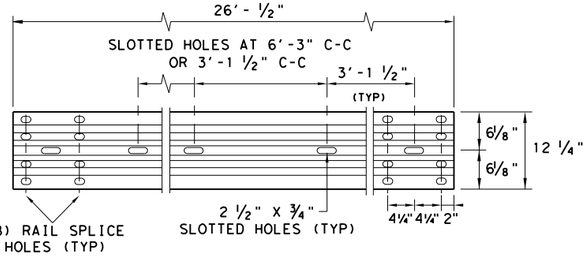
ROUTED WOOD BLOCK TO I-BEAM STEEL POST

NOTE: ** "WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.



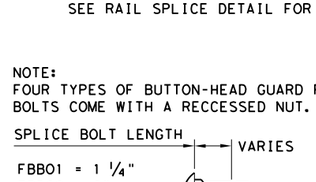
ELEVATION
MID-SPAN RAIL SPLICE

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



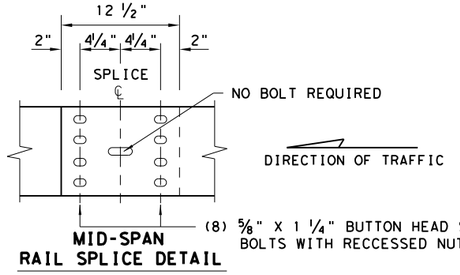
ELEVATION 25'- 0" (NOM.) W-BEAM SECTION

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



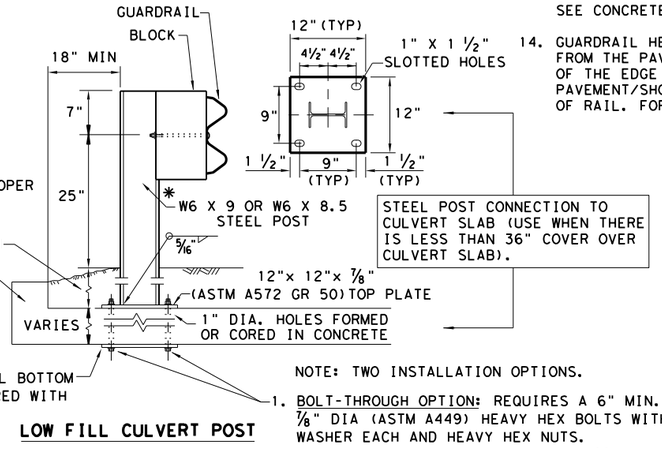
BUTTON HEAD BOLT

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



MID-SPAN RAIL SPLICE DETAIL

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



LOW FILL CULVERT POST

NOTE: TWO INSTALLATION OPTIONS.

1. BOLT-THROUGH OPTION: REQUIRES A 6" MIN. SLAB THICKNESS. ⅞" DIA (ASTM A449) HEAVY HEX BOLTS WITH TWO HARDENED WASHER EACH AND HEAVY HEX NUTS.
   NOTE: BOLT LENGTH = SLAB PLUS 2 ¼" MIN.

2. EPOXY ANCHOR OPTION: THIS OPTION MAY ONLY BE USED IF THE CULVERT SLAB IS 9" MIN. THICK. THREADED ANCHOR RODS MUST BE ⅞" DIA. ASTM A449 OR A193 GRADE B7 WITH HEAVY HEX NUT, AND ONE HARDENED WASHER EACH. EMBED ANCHOR RODS 6" WITH HILTI HIT RE 500 EPOXY ADHESIVE. OTHER TYPE III CLASS C EPOXY ADHESIVES MEETING THE REQUIREMENTS OF DMS-6100, "EPOXIES AND ADHESIVES", MAY BE USED IF IT CAN BE DEMONSTRATED THAT THEY MEET OR EXCEED THE STRENGTH OF HILTI HIT RE 500 WITH THE SAME EMBEDMENT DEPTH AND THREADED ROD DIA. FOLLOW THE MANUFACTURER'S REQUIREMENTS FOR INSTALLING EPOXIED THREADED RODS. EXTEND RODS ¼" MIN. BEYOND NUT.

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

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

GENERAL NOTES

1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540,"METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'- 0", OR 12'- 6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 ½" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE DOWNSTREAM ANCHOR TERMINAL (DAT) AND THE TRANSITION SECTIONS OF GUARDRAIL.
3. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND ⅝" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445,"GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
6. THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A MAXIMUM SLOPE OF 1V:10H.
7. IF SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER, THE GUARD FENCE MAY BE FLARED AT A RATE OF 25:1 OR FLATTER.
8. UNLESS OTHERWISE SHOWN IN THE PLANS, GUARD FENCE PLACED IN THE VICINITY OF CURBS SHALL BE POSITIONED SO THAT THE FACE OF CURB IS LOCATED DIRECTLY BELOW OR BEHIND THE FACE OF THE RAIL. RAIL PLACED OVER CURBS SHALL BE INSTALLED SO THAT THE POST BOLT IS LOCATED APPROXIMATELY 25 INCHES ABOVE THE GUTTER PAN OR EDGE OF SHOULDER.
9. APPLICATIONS IN SOLID ROCK ARE ONLY ALLOWED WITH STEEL POSTS. IF SOLID ROCK IS ENCOUNTERED WITHIN 0 TO 18" OF THE FINISHED GRADE, DRILL A 24" DIA. HOLE, 24" INTO THE ROCK. IF SOLID ROCK IS ENCOUNTERED BELOW 18", DRILL A 12" DIA. HOLE, 12" INTO THE ROCK OR TO THE STANDARD EMBEDMENT DEPTH, WHICHEVER MAYBE LESS. ANY EXCESS POST LENGTH, AFTER MEETING THESE DEPTHS, MAY BE FIELD CUT TO ENSURE PROPER GUARDRAIL MOUNTING HEIGHT. BACKFILL WITH COARSE AGGREGATE MATERIAL.
10. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
11. SPECIAL FABRICATION WILL BE REQUIRED AT INSTALLATION LOCATIONS HAVING A CURVATURE OF LESS THAN 150 FT. RADIUS.
12. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210,"COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210 ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
13. FOR THE LOW FILL CULVERT OPTION, POSTS LOCATED PARTIALLY OR WHOLLY BETWEEN PRECAST BOX CULVERT UNITS, THE USE OF A CAST-IN-PLACE CONCRETE CLOSURE BETWEEN BOXES IS REQUIRED. THE LENGTH OF THE CAST-IN-PLACE CONCRETE CLOSURE SHALL ACCOMMODATE THE PLACEMENT OF THE LOW FILL CULVERT OPTION. SEE CONCRETE CLOSURE DETAILS ON BRIDGE STANDARD SCP-MD.
14. GUARDRAIL HEIGHT MEASUREMENT: WHEN THE GUARDRAIL IS LOCATED ABOVE PAVEMENT, MEASURE THE HEIGHT FROM THE PAVEMENT TO THE TOP OF THE W-BEAM RAIL. WHEN THE GUARDRAIL IS LOCATED UP TO 2 FT. OFF OF THE EDGE OF PAVEMENT OR FOR A PAVEMENT OVERLAY, USE A 10-FOOT STRAIGHTEDGE TO EXTEND THE PAVEMENT/SHOULDER SLOPE TO THE BACK OF RAIL, MEASURE FROM THE BOTTOM OF STRAIGHTEDGE TO THE TOP OF RAIL. FOR GUARDRAIL LOCATED DOWN A 10:1 SLOPE, MEASURE FROM THE NOMINAL TERRAIN.

Texas Department of Transportation — Design Division Standard

METAL BEAM GUARD FENCE
TL-3 MASH COMPLIANT
GF(31)-19

FILE: gf3119.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
	WAC	HILL		60

DATE: 5/19/2022
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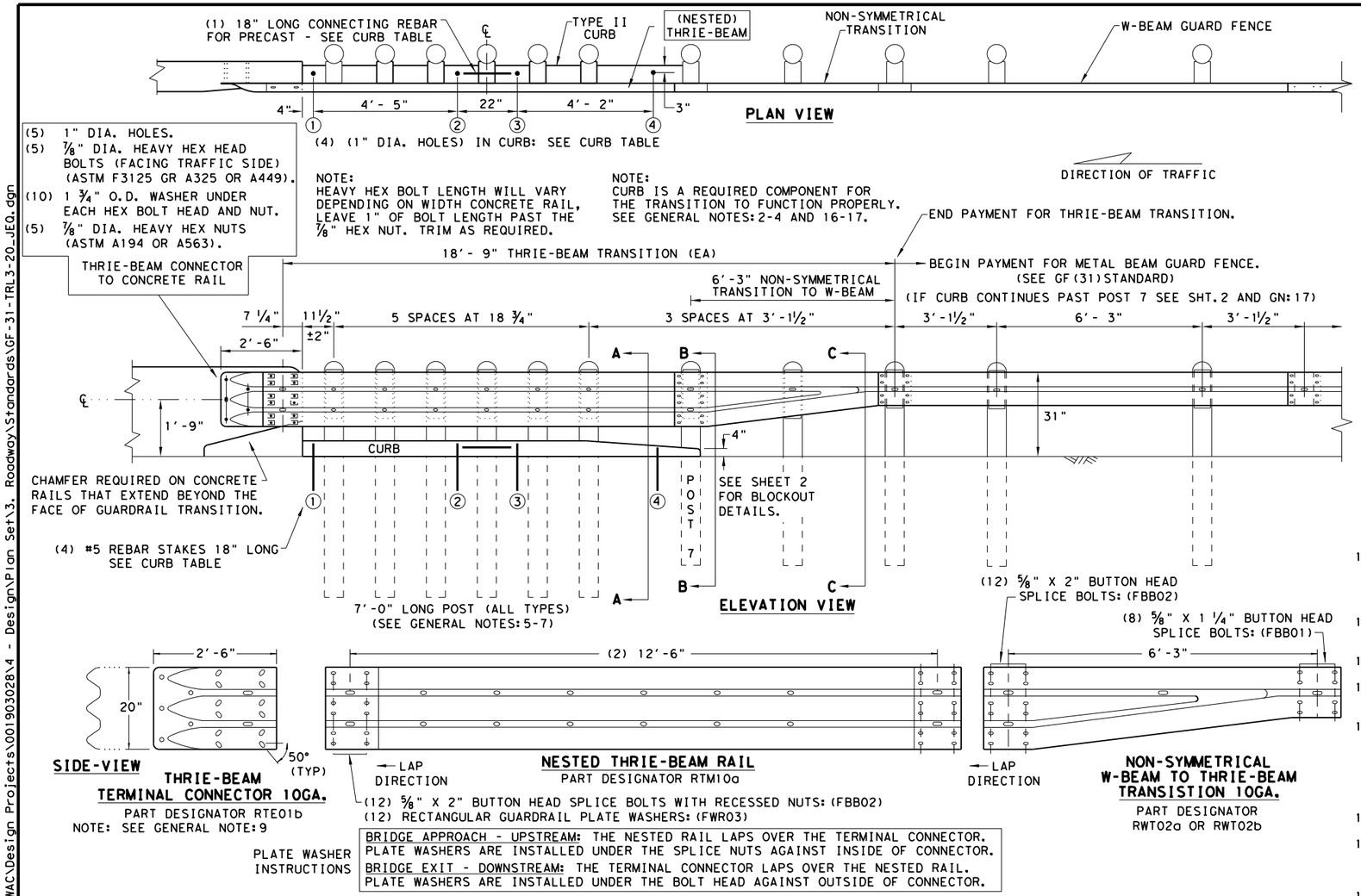


GENERAL NOTES

1. CONTACT THE DESIGN DIVISION FOR DRAINAGE CUT OUT OPTIONS NEEDED WITHIN THE CURB SECTION OF THE THRIE-BEAM TRANSITION. (512) 416-2678
2. CONCRETE CURB MAY BE CAST-IN-PLACE OR PRECAST AS SHOWN ON THIS SHEET. WHEN USED IN CONJUNCTION WITH THE THRIE-BEAM TRANSITIONS, CURB SHALL BE TYPE II (5- ¾" HEIGHT); SEE CURRENT CCCG STANDARD SHEET FOR FURTHER DETAILS. IF OTHER CURB HEIGHTS ARE SHOWN IN THE PLANS IN CONJUNCTION WITH THE TRANSITION, THE CURB HEIGHT MAY BE FROM 4" TO 8" WITH A RELATIVELY VERTICAL FACE. CONCRETE CURB SHALL BE CONTINUOUS TO THE SEVENTH POST UNLESS OTHERWISE SHOWN IN THE PLANS. SEE GENERAL NOTE: 17 FOR CIRCUMSTANCES WHERE CURB CONTINUES PAST POST 7.
3. CONCRETE CURB TYPE II SUBSIDIARY TO "METAL BEAM GUARD FENCE TRANSITION". IF NO ADDITIONAL CURB IS INDICATED BEYOND THE TRANSITION, THEN ANY CURB HEIGHT GREATER THAN 4" WILL BE TAPERED DOWN BEGINNING AT THE LAST 7 FT. POST TO A MAXIMUM HEIGHT OF 4" AT POST 7. IF SHOWN ELSEWHERE IN THE PLANS, ADDITIONAL CURB UNDERNEATH GUARDRAIL WILL BE PAID FOR BY THE LINEAR FOOT.
4. UNLESS OTHERWISE SHOWN IN THE PLANS, TRANSITIONS SHALL BE PLACED WITH THE BLOCKOUT FACE IN FRONT OF OR DIRECTLY ABOVE THE CURB FACE. SEE SECTION A-A.
5. FOR ROUND WOOD POST SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 ½" DIA. MINIMUM THROUGHOUT THE THRIE-BEAM TRANSITION.
6. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. REFER TO GF(31) STANDARD SHEET.
7. THE POST LENGTH SHALL BE MARKED ON ALL 7'- 0" LONG POSTS BY THE MANUFACTURER. THE MARK SHALL BE LOCATED WITHIN THE TOP 1 FT. REGION OF THE POST, AT LEAST ⅝" IN HEIGHT, AND VISIBLE AFTER INSTALLATION. WOODEN POSTS SHALL BE MARKED WITH A BRAND, AND STEEL POSTS WITH A STENCIL BEFORE GALVANIZING.
8. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
9. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE THRIE-BEAM TERMINAL CONNECTOR AND THE THRIE-BEAM TRANSITION TO W-BEAM SHALL BE OF THE SAME MATERIAL, BUT SHALL NOT BE LESS THAN 10 GAUGE. CONTRACTOR SHALL VERIFY THAT THE LOCATIONS OF BOLT HOLES MATCH THOSE IN THE THRIE-BEAM TERMINAL CONNECTOR PRIOR TO ORDERING MATERIALS.
10. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND ⅝" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
11. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
12. CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
13. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
14. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. TXDOT'S MATERIALS AND TESTS DIVISION MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL CAN FURNISH COMPOSITE MATERIAL BLOCKS.
15. REFER TO GF(31) STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
16. THE INSTALLATION OF THE TYPE II CURB IS CRITICAL FOR THE PERFORMANCE OF THE THRIE-BEAM TRANSITION SYSTEM. THE CURB PREVENTS (VEHICLE WHEEL SNAGGING) AT THE CONCRETE RAIL AND IS REQUIRED TO MEET MASH CRASH TEST CRITERIA.
17. IF CURB EXTENDS BEYOND POST 7, 25' OF NESTED W-BEAM GUARDRAIL SHALL BE INSTALLED BEYOND THE PAY LIMITS OF THRIE-BEAM TRANSITION SECTION, (SEE SHT.2). PAYMENT FOR THIS 25' SECTION WILL BE BY LINEAR FOOT, PAY ITEM "0540 6XXX MTL W-BEAM GD FEN (NESTED) (TIM POST)" OR "540 6XXX MTL W-BEAM GD FEN (NESTED) (STEEL POST)" AS APPLICABLE FOR POST TYPE. SEE SHT.2 FOR ADDITIONAL INFORMATION.

THRIE-BEAM TERMINAL - CURB TABLE

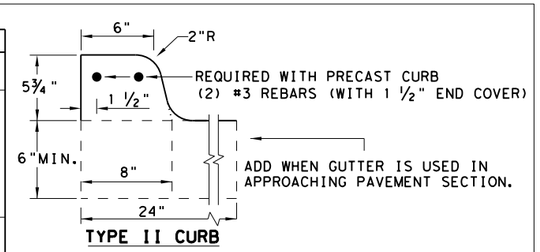
PRECAST CURB FULL LENGTH EQUALS 12'- 2"
THE PRECAST CURB MAY BE FORMED INTO TWO SECTIONS.

CURB (1) LENGTH 5'- 8"
CURB (2) LENGTH 6'- 6"
TAPER CURB (2) TO A HEIGHT OF 4" AT POST 7

CONNECTING PRECAST CURB SECTIONS (1) & (2):
FORM OR CORE 1" DIA. HOLE 9" LONG INTO EACH CURB END. USE (1) #5 GR.60 REBAR 18" LONG TO CONNECT BOTH CURBS.

SECURING PRECAST OR CAST-IN-PLACE TO FINISHED GRADE *:
FORM OR CORE (4) 1" DIA. HOLES, SEE PLAN AND ELEVATION VIEWS FOR HOLE LOCATIONS. DRIVE (4) #5 GR.60 REBAR STAKES 18" LONG INTO THE GROUND AND ½" BELOW TOP OF CURB.
FILL HOLES WITH APPROVED GROUT MIXTURE.

* NOTES: NOT NEEDED FOR CAST-IN-PLACE.
SEE TYPE II CURB DETAIL FOR REBAR AND COVER REQUIREMENTS.
PERCUSSION DRILLING IS NOT PERMITTED WITH:
TYPE II CURB, BRIDGE RAIL OR CONCRETE TRAFFIC RAIL.



TYPE II CURB

NOTE: OPTIONS FOR TYPE II CURB:
1. PRECAST
2. CAST-IN-PLACE

TYPE II CURB DETAILS

HIGH-SPEED TRANSITION

SHEET 1 OF 2

Texas Department of Transportation | Design Division Standard

METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-3 MASH COMPLIANT

GF(31)TR TL3-20

FILE: gf31tr1320.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG		
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REVISIONS	0019	03	028 Etc.	SH 171		
	DIST	COUNTY		SHEET NO.		
	WAC	HILL		61		

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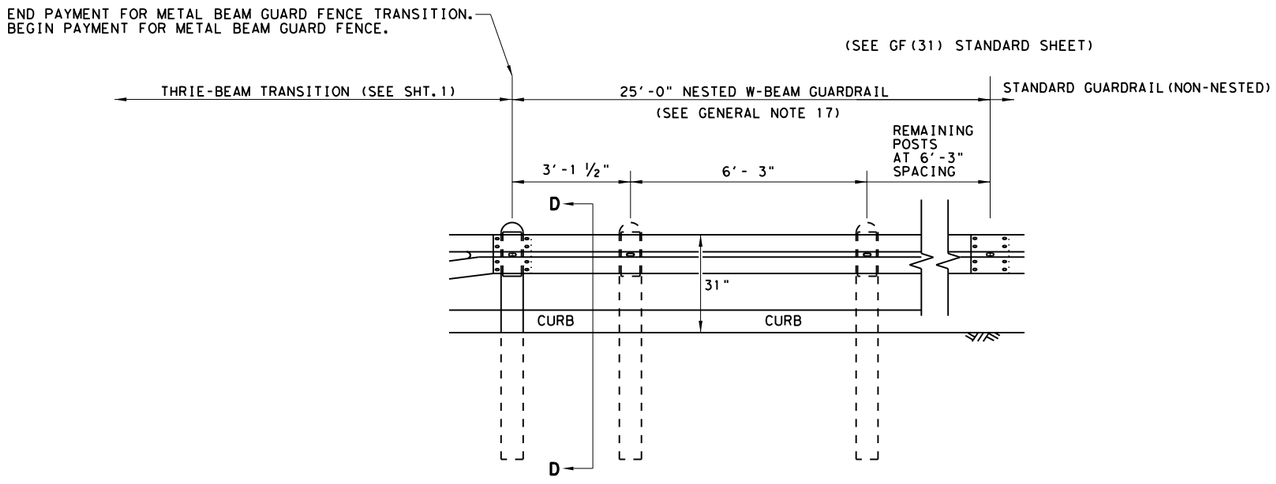
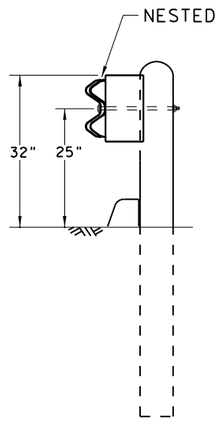
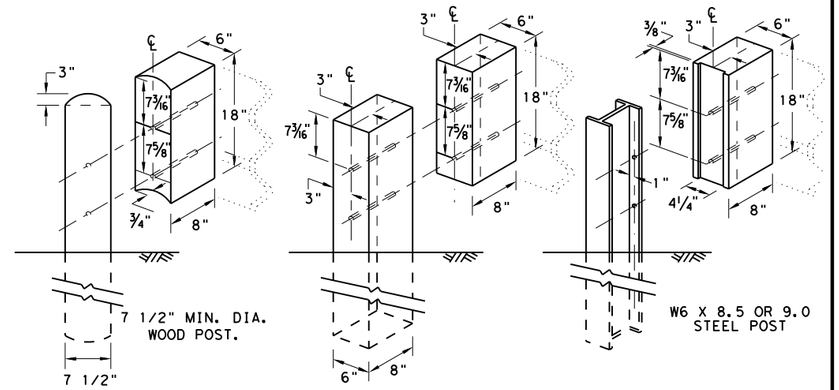
REQUIRED ALTERNATIVE FOR CONTINUOUS CURB EXTENDING PAST POST 7 (SEE SHT. 1 GENERAL NOTE 17)



ELEVATION VIEW



SECTION D-D



THRIE BEAM TRANSITION BLOCKOUT DETAILS

HIGH-SPEED TRANSITION

SHEET 2 OF 2

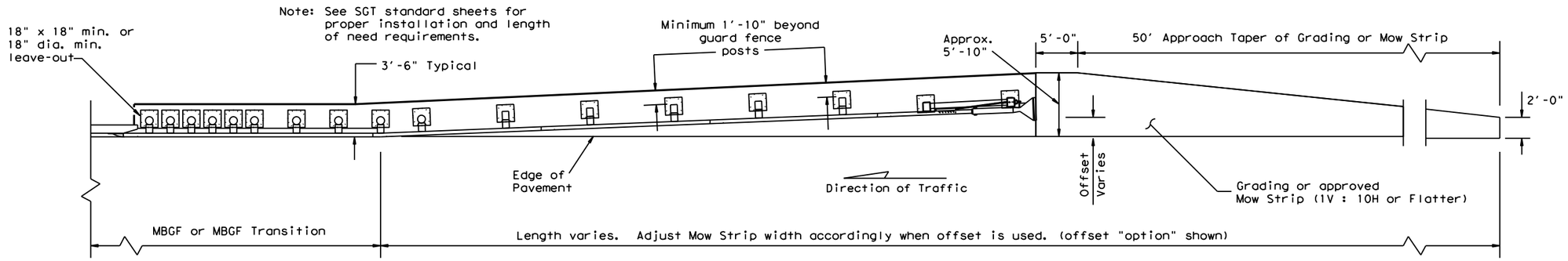
Texas Department of Transportation — Design Division Standard

METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-3 MASH COMPLIANT

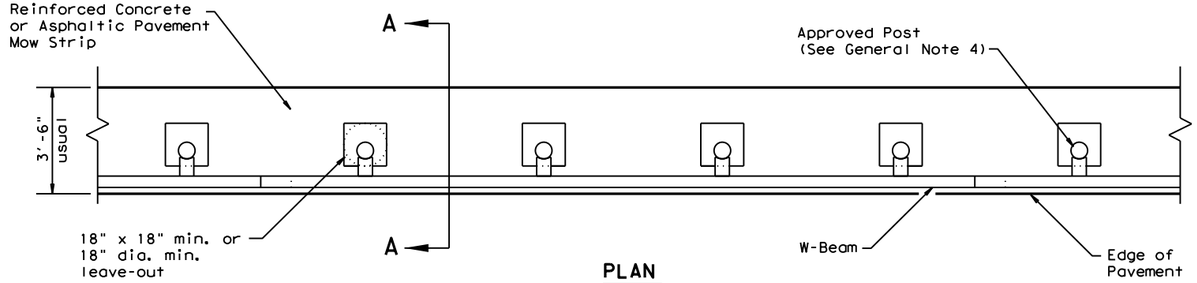
GF(31)TR TL3-20

FILE: gf31trt1320.dgn	DN: TxDOT	CK: KM	DW: KM	CK: CGL/AG	
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0019	03	028 Etc.	SH 171	
	DIST	COUNTY		SHEET NO.	
	WAC	HILL		62	

DATE: 5/19/2022
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\0019030284 - Design\Plan Set\3. Roadway\Standards\GF-31-MS-19_JEQ.dgn

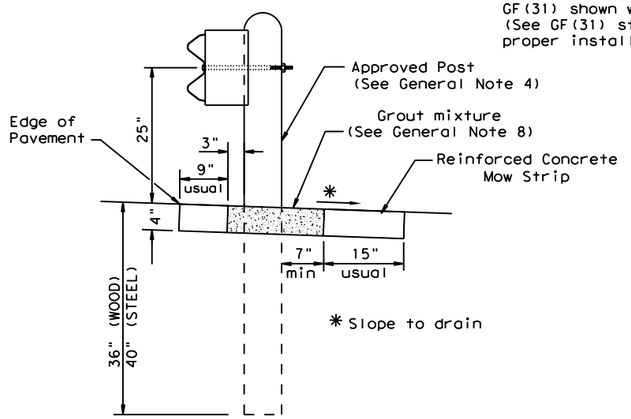


GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



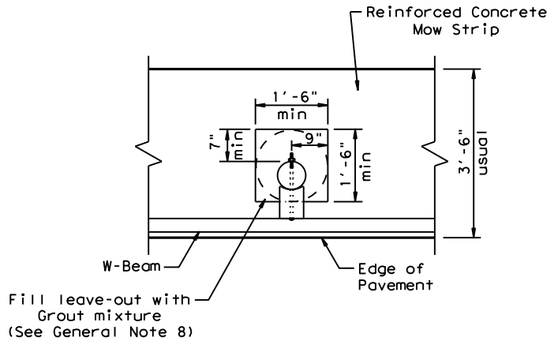
PLAN

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



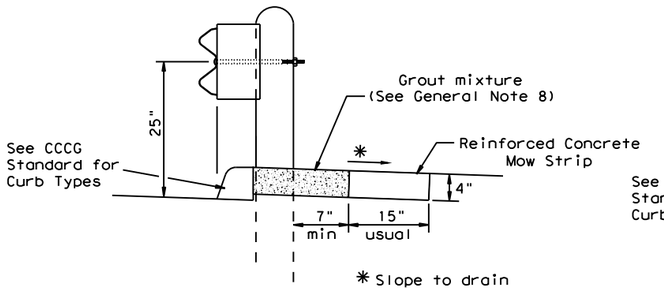
SECTION A-A

Typical



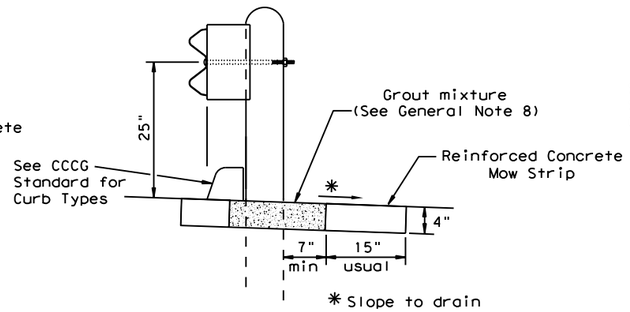
MOW STRIP DETAIL

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



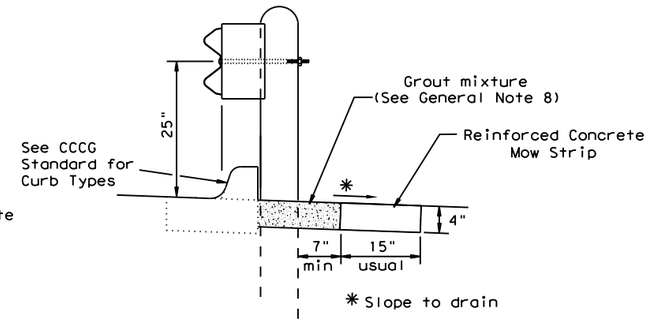
CURB OPTION (1)

This option will increase the post embedment throughout the system.



CURB OPTION (2)

Curb shown on top of mow strip



CURB OPTION (3)

Note: Site Condition(s)

Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.

Approach grading or mow strip may be decreased or eliminated, as directed by the Engineer.

GENERAL NOTES

1. This mow strip design is for use with metal beam guard fence, guard fence transitions, and guard fence end treatments. See applicable GF(31) MBGF or GF(31) Transition Standard sheet for additional information.
2. Mow strips shall be reinforced concrete with (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item. Reinforced concrete shall be placed in accordance with Item 432, "Riprap." The use of the synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Material Producer List (MPL), maintained by TxDOT, Construction Division.
3. The leave-out behind the post shall be a minimum of 7".
4. Only steel (W6 x 8.5 or W6 x 9.0), or 7 ½" Dia. round wood posts are acceptable for use in the mow strip. See GF(31) Standard for additional details.
5. Other curb placement options may be used. Curbs are not considered part of the mow strip and will be paid for under other pertinent bid item.
6. Thickness of the mow strip will be 4".
7. The limits of payment for reinforced concrete will include leave-outs for the posts.
8. The leave-outs shall be filled with a Grout mixture consisting of: 2719 pounds sand, 188 pounds Type 1 or II cement, and 550 pounds of water per cubic yard, with a 28-day compressive strength of approximately 230 psi or less. Provide grout with a consistency that will flow into and completely fill all voids. Due to auger size, larger leave-out dimensions are acceptable from both an impact performance and maintenance repair standpoint (Suggested Maximum leave-out of 20"). Payment for furnishing and placing the grout mixture will be subsidiary to the pay item of riprap mow strip.

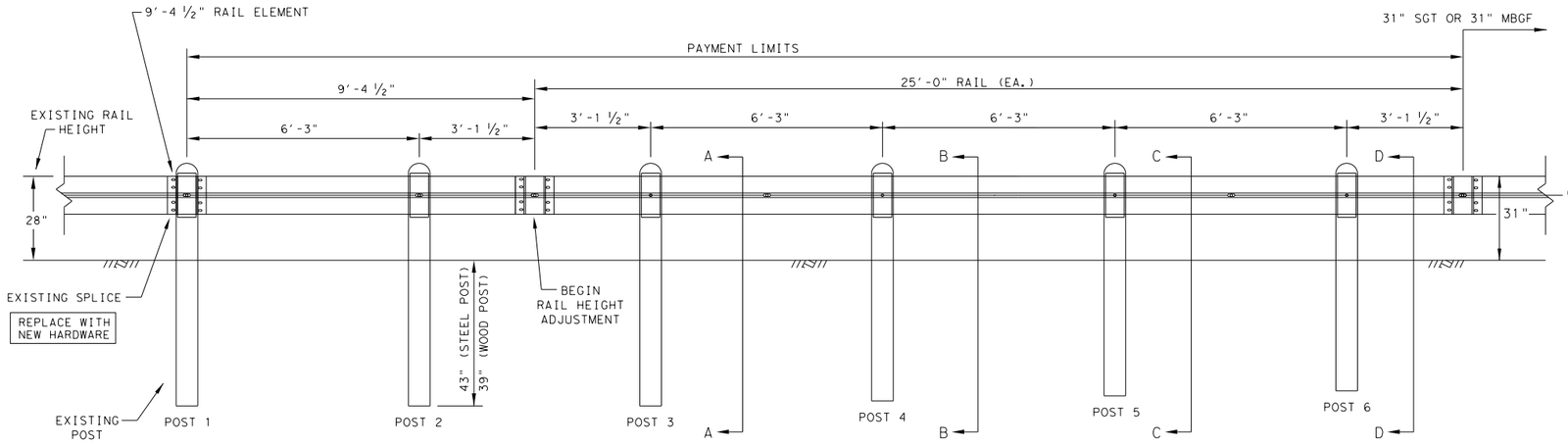
Texas Department of Transportation

Design Division Standard

METAL BEAM GUARD FENCE (MOW STRIP) TL-3 MASH COMPLIANT

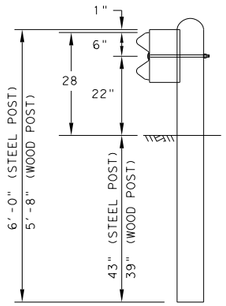
GF(31)MS-19

FILE: gf31ms19.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		63

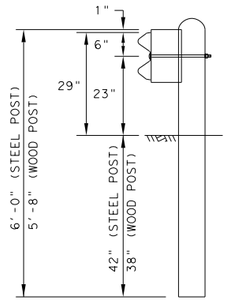


ELEVATION VIEW

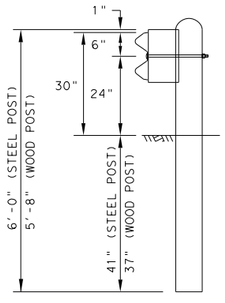
✳ "WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.



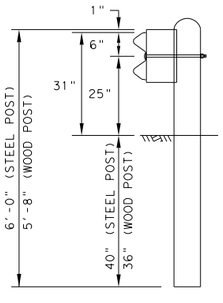
SECTION A-A



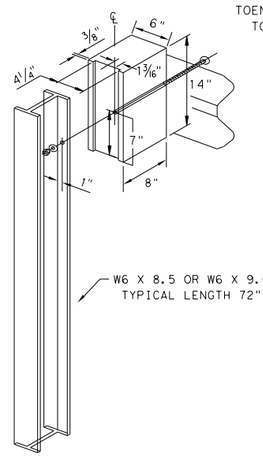
SECTION B-B



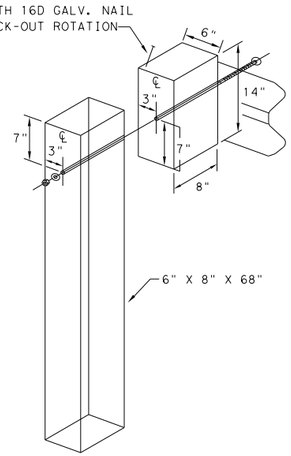
SECTION C-C



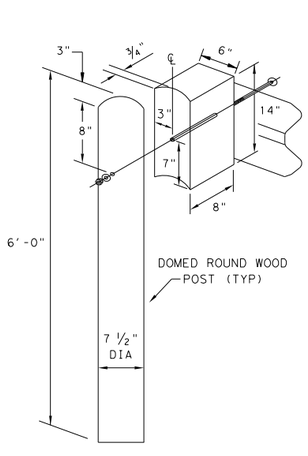
SECTION D-D



ROUTED WOOD BLOCK-OUT TO STEEL POST



WOOD BLOCK TO RECTANGULAR WOOD POST



WOOD BLOCK-OUT TO DOMED ROUND WOOD POST

POST AND BLOCK-OUT TYPES AVAILABLE

FOR WOOD POST

FOR STEEL POST

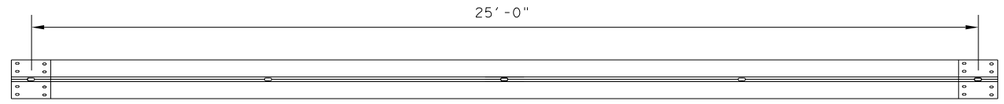
HARDWARE LIST	
QTY	DESCRIPTION
1	9′-4 ½" W-BEAM RAIL ELEMENT 12GA.
1	25′-0" W-BEAM RAIL ELEMENT 12GA. (TYP)
6	7 ½" DIA X 6′-0" DOMED ROUND WOOD POSTS (TYP)
6	6" X 8" X 68" RECTANGULAR WOOD POSTS (TYP)
6	W6 X 8.5 OR W6 X 9 X 72" STEEL POSTS (TYP)
6	6" X 8" X 14" WOOD BLOCKS OR COMPOSITE (TYP)
6	⅝" X 18" GUARDRAIL BOLTS WITH NUTS (FBB04)
6	⅝" ROUND WASHERS (ASTM F436)(FWC16a)
6	⅝" X 10" GUARDRAIL BOLTS WITH NUTS (FBB03)
24	⅝" X 1- ¼" GUARDRAIL SPLICE BOLTS WITH DOUBLE RECESSED NUTS (ASTM A563) (FBB01)

NOTE: HARDWARE SHALL MEET THE FOLLOWING REQUIREMENTS.

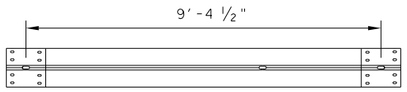
GUARDRAIL POST BOLTS (ASTM A307 GR.A)
GUARDRAIL ROUND WASHERS (ASTM F436)
GUARDRAIL DOUBLE RECESSED NUTS (ASTM A563)
GUARDRAIL SPLICE BOLTS (ASTM A307 GR.A)
GUARDRAIL SPLICE NUTS (ASTM A563)

GENERAL NOTES

1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25′- 0", OR 12′- 6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3′- 1 ½" C-C OR 6′-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
3. BUTTON HEAD "POST" BOLTS (ASTM A307) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND ⅝" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPLICE" BOLTS (ASTM A307) ARE ⅝" X 1- ¼" WITH ⅝" NUTS (ASTM A563).
4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
6. THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A MAXIMUM SLOPE OF 1V:10H.
7. IF SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER, THE GUARD FENCE MAY BE FLARED AT A RATE OF 25:1 OR FLATTER.
8. APPLICATIONS IN SOLID ROCK ARE ONLY ALLOWED WITH STEEL POSTS. SEE GF(31) STANDARD FOR INSTALLATION GUIDANCE.
9. POSTS SHALL NOT BE SET IN CONCRETE.
10. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
11. REFER TO STANDARD GF(31) FOR ADDITIONAL DETAILS.
12. RAIL HEIGHT ADJUSTMENT IS ASSESSED AT TL-3 MASH COMPLIANT FOR STEEL POST HEIGHT TRANSITION TO 28" STEEL POST GUARDRAIL.



25′-0" (NOM.) W-BEAM RAIL ELEMENT



9′-4 ½" (NOM.) W-BEAM RAIL ELEMENT

Texas Department of Transportation

Design Division Standard

METAL BEAM GUARD FENCE RAIL HEIGHT ADJUSTMENT (28" TO 31") TL-3 MASH COMPLIANT

RAIL-ADJ(A)-19

FILE: railadja19	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG	
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0019	03	028 Etc.	SH 171	
	DIST	COUNTY		SHEET NO.	
	WAC	HILL		64	

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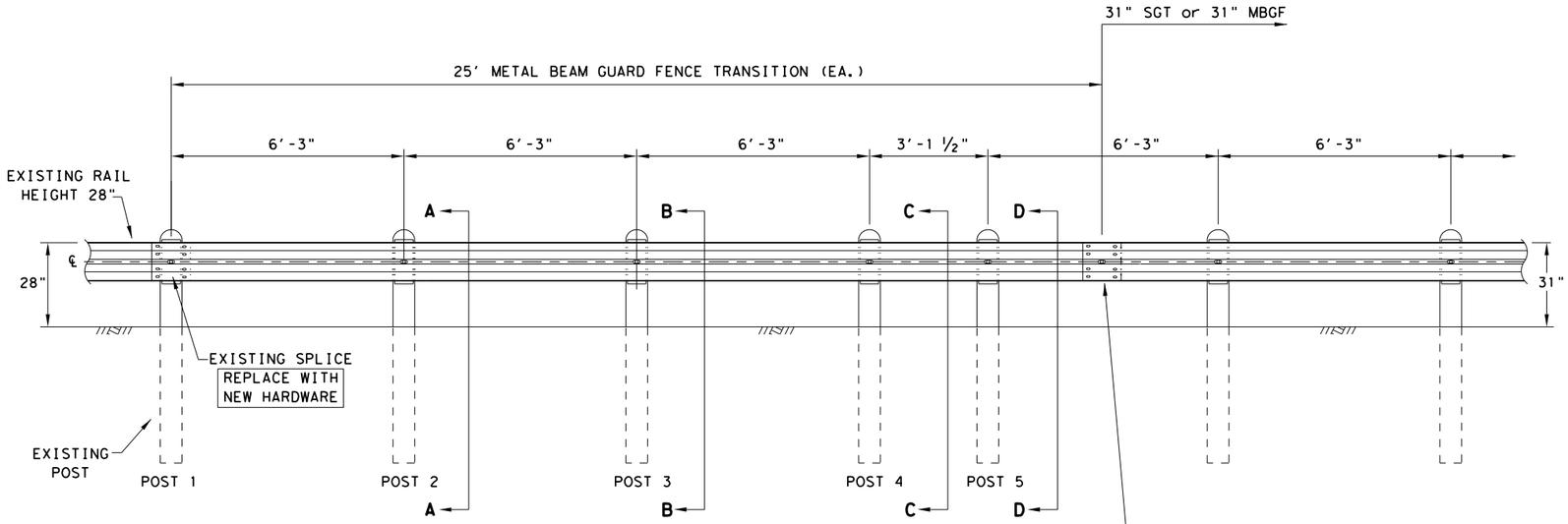
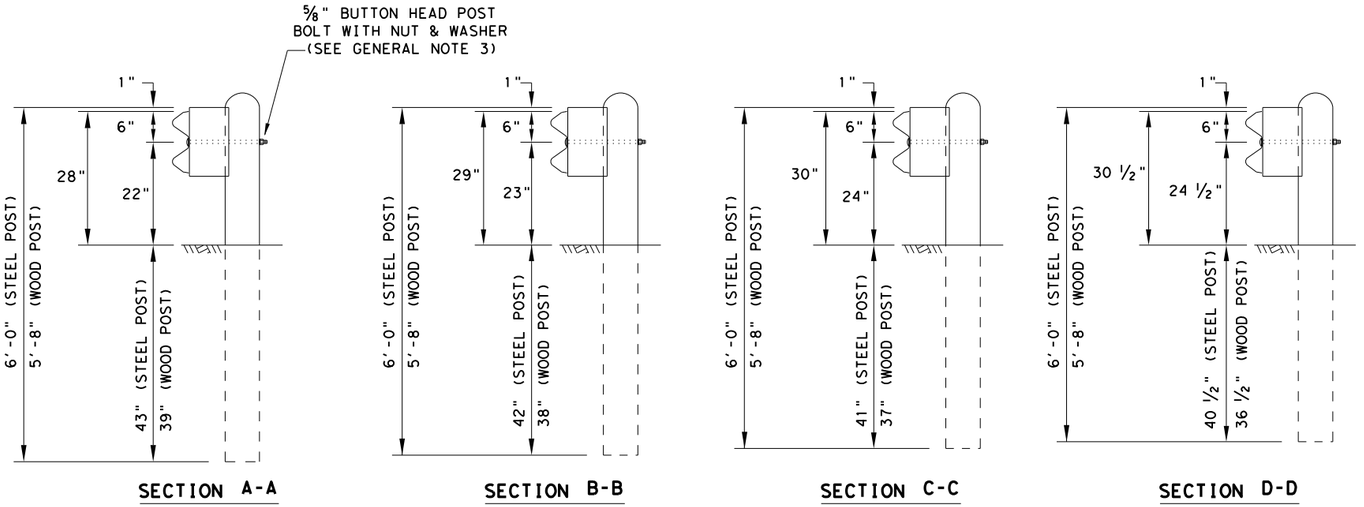
NOTE: (SINGLE) W-BEAM SHALL MATCH THE GAUGE OF THE ADJACENT RUN OF MBGF.

PLAN VIEW



ELEVATION VIEW

* "WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.



SECTION A-A | SECTION B-B | SECTION C-C | SECTION D-D

GENERAL NOTES

1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'-0", OR 12'-6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
3. BUTTON HEAD "POST" BOLTS (ASTM A307) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 5/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPLICE" BOLTS (ASTM A307) ARE 5/8" X 1-1/4" WITH 5/8" NUTS (ASTM A563).
4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
6. THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A MAXIMUM SLOPE OF 1V:10H.
7. IF SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER, THE GUARD FENCE MAY BE FLARED AT A RATE OF 25:1 OR FLATTER.
8. APPLICATIONS IN SOLID ROCK ARE ONLY ALLOWED WITH STEEL POSTS. SEE GF(31) STANDARD FOR INSTALLATION GUIDANCE.
9. POSTS SHALL NOT BE SET IN CONCRETE.
10. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
11. REFER TO STANDARD GF(31) FOR ADDITIONAL DETAILS.
12. RAIL HEIGHT ADJUSTMENT IS ASSESSED AT TL-3 MASH COMPLIANT FOR STEEL POST HEIGHT TRANSITION TO 28" STEEL POST GUARDRAIL.

POST AND BLOCK-OUT TYPES AVAILABLE

HARDWARE LIST	
QTY	DESCRIPTION
1	25'-0" W-BEAM RAIL ELEMENT 12GA. (TYP)
5	7 1/2" DIA X 6'-0" DOMED ROUND WOOD POSTS (TYP)
5	6" X 8" X 68" RECTANGULAR WOOD POSTS (TYP)
5	W6 X 8.5 OR W6 X 9 X 72" STEEL POSTS (TYP)
5	6" X 8" X 14" WOOD BLOCKS OR COMPOSITE (TYP)
FOR WOOD POST: 5	5/8" X 18" GUARDRAIL BOLTS AND NUTS (FBB04)
5	5/8" ROUND WASHERS (ASTM F436)(FWC16a)
FOR STEEL POST: 5	5/8" X 10" GUARDRAIL BOLTS AND NUTS (FBB03)
16	5/8" X 1-1/4" GUARDRAIL SPLICE BOLTS WITH DOUBLE RECESSED NUTS (ASTM A563) (FBB01)

NOTE: HARDWARE SHALL MEET THE FOLLOWING REQUIREMENTS.

GUARDRAIL POST BOLTS (ASTM A307 GR.A)
GUARDRAIL ROUND WASHERS (ASTM F436)
GUARDRAIL DOUBLE RECESSED NUTS (ASTM A563)
GUARDRAIL SPLICE BOLTS (ASTM A307 GR.A)
GUARDRAIL SPLICE NUTS (ASTM A563)

Texas Department of Transportation | Design Division Standard

METAL BEAM GUARD FENCE RAIL HEIGHT ADJUSTMENT (28" TO 31") TL-3 MASH COMPLIANT

RAIL-ADJ(B)-19

FILE: railadjb19	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		65

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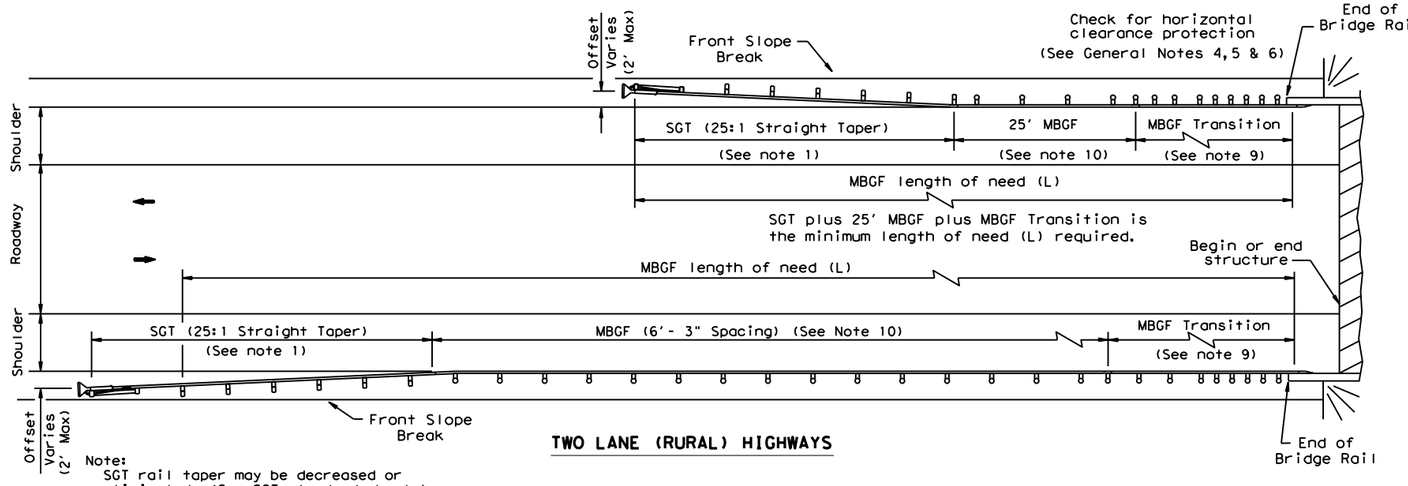
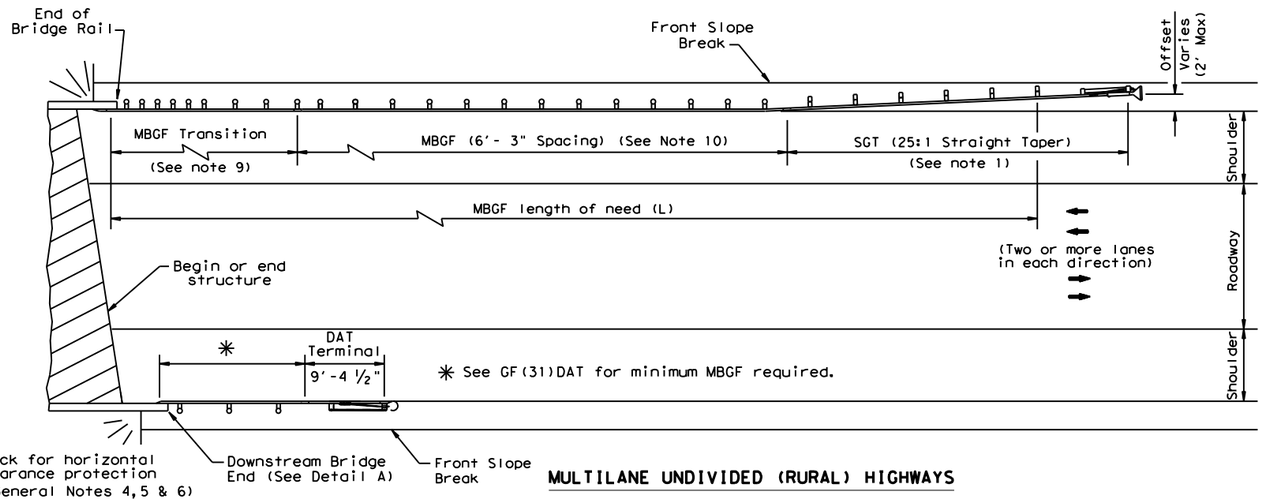
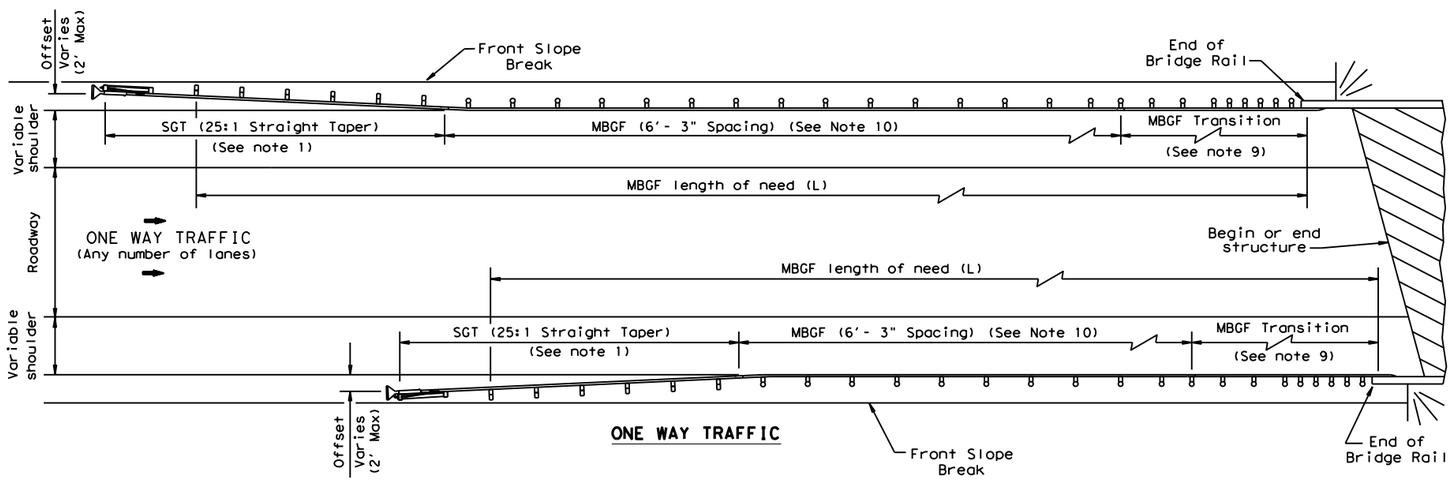


TWO LANE (RURAL) HIGHWAYS

Note:
SGT rail taper may be decreased or eliminated. (See SGT standard sheets)



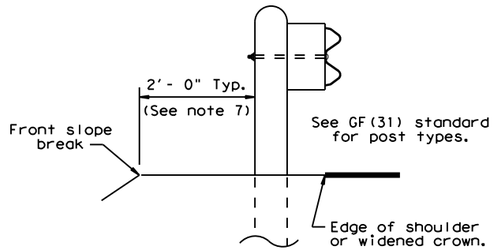
MULTILANE UNDIVIDED (RURAL) HIGHWAYS



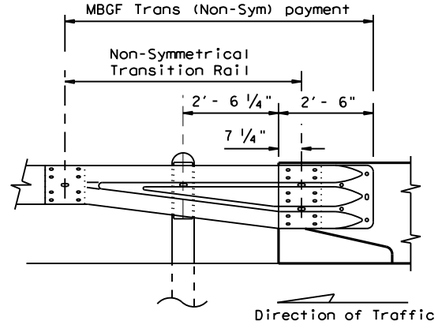
ONE WAY TRAFFIC

GENERAL NOTES

1. For more detail: See GF(31), SGT( )31, GF(31)TR, and GF(31)TL2 standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are as shown in the plans.
3. Use average daily traffic (ADT) for the current year to determine MBGF length of need in accordance with the Roadway Design Manual unless otherwise specified. Where significant traffic volume growth is anticipated on low volume (0-750 ADT) highways, use length determinations for the higher volume category.
4. MBGF may not be required to shield departure end of bridge unless other obstacles within the horizontal clearance limits or opposing traffic indicate a MBGF consideration.
5. Downstream anchor terminals (DAT) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF to concrete rails are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (This requires a minimum of three standard line posts plus the DAT terminal, See Detail A)
7. The crown shall be widened to accommodate MBGF. Typically the "front slope" break should be 2'- 0" from the back of the MBGF post. This applies to new construction on new alignment or where existing roadway cross section is to be widened to increase roadway width. This does not apply to rehabilitation work where existing roadway crown width is to be retained (See Typical Cross Section at MBGF).
8. For restrictive bridge widths: The MBGF should be properly transitioned from the existing bridge rail to the adjoining MBGF (See MBGF Transition Standards). Metal beam guard fence at these bridge location(s) shall be flared at the rate of 25:1 or flatter, and be of the length necessary to locate the terminal end at the 2 ft. "maximum" offset from the shoulder edge in the approach direction.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.
10. A minimum 25' length of MBGF will be required.



TYPICAL CROSS SECTION AT MBGF



Note:
All rail elements shall be lapped in the direction of adjacent traffic.

DETAIL A

Showing Downstream Rail Attachment

Texas Department of Transportation

Design Division Standard

BRIDGE END DETAILS

(METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)

BED-14

FILE: bed14.dgn	DN: TxDOT	CK: AM	DW: BD/VP	CK: CGL
© TxDOT: December 2011	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
REVISED APRIL 2014 SEE (MEMO 0414)	DIST	COUNTY		SHEET NO.
	WAC	HILL		66

DATE: 5/19/2022
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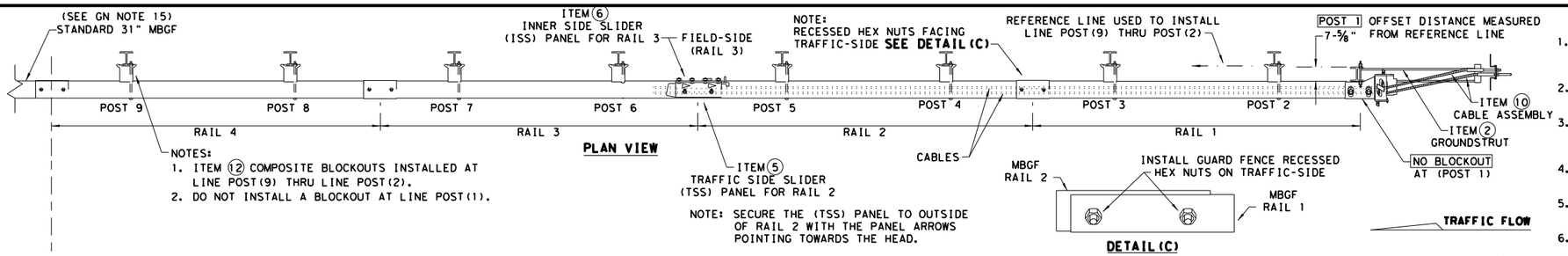

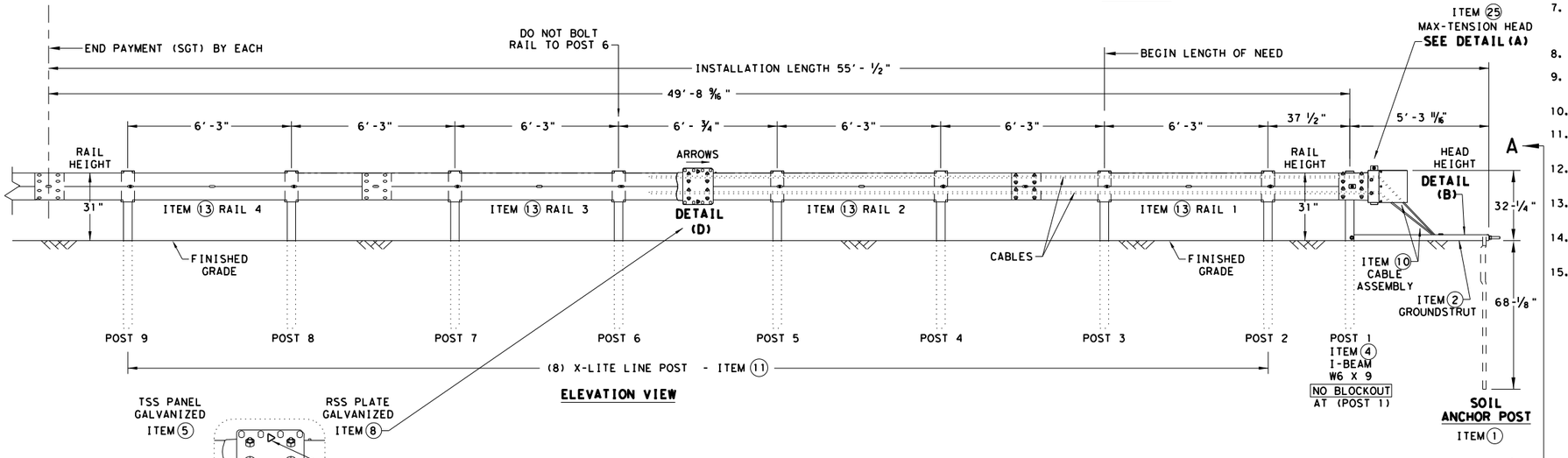

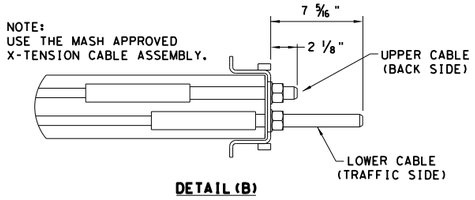

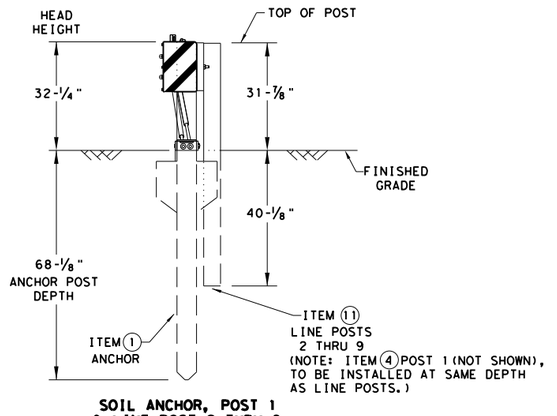

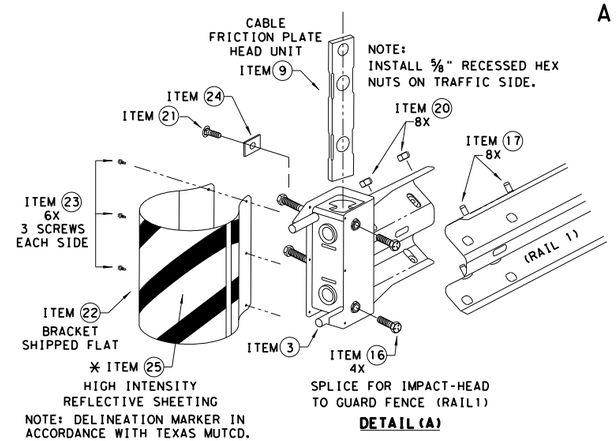

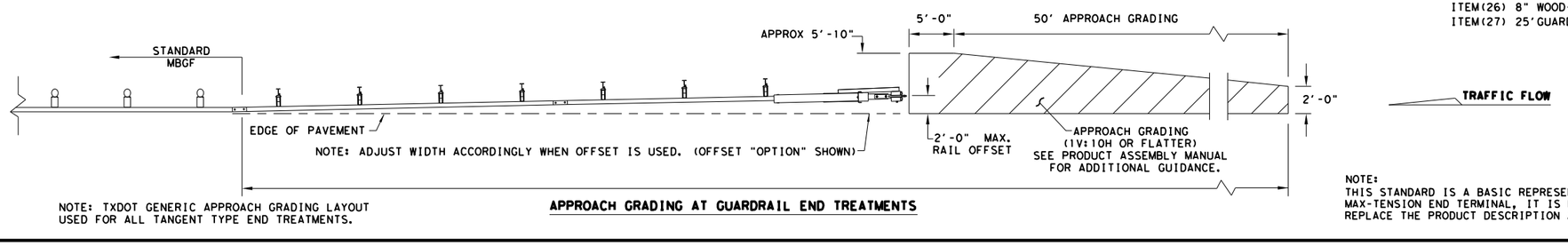

TRAFFIC FLOW

GENERAL NOTES

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

ITEM #	PART NUMBER	DESCRIPTION	QTY
1	BSI-1610060-00	SOIL ANCHOR - GALVANIZED	1
2	BSI-1610061-00	GROUND STRUT - GALVANIZED	1
3	BSI-1610062-00	MAX-TENSION IMPACT HEAD	1
4	BSI-1610063-00	W6x9 I-BEAM POST 6FT.-GALVANIZED	1
5	BSI-1610064-00	TSS PANEL - TRAFFIC SIDE SLIDER	1
6	BSI-1610065-00	ISS PANEL - INNER SIDE SLIDER	1
7	BSI-1610066-00	TOOTH - GEOMET	1
8	BSI-1610067-00	RSS PLATE - REAR SIDE SLIDER	1
9	B061058	CABLE FRICTION PLATE - HEAD UNIT	1
10	BSI-1610069-00	CABLE ASSEMBLY - MASH X-TENSION	2
11	BSI-1012078-00	X-LITE LINE POST-GALVANIZED	8
12	B090534	8" W-BEAM COMPOSITE-BLOCKOUT XT110	8
13	BSI-4004386	12'-6" W-BEAM GUARD FENCE PANELS 12GA.	4
14	BSI-1102027-00	X-LITE SQUARE WASHER	1
15	BSI-2001886	5/8" X 7" THREAD BOLT HH (GR.5)GEOMET	1
16	BSI-2001885	3/4" X 3" ALL-THREAD BOLT HH (GR.5)GEOMET	4
17	4001115	5/8" X 1 1/4" GUARD FENCE BOLTS (GR.2)MGAL	48
18	2001840	5/8" X 10" GUARD FENCE BOLTS MGAL	8
19	2001636	5/8" WASHER F436 STRUCTURAL MGAL	2
20	4001116	5/8" RECESSED GUARD FENCE NUT (GR.2)MGAL	59
21	BSI-2001888	5/8" X 2" ALL THREAD BOLT (GR.5)GEOMET	1
22	BSI-1701063-00	DELINEATION MOUNTING (BRACKET)	1
23	BSI-2001887	1/4" X 3/4" SCREW SD HH 410SS	7
24	4002051	GUARDRAIL WASHER RECT AASHTO FWR03	1
* 25	SEE NOTE BELOW	HIGH INTENSITY REFLECTIVE SHEETING	1
** 26	4002337	8" W-BEAM TIMBER-BLOCKOUT, PDB01B	8
** 27	BSI-4004431	25' W-BEAM GUARDRAIL PANEL,8-SPACE,12GA.	2
28	MANMAX Rev-(D)	MAX-TENSION INSTALLATION INSTRUCTIONS	1

* TO BE PROVIDED BY DISTRIBUTOR OR CONTRACTOR.

** ALTERNATIVE ITEMS NOT SHOWN.
ITEM(26) 8" WOOD-BLOCKOUTS
ITEM(27) 25'GUARD FENCE PANELS

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

Texas Department of Transportation

Design Division Standard

MAX-TENSION END TERMINAL MASH - TL-3

SGT(11S)31-18

FILE: sgt11s3118.dgn	DN: TxDOT	CK: KM	DW: TxDOT	CK: CL
© TxDOT: FEBRUARY 2018	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		67

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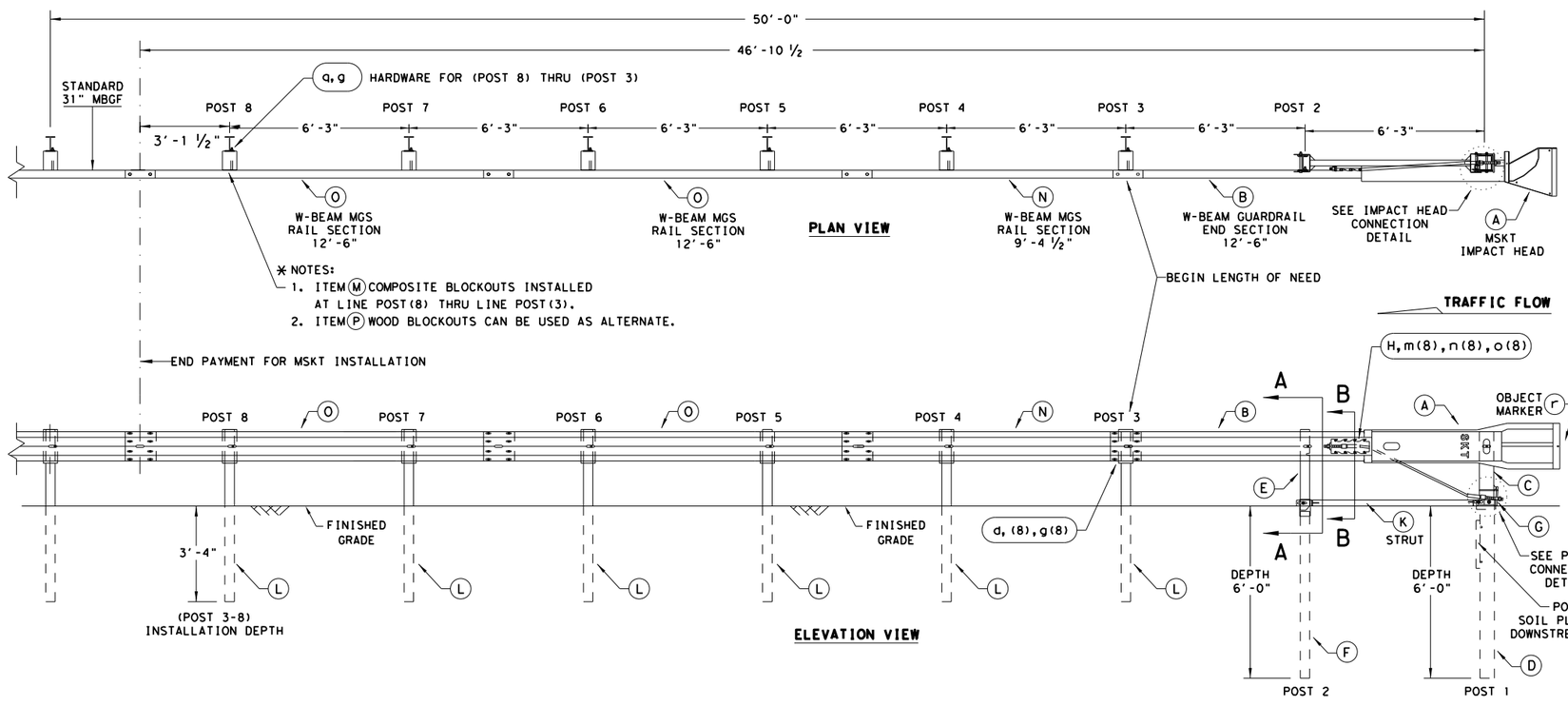
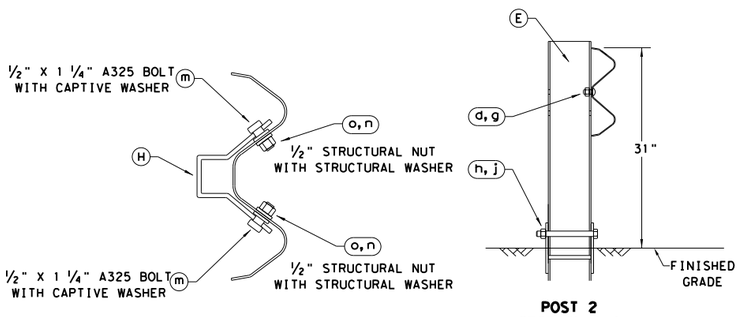
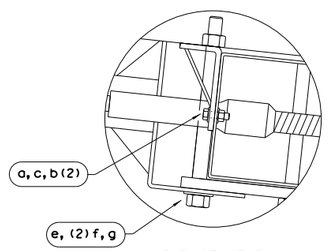
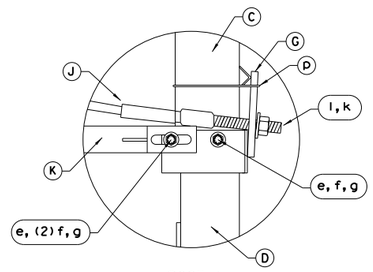
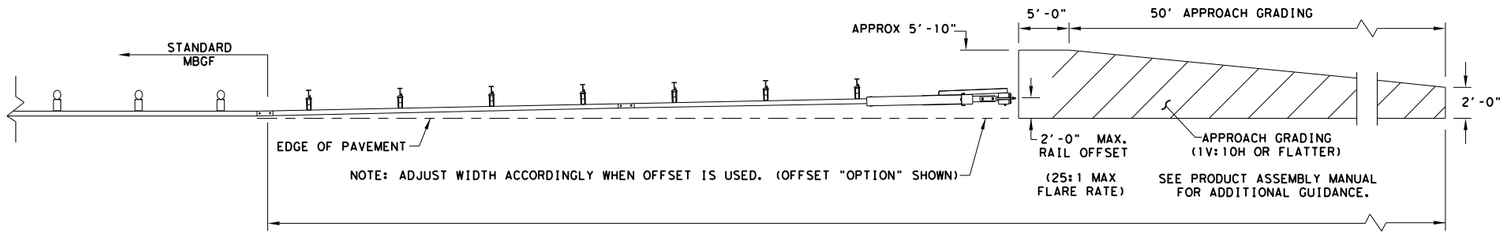


NOTE: SEE (GENERAL NOTE 14) FOR DRIVING CAP INFORMATION.









APPROACH GRADING AT GUARDRAIL END TREATMENTS

NOTE: TXDOT GENERIC APPROACH GRADING LAYOUT USED FOR ALL TANGENT TYPE END TREATMENTS.

GENERAL NOTES

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

ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM NUMBERS
A	1	MSKT IMPACT HEAD	MS3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga.	SF1303
C	1	POST 1 - TOP (6" X 6" X 1/8" TUBE)	MTPHP1A
D	1	POST 1 - BOTTOM (6' W6X15)	MTPHP1B
E	1	POST 2 - ASSEMBLY TOP	UHP2A
F	1	POST 2 - ASSEMBLY BOTTOM (6' W6X9)	HP2B
G	1	BEARING PLATE	E750
H	1	CABLE ANCHOR BOX	S760
J	1	BCT CABLE ANCHOR ASSEMBLY	E770
K	1	GROUND STRUT	MS785
L	6	W6x9 OR W6x8.5 STEEL POST	P621
M	6	COMPOSITE BLOCKOUTS	CBSP-14
N	1	W-BEAM MGS RAIL SECTION (9'-4 1/2")	G12025
O	2	W-BEAM MGS RAIL SECTION (12'-6")	G1203A
P	6	WOOD BLOCKOUT 6" X 8" X 14"	P675
Q	1	W-BEAM MGS RAIL SECTION (25'-0")	G1209
		SMALL HARDWARE	
a	2	5/16" x 1" HEX BOLT (GRD 5)	B5160104A
b	4	5/16" WASHER	W0516
c	2	5/16" HEX NUT	N0516
d	25	5/8" Dia. x 1 1/4" SPLICE BOLT (POST 2)	B580122
e	2	5/8" Dia. x 9" HEX BOLT (GRD A449)	B580904A
f	3	5/8" WASHER	W050
g	33	5/8" Dia. H.G.R NUT	N050
h	1	3/4" Dia. x 8 1/2" HEX BOLT (GRD A449)	B340854A
j	1	3/4" Dia. HEX NUT	N030
k	2	1 ANCHOR CABLE HEX NUT	N100
l	2	1 ANCHOR CABLE WASHER	W100
m	8	1/2" x 1 1/4" A325 BOLT WITH CAPTIVE WASHER	SB12A
n	8	1/2" STRUCTURAL NUTS	N012A
o	8	1 1/16" O.D. x 5/16" I.D. STRUCTURAL WASHERS	W012A
p	1	BEARING PLATE RETAINER TIE	CT-100ST
q	6	5/8" x 10" H.G.R. BOLT	B581002
r	1	OBJECT MARKER 18" X 18"	E3151

SEE NOTES: *

ALTERNATIVE ITEMS NOT SHOWN. **
* ITEM(P) 8" WOOD-BLOCKOUT
** ITEM(Q) 25'GUARD FENCE PANEL

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

Texas Department of Transportation

Design Division Standard

SINGLE GUARDRAIL TERMINAL
MSKT-MASH-TL-3
SGT(12S)31-18

FILE: sgt12s3118.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CL	
© TxDOT: APRIL 2018	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0019	03	028 Etc.	SH 171	
	DIST	COUNTY		SHEET NO.	
	WAC	HILL		68	

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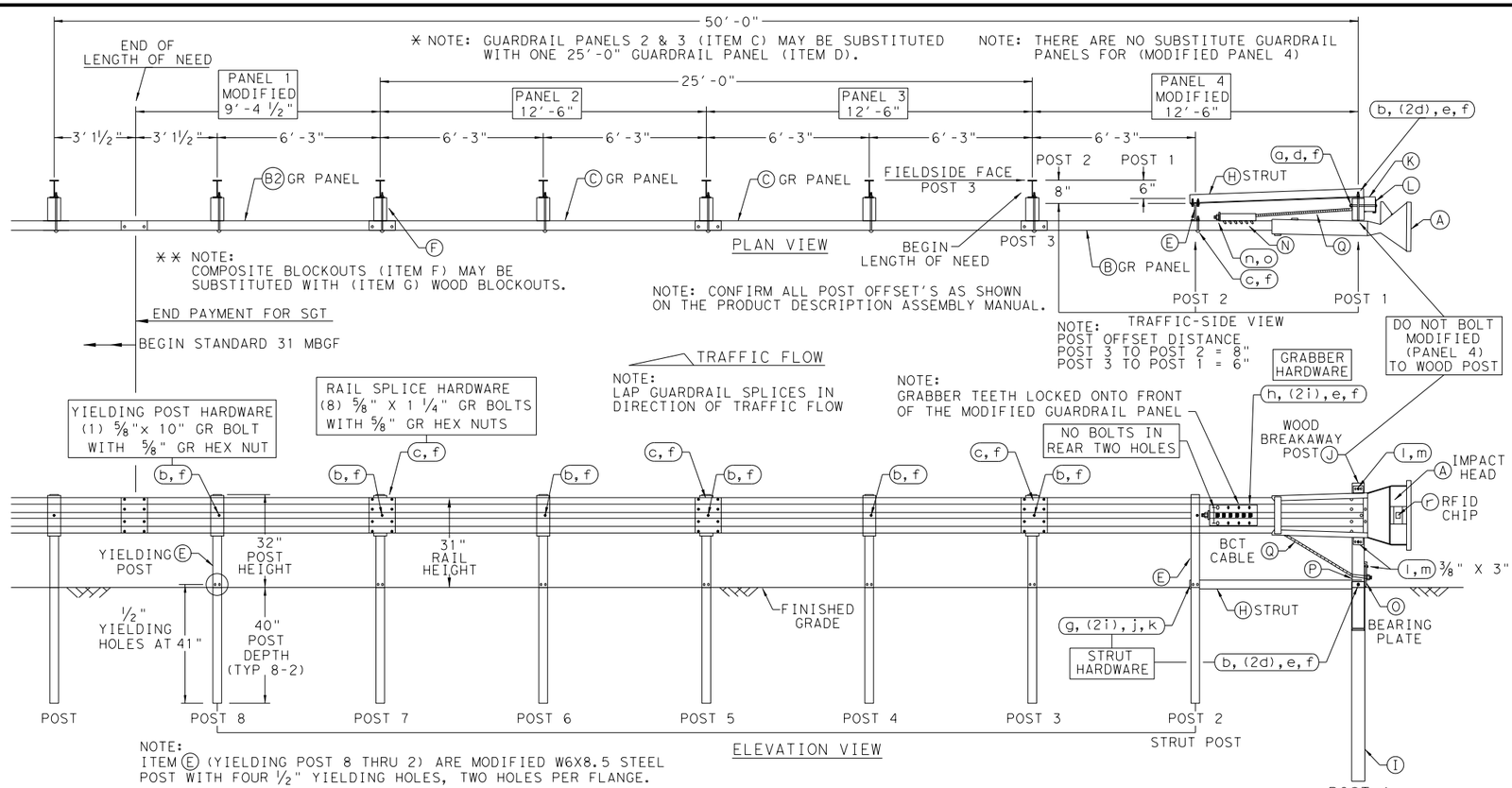
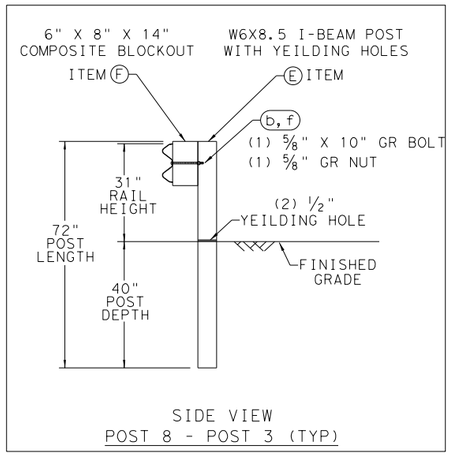


GENERAL NOTES

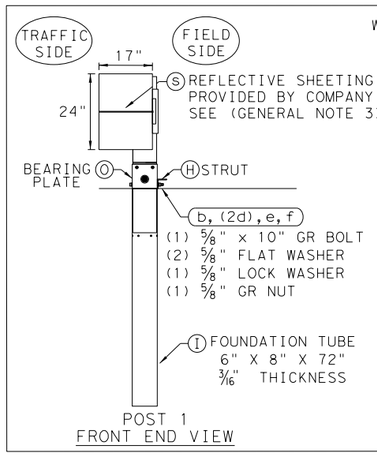
1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: SPIG INDUSTRY, INC. AT 1(267) 644-9510. 14675 INDUSTRIAL PARK RD; BRISTOL, VA 24202
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE MANUFACTURER'S; SGET END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY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

ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM #
A	1	SGET IMPACT HEAD	SIH1A
B	1	MODIFIED GUARDRAIL PANEL 12'-6" 12GA	126SPZGP
B2	1	MODIFIED GUARDRAIL PANEL 9'-4 1/2" 12GA	GP94
C	2	STANDARD GUARDRAIL PANEL 12'-6" 12GA	GP126
D	1	STANDARD GUARDRAIL PANEL 25'-0" 12GA	GP25
E	7	MODIFIED YIELDING I-BEAM POST W6x8.5	YP6MOD
F	6	COMPOSITE BLOCKOUT 6" X 8" X 14"	CBO8
G	6	WOOD BLOCKOUT 6" X 8" X 14"	WBO8
H	1	STRUT 3" X 3" X 80" x 1/4" A36 ANGLE	STR80
I	1	FOUNDATION TUBE 6" X 8" X 72" x 3/16"	FNDT6
J	1	WOOD BREAKAWAY POST 5 1/2" x 7 1/2" x 50"	WBRK50
K	1	WOOD STRIKE BLOCK	WSBLK14
L	1	STRIKE PLATE 1/4" A36 BENT PLATE	SPLT8
M	1	REINFORCEMENT PLATE 12 GA. GR55	REPLT17
N	1	GUARDRAIL GRABBER 2 1/2" X 2 1/2" X 16 1/2"	GGR17
O	1	BEARING PLATE 8" X 8 5/8" X 5/8" A36	BPLT8
P	1	PIPE SLEEVE 4 1/4" X 2 3/8" O.D. (2 1/8" I.D.)	PSLV4
Q	1	BCT CABLE 3/4" X 81" LENGTH	CBL81
		SMALL HARDWARE	
a	1	5/8" X 12" GUARDRAIL BOLT 307A HDG	12GRBLT
b	7	5/8" X 10" GUARDRAIL BOLT 307A HDG	10GRBLT
c	33	5/8" X 1 1/4" GR SPLICE BOLTS 307A HDG	1GRBLT
d	3	5/8" FLAT WASHER F436 A325 HDG	58FW436
e	1	5/8" LOCK WASHER HDG	58LW
f	39	5/8" GUARDRAIL HEX NUT HDG	58HN563
g	2	1/2" X 2" STRUT BOLT A325 HDG	2BLT
h	6	1/2" X 1 1/4" PLATE BOLT A325 HDG	125BLT
i	16	1/2" FLAT WASHER F436 A325 HDG	12FWF436
j	8	1/2" LOCK WASHER HDG	12LW
k	8	1/2" HEX NUT A563 HDG	12HN563
l	4	3/8" X 3" HEX LAG SCREW GR5 HDG	38LS
m	4	3/8" FLAT WASHER F436 A325 HDG	38FW844
n	2	1" FLAT WASHER F436 A325 HDG	1FWF436
o	2	1" HEX NUT A563DH HDG	1HN563
p	1	18" TO 24" LONG ZIP TIE RATED 175-200LB	ZPT18
q	1	1 1/2" X 4" SCH-40 PVC PIPE	PSPCR4
r	1	RFID CHIP RATED MIL-STD-810F	RFID810F
s	1	IMPACT HEAD REFLECTIVE SHEETING	RS30M

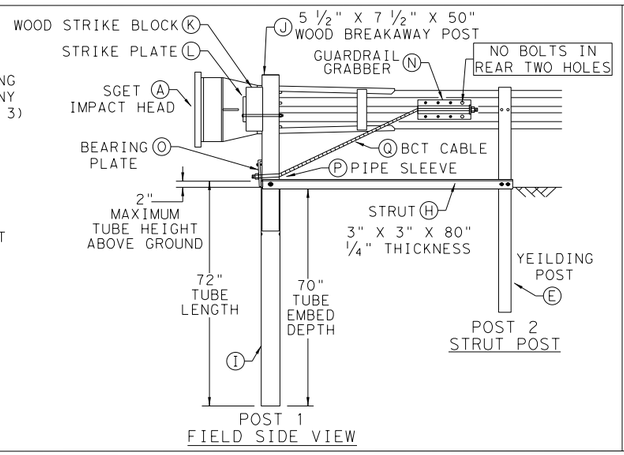
ALTERNATIVE ITEMS
* D
** G
NOTE: SEE PLAN VIEW



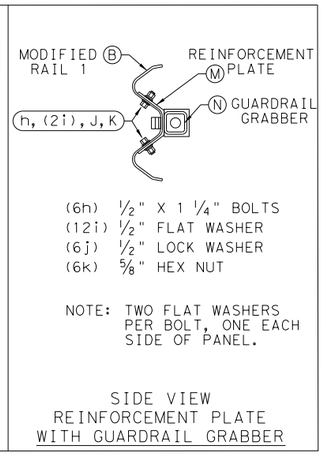
SIDE VIEW
POST 8 - POST 3 (TYP)



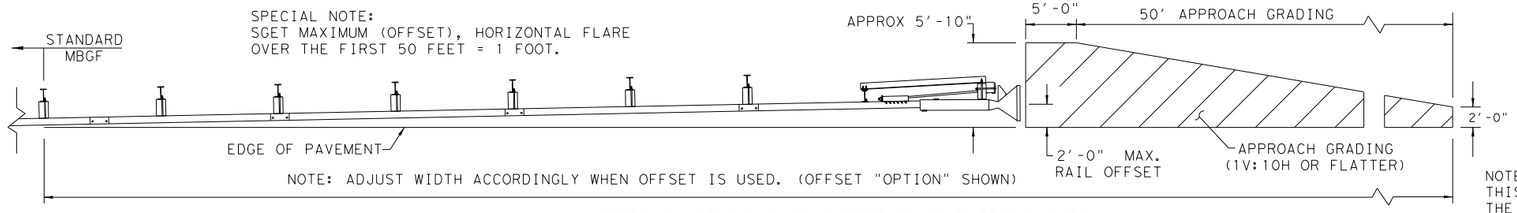
POST 1
FRONT END VIEW



POST 1
FIELD SIDE VIEW



SIDE VIEW
REINFORCEMENT PLATE
WITH GUARDRAIL GRABBER



APPROACH GRADING AT GUARDRAIL END TREATMENTS

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

Texas Department of Transportation

Design Division Standard

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

FILE: sgt153120.dgn	DN: TxDOT	CK: KM	DW: VP	CK: VP	
©TxDOT: APRIL 2020	CONT	SECT	JOB	HIGHWAY	
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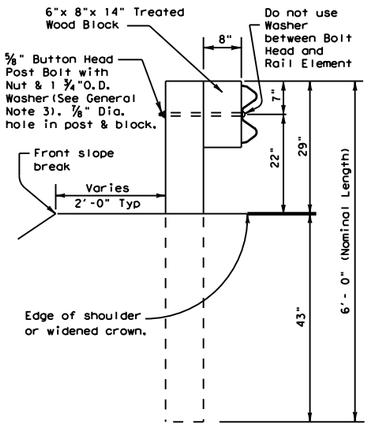
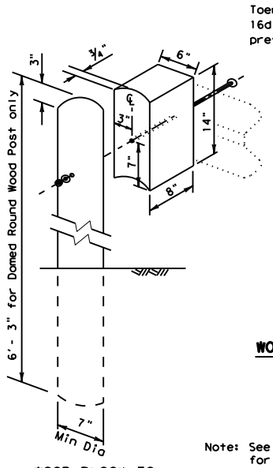
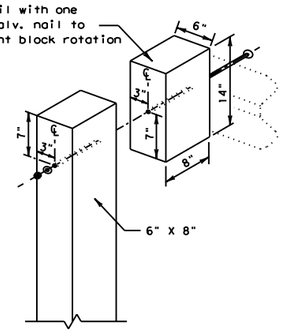


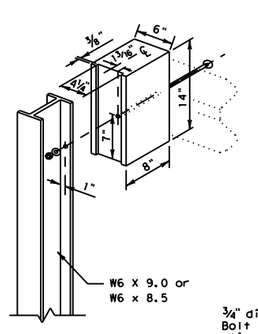
TYPICAL POST



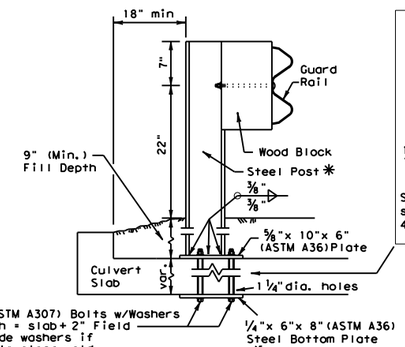
WOOD BLOCK TO ROUND WOOD POST



WOOD BLOCK TO RECTANGULAR WOOD POST

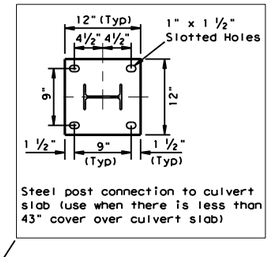


WOOD BLOCK TO STEEL POST

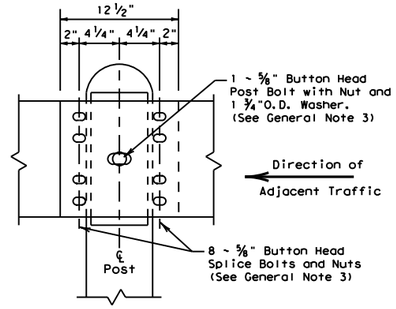


*LOW FILL CULVERT POST

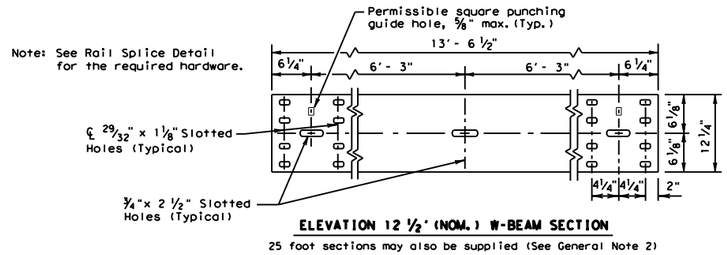
FOR USE ON NON-BRIDGE CLASS CULVERTS ONLY



* Post(s) may require field modifications to ensure proper guardrail height.

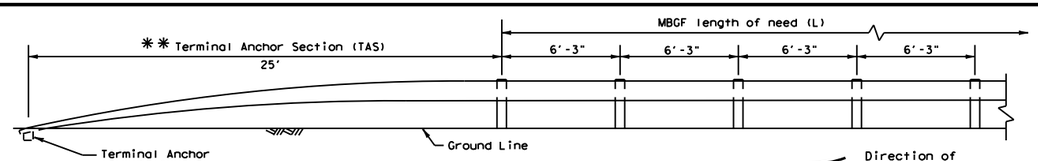


RAIL SPLICE DETAIL



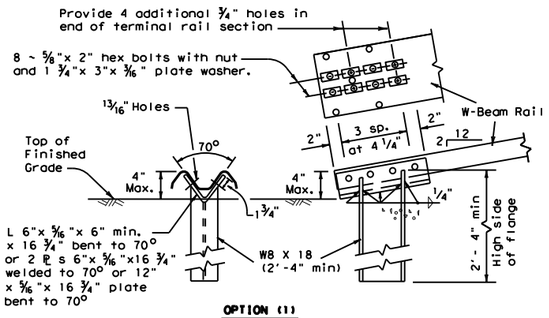
ELEVATION 12½' (NOM.) W-BEAM SECTION

25 foot sections may also be supplied (See General Note 2)



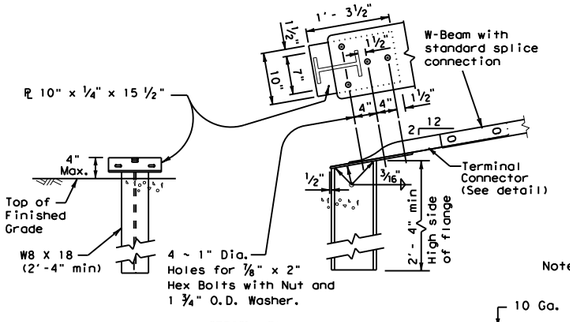
** TERMINAL ANCHOR SECTION (TAS)

Terminal anchor sections are only for downstream use, when located outside the horizontal clearance area of opposing traffic.



OPTION (1)

Note: This anchor post requires four additional ¾" holes (shop or field) in the rail member with eight ⅝" hex bolts with nut and plate washer.

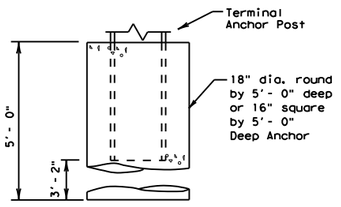


OPTION (2)

Note: This anchor post requires the use of the 10 ga. terminal connector with four ⅞" hex bolts with nut and washer.

TERMINAL ANCHOR POST OPTIONS

(See General Note 11)



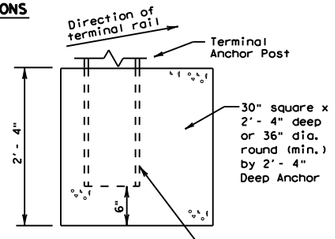
Notes:

Either concrete anchor may be used with either post option above.

No construction joint is allowed in the concrete anchor.

Terminal rail may be bolted to post and in twist position prior to placing concrete anchor.

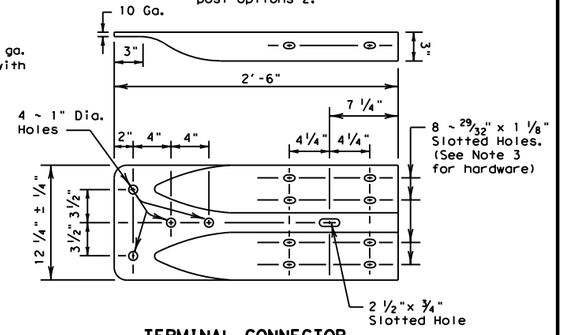
If concrete anchor is precast, the area should be compacted as directed by the Engineer, when placed in the field.



TERMINAL CONCRETE ANCHOR OPTIONS

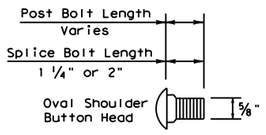
(See General Note 11)

Note: Terminal Connector to be used with terminal anchor post options 2.



TERMINAL CONNECTOR

For connection hardware to concrete rails, see the MBGF transition standards.



BUTTON HEAD BOLT

Post and Splice Bolts (See General Note 3)

GENERAL NOTES

1. The type of post (round wood post, rectangular wood post, or steel post) will be shown elsewhere in the plans. The exact position of MBGF shall be shown elsewhere in the plans or as directed by the Engineer. Steel posts to be galvanized in accordance with Item 445, "Galvanizing."
2. Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified on the plans. The Contractor may furnish rail elements of 12½ or 25 foot nominal lengths.
3. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and Type A (1¾" O.D.) washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 1¼" (or 2" long at triple rail splices) with a ⅝" double recessed nut (ASTM A563).
4. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item.
5. Crown shall be widened to accommodate the Metal Beam Guard Fence.
6. The lateral approach to the guard fence, shall have a slope rate of not more than 1V:10H.
7. Unless otherwise shown in the plans, guard fence placed in the vicinity of curbs shall be positioned so that the face of curb is located directly below or behind the face of the block. Rail placed over curbs shall be installed so that the post bolt is located approximately 21 inches above the gutter pan or roadway surface.
8. If solid rock is encountered within 0 to 18" of the finished grade, drill a 22" dia. hole, 24" into the rock, or drill two 12" dia. front to back overlapping holes, 24" into the rock. If solid rock is encountered below 18", drill a 12" dia. hole, 12" into the rock or to the standard embedment depth, whichever is less. Any excess post length, after meeting these depths, may be field cut to ensure proper guardrail mounting height. Backfill with a cohesionless material.
9. Posts shall not be set in concrete, of any depth.
10. Special fabrication will be required at installations having a curvature of less than 150 ft. radius.
11. The terminal anchor section (TAS) post shall be set in Class A concrete (unless otherwise shown in the plans) in accordance with Item 421, "Hydraulic Cement Concrete." Concrete shall be subsidiary to the bid item requiring construction of the terminal anchor section (TAS). Terminal anchor post to be galvanized in accordance with Item 445, "Galvanizing."
12. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.

ONLY FOR USE IN MAINTENANCE REPAIRS OR HIGHLY CONSTRAINED SITE CONDITIONS.

Texas Department of Transportation

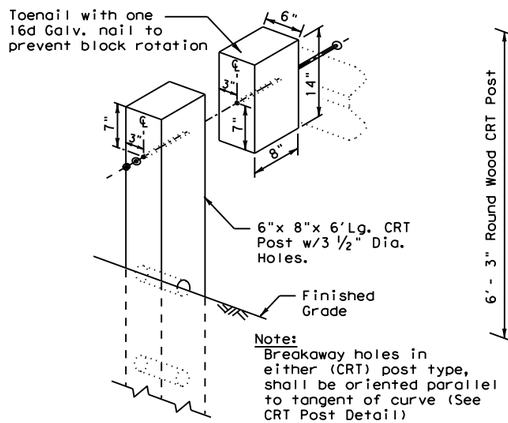
Design Division Standard

METAL BEAM GUARD FENCE

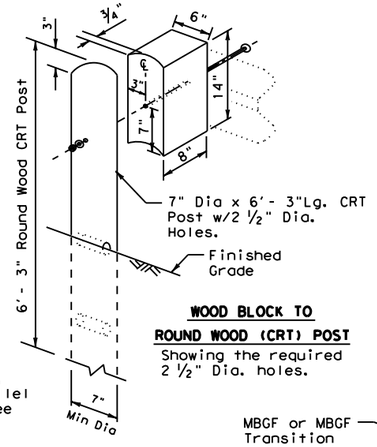
MBGF-19

FILE: mbgf19.dgn	DN: TxDOT	CK: KM	DW: BD	CK: VP
©TxDOT NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		70

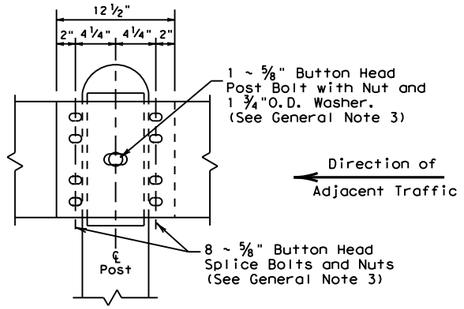
DATE: 5/19/2022
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\001903028\4 - Design\Plan Set\3. Roadway\Standards\MBGF-SR-19_JEQ.dgn



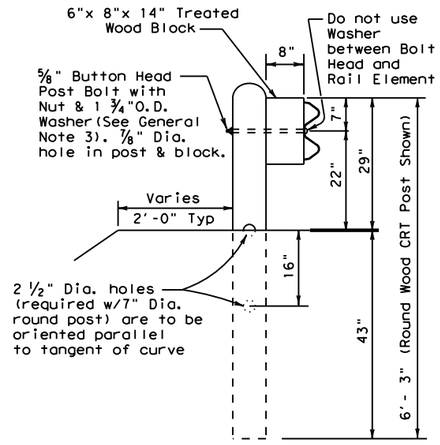
WOOD BLOCK TO RECTANGULAR WOOD (CRT) POST
Showing the required 3 ½" Dia. holes.



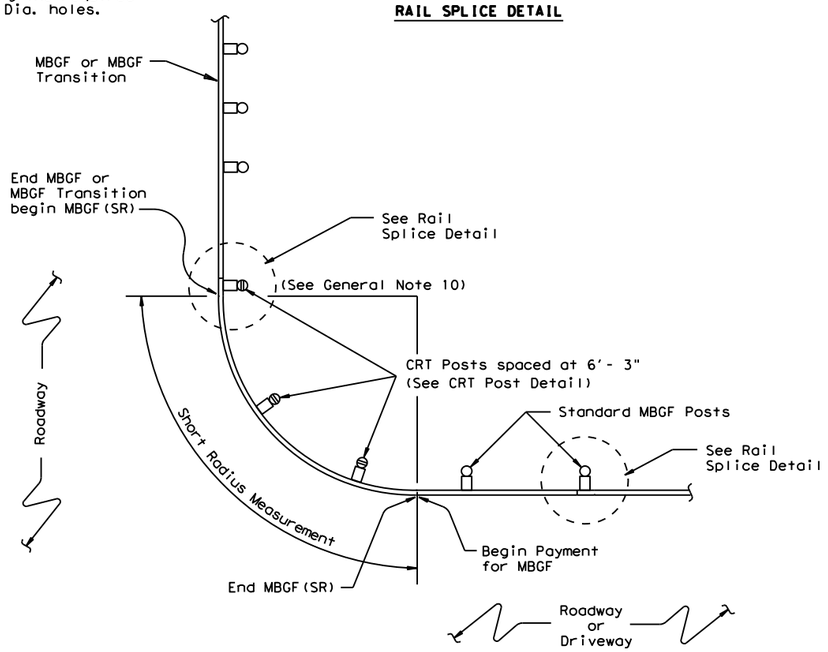
WOOD BLOCK TO ROUND WOOD (CRT) POST
Showing the required 2 ½" Dia. holes.



RAIL SPLICE DETAIL



(CRT) POST DETAIL
CONTROLLED RELEASE TERMINAL POST
Two or more wood CRT post(s) are required at any radius installation located at intersecting roadways or driveways.



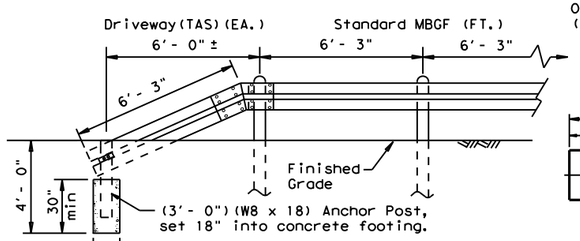
PLAN VIEW
SHOWING TYPICAL RADIUS
The required radius is shown elsewhere on the plans.

GENERAL NOTES

1. The type of (CRT) post (round wood post, or rectangular wood post) will be shown elsewhere in the plans. The exact position of MBGF shall be shown elsewhere in the plans or as directed by the Engineer.
2. Steel posts are not permitted at CRT post positions.
3. Rail element shall meet the requirements of Item 540,"Metal Beam Guard Fence" except as modified on the plans. The Contractor may furnish rail elements of 12 ½ or 25 foot nominal lengths.
4. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and Type A (1 ¾" O.D.)washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 1 ¼" (or 2" long at triple rail splices) with a ⅝" double recessed nut (ASTM A563).
5. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item.
6. Crown shall be widened to accommodate the Metal Beam Guard Fence.
7. The lateral approach to the guard fence, shall have a slope rate of not more than 1V:10H.
8. Unless otherwise shown in the plans, guard fence placed in the vicinity of curbs shall be positioned so that the face of curb is located directly below or behind the face of the block. Rail placed over curbs shall be installed so that the post bolt is located approximately 21 inches above the gutter pan or roadway surface.
9. If solid rock is encountered within 0 to 18" of the finished grade, drill a 22" dia. hole, 24" into the rock, or drill two 12" dia. front to back overlapping holes, 24" into the rock. If solid rock is encountered below 18",drill a 12" dia. hole, 12" into the rock or to the standard embedment depth, whichever is less. Any excess post length, after meeting these depths, may be field cut to ensure proper guardrail mounting height. Backfill with a cohesionless material.
10. Guardrail posts shall not be set in concrete, of any depth.
11. Special rail fabrication will be required at installations having a curvature of less than 150 ft. radius. The required radius shall be shown on the plans.
12. The terminal anchor section (TAS) post shall be set in Class A concrete (unless otherwise shown in the plans) in accordance with Item 421,"Hydraulic Cement Concrete." Concrete shall be subsidiary to the bid item requiring construction of the terminal anchor section (TAS). Terminal anchor post to be galvanized in accordance with Item 445, "Galvanizing."
13. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210,"Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.

"DRIVEWAY" TERMINAL ANCHOR SECTION

Only for use within driveway locations, where a standard (TAS) Terminal Anchor Section can not be installed.



ELEVATION LAYOUT

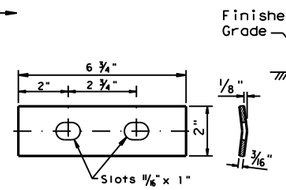
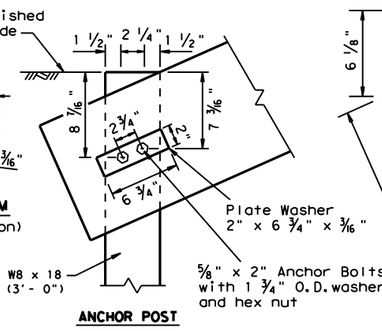
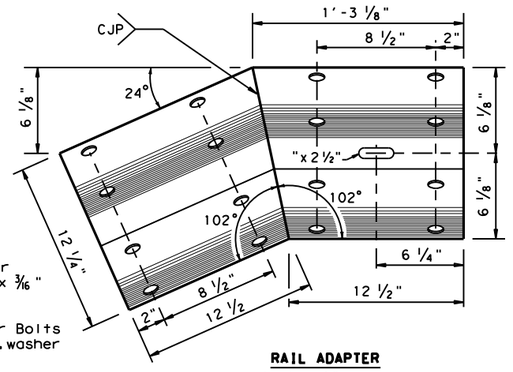


PLATE WASHER FOR METAL BEAM
(Galvanized after fabrication)



ANCHOR POST



RAIL ADAPTER
Rail - 10 gauge
(Galvanized after fabrication)

GENERAL NOTES

1. The "Driveway" Terminal Anchor Section is ONLY to be used within driveway locations, where the ROW is limited and a standard 25 ft.(TAS)Terminal Anchor Section,is too long.
2. Terminal anchor post shall be set in Class A concrete.
3. All steel shall be galvanized after fabrication in accordance with Item 445, "Galvanizing."

ONLY FOR USE IN MAINTENANCE REPAIRS OR HIGHLY CONSTRAINED SITE CONDITIONS.

Texas Department of Transportation — Design Division Standard

METAL BEAM GUARD FENCE
(SHORT RADIUS)
MBGF(SR)-19

FILE: mbgfsr19.dgn	DN: TxDOT	CK: KM	DW: BD	CK: VP
©TxDOT NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		71

				NRCS Time of Concentration		Rational Method				NRCS Method		
Drainage Area	Area (ac)	Area (sm)	C	NRCS t_c (hr)	NRCS t_c (min)	I (in/hr) (10 yr)	I (in/hr) (100 yr)	Q (cfs) (10 yr)	Q (cfs) (100 yr)	SCS Lag Time (min)	Q (cfs) (10 yr)	Q (cfs) (100 yr)
1	33.73	0.0527	0.37	0.51	30.81	4.02	6.35	50.2	79.3			
2	351.13	0.5486	0.37	1.296	77.74	NRCS	NRCS	NRCS	NRCS	46.6	593.20	1057.50
3	969.79	1.5153	0.37	1.788	107.25	NRCS	NRCS	NRCS	NRCS	64.4	1303.30	2321.40
4	437.18	0.6831	0.37	1.118	67.05	NRCS	NRCS	NRCS	NRCS	40.2	832.10	1479.60
5	214.29	0.3348	0.37	0.848	50.89	NRCS	NRCS	NRCS	NRCS	30.5	472.20	838.10
6	40.87	0.0639	0.37	0.446	26.74	4.37	6.88	66.1	104.1			
6a	206.53	0.3227	0.37	0.649	38.94	NRCS	NRCS	NRCS	NRCS	23.4	515.60	916.80
6b	7.01	0.0110	0.37	0.427	25.62	4.48	7.04	11.6	18.3			
6c	4.76	0.0074	0.37	0.300	18.01	5.41	8.44	9.5	14.9			
7	32.21	0.0503	0.37	0.700	41.97	3.32	5.28	39.6	62.9			
7a	29.30	0.0458	0.37	0.740	44.42	3.20	5.10	34.7	55.2			
8	1022.00	1.5969	0.37	1.415	84.90	NRCS	NRCS	NRCS	NRCS	50.9	1627.40	2912.20
9	14.08	0.0220	0.37	0.548	32.89	3.87	6.12	20.2	31.9			
10	25.13	0.0393	0.37	0.536	32.14	3.92	6.20	36.5	57.6			
11	425.30	0.6645	0.37	1.129	67.71	NRCS	NRCS	NRCS	NRCS	40.6	768.60	1373.60
12	62.26	0.0973	0.37	0.679	40.74	3.39	5.38	78.0	123.9			
14	13.25	0.0207	0.37	0.397	23.84	4.66	7.32	22.9	35.9			
15	26.06	0.0407	0.37	0.483	28.97	4.17	6.58	40.2	63.5			
16	89.69	0.1401	0.37	0.784	47.05	3.09	4.91	102.4	163.1			
17	27.89	0.0436	0.37	0.611	36.65	3.62	5.74	37.4	59.2			
18	2.95	0.0046	0.37	0.333	19.99	5.13	8.02	5.6	8.8			
19	3.82	0.0060	0.37	0.340	20.39	5.07	7.94	7.2	11.2			
20	237.64	0.3713	0.37	1.400	83.98	NRCS	NRCS	NRCS	NRCS	50.4	381.30	682.10
21	324.90	0.5077	0.37	1.289	77.34	NRCS	NRCS	NRCS	NRCS	46.4	550.20	980.90
22	330.13	0.5158	0.37	1.265	75.92	NRCS	NRCS	NRCS	NRCS	45.6	564.30	1005.10
23	65.94	0.1030	0.37	0.644	38.61	3.50	5.56	85.5	135.6			
24	219.26	0.3426	0.37	1.248	74.90	NRCS	NRCS	NRCS	NRCS	44.9	377.80	672.50
25	9.80	0.0153	0.37	0.374	22.47	4.82	7.56	17.5	27.4			
26	5.39	0.0084	0.37	1.149	68.92	2.39	3.82	4.8	7.6			
27	1609.39	2.5147	0.37	1.098	65.89	NRCS	NRCS	NRCS	NRCS	39.5	2966.90	5296.80
28	455.82	0.7122	0.37	1.321	79.25	NRCS	NRCS	NRCS	NRCS	47.5	761.50	1358.80
29	27.23	0.0426	0.37	0.534	32.05	3.93	6.21	39.6	62.6			
30	458.97	0.7171	0.37	1.536	92.15	NRCS	NRCS	NRCS	NRCS	55.3	679.30	1212.10
31	130.84	0.2044	0.37	1.359	81.55	2.12	3.40	102.7	164.8			
32	60.62	0.0947	0.37	1.014	60.82	2.60	4.16	58.3	93.2			
32a	3.53	0.0055	0.37	0.508	30.46	4.05	6.39	5.3	8.4			
33	27.54	0.0430	0.37	0.798	47.86	3.05	4.86	31.1	49.5			
34	17.86	0.0279	0.37	0.775	46.53	3.11	4.95	20.5	32.7			
35	18.61	0.0291	0.37	0.909	54.53	2.80	4.47	19.3	30.8			
36	4486.14	7.0096	0.37	1.338	80.30	NRCS	NRCS	NRCS	NRCS	48.2		
37	4227.62	6.6057	0.37	0.898	53.85	NRCS	NRCS	NRCS	NRCS	32.3		

1. THE DESIGN STORM IS THE 10-YEAR STORM.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

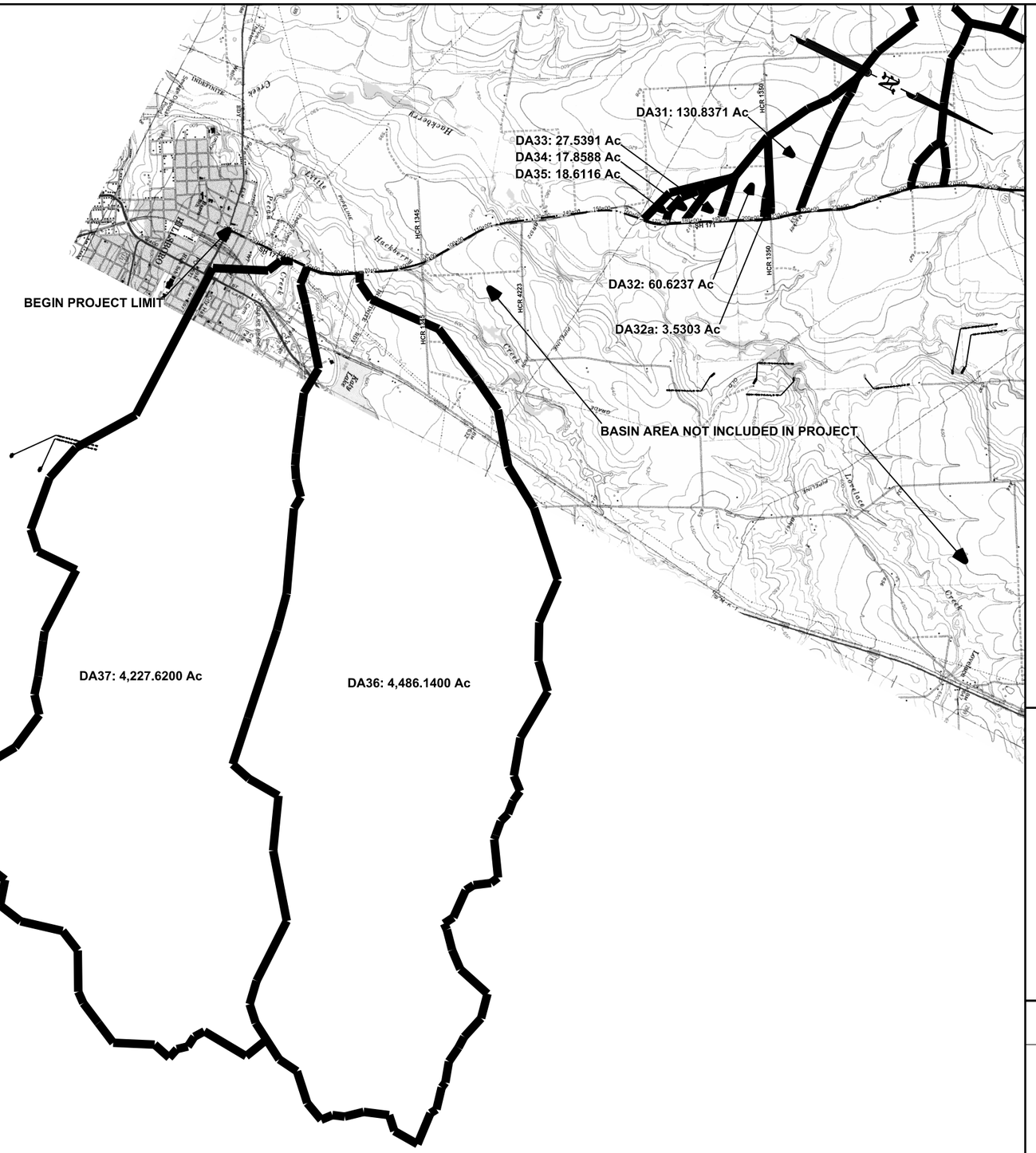
Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

DRAINAGE CALCULATIONS

SHEET 1 OF 1

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		72



NOTES:

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/19/2022

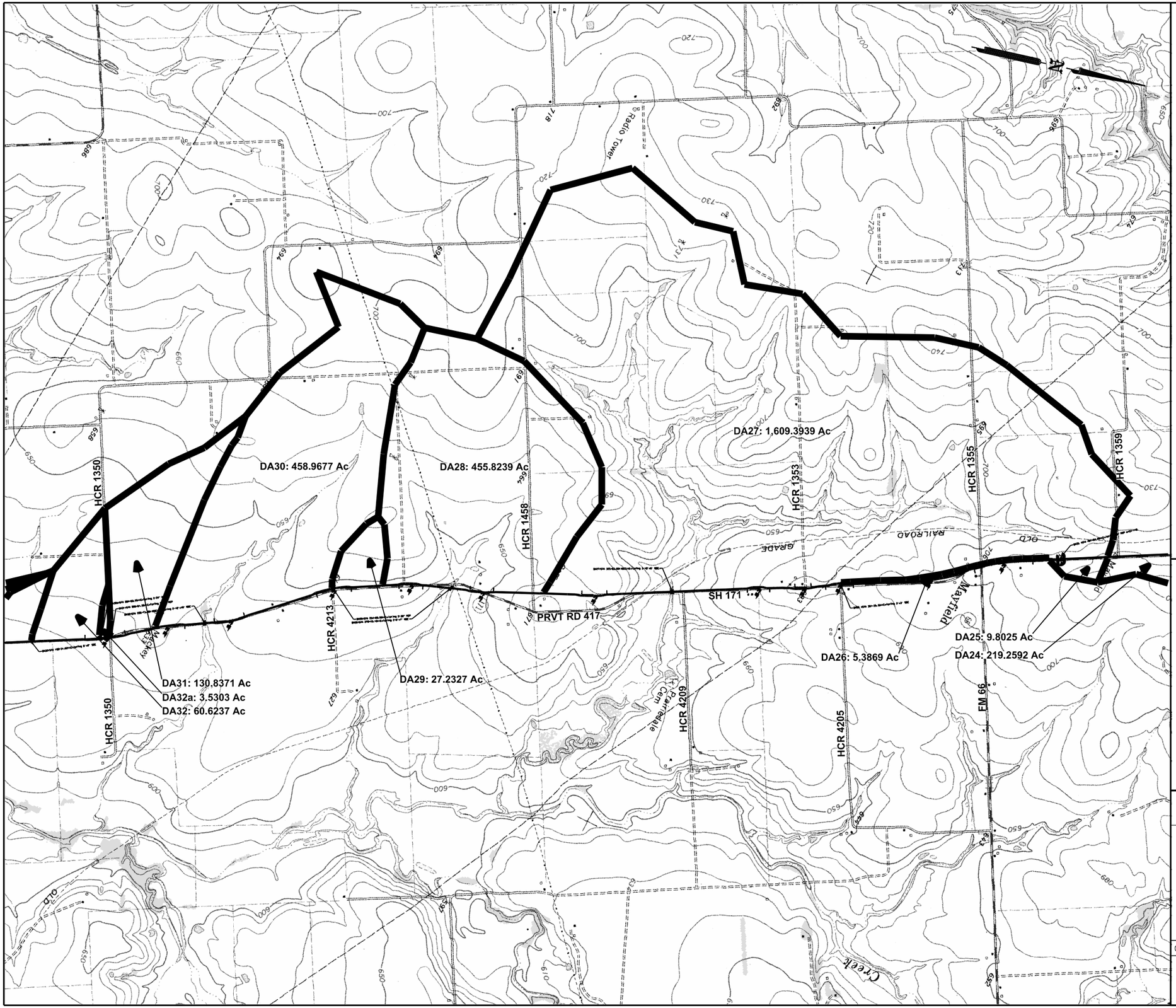
SIGNATURE OF REGISTRANT & DATE

DRAINAGE AREA MAP

1" = 4,000'

SHEET 1 OF 5

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	HILL		73



NOTES:

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. — 5/19/2022

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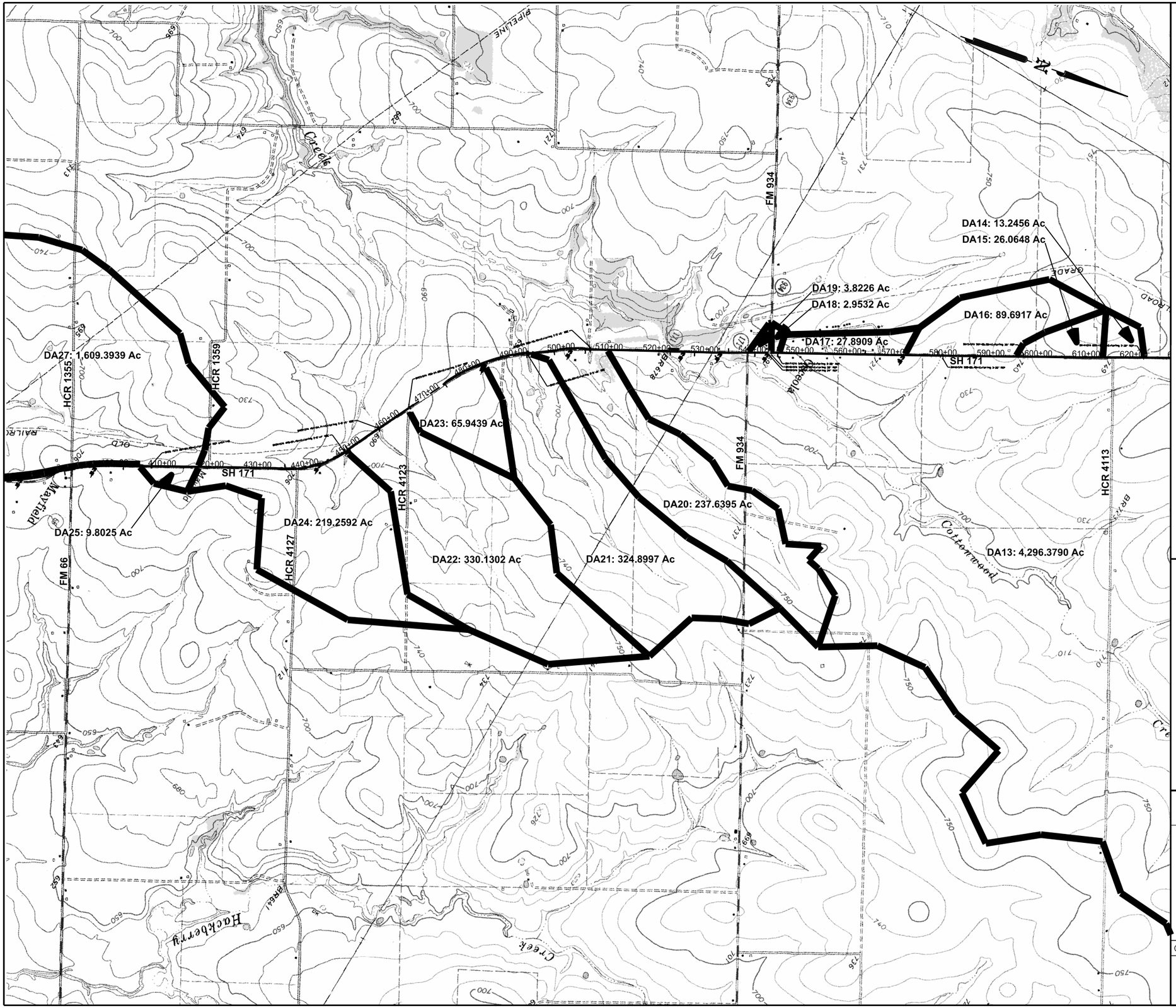
DRAINAGE AREA MAP

1" = 2,000'

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	HILL		74



NOTES:

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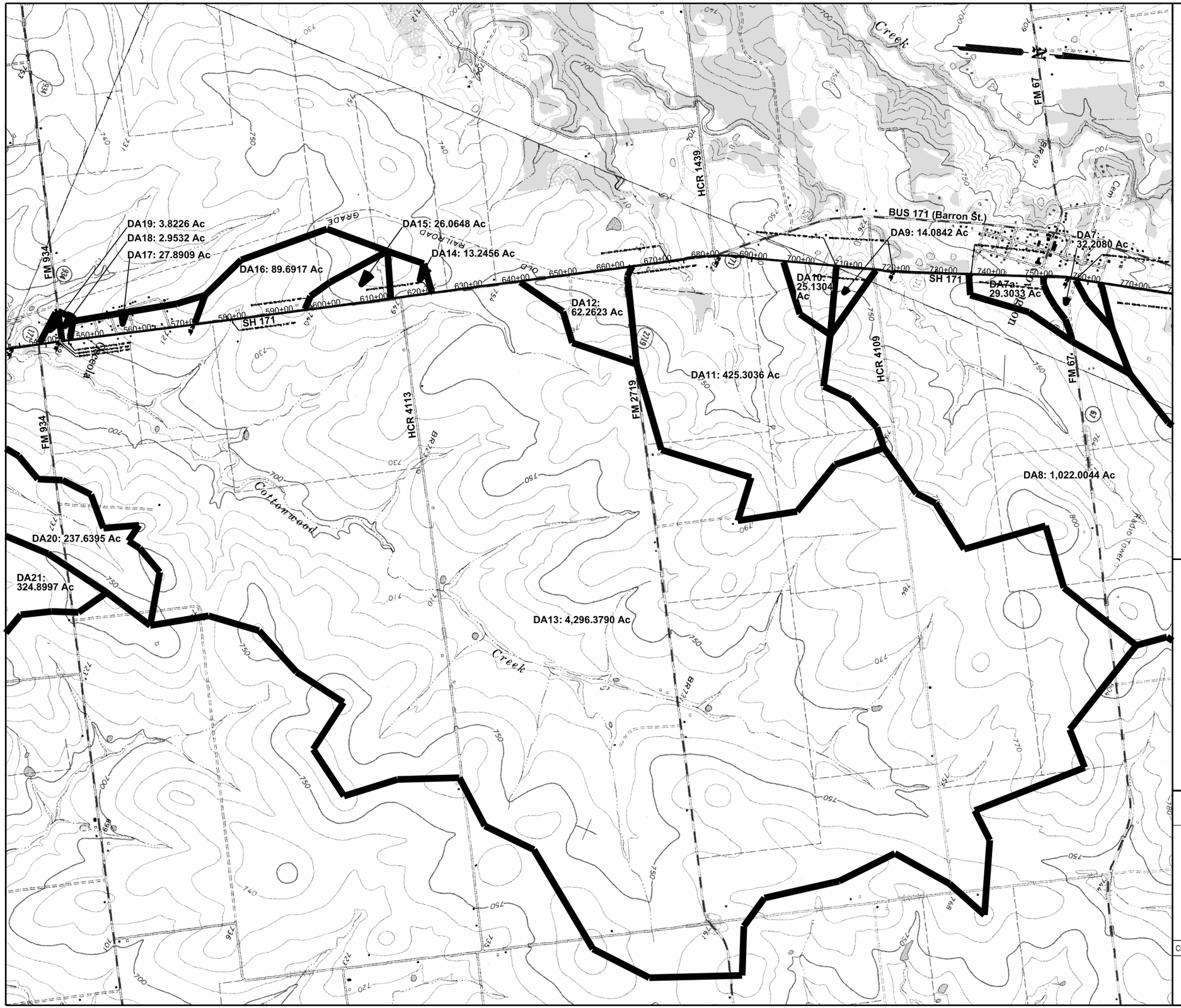
DRAINAGE AREA MAP

1" = 2,000'

SHEET 3 OF 5

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	HILL		75



NOTES:

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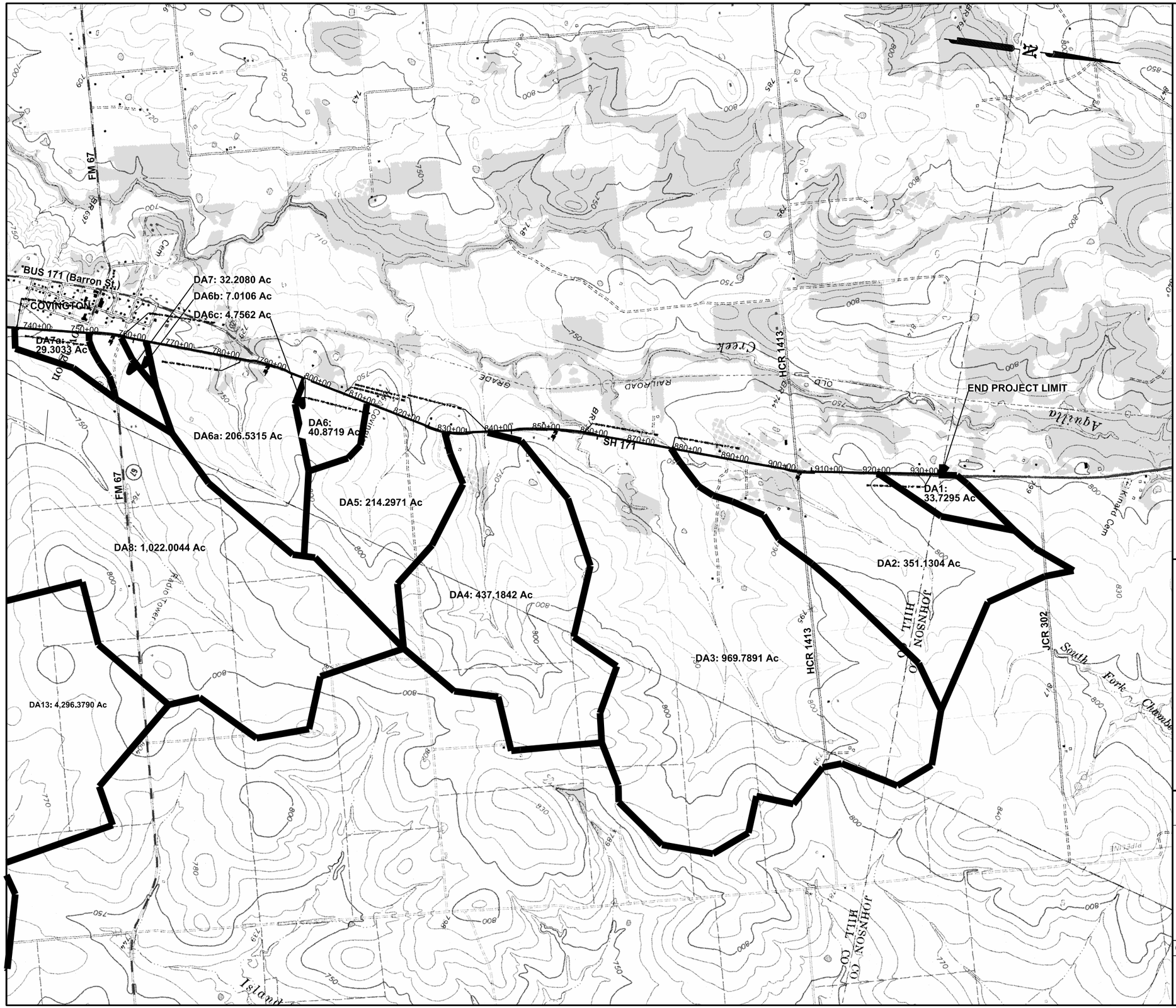
DRAINAGE AREA MAP

1" = 2,000' SHEET 4 OF 5

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	HILL		76



NOTES:

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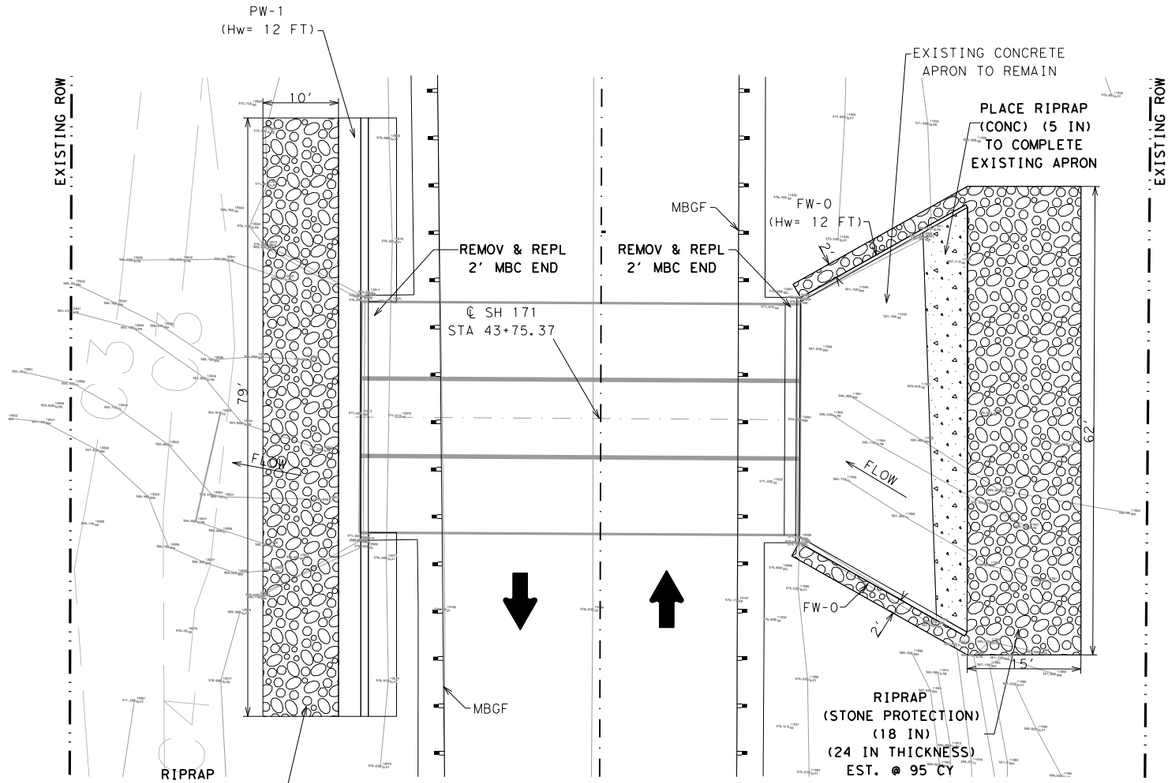
DRAINAGE AREA MAP

1" = 2,000' SHEET 5 OF 5

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	HILL		77



NOTE: EXISTING CULVERT TO REMAIN.
HISTORICAL RECORDS SHOW THAT THIS CULVERT HAS NOT OVERTOPPED. BASED ON ENGINEERING JUDGEMENT, HYDRAULIC ANALYIS IS NOT REQUIRED.

STATION 43+75.37 (CULVERT 37) (NBI: 091100041803042)
EXISTING 3 ~ 10' X 10' X 58' MBC (BRIDGE CLASS)
REMOVE AND REPLACE 2' ON EACH END; REMOVE & REPLACE ENDS; ADD CONC RIPRAP APRON RT;
PROTECT ENDS W/MBGF;
PW LT & FW-0 RT, MC-MD, MC-10-7, ECD, SRR LT & RT

NOTES:

1. SEE MBGF LAYOUTS FOR INFORMATION REGARDING METAL BEAM GUARD FENCE.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.
4. TIE PROPOSED CONCRETE TO EXISTING CONCRETE WITH 24" #4 REBAR SPACED AT 24".

ITEM	DESCRIPTION	UNIT	QTY
0110-6002	EXCAVATION (CHANNEL)	CY	20
0132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	10
0403-6001	TEMPORARY SPL SHORING	SF	936
0432-6002	RIPRAP (CONC)(5 IN)	CY	5
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	177
0480-6001	CLEAN EXIST CULVERTS	EA	1
0462-6078	CONC BOX CULV (10 FT X 10 FT)(EXTEND)	LF	12
0466-6144	WINGWALL (FW-0) (HW-12 FT)	EA	1
0466-6173	WINGWALL (PW - 1) (HW=12 FT)	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	12

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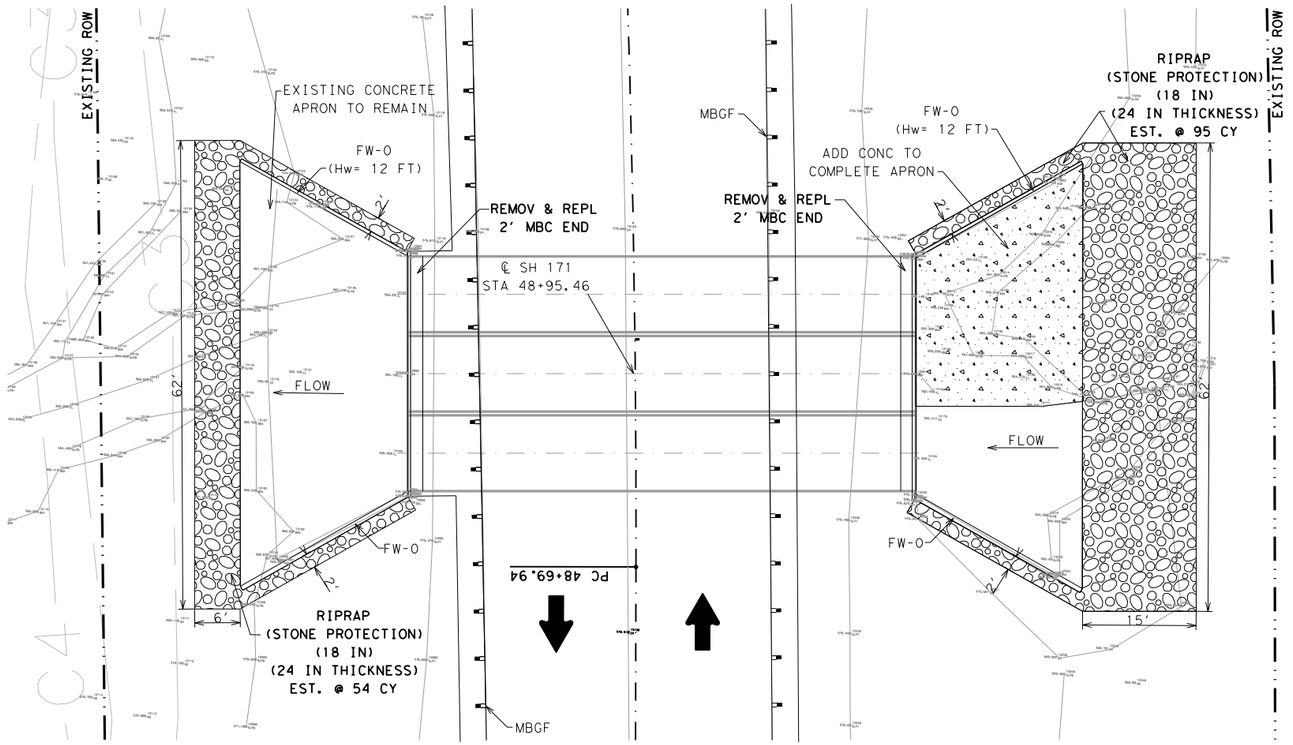
CULVERT LAYOUTS

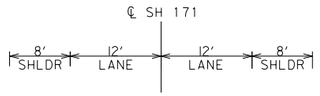
SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		78

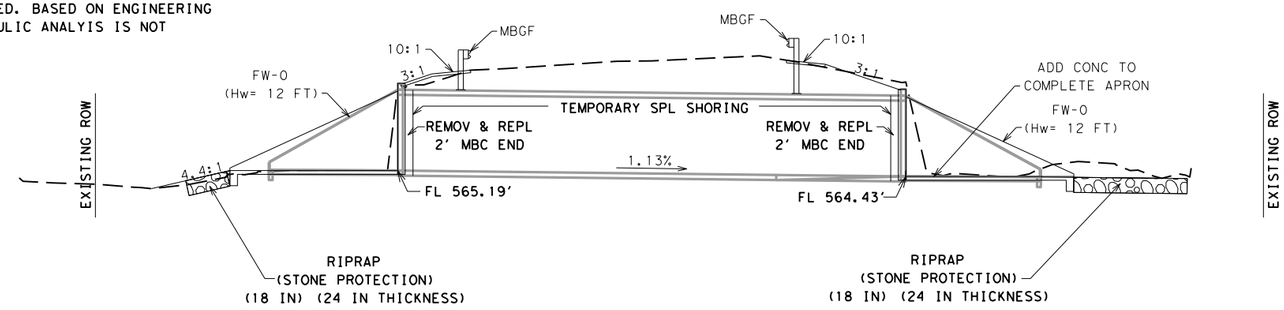


BMP #4
INSTALLED _____
REMOVED _____

BMP #4
INSTALLED _____
REMOVED _____



NOTE: EXISTING CULVERT TO REMAIN. HISTORICAL RECORDS SHOW THAT THIS CULVERT HAS NOT OVERTOPPED. BASED ON ENGINEERING JUDGEMENT, HYDRAULIC ANALYIS IS NOT REQUIRED.



STATION 48+95.46 (CULVERT 36) (NBI: 091100041803041)
EXISTING 3 ~ 10' X 10' X 67' MBC (BRIDGE CLASS)
REMOVE AND REPLACE 2' ON EACH END; PROTECT ENDS W/MBGF;
FW-0, MC-MD, MC-10-7, ECD, SRR LT & RT

NOTES:

1. SEE MBGF LAYOUTS FOR INFORMATION REGARDING METAL BEAM GUARD FENCE.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.
4. TIE PROPOSED CONCRETE TO EXISTING CONCRETE WITH 24" #4 REBAR SPACED AT 24".

ITEM	DESCRIPTION	UNIT	QTY
0104-6009	REMOVING CONC (RIPRAP)	SY	42
0110-6002	EXCAVATION (CHANNEL)	CY	20
0132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	10
0403-6001	TEMPORARY SPL SHORING	SF	936
0432-6002	RIPRAP (CONC)(5 IN)	CY	9
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	149
0462-6078	CONC BOX CULV (10 FT X 10 FT)(EXTEND)	LF	12
0466-6144	WINGWALL (FW-0) (HW-12 FT)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	12

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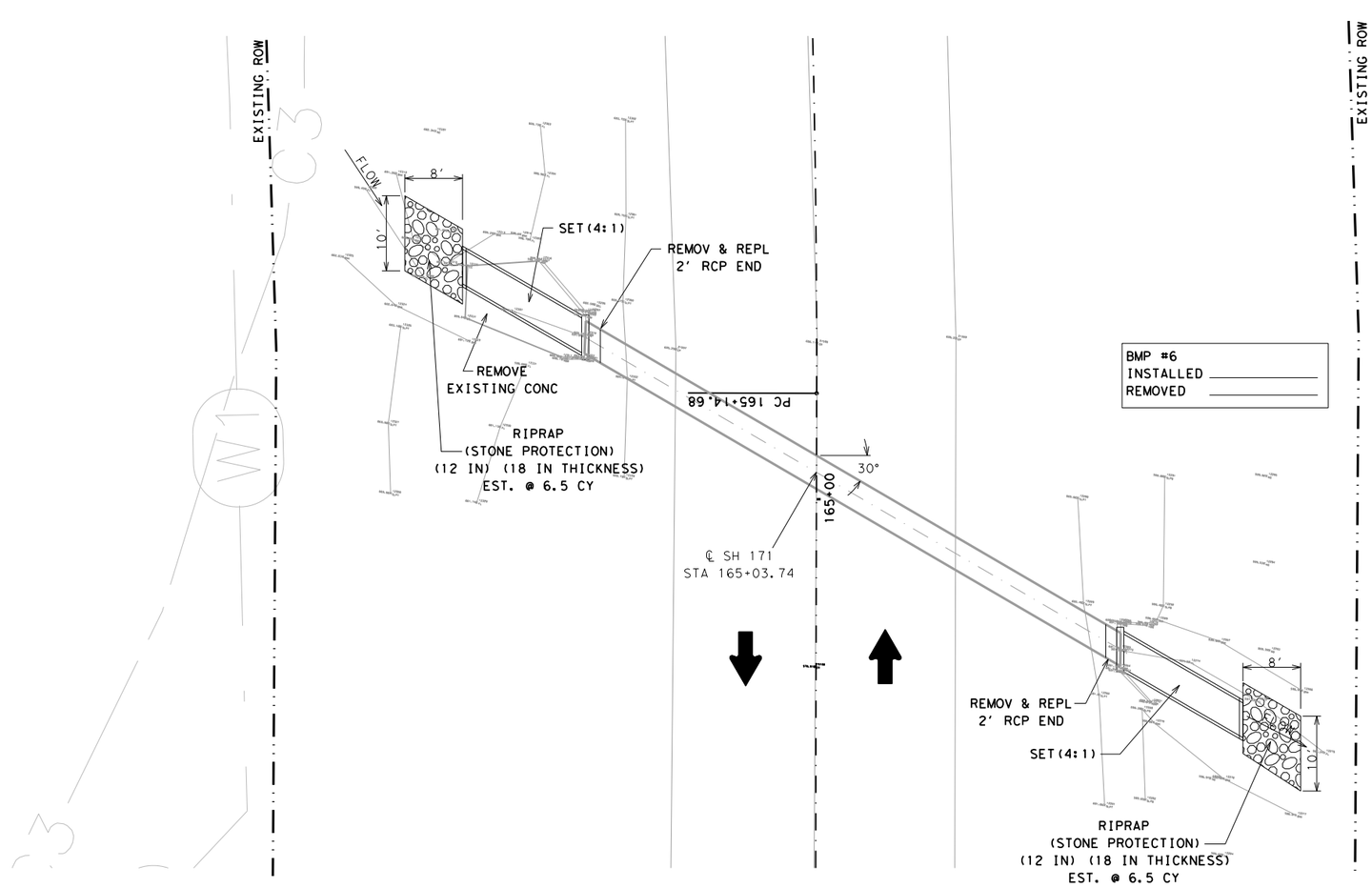
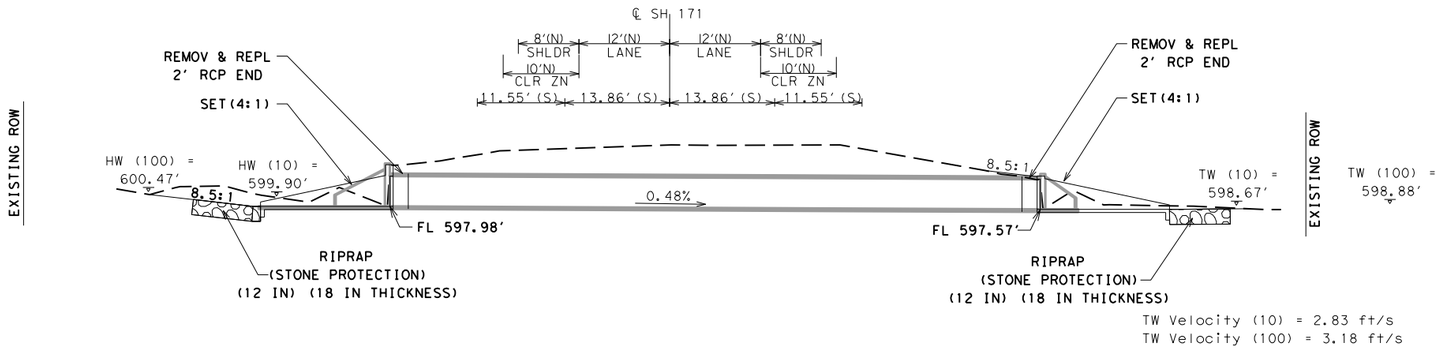
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		79





STATION 165+03.74 (CULVERT 35)
EXISTING 48" DIA. X 86' RCP (30 DEG LFS)
REMOVE EXISTING HEADWALLS LT & RT AND CONCRETE RIPRAP LT:
INSTALL SETP-CD OR PSET-SC LT & RT; SRR LT & RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0104-6009	REMOVING CONC (RIPRAP)	SY	2.8
0110-6002	EXCAVATION (CHANNEL)	CY	6
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	13
0464-6010	RC PIPE (CL III)(48 IN)	LF	4
0467-6477	SET (TY II) (48 IN) (RCP) (4: 1) (C)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	4
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	4

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Chris J. Mashek, P.E. 6/3/2022
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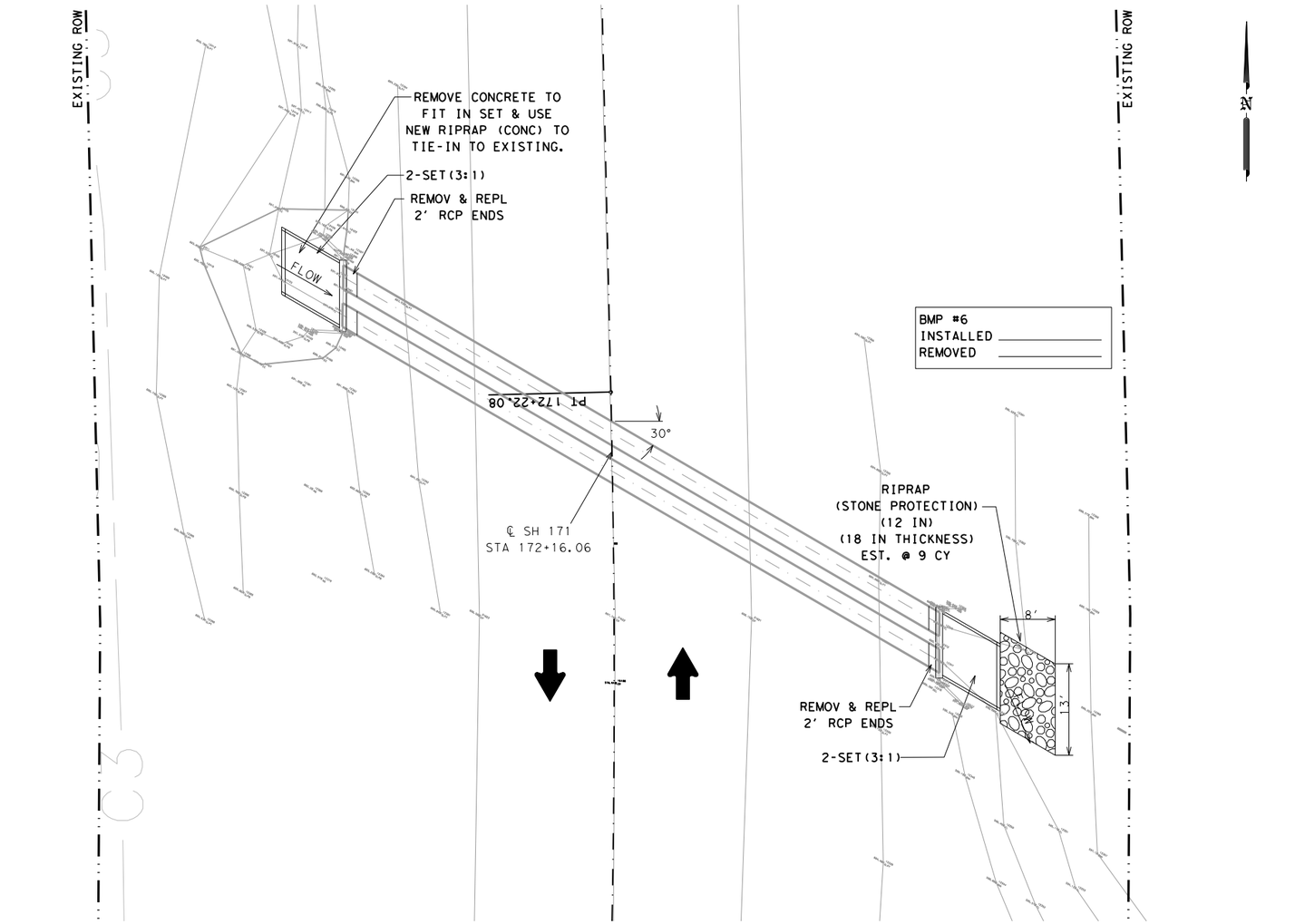
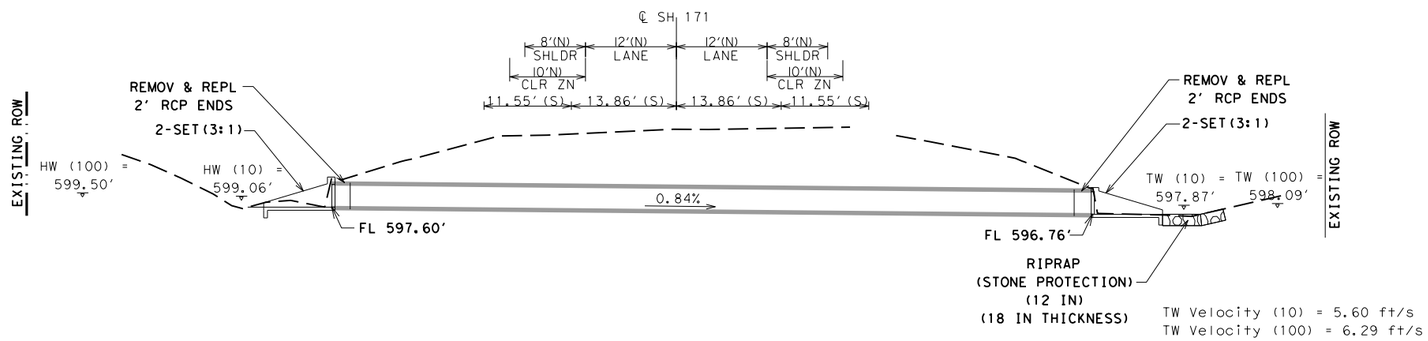
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		80





STATION 172+16.06 (CULVERT 34)
EXISTING 2 ~ 36" DIA. X 100' RCP (30 DEG LFS)
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL SETP-CD OR PSET-SC LT & RT; SRR RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0104-6009	REMOVING CONC (RIPRAP)	SY	9
0432-6002	RIPRAP (CONC)(5 IN)	CY	3
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	9
0464-6007	RC PIPE (CL III)(30 IN)	LF	8
0467-6448	SET (TY II) (36 IN) (RCP) (3:1) (C)	EA	4
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	8
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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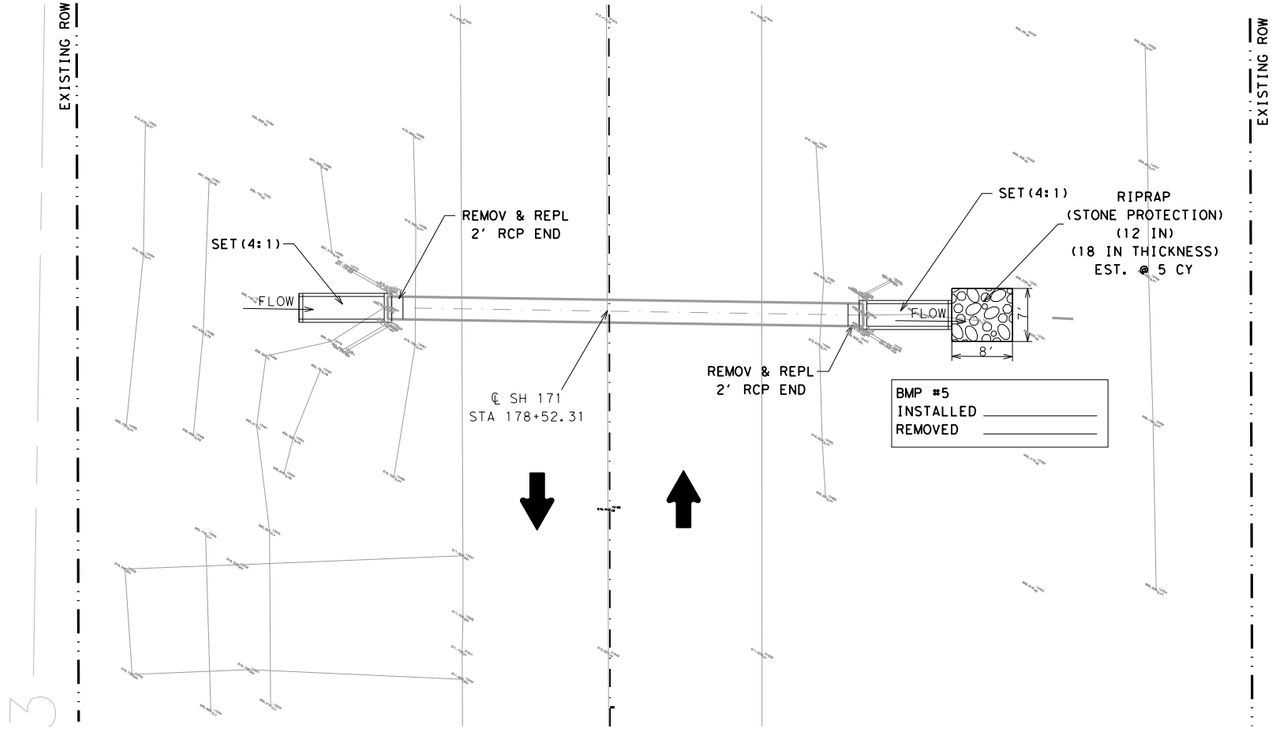
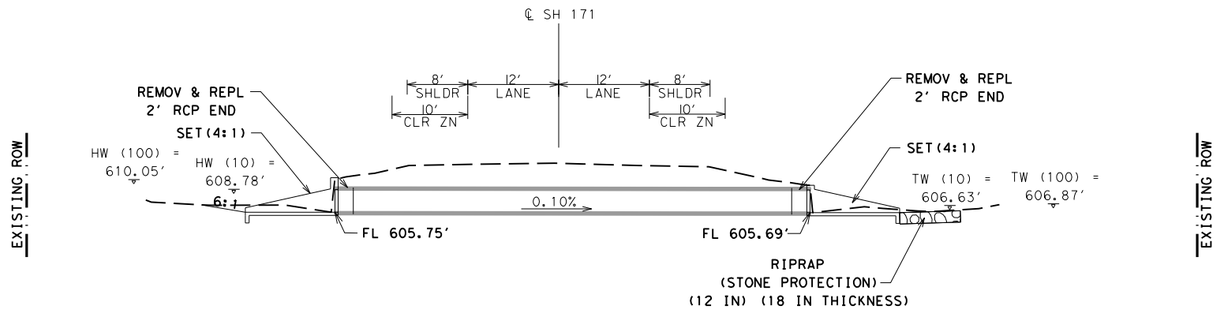
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		81





TW Velocity (10) = 4.26 ft/s
TW Velocity (100) = 4.83 ft/s

STATION 178+52.31 (CULVERT 33)
EXISTING 36" DIA. X 63' RCP
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL SETP-CD OR PSET-SC LT & RT; SRR RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.

2. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0432-6031	**RIPRAP (STONE PROTECTION)(12 IN)**	**CY**	5
0464-6008	**RC PIPE (CL III)(36 IN)**	**LF**	4
0467-6450	**SET (TY II) (36 IN) (RCP) (4: 1) (C)**	**EA**	2
0480-6001	**CLEAN EXIST CULVERTS**	**EA**	1
0496-6006	**REMOV STR (HEADWALL)**	**EA**	2
0496-6007	**REMOV STR (PIPE)**	**LF**	4
0658-6046	**INSTL OM ASSM (OM-2X)(WC)GND**	**EA**	2

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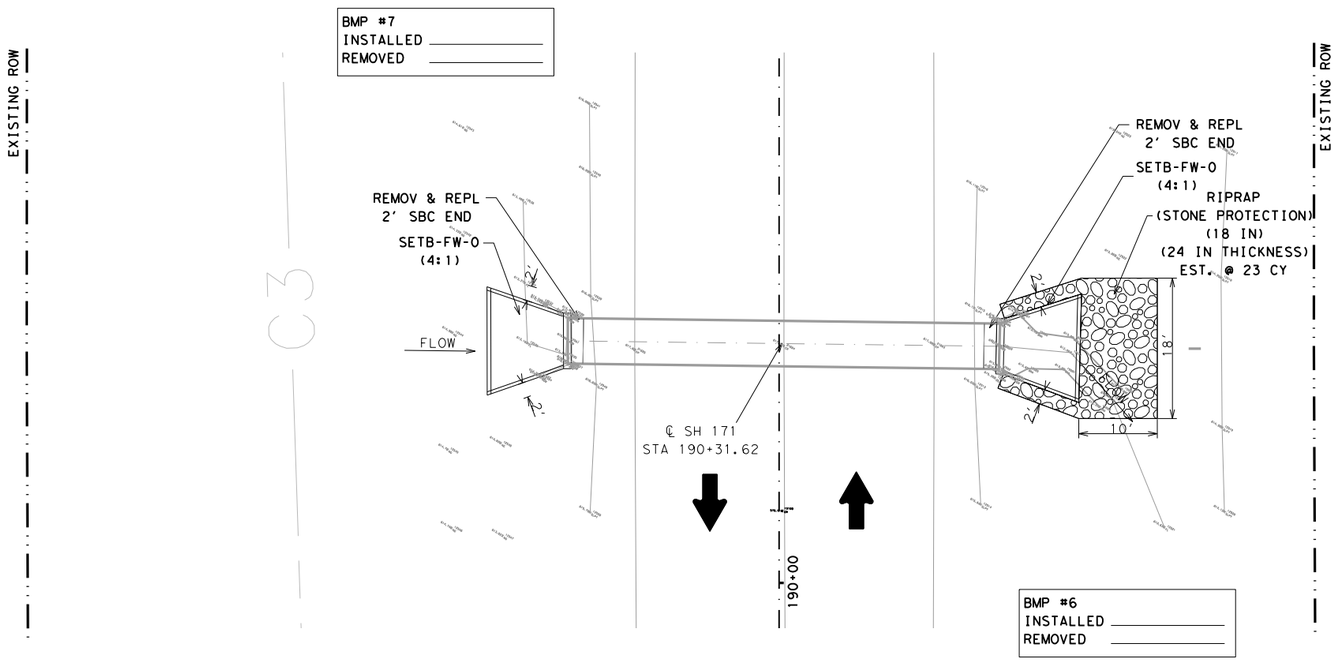
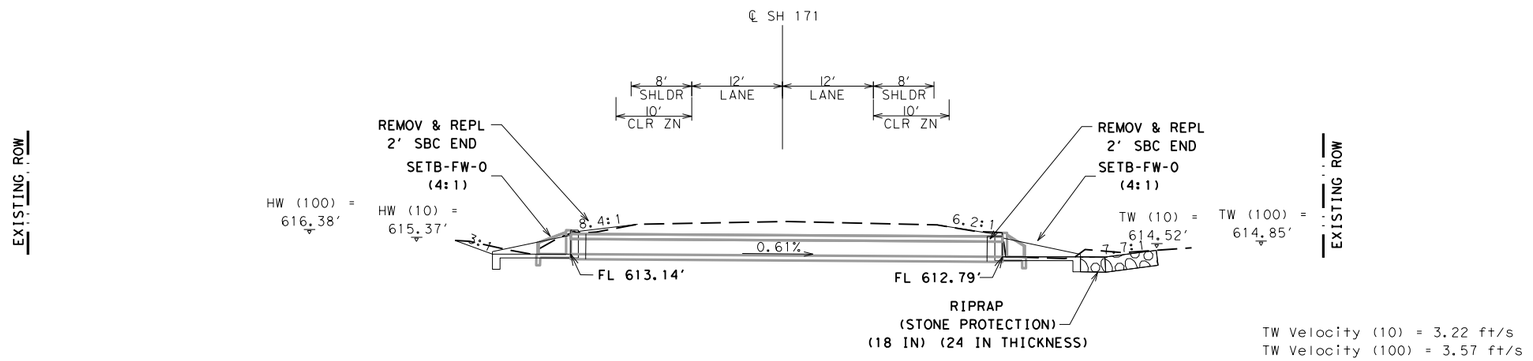
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		82





TW Velocity (10) = 3.22 ft/s
TW Velocity (100) = 3.57 ft/s

STATION 190+31.62 (CULVERT 32)
EXISTING 6' X 2' X 57' SBC
REMOVE EXISTING WINGWALLS LT & RT;
INSTALL SETB-FW-0 LT & RT; SRR RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0432-6002	RIPRAP (CONC)(5 IN)	CY	3
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	23
0462-6095	CONC BOX CULV (6 FT X 2 FT) (EXTEND)	LF	4
0467-6205	SET (TY I)(S= 6 FT)(HW= 3 FT)(4:1) (C)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	4
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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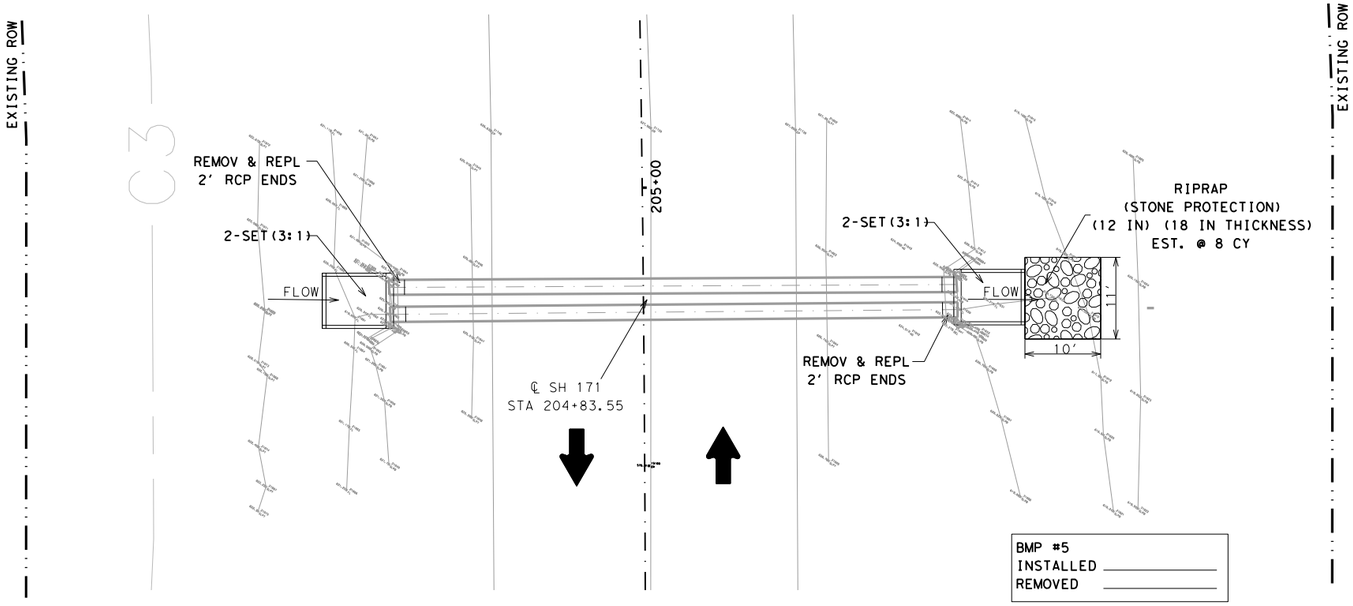
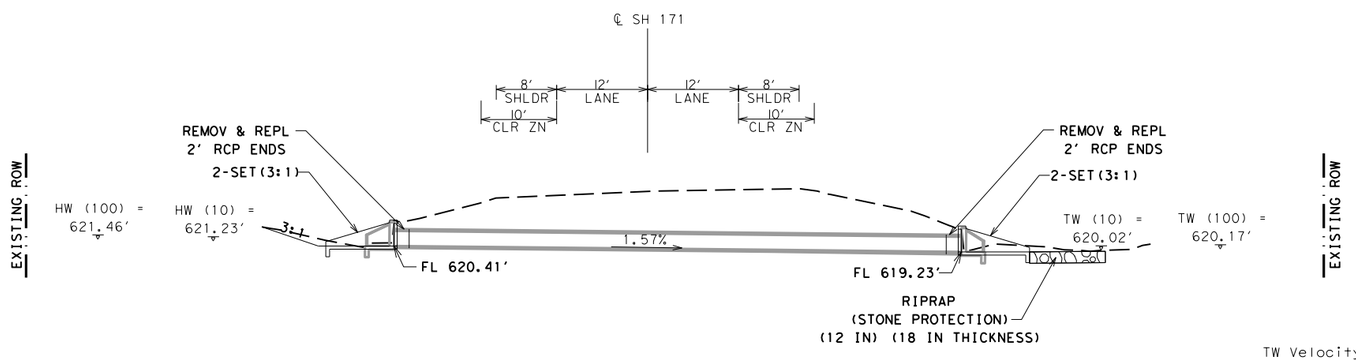
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		83





TW Velocity (10) = 1.57 ft/s
TW Velocity (100) = 1.76 ft/s

STATION 204+83.55 (CULVERT 32a)
EXISTING 2 ~ 24" DIA. X 75' RCP
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL SETP-CD OR PSET-SC LT & RT; SRR RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	8
0464-6005	RC PIPE (CL III)(24 IN)	LF	8
0467-6388	SET (TY II) (24 IN) (RCP) (3: 1) (C)	EA	4
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	8
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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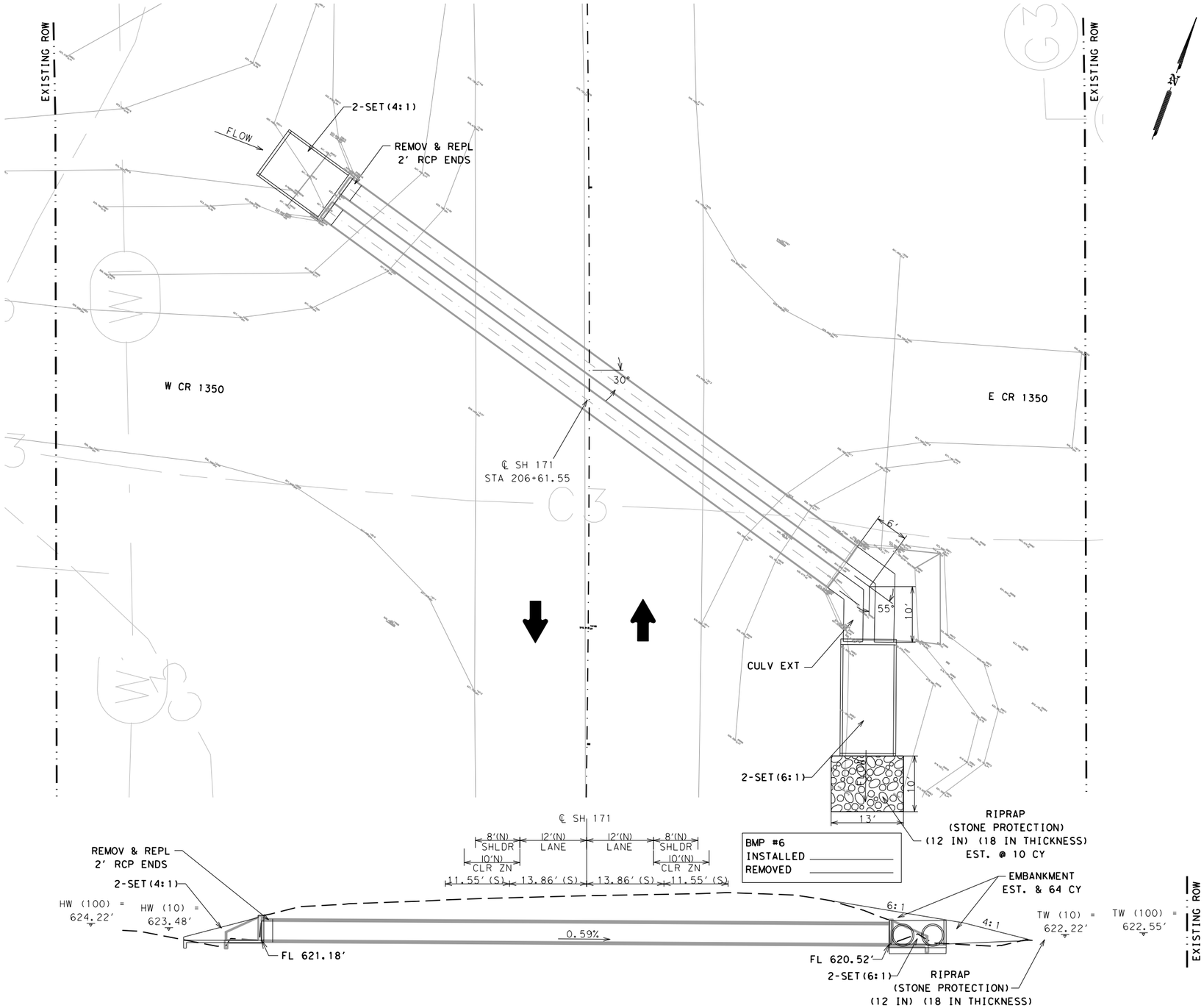
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		84



TW Velocity (10) = 5.09 ft/s
TW Velocity (100) = 5.97 ft/s

STATION 206+61.55 (CULVERT 31)
EXISTING 2 ~ 42" DIA. X 113' RCP (30 DEG LFS)
REMOVE EXISTING HEADWALLS LT & RT;
EXTEND 16' DOWNSTREAM DITCH RT;
INSTALL SETP-CD OR PSET-SC LT;
SETP-PD OR PSET-SP RT; SRR RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	64
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	10
0464-6009	RC PIPE (CL III)(42 IN)	LF	36
0467-6463	SET (TY II) (42 IN) (RCP) (4: 1) (C)	EA	2
0467-6466	SET (TY II) (42 IN) (RCP) (6: 1) (P)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	4
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

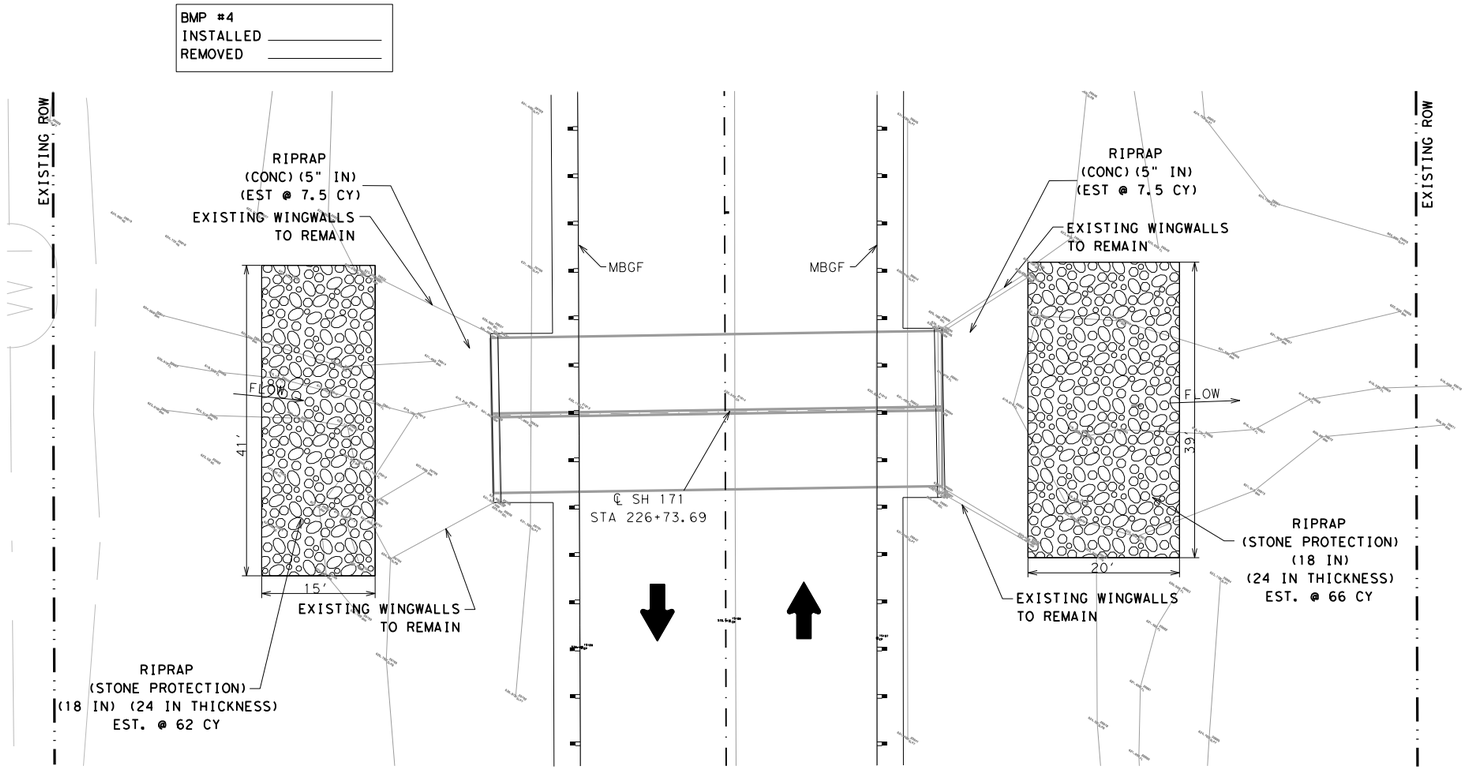
STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E.
SIGNATURE OF REGISTRANT & DATE 5/19/2022

CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		85



TW Velocity (10) = 5.73 ft/s
TW Velocity (100) = 5.96 ft/s

STATION 226+73.69 (CULVERT 30) (NBI: 091100041803036)
EXISTING 2 ~ 10' X 10' X 60' MBC (BRIDGE CLASS)
NO PROPOSED CULVERT WORK
PROTECT EXISTING ENDS WITH MBGF,
SRR LT & RT

NOTES:

1. SEE MBGF LAYOUTS FOR INFORMATION REGARDING METAL BEAM GUARD FENCE.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0110-6002	**EXCAVATION (CHANNEL)**	**CY**	22
0432-6002	**RIPRAP (CONC)(5 IN)**	**CY**	15
0432-6033	**RIPRAP (STONE PROTECTION)(18 IN)**	**CY**	128
0480-6001	**CLEAN EXIST CULVERTS**	**EA**	1

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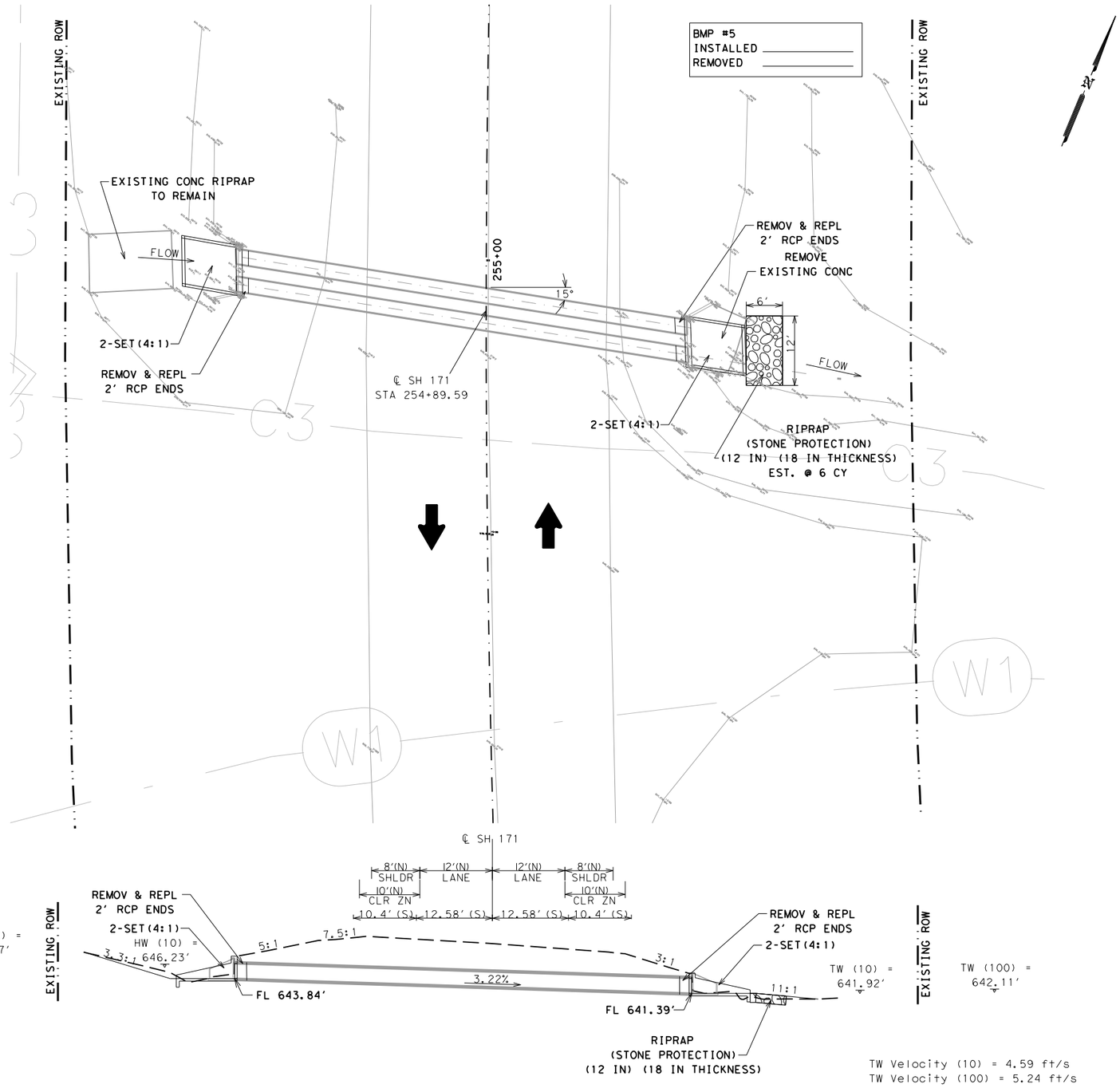
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		86



TW Velocity (10) = 4.59 ft/s
TW Velocity (100) = 5.24 ft/s

STATION 254+89.59 (CULVERT 29)
EXISTING 2 ~ 30" DIA. X 76' RCP (15 DEG LFS)
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL SETP-CD OR PSET-SC LT & RT, SRR RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0104-6009	REMOVING CONC (RIPRAP)	SY	3.8
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	6
0464-6007	RC PIPE (CL III)(30 IN)	LF	8
0467-6419	SET (TY II) (30 IN) (RCP) (4: 1) (C)	EA	4
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	8
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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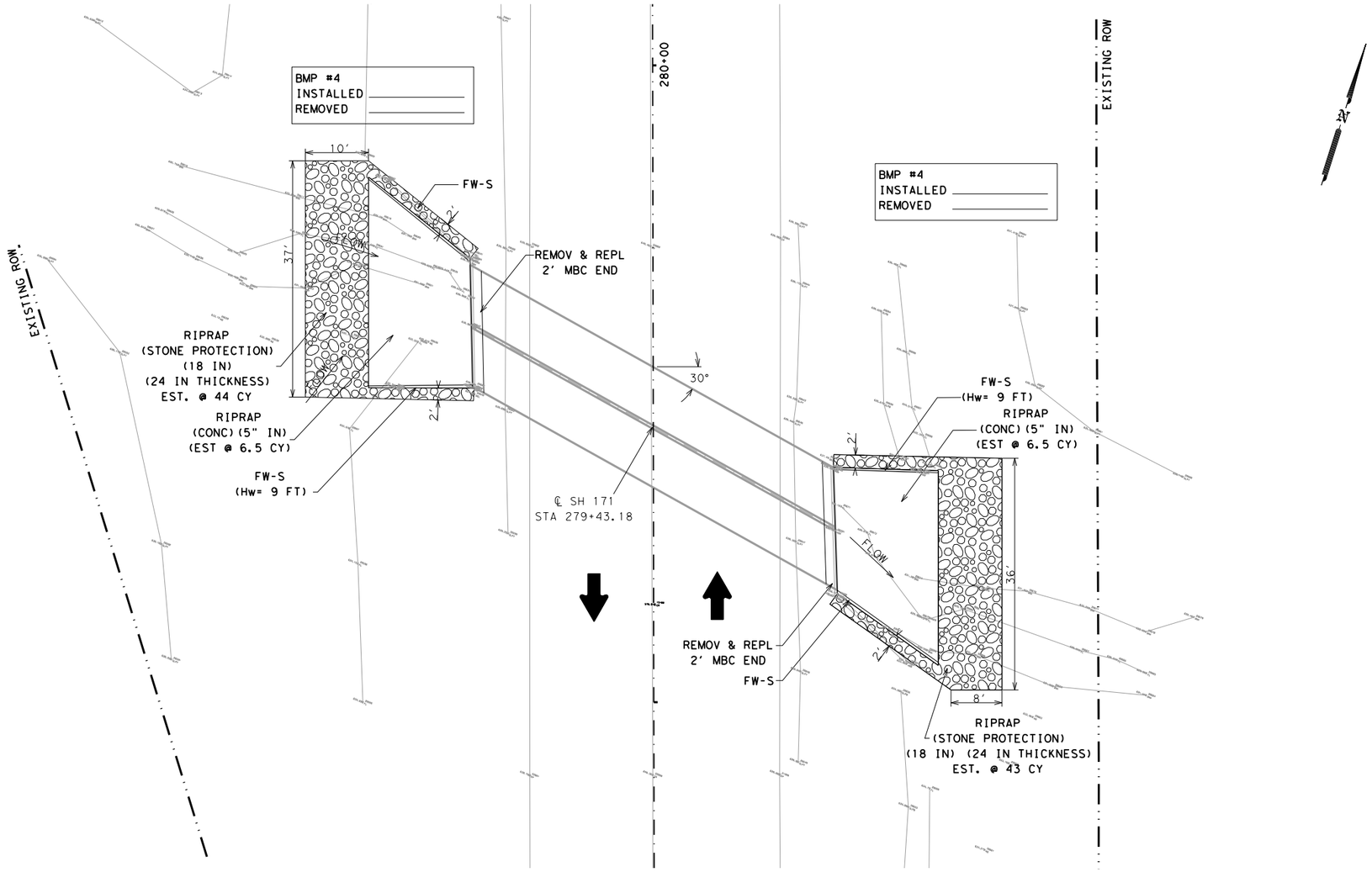
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		87



TW Velocity (10) = 7.69 ft/s
TW Velocity (100) = 8.33 ft/s

STATION 279+43.18 (CULVERT 28)
EXISTING 2 ~ 8' X 7' X 65' MBC
REMOVE EXISTING WINGWALLS LT & RT;
INSTALL FW-S LT & RT;
SCC-MD, SCC-8, SRR LT & RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0432-6002	RIPRAP (CONC)(5 IN)	CY	13
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	87
0462-6066	CONC BOX CULV (8 FT X 7 FT)(EXTEND)	LF	8
0466-6170	WINGWALL (FW - S) (HW=9 FT)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	8
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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CULVERT LAYOUTS

SCALE: FEET
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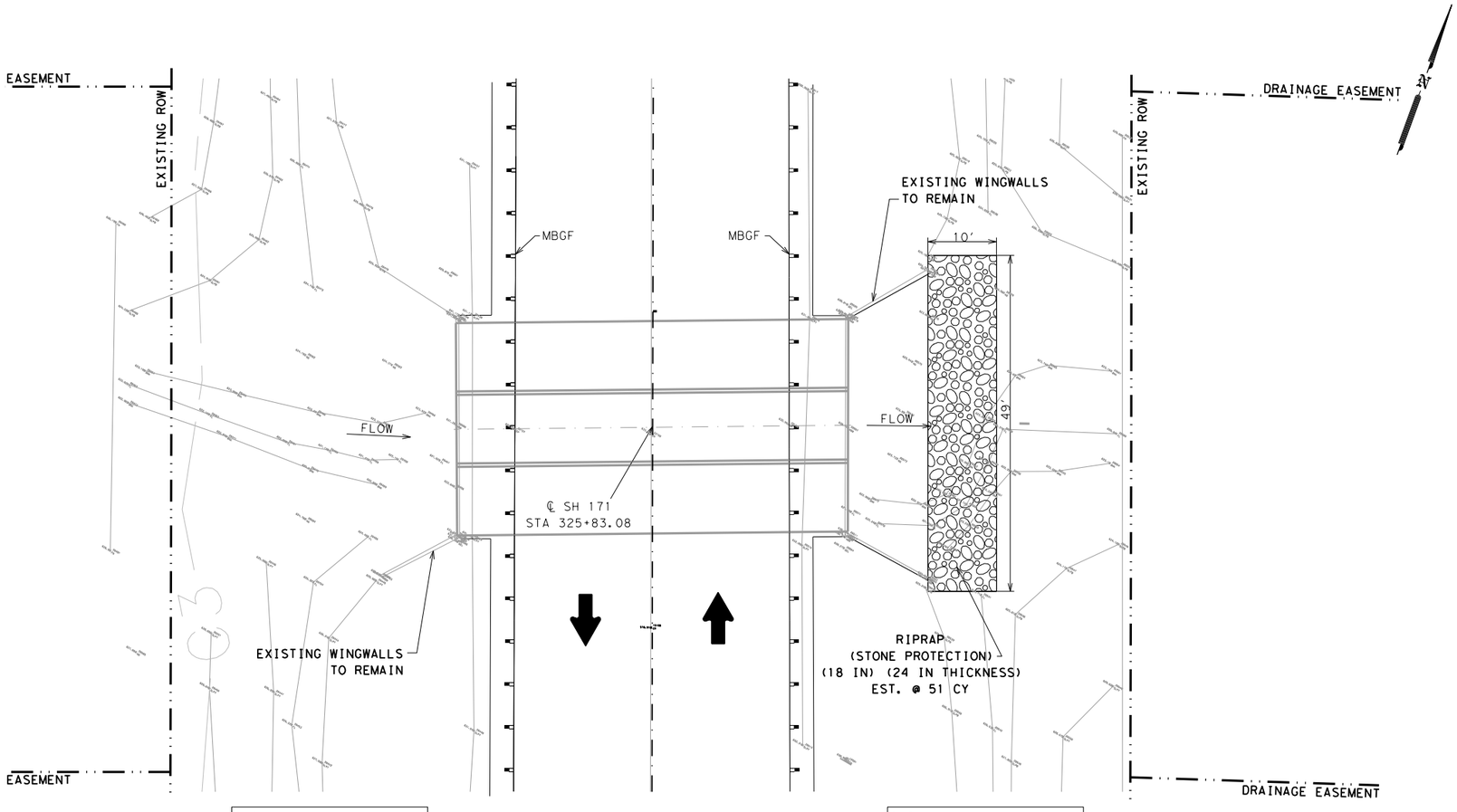
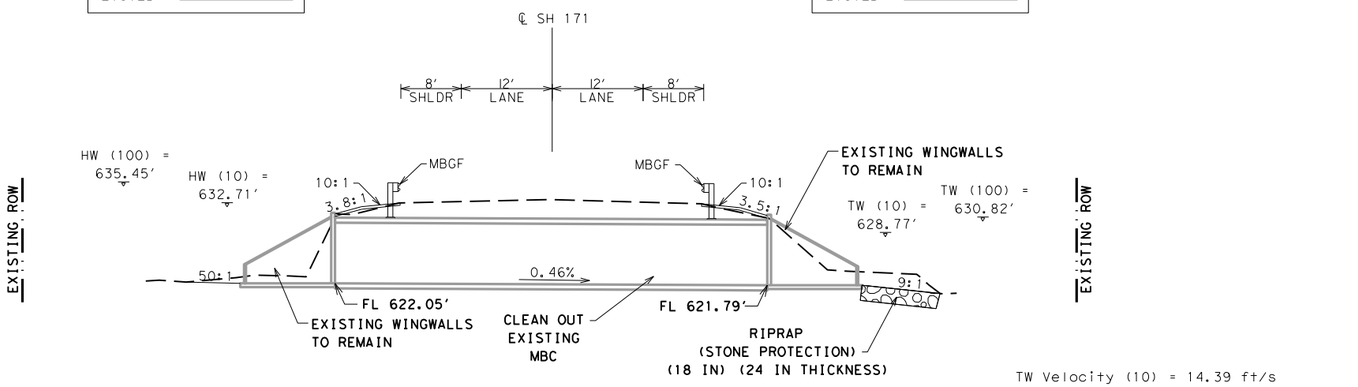
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		88





TW Velocity (10) = 14.39 ft/s
TW Velocity (100) = 13.65 ft/s

STATION 325+83.08 (CULVERT 27) (NBI: 091100041803038)
EXISTING 3 ~ 10' X 8' X 57' MBC (BRIDGE CLASS)
NO PROPOSED EXTENSIONS OR ENDS, CLEAN OUT EXISTING MBC;
PROTECT EXISTING ENDS W/ MBGF, SRR LT & RT

NOTES:

1. SEE MBGF LAYOUTS FOR INFORMATION REGARDING METAL BEAM GUARD FENCE.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0432-6033	**RIPRAP (STONE PROTECTION)(18 IN)**	**CY**	51
0480-6001	**CLEAN EXIST CULVERTS**	**EA**	1

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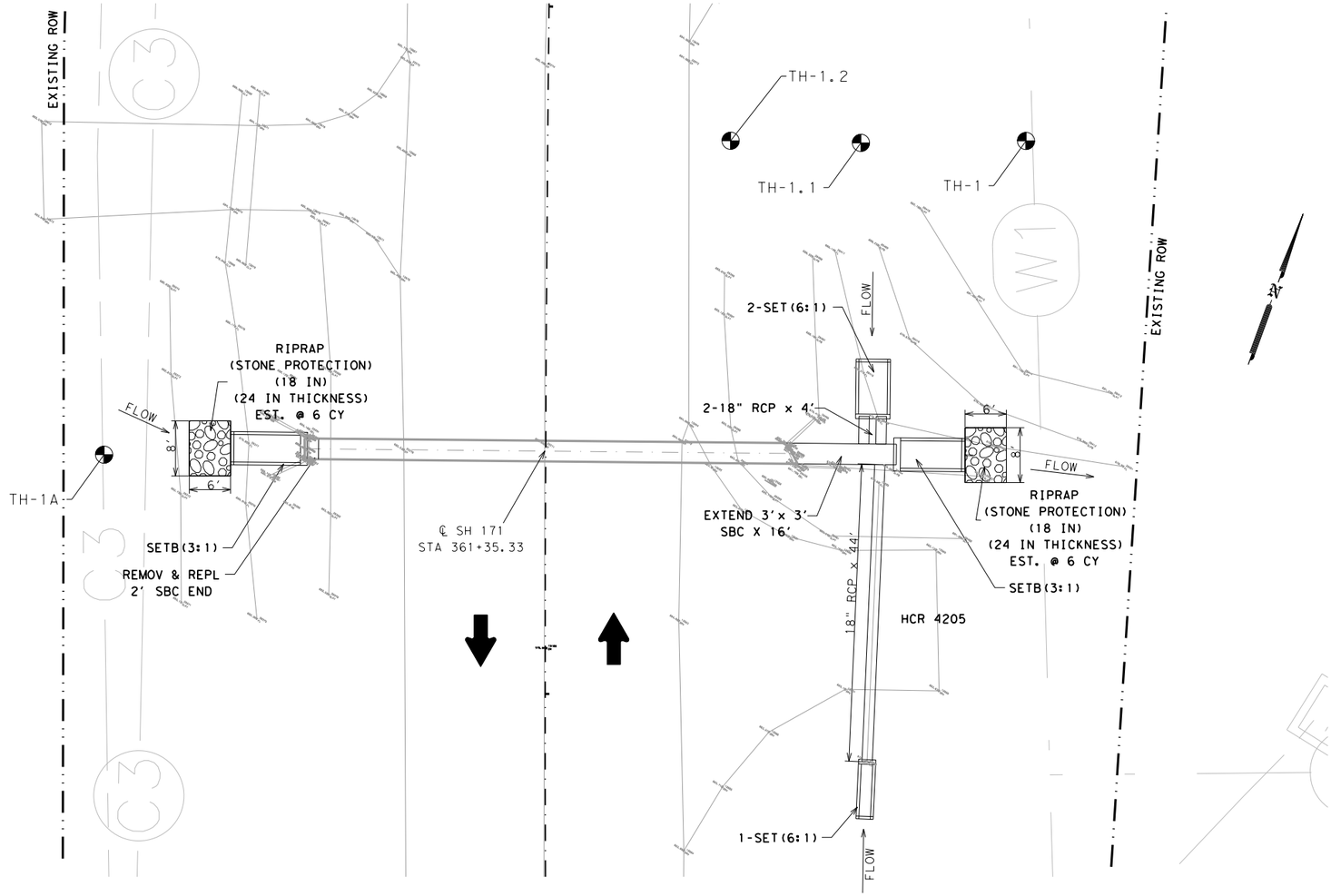
CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		89



TW Velocity (10) = 0.88 ft/s
TW Velocity (100) = 1.03 ft/s

STATION 361+35.33 (CULVERT 26)
EXISTING 3' X 3' X 71' SBC
REMOVE EXISTING HEADWALLS LT & RT;
EXTEND 16' RT;
ADD 44' RCP 18" CL III SOUTH DITCH RT;
ADD 4' PER BARREL RCP 18" CL III NORTH DITCH RT;
INSTALL SETB, SCC-MD, SCC-3&4 & SRR LT AND RT;
INSTALL SETP-PD OR PSET-SP NORTH RT AND SOUTH RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	10
0432-6002	RIPRAP (CONC)(5 IN)	CY	2.6
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	12
0462-6046	CONC BOX CULV (3 FT X 3 FT)(EXTEND)	LF	18
0464-6003	RC PIPE (CL III)(18 IN)	LF	52
0467-6111	SET (TY I)(S=3 FT)(HW= 4 FT)(3:1)(C)	EA	2
0467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	3
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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CULVERT LAYOUTS

SCALE: FEET
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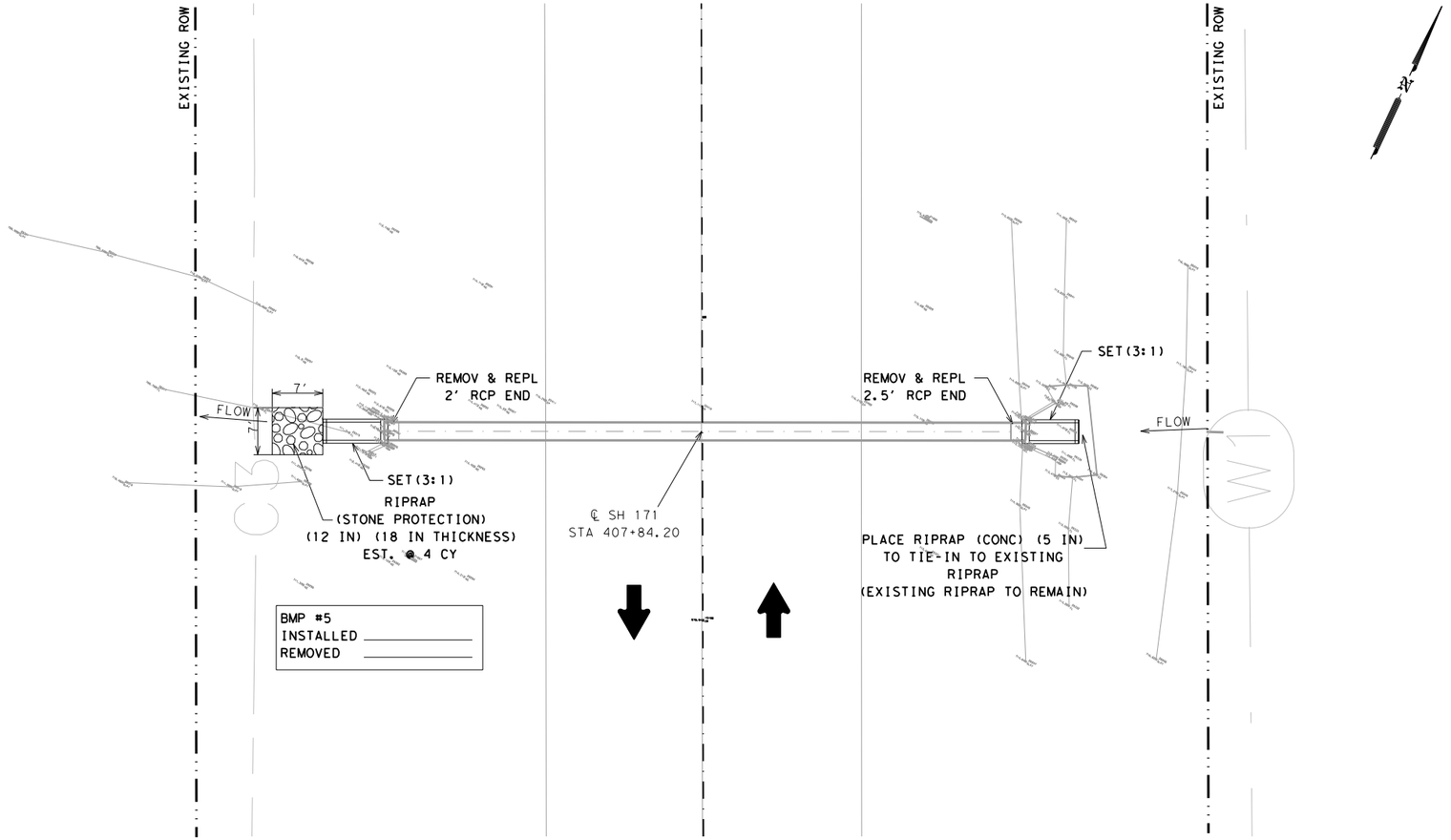
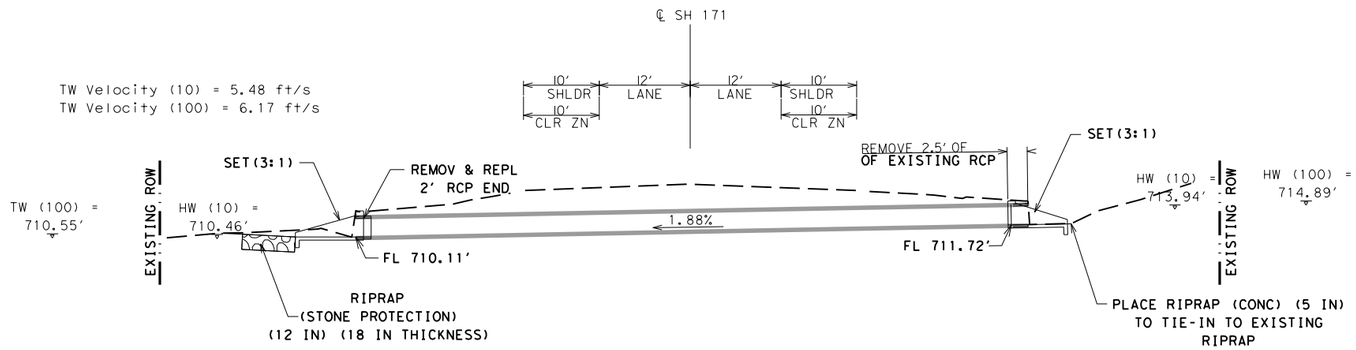
1" = 10' VERT.

SHEET 13 OF 41

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		90





STATION 407+84.20 (CULVERT 25)
EXISTING 30" DIA. X 89' RCP W/CH-11B
REMOVE EXISTING HEADWALL LT & RT;
INSTALL SETP-CD OR PSET-SC LT & RT, SRR LT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.
3. TIE PROPOSED CONCRETE TO EXISTING CONCRETE WITH 24" #4 REBAR SPACED AT 24".

ITEM	DESCRIPTION	UNIT	QTY
0432-6002	RIPRAP (CONC)(5 IN)	CY	0.25
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	4
0464-6007	RC PIPE (CL III)(30 IN)	LF	2
0467-6417	SET (TY II) (30 IN) (RCP) (3: 1) (C)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	4.5
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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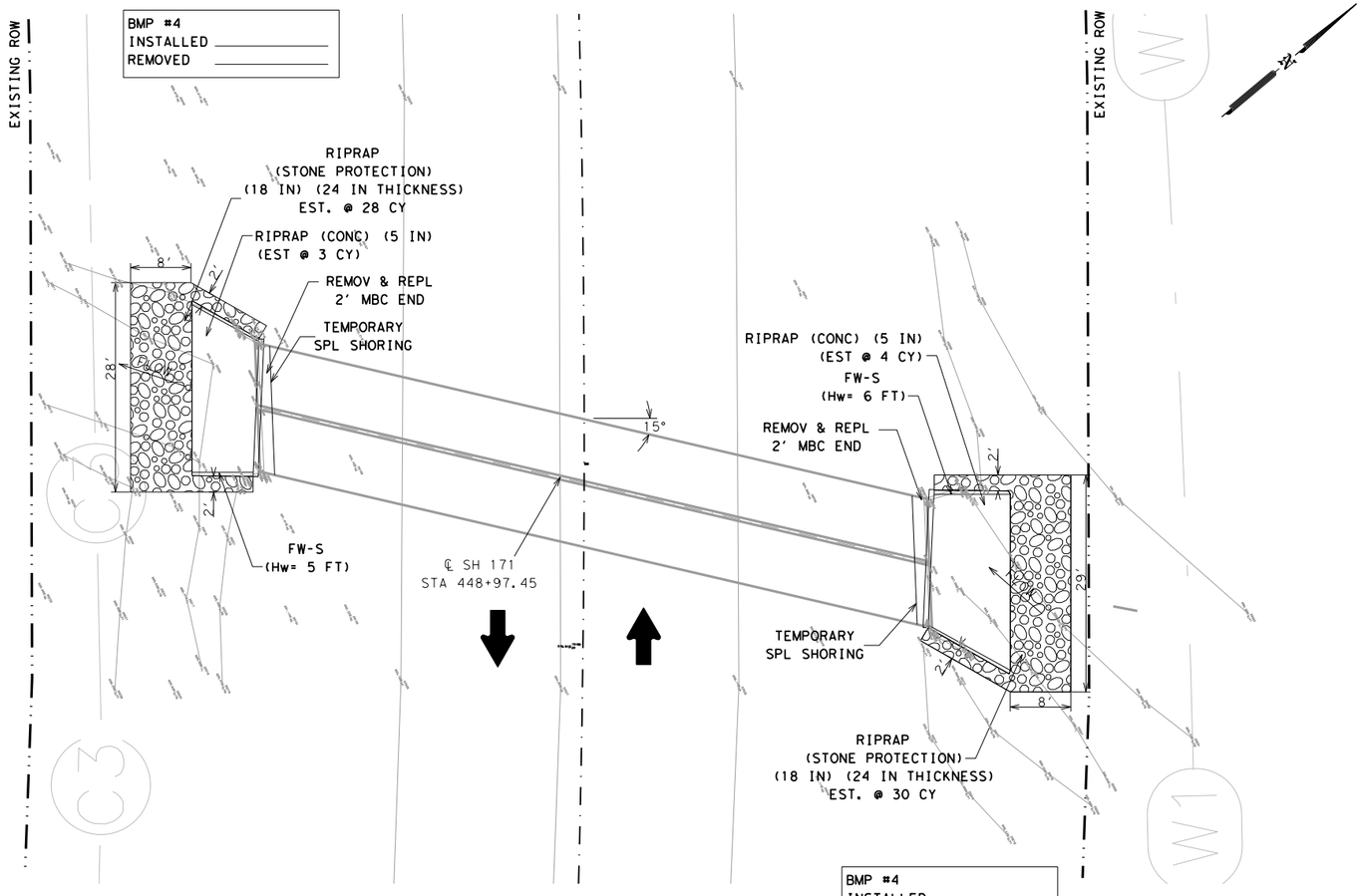
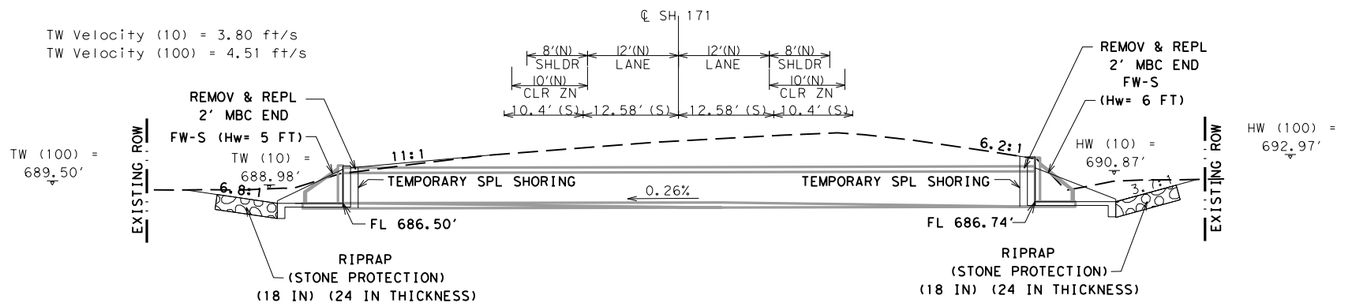
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		91





STATION 448+97.45 (CULVERT 24)
EXISTING 2 ~ 8' X 4' X 91' MBC (15 DEG LFS)
REMOVE EXISTING WINGWALLS LT & RT;
INSTALL FW-S, MC-MD, MC-8-13 LT & RT; ECD RT; SRR LT & RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0110-6002	EXCAVATION (CHANNEL)	CY	31
0403-6001	TEMPORARY SPL SHORING	SF	359
0432-6002	RIPRAP (CONC)(5 IN)	CY	7
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	58
0466-6166	WINGWALL (FW - S) (HW=5 FT)	EA	1
0466-6167	WINGWALL (FW - S) (HW=6 FT)	EA	1
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6008	REMOV STR (BOX CULVERT)	LF	8
0462-6063	CONC BOX CULV (8 FT X 4 FT)(EXTEND)	LF	8
0496-6005	REMOV STR (WINGWALL)	EA	2
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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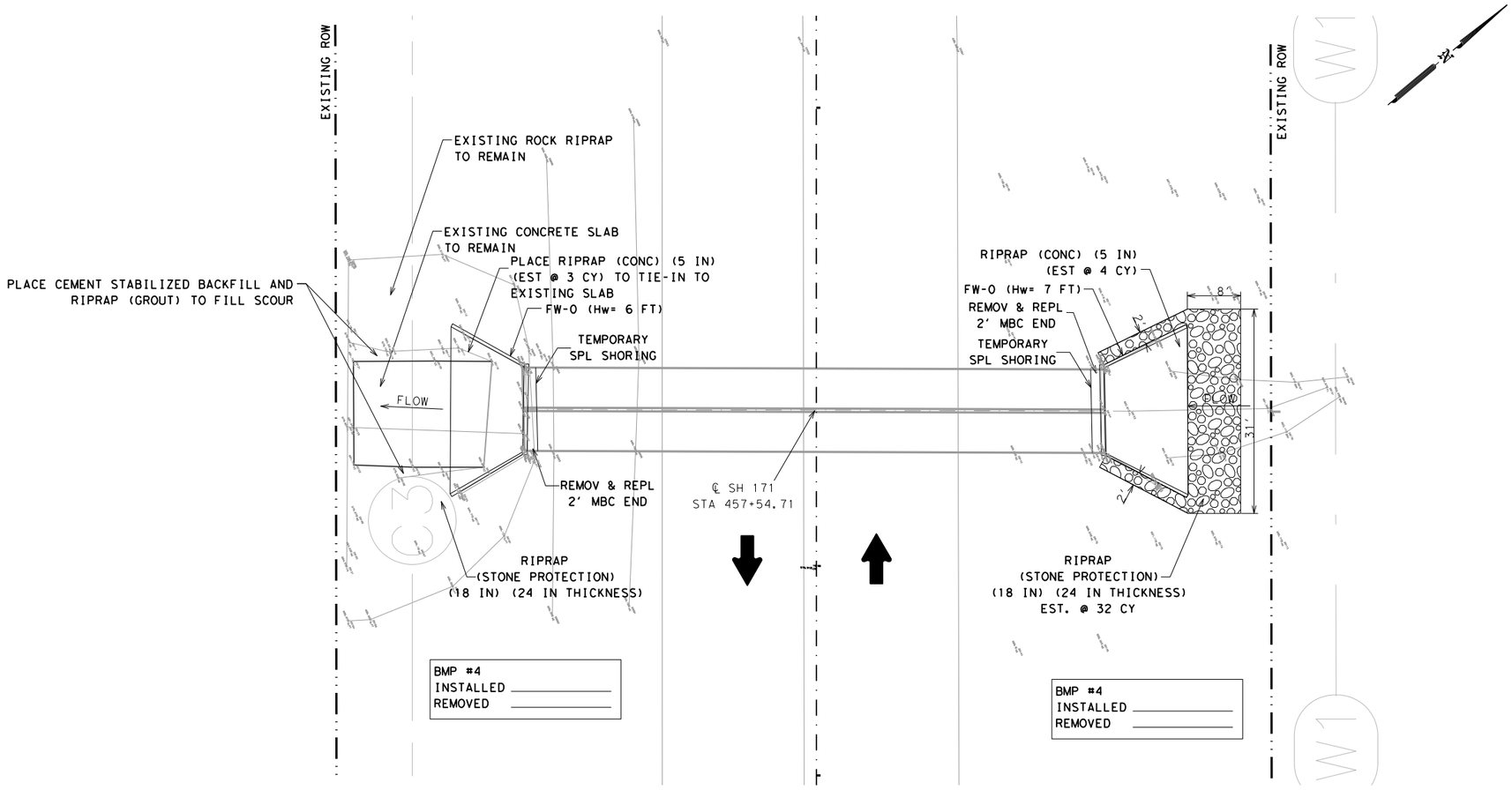
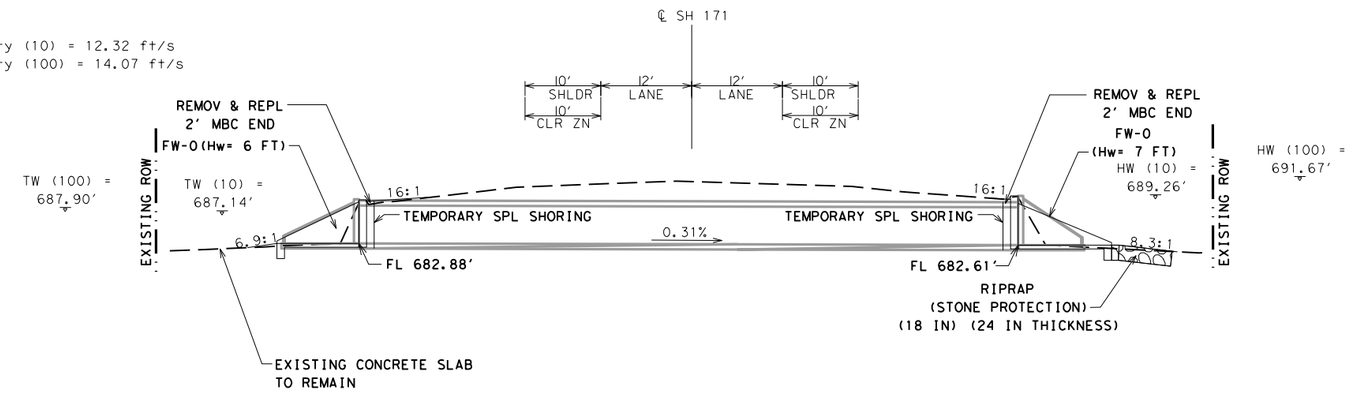
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		92



TW Velocity (10) = 12.32 ft/s
TW Velocity (100) = 14.07 ft/s



STATION 457+54.71 (CULVERT 22)
EXISTING 2 ~ 6' X 5' X 87' MBC
REMOVE EXISTING WINGWALLS LT & RT;
INSTALL FW-0, MC-MD, MC-6-16 LT & RT, ECD RT, SRR LT & RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0400-6005	CEM STABIL BKFL	CY	2.25
0403-6001	TEMPORARY SPL SHORING	SF	411
0432-6002	RIPRAP (CONC)(5 IN)	CY	7
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	32
0432-6051	RIPRAP (STONE COMMON)(GROUT)(18 IN)	CY	2.25
0466-6153	WINGWALL (FW - 0) (HW=6 FT)	EA	1
0466-6154	WINGWALL (FW - 0) (HW=7 FT)	EA	1
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6008	REMOV STR (BOX CULVERT)	LF	8
0462-6056	CONC BOX CULV (6 FT X 5 FT)(EXTEND)	LF	8
0496-6005	REMOV STR (WINGWALL)	EA	2
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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SCALE: FEET
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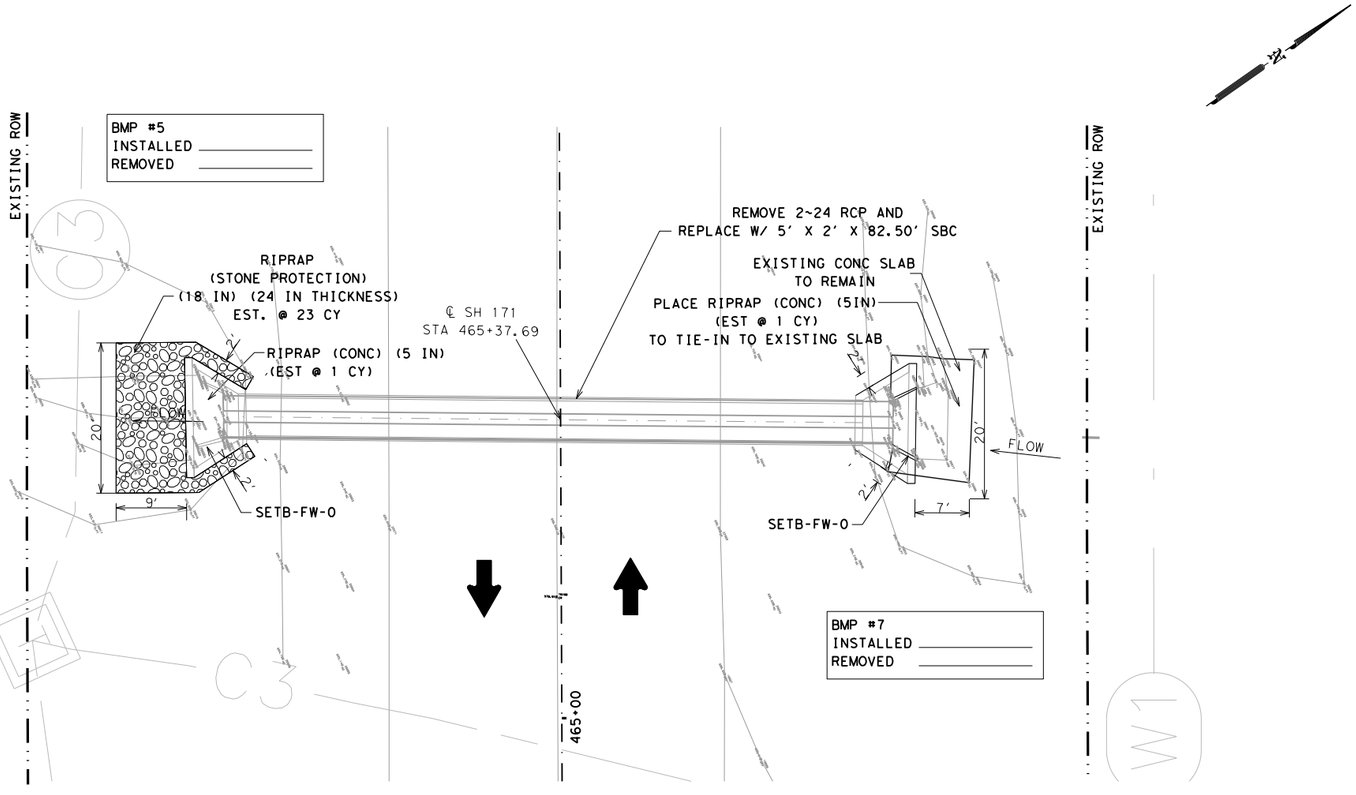
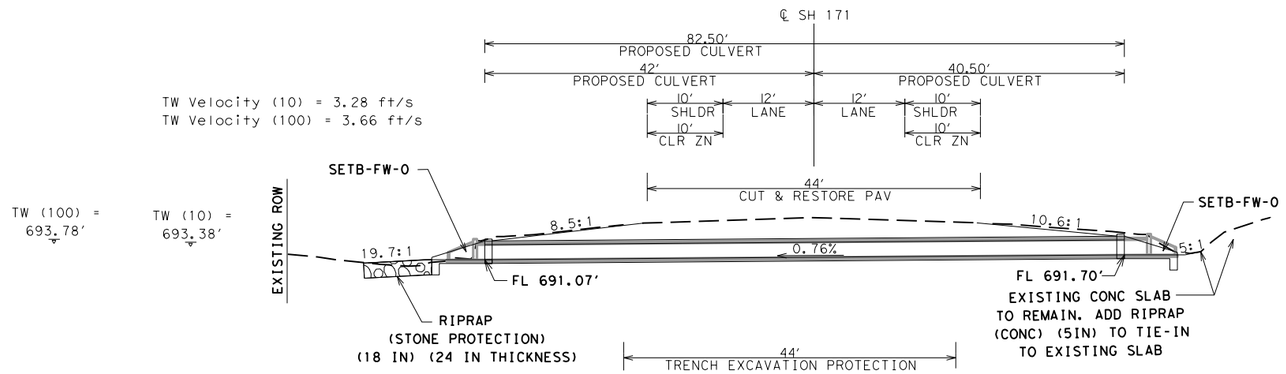
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		93





STATION 465+37.69 (CULVERT 23)
EXISTING 2 ~ 24" DIA. X 89' RCP
REMOVE EXISTING 2-24" x 89' RCP;
REMOVE EXISTING HEADWALLS;
INSTALL 1-5'X 2'X 82.50' SBC, SCP-5, SCP-MD;
INSTALL SETB-FW-0 LT & RT, SRR LT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.
3. TIE PROPOSED CONCRETE TO EXISTING CONCRETE WITH 24" #4 REBAR SPACED AT 24".

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	**BLADING**	**STA**	1
0400-6005	**CEM STABIL BKFL**	**CY**	21.7
0400-6006	**CUT & RESTORING PAV**	**SY**	49
0402-6001	**TRENCH EXCAVATION PROTECTION**	**LF**	44
0432-6002	**RIPRAP (CONC)(5 IN)**	**CY**	2
0432-6033	**RIPRAP (STONE PROTECTION)(18 IN)**	**CY**	23
0462-6006	**CONC BOX CULV (5 FT X 2 FT)**	**LF**	84
0467-6171	**SET (TY I)(S= 5 FT)(HW= 3 FT)(3:1) (C)**	**EA**	2
0496-6006	**REMOV STR (HEADWALL)**	**EA**	2
0496-6007	**REMOV STR (PIPE)**	**LF**	178
0496-6018	**REMOVE STR (CONC)**	**EA**	1
0658-6046	**INSTL OM ASSM (OM-2X)(WC)GND**	**EA**	2

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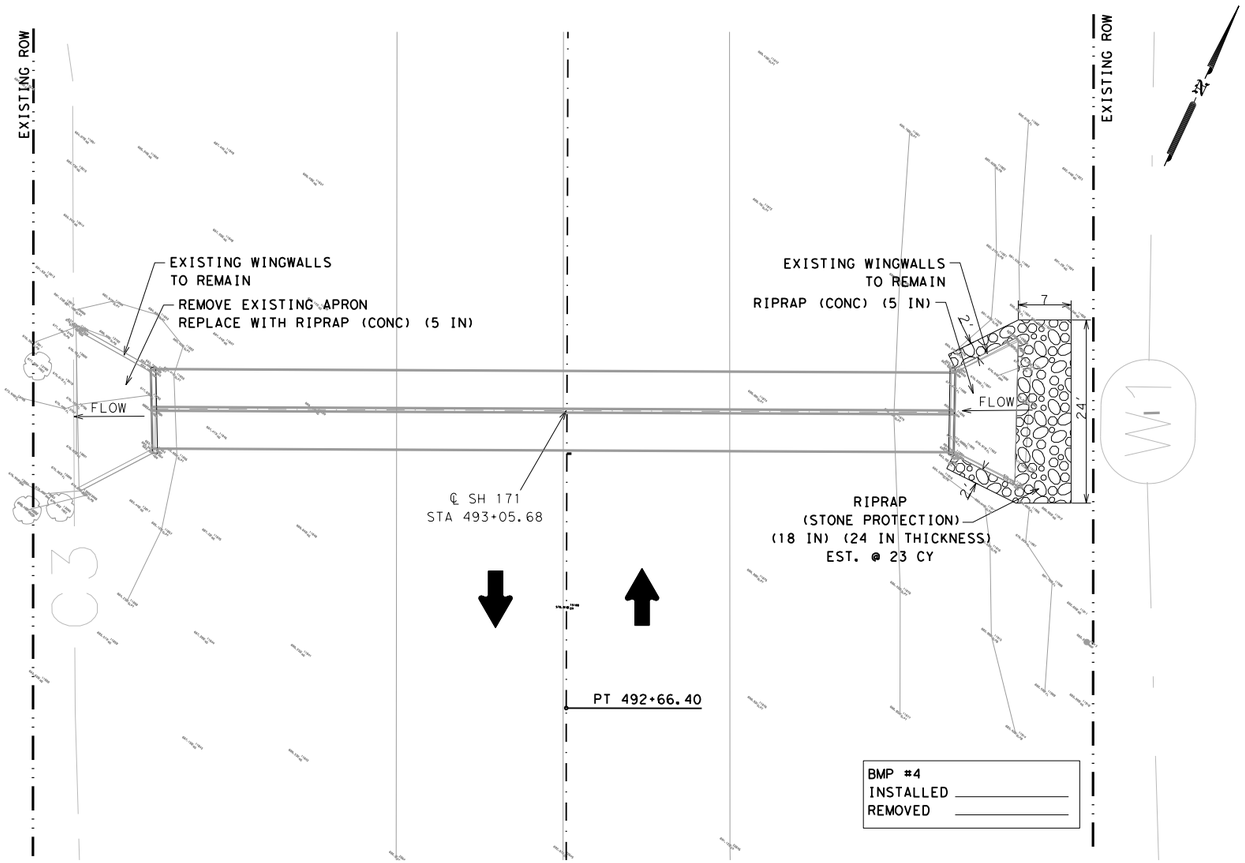
PROFESSIONAL ENGINEER

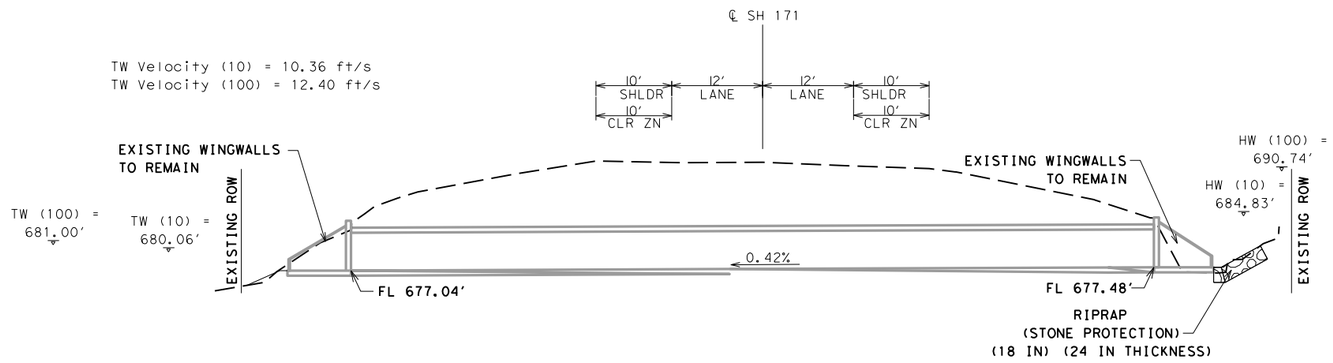
Chris J. Mashek, P.E. 5/19/2022
SIGNATURE OF REGISTRANT & DATE

CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		94





STATION 493+05.68 (CULVERT 21)
EXISTING 2 ~ 5' X 5' X 106' MBC
NO PROPOSED CULVERT WORK
SRR LT & RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0100-6002	**PREPARING ROW**	**STA**	1
0104-6010	**REMOVING CONC (RIPRAP)**	**CY**	4
0432-6002	**RIPRAP (CONC)(5 IN)**	**CY**	4
0432-6033	**RIPRAP (STONE PROTECTION)(18 IN)**	**CY**	23
0480-6001	**CLEAN EXIST CULVERTS**	**EA**	1
0658-6046	**INSTL OM ASSM (OM-2X)(WC)GND**	**EA**	2

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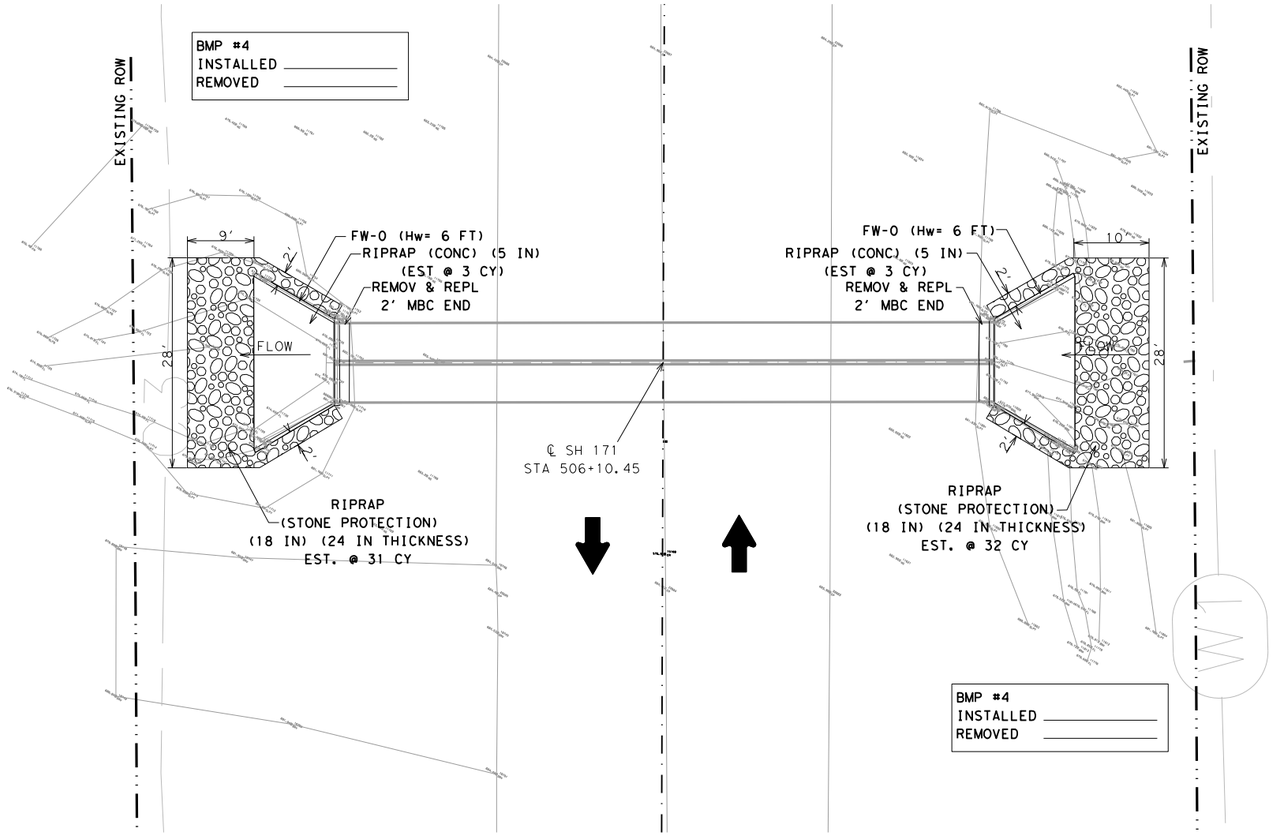
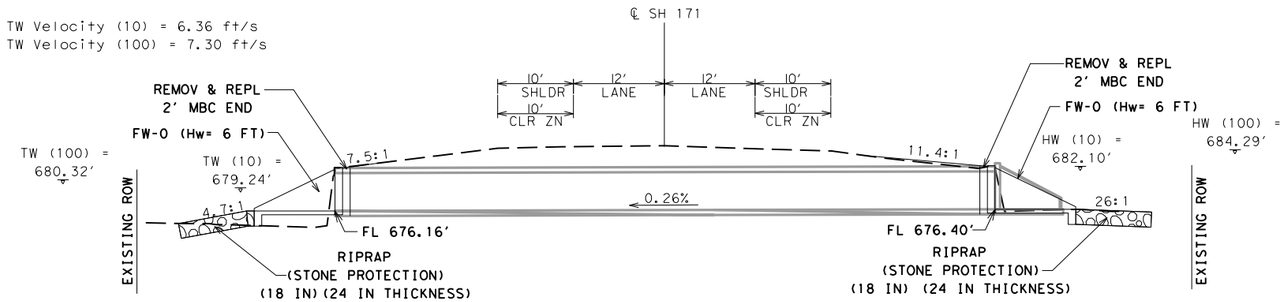
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		95





STATION 506+10.45 (CULVERT 20)
EXISTING 2 ~ 5' X 5' x 87' MBC
REMOVE EXISTING WINGWALLS;
INSTALL FW-0, MC-MD, MC-5-20 LT & RT, SRR LT & RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0432-6002	RIPRAP (CONC)(5 IN)	CY	6
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	63
0462-6053	CONC BOX CULV (5 FT X 5 FT)(EXTEND)	LF	4
0466-6153	WINGWALL (FW - 0) (HW=6 FT)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	4
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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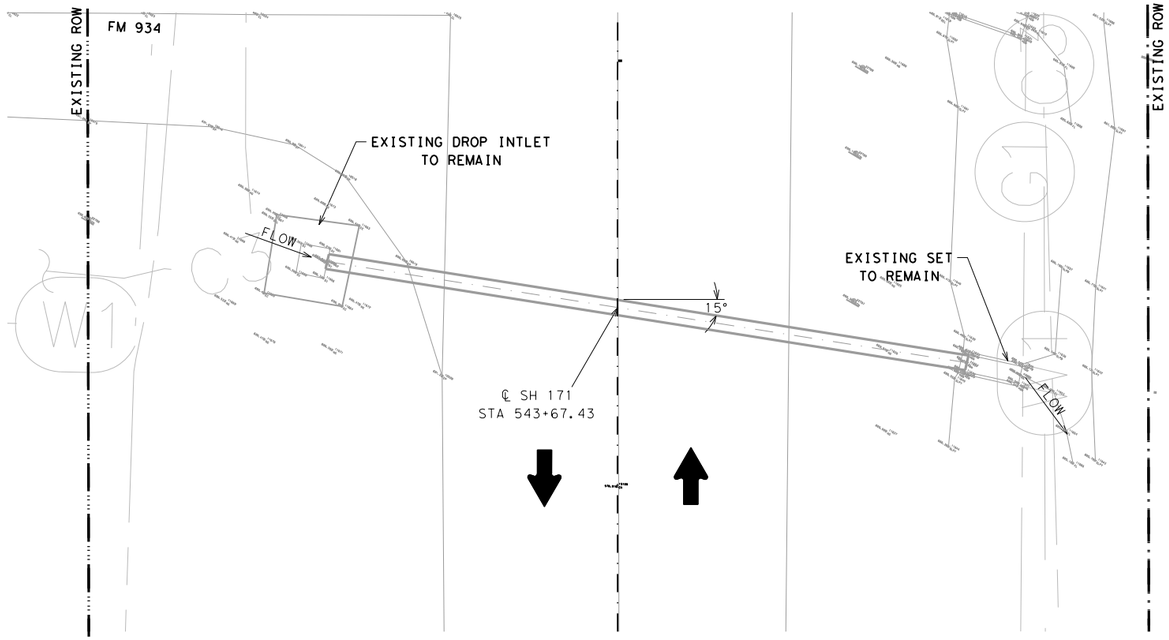
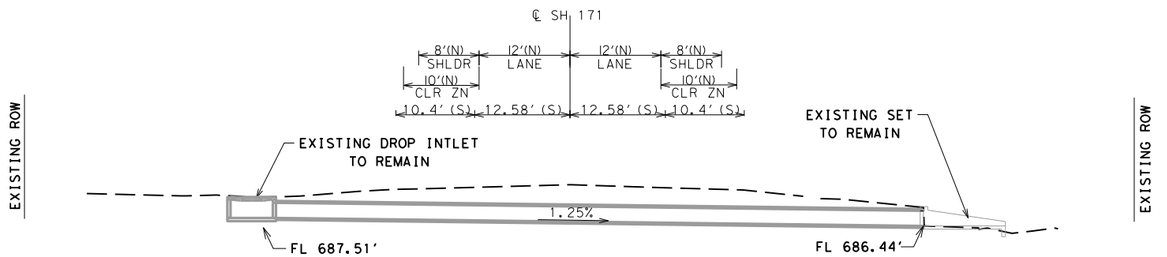
CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		96





STATION 543+67.43 (CULVERT 19)
EXISTING 24" DIA. x 85' RCP W/DROP INLET
NO PROPOSED WORK AT THIS LOCATION

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS ON STONE RIPRAP. A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0480-6001	**CLEAN EXIST CULVERTS**	**EA**	1
0658-6046	**INSTL OM ASSM (OM-2X)(WC)GND**	**EA**	2

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SCALE: FEET
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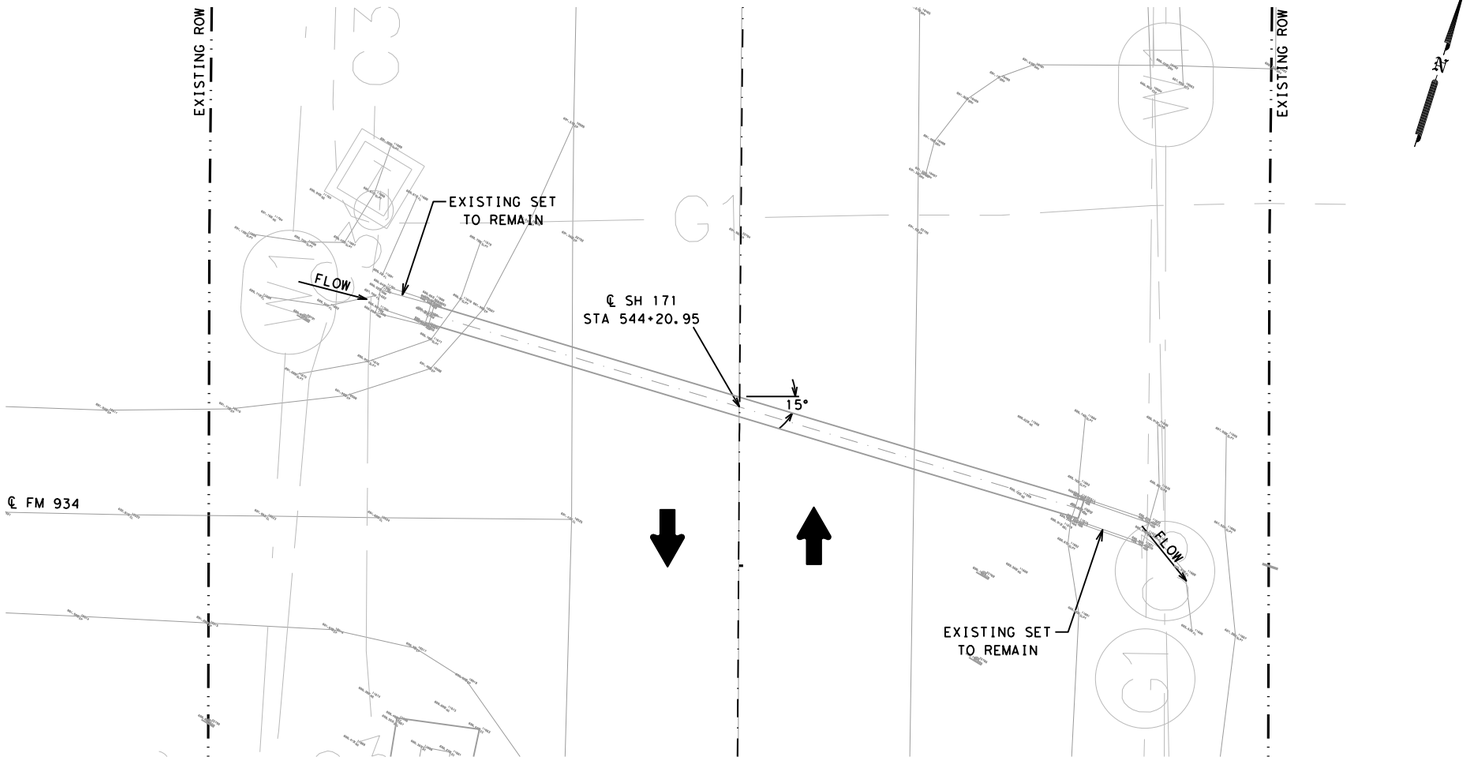
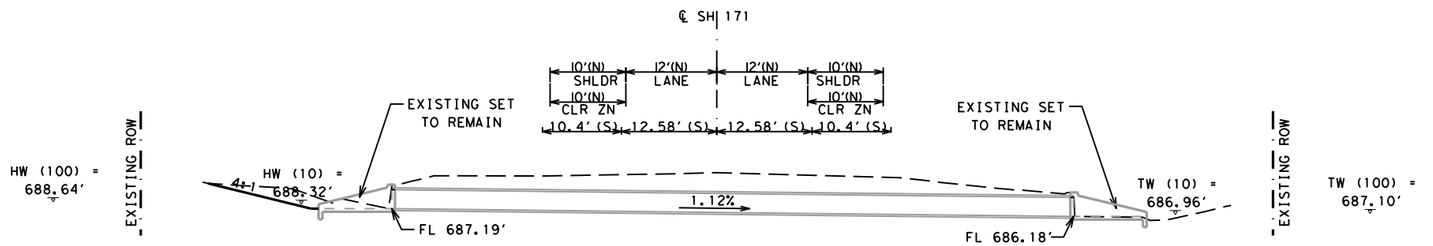
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		97





TW Velocity (10) = 2.22 ft/s
TW Velocity (100) = 2.49 ft/s

STATION 544+20.95 (CULVERT 18)
EXISTING 30" DIA. x 95' RCP (15 DEG LFS)
NO WORK @ THIS LOCATION

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP.

ITEM	DESCRIPTION	UNIT	QTY
0480-6001	**CLEAN EXIST CULVERTS**	EA	1
0658-6046	**INSTL OM ASSM (OM-2X)(WC)GND**	EA	4

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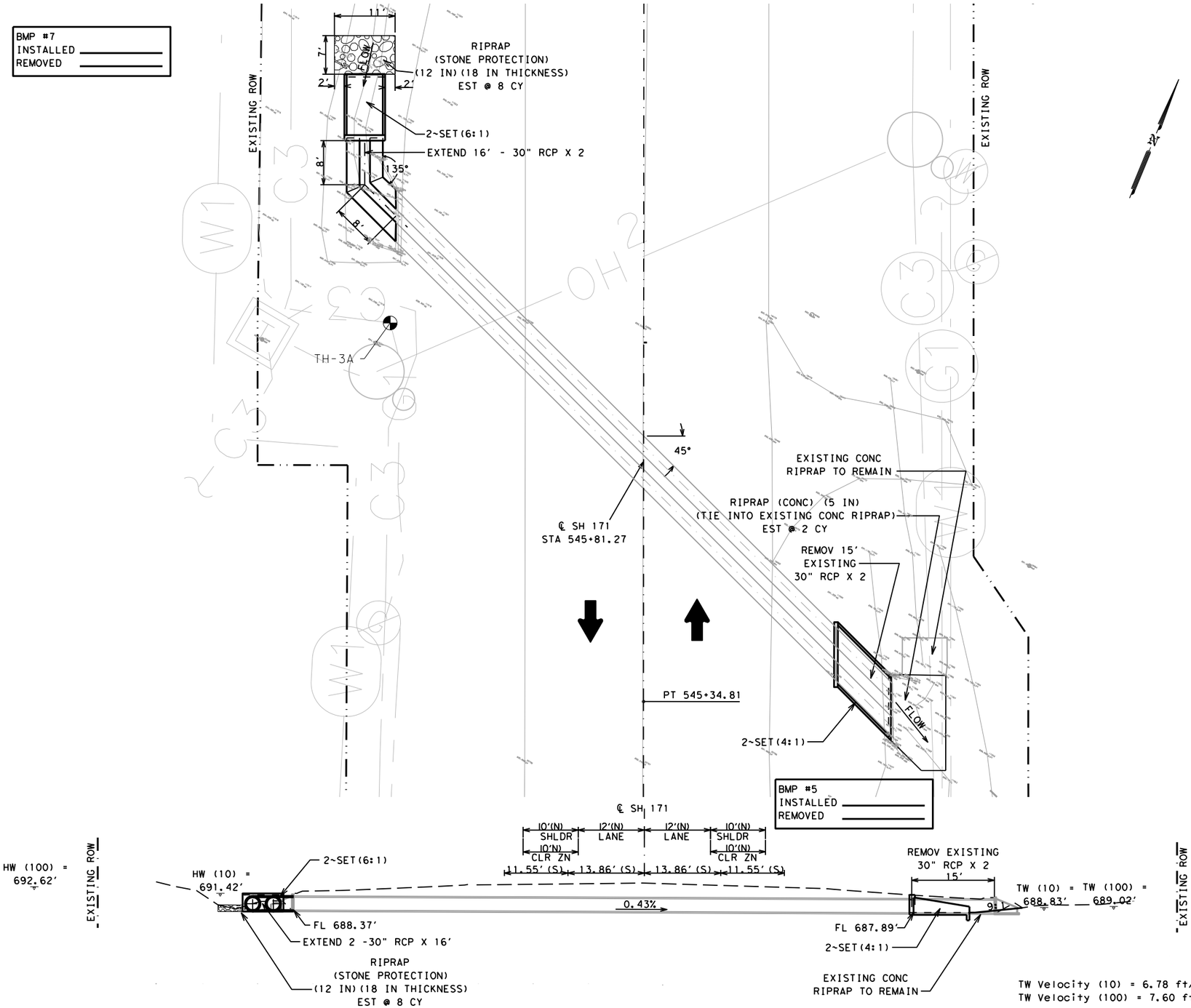
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		98

MATCH THIS TEXT



STATION 545+81.27 (CULVERT 17)
EXISTING 2 ~ 30" DIA. x 127' RCP (RFS)
REMOVE EXISTING HEADWALLS LT & RT;
REMOVE 15' RCP RT;
EXTEND 16' PER BARREL 2 ~ 30" RCP NORTH LT;
INSTALL SETP-PD OR PSET-SP LT;
INSTALL SETP-CD OR PSET-SC RT;
SRR LT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP.

ITEM	DESCRIPTION	UNIT	QTY
0132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	10
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	4
0464-6007	RC PIPE (CL III)(30 IN)	LF	32
0467-6419	SET (TY II)(30 IN)(RCP)(4:1)(C)	EA	2
0467-6423	SET (TY II) (30 IN) (RCP) (6: 1) (P)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	30
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2
0432-6002	RIPRAP (CONC)(5 IN)	CY	2
0150-6001	BLADING	STA	1

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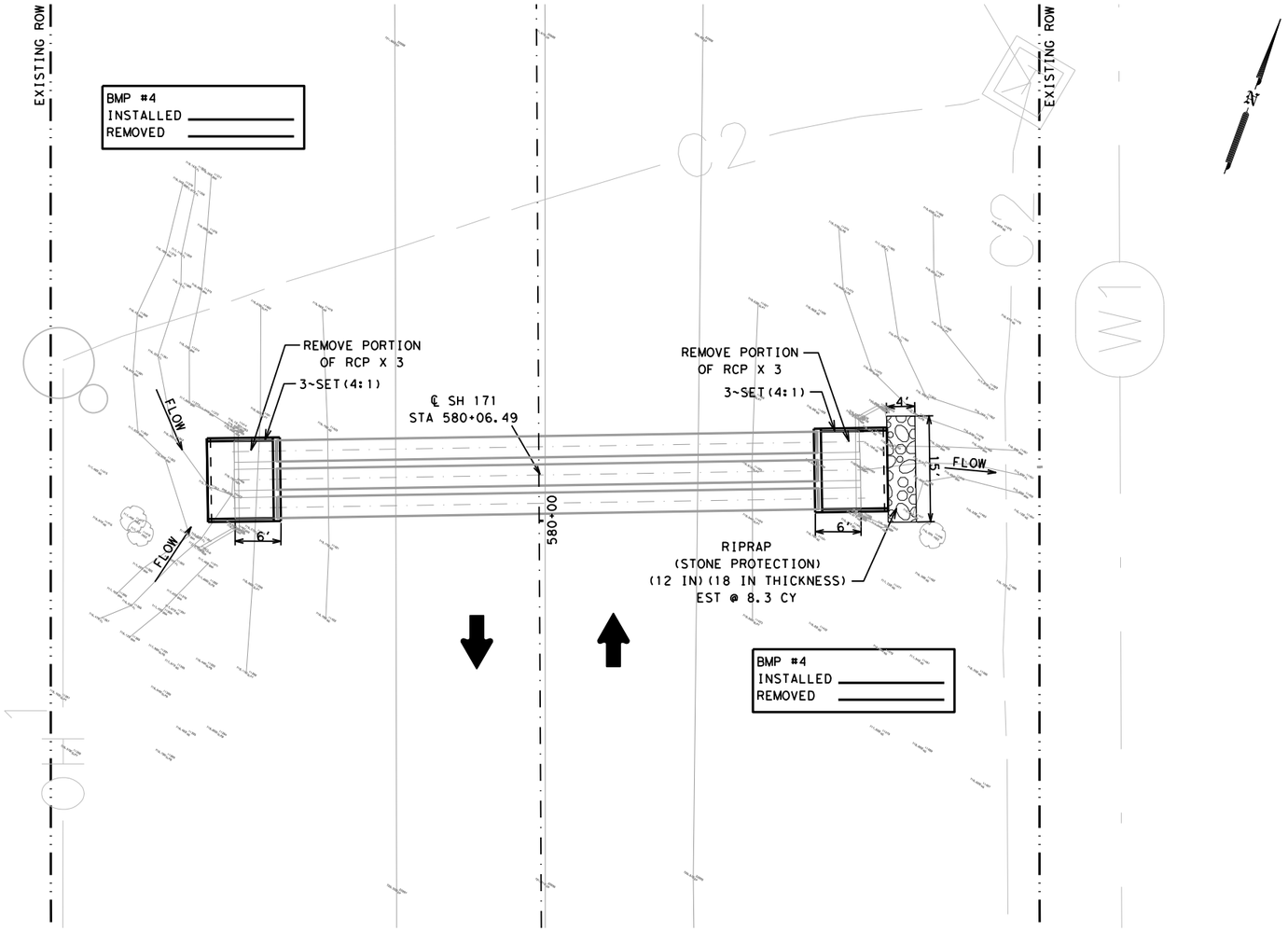
1" = 10' VERT.

SHEET 22 OF 41

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		99



TW Velocity (10) = 1.68 ft/s
TW Velocity (100) = 1.72 ft/s

STATION 580+06.49 (CULVERT 16)
EXISTING 3 ~ 36" DIA. x 89' RCP
REMOVE EXISTING HEADWALLS & BROKEN PIPE LT & RT;
INSTALL SETP-CD OR PSET-SC LT & RT; SRR RT

NOTES:

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2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	4
0467-6450	SET (TY II)(36 IN)(RCP)(4:1)(C)	EA	6
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	36
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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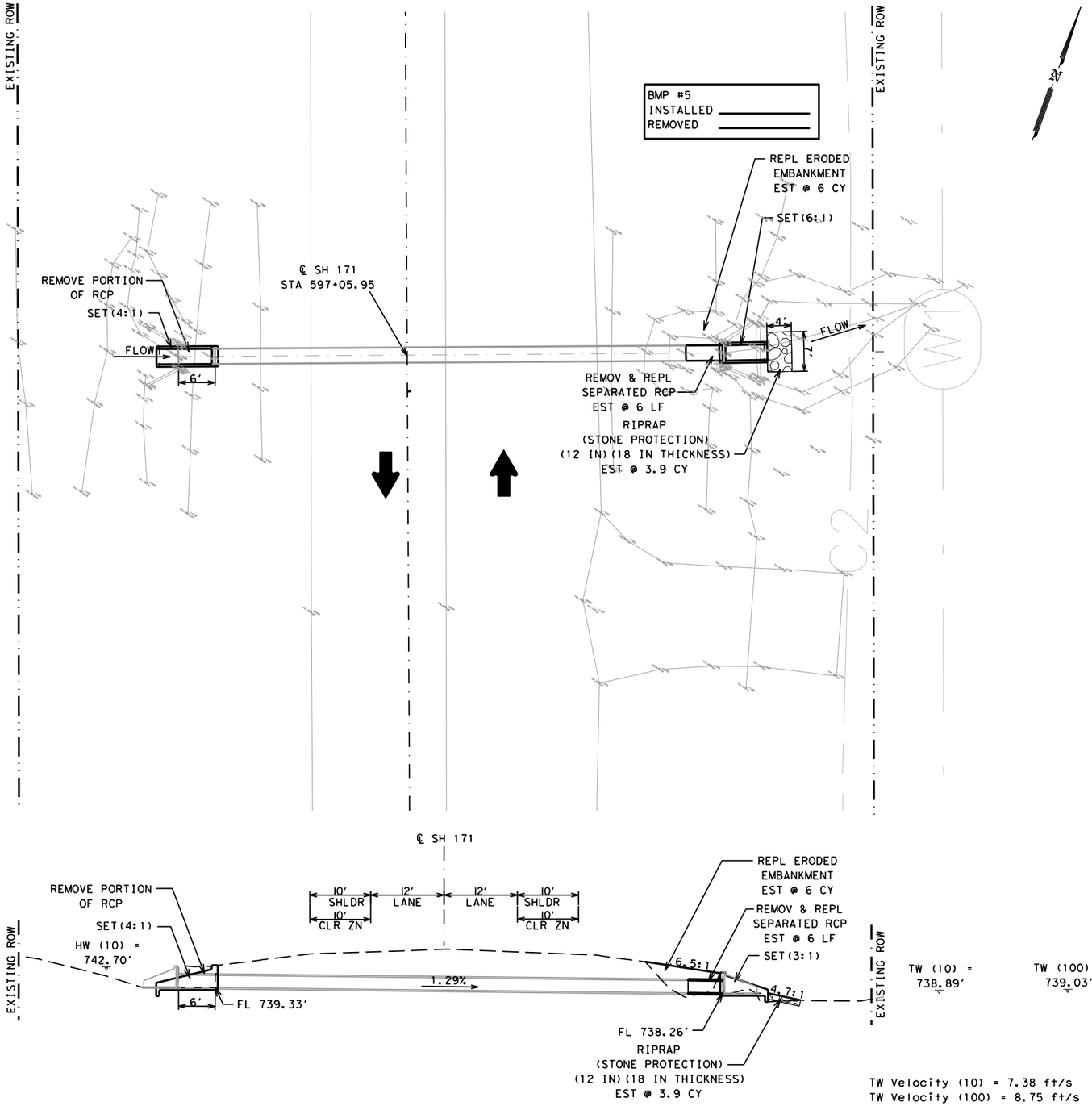
CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		100



STATION 597+05.95 (CULVERT 15)
EXISTING 30" DIA. X 89' RCP
REMOVE EXISTING HEADWALLS & BROKEN PIPE LT & RT;
REPLACE BROKEN PIPE RT;
INSTALL SETP-CD OR PSET-SC LT & RT; SRR RT

NOTES:

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2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	6
0150-6001	BLADING	STA	1
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	2
0464-6007	RC PIPE (CL III)(30 IN)	LF	6
0467-6417	SET (TY II) (30 IN) (RCP) (3: 1) (C)	EA	1
0467-6419	SET (TY II)(30 IN)(RCP)(4:1)(C)	EA	1
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	12
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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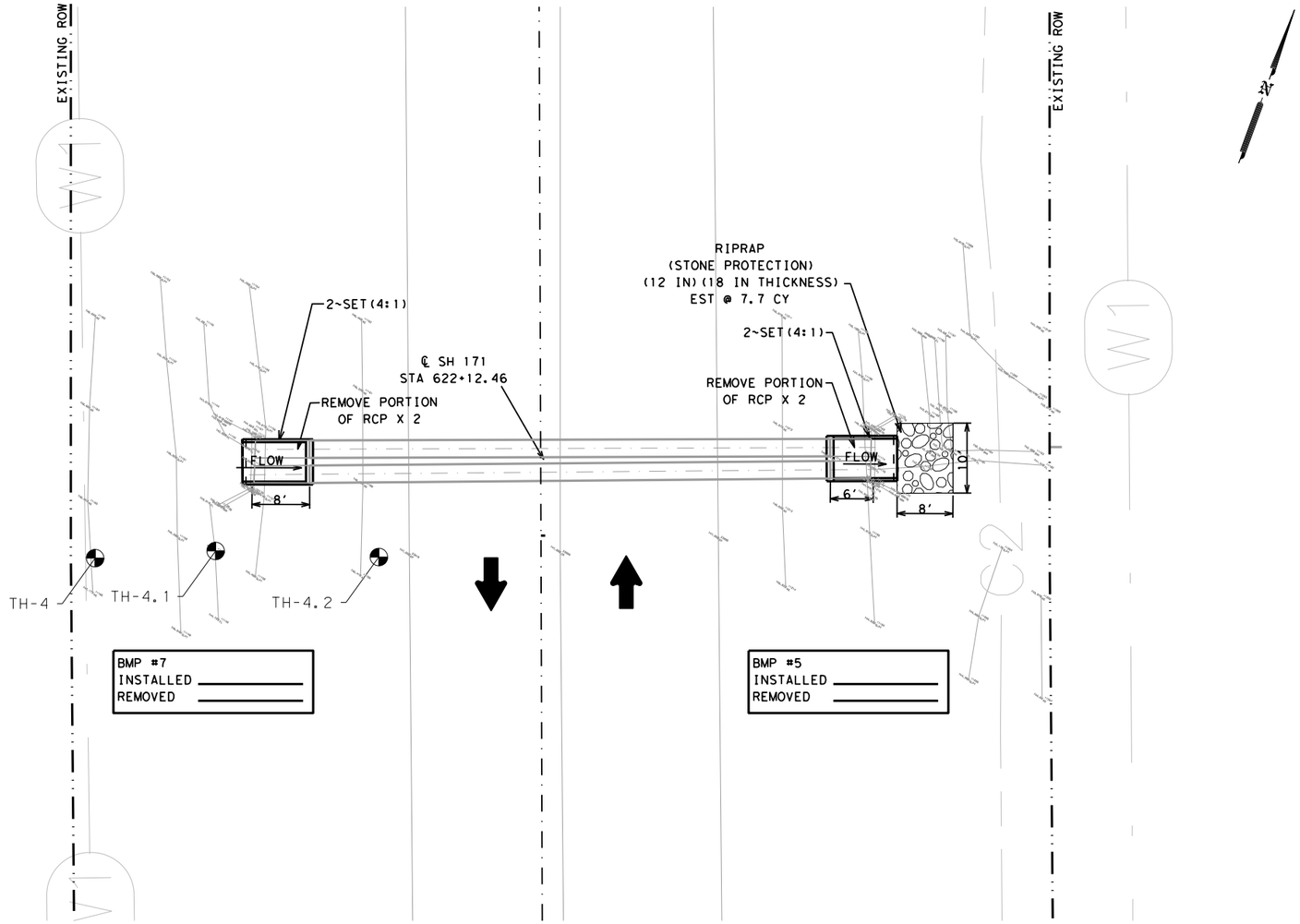
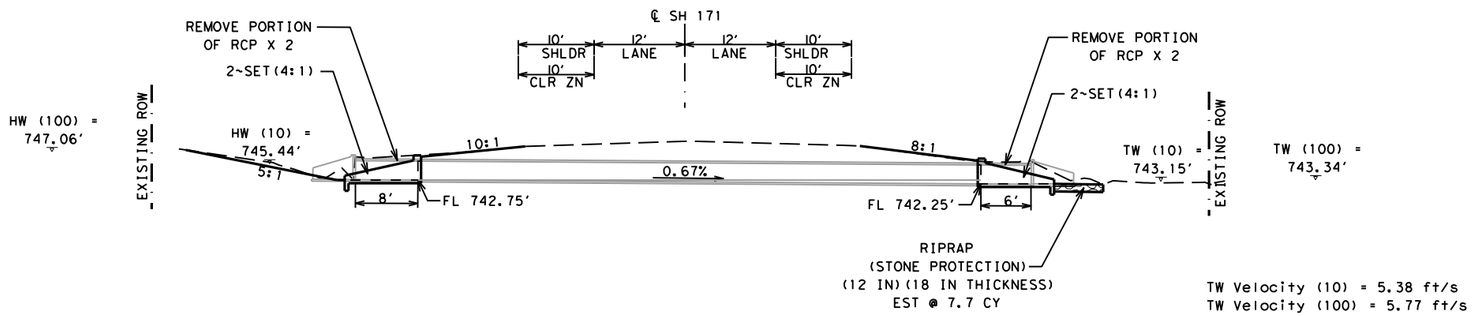
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		101





TW Velocity (10) = 5.38 ft/s
TW Velocity (100) = 5.77 ft/s

STATION 622+12.46 (CULVERT 14)
EXISTING 2 ~ 30" DIA. X 89' RCP
REMOVE EXISTING HEADWALLS;
REMOVE PORTIONS OF EXISTING 2 ~ 30" DIA. RCP X 8' LT & X 6' RT;
INSTALL SETP-CD OR PSET-SC LT & RT; SRR RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	3
0467-6419	SET (TY II)(30 IN)(RCP)(4:1)(C)	EA	4
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	28
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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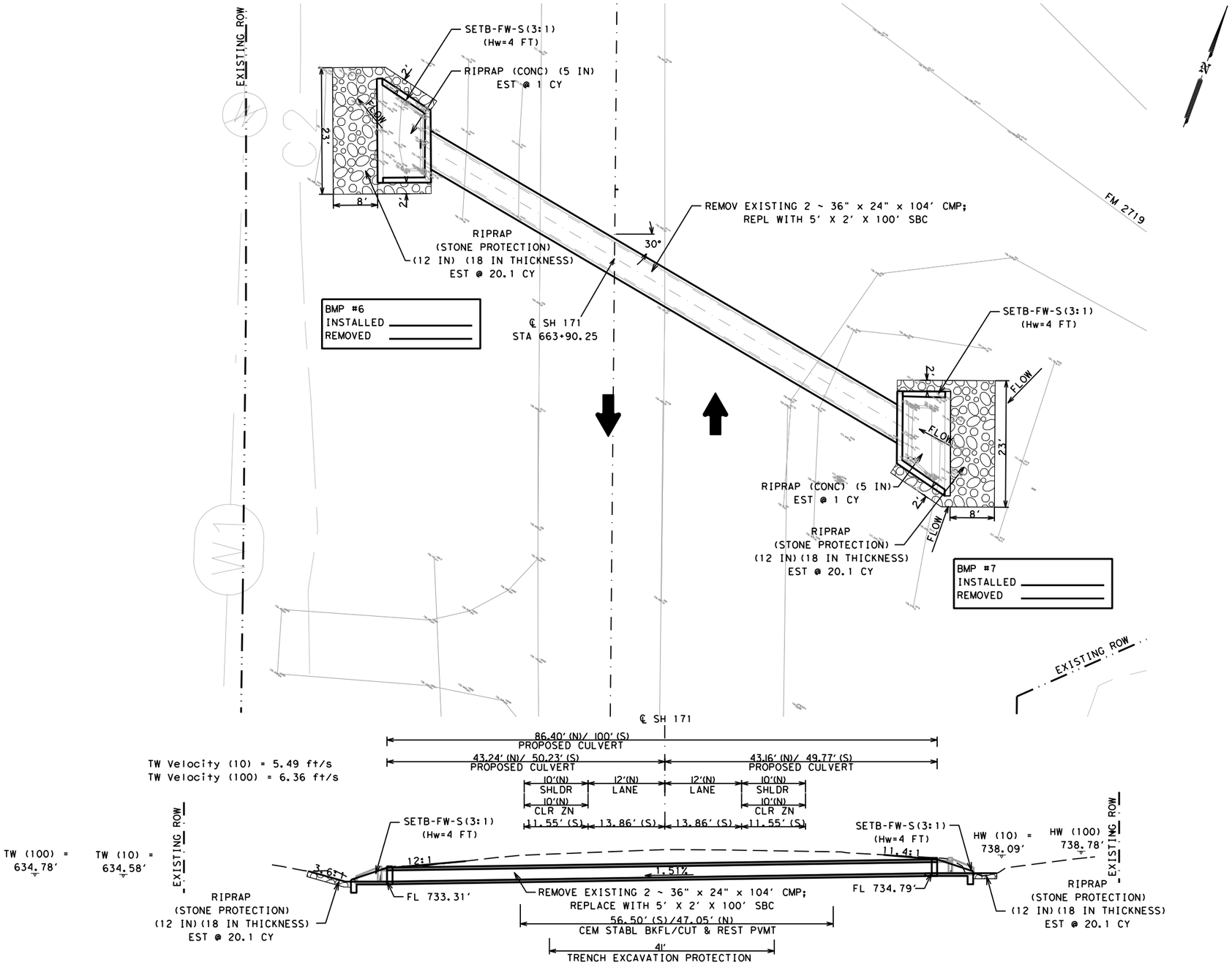
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		102



STATION 663+90.25 (CULVERT 12)
EXISTING 2 ~ 36" x 24" x 104' CMP (30 DEG LFS)
REMOVE EXISTING 2 ~ 36" x 24" x 104' CMP (30 DEG LFS);
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL 1 ~ 5' X 2' X 100' SBC (30 DEG LFS);
SCP-5, SCP-MD, SETB-FW-S LT & RT; SRR LT & RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0400-6005	CEM STABIL BKFL	CY	38.4
0400-6006	CUT & RESTORING PAV	SY	54
0402-6001	TRENCH EXCAVATION PROTECTION	LF	41
0432-6002	RIPRAP (CONC)(5 IN)	CY	3.5
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	23
0462-6006	CONC BOX CULV (5 FT X 2 FT)	LF	100
0467-6171	SET (TY I)(S= 5 FT)(HW= 3 FT)(3:1) (C)	EA	2
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	208
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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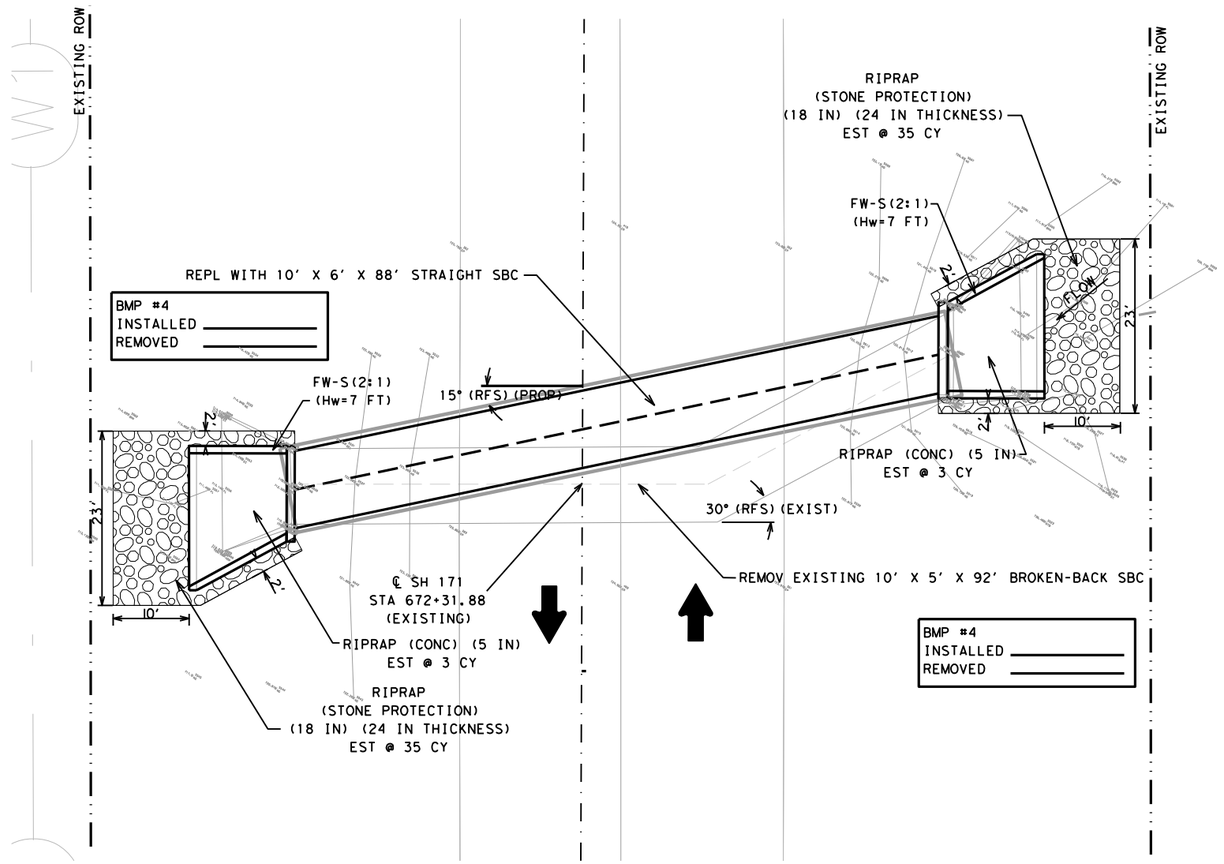
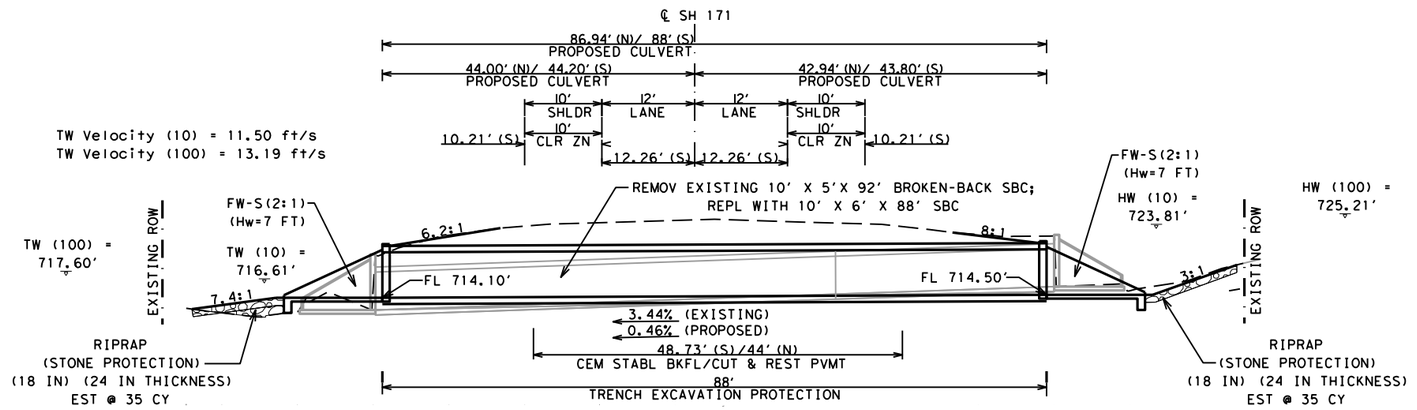
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		103





STATION 672+31.88 (CULVERT 11)
EXISTING 10' X 5' X 92' SBC
REMOVE EXISTING 10' X 5' X 92' SBC;
REMOVE EXISTING WINGWALLS LT & RT;
INSTALL 1 ~ 10' X 6' X 88' SBC (15° RFS);
SCP-10, SCP-MD; INSTALL FW-S LT & RT; SRR LT & RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0400-6005	CEM STABIL BKFL	CY	88.7
0400-6006	CUT & RESTORING PAV	SY	79
0402-6001	TRENCH EXCAVATION PROTECTION	LF	88
0432-6002	RIPRAP (CONC)(5 IN)	CY	6
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	70
0462-6030	CONC BOX CULV (10 FT X 6 FT)	LF	88
0466-6168	WINGWALL (FW - S) (HW=7 FT)	EA	2
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	92
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2
0100-6002	PREPARING ROW	STA	1

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PROFESSIONAL ENGINEER

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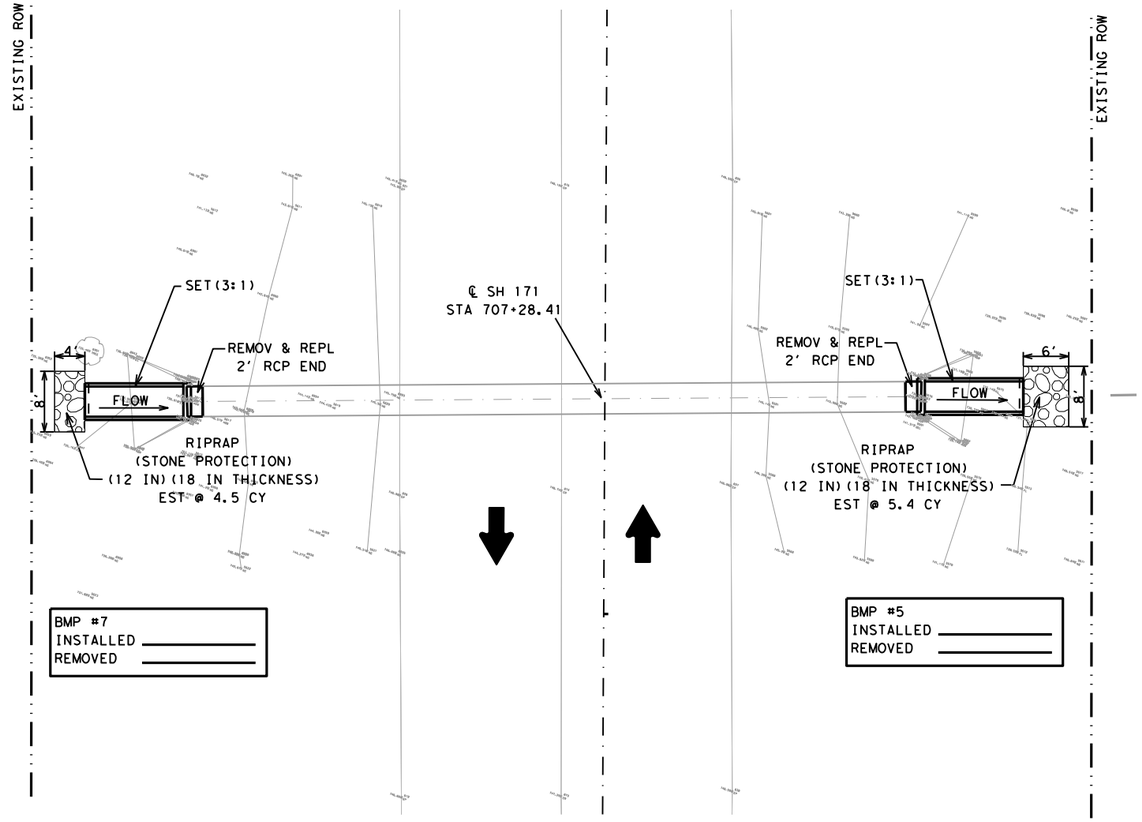
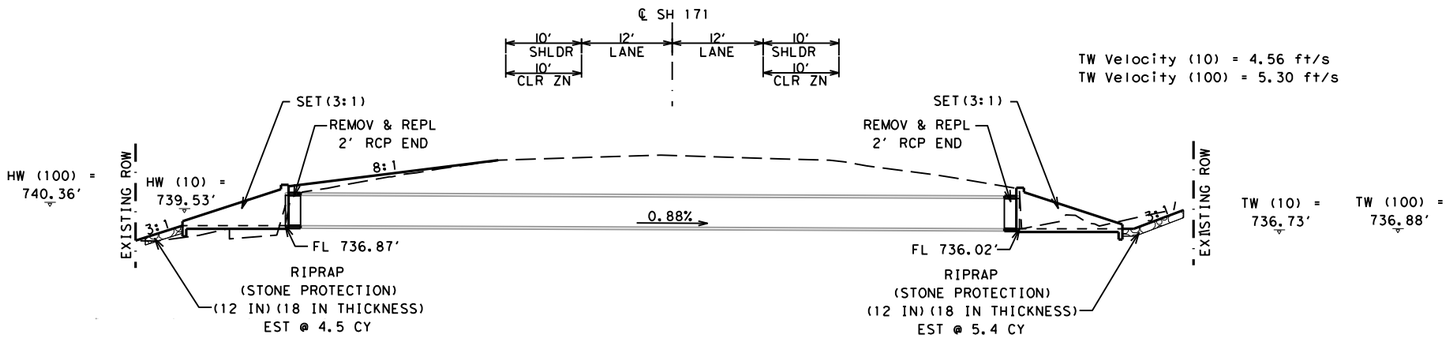
SIGNATURE OF REGISTRANT & DATE

CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		104





STATION 707+28.41 (CULVERT 10)
EXISTING 48" DIA. X 97' RCP W/CH-11B
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL SETP-CD OR PSET-SC LT & RT; SRR LT & RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0132-6001	EMBANKMENT (FINAL)(ORD COMP)(TY A)	CY	6
0150-6001	BLADING	STA	1
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	9.9
0464-6010	RC PIPE (CL III)(48 IN)	LF	4
0467-6474	SET (TY II)(48 IN)(RCP)(3:1)(C)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	4
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

STATE OF TEXAS
CHRIS J. MASHEK
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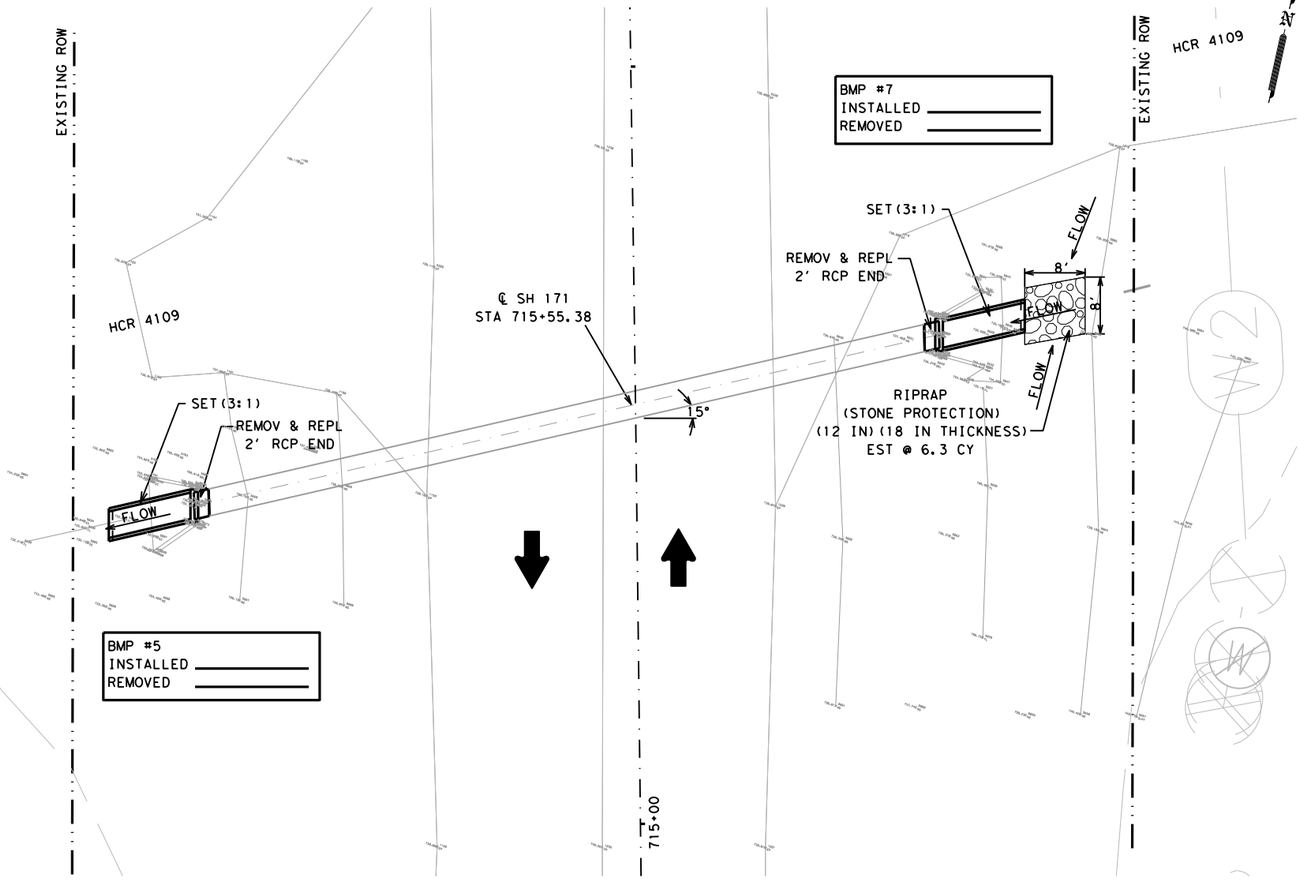
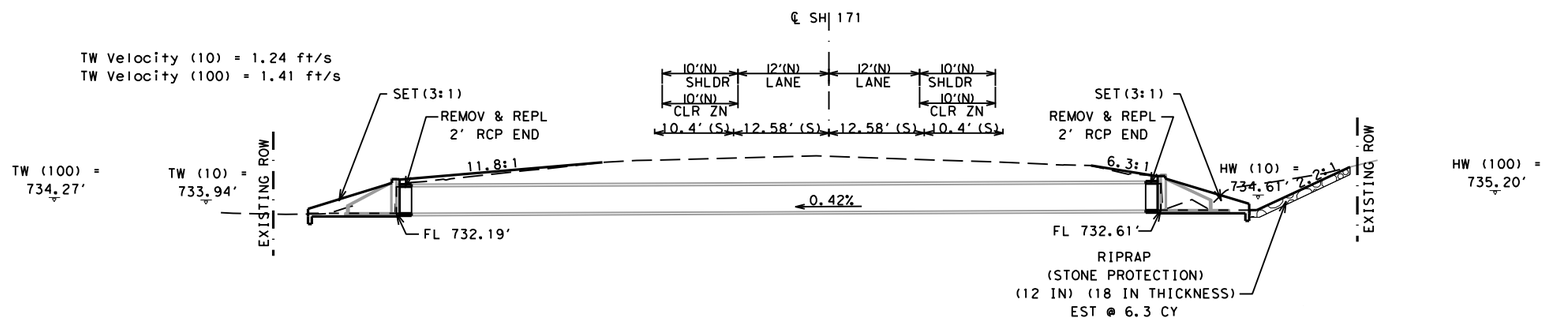
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		105





STATION 715+55.38 (CULVERT 09)
EXISTING 42" DIA. X 100' RCP (15 DEG RFS)
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL SETP-CD OR PSET-SC LT & RT; SRR RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	6.3
0464-6009	RC PIPE (CL III)(42 IN)	LF	4
0467-6461	SET (TY II) (42 IN) (RCP) (3:1) (C)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	4
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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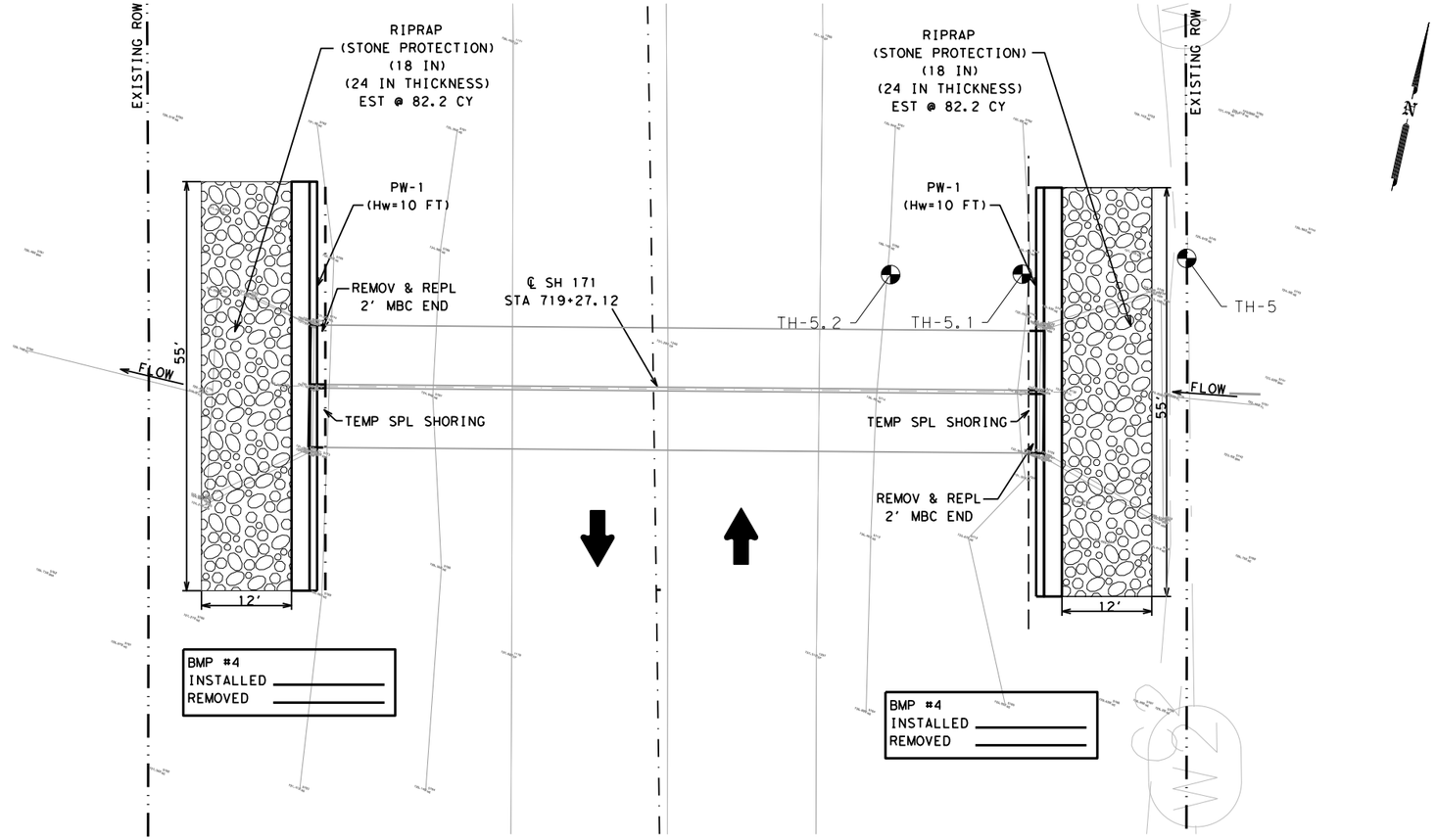
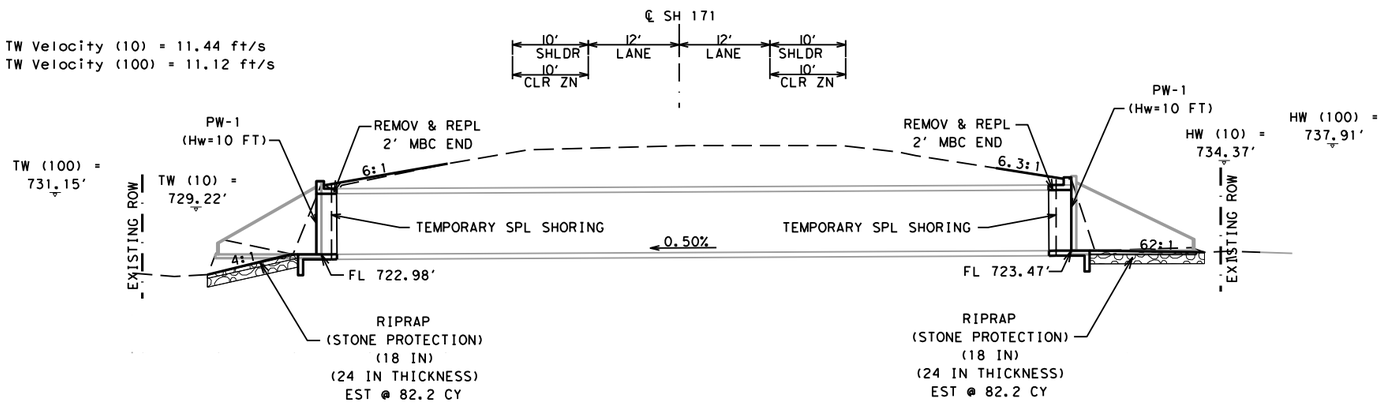
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		106





STATION 719+27.12 (CULVERT 08)
EXISTING 2 ~ 8' X 8' X 99' MBC
INSTALL MC-MD, MC-8-13, PW-1, ECD LT & RT; SRR LT & RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0100-6002	PREPARING ROW	STA	1
0150-6001	BLADING	STA	1
0403-6001	TEMPORARY SPL SHORING	SF	1140
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	164.4
0462-6067	CONC BOX CULV (8 FT X 8 FT)(EXTEND)	LF	8
0466-6171	WINGWALL (PW - 1) (HW=10 FT)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	8
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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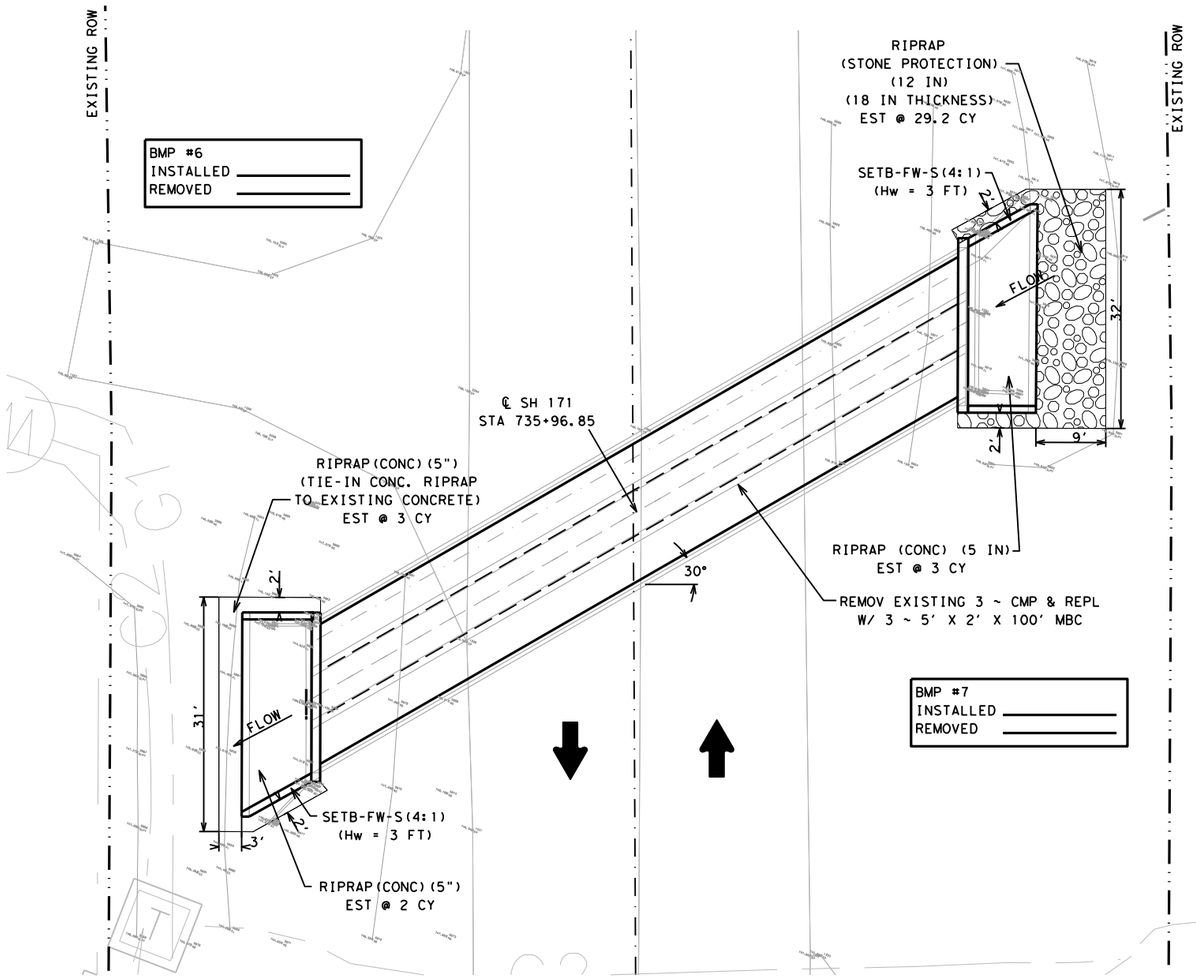
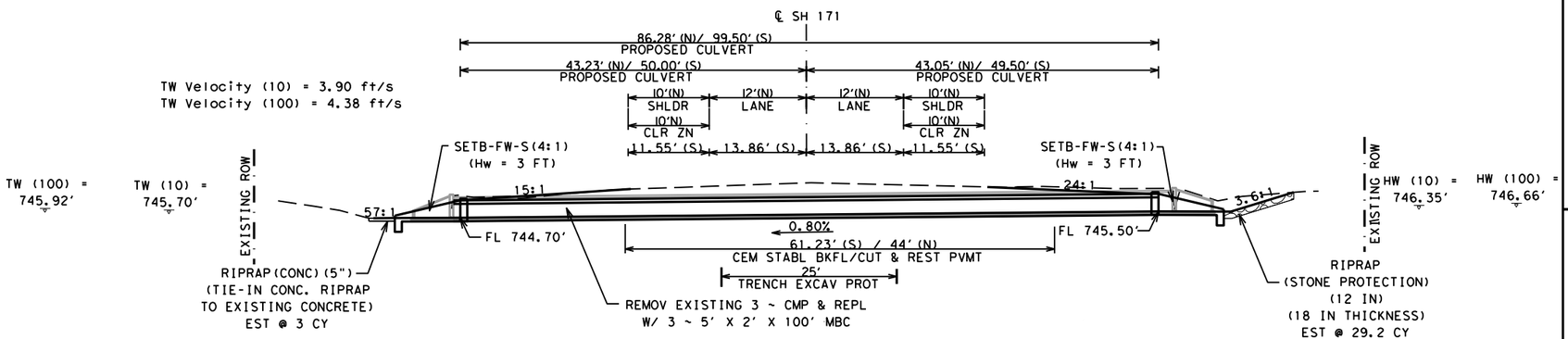
CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		107





STATION 735+96.85 (CULVERT 07a)
EXISTING 3 ~ 48" X 33" X 103' ARCH CMP (30 DEG RFS)
REMOVE EXISTING 3 ~ 48" X 33" X 103' ARCH CMP (30 DEG RFS);
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL 3 ~ 5' X 2' X 100' MBC (30 DEG RFS);
SCP-5, SCP-MD;
INSTALL SETB-FW-S LT & RT; SRR LT & RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.
5. TIE PROPOSED CONCRETE TO EXISTING CONCRETE WITH 24" #4 REBAR SPACED AT 24".

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0400-6005	CEM STABIL BKFL	CY	65.2
0400-6006	CUT & RESTORING PAV	SY	127
0402-6001	TRENCH EXCAVATION PROTECTION	LF	25
0432-6002	RIPRAP (CONC)(5 IN)	CY	8.2
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	29.2
0462-6006	CONC BOX CULV (5 FT X 2 FT)	LF	300
0467-6172	SET (TY I)(S= 5 FT)(HW= 3 FT)(4:1) (C)	EA	6
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	309
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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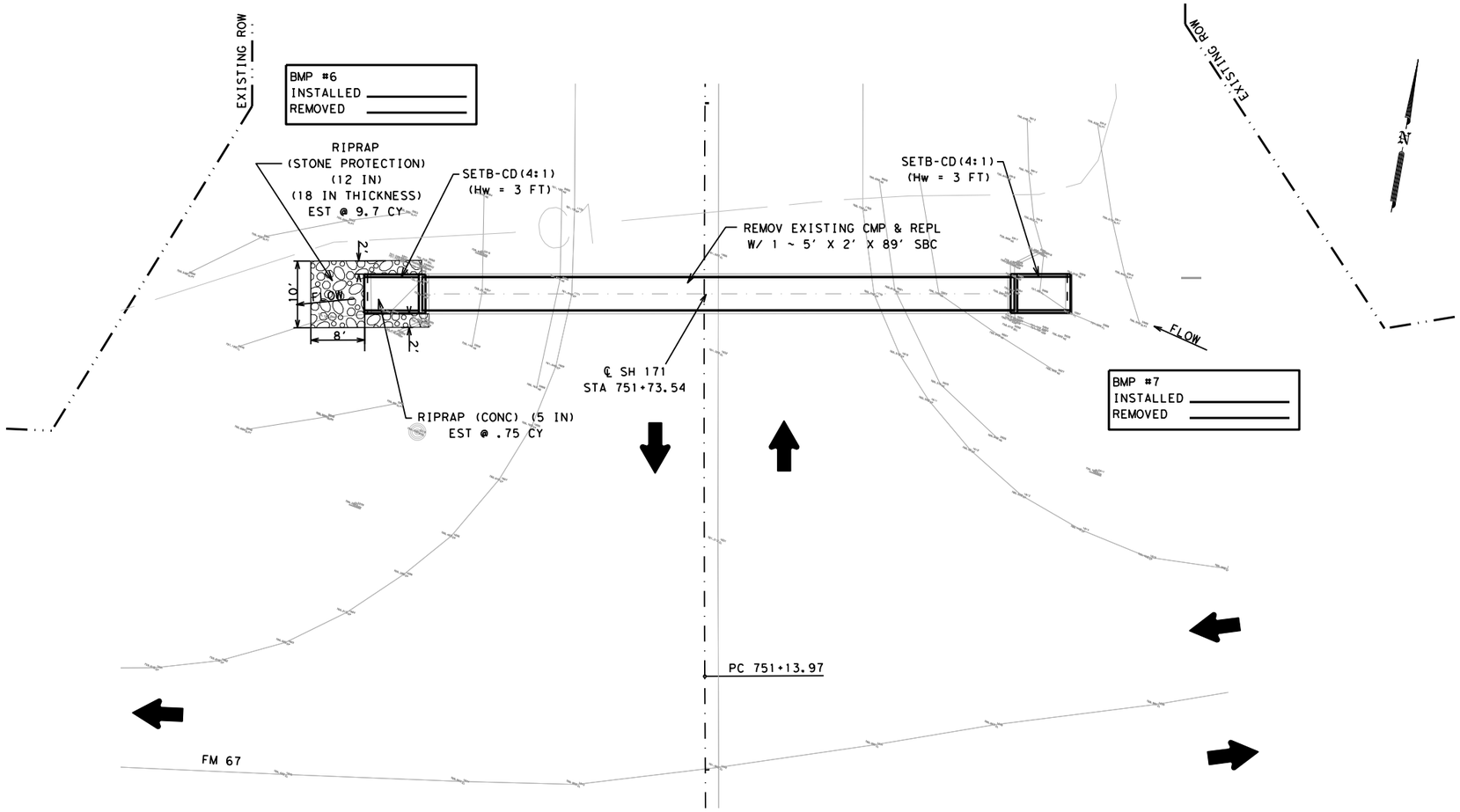
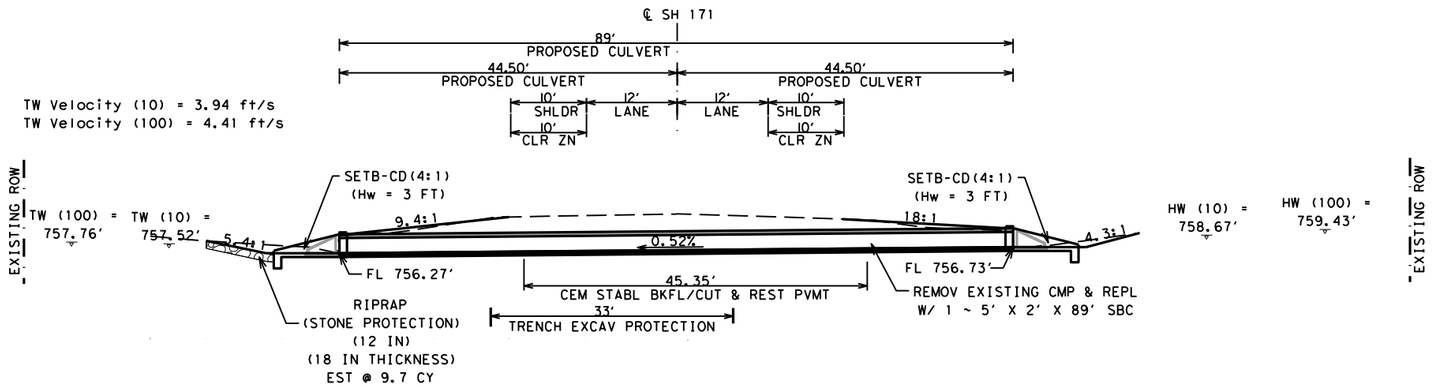
1" = 10' VERT.

SHEET 31 OF 41

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		108





STATION 751+73.54 (CULVERT 07)
EXISTING 2 ~ 36" X 24" X 89' ARCH CMP
REMOVE EXISTING 2 ~ 36" X 24" X 89' ARCH CMP;
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL 1 ~ 5' X 2' X 89' SBC, SCP-5, SCP-MD;
INSTALL SETB-CD LT & RT; SRR LT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0400-6005	CEM STABIL BKFL	CY	32.6
0400-6006	CUT & RESTORING PAV	SY	50
0402-6001	TRENCH EXCAVATION PROTECTION	LF	33
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	9.7
0462-6006	CONC BOX CULV (5 FT X 2 FT)	LF	89
0467-6172	SET (TY I)(S= 5 FT)(HW= 3 FT)(4:1) (C)	EA	2
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	178
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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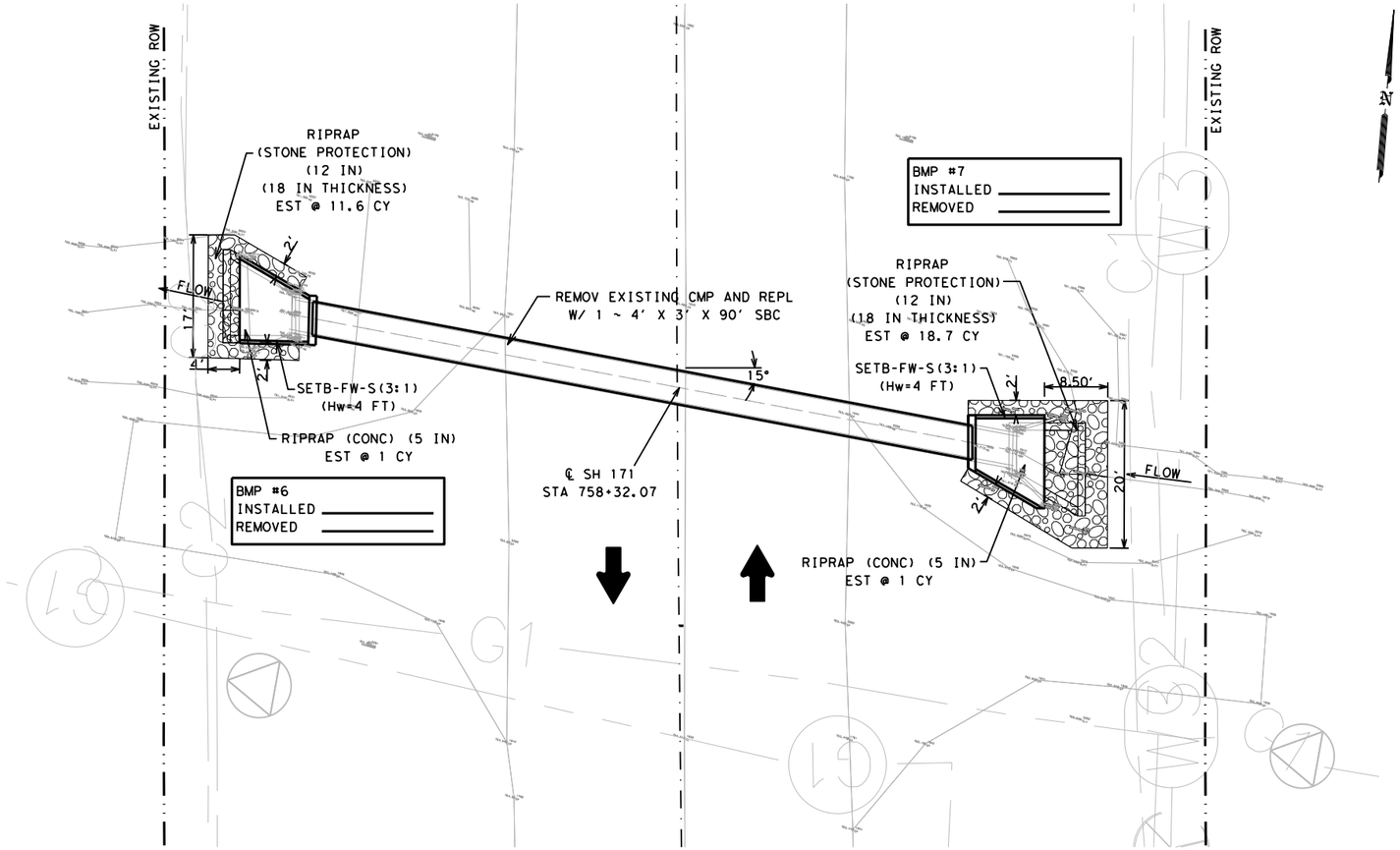
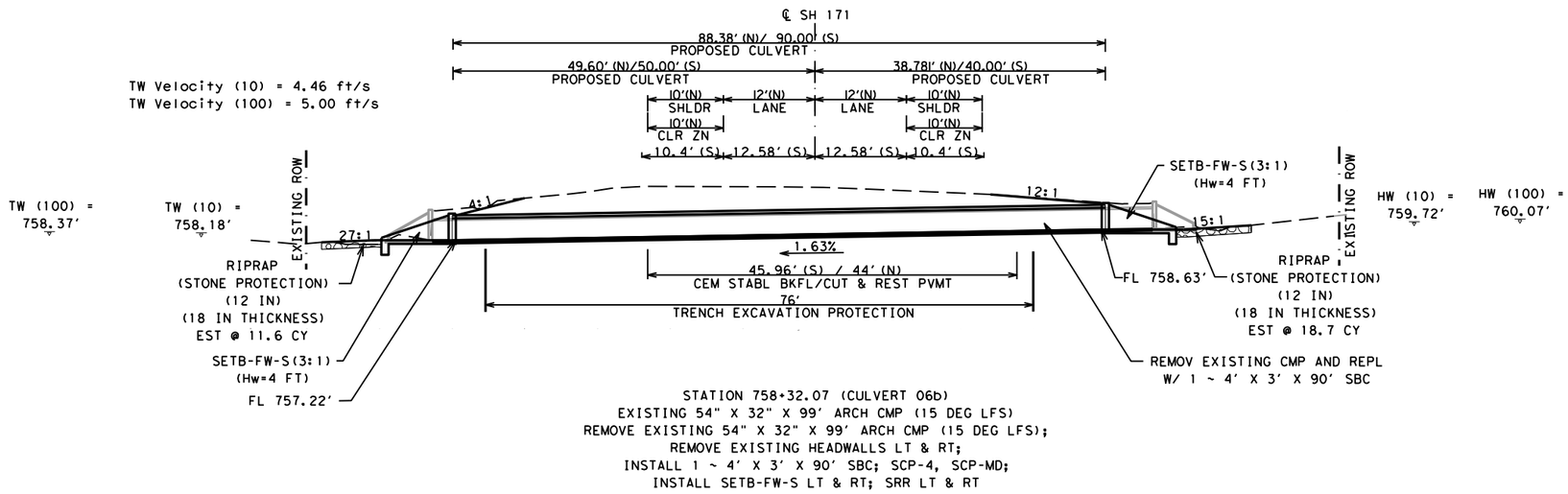
1" = 10' VERT.

SHEET 32 OF 41

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		109





STATION 758+32.07 (CULVERT 06b)
EXISTING 54" X 32" X 99' ARCH CMP (15 DEG LFS)
REMOVE EXISTING 54" X 32" X 99' ARCH CMP (15 DEG LFS);
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL 1 ~ 4' X 3' X 90' SBC; SCP-4, SCP-MD;
INSTALL SETB-FW-S LT & RT; SRR LT & RT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0400-6005	CEM STABIL BKFL	CY	40.3
0400-6006	CUT & RESTORING PAV	SY	45
0402-6001	TRENCH EXCAVATION PROTECTION	LF	76
0432-6002	RIPRAP (CONC)(5 IN)	CY	2
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	30.3
0462-6004	CONC BOX CULV (4 FT X 3 FT)	LF	90
0467-6143	SET (TY I)(S= 4 FT)(HW= 4 FT)(3:1) (C)	EA	2
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	99
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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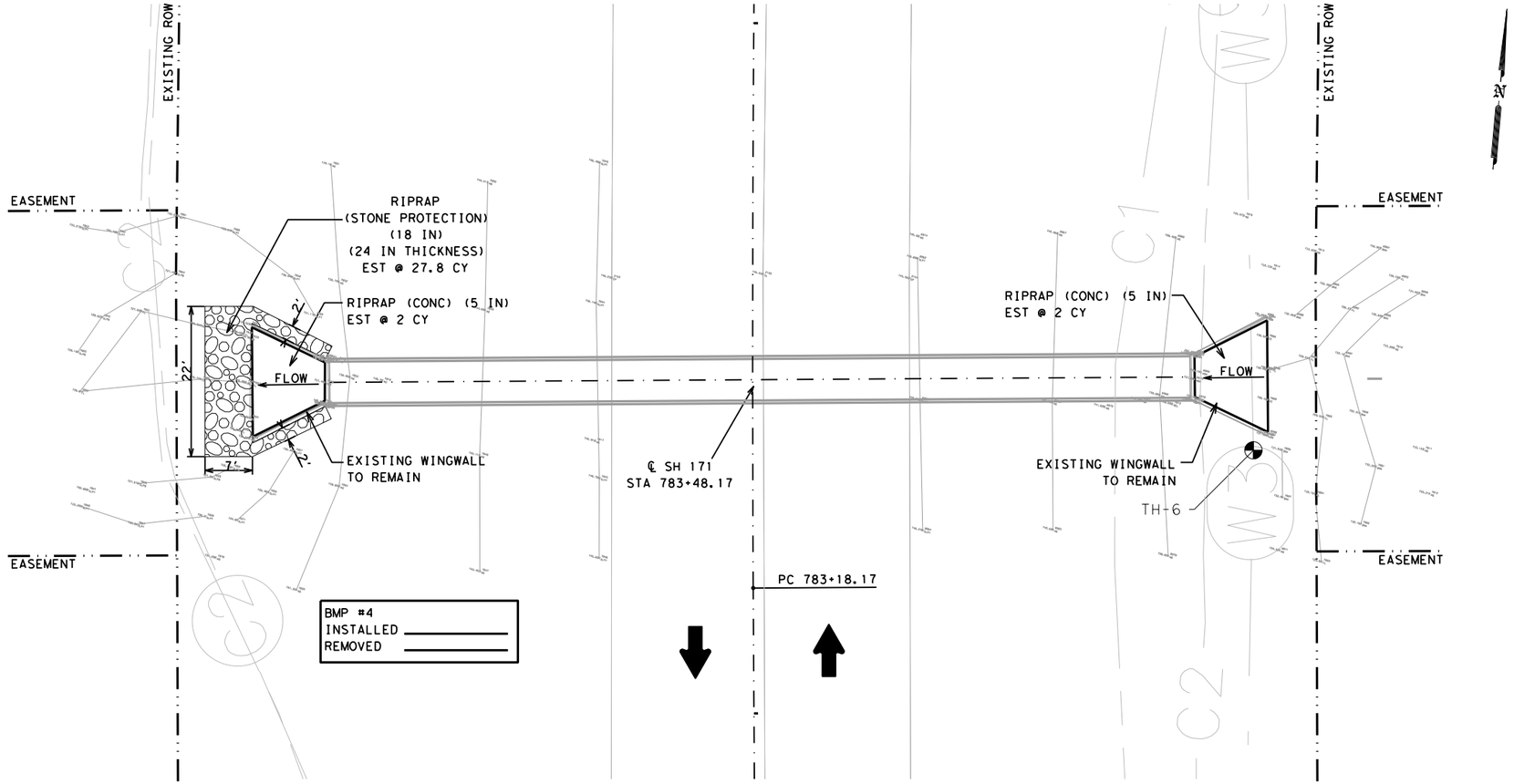
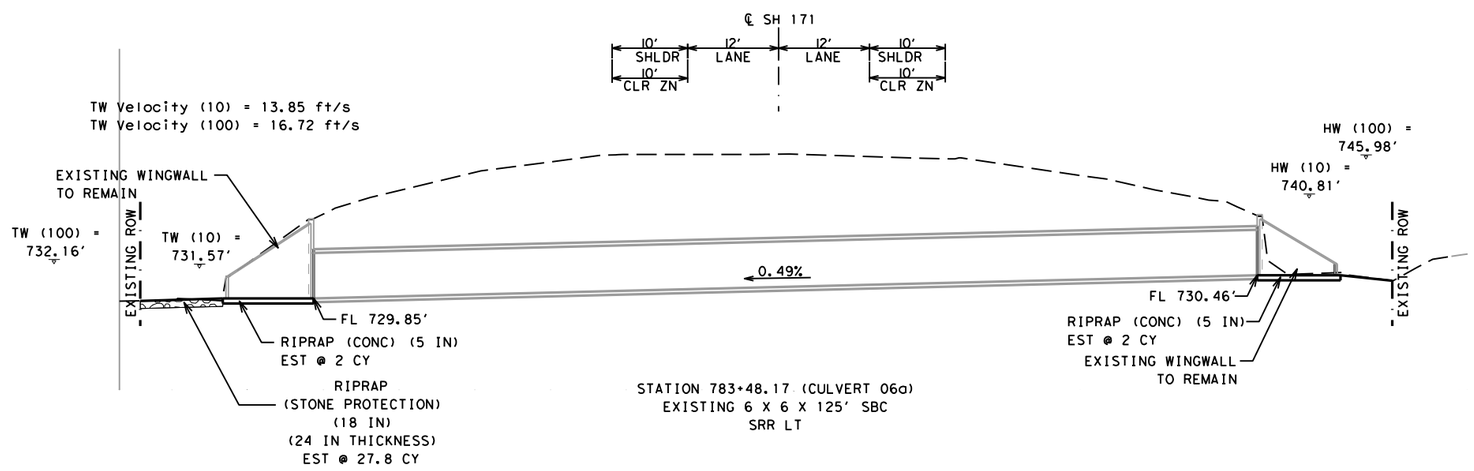
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

SHEET 33 OF 41

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		110





NOTES:

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2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0100-6002	PREPARING ROW	STA	1
0432-6002	RIPRAP (CONC)(5 IN)	CY	4
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	27.8
0480-6001	CLEAN EXIST CULVERTS	EA	1
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	4

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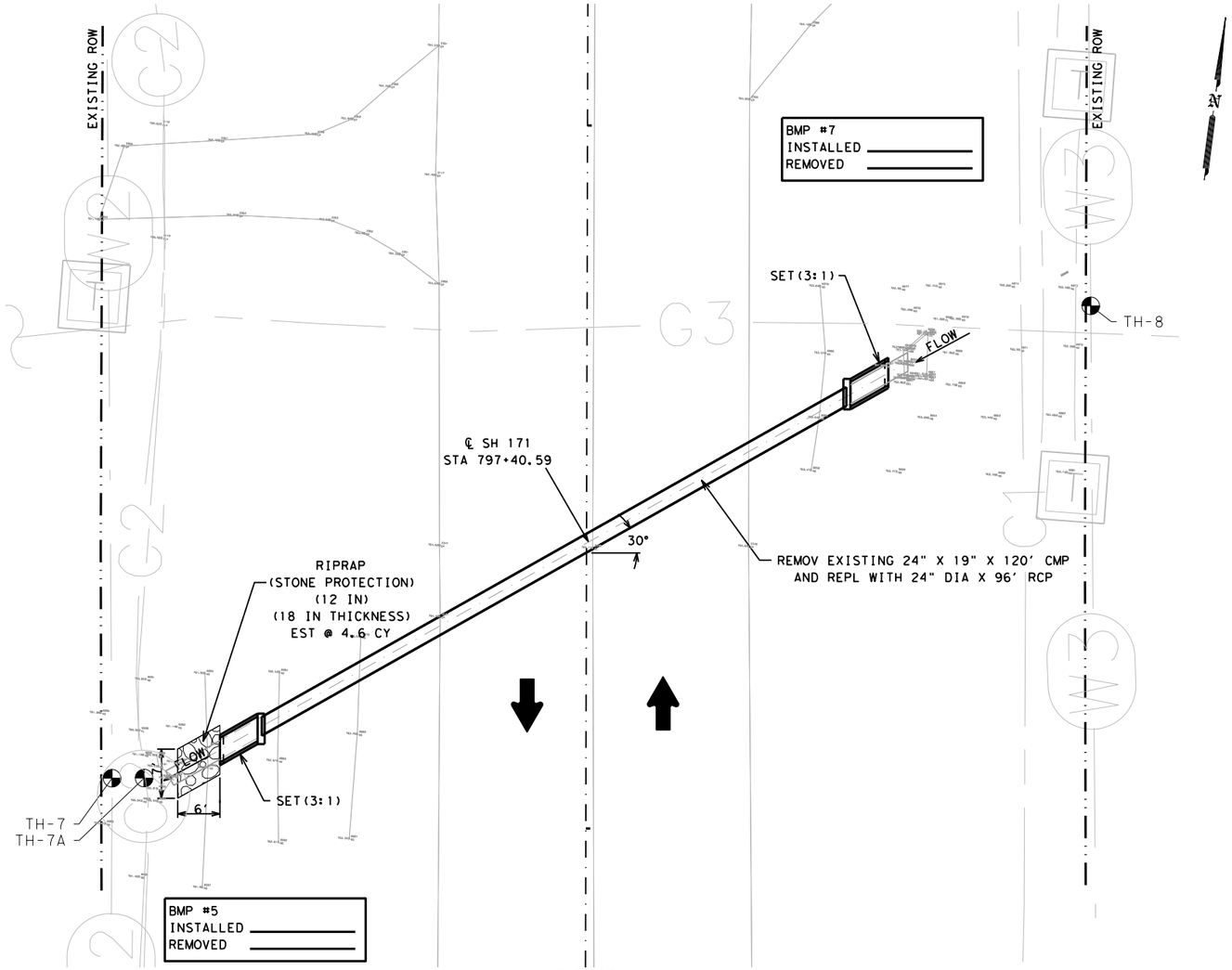
SHEET 34 OF 41

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		III



STATION 797+40.59 (CULVERT 06c)
EXISTING 28" X 19" X 120' ARCH CMP (30 DEG RFS)
REMOVE EXISTING 28" X 19" X 120' ARCH CMP (30 DEG RFS);
REMOVE EXISTING HEADWALLS LT & RT;
INSTALL 24" DIA X 96' RCP;
INSTALL SETP-CD OR PSET-SC LT & RT; SRR LT

NOTES:

1. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
4. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0400-6005	CEM STABIL BKFL	CY	88
0400-6006	CUT & RESTORING PAV	SY	38
0402-6001	TRENCH EXCAVATION PROTECTION	LF	96
0432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	4.6
0464-6005	RC PIPE (CL III)(24 IN)	LF	96
0467-6394	SET (TY II) (24 IN) (RCP) (6: 1) (C)	EA	2
0496-6006	REMOV STR (HEADWALL)	EA	2
0496-6007	REMOV STR (PIPE)	LF	120
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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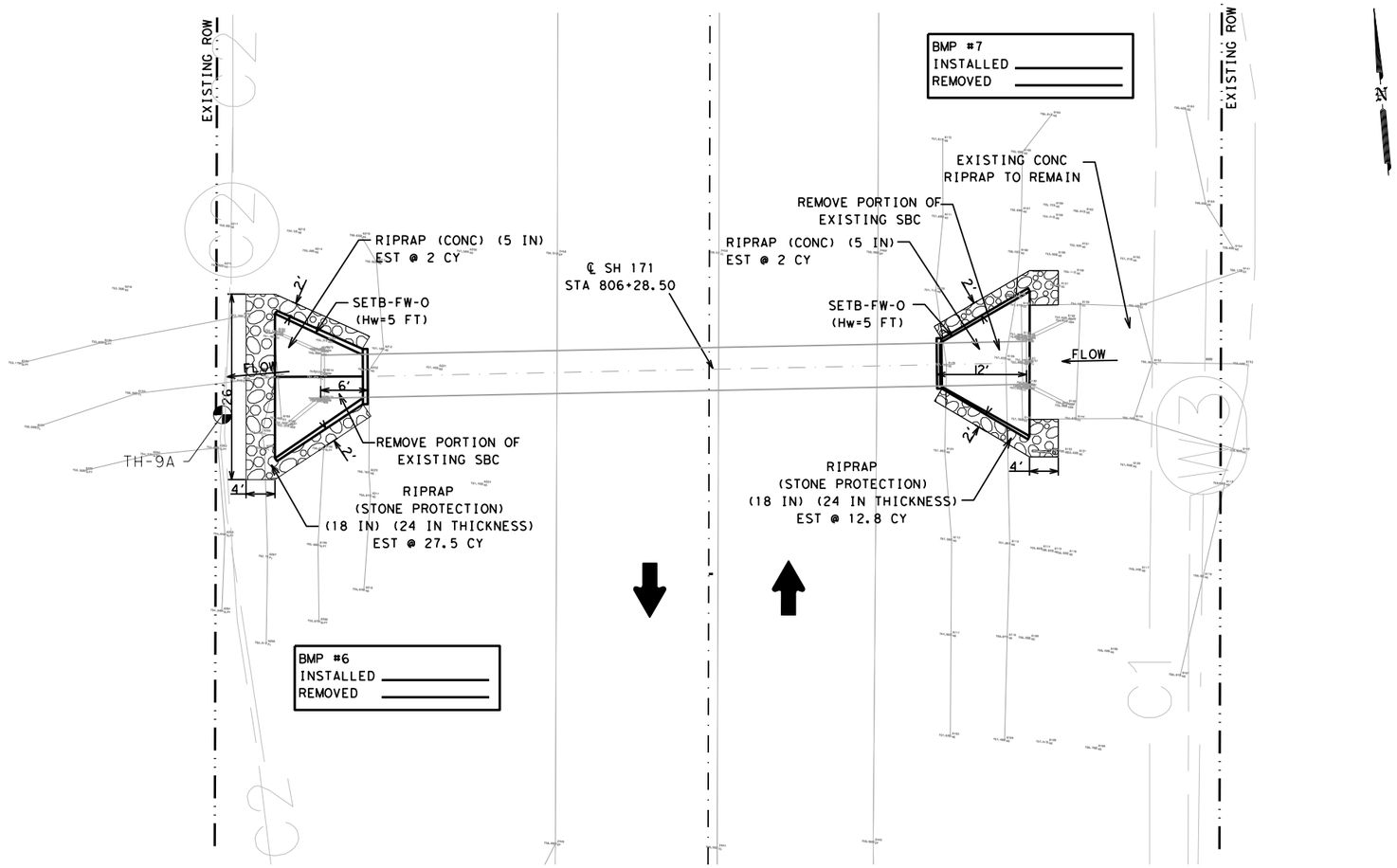
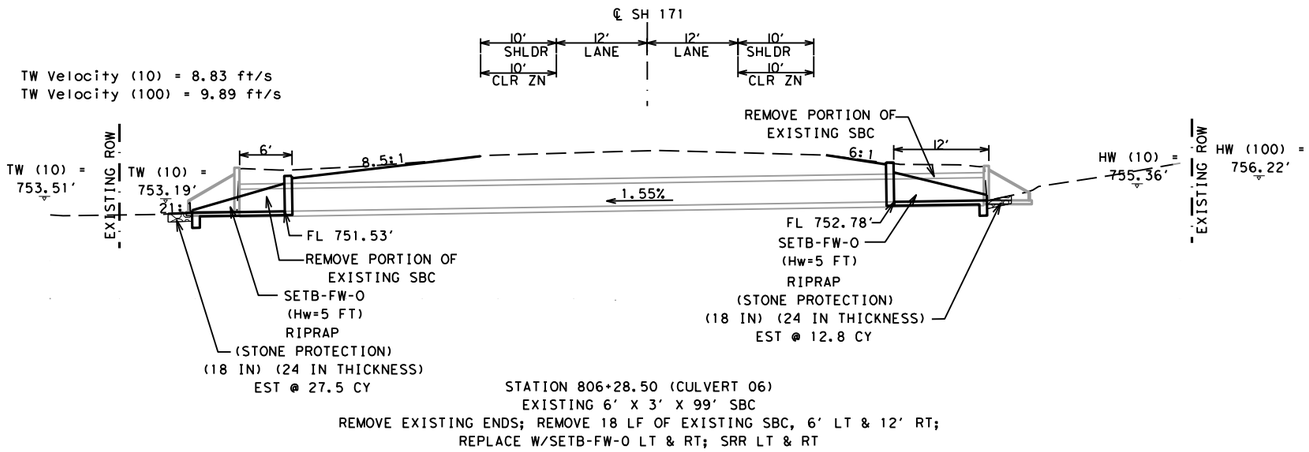
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		112





STATION 806+28.50 (CULVERT 06)
EXISTING 6' X 3' X 99' SBC
REMOVE EXISTING ENDS; REMOVE 18 LF OF EXISTING SBC, 6' LT & 12' RT;
REPLACE W/SETB-FW-O LT & RT; SRR LT & RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0150-6001	BLADING	STA	1
0432-6002	RIPRAP (CONC)(5 IN)	CY	4
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	40.3
0467-6217	SET (TY I)(S= 6 FT)(HW= 5 FT)(3:1) (C)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	18
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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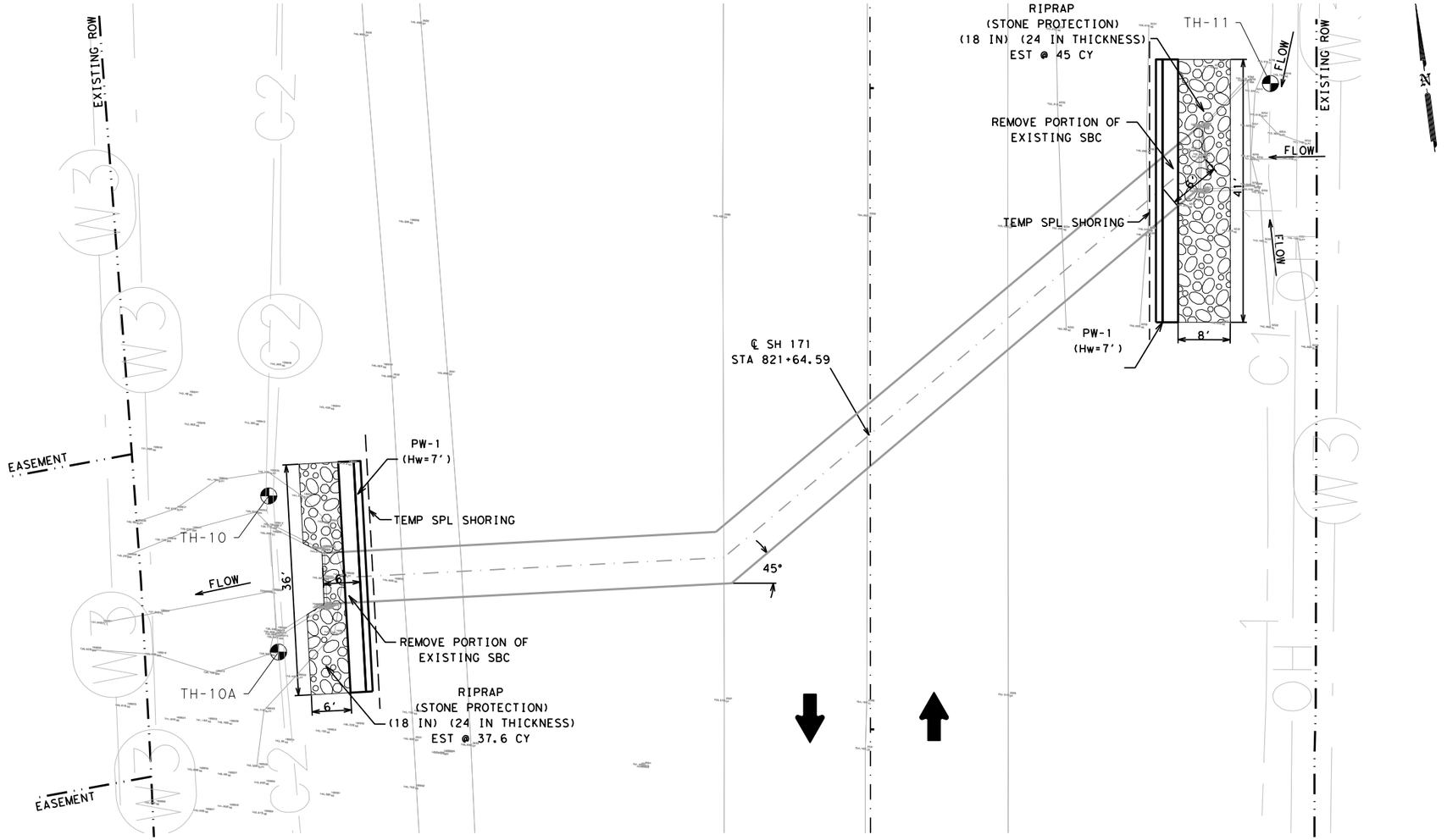
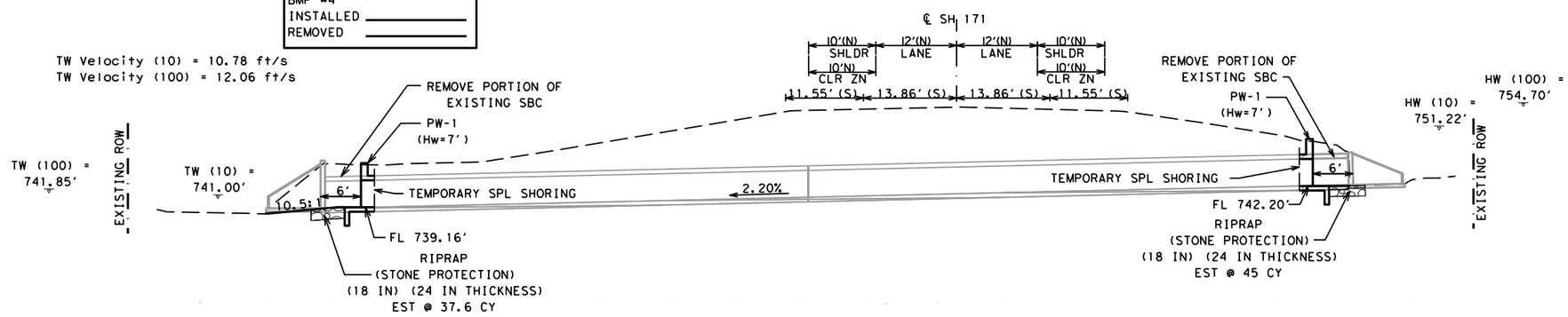
SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		113



BMP #4
INSTALLED _____
REMOVED _____

TW Velocity (10) = 10.78 ft/s
TW Velocity (100) = 12.06 ft/s



STATION 821+64.59 (CULVERT 05)
EXISTING 8' X 4' X 160' SBC (30 DEG RFS)
REMOVE EXISTING WINGWALLS LT & RT; REMOVE 6' OF SBC LT & RT;
INSTALL PW-1, ECD, SRR LT & RT

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0100-6002	PREPARING ROW	STA	1
0150-6001	BLADING	STA	1
0403-6001	TEMPORARY SPL SHORING	SF	490
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	79.4
0466-6182	WINGWALL (PW - 1) (HW=7 FT)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	12
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

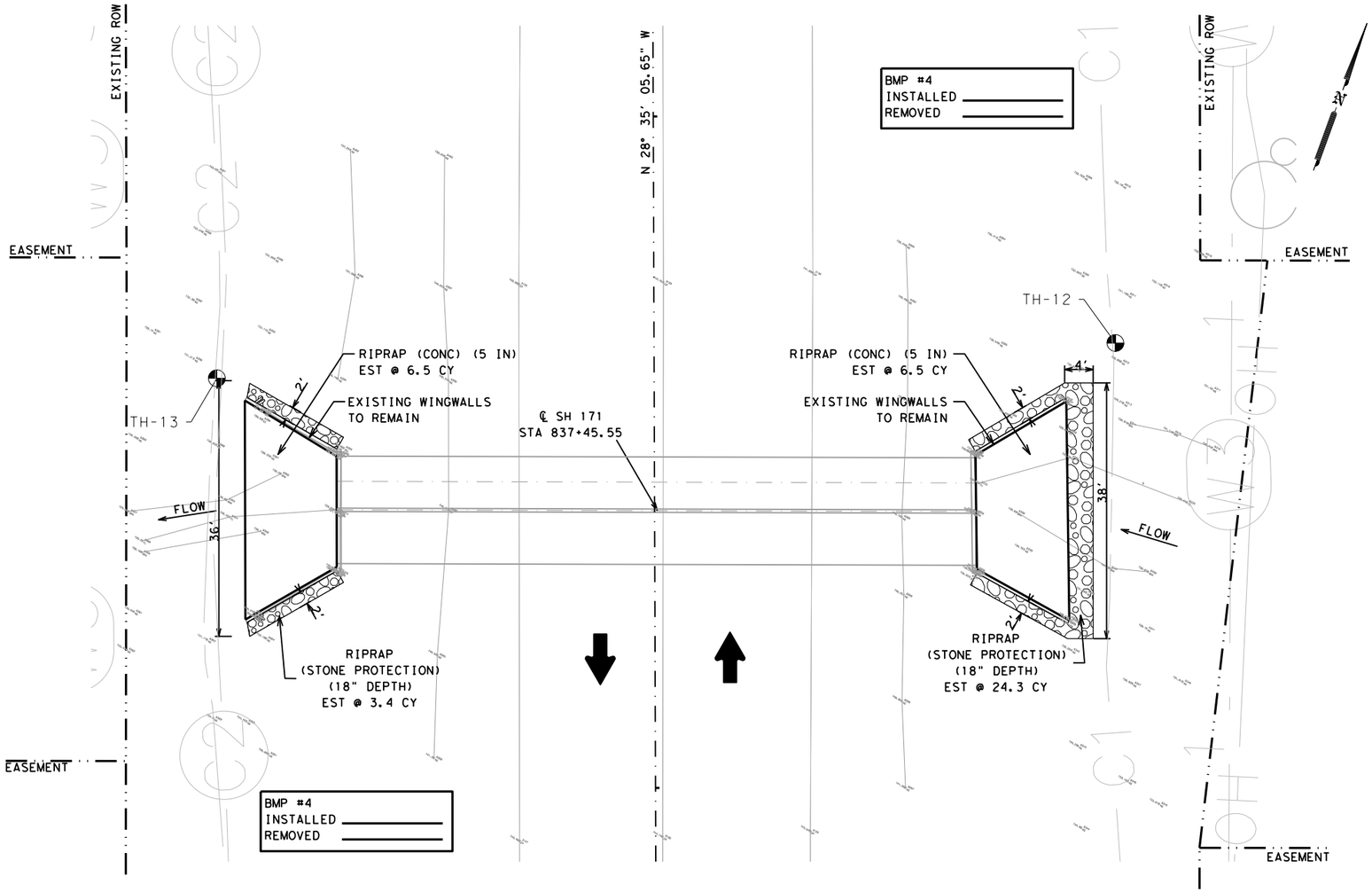
STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

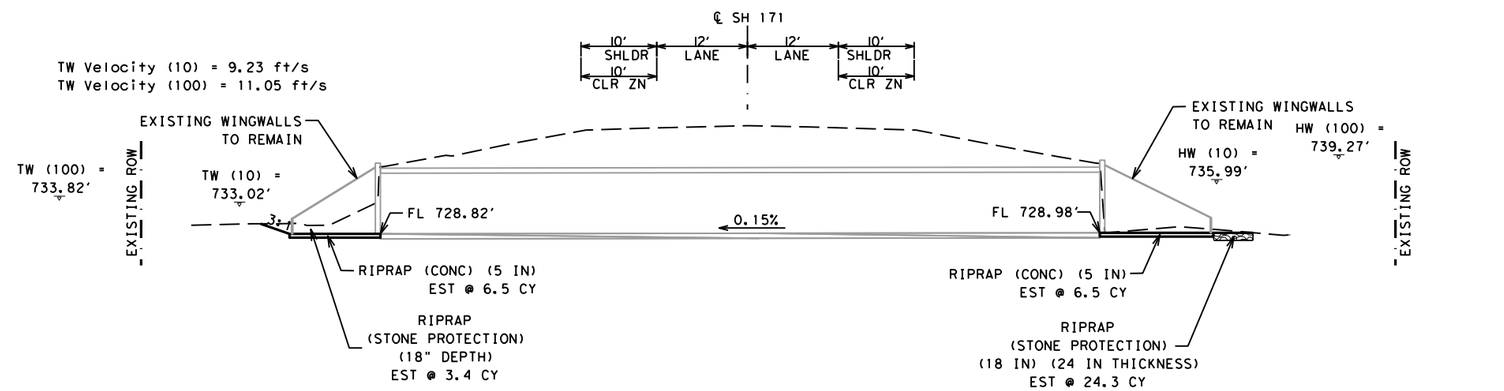
Chris J. Mashek, P.E. 5/19/2022
SIGNATURE OF REGISTRANT & DATE

CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		114





STATION 837+45.55 (CULVERT 04)
EXISTING 2 ~ 8' X 8' X 95' MBC
INSTALL CRR & SRR LT & RT

NOTE: CLEAN OUT CHANNEL AT INLET AND OUTLET.

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0110-6002	EXCAVATION (CHANNEL)	CY	20
0432-6002	RIPRAP (CONC)(5 IN)	CY	11
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	34.4
0480-6001	CLEAN EXIST CULVERTS	EA	1
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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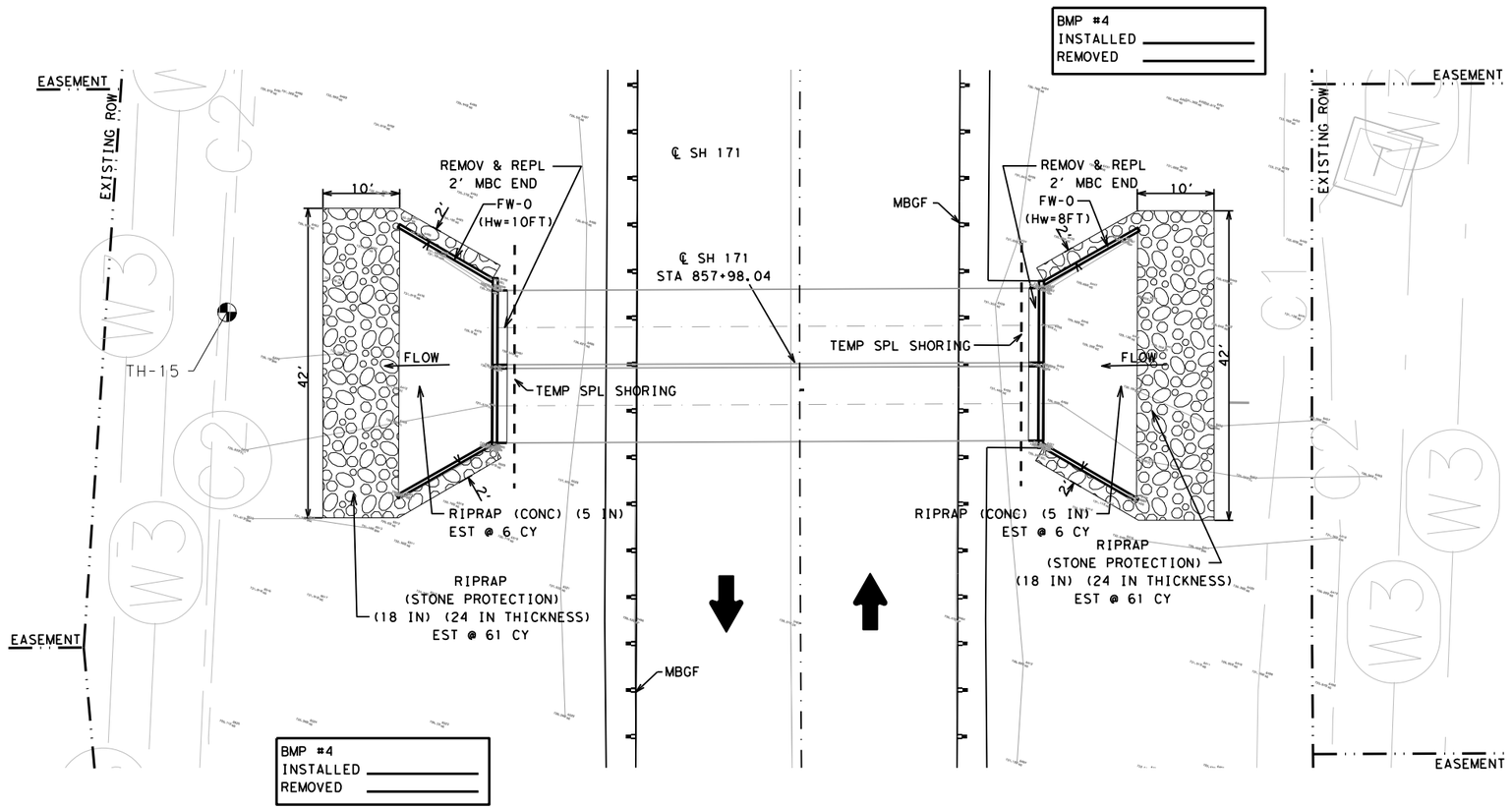
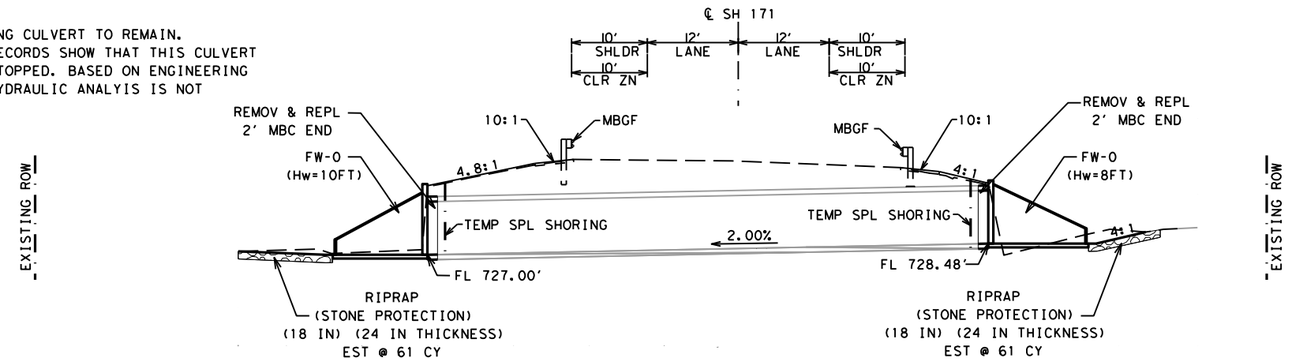
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		115



NOTE: EXISTING CULVERT TO REMAIN.
HISTORICAL RECORDS SHOW THAT THIS CULVERT HAS NOT OVERTOPPED. BASED ON ENGINEERING JUDGEMENT, HYDRAULIC ANALYIS IS NOT REQUIRED.



STATION 857+98.04 (CULVERT 03) (NBI: 091100001903039)
EXISTING 2 ~ 10' X 7' X 74' MBC (BRIDGE CLASS)
CLEAN EXISTING CULVERT; REMOVE EXISTING ENDS;
REPLACE W/FW-0 LT & RT;
PROTECT ENDS W/MBGF; SRR LT & RT;
MC-MD, MC 7-10, & ECD STANDARDS LT & RT

NOTES:

1. SEE MBGF LAYOUTS FOR INFORMATION REGARDING METAL BEAM GUARD FENCE.
2. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
3. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	12
0403-6001	TEMPORARY SPL SHORING	SF	310
0432-6002	RIPRAP (CONC)(5 IN)	CY	12
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	122
0462-6075	CONC BOX CULV (10 FT X 7 FT)(EXTEND)	LF	8
0466-6155	WINGWALL (FW - S) (HW=8 FT)	EA	1
0466-6157	WINGWALL (FW - S) (HW=10 FT)	EA	1
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	8

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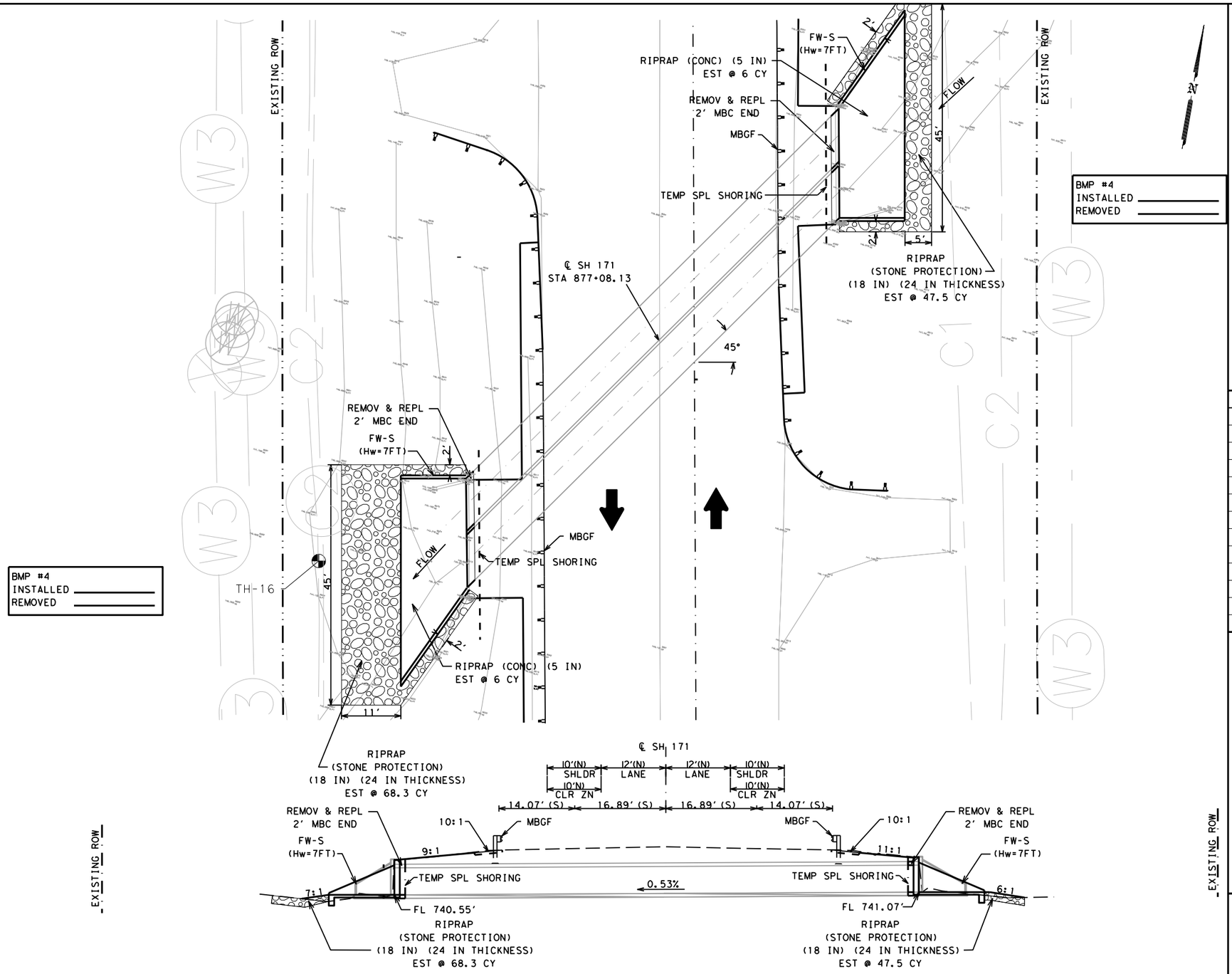
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		116



NOTE: EXISTING CULVERT TO REMAIN.
HISTORICAL RECORDS SHOW THAT THIS CULVERT HAS NOT OVERTOPPED. BASED ON ENGINEERING JUDGEMENT, HYDRAULIC ANALYIS IS NOT REQUIRED.

STATION 877+08.13 (CULVERT 02) (NBI: 0911000019030038)
PROTECT ENDS W/MBGF; SRR LT & RTEXISTING 2 ~ 7' X 5' X 97' MBC (45 DEG RFS) (BRIDGE CLASS)
CLEAN EXISTING CULVERT; REMOVE EXISTING ENDS;
REPLACE W/FW-S LT & RT;
MC-MD, MC 7-10, & ECD STANDARDS LT & RT

NOTES:

1. SEE MBGF LAYOUTS FOR INFORMATION REGARDING METAL BEAM GUARD FENCE.
2. FOR ALL SKEWED CULVERTS, DIMENSIONS LABELED "N" ARE NORMAL TO ROADWAY CENTERLINE. DIMENSIONS LABELED "S" ARE PARALLEL WITH CULVERT.
3. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
4. ALL CULVERT PROFILES ARE SHOWN ALONG THE CENTERLINE OF THE CULVERT.
5. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	12
0403-6001	TEMPORARY SPL SHORING	SF	296
0432-6002	RIPRAP (CONC)(5 IN)	CY	12
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	115.8
0462-6060	CONC BOX CULV (7 FT X 5 FT)(EXTEND)	LF	8
0466-6168	WINGWALL (FW - S) (HW=7 FT)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	8

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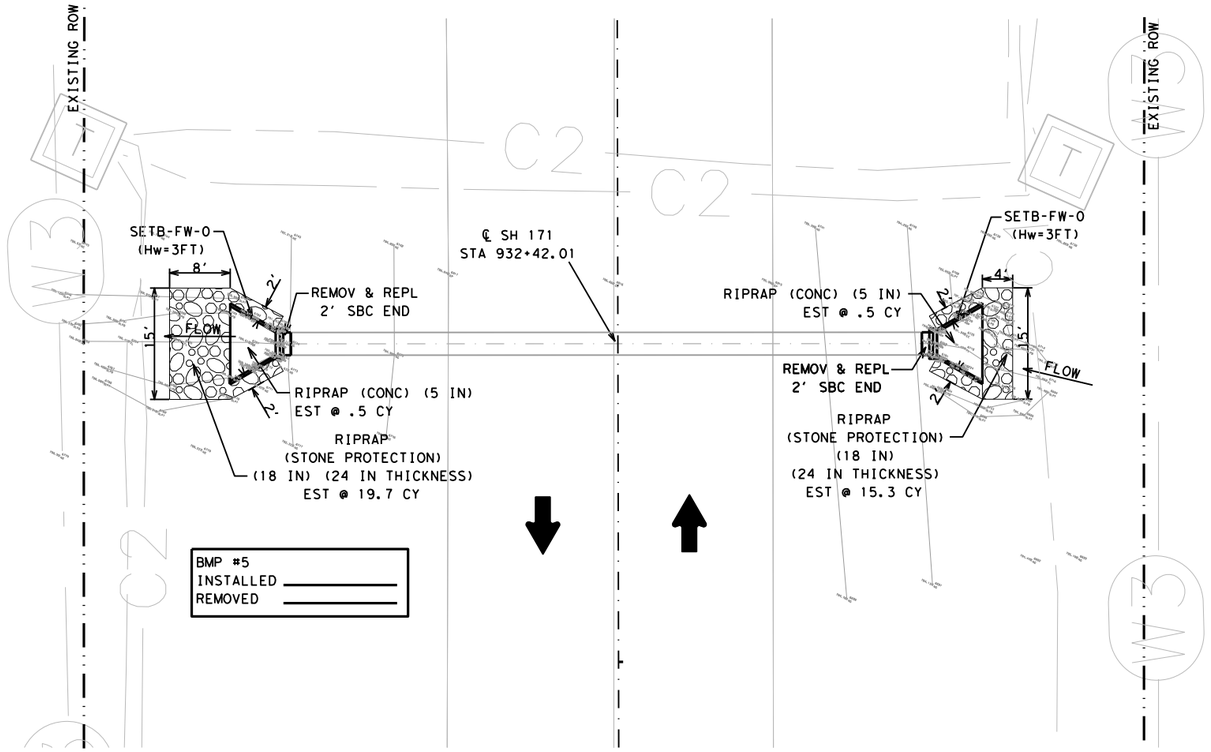
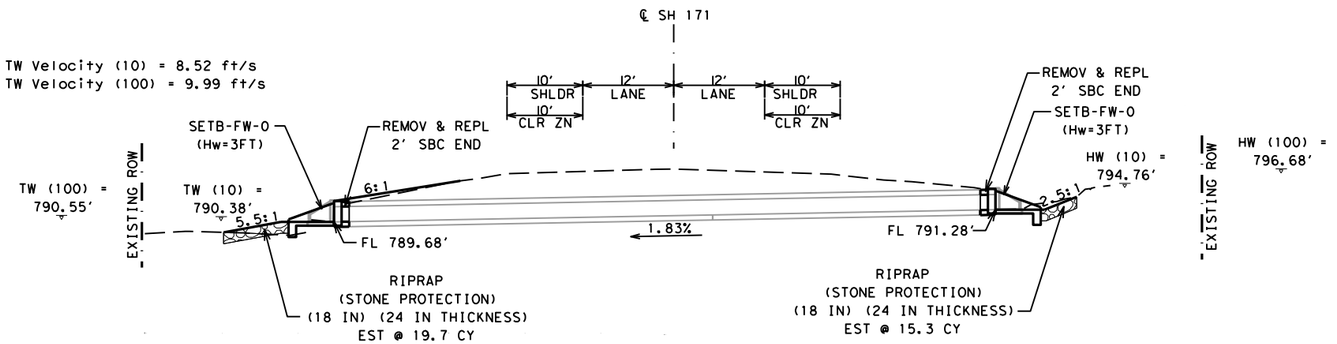
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		117





STATION 931+42.01 (CULVERT 01)
EXISTING 3' X 2' X 87' SBC
REMOVE EXISTING ENDS;
REPLACE W/FW-O LT & RT; SRR LT & RT;
MC-MD, MC-3-23 STANDARD

NOTES:

1. THE CENTERLINE SHOWN IN THE PLAN VIEW IS FOR REFERENCE TO STATIONING ONLY AND MAY NOT ALIGN WITH THE CENTER OF THE ROADWAY. THE CENTERLINE IN THE PROFILE VIEW WILL ALIGN WITH THE CENTER OF THE ROADWAY.
2. REFER TO SRR STANDARD FOR MORE DETAILS REGARDING STONE RIPRAP, A TOE IS REQUIRED.

ITEM	DESCRIPTION	UNIT	QTY
0132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	7
0432-6002	RIPRAP (CONC)(5 IN)	CY	1
0432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	35
0462-6045	CONC BOX CULV (3 FT X 2 FT)(EXTEND)	LF	4
0467-6105	SET (TY I)(S=3 FT)(HW=3 FT)(3:1)(C)	EA	2
0480-6001	CLEAN EXIST CULVERTS	EA	1
0496-6005	REMOV STR (WINGWALL)	EA	2
0496-6008	REMOV STR (BOX CULVERT)	LF	4
0658-6046	INSTL OM ASSM (OM-2X)(WC)GND	EA	2

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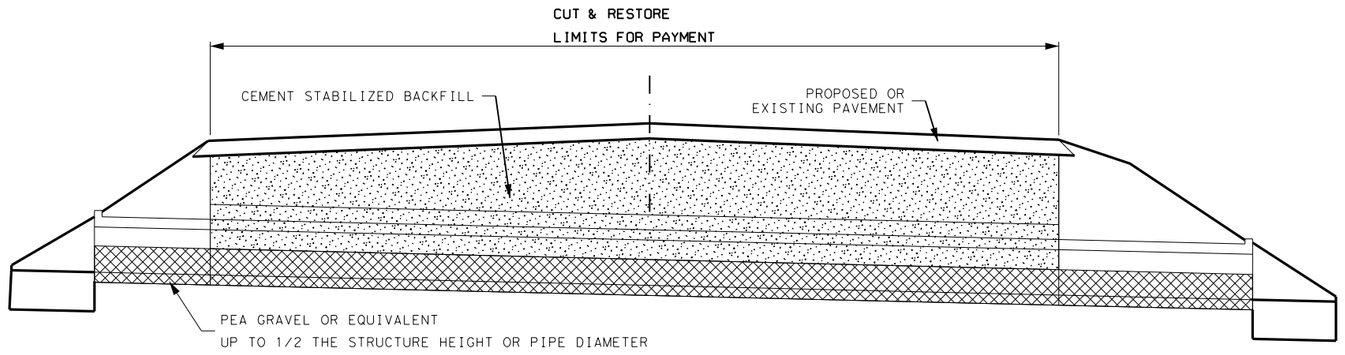
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERT.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028, ETC.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		118



CEMENT STABILIZED BACKFILL DETAIL

SCALE: N.T.S.

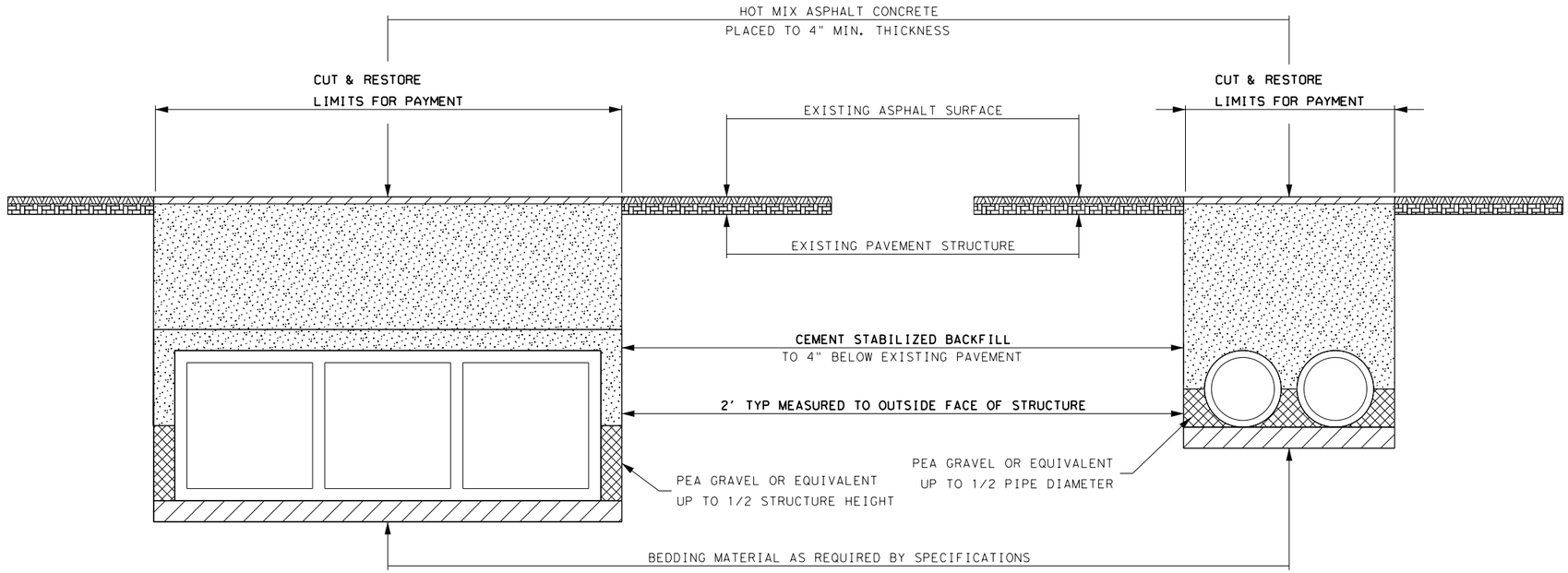
GENERAL NOTES:

1. SAW CUT EXISTING PAVEMENT ON BOTH SIDES OF CULVERT TO PROVIDE A SMOOTH, EVEN EDGE FOR PAVEMENT REPAIR. SAW CUTTING WILL BE SUBSIDIARY TO CULVERT ITEMS.

2. PAYMENT FOR CEMENT STABILIZED BACKFILL WILL BE AS ITEM 400-6005 "CEM STABIL BKFL" BY THE C.Y.

3. PAYMENT FOR PAVEMENT REPAIR WILL BE AS ITEM 400-6008 "CUT & RESTORE ASPH PAVING" BY THE S.Y. OR ITEM 0361-6083 "FULL-DEPTH REPAIR CRCP (7"-8")HES BY THE S.Y.

4. PEA GRAVEL OR EQUIVALENT WILL BE CONSIDERED SUBSIDIARY TO STRUCTURE. GRAVEL WILL BE ALONG THE ENTIRE LENGTH OF STRUCTURE.



SECTION OF CEMENT STABILIZED BACKFILL DETAIL

SCALE: N.T.S.

(DETAIL ILLUSTRATES CULVERT PLACEMENT UNDER TRAFFIC / EXISTING PAVEMENT)

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DRAINAGE DETAILS

(CEMENT STABILIZED BACKFILL)

SHEET 1 OF 1

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		119

Culvert Station and/or Creek Name followed by applicable end (Lt, Rt or Both)	Description of Box Culvert No. Spans ~ Span X Height	Max Fill Height (Ft)	Applicable Box Culvert Standard (4)	Applicable Wingwall or End Treatment Standard	Skew Angle (0°,15°, 30° or 45°)	Side Slope or Channel Slope Ratio (SL:1)	T Culvert Top Slab Thickness (In)	U Culvert Wall Thickness (In)	C Estimated Curb Height (Ft)	Hw (1) Height of Wingwall (Ft)	A Curb to End of Wingwall (Ft)	B Offset of End of Wingwall (Ft)	Lw Length of Longest Wingwall (Ft)	Ltw Culvert Toewall Length (Ft)	Atw Anchor Toewall Length (Ft)	Riprap Apron (CY)	Class "C" (2) Conc (Curb) (CY)	Class "C" (3) Conc (Wingwall) (CY)	Total Wingwall Area (SF)
Culvert 37 Sta 43+75.37 (Lt)	3 ~ 10' X 10'	3.26'	MC-10-7	PW-1	0	2:1	8"	7"	1.000	11.667	N/A	N/A	23.333	32.333	N/A	0.0	1.2	42.2	544
Culvert 37 Sta 43+75.37 (Rt)	3 ~ 10' X 10'	3.26'	MC-10-7	FW-0	0	2:1	8"	7"	1.000	11.417	22.167	12.798	25.596	N/A	N/A	14.1	1.2	18.5	301
Culvert 36 Sta 48+95.46 (Both)	3 ~ 10' X 10'	5'	MC-10-7	FW-0	0	2:1	8"	7"	1.000	11.417	22.167	12.798	25.596	N/A	N/A	28.2	2.4	37.0	602
Culvert 32 Sta 190+31.62 (Both)	1 ~ 6' X 2'	1.8'	SCC-5&6	SETB-FW-0	0	4:1	8"	7"	0.500	2.917	10.333	5.966	11.932	N/A	17.932	2.8	0.2	8.6	N/A
Culvert 28 Sta 279+43.18 (Both)	2 ~ 8' X 7'	2.2'	MC-8-13	FW-S	30	2:1	8"	7"	1.000	8.417	16.167	16.167	22.863	N/A	N/A	12.8	1.6	20.8	342
Culvert 26 Sta 361+35.33 (Rt)	1 ~ 3' X 3'	2.6'	SCC-3&4	SETB-CD	0	3:1	8"	7"	0.250	3.667	N/A	N/A	10.000	N/A	4.167	0.0	0.0	1.9	N/A
Culvert 26 Sta 361+35.33 (Lt)	1 ~ 3' X 3'	2.6'	SCC-3&4	SETB-CD	0	3:1	8"	7"	0.500	3.917	N/A	N/A	10.750	N/A	4.167	0.0	0.1	2.1	N/A
Culvert 24 Sta 448+97.45 (Rt)	2 ~ 8' X 4'	4.46'	MC-8-13	FW-S	15	2:1	8"	7"	1.250	5.667	10.667	6.158	12.317	N/A	N/A	3.4	0.9	4.2	69
Culvert 24 Sta 448+97.45 (Lt)	2 ~ 8' X 4'	4.46'	MC-8-13	FW-S	15	2:1	8"	7"	0.250	4.667	8.667	5.004	10.007	N/A	N/A	2.7	0.2	3.2	47
Culvert 22 Sta 457+54.71 (Rt)	2 ~ 6' X 5'	2.67'	MC-6-16	FW-0	0	2:1	9"	7"	1.000	6.500	12.333	7.121	14.241	N/A	N/A	3.7	0.5	5.9	97
Culvert 23 Sta 465+37.69 (Both)	1 ~ 5' X 2'	1.65'	SCP-5	SETB-FW-0	0	3:1	8"	6"	0.250	2.667	7.000	4.041	8.083	N/A	13.083	1.2	0.2	5.8	N/A
Culvert 22 Sta 457+54.71 (Lt)	2 ~ 6' X 5'	2.7'	MC-6-16	FW-0	0	2:1	9"	7"	0.250	5.750	10.833	6.255	12.509	N/A	N/A	3.2	0.1	4.6	76
Culvert 20 Sta 506+10.45 (Both)	2 ~ 5' X 5'	2.7'	MC-5-20	FW-0	0	2:1	8"	7"	0.250	5.667	10.667	6.158	12.317	N/A	N/A	5.6	0.2	9.0	148
Culvert 12 Sta 663+90.25 (Both)	1 ~ 5' X 2'	2.48'	SCP-5	SETB-FW-S	30	3:1	6"	6"	0.250	2.500	6.500	6.500	9.192	N/A	12.274	1.2	0.2	5.4	N/A
Culvert 11 Sta 672+31.88 (Both)	1 ~ 10' X 6'	3.7'	SCP-10	FW-S	15	2:1	10"	10"	0.250	6.833	13.000	7.506	15.011	N/A	N/A	5.2	0.2	11.6	200
Culvert 8 Sta 719+27.12 (Both)	2 ~ 8' X 8'	5.3'	MC-8-13	PW-1	0	2:1	8"	7"	1.000	9.667	N/A	N/A	19.333	17.750	N/A	0.0	1.4	51.8	748
Culvert 7a Sta 735+96.85 (Both)	3 ~ 5' X 2'	1.87'	SCP-5	SETB-FW-S	30	4:1	8"	6"	0.250	2.667	9.333	9.333	13.199	N/A	30.118	6.0	0.4	10.0	N/A
Culvert 7 Sta 751+73.54 (Both)	1 ~ 5' X 2'	2.29'	SCP-5	SETB-CD	0	4:1	6"	6"	0.250	2.500	N/A	N/A	8.667	N/A	6.167	0.0	0.2	3.6	N/A
Culvert 6b Sta 758+32.07 (Both)	1 ~ 4' X 3'	3.06'	SCP-4	SETB-FW-S	15	3:1	5"	5"	0.250	3.417	9.250	5.340	10.681	N/A	9.482	1.2	0.0	6.6	N/A
Culvert 6 Sta 806+28.50 (Both)	1 ~ 6' X 3'	3.6'	SCC-5&6	SETB-FW-0	0	3:1	8"	7"	1.000	4.417	12.250	7.073	14.145	N/A	20.145	3.6	0.6	12.0	N/A
Culvert 5 Sta 821+64.59 (Lt)	1 ~ 8' X 4'	8.2'	SCC-8	PW-1	0	2:1	8"	7"	2.000	6.667	N/A	N/A	13.333	9.167	N/A	0.0	0.7	12.4	178
Culvert 5 Sta 821+64.59 (Rt)	1 ~ 8' X 4'	8.2'	SCC-8	PW-1	30	2:1	8"	7"	2.000	6.667	N/A	N/A	15.396	10.585	N/A	0.0	0.8	14.3	205
Culvert 3 Sta 857+98.04 (Lt)	2 ~ 10' X 7'	4.6'	MC-10-7	FW-0	0	2:1	8"	7"	1.750	9.167	17.667	10.200	20.400	N/A	N/A	7.9	1.4	11.9	194
Culvert 3 Sta 857+98.04 (Rt)	2 ~ 10' X 7'	4.6'	MC-10-7	FW-0	0	2:1	8"	7"	0.500	7.917	15.167	8.756	17.513	N/A	N/A	6.8	0.4	8.5	144
Culvert 2 Sta 877+08.13 (Both)	2 ~ 7' X 5'	3'	MC-7-10	FW-S	45	2:1	8"	7"	1.000	6.417	12.167	21.073	24.333	N/A	N/A	11.8	1.6	15.2	246
Culvert 1 Sta 931+42.01 (Both)	1 ~ 3' X 2'	3.6'	SCP-3	SETB-FW-0	0	3:1	4"	4"	0.250	2.333	6.000	3.464	6.928	N/A	9.928	0.6	0.0	4.6	N/A
Driveway 43 Culvert Sta 178+10 (Both)	2 ~ 6' X 3'	1.46'	SCP-6	SETB-PD	0	6:1	8"	7"	0.250	3.667	N/A	N/A	20.500	N/A	14.833	0.0	0.2	19.0	N/A
Driveway 44 Culvert Sta 180+20 (Both)	2 ~ 6' X 3'	0.98'	SCP-6	SETB-PD	0	6:1	8"	7"	0.250	3.667	N/A	N/A	20.500	N/A	14.833	0.0	0.2	19.0	N/A
Driveway 45 Culvert Sta 181+20 (Both)	2 ~ 5' X 4'	0.37'	SCP-5	SETB-PD	0	6:1	8"	6"	0.250	4.667	N/A	N/A	26.500	N/A	12.667	0.0	0.2	23.4	N/A
Driveway 46 Culvert Sta 182+60 (Both)	2 ~ 5' X 4'	0.08'	SCP-5	SETB-PD	0	6:1	8"	6"	0.250	4.667	N/A	N/A	26.500	N/A	12.667	0.0	0.2	23.4	N/A
Driveway 47 Culvert Sta 183+20 (Both)	2 ~ 6' X 3'	0.73'	SCP-6	SETB-PD	0	6:1	8"	7"	0.250	3.667	N/A	N/A	20.500	N/A	14.833	0.0	0.2	19.0	N/A
Driveway 48 Culvert Sta 185+60 (Both)	2 ~ 6' X 3'	1.28'	SCP-6	SETB-PD	0	6:1	8"	7"	0.250	3.667	N/A	N/A	20.500	N/A	14.833	0.0	0.2	19.0	N/A
Driveway 49 Culvert Sta 188+50 (Both)	2 ~ 6' X 3'	1.18'	SCP-6	SETB-PD	0	6:1	8"	7"	0.250	3.667	N/A	N/A	20.500	N/A	14.833	0.0	0.2	19.0	N/A

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

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

T = Box culvert top slab thickness. Dimension can be found on the applicable box culvert standard sheet.

U = Box culvert wall thickness. Dimension can be found on the applicable box culvert standard sheet.

C = Curb height

See applicable wing or end treatment standard sheets for calculations of Hw, A, B, Lw, Ltw, Atw, and Total Wingwall Area.

Hw = Height of wingwall

A = Distance from face of curb to end of wingwall (not applicable to parallel or straight wingwalls)

B = Offset of end of wingwall (not applicable to parallel or straight wingwalls)

Lw = Length of longest wingwall.

Ltw = Length of culvert toewall (not applicable when using riprap apron)

Atw = Length of anchor toewall (applicable to safety end treatment only)
Total Wingwall Area = Wingwall area in sq. ft. for two wingwalls (one structure end) if Lt or Rt.
Area for four wingwalls (two structure ends) if Both.

(1) Round the wall heights shown to the nearest foot for bidding purposes.

(2) Concrete volume shown is for box culvert curb only. For curbs using the Box Culvert Rail Mounting Details (RAC) standard sheet quantities shown must be increased by a factor of 2.25. If Class S concrete is required for the top slab of the culvert, also provide Class S concrete for the curb. Curb concrete is considered part of the Box Culvert for payment.

(3) Concrete volume shown is total of wings, footings, culvert toewall (if any), anchor toewalls (if any) and wingwall toewalls. Riprap aprons, culverts, and curb quantities are not included.

(4) Regardless of the type of culvert shown on this sheet, the Contractor has the option of furnishing cast-in-place or precast culverts unless otherwise shown elsewhere on the plans. If the Contractor elects to provide culverts of a different type than those shown on this sheet, it is the Contractor's responsibility to make the necessary adjustments to the dimensions and quantities shown.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E.
SIGNATURE OF REGISTRANT & DATE 5/19/2022

SPECIAL NOTE:

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

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

Texas Department of Transportation | Bridge Division Standard

BOX CULVERT SUPPLEMENT
WINGS AND END TREATMENTS

BCS

FILE: bcsstde1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		120

DATE: 5/19/2022 6:07:04 PM
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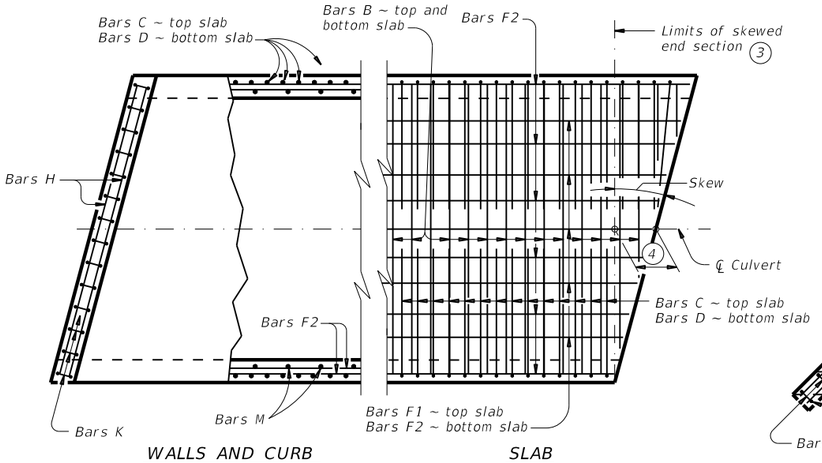
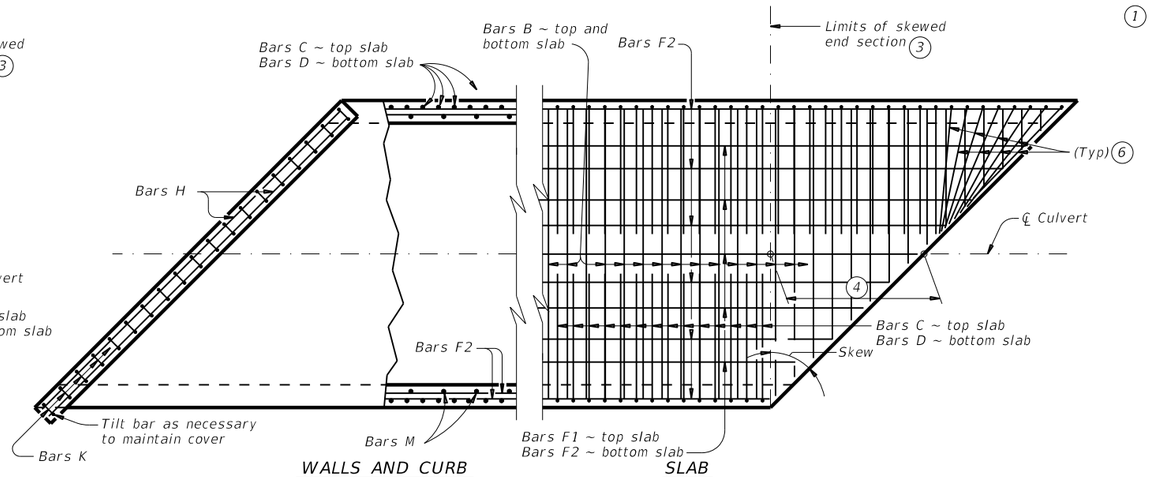
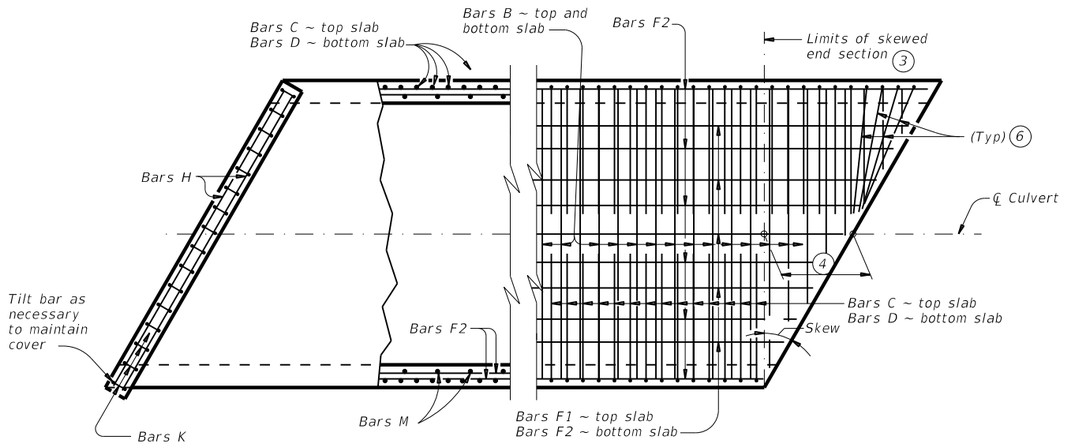


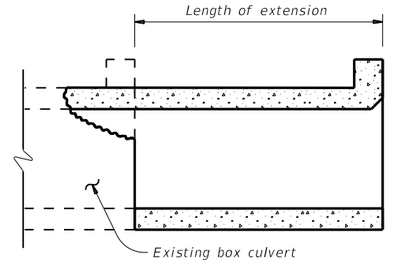
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° (7)



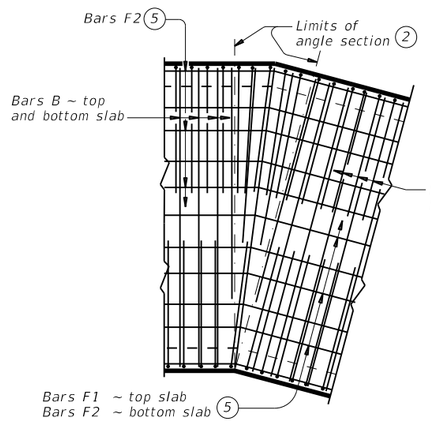
PLAN OF SKEWED ENDS ~ OVER 30° TO 45°



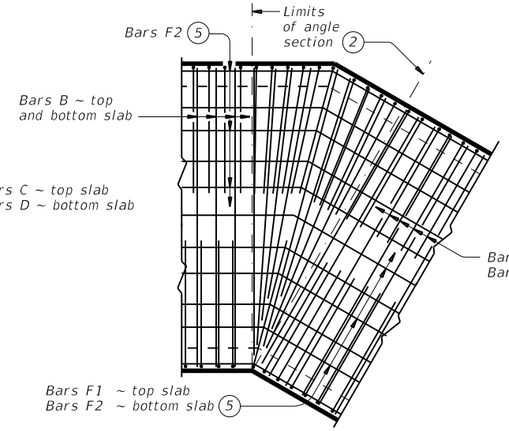
PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



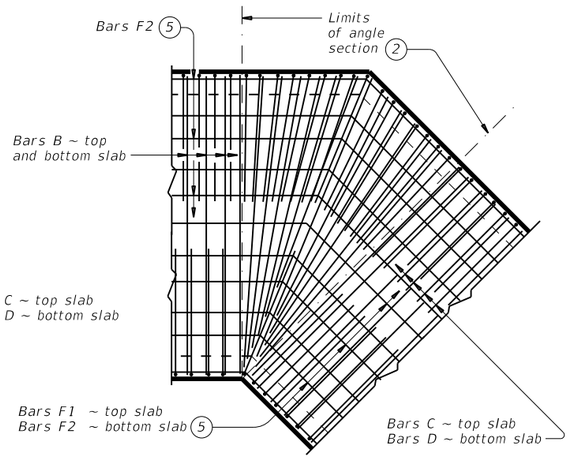
LENGTHENING DETAIL (1)



PLAN OF ANGLE SECTION ~ FROM 0° TO 15°



PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°

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

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

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

Refer to Single Box Culverts Cast-in-Place (SCC) standard sheets for details of straight sections of culvert.

For skewed sections and angle sections, refer to Single Box Culverts Cast-in-Place (SCC) standard sheets for slab and wall dimensions, bar sizes, maximum bar spacing, and any other details not shown.

For skewed ends with curbs, adjust length of Bars H, number of Bars K, curb concrete volume, and reinforcing steel weight by dividing the values shown on the culvert Single Box Culverts Cast-In-Place (SCC) standard sheets by the cosine of the skew angle.

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation

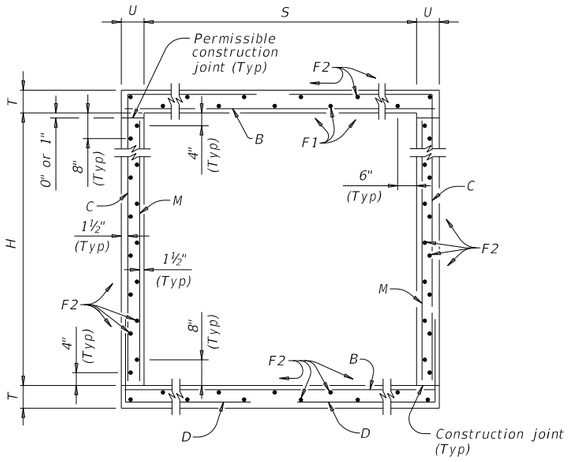
Bridge Division Standard

SINGLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

SCC-MD

FILE: sccmdste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		121

DATE:
FILE:



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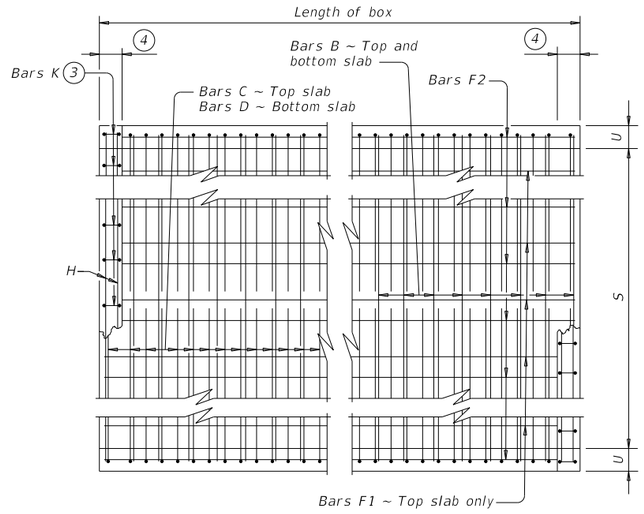
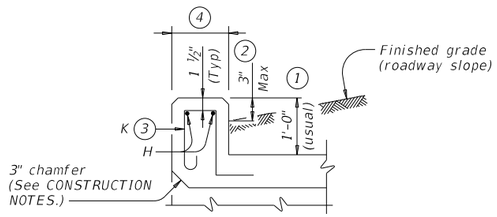


PLAN OF REINF STEEL



SECTION THRU CURB

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

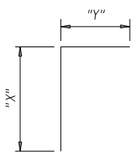
Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Provide Class C concrete (f'c = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of:
- culverts with overlay,
- culverts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

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

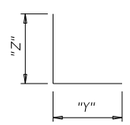
GENERAL NOTES:

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

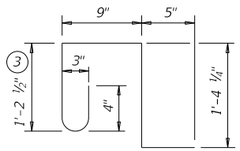
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.



BARS C



BARS D



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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

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

SCC-3 & 4

FILE: scc34ste-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	WAC	HILL		122

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DATE:
FILE:

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

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

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

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

SCC-3 & 4

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©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
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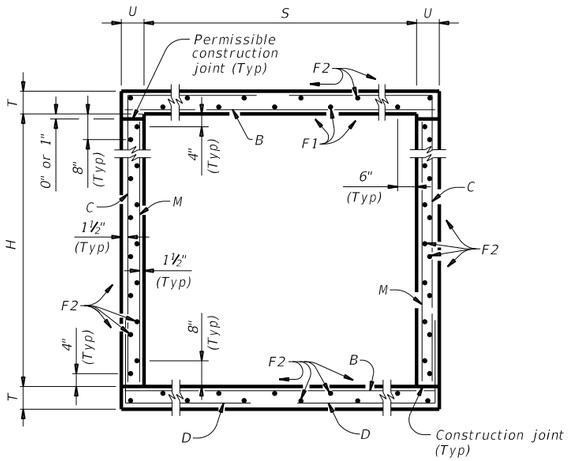
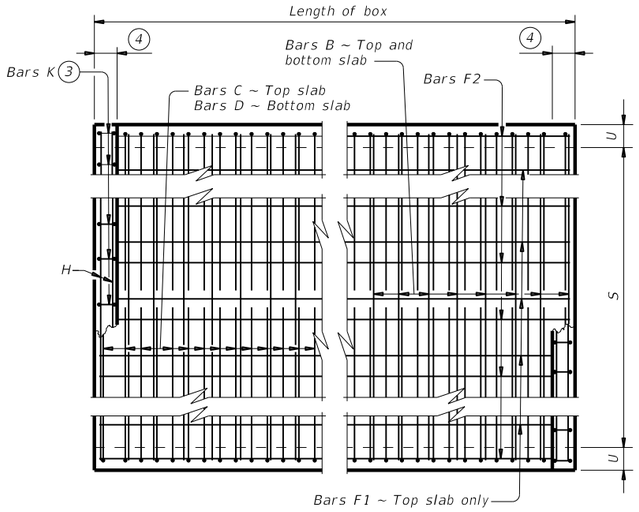
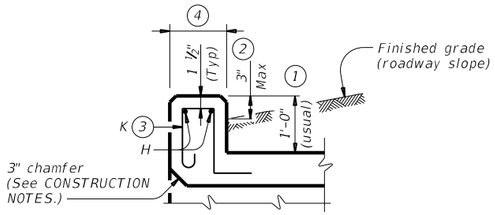


TYPICAL SECTION



PLAN OF REINF STEEL



SECTION THRU CURB

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

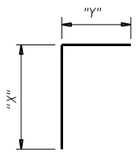
Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Provide Class C concrete (f'_c = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete (f'_c = 4,000 psi) for top slabs of:
- culverts with overlay,
-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

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

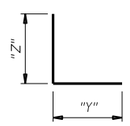
GENERAL NOTES:

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

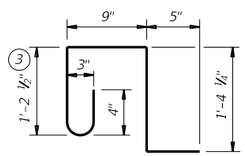
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.



BARS C



BARS D



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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation — Bridge Division Standard

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

SCC-5 & 6

FILE: scc56ste-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	WAC	HILL		124

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

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

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

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

SCC-5 & 6

FILE: scc56ste-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	WAC	HILL		125

DATE: 5/19/2022 6:07:33 PM
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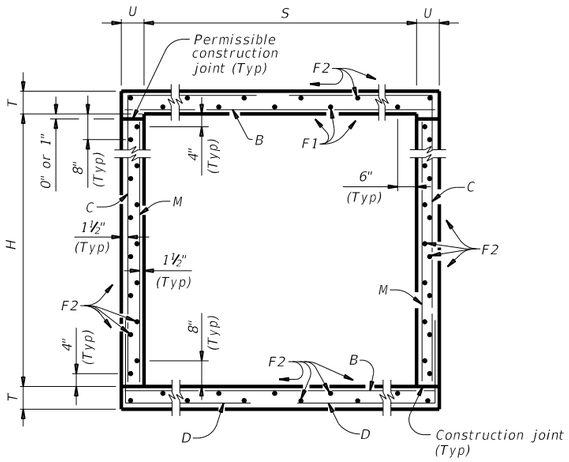
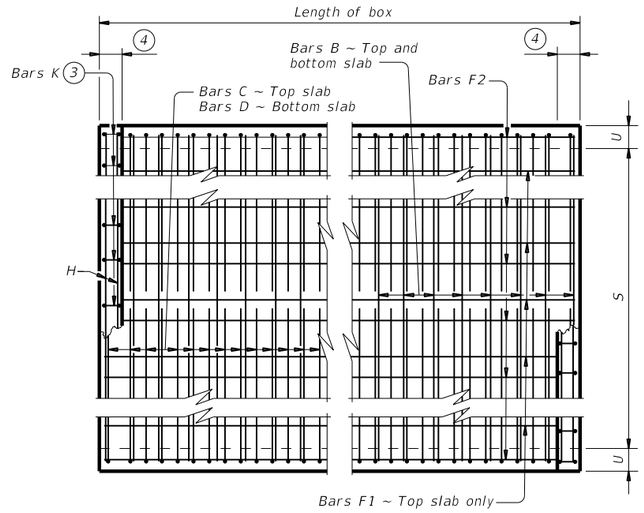
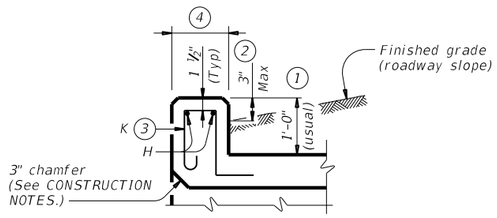


TYPICAL SECTION



PLAN OF REINF STEEL



SECTION THRU CURB

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

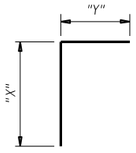
Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Provide Class C concrete ($f'c$ = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete ($f'c$ = 4,000 psi) for top slabs of:
- culverts with overlay,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

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

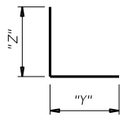
GENERAL NOTES:

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

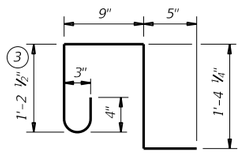
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.



BARS C



BARS D



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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation — Bridge Division Standard

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

SCC-7

FILE: scc07ste-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	WAC	HILL		126

SECTION DIMENSIONS				FILL HEIGHT (5)	BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																										QUANTITIES					
					Bars B					Bars C							Bars D							Bars M ~ #4				Bars F1 ~ #4 at 18" Spa			Bars F2 ~ #4 at 18" Spa			Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
S	H	T	U		No.	Size	Spa	Length	Weight	No.	Size	Spa	Length	Weight	" X "	" Y "	No.	Size	Spa	Length	Weight	" Y "	" Z "	No.	Spa	Length	Weight	No.	Length	Wt	No.	Length	Weight	Length	Wt	No.	Wt	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)	Conc (CY)	Reinf (Lb)
7' – 0"	3' – 0"	8"	7"	16'	108	#6	9"	7' – 11"	1,284	162	#5	6"	7' – 11"	1,338	3' – 6"	4' – 5"	162	#5	6"	7' – 1"	1,197	4' – 5"	2' – 8"	108	9"	3' – 0"	216	5	39' – 9"	133	31	39' – 9"	823	7' – 11"	21	18	50	0.533	124.8	0.6	71	21.9	5,062
7' – 0"	3' – 0"	9"	7"	20'	108	#6	9"	7' – 11"	1,284	162	#5	6"	8' – 0"	1,352	3' – 7"	4' – 5"	162	#5	6"	7' – 2"	1,211	4' – 5"	2' – 9"	108	9"	3' – 0"	216	5	39' – 9"	133	31	39' – 9"	823	7' – 11"	21	18	50	0.583	125.5	0.6	71	23.9	5,090
7' – 0"	3' – 0"	10"	8"	23'	108	#6	9"	8' – 1"	1,311	162	#5	6"	8' – 2"	1,380	3' – 8"	4' – 6"	162	#5	6"	7' – 4"	1,239	4' – 6"	2' – 10"	82	12"	3' – 0"	164	5	39' – 9"	133	31	39' – 9"	823	8' – 1"	22	20	56	0.663	126.3	0.6	78	27.1	5,128
7' – 0"	3' – 0"	11"	8"	30'	108	#6	9"	8' – 1"	1,311	162	#5	6"	8' – 3"	1,394	3' – 9"	4' – 6"	162	#5	6"	7' – 5"	1,253	4' – 6"	2' – 11"	82	12"	3' – 0"	164	5	39' – 9"	133	31	39' – 9"	823	8' – 1"	22	20	56	0.714	127.0	0.6	78	29.2	5,156
7' – 0"	4' – 0"	8"	7"	16'	108	#6	9"	7' – 11"	1,284	162	#5	6"	8' – 11"	1,507	4' – 6"	4' – 5"	162	#5	6"	7' – 1"	1,197	4' – 5"	2' – 8"	108	9"	4' – 0"	289	5	39' – 9"	133	31	39' – 9"	823	7' – 11"	21	18	50	0.576	130.8	0.6	71	23.6	5,304
7' – 0"	4' – 0"	9"	7"	20'	108	#6	9"	7' – 11"	1,284	162	#5	6"	9' – 0"	1,521	4' – 7"	4' – 5"	162	#5	6"	7' – 2"	1,211	4' – 5"	2' – 9"	108	9"	4' – 0"	289	5	39' – 9"	133	31	39' – 9"	823	7' – 11"	21	18	50	0.627	131.5	0.6	71	25.7	5,332
7' – 0"	4' – 0"	10"	8"	23'	108	#6	9"	8' – 1"	1,311	162	#5	6"	9' – 2"	1,549	4' – 8"	4' – 6"	162	#5	6"	7' – 4"	1,239	4' – 6"	2' – 10"	82	12"	4' – 0"	219	5	39' – 9"	133	31	39' – 9"	823	8' – 1"	22	20	56	0.712	131.9	0.6	78	29.1	5,352
7' – 0"	4' – 0"	11"	8"	30'	162	#6	6"	8' – 1"	1,967	162	#5	6"	9' – 3"	1,563	4' – 9"	4' – 6"	162	#5	6"	7' – 5"	1,253	4' – 6"	2' – 11"	82	12"	4' – 0"	219	5	39' – 9"	133	31	39' – 9"	823	8' – 1"	22	20	56	0.763	149.0	0.6	78	31.1	6,036
7' – 0"	5' – 0"	8"	7"	16'	108	#6	9"	7' – 11"	1,284	162	#5	6"	9' – 11"	1,676	5' – 6"	4' – 5"	162	#5	6"	7' – 1"	1,197	4' – 5"	2' – 8"	108	9"	5' – 0"	361	5	39' – 9"	133	35	39' – 9"	929	7' – 11"	21	18	50	0.619	139.5	0.6	71	25.4	5,651
7' – 0"	5' – 0"	9"	7"	20'	108	#6	9"	7' – 11"	1,284	162	#5	6"	10' – 0"	1,690	5' – 7"	4' – 5"	162	#5	6"	7' – 2"	1,211	4' – 5"	2' – 9"	108	9"	5' – 0"	361	5	39' – 9"	133	35	39' – 9"	929	7' – 11"	21	18	50	0.670	140.2	0.6	71	27.4	5,679
7' – 0"	5' – 0"	10"	8"	23'	108	#6	9"	8' – 1"	1,311	162	#5	6"	10' – 2"	1,718	5' – 8"	4' – 6"	162	#5	6"	7' – 4"	1,239	4' – 6"	2' – 10"	82	12"	5' – 0"	274	5	39' – 9"	133	35	39' – 9"	929	8' – 1"	22	20	56	0.761	140.1	0.6	78	31.1	5,682
7' – 0"	5' – 0"	11"	8"	30'	162	#6	6"	8' – 1"	1,967	162	#5	6"	10' – 3"	1,732	5' – 9"	4' – 6"	162	#5	6"	7' – 5"	1,253	4' – 6"	2' – 11"	82	12"	5' – 0"	274	5	39' – 9"	133	35	39' – 9"	929	8' – 1"	22	20	56	0.813	157.2	0.6	78	33.1	6,366
7' – 0"	6' – 0"	8"	7"	16'	108	#6	9"	7' – 11"	1,284	162	#5	6"	10' – 11"	1,845	6' – 6"	4' – 5"	162	#5	6"	7' – 1"	1,197	4' – 5"	2' – 8"	108	9"	6' – 0"	433	5	39' – 9"	133	39	39' – 9"	1,036	7' – 11"	21	18	50	0.663	148.2	0.6	71	27.1	5,999
7' – 0"	6' – 0"	9"	7"	20'	108	#6	9"	7' – 11"	1,284	162	#5	6"	11' – 0"	1,859	6' – 7"	4' – 5"	162	#5	6"	7' – 2"	1,211	4' – 5"	2' – 9"	108	9"	6' – 0"	433	5	39' – 9"	133	39	39' – 9"	1,036	7' – 11"	21	18	50	0.713	148.9	0.6	71	29.1	6,027
7' – 0"	6' – 0"	10"	8"	23'	108	#6	9"	8' – 1"	1,311	162	#5	6"	11' – 2"	1,887	6' – 8"	4' – 6"	162	#5	6"	7' – 4"	1,239	4' – 6"	2' – 10"	82	12"	6' – 0"	329	5	39' – 9"	133	39	39' – 9"	1,036	8' – 1"	22	20	56	0.811	148.4	0.6	78	33.1	6,013
7' – 0"	6' – 0"	11"	8"	30'	162	#6	6"	8' – 1"	1,967	162	#5	6"	11' – 3"	1,901	6' – 9"	4' – 6"	162	#5	6"	7' – 5"	1,253	4' – 6"	2' – 11"	82	12"	6' – 0"	329	5	39' – 9"	133	39	39' – 9"	1,036	8' – 1"	22	20	56	0.862	165.5	0.6	78	35.1	6,697
7' – 0"	7' – 0"	8"	7"	16'	108	#6	9"	7' – 11"	1,284	162	#5	6"	11' – 11"	2,014	7' – 6"	4' – 5"	162	#5	6"	7' – 1"	1,197	4' – 5"	2' – 8"	108	9"	7' – 0"	505	5	39' – 9"	133	39	39' – 9"	1,036	7' – 11"	21	18	50	0.706	154.2	0.6	71	28.8	6,240
7' – 0"	7' – 0"	9"	7"	20'	108	#6	9"	7' – 11"	1,284	162	#5	6"	12' – 0"	2,028	7' – 7"	4' – 5"	162	#5	6"	7' – 2"	1,211	4' – 5"	2' – 9"	108	9"	7' – 0"	505	5	39' – 9"	133	39	39' – 9"	1,036	7' – 11"	21	18	50	0.756	154.9	0.6	71	30.8	6,268
7' – 0"	7' – 0"	10"	8"	23'	108	#6	9"	8' – 1"	1,311	162	#5	6"	12' – 2"	2,056	7' – 8"	4' – 6"	162	#5	6"	7' – 4"	1,239	4' – 6"	2' – 10"	108	9"	7' – 0"	505	5	39' – 9"	133	39	39' – 9"	1,036	8' – 1"	22	20	56	0.860	157.0	0.6	78	35.0	6,358
7' – 0"	7' – 0"	11"	8"	30'	162	#6	6"	8' – 1"	1,967	162	#5	6"	12' – 3"	2,070	7' – 9"	4' – 6"	162	#5	6"	7' – 5"	1,253	4' – 6"	2' – 11"	108	9"	7' – 0"	505	5	39' – 9"	133	39	39' – 9"	1,036	8' – 1"	22	20	56	0.912	174.1	0.6	78	37.1	7,042

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

DATE: 5/19/2022 6:07:40 PM
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HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

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

SCC-7

FILE: scc07ste-21.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
04/2021 Updated X values.	DIST	COUNTY		SHEET NO.
	WAC	HILL		127

DATE: 5/19/2022 6:07:46 PM
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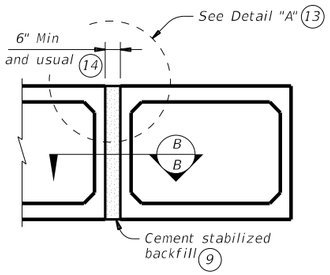
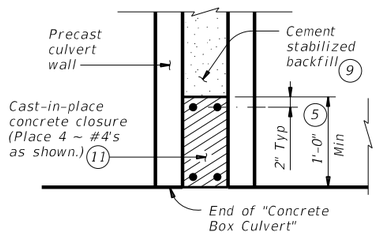
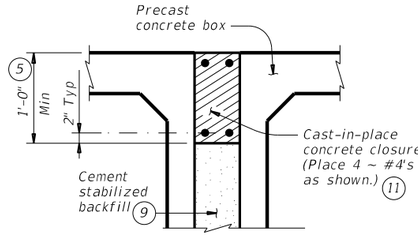


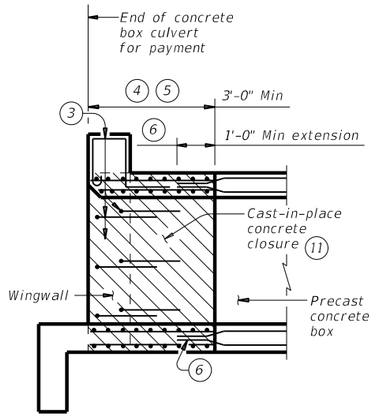
MULTIPLE UNIT PLACEMENT



SECTION B-B

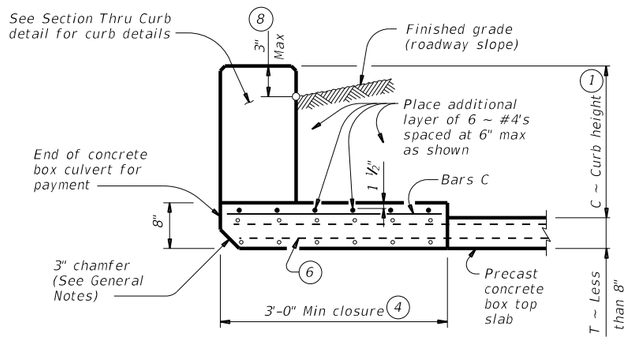


DETAIL "A" (13)

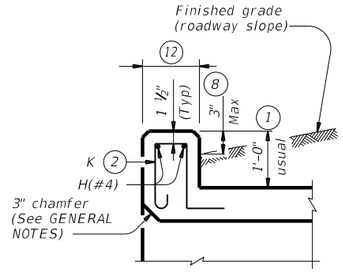


WINGWALL CONNECTION

(Also applies to safety end treatment.)

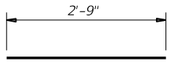


SECTION THRU TOP SLABS LESS THAN 8"

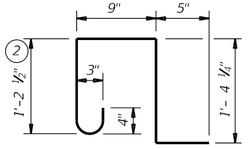


SECTION THRU CURB

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



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



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

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

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

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

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

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

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

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

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

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

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

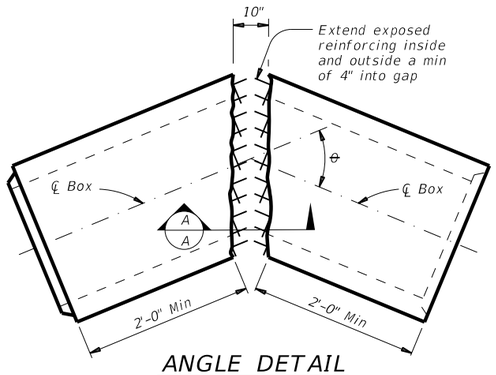
10 All curb concrete and reinforcing is considered part of the box culvert for payment.

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

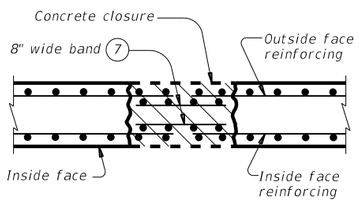
12 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elsewhere in the plans.

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

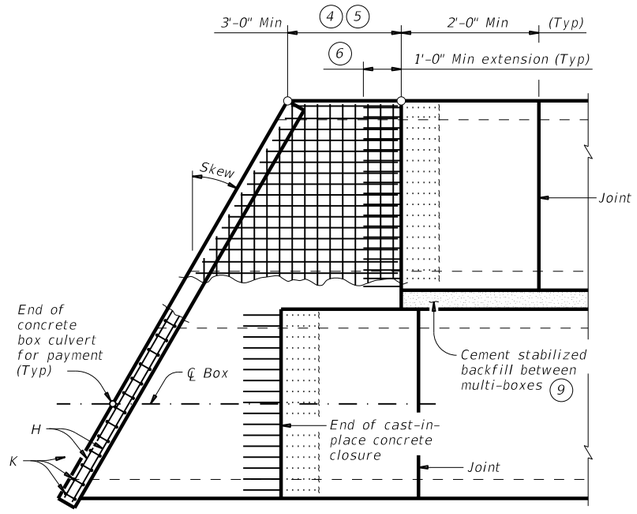
14 This dimension may be increased with approval of the Engineer to allow the precast boxes to be tunneled or jacked in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box". No payment will be made for any additional material in the gap between adjacent boxes.



ANGLE DETAIL



SECTION A-A



PLAN OF SKEWED ENDS

(Showing multi-box placement.)

MATERIAL NOTES:

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

GENERAL NOTES:

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

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

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

BOX CULVERTS PRECAST MISCELLANEOUS DETAILS

SCP-MD

FILE: scpmdsts-20.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		128

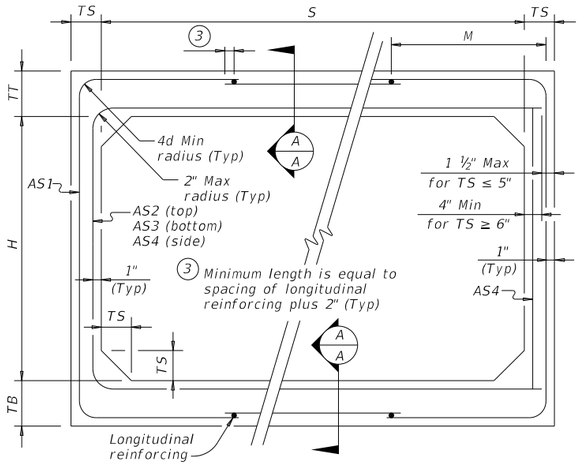
DATE:
FILE:

BOX DATA

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

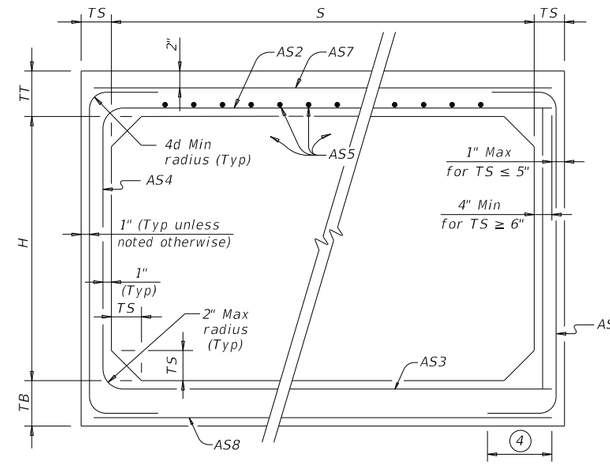
(1) For box length = 8'-0"

(2) AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

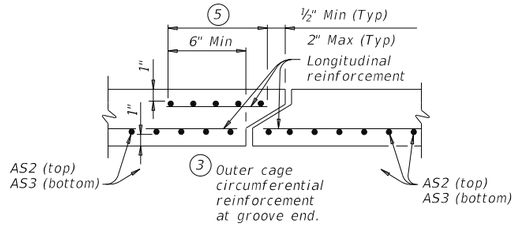
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

(4) Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f`c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.

See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

3'-0" SPAN

SCP-3

FILE: scp03sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		129

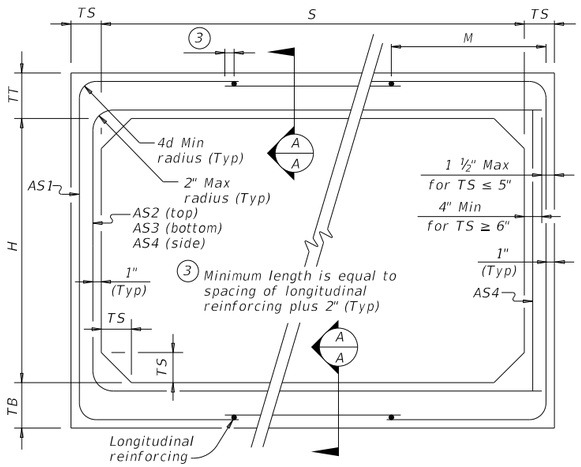
DATE: 05/19/2022 07:57 AM
FILE: DOCUMENT NAME

BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (sq. in. / ft.) (2)							(1) Lift Weight
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)	(ft.)	(in.)	AS1	AS2	AS3	AS4	AS5	AS7	AS8	(tons)
4	2	7.5	6	5	< 2	–	0.18	0.27	0.15	0.12	0.18	0.18	0.14	4.5
4	2	5	5	5	2 < 3	38	0.18	0.19	0.17	0.12	–	–	–	3.6
4	2	5	5	5	3 – 5	38	0.13	0.13	0.13	0.12	–	–	–	3.6
4	2	5	5	5	10	38	0.12	0.12	0.12	0.12	–	–	–	3.6
4	2	5	5	5	15	38	0.14	0.16	0.16	0.12	–	–	–	3.6
4	2	5	5	5	20	38	0.18	0.20	0.21	0.12	–	–	–	3.6
4	2	5	5	5	25	38	0.23	0.25	0.25	0.12	–	–	–	3.6
4	2	5	5	5	30	38	0.28	0.30	0.30	0.12	–	–	–	3.6
4	3	7.5	6	5	< 2	–	0.18	0.31	0.18	0.12	0.18	0.18	0.14	5.0
4	3	5	5	5	2 < 3	38	0.15	0.23	0.20	0.12	–	–	–	4.1
4	3	5	5	5	3 – 5	38	0.12	0.16	0.16	0.12	–	–	–	4.1
4	3	5	5	5	10	38	0.12	0.14	0.14	0.12	–	–	–	4.1
4	3	5	5	5	15	38	0.12	0.18	0.18	0.12	–	–	–	4.1
4	3	5	5	5	20	38	0.14	0.23	0.24	0.12	–	–	–	4.1
4	3	5	5	5	25	38	0.17	0.29	0.29	0.12	–	–	–	4.1
4	3	5	5	5	30	38	0.21	0.35	0.35	0.12	–	–	–	4.1
4	4	7.5	6	5	< 2	–	0.18	0.33	0.20	0.12	0.18	0.18	0.14	5.5
4	4	5	5	5	2 < 3	38	0.12	0.26	0.23	0.12	–	–	–	4.6
4	4	5	5	5	3 – 5	38	0.12	0.18	0.18	0.12	–	–	–	4.6
4	4	5	5	5	10	38	0.12	0.15	0.15	0.12	–	–	–	4.6
4	4	5	5	5	15	38	0.12	0.19	0.20	0.12	–	–	–	4.6
4	4	5	5	5	20	38	0.12	0.25	0.25	0.12	–	–	–	4.6
4	4	5	5	5	25	38	0.14	0.31	0.31	0.12	–	–	–	4.6
4	4	5	5	5	30	38	0.17	0.37	0.37	0.12	–	–	–	4.6

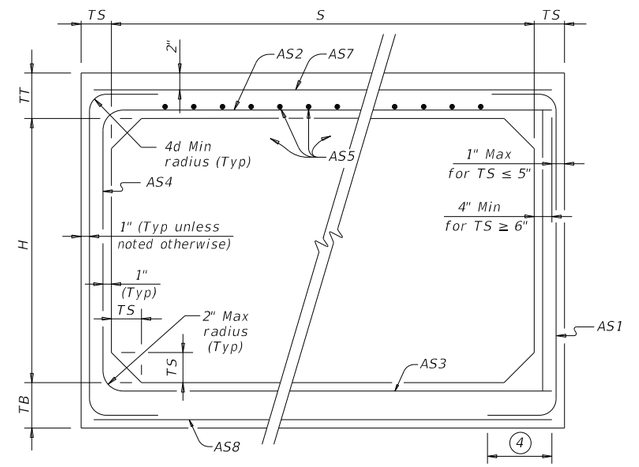
(1) For box length = 8'-0"

(2) AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

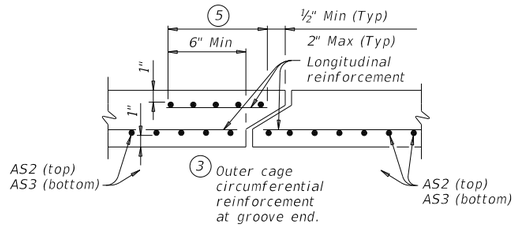
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

(4) Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f`c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.

See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation | Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

4'-0" SPAN

SCP-4

FILE: scp04sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		129A

DATE: 5/19/2022 6:08:01 PM
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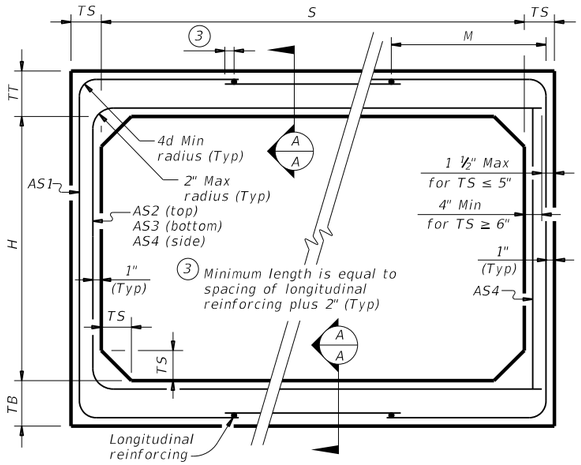
BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (sq. in. / ft.) (2)							(1) Lift Weight
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)	(ft.)	(in.)	AS1	AS2	AS3	AS4	AS5	AS7	AS8	(tons)
5	2	8	7	6	< 2	–	0.19	0.27	0.18	0.14	0.19	0.19	0.17	6.0
5	2	6	6	6	2 < 3	44	0.22	0.20	0.16	0.14	–	–	–	5.1
5	2	6	6	6	3 – 5	44	0.16	0.14	0.14	0.14	–	–	–	5.1
5	2	6	6	6	10	36	0.15	0.14	0.14	0.14	–	–	–	5.1
5	2	6	6	6	15	36	0.20	0.18	0.18	0.14	–	–	–	5.1
5	2	6	6	6	20	36	0.26	0.23	0.24	0.14	–	–	–	5.1
5	2	6	6	6	25	36	0.33	0.29	0.29	0.14	–	–	–	5.1
5	2	6	6	6	30	36	0.39	0.34	0.35	0.14	–	–	–	5.1
5	3	8	7	6	< 2	–	0.19	0.31	0.21	0.14	0.19	0.19	0.17	6.6
5	3	6	6	6	2 < 3	45	0.18	0.24	0.19	0.14	–	–	–	5.7
5	3	6	6	6	3 – 5	36	0.14	0.17	0.16	0.14	–	–	–	5.7
5	3	6	6	6	10	36	0.14	0.16	0.17	0.14	–	–	–	5.7
5	3	6	6	6	15	35	0.16	0.21	0.22	0.14	–	–	–	5.7
5	3	6	6	6	20	35	0.21	0.27	0.28	0.14	–	–	–	5.7
5	3	6	6	6	25	35	0.26	0.34	0.34	0.14	–	–	–	5.7
5	3	6	6	6	30	35	0.31	0.41	0.41	0.14	–	–	–	5.7
5	4	8	7	6	< 2	–	0.19	0.33	0.24	0.14	0.19	0.19	0.17	7.2
5	4	6	6	6	2 < 3	45	0.16	0.27	0.22	0.14	–	–	–	6.3
5	4	6	6	6	3 – 5	45	0.14	0.19	0.18	0.14	–	–	–	6.3
5	4	6	6	6	10	36	0.14	0.18	0.18	0.14	–	–	–	6.3
5	4	6	6	6	15	35	0.14	0.23	0.24	0.14	–	–	–	6.3
5	4	6	6	6	20	35	0.17	0.30	0.31	0.14	–	–	–	6.3
5	4	6	6	6	25	35	0.21	0.37	0.38	0.14	–	–	–	6.3
5	4	6	6	6	30	35	0.25	0.44	0.45	0.14	–	–	–	6.3
5	5	8	7	6	< 2	–	0.19	0.35	0.26	0.14	0.19	0.19	0.17	7.8
5	5	6	6	6	2 < 3	45	0.14	0.29	0.24	0.14	–	–	–	6.9
5	5	6	6	6	3 – 5	45	0.14	0.21	0.20	0.14	–	–	–	6.9
5	5	6	6	6	10	45	0.14	0.19	0.20	0.14	–	–	–	6.9
5	5	6	6	6	15	36	0.14	0.24	0.25	0.14	–	–	–	6.9
5	5	6	6	6	20	35	0.15	0.31	0.32	0.14	–	–	–	6.9
5	5	6	6	6	25	35	0.18	0.38	0.39	0.14	–	–	–	6.9
5	5	6	6	6	30	35	0.21	0.46	0.47	0.14	–	–	–	6.9

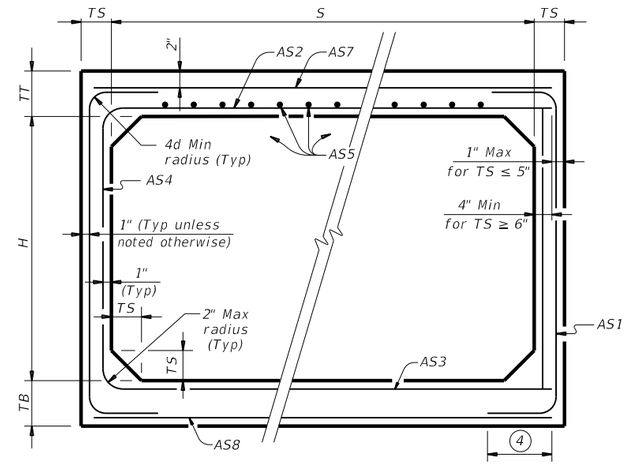
(1) For box length = 8'-0"

(2) AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

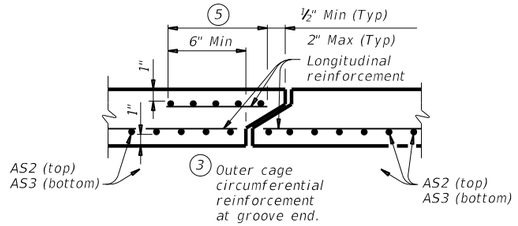
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

(4) Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f`c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.

See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

5'-0" SPAN

SCP-5

FILE: scp05sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		130

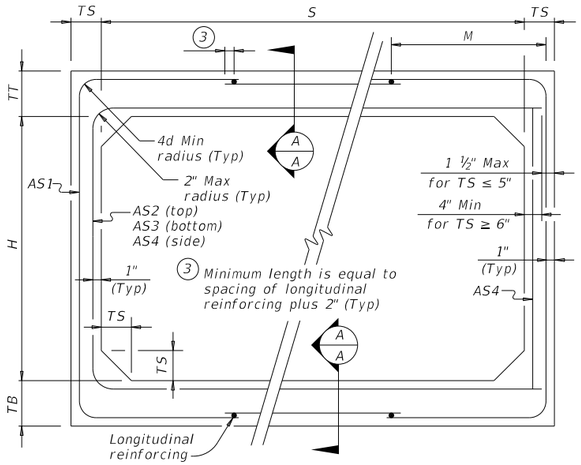
DATE:
FILE:

BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (sq. in. / ft.) (2)							(1) Lift Weight
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)	(ft.)	(in.)	AS1	AS2	AS3	AS4	AS5	AS7	AS8	(tons)
10	4	10	10	10	< 2	–	0.33	0.34	0.27	0.24	0.24	0.24	0.24	16.5
10	4	10	10	10	2 < 3	58	0.38	0.35	0.30	0.24	–	–	–	16.5
10	4	10	10	10	3 – 5	53	0.31	0.28	0.27	0.24	–	–	–	16.5
10	4	10	10	10	10	52	0.36	0.32	0.33	0.24	–	–	–	16.5
10	4	10	10	10	15	52	0.47	0.42	0.43	0.24	–	–	–	16.5
10	4	10	10	10	20	52	0.61	0.54	0.55	0.24	–	–	–	16.5
10	4	10	10	10	25	52	0.75	0.67	0.68	0.24	–	–	–	16.5
10	5	10	10	10	< 2	–	0.30	0.36	0.30	0.24	0.24	0.24	0.24	17.5
10	5	10	10	10	2 < 3	58	0.35	0.39	0.34	0.24	–	–	–	17.5
10	5	10	10	10	3 – 5	52	0.28	0.31	0.30	0.24	–	–	–	17.5
10	5	10	10	10	10	52	0.33	0.35	0.36	0.24	–	–	–	17.5
10	5	10	10	10	15	47	0.42	0.46	0.47	0.24	–	–	–	17.5
10	5	10	10	10	20	47	0.55	0.59	0.61	0.24	–	–	–	17.5
10	5	10	10	10	25	47	0.68	0.73	0.75	0.24	–	–	–	17.5
10	6	10	10	10	< 2	–	0.28	0.38	0.33	0.24	0.24	0.24	0.24	18.5
10	6	10	10	10	2 < 3	58	0.32	0.42	0.37	0.24	–	–	–	18.5
10	6	10	10	10	3 – 5	53	0.26	0.34	0.33	0.24	–	–	–	18.5
10	6	10	10	10	10	52	0.30	0.38	0.39	0.24	–	–	–	18.5
10	6	10	10	10	15	47	0.39	0.49	0.51	0.24	–	–	–	18.5
10	6	10	10	10	20	47	0.50	0.63	0.65	0.24	–	–	–	18.5
10	6	10	10	10	25	47	0.61	0.78	0.80	0.24	–	–	–	18.5
10	7	10	10	10	< 2	–	0.25	0.40	0.36	0.24	0.24	0.24	0.24	19.5
10	7	10	10	10	2 < 3	58	0.30	0.45	0.40	0.24	–	–	–	19.5
10	7	10	10	10	3 – 5	58	0.24	0.36	0.35	0.24	–	–	–	19.5
10	7	10	10	10	10	52	0.28	0.40	0.42	0.24	–	–	–	19.5
10	7	10	10	10	15	47	0.36	0.52	0.54	0.24	–	–	–	19.5
10	7	10	10	10	20	47	0.46	0.67	0.69	0.24	–	–	–	19.5
10	7	10	10	10	25	47	0.56	0.82	0.85	0.24	–	–	–	19.5
10	8	10	10	10	< 2	–	0.24	0.41	0.38	0.24	0.24	0.24	0.24	20.5
10	8	10	10	10	2 < 3	64	0.27	0.47	0.43	0.24	–	–	–	20.5
10	8	10	10	10	3 – 5	58	0.24	0.38	0.38	0.24	–	–	–	20.5
10	8	10	10	10	10	52	0.26	0.42	0.44	0.24	–	–	–	20.5
10	8	10	10	10	15	47	0.34	0.54	0.57	0.24	–	–	–	20.5
10	8	10	10	10	20	47	0.43	0.69	0.72	0.24	–	–	–	20.5
10	9	10	10	10	< 2	–	0.24	0.42	0.41	0.24	0.24	0.24	0.24	21.5
10	9	10	10	10	2 < 3	70	0.26	0.50	0.46	0.24	–	–	–	21.5
10	9	10	10	10	3 – 5	64	0.24	0.40	0.40	0.24	–	–	–	21.5
10	9	10	10	10	10	58	0.25	0.43	0.46	0.24	–	–	–	21.5
10	9	10	10	10	15	52	0.32	0.56	0.59	0.24	–	–	–	21.5
10	9	10	10	10	20	47	0.40	0.71	0.75	0.24	–	–	–	21.5
10	10	10	10	10	< 2	–	0.24	0.44	0.44	0.24	0.24	0.24	0.24	22.5
10	10	10	10	10	2 < 3	79	0.25	0.52	0.48	0.24	–	–	–	22.5
10	10	10	10	10	3 – 5	70	0.24	0.42	0.43	0.24	–	–	–	22.5
10	10	10	10	10	10	64	0.24	0.44	0.48	0.24	–	–	–	22.5
10	10	10	10	10	15	52	0.30	0.57	0.61	0.24	–	–	–	22.5
10	10	10	10	10	20	52	0.38	0.73	0.77	0.24	–	–	–	22.5

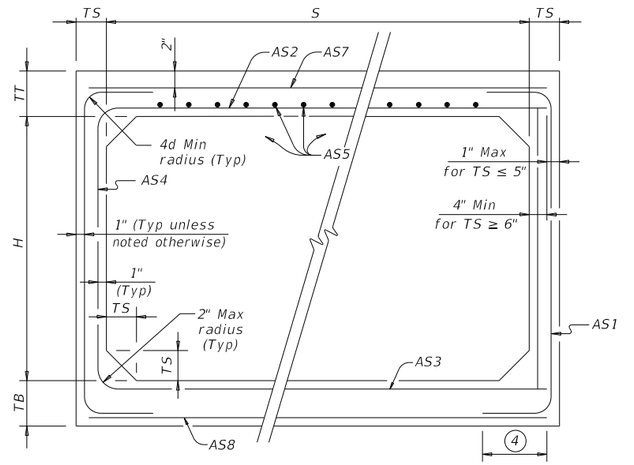
(1) For box length = 8'-0"

(2) AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

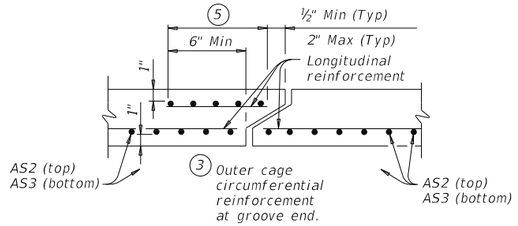
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

(4) Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f`c = 5,000 psi).

GENERAL NOTES:

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HL93 LOADING

Texas Department of Transportation

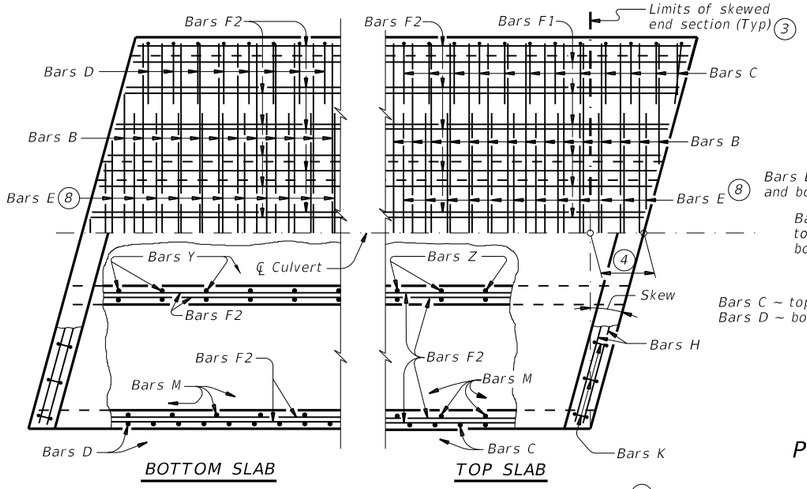
Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

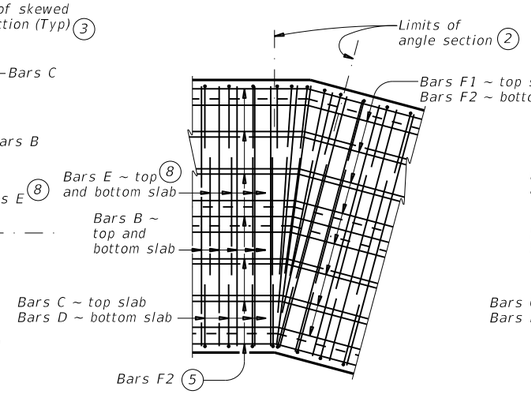
10'-0" SPAN

SCP-10

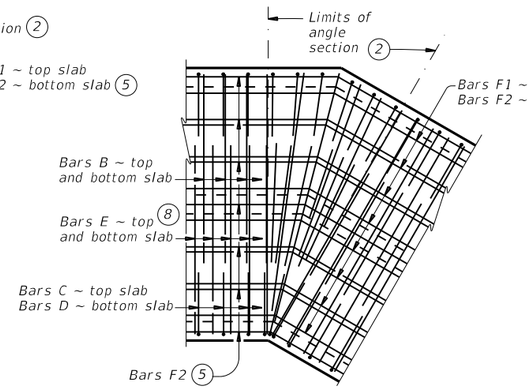
FILE: scp10sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		131



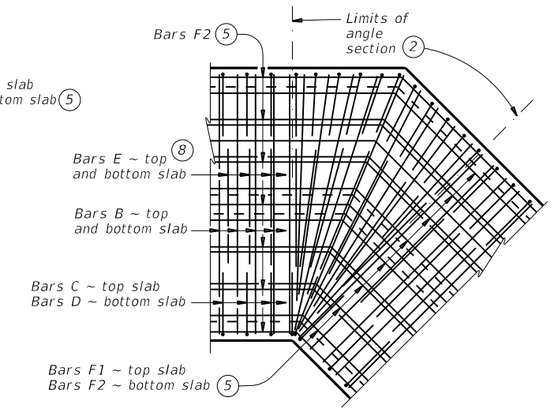
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° (7)



PLAN OF ANGLE SECTION ~ FROM 0° TO 15°

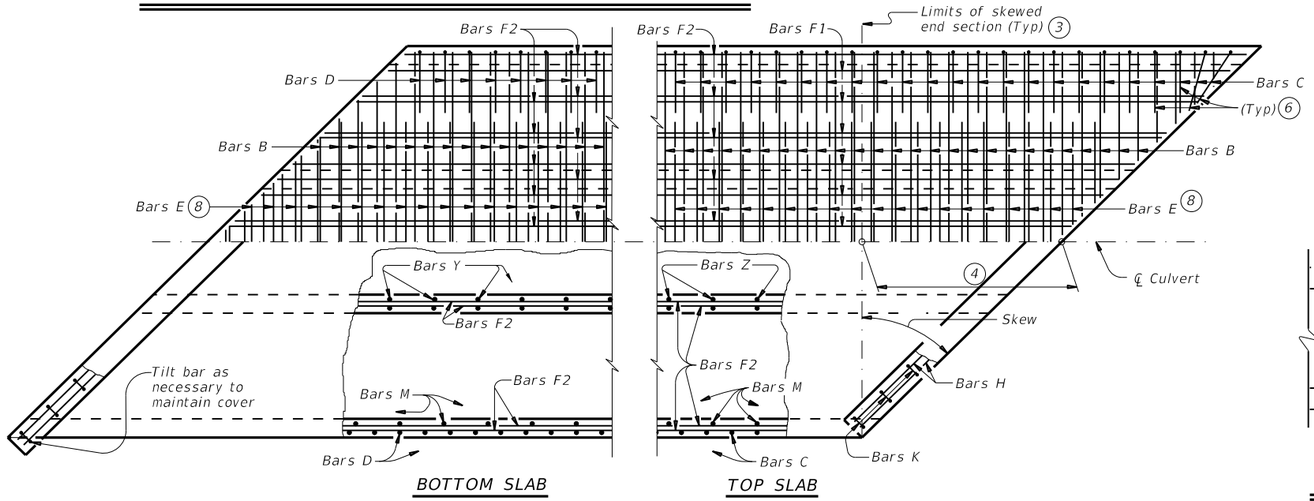


PLAN OF ANGLE SECTION ~ OVER 15° TO 30°

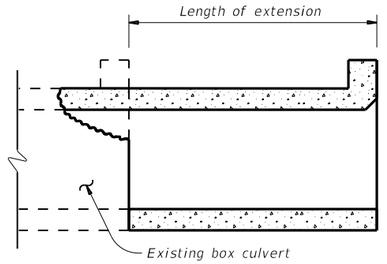


PLAN OF ANGLE SECTION ~ OVER 30° TO 45°

PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°



LENGTHENING DETAIL (1)

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

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

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

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

GENERAL NOTES:

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

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

MC-MD

FILE: mc-mdste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		132

DATE: 5/19/2022 6:08:12 PM
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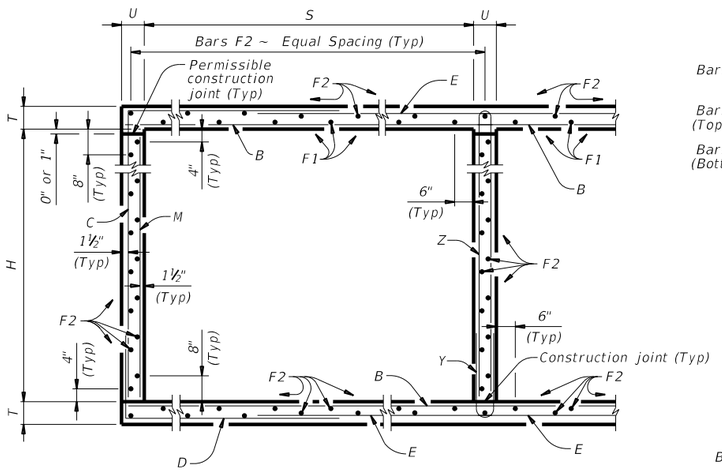
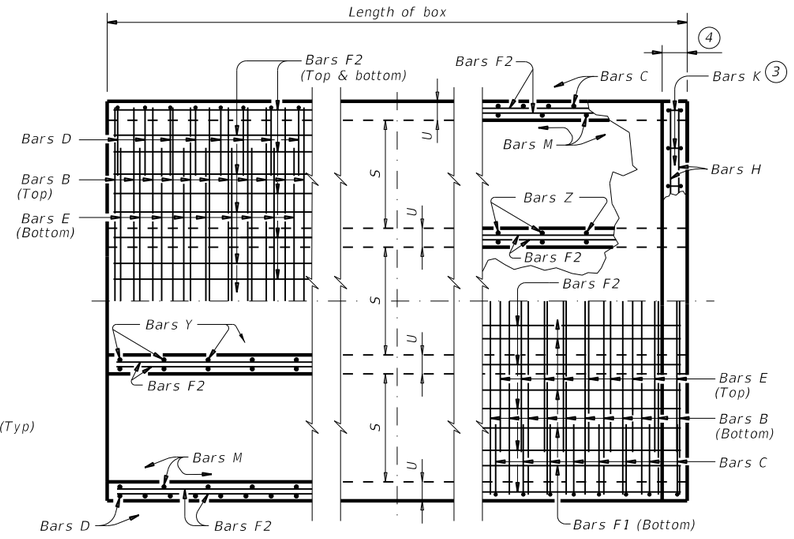
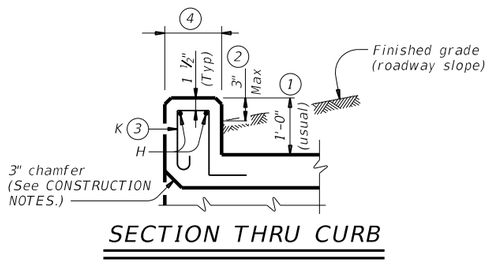


TYPICAL SECTION



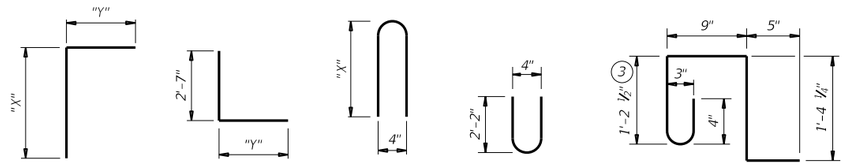
BOTTOM SLAB TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
2'-0"	2'-6 ½"	3'-8 ½"
3'-0"	3'-6 ½"	3'-8 ½"
4'-0"	4'-6 ½"	3'-8 ½"
5'-0"	5'-6 ½"	3'-8 ½"



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

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

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

GENERAL NOTES:

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

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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
5'-0" SPAN
0' TO 20' FILL

MC-5-20

FILE: mc520ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		133

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																														QUANTITIES					
					Bars B					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4						Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Bars C Length	Bars C Wt	Bars D Length	Bars D Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Bars Y Length	Bars Y Wt	Bars Z Length	Bars Z Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	5' – 0"	2' – 0"	8"	7"	108	#5	9"	11' – 6"	1,295	108	#5	9"	6' – 3"	704	6' – 4"	713	108	#5	9"	8' – 8"	976	8	18"	39' – 9"	212	38	18"	39' – 9"	1,009	108	9"	2' – 0"	144	54	9"	4' – 7"	165	5' – 3"	189	11' – 6"	31	26	72	0.710	135.2	0.9	103	29.3	5,510
3	5' – 0"	2' – 0"	8"	7"	108	#5	9"	17' – 1"	1,924	108	#5	9"	6' – 3"	704	6' – 4"	713	108	#5	9"	14' – 3"	1,605	12	18"	39' – 9"	319	54	18"	39' – 9"	1,434	108	9"	2' – 0"	144	108	9"	4' – 7"	331	5' – 3"	379	17' – 1"	46	38	106	1.029	188.8	1.3	152	42.4	7,705
4	5' – 0"	2' – 0"	8"	7"	108	#5	9"	22' – 8"	2,553	108	#5	9"	6' – 3"	704	6' – 4"	713	108	#5	9"	19' – 10"	2,234	16	18"	39' – 9"	425	70	18"	39' – 9"	1,859	108	9"	2' – 0"	144	162	9"	4' – 7"	496	5' – 3"	568	22' – 8"	61	48	134	1.348	242.4	1.7	195	55.6	9,891
5	5' – 0"	2' – 0"	8"	7"	108	#5	9"	28' – 3"	3,182	108	#5	9"	6' – 3"	704	6' – 4"	713	108	#5	9"	25' – 5"	2,863	20	18"	39' – 9"	531	86	18"	39' – 9"	2,284	108	9"	2' – 0"	144	216	9"	4' – 7"	661	5' – 3"	758	28' – 3"	75	60	167	1.667	296.0	2.1	242	68.8	12,082
6	5' – 0"	2' – 0"	8"	7"	108	#5	9"	33' – 10"	3,811	108	#5	9"	6' – 3"	704	6' – 4"	713	108	#5	9"	31' – 0"	3,492	24	18"	39' – 9"	637	102	18"	39' – 9"	2,708	108	9"	2' – 0"	144	270	9"	4' – 7"	827	5' – 3"	947	33' – 10"	90	70	195	1.986	349.6	2.5	285	82.0	14,268
2	5' – 0"	3' – 0"	8"	7"	108	#6	9"	11' – 6"	1,865	108	#5	9"	7' – 3"	817	6' – 4"	713	108	#5	9"	8' – 8"	976	8	18"	39' – 9"	212	44	18"	39' – 9"	1,168	108	9"	3' – 0"	216	54	9"	4' – 7"	165	7' – 3"	262	11' – 6"	31	26	72	0.775	159.9	0.9	103	31.9	6,497
3	5' – 0"	3' – 0"	8"	7"	108	#6	9"	17' – 1"	2,771	108	#5	9"	7' – 3"	817	6' – 4"	713	108	#5	9"	14' – 3"	1,605	12	18"	39' – 9"	319	62	18"	39' – 9"	1,646	108	9"	3' – 0"	216	108	9"	4' – 7"	331	7' – 3"	523	17' – 1"	46	38	106	1.115	223.5	1.3	152	45.9	9,093
4	5' – 0"	3' – 0"	8"	7"	108	#6	9"	22' – 8"	3,677	108	#5	9"	7' – 3"	817	6' – 4"	713	108	#5	9"	19' – 10"	2,234	16	18"	39' – 9"	425	80	18"	39' – 9"	2,124	108	9"	3' – 0"	216	162	9"	4' – 7"	496	7' – 3"	785	22' – 8"	61	48	134	1.456	287.2	1.7	195	59.9	11,682
5	5' – 0"	3' – 0"	8"	7"	108	#6	9"	28' – 3"	4,583	108	#5	9"	7' – 3"	817	6' – 4"	713	108	#5	9"	25' – 5"	2,863	20	18"	39' – 9"	531	98	18"	39' – 9"	2,602	108	9"	3' – 0"	216	216	9"	4' – 7"	661	7' – 3"	1,046	28' – 3"	75	60	167	1.796	350.8	2.1	242	73.9	14,274
6	5' – 0"	3' – 0"	8"	7"	108	#6	9"	33' – 10"	5,488	108	#5	9"	7' – 3"	817	6' – 4"	713	108	#5	9"	31' – 0"	3,492	24	18"	39' – 9"	637	116	18"	39' – 9"	3,080	108	9"	3' – 0"	216	270	9"	4' – 7"	827	7' – 3"	1,308	33' – 10"	90	70	195	2.137	414.5	2.5	285	88.0	16,863
2	5' – 0"	4' – 0"	8"	7"	108	#6	9"	11' – 6"	1,865	108	#5	9"	8' – 3"	929	6' – 4"	713	108	#5	9"	8' – 8"	976	8	18"	39' – 9"	212	44	18"	39' – 9"	1,168	108	9"	4' – 0"	289	54	9"	4' – 7"	165	9' – 3"	334	11' – 6"	31	26	72	0.840	166.3	0.9	103	34.5	6,754
3	5' – 0"	4' – 0"	8"	7"	108	#6	9"	17' – 1"	2,771	108	#5	9"	8' – 3"	929	6' – 4"	713	108	#5	9"	14' – 3"	1,605	12	18"	39' – 9"	319	62	18"	39' – 9"	1,646	108	9"	4' – 0"	289	108	9"	4' – 7"	331	9' – 3"	667	17' – 1"	46	38	106	1.202	231.8	1.3	152	49.4	9,422
4	5' – 0"	4' – 0"	8"	7"	108	#6	9"	22' – 8"	3,677	108	#5	9"	8' – 3"	929	6' – 4"	713	108	#5	9"	19' – 10"	2,234	16	18"	39' – 9"	425	80	18"	39' – 9"	2,124	108	9"	4' – 0"	289	162	9"	4' – 7"	496	9' – 3"	1,001	22' – 8"	61	48	134	1.564	297.2	1.7	195	64.3	12,083
5	5' – 0"	4' – 0"	8"	7"	108	#6	9"	28' – 3"	4,583	108	#5	9"	8' – 3"	929	6' – 4"	713	108	#5	9"	25' – 5"	2,863	20	18"	39' – 9"	531	98	18"	39' – 9"	2,602	108	9"	4' – 0"	289	216	9"	4' – 7"	661	9' – 3"	1,335	28' – 3"	75	60	167	1.926	362.7	2.1	242	79.1	14,748
6	5' – 0"	4' – 0"	8"	7"	108	#6	9"	33' – 10"	5,488	108	#5	9"	8' – 3"	929	6' – 4"	713	108	#5	9"	31' – 0"	3,492	24	18"	39' – 9"	637	116	18"	39' – 9"	3,080	108	9"	4' – 0"	289	270	9"	4' – 7"	827	9' – 3"	1,668	33' – 10"	90	70	195	2.288	428.1	2.5	285	94.0	17,408
2	5' – 0"	5' – 0"	8"	7"	108	#6	9"	11' – 6"	1,865	108	#5	9"	9' – 3"	1,042	6' – 4"	713	108	#5	9"	8' – 8"	976	8	18"	39' – 9"	212	50	18"	39' – 9"	1,328	108	9"	5' – 0"	361	54	9"	4' – 7"	165	11' – 3"	406	11' – 6"	31	26	72	0.904	176.7	0.9	103	37.0	7,171
3	5' – 0"	5' – 0"	8"	7"	108	#6	9"	17' – 1"	2,771	108	#5	9"	9' – 3"	1,042	6' – 4"	713	108	#5	9"	14' – 3"	1,605	12	18"	39' – 9"	319	70	18"	39' – 9"	1,859	108	9"	5' – 0"	361	108	9"	4' – 7"	331	11' – 3"	812	17' – 1"	46	38	106	1.288	245.3	1.3	152	52.8	9,965
4	5' – 0"	5' – 0"	8"	7"	108	#6	9"	22' – 8"	3,677	108	#5	9"	9' – 3"	1,042	6' – 4"	713	108	#5	9"	19' – 10"	2,234	16	18"	39' – 9"	425	90	18"	39' – 9"	2,390	108	9"	5' – 0"	361	162	9"	4' – 7"	496	11' – 3"	1,217	22' – 8"	61	48	134	1.672	313.9	1.7	195	68.6	12,750
5	5' – 0"	5' – 0"	8"	7"	108	#6	9"	28' – 3"	4,583	108	#5	9"	9' – 3"	1,042	6' – 4"	713	108	#5	9"	25' – 5"	2,863	20	18"	39' – 9"	531	110	18"	39' – 9"	2,921	108	9"	5' – 0"	361	216	9"	4' – 7"	661	11' – 3"	1,623	28' – 3"	75	60	167	2.056	382.5	2.1	242	84.3	15,540
6	5' – 0"	5' – 0"	8"	7"	108	#6	9"	33' – 10"	5,488	108	#5	9"	9' – 3"	1,042	6' – 4"	713	108	#5	9"	31' – 0"	3,492	24	18"	39' – 9"	637	130	18"	39' – 9"	3,452	108	9"	5' – 0"	361	270	9"	4' – 7"	827	11' – 3"	2,029	33' – 10"	90	70	195	2.439	451.0	2.5	285	100.1	18,326

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HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
5'-0" SPAN
0' TO 20' FILL

MC-5-20

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©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
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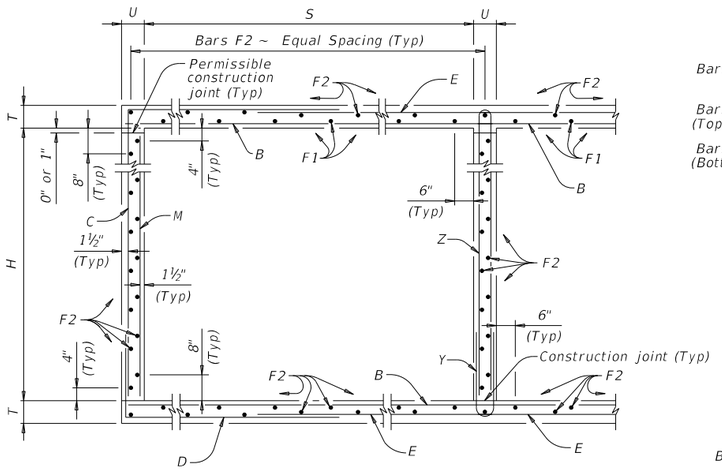

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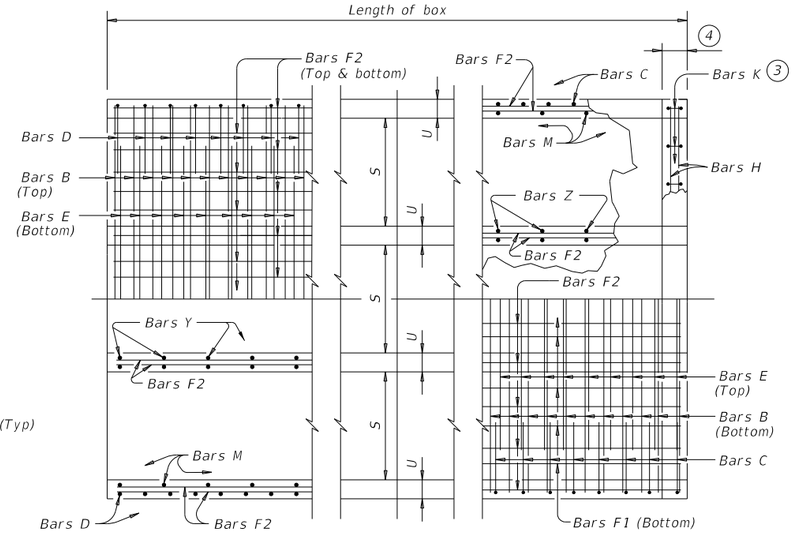
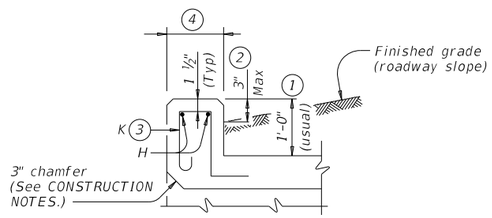


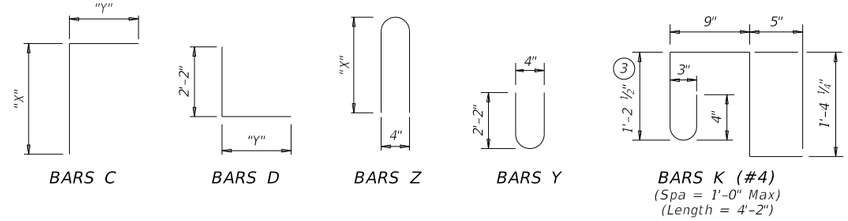
BOTTOM SLAB TOP SLAB

PART PLANS



SECTION THRU CURB

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



BARS C BARS D BARS Z BARS Y

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

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

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

GENERAL NOTES:

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

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

Use this standard only when lengthening existing multiple box culverts.

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation — Bridge Division Standard

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

FILE: mc323ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		134A

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

DATE: 05/19/2022 08:05 AM
FILE: DOCUMENT NAME

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

Use this standard only when lengthening existing multiple box culverts.

HL93 LOADING SHEET 2 OF 2

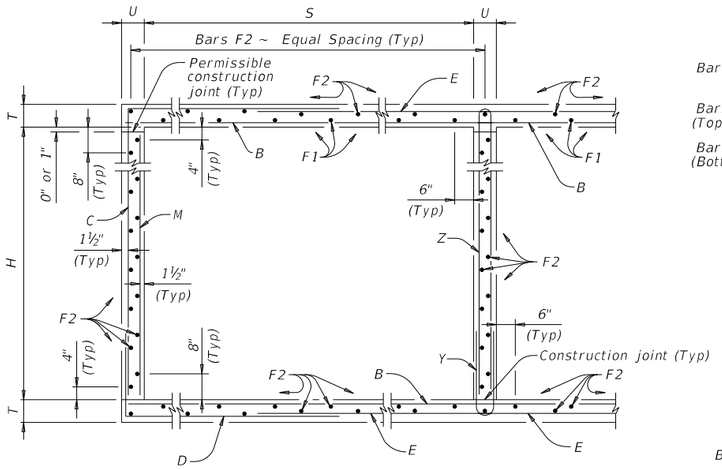
Texas Department of Transportation

Bridge Division Standard

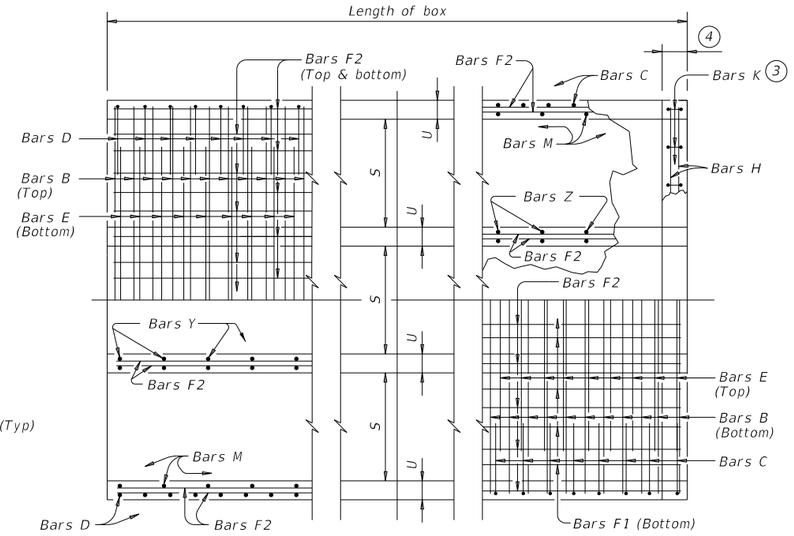
MULTIPLE BOX CULVERTS
CAST-IN-PLACE
3'-0" SPAN
0' TO 23' FILL
FOR LENGTHENING ONLY
MC-3-23

FILE: mc323ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		134B

DATE: 05/19/2022 08:02 AM
FILE: DOCUMENT NAME

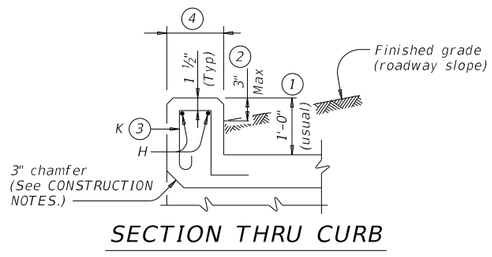


TYPICAL SECTION



BOTTOM SLAB TOP SLAB

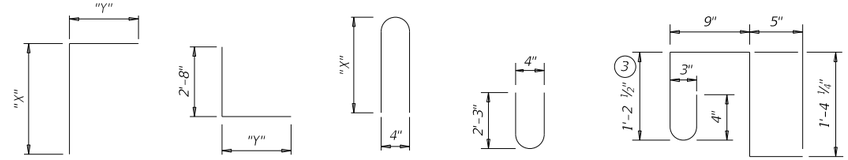
PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS

H	"X"	"Y"
2'-0"	2'-7 ½"	4'-1"
3'-0"	3'-7 ½"	4'-1"
4'-0"	4'-7 ½"	4'-1"
5'-0"	5'-7 ½"	4'-1"
6'-0"	6'-7 ½"	4'-1"



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

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

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

GENERAL NOTES:

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

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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation — Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
6'-0" SPAN
0' TO 16' FILL

MC-6-16

FILE: mc616ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		134C

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DATE: 05/19/2022 08:02 AM
FILE: DOCUMENT NAME

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																																QUANTITIES					
					Bars B					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4								Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Bars C		Bars D		No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Bars Y		Bars Z		Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
													Length	Wt	Length	Wt																					Length	Wt	Length	Wt										
2	6' – 0"	2' – 0"	9"	7"	108	#6	9"	13' – 6"	2,190	108	#5	9"	6' – 8"	751	6' – 9"	760	108	#6	9"	10' – 2"	1,649	10	18"	39' – 9"	266	44	18"	39' – 9"	1,168	108	9"	2' – 0"	144	54	9"	4' – 9"	171	5' – 5"	195	13' – 6"	36	30	84	0.894	182.4	1.0	120	36.8	7,414
3	6' – 0"	2' – 0"	9"	7"	108	#6	9"	20' – 1"	3,258	108	#5	9"	6' – 8"	751	6' – 9"	760	108	#6	9"	16' – 9"	2,717	15	18"	39' – 9"	398	63	18"	39' – 9"	1,673	108	9"	2' – 0"	144	108	9"	4' – 9"	343	5' – 5"	391	20' – 1"	54	44	122	1.302	260.9	1.5	176	53.6	10,611
4	6' – 0"	2' – 0"	9"	7"	108	#6	9"	26' – 8"	4,326	108	#5	9"	6' – 8"	751	6' – 9"	760	108	#6	9"	23' – 4"	3,785	20	18"	39' – 9"	531	82	18"	39' – 9"	2,177	108	9"	2' – 0"	144	162	9"	4' – 9"	514	5' – 5"	586	26' – 8"	71	56	156	1.711	339.4	2.0	227	70.4	13,801
5	6' – 0"	2' – 0"	9"	7"	108	#6	9"	33' – 3"	5,394	108	#5	9"	6' – 8"	751	6' – 9"	760	108	#6	9"	29' – 11"	4,853	25	18"	39' – 9"	664	101	18"	39' – 9"	2,682	108	9"	2' – 0"	144	216	9"	4' – 9"	685	5' – 5"	782	33' – 3"	89	70	195	2.120	417.9	2.5	284	87.3	16,999
6	6' – 0"	2' – 0"	9"	7"	108	#6	9"	39' – 10"	6,462	108	#5	9"	6' – 8"	751	6' – 9"	760	108	#6	9"	36' – 6"	5,921	30	18"	39' – 9"	797	120	18"	39' – 9"	3,186	108	9"	2' – 0"	144	270	9"	4' – 9"	857	5' – 5"	977	39' – 10"	106	82	228	2.529	496.4	3.0	334	104.1	20,189
2	6' – 0"	3' – 0"	9"	7"	108	#6	9"	13' – 6"	2,190	108	#5	9"	7' – 8"	864	6' – 9"	760	108	#6	9"	10' – 2"	1,649	10	18"	39' – 9"	266	50	18"	39' – 9"	1,328	108	9"	3' – 0"	216	54	9"	4' – 9"	171	7' – 5"	268	13' – 6"	36	30	84	0.958	192.8	1.0	120	39.3	7,832
3	6' – 0"	3' – 0"	9"	7"	108	#6	9"	20' – 1"	3,258	108	#5	9"	7' – 8"	864	6' – 9"	760	108	#6	9"	16' – 9"	2,717	15	18"	39' – 9"	398	71	18"	39' – 9"	1,885	108	9"	3' – 0"	216	108	9"	4' – 9"	343	7' – 5"	535	20' – 1"	54	44	122	1.389	274.4	1.5	176	57.1	11,152
4	6' – 0"	3' – 0"	9"	7"	108	#6	9"	26' – 8"	4,326	108	#5	9"	7' – 8"	864	6' – 9"	760	108	#6	9"	23' – 4"	3,785	20	18"	39' – 9"	531	92	18"	39' – 9"	2,443	108	9"	3' – 0"	216	162	9"	4' – 9"	514	7' – 5"	803	26' – 8"	71	56	156	1.819	356.1	2.0	227	74.7	14,469
5	6' – 0"	3' – 0"	9"	7"	108	#6	9"	33' – 3"	5,394	108	#5	9"	7' – 8"	864	6' – 9"	760	108	#6	9"	29' – 11"	4,853	25	18"	39' – 9"	664	113	18"	39' – 9"	3,000	108	9"	3' – 0"	216	216	9"	4' – 9"	685	7' – 5"	1,070	33' – 3"	89	70	195	2.250	437.7	2.5	284	92.5	17,790
6	6' – 0"	3' – 0"	9"	7"	108	#6	9"	39' – 10"	6,462	108	#5	9"	7' – 8"	864	6' – 9"	760	108	#6	9"	36' – 6"	5,921	30	18"	39' – 9"	797	134	18"	39' – 9"	3,558	108	9"	3' – 0"	216	270	9"	4' – 9"	857	7' – 5"	1,338	39' – 10"	106	82	228	2.681	519.3	3.0	334	110.2	21,107
2	6' – 0"	4' – 0"	9"	7"	108	#6	9"	13' – 6"	2,190	108	#5	9"	8' – 8"	976	6' – 9"	760	108	#6	9"	10' – 2"	1,649	10	18"	39' – 9"	266	50	18"	39' – 9"	1,328	108	9"	4' – 0"	289	54	9"	4' – 9"	171	9' – 5"	340	13' – 6"	36	30	84	1.023	199.2	1.0	120	41.9	8,089
3	6' – 0"	4' – 0"	9"	7"	108	#6	9"	20' – 1"	3,258	108	#5	9"	8' – 8"	976	6' – 9"	760	108	#6	9"	16' – 9"	2,717	15	18"	39' – 9"	398	71	18"	39' – 9"	1,885	108	9"	4' – 0"	289	108	9"	4' – 9"	343	9' – 5"	679	20' – 1"	54	44	122	1.475	282.6	1.5	176	60.5	11,481
4	6' – 0"	4' – 0"	9"	7"	108	#6	9"	26' – 8"	4,326	108	#5	9"	8' – 8"	976	6' – 9"	760	108	#6	9"	23' – 4"	3,785	20	18"	39' – 9"	531	92	18"	39' – 9"	2,443	108	9"	4' – 0"	289	162	9"	4' – 9"	514	9' – 5"	1,019	26' – 8"	71	56	156	1.927	366.1	2.0	227	79.1	14,870
5	6' – 0"	4' – 0"	9"	7"	108	#6	9"	33' – 3"	5,394	108	#5	9"	8' – 8"	976	6' – 9"	760	108	#6	9"	29' – 11"	4,853	25	18"	39' – 9"	664	113	18"	39' – 9"	3,000	108	9"	4' – 0"	289	216	9"	4' – 9"	685	9' – 5"	1,359	33' – 3"	89	70	195	2.380	449.5	2.5	284	97.7	18,264
6	6' – 0"	4' – 0"	9"	7"	108	#6	9"	39' – 10"	6,462	108	#5	9"	8' – 8"	976	6' – 9"	760	108	#6	9"	36' – 6"	5,921	30	18"	39' – 9"	797	134	18"	39' – 9"	3,558	108	9"	4' – 0"	289	270	9"	4' – 9"	857	9' – 5"	1,698	39' – 10"	106	82	228	2.832	533.0	3.0	334	116.2	21,652
2	6' – 0"	5' – 0"	9"	7"	108	#6	9"	13' – 6"	2,190	108	#5	9"	9' – 8"	1,089	6' – 9"	760	108	#6	9"	10' – 2"	1,649	10	18"	39' – 9"	266	56	18"	39' – 9"	1,487	108	9"	5' – 0"	361	54	9"	4' – 9"	171	11' – 5"	412	13' – 6"	36	30	84	1.088	209.6	1.0	120	44.5	8,505
3	6' – 0"	5' – 0"	9"	7"	108	#6	9"	20' – 1"	3,258	108	#5	9"	9' – 8"	1,089	6' – 9"	760	108	#6	9"	16' – 9"	2,717	15	18"	39' – 9"	398	79	18"	39' – 9"	2,098	108	9"	5' – 0"	361	108	9"	4' – 9"	343	11' – 5"	824	20' – 1"	54	44	122	1.562	296.2	1.5	176	64.0	12,024
4	6' – 0"	5' – 0"	9"	7"	108	#6	9"	26' – 8"	4,326	108	#5	9"	9' – 8"	1,089	6' – 9"	760	108	#6	9"	23' – 4"	3,785	20	18"	39' – 9"	531	102	18"	39' – 9"	2,708	108	9"	5' – 0"	361	162	9"	4' – 9"	514	11' – 5"	1,235	26' – 8"	71	56	156	2.035	382.7	2.0	227	83.4	15,536
5	6' – 0"	5' – 0"	9"	7"	108	#6	9"	33' – 3"	5,394	108	#5	9"	9' – 8"	1,089	6' – 9"	760	108	#6	9"	29' – 11"	4,853	25	18"	39' – 9"	664	125	18"	39' – 9"	3,319	108	9"	5' – 0"	361	216	9"	4' – 9"	685	11' – 5"	1,647	33' – 3"	89	70	195	2.509	469.3	2.5	284	102.8	19,056
6	6' – 0"	5' – 0"	9"	7"	108	#6	9"	39' – 10"	6,462	108	#5	9"	9' – 8"	1,089	6' – 9"	760	108	#6	9"	36' – 6"	5,921	30	18"	39' – 9"	797	148	18"	39' – 9"	3,930	108	9"	5' – 0"	361	270	9"	4' – 9"	857	11' – 5"	2,059	39' – 10"	106	82	228	2.983	555.9	3.0	334	122.3	22,570
2	6' – 0"	6' – 0"	9"	7"	108	#6	9"	13' – 6"	2,190	108	#5	9"	10' – 8"	1,202	6' – 9"	760	108	#6	9"	10' – 2"	1,649	10	18"	39' – 9"	266	62	18"	39' – 9"	1,646	108	9"	6' – 0"	433	54	9"	4' – 9"	171	13' – 5"	484	13' – 6"	36	30	84	1.153	220.0	1.0	120	47.1	8,921
3	6' – 0"	6' – 0"	9"	7"	108	#6	9"	20' – 1"	3,258	108	#5	9"	10' – 8"	1,202	6' – 9"	760	108	#6	9"	16' – 9"	2,717	15	18"	39' – 9"	398	87	18"	39' – 9"	2,310	108	9"	6' – 0"	433	108	9"	4' – 9"	343	13' – 5"	968	20' – 1"	54	44	122	1.648	309.7	1.5	176	67.4	12,565
4	6' – 0"	6' – 0"	9"	7"	108	#6	9"	26' – 8"	4,326	108	#5	9"	10' – 8"	1,202	6' – 9"	760	108	#6	9"	23' – 4"	3,785	20	18"	39' – 9"	531	112	18"	39' – 9"	2,974	108	9"	6' – 0"	433	162	9"	4' – 9"	514	13' – 5"	1,452	26' – 8"	71	56	156	2.144	399.4	2.0	227	87.7	16,204
5	6' – 0"	6' – 0"	9"	7"	108	#6	9"	33' – 3"	5,394	108	#5	9"	10' – 8"	1,202	6' – 9"	760	108	#6	9"	29' – 11"	4,853	25	18"	39' – 9"	664	137	18"	39' – 9"	3,638	108	9"	6' – 0"	433	216	9"	4' – 9"	685	13' – 5"	1,936	33' – 3"	89	70	195	2.639	489.1	2.5	284	108.0	19,849
6	6' – 0"	6' – 0"	9"	7"	108	#6	9"	39' – 10"	6,462	108	#5	9"	10' – 8"	1,202	6' – 9"	760	108	#6	9"	36' – 6"	5,921	30	18"	39' – 9"	797	162	18"	39' – 9"	4,302	108	9"	6' – 0"	433	270	9"	4' – 9"	857	13' – 5"	2,420	39' – 10"	106	82	228	3.134	578.9	3.0	334	128.3	23,488

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

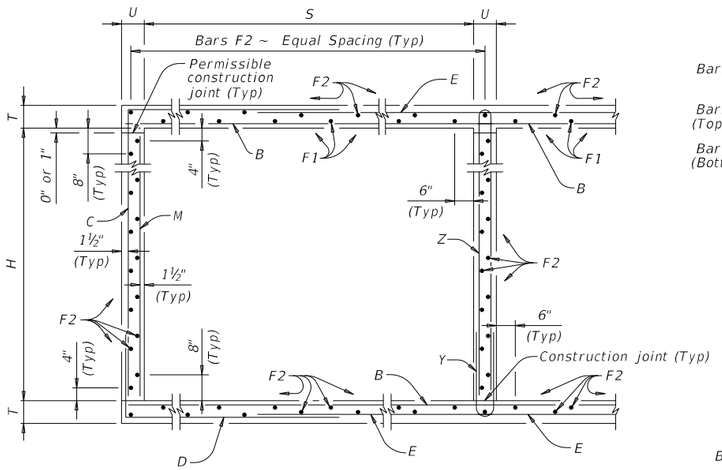
Bridge Division Standard

MULTIPLE BOX CULVERTS
CAST-IN-PLACE
6'-0" SPAN
0' TO 16' FILL

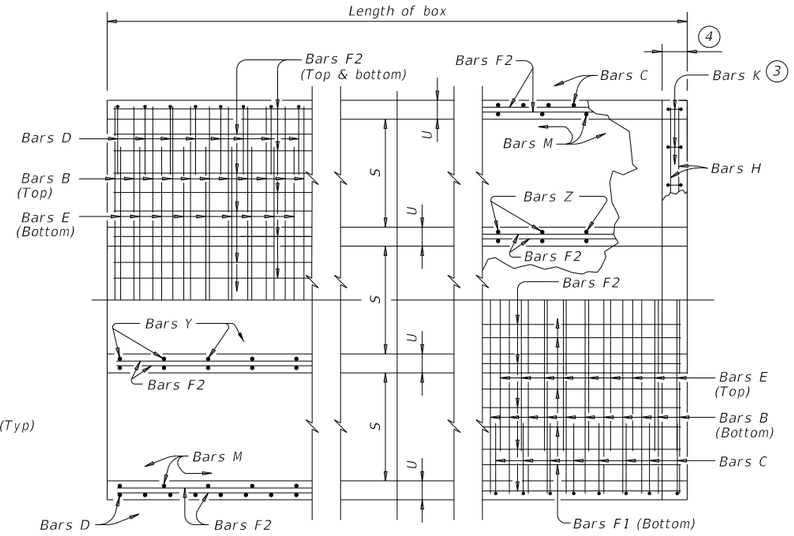
MC-6-16

FILE: mc616ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		134D

DATE: 05/19/2022 07:51 AM
FILE: DOCUMENT NAME

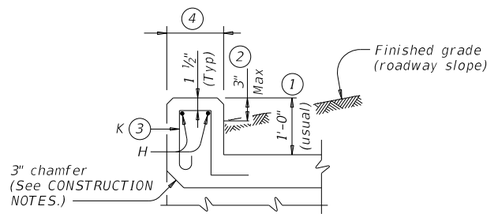


TYPICAL SECTION



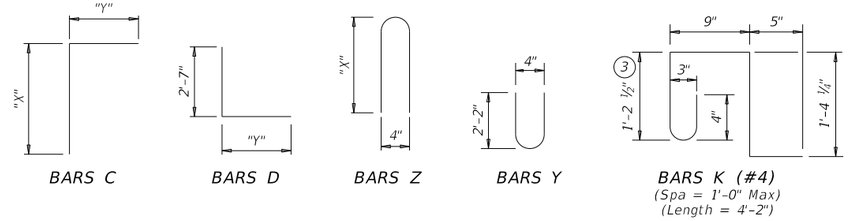
BOTTOM SLAB TOP SLAB

PART PLANS



SECTION THRU CURB

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



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

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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

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

GENERAL NOTES:

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

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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation — Bridge Division Standard

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

MC-7-10

FILE: mc710ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		134E

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

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

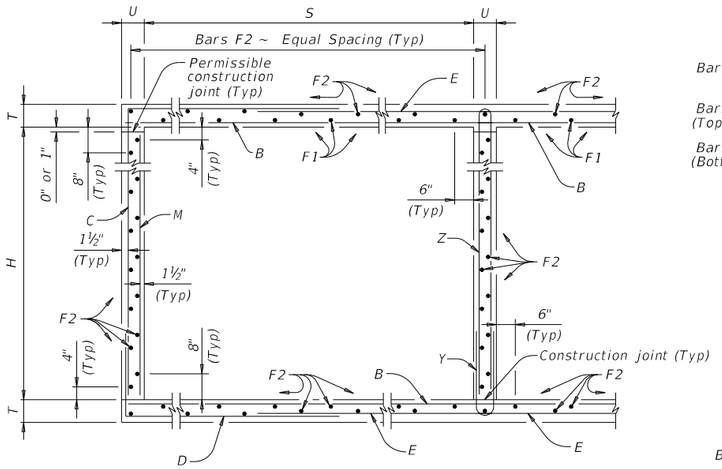
7'-0" SPAN

0' TO 10' FILL

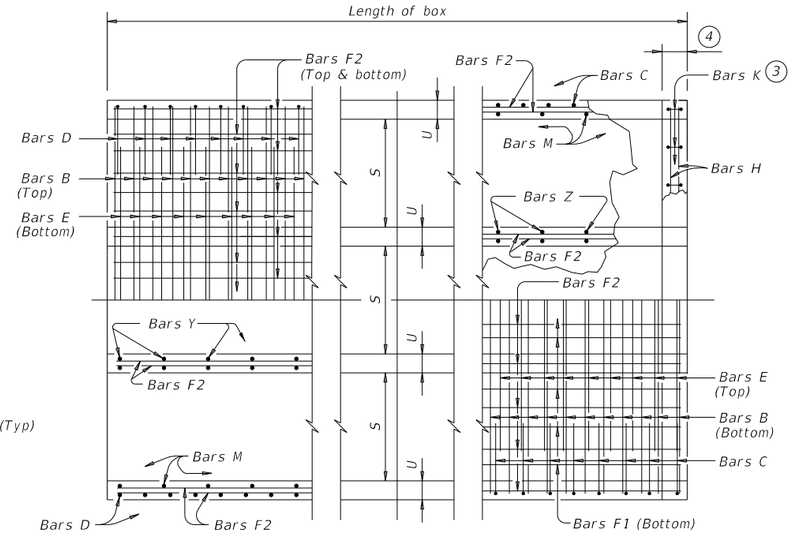
MC-7-10

FILE: mc710ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		134F

DATE: 05/18/2022 09:20 AM
FILE: DOCUMENT NAME

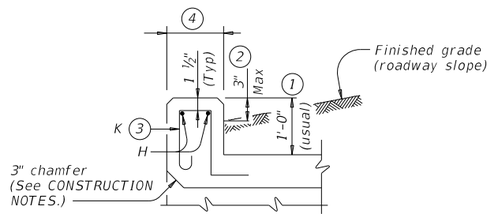


TYPICAL SECTION



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:

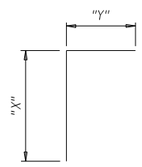
Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Provide Class C concrete (f'c = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of:
- culverts with overlay,
- culverts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

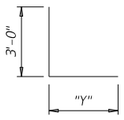
GENERAL NOTES:

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.

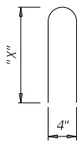
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.



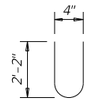
BARS C



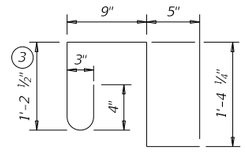
BARS D



BARS Z



BARS Y



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

HL93 LOADING SHEET 1 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: mc813ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		134G

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DATE: 05/18/2022 09:20 AM
FILE: DOCUMENT NAME

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

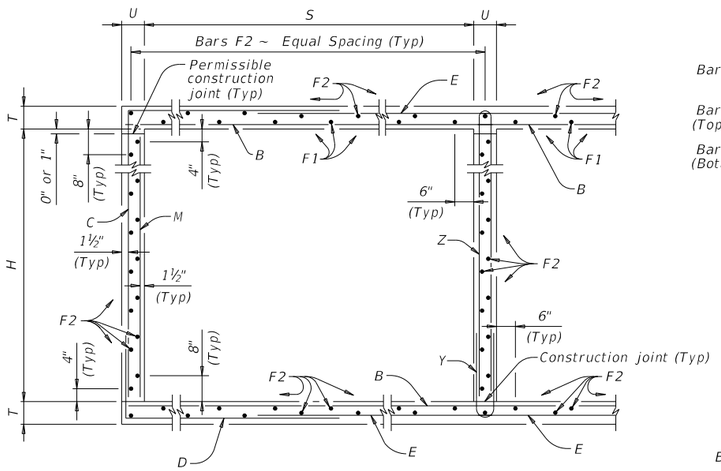
8'-0" SPAN

0' TO 13' FILL

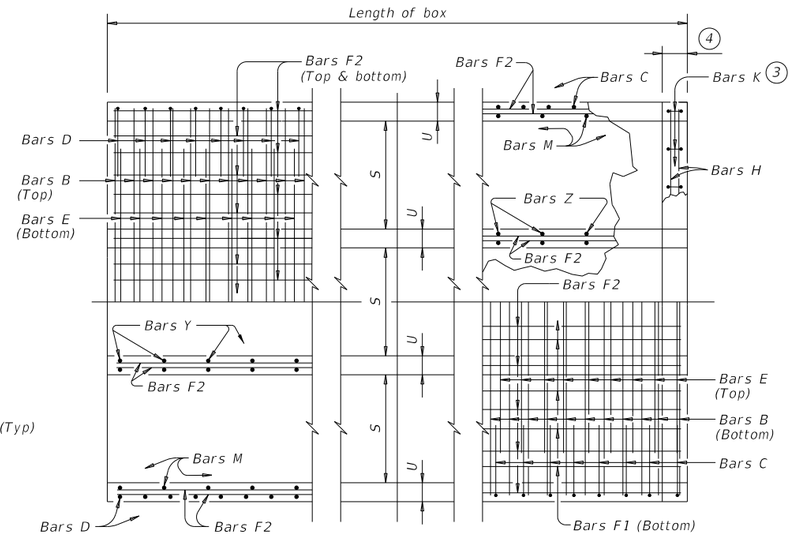
MC-8-13

FILE: mc813ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		134H

DATE: 05/19/2022 08:31 AM
FILE: DOCUMENT NAME

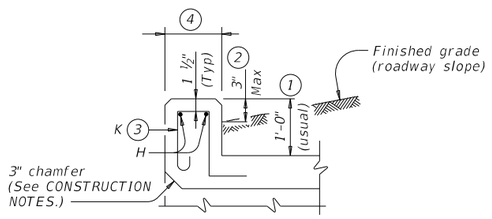


TYPICAL SECTION



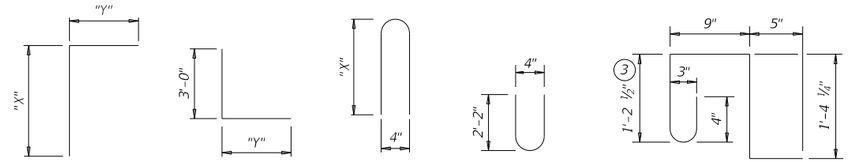
BOTTOM SLAB TOP SLAB

PART PLANS



SECTION THRU CURB

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



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

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

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

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

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

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

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

CONSTRUCTION NOTES:

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

MATERIAL NOTES:

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

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

GENERAL NOTES:

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

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

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation — Bridge Division Standard

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

MC-10-7

FILE: mc107ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		1341

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DATE: 05/19/2022 08:31 AM
FILE: DOCUMENT NAME

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	
												Bars C		Bars D																				Bars Y		Bars Z											
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Length	Wt	Length	Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	10' – 0"	4' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	66	18"	39' – 9"	1,752	108	9"	4' – 0"	289	54	9"	4' – 7"	165	9' – 3"	334	21' – 6"	57	46	128	1.333	374.6	1.6	185	54.9	15,168
3	10' – 0"	4' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	95	18"	39' – 9"	2,523	108	9"	4' – 0"	289	108	9"	4' – 7"	331	9' – 3"	667	32' – 1"	86	68	189	1.942	539.8	2.4	275	80.1	21,865
4	10' – 0"	4' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	124	18"	39' – 9"	3,293	108	9"	4' – 0"	289	162	9"	4' – 7"	496	9' – 3"	1,001	42' – 8"	114	88	245	2.551	704.9	3.2	359	105.2	28,553
5	10' – 0"	4' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	153	18"	39' – 9"	4,063	108	9"	4' – 0"	289	216	9"	4' – 7"	661	9' – 3"	1,335	53' – 3"	142	110	306	3.160	870.0	3.9	448	130.3	35,248
6	10' – 0"	4' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	182	18"	39' – 9"	4,833	108	9"	4' – 0"	289	270	9"	4' – 7"	827	9' – 3"	1,668	65' – 6"	175	130	362	3.770	1,050.3	4.7	537	155.5	42,550
2	10' – 0"	5' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	72	18"	39' – 9"	1,912	108	9"	5' – 0"	361	54	9"	4' – 7"	165	11' – 3"	406	21' – 6"	57	46	128	1.398	386.2	1.6	185	57.5	15,634
3	10' – 0"	5' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	103	18"	39' – 9"	2,735	108	9"	5' – 0"	361	108	9"	4' – 7"	331	11' – 3"	812	32' – 1"	86	68	189	2.029	554.5	2.4	275	83.5	22,456
4	10' – 0"	5' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	134	18"	39' – 9"	3,558	108	9"	5' – 0"	361	162	9"	4' – 7"	496	11' – 3"	1,217	42' – 8"	114	88	245	2.659	722.7	3.2	359	109.5	29,268
5	10' – 0"	5' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	165	18"	39' – 9"	4,381	108	9"	5' – 0"	361	216	9"	4' – 7"	661	11' – 3"	1,623	53' – 3"	142	110	306	3.290	891.0	3.9	448	135.5	36,088
6	10' – 0"	5' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	196	18"	39' – 9"	5,204	108	9"	5' – 0"	361	270	9"	4' – 7"	827	11' – 3"	2,029	65' – 6"	175	130	362	3.921	1,074.5	4.7	537	161.6	43,516
2	10' – 0"	6' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	78	18"	39' – 9"	2,071	108	9"	6' – 0"	433	54	9"	4' – 7"	165	13' – 3"	478	21' – 6"	57	46	128	1.463	397.9	1.6	185	60.1	16,100
3	10' – 0"	6' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	111	18"	39' – 9"	2,947	108	9"	6' – 0"	433	108	9"	4' – 7"	331	13' – 3"	956	32' – 1"	86	68	189	2.115	569.3	2.4	275	87.0	23,047
4	10' – 0"	6' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	144	18"	39' – 9"	3,824	108	9"	6' – 0"	433	162	9"	4' – 7"	496	13' – 3"	1,434	42' – 8"	114	88	245	2.767	740.7	3.2	359	113.8	29,986
5	10' – 0"	6' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	177	18"	39' – 9"	4,700	108	9"	6' – 0"	433	216	9"	4' – 7"	661	13' – 3"	1,912	53' – 3"	142	110	306	3.420	912.1	3.9	448	140.7	36,931
6	10' – 0"	6' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	210	18"	39' – 9"	5,576	108	9"	6' – 0"	433	270	9"	4' – 7"	827	13' – 3"	2,390	65' – 6"	175	130	362	4.072	1,098.7	4.7	537	167.6	44,484
2	10' – 0"	7' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	78	18"	39' – 9"	2,071	108	9"	7' – 0"	505	54	9"	4' – 7"	165	15' – 3"	550	21' – 6"	57	46	128	1.528	405.5	1.6	185	62.7	16,406
3	10' – 0"	7' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	111	18"	39' – 9"	2,947	108	9"	7' – 0"	505	108	9"	4' – 7"	331	15' – 3"	1,100	32' – 1"	86	68	189	2.202	578.8	2.4	275	90.5	23,425
4	10' – 0"	7' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	144	18"	39' – 9"	3,824	108	9"	7' – 0"	505	162	9"	4' – 7"	496	15' – 3"	1,650	42' – 8"	114	88	245	2.876	751.9	3.2	359	118.2	30,436
5	10' – 0"	7' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	177	18"	39' – 9"	4,700	108	9"	7' – 0"	505	216	9"	4' – 7"	661	15' – 3"	2,200	53' – 3"	142	110	306	3.549	925.1	3.9	448	145.9	37,453
6	10' – 0"	7' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	210	18"	39' – 9"	5,576	108	9"	7' – 0"	505	270	9"	4' – 7"	827	15' – 3"	2,750	65' – 6"	175	130	362	4.223	1,113.5	4.7	537	173.7	45,078
2	10' – 0"	8' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	84	18"	39' – 9"	2,230	108	9"	8' – 0"	577	54	9"	4' – 7"	165	17' – 3"	622	21' – 6"	57	46	128	1.593	417.2	1.6	185	65.3	16,871
3	10' – 0"	8' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	119	18"	39' – 9"	3,160	108	9"	8' – 0"	577	108	9"	4' – 7"	331	17' – 3"	1,244	32' – 1"	86	68	189	2.288	593.5	2.4	275	93.9	24,016
4	10' – 0"	8' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	154	18"	39' – 9"	4,089	108	9"	8' – 0"	577	162	9"	4' – 7"	496	17' – 3"	1,867	42' – 8"	114	88	245	2.984	769.8	3.2	359	122.5	31,152
5	10' – 0"	8' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	189	18"	39' – 9"	5,019	108	9"	8' – 0"	577	216	9"	4' – 7"	661	17' – 3"	2,489	53' – 3"	142	110	306	3.679	946.2	3.9	448	151.1	38,295
6	10' – 0"	8' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	224	18"	39' – 9"	5,948	108	9"	8' – 0"	577	270	9"	4' – 7"	827	17' – 3"	3,111	65' – 6"	175	130	362	4.374	1,137.7	4.7	537	179.7	46,045
2	10' – 0"	9' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	90	18"	39' – 9"	2,390	108	9"	9' – 0"	649	54	9"	4' – 7"	165	19' – 3"	694	21' – 6"	57	46	128	1.657	477.8	1.6	185	67.9	19,297
3	10' – 0"	9' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	127	18"	39' – 9"	3,372	108	9"	9' – 0"	649	108	9"	4' – 7"	331	19' – 3"	1,389	32' – 1"	86	68	189	2.374	657.3	2.4	275	97.3	26,567
4	10' – 0"	9' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	164	18"	39' – 9"	4,355	108	9"	9' – 0"	649	162	9"	4' – 7"	496	19' – 3"	2,083	42' – 8"	114	88	245	3.092	836.7	3.2	359	126.8	33,828
5	10' – 0"	9' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	201	18"	39' – 9"	5,337	108	9"	9' – 0"	649	216	9"	4' – 7"	661	19' – 3"	2,778	53' – 3"	142	110	306	3.809	1,016.2	3.9	448	156.3	41,096
6	10' – 0"	9' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	238	18"	39' – 9"	6,320	108	9"	9' – 0"	649	270	9"	4' – 7"	827	19' – 3"	3,472	65' – 6"	175	130	362	4.526	1,210.9	4.7	537	185.8	48,972
2	10' – 0"	10' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	90	18"	39' – 9"	2,390	108	9"	10' – 0"	721	54	9"	4' – 7"	165	21' – 3"	767	21' – 6"	57	46	128	1.722	487.5	1.6	185	70.5	19,685
3	10' – 0"	10' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	127	18"	39' – 9"	3,372	108	9"	10' – 0"	721	108	9"	4' – 7"	331	21' – 3"	1,533	32' – 1"	86	68	189	2.461	668.8	2.4	275	100.8	27,026
4	10' – 0"	10' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	164	18"	39' – 9"	4,355	108	9"	10' – 0"	721	162	9"	4' – 7"	496	21' – 3"	2,300	42' – 8"	114	88	245	3.200	850.0	3.2	359	131.2	34,360
5	10' – 0"	10' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	201	18"	39' – 9"	5,337	108	9"	10' – 0"	721	216	9"	4' – 7"	661	21' – 3"	3,066	53' – 3"	142	110	306	3.938	1,031.3	3.9	448	161.5	41,699
6	10' – 0"	10' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	238	18"	39' – 9"	6,320	108	9"	10' – 0"	721	270	9"	4' – 7"	827	21' – 3"	3,833	65' – 6"	175	130	362	4.677	1,227.8	4.7	537	191.8	49,648

(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
0' TO 7' FILL

MC-10-7

FILE: mc107ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		134J

DATE: 5/19/2022 6:08:24 PM
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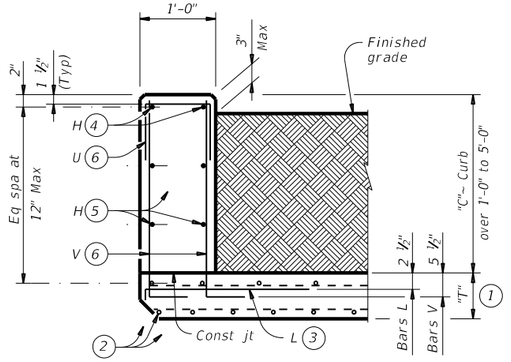
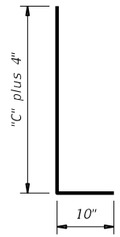
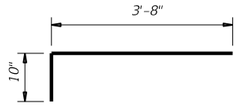


TYPICAL SECTION

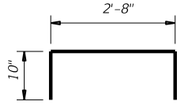
Used for curbs over 1'–0" to 5'–0"



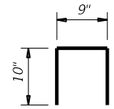
BARS V (#5) (6)
Spaced at 12" Max



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



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



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

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

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

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

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

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

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

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

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

TABLE OF ESTIMATED CURB QUANTITIES (8)

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

CONSTRUCTION NOTES:

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

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

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.

Provide galvanized reinforcing steel if required elsewhere in the plans.

Provide Class "C" concrete (f'_c = 3,600 psi) minimum for curbs.

Provide bar laps, where required, as follows:

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

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

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

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

Cover dimensions are clear dimensions, unless noted otherwise.

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

Texas Department of Transportation

Bridge Division Standard

EXTENDED CURB DETAILS

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

ECD

FILE: ecdstde1-20.dgn	DN: GAF	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		135

DATE: 5/19/2022 6:08:29 PM
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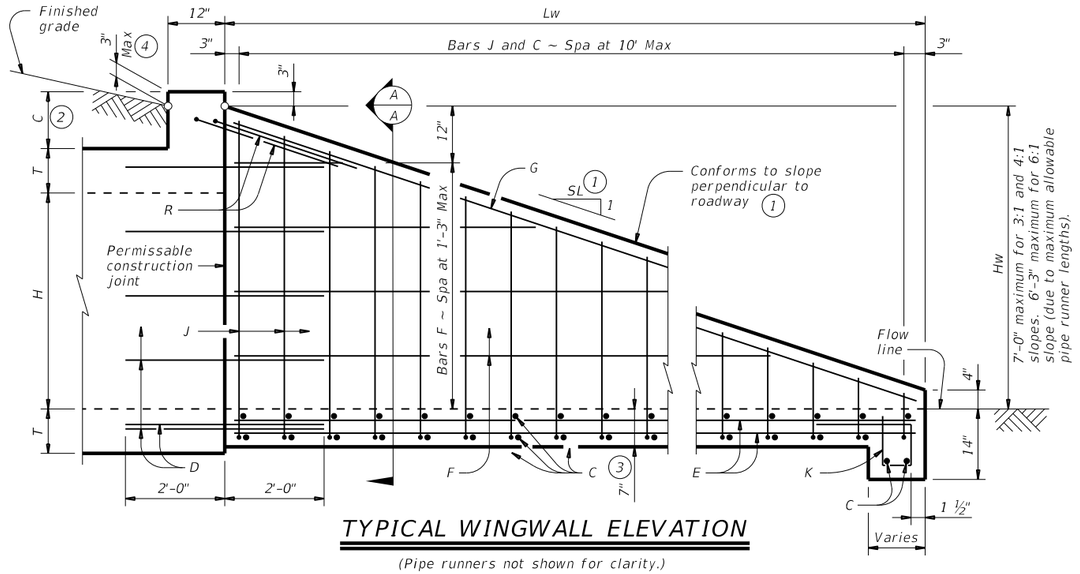
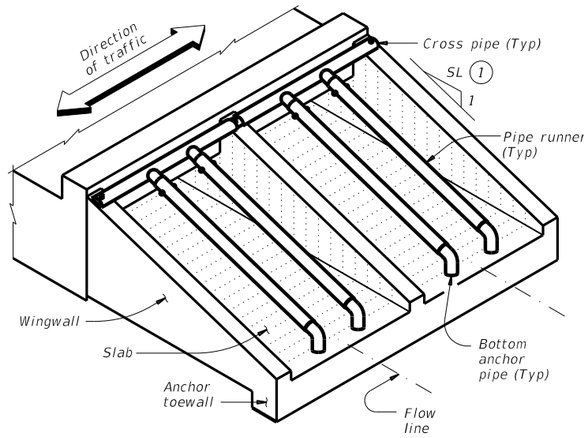


TYPICAL WINGWALL ELEVATION

(Pipe runners not shown for clarity.)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

WING DIMENSION CALCULATIONS:

$Hw = H + T + C - 0.250'$

$Lw = (Hw - 0.333') (SL)$

For cast-in-place culverts:

$Atw = (N) (S) + (N + 1) (U)$

For precast culverts:

$Atw = (N) (2U + S) + (N - 1) (0.500')$

Total Wingwall Area (SF)
$= (0.5) (Hw + 0.333') (Lw) (N + 1)$

Total Concrete Volume (CY)
$= [(\text{Wingwall Area}) (0.583') + (Lw) (Atw) (0.583') + (Atw) (1.167') (1.167' - 0.583')] \div (27)$

PIPE RUNNER DIMENSION CALCULATIONS:

Pipe Runner Length
$= (Lw) (K1) - (1.917')$

Total Reinforcing (Lb)
$= (1.55) (Lw) (Atw) + (4.43) (Atw) + (K2) (Hw) (N + 1) (\sqrt{Lw})$

C = Height of curb above top of top slab (feet)
Hw = Height of wingwall (feet)
K = Constant value for use in formulas

Slope SL:1	K1	K2
3:1	~ 1.054 ~	7.45
4:1	~ 1.031 ~	8.49
6:1	~ 1.014 ~	10.30

Atw = Anchor toewall length (feet)
Lw = Length of wingwall (feet)
N = Number of culvert barrels
SL:1 = Side slope ratio (horizontal : 1 vertical)

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

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.

Provide galvanized reinforcing steel if required elsewhere in the plans.

Adjust reinforcing as necessary to provide a minimum clear cover of 1 ½".

Provide Class "C" concrete (f`c = 3,600 psi).

Provide pipe runners, cross pipes, and anchor pipes meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.

Provide ASTM A307 bolts.

Galvanize all steel components, except the concrete reinforcing, unless required elsewhere in the plans, after fabrication.

Repair galvanizing damaged during transport or construction in accordance with the Item 445, "Galvanizing".

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

The safety end treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.

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

The quantities for pipe runners, reinforcing steel, and concrete resulting from the formulas given herein are for Contractor's information only.

See the Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.

Alternate design drawings bearing the seal of a professional engineer will be acceptable for precast construction of the safety end treatments.

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

SECTION A-A

(Showing typical wingwall and wing slab reinforcing. Pipe runners not shown for clarity.)

AT TOP OF EXTERIOR WINGWALL
(Cast-in-place culvert)

AT TOP OF INTERIOR WINGWALL
(Cast-in-place culvert)

AT OUTSIDE OF BOTTOM SLAB
(Cast-in-place culvert)

AT INTERIOR WINGWALL
(Precast culvert)

PLAN VIEWS OF CORNER DETAILS

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

(2) 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet.

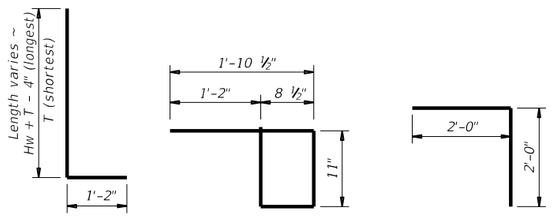
(3) Wingwall and slab thicknesses may be the same as the adjacent culvert wall and slab thicknesses (7" minimum). If thicknesses greater than the minimum (7") are used, no changes will be made in quantities and no additional compensation will be allowed.

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

(5) For culverts with C = 0", the precast culvert reinforcing may extend 1'-0" minimum into wingwall. Wingwall Bars D and R may be omitted. Otherwise, refer to the Wingwall Connection detail on the Box Culvert Precast Miscellaneous Details (SCP-MD) standard sheet.

TABLE OF REINFORCING BAR SIZES AND SPACING

Bar	Size	Spacing
C	#4	10" Max
D	#4	Match F and E
E	#4	1'-0" Max
F	#4	1'-3" Max
G	#6	As shown
J	#4	10" Max
K	#4	1'-0" Max
R	#4	As shown



BARS J

BARS K
(Length = 4'-3")

BARS R

SHEET 1 OF 2

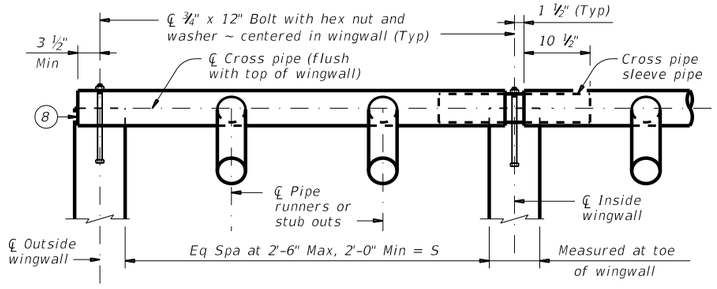
Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR 0° SKEW BOX CULVERTS
(MAXIMUM Hw = 7'-0")
TYPE I ~ CROSS DRAINAGE

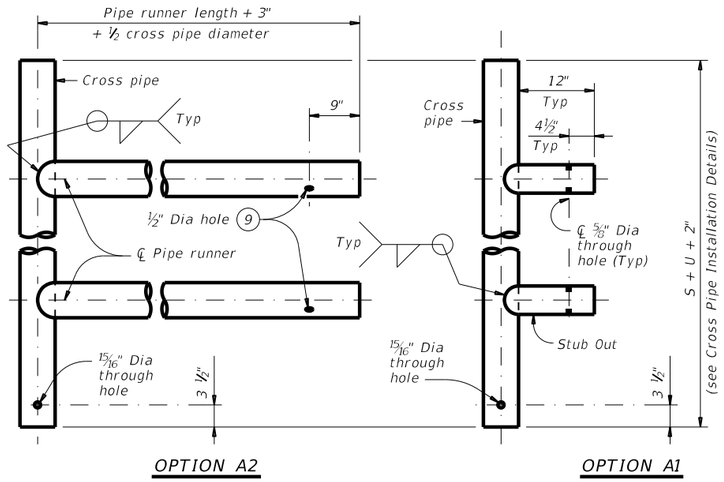
SETB-CD

FILE: setbcdse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		136



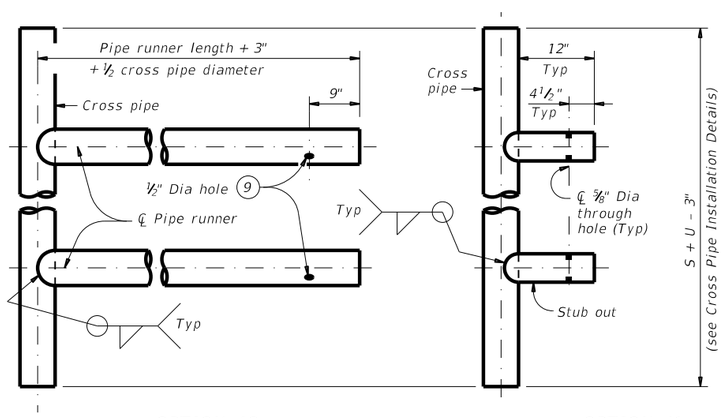
NOTE: At Contractor's option, make the cross pipe continuous across the inside wingwalls. If option is selected, omit the sleeve pipe and make a 15⁄16" diameter through hole in the cross pipe to accept the anchor bolt at the centerline of each inside wingwall.

CROSS PIPE INSTALLATION DETAILS



OPTION A2 OPTION A1

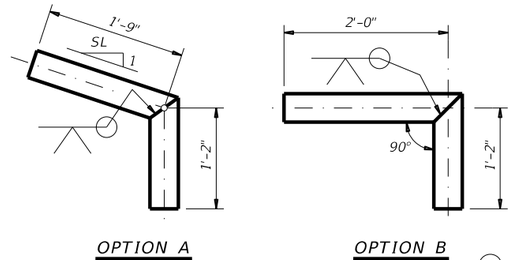
FOR USE IN OUTSIDE CULVERT BAY



OPTION A2 OPTION A1

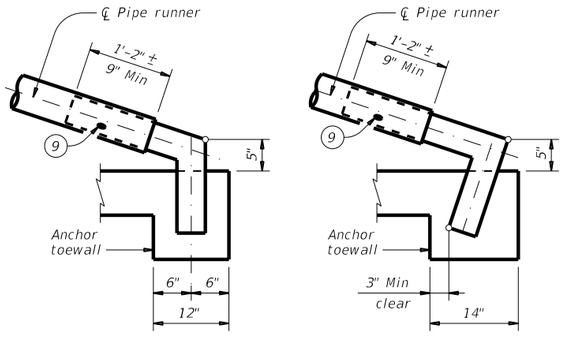
FOR USE IN INSIDE CULVERT BAY

CROSS PIPE AND CONNECTIONS DETAILS



OPTION A OPTION B

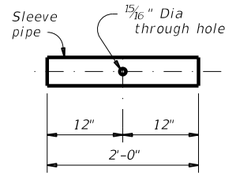
BOTTOM ANCHOR PIPE DETAILS (10)



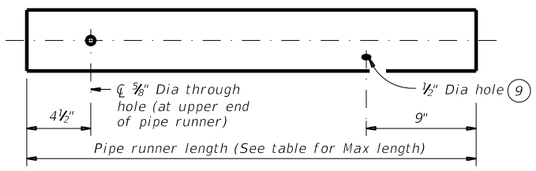
OPTION B1 OPTION B2

BOTTOM ANCHOR TOEWALL DETAILS

(Wingwall not shown for clarity.)

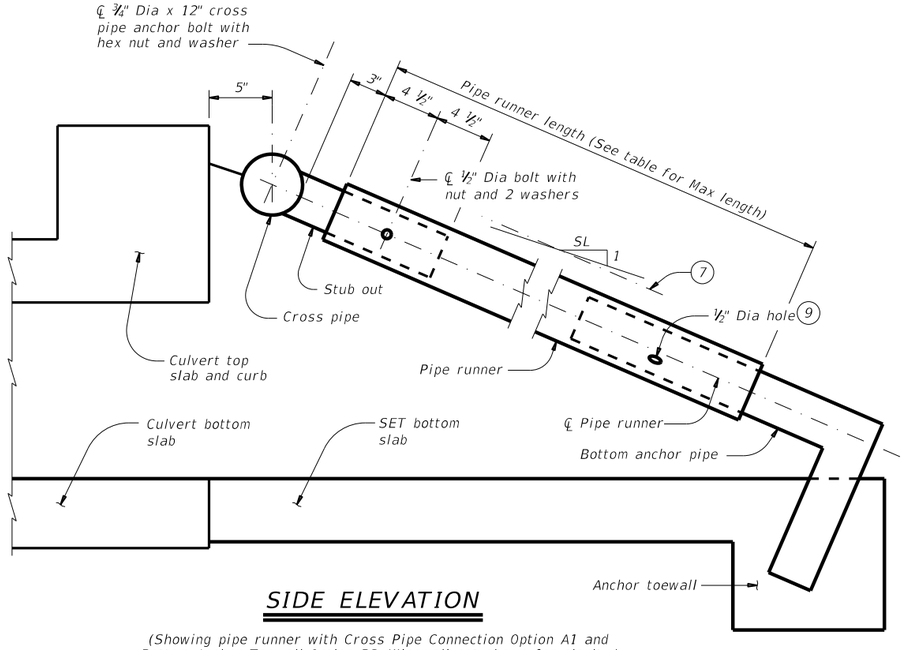


CROSS PIPE SLEEVE PIPE DETAILS



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

PIPE RUNNER DETAILS



SIDE ELEVATION

(Showing pipe runner with Cross Pipe Connection Option A1 and Bottom Anchor Toewall Option B2. Wingwall not shown for clarity.)

(6) Cross pipe is the same size as the pipe runner. Cross pipe stub out is the same size as the anchor pipe.

(7) Note that actual slope of safety pipe runner may vary slightly from side slope.

(8) Take care to ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access.

(9) After installation, inspect the 1#2" hole to ensure that the lap of the safety pipe runner with the bottom anchor pipe is adequate.

(10) At fabricator's option, a heat bend to a smooth 5" radius or a manufactured elbow (of the same material as the runner) may be substituted for the mitered and welded joint in the bottom anchor pipe.

MAXIMUM PIPE RUNNER LENGTHS AND (6) REQUIRED PIPE RUNNER AND ANCHOR PIPE SIZES

Maximum Pipe Runner Length	Required Pipe Runner Size			Required Anchor Pipe Size		
	Pipe Size	Pipe O.D.	Pipe I.D.	Pipe Size	Pipe O.D.	Pipe I.D.
10'- 0"	3" STD	3.500"	3.068"	2" STD	2.375"	2.067"
19'- 8"	4" STD	4.500"	4.026"	3" STD	3.500"	3.068"
34'- 2"	5" STD	5.563"	5.047"	4" STD	4.500"	4.026"

SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 0° SKEW BOX CULVERTS
(MAXIMUM Hw = 7'-0")
TYPE I ~ CROSS DRAINAGE

SETB-CD

FILE: setbcdse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		137

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

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

TABLE OF WING WALL REINFORCING (Two~Wings)

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

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

TABLE OF ESTIMATED ANCHOR TOEWALL QUANTITIES

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

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

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

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

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

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

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

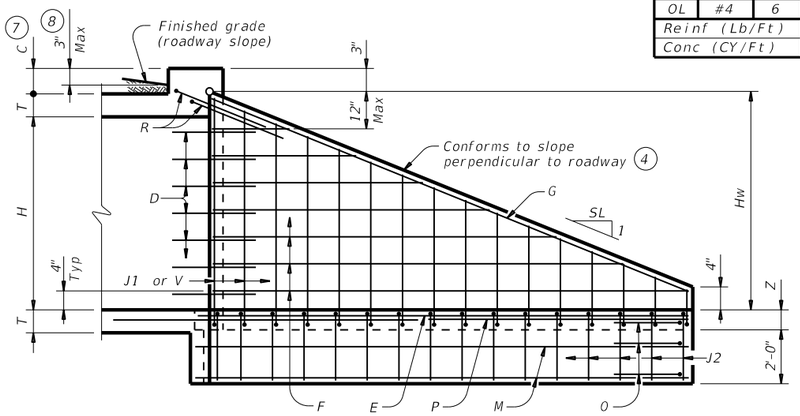
(7) 3" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to the Extend Curb Details (ECD) standard sheet.

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

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

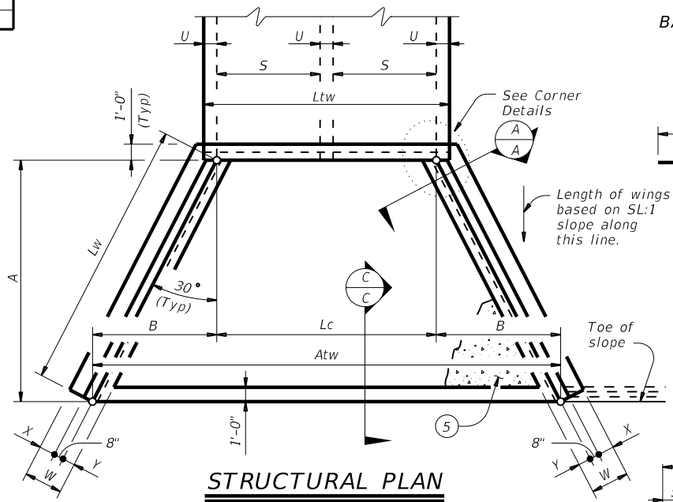
TABLE OF MAXIMUM WING HEIGHTS (9)

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



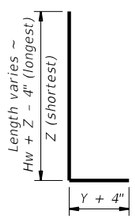
INSIDE ELEVATION OF WINGWALL

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



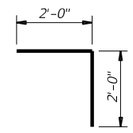
STRUCTURAL PLAN

(Showing dimensions.)

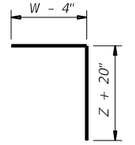


BARS J1

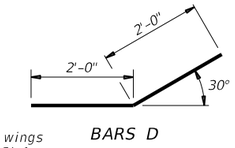
BARS V



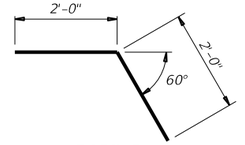
BARS L



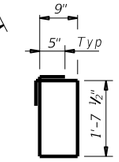
BARS J2



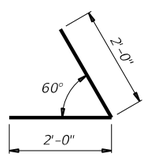
BARS D



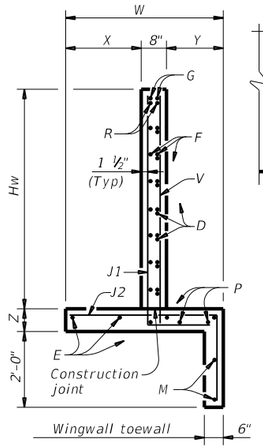
BARS R



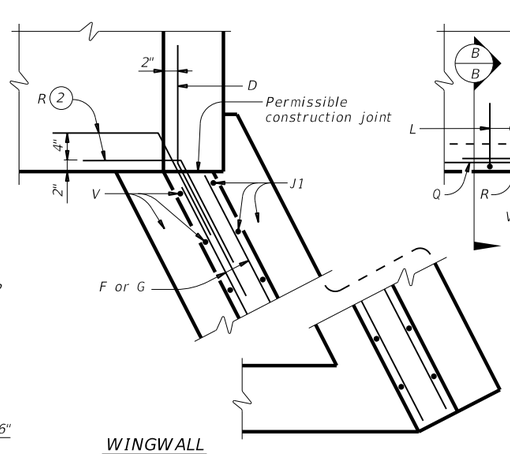
BARS K
(Length = 5'-5")



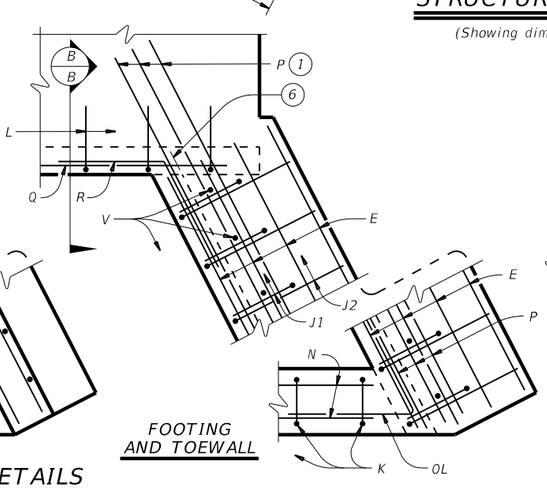
BARS OL



SECTION A-A



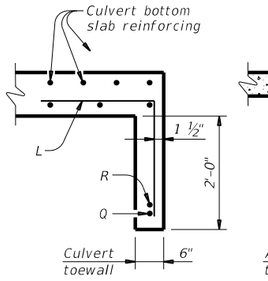
WINGWALL



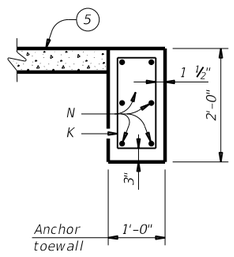
FOOTING AND TOEWALL

CORNER DETAILS

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



SECTION B-B (5)



SECTION C-C

WING DIMENSION CALCULATIONS:

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

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

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

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

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

MATERIAL NOTES:

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

GENERAL NOTES:

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

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

SHEET 1 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-0

FILE: setbf0se-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020 REVISIONS	CONT	SECT	JOB	HIGHWAY
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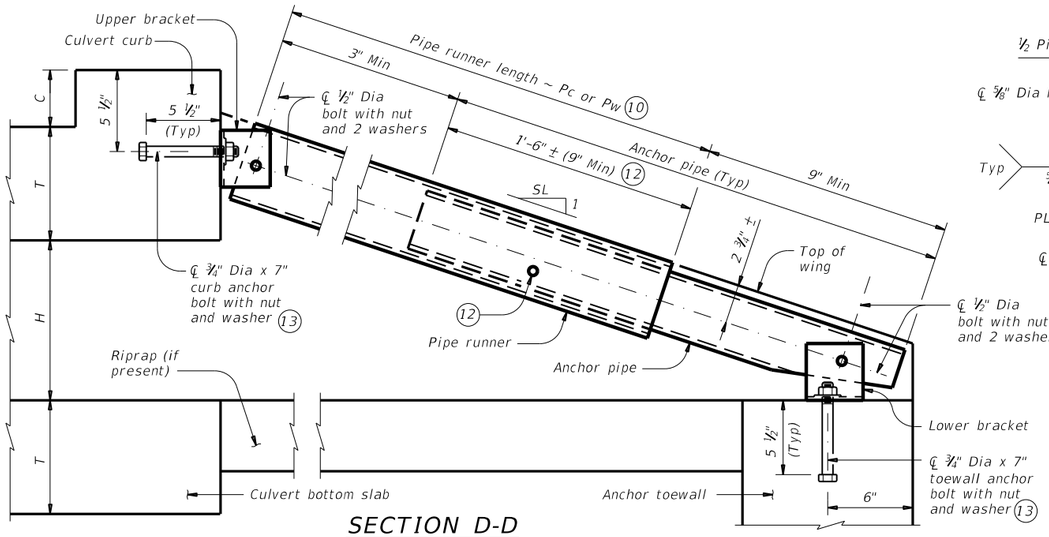
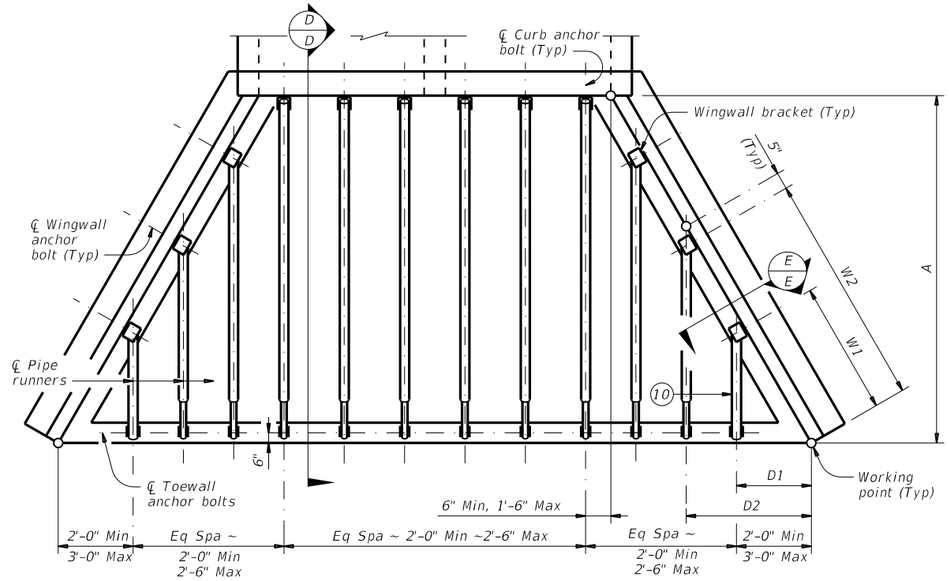
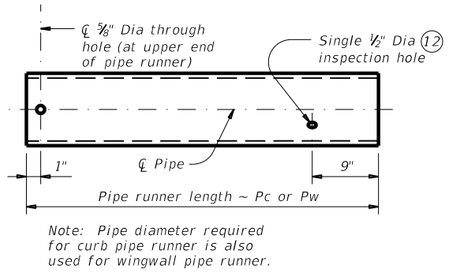


SECTION D-D

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

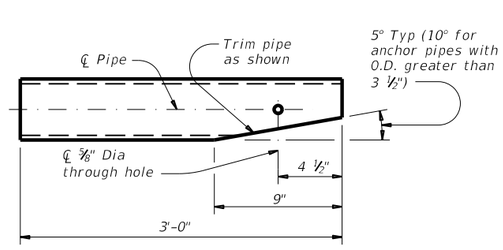


PIPE RUNNER PLAN

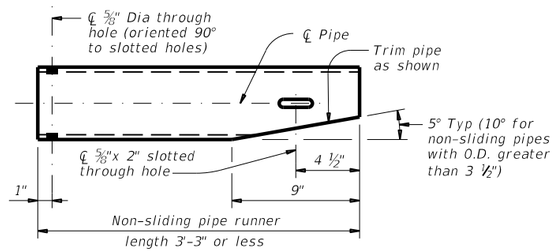


Note: Pipe diameter required for curb pipe runner is also used for wingwall pipe runner.

PIPE RUNNER DETAILS

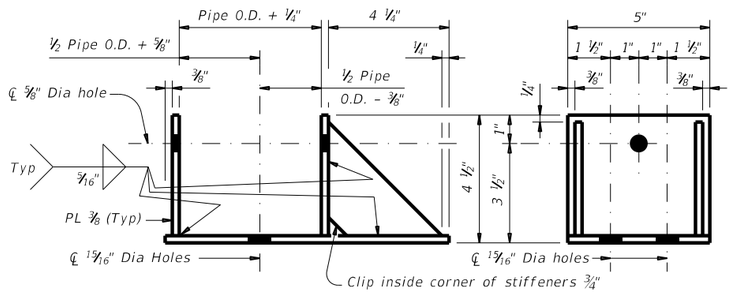


ANCHOR PIPE DETAILS



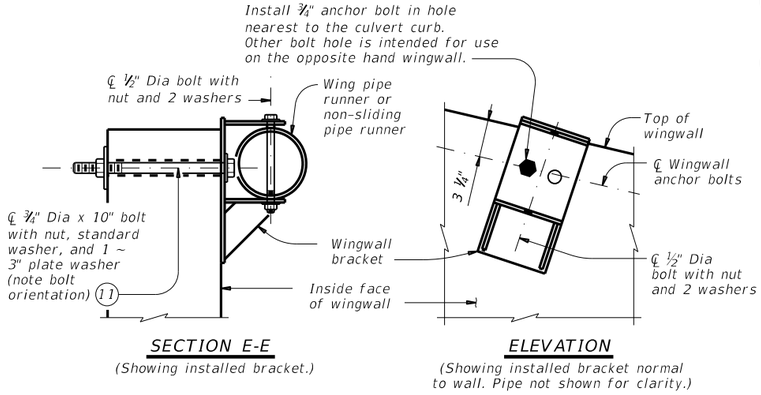
Note: Pipe size is the same as required for curb pipe runner. Adjust the corresponding lower bracket accordingly.

NON-SLIDING PIPE RUNNER DETAILS



ELEVATION

SIDE VIEW



SECTION E-E

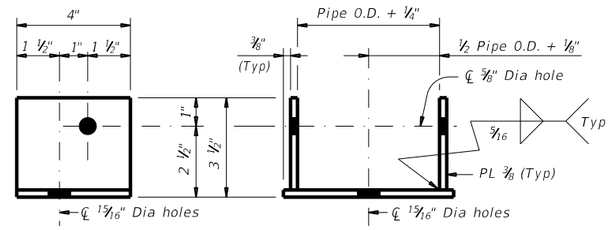
(Showing installed bracket.)

ELEVATION

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

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

WINGWALL BRACKET DETAILS



SIDE VIEW

ELEVATION

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

UPPER AND LOWER BRACKET DETAILS

MAXIMUM PIPE RUNNER LENGTHS AND REQUIRED PIPE RUNNER SIZES

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

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

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

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

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

PIPE RUNNER DIMENSION CALCULATIONS:

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

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

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

n = Wing pipe runner number

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-0

FILE: setbf0se-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
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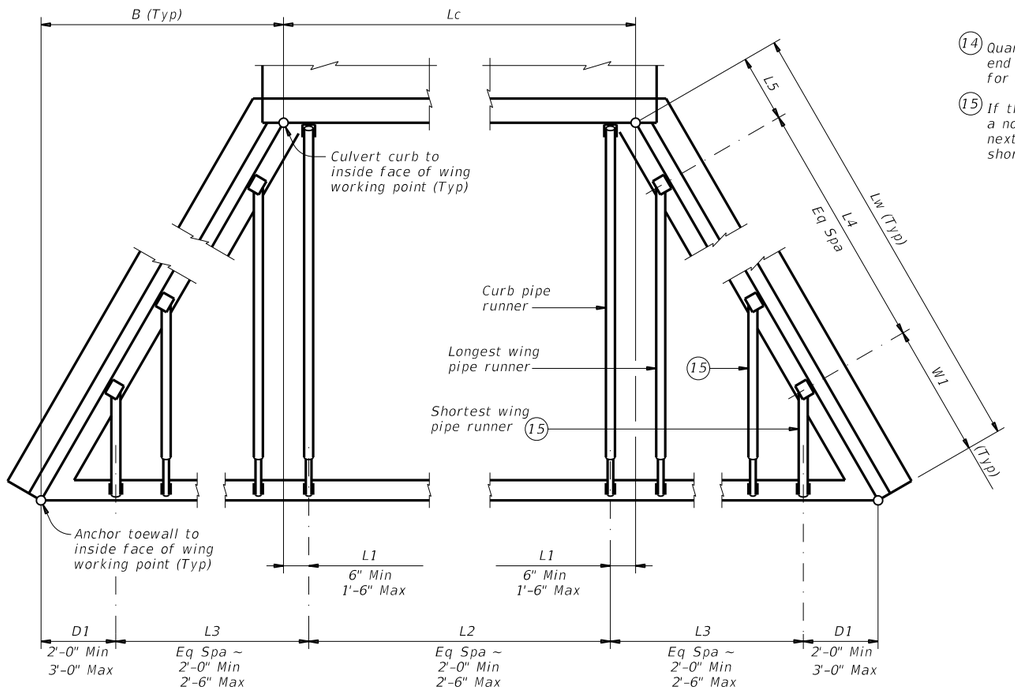
	DIST	COUNTY		SHEET NO.
	WAC	HILL		139

Culvert Station and/or Creek name followed by applicable end (Lt, Rt or Both) (14)	Lc (Ft)	L1 (Ft)	L2 No. Spa	L2 Spa at (Ft)	L2 Overall Length (Ft)	D1 (Ft)	L3 No. Spa	L3 Spa at (Ft)	L3 Overall Length (Ft)	W1 (Ft)	L4 No. Spa	L4 Spa at (Ft)	L4 Overall Length (Ft)	L5 (Ft)	Curb Pipe Runner (Pc) No.	Curb Pipe Runner (Pc) Length (Ft)	Longest Wing Pipe Runner (Pw) (Ft)	Shortest Wing Pipe Runner (Pw) (Ft)	Non-Sliding Wing Pipe Runner (if applicable) (Ft)	Curb, Wing, and/or Non-Sliding Pipe Runners Size (3",4" or 5")	Curb, Wing, and/or Non-Sliding Pipe Runners Total Length (14) (Ft)	3'-0" Anchor Pipe Size (2",3" or 4")	3'-0" Anchor Pipe Total Length (14) (Ft)
Culvert 32 Sta 190+31.62 (Both)	6.000'	0.500'	2	2.500'	5.000'	2.000'	2	2.233'	4.466'	3.583'	1	4.466'	4.466'	3.883'	3	8.958'	5.500'	N/A	3.000'	3"	87.750'	2"	30.000'
Culvert 23 Sta 465+37.69 (Both)	5.000'	1.250'	1	2.500'	2.500'	2.833'	1	2.458'	2.458'	5.249'	0	4.917'	0.000'	2.834'	2	5.688'	3.104'	N/A	N/A	3"	35.167'	2"	24.000'
Culvert 6 Sta 806+28.50 (Both)	6.000'	0.500'	2	2.500'	5.000'	2.583'	2	2.495'	4.990'	4.749'	1	4.990'	4.990'	4.406'	3	11.229'	7.208'	2.646'	N/A	4"	106.792'	3"	42.000'
Culvert 1 Sta 931+42.01 (Both)	3.000'	1.500'	0	0.000'	0.000'	2.500'	1	2.464'	2.464'	4.583'	0	4.928'	0.000'	2.345'	1	4.646'	2.500'	N/A	N/A	3"	19.292'	2"	18.000'



PIPE RUNNER LAYOUT

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

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

SPECIAL NOTE:

This tabular sheet is to be filled out by the culvert specifier and provides information for the construction details and quantities of pipe runners.

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.

Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, all dimensions must be verified by the Contractor in the field prior to fabrication of the safety end treatment components.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

SHEET 3 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW BOX CULVERTS TYPE I ~ CROSS DRAINAGE

SETB-FW-0

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	WAC	HILL		140

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

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

TABLE OF WINGWALL REINFORCING (Two~Wings)

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

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

TABLE OF ESTIMATED ANCHOR TOEWALL QUANTITIES

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

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

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

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

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

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

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

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

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

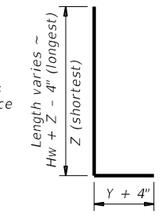
(9) Culvert skew (limit to 15° or 30°)

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

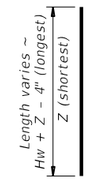
(11) Typical wingwall angle for all skews.

TABLE OF MAXIMUM WING HEIGHTS (10)

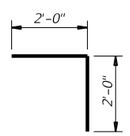
Side Slope	Hw Max
3:1	11'- 5"
4:1	8'-10"
6:1	6'- 1"



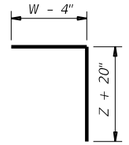
BARS J1



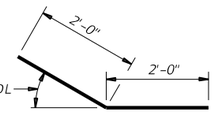
BARS V



BARS L

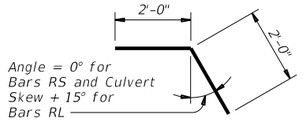


BARS J2



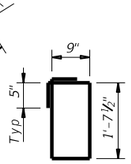
Angle = Culvert Skew for Bars DS and 15° for Bars DL

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

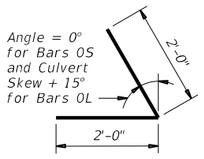


Angle = 0° for Bars RS and Culvert Skew + 15° for Bars RL

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



BARS K
(Length = 5'-5")



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

WING DIMENSION CALCULATIONS:

Formulas:

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

For cast-in-place culverts:

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

For precast culverts:

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

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

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

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

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.

Provide galvanized reinforcing steel if required elsewhere in the plans.

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

Provide Class "C" concrete (f`c = 3,600 psi).

Adjust reinforcing as necessary to provide a minimum clear cover of 1 ½".

Provide pipe runners and anchor pipes meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.

Provide ASTM A307 bolts and nuts.

Provide ASTM A36 steel plates.

Galvanize all steel components, except reinforcing unless required elsewherein the plans, after fabrication.

Repair galvanizing damaged during transport or construction in accordance with the Item 445, "Galvanizing".

For optional adhesive anchors, install adhesive anchorages in accordance with the manufacturer's instructions including hole size, drilling equipment and method, hole cleaning equipment and method, mixing and dispensing adhesive, and anchor insertion. Do not alter the manufacturer's mixing nozzle or dispenser. Provide anchorage rods that are clean and free of grease, oil, or any other foreign material. Demonstrate hole cleaning method to the Engineer for approval and continue the approved process for all anchorage locations. Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

The safety end treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.

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

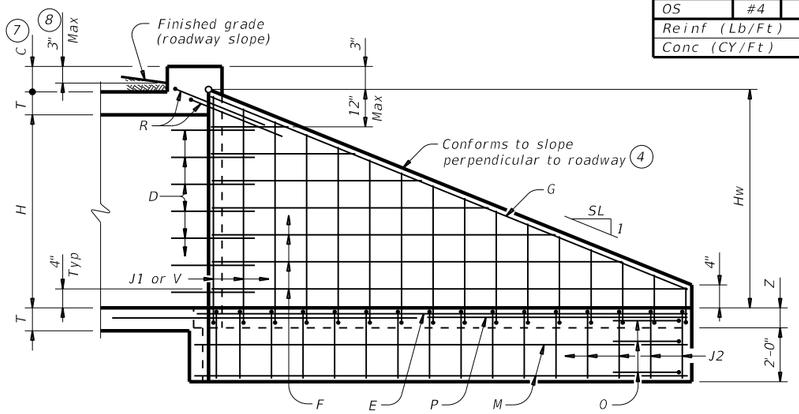
When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.

All bolts, nuts, washers, brackets, angles, and pipe runners are considered parts of the safety end treatment for payment

The quantities for pipe runners, reinforcing steel, and concrete, resulting from the formulas given herein are for Contractor's information only.

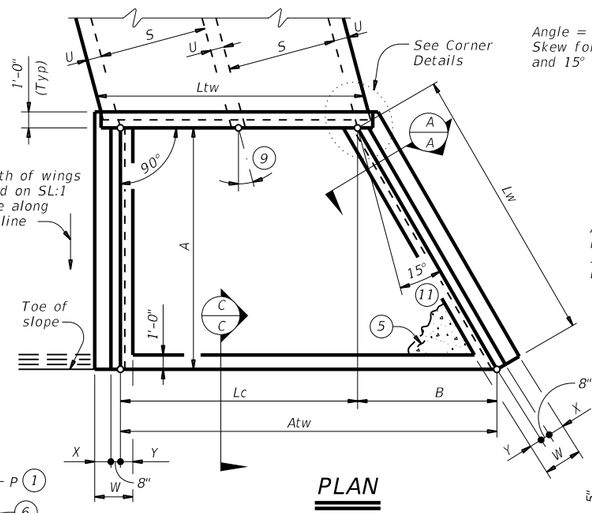
See Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.

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



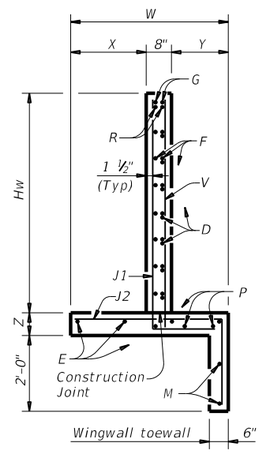
INSIDE ELEVATION OF WINGWALL

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

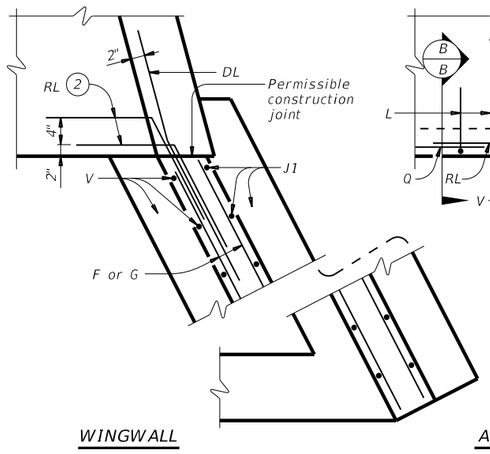


PLAN

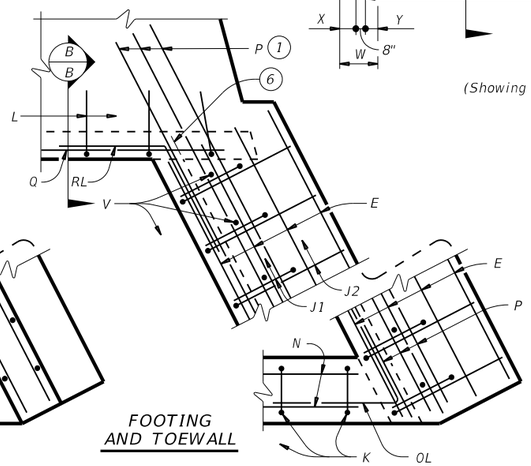
(Showing dimensions and 15° skew.)



SECTION A-A



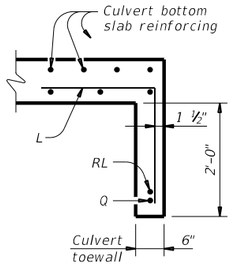
WINGWALL



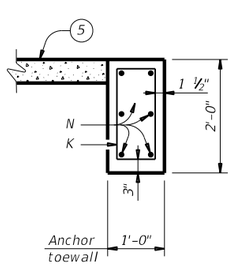
FOOTING AND TOEWALL

CORNER DETAILS

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



SECTION B-B (5)



SECTION C-C

SHEET 1 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

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

SETB-FW-S

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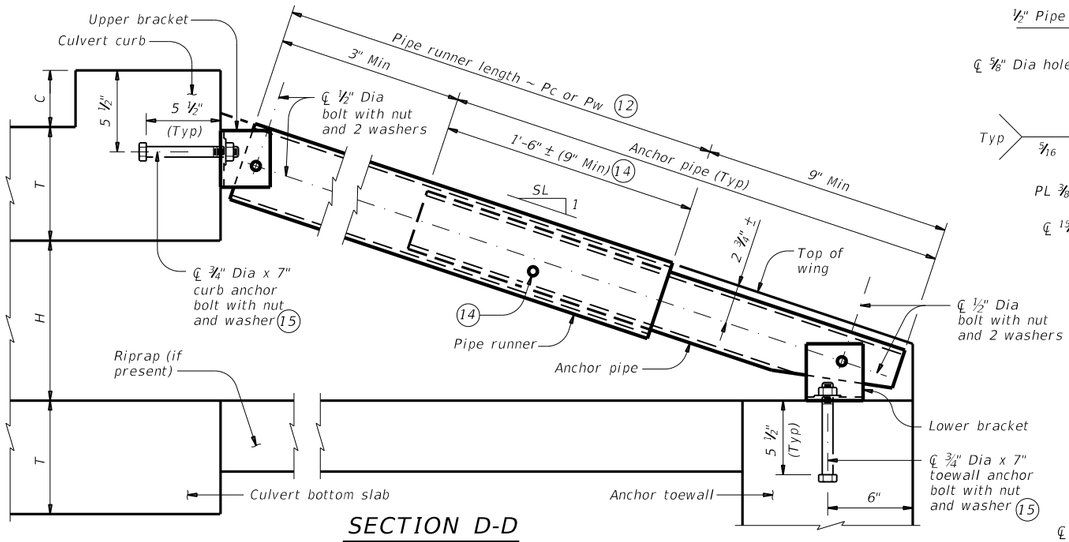
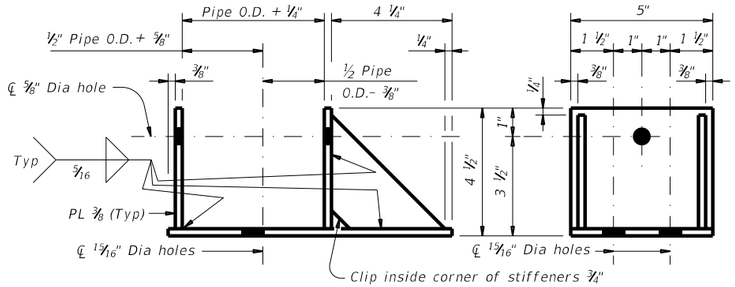


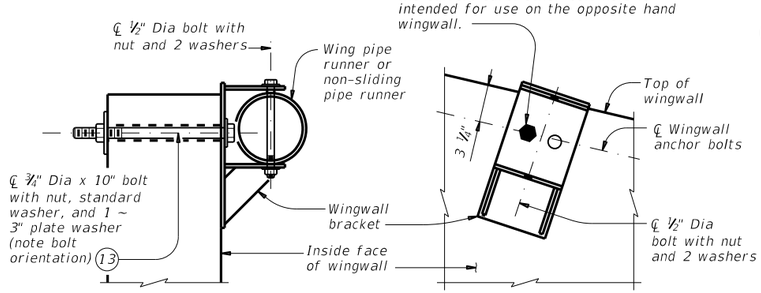
SECTION D-D

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



ELEVATION

SIDE VIEW



SECTION E-E

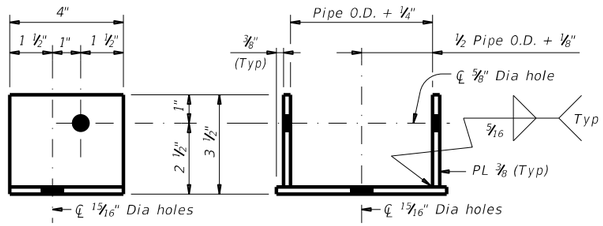
(Showing installed bracket.)

ELEVATION

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

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

WINGWALL BRACKET DETAILS

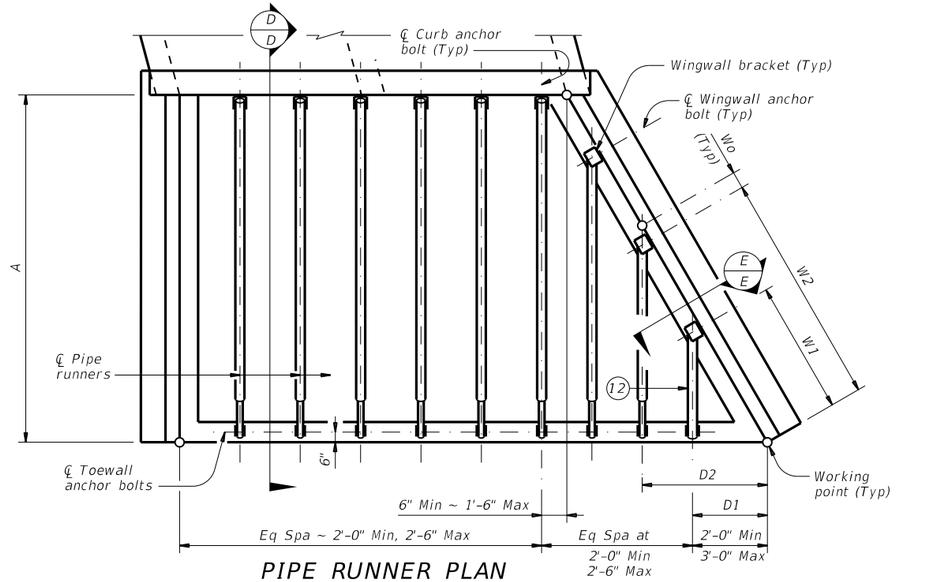


SIDE VIEW

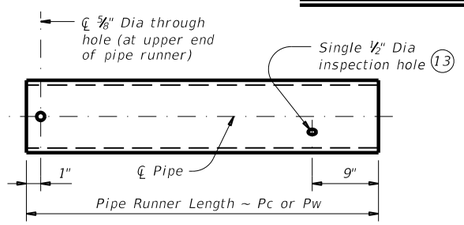
ELEVATION

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

UPPER AND LOWER BRACKET DETAILS

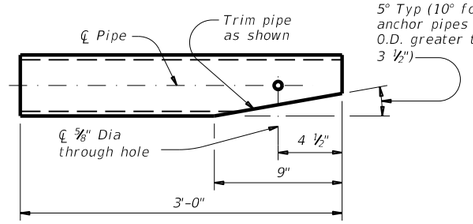


PIPE RUNNER PLAN

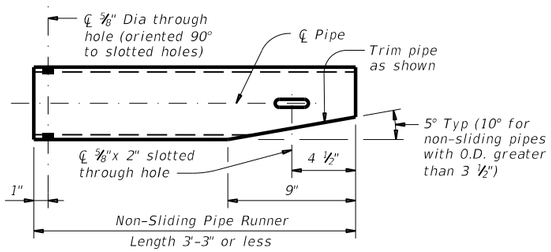


Note: Use pipe diameter required for curb pipe runner for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS



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

NON-SLIDING PIPE RUNNER DETAILS

MAXIMUM PIPE RUNNER LENGTHS AND REQUIRED PIPE RUNNER AND ANCHOR PIPE SIZES

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

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

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

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

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

PIPE RUNNER DIMENSION CALCULATIONS:

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

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

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

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

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

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

SETB-FW-S

FILE: setbfsse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
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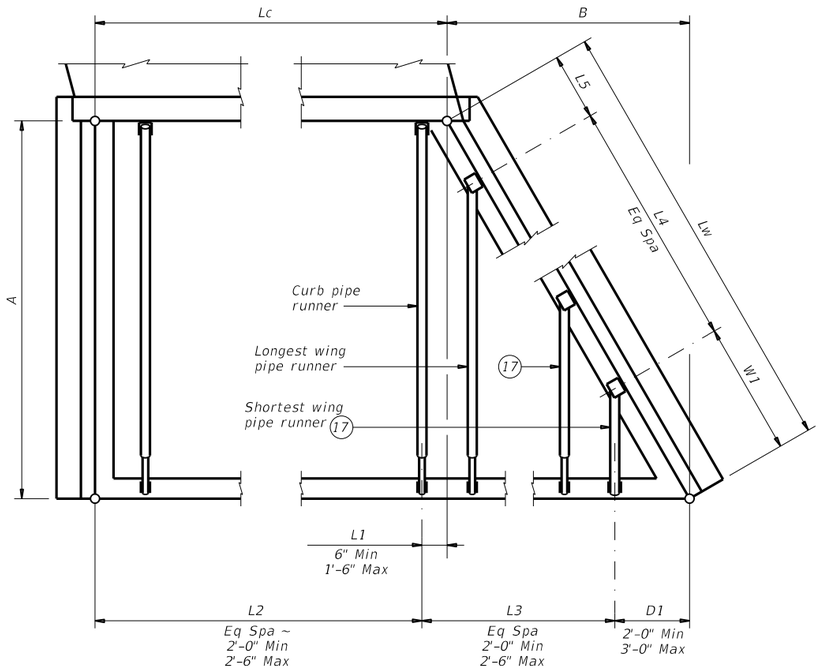
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		142

Culvert Station and/or Creek name followed by applicable end (Lt, Rt or Both) (16)	Lc (Ft)	L1 (Ft)	L2 No. Spa	L2 Spa at (Ft)	L2 Overall Length (Ft)	D1 (Ft)	L3 No. Spa	L3 Spa at (Ft)	L3 Overall Length (Ft)	W1 (Ft)	L4 No. Spa	L4 Spa at (Ft)	L4 Overall Length (Ft)	L5 (Ft)	Curb Pipe Runner (Pc) No.	Curb Pipe Runner (Pc) Length (Ft)	Longest Wing Pipe Runner (Pw) (Ft)	Shortest Wing Pipe Runner (Pw) (Ft)	Non-Sliding Wing Pipe Runner (if applicable) (Ft)	Curb, Wing, and/or Non-Sliding Pipe Runners Size (3",4" or 5")	Curb, Wing, and/or Non-Sliding Pipe Runners Total (16) Length (Ft)	3'-0" Anchor Pipe Size (2",3" or 4")	3'-0" Anchor Pipe Total (16) Length (Ft)
Culvert 12 Sta 663+90.25 (Both)	5.774'	0.833'	2	2.470'	4.940'	2.417'	2	2.458'	4.916'	3.209'	1	3.476'	3.476'	2.507'	2	5.167'	3.083'	N/A	1.979'	3"	30.792'	2"	18.000'
Culvert 7a Sta 735+96.85 (Both)	20.785'	0.833'	8	2.494'	19.951'	2.667'	3	2.500'	7.500'	3.563'	2	3.535'	7.070'	2.567'	8	7.938'	5.833'	3.271'	2.188'	3"	149.583'	2"	60.000'
Culvert 6b Sta 758+32.07 (Both)	4.141'	1.500'	1	2.641'	2.641'	2.000'	2	2.420'	4.840'	3.583'	1	4.840'	4.840'	2.257'	1	8.063'	6.000'	N/A	3.083'	3"	34.292'	2"	12.000'



PIPE RUNNER LAYOUT

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

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

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

SPECIAL NOTE:

This tabular sheet is to be filled out by the culvert specifier and provides information for the construction details and quantities of pipe runners.

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.

Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, all dimensions must be verified by the Contractor in the field prior to fabrication of the safety end treatment components.

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

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

SETB-FW-S

FILE: setbfsse-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		143

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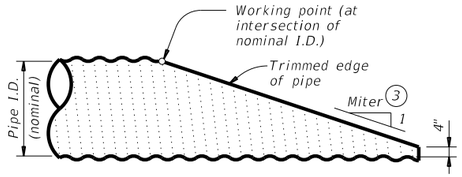
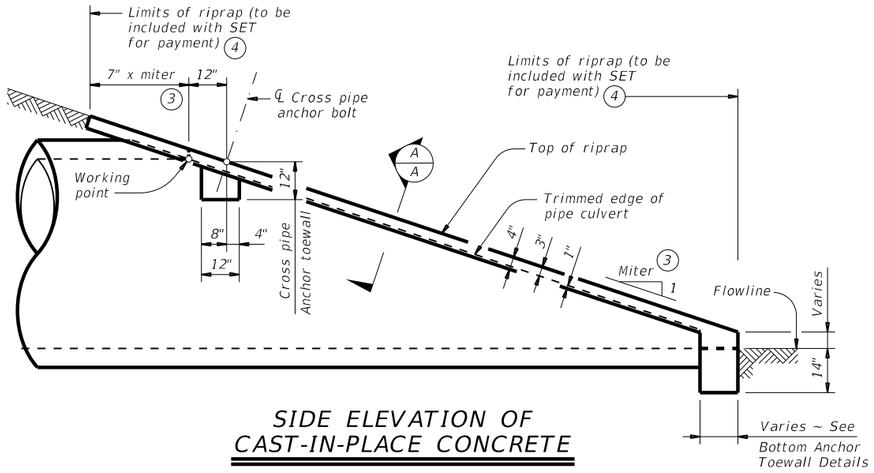


NOTE: All pipe runners, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

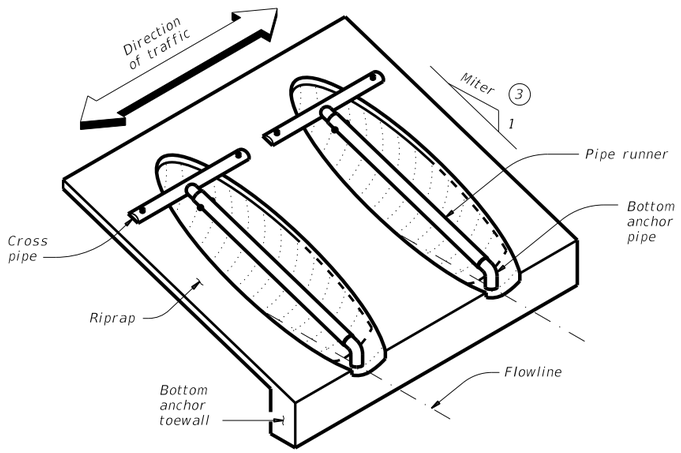
SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

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



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing reinforced concrete pipe (RCP) culvert.
Details of corrugated metal pipe (CMP) culvert
are similar. Pipe runners not shown for clarity)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

(Showing installation with no skew.)

CROSS PIPE LENGTHS AND PIPE RUNNER LENGTHS (1) (2)

Nominal Culvert I.D.	Pipe Culvert Spa ~ G	Cross Pipe Length	Pipe Runner Length											
			3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
			0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
24"	1' – 7"	3' – 5"	N/A	N/A	N/A	5' – 10"	N/A	N/A	N/A	8' – 1"	N/A	N/A	N/A	12' – 9"
27"	1' – 8"	3' – 8"	N/A	N/A	5' – 5"	6' – 11"	N/A	N/A	7' – 7"	9' – 7"	N/A	N/A	11' – 11"	14' – 11"
30"	1' – 10"	3' – 11"	N/A	N/A	6' – 4"	8' – 0"	N/A	N/A	8' – 9"	11' – 0"	N/A	N/A	13' – 8"	17' – 0"
33"	1' – 11"	4' – 2"	6' – 2"	6' – 5"	7' – 3"	9' – 1"	8' – 6"	8' – 10"	10' – 0"	12' – 5"	13' – 3"	13' – 9"	15' – 5"	19' – 2"
36"	2' – 1"	4' – 5"	6' – 11"	7' – 3"	8' – 2"	10' – 2"	9' – 6"	9' – 11"	11' – 2"	13' – 10"	14' – 9"	15' – 3"	17' – 2"	21' – 3"
42"	2' – 4"	4' – 11"	8' – 6"	8' – 10"	9' – 11"	12' – 4"	11' – 7"	12' – 0"	13' – 6"	16' – 8"	17' – 9"	18' – 5"	20' – 8"	25' – 7"
48"	2' – 7"	5' – 5"	10' – 1"	10' – 5"	11' – 9"	N/A	13' – 7"	14' – 2"	15' – 10"	N/A	20' – 9"	21' – 6"	24' – 2"	N/A
54"	3' – 0"	5' – 11"	11' – 8"	12' – 1"	N/A	N/A	15' – 8"	16' – 3"	N/A	N/A	23' – 10"	24' – 8"	N/A	N/A
60"	3' – 3"	6' – 5"	13' – 3"	N/A	N/A	N/A	17' – 9"	N/A	N/A	N/A	26' – 10"	N/A	N/A	N/A

TYPICAL PIPE CULVERT MITERS (3)

Side Slope	0° Skew	15° Skew	30° Skew	45° Skew
3:1	3:1	3.106:1	3.464:1	4.243:1
4:1	4:1	4.141:1	4.619:1	5.657:1
6:1	6:1	6.212:1	6.928:1	8.485:1

CONDITIONS WHERE PIPE RUNNERS ARE NOT REQUIRED (2)

Nominal Culvert I.D.	Single Pipe Culvert	Multiple Pipe Culverts
12" thru 21"	Skews thru 45°	Skews thru 45°
24"	Skews thru 45°	Skews thru 30°
27"	Skews thru 30°	Skews thru 15°
30"	Skews thru 15°	Skews thru 15°
33"	Skews thru 15°	Always required
36"	Normal (no skew)	Always required
42" thru 60"	Always required	Always required

STANDARD PIPE SIZES AND MAX PIPE RUNNER LENGTHS (1)

Pipe Size	Pipe O.D.	Pipe I.D.	Max Pipe Runner Length
2" STD	2.375"	2.067"	N/A
3" STD	3.500"	3.068"	10' – 0"
4" STD	4.500"	4.026"	19' – 8"
5" STD	5.563"	5.047"	34' – 2"

ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) (5)

Nominal Culvert I.D.	3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
12"	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.8
15"	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9
18"	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	1.0
21"	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.2
24"	0.6	0.7	0.7	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.1	1.3
27"	0.7	0.7	0.8	0.9	0.8	0.9	0.9	1.1	1.1	1.1	1.2	1.4
30"	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.2	1.2	1.3	1.6
33"	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.3	1.4	1.5	1.7
36"	0.9	0.9	0.9	1.1	1.1	1.1	1.2	1.4	1.4	1.5	1.6	1.8
42"	1.0	1.0	1.1	1.3	1.2	1.3	1.3	1.6	1.6	1.7	1.8	2.1
48"	1.1	1.1	1.2	N/A	1.4	1.4	1.5	N/A	1.9	1.9	2.1	N/A
54"	1.3	1.3	N/A	N/A	1.6	1.6	N/A	N/A	2.1	2.1	N/A	N/A
60"	1.4	N/A	N/A	N/A	1.7	N/A	N/A	N/A	2.3	N/A	N/A	N/A

(1) Provide pipe runner of the size shown in the tables. Provide cross pipe of the same size as the pipe runner. Provide cross pipe stub out and bottom anchor pipe of the next smaller size pipe as shown in the Standard Pipe Sizes and Max Pipe Runner Lengths table.

(2) This standard allows for the placement of only one pipe runner across each culvert pipe opening. In order to limit the clear opening to be traversed by an errant vehicle, the following conditions must be met:

For 60" culvert pipes, the skew must not exceed 0°.
For 54" culvert pipes, the skew must not exceed 15°.
For 48" culvert pipes, the skew must not exceed 30°.
For all culvert pipe sizes 42" and less, the skew must not exceed 45°.

If the above conditions cannot be met, the designer should consider using a safety end treatment with flared wings. For further information, refer to the TxDOT Roadway Design Manual.

(3) Miter = slope of mitered end of pipe culvert.

(4) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(5) Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. For multiple pipe culverts or for corrugated metal pipe (CMP) culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA
PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD

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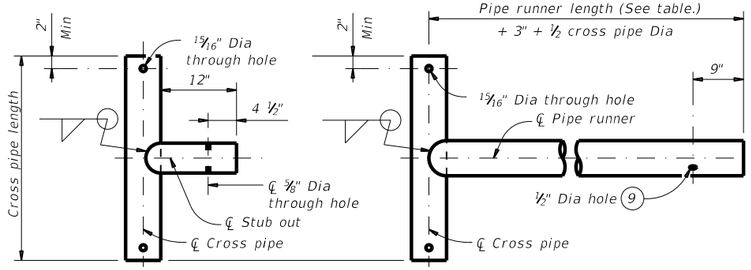
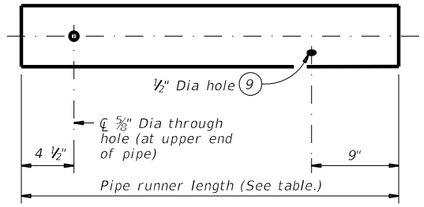


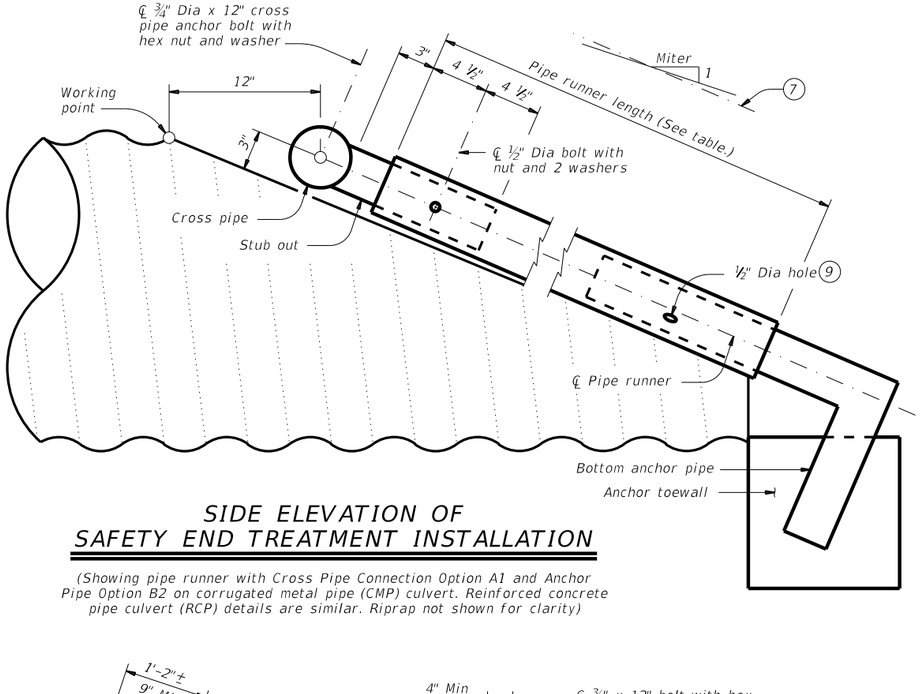
OPTION A1 OPTION A2

CROSS PIPE AND CONNECTIONS DETAILS



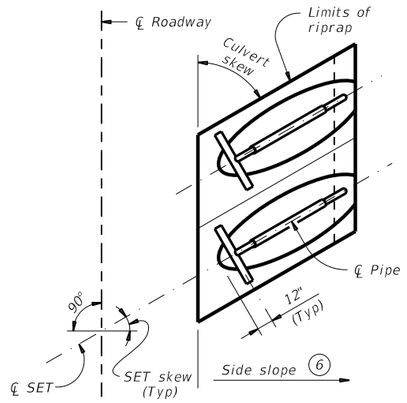
NOTE: The separate pipe runner shown is required when Cross Pipe Connection Option A1 is used.

PIPE RUNNER DETAILS

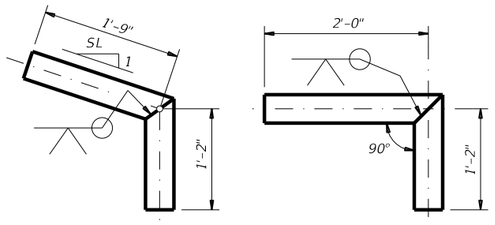


SIDE ELEVATION OF SAFETY END TREATMENT INSTALLATION

(Showing pipe runner with Cross Pipe Connection Option A1 and Anchor Pipe Option B2 on corrugated metal pipe (CMP) culvert. Reinforced concrete pipe culvert (RCP) details are similar. Riprap not shown for clarity)

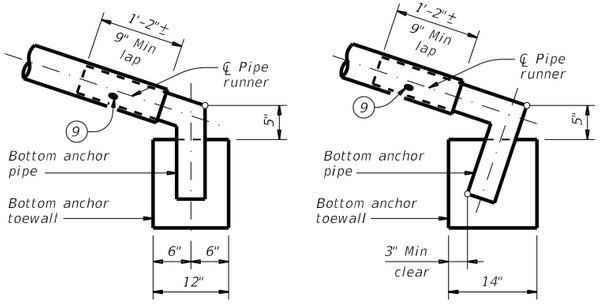


PLAN OF SKEWED INSTALLATION



OPTION B1 OPTION B2

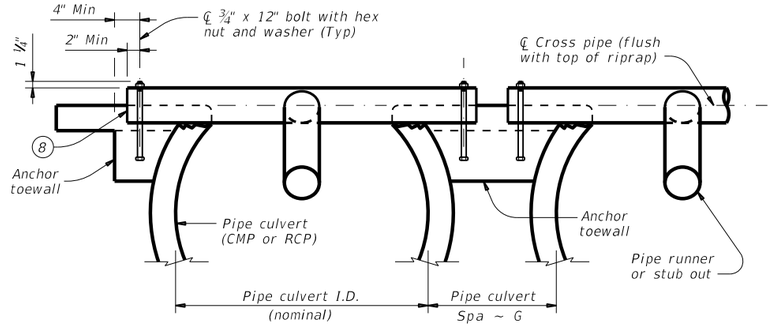
BOTTOM ANCHOR PIPE DETAILS (10)



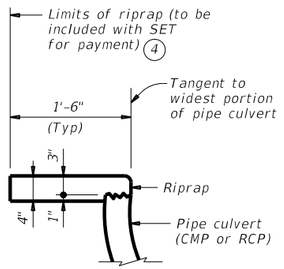
OPTION B1 OPTION B2

BOTTOM ANCHOR TOEWALL DETAILS

(Culvert and riprap not shown for clarity.)



SHOWING CROSS PIPE AND ANCHOR TOEWALL



SHOWING TYPICAL PIPE CULVERT AND RIPRAP

SECTION A-A

(4) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(6) Recommended values of side slope are 3:1, 4:1, and 6:1. All quantities, calculations, and dimensions shown herein are based on these recommended values. Slope of 3:1 or flatter is required for vehicle safety.

(7) Note that actual slope of pipe runner may vary slightly from side slope of riprap and trimmed culvert pipe edge.

(8) Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access.

(9) After installation, inspect the 1/2" hole to ensure that the lap of the pipe runner with the bottom anchor pipe is adequate.

(10) At fabricator's option, a heat bend to a smooth 5" radius or a manufactured elbow (of the same material as the runner) may be substituted for the mitered and welded joint in the bottom anchor pipe.

MATERIAL NOTES:

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

Provide pipe runners, cross pipes, and anchor pipes conforming to the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.

Provide ASTM A307 bolts and nuts.

Galvanize all steel components, except concrete reinforcing, after fabrication.

Repair galvanizing damaged during transport or construction in accordance with the specifications.

GENERAL NOTES:

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

Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.

Payment for riprap and toewall is included in the price bid for each safety end treatment.

Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA
PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD

FILE: setpcdse-20.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
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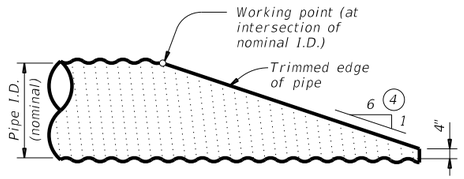
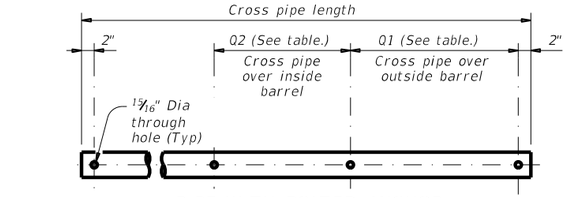
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		145



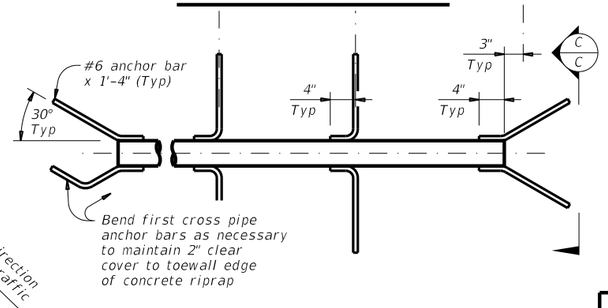
NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

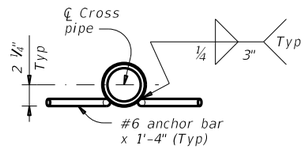
(Showing corrugated metal pipe (CMP) culvert Details at reinforced concrete pipe (RCP) culvert are similar.)



PIPE WITH BOLTED ANCHOR

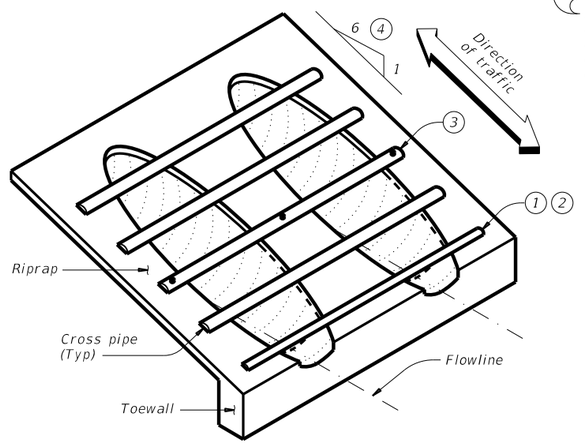


PIPE WITH ANCHOR BARS

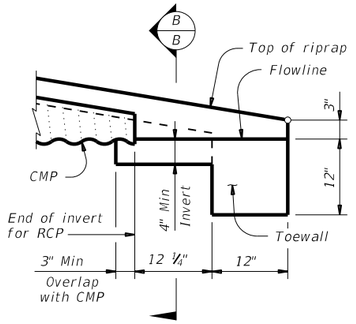


SECTION C-C

CROSS PIPE DETAILS

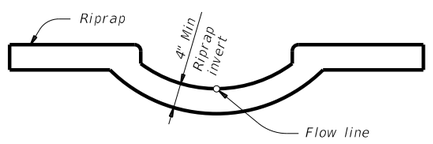


ISOMETRIC VIEW OF TYPICAL INSTALLATION



DETAIL "A"

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



SECTION B-B

(Cross pipes not shown for clarity.)

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, AND RIPRAP QUANTITIES (2)

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

(1) The proper installation of the first cross pipe is critical for vehicle safety. Place the top of the first cross pipe no more than 6" above the flow line.

(2) Provide cross pipes, except the first bottom pipe, of the size shown in the table. Provide a 3 1#2" standard pipe (4" O.D.) for the first bottom pipe.

(3) Install the third cross pipe from the bottom of the culvert using a bolted connection. Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, install all other cross pipes using the bolted connection details.

(4) Match cross slope as shown elsewhere in the plans. Cross slope of 6:1 or flatter is required for vehicle safety.

(5) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(6) Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. For multiple pipe culverts or for corrugated metal pipe (CMP) culverts, quantities will need to be adjusted. Riprap quantities are for contractor's information only.

MATERIAL NOTES:

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

Provide cross pipes that meet the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 (Gr B), or API 5LX52.

Provide ASTM A307 bolts and nuts.

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

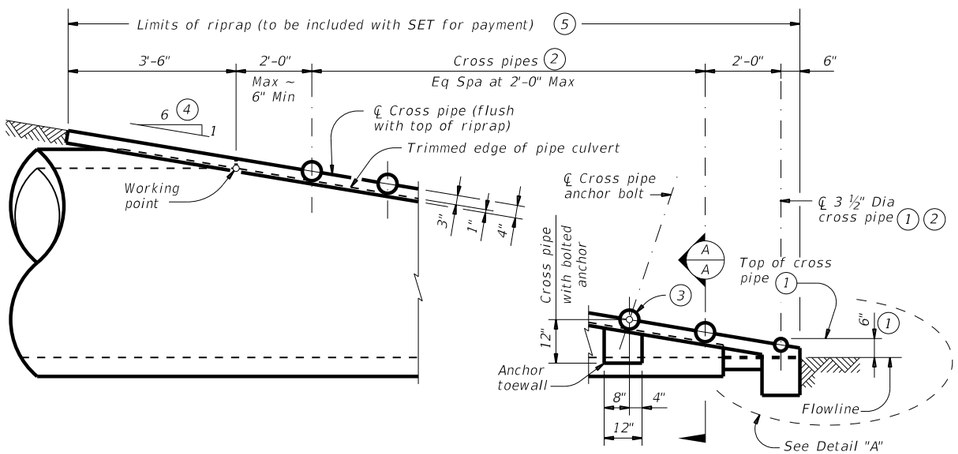
GENERAL NOTES:

Cross pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the cross pipes.

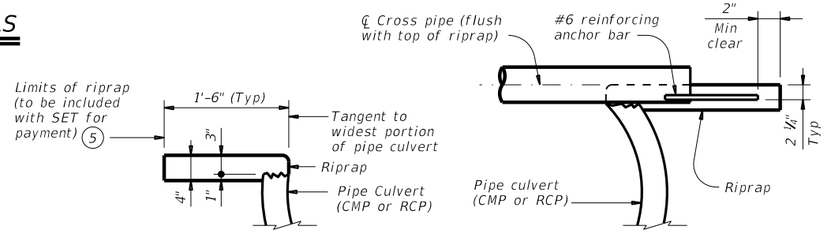
Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

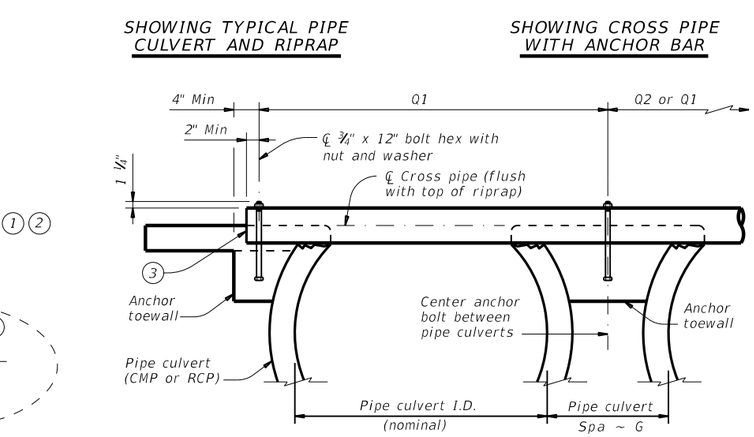


SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

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



SHOWING CROSS PIPE WITH ANCHOR BAR



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

SHOWING TYPICAL PIPE CULVERT AND RIPRAP

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 72" DIA PIPE CULVERTS TYPE II ~ PARALLEL DRAINAGE

SETP-PD

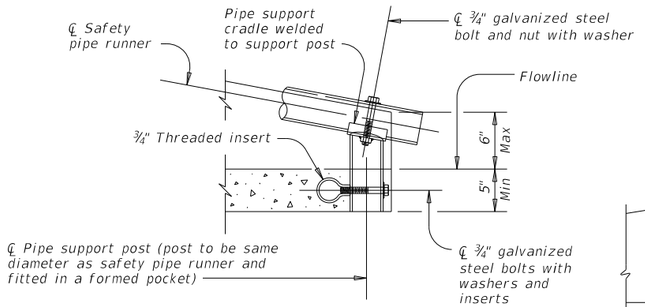
FILE: setppdse-20.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		146

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

DATE:
FILE:

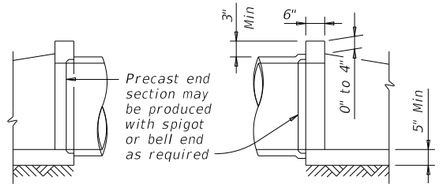
REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (8)	"D" (1)	Slope	Min Length of Unit	Single Pipe		Multiple Pipes	
						Skew	Pipe Runners Required	Skew	Pipe Runners Required
12"	2"	1.15"	17.00"	3:1	2' – 11"	≤ 45°	No	≤ 45°	No
				4:1	3' – 6"				
				6:1	4' – 9"				
15"	2 ¼"	1.30"	20.50"	3:1	3' – 8"	≤ 45°	No	≤ 45°	No
				4:1	4' – 7"				
				6:1	6' – 5"				
18"	2 ½"	1.60"	24.00"	3:1	4' – 6"	≤ 45°	No	≤ 45°	No
				4:1	5' – 8"				
				6:1	8' – 0"				
24"	3"	1.95"	31.00"	3:1	6' – 2"	≤ 45°	No	= 30°	No
				4:1	7' – 10"			> 30°	Yes
				6:1	11' – 3"				
30"	3 ½"	2.65"	38.50"	3:1	7' – 10"	= 15°	No	= 15°	No
				4:1	10' – 1"	> 15°	Yes	> 15°	Yes
				6:1	14' – 8"				
36"	4"	2.75"	45.50"	3:1	9' – 5"	= 0°	No	≥ 0°	Yes
				4:1	12' – 3"	> 0°	Yes		
				6:1	17' – 11"				
42"	4 ½"	2.7"	52.50"	3:1	11' – 1"	≥ 0°	Yes	≥ 0°	Yes
				4:1	14' – 5"				
				6:1	21' – 2"				



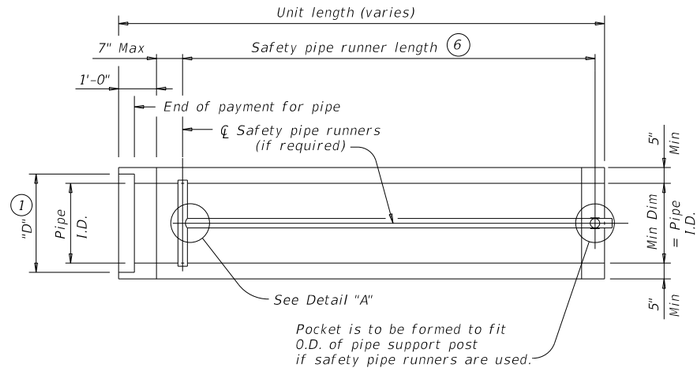
END DETAIL FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)



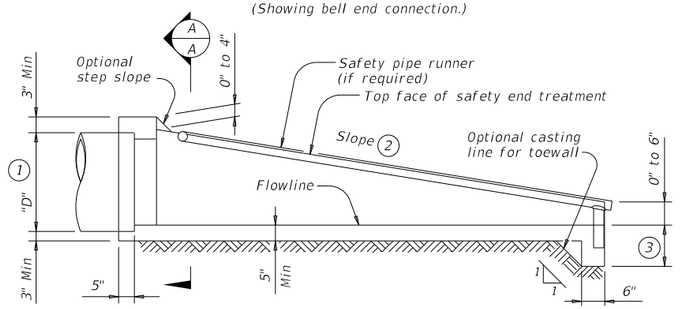
OPTIONAL JOINT FOR RCP

(Showing joint between RCP and precast safety end treatment)



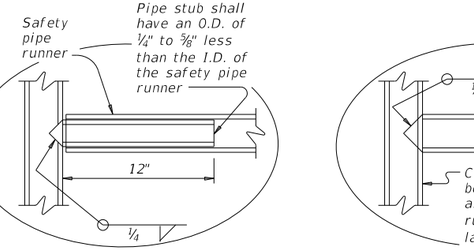
PLAN

(Showing bell end connection.)



LONGITUDINAL ELEVATION

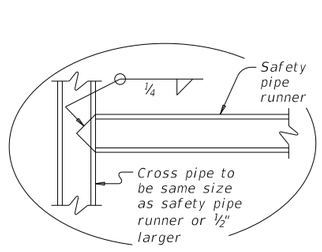
(Showing bell end connection.)



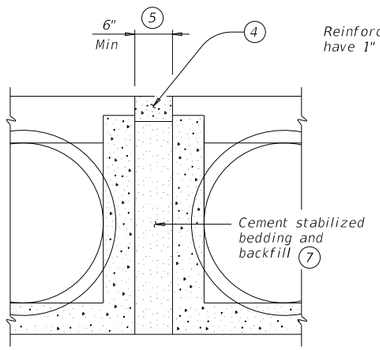
OPTION A

DETAIL A

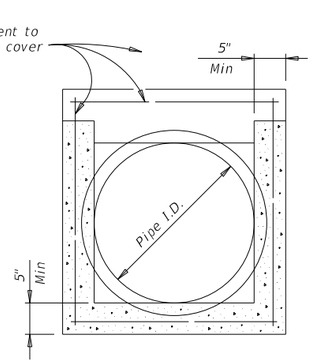
(If required)



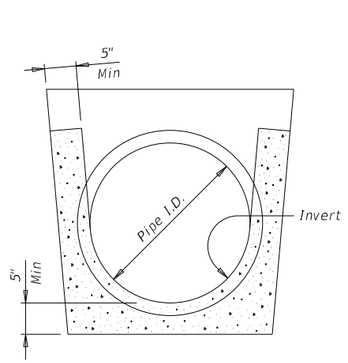
OPTION B



MULTIPLE PIPE INSTALLATION

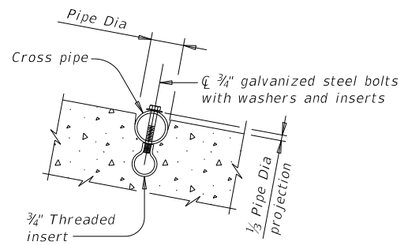


OPTION WITH SQUARE BOTTOM



OPTION WITH INVERT BOTTOM

SECTION A-A



INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)

SAFETY PIPE RUNNER DIMENSIONS

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

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

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

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

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

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

(6) Measured along slope.

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

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

GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

Texas Department of Transportation

Bridge Division Standard

PRECAST SAFETY END TREATMENT

TYPE II ~ CROSS DRAINAGE

PSET-SC

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©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: Added 42" TP	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		147

DATE: 5/19/2022 6:09:09 PM
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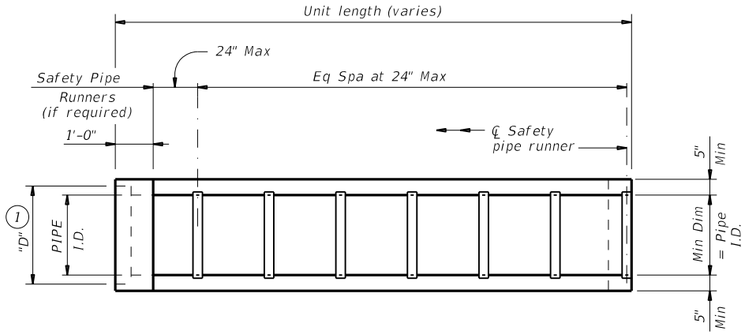
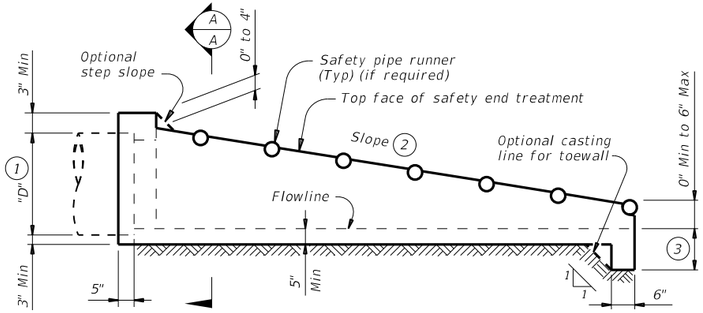


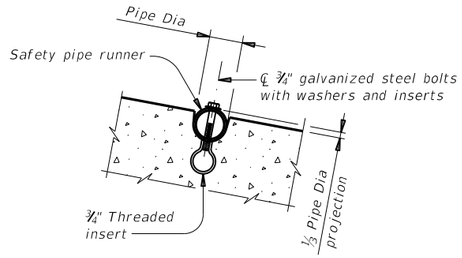
PLAN

(Showing bell end connection.)



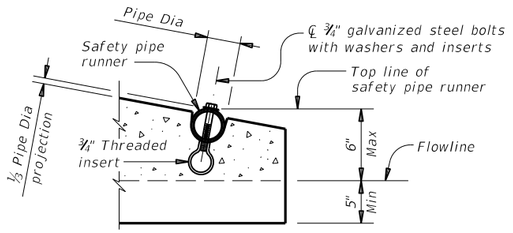
LONGITUDINAL ELEVATION

(Showing bell end connection.)

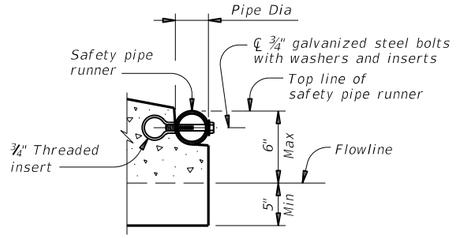


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



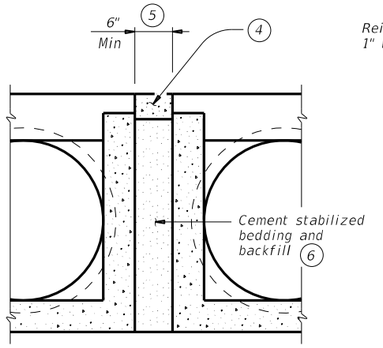
OPTION A



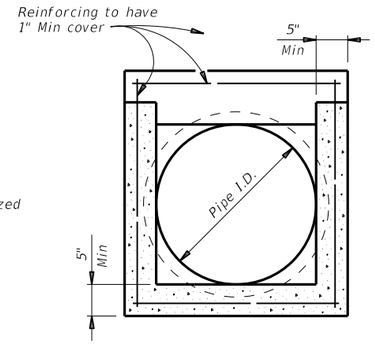
OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

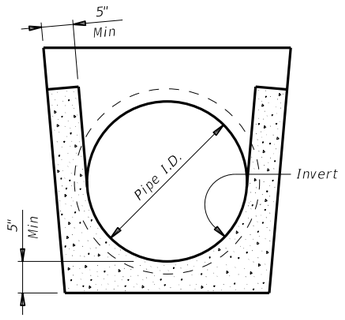
(If required)



MULTIPLE PIPE INSTALLATION

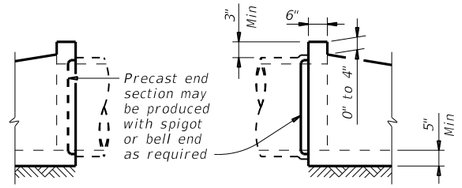


OPTION WITH SQUARE BOTTOM



OPTION WITH INVERT BOTTOM

SECTION A-A



OPTIONAL JOINT FOR RCP

(Showing joint between RCP and precast safety end treatment.)

REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (7)	"D" (1)	Slope	Min Length	Pipe Runners Required		Required Pipe Runner Size		
						Single Pipe	Multiple Pipe	Nominal Dia.	O.D.	I.D.
12"	2"	1.15"	17.00"	6:1	4' – 9"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
15"	2 ¼"	1.30"	20.50"	6:1	6' – 5"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
18"	2 ½"	1.60"	24.00"	6:1	8' – 0"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
24"	3"	1.95"	31.00"	6:1	11' – 3"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
30"	3 ½"	2.65"	38.50"	6:1	14' – 8"	No	Yes	4" STD	4.500"	4.026"
36"	4"	2.75"	45.50"	6:1	17' – 11"	Yes	Yes	4" STD	4.500"	4.026"
42"	4 ½"	2.7"	52.50"	6:1	21' – 2"	Yes	Yes	4" STD	4.500"	4.026"

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

(2) Slope as shown elsewhere in the plans. Slope of 6:1 or flatter is required for vehicle safety.

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

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

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

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

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

GENERAL NOTES:

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

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

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

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

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

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

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

Pipe runners are designed for a traversing load of 10,000 Lbs at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

Provide pipe runners meeting the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

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

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

Texas Department of Transportation

Bridge Division Standard

PRECAST SAFETY END TREATMENT

TYPE II ~ PARALLEL DRAINAGE

PSET-SP

FILE: psetspss-21.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: Added 42" TP	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		148

DATE:
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°)

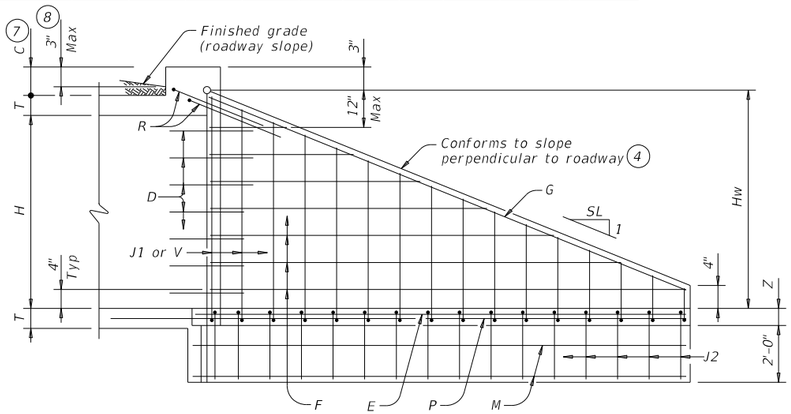
For cast-in-place culverts:
Ltw = (N) (S) + (N + 1) (U)

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

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

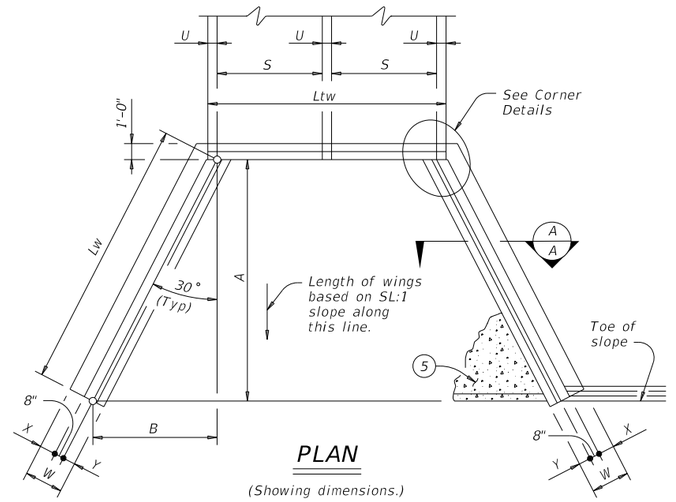
Hw = Height of wingwall
SL:1 = Side slope ratio (horizontal:1 vertical)
Lw = Length of wingwall
Ltw = Culvert toewall length
N = Number of culvert spans

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



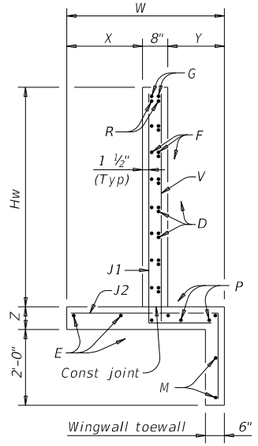
INSIDE ELEVATION

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

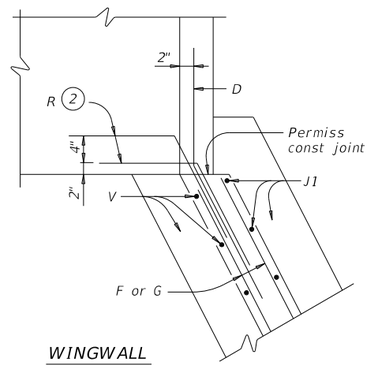


PLAN

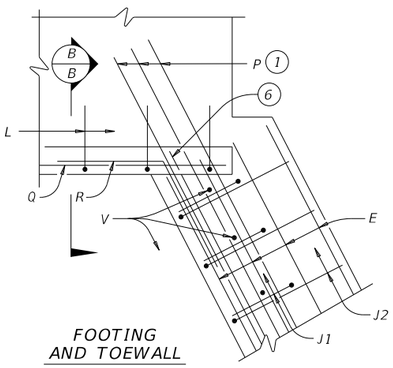
(Showing dimensions.)



SECTION A-A



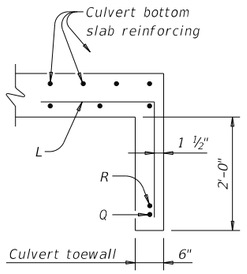
WINGWALL



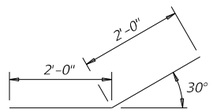
FOOTING AND TOEWALL

CORNER DETAILS

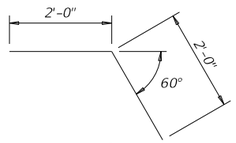
(Culvert and culvert toewall reinforcing not shown for clarity.)



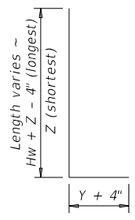
SECTION B-B (5)



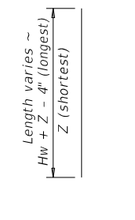
BARS D



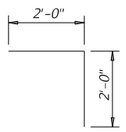
BARS R



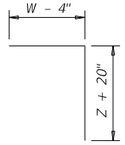
BARS J1



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	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		149

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

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

TABLE OF WINGWALL REINFORCING
(2~wings)

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

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

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

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

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

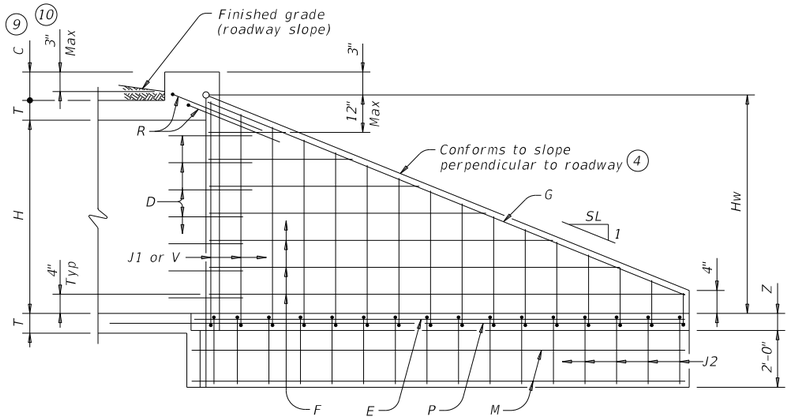
For cast-in-place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ cosine θ

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

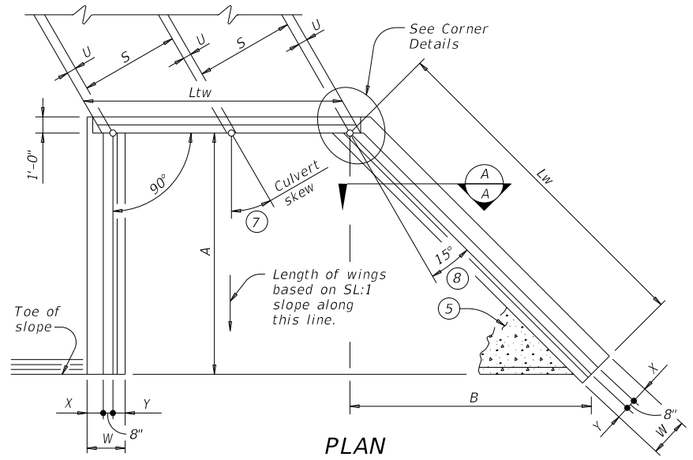
Total wingwall area (two wings ~ SF) = 0.5 (Hw + 0.333') (Lw + A)

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

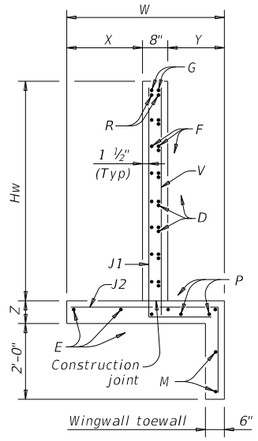
See applicable box culvert standard sheet for H, S, T, and U values.



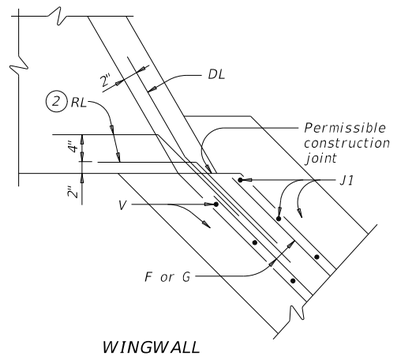
INSIDE ELEVATION
(Showing reinforcing. Culvert and culvert toewall reinforcing not shown for clarity.)



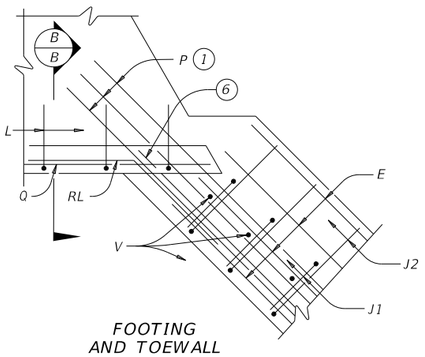
PLAN
(Showing dimensions and 30° skew.)



SECTION A-A

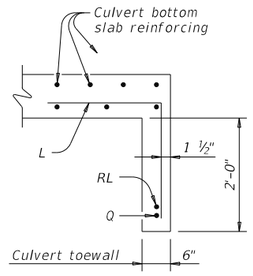


WINGWALL

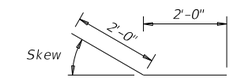


FOOTING AND TOEWALL

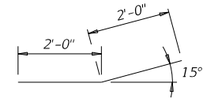
CORNER DETAILS
(Culvert and culvert toewall reinforcing not shown for clarity.)



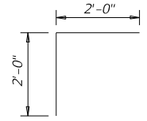
SECTION B-B ⑤



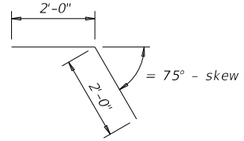
BARS DS
(Short wing)



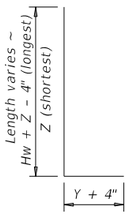
BARS DL
(Long wing)



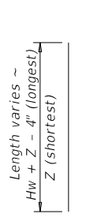
BARS RS
(Short wing)



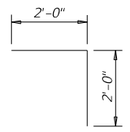
BARS RL
(Long wing)



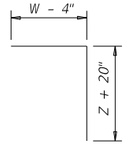
BARS J1



BARS V



BARS L



BARS J2

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

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

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

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

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

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

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

⑧ Typical wingwall angle for all skews.

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

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

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

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

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

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

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 REVISIONS	CONT	SECT	JOB	HIGHWAY
	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		150

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

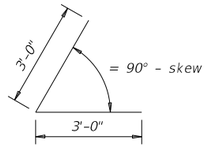
Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing (2–wings) (4)		Estimated Quantities per ft of Toewall (1–toewall)	
					Bars J1		Bars J2					
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'–6"	2'–10"	10"	1'–0"	7"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

TABLE OF WINGWALL REINFORCING
(2–wings)

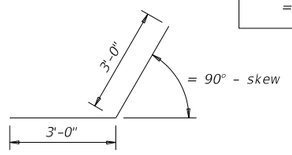
Bar	Size	No.	Spa
D1	#6	~	1'–0"
D2	#6	~	1'–0"
E1	#4	~	1'–0"
F	#4	~	1'–0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'–0"
V	#4	~	1'–0"

TABLE OF TOEWALL REINFORCING

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



BARS D1



BARS D2

WING DIMENSION FORMULAS:

(All values are in feet.)

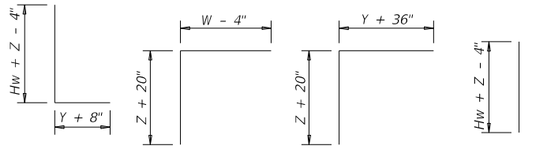
Hw = H + T + C
Lw = (Hw) (SL) ÷ cosine (θ) for Type PW–1
= (Hw – 1') (SL) ÷ cosine (θ) for Type PW–2 and Hw ≥ 4'
= (Hw – 0.5') (SL) ÷ cosine (θ) for Type PW–2 and Hw < 4'

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

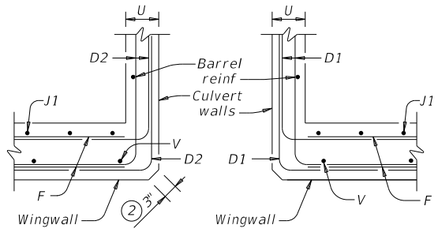
For precast culverts:
Ltw = [(N) (2 U + S) + (N – 1) (0.5')] ÷ cosine (θ)
Total Wingwall Area (two wings ~ SF)
= (2)(Hw)(Lw) for Type PW–1
= (2)(Hw)(Lw) – 6 SF for Type PW–2 and Hw ≥ 4'
= (2)(Hw)(Lw) – 1.5 SF for Type PW–2 and Hw < 4'

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

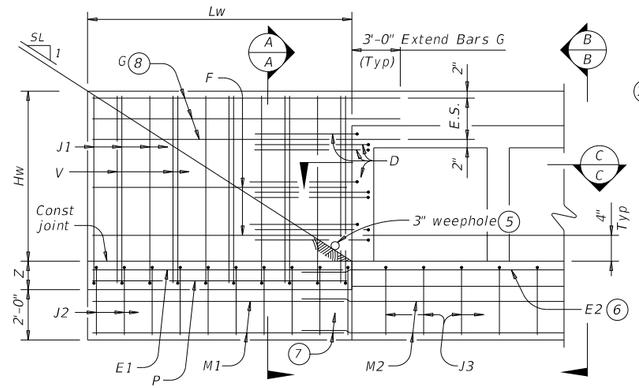
See applicable box culvert standard sheet for S, H, T, and U values.



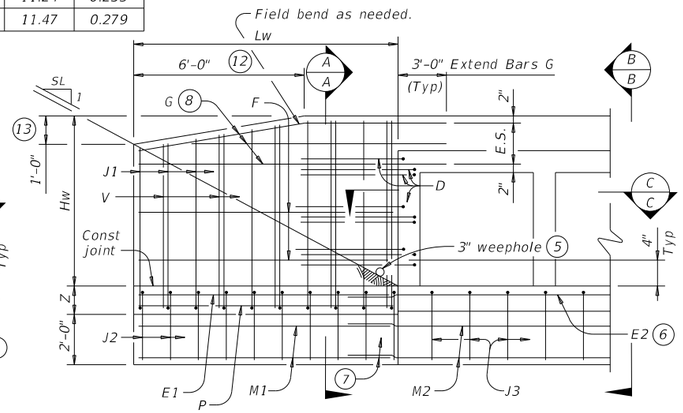
BARS J1 BARS J2 BARS J3 BARS V



SECTION C-C - PW-1

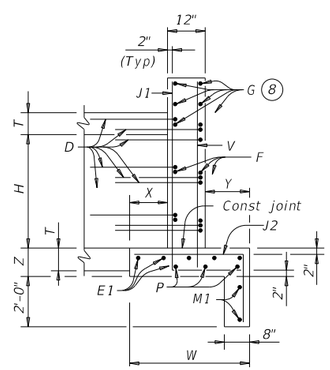


PARTIAL ELEVATION - PW-1

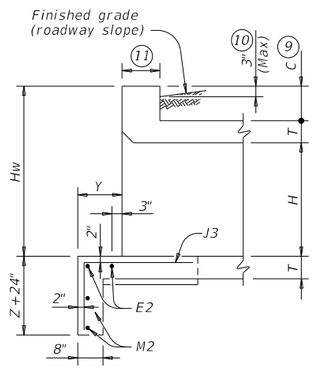


PARTIAL ELEVATION - PW-2

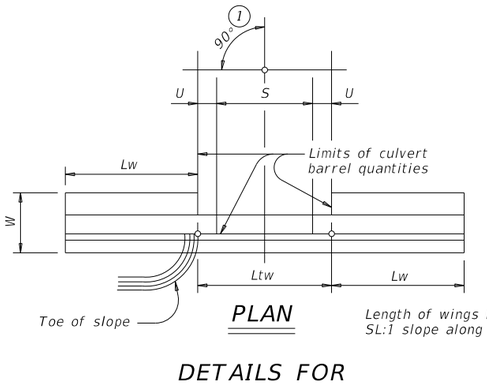
SECTION C-C - PW-2



SECTION A-A
(Showing wing reinforcement.)

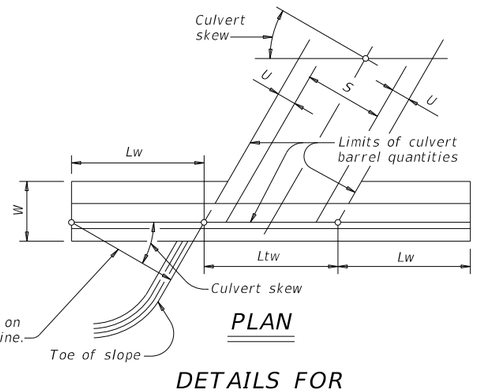


SECTION B-B
(Showing wing reinforcement.)



PLAN

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

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

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

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

DESIGNER NOTES:

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

MATERIAL NOTES:

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

GENERAL NOTES:

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

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

Texas Department of Transportation

Bridge Division Standard

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

PW

FILE:	pwstde01-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT	February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS		0019	03	028 Etc.	SH 171
		DIST	COUNTY		SHEET NO.
		WAC	HILL		151

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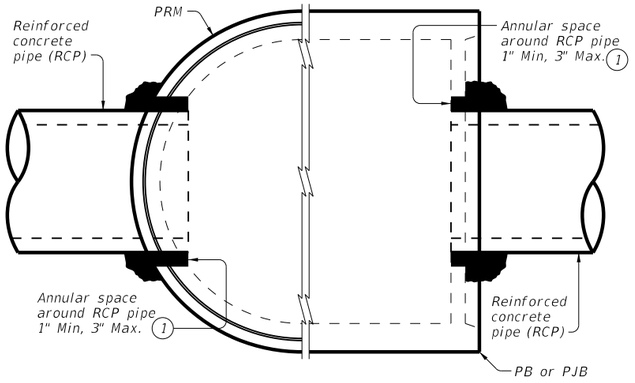
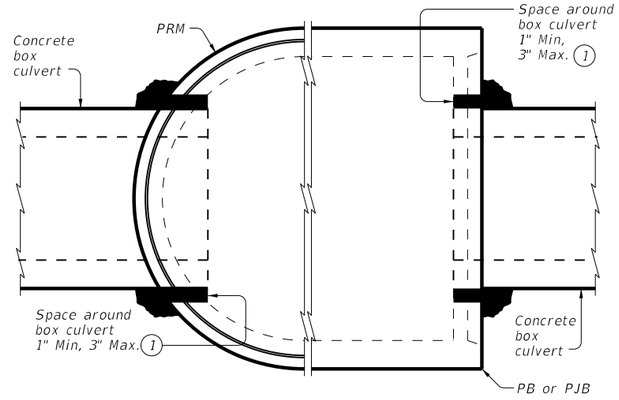


PRECAST ROUND MANHOLE (PRM) WITH THROUGH-HOLE

PRECAST BASE (PB) OR PRECAST JUNCTION BOX (PJB) WITH THIN-WALL KNOCK-OUT

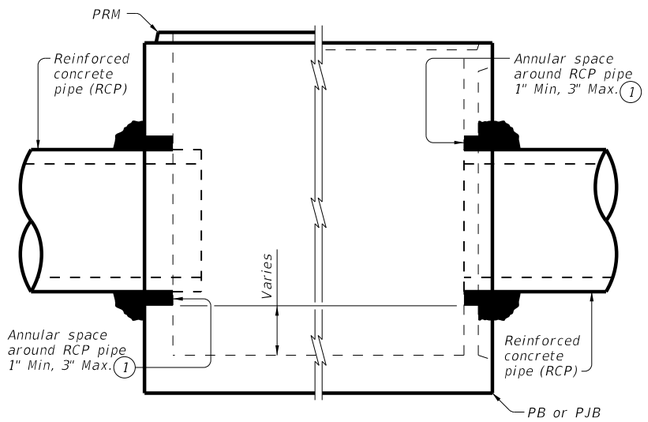
TYPICAL HALF PLAN



PRECAST ROUND MANHOLE (PRM) WITH THROUGH-HOLE

PRECAST BASE (PB) OR PRECAST JUNCTION BOX (PJB) WITH THIN-WALL KNOCK-OUT

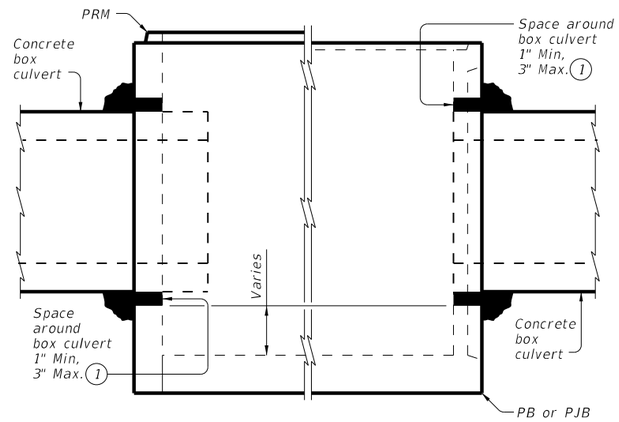
TYPICAL HALF PLAN



PRECAST ROUND MANHOLE (PRM) WITH THROUGH-HOLE

PRECAST BASE (PB) OR PRECAST JUNCTION BOX (PJB) WITH THIN-WALL KNOCK-OUT

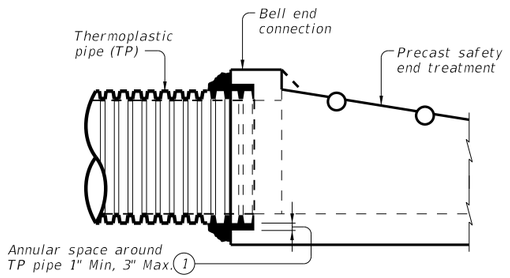
TYPICAL HALF ELEVATION



PRECAST ROUND MANHOLE (PRM) WITH THROUGH-HOLE

PRECAST BASE (PB) OR PRECAST JUNCTION BOX (PJB) WITH THIN-WALL KNOCK-OUT

TYPICAL HALF ELEVATION



TYPICAL PARTIAL ELEVATION OF PRECAST SAFETY END TREATMENTS

Showing square PSET for parallel drainage, cross drainage shown similar.

(1) Completely fill the void between the precast structure and the connecting pipe or box with cementitious grouts and mortars in accordance with DMS-4675 "Cementitious Grouts and Mortars for Miscellaneous Application".

CONSTRUCTION NOTES:

Do not grout rubber gasket joints without Manufacturer's recommendations.

Do not use bricks, masonry blocks, native stone, or similar materials in conjunction with grouted connections when filling void spaces around pipes or box culverts.

MATERIAL NOTES:

Provide grouted connections in accordance with DMS-4675 "Cementitious Grouts and Mortars for Miscellaneous Application".

GENERAL NOTES:

See applicable standards for notes and details not shown:

- Precast Base (PB)
- Precast Junction Box (PJB)
- Precast Round Manhole (PRM)
- Precast Safety End Treatments C/D Square (PSET-SC)
- Precast Safety End Treatments P/D Square (PSET-SP)

Provide Concrete Box Culverts in accordance with Item 462 "Concrete Box Culverts and Drains".

Provide Reinforced Concrete Pipe (RCP) in accordance with Item 464 "Reinforced Concrete Pipe".

Provide Thermoplastic Pipe (TP) in accordance with Special Specification Thermoplastic Pipe.

Payment for grouted connections is considered subsidiary to other bid Items.

Texas Department of Transportation

Bridge Division Standard

PIPE AND BOX GROUTED CONNECTIONS FOR PRECAST STRUCTURES

PBGC

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©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		152

DATE:
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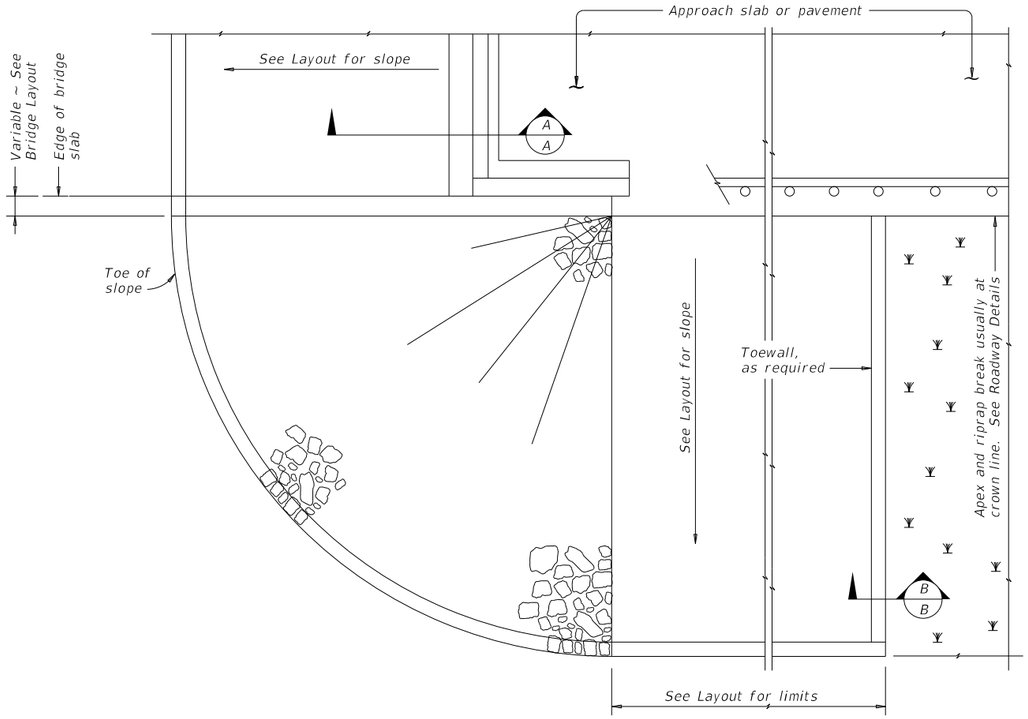
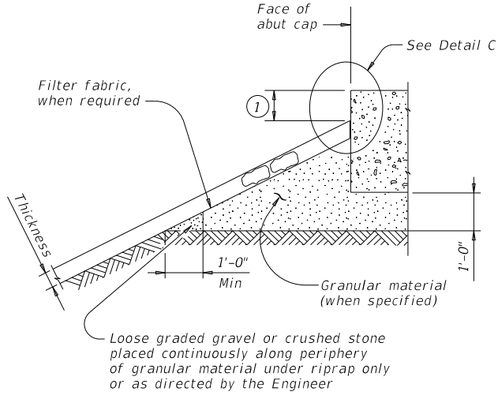
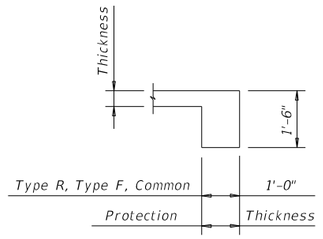


PLAN

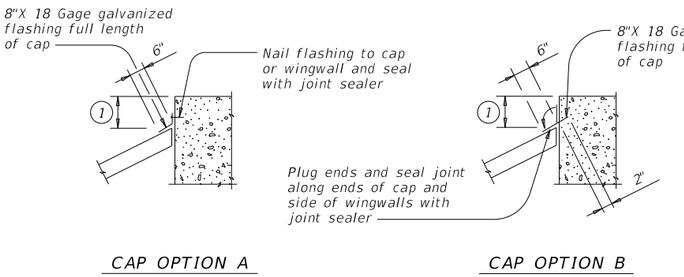


SECTION A-A AT CAP



SECTION B-B

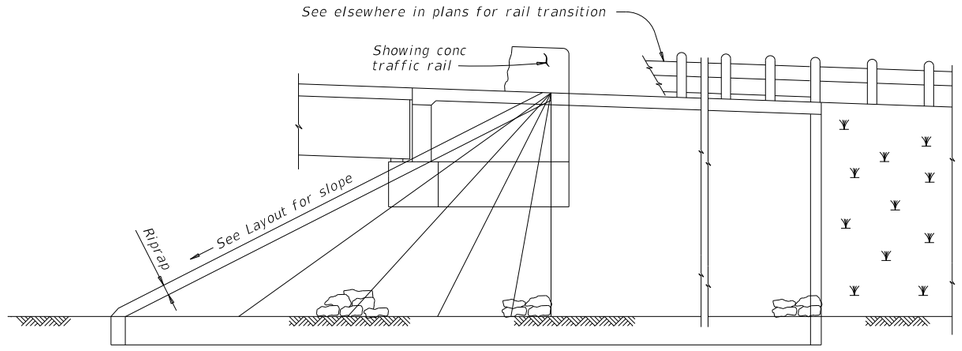
Provide toewall when shoulder drain is located adjacent to limits of stone riprap. Omit toewall when thickness of protection riprap is greater than 18".



CAP OPTION A

CAP OPTION B

DETAIL C



ELEVATION

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

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

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

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	DIST	COUNTY		SHEET NO.
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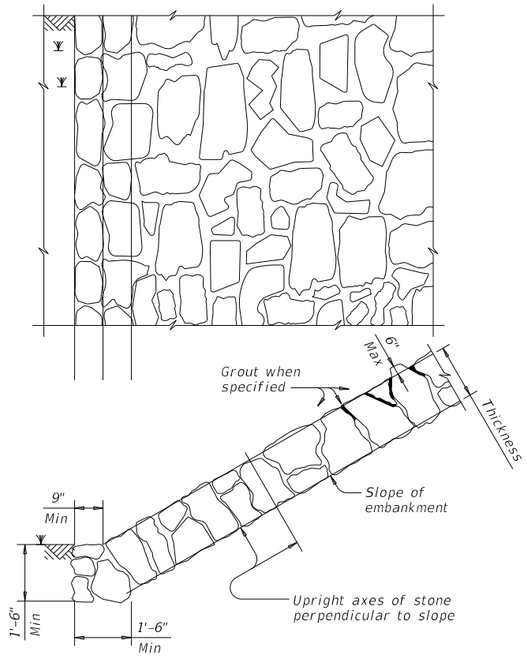


FIGURE 1 ~ TYPE R STONE RIPRAP

dry or grouted

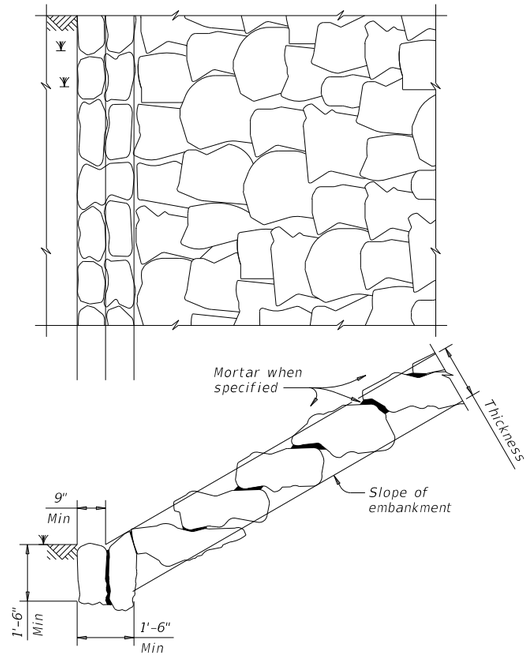


FIGURE 2 ~ TYPE F STONE RIPRAP

dry or mortared

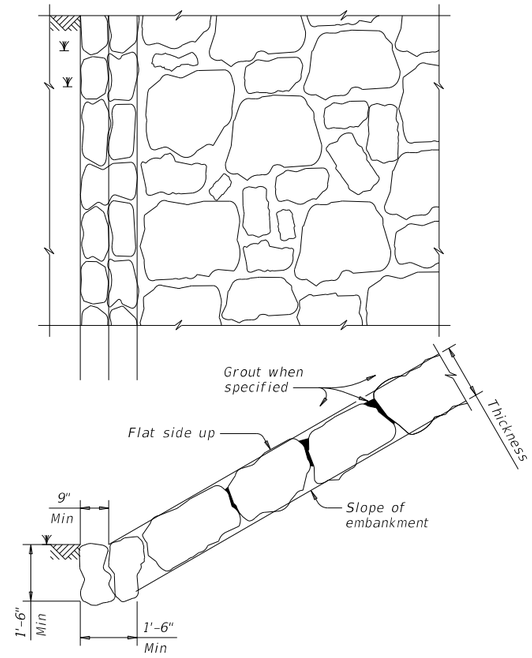


FIGURE 3 ~ TYPE F STONE RIPRAP

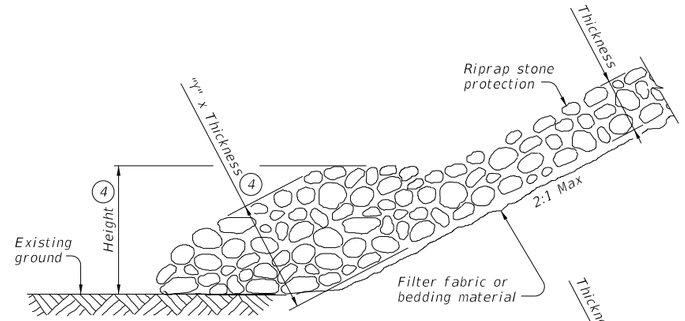
grouted

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

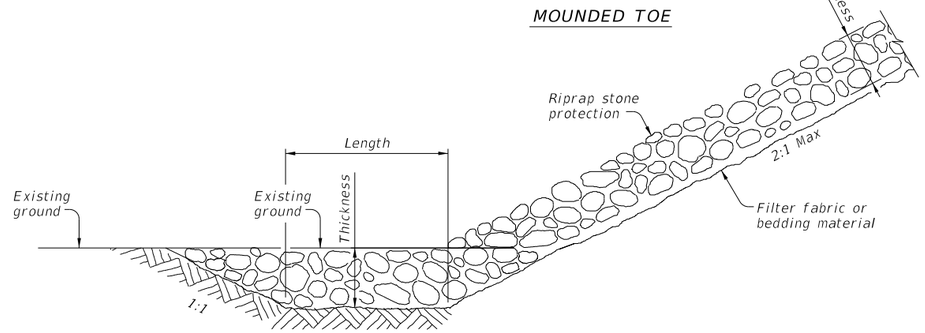
(3) Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.

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

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



MOUNDED TOE



EXTENDED ROCK FILLED TRENCH

PROTECTION STONE RIPRAP TOE OPTIONS (5)

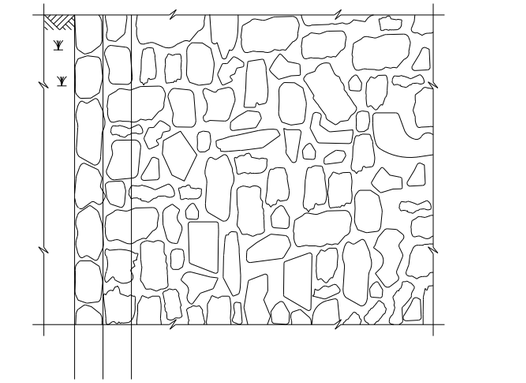


FIGURE 4 ~ COMMON STONE RIPRAP

dry or grouted

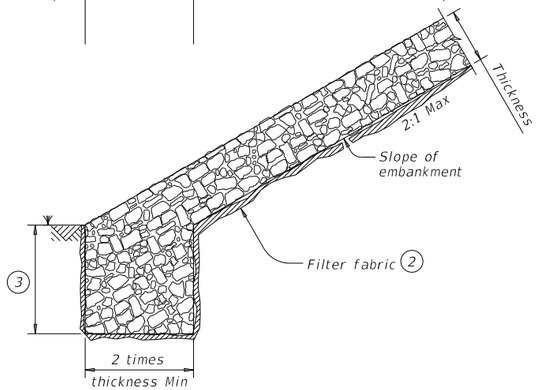


FIGURE 5 ~ PROTECTION STONE RIPRAP (5)

SHEET 2 OF 2

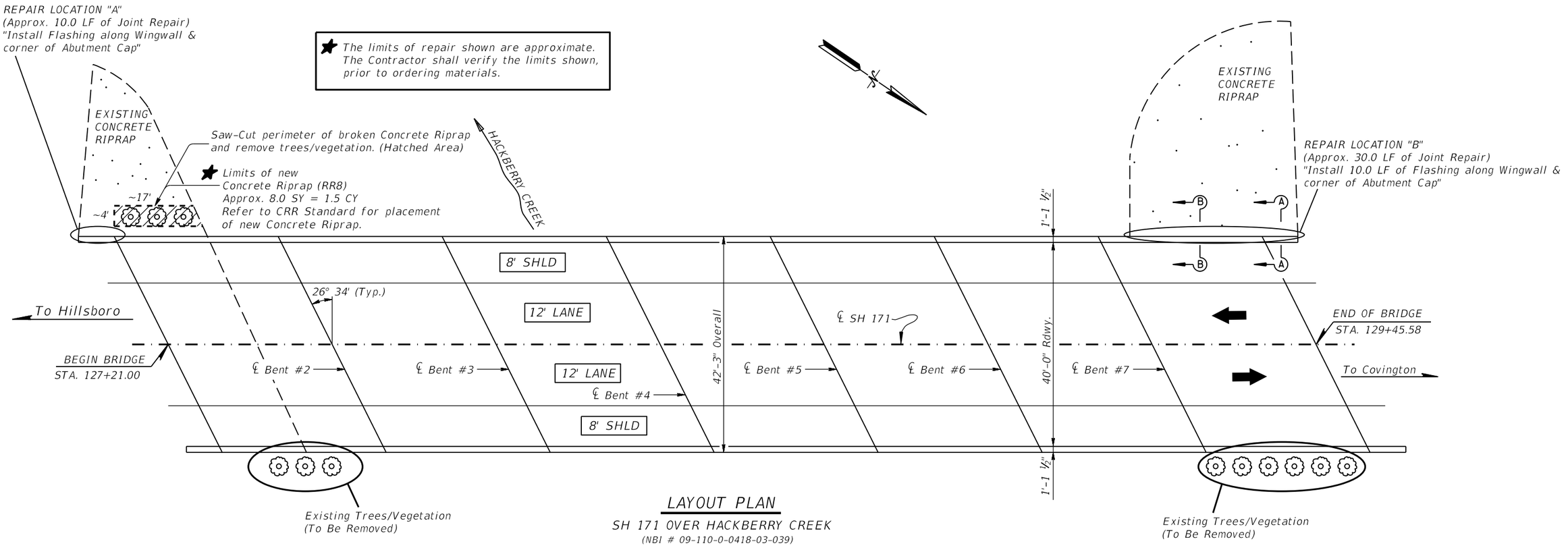
Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

FILE: srrstde1-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		154



LAYOUT PLAN

SH 171 OVER HACKBERRY CREEK

(NBI # 09-110-0-0418-03-039)

SH 171 over Hackberry Creek
Overall Length = 224'-7"
224'-7" (7 @ 32'-1") Pan Girder Spans
40'-0" Rdwy. 26° 34' RFS Rail Type T201

0 10 20 40

SCALE: 1" = 20'

ESTIMATED QUANTITIES

ITEM	100-6002	104-6009	432-6002	▲ 438-6003	◑
LOCATION	PREPARING ROW	REMOVING CONC (RIPRAP)	RIPRAP (CONC) (5 IN)	CLEANING AND SEALING EXIST JOINTS (CL 5)	CONCRETE GROUT
	STA.	S.Y.	C.Y.	L.F.	C.Y.
STR. #039 SH 171 OVER HACKBERRY CREEK	2.3	8.0	1.5	40.0	0.4
TOTAL	2.3	8.0	1.5	40.0	0.4

▲ Includes Repair Locations "A" & "B"

◑ For Contractors Information Only.

NOTE:
All materials and labor required for filling void between Wingwall and Riprap with Concrete Grout will be subsidiary to Item 432.

STATE OF TEXAS
PAUL F. CEPAK
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LICENSED
PROFESSIONAL ENGINEER

Paul F. Cepak, P.E.

05/25/2022

SHEET 1 OF 2 SHEETS

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LAYOUT & DETAILS FOR CONCRETE RIPRAP AND JOINT REPAIR

(SH 171 OVER HACKBERRY CREEK)

(STR.#039)

FILE: HACKRIPRAP.dgn	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT •	SHEET
REVISIONS	WACO	6		155
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HILL		0019 03 028	SH 171

LEVELS DISPLAYED
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 43 73 83 94 104 114 124 134 144 154 164 174 184
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

ACC:

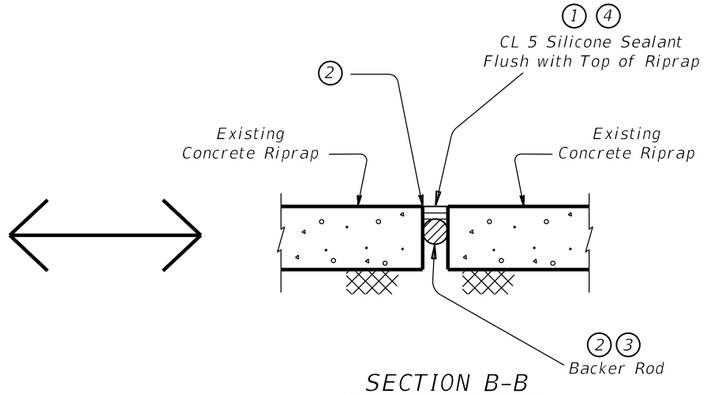
Etc.

RIPRAP JOINT REPAIR

SHOWING LIMITS OF VEGETATION ALONG RIPRAP

CONCRETE RIPRAP REPLACEMENT

SHOWING LIMITS OF TREE REMOVAL/REPAIR

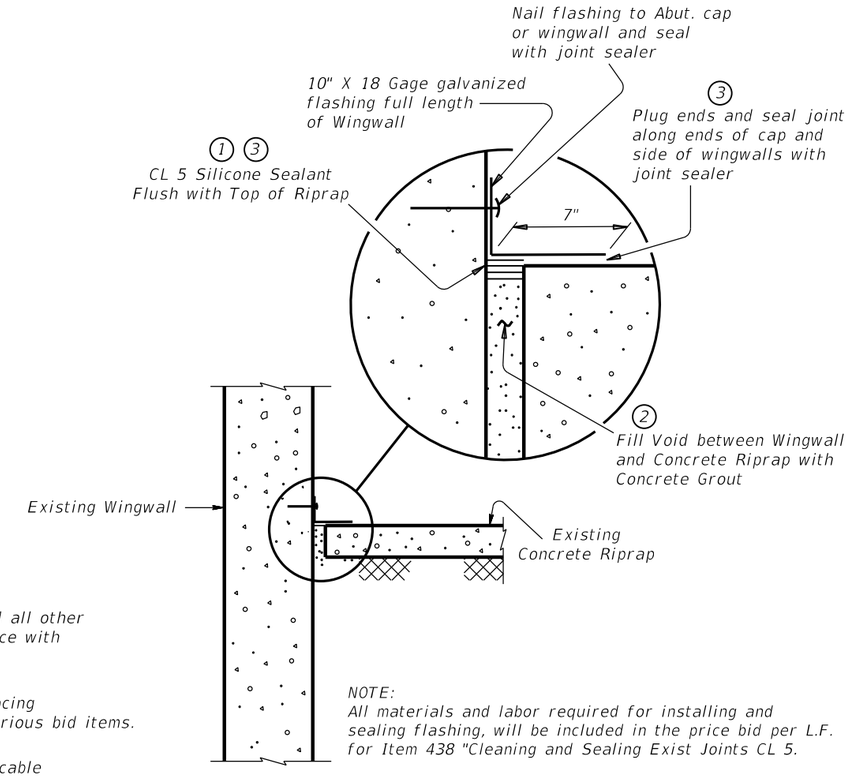


SECTION B-B

REPAIR LOCATION "B"

REPAIR PROCEDURES FOR LOCATION "B"

1. Clean joint opening of all bituminous materials, dirt, grease and all other deleterious materials to access full length of joint, in accordance with Item 438, "Cleaning and Sealing Joints".
2. Repair any spalled or damaged riprap if necessary, prior to placing backer rod and sealing joint. This work will be Subsidiary to various bid items.
3. Fill any voided areas below Riprap with Concrete Grout or applicable repair material suitable for repair. Place Backer Rod 1" below top of Riprap. Backer Rod 25% larger than opening.
4. Seal joint opening with Class 5 (Silicone) in accordance with DMS-6310 "Joint Sealants and Fillers".



NOTE:
All materials and labor required for installing and sealing flashing, will be included in the price bid per L.F. for Item 438 "Cleaning and Sealing Exist Joints CL 5.

SECTION A-A

REPAIR LOCATIONS "A & B"

REPAIR PROCEDURES FOR LOCATION "A" AND "B"

1. Clean joint opening of all bituminous materials, dirt, grease and all other deleterious materials to access full length of joint, in accordance with Item 438, "Cleaning and Sealing Joints".
2. Fill Void between Wingwall/Cap and Concrete Riprap with Concrete Grout. Sudsidiary to various Bid Items.
3. Seal with Class 5 (Silicone) and install Flashing.

STATE OF TEXAS
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PROFESSIONAL ENGINEER

Paul F. Cepak, P.E.

05/25/2022

SHEET 2 OF 2 SHEETS

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LAYOUT & DETAILS FOR CONCRETE RIPRAP AND JOINT REPAIR

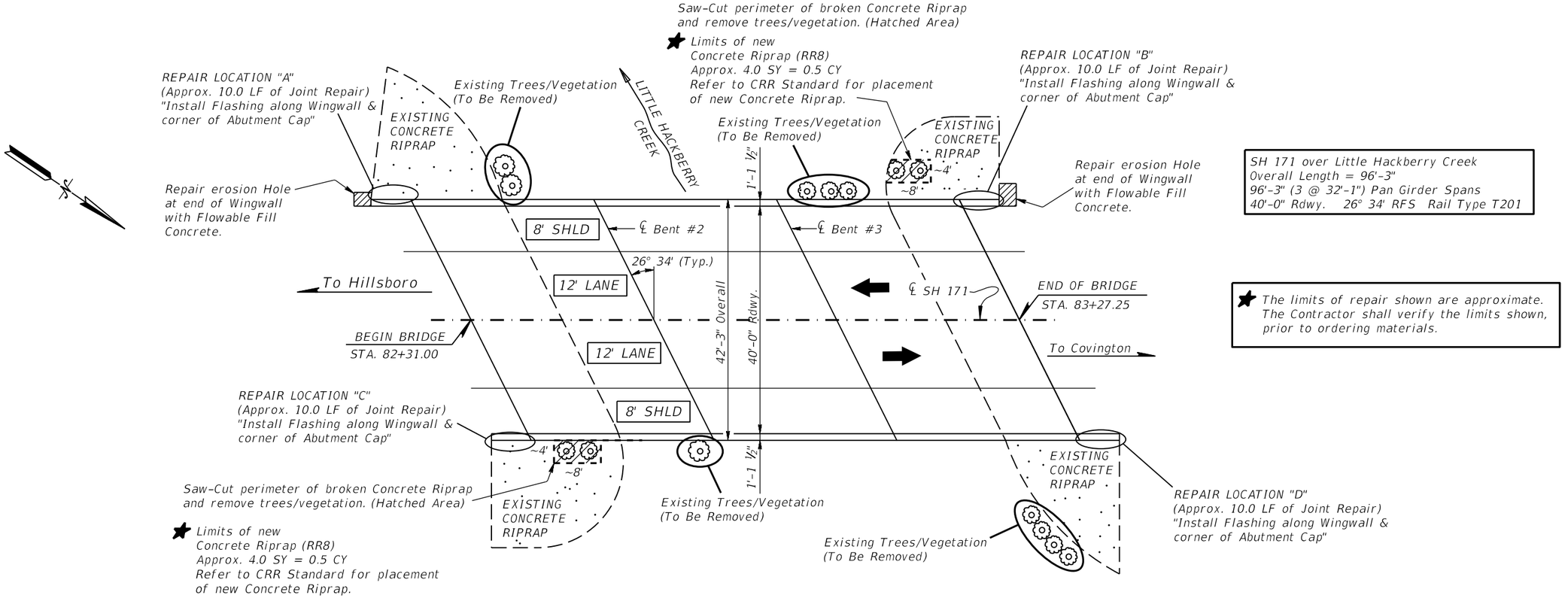
(SH 171 OVER HACKBERRY CREEK)

(STR.#039)

FILE: HACKRIPRAP.dgn	DN: DOT	CK: DOT	DW: GNH	CK: DOT		
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT •			SHEET
REVISIONS	WACO	6				156
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HILL		0019	03	028	SH 171

LEVELS DISPLAYED
ACC:

Etc.



SH 171 over Little Hackberry Creek
Overall Length = 96'-3"
96'-3" (3 @ 32'-1") Pan Girder Spans
40'-0" Rdwy. 26° 34' RFS Rail Type T201

★ The limits of repair shown are approximate. The Contractor shall verify the limits shown, prior to ordering materials.

LAYOUT PLAN

SH 171 OVER LITTLE HACKBERRY CREEK

(NBI # 09-110-0-0418-03-040)

0 10 20 40

SCALE: 1" = 20'

ESTIMATED QUANTITIES

ITEM	100-6002	104-6009	432-6002	438-6003	◑
LOCATION	PREPARING ROW	REMOVING CONC (RIPRAP)	RIPRAP (CONC) (5 IN)	CLEANING AND SEALING EXIST JOINTS (CL 5)	CONCRETE GROUT
	STA.	S.Y.	C.Y.	L.F.	C.Y.
STR. #040 SH 171 OVER LITTLE HACKBERRY CREEK	1.0	8.0	2.0	40.0	0.4
TOTAL	1.0	8.0	✳ 2.0	40.0	0.4

✳ Quantity includes flowable Fill for filling Erosion behind wingwalls

◑ For Contractors Information Only.

NOTE:
All materials and labor required for filling void between Wingwall and Riprap with Concrete Grout will be subsidiary to Item 432.

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05/25/2022

SHEET 1 OF 2 SHEETS

Texas Department of Transportation

LAYOUT & DETAILS FOR CONCRETE RIPRAP JOINT REPAIR

(SH 171 OVER LITTLE HACKBERRY CREEK)

(STR.#040)

FILE: LITTLEHACKRIP.dgn	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT •	SHEET
REVISIONS	WACO	6		157
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HILL		0019 03 028	SH 171

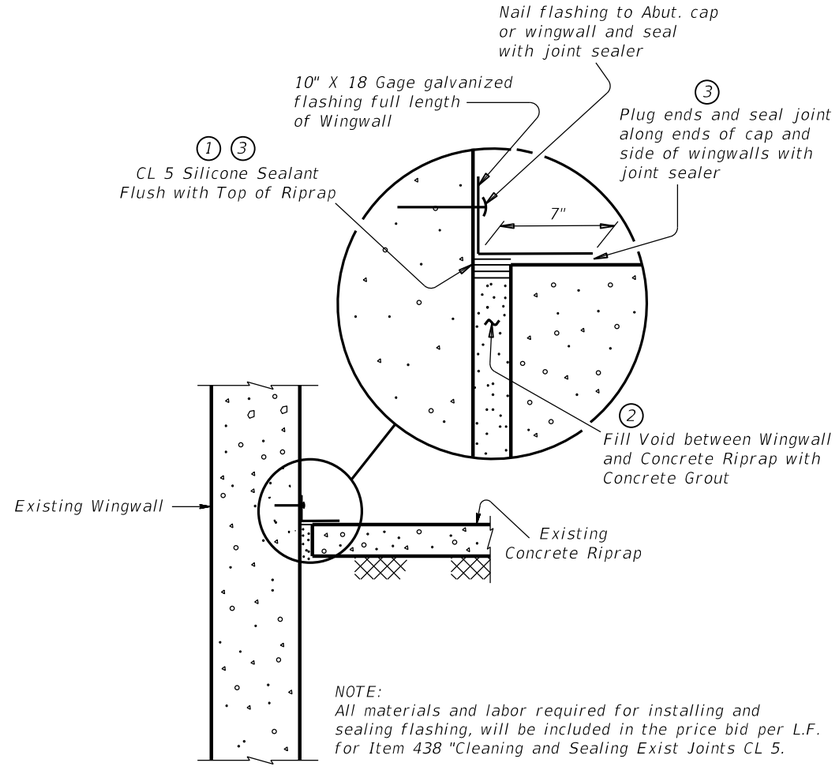
Etc.

LEVELS DISPLAYED
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66

ACC:

JOINT REPAIR AT EXISTING WINGWALLS

SHOWING GAP BETWEEN RIPRAP AND WINGWALLS



NOTE:
All materials and labor required for installing and sealing flashing, will be included in the price bid per L.F. for Item 438 "Cleaning and Sealing Exist Joints CL 5.

SECTION A-A

REPAIR LOCATIONS "A" THRU "D"

REPAIR PROCEDURES FOR LOCATIONS "A" THRU "D"

1. Clean joint opening of all bituminous materials, dirt, grease and all other deleterious materials to access full length of joint, in accordance with Item 438, "Cleaning and Sealing Joints".
2. Fill Void between Wingwall/Cap and Concrete Riprap with Concrete Grout. Subsidiary to various Bid Items.
3. Seal with Class 5 (Silicone) and install Flashing.

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05/25/2022

LAYOUT & DETAILS FOR CONCRETE RIPRAP JOINT REPAIR

(SH 171 OVER LITTLE HACKBERRY CREEK)

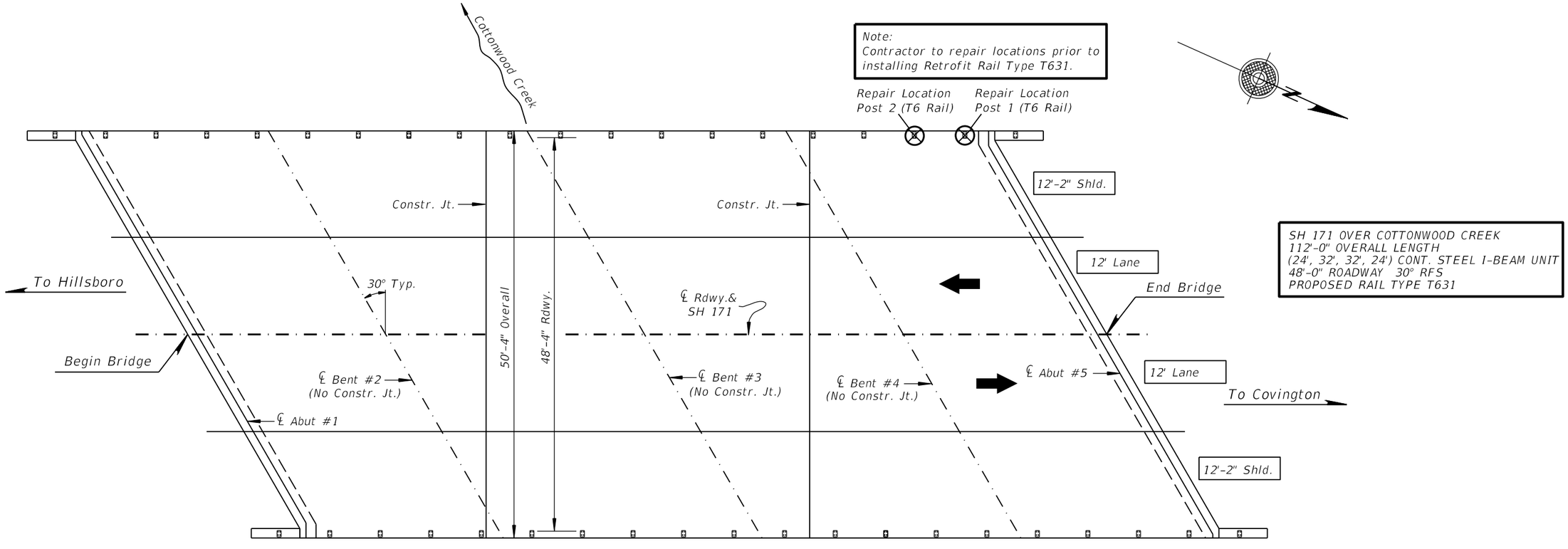
(STR.#040)

FILE: LITTLEHACKRIP.dgn	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT •	SHEET
REVISIONS	WACO	6		158
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HILL		0019	03	028	SH 171

Etc.

LEVELS DISPLAYED
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

ACC:



SH 171 OVER COTTONWOOD CREEK

(NBI # 09-110-0-0418-03-037
(N.T.S.)

ESTIMATED QUANTITIES

(FOR CONCRETE SPALL REPAIR AT EXISTING RAIL ANCHORAGE LOCATIONS)

ITEM	429-6005
STR. #037 COTTONWOOD CREEK	CONC STR REPAIR (DECK REP (FULL DEPTH)
	S.F.
LOCATION (POST 1)	3.0
LOCATION (POST 2)	3.0
TOTAL	6.0

Refer to Item "429".

GENERAL NOTES

All Reinforcing for Bridge Overhang Repair shall be Grade 60.
Chamfer all exposed corners 3/4" unless otherwise shown.

Provide materials as outlined in the CONCRETE REPAIR MANUAL. Provide repair materials suitable for the appropriate horizontal, vertical, or overhead application meeting the requirements in DMS-4655, "Concrete Repair Materials."

A Pre-approved Rapid Repair Type A-2 or other approved applicable material shall be used to repair the Bridge Deck Overhang. The material must be extended with coarse aggregate.

Obtain a compressive strength of 3,000 psi before opening to traffic.

Obtain approval for all tools, equipment, materials and techniques proposed for use to repair Bridge Deck Overhang and Railing.

All Materials and Labor required for repairing Bridge Deck Overhang, shall be included in the price bid per SF for Item 429: CNC STR REPAIR (DECK REP (FULL DEPTH).

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Sheet 1 of 2 Sheets

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LAYOUT & DETAILS FOR BRIDGE OVERHANG REPAIR AT RAIL POSTS

(SH 171 OVER COTTONWOOD CREEK)

(STR #037)

FILE: COTSLABREP.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT NO.●	SHEET
REVISIONS	WACO	6		159
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HILL		0019 03 028	SH 171

ETC.

LEVELS DISPLAYED
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
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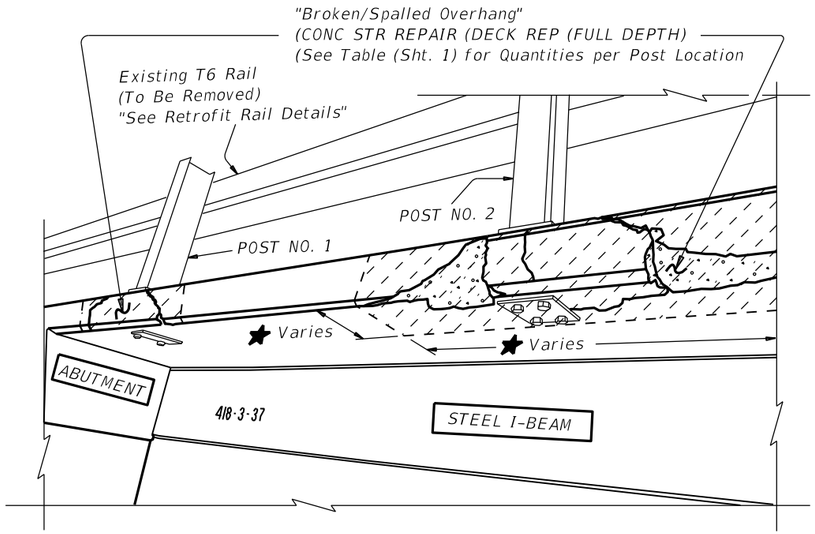
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

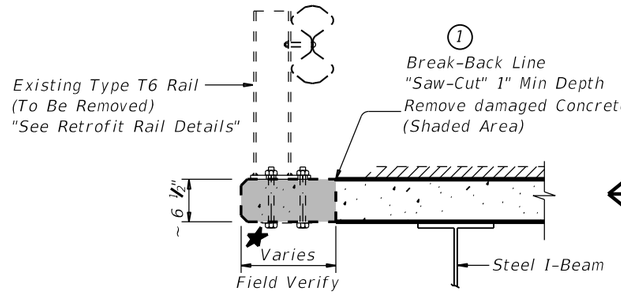
ACC:



ELEVATION

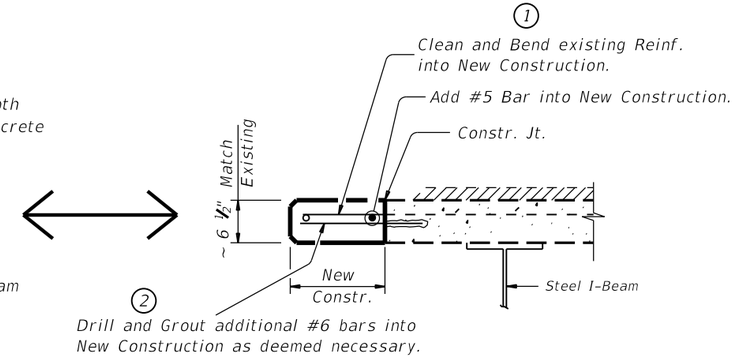
(Posts No. 1 and 2)

★ *The limits of repair shown are approximate. The Contractor shall verify the limits shown, prior to ordering materials. Additional removal of the broken Slab Overhang may be required, with approval by the Engineer, and in accordance with Item 429.*



SECTION THRU SLAB OVERHANG

(Showing Break-Back Limits)



SECTION THRU SLAB OVERHANG

(Showing New Construction)

NOTES:

1. *Saw-Cut (1" Min. depth) the perimeter of damaged Bridge Deck. Clean and Bend existing Reinf. into New Construction. Replace any damaged reinforcing with like reinforcing.*
2. *As deemed necessary, Drill and Grout Bars (#6) a Min. of 6" into existing structure using Epoxy Adhesive. Conforming to the requirements of (DMS-6100).*

LEVELS DISPLAYED

1	2	3		5	6	7	8	9	10	11	12	13	14	15	16	
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	

ACC:

Sheet 2 of 2 Sheets

STATE OF TEXAS
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05/25/2022

Texas Department of Transportation

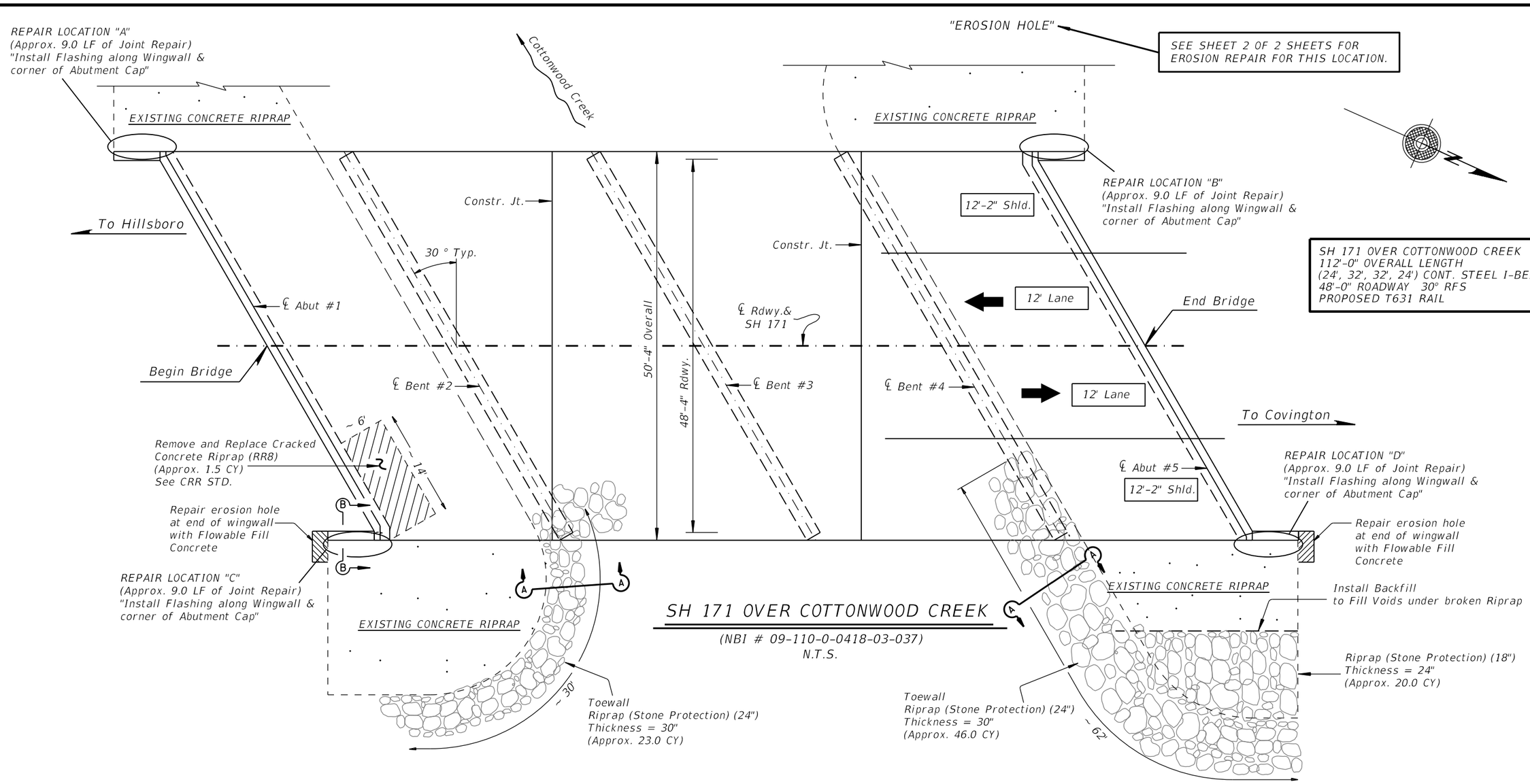
LAYOUT & DETAILS FOR BRIDGE OVERHANG REPAIR AT RAIL POSTS

(SH 171 OVER COTTONWOOD CREEK)

(STR #037)

FILE: COTSLABREP.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT NO.●	SHEET
REVISIONS	WACO	6		160
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HILL		0019 03 028	SH 171

ETC.



SH 171 OVER COTTONWOOD CREEK

(NBI # 09-110-0-0418-03-037)
N.T.S.

ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QTY
0432-6002	RIPRAP (CONC) (5 IN)	C.Y.	* 2.5
0432-6033	RIPRAP (STONE PROTECTION) (18 IN)	C.Y.	20.0
0432-6035	RIPRAP (STONE PROTECTION) (24 IN)	C.Y.	81.0
0438-6003	CLEANING AND SEALING EXIST JOINTS (CL 5)	L.F.	36.0

*Quantity includes Flowable Concrete behind wingwalls.

GENERAL NOTES:

1. THE DETAILS SHOWN ARE PROVIDED AS AN APPROXIMATE GUIDE FOR INSTALLATION OF RIPRAP STONE PROTECTION. THE CONTRACTOR WILL DETERMINE THE LIMITS OF THESE ITEMS AS DICTATED BY FIELD CONDITIONS AND AS DIRECTED PRIOR TO MATERIAL PURCHASE AND DELIVERY.

2. IF NO PAY ITEM FOR DEBRIS REMOVAL IS NOTED; DEBRIS WILL BE REMOVED AS NEEDED TO PLACE RIPRAP. THIS WORK WILL NOT BE PAID FOR DIRECTLY, BUT CONSIDERED SUBSIDIARY TO THE VARIOUS BID ITEMS.

3. ALL EXCAVATION, GRADING, BACKFILLING AND FINISHING OF SOIL WILL BE SUBSIDIARY TO THE VARIOUS BID ITEMS.

STATE OF TEXAS
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05/25/2022

LEVELS DISPLAYED
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
ACC:

Sheet 1 of 2 Sheets

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LAYOUT & DETAILS FOR CONCRETE RIPRAP REPAIR

(SH 171 OVER COTTONWOOD CREEK)

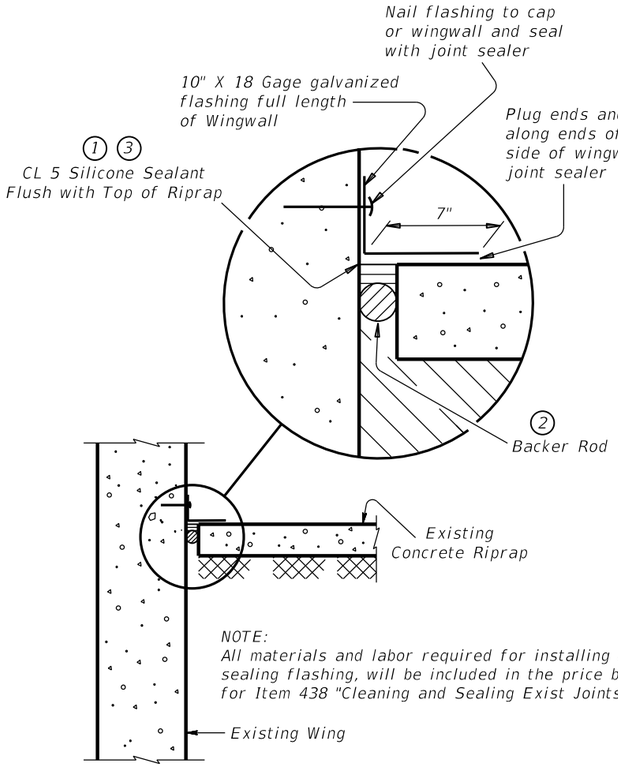
(STR #037)

FILE: COTRIPRAP.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT			
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT NO.●				SHEET
REVISIONS	WACO	6					161
	COUNTY			CONTROL	SECT	JOB	HIGHWAY
	HILL			0019	03	028	SH 171

ETC.

JOINT REPAIR AT EXISTING WINGWALLS

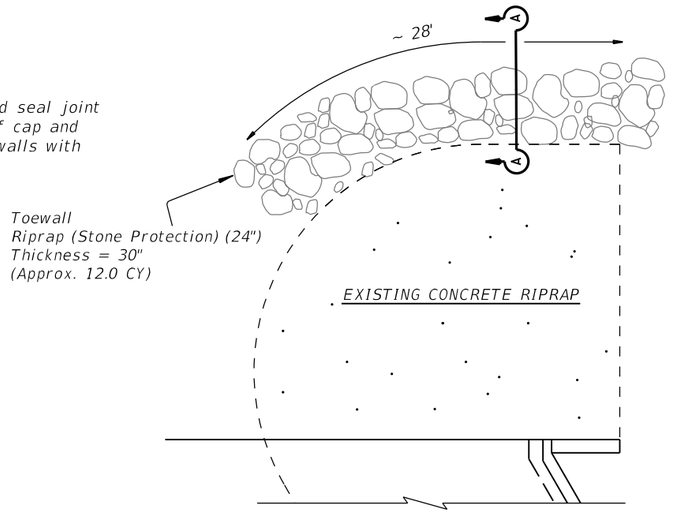
SHOWING GAP BETWEEN RIPRAP AND WINGWALL



NOTE:
All materials and labor required for installing and sealing flashing, will be included in the price bid per L.F. for Item 438 "Cleaning and Sealing Exist Joints CL 5.

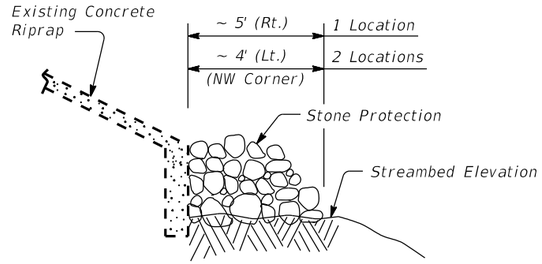
SECTION B-B

REPAIR LOCATIONS "A" THRU "D"



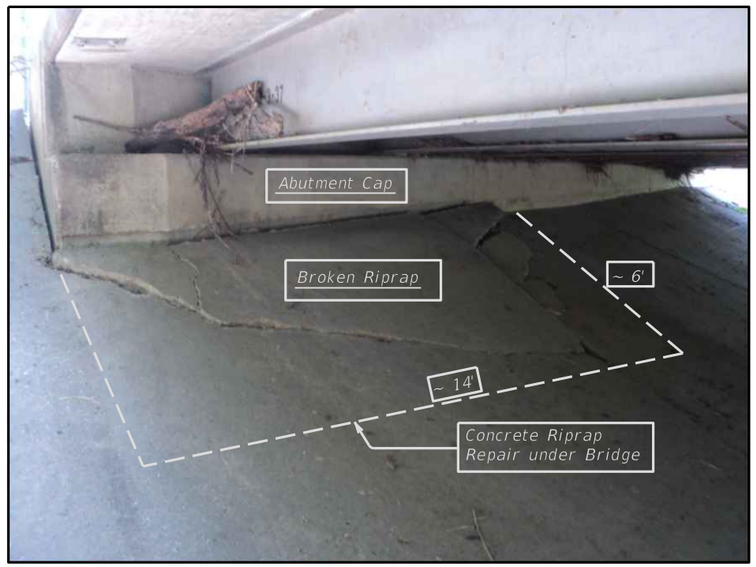
CONCRETE RIPRAP AT NW QUADRANT

SHOWING LIMITS OF STONE PROTECTION ALONG EXPOSED TOEWALL



SECTION A-A

(SHOWING LIMITS OF STONE PROTECTION AT EXISTING RIPRAP TOEWALL)



REPAIR AT EXISTING RIPRAP UNDER BRIDGE

SHOWING LIMITS OF REPAIR AREA

REPAIR PROCEDURES FOR LOCATIONS "A" THRU "D"

1. Clean joint opening of all bituminous materials, dirt, grease and all other deleterious materials to access full length of joint, in accordance with Item 438, "Cleaning and Sealing Joints".
2. Place Backer Rod 1" below top of Riprap. Backer Rod 25% larger than opening.
3. Seal joint opening with Class 5 (Silicone) in accordance with DMS-6310 "Joint Sealants and Fillers".

STATE OF TEXAS
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Sheet 2 of 2 Sheets

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LAYOUT & DETAILS FOR CONCRETE RIPRAP REPAIR

(SH 171 OVER COTTONWOOD CREEK)

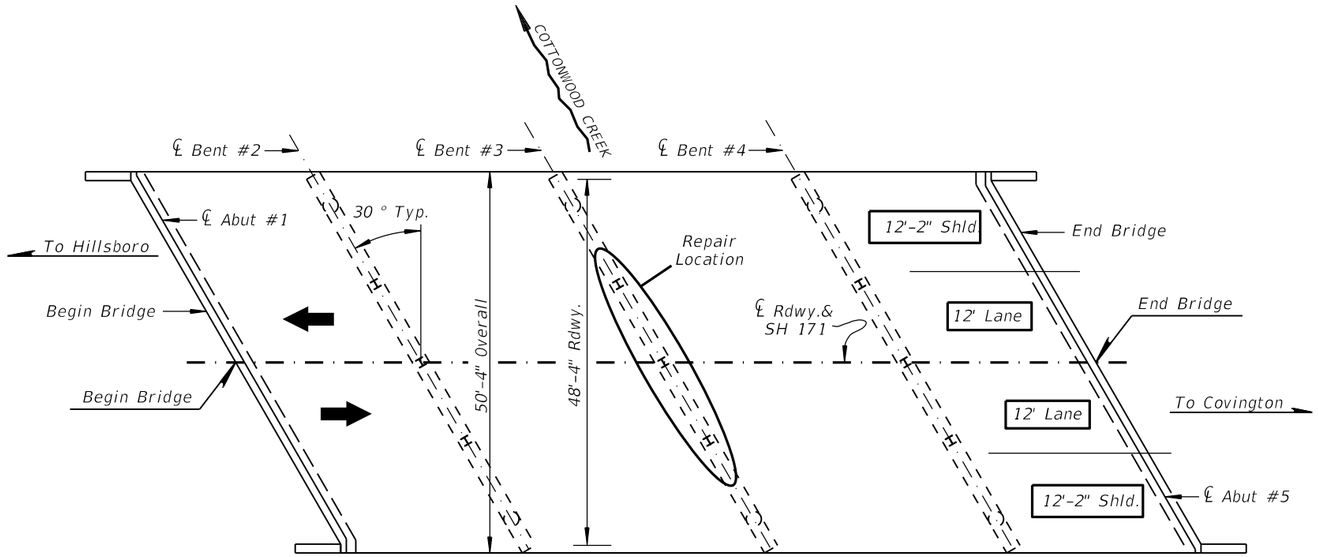
(STR #037)

FILE: COTSLABRAP.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT NO.●	SHEET
REVISIONS	WACO	6		162
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HILL		0019 03 028	SH 171

ETC.

LEVELS DISPLAYED
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

ACC:

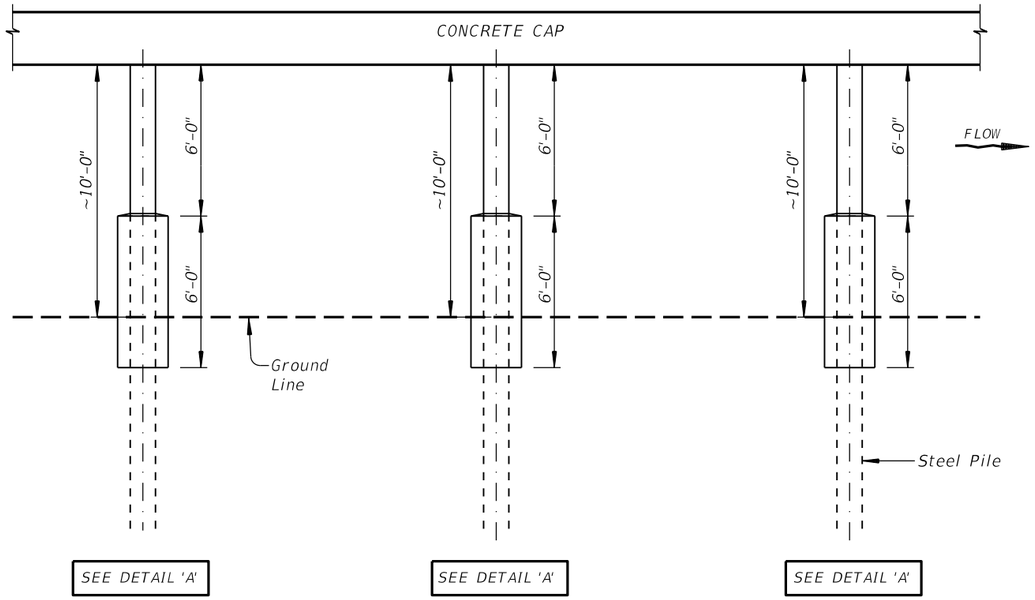


SH 171 OVER COTTONWOOD CREEK

(NBI # 09-110-0-0418-03-037

0 10 20 40

SCALE: 1" = 20'



ELEVATION BENT #3
(SHOWING 3 PILE BENT)
(LOOKING SOUTH)

SH 171 over Cottonwood Creek
112'-0" Overall Length
(24', 32', 32', 24') Cont. Steel I-Beam Unit
48'-0" Roadway 30 ° RFS
Proposed T631 Rail

GENERAL NOTES:

All reinforcing steel shall be Grade 60.
Concrete for Steel Pile Encasements shall be Class "C"
Obtain approval for all tools, equipment, materials and techniques proposed for use to perform repairs.
All materials and Labor required for preparing and constructing Steel Pile Encasements, shall be included in the price bid per CY for CL. "C" CONC (PILE ENCASEMENT).

STATE OF TEXAS
PAUL F. CEPAK
85408
LICENSED
PROFESSIONAL ENGINEER

Paul F. Cepak, P.E.

05/25/2022

SHEET 1 OF 2 SHEETS

Texas Department of Transportation

PILE ENCASEMENT DETAILS

(SH 171 OVER COTTONWOOD CREEK)

(STR #037)

FILE: COTENC.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT			
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT NO.●				SHEET
REVISIONS	WACO	6					163
	COUNTY			CONTROL	SECT	JOB	HIGHWAY
	HILL			0019	03	028	SH 171

ETC.

LEVELS DISPLAYED
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

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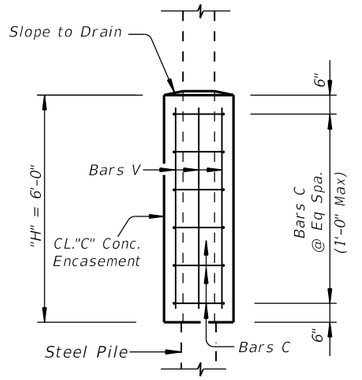


DETAIL 'A' @ BENT #3

CONCRETE ENCASEMENT

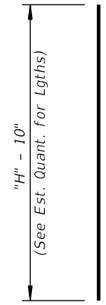
ITEM	420-6070
LOCATION	CL C CONC (PILE ENCASEMENT)
	C.Y.
BENT #3 ENCASEMENTS	2.7
TOTAL	2.7

*ESTIMATED QUANTITIES

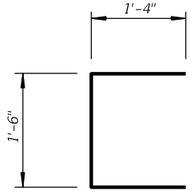
(FOR 3 ENCASEMENTS)

Bar	No.	Size	Length	Weight
C	36	#4	4'-2"	100
V	24	#6	5'-2"	186
Reinforcing Steel			Lb	286

*For Contractors Information Only

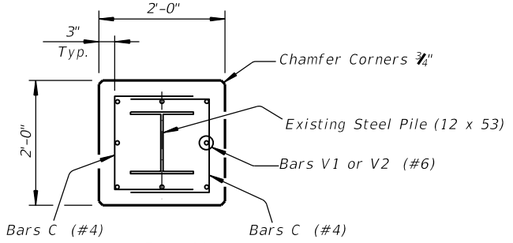


BARS V (#6)



BARS C (#4)

NOTE:
CONTRACTOR TO FIELD VERIFY DIMENSIONS PRIOR TO ORDERING MATERIALS.



PLAN

CONCRETE ENCASEMENT

STATE OF TEXAS
PAUL F. CEPAK
85408
LICENSED
PROFESSIONAL ENGINEER

Paul F. Cepak, P.E.

05/25/2022

SHEET 2 OF 2 SHEETS

Texas Department of Transportation

PILE ENCASEMENT DETAILS

(SH 171 OVER COTTONWOOD CREEK)

(STR #037)

FILE: COTENC.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT NO.●	SHEET
REVISIONS	WACO	6		164
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HILL		0019 03 028	SH 171

ETC.

LEVELS DISPLAYED
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

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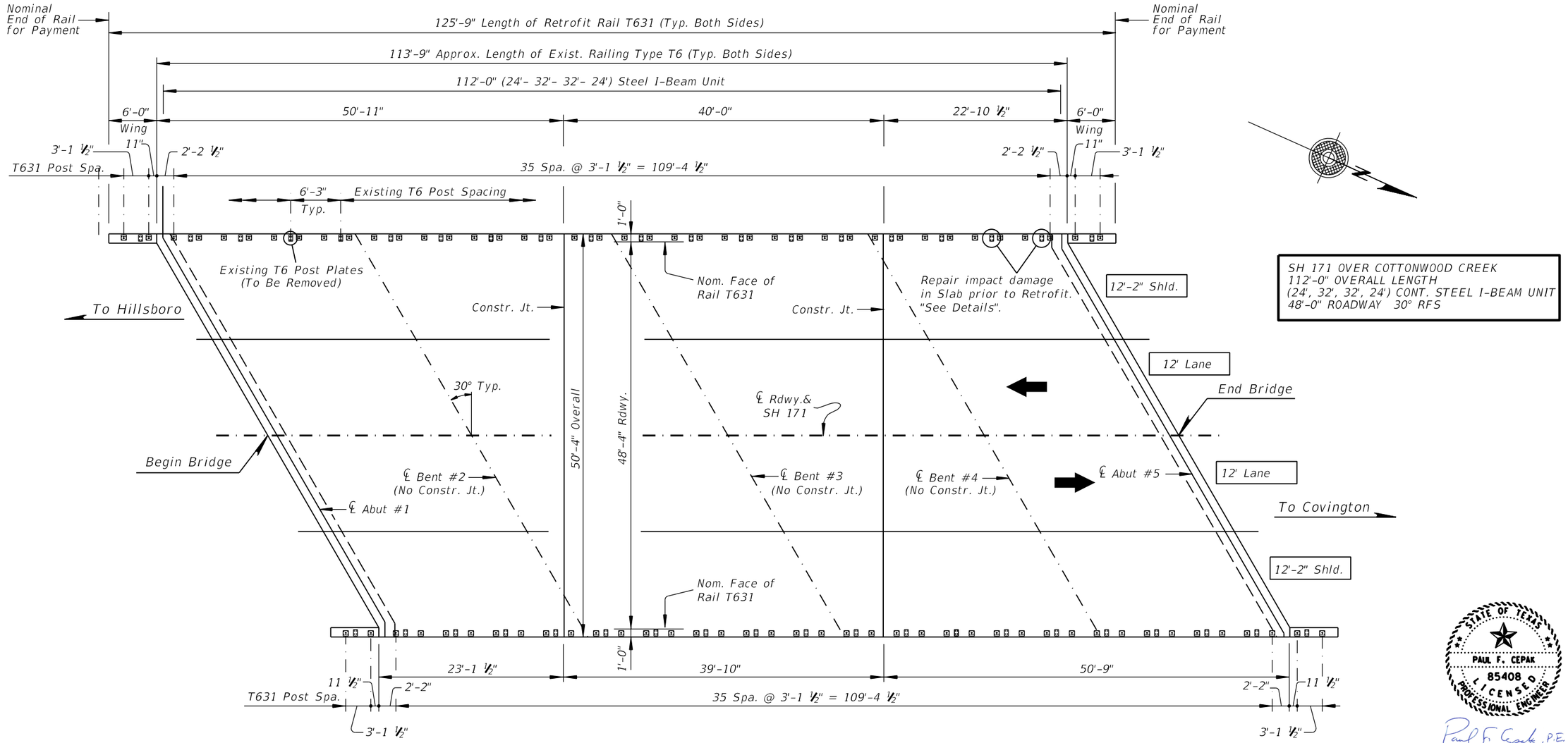


SH 171 OVER COTTONWOOD CREEK
112'-0" OVERALL LENGTH
(24', 32', 32', 24') CONT. STEEL I-BEAM UNIT
48'-0" ROADWAY 30° RFS

SH 171 OVER COTTONWOOD CREEK

(NBI # 09-110-0-0418-03-037)
(N.T.S.)

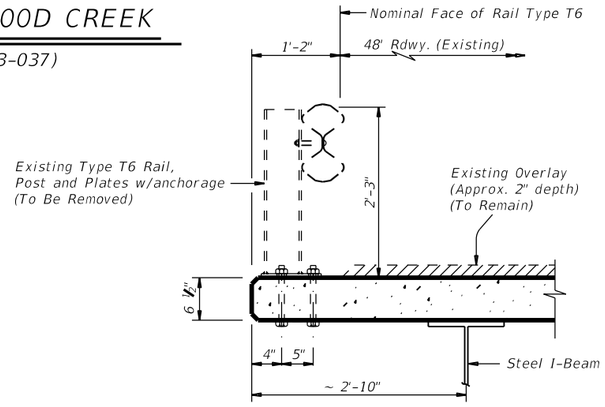
Note:
See Standards GF(31)TRTL3-20, GF(31)-19 and BED-14 for additional Details not shown.

NOTE:
Existing Rail and Posts will become property of the Contractor.

ESTIMATED QUANTITIES

ITEM	0451-6019	* EXISTING RAIL (REMOVAL)
LOCATION	RETROFIT RAIL (TY T631)	
	L.F.	L.F.
SH 171@ COTTONWOOD CREEK	251.50	227.50
TOTAL	251.50	227.50

* FOR CONTRACTORS INFORMATION ONLY



SECTION THRU EXISTING RAIL

(SHOWING TYPE T6 RAIL - TO BE REMOVED)

Removal of Existing Rail is included in the Unit Bid Price per LF for Retrofit Rail (TY T631).

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05/25/2022

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RETROFIT TRAFFIC RAIL LAYOUT

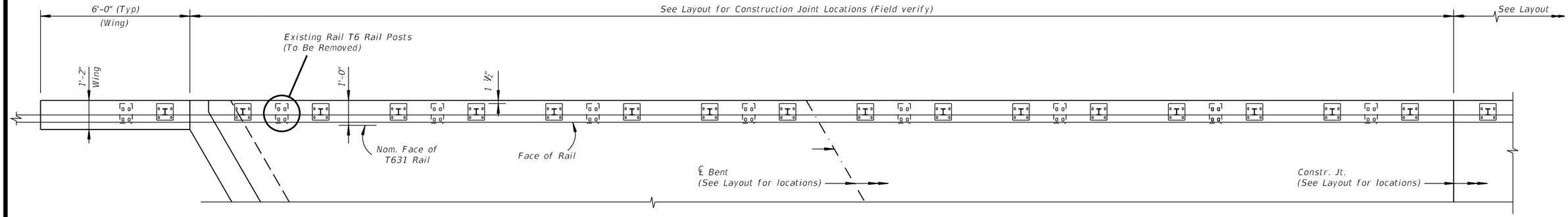
(SH 171 @ COTTONWOOD CREEK)

(STR.#037) TYPE T631

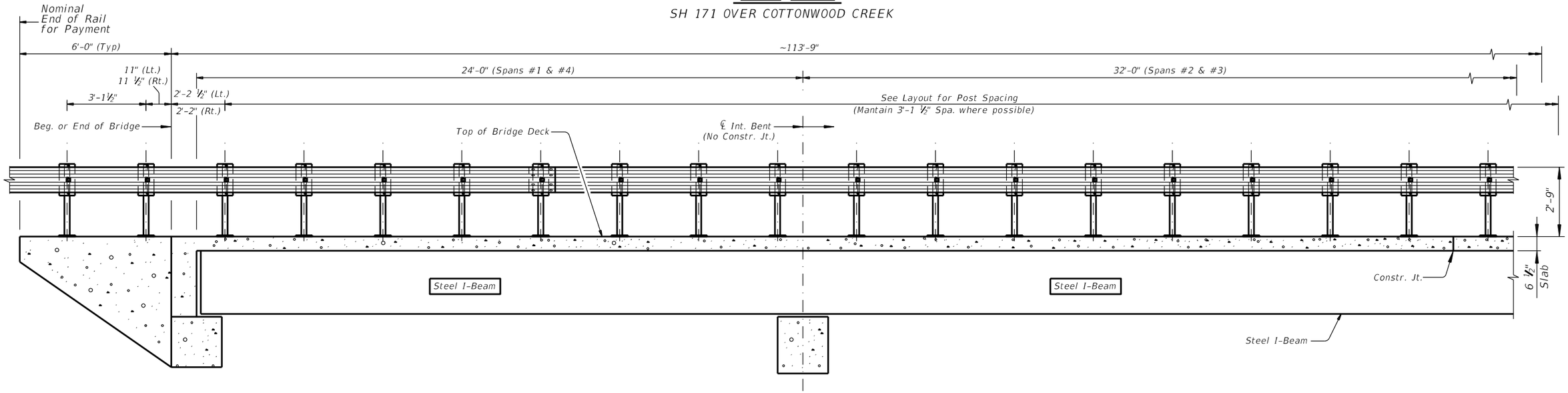
FILE: COTTONRETRO.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT	SHEET
REVISIONS	WACO	6		165
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HILL	0019	03	028	SH 171

LEVELS DISPLAYED ACC:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

Etc.



PART PLAN
SH 171 OVER COTTONWOOD CREEK



PART ELEVATION
SH 171 OVER COTTONWOOD CREEK

SEE SHEETS 2 AND 3 FOR ADDITIONAL RAIL INSTALLATION INFORMATION.

STATE OF TEXAS
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PROFESSIONAL ENGINEER

Paul F. Cepak, P.E.

05/25/2022

SHEET 1 OF 3 SHEETS

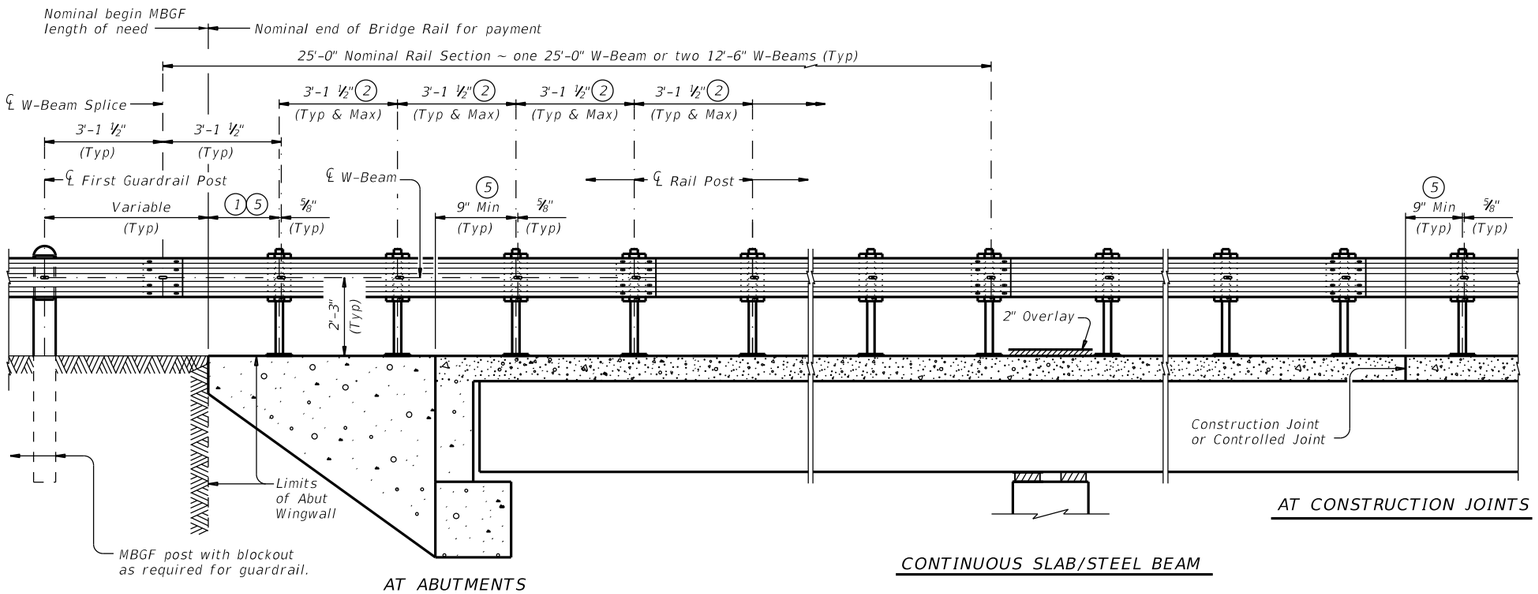
Texas Department of Transportation

RETROFIT TRAFFIC RAIL DETAILS
(SH 171 @ COTTONWOOD CREEK)

(STR.#037) TYPE T631

FILE: COTTONRETRO.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT •	SHEET
REVISIONS	WACO	6		166
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HILL		0019 03 028	SH 171

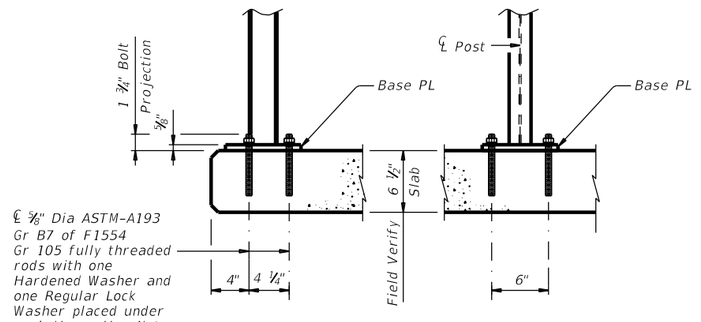
Etc.



PART ROADWAY ELEVATION OF RAIL

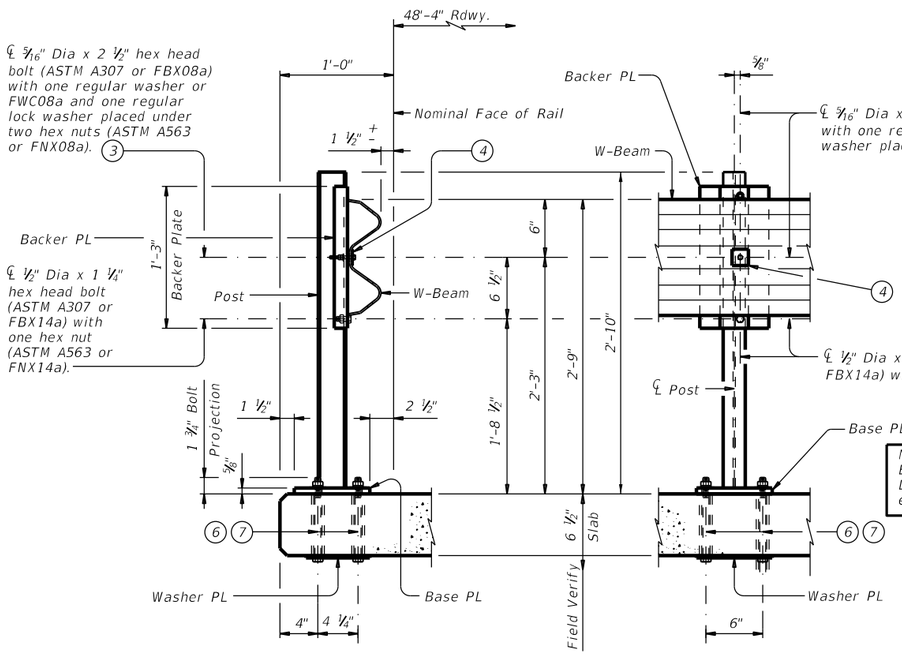
Showing with overlay.

Note:
Do not attach Base Plates over existing Overlay.



RAIL DETAILS ON BRIDGE SLAB

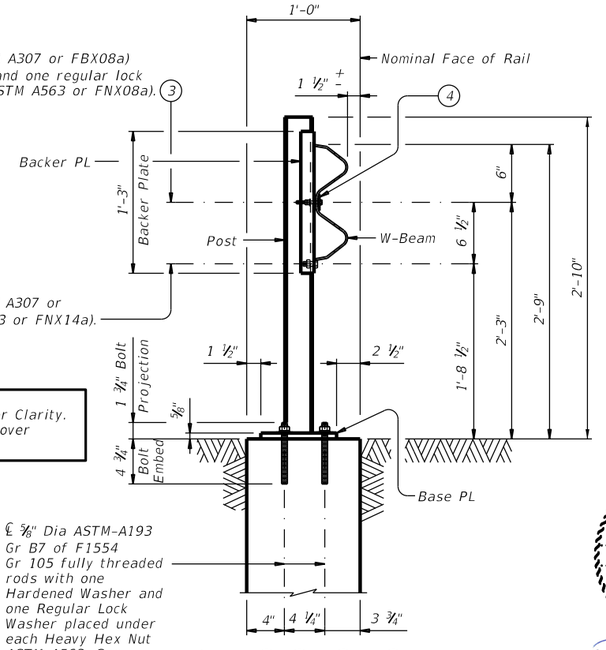
OPTIONAL ANCHORAGE



RAIL DETAILS ON BRIDGE SLAB

Note: Dimensions shown to accommodate existing Overlay.

Note:
Existing Overlay omitted for Clarity.
Do not attach Base Plates over existing Overlay.



RAIL SECTION ON ABUTMENT WINGWALL

Note: Dimensions shown to accommodate existing Overlay.

(1) 9" Min, 5'-9" Max

(2) Maintain 3'-1 ½" Rail Post spacing wherever possible for use with nominal 25'-0" or 12'-6" W-Beam sections. Symmetry of post spacing on both sides and along the structure is not necessary.

(3) Tighten the first hex nut by hand until the top and bottom edges of the W-Beam engage the Backer Plate (Backer Plate should be snug against the post). Then tighten hex nut one revolution with wrench and secure with the second hex nut.

(4) PL ⅛ x 1 ¾ x 1¾ with ⅜ Dia Hole centered in PL (ASTM A36). Square Guardrail Washer (FWR01).

(5) The post nearest to a slab joint or end of structure may be shifted up to 9" in order to satisfy the minimum offset dimension. Drill a new ¾" Dia hole on the centerline of W-beam for shifted post. Paint hole with two coats of zinc-rich paint conforming to the Item "Galvanizing". All other posts must remain on the typical spacing.

(6) ℄ ⅞" Dia holes. Core drill holes through existing deck (percussion drilling not permitted). Concrete spalls in the bottom of deck exceeding ½" from edge of holes will be patched in accordance with Item 429, "Concrete Structure Repair" at the Contactor's expense.

(7) ℄ ⅝" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack weled for each threaded rod.

SHEET 2 OF 3 SHEETS

Texas Department of Transportation

RETROFIT TRAFFIC RAIL DETAILS

(SH 171 @ COTTONWOOD CREEK)

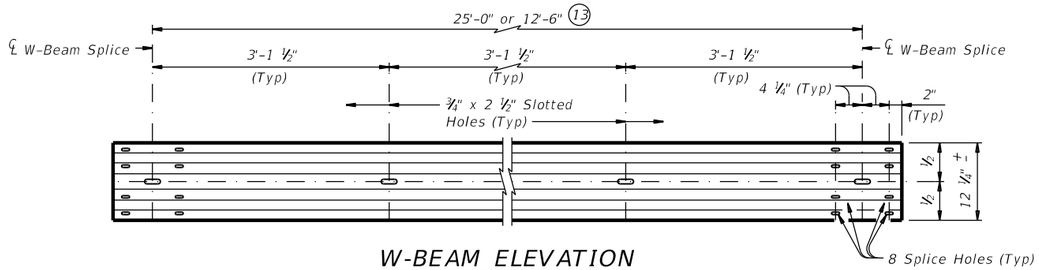
(STR.#037) TYPE T631

STATE OF TEXAS
PAUL F. CEPAK
85408
LICENSED
PROFESSIONAL ENGINEER

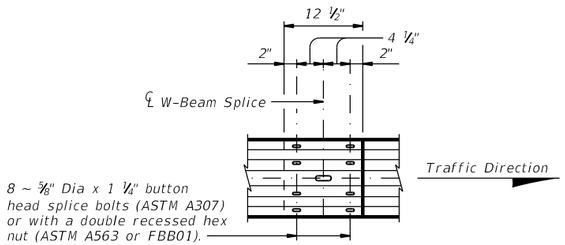
Paul F. Cepak, P.E.
05/25/2022

FILE: COTTONRETRO.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT •	SHEET
REVISIONS	WACO	6		167
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HILL	0019	03	028	SH 171

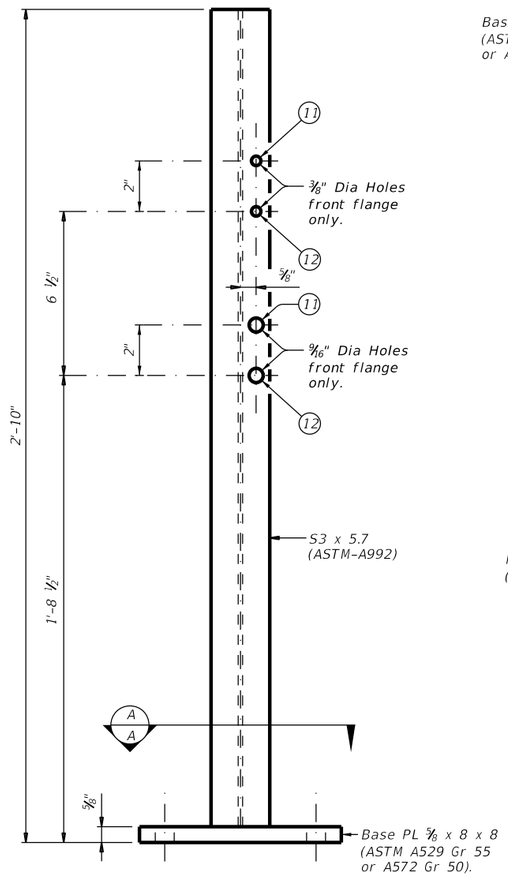
Etc.



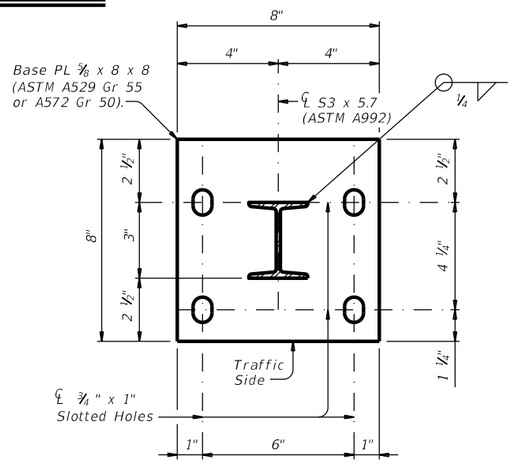
W-BEAM ELEVATION



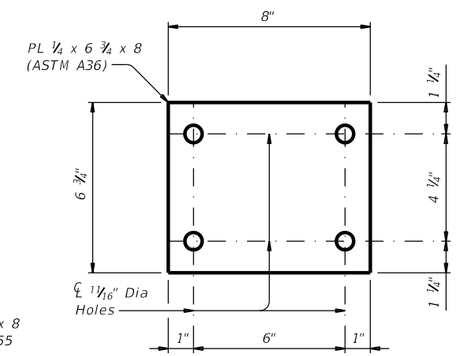
W-BEAM SPLICE ELEVATION



POST ELEVATION

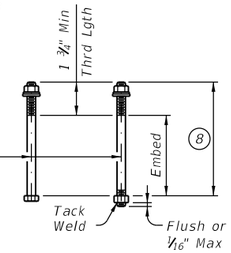


SECTION A-A



WASHER PLATE DETAIL

℄ ⅝" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod.



CAST-IN-PLACE & FORMED HOLE ANCHOR BOLT OPTIONS (9)

(8) See "Rail Details On Bridge Slab" and/or "Rail Section On Abutment Wingwall".

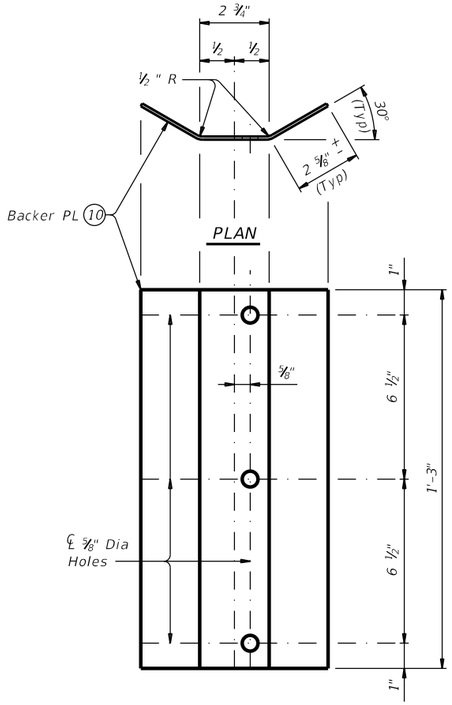
(9) See "Material Notes" for anchor bolt information.

(10) Backer PL ⅛ x 8 x 1'-3" (ASTM A1011 CS or SS Gr 33, or A1008 CS or SS Gr 33 (11 Gage acceptable)).

(11) Used for structures with overlay.

(12) Used for structures without overlay.

(13) At the nominal end of the bridge rail for payment, one 9'-4 ½" or 6'-3" W-beam section is permitted in order to achieve the required W-Beam splice location on the MBGF.



ELEVATION

BACKER PLATE

MBGF AND END TREATMENT NOTES:

This traffic railing must be anchored by metal beam guard fence (MBGF) and guard fence end treatments. Determine MBGF length of need in accordance with the Roadway Design Manual, unless otherwise specified. The minimum MBGF length of need required for anchoring the railing is 25' of MBGF plus the appropriate end treatment.

CONSTRUCTION NOTES:

Face of rail post must be plumb unless otherwise approved by the Engineer. Post must be perpendicular to adjacent roadway grade. Use epoxy mortar under post base plates if gaps larger than 1/16" exist.

Fully anchored guardrail must be attached to each end of rail. A metal beam guard fence transition is not used with this rail.

At the Contractor's option anchor bolts may be an adhesive anchor system. See "Material Notes".

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

It is recommended to show a Rail Layout with rail posts and W-beam splices. Fabricator must submit erection drawings to the Engineer for approval.

Round or chamfer exposed edges of rail post and backer plate to approximately 1/16" by grinding.

Shop drawings are not required for this rail.

MATERIAL NOTES:

Galvanize all steel components.

Anchor bolts for base plate must be ⅝" Dia ASTM F3125 Gr A325 or A449 bolts (or ASTM A193 Gr B7 or F1554 Gr 105 threaded rods with one tack welded heavy hex nut each) with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements.

Optional adhesive anchorage system must be ⅝" Dia ASTM A193 Gr B7 or F1554 Gr 105 fully threaded rods with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements. Embed fully threaded rod into slab and/or abutment wingwall using a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4 ¾". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 8 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing."

W-beam must meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified in the plans. The Contractor may furnish rail elements of 25'-0" or 12'-6" (Nominal) lengths and a single rail element of 9'-4 ½" or 6'-3" (Nominal) length.

W-Beam must have slotted holes at 3'-1 ½".

Some part numbers from the "Task Force 13" Guide to Standardized Highway Barrier Hardware have been furnished for quick reference.

GENERAL NOTES:

This railing has been successfully evaluated by full-scale crash test to meet MASH TL-3 criteria. This railing can be used for speeds of 50 mph and greater.

This rail is designed to deflect approximately 4' to 4'-6" as it contains and redirects the errant vehicle. This rail may not be installed on top of or behind curbs that project above finished grade, on bridges with expansion joints providing more than 5" movement, on retaining walls, or on grade separations and interchanges.

Repairs to impact-damaged post and base plate unit are not permitted. Replace all impact-damaged posts with a new post and base plate unit.

Average weight of railing with no overlay: 20 plf total.

SHEET 3 0F 3 SHEETS

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RETROFIT TRAFFIC RAIL DETAILS

(SH 171 @ COTTONWOOD CREEK)

(STR.#037) TYPE T631

STATE OF TEXAS
PAUL F. CEPAK
85408
LICENSED
PROFESSIONAL ENGINEER

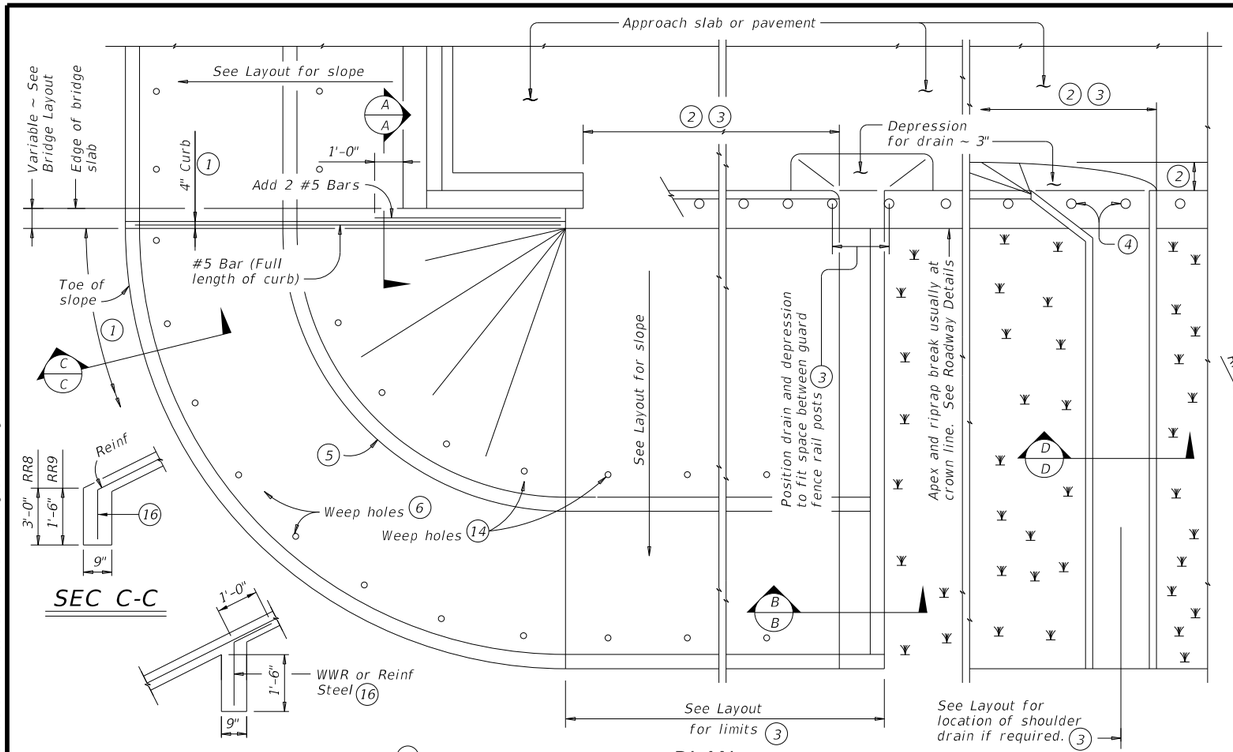
Paul F. Cepak, P.E.

05/25/2022

FILE: COTTONRETRO.DGN	DN: DOT	CK: DOT	DW: GNH	CK: DOT
ORIG DATE: AUG. 2021	DIST	FED REG	FEDERAL AID PROJECT	SHEET
REVISIONS	WACO	6		168
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HILL		0019	03	028	SH 171

Etc.

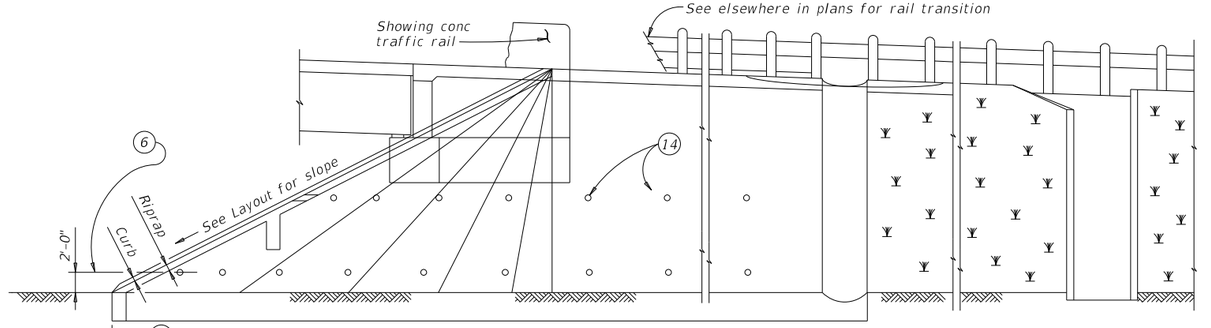
DATE: 04/29/2022 04:14 PM
FILE: DOCUMENT NAME



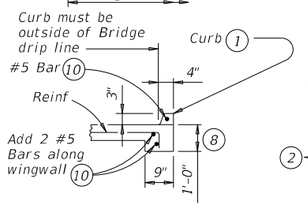
PLAN

SEC C-C

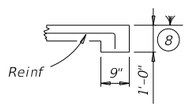
INTERMEDIATE TOEWALL



ELEVATION

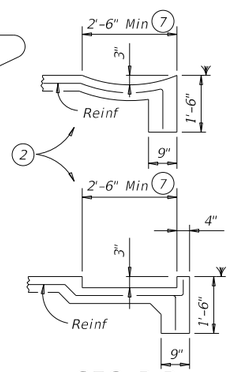


SEC A-A



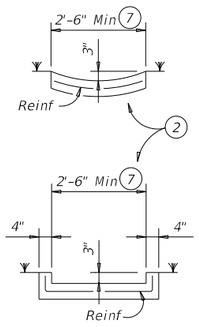
SEC B-B

(No drain)



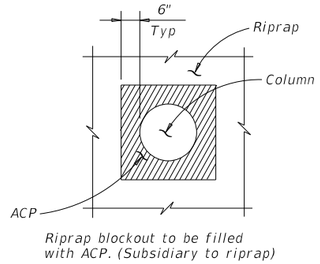
SEC B-B

(Shoulder drain integral with riprap)



SEC D-D

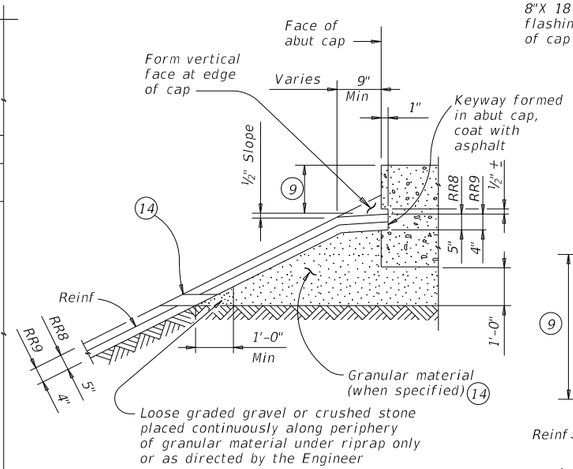
(Shoulder drain)



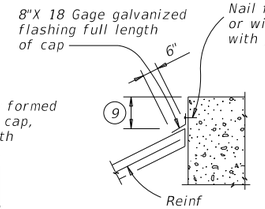
Riprap blockout to be filled with ACP. (Subsidiary to riprap)

RIPRAP DETAIL AT COLUMNS

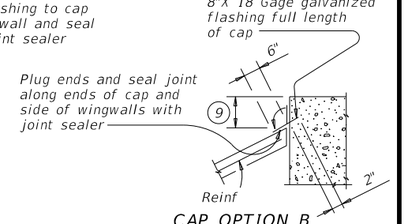
(As directed by the Engineer)



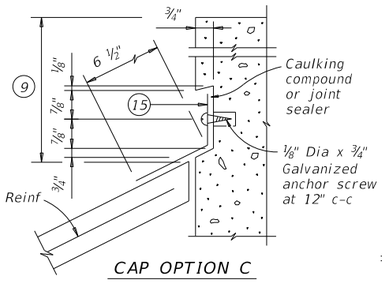
SHOWING KEYWAY OPTION



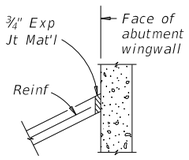
CAP OPTION A



CAP OPTION B

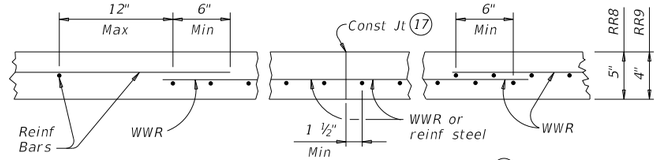


CAP OPTION C



SECT THRU RIPRAP AT WINGWALL (12)

SECTIONS THRU RIPRAP AT CAP (11)



REINFORCEMENT DETAILS (13)

See General Notes for optional synthetic fiber reinforcement.

(1) When riprap is shown extended around header on layout, extend slab and toewall as shown and eliminate 4" curb.

(2) Limits and configuration of drains and depressions are as shown elsewhere in plans or as directed by the Engineer.

(3) Location of shoulder drain must consider limitations imposed by rail transition. Do not locate shoulder drains at expansion joints between approach slab and concrete pavement.

(4) See details elsewhere in plans for installation of guard fence posts through concrete riprap.

(5) Provide intermediate toewall only when designated elsewhere in the plans or included in the specifications.

(6) Provide lower level of 2" Dia weep holes at 10' c-c backed by 1 CF packet of gravel and galvanized hardware cloth at all locations unless directed by the Engineer to eliminate.

(7) Use wider or other drain configurations if shown elsewhere in plans or if directed by the Engineer.

(8) Wall extension may be reduced or modified if approved by the Engineer. Increase wall extension to 1'-6" whenever the optional intermediate toewall is called for in the plans.

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

(10) #5 bars shown are required even when synthetic fiber reinforcing option is selected.

(11) Provide sealing option for joint between the face of cap and riprap as designated by the Engineer or as shown elsewhere on plans.

(12) Flashing (shown in Cap Option A) may be used at wingwall in addition to Exp Jt Mat'l if shown on plans or directed by the Engineer.

(13) Provide #3 reinforcing bars at 18" Spa c-c. Provide Welded Wire Reinforcement (WWR) as 6x6-D2.9xD2.9 or D3xD3. Combinations of WWR and reinforcing bars may be used if both are permitted. Use lap splices of a minimum 6 inches, measured from the transverse wire of WWR, and the ends of reinforcing bars.

(14) If granular material is specified, provide upper level of 2" Dia weep holes at 10' c-c backed by galvanized hardware cloth.

(15) 8" x 18 Gage Galv Sheet Metal

(16) Provide WWR or #3 bars, with 1'-0" extension into slope.

(17) WWR or reinforcing steel is continuous through riprap construction joints. Provide WWR or reinforcing steel that extends 1'-1" minimum into adjacent riprap on each side of construction joint even if synthetic reinforcing fiber is utilized.

FOR CONTRACTOR'S INFORMATION ONLY:
5" of RR8 = 0.015 CY/SF
4" of RR9 = 0.012 CY/SF
#3 Reinf at 18" c-c = 0.501 Lbs/SF
6x6-D3xD3 = 0.408 Lbs/SF

GENERAL NOTES:

Provide Class "B" concrete (f'c = 2,000 psi) unless noted elsewhere in plans.

Provide Grade 60 reinforcing steel.

Provide deformed welded wire reinforcement (WWR) meeting ASTM A1064, unless otherwise shown.

Provide reinforcing bars, deformed WWR, or any suitable combination of both types for riprap reinforcing, unless specified elsewhere in the plans.

Optionally synthetic fibers may be used if approved by the Engineer. Provide synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) in lieu of steel reinforcing in riprap concrete.

Install construction joints or grooved joints extending the full slant slope height at intervals of approximately 20 feet unless otherwise directed by the Engineer.

Hardware cloth, loose grade stone behind weep holes, flashing, or other sealing material are subsidiary to the bid item "Riprap".

See Layout for limits of riprap.

RR8 is to be used on stream crossings.

RR9 is to be used on other embankments.

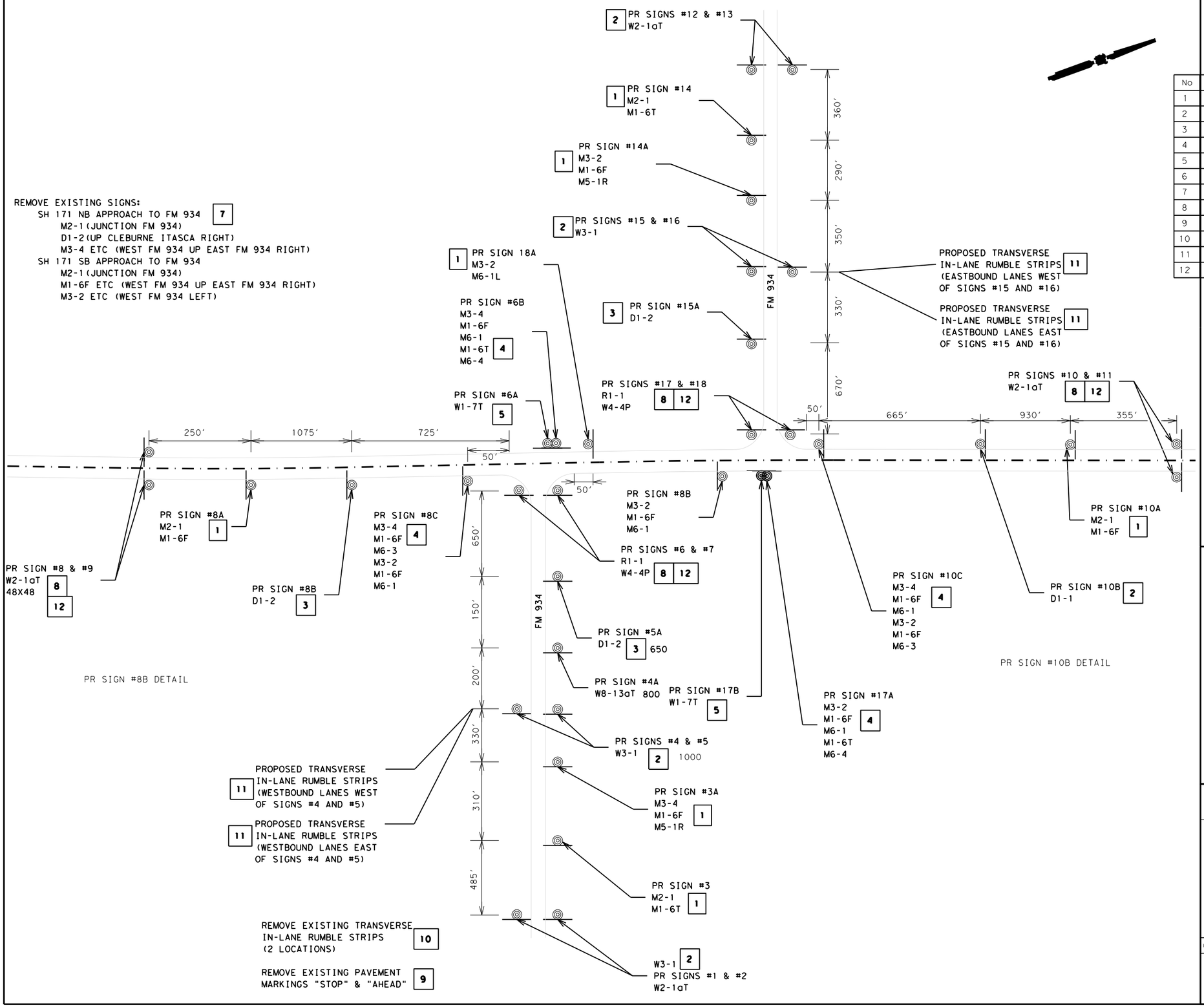
Texas Department of Transportation

Bridge Division Standard

CONCRETE RIPRAP AND SHOULDER DRAINS
EMBANKMENTS AT BRIDGE ENDS (TYPES RR8 & RR9)

CRR

FILE: crrstde1-19.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028, Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		169



REMOVE EXISTING SIGNS: 7
- SH 171 NB APPROACH TO FM 934
  - M2-1 (JUNCTION FM 934)
  - D1-2 (UP CLEBURNE ITASCA RIGHT)
  - M3-4 ETC (WEST FM 934 UP EAST FM 934 RIGHT)
- SH 171 SB APPROACH TO FM 934
  - M2-1 (JUNCTION FM 934)
  - M1-6F ETC (WEST FM 934 UP EAST FM 934 RIGHT)
  - M3-2 ETC (WEST FM 934 LEFT)

NOTES:

1. ALL LED SIGNS TO BE 48"X48"(OVERSIZED), SOLAR POWERED AND VEHICLE ACTIVATED.
2. SEE SIGN DETAILS FOR MORE INFORMATION.

No	Item	Description	Unit	Qty
1	0644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	9
2	0644-6004	IN SM RD SN SUP&AM TY10BWG(1)SA(T)	EA	9
3	0644-6030	IN SM RD SN SUP&AM TYS80(1)SA(T)	EA	2
4	0644-6033	IN SM RD SN SUP&AM TYS80(1)SA(U)	EA	4
5	0644-6051	IN SM RD SN SUP&AM TYS80(2)SA(P-EXAL	EA	2
6	0644-6070	RELOCATE SM RD SN SUP&AM TY S80	EA	
7	0644-6076	REMOVE SM RD SN SUP&AM	EA	19
8	0644-6094	ISRSA TY10BWG(1)SA(T) (EXCLUDING SIGN	EA	8
9	0677-6012	ELIM EXT PAV MRK & MRKS (WORD)	EA	2
10	0677-6028	ELIM EXT PV MRK & MRKS (RUMBLE STRIP	LF	80
11	6056-6001	PREFORMED IN-LANE(TRANS) RUMBLE STRI	LF	##
12	6368-6001	SOLAR POWERED LED SIGN	EA	8

REMOVE EXISTING SIGNS: 7
- FM 934 WB APPROACH TO SH 171
  - W3-1 (STOP SIGN AHEAD)
  - W8-13aT (BRIDGE MAY ICE IN COLD WEATHER)
  - D1-2 (CLEBURNE RIGHT HILLSBORO LEFT)
  - R1-1 (STOP)
  - M2-1 (JUNCTION SH 171)
  - M3-4 ETC (SH 171/WEST FM 934 RIGHT ARROW)
  - W1-7T (T-INTERSECTION)
- FM 934 EB APPROACH TO SH 171
  - W3-1 (STOP SIGN AHEAD)
  - D1-2 (LEFT COVINGTON HILLSBORO RIGHT)
  - M2-1 (JUNCTION SH 171)
  - R1-1 (STOP)
  - M3-4 ETC (SH 171/EAST FM 934 RIGHT ARROW)
  - W1-7T (T-INTERSECTION)

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED PROFESSIONAL ENGINEER

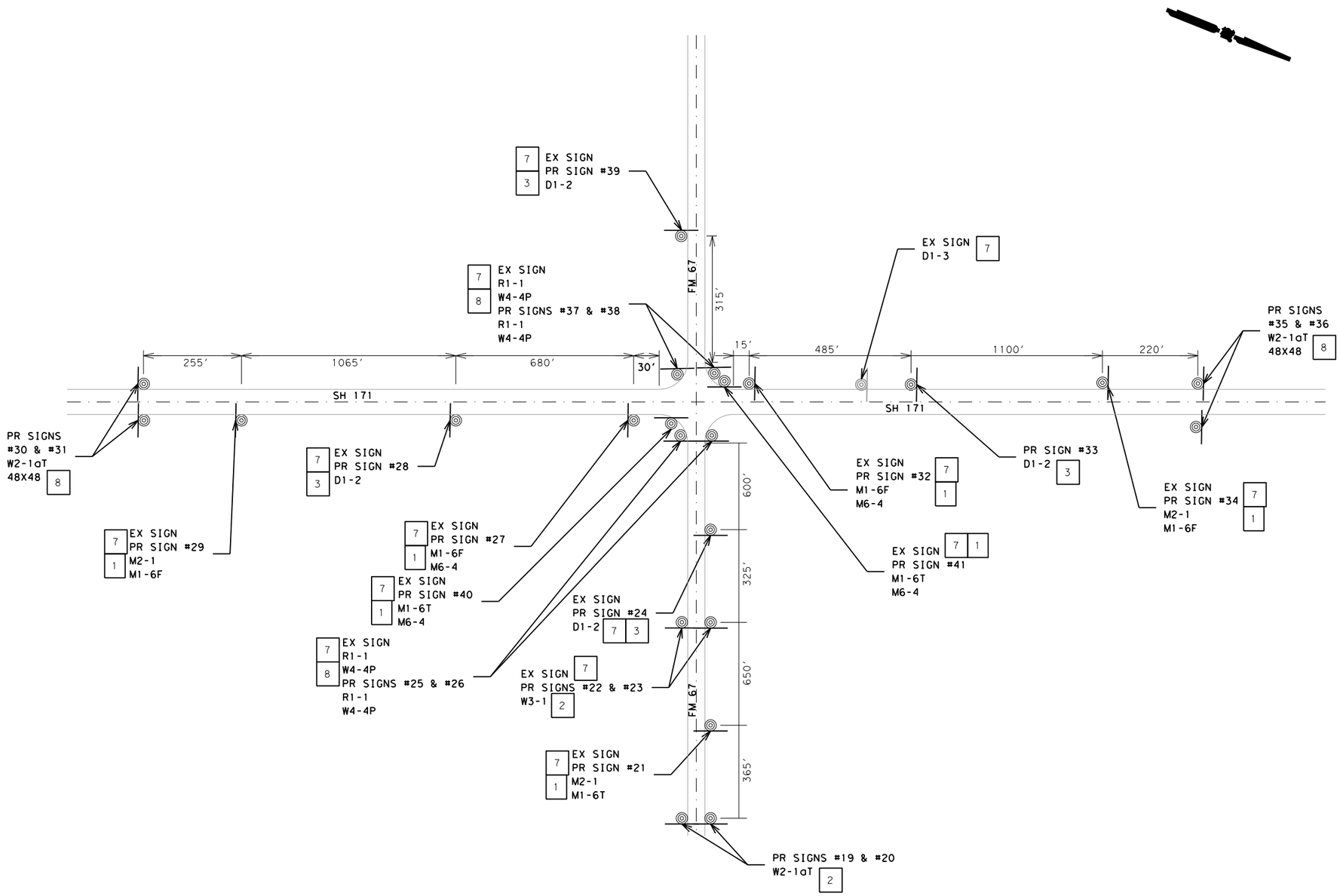
Chris J. Mashek, P.E. — 5/19/2022
SIGNATURE OF REGISTRANT & DATE

SIGN LAYOUTS

SH 171 AT FM 934

SHEET 1 OF 2 NTS

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		170



NOTES:

1. ALL LED SIGNS TO BE 48"X48"(OVERSIZED), SOLAR POWERED AND VEHICLE ACTIVATED.
2. SEE SIGN DETAILS FOR MORE INFORMATION.

No	Item	Description	Unit	Qty
1	0644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	7
2	0644-6004	IN SM RD SN SUP&AM TY10BWG(1)SA(T)	EA	4
3	0644-6030	IN SM RD SN SUP&AM TYS80(1)SA(T)	EA	4
4	0644-6033	IN SM RD SN SUP&AM TYS80(1)SA(U)	EA	
5	0644-6051	IN SM RD SN SUP&AM TYS80(2)SA(P-EXAL	EA	
6	0644-6070	RELOCATE SM RD SN SUP&AM TY S80	EA	
7	0644-6076	REMOVE SM RD SN SUP&AM	EA	14
8	0644-6094	ISRSA TY10BWG(1)SA(T) (EXCLUDING SIGN	EA	8
9	0677-6012	ELIM EXT PAV MRK & MRKS (WORD)	EA	
10	0677-6028	ELIM EXT PV MRK & MRKS (RUMBLE STRIP	LF	
11	6056-6001	PREFORMED IN-LANE(TRANS) RUMBLE STRI	LF	
12	6368-6001	SOLAR POWERED LED SIGN	EA	8

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

SIGN LAYOUT

SH 171 AT FM 67

SHEET 2 OF 2 NTS

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		171

DATE: 5/19/2022 6:11:19 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\0019030284 - Design\Plan Set\8. Traffic\sums16.dgn

PROPOSED SMALL SIGN DATA SHEET

SHEET	SIGN	DST FROM INT ROAD (FOR CONTRACTOR INFO ONLY)		ID	LEGEND OR TYPE	SIGN WIDTH (IN)	SIGN HEIGHT (IN)	SIGN AREA (SF)	SIGN AREA (TOTAL) (SF)	PANEL	POST SIZE	NO. OF POST	ANCHOR TYPE	SIGN MOUNT
1	01	SH 171 @ FM 934	2125′	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	16.0	TY A	10 BWG	1	SA	T
1	02	SH 171 @ FM 934	2125′	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	16.0	TY A	10 BWG	1	SA	T
1	03	SH 171 @ FM 934	1640′	M2-1	JUNCTION	30	24	5.0	14.0	TY A	10 BWG	1	SA	P
				M1-6T	SH 171	36	36	9.0						
1	3A	SH 171 @ FM 934	1330′	M3-4	WEST	24	12	2.0	8.2	TY A	10 BWG	1	SA	P
				M1-6F	FM 934	24	24	4.0						
				M5-1R	RIGHT ARROW	21	15	2.2						
1	04	SH 171 @ FM 934	1000′	W3-1	STOP AHEAD	48	48	16.0	48.0	TY A	10 BWG	1	SA	T
	4A	SH 171 @ FM 934	800′	W8-13aT	BRIDGE MAY ICE IN COLD WEATHER	36	36	9.0	48.0	TY A	10 BWG	1	SA	P
1	05	SH 171 @ FM 934	1000′	W3-1	STOP AHEAD	48	48	16.0	48.0	TY A	10 BWG	1	SA	T
1	5A	SH 171 @ FM 934	650′	D1-2	LT HILLSBORO; COVINGTON RT	90	30	18.8	18.8	TY A	S 80	1	SA	T
1	06	SH 171 @ FM 934		R1-1	STOP	48	48	16.0	20.5	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
				W4-4P	CROSS TRAFFIC DOES NOT STOP	36	18	4.5						
1	6B	SH 171 @ FM 934		M3-4	WEST	24	12	2.0	19.4	TY A	S 80	1	SA	U
				M1-6F	FM 934	24	24	4.0						
				M6-1	RIGHT ARROW	21	15	2.2						
				M1-6T	SH 171	36	36	9.0						
				M6-4	LEFT & RIGHT ARROW	21	15	2.2						
1	6A	SH 171 @ FM 934		W1-7T	T INTSCTN-LEFT & RIGHT ARROW	96	36	24.0	24.0	TY G	S 80	2	SA	P-EXAL
1	07	SH 171 @ FM 934		R1-1	STOP	48	48	16.0	20.5	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
				W4-4P	CROSS TRAFFIC DOES NOT STOP	36	18	4.5						
1	08	SH 171 @ FM 934	2050′	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0		TY A	10 BWG	1	SA	T-EXCLUDING SIGN
1	8A	SH 171 @ FM 934	1800′	M2-1	JUNCTION	30	24	5.0	9.0	TY A	10 BWG	1	SA	P
				M1-6F	FM 934	24	24	4.0						
1	8B	SH 171 @ FM 934	725′	D1-2	UP ARROW CLEBURNE; ITASCA RIGHT ARROW	78	30	16.3	16.3	TY A	S 80	1	SA	T
1	8C	SH 171 @ FM 934		M3-4	WEST	24	12	2.0	16.4	TY A	S 80	1	SA	U
				M1-6F	FM 934	24	24	4.0						
				M6-3	UP ARROW	21	15	2.2						
				M3-2	EAST	24	12	2.0						
				M1-6F	FM 934	24	24	4.0						
				M6-1	RIGHT ARROW	21	15	2.2						
1	09	SH 171 @ FM 934	2050′	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0		TY A	10 BWG	1	SA	T-EXCLUDING SIGN
1	10	SH 171 @ FM 934	2000′	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0		TY A	10 BWG	1	SA	T-EXCLUDING SIGN
1	10A	SH 171 @ FM 934	1645′	M2-1	JUNCTION	30	24	5.0	9.0	TY A	10 BWG	1	SA	P
				M1-6F	FM 934	24	24	4.0						
1	10B	SH 171 @ FM 934	715′	D1-1	HILLSBORO UP ARROW	78	18	9.8	9.8	TY A	10 BWG	1	SA	T
1	10C	SH 171 @ FM 934		M3-4	WEST	24	12	2.0	16.4	TY A	S 80	1	SA	U
				M1-6F	FM 934	24	24	4.0						
				M6-1	RIGHT ARROW	21	15	2.2						
				M3-2	EAST	24	12	2.0						
				M1-6F	FM 934	24	24	4.0						
				M6-3	UP ARROW	21	15	2.2						
1	11	SH 171 @ FM 934	2000′	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	86.2	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
1	12	SH 171 @ FM 934	2000′	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	104.9	TY A	10 BWG	1	SA	T
1	13	SH 171 @ FM 934	2000′	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	104.9	TY A	10 BWG	1	SA	T
1	14	SH 171 @ FM 934	1640′	M2-1	JUNCTION	30	24	5.0	93.4	TY A	10 BWG	1	SA	P
				M1-6T	SH 171	36	36	9.0	131.8					
1	14A	SH 171 @ FM 934	1350′	M3-2	EAST	24	12	2.0	8.2	TY A	10 BWG	1	SA	P
				M1-6F	FM 934	24	24	4.0						
				M5-1R	RIGHT ARROW	21	15	2.2						
1	15	SH 171 @ FM 934		W3-1	STOP AHEAD	48	48	16.0	130.6	TY A	10 BWG	1	SA	T
1	15A	SH 171 @ FM 934		D1-2	LEFT ARROW COVINGTON; HILLSBORO RIGHT ARROW	90	30	18.8	18.8	TY A	S 80	1	SA	T
1	16	SH 171 @ FM 934		W3-1	STOP AHEAD	48	48	16.0	100.4	TY A	10 BWG	1	SA	T
1	17	SH 171 @ FM 934		R1-1	STOP	48	48	16.0	84.4	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
				W4-4P	CROSS TRAFFIC DOES NOT STOP	36	18	4.5	76.6					
1	17A	SH 171 @ FM 934		M3-2	EAST	24	12	2.0	19.4	TY A	S 80	1	SA	U
				M1-6F	FM 934	24	24	4.0						
				M6-1	RIGHT ARROW	21	15	2.2						
				M1-6T	SH 171	36	36	9.0						
				M6-4	LEFT & RIGHT ARROW	21	15	2.2						
1	17B	SH 171 @ FM 934		W1-7T	T INTSCTN-LEFT & RIGHT ARROW	96	36	24.0	68.7	TY G	S 80	2	SA	P-EXAL
1	18	SH 171 @ FM 934		R1-1	STOP	48	48	16.0	60.7	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
				W4-4P	CROSS TRAFFIC DOES NOT STOP	36	18	4.5	49.7					
1	18A	SH 171 @ FM 934		M3-2	EAST	24	12	2.0	8.2	TY A	10 BWG	1	SA	P
				M1-6F	FM 934	24	24	4.0						
				M6-1L	LEFT ARROW	21	15	2.2						

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

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

http://www.txdot.gov/

NOTE:

1. Sign supports shall be located as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise shown on the plans, the Contractor shall stake and the Engineer will verify all sign support locations.
2. For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS)Standard Sheet.
3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

Texas Department of Transportation

SUMMARY OF SMALL SIGNS

SHEET 1 OF 2 **SOSS**

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
4-16	DIST	COUNTY		SHEET NO.
8-16	WAC	HILL		172

PROPOSED SMALL SIGN DATA SHEET

SHEET	SIGN	DST FROM INT ROAD (FOR CONTRACTOR INFO ONLY)		ID	LEGEND OR TYPE	SIGN WIDTH (IN)	SIGN HEIGHT (IN)	SIGN AREA (SF)	SIGN AREA (TOTAL) (SF)	PANEL	POST SIZE	NO. OF POST	ANCHOR TYPE	SIGN MOUNT
2	19	SH 171 @ FM 67	1940'	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	16.0	TY A	10 BWG	1	SA	T
2	20	SH 171 @ FM 67	1940'	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	16.0	TY A	10 BWG	1	SA	T
2	21	SH 171 @ FM 67	1575'	M2-1	JUNCTION	30	24	5.0	14.0	TY A	10 BWG	1	SA	P
				M1-6T	SH 171	36	36	9.0	79.0					
2	22	SH 171 @ FM 67	925'	W3-1	STOP AHEAD	48	48	16.0	16.0	TY A	10 BWG	1	SA	T
2	23	SH 171 @ FM 67	925'	W3-1	STOP AHEAD	48	48	16.0	48.0	TY A	10 BWG	1	SA	T
2	24	SH 171 @ FM 67	600'	D1-2	LEFT ARROW HILLSBORO; CLEBURNE RIGHT ARROW	84	30	17.5	17.5	TY A	S 80	1	SA	T
2	25	SH 171 @ FM 67		R1-1	STOP	48	48	16.0	20.5	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
				W4-4P	CROSS TRAFFIC DOES NOT STOP	36	18	4.5						
2	26	SH 171 @ FM 67		R1-1	STOP	48	48	16.0	20.5	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
				W4-4P	CROSS TRAFFIC DOES NOT STOP	36	18	4.5						
2	27	SH 171 @ FM 67	30'	M1-6F	FM 67	24	24	4.0	6.2	TY A	10 BWG	1	SA	P
				M6-1	LEFT ARROW RIGHT ARROW	21	15	2.2						
2	28	SH 171 @ FM 67	710'	D1-2	UP ARROW CLEBURN; LEFT ARROW BLUM	84	30	17.5	17.5	TY A	S 80	1	SA	T
2	29	SH 171 @ FM 68	1775'	M2-1	JUNCTION	30	24	5.0	9.0	TY A	10 BWG	1	SA	P
				M1-6F	FM 934	24	24	4.0						
2	30	SH 171 @ FM 68	2030'	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	16.0	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
2	31	SH 171 @ FM 68	2030'	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	16.0	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
	32	SH 171 @ FM 69	15'	M1-6F	FM 67	24	24	4.0	6.2	TY A	10 BWG	1	SA	P
				M6-1	LEFT ARROW RIGHT ARROW	21	15	2.2						
2	33	SH 171 @ FM 69	500'	D1-2	UP ARROW HILLSBORO; BLUM RIGHT ARROW	78	30	16.3	16.3	TY A	S 80	1	SA	T
2	34	SH 171 @ FM 69	1600'	M2-1	JUNCTION	30	24	5.0	9.0	TY A	10 BWG	1	SA	P
				M1-6F	FM 934	24	24	4.0						
2	35	SH 171 @ FM 69	1820'	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	16.0	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
2	36	SH 171 @ FM 69	1820'	W2-1aT	HIGHWAY INTERSECTION AHEAD	48	48	16.0	16.0	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
2	37	SH 171 @ FM 69		R1-1	STOP	48	48	16.0	20.5	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
				W4-4P	CROSS TRAFFIC DOES NOT STOP	36	18	4.5						
2	38	SH 171 @ FM 69		R1-1	STOP	48	48	16.0	20.5	TY A	10 BWG	1	SA	T-EXCLUDING SIGN
				W4-4P	CROSS TRAFFIC DOES NOT STOP	36	18	4.5						
2	39	SH 171 @ FM 69	315'	D1-2	LEFT ARROW CLEBURNE; HILLSBORO RIGHT ARROW	84	30	17.5	17.5	TY A	S 80	1	SA	T
2	40	SH 171 @ FM 69		M1-6T	SH 171	24	24	4.0	6.2	TY A	10 BWG	1	SA	P
				M6-4	LEFT ARROW RIGHT ARROW	21	15	2.2						
2	41	SH 171 @ FM 69		M1-6T	SH 171	24	24	4.0	6.2	TY A	10 BWG	1	SA	P
				M6-4	LEFT ARROW RIGHT ARROW	21	15	2.2						

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

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http://www.txdot.gov/

NOTE:

1. Sign supports shall be located as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise shown on the plans, the Contractor shall stake and the Engineer will verify all sign support locations.
2. For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS)Standard Sheet.
3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

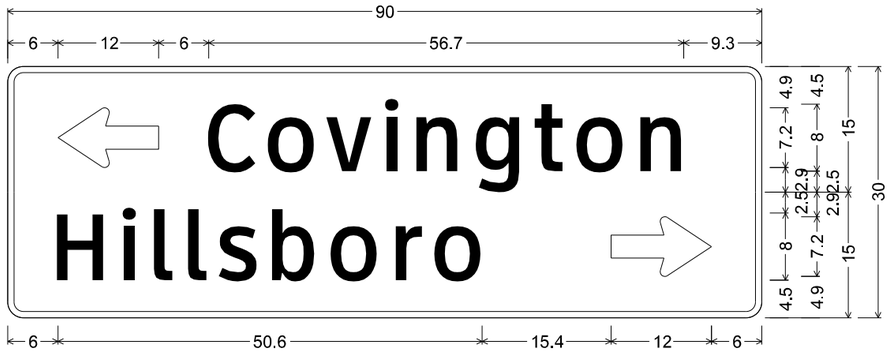
Texas Department of Transportation

SUMMARY OF SMALL SIGNS

SHEET 2 OF 2 **SOSS**

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
4-16	DIST	COUNTY		SHEET NO.
8-16	WAC	HILL		173

PR SIGN #15A DETAIL

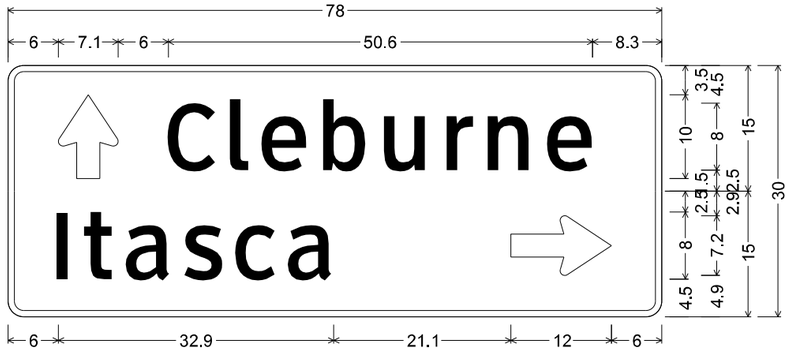


D1-2 8in LT-RT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 12.0" X 7.1" 180"; "Covington", ClearviewHwy-3-W;

1.9" Radius, 0.8" Border, White on, Green;
"Hillsboro", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0';

PR SIGN #8B DETAIL

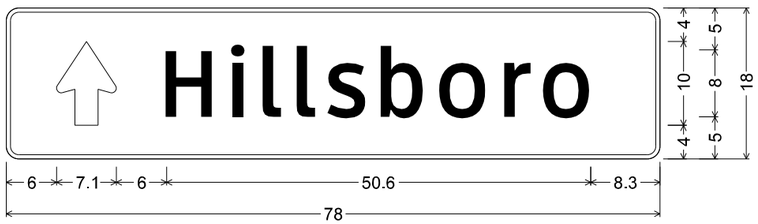


D1-2 8in UP-RT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 10.0" X 7.1" 90"; "Cleburne", ClearviewHwy-3-W;

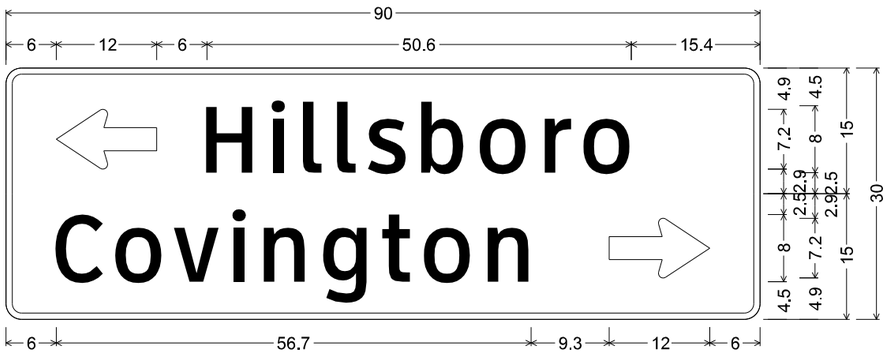
1.9" Radius, 0.8" Border, White on, Green;
"Itasca", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0';

PR SIGN #10B DETAIL



D1-1 8in UP;
1.5" Radius, 0.5" Border, White on, Green;
Standard Arrow Custom 10.0" X 7.1" 90"; "Hillsboro", ClearviewHwy-3-W;

PR SIGN #5A DETAIL



D1-2 8in LT-RT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 12.0" X 7.1" 180"; "Hillsboro", ClearviewHwy-3-W;

1.9" Radius, 0.8" Border, White on, Green;
"Covington", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0';

NOTES:

SEE SIGN LAYOUTS FOR MORE DETAILS.

Chris J. Mashek, P.E. 5/19/2022

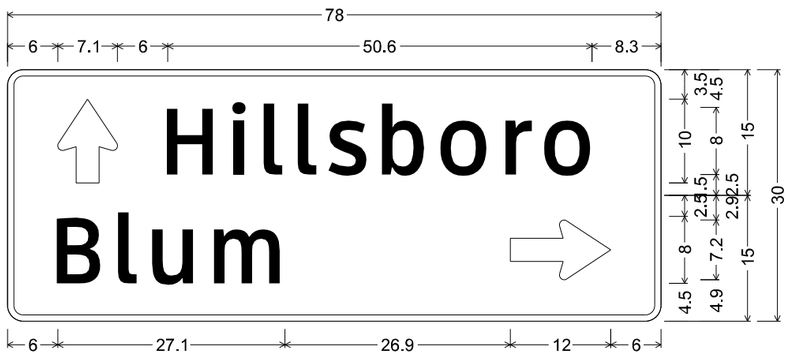
SIGNATURE OF REGISTRANT & DATE

SIGN DETAILS

SHEET 1 OF 2 NTS

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		174

PR SIGN #33 DETAIL

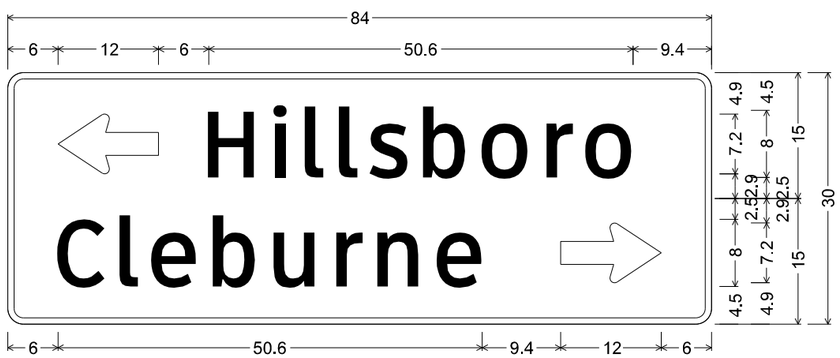


D1-2 8in UP-RT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 10.0" X 7.1" 90'; "Hillsboro", ClearviewHwy-3-W;

1.9" Radius, 0.8" Border, White on, Green;
"Blum", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0';

PR SIGN #24 DETAIL

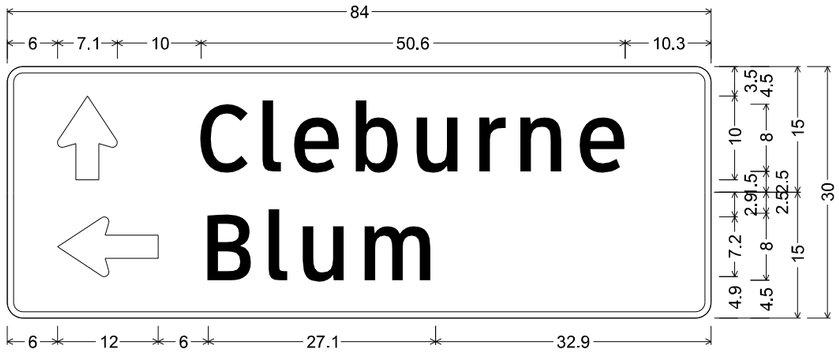


D1-2 8in LT-RT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 12.0" X 7.1" 180'; "Hillsboro", ClearviewHwy-3-W;

1.9" Radius, 0.8" Border, White on, Green;
"Cleburne", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0';

PR SIGN #28 DETAIL

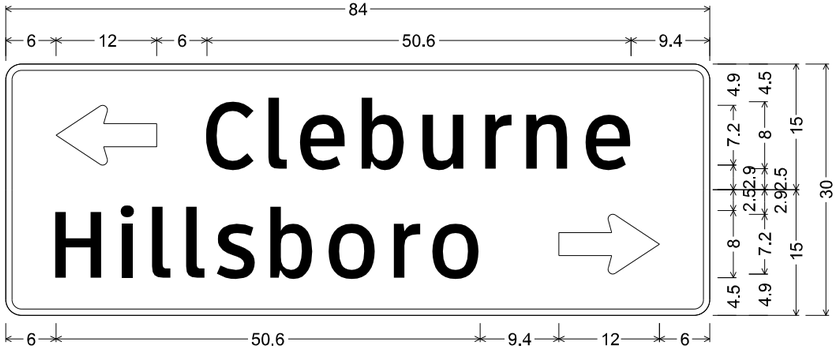


D1-2 8in UP-LT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 10.0" X 7.1" 90'; "Cleburne", ClearviewHwy-3-W;

Sign # : 28;
Sheet # : 2;
1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 12.0" X 7.1" 180'; "Blum", ClearviewHwy-3-W;

PR SIGN #39 DETAIL



D1-2 8in LT-RT;

1.9" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 12.0" X 7.1" 180'; "Cleburne", ClearviewHwy-3-W;

1.9" Radius, 0.8" Border, White on, Green;
"Hillsboro", ClearviewHwy-3-W; Standard Arrow Custom 12.0" X 7.1" 0';

NOTES:

SEE SIGN LAYOUTS FOR MORE DETAILS.

Chris J. Mashek, P.E. 5/19/2022

SIGNATURE OF REGISTRANT & DATE

SIGN DETAILS

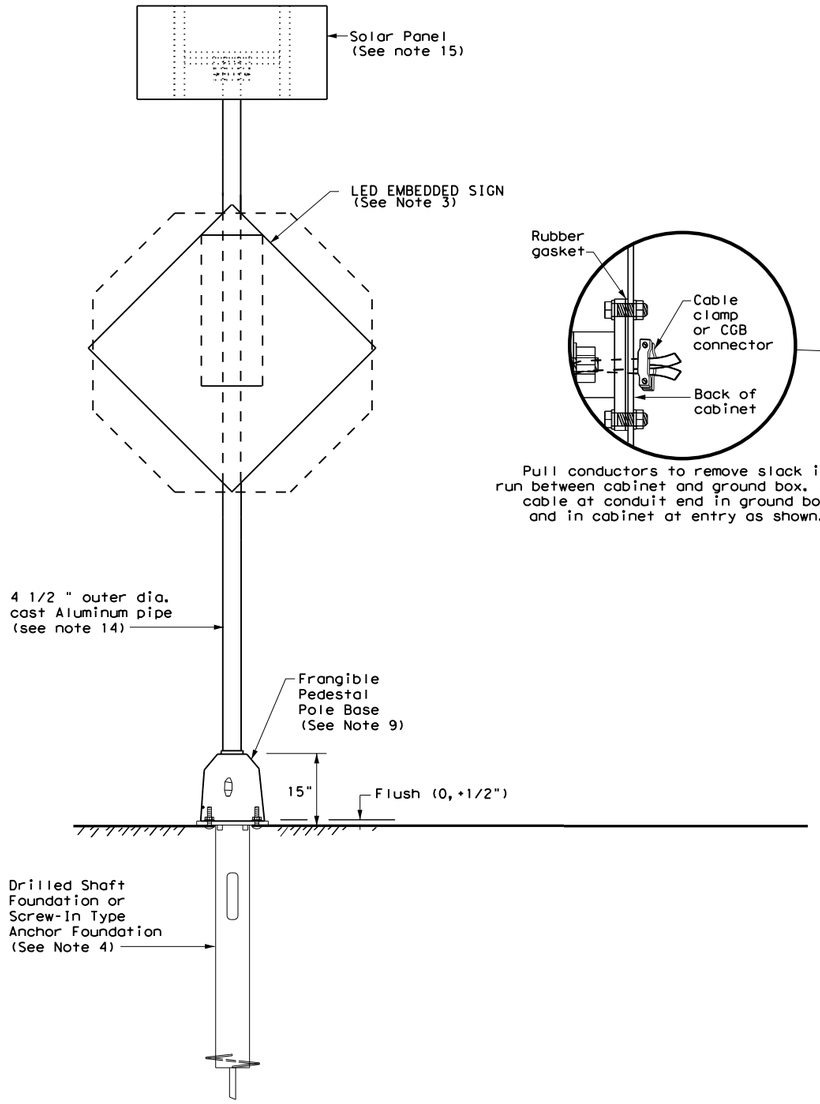
SHEET 2 OF 2 NTS

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	0019	03	028 Etc.	SH 171
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WACO	HILL		175

DATE: 5/31/2022 11:50:22 AM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\07990284 at Hwy 77 Sign\Proposed Signs\spb1-13.dgn

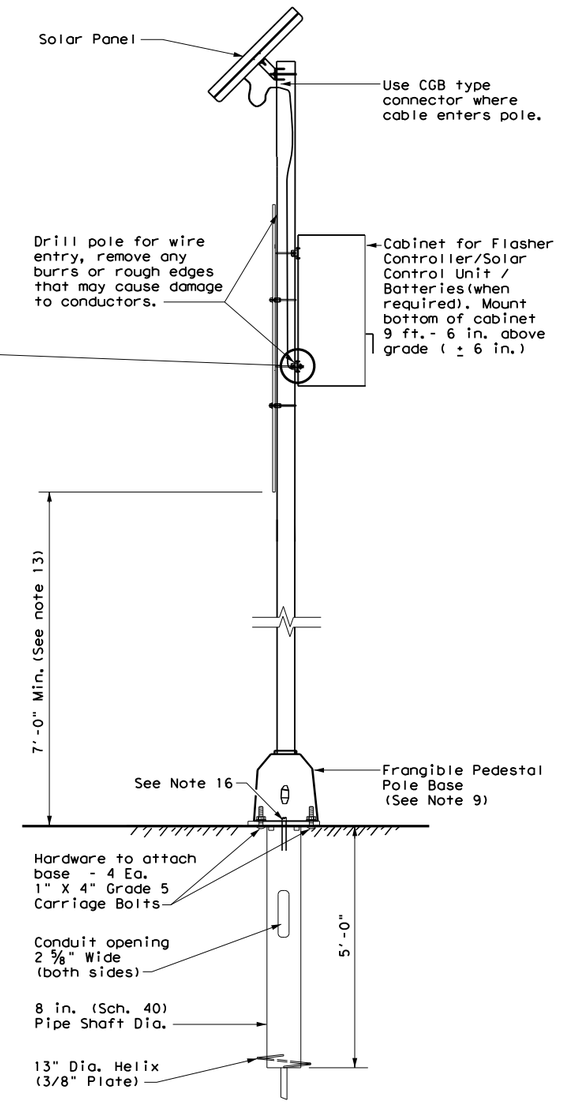
GENERAL NOTES:

1. Details show a typical warning sign with LED embeddment, other arrangements are possible.
2. See Special Specification 6368, "Solar Powered Vehicle Detection Activated LED Embedded Sign" for further requirements.
3. See SMD standard sheets for lateral and vertical clearances and sign mounting details. Install signs as shown on the sign layout sheets.
4. Use either a Screw-In Type Anchor Foundation or a Drilled Shaft Foundation as shown elsewhere in the plans. When plans require a Drilled Shaft Foundation, see standard sheet TS-FD. Install the Screw-In Type Anchor Foundation as per manufacturer's recommendations. On a slope, install one edge at ground level. Screw-In/Drilled Shaft Foundation is subsidiary to Item 685. Installation of a ground rod is not required for solar powered flashing beacon assemblies.
5. When used, provide Screw-In Type Anchor Foundations as shown on TxDOT's Material Producer List (MPL) in the file "Highway Traffic Signals".
6. Use materials specifically designed for attaching cabinets, LED embeded signs, solar panels, etc., to poles.
7. Install LED embedded signs as shown here, as shown elsewhere on the plans, or as directed. Use hardware specifically designed for mounting beacon heads on poles.
8. Conduit in foundation, if required, is subsidiary to the Item 6368, "Solar Powered Vehicle Detection Activated LED Embedded Sign."
9. Per manufacturer's recommendations, engage all threads on the pedestal pole base and pipe unless the pipe is fully seated into base. In high winds, use a pole and base collar assembly to add strength and prevent loosening on connection.
10. Provide single pole non-fused watertight breakaway electrical connectors for frangible pedestal pole bases, as shown on TxDOT's MPL in the file "Roadway Illumination and Electrical Supplies." Approved models are listed under Item 685. For ungrounded (hot) conductors, install a breakaway connector with a dummy fuse slug). For grounded (neutral) conductors, install a breakaway connector with a white colored marking and a permanently installed dummy fuse (slug).
11. Install the batteries in a battery box. Place the batteries on a 3/16" thick plastic sheet and connect together. Place a plastic cover (battery bell jar) over the top of each battery and secure the battery bell jar to the battery with a strap. The batteries, bell jars, straps and 3/16" plastic sheet are subsidiary to the Item 685, "Roadside Flashing Beacon Assemblies." When required, install batteries in the flasher cabinet. Wire batteries according to manufacturers recommendations. Provide the number of batteries as required by the manufacturer.
12. See standard sheet Electrical Details (ED) for additional requirements regarding the installation of ground boxes/battery boxes, conduit, and cabinets.
13. Provide clearance as shown above the sidewalk or pavement grade at the edge of the road. When a bottom beacon is not used, mount the bottom of the sign at least 7 ft. above the sidewalk or pavement grade at the edge of the road.
14. Unless otherwise shown on the plans, pole shaft shall be one piece, Schedule 40 Aluminum pipe, ASTM B429 or B221 (Alloy 6061-T6 only). Aluminum conduit will not develop the necessary strength and will not be allowed.
15. Orient solar panel for optimum exposure to sunlight (face to the south). Prior to installation, check the location to ensure there is no overhead obstruction that would block the solar panel from receiving full sunlight. Unless specified elsewhere, mount a minimum of 14' above grade.
16. Ensure height of conduit is below top of anchor bolts.



FRONT

Pull conductors to remove slack in run between cabinet and ground box. Clamp cable at conduit end in ground box and in cabinet at entry as shown.



SIDE

STATE OF TEXAS
CHRIS J. MASHEK
102242
LICENSED
PROFESSIONAL ENGINEER

Chris J. Mashek, P.E. 5/31/2022
SIGNATURE OF REGISTRANT & DATE

Texas Department of Transportation

SOLAR POWERED LED EMBEDDED SIGN ASSEMBLY DETAILS

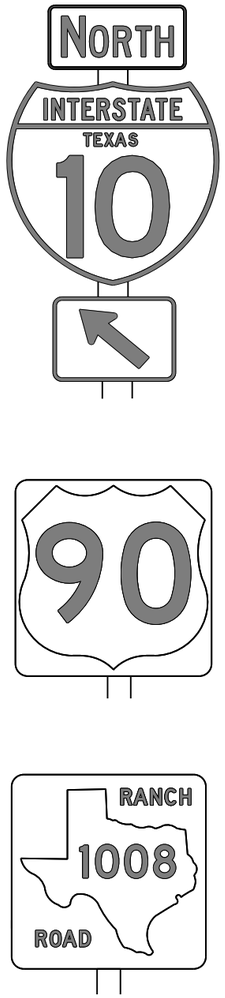
FILE: spb1-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT May 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
12-04	DIST	COUNTY		SHEET NO.
3-13	WAC	HILL		176

75A

DATE: 04/04/2022 11:27 AM
FILE: DOCUMENT NAME

REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

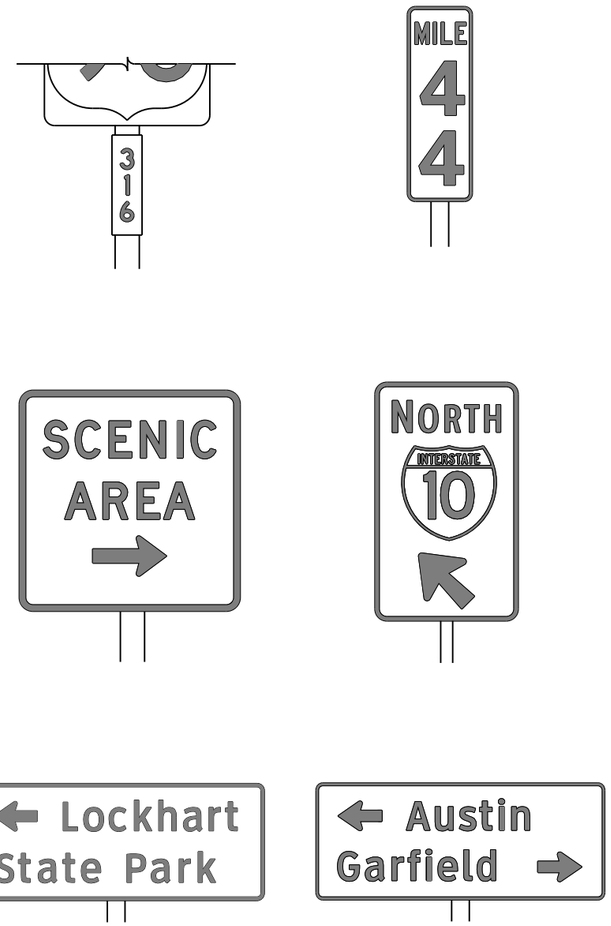
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE A SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B or C SHEETING



TYPICAL EXAMPLES

REQUIREMENTS FOR BLUE, BROWN & GREEN D AND I SERIES GUIDE SIGNS

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	ALL	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE D SHEETING
LEGEND, SYMBOLS & BORDERS	ALL OTHERS	TYPE B OR C SHEETING



TYPICAL EXAMPLES

GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).

2. White legend shall use the Clearview Alphabet. The following Clearview fonts shall be used to replace the existing white Federal Highway Administration (FHWA) Standard Highway Alphabets, when not specified in the SHSD, or in the plans.

B	CV-1W
C	CV-2W
D	CV-3W
E	CV-4W
Emod	CV-5WR
F	CV-6W

3. Route sign legend (ie. IH, US, SH and FM shields) shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets B, C, D, E, Emod or F).

4. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.

5. Independent mounted route sign with white or colored legend and borders shall be applied by screening process with transparent color ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof. White legend, symbols and borders on all other signs shall be cut-out white sheeting applied to colored background sheeting.

6. Information regarding borders and radii for signs is found in the "Standard Highway Sign Designs for Texas". Dimensions shown and described for borders and corner radii on parent sign are nominal. Borders may vary in width as much as 1/2 inch. Corner radii above 3 inches may vary in width as much as 1 inch. Borders and corner radii within a parent sign must be of matching widths. The sign area outside the corner radius should be trimmed or rounded.

7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.

8. Mounting details of roadside signs are shown in the "SMD series" Standard Plan Sheets.

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

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

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

http://www.txdot.gov/

Texas Department of Transportation

Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

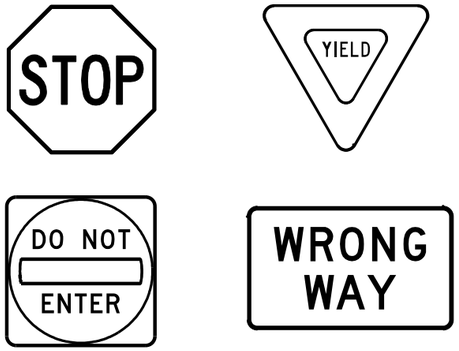
TSR(3)-13

FILE: tsr3-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
12-03 7-13	DIST	COUNTY		SHEET NO.
9-08	WAC	HILL		177

DATE: 5/19/2022 6:11:49 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\0019028Q4 Attachments\Prop\Part 2\Sec 8\prop_part2_sec8_tsr4-13.dgn

REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS

(STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



REQUIREMENTS FOR FOUR SPECIFIC SIGNS ONLY

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	WHITE	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE B OR C SHEETING
LEGEND	RED	TYPE B OR C SHEETING

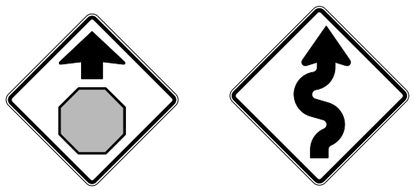
REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS

(EXCLUDING STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)

TYPICAL EXAMPLES

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

REQUIREMENTS FOR WARNING SIGNS



TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLOURESCENT YELLOW	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

REQUIREMENTS FOR SCHOOL SIGNS

TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	FLOURESCENT YELLOW GREEN	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
SYMBOLS	RED	TYPE B OR C SHEETING

GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Sign legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod or F).
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
6. Colored legend shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to background sheeting, or combination thereof.
7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
8. Mounting details for roadside mounted signs are shown in the "SMD series" Standard Plan Sheets.

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

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

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

http://www.txdot.gov/

Texas Department of Transportation

Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

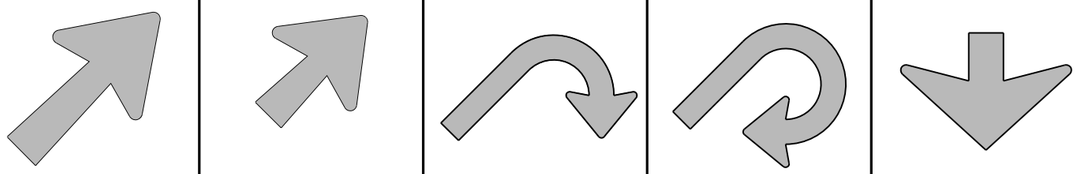
TSR(4)-13

FILE: tsr4-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
12-03 7-13 9-08	DIST	COUNTY		SHEET NO.
	WAC	HILL		178

DATE: 5/19/2022 6:11:54 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\07090028\Standards\tsr5-13.dgn

ARROW DETAILS

for Large Ground-Mounted and Overhead Guide Signs



TYPE	LETTER SIZE	USE
A-1	10.67" U/L and 10" Caps	Single Lane Exits
A-2	13.33" U/L and 12" Caps	
A-3	16" & 20" U/L	
B-1	10.67" U/L and 10" Caps	Multiple Lane Exits
B-2	13.33" U/L and 12" Caps	
B-3	16" & 20" U/L	

CODE	USED ON SIGN NO.
E-3	E5-1aT
E-4	E5-1bT

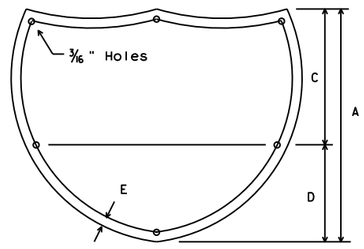
NOTE

Arrow dimensions are shown in the "Standard Highway Sign Designs for Texas" manual.

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

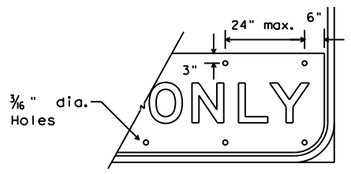
http://www.txdot.gov/

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

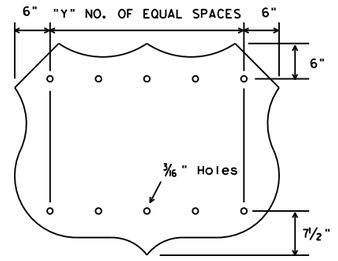


INTERSTATE ROUTE MARKERS

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

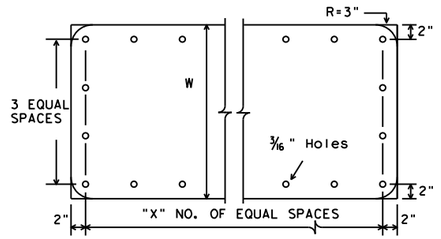


EXIT ONLY PANEL



U.S. ROUTE MARKERS

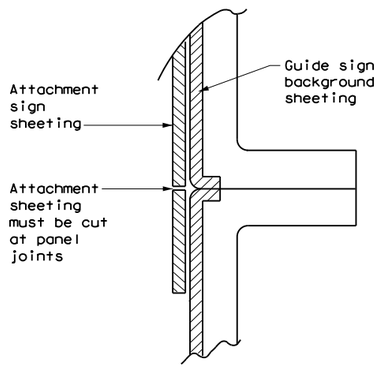
Sign Size	"Y"
24x24	2
30x24	3
36x36	3
45x36	4
48x48	4
60x48	5



STATE ROUTE MARKERS

No. of Digits	W	X
4	24	4
4	36	5
4	48	6
3	24	3
3	36	4
3	48	5

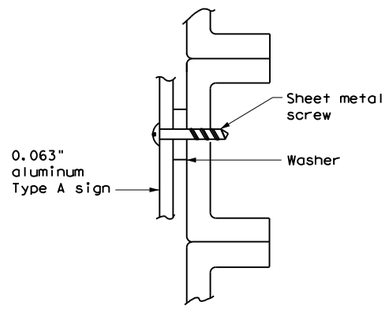
MOUNTING DETAILS OF ATTACHMENTS TO GUIDE SIGN FACE ("EXIT ONLY" AND "LEFT EXIT" PANELS, ROUTE MARKERS AND OTHER ATTACHMENTS)



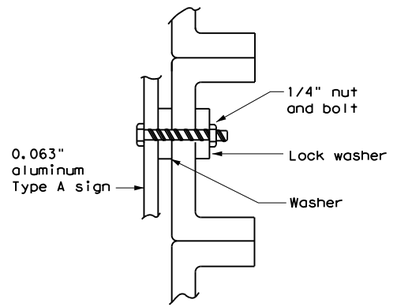
DIRECT APPLIED ATTACHMENT

NOTE:

1. Sheeting for legend, symbols, and borders must be cut at panel joints.
2. Direct applied attachment signs will be subsidiary to "Aluminum Signs" or "Fiberglass Signs".



SCREW ATTACHMENT



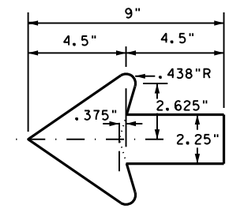
NUT/BOLT ATTACHMENT

NOTE:

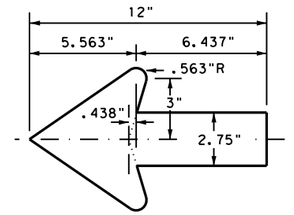
Furnish Type A aluminum sign attachments only when specified in the plans. These signs will be paid for under "Aluminum Signs".

ARROW DETAILS

for Destination Signs (Type D)



Standard arrow to be used with 6 inch letters.



Standard arrow to be used with 8 inch letters.

Texas Department of Transportation

Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

TSR(5)-13

FILE: tsr5-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
12-03 7-13	DIST	COUNTY		SHEET NO.
9-08	WAC	HILL		179

DATE: 5/19/2022 6:11:59 PM
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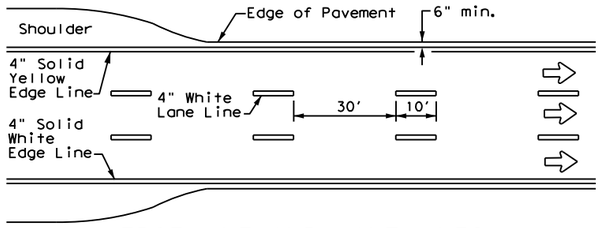
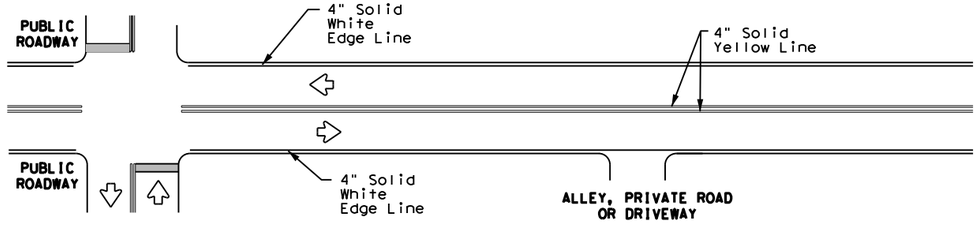
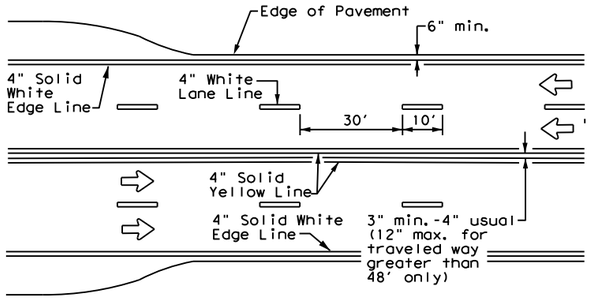


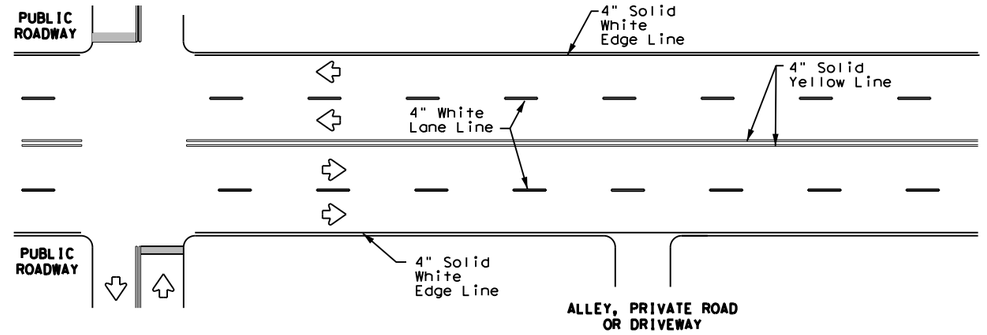
EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



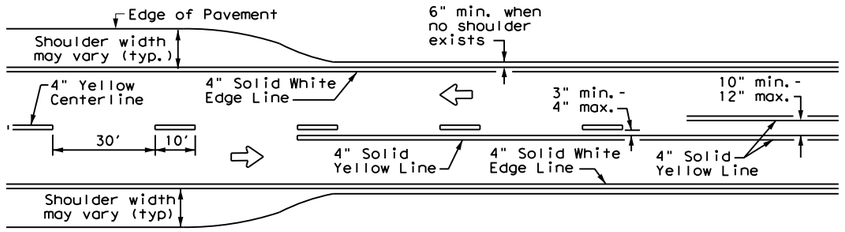
TYPICAL TWO-LANE, TWO-WAY PAVEMENT MARKINGS THROUGH INTERSECTIONS



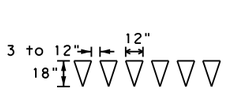
CENTERLINE AND LANE LINES FOUR LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS



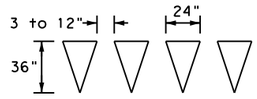
TYPICAL MULTI-LANE, TWO-WAY PAVEMENT MARKINGS THROUGH INTERSECTIONS



TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS

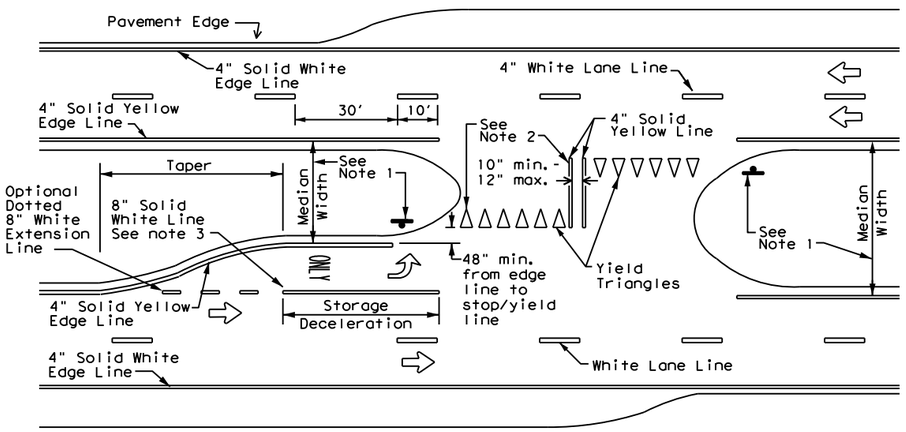


For posted speed on road being marked equal to or less than 40 MPH.



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

YIELD LINES



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

1. Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs are optional as determined by the Engineer.

2. Install median striping (double yellow centerlines and stop bars/yield triangles) when a 50' or greater median centerline can be placed. Stop bars shall only be used with stop signs. Yield traingles shall only be used with yield signs.

3. Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

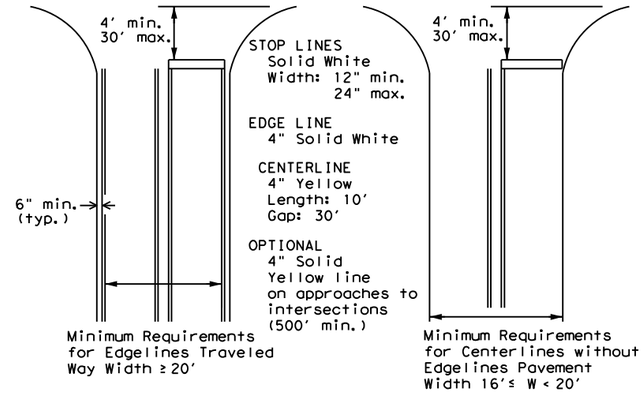
GENERAL NOTES

1. Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should not be placed less less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edgelines are not required in curb and gutter sections of roadways.

2. The traveled way includes only that portion of the roadway used for vehicular travel. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to the inside of edgeline of a two lane roadway.

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

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



GUIDE FOR PLACEMENT OF STOP LINES, EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths for Undivided Highways

Texas Department of Transportation

Traffic Safety Division Standard

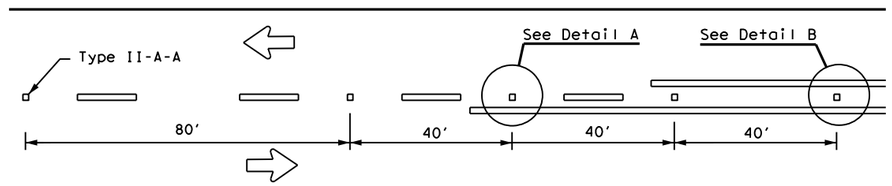
TYPICAL STANDARD PAVEMENT MARKINGS

PM(1)-20

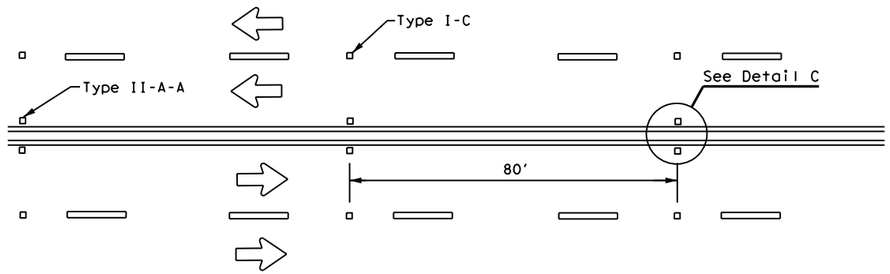
FILE: pm1-20.dgn	DN:	CK:	DW:	CK:
© TxDOT November 1978	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03	0019	03	028 Etc.	SH 171
5-00 2-12	DIST	COUNTY		SHEET NO.
8-00 6-20	WAC	HILL		180

22A

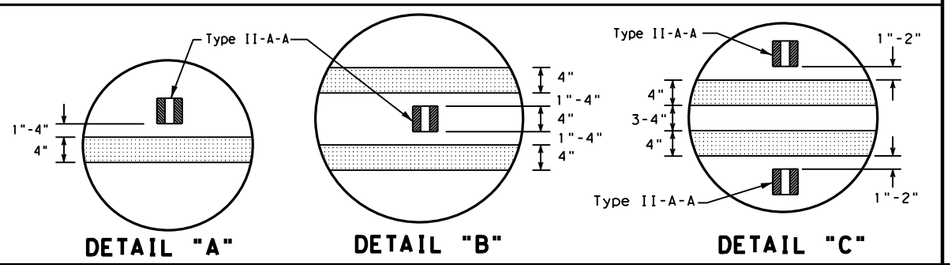
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE



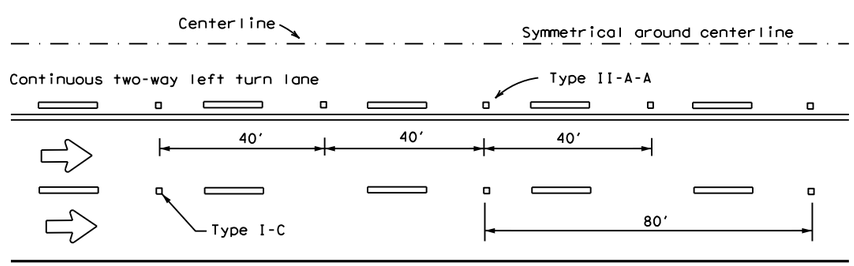
CENTERLINE FOR ALL TWO LANE ROADWAYS



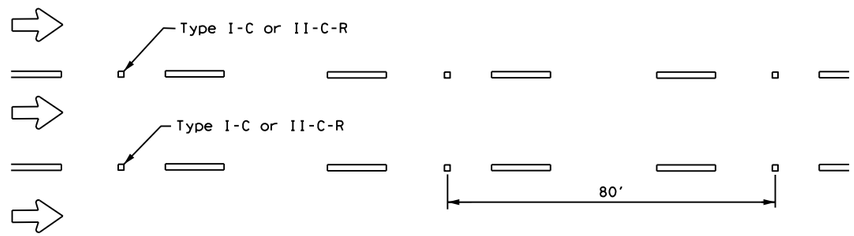
CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY HIGHWAYS



DETAIL "A" **DETAIL "B"** **DETAIL "C"**

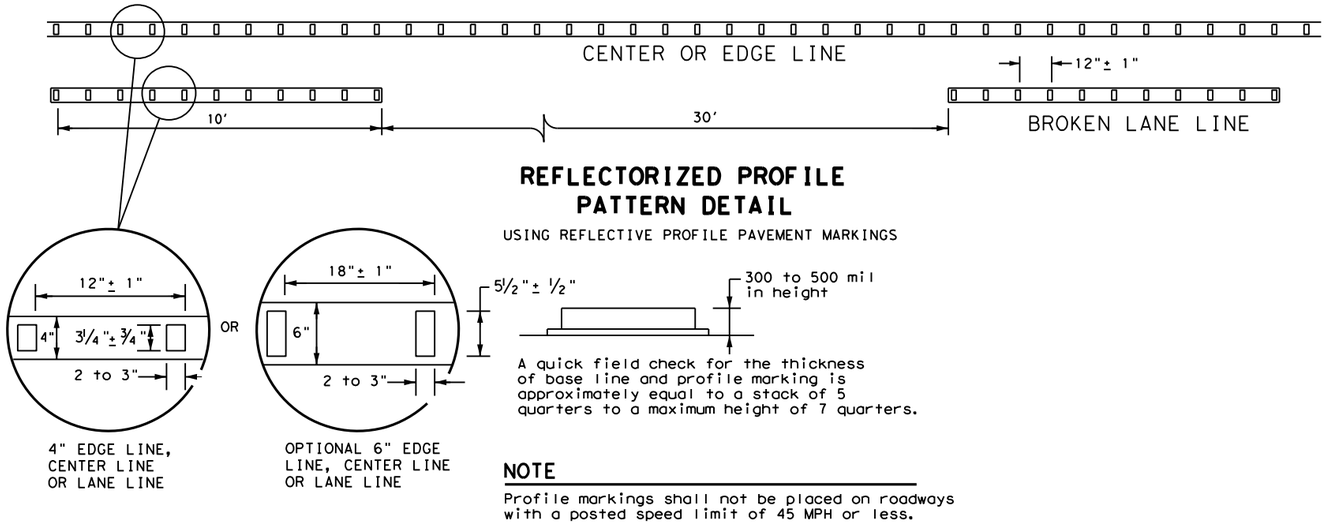


CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



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

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



REFLECTORIZED PROFILE PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS

A quick field check for the thickness of base line and profile marking is approximately equal to a stack of 5 quarters to a maximum height of 7 quarters.

4" EDGE LINE, CENTER LINE OR LANE LINE

OPTIONAL 6" EDGE LINE, CENTER LINE OR LANE LINE

NOTE

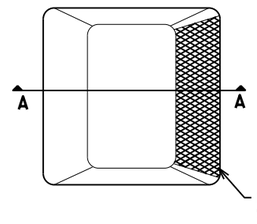
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

GENERAL NOTES

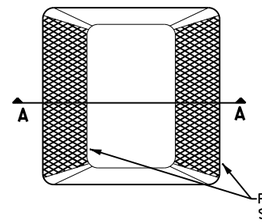
1. All raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.

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

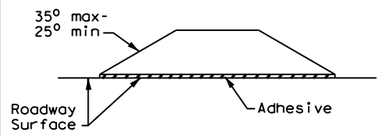
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)



Type II (Top View)



SECTION A

RAISED PAVEMENT MARKERS

Texas Department of Transportation

Traffic Safety Division Standard

POSITION GUIDANCE USING RAISED MARKERS RELECTORIZED PROFILE MARKINGS PM(2)-20

FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
©TxDOT April 1977	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-92 2-10 5-00 2-12 8-00 6-20	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		181

22B

DATE: 5/19/2022 6:12:09 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\0019030284 - Design\Plan Set\8. Traffic\Standards\smdgen.dgn

SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

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

Post Type

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

Number of Posts (1 or 2)

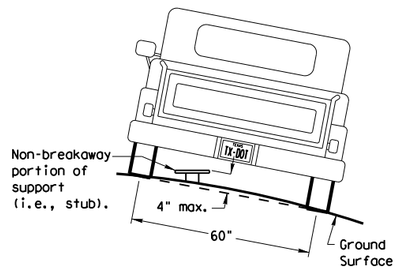
Anchor Type

UA = Universal Anchor - Concreted (see SMD(FRP) and (TWT))
UB = Universal Anchor - Bolted down (see SMD(FRP) and (TWT))
WS = Wedge Anchor Steel - (see SMD(TWT))
WP = Wedge Anchor Plastic (see SMD(TWT))
SA = Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))
SB = Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

Sign Mounting Designation

P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))
IF REQUIRED
1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))
WC = 1.12 #/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))
EXAL = Extruded Aluminum Sign Panels (see SMD(SLIP-1) to (SLIP-3))

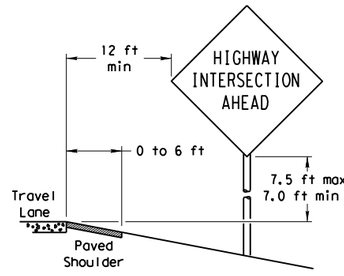
REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



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

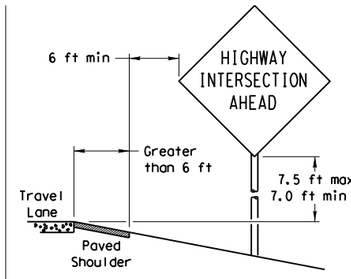
SIGN LOCATION

PAVED SHOULDERS



LESS THAN 6 FT. WIDE

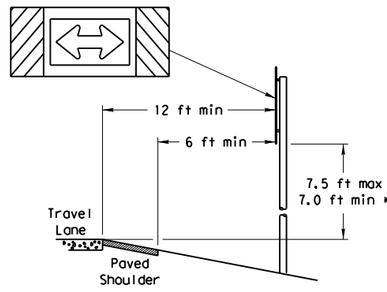
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



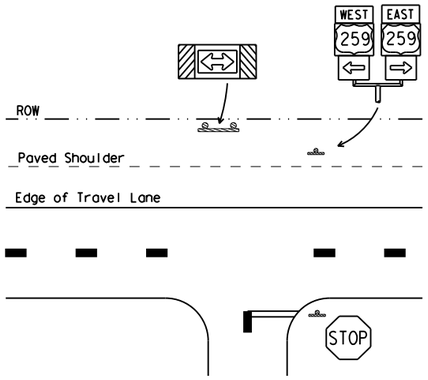
GREATER THAN 6 FT. WIDE

When the shoulder is greater than 6 ft in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

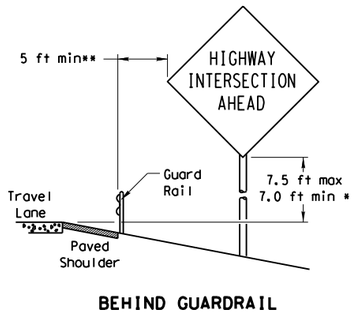
T-INTERSECTION



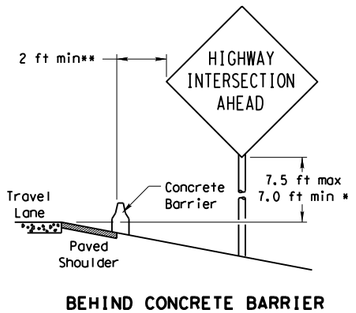
When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.



BEHIND BARRIER



BEHIND GUARDRAIL



BEHIND CONCRETE BARRIER

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

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

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

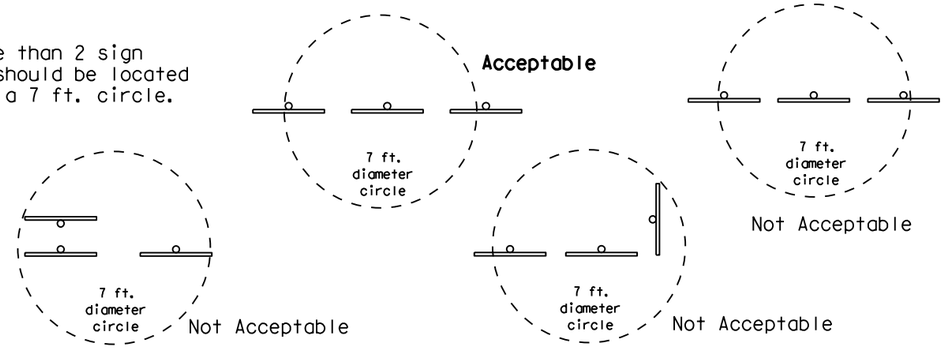
(2) a minimum of 7 to a maximum of 7.5 feet above the grade at the base of the support when sign is installed on the backslope.

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

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

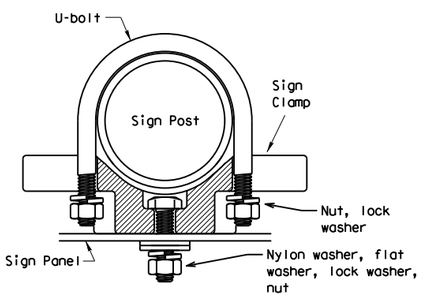
The website address is:
http://www.txdot.gov/publications/traffic.htm

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



TYPICAL SIGN ATTACHMENT DETAIL

Single Signs

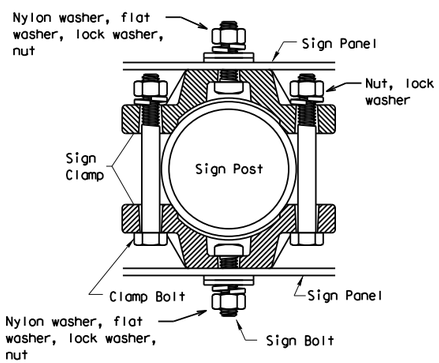


Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

When two sign clamps are used to mount signs back-to-back, use a 5/16-18 UNC galvanized hex head per ASTM A307 with nut and helical-spring lock washer. The approximate bolt lengths for various post sizes and sign clamp types are given in the table at right. The bolt length may need to be adjusted depending upon field conditions.

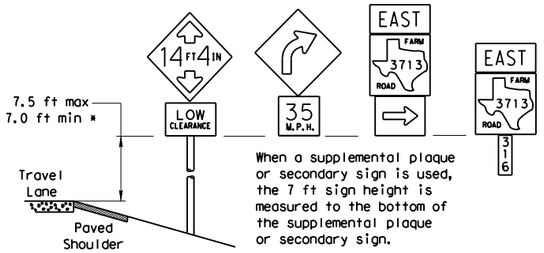
Sign clamps may be either the specific size clamp or the universal clamp.

Back-to-Back Signs



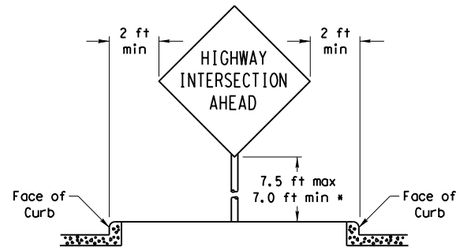
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES



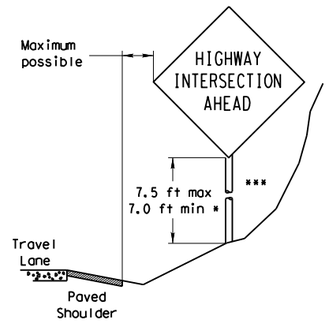
When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

CURB & GUTTER OR RAISED ISLAND



RESTRICTED RIGHT-OF-WAY

(When 6 ft min. is not possible.)



Right-of-way restrictions may be created by rocks, water, vegetation, forest, buildings, a narrow island, or other factors.

In situations where a lateral restriction prevents the minimum horizontal clearance from the edge of the travel lane, signs should be placed as far from the travel lane as practical.

*** Post may be shorter if protected by guardrail or if Engineer determines the post could not be hit due to extreme slope.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

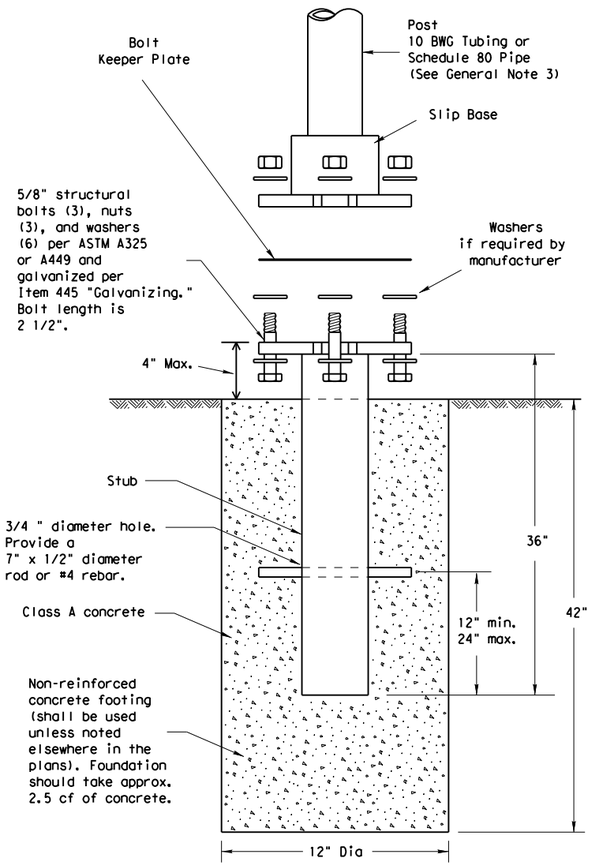
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS 9-08

CONT	SECT	JOB	HIGHWAY
0019	03	028 Etc.	SH 171
DIST	COUNTY		SHEET NO.
WAC	HILL		182

DATE: 5/19/2022 6:12:14 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\0019030281\90302814 - Design\Plan Set\8. Traffic\Standards\smdsl.dgn

TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



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

NOTE

There are various devices approved for the Triangular Slipbase System. Please reference the Material Producer List for approved slip base systems. http://www.txdot.gov/business/producer_list.htm The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.

GENERAL NOTES:

1. Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
2. Material used as post with this system shall conform to the following specifications:
   10 BWG Tubing (2.875" outside diameter)
   - 0.134" nominal wall thickness
   - Seamless or electric-resistance welded steel tubing or pipe
   - Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
   - Other steels may be used if they meet the following:
     - 55,000 PSI minimum yield strength
     - 70,000 PSI minimum tensile strength
     - 20% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
   - Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
   - Galvanization per ASTM A123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.

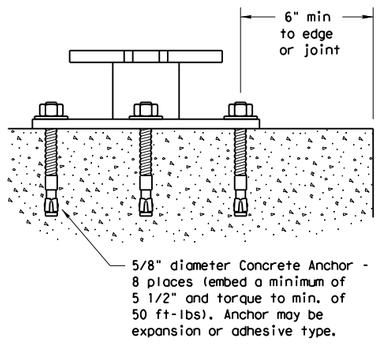
   Schedule 80 Pipe (2.875" outside diameter)
   - 0.276" nominal wall thickness
   - Steel tubing per ASTM A500 Gr C
   - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
     - 46,000 PSI minimum yield strength
     - 62,000 PSI minimum tensile strength
     - 21% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
   - Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
   - Galvanization per ASTM A123
3. See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is: http://www.txdot.gov/publications/traffic.htm
4. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

ASSEMBLY PROCEDURE

Foundation
1. Prepare 12-inch diameter by 42-inch deep hole. If solid rock is encountered, the depth of the foundation may be reduced such that it is embedded a minimum of 18 inches into the solid rock.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor-driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
3. Push the pipe end of the slip base stub into the center of the concrete. Rotate the stub back and forth while pushing it down into the concrete to assure good contact between the concrete and stub. Continue to work the stub into the concrete until it is between 2 to 4 inches above the ground.
4. Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
5. The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

Support
1. Cut support so that the bottom of the sign will be 7 to 7.5 feet above the edge of the travelway (i.e., edge of the closest lane) when slip plate is below the edge of pavement or 7 to 7.5 feet above slip plate when the slip plate is above the edge of the travelway. The cut shall be plumb and straight.
2. Attach sign to support using connections shown. When multiple signs are installed on the same support, ensure the minimum clearance between each sign is maintained. See SMD(SLIP-2) for clearances based on sign types.

CONCRETE ANCHOR



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

Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. Heavy hex nut per ASTM A563, and hardened washer per ASTM F436. The stud bolt shall have a minimum yield and ultimate tensile strength of 50 and 75 KSI, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxies and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations. Top of bolt shall extend at least flush with top of the nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 5 1/2" minimum embedment, shall have a minimum allowable tension and shear of 3900 and 3100 psi, respectively.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-1)-08

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

REVISIONS
9-08

CONT	SECT	JOB	HIGHWAY
0019	03	028 Etc.	SH 171

DIST	COUNTY	SHEET NO.
WAC	HILL	183

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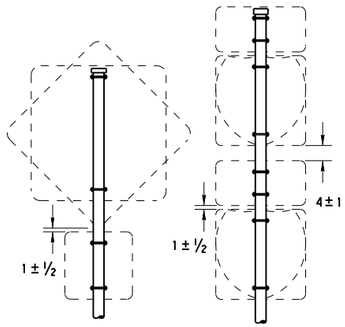

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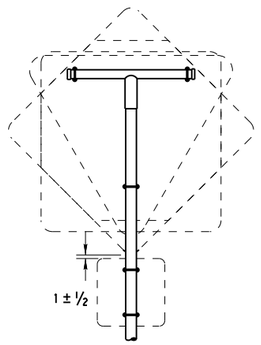
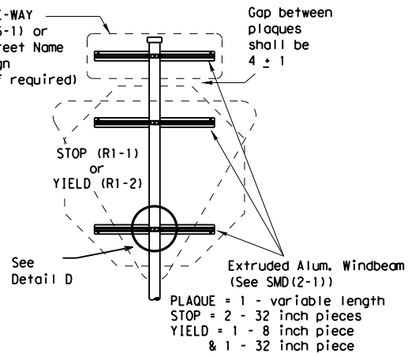


SM RD SGN ASSM TY XXXXX(1)XX(T)



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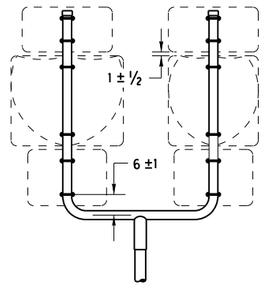

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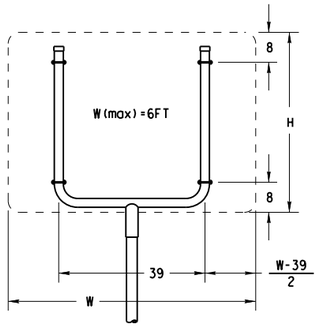

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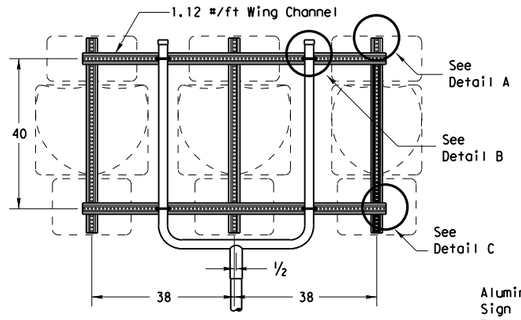
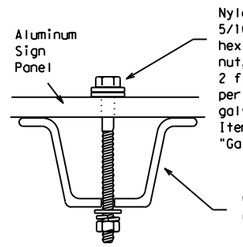
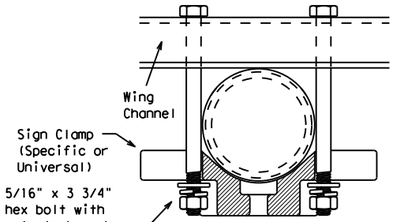


SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)



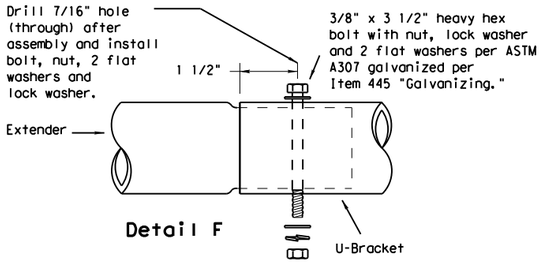
Top View

Detail A



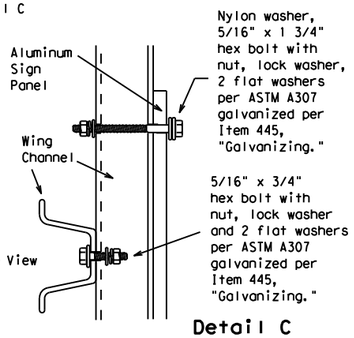
Top View

Detail B

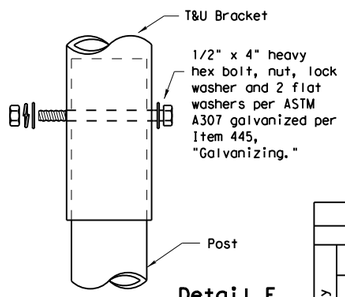


Detail F

Splices shall only be allowed behind the sign substrate.



Detail C



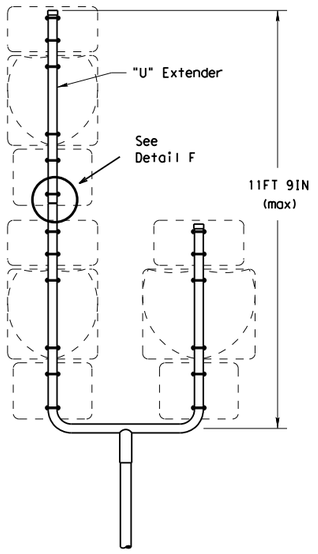
Detail E

GENERAL NOTES:

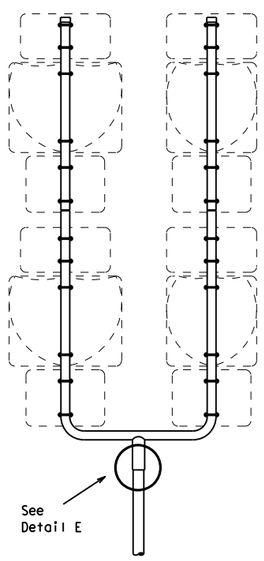
1.

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
6. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
10. Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
11. Additional sign clamp required on the "T-bracket" post for 24 inch height signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.
13. Sign blanks shall be the sizes and shapes shown on the plans.



SM RD SGN ASSM TY S80(1)XX(U-1EXT)



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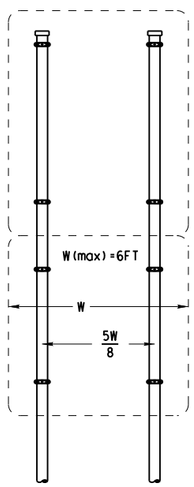
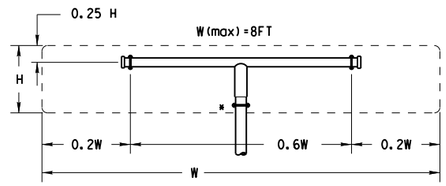


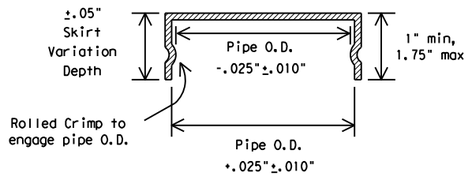
SM RD SGN ASSYM TY XXXXX(2)XX(P)



All dimensions are in english unless detailed otherwise.

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

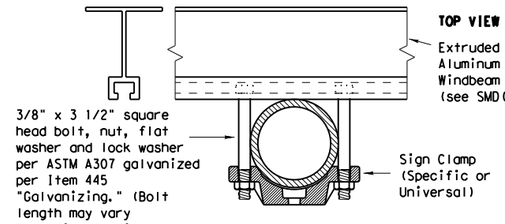
FRICTION CAP DETAIL



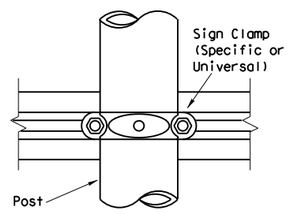
Friction caps may be manufactured from hot rolled or cold rolled steel sheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes.

The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture.

Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.



Detail D



REQUIRED SUPPORT

	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
Warning	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-2)-08

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

9-08 REVISIONS

CONT	SECT	JOB	HIGHWAY
0019	03	028 Etc.	SH 171

DIST	COUNTY	SHEET NO.
WAC	HILL	184

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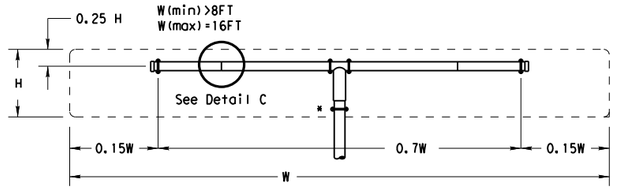
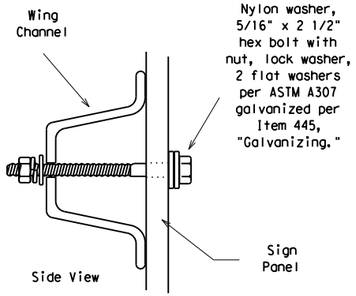
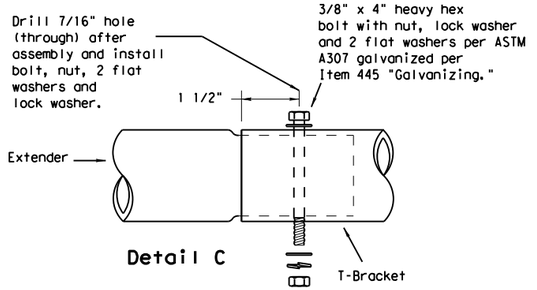


SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)
(* - See Note 12)



Detail B



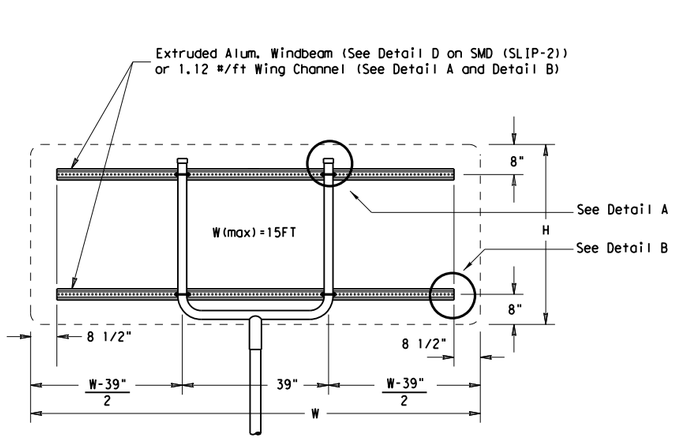
Detail C

Splices shall only be allowed behind the sign substrate.

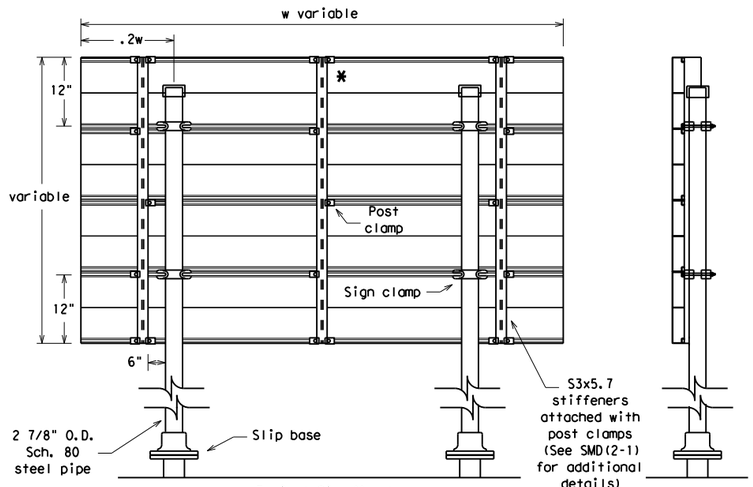
GENERAL NOTES:

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

1. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
2. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
3. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
4. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
5. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
6. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
7. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
8. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
9. Sign blanks shall be the sizes and shapes shown on the plans.
10. Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
11. Post open ends shall be fitted with Friction Caps.



SM RD SGN ASSM TY XXXXX(1)XX(U-XX)

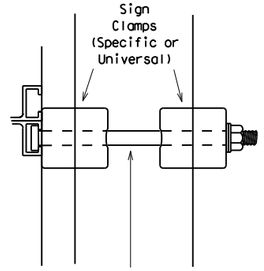


Typical Sign Mount

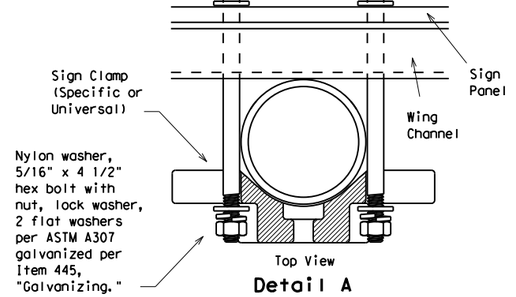
SM RD SGN ASSM TY S80(2)XX(P-EXAL)

* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.

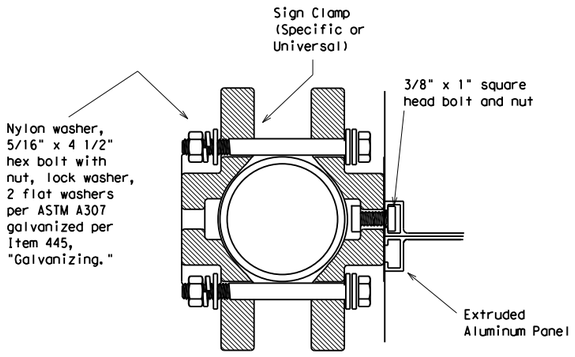
See Detail E
for clamp installation



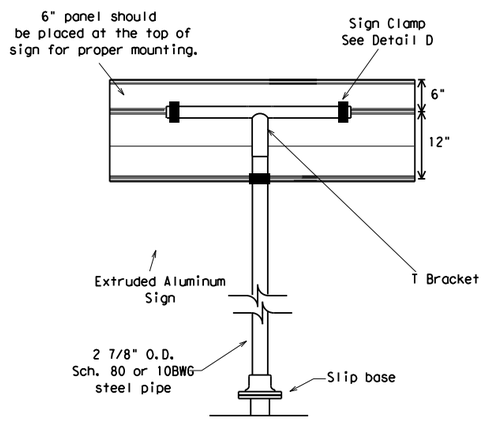
Detail E



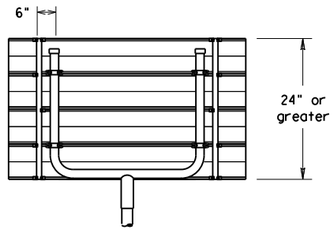
Detail A



Detail D
EXTRUDED ALUMINUM SIGN WITH T BRACKET



Extruded Aluminum Sign
With T Bracket



Use Extruded Alum. Windbeam as stiffeners
See SMD (2-1) for additional details

See Detail E
for clamp installation

REQUIRED SUPPORT		
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
Warning	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-3)-08

REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-08	CONT	SECT	JOB	HIGHWAY
	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		185

GENERAL NOTES FOR ALL ELECTRICAL WORK

1. The location of all conduits, junction boxes, ground boxes, and electrical services is diagrammatic and may be shifted to accommodate field conditions.

2. Provide new and unused materials. Ensure that all materials and installations comply with the applicable articles of the National Electrical Code (NEC), TxDOT standards and specifications, National Electrical Manufacturers Association (NEMA), and are listed by Underwriters Laboratories (UL) or a Nationally Recognized Testing Lab (NRTL). NRTLs such as Canadian Standard Association (CSA), Intertek Testing Services NA Inc., or FM Approvals LLC can be considered equivalent to UL. Where reference is made to NEMA listed devices, International Electrotechnical Commission (IEC) listed devices will not be considered an acceptable equal to a NEMA listed device. Acceptable devices may have both a NEMA and IEC listing. Faulty fabrication or poor workmanship in any material, equipment, or installation is justification for rejection. Replace or reinstall rejected material or equipment at no additional cost to the Department.

3. Miscellaneous nuts, bolts and hardware, except for high strength bolts, may be stainless steel when plans specify galvanized, provided the bolt size is ½ in. or less in diameter.

4. Provide the following test equipment as required by the Engineer to confirm compliance with the contract and the NEC: voltmeter, ammeter, megohm meter (1000 volt DC), ground resistance tester, torque wrenches, and torque screwdrivers. Ensure all equipment has been properly calibrated within the last year. Provide calibration certification to the Engineer upon request. Operate test equipment during inspection as requested by the Engineer.

5. Install grounding as shown on the plans and in accordance with the NEC. Ensure all metallic conduits; metal poles; luminaires; and metal enclosures are bonded to the equipment grounding conductor. Provide stranded bare copper or green insulated grounding conductors. Ground rods, connectors, and bonding jumpers are subsidiary to the various bid items.

6. When required by the Engineer, notify the Department in writing of materials from the Material Producers List (MPL) intended for use on each project. Prequalified materials are listed on the MPL on TxDOT's website under "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials on this list.

CONDUIT

A. MATERIALS

1. Provide conduit, junction boxes, fittings, and hardware as per TxDOT Departmental Material Specification (DMS) 11030 "Conduit" and Item 618 "Conduit" of TxDOT's "Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges," latest edition. Provide conduits listed under Item 618 on the MPL under "Roadway Illumination and Electrical Supplies." Provide conduit types according to the descriptive code or as shown on the plans. Do not substitute other types of conduits for those shown. Provide liquidtight flexible metal conduit (LFMC) when flexible conduit is called for on galvanized steel rigid metallic conduit (RMC) systems. Provide liquidtight flexible nonmetallic conduit (LFNC) when flexible conduit is called for on polyvinyl chloride (PVC) systems.

2. Provide galvanized steel RMC for all exposed conduits, unless otherwise shown on the plans. Properly bond all metal conduits.

3. Unless otherwise shown on the plans, provide junction boxes with a minimum size as shown in the following table, which applies to the greatest number of conductors entering the box through one conduit with no more than four conduits per box. When a mixture of conductor sizes is present, count the conductors as if all are of the larger size. For situations not applicable to the table, size junction boxes in accordance with NEC.

AWG	3 CONDUCTORS	5 CONDUCTORS	7 CONDUCTORS
#1	10" x 10" x 4"	12" x 12" x 4"	16" x 16" x 4"
#2	8" x 8" x 4"	10" x 10" x 4"	12" x 12" x 4"
#4	8" x 8" x 4"	10" x 10" x 4"	10" x 10" x 4"
#6	8" x 8" x 4"	8" x 8" x 4"	10" x 10" x 4"
#8	8" x 8" x 4"	8" x 8" x 4"	8" x 8" x 4"

4. Junction boxes with an internal volume of less than 100 cu. in. and supported by entering raceways must have threaded entries or hubs identified for the intended purpose and supported by connection of two or more rigid metal conduits. Secure conduit within 3 ft. of the enclosure or within 18 in. of the enclosure if all conduit entries are on the same side. Mechanically secure all junction boxes with an internal volume greater than 100 cu. inches.

5. Provide hot dipped galvanized cast iron or sand cast aluminum outlet boxes for junction boxes containing only 10 AWG or 12 AWG conductors. Do not use die cast aluminum boxes. Size outlet boxes according to the NEC.

6. Do not use intermediate metal conduit (IMC) or electrical metallic tubing (EMT) unless specifically required by the plan sheets. When EMT is called for, provide junction boxes made from galvanized steel sheeting, listed and approved for outdoor use, unless otherwise noted on the plans. Size all galvanized steel junction boxes in accordance with the NEC. Provide junction boxes for IMC conduit systems that meet the same requirements for junction boxes used with RMC systems.

7. Provide PVC junction boxes intended for outdoor use on PVC conduit systems, unless otherwise noted on the plans.

8. Provide PVC elbows in PVC conduit systems, unless otherwise shown on the plans. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the PVC conduit system. When galvanized steel RMC elbows are specifically called for in the plans and any portion of the RMC elbow is buried less than 18 in., ground the RMC elbow by means of a grounding bushing on a rigid metal extension. Grounding of the rigid metal elbow is not required if the entire RMC elbow is encased in a minimum of 2 in. of concrete. PVC extensions are allowed on these concrete encased rigid metal elbows. RMC or PVC elbows are subsidiary to various bid items.

9. When required, provide High-Density Polyethylene (HDPE) conduit with factory installed internal conductors according to Item 622 "Duct Cable." At the Contractor's request and with approval by the Engineer, substitute HDPE conduit with no conductors for bored schedule 40 or schedule 80 PVC conduit bid under Item 618. Ensure bored HDPE substituted for PVC is schedule 40 and of the same size PVC called for in the plans. Ensure the substituted HDPE meets the requirements of Item 622, except that the conduit is supplied without factory-installed conductors. Make the transition of the HDPE conduit to PVC (or RMC elbow when required) at the bore pit. Provide conduit of the size and schedule as shown on the plans. Do not extend substituted conduit into ground boxes or foundations. Provide PVC or galvanized steel RMC elbows as called for at all ground boxes and foundations.

10. Use two-hole straps when supporting 2 in. and larger conduits. On electrical service poles, properly sized stainless steel or hot dipped galvanized one-hole standoff straps are allowed on the service riser conduit.

B. CONSTRUCTION METHODS

1. Provide and install expansion joint conduit fittings on all structure-mounted conduits at the structure's expansion joints to allow for movement of the conduit. In addition, provide and install expansion joint fittings on all continuous runs of galvanized steel RMC conduit externally exposed on structures such as bridges at maximum intervals of 150 ft. When requested by the project Engineer, supply manufacturer's specification sheet for expansion joint conduit fittings. Repair or replace expansion joint fittings that do not allow for movement at no additional cost to the Department. Provide the method of determining the amount of expansion to the Engineer upon request. Do not use LFMC or LFNC as a substitute for the required expansion conduit fittings.

2. Space all conduit supports at maximum intervals of 5 ft. Install conduit spacers when attaching metal conduit to surface of concrete structures. See "Conduit Mounting Options" on ED(2). Install conduit support within 3 ft. of all enclosures and conduit terminations.

3. Do not attach conduit supports directly to pre-stressed concrete beams except as shown specifically in the plans or as approved by the Engineer.

4. Unless otherwise shown on the plans, jack or bore conduit placed beneath existing roadways, driveways, sidewalks, or after the base or surfacing operation has begun. Backfill and compact the bore pits below the conduit per Item 476 "Jacking, Boring, or Tunneling Pipe or Box" prior to installing conduit or duct cable to prevent bending of the connections.

5. When placing conduit in the sub-grade of new roadways, backfill all trenches with excavated material unless otherwise noted on the plans. When placing conduit in the sub-base of new roadways, backfill all trenches with cement-stabilized base as per requirements of Items 110 "Excavation", 400 "Excavation and Backfill for Structures", 401 "Flowable Backfill", 402 "Trench Excavation Protection", and 403 "Temporary Special Shoring."

6. Provide and place warning tape approximately 10 in. above all trenched conduit as per Item 618.

7. During construction, temporarily cap or plug open ends of all conduit and raceways immediately after installation to prevent entry of dirt, debris and animals. Temporary caps constructed of durable duct tape are allowed. Tightly fix the tape to the conduit opening. Clean out the conduit and prove it clear in accordance with Item 618 prior to installing any conductors.

8. Ensure conduit entry into the top of any enclosure is waterproof by installing conduit sealing hubs or using boxes with threaded bosses. This includes surface mounted safety switches, meter cans, service enclosures, auxiliary enclosures and junction boxes. Grounding bushings on water tight sealing hubs are not required.

9. Fit the ends of all PVC conduit terminations with bushings or bell end fittings. Provide and install a grounding type bushing on all metal conduit terminations.

10. Install a bonding jumper from each grounding bushing to the nearest ground rod, grounding lug, or equipment grounding conductor. Ensure all bonding jumpers are the same size as the equipment grounding conductor. Bonding of conduit used as a casing under roadways for duct cable is not required, if the duct extends the full length through the casing.

11. At all electrical services, install a 6 AWG solid copper grounding electrode conductor.

12. Place conduits entering ground boxes so that the conduit openings are between 3 in. and 6 in. from the bottom of the box. See the ground box detail on sheet ED(4).

13. Seal ends of all conduits with duct seal, expandable foam, or by other methods approved by the Engineer. Seal conduit immediately after completion of conductor installation and pull tests. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a conduit sealant.

14. File smooth the cut ends of all mounting strut and conduit. Before installing, paint the field cut ends of all mounting strut and RMC (threaded or non-threaded) with zinc rich paint (94% or more zinc content) to alleviate overspray. Use zinc rich paint to touch up galvanized material as allowed under Item 445 "Galvanizing." Do not paint non-galvanized material with a zinc rich paint as an alternative for materials required to be galvanized.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS CONDUITS & NOTES

ED(1)-14

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ELECTRICAL CONDUCTORS

A. MATERIAL INFORMATION

1. Provide Type XHHW insulated conductors in accordance with Departmental Material Specification (DMS)11040 "Conductors" and Item 620 "Electrical Conductors." Provide conductors as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 620. Color code insulated conductors in conformance with the NEC. Identify grounded (neutral) conductors with white insulation. Identify grounding conductors (ground wires) with green insulation or bare conductors. Identify ungrounded (hot) conductors with any color insulation except green, white, or gray. Keep color scheme consistent throughout the wiring system. Identify conductors 6 American Wire Gauge (AWG) and smaller by continuous color jacket. Identify electrical conductors 4 AWG and larger by continuous color jacket or by colored tape. When identifying conductors with colored tape, mark at least 6 in. of the conductor's insulation with half laps of tape.
2. Provide a solid copper 6 AWG grounding electrode conductor to bond the electrical service equipment to the concrete encased grounding electrode or the ground rod at the service location. Connect the grounding electrode conductor to the ground rod with a UL listed connector in accordance with DMS 11040. Connect the grounding electrode conductor to the concrete encased grounding electrode as shown in the plans.
3. Where two or more circuits are present in one conduit or enclosure, permanently identify the conductors of each branch circuit by attaching a non-metallic tag around both circuit conductors at each accessible location. Provide tags with two straps, large enough to indicate circuit number, letter, or other identification as shown in the plans. Print circuit identification on the tag with a permanent marker.
4. Use listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors for splicing as specified in DMS 11040. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Provide UL listed gel-filled insulating splice covers. Splicing materials, insulating materials, breakaway disconnects, splice covers, and fuse holders are subsidiary to various bid items.

B. CONSTRUCTION METHODS

1. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull test. If a conductor cannot be freely pulled, make any needed alterations or repairs at no additional cost to the department. Perform insulation resistance tests in accordance with Item 620. Coordinate with the Engineer to witness the tests.
2. Leave 2 ft. minimum, 3 ft. maximum length for each conductor up to the splice in ground boxes. Leave 3 ft. minimum, 4 ft. maximum length of conductor in ground boxes when pulled through with no splice. Leave 1 ft. minimum, 1.5 ft. maximum length of conductor at enclosures, weatherheads and pole bases.
3. Make splices only in junction boxes, ground boxes, pole bases, or electrical enclosures and use only listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors. Insulate splices with heavy wall heat shrink tubing or gel-filled insulating splice covers to provide a watertight splice. Overlap conductor insulation with heat shrink tubing a minimum of 2 in. past both sides of the splice. Where heat shrink tubing may not shrink sufficiently to provide a watertight seal around the individual conductors, prior to heating the tubing, increase the diameter of the conductor insulation using hot melt adhesive tape to provide a watertight seal between the individual conductors and the heat shrink tubing. Ensure the tape extends past the heat shrink tubing. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Heat shrink tubing that appears to have been burned, or overheated, is considered defective and must be replaced.
4. Size and install gel-filled insulating splice covers according to manufacturer's specifications when used in place of heat shrink tubing.
5. Wire nuts with factory applied waterproof sealant may be used for 8 AWG or smaller conductors in above ground junction boxes, but not in pole bases or ground boxes. Install wire nuts in an upright position to prevent the accumulation of water.
6. Support conductors in illumination poles with a J-hook at the top of the pole.
7. When terminating conductors, remove the insulation and jacketing material without nicking the individual strands of the conductor. Conductors with nicked individual conductor strands or removed strands will be considered damaged.
8. Replace conductors and cables that are damaged beyond repair or that fail an insulation resistance test at no additional cost to the department.
9. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Use only approved splicing methods.
10. Do not terminate more than one conductor under a single connector, unless the connector is rated for multiple conductors. Do not exceed the pressure connector's listing for maximum number and size of conductors allowed.
11. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a breakaway support device. Follow manufacturer's instructions when terminating conductors to breakaway connectors. Properly torque threaded connections. Proper terminations are critical to the safe operation of breakaway devices. Trim waterproofing boots on breakaway connectors to fit snugly around the conductor to ensure waterproof connection. Only one conductor may enter a single opening in a boot. Provide waterproof boots with the correct number of openings. Leave unused openings factory sealed. Use prequalified breakaway connectors as shown on the MPL.
12. Provide and install a separate stranded equipment grounding conductor (EGC) in all conduits that contain circuit wiring of 50 volts or more. Unless shown elsewhere, size the EGC to be the same size as the largest current carrying conductor contained in the conduit. Ensure all EGCs are bonded together at every accessible location. For traffic signal installations, provide a minimum size 8 AWG EGC. The EGC is paid for under Item 620.

C. TEMPORARY WIRING

1. Install temporary conductors and electrical equipment in accordance with the NEC article "Temporary Installations" and Department standard sheets.
2. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins and refrigerators located outdoors at grade. GFCI may be any one of the following: molded cord and plug set, receptacle, or circuit breaker type.
3. Use listed wire nuts with factory applied sealant for temporary wiring where approved.
4. Enclose conductor splices within a listed enclosure or ground box, or ensure the splices are more than 10 ft. above grade vertically and more than 5 ft. horizontally from any metal structure. Where installing temporary conductors in areas subject to vehicle traffic or mobile construction equipment, ensure the vertical clearance to ground is at least 18 ft. when measured at the lowest point. Ground messenger wires that support power conductors in conformance with the NEC.
5. Protect and when necessary repair any existing electrical conduits uncovered during the construction process in a timely manner and in conformance with the NEC.

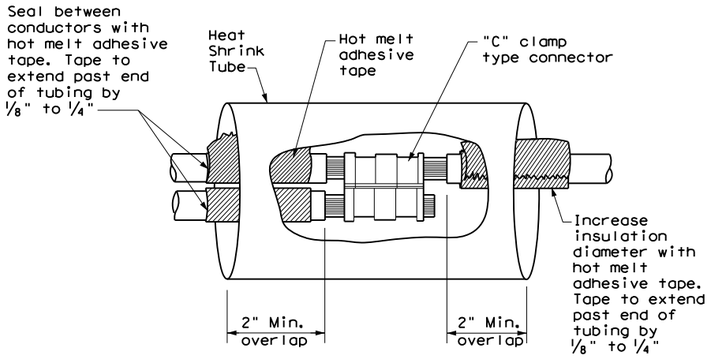
GROUND RODS & GROUNDING ELECTRODES

A. MATERIAL INFORMATION

1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in specific locations including electrical service, see individual plan sheets.

B. CONSTRUCTION METHODS

1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, ensure that the upper end is between 2 to 4 in. below finished grade.
2. Do not place ground rods in the same drilled hole as a timber pole.
3. Install ground rods so the imprinted part number is at the upper end of the rod.
4. Remove all non-conductive coatings such as concrete splatter from the rod at the clamp location.
5. Route all conductors as short and straight as possible for connection to lightning protection ground rods. When a bend is required, ensure a minimum radius bend of four inches for these conductors.
6. Unless otherwise called for in the plans, protect grounding electrode conductors with non-metallic conduit. When protecting grounding electrode conductors with metal conduit, provide and install a grounding type bushing and properly sized bonding jumper on each end of the metal conduit.
7. Written authorization is required before installing a ground rod in a horizontal trench for rocky soil or a solid rock bottom.



SPLICE OPTION 1
Compression Type

SPLICE OPTION 2
Split Bolt Type

SPLICE OPTION 3
Listed Screw Type

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS CONDUCTORS

ED(3)-14

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71C

BATTERY BOX GROUND BOXES NOTES

A. MATERIALS

1. Provide polymer concrete or fiberglass reinforced plastic (FRP) battery box ground box and cover in accordance with Departmental Material Specification (DMS) 11071 "Battery Box Ground Boxes." Battery box will accommodate up to 4 batteries, each measuring 8 in. x 13.5 in. x 10 in. (W x L x D). Label battery box ground box cover in accordance with DMS 11071.

2. Supply a marine grade batteries with covers. Secure the marine grade batteries with covers to the stainless steel rack in the bottom of the ground box with tie down straps.

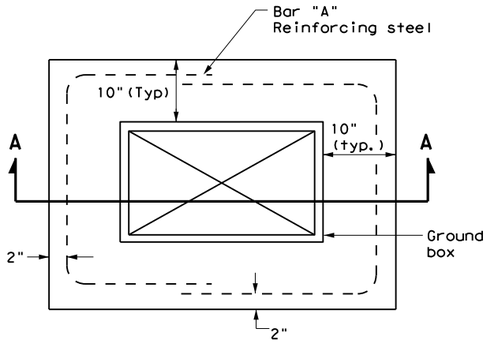
B. CONSTRUCTION METHODS

1. Ensure conduit entry will not interfere with placement of the batteries in the battery box ground box.

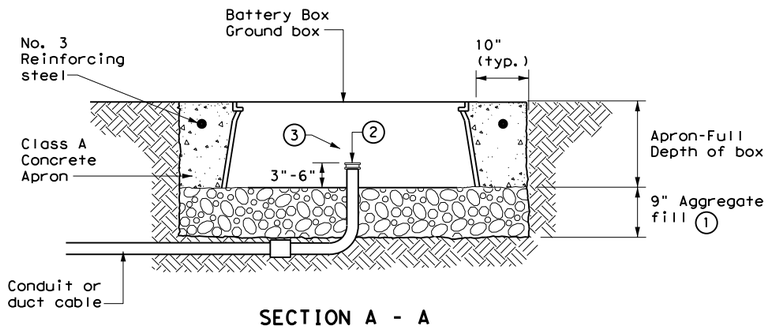
2. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting battery box ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure the aggregate bed is in place and is a minimum of 9 in. deep prior to setting the box. Install battery box ground box on top of aggregate.

3. Cast battery box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Battery box ground box aprons, including concrete and reinforcing steel, are subsidiary to battery box ground boxes when called for by descriptive code.

4. Bolt covers down when not working in battery box ground boxes. Keep bolt holes in the box clear of dirt.



PLAN VIEW



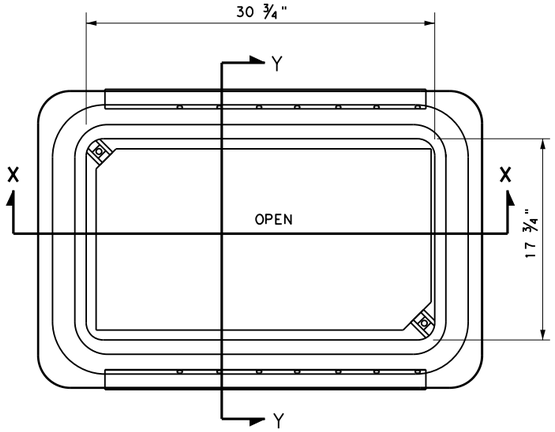
SECTION A - A

APRON FOR BATTERY BOX GROUND BOXES

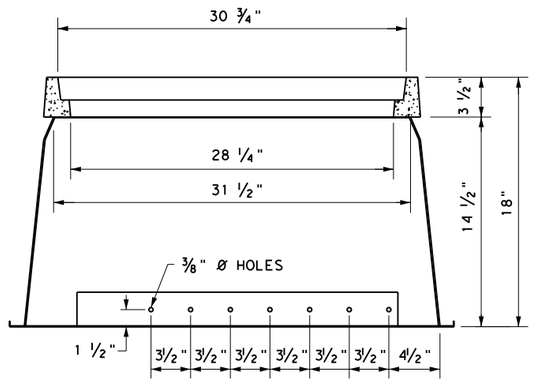
(1) Place aggregate under the box and not in the box. Aggregate should not encroach on the interior volume of the box.

(2) Install bushing or bell end fitting on the upper end of all ells.

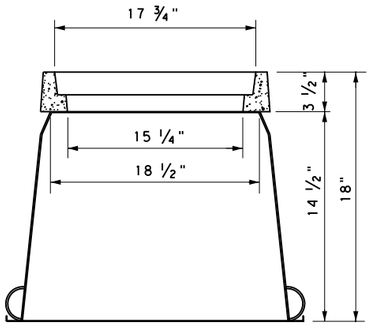
(3) Install all conduits in a neat and workmanlike manner.



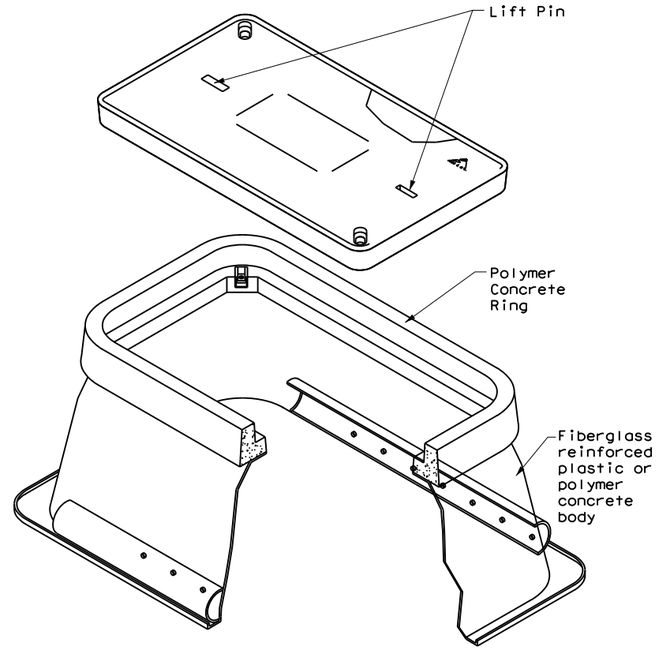
BATTERY BOX TOP VIEW



SECTION X-X



SECTION Y-Y



Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS
BATTERY BOX
GROUND BOXES

ED(12)-14

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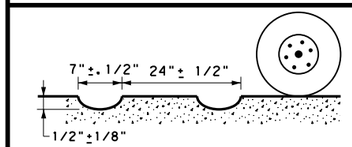
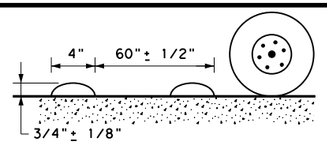
71M

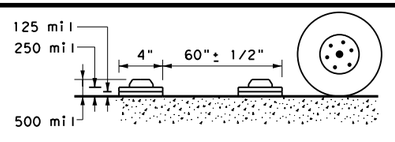
CENTERLINE RUMBLE STRIPS



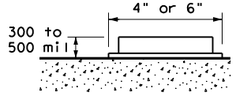
MILLED RUMBLE STRIPS



RAISED TRAFFIC BUTTONS

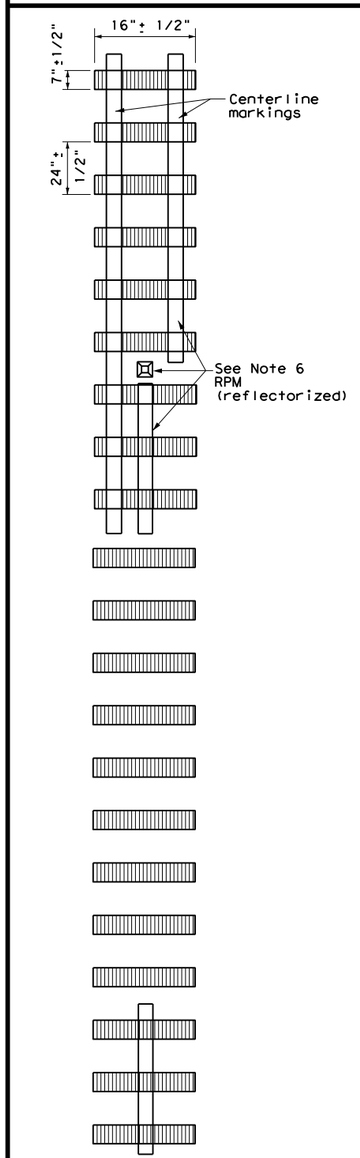


PREFORMED THERMOPLASTIC STRIPS



PROFILE MARKINGS

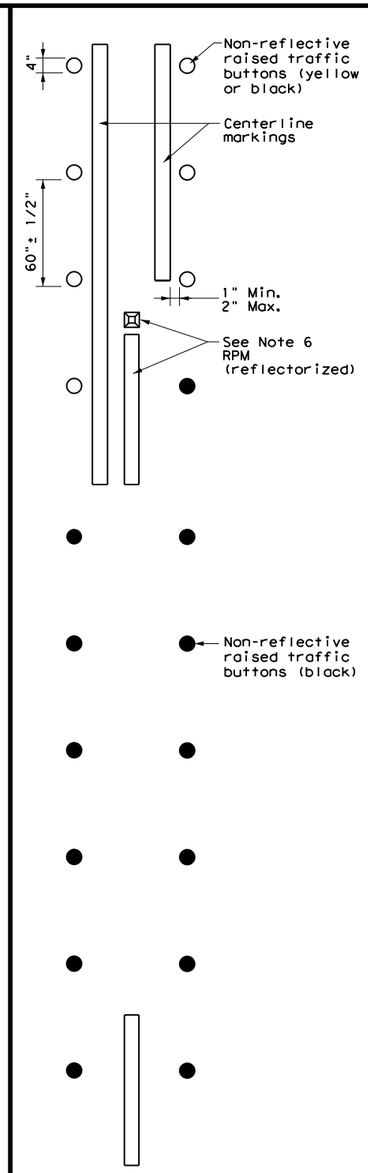
PROFILE VIEW



PLAN VIEW
OPTION 1

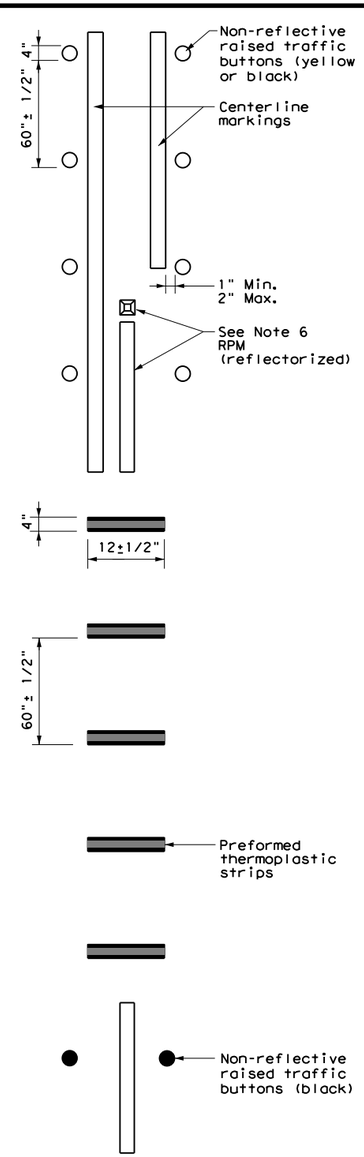
TWO LANE TWO-WAY ROADWAYS

MILLED CENTERLINE RUMBLE STRIPS



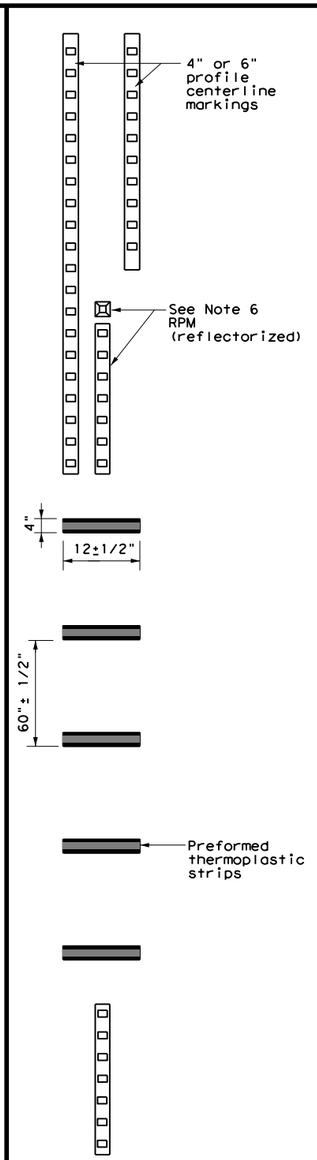
PLAN VIEW
OPTION 2

RAISED CENTERLINE RUMBLE STRIPS



PLAN VIEW
OPTION 3

RAISED CENTERLINE RUMBLE STRIPS AND PREFORMED THERMOPLASTIC STRIPS



PLAN VIEW
OPTION 4

PROFILE CENTERLINE MARKINGS AND PREFORMED THERMOPLASTIC STRIPS

GENERAL NOTES

1. This standard sheet provides guidelines for installing centerline rumble strips on two-lane highways with or without shoulders.
2. Centerline and edgeline rumble strips or profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
3. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
4. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
5. Breaks in milled centerline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks.
6. Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, and dimensions pavement markings and profile markings.
7. Consideration should be given to noise levels when centerline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inch depth of milled rumble strip may be considered in these areas.
8. Pavement markings must be applied over milled centerline rumble strips.

WHEN INSTALLING CENTERLINE RUMBLE STRIPS:

9. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per manufacturer's recommendations.
10. When using non-reflective raised traffic buttons as a centerline rumble strip, the button shall be placed adjacent to the pavement marking delineating the centerline. The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
11. The color of the button should be yellow for a continuous no passing roadway. Black buttons should be used in areas where passing is allowed.

WHEN INSTALLING EDGELINE RUMBLE STRIPS WITH OR WITHOUT CENTERLINE RUMBLE STRIPS ON UNDIVIDED HIGHWAYS:

12. See standard sheet RS(4).

Texas Department of Transportation®

Traffic Operations Division Standard

CENTERLINE RUMBLE STRIPS ON TWO LANE TWO-WAY HIGHWAYS

RS(3)-13

FILE: rs(3)-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		189

DATE: 5/19/2022 6:12:50 PM
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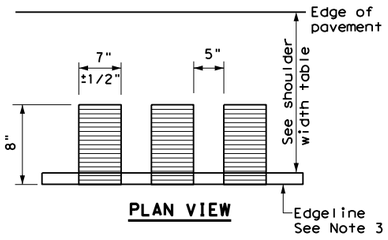
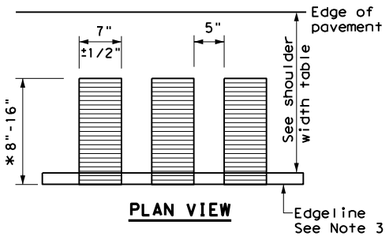


OPTION 1

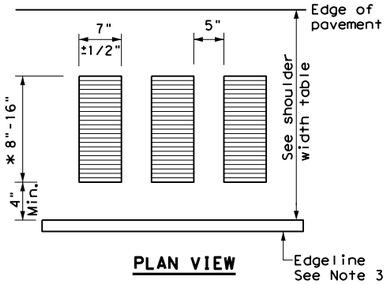
CONTINUOUS MILLED DEPRESSIONS (Rumble Stripes)



* This distance may vary based on width of shoulder

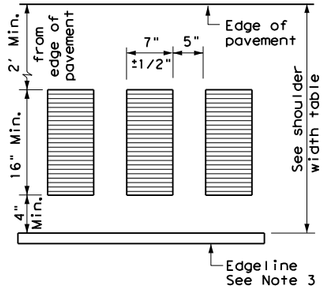
OPTION 2

CONTINUOUS MILLED DEPRESSIONS (Rumble Stripes)



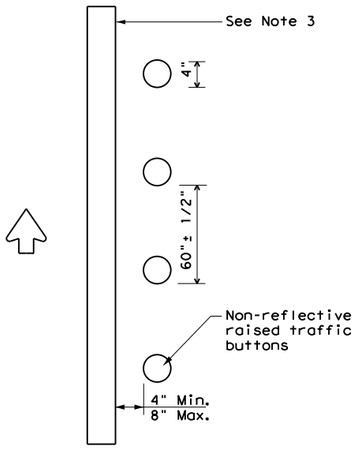
OPTION 3

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



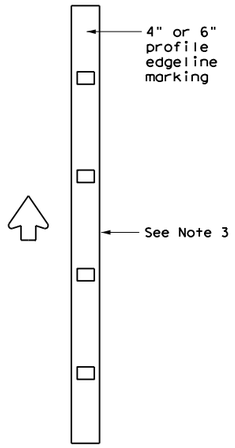
OPTION 4

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



OPTION 5

RAISED EDGELINE RUMBLE STRIPS



OPTION 6

PROFILE EDGELINE MARKINGS

SHOULDER WIDTH TABLE		
EQUAL TO OR LESS THAN 2 FEET	GREATER THAN 2 FEET LESS THAN 4 FEET	EQUAL TO OR GREATER THAN 4 FEET
Option 1, 5 OR 6	Option 1, 2, 3 5 OR 6	Option 2, 4, 5 OR 6

GENERAL NOTES

1. Rumble strips and profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
2. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
3. Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings, and profile markings.
4. See the table below for determining what options may be used for edgeline rumble strips.

WHEN INSTALLING MILLED DEPRESSION EDGELINE RUMBLE STRIPS:

5. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
6. Pavement markings can be applied over milled shoulder rumble strips to create an edgeline rumble stripe.
7. Breaks in edgeline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks when installed on conventional highways.
8. Rumble strips shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
9. Consideration should be given to noise levels when edgeline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inches depth of milled rumble strip may be considered in these areas.
10. On roadways with high bicycle activity, consideration should be given before the installation of edgeline rumble strips. Things to consider include size of rumble strips, rumble strip material and location of rumble strips on the shoulder. If the designer determines that gaps are needed in the rumble strips due to bicycle use of the road, then follow the requirement shown in FHWA Technical Advisory T5040.39, or latest version. A detail of the spacing shall be included in the plans.

WHEN INSTALLING RAISED OR PROFILE EDGELINE RUMBLE STRIPS:

11. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per the manufacturer's recommendations.
12. Non-reflective traffic buttons shall be placed adjacent to the pavement marking delineating the edgeline when used as a rumble strip. The color of the button should match the color of the adjacent edgeline marking (white or yellow). The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
13. Non-reflective traffic buttons shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
14. Breaks in edgeline rumble strips using raised traffic buttons shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossing, intersections and driveways with high usage of large trucks when installed on conventional highways.
15. The minimum distance between the edgeline and the buttons should be used if the shoulder is less than 8 feet in width.
16. Raised profile thermoplastic markings used as edgelines may substitute for buttons.

Texas Department of Transportation

Traffic Operations Division Standard

EDGELINE RUMBLE STRIPS ON UNDIVIDED OR TWO LANE HIGHWAYS RS(4)-13

FILE: rs(4)-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		190

DATE: 5/19/2022 6:12:55 PM
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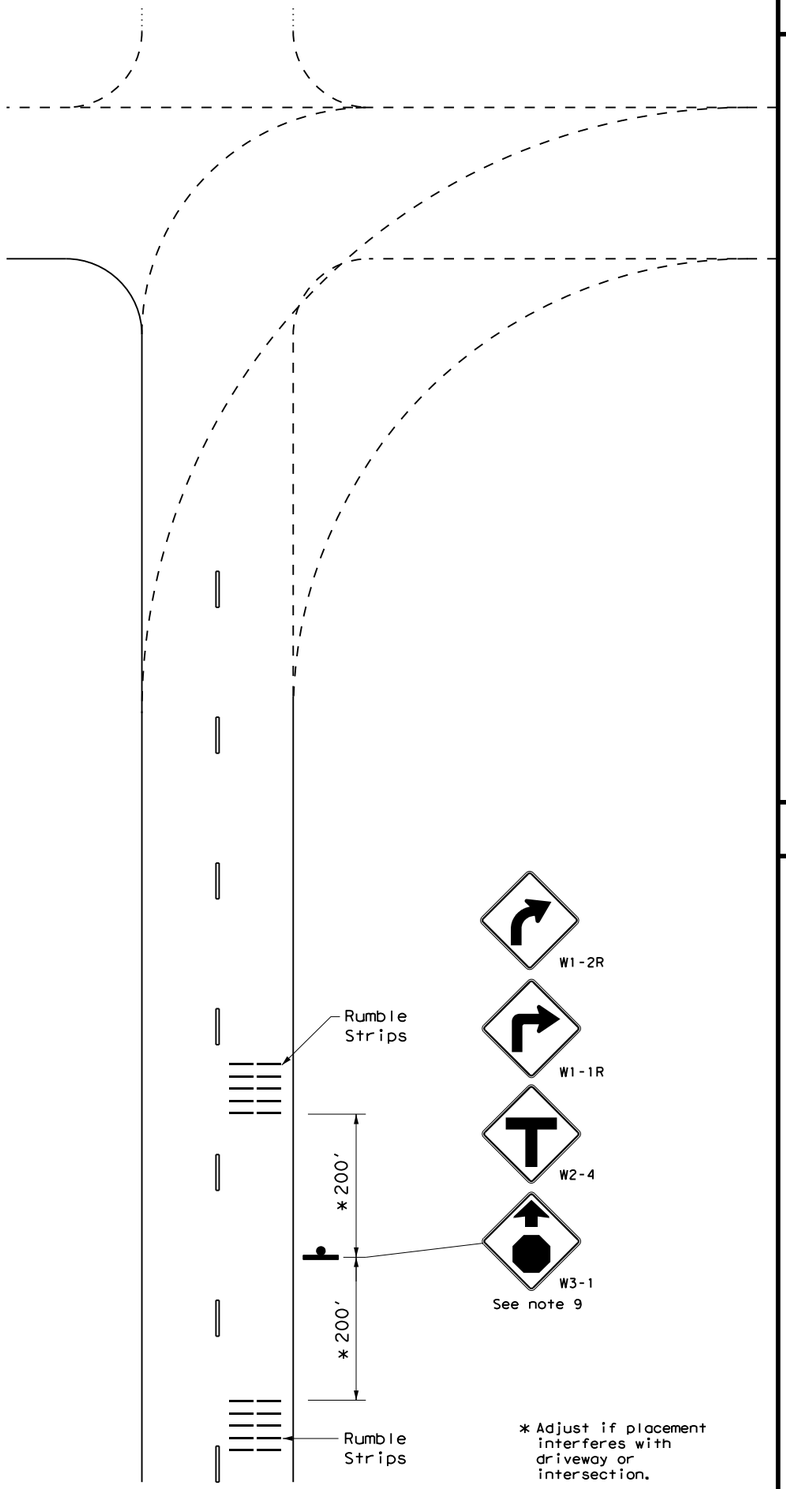
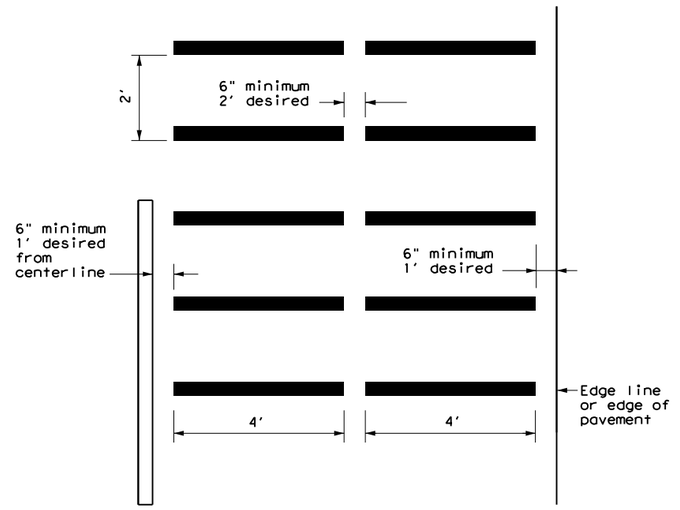
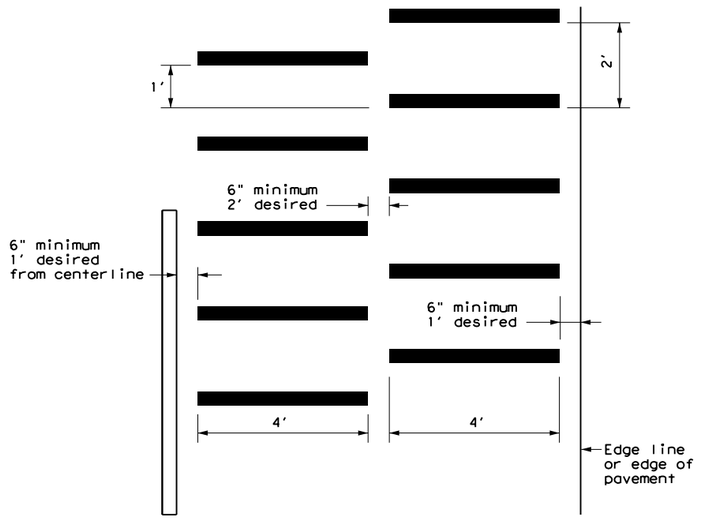


STANDARD PATTERN



ALTERNATIVE PATTERN



GENERAL NOTES

1. Transverse or in-lane rumble strips should only be used at high incident and special geometric locations. These special geometric locations may include: approaches to rural, high speed signalized or Stop -controlled intersections with sight restrictions and/or high crash rates, approaches to unexpected urban intersections, approaches to newly installed Stop or signalized controlled intersections, approaches to toll plazas, approaches to hazardous horizontal curves, and approaches to railroad grade crossings.
2. When used, the rumble strips shall be placed 200 feet prior to and after the placement of the warning device.
3. The use of rumble strips should not be widespread or used indiscriminately.
4. Preformed black raised rumble strips should be used. They should be installed in accordance with the manufacturer's recommendations.
5. A list of approved, preformed raised rumble strips can be obtained from the Traffic Operations Division.
6. Consideration should be given to noise levels when in -lane or transverse rumble strips are installed near residential areas, schools, churches, etc.
7. The use of the "Rumble Strips Ahead" sign may be used in advance of in -lane or transverse rumble strips, based on engineering judgement. This sign is typically not necessary for rumble strip installations built to the guidelines on this standard sheet. When used, this sign should be spaced in advance of the rumble strips based on the guidelines for advance placement of warning sign included in the "Texas Manual on Uniform Traffic Control Devices".

W17-2T

8. Consideration should be given to bicyclists. A 12 inch gap from the edge line may be used to accommodate bicyclists when a usable shoulder is not available. Additional gaps in the in -lane or transverse rumble strips are not recommended since they could cause motorists to swerve to avoid the rumble strips.
9. Other signs can be used as conditions warrant.

Texas Department of Transportation

Traffic Operations Division Standard

TRANSVERSE OR IN-LANE RUMBLE STRIPS

RS(5)-13

FILE: rs(5)-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT April 2006	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
2-10	DIST	COUNTY		SHEET NO.
10-13	WAC	HILL		191

DATE: 5/19/2022 6:13:01 PM
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REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

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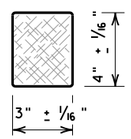
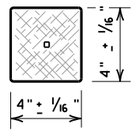
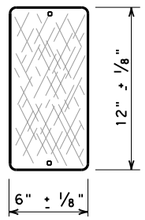
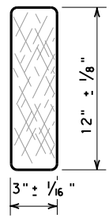
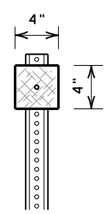
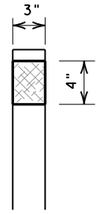
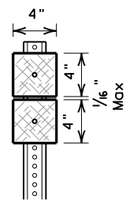
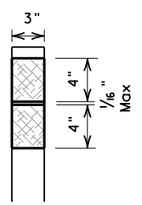
DEVICE				
SHEETING	Yellow, White or Red Type B or C reflective sheeting			
NOTE	1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (flx). 2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.			

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

D & OM DESCRIPTIVE CODES

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

NUMBER OF REFLECTORS
S = Single
D = Double

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

REFLECTOR UNIT SIZE
1 or 2

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

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

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

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

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

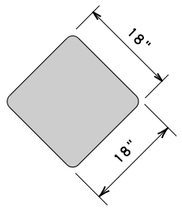
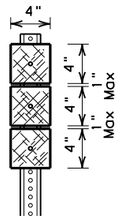
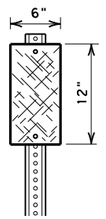
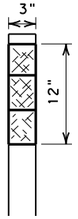
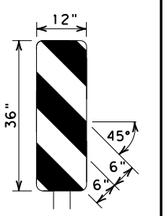
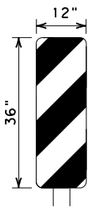
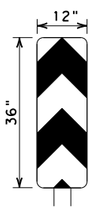
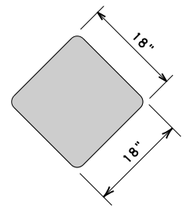
NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

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

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

DIRECTION
If Required
BI = Bi-Directional

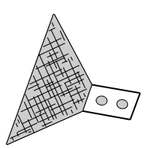
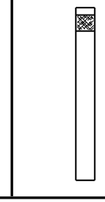
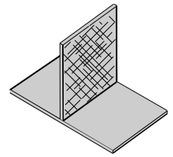
OBJECT MARKERS

	Type 1 (OM-1)	Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)
	OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4
DEVICE								
		3-Size 2 reflector units	1-Size 3 reflector unit	3-Size 1 reflector units or 1-Size 4 reflector unit				
SHEETING	Yellow-Type B_{FL} or C_{FL} Sheeting	Yellow - Type B or C Sheeting			Alternating acrylic black and retroflective yellow - Type B_{FL} or C_{FL} Sheeting			Red -Type B_{FL} or C_{FL} Sheeting
POST TYPE	TWT	WC	WC	WFLX	TWT			TWT
MOUNT TYPE	WAS, WAP	GND	GND	GND, SRF	WAS, WAP			WAS, WAP

DEPARTMENTAL MATERIAL SPECIFICATIONS

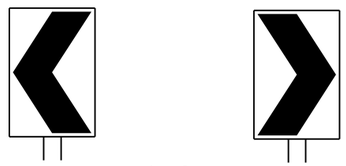
FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES)	DMS-4400
SIGN FACE MATERIALS	DMS-8300
DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS	DMS-8600

BARRIER REFLECTORS (BRF)

	GF1	GF2	CTB
DEVICE			
	1. Barrier reflectors shall meet the requirements of DMS 8600. 2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov.		
SHEETING	Yellow, White, Red		
NOTE	1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches.		

CHEVRONS

DEVICE

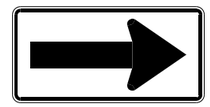


SIZE (W x L)	18"x 24" (Conventional)	24"x 30" (Conventional Oversize)	30"x 36" (Expressway)	36" x 48" (Freeway)
MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only	

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



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

NOTE:

Delineator and object marker substrates and sign substrates shall be 0.080" Aluminum sign blank to conform to ASTM B-209 Alloy 6061-T6 or approved alternative.

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

D & OM(1)-20

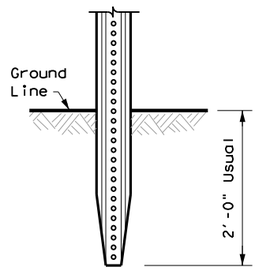
FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	WAC	HILL		192

20A

POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

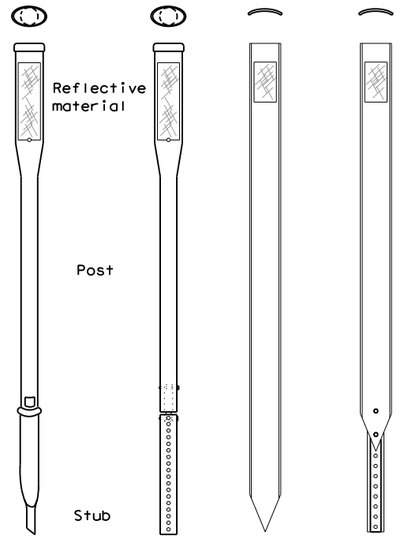


NOTES

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.

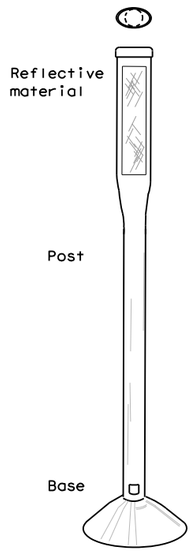
FLEXIBLE POSTS (YFLX, WFLX)

GND



EMBEDDED

SRF



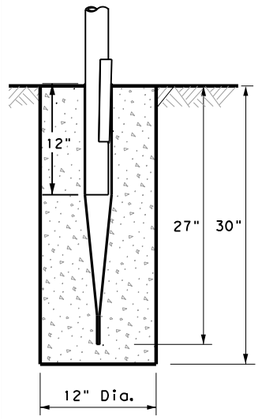
SURFACE MOUNT

NOTES

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

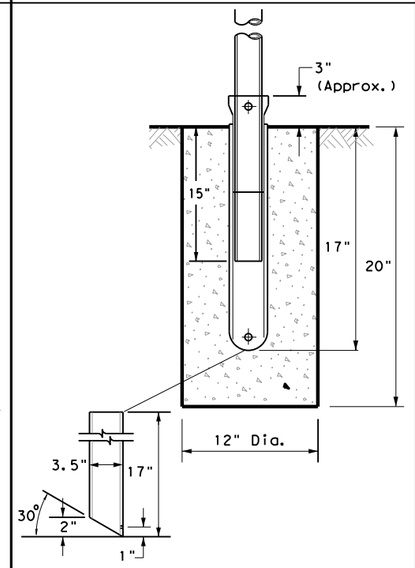
WEDGE ANCHOR SYSTEMS

WAS



STEEL

WAP



PLASTIC

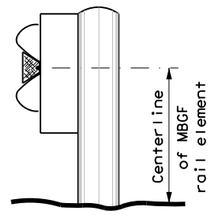
NOTE

1. Install per manufacturer's recommendations.

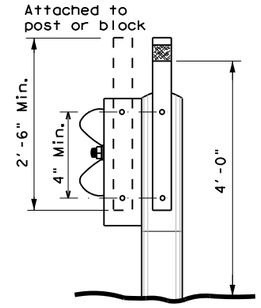
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

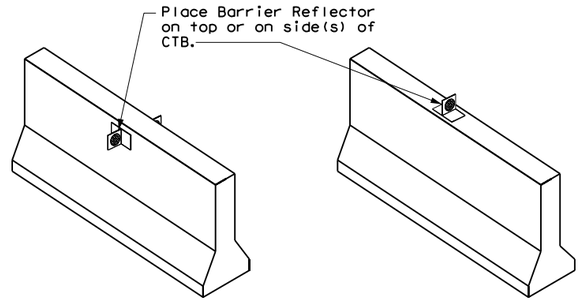
GF1



GF2



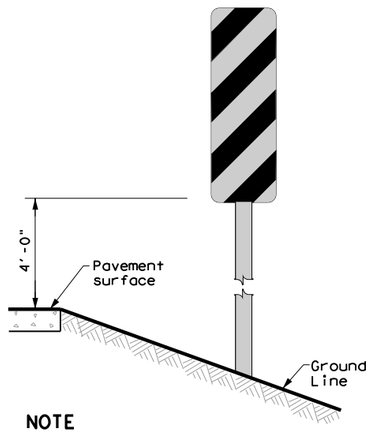
CONCRETE TRAFFIC BARRIER (CTB)



GENERAL NOTES

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

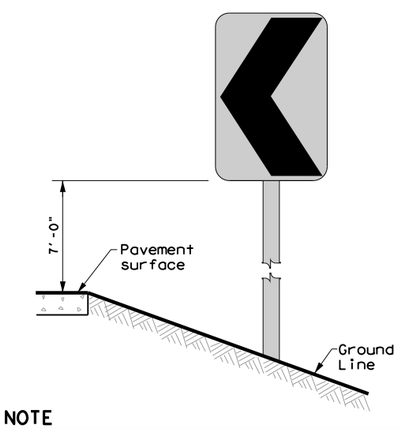
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



NOTE

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

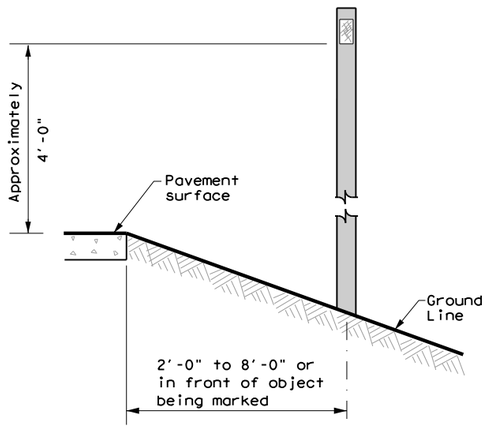
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



NOTE

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

DELINEATORS AND TYPE 2 OBJECT MARKERS



See general notes 1, 2 and 3.

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

FILE: dom2-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	WAC	HILL		193

20B

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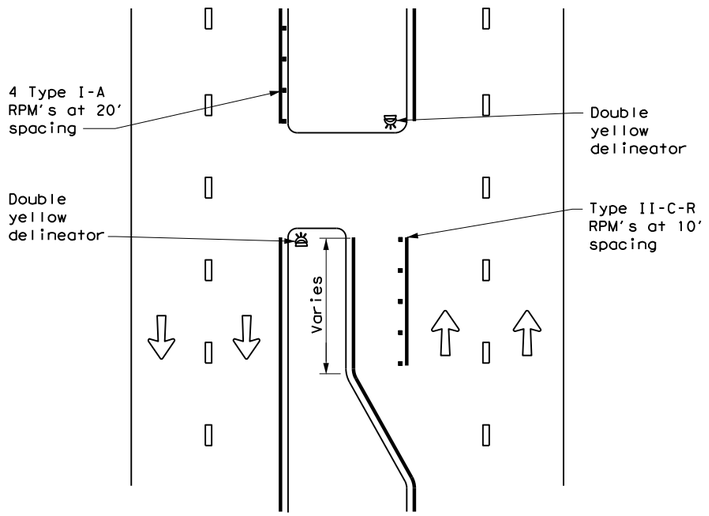
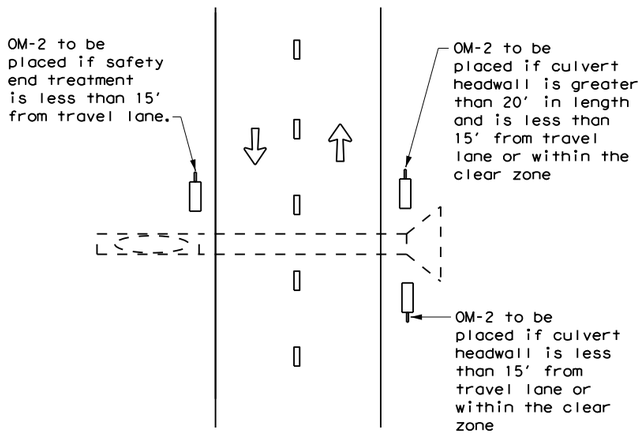
CROSSOVERS



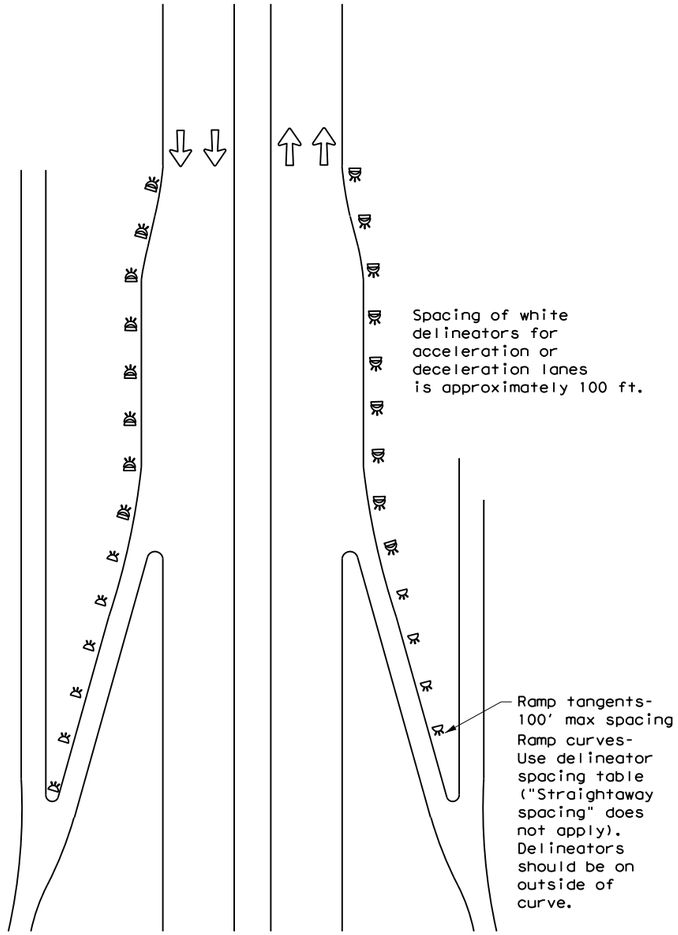
DETAIL 1

FOR CULVERTS WITHOUT MBGF



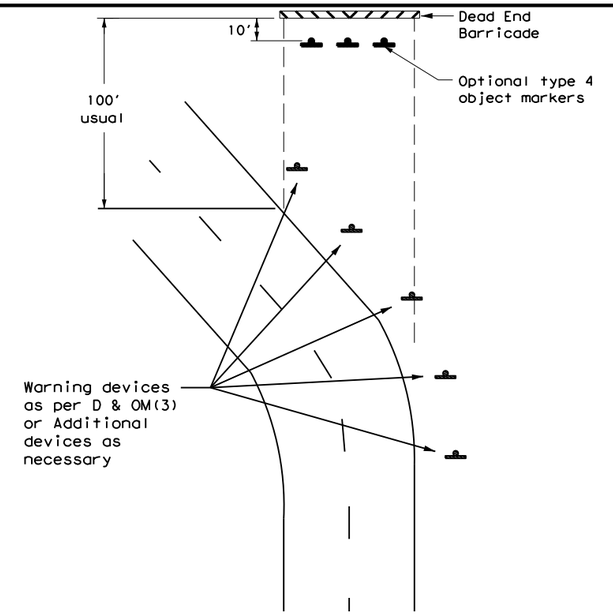
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



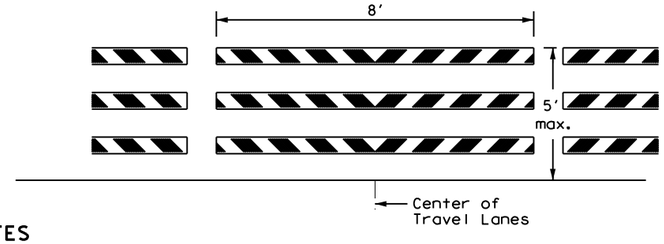
DETAIL 3

TYPICAL APPLICATION OF DEAD END BARRICADE



DETAIL 4

TYPICAL DEAD END BARRICADE INSTALLATION



NOTES

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

DETAIL 5

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(4)-20

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
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REVISIONS	0019	03	028 Etc.	SH 171
3-15	DIST	COUNTY		SHEET NO.
7-20	WAC	HILL		194

20D

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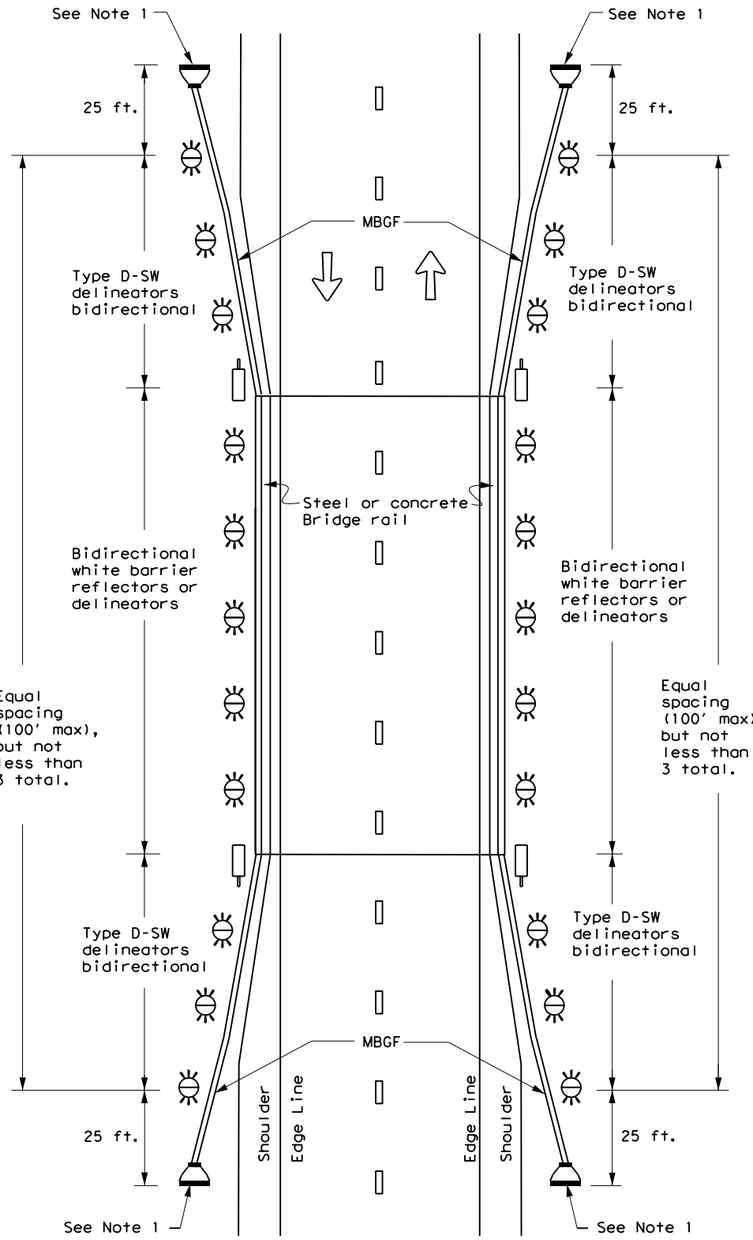
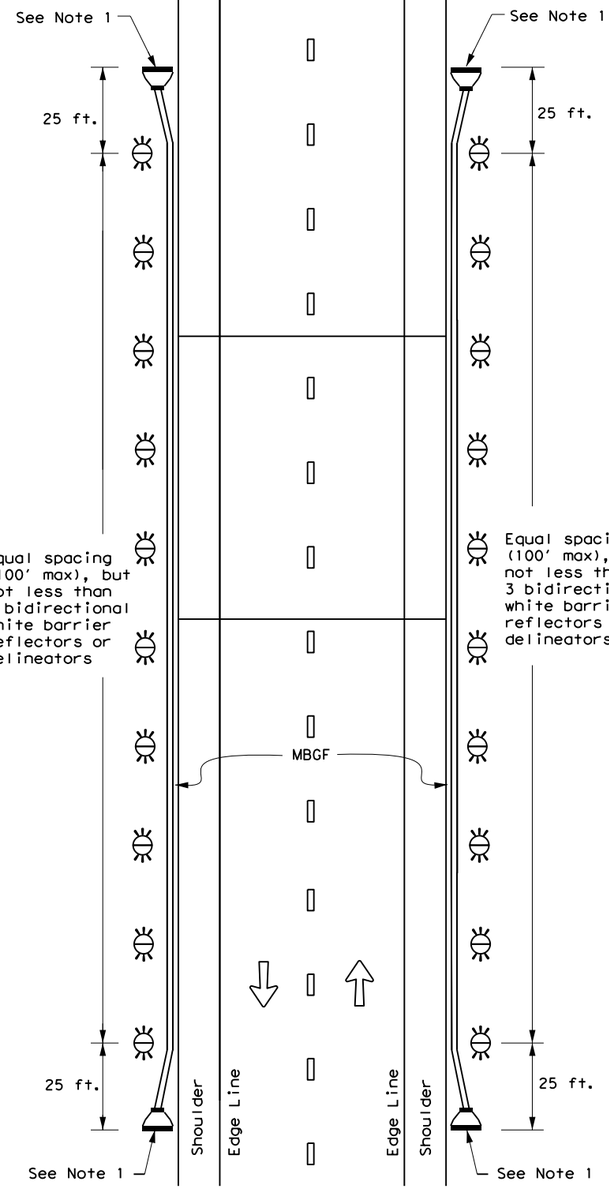
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



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.

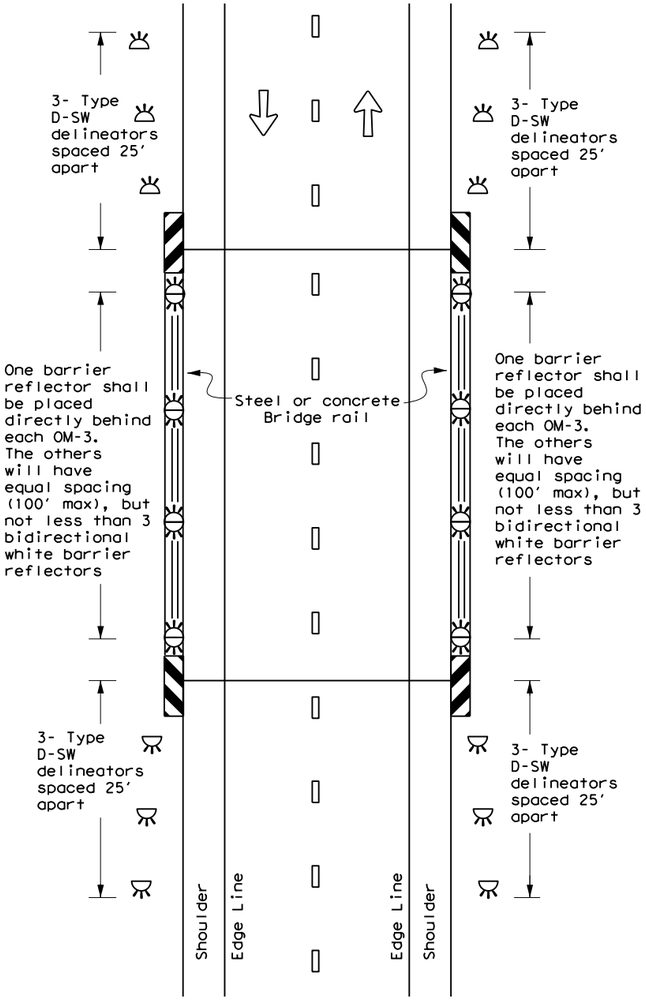
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



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
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20E

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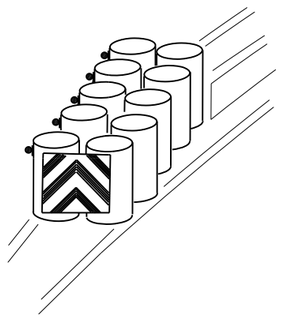
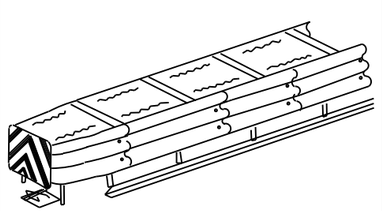
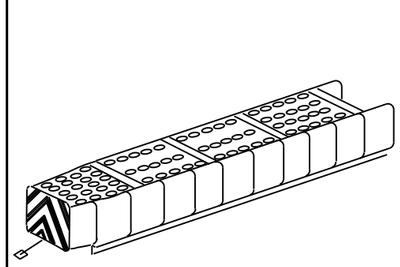
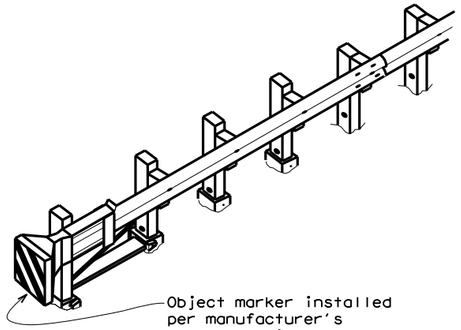
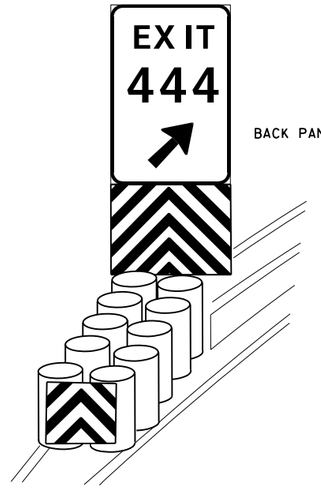
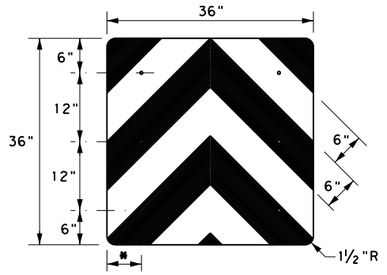


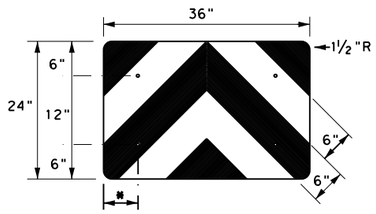




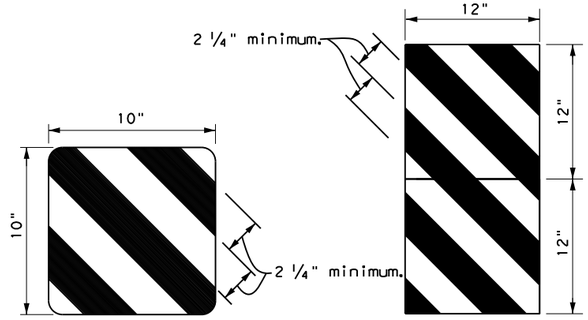




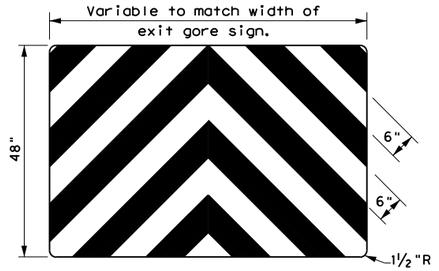


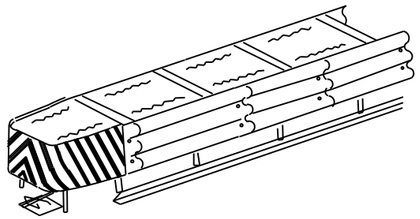


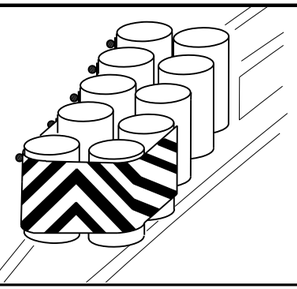
* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

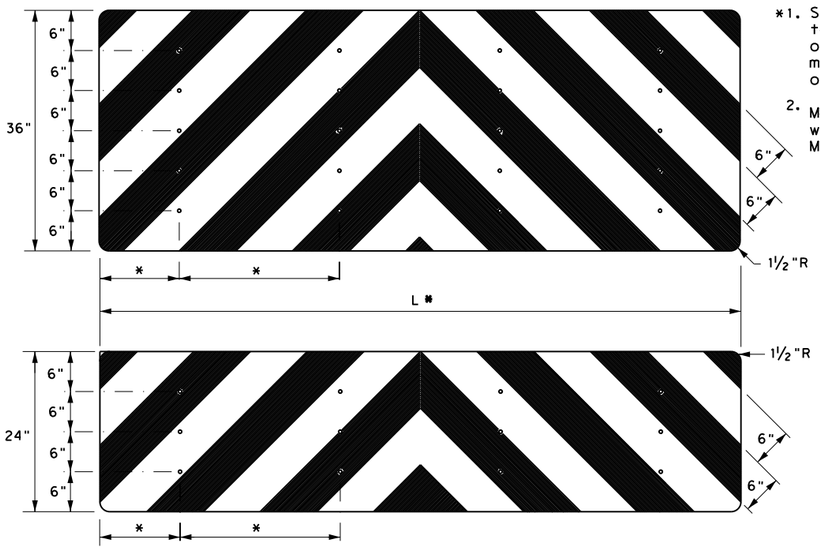


OBJECT MARKERS SMALLER THAN 3 FT^2









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	0019	03	028 Etc.	SH 171
4-92 8-04	DIST	COUNTY		SHEET NO.
8-95 3-15	WAC	HILL		196
4-98 7-20				

20G

SITE DESCRIPTION

PROJECT LIMITS:

CCSJ 0019-03-028: From FM 2719 to Johnson County Line

CSJ 0418-03-025: From SH 22 to FM 2719

LOCATION MAPS:

Refer to title sheet for project location map.

PROJECT DESCRIPTION:

CSJ 0019-03-028, etc.:

For the construction of hazard elimination and safety consisting of safety treat fixed objects.

MAJOR SOIL DISTURBING ACTIVITIES:

The major soil disturbing activities for this project will consist of excavation, embankment, grading and construction at existing culverts.

TOTAL PROJECT AREA:	293.2 AC
TOTAL AREA TO BE DISTURBED:	1.45 AC

EXISTING CONDITION OF SOIL & VEGETATIVE COVER AND % OF EXISTING VEGETATIVE COVER:

CSJ 0019-03-028 Etc:
The predominate soil type is Houston Black clay.
Vegetative cover is in fair condition with 80% coverage.

NAME OF RECEIVING WATERS:

CSJ 0019-03-028 Etc:
Aquilla Creek and Hackberry Creek receive all drainage from this project, which drains into Aquilla Reservoir, which drains into Aquilla Creek, which ultimately drains into the Brazos River within stream segment 1256.

EROSION AND SEDIMENT CONTROLS

SOIL STABILIZATION PRACTICES:

- [X] TEMPORARY SEEDING
- [X] PERMANENT PLANTING, SODDING, OR SEEDING
- [ ] MULCHING
- [X] SOIL RETENTION BLANKET
- [X] NATURAL BARRIERS OR BUFFER ZONES
- [X] PRESERVATION OF NATURAL RESOURCES

OTHER: TXR 150000, Part III, Section G, 2 Stabilization of disturbed areas must, at a minimum, be initiated immediately whenever any clearing, grading, excavating, or other earth disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days. Temporary stabilization must be completed no more than 14 calendar days after initiation of soil stabilization measures, and final stabilization must be achieved prior to termination of permit coverage.

STRUCTURAL PRACTICES:

- [T] SILT FENCES
- [ ] HAY BALES
- [T] SANDBAG OR ROCK BERMS
- [ ] DIVERSION, INTERCEPTOR, OR PERIMETER DIKES
- [ ] DIVERSION, INTERCEPTOR, OR PERIMETER SWALES
- [ ] DIVERSION DIKE AND SWALE COMBINATIONS
- [ ] PIPE SLOPE DRAINS
- [ ] PAVED FLUMES
- [ ] ROCK BEDDING AT CONSTRUCTION EXIT
- [ ] TIMBER MATTING AT CONSTRUCTION EXIT
- [ ] CHANNEL LINERS
- [ ] SEDIMENT TRAPS
- [ ] SEDIMENT BASINS
- [ ] STORM INLET SEDIMENT TRAP
- [P] STONE OUTLET STRUCTURES
- [ ] CURBS AND GUTTERS
- [ ] STORM SEWERS
- [ ] VELOCITY CONTROL DEVICES

OTHER:

NARRATIVE - SEQUENCE OF CONSTRUCTION (STORM WATER MANAGEMENT) ACTIVITIES:

The order of activities will be as follows:

1. Preserve existing vegetative cover as much as possible.
2. Install temporary sediment control fencing, rock berms and other items as shown on plans prior to any soil disturbing activities.
3. Construct proposed culvert, bridge and roadway improvements and perform any necessary excavation, embankment and grading.
4. Place soil retention blankets and temporary/permanent seeding as shown in the plans and as directed.

STORM WATER MANAGEMENT:

An integral part of the SWPPP for this project includes the EPIC Sheet, Item 506, Waco District Waters of the US Notes, Waco District Typical Applications for Best Management Practices, Form 2118 TxDOT inspection forms, Contractor daily inspection forms, miscellaneous general notes on environmental requirements, TxDOT EC Standards, 2014 Standard Specifications, TxDOT roadway design drawings, SWPPP design and working BMP drawings, Site Manager Data Base, EMS Stage Gate Inspections and the Waco District environmental folders. The requirements of the TxDOT EMS will be fully implemented including training requirements for Contractors and TxDOT staff.

STATE OF TEXAS
CHRIS J. MASHEK
102242
REGISTERED PROFESSIONAL ENGINEER

Chris J. Mashek, P.E.

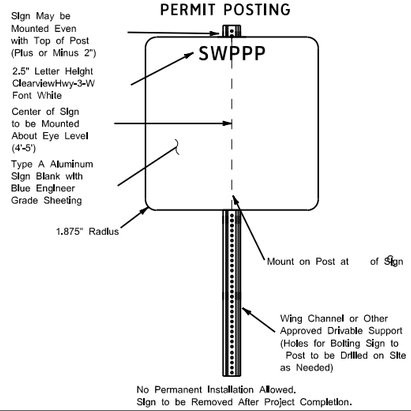
SIGNATURE OF REGISTRANT

5/19/2022

DATE

Texas Department of Transportation
Waco District Office
Advanced Project Development
100 South Loop Drive
Waco Texas, 76704-2858

STORM WATER POLLUTION PREVENTION PLAN PERMIT POSTING



No Permanent Installation Allowed.
Sign to be Removed After Project Completion.

OTHER EROSION AND SEDIMENT CONTROLS:

MAINTENANCE: All erosion and sediment best management practices (BMPs) will be maintained in good working order per the environmental notes, details and standards included as part of the project plans and contract documents. BMP repairs will be made at the earliest possible date, but no later than seven calendar days after the inspection report has been completed and immediately after the ground has dried sufficiently to allow equipment access. BMPs damaged by the Contractor will be repaired or replaced immediately. The installation and repair of BMPs at creeks and outfalls will be given priority.

INSPECTION: TxDOT Form 2118 inspections to support TXR150000 and 404 permits will be conducted on a seven day interval on the same day of the week, until permits are terminated. The Contractor will provide daily BMP inspection reports on work days. Stage Gate Inspections and other BMP inspections will be conducted by the District and Area Office Staff based on requirements of the TxDOT Environmental Management System (EMS).

WASTE MATERIALS:
Any waste materials generated during construction will be disposed of in accordance with existing federal, state, and local laws.

HAZARDOUS WASTE (INCLUDING SPILL REPORTING):

At a minimum, any products in the following categories are considered to be hazardous: Fuels, Lubricating products, Asphalt products, or Concrete curing compounds and any additives. In the event of a spill which may be hazardous, clean-up will be done in accordance with federal, state, and local regulations. The Contractor will maintain a list of all chemicals and wastes required for the project; including chemicals used by sub-contractors, and will implement written spill prevention and clean-up plans.

SANITARY WASTE:
Sanitary waste from portable units will be collected by a licensed sanitary waste management contractor.

OFF SITE VEHICLE TRACKING:

- [ ] HAUL ROADS DAMPENED FOR DUST CONTROL
- [X] LOADED HAUL TRUCKS TO BE COVERED WITH TARPAULIN
- [X] EXCESS DIRT ON ROAD REMOVED DAILY
- [ ] STABILIZED CONSTRUCTION ENTRANCE

REMARKS:
Disposal areas, stockpiles, and haul roads will be constructed in a manner that will minimize and control the amount of sediment that may enter receiving waters. Disposal areas will not be located in any wetland, waterbody or streambed. Construction staging area and vehicle maintenance area will be constructed by the contractor in a manner to minimize the runoff pollutants.

Furnish one SW3P permit posting sign and sign support as detailed on the SW3P Sheet. Install this sign in a location selected by the Engineer. The sign and support should be removed upon completion of the project and is the property of the Contractor. The purchase of the sign and support, installation, relocation(s) if determined necessary by the Engineer and removal at project end will be subsidiary to Item 506.

Sedimentation Basins - Since the area disturbed is less than 10 acres, per outfall location, a sedimentation basin is not required.

WACO DISTRICT STORM WATER POLLUTION PREVENTION PLAN (SW3P)

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		SHEET NO.
6			197
STATE	DIST.	COUNTY	
TEXAS	WACO	HILL	
CONT.	SECT.	JOB	HIGHWAY NO.
0019	03	028 ETC	SH 171

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DATE:
FILE:

I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

1.

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. Project will disturb more than 5 acres, 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. Waters of the US are at Stations:

-43+75	-457+54	-806+28
-48+95	-493+05	-821+64
-52+86	-506+10	-837+45
-128+07	-522+26	-857+98
-172+16	-543+67	-877+08
-226+73	-580+06	
-279+43	-597+05	
-325+83	-672+31	
-448+97	-719+27	

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. SEE STATEMENT ABOVE

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. Vegetation clearing within the project limits/drainge areas must be completed during the non-nesting season September 15 - March 1.

☐ No Action Required ☒ Required Action

Action No.

1. Comply with Migratory Bird Treaty Act (MBTA)

2. Plains Spotted Skunk: Contractors will be advised of potential occurence in the project area, and to avoid harming the species if encountered, and to avoed unnecessary impacts to dens

3. SEE STATEMENT BELOW

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.

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

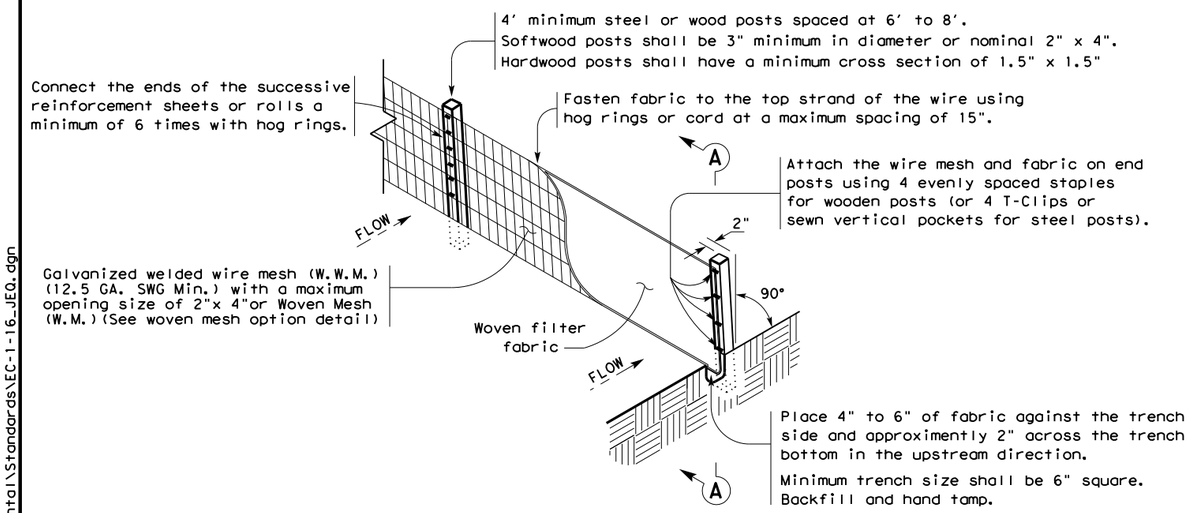
Design Division Standard

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

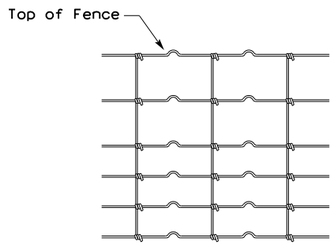
FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR
©TxDOT: February 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
12-12-2011 (DS) 05-07-14 ADDED NOTE SECTION IV. 01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	DIST	COUNTY		SHEET NO.
	09	HILL		198

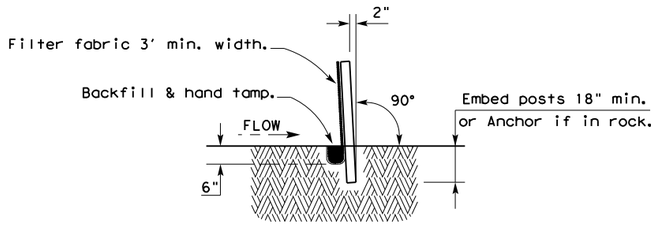
DATE: 6/30/2022
FILE: pwbt@txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\0019030284 - Design\Plan Set\9. Environmental\Standards\EC-1-16_JEQ.dgn



TEMPORARY SEDIMENT CONTROL FENCE

SCF





SECTION A-A

HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL

Galvanized hinge joint knot woven mesh (12.5 GA.SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

SEDIMENT CONTROL FENCE USAGE GUIDELINES

A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2 year storm frequency may be used to calculate the flow rate to be filtered.

Sediment control fence should be sized to filter a maximum flow through rate of 100 GPM/FT^2. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

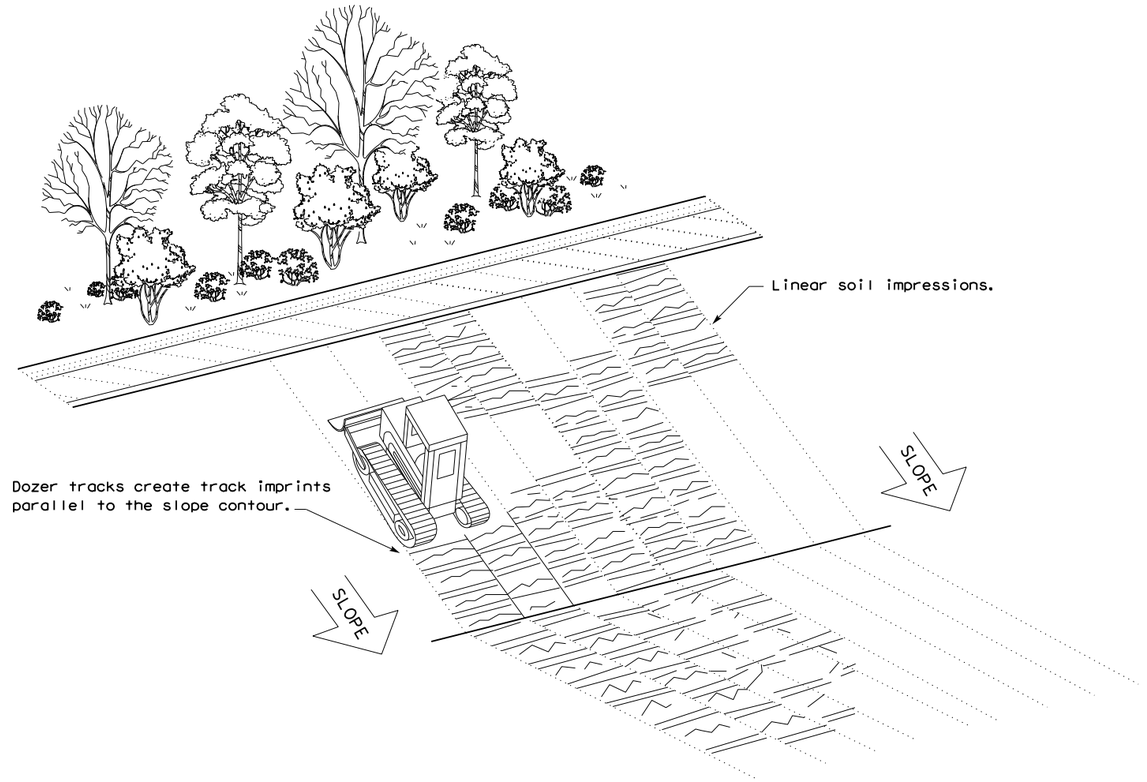
LEGEND

Sediment Control Fence

SCF

GENERAL NOTES

1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.



VERTICAL TRACKING

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

FENCE & VERTICAL TRACKING

EC(1)-16

FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		199

DATE: 6/1/2022
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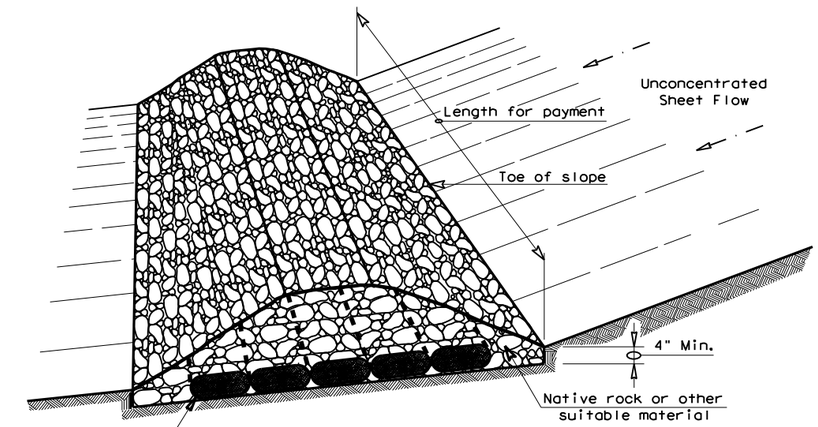
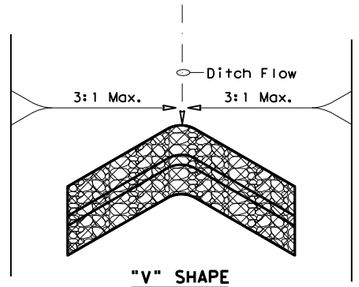
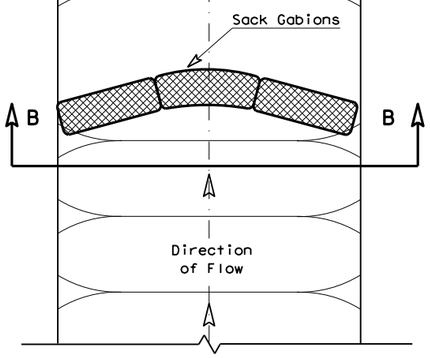


FILTER DAM AT TOE OF SLOPE

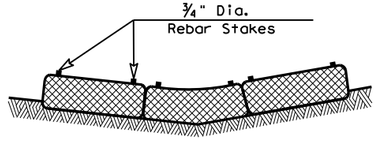
RFD1



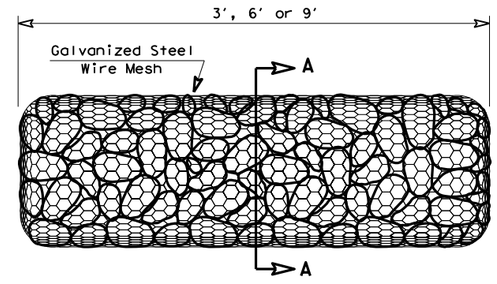
"V" SHAPE PLAN VIEW



PLAN VIEW

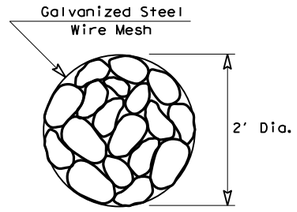


SECTION B-B

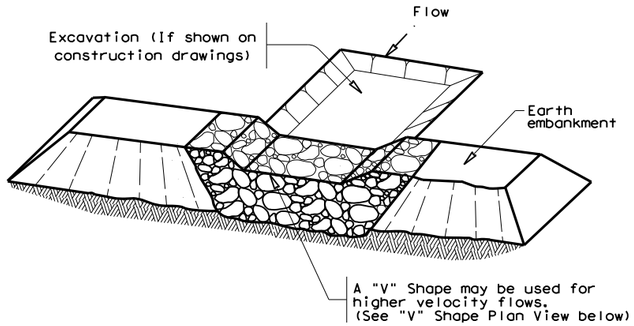


TYPE 4 (SACK GABIONS)

RFD4

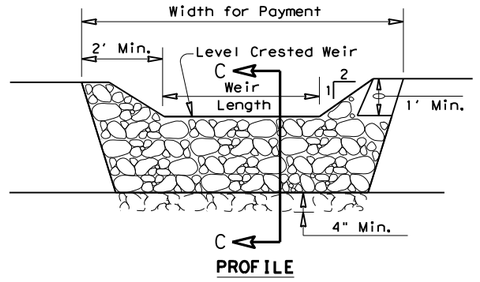


SECTION A-A

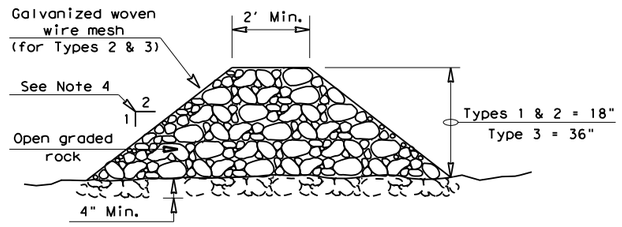


FILTER DAM AT SEDIMENT TRAP

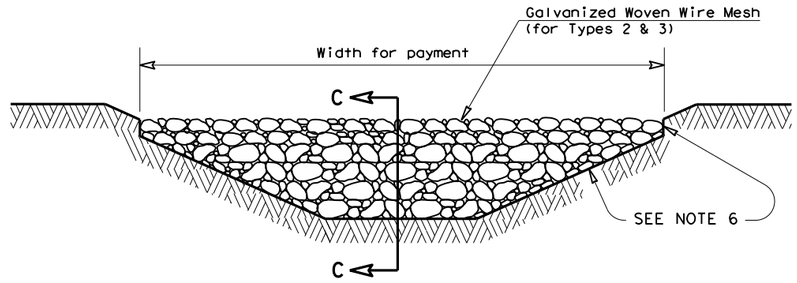
RFD1 — OR — RFD2



PROFILE



SECTION C-C



FILTER DAM AT CHANNEL SECTIONS

RFD1 — OR — RFD2 — OR — RFD3

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.

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.

PLAN SHEET LEGEND

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

Texas Department of Transportation — Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

ROCK FILTER DAMS

EC(2)-16

FILE: ec216	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
	DIST	COUNTY		SHEET NO.
	WAC	HILL		200

BEST MANAGEMENT PRACTICE (BMP) GENERAL NOTES

1. Prior to TxDOT allowing the Contractor to start construction, the Contractor will provide the required storm water and 404 permit documentation and support activities, including but not limited to the following:

   - Provide a list of all chemicals, construction and waste products that will be generated, stored or brought upon TxDOT ROW. The list includes expected construction debris, sanitary wastes, construction chemicals and petroleum products used or generated by the Contractor and sub-contractors. Along with the list, the Contractor will supply a spill prevention plan and clean up procedures that will include each of these chemical products or generated waste.

   - Provide in the construction schedule the necessary line items that will comply with the schedule and planning requirements of the storm water permit.

   - Post the TxDOT storm water permit and any Contractor permits, per permit requirements.

   - Provide copies of storm water permits for Contractor PSL(s). As new PSL(s) may be obtained for the project, provide copies of new or amended permits to TxDOT. The Contractor will not disturb soil without the proper permits.

   - Provide scale drawings of off ROW PSL's within one mile of the project, for field offices, borrow sources, plant sites or other uses.

   - Provide permit information on any Contractor batch plants or concrete crushing plants to be located at a Contractor PSL(s) within one mile of the project limits or boundaries. Copies of the air and water permits are to be provided to TxDOT before materials will be used on the project. No asphalt or concrete batch plants or concrete crushing plants will be located on TxDOT ROW.

   - Provide a letter indicating a Contractor Responsible Person for environmental compliance (CRP) for the project, and maintain a CRP throughout the project duration.

   - Provide all environmental documentation including certification of compliance and EMS training documents/certificates prior to starting work. The Contractor is to provide daily BMP inspection reports that document all field BMPs needing repair or replacement. The Contractor is to clearly document specific BMPs needing repair and location each work day. The Contractor is encouraged to be proactive in fixing BMPs without TxDOT direction.

   - Provide documentation required for Waters of the US, Note #3 and submittals for Item 496 bridge removal. Bridge removal methods submitted will follow all Waters of the US note requirements. The Contractor is not to start construction within the Ordinary High Water Marks of any stream until receiving approval for stream channel construction methods from TxDOT.

   - Provide a written procedure for managing all chemicals and construction items placed in vertical containment structures. Also, provide methods to be used for the treatment, disposal, collection or release of storm water.

   - Provide an estimated date by letter, for the submittal of marked up bridge drawings, indicating cut locations for any structural steel requiring cutting or torching of steel, coated with lead containing paints.

2. Place and maintain trash cans and portable sanitary facilities at locations where there is active construction. Worker generated trash and construction debris will be kept from being transported by storm water and will be collected daily from the ground and routinely hauled from the work area.

3. Contractor will provide TxDOT copies of all correspondence with MS4s, TCEQ, EPA, DSHS and Corps of Engineers regarding activities on this project.

4. Contractor to conduct storm water inspections and develop SWPPP documents to support Contractor permits obtained for the project including PSL(s).

5. Contractor will maintain written documentation of locations of all portable sanitary facilities. The Contractor is required to document the location and disposition of all spills and cleanups from portable sanitary facilities.

6. Contractor will not store chemicals on TxDOT ROW, unless chemicals are stored following all environmental and safety regulations. Fuels for construction equipment will not be stored on TxDOT ROW.

7. The Contractor will store fuels and bulk chemicals on Contractor PSL(s) using a secondary containment method, such as double lined tanks and/or free standing containment reservoirs made of plastic or steel designed to hold bulk chemicals or drums.

8. The Contractor will not remove sediment controls without the prior approval of TxDOT, except for a sediment control that may back up water and cause safety or traffic problems.

SCALE = NTS SHEET 1 OF 10

Texas Department of Transportation
Waco District Standard

TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

TA-BMP

FILE: BMPLAYOUTS.dgn	DN:	CK:	DW:	CK:
© TxDOT 2009	CONT	SECT	JOB	HIGHWAY
REVISIONS	0019	03	028 Etc.	SH 171
DEC 2013	DIST	COUNTY		SHEET NO.
FEB 2015	WAC	HILL		201

BEST MANAGEMENT PRACTICE (BMP) GENERAL NOTES

9. Any sediment controls removed by the Contractor must be re-installed before the next rainfall event or by the end of day, as approved in advance.

10. Vegetative buffer strips may be used in place of temporary sediment controls such as silt fences and rock filter dams. The amount of disturbed soil area will be limited to 1/3 of an acre or less for a minimum of 50 feet of grassed ditch and 2/3 of an acre of disturbed soil for a minimum of 100 feet of grassed ditch.

11. Construction equipment found to be leaking oil, fuel or coolant will be immediately stopped, the leaking fluid collected and the equipment fixed. Equipment continuing to leak will be removed from the project at no cost to TxDOT. Leaking fluids from equipment will be collected and removed from the project or PSL.

12. Earth berms or mounds typically used to stockpile topsoil and used in place of boundary silt fence will be seeded upon being constructed. Long term use of earth berms or mounds will not be continued without establishing grass on the control.

13. The Contractor will inform TxDOT of new areas where soil will be disturbed to facilitate planning for new sediment controls. Areas of vegetated soil will not be disturbed by the Contractor, unless adequate sediment controls can be installed before the next rainfall event. The Contractor will assist TxDOT in keeping an accurate set of working SWPPP drawings that show the locations of all temporary sediment and erosion controls.

14. The Contractor will maintain an adequate amount of temporary sediment controls on hand at the field office or project staging area for critical SWPPP maintenance, including silt fence (minimum of 200 feet) and rock / fabric for rock filter dams (minimum for 100 feet of Type III dams).

    The requirement for BMP rock quantities on hand is waived for small projects for on and off system bridge installations. The Contractor having a BMP Subcontractor does not eliminate the requirement for the Contractor to have the required silt fence and rock on hand, typically stored at the Contractor PSL.

15. Failure of a sub-contractor to complete storm water work on time will require the Contractor to start storm water sediment control work immediately and complete the work with high priority, or be subject to stop work on the entire project.

16. Earth materials on roads as a result of soil tracking will not be allowed to be transported off ROW in storm water. Soil or rock material found on roadways deposited from Contractor equipment will be removed daily.

17. Unless approved, completed concrete curb inlets will not be blocked by sediment controls. The contractor will frequently sweep the completed or partially completed roadway to keep sediment out of drainage pipes.

18. The Contractor will be responsible for proper dust control and will route construction traffic in a manner that minimizes dust generation.

19. Water for dust control will contain no pollutants, but may be non-potable from upland stock ponds. No quantity of water to be used for construction purposes may be taken from a 404 stream, prior to the proper authorizations or permits being obtained by the Contractor.

20. Contractor is to direct workers and sub-contractors to use portable sanitary facilities provided by the Contractor and not to trespass off ROW.

21. Contractor will provide written verification to TxDOT that earth borrow pits and disposal sources meet environmental and regulatory requirements, prior to use. Excavations will meet all OSHA requirements and the current safety guidelines established for TxDOT Quarries and Pits.

22. Boundary silt fences that are terminated down slope, with one end being at the lowest elevation, will be installed with an L - hook to contain sediment. Boundary silt fences that are installed on flat ground will have L-hooks on both ends.

23. Rock filter dams across ditches will be constructed where the rock filter dam ends are embedded within the ditch side slopes and ditch bottom. The top center elevation of the rock filter dam will be at least 6 inches lower than the elevations on the rock filter dam ends.

24. Silt fence will be constructed in a U or V pattern across ditch lines and up the ditch side slope to keep storm water from flowing around the ends of the silt fence. Small silt fences that do not adequately span the ditch and allows storm water around the end(s) will not be used. Where there is adequate space, large U pattern silt fences are preferred to facilitate sediment collection and sediment removal with equipment.

25. Sediment controls (RFDs or silt fences) will be located along road ditches as marked on the SWPPP drawings. Modifications to the sediment control spacing will be adjusted during the project based on sediment control effectiveness. The installation and maintenance of sediment controls at or near outfalls, where storm water leaves TxDOT ROW, takes persistent over ditch line sediment controls.

Texas Department of Transportation
Waco District Standard

TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

TA-BMP

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BEST MANAGEMENT PRACTICE (BMP) GENERAL NOTES

26. Storm water draining sheet flow over disturbed soil sloped towards the ROW property line, will be intercepted by a boundary silt fence typically installed with L-shaped ends.

27. For ditch grading and shoulder up work, the Contractor is limited during good weather to remove up to one mile (limited to five acres of disturbed soil) of ditch line sediment controls; on one side of the roadway. Outfall controls cannot be removed during this activity. Ditch line controls must be replaced upon completion of work and before the next rain event.

28. Sediment controls damaged by the Contractor, as defined by permit, must be fixed or replaced immediately upon discovery.

29. Notches in silt fences are not typically allowed. Specific silt fences that back up water onto lanes of traffic may be notched if approved.

30. For silt fence maintenance, the Contractor will leave approximately 4 inches of deposited sediment up stream of silt fences and not over excavate around silt fences or rock filter dams.

31. The Contractor will inform TxDOT of new construction areas and where soil is planned to be disturbed. Sediment controls will be installed at outfalls prior to the Contractor beginning soil disturbing activities up slope from the outfall.

32. Water from concrete saw cutting, concrete grinding and concrete coring activities; or fine materials from concrete chipping and salvage will not be allowed to enter storm drains or enter streams.

33. Storm water containing suspended sediment and turbidity needing to be removed from excavations or low areas will be pumped or gravity drained through vegetated buffer strips (50 foot minimum) or placed in ditches with temporary sediment controls, prior to the water being discharged into a stream.

34. Uncontaminated water from natural groundwater seepage, springs, foundations and drains that does not contain suspended sediment or any pollutants may be discharged without storm water controls.

35. Lime or cement if spilled in ditches or outside the defined limits of application is considered a pollutant and will be excavated and removed the same day, to avoid contaminating streams.

36. If located along the project ROW, RAP stockpiles will be located where there is a minimum 100 feet of vegetative buffer strip before storm water will reach a stream. RAP will not be used as a construction material within the Ordinary High Water Marks of a stream channel of a 404 designated stream.

37. If allowed on the project, concrete truck wash out areas will have adequate volume to allow 12 inch freeboard for rain and will be lined with 6 mils of plastic. No concrete will be stored higher than the 12 inch freeboard. Cleaning of truck chutes and equipment does not constitute concrete truck wash out and this activity may be completed at the concrete placement location. Wash out areas will not be located closer than 50 ft from down slope inlets or stream channels.

38. For outfalls near stock ponds closer than 50 foot from disturbed soil at the ROW line, redundant sediment controls will be provided, typically a combination of rock filter dam and a silt fence constructed in line of the flow.

39. Earth stockpiles will utilize silt fence sediment controls, positioned on the low end of the stockpile drainage area with L-hooks or silt fence installed around the entire stockpile.

40. Sediment controls including rock filter dams and silt fences will not be installed across any 404 streams. Sediment controls at 404 streams will be positioned to limit sediment entering the stream from the banks and around structures/culverts, and will allow free flow of storm water to pass through the ROW without being dammed by any sediment controls. Remove loose materials from stream channels prior to each rain event.

41. Sediment controls for non-404 streams may be constructed across the drainage channel in unlimited locations. It is appropriate to use sediment control details typically used for 404 streams for non-404 streams when flow velocities are high. Remove loose material from stream channels prior to each rain event.

42. Incomplete drainage pipe installation across the roadway does not remove the requirement for having sediment controls around the ends of the pipe. To stay within permit requirements, sediment controls should be installed over and around the terminated end and along each side of the banks as soon as construction on the pipe has been completed. Remove loose material from stream channels prior to each rain event.

43. Safety end / headwall construction temporarily will require the removal of part of the sediment control placed over and around the pipe end. Retain in place as much functioning sediment control as possible. Replace the silt fence over and around the top of the pipe, immediately upon concrete placement and form removal. Do not remove culvert sediment controls that cannot be replaced before the next rain event. Sediment control at the ends of culverts must be in place and available for any rain event until the disturbed soil areas are re-vegetated.

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BEST MANAGEMENT PRACTICE (BMP) GENERAL NOTES

44. Between the Ordinary High Water Marks of a 404 stream channel, the Contractor will disturb only the minimum amount of stream channel that is necessary to complete the work.

45. Rock riprap for erosion control does not replace the requirements to maintain sediment control until vegetation is re-established. Replace sediment controls immediately after installing erosion rock.

46. At the direction of TxDOT, sediment deposited into existing and new culverts will be removed subsidiary to Item 506. Sediment to be removed is either pre-existing material before construction starts or sediment generated as a part of this project.

47. Provide treated 2X4 cross bracing for rectangular inlet silt fence, subsidiary to Item 506.

48. Loose or granular earth materials will not be used to repair silt fence undercuts. Silt fence undercut repairs will be conducted with well compacted soils or the silt fence will be reset in a nearby location.

49. Silt fence steel T posts of approximately 1.25 pounds per foot are allowed at a spacing of 8 feet or less. Silt fence steel T posts between approximately 1.25 pounds per foot and 0.85 pounds per foot are allowed for T post spacing of 5 feet or less.

50. Silt fence to be used to slow the flow of storm water down slopes will be positioned approximately horizontal (on the contour) with L hooks on the ends and limited to approximately 200 feet in length. Multiple sections and levels of silt fence may be required in addition to temporary / permanent erosion control flumes.

51. Soil retention blankets will be installed rolled down the slope with the small dimension side embedded at the top of slope, unless recommended otherwise by the manufacturer. Excess grass, rocks, trash, debris or clods will be removed before seeding and installing soil retention blankets. All installations will be by the manufacturer recommendations. Contractor equipment, including tractor mowers will be kept off areas with soil retention blankets until the grass is established.

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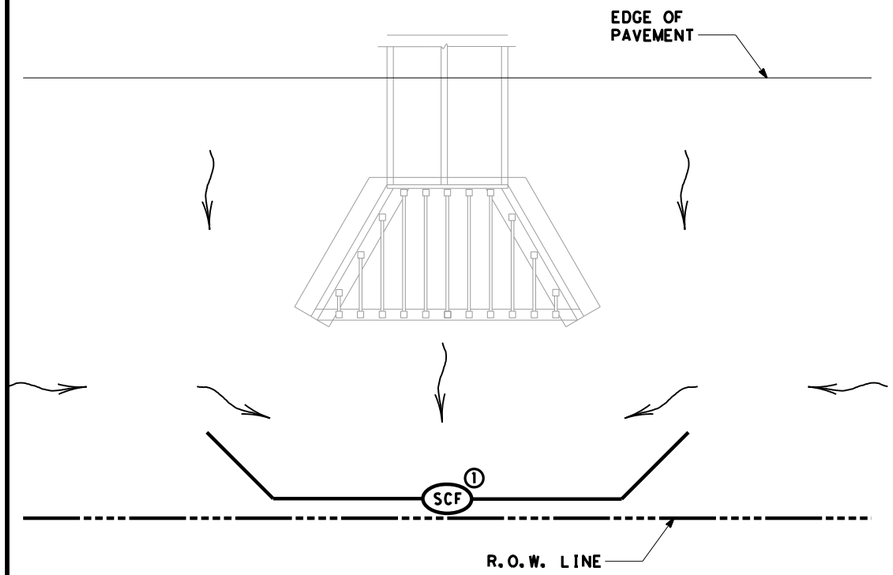
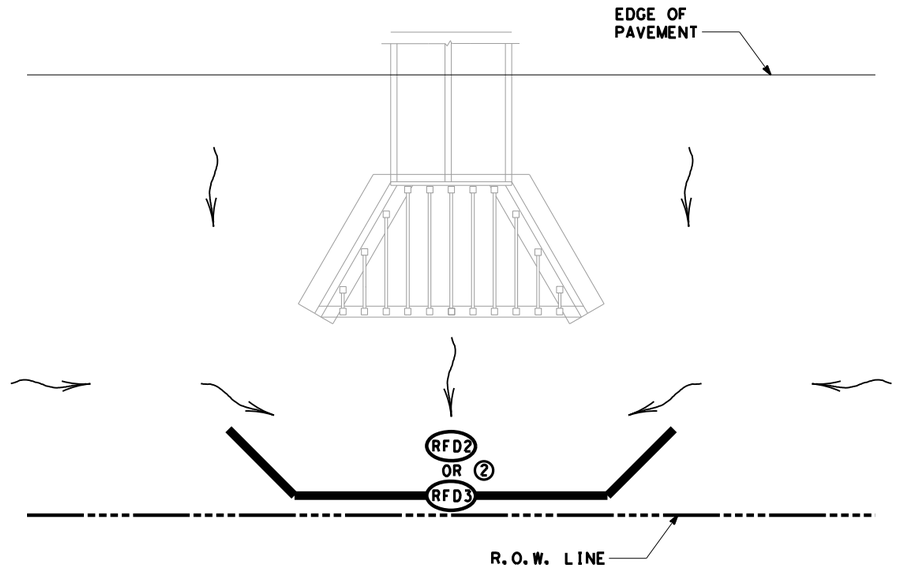


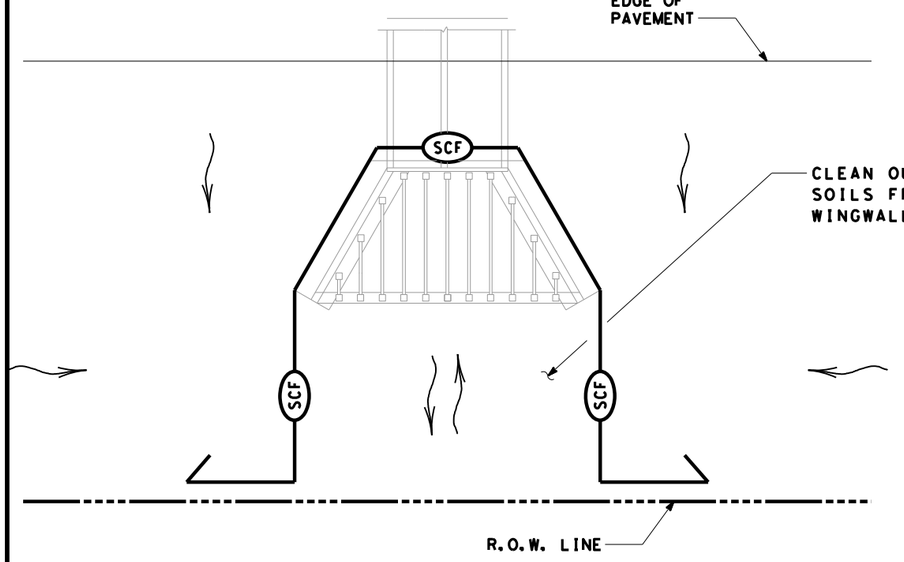
BEST MANAGEMENT PRACTICE (BMP) #1

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT



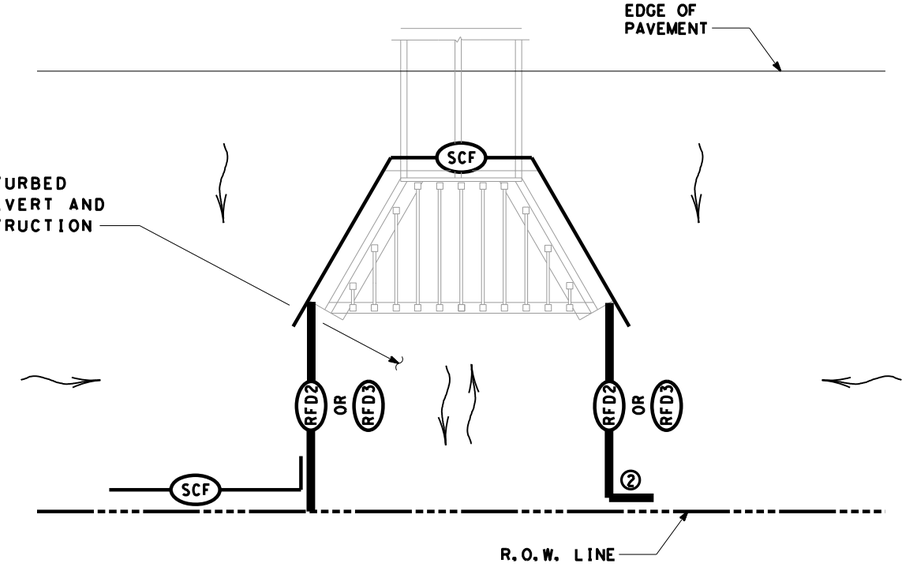
BEST MANAGEMENT PRACTICE (BMP) #2

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT



BEST MANAGEMENT PRACTICE (BMP) #3

FOR 404 OR NON-404 STREAMS ~ SEDIMENT CONTROL AT EXIT OR ENTRANCE OF CULVERT



BEST MANAGEMENT PRACTICE (BMP) #4

FOR 404 OR NON-404 STREAMS ~ SEDIMENT CONTROL AT EXIT OR ENTRANCE OF CULVERT

SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)
	DIRECTION OF FLOW

NOTES:

1. EXTEND SILT FENCE SO STORM WATER DOES NOT GO AROUND THE ENDS. USE L-HOOKS ON ENDS AS REQUIRED.
2. EXTEND ROCK FILTER DAM SO STORM WATER DOES NOT GO AROUND THE ENDS.

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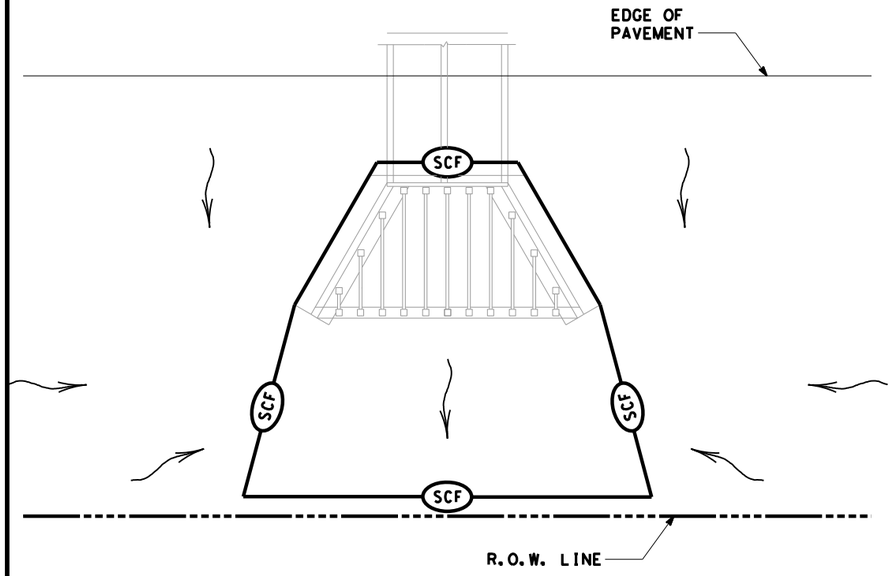
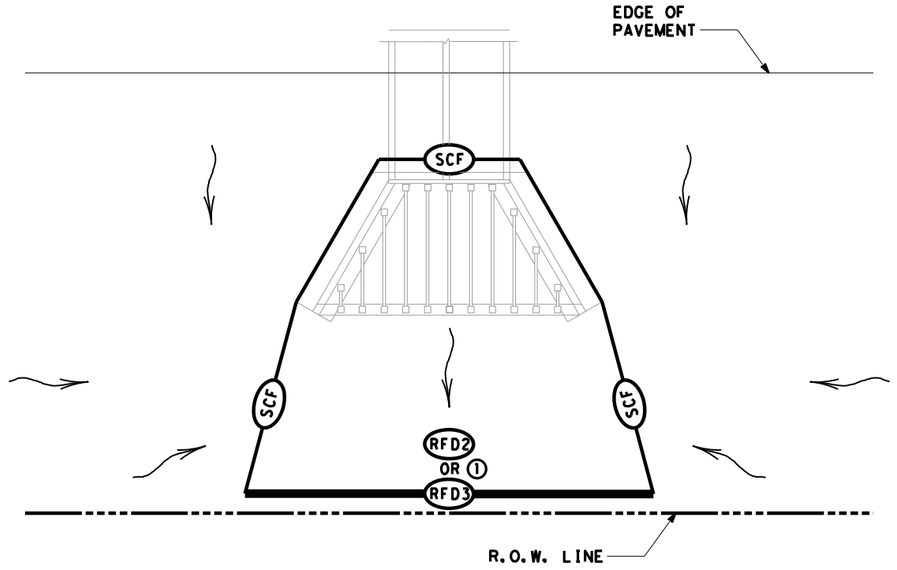


BEST MANAGEMENT PRACTICE (BMP) #5

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT



BEST MANAGEMENT PRACTICE (BMP) #6

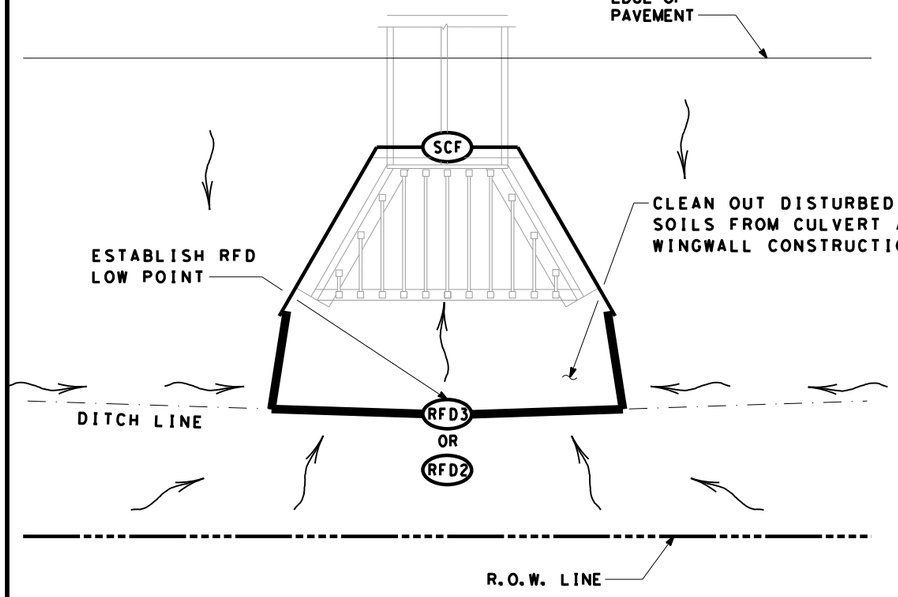
FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT

SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)
	DIRECTION OF FLOW

NOTES:

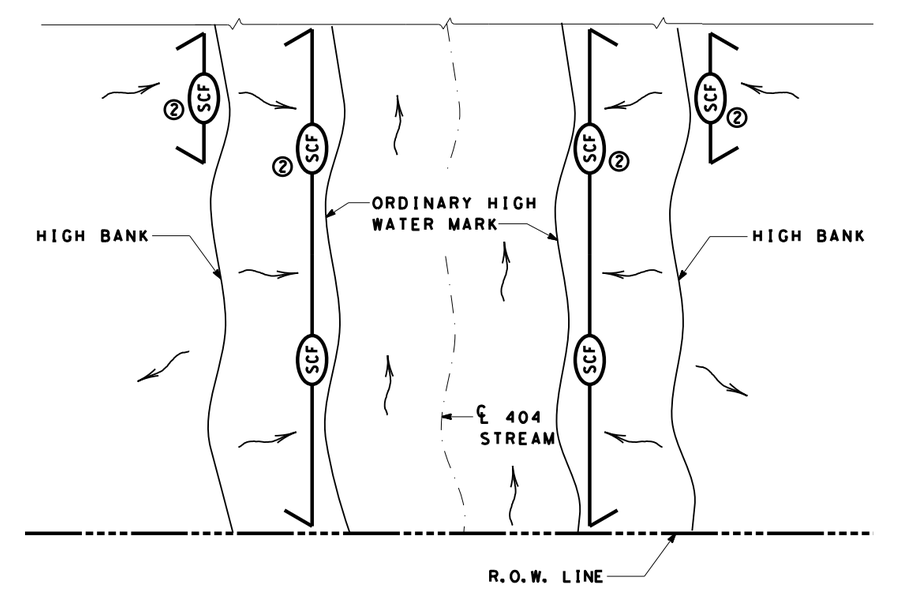
① PROVIDE OVERLAP OF SILT FENCE WITH ROCK FILTER DAM.

② USE SILT FENCE L-HOOKS ON ENDS TO BLOCK STORM WATER SEDIMENT



BEST MANAGEMENT PRACTICE (BMP) #7

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT ENTRANCE OF CULVERT



BEST MANAGEMENT PRACTICE (BMP) #8

FOR 404 STREAMS ~ SEDIMENT CONTROL DURING PROJECT CLEARING AND GRUBBING

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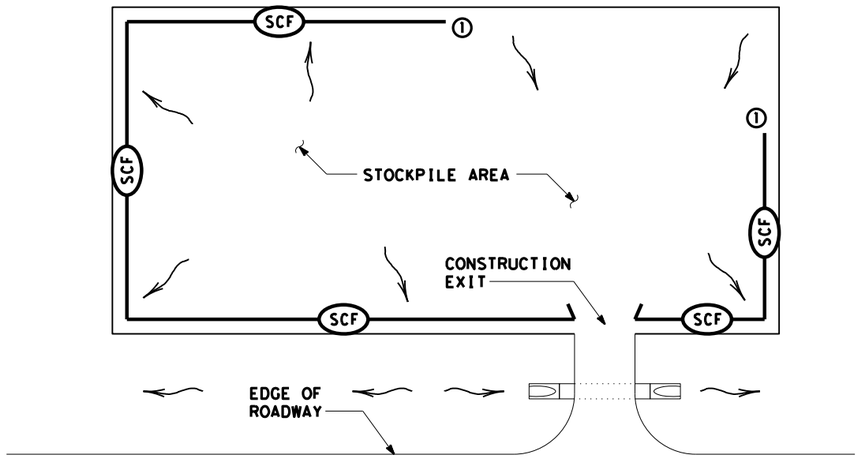
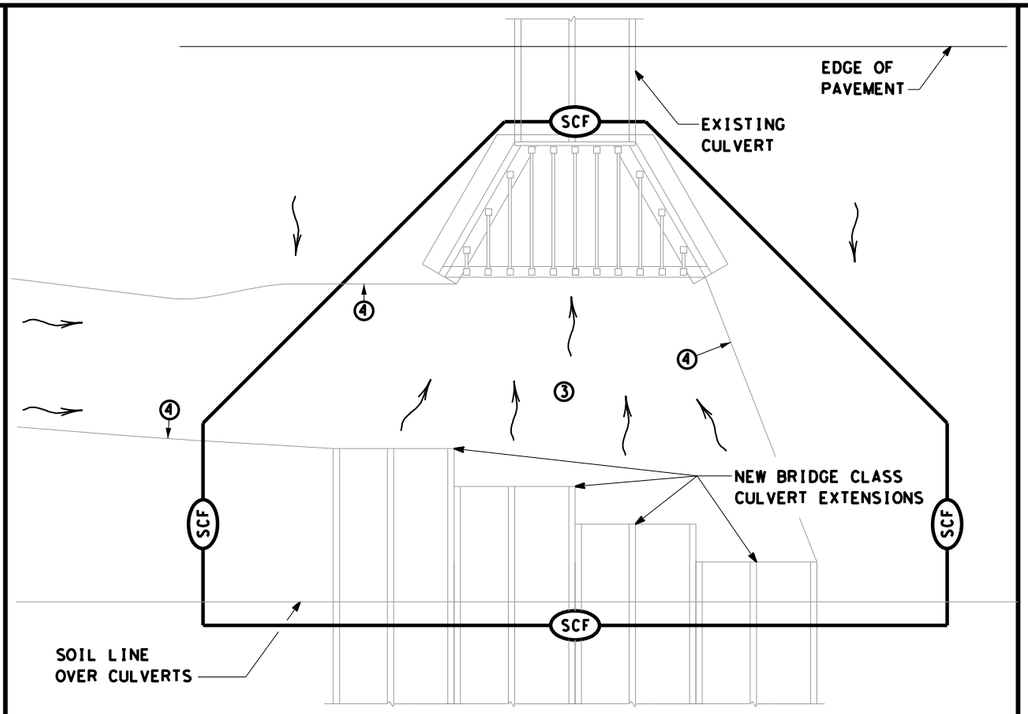


BEST MANAGEMENT PRACTICE (BMP) #9

STOCKPILE SEDIMENT CONTROL



BEST MANAGEMENT PRACTICE (BMP) #10

FOR 404 OR NON-404 STREAMS ONLY ~
SEDIMENT CONTROL AT PHASED CONSTRUCTION OF BRIDGE CLASS CULVERTS

SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)
	DIRECTION OF FLOW

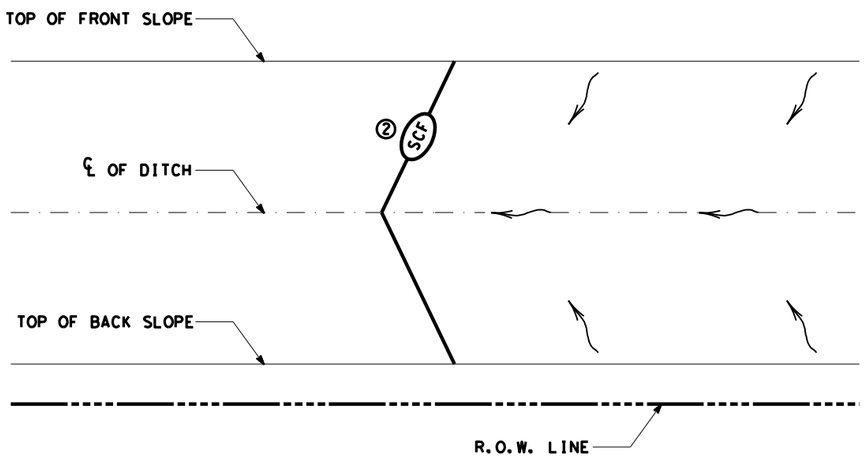
NOTES:

① START SEDIMENT CONTROL AT LOCATION SO ALL STORM WATER WITH SEDIMENT IS COLLECTED

② ROCK FILTER DAMS OR EARTH/GRASSED EMBANKMENTS CAN BE SUBSTITUTED AS DIRECTED.

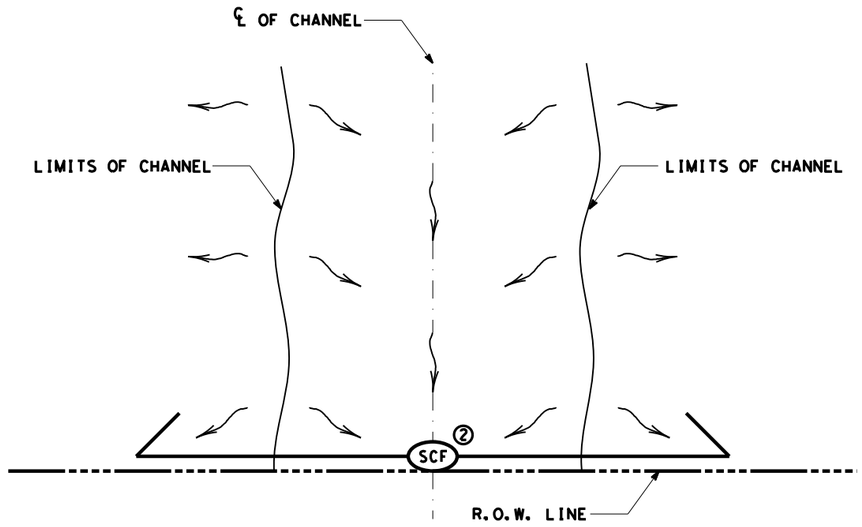
③ PROVIDE A SMOOTH TRANSITION FROM THE INVERT ELEVATIONS BETWEEN CULVERTS. REMOVE LOOSE SOIL FROM EXCAVATED AREA BETWEEN CULVERTS.

④ PROVIDE AND INSTALL PNEUMATICALLY PLACED CONCRETE ON THE DITCH BOTTOM AND SIDE SLOPES BETWEEN TEMPORARY TERMINATIONS BETWEEN OLD AND NEW CULVERTS. PNEUMATICALLY PLACED CONCRETE WILL BE PLACED TO THE HEIGHT OF THE LARGEST CULVERT ON THE DITCH SIDE SLOPES; AND TO A LIMIT 10 FEET OUTSIDE THE LOCATION OF BMPS ALONG THE DITCH BOTTOM. CEMENT STABILIZED SAND MAY BE SUBSTITUTED FOR PNEUMATICALLY PLACED CONCRETE, IN AREAS WHERE INSTALLATION WORKS AND AT THE OPTION OF TXDOT.



BEST MANAGEMENT PRACTICE (BMP) #11

BOUNDRY SEDIMENT CONTROL ~ BOTH ENDS OF CONTROL TERMINATED UP SLOPE



BEST MANAGEMENT PRACTICE (BMP) #12

BOUNDRY SEDIMENT CONTROL ~ BOTH ENDS OF CONTROL TERMINATED DOWN SLOPE

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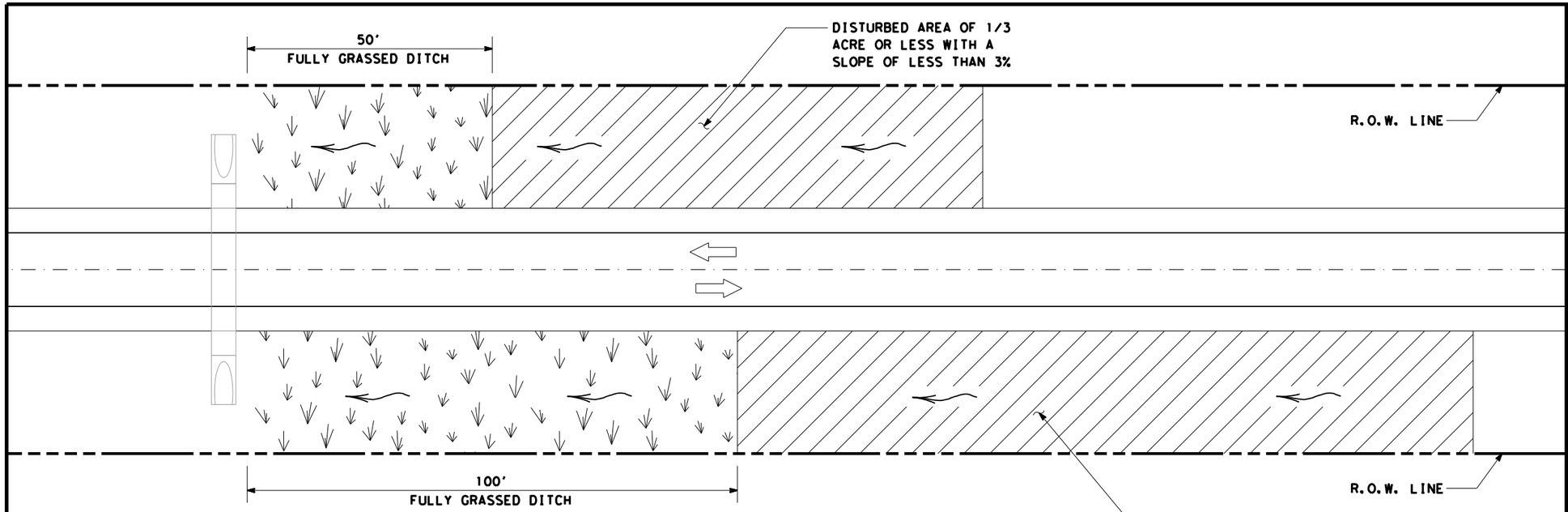


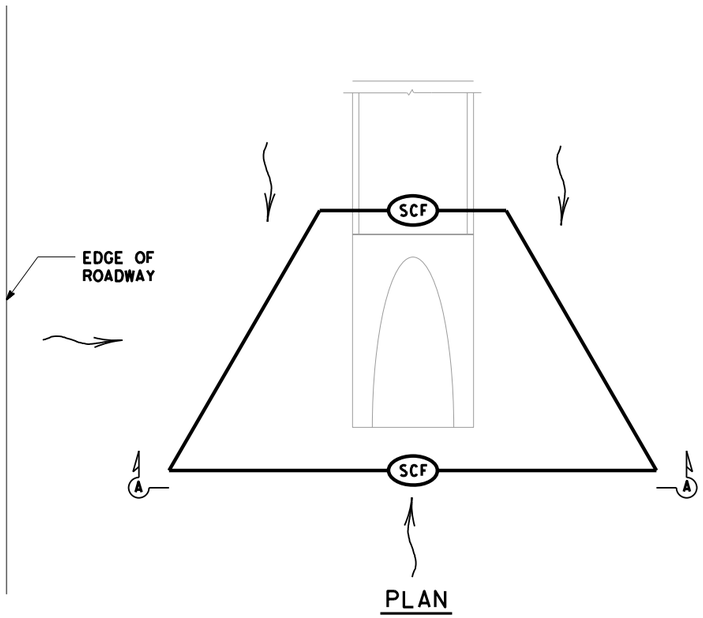
BEST MANAGEMENT PRACTICE (BMP) #13

USE OF VEGETATIVE BUFFERS IN PLACE OF TEMPORARY SEDIMENT CONTROLS SUCH AS SILT FENCE AND ROCK FILTER DAMS

	FULLY GRASSED DITCH
	DISTURBED AREA
	DIRECTION OF FLOW
SCF	SEDIMENT CONTROL FENCE

① FOR H DIMENSIONS LESS THAN 1.5' SILT FENCE MAY NEED TO BE NOTCHED AS SHOWN IN VIEW A-A. ADD EXTRA POSTS AT NOTCH.

② BMP #14 MAY BE USED AT CROSS DRAINAGE STRUCTURES AS DIRECTED.



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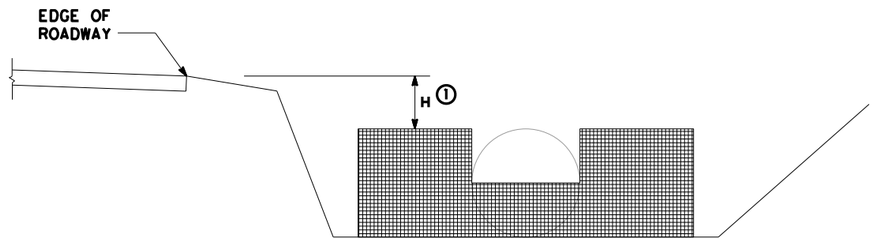

VIEW A-A

BEST MANAGEMENT PRACTICE (BMP) #14

NON-404 STREAMS AND DITCHES ONLY - SEDIMENT CONTROL AT PARALLEL DRAINAGE STRUCTURE ENTRANCE ②

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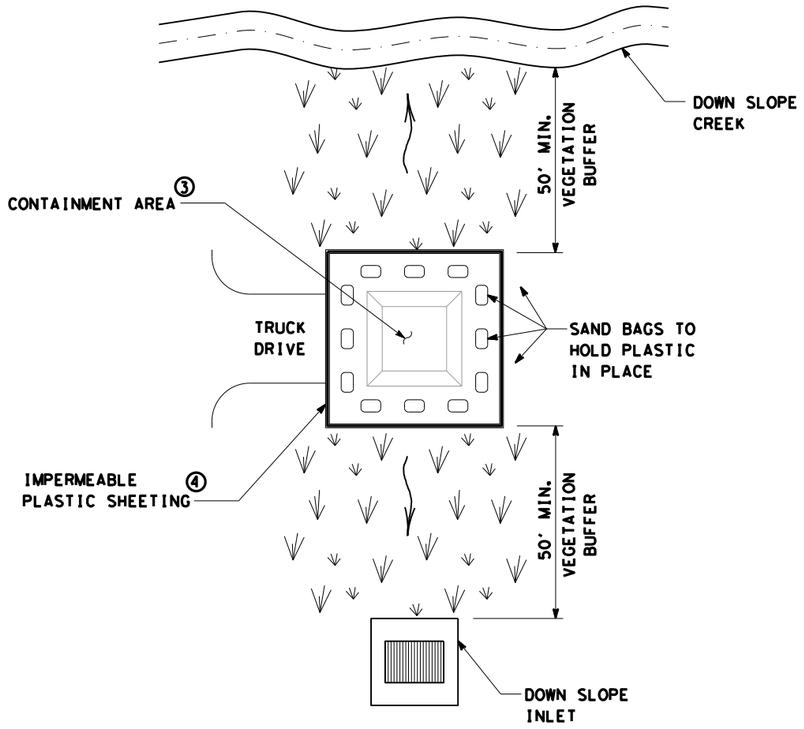
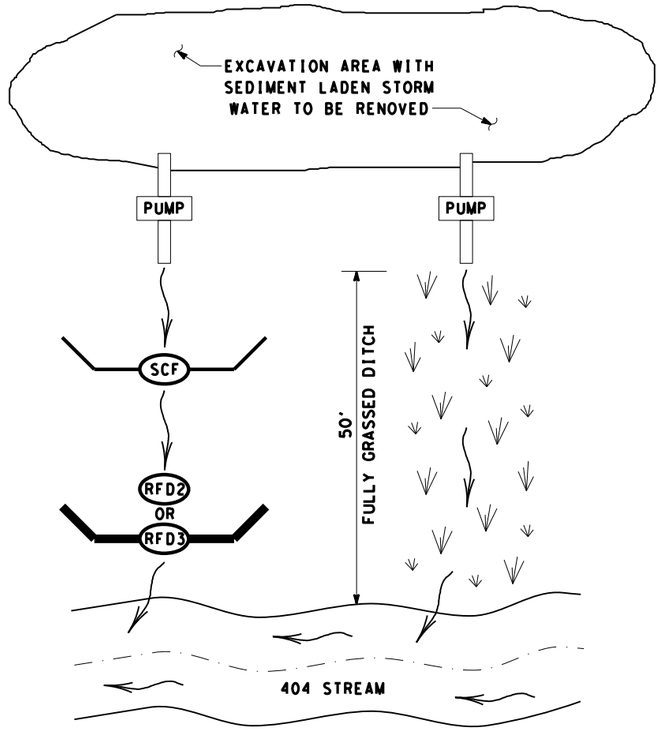


BEST MANAGEMENT PRACTICE (BMP) #15

CONCRETE TRUCK WASHOUT AREA



BEST MANAGEMENT PRACTICE (BMP) #16

PUMPED STORM WATER SEDIMENT CONTROLS ①

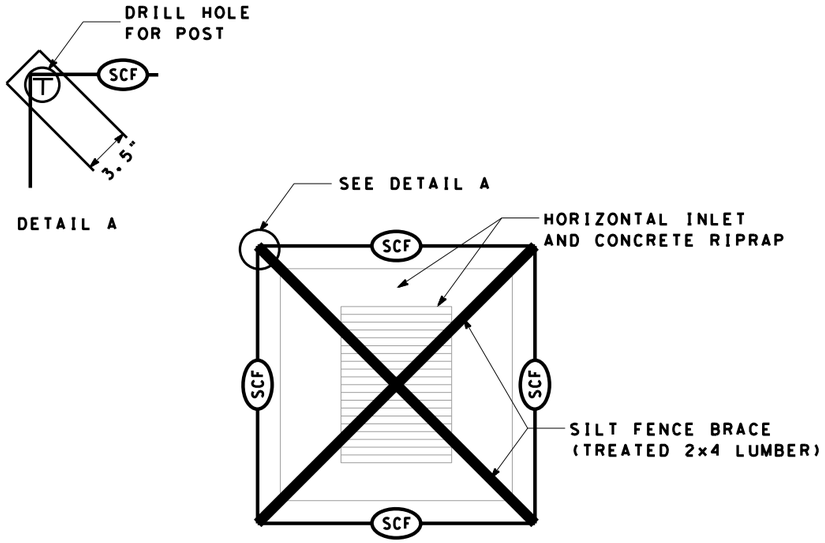
	FULLY GRASSED DITCH
	DIRECTION OF FLOW
SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)

① PUMPED STROM WATER FROM AN EXCAVATION AREA SHOULD BE DISCHARGED IN A 50' VEGETATIVE BARRIER OR THROUGH TWO TEMPORARY SEDIMENT CONTROLS BEFORE ENTERING A 404 STREAM.

② FOR LANDOWNER STOCKPONDS WITHIN 50' OF THE RIGHT OF WAY LINE, PROVIDE REDUNDANT SEDIMENT CONTROLS AT THE CONVEYANCE OF THE POND. MINIMUM OF TWO SEDIMENT CONTROLS.

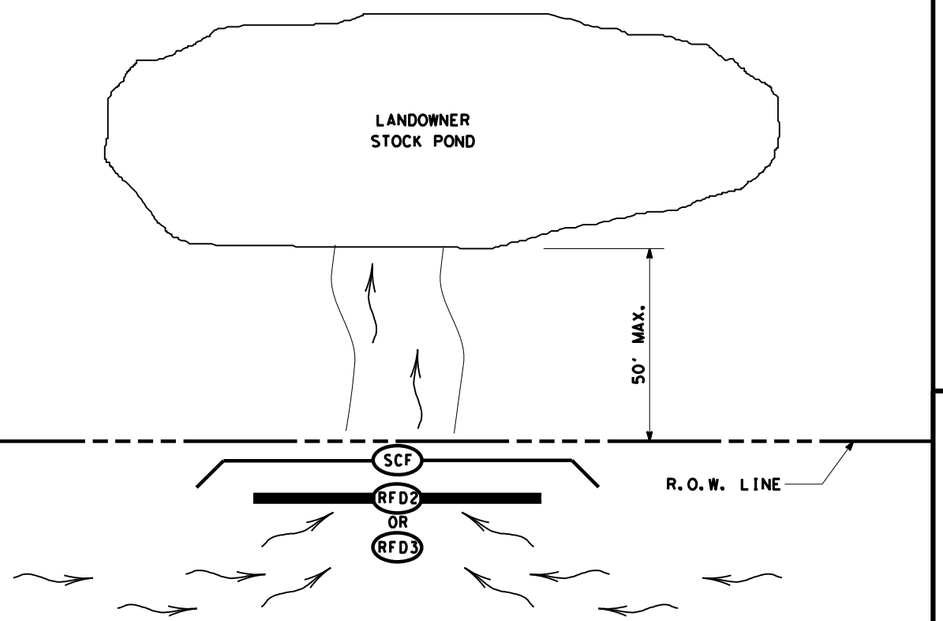
③ WHEN CONTAINMENT AREA REACHES 1' FREEBOARD, DISCONTINUE WASHOUT PLACEMENT AND REMOVE MATERIAL UPON SOLIDIFICATION.

④ EACH TIME SOLIDIFIED MATERIAL IS REMOVED REPLACE PLASTIC SHEETING.



BEST MANAGEMENT PRACTICE (BMP) #17

HORIZONTAL INLET SEDIMENT CONTROL



BEST MANAGEMENT PRACTICE (BMP) #18

LANDOWNER STOCKPOND SEDIMENT CONTROL ②

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

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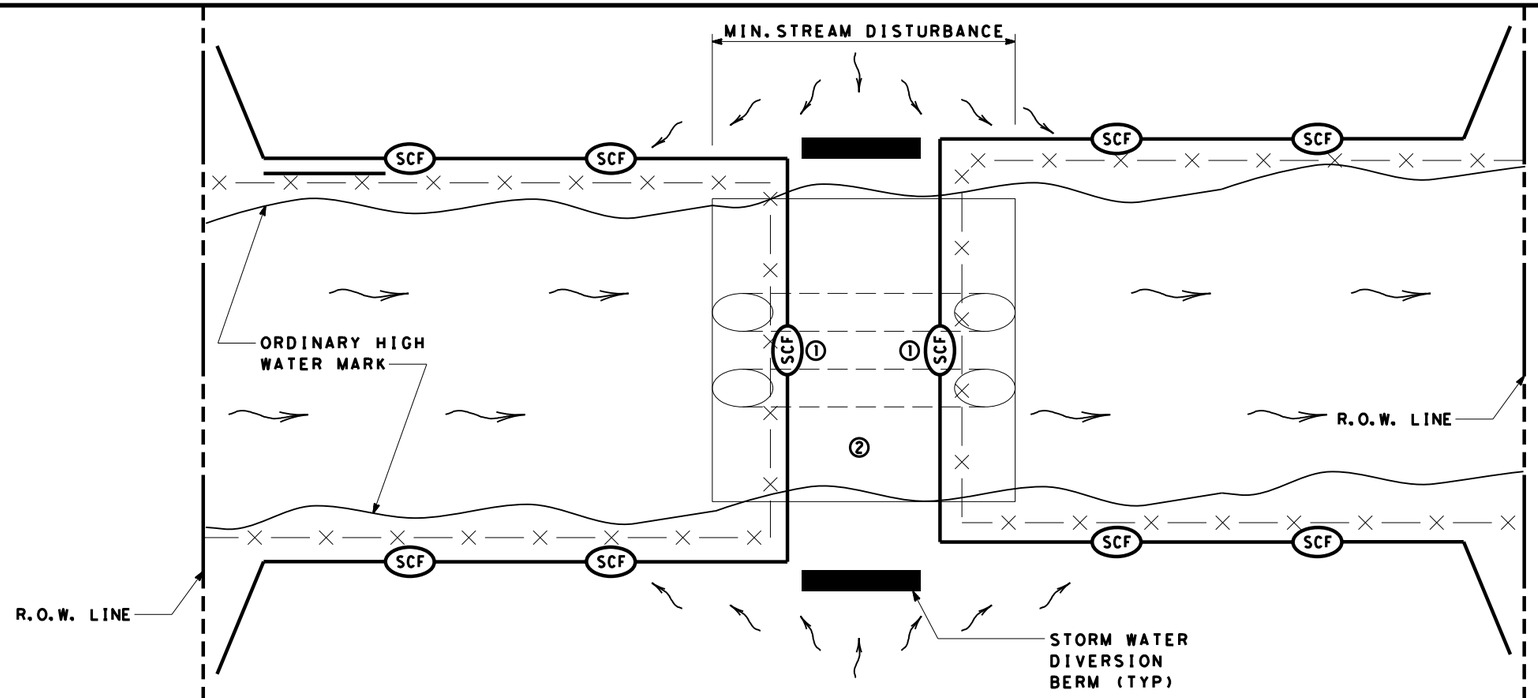


BEST MANAGEMENT PRACTICE (BMP) #19

TYPICAL 404 STREAM CROSSING (SEDIMENT CONTROL AT CROSSING)

	DIRECTION OF FLOW
SCF	SEDIMENT CONTROL FENCE
RFD	ROCK FILTER DAM
	SECURITY FENCING

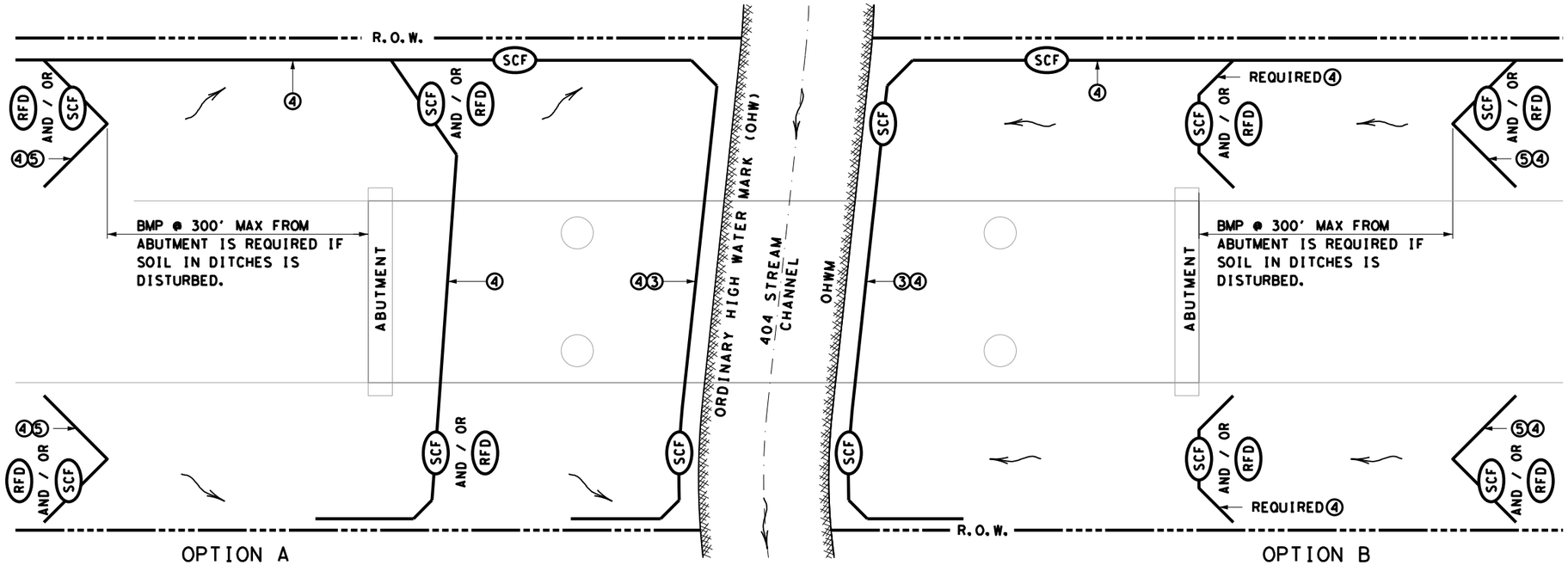
① HAY BALES MAY BE SUBSTITUTED FOR SILT FENCE OVER THE STREAM CROSSING.

② CROSSING WILL BE AS PER REQUIREMENTS OF THE WATERS OF THE US GENERAL NOTES.

③ INSTALL SILT FENCE SLIGHTLY UP FROM OHW MARK FROM R.O.W. TO R.O.W.

④ USE SILT FENCE L-HOOKS ON LEVEL OR DOWN SLOPING ENDS TO BLOCK STORM WATER SEDIMENT

⑤ INSTALL LARGE V OR U SHAPED BMP'S FROM ABUTMENT AS SHOWN. IF THERE IS STEEP DITCH CONDITIONS DECREASE SPACING AND CONSIDER RFD'S. ADD ADDITIONAL BMP'S IF GRADE IS STEEP OR IF FLOW IS HIGH.



BEST MANAGEMENT PRACTICE (BMP) #20

FOR 404 STREAMS ~ BMP'S AT BRIDGES

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

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